

Mullard



quick reference guide

Part 1

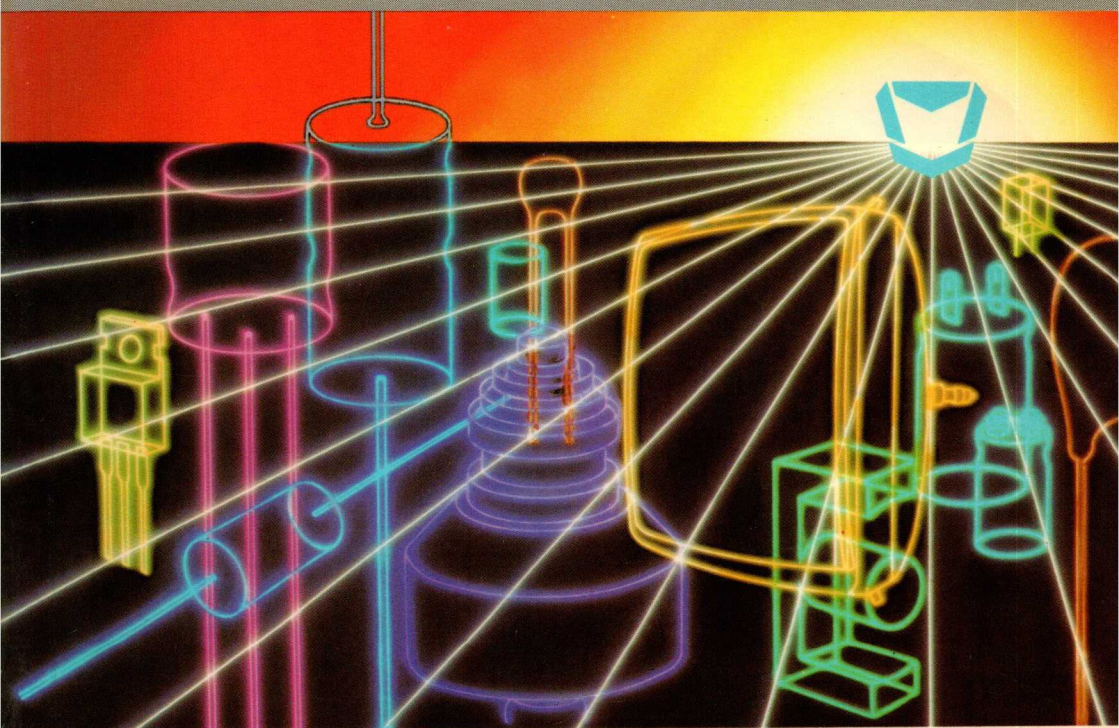
Discrete semiconductors

Valves and tubes

Passive components

Magnetic materials

Special products and assemblies



1985

See Part Two for Mullard integrated circuits



Mullard quick reference guide 1985

Part 1: discrete semiconductors, valves and tubes, passive components, magnetic materials, special products and assemblies

This guide gives quick reference data on Mullard electronic components. The information is deliberately abbreviated to give a rapid appreciation of salient characteristics, and to enable the performance of similar types to be compared quickly. For the convenience of Mullard Technical Handbook users, the relevant Book and Part numbers are indicated at the top of each data table. Part 2, a companion Quick Reference Guide for Mullard ICs, including Philips and Signetics types, is available on request.

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*Registered trade mark for television camera tubes.

Combined index of Mullard discrete semiconductors, passive components, valves and tubes (and valve and tube equivalents)

This combined index lists the types of discrete semiconductors, passive components, valves and tubes briefly described in this guide together with the status code and the page number. Maintenance types of discrete semiconductors, valves and tubes are included in the index with suggested alternatives where applicable. In addition, some types of valves and tubes marketed by other manufacturers are included with suggested Mullard alternatives.

• Products included for the first time in this guide are indicated in both the index pages and data pages by a black dot alongside the type number.

Status codes

The following status codes have been used:

D Design type. Recommended for new equipment designs.

C Current type. Available for equipment production and use in existing equipment installations. No longer recommended for new equipment designs.

M Maintenance Type. Available for the maintenance of existing equipments. No longer recommended for equipment production.

S Consult Mullard Ltd.

O Obsolete type. No longer generally available though limited stocks may still exist.

Suggested alternatives

The following notes apply:

* Near equivalent only.

† There is a Special Quality version of this type.

Type No.	Status Code	Page No. or Suggested Alternatives	Type No.	Status Code	Page No. or Suggested Alternatives	Type No.	Status Code	Page No. or Suggested Alternatives
A24-512W	S		A66-510X	M		• AD11740/T	D	248
A31-322W	S		A66-540X	D	126	AD11800/T8	D	244
A31-410W	M		A67-100X		A67-120X	AD11810/T8	D	244
A31-510W	D	126	A67-120X	M		AD11830/T	S	
A34-111W	S		A67-130X		A67-120X	AD12100/HP	S	
A34-510W	D	126	• AC series	D	206	AD12100/M	S	
• A34EAC00X	D	126	ACS4		QY5-3000A	AD12200/W	S	
A37-550X	M		ACX-01A	D	96	AD12201/M8	D	245
A37-590X	D	126	AD0140/T	S		AD12201/W8	D	245
• A38EAC00X	D	126	AD0141/T	S		AD12250/W	S	
A42-590X	D	126	AD0162/T	S		AD12650/W	S	
• A43EAC00X	D	126	AD0163/T	S		AD12652/M8	D	245
A44-13W		A44-120W	• AD0198/Z	D	247	AD20302/T8	D	244
A44-120W	M		AD20	S		AD20310/T8/T15	D	246
A44-120W/R	M		AD1065/M	S		AD20850/T8	D	244
A44-510W	D	126	AD1265/M	S		AD22302/T8	D	244
A44-520W	S		AD2000/TP	S		AD22310/T	D	246
A47-14W	M	A47-14W	AD2071/Z	D	247	AD22850/T8	D	244
A47-15W			AD2096/T	S		AD26921/X	S	
A47-342X	M		AD2099/Z	D	247	AD33801/SQ8	D	244
A47-343X	M		AD2200/TP	S		AD33910/X4	S	
A49-11X		A49-120X	AD2273/T	D	247	AD35720/X	D	247
A49-15X		A49-120X	AD2274/T	D	248	AD35721/X	D	247
A49-18X		A49-120X	AD2296/T	S		AD35722/X	D	247
A49-120X	M		• AD3071/Y	D	247	• AD35725/X	D	247
A49-191X		A49-120X	AD3071/Z	S		• AD35726/X	D	247
A49-192X		A49-120X	AD3074/Z	D	248	• AD35727/X	D	247
A49-200X		A49-120X	AD3080/M4	S		• AD35740/X	D	248
A50-120W	M		AD3080/X4	S		AD35741/X	D	248
A50-120W/R	M		AD3094/Y	S		AD35742/X	D	248
A50-520W	D	126	AD3371/Y	D	247	• AD35746/X	D	248
A51-110X		A51-200X	AD3374/Y	D	248	• AD35747/X	D	248
A51-112X		A51-220X	AD3380/M4	S		• AD35748/X	D	248
A51-220X	M		AD3595/X	S		AD36510/W4	S	
A51-500X		A51-510X	AD4060/W8	D	245	• AD36720/X	D	247
A51-510X	M		AD4072/X	D	247	• AD36722/X	D	247
A51-540X	D	126	• AD4074/X	D	248	• AD36725/X	D	247
A51-570X	C		AD4472/X	D	247	• AD36727/X	D	247
A51-580X	M		• AD4474/X	D	248	• AD36740/X	D	248
A51-590X	D	126	AD5061/M	S		• AD36742/X	D	248
A56-120X	M		AD5062/W	S		• AD36746/X	D	248
A56-123X		A56-120X	AD0090/T	S		• AD36748/X	D	248
A56-410X	M		• AD0170/T	D	247	AD3690/P	D	246
A56-500X		A56-510X	• AD01740/T	D	248	AD36901/X	D	246
A56-510X	M		• AD0198/Y	D	247	AD38900/P	D	246
A56-540X	D	126	• AD01985/Y	D	247	AD38900/X	D	246
A59-15W	M		AD02110/SQ	S		AD38901/X	S	
A61-120W	M		AD02150/SQ	S		AD38902/P	S	
A61-120W/R	M		AD10200/W8	S		AD40501/W	S	
A61-520W	D	126	AD10250/W8	S		• AD40725/X	D	247
A63-11X		A63-120X	AD10552/W8	S		• AD40745/X	D	248
A63-14X		A63-120X	AD10600/W8	S		AD40880/X	S	
A63-16X		A63-120X	AD10650/W8	S		AD44400/M4	S	
A63-17X		A63-120X	AD10652/W8	D	245	AD44401/M4	D	246
A63-120X	M		AD11400/T8	D	244	• AD44725/X	D	247
A63-200X		A63-120X	AD11410/T8	D	244	• AD44745/X	D	248
A66-120X	M		AD11430/T	S		AD44801/X	S	
A66-140X	M		AD11600/T8	D	244	AD44830/X4	D	246
A66-410X	M		AD11610/T8	D	244	AD44860/X	D	246
A66-500X		A65-510X	• AD11700/T	D	247	AD44880/X	S	

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AD44900/P	D	246	AEY35	S		AVHC201	M	136
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AD44900/X	D	246	AT1038/40	S		AW59-90		A59-15W
AD44901/M	S		AT1038/40A	D	132	AW59-91		A59-15W
AD44901/W4	S		AT1039/00	D	132	AX9000		TY2-25
AD46720/X	D	247	AT1039/01	D	132	AX9901		TY4-400
AD46721/X	D	247	● AT1039/03	D	132	AX9902		TY4-500
AD46722/X	D	247	AT1040/04	S		AX9903		QV06-40A
● AD46725/X	D	247	AT1071/03	D	132	AX9904		TY6-5000W
● AD46726/X	D	247	AT1071/05	S		AX9904R		TY6-5000A
● AD46727/X	D	247	AT1071/07	S		AX9907		QY5-3000W
AD46740/X	D	248	AT1074/00	M		AX9907R		QY5-3000A
AD46741/X	D	248	AT1074/01	O		AX9908		QY5-500
AD46742/X	D	248	AT1077/01	S		B8-700-67	M	
● AD46746/X	D	248	AT1077/02	S		B310AL/01	C	138
● AD46747/X	D	248	AT1077/05	D	132	B310BL/01	C	138
● AD46748/X	D	248	AT1077/06	S		B312AL/01	C	138
AD46800/M8	S		● AT1077/09	D	132	B312BL/01	C	138
AD46801/X4	D	246	AT1080	O		B314AL/01	C	138
AD46810/X4	S		AT1102/01	D	129	B314BL/01	C	138
AD46860/X	D	246	AT1106	D	129	B318AL/01	C	138
AD46861/X8	S		AT1106S	D	129	B318BL/01	C	138
AD46900/M	D	246	AT1109/01	D	129	B330AL/01	O	
AD46950/X	D	246	AT1109/01S	D	129	B330BL/01	O	
AD46951/X	S		AT1109/10	D	129	B410AL/01	C	138
AD48901/X	S		● AT1109/13S	D	129	B410BL/01	C	138
AD50400/M4	S		● AT1109/13T	D		B413AL/01	C	138
AD50600/DSQ8	D	244	AT1113/03	S		B413BL/01	C	138
AD50600/SQ8	D	244	AT1115/01	D	129	B419AL/01	C	138
AD50700/M4	S		AT1116	M		B419BL/01	C	138
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● AD50725/X	D	247	AT1116S	D	129	B1152		TY5-500
AD50740/X	D	248	AT1117	M		B127122	S	
● AD50745/X	D	248	AT1119/01	D	129	B127124	S	
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AD50800/M8	D	245	AT1126S	D	129	BA223	C	62
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● AD55725/X	D	247	AT1237	M		BAS11	D	61
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AD70602/W8	S		AT1331/10	D	133	BAS28,29	S	
AD70612/W8	D	245	AT1331/20	D	133	BAS31,32	S	
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AD70680/W8	D	245	AT1331/50	D	133	● BAS45	D	61
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● AD70745/X	D	248	● AT2076/54	D	132	BAT17	D	56
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AD76742/X	S		AT2102/04C	D	132	BAT51,51R	D	93
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● AD77721/X	D	247	AT2240/16	D	132	● BAT72A	S	93
● AD77725/X	D	247	AT4036	D	133	BAT81	D	62
● AD77726/X	D	247	AT4042/04	S		BAT82	D	62
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● AD77741/X	D	248	AT4042/30	D	126	BAT85	D	62
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BAY96	D	94	BD242,A,B,C	S		BF536	D	53
BB119	D	62	BD243,A,B,C	S		BF550	D	53
BB212	D	62	BD244,A,B,C	S		BF569	D	53
BB405B	D	62	BD329,330	S		BF579	D	53
BB809	D	62	BD331 to 338	S		BF620,622	D	51
BBY31	D	56	BD433 to 438	D	31	BF621,623	D	53
BBY40	D	56	BD645 to 652	D	37	BF660	D	53
BC107 to 109	D	25	BD675 to 684	D	37	BF689K	D	41
BC146	S		BD813 to 818	D	31	BF767	D	53
BC147 to 149	O	BC547 to 549	BD825 to 830	D	31	BF819	D	53
BC157 to 159	O	BC557 to 559	BD839 to 850	D	31	BF820,822	D	51
BC177,8,9	S		BD933 to 942	D	31	BF821,823	D	53
BC237 to 239		BC547 to 549	BD943 to 956	D	31	• BF824	D	53
• BC264A to D	D	49	BDT20	M		BF857,8,9	D	33
BC307 to 309	D	BC557 to 559	BDT21	D	37	BF869 to 872	D	33,36
BC327,8	D	27	BDT29,A,B,C	S	TIP29,A,B,C	• BF926	D	40
BC327A	D	27	BDT30,A,B,C	S	TIP30,A,B,C	• BF936	D	40
BC337,8	D	25	BDT31,A,B,C	S	TIP31,A,B,C	BF960	D	50
BC337A	D	25	BDT32,A,B,C	S	TIP32,A,B,C	• BF964	D	50
BC338	D	25	BDT41,A,B,C	S	TIP41,A,B,C	• BF966,7	D	40,50
BC368	D	26	BDT42,A,B,C	C	TIP42,A,B,C	• BF970	D	40
BC369	D	28	BDT60,A,B,C	D	37	• BF979,80	D	40,50
BC375	D	26	BDT61,A,B,C	D	37	BF981	D	50
BC376	D	28	BDT62,A,B,C	D	38	• BF982	D	50
BC462,464	O	BC369	BDT63,A,B,C	D	38	BF985	D	55
BC463,465	O	BC368	BDT64,A,B,C	D	38	• BF990	D	55
BC546 to 550	D	25	BDT65,A,B,C	D	38	BF991,992	D	55
BC556 to 560	D	27	BDT81 to 88	D	32	• BF994,6	D	55
BC635,7,9	D	26	BDT91 to 96	D	32	• BFG34	D	41
BC636,8,40	D	28	BDV64,A,B,C	D	38	• BFG65	D	41
BC807,8	D	53	BDV65,A,B,C	D	38	BFG90A,91A,96	D	41
BC817,8	D	51	BDV66,A,B,C,D	D	38	BF90A,91A,96	D	41
BC846,7,8	D	51	BDV67,A,B,C,D	D	38	BFQ10 to 16	D	49
BC849,850	D	51	BDV91 to 96	D	32	BFQ17,18A,19	D	51
BC856,7,8	D	53	BDW55 to 60	M		BFQ22	D	41
BC859,860	D	53	BDX35,36,37	D	31	BFO22S	D	41
BC868	D	51	BDX42,43,44	D	37	BFQ23,24	D	41
BC869	D	53	BDX45,46,47	D	37	BFQ32	D	41
BCF29,30	D	53	BDX62,A,B,C	D	37	BFQ33	D	41
BCF32,33	D	51	BDX63,A,B,C	D	37	BFQ34	D	41
BCF70	D	53	BDX64,A,B,C	D	38	BFQ34T	D	41
BCF81	D	51	BDX65,A,B,C	D	38	BFQ38,39,40	D	41
• BCY61	D	51	BDX66,A,B,C	D	38	BFQ42,43	D	46
• BCY62	D	53	BDX67,A,B,C	D	38	BFQ51,52,53	D	41
BCY71,72	D	51	BDX68,A,B,C	D	38	• BFO63	D	41
BCW29,30	D	53	BDX69,A,B,C	D	38	BFQ65,66	D	41
BCW31 to 33	D	51	BDX77,78	D	32	• BFO67	D	51
BCW60A,B,C,D	D	51	BDX91,93,95	D	32	BFQ68	D	41
BCW61A,B,C,D	D	53	BDX92,94,96	D	32	BFR29	D	50
BCW69,70	D	53	BDY20	C	32	BFR30,31	D	53
BCW71,72	D	51	BDY90 to 92	D	32	BFR49	D	41
BCW81	D	51	BDY90A	D	32	BFR53	D	51
BCW89	D	53	BF115	M	BF494	BFR54	D	25
BCX17,18	D	53	BF167	O	BF198	• BFR64,5	D	41
BCX19,20	D	51	BF173	O	BF199	BFR84	D	50
BCX31 to 34	O	BC635 to 39	BF180,181	M	BF496	BFR90,90A	D	41
BCX35 to 37	O	BC636,638,840	BF182,3	S		BFR91,91A	D	41
BCX51 to 53	D	53	BF194,195	O	BF494,495	BFR92,92A	D	51
BCX54 to 56	D	52	BF196,197	O	BF198,199	BFR95,93A	D	51
BCX68,69	D	51	BF198,199	D	40	BFR94	M	BFR95
• BCX70G,H	D	51	BF200	M	BF496	• BFR95	D	41
• BCX70J,K	D	51	BF240,1	D	40	BFR96	C	41
• BCX71G,H	D	53	BF244A,B,C	D	49	BFR96S	D	41
• BCX71J,K	D	53	BF245A,B,C	D	49	BFR101A,B	D	54
BCY30 to 34	O		BF246A,B,C	D	49	BFS17 to 20	D	51
BCY30A to 34A	O		BF247A,B,C	D	49	BFS21,21A	C	49
BCY55		BCY87	BF256A,B,C	D	49	BFS22A,23A	D	46
BCY56 to 59	D	25	BF324	D	40	BFS28	O	
BCY70,71,72	D	27	BF327	M	BF982	BFS92 to 95	O	BSV15 to 17
BCY78,79	D	27	BF336 to 338	O	BF457,8,9	BFT24	D	41
BCY87,88,89	D	48	BF362,363	O		BFT25	D	51
BD131,132	C	31	BF370	D	25	BFT44,45	D	27
BD133	M	BDX35	BF410A to D	D	49	BFT46	D	53
BD135 to 140	D	31	BF419	D	33	BFT92	D	53
BD181	O	BDX91	BF420,422	D	25	BFT93	D	53
BD182,183	O	BDX93	BF421,423	D	27	BFW10,11	D	49
BD201 to 204	D	32	BF450,451	D	40	BFW12,13	D	49
BD226 to 231	D	31	BF457,8,9	D	33	BFW16A	D	41
BD232	M	BUX86	BF469 to 472	D	33,36	BFW17A	D	41
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BFW57 to 60		BC635 to 639	BLW32,33,34	D	44	• BSS83	D	55
BFW61	D	49	BLW50F	D	46	• BST15,16	D	53
BFW87 to 91		BC639 to 640	BLW60,60C	D	46	• BST39,40	D	53
BFW92	S		BLW64	O		BST50,51,52	D	51
BFW92A	D	41	BLW75	O		BST60,61,62	D	53
BFW93	S		BLW76	D	46	• BST70A	D	50
BFW96		BFR29	BLW77	D	46	• BST72A	D	50
BFX29,30	D	27	BLW78	D	46	• BST74A	D	50
BFX34	D	29	BLW79 to 81	D	47	• BST76A	D	50
BFX37	O		BLW82	S		BST78	D	50
BFX84,85,86	D	26	BLW83 to 87	D	46	• BST80	D	55
BFX87,88	D	27	BLW89,90,91	D	47	• BST82	D	55
BFX89	D	41	BLW95	D	46	• BST84	D	55
BFY50 to 52	D	26	BLW96	D	46	• BST86	D	55
BFY55	S		BLW97	D	46	BSV15,16,17	D	28
BFY90	D	41	BLW98	D	44	BSV52	D	51
• BGD102	D	42	BLW99	D	46	BSV64	D	29
• BGD104	D	42	BLX13,13C	D	46	BSV68	O	BSS68
BGX11 series	D	82	BLX14	C	46	BSV78,79,80	D	49
BGX12 series	D	82	BLX15	D	46	BSV81	D	50
BGX13 series	D	82	BLX39	D	46	BSW41	O	CV8616
BGX14 series	D	82	BLX65	D	47	BSW41A	O	CV8616
BGX15 series	D	82	• BLX65E	D	46	BSW66,67,68	O	BSW66A-68A
BGX17 series	D	82	• BLX66	S		BSW66A,67A,68A	D	29
• BGX25 series	D	79	BLX67	D	47	BSX19,20	D	29
BGY21	O		BLX68	D	47	BSX45,46,47	D	26
BGY22,23	D	45	BLX69	D	47	BSX59 to 61	D	29
BGY22A,23A	D	45	BLX69A	D	47	BSY10,11	O	BFY50 series
BGY32,33,35,36	D	45	BLX91 to 94	D	47	BSY38,39	O	BSX20
BGY38	O		BLX91A to 94A	D	47	BSY95A	D	29
BGY40A,B	D	45	• BLX91CB	D	47	BT136 series	D	87
BGY41A,B	D	45	BLX93A	D	47	BT137 series	D	87
BGY43	D	45	BLX94A,C	D	47	BT138 series	D	87
BGY45A,B	D	45	BLX95,96,97	D	47	BT139 series	D	87
BGY46A,B	D	45	BLX98	D	44	BT149 series	D	84
BGY47A,C,D,E,F	D	45	BLY17,17A	O		BT151 series	D	84
BGY50 to 61	D	42	BLY33,34	M		BT152 series	D	84
BGY58A	D	42	BLY35,36	M		BT153	D	85
BGY59 to 61	D	42	BLY53AP	C	47	BT154	M	BT155 series
BGY65	D	42	BLY55	M		BT155 series	D	85
BGY67	D	42	BLY83	M		BT157 series	D	85
BGY70,71	D	42	BLY84	M		BTV24 series	D	84
BGY74,75	D	42	BLY85	S		BTV34 series	D	87
BGY78	D	42	BLY87A,87C	D	46	BTV56 series	D	85
• BGY84,84A	D	42	BLY88A,88C	D	46	BTV59 series	D	85
• BGY85,85A	D	42	BLY89A,89C	D	46	• BTV60	D	85
BGY93A,B,C	D	45	BLY90	S		BTW23 series	D	84
BGY94A,B,C	D	45	BLY91A,91C	D	46	BTW24 series	M	
BLU20/12	D	47	BLY92A,92C	D	46	BTW30 series	M	BT155 series
BLU30/12	D	47	BLY93A,93C	D	46	BTW31 series	M	BTW63 series
BLU45/12	D	47	BLY94	S	47	BTW37 series	M	BTW43G series
• BLU50,51	D	47	BLY97	M		BTW38 series	D	84
BLU60/12	D	47	BP11,12	C		BTW40 series	D	84
BLU52	D	47	BP22 to 26	M		BTW42 series	D	84
BLU53	D	47	BP24	D	100	BTW43G series	D	87
• BLU97	D	47	BPW50	D	99	BTW43H series	D	87
BLU98	D	47	BR100/03	D	48	BTW45 series	D	84
BLU99	D	47	BR101	D	48	BTW47 series	M	BTW92 series
BLV10,11	D	46	BR191	D		BTW48 series	M	BTX94H series
BLV20,21	D	46	BRV39	D		BTW58 series	D	85
BLV25	D	47	BRV56	D	48	BTW59 series	D	85
BLV30/12	D	46	BRV61	D	55	BTW63 series	D	85
BLV30,31	D	44	BRV62	D	55	BTW92 series	D	84
BLV32F	D	44	• BSD10,12	D	50	BTX18 series	M	
BLV33	D	44	• BSD20,22	D	55	BTX94H series	D	87
BLV33F	D	44	• BSD212 to 215	D	50	BTX94J series	D	87
BLV36	D	44	BSR12	D	53	BTY79 series	C	84
• BLV37	D	43	BSR13,14	D	51	BTY87 series	M	BTY91 series
BLV45/12	D	46	BSR15,16	D	53	BTY91 series	C	84
BLV57	D	44	BSR17	D	51	BU208A,8B	S	
BLV59	D	47	BSR17A	D	51	BU326,6A	M	BUX82,3
BLV75/12	D	47	BSR18,18A	D	53	BU406,7	D	34
BLV80/28	D	47	BSR30 to 33	D	53	BU426,6A	D	34
BLV90	D	47	BSR40 to 43	D	52	BU433	C	34
BLV91	D	47	BSR50,51,52	D	37	BU505	D	33
BLV92	D	47	BSR56 to 58	D	54	• BU506	D	33
BLV93	D	47	BSR60,61,62	D	37	BU508A	D	34
• BLV94,5,6	D	47	BSS38	D	29	• BU705,6	D	33
BLV97	D	47	BSS50,51,52	D	37	• BU724,A	D	36
• BLV98,99	D	47	BSS60,61,62	D	37	BU806,807	D	38
BLW26	O		BSS63	D	53	BU824	S	BU826
BLW29	S	46	BSS64	D	51	• BUP21,A,B,C	D	33
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• BUP22,A,B,C	D	34	BY114		BYX22 series	BYX98 series	D	76
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BUS11,11A	D	33	BY215	S		BZT03 series	D	69
BUS12,12A	D	34	BY223	M	BY359 series	BZV10 to 14	D	64
BUS13,13A	D	34	BY224 series	D	79	BZV15 series	M	
BUS14,14A	D	35	BY225 series	D	79	BZV46 series	D	64
• BUS21,A,B,C	D	33	BY228	D	63	BZV49 series	D	58
• BUS22,A,B,C	D	34	BY229 series	D	79	BZV95 series	S	
• BUS23,A,B,C	D	34	BY249 series	D	76	BZV85 series	D	67
• BUS24,A,B,C	D	35	BY260 series	D	79	BZW03 series	D	70
BUT11,11A	D	33	BY261 series	D	79	BZW10 series	O	
BUT21,A,B,C	D	33	BY277 series	M	BY229 series	BZW70 series		BZX70 series
BUV24	D	35	BY329 series	D	79	BZW86 series	D	72
BUV25	D	34	BY359 series	D	79	BZW91 series	M	BZY91 series
BUV26,26A	D	34	BY448	D	63	BZW93 series		BZY93 series
BUV27,27A	D	34	BY458	S		BZW95 series		BZY95 series
BUV28,28A	D	34	BY476	O		BZW96 series		BZY96 series
BUV46,46A	D	34	BY509	D	64	BZX70 series	D	71
BUV47,47A	D	34	BY584	D	64	BZX79 series	D	66
BUV48,48A	D	34	• BY710 to 14	D	64	BZX84 series	D	57
BUV82,83	D	34	• BYQ28 series	D	78	BZX87 series	C	68
BUV89	D	34	• BYR29 series	D	78	BZX90 to 94	D	64
BUV90	D	38	• BYT28 series	D	78	BZY91 series	D	71
• BUV90A	D	38	• BYT79 series	D	78	BZY93 series	D	71
BUW11,11A	D	33	• BYV18 series	D	77	BZY95 series	M	71
BUW12,12A	D	34	• BYV19 series	D	77	BZY96 series	M	71
BUW13,13A	D	34	BYV20 series	D	77	C19/7A		A47-14W
BUW84,85	D	33	BYV21 series	D	77	C19/10A		A47-14W
BUW86	D	32	BYV22 series	D	77	C19AK		A47-14W
			BYV23 series	D	77	C23/7A		A59-15W
BUW87,87A	D	34	BYV24 series	D	79	C23/10A		A59-15W
BUW88	O	BUT11	BYV27 series	D	63	C23AK		A59-15W
BUX46,A	D	33	BYV28 series	D	63	C40 series		
BUX47,A	D	34	BYV29 series	D	78	MONO-GLASS	D	171
BUX48,A	D	34	BYV30 series	D	78	C41 series		
BUX80,81	C	34	• BYV31 series	D	78	MONO-GLASS	D	171
BUX82,83	C	34	BYV32 series	D	78	C43 series		
BUX84,85	D	33	BYV33 series	D	77	MONO-GLASS	D	171
BUX86,87	D	33	BYV34 series	D	78	C120	S	
BUX88	D	34	• BYV39 series	D	77	C143		QY2-100
BUX90	M	BUV90	BYV42 series	D	78	C178A		QQV06-4A0
BUX98,A	D	35	BYV43 series	D	77	C281 series	D	151
BUY89	D	34	• BYV44 series	D	78	C1108		QY3-125
BUZ10,10A	D	39	• BYV72 series	D	78	C1112		QY4-250
BUZ11,11A	D	39	• BYV73 series	D	77	C1136		QY4-400
BUZ14,15	D	39	• BYV79 series	D	78	CAY10	D	95
BUZ20,21	D	39	BYV92 series	D	78	CAY18	D	93
BUZ23,24,25	D	39	BYV95A,B,C	D	63	CAY19	D	93
BUZ30	S		BYV96D,E	D	63	CEM4010		B330AL/01
BUZ31,32	D	39	BYW19 series	M	BY229/BY329 series			B330BL/01
BUZ33	S		BYW25 series	D	79	CEM4013		*B310AL/01
BUZ34	D	39	BYW29 series	D	78			*B318BL/01
BUZ35,36	D	39	BYW30 series	D	78			*B419AL/01
BUZ40	S		BYW31 series	D	78			*B419BL/01
BUZ41A,42	D	39	BYW54,55,56	D	63	CEM4013		*B318AL/01
BUZ43	S		BYW92 series	D	78			*B318BL/01
BUZ44A	D	39	BYW93 series	D	78			*B419AL/01
BUZ45,45A,45B	D	39	BYW94 series	D	78			*B419BL/01
BUZ45C	S		BYW95A,B,C	D	63	CFX13	D	92
BUZ46	D	39	BYW96D,E	D	63	CFX14	D	92
BUZ50A,50B	D	39	BYX10	O	BY448	CFX21	D	92
BUZ53A	D	39	BYX22 series	M		CFX30	D	92
BUZ54,54A	D	39	BYX25 series	C	76	CFX31	D	92
BUZ60	D	39	BYX29 series	S		CFX32	D	92
BUZ60B	S		BYX30 series	C		CFX33	D	92
BUZ63,64	D	39	BYX30 series	S	76	CL5027 to 5951	D	97,98
BUZ63B	S		BYX32 series	S		CL6041 to 6291	D	98
BUZ71,71A	D	39	BYX38 series	D	76	CL7500,20	D	96
BUZ72,72A	D	39	BYX39 series	C	76	CL8030 series	D	96
BUZ73A	D	39	BYX40 series	O	BYX25 series	CL8060 series	D	96
BUZ74,74A	D	39	BYX42 series	D	76	CL8310	O	
BUZ76,76A	D	39	BYX45 series	M		CL8630,30S	D	96
BUZ80,80A	D	39	BYX46 series	D	72,79	CL8632,32S	D	96
BUZ83,83A	D	39	BYX48 series		BYX98 series	CL8633,33S	D	96
BUZ84,84A	D	39	BYX49 series	M	BY249 series	CL8640R,T	O	
BXY27,28,29	D	94	BYX50 series	O	BYW29,30	CL8690	O	
BXY32	D	94	BYX52 series	C	76	CL8880,2 series	O	
BXY35 to 41 series	D	94	BYX56 series	C	76	CL8960 to 68	D	96
BXY48 series	D	95	BYX71 series	O	BY229 series	CL8960,L,U	S	
BXY50 to 52	D	94	BYX72 series	O		CL9022	O	
BXY53 series	O		BYX91 series	O		CME1713R		A44-120W/R
BXY56,57	D	95	BYX96 series	D	76	CME1902		A47-14W
BXY60	S		BYX97 series	C	76	CME1903		A47-14W

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CME2013R		A50-120W/R	CV5239	M		DT2150	O	
CME2203		A59-15W	CV5397	M	EC157	DT2151	O	
CME2302		A59-15W	CV5473	M	QQV02-6	DT2152	O	
CME2308		A59-15W	CV5847	M		DT2156	S	
CME2413R		A61-120W/R	CV5937	M	QQV06-40A	DT2158	S	
CMP/SK	S		CV5959	S		DT2159	S	
CMP/SL	S		CV6122	M		DT2160	S	
CMP10	S	224	CV6223	S		DT2161	S	
CMP20	S	224	CV7099-7105	S		DT2162	S	
CMP40	S	224	CV7138-7146	S		DT2163	S	
CN series	D	169	CV7367/7368	D	61	DT2169	D	232
CNX35 to 38	D	100	CV7756/7757	D	61	DT2170	C	232
CNX48	D	100	CV7762	D		DT2178	C	232
CNX62	D	100	CV7776	S		DT2179	C	232
CNY50	C		CV7777	S		DT2180	D	232
CNY50-1	D	100	CV7778	S		DT2181	O	
CNY62,63	C	100	CV7875	D	61	DT2183	O	
CP13	D	217	CV8308	D	63	DT2184	O	(use DT2633)
CP16	D	218	CV8479	M	TY4-400	DT2186	O	
CP20	S		CV8617	D	61	DT2187	O	
CP21	C		CV8790	D	61	DT2191	S	
CP22	S		CV8805	D	63	DT2196	S	
CP23	D	217	CV9637,8	D	61	DT2197	S	
CP24	S		CV9640	M		DT2202	C	232
CQF24	D	100	CV10112	M	QQV06-40A (BS)	DT2204	C	232
CQL10A	D	100	CVA7026 to 7030	D	63	DT2205	D	232
CQL13A	D	100	CVA7476	D	63	DT2206	D	232
CQL13C	D	100	CW series	D	169	DT2207	S	
CQL14A	D	100	CW1100	D	QY5-3000W	DT2254	S	
CQL14B	D	100	CXY10	D	95	DT2258	M	
• CQL16	D	100	CXY11A,11B,11C	D	94	DT2259	M	
• CQS93L	D	99	CXY12	D	95	DT2266	S	
• CQS95L	D	99	CXY14A,14B,14C	D	94	DT2267	S	
• CQS97L	D	99	CXY19,19A,19B	D	94	DT2268	S	
• CQT10	D	99	CXY21	D	94	DT2269	S	
• CQT24	D	99	CXY22A,22B	D	95	DT2270	S	
CQV70,70A,71,72	D	99	CXY23 series	D	95	DT2279	C	232
CQW10 series	C	99	CXY24A,24B	D	94	DT2281	C	232
CQW11 series	C	99	CXY26 series	D	95	DT2282	C	232
CQW12 series	C	99	CZ series	D	170	DT2283	C	232
CQW24 series	D	99	D7-190GH	M		DT2284	D	232
CQX24 series	D	99	D7-220GH	M		DT2285	D	237
CQX51 series	D	99	D7-221GH	M		DT2286	S	
CQX54	D	99	D7-221GY	D	130	DT2294	S	
CQX64	D	99	D7-222GY	D	130	DT2295	S	
CQX74	D	99	D10-160GH	M		DT2297	S	
CQY24B series	D	99	D10-180GY	D	130	DT2298	S	
CQY50	D	99	D10-181GY	D	130	DT2309	D	237
CQY52	D	99	D12-130../119	S		DT2311	C	237
CQY89A	D	99	D13-480GH	C	130	DT2312	C	237
CQY94B series	D	99	D14-120GH	O		DT2335	S	
CQY96 series	D	99	D14-120GH/08	O		DT2341	D	232
CR1100	M	QY5-3000A	D14-121GH	O		DT2342	D	232
CR16 series	M		D14-162GH/09	O		DT2344	D	232
CR25 series	C		D14-250GH	O		DT2346	C	232
CR37 series	M		D14-251GH	O		DT2347	C	232
CR52	S		D14-252GH	O		DT2349	C	232
CR68	S		D14-261GH	M		DT2351	C	232
CSP25	D	220	D14-262GH	M		DT2352	C	232
CSP40	D	220	D14-292GH	M		DT2354	C	232
CSP60	D	220	D14-302GH/93	M		DT2356	C	232
CT16 series	M		D14-361GH	M	130	DT2357	C	232
CTA1950	M	A49-120X	D14-362GH	D	130	DT2359	C	232
CTA1951	M	A49-120X	D14-370GH/93	D	130	DT2361	C	232
CTA2250	M	A63-120X	D14-380GH/93	D	130	DT2362	C	232
CTP10	D	215	• D44Q5	D	33	DT2364	C	232
CTP14	C		DA20	S		DT2366	C	232
CTP18	D	215	DET20		*EC157	DT2367	C	232
CV424	M	QQV06-40A	DET29		*EC157	DT2369	C	232
CV492	M		DL701	D	249	DT2371	D	232
CV635	M	TY4-350	DL711	D	249	DT2372	D	232
CV1351	M	TY4-500	DM160	M		DT2374	D	232
CV1905	M	QY3-85	DM70	O		DT2376	D	232
CV1924	M		DT1165	S		DT2377	D	232
CV2130	M		DT2047	M		DT2379	D	232
CV2131	M		DT2076/54	S		DT2382	S	
CV2466	M		DT2111	M		DT2387	C	232
CV2797	M	QQV06-40A	DT2112	M		DT2391	D	232
CV2798	M		DT2114	M		DT2392	D	232
CV3522	M	QY5-500	DT2145	O		DT2396	C	231
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DT2410	C		EA52	O		FX1598	S	
DT2430	C		EA53	O		FX1652	C	236
DT2452	C		EC56		*EC157	FX1653	C	236
DT2467	D	232	EC57		*EC157	FX1818	C	236
DT2468	D	232	EC156		*EC157X	FX1819	C	
DT2470	D	231	EC157	M	143	FX1869	S	
DT2477	D	232	EC158	M	143	FX1886	S	
DT2480	D	231	EC8010	O		FX1898	D	234
DT2481	D	232	ECC051S	O		FX2049	C	233
DT2487	D	232	EGP10	D	M8162	FX2073	O	
DT2491	D	231	EGP10	D	215	FX2236	C	232
DT2492	D	231	EMP10	D	216	FX2238	C	232
DT2494	D	232	ES-SFR25	S		FX2239	C	232
DT2496	D	231	ES85		*TY2-125	FX2240	C	232
DT2498	D	231	ES204A		TY4-400	FX2241	C	232
DT2500	D	239	ES833		TY4-350	FX2242	D	232
DT2501	D	232	ETD accessories	S		FX2243	D	232
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DT2502	D	232	ETD39	S		FX2249	D	233
DT2504	D	232	ETD44	S		FX2318	S	
DT2505	D	239	ETD49	S		FX2380	S	
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DT2517	D	232	F046 series	O		FX2395	S	
DT2518	D	239	F047 series	O		FX2431	C	233
DT2519	D	239	F050 series	O		FX2468	S	
DT2522	S		F053 series	O		FX2478	M	
DT2523	D	232	F054 series	O		FX2501	D	232
DT2534	D	231	F061 series	O		FX2502	C	232
DT2535	D	231	F068 accessories	O		FX2507	M	
DT2538	S		F068 series	O		FX2527	S	
DT2539	D	232	F080 series	O		FX2633	D	233
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DT2551	C		F088 series	O		FX2635	D	233
DT2556	C		F095 series	O		FX2675	S	
DT2601	D	232	F120 series	O		FX2691	D	233
DT2602	D	232	F121 series	O		FX2729	S	
DT2603	S		F161 series	O		FX2754	D	233
DT2604	S		F303 series	O		FX2780	S	
DT2605	D	239	F501	O		FX2826	S	
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DT2630	D	239	FX1054	S		FX3009	C	233
DT2631	D	231	FX1073	S		FX3011	S	
DT2632	D	231	FX1076	S		FX3012	S	
DT2633	D	231	FX1089	S		FX3013	S	
DT2640	S	230	FX1098	S		FX3014	M	
DT2641	D	231	FX1105	S		FX3187	O	
DT2642	D	231	FX1107	S		FX3188	O	
DT2643	D	232	FX1115	D	234	FX3225	S	
DT2644	D	232	FX1123	S		FX3234	S	
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DT2700	D	230	FX1145	M		FX3245	S	
DT2701	D	230	FX1164	S		FX3251	O	
DT2702	D	230	FX1169	S		FX3267	S	
DT2723	D	230	FX1172	S		FX3268	S	
DT2724	D	230	FX1238	C	236	FX3280	D	232
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DT2733	D	230	FX1276	S		FX3311	D	233
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DT2738	S		FX1441	S		FX3342	S	
DT2740	S		FX1468	S		FX3391	C	
DT2743	D	230	FX1471	S		FX3417	S	
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FX3590	C	230	G12-36DT/0	D	139	LA1217	D	237
FX3591	C	230	G12-36DT/13	D	139	LA1218	C	237
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FX3670	D	231	H7	C		LA1276	O	
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LA1553	S		LA4528	D	239	M338RPY	S	
LA1555	D	239	LA4529	D	239	M339RPY	S	
LA1556	S		LA4543	D	238	M340RPY	S	
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LA1562	D	239	LA4546	D	238	M347RPY	S	
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LA1631	D	231	LJE series	D	90	MB1068	M	
LA1632	D	231	LKE series	D	89	MB1082	O	
LA1641	D	231	LP36	M		MB1096	M	
LA1642	D	231	LP46	M		MB1099	M	
LA1643	D	231	LP66	M		MB1100	M	
LA1644	D	231	LP1500 series	S	251	MB1102	M	
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LA1672	D	231	LZ series	D	90	MB2030	O	
LA1674	D	231	M1RPY	S		MB3004	O	
LA1675	D	231	M3RPY	S		MB3010	O	
LA1676	D	231	M4RPY	S		MB3011	O	
LA3142	S		M17-140W	D	131	MB3020	O	
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LA3247	S		M17-142..	S		MB8004	O	
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LA3549	S		M24-101W	M		MC60 38400	M	
LA3746	S		M24-101WA	S	131	MC120	S	
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LA4078	D	238	M31-326W/GH/GRD	D	132	MK0912 series	D	92
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MPR24	D	202	OSS9210 series	M	OSS9215 series	QB3.5/750		QY4-250
MPR34	D	202	OSS9215 series	D	80	QB4/1100		QY4-400
MR1011 series	D	92	OSS9410 series	M	OSS9415 series	QB5/1750		QY5-500
MR16 series	S		OSS9415 series	D	80	QBL4/800		QY4-500A
MR25 series	S		OT400		TY4-350	QBL5/3500		QY5-3000A
MR30 series	S		OU115	M		QBW5/3500		QY5-3000W
MR30-8 series	S		OX122,123		BFX87	QC05/35		QZ06-20
MR52 series	O		P110	C		QE05/40	O	QV06-20
MRB series	D	92	P453	S		QE08/200		QV08-100
MRS16T	D	204	P454	S		QOC03/14	O	QQZ03-10
MRS25	D	204	P455	S		QQE02/5		QQV02-6
MS series	D	92	P457	S		QEE03/12		QQV03-10
MSB series	D	92	P.C.B. service	D	255	QQE06/40		QQV06-40A
MTP10	D	216	PC20	D	235	QQV02-6	M	141
MU115	M		PC20 modules	D	253	QQV03-10	M	141
MX118	O		PCB115	M		QQV03-20A	O	
MX123		ZP1470	PDE series	D	90	QQV06-40		*QQV06-40A
MX145		ZP1220	PEE series	D	90	QQV06-40A	M	
MX146		ZP1200	PGB series	D	90	QQV07-50	M	
MX147		ZP1400	PH155	M		QQZ02-6	O	
MX148		ZP1410	PH2222,A	D	29	QQZ03-10	O	
MX149		ZP1431	PH2369	D	29	QQZ03-20	D	YL1020/QQZ03-20
MX151		ZP1310	PH2907,A	D	30	QQZ06-40	O	YL1030/QQZ06-40
MX152/01		ZP1441	PH2955T	S		QV05-25	M	141
MX155		ZP1700	PH3055T	S		QV06-20	O	
MX159		ZP1600	PH4515,6	D	28	QV06-20B	O	
MX163		ZP1300	PH13002,3	D	33	QV06-20C	O	
MX164		ZP1320	PHSD51	D	77	QV08-100	C	141
MX166/01	O	ZP1451	PJC series	D	91	QY2-100	O	
MX167/01	O	ZP1461	PKB series	D	90	QY3-65	M	141
MX168		ZP1481	PL6549		*QY3-65	QY3-125	M	141
MX168/01		ZP1480	PM1911	D	134	QY4-250	M	141
MX177		ZP1330	PM1980	O	PM2972	QY4-400	M	141
MX1201/01		ZP1210	PM1982	O	PM2982	QY4-500A	M	141
MZ0912 series	D	92	PM1991	S		QY5-500	M	141
NFR25	D	204	PM2018B	M	134	QY5-800	S	
NFR30	S		PM2102	D	135	QY5-3000A	M	141
OA47	M	BAT85	PM2203B	O	XP2203B	QY5-3000W	M	141
OA90,91	O		PM2233B	O	XP2233B 135	QZ06-20	O	
OA95	O		PM2242B	D	135	Rare earth magnets	D	241
OA200	C	61	PM2254B	C	135	RB115	M	
OA202	C	61	PM2262	O	XP2262	RC-01	D	202
OA210,211	S		PM2312	D	135	RFI kit	D	235
OA2290 to 292		BZY93 series	PM2312B	D	135	RI-20	O	
OA2292 to 237		BZY93 series	PM2402	D	135	RI-21	O	
OM20	S		PM2402B	D	135	RI-22 series	D	140
OM21	S		PM2412	C	135	RI-23 series	D	140
OM22	S		PM2422	D	135	RI-27 series	D	140
OM23	S		PM2422B	D	135	RI-40	O	
OM67		YJ1510	PM2432	D	135	RI-45	D	140
OM186	O		PM2432B	D	135	RK84A		QY2-100
OM286	D	251	PM2442	D	135	RP20	D	
OM287	D	251	PM2442B	D	135	RPY86,88	M	
OM320	M	250	PM2692	S		RPY87,89	M	101
OM321	M	250	PM2962	D	134	RPY90,91	D	101
OM322	M	250	PM2963	D	134	RPY96	D	101
OM323	M	250	PM2972	O	XP2972	RPY97	D	101
OM335	C	250	PM2982	D	134	RPY98	D	101
OM336	M	250	PO40A	D	100	RPY99	D	101
OM337	M	250	PO41A	D	100	RPY100	D	101
OM345	D	250	PO42A	D	100	RPY101	D	101
OM350	D	250	PO43A	D	100	RPY102	D	101
OM360	D	250	PO44A	D	100	RPY103	D	101
OM361	D	250	PP17	D	222	RPY109D	S	
OM370	D	250	PPC series	D	91	RR115	M	
OM386	D	251	PQC series	D	91	RS20	S	
OM387	D	251	PR37 series	D	205	RS613		TY2-125
OM504	C		PR52 series	D	205	RS630		TY4-400
OM901	D	250	PSU61	M		RS631		TY4-500
ORP12	O	207	PTB series	D	91	RS683		*QY3-125
OSB9110 series	M		PU20	D	252	RS685		QY3-125
OSB9115 series	D	80	PU23	D	252	RS686		QY4-250
OSB9215 series	D	80	PU115	M		RS687		QY4-400
OSB9415 series	D	80	PV3742	D	91	RS1002		*QY4-250
OSM9110 series	M	OSM9115 series	PV3742B4X	M	253	RS1002A		QY4-400
OSM9115 series	D	80	PV11 to 19	D	90	RS1006		*TY2-125
OSM9210 series	M	OSM9215 series	PWB series	D	90	RS1007		QY3-125
OSM9215 series	D	80	PZ series	D	91	RS1009		QQV06-40A
OSM9410 series	M	OSM9415 series	PZB series	S		RS1012L		*QY5-3000A
OSM9415 series	D	80	Q13-110GU	M	131	RS1012W		*QY5-3000W
OSM9510 series	D	80	QB2/250		QY2-100	RS1016		TY4-500

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RS1029		QQV03-10	●TIP2955T	D	32	●X812AL	D	138
RS1036		TY5-500	TIP3055	D	32	●X814AL	D	138
RS1046		TY6-800	●TIP3055T	D	32	●X818AL	D	138
RSA61	M		TS521B	D	126	X910AL	D	138
RV series	S		TS561/3	D	126	X910BL	D	138
RW153A	S		TT10		QY2-100	X913AL	D	138
RW154	S		TT16D		QY3-125	X913BL	D	138
RW173	S		TT23		QQV02-6	X914AL	D	138
RW173A	S		TT24		QQV03-10	X914BL	D	138
RW180	S		TT25		QQV06-40A	X919AL	D	138
RW200			TT61	M		X919BL	D	138
RW300			TU60	M		X919CL	D	138
RW303			TVHC40	D	136	X959AL	D	138
RW400	S		TY2-125	M	142,144	X958BL	D	138
RW651	D	102	TY3-250	M	TY4-400	XA1002	D	136
RW652	D	102	TY4-300	M		XA1003	D	136
RW661	D	102	TY4-350	M	144	XP1000	O	
RW662	D	102	TY4-400	M	142,144	XP1002	M	XP2203B
RW663	D	102	TY4-400C	O		XP1010	O	XP2010
RW664	D	102	TY4-500	M	144	XP1016	O	XP2013B
RW671	D	102	TY5-500	M	144	XP1017	M	134
RW672	D	102	TY6-800	M	144	XP1110	O	PM1911
RW681	D	102	TY6-1250A	M	144	XP1117	M	134
RZ series	D	92	TY6-5000A	M	142	XP1118	O	
S58XQ	M		TY6-5000H	M	142	XP1143	M	PM555
SF115-S	M		TY6-5000W	M	142	XP1230	O	
SFR16T	D	203	TY7-6000A	M	142	XP1910	O	PM1911
SFR25	D	203	TY7-6000H	M	142	XP1920	M	134
SFR25-OR	D	203	TY7-6000W	M	142	XP1931	D	134
●SFR25H	D	203	TY8-15A	M	144	XP2000	O	PM2102
SFR30	S		TY8-15H	M	144	XP2008	C	XP2011B 134
SFR360	S	TY4-400	TY8-15W	M	144	XP2010	M	XP2012B
SM20	S		TY8-6000A	M	144	XP2011	D	134
SMD chip capacitors	D	175	TY8-6000H	M	144	XP2011B	D	134
SO20	S		TY8-6000W	M	144	XP2012B	D	134
SWF134-28,30	S		TY12-15A	M	142	TYC12013B	C	XP2023B 134
SWF324AA	S		TY12-15W	M	142	XP2020	C	135
T130-1		TY2-125	TY12-20W	M		XP2020Q	C	135
			TYS4-500	O		XP2023B	D	134
T350-1		TY4-400	TYS5-3000	O		XP2030	O	PM2412
T813		QY2-100	U321/U321LO	M		XP2040	M	135
TB2.5/300		TY2-125	U322/U322LO	M		XP2040Q	M	
TB3/750		TY4-400	U341/U341LO	D	249	XP2041	C	135
TB4/1250		TY4-500	U342/U342LO	D	249	XP2041Q	C	
TB4/1500		TY5-500	U411/U412	D	249	XP2050	C	135
TB5/2500		TY6-800	UPA60	M		XP2060B	C	XP2061B
TBH6/14		TY8-15HOH	UV411	D	249	XP2061	D	134
TBH6/600		TY6-5000H	UV412	D	249	XP2061B	D	134
TBH7/8000		TY7-6000H	UV413	D	249	XP2202	C	134
TBH7/9000		TY8/6000H	UV414	D	249	XP2202B	C	134
TBL6/14		TY8-15A	UV415	D	249	XP2203B	D	135
TBL6/4000		TY6/1250A	UV416	D	249	XP2212	C	135
TBL6/6000		TY6-5000A	UV417	D	249	XP2212B	C	135
TBL7/8000		TY7-6000A	UV418	D	249	XP2230	C	135
TBL7/9000		TY8-6000A	UVF10	D	249	XP2230B	C	135
TBW6/6000		TY6-5000W	V1103		QQV03	XP2232	O	XP2262
TBW7/8000		TY7-6000W	V317/317LO	D	249	XP2232B	O	XP2262B
TBW7/9000		TY8-6000W	V334/334LO	D	249	XP2233B	C	135
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TD25		QQV06-40A	VM6101 series	C	251	XQ1022	C	127
TH813		QY2-100	VM6500	M	251	XQ1023 series	C	127
TIP29,A,B,C	D	31	VM6510	C	251	XQ1024 series	C	127
TIP30,A,B,C	D	31	VM6520	C	251	XQ1025 series	C	127
TIP31,A,B,C	D	31	VM6530	C	251	XQ1026 series	C	127
TIP32,A,B,C	D	31	VM6600 series	D	251	XQ1031	C	128
●TIP33,A,B,C	D	32	VM6780 series	S		XQ1032	C	128
●TIP34,A,B,C	D	32	VR25 series	D	205	XQ1070 series	C	127
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TIP42,A,B,C	D	32	VR68 series	D	205	XQ1072	C	127
●TIP47 to 50	D	32	VSD	O		XQ1073 to 76	C	127
TIP110,111,112	D	37	●VST86	S		XQ1080 series	C	127
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TIP120,121,122	D	37	WP23	M		XQ1083 to 86	C	127
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TIP130,131,132	D	37	WP42	M		XQ1091 series	C	127
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XQ1280	C	128	YD1332	D	142	YL1541	D	141
XQ1285	C	128	YD1333	M		YL1560	D	141
XQ1380	D	128	YD1334	S		YL1580	O	
XQ1381	D	128	YD1335	S		YL1590	D	141
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XQ1411 series	D	127	YD1336	S	142	YL1630	D	142
XQ1413 series	D	127	YD1342	D	143	• YL1631	D	142
XQ1414 series	D	127	• YD1343	S		YL1640	D	141
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XQ1416 series	D	127	YD1412S	S		• YL1680	D	141
XQ1427 series	D	127	YD1432	S		YL1690	D	141
XQ1428 series	D	127	YG1100 series			Z15021		TY6-800
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XQ1442	D	128	YH1060	O		ZP1200		137
XQ1443	D	128	VH1090	O		ZP1201		
XQ1444	D	128	VH1170	O		ZP1210		137
XQ1500 series	D	127	VH1172	O		ZP1220		137
XQ1501	D	127	VH1210	O		ZP1240		
XQ1503 to 1506	D	127	YJ1023	O		ZP1300	C	137
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XQ1513	S		YJ1162	O		ZP1310	C	137
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XQ1520 series	D	127	YJ1180	O		ZP1313	O	
XQ1521 series	D	127	YJ1181	O		ZP1320	C	137
XQ1523	D	127	YJ1193	O		ZP1322	C	137
XQ1524	D	127	YJ1194	O		ZP1330	C	
XQ1525	D	127	YJ1280	O		ZP1400	C	137
XQ1526	D	127	YJ1320	O		ZP1401	C	137
XQ1590	D	128	YJ1321	O		ZP1410	C	137
• XQ1600	D	128	YJ1441	O		ZP1430	C	137
• XQ1601	D	128	YJ1442	O		ZP1431	C	137
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XQ2075/02	D	127	YJ1510	O		ZP1452	C	137
XQ2427	D	127	YJ1511	D	145	ZP1460	O	ZP1461
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• XQ3070/02	D	127	YJ1521	S		ZP1470	C	137
• XQ3073/02	D	127	YJ1522	S		ZP1480	C	137
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• XQ3427	D	127	YJ1540	D	145	ZP1600	C	138
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2N708	S		4F21		QY3-125	429 series	S	
2N718	S		4H/180E		*QY4-500A	430 series	S	
2N918	C	41	4H/181F		*QY4-500A	431 series	S	
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2N2221	D	25	6B08		*QQV02-6	470DUB22		A47-342X
2N2221A	C	29	6F50R		QY4-500A	470EMB22		A47-343X
2N2222	D	25	6T35		*TY6-80	490AXB22		A49-120X
2N2222A	D	29	7C23		TY6-5000A	490BTB22A		A49-120X
2N2297	C	26	8F65R		*QY4-400	490BUB22		A49-120X
2N2303	O	2N2905	8T72		*TY12-20W	490BxB22,A,B		A49-120X
2N2368	M	BSX19	8T90,92		*TY12-20W	490CJB22		A49-120X
2N2369,69A	D	29	11E13		QQV03-10	490CVB22		A51-220X
2N2410	O	BSX59	11E16		QV06-40A	510AEB22A		A51-220X
2N2483,84	C		14D12		TY5-500	510ARB22		A51-220X
2N2904,04A	D	30	15D12		TY6-800	510AUB22A		A51-220X
2N2905,05A	D		20PE11		XQ1270	510MBB22		A51-220X
2N2906,06A	D		20PE13		XQ1271	510CKB22		A51-220X
2N2907,07A	D		20PE14		XQ1272	510CLB22		A51-220X
2N3019,20	D	26	25UP22		A63-120X	510DB22A		A51-220X
2N3053	D	25	25XX	S		510DJB22A		A51-220X
2N3055	C		44A/160M		*QQV03-10	510ELB22		A51-220X
2N3133,34	M	2N2904,04A	50MXX	O		510HB22		A51-220X
2N3135,36	M	2N2906,06A	56Aq2VP	O	XP2230B/XP2020	510LB22		A51-220X
2N3375	C	46	56CVP	O		552 0....	S	
2N3553	C	46	56DUIP	O	XP2020	561 series	D	173
2N3632	C	46	56DVP	O	XP2202B/XP2020	590 series	S	
2N3771,72	O		56TUIP	O	PM2245B	591 series	S	
2N3822	D	49	56TVP	O		629 series	D	167
2N3823	D	49	58Aq2VP	O		630 series	D	167
2N3866	D	47	58DVP	O	XP2040	631 series	S	
2N3903	D	29	58LVP	O	XP2041	632 series	S	
2N3904	D	29	61SV	D	XP2041Q	638 series	S	
2N3905	D	30	74XQLOC	S		640 series	S	
2N3906	D	30	106 series	C	196	641 series	S	
2N3924,6,7	S		107 series	C	196	642 series	S	
2N3966	D	49	108 series	D	197	650 series	S	
2N4030 to 33	D	28	114 series	D	198	652 series	S	
2N4036	S	2N4033	115 series	D	199	654 series	S	
2N4091,92,93	D	49	121 series	S		655 03 series	S	
2N4123	D	25	122 series	D	200	655 09 series	S	
2N4124	D	25	123 series	D	201	655 53 series	S	
2N4125	D	27	141 series	S		679 series	M	
2N4126	D	27	● 143 04040	D	249	682 series	D	168
2N4391,92,93	D	49	● 143 04050	D	249	683 series	D	168
2N4427	D	47	● 143 04090	D	249	802CPY	D	101
2N4856 to 61	D	49	● 143 04100	D	249	807		QV02/25
2N5400 to 5401	D	27	● 143 04890	D	249	808 series	D	179
2N5415,5416	D	28	143 series	D		809 series	D	180
2N5550,5551	D	25	150AV	D	136	812		*QY4-250
● 2N6678	D	34	150AVP	O	XP2011B	812A		*TY2-125
2NOR60	M		150CV	O		813		QY2-100
2SF60	O		150CVP	M	134	814		*QY3-65
3C/351H		*TY4-350	150TV	O		825CPY	D	101
3J/192E		*TY6-5000A	150UV	O		833A		TY4-350
3J/202E		*TY7-6000A	150UVP		PM2018B	851 to 863 series	S	
3L5T		*TY7-6000A	155UG	M		860		*QY3-125
3N68		BRY39	330 series	D	158	865E		*QYV06-20
3N211	D	50	341 series	S		1513		*TY5-500
3Q/221E		*TY12-20W	344 series	D	152	1619		*QV06-20
3Q/252E		*TY12-20W	352 series	S		2322 522 series	O	
3Q/260E		*TY12-20W	357 series	D	163	2322 592 series	D	214
3Q/261E		*TY12-20W	365 series	D	155	2322 593 series	D	214
3T1100		*TY6-800	366 series	S		2322 594 series	D	214
3T500A1		*TY4-500	368 series	D	156	2322 595 series	D	214
3V5T		*TY7-6000W	370 series	D	157	2322 600 95001	S	
3V202-3		*TY12-20W	371 series	D	154	2322 610 series	D	208
3V20T		*TY12-20W	376 series	D	163	2322 610 12339	D	106
3V25T		*TY12-20W	416B		*EC157	2322 626 series	D	211

Type No.	Status Code	Page No. or Suggested Alternatives	Type No.	Status Code	Page No. or Suggested Alternatives	Type No.	Status Code	Page No. or Suggested Alternatives
2322 627 3....	S		4322 043 04291	S		9596B		XP2203B
2322 633 series	D	211	4322 043 12990	S		9597B		XP2233B
2322 635 series	D		4330 030 30080	D	234	9597QB		PM2254B
2322 640 series	D	208	4330 030 30110	D	234	9635B		XP2230
2322 642 series	D	208	4517		XP2011B	9635QB		XP2020Q
2322 644 series	D	208	4522		XP2040 or XP2041	9656KB		PM2102
2322 644 90008	D		4523		XP2000	9698B		PM1117
2322 660 series	D	213	4524		PM2312	9708B		XP2312
2322 661 series	D	212/3	5586	S		9710/M8	S	
2322 662 series	D	212/3	5586	O		9734B		XP2008
2322 663 series	S	212	5656		*QQV02-6	9758B		PM2312
2322 664 series	D	213	5656KS		XP2000	9813B, 14B, 15B		PM2412
2322 672 series	S		5866		TY2-125	18503		ZP1200
2322 678 93001	D	213	5867		TY4-400	18504		ZP1400
2322 680 series	S		5868		TY4-500	18505		ZP1410
2322 691 90001	D	207	5894		QQV06-40A	18506		ZP1430
2422 136 7....	S		5923		TY6-5000W	18509		ZP1310
2422 136 802..	S		5924		TY6-5000A	18515/01		ZP1441
3122 104 90490	D	234	6075	S	QY5-3000W	18518		ZP1700
3122 104 91110	D	234	6076		QY5-3000A	18520		ZP1210
3122 104 91150	D	234	6079	O	TY5-500	18529		ZP1300
3122 104 83760	D	234	6146		QV06-20	18536/01		ZP1451
3122 131 00732	D	126	6146B		YL1370	18545		ZP1220
3122 134 90110	D	234	6155		QY3-125	18546/01		ZP1461
3122 137 62300	D		6156		QY4-250	18550		ZP1320
3122 137 63370	D	126	6199		XP2061	18555		ZP1330
3122 138 56070	D	126	6291		XP2008	40743		
3122 138 56310	D	126	6292		PM2102	40744		
3122 138 56320	D	126	6293		*QV06-20	40745		
3122 138 94440	S		6360		QQV03-10	40746		
3122 138 99840	D	126	6363		XP2030	40747	S	
3122 138 99850	D	126	6549		*QY3-65	40748	S	
3874A		QY2-100	6810A		XP2230/XP2020	40755	S	
4312 020 36630	D	235	6939		QQV02-6	40756	S	
4312 020 36640	D	235	6960		TY7-6000W	40757	S	
4312 020 36650	D	235	6961		TY7-6000A	40758	S	
4312 020 36690	D	235	7064		PM2102	40759	S	
4312 020 36700	D	235	7065		XP2008	40760	S	
4312 020 36710	D	235	7090	O	TY6-800	40768	S	
4312 020 37000	D	230	7092			40775	S	
4312 020 37010	D	230	7102		150CVP	55029	O	
4312 020 37020	D	230	7237		TY7-6000A	55030	O	
4312 020 37030	D	230	7262A		XQ1032	55031	O	
4312 020 37040	D	230	7378		QV08-100	55032	O	
4312 020 37050	D	230	7527		QY4-400	55340	O	
4312 020 37060	D	230	7537	O		55342	O	
4312 020 37070	D	230	7650		YL1110	56030	O	
4312 020 37080	D	230	7696		PM2102			
4312 020 37090	D	230	7753		TY6-1250A			
4312 020 37100	D	230	7804		TY8-15A			
4312 020 37110	D	230	7809		TY12-20W			
4312 020 37120	D	230	7983		QQZ03-10			
4312 020 37130	D	230	8020	O				
4312 020 37140	D	230	8042		QZ06-20			
4312 020 37150	D	230	8053		PM2102			
4312 020 37160	D	230	8054		PM2312			
4312 020 37170	D	230	8108		EC157			
4312 020 37180	D	230	8118		YL1020/QQZ03-20			
4312 020 37190	D	230	8268		TY8-6000W			
4322 020 08820	D	242	8269		TY8-6000A			
4322 020 08840	D	242	8348		YL1080			
4322 020 08850	D	242	8408		YL1130			
4322 020 08860	D	242	8505		YL1520			
4322 020 08870	D	242	8575		XP2230			
4322 020 08880	D	242	8580		YL1190			
4322 020 08890	D	242	8644		XP1117			
4322 020 08930	D	242	8666		YD1170			
4322 020 34400	D	234	8667		YD1171			
4322 020 34420	D	234	8668		YD1172			
4322 020 36750	D	234	8680		YD1212			
4322 021 33850	D	230	8728		YD1150			
4322 021 33860	D	230	8730		YD1152			
4322 021 33870	D	230	8731		YD1160			
4322 021 33880	D	230	8732		YD1161			
4322 021 33890	D	230	8733		YD1162			
4322 021 33900	D	230	8734		YD1173			
4322 021 33910	D	230	8735		YD1182			
4322 021 33920	D	230	8736		YD1192			
4322 043 03301	S		8752		YD1202			
4322 043 03311	S		9514B, 14S		XP2230			
4322 043 03331	S		9524B		XP2008			
4322 043 04272	S		9594B		XP2022			
4322 043 04281	S		9595B		PM2102			

Mullard Approved Devices

The following devices have been approved and are available to British Standard and/or CECC specifications, although certain purchasing conditions may apply. For additional information see companion brochure "Mullard Professional Quality Approved Components".

BS9000

THYRISTORS & TRIACS

Type No.	B.S. Spec. No.	
BTW38 Series	BS9341-F082	see CECC
BTW40 Series	BS9341-F083	
BTW42 Series	BS9341-F084	see CECC
BTW43 Series	BS9343-F001	
BTW92 Series	BS9341-F039	
BTY79-100R	BS9341-F001	see CECC
BTY79-200R	BS9341-F002	see CECC
BTY79-300R	BS9341-F003	see CECC
BTY79-400R	BS9341-F004	see CECC
BTY79-500R	BS9341-F005	see CECC
BTY79-600R	BS9341-F006	see CECC
BTY79-700R	BS9341-F007	see CECC
BTY79-800R	BS9341-F008	see CECC
BTY79-1000R	BS9341-F009	see CECC

DIODES

Type No.	B.S. Spec. No.	
BYX22 Series	BS9331-F131	
BYX25 Series	BS9333-F003	see CECC
BYX30 Series	BS9333-F002	
BYX38 Series	BS9331-F127	see CECC
BYX42 Series	BS9331-F128	see CECC
BYX45 Series	BS9333-F004	
BYX50 Series	BS9331-F028	see CECC
BYX52 Series	BS9331-F026	see CECC
BYX96 Series	BS9331-F129	
BYX97 Series	BS9331-F130	
BYX98 Series	BS9331-F114	see CECC
BYX99 Series	BS9331-F047	see CECC
BZW91 Series	BS9306-F004	
BZW93 Series	BS9306-F001	
BZW95 Series	BS9306-F002	
BZW96 Series	BS9306-F003	
BZY91 Series	BS9305-F052	
BZY93 Series	BS9305-F051	
BZY95 Series	BS9305-F050	
BZY96 Series	BS9305-F049	
1N3889 to 3892	BS9331-F148	see CECC

VALVES & TUBES

Type No.	B.S. Spec. No.
QQV06-40A	BS9011-F006
CV2797	BS9011-F006

CECC

SEMICONDUCTORS

Types Approved:

Type No.	Spec. No.
BA314	CECC 50 001-026
BAV18 to 21	CECC 50 001-022
BAW62	CECC 50 001-021
BAX16, 17	CECC 50 001-022
BC107	CECC 50 002-076
BC108	CECC 50 002-077
BC109	CECC 50 002-078
BC140, 141	CECC 50 002-004
	005
BC160	CECC 50 002-015
BC161	CECC 50 002-016
BC177 to 179	CECC 50 002-012
	013 014
BCY56, 57	CECC 50 002-164
BCY58	CECC 50 002-030
BCY59	CECC 50 002-031
BCY65E	CECC 50 002-032
BCY70, 71, 72	CECC 50 002-079
	080 081
BF967	CECC 50 002-127
BFR90	CECC 50 002-086
BFR91	CECC 50 002-125
BFR96	CECC 50 002-126
BFX29	CECC 50 002-072
BFX30	CECC 50 004-083
BFX34	CECC 50 004-025
BFX37	CECC 50 002-185
BFX84, 85, 86	CECC 50 004-100
BFX87, 88	CECC 50 002-071
BFY50, 51, 52	CECC 50 002-089
BLW78	CECC 50 007-001
BSS50 to 52	CECC 50 004-073
BSS60 to 62	CECC 50 004-074
BSV15, 16, 17	CECC 50 002-131
BSV64	CECC 50 004-008 025
BSV78 to 80	CECC 50 012-011
BSW66A, 67A, 68A	CECC 50 004-040
BSX45, 46, 47	CECC 50 002-174

Type No.	Spec. No.
BSX62, 63, 64	CECC 50 004-025
BT151 Series	CECC 50 011-003
BT152 Series	CECC 50 011-011
BTW38 Series	CECC 50 011-006
BTW42 Series	CECC 50 011-006
BTW45 Series	CECC 50 011-002
BTY79 Series	CECC 50 011-006
BUS11, 11A	CECC 50 004-124
BUS12, 12A	CECC 50 004-106
BUS13, 13A	CECC 50 004-125
BY229 Series	CECC 50 009-021
BYV20 Series	CECC 50 009-033
BYV21 Series	CECC 50 009-018
BYV22 Series	CECC 50 009-034
BYV23 Series	CECC 50 009-036
BYV32 Series	CECC 50 009-026
BYW29 Series	CECC 50 009-014
BYW30 Series	CECC 50 009-001
BYW31 Series	CECC 50 009-002
BYW54, 55, 56	CECC 50 008-015
BYW92 Series	CECC 50 009-003
BYW93 Series	CECC 50 009-028
BYX25 Series	CECC 50 009-022
BYX38 Series	CECC 50 009-019
BYX42 Series	CECC 50 009-020
BYX52 Series	CECC 50 009-024
BYX56 Series	CECC 50 009-023
BYX98 Series	CECC 50 009-004
BYX99 Series	CECC 50 009-005
BZT03 Series	CECC 50 005-017
BZV85 Series	CECC 50 005-010
BZW03 Series	CECC 50 005-019
BZW70 Series	CECC 50 005-015
BZX70 Series	CECC 50 005-015
BZX79 Series	CECC 50 005-005
CVA7026 to 7030	CECC 50 008-015
CV7099 to 7106	CECC 50 005-005

CECC (cont.)

SEMICONDUCTORS (cont.)

Types Approved:

Type No.	Spec. No.
CV7138 to 7146	CECC 50 005-005
CV7311 to 7320	CECC 50 009-019
CV7367, 8	CECC 50 001-021
CV7379 to 7382	CECC 50 009-020
CVA7476	CECC 50 008-015
CV7667, 8	CECC 50 009-022
CV7669 to 7672	CECC 50 002-132
CV7673 to 7676	CECC 50 002-133
CV7722 to 7724	CECC 50 002-177
CV7725 to 7727	CECC 50 004-096
CV7756, 7	CECC 50 001-021
CV7764 to 7766	CECC 50 004-093
CV7768 to 7770	CECC 50 004-094
CV7875	CECC 50 001-038
CV8308	CECC 50 001-020
CV8617	CECC 50 001-021
CV8790	CECC 50 001-022
CV8805	CECC 50 001-020
CV9507	CECC 50 004-050
CV9637	CECC 50 001-021
CV9638	CECC 50 001-037
CV9790	CECC 50 002-168
CV10253	CECC 50 004-095
CV10254	CECC 50 002-176
CV10440	CECC 50 004-087
CV10806	CECC 50 002-165
CV10807	CECC 50 004-085
CV10814	CECC 50 002-141
CV12253	CECC 50 004-095
PO15	CECC 50 004-084
PO17	CECC 50 004-085
PO33	CECC 50 001-026
1N914, 6	CECC 50 001-021
1N4148, 9	CECC 50 001-021
1N4446 to 9	CECC 50 001-021
2N1613	CECC 50 002-104
2N1711	CECC 50 002-104
2N1893	CECC 50 002-104
2N2904, 4A	CECC 50 002-102
2N2905, 5A	CECC 50 002-102
2N2906, 6A	CECC 50 002-103
2N2907, 7A	CECC 50 002-103
2N2218, 8A	CECC 50 004-029
2N2219, 9A	CECC 50 004-029
2N2221, 1A	CECC 50 004-030
2N2222, 2A	CECC 50 004-030
2N3019, 20	CECC 50 002-175

VALVES & TUBES

Types Approved:

Type No.	Spec. No.
CV 2131	CECC 45 003-007
QY4-250	CECC 45 003-007
QY4-400	CECC 45 003-006
CV1905	CECC 45 003-009
CV2130	CECC 45 003-008
CV2797	CECC 45 003-005
CV5959	CECC 45 003-006
QQV06-40A	CECC 45 003-005
QY3-65	CECC 45 003-009
QY3-125	CECC 45 003-008

CAPACITORS

Types Approved:

Type No.	Spec. No.
050, 052 series	CECC 30 301-033
108 series	CECC 30 301-027
122 series	CECC 30 302-002
344 series	CECC 30 401-023

RESISTORS

Types Approved:

Type No.	Spec. No.
MR16 series 1%, 2%	CECC 40 101-001 style RC8U
MR16 series 1%, 2%	CECC 40 101-002 style AK
MR16 series 1%, 2%	CECC 40 101-009 style AB
MR16 series 1%, 2%	CECC 40 101-019 style GZ
MR25 series 0.5%, 1%, 2%	CECC 40 101-002 styles BK, BY
MR25 series 0.5%, 1%, 2%	CECC 40 101-008 styles BK, BY
MR25 series 2%	CECC 40 101-009 style BY
MR25 series 1%, 2%	CECC 40 101-019 styles FZ, FX
MR30 series 0.5%, 1%, 2%	CECC 40 101-002 styles CK, CY
MR30 series 0.5%, 1%, 2%	CECC 40 101-008 styles CK, CY
MR30 series 2%	CECC 40 101-009 style CY
MR30-8 series 1%, 2%	CECC 40 101-019 styles EX, EZ
ES-SFR25 series 2%, 5%	CECC 40 101-019 style FX

D3007 (British Telecom approvals)

BC327/BT
BC328/BT
BC337/BT
BC338/BT
BC368/BT
BC369/BT
BC375/BT
BC376/BT
BC546/BT
BC547/BT

BC548/BT
BC549/BT
BC550/BT
BC556/BT
BC557/BT
BC558/BT
BC559/BT
BC560/BT
BC635/BT
BC636/BT

BC637/BT
BC638/BT
BC639/BT
BC640/BT
BF422/BT
BF423/BT
BSS38/BT
BSS68/BT
PH2222/BT
PH2222A/BT

PH2369A/BT
PH2907/BT
PH2907A/BT
PH8616/BT
PH9507/BT
PH9790/BT
PH10253/BT
PH10254/BT
PH10440/BT
PH10806/BT

PH10807/BT
PH10814/BT

Mullard Approved Devices (cont.)

SEMICONDUCTORS

Qualification Approval has been obtained for all CV7000 series devices eligible for conversion to BS9300 Appendix C and these are indicated in the list by means of a dagger, e.g. CV7158† to BS9300-C158. Qualification Approvals to the BS9000 scheme (including CV) are regularly listed in BS9002. For information on new or replacement types, please contact Mullard Ltd. The list indicates the nearest commercial equivalent to devices for which Mullard Ltd. has held CV approval. It does not imply that all types shown here are still available.

Obsolete/obsolescent types are indicated by an asterisk(*).

C.V. No.	Comparable Type	C.V. No.	Comparable Type	C.V. No.	Comparable Type	C.V. No.	Comparable Type
CV5712	CV7005*	CV7221†	BZY93-C56R*	CV7412†	BZY96-C6V2*	CV7704†	BZY91-C15R*
CV7026	BVX22-200, BYW54	CV7222†	BZY93-C62R*	CV7413†	BZY96-C6V8*	CV7705†	BZY91-C16R*
CV7027	BVX22-200, BYW54	CV7223†	BZY93-C68R*	CV7414†	BZY96-C7V5*	CV7706†	BZY91-C18R*
CV7028	BVX22-400, BYW54	CV7242	BZY93-C75R*	CV7415†	BZY96-C8V2*	CV7707†	BZY91-C20R*
CV7029	BVX22-600, BYW54	CV7243†	BZY93-C8V2*	CV7416†	BZY96-C9V1*	CV7708†	BZY91-C22R*
CV7030	BVX22-800, BYW55	CV7244†	BZY93-C8V2*	CV7417†	BZY95-C10*	CV7709†	BZY91-C24R*
CV7043	OC200*	CV7245†	BZY93-C9V1*	CV7418†	BZY95-C11*	CV7710†	BZY91-C27R*
CV7044	OC201*	CV7246†	BZY93-C10*	CV7419†	BZY95-C12*	CV7711†	BZY91-C30R*
CV7099	BZX79-C4V7	CV7247†	BZY93-C11*	CV7420†	BZY95-C13*	CV7712†	BZY91-C33R*
CV7100	BZX79-C5V1	CV7248†	BZY93-C12*	CV7421†	BZY95-C15*		
		CV7249†	BZY93-C13*			CV7713†	BZY91-C36R*
		CV7249†	BZY93-C15*	CV7422†	BZY95-C16*	CV7714†	BZY91-C39R*
CV7101	BZX79-C5V6			CV7423†	BZY95-C18*	CV7715†	BZY91-C43R*
CV7102	BZX79-C6V2	CV7250†	BZY93-C16*	CV7424†	BZY95-C20*	CV7716†	BZY91-C47R*
CV7103	BZX79-C6V8	CV7251†	BZY93-C18*	CV7425†	BZY95-C22*	CV7717†	BZY91-C51R*
CV7104	BZX79-C7V5	CV7252†	BZY93-C20*	CV7426†	BZY95-C24*	CV7718†	BZY91-C56R*
CV7105	BZX79-C8V2	CV7253†	BZY93-C22*	CV7427†	BZY95-C27*	CV7719†	BZY91-C62R*
CV7138	BZX79-C3V3	CV7254†	BZY93-C24*	CV7428†	BZY95-C30*	CV7720†	BZY91-C68R*
CV7139	BZX79-C3V6	CV7255†	BZY93-C27*	CV7429†	BZY95-C33*	CV7721†	BZY91-C75R*
CV7140	BZX79-C3V9	CV7256†	BZY93-C30*	CV7476†	BYX45/BYW56	CV7722†	BFY50
CV7141	BZX79-C4V3	CV7257†	BZY93-C33*	CV7495†	2N696		
CV7142	BZX79-C9V1	CV7258†	BZY93-C36*			CV7723†	BFY51
		CV7259†	BZY93-C39*			CV7724†	BFY52
CV7143	BZX79-C10			CV7581†	2N1131	CV7725†	BFY50
CV7144	BZX79-C11	CV7260†	BZY93-C43*	CV7581†	2N1132	CV7726†	BFY51
CV7145	BZX79-C12	CV7261†	BZY93-C47*	CV7644†	2N1718	CV7727†	BFY52
CV7146	BZX79-C13	CV7262†	BZY93-C51*	CV7648	BSY95A	CV7756	BAW62
CV7158†	BZY96-C4V7*	CV7263†	BZY93-C56*	CV7667†	BYX25-1000R	CV7757	BAW62
CV7159†	BZY96-C5V1*	CV7264†	BZY93-C62*	CV7668†	BYX25-1000	CV7762†	BAT39*
CV7160†	BZY96-C5V6*	CV7265†	BZY93-C68*	CV7669†	2N2904	CV7772†	BAT51
CV7161†	BZY96-C6V2*	CV7266†	BZY93-C75*	CV7670†	2N2905	CV7777†	BAT51R
CV7162†	BZY96-C6V8*	CV7311	BYX38-300	CV7671†	2N2904A		
CV7163†	BZY96-C7V5*	CV7312	BYX38-300			CV7778†	BAT51 51R pair
		CV7313	BYX38-600	CV7672†	2N2905A	CV7780†	BZY93-C6V8R*
CV7164†	BZY96-C8V2*	CV7314	BYX38-900	CV7673†	2N2906	CV7781†	BZY93-C7V5R*
CV7165†	BZY96-C9V1*	CV7315	BYX38-900	CV7674†	2N2907	CV7782†	BZY93-C8V2R*
CV7166†	BZY95-C10*	CV7316	BYX38-300R	CV7675†	2N2906A	CV7783†	BZY93-C9V1R*
CV7167†	BZY95-C11*	CV7317	BYX38-300R	CV7676†	2N2907A	CV7784†	BZY93-C10R*
CV7168†	BZY95-C12*	CV7318	BYX38-600R	CV7677†	BZY91-C10*	CV7785†	BZY93-C11R*
CV7188	OC205*	CV7319	BYX38-900R	CV7679†	BZY91-C11*	CV7786†	BZY93-C12R*
CV7218†	BYZ93-C43R*	CV7320	BYX38-900R	CV7680†	BZY91-C12*	CV7787†	BZY93-C13R*
CV7200	BZY93-C7V5R*	CV7343	CV7346*	CV7681†	BZY91-C13*	CV7788†	BZY93-C15R*
CV7201†	BZY93-C8V2R*	CV7347	OC202*	CV7682†	BZY91-C15*		
CV7202†	BZY93-C9V1R*	CV7348	2N1302*			CV7789†	BZY93-C16R*
				CV7683†	BZY91-C16*	CV7790†	BZY93-C18R*
CV7203†	BZY93-C10R*	CV7349	2N1304*	CV7684†	BZY91-C18*	CV7791†	BZY93-C20R*
CV7204†	BZY93-C11R*	CV7350	2N1306*	CV7685†	BZY91-C20*	CV7792†	BZY93-C22R*
CV7205†	BZY93-C12R*	CV7351	2N1308*	CV7686†	BZY91-C22*	CV7793†	BZY93-C24R*
CV7206†	BZY93-C13R*	CV7352	2N1303*	CV7687†	BZY91-C24*	CV7794†	BZY93-C27R*
CV7207†	BZY93-C15R*	CV7353	2N1305*	CV7688†	BZY91-C27*	CV7795†	BZY93-C30R*
CV7208†	BZY93-C16R*	CV7354	2N1307*	CV7689†	BZY91-C30*	CV7796†	BZY93-C33R*
CV7209†	BZY93-C18R*	CV7355	2N1309*	CV7690†	BZY91-C33*	CV7797†	BZY93-C36R*
CV7210†	BZY93-C20R*	CV7357	BAW62	CV7691†	BZY91-C36*	CV7798†	BZY93-C39R*
CV7211†	BZY93-C22R*	CV7358	BAW62	CV7692†	BZY91-C39*		
CV7212†	BZY93-C24R*	CV7379†	BYX42-300R			CV7799†	BZY93-C43R*
				CV7693†	BZY91-C43*	CV7800†	BZY93-C47R*
CV7213†	BZY93-C27R*	CV7380†	BYX42-600R	CV7694†	BZY91-C47*	CV7801†	BZY93-C51R*
CV7214†	BZY93-C30R*	CV7381†	BYX42-900R	CV7695†	BZY91-C51*	CV7802†	BZY93-C56R*
CV7215†	BZY93-C33R*	CV7382†	BYX42-1200R	CV7696†	BZY91-C55*	CV7803†	BZY93-C62R*
CV7216†	BZY93-C36R*	CV7384†	BYX42-300	CV7697†	BZY91-C62*	CV7804†	BZY93-C68R*
CV7217†	BZY93-C39R*	CV7385†	BYX42-600	CV7698†	BZY91-C68*	CV7805†	BZY93-C75R*
CV7218†	BYZ93-C43R*	CV7386†	BYX42-900	CV7699†	BZY91-C68*	CV7806†	BZY93-C68R*
CV7219†	BZY93-C47R*	CV7387†	BYX42-1200	CV7700†	BZY91-C75*	CV7807†	BZY93-C75R*
CV7220†	BZY93-C51R*	CV7409†	BZY96-C4V7*	CV7701†	BZY91-C10R*	CV7808†	BZY93-C8V2*
		CV7410†	BZY96-C5V1*	CV7702†	BZY91-C11R*		
		CV7411†	BZY96-C5V6*	CV7703†	BZY91-C13R*	CV7809†	BZY93-C9V1*
						CV7810†	BZY93-C10*
						CV7811†	BZY93-C11*

Mullard Approved Devices (cont.)

CV cross reference list (continued)

C.V. No.	Comparable Type	C.V. No.	Comparable Type	C.V. No.	Comparable Type
CV7812†	BZY93-C12*	CV7829†	BZY93-C62*	CV8616	**
CV7813†	BZY93-C13*	CV7830†	BZY93-C68*	CV8617	BAW62
CV7814†	BZY93-C15*	CV7831†	BZY93-C75*	CV8760	BCY31A*
CV7815†	BZY93-C16*	CV7841†	BZY95-C36*	CV8790	BAX16
CV7816†	BZY93-C18*	CV7842†	BZY95-C39*	CV8805	**
CV7817†	BZY93-C20*	CV7843†	BZY95-C43*	CV8841	BCY34A*
CV7818†	BZY93-C22*	CV7844†	BZY95-C47*	CV8842	BCY31A*
CV7819†	BZY93-C24*	CV7845†	BZY95-C51*	CV9297	BTX18-200
CV7820†	BZY93-C27*	CV7846†	BZY95-C56*	CV9507	BFX30**
CV7821†	BZY93-C30*	CV7847†	BZY95-C62*	CV9543	BCY72
CV7822†	BZY93-C33*	CV7848†	BZY95-C68*	CV9637	BAW62
CV7823†	BZY93-C36*	CV7849†	BZY95-C75*	CV9638	BAX12A
CV7824†	BZY93-C39*	CV7873	BSX60	CV9790	BFX29
CV7825†	BZY93-C43*	CV7874	BSX59	CV9919	BYX30-200
CV7826†	BZY93-C47*	CV7875	BAS11	CV9936	BUW87
CV7827†	BZY93-C51*	CV8308	**		
CV7828†	BZY93-C56*	CV8615	**		

**Approved to BS9000 'N' specs. (Post Office)

VALVES AND TUBES

C.V. No.	Comparable Type	C.V. No.	Comparable Type	C.V. No.	Comparable Type
CV424	QQV06-40A	CV3522	QY5-500	CV6122	QY3-65
CV635	TY4-350	CV3523	QV06-20	CV6223	LB3-250B
CV1351	TY4-500	CV3926	TY6-5000A	CV8479	TY4-400
CV1905	QY3-65	CV5219	QY5-3000A	CV9640	Q13-110BA
CV1924	TY2-125	CV5239	TY7-6000A	CV10112	QQV06-40A(BS)
CV2130	QY3-125	CV5397	EC157		
CV2131	QY4-250	CV5473	QQV02-6		
CV2466	QQV02-6	CV5847	QQV07-50		
CV2797	QQV06-40A	CV5937	QQV06-40A		
CV2798	QQV03-10	CV5959	QY4-400		

Obsolete/obsolescent types are indicated by an asterisk (*)

Mullard Discrete Semiconductors

- Products included for the first time in this guide are indicated both in the index pages and data pages by a black dot alongside the type number.

En-p-n silicon low/medium power transistors

book 1 part 1a

I _{C(AV)} max. (A)	Type No	Maximum Ratings				Characteristics		at I _C (mA)	f _T min. (MHz)	V _{CE(sat)} max. (V)	at I _C /I _B (mA)	Comments	Outline	Dwg. ref.
		V _{CBO} (V)	V _{CEO} (V)	I _{CM} (A)	P _{TOT} at 25°C (mW)	min.	h _{FE} max.							
GENERAL PURPOSE														
0.05	‡BF420	300	300†	1.0	830	50	—	25	60	—	—	-C _{re} < 1.6pF at 1MHz	TO-92	BR5
	‡BF422	250	250											
0.1	‡BC107	50	45	0.2	300	110	450	2	300*	0.25	10/0.5	N < 4dB at f = 30Hz to 15kHz	TO-18	BJ1
	‡BC108	30	20	—	—	110	800							
	‡BC109	30	20	—	—	200	800							
0.1	‡BCY56	45	45	0.1	300	100	450	2	250*	0.2*	100/10		TO-18	BJ1
	‡BCY57	25	20	—	—	200	800		350*					
0.1	‡BC546	80	65	0.2	500	110	450	2	300*	0.25	10/0.5	N < 4dB at f = 30Hz to 15kHz N < 3dB at f = 30Hz to 15kHz	TO-92	BR1
	‡BC547	50	45	—	—	110	800							
	‡BC548	30	30	—	—	110	800							
	‡BC549	30	30	—	—	200	800							
	‡BC550	50	45	—	—	200	800							
0.1	BF370	40	15	—	500	40	—	10	500	—	—	Typ G _v = 24dB at 36MHz	TO-92	BR1
0.2	2N4123	40	30	—	350	50	150	2	250	0.3	50/5		TO-92	BR1
	2N4124	30	25	—	—	120	360		300					
0.2	‡BCY58	32	32	—	1W	120	630	2	280*	0.7	100/2.5		TO-18	BJ1
	‡BCY59	45	45	—	—									
0.5pk	BFR54	40	15	0.5	500	40	—	10	500	0.25	10/1	Typ. G _{UM} = 19dB at 200MHz	TO-92	BR1
0.5pk	2N696	60	40	0.5	600	20	60	150	40	1.5	150/15		TO-39	BL3
	2N697					40	120		50					
0.5pk	‡2N1613	75	30	0.5	800	40	120	150	60	1.5	150/15		TO-39	BL3
0.5	‡BC337	50	45	1	625	100	600	100	200*	0.7	500/50		TO-92	BR1
	‡BC337A	60	60	—	—	100	400							
	‡BC338	30	25	—	—	100	600							
0.5	‡2N1893	120	80	—	800	40	120	150	50	1.2	50/5		TO-39	BL3
0.6	2N5550	160	140	—	625	60	250	10	100	0.25	50/5		TO-92	BR9
	2N5551	180	160	—	—	80	250			0.20				
0.7	2N3053	60	40	—	5.0W ¹⁾	50	250	150	100	1.4	150/15		TO-39	BL3
0.8	‡2N2221	60	30	—	500	35	—	10	250	0.4	150/15		TO-18	BJ1
	‡2N2222					75	—							
0.8	‡2N2219	60	30	—	800	75	—	10	250	0.4	150/15		TO-39	BL3

*Typical †V_{CEr} ¹⁾T_{case} = 25°C ‡Also available to CECC 50 000
‡Also available to D3007

continued

Transistors

n-p-n silicon low/medium power transistors (cont.)

book 1 part 1a

I _{C(AV)} max. (A)	Type No.	Maximum Ratings				Characteristics		at I _C (mA)	f _T min. (MHz)	V _{CE(sat)} max. (V)	at I _C /I _B (mA)	Comments	Outline	Dwg. ref.
		V _{CB0} (V)	V _{CE0} (V)	I _{CM} (A)	P _{tot} at 25°C (mW)	min.	max.							
GENERAL PURPOSE														
1pk	‡2N1711	75	30	1	800	100	300	150	70	1.5	150/15		TO-39	BL3
1	‡BC375	25	20	1.5	800	60	340	150	150*	0.5	700/70	n-p-n complement of BC376	TO-92	BR1
1	§BFX84	100	60	1	800	30	—	150	50	0.35	150/15		TO-39	BL3
	§BFX85	100	60			70								
	§BFX86	40	35			70								
1	§BFY50	80	35	1	800	30	—	150	60	0.2	150/15		TO-39	BL3
	§BFY51	60	30			40			50	0.35				
	§BFY52	40	20			60			50	0.35				
1	2N2297	80	35	—	800	40	120	150	60	0.2	150/15		TO-39	BL3
1	§2N3019	140	80	—	800	100	300	150	100	0.5	500/50		TO-39	BL3
	§2N3020					40	120		80			Gain linearity		
1	‡BC368	25	20	2	1W	85	375	500	60*	0.5	1A/100	n-p-n complement of BC369	TO-92	BR5
1	‡BC635	45	45	1.5	1W	40	250	150	130*	0.5	500/50	n-p-n complements of BC636, 638, 640	TO-92	BR5
	‡BC637	60	60			40	160							
	‡BC639	100	80			40	160							
1	§BSX45	80	40	—	6.2W ⁽¹⁾	40	250	100	50	1.0	1A/100	200 850 100 (t _{on} t _{off} I _C)	TO-39	BL3
	§BSX46	100	60			40	250			1.0	1A/100			
	§BSX47	120	80			40	160			0.9	500/25			

*Typical ⁽¹⁾T_{case} = 25°C §Also available to CECC 50 000
‡Also available to D3007

Transistors

⊖ p-n-p silicon low/medium power transistors

book 1 part 1a

I _{C(AV)} max. (A)	Type No.	Maximum Ratings				Characteristics		at I _C (mA)	f _T min. (MHz)	V _{CE(sat)} max. (V)	at I _C /I _B (mA)	Comments	Outline	Dwg. ref.
		V _{CB0} (V)	V _{CEO} (V)	I _{CM} (A)	P _{tot} at 25°C (mW)	min.	max.							
GENERAL PURPOSE														
0.05	‡BF421	-300	-300†	100	830	50	—	25	60	—	—	C _{re} <1.6pF at 1MHz	TO-92	BR5
	‡BF423	-250	-250											
0.1	‡BC556	-80	-65	200	500	75	475	2.0	200*	-0.3	10/0.5	N<4dB at f=30Hz N<3dB to 15kHz	TO-92	BR1
	‡BC557	-50	-45			75	475							
	‡BC558	-30	-30			75	475							
	‡BC559	-30	-30			125	475							
	‡BC560	-50	-45			125	475							
0.2	§BCY78	-32	-32	—	345	120	630	2	180*	-0.25	10/0.25	N = 2dB at 1 kHz	TO-18	BJ1
	§BCY79	-45	-45			120	460							
0.2	§BCY70	-50	-40	200	350	100	290*	10	250	-0.25	10/1	N<dB(BCY71)	TO-18	BJ1
	§BCY71	-45	-45			100	400							
	§BCY72	-30	-25			100	290*							
0.2	2N4125	-30	-30	—	350	50	150	2	200	-0.4	50/5		TO-92	BR9
	2N4126	-25	-25			120	360		250					
0.5	‡BC327	-50	-45	1A	625	100	600	100	100*	-0.7	500/50		TO-92	BR1
	‡BC327A	-60	-60			100	400							
	‡BC328	-30	-25			100	600							
0.5	BFT44	-300	-300	500	5W ¹⁾	50	150	10	70*	-5.0	500/100		TO-39	BL3
	BFT45	-250	-250							-3.0				
0.6	§BFX29	-60	-60	600	600	50	125*	10	100	-0.4	150/15	t _s <250ns at 100mA	TO-39	BL3
	§BFX30	-65	-65			50	200	10	—	—	—			
0.6	BFX87	-50	-50	600	600	40	125*	10	100	-0.4	150/15		TO-39	BL3
	BFX88	-40	-40											
0.6	2N5400	-130	-120	—	620	40	180	10	100	-0.5	50/5		TO-92	BR9
	2N5401	-160	-150			60	240							

*Typical †V_{CER} 1)T_{case} = 50°C §Also available to CECC 50 000
‡Also available to D3007

continued

Transistors

p-n-p silicon low/medium power transistors (cont.)



book 1 part 1a

I _{C(AV)} max. (A)	Type No.	Maximum Ratings				Characteristics					Comments	Outline	Dwg. ref.	
		V _{CB0} (V)	V _{CEO} (V)	I _{CM} (A)	P _{tot} at 25°C (mW)	min.	h _{FE} max.	at I _C (mA)	f _T min. (MHz)	V _{CE(sat)} max. (V)				at I _C /I _B (mA)
GENERAL PURPOSE														
1	†BC369	-25	-20	2A	800	85	375	500	60*	-0.5	1A/100	p-n-p complement of BC368	TO-92	BR5
1	†BC376	-25	-20	1.5A	800	60	340	150	150*	-0.5	700/70	p-n-p complement of BC375	TO-92	BR1
1	2N4030 2N4031	-60 -80	-60 -80	—	800	25	—	500	100	-0.5	500/50		TO-39	BL3
1	2N4032 2N4033	-60 -80	-60 -80	—	800	70	—	500	150	-0.5	500/50		TO-39	BL3
1	‡BSV15 ‡BSV16 ‡BSV17	-40 -60 -90	-40 -60 -80	—	800	40 40 40	250 250 160	100	50	-1.0	500/25		TO-39	BL3
1	†BC636 †BC638 †BC640	-45 -60 -100	-45 -60 -80	1.5A	1W	40 40 40	250 160 160	150	50*	-0.5*	500/50	p-n-p complements of BC635, 7, 9	TO-92	BR5
1	•PH5415 •PH5416	-200 -350	-200 -300	—	500	30 30	150 120	50	15	-2.5 -2.0	50/5		TO-92	BR1
1	2N5415 2N5416	-200 -350	-200 -300	1A	1W	30 30	150 120	50	15	-2.5 -2.0	50/5		TO-39	BL3

*Typical ‡Also available to CECC 50 000
†Also available to D3007

Transistors

n-p-n silicon low/medium power switching transistors

book 1 part 1a

$I_{C(AV)}$ max. (A)	Type No.	Maximum Ratings				Characteristics			t_{on} max. (ns)	t_{off} max. (ns)	t_s max. (ns)	at I_C (mA)	Outline	Dwg. ref.
		V_{CBO} (V)	V_{CEO} (V)	I_{CM} (mA)	P_{tot} at 25°C (mW)	min.	h_{FE}	max.						
0.1	BSY95A	20	15	200	300	50	200	10	—	—	50	10	TO-18	BJ1
0.1	BSS38	120	100	250	500	20	—	4	—	1000	—	15	TO-92	BR1
0.2	2N3903	60	40	—	350	50	150	10	70	225	175	10	TO-92	BR9
	2N3904					100	300			250	200			
0.2	2N2369	40	15	500	360	40	120	10	12	18	13	10	TO-18	BJ1
	2N2369A													
0.5pk	BSX19	40	15	500	360	20	60	10	12	15	10	10	TO-18	BJ1
	BSX20					40	120	10		18	13			
0.5pk	PH2369	40	15	500	500	40	120	10	12	18	13	10	TO-92	BR1
0.8	§2N2221A	75	40	—	500	35	—	10	35	285	225	150	TO-18	BJ1
	§2N2222A					75	—							
0.8	•PH2222	60	30	—	625	100	300	150	35	285	225	150	TO-92	BR1
	•PH2222A	75	40											
0.8	§2N2219A	75	40	—	800	75	—	10	35	285	225	150	TO-39	BL3
1	§BSW66A	100	100	2A	800	40	—	100	500	900	—	500	TO-39	BL3
	§BSW67A	120	120											
	§BSW68A	150	150											
1	BSX59	70	45	1A	800	30	—	500	35	60	—	500	TO-39	BL3
	BSX60	70	30						40	70				
	BSX61	70	45						50	100				
2	§BFX34	120	60	5A	870	40	150	2A	600	1200	—	5A	TO-39	BL3
2	§BSV64	100	60	5A	870	40	—	2A	600	1200	—	5A	TO-39	BL3

§Also available to CECC 50 000

Transistors

p-n-p silicon low/medium power switching transistors

book 1 part 1a

$I_{C(AV)}$ max. (A)	Type No.	Maximum Ratings				Characteristics							Outline	Dwg. ref.
		V_{CBO} (V)	V_{CEO} (V)	I_{CM} (mA)	P_{Tot} at 25°C (mW)	min.	h_{FE}	max.	at I_C (mA)	t_{on} max. (ns)	t_{off} max. (ns)	t_s max (ns)		
0.1	BSS68	-110	-100	—	500	30	—	25	—	—	—	—	TO-92	BR1
0.2	2N3905	-40	-40	—	350	50	150	10	70	260	200	10	TO-92	BR9
	2N3906	—	—	—	—	100	300	—	—	295	225	—	—	—
0.6	2N2906	-60	-40	—	400	40	120	150	45	100	80	150	TO-18	BJ1
	2N2906A	-60	-60	—	—	—	—	—	—	—	—	—	—	—
0.6	2N2907	-60	-40	—	400	100	300	150	45	100	80	150	TO-18	BJ1
	2N2907A	-60	-60	—	—	—	—	—	—	—	—	—	—	—
0.6	2N2904	-60	-40	—	600	40	120	150	45	100	80	150	TO-39	BL3
	2N2904A	-60	-60	—	—	—	—	—	—	—	—	—	—	—
0.6	2N2905	-60	-40	—	600	100	300	150	45	100	80	150	TO-39	BL3
	2N2905A	-60	-60	—	—	—	—	—	—	—	—	—	—	—
0.6	PH2907	-60	-40	—	625	100	300	150	45	100	80	150	TO-92	BR1
	PH2907A	-60	-60	—	—	—	—	—	—	—	—	—	—	—

§Also available to CECC 50 000

‡Also available to D3007

I _{C(AV)} max. (A)	Type No.		Maximum Ratings				P _{TOT} 25°C (W)		Characteristics		f _T min. (MHz)	V _{CE(sat)} max (V)	at I _C /I _B (A)	Outline	Dwg. ref.
	N-P-N	P-N-P	V _{CEO} (V)	V _{CE0} (V)	I _{CM} (A)	T _{mb} (°C)	min.	max.	at I _C (mA)						
1	BD135	BD136	45	45	1.5	8	40	250	150	250*a)	0.5	0.5/0.05	TO-126	BU	
	BD137	BD138	60	60											
	BD139	BD140	100	80											
1	BD825	BD826	45	45	1.5	2‡	40	250	150	250*a)	0.5	0.5/0.05	TO-202	BB	
	BD827	BD828	60	60											
	BD829	BD830	100	80											
1	TIP29	TIP30	80	40	3	30	15	75	1A	3	0.7	1/0.125	TO-220	BV1	
	TIP29A	TIP30A	100	60											
	TIP29B	TIP30B	120	80											
	TIP29C	TIP30C	140	100											
1.5	BD226	BD227	45	45	3	12.5	40	250	150	125*b)	0.8	1/0.1	TO-126	BU	
	BD228	BD229	60	60											
	BD230	BD231	100	80											
1.5	BD839	BD840	45	45	3	2‡	40	250	150	125*b)	0.8	1/0.1	TO-202	BB	
	BD841	BD842	60	60											
	BD843	BD844	100	80											
1.5	BD845	BD846	100	100	3	2‡	40	250	150	150*a)	1.0	0.5/0.05	TO-202	BB	
	BD847	BD848	120	120											
	BD849	BD850	140	140											
2	BD233	BD234	45	45	6	25	25	—	1A	3	0.6	1/0.1	TO-126	BU	
	BD235	BD236	60	60											
	BD237	BD238	100	80											
2	BD813	BD814	45	45	6	2‡	40	250	150	3	0.6	1/0.1	TO-202	BB	
	BD815	BD816	60	60											
	BD817	BD818	100	80											
3	BD131		70	45	6	15	40	—	500	60	0.3	0.5/0.05	TO-126	BU	
		BD132	45	45											
3	TIP31	TIP32	80	40	5	40	10	50	3A	3	1.2	3/0.375	TO-220	BV1	
	TIP31A	TIP32A	100	60											
	TIP31B	TIP32B	120	80											
	TIP31C	TIP32C	140	100											
3	BD933	BD934	45	45	7	30	40	250	150	3	0.6	1/0.1	TO-220	BV1	
	BD935	BD936	60	60											
	BD937	BD938	100	80											
	BD939	BD940	120	100											
	BD941	BD942	140	120											
4	BD433	BD434	22	22	7	36	50	—	2A	7	0.5	2/0.2	TO-126	BU	
	BD435	BD436	32	32											
	BD437	BD438	45	45											
5	BDX35		100	60	10	15	45	450	500	100*	0.9	5/0.5	TO-126	BU	
	BDX36		120	60											
	BDX37		120	80											
5	BD943	BD944	22	22	8	40	85	475	500	3	0.5	2/0.2	TO-220	BV1	
	BD945	BD946	32	32											
	BD947	BD948	45	45											
5	BD949	BD950	60	60	8	40	40	—	500	3	1.0	2/0.2	TO-220	BV1	
	BD951	BD952	80	80											
	BD953	BD954	100	100											
	BD955	BD956	120	120											

*Typical f_T=a) 75MHz for p-n-p types, ‡ In free air

b) 50MHz for p-n-p types

Transistors

low-voltage power transistors (cont.) book 1 part 1b

I _{C(AV)} max. (A)	Type No.		Maximum Ratings				Characteristics		at I _C (mA)	f _T min. (MHz)	V _{CE(sat)} max (V)	at I _C /I _B (A)	Outline	Dwg. ref.
	N-P-N	P-N-P	V _{CEO} (V)	V _{CE0} (V)	I _{CM} (A)	P _{tot} T _{mb} = 25°C (W)	min.	h _{FE} max.						
6	TIP41	TIP42	80	40	10	65	15	75	3	3	1.5	6/0.6	TO-220	BV1
	TIP41A	TIP42A	100	60										
	TIP41B	TIP42B	120	80										
	TIP41C	TIP42C	140	100										
8	BD201	BD202	60	45	12	60	30	—	3	7	1.0	3/0.3	TO-220	BV1
	BD203	BD204	60	60										
8	BDX77		100	80	12	60	30	—	2	7	1.0	3/0.3	TO-220	BV1
		BDX78	80	80										
8	BDX91	BDX92	60	60	12	90	20	—	3	4	1.0	5/1	TO-3	BE1
	BDX93	BDX94	80	80										
	BDX95	BDX96	100	100										
10	BDT91	BDT92	60	60	20	90	20	200	4	4	1.0	4/0.4	TO-220	BV1
	BDT93	BDT94	80	80										
	BDT95	BDT96	100	100										
10	BDV91	BDV92	60	60	20	100	20	—	4	3	1.0	4/0.4	SOT-93	AR
	BDV93	BDV94	80	80										
	BDV95	BDV96	100	100										
10	•TIP33	•TIP34	80	40	15	80	20	100	3	3	1.0	3/0.3	SOT-93	AR
	•TIP33A	•TIP34A	100	60										
	•TIP33B	•TIP34B	120	80										
	•TIP33C	•TIP34C	140	100										
10	•TIP3055T	•TIP2955T	70	60	12	75	20	70	4	2	0.8	4/0.4	TO-220	BV1
10	BUW86		150	120	15	62.5	30	120	5	35	0.5	5/0.5	TO-3	BE1
10	BDY90		120	100	15	40	30	120	5	70*	0.5	5/0.5	TO-3	BE1
	BDY91		100	80										
	BDY92		80	60										
12	BDY90A		120	100	15	40	30	120	5	70*	0.5	5/0.5	TO-3	BE1
15	TIP3055	TIP2955	100	60	—	100	20	70	4	3	1.1	4/0.4	SOT-93	AR
15	BDY20		100	60	15	115	20	70	4	1*	1.1	4/0.4	TO-3	BE1
15	2N3055		100	70	—	115	20	70	4	0.8	1.1	4/0.4	TO-3	BE1
	BDT81	BDT82	60	60	20	125	20	50	5	—	1.0	5/0.5	TO-220	BV1
	BDT83	BDT84	80	80										
	BDT85	BDT86	100	100										
	BDT87	BDT88	120	120										

*Typical

Transistors

book 1 part 1b n-p-n high-voltage power transistors

$I_{C(AV)}$ max. (A)	Type No.	Maximum V_{CBO} (V)	Ratings V_{CEO} (V)	I_{CM} (A)	P_{tot} $T_{mb}=25^\circ C$ (W)	Characteristics $t_{r1}^{\dagger\dagger}$ $V_{CE(sat)}$ max. (V) at I_C/I_B (A)			h_{FE} min.	max.	at I_C (mA)	Comments	Outline	Dwg. ref.
0.05	BF469	250	250	0.1	1.8	—	—	—	50	—	25	Class AB or Class B video output	TO-126	BU
	BF471	300	300**											
0.05	BF869	250	250	0.1	1.6	—	—	—	50	—	25	Video output class AB or B	TO-202	BB
	BF871	300	300**											
0.1	BF419	300	250	0.3	6	—	11	0.2/0.02	45*	—	20	Line output drive colour tv	TO-126	BU
0.1	BF457	160	160	0.3	6	—	1.0	0.03/0.006	26	—	30	Class A video output	TO-126	BU
	BF458	250	250											
	BF459	300	300											
0.1	BF819	300	250	0.3	2	—	11	0.2/0.02	45*	—	20	Line output drive for colour tv	TO-202	BB
0.1	BF857	160	160	0.3	2	—	1.0	0.03/0.006	26	—	30	Video output class A	TO-202	BB
	BF858	250	250											
	BF859	300	300											
0.5	BUX86	800†	400	1	20	0.4	1.0	0.2/0.02	50*	—	50	SMPS	TO-126	BU
	BUX87	1000†	450											
1	•TIP47	350	250	2	40	—	1.0	1/0.2	30	150	300	Switch	TO-220	BV1
	•TIP48	400	300											
	•TIP49	450	350											
	•TIP50	500	400											
1.5	•PH13002	—	300	3	40	0.7	0.5	0.5/0.1	8	40	500	SMPS	TO-126	BU
	•PH13003	—	400											
2	BUW84	800†	400	3	50	0.4	1.0	1/0.2	50*	—	100	SMPS	SOT-82	AP
	BUW85	1000†	450											
2	BUX84	800†	400	3	40	0.4	1.0	1/0.2	50*	—	100	SMPS	TO-220	BV1
	BUX85	1000†	450											
2.5	BU505	1500†	700	4	75	0.7*	5.0	2/0.9	2.2	—	2A	Line output	TO-220	BV1
2.5	•BU705	1500†	700	4	75	0.9*	5.0	2/0.9	2.2	—	2A	TV horizontal deflection	SOT-93A	AR
3.5	BUX46	850†	400	5	85	0.8	1.5	2.5/0.5	30*	—	500	SMPS	TO-3	BE1
	BUX46A	1000†	450											
4	•D44Q5	300	225	—	31.3	1.7	1.0	2/0.2	20	—	2A		TO-220	BV1
4	•MJE13004	—	300	8	75	0.9	0.5	1/0.2	10	60	1A	SMPS	TO-220	BV1
	•MJE13005	—	400											
4	•BU506	—	700	6	78	0.7*	5.0	3/1.33	—	—	—	TV line output	TO-220	BV1
	•BU706	—	700											
5	BUT11	850†	400	10	100	0.8	1.5	3/0.6	30*	—	300	SMPS	TO-220	BV1
	BUT11A	1000†	450											
5	BUW11	850†	400	10	100	0.8	1.5	3/0.6	30*	—	300	SMPS	SOT-93	AR
	BUW11A	1000†	450											
5	BUS11	850†	400	10	100	0.8	1.5	3/0.6	30*	—	500	SMPS	TO-3	BE1
	BUS11A	1000†	450											
5	•BUP21	—	300	10	100	0.25*	1.5	3/0.3	25*	—	0.5	SMPS	SOT-93	AR
	•BUP21A	—	350											
	•BUP21B	—	400											
	•BUP21C	—	450											
5	•BUS21	—	300	10	100	0.25*	1.5	3/0.3	25*	—	0.5	SMPS	TO-3	BE1
	•BUS21A	—	350											
	•BUS21B	—	400											
	•BUS21C	—	450											
5	•BUT21	—	300	10	100	0.25*	1.5	3/0.3	25*	—	0.5	SMPS	TO-220	BV1
	•BUT21A	—	350											
	•BUT21B	—	400											
	•BUT21C	—	450											

*Typical $1V_{CESM}$ max. † V_{CEX} max. ** V_{CEM} max., $R = 2.7k\Omega$ ††Under resistive conditions

Transistors

n-p-n high-voltage power transistors book 1 part 1e (cont.)

I _{C(AV)} max. (A)	Type No.	Maximum Ratings			P _{tot} T _{mb} = 25°C (W)	Characteristics					Comments	Outline	Dwg. ref.			
		V _{CB0} (V)	V _{CEO} (V)	I _{CM} (A)		t _r ^{††} max. (μs)	V _{CE(sat)} max. (V)	at I _C /I _B (A)	min.	h _{FE} max.				at I _C (mA)		
6	BU426	800†	375	10	70	0.3 *	1.5	2.5/0.5	30*	60	600	SMPS	SOT-93	AR		
	BU426A	900†	400			0.3 *				60						
	BU433	800†	375			0.45*				80						
6	BUV46	850±	400	8	85	0.8	1.5	2.5/0.5	—	—	—	SMPS	TO-220	BV1		
	BUV46A	1000±	450													
6	BUV82	850†	400	10	70	0.3 *	1.5	2.5/0.5	35*	—	600	SMPS	SOT-93	AR		
	BUV83	1000†	450													
6	BUX82	800†	400	8	60	0.3 *	1.5	2.5/0.5	30*	—	600	SMPS	TO-3	BE1		
	BUX83	1000†	450													
6	BUY89	1500†	800	10	80	0.5*	1.0	4.5/2	2.5	—	4.5A	For use in 3-phase a.c. motor control systems	TO-3	BE1		
7	BU406	400	200	15	60	0.75	1.0	5/0.5	—	—	—	Switch	TO-220	BV1		
	BU407	330	150													
8	•MJE13006	—	300	16	80	0.7	1.0	2/0.4	8	40	2	SMPS	TO-220	BV1		
	•MJE13007	—	400													
8	BUW12	850†	400	20	125	0.8	1.5	6/1.2	30*	—	1	SMPS	SOT-93	AR		
	BUW12A	1000†	450													
8	BUS12	850†	400	20	125	0.8	1.5	6/1.2	30*	—	1	SMPS	TO-3	BE1		
	BUS12A	1000†	450													
8	•BUP22	500†	300	20	125	0.25*	1.5	6/0.6	25*	—	1	SMPS	SOT-93	AR		
	•BUP22A	650†	350												0.25*	6/0.67
	•BUP22B	750†	400												0.3 *	6/0.8
	•BUP22C	850†	450												0.3 *	6/1
	•BUS22	550†	300												0.25*	6/0.6
8	•BUS22A	650†	350	20	125	0.25*	1.5	6/0.6	18*	—	1	SMPS	TO-3	BE1		
	•BUS22B	750†	400												0.25*	6/0.67
	•BUS22C	850†	450												0.3 *	6/0.8
	•BUS22C	850†	450												0.3 *	6/1
	•BUS22C	850†	450												0.3 *	6/1
8	BU508A	1500†	700	15	125	0.7 *	1.0	4.5/2	—	—	—	TV line output	SOT-93A	AR		
8	BUV89	1200†	800	15	125	0.5 *	1.0	4.5/2	2.5	—	4.5	A.C. motor control	SOT-93A	AR		
9	BUV47	850±	400	15	120	0.8	1.5	5/1	—	—	—	SMPS	SOT-93A	AR		
	BUV47A	1000±	450													
9	BUX47	850†	400	15	125	0.8	1.5	6/1.2	30*	—	1	SMPS	TO-3	BE1		
	BUX47A	1000†	450													
10	BUW87	300	150	15	62.5	0.3	1.0	7/0.7	20	—	4	SMPS	TO-3	BE1		
	BUW87A	400	200												1.0	5/0.5
10	BUX80	800†	400	15	100	0.3 *	1.5	5/1	30*	—	1.2	SMPS	TO-3	BE1		
	BUX81	1000†	450													
10	BUV28	400†	200	15	65	0.25	1.5	6/0.6	—	—	—	SMPS	TO-220	BV1		
	BUV28A	450†	225												1.5	4/0.4
10	•MJ8504	—	700	15	175	2	2.0	5/2	7.5	—	1.5	SMPS	TO-3	BE1		
	•MJ8505	—	800													
12	BUV27	240±	120	20	65	0.4	1.5	8/0.8	—	—	—	SMPS	TO-220	BV1		
	BUV27A	300†	150												1.0	7/0.7
12	BUX88	1200†	800	20	160	0.5 *	1.0	9/4	—	—	—	A.C. motor control	TO-3	BE1		
12	•MJE13008	—	300	24	100	0.7	1.0	5/1	8	40	5	SMPS	TO-220	BV1		
	•MJE13009	—	400													
14	BUV26	180†	90	25	65	0.25	1.5	12/1.2	—	—	—	SMPS	TO-220	BV1		
	BUV26A	200†	100												1.0	10/1
15	BUW13	850†	400	30	175	0.8	1.5	10/2	30*	—	1	SMPS	SOT-93	AR		
	BUW13A	1000†	450												1.5	8/1.6
15	BUS13	850†	400	30	175	0.8	1.5	10/2	30*	—	1	SMPS	TO-3	BE1		
	BUS13A	1000†	450												1.5	8/1.6
15	•BUP23	—	300	30	175	0.27*	1.5	10/1	25*	—	1.5	SMPS	SOT-93	AR		
	•BUP23A	—	350												10/1.11	
	•BUP23B	—	400												10/1.33	
	•BUP23C	—	450												10/1.67	

*Typical †V_{CE(sat)}max. ‡V_{CE(sat)}max. **V_{CE(sat)}max., R = 2.7kΩ ††Under resistive conditions

Transistors

book 1 part 1e n-p-n high-voltage power transistors (cont.)

$I_{C(AV)}$ max. (A)	Type No.	Maximum Ratings			P_{tot} $T_{mb}=25^{\circ}C$ (W)	Characteristics				Comments	Outline	Dwg. ref.		
		V_{CBO} (V)	V_{CEO} (V)	I_{CM} (A)		$t_r^{\dagger\dagger}$ max. (μs)	$V_{CE(sat)}$ max. (V)	at I_C/I_B (A)	min.				h_{FE} max.	at I_C (mA)
15	•BUS23	—	300	30	175	0.27*	1.5	10/1	25*	—	1.5	SMPS	TO-3	BE1
	•BUS23A	—	350					10/1.11						
	•BUS23B	—	400					10/1.33						
	•BUS23C	—	450					10/1.67						
15	•2N6678	650	400	30	175	0.5	1.5	15/3	8	—	15	SMPS	TO-3	BE1
15	BUV25	500	500	30	250	1.6	1.0	8/1.6	15	60	4	SMPS	TO-3	BE1
15	BUX48	850†	400	30	150	0.8	1.5	10/2	—	—	—	SMPS	SOT-93A	AR
	BUX48A	1000†	450					1.5						
15	BUX48	850†	400	30	175	0.8	1.5	10/2	30*	—	1	SMPS	TO-3	BE1
	BUX48A	1000†	450					1.5						
30	BUX24	500	400	50	250	1.4	1.5	20/4	15	60	6	SMPS	TO-3	BE1
	BUS14	850†	400					1.5						
30	BUS14	1000†	450	50	250	0.8	1.5	20/4	30*	—	5	SMPS	TO-3	BE1
	BUS14A	—	450					1.5						
30	•BUS24	—	300	50	250	0.27*	1.5	20/2	25*	—	3	SMPS	TO-3	BE1
	•BUS24A	—	350					20/2.22						
	•BUS24B	—	400					20/2.66						
	•BUS24C	—	450					20/3.34						
30	BUX98	850†	400	60	250	0.8	1.5	20/4	30*	—	5	SMPS	TO-3	BE1
	BUX98A	1000†	450					1.5						

*Typical † $V_{CESMmax.}$ ‡ $V_{CEXmax.}$ ** $V_{CERmax.}$, $R = 2.7k\Omega$ ††Under resistive conditions

Transistors

p-n-p high-voltage power transistors book 1 part 1e

I _{C(AV)} max. (A)	Type No.	Maximum Ratings				Characteristics				h _{FE} min.	h _{FE} max.	at I _C (mA)	Comments	Outline	Dwg. ref.
		V _{CEO} (V)	V _{CE0} (V)	I _{CM} (A)	P _{tot} at 25°C (W)	t _r max. (μs)	V _{CE(sat)} max. (V)	at I _C /I _B (A)							
0.05	BF470	-250	-250	0.1	1.8	—	—	—	50	—	25	Video output, class AB or B	TO-126	BU	
	BF472	-300	-300**												
0.05	BF870	-250	-250	0.1	1.6	—	—	—	50	—	25	Video output class AB or B	TO-202	BB	
	BF872	-300	-300**												
0.75	•BU724	—	-375	—	25	—	5	0.4/0.001	1000*	—	200		SOT-82	AP	
	•BU724A	—	-400												

* Typical **V_{CE0} max., R = 2.7 kΩ

Transistors

book 1 parts 1a and 1b

low-voltage darlingtontons

P _{tot} max. (T _{mb} ≤ 25°C)	Type No.		Outline Dwg. ref.		Maximum Ratings				Characteristics				Special Features			
	N-P-N	P-N-P			V _{CBO} (V)	V _{CEO} V _{CER} (V)	I _{CM} (A)	I _{C(AV)} (A)	h _{FE} min.	at I _C (A)	V _{CE(sat)} max. (V)	I _C (A)	I _B (mA)	t _{on} typ. (μs)	t _{off} typ. (μs)	at I _C (A)
800mW†	BSR50	BSR60	TO-92	BR5	60	45	2	1	2000	0.5	1.3	0.5	0.5	BSR50,1,2		
					-60	-45								0.4	<1.5	0.5
	BSR51	BSR61			80	60								BSR,60,1,2		
	BSR52	BSR62			-80	-60			100	80	<1	<1.5	0.5			
					-100	-80										
800mW†	BSS50	BSS60	TO-39	BL3	60	45	2	1	2000	0.5	1.6	1	4.0	0.4	1.5	0.5
					-60	-45								4.0		
	BSS51	BSS61			80	60								1.0		
	BSS52	BSS62			-80	-60			100	80	1.0					
					-100	-80					4.0					
5.0W	BDX42	BDX45	TO-126	BU	60	45	2	1	2000	0.5	1.6	1	4.0	0.4	1.5	0.5
					-60	-45								4.0		
	BDX43	BDX46			80	60								1.0		
	BDX44	BDX47			-80	-60			100	80	1.0					
					-100	-80					4.0					
40W	BD675	BD676	TO-126	BU	60	45	6	4	750	1.5	2.5	1.5	6	BD675-683		
					-45	-45								0.8	4.5	1.5
	BD677	BD678			80	60								BD636-684		
					-60	-60								0.3	1.5	1.5
	BD679	BD680			100	80										
					-80	-80										
	BD681	BD682			120	100										
	BD683	BD684			-100	-100										
					140	120										
					-120	-120										
50W	TIP110	TIP115	TO-220	BV1	60	60	6	4	500	2	2.5	2	8	2.6	4.5	2
					-60	-60										
	TIP111	TIP116			80	80										
	TIP112	TIP117			-80	-80			100	100						
					-100	-100										
50W	BDT61	BDT60	TO-220	BV1	60	60	6	4	750	1.5	2.5	1.5	6	BDT60, A, B, C:		
					-60	-60								0.3	1.5	1.5
	BDT61A	BDT60A			80	80								BDT61, A, B, C:		
					-80	-80								0.8	4.5	1.5
	BDT61B	BDT60B			100	100										
	BDT61C	BDT60C			-100	-100										
					120	120										
					-120	-120										
62.5W	BD645	BD646	TO-220	BV1	80	60	12	8	750	3	2.0	3	12	1	5	3
					-60	-60										
	BD647	BD648			100	80										
					-80	-80										
	BD649	BD650			120	100										
	BD651	BD652			-100	-100										
					140	120										
					-120	-120										
62.5W	BDT21		TO-220	BV1	130	130	12	8	500	3	2.0	3	12	1	5	3
65W	TIP120	TIP125	TO-220	BV1	60	60	8	5	1000	3	2.0	3	12	1.5	8.5	3
					-60	-60										
	TIP121	TIP126			80	80										
					-80	-80										
	TIP122	TIP127			100	100										
					-100	-100										
70W	TIP130	TIP135	TO-220	BV1	60	60	12	8	1000	4	2.0	4	16	TIP130, 1, 2		
					-60	-60								1	5	3
	TIP131	TIP136			80	80								TIP135, 6, 7		
					-80	-80								0.5	2.5	3
	TIP132	TIP137			100	100										
					-100	-100										
90W	BDX63	BDX62	TO-3	BE	80	60	12	8	1000	3	2.0	3	12	BDX62, A, B, C:		
					-60	-60								0.5	2.5	3
	BDX63A	BDX62A			100	80								BDX63, A, B, C:		
					-80	-80								0.5	5	3
	BDX63B	BDX62B			120	100										
	BDX63C	BDX62C			-100	-100										
					140	120										
					-120	-120										

†T_{amb} ≤ 25°C

Transistors

low-voltage darlington's (cont.)

book 1 part 1b

P _{tot} max. (T _{mb} ≤ 25°C)	Type No.		Outline Dwg. ref.	Maximum Ratings				Characteristics				Special Features												
	N-P-N	P-N-P		V _{CEBO} V _{CEr} (V)	V _{CEO} (V)	I _{CM} (A)	I _{CAV} min. (A)	h _{FE} I _c	at max. (A)	V _{CE(sat)} I _c (V)	I _B (A)	at typ. (mA)	t _{on} typ. (μs)	t _{off} I _c (μs)	at (A)									
90W	BDT63	BDT62	TO-220 BV1	60	60	15	10	1000	3	2.5	8	80	BDT62, A, B, C: 0.5 2.5	3										
	BDT63A			BDT62A	-60										-60									
	BDT63B	BDT62B		80	80																			
	BDT63C	BDT62C		100	100																			
				-100	-100																			
117W	BDX65	BDX64	TO-3 BE1	60	60	16	12	1000	5	2	5	20	BDX64, A, B, C: 1 2.5	5										
	BDX65A			BDX64A	-60										-60									
	BDX65B	BDX64B		100	100																			
	BDX65C	BDX64C		-80	-80																			
				120	100																			
125W	BDT65	BDT64	TO-220 BV1	60	60	20	12	1000	5	3	10	100	BDT64, A, B, C: 0.5 2.5	5										
BDT65A	BDT64A			-60	-60																			
BDT65B	BDT64B	80		80																				
BDT65C	BDT64C	-80		-80																				
		100		100																				
125W	TIP140	TIP145	SOT-93 AR	60	60	15	10	1000	5	2.0	5	10	0.9 11 10	10										
TIP141	TIP146			-60	-60																			
TIP142	TIP147	80		80																				
125W	BDV65	BDV64		SOT-93 AR	60										60	20	12	1000	5	2	5	20	BDV64, A, B, C: 0.5 2	5
	BDV65A				BDV64A										-60									
	BDV65B	BDV64B	80		80																			
	BDV65C	BDV64C	-80		-80																			
			100		100																			
150W	BDX67	BDX66	TO-3 BE	80	60	20	16	1000	10	2	10	40	1 3.5 10	10										
BDX67A	BDX66A			-60	-60																			
BDX67B	BDX66B	100		80																				
BDX67C	BDX66C	-80		-80																				
		120		100																				
200W	BDV67A	BDV66A	SOT-93 AR	100	80	20	16	1000	10	2	10	40	1 3.5 10	10										
BDV67B	BDV66B			-100	-80																			
BDV67C	BDV66C	120		100																				
BDV67D	BDV66D	-120		-100																				
		140		120																				
200W	BDX69	BDX68	TO-3 BE	80	60	40	25	1000	20	2	20	80	1 3.5 20	20										
BDX69A	BDX68A			-60	-60																			
BDX69B	BDX68B	100		80																				
BDX69C	BDX68C	-80		-80																				
		120		100																				
			-100	-100																				
			140	120																				
			-120	-120																				

high-voltage darlington's

book 1 part 1e

60W	BU806	TO-220 BV1	400	200	15	8	—	—	1.5	5	50	0.35	0.2	5
	BU807		330	150										
125W	BU826	SOT-93 AR	800†	375	8	6	—	—	2	2.5	55	<1.3	0.2	2.5
	BU826A		900†	400										
125W	BUV90	SOT-93 AR	650†	400	30	12	—	—	1.5	5	50	—	—	—
	• BUV90A		650†	400										

†V_{CESM}

V_{DS} max. (V)	Type No.	$R_{DS(on)}$ max. (Ω)	P_{tot} max. $T_{m=25^{\circ}C}$ (W)	I_D max. (A)	I_{DM} max. (A)	g_{fs} typ. (A/V)	t_r typ. (ns)	Outline	Dwg. Ref.
50	BUZ71A	0.12	40	12	36	4.8	150	TO-220	BV6
	BUZ10A	0.12	75	12	36	4.8	60	TO-220	BV6
	BUZ71	0.1	40	12	36	4.8	150	TO-220	BV6
	BUZ10	0.1	75	12	36	4.8	60	TO-220	BV6
	BUZ11A	0.06	75	25	75	8	450	TO-220	BV6
	BUZ11	0.04	75	30	90	8	450	TO-220	BV6
	BUZ14	0.04	125	39	115	12	200	TO-3	BE3
BUZ15	0.03	125	45	135	12	200	TO-3	BE3	
100	BUZ72A	0.25	40	9	27	3.8	150	TO-220	BV6
	BUZ72	0.2	40	10	30	3.8	150	TO-220	BV6
	BUZ20	0.2	75	12	36	4	60	TO-220	BV6
	BUZ23	0.2	78	10	30	4	60	TO-3	BE2
	BUZ21	0.1	75	18	54	6	60	TO-220	BV6
	BUZ25	0.1	78	19	57	8	320	TO-3	BE3
	BUZ24	0.06	125	32	95	10	200	TO-3	BE3
200	BUZ73A	0.6	40	5.8	17	3.5	130	TO-220	BV6
	BUZ32	0.4	75	9.5	28	5	60	TO-220	BV6
	BUZ35	0.4	78	9.9	29	5	60	TO-3	BE2
	BUZ31	0.2	75	12.5	37	5	60	TO-220	BV6
	BUZ34	0.2	125	17	50	5	200	TO-3	BE3
	BUZ36	0.12	125	22	65	13	200	TO-3	BE3
400	BUZ76A	2.5	40	2.6	7.5	2.5	100	TO-220	BV6
	BUZ76	1.8	40	3	9	2.5	100	TO-220	BV6
	BUZ60	1.0	75	5.5	16	2.5	100	TO-220	BV6
	BUZ63	1.0	78	5.9	17	2.5	100	TO-3	BE2
	BUZ64	0.4	125	10.5	31	4.5	100	TO-3	BE2
500	BUZ74A	4.0	40	2	6	2.5	100	TO-220	BV6
	BUZ74	3.0	40	2.4	7	2.5	100	TO-220	BV6
	BUZ42	2.0	75	4	12	2.5	100	TO-220	BV6
	BUZ46	2.0	78	4.2	12	2.5	100	TO-3	BE2
	BUZ41A	1.5	75	4.5	13	2.5	100	TO-220	BV6
	BUZ44A	1.5	78	4.8	14	2.5	100	TO-3	BE2
	BUZ45A	0.8	125	8.3	24	5	100	TO-3	BE2
	BUZ45	0.6	125	9.6	28	5	100	TO-3	BE2
	BUZ45B	0.5	125	10	30	5	100	TO-3	BE2
800	BUZ80	4.0	75	2.6	7.5	1.8	100	TO-220	BV6
	BUZ83	4.0	78	2.9	8.5	1.8	100	TO-3	BE2
	BUZ80A	3.0	75	3	9	1.8	100	TO-220	BV6
	BUZ83A	3.0	78	3.4	10	1.8	100	TO-3	BE2
	BUZ84	2.0	125	5.3	15	3.0	100	TO-3	BE2
	BUZ84A	1.5	125	6	18	3.0	100	TO-3	BE2
1000	BUZ50B	8.0	75	2	6	1.5	100	TO-220	BV6
	BUZ50A	5.0	75	2.5	7.5	1.5	100	TO-220	BV6
	BUZ53A	5.0	78	2.6	7.5	1.5	100	TO-3	BE2
	BUZ54A	2.6	125	4.6	13	2.0	100	TO-3	BE2
	BUZ54	2.0	125	5.3	15	2.0	100	TO-3	BE2

All types: $\pm V_{GSmax} = 20V$

Transistors

silicon r.f. amplifier low-power transistors

book 1 part 1a

I _{C(AV)} max (mA)	Type No.	Maximum Ratings				Characteristics		at I _C (mA)	f _T min. (MHz)	Comments	Outline	Dwg. ref.
		V _{CB0} (V)	V _{CEO} (V)	I _{CM} (mA)	P _{tot} at 25°C (mW)	min.	h _{FE} max.					
N-P-N TYPES												
20	BF496	30	20	20	300	40*	—	2	550*	Typ. G _{UM} at 200MHz = 27dB	TO-92	BR1
25	•BF240	40	40	—	250	67	222	1	380*	C _{re} < 0.34pF at 1 MHz	TO-92	BR2
	•BF241					36	125	1	350*			
25	BF198	40	30	25	500	22	—	6	400*	C _{re} = 0.2pF at 10.7 MHz C _{re} = 0.3pF at 10.7MHz	TO-92	BR2
	BF199	40	25	—	—	38	—	7	550*			
30	BF494	30	20	30	300	115*	—	1	260*	C _{re} = 0.85pF at 0.45MHz	TO-92	BR2
	BF495					67*	—	1	200*			
P-N-P TYPES												
20	•5BF967	-30	-30	—	160	15	60*	3	700	Typ. G _T at 800MHz = 13dB	SOT-37	AE1
25	BF324	-30	-30	—	250	25	—	4	450*	N = 3dB typ. at f = 100MHz	TO-92	BR1
25	BF450	-40	-40	—	250	60	—	1	325*		TO-92	BR2
	BF451					30	—	1				
25	•BF926	-30	-20	—	250	30	—	1	400	Typ. G _{Tr} at 200MHz = 17.5dB	TO-92	BR2
25	•BF936	-30	-20	—	250	25	—	1	350*	Typ. G _{Tr} at 200MHz = 17.5 dB	TO-92	BR2
30 pk	•BF979	-20	-20	30	140	20	—	10	1350	Typ. G _{Tr} at 800MHz = 16dB	SOT-37	AE1
30	•BF970	-40	-35	—	160	25	50*	3	750	Typ. G _{Tr} at 200MHz = 14.5 dB	SOT-37	AE1

*Typical §Also available to CECC 50 000

$I_{C(AV)}$ max (mA)	Type No.	Maximum Ratings				Characteristics		at I_C (mA)	f_T min. (GHz)	Comments	Outline	Dwg. ref.
		V_{CB0} (V)	V_{CE0} (V)	I_{CM} (mA)	P_{TOT} at 25°C (mW)	min.	max					
2.5	BFT24	8	5	5	30	20	—	1	1.2	Typ. $G_{UM} = 17\text{dB}$ at 500MHz	SOT-37	AE2
20	BFQ33	9	7	—	140	25	—	14	12*	Typ. $G_{UM} = 17\text{dB}$ at 500MHz	SOT-100	AS
25	BFQ53	20	15	35	150	25	—	14	5	BFR90 in TO-72	TO-72	BQ2
25	BFG90A	20	15	—	180	40	—	14	5*	Typ. $G_{UM} = 18\text{dB}$ at 800MHz	SOT-103	AT2
25	BFR49	20	15	—	180	25	—	14	5*	Typ. $G_{UM} = 6.5\text{dB}$ at 4GHz	SOT-100	AS
25	BFR90 BR90A	20	15	—	180	25	50*	14	5*	$N = 2.4\text{dB}$ typ. at 500MHz Low-noise BFR90	SOT-37	AE2
25	BFW92A	25	15	50	200	20	150	2	2.8*	$V_O = 150\text{mV}$ at $d_{im} = -60\text{dB}$	SOT-37	AE2
25	BFX89	30	15	50	200	25	150	2	1.1*	$N = 7\text{dB}$ at 800MHz	TO-72	BQ2
25	BFY90	30	15	50	200	25	150	2	1	$N < 3.5\text{dB}$ at 200MHz	TO-72	BQ2
25	BF689K	25	15	50	360	35	70	20	1.8*	Typ. $G_p = 16\text{dB}$ at 200MHz	TO-92	BR1
30	BFP90A	20	15	—	250	40	—	14	5*	Typ. $G_{UM} = 19\text{dB}$ at 800MHz	SOT-173	DE
35	BFQ22 BFQ22S	15	12	50	150	25	—	30	5*	BFR91 in TO-72	TO-72	BQ2
35	BFR91 BFR91A	15	12	—	180 300	25 40	50* 90*	30	5* 6*	$N = 1.9\text{dB}$ typ. at 500MHz $N = 1.6\text{dB}$ typ. at 800MHz	SOT-37	AE2
35	BFG91A	15	12	—	300	40	—	30	6*	Typ. $G_{UM} = 17\text{dB}$ at 800MHz	SOT-103	AT2
50	2N918	30	15	—	200	20	—	3	9*	$G_p > 15\text{dB}$ at 200MHz	TO-72	BQ2
50	BFW30	20	10	100	250	25	—	50	1.6*	$N < 5.0\text{dB}$ at 500MHz	TO-72	BQ2
50	•BFG65	20	10	—	300	25	100*	15	7.5*	Typ. $G_{UM} = 11.5\text{dB}$ at 2GHz	SOT-103	AT2
50	BFQ65	20	10	—	300	60	—	15	7.5*	Typ. $G_{UM} = 8\text{dB}$ at 2GHz	SOT-37	AE2
50	BFP91A	15	12	—	350	40	—	30	6 *	Typ. $G_{UM} = 18\text{dB}$ at 800MHz	SOT-173	DE
50	BFQ66	20	10	—	350	60	—	15	7.5*	Typ. $G_{UM} = 12.5\text{dB}$ at 2GHz	SOT-173	DE
75	•BFQ63	20	15	150	250	50	150	20	4.5*	Typ. $G_{UM} = 11.5\text{dB}$ at 500MHz	TO-72	BQ2
75	BFR96	20	15	150	500	25	—	50	4	$V_O = 0.5\text{V}$ at $d_{im} = -60\text{dB}$	SOT-37	AE2
100	BFR96S	—	—	—	700	100	—	70	5*	$V_O = 0.7\text{V}$ at $d_{im} = -60\text{dB}$		
100	BFP96	20	15	—	500	25	—	50	4.5*	Typ. $G_{UM} = 15\text{dB}$ at 800MHz	SOT-173	DE
150	BFG96	20	15	—	500	25	—	50	5*	Typ. $G_{UM} = 14\text{dB}$ at 800MHz	SOT-103	AT2
150	•BFG34	25	18	—	1W	25	—	100	3.7*	Typ. $G_{UM} = 14\text{dB}$ at 800MHz	SOT-103	AT2
150	BFQ34T	25	18	—	1W	25	—	100	3.7*	$V_O = 1\text{V}$ at $d_{im} = -60\text{dB}$	SOT-37	AE2
150	•BFR95	30	25	300	1.5W	30	—	150	3.5*	Typ. $G_p = 9\text{dB}$, 40-300MHz	TO-39	BL3
150	BFW16A	40	25	300	1.5W	25	—	150	1.2*	Typ. $G_p = 6.5\text{dB}$ at 800MHz	TO-39	BL3
150	BFW17A	40	25	300	1.5W	25	—	150	1.1*	Typ. $G_p = 16\text{dB}$ at 200MHz	TO-39	BL3
150	BFQ34	25	18	—	2.2W	25	—	75	3	$V_O = 1.2\text{V}$ at $d_{im} = -60\text{dB}$	SOT-122	AZ
200	•BFR64	40	25	500	3.5W	25	—	150	1.2*	Typ. $G_p = 16\text{dB}$ at 200MHz	SOT-48	AG
300	BFQ68	25	18	—	4.5W	25	—	240	4*	$V_O = 1.6\text{V}$ at $d_{im} = -60\text{dB}$	SOT-122	AZ
400	•BFR65	40	25	1A	5W	30	—	200	1.2*	Typ. $G_p = 19\text{dB}$ at 200MHz	SOT-48	AG

*Typical

Transistors

p-n-p broadband transistors

book 1 part 2a

I _{C(AV)} max (mA)	Type No.	Maximum Ratings				Characteristics		I _c (mA)	f _T min. (MHz)	Comments	Outline	Dwg. ref.
		V _{CB0} (V)	V _{CE0} (V)	I _{CM} (mA)	P _{TOT} at 25°C (mW)	min.	h _{FE} max					
25	BFQ51	-20	-15	35	180	20	—	14	5*	P-N-P equivalent of BFR90	SOT-37	AE2
	BFQ52				150						TO-72	BQ2
35	BFQ23	-15	-12	50	180	20	—	30	5*	N = 2.4dB typ. at 500MHz	SOT-37	AE2
	BFQ24				150						TO-72	BQ2
75	BFQ32	-20	-15	150	500	20	—	50	3.6	d _m = -60dB typ. at V _o = 0.5V, 500MHz	SOT-37	AE2

*Typical

catv modules

Outline: SOT-115, Drawing reference: CZ**

Type No.	f (MHz)	G _p at f = 50MHz (dB)	V _o min. (dBmV)	N max. (dB)	Typ. d.c. current consumption † (mA)
BGY50	40-330	12.5	61	7	160
BGY51			63.5	8	200
BGY52	40-330	16.4	61	6	160
BGY53			61	7	200
BGY54	40-330	17	61	6	160
BGY55			63.5	6.5	200
BGY56	40-330	22	61.5	6	160
BGY57			64	7	200
BGY58	40-330	33	64	6	320
BGY58A		34			
BGY59	40-330	38.5	64	6	320
BGY60	40-330	33.3	64	6	320
BGY61	5-200	13	64	7*	200
BGY65	5-200	18.5	65	6*	200
BGY67	5-200	22.5	64	5*	200
BGY70	40-450	12.5	61	7.5	160
BGY71			63.5	8.5	200
BGY74	40-450	17	61	7	160
BGY75			63.5	7.5	200
BGY78	40-450	34	47	6	320
•BGY84	40-450	17	60	6.5	180
•BGY84A		18.4			
•BGY85	40-450	17	62.5	7	220
•BGY85A		18.4			
•BGD102	40-450	18.5	65.5	7	415
•BGD104		20	65		

*Typical †At supply voltage = +24V **BGY60: pin 4 = output pre-stage, pin 6 = input final stage

Transistors

r.f. power transistors and modules book 1 parts 2a and 2b selection guide

P _o (W)	H.F.-S.S.B. (1.6-30MHz)	V.H.F. mobile (30-175MHz)	F.M. broadcast (87-108MHz)	Band III transposer (175-225MHz)	U.H.F. mobile (225-512MHz)	Band IV/V transposer (470-860MHz)	U.H.F. mobile (790-960MHz)
0.5				BGY55*		BLW32	BLU98
1	BLY87, BLV10 BLY91, BLV20	2N3866, 2N4427	2N3866	BLV30	2N3866	BLW33 BLW34	BLV90
2		BGY93*, BFQ42 ●BLX65E			BGY46*, 47* ●BLX65E BLW89, BLW79 BLW80, BLW90, BLU99	BLW98, BLX98	BLV91, ●BLV99
4		BFS22A, 23A BFQ43, BGY94*	BLW90	BLV31	●BLU97, BGY40,*		BLV92, BLU99
8		BLY91, BLV20 BLY87, BLV10				BLV57	BLV93
10	BLY88, BLV11 BLY92			BLV32F	BLW81, BLW91		
13		BGY43*			BGY41*		●BLV94
14							●BLV98
15	BLY89, BLW87	BLY88, BLV11, BLY92, BLV21	BLV21				
18		BGY32, 35, 36*	BGY33*	BLV33F			
20					BLU20/12		
21				BLV33			
25		BLY89, BLY93 BLW84, BLW87					●BLV95
30	BLX13, BLW83 BLW85, BLW60	●BLU50 BGY45*, BLV30/12			●BLU50 BLU30/12 BLU45/12	BLV59	BLV97
45	BLX39, BLW86	BLX39, BLW86, BLW60, BLW85, ●BLU51, BLV45/12	BLX39, BLW86		●BLU51		●BLV96
50	BLX14	BLY90, BLY94					
65	BLW50F				BLU60/12 BLU52		
80	BLW76; BLW99	BLV75/12 BLV80/28	BLV80/28, BLW76 BLW78				
100					BLU53		
130	BLW77	BLW77					
150	BLX15	BLV25, BLX15,	BLV25				
160	BLW95	BLW95					
180	BLW97	BLW97					
200	BLW96	BLW96					
250			●BLV37				

*Modules

Transistors

tv transposer transistors

book 1 part 2b

Type No.	Outline	Dwg. Ref.	Maximum Ratings				P _{tot} at 25°C (W)	Characteristics			f _r min. (GHz)	Special Features
			V _{CB0} (V)	V _{CE0} (V)	I _{CM} (A)	I _{C(AV)} (A)		min.	h _{FE}	max.		
N-P-N TYPES												
BLV30	SOT-122	AZ	60	30	3.5	1.5	32.5	15	120	500	1.2*	P _{O sync} = 1.7W at 224MHz = 7W
BLV31					6	3	48			800	1.1*	
BLV32F	SOT-160	AN	60	32	12	4	82	20	120	1.6A	2*	d _{im} = -55dB typ. at P _{O sync} > 10W, 224MHz
BLV33	SOT-147	CC	65	33	20	12.5	132	15	100	3A	0.75*	P _{O sync} > 19W, 224MHz > 16W
BLV33F	SOT-119	AW					133					
BLV36	SOT-161	CY	65	33	20	10	285	15	100	4A	0.75*	P _{O sync} > 120W at 224MHz for 1dB gain compression
BLV57	SOT-161		50	27	4	2	77	15	-	850	2.5*	d _{im} = -60dB typ. at P _{O sync} > 6W, 860MHz
BLV59	SOT-171	DC	50	27	-	3	90	15	-	2.5A	-	G _p > 60dB at 900MHz
BLW32	SOT-122	AZ	50	30	1	0.65	10.8	20	-	150	3.5	P _{O sync} = 0.63W at 860MHz = 1.15W = 2.15W
BLW33					1.9	1.25	19.3			300	3.4	
BLW34					3.5	2.25	31			600	3.3	
BLW98	SOT-122	AZ	50	27	4	2	21.5	15	-	850	2.5*	d _{im} = -60dB typ. at P _{O sync} > 3.5W, 860MHz
BLX98	SOT-48/2	AF	50	27	4	2	21.5	15	-	1A	2.5*	d _{im} = -60dB typ. at P _{O sync} > 3.5W, 860MHz

*Typical

Type No.	Description	Drawing reference	Frequency Range (MHz)	Supply voltage		Min. Power Output (W)	at P_{DR} (mW)	Efficiency typ. (%)
				V_{S1} (V)	V_{S2} (V)			
BGY22	U.H.F. amplifier modules	BX	380-512	13.5		2.5	50	50
BGY23	designed for mobile		380-512	13.5		7	2.5W	70
BGY22A	communications		420-480	12.5		2.5	50	50
BGY23A	equipment		420-480	12.5		7	2.5W	70
BGY32	V.H.F. amplifier modules	BY	68-88	12.5	12.5	18	100	>40
BGY33	designed for mobile		80-108				100	
BGY35	communications		132-156				150	
BGY36	equipment		148-174				150	
BGY40A	U.H.F. amplifier modules	BY	400-440	12.5	12.5	7.5	100	>35
BGY41A	designed for mobile		400-440			13	150	
BGY40B	communications		440-470			7.5	100	
BGY41B	equipment		440-470			13	150	
BGY43	V.H.F. amplifier module designed for mobile communications equipment	BY	148-174	12.5	12.5	13	80	48
BGY45A	V.H.F. amplifier modules	DG	68-88	12.5	12.5	30	<150	>40
BGY45B	designed for mobile communications equipment		148-174	12.5	12.5	30	<300	>40
BGY46A	U.H.F. amplifier modules	DH	400-440	7.5	9.6	1.4	<45	>40
BGY46B	designed for portable		430-470	7.5	9.6	1.4	<45	>40
BGY47A	equipment		400-440	7.5	7.5	2.0	<50	>40
BGY47C			460-512	9.6	9.6	2.0	<50	>40
BGY47D			370-420	7.5	9.6	3.2	<50	>36
BGY47E			410-470	7.5	9.6	3.2	<50	>36
BGY47F			460-512	7.5	9.6	3.2	<50	>36
BGY93A	V.H.F. amplifier modules	DF	68-88	9.6	9.6	2.0	<35	>40
BGY93B	designed for portable		136-156	9.6	9.6	2.0	<35	>40
BGY93C	equipment		148-174	9.6	9.6	2.0	<35	>40
BGY94A			68-88	9.6	9.6	6.0	<35	>40
BGY94B			136-156	9.6	9.6	6.0	<35	>40
BGY94C			144-175	9.6	9.6	6.0	<35	>40

Transistors

n-p-n r.f power transistors

book 1 part 2b

P _O (W)	Type No.	Outline	Dwg. ref.	Maximum Ratings			Characteristics			G _p (dB)	at f (MHz)	at V _{CC} (V)				
				V _{CE0} (V)	V _{CEO} (V)	I _{CAV} (A)	min.	h _{FE} max.	at I _c (A)				f _r typ. (MHz)			
H.F. TYPES																
25	BLX13 BLX13C	SOT-56 SOT-120	AM AX	65	36	3	10	100	1	500	\$>18	28	28			
30	BLW83	SOT-123	BA	65	36	3	10	100	1	500	\$>18	28	28			
30	BLW60	SOT-56	AM	36	18	8	20	100	1	550	\$ 19.5	28	12.5			
	BLW60C	SOT-120	AX			9	10	80	4	650	\$ 19.5	28	12.5			
	BLW85	SOT-123	BA			9	10	80	4	650	\$ 19.5	28	12.5			
42.5	BLX39	SOT-120	AX	65	36	4	10	80	2.5	570	\$ 19	28	28			
47.5	BLW86	SOT-123	BA	65	36	4	10	80	2.5	570	\$ 19	28	28			
50	BLX14	SOT-55	AL	85	36	4	15	100	1.4	250	\$>13	28	28			
65	BLW50F	SOT-123	BA	110	55	2.5	15	100	1.2	540	\$ 18	28	50			
80	BLW76	SOT-121	AY	70	35	8	15	80	4	315	\$>13	28	28			
80	BLW99	SOT-121	AY	36	17	18	15	80	10	290	\$>12.5	28	12.5			
100	BLW78	SOT-121	AY	70	35	10	20	80	1	370	\$ 19	28	28			
130	BLW77	SOT-121	AY	70	35	12	15	80	7	320	\$>12	28	28			
150	BLX15	SOT-55	AL	110	53	6.5	15	50	1.4	275	\$>14	28	50			
160	BLW95	SOT-121	AY	110	53	8	15	50	4	285	\$>14	28	50			
175	BLW97	SOT-121	AY	65	33	15	15	50	10	235	\$>11.5	28	28			
200	BLW96	SOT-121	AY	110	55	12	15	50	7	245	\$>13.5	28	50			
V.H.F. TYPES																
2	BFO42	TO-39	BL3	36	18	0.6	10	60	0.25	750	>11	175	13.5			
2	BLX65E	TO-39	BL7	36	16	0.7	10	—	0.1	1400	16	175	12.5			
2.5	2N3553	TO-39	BL3	65	40	0.35	10	100	0.25	500	—	175	28			
>3	2N3375	TO-60	BN	65	40	0.5	10	100	0.25	500	—	400	28			
4	BFS23A	TO-39	BL3	65	36	0.5	5	—	0.5	500	>10	175	12.5			
4	BFS22A	TO-39	BL3	36	18	0.75	5	—	0.5	700	8	175	13.5			
4	BFO43	TO-39	BL7	36	18	1.25	10	80	0.5	750	>12	175	13.5			
8	BLY91A	SOT-48/2	AF	65	36	0.75	5	—	0.5	500	>12	175	28			
	BLY91C	SOT-120	AX			0.9										
8	BLV20	SOT-123	BA	65	36	0.9	10	100	0.4	600	>12	175	12.5			
8	BLY87A	SOT-48/2	AF	36	18	1.25	5	—	0.5	700	>9	175	12.5			
	BLY87C	SOT-120	AX			1.5										
8	BLV10	SOT-123	BA	36	18	1.5	10	100	0.75	950	>9	175	13.5			
>13.5	2N3632	TO-60	BN	65	40	1	10	150	0.25	400	—	175	28			
15	BLY92A	SOT-48/2	AF	65	36	1.5	5	—	0.5	500	>10	175	28			
	BLY92C	SOT-120	AX			1.75										
15	BLV21	SOT-123	BA	65	36	1.75	10	100	0.7	650	>10	175	28			
15	BLY88A	SOT-48/2	AF	36	18	2.5	5	—	0.5	700	7.5	175	12.5			
	BLY88C	SOT-120	AX			3										
15	BLW29	SOT-120	AX	36	18	2.75	10	80	1.75	900	>10	175	13.5			
15	BLV11	SOT-123	BA	36	18	3	10	100	1.5	850	>8	175	13.5			
25	BLY93A	SOT-56	AM	65	36	3	10	120	1	500	>9	175	28			
	BLY93C	SOT-120	AX							500						
	BLW84	SOT-123	BA							100				650		
25	BLY89A	SOT-56	AM	36	18	5	10	120	1	650	>6	175	13.5			
	BLY89C	SOT-120	AX			6				80				800		
	BLW87	SOT-123	BA			6				10				800		
28	BLW31	SOT-120	AX	36	18	6	10	80	3.5	850	>9	175	13.5			
30	BLV30/12	SOT-119	AW	36	18	6	10	—	3.5	—	>8.2	175	12.5			
45	BLW86	SOT-123	BA	65	36	4	10	80	2.5	570	8	175	28			
45	BLW60	SOT-56	AM	36	18	8	20	80	1	550	>5.5	175	12.5			
	BLW60C	SOT-120	AX			9				10				80	4	650
	BLW85	SOT-123	BA			9				10				80	4	650
45	BLV45/12	SOT-119	AW	36	18	9	10	—	5	—	>6.5	175	12.5			

*Typical \$s.s.b. operation

P _O (W)	Type No.	Outline	Dwg. ref.	Maximum Ratings			Characteristics		at I _c (A)	f _r typ. (MHz)	G _p (dB)	at f (MHz)	at V _{CC} (V)
				V _{CB0} (V)	V _{CEO} (V)	I _{C(AV)} (A)	min.	h _{FE} max.					
V.H.F TYPES (cont.)													
50	BLV94	SOT-55	AL	65	36	6	10	120	1	500	>7	175	28
50	BLV90	SOT-55	AL	36	18	8	10	50*	1	550	>5	175	12.5
75	BLV75/12	SOT-119	AW	36	18	15	10	—	8	—	>7	175	12.5
80	BLV80/28	SOT-121	AY	65	33	8.5	15	100	3.5	600	>6.5	175	28
175	BLV25	SOT-119	AW	65	33	17.5	15	100	8.5	600	>10	108	28
250	•BLV37	SOT-179	—	75	40	10	15	—	6	—	10.3*	108	35
U.H.F. TYPES													
0.5	BLU98	SOT-103	AT2	36	16	0.15	25	—	0.1	4000	>9	900	12.5
0.6	BLX96	SOT-48	AG	40	27	0.4	30	—	0.2	1500	>6	860	25
1	BLV90	SOT-172	DD	36	16	0.2	25	—	0.15	4800	>7.5	900	12.5
1	2N3866	TO-39	BL3	55	30	0.4	10	200	0.05	700	>10	400	28
1	2N4427	TO-39	BL3	40	20	0.4	10	200	0.1	700	—	175	12
1.1	BLX97	SOT-48	AG	40	27	0.8	30	—	0.4	1500	>5.5	860	25
1.45	BLX91A	SOT-48/3	AG	65	33	0.4	10	—	0.1	1200	12	470	28
—	•BLX91CB†	SOT-48/3	AG	65	33	0.4	10	160	0.1	1000	—	—	—
2	BLW89	SOT-122	AZ	60	30	0.32	10	100	0.15	1200	>12	470	28
2	BLV91	SOT-172	DD	36	16	0.4	25	—	0.3	4000	>6.5	900	12.5
2	•BLV99	SOT-172	DD	50	27	0.2	15	—	0.15	—	10	900	24
2	BLW79	SOT-122	AZ	36	17	0.5	10	—	0.25	1500	>9	470	12.5
2	BLX65	TO-39	BL3	36	18	0.7	10	—	0.1	1400	—	470	13.8
2.5	BLX92A	SOT-48/3	AG	65	33	0.7	10	—	0.1	1200	—	1000	28
3	BLX67	SOT-48/3	AG	36	18	0.7	10	—	0.1	1400	—	470	13.8
4	BLW90	SOT-122	AZ	60	30	0.62	10	100	0.3	1200	>11	470	28
4	BLU99	SOT-122	AZ	36	16	0.8	25	100*	0.6	4000	7	900	12.5
4	BLV92	SOT-171	DC	36	16	0.8	25	—	0.6	—	>8	900	12.5
4	BLW80	SOT-122	AZ	36	17	1	10	—	0.5	1750	>8	470	12.5
5	BLX93A	SOT-48/3	AG	65	33	1	10	—	0.1	1200	—	1000	28
7	•BLU97	SOT-122	AZ	36	16	1.2	25	100*	0.9	4000	>8.5	470	12.5
7.8	BLX68 (BLY53AP)	SOT-48/3	AG	36	18	1	10	—	0.5	1300	>5.9	470	13.8
8	BLV93	SOT-171	DC	36	16	1.6	25	—	1.2	—	>6	900	12.5
10	BLW91	SOT-122	AZ	60	30	1.5	10	100	0.6	1200	>9	470	28
10	BLW81	SOT-122	AZ	36	17	2.5	10	—	1.25	1300	>6	470	12.5
12.5	•BLV94	SOT-171	DC†	36	16	3	15	—	2	—	>6	900	12.5
14	•BLV98	SOT-171	DC†	50	27	1.5	15	—	1	—	>8.5	900	24
20	BLX69A	SOT-48/2	AF	36	18	3.5	10	—	1.0	1000	>4	470	13.5
20	BLU20/12	SOT-119	AW	36	17	4	10	—	2.7	—	>6.5	470	12.5
25	•BLV95	SOT-171	DC†	36	16	5	15	—	3.5	—	>4.5	900	12.5
25	BLX94A	SOT-48/2	AF	65	30	2.5	15	50*	1.5	1100	>6	470	28
25	BLX94C	SOT-122	AZ	65	30	2.5	15	50*	1.5	1100	>6.5	470	28
30	BLV59	SOT-171	DC	50	27	3	15	—	2.5	—	>6	900	24
30	BLV97	SOT-171	DC†	50	27	3	15	—	2.5	—	>6	900	24
30	•BLU50	SOT-161	CY	60	45**	3.6	—	—	—	—	>10	400	28
30	BLU30/12	SOT-119	AW	36	17	6	10	—	4	—	>6	470	12.5
40	•BLV96	SOT-171	DC†	36	16	8	15	—	6	—	>4.5	900	12.5
40	BLX95	SOT-56	AM	65	30	3	25	100	1.0	900	>4.5	470	28
45	•BLU51	SOT-161	CY	60	45**	5	—	—	—	—	>9	400	28
45	BLU45/12	SOT-119	AW	36	17	9	10	—	8	—	>5.1	470	12.5
60	BLU60/12	SOT-119	AW	36	17	12	10	—	8	—	>4.8	470	12.5
>60	BLU52	SOT-161	CY	60	45*	8	—	—	—	—	>8	400	28
>100	BLU53	SOT-161	CY	—	30	5	—	—	—	—	>7	400	28

*Typical †Wide-band video **V_{CEr} max ‡Pin connections: b,c,b,
b,e,b

Transistors

silicon planar n-p-n differential transistors

book 1 part 1a

$I_{C(AV)}$ max. (mA)	Type No.	Maximum Ratings			Characteristics				I_{C1}/I_{C2} ratio at equal V_{BE}	Comments	Outline	Dwg. ref.	
		V_{CBO} (V)	V_{CEO} (V)	P_{tot} at 25°C (mW)	min.	h_{FE} max.	at I_C (mA)	f_T min. (MHz)					min.
30	BCY87 BCY88 BCY89	45	40	150	100	450	0.05	50	0.9	1.11	Matched dual. For differential amplifiers	TO-71	BPI
					120	600	0.5	50	0.8	1.25			
					100	600	10	50	0.67	1.5			

silicon planar p-n-p-n switches

book 1 parts 1a and 4b

I_{ARM} max. (A)	Type No.	Description	V_{GAK} (V)	$V_{GA A}$ (V)	Maximum Ratings				V_A (V)	at I_A (mA)	Outline	Dwg. ref.
					I_A (mA)	T_j (°C)	P_{tot} at 25°C (mW)					
2	BR100/03	Bi-directional trigger device for use in triac and thyristor trigger circuits	—	28 to 36 (V_{BO})	—	100	150	—	—	—	—	O
2.5	BR101	p-n-p-n controlled switch for use as a saw tooth generator in t.v. field timebase applications	50	50	175	150	275	<1.4	50	TO-72	BQ6	
2.5	BRY39	Integrated p-n-p-n transistor pair Applications include controlled switch programmable unijunction transistor and thyristor tetrode	70	70	175	150	275	<1.4	100	TO-72	BQ6	
2.5	BRY56	Trigger device for switching applications such as motor control, oscillators, relay replacements, timers, pulse shapers	70	70	175	150	300	<1.4	100	TO-92	BR4	

junction field-effect transistors (n-channel)

book 1 part 1c

Type No.	Outline	Dwg. ref.	Maximum ratings				Characteristics				Special Features		
			$\pm V_{DS}$ V_{DG} (V)	V_{GS} (V)	I_D (mA)	P_{tot} at 25°C (mW)	$-V_{(P)GS}$ max. (V)	I_{GSS} max. (nA)	min. I_{DSS} (mA)	max. I_{DSS} (mA)		V_{IS} min. (f = 1kHz) (mA/V)	
AMPLIFIERS													
• BC264A • BC264B • BC264C • BC264D	TO-92	BR3	30	-30	10 (I_G)	300	>0.5	10	2 3.5 5 7	4.5 6.5 8 12	2.5 3 3.5 4	For audio frequency use	
BF245A BF245B BF245C	TO-92	BR3	30	-30	25	300	8	5	2 6 12	6.5 15 25	3	N=1.5dB typ. at f=100MHz, $R_G=1k\Omega$	
BF247A BF247B BF247C	TO-92	BR6	25	-25	-	300	14.5	5	30 60 110	80 140 250	8	For amplifiers and general purpose switching	
BF256A BF256B BF256C	TO-92	BR3	30	-30	-	300	-	5	3 6 11	7 13 18	4.5	$G_p=11dB$ typ. at f=800MHz, $R_G=47\Omega$	
BF410A BF410B BF410C BF410D	TO-92	BR3	20	-	30	300	0.8* 1.5* 2.2* 3.0*	10	0.7 2.5 6.0 10	3.0 7.0 12 18	2.5 4.0 6.0 7.0	N=1.5dB typ. at f=100MHz	
BFW10 BFW11 BFW12 BFW13	TO-72	BQ3	30	-30	20 20 10 10	300 300 150 150	8 6 2.5 1.2	0.1	8 4 1 0.2	20 10 5 1.5	3 3 0.5 0.5	Noise voltage <75nV/ \sqrt{Hz} at 10Hz	
BFW61	TO-72	BQ3	25	-25	20	300	8	1	2	20	2		
2N3822	TO-72	BQ3	50	-50	10 (I_G)	300	6	0.1	2	10	3		
2N3823	TO-72	BQ3	30	-30	-	300	8	0.5	4	20	3.5	N<2.5dB at 100MHz	
SWITCHING													
BSV78 BSV79 BSV80	TO-18	BJ2	40	-40	50 (I_G)	350	11 7 5	0.25	50 20 10	- - -	-	RDS(on)<25 Ω <40 Ω <60 Ω	
2N3966	TO-72	BQ3	30	-30	-	300	6	0.1	2	-	-	RDS(on)<220 Ω	
2N4091 2N4092 2N4093	TO-18	BJ2	40	-40	-	1800 (T_{case})	10 7 5	0.2 (I_{SGO})	30 15 8	- - -	-	RDS(on)<30 Ω <50 Ω <80 Ω	
2N4391 2N4392 2N4393	TO-18	BJ2	40	-40	50 (I_G)	1800 (T_{case})	10 5 3	0.1	50 25 5	150 75 30	-	RDS(on)<30 Ω <60 Ω <100 Ω	
2N4856 2N4857 2N4858	TO-18	BJ2	40	-40	50 (I_G)	360	10 6 4	0.25	50 20 8	- 100 80	-	RDS(on)<25 Ω <40 Ω <60 Ω	
2N4859 2N4860 2N4861	TO-18	BJ2	30	-30	50 (I_G)	360	10 6 4	0.25	50 20 8	- 100 80	-	RDS(on)<25 Ω <40 Ω <60 Ω	
MATCHED PAIRS													
BFS21 BFS21A	2XTO-72	BQ3	30	-30	4	30	6	0.5	1	-	-	$V_{G1S1}-V_{G2S2}$ <20mV <10mV	
MONOLITHIC DUAL FIELD-EFFECT TRANSISTORS													
									ΔI_G (pA)	ΔV_{GS} (mV)	$\frac{d\Delta V_{GS}}{dT}$ ($\mu V/^\circ C$)	CMRR (dB)	
BFQ10 BFQ11 BFQ12 BFQ13 BFQ14 BFQ15 BFQ16	TO-71	BP2	30	-30	30	250	3.5	<10	<5 <10 <10 <10 <15 <20 <50	<5 <5 <10 <20 <20 <40 <50	>100 >90 >90 >90 >90 >90 >80	Intended for high-performance low-level differential amplifiers	

*Typical

Transistors

mos field-effect transistors (n-channel)

book 1 part 1c

SINGLE INSULATED-GATE FETs

Type No.	Outline	Dwg. ref.	Maximum Ratings			Characteristics				Special Features	
			V_{DS} (V)	$\pm V_{GS}$ (V)	I_D (mA)	P_{tot} at 25°C (mW)	I_{GSS} max. (nA)	typ. (nA)	I_{DSS} max. (nA)	$RDS_{(on)}$ typ. (Ω)	
Depletion											
BFR29	TO-72	BQ5	—	10	20	200	0.01	>10 (mA)	40	—	For linear applications in the audio as well as the i.f. and v.h.f. frequency region
• BSD10 • BSD12	TO-72	BQ7	10 20	15	50	275	100	1	—	15	For analogue and/or digital switching, converter and chopper applications
BSV81	TO-72	BQ5	—	10	50 (peak)	200	0.01	—	—	50	For switching and particularly for chopper applications
Enhancement											
• BSD212 • BSD213 • BSD214 • BSD215	TO-72	BQ7	10 10 20 20	40 15 40 15	50	275	—	1	—	25	For analogue and/or digital switching, converter and chopper applications

DUAL INSULATED-GATE FETs

Type No.	Outline	Dwg. ref.	Maximum Ratings			Characteristics				Special Features	
			V_{DS} (V)	I_D (mA)	P_{tot} at 25°C (mW)	I_{GSS} (max.) (nA)	min. (mA)	I_{DSS} max. (mA)	$-C_{rss}$ typ. (fF)	$ y_{fs} $ min. (mA/V)	
Depletion											
† BF960	SOT-103	AT1	20	20	225	50	2	20	25	9.5	$N = 2.8\text{dB}$ at $f = 800\text{MHz}$
• BF964	SOT-103	AT1	20	30	225	50	2	20	25	15	$N = 1.5\text{dB}$ at $f = 200\text{MHz}$
• BF966	SOT-103	AT1	20	30	225	50	2	20	25	15	$N = 2.8\text{dB}$ at $f = 800\text{MHz}$
• BF980	SOT-103	AT1	18	30	225	25	—	—	25	17	$N = 2.8\text{dB}$ at $f = 800\text{MHz}$
† BF981	SOT-103	AT1	20	20	225	50	4	25	20	10	$N < 2\text{dB}$ at 200MHz
• † BF982	SOT-103	AT1	20	40	225	25	—	—	30	20	$N = 1.2\text{dB}$ at 200MHz
† BFR84	TO-72	BQ4	20	50	300	10	20	55	30	12	$N < 3\text{dB}$ at 200MHz
† 3N211	TO-72	BQ4	27	50	360	10	6	40	>5	17	$G_{ps} > 24\text{dB}$ at 200MHz

D-MOS ENHANCEMENT FETs

Type No.	Outline	Dwg. ref.	Maximum Ratings				Characteristics				Switching times		
			V_{DS} (V)	V_{GSO} (V)	I_{DM} (A)	I_D (A)	P_{tot} at 25°C (W)	I_{GSS} max. (nA)	I_{DSS} max. (μA)	$RDS_{(on)}$ typ. (Ω)	t_{on} max. (ns)	t_{off} max. (ns)	at I_D (mA)
• BST70A	TO-92	BR10	80	20	1	0.5	1	100	10	2.5	10	15	500
• BST72A	TO-92	BR10	80	20	0.6	0.3	0.83	100	1.0	7	10	10	200
• BST74A	TO-92	BR10	200	20	0.8	0.3	1	100	10	6	10	15	400
• BST76A	TO-92	BR10	180	20	0.8	0.3	1	100	10	7	10	15	400
BST78	TO-126	BU	450	20	1.5	0.75	15	100	25	10	10	100	100

*Typical

†The gates are diode-protected

Surface mounted devices

n-p-n transistors primarily intended for hybrid, thin and thick film circuits

book 1 part 1d

I _{C(AV)} max. (mA)	Type No.	Maximum Ratings			Characteristics						Outline	Dwg. ref.	
		V _{CBO} (V)	V _{CEO} (V)	P _{tot} at 25°C (mW)	h _{FE} min.	h _{FE} max.	f _T min. (MHz)	V _{CE(sat)} max. (V)	I _{C/I_B} at (mA)	Nearest conventional type			
2.5	BFT25	8	5	50	20	40*	1	1200	0.175	1.0/0.1	BFT24	SOT-23	AC7
25	BFR92 BFR92A	20	15	200	25 40	—	14	5.0G*	—	—	BFR90 BFR90	SOT-23	AC7
25	BFS17	25	15	250	25	150	2	1300*	—	—	BFY90	SOT-23	AC7
25	BFS20	30	20	250	40	—	7	275	—	—	BF199	SOT-23	AC7
30	BFS18	30	20	250	35	125	1.0	200*	—	—	BF495	SOT-23	AC7
30	BFS19	30	20	250	65	225	1.0	260*	—	—	BF494	SOT-23	AC7
35	BFR93 BFR93A	15	12	200 250	25 40	—	30	5G*	—	—	BFR91 BFR91	SOT-23	AC7
50	BFR53	18	10	250	25	—	50	2.0G*	—	—	BFW30, BFW93	SOT-23	AC7
50	•BFQ67	20	10	300	60	100*	15	7.5G*	—	—	BFQ66	SOT-23	AC7
50	BF820 BF822	300 250	330† 250	310	50	—	25	60	0.6	30/5	BF420 BF422	SOT-23	AC7
50	BF620 BF622	300 250	300† 250	1W	50	—	25	60	0.6	30/5	BF420 BF422	SOT-89	AQ1
75	BFQ19	20	15	500	25	—	50	5.5G*	—	—	BFY96	SOT-89	AQ1
100	BC846 BC847 BC848	80 50 30	65 45 30	200	110 110 110	450 800 800	2	300*	0.6	100/5	BC546 BC547 BC548	SOT-23	AC7
100	BC849 BC850	30 50	30 25	200	200	800	2	300*	0.60	100/5	BC549 BC550	SOT-23	AC7
100	•BCV61	30	30	200	100	800	2	300*	0.25	10/0.5	—	SOT-143	DB4
100	BSV52	20	12	250	40	120	10	400	0.25	10/1	BSX20, 2N2369	SOT-23	AC7
100	BCF32 BCF33	32	22	350	200 420	450 800	2	300*	0.25	10/0.5	BC549B BC549C	SOT-23	AC7
100	BCF81	50	45	350	420	800	2	300*	0.25	10/0.5	BC550C	SOT-23	AC7
100	BCV71 BCV72	80	60	350	110 200	220 450	2	300*	0.25	10/0.5	BC546A BC546B	SOT-23	AC7
100	BCW31 BCW32 BCW33	32	32	350	110 200 420	220 450 800	2	300*	0.25	10/0.5	BC548A BC548B BC548C	SOT-23	AC7
100	BCW71 BCW72	50	45	350	110 200	220 450	2	300*	0.25	10/0.5	BC547A BC547B	SOT-23	AC7
100	BCW81	50	45	350	420	800	2	300*	0.25	10/0.5	BC547C	SOT-23	AC7
100	BSS64	120	80	350	20	—	10	60	0.15	4/0.4	BSS38	SOT-23	AC7
150	BFQ17 BFQ18A	40 25	25 15	1W	25	—	150 100	1.2G* 3.6G*	—	—	BFW16A BFQ34	SOT-89	AQ1
200	BCW60A BCW60B BCW60C BCW60D	32	32	150	120 180 250 380	220 310 460 630	2	125	0.35	10/0.25	BC548A BC548B BC548C	SOT-23	AC7
200	•BCX70G •BCX70H •BCX70J •BCX70K	45**	45	150	120 180 250 380	220 310 460 630	2	125	0.35	10/0.25	BCY59, BC550	SOT-23	AC7
200	BSR17 BSR17A	60	40	350	50 100	150 300	10	250 300	0.2	10/1	2N3903 2N3904	SOT-23	AC7
500	BC817 BC818	50 30	45 25	310	100	600	100	200*	0.70	500/50	BC337 BC338	SOT-23	AC7
500	BCX19 BCX20	50 30	45 25	425	100	600	100	200*	0.62	500/50	BC337 BC338	SOT-23	AC7
500	BST50 BST51 BST52	60 80 100	45† 60† 80†	1W	2000	—	500	—	1.3	500/0.5	BSR50 BSR51 BSR52	SOT-89	AQ1
800	BSR13 BSR14	60 75	30 40	425	100	300	150 300	250 0.3	0.4	150/15	2N2222 2N2222A	SOT-23	AC7
1A	BC868	25	20	1W	85	375	500	60*	0.5	1A/100	BC368	SOT-89	AQ1

continued

Surface mounted devices

n-p-n transistors primarily intended for hybrid, thin and thick film circuits (cont.)

book 1 part 1d

$I_{C(AV)}$ max. (mA)	Type No.	Maximum Ratings			Characteristics						Nearest conventional type	Outline	Dwg. ref.
		V_{CB0} (V)	V_{CE0} (V)	P_{tot} at 25°C (mW)	min.	h_{FE} max.	at I_C (mA)	f_T min. (MHz)	$V_{CE(sat)}$ max. (V)	at I_C/I_B (mA)			
1A	BCX54	45	45	1W	40	250	150	130*	0.5	500/50	BC635 BC637 BC639	SOT-89	AQ1
	BCX55	60	60		40	160							
	BCX56	100	80		40	160							
1A	BSR40	70	60	1W	40	120	100	100	—	—	BSX46/47 2N3019/3020	SOT-89	AQ1
	BSR41	70	60		100	300							
	BSR42	90	80		40	120							
	BSR43	90	80		100	300							

*Typical $f_{V_{CES}}$ ** V_{CES}

Surface mounted devices

p-n-p transistors primarily intended for hybrid, thin and thick film circuits

book 1 part 1d

I _{C(AV)} max. (mA)	Type No.	Maximum Ratings			Characteristics						Outline	Dwg. ref.	
		V _{CBO} (V)	V _{CEO} (V)	P _{TOT} at 25°C (mW)	h _{FE} min.	h _{FE} max.	at I _C (mA)	f _T min. (MHz)	V _{CE(sat)} max. (V)	at I _C /I _B (mA)			Nearest conventional type
20	BF767	-30	-30	200	15	—	3	900*	—	—	BF967	SOT-23	AC7
25pk	BF660	-40	-30	200	30	—	3	650*	—	—	BF606A	SOT-23	AC7
25	BF579	-20	-20	150	20	—	10	1350*	—	—	BF979	SOT-23	AC7
25	BF536	-30	-30	200	25	—	1	350*	—	—	BF936	SOT-23	AC7
25	BF550	-40	-40	200	50	—	1	325*	—	—	BF450	SOT-23	AC7
25	BFT92	-20	-15	250	20	—	14	5G*	—	—	BFQ23/24	SOT-23	AC7
25	•BF824	-30	-30	300	25	50*	4	450*	—	—	BF324	SOT-23	AC7
30	BF569	-40	-35	200	25	—	3	900*	—	—	BF970	SOT-23	AC7
35	BFT93	-15	-12	200	20	—	30	5G*	—	—	BFQ23/24	SOT-23	AC7
50	BF821 BF823	-300 -250	-300† -250	310	50	—	25	60	-0.8	30/5	BF421 BF423	SOT-23	AC7
50	BF621 BF623	-300 -250	-300† -250	1W	50	—	25	60	-0.8	30/5	BF421 BF423	SOT-89	AQ1
100	BC856 BC857 BC858	-80 -50 -30	-65 -45 -30	200	75 75 75	475 475 800	2	150*	-0.65	100/5	BC556 BC557 BC558	SOT-23	AC7
100	BC859 BC860	-30 -50	-30 -45	200	125	800	2	150*	-0.65	100/5	BC559 BC560	SOT-23	AC7
100	•BCV62	-30	-30	200	100	800	2	150*	-0.3	10/0.1		SOT-143	DB4
100	BSR12	-15	-15	250	20	—	100	1.5G	-0.45	100/10	2N2894A	SOT-23	AC7
100	BCF29 BCF30	-32	-32	350	120 215	260 500	2	150*	-0.3	10/0.5	BC559A BC559B	SOT-23	AC7
100	BCF70	-50	-45	350	215	500	2	150*	-0.3	10/0.5	BC560B	SOT-23	AC7
100	BCW29 BCW30	-32	-32	350	120 215	260 500	2	150*	-0.3	10/0.5	BC558A BC558B	SOT-23	AC7
100	BCW69 BCW70	-50	-45	350	120 215	260 500	2	150*	-0.3	10/0.5	BC557A BC557B	SOT-23	AC7
100	BCW89	-80	-60	350	120	260	2	150*	-0.3	10/0.5	BC556A	SOT-23	AC7
100	BSS63	-110	-100	350	30	—	25	50	-0.25	25/2.5	BSS66B	SOT-23	AC7
200	BCW61A BCW61B BCW61C BCW61D	-32	-32	150	120 180 250 380	220 310 460 630	2	180*	-0.25	10/0.25	BC558A BC558B BC558B BC558C	SOT-23	AC7
200	•BCX71G •BCX71H •BCX71J •BCX71K	-45**	-45	150	120 180 250 380	220 310 460 630	2	180*	-0.25	10/0.25	BCY79,BC560	SOT-23	AC7
200	BSR18 BSR18A	-40	-40	250	50 100	150 300	10	200 250	-0.4	50/5	2N3905 2N3906	SOT-23	AC7
500	BC807 BC808	-50 -30	-45 -25	310	100	600	100	100*	-0.70	500/50	BC327 BC328	SOT-23	AC7
500	BCX17 BCX18	-50 -30	-45 -25	425	100	600	100	100*	-0.62	500/50	BC327 BC328	SOT-23	AC7
500	BST60 BST61 BST62	-60 -80 -100	-45† -60† -80†	1W	2000	—	500	—	-1.3	500/0.5	BSR60 BSR61 BSR62	SOT-89	AQ1
600	BSR15 BSR16	-60 -60	-40 -40	425	100	300	150	200	-0.4	150/15	2N2907 2N2907A	SOT-23	AC7
1A	BC869	-25	-20	1W	85	375	500	60*	-0.5	1A/100	BC369	SOT-89	AQ1
1A	BCX51 BCX52 BCX53	-45 -60 -100	-45 -60 -80	1W	40	250	150	50*	-0.5	500/50	BC636 BC638 BC640	SOT-89	AQ1
1A	BSR30 BSR31 BSR32 BSR33	-70 -70 -90 -90	-60 -60 -80 -80	1W	40 100 40 100	120 300 120 300	100	100	-0.5	500/50	BSV16/17 (2N4030-4033)	SOT-89	AQ1
1A	BST15 BST16	-200 -350	-200 -300	1W	30 30	150 120	50	15 2.0	-2.5 -2.0	50/5	2N5415 2N5416	SOT-89	AQ1
1A	•BST39 •BST40	-450 -300	-350 -250	1W	40	160	20	15	-0.5	50/4	BF459/859 BF457/857	SOT-89	AQ1

*Typical I_VCER **V_{CES}

Surface mounted devices

n-channel junction field-effect transistors

book 1 part 1d

Outline SOT-23

Type No.	Dwg. ref.	Maximum Ratings			I_D (mA)	P_{tot} at 25°C (mW)	Characteristics			I_{DSS} ($V_{GS}=0$)		at V_{DS} (V)	Nearest conventional type	
		V_{DGO} (V)	V_{GSO} (V)	$\pm V_{DS}$ (V)			$-V_{(PI)GS}$ max. (V)	at I_D (nA)	$-I_{GSS}$ max. (nA)	min. (mA)	max. (mA)			
BF510	AC1	20	-	20	30	300	0.8*	10 μ	10	0.7	3.0	10	BF410A	
BF511							1.5*			2.5	7.0			BF410B
BF512							2.2*			6.0	12			
BF513							3.0*			10	18			BF410D
BFR30	AC2	25	-25	25	10	250	5.0	0.5	0.2	4.0	10	10	BFW11	
BFR31							2.5			1.0	5.0			BFW12
BFT46	AC2	25	-25	25	10	250	1.2	0.5	0.2	0.2	1.5	10	BFW13	
BSR56	AC2	40	-40	40	50 (I_{GF})	250	10	0.5	1.0	50	-	15	2N4856	
BSR57							6			20	100			2N4857
BSR58							4			8	80			

Outline SOT-143

BFR101A	DB3	30	-30	30	20	200	1.0	1 μ	5	0.2	1.5	6	—
BFR101B							2.5			1.0	5.0		

Surface mounted devices

n-channel mos field-effect transistors

Type No.	Dwg. ref.	Maximum Ratings		V_{SB} (V)	I_D (mA)	P_{tot} at 25°C (mW)	Characteristics		$R_{DS(on)}$ max (Ω)	C_{rss} typ. (pF)
		$\pm V_{DS}$ (V)	V_{DB} (V)				$V_{(PIGS)}$ (V)	at I_D (μA)		
INSULATED GATE (Enhancement)										
BSS83†	DB5	10	15	15	50	230	0.1-2.0	1	45	0.6
INSULATED GATE (Depletion)										
BSD20†	DB6	10	15	15	50	230	<-2.0	10	30†	0.6
BSD22†		20	25	25						

Outline SOT-143

Type No.	Dwg. ref.	Maximum Ratings			Characteristics					Comments	
		V_{DS} (V)	I_{DM} (mA)	I_D (mA)	P_{tot} at 25°C (mW)	I_{G1-SS} I_{G2-SS} (max.) (nA)	min.	I_{loss} max. (mA)	C_{rs} typ. (fF)		$ y_{fs} $ min. (mA/V)
BF989†	DB1	20	30	20	200	50	2	20	25	9.5	For u.h.f. tv tuners
BF990	DB1	18	—	30	200	25	—	—	25	17	For u.h.f. tv tuners
BF991†	DB1	20	30	20	200	50	4	25	20	10	For v.h.f. tv tuners
BF992†	DB1	20	—	40	200	25	—	—	30	20	For v.h.f. tv tuners
BF994	DB1	20	—	30	200	10	2	20	25	15	For u.h.f./v.h.f. tv tuners
BF996	DB1	20	—	30	200	50	2	20	25	15	For u.h.f. applications

†The gates are diode protected $\pm V_{GS} = 10V$

Type No.	Outline	Dwg. ref.	Maximum Ratings			Characteristics				Switching times			
			V_{DS} (V)	V_{GSO} (V)	I_{DM} (A)	I_D (A)	P_{tot} at 25°C (W)	I_{GSS} max. (nA)	I_{loss} max. (μA)	$R_{DS(on)}$ typ. (Ω)	t_{on} max. (ns)	t_{off} max. (ns)	at I_D (mA)
BST80	SOT-89	AQ3	80	20	1	0.5	1	100	10	2	10	15	500
BST82	SOT-23	AC10	80	20	0.6	0.175	0.3	100	1	7	10	10	200
BST84	SOT-89	AQ3	200	20	0.8	0.3	1	100	10	6	10	15	400
BST86	SOT-89	AQ3	180	20	0.8	0.3	1	100	10	7	10	15	400

silicon planar p-n-p-n switches

Type No.	Description	Outline	Dwg. ref.	Maximum Ratings							Nearest conventional type
				V_{GA} (V)	I_{ARM} (A)	I_A (mA)	T_j (°C)	P_{tot} at 25°C (mW)	V_A (V)	at I_A (mA)	
BRY61	Trigger device for switching applications such as motor control, oscillators, relay replacements, timers, pulse shapers	SOT-23	AC8	70	2.5	175	150	275	<1.4	100	BRY56
BRY62	Integrated p-n-p-n transistor pair Applications include controlled switch, programmable unijunction transistor and thyristor tetrode	SOT-143	DB2	70	2.5	175	150	275	<1.4	50	BRY39

Surface mounted devices

diodes

book 1 part 1d

Outline SOT-23

Type No.	Description	Dwg. Ref.	Max. Ratings			Characteristics			t_r , max. ($I_F=10\text{mA}$, $V_R=1\text{V}$) (ns)	Nearest conventional type
			V_{RRM} (V)	I_{FRM} (mA)	$I_{F(AV)}$ (mA)	V_F at I_F (V)	I_F (mA)			
BAS16	Single diode	AC3	85	200	100	<1.1	50	6	1N4148	
BAS17	Low-voltage stabistor	AC3	–	250	–	<0.96	100	–	BA314	
BAT18	Bandswitch diode	AC3	35(V_R)	–	100	<1.2	100	–	BA482	
BAV70	Common cathode double diode	AC4 AC5 AC6	70	200	100	<1.1	50	6	2 x 1N4148	
BAW56	Common anode double diode									
BAV99	Two diodes in series									

variable capacitance diodes

Outline SOT-23

Type No.	Description	Dwg. Ref.	Max. Ratings		Characteristics			Capacitance Ratio typ.	Nearest conventional type
			V_R max. (V)	I_R max. (nA)	C_d (pF) min.	C_d (pF) max.	at V_R (V)		
BBY31	UHF varicap diode	AC3	28	100	1.8	2.8	25	5	BB405B
BBY40	VHF varicap diode	AC3	28	50	4.3	6	25	5–6.5	BB809

schottky diode

Outline SOT-23

Type No.	Dwg. Ref.	Max. Ratings			Characteristics				Nearest conventional type
		V_R max. (V)	I_F max. (mA)	T_J max. (°C)	$V_F^{1)}$ (V)	C_d (pF)	$N^{2)}$ (dB)		
BAT17	AC3	4	30	100	<0.6	<1	<8	BA481	

¹⁾ At $I_F = 10\text{mA}$

²⁾ At $f = 900\text{MHz}$

Surface mounted devices

silicon planar voltage regulator diodes

book 1 part 1d

350mW ($T_{amb} = 25^{\circ}\text{C}$) $\pm 5\%$ voltage tolerance; I_{FRM} ; $I_{ZRM} = 250\text{mA}$

Outline SOT-23 Drawing reference AC3

Type No.	Nom. Zener Voltage (V)	Measured at Test I_Z Min. Voltage (V)	Max. Voltage (V)	Max. Slope Resistance (Ω)	Typ. Temp. Coefficient (mV/ $^{\circ}\text{C}$)	Test I_Z (mA)	Max. I_R at V_R (μA)	(V)
BZX84								
-C2V4	2.4	2.2	2.6	100	-1.6	5	50	1
-C2V7	2.7	2.5	2.9	100	-2.0	5	20	1
-C3V0	3.0	2.8	3.2	95	-2.1	5	10	1
-C3V3	3.3	3.1	3.5	95	-2.4	5	5.0	1
-C3V6	3.6	3.4	3.8	90	-2.4	5	5.0	1
-C3V9	3.9	3.7	4.1	90	-2.5	5	3.0	1
-C4V3	4.3	4.0	4.6	90	-2.5	5	3.0	1
-C4V7	4.7	4.4	5.0	80	-1.4	5	3.0	2
-C5V1	5.1	4.8	5.4	60	-0.8	5	2.0	2
-C5V6	5.6	5.2	6.0	40	+1.2	5	1.0	2
-C6V2	6.2	5.8	6.6	10	+2.3	5	3.0	4
-C6V8	6.8	6.4	7.2	15	+3.0	5	2.0	4
-C7V5	7.5	7.0	7.9	15	+4.0	5	1.0	5
-C8V2	8.2	7.7	8.7	15	+4.6	5	0.7	5
-C9V1	9.1	8.5	9.6	15	+5.5	5	0.5	6
-C10	10	9.4	10.6	20	+6.4	5	0.2	7
-C11	11	10.4	11.6	20	+7.4	5	0.1	8
-C12	12	11.4	12.7	25	+8.4	5	0.1	8
-C13	13	12.4	14.1	30	+9.4	5	0.1	8
-C15	15	13.8	15.6	30	+11.4	5	0.05	10.5
-C16	16	15.3	17.1	40	+12.4	5	0.05	11.2
-C18	18	16.8	19.1	45	+14.4	5	0.05	12.6
-C20	20	18.8	21.2	55	+16.4	5	0.05	14
-C22	22	20.8	23.3	55	+18.4	5	0.05	15.4
-C24	24	22.8	25.6	70	+20.4	5	0.05	16.8
-C27	27	25.1	28.9	80	+23.4	2	0.05	18.9
-C30	30	28	32	80	+26.6	2	0.05	21
-C33	33	31	35	80	+29.7	2	0.05	23.1
-C36	36	34	38	90	+33.0	2	0.05	25.2
-C39	39	37	41	130	+36.4	2	0.05	27.3
-C43	43	40	46	150	+41.2	2	0.05	30.1
-C47	47	44	50	170	+46.1	2	0.05	32.9
-C51	51	48	54	180	+51.0	2	0.05	35.7
-C56	56	52	60	200	+57.0	2	0.05	39.2
-C62	62	58	66	215	+64.4	2	0.05	43.4
-C68	68	64	72	240	+71.7	2	0.05	47.6
-C75	75	70	79	255	+80.2	2	0.05	52.5

Surface mounted devices

silicon planar voltage regulator diodes (cont.)

book 1 part 1d

Outline SOT-89 Drawing reference AQ2

1W ($T_{amb} = 25^{\circ}\text{C}$) $\pm 5\%$ voltage tolerance; $I_{FRM} = 250\text{mA}$

Type No.	Nom. Zener Voltage (V)	Measured at Test Min. Voltage (V)	Test I_Z Max. Voltage (V)	Max. Slope Resistance (Ω)	Typ. Temp. Coefficient ($\text{mV}/^{\circ}\text{C}$)	Test I_Z (mA)	Max. I_R at V_R (μA)	(V)
BZV49								
-C2V4	2.4	2.2	2.6	100	-1.6	5	50	1
-C2V7	2.7	2.5	2.9	100	-2.0	5	20	1
-C3V0	3.0	2.8	3.2	95	-2.1	5	10	1
-C3V3	3.3	3.1	3.5	95	-2.4	5	5.0	1
-C3V6	3.6	3.4	3.8	90	-2.4	5	5.0	1
-C3V9	3.9	3.7	4.1	90	-2.5	5	3.0	1
-C4V3	4.3	4.0	4.6	90	-2.5	5	3.0	1
-C4V7	4.7	4.4	5.0	80	-1.4	5	3.0	2
-C5V1	5.1	4.8	5.4	60	-0.8	5	2.0	2
-C5V6	5.6	5.2	6.0	40	+1.2	5	1.0	2
-C6V2	6.2	5.8	6.6	10	+2.3	5	3.0	4
-C6V8	6.8	6.4	7.2	15	+3.0	5	2.0	4
-C7V5	7.5	7.0	7.9	15	+4.0	5	1.0	5
-C8V2	8.2	7.7	8.7	15	+4.6	5	0.7	5
-C9V1	9.1	8.5	9.6	15	+5.5	5	0.5	6
-C10	10	9.4	10.6	20	+6.4	5	0.2	7
-C11	11	10.4	11.6	20	+7.4	5	0.1	8
-C12	12	11.4	12.7	25	+8.4	5	0.1	8
-C13	13	12.4	14.1	30	+9.4	5	0.1	8
-C15	15	13.8	15.6	30	+11.4	5	0.05	10.5
-C16	16	15.3	17.1	40	+12.4	5	0.05	11.2
-C18	18	16.8	19.1	45	+14.4	5	0.05	12.6
-C20	20	18.8	21.2	55	+16.4	5	0.05	14
-C22	22	20.8	23.3	55	+18.4	5	0.05	15.4
-C24	24	22.8	25.6	70	+20.4	5	0.05	16.8
-C27	27	25.1	28.9	80	+23.4	2	0.05	18.9
-C30	30	28	32	80	+26.6	2	0.05	21
-C33	33	31	35	80	+29.7	2	0.05	23.1
-C36	36	34	38	90	+33.0	2	0.05	25.2
-C39	39	37	41	130	+36.4	2	0.05	27.3
-C43	43	40	46	150	+41.2	2	0.05	30.1
-C47	47	44	50	170	+46.1	2	0.05	32.9
-C51	51	48	54	180	+51.0	2	0.05	35.7
-C56	56	52	60	200	+57.0	2	0.05	39.2
-C62	62	58	66	215	+64.4	2	0.05	43.4
-C68	68	64	72	240	+71.7	2	0.05	47.6
-C75	75	70	79	255	+80.2	2	0.05	52.5

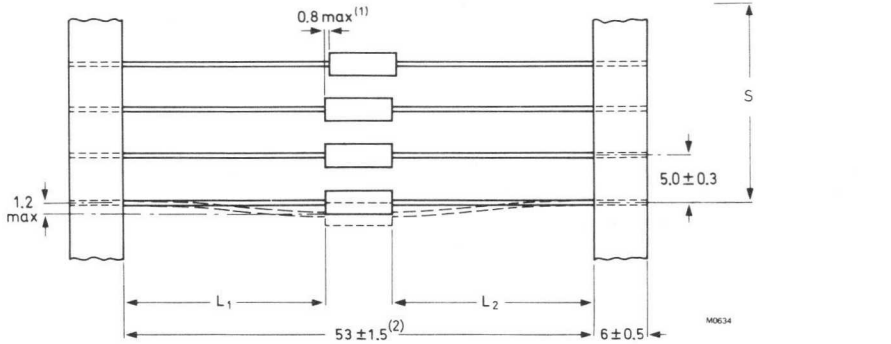
Mullard diodes are normally supplied bandoliered.

BANDOLIER AND REEL SPECIFICATIONS FOR AXIAL-TAPED DIODES

This specification concerns all axial-leaded diodes in this publication.

The taped and reeled products fulfil the requirements of IEC 286-1: Tape packaging of components with axial leads on continuous tapes.

Fig. 1 Configuration of bandolier:



The red tape indicates the diode cathode side.

(1) Displacement between any two diodes; for DO-34 maximum 0.4.

(2) For outlines SOD-34, SOD-56 and SOD-61 this dimension is 58 ± 2 .

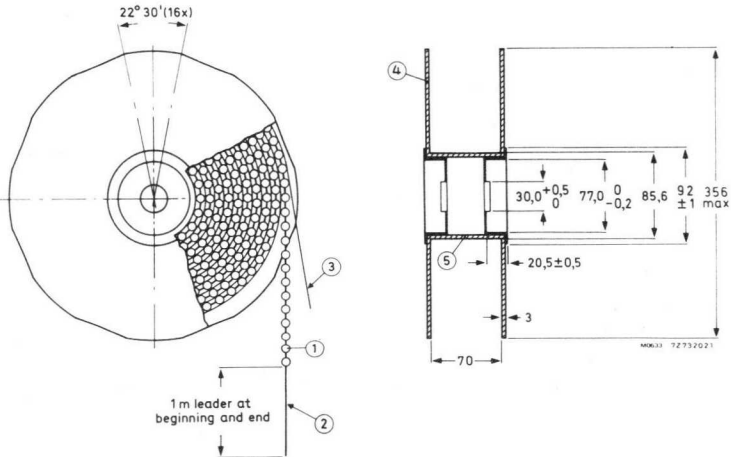
The cumulative space (S) measured over ten spacings = 50 ± 2 .

The diodes are centred so that $|L_1 - L_2| \leq 1.2$ mm.

A black marker is printed on the white tape of the bandolier every 50 diodes.

The axial taping specification described above is compatible with automatic insertion equipment as manufactured by Universal, U.S.M. (Dynapert) and M.E.I. (Panasert).

Fig. 2 Reel dimensions (mm) for axial-taped components.



- (1) Diode
- (2) Bandolier
- (3) Paper

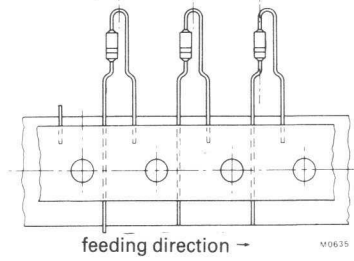
- (4) Flange
- (5) Cylinder

(1) For outlines SOD-34, SOD-36 and SOD-61 this dimension is 75.

Diodes

BANDOLIER AND REEL SPECIFICATION FOR RADIAL-TAPED DIODES.

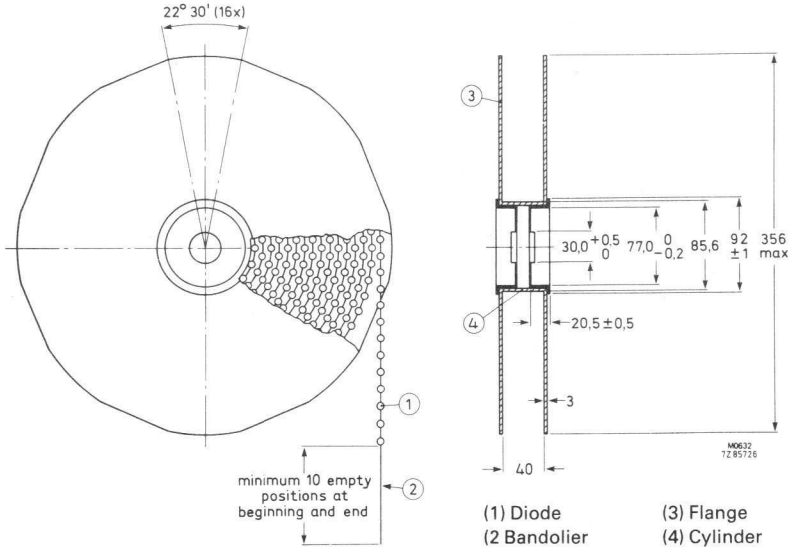
Fig. 1 Configuration of bandolier:



Dimensions in mm

This specification concerns radial-taped diodes in DO-34 and DO-35 envelopes. The taped and reeled products fulfil the requirements of IEC 286-2: Tape packaging of components with unidirectional leads.

Fig 2 Reel dimensions (mm) for radial-taped diodes.



Quantity per reel for DO-34 and DO-35 encapsulations 5000 diodes.

The diodes can be delivered on request with anode-leading (+ leading) or with cathode-leading (- leading) configuration.

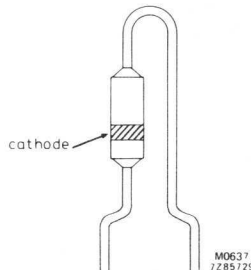


Fig. 3 + leading.

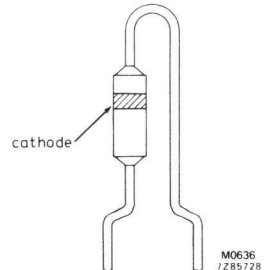


Fig. 4 - leading.

For further details refer to Mullard handbook Book 1, Part 3.

book 1 part 3

Type No.	Description	Outline	Dwg. ref.	V _{ARM} max. (V)	I _{FRM} max. (mA)	I _{F(AV)} max. (mA)	C _{dmax} (pF)	V _r max (V)	at I _F (mA)	Max. reverse recovery time measured at:					
										t _{rr} (ns)	I _F (mA)	V _R (V)	R _i (Ω)	I _R (mA)	
§BA314	Low voltage stabistor	DO-35	H	—	250	—	140	0.96	100	—	—	—	—	—	
BA316 BA317 BA318	10V, 30V and 50V general purpose diodes	DO-35	H	10 30 50	225	100	3	1.1	100	4	10	6	100	1	
BAS11	General purpose avalanche diode	DO-35	H	300 (V _{RW})	900	300	1.5 (typ)	1.1	300	1μ	400	50	-di/dt=400mA/μs		
•BAS45	Switching diode with a very low reverse current	DO-34	CS	125†	450	225	8	1.0	200	I _R	<1nA at V _R = 125V				
BAV10	High speed diode for core gating applications in very fast memories	DO-35	H	60	600	300	2.5	1.0	200	6	400	—	100	40	
§BAV18 §BAV19 §BAV20 §BAV21	General purpose switching diodes	DO-35	H	60 120 200 250	625	250	5	1.25	200	50	30	—	100	3	
§BAW62	High speed diode for fast logic applications	DO-35	H	75	225	100	2	1.0	100	4	10	1	100	1	
BAX12A	Controlled avalanche diode Avalanche 120-175V at 1mA	DO-35	H	90	800	400	35	1.0	200	50	30	—	100	3	
BAX13	High speed diode intended for logic applications	DO-35	H	50	150	75	3	1.0	20	4	10	6	100	1	
§BAX16	Intended for general purpose industrial applications	DO-35	H	150	300	200	10	1.3	100	120	30	3	100	1	
§BAX17	Intended for general purpose industrial applications	DO-35	H	200	300	200	10	1.2	200	120	30	3	100	1	
§CV7367	For telephony applications	DO-35	H	100†	450	100	4	1.0	10	5	10	—	—	1	
§CV7368	For telephony applications	DO-35	H	100†	450	100	2	1.0	10	5	10	—	—	1	
§CV7756	For telephony applications	DO-35	H	75†	450	100	4	1.0	10	8	10	—	—	1	
§CV7757	For telephony applications	DO-35	H	75†	450	100	2	1.0	10	8	10	—	—	1	
§CV7875	General purpose avalanche diode	DO-35	H	150†	750	150	35	1.2	100	—	—	—	—	—	
§CV8617	For telephony applications	DO-35	H	100	450	75	6	1.5	50	Q _S <100pC at I _F 1mA, t _p 1μs					
§CV8790	General purpose diode	DO-35	H	150	625	150	10	1.2	100	—	—	—	—	—	
§CV9637	For telephony applications	DO-35	H	75†	450	100	2.8	0.87	10	5	10	—	—	1	
§CV9638	For telephony applications	DO-35	H	65†	750	200	15	0.9	200	70	200	—	—	20	
OA200 OA202	General purpose diodes	DO-35	H	50 150	250	80	25	1.15	30	3.5μ (typ)					
§1N914 §1N916	High speed diodes for computer and other applications	DO-35	H	100	225	75	4 2	1.0	10	4	10	6	100	1	
§1N4148	High speed diode for computer and other applications	DO-35	H	75	225	75	4	1.0	10	4	10	6	100	1	
§1N4446 §1N4448	High speed diodes for fast logic applications	DO-35	H	75	450	150	4	1.0 1.0	20 100	4	10	—	100	1	

§Also available to CECC 50 000

†V_R

Diodes

silicon Schottky-barrier diodes

book 1 part 3
Outline DO-34 Drawing reference CS

Type No.	Description	V_R max. (V)	I_F max. (mA)	I_{FSM} max. (mA)	V_F max. at I_F (V)	C_d max. (pF)	t_{rr} max. (ns)	
BA481	U.H.F. mixer diode	4	30	—	0.55	10	—	
BAT81	Switching diodes	40	30	150	0.41	1.0	1.6	
BAT82		50						
BAT83		60						
BAT85	Switching diode	30	200	600	0.4	10	10	5

†Switched from $I_F = 10\text{mA}$ to $I_R = 10\text{mA}$; $R_L = 100\Omega$

tuner diodes

book 1 part 3

Type No.	Description	Outline	Dwg. Ref.	Ratings			Characteristics			Capacitance Ratio	
				V_{Rmax} (V)	I_F max. (mA)	I_R max. (μA)	C_d (pF) min.	C_d (pF) max.	at V_R (V)	min.	max.
BA223	Band switching in a.m. radio receivers	DO-35	H	20	50	0.1	—	3.5	6	$r_D < 1.5\Omega$	
BA482	Band switching in v.h.f. tv tuners	DO-34	CS	35	100	0.1	—	1.2	3	$r_D < 0.7\Omega$	
BB119	Intended for automatic frequency control in radio and tv receivers	DO-35	H	15	200	2.0	20	25	4	1.3	—
BB212	Double-tuning diode (common cathode) for car and domestic receivers	TO-92	BR7	12	100	0.05	500	620	0.5	23	36
BB405B	For u.h.f. tuning	DO-34	CS	28	20	0.01	2.0	2.3	25	4.8	5.8
BB809	For v.h.f. tv tuners	DO-34	CS	28	20	0.01	26	32	3	5	6.5

silicon picoampere diode

book 1 part 3

Type No.	Description	Ratings			Characteristics			
		V_{RRM} max. (V)	I_{FRM} max. (mA)	I_F max. (mA)	I_R at $V_R 5\text{V}$ (pA)	I_R at $V_R 20\text{V}$ (pA)	(V)	V_F at I_F (mA)
BAV45	Extremely low leakage and low capacitance diode, Outline TO-18, Dwg. ref. BJ5	35	100	50	<5	<10	<1.0	10

ultra-fast low-power rectifier diodes

book 1 part 3

Type No.	Description	Outline	Dwg. ref.	Ratings			Characteristics			Max. reverse recovery time when switched from		
				V_{RRM} max. (V)	I_{FSM} max. (A)	$I_{F(AV)}$ max. (A)	V_F max. (V)	at I_F (A)	t_{rr} max. (ns)	I_F (A)	to	I_R (A)
BYV27-50 -100 -150 -200	Glass passivated diodes for SMPS and other high frequency circuits	SOD-57	CV1	50 100 150 200	50	2	1.25	5	25	0.5		1.0
BYV28-50 -100 -150 -200	Glass passivated diodes for SMPS and other high frequency circuits	SOD-64	CV2	50 100 150 200	80	3.5	1.1	5	30	0.5		1.0

fast soft-recovery low-power rectifier diodes

Type No.	Description	Outline	Dwg. ref.	Ratings			Characteristics			Max. reverse recovery time measured at:		
				V_{RRM} max. (V)	I_{FSM} max. (A)	$I_{F(AV)}$ max. (A)	V_F max. (V)	at I_F (A)	t_{rr} max. (ns)	I_F (A)	V_R (V)	-di/dt (A/ μ s)
BYV95A BYV95B BYV95C	Glass passivated diodes for SMPS, scan rectifiers, inverters and converters	SOD-57	CV1	200 400 600	35	1.5	1.6	3	250	1	≥ 30	20
BYV96D BYV96E	As BYV95	SOD-57	CV1	800 1000	35	1.5	1.6	3	300	1	≥ 30	20
BYW95A BYW95B BYW95C	Glass passivated diodes for SMPS, scan rectifiers, inverters and converters	SOD-64	CV2	200 400 600	70	3	1.5	5	250	1	≥ 30	20
BYW96D BYW96E	As BYW95	SOD-64	CV2	800 1000	70	3	1.5	5	300	1	≥ 30	20

low-power silicon rectifier diodes

Type No.	Description	Outline	Dwg. ref.	Ratings			Characteristics		
				V_{RRM} max. (V)	I_{FSM} max. (A)	$I_{F(AV)}$ max. (A)	V_F max. at I_F (V)	at I_F (A)	I_R max. at V_{RRM} (μ A)
BY228	Parallel efficiency diode	SOD-64	CV2	1500	50	5(I_{FWM})	1.5	5	200
BY448	Parallel efficiency diode	SOD-57	CV1	1500	30	4(I_{FWM})	1.6	3	200
§BYW54 §BYW55 §BYW56	Double diffused passivated rectifiers intended for telephony and gen. purpose application	SOD-57	CV1	600 800 1000	50	2	1.65	10*	1
§CV8308 §CV8805	Controlled avalanche rectifier diodes	SOD-81	DR	60 150	20	0.25	0.9	0.25	1
§CVA7026 §CVA7027 §CVA7028 §CVA7029 §CVA7030 §CVA7476**	General purpose glass-bead diodes	SOD-57	CV1	100 200 400 600 800 1200	15 15 15 15 15 20	0.75	1.15	2.5	20
1N4001G to 1N4007G	General purpose diodes	SOD-57	CV1	50 to 1000	30	1	1.1	1	10

*Measured under pulse conditions
§Also available to CECC 50 000

†At 800V

**Controlled avalanche

Diodes

low-power high-voltage diodes

book 1 part 3

I_F (AV) max (mA)	Type No	Outline	Dwg. Ref.	V_{RW} max (kV)	V_{RRM} max (kV)	Description
3	●BY710 ●BY711 ●BY712 ●BY713 ●BY714	SOD-61	DP	14	17	E.H.T rectifier diodes featuring non-snap-off characteristics, for use in high-voltage supplies of t.v. receivers and monitors.
				16	19	
				18	22	
				20	24	
				24	30	
4	BY509	SOD-61	DP	11.5	15	E.H.T rectifier diode featuring non-snap-off characteristics, for use in triplers and diode-split transformers.
85	BY584	SOD-61	DP	1.5	1.8	High-voltage rectifier diode featuring non-snap-off characteristics, for use as V_{G2} supply in colour t.v. receivers and as a general purpose rectifier.

silicon voltage reference diodes

Type No.	Outline	Dwg. ref.	Zener Voltage (at test I_Z) (V)		Typical Temperature Coefficient (%/°C)	Ambient Temperature Range °C		Max. Dynamic Resistance (at test I_Z) (Ω)	Test I_Z (mA)	I_{ZM} max. (mA)	P_{tot} max. (mW)
			Min.	Max.		Min.	Max.				
BZV10	DO-34	CS	6.2	6.8	± 0.01	0	+70	50	2	50	400
BZV11					± 0.005						
BZV12					± 0.002						
BZV13					± 0.001						
BZV14					± 0.0005						
BZX90	DO-34	CS	6.2	6.8	± 0.01	-55	+100	15	7.5	50	400
BZX91					± 0.005						
BZX92					± 0.002						
BZX93					± 0.001						
BZX94					± 0.0005						
1N821	DO-34	CS	5.8	6.5	± 0.01	-55	+100	15	7.5	50	400
1N823					± 0.005						
1N825					± 0.002						
1N827					± 0.001						
1N829					± 0.0005						

silicon voltage regulator diodes (stabistors)

Type No.	Outline	Dwg. ref.	V_{RRM} max. (V)	I_{FRM} max. (mA)	V_F at $I_F=5mA$ (V)	r_{diff} max. at $I_F=5mA$ (Ω)	P_{tot} max. (mW)
BZV46-1V5	DO-35	H	4	120	1.35-1.55	20	250
BZV46-2V0				80		30	

Silicon voltage regulator diodes

book 1 parts 3 and 4

selection guide

REGULATOR MODE (Maximum dissipation, P _{tot} max)										Reg- ulated voltage	Suppres- sion stand off voltage	Suffix to type no.			
350mW	400mW	1W	1.3W	1.5W	2.5W		20W	75W							
SUPPRESSOR MODE (Maximum non-repetitive peak power dissipation* P _{RSM} max)															
										280W	190W	500W	700W	9.5kW	25kW
** BA 314											0.7V				
** BZV 46											1.5V		- 1V5		
** BZV 46											2.0V		- 2V0		
** BZV 46											2.4V		- 2V4		
	2.4										2.7V		- 2V7		
	2.4										3.0V		- 3V0		
	2.4										3.3V		- 3V3		
											3.6V		- 3V6		
											3.9V		- 3V9		
											4.3V		- 4V3		
											4.7V	3.6V	- 4V7		
											5.1V	3.9V	- 5V1		
											5.6V	4.3V	- 5V6		
											6.2V	4.7V	- 6V2		
											6.8V	5.1V	- 6V8		
											7.5V	5.6V	- 7V5		
											8.2V	6.2V	- 8V2		
											9.1V	6.8V	- 9V1		
											10V	7.5V	- 10V		
											11V	8.2V	- 11V		
											12V	9.1V	- 12V		
											13V	10V	- 13V		
											15V	11V	- 15V		
											16V	12V	- 16V		
											18V	13V	- 18V		
											20V	15V	- 20V		
											22V	16V	- 22V		
											24V	18V	- 24V		
											27V	20V	- 27V		
											30V	22V	- 30V		
											33V	24V	- 33V		
											36V	27V	- 36V		
											39V	30V	- 39V		
											43V	33V	- 43V		
											47V	36V	- 47V		
											51V	39V	- 51V		
											56V	43V	- 56V		
											62V	47V	- 62V		
											68V	51V	- 68V		
											75V	56V	- 75V		
											82V	62V	- 82V		
											91V	68V	- 91V		
											100V	75V	- 100V		
											110V	82V	- 110V		
											120V	91V	- 120V		
											130V	100V	- 130V		
											150V	110V	- 150V		
											160V	120V	- 160V		
											180V	130V	- 180V		
											200V	150V	- 200V		
											270V	180V	- 270V		
† Maintenance types															
* 1ms exponential pulse ** Forward voltage															
SOT - 23 Plastic	DO - 35 Glass	SOT - 89 Plastic	DO - 41 Glass	500 - 57 Glass	500 - 51 Glass	DO - 1 Metal	500 - 84 Glass	500 - 18 Plastic	DO - 1 Metal	DO - 4 Metal	DO - 5 Metal	DO - 30 Metal	Encapsulation		
Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Both	Both	Normal	Polarity		
Tamb 25°C	Tamb 50°C	Tamb 25°C	Tamb 25°C	Tamb 45°C	Tamb 25°C	Tamb 25°C	Tamb 45°C	Tamb 25°C	Tamb 25°C	Tamb 25°C	Tmb 65°C		Rated diss at temp.		

The following CV series is available from: BZX79 to CECC 50 005-005

- | | | | | |
|--------------|--------------|--------------|--------------|--------------|
| CV7138 (3V3) | CV7099 (4V7) | CV7103 (6V8) | CV7143 (10V) | CV7106 (15V) |
| CV7139 (3V6) | CV7100 (5V1) | CV7104 (7V5) | CV7144 (11V) | |
| CV7140 (3V9) | CV7101 (5V6) | CV7105 (8V2) | CV7145 (12V) | |
| CV7141 (4V3) | CV7102 (6V2) | CV7142 (9V1) | CV7146 (13V) | |

Silicon voltage regulator diodes

low power 

350mW (BZX84 series): see Surface mounted devices

400mW ($T_{amb} = 50^{\circ}\text{C} \pm 5\%$ voltage tolerance)

book 1 part 3

Outline DO-35 Drawing reference H

Type No.	Nom. Zener Voltage (V)	Min. Voltage (V)	Measured at Test I_z		Typ. Temp. Coefficient (mV/°C)	Test I_z (mA)	Max. I_R (μA)	at	V_R (V)
			Max. Voltage (V)	Max. Slope Resistance (Ω)					
5BZX79									
-C2V4	2.4	2.2	2.6	100	-1.7	5	100		1.0
-C2V7	2.7	2.5	2.9	100	-1.7	5	75		1.0
-C3V0	3.0	2.8	3.2	95	-1.7	5	50		1.0
-C3V3	3.3	3.1	3.5	95	-1.7	5	25		1.0
-C3V6	3.6	3.4	3.8	90	-1.7	5	15		1.0
-C3V9	3.9	3.7	4.1	90	-1.6	5	10		1.0
-C4V3	4.3	4.0	4.6	90	-1.2	5	5.0		1.0
-C4V7	4.7	4.4	5.0	80	-1.4	5	3.0		2.0
-C5V1	5.1	4.8	5.4	60	-0.8	5	2.0		2.0
-C5V6	5.6	5.2	6.0	40	+1.2	5	1.0		2.0
-C6V2	6.2	5.8	6.6	10	+2.3	5	3.0		4.0
-C6V8	6.8	6.4	7.2	15	+3.0	5	2.0		4.0
-C7V5	7.5	7.0	7.9	15	+4.0	5	1.0		5.0
-C8V2	8.2	7.7	8.7	15	+4.6	5	0.7		5.0
-C9V1	9.1	8.5	9.6	15	+5.5	5	0.5		6.0
-C10	10	9.4	10.6	20	+6.4	5	0.2		7.0
-C11	11	10.4	11.6	20	+7.4	5	0.1		8.0
-C12	12	11.4	12.7	25	+8.4	5	0.1		8.0
-C13	13	12.4	14.1	30	+9.4	5	0.1		8.0
-C15	15	13.8	15.6	30	+11.4	5	0.05		10.5
-C16	16	15.3	17.1	40	+12.4	5	0.05		11.2
-C18	18	16.8	19.1	45	+14.4	5	0.05		12.6
-C20	20	18.8	21.2	55	+16.4	5	0.05		14
-C22	22	20.8	23.3	55	+18.4	5	0.05		15.4
-C24	24	22.8	25.6	70	+20.4	5	0.05		16.8
-C27	27	25.1	28.9	80	+23.4	2	0.05		18.9
-C30	30	28	32	80	+26.6	2	0.05		21.0
-C33	33	31	35	80	+29.7	2	0.05		23.1
-C36	36	34	38	90	+33	2	0.05		25.2
-C39	39	37	41	130	+36.4	2	0.05		27.4
-C43	43	40	46	150	+41.2	2	0.05		30.1
-C47	47	44	50	170	+46.1	2	0.05		33.0
-C51	51	48	54	180	+51	2	0.05		35.7
-C56	56	52	60	200	+57	2	0.05		39.3
-C62	62	58	66	215	+64.4	2	0.05		43.5
-C68	68	64	72	240	+71.7	2	0.05		47.7
-C75	75	70	79	255	+80.2	2	0.05		52.5

5available to CECC 50 005-005

continued

Silicon voltage regulator diodes

 low power (cont.)

book 1 part 3

1W (BZV49 series): see Surface mounted devices

Outline DO-41 Drawing reference AA

1.3W ($T_{TP} = 55^{\circ}\text{C}$) $\pm 5\%$ voltage tolerance

Type No.	Nom. Zener Voltage (V)	Min. Voltage (V)	Measured at Test I_z		Temp. Coefficient		Test I_z (mA)	Max I_R (nA)	at	V_R (V)
			Max. Voltage (V)	Max. Slope Resistance (Ω)	Min.	Max.				
BZV85	3.6	3.4	3.8	15	-2.4*	-	60	50000		1.0
-C3V6	3.9	3.7	4.1	15	-2.2*	-	60	10000		1.0
-C4V3	4.3	4.0	4.6	13	-1.4*	-	50	5000		1.0
-C4V7	4.7	4.4	5.0	13	-0.7*	-	45	3000		1.0
-C5V1	5.1	4.8	5.4	10	-0.5	2.2	45	3000		2.0
-C5V6	5.6	5.2	6.0	7	0	2.7	45	2000		2.0
-C6V2	6.2	5.8	6.6	4	0.6	3.6	35	2000		3.0
-C6V8	6.8	6.4	7.2	3.5	1.3	4.3	35	2000		4.0
-C7V5	7.5	7.0	7.9	3	2.5	5.5	35	1000		4.5
-C8V2	8.2	7.7	8.7	5	3.1	6.1	25	700		5.0
-C9V1	9.1	8.5	9.6	5	3.8	7.2	25	700		6.5
-C10	10	9.4	10.6	8	4.7	8.5	25	200		7.0
-C11	11	10.4	11.6	10	5.3	9.3	20	200		7.7
-C12	12	11.4	12.7	10	6.3	10.8	20	200		8.4
-C13	13	12.4	14.1	10	7.4	12.0	20	200		9.1
-C15	15	13.8	15.6	15	8.9	13.6	15	50		10.5
-C16	16	15.3	17.1	15	10.7	15.4	15	50		11.0
-C18	18	16.8	19.1	20	11.8	17.1	15	50		12.5
-C20	20	18.8	21.2	24	13.6	19.1	10	50		14.0
-C22	22	20.8	23.3	25	16.6	22.1	10	50		15.5
-C24	24	22.8	25.6	30	18.3	24.3	10	50		17
-C27	27	25.1	28.9	40	20.1	27.5	8	50		19
-C30	30	28	32	45	22.4	32.0	8	50		21
-C33	33	31	35	45	24.8	35.0	8	50		23
-C36	36	34	38	50	27.2	39.9	8	50		25
-C39	39	37	41	60	29.6	43.0	6	50		27
-C43	43	40	46	75	34.0	48.3	6	50		30
-C47	47	44	50	100	37.4	52.5	4	50		33
-C51	51	48	54	125	40.8	56.5	4	50		36
-C56	56	52	60	150	46.8	63.0	4	50		39
-C62	62	58	66	175	52.2	72.5	4	50		43
-C68	68	64	72	200	60.5	81.0	4	50		48
-C75	75	70	79	225	66.5	88.0	4	50		53

§Available to CECC 50 005-010

*Typical

Silicon voltage regulator diodes

low power (cont.)

book 1 part 3

1.5W ($T_{amb} = 25^{\circ}\text{C}$) $\pm 5\%$ voltage tolerance

Outline SOD-51 Drawing reference W

Type No.	Nom. Zener Voltage (V)	Min. Voltage (V)	Measured at Test I_z		Typ. Temp. Coefficient (mV/°C)	Test I_z (mA)	Max I_R (μA)	at	V_R (V)
			Max. Voltage (V)	Max. Slope Resistance (Ω)					
BZX87									
-C5V1	5.1	4.8	5.4	10	0	50	10		2
-C5V6	5.6	5.2	6.0	5	+1.5	50	5		2
-C6V2	6.2	5.8	6.6	3	+2.4	50	3		2
-C6V8	6.8	6.4	7.2	3	+3.1	20	1.5		3
-C7V5	7.5	7.0	7.9	3	+3.8	20	0.6		3
-C8V2	8.2	7.7	8.7	4	+4.5	20	0.4		3
-C9V1	9.1	8.5	9.6	4	+5.4	20	0.3		5
-C10	10	9.4	10.6	5	+6.3	20	0.2		6.7
-C11	11	10.4	11.6	5	+7.4	20	0.2		7.3
-C12	12	11.4	12.7	6	+8.4	20	0.2		8
-C13	13	12.4	14.1	7	+9.4	20	0.2		8.7
-C15	15	13.8	15.6	10	+11.4	20	0.2		10
-C16	16	15.3	17.1	10	+12.5	10	0.2		10.7
-C18	18	16.8	19.1	15	+14.5	10	0.2		12
-C20	20	18.8	21.2	15	+16.6	10	0.2		13.3
-C22	22	20.8	23.3	20	+18.6	10	0.2		14.7
-C24	24	22.8	25.6	20	+20.7	10	0.2		16
-C27	27	25.1	28.9	25	+23.8	10	0.2		18
-C30	30	28	32	25	+26.9	10	0.2		20
-C33	33	31	35	30	+30	10	0.2		22
-C36	36	34	38	35	+33.4	10	0.2		24
-C39	39	37	41	40	+37	5	0.2		26
-C43	43	40	46	50	+41.6	5	0.2		29
-C47	47	44	50	60	+46.1	5	0.2		32
-C51	51	48	54	70	+51	5	0.2		34
-C56	56	52	60	80	+56.6	5	0.2		37
-C62	62	58	66	90	+63.4	5	0.2		41
-C68	68	64	72	110	+70.4	5	0.2		46
-C75	75	70	79	125	+78.4	5	0.2		50

Silicon voltage regulator diodes

 low power (cont.)

book 1 part 3

3.25W ($T_{ip} = 25^{\circ}\text{C} \pm 5\%$ voltage tolerance)

Outline SOD-57 Drawing reference CV1

Type No.	Nom. Zener Voltage (V)	Min. Voltage (V)	Max. Voltage (V)	Measured at Test Max. Slope Resistance (Ω)	Temp. Coefficient		Test I_z (mA)	Max. I_R (μA)	at	V_R (V)
					Min.	Max.				
§BZT03						(%/°C)				
-C7V5	7.5	7.0	7.9	2	0	0.07	100	750		5.6
-C8V2	8.2	7.7	8.7	2	0.03	0.08	100	600		6.2
-C9V1	9.1	8.5	9.6	4	0.03	0.08	50	10		6.8
-C10	10.0	9.4	10.6	4	0.05	0.09	50	5		7.5
-C11	11.0	10.4	11.6	7	0.05	0.10	50	4		8.2
-C12	12.0	11.4	12.7	7	0.05	0.10	50	3		9.1
-C13	13.0	12.4	14.1	10	0.05	0.10	50	2		10
-C15	15.0	13.8	15.6	10	0.05	0.10	50	1		11
-C16	16.0	15.3	17.1	15	0.06	0.11	25	1		12
-C18	18.0	16.8	19.1	15	0.06	0.11	25	1		13
-C20	20.0	18.8	21.2	15	0.06	0.11	25	1		15
-C22	22.0	20.8	23.3	15	0.06	0.11	25	1		16
-C24	24.0	22.8	25.6	15	0.06	0.11	25	1		18
-C27	27.0	25.1	28.9	15	0.06	0.11	25	1		20
-C30	30	28	32	15	0.06	0.11	25	1		22
-C33	33	31	35	15	0.06	0.11	25	1		24
-C36	36	34	38	40	0.06	0.11	10	1		27
-C39	39	37	41	40	0.06	0.11	10	1		30
-C43	43	40	46	45	0.07	0.12	10	1		33
-C47	47	44	50	45	0.07	0.12	10	1		36
-C51	51	48	54	60	0.07	0.12	10	1		39
-C56	56	52	60	60	0.07	0.12	10	1		43
-C62	62	58	66	80	0.08	0.13	10	1		47
-C68	68	64	72	80	0.08	0.13	10	1		51
-C75	75	70	79	100	0.08	0.13	10	1		56
-C82	82	77	87	100	0.08	0.13	10	1		62
-C91	91	85	96	200	0.09	0.13	5	1		68
-C100	100	94	106	200	0.09	0.13	5	1		75
-C110	110	104	116	250	0.09	0.13	5	1		82
-C120	120	114	127	250	0.09	0.13	5	1		91
-C130	130	124	141	300	0.09	0.13	5	1		100
-C150	150	138	156	300	0.09	0.13	5	1		110
-C160	160	153	171	350	0.09	0.13	5	1		120
-C180	180	168	191	400	0.09	0.13	5	1		130
-C200	200	188	212	500	0.09	0.13	5	1		150
-C220	220	208	233	750	0.09	0.13	2	1		160
-C240	240	228	256	850	0.09	0.13	2	1		180
-C270	270	251	289	1000	0.09	0.13	2	1		200

§Also available to CECC 50 005-017

Silicon voltage regulator diodes

low power (cont.)

book 1 part 3

6W ($T_{ip} = 25^{\circ}\text{C}$) $\pm 5\%$ voltage tolerance

Outline SOD-64 Drawing reference CV2

Type No.	Nom. Zener Voltage (V)	Min. Voltage (V)	Measured at Test I_z		Temp. Coefficient		Test I_z (mA)	Max I_R (A)	at	V_R (V)
			Max. Voltage (V)	Max. Slope Resistance (Ω)	Min.	Max. (%/°C)				
5BZW03										
-C7V5	7.5	7.0	7.9	1.5	0	0.07	175	1500		5.6
-C8V2	8.2	7.7	8.7	1.5	0.03	0.08	150	1200		6.2
-C9V1	9.1	8.5	9.6	2	0.03	0.08	150	40		6.8
-C10	10	9.4	10.6	2	0.05	0.09	125	20		7.5
-C11	11	10.4	11.6	2.5	0.05	0.10	125	15		8.2
-C12	12	11.4	12.7	2.5	0.05	0.10	100	10		9.1
-C13	13	12.4	14.1	2.5	0.05	0.10	100	4		10
-C15	15	13.8	15.6	2.5	0.05	0.10	75	2		11
-C16	16	15.3	17.1	2.5	0.06	0.11	75	2		12
-C18	18	16.8	19.1	2.5	0.06	0.11	65	2		13
-C20	20	18.8	21.2	3	0.06	0.11	65	2		15
-C22	22	20.8	23.3	3.5	0.06	0.11	50	2		16
-C24	24	22.8	25.6	3.5	0.06	0.11	50	2		18
-C27	27	25.1	28.9	5	0.06	0.11	50	2		20
-C30	30	28	32	8	0.06	0.11	40	2		22
-C33	33	31	35	10	0.06	0.11	40	2		24
-C36	36	34	38	11	0.06	0.11	30	2		27
-C39	39	37	41	14	0.06	0.11	30	2		30
-C43	43	40	46	20	0.07	0.12	30	2		33
-C47	47	44	50	25	0.07	0.12	25	2		36
-C51	51	48	54	27	0.07	0.12	25	2		39
-C56	56	52	60	35	0.07	0.12	20	2		43
-C62	62	58	66	42	0.08	0.13	20	2		47
-C68	68	64	72	44	0.08	0.13	20	2		51
-C75	75	70	79	45	0.08	0.13	20	2		56
-C82	82	77	87	65	0.08	0.13	15	2		62
-C91	91	85	96	75	0.09	0.13	15	2		68
-C100	100	94	106	90	0.09	0.13	12	2		75
-C110	110	104	116	125	0.09	0.13	12	2		82
-C120	120	114	127	170	0.09	0.13	10	2		91
-C130	130	124	141	190	0.09	0.13	10	2		100
-C150	150	138	156	260	0.09	0.13	8	2		110
-C160	160	153	171	350	0.09	0.13	8	2		120
-C180	180	168	191	430	0.09	0.13	5	2		130
-C200	200	188	212	500	0.09	0.13	5	2		150
-C220	220	208	233	700	0.09	0.13	5	2		160
-C240	240	228	256	900	0.09	0.13	5	2		180
-C270	270	251	289	1200	0.09	0.13	5	2		200

§Also available to CECC 50 005-019 (BZW03-C9V1 to C270).

Silicon voltage regulator diodes

book 1 part 4a

medium to high power

	W	2.5	2.5	2.5	20	75
P_{tot}	°C	25	25	25		
up to T_{amb}	°C				75	65
up to T_{mb}	°C					
Voltage tolerance	%	5	5	5	5	5
I_{ZRM}	A	3.5	5	5	20	100
P_{ZSM}	W	20	100	100	50	4400
T_{jmax}	°C	175	175	150	175	175
Case		DO-1	DO-1	SOD-18	DO-4	DO-5
Drawing reference				K	B	C
Series number		†BZY96-*	†BZY95-**	BZX70-	‡BZY93- (R)	§BZY91- (R)
Operating voltage		Type number suffix				
4.7		C4V7				
5.1						
5.6	100 mA	C5V6				
6.2		C6V2				
6.8		C6V8				
7.5	50 mA	C7V5		C7V5	2000 mA C7V5	5000 mA C7V5
8.2		C8V2		C8V2	C8V2	C8V2
9.1		C9V1		C9V1	C9V1	C9V1
10			C10	C10	C10	C10
11			C11	50 mA C11	C11	C11
12			50 mA C12	C12	1000 mA C12	2000 mA C12
13			C13	C13	C13	C13
15			C15	C15	C15	C15
16			C16	C16	C16	C16
18			C18	C18	C18	C18
20			C20	C20	C20	C20
22			C22	C22	500 mA C22	C22
24			20 mA C24	20 mA C24	C24	1000 mA C24
27			C27	C27	C27	C27
30			C30	C30	C30	C30
33			C33	C33	C33	C33
36			C36	C36	C36	C36
39			C39	C39	C39	C39
43			C43	C43	C43	C43
47			C47	C47	C47	C47
51			10 mA C51	10 mA C51	200 mA C51	500 mA C51
56			C56	C56	C56	C56
62			C62	C62	C62	C62
68			C68	C68	C68	C68
75			C75	C75	C75	C75

current in mA at which voltage is specified

Note:

For acceptance testing purposes it is important to appreciate that V_Z is measured using a pulse method with a pulse width $\leq 100\mu s$ and duty cycle ≤ 0.001 so that the values correspond to a $T_j = 25^\circ C$. A V_Z measurement made on a curve tracer will produce a rise in junction temperature to make V_Z appear out of specification.

†Maintenance types Also available to: *BS9305-F049, **BS9305-F050, ‡BS9305-F051, §BS9305-F052

Silicon surge suppressor diodes

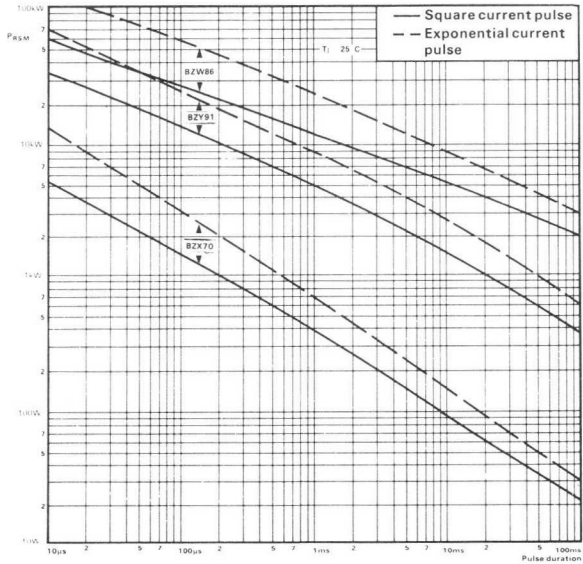
basic data

book 1 part 4a

Power rating (Maximum non-repetitive peak power dissipation*)	Encapsulation	Drawing reference	Series No.	Stand-off voltages
200W	DO-1 metal		†BZY96	3.6V to 6.8V
700W	DO-1 metal		†BZY95	7.5V to 56V
700W	SOD-18 plastic DO-4 metal (UNF thread)	K	BZX70	5.6V to 56V
		B	BZY93	5.6V to 56V
9500W	DO-5 metal (UNF thread)	C	BZY91	5.6V to 56V
25kW	DO-30 metal (UNF thread)	F	BZW86	7.5V to 56V

*1ms exponential pulse.
†Maintenance types

Maximum permissible non-repetitive
peak power dissipation
($T_j = 25^\circ\text{C}$ prior to surge)

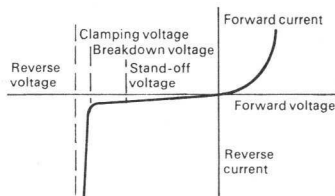
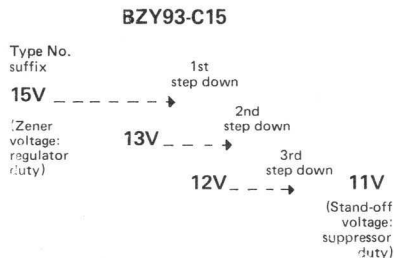


Silicon surge suppressor diodes

book 1 part 4a

Mullard power zeners will switch in less than 5ns and are therefore recommended for transient suppressor as well as voltage regulator duty. Suppressors are normally chosen with a stand-off voltage equal to that of the steady-state voltage of the line on which they will be used. The stand-off voltage is the maximum reverse voltage that can be applied without causing significant reverse dissipation.

In practice, the stand-off voltage of a device is 'three steps down' in the series from the zener voltage given by the suffix. For example, a BZY93-C15 would be used as a voltage regulator on a 15V line, and as a transient suppressor on a 11V line:



A note on type number suffixes

The suffix to the type numbers of voltage regulator diodes indicates the ZENER voltage (from which the STAND-OFF VOLTAGE for suppressor duty can be determined as shown above).

The suffix to the type numbers of the BZW -- transient suppressor range (three of which are now relegated to 'maintenance' status) directly indicates the stand-off voltage.

The following table relates the two suffix systems:

BZW— transient suppressors— with suffixes:	can be replaced by present zeners with suffixes
3V9	C5V1 or C5V6
4V3	C5V1 or C5V6 or C5V2
4V7	C5V6 or C6V2 or C6V8
5V1	C6V2 or C6V8 or C7V5
5V6	C6V8 or C7V5 or C8V2
6V2	C7V5 or C8V2 or C9V1
6V8	C8V2 or C9V1 or C10
7V5	C9V1 or C10 or C11
8V2	C10 or C11 or C12
9V1	C11 or C12 or C13
10	C12 or C13 or C15
11	C13 or C15 or C16
12	C15 or C16 or C18
13	C16 or C18 or C20
15	C18 or C20 or C22
16	C20 or C22 or C24
18	C22 or C24 or C27
20	C24 or C27 or C30
22	C27 or C30 or C33
24	C30 or C33 or C36
27	C33 or C36 or C39
30	C36 or C39 or C43
33	C39 or C43 or C47
36	C43 or C47 or C51
39	C47 or C51 or C56
43	C51 or C56 or C62
47	C56 or C62 or C68
51	C62 or C68 or C75
56	C68 or C75
62	C75

Silicon rectifier diodes and bridge modules

selection guide

book 1 part 4a

GENERAL PURPOSE RECTIFIERS

I _{F(AV)} max.	Type No.	V _{RRM} max. (V)				Outline
		300	600	1200	1600	
6A	BYX38	•	•	•		DO-4
6.5A	BY249	•	•			TO-220AC
10A	BYX98	•	•	•		DO-4
12A	BYX42	•	•	•		DO-4
15A	BYX99	•	•	•		DO-4
30A	BYX96	•	•	•	•	DO-4
47A	BYX97	•	•	•	•	DO-5
48A	BYX52	•	•	•		DO-5

AVALANCHE RECTIFIERS

I _{F(AV)} max.	Type No.	V _{RRM} max. (V)								Outline	
		200	300	400	500	600	800	1000	1200		1400
9.5A	BYX39					•	•	•	•	•	DO-4
14A	BYX30	•	•	•	•	•	•	•	•	•	DO-4
20A	BYX25					•	•	•	•	•	DO-4
22A	BYX46	•	•	•	•	•					DO-4
48A	BYX56					•	•	•	•	•	DO-5

SCHOTTKY-BARRIER RECTIFIERS

I _{F(AV)} max.	Type No.	V _{RRM} max. (V)					Outline
		30	35	40	40A*	45	
2x 5A	•BYV18	•	•	•	•	•	TO-220AB
10A	BYV19	•	•	•	•	•	TO-220AC
2x10A	BYV33†	•	•	•	•	•	TO-220AB
15A	BYV20	•	•	•	•	•	DO-4
2x15A	BYV43†	•	•	•	•	•	TO-220AB
2x15A	•BYV73†	•	•	•	•	•	SOT-93
16A	•BYV39	•	•	•	•	•	TO-220AC
28A	BYV21	•	•	•	•	•	DO-4
60A	BYV22	•	•	•	•	•	DO-5
60A	PHSD51					•	DO-5
80A	BYV23	•	•	•	•	•	DO-5

*With guaranteed reverse surge capability.

†Monolithic dual rectifier diodes.

Silicon rectifier diodes and bridge modules

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selection guide (cont.)

FAST-RECOVERY RECTIFIERS

$I_{F(AV)}$ max.	Type No.	V_{RRM} max. (V)								Outline	
		50	100	150	200	300	400	500	600		800
ULTRA FAST TYPES (Epitaxial)											
2×5A	●BYQ28†	•	•	•	•						TO-220AB
2×5A	●BYT28†					•	•	•			TO220AB
7.6A	BYW29	•	•	•	•						TO-220AC
8A	●BYR29								•	•	TO-220AC
9A	BYV29					•	•	•			TO-220AC
2×10A	BYV32†	•	•	•	•						TO-220AB
2×10A	BYV34†					•	•	•			TO-220AB
12A	BYV30					•	•	•			DO-4
14A	BYT79					•	•	•			TO-220AC
14A	BYW30	•	•	•	•						DO-4
14A	BYV79	•	•	•	•						TO-220AC
2×15A	BYV42†	•	•	•	•						TO-220AB
2×15A	●BYV44†					•	•	•			TO-220AB
2×15A	BYV72†	•	•	•	•						SOT-93
28A	●BYV31					•	•	•			DO-4
28A	BYW31	•	•	•	•						DO-4
35A	BYV92					•	•	•			DO-5
40A	BYW92	•	•	•	•						DO-5
60A	BYW93	•	•	•	•						DO-5
80A	BYW94	•	•	•	•						DO-5

†Monolithic dual rectifier diodes

FAST TYPES

$I_{F(AV)}$ max.	Type No.	V_{RRM} max. (V)								Outline		
		200	300	400	500	600	800	1000	1200		1300	1500
4.5A	BY359							•		•	•	TO-220AC
7A	BY229	•		•		•	•					TO-220AC
8A	BY329						•	•	•			TO-220AC
12A	BYV24						•	•				DO-4
14A	BYX30	•	•	•	•	•						DO-4
22A	BYX46	•	•	•	•	•						DO-4
40A	BYW25						•	•				DO-5

SILICON RECTIFIER BRIDGES

$I_{O(AV)}$ max.	Type No.	$V_{I(RMS)}$ max. (V)					
		50	80	140	220	280	420
Single-phase							
4.8A	BY224				•	•	
4.8A	BY225	•	•				
12A	BY260			•		•	•
25A	BY261			•		•	•
Three-phase							
		340	425	510			
25A	●BGX25	•	•	•			

Silicon rectifier diodes and bridge modules

general purpose rectifiers

book 1 part 4a

Type No.	Approvals	Outline	Drawing reference	$I_{F(AV)}$ max. (A)	V_{RRM} max. (V)	$I_{FSM}^{(1)}$ max. (A)	V_F max. ⁽²⁾ at I_F
†BYX38-300 -600 -1200	CECC 50 009-019	DO-4 metal (UNF thread)	B1	6	300 600 1200	50	1.7V at 20A
†BY249-300 -600		TO-220AC plastic	BV3	6.5	300 600	60	1.6V at 20A
†BYX98-300 -600 -1200	CECC 50 009-004	DO-4 metal (UNF thread)	B1	10	300 600 1200	75	1.7V at 20A
†BYX42-300 -600 -1200	CECC 50 009-020	DO-4 metal (UNF thread)	B1	12	300 600 1200	125	1.4V at 15A
†BYX99-300 -600 -1200	CECC 50 009-005	DO-4 metal (UNF thread)	B1	15	300 600 1200	180	1.55V at 50A
†BYX96-300 -600 -1200 -1600	BS9331-F129	DO-4 metal (Metric thread)	B1	30	300 600 1200 1600	400	1.7V at 100A
†BYX97-300 -600 -1200 -1600	BS9331-F130	DO-5 metal (Metric thread)	C1	47	300 600 1200 1600	800	1.45V at 150A
†BYX52-300 -600 -1200	CECC 50 009 024	DO-5 metal (UNF thread)	C1	48	300 600 1200	800	1.8V at 150A

avalanche rectifiers

Type No.	Approvals	Outline	Drawing reference	$I_{F(AV)}$ max. (A)	V_{RRM} max. (V)	$I_{FSM}^{(1)}$ max. (A)	$P_{RRM}^{(3)}$ max. (kW)	$P_{RSM}^{(3)}$ max. (kW)	$V_{Fmax.}$ at $I_F^{(2)}$
†BYX39-600 -800 -1000 -1200 -1400	BS9333-F005	DO-4 metal (UNF thread)	B1	9.5	600 800 1000 1200 1400	125	2	4	1.7V at 20A
†BYX30-200 -300 -400 -500 -600	BS9333-F002	DO-4 metal (UNF thread)	B1	14	200 300 400 500 600	250	5.5	18	3.2V at 50A
†BYX25-600 -800 -1000 -1200 -1400	CECC 50 009-022	DO-4 metal (UNF thread)	B1	20	600 800 1000 1200 1400	360	3	18	1.8V at 50A
BYX46-200 -300 -400 -500 -600		DO-4 metal (UNF thread)	B1	22	200 300 400 500 600	300	9.5	18	2.0V at 50A
†BYX56-600 -800 -1000 -1200 -1400	CECC 50 009-023	DO-5 metal (UNF thread)	C1	48	600 800 1000 1200 1400	800	6.5	40	1.8V at 150A

⁽¹⁾ At $T_j = T_j$ max.
 $t = 10ms$

⁽²⁾ At $T_j = 25^\circ C$.

⁽³⁾ $t = 10\mu s$

†Reverse polarity types (stud anode) are also available. They are denoted by the final letter R, e.g. BYX25-600R.

Silicon rectifier diodes and bridge modules

book 1 part 4a.

schottky-barrier rectifiers

Type No.	Approvals	Outline	Drawing reference	$I_{F(AV)}$ max. (A)	V_{RRM} max. (V)	$I_{FSM}^{(1)}$ max. (A)	C_d typ. (pF)	V_F max at I_F ($T_J = 100^\circ\text{C}$)
•BYV18-30 -35 -40(A) -45		TO-220AB plastic	BV5	2 x 5	30 35 40 45	2 x 50	100	0.6V at 5A
BYV19-30 -35 -40(A) -45		TO-220AC plastic	BV3	10	30 35 40 45	150	200	0.6V at 5A
BYV33-30 -35 -40(A) -45		TO-220AB plastic	BV5	2 x 10	30 35 40 45	2 x 200	300	0.6V at 7A
BYV20-30 -35 -40(A) -45	CECC 50 009-033	DO-4 metal (UNF Thread)	B1	15	30 35 40 45	300	520	0.6V at 15A
BYV43-30 -35 -40(A) -45		TO-220AB plastic	BV5	2 x 15	30 35 40 45	2 x 200	500	0.6V at 15A
•BYV73-30 -35 -40(A) -45		SOT-93 plastic	AR	2 x 15	30 35 40 45	2 x 150	500	0.6V at 15A
•BYV39-30 -35 -40(A) -45		TO-220AC plastic	BV3	16	30 35 40 45	150	520	0.6V at 15A
BYV21-30 -35 -40(A) -45	CECC 50 009-018	DO-4 metal (UNF thread)	B1	28	30 35 40 45	600	1150	0.55V at 30A
BYV22-30 -35 -40(A) -45	CECC 50 009-034	DO-5 metal (UNF Thread)	C1	60	30 35 40 45	1000	2100	0.55V at 50A
PHSD51		DO-5 metal (UNF Thread)	C1	60	45	700	2100	0.6V at 60A ($T_J = 125^\circ\text{C}$)
BYV23-30 -35 -40(A) -45	CECC 50 009-036	DO-5 metal (UNF Thread)	C1	80	30 35 40 45	1500	2500	0.55V at 70A

⁽¹⁾ $T_J = 125^\circ\text{C}$; $t = 10\text{ms}$

Silicon rectifier diodes and bridge modules

fast-recovery rectifier diodes

book 1 part 4a

Type No.	Approvals	Outline and Drawing reference	$I_{F(AV)}$ max. (A)	V_{RRM} max. (V)	$I_{FSM}^{(1)}$ max. (A)	t_{rr} max. (ns)	V_F at $I_F^{(2)}$ max.
ULTRA FAST TYPES (epitaxial)							
●BYQ28-50 -100 -150 -200		TO-220 AB plastic BV5	2x5	50 100 150 200	2x50	20	0.85V at 5A
●BYT28-300 -400 -500		TO-220 AB plastic BV5	2x5	300 400 500	2x50	50	1.05V at 5A
BYW29-50 -100 -150 -200	CECC 50 009-014	TO-220 AC plastic BV3	7.6	50 100 150 200	80	35	0.85V at 5A
●BYR29-600 -800		TO-220 AC plastic BV3	9	600 800	60	75	1.3V at 10A
BYV29-300 -400 -500		TO-220 AC plastic BV3	9	300 400 500	100	50	1.05V at 5A
BYV32-50 -100 -150 -200	CECC 50 009-026	TO-220 AB plastic BV5	2x10	50 100 150 200	2x150	35	1.15V at 20A
BYV34-300 -400 -500		TO-220 AB plastic BV5	2x10	300 400 500	2x120	50	1.1V at 10A
BYV30-300 -400 -500		DO-4 metal (UNF thread) B1	12	300 400 500	150	100	1.35V at 10A
BYT79-300 -400 -500		TO-220 AC plastic BV3	14	300 400 500	150	50	1.05V at 10A
BYW30-50 -100 -150 -200	CECC 50 009-001	DO-4 metal (Metric thread*) B1	14	50 100 150 200	200	35	0.85V at 10A
BYV79-50 -100 -150 -200		TO-220 AC plastic BV3	14	50 100 150 200	200	35	0.85V at 10A
BYV42-50 -100 -150 -200		TO-220 AB plastic BV5	2x15	50 100 150 200	2x200	35	0.85V at 10A
●BYV44-300 -400 -500		TO-220 AB plastic BV5	2x15	300 400 500	2x150	50	1.05V at 10A
BYV72-50 -100 -150 -200		SOT-93 plastic AR	2x15	50 100 150 200	2x200	35	0.85V at 10A
●BYV31-300 -400 -500		DO-4 metal (UNF thread) B1	28	300 400 500	200	60	0.85V at 10A
BYW31-50 -100 -150 -200	CECC 50 009-002	DO-4 metal (Metric thread*) B1	28	50 100 150 200	320	50	0.85V at 20A
BYV92-300 -400 -500		DO-5 metal (UNF thread) C1	35	300 400 500	500	100	1.4V at 100A
BYW92-50 -100 -150 -200	CECC 50 009-003	DO-5 metal (Metric thread*) C1	40	50 100 150 200	500	50	0.95V at 35A
BYW33-50 -100 -150 -200	CECC 50 009-028	DO-5 metal (Metric thread*) C1	60	60 100 150 200	800	60	0.85V at 50A
BYW94-50 -100 -150 -200		DO-5 metal (Metric thread*) C1	80	50 100 150 200	1500	60	0.85V at 70A

⁽¹⁾ At $T_J = T_{Jmax}$.
 $t = 10ms$

⁽²⁾ At $T_J = 100^\circ C$

*UNF thread available on request.

Silicon rectifier diodes and bridge modules

book 1 part 4a fast-recovery rectifier diodes (cont.)

Type No.	Approvals	Outline and Drawing reference	$I_{F(AV)}$ max. (A)	V_{RRM} max. (V)	$I_{FSM}^{(1)}$ max. (A)	t_{rr} max. (ns)	V_F at $I_F^{(2)}$ max.
FAST TYPES (double-diffused)							
BY359-1000 -1300 -1500		TO-220AC plastic BV3	4.5	1000 1300 1500	60	600	2.3V at 20A
†BY229-200 -400 -600 -800	CECC 50 009-021	TO-220 AC plastic BV3	7	200 400 600 800	60	450	1.8V at 20A
BY329-800 -1000 -1200		TO-220 AC plastic BV3	8	800 1000 1200	80	150	1.85V at 20A
†BYV24-800 -1000		DO-4 metal B1	14	800 1000	150	1000	1.7V at 20A
†BYX30-200 -300 -400 -500 -600	BS9333-F002	DO-4 metal (UNF thread) B1	14	200 300 400 500 600	250	200	3.2V at 50A
†BYX46-200 -300 -400 -500 -600		DO-4 metal (UNF thread) B1	22	200 300 400 500 600	300	200	2.0V at 50A
†BYW25-800 1000		DO-5 metal (Metric thread) C1	40	800 1000	550	450	2.25V at 150A

⁽¹⁾ At $T_j = T_{jmax}$.
 $t = 10ms$

⁽²⁾ At $T_j = 25^\circ C$

†Reverse polarity types (stud anode) are also available. They are denoted by the final letter R e.g. BYW25-800R.

book 1 part 4a

bridge modules

SINGLE-PHASE

pcb mounted types

Type No.	Outline	Drawing reference	$I_{O(AV)}$ max. (A)	$V_{(RMS)}$ max. (V)	V_{IRM} max. (V)	I_{SM} max. (A)
BY224-400 -600	Plastic module with heatsink face (SOT-112)	CD	4.8	220 280	400 600	100
BY225-100 -200	Plastic module with heatsink face (SOT-112)	CD	4.8	50 80	100 200	100

bolt-down types

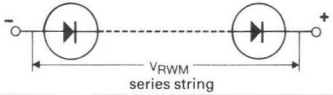
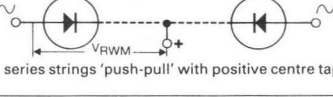
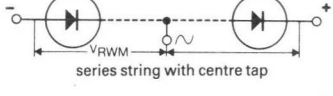
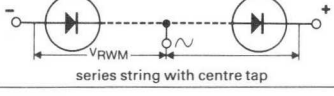
BY260-200 -400 -600	Round case with heatsink face and fast-on connectors	CE	12	140 280 420	200 400 600	125
BY261-200 -400 -600	Square case with heatsink face and fast-on connectors	CF	25	140 280 420	200 400 600	320

THREE-PHASE

• BGX25-800 -1000 -1200	Plastic modules with isolated metal baseplate	DQ	25	340 425 510	800 1000 1200	80
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High-voltage rectifier stacks

book 1 part 4a

Type No.	I_{FAV} max.	V_{RWM} max.	Configuration
OSS9115-3 to -36	3.5A (6A in oil)	4.5kV to 54kV	
OSS9215-3 to -36	5A (20A in oil)		
OSS9415-3 to -36	10A (30A in oil)		
OSB9115-4 to -36	7A (12A in oil)	3kV to 27kV	
OSB9215-4 to -36	10A (40A in oil)		
OSB9415-4 to -36	20A (60A in oil)		
OSM9115-4 to -36	3.5A (6A in oil)	3kV to 27kV	
OSM9215-4 to -36	5A (20A in oil)		
OSM9415-4 to -36	10A (30A in oil)		
OSM9510-8 -12	1.5A 1.5A	*kV bKV to 12kV	

All the above rectifier assemblies (except OSM9510) include 1500V avalanche voltage devices.

For replacement purposes and in existing designs, assemblies with 1000V rectifiers, e.g. OSS9110 etc., are still available.

Stack selection

The last digit(s) in the type description refer to the number of diodes in the stack. The following is intended as a brief guide to selection; for detailed information refer to Mullard published data.

OSM9-15 and OSB9-15 series

Each diode in the stack has a rated V_{RWM} of 1.5kV and the stack rated V_{RWM} is measured from the centre tap to either end terminal. Therefore, the number of diodes per arm = stack rated V_{RWM} in kV/1.5 and total number of diodes in stack = 2 x number of diodes per arm. eg. OSM9215 with rated V_{RWM} of 12kV:

number of diodes per arm = $12/1.5 = 8$,
number of diodes in stack = 16 and type description becomes OSM9215-16.

OSS9-15 series

Each diode in the stack has a rated V_{RWM} of 1.5kV and stack V_{RWM} is measured across the whole string.

Therefore, the number of diodes in stack = stack rated V_{RWM} in kV/1.5

Since the stack is offered in rows of 3 devices, this number must be rounded up to the nearest multiple of 3.

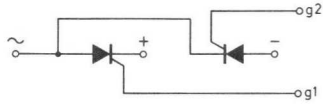
eg. OSS9215 with rated V_{RWM} of 12kV:

number of diodes in stack = $12/1.5 = 8$.

The nearest multiple of 3 is 9, hence type description becomes OSS9215-9.

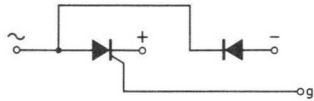
THYRISTOR-THYRISTOR MODULES

$I_{T(AV)}$ max.	Type No.	V_{DRM}/V_{RRM} (V)			
		600	800	1200	1400
40A	BGX12-TT	•	•	•	•
50A	BGX13-TT	•	•	•	•
55A	BGX14-TT	•	•	•	•
65A	BGX15-TT	•	•	•	•
90A	BGX17-TT	•	•	•	•



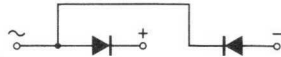
THYRISTOR-DIODE MODULES

$I_{T(AV)}$ $I_{F(AV)}$ max.	Type No.	V_{RRM} (V)	
		600	1200
25A	BGX11-TD	•	•
43A	BGX12-TD	•	•



DIODE-DIODE MODULES

$I_{F(AV)}$ max.	Type No.	V_{RRM} (V)	
		600	1200
25A	BGX11-DD	•	•
48A	BGX12-DD	•	•



Isolated power modules

thyristor-thyristor modules

book 1 part 4b

Outline TO-240 Drawing reference BD

Type No.	$I_{T(RMS)}^{(1)}$ max. (A)	$I_{T(AV)}^{(1)}$ max. (A)	V_{DRM} V_{RRM} max. (V)	$I_{TSM}^{(2)}$ max. (A)	di_T/dt max. (A/ μ s)	dV_D/dt max. (V/ μ s)	V_{GT} min. (V)	I_{GT} min. (mA)
BGX12-600TT -800TT -1200TT -1200CTT -1400CTT	75	40	600 800 1200 1200 1400	700	100	200 200 200 1000 1000	1.5	100
BGX13-600TT -800TT -1200TT 1200CTT -1400CTT	80	50	600 800 1200 1200 1400	1000	100	200 200 200 1000 1000	1.5	150
BGX14-600TT -800TT -1200TT 1200CTT -1400CTT	95	55	600 800 1200 1200 1400	1350	100	200 200 200 1000 1000	1.5	150
BGX15-600TT -800TT -1200TT 1200CTT -1400CTT	110	65	600 800 1200 1200 1400	1500	100	200 200 200 1000 1000	1.5	150
BGX17-600TT -800TT -1200TT 1200CTT -1400CTT	140	90	600 800 1200 1200 1400	1700	100	200 200 200 1000 1000	1.5	150

thyristor-diode modules

Type No.	$I_{T(RMS)}^{(1)}$ $I_{F(RMS)}$ max. (A)	$I_{T(AV)}^{(1)}$ $I_{F(AV)}$ max. (A)	V_{RRM} max. (V)	$I_{TSM}^{(2)}$ I_{FSM} max. (A)	di_T/dt max. (A/ μ s)	dV_D/dt max. (V/ μ s)	V_{GT} min. (V)	I_{GT} min. (mA)
BGX11-600TD -1200TD	50	25	600 1200	400	150	200 1000	2.5	80
BGX12-600TD -1200TD	80	43	600 1200	700	100	— 1000	2.5	150

diode-diode modules

Type No.	$I_{F(RMS)}^{(1)}$ max. (A)	$I_{F(AV)}^{(1)}$ max. (A)	V_{RRM} max. (V)	$I_{FSM}^{(2)}$ max. (A)	V_F max. at $T_J = 25^\circ\text{C}$	I_F	$V_{T(O)}$ typ. $T_J = 150^\circ\text{C}$ (V)	r_F typ. $T_J = 150^\circ\text{C}$ (m Ω)
BGX11-600DD -1200DD	50	25	600 1200	420	1.65V	100A	0.85	8
BGX12-600DD -1200DD	100	48	600 1200	1000	1.7V	200A	0.85	4

⁽¹⁾ At $T_{mb} = 85^\circ\text{C}$ ⁽¹⁾ At $T_J = T_J \text{ max.}; t = 10\text{ms}$
NOTE: Values apply to individual thyristors and diodes

$I_{T(RMS)}$ max.	Type No.	V_{RRM} max. (V)											Outline	
		100	200	400	500	600	800	1000	1200	1300	1400	1500		1600
GENERAL PURPOSE TYPES														
1A	BT149	•	•	•	•	•								TO-92
12A	BT151				•	•(650V)•								TO-220AB
16A	BTY79			•	•	•	•	•						TO-64
16A	BTW38					•	•	•						TO-64
16A	BTW42					•	•	•	•					TO-64
20A	BT152			•		•	•							TO-220AB
25A	BTW45			•		•	•	•	•					TO-48
25A	BTY91			•	•	•	•							TO-48
32A	BTW40			•		•	•							TO-48
32A	BTW92						•	•	•			•		TO-48
70A	BTV24					•	•		•			•		TO-65
140A	BTW23					•	•	•	•			•	•	TO-94
FAST TURN-OFF TYPES														
		V_{DRM} max. (V)												
6A	BT153				•									TO-220AB
15A	§BT155 RK/RN/RP					•	•							TO-220AB
40A	§BTW63 RK/RN/RP					•	•	•						TO-48
GATE TURN-OFF SWITCHES														
I_{TCRM} max	$I_{T(AV)}$ max.	V_{DRM} max (V)												
12A	3.2A	BT157									•		•	TO-220AB
25A	6.5A	BTW58						•		•		•		TO-220AB
25A	10A	BTV58				•	•(850V)•							TO-220AB
50A	13.5A	BTW59								•		•		TO-238AA
50A	15A	BTV59				•	•(850V)•							TO-238AA
120A	25A	•BTV60					•(850V)•		•					TO-238AA

§Asymmetrical types (ASCR)

Thyristors

general purpose thyristors

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Type No.	Approvals	Outline & Drawing ref.	$I_{T(RMS)}^{(1)}$ max. (A)	$I_{T(AV)}^{(1)}$ max. (A)	V_{RRM} max. (V)	$I_{TSM}^{(2)}$ max. (A)	di_T/dt max. (A/ μ s)	dV_D/dt max. (V/ μ s)	$V_{GT}^{(3)}$ min. (V)	$I_{GT}^{(3)}$ min. (mA)
BT149-F -A -B -D -E -M‡		TO-92 plastic BR8	1	0.6	50 100 200 400 500 600	15	30	10	0.8	0.2
BT151-500R -650R -800R	CECC 50 011-003	TO-220 plastic BV4	12	7.5	500 650 800	100	50	200	1.5	15
BTY79-400R -500R -600R -800R -1000R	CECC 50 011-006	TO-64 metal (UNF thread) BO	16	10	400 500 600 800 1000	150	50	200	1.5	30
BTW38-600R -800R -1000R	CECC 50 011-006	TO-64 metal (Metric thread) BO	16	10	600 800 1000	150	50	200	1.5	50
BTW42-600R -800R -1000R -1200R	CECC 50 011-006	TO-64 metal (Metric thread) BO	16	10	600 800 1000 1200	150	50	500*	1.5	50
BT152-400R -600R -800R		TO-220AB plastic BV4	20	13	400 600 800	200	200	200	1.0	32
BTW45-400R -600R -800R -1000R -1200R	CECC50011-002	TO-48 metal (Metric thread**) BM	25	16	400 600 800 1000 1200	300	100	200*	1.5	75
BTY91-400R -500R -600R -800R		TO-48 metal (UNF thread) BM	25	16	400 500 600 800	200	20	200	3.0	40
BTW40-400R -600R -800R	BS9341-F083	TO-48 metal (Metric thread**) BM	32	20	400 600 800	400	100	100	1.5	75
BTW92-800R -1000R -1200R -1400R -1600R	BS9341-F039	TO-48 metal (Metric thread**) BM	32	20	800 1000 1200 1400 1600	400	300	300*	3.5	100
BTV24-600R -800R -1200R -1400R		TO-65 metal (UNF thread) CN1	70	45	600 800 1200 1400	800	100	200*	2.5	100
BTW23-600R -800R -1000R -1200R -1400R -1600R		TO-94 metal (Metric thread**) BS	140	90	600 800 1000 1200 1400 1600	2000	300	200*	2.5	150

(1) At $T_{mb} = 85^\circ\text{C}$

(2) At $T_j = T_{jmax}$.
 $t = 10\text{ms}$

(3) $V_D = 6\text{V}$; $T_j = 25^\circ\text{C}$
(BT152: $V_D = 12\text{V}$)

‡Pins: a g k,
in-line.

*Types with dV_D/dt of 1000V/ μ s available on request.
**UNF thread available on request.

Type No.	Outline & Drawing ref.	$I_{T(RMS)}$ max. (A)	$I_{T(AV)}$ max. (A) ⁽¹⁾	V_{DRM} max. (V)	I_{TSM} max. (A) ⁽²⁾	di_T/dt max. (A/ μ s)	dV_G/dt max. (V/ μ s)	V_{GT} min. (V) ⁽³⁾	I_{GT} min. (mA) ⁽³⁾	t_q max. (μ s)
BT153	TO-200AB plastic BV4	6	4	500	40	200	200	2.5	40	20
BT155-600RK -600RN -600RP -800RK -800RN -800RP	TO-220AB plastic BV4	15	9.5†	600 600 600 800 800 800	110	30	500	2.0	100	4 6 8 4 6 8
BTW63-600RK -600RN -600RP -800RK -800RN -800RP -1000RK -1000RN -1000RP	TO-48 metal (UNF thread) BM	40	25	600 600 600 800 800 800 1000 1000 1000	370	50	500	2.0	250	4 6 8 4 6 8 4 6 8

⁽¹⁾ At $T_{mb} = 85^\circ\text{C}$

⁽²⁾ At $T_j = T_j \text{ max.}$
 $t = 10\text{ms}$

⁽³⁾ $V_D = 6\text{V}; T_j = 25^\circ\text{C}$
(BT155: $V_D = 12\text{V}$)

*With -25V gate bias

†At $T_{mb} = 72^\circ\text{C}$

gate turn-off switches

Type No.	Outline and Drawing ref.	I_{TCRM} max. (A) ⁽¹⁾	$I_{T(AV)}$ max. (A)	I_{TSM} max. (A) ⁽²⁾	V_{DRM} max. (V)	dV_D/dt max. (V/ μ s)	V_{GT} min. (V)	I_{GT} min. (mA)	t_{off} max. (μ s) ⁽³⁾
BT157-1300R -1500R	TO-220AB Plastic BV4	12	3.2	20	1300 1500	10 000	1.5	200	0.70
BTW58-1000R -1300R -1500R	TO-220AB Plastic BV4	25	6.5	50	1000 1300 1500	10 000	1.5	200	0.75
BTV58-600R -850R -1000R	TO-220AB Plastic BV4	25	10	75	600 850 1000	10 000	1.5	200	0.75
BTW59-1300R -1500R	TO-238AA CU	50	13.5	100	1300 1500	10 000	1.5	300	0.85
BTV59-600R -850R -1000R	TO-238AA CU	50	15	100	600 850 1000	10 000	1.5	200	0.85
•BTV60-850R -1000R -1200R	TO-238AA CU	120	25	150	850 1000 1200	10 000	1.5	500	1.3

⁽¹⁾ I_{TCRM} is the maximum controllable anode current.

⁽²⁾ at $T_{mb} = 120^\circ\text{C}; t = 10\text{ms}$

⁽³⁾ When switching off $0.2 \times I_{TCRM} \text{ max.}$, $V_{GR} = 10\text{V}; T_j = 25^\circ\text{C}$

Triacs

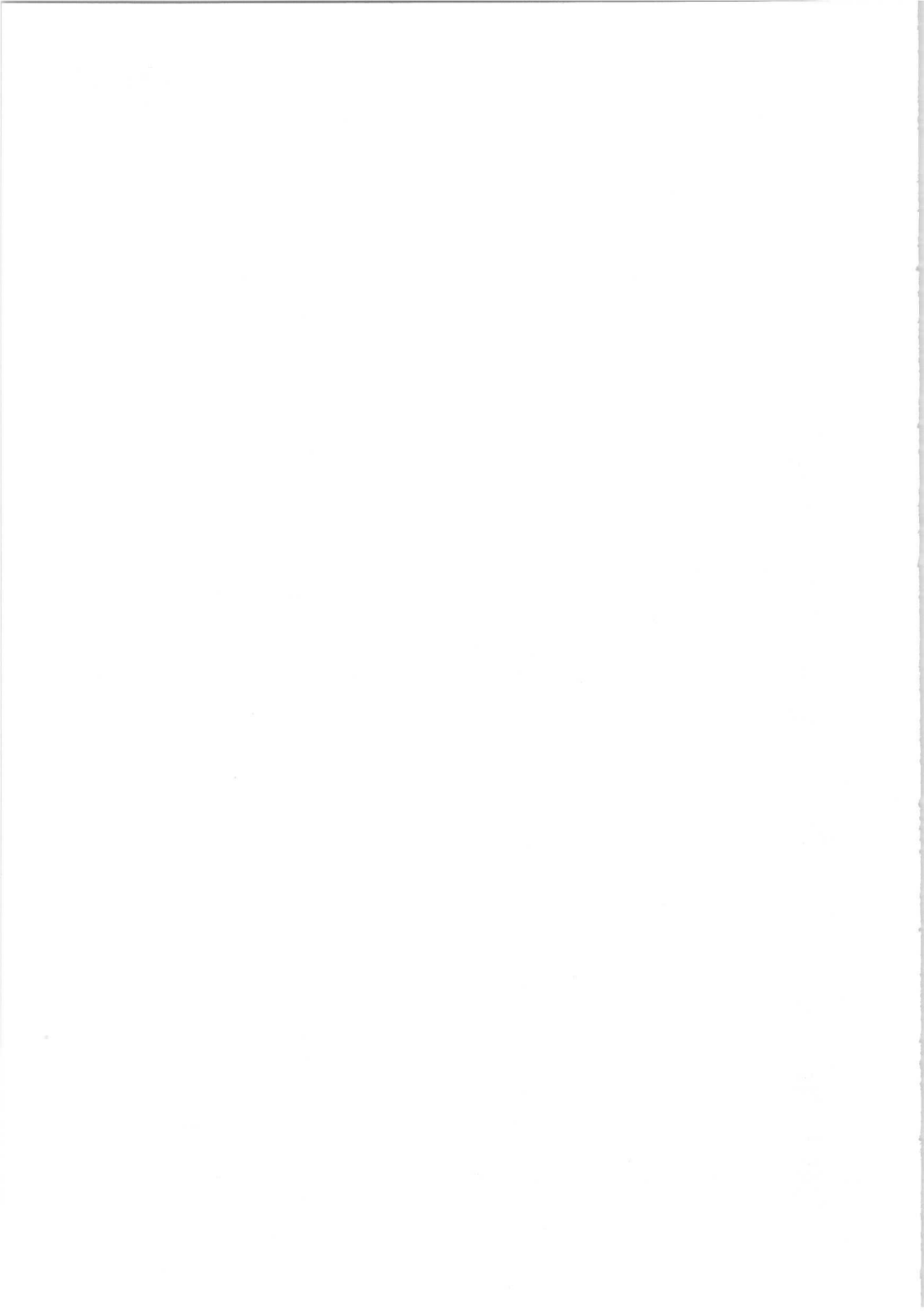
selection guide

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$I_{T(RMS)}$ max.	Type No.	V_{DRM} max. (V)						Outline	
		400	500	600	800	1000	1200		1400
4A	BT136, G,F,E,D		•	•	•				TO220AB
8A	BT137, G,F,E,D		•	•	•				TO-220AB
12A	BT138, G,F,E		•	•	•				TO-220AB
12A	BTW43G,H			•	•	•	•		TO-64
16A	BT139, G,F,E		•	•	•				TO-220AB
25A	BTX94H,J	•		•	•	•	•		TO-48
55A	BTV34G,H			•	•		•	•	TO-65

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Type No.	Approvals	Outline & Drawing Ref	$I_{T(RMS)}$ max. (A)	V_{DRM} max. (V)	I_{TSM} max. (A)	di_t/dt max. (A/ μ s)	dV_t/dt max. (V/ μ s)	dV_{com}/dt max. at $-di_t/dt$ (V/ μ s) at (A/ms)	V_{GT} min. (V)	I_{GT} min.		
										I+I-III- (mA)	III+ (mA)	
BT136-500G -600G -800G				500 600 800			100	10 at 1.8	1.5	50	100	
BT136-500 -600 -800		TO-220AB Plastic BV2	4	500 600 800	25	10	50	typ. 10 at 1.8	1.5	35	70	
BT136-500F -600F -800F				500 600 800			50	typ. 10 at 1.8	1.5	25	70	
BT136-500E -600E -800E				500 600 800			typ. 50	—	1.5	10	25	
BT136-500D				500			typ. 5	—	1.5	5	10	
BT137-500G -600G -800G				500 600 800			100	10 at 3.6	1.5	50	100	
BT137-500 -600 -800		TO-220AB Plastic BV2	8	500 600 800	55	20	50	typ. 10 at 3.6	1.5	35	70	
BT137-500F -600F -800F				500 600 800			50	typ. 10 at 3.6	1.5	25	70	
BT137-500E -600E -800E				500 600 800			typ. 50	—	1.5	10	25	
BT137-500D				500			typ. 5	—	1.5	5	10	
BT138-500G -600G -800G				500 600 800			100	10 at 5.4	1.5	50	100	
BT138-500 -600 -800		TO-220AB plastic BV2	12	500 600 800	90	30	50	typ. 10 at 5.4	1.5	35	70	
BT138-500F -600F -800F				500 600 800			50	typ. 10 at 5.4	1.5	25	70	
BT138-500E -600E -800E				500 600 800			typ. 50	—	1.5	10	25	
BTW43-600H -800H -1000H -1200H	BS9343	TO-64 metal (Metric thread) BO	12	600 800 1000 1200	120	50	200	10 at 12	[2.5 III+ 5.0]	100	200	
BTW43-600G -800G -1000G -1200G	F001			600 800 1000 1200				10 at 5				
BT139-500G -600G -800G				500 600 800			100	10 at 7.2	1.5	50	100	
BT139-500 -600 -800		TO-220AB plastic BV2	16	500 600 800	115	50	50	typ. 10 at 7.2	1.5	35	70	
BT139-500F -600F -800F				500 600 800			50	typ. 10 at 7.2	1.5	25	70	
BT139-500E -600E -800E				500 600 800			typ. 50	—	1.5	10	25	
BTX94-400J -600J -800J -1000J -1200J				400 600 800 1000 1200				30 at 50	[3.0 III+ 5.0]	150	200	
BTX94-400H -600H -800H -1000H -1200H		TO-48 Metal (UNF thread) BM	25	400 600 800 1000 1200	250	50	100	30 at 25				
BTV34-600H -800H -1200H -1400H				600 800 1200 1400				30 at 50				
BTV34-600G -800G -1200G -1400G		TO-65 Metal (UNF thread) CN2	55	600 800 1200 1400	350	50	200	30 at 25	2.5	200	—	



Microwave transistors

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LOW NOISE SILICON TRANSISTOR

Type No.	Description	Outline	Drawing reference	V _{CB0} max. (V)	I _c max. (mA)	P _{tot} max. (mW)	f _T typ. (GHz)	N ₀ typ. (dB)	at f (GHz)
BFQ33	N-P-N silicon transistor for use up to C-band frequencies	SOT-100	AS	9	20	140	12	3.8 2.5	4.0 2.0

CLASS A BIPOLAR POWER TRANSISTORS without prematching. All values typical

Type No.	Package	Drawing Reference	Microwave Performance							Characteristics					
			f GHz	V _{CE} V	I _c mA	P _{L1} min mW	G _{PO} min dB	I _{CB0} max μA	V _{CB} V	C _{CB} typ pF	V _{CB} V	h _{FE} typ	V _{CE} V	I _c mA	R _{th} °C/W
LBE1001T	FO45	AO BH	1	20	35	100	10	01	15	.55	20	80	1	10	120
LCE1001T	FO46	AO BH	1	20	35	100	10	01	15	.55	20	80	1	10	120
LBE1004R	FO45	AO BH	1	15	100	400	8	200	20	1.7	14	80	5	75	30
LCE1004R	FO46	AO BH	1	15	100	400	8	200	20	1.7	14	80	5	75	30
LBE1010R	FO45	AO BH	1	15	200	800	7	400	20	2	14	80	5	75	17
LCE1010R	FO46	AO BH	1	15	200	800	7	400	20	2	14	80	5	75	17
LKE1004R	FO53	CG	1	15	100	310	8	200	20	1.5	14	80	5	75	30
LAE2001R	SOT100	AS	2	15	35	80	8	0.01	15	.5	10	80	1	10	180
LBE2003S	FO45	AO BH	2	18	30	200	10	.1	20	.3	18	80	5	30	65
LCE2003S	FO46	AO BH	2	18	30	200	10	.1	20	.3	18	80	5	30	65
LBE2005Q	FO45	AO BH	1.65	12	80	300	7	5	20	1	10	120	5	65	45
LCE2005Q	FO46	AO BH	1.65	12	80	300	7	5	20	1	10	120	5	65	45
LBE2008T	FO45	AO BH	1.65	20	150	800	6	100	20	1.3	20	100	5	150	26
LCE2008T	FO46	AO BH	1.65	20	150	800	6	100	20	1.3	20	100	5	150	26
LBE2009S	FO45	AO BH	2	18	110	700	9	.1	20	.6	18	100	5	110	36
LCE2009S	FO46	AO BH	2	18	110	700	9	.1	20	.6	18	100	5	110	36
LKE2002T	FO53	CG	2	15	70	150	7	50	28	.8	20	100	5	70	45
LKE2004T	FO53	CG	2	15	140	300	6.5	100	28	1.5	20	100	5	140	22
LKE2015T	FO53	CG	2	20	200	1250	7.5	300	20	3.5	20	80	5	200	11
LWE2015R	FO93	N	2.3	16	250	1200	7.5	10	25	2	16	40	5	230	12
LWE2025R	FO93	N	2.3	16	400	2000	7	15	25	3	16	40	5	400	8
LAE4000Q	SOT100	AS	4	15	30	70	4.7	100	30	.4	15	100	5	10	180
LAE4001R	SOT100	AS	4	15	25	85	8.5	.1	15	.25	15	100	5	25	210
LAE4002S	SOT100	AS	4	18	30	125	7.5	.1	20	.3	18	80	5	30	200
LAE6000Q*	SOT100	AS	2	10	4	NF _{typ} 1.8dB	G _{a,typ} 12dB	.1	10	.15	10	110	10	4	300

*low noise device

CLASS A BIPOLAR POWER TRANSISTORS with input prematching. All values typical

Type No.	Package	Drawing Reference	Microwave Performance							Characteristics					
			f GHz	V _{CE} V	I _C mA	P _{L1} min mW	G _{PO} min dB	I _{CBO} max μA	V _{CB} V	C _{CB} typ pF	V _{CB} V	h _{FE} typ	V _{CE} V	I _C mA	R _{th} °C/W
LKE21004R	FO53	CG	2.1	15	140	400	8	100	15	2	10	100	5	140	22
LKE21015T	FO53	CG	2.1	20	300	1500	8	25	20	3.5	20	40	5	250	11
LKE21050T	FO53	CG	2.1	20	1200	5000	7	75	20	9	20	40	5	500	4
LKE27010R	FO53	CG	2.7	16	200	630	7	200	25	3.4	10	100	5	200	12
LKE27025R	FO53	CG	2.7	16	650	2150	6.5	500	20	10	10	150	5	500	6
LKE32001QC	FO53	CG	3	12	50	90	7	5	20	1	10	100	5	50	45
LKE32002T	FO53	CG	3	20	65	200	8	5	20	.85	20	150	5	65	45
LKE32004T	FO53	CG	3	20	130	630	8	10	20	1.8	20	150	5	130	22
LJE42002T	FO41A	Z	4	20	65	150	5.8	5	20	.7	20	100	5	65	41
LJE42004T	FO41A	Z	4.15	20	125	300	6	150	30	1.3	10	50	5	125	22
LTE42005S	FO41B	AD	4.2	18	110	450	6.6	.1	20	.5	20	80	5	110	36
LTE42008R	FO41B	AD	4.2	16	250	800	7	150	20	2	16	80	5	250	12
LTE42012R	FO41B	AD	4.2	16	400	1000	6	200	20	3	16	80	5	400	10

CLASS A BIPOLAR POWER TRANSISTORS with input and output prematching. All values typical

Type No.	Package	Drawing Reference	Microwave Performance							Characteristics				
			f GHz	V _{CE} V	I _C A	P _{L1} min W	G _{PO} min dB	I _{CBO} max μA	V _{CB} V	h _{FE} typ	V _{CE} V	I _C mA	R _{th} °C/W	
LZ1418E100R	FO57C	BK	1.4 to 1.8	16	2	9	10	1000	20	30	3	2000	2.2	
LV1721E50R	FO83	CH	1.7 to 2.1	16	1.2	5	7	500	20	30	3	1000	4	
LV2024E45R	FO83	CH	2.0 to 2.4	16	1.2	4.5	7	500	20	30	3	1000	4	
LV2327E40R	FO83	CH	2.3 to 2.7	16	1	4.5	7	500	20	30	3	1000	4	
LV3742E16R	FO83	CH	3.7 to 4.2	16	0.5	1.3	5.5	300	20	30	3	500	6.5	
LV3742E24R	FO83	CH	3.7 to 4.2	16	0.8	2	5	400	20	30	3	800	5	

CLASS B BIPOLAR POWER TRANSISTORS with prematching. All values typical

Type No.	Package	Drawing Reference	Microwave Performance							Characteristics			
			f GHz	V _{CC} V	P _L min W	G _P min dB	η _C min %	I _{CBO} max μA	V _{CB} V	C _{CB} typ pF	V _{CB} V	R _{th} °C/W	
PEE1001T	FO38	P	1	18	1	5	40	100	15	4	20	35	
PDE1001T	FO58	BW											
PDE1001U	FO58	BW	1	28	1.5	6	55	50	30	1.3	30	25	
PEE1003U	FO38	P	1	28	3.7	5.9	49	100	30	1.5	30	18	
PDE1003U	FO58	BW											
PEE1005U	FO38	P	1	28	7	5.4	53	200	30	2.6	30	10	
PDE1005U	FO58	BW											
PEE1010U	FO38	P	1	28	9	6.5	60	1000	30	5	30	6	
PDE1010U	FO58	BW											
PWB2001U	FO93	N	2	28	1	9	35	100	28	2.5	28	22	
PWB2010U	FO93	N	2	28	8	9	29	250	28	10	28	4.5	
PKB3000U	FO53	CG	3	28	.5	8	25	50	28	2.5	28	45	
PKB3001U	FO53	CG	3	28	1	9	30	100	28	2.7	28	22	
PKB3003U	FO53	CG	3	28	3	6	30	150	28	4	28	11	
PKB3005U	FO53	CG	3	28	4.6	4.9	26	500	28	6.3	28	7	
PGB4001U	FO49A	CR	4	28	1.1	4.4	30	75	20	2	28	22	

Microwave transistors

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CLASS B BIPOLAR POWER TRANSISTORS with input and output prematching. All values typical

Type No.	Package	Drawing Reference	Microwave Performance					Characteristics			
			f GHz	V _{CC} V	P _L min W	G _{po} min dB	η _c min %	I _{CB0} max μA	V _{CB} V	R _{th} °C/W	
PZ1418B15U	FO57C	BK	1.4 to 1.8	28	12.5	7	38	2500	30	4	
PZ1418B30U	FO57C	BK	1.4 to 1.8	28	27	7.3	38	5000	30	2.2	
PZ1721B12U	FO57C	BK	1.7 to 2.1	28	12	6.8	35	2500	30	4	
PZ1721B25U	FO57C	BK	1.7 to 2.1	28	25	7	35	5000	30	2.2	
PZ2024B10U	FO57C	BK	2.0 to 2.4	28	9	5.6	30	2500	30	4	
PZ2024B20U	FO57C	BK	2.0 to 2.4	28	20	6	35	5000	30	2.2	
PV3742B4X	FO83	CH	3.7 to 4.2	24	4	6	25	50	24	6.5	

CLASS B BIPOLAR POWER TRANSISTORS with input prematching. All values typical.

Type No.	Package	Drawing Reference	Microwave Performance					Characteristics				
			f GHz	V _{CC} V	P _L min W	G _p min dB	η _c min %	I _{CB0} max μA	V _{CB} V	C _{CB} typ pF	V _{CB} V	R _{th} °C/W
PKB12005U	FO53	CG	1.2	28	6	10	40	1000	28	4	28	12
PZB16035U	FO57C	BK	1.55	28	35	8	45	5000	30	12	28	2.2
PKB23001U	FO53	CG	2	28	.8	6	25	100	28	2.1	28	30
PKB23003U	FO53	CG	2	28	2.5	8	38	200	28	2.7	28	18
PKB23005U	FO53	CG	2	28	5	6	43	500	28	5	28	7
PKB20010U	FO53	CG	2	28	8	5	36	100	30	10	28	4
PKB25006T	FO53	CG	2.45	21	7	8.4	35	100	24	10	22	4
PKB27005U	FO53	CG	2.7	28	4	6	25	1000	30	6.8	30	6
PKB32000U	FO53	CG	3	28	.5	8	27	50	28	2.5	28	45
PKB32001U	FO53	CG	3	28	1	7	30	100	28	3.2	28	22
PKB35002U	FO53	CG	3	28	2.2	6.5	30	500	40	3.5	30	15
PKB32003U	FO53	CG	3	28	2.4	5.7	30	300	28	4.5	28	11
PKB32005U	FO53	CG	3	28	5	4.7	30	500	28	7	28	6.6
PTB42001X	FO41B	AD	4.2	24	.8	5	28	10	24	2.2	24	22
PTB42002X	FO41B	AD	4.2	24	1.6	5	28	20	24	3	24	12
PTB42003X	FO41B	AD	4.2	24	3	6	30	30	24	3.8	24	8.5

BIPOLAR OSCILLATOR TRANSISTORS without prematching. All values typical

Type No.	Package	Drawing Reference	Microwave Performance ¹⁾						Characteristics						
			f GHz	V _{CE} V	I _C mA	P _L typ mW	η _{rac} typ %	I _{CB0} max μA	V _{CB} V	C _{CB} typ pF	V _{CB} V	h _{FE} typ	V _{CE} V	I _C mA	R _{th} °C/W
PJC4001T	FO41A	Z	4.35	20	140	450	16	500	20	4.5	20	30	5	140	24
PJC4003T	FO41A	Z	3.8	20	400	1400	17.5	250	20	4.5	20	30	5	400	12
PPC4001T	FO102	DJ	4.5	20	140	450	16	500	20	4.5	20	30	5	140	24
PQC4001T	FO85	A	4.5	20	140	450	16	500	20	4.5	20	30	5	140	24
PPC5001T	FO102	DJ	5	20	200	450	11	100	24	1.4	18	80	5	200	24
PQC5001T	FO85	A	5	20	200	450	11	100	24	1.4	18	80	5	200	24

¹⁾ Typical performance in a microstrip oscillator (common collector)

BIPOLAR PULSED POWER TRANSISTORS FOR RADAR AND NAVAIDS

Type No.	Package	Drawing Reference	Application	Microwave Performance								Characteristics			
				f GHz	V _{CC} V	t _{on} μs	δ %	P _L min W	G _m min dB	η _c min %	I _{CEO} max mA	V _{CB} V	C _{CB} typ pF	V _{CB} V	R _{th} °C/W
MKB12040WS	FO53	CG	IFF	1.09	45	10	1	37	10.5	42	0.1	30	15	45	8
MKB12100WS	FO53	CG		1.09	45	10	1	65	7.2	35	1	50	24	45	3.5
MKB12140W	FO53	CG		1.09	45	10	1	100	9	45	2	50	35	45	2.5
MRB12175YR	FO67A	CQ		1.09	50	10	1	175	8.5	40	5	50	45	50	.08*
MRB12350YR	FO67A	CQ		1.09	50	10	1	350	7	32	10	50	90	50	.04*
MRB12375Y	FO67B	DK		1.09	50	10	1	400	7.5	35	10	50	60	50	.05*
MSB12900Y	FO96	DL		1.09	50	10	1	800	7.3	30	10	50	2x160	50	.02*
MKB12040WD	FO53	CG			45	10	1	32	8.5	35	0.1	30	15	45	8
MR1011B40W	FO67A	CQ			45	10	1	32	8.5	35	0.1	30	15	45	8
MO1011B150Y	FO57B	Y			50	10	1	150	7	35	10	50			.2*
MO1011B250Y	FO57B	Y	DME	1.025	50	10	1	250	6.2	35	20	50			.1*
MR1011B150Y	FO67A	CQ		to	50	10	1	150	7	30	5	50	45	50	.08*
MR1011B300Y	FO67A	CQ		1.150	50	10	1	280	6	28	10	50	90	50	.04*
MR1011B375Y	FO67B	DK			50	10	1	375	7	30	10	50	60	50	.05*
MS1011B700Y	FO96	DL			50	10	1	600	6	30	10	50	2x160	50	.02*
MS1011B800Y	FO96	DL			50	10	1	800	7	30	10	50	2x160	50	.025*
MK0912B15Y	FO53	CG		TACAN	50	10	15	10.8	30	0.2	30	15	45	.4 *	
MZ0912B75Y	FO57C	BK			.960	50	10	10	75	7.8	30	5	50		.2 *
MK0912B150Y	FO57C	BK			to	50	10	10	150	7	30	10	50		.1 *
MZ0912B200Y ¹⁾	FO57C	BK			1.215	50	10	200	8	35	15	42			0.8
MKB12040W	FO53	CG	IFF	0.6	48	10	1	32	10.5	30	0.1	30	15	45	8
MKB12100W	FO53	CG		to	48	10	1	70	8.5	30	1	50	24	45	3.5
MO6075B210Z	FO57B	Y		to	48	10	1	160	8.1	30	5	45	30	45	.075*
MO6075B400Z	FO57B	Y		0.75	48	10	1	380	6.8	30	10	48	90	48	.04*
MS6075B800Z	FO96	DL			48	10	1	750	7	30	10	48	2x160	50	0.2*
RZ1214B60W	FO57C	BK		L-Band Radar	1.2	42	100	10	50	7	30	5	42	28	42
RZ1214B125W	FO57C	BK	to		42	100	10	110	5.8	30	10	42	28	42	1
RZ1214B150W ¹⁾	FO57C	BK	1.4		42	300	10	150	6	35	15	42			0.8
RV3135B5X	FO83	CH	S-Band Radar		24	100	10	4	4.3	30	0.1	24			6.5
RZ3135B15U	FO57C	BK		3.1	30	100	10	12	4	30	0.5	30			3.5
RZ3135B25U	FO57C	BK		to	30	100	10	25	4	30	1	30			1.75
RZ3135B40V	FO57C	BK		3.5	30	100	10	45	5	35	1.5	30			1.25

¹⁾ Development type; microwave performance data are typical values.

*Note: for t_{on} and δ listed under Microwave Performance.

LOW NOISE AND CLASS A POWER GaAs FETs. All values typical

Type No.	Package	Drawing Reference	Microwave Performance								Characteristics							
			f GHz	V _{DS} V	I _D mA	P _{L1} min mW	G _{PO} min dB	N _F max dB	G _A min dB	I _{DSS} typ mA	V _p typ V	V _{DS} V	I _D mA	g _m typ mA/V	V _{DS} V	I _D mA	R _{th} °C/W	
CFX13	FO92	CW	12	3	10			3	6.5	70	3	-3	3	.2	28	3	10	200
CFX14	FO92	CW	16	3	10			3	6	70	3	-3	3	.2	28	3	10	200
CFX21	FO92	CW	11	6	40	50	7			80	3	-4	3	.2	23	6	40	200
CFX30	FO85	A	11	8	50	100	7			80	3	-2.5	3	1	40	3	65	90
CFX31	FO85	A	11	8	100	250	7			160	3	-4	3	1	60	3	130	90
CFX32	FO85	A	8.5	8	180	500	7			350	3	-4	3	3	120	3	300	60
CFX33	FO85	A	8.5	8	370	1000	5			700	3	-4	3	5	240	3	600	30

Schottky barrier mixer diodes

Type No.	Maximum Operating Frequency (GHz)	Typical Noise Figure† (dB)	Typical Impedance Z_{if} (Ω)	Operating Temperature ($^{\circ}\text{C}$)	Outline	Drawing reference
BAT10	12	7.0	350	-55 to +150	MO-28	BZ
BAT11	12	6.5	320	-55 to +150	MO-27	CA
BAT38	40	8.5	900	-55 to +100	SOD-42	Q
BAT39 (CV7762) }	18	6.0	350	-55 to +100	SOD-42	Q
BAT50 BAT50R*	12	6.2	400	-55 to +100	(B.S.)SO-26 MO-74	CB
BAT51 (CV7776) BAT51R* (CV7777) } **	18	7.0	350	-55 to +100	SOD-49	J
BAT52 BAT52R*	18	8.0	350	-55 to +100	DO-37 SOD-49	J
BAV72	40	8.5	900	-55 to +150	SOD-50	V
BAV96A BAV96B BAV96C BAV96D	12	7.0 6.5 6.0 5.5	325	-55 to +150	SOD-50	V
BAW95D BAW95E BAW95F BAW95G 1N415E	12	7.8 7.2 6.8 6.3 7.2	415 400	-55 to +150	SOD-47	E
MOTT MIXER DIODES						
CAY18**	40	7.0	50	-45 to +85	Coplanar chip	—
CAY19**	110	8.0	—	-40 to +85	Coplanar chip	—

*Reverse polarity version

†Includes 1.5dB i.f. noise contribution

**Available as a matched pair, (BAT51 & BAT51R as CV7778), 2CAY18M, 2CAY19M

Schottky barrier detector diodes

Type No.	Description	Frequency Range (GHz)	Typical Tangential Sensitivity (dBm)*	Typical 1/f Noise (dB)	Typical Video Impedance (Ω)	Outline	Drawing reference
BAS46	For user in X-band Doppler radar systems	1 to 12	-55	10	850	JEDEC DO-23** SOD-48	E
BAV75		1 to 12	-50	10	310	BS SO-86 SOD-31	M
BAV97	Low level detector applications	1 to 12	-54	10	500	SOD-50	V
BAT10		1 to 12	-50	12	600	MO-28	BZ
BAT11		1 to 12	-52	10	320	MO-27	CA

*Bandwidth 2Mz.

**Other packages available.

Microwave diodes

backward diode

book 1 part 5

Type No.	Description	Outline	Drawing reference	Frequency Range (GHz)	Typical Tangential Sensivity (dBm)	Min. Figure of Merit	Typical Video Impedance (Ω)
AEY33	Germanium bonded backward diode	SOD-49	J	12 to 18	-53	50†	300

† Measured at 16.5 GHz in JAN 201 holder.

Gunn effect diodes

Type No.	Description	Outline	Drawing reference	Operating Voltage (V)	Frequency Range (GHz)	P_{out} (typ.) (mW)	P_{tot} Max. (25°C) (W)
CXY11A CXY11B CXY11C	Ga As bulk effect devices employing the Gunn effect to produce c.w. oscillations in X-band	(B.S.) SO-86 SOD-31	M	7.0	8 to 12	8.0 12 20	1.0
CXY14A CXY14B CXY14C	Ga As bulk effect devices employing the Gunn effect to produce c.w. oscillations in J-band	(B.S.) SO-86 SOD-31	M	7.0	12 to 18	8.0 12 20	1.0
CXY19 CXY19A CXY19B	Ga As bulk effect devices employing the Gunn effect to produce c.w. oscillations in X-band	(B.S.) SO-86 SOD-31	M	10	8 to 12	150 250 325	6.0 6.0 7.5
CXY21	Ga As bulk effect device employing the Gunn effect to produce c.w. oscillations in X-band	(B.S.) SO-86 SOD-31	M	8.0	8 to 12	30	2.5
CXY24A CXY24B	Ga As bulk effect devices employing the Gunn effect to produce c.w. oscillations in Q-band	MO-75	BF	3.5	30 to 38	30 60	4.0

impatt diodes

Type No.	Description	Outline	Drawing reference	Frequency Range (GHz)	Power Output (min.) (mW)	Operating Voltage (V)
BXY50 BXY51 BXY52 BXY60	High power diodes for use as oscillators or negative resistance amplifiers	SOD-45	T	8 to 10 10 to 12 12 to 14 6 to 8	500 400 300 650	90 80 70 120

multiplier varactor diodes

Type No.	Description	Outline	Drawing reference	Capacitance at V_R		V_R max. (V)	Maximum Transit Time (ps)	Typical Cut-off Frequency (GHz)
				(pF)	(V)			
BAY96	Silicon planar diode for use in high efficiency multiplier circuits, input powers up to 30W	DO-4	B1	16 35	40 6	120	-	25
BXY27	Silicon planar epitaxial varactor diode for use in multipliers up to S-band and input powers up to 10W	SOD-31	M	4.5	6	45	-	100
BXY28	Silicon planar epitaxial varactor diode for use in high efficiency multipliers in the 2 to 4 GHz range	SOD-31	M	1.5	6	45	-	120
BXY29	Silicon planar epitaxial varactor diode for use in frequency multipliers circuits in the 4 to 8 GHz range	SOD-31	M	1.0	6	25	-	120
BXY32	Silicon planar step recovery diode for high order frequency multipliers with outputs in X-Band	SOD-31	M	0.75	6	20	150	150
BXY35A BXY36B,C,D,E BXY37B,C,D,E BXY38B,C,D,E BXY39B,C,D,E BXY40B,C,D,E BXY41B,C,D,E	Silicon planar epitaxial varactor diodes for frequency multipliers up to 18 GHz, available in a variety of outlines			9 5 3 1.6 1.0 0.65 0.4	6 6 6 6 6 6 6	100 70 70 50 40 25 25	- 500 350 300 200 150 100	25 75 100 120 150 180 200
	Suffix A = Outline and drawing ref.	SOD-4/8	B					
	B =	SOD-31	M					
	C =	SOD-43	R					
	D =	SOD-44	S					
	E =	SOD-45	T					

Microwave diodes

book 1 part 5

multiplier varactor diodes (cont.)

Type No.	Description	Outline	Drawing reference	Capacitance at V_R		V_R max. (V)	Maximum Transit Time (ps)	Typical Cut-off Frequency (GHz)
				(pF)	(V)			
BXY56 BXY57	High efficiency silicon diodes for multipliers with output frequencies in C and X-bands	(B.S.) SO-86	M	2.0 3.0	6 6	60 60	-	160 140
1N5152 1N5153	Silicon planar epitaxial varactor diodes for use in multipliers up to S-band	(B.S.) SO-86 SOD-31 SOD-43	M R	6 6	6 6	75 75	-	100 100
1N5155	Silicon planar epitaxial varactor diode for use in multipliers up to C-band	(B.S.) SO-86 SOD-31	M	2	6	35	-	120
1N5157	Silicon planar epitaxial varactor diode for use in multipliers up to X-band	(B.S.) SO-86 SOD-31	M	0.8	6	20	-	200
BXY56 BXY57	High efficiency silicon diodes for multipliers with output frequencies in C and X-bands	(B.S.) SO-86	M	2.0 3.0	6 6	60 60	-	160 140
1N5152 1N5153	Silicon planar epitaxial varactor diodes for use in multipliers up to S-band	(B.S.) SO-86 SOD-31 SOD-43	M R	6 6	6 6	75 75	-	100 100
1N5155	Silicon planar epitaxial varactor diode for use in multipliers up to C-band	(B.S.) SO-86 SOD-31	M	2	6	35	-	120
1N5157	Silicon planar epitaxial varactor diode for use in multipliers up to X-band	(B.S.) SO-86 SOD-31	M	0.8	6	20	-	200

special purpose varactor diodes

Type No.	Description	Outline	Drawing reference	Capacitance at V_R		V_R max. (V)	Series Resonant Frequency (GHz)	Typical Cut-off Frequency (GHz)
				(pF)	(V)			
CAY10	Gallium arsenide diode, diffused mesa type, for use in microwave parametric amplifiers, frequency multipliers and switches	(B.S.) SO-86 SOD-31	M	0.4	0	6	10	240
CXY10	Gallium arsenide diode with a high cut-off frequency for use in parametric amplifiers, frequency multipliers and switches	SOD-46	U	0.2	0	6	30	350
CXY12	Gallium arsenide diode with a high cut-off frequency for use in frequency multipliers up to Q-band	SOD-46	U	0.25	6	10	29	500

Type No.	Description	Outline		Frequency Range (GHz)	Attenuation (dB)	Insertion Loss (dB)
CXY22A CXY22B	Gallium arsenide devices for limiter applications from C to X-band	SOD-31	M	2-7 7-12	20 16	0.2 0.3

Type No.	Description	Outline		Excess Noise Ratio (dB)	C_j (pF)	I_R (mA)
BAT31	Silicon avalanche device for use as noise source from 10Hz to 18GHz	(B.S.) SO-86 SOD-31	M	34	0.6	15.0

tuning varactor diodes

Type No.	Description	Outline	Drawing reference	Range of Q at -4V	Capacitance at -4V min. (pF)	Capacitance at -4V max. (pF)	V_R typ. (V)
BXY48 series	Silicon planar tuning diodes. Highly reproducible abrupt junction performance	Various	—	1000 to 2500	0.3	4.5	25 to 48
CXY23 series	Gallium arsenide tuning diodes. Highly reproducible abrupt junction performance	Various	—	6000 typ.	0.3	2.0	30
CXY26 series	Gallium arsenide hyper-abrupt tuning diodes for linear applications	Various	—	3000 at -2V	0.8	10 at -2V	15 min

**Development sample data only

Microwave sub-assemblies

solid state oscillators

book 1 part 5

This selection represents only a part of the Mullard range of solid state sources. Custom-built sources, including many with higher output powers, are available on request. Mullard offers a comprehensive capability in the area of general solid state oscillators, with complex phase locked and frequency agile sources for military applications.

Type No.	Description	Nominal Centre Frequency (GHz)	P _{out} (mw)	Minimum Mechanical Tuning Range (MHz)	Typical Electronic Tuning Range (MHz)	Output Coupling to
CL8030 series	A range of c.w./pulsed FET oscillators for miniature Doppler radars	9.47 to 10.687	8	—	—	WG16/WR90
CL8630	Fixed frequency Gunn effect oscillators for miniature radar systems	10.687	8	—	—	WG16/WR90
CL8632		9.47	8	—	—	WG16/WR90
CL8633		10.525	8	—	—	WG16/WR90
CL8630S CL8632S CL8633S	Fixed frequency Gunn effect oscillators for self oscillating mixer (auto-detector) use in proximity switching	10.687 9.47 10.525	8 8 8	Typical output voltage for input 66dB down on output power (at 12dB min. signal + noise noise		WG16/WR90 WG16/WR90 WG16/WR90
				= 120µV		

NOTE: All the oscillators described above require a negative 7V stabilised power supply, with the exception of the **CL8630 series (+7V)**

mixer/detector modules

Mullard offers a large-scale production capability for custom-built and standard microwave integrated circuits on alumina, sapphire, quartz and ferrite substrates, integrating passive microwave components with unpackaged semiconductor devices in chip and beam lead form.

Type No.	Description	Frequency Range (GHz)	Noise Level (µv)	Mixer* Sensitivity (µV)	Tangential† Sensitivity (dBm)	Output Coupling to
CL7500	Waveguide single ended mixers or microwave detectors for use in doppler control systems in conjunction with CL8630 or CL8632	10.687	1.0	40	-50	WG16/WR90
CL7520		9.35	1.0	40	-50	WG16/WR90

* For -90dBm input signal † 32µA d.c. bias. Bandwidth 0 to 2 MHz

x-band Doppler radar modules

Type No.	Description	Centre Frequency (GHz)	Power Output (mW)	Typical Output Voltage (µV)
CL8060 series	A range of FET Doppler modules for c.w. and pulsed miniature radars	9.47 to 10.687	8	25
CL8960 CL8960U CL8960L CL8962 CL8963 CL8964 CL8965 CL8966 CL8967 CL8968	Doppler twin cavity modules for volumetric presence detection, industrial process control, proximity switching and similar applications using a Gunn diode transmitter	10.687 10.687+3MHz 10.687-3MHz 9.470 10.525 9.900 10.565 10.450 10.365 9.520	10	40

Note: Upper and lower frequency variants (+3MHz or -3MHz) are available to special order with all types.

microwave horn antenna

Type	Description	Frequency range (GHz)	Gain (dB)	Flange
ACX-01A	Cast construction, low v.s.w.r.	9 to 11	16	UBR100

Microwave sub-assemblies

ferrite components – circulators and isolators

book 1 part 5

Type No.	Frequency Range (GHz)	Max. Insertion Loss (dB)	Min. Isolation (dB)	v.s.w.r.	C.W. Power Rating (W)	Coaxial Terminals	Waveguide Flange Type
V.H.F. circulators for television band III							
CL5861	0.17 to 0.20	0.35	20	1.2	1000	EIA 1 5/8	–
CL5851	0.20 to 0.23	0.35	20	1.25	500	N Female	–
CL5931	0.225 to 0.27	0.35	20	1.25	100	N Female	–
U.H.F. circulators for television bands IV and V							
CL5941	0.27 to 0.33	0.35	20	1.25	100	N Female	–
CL5951	0.33 to 0.40	0.35	20	1.25	100	N Female	–
CL5411	0.40 to 0.47	0.5	20	1.25	100	N Female	–
CL5571	0.40 to 0.47	0.35	20	–	300	N Female	–
CL5621	0.40 to 0.47	0.35	20	1.25	300	HF7/16D1N47223	–
CL5551	0.47 to 0.60	0.5	20	1.25	100	N Female	–
CL5631	0.47 to 0.60	0.35	20	1.25	300	HF7/16D1N47223	–
CL5581	0.47 to 0.60	0.35	20	1.25	300	N Female	–
CL5027	0.47 to 0.60	0.35	22	1.2	500	N Female	–
CL5261	0.47 to 0.60	0.35	20	1.25	2000	HF7/16D1N47223	–
CL5641	0.59 to 0.72	0.35	20	1.25	300	HF7/16D1N47223	–
CL5591	0.59 to 0.72	0.35	20	1.25	300	N Female	–
CL5028	0.59 to 0.72	0.35	22	1.2	500	N Female	–
CL5282	0.59 to 0.72	0.35	22	1.2	2000	HF7/16D1N47223	–
CL5561	0.60 to 0.80	0.5	20	1.25	100	N Female	–
CL5651	0.60 to 0.80	0.35	20	1.25	300	HF7/16D1N47223	–
CL5601	0.60 to 0.80	0.35	20	1.25	300	N Female	–
CL5331	0.60 to 0.80	0.35	20	1.25	2000	HF7/16D1N47223	–
CL5611	0.71 to 0.86	0.35	20	1.25	300	N Female	–
CL5661	0.71 to 0.86	0.35	20	1.25	300	HF7/16D1N47223	–
CL5029	0.71 to 0.86	0.35	22	1.2	500	N Female	–
CL5271	0.71 to 0.86	0.35	22	1.2	2000	HF7/16D1N47223	–
CL5262	0.79 to 1.0	0.5	20	1.25	100	N Female	–
Broadband microwave coaxial circulators							
CL5501	2.0 to 4.0	0.5	20	1.25	50	SMA	–
CL5491	2.0 to 4.0	0.5	20	1.25	50	N Female	–
CL5511	3.0 to 6.0	0.5	20	1.25	20	SMA	–
CL5811	4.0 to 8.0	0.5	20	1.25	10	SMA	–
CL5821	7.0 to 12.7	0.6	20	1.25	10	SMA	–
CL5301	12 to 18	0.5	20	1.3	5	SMA	–

continued

A comprehensive range of microstrip circulators and isolators is available. Full details may be obtained on request to: Solid State Microwave, Mullard Ltd, Mullard House, Torrington Place, London WC1E 7HD.

Microwave sub-assemblies

ferrite components – circulators and isolators (cont.)

book 1 part 5

Type No.	Frequency Range (GHz)	Max. Insertion Loss (dB)	Min. Isolation (dB)	v.s.w.r.	C.W. Power Rating (W)	Coaxial Terminals	Waveguide Flange Type
Coaxial isolators							
CL6041	1.48 to 1.95	0.3	20	1.2	*50	N Female	–
CL6091	2.0 to 4.0	0.5	20	1.25	**50	N Female	–
CL6101	2.0 to 4.0	0.5	20	1.25	**50	SMA	–
CL6071	3.0 to 6.0	0.5	20	1.25	**20	SMA	–
CL6111	4.0 to 8.0	0.5	20	1.25	**10	SMA	–
CL6122	7.0 to 12.7	0.6	20	1.25	*10	SMA	–
CL6232	7.9 to 10.4	0.4	20	1.25	**5	SMA	–
CL6223	12 to 18	0.5	20	1.25	***5	SMA	–
Maximum permissible power reflected into Port 2:–			*2W	**5W	***1W		
Waveguide isolators							
CL6240	3.8 to 4.2	0.5	30	1.05	10	–	UER40
CL6202	4.2 to 4.6	0.5	30	1.05	10	–	UER48
CL6203	4.6 to 5.0	0.8	30	1.05	10	–	UER48
CL6206	5.925 to 6.425	0.3	30	1.05	20	–	UER70
CL6251	6.425 to 7.15	0.3	30	1.05	20	–	UER70
CL6231	6.825 to 7.425	0.3	30	1.05	20	–	UER70
CL6291	7.125 to 7.75	0.3	30	1.05	20	–	UER70
CL6241	7.25 to 7.75	0.3	30	1.05	20	–	UER70
CL6214	7.7 to 8.5	0.5	30	1.05	10	–	UBR84
CL6222	8.5 to 9.6	0.5	30	1.05	10	–	UBR100
CL6221	8.5 to 9.6	0.6	15	1.15	1	–	UBR100
CL6261	8.5 to 9.6	1.2	55	1.2	10	–	UBR100
CL6271	8.5 to 9.6	1.0	20	1.15	10	–	UBR100
CL6215	10.7 to 11.7	0.8	30	1.05	5	–	UBR100
CL6217	12.5 to 13.5	0.5	30	1.05	10	–	UBR140
3-port waveguide circulators							
CL5232	3.8 to 4.2	0.2	28	1.08	50	–	UER40
CL5101	5.925 to 6.425	0.2	30	1.06	100	–	1541EC/UER70
CL5281	6.425 to 7.125	0.15	30	1.07	100	–	1541EC/UER70
CL5291	7.125 to 7.75	0.2	30	1.06	100	–	1541EC/UER70
CL5283	7.7 to 8.5	0.5	25	1.1	50	–	UER84/UBR84
4-port cross junction waveguide circulators							
CL5081	5.925 to 6.175	0.1	33	1.05	150	–	UER70
CL5091	6.125 to 6.425	0.1	30	1.06	150	–	UER70
CL5053	6.575 to 6.875	0.4	25	1.1	100	–	UER70
CL5051	6.825 to 7.125	0.4	25	1.08	100	–	UER70
CL5050	7.125 to 7.425	0.3	25	1.1	100	–	UER70
CL5054	7.425 to 7.725	0.4	30	1.1	100	–	UER70
CL5056	10.7 to 11.7	0.3	30	1.1	25	–	UBR100
CL5055	12.5 to 13.5	0.3	25	1.1	25	–	UBR140
							UBR140

A comprehensive range of microstrip circulators and isolators is available. Full details may be obtained on request to: Solid State Microwave, Mullard Ltd, Mullard House, Torrington Place, London WC1E 7HD.

Optoelectronic and special semiconductors

book 1 part 6

Optoelectronic devices

PHOTODIODE

Type No.	Spectral Response Peak (nm)	Cut-off (nm)	Description	BG	Max. dark current (μA)	Light switching time (ns)	T_j max. ($^{\circ}\text{C}$)	V_R max. (V)	I_R max. (mA)
BPW50	930	1100	Silicon photo p-i-n diode	BG	0.03	50	100	32	0.1

LIGHT EMITTING DIODES (INFRARED)

Type No.	Spectral Emission (nm)	Description	Drawing reference	I_{FRM} max. (mA)	I_F max. (mA)	I_F min. at 20mA ($\mu\text{W/sr}$)	t_r typ. (ns)	T_{stg} temperature range ($^{\circ}\text{C}$)
CQY50	930	Subminiature encapsulation with lensed window	G1	500	100	350	600	-65
CQY52	930			500	100	1000	600	-65
CQY89A series	930	Plastic encapsulation	AB	1000	130	9000*	—	-55 to+100

*at $I_F=100\text{mA}$

LIGHT EMITTING DIODES (VISIBLE)

Type No.	Lens	Luminous Intensity			Forward Voltage		Drawing reference
		Min. (mcd)	Max. (mcd)	at I_F (mA)	Max. (V)	at I_F (mA)	
• CQS93L	Red diffused	0.7	2.2	20	5.0	25	
• CQS95L	Green diffused	1.6	7.0	10	5.0	30	
• CQS97L	Yellow diffused	1.6	7.0	10	5.0	30	
CQX51 series	Super red	1.6	11	10	3.0	20	AB
CQY24B series	Red diffused	0.7	3.5	20	3.0	50	AB
CQY94B series	Green diffused	0.7	7.0	10	3.0	20	AB
CQY96 series	Yellow diffused	0.7	7.0	10	3.0	20	AB

RECTANGULAR LIGHT EMITTING DIODES (SUPER-RED, GREEN AND YELLOW)

Type No.	Description	Luminous Intensity			Forward Voltage		Drawing reference
		Min. (mcd)	Max. (mcd)	at I_F (mA)	Max. (V)	at I_F (mA)	
CQW10 series	Super-red diffused	0.5	3.5	10	5	20	CX
CQW11 series	Green diffused	0.5	3.5	10	5	20	CX
CQW12 series	Yellow diffused	0.5	3.5	10	5	20	CX
CQT10	Bi-coloured (hyper-red/green, diffused)	1.0	1.75	10/20	2.2/3.0	100/60	CK
• CQT24	Bi-coloured	1.0	1.75	10/20	2.2/3.0	100/60	AB
CQV70 series	Super-red diffused	0.7	3.5	10	5	20	BT
CQV70A series	Hyper-red diffused	0.7	7.0	10	5	20	BT
CQV71 series	Green diffused	0.7	7.0	10	5	20	BT
CQV72 series	Yellow diffused	0.7	3.5	10	5	20	BT

*typical

HYPER-RED LIGHT EMITTING DIODES

Type No.	Lens form	Luminous Intensity			Forward Voltage		Drawing reference
		Typ. (mcd)	at I_F (mA)	Typ. (mcd)	at I_F (mA)	Typ. (V)	at I_F (mA)
CQW24 series	red	15	10	75	50	1.75	10
CQX24 series	red non-diffused, colourless	120	10	600	50	1.75	10

HIGH INTENSITY LIGHT EMITTING DIODES (SUPER-RED, GREEN AND YELLOW)

Type No.	Lens form	Luminous Intensity		Forward Voltage		Drawing reference
		Typ. (mcd)	at I_F (mA)	Max. (V)	at I_F (mA)	
CQX54	Super-red non-diffused colourless	20	10	3	10	AB
CQX64	Green non-diffused colourless	20	10	3	10	AB
CQX74	Yellow non-diffused colourless	20	10	3	10	AB

Optoelectronic and special semiconductors

Optoelectronic devices

book 1 part 6

LASER AND FIBRE-OPTIC DEVICES

Light emitting diode (infrared)

Type No.	Spectral emission (nm)	Description	Drawing reference	I_{FRM} max. (mA)	I_F max. (mA)	I_B min. at 100mA (μ W/sr)	t_r typ. (ns)	T_{atg} Temperature range ($^{\circ}$ C)
CQF24	830	Modified TO-18 with coupling lens	DM	300	100	5000	10	-65 to +150

P-I-N photodiode (infrared)

Type No.	Wavelength at peak response (nm)	Description	Drawing reference	Max. dark current (nA)	Light switching time (ns)	T_j max. ($^{\circ}$ C)	V_R max. (V)	P_{tot} max. (mW)
BPF24	750	Modified TO-18 with coupling lens	DM	0.8	1	150	50	300

Laser diodes

Type No.	Wavelength at peak response (nm)	Description	Drawing reference	Operating mode	Radiant output power Φ_e (mW)
CQL10A	820	TO-39 with window	DN	cw	5
CQL13A	820	Collimated	DO	cw	2
CQL13C	870	Collimated	DO	cw	2
CQL14A	820	Collimated	DO	pulsed =0.1	20
CQL14B	850	Collimated	DO	pulsed =0.1	20
CQL16	780	Collimated	DO	cw	2

Fibre coupled laser diodes

A range of fibre coupled semiconductor laser diodes is currently in development, for operation in 800 nm and 1300 nm applications. Contact Mullard Ltd for information.

PHOTOCOUPLERS

Type No.	Description	Current transfer ratio (%)	at V_{CE} (v)	& I_F (mA)	Isolation voltage (kV)	t_{on} (typ.) (μ s)	t_{off} (typ.) (μ s)	Drawing reference
CNX35	Optically coupled isolated with transistor output	40	0.4	10	4.4	3.0	3.0	CT
CNX36		80	0.4	10	4.4	3.0	3.0	CT
CNX37		150	5	10	5.3	12	12	CT
CNX38		70 to 210	10	10	4.3	5.0	5.0	CT
CNX48		>600	1	1	4.4	—	—	CT
CNX62		150	4	10	5.3	12	12.5	—
CNY50-1		25	0.4	10	10	—	—	AU
CNY62		25	0.4	10	5.3	3.0	3.0	CO
CNY63		50	0.4	10	4.3	5.0	5.0	CO
PO40A		60 to 150	0.5	10	1.5*	7	7	CT
PO41A	Post Office approved couplers with transistor output	25	0.4	20	1.5*	7	7	CT
PO42A		25	10	10	1.5*	7	7	CT
PO43A		30	5	5	1.5*	7	7	CT
PO44A		30	1	3	1.5*	10	10	CT

*d.c. continuous operation

Optoelectronic and special semiconductors

book 1 part 6

Optoelectronic devices

PYROELECTRIC DETECTORS

Type No.	Typ. Noise Equivalent Power (500K, 10, 1) ($\text{WHz}^{-1/2}$)	Wavelength range (μm)	Typical Responsivity (VW^{-1})	Frequency range	Sensitive area (mm)	Drawing reference
802CPY	1.5×10^{-9} (at 90Hz)	2—25	1×10^3	10Hz—100kHz	Various	—
825CPY	3×10^{-10}	2—25	2×10^5	5Hz—50Hz	Various	—
RPY87	1.05×10^{-9}	1.0—15	500	0.1Hz—1kHz	2×1	AK
RPY89	2.0×10^{-9}	1.0—15	250	0.1Hz—1kHz	2×2	AK
RPY90	1.0×10^{-10}	1.0—70	8×10^3	10Hz—1kHz	2×0.5	BC
RPY91	1.5×10^{-10}	1.0—70	6.5×10^3	10Hz—1kHz	2×0.5	BC
RPY96	3.5×10^{-9}	6.5—14	130	0.1Hz—1kHz	2×1	CJ
RPY97	2.5×10^{-9}	6.5—14	150	0.1Hz—20Hz	2.1×0.9	CP
RPY98	5.0×10^{-10}	1.0—70	5×10^3	0.1Hz—20Hz	2×2	DA
RPY99	5.0×10^{-10}	1.0—70	5×10^3	0.1Hz—20Hz	2×2	DA
RPY100	2.5×10^{-9}	6.5—14	150	0.1Hz—20Hz	2×1	CP
RPY101	3.8×10^{-9}	6.5—14	150	0.1Hz—20Hz	2.1×1.5	CP
RPY102	5.0×10^{-9}	6.5—14	75	0.1Hz—20Hz	2×2	CP
RPY103	2.2×10^{-9}	6.5—14	150	0.1Hz—20Hz	2×1	CP
RPY109	6.0×10^{-9}	1.0—15	65	0.1Hz—20Hz	2×2	CP

In addition to the above types, Mullard offer devices customized to your requirements. Further information from Mullard Ltd.

INFRARED PHOTOCONDUCTIVE DETECTORS

Mullard manufacture a range of photoconductive Cadmium Mercury Telluride detectors for the 8-14 micron regions. Further information available from Mullard Ltd.

Optoelectronic and special semiconductors

Silicon sensors

TEMPERATURE SENSORS

Type No.	Outline	Drawing reference	Temperature range (°C)	Resistance at 25°C (Ω)	Temperature coefficient (%/°C)
KTY81-100 series				1000 nom.	
KTY81-200 series	TO-92	BR	-55 to +150	2000 nom.	0.75
KTY83-100 series	DO-34	CS	-55 to +175	1000 nom.	0.75
KTY84-100 series	DO-34	CS	-0 to +300	1000 nom.	0.60

PRESSURE SENSORS

Type No.	Description	Pressure range (bar)	Sensitivity (mV/Vbar)
KP100A	Monolithic absolute pressure gauge	0 to 2	13
KPZ10G	Thin film relative pressure gauge	-1 to 2	9.5
KPZ11G	Thin film relative pressure gauge	-1 to 10	3.5

STRAIN/FORCE SENSORS

The above relative pressure gauge units can also be applied to measure strain up to 50 micron or force up to 30 newton.

MAGNETORESISTIVE SENSORS

Type No.	Supply voltage max (V)	Sensitivity (mV/V)/(kA/m)	H _{max} (A/m)
• KMZ10A	10	12	900
• KMZ10B	12	5	2500

Professional surface wave devices

book 1 part 7

Type No.	Outline	Application	Insertion Loss typ. (dB)	Reference frequency (MHz)	System
RW651			28	39.0	B/G
RW652			24	37.5	B/G
RW661		TV	27	39.5	I
RW662	24	transmitters	26	39.0	1
RW663	pin	and	28	33.0	1
RW664	DIL	transposers	28	37.0	I
RW671			25	45.9	M
RW672			22	37.5	M
RW681			27	37.5	D/K

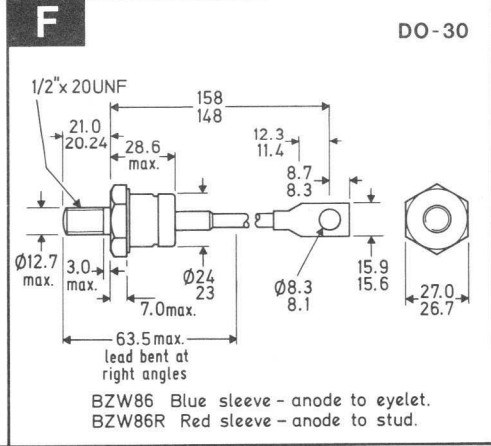
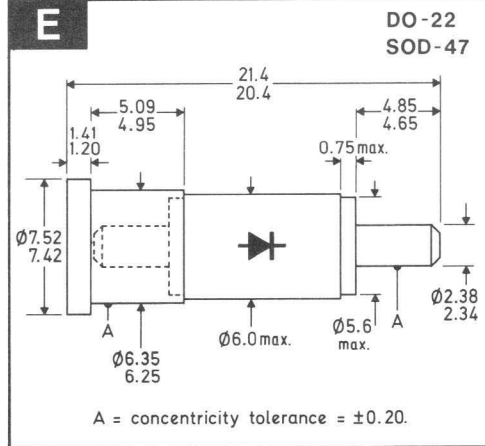
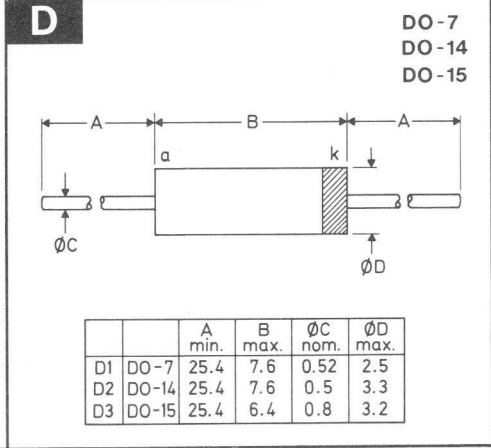
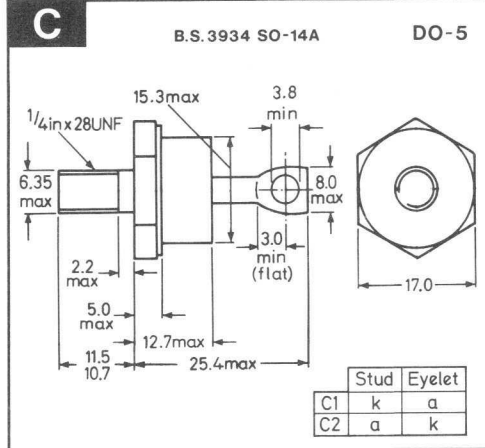
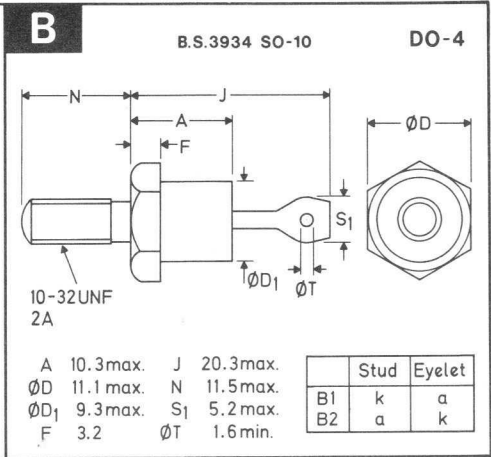
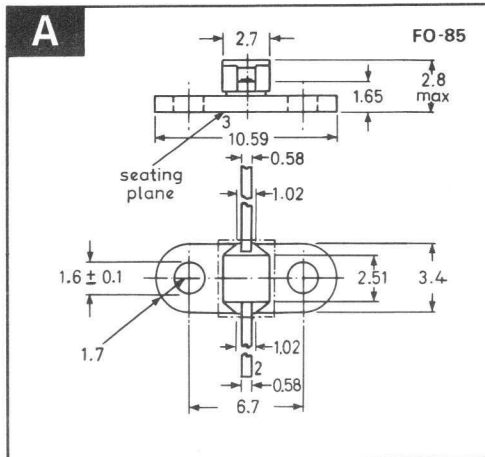
Mullard have the facility to manufacture a wide range of surface wave devices to meet individual customer requirements. For full details of this service, please contact Mullard Ltd.

Liquid crystal displays

Mullard offer the Videlec range of standard and custom designed liquid crystal displays. For full details of this service please contact Mullard Ltd.

OUTLINES and DIMENSIONS

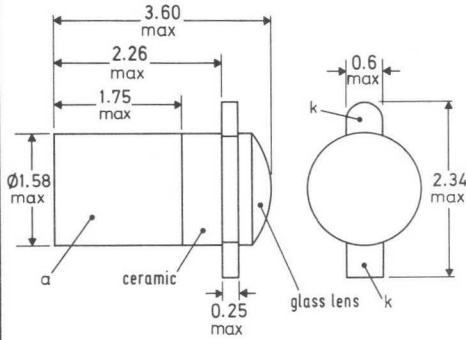
OUTLINES and DIMENSIONS (millimetres)



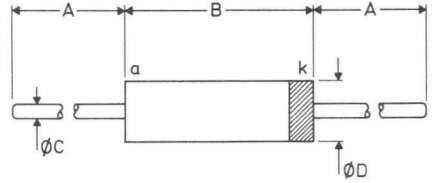
These drawings give limited information for quick reference purposes. For equipment design more complete information should be obtained from individual data sheets in the Technical Handbook or from standard B.S. or JEDEC outline drawings.

G

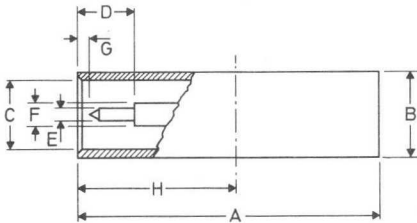
DO-31

**H**

DO-35



A	B	$\varnothing C$	$\varnothing D$
min.	max.	max.	max.
25.4	4.25	0.56	1.85

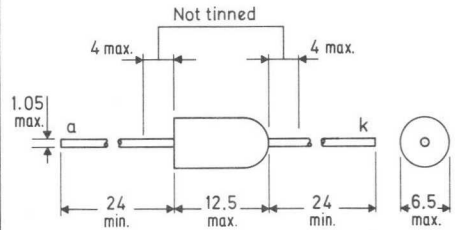
JDO-37
SOD-49

A	19.43/18.67	$\varnothing E$	0.84/0.79
$\varnothing B^*$	5.59/5.49	$\varnothing F$	1.57/1.52
$\varnothing C$	4.80/4.72	G	0.71/0.15
D	3.73 min.	H	10.32 nom.

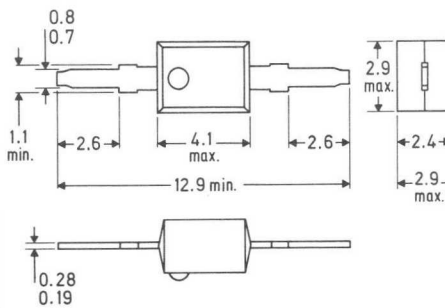
* These tolerances apply only over H.

K

SOD-18

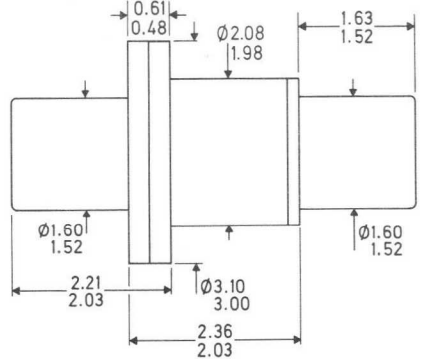
**L**

SOD-23

**M**

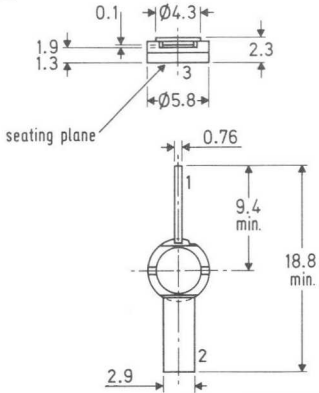
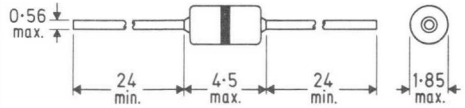
B.S.3934 SO-86

SOD-31

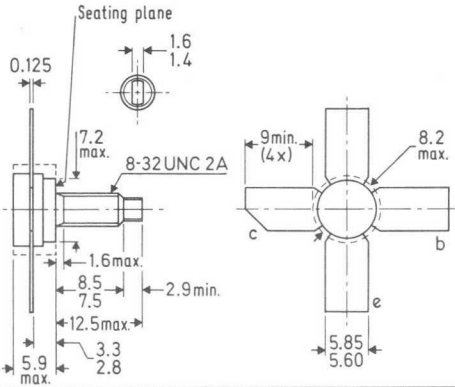


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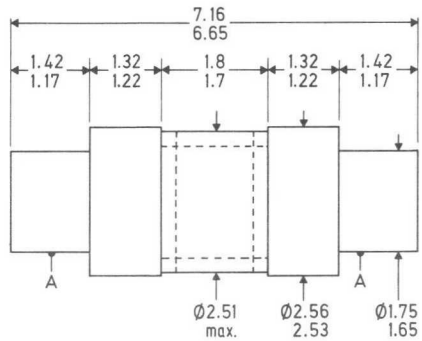
FO-93

**O****P**

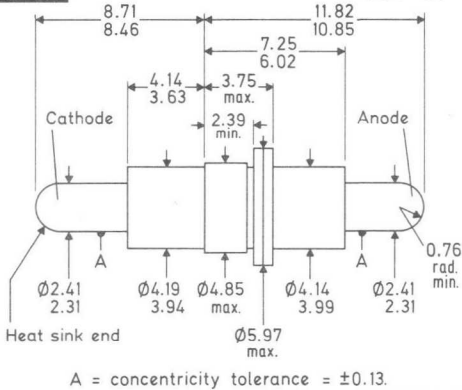
FO-38

**Q**

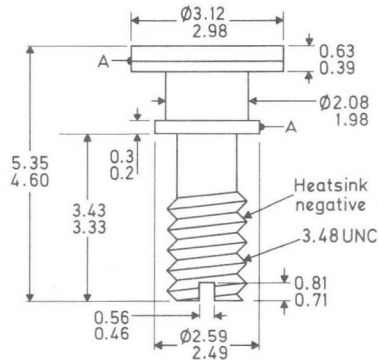
SOD-42

A = concentricity tolerance = ± 0.15 .**R**

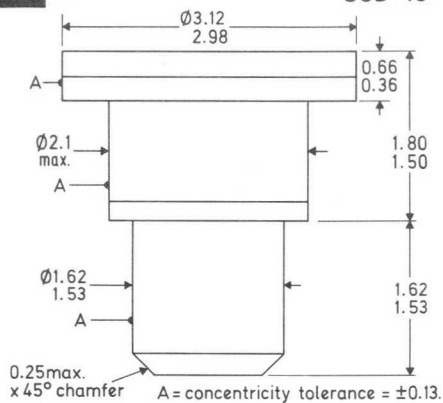
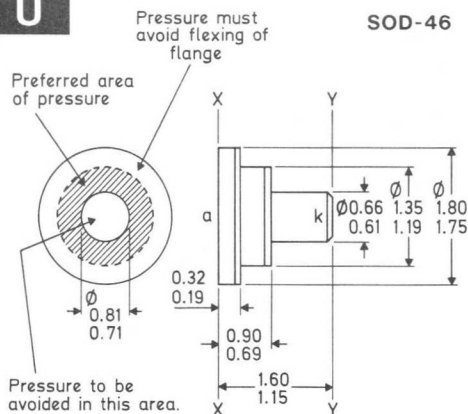
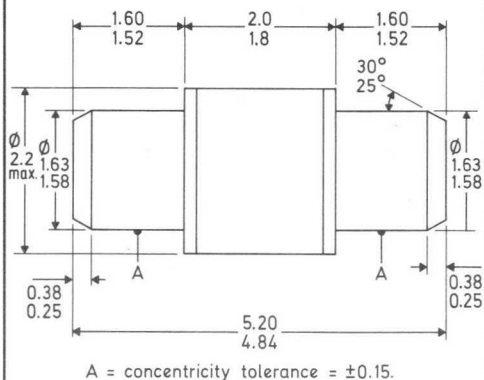
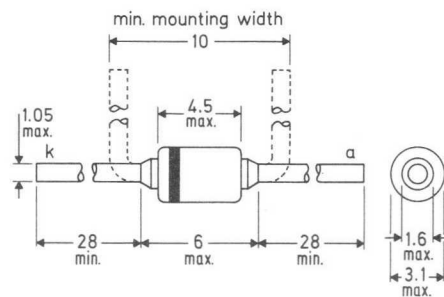
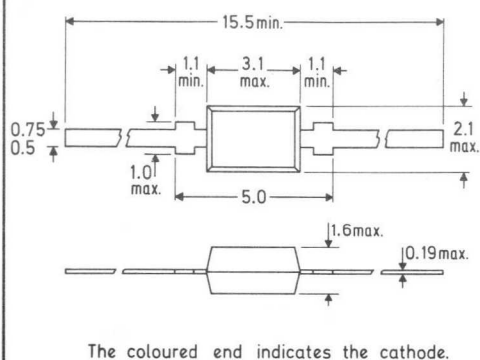
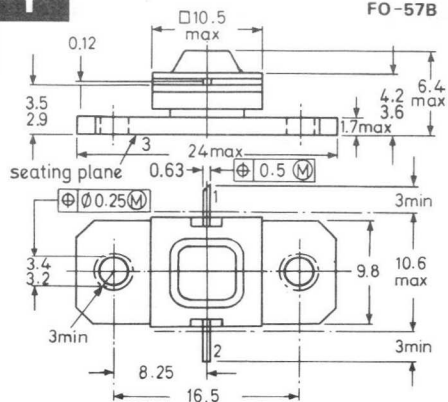
SOD-43

A = concentricity tolerance = ± 0.13 .**S**

SOD-44

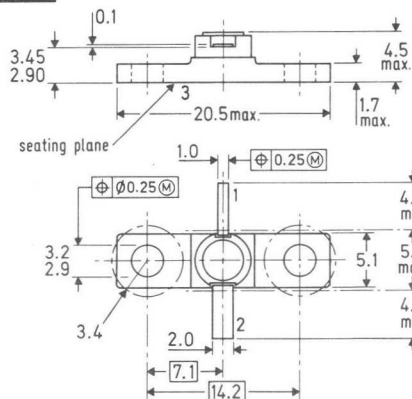
A = concentricity tolerance = ± 0.13 .

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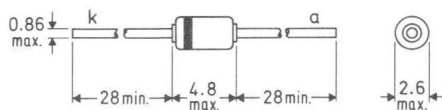
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Z

FO-41A

**AA**

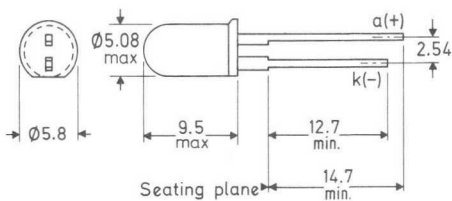
DO-41, SOD-66



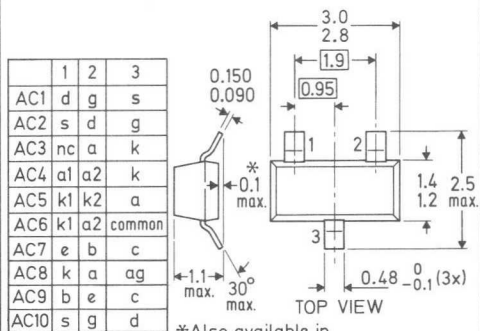
Cathode indicated by coloured band.

AB

SOD-63

**AC**

SOT-23

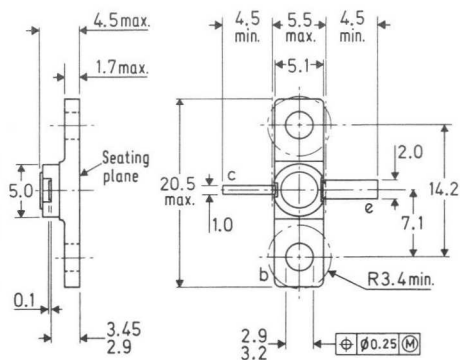


	1	2	3
AC1	d	g	s
AC2	s	d	g
AC3	nc	a	k
AC4	a1	a2	k
AC5	k1	k2	a
AC6	k1	a2	common
AC7	e	b	c
AC8	k	a	ag
AC9	b	e	c
AC10	s	g	d

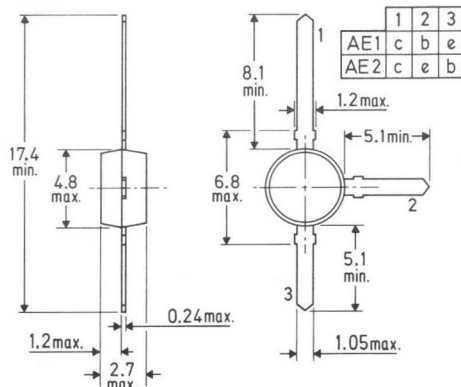
*Also available in 0.1-0.2mm version.

AD

FO-41B

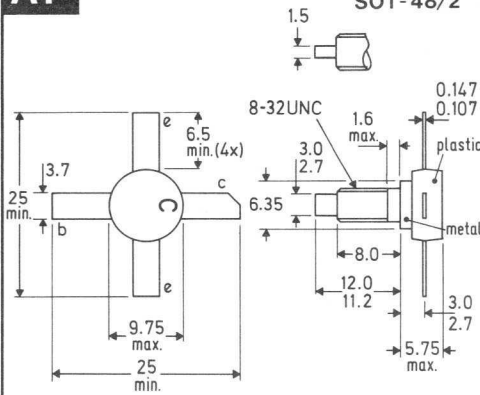
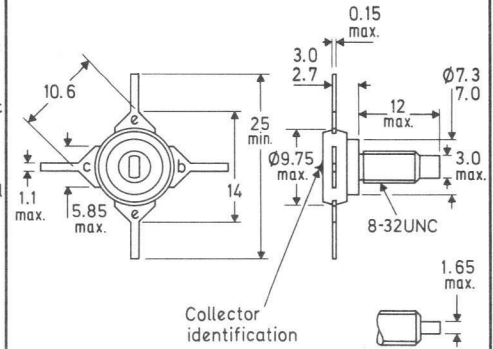
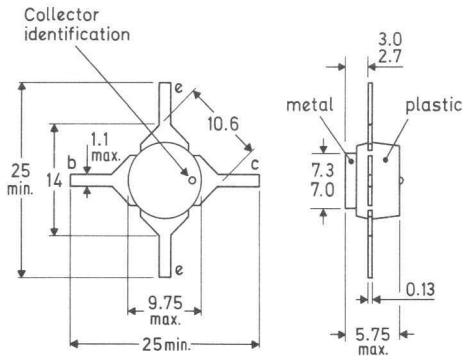
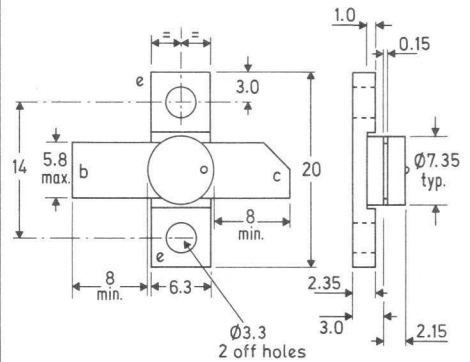
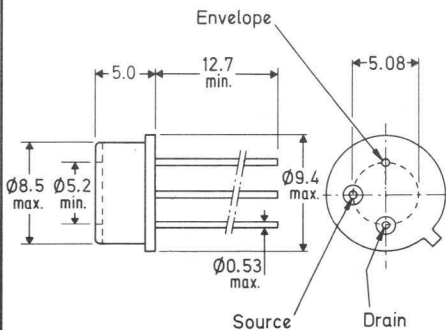
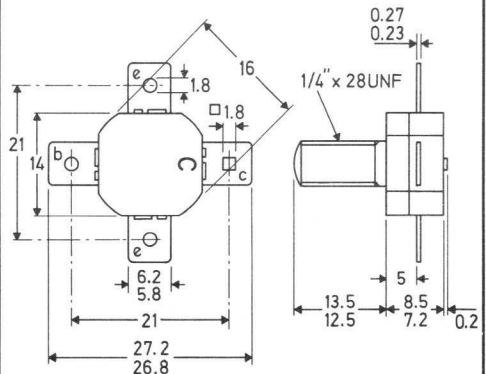
**AE**

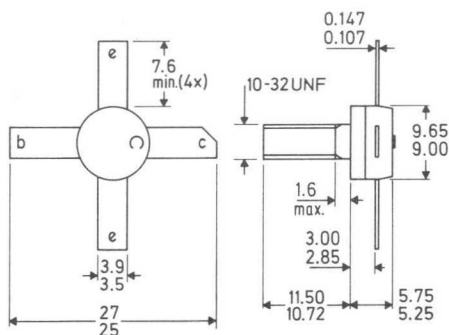
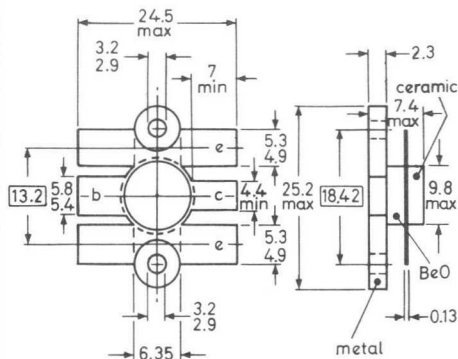
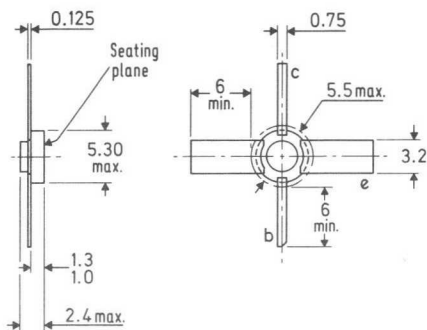
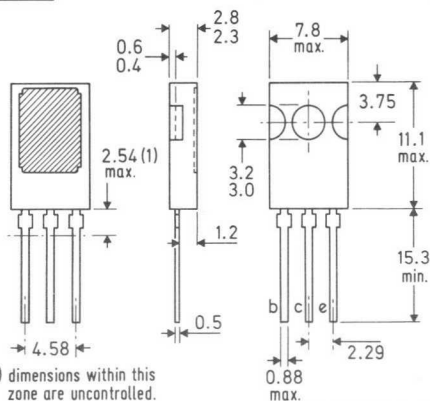
SOT-37



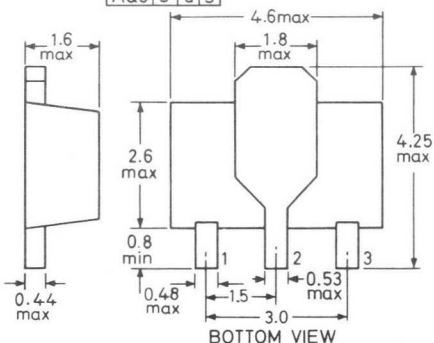
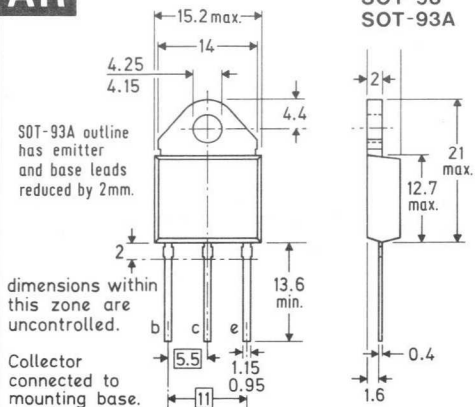
	1	2	3
AE1	c	b	e
AE2	c	e	b

These drawings give limited information for quick reference purposes. For equipment design more complete information should be obtained from individual data sheets in the Technical Handbook or from standard B.S. or JEDEC outline drawings.

AF**SOT-48/2****AG****SOT-48/3****AH****SOT-48/4****AJ****SOT-48
HEADER****AK****SOT-49E****AL****SOT-55**

AM**SOT-56****AN****SOT-160****AO****FO-45****AP****SOT-82****AQ****SOT-89**

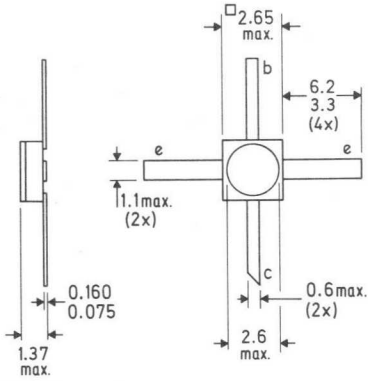
	1	2	3
AQ1	e	c	b
AQ2	a	c	a
AQ3	s	d	g

**AR****SOT-93
SOT-93A**

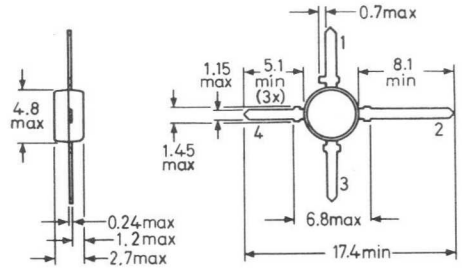
These drawings give limited information for quick reference purposes. For equipment design more complete information should be obtained from individual data sheets in the Technical Handbook or from standard B.S. or JEDEC outline drawings.

AS

SOT-100

**AT**

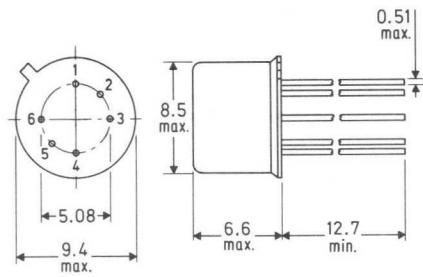
SOT-103



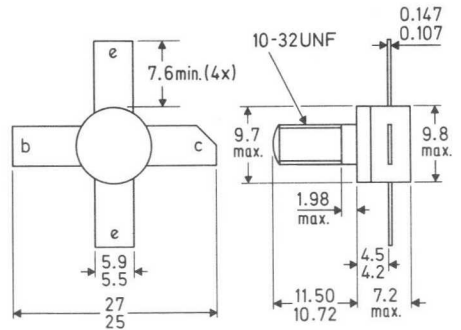
	1	2	3	4
AT1	s	d	92	91
AT2	e	c	e	b

AU

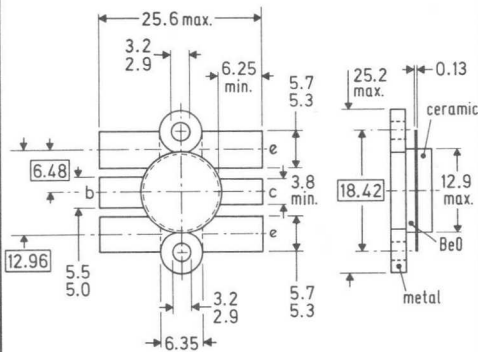
SOT-104B

**AV**

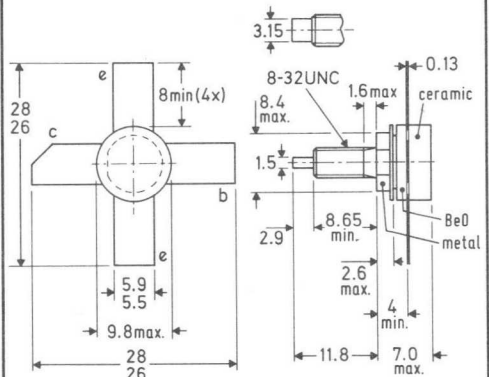
SOT-105

**AW**

SOT-119

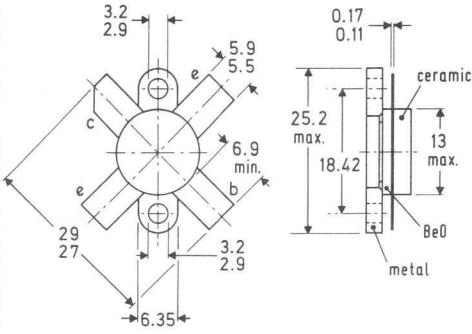
**AX**

SOT-120



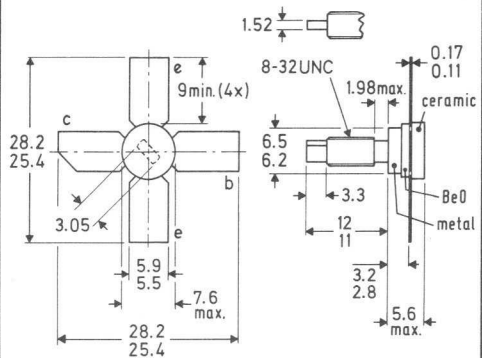
AY

SOT-121



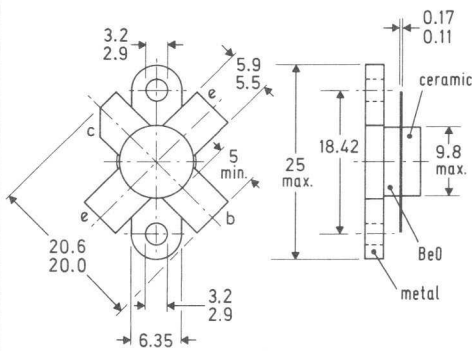
AZ

SOT-122



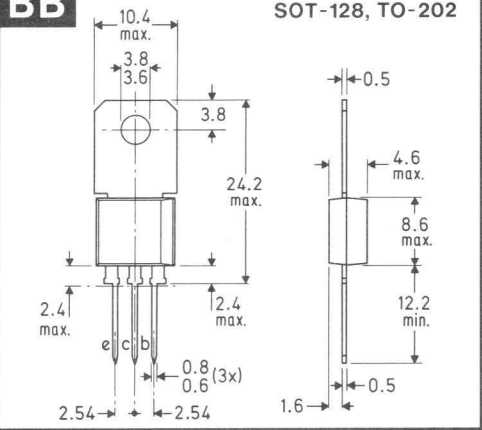
BA

SOT-123

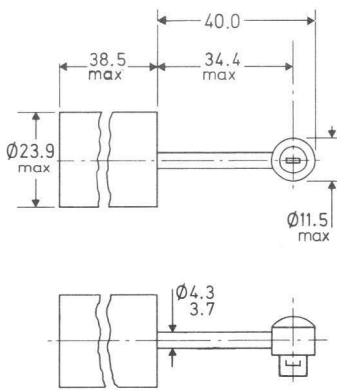


BB

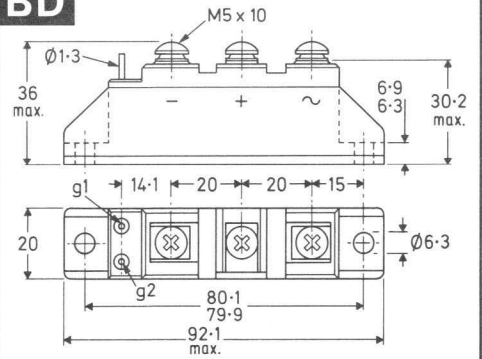
SOT-128, TO-202



BC



BD



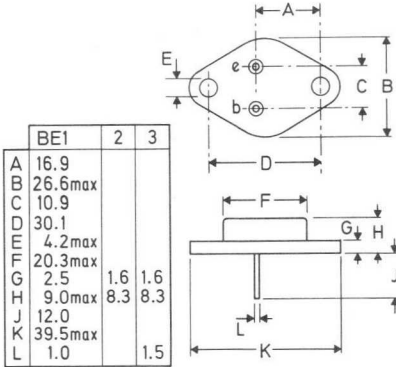
Gate pins as appropriate.

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BE

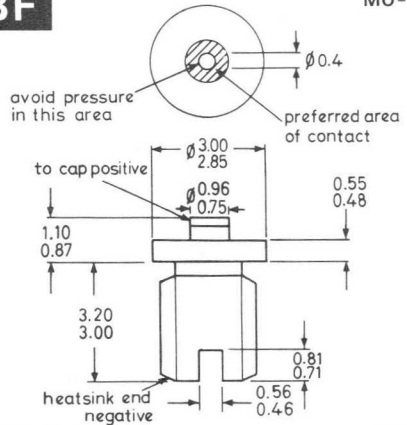
B.S.3934 SO-5B/SB2-2

TO-3

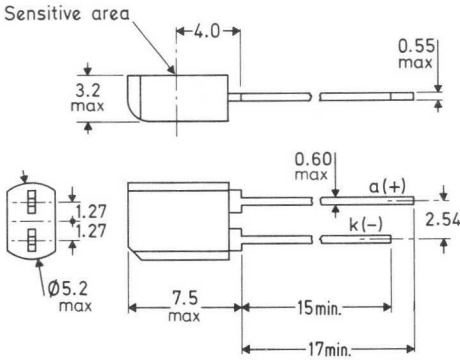


BF

MO-75

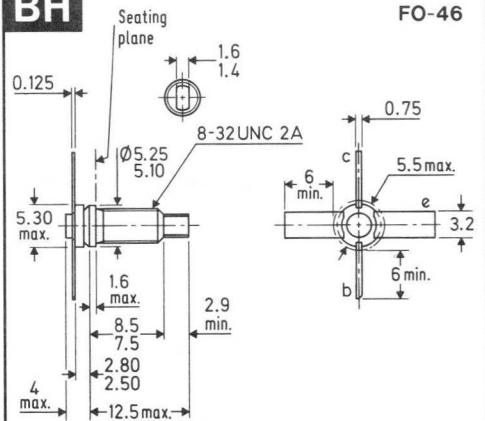


BG



BH

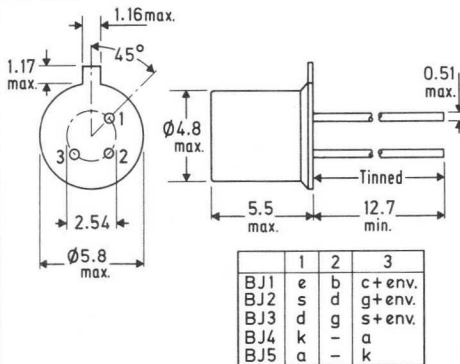
FO-46



BJ

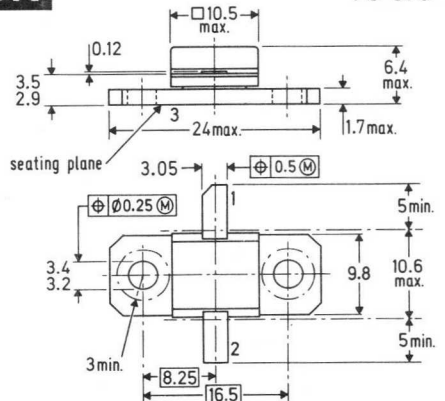
B.S.3934 SO-12A/SB3-6A

TO-18



BK

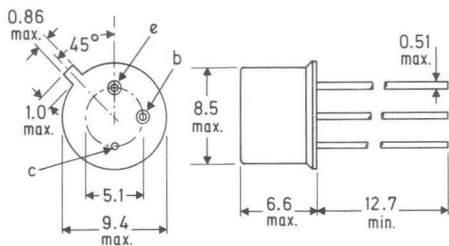
FO-57C



BL

B.S.3934 SO-3/SB3-3A

TO-39



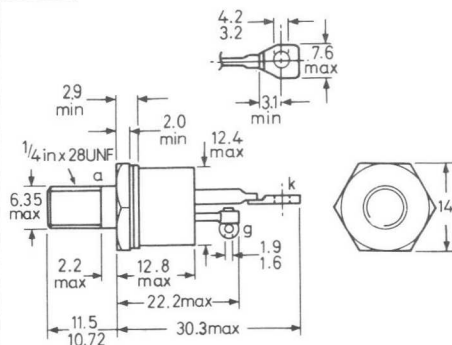
BL1: b + case.
 BL2: case isolated.
 BL3: c + case.
 BL4: e. cathode.
 b. gate.
 c. anode + case.

BL6: red spot indicates +ve connection.
 BL7: pins c, b, e + case (clockwise).

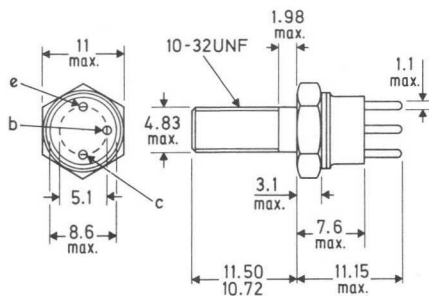
BM

B.S.3932 SO-36

TO-48

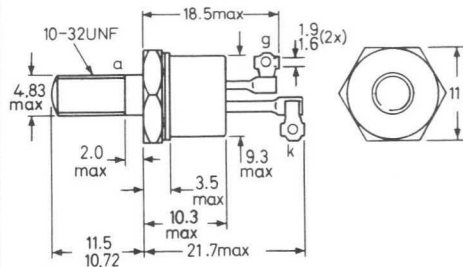
**BN**

TO-60

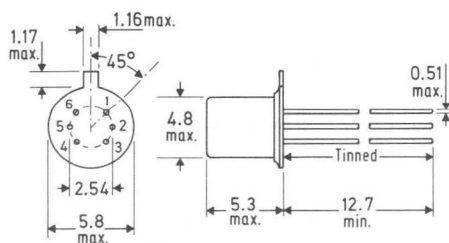
**BO**

B.S.3934 SO-35A

TO-64

**BP**

TO-71

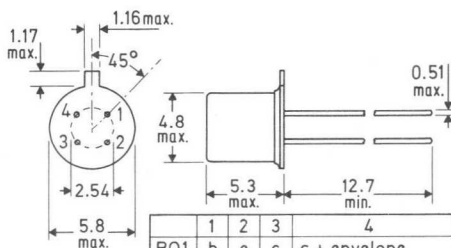


Pin	1	2	3	4	5	6
BP1	e1	e2	c2	b2	b1	c1
BP2	s1	d1	g1	s2	d2	g2

BQ

B.S.3934 SO-12A/SB4-3

TO-72



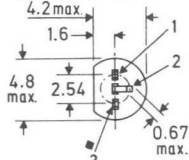
	1	2	3	4
BQ1	b	e	c	s + envelope
BQ2	e	b	c	s + envelope
BQ3	s	d	g	screen + envelope
BQ4	d	g2	g1	s + b + envelope
BQ5	d	s	g	b + envelope
BQ6	k	gk	ga	a
BQ7	s	d	g	b + envelope

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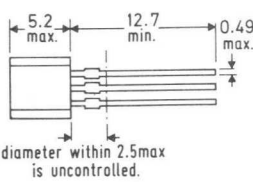
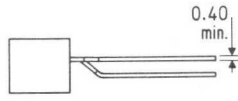
BR

TO-92 variant

Pin	1	2	3
BR1	e	b	c
BR2	b	d	c
BR3	d	a	c
BR4	b	d	g
BR5	b	d	k
BR6	a	c	e
BR7	a	2	a
BR8	k	c	a
BR9	k	c	e
BR10	g	d	e



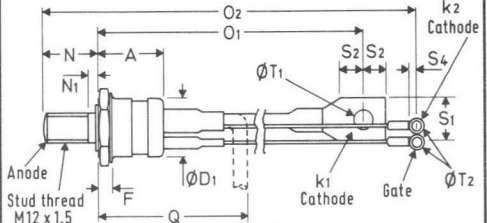
* in-line pinning



BS

B.S.3934 SO-30C

TO-94

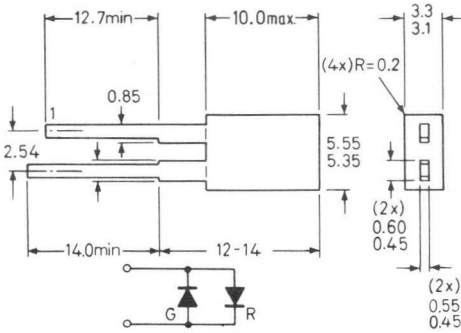


Height to be allowed if cathode lead is bent at right angles.

A	28.5 max.	O1	158 max.	S4	3.8 min.
ØD1	24.1 max.	O2	190 max.	ØT1	8.3 max.
F	8.9 max.	Q	63.5 max.	ØT2	4.2 max.
N	21.0 max.	S1	16.5 max.		
N1	3.0 max.	S2	9.6 min.		

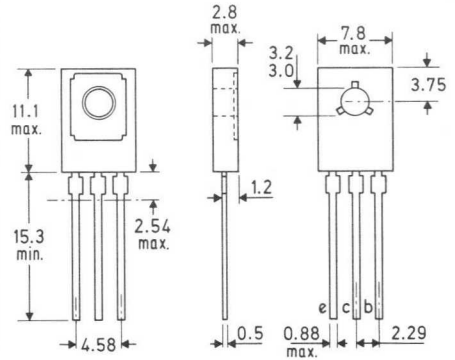
BT

SOD-77



BU

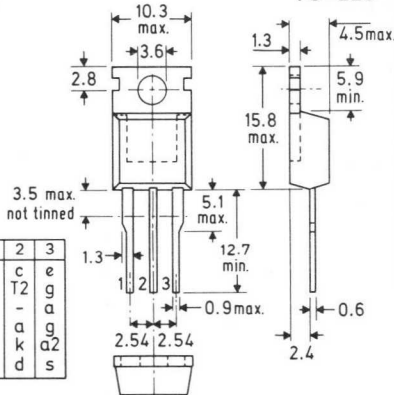
TO-126



BST78: for ecb read sdg.

BV

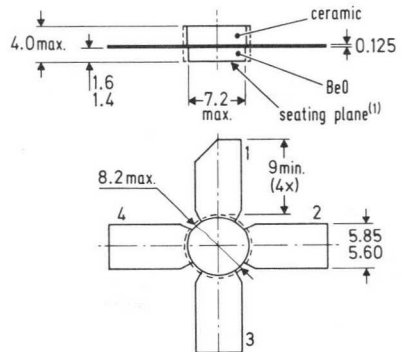
TO-220

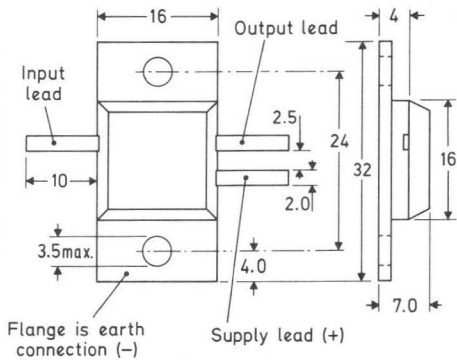
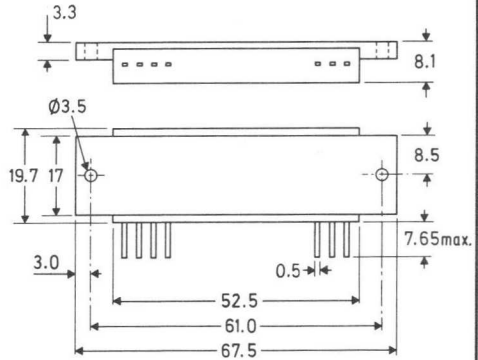
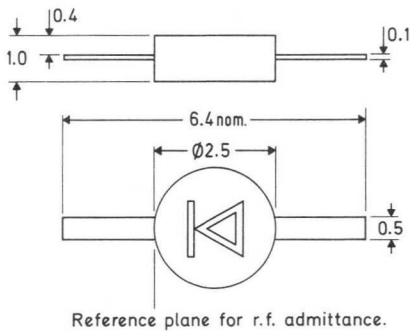
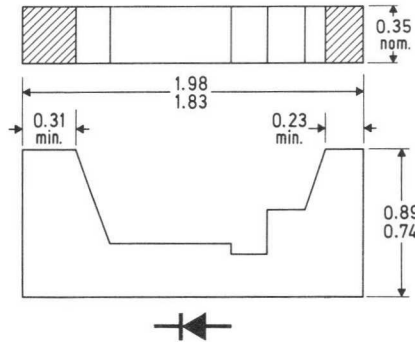
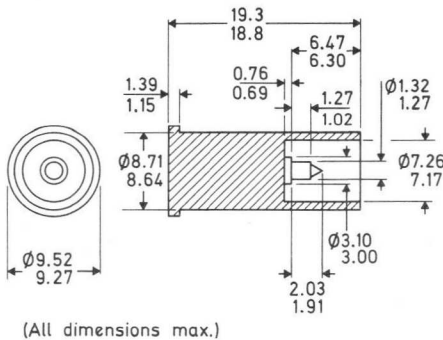
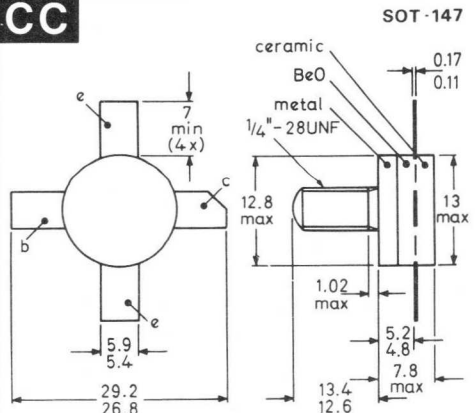


Pin	1	2	3
BV1	b	c	e
BV2	T1	T2	g
BV3	k	a	g
BV4	k	a	g
BV5	a1	k	a2
BV6	g	d	s

BW

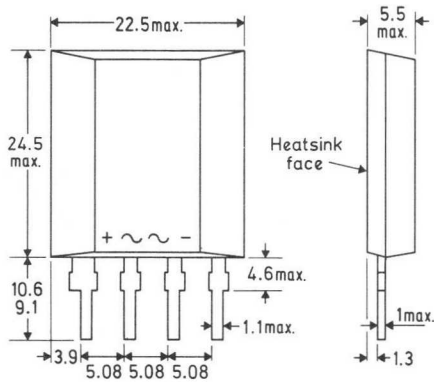
FO-58



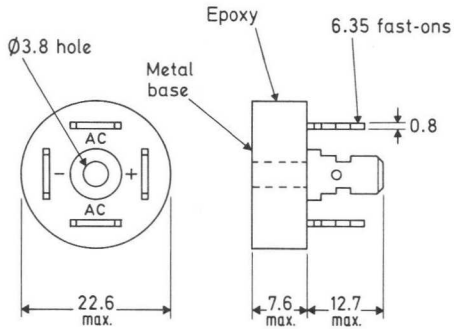
BX**BY****BZ****CA****CB****CC**

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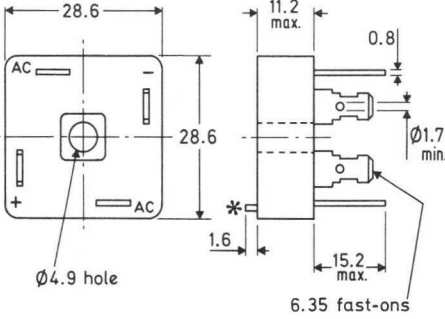
CD



CE



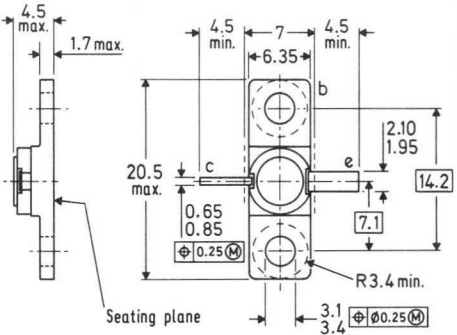
CF



* Positioning pin under + terminal.

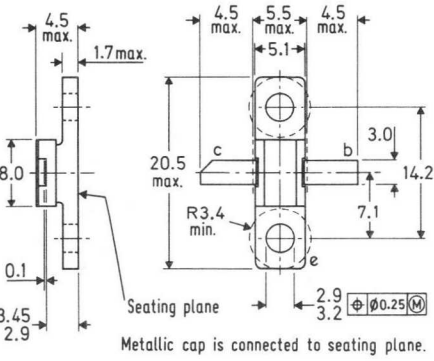
CG

FO-53



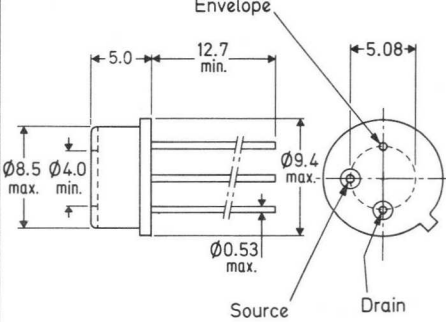
CH

FO-83



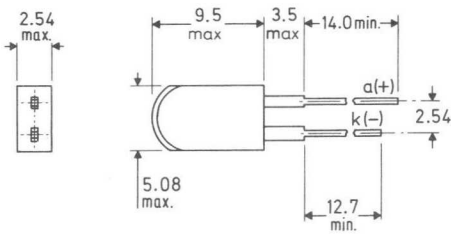
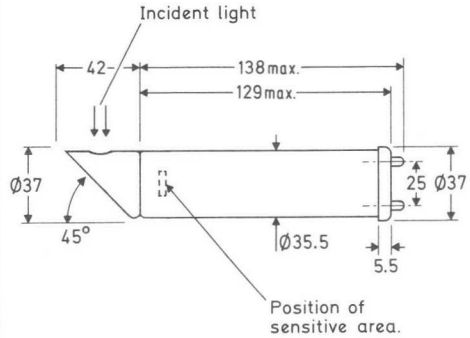
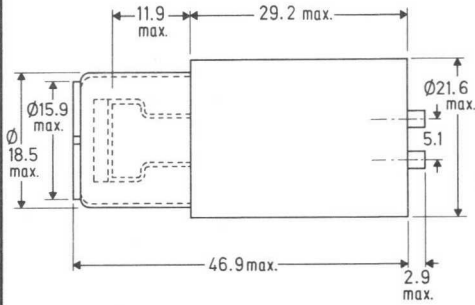
CJ

SOT-49F

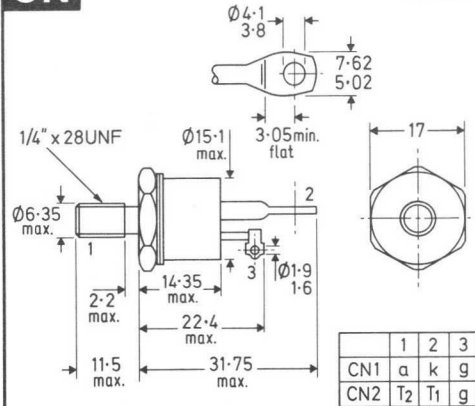


CK

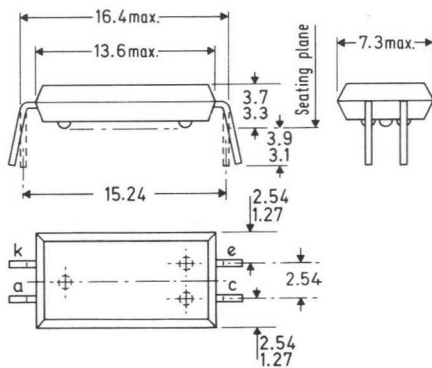
SOD-65

**CL****CM****CN**

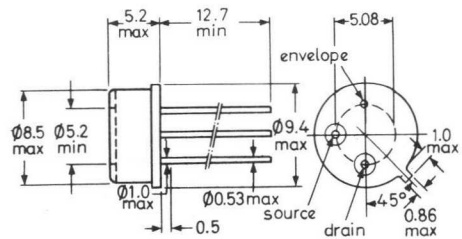
TO-65

**CO**

SOT-91B

**CP**

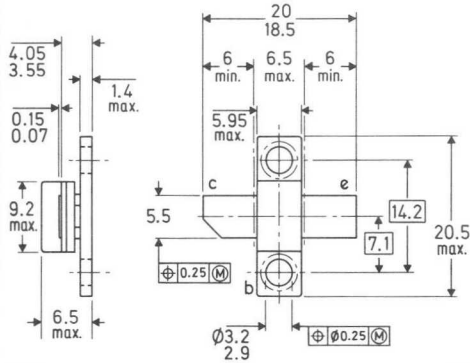
SOT-49H



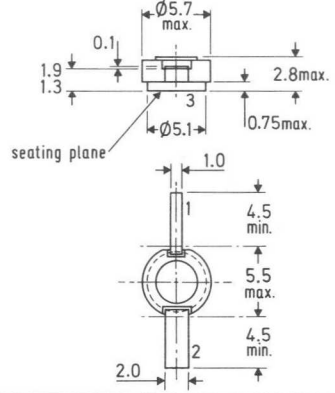
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CQ

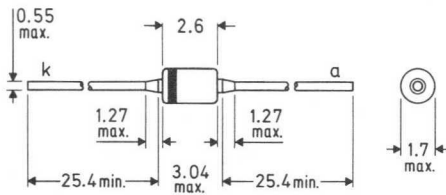
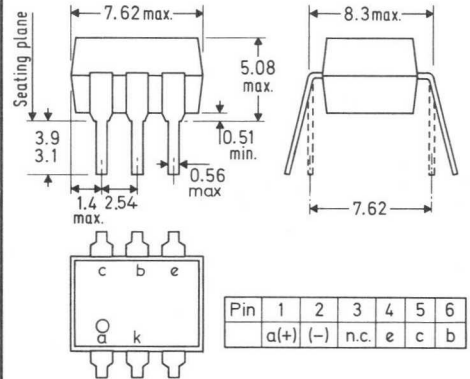
FO-67A

**CR**

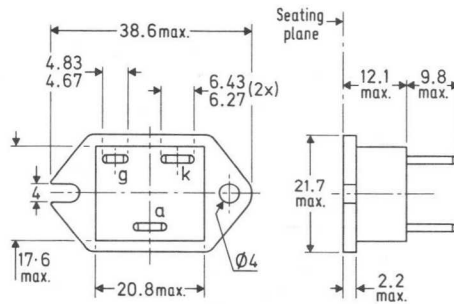
FO-49A

**CS**

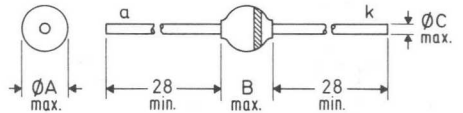
DO-34

**CT****CU**

TO-238A

**CV**

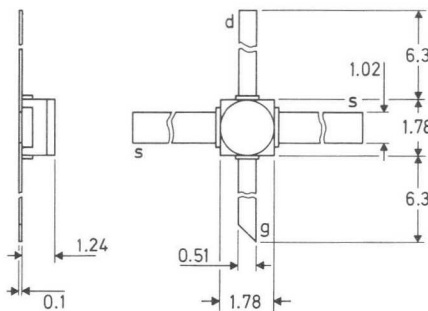
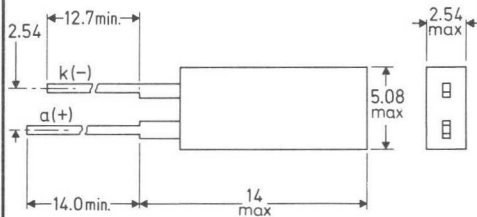
	ϕA	B	ϕC
CV1 (SOD-57)	3.81	4.57	0.81
CV2 (SOD-64)	4.5	5.0	1.35



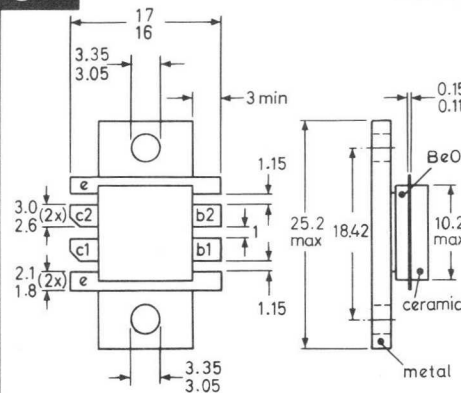
The marking band indicates the cathode.

CW

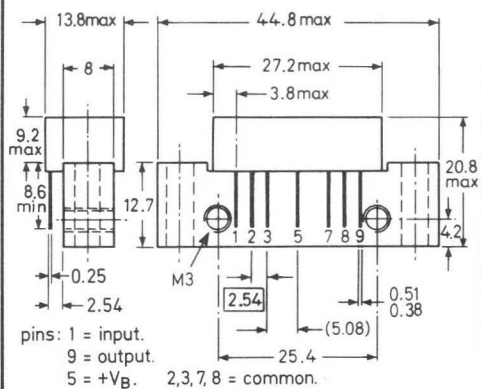
FO-92

**CX****CY**

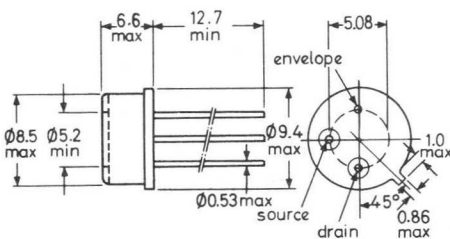
SOT-161

**CZ**

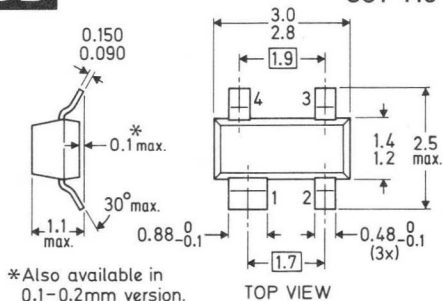
SOT-115

**DA**

SOT-49G

**DB**

SOT-143



*Also available in
0.1-0.2mm version.

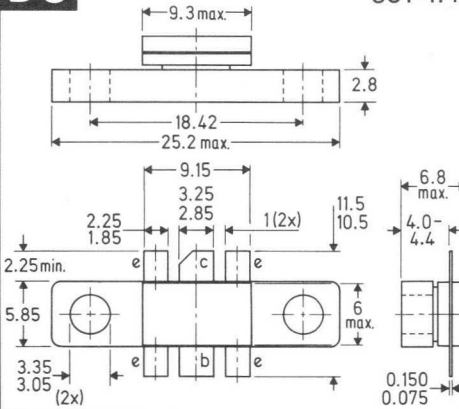
TOP VIEW

	1	2	3	4
DB1	s,b	d	g2	g1
DB2	g a	a	k	gk
DB3	g	i,d.	s	d

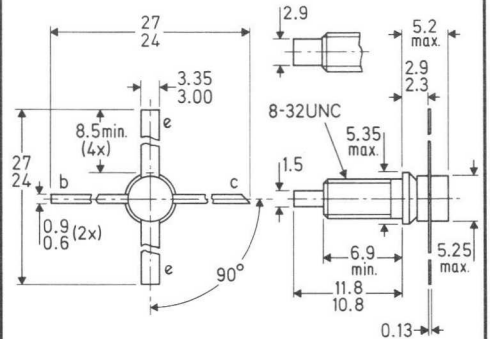
	1	2	3	4
DB4	c2	c1	e1	e2
DB5	s	b	d	g
DB6	b	s	d	g

DC

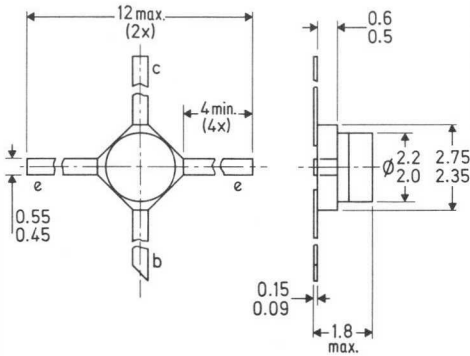
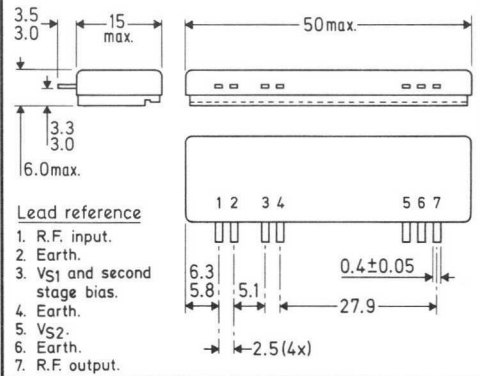
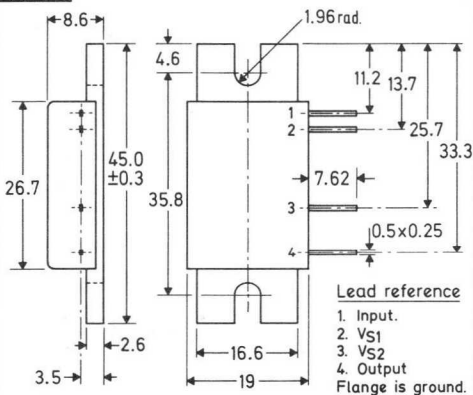
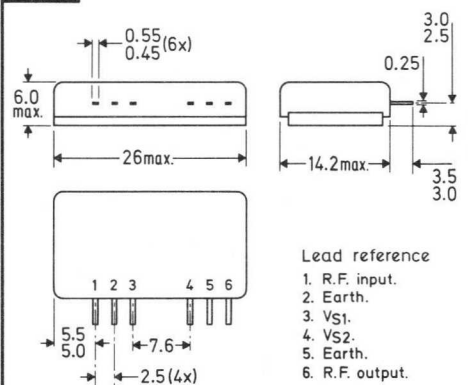
SOT-171

**DD**

SOT-172

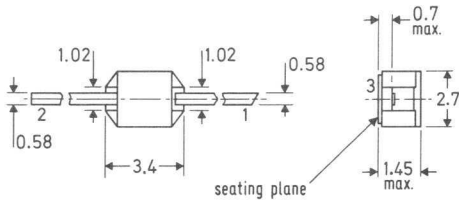
**DE**

SOT-173

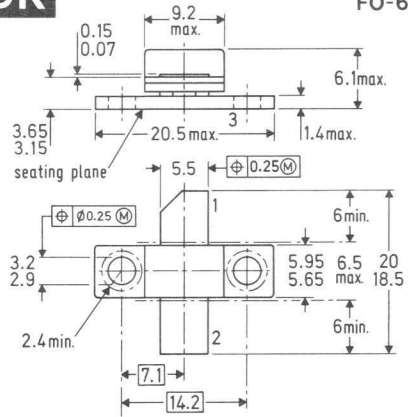
**DF****DG****DH**

DJ

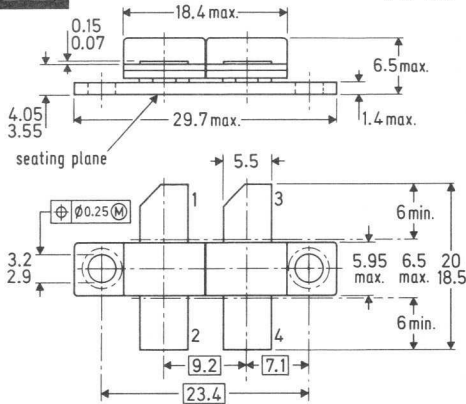
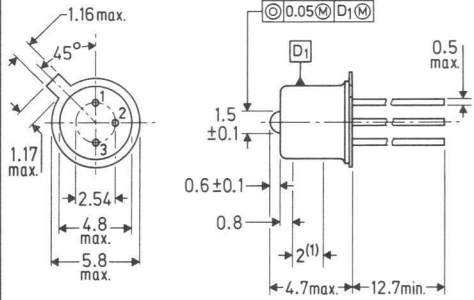
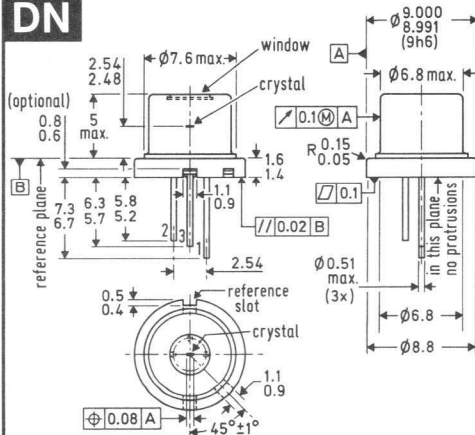
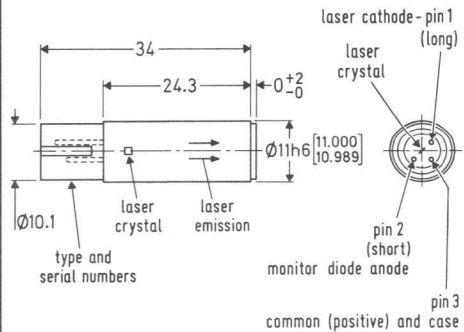
FO-102

**DK**

FO-67B

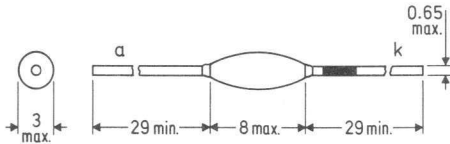
**DL**

FO-96

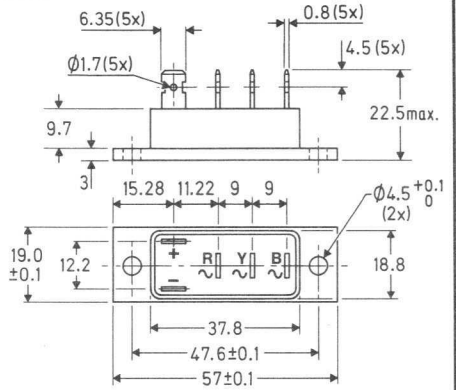
**DM**(1) Case diameter over this length is $4.7^{+0.05}_{-0.1}$ mm.**DN****DO**

DP

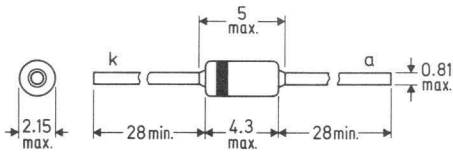
SOD-61



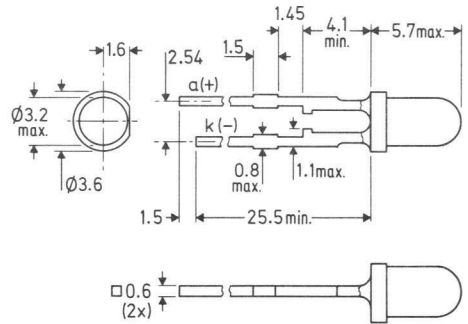
Cathode indicated by coloured band.

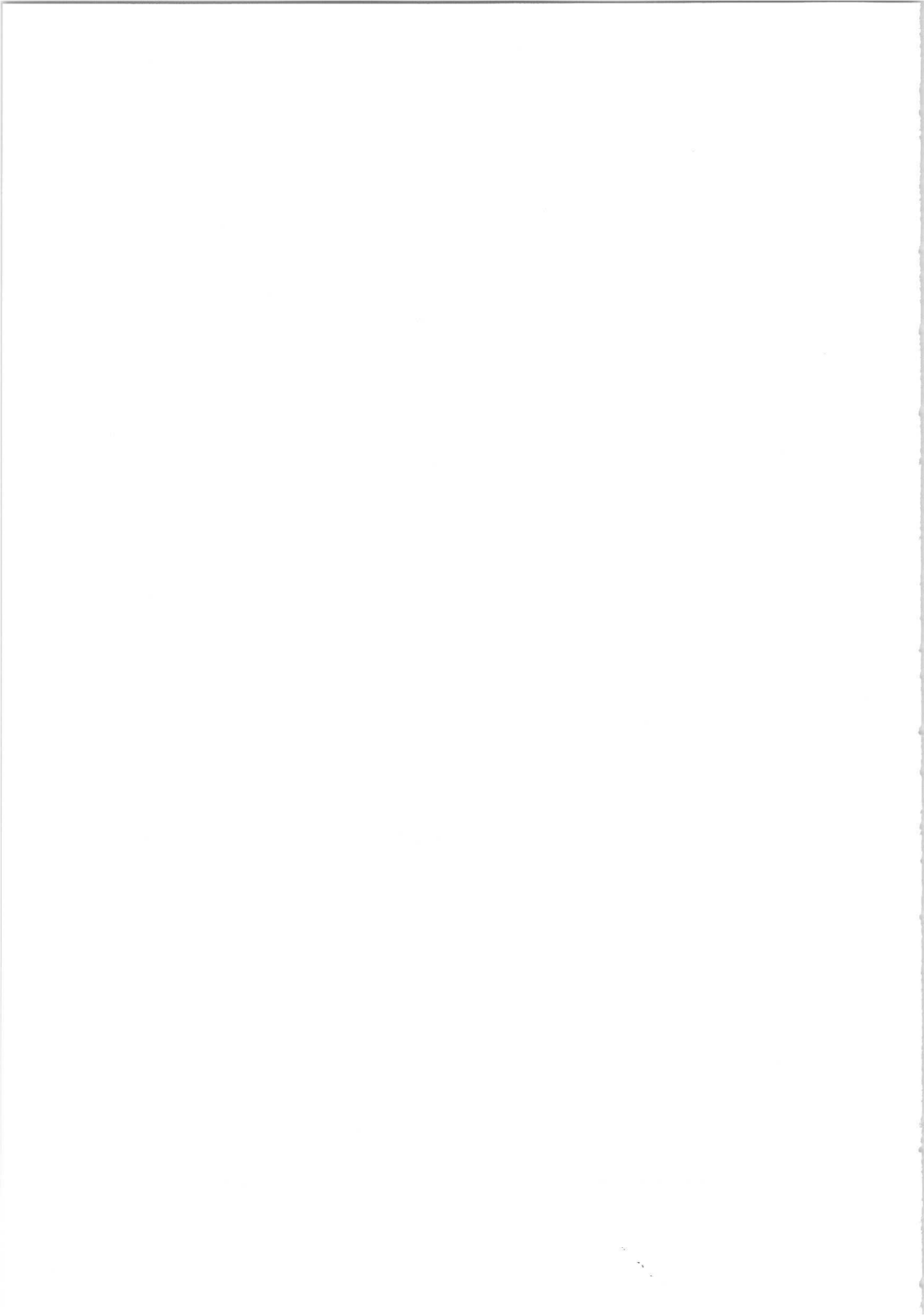
DQ**DR**

SOD-81



Cathode indicated by coloured band.

DS



Mullard Valves & Tubes

- Products included for the first time in this guide are indicated both in the index pages and data pages by a black dot alongside the type number.

Picture tubes

colour picture tubes (in-line)

All types: Slotted shadow mask. 3 guns in line. Hi-Bri screen with push-through super square presentation. Soft-Flash technology. $V_h = 6.3V$. Quick heating (5 seconds).

Type No.	Tube diagonal		Final Anode Max.	Voltage Min.	Typical V_{g2}	Operating $+V_k$	conditions** Focusing electrode (V)	I_h	Light transmission (%)	Neck diameter (mm)	Base	Deflection unit
	(cm)	(in)	(kV)	(kV)	(V)	(V)	(V)	(mA)				
30AX types 110° deflection angle												
A51-540X	51	20	27.5	22.5	560 to 800	140	6500 to 7450	720	64	36.5	B12-246	AT1250
A56-540X	56	22	27.5	22.5	560 to 800	140	6500 to 7450	720	64	36.5	B12-246	AT1260
A66-540X	66	26	27.5	22.5	560 to 800	140	6500 to 7450	720	68	36.5	B12-246	AT1270
Mini-neck types 90° deflection angle, raster correction free												
• A34EACOOX	38	14	27.5	20	310 to 600	125	6100 to 6900	290	68	22.5	B8-288	AT1625 series
• A38EACOOX	42	16	27.5	20	310 to 600	125	6100 to 6900	290	67	22.5	B8-288	AT1635 series
• A43EACOOX	51	20	27.5	20	310 to 630	125	7600 to 8400	290	64	22.5	B8-288	AT1645 series
Narrow neck types 90° deflection angle, raster correction free												
A37-590X	37	14	27.5	20	390 to 760	140	6600 to 7500	685	68	29.1	B10-277	AT1206
A42-590X	42	16	27.5	20	390 to 760	140	6600 to 7500	685	68	29.1	B10-277	AT1216
A51-590X	51	20	27.5	20	390 to 760	140	6600 to 7500	685	64	29.1	B10-277	AT1236

* Design maximum rating. **Cathode drive. Voltages with respect to g1.

monochrome picture tubes

All types: 110° deflection. Short unipotential gun. Push-through presentation. Quick heating (5 seconds).

Type No.	Screen diagonal	Max. Final Anode Voltage*	Typical Operating Conditions**			V_h	I_h	Light Transmission (%)	Neck Diameter (mm)	Base	
	(cm)	(in)	V_{a1}	$+V_k$	Focusing Electrode (V)	(V)	(mA)				
A31-510W	31	12	17	130	30 to 50	0 to +130	11	140	50	20	B7G special
A34-510W	34	14	17	130	30 to 50	0 to +130	11	140	48	20	B7G special
A44-510W	44	17	17	130	30 to 50	0 to +130	11	140	48	20	B7G special
A50-520W	50	20	23	130	42 to 62	0 to +130	6.3	240	45	28.6	B8H
A61-520W	61	24	23	130	42 to 62	0 to +130	6.3	240	42	28.6	B8H

*Design maximum rating. **Cathode drive. Voltages with respect to grid.

wound assemblies

Colour TV power supply and deflection systems

90° recommended combinations

Picture tube:	A37-590X	A42-590X	A51-590X
Deflection unit:	AT1206/20	AT1216/20	AT1236/20
Degaussing coil (single insulation)	3122-138-99840	3122-138-99850	3122-138-56070
Mains filter	AT4043/55	AT4043/55	AT4043/55
Switched mode driver transformer	AT4043/82	AT4043/82	AT4043/82
Mains transformer	TS561/3 or TS521B	TS561/3 or TS521B	TS561/3 or TS521B
Current sense transformer	AT4043/46	AT4043/46	AT4043/46
Input choke	AT4043/81	AT4043/81	AT4043/81
Synchronous power pack transformer	AT2076/80 or AT2077/80	AT2076/80 or AT2077/80	AT2076/80 or AT2077/80

110° recommended combinations

Picture tube:	A51-540X	A56-540X	A66-540X
Deflection unit:	AT1250/10	AT1260/10	AT1270/10
Degaussing coil (double insulation)	3122-138-56320	3122-138-56320	3122-138-56310
Mains filter	AT4043/55	AT4043/55	AT4043/55
Bridge coil	AT4043/68	AT4043/68	AT4043/68
Linearity control unit	AT4042/30	AT4042/30	AT4042/30
Diode split line output transformer	AT2076/81 or AT2077/82	AT2076/81 or AT2077/82	AT2076/81 or AT2077/82
Screened e.h.t. cable	3122-137-63370	3122-137-63370	3122-137-63370
Focus cable	3122-131-00732	3122-131-00732	3122-131-00732

Basic Type No.	Quality Grade	Application	Spectral Response		Loading	Typical mod. depth	
			Cut-off (nm)			%	B/W or L MHz
18mm (2/3") dia. Plumbicon tubes (95mA 6.3V Heater)							
XQ1427	Broadcast	B/W RGB	850		Rear	60	4
XQ1428	Industrial	B/W RGB	850		Rear	60	4
18mm (2/3") dia. Plumbicon tubes with diode gun							
XQ2427	Broadcast	B/W RGB	650 to 850		Rear	50	5
*XQ2428	Industrial	B/W RGB	650 to 850		Rear	50	5
18mm (2/3") dia. Plumbicon tubes with diode gun and low output capacitance (LOC)							
*XQ3427	Broadcast	B/W RGB	650 to 850		Rear	50	5
*XQ3428	Industrial	B/W RGB	650 to 850		Rear	50	5
25mm (1") dia. Plumbicon tubes – standard range (95mA 6.3V Heater)							
†XQ1070	Broadcast	B/W LRGB	650		Front	40	5
†XQ1071	Industrial	B/W RGB	650		Front	40	5
XQ1072	Medical	–	650		Front	–	–
†XQ1073	Broadcast	B/W R	850 to 950		Front	50	5
†XQ1074	Industrial	B/W R	850 to 950		Front	50	5
*XQ1075	Broadcast	B/W R	750		Front	50	5
*XQ1076	Industrial	B/W R	750		Front	50	5
Can be supplied with provision for light bias.							
25mm (1") dia. Plumbicon tubes – technically advanced range (95mA 6.3V Heater)							
XQ1080	Broadcast	B/W LRGB	650		Rear	40	5
XQ1081	Industrial	B/W RGB	650		Rear	40	5
XQ1083	Broadcast	B/W R	850 to 950		Rear	50	5
XQ1084	Industrial	B/W R	850 to 950		Rear	50	5
*XQ1085	Broadcast	B/W R	750		Rear	50	5
*XQ1086	Industrial	B/W R	750		Rear	50	5
XQ1090	Broadcast	B/W LRGB	650		Front	40	5
XQ1091	Industrial	B/W RGB	650		Front	40	5
XQ1093	Broadcast	B/W R	850 to 950		Front	50	5
XQ1094	Industrial	B/W R	850 to 950		Front	50	5
*XQ1095	Broadcast	B/W R	750		Front	50	5
*XQ1096	Industrial	B/W R	750		Front	50	5
25mm (1") dia. Plumbicon tubes with diode gun (new development)							
XQ2070/02	Broadcast	B/W RGB	650		Rear	60	5
XQ2073/02	Broadcast	B/W RGB	850 to 950		Rear	65	5
*XQ2075/02	Broadcast	B/W RGB	750		Rear	65	5
25mm (1") dia. Plumbicon tubes with diode gun and low output capacitance (LOC)							
*XQ3070/02	Broadcast	B/W RGB	650		Rear	60	5
*XQ3073/02	Broadcast	B/W RGB	850 to 950		Rear	65	5
*XQ3075/02	Broadcast	B/W RGB	750		Rear	65	5
25mm (1") dia. high resolution Plumbicon tubes with A.C.T. (190mA 6.3V Heater)							
XQ1500	Broadcast	B/W LRGB	650		Rear	50	5
XQ1501	Industrial	B/W RGB	650		Rear	50	5
XQ1503	Broadcast	B/W R	850 to 950		Rear	55	5
XQ1504	Industrial	B/W R	850 to 950		Rear	55	5
XQ1505	Broadcast	B/W R	750		Rear	55	5
XQ1506	Industrial	B/W R	750		Rear	55	5
30mm (1 1/4") dia. Plumbicon tubes – standard range (300mA 6.3V Heater)							
XQ1020	Broadcast	B/W LRGB	650		Rear	40	5
XQ1021	Industrial	B/W RGB	650		Rear	40	5
XQ1022	Medical	–	650		Rear	–	–
XQ1023	Broadcast	B/W LR	850		Rear	55	5
XQ1024	Industrial	B/W R	850		Rear	55	5
*XQ1025	Broadcast	B/W LR	750		Rear	55	5
*XQ1026	Industrial	B/W R	750		Rear	55	5
30mm (1 1/4") dia. Plumbicon tubes – technically advanced range (300mA 6.3V Heater)							
XQ1410	Broadcast	B/W LRGB	650		Rear	55	5
XQ1411	Industrial	B/W RGB	650		Rear	55	5
XQ1413	Broadcast	B/W LR	900		Rear	60	5
XQ1414	Industrial	B/W R	850		Rear	60	5
†XQ1415	Broadcast	B/W LR	750		Rear	60	5
†XQ1416	Industrial	B/W R	750		Rear	60	5
30mm (1 1/4") dia. Plumbicon tubes high resolution with A.C.T. (190mA 6.3V Heater)							
XQ1520	Broadcast	B/W LRGB	650		Rear	55	5
XQ1521	Industrial	B/W RGB	650		Rear	55	5
XQ1523	Broadcast	B/W R	900		Rear	55	5
XQ1524	Industrial	B/W R	900		Rear	55	5
*XQ1525	Broadcast	B/W R	750		Rear	55	5
*XQ1526	Industrial	B/W R	750		Rear	55	5

*Registered trade mark for television camera tubes

†Can be supplied without anti-halation disc denoted by suffix /01 to type number

‡Supplied with infrared filter on disc

Type Numbers:— No letter suffix for black/white application; L suffix for luminance; R for red image; G for green image; B for blue image. Where a /01 suffix is also used, the complete type number of an example would be XQ1070/01G.

Electro-optical devices

camera tubes

book 2 part 2a

	application	feature	max length mm	focus	spectral response nm	limiting resolution tv lines
1/2" Vidicon						
•XQ1600	surveillance consumer	ultra compact cameras	85	E	550	450
2/3" Vidicons						
XQ1270	surveillance	int. mesh I, 110 mA	108	M	550	500
XQ1271	surveillance	improved resolution	108	M	550	600
XQ1272	surveillance consumer	compact cameras	108	E	550	550
XQ1590	surveillance consumer	compact cameras	108	E	550	550
1" Vidicons						
XQ1031	educational	integral mesh	130	M	550	600
XQ1032	industrial	integral mesh	130	M	550	600
XQ1240	teletext X-ray	high resolution	159	M	550	800
XQ1241	industrial surveillance	high resolution	159	M	550	800
XQ1280	med./ind. X-ray	very high resolution	159	M	480	1600
XQ1285	X-ray image intensifier	fibre optic	189	M	480	1200
1/2" Newvicons						
•XQ1601	security surveillance	ultra compact cameras	85	E	750	450
•XQ1602	radiation environment	ultra compact cameras	85	E	750	450
2/3" Newvicons*						
XQ1274	security surveillance	high sensitivity	108	M	750	650
XQ1275	security surveillance	high sensitivity	108	E	750	600
XQ1276	security surveillance	extended red	108	M	775	650
XQ1277	security surveillance	extended red	108	E	775	550
XQ1278	security surveillance	high sensitivity	108	E	750	550
XQ1380	radiation environment	high sensitivity	108	M	750	650
XQ1381	radiation environment	high sensitivity	108	E	750	600
1" Newvicons*						
XQ1440	surveillance X-ray	high resolution	159	M	750	750
XQ1442	image intensifier	fibre optic	160	M	750	650
XQ1443	security surveillance	extended red	159	M	775	750
XQ1444	radiation environment	high resolution	159	M	750	750

*Registered Trade Mark for television camera tubes.

All tubes have 6.3V x 95mA heaters apart from XQ1270 which is 6.3V at 110 mA.

All tubes have magnetic deflection and separate mesh unless otherwise indicated.

Electro-optical devices

book 2 part 2a camera tube deflection assemblies

tube diameter	type number	triplet or single	inductance mH		resistance Ω			current mA			remarks
			line coils	frame coils	line coils	frame coils	focus coils	p-p line	p-p frame	d.c. focus	
30mm (1 1/4")	AT1130	T	0.84	5.5	2.1	14.5	1125	180	55	35	rear loading + alignment coils
	AT1130S	S	0.84	5.5	2.1	14.5	1125	180	55	35	rear loading + alignment coils
25mm (1")	AT1102/01	S	1.1	22	2.6	84	3604	148	23	17	for vidicon tube
	AT1115/01	T	0.79	26	2.2	62	1718	260	36	32	rear loading + alignment coils
	AT1119/01	S	0.79	26	2.2	62	1718	260	36	32	rear loading + alignment coils
	AT1116/06	T	0.79	28	2.2	62	140	280	34	108	front loading + alignment coils
	AT1116S	S	0.79	28	2.2	62	140	280	34	108	front loading + alignment coils
	AT1126	T	0.8	4.4	2.2	10	1300	230	80	30	rear loading + alignment coils
	AT1126S	S	0.8	4.4	2.2	10	1300	230	80	30	rear loading + alignment coils
	KV9G	S	1.6	70	4.4	125	104	200	29	140	for vidicon tube
18mm (3/4")	AT1106	T	0.48	6.9	2.3	48	64	230	48	135	front loading + alignment rings
	AT1106/S	S	0.48	6.9	2.3	48	64	230	48	135	front loading + alignment rings
	AT1109/01	T	0.91	2.8	3.8	12.7	60	260	114	120	front loading + alignment rings
	AT1109/01S	S	0.91	2.8	3.8	12.7	60	260	114	120	rear loading + alignment rings
	AT1109/10	T	0.91	2.8	3.8	12.7	60	230	104	115	for low output-capacitance tubes
	•AT1109/13S	S	0.91	2.8	3.8	12.7	60	230	104	—	for low output capacitance tubes
	•AT1109/13T	T	0.91	2.8	3.8	12.7	60	230	104	—	for low output capacitance tubes
13.5mm (1/2")	KV12S	S	0.86	28.7	3.2	146	55	160	25	120	for vidicon tube
	KV19G	S	0.9	23	4.6	146	—	160	25	—	for electrostatic vidicon tube
	KV19L	S	0.9	26	4.4	145	—	—	—	—	for vidicon and Newvicon tubes
	KV22B	S	0.86	28	3.2	146	55	—	—	—	for vidicon and Newvicon tubes
	•KV29E	S	1.4	5.7	11.3	80.7	—	70	26	—	for vidicon and Newvicon tubes

camera tube sockets – a range of sockets for Plumbicon, vidicon and Newvicon tubes is available from Mullard Ltd.

night vision components

Mullard manufacture a wide range of night vision components, including image intensifiers and thermal imaging detectors. Full details may be obtained on request to the Night Vision Department, Mullard Ltd., Mullard House, Torrington Place, London WC1E 7HD.

Electro-optical devices

instrument tubes

book 2 part 1b

Type No.	Description or Application	Screen Dia. (cm)	Deflection Sensitivity (V/cm) Sy	Sx	Abs. Max. Final Anode Voltage (kV)	Operation		Post Defl. Acc.	Ih at 6.3V (mA)	Base	
						y-plates	x-plates				
D7-222GY	Inexpensive oscilloscopes Monitoring devices	7 (Rectangular)	2 1/2 × 2 (Va1 + a3 = 1.0kV)	21	13	2.2	Sym.	Sym.	None	300	B12-246
D7-221GY	Low consumption heater version										
D10-180GY	Short length with dynamic focus Rectangular	10	7 × 5.6	23	40	2.0	Sym.	Sym.	None	240	55566 55589
D10-181GY	Low consumption heater version									95	
D13-480GH	Inexpensive oscilloscopes Read-out devices	13	5 (Va1 + a3 = 2.0kV)	15	31	2.2	Sym.	Sym.	None	300	Special 14-pin 55566
D14-361GH	Inexpensive oscilloscopes Medical applications	14 (Rectangular)	4 1/2 × 4 (Va1 + a3 = 2.0kV)	11.5	22	2.2	Sym.	Sym.	None	95	Special 14-pin 55589
D14-362GH	Low consumption heater Inexpensive oscilloscopes	14 (Rectangular)	4 1/2 × 4 (Va1 + a3 = 2.0kV)	11.5	19	2.2	Sym.	Sym.	None	240	12-pin 55594
D14-370GH /93	Compact oscilloscopes	14 (Rectangular)	10 × 8	4	8	10	Sym.	Sym.	Yes	240	12-pin 55594 55595
D14-380GH /93	Compact oscilloscopes	14 (Rectangular)	10 × 8	4	8.3	16.5	Sym.	Sym.	None	240	12-pin 55594 55595
L14-111GH /55	Storage oscilloscopes	14	9 × 7.2	4.1	9.5	8.5	Sym.	Sym.	None	300	Special 14-pin 55566
L14-131GH /55	Storage oscilloscopes	14	9 × 7.2	8.5	9.5	8.5	Sym.	Sym.	None	300	Special 14-pin 55566
L14-140GH /95	Storage oscilloscopes	14	9 × 7.2	4.8	18.5	10	Sym.	Sym.	None	240	Special 14-pin 55572

designation of preferred Mullard phosphors

Present System (Pro-Electron)	Old System	Fluorescent colour	Phosphorescent colour	Persistence	Equivalent JEDEC designation
BA	C	Purplish-blue	—	Very short	—
BE	B	Blue	Blue	Medium short	P11
BF	U	Blue	—	Medium short	—
GH	H	Green	Green	Medium short	P31
GK	C*	Yellowish-green	Yellowish-green	Medium	—
GM	P	Purplish-blue	Yellowish-green	Long	P7
GR	—	Green	Green	Long	P39
GU	—	White	White	Very short	—
GY	—	Green	Green	—	P43
W	W	White	—	—	P4
WA	—	White	—	—	—
WE	—	White	White	Medium short	P45
YA	Y	Yellowish-orange	Yellowish-orange	Medium	—

*Used in projection tubes

Electro-optical devices

book 2 part 1b

flying spot scanner tube

Type No.	Description	Screen Dia.		Resolution (Lines)	V_a (kV)	$-V_g$ (V)	I_h at 6.3V (mA)	Base
		(cm)	(in)					
Q13-110GU	Magnetic tube for colour television. Metal backed screen and white phosphor.	13	5	1000	25	50 to 100	300	B12A

television monitor tubes

All Types: Magnetic Deflection. Electrostatic Focusing. Metal-backed Rectangular Screen.

Type No.	Description	Screen diagonal		Deflection Angle (deg.)	Max. Final Anode Voltage (kV)	Typical Operating Conditions			V_h (V)	I_h (mA)	Base
		(cm)	(in)			V_{a1} (kV)	$-V_g$ (V)	Focusing Electrode (V)			
M17-140W	Television viewfinder tube	17	7	70	16	400	32 to 62	0 to +400	6.3	300	B8H
M17-141W	As M17-140W but with reinforced faceplate	17	7	70	18	400	32 to 62	0 to +400	6.3	300	B8H
M24-101WA*	Precision television studio monitor with reinforced envelope	24	9½	90	16	600	32 to 85	0 to +400	6.3	300	B8H

very high resolution data display tube

M38-201GH, WA, WE	Facsimile display tube A4 format 1728 × 2288 pixels resolution	38	15	70	20	800	50 to 110	5 to 7kV	6.3	90	55589A
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*To special order only

Datagraphic display components

High resolution monochrome c.r.t.s for data graphic displays

All tubes have quick heat cathodes

Type No.	Approx. Screen Diagonal	Deflection Angle	Approx. Screen Curvature Radius (mm)	Approx. Neck Diameter (mm)	Approx. Mounting Lugs Position (mm)	Overall Length (mm)	V _f (V)	I _f (mA)	V _{g2} (V)	V _a (kV)
M24-306	9 in	90°	690	20	212 x 160	227.0	12	130	400	12
M31-326	12 in	110°	635	29	273 x 190	241.0	6.3	240	400	17
M31-336	12 in	90°	510	20	273 x 190	280.0	12	130	400	12
M31-340	12 in	90°	635	20	273 x 190	277.0	12	130	400	12
M38-328	15 in	110°	635	29	311 x 245	279.0	6.3	240	400	17

Phosphor options are:

W = white medium short persistence (P4)
 WD = white medium persistence
 GH = green medium short persistence (P31)
 GR = green long persistence (P39)
 LA = orange medium persistence

Anti-glare options are:

/P = ground finish with 50% transmission glass
 /PD = ground finish with 30% transmission glass
 /ED = etched finish with 30% transmission glass

Deflection coils for high resolution monochrome c.r.t.s

Type No.	Deflection Angle	Approx. Tube Neck Diameter (mm)	Inductance		Resistance		EHT (kV)	Sensitivity Line (A p-p)	Field (A p-p)
			Line (mH)	Field (mH)	Line (Ω)	Field (Ω)			
• AT 1077/09	90°	20	0.48	18	0.8	10.0	12	2.91	0.51
AT 1077/05	90°	20	0.47	18	0.86	10.0	12	3.12	0.49
AT 1071/03	90°	29*	0.93	56/14	0.15	6.75	15	9.3	0.90
AT 1038/40A	110°	29	0.7	58/15	1.2	7.6	17	4.4	1.08
AT 1039/01	110°	29	0.2	9.7/2.4	0.39	2.7			
					1.56	10.6	17	8.4	1.02
AT 1039/00	110°	29	0.2	9.1/4.3	0.4	2.55			
					1.64	10.2	17	6.4	1.35
• AT 1039/03	110°	29	0.23	9.2/2.3	0.14	2.55	17	7.95	1.21
					1.64	10.2			

*Packing piece available for 20 mm neck.

Line output transformers for high resolution monochrome c.r.t.s

Type No.	Supply		Volts (kV)	e.h.t. Output Current (μA)	R ₁ (MΩ)	Line Deflection Current (A p-p)
	Volts (V)	Current (mA)				
AT 2240/16	12	620	12	100	7	3.2
AT 2102/02	12	1800	15	100	10	8.5
AT 2102/04C	24	820	17	100	6.5	4.6
AT 2102/06C	24	955	17	100	8	4.4
AT 2076/53	150	450	25	100	2	5.3
DT 2076/54	130	210	17	500	1.3	3.8

Datagraphic display components

Linearity controls for high resolution monochrome c.r.t.s

Line driver transformers for high resolution monochrome c.r.t.s

Type No.	Correction Voltage (V)	Deflection Current (A p-p)	Damping Resistor (Ω)
AT 4042/46	6	3	820
AT 4036	1.5-1.95	6	820
• AT 4042/08A	8-15	4.65	820
AT 4042/42	8-15	4.65	820

Type No.	Supply Voltage (V)	Primary Inductance (mH)	Secondary Inductance (μ H)	Leakage Inductance (μ H)	Transformation Ratio
AT 4043/59	24	≥ 61	≤ 12	—	4.18:1
AT 4043/64	12	1.2	≤ 5	—	2:1
AT 4043/83	70	80	≤ 6	—	12.1:1
AT 4043/87	105	76	≤ 2	—	29:1

Recommended combinations for high resolution monochrome monitor design

Designation	C2	C3	C5	C6T	C7	C52 (portrait)	C64
Deflection Angle	110°	90°	110°	70°	110°	70°	—
Tube Type	M38-328 M31-326	M24-306 M31-336	M38-328 M31-326	M31-336 M24-306 AT1077/05	M31-326 M38-328	M38-200	M31-326 M38-328
Deflection Coil	AT1038/40A AT2102/04C	AT1071/03 AT2102/02	AT1038/40A AT2102/06C	AT2240/16 AT4042/08A	AT2076/84 AT4042/08A	AT1991 AT2076/54	AT1039/01 AT1039/00 AT2076/84 AT4042/08A AT4043/64
LOPT	AT4043/59	AT4036 AT4043/64	AT4043/59 AT4043/67	—	AT4043/67	—	—
Lin. control	—	—	—	—	—	—	—
Line driver transformer	—	—	—	—	—	—	—
Dynamic focus transformer	—	—	—	—	—	—	—
D.C. picture shift transformer	—	—	—	—	—	—	—
Characters per row	80	80	80	40-80	80	192	100-132
Supply (V)	24	11	24	12	20-80	120	30-120
EHT (kV)	17	15	17	11	17	17	—
Line deflection frequency (kHz)	15.6	15.6	21.3	15-22	15-25	125	30-120

High-resolution colour c.r.t.s for datagraphic displays

Type No.	Screen diagonal (viewable) (in)	Deflection Angle	Transmission	Dot Triplet Pitch (mm)	Min. Resolution (pixels)
M25-101X/4100	10 (8.5)	76°	87.5	—	576 x 480
M25-101X/N4100	10 (8.5)	76°	55	0.28	576 x 480
M32-101X/5100	12 (11.5)	76°	85.5	0.31	720 x 580
M32-102X/N5100	12 (11.5)	76°	44	0.31	720 x 580
• M37-103X/N/1000	14 (13)	90°	85.5	0.29	800 x 600
M37-104X/3100	14 (13)	90°	85.5	0.31	800 x 654
M37-105X/N3100	14 (13)	90°	46.5	0.31	760 x 620
M42-105X/6100	16 (15)	90°	86	0.31	820 x 670
M42-106X/N6100	16 (15)	90°	45	0.31	820 x 670
M51-106X/7100	20 (19)	90°	85	0.32	860 x 720
M51-107X/N7100	20 (19)	90°	40	0.32	820 x 670

All high-resolution colour tubes have a dot trio mask and an in-line gun.

Deflection coils for high-resolution colour c.r.t.s

Type No.	L_H (mH)	R_H (Ω)	L_V (mH)	R_V (Ω)	Line Defl. Current Edge-Edge (A)	Field Defl. Current (A)	Pin Cushion N-S%	E-W%
AT1331/00	0.71	0.88	96	48	4.89	0.46	2.0	4.5
AT1331/10	1.06	1.32	42	21	4.0	0.70	2.0	4.5
AT1331/20	1.36	1.69	42	21	3.54	0.70	2.0	4.5
AT1331/30	1.93	2.93	19.2	9.6	2.97	1.03	2.0	4.5
AT1331/50	2.3	2.3	24	12.4	2.75	0.86	2.0	4.5

All tubes and coils are supplied as matched packages

Use line transformer **AT2076/51** and linearity control **AT4042/04**

Application reports **EDS8202, 8203, 8204, 8205** and **8302** dealing with colour DGD designs are available on request.

All c.r.t.s have safety approvals from the major test-houses i.e. British Standards Institution and/or V.D.E. Prüfstelle, Underwriter's Laboratories and Canadian Standards Authority.

Photosensitive devices

photomultipliers

book 2 part 3

Type No.	Description	Photocathode Diam. (mm)	Type	No. of Stages	Average cathode sensitivity		Anode sensitivity or gain Sensitivity (A/lm) or (kA/W)	Gain	V _b (kV)	Rise Time (ns)
					White Light (μA/lm)	Mono-chromatic* (mA/W)				
PM1911	Intended for scintillation counting under limited dimensional conditions	14	D	10	60	70	70kA/W	1-10 ⁶	1.25	2.3
XP1920	Intended for optical measurements and industrial applications under limited dimensional conditions	14	A(S11)	6	60	60	0.2kA/W	—	0.80	2.0
XP1117	Rugged construction suitable for laser applications	14	T(S20)	9	140	13	30A/lm	—	1.52	3.5
XP1931	Extended UV version of PM1911	14	D(UV)	10	60	70	70kA/W	1.10 ⁶	1.25	2.3
PM2962	8-stage variation of PM2982. Specialty developed for linearity at 10 ⁵ gain	23	D	8	—	75	15kA/W	—	1.10	2.0
PM2963	S20 photocathode version of PM2962. For laser reading, etc.	23	T(S20)	8	200	20	7A/lm	3.10 ⁴	1.05	2.0
XP2972	Intended for applications in high energy physics and scintillation counting	23	D	10	65	75	40kA/W	—	1.2	2.0
PM2982	Bi-alkali photocathode	23	D	11	—	75	210kA/W	—	1.35	1.9
150CVP	Suitable for laser detection and pollution monitoring; has good response in the red and near infra-red regions	32	C(S1)	10	20	1.4	10A/lm	—	1.60	3.5
PM2018B	Intended for UV spectrophotonic applications. Replaces 150UVP	32	U(S13)	10	85	75	60kA/W	—	1.35	2.5
XP2012B	Intended for use in X-ray and spectrometry and other applications requiring low background noise and/or dark current	32	D	10	—	77	60kA/W	—	1.35	3.5
XP2023B	General purpose tube for low light level use in the visible spectrum. Replaces XP2013B	32	T(S20)	8	200	20	6A/lm	—	1.12	2.5
XP1017	Extended-red response version of XP1016	32	S20R	10	210	6.5	60A/lm	—	1.47	3.5
XP2011	Intended for applications such as scintillation counting, laboratory and industrial photometry	32	D	10	110	85	7.5A/lm	—	1.18	3.5
XP2011B										
XP2061	Short version of XP2008	32	D	10	110	85	7.5A/lm	—	1.30	2.5
XP2061B										
XP2013B	Replaced by XP2023B									
XP2008	Replaced by XP2011B									
XP2008UB	Replaced by XP2011									
XP2060B	Replaced by XP2061B									
XP2060	Replaced by XP2061									
XP2010	Replaced by XP2012B									
56AVP	replaced by XP2230/XP2020									
56DVP	replaced by XP2230/XP2020									
56DUVP	Replaced by XP2020Q									
56TUVP	Replaced by PM2254B									
XP2232	Replaced by XP2262,B									
XP2232B										
XP2202	Linear focused CuBe dynode offering high cathode sensitivity, very low dark current and high gain stability	44	D	10	—	75	60kA/W	—	1.70	3.5
XP2202B										

continued

*At wavelength Y:— T and TU = 698 nm
 C = 903 nm
 S20R = 858 nm
 A, super A and U = 437 nm
 D and DU = 401 nm

Notes:— 1. The letters VB (in No. of stages column) indicate Venetian Blind.
 2. The suffix B in the type description denotes blue plastic base version.

Photosensitive devices

book 2 part 3

photomultipliers (cont.)

Type No.	Description	Photocathode Diam. (mm)	Type	No. of Stages	Average cathode sensitivity		Anode sensitivity or gain Sensitivity (A/lm) or (kA/W)	Gain	V _b (kV)	Rise Time (ns)
					White Light ($\mu\text{A/lm}$)	Mono-chromatic* (mA/W)				
XP2212 XP2212B	12 stage version of PM2202 with high gain	44	D	12	—	75	—	3.10^7	1.90	4.0
XP2203B	Intended for low light level measurements of visible part of spectrum	44	T(S20)	10	165	16	60	—	1.46	3.5
PM2102	Intended for detection/measurement of nuclear radiation	44	D	10VB	—	85	10kA/W	—	1.25	10.0
XP2020	Intended for applications requiring good time resolution	44	D	12	—	85	—	3.10^7	2.20	1.6
XP2262 • XP2262B	replaces XP2232: good linearity and time characteristics plus good single electron resolution	44	D	12	—	80	—	6.10^7	2.4	2.0
PM2242B	6-stage tube with good pulse linearity and time characteristics of high amplitude pulses at high count rates	44	D	6	70	80	—	—	1.1	1.6
XP2020Q	Quartz window version of XP2020 for extended UV applications	44	D	12	—	80	—	3.10^7	2.20	1.6
XP2230 XP2230B	Applications requiring very high gain and very good time characteristics	44	D	12	—	90	—	3.10^7	2.30	1.6
PM2254B	Useful in applications where high sensitivity from UV to near infrared is required	44	TU	12	150	15	—	15.10^7	2.30	1.5
XP2233B	Intended for use where high sensitivity in the visible and ultraviolet regions is required; also suitable for laser applications	44	T(S20)	12	150	15	—	3.10^7	2.05	2.0
• PM2422 • PM2422B	Hexagonal tube intended for detection and measurement of nuclear radiation especially in gamma cameras where good pulse resolution is required	56	D	10VB	72	90	11k A/W	—	1.25	10
• PM2432 • PM2432B	Intended for detection and measurement of nuclear radiation especially in gamma cameras where good pulse resolution is required	56	D	10VB	72	90	12k A/W	—	1.25	10
PM2402 PM2402B	Intended for detection and measurement of nuclear radiation especially in gamma cameras where good pulse resolution is required	61	D	10VB	—	90	11kA/W	—	1.25	10
PM2312 PM2312B	Fast tube intended for use in nuclear physics; features high cathode sensitivity, good linearity and time characteristics	68	D	12	—	85	—	3.10^7	2.00	2.5
• PM2442 • PM2442B	Hexagonal tube intended for detection and measurement of nuclear radiation especially in gamma cameras where good pulse resolution is required	70	D	10VB	78	105	12kA/W	—	1.25	11
PM2412	Intended for detection/measurement of nuclear radiation	70	D	10VB	—	105	10kA/W	—	1.25	11
XP2040	Replaced by XP2041									
XP2041	Bi-alkali cathode version of XP2040; both tubes may be supplied with plano-concave quartz adaptor enabling transmission at $>200\text{nm}$ and identified by suffix Q	110	D	14	—	85	—	3.10^7	2.20	2.0
XP2050	Intended for detection/measurement of nuclear radiation	105	10kA/W	—	1.25	11				
PM2233B XP2030	replaced by XP2233B replaced by PM2412									

*At wavelength Y:— T and TU = 698 nm, C = 903 nm, S20R = 858 nm, A, super A and U = 437 nm, D and DU = 401 nm.

Notes:— 1. The letters VB (in No. of stages column) indicate Venetian Blind.
2. The suffix B in the type description denotes blue plastic base version.

Photosensitive devices

phototubes

book 2 part 3

Type No.	Photocathode Spectral Response	Average Sensitivity White Light ($\mu\text{A}/\text{lm}$)	Anode Voltage Max. (kV)	Minimum Dark Current at 2.5kV (nA)	Rise Time Min. (ns)	Tube Dia. (mm)	Tube Length (mm)
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HIGH CURRENT LASER DETECTORS

XA1002	A blue (S4) 300 to 600nm	30	4.0	5	0.2	35	33
XA1003	S1 280 to 1100nm	20	2.5	10	0.2	35	33
TVHC40	T(S20) 300 to 800 nm	150	5.0	5	0.4	57	46
AVHC201	A blue (S4) 300 to 600nm	35	5.0	10	1.0	127	55.5

PHOTOMETRIC APPLICATIONS

Type No.	Photocathode Spectral Response	Average Sensitivity White Light ($\mu\text{A}/\text{lm}$)	Sensitive Surface Area (cm^2)	Dark Current at $V = 1\text{V}$ (pA)	Rise Time Min (ns)	Tube Dia. (mm)	Tube Length (mm)
AV29	A blue 390 to 450nm	100	3.15	<100	3	29	68.5 max.
150AV	A blue (S11) 300 to 600nm	70	7.0	<2	14	39.5	85

Particle and radiation detectors

book 2 part 2b

high current G-M tubes

Type No.	Gamma Sensitivity at 0.1mGy/h ¹³⁷ Cs Source (counts/min)	Wall Thickness (mg/cm ²)	Recommended Working Voltage (V)	Max* Background (counts/min)	Dead Time (approx.) (μs)
ZP1300**	180	80 to 100	550	1	11
ZP1310†	1200	80 to 100	575	2	15
ZP1320	10000	32 to 40	575	12	45
ZP1322	10000	32 to 40	575	12	45

*Shielded with 50mm lead and 3mm aluminium.

**This tube is available in an energy compensated filter and is numbered ZP1301.

†This tube is available in an energy compensated filter and is numbered ZP1313.

end window beta G-M tubes

Type No.	Window Diameter (mm)	Window Thickness (mg/cm ²)	Recommended Working Voltage (V)	Max* Background (counts/min)	Dead Time (approx.) (μs)
ZP1400	9	2.0 to 3.0	500	10	90
ZP1480	17	2.5 to 3.0	450	30	120
ZP1481	17	2.5 to 3.0	450	30	120
ZP1442	19.8	2.0 to 3.0	600	8	65
ZP1470	24.1	1.5 to 2.5	600	25	70
ZP1431	27.8	2.0 to 3.0	575	25	190
ZP1452	27.8	2.0 to 3.0	625	18	60
ZP1461	51	3.5 to 4.0	800	45	45

*Shielded with 50mm lead and 3mm aluminium.

end window alpha tubes

Type No.	Window Diameter (mm)	Window Thickness (mg/cm ²)	Recommended Working Voltage (V)	Max* Background (counts/min)	Dead Time (approx.) (μs)
ZP1401	9	1.5 to 2.0	500	10	90
ZP1430	27.8	1.5 to 2.0	575	25	190
ZP1441	19.8	1.5 to 2.0	600	5†	65
ZP1451	27.8	1.5 to 2.0	625	9†	60
ZP1410	19.8	1.5 to 2.0	575	15	175

*Shielded with 50mm lead and 3mm aluminium.

†When used in anti-coincidence applications with guard counter tube ZP1700 shielded with 100mm iron (outside) and 300mm lead, the background is <1.2 count/min for ZP1441 and < 2 count/min for ZP1451.

gamma sensitive G-M tubes

Type No.	Gamma Sensitivity at 0.1mGy/h (counts/min)	Recommended Working Voltage (V)	Max.* Background (counts/min)	Dead Time (approx.) (μs)
ZP1200**	13500 (¹³⁷ Cs)	500	10	90
ZP1210	78000 (⁶⁰ Co)	450	70	200
ZP1220	110 000 (⁶⁰ Co)	450	90	210

*Shielded with 50mm lead and 3mm aluminium.

**This tube is available in an energy compensated filter and is numbered ZP1201.

Particle and radiation detectors

X-ray counter tubes

book 2 part 2b

Type No.	Window Diameter (mm)	Window Thickness (mg/cm ²)	Recommended Working Voltage (V)	Max.* Background (counts/min)	
ZP1600	19.8	2.5 to 3.5	1800	25	Halogen quenched
ZP1610	7 x 18 (rect.)	2.0 to 2.5	1500 to 1800	—	Organic quenched

*Shielded with 50mm lead and 3mm aluminium

cosmic ray guard counter tube

Type No.	Wall Thickness (mg/cm ²)	Recommended Working Voltage (V)	Background* (counts/min)	Dead Time (ms)
ZP1700	760	1000	70	1

*Shielded with 50mm lead and 3mm aluminium.

channel electron multipliers

book 2 part 3

Type No.	Description	Max. Operating Voltage	Output	Nominal Resistance (Ω)	Nominal Gain	†Nominal Background Count Rate (pulse/s)	†Pulse Height Distribution Resolution
B310AL/01 B310BL/01	Planar spiral tube of internal diameter 1.25mm	4.0	Open-ended Closed	3x10 ⁹	1.3x10 ⁸ at 3kV	0.1 at 3kV	0.5
B312AL/01 B312BL/01	Planar spiral tube of internal diameter 1.25mm with effective aperture of 2x8mm	4.0	Open-ended Closed	3x10 ⁹	1.3x10 ⁸ at 3kV	0.2 at 3kV	0.5
B314AL/01 B314BL/01	As B312 types except input cone turned through 90°	4.0	Open-ended Closed	3x10 ⁹	1.3x10 ⁸ at 3kV	0.2 at 3kV	0.5
B318AL/01 B313BL/01	Planar spiral tube of internal diameter 1.25mm with effective aperture of 4mm	4.0	Open-ended Closed	3x10 ⁹	1.3x10 ⁸ at 3kV	0.25 at 3kV	0.5
B410AL/01 B410BL/01	Planar spiral tube of internal diameter 2.2mm	3.5	Open-ended Closed	3x10 ⁹	1.5x10 ⁸ at 2.5kV	0.1 at 2.5kV	0.5
B413AL/01 B413BL/01	Planar spiral tube of internal diameter 2.2mm with effective aperture of 3.5x15.5mm	3.5	Open-ended Closed	3x10 ⁹	1.7x10 ⁸ at 2.5kV	0.25 at 2.5kV	0.5
B419AL/01 BR19BL/01	Planar spiral tube of internal diameter 2.2mm with effective aperture of 9mm	3.5	Open-ended Closed	3x10 ⁹	1.7x10 ⁸ at 2.5kV	0.25 at 2.5kV	0.5
• X810AL	Planar spiral tube of internal diameter 1.25mm	3.5	Open-ended	6x10 ⁸	5.0x10 ⁷ at 2.5kV	0.2 at 2.5kV	0.5
• X812AL	Planar spiral tube of internal diameter 1.25mm with effective aperture of 2x8mm	3.5	Open-ended	6x10 ⁸	5.0x10 ⁷ at 2.5kV	0.2 at 2.5kV	0.5
• X814AL	As X812 except input cone turned through 90°	3.5	Open-ended	6x10 ⁸	5.0x10 ⁷ at 2.5kV	0.2 at 2.5kV	0.5
• X818AL	Planar spiral tube of internal diameter 1.25mm with effective aperture of 4mm	3.5	Open-ended	6x10 ⁸	5.0x10 ⁷ at 2.5kV	0.2 at 2.5kV	0.5
X910AL X910BL	Planar spiral tube of internal diameter 2.2mm	4.0	Open-ended Closed	6x10 ⁸	1.8x10 ⁸ at 2.5kV	0.15 at 2.5kV	0.5
X913AL X913BL	Planar spiral tube of internal diameter 2.2mm with effective aperture of 3.5x15.5mm	4.0	Open-ended Closed	6x10 ⁸	2.0x10 ⁸ at 2.5kV	0.15 at 2.5kV	0.5
X914AL X914BL	As X913 types except input cone turned through 90°	4.0	Open-ended Closed	6x10 ⁸	2.0x10 ⁸ at 2.5kV	0.15 at 2.5kV	0.5
X919AL X919BL	Planar spiral tube of internal diameter 2.2mm with effective aperture of 9mm	4.0	Open-ended Closed	6x10 ⁸	2.0x10 ⁸ at 2.5kV	0.15 at 2.5kV	0.5
X919CL		4.0	Closed	7.5x10 ⁸	1.5x10 ⁸ at 2.5kV	0.15 at 2.5kV	0.5
X959AL X959BL	Planar spiral tube of internal diameter 2.2mm with effective aperture of 14mm	4.0	Open-ended Closed	6x10 ⁸	2.0x10 ⁸ at 2.5kV	0.15 at 2.5kV	0.5

†Above an equivalent threshold of 2x10⁷ electrons. ‡At a modal gain of 10⁸ and 1000 pulse/s
All the above channel electron multipliers can be vacuum baked to 400°C.
The B300 series will eventually be replaced by the lower resistance X800 series.

Particle and radiation detectors

book 2 part 3

channel electron multiplier plates

Type	Description	Channel Diameter (μm)	Diameter of Disc (mm)	Thickness of Disc (mm)	Current Gain at 1kV	Resistance (Ω)	Channel Pitch (μm)
G12-25SE	An array of channel electron multipliers fused into the shape of a disc	12.5	25	0.5	1000	approx. 5×10^8	15
G12-36		12.5	36	0.5	1000	approx. 6.5×10^7	15
G12-36DT/0		12.5	36	1.0	1000	approx. 12.5×10^7	15
G12-36DT/13		12.5	36	1.0	1000	approx. 12.5×10^7	15
G12-46		12.5	46	0.5	1000	approx. 4.5×10^7	15
G12-46DT/0		12.5	46	1.0	1000	approx. 7.5×10^7	15
G12-46DT/13		12.5	46	1.0	1000	approx. 7.5×10^7	15
G25-25	An array of channel electron multipliers fused into the shape of a disc	25	27.1	1.0	1000	approx. 5×10^7	31
G25-50		25	53	1.0	1000	approx. 1×10^7	31
G25-70		25	70	1.0	1000	approx. 5×10^6	31
G25-20x50		An array of channel electron multipliers fused into the shape of a rectangle.	25	20x50 (rectangle)	1.0	1000	approx. 3.5×10^7
G25-25x90	An array of channel electron multipliers fused into the shape of a rectangle.	25	25x90 (rectangle)	1.0	1000	approx. 1×10^7	31

*For linear operation the output current should not exceed 0.1 of standing current.

Note 1: Pairs of plates of the same diameter for high gain applications ($>10^5$) are obtainable under type numbers G25-25/A and G25-50/A.

Micro dry reed contacts – all types have normally open contacts and are inert gas-filled

Type No.	Operate range (At)	Release range (At)	Switch power (W)	Contact resistance (mΩ)
RI-22 series (2.8mm dia. max.)				
RI-22AA	14 to 23	8 to 19	10	60
RI-22/3A	18 to 32	8 to 22	10	60
RI-22/3B	28 to 52	12 to 32	10	60
RI-22/3C	46 to 70	12 to 32	10	60
RI-23 series (2.54mm dia. max.)				
RI-23AA	14 to 23	8 to 19	10	70
RI-23/3A	18 to 32	8 to 22	10	70
RI-23/3B	28 to 52	12 to 32	10	70
RI-23/3C	46 to 70	12 to 32	10	70
RI-27A (1.8mm dia. max.)				
RI-27A	20 to 34	8 to 19	10	90
RI-27AA	16 to 25	8 to 14	10	90
RI-45 (2.8mm dia. max.)				
RI-45	30 to 65	19 to 27	20	90

Transmitting tubes

telecommunications power tetrodes book 2 part 4

Type No.	Description	Approx. Output at Full Ratings (kW)	Max. Frequency at Full Ratings (MHz)	Max. Frequency at Reduced Ratings (MHz)	p_a max. (kW)	V_a max. (kV)	V_g^2 max. (V)	I_a max. (A)	V_r or V_h (V)	I_r or I_h (A)	Base
QV05-25 (807)	Radiation cooled	0.08	80	125	0.02	0.75	300	0.125	6.3	0.9	5pin
QY3-65 (CV6122)	Radiation cooled	0.23	150	250	0.06	3.0	600	0.15	6	3.5	B7A
QV08-100	Radiation cooled	0.29	30	—	0.1	1.0	300	0.4	6.3	3.9	B5F
QY3-125 (CV2130)	Radiation cooled	0.375	120	200	0.12	3.0	400	0.3	5.0	6.5	B5F
QY4-500A	External anode Forced air cooled	0.93	110	220	0.5	4.0	500	0.44	5.0	13.5	Special
QY4-250 (CV2131)	Forced-air cooled	1.0	75	120	0.25	4.0	600	0.42	5.0	14.1	B5F
QY4-400 (CV5959)	Forced-air cooled	1.1	110	—	0.4	4.0	600	0.42	5.0	14.5	B5F
YL1540	Forced-air cooled	1.1	260	175	2.0	4.2	750	1.2	4.2	53	Coaxial
YL1590	Forced-air cooled	1.2	860	1000	1.5	4.5	1000	0.75	3.5	50	—
QY5-500	Radiation cooled	1.76	75	110	0.5	5.0	700	0.6	10	9.9	B5K
YL1541	External anode Forced air cooled Ceramic metal	2.1	110	—	2.0	4.5	750	1.2	4.2	53	Coaxial
YL1440	Forced-air cooled Ceramic/metal	2.4	250	—	1.5	4.0	600	1.2	4.2	55	Coaxial
QY5-3000A (CV5219)	Forced-air cooled	4.1	75	220	3.0	5.0	800	1.3	6.3	32.5	Special
QY5-3000W	Water cooled										
YL1560	Forced-air cooled	6.0	860	1000	6.0	6.0	1000	2.5	5.0	130	Coaxial
YL1420	Forced-air cooled Ceramic/metal	8.6	260	—	6.0	6.0	1000	4.5	6.3	120	Coaxial
YL1690	Forced-air cooled Ceramic/metal	10	120	—	18	9.0	1000	7.0	10.4	120	Coaxial
• YL1610	Forced-air Ceramic/metal	11	225	—	14	7.0	800	4.0	8.0	113	Coaxial
YL1470	Forced-air cooled Ceramic/metal	11	110	—	6.0	7.0	1000	4.5	6.3	120	Coaxial
YL1430	Forced-air cooled Ceramic/metal	18.4	250	—	12	8.0	1000	8.5	8.0	120	Coaxial
YL1520	External anode Forced-air cooled Ceramic/metal	27.5	250	—	18	9.0	1000	9.0	11.5	120	Coaxial
YL1530	External anode Forced-air cooled Ceramic/metal	35.0	250	—	30	12	1200	8.0	7.5	180	Coaxial
• YL1531	Water cooled Ceramic/metal	50	250	—	30	14	1200	8.0	7.5	180	Coaxial
• YL1680	Water cooled Ceramic/metal	120	250	—	100	14	1200	21	12	265	Coaxial
YL1640	Water cooled Ceramic/metal	125	30	—	150	13	1200	17	10	280	Coaxial
YL1660	Water cooled Ceramic/metal	520	30	—	500	13.5	1250	65	23	500	Coaxial

double tetrodes

Type No.	Approx. Output at Full Ratings (W)	Max. Frequency at Full Ratings (MHz)	Max. Frequency at Reduced Ratings (MHz)	p_a max. (W)	V_a max. (V)	V_g^2 max. (V)	I_a max. (mA)	V_h (V)	I_h (A)	Base
QQV02-6 (CV2466)	5.8	500	—	2x3.0	250	200	2x45	6.3 12.6	0.6 0.3	B9A
QQV03-10 (CV2798)	16	100	225	2x5.0	300	200	2x50	6.3 12.6	0.83 0.42	B9A

Transmitting tubes

telecommunications power triodes

book 2 part 4

Type No.	Approx Output Full Ratings (kW)	Max. Frequency At Full Ratings (MHz)	Max. Frequency at Reduced Ratings (MHz)	P_a max. (kW)	V_a max. (kV)	I_a max. (A)	V_f or V_h (V)	I_f or I_h (A)	Base
TY2-125 (CV1924)	0.39	150	200	0.135	2.5	0.25	6.3	5.4	B5F
TY4-400	1.2	100	—	0.35	4.0	0.49	5.0	14	B5F
TY4-500	1.69	100	120	0.45	4.0	0.65	10	9.9	B5K
TY6-5000A (CV3926)	6.9	75	220	5.0	6.0	1.85	12.6	33	—
TY6-5000W				6.0					
TY6-5000H				6.0					
TY7-6000A (CV5239)	10	30	—	6.0	7.2	2.8	12.6	33	—
TY7-6000W				6.0					
TY7-6000H				6.0					
TY12-15A	41	30	—	15	13	4.0	8.0	130	—

Suffixes A, W, and H to power triode type numbers indicate forced-air, water cooled and water cooled (integral helix) respectively.

triodes for television translator service

Type No.	Description	Typical Output Power (W)	Power Gain (dB)	Max. Frequency (GHz)	P_a max. (W)	V_a max. (kV)	I_a max. (mA)	Inter-modulation Product (dB)
YD1332	Amplifier	220	16.5	1.0	1800	3.5	550	-53
YD1336	Amplifier	220	16.5	1.0	1800	3.5	550	-53

tetrodes for television translator service

Type No.	Description	Typical Output Power (kW)	Power Gain (dB)	Max. Frequency (MHz)	P_a max. (kW)	V_a max. (kV)	I_a max. (A)	Inter-modulation Product (dB)
YL1590*	Amplifier	0.22	15.6	1000	2	4.0	1.0	-54
YL1440	Amplifier	0.55	15	260	1.5	4.0	0.73	-52
YL1560	Amplifier	2.2	16	1000	6.0	6.0	1.5	-55
YL1420	Amplifier	2.5	15	260	6.0	6.5	1.0	-52
YL1430	Amplifier	7.0	15	260	12	9.0	1.2	-52
•YL1631	Amplifier	10	16	250	17	9.0	7.0	-54
YL1520	Amplifier	10.5	16	260	18	9.0	1.8	-55
YL1610	Amplifier	11	17	250	14	7.0	4.0	—
YL1630	Amplifier	30	18	250	26	8.5	8.0	-54

*Data derived from development samples

Transmitting tubes

book 2 part 4a ceramic triodes for industrial heating

Type No.	Cooling	Approx. Output at Full Ratings (kW)	Max. Frequency at Full Ratings (MHz)	P_a max. (kW)	V_a max. (kV)	I_a max. (A)	V_f (V)	I_f (A)
YD1240	Forced-air	2.7	250	1.5	5.5	1.1	6.3	33
YD1244	Forced-air							
YD1150	Forced-air	4.75	85	2.5	7.2	1.1	6.3	33
YD1152	Water (helix)							
YD1160	Forced-air	8.8	85	5.0	7.2	2.2	6.3	66
YD1161	Water (separate jacket)							
YD1162	Water (helix)							
YD1170	Forced-air	15.4	120	10	7.2	4.0	5.8	130
YD1171	Water (separate jacket)							
YD1172	Water (helix)							
YD1173	Forced-air	13.2	50	10	12	2.0	5.4	65
YD1175	Forced-air	26.5	120	10	12	4.0	5.8	130
YD1177	Water (helix)	26.5	120	15	12	4.0	5.8	130
YD1180	Forced-air	31.6	100	20	9.0	6.0	7.0	175
YD1182	Water (integral jacket)							
YD1185	Forced-air	50	100	15	14.4	6.0	7.0	175
YD1187	Water (integral jacket)			20				
YD1192	Water (integral jacket)	62.7	100	40	9.6	12	8.4	235
YD1195	Forced-air	108	30	30	14.4	12	8.4	235
YD1197	Water (integral jacket)			40		15		
YD1202	Water (integral jacket)	163	30	80	15	19	12.2	250
YD1212	Water (integral jacket)	240	30	120	16.8	25	12.6	380
YD1342	Water (integral jacket)	480	30	240	19.2	45	14	555

u.h.f. disc-seal triodes

Type No.	Description	Typical power output at f (W)	Max. f (GHz)	Max. f (GHz)	P_a max. (W)	V_a max. (V)	g_m (mA/V)	I_f (A)
EC157	Oscillator or Amplifier	1.8	4.0	4.0	12.5	300	21	0.74
EC158	Oscillator or Amplifier	5.0	4.0	—	30	300	22	0.9

Transmitting tubes

triodes for industrial heating

book 2 part 4

Type No.	Description	Approx. Output at Full Ratings (kW)	Max. Frequency at Full Ratings (MHz)	p_a max. (kW)	V_a max. (kV)	I_k max. (A)	Vf or Vh (V)	If or Ih (A)	Base
TY2-125 (CV1924)	R.F. Power Triode for general purpose industrial heating applications	0.32	150	0.135	2.5	0.2	6.3	5.4	B5F
TY4-400	R.F. Power Triode	1.1	50	0.35	3.8	0.45	5	14.1	B5F
TY4-350 (8330)	R.F. Power Triode for general purpose industrial heating applications	1.4	30	0.4	4.0	0.6	10	10	—
TY5-500	Radiation cooled Triode for general purpose industrial heating applications	1.58	50	0.5	7.0	0.56	5.0	32.5	4-pin Special
TY4-500	Radiation cooled Triode for general purpose industrial heating applications	1.63	100	0.45	4.0	0.53	10	9.9	B5K
TY6-800	Radiation cooled Triode for general purpose industrial heating applications	2.73	50	0.8	6.0	0.75	6.3	32.5	4-pin Special
TY6-1250A	External anode Power Triode for general purpose industrial heating applications	4.85	50	2.1	8.0	1.0	6.3	65	—
TY8-6000A TY8-6000W TY8-6000H	External anode Power Triodes for general purpose industrial heating applications	7.2	50	6.0	8.0	1.8	12.6	33	—
TY7-6000A (CV5239) TY7-6000W TY7-6000H	External anode Power Triodes for general purpose industrial heating applications	8.25	55	6.0	7.2	1.8	12.6	33	—
TY8-15A TY8-15H TY8-15W	External anode Power Triodes for general purpose industrial heating applications	17.7	30	10 15 15	8.0	4.0	6.3	136	—
TY12-15A TY12-15W	External anode Power Triodes for general purpose industrial heating applications	41	30	15	13	5.8	8.0	130	—

Suffixes A, W, and H to the type number indicate forced-air cooled, water cooled and water cooled (integral helix) respectively.

Microwave tubes

u.h.f. high power klystrons – TV operation

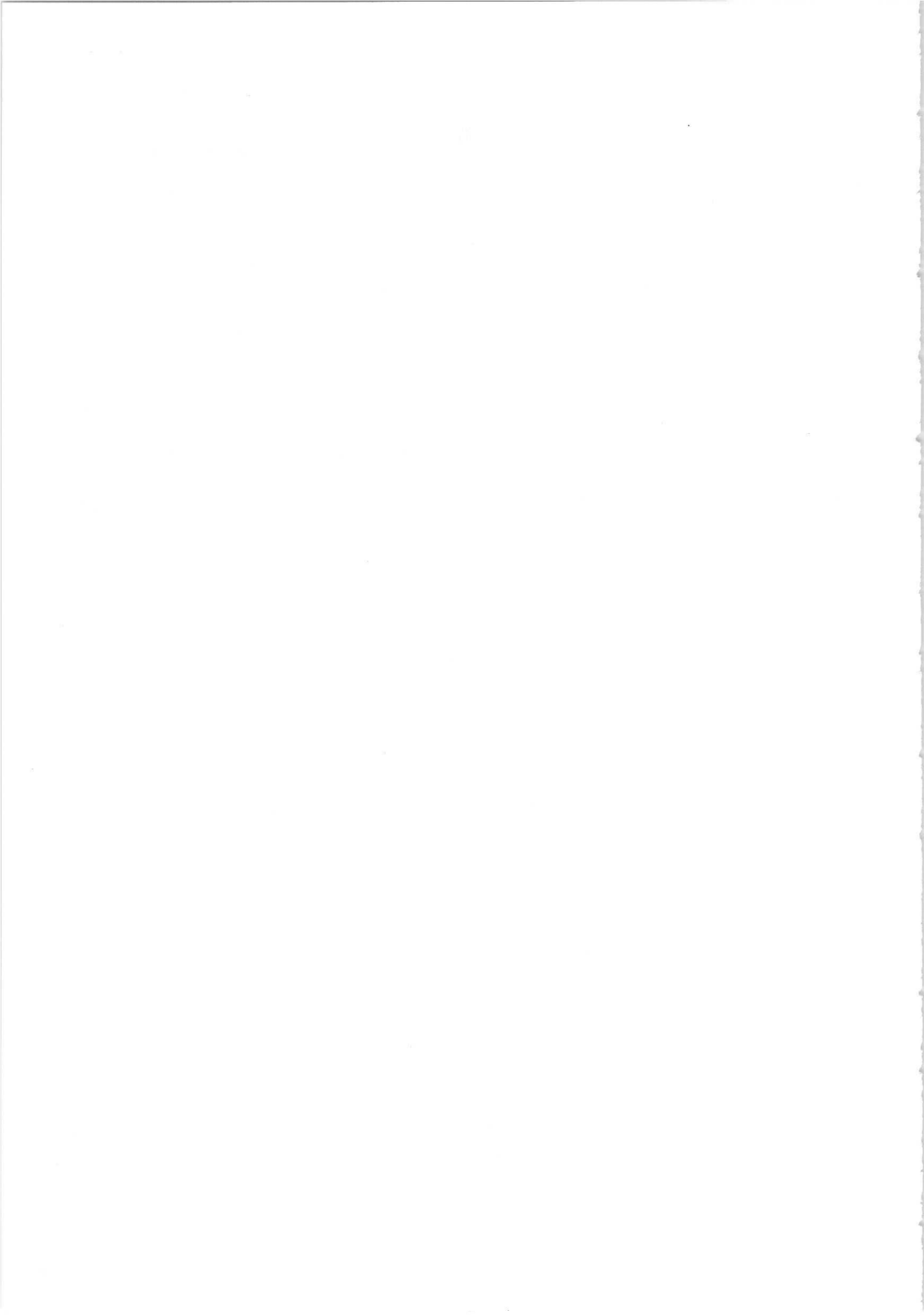
book 2 part 4c

Type No.	Description	Frequency range (MHz)	Power output (kW)	Gain (dB)	Cooling	Focusing system	Beam voltage (kV)	Beam current (A)
YK1190	Multi-cavity amplifier	470 to 610	45	44	vapour	electromagnetic	20.5 to 22	5.7 to 6.3
YK1191	Multi-cavity amplifier	590 to 720	45	44	vapour	electromagnetic	20.5 to 22	5.7 to 6.3
YK1195	Multi-cavity amplifier	470 to 610	58	41	water or vapour	electromagnetic	22 to 27	5.5 to 6.5
YK1196	Multi-cavity amplifier	590 to 720	58	42	water or vapour	electromagnetic	22 to 27	4.8 to 5.5
YK1197	Multi-cavity amplifier	710 to 860	58	46	water or vapour	electromagnetic	22 to 27	4.9 to 5.9
YK1210	Multi-cavity amplifier	11800 to 12200	1.15	43	air, water or vapour	permanent magnet	10.5	0.4
YK1220	Multi-cavity amplifiers	470 to 860	16.5	42	air, water or vapour	electromagnetic	16.5 to 19	2 to 2.35
YK1223								
YK1230	Multi-cavity amplifiers	470 to 860	27	43	air, water or vapour	electromagnetic	21 to 23.5	2.5 to 3.0
YK1233								

book 2 part 4d

heating magnetrons

Type No.	Frequency range (GHz)	Power output (kW)	Anode voltage (kV)	Anode current (mA)	Pre-heat time (s)	Cooling
YJ1511	2.46 ± 0.010	0.31	3.0	150	0	Forced air
YJ1530	2.46 ± 0.010	0.31	3.0	150	0	Forced air
YJ1540	2.445 ± 2.470	1.26	4.5	400	0	Forced air
•YJ1600	2.46 ± 0.010	5.0	7.2	950	10	Water



Mullard Passive Components

- Products included for the first time in this guide are indicated both in the index pages and data pages by a black dot alongside the type number.

Capacitors and resistors

conversion list – catalogue numbers to type numbers

For customers receiving our components under Mullard catalogue numbers, this conversion list indicates the equivalent Mullard type numbers.

Capacitors		Fixed resistors		Non-linear resistors	
catalogue number	type number	catalogue number	type number	catalogue number	type number
2222 341 05103	C281VV/A10K	2322 150 series	MR16 series	2322 600 95001	ORP12
2222 341 05104	C281VV/A100K			2322 610 11131	VA1040
2222 341 05105	C281VV/A1M	2322 151 series	MR25 series	2322 610 11132	VA1038
2222 341 05153	C281VV/A15K			2322 610 11159	VA1100
2222 341 05154	C281VV/A150K	2322 152 series	MR30 series	2322 610 11228	VA1086
2222 341 05155	C281VV/A1M5			2322 610 11408	VA1033
2222 341 05223	C281VV/A22K	2322 180 series	SFR16T series	2322 610 11501	VA1039
2222 341 05224	C281VV/A220K			2322 610 11509	VA1034
2222 341 05225	C281VV/A2M2	2322 181 series	SFR25 series	2322 610 11608	VA1074
2222 341 05333	C281VV/A33K			2322 610 11808	VA1053
2222 341 05334	C281VV/A330K	2322 182 series	SFR30 series		
2222 341 05473	C281VV/A47K			2322 635 01153	VA1055S
2222 341 05474	C281VV/A470K	2322 191 series	PR37 series	2322 635 01154	VA1067S
2222 341 05683	C281VV/A68K			2322 635 01472	VA1066S
2222 341 05684	C281VV/A680K	2322 192 series	PR52 series	2322 635 01473	VA1056S
2222 341 59103	C281CD/A10K			2322 644 90005	VA1104
2222 341 59104	C281CD/A100K	2322 241 series	VR25 series		
2222 341 59153	C281CD/A15K			2322 661 91002	E220ZZ/03
2222 341 59154	C281CD/A150K	2322 242 series	VR37 series	2322 661 91003	E220ZZ/04
2222 341 59223	C281CD/A22K			2322 661 91004	E220ZZ/02
2222 341 59224	C281CD/A220K	2322 244 series	VR68 series	2322 661 91005	E220ZZ/01
2222 341 59333	C281CD/A33K				
2222 341 59334	C281CD/A330K	2322 715 series	RC-01 series	2322 662 93037	VA8650
2222 341 59473	C281CD/A47K				
2222 341 59474	C281CD/A470K				
2222 341 59683	C281CD/A68K				
4322 043 03301	B127122				
4322 043 04272	B127124				
4322 043 03331	B127125				
4322 043 03291	B127121				
4322 043 03501	B127122				

preferred values

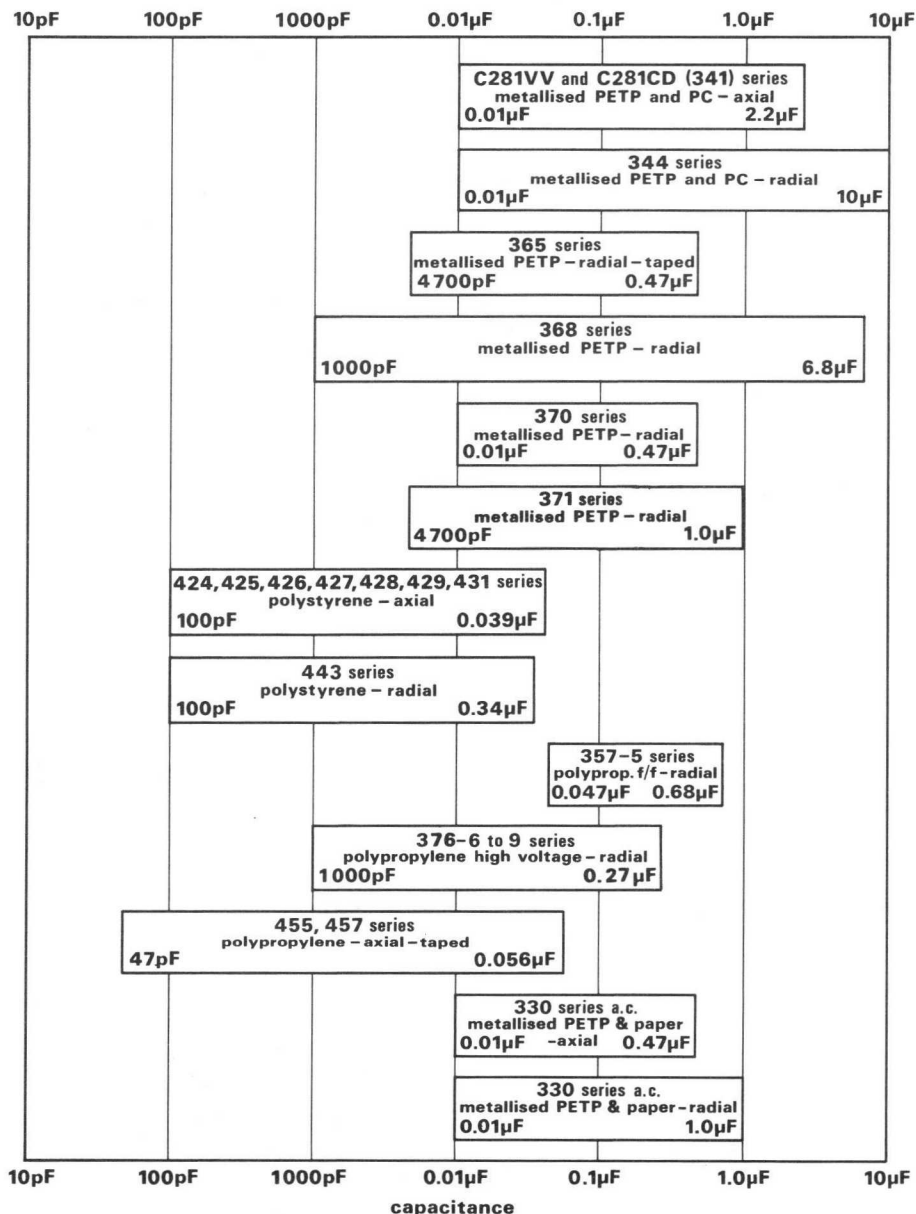
The figures given in the tables below, and their decimal multiples and submultiples, are the series of preferred values for capacitors and resistors, in accordance with BS2488 and IEC publication 63.

E6 series:	10	15	22	33	47	68						
E12 series:	10	12	15	18	22	27	33	39	47	56	68	82
E24 series:	10	11	12	13	15	16	18	20	22	24	27	30
	33	36	39	43	47	51	56	62	68	75	82	91
E48 series:	100	105	110	115	121	127	133	140	147	154	162	169
	178	187	196	205	215	226	237	249	261	274	287	301
	316	332	348	365	383	402	422	442	464	487	511	536
	562	590	619	649	681	715	750	787	825	866	909	953
E96 series:	100	102	105	107	110	113	115	118	121	124	127	130
	133	137	140	143	147	150	154	158	162	165	169	174
	178	182	187	191	196	200	205	210	215	221	226	232
	237	243	249	255	261	267	274	280	287	294	301	309
	316	324	332	340	348	357	365	374	383	392	402	412
	422	432	442	453	464	475	487	499	511	523	536	549
	562	576	590	604	619	634	649	665	681	698	715	732
	750	768	787	806	825	845	866	887	909	931	953	976

Film capacitors

selection guide

book 3 part 1a*



* A new handbook for film and variable capacitors is now in preparation, and is likely to be issued in the second half of 1985.

Metallised film capacitors

book 3 part 1a

* PETP, MKT, moulded, axial leads

C281VV/8017B (341) Series U_R (d.c.) = 250V

Type No.	Code No.	Capacitance (μF)	Dimensions (mm)				
			L	T	H	d	l
C281VV/A10K	341 05103	0.01	14.6	4.8	8.8	0.8	40
C281VV/A15K	341 05153	0.015	14.6	4.8	8.8	0.8	40
C281VV/A22K	341 05223	0.022	14.6	4.8	8.8	0.8	40
C281VV/A33K	341 05333	0.033	14.6	4.8	8.8	0.8	40
C281VV/A47K	341 05473	0.047	14.5	4.9	8.7	0.8	40
C281VV/A68K	341 05683	0.068	14.5	4.9	8.7	0.8	40
C281VV/A100K	341 05104	0.10	14.5	5.5	9.4	0.8	40
C281VV/A150K	341 05154	0.15	18.0	6.7	10.4	0.8	40
C281VV/A220K	341 05224	0.22	18.0	6.5	10.4	0.8	40
C281VV/A330K	341 05334	0.33	23.8	7.8	11.7	0.8	40
C281VV/A470K	341 05474	0.47	23.5	7.4	11.5	0.8	40
C281VV/A680K	341 05684	0.68	23.5	9.2	12.8	0.8	40
C281VV/A1M	341 05105	1.0	31.0	10.4	14.6	0.8	50
C281VV/A1M5	341 05155	1.5	31.0	12.4	19.5	0.8	50
C281VV/A2M2	341 05225	2.2	31.0	12.4	19.5	0.8	50

C281VV are approved to British Telecom Specification D2283 and marked with B.T. type number "8017B". They are otherwise identical to the 341 89 . . . series detailed in the handbook.

* polyethylene terephthalate

Capacitance tolerance ±10%

polycarbonate, MKC, moulded, axial leads

C281CD (341) Series U_R (d.c.) = 400V

Type No.	Code No.	Capacitance (μF)	Dimensions (mm)				
			L	T	H	d	l
C281CD/A10K	341 59103	0.010	14.5	4.9	8.7	0.8	40
C281CD/A15K	341 59153	0.015	14.5	4.9	8.7	0.8	40
C281CD/A22K	341 59223	0.022	14.5	4.9	8.7	0.8	40
C281CD/A33K	341 59333	0.033	14.5	5.5	9.4	0.8	40
C281CD/A47K	341 59473	0.047	14.5	6.5	10.4	0.8	40
C281CD/A68K	341 59683	0.068	18.0	6.7	10.4	0.8	40
C281CD/A100K	341 59104	0.10	18.1	7.9	11.5	0.8	40
C281CD/A150K	341 59154	0.15	23.8	7.8	11.7	0.8	40
C281CD/A220K	341 59224	0.22	23.5	9.2	12.8	0.8	40
C281CD/A330K	341 59334	0.33	23.5	10.4	14.4	0.8	40
C281CD/A470	341 59474	0.47	31.0	10.4	14.6	1.0	50

Capacitance tolerance ± 10%

Losses (at 10kHz)

C281VV series $\tan \delta \leq 150 \times 10^{-4}$

C281CD series $\tan \delta \leq 75 \times 10^{-4}$

Insulation resistance at 23°C for C ≤ 0.33 μF R > 30 000 MΩ
for C ≥ 0.47 μF RC > 10 000 s

Temperature range -55 to +85°C at rated voltage U_R

+86 to +100°C at 0.8 U_R

Climatic category (IEC68) 55/100/56

Metallised film capacitors

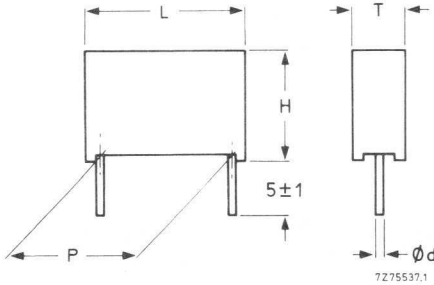
* PETP, MKT, radial, moulded

book 3 part 1a

344 1 Series, U_R (d.c.) = 63V

Type No.	Capacitance (μF)	Dimensions (mm)			
		P	L	T	H
344 15224	0.22	10	13	4.5	10
344 15334	0.33	10	13	5	11
344 15474	0.47	10	13	6	12
344 15684	0.68	15	17.5	6	11.5
344 15105	1.0	15	17.5	7	13
344 15155	1.5	15	17.5	8.5	14.5
344 15225	2.2	22.5	26	6.5	15.5
344 15335	3.3	22.5	26	8.5	18
344 15475	4.7	22.5	26	9.5	19
344 15685	6.8	27.5	30	11	20.5
344 15106	10.0	27.5	30	13.5	23

*polyethylene terephthalate



* PETP, MKT, or polycarbonate, MKC, radial, moulded

344 2 Series U_R (d.c.) = 100V PETP range approved to CECC 30401-023 and to B.T. D2596

Type No.		Capacitance (μF)	Dimensions (mm)			
PETP, MKT	polycarbonate, MKC		P	L	T	H
344 25104	344 21104	0.1	10	13	4.5	10
344 25154	344 21154	0.15	10	13	4.5	10
344 25224	344 21224	0.22	10	13	5	11
344 25334	344 21334	0.33	15	17.5	5	11
344 25474	344 21474	0.47	15	17.5	6	11.5
344 25684	344 21684	0.68	15	17.5	7	13
344 25105	344 21105	1	15	17.5	8.5	14.5
344 25155	344 21155	1.5	22.5	26	6.5	15.5
344 25225	344 21225	2.2	22.5	26	8.5	18
344 25335	344 21335	3.3	22.5	26	9.5	19
344 25475	344 21475	4.7	27.5	note 1	11	20
344 25685	344 21685	6.8	27.5	31	13.5	22.5
344 25106	—	10	27.5	31	15	25

*polyethylene terephthalate

(1) For the 4.7 μF capacitor L_{max} is 30mm for the PETP, MKT version and 31mm for the polycarbonate MKC version.

Metallised film capacitors

* PETP, MKT, or polycarbonate, MKC radial, moulded

book 3 part 1a

344 4 Series U_R (d.c.) = 250V PETP range approved to CECC 30401-023 and to B.T. D2596

PETP, MKT	Type No.	Capacitance (μ F)	P	Dimensions (mm)		
	polycarbonate, MKC			L	T	H
344 41473	344 45473	0.047	10	13	4.5	10
344 41683	344 45683	0.068	10	13	4.5	10
344 90188	-	0.10	10	13	5.0	11
344 41104**	344 45104	0.10	15	17.5	5.0	11
344 41154	-	0.15	15	17.5	5.0	11
-	344 45154	0.15	15	17.5	6.0	11.5
344 41224	-	0.22	15	17.5	6.0	11.5
-	344 45224	0.22	15	17.5	7.0	13
344 41334	-	0.33	15	17.5	7.0	13
-	344 45334	0.33	15	17.5	8.5	14.5
344 41474	-	0.47	22.5	26	6.5	15.5
-	344 45474	0.47	22.5	26	6.5	15.5
344 41684	-	0.68	22.5	26	6.5	15.5
-	344 45684	0.68	22.5	26	7.5	16.5
344 41105	-	1.0	22.5	26	8.5	18.0
-	344 45105	1.0	22.5	26	9.5	19.0
344 41155	344 45155	1.5	27.5	31	11	20
344 41225	-	2.2	27.5	31	11	20
-	344 45225	2.2	27.5	31	13.5	22.5

*polyethylene terephthalate

**0.1 μ F, 250V, PETP capacitor type 344 41104 is not approved to CECC 30401-023 and to B.T. D2596 for dimensional reasons.

344 5 Series U_R (d.c.) = 400V PETP range approved to CECC 30401-023 and B.T. D2596

PETP, MKT	Type No.	Capacitance μ F	P	Dimensions (mm)		
	polycarbonate, MKC			L	T	H
344 55103	344 51103	0.010	10	13	4.5	10
344 55153	344 51153	0.015	10	13	4.5	10
344 55223	344 51223	0.022	10	13	4.5	10
344 55333	344 51333	0.033	10	13	4.5	10
344 55473	344 51473	0.047	15	17.5	5.0	11
344 55683	344 51683	0.068	15	17.5	6.0	11.5
344 55104	344 51104	0.10	15	17.5	7.0	13
344 55154	344 51154	0.15	15	17.5	8.5	14.5
344 55224	344 51224	0.22	22.5	26	6.5	15.5
344 55334	344 51334	0.33	22.5	26	7.5	16.5
344 55474	344 51474	0.47	22.5	26	9.5	19
344 55684	344 51684	0.68	27.5	31	11	20
344 55105	344 51105	1.0	27.5	31	13.5	22.5

*polyethylene terephthalate

Note: With the exception of the 63V version, the standard range of PETP dielectric capacitors are approved to CECC 30401-023 and to British Telecom specification D2596, Capacitors Type 9621, 9622, and 9623. In addition to CECC and B.T. approvals these capacitors are recommended by RSRE.

Capacitance tolerance
Temperature range

Losses (at 10kHz)

Insulation resistance at 23°C
63V and 100V versions

250V and 400 V versions

Climatic category (IEC 68)

$\pm 10\%$

-55 to +85°C at rated voltage (U_R)

+86 to +100°C at 0.8 U_R

$\tan \delta \leq 75 \times 10^{-4}$... polycarbonate types

$\tan \delta \leq 150 \times 10^{-4}$... PETP types

for $C \leq 0.33 \mu$ F; $R > 15\ 000\ M\Omega$

for $C > 0.33 \mu$ F; $RC > 5\ 000\ s$

for $C \leq 0.33 \mu$ F; $R > 30\ 000\ M\Omega$

for $C > 0.33 \mu$ F; $RC > 10\ 000\ s$

55/100/66

Metallised film capacitors

* PETP, MKT, radial, moulded

book 3 part 1a

371 1 Series, U_R (d.c.) = 63V

Type No.	Capacitance (μ F)	Dimensions (mm)	
		T	H _{max}
371 11224	0.22	3	8
371 11334	0.33	4	9
371 11474	0.47	4	9
371 11684	0.68	5	10.5
371 11105	1.0	6	11.5

371 2 Series, U_R (d.c.) = 100 V

Type No.	Capacitance (μ F)	Dimensions (mm)	
		T	H _{max}
371 21223	0.022	2.5	6
371 21333	0.033	2.5	6
371 21473	0.047	2.5	6
371 21683	0.068	3	8
371 21104	0.10	3	8
371 21154	0.15	4	9

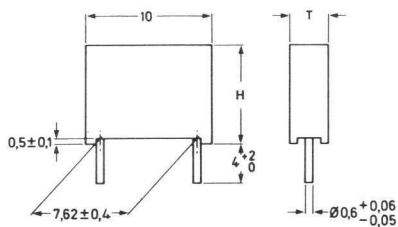
371 4 Series, U_R (d.c.) = 250 V

Type No.	Capacitance (μ F)	Dimensions (mm)	
		T	H _{max}
371 41103	0.010	2.5	6
371 41153	0.015	2.5	6
371 41223	0.022	3	8
371 41333	0.033	3	8
371 41473	0.047	4	9

371 5 Series U_R (d.c.) = 400V

Type No.	Capacitance (μ F)	Dimensions (mm)	
		T	H _{max}
371 51472	0.0047	2.5	6
371 51682	0.0068	2.5	6
371 51103	0.010	3	8
371 51153	0.015	4	9

*polyethylene terephthalate



Capacitance tolerance
 Temperature range
 Rated temperature
 Losses (at 10kHz)
 Insulation resistance at 20°C
 100 V versions R > 15000 M Ω
 250 V, 400 V versions R > 30 000 M Ω
 Climatic category (IEC 68) 55/100/56
 Basic specification IEC 384-2
 long life grade
 (CECC 30400)

$\pm 10\%$
 -55 to +100°C
 85°C
 $\tan \delta \leq 130 \times 10^{-4}$

Metallised film capacitors

book 3 part 1a

*PETP, MKT, dipped, radial

365 Series U_R (d.c.) = 63V 2e; 5.08mm (3e; 7.62mm) lead spacing

Type Number	Capacitance (μF)	Dimensions (mm)		
		T _{max}	H _{max}	L _{max}
365 11334	0.33	5	14.5	10.5
365 11474	0.47	5.5	15.0	10.5

365 Series U_R (d.c.) = 100V 2e; 5.08mm (3e; 7.62mm) lead spacing

365 21473	0.047	4	13.5	10
365 21683	0.068	4	13.5	10
365 21104	0.10	4	13.5	10
365 21154	0.15	5	14.5	10.5
365 21224	0.22	5.5	15.0	10.5

365 Series U_R (d.c.) = 250V 2e; 5.08mm (3e; 7.62mm) lead spacing

365 41223	0.022	4	13.5	10
365 41333	0.033	4	13.5	10

365 Series U_R (d.c.) = 400V 2e, 5.08mm (3e; 7.62mm) lead spacing

365 51472	0.0047	4	13.5	10
365 51682	0.0068	4	13.5	10
365 51103	0.010	4	13.5	10
365 51153	0.015	4	13.5	10

*polyethylene terephthalate

Electrical characteristics: see next table.

These products have a natural lead pitch of 7.62mm (3e). The lead pitch is reduced to 5.08mm (2e) by a preforming during manufacture. They are tape packaged (see below)

365 Series U_R (d.c.) = 63V 2e; 5.08mm lead spacing

Type Number	Capacitance (μF)	Dimensions (mm)		
		T _{max}	H _{max}	L _{max}
365 71473	0.047	3.5	12.5	7.5
365 71683	0.068	3.5	12.5	7.5
365 71104	0.10	3.5	12.5	7.5
365 71224	0.22	4.5	13.5	7.5
365 71334	0.33	5.5	14.5	7.5
365 71474	0.47	6	15.5	7.5

365 Series U_R (d.c.) = 100V 2e; 5.08mm lead spacing

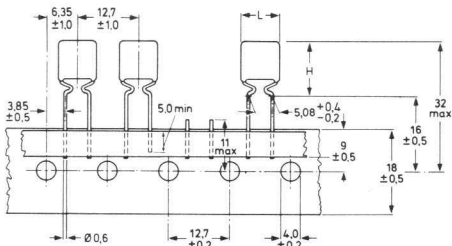
365 81103	0.010	3.5	12.5	7.5
365 81153	0.015	3.5	12.5	7.5
365 81223	0.022	3.5	12.5	7.5
365 81333	0.033	3.5	12.5	7.5

*polyethylene terephthalate

These products have a natural lead pitch of 5.08 (2e). They are tape packaged (see below).

Capacitance tolerance ±10%
 Typical losses at 10kHz tan δ ≤90 × 10⁻⁴
 Insulation resistance at 20°C
 for C_R ≤ 0.33μF 63V and 100V capacitors >15 000MΩ
 250V and 400V capacitors >30 000 MΩ
 for C_R > 0.33μF RC > 5000 s
 Climatic category 40/100/21

Tape packaging dimensions



Metallised film capacitors

*PETP, MKT, dipped, radial

book 3 part 1a

368 Series $U_R(d.c.) = 100V$

Style A		Style B		Capacitance (μF)	Dimensions (mm)				
Type No.	Type No.	Type No.	Type No.		L_{max}	H_{max}	T_{max}	$\varnothing d$	S
368 21... ($\pm 10\%$)	368 25... ($\pm 10\%$)								
104	104	0.10		12.5	12.0	4.0	0.6	10.16	
154	154	0.15		12.5	12.5	4.5	0.6	10.16	
224	224	0.22		12.5	13.5	5.5	0.6	10.16	
334	334	0.33		17.5	14.0	5.0	0.8	15.24	
474	474	0.47		17.5	15.0	6.0	0.8	15.24	
684	684	0.68		17.5	16.0	7.0	0.8	15.24	
105	105	1.0		17.5	17.5	8.5	0.8	15.24	
155	155	1.5		26.0	18.5	6.5	0.8	22.86	
225	225	2.2		26.0	20.0	8.0	0.8	22.86	
335	335	3.3		26.0	21.5	9.5	0.8	22.86	
475	475	4.7		30.0	23.0	11.0	0.8	27.94	
685	685	6.8		30.0	25.0	13.0	0.8	27.94	

368 Series $U_R(d.c.) = 250V$

Style A		Style B		Capacitance (μF)	Dimensions (mm)				
Type No.	Type No.	Type No.	Type No.		L_{max}	H_{max}	T_{max}	$\varnothing d$	P
368 41... ($\pm 10\%$)	368 45... ($\pm 10\%$)								
333	333	0.033		12.5	12.0	4.0	0.6	10.16	
473	473	0.047		12.5	12.0	4.0	0.6	10.16	
683	683	0.068		12.5	12.5	4.5	0.6	10.16	
104	104	0.10		12.5	13.0	5.0	0.6	10.16	
154	154	0.15		17.5	14.0	5.0	0.6	15.24	
224	224	0.22		17.5	15.0	6.0	0.8	15.24	
334	334	0.33		17.5	16.0	7.0	0.8	15.24	
474	474	0.47		26.0	17.5	5.5	0.8	22.86	
684	684	0.68		26.0	18.5	6.5	0.8	22.86	
105	105	1.0		26.0	19.5	7.5	0.8	22.86	
155	155	1.5		30.0	20.5	8.5	0.8	27.94	
225	225	2.2		30.0	22.5	10.5	0.8	27.94	

368 Series $U_R(d.c.) = 400V$

Style A		Style B		Capacitance (μF)	Dimensions (mm)				
Type No.	Type No.	Type No.	Type No.		L_{max}	H_{max}	T_{max}	$\varnothing d$	P
368 51... ($\pm 10\%$)	368 55... ($\pm 10\%$)								
102	102	0.001		12.5	12.0	4.0	0.6	10.16	
152	152	0.0015		12.5	12.0	4.0	0.6	10.16	
222	222	0.0022		12.5	12.0	4.0	0.6	10.16	
332	332	0.0033		12.5	12.0	4.0	0.6	10.16	
472	472	0.0047		12.5	12.0	4.0	0.6	10.16	
682	682	0.0068		12.5	12.0	4.0	0.6	10.16	
103	103	0.010		12.5	12.0	4.0	0.6	10.16	
153	153	0.015		12.5	12.0	4.0	0.6	10.16	
223	223	0.022		12.5	12.0	4.0	0.6	10.16	
333	333	0.033		12.5	12.5	4.5	0.6	10.16	
473	473	0.047		17.5	14.0	5.0	0.8	15.24	
683	683	0.068		17.5	14.0	5.0	0.8	15.24	

*polyethylene terephthalate

Metallised film capacitors

book 3 part 1a

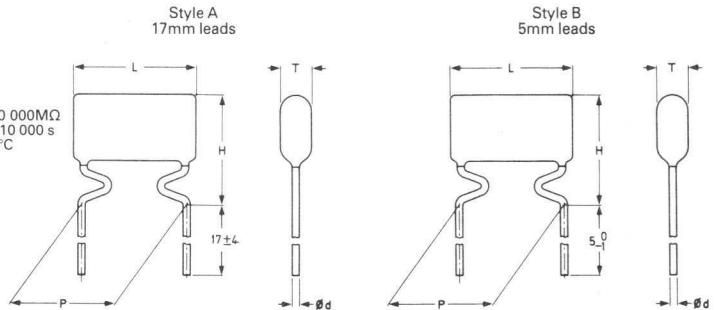
*PETP, MKT, dipped, radial (cont'd)

368 Series U_R (d.c.) = 400V

Style A		Style B		Capacitance (μF)	Dimensions (mm)				
Type No.	Type No.	L_{max}	H_{max}		T_{max}	$\varnothing d$	P		
368 51...($\pm 10\%$)	368 55...($\pm 10\%$)								
104	104	0.10	17.5	15.0	6.0	0.8	15.24		
154	154	0.15	17.5	16.0	7.0	0.8	15.24		
224	224	0.22	26.0	17.5	5.5	0.8	22.86		
334	334	0.33	26.0	18.5	6.5	0.8	22.86		
474	474	0.47	26.0	20.0	8.0	0.8	22.86		
684	684	0.68	30.0	20.5	8.5	0.8	27.94		
105	105	1.0	30.0	23	11	0.8	27.94		

*polyethylene terephthalate

Capacitance tolerance $\pm 10\%$
 Typical losses at 10kHz $\tan \delta \leq 150 \times 10^{-4}$
 Insulation resistance at 20°C
 100V versions for $C \leq 0.33 \mu\text{F}$ $R > 15\ 000 \Omega$
 for $C > 0.33 \mu\text{F}$ $RC > 5\ 000 \text{ s}$
 250V and 400V versions for $C \leq 0.33 \mu\text{F}$ $R > 30\ 000 \Omega$
 for $C > 0.33 \mu\text{F}$ $RC > 10\ 000 \text{ s}$
 Rated temperature at rated voltage U_R 85°C
 at 0.8 U_R up to 100°C
 Climatic category 40/100/56



*PETP, MKT, potted, radial

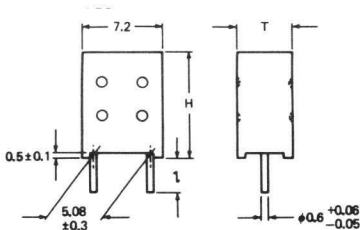
370 1 Series, U_R (d.c.) = 63V

Type No.	Capacitance (μF)	Dimensions (mm)	
		T	H_{max}
370 11473	0.047	2.5	6
370 11683	0.068	2.5	6
370 11104	0.10	2.5	6
370 11154	0.15	3.5	8
370 11224	0.22	3.5	8
370 11334	0.33	4.5	9
370 11474	0.47	5.0	10

370 2 Series, U_R (d.c.) = 100 V

Type No.	Capacitance (μF)	Dimensions (mm)	
		T	H_{max}
370 21103	0.010	2.5	6
370 21153	0.015	2.5	6
370 21223	0.022	2.5	6
370 21333	0.033	2.5	6
370 21473	0.047	3.5	8
370 21683	0.068	3.5	8
370 21104	0.10	3.5	8

*polyethylene terephthalate



lead length (l) = 5 ± 0 mm

Capacitance tolerance $\pm 10\%$
 Typical losses at 10kHz $\tan \delta \leq 130 \times 10^{-4}$
 Insulation resistance at 20°C
 $C \leq 0.33 \mu\text{F}$ $R > 15\ 000 \Omega$
 $C > 0.33 \mu\text{F}$ $RC > 5000 \text{ s}$
 Rated temperature 85°C
 Climatic category (IEC68) 55/100/56

This range is also available on tape or reel.

Metallised film capacitors

*PETP and paper dual dielectric, MKT-P

(approved to VDE 0565, part 1)

book 3 part 1a

330 Series interference suppression capacitors $U_R(a.c.)=250V$ (Class X2)

Axial Leads (Fig 1)

Type No. ($\pm 10\%$)	Capacitance (μF)	Dimensions (mm)				
		T_{max}	L_{max}	H_{max}	l	$\varnothing d$
330 01103	0.01	6.7	18	10.4	40	0.8
330 01153	0.015	6.7	18	10.4	40	0.8
330 01223	0.022	6.7	18	10.4	40	0.8
330 01333	0.033	6.7	18	10.4	40	0.8
330 01473	0.047	6.7	18	10.4	40	0.8
330 01683	0.068	7.9	18.1	11.5	40	0.8
330 01104	0.1	7.8	23.8	11.7	40	0.8
330 01154	0.15	9.2	23.5	12.8	40	0.8
330 01224	0.22	10.4	23.5	14.4	40	0.8
330 01334	0.33**	12.4	31	19.5	50	1.0
330 01474	0.47**	12.4	31	19.5	50	1.0

*polyethylene terephthalate

**VDE approval applied for

All capacitors are intended for operation directly across the incoming mains supply.

Capacitance tolerance $\pm 10\%$

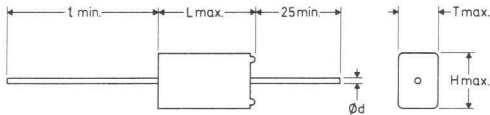


Fig. 1

Metallised film capacitors

*PETP and paper dual dielectric, MKT-P book 3 part 1a (approved to VDE 0565, part 1 and SEMKO)

330 Series interference suppression capacitors $U_R(a.c.) = 250V$ (Class X2)

Radial Leads (Fig. 2)

Type No. 330 followed by		Capacitance (μF)	Dimensions (mm)				
$l = 5 \pm 1$	$l = 25 \pm 2$		T_{max}	H_{max}	P L_{max}	± 0.4	$\varnothing d$
41103	45103	0.010	5	11	17.5	15	0.8
41153	45153	0.015	5	11	17.5	15	0.8
41223	45223	0.022	5	11	17.5	15	0.8
41333	45333	0.033	5	11	17.5	15	0.8
41473	45473	0.047	6	11.5	17.5	15	0.8
41683	45683	0.068	7	13	17.5	15	0.8
41104	45104	0.10	8.5	14.5	17.5	15	0.8
41154	45154	0.15	7	16	26	22.5	0.8
41224	45224	0.22	8.5	17.5	26	22.5	0.8
41334	45334	0.33	10	18.5	26	22.5	0.8
41474	45474	0.47**	13.5	22.5	31	27.5	0.8
41684	45684	0.68**	15	25	31	27.5	0.8
41105	45105	1.0**	18	28	31	27.5	1.0

*polyethylene terephthalate

**VDE0560-7 and SEMKO approvals applied for

All capacitors are intended for operation directly across the incoming mains supply.

Capacitance tolerance $\pm 10\%$

330 Series interference suppression capacitors; $U_R(a.c.) = 250V$ (Class X2)

Insulated radial leads (Fig. 3)

Type No. 330 followed by ($\pm 10\%$)	Capacitance (μF)	Dimensions (mm)		Type No. 330 followed by ($\pm 10\%$)	Capacitance (μF)	Dimensions (mm)	
		T_{max}	H_{max}			T_{max}	H_{max}
85103	0.010	6	12	85473	0.047	6	12
85153	0.015	6	12	85683	0.068	7	13
85223	0.022	6	12	85104	0.10	8.5	14.5
85333	0.033	6	12				

Capacitance tolerance: $\pm 10\%$

All capacitors are intended for operation directly across the incoming mains supply.

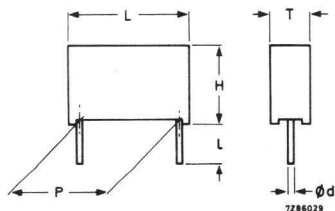


Fig. 2

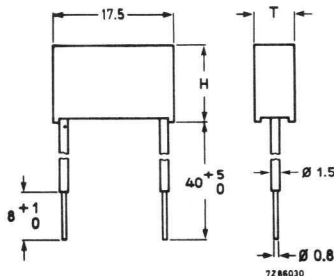


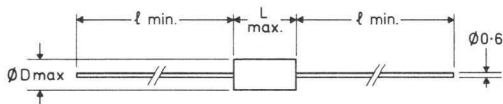
Fig. 3

Film/foil capacitors, (extended foil) axial leads

miniature, polystyrene, KS

book 3 part 1a

Type No.		Capacitance (pF)	Dimensions (mm)			Type No.		Capacitance (pF)	Dimensions (mm)		
(±1%)	(±5%)		L	D	l	(±1%)	(±5%)		L	D	l
424 Series U_R (d.c.) = 63V											
424 49102	-	9 100	15	5.0	28	424 42003	-	20 000	15	6.0	28
424 41003	-	10 000	15	5.0	28	424 42203	-	22 000	15	6.5	28
424 41103	-	11 000	15	5.5	28	424 42403	-	24 000	15	6.5	28
424 41203	-	12 000	15	5.5	28	424 42703	-	27 000	15	7.0	28
424 41303	-	13 000	15	5.5	28	424 43003	-	30 000	15	7.0	28
424 41503	-	15 000	15	5.5	28	424 43303	-	33 000	15	7.5	28
424 41603	-	16 000	15	6.0	28	424 43603	-	36 000	15	7.5	28
424 41803	-	18 000	15	6.0	28	424 43903	-	39 000	15	8.0	28
425 Series U_R (d.c.) = 160V											
425 41102	425 21102	1 100	10.9	3.8	30	425 43002	425 23002	3 000	10.9	5.0	30
425 41202	425 21202	1 200	10.9	4.0	30	425 43302	425 23302	3 300	10.9	5.0	30
425 41302	425 21302	1 300	10.9	4.0	30	425 43602	425 23602	3 600	10.9	5.0	30
425 41502	425 21502	1 500	10.9	4.0	30	425 43902	425 23902	3 900	10.9	5.0	30
425 41602	425 21602	1 600	10.9	4.0	30	425 44302	425 24302	4 300	15	5.0	28
425 41802	425 21802	1 800	10.9	4.0	30	425 44702	425 24702	4 700	15	5.0	28
425 42002	425 22002	2 000	10.9	4.5	30	425 45102	425 25102	5 100	15	5.0	28
425 42202	425 22202	2 200	10.9	4.5	30	425 45602	425 25602	5 600	15	5.0	28
425 42402	425 22402	2 400	10.9	4.5	30	425 46202	425 26202	6 200	15	5.0	28
425 42702	425 22702	2 700	10.9	4.5	30	425 46802	425 26802	6 800	15	5.5	28
						425 47502	425 27502	7 500	15	5.5	28
						425 48202	425 28202	8 200	15	6.0	28
426 Series U_R (d.c.) = 250V											
426 48201	426 28201	820	10.9	4.0	30						
426 49101	426 29101	910	10.9	4.0	30						
426 41002	426 21002	1000	10.9	4.0	30						
427 Series U_R (d.c.) 630V											
427 41001	427 21001	100	10.9	3.8	30	427 43001	427 23001	300	10.9	3.8	30
427 41101	427 21101	110	10.9	3.8	30	427 43301	427 23301	330	10.9	4.0	30
427 41201	427 21201	120	10.9	3.8	30	427 43601	427 23601	360	10.9	4.0	30
427 41301	427 21301	130	10.9	3.8	30	427 43901	427 23901	390	10.9	4.0	30
427 41501	427 21501	150	10.9	3.8	30	427 44301	427 24301	430	10.9	4.0	30
427 41601	427 21601	160	10.9	3.8	30	427 44701	427 24701	470	10.9	4.5	30
427 41801	427 21801	180	10.9	3.8	30	427 45101	427 25101	510	10.9	4.5	30
427 42001	427 22001	200	10.9	3.8	30	427 45601	427 25601	560	10.9	4.0	30
427 42201	427 22201	220	10.9	3.8	30	427 46201	427 26201	620	10.9	4.5	30
427 42401	427 22401	240	10.9	3.8	30	427 46801	427 26801	680	10.9	4.5	30
427 42701	427 22701	270	10.9	3.8	30	427 47501	427 27501	750	10.9	5.0	30



Capacitance tolerance $\pm 1\%$ or $\pm 5\%$
 Losses (at 10kHz) $C > 20\,000\text{pF}$ $\tan \delta \leq 10 \times 10^{-4}$
 (at 100kHz) $10\,000\text{pF} < C < 20\,000\text{pF}$ $\tan \delta \leq 15 \times 10^{-4}$
 (at 100kHz) $1000\text{pF} < C < 10\,000\text{pF}$ $\tan \delta \leq 10 \times 10^{-4}$
 (at 1MHz) $C \leq 1000\text{pF}$ $\tan \delta \leq 10 \times 10^{-4}$

Insulation resistance at 23°C $> 10^9\text{M}\Omega$
 Temperature range 630V -40 to +85°C
 250V -40 to +85°C
 160V -40 to +85°C
 63V -40 to +70°C

Climatic category (IEC68)
 160V, 250V, 630V versions 40/085/21
 63V versions 40/070/21

Film/foil capacitors (extended foil) axial leads

book 3 part 1a

miniature, polystyrene, KS (cont.)

The 424, 425, 426 and 427 Series can be supplied tape packaged to facilitate automatic handling by either crop and form processing or fully automatic insertion.

In these cases the equivalent series numbers are as follows:-

63V - 424 Series loose in boxes - 428 Series bandoliered on reels
160V - 425 Series loose in boxes - 429 Series bandoliered on reels
250V - 426 Series loose in boxes - 430 Series bandoliered on reels
630V - 427 Series loose in boxes - 431 Series bandoliered on reels

The final part of the type number is also amended as follows:-

for example 425 43602 (1% loose in boxes) becomes 429 83602 (1% on reels)

and 425 23602 (5% loose in boxes) becomes 429 63602 (5% on reels)

Examples

250V 820 pF 1% capacitors loose in boxes are ordered as 426 48201
and 250V 820 pF 1% capacitors bandoliered on reels are ordered as 430 88201.

For full details of tape packaging specifications and reel quantities consult Mullard Limited.

Film/foil capacitors (wound cell), radial

miniature, polystyrene, KS

book 3 part 1a

443 Series, U_R (d.c.) = 63V, U_R (a.c.) = 25V

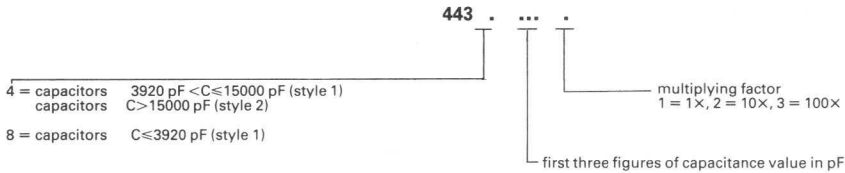
Rated capacitance range (E96* series)	100 to 34000 pF
Capacitance tolerance	± 1%
Rated temperature 70°C	Climatic category (IEC68)
	40/070/56
Basic specification IEC 384-7	

Losses		
at 10kHz	$C > 15000$ pF	$\tan \delta \leq 10 \times 10^{-4}$
at 100kHz	10000 pF $< C < 15000$ pF	$\tan \delta \leq 15 \times 10^{-4}$
at 100kHz	1000 pF $< C < 10000$ pF	$\tan \delta \leq 10 \times 10^{-4}$
at 1MHz	500 pF $< C < 1000$ pF	$\tan \delta \leq 10 \times 10^{-4}$
at 1MHz	$C \leq 500$ pF	$\tan \delta \leq 5 \times 10^{-4}$

Insulation resistance at $T_{amb} = 23^\circ\text{C}$ > 500000 MΩ

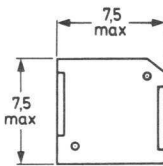
*E96 series of values shown at beginning of passive components section.

Composition of type number

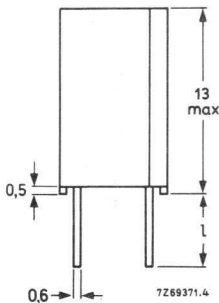
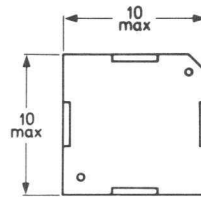


Examples: capacitors of 4750 pF ordered by type number 443 44752
 capacitors of 121 pF ordered by type number 443 81211

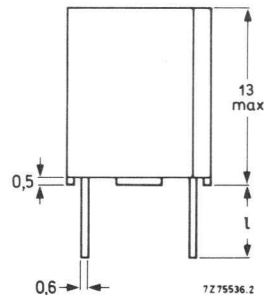
Style 1



Style 2



7269371.4



7275536.2

Film/foil capacitors (extended foil) radial

book 3 part 1a

polypropylene, KP, high pulse

357 Series U_R (d.c.) = 250V, U_R (a.c.) = 160V

Type No.*	Capacitance (μF)	Dimensions (mm)			
		P	L max.	T max.	H max.
357 51473	0.047	15.0	21.5	8	15
357 51683	0.068	15.0	21.5	10	17
357 51104	0.10	22.5	29	8.5	18.5
357 51154	0.15	22.5	29	8.5	18.5
357 51224	0.22	27.5	34	10	20

Type No.*	Capacitance (μF)	Dimensions (mm)			
		P	L max.	T max.	H max.
357 51334	0.33	27.5	34	12	22
357 51474	0.47	27.5	34	15	25
357 51564	0.56	27.5	34	15	25
357 51684	0.68	27.5	34	18	28

376 Series U_R (d.c.) = 630V, U_R (a.c.) = 300V

376 6-473	0.047	22.5	26	8.5	17.5
376 6-563	0.056	22.5	26	9.5	18.5
376 6-683	0.068	27.5	31	11	20
376 6-823	0.082	27.5	31	11	20
376 6-104	0.10	27.5	31	11	20

376 6-124	0.12	27.5	31	13	22.5
376 6-154	0.15	27.5	31	13	22.5
376 6-184	0.18	27.5	31	15	25
376 6-224	0.22	27.5	31	17	28
376 6-274	0.27	27.5	31	18	28

376 Series U_R (d.c.) = 1000V, U_R (a.c.) = 400V

376 72183	0.018	22.5	26	7.5	16
376 72223	0.022	22.5	26	8.5	17.5
376 72273	0.027	22.5	26	8.5	17.5
376 7-333	0.033	22.5	26	8.5	17.5
376 7-393	0.039	22.5	26	9.5	18.5
376 7-473	0.047	27.5	31	11	20
376 7-563	0.056	27.5	31	11	20

376 7-683	0.068	27.5	31	11	20
376 7-823	0.082	27.5	31	13	22.5
376 7-104	0.10	27.5	31	13	22.5
376 7-124	0.12	27.5	31	15	25
376 7-154	0.15	27.5	31	18	28
376 7-184	0.18	27.5	31	18	28

376 Series U_R (d.c.) = 1500V, U_R (a.c.) = 450V

376 82822	0.0082	22.5	26	6.5	15
376 82103	0.010	22.5	26	8.5	16

376 82123	0.012	22.5	26	7.5	17.5
376 82153	0.015	22.5	26	9.5	18.5

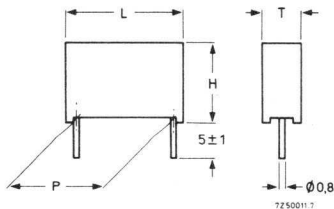
376 Series U_R (d.c.) = 2000V, U_R (a.c.) = 500V

376 92102	0.001	22.5	26	6.5	15
376 92122	0.0012	22.5	26	6.5	15
376 92152	0.0015	22.5	26	6.5	15
376 92182	0.0018	22.5	26	6.5	15
376 92222	0.0022	22.5	26	6.5	15
376 92272	0.0027	22.5	26	6.5	15
376 92332	0.0033	22.5	26	6.5	15

376 92392	0.0039	22.5	26	6.5	15
376 92472	0.0047	22.5	26	6.5	15
376 92562	0.0056	22.5	26	7.5	16
376 92682	0.0068	22.5	26	7.5	16
376 92822	0.0082	22.5	26	8.5	17.5
376 92103	0.010	22.5	26	9.5	18.5

*Where a dot is shown, replace the dot by
1 for ±10% tolerance
2 for ± 5% tolerance

Other capacitance values available on request.



Capacitance tolerance:
250V range
630V, 1000V, ranges
1500V, 2000V ranges

±10%
±10% or ±5%
±5%

Losses at 100kHz
250V range

For pitches P = 15 or 22.5mm

For pitches P = 27.5mm

$C \leq 0.33 \mu\text{F}$

$0.33 \mu\text{F} < C \leq 0.47 \mu\text{F}$

$C > 0.47 \mu\text{F}$

630V range.

For pitch P = 22.5

For pitch P = 27.5

$\tan \delta \leq 10 \times 10^{-4}$

$\tan \delta \leq 15 \times 10^{-4}$

$\tan \delta \leq 20 \times 10^{-4}$

$\tan \delta \leq 25 \times 25^{-4}$

$\tan \delta \leq 15 \times 10^{-4}$

$\tan \delta \leq 20 \times 10^{-4}$

1000V, 1500V, 2000V ranges

For pitch P = 22.5

For pitch P = 27.5

$\tan \delta \leq 10 \times 10^{-4}$

$\tan \delta \leq 15 \times 10^{-4}$

Insulation resistance (23°C)

Temperature range

Climatic category (IEC68)

>100,000 MΩ

-40 to +85°C

40/085/56

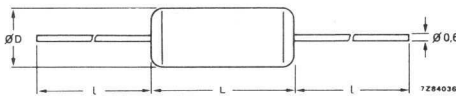
Film/foil capacitors (wound cell)

polypropylene, KP, axial leads

book 3 part 1a

455 Series, U_R (d.c.) = 63V, U_R (a.c.) = 40V

Type No.	Capacitance (pF)	Dimensions (mm)		
		L_{max}	D_{max}	l_{min}
455 33302	3300	11.0	4.0	30
455 33602	3600	11.0	4.0	30
455 33902	3900	11.0	4.0	30
455 34302	4300	11.0	4.0	30
455 34702	4700	11.0	4.5	30
455 35102	5100	11.0	4.5	30
455 35602	5600	11.0	4.5	30
455 36202	6200	11.0	4.5	30
455 36802	6800	11.0	5.0	30
455 37502	7500	11.0	5.0	30
455 38202	8200	11.0	5.0	30
455 39102	9100	11.0	5.0	30
455 31003	10000	15.0	4.5	28
455 31103	11000	15.0	4.5	28
455 31203	12000	15.0	4.5	28
455 31303	13000	15.0	5.0	28
455 31503	15000	15.0	5.0	28
455 31603	16000	15.0	5.0	28
455 31803	18000	15.0	5.5	28
455 32003	20000	15.0	5.5	28
455 32203	22000	15.0	5.5	28
455 32403	24000	15.0	6.0	28
455 32703	27000	15.0	6.0	28
455 33003	30000	15.0	6.5	28
455 33303	33000	15.0	6.5	28
455 33603	36000	15.0	7.0	28
455 33903	39000	15.0	7.0	28
455 34303	43000	15.0	7.5	28
455 34703	47000	15.0	7.5	28
455 35013	51000	15.0	8.0	28
455 35603	56000	15.0	8.0	28



Capacitance tolerance	$\pm 2\%$	
Losses		
at 100kHz	$1000 \leq C \leq 5000$ pF	$\tan \delta \leq 10 \times 10^{-4}$
	$5000 < C \leq 20000$ pF	$\tan \delta \leq 15 \times 10^{-4}$
at 10kHz	$C > 20000$ pF	$\tan \delta \leq 10 \times 10^{-4}$
Insulation resistance at 20°C		> 100000 M Ω
Temperature range		-40 to +100°C
Climatic category (IEC68)		40/100/21

Also available tape packaged in accordance with IEC 286-1 (BS 6062 part 1) to special order.

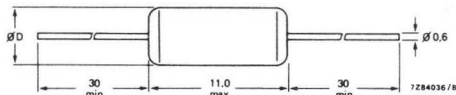
Film/foil capacitors (wound cell)

book 3 part 1a

polypropylene, KP, axial leads

457 Series, U_R (d.c.) = 250V, U_R (a.c.) = 100V

Type No.	Capacitance (pF)	Dimensions (mm)		
		L_{max}	D_{max}	l_{min}
457 34709	47	11.0	4.0	30
457 35109	51	11.0	4.0	30
457 35609	56	11.0	4.0	30
457 36209	62	11.0	4.0	30
457 36809	68	11.0	4.0	30
457 37509	75	11.0	4.0	30
457 38209	82	11.0	4.0	30
457 39109	91	11.0	4.0	30
457 31001	100	11.0	4.0	30
457 31101	110	11.0	4.0	30
457 31201	120	11.0	4.0	30
457 31301	130	11.0	4.0	30
457 31501	150	11.0	4.0	30
457 31601	160	11.0	4.0	30
457 31801	180	11.0	4.0	30
457 32001	200	11.0	4.0	30
457 32201	220	11.0	4.0	30
457 32401	240	11.0	4.0	30
457 32701	270	11.0	4.0	30
457 33001	300	11.0	4.0	30
457 33301	330	11.0	4.0	30
457 33601	360	11.0	4.0	30
457 33901	390	11.0	4.0	30
457 34301	430	11.0	4.0	30
457 34701	470	11.0	4.5	30
457 35101	510	11.0	4.5	30
457 35601	560	11.0	4.5	30
457 36201	620	11.0	4.5	30
457 36801	680	11.0	4.5	30
457 37501	750	11.0	4.5	30
457 38201	820	11.0	4.5	30
457 39101	910	11.0	4.5	30
457 31002	1000	11.0	4.5	30
457 31102	1100	11.0	4.5	30
457 31202	1200	11.0	4.5	30
457 31302	1300	11.0	4.5	30
457 31502	1500	11.0	4.5	30
457 31602	1600	11.0	4.5	30
457 31802	1800	11.0	4.5	30
457 32002	2000	11.0	4.5	30
457 32202	2200	11.0	4.5	30
457 32402	2400	11.0	5.0	30
457 32702	2700	11.0	5.0	30
457 33002	3000	11.0	5.0	30



457 Series

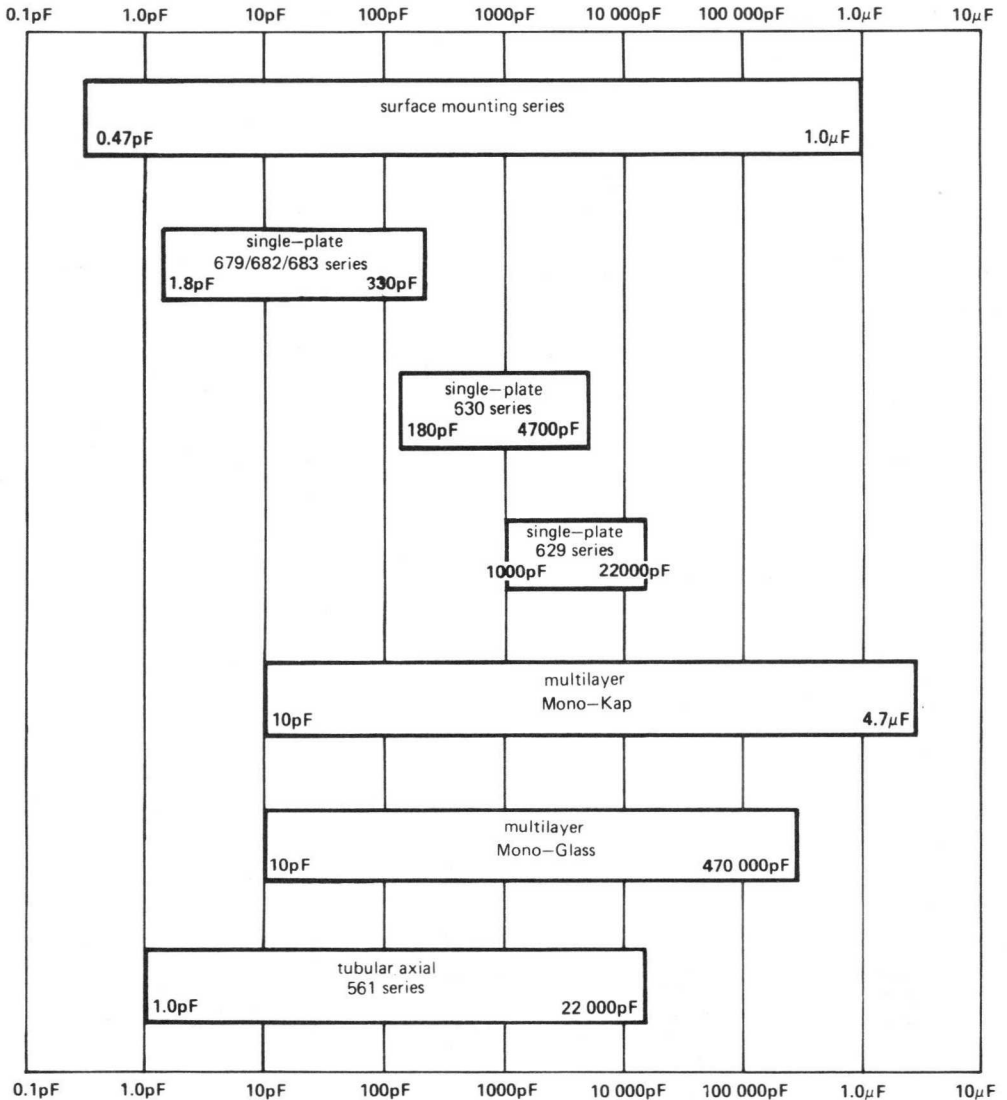
Capacitance tolerance
 Losses
 at 10kHz $C > 20\ 000\text{pF}$
 at 100kHz $5000\text{pF} < C \leq 20\ 000\text{pF}$
 Insulation resistance at 20°C
 Temperature range
 Climatic category (IEC68)

$\pm 2\%$
 $\tan \delta \leq 10 \times 10^{-4}$
 $\tan \delta \leq 15 \times 10^{-4}$
 $> 100000\ \text{M}\Omega$
 -40 to $+100^\circ\text{C}$
 40/100/21

Ceramic capacitors

selection guide

book 3 part 1a*



*A new handbook for film and variable capacitors is now in preparation and is likely to be issued in the second half of 1985.

Ceramic capacitors, dipped radial

book 3 part 1a

miniature, plate (high-K)

629 Series U_R (d.c.) = 63V (leads length 4mm)

Type No. 629 followed by		Capacitance (pF)	Dimensions (mm)		
0.1" lead pitch version	0.2" lead pitch version		W_{max}	H_{max}	
				0.1" lead pitch version	0.2" lead pitch version
18102	19102	1000*	3.6	5.0	6.3
18222	19222	2200	3.6	5.0	6.3
18472	19472	4700	3.6	5.0	6.3
18103	19103	10 000	4.5	6.0	7.3
18223	19223	22 000	6.2	7.7	9.0

*Maximum capacitor thickness is 2.5 mm for the 1000 pF type; for all other 629 Series types the maximum capacitor thickness is 2.3 mm.

Tolerance on capacitance
Insulation resistance at 20°C
Losses at 1kHz $\tan \delta$
Temperature range
Climatic category (IEC68)

-20 to +80%
 $\geq 1000 M \Omega$
 $\leq 650 \times 10^{-4}$
-10 to +55°C
10/055/21

Body colour: tan
Colour band: green

630 Series U_R (d.c.) = 100V (leads length 4mm)

Type No. 630 followed by		Capacitance (pF)	Dimensions (mm)		
0.1" lead pitch version	0.2" lead pitch version		W_{max}	H_{max}	
				0.1" lead pitch version	0.2" lead pitch version
18181	19181	180*	3.6	5.0	6.3
18221	19221	220**	3.6	5.0	6.3
18271	19271	270	3.6	5.0	6.3
18331	19331	330	3.6	5.0	6.3
18391	19391	390	3.6	5.0	6.3
18471	19471	470	3.6	5.0	6.3
18561	19561	560	3.6	5.0	6.3
18681	19681	680	3.6	5.0	6.3
18821	19821	820	3.6	5.0	6.3
18102	19102	1000	3.9	5.3	6.7
18122	19122	1200	3.9	5.3	6.7
18152	19152	1500	4.5	6.0	7.3
18182	19182	1800	4.5	6.0	7.3
18222	19222	2200	5.1	6.6	7.9
18272	19272	2700	5.1	6.6	7.9
18332	19332	3300	6.2	7.7	9.0
18392	19392	3900	6.2	7.7	9.0
18472	19472	4700	6.2	7.7	9.0

*Capacitor thickness 2.7 mm max.

**Capacitor thickness 2.5 mm max.

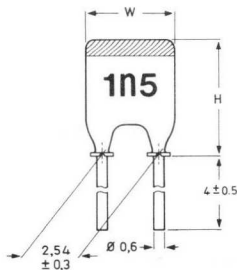
All other types capacitor thickness 2.3 mm max.

Body colour: tan

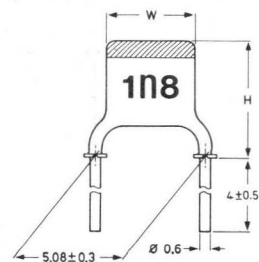
Colour band: yellow

Tolerance on capacitance
Insulation resistance at 20°C
Losses at 1kHz $\tan \delta$
Temperature range
Climatic category (IEC68)

$\pm 10\%$
 $\geq 4000 M \Omega$
 $\leq 350 \times 10^{-4}$
-55 to +85°C
55/085/21



0.1" lead pitch version



0.2" lead pitch version

Ceramic capacitors, dipped radial

miniature, plate (low-K)

book 3 part 1a

682 Series 100V d.c. working (lead length 4 mm, lead pitch 0.1 in.)

683 Series 100V d.c. working (lead length 4 mm, lead pitch 0.2 in.)

Type No.	Capacitance (pF)	Temperature co-efficient	W _{max}	Dimensions (mm)	
				0.1 in. lead pitch version	0.2 in. lead pitch and taped versions
... 09188	1.8*	NP0	3.6	5.0	6.3
... 09228	2.2*	NP0	3.6	5.0	6.3
... 09278	2.7	NP0	3.6	5.0	6.3
... 09338	3.3	NP0	3.6	5.0	6.3
... 09398	3.9	NP0	3.6	5.0	6.3
... 09478	4.7	NP0	3.6	5.0	6.3
... 09568	5.6	NP0	3.6	5.0	6.3
... 09688	6.8	NP0	3.6	5.0	6.3
... 09828	8.2	NP0	3.6	5.0	6.3
... 10109	10	NP0	3.6	5.0	6.3
... 10129	12	NP0	3.6	5.0	6.3
... 10159	15	NP0	3.6	5.0	6.3
... 10189	18	NP0	3.6	5.0	6.3
... 34229	22	N150	3.6	5.0	6.3
... 34279	27	N150	3.6	5.0	6.3
... 34339	33	N150	3.6	5.0	6.3
... 34399	39	N150	3.9	5.3	6.7
... 34479	47	N150	3.9	5.3	6.7
... 34569	56	N150	4.5	6.0	7.3
... 34689	68	N150	4.5	6.0	7.3
... 34829	82	N150	5.1	6.6	7.9
... 34101	100	N150	5.1	6.6	7.9
... 34121	120	N150	6.2	7.7	9.0
... 34151	150	N150	6.2	7.7	9.0
... 58181	180	N750	6.2	7.7	9.0
... 58221	220	N750	6.2	7.7	9.0
... 58271	270	N750	6.2	9.9	11.2
... 58331	330	N750	6.2	9.9	11.2

*Capacitor thickness is 2.5 mm for these types. All other types are 2.3 mm thick (max).

Capacitor body colour: grey

T.C. colour bands -

NP0 = Black

N150 = Orange

N750 = Violet

Capacitance tolerance

1.8 to 8.2 pF ± 0.25pF

10 to 330 pF ± 2%

>10 000 MΩ

Insulation resistance at 20°C

Losses at 1MHz, ≤5V

Temperature range

Climatic category (IEC68)

$\tan \delta \leq 55 \times 10^{-4}$

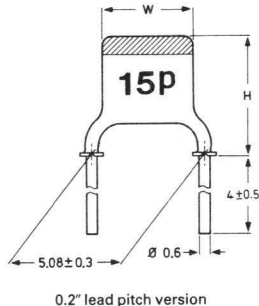
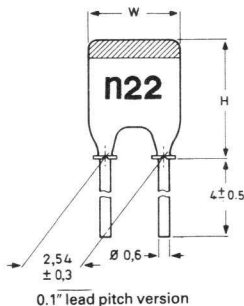
$\tan \delta \leq 15 \times 10^{-4}$

C ≤ 50pF

C > 50pF

-55 to +85°C

55/085/21



Ceramic capacitors, dipped radial

MONO-KAP miniature, monolithic, multilayer book 3 part 1a

CN series

Dielectric material (low-K)	NPO
Capacitance range (E12 series)	10 to 22 000pF
Capacitance tolerance	±5% ; ±10%
Rated d.c. voltages	50V ; 100V
Basic specification	IEC 384-10
Climatic category (IEC 86)	55/125/56

Table 1 Working voltage = 50V d.c.

type number	capacitance range	capacitance tolerance	size
CN15C...J	10 to 560 pF	±5%	15
CN15C...K		±10%	
CN20C...J	680 to 3300 pF	±5%	20
CN20C...K		±10%	
CN30C...J	3900 to 10 000 pF	±5%	30
CN30C...K		±10%	
CN40C...J	12 000 to 22 000 pF	±5%	40
CN40C...K		±10%	

Table 2 Working voltage = 100V d.c.

type number	capacitance range	capacitance tolerance	size
CN15A...J	10 to 220 pF	±5%	15
CN15A...K		±10%	
CN20A...J	270 to 1500 pF	±5%	20
CN20A...K		±10%	
CN30A...J	1800 to 6800 pF	±5%	30
CN30A...K		±10%	
CN40A...J	8200 to 10 000 pF	±5%	40
CN40A...K		±10%	

Tested at 1kHz; 1.0 ± 0.25 Vrms; for values of capacitance less than 100 pF, capacitors are tested at 1 MHz. Reference temperature 25°C.

CW series

Dielectric material (medium-K)	X 7R
Capacitance range (E12 series)	150pF to 1.0 μ F
Capacitance tolerance	±5% ; ±10%
Rated d.c. voltages	50V ; 100V
Basic specification	IEC 384-10
Climatic category (IEC 68)	55/125/56

Table 3 Working voltage = 50V d.c.

type number	capacitance range	capacitance tolerance	size
CW15C...K	150 to 15 000 pF	±10%	15
CW15C...M		±20%	
CW20C...K	10 000 pF	±10%	20
CW20C...M		±20%	
CW20C...K	18 000 pF to 0.1 μ F	±10%	20
CW20C...M		±20%	
CW30C...K	0.1 to 0.33 μ F	±10%	30
CW30C...M		±20%	
CW40C...K	0.39 to 0.68 μ F	±10%	40
CW40C...M		±20%	
CW50C...K	0.82 and 1.0 μ F	±10%	50
CW50C...M		±20%	

Table 4 Working voltage = 100V d.c.

type number	capacitance range	capacitance tolerance	size
CW15A...K	150 to 5600 pF	±10%	15
CW15A...M		±20%	
CW20A...K	6800 to 27 000 pF	±10%	20
CW20A...M		±20%	
CW30A...K	33 000 pF to 0.15 μ F	±10%	30
CW30A...M		±20%	
CW40A...K	0.18 to 0.33 μ F	±10%	40
CW40A...M		±20%	
CW50A...K	0.39 to 0.56 μ F	±10%	50
CW50A...M		±20%	

Tested at 1kHz; 1.0 ± 0.25 Vrms at 25°C

Ceramic capacitors, dipped radial

MONO-KAP miniature, monolithic, multilayer

book 3 part 1a

CZ series

Dielectric material (high-K)	Z5U
Capacitance range (E12 series)	100pF to 4.7 μ F
Capacitance tolerance	$\pm 20\%$; $+80\%$ - 20%
Rated d.c. voltages	50V; 100V
Basic specification	IEC 384-10
Climatic category (IEC 68)	55/085/56

Table 5 Working voltage = 50V d.c.

type number	capacitance range	capacitance tolerance	size
CZ15C...M CZ15C...Z	1000 to 39 000 pF	$\pm 20\%$ $+80\%$, -20%	15
CZ20C...M CZ20C...Z	47 000 pF to 0.22 μ F	$\pm 20\%$ $+80\%$, -20%	20
CZ30C...M CZ30C...Z	0.27 to 1.2 μ F	$\pm 20\%$ $+80\%$, -20%	30
CZ40C...M CZ40C...Z	1.5 to 2.2 μ F	$\pm 20\%$ $+80\%$, -20%	40
CZ50C...M CZ50C...Z	2.7 to 4.7 μ F	$\pm 20\%$ $+80\%$, -20%	50

Table 6 Working voltage = 100V d.c.

type number*	capacitance range	capacitance tolerance	size
CZ15A...M CZ15A...Z	1000 to 18 000 pF	$\pm 20\%$ $+80\%$, -20%	15
CZ20A...M CZ20A...Z	22 000 pF to 0.12 μ F	$\pm 20\%$ $+80\%$, -20%	20
CZ30A...M CZ30A...Z	0.15 to 0.56 μ F	$\pm 20\%$ $+80\%$, -20%	30
CZ40A...M CZ40A...Z	0.68 to 1.2 μ F	$\pm 20\%$ $+80\%$, -20%	40
CZ50A...M CZ50A...Z	1.5 to 2.2 μ F	$\pm 20\%$ $+80\%$, -20%	50

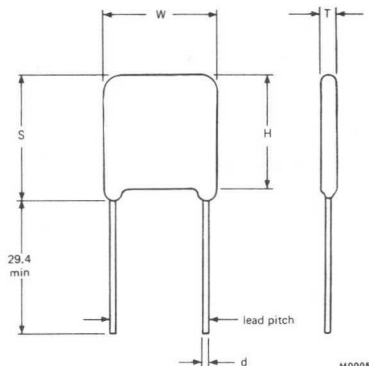
Tested at 1kHz, 0.1 Vrms; at 25°C

MECHANICAL DATA

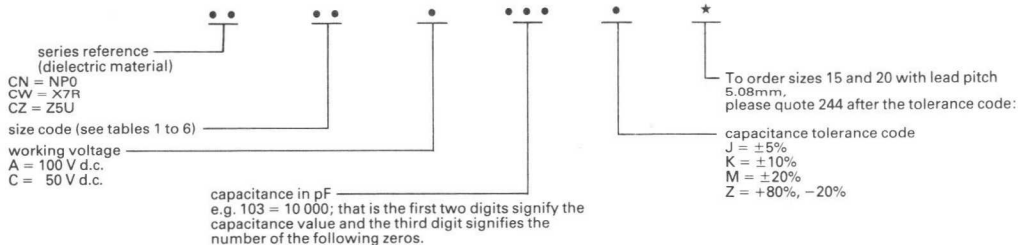
Table 7 MONO-KAP size codes

Size code	H max.	S max.	W max.	T max.	lead pitch (± 0.79)	$\varnothing d$
15	3.81	5.39	3.81	2.54	2.54	0.40
*15	3.81	6.71	3.81	2.54	5.08	0.50
20	5.08	6.66	5.08	3.18	2.54	0.50
*20	5.08	7.37	5.08	3.18	5.08	0.50
30	7.62	9.20	7.62	3.81	5.08	0.50
40	10.16	11.74	10.16	3.81	5.08	0.50
50	12.70	14.28	12.70	5.08	10.16	0.63

Dimensions in mm



COMPOSITION OF TYPE NUMBER



PACKING

MONO-KAP capacitors are supplied loose in multiples of 1000 pieces. They can also be supplied in a radial tape and reel packing in multiples of 5000 pieces.

Ceramic capacitors

MONO-GLASS miniature, monolithic chip axial leads

book 3 part 1a

C40 series

Dielectric material (low-K)	NPO
Capacitance range	10 to 6800 pF
Capacitance tolerance	± 5% ; ± 10%
Rated voltage	50V
Basic specification	EIA RS 198-B
Climatic category (IEC-68)	55/125/56

type number	capacitance range	capacitance tolerance	body length L max. (mm)
C40C...J	10 to 470 pF	±5%	4.32
C40C...K		±10%	
C40C...J	560 to 680 pF	±5%	5.08
C40C...K		±10%	
C40C...J	820 to 1200 pF	±5%	6.35
C40C...K		±10%	
C40C...J	1500 to 4700 pF	±5%	7.62
C40C...K		±10%	
C40C...J	5600 to 6800 pF	±5%	10.16
C40C...K		±10%	

C41 series

Dielectric material (medium-K)	X7R
Capacitance range	100 pF to 220 nF
Capacitance tolerance	± 10% , ± 20%
Rated voltage	50V
Basic specification	EIA RS 198-B
Climatic category (IEC-68)	55/125/56

type number	capacitance range	capacitance tolerance	body length L max. (mm)
C41C...K	100 pF to 470 nF	±10%	4.32
C41C...M		±20%	
C41C...K	18 to 22 nF	±10%	5.08
C41C...M		±20%	
C41C...K	27 to 33 nF	±10%	6.35
C41C...M		±20%	
C41C...K	39 to 120 nF	±10%	7.62
C41C...M		±20%	
C41C...K	150 to 220 nF	±10%	10.16
C41C...M		±20%	

Tested at 1kHz; ±0.25 V_{rms} at 25°C

Ceramic capacitors

MONO-GLASS miniature, monolithic chip axial leads

book 3 part 1a

C43 series

Dielectric material (high-K)	Z5U
Capacitance range	560 pF to 470 nF
Capacitance tolerance	± 20% ; +80% , -20%
Rated voltage	50V
Basic specification	EIA RS 198-B
Climatic category	55/085/56

type number	capacitance range	capacitance tolerance	body length L max. (mm)
C43C...M C43C...Z	560 pF to 27 nF	± 20% +80%, -20%	4.32
C43C...M C43C...Z	33 to 39 nF	± 20% +80%, -20%	5.08
C43C...M C43C...Z	47 to 100 nF	± 20% +80%, -20%	6.35
C43C...M C43C...Z	120 to 270 nF	± 20% +80%, -20%	7.62
C43C...M C43C...Z	330 to 470 nF	± 20% +80%, -20%	10.16

Tested at 1kHz; 0.1Vrms at 25°C

Automatic insertion in a 0.3in (7.62mm) hole pattern

MONO-GLASS capacitors in the C43 (Z5U) series of body length 4.32mm are available for automatic insertion on to a 0.3in

type number	description	body size (mm)	
		L max.	D max.
C43C473MDP	47 nF, ±20%, 50V	4.32	2.54
C43C104MDP	0.1 µF, ±20%, 50V	4.32	3.81
C43D104MDP	0.1 µF, ±20%, 25V	4.32	2.54

Tested at 1kHz; 0.1Vrms at 25°C

MECHANICAL DATA

Table 1 MONO-GLASS; size chart

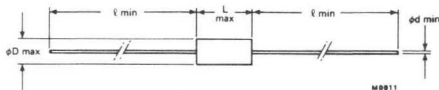
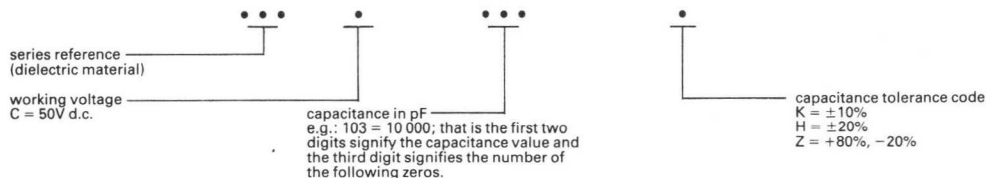
body length L max.	D max.	l min.	d min.
4.32	2.54	30.48	0.51
5.08	2.54	30.48	0.51
6.35	2.54	30.48	0.51
7.62	3.81	30.48	0.51
10.16	3.81	30.48	0.51

Dimensions in mm

PACKING

MONO-GLASS capacitors are banded and packed in reels (5000 per reel).

COMPOSITION OF TYPE NUMBER



Ceramic capacitors

book 3 part 1a

miniature, tubular, axial leads

•561 Series

561 Series – Type 1 U_R (d.c.) = 50V

Type number 2020 561 followed by:

NPO	N220	N750	SL	Nominal capacitance C_{nom} (pF)	Tolerance on C_{nom}
—	—	—	47108	1.0	±20%
—	—	—	47128	1.2	±20%
—	—	—	47158	1.5	±20%
—	—	—	47188	1.8	±20%
—	—	—	48228	2.2	±10%
—	—	—	48278	2.7	±10%
31338	39338	—	48338	3.3	±10%
31398	39398	—	48398	3.9	±10%
31478	39478	—	48478	4.7	±10%
31568	39568	—	48568	5.6	±10%
31668	39688	—	48688	6.8	±10%
31828	39828	45828	48828	8.2	±10%
32109	40109	46109	49109	10	± 5%
32119	40119	46119	49119	11	± 5%
32129	40129	46129	49129	12	± 5%
32139	40139	46139	49139	13	± 5%
32159	40159	46159	49159	15	± 5%
32169	40169	46169	49169	16	± 5%
32189	40189	46189	49189	18	± 5%
32209	40209	46209	49209	20	± 5%
32229	40229	46229	49229	22	± 5%
32249	40249	46249	49249	24	± 5%
32279	40279	46279	49279	27	± 5%
32309	40309	46309	49309	30	± 5%
32339	40339	46339	49339	33	± 5%
32369	40369	46369	49369	36	± 5%
32399	40399	46399	49399	39	± 5%
32439	40439*	46439	49439	43	± 5%
32479*	40479*	46479	49479	47	± 5%
32519*	40519*	46519	49519	51	± 5%
32569*	40569*	46569	49569	56	± 5%
32629*	40629*	46629	49629	62	± 5%
32689*	40689*	46689	49689	68	± 5%
—	40759*	46759	49759	75	± 5%
—	40829*	46829	49829	82	± 5%
—	—	46919*	49919	91	± 5%
—	—	46101*	49101	100	± 5%
—	—	46121*	49121	120	± 5%
—	—	—	49151*	150	± 5%
—	—	—	49181*	180	± 5%

* These capacitors are size 250; all other capacitors are size 125

Temperature Coefficient of Capacitance

NPO = 0 ± 60 ppm per °C
 N220 = -220 ± 60 ppm per °C
 N750 = -750 ± 60 ppm per °C
 SL = $+100$ to -750 ppm per °C

Ceramic capacitors

miniature, tubular, axial leads

book 3 part 1a

561 Series

561 Series – Type 2

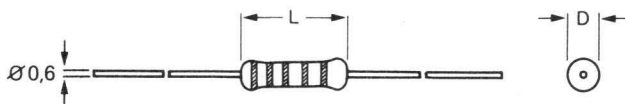
Type number 2020 561 followed by:

± 10%	± 20%	± 30%	Nominal capacitance C_{nom} (pF)	U_R (d.c.) (V)	Temp. char.	Size
50151	—	—	150	50	SB	125
50181	—	—	180	50	SB	125
50221	—	—	220	50	SB	125
50331	—	—	330	50	SB	125
50391	—	—	390	50	SB	125
50471	—	—	470	50	SB	125
50561	—	—	560	50	SB	125
50681	—	—	680	50	SB	125
50821	—	—	820	50	SB	125
50102	—	—	1 000	50	SB	125
—	52102	—	1 000	50	SB	125
50122	—	—	1 200	50	SB	250
—	52122	—	1 200	50	SB	125
50152	—	—	1 500	50	SB	250
—	53152	—	1 500	50	X	125
51152	—	—	1 500	50	V	125
—	53222	—	2 200	50	X	125
51222	—	—	2 200	50	V	125
—	53332	—	3 300	50	X	125
51332	—	—	3 300	50	V	125
—	53472	—	4 700	50	X	125
51472	—	—	4 700	50	V	125
—	54682	—	6 800	25	X	125
—	54103	—	10 000	25	X	125
—	—	57123	15 000	25	X	125
—	—	57223	22 000	25	X	250
—	—	59223	22 000	16	Y	125

Dimensions in mm

MECHANICAL DATA

size	L max.	D max.
125	7.1	2.8
250	9.1	3.0



PACKAGING

561 series capacitors are supplied bandoliered with a tape spacing of 52mm. Those values with a body size of 125 are 5000 pieces per reel; body size 250 are 4000 pieces per reel.

Ceramic capacitors

book 3 part 1a

S.M.D. multilayer chip capacitors

NPO material

Dielectric material	NPO
Capacitance range (E12 series)	0.47 to 10 000pF
Capacitance tolerances ($C \leq 10\text{pF}$, $\pm 0.5\text{pF}$; $\pm 0.25\text{pF}$)	$\pm 5\%$; $\pm 10\%$
Rated voltage	63V
Basic specification	IEC 384-10
Climatic category (IEC-68)	55/125/56

Size	Capacitance Range (pF)	
	loose packed	on 8mm tape
0805	0.47 to 1 000	0.47 to 560
1206	0.47 to 3 300	0.47 to 1 800
1210	47 to 4 700	—
1808	100 to 5 600	—
1812	330 to 5 600	—
2220	470 to 10 000	—

X7R material

Dielectric material	X7R
Capacitance range (E12 series)	180 to 470 000 pF (0.47 μF)
Capacitance tolerance	$\pm 10\%$; $\pm 20\%$
Rated voltage	63V
Basic specification	IEC 384-10
Climatic category (IEC-68)	55/125/56

Size	Capacitance Range (pF)	
	loose packed	on 8mm tape
0805	180 to 22 000	180 to 18 000
1206	680 to 56 000	680 to 56 000
1210	2 200 to 100 000	—
1808	2 200 to 150 000	—
1812	4 700 to 270 000	—
2220	1 200 to 470 000	—

Ceramic capacitors

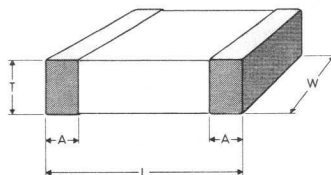
S.M.D. multilayer chip capacitors

book 3 part 1a

Z5U (Y5U) material

Dielectric material	Z5U (Y5U)
Capacitance range	2200 to 1 000 000pF (1 μ F)
Capacitance tolerance	$\pm 20\%$; +80% to -20%
Basic specification	IEC 384-10
Climatic category	+10/085/56

Size	Capacitance Range (pF)	
	loose packed	on 8mm tape
0805	2 200 to 33 000	2 200 to 22 000
1206	10 000 to 100 000	10 000 to 68 000
1210	68 000 to 220 000	—
1808	68 000 to 330 000	—
1812	68 000 to 470 000	—
2220	68 000 to 1 000 000	—



MECHANICAL DATA

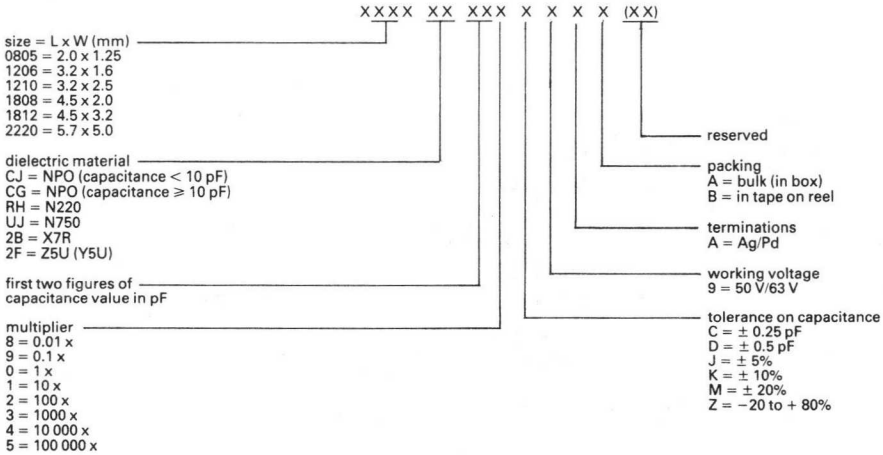
size	L	W	T		A	
			min.	max.	min.	max.
0805	2.0 \pm 0.15	1.25 \pm 0.15	0.51	1.27	0.25	0.75
1206	3.2 \pm 0.15	1.6 \pm 0.15	0.51	1.60	0.3	1.0
1210	3.2 \pm 0.3	2.5 \pm 0.2	0.51	1.90	0.3	1.0
1808	4.5 \pm 0.3	2.0 \pm 0.2	0.51	1.90	0.3	1.0
1812	4.5 \pm 0.3	3.2 \pm 0.3	0.51	1.90	0.3	1.0
2220	5.7 \pm 0.4	5.0 \pm 0.4	0.51	1.90	0.3	1.0

PACKAGING

Capacitors are available either loose packed in 1000 pieces or for part of the 0805 and 1206 sizes on reels of 4000 pieces.

HOW TO ORDER

Order the capacitors by quoting the 15-digit ordering code, which can be constructed as shown below.



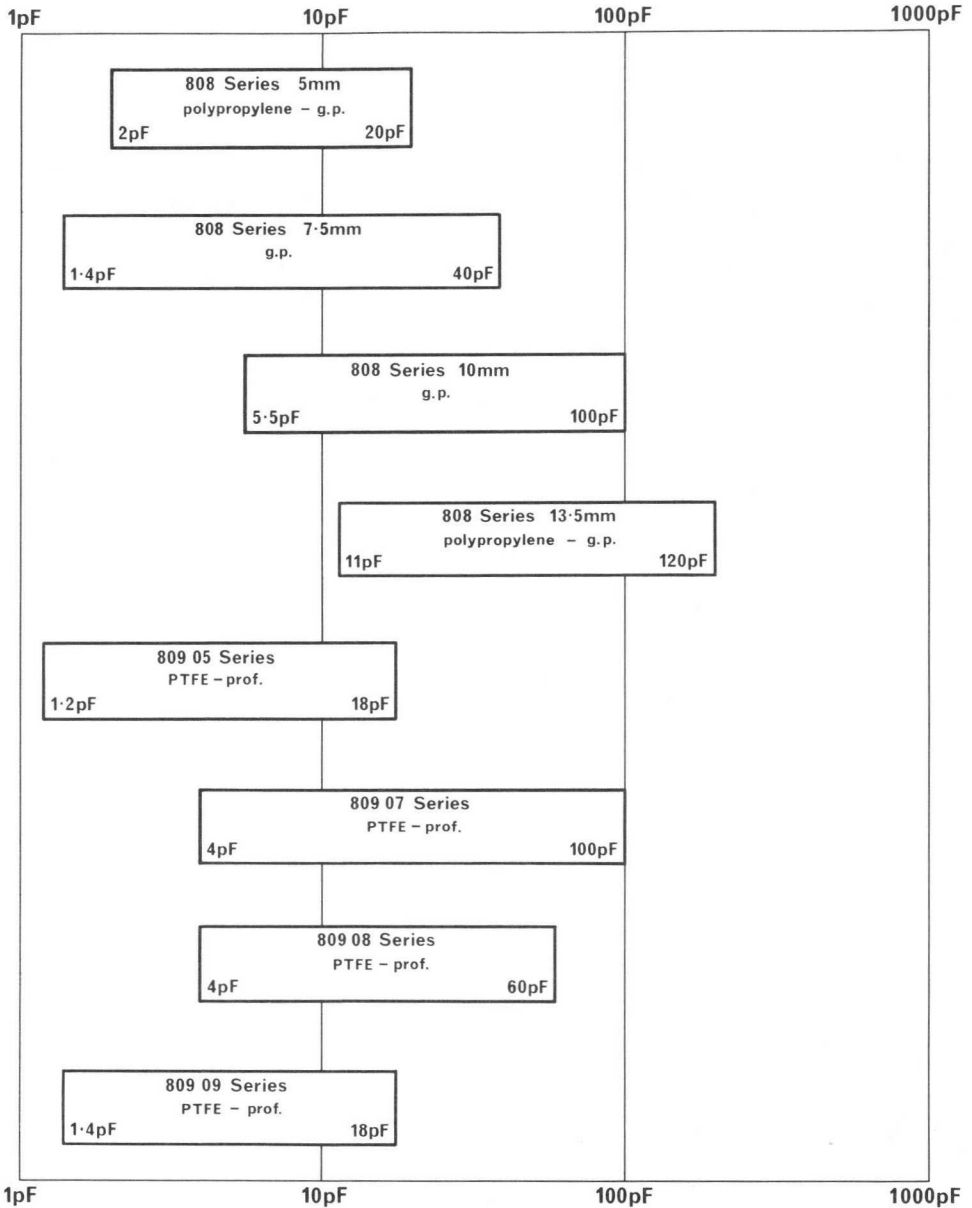
Example

8000 capacitors, 150 pF, ± 5%, NPO dielectric, size 1206, in tape, should be ordered as:
 8000 x 1206 CG 151 J 9 A B.

Variable capacitors

selection guide

book 3 part 1a*



*A new handbook for film and variable capacitors is now in preparation and is likely to be available in the second half of 1985

Variable capacitors

film dielectric trimmers, miniature, general purpose

book 3 part 1a

808 Series (7.5mm dia.)

Type No.	Capacitance swing (pF)	Minimum capacitance (pF)	Rated voltage (V_{dc})	maximum dimensions (mm)		
				Length	Width	Height above board
808 11558	4.1	1.4	250	8.8	8	10
808 11109	7	2	250	8.8	8	10
808 11159	13	2	250	8.8	8	10
808 11229	20	2	250	8.8	8	10
808 11279	25	2	250	8.8	8	10
808 11409	37	3	250	8.8	8	10

808 Series (5.0mm dia.)

808 23109	8	2	150	7	5.5	6.8
808 23159	12.5	2.5	150	7	5.5	8.8
808 23209	16	4	150	7	5.5	8.8

808 Series (10.0mm dia.)

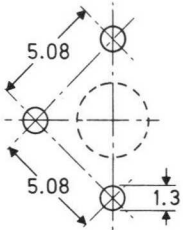
808 32409	34.5	5.5	250	11.5	10.6	11
808 32659	59.5	5.5	250	11.5	10.6	11
808 32809	74	6	250	11.5	10.6	11
808 32101	93	7	250	11.5	10.6	11

808 Series (13.5mm dia.)

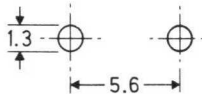
808 41121	108	12	150	14.9	14.1	11
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Climatic category (IEC68)
40/070/21, 40/085/21 depending on type

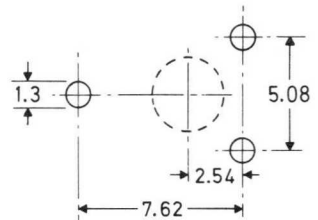
PIERCING DIAGRAMS FOR PWB MOUNTING



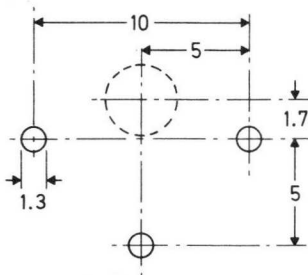
808 11... SERIES



808 23... SERIES



808 32... SERIES



808 41... SERIES

Variable capacitors

film dielectric trimmers, miniature, professional

book 3 part 1a

809 05 Series

Type No.	Capacitance swing (pF)	Minimum capacitance (pF)	Rated voltage (V_{dc})	maximum dimensions (mm)		
				Length	Width	Height above board
809 05001	2.3	1.2	300	7.4	6.7	9
809 05002	8.2	1.8	300	7.4	6.7	9
809 05003	16	2	300	7.4	6.7	9

809 07 Series

Type No.	Capacitance swing (pF)	Minimum capacitance (pF)	Rated voltage (V_{dc})	maximum dimensions (mm)		
				Length	Width	Height above board
809 07008	36	4	200	14	11.5	9.2
809 07011	55	5	200	14	11.5	9.2
809 07013	74	6	200	14	11.5	9.2
809 07015	93	7	200	14	11.5	9.2

809 08 Series

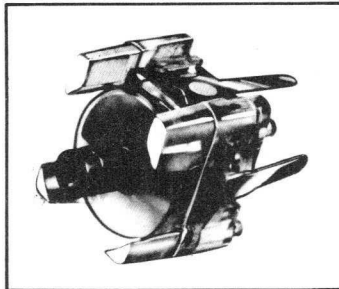
Type No.	Capacitance swing (pF)	Minimum capacitance (pF)	Rated voltage (V_{dc})	maximum dimensions (mm)		
				Length	Width	Height above board
809 08002	36	4	300	10.9	10.5	11
809 08003	55	5	300	10.9	10.5	11

809 09 Series

Type No.	Capacitance swing (pF)	Minimum capacitance (pF)	Rated voltage (V_{dc})	maximum dimensions (mm)		
				Length	Width	Height above board
809 09001	4.1	1.4	300	8.8	8	10
809 09002	7	2	300	8.8	8	10
809 09003	16	2	300	8.8	8	10

Category temperature range -40 to $+125^{\circ}\text{C}$

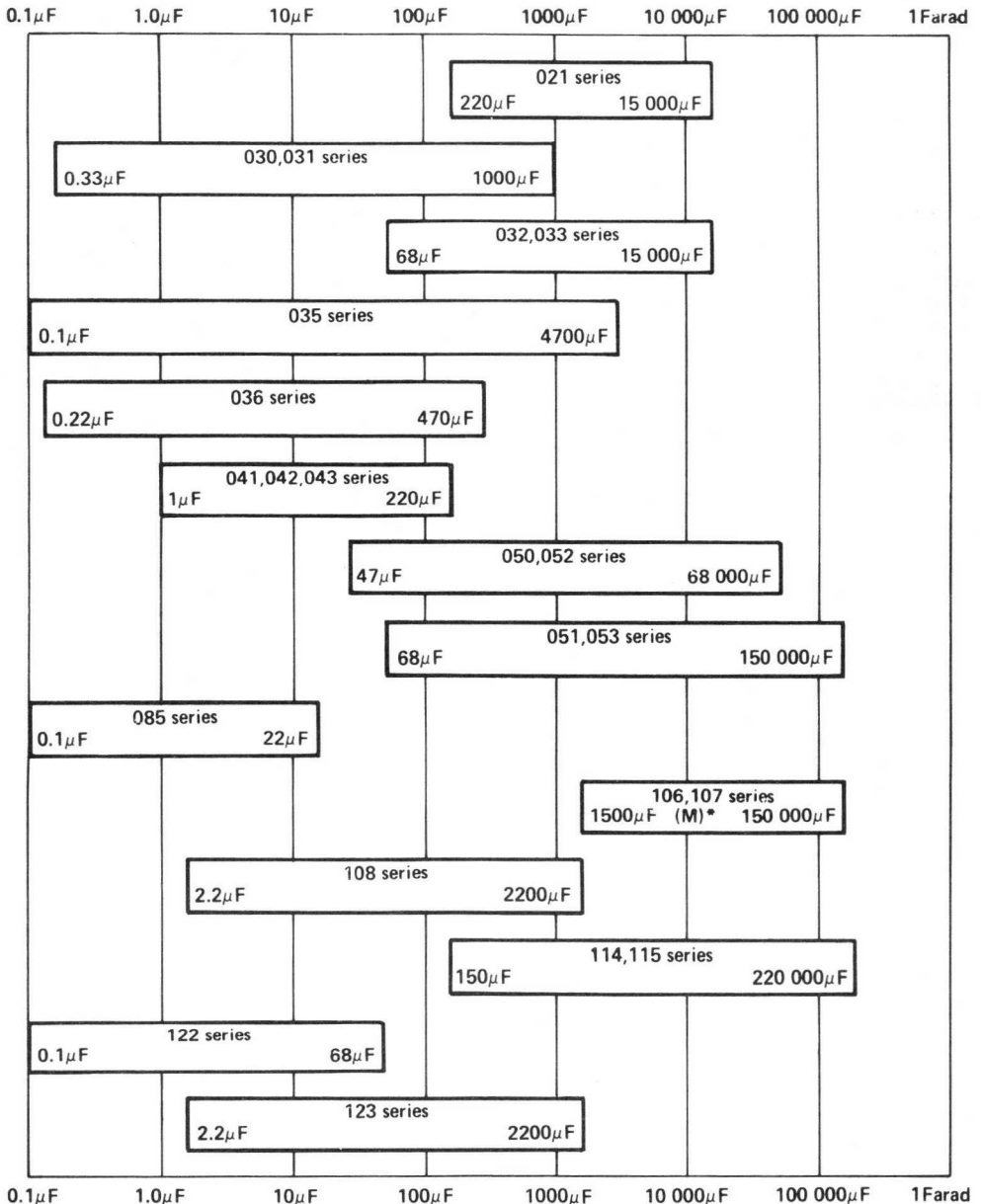
For further details and piercing diagram for printed wiring boards see published data



Electrolytic capacitors

book part 1b

selection guide



*M=maintenance types

Electrolytic capacitors

long life, small, axial leads

book 3 part 1b

021 Series

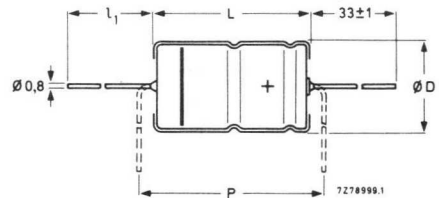
Type No.	Rated Voltage (U_N) (V_{ac})	Capacitance (μF)	Case size
021 14152	10	1500	00
021 14222	10	2200	01
021 14332	10	3300	01
021 14472	10	4700	02
021 14682	10	6800	03
021 14103	10	10 000	04
021 14153	10	15 000	05
021 15102	16	1000	00
021 15152	16	1500	01
021 15222	16	2200	01
021 15332	16	3300	02
021 15472	16	4700	03
021 15682	16	6800	04
021 15103	16	10 000	05
021 16681	25	680	00
021 16102	25	1000	01
021 16152	25	1500	01
021 16222	25	2200	02

Type No.	Rated Voltage (U_N) (V_{ac})	Capacitance (μF)	Case size
021 16332	25	3300	03
021 16472	25	4700	04
021 16682	25	6800	05
021 17471	40	470	00
021 17681	40	680	01
021 17102	40	1000	01
021 17152	40	1500	02
021 17222	40	2200	03
021 17332	40	3300	04
021 17472	40	4700	05
021 18221	63	220	00
021 18331	63	330	01
021 18471	63	470	01
021 18681	63	680	02
021 18102	63	1000	03
021 18152	63	1500	04
021 18222	63	2200	05

Tolerance on capacitance $\pm 20\%$
 Temperature range -55 to $+85^\circ$
 Basic specification: IEC384-4 long life grade
 Detailed specification DIN 41316
 Climatic category (IEC68) 55/085/56

021 Series axial leads

case size	D_{max}	L_{max}	l_{1min}	P_{min}
00	10.5	30.5	54	35.0
01	13.0	30.5	54	35.0
02	15.5	30.5	54	35.0
03	18.5	30.5	54	35.0
04	18.5	41.5	33	45.0
05	21.5	41.5	33	45.0



axial leads

Dimensions in mm

NOTE: Non-solid electrolytic capacitors may contain chemicals which can be regarded as hazardous if incorrectly handled. Caution is necessary should the outer case be fractured.

PACKING

Capacitors are supplied loose in boxes of 200 pieces for case sizes 00 to 03 and 100 pieces for case sizes 04 to 05.

Electrolytic capacitors

book 3 part 1b

long life, miniature, axial leads

030, 031 Series

Type No.		Rated Voltage (U _R) (V _{dc})	Capacitance (μF)	Case size
bandoliered (on reels)	bandoliered (in boxes)			
030 23109	030 33109	6.3	10	1
030 23339	030 33339	6.3	33	2
030 23689	030 33689	6.3	68	2
030 23151	030 33151	6.3	150	3
031 23471	031 33471	6.3	470	5
031 23681	031 33681	6.3	680	6
031 23102	031 33102	6.3	1000	7
030 24688	030 34688	10	6.8	1
030 24229	030 34229	10	22	2
030 24479	030 34479	10	47	2
030 24101	030 34101	10	100	3
030 24221	030 34221	10	220	5a
031 24221	031 34221	10	220	4
031 24331	031 34331	10	330	5
031 24471	031 34471	10	470	6
031 24681	031 34681	10	680	7
030 25478	030 35478	16	4.7	1
030 25159	030 35159	16	15	2
030 25339	030 35339	16	33	2
030 25689	030 35689	16	68	3
030 25151	030 35151	16	150	5a
031 25151	031 35151	16	150	4
031 25221	031 35221	16	220	5
031 25331	031 35331	16	330	6
031 25471	031 35471	16	470	7
030 26338	030 36338	25	3.3	1
030 26109	030 36109	25	10	2
030 26229	030 36229	25	22	2
030 26479	030 36479	25	47	3
030 26101	030 36101	25	100	5a
031 26101	031 36101	25	100	4
031 26151	031 36151	25	150	5
031 26221	031 36221	25	220	6
031 26331	031 36331	25	330	7

Packing quantities and preferred packing

case size	quantity	
	reel	box
1	4000	1000
2	3000	1000
3	1000	1000
5a	500	500
4	1000	1000
5	500	500
6	500	500
7	500	500

Sizes 1 to 4 reel packing preferred
 Sizes 5a to 7 box packing preferred

Type No.		Rated Voltage (U _R) (V _{dc})	Capacitance (μF)	Case size
bandoliered (on reels)	bandoliered (in boxes)			
030 27228	030 37228	40	2.2	1
030 27688	030 37688	40	6.8	2
030 27109	030 37109	40	10	2
030 27159	030 37159	40	15	2
030 27229	030 37229	40	22	3
030 27339	030 37339	40	33	3
030 27479	030 37479	40	47	5a
031 27479	031 37479	40	47	4
031 27101	031 37101	40	100	5
031 27151	031 37151	40	150	6
031 27221	031 37221	40	220	7
030 28337	030 38337	63	0.33	2
030 28477	030 38477	63	0.47	2
030 28687	030 38687	63	0.68	2
030 28108	030 38108	63	1.0	2
030 28158	030 38158	63	1.5	2
030 28228	030 38228	63	2.2	2
030 28338	030 38338	63	3.3	2
030 28478	030 38478	63	4.7	2
030 28688	030 38688	63	6.8	2
030 28109	030 38109	63	10	3
030 28159	030 38159	63	15	3
030 28229	030 38229	63	22	5a
031 28229	031 38229	63	22	4
031 28479	031 38479	63	47	5
031 28689	031 38689	63	68	6
031 28101	031 38101	63	100	7
030 29108	030 39108	100	1.0	2
030 29228	030 39228	100	2.2	2
030 29338	030 39338	100	3.3	2
030 29478	030 39478	100	4.7	3
030 29688	030 39688	100	6.8	3
030 29109	030 39109	100	10	5a
031 29109	031 39109	100	10	4
031 29229	031 39229	100	22	5
031 29339	031 39339	100	33	6
031 29479	031 39479	100	47	7

Tolerance on capacitance -10 to +50%
 Temperature range -55 to +85°C
 Basic specification: IEC384-4 long life grade*
 Detailed specification
 U_R = 6.3 to 63V DIN 41316
 U_R = 100V DIN 41332
 Climatic category (IEC68) 55/085/56

*Case size 1 is general purpose grade.

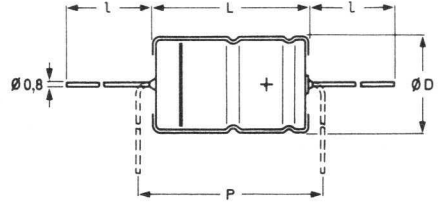
Electrolytic capacitors

long life, miniature, axial leads (cont.) book 3 part 1b

030, 031 Series

Table 1

Case Size	Dimensions (mm)			
	D max	L max	P min	d
1	3.5	11.0	15	0.6
2	5.0	10.5	15	0.6
3	6.3	10.5	15	0.6
5a	8.5	11.5	15	0.6
4	6.9	18.5	25	0.8
5	8.5	18.5	25	0.8
6	10.5	18.5	25	0.8
7	10.5	25.0	30	0.8



lead length l depends on bandoliering format
(see published data)

NOTE:

Non-solid electrolyte capacitors may contain chemicals which can be regarded as hazardous if incorrectly handled. Caution is necessary should the outer case be fractured.

Electrolytic capacitors

long life, small, axial leads

book 3 part 1b

032, 033 Series

Type Number	Rated voltage (U_R) (Vdc)	Capacitance (μ F)	Case size	max. ripple current at 100Hz and 85°C (mA)
Axial leads				
032 13152	6.3	1500	00	450
032 13222	6.3	2200	01	610
032 13332	6.3	3300	02	790
032 13472	6.3	4700	03	1000
033 13682	6.3	6800	04	1280
033 13103	6.3	10 000	05	1570
033 13153	6.3	15 000	05	1600
032 14102	10	1000	00	430
032 14152	10	1500	01	570
032 14222	10	2200	02	740
032 14332	10	3300	03	950
033 14472	10	4700	04	1220
033 14682	10	6800	05	1500
033 14103	10	10 000	05	1520
032 15681	16	680	00	400
032 15102	16	1000	01	550
032 15152	16	1500	02	680
032 15222	16	2200	03	880
033 15332	16	3300	04	1160
033 15472	16	4700	05	1430
033 15682	16	6800	05	1460
032 16471	25	470	00	360
032 16681	25	680	01	500
032 16102	25	1000	02	660
032 16152	25	1500	03	810
033 16222	25	2200	04	1060
033 16332	25	3300	05	1340
033 16472	25	4700	05	1370
032 17221	40	220	00	260
032 17331	40	330	01	370
032 17471	40	470	01	440
032 17681	40	680	02	580
032 17102	40	1000	03	780
033 17152	40	1500	04	970
033 17222	40	2200	05	1220
033 17332	40	3300	05	1284
032 18151	63	150	00	260
032 18221	63	220	01	350
032 18331	63	330	02	480
032 18471	63	470	02	570
032 18681	63	680	03	770
033 18102	63	1000	05	1140
033 18152	63	1500	05	1170

Tolerance on capacitance - 10 to +50%
Temperature 40 - to +85°C
Basic specifications IEC 384-4 long-life grade

DIN41316 (6.3 to 63V versions) DIN41332 (100V versions)
Climatic category (IEC68) 40/085/56

Electrolytic capacitors

general purpose long life, small, axial leads (cont.)

book 3 part 1b

032/033 Series, axial leads

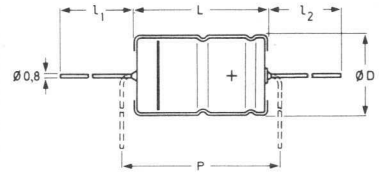
Type Number Axial leads	Rated voltage (U_R) (Vdc)	Capacitance (μ F)	Case size	max. ripple current at 100Hz and 85°C (mA)
032 19689	100	68	00	130
032 19101	100	100	01	190
032 19151	100	150	02	250
032 19221	100	220	03	330
033 19331	100	330	04	460
033 19471	100	470	05	600
033 19681	100	680	05	650

Tolerance on capacitance -10 to +50%
Temperature -40 to +85°C
Basic specifications IEC 384-4 long-life grade

DIN41316 (6.3 to 63V versions) DIN41332 (100V versions)
Climatic category (IEC68) 40/085/56

case size	D_{max}	L_{max}	l_{1min}	l_{2min}	P_{min}
00	10.5	30.5	54	32	35
01	13.0	30.5	54	32	35
02	15.5	30.5	54	32	35
03	18.5	30.5	54 </td <td>32</td> <td>35</td>	32	35
04	18.5	41.5	33	32	45
05	21.5	41.5	33	32	45

dimensions in mm



NOTE: Non-solid electrolytic capacitors may contain chemicals which can be regarded as hazardous if incorrectly handled. Caution is necessary should the outer case be fractured.

PACKING

Capacitors are supplied loose in boxes of 200 pieces for case sizes 00 to 03 and 100 pieces for case sizes 04 to 05.

Electrolytic capacitors

general purpose, miniature and small, single ended

book 3 part 1b

035 series

Type Number 035 followed by		Rated Voltage (U_R) (V_{dc})	Nominal Capacitance (μF)	case size
style 1	tape packaged			
53151	23151	6.3	150	12
53331	23331	6.3	330	13
53681	-	6.3	680	15
53102	-	6.3	1000	16
53152	-	6.3	1500	17
53222	-	6.3	2200	18
53332	-	6.3	3300	19
53472	-	6.3	4700	20
54479	24479	10	47	11
54101	24101	10	100	12
54221	24221	10	220	13
54331	-	10	330	14
54471	-	10	470	15
54681	-	10	680	16
54102	-	10	1000	17
54152	-	10	1500	18
55339	25339	16	33	11
55689	25689	16	68	12
55151	25151	16	150	13
55221	-	16	220	14
55331	-	16	330	15
55471	-	16	470	16
55681	-	16	680	17
55102	-	16	1000	18
55152	-	16	1500	19
55222	-	16	2200	19
55332	-	16	3300	20
56479	26479	25	47	12
56101	26101	25	100	13
56151	-	25	150	14
56221	-	25	220	15
56331	-	25	330	16
56471	-	25	470	17
56681	-	25	680	18
56102	-	25	1000	19
56152	-	25	1500	20
90003	90034	35	22	11
90059	-	35	100	14
90006	-	35	1000	19
57159	27159	40	15	11
57229	27229	40	22	12
57339	27339	40	33	12
57689	27689	40	68	13
57151	-	40	150	15

Type Number 035 followed by		Rated Voltage (U_R) (V_{dc})	Nominal Capacitance (μF)	case size
style 1	tape packaged			
57221	-	40	220	16
57331	-	40	330	17
57471	-	40	470	18
57681	-	40	680	19
90008	90035	50	10	11
90012	90036	50	22	12
90015	90037	50	47	13
90017	-	50	68	14
90019	-	50	100	15
90022	-	50	150	16
90024	-	50	220	17
90026	-	50	330	18
90028	-	50	680	19
90031	-	50	1000	20
58107	28107	63	0.1	11
58157	28157	63	0.15	11
58227	28227	63	0.22	11
58337	28337	63	0.33	11
58477	28477	63	0.47	11
58687	28687	63	0.68	11
58108	28108	63	1.0	11
58158	28158	63	1.5	11
58228	28228	63	2.2	11
58338	28338	63	3.3	11
58478	28478	63	4.7	11
58688	28688	63	6.8	11
58109	28109	63	10	12
58159	28159	63	15	12
58229	28229	63	22	13
58339	28339	63	33	13
58479	-	63	47	14
58689	-	63	68	15
58101	-	63	100	16
58151	-	63	150	17
58221	-	63	220	18
58331	-	63	330	19
58471	-	63	470	19
58681	-	63	680	20
59227	29227	100	0.22	11
59477	29477	100	0.47	11
59108	29108	100	1.0	11
59158	29158	100	1.5	11
59228	29228	100	2.2	11
59338	29338	100	3.3	11
59478	29478	100	4.7	12
59688	29688	100	6.8	12

100V range continues on next page.

Electrolytic capacitors

general purpose, miniature and small, single ended (cont.)

book 3 part 1b

Type Number 035 followed by		Rated Voltage (U_R) (V_{dc})	Nominal Capacitance (μF)	case size
style 1	tape packaged			
59109	29109	100	10	13
59159	29159	100	15	13
59229	-	100	22	14
59339	-	100	33	15
59479	-	100	47	16

Type Number 035 followed by		Rated Voltage (U_R) (V_{dc})	Nominal Capacitance (μF)	case size
style 1	tape packaged			
59689	-	100	68	17
59101	-	100	100	18
59151	-	100	150	18
59221	-	100	220	19
59331	-	100	330	20

Tolerance on nominal capacitance $\pm 20\%$
 Climatic category (IEC68) 40/085/56
 Basic specifications IEC 384-4 G.P. grade
 DIN 41332

Table 1

Case Size	dimensions (mm)			
	d	D max.	L max.	P
11	0.5	5.5	12.0	2.0
12	0.6	6.5	12.0	2.5
13	0.6	8.5	12.5	3.5
14	0.6	10.5	12.5	5.0
15	0.6	10.5	17.0	5.0
16	0.6	10.5	21.0	5.0
17	0.6	13.0	21.0	5.0
18	0.6	13.0	26.0	5.0
19	0.8	16.5	26.0	7.5
20	0.8	16.5	32.0	7.5

± 0.5

Table 2

	Symbol	Case size	Tol.
Pitch of component	P	12.7	± 1.0
Feed-hole pitch	P_0	12.7	$\pm 0.2^*$
Hole centre to lead	P_1	3.85	± 0.5
Feed hole centre to component centre	P_2	6.35	± 1.0
Lead-to-lead distance	F	5.0	$\pm 0.6/-0$
Tape width	W	18.0	± 0.5
Hole position	W_1	9.0	± 0.5
Height of component from tape centre	H	18.0	$\pm 1.5/-0$
Lead-wire clinch height	H_0	16.0	± 0.5
Feed-hole diameter	D_0	4.0	± 0.2

*Cumulative pitch error: $\pm 1\text{mm}/20$ pitches

PACKING

Capacitors of style 1 are supplied in boxes in the quantities given in Table 3. Case sizes 11 to 13 are also available on tape on reels in the quantities given in Table 3.

NOTE: Non-solid electrolytic capacitors may contain chemicals which can be regarded as hazardous if incorrectly handled. Caution is necessary should the outer case be fractured.

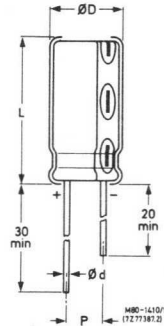


Fig. 1. Style 1; see Table 1 for dimensions d, D, L and P

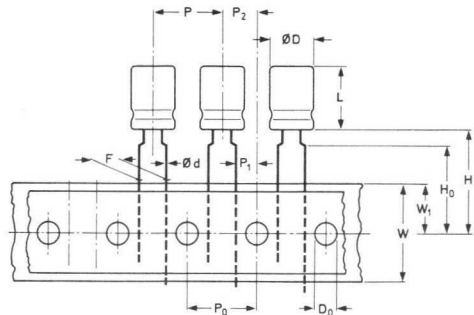


Fig. 2 Tape packaging. See Table 1 for dimensions of L and D

Table 3

Case size	style 1	tape packaged
11	1000	1000
12	1000	1000
13	1000	500
14	1000	
15	500	
16	500	
17	200	
18	200	
19	200	
20	200	

Electrolytic capacitors

long life, miniature, single ended

book 3 part 1b

● 036 Series

Type Number	Rated Voltage	Nominal Capacitance	Case Size
036 23101	6.3	100	11
036 23331	6.3	330	13
036 24479	10	47	11
036 24689	10	68	11
036 24151	10	150	11
036 24221	10	220	13
036 24471	10	470	13
036 25339	16	33	11
036 25101	16	100	11
036 25151	16	150	13
036 25331	16	330	13
036 26689	25	68	11
036 26101	25	100	13
036 26221	25	220	13
036 90016	35	22	11
036 90097	35	47	11
036 90102	35	150	13

Type Number	Rated Voltage	Nominal Capacitance	Case Size
036 27159	40	15	11
036 27689	40	68	13
036 90017	50	10	11
036 90107	50	33	11
036 90019	50	47	13
036 90112	50	100	13
036 28227	63	0.22	11
036 28337	63	0.33	11
036 28447	63	0.47	11
036 28687	63	0.68	11
036 28108	63	1.0	11
036 28158	63	1.5	11
036 28228	63	2.2	11
036 28338	63	3.3	11
036 28478	63	4.7	11
036 28688	63	6.8	11
036 28109	63	10	11
036 28229	63	22	11
036 28339	63	33	13
036 28689	63	68	13

Tolerance on capacitance $\pm 20\%$
 Climatic category (IEC68) 55/085/56
 Basic specification IEC 384-4, long life grade

Table 1

Symbol	Case size		Tol.	
	11	13		
Body diameter	D	5.5	8.7	max
Body height	L	12.0	12.0	max
Lead-wire diameter	d	0.5	0.6	± 0.5
Pitch of component	P	12.7	12.7	± 1.0
Feed-hole pitch	P ₀	12.7	12.7	$\pm 0.2^*$
Hole centre to lead	P ₁	3.85	3.85	± 0.5
Feed hole centre to component centre	P ₂	6.35	6.35	± 0.7
Lead-to-lead distance	F	5.0	5.0	$\pm 0.6/-0$
Tape width	W	18.0	18.0	± 0.5
Hole position	W ₁	9.0	9.0	± 0.5
Height of component from tape centre	H	18.0	18.0	$\pm 1.5/-0$
Lead-wire clinch height	H ₀	16.0	—	± 1.5
Feed-hole diameter	D ₀	4.0	4.0	± 0.2

*Cumulative pitch error: $\pm 1\text{mm}/20$ pitches

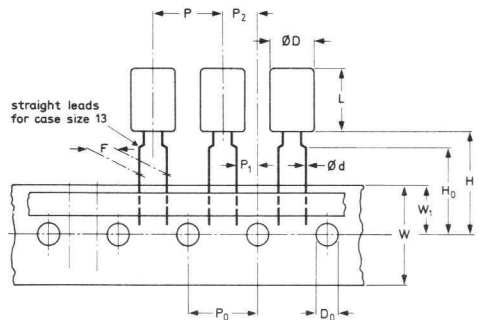


Fig. 1 Tape packaging. See table 1.

PACKING

Capacitors are supplied bandoliered on reels of 1000 for case size 11 or 500 pieces for case size 13.

NOTE: Non-solid electrolytic capacitors may contain chemicals which can be regarded as hazardous if incorrectly handled. Caution is necessary should the outer case be fractured.

Electrolytic capacitors

long life, miniature,
high voltage, axial leads

book 3 part 1b

041/042/043 Series

Type number		Rated Voltage (U_R) (V_{dc})	Capacitance (μF)	case size
axial style 1 bandoliered (in boxes)	axial style 2 (loose packed)			
041 31478	–	160	4.7	4
041 31109	–	160	10	5
041 31229	–	160	22	7
–	042 11229	160	22	00
–	042 11339	160	33	01
–	042 11479	160	47	02
–	042 11689	160	68	03
–	042 11101	160	100	03
–	043 11151	160	150	04
–	043 11221	160	220	05
041 33228	–	250	2.2	4
041 33478	–	250	4.7	5
041 33109	–	250	10	7
–	042 13109	250	10	00
–	042 13159	250	15	01
–	042 13229	250	22	01
–	042 13339	250	33	02
–	042 13479	250	47	03
–	043 13689	250	68	04
–	043 13101	250	100	05

Type number		Rated Voltage (U_R) (V_{dc})	Capacitance (μF)	case size
axial style 1 bandoliered (in boxes)	axial style 2 (loose packed)			
041 35478	–	350	4.7	6
–	042 15688	350	6.8	00
–	042 15109	350	10	01
–	042 15159	350	15	01
–	042 15229	350	22	02
–	042 15339	350	33	03
–	043 15479	350	47	04
–	043 15689	350	68	05
–	–	–	–	–
–	–	–	–	–
041 38108	–	385	1.0	4
041 38228	–	385	2.2	5
041 38478	–	385	4.7	7
–	042 18688	385	6.8	00
–	042 18109	385	10	01
–	042 18159	385	15	02
–	042 18229	385	22	03
–	043 18339	385	33	04
–	043 18479	385	47	04
–	043 18689	385	68	05

Tolerance on capacitance –10 to +50%
 Temperature range –40 to +85°C
 Climatic category (IEC68) 40/085/56
 Basic specification IEC384-4, long life grade

NOTE: Non-solid electrolyte capacitors may contain chemicals which can be regarded as hazardous if incorrectly handled. Caution is necessary should the outer case be fractured.

Electrolytic capacitors

long life, miniature, high voltage, axial leads (cont.)

book 3 part 1b

041 Series axial leads, style 1

case size	D_{max}	L_{max}	P_{min}
4	6.9	18.5	25
5	8.5	18.5	25
6	10.5	18.5	25
7	10.5	25	30

dimensions in mm

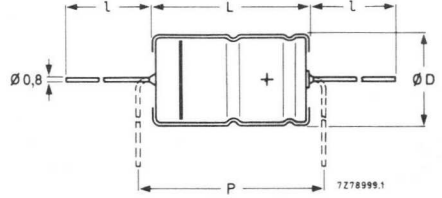
042/043 Series axial leads, style 2

case size	D_{max}	L_{max}	P_{min}	l_1
00	10.5	30.5	35	55 ± 1
01	13.0	30.5	35	55 ± 1
02	15.5	30.5	35	55 ± 1
03	18.5	30.5	35	55 ± 1
04	18.5	41.5	45	34 ± 1
05	21.5	41.5	45	34 ± 1

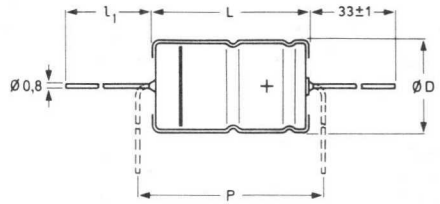
dimensions in mm

Packing quantities

case size	Axial	
	bandoliered in boxes	loose packed
4	1000	-
5	500	-
6	500	-
7	500	-
00	-	200
01	-	200
02	-	200
03	-	200
04	-	100
05	-	100



axial leads, style 1
lead length depends on bandoliering format
(see published data)



axial leads, style 2

Electrolytic capacitors

industrial, large, solder terminals or p.w. pins  book 3 part 1b

050 Series

solder-tag version	Type number:		Rated voltage (U_R) (V_{dc})	Capacitance (μF)	Max. r.m.s. ripple current at 100Hz and 85°C (A)	case size
	printed-wiring version case size 6*	printed-wiring version				
050 14472	-	050 54472	10	4 700	2.4	1
050 14682	-	050 54682	10	6 800	3.2	2
050 14103	-	050 54103	10	10 000	3.8	3
050 14153	-	050 54153	10	15 000	4.1	4
050 14223	-	050 54223	10	22 000	5.0	5
-	050 44223	-	10	22 000	4.2	6
050 14333	-	050 54333	10	33 000	5.0	7
050 14473	-	050 54473	10	47 000	6.8	8
050 14683	-	050 54683	10	68 000	9.2	9
050 15332	-	050 55332	16	3 300	2.4	1
050 15472	-	050 55472	16	4 700	3.1	2
050 15682	-	050 55682	16	6 800	3.7	3
050 15103	-	050 55103	16	10 000	4.1	4
050 15153	-	050 55153	16	15 000	5.0	5
-	050 45153	-	16	15 000	4.2	6
050 15223	-	050 55223	16	22 000	5.0	7
050 15333	-	050 55333	16	33 000	6.7	8
050 15473	-	050 55473	16	47 000	9.1	9
050 16222	-	050 56222	25	2 200	2.3	1
050 16332	-	050 56332	25	3 300	3.1	2
050 16472	-	050 56472	25	4 700	3.7	3
050 16682	-	050 56682	25	6 800	4.1	4
050 16103	-	050 56103	25	10 000	5.0	5
-	050 46103	-	25	10 000	4.2	6
050 16153	-	050 56153	25	15 000	5.0	7
050 16223	-	050 56223	25	22 000	6.8	8
050 16333	-	050 56333	25	33 000	9.2	9
050 17152	-	050 57152	40	1 500	2.0	1
050 17222	-	050 57222	40	2 200	2.7	2
050 17332	-	050 57332	40	3 300	3.3	3
050 17472	-	050 57472	40	4 700	3.8	4
050 17682	-	050 57682	40	6 800	4.7	5
-	050 47682	-	40	6 800	4.1	6
050 17103	-	050 57103	40	10 000	4.9	7
050 17153	-	050 57153	40	15 000	6.6	8
050 17223	-	050 57223	40	22 000	9.0	9
050 18102	-	050 58102	63	1 000	1.8	1
050 18152	-	050 58152	63	1 500	2.5	2
050 18222	-	050 58222	63	2 200	3.1	3
050 18332	-	050 58332	63	3 300	3.6	4
050 18472	-	050 58472	63	4 700	4.4	5
-	050 48472	-	63	4 700	3.8	6
050 18682	-	050 58682	63	6 800	4.7	7
050 18103	-	050 58103	63	10 000	6.2	8
050 18153	-	050 58153	63	15 000	8.5	9

*Not available in solder tag version.

Tolerance on capacitance -10 to +30%
 Temperature range -40 to +85°C
 Basic specification IEC384-4 long life grade
 DIN 41240

Dimensional specification DIN41238
 Climatic category (IEC68) 40/085/56
 Approved to CECC 30301-033

Electrolytic capacitors

industrial, large, solder terminals or p.w. pins E (cont.)

book 3 part 1b

050/052 Series

Type number:			Rated voltage (U_n) (V_{dc})	Capacitance (μF)	Max. r.m.s. ripple current at 100Hz and 85°C (A)	case size
solder-tag version	printed- wiring version case size 6*	printed- wiring version				
050 19471	–	050 59471	100	470	1.2	1
050 19681	–	050 59681	100	680	1.7	2
050 19102	–	050 59102	100	1 000	2.2	3
050 19152	–	050 59152	100	1 500	2.6	4
050 19222	–	050 59222	100	2 200	3.2	5
–	050 49222	–	100	2 200	3.0	6
050 19332	–	050 59332	100	3 300	3.6	7
050 19472	–	050 59472	100	4 700	5.0	8
050 19682	–	050 59682	100	6 800	6.9	9
052 13101	–	052 53101	250	100	0.6	1
052 13151	–	052 53151	250	150	0.8	2
052 13221	–	052 53221	250	220	1.0	3
052 13331	–	052 53331	250	330	1.4	4
052 13471	–	052 53471	250	470	1.8	5
–	052 43471	–	250	470	1.8	6
052 13681	–	052 53681	250	680	2.3	7
052 13102	–	052 53102	250	1 000	3.0	8
052 18479	–	052 58479	385	47	0.4	1
052 18689	–	052 58689	385	68	0.6	2
052 18101	–	052 58101	385	100	0.8	3
052 18151	–	052 58151	385	150	1.0	4
052 18221	–	052 58221	385	220	1.3	5
–	052 48221	–	385	220	1.3	6
052 18331	–	052 58331	385	330	1.7	7
052 18471	–	052 58471	385	470	2.8	8

*Not available with solder tags.

NOTE:

Non-solid electrolyte capacitors may contain chemicals which can be regarded as hazardous if incorrectly handled. Caution is necessary should the outer case be fractured.

Tolerance on capacitance -10 to $+30\%$
Temperature range -40 to $+85^\circ\text{C}$
Basic specification IEC384-4 long life grade
DIN 41240

Dimensional specification DIN41238
Climatic category (IEC68) 40/085/56
Approved to CECC 30301-033

Case sizes and mounting clips - solder tag version

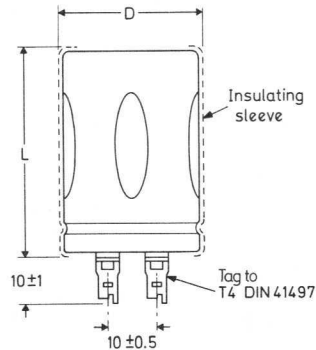
case size	D_{max}	L_{max}	mounting clips type number
1	25.6	36.3	4322 043 03301 (B127122)
2	25.6	46.3	4322 043 03301 (B127122)
3	30.6	46.3	4322 043 03311 –
4	35.6	46.3	4322 043 04272 (B127124)
5	35.6	56.3	4322 043 04272 (B127124)
6	40.6	46.3	– –
7	40.6	56.3	4322 043 03331 (B127125)
8	40.6	76.3	4322 043 03331 (B127125)
9	40.6	106.3	4322 043 03331 (B127125)

dimensions in mm

Case sizes are the same for printed wiring and solder tag versions.
(Case size 6 is not available with solder tags.)

See published data on 050, 052 series for positioning and dimensioning of printed wiring pins.

The type numbers given in brackets are alternative type numbers for identical mounting clips. Clip DT2402 may be used for case size 3 but is not interchangeable.



Electrolytic capacitors

industrial, large, or p.w. pins (cont.)

book 3 part 1b

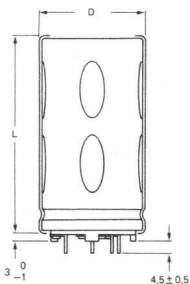
• 051/053 Series Development Sample Data

Type Number	Rated voltage (V _R) (V _{dc})	Nominal capacitance (μF)	I _R max. at 100Hz/85°C	Case Size	Type Number	Rated voltage (V _R) (V _{dc})	Nominal capacitance (μF)	I _R max. at 100Hz/85°C	Case Size
051 54103	10	10000	3.1	1	051 58222	63	2200	2.5	1
051 54153	10	15000	4.1	2	051 58332	63	3300	3.3	2
051 54223	10	22000	5.0	3	051 58472	63	4700	4.1	3
051 54333	10	33000	5.5	4	051 58682	63	6800	4.5	4
051 54473	10	47000	6.8	5	051 58103	63	10000	5.4	5
051 44473	10	47000	5.8	6	051 48103	63	10000	4.6	6
051 54683	10	68000	7.1	7	051 58153	63	15000	7.5	8
051 54104	10	100000	9.2	8	051 58223	63	22000	10.0	9
051 54154	10	150000	12.0	9					
051 55682	16	6800	3.1	1	051 59681	100	680	1.74	1
051 55103	16	10000	4.0	2	051 59102	100	1000	2.34	2
051 55153	16	15000	5.0	3	051 59152	100	1500	2.95	3
051 55223	16	22000	5.5	4	051 59222	100	2200	3.69	4
051 45333	16	33000	6.7	5	051 59332	100	3300	4.37	5
051 55333	16	33000	5.7	6	051 49332	100	3300	4.16	6
051 55473	16	47000	7.0	7	051 59472	100	4700	5.21	7
051 55683	16	68000	9.2	8	051 59682	100	6800	6.97	8
051 55104	16	100000	12.0	9	051 59103	100	10000	9.50	9
051 56472	25	4700	2.9	1	051 52151	200	150	0.70	1
051 56682	25	6800	3.9	2	051 52221	200	220	0.94	2
051 56103	25	10000	4.8	3	051 52331	200	330	1.27	3
051 56153	25	15000	5.3	4	051 52471	200	470	1.66	4
051 56223	25	22000	6.5	5	051 52681	200	680	2.19	5
051 46223	25	22000	5.7	6	051 42681	200	680	2.17	6
051 56333	25	33000	7.0	7	051 52102	200	1000	2.86	7
051 56473	25	47000	9.2	8	051 52152	200	1500	3.81	8
051 56683	25	68000	12.0	9	051 52222	200	2200	5.20	9
051 57332	40	3300	2.9	1	051 58689	385	68	0.47	1
051 57472	40	4700	3.8	2	051 58101	385	100	0.64	2
051 57682	40	6800	4.7	3	051 58151	385	150	0.90	3
051 57103	40	10000	5.2	4	051 58221	385	220	1.15	4
051 57153	40	15000	6.3	5	051 58331	385	330	1.53	5
051 47153	40	15000	5.6	6	051 48331	385	330	1.52	6
051 57223	40	22000	5.8	7	051 58471	385	470	1.96	7
051 57333	40	33000	7.8	8	051 58681	385	680	2.70	8
051 57473	40	47000	10.4	9	053 58102	385	1000	3.70	9

Case sizes

case size	D _{max}	L _{max}
1	25.6	36.3
2	25.6	46.3
3	30.6	46.3
4	35.6	46.3
5	35.6	56.3
6	40.6	46.3
7	40.6	56.3
8	40.6	76.3
9	40.6	106.3

Dimensions in mm



Tolerance on capacitance ±20%
 Temperature range -40 to 85°C
 Basic specification IEC 384-4 long life grade
 Climatic category (IEC 68) 100/085/56

See published data 051/053 series
 for positioning of the p.w. pins.

NOTE: Non-solid electrolytic capacitors may contain chemicals which can be regarded as hazardous if incorrectly handled. Caution is necessary should the outer case be fractured.

Electrolytic capacitors

book 3 part 1b

S.M.D. general purpose

• 085 Series

Type No.	Rated voltage (U_R) (Vdc)	Capacitance (μF)	Case size
085 13109	6.3	10	1a
085 13229	6.3	22	1
085 14688	10	6.8	1a
085 14159	10	15	1
085 15478	16	4.7	1a
085 15109	16	10	1
085 16338	25	3.3	1a
085 16688	25	6.8	1
085 17228	40	2.2	1a
085 17478	40	4.7	1
085 18107	63	0.1	1a
085 18157	63	0.15	1a
085 18227	63	0.22	1a
085 18337	63	0.33	1a
085 18477	63	0.47	1a
085 18687	63	0.68	1a
085 18108	63	1	1a
085 18158	63	1.5	1a
085 18228	63	2.2	1
085 18338	63	3.3	1

Tolerance on capacitance -10% to +50%
 Climatic category (IEC 68) 40/085/56
 Basic specification IEC 384-4, general purpose

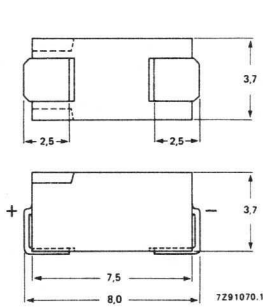
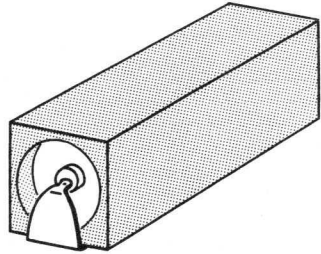


Fig. 1a Case size 1a

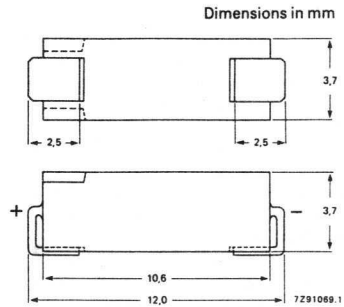


Fig. 1b Case size 1

MARKING

The capacitors are marked on top with nominal capacitance, -ve sign for polarity and a code letter for voltage. The numbers are those for capacitance in μF . The voltage code letter taking the place of the decimal point in the capacitance value, e.g. 3H3 indicates 3.3 μF , 63V

Rated voltage V	Code letter
6.3	C
10	D
16	E
25	F
40	G
63	H

NOTE: Non-solid electrolytic capacitors may contain chemicals which can be regarded as hazardous if incorrectly handled. Caution is necessary should the outer case be fractured.

Electrolytic capacitors

computer grade, screw terminal

book 3 part 1b

106, 107 Series (for use in existing designs only. The 114/115 series should be used for new designs)

Type No.	Rated voltage (U_R) (V_{dc})	Capacitance (μF)	Case size	I_s max. at 100Hz and $T_{amb} = 85^\circ C$ (A)
106 33223	6.3	22 000	11	5.5
106 33333	6.3	33 000	12	7.9
106 33473	6.3	47 000	14	9.4
106 33683	6.3	68 000	15	13.2
106 33154	6.3	150 000	16	21.3
106 34153	10	15 000	11	5.3
106 34223	10	22 000	12	7.5
106 34333	10	33 000	14	9.1
106 34473	10	47 000	15	12.8
106 34104	10	100 000	16	20.5
106 35103	16	10 000	11	5.0
106 35153	16	15 000	12	7.1
106 35223	16	22 000	14	8.6
106 35333	16	33 000	15	12.4
106 35683	16	68 000	16	19.7
106 36682	25	6 800	11	4.7
106 36103	25	10 000	12	6.7
106 36153	25	15 000	14	8.2
106 36223	25	22 000	15	11.6
106 36473	25	47 000	16	18.7
106 37472	40	4 700	11	4.3
106 37682	40	6 800	12	6.0
106 37103	40	10 000	14	7.4
106 37153	40	15 000	15	10.6
106 37333	40	33 000	16	17.6
106 38222	63	2 200	11	3.6
106 38332	63	3 300	12	5.2
106 38472	63	4 700	14	6.3
106 38682	63	6 800	15	8.8
106 38153	63	15 000	16	14.8
107 30152	100	1 500	11	3.1
107 30222	100	2 200	12	4.5
107 30332	100	3 300	14	5.4
107 30472	100	4 700	15	7.7
107 30103	100	10 000	16	12.6

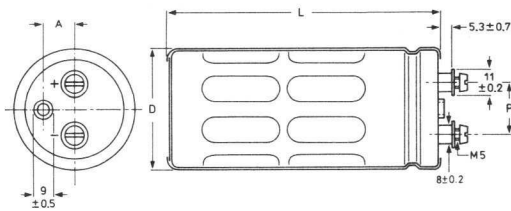
Approvals

106 Series British Telecom specification D2543, type no. 4513A;
106, 107 Series: RSRE specification 070/8/01

Capacitance tolerance -10 to +50%
Temperature ranges:
106 Series -40 to +85°C
107 Series -25 to +85°C

Climatic category (IEC68)
106 series 40/085/56
107 series 25/085/56

Basic specification:
IEC 384-4, long-life grade



Case size	L_{max}	D_{max}	P_{max}	A	Clips
11	83	36.5	15.1	8.4	DT2401
12	115	36.5	15.1	8.4	DT2401
14	83	51.5	22.1	14.3	DT2254
15	115	51.5	22.1	14.3	DT2254
16	115	66.5	31.1	19.0	DT2400

Dimensions in mm

NOTE: Non-solid electrolyte capacitors may contain chemicals which can be regarded as hazardous if incorrectly handled. Caution is necessary should the outer case be fractured.

Electrolytic capacitors

book 3 part 1b

long life, small, axial leads 

108 Series $U_R = 6.3V$ to $100V$

Type No.	Rated voltage (U_R) (V _{dc})	Capacitance (μ F)	Case size	I_R max. at 100Hz (mA) at 85°C
108 33151	6.3	150	5	130
108 33331	6.3	330	6	220
108 33471	6.3	470	00	325
108 33102	6.3	1000	01	470
108 33152	6.3	1500	02	630
108 33222	6.3	2200	03	920
108 34101	10	100	5	120
108 34221	10	220	6	205
108 34331	10	330	00	325
108 34681	10	680	01	470
108 34102	10	1000	02	630
108 34152	10	1500	03	920
108 35689	16	68	5	110
108 35151	16	150	6	190
108 35221	16	220	00	270
108 35471	16	470	01	360
108 35681	16	680	02	500
108 35102	16	1000	03	650
108 36339	25	33	5	85
108 36479	25	47	5	100
108 36101	25	100	6	170
108 36151	25	150	00	270
108 36221	25	220	01	360
108 36471	25	470	02	500
108 36681	25	680	03	650

Type No.	Rated voltage (U_R) (V _{dc})	Capacitance (μ F)	Case size	I_R max. at 100Hz (mA) at 85°C
108 37159	40	15	5	65
108 37229	40	22	5	80
108 37339	40	33	6	110
108 37479	40	47	6	130
108 37689	40	68	00	195
108 37101	40	100	01	245
108 37141	40	150	01	280
108 37221	40	220	02	360
108 37331	40	330	03	495
108 38228	63	2.2	5	25
108 38338	63	3.3	5	30
108 38478	63	4.7	5	35
10838688	63	6.8	5	45
108 38109	63	10	5	50
108 38159	63	15	6	75
108 38229	63	22	6	90
108 38339	63	33	00	125
108 38479	63	47	00	150
108 38689	63	68	01	195
108 38101	63	100	02	275
108 38151	63	150	03	355
108 39478	100	4.7	5	40
108 39668	100	4.8	5	50
108 39109	100	10	5	60
108 39159	100	15	6	80
108 39229	100	22	6	90
108 39339	100	33	00	105
108 39479	100	47	00	125
108 39689	100	68	01	165
108 39101	100	100	02	225
108 39151	100	100	03	300

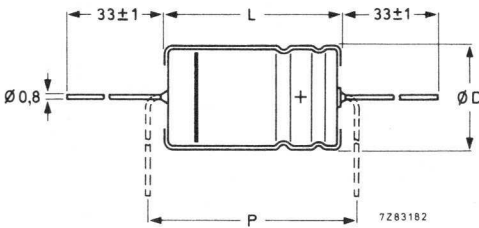


Fig. 1 case sizes 5 and 6

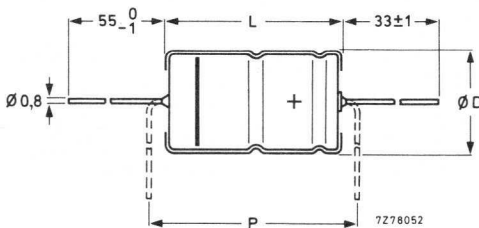


Fig. 2 case sizes 00, 01, 02 and 03

Capacitance tolerance -10 to +50%
 Temperature range -40 to +85°C
 Basic specification IEC384-4, long life grade
 Climatic category (IEC68) 40/085/56

Dimensions in mm

Case size	L_{max}	D_{max}	P_{min}
5	18.5	8.5	25
6	18.5	10.5	25
00	30.5	10.5	35
01	30.5	13	35
02	30.5	15.5	35
03	30.5	18.5	35

Case sizes 5 and 6 supplied on bandoliers in boxes of 500 pieces.
 Case sizes 00 to 03 supplied loose in boxes of 200 pieces.

Approved to British Telecom specification D2541, Type 4511A
 and to RSRE Specification 070/8/03 (except 100V range)
 Approved to CECC 30-301-027 (except 100V range)

NOTE

Non-solid electrolyte capacitors may contain chemicals which can be regarded as hazardous if incorrectly handled. Caution is necessary should the outer case be fractured.

Electrolytic capacitors

computer grade, large, screw terminal

book 3 part 1b

114/115 Series

Type No.	Rated voltage (U_R) (V_{dc})	Capacitance (μF)	Case size	I_R max. at 100Hz $T_{amb} = 85^\circ C$ (A_{rms})
114 14153	10	15 000	10	6
114 14223	10	22 000	11	7.5
114 14333	10	33 000	12a	10
114 14473	10	47 000	14	14
114 14683	10	68 000	15a	18
114 14104	10	100 000	16a	30
114 14154	10	150 000	16a	30
114 14224	10	220 000	17	37
114 15103	16	10 000	10	6
114 15153	16	15 000	11	7.5
114 15223	16	22 000	12a	10
114 15333	16	33 000	14	13
114 15473	16	47 000	15a	18
114 15683	16	68 000	16a	28
114 15104	16	100 000	16a	28
114 15154	16	150 000	17	37
114 16472	25	4 700	10	5.2
114 16682	25	6 800	10	5.2
114 16103	25	10 000	11	6.7
114 16153	25	15 000	12a	9.7
114 16223	25	22 000	14	12.5
114 16333	25	33 000	15a	18
114 16473	25	47 000	16a	27
114 16683	25	68 000	16a	27
114 16104	25	100 000	17	37
114 17332	40	3 300	10	4.5
114 17472	40	4 700	10	4.5
114 17682	40	6 800	11	6
114 17103	40	10 000	12a	7.5
114 17153	40	15 000	14	10
114 17223	40	22 000	15a	15
114 17333	40	33 000	16a	21
114 17473	40	47 000	16a	22
114 17683	40	68 000	17	30
114 18222	63	2 200	10	3.7
114 18332	63	3 300	10	3.7
114 18472	63	4 700	11	5.2
114 18682	63	6 800	12a	7.5
114 18103	63	10 000	14	9.5
114 18153	63	15 000	15a	13.5
114 18223	63	22 000	16a	21
114 18333	63	33 000	16a	22
114 18473	63	47 000	17	30

Electrolytic capacitors

computer grade, large, screw terminal (cont.) book 3 part 1b

114/115 Series

Type No.	Rated voltage (U_R) (V_{dc})	Capacitance (μF)	Case size	I_R max. at 100Hz $T_{amb} = 85^\circ C$ (A_{rms})
114 19102	100	1 000	10	2.2
114 19152	100	1 500	10	2.2
114 19222	100	2 200	11	3.3
114 19332	100	3 300	12a	4.5
114 19472	100	4 700	14	5.7
114 19682	100	6 800	15a	8.0
114 19103	100	10 000	16a	13.5
114 19153	100	15 000	16a	13.5
114 19223	100	22 000	17	15.0
115 13331	250	330	10	1.8
115 13471	250	470	11	2.5
115 13681	250	680	12a	3.5
115 13102	250	1 000	14	4.2
115 13152	250	1 500	15a	6.3
115 13222	250	2 200	16a	8.8
115 13332	250	3 300	16a	10.5
115 13472	250	4 700	17	14
115 18151	385	150	10	1.2
115 18221	385	220	11	1.6
115 18331	385	330	12a	2.2
115 18471	385	470	14	2.7
115 18681	385	680	15a	4.8
115 18102	385	1 000	16a	7
115 18152	385	1 500	16a	7
115 18222	385	2 200	17	9

Details of case sizes and mounting clamps are shown in Table 1

Tolerance on capacitance -10 to +30%
 Temperature range -40 to +85°C
 Basic specification IEC 384-4 long-life grade
 Detail specification DIN 41240
 DIN 41248
 Climatic category (IEC68) 40/085/56
 Endurance test 5000hrs

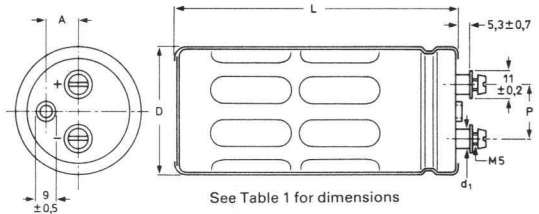


Table 1

Case size	Dmax	Lmax	P (± 0.1)	A	d_1	mounting clamps
10	36.5	63	13.0	8.4	8	4322 043 04272
11	36.5	83	13.0	8.4	8	4322 043 04272
12a	36.5	108	13.0	8.4	8	4322 043 04272
14	51.5	83	22.0	14.3	8	4322 043 04281
15a	51.5	108	22.0	14.3	8	4322 043 04281
16a	66.5	108	28.5	19.0	11	4322 043 04291
17	76.5	108	32.0	21.0	11	4322 043 12990

Dimensions in mm

NOTE: Non-solid electrolyte capacitors may contain chemicals which can be regarded as hazardous if incorrectly handled. Caution is necessary should the outer case be fractured.

Electrolytic capacitors

solid aluminium, miniature, single ended, dipped E

book 3 part 1b

122 Series

Type No.	Rated voltage (U_R) (Vdc)	Capacitance (μF)	Case size
122 53109	6.3	10	1
122 53159	6.3	15	2
122 53229	6.3	22	2
122 53339	6.3	33	3
122 53479	6.3	47	4
122 53689	6.3	68	4
122 54478	10	4.7	1
122 54688	10	6.8	1
122 54109	10	10	2
122 54159	10	15	2
122 54229	10	22	3
122 54339	10	33	4
122 55228	16	2.2	1
122 55338	16	3.3	1
122 55478	16	4.7	2
122 55688	16	6.8	2
122 55109	16	10	3
122 55159	16	15	4

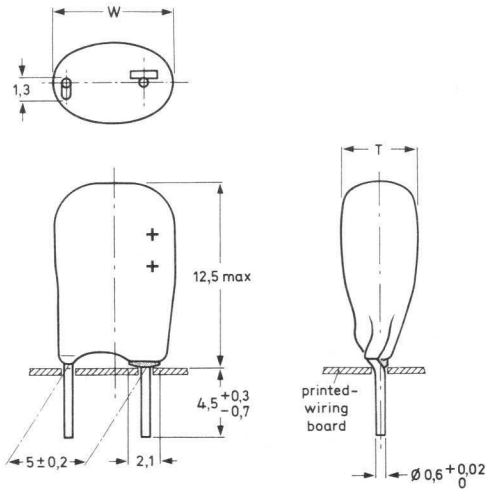
Type No.	Rated voltage (U_R) (Vdc)	Capacitance (μF)	Case size
122 56687	25	0.68	1
122 56108	25	1.0	1
122 56158	25	1.5	1
122 56228	25	2.2	2
122 56338	25	3.3	2
122 56478	25	4.7	3
122 56688	25	6.8	4
122 57107	40	0.1	1
122 57157	40	0.15	1
122 57227	40	0.22	1
122 57337	40	0.33	1
122 57477	40	0.47	2
122 57687	40	0.68	2
122 57108	40	1.0	3
122 57158	40	1.5	4
122 57228	40	2.2	4

122 Series capacitors are approved to CECC 30-302-002
and are approved for British Telecom use

Capacitance tolerance $\pm 20\%$
Category temperature range 6.3 to 40V ranges -55 to $+125^\circ\text{C}$
40V range derates to 25V
in temperature range $+85$ to $+125^\circ\text{C}$
IEC 384-4 long life grade

Basic specification

Climatic category (IEC68) 55/125/56



Case size	W_{max}	H_{max}	T_{max}
1	8	12.5	3.5
2	8	12.5	4.5
3	8	12.5	5
4	8	12.5	6

Dimensions in mm

Electrolytic capacitors

solid aluminium, small axial leads, metal cased

book 3 part 1b

123 Series

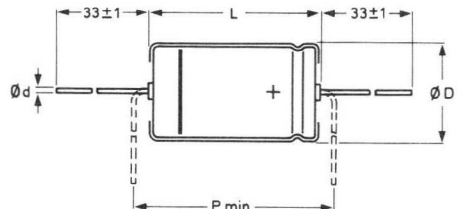
Type No.	Rated voltage (U _R) (Vdc)	Capacitance (μF)	Case size
123 12689	4	68	1
123 12221	4	220	2a
123 12471	4	470	4
123 12102	4	1000	5
123 12152	4	1500	6
123 12222	4	2200	6
123 13479	6.3	47	1
123 13151	6.3	150	2a
123 13331	6.3	330	4
123 13681	6.3	680	5
123 13102	6.3	1000	6
123 13152	6.3	1500	6
123 14339	10	33	1
123 14479	10	47	1
123 14689	10	68	2a
123 14101	10	100	2a
123 14151	10	150	4
123 14221	10	220	4
123 14331	10	330	5
123 14471	10	470	5
123 14681	10	680	6
123 14102	10	1000	6
123 15109	16	10	1
123 15159	16	15	1
123 15229	16	22	1
123 15339	16	33	2a
123 15479	16	47	2a
123 15689	16	68	2a
123 15101	16	100	4
123 15151	16	150	4
123 15221	16	220	5
123 15331	16	330	5
123 15471	16	470	6
123 15681	16	680	6

Type No.	Rated voltage (U _R) (Vdc)	Capacitance (μF)	Case size
123 90037	20	10	1
123 90038	20	15	1
123 90042	20	47	2a
123 90044	20	100	4
123 90045	20	150	5
123 90046	20	220	5
123 90047	20	330	6
123 90048	20	470	6
123 16109	25	10	1
123 16229	25	22	2a
123 16339	25	33	2a
123 16689	25	68	4
123 16101	25	100	4
123 16151	25	150	5
123 16221	25	220	6
123 97228	35	2.2	1
123 97338	35	3.3	1
123 97478	35	4.7	1
123 97688	35	6.8	1
123 97109	35	10	2a
123 97159	35	15	2a
123 97229	35	22	4
123 97339	35	33	4
123 97479	35	47	4
123 97689	35	68	5
123 97101	35	100	6
123 97151	35	150	6
123 17228	40	2.2	1
123 17338	40	3.3	1
123 17478	40	4.7	1
123 17688	40	6.8	1
123 17109	40	10	2a
123 17159	40	15	2a
123 17229	40	22	4
123 17339	40	33	4
123 17479	40	47	5
123 17689	40	68	5
123 17101	40	100	6

Tolerance on capacitance ±20%
 Category temperature range -55 to +125°C
 Basic specification IEC384-4, long life grade
 Climatic category (IEC68) 55/125/56

Case size	D _{max}	L _{max}	P _{min}	Ød
1	6.7	15.3	17.5	0.6
2a	7.6	20.4	22.5	0.6
4	9.3	23.3	25	0.6
5	10.3	32	35	0.8
6	12.9	32	35	0.8

Dimensions in mm



Fixed resistors

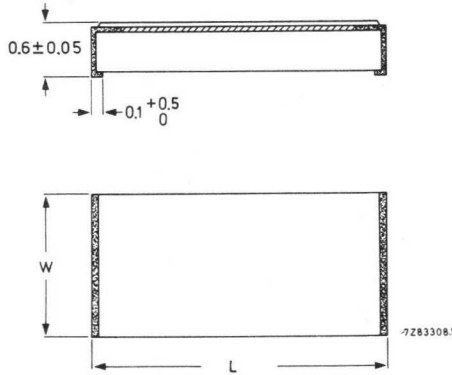
surface mounting, chip

book 3 part 1c

The RC-01 is a 1206 size chip resistor available with $\pm 2\%$, and $\pm 5\%$ selection tolerances over the range 1Ω to $1M\Omega$

Style	Dimensions		Resistance range	Tolerance (%)	Preferred value series	Max. power dissipation at 70°C (W)	Temperature coefficient (ppm/°C)
	W(max)	L(max)					
RC-01	1.75	3.35	1Ω to $1M\Omega$	± 5	E24	0.25	$< \pm 200$
			10Ω to $1M\Omega$	± 2	E24	0.25	$< \pm 200$

The chips are supplied on 8mm tape on reels of 4000 pieces.



precision metal film

Two sizes of resistor, MPR24 and the MPR34 are available with resistance values between 4.99Ω and $1M\Omega$, selection tolerances from 0.5% down to 0.01% and temperature coefficients from ± 25 ppm/°C down to ± 5 ppm/°C.

Due to the large combinations of value, tolerance and temperature coefficient available, these resistors tend to be manufactured against order only.

Style	Dimensions			Resistance range	Tolerance (%)	Preferred value series	Max. power rating (W)	Temperature coefficient (ppm/°C)
	D(max)	L(max)	d(nom)					
● MPR24	2.5	6.5	0.6	24Ω to $100k\Omega$	0.05; 0.02; 0.01	Values to order	0.125	± 5 ; 10
				4.9Ω to $1M\Omega$	0.5; 0.25; 0.1		0.250	± 5 ; 10
● MPR34	3.0	10	0.6	24Ω to $100k\Omega$	0.05; 0.02; 0.01	to order	0.25	± 15 ; 25
				4.9Ω to $1M\Omega$	0.5; 0.25; 0.1		0.40	± 15 ; 25

book 3 part 1c

SFR16T is a miniature resistor similar in size to the CR16 and SFR16 which it has replaced.

SFR25 is available with a 5% tolerance over the range 1Ω to $10M\Omega$. As the ES-SFR25 it is available with 2% and 5% tolerances approved to CECC40101-019 Style FX and British Telecoms D2452 Style 91F over the range 1Ω to $1M\Omega$. It replaces the MR25 2% tolerance.

SFR25H is a 0.5 watt, 5% tolerance resistor replacing the CR37 and SFR30.

A 'zero ohm jumper', SFR25-0R, provides a bridging link which may be auto inserted into p.c.b.'s.

Style	Dimensions			Resistance range	Tolerance (%)	Preferred value series	Nominal power rating (W)	Max. voltage (V)	Temperature coefficient (ppm/°C)
	D(max)	L(max)	d(nom)						
SFR16T	1.9	3.7	0.5	10Ω to $1M\Omega$	± 5	E24	0.5	200	$R \leq 100k\Omega < \pm 100$ $R > 100k\Omega < \pm 250$
SFR25	2.5	6.5	0.6	1Ω to $10M\Omega$	± 5	E24	0.4	250	$R \leq 1M\Omega < \pm 100$ $R > 1M\Omega < \pm 250$
ES-SFR25	2.5	6.5	0.6	1Ω to $1M\Omega$	$\pm 5; \pm 2$	E24	0.4	250	$< \pm 100$
SFR25-0R	2.5	6.5	0.6	zero ohm	$+10m\Omega$	—	5 Amps	250	
● SFR25H	2.5	6.5	0.6	1Ω to $10M\Omega$	± 5	E24	0.5	350	$R \leq 1M\Omega < \pm 100$ $R > 1M\Omega < \pm 250$

The SFR16T and SFR25 are coated with a light green lacquer. The SFR25H has a red brown lacquer. All are colour coded with four colour bands giving value and tolerance in accordance with BS1852.

Resistors are supplied bandoliered either in 1000 piece ammpacks or 5000 pieces on a drum.

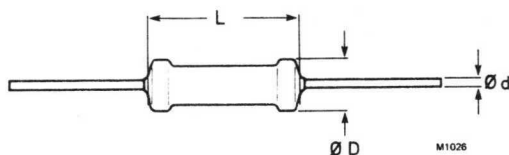


Fig. 1 Resistor dimensions (mm)

Fixed resistors

metal film (1% tolerance)

book 3 part 1c

MRS16T is a miniature resistor similar in size to the MR16 which it replaces. It is rated at 0.4W.

MRS25 is similar in size to the MR25. It is rated at 0.6 watt and replaces MR25 (1% tolerance), MR30 and MR30-8.

Style	Dimensions (Fig. 1)			Resistance range	Tolerance (%)	Preferred value series	Nominal power rating (W)	Max. voltage (V)	Temperature coefficient (ppm/°C)
	D(max)	L(max)	d(nom)						
● MRS16T*	1.9	3.7	0.5	10Ω to 100kΩ	±1	E24; E96	0.4	200	<±50
● MRS25*	2.5	6.5	0.6	1Ω to 1MΩ	±1	E24; E96	0.6	250	<±50†

*Development sample data. †Less than 4.99Ωt.c. <±100 ppm.

The MRS16T and MRS25 are coated with a dark green lacquer.

The MRS16T is coded for resistance value and tolerance using five colour bands, giving the first, second and third significant figure; the multiplier and tolerance.

The MRS25 is coded for resistance value, tolerance and temperature coefficient, using six bands giving the first, second and third significant figures; multiplier; tolerance and temperature coefficient. A temperature coefficient of 50 ppm is a red band; a t.c. of 100 ppm is brown.

fusible

NFR25 is a range of resistors with defined fusing characteristics under overload conditions. Typically a power overload of 10 times causes the resistor to fail open circuit within less than 10s without fire risk.

Style	Dimensions (Fig. 1)			Resistance range	Tolerance (%)	Preferred value series	Nominal power rating (W)	Max. voltage (V)	Temperature coefficient (ppm/°C)
	D(max)	L(max)	d(nom)						
● NFR25	2.5	6.5	0.6	1Ω to 15kΩ	±5	E24	0.33	250	≤100

The NFR25 is coated with a grey lacquer colour coded with four bands giving resistance value and tolerance.

Resistors are supplied bandoliered either in 1000 pieces ammopacks or 5000 pieces on a drum.

The VR series of metal glaze resistors offer a range of high ohmic values combined with high working voltages.

Style	Dimensions (Fig. 1)			Resistance range	Tolerance (%)	Preferred value series	Nominal power rating (W)	Max. voltage (Vrms)
	D(max)	L(max)	d(nom)					
VR25	2.5	6.5	0.6	220k Ω to 10M Ω	± 5	E12	0.25	1150
VR37	3.7	9.0	0.7	220k Ω to 33M Ω	± 5	E12	0.5	2250
VR68	6.8	16.5	0.8	100k Ω to 68M Ω	± 5	E12	1.0	7000

Coated with a light blue lacquer and colour coded in accordance with BS1852 except that the 4th (tolerance) band is yellow.

This series is packed on bandoliers in ammoboxes of 1000 pieces.

metal film, high power

The PR series of metal film resistors are rated at 1.6 watt or 2.5 watt and offer a high power rating in a small body size.

Style	Dimensions (Fig. 1)			Resistance range	Tolerance (%)	Preferred value series	Nominal power rating at 70°C	Max. voltage (V)
	D(max)	L(max)	d(nom)					
PR37	3.9	10	0.6	2.2 Ω to 1M Ω	± 5	E12	R \leq 27k Ω , 1.6W R $>$ 27k Ω , 1.2W	500
PR52	5.2	16.7	0.6	2.2 Ω to 51k Ω	± 5	E12	2.5W	

Coated with a red brown high temperature silicon paint, with the value and tolerance printed on the body.

Fixed resistors

wire wound

The AC series of resistors cover the power ratings from 3 watt to 20 watt in seven body sizes from 0.1 Ω to 33k Ω . The resistors are coated with a green non-flammable silicon cement.

Style	Dimensions (Fig. 1)			Resistance range	Tolerance (%)	Preferred value series	Max. power rating at 70°C (W)
	D(max)	L(max)	d(nom)				
• AC03	5.5	13	0.8	0.3 Ω to 10 Ω 12 Ω to 3k Ω	± 10 ± 5	E12 E12	2.5
• AC04	5.5	17	0.6	0.1 Ω to 8.2 Ω 10 Ω to 4.7k Ω	± 10 ± 5	E12 E12	3.5
• AC05	7.5	17	0.8	0.1 Ω to 8.2 Ω 10 Ω to 5.6k Ω	± 10 ± 5	E12 E12	4.7
• AC07	7.5	25	0.8	0.1 Ω to 8.2 Ω 10 Ω to 10k Ω	± 10 ± 5	E12 E12	5.8
• AC10	8	44	0.8	0.68 Ω to 8.2 Ω 10 Ω to 15k Ω	± 10 ± 5	E12 E12	8.4
• AC15	10	51	0.8	0.82 Ω to 8.2 Ω 10 Ω to 22k Ω	± 10 ± 5	E12 E12	12.5
• AC20	10	67	0.8	1.2 Ω to 8.2 Ω 10 Ω to 33k Ω	± 10 ± 5	E12 E12	16

The AC03 to AC07 series are supplied banded in ammpacks of 500 pieces. The three larger sizes are supplied loose in boxes of 100 pieces.

Resistor kits

To assist in laboratory development work, resistor kits can be made available. They are based on the standard film ranges; the metal film ranges; the VR25 range of metal glaze and the PR52 range of high power film. Each kit consists of 100 pieces of either the E12 or E24 values over the available resistor range. Further details are available on request.

Preferred Value Series

E12 Series: 10 12 15 18 22 27 33 39 47 56 68 82

E24 Series: 10 11 12 13 15 16 18 20 22 24 27 30 33 36 39 43 47 51 56 62 68 75 82 91

E96 Series: 100 102 105 107 110 113 115 118 121 124 127 130 133 137 140 143 147 150 154 158 162 165 169 174 178
182 187 191 196 200 205 210 215 221 226 232 237 243 249 255 261 267 274 280 287 294 301 309 316 324
332 340 348 357 365 374 383 392 402 412 422 432 442 453 464 475 487 499 511 523 536 549 562 576 590
604 619 634 649 665 681 698 715 732 750 768 787 806 825 845 866 887 909 931 953 976

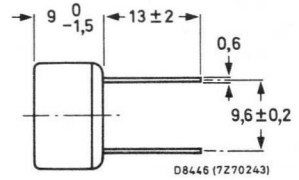
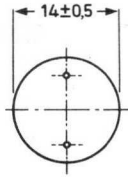
Non-linear resistors

light dependent resistor

book 3 part 1c

Type no.	Catalogue No.	R_{dark} (M Ω)	R_{light} (Ω)	P_{max} (W)	Recovery rate (k Ω /s)
ORP 12	2322 600 95001	>10	75 to 300	0.2	>200

Dimensions in mm



humidity sensor

Type no.	Capacitance at 25°C (pF)	Humidity Range (% R.H.)	Frequency Range (kHz)	Sensitivity* (pF/% R.H.)
2322 691 90001	122 ± 15%	10 to 90	1 to 1000	0.4

*Measured with relative humidity in the range 33 to 43%.

Dimensions in mm

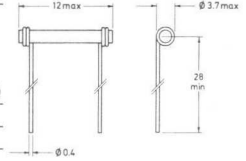
Non-linear resistors

negative temperature coefficient (NTC)

book 3 part 1c

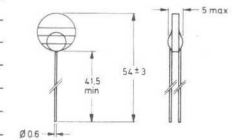
Rod types 0.6W dissipation for temperature compensation

Type No.	Code No. 2322 . . .	Resistance at 25°C (R ₂₅) (Ω)	B value (°K)	Approx. resistance at maximum dissipation (Ω)	Approx. operating current at maximum dissipation (mA)	Approx. dissipation factor (mW per deg C)
VA1066S	635 01472	4.7k	3300	200	55	5.0
VA1055S	635 01153	15k	3600	540	33	5.0
VA1056S	635 01473	47k	3925	1k	23	5.0
VA1067S	635 01154	150k	4075	3k	15	5.0



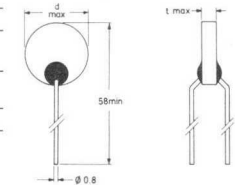
Disc types 1W dissipation for temperature compensation

VA1033	610 11408	4	2800	0.25	2000	10
VA1053	610 11808	8	2900	0.8	1100	10
VA1100	610 11159	15	3125	0.7	1200	10
VA1034	610 11509	50	3300	2.6	600	10
VA1040	610 11131	130	4600	2.6	600	10
VA1039	610 11501	500	5200	6.8	380	10
VA1038	610 11132	1300	5450	10.3	300	10
2322 610 12339		33	3250	0.58	620	10



Disc types for surge current limiting

Type no.	R ₂₅ (Ω)	P _{max} (W)	I _{max}	Dimensions (mm)	
				d	t
2322 644 90005 (was VA1104)	15	1.5	2.2	16	5
• 2322 644 90008	20	4.0	—	22.8	3.5



Dimensions in mm

Non-linear resistors

negative temperature coefficient (NTC)

book 3 part 1c

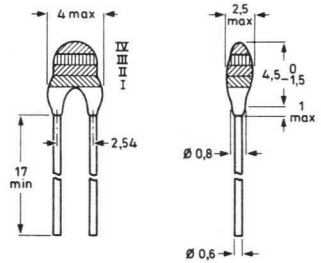
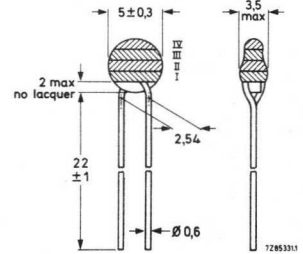
Temperature measurement and control types

0.5W small disc types (resistance tolerance is $\pm 10\%$)

Type No.	Resistance at 25°C (Ω)	B _{25/85} (K)	Remarks
2322 642.....			
62338	3.3	2675	-
62478	4.7	2750	-
62109	10	2875	-
62229	22	3025	-
62479	47	3150	-
62101	100	3300	-
62151	150	3375	replaces VA1096
62221	220	3475	-
62471	470	3650	replaces VA1097
62102	1000	3825	-
62152	1500	3975	replaces VA1098
62222	2200	4125	replaces VA1106
62472	4700	4350	replaces VA1109
62103	10 000	4275	-
62153	15 000	4200	replaces VA1108
62223	22 000	4275	replaces VA1112
62333	33 000	4350	replaces VA1111
62473	47 000	4400	-
62104	100 000	4500	-
62224	220 000	4600	-
62474	470 000	4650	-

0.25W miniature disc types (resistance tolerance is $\pm 5\%$)

Type No.	Resistance at 25°C (Ω)	B _{25/85} (K)
2322 640.....		
13272	2700	4000
13472	4700	3660
13123	12 000	3700
13223	22 000	3700
13473	47 000	3850
13683	68 000	3880
13334	33 000	4150



Dimensions in mm

Marking The thermistors are marked with three or four colour code bands giving their resistance at 25°C.

Non-linear resistors

negative temperature coefficient (NTC) (cont.)

book 3 part 1c

Temperature measurement and control types

Two point types for guaranteed control over a temperature range

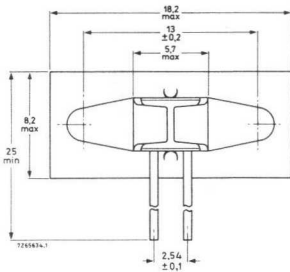
Type No. 2322...	Colour code	Encapsulation	Controlled Temperature range (°C)	Resistance (k Ω)	at Temperature (°C)	Resistance (k Ω)	at Temperature (°C)
640 98015	red	plastic moulded	-10 to +25	15	-10 \pm 1.5	2.7	+25 \pm 1.5
640 98013	brown	plastic moulded	-30 to -10	50	-30 \pm 1.5	15	-10 \pm 1.5
640 98004	grey	plastic moulded	+25 to +100	12 \pm 7%	+25	0.95 \pm 5%	+100
640 98005	black	plastic moulded	+100 to +200	16.7 \pm 7%	+100	1.12 \pm 7%	+200
640 90012	brown	lacquer-dipped	-30 to -10	50	-30 \pm 1.5	15	-10 \pm 1.5
640 90014	red	lacquer-dipped	-10 to +25	15	-10 \pm 1.5	2.7	25 \pm 1.5
640 19472	acc.BS1852	lacquer-dipped	+5 to +25	10.9	5 \pm 1	4.7	25 \pm 1
640 19103	acc.BS1852	lacquer-dipped	+5 to +25	23	5 \pm 1	10	25 \pm 1
640 19223	acc.BS1852	lacquer-dipped	+5 to +25	52	5 \pm 1	22	25 \pm 1
640 19473	acc.BS1852	lacquer-dipped	+5 to +25	114	5 \pm 1	47	25 \pm 1
640 19104	acc.BS1852	lacquer-dipped	+5 to +25	250	5 \pm 1	100	25 \pm 1
640 19224	acc.BS1852	lacquer-dipped	+5 to +25	567	5 \pm 1	220	25 \pm 1

The plastic moulded versions are now supplied with aluminium heatsink attached for improved thermal contact.

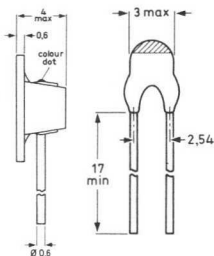
plastic moulded

lacquer dipped

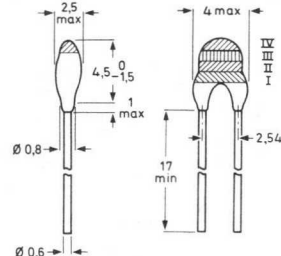
lacquer dipped
colour coded.



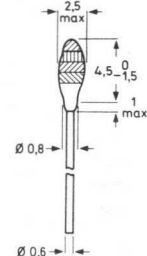
7Z65634.1



7Z72212.2



7Z83089.1



Dimensions in mm

negative temperature coefficient (NTC) (cont.)

book 3 part 1c

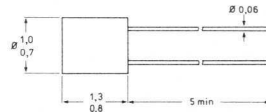
Temperature measurement and control types

Miniature bead types for use in fluids

Type number	replaces type	Resistance at 25°C $R_{25}(\Omega)$	B-value (K)
2322 633...			

Plain beads (not for use in fluids which are electrically conducting. Replaces VA3100 family)

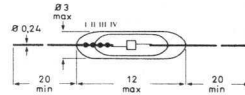
12102	VA3100	1000	2375
12222	VA3102	2200	2600
12472	VA3104	4700	3725
12103	VA3106	10 000	3750
12223	VA3108	22 000	3560
12473	VA3110	47 000	3750
12104	VA3112	100 000	3900
12224	VA3114	220 000	3860
12474	VA3116	470 000	3950
• 12105		1 000 000	4100



plain bead

gas-filled glass tube version (replaces VA3200 family)

22102	VA3200	1000	2375
22222	VA3202	2200	2600
22472	VA3204	4700	3725
22103	VA3206	10 000	3750
22223	VA3208	22 000	3560
22473	VA3210	47 000	3750
22104	VA3212	100 000	3900
22224	VA3214	220 000	3860
22474	VA3216	470 000	3950
• 22105		1 000 000	4100

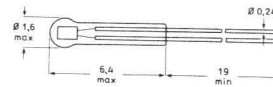


gas-filled glass tube

Type number	replaces type	Resistance $R_{25}(\Omega)$	B-value (K)
2322 626...			

glass dipped bead version (replaces VA3400 family)

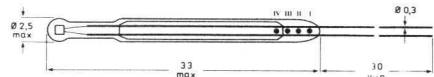
22102	VA3400	1000	2375
22222	VA3402	2200	2600
22472	VA3404	4700	3725
22103	VA3406	10 000	3750
22223	VA3408	22 000	3560
22473	VA3410	47 000	3750
22104	VA3412	100 000	3900
22224	VA3414	220 000	3860
22474	VA3416	470 000	3950
• 22105		1 000 000	4100



glass dipped bead

thermometer version (replaces VA3700 family)

12102	VA3700	1000	2375
12222	VA3702	2200	2600
12472	VA3704	4700	3725
12103	VA3706	10 000	3750
12223	VA3708	22 000	3560
12473	VA3710	47 000	3750
12104	VA3712	100 000	3900
12224	VA3714	220 000	3860
12474	VA3716	470 000	3950
• 12105		1 000 000	4100



Dimensions in mm

thermometer version

Family characteristics

configuration	P_{max} (mW)	Dissipation constant (mW/°C)	T_{max} (°C)	Stability after 1000h (%)
*plain bead	60	0.1	155	3
gas-filled glass tube	60	0.5	200	3
glass dipped bead	25	0.8	200	3
thermometer version	25	1.2	200	3

*tentative data for this configuration.

Non-linear resistors

positive temperature coefficient (PTC) book 3 part 1c

Temperature sensitive switching types

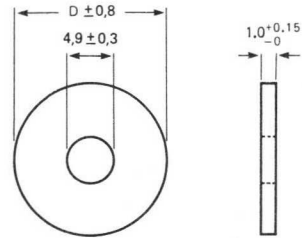
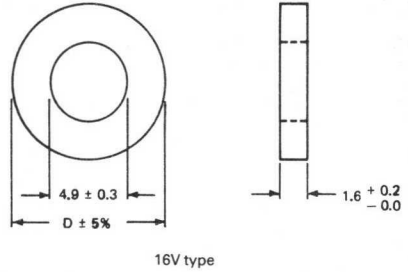
Type No.	Code No. 2322...	Resistance at 25°C (R_{25}) Ω	Switch temp. (°C)	App. res. at switch temp. (Ω)	Temp. coef. at switch temp. (% per °C)	Dissipation factor (mW per°C)	Max. voltage (V)	Dimensions (mm)	
								Max Body dimension	Lead length (min)
E220ZZ/01	661 91005	50	+25	50	9	6	40	7.5	39
E220ZZ/02	661 91004	30	+45	60	16	8.5	50	7.5	39
E220ZZ/03	661 91002	50	+80	150	18	8.5	50	7.5	39
E220ZZ/04	661 91003	40	+110	80	75	8.5	50	7.5	39
VA8650	662 93037	80	+75	220	23	21	265	12.6	38.4

Dual degaussing types for colour tv tubes

Type No. 2322 662...	Max. inrush current (A)	Max. voltage (Vrms)	Residual current after 3 min. (mA)	Switch temp (°C)	Construction
98001	5	245	2	75	Series elements
98003	5	265	2	75	Series elements
98009	5	265	2	65	Parallel-series element
98013	10	145	5	70	Parallel-series element

Heating elements - non-insulated

Type No. 2322 663...	Resistance at 25°C (Ω)	Switch Temp. (°C)	Max. voltage (V)	Dia., D (mm)
94001	270	120	265	16
94002	820	160	265	16
94003	1500	200	265	16
94005	470	120	265	13
94006	1500	160	265	13
94007	2700	200	265	13
95002	2.5	120	16	16
95003	2.5	160	16	16
95004	2.5	200	16	16
95005	3.5	120	16	13
95006	3.5	160	16	13
95007	3.5	200	16	13



7Z89642

Non-linear resistors

book 3 part 1c positive temperature coefficient (PTC)

Overload protection – high voltage (based on Development Sample Data)

switch temperature = 120°C, Vmax at 55°C = 265V

Type No. 2322...	I_{nt} at 55°C (mA)	I_t (mA)		I_{max} at 0°C (mA)	I_{res} (mA)	R_{25} at 25°C (Ω)	Diameter (mm)
		10°C	25°C				
660 11293	12	24	21.9	110	5	1900	4.5
660 11593	15	30	27.4	130	5	1200	4.5
660 11893	18	36	32.9	165	5	850	4.5
660 12293	22	44	40.2	200	6	560	4.5
660 12793	27	54	49.3	250	6	380	4.5
660 13393	33	66	60.2	290	7	280	6.5
661 13993	39	78	71.2	350	7	200	6.5
661 14793	47	94	85.8	420	7	140	6.5
661 15693	56	112	102.2	500	8	100	6.5
661 16893	68	136	124.2	600	8	72	8
661 18293	82	164	149.7	730	9	50	8
661 11013	100	200	182.6	900	9	33	8
662 11213	120	240	219.1	1100	12	26	10
662 11513	150	300	273.7	1300	12	20	12
662 11813	180	360	328.6	1700	14	14	12
663 12213	220	440	401.7	2100	16	10	13
663 12713	270	540	493.0	2500	19	8	16
664 13313	330	660	602.5	3000	25	7	20
664 13913	390	780	712.0	3600	25	5	20
664 14713	470	940	858.1	4300	25	3.5	20

Overload protection - low voltage (based on Development Sample Data)

switch temperature = 120°C, Vmax at 55°C = 56V d.c.

660 15691	56	112	102.2	460	30	90	4.5
660 16891	68	136	124.2	600	30	60	4.5
660 18291	82	164	149.7	750	30	42	4.5
661 11011	100	200	182.6	950	35	32	6.5
661 11211	120	240	219.1	1300	35	22	6.5
661 11511	150	300	273.7	1600	40	18	8
662 11811	180	360	328.6	2200	45	12.5	10
662 12211	220	440	401.7	2900	50	10	12
662 12711	270	540	493.0	4000	50	6.5	12
663 13311	330	660	602.5	6300	60	4.3	13
663 13911	390	780	712.0	7300	70	3.8	16
663 14711	470	940	808.0	12000	70	2.6	16
664 15611	560	1120	1022	14000	100	2.2	20
664 16811	680	1360	1242	18000	100	1.6	20

I_{nt} = guaranteed non-trip current; I_{max} = maximum inrush current,

I_t = guaranteed trip current; I_{res} = residual current after tripping.

Current sensitive switch for compressor motor start winding

Type No.	Resistance at 25°C (Ω)	Max. Voltage (V)	Max. Current (A)	No. of cycles	Switch Temp. (°C)	Heat-up time (s)
2322 678 93001	11	300	8	300 000	120	0.48

Non-linear resistors

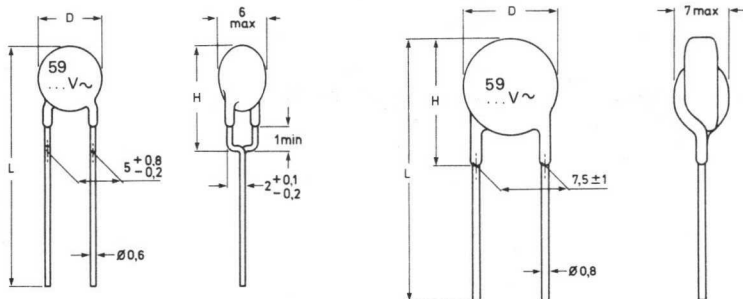
voltage dependent resistors (VDR)

book 3 part 1c

Type No.	Max Ratings		Volts at 1mA		2322 592 family	2322 593 family	2322 594 family	2322 595 family
	rms rated voltage (V)	dc rated voltage (V)	min (V)	max. (V)	Max non-repetitive transient current (8/20 µs): 400A	Max non-repetitive transient current (8/20 µs): 1200A	Max non-repetitive transient current (8/20 µs): 2500A	Max non-repetitive transient current (8/20 µs): 4500A
2322 592 ...					Max. clamping voltage at 50A (V)	Max. clamping voltage at 100A (V)	Max. clamping voltage at 100A (V)	Max. clamping voltage at 100A (V)
2322 593 ...								
2322 594 ...								
2322 595 ...								
66002	60	85	90	110	220	210	185	175
67502	75	100	108	132	240	250	225	210
69502	95	125	135	165	295	310	285	270
61312	130	170	185	225	405	425	385	360
61512	150	200	216	264	470	485	455	415
61712	175	225	243	297	525	550	520	480
62312	230	300	324	396	675	720	686	650
62512	250	320	351	429	745	780	740	695
62712	275	350	387	473	820	850	815	765
63012	300	385	423	517	905	930	880	835
64212	420	560	612	748	1340	1350	1310	1225
64612	460	615	675	825	1480	1490	1440	1342

Dimensions in mm

Outlines



	Dmax	Hmax	L
592 series	7	11	31
593 series	9	13	33

	Dmax	Hmax	L
594 series	12.5	14	33
595 series	16	19	35

The 2322 592 and 593 ranges are available on radial tape bandoliers, to special order. Normally supplies are loose-packed in boxes.

Potentiometers

book 3 part 1d

preset carbon potentiometers

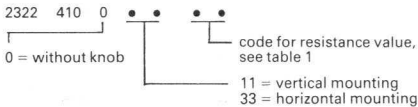
Preset potentiometers are mainly used for preset resistance control with provision for re-adjustment. They are particularly suitable for use in radio and television receivers and are available in both horizontal and vertical mounting positions.

Survey of types

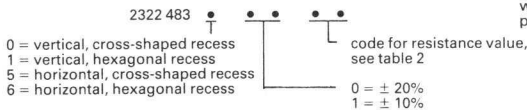
Style	Tolerance range (preferred)	Resistance range (preferred)	Max. power dissipation (W)	Resistance series (preferred)
CTP10 series	20%	47Ω to 4.7 MΩ	0.1	E3 linear
ECP10 series	20%	100Ω to 4.7 MΩ	0.1	E3 linear
CTP18 series	20%	100Ω to 4.7 MΩ	0.25	E3 linear

COMPOSITION OF TYPE NUMBER

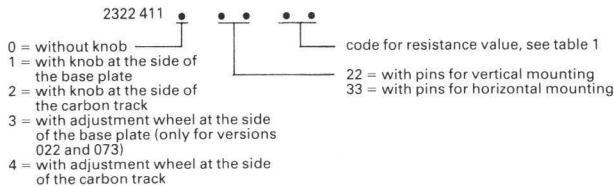
CTP10 series



ECP10 series

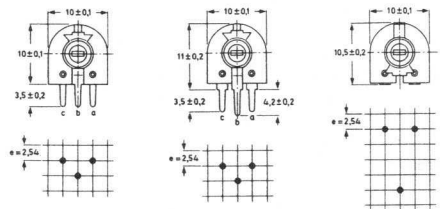


CTP18 series



OUTLINE

CTP10 series (mounting position)

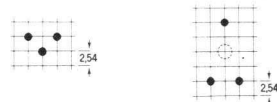


Vertically mounted without shoulder on pins

Vertically mounted with shoulder on pins

Horizontally mounted

ECP10 series (mounting positions)



Vertically mounted.

Horizontally mounted.

Table 1

nom. resistance	code in type number
R_n	
47 Ω	91
100 Ω	51
220 Ω	52
330 Ω	69
470 Ω	53
1 kΩ	54
2.2 kΩ	55
4.7 kΩ	56
10 kΩ	57
22 kΩ	58
47 kΩ	59
100 kΩ	61
220 kΩ	62
470 kΩ	63
1 MΩ	64
2.2 MΩ	65
4.7 MΩ	66

Table 2

nom. resistance	code in type number	nom. resistance	code in type number
R_n		R_n	
100 Ω	101	33 kΩ	333
150 Ω	151	47 kΩ	473
220 Ω	221	68 kΩ	683
330 Ω	331	100 kΩ	104
470 Ω	471	150 kΩ	154
680 Ω	681	220 kΩ	224
1 kΩ	102	330 kΩ	334
1.5 kΩ	152	470 kΩ	474
2.2 kΩ	222	680 kΩ	684
3.3 kΩ	332	1 MΩ	105
4.7 kΩ	472	1.5 MΩ	155
6.8 kΩ	682	2.2 MΩ	225
10 kΩ	103	3.3 MΩ	335
15 kΩ	153	4.7 MΩ	475
22 kΩ	223	6.8 MΩ	685

Potentiometers

preset cermet potentiometers

book 3 part 1d

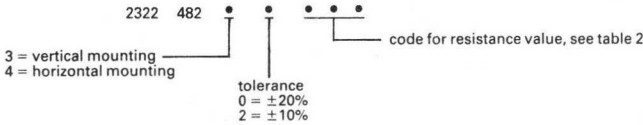
Preset potentiometers are mainly used for preset resistance control with provision for re-adjustment. Preset cermet potentiometers are particularly suitable for use in professional apparatus and/or in those applications where stability is of extreme importance. The EMP10 series is completely enclosed rendering them suitable for applications in unfavourable environments.

Survey of types

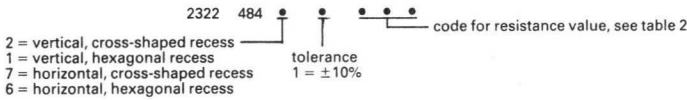
Style	Tolerance range (preferred)	Resistance range (preferred)	Max. power dissipation (W)	Resistance series (preferred)
MTP10 series	10%	47 Ω to 10M Ω	0.5	E6 linear
EMP10 series	10%	47 Ω to 10M Ω	0.5	E6 linear

COMPOSITION OF TYPE NUMBER

MTP10 series



EMP10 series



The CP13 series of potentiometers are for use in miniaturized equipment such as small radio sets, hearing aids, dictaphones etc. On account of their applications a special construction has been used making the addition of a control knob un-necessary.

The CP16 series of potentiometers are for general purpose control type applications. Single tandem and switch options are available.

The CP23 series of potentiometers are widely used in electronic equipment.

Quick reference data

CP13 series

Nominal resistance	4.7, 10 and 22k
Tolerance	20%
Resistance law	linear and logarithmic
Effective angle of rotation	$248 \pm 10^\circ$
Mechanical angle of rotation	$285 \pm 3^\circ$
Life	15 000 cycles

CP16 series

Resistance range	200 Ω to 4.7M Ω
linear law	1k Ω to 2.2M Ω
logarithmic law	$\pm 20\%$
Tolerance	
Effective angle of rotation	
single	235 to 250 $^\circ$
tandem	265 to 275 $^\circ$
Mechanical angle of rotation	
(single potentiometer)	
without switch	270 \pm 5 $^\circ$
with switch	292 \pm 5 $^\circ$
tandem potentiometers	300 \pm 5 $^\circ$

CP23 series

Resistance range	220 Ω to 4.7M Ω
linear law	1k Ω to 4.7M Ω
logarithmic law	$\pm 20\%$
Tolerance	
Effective angle of rotation	250 to 265 $^\circ$
Mechanical angle of rotation	300 \pm 5 $^\circ$

COMPOSITION OF TYPE NUMBER

CP13 series

2222 240 100



06 = 4.7k Ω	} linear law
07 = 10 k Ω	
08 = 22 k Ω	
26 = 4.7k Ω	} logarithmic law
27 = 10 k Ω	
28 = 22 k Ω	

Table 1

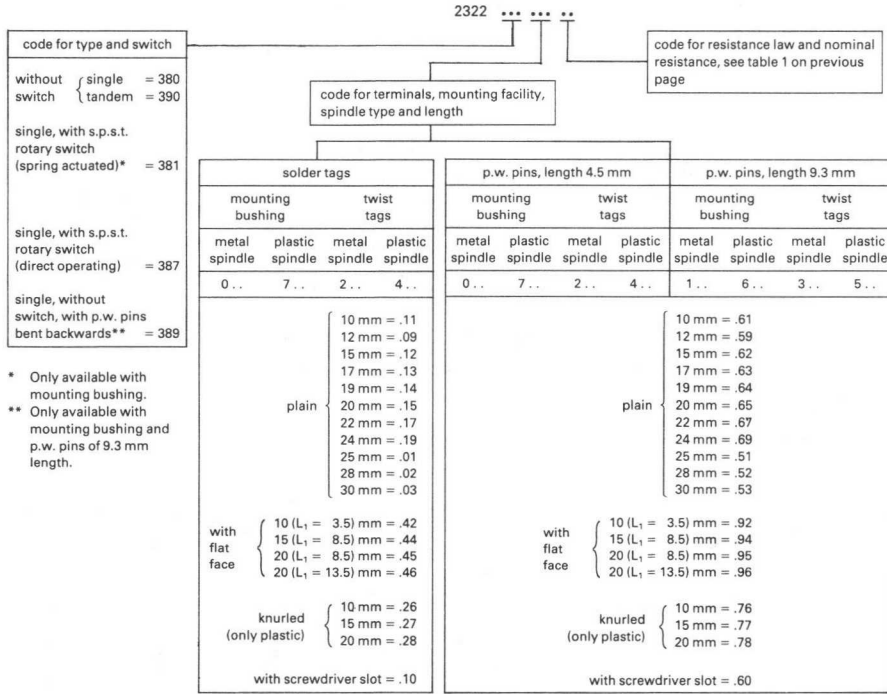
nominal resistance	code in type number			
	linear law	log. law	rev. log. law	balance
220 Ω	02	—	—	—
470 Ω	03	—	—	—
1 k Ω	04	24	44	—
2.2 k Ω	05	25	45	—
4.7 k Ω	06	26	46	—
10 k Ω	07	27	47	91
22 k Ω	08	28	48	92
47 k Ω	09	29	49	93
100 k Ω	11	31	51	94
220 k Ω	12	32	52	95
470 k Ω	13	33	53	96
1 M Ω	14	34	54	97
2.2 M Ω	15	35	55	—
4.7 M Ω	16	—	—	—

Potentiometers

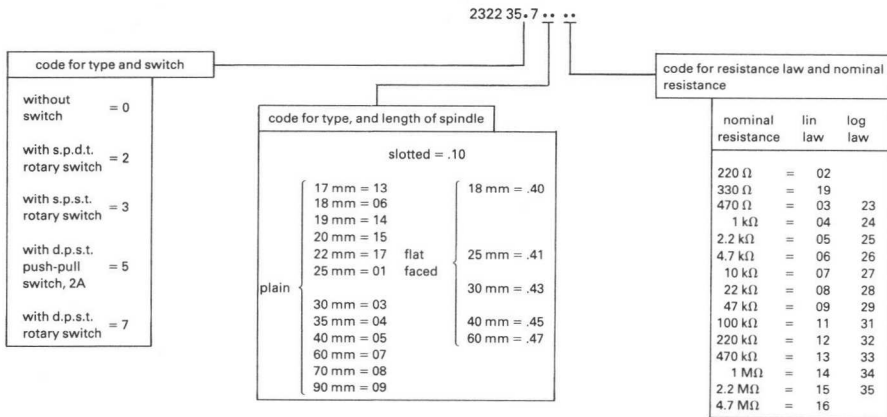
carbon control potentiometers

book 3 part 1d

CP16 series



CP23 series



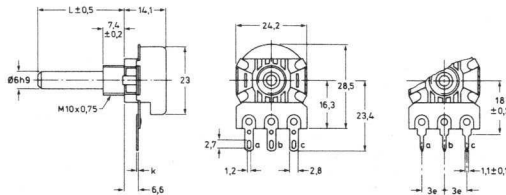
The MCP23 series of cermet control potentiometers are for control functions where high dissipation and stability are necessary, e.g. in industrial control functions.

The potentiometers have a metal glaze resistive element on a ceramic base. The actuating device is an isolated rotor with a multiple wiper operated by a metal or plastic spindle. The bushing is profiled to act as a heatsink.

Quick reference data

Resistance range (Linear E3)	220 Ω to 22 M Ω
Maximum dissipation	5W
Tolerance	$\pm 10\%$
Effective angle of rotation	$270 \pm 2^\circ$
Mechanical angle of rotation	$300 \pm 5^\circ$
Rotational life	25 000 cycles

Outline drawings



Dimensions in mm

COMPOSITION OF TYPE NUMBER

2322 481		
code for terminals and spindle material		code for nominal resistance	
0 = solder tags, metal spindle		02 = 220 Ω	11 = 100 k Ω
1 = p.w. tags, metal spindle		03 = 470 Ω	12 = 220 k Ω
2 = faston tags, metal spindle		04 = 1 k Ω	13 = 470 k Ω
7 = solder tags, plastic spindle		05 = 2.2 k Ω	14 = 1 M Ω
6 = p.w. tags, plastic spindle		06 = 4.7 k Ω	15 = 2.2 M Ω
5 = faston tags, plastic spindle		07 = 10 k Ω	16 = 47 M Ω
		08 = 22 k Ω	17 = 10 M Ω
		09 = 47 k Ω	18 = 22 M Ω
code for spindle length			
06 = 18 mm length			
03 = 30 mm length			
07 = 60 mm length			

Potentiometers

slide carbon potentiometers

book 3 part 1d

The CSP25 series of potentiometers are particularly suitable for use in radio and television receivers. They comprise a straight carbon track fitted to a base plate of resin bonded paper mounted within a housing of black synthetic resin.

The CSP40 and CSP60 series of potentiometers includes two types:
 single potentiometers, for general purposes
 tandem potentiometers, for stereophonic purposes

Survey of types

Style	Nominal resistance			Tolerance	Operating life (both directions)
	linear law	log. law	reversed log-law		
CSP25 series	1kΩ to 4.7MΩ	1kΩ to 2.2MΩ	—	±20%	5 000 cycles
CSP40 series	220Ω to 4.7MΩ	1kΩ to 2.2MΩ	1kΩ to 2.2MΩ	±20%	10 000 cycles
CSP60 series	220Ω to 10MΩ	1kΩ to 4.7MΩ	1kΩ to 4.7MΩ	±20%	10 000 cycles

COMPOSITION OF TYPE NUMBER

CSP25 series

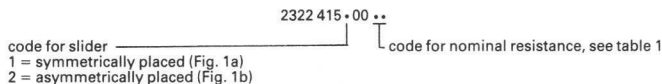


Table 1

nominal resistance	code in type number			
	linear law	log. law	reversed log. law (2)	balance* (2)
220 Ω	02 (1)			
470 Ω	03 (1)			
1 kΩ	04	24	44	
2.2 kΩ	05	25	45	
4.7 kΩ	06	26	46	
10 kΩ	07	27	47	
22 kΩ	08	28	48	
47 kΩ	09	29	49	
100 kΩ	11	31	51	
220 kΩ	12	32	52	
470 kΩ	13	33	53	
1 MΩ	14	34	54	
2.2 MΩ	15	35	55	
4.7 MΩ	16			
330 Ω	19 (1)			

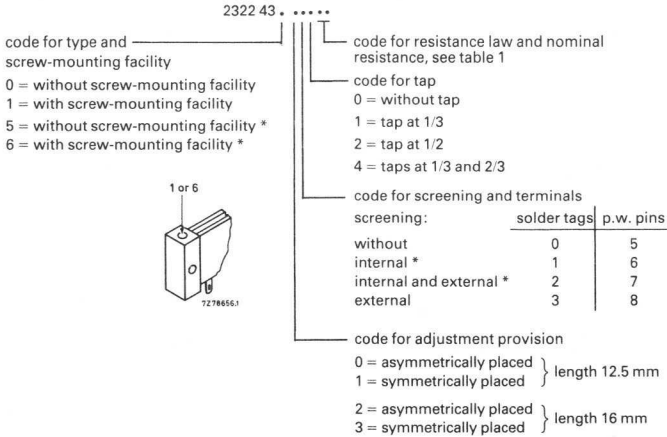
87 }
 88 }
 89 } **
 91 } only available
 92 } without
 93 } tap
 94 }
 95 }

(1) Versions not available in CSP25 series.
 (2) Only for CSP40 and CSP60 series
 * For tandem potentiometers only.
 ** Only available without tap and with tap at 1/3 of total travel. This note applies only to the CSP60 series.

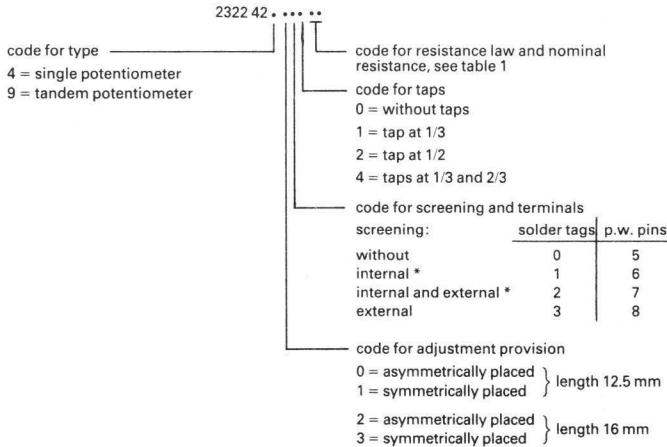
Potentiometers

book 3 part 1d slide carbon potentiometers (cont.)

CSP40 series (available versions)



CSP60 series (available versions)



Potentiometers

pot packs, carbon and cermet

book 3 part 1d

The PP17 series is a range of modular based potentiometers. The series includes resistance elements (linear and logarithmic), battery switches, drive units, mounting brackets, detents, shielding covers and heatsinks which can be assembled to customer's order to form an almost infinite variety of carbon and cermet control potentiometers.

The potentiometer series can be divided into two groups:
 versions without spindle, to be activated by snap-in devices of customer
 versions with one of many available spindle types

Quick reference data

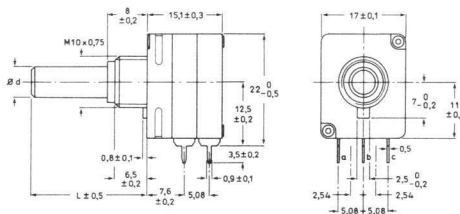
Resistance range (E3 series)

carbon, linear law 220 Ω to 1 MΩ
 carbon, logarithmic law 2.2 to 470 kΩ
 cermet, linear law 220 Ω to 4.7 MΩ

Maximum dissipation

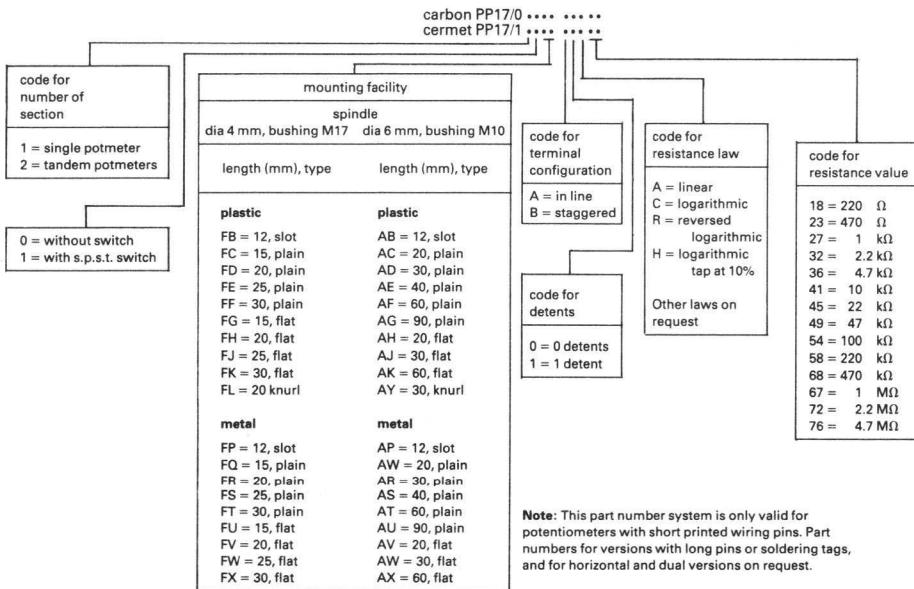
carbon, linear law 0.2W
 carbon, logarithmic law 0.1W
 cermet, linear law 1.25 to 3W

Outline: version with spindle, tandem vertical



with mounting bush M10 x 0.75mm

COMPOSITION OF THE PART NUMBER for versions with spindle



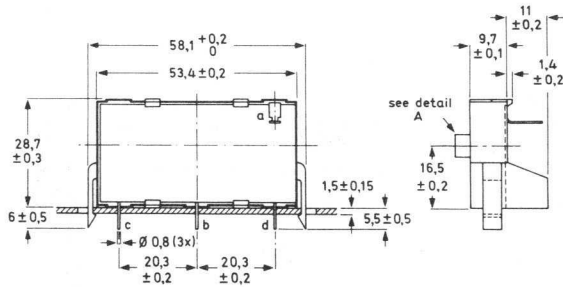
Focus potentiometers are for adjustment of the focusing voltage for colour picture tubes. Type MFU4.5 is used for low-bi colour picture tubes and type MFU7 is for hi-bi colour tubes. Their focusing voltages are approximately 4.5kV and 7kV respectively.

Quick reference data

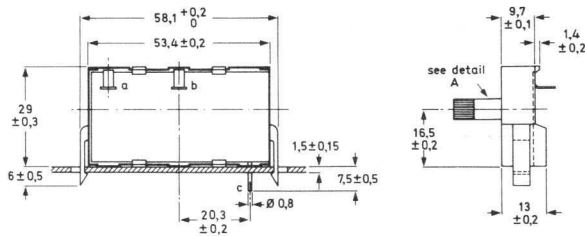
	MFU 4.5				MFU 7	
	2322 460 90016	2322 460 90018	2322 460 90022	2322 460 90027	2322 460 90028	2322 460 90029
Nominal resistance	24 M Ω \pm 20%	59 M Ω \pm 20%	24 M Ω \pm 10%	24 M Ω \pm 10%	83 M Ω \pm 15%	83 M Ω \pm 15%
Maximum dissipation at 70°C	3.8 W	3.8 W	3.8 W	3.8 W	3.8 W	3.8 W
Climatic category, IEC 68	20/070/21	20/070/21	20/070/21	20/070/21	20/070/21	20/070/21

OUTLINES

MFU4.5



MFU7



Potentiometers

multi-turn carbon preset potentiometers

book 3 part 1d

These potentiometers are for preset tuning adjustment in variable capacitance diode television tuners, but can also be used for variable capacitance diode tuning radio receivers, or for any other fine resistance adjustment.

Quick reference data

Nominal resistance
 linear law 100 Ω – 4.7 MΩ
 logarithmic law 1 kΩ – 2.2 MΩ
 special law 100 kΩ

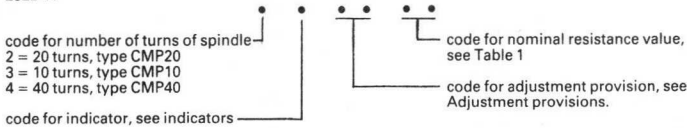
Number of turns of spindle potentiometers CMP10 10
 potentiometers CMP20 20
 potentiometers CMP40 40

Climatic category (IEC 68) 25/070/21

Composition of type number

CMP Series

2322 41



Outline

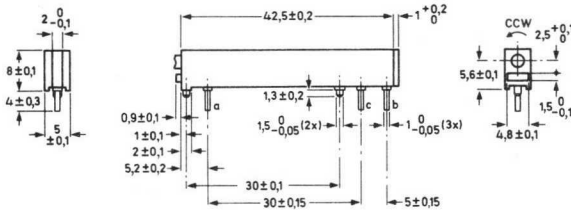


Table 1

nominal resistance	resist. law	limiting slider current	code in type no.
R_n		mA	
100 Ω		55	01
220 Ω		37	02
470 Ω		25	03
1 kΩ		17	04
2.2 kΩ		11	05
4.7 kΩ		8	06
10 kΩ	linear	5.3	07
22 kΩ		3.5	08
47 kΩ		2.3	09
100 kΩ		1.5	11
220 kΩ		0.99	12
470 kΩ		0.85	13
1 MΩ		0.43	14
2.2 MΩ		0.27	15
4.7 MΩ		0.18	16
1 kΩ		10	24
2.2 kΩ		6.8	25
4.7 kΩ		4.4	26
10 kΩ		2.9	27
22 kΩ	logarithmic	1.9	28
47 kΩ		1.3	29
100 kΩ		0.85	31
220 kΩ		0.55	32
470 kΩ		0.37	33
1 MΩ		0.24	34
2.2 MΩ		0.16	35
100 kΩ	special	0.85	(4) 38

Position indicators

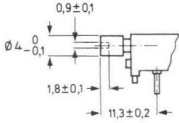
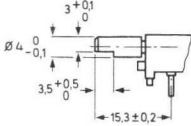
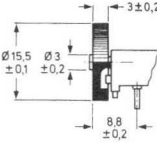
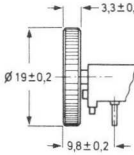
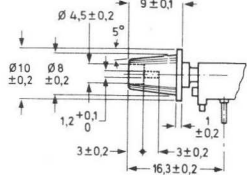
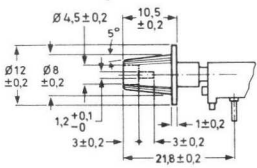
type	code in type number 2322 41	type	code in type number 2322 41
<p>Colour-yellow</p>	4	without indicator	0
<p>Colour-red</p>	5	without indicator, with black dust cover on the housing	8

Potentiometers

book 3 part 1d

multi-turn carbon preset potentiometers

Adjustment provisions

type	colour	code in type number 2322 41 •
	grey	51
	grey	52
 <p data-bbox="266 742 448 762">Knob: approx. 60 notches</p>	red	61
 <p data-bbox="266 925 448 946">Knob: approx. 48 notches</p>	black	62
	black	63
	black	64

1870

1871

1872

1873

1874

1875

1876

1877

1878

1879

1880

1881

1882

1883

Mullard Magnetic Materials

- Products included for the first time in this guide are indicated both in the index pages and data pages by a black dot alongside the type number.

APPLICATION NOTES FOR MANGANESE-ZINC FERROXCUBE

Grade A8 (3E4*)	High permeability material suitable for pulse applications, where the pulse repetition frequency is less than about 500 kHz and for wide band applications where the lowest frequency of the transmission band does not exceed about 1 MHz.
Grade A10 (3D3*)	This is a low-loss high-stability material for use at frequencies between 200 kHz and 2 MHz. Normally available in pot core or RM core form.
Grade A13 (3H1*)	A low-loss high permeability, high stability material. Used in the form of pot cores or RM cores for frequencies up to 300 kHz, or in toroidal form for pulse and wideband transformers where the lowest frequency of the transmission band does not exceed about 10 MHz.
Grade A14 (3H3*)	A very low-loss, high permeability material with excellent long term stability characteristics. Used in the form of RM cores for frequencies up to 300 kHz.
Grade A16 (3C8*)	Suitable for power applications where a high operating flux density and low total core-loss are required. Generally available in U-core and E-core forms, for use in tv line output transformers, switched-mode power supplies and inverters.
Grade 3B } Grade 3C6 }	Materials for extruding as rods and tubes, for use in wide-band chokes.
Grade 3E1 } Grade 3E2 }	High permeability materials for general purpose toroids.
Grade 3H2	Material for general purpose toroids.
Grade 3S1 } Grade 3S2 }	Materials exclusively for RFI suppression beads.

APPLICATION NOTES FOR NICKEL-ZINC FERROXCUBE

Grade B1	A relatively high permeability material with a high intrinsic resistivity. For use at frequencies up to 1 MHz and in applications where the eddy-current loss of a manganese-zinc Ferroxcube becomes unacceptable. It is available as single and double aperture cores.
Grade B2 (4B1*)	This grade is widely used for applications in the frequency range 500 kHz to 2 MHz. It is available in the form of double aperture cores and extruded as rods and tubes, for use in wide band chokes.
Grade B10 (4C6*)	A low-loss high-stability material for use in the frequency range 1 to 15 MHz. Normally available in the form of toroids, pot cores and RM cores for inductor and transformer applications.
Grade 4S3	Material exclusively for RFI suppression beads.

Obsolete materials

Grades A4 and A5 are obsolete materials replaced by grade A13.

Grade A9 is an obsolete material replaced by grade A16.

Grades A19, B4 and B5 have been withdrawn.

*Similar Philips material guides.

cores for power applications in Ferroxcube grade A16 (3C8)

book 3 part 2

For use in switched-mode power supplies and inverters

Description and nominal dimensions	Type number	Accessories		Max. throughput power in push-pull configuration at 25 kHz (W)	Other features	
		Coil former	Other			
E-CORES						
E25/9/6	FX3591*	—	—	—	core pair EE25/19/6	
E25/9/12	FX3590*	—	—	—	core pair EE25/19/12	
E34/13/8	FX3579*	—	—	—	core pair EE34/26/8	
E41/22/9	FX3574*	—	—	—	core pair EE41/44/9	
E44/17/18	FX3838/9†	—	clamp DT2640†	—	circular centre pole; for telephony line hybrid transformer	
E42/21/20	FX3607	—	—	—	—	
E42/21/20	FX3687	—	—	330	transformer core gapped core	
E55/28/21	FX3608	—	—	—	—	
E55/28/21	FX3688	—	—	600	transformer core gapped core	
E55/28/25	FX3609	—	—	—	—	
E55/28/25	FX3689	—	—	700	transformer core gapped core	
E65/33/27	FX3845	—	—	—	—	
E65/33/27	FX3865	—	—	1000	transformer core gapped core	
E186/76/30	FX3690	—	—	—	—	
EC-CORES						
EC35/17/10**	FX3720 FX3721	{DT2723 DT2724}	solder tag	{DT2700 —}	100	transformer core gapped core
EC41/19/12**	FX3730 FX3731	{DT2733 DT2734}	solder tag	{DT2700 DT2701}	150	transformer core gapped core
EC52/24/14**	FX3740 FX3741	{DT2743 DT2744}	solder tag	{DT2700 DT2702}	300	transformer core gapped core
EC70/34/17**	FX3750 FX3751	{DT2753 DT2754}	solder tag	{DT2700 DT2702}	700	transformer core gapped core
ETD CORES						
ETD34/17/11	4312 020 37000 4312 020 37010 4312 020 37020 4312 020 37030 4312 020 37040	4322 021 33850	stainless steel clips 2 per transformer	4322 021 33890	—	nominal gap length = zero nominal gap length = 0.1 mm nominal gap length = 0.2 mm nominal gap length = 0.5 mm nominal gap length = 1.0 mm
ETD39/20/13	4312 020 37050 4312 020 37060 4312 020 37070 4312 020 37080 4312 020 37090	4322 021 33860	stainless steel clips 2 per transformer	4322 021 33900	—	nominal gap length = zero nominal gap length = 0.1 mm nominal gap length = 0.2 mm nominal gap length = 0.5 mm nominal gap length = 1.0 mm
ETD44/22/15	4312 020 37100 4312 020 37110 4312 020 37120 4312 020 37130 4312 020 37140	4322 021 33870	stainless steel clips 2 per transformer	4322 021 33910	—	nominal gap length = zero nominal gap length = 0.2 mm nominal gap length = 0.5 mm nominal gap length = 1.0 mm nominal gap length = 1.5 mm
ETD49/25/16	4312 020 37150 4312 020 37160 4312 020 37170 4312 020 37180 4312 020 37190	4322 021 33880	stainless steel clips 2 per transformer	4322 021 33920	—	nominal gap length = zero nominal gap length = 0.2 mm nominal gap length = 0.5 mm nominal gap length = 1.0 mm nominal gap length = 2.0 mm

* Current types. Available for equipment in current production and in service. Not recommended for new designs.

**Current types. For new designs please consider cores from the ETD series.

† Special types.

cores for power applications in Ferroxcube grade A16 (3C8)

book 3 part 2

For use in switched-mode power supplies and inverters

Description and nominal dimensions	Type number	Accessories			Other features
		Coil former	Number of Pins	Clips*	
U-CORES					
U10/8/3	FX3676	DT2606	4	—	rectangular section
U15/11/6	FX3604	DT2607	4	—	rectangular section
U20/16/7	FX3605	DT2608	4	—	rectangular section
U25/20/13	FX3606	DT2609	10	—	rectangular section
U30/25/16	FX3837	DT2610	10	—	rectangular section
U60/35/15	FX3234	—	—	—	rectangular section
U60/55/15	FX3235	—	—	—	rectangular section
U,I-CORES					
U93/76/30	FX3862	—	—	—	rectangular section
I 93/30/30	FX3863	—	—	—	
U100/57/25	FX3860	—	—	—	rectangular section
I 100/25/25	FX3861	—	—	—	
RM CORES					
RM6-S	FX3970 LA1661 LA1662 LA1663	DT2491 DT2492	4 6	DT2398** or DT2498	transformer core gapped core assembly $A_L = 63$ gapped core assembly $A_L = 100$ gapped core assembly $A_L = 160$
RM8	FX3670 LA1630 LA1631 LA1632	DT2470 DT2480	4 8	DT2396** or DT2496	transformer core gapped core assembly $A_L = 100$ gapped core assembly $A_L = 160$ gapped core assembly $A_L = 250$
RM10	FX3920 LA1641 LA1642 LA1643 LA1644 LA1645	DT2534 DT2614 DT2641	0 5	DT2406** or DT2506	transformer core gapped core assembly $A_L = 160$ gapped core assembly $A_L = 250$ gapped core assembly $A_L = 315$ gapped core assembly $A_L = 400$ gapped core assembly $A_L = 630$
RM14	FX3980 LA1671 LA1672 LA1674 LA1675 LA1676	DT2631 DT2632	12 0	DT2633	transformer core gapped core assembly $A_L = 160$ gapped core assembly $A_L = 250$ gapped core assembly $A_L = 400$ gapped core assembly $A_L = 630$ gapped core assembly $A_L = 1000$

*Clips, 2 required per transformer.

**Current types. Available for equipment in current production and in service. Not recommended for new designs.

Transformer pot cores

Size (mm)		Grade A13 (3H1)		Grade A8 (3E4)		Accessories				
dia.	height	type number	A _L min (μe min)	type number	A _L min	Coil former		pressure ring	clips (4 per transformer)	tag board
						1 section	2 section			
10	3.4	FX2501	1205	FX3280	2493	DT2169	—	DT2341	DT2342	DT2344
12	3.9	FX2502*	(900)	—	—	DT2170	—	DT2346	DT2347	DT2349
14	4.5	FX2236**	(950)	—	—	DT2202	DT2279	DT2351	DT2352	DT2354
18	5.6	FX2238**	(1150)	—	—	DT2178	DT2281	DT2356	DT2357	DT2359
21	6.8	FX2239**	(1150)	—	—	DT2204	DT2282	DT2361	DT2362	DT2364
25	8.0	FX2240**	(1200)	—	—	DT2179	DT2283	DT2366	DT2367	DT2369
30	9.4	FX2241	5815	FX3286	11250	DT2205	DT2284	DT2371	DT2372	DT2374
35	11.4	FX2242	6950	FX3287	13350	DT2180	DT2285	DT2376	DT2377	DT2379
45	14.6	FX2243	8830	FX3288	15000	DT2206	—	DT2501	DT2502	DT2504

*Current type. Available for equipment in current production and in service. Not recommended for new designs.

**Current type. For new designs please refer to small signal transformer RM cores.

Transformer RM cores (to IEC 431)

Size	Grade A13 (3H1)		Grade A8 (3E4)		Accessories					
	type number	A _L min	type number	A _L min	Coil former			Clips (2 per transformer)		
					No of pins	1 section	2 section	Plain	With earth tags	
RM5	—	—	+*LA1577 LA1578	2587 3731	4	DT2612	—	—	—	DT2601
					6	DT2602				
RM6-S	FX3432	1930	FX3437 LA1522	3300 4125	4	DT2491	—	DT2494	DT2398†	DT2498
					6	DT2492				
					6	—				
RM6-R	FX3433	2000	FX3438 LA1523	3560 5400	4	DT2467	—	DT2477	DT2398†	DT2498
					6	DT2517				
RM7	FX3434	2230	FX3439	4200	4	DT2468	—	DT2523	DT2387†	DT2487
					5	DT2391				
					8	DT2392				
RM8	FX3435	2400	FX3440 LA1524	4725 6000	4	DT2470	—	DT2481	DT2396†	DT2496
					8	DT2480				
RM10	FX3436	3260	FX3441 +**FX3971	6450 7875	5	DT2534	—	DT2539	DT2406†	DT2506
					8	DT2335				
					5	DT2641				
					8	DT2642				
					12	DT2644				

*LA1577 manufactured in 3E1 material.

**FX3971 – special product.

†Current types. Available for equipment in current production and in service. Not recommended for new designs.

cores for small signal applications (cont.)

book 3 part 2

Small pressed cores

Toroids – design range nylon coated

Nominal dimensions (mm)	Design data (mm)	Type number			
		grade 3H2 (A13) (grey)	grade 3E1 (green)	grade 3E2 (blue)	grade 4C6 (violet)
4.3 x 1.9 x 1.4	4 x 2.2 x 1.1	FX4060	—	FX4050	—
6.3 x 3.7 x 2.3	6 x 4 x 2	FX4061	—	FX4051	FX3850
9.4 x 5.6 x 3.4	9 x 6 x 3	FX4062	—	FX4052	FX3851
14.5 x 8.5 x 5.5	14 x 9 x 5	FX4063	—	FX4053	FX3852
23.6 x 13.4 x 7.6	23 x 14 x 7	FX4064	—	FX4054	FX3853
29.6 x 18.4 x 8.1	29 x 19 x 7.5	—	FX4072	—	—
36.6 x 22.4 x 10.6	36 x 23 x 10	—	FX4073	—	—
36.6 x 22.4 x 15.6	36 x 23 x 15	—	FX4074	—	FX3854

Toroids – non-preferred range: not coated

Nominal dimensions (mm)	Type number	
	grade A13	grade A8
12.7 x 6.3 x 3.2	FX2691	FX3311
	FX3008*†	—
	FX3009*	—
25.4 x 19 x 4.8	—	FX3312
38.1 x 25.4 x 6.3	—	FX3313

*coated types; †FX3008 – special product.

Toroids – special range: intended for use in a.c. motor speed control; nylon coated: purple

Nominal dimensions (mm)	Type number grade A16 (3C8)
13.2 x 5.4 x 4.1	FX3848
27.6 x 17.1 x 6.3	FX3849

Single and double aperture cores

Basic shape and nominal dimensions (mm)	Ferroxcube grade	Type number
	A13	FX2633
	B1	FX2431*
	A13	FX2754
	B2	FX2049*
	A8	FX3316 (half channel)
	A13	FX3991*
	A8	FX2837 (half channel)
	A13	FX2634
	B1	FX2249 (full channel)

*Current types. Available for equipment in current production and in service. Not recommended for new designs.

Ferrocube

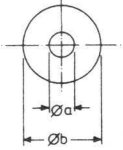
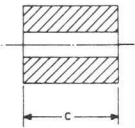
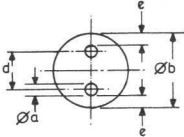
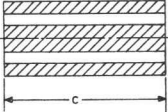
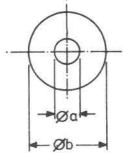
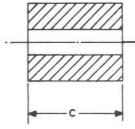
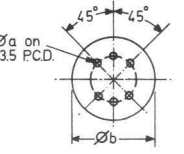
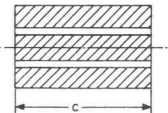
cores for small signal applications (cont.)

book 3 part 2

Extruded cores

Screening beads

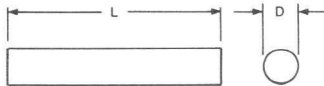
Ferrocube beads with 1, 2 or 6 holes which can be used to introduce, in a simple way, additional impedance for the suppression of unwanted parasitic oscillations, or to provide screening.

Nominal Dimensions (mm)			Ferrocube grade	Nominal dimensions (mm)					Ferrocube grade		
a	b	c		a	b	c	d	e			
1.55	4.15	5.6	A1	0.7	5.9	12.4	2.6	0.8	B2		
											
1.55	4.15	5.6	B2	0.6	6.3	10.5	—	—	B2		
											

Rods and tubes

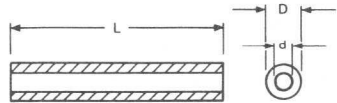
Ferrocube rods and tubes are available in a limited range of sizes and materials. As the available range is subject to change, Mullard Ltd. will be pleased to discuss requirements for rods and tubes in significant quantities.

Rods



Type No.	Ferrocube grade	Nominal dimensions (mm)	
		D _{max}	L _{max}
3122 104 91110	4B1	1.65	12.2
3122 104 91150	4B1	1.75	18.5
8122 104 90490	3C6	4.95	36.0
3122 134 90110	3C6	4.95	50.0
4330 030 30080	4B1	5.00	25.0
4330 030 30110	4B1	5.00	14.0

Tubes



Type No.	Ferrocube grade	Nominal dimensions (mm)		
		D _{max}	d _{max}	L _{max}
4322 020 34400	3B	3.7	1.2	3.5
4322 020 34420	4B1	3.7	1.2	3.5
4322 020 36750	3B	4.3	2.0	15.4
3122 104 93760	3C6	4.95	2.9	36.0

Mullard Ltd. will be pleased to discuss requirements for other rods and tubes in significant quantities.

cores for small signal applications (cont.)

book 3 part 2

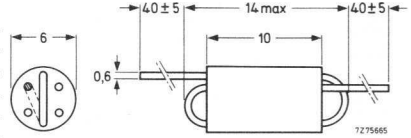
Extruded cores (cont.)

Wideband h.f. chokes

Wideband h.f. chokes are used for interference suppression, for example, in electric motors. Double chokes are used for twin leads, in which case the advantages of mutual induction can be realized. The chokes are supplied with six axial holes through which 1.5, 2.5 or 2 x 1.5 (double chokes) turns of tinned copper wire are threaded.

number of turns	Z _{max} kΩ	f at Z _{max} MHz	decrease of impedance		grade	catalogue number
			in the freq. range MHz	dB		
1.5	≥0.3	120	10-300	≤7	3B	4312 020 36630
1.5	≥0.35	250	80-300	≤3	4B1	4312 020 36690
2.5	≥0.6	50	10-200, 30-100	≤7, ≤3	3B	4312 020 36640
2.5	≥0.7	180	50-300, 80-220	≤6, ≤3	4B1	4312 020 36700
2 x 1.5	≥0.7*	50	10-220, 30-100	≤7, ≤3	3B	4312 020 36650
2 x 1.5	≥0.8*	110	50-300, 80-220	≤7, ≤3	4B1	4312 020 36710

*Measure with two 1.5 turn windings in series.



R.F.I. suppression beads

The suppression of radio frequency interference can often be achieved by the use of Ferroxcube beads. A simple bead combination of beads threaded on the leads of one or two components in the circuit can give the required damping or attenuation characteristic.

FX4000 Series

Material grade	Type number	Dimensions (mm)	Minimum Z (Ω) at different frequencies					
			1 MHz	3 MHz	10 MHz	30 MHz	100 MHz	300 MHz
3S1 plain	FX4000	3 × 0.7 × 4	24	38	39	31	26	23
	FX4001	3 × 0.7 × 10	58	95	97	77	66	58
	FX4002	3 × 1.0 × 4	18	29	30	24	20	18
	FX4003	3 × 1.0 × 10	44	72	73	59	50	44
	FX4004	5 × 0.7 × 4	32	52	53	42	36	32
	FX4005	5 × 0.7 × 10	79	128	131	105	89	79
	FX4006	5 × 1.5 × 4	20	31	32	26	22	20
	FX4007	5 × 1.5 × 10	48	78	80	64	55	48
	FX4008	5 × 2.0 × 4	15	24	24	20	17	15
	FX4009	5 × 2.0 × 10	37	60	61	49	42	37
3S2 blue tint	FX4010	3 × 0.7 × 4	4	12	25	32	42	27
	FX4011	3 × 0.7 × 10	9	20	63	81	104	67
	FX4012	3 × 1.0 × 4	3	9	19	25	32	20
	FX4013	3 × 1.0 × 10	7	23	48	61	79	51
	FX4014	5 × 0.7 × 4	5	16	24	44	57	37
	FX4015	5 × 0.7 × 10	12	40	85	10	142	91
	FX4016	5 × 1.5 × 4	3	10	21	27	35	22
	FX4017	5 × 1.5 × 10	7	25	52	68	87	55
	FX4018	5 × 2.0 × 4	2	8	16	20	26	17
	FX4019	5 × 2.0 × 10	6	19	40	51	66	43
	FX4020	8 × 1.5 × 4	4	14	29	38	48	31
	FX4021	8 × 1.5 × 10	10	34	72	93	120	77
	FX4022	8 × 2.0 × 4	4	11	24	31	40	26
	FX4023	8 × 2.0 × 10	9	28	60	77	100	64
FX4024	8 × 3.0 × 4	2	8	17	22	28	18	
FX4025	8 × 3.0 × 10	6	20	42	55	71	45	
4S3 red tint	FX4026	3 × 0.7 × 4	1	3	11	27	50	57
	FX4027	3 × 0.7 × 10	2	9	28	67	126	140
	FX4028	3 × 1.0 × 4	1	3	9	20	38	43
	FX4029	3 × 1.0 × 10	2	8	21	50	95	107
	FX4030	5 × 0.7 × 4	2	5	16	36	68	77
	FX4031	5 × 0.7 × 10	4	12	38	90	170	190
	FX4032	5 × 1.5 × 4	1	3	9	22	41	47
	FX4033	5 × 1.5 × 10	2	7	23	55	104	116
	FX4034	5 × 2.0 × 4	1	2	7	17	32	36
	FX4035	5 × 2.0 × 10	2	6	18	42	80	89
	FX4036	8 × 1.5 × 4	1	4	13	31	57	65
	FX4037	8 × 1.5 × 10	3	10	32	77	145	161
	FX4038	8 × 2.0 × 4	1	3	11	26	49	55
	FX4039	8 × 2.0 × 10	2	9	27	64	121	134
	FX4040	8 × 3.0 × 4	1	3	8	18	34	38
	FX4041	8 × 3.0 × 10	2	6	19	45	85	95

A range kit of the FX4000 Series of suppression beads is available for development and laboratory use. Some of the above types may be subject to a minimum manufacturing quantity.

Ferroxcube

cores for small signal applications (cont.)

book 3 part 2

Miscellaneous cores

E-cores

Type No.	Minimum effective permeability (μ_e) for two 'E' cores at 25°C	Dimensions for two E cores (mm)		
		length	height	width
FX1052*	900	13	13	3
FX1652*	1020	20	19	5
FX1238*	1100	25	19	6
FX1007*	1150	41	44	9
FX1239*	1150	34	26	8
FX1818*	1150	42	35	9
FX1653*	1150	90	63	24

*Current types. Available for equipment in current production and in service. Not recommended for new designs.

H core assembly

Type No.	Minimum effective permeability (μ_e) at 25°C	Dimensions (mm)			No. of pins
		length	width	height	
*LA1246 (H10)	3820	12.4	11.2	6.1	8

*Current type. Available for equipment in current production and in service. Not recommended for new designs.

Cross cores (X cores)

Type No.	Minimum effective permeability (μ_e) at 25°C	Dimensions (mm)			
		length	width	height (pair)	centre hole (min)
FX2856 (X 22)	1440	21.3	21.3	14.2	ø3
FX2857 (X 30)	1525	29.6	29.6	23.6	ø4.5
FX2858 (X 35)	1580	34.6	34.6	28	ø5.5

book 3 part 3 Vinkor pot cores (to BS4061 range 1)

Size mm	Violet range Ferroxcube grade A13 (3H1)			Red range Ferroxcube grade A10 (3D3)			Blue range Ferroxcube grade B10 (4C6)		
	Type No.	Standard adjuster	Effective permeability (μ_e) with adjuster in mid-range position	Type No.	Standard adjuster	Effective permeability (μ_e) with adjuster in mid-range position	Type No.	Standard adjuster	Inductance factor (A_L) (nH)
10	LA1421	LA1383	100				LA1378	LA1384	33.8
	LA1422	LA1383	63				LA1379	LA1384	32.0
	LA1423	LA1383	40				LA1380	LA1384	30.0
12*	*LA1418	LA1383	100						
	*LA1419	LA1383	63						
	*LA1420	LA1383	40						
14**	LA1228	LA1505	250	LA1157	LA1506	63	LA1375	LA1526	55.0
	LA1229	LA1505	160	LA1158	LA1506	40	LA1376	LA1526	45.7
	LA1230	LA1505	100				LA1377	LA1526	37.0
	LA1417	LA1506	63						
	LA1225	LA1502	250	LA1161	LA1503	63	LA1372	LA1525	76.2
18**	LA1226	LA1502	160	LA1162	LA1503	40	LA1373	LA1525	59.4
	LA1227	LA1502	100	LA1163	LA1503	25	LA1374	LA1525	45.4
	LA1416	LA1503	63						
	LA1222	LA1502	250	LA1164	LA1503	63			
	LA1223	LA1502	160	LA1165	LA1503	40			
21**	LA1224	LA1502	100	LA1166	LA1503	25			
	LA1415	LA1503	63						
	LA1218	LA1428	400	LA1167	LA1432	63			
25**	LA1219	LA1428	250	LA1168	LA1432	40			
	LA1220	LA1428	160	LA1169	LA1432	25			
	LA1221	LA1428	100						
	LA1414	LA1432	63						
	LA1214	LA1428	400	LA1170	LA1428	63			
30	LA1215	LA1428	250	LA1171	LA1432	40			
	LA1216	LA1428	160	LA1172	LA1432	25			
	LA1217	LA1428	100						
	LA1413	LA1428	63						
	LA1210	LA1362	400	*LA1173	LA1428	63			
35	LA1211	LA1362	250	*LA1174	LA1432	40			
	LA1212	LA1362	160	LA1175	LA1432	25			
	LA1213	LA1428	100						
45	LA1412	LA1428	63						
	LA1409	LA1362	250						
	LA1410	LA1362	160						
	LA1411	LA1362	100						

ACCESSORIES

Size (mm)	Coil former		Clips (4 per assembly)	Ring (1 per assembly)	Tag board (1 per assembly)
	1 Section	2 Section			
10	DT2169 †DT2309	—	DT2342	DT2341	DT2344
12*	DT2170	—	DT2347	DT2346	DT2349
14**	DT2202 †DT2311	DT2279 —	DT2352	DT2351	DT2354
18**	DT2178 †DT2312	DT2281	DT2357	DT2356	DT2359
21**	DT2204	DT2282	DT2362	DT2361	DT2364
25**	DT2179	DT2283	DT2367	DT2366	DT2369
30	DT2205	DT2284	DT2372	DT2371	DT2374
35	DT2180	DT2285	DT2377	DT2376	DT2379
45	DT2206	—	DT2502	DT2501	DT2504

*Current type. Available for equipment in current production and in service. Not recommended for new designs.

**Current type. Available for equipment in current production and service. For new designs refer to RM inductor cores, Book 3 part 4.

†Spaced-off coil former for blue range Ferroxcube grade B10 (4C6).

RM inductor cores (to IEC 431)

book 3 part 4

The LA4000 'RM' range of high quality inductor cores for direct mounting on printed-wiring boards, is designed to achieve a greater packing density and to reduce the time and cost of assembly. Each core consists of two halves, held together by metal clips, thus providing a quick and easy method of assembly on a printed-wiring board with a grid spacing of 2.54 mm (0.1 in) by means of pins in the coil former.

Size	Grey Range Ferroxcube grade A14 (3H3)			Violet range Ferroxcube grade A13 (3H1)		
	Type No.	Inductance factor A_L (nH)	Standard adjuster	Type No.	Inductance factor A_L (nH)	Standard adjuster
RM5 (LA4000 Series)	LA4076	250	LA1519 (Grey)	LA4046	250	LA1519 (Grey)
	LA4077	160	LA1495 (Brown)	LA4047	160	LA1495 (Brown)
	LA4078	100	LA1494 (Yellow)	LA4048	100	LA1494 (Yellow)
RM6-S Series	LA1584 to LA1587 are obsolete types. Refer to Mullard House for alternative types.			LA1530	630	LA1501 (Blue)
				LA1487	400	LA1501 (Blue)
				LA1436	315	LA1501 (Blue)
				LA1437	250	LA1429 (Natural)
				LA1441	160	LA1429 (Natural)
				LA1442	100	LA1500 (Red)
RM6-R (LA4100 Series)	LA4175	400	LA1501 (Blue)	LA4145	400	LA1501 (Blue)
	LA4176	250	LA1429 (Natural)	LA4146	250	LA1429 (Natural)
	LA4177	160	LA1429 (Natural)	LA4147	160	LA1429 (Natural)
	LA4178	100	LA1500 (Red)	LA4148	100	LA1500 (Red)
RM7 (LA4200 Series)	LA4275	400	LA1400 (Blue)	LA4245	400	LA1400 (Blue)
	LA4276	250	LA1399 (Natural)	LA4246	250	LA1399 (Natural)
	LA4277	160	LA1399 (Natural)	LA4247	160	LA1399 (Natural)
	LA4278	100	LA1427 (Red)	LA4248	100	LA1427 (Red)
RM8 (LA4300 Series)	—	—	—	LA4344	630	LA1430 (Blue)
	LA4375	400	LA1424 (Natural)	LA4345	400	LA1424 (Natural)
	LA4376	250	LA1424 (Natural)	LA4346	250	LA1424 (Natural)
	LA4377	160	LA1431 (Red)	LA4347	160	LA1431 (Red)
RM10 (LA4500 Series)	—	—	—	LA4348	100	LA1431 (Red)
	—	—	—	LA4543	1000	LA1433 (Blue)
	—	—	—	LA4544	630	LA1428 (Natural)
	—	—	—	LA4545	400	LA1428 (Natural)
	—	—	—	LA4546	250	LA1432 (Red)
	—	—	LA4547	160	LA1432 (Red)	

Size	Red range Ferroxcube grade A10 (3D3)			Blue range Ferroxcube grade B10 (4C6)		
	Type No.	Inductance factor A_L (nH)	Standard adjuster	Type No.	Inductance factor A_L (nH)	Standard adjuster
RM5 (LA4000 Series)	LA4028	100	LA1494 (Yellow)	—	—	—
	LA4029	63	LA1493 (Red)	—	—	—
	LA4030	40	LA1492 (Natural)	—	—	—
RM6-S Series	LA1497	100	LA1500 (Red)	LA1562	36	LA1555
	LA1498	63	LA1500 (Red)	LA1563	51	LA1555
	LA1485	40	LA1500	—	—	—
	—	—	—	—	—	—
RM6-R (LA4100 Series)	LA4128	100	LA1500 (Red)	LA4161	47	LA1555
	LA4129	63	LA1500 (Red)	LA4162	40	LA1555
	LA4130	40	LA1500 (Red)	LA4163	34	LA1555
	—	—	—	—	—	—
RM7 (LA4200 Series)	LA4228	100	LA1427 (Red)	—	—	—
	LA4229	63	LA1427 (Red)	—	—	—
	LA4230	40	LA1427 (Red)	—	—	—
RM8 (LA4300 Series)	LA4328	100	LA1431 (Red)	—	—	—
	LA4329	63	LA1431 (Red)	—	—	—
	—	—	—	—	—	—
RM10 (LA4500 Series)	LA4528	100	LA1432 (Red)	—	—	—
	LA4529	63	LA1432 (Red)	—	—	—
	—	—	—	—	—	—

ACCESSORIES

Size	Coil formers			Clips (2 per assembly)		Aligning plug
	1 section	No. of pins	2 section	Without earth tag	With earth tag	
RM5	DT2612	4	—	—	DT2630	DT2500
	DT2602	6	—	—	—	
RM6-S	DT2491	4	—	DT2398*	DT2498	DT2505
	DT2492	6	—	—	—	
RM6-R	DT2467	4	—	—	—	DT2505
	DT2605	4	—	DT2398*	DT2498	
	DT2517	6	DT2477	—	—	
RM7	DT2468	4	—	—	—	DT2505
	DT2391	5	—	DT2387*	DT2487	
	DT2392	8	DT2523	—	—	
RM8	DT2470	4	—	—	—	DT2518
	DT2480	8	DT2481	DT2396*	DT2496	
RM10	DT2534	5	—	—	—	DT2519
	DT2535	8	DT2539	DT2406*	DT2506	
	DT2641	5	—	—	—	
	DT2642	8	DT2643	—	—	
	DT2644	12	DT2645	—	—	

Note:

RM5 CLIPS – DT2630 replaces DT2601.

*Current types. Available for equipment in current production and in service. Not recommended for new designs.

Permanent magnets

In addition to designs produced in consultation with the customer, using our design and application facilities, Mullard provide a service for the design and manufacture of RARE EARTH (page 121) and ceramic (FERROXDURE) magnets to customers' specialised requirements. A range of standard shapes and sizes is also available, including segments, rings, discs and blocks. Please consult Mullard House for your requirements.

material properties — Ferroxdure

Material	$(BH)_{max}$ (kJ/m ³)	Br (typ) (mT)	H _c J (typ) (kA/m)
Ferroxdure 300	29.5	400	145 (H _c B) min
Ferroxdure 370	27.9	390	247
Ferroxdure 330	25.5	370	247
Ferroxdure 270	21.5	340	255
Ferroxdure 380	28.5	390	275
Ferroxdure 400	31.5	410	275
Ferroxdure 410	27.0	380	320
Ferroxdure 425	33.0	420	240

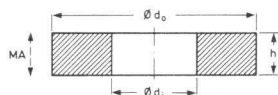
preferred loudspeaker rings in Ferroxdure 300 material

Type No.	nominal dimensions (mm)			Type No.	nominal dimensions (mm)		
	o.diam.	i.diam.	height		o.diam.	i.diam.	height
*FD5390	36	18	8	FD5134	90	36	17
FD501	45	22	8	FD505	102	51	14
FD5026	51	24	9	FD5383	102	51	18
FD5422	55	24	8	FD5410	102	51	20
FD5551	60	24	9	FD5397	110	45	18
FD5406	60	24	14	FD506	121	57	12
FD5018	60	30	10	FD5328	121	57	17.5
FD5269	72	32	10	FD5424	121	57	20
FD5112	72	32	15	FD5363	134	57	20
FD5356	84	32	15	FD5387	224	122	25.3

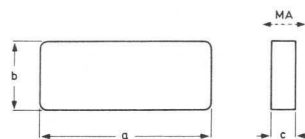
blocks in Ferroxdure 330 material

Type No.	Nominal dimensions (mm)		
	a	b	c
FD538	50	19	4.9
*FD541	50	19	6.1
*FD5306	40	25	10
FD5286	152.4	101.6	25.4
FD5288	131	51	17.5
FD5323	102	76	25

*Magnetised; magnetisation direction is c



Preferred loudspeaker rings



FXD blocks.

Rare earth magnets

Rare earth magnets provide more magnetic energy than magnets made from any other available material. They have high values of remanence and coercivity together with low temperature coefficients of these properties.

The development of rare earth magnets enables designers to reduce the volume of magnetic material used. The high value of remanence often eliminates the need for steel pole pieces to concentrate the flux. High values of coercivity enable very short magnetic path lengths to be specified.

RES rare earth magnets

RES magnets (rare earth sintered) are intermetallic compounds of the rare earth samarium and cobalt. These magnets can operate continuously at 250 °C and do not demagnetise. However, to prevent mechanical damage they should be magnetised, whenever possible, after assembly. To enhance the stability with temperature, the magnets can be aged at a controlled temperature.

Typical material properties – RES rare earth magnets

Material	B_r (mT)	H_cB (kA/m)	H_cJ min. (kA/m)	$(BH)_{max}$ (kJ/m ³)
RES 160	810	600	1100	128
RES 190	890	670	1100	154
RES 220	950	710	1100	176

maximum continuous operating temperature: +250°C

Rare earth magnets: test conditions and sampling

Test conditions: temperature of test piece is $25 \pm 2^\circ\text{C}$

Sampling: These specifications relate to tests carried out on test pieces made from each batch of material taken from normal production.

Standard Sizes

DISCS in RES 190	Diameter	Height	Type numbers
	5.0 ± 0.15	1.5 ± 0.05	4313-059-66040
	5.0 ± 0.15	2.0 ± 0.05	4313-059-66070
	6.0 ± 0.2	4.0 ± 0.2	4313-059-66000
	10.0 ± 0.2	4.0 ± 0.2	4313-059-66020
	10.5 / 10.0	1.5 / 1.4	4313-059-66030
	14.0 ± 0.2	4.0 ± 0.2	4313-059-66010
	17.5 ± 0.05	2.5 ± 0.05	4313-059-66100

BLOCKS in RES 190	Length	Width	Thickness	Type numbers
	3.0 ± 0.1	2.0 ± 0.1	1.0 ± 0.1	4313-059-68080
	4.0 ± 0.1	4.0 ± 0.1	2.0 ± 0.15	4313-059-68330
	8.0 ± 0.2	5.0 ± 0.2	3.0 ± 0.1	4313-059-68350
	13.0 ± 0.2	7.0 ± 0.2	2.5 ± 0.1	4313-059-68370
	13.0 ± 0.2	7.0 ± 0.2	2.5 ± 0.1	4313-059-68200
	20.0 ^{+0.3} _{-0.7}	10.0 ± 0.1	10.0 ± 0.1	4313-059-68220
	42.0 ± 1.5	42.0 ± 1.5	5.0 ± 0.1	4313-059-68290
	42.0 ± 1.5	42.0 ± 1.5	10.0 ± 0.1	4313-059-68300
	63.0 ± 1.5	36.0 ± 1.5	5.0 ± 0.1	4313-059-68260
	63.0 ± 1.5	36.0 ± 1.5	10.0 ± 0.1	4313-059-68270

Notes:

Magnetised except where marked *

Magnetic axis through height or thickness.

All dimensions in mm.

Mullard supply magnets made to customer's drawings.

PXE piezoelectric ceramic components

Piezoelectricity is 'pressure' electricity, a property of certain crystalline materials and of man-made poly-crystalline ceramic materials. It provides a simple, direct method for electro-mechanical, and mechano-electrical energy transformations. Mullard have introduced into their range of electrical ceramics piezoelectric elements chosen from three main grades of material. These elements are robust and have a high mechanical stiffness. They have the advantage that element shapes and their piezoelectric properties are formed during manufacture, and can be chosen to meet the requirements for particular applications. There are many fields in which modern piezoelectric elements have already been applied, and these materials are now of increasing importance to industry.

material properties

Material	PXE5	PXE21	PXE41	PXE42	PXE43	PXE52	Unit
Thermal and mechanical data							
Curie temperature	285	270	315	325	300	170	°C
Density ρ_m	7.65	7.75	7.90	7.7	7.7	7.9	10^3kg/m^3
Mechanical quality factor for radial mode							
Q_m^E	≈ 80	≈ 80	≈ 1000	≈ 750	≈ 1000	≈ 50	—
N_p^E	2000	2000	2200	2200	2350	2000	—
Frequency constants							
N_3^D	1900	1900	2000	2015	2050	1920	Hz m or m/s
N_1^E	1460	—	1620	—	—	—	—
N_5^E	930	—	950	—	—	—	—
Electrical data							
Relative permittivity $\epsilon_{33}^{T/0}$	1800	1750	1200	1300	1000	3500	—
Dielectric loss factor $\tan \delta$	20	18	2.5	2.5	2.0	22	10^{-3}
Electro-mechanical data							
Coupling factors							
k_p	0.60	0.62	0.58	0.58	0.5	0.63	—
k_{33}	0.69	0.72	0.68	0.68	0.63	0.73	—
k_{31}	0.35	0.37	0.34	0.34	0.3	0.37	—
k_{15}	0.66	—	0.7	—	—	—	—
Piezoelectric charge constants							
d_{33}	362	385	268	285	210	550	10^{-12}C/N
d_{31}	-175	-180	-119	-130	-95	-250	or m/V
d_{15}	515	—	480	—	—	—	—
Piezoelectric voltage constants							
g_{33}	22.7	25.0	25.2	25.0	25.0	17.8	10^{-3}Vm/N
g_{31}	-11.0	-11.6	-11.6	-11.0	-10.7	-8.1	or m^2/C
g_{15}	32.5	—	38.5	—	—	—	—

preferred types

Ultrasonic cleaning and welding

Type No.	PXE	Dimensions (mm)		
		o.d.	i.d.	thickness
MB1109	41	50	—	3
MB2023	42	38.1	12.7	6.35

Discs for tone generator applications in PXE52

Type No. 4322 020	Number of electrodes	Disc diameter (mm)	Nominal capacitance (nF)	Series resonant frequency (kHz)
08860	2	12.5	6	12
08820	2	20	15	6.5
08840	2	27	25	4.5
08850	2	35	40	2.8
08930*	2	50	40	1.6
08870	3	20	12	6.5
08880	3	27	22	4.5
08890	3	35	35	2.8

*Specifically designed for use in telephones.

Special PXE products

Some special products have been developed for specific applications. For applications of small movement transducers, fluid valves and automobile 'knock' sensing, please send written enquiries direct to Mullard House.

Mullard Special products and Assemblies

- Products included for the first time in this guide are indicated both in the index pages and data pages by a black dot alongside the type number.

Loudspeakers

high fidelity applications

book 3 part 6

DOME TWEETERS

Type number	Size (in)	Power handling capacity (W) (note 1)	Sound power level (dB/m per W)	Resonance frequency (Hz)	Impedance (Ω)	Dome, cone, surround material
AD11800/T8	1	20/4	89	1700	8	textile
AD11810/T8	1	20/4	89	1700	8	polycarbonate
AD11400/T8	1	20/4	92	1500	8	textile
AD11410/T8	1	20/4	92	1500	8	polycarbonate
AD11600/T8	1	50/6	95	1300	8	textile
AD11610/T8	1	50/6	95	1300	8	polycarbonate

CONE TWEETERS

AD20302/T8	2	40/4	88	2000	8	paper
AD22302/T8	2	40/4	88	2000	8	paper (note 2)
AD20850/T8	2	40/4	91	1700	8	paper
AD22850/T8	2	40/4	91	1700	8	paper (note 3)

MID RANGE (note 4)

AD33801/SQ8	3	60/10	89	470	8	paper cone textile surround
AD50800/SQ8	5	60/15	89	280	8	paper cone textile surround
AD50600/SQ8	5	60/20	90	260	8	paper cone textile surround
AD50800/DSQ8 (note 5)	5	60/15	89	280	8	paper cone textile surround
AD50600/DSQ8 (note 5)	5	60/20	90	260	8	paper cone textile surround

Notes

1. Where the power handling capacity (PHC) is expressed as two figures, the first figure is for a typical two or three way system, the second figure is the PHC is of the loudspeaker alone.
2. As AD20302/T8 but with a square front plate.
3. As AD20850/T8 but with a square front plate.
4. AD33801/SQ8 is without damping pot.
AD50800/SQ8 and AD50600/SQ are with damping pot.
5. Cone-dome versions.

Type number	Size (in)	Power handling capacity (W)	Sound power level (dB/m per W)	Resonance frequency (Hz)	Impedance (Ω)	Dome, cone, surround material
WOOFERS						
AD12201/W8	12	80	–	–	8	paper cone foam surround
AD10652/W8	10	60	–	–	8	paper cone foam surround
*AD80606/W8	8	50	91	38	8	paper cone foam surround
AD80605/W8	8	40	90	50	8	paper cone foam surround
AD80405/W8	8	35	87.5	50	8	paper cone foam surround
AD70801/W8	6½	25	89	68	8	paper cone textile surround
AD70802/W8	6½	20	88	79	8	paper cone paper surround
AD70612/W8	6½	45	86	50	8	paper cone textile surround
AD70680/W8	6½	50	87	48	8	paper cone foam surround
AD51610/W8	5¼	30	89	62	8	paper cone foam surround
AD4060/W8	4	30	88	68	8	paper cone rubber surround
FULL RANGE (dual cone)						
AD12201/M8	12	60	–	–	8	paper cone
AD12652/M8	12	40	–	–	8	paper cone
AD80800/M8	8	15	89	85	8	paper cone paper surround
AD70800/M8	6½	12	89	105	8	paper cone paper surround
AD70850/M8	6½	7	89	105	8	paper cone paper surround
AD50800/M8	5	6	91	140	8	paper cone paper surround

*AD80606/W8 replaces AD80603/W8.

Loudspeakers

medium power – 3 to 10W TV applications (screened)

book 3 part 6

Type number (note 1)	Size (in)	Power handling capacity (W) (note 2)	Sound power level (dB/m per W)	Resonance frequency (Hz)	Impedance (Ω)	Dome, cone, surround material
AD20310/T8 /T15	2	40/4	88	2000	8 15	paper cone (note 3)
AD22310/T8 /T15	2	40/4	88	2000	8 15	paper cone (note 4)
AD2274/T4 /T8 /T15 /T25	2¼	20/1	83	1000	4 8 15 25	paper cone paper surround
AD44860/X8 /X15	4	4	90.5	175	8 15	paper cone treated surround
*AD44900/X8 /X15	4	8	91.5	100	8 15	paper cone foam surround
*AD44900/P8 /P15	4	8	88	110	8 15	paper cone foam surround
*AD44900/W8 /W15	4	8	86	82	8 15	paper cone foam surround
AD46860/X8 /X15	4x6	4	90	140	8 15	paper cone paper surround
*AD46950/X8 /X15	4x6	5	90.5	140	8 15	paper cone paper surround
*AD46900/M8 /M15	4x6	8	90	150	8 15	paper cone paper surround
*AD36901/X8 /X15	3x6	8	87	95	8 15	paper cone textile surround
*AD36900/P8 /P15	3x6	8	88	85	8 15	paper cone textile surround
*AD38900/X8 /X15	3x6	8	87	95	8 15	paper cone textile surround
*AD38900/P8 /P15	3x6	8	88	95	8 15	paper cone textile surround

*compensated

Notes

1. T = tweeter, X = full range, P = open application woofer.
2. Where the power handling capacity (P.H.C.) is expressed as two figures, the first figure is for a typical two or three way system, the second figure is the P.H.C. of the loudspeaker alone.
3. AD20310/T8, T15 are screened tweeters.
4. As AD20310/T8, T15, but with square front plate.

car radio applications

Type number	Size (in)	Power handling capacity (W)	Sound pressure level (dB/m per W)	Resonance frequency (Hz)	Impedance (Ω)	Dome, cone, surround material
AD44830/X4	4	8	90	140	4	paper cone textile surround
AD44401/M4	4	15	90	110	4	paper cone textile surround
AD46801/X4	4x6	8	89	120	4	paper cone treated surround
AD51400/M4	5	15	92	90	4	paper cone treated surround

Loudspeakers

plastic frame, unscreened (dome, cone, surround material: paper)

book 3 part 6

Type number (note 1)	Size (in)	Power handling capacity (W)	Operating power (sound level 90dB, 0.5m) (W)	Resonance frequency (Hz)	Impedance (Ω)	Comments
● AD0198/Z ..	1¼	0.3	0.09	500	8, 15, 25	
● AD01980/Y ..	1½	0.3	0.055	600	8, 15, 25	
● AD01985/Y ..	1½	0.3	0.05	600	8, 15, 25	
AD2099/Z ..	2	0.5	0.04*	420	8, 15, 25	
AD2071/Z ..	2½	1	0.55	360	(note 2), 50, 150	
● AD3071/Y ..	3	2	0.6	250	(note 2), 50, 150	
AD3371/Y ..	3	2	0.6	250	(note 2), 50	
AD4072/X ..	4	3	0.45	170	(note 2)	
AD4472/X ..	4	3	0.45	170	(note 2)	
● AD40725/X	4	5	0.45	170	(note 2)	note 4
● AD44725/X	4	5	0.45	170	(note 2)	note 4
AD50720/X ..	5¼	3	0.3	130	(note 2)	
AD55720/X ..	5¼	3	0.3	130	(note 2)	
● AD50725/X ..	5¼	5	0.3	130	(note 2)	
● AD55725/X ..	5¼	5	0.3	130	(note 2)	
AD70720/X ..	7	3	0.4	100	(note 2)	
AD77720/X ..	7	3	0.4	100	(note 2)	
● AD77721/X ..	7	5	0.4	100	(note 2)	
● AD70725/X ..	7	5	0.4	100	(note 2)	
● AD77725/X ..	7	5	0.4	100	(note 2)	
● AD77726/X ..	7	5	0.4	100	(note 2)	
AD35720/X ..	3x5	3	0.65	160	(note 2)	
AD35721/X ..	3x5	3	0.65	160	(note 2)	
AD35722/X ..	3x5	3	0.65	160	(note 2)	
● AD35725/X ..	3x5	5	0.65	160	(note 2)	note 4
● AD35726/X ..	3x5	5	0.65	160	(note 2)	note 4
● AD35727/X ..	3x5	5	0.65	160	(note 2)	note 4
● AD36720/X ..	3x6	3	0.45	130	(note 2)	
● AD36722/X ..	3x6	3	0.45	130	(note 2)	
● AD36725/X ..	3x6	5	0.45	130	(note 2)	
● AD36727/X ..	3x6	5	0.45	130	(note 2)	
AD46720/X ..	4x6	4	0.4	130	(note 2)	
AD46721/X ..	4x6	4	0.4	130	(note 2)	
AD46722/X ..	4x6	4	0.4	130	(note 2)	
● AD46725/X ..	4x6	5	0.4	130	(note 2)	note 4
● AD46726/X ..	4x6	5	0.4	130	(note 2)	note 4
● AD46727/X ..	4x6	5	0.4	130	(note 2)	note 4
AD2273/T ..	2¼	20/1 (note 3)	0.5	1000	(note 2)	
● AD01700/T ..	½	20	1.3†	2000	(note 2)	
● AD11700/T ..	½	20	1.3†	2000	(note 2)	

* Sound level 74dB, 0.5m. † Sound level 90dB, 1m.

Notes

1. Impedance value should be included in type number, following last letter.
2. Impedance values of 4, 8, 15 and 25Ω available. See note 1 for type number construction.
3. Where power handling capacity (P.H.C.) is expressed as two figures, the first figure is for a typical 2 or 3 way system, the second figure is the P.H.C. of the loudspeaker alone.
4. High thermal stability plastic.

Loudspeakers

plastic frame for TV applications, screened; (dome, cone, surround material: paper) book 3 part 6

Type number (note 1)	Size (in)	Power handling capacity (W)	Operating power (sound level 90dB, 0.5m) (W)	Resonance frequency (Hz)	Impedance (Ω)	Comments
AD3074/Z ..	3	2	0.6	250	(note 2), 50, 150	
AD3374/Y ..	3	2	0.6	250	(note 2), 50, 150	
• AD4074/X ..	4	2.5	0.45	170	(note 2)	
• AD40745/X ..	4	5	0.45	170	(note 2)	note 4
• AD4474/X ..	4	2.5	0.45	170	(note 2)	
• AD44745/X ..	4	5	0.45	170	(note 2)	note 4
AD50740/X ..	5¼	2.5	0.3	130	(note 2)	
• AD50745/X ..	5¼	5	0.3	130	(note 2)	
AD55740/X ..	5¼	2.5	0.3	130	(note 2)	
• AD55745/X ..	5¼	5	0.3	130	(note 2)	
AD70740/X ..	7	2.5	0.4	100	(note 2)	
• AD70745/X ..	7	5	0.4	100	(note 2)	
AD77740/X ..	7	3	0.4	100	(note 2)	
• AD77741/X ..	7	3.5	0.4	100	(note 2)	
• AD77745/X ..	7	3.5	0.4	100	(note 2)	
• AD77746/X ..	7	3.5	0.4	100	(note 2)	
AD35740/X ..	3x5	2.5	0.65	160	(note 2)	
AD35741/X ..	3x5	2.5	0.65	160	(note 2)	
AD35742/X ..	3x5	2.5	0.65	160	(note 2)	
• AD35746/X ..	3x5	3.5	0.65	160	(note 2)	note 4
• AD35747/X ..	3x5	3.5	0.65	160	(note 2)	note 4
• AD35748/X ..	3x5	3.5	0.65	160	(note 2)	note 4
• AD36740/X ..	3x6	2.5	0.45	130	(note 2)	
• AD36742/X ..	3x6	2.5	0.45	130	(note 2)	
• AD36746/X ..	3x6	4.5	0.45	130	(note 2)	
• AD36748/X ..	3x6	4.5	0.45	130	(note 2)	
AD46740/X ..	4x6	2.5	0.4	130	(note 2)	
AD46741/X ..	4x6	2.5	0.4	130	(note 2)	
AD46742/X ..	4x6	2.5	0.4	130	(note 2)	
• AD46746/X ..	4x6	3.5	0.4	130	(note 2)	note 4
• AD46747/X ..	4x6	3.5	0.4	130	(note 2)	note 4
• AD46748/X ..	4x6	3.5	0.4	130	(note 2)	note 4
AD2274/T ..	2¼	20/1 (note 3)	0.5	1000	(note 2)	
• AD01740/T ..	½	20	—	2000	(note 2)	
• AD11740/T ..	½	20	—	2000	(note 2)	

Notes

1. Impedance value should be included in type number following last letter.
2. Available with impedances of 4 Ω , 8 Ω , 15 Ω and 25 Ω (see note 1 for type number construction.)
3. Where power handling capacity (P.H.C.) is expressed as two figures, the first figure is the P.H.C. of a typical two or three way system, the second figure is that of the loudspeaker alone.
4. High thermal stability plastic.

Television assemblies

tuners (with diode tuning)

Type No.	Channel coverage		Supply voltage (V)		Noise figure (dB)	Power gain (dB)
			transistors	tuning diodes		
U341/U341LO (note 1)	u.h.f.	E21 to E69	+12	+1 to +28	6.5	23
U342/U342LO (note 1)	v.h.f.	E21 to E69	+12	+1 to +28	6.0 to 6.5	25 to 27
U411/U412 (note 2)	u.h.f.	E21 to E69	+12	+1 to +28	10 max.	20 min.
UV411 UV412 (note 3)	v.h.f./u.h.f.	NZ1 to C, M4 to E12 E21 to E69	+12	+1 to +28	4 to 10 depending on channel	21 to 28 depending on channel
UV413 UV414 (note 4)	v.h.f./u.h.f.	NZ1 to E4 M4 to E12 E21 to E69	+12	+1 to +28	4 to 10 depending on channel	21 to 28 depending on channel
UV415 UV416 (note 5)	v.h.f./u.h.f.	E2 to S1, S2 to S19 E21 to E69	+12	+1 to +28	5 to 10 depending on channel	17 to 28 depending on channel
UV417 UV418 (note 6)	v.h.f./u.h.f.	E2 to S1, S2 to S20 E21 to E69	+12	+1 to +28	8 to 13 depending on channel	16 to 20 depending on channel
UVF10	v.h.f./u.h.f.	A to E4 incl. A to C M4 to E12 incl. 1 to 6 E21 to E69	+12	+0.5 to +28	5 to 10 depending on channel	19 to 22 depending on channel
V317/V317LO	v.h.f.	E2 to R5 S2 to S19	+12	+1 to +28	5.5 to 8	26 to 28
V334/V334LO	v.h.f.	NZ1 to C M4 to E12	+12	+1 to +28	6 to 8	23 to 24

Notes. 1. Mark II version.
2. U412 equivalent to U411 but with an integral frequency divider.
3. UV412 equivalent to UV411 but with an integral frequency divider.
4. UV414 equivalent to UV413 but with an integral frequency divider.
5. UV416 equivalent to UV415 but with an integral frequency divider.
6. UV418 equivalent to UV417 but with an integral frequency divider.

delay lines (colour)

Type No.	Phase delay time (μ s)	Insertion loss (dB)	Unwanted reflections relative to 1 τ signal (dB)		Storage temperature range
			3 τ	others	
DL701	63.943	9	-25 max.	-33 max.	-40 to +70°C
DL711	63.943	9	-33 max.	-33 max.	-40 to +70°C

quartz crystals

Type No.	Frequency (MHz)	Mode of vibration	Cut	Case	Application
• 143 04090	4.0	fundamental	AT	RW-43	CITAC
• 143 04040	4.433619	fundamental	AT	RW-43	TV sub-carrier
• 143 04100	6.0	fundamental	AT	RW-43	Text
• 143 04050	8.867238	fundamental	AT	RW-43	TV sub-carrier
• 143 04890	13.875	fundamental	AT	RW-43	Text

Assemblies and modules

hybrid v.h.f./u.h.f. wideband amplifiers

A range of hybrid VHF/UHF wideband amplifiers designed for use as masthead booster amplifiers in antenna systems, preamplifiers and trunk amplifiers in MATV systems and as instrumentation amplifiers. Frequency range 40 to 860 MHz.

Source and load impedance 75 ohms.

The range covers types which operate from both 12V and 24V supplies.

Types of VHF/UHF hybrid wideband amplifiers — 40 MHz to 860 MHz

Type No.	Stages	Gain (dB)	min. $V_{o(rms)}$ (dB μ V)		Noise figure (dB)	VSWR (note 3)		Dimensions (mm)	
			-60dB IMD (note 1)	1dB comp. (note 2)		input	output		
24 volt types (24V \pm 10%)									
low	OM320	2	15.5	92	111	5.5	2.2	2.5	30 \times 12 \times 4
output	OM321	2	15.5	98	113	6.0	2.5	2.0	30 \times 12 \times 4
	OM335	3	27	98	115	5.5	1.9	3.2	30 \times 12 \times 4
medium	OM322	2	15	103	119	7.0	1.7	1.7	40 \times 22 \times 5
	OM336	3	22	105	122	7.0	1.4	1.6	30 \times 19 \times 4
high	OM323	2	15	113	127	9.0	1.9	2.3	30 \times 18 \times 15
	OM337	3	26	112	126	9.8	2.3	1.8	30 \times 18 \times 15

12 volt types (12V \pm 10%)

low	OM345	1	12	99	114	5.5	2.0	1.4	14 \times 8* \times 3
output	OM350	2	18	100	116	6.0	1.5	1.9	18 \times 9* \times 3
medium	OM360	3	23	105	123	7.0	1.3	1.5	27 \times 9* \times 3
	OM361	3	28	105	122	6.0	1.5	1.7	27 \times 9* \times 3
high	OM370	3	28	112	129	7.0	1.5	1.7	27 \times 22* \times 5
output									

- Notes:
1. Measured at -60dB intermodulation distortion (DIN 45 004, par. 6.3: 3 tone), $f = 470$ MHz.
 2. Measured at saturation for 1dB gain compression.
 3. The typical maximum VSWR occurring in the frequency range 40-860 MHz, for a sample connected to a 75 Ω line.

*Seated height

All modules are of single in-line construction except OM322 which has stripline format. OM323 and 337 have an integral mounting bracket.

All amplifiers have a flat frequency response (40 to 860 MHz) within ± 1 dB except OM335 which is typically ± 1.6 dB, OM322 which is typically ± 0.3 dB, and OM360 which is typically ± 0.5 dB.

hybrid 14 bit digital to analogue converter

Type No.	Resolution (bits)	Signal-to-noise ratio (dB)	Linearity $T_{amb} = 25^\circ\text{C}$	Supply-voltage (V)
OM901	14	85	$\pm 1/4$ LSB	$\pm 5, -17$

This hybrid integrated circuit is intended for use in digital signal processing; for sound reproduction, electronic telephones, graphic displays; for distortion meters, signal generators and other test equipment.

Assemblies and modules

hybrid ICs for inductive proximity detectors

Type No.	Supply voltage (V _{dc})	Output current (max) (mA)	Switching distance (mm)
OM286	+4.5 to +30	250	1 to 5
OM287	-4.5 to -30	250	1 to 5
OM386	+10 to +30	400	1 to 5
OM387	-10 to -30	400	1 to 5

Note: switching distance depends on the value of an external adjustment resistor and the oscillator coil.

motor control modules for washing machines

Type No.	Description	Dimensions (mm) L x W x h
LP1500 series	These modules are especially designed to control washing machine drives based on series motors. A versatile custom IC provides all the functions of control and protection. A wide variety of control configurations can be accommodated. Typical supply voltages for the modules are 240V a.c. and 220V a.c.	110 x 81 x 34

teletext modules

Type No.	Supply voltage (V _{dc})	Description	Dimensions (mm) L x W x h
VM6101 series	+5V +12V (both ±5%)	Teletext decoder module fulfills the requirement for teletext processing in tv circuits. Used in conjunction with remote control ICs. Various language options are available on request.	121 x 160 x 21
VM6600 series	+5V +12V (both ±5%)	Teletext decoder module fulfills the requirement for teletext processing in tv circuits. Used in conjunction with remote control ICs. Various language options are available. Manufactured using latest surface-mounted component techniques for minimum size.	110 x 110 x 17

viewdata modules

Type No.	Supply voltage (V _{dc})	Description	Dimensions (mm) L x W x h
VM6500/VM6510	+5V +12V (both ±5%)	Viewdata line terminating unit module. Provides an interface between the telephone network and the viewdata decoder circuits. Provides a range of viewdata terminal facilities.	150 x 166 x 35
VM6520	+5V +12V -30V (all ±5%)	Viewdata compatible teletext module. Accepts a composite video signal and extracts teletext data. Acts as a viewdata display module in conjunction with VM6530.	140 x 166 x 20
VM6530	+5V +12V -30V (all ±5%)	Viewdata acquisition and control module. Uses SAA5070 viewdata peripheral and an 8035 microprocessor to provide a wide range of viewdata/teletext decoding facilities.	172 x 166 x 17

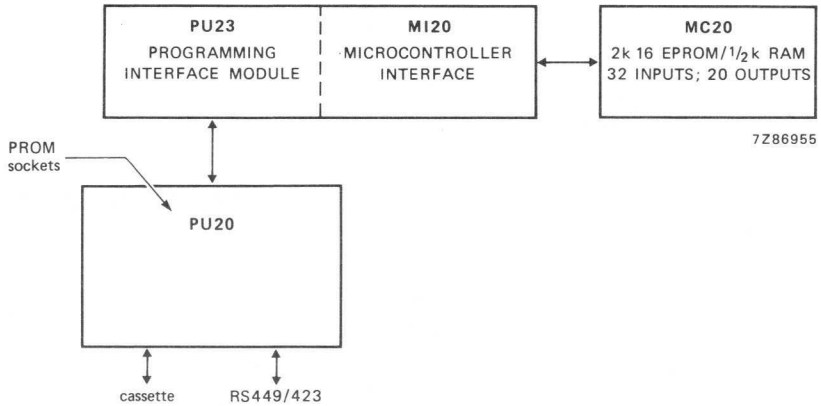
Assemblies and modules

programmable controllers

MC20 system

The microcontroller MC20 is suited for controlling small systems. This controller is based on the same principles as the PC20 system; however it is built on a single printed board with sufficient inputs and outputs for the general run of machine tool and process controls.

Software modules are available, e.g. for communications.



MC20 system modules

type number	description
MC20	microcontroller
MI20	microcontroller interface for MC20

Programming aids

type number	description
PU20	programming unit for PC20 and MC20
PU23	programming unit interface for PC20 and MC20

For software modules see next page.

Assemblies and modules

programmable controllers

PC20 system

The programmable controller PC20 is used for controlling machines and/or processes. The controller is capable of very fast cycle times and can be easily programmed and re-programmed. Modules are available to provide for communication in hierarchical systems and to computers.

The modular design of the PC20 enables a user to build a programmable controller which is 'tailor-made' for his control task. By specifying the number and the types of PC20 modules that he requires he only has to purchase the electronic capability he needs.

The PC20 modules are on standard double Eurocards. Optically isolated interface circuits, specifically designed for an industrial environment, provide excellent noise immunity and a high degree of isolation. The internationally accepted machine signal level of 24V is used and generous tolerances on operational margins and thresholds ensure good compatibility.

PC20 system modules

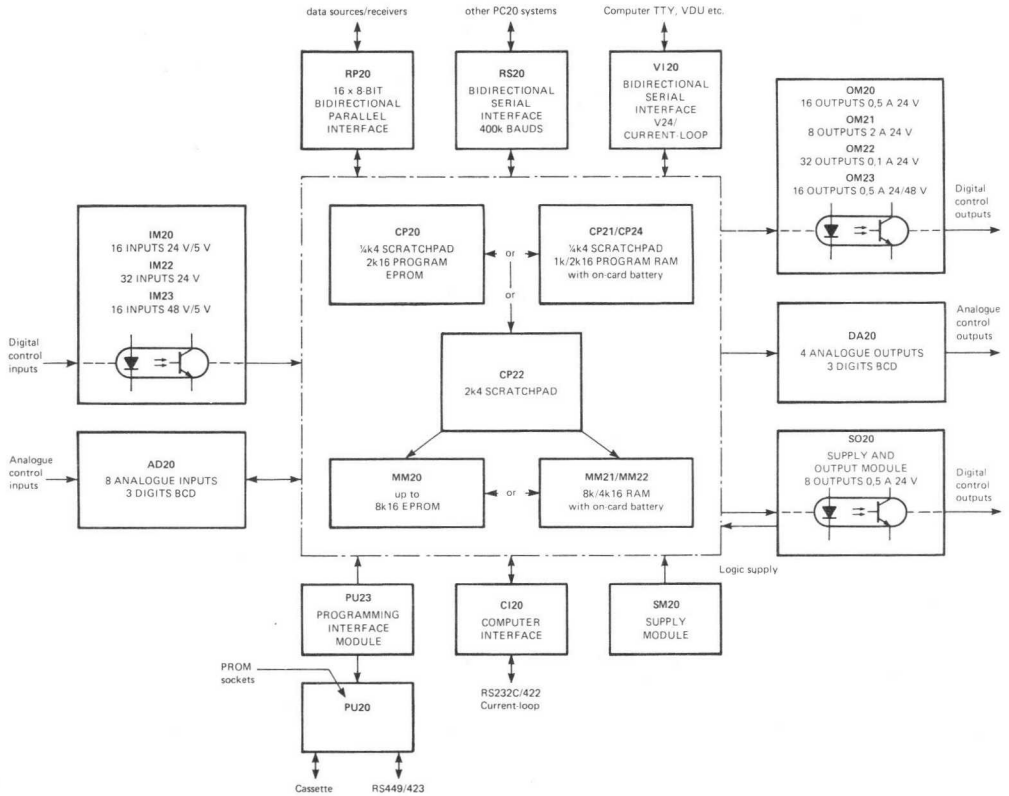
type number	description
AD20	analogue to digital module (8 channels)
CI20	computer interface module
CP20	central processor with program memory (2 k (E)PROM)
CP21	central processor with program memory (1 k RAM)
CP22	central processor with program memory
CP24	central processor with program memory (2 k RAM)
DA20	digital to analogue module (4 channels)
IM20	input module (16 inputs)
•IM22	input module (32 inputs)
•IM23	input module (16 inputs)
MM20	program memory module (8 k (E)PROM)
MM21	program memory module (8 k RAM)
MM22	program memory module (4 k RAM)
OM20	output module (16 x 0.5 A)
OM21	output module (8 x 2 A)
OM22	output module (32 x 0.1 A)
•OM23	output module (16 x 0.5A)
RP20	bidirectional parallel interface
RS20	bidirectional serial interface
SM20	supply module
SO20	supply and output module (8 x 0.5 A)
VI20	bidirectional serial interface

Software modules in EPROM for VI20

type number	description
PVI1	message program
PVI2	data terminal program
PVI3	mass memory program
PVI4	communication program A
PVI5	communication program B
PVI6	arithmetic program
PVI7	communication program C
PVI8	PID control loop

Assemblies and modules programmable controllers

PC20 system



Assemblies and modules customised P.C.B. service

property	unit	format			
		single-sided rigid	double-sided rigid	multilayer	flexible and flex-rigid
base material	—	paper/phenolic, paper/epoxy glass/epoxy glass polyester	paper/phenolic, paper/epoxy glass/epoxy glass/polyester Teflon*/polyimide	glass/epoxy glass/polyimide	glass/epoxy, polyimide (copper-clad)
laminate thickness	mm	0.6 to 3.2	0.6 to 3.2mm	—	0.1 to 3.2mm
cladding thickness	μm	105, 70, 35, 17.5, 5	105, 70, 35, 17.5, 5	70, 35, 17.5	70, 35, 17.5
max. standard size (note 1)	mm	540 x 460	540 x 460	540 x 460	540 x 460
min hole diameter drilled	mm	0.3	0.3	0.3	0.5
punched		half-board thickness	half-board thickness		
max. ratio of thickness to hole dia		—	4:1	4:1	4:1
min track width/spacing	μm	80/125	80/125	80/125	80/125
tolerance on track width spacing	μm	down to ±30	down to ±30	down to ±30	(note 2)

Notes (1) for larger sizes please enquire. (2) depends on material and construction

Customised P.C.B.s from Mullard Ltd also feature:

- surface finish of external layer
 - PbSn (with or without reflow)
 - selective Au and Ni plating
 - selective PbSn plating
 - conservation; roller tinning
- silk-screen or photo process solder resist
- silk-screen legend print
- profiling: cutting, sawing, punching, routing
- 100% electrical testing for short and open circuits on purpose designed or standard nailed.

Contact P.C.B. Product Marketing for further details
*registered trademark of E.I. du Pont de Nemours & Co.

Printers

dual mode dot matrix printers and accessories

Type No.	Hard copy format	Printing speed
● GP300-3	plain paper fabric ribbon max. paper width 340mm	80 characters per second (correspondence quality) 300 characters per second (data quality), block and dot addressable graphics.
● GP300L-3	plain paper fabric ribbon max. paper width 400mm	80 characters per second (correspondence quality) 300 characters per second (data quality), block and dot addressable graphics.
● GP300LC	colour printer plain paper fabric ribbon max. paper width 400mm	80 characters per second (correspondence quality) 300 characters per second (data quality), block and dot addressable graphics.

ACCESSORIES

Type No.	Description
GP300-TF	tractor feed for GP300-3
GP300L-TF	tractor feed for GP300L-3
GP300-PR	paper run check for use with tractor feeds
GP300-FF	front feed
GP300-PHOPT	front feed control board
GP300-ASSH-A	automatic single sheet handler (dual hopper)
● GP300-ASSHLS	automatic single sheet feeder (dual hopper-adjustable paper width)
GP300-MAGA4	A4 paper magazine for ASSH
GP300-MAG220	envelope (220mm) magazine for automatic single sheet handler
● GP300-MAGLS	magazine for GP300-ASSHLS
GP300-32KROM	ROM extension board 32K to 64K
● GP300-32KRAA/OM	extension board 32 KRAM +32KROM
● GP300-PED340	pedestal for GP300-3
GP300-PED400	pedestal for GP300L-3
GP300-FS	form stacker
GP300-ASSHNS	noise shield for GP300-3 with ASSH
● GP300 L-ASSHNS-A	noise shield for GP300L-3 with ASSH
GP300L-TFNS	noise shield for GP300L-3 with front feed and tractor feed
GP300L-CCAS	ribbon cassette
● GP300-RIB-BK	ribbon cassette black (draft/data quality)
● GP300LC-RIB-CL	colour ribbon for GP300LC
● GP300LC-RIB-BK	black ribbon for GP300LC

For details of IBM PC version and special emulations refer to Mullard House.

printer heads

Type No.	Hard copy format	Description
MPH3	plain paper ink ribbon	7 needle print head
MPHE9	plain paper ink ribbon	9 needle print head
MPHE18	plain paper ink ribbon	18 needle print head with 2 rows of needles



THE MULLARD

STOCK	FRANCHISED DISTRIBUTORS	TELEPHONE	TELEX
ICs Discrete – Semiconductors Passives	B.A. Electronics Ltd Hitchin Road, Arlesey, Bedfordshire SG15 6SG	Hitchin (0462) 834744	826257
ICs Discrete – Semiconductors Passives	Farnell Electronic Components Ltd Canal Road, Leeds LS12 2TU	Leeds (0532) 636311	55147
ICs Discrete – Semiconductors Passives	Gothic Crellon Ltd 380 Bath Road, Slough SL1 6JE	Burnham (06286) 4434	847571
ICs Discrete – Semiconductors Passives	Intel Electronics Group Ltd Electronic Resources for semiconductors Trading Estate, Henlow Bedfordshire SG16 6DS	Hitchin (0462) 812505 (0462) 815555	825637
ICs Discrete – Semiconductors Passives	Jermyn Distribution Ltd Vestry Estate, Sevenoaks Kent TN13 5EU	Sevenoaks (0732) 450144	95142
ICs Discrete – Semiconductors	Macro Burnham Lane, Slough SL1 6LN	Burnham (06286) 4422	847945
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ICs Discrete – Semiconductors Passives Ferrites	STC Electronic Services Edinburgh Way, Harlow Essex CM20 2DF	Harlow (0279) 26777	81525
ICs Discrete – Semiconductors Passives Ferrites	Swift-Sasco Ltd Gatwick Road, Crawley Sussex RH10 2RU	Crawley (0293) 28700	87131

DISTRIBUTOR SERVICE

A few ranges of components need highly specialised information and stocks of associated components for particular applications – for example nucleonic devices. We have therefore appointed, where necessary, stockists to augment the major broadline franchised distributors in these areas.

Electron-optical devices Nucleonic and associated devices	Arad Instruments Ltd., Turnpike Road, Newbury, Berks RG13 2NS	Tel: Newbury (0635) 30345 Telex: 8474143
Norbits and PXE	Intel Electronics Group Ltd., Trading Estate Henlow, Beds SG16 6DS	Tel: Hitchin (0462) 812505 Telex: 825637
Programmed logic controllers & Norbits	STC-E.C.C.S. Ltd., P.O. Box 27, Alexandra Road, Wellington, Telford, Shropshire TF1 1QF	Tel: Telford (0952) 54161 Telex: 35120
Ferrite Materials, Data Graphics Motor Control, TV Components for industrial applications	Hawnt Electronics Ltd., Firwood Road, Garretts Green, Birmingham B33 0TQ	Tel: Birmingham (021) 7843355 Telex: 338814
Microprocessors and ICs	Quarndon Electronics (Semiconductors) Ltd., Slack Lane, Derby DE3 3ED	Tel: Derby (0332) 32651 Telex: 37163
Power Semiconductors	Bowman Electronics Ltd., Europa Trading Estate, Fraser Road, Erith, Kent DA8 1QL	Tel: Erith (03224) 38182 Telex: 892332
Printers GP300 and associated accessories	Celdis Microsystems Ltd., 37 Loverock Road, Reading, Berks RG3 1ED MBS Rentals, 119/120 High Street, Eton, Windsor, Berks. SL4 6AN RIVA Terminals Ltd., 9 Woking Business Park, Albert Drive, Woking, Surrey GU21 5JY STC Electronic Services, Edinburgh Way, Harlow, Essex CM20 2DF WPS Services Ltd., 13 Pall Mall, London SW1Y 5LU	Tel: Reading (0734) 586191 Telex: 848370 Tel: Windsor (07535) 68171 Telex: 848945 Tel: Woking (04862) 71001 Telex: 859502 Tel: Harlow (0279) 26777 Telex: 81525 Tel: London (01) 930 4884
Printers Field maintenance GP300	Computer Field Maintenance Ltd. Telephone for nearest service centre	Tel: Hitchin (0462) 51511
Surface mounting devices for hybrids & PWBS	Swift-Sasco Ltd., Gatwick Road, Crawley, Sussex RH10 2RU STC Electronic Services, Edinburgh Way, Harlow, Essex CM20 2DF United Components Ltd., SM Components Div., Unit 7, Crown Way, Horton Road, West Drayton, Middx UB7 8PS	Tel: Crawley (0293) 28700 Telex: 87131 Tel: Harlow (0279) 26777 Telex: 81525 Tel: London (01) 573 7755 Telex: 8952920
Valves & Transmitting tubes for maintenance	Langrex Supplies Ltd., Climax House, Fallsbrook Road, London SW16 6ED	Tel: London (01) 677 2424/7 Telex: 946708



The Mullard Data Base

For the equipment designer, technical information on electronic components is vital. Mullard market the widest range of components in the U.K., supported by a comprehensive information service — the Mullard Data Base.

Brief details are given here. For further information and an order form, please write to:-

Technical Publications Dept.
Mullard Limited,
New Road, Mitcham,
Surrey CR4 4XY.

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Mullard Bulletin

A must for designers, this bi-monthly, newspaper-style publication briefly describes new components and offers further information on subjects of interest.

Consumer Electronics

A review, in newspaper style, published every four months. Articles and features of interest to those in the consumer electronics industry, with emphasis on television technology and allied subjects.

Technical Brochures and Range Leaflets

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The Mullard data base begins on page 556201.



Electronic Components and Applications

A quarterly technical journal covering, in depth, developments in electronics based on the work of Philips, Signetics and Mullard laboratories. Please ask for a sample copy and subscription form.



Quick reference guides

All products marketed by Mullard are listed alpha-numerically and described briefly in these guides. Part 1 covers passive components, discrete semiconductors, and valves and tubes; Part 2 deals with integrated circuits, including Signetics.



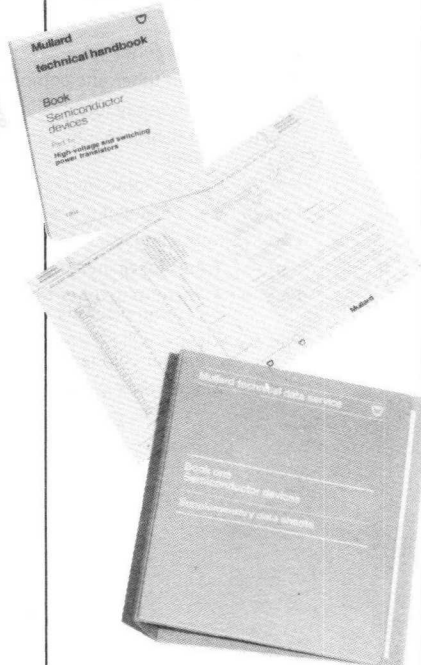
Technical Data Service

This service provides detailed, up-to-date information on the characteristics and performance of Mullard components.

Subscribers to any or all of the four handbook sections receive all relevant handbooks, looseleaf binders, monthly mailings of new data sheets, and new handbook parts as they are published.

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The Mullard Technical Handbook

The Mullard Technical Handbook is made up of four sets of Books, each comprising several parts:-

Book 1 (light blue) Semiconductor Devices
Book 2 (orange) Valves and Tubes

Book 3 (green) Components, Materials and Assemblies
Book 4 (dark blue) Integrated Circuits

Book 1, Semiconductor Devices

- Part 1a Small-signal transistors
- Part 1b Low-frequency power transistors
- Part 1c Field-effect transistors
- Part 1d Surface mounted devices
- Part 1e High-voltage and switching power transistors
- Part 1f Power MOS transistors
- Part 2a R.F. wideband devices
- Part 2b R.F. power devices
- Part 3 Diodes
- Part 4a Power diodes
- Part 4b Thyristors and triacs
- Part 5a Microwave diodes and sub-assemblies
- Part 5b Microwave transistors
- Part 6 Optoelectronic devices
- Part 7 Surface acoustic wave filters

Book 2, Valves and Tubes

- Part 1a Colour tubes and components
- Part 1b Cathode-ray tubes
- Part 1c Monochrome tubes and deflection units
- Part 2a Camera tubes and image intensifiers
- Part 2b Geiger-Muller tubes
- Part 3 Photo and electron multipliers
- Part 4a Tubes for r.f. heating
- Part 4b Transmitting tubes for communications
- Part 4c Klystrons, TWTs and microwave vacuum diodes
- Part 4d Magnetrons for microwave heating

Book 3, Components, Materials and Assemblies

- Part 1a Ceramic capacitors
- Part 1b Electrolytic and solid capacitors
- Part 1c Fixed and non-linear resistors
- Part 1d Potentiometers
- Part 1e Film capacitors
- Part 1f Variable capacitors
- Part 2 Magnetic materials and components
- Part 3 Vinkor inductor cores
- Part 4 RM inductor cores
- Part 5 Connectors
- Part 6 Loudspeakers
- Part 7 Programmable logic controllers, PC20 modules

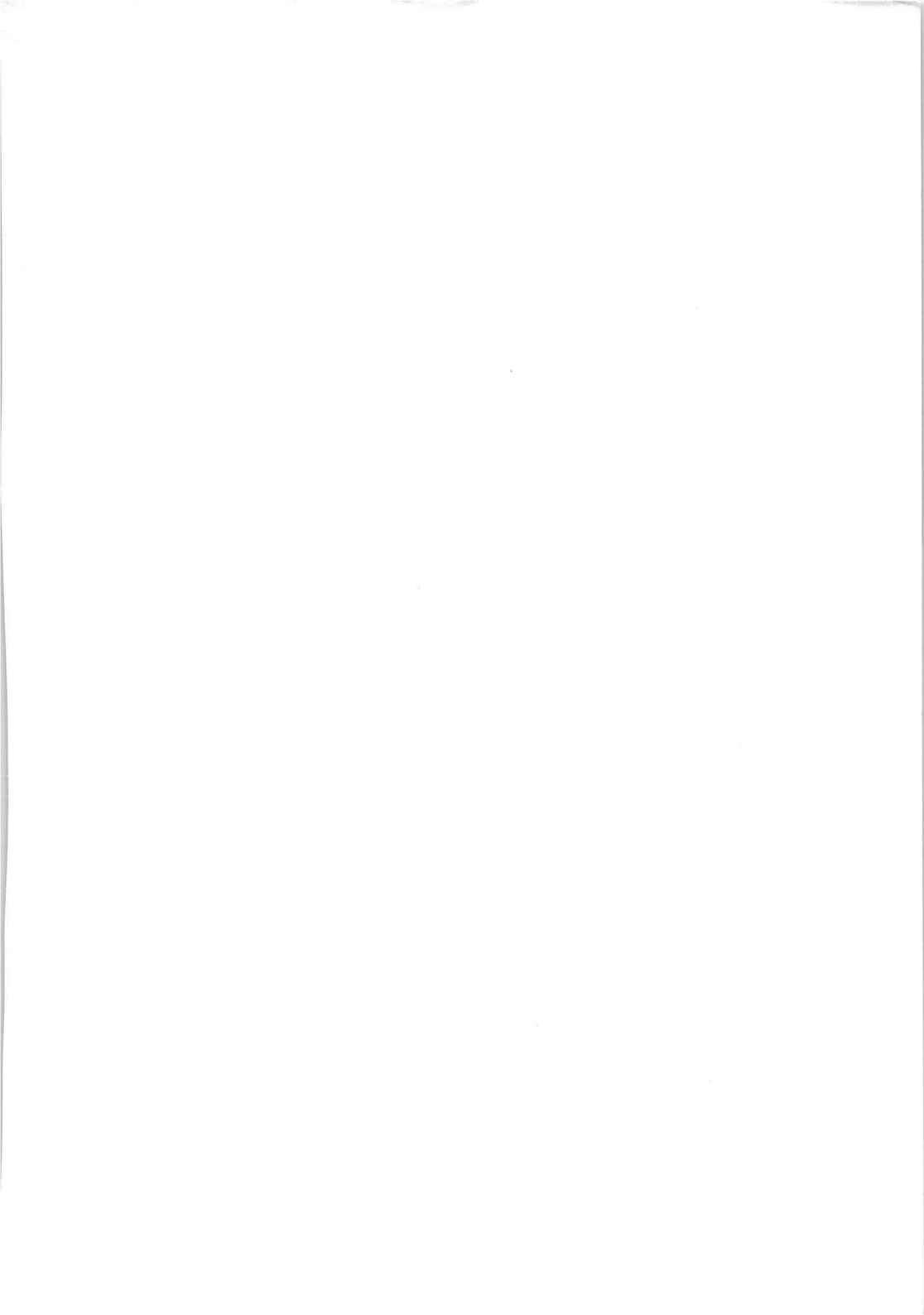
Book 4, Integrated Circuits

- Part 1 Bipolar ICs for radio and audio equipment
- Part 2 Bipolar ICs for video equipment
- Part 3 ICs for telephony
- Part 4 CMOS digital ICs
- Part 6 Signetics linear LSI
- Part 6a Professional analog ICs
- Part 7 Bipolar memory ICs
- Part 7a Integrated Fuse Logic
- Part 8 TTL digital ICs
- Part 8a FAST TTL digital ICs
- Part 9 Microprocessors microcomputers and peripheral ICs
- Part 10 ECL digital ICs

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Mullard



quick reference guide

Part 1, 1985



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In the event of any problem you have in locating a specific component, phone the Mullard Industrial Distributor Support Desk on (01) 580 6633 ext. 2271.

Mullard

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London WC1E 7HD. Telephone: (01) 580 6633. Telex: 264341



Mullard manufacture and market electronic components under their own name and those of associated companies.