Mullard quick reference guide 1978/79

— discrete semiconductors — passive components — valves and tubes

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.

Contents

*Registered trade mark for television camera tubes.

Mullard Approved Devices

The following devices have been approved and are available to British Standard and/or CECC specifications.

BS9000

TRANSISTORS

Type No.	B.S. Spec. No.
BC107, 8, 9	BS9365—F112
BC147, 8, 9	BS9360—F008
BC157, 8, 9	BS9360—F009
BCX31 to 34	BS9365—F178
BCX35, 36, 37	BS9365—F179
BCY30A to 34A	BS9360—F012
BCY70, 71, 72	BS9365—F009
BFX29	BS9365—F010
BFX30	BS9365—F011
BFX84, 85, 86	BS9365—F174
BFY50, 51, 52	BS9365—F012
BSV15, 16, 17	BS9360—F013
BSX45, 46, 47	BS9360—F007
CV7341A to 6A	BS9360—F021

THYRISTORS

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

DIODES

Type No.	B.S.Spec. No.
BYX22 Series	BS9331—F131
BYX25 Series	BS9333—F003
BYX30 Series	BS9333—F002
BYX38 Series	BS9331—F127
BYX42 Series	BS9331—F128
BYX45 Series	BS9333—F004
BYX50 Series	BS9331—F028
BYX52 Series	BS9331—F026
BYX96 Series	BS9331—F129
BYX97 Series	BS9331—F130
BYX98 Series	BS9331—F114
BYX99 Series	BS9331—F047
BZX61—C7V5 to —C75	BS9305—F047/F048
BZY88—C2V7 to —C33	BS9305—N041
BZY91 Series	BS9305—F052
BZY93 Series	BS9305—F051
BZY95 Series	BS9305—F050
BZY96 Series	BS9305—F049
1N3889 to 3892	BS9331—F148

CAPACITORS

Type No.	B.S.Spec.No.
015 series	BS9078—F003

VALVES & TUBES

Type No.	B.S.Spec.No.
QQV06—40A	BS9011—F006

CECC

All the devices shown approved to BS9000 will ultimately be converted to CECC approval.

SEMICONDUCTORS

Types approved:

Type No.	Spec. No.
BD131	BS CECC 50 003 — 001
BD132	BS CECC 50 003 — 011
BDX35, 36, 37	BS CECC 50 003 — 001

Approval pending:

Type No.	Spec. No.
BFX34	BS CECC 50 004 — 025
BSV64	BS CECC 50 004 — 008
BYW30	BS CECC 50 009 — 001
BYW31	BS CECC 50 009 — 002
BYW92	BS CECC 50 009 — 003
BYX98	BS CECC 50 009 — 004

CAPACITORS

Approval pending:

Type No.	Spec. No.
121 series	BS CECC 30 302 — 001

RESISTORS

Types approved:

Type No.	Spec. No.
MR25 series 1%	BS CECC 40 101 — 008 style BK
MR25 series 1%	BS CECC 40 101 — 008 style BY
MR25 series 1%	BS CECC 40 100 — 002 style BK
MR25 series 1%	BS CECC 40 100 — 002 style BY
MR25 series 2%	BS CECC 40 101 — 009 style BY
MR30 series 1%	BS CECC 40 101 — 008 style CK
MR30 series 1%	BS CECC 40 101 — 008 style CY
MR30 series 1%	BS CECC 40 100 — 002 style CK
MR30 series 1%	BS CECC 40 100 — 002 style CY
MR30 series 2%	BS CECC 40 101 — 009 style CY

Mullard Approved Devices (cont.)

CV cross reference list

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. CV7083† to BS9300—C083. 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 the types shown are still available.
Obsolete/obsolescent types are indicated by an asterisk(*).

C.V. No.	Comparable Type
CV2154	SIM2
CV2155	SIM5
CV5712	CV7005*
CV7001	AC128*
CV7002	AC128*
CV7005	AC128*
CV7006	AC128*
CV7026	BYX22—200
CV7027	BYX22—200
CV7028	BYX22—400
CV7029	BYX22—600
CV7030	BYX22—800
CV7041	OA95
CV7043	OC200*
CV7044	OC201*
CV7054	OC23*
CV7089	OC170*
CV7099	BZY38—C4V7
CV7100	BZY88—C5V1
CV7101	BZY88—C5V6
CV7102	BZY88—C6V2
CV7103	BZY88—C6V8
CV7104	BZY88—C7V5
CV7105	BZY88—C8V2
CV7106	BZY88—C15
CV7130	OA91
CV7138	BZY88—C3V3
CV7139	BZY88—C3V6
CV7140	BZY88—C3V9
CV7141	BZY88—C4V3
CV7142	BZY88—C9V1
CV7143	BZY88—C10
CV7144	BZY88—C11
CV7145	BZY88—C12
CV7146	BZY88—C13
CV7158†	BZY96—C4V7
CV7159†	BZY96—C5V1
CV7160†	BZY96—C5V6
CV7161†	BZY96—C6V2
CV7162†	BZY96—C6V8
CV7163†	BZY96—C7V5
CV7164†	BZY96—C8V2
CV7165†	BZY96—C9V1
CV7166†	BZY95—C10
CV7167†	BZY95—C11
CV7168†	BZY95—C12
CV7188	OC205*
CV7189	2/CV2154
CV7200	BZY93—C7V5R
CV7201†	BZY93—C8V2R
CV7202†	BZY93—C9V1R
CV7203†	BZY93—C10R
CV7204†	BZY93—C11R
CV7205†	BZY93—C12R
CV7206†	BZY93—C13R
CV7207†	BZY93—C15R
CV7208†	BZY93—C16R
CV7209†	BZY93—C18R
CV7210†	BZY93—C20R
CV7211†	BZY93—C22R
CV7212†	BZY93—C24R
CV7213†	BZY93—C27R
CV7214†	BZY93—C30R
CV7215†	BZY93—C33R
CV7216†	BZY93—C36R
CV7217†	BZY93—C39R
CV7218†	BZY93—C43R
CV7219†	BZY93—C47R
CV7220†	BZY93—C51R
CV7221†	BZY93—C56R
CV7222†	BZY93—C62R
CV7223†	BZY93—C68R
CV7224†	BZY93—C75R
CV7242	BZY93—C7V5
CV7243†	BZY93—C8V2
CV7244†	BZY93—C9V1
CV7245†	BZY93—C10
CV7246†	BZY93—C11
CV7247†	BZY93—C12
CV7248†	BZY93—C13
CV7249†	BZY93—C15
CV7250†	BZY93—C16
CV7251†	BZY93—C18
CV7252†	BZY93—C20
CV7253†	BZY93—C22
CV7254†	BZY93—C24
CV7255†	BZY93—C27
CV7256†	BZY93—C30
CV7257†	BZY93—C33
CV7258†	BZY93—C36
CV7259†	BZY93—C39
CV7260†	BZY93—C43
CV7261†	BZY93—C47
CV7262†	BZY93—C51
CV7263†	BZY93—C56
CV7264†	BZY93—C62
CV7265†	BZY93—C68
CV7266†	BZY93—C75
CV7311	BYX38—300
CV7312	BYX38—300
CV7313	BYX38—600
CV7314	BYX38—900
CV7315	BYX38—900
CV7316	BYX38—300R
CV7317	BYX38—300R
CV7318	BYX38—600R
CV7319	BYX38—900R
CV7320	BYX38—900R
CV7341	BCY33*
CV7342	BCY34*
CV7343	CV7346*
CV7344	BCY30*
CV7345	BCY31*
CV7346	BCY32*
CV7347	OC202*
CV7348	2N1302*
CV7349	2N1304*
CV7350	2N1306*
CV7351	2N1308*
CV7352	2N1303*
CV7353	2N1305*
CV7354	2N1307*
CV7355	2N1309*
CV7363	BZC11*
CV7367	CV9637
CV7376	ACY17*
CV7379†	BYX42—300R
CV7380†	BYX42—600R
CV7381†	BYX42—900R
CV7382†	BYX42—1200R
CV7384†	BYX42—300
CV7385†	BYX42—600
CV7386†	BYX42—900
CV7387†	BYX42—1200
CV7409†	BZY96—C4V7
CV7410†	BZY96—C5V1
CV7411†	BZY96—C5V6
CV7412†	BZY96—C6V2
CV7413†	BZY96—C6V8
CV7414†	BZY96—C7V5
CV7415†	BZY96—C8V2
CV7416†	BZY96—C9V1
CV7417†	BZY95—C10
CV7418†	BZY95—C11
CV7419†	BZY95—C12
CV7420†	BZY95—C13
CV7421†	BZY95—C15
CV7422†	BZY95—C16
CV7423†	BZY95—C18
CV7424†	BZY95—C20
CV7425†	BZY95—C22
CV7426†	BZY95—C24
CV7427†	BZY95—C27
CV7428†	BZY95—C30
CV7429†	BZY95—C33
CV7430	BSY26*
CV7431	BSY27*
CV7436†	ACY18*
CV7437†	ACY19*
CV7438†	ACY20*
CV7439†	ACY21*
CV7476†	BYX45
CV7494†	OC20*
CV7495†	2N696
CV7496†	2N697
CV7580†	2N1131
CV7581†	2N1132
CV7644†	2N718
CV7648	BSY95A
CV7667†	BYX25—1000R
CV7668†	BYX25—1000
CV7669†	2N2904
CV7670†	2N2905
CV7671†	2N2904A
CV7672†	2N2905A
CV7673†	2N2906
CV7674†	2N2907
CV7675†	2N2906A
CV7676†	2N2907A
CV7678†	BZY91—C10
CV7679†	BZY91—C11
CV7680†	BZY91—C12
CV7681†	BZY91—C13
CV7682†	BZY91—C15
CV7683†	BZY91—C16
CV7684†	BZY91—C18
CV7685†	BZY91—C20
CV7686†	BZY91—C22
CV7687†	BZY91—C24
CV7688†	BZY91—C27
CV7689†	BZY91—C30
CV7690†	BZY91—C33
CV7691†	BZY91—C36
CV7692†	BZY91—C39
CV7693†	BZY91—C43
CV7694†	BZY91—C47
CV7695†	BZY91—C51
CV7686†	BZY91—C56
CV7687†	BZY91—C62
CV7698†	BZY91—C68
CV7689†	BZY91—C75
CV7700†	BZY91—C10R
CV7701†	BZY91—C11R
CV7702†	BZY91—C12R
CV7703†	BZY91—C13R
CV7704†	BZY91—C15R
CV7705†	BZY91—C16R
CV7706†	BZY91—C18R
CV7707†	BZY91—C20R
CV7708†	BZY91—C22R
CV7709†	BZY91—C24R
CV7710†	BZY91—C27R
CV7711†	BZY91—C30R
CV7712†	BZY91—C33R
CV7713†	BZY91—C36R
CV7714†	BZY91—C39R
CV7715†	BZY91—C43R
CV7716†	BZY91—C47R
CV7717†	BZY91—C51R
CV7718†	BZY91—C56R
CV7719†	BZY91—C62R
CV7720†	BZY91—C68R
CV7721†	BZY91—C75R
CV7722†	BFY50
CV7723†	BFY51
CV7724†	BFY52
CV7725†	BFY50
CV7726†	BFY51
CV7727†	BFY52
CV7740†	ACY44*
CV7746	BCY39
CV7747	BCY40
CV7762†	BAT39
CV7776†	BAT51
CV7777†	BAT51R
CV7778	BAT51/51R pair
CV7780†	BZY93—C6V8R
CV7781†	BZY93—C7V5R
CV7782†	BZY93—C8V2R
CV7783†	BZY93—C9V1R
CV7784†	BZY93—C10R
CV7785†	BZY93—C11R
CV7786†	BZY93—C12R
CV7787†	BZY93—C13R
CV7788†	BZY93—C15R
CV7789†	BZY93—C16R
CV7790†	BZY93—C18R
CV7791†	BZY93—C20R
CV7792†	BZY93—C22R
CV7793†	BZY93—C24R
CV7794†	BZY93—C27R
CV7795†	BZY93—C30R
CV7796†	BZY93—C33R
CV7797†	BZY93—C36R
CV7798†	BZY93—C39R
CV7799†	BZY93—C43R
CV7800†	BZY93—C47R
CV7801†	BZY93—C51R
CV7802†	BZY93—C56R
CV7803†	BZY93—C62R
CV7804†	BZY93—C68R

Continued

Mullard Approved Devices (cont.)

CV cross reference list (continued)

C.V. No.	Comparable Type
CV7805†	BZY93—C75R
CV7806†	BZY93—C6V8
CV7807†	BZY93—C7V5
CV7808†	BZY93—C8V2
CV7809†	BZY93—C9V1
CV7810†	BZY93—C10
CV7811†	BZY93—C11
CV7812†	BZY93—C12
CV7813†	BZY93—C13
CV7814†	BZY93—C15
CV7815†	BZY93—C16
CV7816†	BZY93—C18
CV7817†	BZY93—C20
CV7818†	BZY93—C22
CV7819†	BZY93—C24
CV7820†	BZY93—C27
CV7821†	BZY93—C30
CV7822†	BZY93—C33
CV7823†	BZY93—C36

C.V. No.	Comparable Type
CV7824†	BZY93—C39
CV7825†	BZY93—C43
CV7826†	BZY93—C47
CV7827†	BZY93—C51
CV7828†	BZY93—C56
CV7829†	BZY93—C62
CV7830†	BZY93—C68
CV7831†	BZY93—C75
CV7841†	BZY95—C36
CV7842†	BZY95—C39
CV7843†	BZY95—C43
CV7844†	BZY95—C47
CV7845†	BZY95—C51
CV7846†	BZY95—C56
CV7847†	BZY95—C62
CV7848†	BZY95—C68
CV7849†	BZY95—C75
CV7873	BSX60
CV7874	BSX59

C.V. No.	Comparable Type
CV7875	OA202
CV8308	BYX26—60
CV8475	BZY88—C5V6
CV8615	**
CV8616	**
CV8617	BAW62
CV8760	BCY31A
CV8790	BAX16
CV8805	BYX26—150
CV8841	BCY34A
CV8842	BCY31A
CV8986	BZY88—C6V2
CV9023	BCY72
CV9068	OC71*
CV9084	BZY88—C20
CV9259	AC128*
CV9297	BTX18—200
CV9507	BFX30**

C.V. No.	Comparable Type
CV9543	BCY72
CV9637	BAW62
CV9790	BFX29
CV9919	BYX30—200
CV9936	BUY87*
CV10253	BFX85**
CV10254	BFX85**
CV10440	BC107**
CV10806	BC109
CV10807	BFX30
CV10814	BCY71
CV10887	BZY88—C18
CV10889	2/BZY88—C4V7
CV11080	ACY22*
CV11123	ACY22*

**Approval pending to BS9000 'N' specs (Post Office).

VALVES AND TUBES

C.V. No.	Comparable Type
CV26	QY2—100
CV131	EF92
CV136	EL91
CV138	EF91
CV140	EB91
CV283	6AL5
CV417	EC91
CV424	QQV06—40A
CV455	ECC81
CV491	ECC82
CV492	ECC83
CV635	TY4—350
CV850	EF95
CV858	ECC91
CV1351	TY4—500
CV1375	EF85
CV1376	EF80
CV1377	GZ34
CV1535	EZ80*
CV1741	EL34
CV1905	QY3—65
CV1924	TY2—125
CV2127	EL821
CV2128	ECH81
CV2130	QY3—125
CV2131	QY4—250
CV2132	92AV
CV2133	90CG
CV2134	90CV
CV2175	DG7—5*

C.V. No.	Comparable Type
CV2235	EY84
CV2270	92AG
CV2302	DH3—91
CV2382	EL822
CV2387	CV2387
CV2411	CV2411
CV2466	QQV02—6
CV2469	CV2469
CV2492	E88CC
CV2493	E88CC/01
CV2522	6AS6
CV2729	E80F
CV2797	QQV06—40A
CV2798	QQV03—10
CV2901	EF86
CV2966	EY87
CV2975	EL84
CV2984	6080*
CV3508	6201
CV3522	QY5—500
CV3523	QV06—20
CV3926	TY6—5000A
CV3998	E180F
CV4003	M8136
CV4004	M8137
CV4007	M8212
CV4010	M8100
CV4011	M8196*
CV4014	M8083
CV4015	M8161

C.V. No.	Comparable Type
CV4024	M8162
CV4025	M8079
CV4031	M8081
CV4039	M8096
CV4044	M8091
CV4058	M8080
CV4059	M8097*
CV4063	M8082
CV4070	M8099*
CV4076	M8179*
CV5072	EZ81
CV5183	M8080
CV5214	E90CC
CV5215	ECF80*
CV5219	QY5—3000A
CV5231	E88CC
CV5239	TY7—6000A
CV5278	ZM1020/Z520M
CV5311	M8248
CV5354	E188CC
CV5358	ECC88
CV5377	CV5377
CV5397	EC157
CV5412	DM160*
CV5473	QQV02—6
CV5766	E182CC
CV5808	E55L*
CV5808	E55L*
CV5809	E810F
CV5810	EF184

C.V. No.	Comparable Type
CV5831	EF183
CV5847	QQV07—50
CV5937	QQV06—40A
CV5959	QY4—400
CV5961	CV5961
CV5989	E80CC
CV6087	LA9—3B
CV6094	DM160*
CV6099	6929
CV6122	QY3—65
CV6123	QZ06—20
CV6183	YH1060
CV6189	CV6189
CV6223	LB3—250B
CV8330	DG7—31
CV8431	E180CC
CV8479	TY4—400
CV8667	E186F
CV8884	DH7—11
CV8959	DG7—32
CV9155	E88C
CV9509	DP7—11
CV9640	Q13—110BA
CV9933	E83F

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

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 and obsolete 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.

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 equipment only. No longer recommended for equipment production.
O Obsolete type. No longer generally available, though in some cases limited stocks may exist.
S Special type. Subject to negotiation at time of ordering.
X Consult Mullard Ltd.

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
A31-410W	M	
A31-510W	D	146
A34-510W	D	146
A37-550X	D	
A44-13W		A44-120W
A44-120W	C	
A44-120W/R	C	
A44-510W	D	146
A47-14W	M	
A47-15W		**A47-14W**
A47-342X	**D**	
A47-343X	D	
A47-500X	D	146
A49-11X		A49-120X
A49-15X		A49-120X
A49-18X		A49-120X
A49-120X	M	
A49-191X		A49-120X
A49-192X		A49-120X
A49-200X		A49-120X
A50-120W	C	
A50-120W/R	C	
A50-520W	D	146
A51-110X		A51-220X
A51-112X		A51-220X
A51-220X	M	
A51-500X	D	146
A51-570X	D	146
A56-120X	C	
A56-123X		A56-120X
A56-410X	C	
A56-500X	D	146
A59-15W	M	
A61-120W	C	
A61-120W/R	C	
A61-520W	D	146
A63-11X		A63-120X
A63-14X		A63-120X
A63-16X		A63-120X
A63-17X		A63-120X
A63-120X	M	
A63-200X		A63-120X
A66-120X	C	
A66-140X	M	
A66-410X	C	
A66-500X	C	
A66-501X		A66-510X
A66-510X	D	146
A67-100X		A67-120X
A67-120X	D	
A67-130X		A67-120X
A1834		*6080
AA119	C	41
AAY30	C	41
AAY32,33		OA47
AAZ13,15,17	C	41

Type No.	Status Code	Page No. or Suggested Alternatives
AC127	M	
AC128		AC188
AC176		AC187
AC187,188	M	
ACS4		QY5-3000A
ACX-01A	D	66
ACY17 to 22		AC188
ACY39		AC188
AD149	X	
AD161,162	X	
AD0140/T	D	122
AD0162/T	D	122
AD0163/T	D	122
AD0210/sq	D	122
AD0211/sq	D	122
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3874A		QY2–100
4440		XP1011
4463		XP1002
4517		XP2010
4522		XP2040 or XP2041
4523		XP2000
4524		XP2030
5551A		ZX1051
5552A		ZX1052
5553B		ZX1053
5557		XG5–500
5559		XG1–2500
5591		*M8100
5654	M	160
5654RT	S	
5654/6AK5W		MIL–5654
5656		*QQV02–6
5656KS		XP2000
5687		*E182CC
5696		EN92
5725		M8196
5725/6AS6W		M8196
5751		*M8137
5819		XP1000
5822A		ZX1061
5866		TY2–125
5867		TY4–400
5868		TY4–500
5876	M	
5893	M	
5894		QQV06–40A
5920		E90CC
5923		TY6–5000W
5924		TY6–5000A
5963		*M8136
5964		*E90CC
5965		*E180CC
6057		M8137
6060		M8162
6064		M8083
6065		M8161
6067		M8136
6075		QY5–3000W
6076		QY5–3000A
6079		TY5–500
6080	O	
6084		E80F
6085		E80CC
6096		M8100
6098		*EL84
6099		M8081
6100		M8080
6100/6C4WA		M8080
6101		M8081
6101/6J6WA		M8081
6135		M8080
6146		QV06–20
6146B		YL1370
6155		QY3–125
6156		QY4–250
6187		M8196
6189		M8136
6197		*E80L
6199		XP2008
6201		M8162
6227		E80L
6263	M	
6264	M	
6267		EF86
6291		XP2008
6292		XP2000
6293		*QV06–20
6342A		XP1000
6346		ZX1051
6347		ZX1052
6348		ZX1053
6350		*E182CC
6360		QQV03–10
6363		XP2030
6374		†EY84
6443		M8091
6486		M8196
6516		M8082
6549		*QY3–65
6582		M8100
6655A		XP1000
6677		EL84
6679		M8162
6680		M8136
6681		*M8137
6686		*E81L
6688		E180F
6689		E83F
6810A		56AVP
6903		XP1004
6914	O	
6922		E88CC
6929	M	
6939		QQV02–6
6960		TY7–6000W
6961		TY7–6000A
6977		DM160
7020		*ZX1051
7021		ZX1051
7025		*†ECC83
7027		*EL34
7030		*ZX1052
7031		ZX1052
7040		*ZX1053
7041		ZX1053
7044		*E182CC
7062		E180CC
7064		XP2000
7065		XP2008
7092		TY6–800
7102		150CVP
7119		E182CC
7189		*EL84
7237		TY7–6000A
7262A		XQ1032
7265		56TVP
7308		E188CC
7316		*M8136
7320		*EL84
7378		QV08–100
7527		QY4–400
7534		E130L
7580	O	
7580W	O	
7609	M	
7643		E80CF
7650		YL1110
7696		XP2000
7704	C	
7722		E280F
7737		E186F
7753		TY6–1250A
7767		XP1110
7788		E810F
7804		TY8–15A

Type No.	Status Code	Page No. or Suggested Alternatives
7807		TY12—20W
7900	C	
7983		QQZ03—10
8037		ZM1020/Z520M
8042		QZ06—20
8053		XP2000
8054		XP2030
8108		EC157
8118		YL1020/ QQZ03—20
8223		E288CC
8228		ZZ1000
8233		E55L
8254		EC1000
8255		E88C
8268		TY8—6000W
8269		TY8—6000A
8330		TY4—350
8348		YL1080
8408		YL1130
8505		YL1520
8532		M8248
8556		EC8010
8575		XP2230
8580		YL1190
8608		EL5070
8621	O	
8644		XP1117
8666		YD1170
8667		YD1171
8668		YD1172
8680		YD1212
8728		YD1150
8730		YD1152

Type No.	Status Code	Page No. or Suggested Alternatives
8731		YD1160
8732		YD1161
8733		YD1162
8734		YD1173
8735		YD1182
8736		YD1192
8752		YD1202
9514B, 14S		XP2230
9524B		XP2008
9526B		150UVP
9594B		XP2020
9595B		XP1000
9596B		XP1002
9597B		56TVP
9597QB		56TUVP
9635B		XP2230
9635QB		56DUVP
9656KB		XP2000
98684B		56CVP
9698B		XP1117
9708B		XP2030
9734B		XP2008
9734QB		150UVP
9758B		XP2030
9813B, 14B, 15B		XP2230
18042	M	160
18045	M	160
18046	M	160
18503		ZP1200
18504		ZP1400
18505		ZP1410
18506		ZP1430
18509		ZP1310
18515/01		ZP1440

Type No.	Status Code	Page No. or Suggested Alternatives
18518		ZP1700
18520		ZP1210
18529		ZP1300
18536/01		ZP1450
18545		ZP1220
18546/01		ZP1460
18550		ZP1320
18553		ZP1330
18555		ZP1330
40743	D	
40744	D	
40745	D	
40746	D	
40747	D	
40748	D	
40755	D	
40756	D	
40757	D	
40758	D	
40759	D	
40760	D	
40768	D	
40775	D	
55702	O	
55850F		XQ1240
55875 series	M	
55875—IG series	M	
2322 594 1xxxx	D	121
2322 610 series	D	118
2322 640 series	D	118
2322 662 98003	D	119
2322 662 98009	D	120
2322 663 93004	D	120

Mullard
Discrete Semiconductors

N-P-N silicon low/medium power transistors

book 1 part 1A

Type No.	Outline	Dwg. ref.	Maximum Ratings V_{CBO} (V)	V_{CEO} (V)	I_{CM} (A)	$I_{C(AV)}$ (A)	T_j (°C)	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 (mA)	at I_B (mA)	Special Features t_{on} (ns)	t_{off} (ns)	at I_C (mA)
GENERAL PURPOSE																		
§BC107	TO-18	BJ1	50	45	0.2	0.1	175	300	110	450	2.0	300*	0.25	10	0.5	100	500	10
§BC108			30	20					110	800						100	500	10
§BC109			30	20					200	800						N<4dB at f = 30Hz to 15kHz		
§BC147	SOT-25	AD1	50	45	0.2	0.1	125	350	110	450	2.0	300*	0.25	10	0.5	I_{CBO} at 20V<15nA		
§BC148			30	30					110	800								
§BC149			30	30					200	800						N<4dB at f = 30Hz to 15kHz		
BC337	TO-92	BR1	50	45	1.0	0.5	150	625	100	600	100	200*	0.7	500	50			
BC338			30	25														
BC463	SOT-25	AD1	35	28	3	1.5	175	1W	50	280	500	200*	0.5	1A	100	Supplied as complementary pairs with BC462, 464		
BC465			25	18					95	280								
BC546	TO-92	BR1	80	65	0.2	0.1	150	500	110	450	2.0	300*	0.25	10	0.5			
BC547			50	45					110	800								
BC548			30	30					110	800								
BC549			30	30					200	800						N<4dB at f = 30Hz to 15kHz		
BC550			50	45					200	800						N = <3dB at f = 30Hz to 15kHz		
§BCX31	SOT-25	AD1	100	80	1.0	0.5	175	1.25W	30	75*	150	80	0.8	500	50			
§BCX32			80	60	2.0	1.0			90	120*			1.6	1.0A	100			
§BCX33			60	40	2.0	1.0			30	75*			1.6	1.0A	100			
§BCX34			40	30	2.0	1.0			90	120*			1.6	1.0A	100			

*Typical

§ Also available to BS9000 (see page 4)

continued

N-P-N silicon low/medium power transistors (cont.)

book 1 part 1A

Type No.	Outline	Dwg. ref.	Maximum Ratings V_{CBO} (V)	V_{CEO} (V)	I_{CM} (A)	$I_{C(AV)}$ (A)	T_j (°C)	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 (mA)	at I_B (mA)	Special Features t_{on} (ns)	t_{off} (ns)	at I_C (mA)
GENERAL PURPOSE																		
BF336	TO-39	BL3	185	180	–	0.1	200	3.0W[1]	20	–	30	80	–	–	–	C_{re} = 3.5 pF max. at 0.5 MHz		
BF337			250	200														
BF338			300	225														
BF355	TO-39	BL3	300	225	0.16	0.1	200	3.0W[1]	–	–	–	–	25	160	10	Line-driver in tv receivers		
BF422	TO-92	BR5	250	250	0.1	0.02	150	830	50	–	25	60	–	–	–	C_{re}<1.6F at 0.5MHz		
BFQ38	TO-39	BL3	300	250	–	1.0	125	5.7W[2]	25	–	50	10	0.5	50	4	For telephony		
BFQ39			300	300									1.0	100	4	and similar		
BFQ40			450	350									0.5	60	4	applications		
§**BFX84**	TO-39	BL3	100	60	1.0	1.0	200	800	30	–	150	50	0.35	150	15			
§**BFX85**			100	60					70									
§**BFX86**			40	35					70									
§**BFY50**	TO-39	BL3	80	35	1.0	1.0	200	800	30	–	150	60	0.2	150	15			
§**BFY51**			60	30					40			50	0.35					
§**BFY52**			40	20					60			50	0.35					
§**BSX45**	TO-39	BL3	80	40	–	1.0	200	5W[2]	40	250	100	50	1.0	1A	100	200	850	100
§**BSX46**			100	60					40	250			1.0	1A	100			
§**BSX47**			120	80					40	160			0.9	500	25			
2N696	TO-39	BL3	60	40	0.5	–	175	600	20	60	150	40	1.5	150	15			
2N697			60	40					120	150								
2N1613	TO-39	BL3	75	30	0.5	–	200	800	40	120	150	60*	1.5	150	15			
2N1711	TO-39	BL3	75	30	1.0	–	200	800	100	300	150	70*	1.5	150	15			
2N2297	TO-39	BL3	80	35	–	1.0	200	800	40	120	150	60*	0.2	150	15			
2N3019	TO-39	BL3	140	80	–	1.0	200	800	100	300	150	100	0.5	500	50			
2N3020			140	80					40	120		80				Gain linearity		
2N3053	TO-39	BL3	60	40	–	0.7	200	5.0W	50	250	150	100	1.4	150	15			

[1] $T_{case} \leq 140°C$ [2] $T_{case} = 25°C$ * Typical § Also available to BS9000 (see page 4)

continued

P-N-P silicon low/medium power transistors

book 1 part 1A

Type No.	Outline	Dwg. ref.	Maximum Ratings V_{CBO} (V)	V_{CEO} (V)	I_{CM} (mA)	$I_{C(AV)}$ (mA)	T_j (°C)	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 (mA)	at I_B (mA)	Special Features
GENERAL PURPOSE																
§**BC157**	SOT-25	AD1	−50	−45	200	100	125	350	75†	260	2.0	150*	−0.3	10	0.5	
§**BC158**			−30	−30					75†	500						
§**BC159**			−30	−30					125†	500						N<4dB at f= 30Hz to 15kHz
BC327	TO-92	BR1	−50	−45	1.0A	500	150	625	100	600	100	100*	−0.7	500	50	
BC328			−30	−25												
BC462	SOT-25	AD1	−35	−28	3A	1.5A	175	1 W	50	280	500	200*	−0.5	1A	100	Supplied as complementary pairs with BC463,5
BC464			−25	−18					95	280						
BC556	TO-92	BR1	−80	−65	200	100	150	500	75	250	2.0	150*	−0.3	10	0.5	
BC557			−50	−45					75	475						
BC558			−30	−30					75	475						
BC559			−30	−30					125	475						N<4dB
BC560			−50	−45					125	475						N<3dB
§**BCX35**	SOT-25	AD1	−80	−80	1.0A	600	175	1.25W	40	75*	150	80	−0.4	150	15	
§**BCX36**			−60	−60					80	100*						
§**BCX37**			−40	−40					40	75*						
§**BCY30A**	TO-5	BF1	−64	−64	100	50	150	600	10	35	20	2*	−0.55	20	3	V_{EBO} max. = −45V
§**BCY31A**			−64	−64					15	60						V_{EBO}max. = −45V
§**BCY32A**			−64	−64					20	70						V_{EBO} max. = −32V
§**BCY33A**			−32	−32					10	35						V_{EBO} max. = −32V
§**BCY34A**			−32	−32					15	60						V_{EBO} max. = −32V
§**BCY70**	TO-18	BJ1	−50	−40	200	200	200	350	100	290*	10	250	−0.25	10	1.0	
§**BCY71**			−45	−45					100	400						N<2dB (BCY71)
§**BCY72**			−30	−25					100	290*						
BF423	TO-92	BR5	−250	−250	100	20	150	830	50	--	25	60	—	—	—	C_{re}<1.6pF at 0.5MHz
BFT44	TO-39	BL3	−300	−300	500	500	200	5W[1])	50	150	10	70	−5.0	500	100	
BFT45			−250	−250									−3.0			
§**BFX29**	TO-39	BL3	−60	−60	600	600	200	600	50	125*	10	100	−0.4	150	15	
§**BFX30**			−65	−65					50	200	10	—	—	—	—	t_s<250ns at 100mA
BFX37	TO-18	BJ1	−60	−60	—	50	200	360	70	300	0.01	40	−0.40	50	5.0	N<3dB
BFX87	TO-39	BL3	−50	−50	600	600	200	600	40	125*	10	100	−0.4	150	15	
BFX88			−40	−40												
§**BSV15**	TO-39	BL3	−40	−40	—	1.0A	200	800	40	250	100	50	−1.0	500	25	
§**BSV16**			−60	−60					40	250						
§**BSV17**			−90	−80					40	160						
2N4030	TO-39	BL3	−60	−60	—	1.0A	200	800	25	—	500	100	−0.5	500	50	
2N4031			−80	−80												
2N4032	TO-39	BL3	−60	−60	—	1.0A	200	800	70	--	500	150	−0.5	500	50	
2N4033			−80	−80												

1) Tcase = 25°C *Typical †h_{fe} § Also available to BS9000 (see page 4)

silicon low/medium power switching transistors

book 1 part 1A

Type No.	Outline	Drawing Reference	Maximum Ratings V_{CBO} (V)	V_{CEO} (V)	I_{CM} (mA)	$I_{C(AV)}$ (mA)	T_j (°C)	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 (mA)	at I_B (mA)	Special Features t_{on} max. (ns)	t_{off} max. (ns)	at I_C (mA)
N-P-N SWITCHING TYPES																		
BSS38	TO-92	BR1	120	100	250	100	150	300	20	–	4.0	60	0.7	4	0.4	–	1000	15
BSW41A	TO-18	BJ1	40	25	500	300	200	350	30	–	10	150	0.7	500	35	50	110	300
BSX19	TO-18	BJ1	40	15	500	–	200	360	20	60	10	400	0.3	10	0.6	12	15	10
BSX20			40	15					40	120	10	500	0.3	10	0.3	12	18	10
BSX21	TO-18	BJ1	120	80	250	100	175	300	20	–	4.0	60	0.7	4	0.4	Numerical indicator tube driver		
BSY95A	TO-18	BJ1	20	15	200	100	175	300	50	200	10	200	0.35	10	0.2	t_s 50ns at 10mA		
2N2369	TO-18	BJ1	40	15	500	–	200	360	40	120	10	500	0.25	10	1.0	12	18	10
2N2369A			40	15		200							0.20	10	1.0			
BFX34	TO-39	BL3	120	60	5A	2A	200	870	40	150	2A	70	1.0	5A	500	600	1200	5A
BSV64	TO-39	BL3	100	60	5.0A	2.0A	200	870	40	–	2A	100*	1.0	5A	500	600	1200	5A
BSW66A	TO-39	BL3	100	100	2.0A	1.0A	200	800	40	–	100	130*	0.4	500	50	For relays and other highly inductive load switching applications		
BSW67A			120	120														
BSW68A			150	150														
BSX59	TO-39	BL3	70	45	–	1.0A	200	800	25	–	500	250	0.3	150	15	35	60	500
BSX61													0.5	150	15	50	100	500
P-N-P SWITCHING TYPES																		
BSS68	TO-92	BR1	–110	–100	–	100	150	300	30	–	25	50	–0.25	25	2.5	Intended for anode switching of numerical indicator tubes		
2N2904	TO-39	BL3	–60	–40	–	600	200	600	40	120	150	200	–0.4	150	15	45	100	150
2N2904A			–60	–60														
2N2905	TO-39	BL3	–60	–40	–	600	200	600	100	300	150	200	–0.4	150	15	45	100	150
2N2905A			–60	–60														
2N2906	TO-18	BJ1	–60	–40	–	600	200	400	40	120	150	200	–0.4	150	15	45	100	150
2N2906A			–60	–60														
2N2907	TO-18	BJ1	–60	–40		600	200	400	100	300	150	200	–0.4	150	15	45	100	150
2N2907A			–60	–60														

*Typical

silicon plastic-encapsulated power transistors
book 1 part 1B

Type No.		Maximum Ratings					P_{tot}	h_{FE}		at	f_T	V_{CEsat}	at		Special Features
		V_{CBO}	V_{CEO}	I_{CM}	$I_{C(AV)}$	T_j	T_{mb}= 25°C	min.	max.	I_C	min.	max.	I_C	I_B	
N-P-N	P-N-P	(V)	(V)	(A)	(A)	(°C)	(W)			(mA)	(MHz)	(V)	(A)	(mA)	
Outline TO-126 Drawing Reference BU															
BF469	BF470	250	250	0.1	0.03	150	1.8	50	–	25	60	–	–	–	Class B video output
BF457		160	160	0.3	0.1	150	6	26	–	30	90*	1.0	0.03	6	Class A video output
BF458		250	250												
BF459		300	300												
BD232		500	300	1	0.25	125	15	25	150	50	20*	1.0	0.15	15	Line-driver in tv receivers
BUX86		800†	400	1	0.5	150	20	50*	–	50	20*	3.0	0.2	20	
BUX87		1000†	450												
BD135	BD136	45	45	1.5	1	150	8	40	250	150	250* a)	0.5	0.5	50	
BD137	BD138	60	60	1.5	1	150	8	40	160	150	250* a)	0.5	0.5	50	
BD139	BD140	100	80	1.5	1	150	8	40	160	150	250* a)	0.5	0.5	50	
BDW55	BDW56	45	45	1.5	1	175	8	40	250	150	250* a)	0.5	0.5	50	
BDW57	BDW58	60	60												
BDW59	BDW60	100	80												
BD226	BD227	45	45	3	1.5	150	12.5	40	250	150	125* b)	0.8	1	100	
BD228	BD229	60	60	3	1.5	150	12.5	40	160	150	125* b)	0.8	1	100	
BD230	BD231	100	80	3	1.5	150	12.5	40	160	150	125* b)	0.8	1	100	
BD233	BD234	45	45	6	2	150	25	25	–	1A	3	0.6	1	100	
BD235	BD236	60	60												
BD237	BD238	100	80												
BD131		70	45	6	3	150	15	40	–	500	60	0.3	0.5	50	
	BD132	45	45												
BD133		90	60	6	3	150	15	40	–	500	60	0.7	2	200	
BD433	BD434	22	22	7	4	150	36	50	–	2A	3	0.5	2	200	
BD435	BD436	32	32					50				0.5	2	200	
BD437	BD438	45	45					40				0.7	3	300	
BDX35		100	60	10	5	150	15	45	450	500	100*	0.9	5	500	
BDX36		120	60									0.7			
BDX37		120	80									0.9			

*Typical †V_{CESM} max. I_T a) 75MHz, b) 50MHz for p-n-p types

silicon plastic-encapsulated power transistors

book 1 part 1B

Type No.		Maximum Ratings					P_{tot} $T_{mb} \leq 25^{\circ}C$	h_{FE}		at	f_T	V_{CEsat}	at		Special Features
		V_{CBO}	V_{CEO}	I_{CM}	$I_{C(AV)}$	T_j		min.	max.	I_C	min.	max.	I_C	I_B	
N-P-N	P-N-P	(V)	(V)	(A)	(A)	(°C)	(W)			(mA)	(MHz)	(V)	(A)	(mA)	
Outline TO-220 Drawing Reference BV1															
BUX84		800†	400	3	2	150	40	50*	–	100	20*	3.0	1	200	
BUX85		1000†	450												
BD201	BD202	60	45	12	8	150	60	30	–	3A	3	1.0	3	300	
BD203	BD204	60	60							2A					
BDX77		100	80	12	8	150	60	30	–	2A	3	1.0	3	300	
	BDX78	80	80												
Outline SOT-93 Drawing Reference AR															
BU426		800†	375	8	6	150	70	30*	60	600	6*	1.5	2.5	500	
BU426A		900†	400						60						
BU433		800†	375						80						
BDV91	BDV92	60	60	20	10	150	90	20	–	4A	4	3.0	10	3.3A	
BDV93	BDV94	80	80												
BDV95	BDV96	100	100												

*Typical †V_{CESM} max.

silicon power transistors

book 1 parts 1B

Outline: TO-3

Type No.	Drawing Reference	Maximum Ratings V_{CBO} (V)	V_{CEO} (V)	I_{CM} (A)	$I_{C(AV)}$ (A)	T_j (°C)	P_{tot} T_{mb}=25°C (W)	h_{FE} min.	h_{FE} max.	at I_C (A)	f_T min. (MHz)	$V_{CE(sat)}$ max. (V)	at I_C (A)	at I_B (mA)	Special Features
N-P-N TYPES															
BD182	BE2	70	60	15	15	200	117	20	70	4	–	–	–	–	For use in high quality
BD183		85	80							3					audio amplifiers
BDX91	BE3	60	60	12	8	200	90	20	–	3	4.0	1.0	5	1A	BDX92 } p-n-p
BDX93		80	80												BDX94 } complements
BDX95		100	100												BDX96 }
BDY20	BE3	100	60	15	15	200	115	20	70	4	1.0*	1.1	4	400	
2N3055	BE3	100	60	–	15	200	115	20	70	4	0.8	1.1	4	400	
BDY90	BE1	120	100	15	10	175	40	30	120	5	70*	0.5	5	500	For use in switched mode
BDY91		100	80												power supplies, inverters
BDY92		80	60												and converters
BU126	BE1	750†	300	6	3	125	30	15	60	1	8.0*	10	2.5	250	For use in switched mode power supplies of colour tv receivers
BU133	BE1	750†	250	6	3	125	30	15	80	1	8.0*	10	2.5	250	
BDY93/01	BE1	800†	400	7	4	150	30	30*	–	1	10*	1.5	2.5	500	For use in converters,
BDY93		750†	350												inverters, switching and motor control systems.
BUX80	BE1	800†	400	15	10	150	100	30*	–	1.2	6.0*	1.5	5	1A	For use in switched mode
BUX81		1000†	450												power supplies, inverters and converters.
BU326	BE1	800†	375	8	6	150	60	30*	–	0.6	6.0*	10	2.5	250	For use in switched
BU326A		900†	400												mode power supplies of colour tv receivers.
BUX82	BE1	800†	400	8	6	150	60	30*	–	0.6	6.0*	1.5	2.5	500	For use in switched mode
BUX83		1000†	450												power supplies, inverters and converters.
BU204	BE1	1300†	600	3	2.5	115	10	2	–	2	7.5*	5.0	2	1A	For use in horizontal
BU205		1500†	700					2	–					1A	deflection circuits
BU206		1700†	800					1.8	–					1.1A	of tv receivers.
BU207A	BE1	1500†	600	7.5	5	115	12.5	2.5	–	4.5	7*	5.0	4.5	2A	For use in horizontal
BU208A		1500†	700	7.5	5					4.5		1.0	4.5	2A	deflection circuits
BU209A		1700†	800	6	4					3		5.0	3	1.3A	of colour tv receivers.
P-N-P TYPES															
BDX92	BE3	–60	–60	12	8	200	90	20	–	3	4	–1.0	5	1A	BDX91 } n-p-n
BDX94		–80	–80												BDX93 } complements
BDX96		–100	–100												BDX95 }

*Typical †V_{CESM} max.

Transistors

silicon r.f. amplifier low power transistors

book 1 part 1A

Type No.	Outline	Drawing reference	Maximum Ratings V_{CBO} (V)	V_{CEO} (V)	I_{CM} (mA)	$I_{C(AV)}$ (mA)	T_j (°C)	P_{tot} at 25°C (mW)	h_{FE} min.	h_{FE} max.	at I_C (mA)	f_T min. (MHz)	Special Features
N-P-N TYPES													
BF115	TO-72	BQ1	50	30	30	30	175	145	40	–	20	230*	
BF180	TO-72	BQ2	30	20	20	20	175	150	–	–	–	675*	N<9.5dB at 800MHz
BF181	TO-72	BQ2	30	20	20	20	175	150	–	–	–	600*	N = 6.8 dB typ. at 900MHz
BF200	TO-72	BQ2	30	20	20	20	175	150	15	–	3.0	270	Typ. G_{UM} at 200 MHz = 22dB
BF194	SOT-25	AD2	30	20	30	30	125	220	115*	–	1.0	260*	N = 4dB typ.
BF195									67*	–		200*	at 100 MHz
BF196	SOT-25	AD2	40	30	25	25	125	250	27	–	4.0	400*	Typ. gain control range = 60dB
BF197	SOT-25	AD2	40	25	25	25	125	250	38	–	7.0	550*	Typ. G_{UM} at 45MHz = 41dB
BF362	SOT-37	AE1	30	20	20	20	125	120	20	–	3.0	800*	N = 5dB typ.
BF363												600	at 800MHz
BF480	SOT-37	AE1	20	15	30	20	125	140	10	–	10	1600*	N = 3.3dB typ. at 800 MHz
BFT24	SOT-37	AE2	8	5	5	2.5	150	30	20	40*	1.0	1200	N = 3.8dB at 500MHz
P-N-P TYPES													
BF324	TO-92	BR1	−30	−30	–	25	150	250	25	–	4.0	450*	N = 3dB typ at f = 100MHz
BF450	TO-92	BR2	−40	−40	–	25	150	250	60	–	1.0	325*	
BF451									30	–			

*Typical

Transistors

broadband and tv transposer transistors

book 1 parts 1A and 2

Type No.	Outline	Drawing Reference	Maximum Ratings V_{CBO} (V)	V_{CEO} (V)	I_{CM} (mA)	$I_{C(AV)}$ (mA)	P_{tot} at 25°C (mW)	h_{FE} min.	h_{FE} max.	at I_C (mA)	f_T min. (MHz)	Special Features
N-P-N TYPES												
BFQ34	SOT-122	AZ	25	18	–	150	2.2W	25	–	75	3000	d_{im}= –60dB typ at V_o=1.2V, 800MHz
BFR90	SOT-37	AE2	20	15	–	25	180	25	50*	14	5000*	N=2.4dB typ. at 500MHz
BFR91	SOT-37	AE2	15	12	–	35	180	25	50*	30	5000*	N=1.9dB typ at 500MHz
BFR94	SOT-48/3	AG	30	25	300	150	3.5W	30	–	150	3500*	d_{im}= –63dB typ. at V_o=1.0V, 200 MHz
BFR96	SOT-37	AE2	20	15	150	75	500	25	–	50	4000	d_{im}= –60dB typ. at V_o=0.5V, 500MHz
BFW16A	TO-39	BL3	40	25	300	150	1.5W	25	–	150	1200*	Typ. Gp=6.5dB at 800MHz
BFW17A	TO-39	BL3	40	25	300	150	1.5W	25	–	150	1100*	Typ. Gp=16dB at 200MHz
BFW30	TO-72	BQ2	20	10	100	50	250	25	–	50	1600*	N < 5.0dB at 500MHz
BFX89	TO-72	BQ2	30	15	50	25	200	25	150	2.0	1100*	N = 7dB at 800MHz
BFY90	TO-72	BQ2	30	15	50	25	200	25	150	2.0	1000	N < 3.5dB at 200MHz
BLW64	SOT-56	AM	60	32	9A	3A	40W	25	100	1A	900*	d_{im}= –55dB typ at P_o sync > 10W, 200MHz
BLW75	SOT-105	AU	60	32	12A	4A	60W	20	–	2A	800*	d_{im}= –55dB typ. at $P_{o\ sync}$>14W, 200MHz
BLW98	SOT-122	AZ	50	27	4A	2A	21.5W	15	–	850	2500*	d_{im}= –60dB typ. at $P_{o\ sync}$>3.5W, 860MHz
BLX98	SOT-48/2	AF	50	27	4A	2A	21.5W	15	–	1A	2500*	d_{im}= –60dB typ. at $P_{o\ sync}$>3.5W, 860MHz
P-N-P TYPES												
BFQ23	SOT-37	AE2	–15	–12	50	35	150	180	20	–	30 5000*	N = 2.4dB typ
BFQ24	TO-72	BQ2					200	150				at 500MHz
BFQ32	SOT-37	AE2	–20	–15	150	75	500	20	–	50	3600	d_{im}= –60dB typ. at V_o=0.5V, 500MHz

*Typical

broadband r.f. power modules

Type No.	Description	Drawing reference	Frequency Range (MHz)	Supply Voltage (V)	Min.Power Output (W)	at P_{DR} (mW)	Efficiency Typ. (%)
BGY21	U.H.F. amplifier module designed for portable equipment	BX	420–470	12	1.2	20	40
BGY22	U.H.F. amplifier modules designed for mobile communications equipment	BX	380–512	13.5	2.5	50	50
BGY23			380–512	13.5	7	2.5W	70
BGY22A			420–480	12.5	2.5	50	50
BGY23A			420–480	12.5	7	2.5W	70
BGY32	V.H.F. amplifier modules designed for mobile communications equipment	BY	68–88	12.5	18	100	40 min.
BGY33			80–108			100	
BGY35			132–156			150	
BGY36			148–174			150	

n-p-n r.f. power transistors

book 1 part 2

Type No.	Outline	Drawing reference	Maximum Ratings V_{CBO} (V)	V_{CEO} (V)	I_{CM} (A)	$I_{C(AV)}$ (A)	P_{tot} ($T_{mb=25^oC}$) (W)	Characteristics h_{FE} at min.	max.	I_C (A)	f_T typ (MHz)	P_o typ (W)	G_p (dB)	at f (MHz)	at V_{CC} (V)
H.F. TYPES															
BLW76	SOT-121A	AY	70	35	20	8	120	15	80	4	315	80 §	>13	28	28
BLW77	SOT-121B	AY	70	35	30	12	192	15	80	7	320	130 §	>12	28	28
BLW78	SOT-121A	AY	70	35	25	10	135	20	80	1	370	100 §	19	28	28
BLX13	SOT-56	AM	65	36	6	3	62	10	100	1	500	25 §	>18	28	28
BLX13C	SOT-120	AX			6	3	55								
BLW83	SOT-123	BA			9	3	67								
BLX14	SOT-55	AL	85	36	12	4	88	15	100	1.4	250	50 §	>13	28	28
BLX15	SOT-55	AL	110	53	20	6.5	195	15	50	1.4	275	150 §	>14	28	50
V.H.F. TYPES															
BFQ42	TO-39	BL3	36	18	1.8	0.6	7.2	10	60	0.25	750	2	>11	175	13.5
BFQ43	TO-39	BL7	36	18	3.75	1.25	12	10	80	0.5	750	4	>12	175	13.5
BFS22A	TO-39	BL3	36	18	2.25	0.75	8	5	–	0.5	700	4	8	175	13.5
BFS23A	TO-39	BL3	65	36	1.5	0.5	8	5	–	0.5	500	4	>10	175	12.5
BLW29	SOT-120	AX	36	18	8	2.75	46	10	80	1.75	900	15	>10	175	13.5
BLW31	SOT-120	AX	36	18	15	6	75	10	80	3.5	850	28	> 9	175	13.5
BLW60	SOT-56	AM	36	18	20	8	88	20	80	1	550	45	> 5.5	175	12.5
BLW60C	SOT-120	AX			22	9	77	10	80	4	650				
BLW85	SOT-123	BA			22	9	85	10	80	4	650				
BLX39	SOT-120	AX	65	36	12	4	62	20	–	1	450	45	8	175	28
BLW86	SOT-123	BA					80								
BLY33	TO-39	BL3	66	33	1.5	0.5	5	10	60*	0.2	>250	2†	8	175	13.8
BLY34			40	20								3			
BLY83	SOT-48/3	AG	66	33	7.5	2.5	12**	10	220	1	>250	7††	13	175	13.8
BLY84			40	20				10	60*			13.2	5.8		
BLY85	SOT-48/3	AG	40	20	3	1	10	10	–	0.2	>250	>4	>10	175	13.8
BLY97			66	33									>13		24
BLY87A	SOT-48/2	AF	36	18	3.75	1.25	17.5	5	–	0.5	700	8	> 9	175	12.5
BLY87C	SOT-120	AX			4	1.5	19.5								
BLY88A	SOT-48/2	AF	36	18	7.5	2.5	32	5	–	0.5	700	15	7.5	175	12.5
BLY88C	SOT-120	AX			8	3	33								
BLY89A	SOT-56	AM	36	18	10	5	62	10	120	1	650	25	> 6	175	13.5
BLY89C	SOT-120	AX			12	6	62	10	80		800				
BLW87	SOT-123	BA			12	6	67	10	80		800				
BLY90	SOT-55	AL	36	18	20	8	113	10	50*	1	550	50	> 5	175	12.5
BLY91A	SOT-48/2	AF	65	36	2.25	0.75	17.5	5	–	0.5	500	8	>12	175	28
BLY91C	SOT-120	AX			2.5	0.9	20								
BLY92A	SOT-48/2	AF	65	36	4.5	1.5	32	5	–	0.5	500	15	>10	175	28
BLY92C	SOT-120	AX			5	1.75	33								
BLY93A	SOT-56	AM	65	36	9	3	62	10	120	1	500	25	> 9	175	28
BLY93C	SOT-120	AX					62		120		500				
BLW84	SOT-123	BA					67		100		650				
BLY94	SOT-55	AL	65	36	12	6	113	10	120	1	500	50	> 7	175	28
2N3375	TO-60	BN	65	40	1.5	0.5	11.6	10	100	0.25	500	>3	–	400	28
2N3553	TO-39	BL3	65	40	1	0.35	7	10	100	0.25	500	>2.5	–	175	28
2N3632	TO-60	BN	65	40	3	1	23	10	150	0.25	400	13.5	–	175	28

*Typical †a.m. operation §s.s.b. operation **at T_{mb} = 90°C

†† a.m. operation in 2-stage amplifier incorporating BLY33 for a typical input power to BLY33 of 350mW and envelope distortion less than 5% at 80% modulation.

Transistors

n-p-n r.f. power transistors (cont.)

book 1 part 2

Type No.	Outline	Drawing reference	Maximum Ratings V_{CBO} (V)	V_{CEO} (V)	I_{CM} (A)	$I_{C(AV)}$ (A)	T_j (°C)	P_{tot} T_{mb} = 25°C (W)	h_{FE} min.	h_{FE} max.	at I_C (A)	f_T typ. (MHz)	P_o typ. (W)	G_p (dB)	at f (MHz)	at V_{CC} (V)
U.H.F. TYPES																
BLW26		BW	36	16	2.0	0.7	–	4.0†	10	–	0.1	1400	2.8	–	470	12.5
BLW79	SOT-122	AZ	36	17	1.5	0.5	200	8.5	10		0.25	1500	2	>9	470	12.5
BLW80					3.0	1		17			0.5	1750	4	>8		
BLW81					7.5	2.5		35			1.25	1300	10	>6		
BLW82	SOT-119	AW	36	17	18	7	200	87	10	80	4	1600	30	>5	470	12.5
BLX65	TO-39	BL3	36	18	2.0	0.7	150	3.0†	10	–	0.1	1400	2.0	–	470	13.8
BLX66	SOT-48/4	AH						4.0†					2.5			
BLX67	SOT-48/3	AG	36	18	2.0	0.7	150	4.5†	10	–	0.1	1400	3.0	–	470	13.8
BLX68 (BLY53A)	SOT-48/3	AG	36	18	4.0	1.0	150	10‡	10	–	0.5	1300	7.8	5.9	470	13.8
BLX69A	SOT-48/2	AF	36	18	10	3.5	200	50	10	–	1.0	1000	20	>4	470	13.5
BLX 91A	SOT-48/3	AG	65	33	0.8	0.4	200	4.0‡	10	–	0.1	1200	1.45	12	470	28
BLX92A	SOT-48/3	AG	65	33	2.0	0.7	200	6.0‡	10	–	0.1	1200	2.5		1000	28
BLX93A	SOT-48/3	AG	65	33	3.0	1.0	200	12.5‡	10	–	0.1	1200	5.0	–	1000	28
BLX94A	SOT-48/2	AF	65	30	6.0	2.0	200	50	15	50*	1.0	1000	25	>6	470	28
BLX95	SOT-56	AM	65	30	10	3.0	200	75	25	100	1.0	900	40	>4.5	470	28
2N3866	TO-39	BL3	55	30	0.4	0.4	200	5.0	10	200	0.05	700	1.0	>10	400	28
2N4427	TO-39	BL3	40	20	0.4	0.4	200	3.5	10	200	0.1	700	1.0	–	175	12

microwave transistors

book 1 part 1A

Type No.	Description	Outline	Drawing reference	V_{CBO} max. (V)	I_C max. (A)	P_{tot} max. (W)	f_T min. (GHz)	P_L at into 50Ω (W)	f (GHz)
BFQ33	N-P-N transistor for use up to C-band frequencies	SOT-100	AS	9	0.020	0.18	14 typ.		
BFR49	N-P-N transistor for amplifiers up to S-band frequencies	SOT-100	AS	20	0.025	0.18	5 typ.		
ML15/28	N-P-N L band power transistors intended for common emitter operation in class AB or B linear amplifiers with 20-26V supplies.	SOT-48 header	AJ	50	0.5	11	3.2	3.5	1.5
ML15/48				50	1.0	20	2.5	7.5	1.5

*Typical † at T_{mb}=90°C ‡at T_{mb}=70°C

silicon planar n-p-n differential amplifiers

book 1 part 1A

Type No.	Outline	Drwg. ref.	Maximum Ratings V_{CBO} (V)	V_{CEO} (V)	$I_{C(AV)}$ (mA)	T_j (°C)	P_{tot} at 25°C (mW)	h_{FE} min.	h_{FE} max.	at I_C (mA)	f_T min. (MHz)	I_{C1}/I_{C2} ratio at equal V_{BE} min.	I_{C1}/I_{C2} ratio at equal V_{BE} max.
BCY87	TO-71	BP1	45	40	30	175	150	100	450	0.05	50	0.9	1.11
BCY88								120	600	0.5	50	0.8	1.25
BCY89								100	600	10	50	0.67	1.5

silicon planar p-n-p-n switches

Type No.	Description	Outline	Dwg. ref.	Maximum Ratings V_{GaK} (V)	V_{GaA} (V)	I_{ARM} (A)	I_A (mA)	T_j (°C)	P_{tot} at 25°C (mW)	V_A (V)	at I_A (mA)
BR100	Bi-directional trigger device for use in triac and thyristor trigger circuits	DO-14	D2	–	28 to 36 ($V_{(BO)}$)	–	2 (I_{FRM})	100	150	–	–
BR101	p-n-p-n controlled switch for use as a saw tooth generator in t.v. field timebase applications	TO-72	BQ6	50	50	2.5	175	150	275	<1.4	50
BRY39	Integrated p-n-p-n transistor pair. Applications include controlled switch, programmable unijunction transistor and thyristor tetrode.	TO-72	BQ6	70	70	2.5	175	150	275	<1.4	100
BRY56	Trigger device for switching applications such as motor control, oscillators, relay replacements, timers, pulse shapers.	TO-92	BR4	70	70	2.5	175	150	300	<1.4	100

junction field-effect transistors (n-channel)

book 1 part 1A

Type No.	Outline	Drawing Reference	Ratings: $+V_{DS}$ / V_{DG} (V)	Ratings: V_{GS} (V)	Ratings: I_D (mA)	Ratings: P_{tot} at 25°C (mW)	Characteristics: $V_{(P)GS}$ max. (V)	Characteristics: I_{GSS} max. (nA)	Characteristics: I_{DSS} min. (mA)	Characteristics: I_{DSS} max. (mA)	Characteristics: Y_{fs}min. (f=1kHz) (mA/V)	Special Features
AMPLIFIERS												
BF245A	TO-92	BR3	30	−30	25	300	8	5	2	6.5	3	N=1.5dB typ. at f=100MHz, R_G=1kΩ
BF245B									6	15		
BF245C									12	25		
BF246A	TO-92	BR6	25	−25	–	300	14.5	5	30	80	8	
BF246B									60	140		
BF246C									110	250		
BF256A	TO-92	BR3	30	−30	–	300	–	5	3	7	4.5	G_p=11dB typ. at f=800MHz, R_s=47Ω
BF256B									6	13		
BF256C									11	18		
BFW10	TO-72	BQ3	30	−30	20	300	8	0.1	8	20	3.5	Noise voltage <75nV/√Hz at 10Hz
BFW11					20	300	6		4	10	3	
BFW12					10	150	2.5		1	5	0.5	
BFW13					10	150	1.2		0.2	1.5	0.5	
BFW61	TO-72	BQ3	25	−25	20	300	8	1	2	20	2	
2N3823	TO-72	BQ3	30	−30	–	300	8	0.5	4	20	3.5	N<2.5dB at 100MHz
SWITCHING												
BSV78	TO-18	BJ2	40	−40	50 (I_G)	350	11	0.25	50	–	–	$r_{DS(on)}$<25Ω
BSV79							7		20	–		<40Ω
BSV80							5		10	–		<60Ω
2N3966	TO-72	BQ3	30	−30	–	300	6	0.1	2	–	–	$r_{DS(on)}$<220Ω
2N4091	TO-18	BJ2	40	−40	–	1800 (T_{case})	10	0.2 (I_{SGO})	30	–	–	$r_{DS(on)}$<30Ω
2N4092							7		15	–	–	<50Ω
2N4093							5		8	–	–	<80Ω
2N4391	TO-18	BJ2	40	−40	50 (I_G)	1800 (T_{case})	10	0.1	50	150	–	$r_{DS(on)}$<30Ω
2N4392							5		25	75		<60Ω
2N4393							3		5	30		<100Ω
2N4856	TO-18	BJ2	40	−40	50 (I_G)	360	10	0.25	50	–	–	$r_{DS(on)}$<25Ω
2N4857							6		20	100		<40Ω
2N4858							4		8	80		<60Ω
2N4859	TO-18	BJ2	30	−30	50 (I_G)	360	10	0.25	50	–	–	$r_{DS(on)}$<25Ω
2N4860							6		20	100		<40Ω
2N4861							4		8	80		<60Ω
MATCHED PAIRS												
BFS21	2XTO-72	BQ3	30	−30	4	30	6	0.5	1	–	–	V_{G1S1}-V_{G2S2} <20mV
BFS21A												<10mV

MONOLITHIC DUAL FIELD-EFFECT TRANSISTORS

							ΔI_G (pA)	ΔV_{GS} (mV)	$\frac{d\Delta V_{GS}}{dT}$ (μV/°C)	CMRR (dB)	
BFQ10	TO-71	BP2	30	−30	30	250	3.5	<10	<5	<5	>100	Intended for high-performance low-level differential amplifiers
BFQ11									<10	<5	>90	
BFQ12									<10	<10	>90	
BFQ13									<10	<20	>90	
BFQ14									<15	<20	>90	
BFQ15									<20	<40	>90	
BFQ16									<50	<50	>80	

mos field-effect transistors (n-channel)

SINGLE INSULATED-GATE FETs

Type No.	Outline	Drawing Reference	Maximum Ratings V_{DS} (V)	$\pm V_{GB}$ (V)	I_D (mA)	P_{tot} at 25°C (mW)	Characteristics I_{GSS} max. (nA)	I_{DSS} typ. (nA)	I_{DSS} max. (nA)	$r_{DS(on)}$ typ. (Ω)	Special Features
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
BSV81	TO-72	BQ5	–	10	50 (peak)	200	0.01	–	–	50	For switching and particularly for chopping applications
Enhancement											
SD200	TO-72	BQ7	25	40	50	300	0.1	1	1000	50	For u.h.f. amplification
†**SD201**				−0.3,+10			1				
SD202	TO-72	BQ7	20	40	50	300	0.1	1	1000	35	For u.h.f. amplification
†**SD203**				−0.3,+10			1				
SD210	TO-72	BQ7	30	40	50	300	–	1	10	45	For analogue and digital switching
†**SD211**			30	−0.3,+25				(I_{DSX})			
SD212			10	40							
†**SD213**	TO-72	BQ7	10	−0.3,+25	50	300	–	1	10	45	For analogue and digital switching
SD214			20	40				(I_{DSX})			
†**SD215**			20	−0.3,+30							

DUAL INSULATED-GATE FETs

Type No.	Outline	Drawing Reference	Maximum Ratings V_{DS} (V)	I_D (mA)	P_{tot} at 25°C (mW)	Characteristics I_{GSS} (max.) (nA)	I_{DSS} typ. (nA)	I_{DSS} max. (nA)	$-C_{rss}$ typ. (fF)	g_{fs} min. (mA/V)	Special Features
Depletion											
†**BF327**	SOT-103	AT	20	50	200	10	>20(mA)	55	30	12(y_{fs})	N<3dB at 200MHz
†**BFR84**	TO-72	BQ4	20	50	300	10	>20(mA)	65	30	12(y_{fs})	N<3dB at 200MHz
BFS28	TO-72	BQ4	20	20	200	1	–	–	25	8(y_{fs})	G_a typ. = 18dB at 200 MHz
Enhancement											
†**SD300**	TO-72	BQ4	25	50	300	100	1	1000	20	8	For v.h.f./u.h.f. amplification and mixing
†**SD303**			20						20	13	
†**SD304**			25						30	8	
†**SD305**	TO-72	BQ4	20	150	300	100	1	1000	30	24	For v.h.f./u.h.f. amplification and mixing
†**SD306**				50						13	
SD307	TO-72	BQ4	20	–	–	–	–	–	30	40*	For u.h.f. amplification and mixing
SD308									20	22*	
†**SD6000**‡	d.i.l.	CU	20	50	625	100	1	1000	25	12	For f.m./v.h.f. front end applications

*Typical †The gates are diode-protected ‡Double-dual gate

Transistors

darlington transistors

book 1 parts 1A and 1B

P_{tot} max. (T_{mb} ≤25°C)	Type No. N-P-N	Type No. P-N-P	Outline	Dwg. ref.	Maximum Ratings V_{CBO} (V)	Maximum Ratings V_{CEO} (V)	Maximum Ratings I_{CM} (A)	Maximum Ratings $I_{C(AV)}$ (A)	Characteristics h_{FE} min.	at I_C (A)	$V_{CE(sat)}$ max. (V)	at I_C (A)	at I_B (mA)	Special Features t_{on} max. (μs)	t_{off} max. (μs)	at I_C (A)
800mW†	BSR50	BSR60	TO-92	BR5	60	45	2	1	2000	0.5	1.3	0.5	0.5	0.4	2.0	0.5
					−60	−45								1.0	1.5	
	BSR51				80	60								0.4	2.0	
		BSR61			−80	−60								1.0	1.5	
800mW†	BSS50	BSS60	TO-39	BL3	60	60	2	1	2000	0.5	1.6	1	1.0	0.4	1.5	0.5
					−60	−45					−1.6		4.0	1.0		
	BSS51				80	60					1.6		1.0	0.4		
		BSS61			−80	−60					−1.6		1.0	1.0		
	BSS52				80	80					1.6		4.0	0.4		
		BSS62			−100	−80					−1.8		4.0	1.0		
5.0W	BDX42	BDX45	TO-126	BU	60	45	–	1	2000	0.5	1.6	1	4.0	0.4	2.0	0.5
					−60	−45	2				−1.6		4.0	1.0		
	BDX43				80	60	–				1.6		1.0	0.4		
		BDX46			−80	−60	2				−1.6		1.0	1.0		
	BDX44				100	80	–				1.6		4.0	0.4		
		BDX47			−100	−80	2				−1.8		4.0	1.0		
40W	BD675	BD676	TO-126	BU	45	45	6	4	750	1.5	2.5	1.5	6			
					−45	−45										
	BD677				60	60										
		BD678			−60	−60										
	BD679				80	80										
		BD680			−80	−80										
	BD681				100	100										
		BD682			−100	−100										
62.5W	BD645	BD646	TO-220	BV1	80	60	12	8	750	3	2.0	3	12	0.5*	2.5*	3
					−60	−60										
	BD647				100	80										
		BD648			−80	−80										
	BD649				120	100										
		BD650			−100	−100										
	BD651				140	120										
		BD652			−120	−120										
90W	BDX63	BDX62	TO-3	BE1	80	60	12	8	1000	3	2.0	3	12	0.5*	2.5*	3
					−60	−60										
	BDX63A				100	80										
		BDX62A			−80	−80										
	BDX63B				120	100										
		BDX62B			−100	−100										
	BDX63C				140	120										
		BDX62C			−120	−120										
117W	BDX65	BDX64	TO-3	BE1	80	60	16	12	1000	5	2.5	5	20	1.0*	2.5*	5
					−60	−60										
	BDX65A				100	80										
		BDX64A			−80	−80										
	BDX65B				120	100										
		BDX64B			−100	−100										
	BDX65C				140	120										
		BDX64C			−120	−120										
125W	BDV65	BDV64	SOT-93	AR	60	60	20	12	1000	5	2.0	5	20	0.5*	2.0*	5
					−60	−60										
	BDV65A				80	80										
		BDV64A			−80	−80										
	BDV65B				100	100										
		BDV64B			−100	−100										
150W	BDX67	BDX66	TO-3	BE2	80	60	20	16	1000	10	2.0	10	40	1.0*	2.5*	10
					−60	−60										
	BDX67A				100	80										
		BDX66A			−80	−80										
	BDX67B				120	100										
		BDX66B			−100	−100										
	BDX67C				140	120										
		BDX66C			−120	−120										

*Typical †T_{amb} ≤25°C ‡T_{mb} ≤100°C

Type No.	Outline	Drawing Reference	Maximum Ratings V_{CBO} (V)	V_{CEO} (V)	$I_{C(AV)}$ (mA)	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 (mA)	at I_B (mA)	Nearest type in TO-18 envelope
N-P-N TRANSISTORS														
BCW31R	SOT-23	AC1	30	20	100	200	110	220	2.0	300*	0.25	10	0.5	**BC108A**
BCW32R							200	450						**BC108B**
BCW33R							420	800						**BC108C**
BCW71R	SOT-23	AC1	50	45	100	200	110	220	2.0	300*	0.25	10	0.5	**BC107A**
BCW72R							200	450						**BC107B**
BCX19	SOT-23	AC7	50	45	500	310	100	600	100	200*	0.62	500	50	**BC337**
BCX20			30	25										**BC338**
BCX54	SOT-89	AQ	45	45	1A	1W	40	250	150	130*	0.5	500	50	**BD135**
BCX55			60	60			40	160						**BD137**
BCX56			100	80			40	160						**BD139**
BF622	SOT-89	AQ	–	250	100	1W	50	–	25	60	–	–	–	–
BFQ17	SOT-89	AQ	40	25	150	1W	25	–	150	1.2G*	–	–	–	**BFW16A**
BFQ18			30	25	150	1W	30	–	150	3.5G*				**BFR94**
BFQ19			20	15	75	500	25	–	50	5.5G*				**BFR96**
BFR53	SOT-23	AC7	18	10	50	180	25	–	50	2.0G*	–	–	–	**BFW30**
BFR92	SOT-23	AC7	20	15	25	180	25	–	14	5.0G*	–	–	–	**BFR90**
BFR93			15	12	35				30					**BFR91**
BFS17R	SOT-23	AC1	25	15	25	200	25	150	2.0	1300*	–	–	–	**BFY90**
BFS18R	SOT-23	AC1	30	–	30†	200	35	125	10	200	–	–	–	–
BFS19R	SOT-23	AC1	30	–	30†	200	65	225	10	260	–	–	–	–
BFS20R	SOT-23	AC1	30	20	25	200	40	–	7.0	275	–	–	–	**BF173**
BFT25	SOT-23	AC7	8	5	2.5	30	20	40*	1.0	1200	0.175	1.0	0.1	**BFT24**
BSS64	SOT-23	AC7	120	80	100	200	20	–	4.0	60	0.7	4	0.4	**BSS38**
BSV52R	SOT-23	AC1	20	12	100	200	40	120	10	400	0.25	10	1.0	**BSX20**
P-N-P TRANSISTORS														
BCW29R	SOT-23	AC1	–30	–20	100	200	120	260	2.0	150*	–0.3	10	0.5	**BC178A**
BCW30R							215	500						**BC178B**
BCW69R	SOT-23	AC1	–50	–45	100	200	120	260	2.0	150*	–0.3	10	0.5	**BC177A**
BCW70R							215	500						**BC177B**
BCX17	SOT-23	AC7	–50	–45	500	310	100	600	100	100*	–0.62	500	50	**BC327**
BCX18			–30	–25										**BC328**
BCX51	SOT-89	AQ	–45	–45	1A	1W	40	250	150	50*	–0.5	500	50	**BD136**
BCX52			–60	–60			40	160						**BD138**
BCX53			–100	–80			40	160						**BD140**
BF623	SOT-89	AQ	–	–250	100	1W	50	–	25	60	–	–	–	–
BFT92	SOT-23	AC7	–20	–15	25	180	20	–	14	5G*	–	–	–	–
BFT93			–15	–12	35				30					
BSR12	SOT-23	AC7	–12	–12	100†	200	20	–	100	2500*	–0.45	100	10	–
BSS63	SOT-23	AC7	–110	–100	100	200	30	–	25	50	–0.25	25	2.5	**BSS68**

*Typical †Peak

Microminiature devices

n-channel junction field-effect transistors

book 1 part 1A

Outline SOT-23

Type No.	Drawing Reference	Maximum Ratings V_{DGO} (V)	V_{GSO} (V)	$\pm V_{DS}$ (V)	I_G (mA)	P_{tot} at 25°C (mW)	$-V_{(P)GS}$ max. (V)	at I_D (nA)	$-I_{GSS}$ max. (nA)	I_{DSS} (V_{GS} = 0) min. (mA)	max. (mA)	at V_{DS} (V)
BFR30	AC2	25	−25	25	5.0	200	5.0	0.5	0.2	4.0	10	10
BFR31							2.5			1.0	5.0	10
BFT46	AC2	–	−30	30	10(I_D)	200	2.5	–	–	2.5	–	15
BSR56	AC2	–	−40	40	50	200	10	–	–	50	–	15
BSR57							6			20	100	
BSR58							4			8	80	

programmable unijunction transistor

Outline SOT-23

Type No.	Drawing Reference	V_{GA} max. (V)	I_A max. (mA)	I_{ARM} [1] max (A)	P_{tot} [2] max (mW)	I_P (μA)	I_V (μA)	at V_s (V)	R_G (MΩ)
BRY61	AC8	70	175	2.5	250	<1	<50	10	1

1) t = 10μs, d = 0.01 2) At 25°C

diodes

book 1 part 3

Outline SOT-23

Type No.	Drawing Reference	Description	V_{RRM} (V)	I_{FRM} (mA)	$I_{F(AV)}$ (mA)	V_F at I_F (V)	(mA)	t_{rr} max. (I_F=10mA,V_R=IV) (ns)	Nearest type
BAS16	AC3	Single diode	85	200	100	<1.1	50	6	--
BAT18	AC3	Single diode	35(V_R)	–	100	<1.2	100	–	--
BAV70	AC4	Common cathode double diode	70	200	100	<1.1	50	6	2 x 1N4148
BAW56	AC5	Common anode double diode							
BAV99	AC6	Two diodes in series intended for high speed switching.							

variable capacitance diode

Outline SOT-23

Type No.	Description	Drawing Reference	V_R max. (V)	I_R max. (nA)	C_d at V_R (pF) min.	max.	(V)	Capacitance Ratio typ.
BBY31	Intended for electronic tuning applications	AC3	28	100	1.8	2.8	25	5

schottky diode

Outline SOT-23

Type No.	Drawing Reference	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	15	100	<0.6	<1	<7

1) At I_F = 10mA 2) At f = 900MHz

silicon planar voltage reference diodes

200mW (T_{amb} = 25°C) ± 5% voltage tolerance

Outline SOT-23 Drawing reference AC3

Type No.	Nom. Zener Voltage	Measured at Test I_z Min. Voltage	Max. Voltage	Max. Slope Resistance	Typ. Temp. Coefficient	Test I_z	Max. I_R at V_R	
	(V)	(V)	(V)	(Ω)	(mV/°C)	(mA)	(μA)	(V)
BZX84								
–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

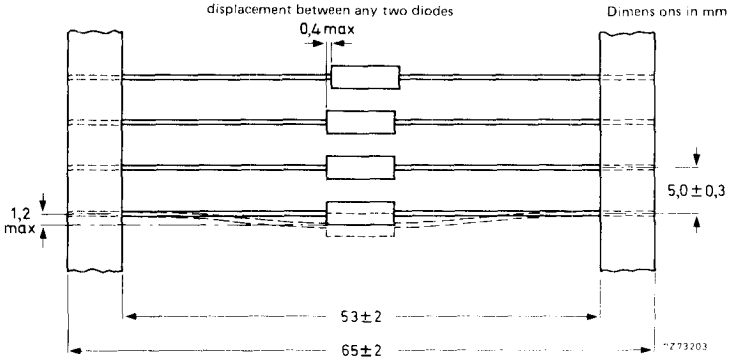
STOP PRESS

Whereas the microminiature transistors shown are the Mullard preferred range, it is now possible for any microminiature transistor to be delivered with either forward or reverse pinning. Reverse-pinned types bear the subscript R, e.g. BCW33R.

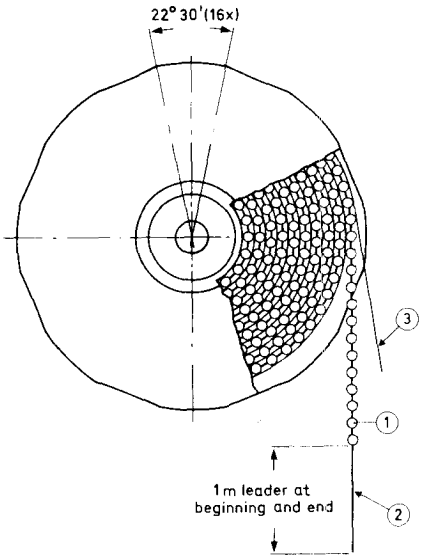
Diodes

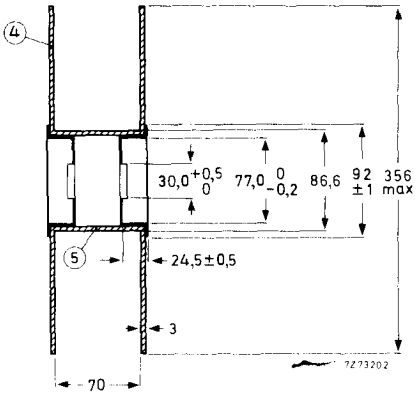
Mullard diodes are normally supplied bandoliered.

Configuration of bandolier



Reel dimensions





(1) Diode
(2) Bandolier
(3) Paper
(4) Flange
(5) Cylinder

Examples:

Outline	Per reel
DO-7	7000
DO-14	5000
DO-15	5000
DO-35	9000

Diodes

germanium point contact diodes

book 1 part 3

Abridged data applying at 25°C T_{amb}

Outline DO-7 Drawing reference D1

Type No.	Description	V_{RRM} (V)	I_{FRM} (mA)	$I_{F(AV)}$ (mA)	Typical V_F at I_F (V)	(mA)	Typical I_R at V_R (μA)	(V)	T_{amb} max. (°C)
OA90	High frequency detector diode	30	45	10	2.0	30	300	30	75
AA119	Detector diode	45	100	35	2.6	30	170	45	60
OA91	General purpose diode	115	150	50	2.1	30	75	100	75
OA95	General purpose diode	115	150	50	1.85	30	80	100	75

germanium gold bonded diodes

Outline DO-7 Drawing reference D1

Type No.	Description	V_{RRM} (V)	I_{FRM} (mA)	Typical V_F at I_F (V)	(mA)	Typical I_R at V_{RRM} (μA)	Q_S (pC)	Typical Recovered Charge Measured at: I_F (mA)	V_R (V)	R_L (Ω)
AAZ13	High speed switching	8	100	0.6	30	30	20	10	5	500
OA47	General purpose	30	150	0.54	30	10	280	10	10	1000
AAY30	High speed switching	30	400	0.88	150	8	250	10	10	1000
AAZ17	General purpose	75	250	0.8	250	60	300	10	10	1000
AAZ15	High voltage	100	250	0.8	250	16	750	10	10	1000

Diodes

silicon whiskerless diodes

book 1 part 3

Type No.	Description	Outline	Drawing ref.	V_{RRM} (V)	I_{FRM} (mA)	$I_{F(AV)}$ (mA)	C_{dmax} (pF)	V_F max at I_F (V)	I_F (mA)	Max. Reverse Recovery Time measured at: t_{rr} (ns)	I_F (mA)	V_R (V)	R_L (Ω)	I_R (mA)
BA314	Low voltage stabiliser	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
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
BAW21A **BAW21B**	Controlled – avalanche diodes for switching inductive loads in semi-electronic telephone exchanges	DO-35	H	70 90	800	400	35	1.0	200	300	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
OA200 **OA202**	General purpose diodes	DO-35	H	50 150	250	80	25	1.15	30	3.5μ (typ)	30	35	2.5k	4
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

tuner diodes

Type No.	Description	Outline	Drawing ref.	V_{Rmax} (V)	I_F max. (mA)	I_R max. (μA)	C_d at V_R (pF) min.	C_d at V_R (pF) max.	V_R (V)	Capacitance Ratio min.	Capacitance Ratio max.
BA102B **BA102C**	Intended for a.f.c. control in tv receivers	DO-7	D1	20	50	5	23 29	31 38	4	1.4	–
BA182	Band switching in v.h.f. tv tuners	SOD-23	L	35	100	0.1	0.6	1.0	20	–	–
BA243 **BA244**	Band switching in v.h.f. tv tuners	DO-35	H	20	100	0.1	–	2.0	15	r_D	<1Ω <0.5Ω
BA280	Schottky barrier u.h.f. mixer diode	SOD-23	L	4	30	0.25	–	1.0	0	–	–
BA379	For controlled attenuators in v.h.f. and u.h.f. tv tuners	SOD-52	X	30	20	1.0	0.3 typ		0	–	–
BB105B **BB105G**	Intended for u.h.f. and v.h.f. tuners	SOD-23	L	28	20	0.05	2.0 1.8	2.3 2.8	25 25	4.5 4	6 6
*BB106	Intended for v.h.f. tuners	SOD-23	L	28	20	0.05	4	5.6	25	4.5	6
BB110B **BB110G**	Silicon planar variable capacitance diodes for tuning in band III f.m. and for r.f. and interstage circuits	SOD-23	L	30	100	0.02	27 29	31 33	3	2.65 typ.	

* These diodes are supplied matched to within ±1½% either in packs of 12 or in bulk packs of minimum 144 but typically 1,000 to a cumulative total of 6,000 per box. For 6,000 bulk packed diodes the type description is BB106P.

Diodes

silicon picoampere diode

book 1 part 3

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

fast-recovery low-power rectifier diodes

Type No.	Description	Outline	Dwg. ref.	V_{RRM} (V)	I_{FSM} (A)	$I_{F(AV)}$ (mA)	V_F max at I_F (V)	I_F (A)	Max. recovered charge measured at: Q_s max. (nC)	I_F (mA)	V_R (V)	$-di/dt$ (mA/μs)
BY206	Fast soft-recovery diode	DO-14	D2	350	15	500	1.5	2	60	400	≥50	400
BY207	Fast soft-recovery diode	DO-14	D2	600	15	500	1.5	2	60	400	≥50	400
BY208-1000	Fast soft-recovery diode	DO-15	D3	1000	20	750	1.8	2	80	400	≥50	400
BY210-400 **-600** **-800**	Fast soft-recovery diodes	DO-15	D3	400 600 800	30	1000	1.3	1	60	400	≥50	400
BYX55-350 **-600**	Fast soft-recovery diodes	SOD-18	K	350 600	40	1200	1.25	5	120	1000	≥50	1000

low-power silicon rectifier diodes

Type No.	Description	Outline	Dwg. ref.	V_{RRM} (V)	I_{FSM} (A)	$I_{F(AV)}$ (A)	V_F max. at I_F (V)	(A)	I_R max. at V_{RRM} (μA)
BY126M	Mains rectifier diode	DO-15	D3	650	40	1	1.5	5*	10
BY127M	Mains rectifier diode	DO-15	D3	1250	40	1	1.5	5*	10
BY226 **BY227**	Mains rectifier diodes	SOD-18	K	650 1250	50	1.75	1.5	5*	10
BYW54 **BYW55** **BYW56**	Double diffused passivated rectifiers intended for telephony and gen. purpose application	Glass bead	CV	600 800 1000	50	2	1.65	10*	1
BYX10	General purpose rectifier diode	DO-14	D2	1600	15	0.5	1.6	2*	501
BYX36-150 **-300** **-600**	Intended for general purpose industrial applications	DO-15	D3	150 300 600	30	1	1.1	1	1
BYX94	Mains rectifier diode	DO-15	D3	1250	40	1	1.5	5*	10
CV8308 **CV8805**	Controlled avalanche rectifier diodes	DO-15	D3	60 150	7	0.25	0.9	0.25	1
1N4001 to 1N4007	General purpose	DO-15	D3	50 to 1000	30	1	1.1	1	10

*Measured under pulse conditions

†At 800V

low-power high-voltage diodes

T_{amb} = 35°C (mA)	$I_{F(AV)}$ max T_{oil} = 50°C (mA)	Type No.	V_{RWM} max. (kV)	Description
2.5	–	**BY209**	11.5	E.H.T. soft-recovery rectifier diode (plastic envelope)
2.5	–	**BY409**	11.5	E.H.T. soft-recovery rectifier diode (plastic envelope)
2.5	–	**BY476**	16	E.H.T. soft-recovery rectifier diode (plastic envelope)
–	50	**BYX35**	25	Silicon diode in a ceramic tube. Intended for oil cooling.
–	200	**BYX90**	6	High voltage rectifier diode (plastic envelope)
–	200	**BYX91-90K**	90	E.H.T. rectifiers in resin-bonded paper tube, capable of absorbing transients; primarily intended for X-ray applications.
		-120K	120	
		-150K	150	
		-180K	180	

silicon voltage reference diodes

Type No.	Outline	Dwg. ref.	Zener Voltage (at test I_Z) (V) Min.	Max.	Typical Temperature Coefficient (%/°C)	Ambient Temperature Range (°C) Min.	Max.	Max. Dynamic Resistance (at test I_Z) (Ω)	Test I_Z (mA)	I_{ZM} max. (mA)	P_{tot} max. (mW)
BZV10	DO-35	H	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-35	H	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						
BZY78	DO-7	D1	5.1	5.6	+0.006	−40	+25	20	11.5	25	400
					−0.004	+25	+100				
1N821	DO-35	H	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						

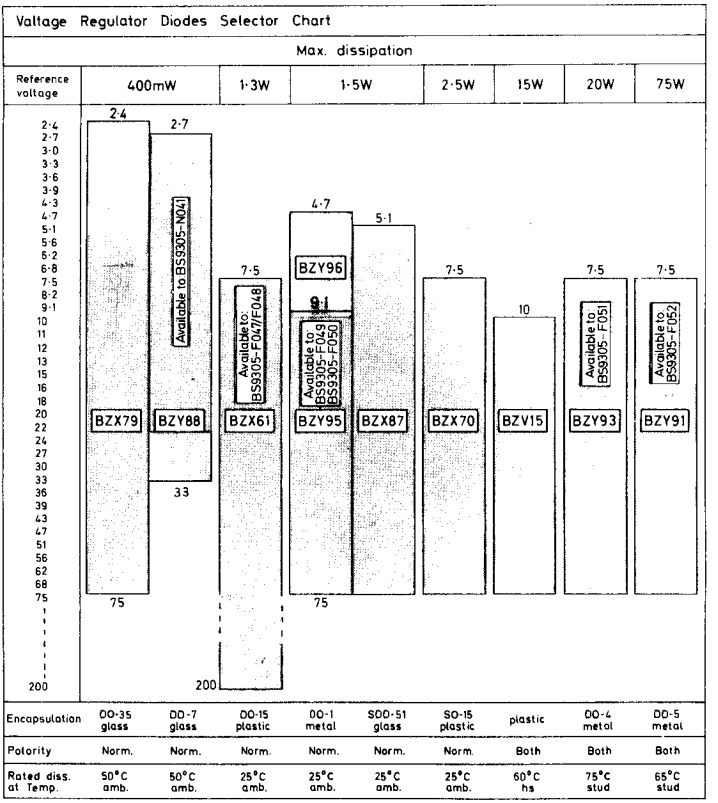
silicon voltage regulator diodes (stabistors)

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	2.00–2.30	30	

Silicon voltage regulator diodes

selection guide

book 1 parts 3 and 4



"SELECT" SERVICE

This service is applicable to the BZX61, and BZY88 ranges.
The following parameters can be specially selected:—

V_Z	At any specified current within the rating of the device as specified in the main data. This voltage can be chosen between 7.5 and 200V for the BZX61 range, and between 2.7 and 33V for the BZY88 range. The voltage tolerance can be selected down to ±1%
r_Z	At any specified current within the rating of the device as specified in the main data. The slope resistance value can be specified down to 50% of the maximum value quoted for the standard device.
I_R	At any specified voltage up to 95% of the nominal V_Z for the device measured at 5mA.
V_F	To customers requirements.
	The scope of this and obviously all other parameters is determined by the overall capabilities of the product.
Markings	Any form of type marking can be supplied

Silicon voltage regulator diodes

low power

400mW (T_{amb} = 50°C) ±5% voltage tolerance

Outline DO-35 Drawing reference H

Type No. BZX79	Nom. Zener Voltage (V)	Measured at Test I_Z Min. Voltage (V)	Max. Voltage (V)	Max. Slope Resistance (Ω)	Typ. Temp. Coefficient (mV/°C)	Test I_Z (mA)	Max. I_R at V_R (μA)	(V)
–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	0.04	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

continued

Silicon voltage regulator diodes

low power (cont.)

400mW (T_{amb} = 50°C) ± 5% voltage tolerance

Outline DO-7 Drawing reference D1

Type No. ‡BZY88	Nom. Zener Voltage (V)	Measured at Test I_Z Min. Voltage (V)	Max. Voltage (V)	Max. Slope Resistance (Ω)	Typ. Temp. Coefficient (mV/°C)	Test I_Z (mA)	Max. I_R at V_R (μA)	(V)
‡BZY88								
–C0V7*	0.7	0.71	0.8	6**	–1.8	5	10	2.0
–C1V3*	1.3	1.24	1.44	15**	–3.7	5	0.5	10
–C2V7	2.7	2.5	2.9	120	–2.2	5	25	1.0
–C3V0	3.0	2.8	3.2	120	–2.4	5	5.0	1.0
–C3V3	3.3	3.1	3.5	110	–2.4	5	3.0	1.0
–C3V6	3.6	3.4	3.8	105	–2.0	5	3.0	1.0
–C3V9	3.9	3.7	4.1	100	–2.05	5	3.0	1.0
–C4V3	4.3	4.0	4.6	90	–1.8	5	3.0	1.0
–C4V7	4.7	4.4	5.0	85	–1.55	5	3.0	2.0
–C5V1	5.1	4.8	5.4	75	–1.2	5	1.0	2.0
–C5V6	5.6	5.3	6.0	55	–0.2	5	1.0	2.0
–C6V2	6.2	5.8	6.6	27	+2.0	5	1.0	2.0
–C6V8	6.8	6.4	7.2	15	+3.2	5	1.0	3.0
–C7V5	7.5	7.0	7.9	15	+4.2	5	0.5	3
–C8V2	8.2	7.7	8.7	20	+5.0	5	0.4	3
–C9V1	9.1	8.5	9.6	25	+6.0	5	0.4	5
–C10	10	9.4	10.6	25	+7.0	5	2.5	7
–C11	11	10.4	11.6	25	+8.7	5	2.5	7
–C12	12	11.4	12.7	35	+9.0	5	2.5	8
–C13	13	12.4	14.1	35	+10.5	5	2.5	9
–C15	15	13.8	15.6	35	+12.5	5	2.5	10
–C16	16	15.3	17.1	40	+13	5	2.5	10
–C18	18	16.8	19.1	45	+15	5	2.5	13
–C20	20	18.8	21.2	50	+17	5	2.5	14
–C22	22	20.8	23.3	60	+19	5	2.5	15
–C24	24	22.7	25.9	75	+21	5	2.5	17
–C27	27	25.1	28.9	85	+23.5	5	2.5	19
–C30	30	28	32	95	+26	5	2.5	21
–C33	33	31	35	120	+28	5	2.5	23

‡available to BS9305–NO41, except BZY88, –C0V7, –C1V3 *Forward voltage regulator diode **typical
1N748A to 1N759A are also available

1.3W (T_{amb} = 25°C) ± 5% voltage tolerance

Outline DO-15 Drawing reference D3

Type No. §BZX61	Nom. Zener Voltage (V)	Measured at Test I_Z Min. Voltage (V)	Max. Voltage (V)	Max. Slope Resistance (Ω)	Typ. Temp. Coefficient (%/°C)	Test I_Z (mA)	Max. I_R at V_R (μA)	(V)
–C7V5	7.5	7.0	7.9	5.0	+0.04	20	5	3
–C8V2	8.2	7.7	8.7	7.5	+0.04	20	5	3
–C9V1	9.1	8.5	9.6	8.0	+0.05	20	5	5
–C10	10	9.4	10.6	8.5	+0.05	20	5	7
–C11	11	10.4	11.6	9.0	+0.05	20	5	7
–C12	12	11.4	12.7	9.0	+0.05	20	5	8
–C13	13	12.4	14.1	10	+0.05	20	5	9
–C15	15	13.8	15.6	14	+0.06	20	5	10
–C16	16	15.3	17.1	16	+0.06	10	5	11
–C18	18	16.8	19.1	20	+0.06	10	5	13
–C20	20	18.8	21.2	22	+0.06	10	5	14
–C22	22	20.8	23.3	23	+0.06	10	5	15
–C24	24	22.7	25.9	25	+0.06	10	5	17
–C27	27	25.1	28.9	35	+0.06	10	5	19
–C30	30	28	32	40	+0.07	10	5	21
–C33	33	31	35	45	+0.07	10	5	23
–C36	36	34	38	50	+0.07	10	5	25

§Also available to BS9305–F047/F048

1.3W (T_{amb} = 25°C) ± 5% voltage tolerance

Outline DO-15 Drawing reference D3

Type No. §BZX61	Nom. Zener Voltage (V)	Measured at Test I_Z Min. Voltage (V)	Measured at Test I_Z Max. Voltage (V)	Max. Slope Resistance (Ω)	Typ. Temp. Coefficient (%/°C)	Test I_Z (mA)	Max. I_R at (μA)	Max. V_R (V)
–C39	39	37	41	60	+0.07	5	5	27
–C43	43	40	46	70	+0.07	5	5	30
–C47	47	44	50	80	+0.08	5	5	33
–C51	51	48	54	95	+0.08	5	5	36
–C56	56	52	60	105	+0.08	5	5	39
–C62	62	58	66	110	+0.08	5	5	43
–C68	68	64	72	120	+0.08	5	5	48
–C75	75	70	79	145	+0.08	5	5	52
–C82	82	77	87	175	+0.09	5	5	55
–C91	91	85	96	200	+0.09	5	5	60
–C100	100	94	106	220	+0.09	5	5	66
–C110	110	104	116	250	+0.09	5	5	70
–C120	120	114	127	270	+0.10	5	5	80
–C130	130	124	141	300	+0.10	5	5	90
–C150	150	138	156	950	+0.11	2	5	100
–C160	160	153	171	1000	+0.11	2	5	110
–C180	180	168	191	1100	+0.11	2	5	120
–C200	200	188	212	1250	+0.11	2	5	140

1.5W (T_{amb} = 25°C) ± 5% voltage tolerance

Outline SOD-51 Drawing reference W

Type No. BZX87	Nom. Zener Voltage (V)	Measured at Test I_Z Min. Voltage (V)	Measured at Test I_Z Max. Voltage (V)	Max. Slope Resistance (Ω)	Typ. Temp. Coefficient (mV/°C)	Test I_Z (mA)	Max. I_R at (μA)	Max. V_R (V)
–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

medium to high power

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P_{tot}	W	1.5	1.5	2.5	15	20	75
up to T_{amb}	°C	25	25	25			
up to T_{mb}	°C				82	75	65
Voltage tolerance	%	5	5	5	5	5	5
I_{ZRM}	A	3.5	5	5		20	100
P_{ZSM}	W	20	100	100	400	500	4400
$T_j$max	°C	175	175	150	150	175	175
Case		DO-1	DO-1	SOD-18	SOD-38	DO-4	DO-5
Drawing reference		A2	A2	K	N	B	C
Series number		*BZY96-	†BZY95-	BZX70-	BZV15- (R)	‡BZY93- (R)	§BZY91- (R)
Operating voltage	Type number suffix						
4.7	100 mA	C4V7					
5.1		C5V1					
5.6		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	C10
11			C11	C11	C11	C11	C11
12			50 mA C12	50 mA C12	1000 mA C12	1000 mA C12	2000 mA C12
13			C13	C13	C13	C13	C13
15			C15	C15	C15	C15	C15
16			C16	C16	C16	C16	C16
18			C18	C18	C18	C18	C18
20			C20	C20	C20	C20	C20
22			C22	20 mA C22	500 mA C22	500 mA C22	C22
24			20 mA C24	C24	C24	C24	1000 mA C24
27			C27	C27	C27	C27	C27
30			C30	C30	C30	C30	C30
33			C33	C33	C33	C33	C33
36			C36	C36	C36	C36	C36
39			C39	C39	C39	C39	C39
43			C43	C43	C43	C43	C43
47			C47	C47	C47	C47	C47
51			10 mA C51	10 mA C51	200 mA C51	200 mA C51	500 mA C51
56			C56	C56	C56	C56	C56
62			C62	C62	C62	C62	C62
68			C68	C68	C68	C68	C68
75			C75	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 $T_j = 25^oC$. A V_Z measurement made on a curve tracer will produce a rise in junction temperature to make V_Z appear out of specification.

Also available to: *BS9305-FO49, †BS9305-F050, ‡BS9305-FO51, §BS9305-FO52

Silicon surge suppresor diodes

basic data

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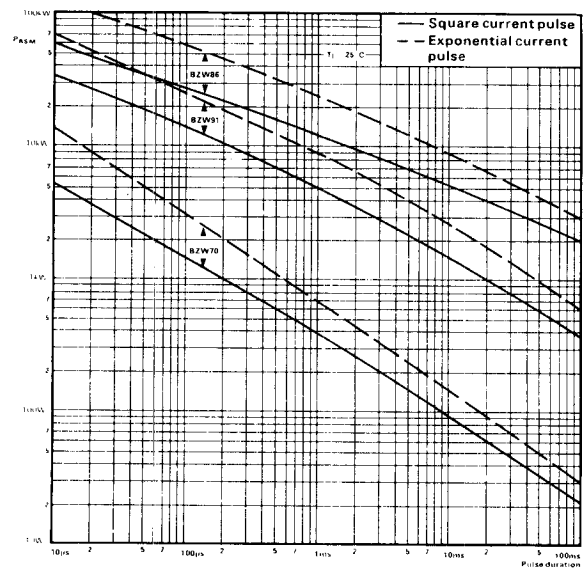
Power rating (Maximum non-repetitive peak power dissipation*)	Encapsulation	Drawing reference	Series No.	Stand-off voltages
200W	DO-1 metal	A2	**BZY96**	3.6V to 6.8V
700W	DO-1 metal	A2	**BZY95**	7.5V to 56V
	SOD-18 plastic	K	**BZX70**	5.6V to 56V
	SOD-18 plastic	K	**BZW70**	6.2V to 62V
	DO-4 metal (UNF thread)	B	**BZY93**	5.6V to 56V
9000W	DO-5 metal (UNF thread)	C	**BZY91**	5.6V to 56V
	DO-5 metal (UNF thread)	C	**BZW91**	6.2V to 62V
25kW	DO-30 metal (UNF thread)	F	**BZW86**	52V

*1ms exponential pulse. †See note on type number suffixes

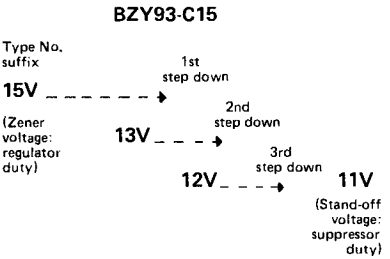


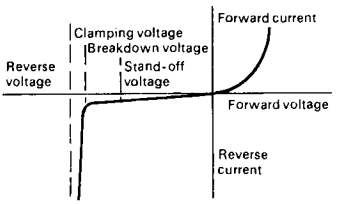
Maximum permissible non-repetitive peak power dissipation
(T_j = 25°C prior to surge)

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 C6V2
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

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GENERAL PURPOSE RECTIFIERS

$I_{F(AV)}$ max.	Type No.	V_{RRM} max. (V)						Outline
		150	300	500	600	1200	1600	
1.4A	BYX22				●	●		DO-1
6A	BYX49		●		●	●		SOD-38
6A	BYX38		●		●	●		DO-4
10A	BYX98		●		●	●		DO-4
10A	BYX72	●	●	●				SOD-38
12A	BYX42		●		●	●		DO-4
15A	BYX99		●		●	●		DO-4
30A	BYX96		●		●	●	●	DO-4
47A	BYX97		●		●	●	●	DO-5
48A	BYX52		●		●	●		DO-5

FAST-RECOVERY RECTIFIERS (DOUBLE DIFFUSED)

$I_{F(AV)}$ max.	Type No.	V_{RRM} max. (V)										Outline
		50	100	150	200	300	350	400	500	600	800	1000	
6A	1N3879	●											DO-4
6A	1N3880		●										DO-4
6A	1N3881				●								DO-4
6A	1N3882					●							DO-4
7A	BYW19										●	●	SOD-38
7A	BYX50				●	●							DO-4
7A	BYX71						●			●			SOD-38
12A	1N3889	●											DO-4
12A	1N3890		●										DO-4
12A	1N3891				●								DO-4
12A	1N3892					●							DO-4
14A	*BYX30				●	●		●	●	●			DO-4
22A	*BYX46				●	●		●	●	●			DO-4

VERY FAST-RECOVERY RECTIFIERS (EPITAXIAL)

7A	BYW29	●	●	●		(DO-220)
12A	BYW30	●	●	●		DO-4
25A	BYW31	●	●	●		DO-4
35A	BYW92	●	●	●		DO-5

EFFICIENCY DIODES

I_{FWM} max.	Type No.	V_{RRM} max. (V)			Outline
		600	750	1500	
5A	BY223			●	SOD-38
10A	BY277	●	●		SOD-38

*With controlled avalanche characteristics

continued

Controlled avalanche characteristics enable these rectifiers to absorb transient energy in the rectifier circuit without damage.

AVALANCHE RECTIFIERS

$I_{F(AV)}$ max.	Type No.	V_{RWM} max. (V)			Outline
		600	800	1000	
1.5A	BYX45	●	●	●	DO-1
9.5A	BYX39	●	●	●	DO-4
20A	BYX25	●	●	●	DO-4
48A	BYX56	●	●	●	DO-5

SILICON RECTIFIER BRIDGES

$I_{O(AV)}$ max.	Type No.	V_{IRM} max. (V)								
		100	120	200	300	400	600	800	900	1200
1.0A	BY179							●		
1.4A	BY164		●							
4.0A	BYW44			●		●	●	●		
4.8A	BY224					●	●			
4.8A	BY225	●		●						
6.0A	BYW45				●		●		●	●
8.0A	BYW46				●		●		●	●
12.5A	BYW47				●		●		●	●

HIGH-VOLTAGE RECTIFIER STACKS

Type No.	$I_{F(AV)}$ max.	V_{RWM} max. (kV)	For use in
OSS9110-3 to 30 OSS9210-3 to 30 OSS9410-3 to 30	3.5A 5A 10A	3 to 30	Single-phase rectifiers
OSB9110-4 to 30 OSB9210-4 to 30 OSB9410-4 to 30	7A 10A 20A	2 to 15	Two-phase half-wave circuits
OSM9110-4 to 30 OSM9210-4 to 30 OSM9410-4 to 30	3.5A 5A 10A	2 to 15	Bridges and voltage doublers, single or three phase
OSM9510-8 to 12	1.5A	8 to 12	Half-wave bridges

Silicon rectifier diodes and bridge modules

general purpose rectifiers — basic data

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Type No.	BS No.	Outline	Drawing reference	$I_{F(AV)}$ max. (A)	V_{RRM} max. (V)	I_{FSM}[1] max. (A)	V_F max.[2] at I_F
BYX22-600 -1200	BS9331-F131	DO-1 metal	A2	1.4	600 1200	40	1.5V at 5A
†**BYX49- 300 -600 -1200**		SOD-38 plastic	N	6	300 600 1200	40	2.3V at 20A
†**BYX38- 300 -600 -1200**	BS9331-F127	DO-4 metal (UNF thread)	B1	6	300 600 1200	50	1.7V at 20A
†**BYX98- 300 -600 -1200**	BS CECC 50 009-004	DO-4 metal (UNF thread)	B1	10	300 600 1200	75	1.7V at 20A
†**BYX72- 150 -300 -500**		SOD–38 plastic	N	10	150 300 500	100	1.25V at 20A
†**BYX42- 300 -600 -1200**	BS9331-F128	OO-4 metal (UNF thread)	B1	12	300 600 1200	125	1.4V at 15A
BYX99 - 300 -600 -1200	8S9331-F047	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**	BS9331-F026	DO-5 metal (UNF thread)	C1	48	300 600 1200	800	1.8V at 150A

[1] At $T_j = T_j$max $t = 10$ms

[2] At $T_j = 25^oC$

†Reverse polarity types (stud anode) are also available. They are denoted by the final letter R, e.g. BYX42–600R.

Silicon rectifier diodes and bridge modules

fast-recovery rectifier diodes — basic data

book 1 part 4

Type No.	BS No.	Outline	Drawing reference	$I_{F(AV)}$ max. (A)	V_{RRM} max. (V)	I_{FSM}[1] max. (A)	t_{rr} max. (ns)	V_F max. at I_F[2]
FAST DOUBLE-DIFFUSED								
†1N3879 †1N3880 †1N3881 †1N3882		DO-4 metal (UNF thread)	B1	6	50 100 200 300	75	200	1.95V at 20A
†BYW19 -800 -1000		SOD-38 plastic	N	7	800 1000	40	450	2.3V at 20A
†BYX50 -200 -300	BS9331-FO28	DO-4 metal (UNF thread)	B1	7	200 300	80	100	1.95V at 20A
†BYX71 -350 -600		SOD-38 plastic	N	7	350 600	60	450	1.25V at 5A
†1N3889 †1N3890 †1N3891 †1N3892	BS9331-F148	DO-4 metal (UNF thread)	B1	12	50 100 200 300	125	200	1.4V at 12A
†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
VERY FAST EPITAXIAL								
BYW29 -50 -100 -150		(DO-220) plastic	BV3	7	50 100 150	80	35	0.85V at 5A
BYW30 -50 -100 -150	§ BS CECC 50 009-001	DO-4 metal (Metric thread)	B1	12	50 100 150	200	35	0.85V at 10A
BYW31 -50 -100 -150	§ BS CECC 60 009-002	DO-4 metal (Metric thread)	B1	25	50 100 150	320	50	0.85V at 20A
BYW92 -50 -100 -150	§ BS CECC 50 009-003	DO-5 metal (Metric thread)	C1	35	50 100 150	500	50	0.95V at 30A
EFFICIENCY DIODES								
BY223		SOD-38 plastic	N	5**	1500	20	–	2.3V at 20A
BY277 -600R -750R		SOD-38 plastic	N	10**	600 750	50	1000	1.55V at 20A

[1] At $T_j = T_j$ max, t = 10ms

[2] At $T_j = 25^oC$

*UNF thread available on request

**Peak currents.

§ CECC specification being negotiated

†Reverse polarity types (stud anode) are also available. They are denoted by the final letter R, e.g. 8YX50-200R.

Silicon rectifier diodes and bridge modules

avalanche rectifiers — basic data

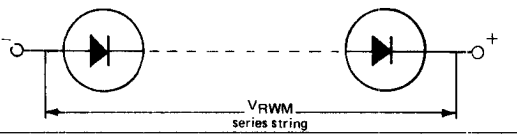
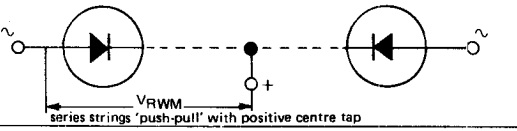
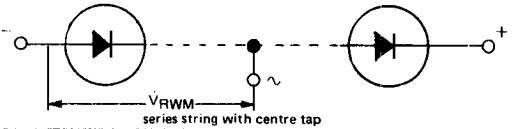
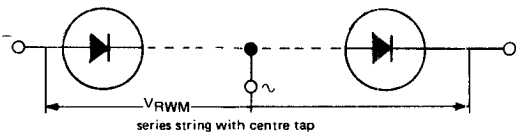
book 1 part 4

Type No	BS No.	Outline	Drawing reference	$I_{F(AV)}$ max. (A)	V_{RWM} max. (V)	I_{FSM} (1) max. (A)	P_{RRM} (2) max. (kW)	P_{RSM} (2) max. (kW)	V_F max. at I_F (3)
BYX45 -600R -800R -1000R	BS9333-F004	DO-1 metal	A1	1.5	600 800 1000	40	0.8	2.5	1.45V at 5A
†BYX39 -600 -800 -1000		DO-4 metal (UNF thread)	B1	9.5	600 800 1000	125	2	4	1.7V at 20A
†BYX25 -600 -800 -1000	BS9333-F003	DO-4 metal (UNF thread)	B1	20	600 800 1000	360	3	18	1.8V at 50A
†BYX56 -600 -800 -1000		DO-5 metal (UNF thread)	C1	48	600 800 1000	800	6.5	40	1.8V at 150A

(1) At $T_j = T_j$ max. (2) $t = 10\mu s$ (3) At $T_j = 25^oC$.

†Reverse polarity types (stud anode) are also available. They are denoted by the final letter R, e.g. 8YX25-600R.

high-voltage rectifier stacks — basic data

Type No.	$I_{F(AV)}$ max.	V_{RWM} max.	Configuration
OSS9110-3 to -30	3.5A (6A in oil)	3kV to 30kV	
OSS9210-3 to -30	5A (20A in oil)		
OSS9410-3 to -30	10A (30A in oil)		
OSB9110-4 to -30	7A (12A in oil)	2kV to 15kV	
OSB9210-4 to -30	10A (40A in oil)		
OSB9410-4 to -30	20A (60A in oil)		
OSM9110-4 to -30	3.5A (6A in oil)	2kV to 15kV	
OSM9210-4 to -30	5A (20A in oil)		
OSM9410-4 to -30	10A (30A in oil)		
OSM9510-8 to -12	1.5A	8kV to 12kV	

Silicon rectifier diodes and bridge modules

bridge modules (single-phase) — basic data

book 1 part 4

PCB MOUNTED TYPES

Type No.	'OSH' type superseded	Outline	Drawing reference	$V_{I(RMS)}$ max. (V)	V_{IRM} max. (V)	I_{ISM} max. (A)	$I_{O(AV)}$ max. (A)
BY179	–	All-plastic module	CC	280	800	25	1
BY164	–	All-plastic module	CC	60	120	25	1·4
BY224-400 **-600**	–	Plastic module with heat-sink face	CD	280	400 600	100	4·8
BY225-100 **-200**	–	Plastic module with heat-sink face	CD	50 80	100 200	100	4·8

BOLT-DOWN TYPES

BYW44-200 **-400** **-600** **-800**	OSH03-200 -400 -600 -800	Plastic single-hole fitting	CE	140 280 420 560	200 400 600 800	40	4
BYW45-200 **-400** **-600** **-800**	OSH05-200 -400 -600 -800	Plastic module two-hole fitting	CF	140 280 420 560	300 600 900 1200	75	6
BYW46-200 **-400** **-600** **-800**	OSH07-200 -400 -600 -800	Plastic module two-hole fitting	CF	140 280 420 560	300 600 900 1200	75	8
BYW47-200 **-400** **-600** **-800**	OSH10A-200 -400 -600 -800	Plastic module two-hole fitting	CF	140 280 420 560	300 600 900 1200	180	12.5

Also available: 'OSH' types

Type No.	V_{IWM} max. (V)	$I_{O(AV)}$ max. (A)
OSH007	800	0.7
OSH01-100 **-200** **-400**	100 200 400	1
OSH01A-100 **-200** **-400**	100 200 400	1 1 1
OSH02A-200 **-400** **-600** **-800**	200 400 600 800	2
OSH10-600 **-800** **-1000**	600 800 1000	10

All of the above bridges are recommended for new equipment designs. The 'bolt-down' types supersede certain types in the earlier 'OSH' range. They are more highly rated than their 'OSH' predecessors but obviously can be used in place of them.

The remainder of the old 'OSH' range continues to be supplied unchanged to customers who are already committed to them in their equipment designs. It comprises the types shown left.

$I_{T(AV)}$ max. (T_{mb}=85°C)	Type No.	V_{RRM} max. (V)										Outline
		100	200	300	400	500	600	800	1000	1200	1400	1600	
GENERAL PURPOSE TYPES													
1A	BTX18	●	●	●	●	●							TO-39
7.5A	*BT151					●	●(650V)						TO-220
10A	*BTY79				●	●	●	●	●				TO-64
10A	BTW38						●	●	●	●			TO-64
10A	*BTW42						●	●	●	●			TO-64
16A	*BTW45				●		●	●	●	●			TO-48
16A	BTW47							●	●	●	●	●	TO-48
16A	BTY87				●	●	●	●					TO-48
16A	BTY91				●	●	●	●					TO-48
20A	*BTW40				●		●	●					TO-48
20A	*BTW92							●	●	●	●	●	TO-48
35A	BTW24						●	●	●	●	●	●	TO-103
90A	*BTW23						●	●	●	●	●	●	TO-94
FAST TURN-OFF TYPES		V_{DRM} max. (V)											
12A	*BTW30							●	●	●			TO-48
16A	*BTW31							●	●	●			TO-48
65A	*BTW33							●	●	●			TO-94

*Principal types

fast turn-off thyristors — basic data

Type No.	Outline & Drawing ref.	$I_{T(AV)}$ (1) max. (A)	V_{DRM} max. (V)	I_{TSM} (2) max. (A)	dI_T/dt max. (A/μs)	dV_D/dt max. (V/μs)	V_{GT} (3) min. (V)	I_{GT} (3) min. (mA)	t_q (2) max. (μs)
BTW30-800R	TO-48 metal	12	800	150	100	200	2.5	200	15
-1000R	(Metric thread)		1000						
-1200R	BM		1200						
BTW31-800R	TO-48 metal	16	800	225	100	200	2.5	200	20
-1000R	(Metric thread)		1000						
-1200R	BM		1200						
BTW33-800R	TO-94 metal	65	800	1500	100	200	2.5	150	15
-1000R	(Metric thread)		1000						
-1200R	BS		1200						

(1) At T_{mb} = 85°C.

(2) At $t_j = T_j$ max. t = 10ms

(3) V_D = 6V; T_j = 25°C

Thyristors

general purpose thyristors — basic data

book 1 part 5

Type No.	BS No.	Outline & Drawing ref.	$I_{T(AV)}$ [1] max. (A)	V_{RRM} max (V)	I_{TSM} [2] max. (A)	dI_T/dt max. (A/µs)	dV_D/dt max. (V/µs)	V_{GT} [3] min. (V)	I_{GT} [3] min. (mA)
BTX18-100 **-200** **-300** **-400** **-500**		TO-39 metal BL4	1	100 200 300 400 500	10	–	15	2	5
BT151-500R **-650R**		TO-220 plastic BV4	7.5	500 650	100	50	200	1.5	15
BTY79-400R **-500R** **-600R** **-800R** **-1000R**	BS9341-F001/9	TO-64 metal (UNF thread) BO	10	400 500 600 800 1000	150	50	50	1.5	30
BTW38-600R **-800R** **-1000R** **-1200R**	BS9341-F082	TO-64 metal (Metric thread) BO	10	600 800 1000 1200	150	50	50	1.5	50
BTW42-600R **-800R** **-1000R** **-1200R**	BS9341-F084	TO-64 metal (Metric thread) BO	10	600 800 1000 1200	150	58	200*	1.5	50
BTW45-400R **-600R** **-800R** **-1000R** **-1200R**		TO-48 metal (Metric thread**) BM	16	400 600 800 1000 1200	300	100	200*	1.5	75
BTW47-800R **-1000R** **-1200R** **-1400R** **-1600R**		TO-48 metal (Metric thread**) BM	16	800 1000 1200 1400 1600	300	200	300*	3.5	100
BTY87-400R **-500R** **-600R** **-800R**		TO-48 metal (UNF thread) BM	16	400 500 600 800	140	–	20	3.5	65
BTY91-400R **-500R** **-600R** **-800R**		TO-48 metal (UNF thread) BM	16	400 500 600 800	200	20	20	3.0	40
BTW40-400R **-600R** **-800R**	BS9341-F083	TO-48 metal (Metric thread**) BM	20	400 600 800	400	100	100	1.5	75
BTW92-800R **-1000R** **-1200R** **-1400R** **-1600R**	BS9341-F039	TO-48 metal (Metric thread**) BM	20	800 1000 1200 1400 1600	400	300	300*	3.5	100
BTW24-600R **-800R** **-1000R** **-1200R** **-1400R** **-1600R**		TO-103 metal (Metric thread) BT	35	600 800 1000 1200 1400 1600	800	300	200*	2.5	100
BTW23-600R **-800R** **-1000R** **-1200R** **-1400R** **-1600R**		TO-94 metal (Metric thread) BS	90	600 800 1000 1200 1400 1600	2000	300	200*	2.5	150

[1] At T_{mb} = 85°C.

[2] At $T_j = T_j$max. t = 10ms

[3] V_D = 6V; T_j = 25°C.

*Types with dV_D/dt of 1000V/µs available on request.

**UNF thread available on request

Triacs

selection guide

book 1 part 5

$I_{T(RMS)}$ max. (T_{mb}=85°C)	Type No.	V_{DRM} max. (V)								Outline
		400	500	600	800	1000	1200	1400	1600	
6A	BT137		●	●						TO-220
10A	BT138		●	●						TO-220
12A	BTW43G			●	●	●	●			TO-64
12A	BTW43H			●	●	●	●			TO-64
15A	BT139		●	●						TO-220
25A	BTX94H	●		●	●	●	●			TO-48
25A	BTX94J	●		●	●	●	●			TO-48
40A	BTW41G		●	●	●					SOT-80
40A	BTW41H		●	●	●					SOT-80
55A	BTW34G			●	●	●	●	●	●	TO-103
55A	BTW34H			●	●	●	●	●	●	TO-103

Triacs for single- and three-phase power control with resistive and inductive loads.

At most current and voltage levels, a choice of commutation characteristics is offered: types having the same type number (except for the final letter) are identical except for their commutation ratings.

All of the types shown here are recommended for new equipment designs. However, for applications in the 40A region attention is particularly drawn to the BTW41G and BTW41H series in the SOT-80 'Tripak' encapsulation.

The British Standards Institution is expected to issue the Blank Detail Specification for triacs in the near future. BS9300 Qualification Approval will then be sought for triacs in the Mullard range. Meanwhile customers have the assurance that they are already being made in our BS9000 approved plant and to BS9000 disciplines.

triacs — basic data

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Type No.	Outline & Drawing ref.	$I_{T(RMS)}$ max. (A)	V_{DRM} max. (V)	I_{TSM} max. (A)	dI_T/dt max. (A/μs)	dV_D/dt max. Normal (V/μs)	dV_D/dt max. Commutating* (V/μs)	V_{GT} min. (V)	I_{GT} min. (mA)
BT137-500 **-600**	TO-220 plastic BV2	6	500 600	55	20	50	6(5A/ms)*	1.5	35
BT138-500 **-600**	TO-220 plastic BV2	10	500 600	90	30	50	4(5A/ms)*	1.5	35
BTW43-600G **-800G** **-1000G** **-1200G**	TO-64 metal (Metric thread) 8O	12	600 800 1000 1200	120	30	50	10(5A/ms)*	2.5	100
BTW43-600H **-800H** **-1000H** **-1200H**	Same as BTW43-600G to BTW43-1200G series (shown above) except for commutation						10(12A/ms)*		
BT139-500 **-600**	TO-220 plastic BV2	15	500 600	115	50	50	4(8A/ms)*	1.5	35
BTX94-400H **-600H** **-800H** **-1000H** **-1200H**	TO-48 metal (UNF thread) BM	25	400 600 800 1000 1200	250	50	100	30(25A/ms)*	3	150
BTX94-400J **-600J** **-800J** **-1000J** **-1200J**	Same as BTX94-400H to BTX94-1200H series (shown above) except for commutation						30(50A/ms)*		
BTW41-500G **-600G** **-800G**	SOT-80 plastic AP	40	500 600 800	260	50	100	5(12A/ms)*	1.5	75
BTW41-500H **-600H** **-800H**	Same as BTW41-500G to BTW41-800G series (shown above) except for commutation						5(23A/ms)*		
BTW34-600G **-800G** **-1000G** **-1200G** **-1400G** **-1600G**	TO-103 metal (Metric thread) BT	55	600 800 1000 1200 1400 1600	400	50	200	30(25A/ms)*	2.5	200
BTW34-600H **-800H** **-1000H** **-1200H** **-1400H** **-1600H**	Same as BTW34-600G to BTW34-1600G series (shown above) except for commutation						30(50A/ms)*		

*The figures in brackets following the dV_D/dt rating show the $-dI/dt$ of the preceding turn-off.

Schottky barrier mixer diodes

book 1 part 8

Type No.	Maximum Operating Frequency (GHz)	Typical Noise Figure (dB)	Typical Impedance Z_{if} (Ω)	Operating Temperature (°C)	Outline	Drawing reference
BAT10	12	7.0	600	−55 to +150	–	BZ
BAT11	12	6.5	320	−55 to +150	–	CA
BAT38	40	10**	1000	−55 to +150	SOD-49	–
BAT39 (CV7762)	18	6.0	350	−55 to +100	SOD-42	Q
BAT40	18	7.8**	350	0 to +80	SOD-49	–
BAT50 *BAT50R	12	6.2	400	−55 to +100	(B.S.)SO-26	CB
BAT51 (CV7776) *BAT51R (CV7777)	18	7.0	350	−55 to +100	DO-37	J J
BAT52 *BAT52R	18	8.0	350	−55 to +100	DO-37	J
BAT59	40	8.5	1000	−55 to +100	SOD-42	Q
BAV22 *BAV22R	12	7.0	425	−55 to +100	(B.S.)SO-26	CB
BAV72	40	10**	1050	−55 to +150	SOD-50	V
BAV96A BAV96B BAV96C BAV96D	12	7.5 7.0 6.5 6.0	325	−55 to +150	SOD-50	V
BAW95D BAW95E BAW95F BAW95G	12	7.8 7.2 6.8 6.3	415	−55 to +150	DO-22	E

*Reverse polarity version ** Maximum.

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
BAV46	For use in X-band Doppler radar systems	1 to 12	−55	10	850	DO-22	E
BAV75	Low level detector applications	1 to 12	−50	10	310	SOD-31	M
BAV97		1 to 12	−54	10	500	SOD-50	V
BAT10		1 to 12	−50	12	600	–	BZ
BAT11		1 to 12	−52	10	320	–	CA

Data for microwave transistors will be found in the transistor section of this guide.

backward diodes

book 1 part 8

Type No.	Description	Outline	Drawing reference	Frequency Range (GHz)	Typical Tangential Sensitivity (dBm)	Min. Figure of Merit	Typical Video Impedance (Ω)
AEY17	Germanium bonded backward diode for use at X-band	SOD-42	Q	1 to 18	–53	120*	300
AEY29 **AEY29R****	Germanium bonded backward diode for use at J-band	DO-37	J	12 to 18	–53	50†	300
AEY31 **AEY31A**	Subminiature germanium bonded backward diode for use up to J-Band	SOD-50	V	1 to 18 1 to 18	–53 –50	120* 50*	300 300
AEY32	Subminiature germanium bonded backward diode for use up to Q-Band	SOD-50	V	18 to 40	–	50	4000

* Measured at 9.375 GHz. ** Reverse polarity version. † Measured at 16.5 GHz in JAN 201 holder.

Gunn effect devices

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	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	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	SOD-31	M	12	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	SOD-31	M	8.0	8 to 12	50	2.5
CXY24A **CXY24B**	Ga As bulk effect devices employing the Gunn effect to produce c.w. oscillations in Q-band	Special	–	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	High power diodes for use as oscillators or negative resistance amplifiers	SOD-45	T	8 to 10	500	90
BXY51				10 to 12	400	80
BXY52				12 to 14	300	70
BXY60				6 to 8	650	120

Microwave solid state

multiplier varactor diodes

Type No.	Description	Outline	Drawing reference	Capacitance at V_R (pF)	(V)	V_R max. (V)	Maximum Transit Time (ps)	Typical Cut-off Frequency (GHz)
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 expitaxial varactor diode for use in multipliers up to S-band and input powers up to 10W	SOD-31	M	4.5	6	55	–	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 multiplier 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	Silicon planar epitaxial varactor			9	6	100	–	25
BXY36B,C,D,E	diodes for frequency multipliers up			5	6	70	500	75
BXY37B,C,D,E	to 18 GHz, available in a variety of			3	6	70	350	100
BXY38B,C,D,E	outlines			1.6	6	50	300	120
BXY39B,C,D,E	Suffix A = Drawing ref.	DO-4	B	1.0	6	40	200	150
BXY40B,C,D,E	B =	SOD-31	M	0.65	6	25	150	180
BXY41B,C,D,E	**C** =	SOD-43	R	0.4	6	25	100	200
	D =	SOD-44	S					
	E =	SOD-45	T					
BXY56	High efficiency silicon diodes for	SOD-31	M	2.0	6	60	–	160
BXY57	multipliers with output frequencies in C and X-bands			3.0	6	60	–	140
1N5152	Silicon planar epitaxial varactor	SOD-31	M	6	6	75	–	100
1N5153	diodes for use in multipliers up to S-band	SOD-43	R	6	6	75	–	100
1N5155	Silicon planar epitaxial varactor diode for use in multipliers up to C-band	SOD-31	M	2	6	35	–	120
1N5157	Silicon planar epitaxial varactor diode for use in multipliers up to X-band	SOD-31	M	0.8	6	20	–	200

special purpose varactor diodes

Type No.	Description	Outline	Drawing reference	Capacitance at V_R (pF)	(V)	V_R max. (V)	Series Resonant Frequency (GHz)	Typical Cut-off Frequency (GHz)
CAY10	Gallium arsenide diode, diffused mesa type, for use in microwave parametric amplifiers, frequency multipliers and switches	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	600

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

Type No.	Description	Outline	Drawing reference	Excess Noise Ratio (dB)	C_j (pF)	f_r (mA)
BAT31	Silicon avalanche device for use as noise source from 10Hz to 18GHz	SOD-31	M	34	0.6	5.0

Microwave solid state

tuning varactor diodes

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Type No.	Description	Outline	Drawing reference	Min Capacitance Ratio $\frac{CT\ 0V}{CT\ 60V}$	Capacitance at V_R 4V min. (pF)	Capacitance at V_R 4V max. (pF)	V_R max. (V)
BXY53	Silicon planar epitaxial tuning devices	SOD-31	M	4.0	0.8	1.2	60
BXY54				6.5	3.7	5.7	60
BXY55				7.0	12	18	60
CXY23A	Gallium arsenide Schottky barrier varactor diodes	SOD-31	M	3.0	0.8	1.2	12
CXY23B					1.2	1.8	
CXY23C					1.6	2.5	
CXY23D					2.5	3.5	

solid state sources

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
CL8670	Transistor oscillator varactor diode multiplier intended for frequency agile radar	9.0	25	–	1100	50 Ω S.M.A.
CL8300	Gunn effect oscillators	9.4	5	±50	200	50 Ω S.M.A.
CL8310	electronically tuned	9.4	5	±50	200	WG16/WR90
CL8640R	Receiver local osc. } in short range	10.49	6	±60	±15	WG16/WR90
CL8640T	Transmitter } data link systems	10.56	6	±60	± 4	WG16/WR90
CL8630		10.687	8	–	–	WG16/WR90
CL8631	Fixed frequency Gunn effect	9.35				
CL8632	oscillators for miniature radar systems	9.47	8	–	–	WG16/WR90
CL8633		10.525	8	–	–	WG16/WR90
CL8634		10.687	25	–	–	WG16/WR90
CL8630S		10.687	8			WG16/WR90
CL8631S	Fixed frequency Gunn effect	9.35		Typical output voltage		
CL8632S	oscillators for self oscillating mixer	9.47	8	for input 66dB down		WG16/WR90
CL8633S	(auto-detector) use in	10.525	8	on output power (at		WG16/WR90
	proximity switching			6dB min. $\frac{signal + noise}{noise}$		
				= 40μV		

NOTE: All the oscillators described here require a negative 7V stabilised power supply, with the exception of the **CL8670** (−24V). The electronically tunable oscillators require a tuning voltage of up to 10V negative.

mixers

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 Figure (dB)	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	–	15	−50	WG16/WR90
CL7520		9.35	–	15	−50	WG16/WR90

* For −95dBm input signal

† 32μA d.c. bias. Bandwidth 0 to 2 MHz

Microwave solid state

parametric amplifier

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Type No.	Description	Frequency Band	Gain (dB)	Noise Figure (dB)	Bandwidth (MHz)	Tuning Range (GHz)
CL9022	Parametric amplifier with Gunn pump.	S	20	2.8	15	2.7 to 3.1

doppler modules

Type No.	Description	Centre Frequency (GHz)	Power Output (mW)	Typical Output Voltage (μV)
CL8960	Doppler twin cavity modules for volumetric presence detection, industrial process control, proximity switching and similar applications.	10.687	8	40
CL8960U		10.687+3MHz	8	40
CL8960L		10.687−3MHz	8	40
CL8961		9.350	8	40
CL8962		9.470	8	40
CL8963		10.525	8	40
CL8964		9.900	8	40
CL8965		10.565	8	40
CL8966		10.450	8	40
CL8967		10.365±15MHz	8	40

radar traffic sensors

Type No.	Description	Centre Frequency (GHz)	Power Output (mW)
CL8880N	Doppler radar with direction sense, designed to operate in conjunction with portable traffic light control systems	10.587	5
CL8880BN	As CL8880N but packaged for mounting on top of traffic light head.	10.587	5
CL8880BNC	As CL8880BN but with supply and signal lines passing through mounting foot to traffic light head.	10.587	5

horn antenna

Type No.	Frequency Range (GHz)	Gain (dB)	Beam Angle (both planes) (deg)
ACX-01A	9 to 11	16	30

ferrite components — circulators and isolators

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	HF7/16DIN47223	–
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	HF7/16DIN47223	–
CL5641	0.59 to 0.72	0.35	20	1.25	300	HF7/16DIN47223	–
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	HF7/16DIN47223	–
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	HF7/16DIN47223	–
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	HF7/16DIN47223	–
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	NF7/16DIN47223	–
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	HF7/16DIN47223	–
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

ferrite components — circulators and isolators (cont.)

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	–	UER100
CL6261	8.5 to 9.6	1.2	55	1.2	10	–	UER100
CL6271	8.5 to 9.6	1.0	20	1.15	10	–	UER100
CL6215	10.7 to 11.7	0.8	30	1.05	5	–	UER100
CL6217	12.5 to 13.5	0.5	30	1.05	10	–	UER140
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	–	UER140 / UBR140

Photodevices

phototransistors

book 1 part 9

Type No.	Spectral Response Peak (μm)	Spectral Response Cut-off (μm)	Description	Drawing reference	Max. Dark Current (μA)	Sensitivity min. (μA/lux)	Cut-off Frequency (kHz)	P_{tot} max. (mW)	V_{CEO} max. (V)	I_{CM} max. (mA)
BPX25	0.8	1.1	Silicon n-p-n general purpose metal encapsulated phototransistor with lensed window	BK2	0.5	5.0	200	300	32	100
BPX29			Silicon n-p-n general purpose metal encapsulated phototransistor with plane window	BJ1		0.25	150			
BPX70	0.8	1.1	Silicon n-p-n phototransistors in modified TO-18 encapsulation with plastic window	AO	0.1	0.1	–	180	30	25
BPX72				AO		0.5				
BPX71	0.8	1.1	Silicon n-p-n phototransistor in subminiature encapsulation to JEDEC DO-31	G2	0.025	1	–	100	50	20
BPX95B	0.8	–	Silicon n-p-n phototransistor for use as detector. Clear epoxy encapsulation	AB	0.1	1	–	100	30	50
BPW22	0.8	–	Miniature plastic silicon n-p-n phototransistor with axial leads	Z2	0.1	2	–	50	30	25

photodiodes

Type No.	Spectral Response Peak (μm)	Spectral Response Cut-off (μm)	Description	Drawing reference	Max. Dark Current (μA)	Sensitivity min. (μA/lux)	Cut-off Frequency (kHz)	T_j max. (°C)	V_R max. (V)	I_R max. (mA)
BPX40	0.8	1.1	Unencapsulated silicon planar photodiodes for general purpose applications	CP1	0.5 at 15V	0.01	500	125	18	2
BPX41	0.8	1.1		CP2	1.0 at 15V	0.03	500	125	18	5
BPX42	0.8	1.1		CQ	5.0 at 10V	0.12	500	125	12	20
BPX98	0.8	1.1		CP2	1.0 at1.0V	0.03	500	125	1.0	5
BPX94	0.8	1.1	Silicon photodiode for low light level applications. Plane window.	BJ5	0.2nA	0.006	500	150	18	–
BPX94A	0.8	1.1	As BPX94, but with lensed window.	BK4	0.2nA	0.03	500	150	18	–
BPW34	0.85	–	Silicon planar photodiode for infrared remote control.	AA	30nA	0.05	–	90	32	–

Photodevices

light emitting diodes (infrared emitting)

book 1 part 9

GaAs diodes emitting near infrared radiation for use in optical transmission of information, optoelectronic couplings and monochromatic sources

Type No.	Spectral Emission (μm)	Description	Drawing reference	I_{FRM} max. (mA)	I_F max. (mA)	I_e min. at 20mA (μW/sr)	t_r typ. (ns)	T_j Temperature Range (°C)	
CQY11B	0.875	Modified TO-18 encapsulation with plane window	BJ6	200	30	38	30	−55	+150
CQY11C	0.875	Modified TO-18 encapsulation with lensed window	BK1	200	30	1250 (typ.)	30	−55	+150
CQY50	0.93	Subminiature encapsulation with lensed window	G1	500	100	180	600	−65	+150
CQY52	0.93			500	100	450	600	−65	+150
CQY49B	0.93	Modified TO-18 encapsulation with plane window	BJ4	500	150	300 (at 50mA)	600	−40	+125
CQY49C	0.93	Modified TO-18 encapsulation with lensed window	BK3	500	150	3000 (at 50mA)	600	−40	+125
CQY58	0.875	Plastic encapsulation with lensed window	Z1	200	50	–	–	−40	+100
CQY89	0.93	Clear epoxy encapsulation with lensed window	AB	1000	130	7000 (at 100mA)	–	−55 to	+100

visible light emitting diodes (LEDs)

Visible LEDs have the advantages of semiconductors (long life, reliability, etc) and the higher brightness of incandescent lamps. These factors combine to make LEDs ideal for use in most environmental conditions experienced by computer, industrial and domestic users.

Type No.	Lens	Luminous Intensity Min. (mcd)	Luminous Intensity Typ. (mcd)	at I_F (mA)	Forward Voltage Max. (V)	at I_F (mA)	Drawing reference
RED EMITTING							
CQY24B	Red diffuse	0.3	1.6	20	2.0	20	AB
CQY46A	Red clear	0.4	0.8	20	2.0	20	P
CQY47A	Colourless clear	0.4	0.8	20	2.0	20	P
CQY61A	Colourless diffuse	0.5	1.5	20	2.0	20	O
CQY54	Red diffuse	–	0.9	20	2.0	20	Y
CQY88	Red diffuse	–	0.3	5	10	5	Y
GREEN EMITTING							
CQY94	Green diffuse	0.3	1.0	10	3.0	20	AB
CQY95	Green diffuse	0.3	1.0	10	3.0	20	Y
YELLOW EMITTING							
CQY96	Yellow diffuse	0.5	–	10	3.0	20	AB
CQY97	Yellow diffuse	0.3	–	10	3.0	20	Y

stackable LEDs (red, green and yellow)

For information, please consult Mullard Ltd.

Photodevices

segmental displays (red emitting) book 1 part 9

Type No.	Character Size (mm)	Luminous Intensity per segment or diode Typ. (mcd)	at I_F (mA)	Forward Voltage per segment or diode Typ. (V)	at I_F (mA)	Drawing reference
CQX82A	11 x 7	0.5	20	1.6	20	BB
CQX85A	19.6 x 12	0.5	20	1.6	20	AV
CQY81	7.6 x 5.2	0.5	20	1.6	20	
CQY81A	as CQY81, but decimal point on the right instead of left					BC
CQY81B	polarity and overflow display for CQY81 family					
CQY82	11 x 7	0.5	20	1.6	20	
CQY82A	as CQY82, but decimal point on the right, instead of left					BB
CQY82B	polarity and overflow display for CQY82 family					
CQY84	19.6 x 12	0.5	20	1.6	20	BD

photocouplers

Type No.	Description	I_C/I_F typ. I_F = 8mA	I_F (max.) (mA)	Minimum Isolation Voltage (pk) (V)	t_r (typ.) (μs)	t_f (typ.) (μs)	Drawing reference
CNY22	Solid state photorelays consisting of a GaAs electro-luminescent diode and a silicon n-p-n photo-transistor	0.5	30	4000	5	5	CR1
CNY23		1.0	30	2800	5	5	CR1
CNY42		0.5	30	4000	5	5	CR2
CNY43		1.0	30	2800	5	5	CR2
CNY44		0.6†	30	1500	2	2	CS1
CNY46		0.6†	30	1500	2	2	CS2
CNY47		0.3†	30	2800	t on3	t off3	CT
CNY47A		0.6†	30	2800	t on5	t off5	CT
CNY48		6.0	60	2100	–	–	CT

†I_F - 10mA

solar module for information, please contact Mullard Ltd.

pyro-electric detectors

Type No.	Typ. Noise Equivalent Power (500K,10,1) (W)	Wavelength Range (μm)	Typical Responsivity (V/W)	Frequency Range	Sensitive Area (mm)	Drawing reference
802CPY	1.5×10^{-9} (at 90Hz)	2–25	1×10^{3}	10Hz–100kHz	2.0 diam.	–
825CPY	3×10^{-10}	2–25	2×10^{5}	5Hz–50Hz	3 x 1	–
553CPY	1.5×10^{-10}	2–25	0.7×10^{3}	–	2 x 0.5	–
F606	1×10^{-9}	7–15	1.3×10^{3}*	–	1 x 1	–
*F606 consists of TGS element mounted in a TO-5 can. Performance is measured at the output of a suitable amplifier.						
RPY86	2.0×10^{-9}	6.5–14	640	0.01Hz–1kHz	2 x 1	AK
RPY87	1.7×10^{-9}	1.0–15	500	0.01Hz–1kHz	2 x 1	AK
RPY88	3.0×10^{-9}	6.5–14	320	0.01Hz–1kHz	2 x 2	AK
RPY89	2.5×10^{-9}	1.0–15	250	0.01Hz–1kHz	2 x 2	AK

infrared photoconductive detectors

Type No.	Spectral Response Peak (μm)	Spectral Response Cut-off (μm)	Description	Drawing reference	Typical Detectivity D*(500K,800,1) cm(Hz) ½W	Typical Monochromatic Responsivity (V/W)	Typical Time Constant (μs)	Sensitive Area (mm)	Element Resistance (kΩ)
RPY75 / **RPY75A**	1.5 to 2.1	2.6	Lead sulphide detectors for room temperature operation RPY75A incorporates a germanium filter to cut off visible radiations	CJ	2.0×10^{10}	200mA/W	250	1.0 x 1.0	>200
RPY76 / **RPY76A**	1.5 to 2.1	2.6	Lead sulphide detectors for room temperature operation RPY76A incorporates a germanium filter to cut off visible radiations	BG	2.0×10^{10}	2700mA/W	250	1.0 x 1.0	>100
61SV	2.2	3.5	Lead sulphide detector for room temperature operation	CK	4.0×10^{10}	8×10^{4}	100	6.0 x 6.0	1 to 4MΩ
62SV	2.5	3.5	Lead sulphide detector for room temperature operation	CK	6.0×10^{10}	1.2×10^{5}	175	6.0 x 6.0	1 to 4MΩ
ORP13	5.3	5.6	Indium antimonide detector for liquid N_2 temperature 77K operation	CL	5.5×10^{10}	3.5×10^{4}	5	6.0 x 0.5	20 to 60
RPY31	5.3	5.6	Indium antimonide detector for liquid N_2 temperature 77K operation	CL	4.0×10^{10}	3.8×10^{3}	5	4.0 x 4.0	1 to 5
RPY35	5.3	5.6	Indium antimonide detector for liquid N_2 or miniature Joule-Thompson coolers	CM	4.0×10^{10}	3.8×10^{3}	5	4.0 x 4.0	1 to 5
RPY51	5.3	5.6	Indium antimonide detectors for 77K operation using liquid N_2 or miniature Joule-Thompson coolers	CM	10×10^{10}	4.5×10^{4}	2.5	0.5 x 0.5	1.2 to 3.5
ORP10	6 to 6.3	7.5	Indium antimonide detector for room temperature operation	CN	2.0×10^{8}	1.0	0.1	6.0 x 0.5	0.03 to 0.12
RPY77	6 to 6.3	7.5	Indium antimonide labyrinth detectors for room temperature operation	CO	1.5×10^{8}	9.0	<0.1	2.0 x 2.0	0.5 to 2
RPY78	6 to 6.3	7.0†							

†Limited spectral response due to sapphire window.

In addition to the above, Mullard manufacture a range of photoconductive Mercury Cadmium Telluride detectors for the 3–5 and 8–14 micron regions. Further information available from Mullard Ltd.

Photodevices

cadmium sulphide photoconductive cells

book 1 part 9

All types: Spectral response range 0.3 to 0.9 μm

Type No.	Incidence of Illumination and Description	Drawing reference	Max. Dissipation (mW)	at (°C)	Max. Cell Voltage (d.c. or pk) (V)	Nominal* Cell Resistance (kΩ)	Ambient Temperature Limits (°C)
ORP60	End-on	CG	70	25	350	60	−40 to +70
ORP61	Side-on	CG	70 20	25 70	350	60	−40 to +70
ORP62	Side-on	CG	100	25	350	45	−40 to +70
ORP69	Side-on and end-on	CG	100	25	350	30	−40 to +70
RPY58A	Side-on (Monograin)	CH	100	25	50	0.6	−40 to +60
RPY71	Side-on (Linear monograin)	CH	50	25	50	3.0 to 6.0 (at 10 lux)	−40 to +70

*Measured at 50 lux and with lamp of colour temperature 2700K.

liquid crystal displays

For information, please contact Mullard Ltd.

surface wave devices

Television i.f. surface acoustic wave filters

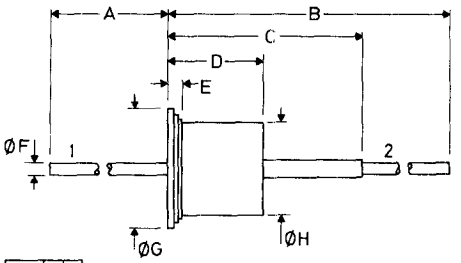
Type No.	TV System	Operating Voltage	Reference Frequency (MHz)	Drawing reference
SW102/M	I	12	39.5	BH
SW211/M	B and G	12	38.9	BH

OUTLINES and DIMENSIONS (millimetres)

A

B.S.3934 SO-16

DO-1
DO-2
DO-3



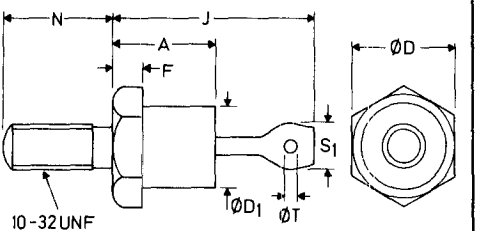
	1	2
A1	a	k
A2	k	a

A min.	B min.	C	D max.	E max.	ØF max.	ØG max.	ØH max.
35	51	17	7.7	1.6	1.1	9.6	7.1

B

B.S.3934 SO-10

DO-4



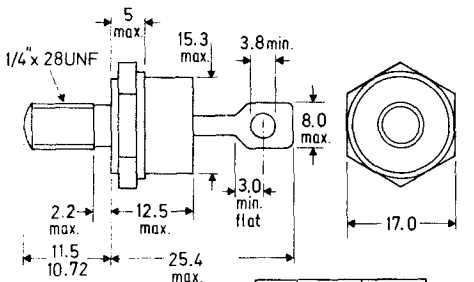
A	10.3max.	J	20.3max.
ØD	11.1 max.	N	11.5max.
ØD1	9.3max.	S1	4.8max.
F	3.2	ØT	1.6min.

	Stud	Eyelet
B1	k	a
B2	a	k

C

B.S.3934 SO-13

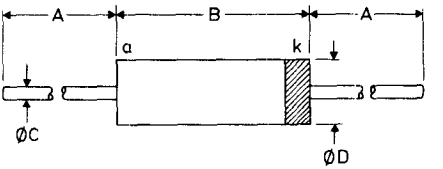
DO-5



	Stud	Eyelet
C1	k	a
C2	a	k

D

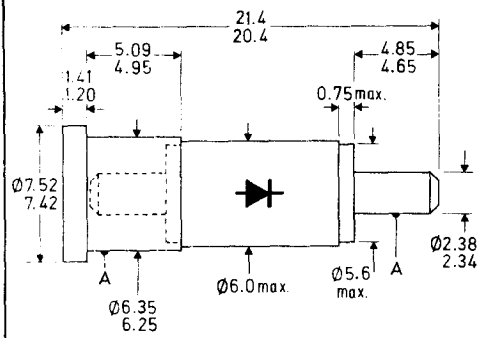
DO-7
DO-14
DO-15



		A min.	B max.	ØC nom.	ØD max.
D1	DO-7	25.4	7.6	0.52	2.5
D2	DO-14	25.4	7.6	0.5	3.3
D3	DO-15	25.4	6.4	0.8	3.2

E

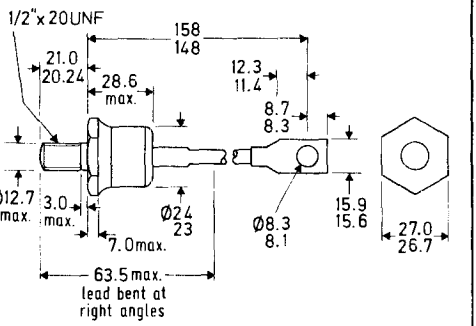
DO-22
SOD-47



A = concentricity tolerance = ±0.20.

F

DO-30

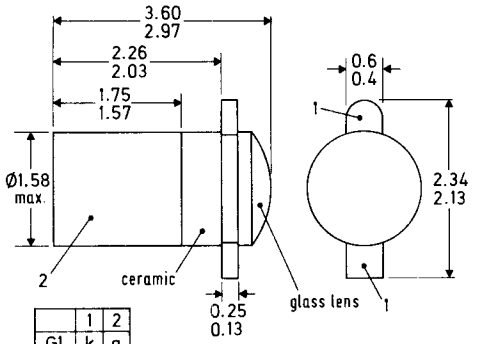


BZW86 Blue sleeve - anode to eyelet.
BZW86R Red sleeve - anode to stud.

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

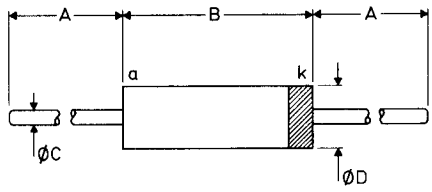


	1	2
G1	k	a
G2	e	c

For LEDs the overall length = 3.60/2.97

H

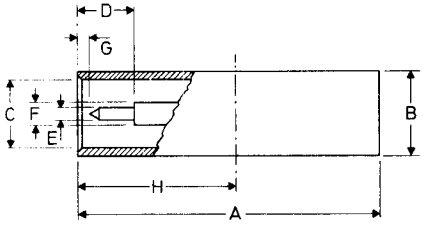
DO-35



A min.	B max.	ØC max.	ØD max.
25.4	4.25	0.56	1.85

J

DO-37
SOD-49

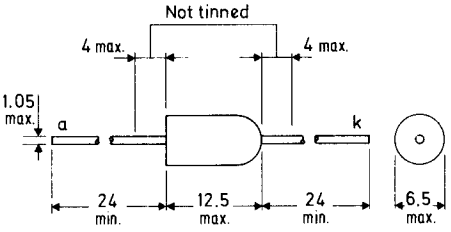


A	19.43/18.67	ØE	0.84/0.79
ØB*	5.59/5.49	ØF	1.57/1.52
ØC	4.80/4.72	G	0.71/0.15
D	3.73 min.	H	10.32 nom.

* These tolerances apply only over H.

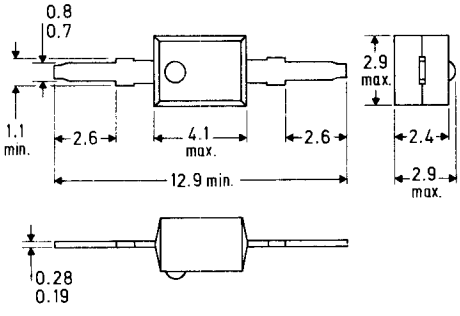
K

SOD-18



L

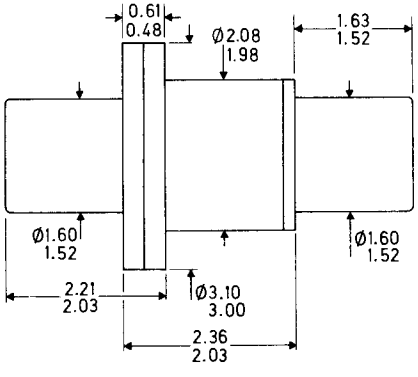
SOD-23



M

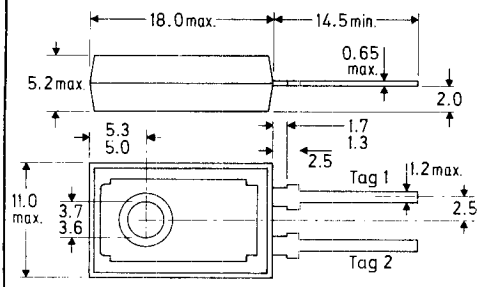
B.S.3934 SO-86

SOD-31



N

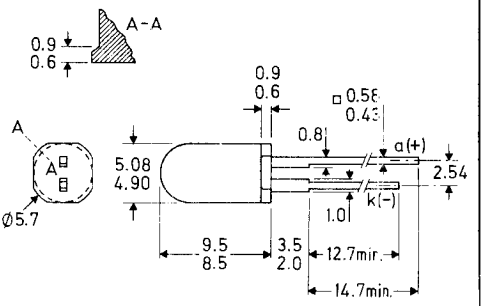
SOD-38



	polarity	
	normal	reverse
Tag 1 = base-plate:	cathode	anode
Tag 2 :	anode	cathode

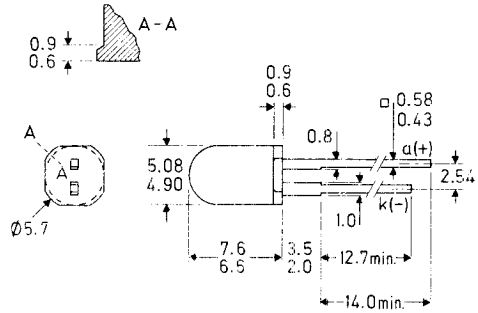
O

SOD-39C



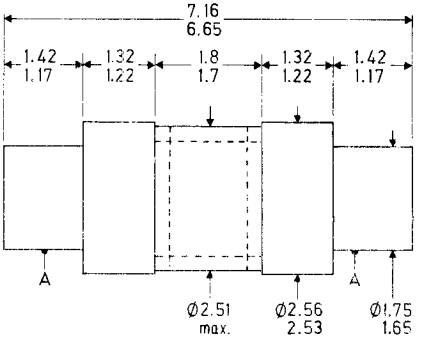
P

SOD-39D



Q

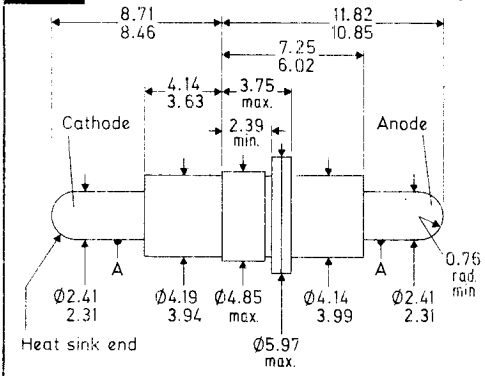
SOD-42



A = cancentricity tolerance = ±0.15.

R

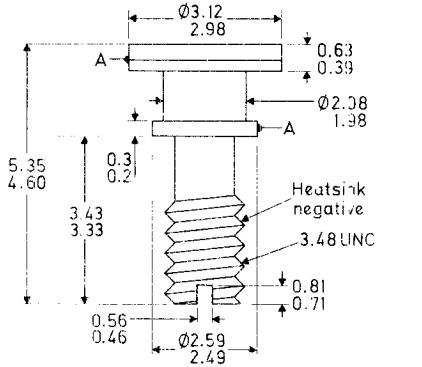
SOD-43



A = cancentricity tolerance = ±0.13.

S

SOD-44

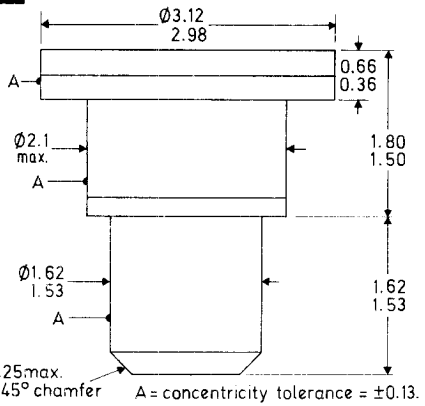


A = concentricity tolerance = ±0.13.

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.

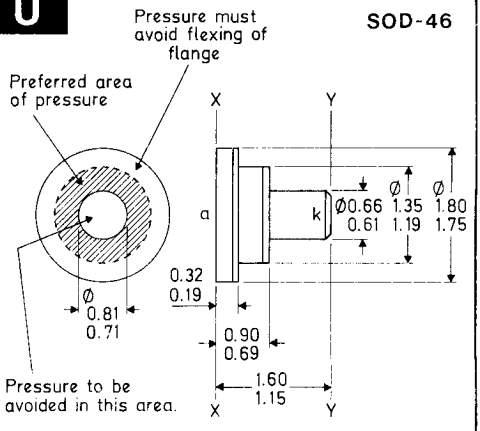
T

SOD-45



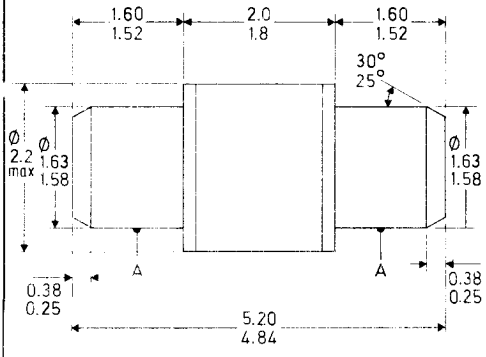
U

SOD-46



V

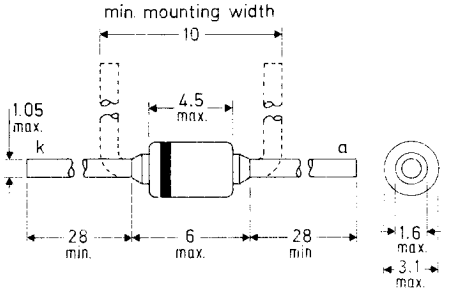
SOD-50



A = concentricity tolerance = ±0.15.

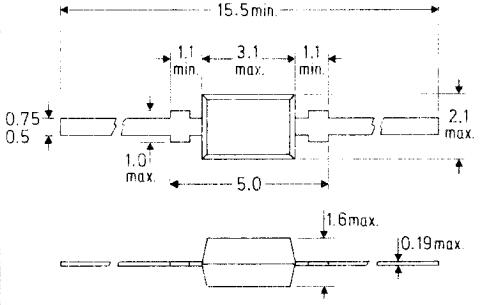
W

SOD-51



X

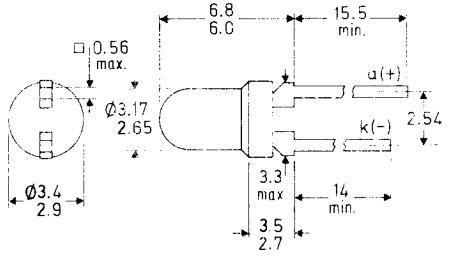
SOD-52



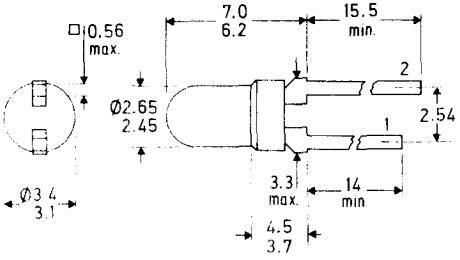
The coloured end indicates the cathode.

Y

SOD-53C

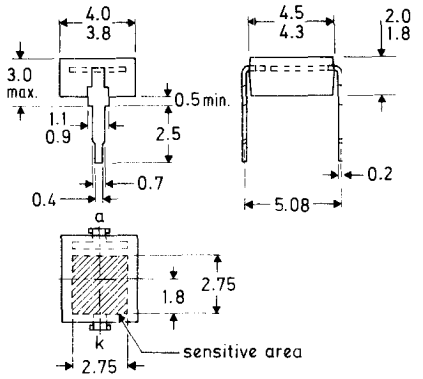


Z — SOD-53D

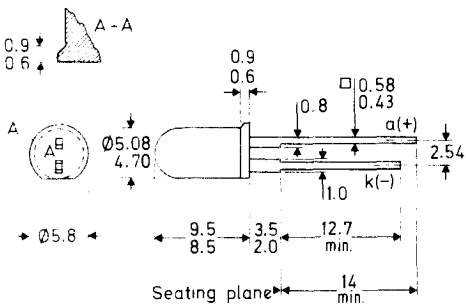


	1	2
Z1	k(−)	a(+)
Z2	c	e

AA — SOD-62A

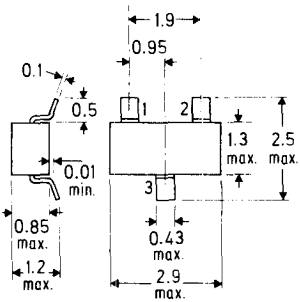


AB — SOD-63



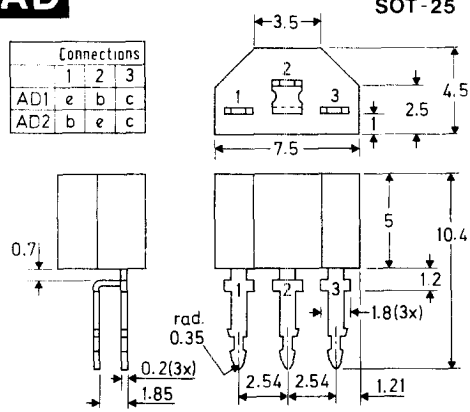
AC — SOT-23

	1	2	3
AC1	b	e	c
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



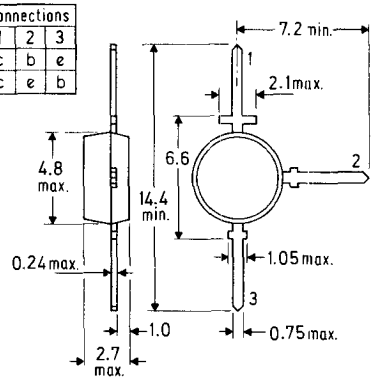
AD — SOT-25

Connections	1	2	3
AD1	e	b	c
AD2	b	e	c



AE — SOT-37

Connections	1	2	3
AE1	c	b	e
AE2	c	e	b



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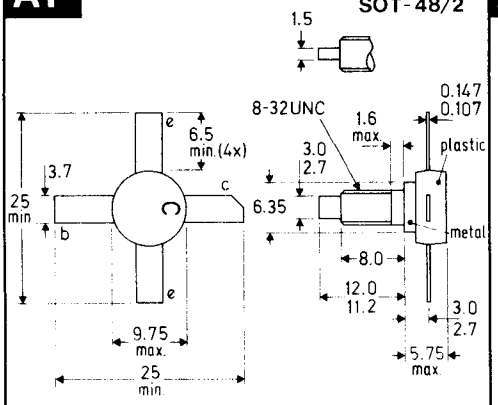
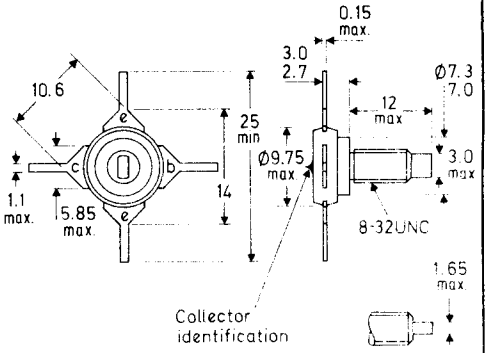
AF

SOT-48/2



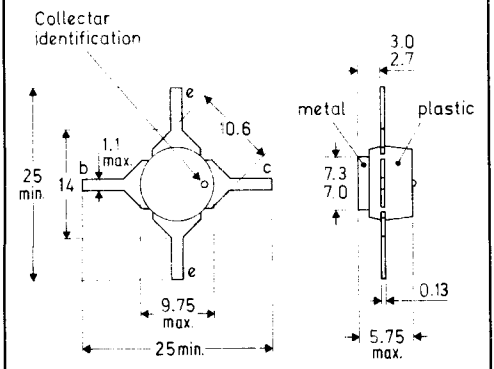
AG

SOT-48/3



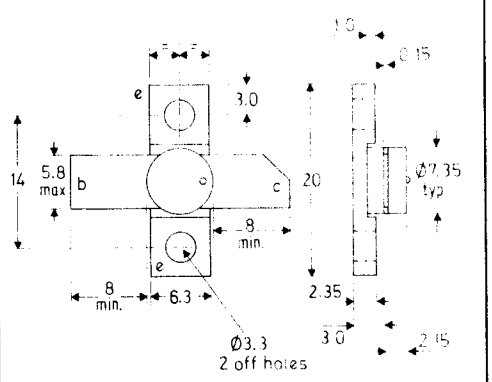
AH

SOT-48/4



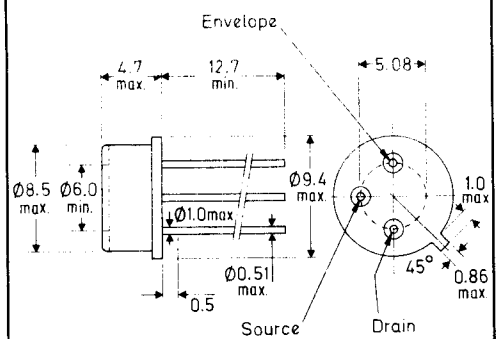
AJ

SOT-48 HEADER



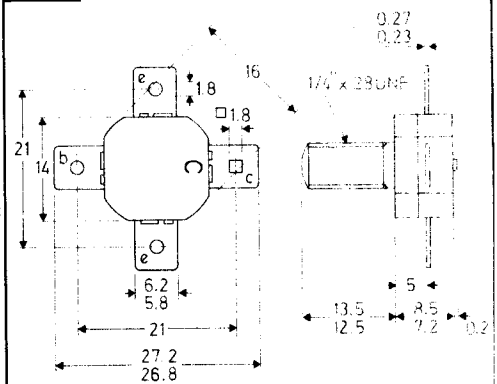
AK

SOT-49D



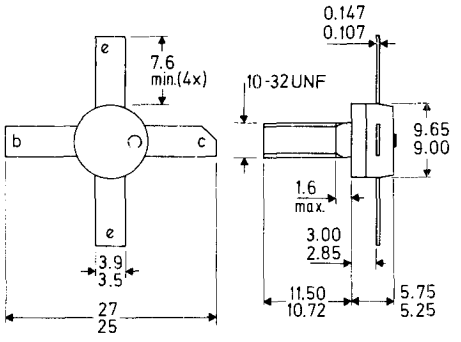
AL

SOT-55



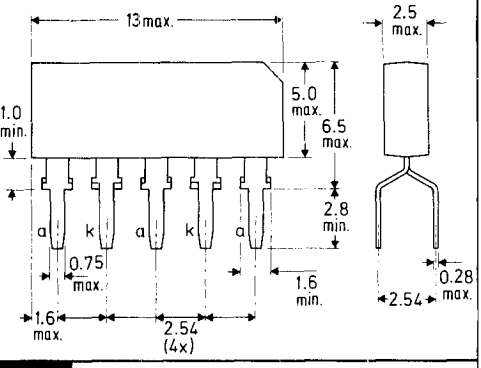
AM

SOT-56



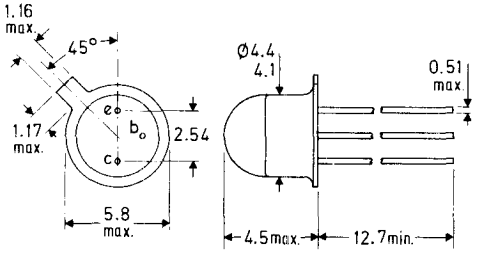
AN

SOT-60



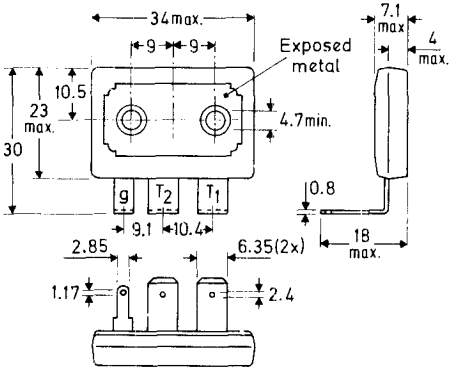
AO

SOT-70



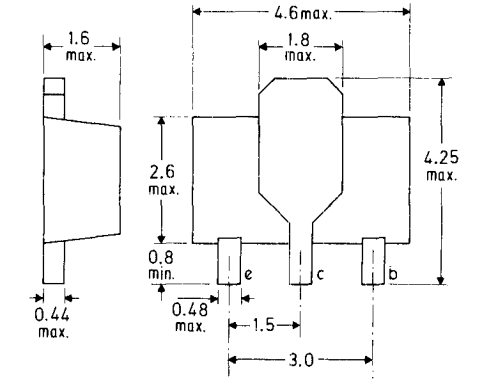
AP

SOT-80



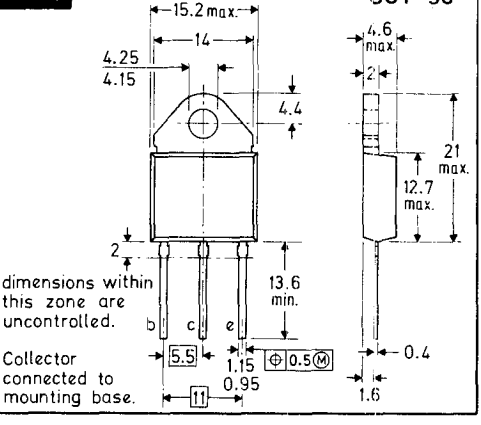
AQ

SOT-89



AR

SOT-93



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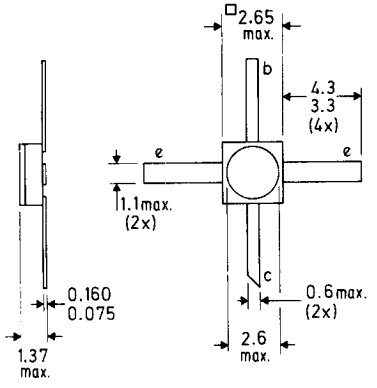
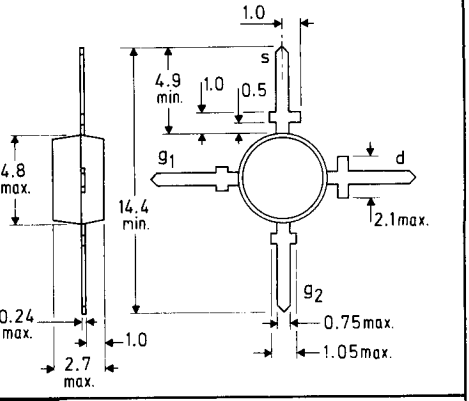
AS

SOT-100



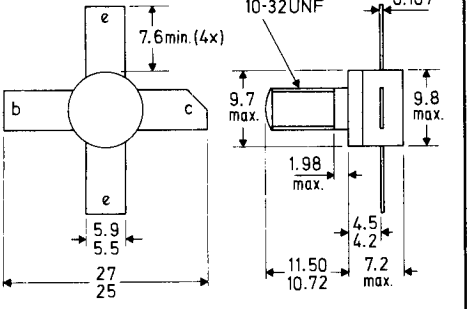
AT

SOT-103



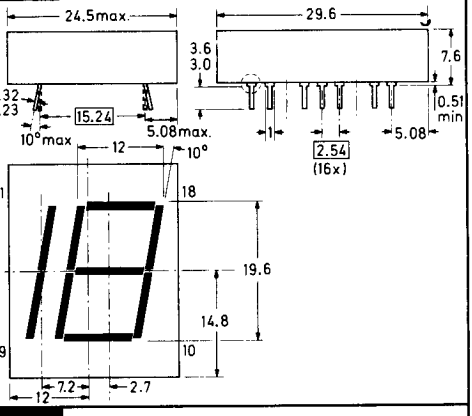
AU

SOT-105



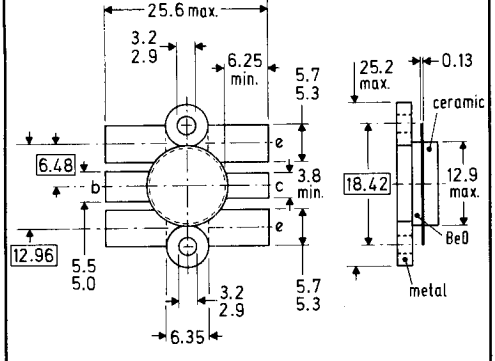
AV

SOT-114



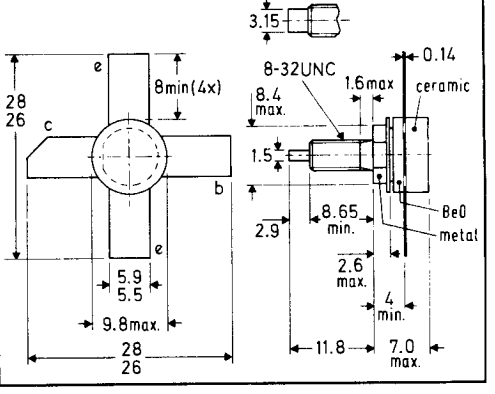
AW

SOT-119



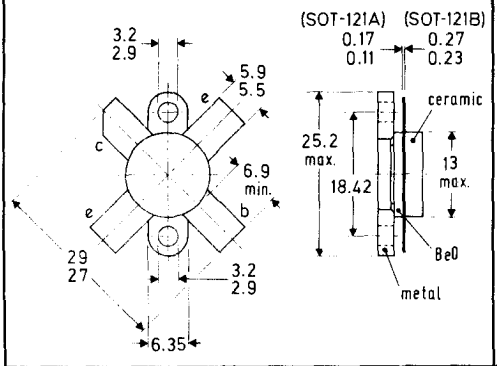
AX

SOT-120



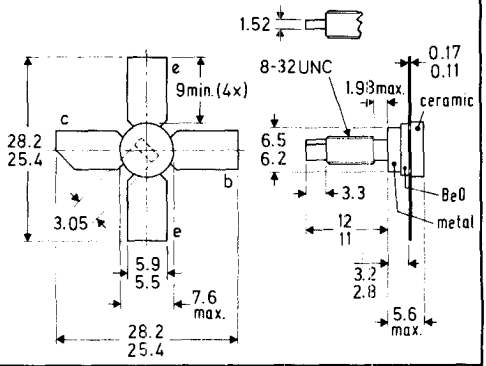
AY

SOT-121A
SOT-121B



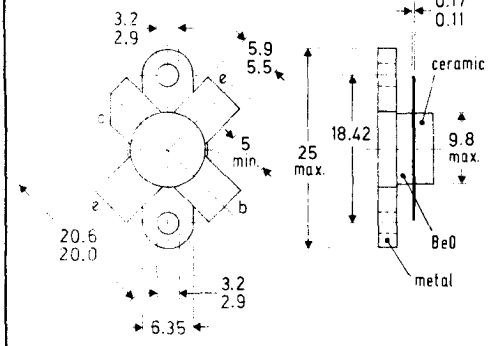
AZ

SOT-122



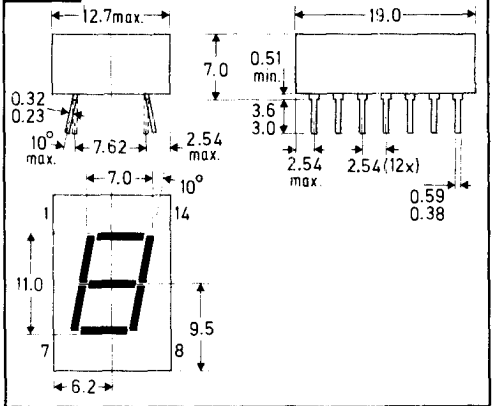
BA

SOT-123



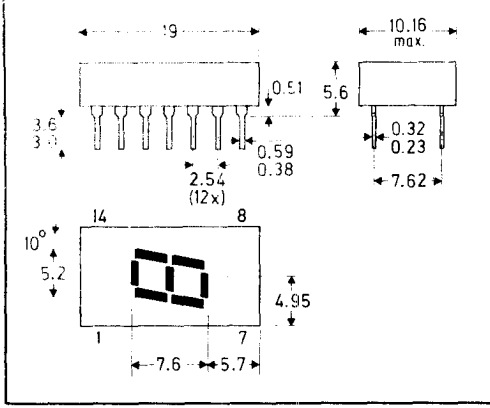
BB

SOT-125A



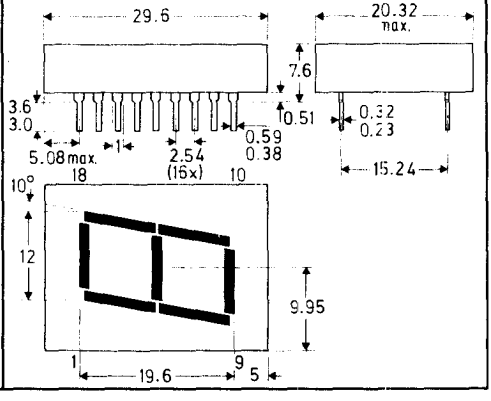
BC

SOT-126A



BD

SOT-127A



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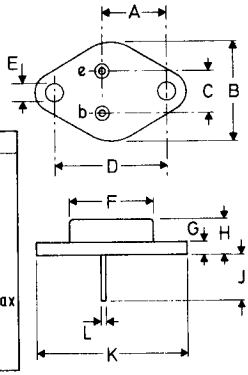
BE

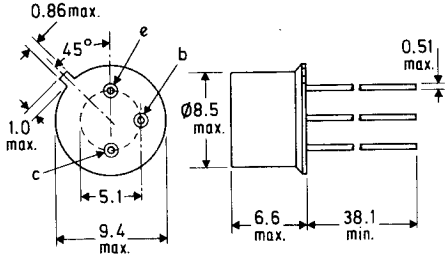
B.S.3934 SO-5B/SB2-2 TO-3



	BE1	BE2	BE3
A		16.9	
B		26.6max	
C		10.9	
D		30.1	
E		4.2max	
F		20.3max	
G	3.15	1.6	1.6
H	9.5max	9.5max	8.63max
J		12.0	
K		39.5max	
L		1.0	

BF

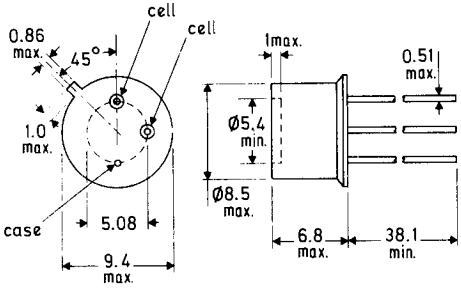
B.S.3934 SO-3/SB3-3B TO-5



BF1: collector connected to case.
BF2: base connected to case.

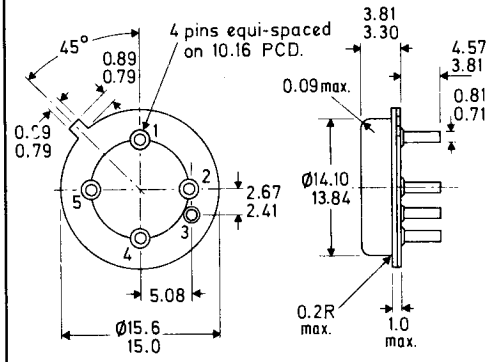
BG

TO-5
(with window)



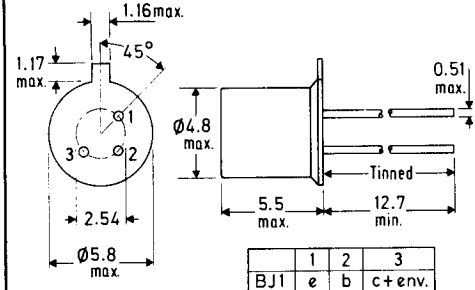
BH

TO-8
(5-lead)



BJ

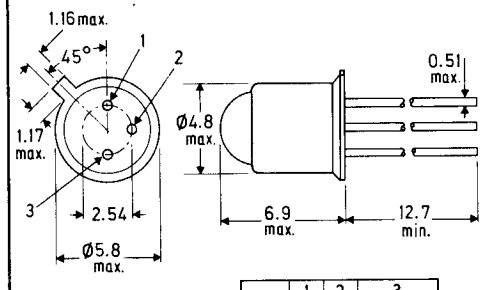
B.S.3934 SO-12A/SB3-6A TO-18



	1	2	3
BJ1	e	b	c+env.
BJ2	s	d	g+env.
BJ3	d	g	s+env.
BJ4	k	-	a
BJ5	a	-	k
BJ6	a	a	k

BK

TO-18
(with lens)

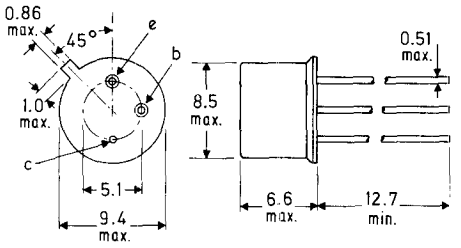


	1	2	3
BK1	a	a	k
BK2	e	b	c+case
BK3	k	-	a
BK4	a	-	k+case

BL

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

TO-39



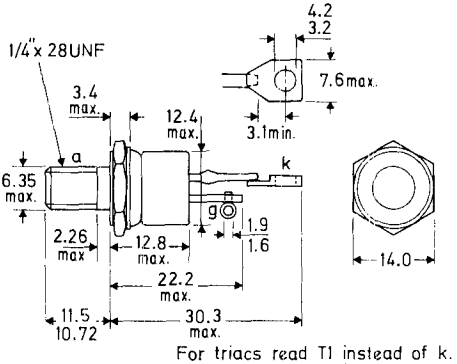
BL1: b + case.
BL2: case isolated.
BL3: c + case.
BL4: e. cathode.
b. gate.
c. anode + case.

BL5: e.b. cell connections.
c. metal case.
BL6: red spot indicates +ve connection.
BL7: pins c, b, e + case (clockwise).

BM

B.S.3932 SO-36

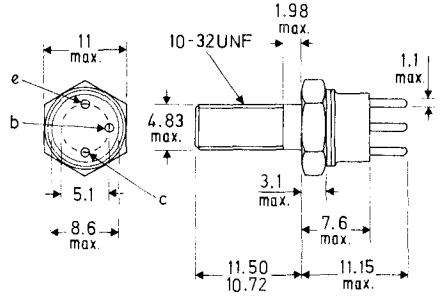
TO-48



For triacs read T1 instead of k.
T2 instead of a.

BN

TO-60

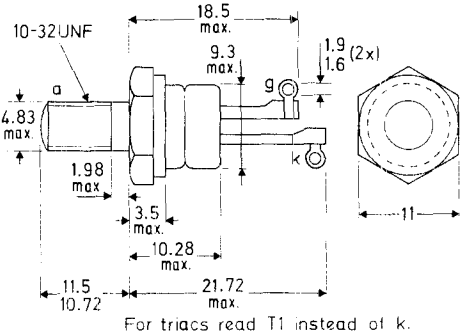


Emitter connected to envelope.

BO

B.S.3934 SO-35A

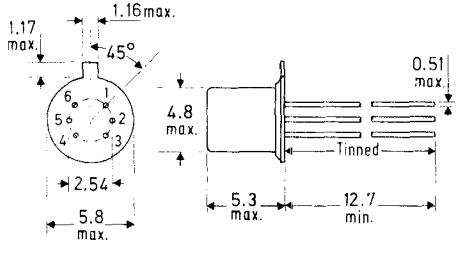
TO-64



For triacs read T1 instead of k.
T2 instead of a.

BP

TO-71

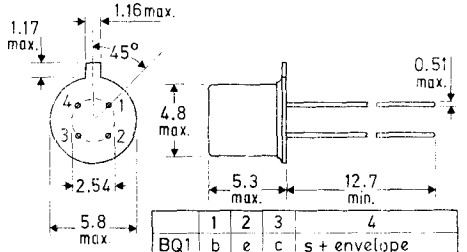


Pin	1	2	3	4	5	6
BP1	e1	e2	c2	b2	b1	c1
BP2	s1	d1	g1	s2	d2	g2

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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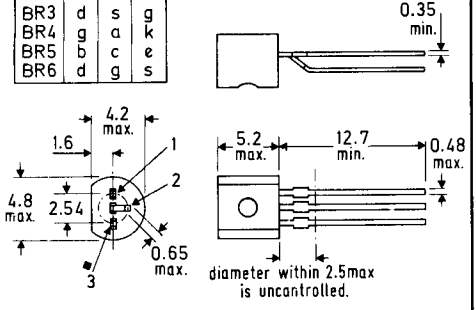
BR

TO-92 variant

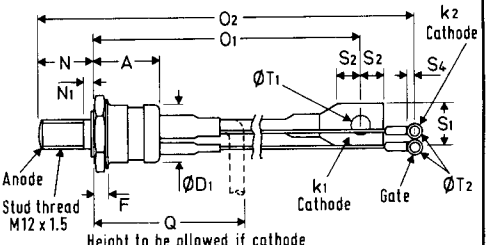
Pin	1	2	3
BR1	e	b	c
BR2	b	e	c
BR3	d	s	g
BR4	g	a	k
BR5	b	c	e
BR6	d	g	s



BS

B.S.3934 SO-30C

TO-94

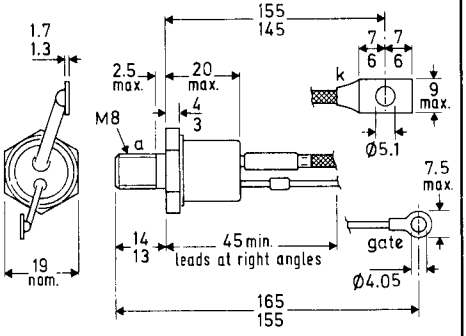


Height to be allowed if cathode lead is bent at right angles.

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

BT

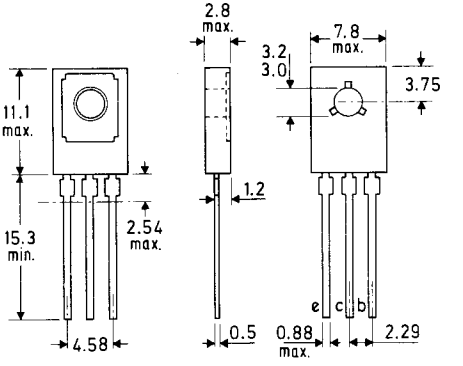
TO-103



For triacs read T1 instead of k.
T2 instead of a.

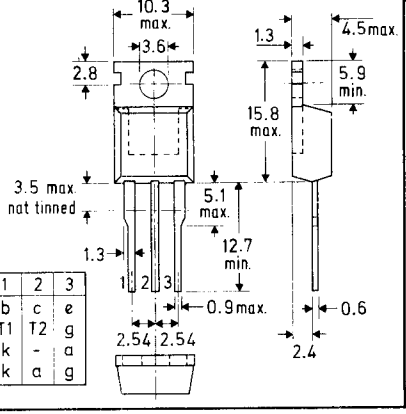
BU

TO-126



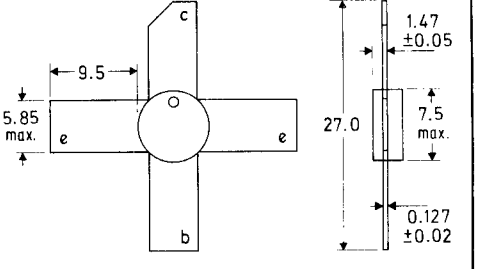
BV

TO-220

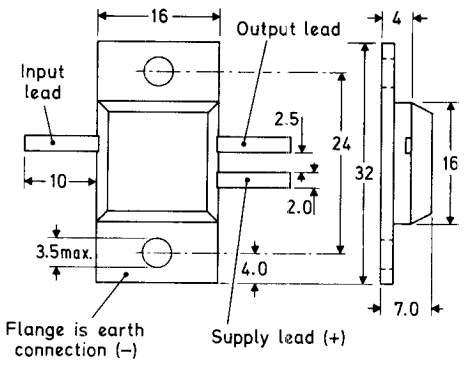


Pin	1	2	3
BV1	b	c	e
BV2	T1	T2	g
BV3	k	-	a
BV4	k	a	g

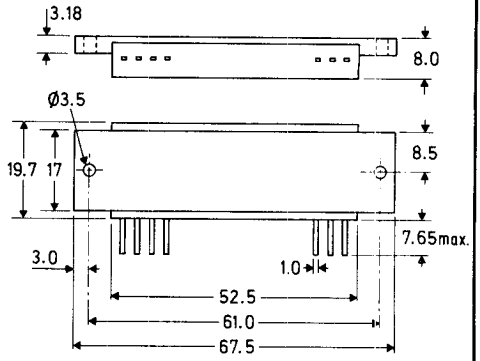
BW



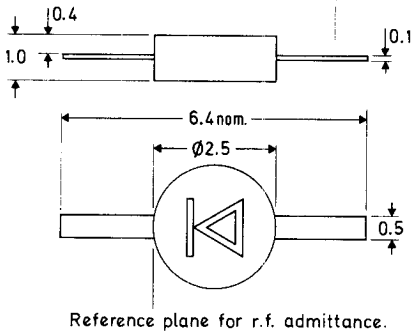
BX



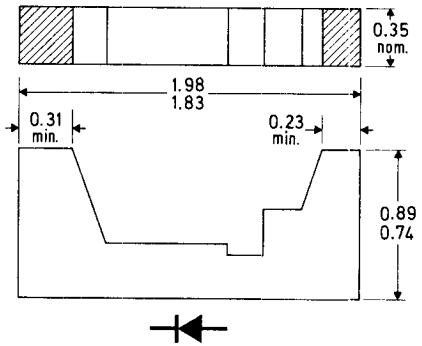
BY



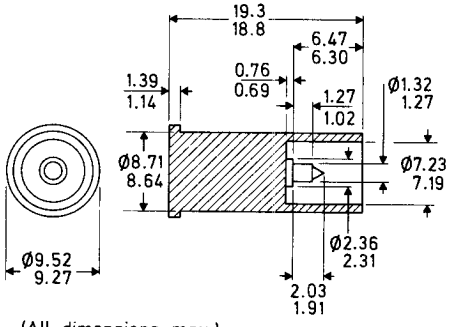
BZ



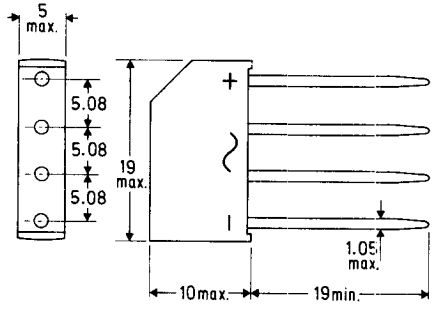
CA



CB

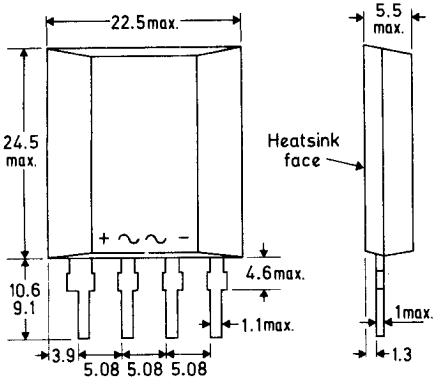


CC



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.

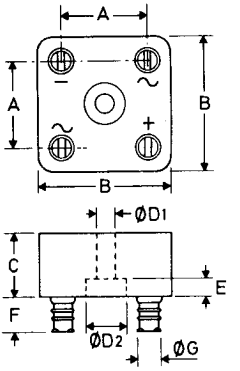
CD



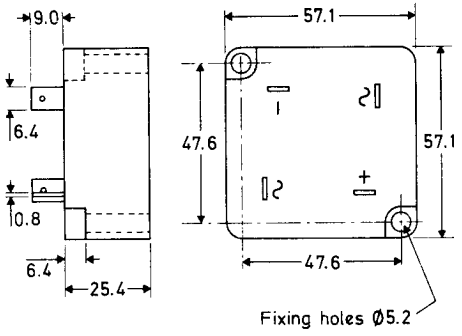
CE

B.S.3934 SO-67

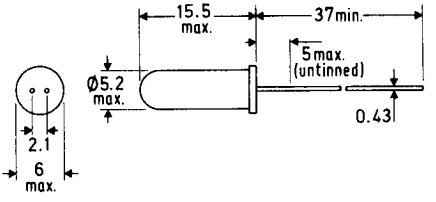
	typ.
A	23
B	35
C	17
ØD1	5
ØD2	11
E	5
F	9
ØG	4.8



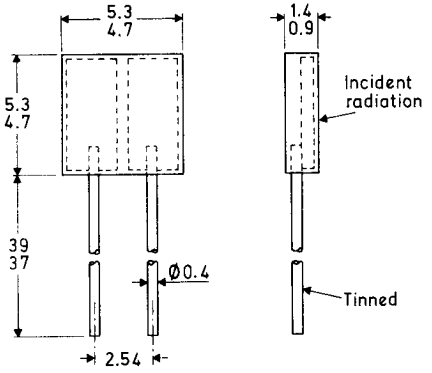
CF



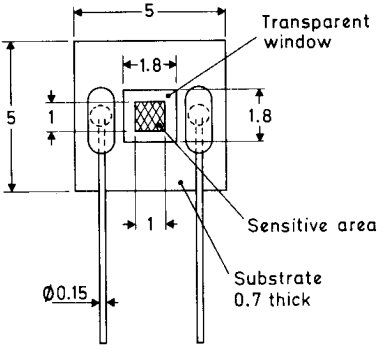
CG



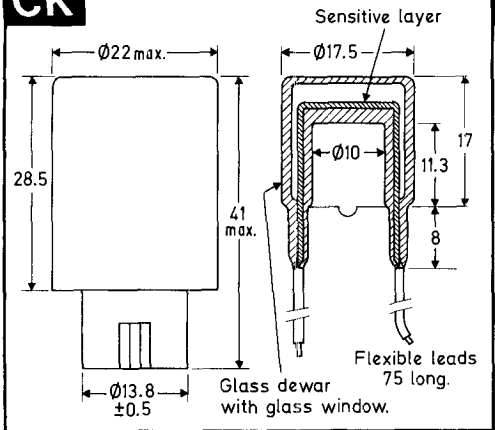
CH



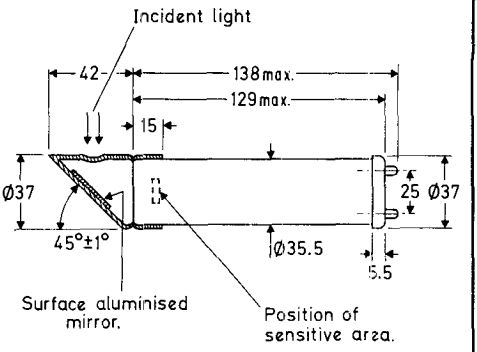
CJ



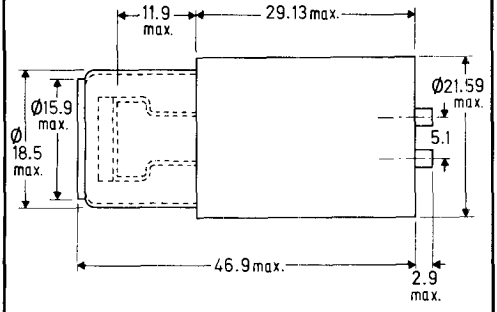
CK



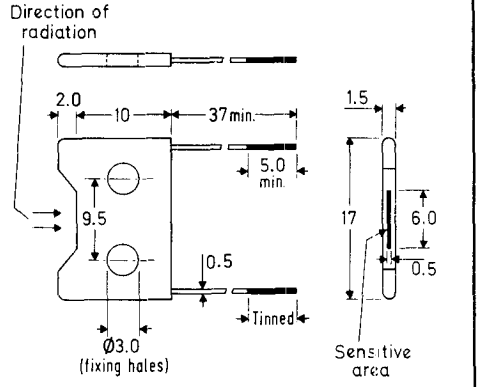
CL



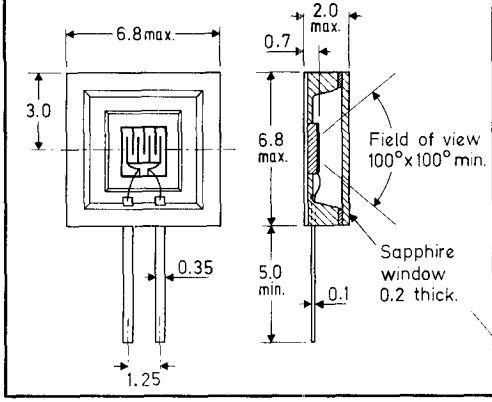
CM



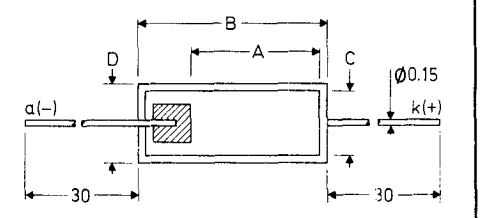
CN



CO



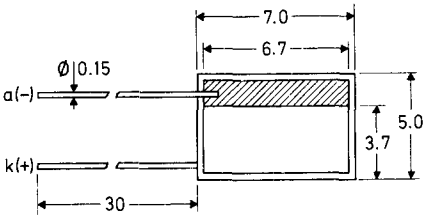
CP



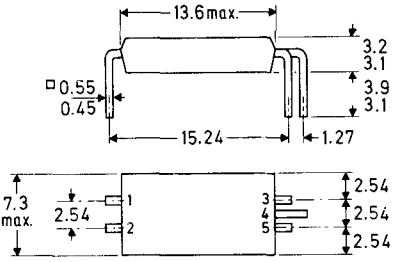
	CP1	CP2
A	2.20	3.50
B	3.35	4.55
C	0.95	1.80
D	1.25	2.05

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.

CQ

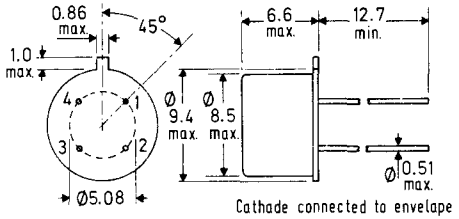


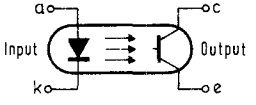
CR



Pin	1	2	3	4	5
CR1	a	k	b	c	e
CR2	k	a	e	amitted	c

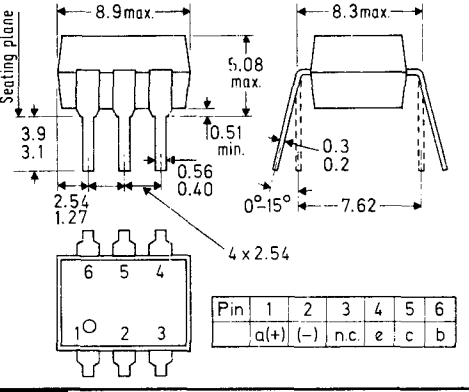
CS





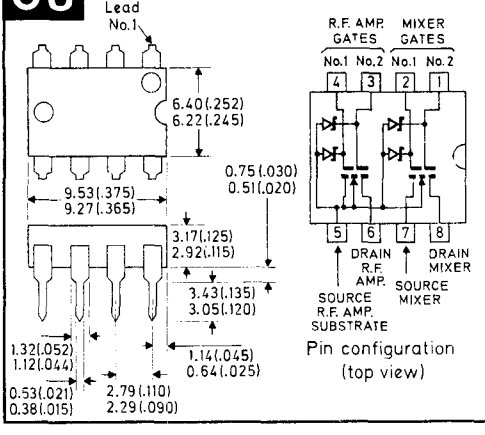
Pin	1	2	3	4
CS1	a	k	e	c
CS2	e	c	a	k

CT



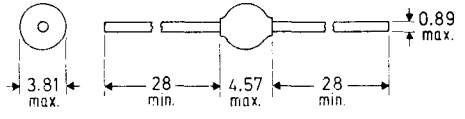
Pin	1	2	3	4	5	6
	a(+)	(-)	n.c.	e	c	b

CU



Pin configuration (top view)

CV



The marking band indicates the cathode.

90

Mullard
Passive Components.

conversion list — code numbers to Mullard type numbers

For customers receiving our components under a Mullard code number, a conversion list to type numbers is given.

Capacitors

Code number	Type Number
2222 311 31103	C296AA/A10K
2222 311 31104	C296AA/A100K
2222 311 31105	C296AA/A1M
2222 311 31153	C296AA/A15K
2222 311 31154	C296AA/A150K
2222 311 31223	C296AA/A22K
2222 311 31224	C296AA/A220K
2222 311 31333	C296AA/A33K
2222 311 31334	C296AA/A330K
2222 311 31473	C296AA/A47K
2222 311 31474	C296AA/A470K
2222 311 31683	C296AA/A68K
2222 311 31684	C296AA/A680K
2222 311 51102	C296AC/A1K
2222 311 51103	C296AC/A10K
2222 311 51104	C296AC/A100K
2222 311 51152	C296AC/A1K5
2222 311 51153	C296AC/A15K
2222 311 51154	C296AC/A150K
2222 311 51222	C296AC/A2K2
2222 311 51223	C296AC/A22K
2222 311 51224	C296AC/A220K
2222 311 51332	C296AC/A3K3
2222 311 51333	C296AC/A33K
2222 311 51334	C296AC/A330K
2222 311 51472	C296AC/A4K7
2222 311 51473	C296AC/A47K
2222 311 51474	C296AC/A470K
2222 311 51682	C296AC/A6K8
2222 311 51683	C296AC/A68K
2222 341 05103	C281VV/A10K
2222 341 05104	C281VV/A100K
2222 341 05105	C281VV/A1M
2222 341 05153	C281VV/A15K
2222 341 05154	C281VV/A150K
2222 341 05155	C281VV/A1M5
2222 341 05223	C281VV/A22K
2222 341 05224	C281VV/A220K
2222 341 05225	C281VV/A2M2
2222 341 05333	C281VV/A33K
2222 341 05334	C281VV/A330K
2222 341 05473	C281VV/A47K
2222 341 05474	C281VV/A470K
2222 341 05683	C281VV/A68K
2222 341 05684	C281VV/A680K
2222 341 59103	C281CD/A10K
2222 341 59104	C281CD/A100K
2222 341 59153	C281CD/A15K
2222 341 59154	C281CD/A150K
2222 341 59223	C281CD/A22K
2222 341 59224	C281CD/A220K
2222 341 59333	C281CD/A33K
2222 341 59334	C281CD/A330K
2222 341 59473	C281CD/A47K
2222 341 59474	C281CD/A470K
2222 341 59683	C281CD/A68K

Resistors

2322 211 Series	CR25 Series
2322 151 Series	MR25 Series
2322 152 Series	MR30 Series
2322 191 Series	PR37 Series
2322 192 Series	PR52 Series
2322 210 Series	CR16 Series
2322 212 Series	CR37 Series
2322 242 Series	VR37 Series

Code number	Type Number
2322 552 01161	E299DD/P116
2322 552 01181	E299DD/P118
2322 552 01201	E299DD/P120
2322 552 02161	E299DD/P216
2322 552 02181	E299DD/P218
2322 552 02201	E299DD/P220
2322 552 02221	E299DD/P222
2322 552 02241	E299DD/P224
2322 552 02261	E299DD/P226
2322 552 02281	E299DD/P228
2322 552 02301	E299DD/P230
2322 552 02321	E299DD/P232
2322 552 02341	E299DD/P234
2322 552 02361	E299DD/P236
2322 552 02381	E299DD/P238
2322 552 03361	E299DD/P336
2322 552 03381	E299DD/P338
2322 552 03401	E299DD/P340
2322 552 03421	E299DD/P342
2322 552 03441	E299DD/P344
2322 552 03461	E299DD/P346
2322 552 03481	E299DD/P348
2322 552 03501	E299DD/P350
2322 552 03521	E299DD/P352
2322 552 03541	E299DD/P354
2322 555 02301	E299DH/P230
2322 564 02582	E298ED/A258
2322 564 02602	E298ED/A260
2322 564 02622	E298ED/A262
2322 564 02681	E298ED/P268
2322 564 90005	E298ZZ/06
2322 564 90014	E298ED/A265
2322 574 90001	E295ZZ/01
2322 574 90002	E295ZZ/02
2322 610 11131	VA1040
2322 610 11132	VA1038
2322 610 11159	VA1100
2322 610 11228	VA1036
2322 610 11408	VA1033
2322 610 11501	VA1039
2322 610 11509	VA1034
2322 610 11608	VA1074
2322 610 11808	VA1053
2322 610 90043	VA1110
2322 627 11102	VA3700
2322 627 11103	VA3706
2322 627 11104	VA3712
2322 627 11222	VA3702
2322 627 11223	VA3708
2322 627 11224	VA3714
2322 627 11472	VA3704
2322 627 11473	VA3710
2322 627 11474	VA3716
2322 627 21102	VA3400
2322 627 21103	VA3406
2322 627 21104	VA3412
2322 627 21222	VA3402
2322 627 21224	VA3414
2322 627 21472	VA3404
2322 627 21473	VA3410
2322 634 11102	VA3100
2322 634 11103	VA3106
2322 634 11104	VA3112
2322 634 11222	VA3102
2322 634 11223	VA3108
2322 634 11224	VA3114
2322 634 11472	VA3104
2322 634 11473	VA3110
2322 634 11474	VA3116
2322 634 21102	VA3200
2322 634 21103	VA3206
2322 634 21104	VA3212
2322 634 21222	VA3202
2322 634 21223	VA3208
2322 634 21224	VA3214
2322 634 21472	VA3204
2322 634 21473	VA3210
2322 634 21474	VA3216
2322 635 01151	VA1055S
2322 635 01154	VA1067S
2322 635 01472	VA1066S
2322 635 01473	VA1056S
2322 642 11151	VA1096
2322 642 11152	VA1098
2322 642 11153	VA1108

Code number	Type Number
2322 642 11222	VA1106
2322 642 11471	VA1097
2322 642 12223	VA1112
2322 642 12333	VA1111
2322 642 12472	VA1109
2322 661 91002	E220ZZ/03
2322 661 91003	E22oZZ/04
2322 661 91004	E220ZZ/02
2322 661 91005	E220ZZ/01
2322 662 93037	VA8650

Metallised film capacitors

*p.e.t.p.

book 3 part 1

C281VV (341) Series 250V d.c. working (U_R)

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	14.6	4.8	8.8	0.8	40
C281VV/A68K	341 05683	0.068	14.6	5.6	9.5	0.8	40
C281VV/A100K	341 05104	0.1	14.6	5.6	9.5	0.8	40
C281VV/A150K	341 05154	0.15	18.1	6.6	10.5	0.8	40
C281VV/A220K	341 05224	0.22	18.1	6.6	10.5	0.8	40
C281VV/A330K	341 05334	0.33	23.6	7.5	11.6	0.8	40
C281VV/A470K	341 05474	0.47	23.6	7.5	11.6	0.8	40
C281VV/A680K	341 05684	0.68	23.6	8.8	12.9	0.8	40
C281VV/A1M	341 05105	1	31.1	10.5	14.7	0.8	50
C281VV/A1M5	341 05155	1.5	31.1	12.5	19.6	0.8	50
C281VV/A2M2	341 05225	2.2	31.1	12.5	19.6	0.8	50

C281VV are approved to Post Office specification D2283 and marked with Post Office type number 8017B

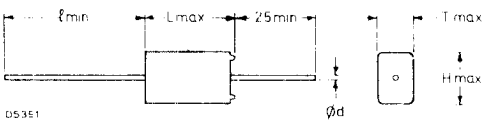
*Polyethylene terephthalate

polycarbonate

C281CD (341) Series 400 d.c. working (U_R)

Type No.	Code No.	Capacitance µF	Dimensions mm L	T	H	d	ℓ
C281CD/A10K	341 59103	0.01	14.6	4.8	8.8	0.8	40
C281CD/A15K	341 59153	0.015	14.6	4.8	8.8	0.8	40
C281CD/A22K	341 59223	0.022	14.6	4.8	8.8	0.8	40
C281CD/A33K	341 59333	0.033	14.6	5.6	9.5	0.8	40
C281CD/A47K	341 59473	0.047	14.6	6.6	10.5	0.8	40
C281CD/A68K	341 59683	0.068	18.1	6.6	10.5	0.8	40
C281CD/A100K	341 59104	0.1	18.1	7.7	11.6	0.8	40
C281CD/A150K	341 59154	0.15	23.6	7.5	11.6	0.8	40
C281CD/A220K	341 59224	0.22	23.6	8.8	12.9	0.8	40
C281CD/A330K	341 59334	0.33	23.6	10.5	14.5	0.8	40
C281CD/A470K	341 59474	0.47	31.1	10.5	14.7	1	50

C281 (341) Series



D5351

Capacitance tolerance ± 10%
Losses (at 10kHz) tan δ (C281 VV) $< 150 \times 10^{-4}$
(C281 CD Series) $< 75 \times 10^{-4}$
Insulation resistance at 20°C for C ≤ 0.33 µF R > 30 000 MΩ
for C ≥ 0.47 µF RC > 10 000 MΩµF
Temperature range −55 to +85 °C at rated voltage U_R
+ 85 to +100 °C at 0.8 U_R

Metallised film capacitors

*p.e.t.p. or polycarbonate

344 2 Series 100V d.c. working (U_R)

Type No.		Capacitance	Dimensions mm			
p.e.t.p.	Polycarbonate	μF	S	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	30	11	20.5
344 25685	**344 21685**	6.8	27.5	30	13.5	23

344 4 Series 250V d.c. working (U_R)

Type No.		Capacitance	Dimensions mm			
p.e.t.p.	Polycarbonate	μF	S	L	T	H
344 41473	**344 45473**	0.047	10	13	4.5	10
344 41683	**344 45683**	0.068	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	30	11	20.5
344 41225	–	2.2	27.5	30	11	20.5
–	**344 45225**	2.2	27.5	30	13.5	23

*Polyethylene terephthalate

continued

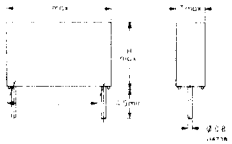
Metallised film capacitors

*p.e.t.p. or polycarbonate

344 5 Series 400V d.c. working (U_R)

Type No.		Capacitance	Dimensions mm			
p.e.t.p.	Polycarbonate	μF	S	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	5.0	11
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	19.0
344 55684	**344 51684**	0.68	27.5	30	11	20.5
344 55105	**344 51105**	1.0	27.5	30	13.5	23.0

The 344 Series has Post Office approval and are RSRE recommended

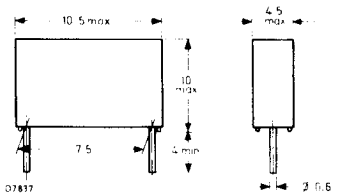


*p.e.t.p.

344 Series miniature range

Type numbers	Rated Voltage (U_R) (V)	Capacitance (μF)
344 67472	630	0.0047
344 67682	630	0.0068
344 57103	400	0.01
344 57153	400	0.015
344 47223	250	0.022
344 47333	250	0.033
344 27473	100	0.047
344 27683	100	0.068
344 27104	100	0.1

DIMENSIONS (millimetres) for miniature range



*Polyethylene terephthalate

Capacitance tolerance ± 10% unless otherwise stated
Temperature range -55 to +85°C at rated voltage (U_R)
Losses (at 10kHz) 85 to 100°C at 0.8 U_R
$\tan\delta < 75 \times 10^{-4}$ ..... polycarbonate types
$< 150 \times 10^{-4}$ ..... p.e.t.p. ^{4} types
Insulation resistance at 20°C for C≤0.33μF R>30,000 MΩ
for C>0.47μF RC>10 000 MΩμF

Metallised film capacitors

*p.e.t.p.

book 3 part 1

352 Series 250V d.c. working (U_R)

Style A	Style B		Dimensions in millimetres					
Code No.	Code No.	Capacitance						
352 44 . . . 20%	352 47 . . . 20%							
352 45 . . . 10%	352 48 . . . 10%	(μF)	L	H	T	d	ℓ	S
. . 472	. . 472	0.0047	12.5	12.5	4.5	0.6	13	10.2 (0.4 in)
. . 682	. . 682	0.0068	12.5	12.5	4.5	0.6	13	10.2 (0.4 in)
. . 103	. . 103	0.010	12.5	12.0	4.0	0.6	13	10.2 (0.4 in)
. . 153	. . 153	0.015	12.5	12.0	4.0	0.6	13	10.2 (0.4 in)
. . 223	. . 223	0.022	12.5	12.0	4.0	0.6	13	10.2 (0.4 in)
. . 333	. . 333	0.033	12.5	12.0	4.0	0.6	13	10.2 (0.4 in)
. . 473	. . 473	0.047	12.5	12.0	4.0	0.6	13	10.2 (0.4 in)
. . 683	. . 683	0.068	12.5	12.5	4.5	0.6	13	10.2 (0.4 in)
. . 104	. . 104	0.10	12.5	13.0	5.0	0.6	13	10.2 (0.4 in)
. . 154	. . 154	0.15	17.5	15.0	6.0	0.8	13	15.3 (0.6 in)
. . 224	. . 224	0.22	17.5	16.0	7.0	0.8	13	15.3 (0.6 in)
45334	48334	0.33	22.5	15.5	6.5	0.8	21	20.3 (0.8 in)
45474	48474	0.47	22.5	16.5	7.5	0.8	21	20.3 (0.8 in)
45684	48684	0.68	22.5	18.0	9.0	0.8	21	20.3 (0.8 in)
45105	48105	1.0	30.0	18.0	9.0	0.8	19	27.9 (1.1 in)
45155	48155	1.5	30.0	21.5	9.5	0.8	19	27.9 (1.1 in)
45225	48225	2.2	30.0	23.5	11.5	0.8	19	27.9 (1.1 in)

*Polyethylene terephthalate

352 Series 400V d.c. working (U_R)

Style A	Style B		Dimensions in millimetres					
Code No.	Code No.	Capacitance						
352 54 . . . 20%	352 57 . . . 20%							
352 55 . . . 10%	352 58 . . . 10%	(μF)	L	H	T	d	ℓ	S
. . 103	. . 103	0.010	12.5	12.5	4.5	0.6	13	10.2 (0.4 in)
. . 153	. . 153	0.015	12.5	12.5	4.5	0.6	13	10.2 (0.4 in)
. . 223	. . 223	0.022	12.5	12.5	4.5	0.6	13	10.2 (0.4 in)
. . 333	. . 333	0.033	12.5	13.5	5.5	0.6	13	10.2 (0.4 in)
. . 473	. . 473	0.047	12.5	14.5	6.5	0.6	13	10.2 (0.4 in)
. . 683	. . 683	0.068	17.5	15.0	6.0	0.8	13	15.3 (0.6 in)
. . 104	. . 104	0.10	17.5	16.0	7.0	0.8	13	15.3 (0.6 in)
. . 154	. . 154	0.15	22.5	15.5	6.5	0.8	21	20.3 (0.8 in)
. . 224	. . 224	0.22	22.5	16.5	7.5	0.8	21	20.3 (0.8 in)
55334	58334	0.33	22.5	18.5	9.5	0.8	21	20.3 (0.8 in)
55474	58474	0.47	30.0	18.5	9.5	0.8	19	27.9 (1.1 in)
55684	58684	0.68	30.0	22.0	10.0	0.8	19	27.9 (1.1 in)
55105	58105	1.0	30.0	24.0	12.0	0.8	19	27.9 (1.1 in)

Each capacitor has a five band colour code.
Bands 1, 2 & 3 denote capacitance value.

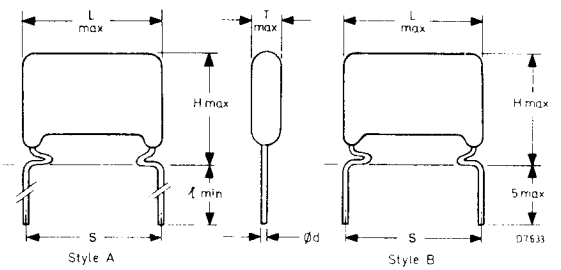
Band 4 denotes tolerance. White ± 10% Black ± 20%
Band 5 denotes working voltage: Red 250V Yellow 400V

Colour code reads from the top of the component

Losses (at 10kHz) $\tan\delta < 150 \times 10^{-4}$
Insulation resistance at 20°C for C ≤ 0.33 μF R > 30 000 MΩ
for C ≥ 0.47 μF RC > 10 000 MΩ μF
Temperature range −40 to + 85°C at rated voltage U_R
+85 to + 100°C at 0.8 U_R

352 Series

*Polyethylene terephthalate



Metallised film capacitors

*p.e.t.p. (cont.)

book 3 part 1

358 Series 100V d.c. working (U_R) – Flame retardant series

Type No.	Capacitance µF	Dimensions mm S	L	T	H	d
358 13104	0.10	10.6	13.5	6.5	13.5	0.6
358 13154	0.15	10.6	13.5	6.5	14.0	0.6
358 13224	0.22	10.6	13.5	7.0	15.0	0.6
358 13334	0.33	15.4	17.5	7.0	16.0	0.8
358 13474	0.47	15.4	17.5	8.0	17.0	0.8
358 13684	0.68	20.32	24.5	7.5	16.5	0.8
358 13105	1.0	20.32	24.5	8.5	17.0	0.8

*p.e.t.p.

Capacitance tolerance ±10%
Losses (at 10kHz) $\tan\delta < 150 \times 10^{-4}$
Insulation resistance (100V) at 20°C for $C \leq 0.33\mu F$ $R > 15\,000\ M\Omega$; for $C \geq 0.47\mu F$ $RC > 5\,000\ M\Omega\mu F$
Temperature range −40 to +85°C at rated voltage U_R; +85 to +100°C at $0.8\ U_R$

358 Series 250V d.c. working (U_R) – Flame retardant series

Type No.	Capacitance µF	Dimensions mm S	L	T	H	d
358 16103	0.01	10.2	13.5	6.5	13.5	0.6
358 16153	0.015	10.2	13.5	6.5	13.5	0.6
358 16223	0.022	10.2	13.5	6.5	13.5	0.6
358 16333	0.033	10.2	13.5	6.5	13.5	0.6
358 16473	0.047	10.2	13.5	6.5	13.5	0.6
358 16683	0.068	10.2	13.5	6.5	14.5	0.6
358 16104	0.1	10.2	13.5	7.5	15.5	0.6
358 16154	0.15	15.3	17.5	7.5	16.5	0.8
358 16224	0.22	15.3	17.5	8.5	17.5	0.8
358 16334	0.33	20.3	24.5	8.0	17.0	0.8
358 16474	0.47	20.3	24.5	9.0	18.0	0.8

*Polyethylene terephthalate

Metallised film Capacitors

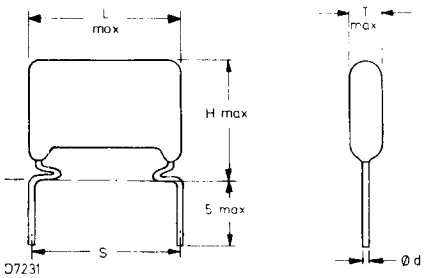
*p.e.t.p. (cont.)

book 3 part 1

358 Series 400V d.c. working (U_R) —Flame retardant series

Type No.	Capacitance µF	Dimensions mm S	L	T	H	d
358 20103	0.010	10.16	13.5	6.5	13.5	0.6
358 20153	0.015	10.16	13.5	6.5	13.5	0.6
358 20223	0.022	10.16	13.5	6.5	13.5	0.6
358 20333	0.033	10.16	13,5	6.5	14.5	0.6
358 20473	0.047	10.16	13.5	7.5	15,5	0.6
358 20683	0.068	15.24	17.5	7.5	16.5	0.8
358 20104	0.10	15.24	17.5	8.5	17.5	0.8
358 20154	0.15	20.32	24.5	8.0	17.5	0.8
358 20224	0.22	20.32	24.5	9.0	18.0	0.8

358 Series



Capacitance tolerance ±20%

Losses (at 10kHz) $\tan\delta < 150 \times 10^{-4}$

Insulation resistance at 20°C for C≤0.33µF R>30 000 MΩ

(250V & 400V) for C≥0.47µF RC>10 000 MΩµF

Temperature range -40 to +85°C at rated voltage U_R

+85 to +100°C at 0.8U_R

Each capacitor has a five band colour code
Bands 1, 2 & 3 denote the capacitance value
Band 4 denotes tolerance: White ±10% Black ±20%
Band 5 denotes working voltage: Brown 100V Red 250V Yellow 400V
Colour code reads from the top of the component

*Polythylene terephthalate

Metallised film capacitors

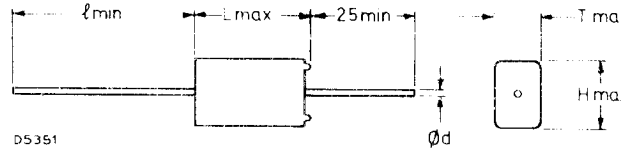
*p.e.t.p. and paper dual dielectric book 3 part 1

Axial Leads

330 0 Series interference suppression capacitors 250V a.c. wkg (Class X)

Type No.	Capacitance (μF)	Dimensions mm T	L	H	d
330 00103	0.01	6.5	18	10.4	0.8
330 00153	0.015	6.5	18	10.4	0.8
330 00223	0.022	6.5	18	10.4	0.8
330 00333	0.033	6.5	18	10.4	0.8
330 00473	0.047	6.5	18	10.4	0.8
330 00683	0.068	7.6	18	11.5	0.8
330 00104	0.1	7.4	23.5	11.5	0.8
330 00154	0.15	8.7	23.5	12.8	0.8
330 00224	0.22	10.5	23.5	14.7	1.0
***330 90008**	0.33	10.5	31.1	14.7	1.0
***330 90001**	0.47	12.5	31.1	19.6	1.0

* Commercial grade components rated at 275V a.c. (rms).
The other types are to VDE approval No. 0560 7.
All capacitors are intended for operation directly across the incoming mains supply.



Radial Leads

330 4 Series interference suppression capacitors 250V a.c. wkg (Class X)

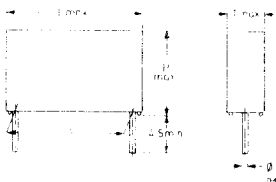
Type No.	Capacitance (μF)	Dimensions mm T	L	H	d
330 40103	0.01	5	17.5	11	0.8
330 40153	0.015	5	17.5	11	0.8
330 40223	0.022	5	17.5	11	0.8
330 40333	0.033	5	17.5	11	0.8
330 40473	0.047	6	17.5	11.5	0.8
330 40683	0.068	7	17.5	13	0.8
330 40104	0.10	8.5	17.5	14.5	0.8
330 40154	0.15	6.5	26	15.5	22.5
330 40224	0.22	7.5	26	16.5	22.5
330 40334	0.33	9.5	26	19	22.5

*Polyethylene terephthalate

These capacitors are to VDE approval No. 0560 7 and are intended for operation directly across the incoming mains supply.

See 660 series for Class 'Y' capacitors.

330 Series



Film/foil capacitors (extended foil)

miniature, polystyrene

424 Series 63V d.c. working

Type No.		Capacitance	Dimensions mm			Type No.		Capacitance	Dimensions mm		
± 1%	± 5%	pF	L	D	ℓ	± 1%	± 5%	pF	L	D	ℓ
424 49102	–	9 100	15	5.0	25.5	**424 42003**	–	20 000	15	6.0	25.5
424 41003	–	10 000	15	5.0	25.5	**424 42203**	–	22 000	15	6.5	25.5
424 41103	–	11 000	15	5.5	25.5	**424 42403**	–	24 000	15	6.5	25.5
424 41203	–	12 000	15	5.5	25.5	**424 42703**	–	27 000	15	7.0	25.5
424 41303	–	13 000	15	5.5	25.5	**424 43003**	–	30 000	15	7.0	25.5
424 41503	–	15 000	15	5.5	25.5	**424 43303**	–	33 000	15	7.5	25.5
424 41603	–	16 000	15	6.0	25.5	**424 43603**	–	36 000	15	7.5	25.5
424 41803	–	18 000	15	6.0	25.5	**424 43903**	–	39 000	15	8.0	25.5

425 Series 160V d.c. working

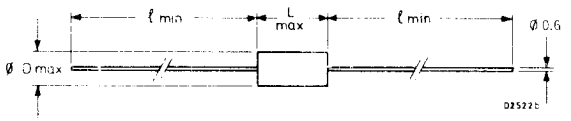
425 48201	**425 28201**	820	10.9	3.5	28	**425 43002**	**425 23002**	3 000	10.9	5.0	28
425 49101	**425 29101**	910	10.9	3.5	28	**425 43302**	**425 23302**	3 300	10.9	5.0	28
425 41002	**425 21002**	1 000	10.9	3.5	28	**425 43602**	**425 23602**	3 600	10.9	5.0	28
425 41102	**425 21102**	1 100	10.9	3.5	28	**425 43902**	**425 23902**	3 900	10.9	5.0	28
425 41202	**425 21202**	1 200	10.9	4.0	28	**425 44302**	**425 24302**	4 300	15	5.0	25.5
425 41302	**425 21302**	1 300	10.9	4.0	28	**425 44702**	**425 24702**	4 700	15	5.0	25.5
425 41502	**425 21502**	1 500	10.9	4.0	28	**425 45102**	**425 25102**	5 100	15	5.0	25.5
425 41602	**425 21602**	1 600	10.9	4.0	28	**425 45602**	**425 25602**	5 600	15	5.0	25.5
425 41802	**425 21802**	1 800	10.9	4.5	28	**425 46202**	**425 26202**	6 200	15	5.0	25.5
425 42002	**425 22002**	2 000	10.9	4.5	28	**425 46802**	**425 26802**	6 800	15	5.5	25.5
425 42202	**425 22202**	2 200	10.9	4.5	28	**425 47502**	**425 47502**	7 500	15	5.5	25.5
425 42402	**425 22402**	2 400	10.9	4.5	28	**425 48202**	**425 28202**	8 200	15	6.0	25.5
425 42702	**425 22702**	2 700	10.9	4.5	28						

427 Series 630V d.c. working

427 41001	**427 21001**	100	10.9	3.5	28	**427 43001**	**427 23001**	300	10.9	3.5	28
427 41101	**427 21101**	110	10.9	3.5	28	**427 43301**	**427 23301**	330	10.9	3.5	28
427 41201	**427 21201**	120	10.9	3.5	28	**427 43601**	**427 23601**	360	10.9	3.5	28
427 41301	**427 21301**	130	10.9	3.5	28	**427 43901**	**427 23901**	390	10.9	4.0	28
427 41501	**427 21501**	150	10.9	3.5	28	**427 44301**	**427 24301**	430	10.9	4.0	28
427 41601	**427 21601**	160	10.9	3.5	28	**427 44701**	**427 24701**	470	10.9	4.0	28
427 41801	**427 21801**	180	10.9	3.5	28	**427 45101**	**427 25101**	510	10.9	4.0	28
427 42001	**427 22001**	200	10.9	3.5	28	**427 45601**	**427 25601**	560	10.9	4.0	28
427 42201	**427 22201**	220	10.9	3.5	28	**427 46201**	**427 26201**	620	10.9	4.5	28
427 42401	**427 22401**	240	10.9	3.5	28	**427 46801**	**427 26801**	680	10.9	4.5	28
427 42701	**427 22701**	270	10.9	3.5	28	**427 47501**	**427 27501**	750	10.9	5.0	28

The 424, 425, and 427 Series can be supplied in bandoliers to facilitate automatic handling by either crop & form processing or fully automatic insertion. Full details of the bandoliering specification, type numbers and drum quantities can be obtained from Mullard Ltd.

424, 425, 427 Series



Capacitance tolerance ±1% or ± 5%

Losses (at 10kHz) $C > 20{,}000$ pF $\tan\delta \leqslant 5 \times 10^{-4}$

(at 100kHz) $C \leqslant 20{,}000$pF, $C > 1000$pF $\tan\delta \leqslant 5 \times 10^{-4}$

(at 1MHz) $C \leqslant 1000$pF $\tan\delta \leqslant 10 \times 10^{-4}$

Insulation resistance at 20°C $> 10^5$ MΩ

Temperature range 63V −40 to +70°C

160V −40 to +85°C

630V −40 to +85°C

Film/foil capacitors (extended foil)

*p.e.t.p.

book 3 part 1

C296AA (311) Series 160V d.c. working (U_R)

Type No.	Code No.	Capacitance µF	Dimensions mm D	L	Type No.	Code No.	Capacitance µF	Dimensions mm D	L
C296AA/A10K	311 31103	0.01	7.5	21	**C296AA/A150K**	311 31154	0.15	12	21
C296AA/A15K	311 31153	0.015	7.5	21	**C296AA/A220K**	311 31224	0.22	10	35
C296AA/A22K	311 31223	0.022	7.5	21	**C296AA/A330K**	311 31334	0.33	12	35
C296AA/A33K	311 31333	0.033	7.5	21	**C296AA/A470K**	311 31474	0.47	14	35
C296AA/A47K	311 31473	0.047	8	21	**C296AA/A680K**	311 31684	0.68	16	35
C296AA/A68K	311 31683	0.068	9	21	**C296AA/A1M**	311 31105	1	18.5	35
C296AA/A100K	311 31104	0.1	10.5	21					

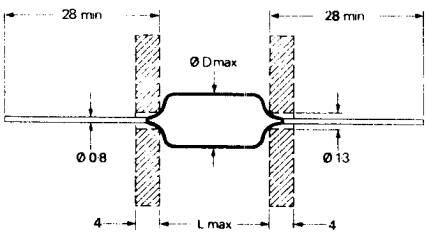
C296AC (311) Series 400V d.c. working (U_R)

C296AC/A1K	311 51102	0.001	7.5	21	**C296AC/A33K**	311 51333	0.033	10	21
C296AC/A1K5	311 51152	0.0015	7.5	21	**C296AC/A47K**	311 51473	0.047	11.5	21
C296AC/A2K2	311 51222	0.0022	7.5	21	**C296AC/A68K**	311 51683	0.068	9.5	35
C296AC/A3K3	311 51332	0.0033	7.5	21	**C296AC/A100K**	311 51104	0.1	11	35
C296AC/A4K7	311 51472	0.0047	7.5	21	**C296AC/A150K**	311 51154	0.15	12.5	35
C296AC/A6K8	311 51682	0.0068	7.5	21	**C296AC/A220K**	311 51224	0.22	14.5	35
C296AC/A10K	311 51103	0.01	7.5	21	**C296AC/A330K**	311 51334	0.33	17	35
C296AC/A15K	311 51153	0.015	7.5	21	**C296AC/A470K**	311 51474	0.47	19.5	35
C296AC/A22K	311 51223	0.022	8.5	21					

*Polyethylene terephthalate

Capacitance tolerance	±10%
Losses (at 1kHz)	$\tan\delta < 60 \times 10^{-4}$
Insulation resistance at 20°C	for C ≤0.33 µF R>50 000 MΩ for C >0.33 µF RC >16 500MΩµF
Temperature range	−40 to +85°C

C296 (311) Series



Film/foil capacitors (extended foil)

*p.e.t.p.

book 3 part 1

347 2 Series 100V d.c. working (U_R)

Type No.	Capacitance nF	Dimensions mm S	L	T	H	d
347 21104	100	15.2	19	7	15.5	0.8
347 21154	150	15.2	19	8	16.5	0.8

347 4 Series 250V d.c. working (U_R)

347 41103	10	10.2	13.5	5	12.5	0.6
347 41153	15	10.2	13.5	6	13.5	0.6
347 41223	22	10.2	13.5	6.5	14	0.6
347 41333	33	15.2	19	5.5	14	0.8
347 41473	47	15.2	19	6.5	15	0.8
347 41683	68	15.2	19	7.5	16	0.8
347 41104	100	22.9	27	6.5	18	0.8
347 41154	150	22.9	27	8	19.5	0.8
347 41224	220	22.9	27	9.5	21	0.8
347 41334	330	27.9	32	10	21.5	0.8
347 41474	470	27.9	32	12	23.5	0.8
347 41684	680	27.9	32	15	26.5	0.8

347 5 Series 400V d.c. working (U_R)

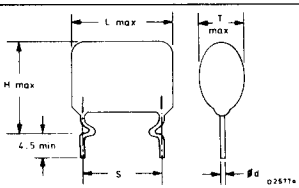
347 51472	4.7	10.2	13.5	4.5	12	0.6
347 51682	6.8	10.2	13.5	5.5	13	0.6

347 6 Series 630V d.c. working (U_R)

347 61222	2.2	10.2	13.5	4.5	12	0.6
347 61332	3.3	10.2	13.5	5.5	13	0.6

*Polyethylene terephthalate

347 Series



Capacitance tolerance	±10%
Losses (at 10kHz)	tan δ $\leqslant 110 \times 10^{-4}$
(at 1kHz)	tan δ $\leqslant 60 \times 10^{-4}$
Insulation resistance at 20°C	for C $\leqslant$ 330 nF R $>$ 50 000M Ω
	for C $>$ 330 nF RC $>$ 16 500s
Temperature range	- 40 to + 85°C at rated voltage U_R
	+85 to + 100°C at 0.8U_R

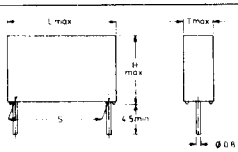
polypropylene

357 Series 250V d.c. working (U_R)

Type No.	Capacitance nF	Dimensions mm S	L	T	H
357 51473	47	15.2	21.5	8	15
357 51104	100	22.9	29	8.5	18.5
357 51224	220	27.9	34	10	20
357 51334	330	27.9	34	12	27

Type No.	Capacitance nF	Dimensions mm S	L	T	H
357 51474	470	27.9	34	15	25
357 51564	560	27.9	34	15	25
357 51684	680	27.9	34	18	28

357 Series



Capacitance tolerance	±10%
Losses (at 10kHz)	tan δ $< 5 \times 10^{-4}$
Insulation resistance at 20°C	for C $\leqslant$ 0.1μF R $>$ 50,000 M Ω
	for C $>$ 0.1μF RC $>$ 5 000s
Temperature range	40 to + 85°C
630V Series 0.047 μF to 0.33 μF inclusive	} are available upon request
1000V Series 0.033 μF to 0.22 μF inclusive	
1500V Series 0.022 μF to 0.15 μF inclusive	

Ceramic capacitors

miniature, plate (high-K)

book 3 part 1

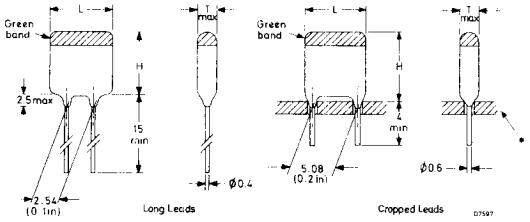
629 Series 63V d.c. working (long lead version)

Type No.	Capacitance nF	Dimensions mm L max.	T max.	H max.
629 02102	1	3.5	2.1	4.5
629 02222	2.2	3.5	2.1	4.5
629 02472	4.7	3.5	2.1	4.5
629 02103	10	4.5	2.1	5.5
629 02223	22	6.5	2.1	7.5

629 Series 63V d.c. working (cropped lead version)

Type No.	Capacitance nF	Dimensions mm L max.	T max.	H max.
629 06102	1	6.5	2.1	6
629 06222	2.2	6.5	2.1	6
629 06472	4.7	6.5	2.1	6
629 06103	10	6.5	2.1	7
629 06223	22	6.5	2.1	9

629 Series



Capacitance tolerance — 20 to + 80%
Insulation resistance at 20°C >1000 M Ω
Temperature range −10 to + 50°C

miniature, plate (medium-K)

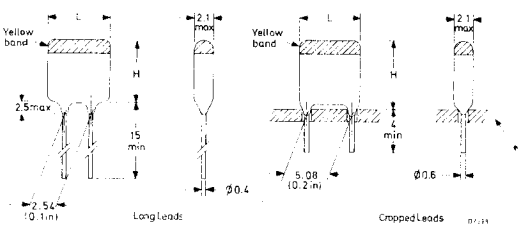
630 Series 100V d.c. working (long lead version)

Type No.	Capacitance pF	Dimensions mm L max.	T max.	H max.
630 02391	390	3.5	2.1	4.5
630 02471	470	3.5	2.1	4.5
630 02561	560	3.5	2.1	4.5
630 02681	680	3.5	2.1	4.5
630 02821	820	3.5	2.1	4.5
630 02102	1000	4.5	2.1	5.5
630 02122	1200	4.5	2.1	5.5
630 02152	1500	4.5	2.1	5.5
630 02182	1800	4.5	2.1	5.5
630 02222	2200	5.5	2.1	6.5
630 02272	2700	5.5	2.1	6.5
630 02332	3300	6.5	2.1	7.5
630 02392	3900	6.5	2.1	7.5
630 02472	4700	6.5	2.1	7.5

630 Series 100V d.c. working (cropped lead version)

Type No.	Capacitance pF	Dimensions mm L max.	T max.	H max.
630 06391	390	6.5	2.1	6
630 06471	470	6.5	2.1	6
630 06561	560	6.5	2.1	6
630 06681	680	6.5	2.1	6
630 06821	820	6.5	2.1	6
630 06102	1000	6.5	2.1	7
630 06122	1200	6.5	2.1	7
630 06152	1500	6.5	2.1	7
630 06182	1800	6.5	2.1	7
630 06222	2200	6.5	2.1	7.5
630 06272	2700	6.5	2.1	7.5
630 06332	3300	6.5	2.1	9
630 06392	3900	6.5	2.1	9
630 06472	4700	6.5	2.1	9

630 Series



Capacitance tolerance ± 10%
Insulation resistance at 20°C R>1000 M Ω
Temperature range − 55 to + 85°C

Ceramic capacitors

miniature, plate (low-K) book 3 part 1

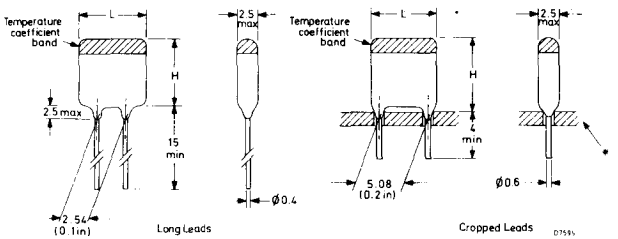
632 Series 100V d.c. working (long lead version)

Type No.	Capacitance pF	Dimensions mm L max.	T max.	H max.
632 09188	1.8	3.5	2.5	4.5
632 09228	2.2	3.5	2.5	4.5
632 09278	2.7	3.5	2.5	4.5
632 09338	3.3	3.5	2.5	4.5
632 09398	3.9	3.5	2.5	4.5
632 09478	4.7	3.5	2.5	4.5
632 09568	5.6	3.5	2.5	4.5
632 09688	6.8	3.5	2.5	4.5
632 09828	8.2	3.5	2.5	4.5
632 10109	10	3.5	2.5	4.5
632 10129	12	3.5	2.5	4.5
632 10159	15	3.5	2.5	4.5
632 10189	18	3.5	2.5	4.5
632 34229	22	3.5	2.5	4.5
632 34279	27	4.5	2.5	5.5
632 34339	33	4.5	2.5	5.5
632 34399	39	4.5	2.5	5.5
632 34479	47	4.5	2.5	5.5
632 34569	56	5.5	2.5	6.5
632 34889	68	5.5	2.5	6.5
632 34829	82	6.5	2.5	7.5
632 34101	100	6.5	2.5	7.5
632 34121	120	6.5	2.5	10.5
632 34151	150	6.5	2.5	10.5
632 58181	180	6.5	2.5	7.5
632 58221	220	6.5	2.5	7.5
632 58271	270	6.5	2.5	10.5
632 58331	330	6.5	2.5	10.5

642 Series 100V d.c. working (cropped lead version)

Type No.	Capacitance pF	Dimensions mm L max.	T max.	H max.
642 09188	1.8	6.5	2.5	6.0
642 09228	2.2	6.5	2.5	6.0
642 09278	2.7	6.5	2.5	6.0
642 09338	3.3	6.5	2.5	6.0
642 09398	3.9	6.5	2.5	6.0
642 09478	4.7	6.5	2.5	6.0
642 09568	5.6	6.5	2.5	6.0
642 09688	6.8	6.5	2.5	6.0
642 09828	8.2	6.5	2.5	6.0
642 10109	10	6.5	2.5	6.0
642 10129	12	6.5	2.5	6.0
642 10159	15	6.5	2.5	6.0
642 10189	18	6.5	2.5	6.0
642 34229	22	6.5	2.5	6.0
642 34279	27	6.5	2.5	7.0
642 34339	33	6.5	2.5	7.0
642 34399	39	6.5	2.5	7.0
642 34479	47	6.5	2.5	7.0
642 34569	56	6.5	2.5	8.0
642 34689	68	6.5	2.5	8.0
642 34829	82	6.5	2.5	9.0
642 34101	100	6.5	2.5	9.0
642 34121	120	6.5	2.5	12.0
642 34151	150	6.5	2.5	12.0
642 58181	180	6.5	2.5	9.0
642 58221	220	6.5	2.5	9.0
642 58271	270	6.5	2.5	12.0
642 58331	330	6.5	2.5	12.0

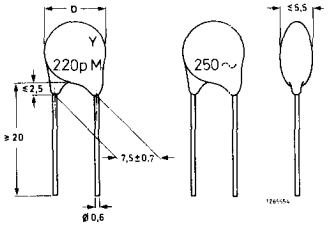
632,642 Series



Capacitance tolerance	1.8 to 8.2 pF ± 0.25 pF 10 to 330 pF ± 2%
Insulation resistance at 20°C	R > 10 000 MΩ
Temperature range	−55 to +85°C
Temperature coefficient	1.8 to 18 pF = NPO 22 to 150 pF = N150 180 to 330 pF = N750
T.C. bands —	NPD = Black N150 = Orange N750 = Violet

660 Series 250V a.c. working (Class 'Y')

Type No.	Capacitance (nF)	Dimension D mm
660 01102	1.0	10
660 01222	2.2	11



These capacitors are to VDE approval No. 0560 - 7 and are intended for use as interference suppression capacitors in home appliances.

See 330 Series for class 'X' capacitors

Electrolytic capacitors

general purpose, miniature and small

book 3 part 1

015, 016, 017 Series – axial version

Type No.	Rated voltage (U_R) (Vdc)	Capacitance µF	Can size
015 12479	4	47	2
015 12101	4	100	3
016 12221	4	220	4
016 12331	4	330	5
017 12102	4	1000	00
017 12472	4	4700	03
015 13339	6.3	33	2
015 13689	6.3	68	3
016 13151	6.3	150	4
016 13471	6.3	470	6
017 13681	6.3	680	00
017 13152	6.3	1500	01
017 13222	6.3	2200	02
017 13332	6.3	3300	03
015 14229	10	22	2
015 14479	10	47	3
016 14101	10	100	4
016 14221	10	220	5
016 14331	10	330	6
017 14471	10	470	00
017 14102	10	1000	01
017 14152	10	1500	02
017 14222	10	2200	03
015 15159	16	15	2
015 15339	16	33	3
016 15689	16	68	4
016 15151	16	150	5
016 15221	16	220	6
017 15331	16	330	00
017 15681	16	680	01
017 15102	16	1000	02
017 15152	16	1500	03

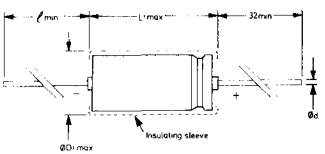
Type No.	Rated voltage (U_R) (Vdc)	Capacitance µF	Can size
015 16109	25	10	2
015 16229	25	22	3
016 16479	25	47	4
016 16101	25	100	5
016 16151	25	150	6
017 16221	25	220	00
017 16471	25	470	01
017 16681	25	680	02
017 16102	25	1000	03
015 17688	40	6.8	2
015 17159	40	15	3
016 17339	40	33	4
016 17479	40	47	5
016 17101	40	100	6
017 17151	40	150	00
017 17221	40	220	01
017 17471	40	470	02
017 17681	40	680	03
015 18108	63	1	3
015 90001	63	1.5	3
015 18228	63	2.2	3
015 18338	63	3.3	3
015 90003	63	4.7	3
015 18688	63	6.8	3
016 18109	63	10	4
016 18159	63	15	4
016 18229	63	22	5
016 18479	63	47	6
017 18689	63	68	00
017 18101	63	100	01
017 18151	63	150	01
017 18221	63	220	02
017 18331	63	330	03

Capacitors in the 015 Series are available with BS approval. Orders for these types must quote 'BS9078 F003' and the relevant 8 digit code number

The 015 and 016 Series can be supplied in bandoliers to facilitate automatic handling by either crop and form processing or by fully automatic insertion. Full details of the bandoliering specification, type numbers and drum quantities can be obtained from Mullard.

Capacitance tolerance	−10 to + 50%
Temperature range	
015 Series	−25 to + 85°C
016,017 Series	−40 to + 85°C

015, 016, 017 Series (axial leads version)



Dimensions mm

Can size	L_1	D_1	ℓ	d
2	12.5	4.8	32	0.6
3	12.5	6.1	32	0.6
4	18.5	6.7	32	0.8
5	18.5	8.3	32	0.8
6	18.5	10.3	32	0.8
00	30.5	10.4	54	0.8
01	30.5	12.9	54	0.8
02	30.5	15.4	54	0.8
03	30.5	18.4	54	0.8

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.

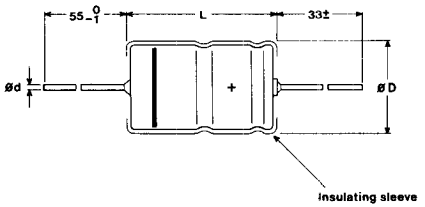
Electrolytic capacitors

general purpose, small

book 3 part 1

032 Series

Type No.	Rated voltage (U_R) (V dc)	Capacitance (μF)	Can size	I_R max. at 100 Hz and 85°C (mA)
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
032 14102	10	1000	00	430
032 14152	10	1500	01	570
032 14222	10	2200	02	740
032 14332	10	3300	03	950
032 15681	16	680	00	400
032 15102	16	1000	01	550
032 15152	16	1500	02	680
032 15222	16	2200	03	880
032 16471	25	470	00	360
032 16681	25	680	01	500
032 16102	25	1000	02	660
032 16152	25	1500	03	810
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
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



Case size	D max	L max	d
00	10.5	30.5	0.8
01	13.0	30.5	0.8
02	15.5	30.5	0.8
03	18.5	30.5	0.8

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

general purpose, large

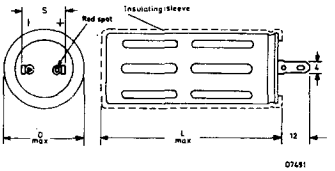
071 Series (to I.E.C. 384 - 4, long life)

Type No.	Rated voltage (U_R)	Capacitance	Can size	I_R max. at 100Hz (A)		
	Vdc	μF		at 50°C	at 70°C	at 85°C
071 13103	6.3	10 000	6	4.0	3.1	1.8
071 13153	6.3	15 000	7	6.1	4.8	2.7
071 13223	6.3	22 000	8	8.3	6.4	3.7
071 13333	6.3	33 000	9	11.0	8.5	4.9
071 13473	6.3	47 000	10	14.2	11.0	6.3
071 14472	10	4 700	5	2.5	1.9	1.1
071 14682	10	6 800	6	4.0	3.1	1.8
071 14103	10	10 000	7	6.0	4.6	2.7
071 14153	10	15 000	8	8.2	6.3	3.7
071 14223	10	22 000	9	10.6	8.3	4.8
071 14333	10	33 000	10	13.4	10.4	6.0
071 15332	16	3 300	5	2.4	1.9	1.1
071 15472	16	4 700	6	3.9	3.0	1.7
071 15682	16	6 800	7	5.8	4.5	2.6
071 15103	16	10 000	8	7.9	6.1	3.5
071 15153	16	15 000	9	10.5	7.6	4.7
071 15223	16	22 000	10	13.8	10.6	6.1
071 16222	25	2 200	5	2.2	1.7	1.0
071 16332	25	3 300	6	3.7	2.8	1.7
071 16472	25	4 700	7	5.4	4.2	2.4
071 16682	25	6 800	8	7.3	5.6	3.3
071 16103	25	10 000	9	9.6	7.4	4.3
071 16153	25	15 000	10	12.6	9.8	5.7
071 17102	40	1 000	5	2.1	1.6	1.0
071 17222	40	2 200	6	2.9	2.2	1.3
071 17332	40	3 300	7	5.2	4.1	2.4
071 17472	40	4 700	8	7.0	5.4	3.1
071 17682	40	6 800	9	9.1	7.1	4.1
071 17103	40	10 000	10	12.0	8.7	5.3
071 18681	63	680	5	2.1	1.4	0.8
071 18102	63	1 000	6	2.9	2.2	1.3
071 18152	63	1 500	7	4.3	3.4	2.0
071 18222	63	2 200	8	5.8	4.5	2.6
071 18332	63	3 300	9	7.8	6.0	3.5
071 18472	63	4 700	10	10.0	7.8	4.5

Approved to Post Office D2186

Capacitance tolerance −10 to + 50%
Temperature range − 40 to + 85°C

071 Series



Dimensions mm

Can size	L	D	S	Clips
5	51.3	21.6	13	B127121
6	51.3	25.6	13	B127122
7	81.3	25.6	13	B127122
8	81.3	30.6	19	DT2402
9	81.3	35.6	19	B127124
10	81.3	40.6	19	B127125

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, high voltage

book 3 part 1

105 Series (to I.E.C. 384 – 4, long life)

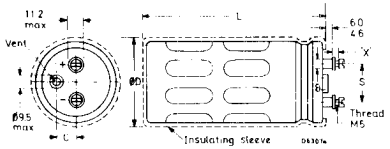
Type No.	Rated voltage (U_R)	Capacitance		I_R max. at 100Hz
	V_{dc}	μF		(A) at 60°C
105 16221	400	220	11	1.8
105 16331	400	330	12	2.5
105 16471	400	470	14	3.1
105 16681	400	680	15	4.4
105 16102	400	1000	16	6.2

105 Series

Capacitance tolerance **−10 to + 50%**

Temperature range **−25 to + 60°C** at rated voltage U_R

+ 60 to + 85°C at 0.94 U_R



Dimensions mm

Can size	L	D	S	C	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

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

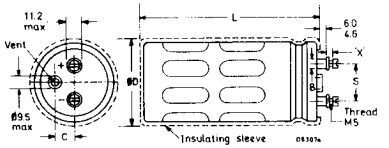
long life, large (computer) book 3 part 1

106, 107 Series (to I.E.C. 384 – 4 long life)

Type No.	Rated voltage (U_R) Vdc	Capacitance µF	Can size	I_R max. at 100Hz (A) at 85°C
106 33223	6.3	22 000	11	5.0
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

106, 107 Series

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



Dimensions mm

Can size	L	D	S	C	Clips
11	83	36.5	15	8.4	DT2401
12	115	36.5	15	8.4	DT2401
14	83	51.5	22	14.3	DT2254
15	115	51.5	22	14.3	DT2254
16	115	66.5	31	19.0	DT2400

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

book 3 part 1

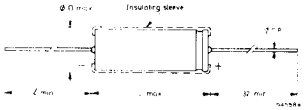
108 Series (to I.E.C. 384 – 4 long life)5

Type No.	Rated voltage (U_R) Vdc	Capacitance µF	Can size	Ir max. at 100Hz (mA) at 85°C
108 13151	6.3	150	5	130
108 13331	6.3	330	6	220
108 13471	6.3	470	00	325
108 13102	6.3	1000	01	470
108 13152	6.3	1500	02	630
108 13222	6.3	2200	03	920
108 14101	10	100	5	120
108 14221	10	220	6	205
108 14331	10	330	00	325
108 14681	10	680	01	470
108 14102	10	1000	02	630
108 14152	10	1500	03	920
108 15689	16	68	5	110
108 15151	16	150	6	190
108 15221	16	220	00	270
108 15471	16	470	01	360
108 15681	16	680	02	500
108 15102	16	1000	03	650
108 16339	25	33	5	85
108 16479	25	47	5	100
108 16101	25	100	6	170
108 16151	25	150	00	270
108 16221	25	220	01	360
108 16471	25	470	02	500
108 16681	25	680	03	650
108 17229	40	22	5	80
108 17479	40	47	6	130
108 17689	40	68	00	195
108 17151	40	150	01	280
108 17221	40	220	02	360
108 17331	40	330	03	495
108 18228	63	2.2	5	25
108 18338	63	3.3	5	30
108 18478	63	4.7	5	35
108 18688	63	6.8	5	45
108 18109	63	10	5	50
108 18159	63	15	6	75
108 18339	63	33	00	125
108 18689	63	68	01	195
108 18101	63	100	02	275
108 18151	63	150	03	355

Approved to Post Office D2186 and Min. of Defence (Naval) DEF5134–1

Capacitance tolerance – 10 to + 50%
Temperature range – 40 to + 85°C

108 Series



Dimensions mm

Can size	L	D	ℓ
5	22.5	8.5	32
6	22.5	10.5	32
00	32.5	10.5	54
01	32.5	13	54
02	32.5	15.5	54
03	32.5	18.5	54

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 electrolyte, aluminium

book 3 part 1

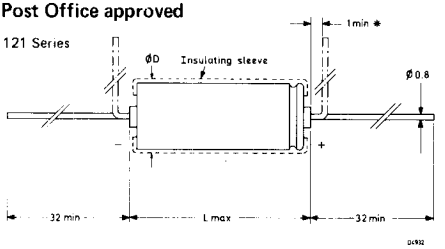
121 Series

Type No.	Rated voltage (U_R) Vdc	Capacitance µF	Can size
121 13229	6.3	22	1
121 13479	6.3	47	2
121 13689	6.3	68	3
121 13151	6.3	150	4
121 13221	6.3	220	5
121 13331	6.3	330	6
121 14159	10	15	1
121 14339	10	33	2
121 14479	10	47	3
121 14101	10	100	4
121 14151	10	150	5
121 14221	10	220	6
121 15109	16	10	1
121 15159	16	15	2
121 15339	16	33	3

Type No.	Rated voltage (U_R) Vdc	Capacitance µF	Can size
121 15479	16	47	4
121 15689	16	68	5
121 15101	16	100	6
121 16478	25	4.7	1
121 16109	25	10	2
121 16229	25	22	3
121 16339	25	33	4
121 16479	25	47	5
121 16689	25	68	6
121 17228	40	2.2	1
121 17478	40	4.7	3
121 17109	40	10	3
121 17229	40	22	4
121 17339	40	33	5
121 17479	40	47	6

Post Office approved

121 Series



Capacitance tolerance ± 20%
Temperature range — 55 to + 85°C at rated voltage (U_R)
- - 55 to + 125°C at 0.63 U_R

Dimensions mm

Can size	L	D	d
1	17.5	6.6	0.8
2	24	6.6	0.8
3	24	8.3	0.8
4	24	10.4	0.8
5	32	10.4	0.8
6	32	12.9	0.8

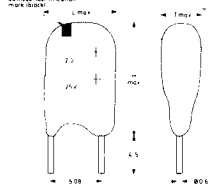
solid electrolyte, aluminium, miniature

122 Series

Type No.	Rated voltage (U_R) Vdc	Capacitance µF	Case size
122 53479	6.3	47	4
122 54109	10	10	2
122 54229	10	22	3
122 56108	25	1	1
122 56228	25	2.2	2
122 56478	25	4.7	3

Type No.	Rated voltage (U_R) Vdc	Capacitance µF	Case size
* **122 57107**	40	0.1	1
* **122 57227**	40	0.22	1
* **122 57477**	40	0.47	2
* **122 57108**	40	1	3

122 Series



Capacitance tolerance —20 to + 40%
Temperature range —55 to + 125 at rated voltage (U_R)
* + 85 to + 125 at 0.63 U_R

Dimensions mm

Case size	L	H	T
1	8	12.5	3.5
2	8	12.5	4.5
3	8	12.5	5
4	8	12.5	6

Variable capacitors

film dielectric trimmers, miniature

808 Series

Type No.	Capacitance swing pF	Minimum capacitance pF	Dimensions mm Length	Width	Height above board
808 11558	4.1	⩽ 1.4	8.8	8	10
808 11109	8	⩽ 2	8.8	8	10
808 11229	20	⩽ 2	8.8	8	10
808 32659	59.5	⩽ 5.5	11.5	10.6	11

Working voltage 250 Vdc
Temperature range − 40 to + 70°C

809 05 Series

Type No.	Capacitance swing pF	Minimum capacitance pF	Dimensions mm Length	Width	Height above board
809 05001	1 to 3.5	⩽1	7.4	6.7	9
809 05002	1.8 to 10	⩽1.8	7.4	6.7	9
809 05003	2 to 18	⩽2	7.4	6.7	9

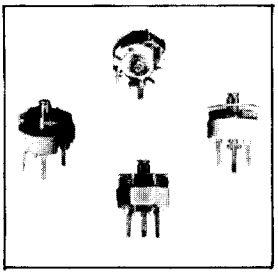
Working voltage 300 Vdc
Temperature range − 40 to + 125°C

809 07 Series

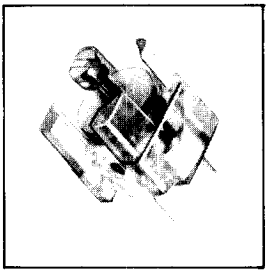
Type No.	Capacitance swing pF	Minimum capacitance pF	Dimensions mm Length	Width	Height above board
809 07008	36	⩽4	14	11.5	9
809 07011	55	⩽5	14	11.5	9
809 07013	74	⩽6	14	11.5	9
809 07015	93	⩽7	14	11.5	9

Working voltage 200 Vdc
Temperature range − 40 to + 125°C

808 Series



809 05 Series



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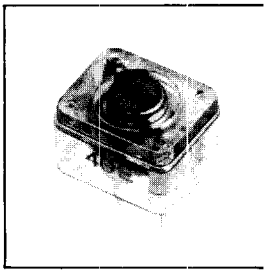


film dielectric trimmers, miniature (cont.)

book 3 part 1

809 08 Series

Type No.	Capacitance swing pF	Minimum capacitance pF	Dimensions mm Length	Width	Height above board
809 08002	36	⩽ 4	10.9	10.5	11
809 08003	55	⩽ 5	10.9	10.5	11

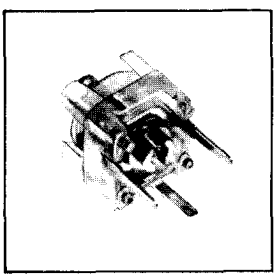
Working voltage 300 Vdc
Temperature range − 40 to + 125°C

809 09 Series

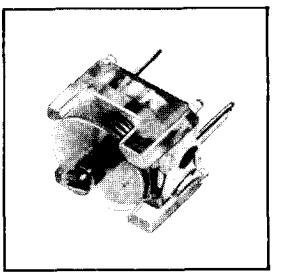
Type No.	Capacitance swing pF	Minimum capacitance pF	Dimensions mm Length	Width	Height above board
809 09001	4.1	⩽ 1.4	8.8	8	10
809 09002	7	⩽ 2	8.8	8	10
809 09003	16	⩽ 2	8.8	8	10

Working voltage 300 Vdc
Temperature range − 40 to + 125°C

809 08 Series



809 09 Series



Linear resistors

lacquered, carbon film

book 3 part 1

Style	Dimensions mm (Fig. 1) D max.	L max.	d	Resistance tolerance	Resistance range	Maximum power dissipation at 70°C W	Preferred value series	Maximum voltage d.c. or rms V
CR16	1.6	4.5	0.4	±5%	10Ω to 220kΩ	0.2	E12	150
				±10%	270kΩ to 1MΩ		E12	150
CR25	2.5	6.8	0.6	±5%	1Ω to 1MΩ	0.33	E24	250
				±10%	1.2MΩ to 10MΩ		E12	250
CR37	3.7	10	0.7	±5%	1Ω to 1MΩ	0.5	E24	350
				±10%	1.2MΩ to 10MΩ		E12	350

On bandoliers (Fig. 2) in boxes of 1000 pieces or (CR25 & 37 only) on drums of 5000 pieces.
Coated with a tan coloured lacquer and colour coded in accordance with BS1852.

lacquered, metal film

Style	Dimensions mm (Fig. 1) D max.	L max.	d	Resistance tolerance	Resistance range	Maximum power dissipation at 70°C W	Preferred value series	Temp. coefficient ppm per°C	Maximum voltage d.c. or rms V
MR25	2.5	6.5	0.6	±1%	4.99Ω to 48.7Ω	0.4	E96	<100	250
				±1%	49.9Ω to 301kΩ		E96	< 50	
				±2%	5.1Ω to 300kΩ		E24	<100	
MR30	3	10	0.6	±1%	4.99Ω to 48.7Ω	0.5	E96	<100	350
				±1%	49.9Ω to 1MΩ		E96	< 50	
				±2%	5.1Ω to 1MΩ		E24	<100	

On bandoliers (Fig. 2) in boxes of 1000 pieces or on drums of 5000 pieces.

Coated with a green coloured lacquer and colour coded in accordance with BS1852.

CECC Approvals.
MR25 & MR30 1% tolerance are approved to CECC 40100–002 and to CECC 40101–00B.
MR25 & MR30 2% tolerance are approved to CECC 40101–009.

metal glaze, high ohmic

Style	Dimensions mm (Fig. 1) D max.	L max.	d	Resistance tolerance	Resistance range	Maximum power dissipation at 70°C W	Preferred value series	Maximum voltage rms V
VR37	3.7	10	0.7	±5%	1MΩ to 33MΩ	0.5	E24	2500
VR68	6.8	18	0.8	±5%	1MΩ to 68MΩ	1.0	E24	7000

On bandoliers (Fig. 2) in boxes of 1000 pieces.
Coated with a blue coloured lacquer and colour coded in accordance with BS1B52, except that 4th (tolerance) band is yellow.

metal film, high power

Style	Dimensions mm (Fig. 1) D max.	L max.	d	Resistance tolerance	Resistance range	Maximum power dissipation at 70°C W	Preferred value series
PR37	3.7	10	0.6	±5%	10Ω to 10kΩ	1.6	E12
PR52	5.2	16.7	0.6	±5%	10Ω to 27kΩ	2.5	E12

On bandoliers (Fig. 2) in boxes of 1000 pieces.
Coated with a red-brown coloured high temperature silicone paint.
The resistance value and tolerance are printed on the resistor body.

Fig. 1 Resistor dimensions (mm)

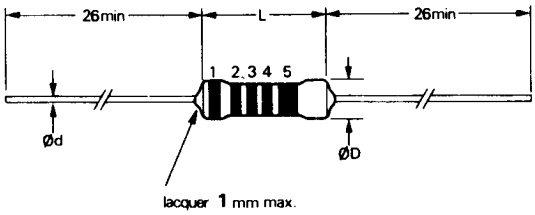
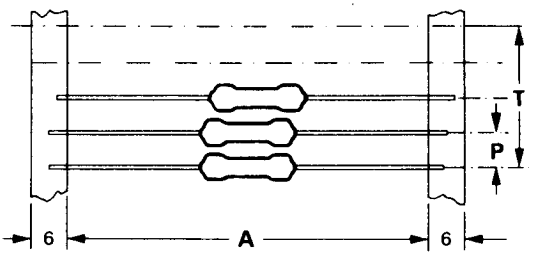


Fig. 2 Resistor bandolier dimensions (mm)



Style	A	P	T
All styles except PR52 & VR68	52.4	5	[5 (n−1)] ±4*
PR52	**66.7	10	[10 (n−1)] ±4*
VR68	†66.7	10	[10 (n−1)] ±4*

*This formula is applicable when the number of resistors (n) is between 50 and 100 pieces.

**This dimension will be changed to 63.5mm in accordance with IE Spec 286.

† This dimension will be changed to 73.0mm in accordance with IE Spec 286.

Colour Coding
Resistors in the E24 series and E12 series are colour coded with 4 bands: (1) first significant figure, (2) second significant figure, (3) multiplier, (4) tolerance.
Resistors in the E96 series with a 1% tolerance are colour coded with 5 bands: (1) first significant figure, (2) second significant figure, (3) third significant figure, (4) multiplier, (5) tolerance.

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

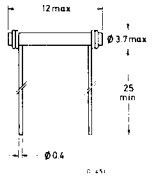
E96 Series: 100 102 105 107 110 113 115 118 121 124 127 130 133 137 140 143 147 150 154 158 162 165 169 174 178
182 187 191 196 200 205 210 215 221 226 232 237 243 249 255 261 267 274 280 287 294 301 309 316 324
332 340 348 357 365 374 383 392 402 412 422 432 442 453 464 475 487 499 511 523 536 549 562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

Non-linear resistors

negative temperature coefficient book 3 part 1

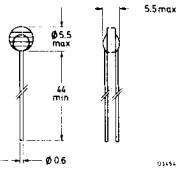
Rod types 0.6W dissipation

Type No.	Code No. 2322 . . .	Resistance at 250°C (R25) 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



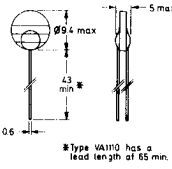
Disc types 0.6W dissipation

VA1096	642 11151	150	3280	19	180	8.5
VA1097	642 11471	470	3520	52	105	8.5
VA1098	642 11152	1.5k	3775	130	70	8.5
VA1106	642 11222	2.2k	3915	280	46	8.5
VA1109	642 12472	4.7k	4200	370	40	8.5
VA1108	642 11153	15k	4375	920	25	8.5
VA1112	642 12223	22k	4200	1.2k	22	8.5
VA1111	642 12333	33k	4250	1.8k	18	8.5



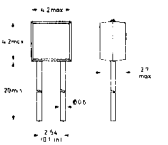
Disc types 1W dissipation

VA1086	610 11228	2.2	2765	0.29	1850	10
VA1033	610 11408	4	2800	0.25	2000	10
VA1074	610 11608	6	2825	0.45	1500	10
VA1053	610 11808	8	2900	0.8	1100	10
VA1100	610 11159	15	3000	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 11118		1.1	2650	0.13	2700	10
2322 610 12109		10	2950	1	1000	10
2322 610 11339		33	3250	0.58	1300	10



Plastic encapsulated 'two point' types

Type No. 2322 . . .	Colour code	Temperature range °C	Resistance Ω	at temperature °C	Resistance Ω	at temperature °C
640 90015	Red	−10 to +25	15k	−10 ±1.5	2.7k	+25 ±1.5
640 90013	Brown	−30 to −10	50k	−30 ±1.5	15k	−10 ±1.5
640 90004	Grey	+25 to +100	12k ±7%	+25	0.95k ±5%	+100
640 90005	Black	+100 to +200	16.7k ±7%	+100	1.12k ±7%	+200



Maximum dissipation 0.25W

Voltage proof (terminals to heatsink) 350 Vrms

These plastic encapsulated thermistors are specially designed for temperature measurement and control.

Non-linear resistors

negative temperature coefficient (cont.)

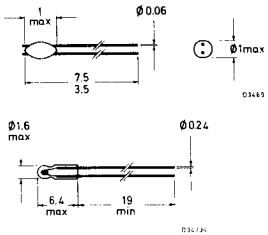
book 3 part 1

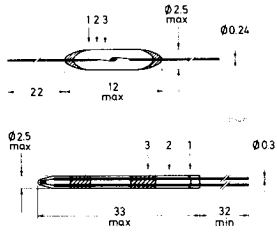
Miniature bead types

Plain beads		Gasfilled glass tube		Glass dipped bead		Thermometer type		Resistance at 25°C (R_{25}) Ω	B-value K
Type No.	Code No. 2322 634 . .	Type No.	Code No. 2322 634 . .	Type No.	Code No. 2322 627 . .	Type No.	Code No. 2322 627 . .		
VA3100	11102	**VA3200**	21102	**VA3400**	21102	**VA3700**	11102	1000	2375
VA3102	11222	**VA3202**	21222	**VA3402**	21222	**VA3702**	11222	2200	2600
VA3104	11472	**VA3204**	21472	**VA3404**	21472	**VA3704**	11472	4700	3725
VA3106	11103	**VA3206**	21103	**VA3406**	21103	**VA3706**	11103	10000	3800
VA3108	11223	**VA3208**	21223	–	–	**VA3708**	11223	22000	3875
VA3110	11473	**VA3210**	21473	**VA3410**	21473	**VA3710**	11473	47000	3850
VA3112	11104	**VA3212**	21104	**VA3412**	21104	**VA3712**	11104	100000	3800
VA3114	11224	**VA3214**	21224	**VA3414**	21224	**VA3714**	11224	220000	3920
VA3116	11474	**VA3216**	21474			**VA3716**	11474	470000	4030

Maximum dissipation 60mW (VA3100 & VA3200)
100mW (VA3400 & VA3700)
Maximum temperature (Tmax) 200°C
Stability R_{25} after 1000 hours at T max. <1%

Dissipation constant approx:
VA3100 Series 0.1mW/°C
VA3200 Series 0.4mW/°C
VA3400 Series 0.75mW/°C
VA3700 Series 0.7 mW/°C





positive temperature coefficient

General purpose disc 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 Body	Leads
E220ZZ/01	661 91005	50	+25	50	+9	6	40	Ø8.5	Ø0.5
E220ZZ/02	661 91004	30	+45	60	+16	8.5	50		
E220ZZ/03	661 91002	50	+80	150	+18	8.5	50		39 long
E220ZZ/04	661 91003	40	+110	80	+75	8.5	50		
VA8650	662 93037	80	+75	220	+23	21	265	Ø12.6	Ø0.8,30 long

Degaussing types for colour tv tubes

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 Body	Leads
VA8650	662 93037	80	+75	220	+23	21	265	Ø12.6	Ø0.8,30 long
2322 662 98003		30 + 8	+75	–	+25	13.5	265	Plastic case Ø17.7	16.5 high

continued

Non-linear resistors

positive temperature coefficient (cont.)

book 3 part 1

Degaussing types for colour tv tubes (cont.)

Type No.	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	Dimension mm Body	Leads
2322 662 98009	Rs40 Rp 1000 to 6000	–	–	–	–	265	Plastic case Ø 17.7 x 16.5 high	

Notes
1. The VA8650 is a single disc type p.t.c. used in conjunction with a v.d.r.
2. The 2322 662 98003 is a dual p.t.c. in which the two elements are in series and used with a parallel fixed resistor. (Blue plastic case)
3. The 2322 662 98009 is a dual p.t.c. in which one element is in parallel with the supply, and the other in series with the coils. (White plastic cap)

p.t.c. thermistor for overload protection

Type No.	Resistance at 25°C (R_{25}) Ω	Max. Voltage Vrms	Min. series Resistance Ω	Max. Working Conditions Current mA	Max. Working Conditions Temp. °C	Min. Overload Conditions Current mA	Min. Overload Conditions Temp. °C
2322 663 93004	30	265	470	140	+36	200	+25

The min. series resistance must be included in the circuit when operated at max. voltage

The max. working conditions represent those at which the p.t.c. will remain in its low ohmic state

The min. overload conditions represent those at which the p.t.c. will "switch" to its high ohmic state

voltage dependent

book 3 part 1

Type No.	Code No. 2322 . . .	C (approx.) V	β value	Reference current mA	Reference voltage V	Diameter mm	Length mm
Rod types (silicon carbide)							
E298ED/A258	564 02582	1550	0.20 to 0.25	10	470	5.2	28
E298ED/A260	564 02602	1800	0.18 to 0.23	10	560	5.2	28
E298ED/A262	564 02622	2200	0.18 to 0.23	10	680	5.2	28
E298ED/A265	564 90014	2400	0.17 to 0.22	10	910	5.2	28
E298ED/P268	564 02681	3000	0.17 to 0.22	10	1200	5.2	28
E298ZZ/06	564 90005	3020	0.16 to 0.21	2	950	5.2	28

Maximum dissipation at 40°C: 700mW

Maximum temperature at zero power: 150°C

continued

Type No.	Code No. 2322 . . .	C (approx) V	β value	Reference current mA	Reference voltage V	Diameter mm	Thickness mm
Disc types (silicon carbide)							
E299DD/P116	552 01161	14	0.25 to 0.4	100	8	15	5
E299DD/P118	552 01181	18	0.25 to 0.4	100	10	15	5
E299DD/P120	552 01201	21	0.25 to 0.4	100	12	15	5
E299DD/P216	552 02161	25	0.25 to 0.4	10	8	15	5
E299DD/P218	552 02181	32	0.25 to 0.4	10	10	15	5
E299DD/P220	552 02201	40	0.25 to 0.4	10	12	15	5
E299DD/P222	552 02221	48	0.25 to 0.4	10	15	15	5
E299DD/P224	552 02241	57	0.21 to 0.35	10	18	15	5
E299DD/P226	552 02261	60	0.21 to 0.35	10	22	15	5
E299DD/P228	552 02281	70	0.21 to 0.35	10	27	15	5
E299DD/P230	552 02301	85	0.18 to 0.25	10	33	15	5
E299DD/P232	552 02321	100	0.18 to 0.25	10	39	15	5
E299DD/P234	552 02341	130	0.18 to 0.25	10	47	15	5
E299DD/P236	552 02361	150	0.18 to 0.25	10	56	15	5
E299DD/P238	552 02381	180	0.18 to 0.25	10	68	15	5
E299DD/P336	552 03361	190	0.14 to 0.23	1	56	15	5
E299DD/P338	552 03381	230	0.14 to 0.23	1	68	15	5
E299DD/P340	552 03401	300	0.14 to 0.21	1	82	15	5
E299DD/P342	552 03421	350	0.14 to 0.21	1	100	15	5.5
E299DD/P344	552 03441	400	0.14 to 0.21	1	120	15	6
E299DD/P346	552 03461	500	0.14 to 0.21	1	150	15	6.5
E299DD/P348	552 03481	600	0.14 to 0.21	1	180	15	7
E299DD/P350	552 03501	750	0.14 to 0.21	1	220	15	7.5
E299DD/P352	552 03521	900	0.14 to 0.21	1	270	15	8
E299DD/P354	552 03541	1100	0.14 to 0.21	1	330	15	9

Maximum dissipation at 40°C: 800mW

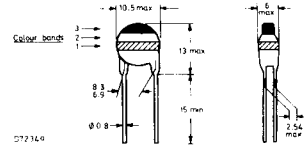
Maximum temperature at zero power: 125°C

The relationship between applied voltage and current is given by $E \approx CI^{\beta}$ where E is in volts; I is in amperes; C is the applied voltage for a current of 1 ampere and β is the slope of the characteristics. The values of C and β are derived from measurements at lower levels.

Disc types (zinc oxide)

Type No. 2322 594 . . .	Nominal rms voltage (V)	Max. d.c. working (V)	Min. volts at 1mA (V)	Max. volts at 1A (V)
18202	50	70	82	140
11012	60	85	100	170
11512	95	135	150	255
11912	120	170	190	325
12212	135	190	220	375
13312	205	290	330	560
13512	220	310	350	595
13912	245	345	390	665
14712	295	415	470	800
16212	390	550	620	1055
16812	425	600	680	1160

Dimensions (mm)



Maximum average power dissipation 100mW

Maximum non-repetitive transient energy 3 to 6J

Loudspeakers

high power to DIN 45500 10 to 80W

book 3 part 5

TWEETERS

Type No.	Size (in)	System power (W)	Resonant frequency (Hz)	Impedance (Ω)	Surround/cone material
AD 0140/T4 T8	1 (dome)	20/40	1200	4,8	Polycarbonate
AD 0162/T8 T15	1 (dome)	20/80	1000	8,15	Polycarbonate/textile
AD 0163/T8 T15	1 (dome)	20/80	1300	8,15	Textile
AD 2095/T4 T8 T15	2 (cone)	20/40	1400	4,8,15	Paper
AD 2295/T4 T8 T15	2 (cone)	20/40	1400	4,8,15	Paper

MID–RANGE

AD 0210/sq 4 sq 8	2 (dome)	60	370	4,8	Textile/paper
AD 0211/sq4 sq 8	2 (dome)	60	370	4,8	Textile
AD 5060/sq 4	5 (cone)	40	210	4	Rubber/paper
AD 5061/sq 4 sq 8	5 (cone)	80	680	4,8	Textile/paper

WOOFERS

AD 4050/W4 W8	4	15	60	4,8	Rubber/paper
AD 7060/W4 W8	7	30	45	4,8	Rubber/paper
AD 7066/W4 W8	7	40	45	4,8	Rubber/paper
AD 8061/W4 W8	8	40	42	4,8	Rubber/paper
AD 8066/W4 W8	8	50	39	4,8	Rubber/paper
AD 8067/W4 W8	8	60	32	4,8	Rubber/paper
AD 10100/W4 W8	10	40	25	4,8	Rubber/paper
AD 12100/W4 W8	12	40	19	4,8	Rubber/paper

FULL RANGE

AD 7062/M4 M8	7	30	45	4,8	Rubber/paper
AD 7063/M4 M8	7	15	55	4,8	Textile/paper
AD 9710/M8	8½	20	50	8	Paper
AD 12100/M4 M8 M15	12	25	45	4,8,15	Paper
AD 12100/HP4 HP8	12	50	60	4,8	Textile/paper

Loudspeakers

medium power 3-10W. book 3 part 5

SINGLE CONE

Type No.	Size (in)	Max. power (W)	Resonant frequency (Hz)	Impedance (Ω)	Surround/cone material
AD 4085/X4 **X8**	4	3	150	4,8	Paper
AD 4485/X4 **X8** **X15**	4	3	150	4,8,15	Paper
AD 4481/X4	4	8	140	4	Textile
AD 7080/X4 **X8** **X15** **X25**	7	6	115	4,8,15,25	Paper
AD 3595/X4 **X8** **X15**	3 x 5	3	170	4,8,15	Paper
AD 3890/X4 **X8** **X15** **X25**	3 x 8	4	120	4,8,15,25	Paper
AD 4681/X4 **X8** **X15** **X25**	4 x 6	6	140	4,8,15,25	Paper
AD 4691/X4 **X8** **X15** **X25**	4 x 6	6	140	4,8,15,25	Paper
AD 4890/X4 **X8** **X15** **X25**	4 x 8	10	110	4,8,15,25	Paper
AD 5780/X4 **X8** **X15** **X25**	5 x 7	6	115	4,8,15,25	Paper
AD 5790/X4 **X8**	5 x 7	4	115	4,8	Paper

continued

medium power 3-10W. (cont.)

DOUBLE CONES

Type No.	Size (in)	Max. power (W)	Resonant frequency (Hz)	Impedance (Ω)	Surround/cone material
AD 7080/M4 **M8** **M15**	7	8	105	4,8,15	Paper
AD 4681/M4 **M8** **M25**	4 x 6	6	135	4,8,25	Paper
AD 4691/M4 **M8** **M15** **M25**	4 x 6	6	135	4,8,15,25	Paper
AD 5780/M4 **M8** **M15** **M25**	5 x 7	6	100	4,8,15,25	Paper
AD 5790/M4 **M8** **M15**	5 x 7	10	100	4,8,15	Paper

low power, plastic frame 1-3W

Type No.	Size (in)	Max. power (W)	Resonant frequency (Hz)	Impedance (Ω)	Surround/cone material
AD 2071/Z4 **Z8** **Z15** **Z25**	2½	1	360	4,8,15,25	Paper
AD 3071/Y4 **Y8** **Y15** **Y25**	3	2	250	4,8,15,25	Paper
AD 3371/Y4 **Y8** **Y15** **Y25**	3	2	250	4,8,15,25	Paper
AD 4072/X4 **X8** **X15** **X25**	4	3	170	4,8,15,25	Paper
AD 4472/X4 **X8** **X15** **X25**	4	3	170	4,8,15,25	Paper

Cross-over Filters

2-WAY SYSTEMS

Type No.	Cross-over frequency (Hz)	Impedance (Ω)
ADF 1500/4	1500	4
ADF 1500/8	1500	8
ADF 2400/4	2400	4
ADF 2400/8	2400	8

3-WAY SYSTEMS

Type No.	Cross-over frequencies (Hz)	Impedance (Ω)
ADF 700/2600/4.4.8	700 & 2600	4
ADF 700/2600/8.8.15	700 & 2600	8

Television assemblies

tuners (with diode tuning) book 3 part 5

Type No.	Channel coverage		Supply voltage V		Noise factor	Power gain
			transistors	tuning diodes	dB	dB
ELC1042	v.h.f.	UK: 405, 625 CCIR	+12	+0.3 to +28	7	20
ELC1042/05	same as ELC1042, but i.f. coil is different					
ELC1043/05	u.h.f.	21 to 69	+12	+0.3 to +25	7	22
ELC1043/06	same as ELC1043/05, but i.f. coil is different					
ELC2000	v.h.f./u.h.f.	C.C.I.R. E5 to E12 E2 to C E21 to E69	+12	+0.5 to +28	6 to 13 depending on channel	28 to 32 depending on channel
EL2004	v.h.f./u.h.f.	C.C.I.R. M4 to E12 E21 to E69	+11	+0.5 to +28	6 to 11 depending on channel	28 to 32 depending on channel
U321/321LO	u.h.f.	21 to 60	+12	+1.0 to +28	7	23
U322/322LO	u.h.f.	21 to 69	+12	+1.0 to +28	6.5	24
V311	v.h.f.	1A to E4 E5 to E12	+12	+1 to +28	6.5	23
V314	v.h.f.	E2 to C 4 to E12	+12	+1 to +28	5 to 7	25
V315/315LO	v.h.f.	E2 to S1 S2 to S17	+12	+1 to +28	—	23

voltage multiplying modules

Voltage doublers and triplers intended for use in transistor line output stages.

Type No.	Description	Vin (p-p)	Vout (e.h.t.)	Vout (focus)	Iout (e.h.t.)
LP1193	Doubler	10.6kV	20kV	10.6kV	750μA
LP1194/30	Tripler	8.9kV	25kV	7.2kV	1.5mA
LP1194/40	Tripler	8.3kV	25kV	8.3kV	1.5mA
LP1196/40	Tripler	8.3kV	25kV	8.3kV	1.0mA
LP1196/60	Tripler	8.3kV	25kV	8.3kV	1.0mA
BG100	Tripler	8.3kV	25kV	8.3kV	1.0mA

line linearity control units (colour)

Type No.	Adjustment range V	Used with deflection coil	Application
AT4042/02	15 to 26	AT1040/15 and AT1027/AT1029 Series	90° colour
AT4042/08	15 to 25	AT1062/01, AT1063/01	110° colour
AT4042/18	Fixed at 30	AT1080	20AX

Television assemblies

deflection coils (colour)

book 3 part 5

Type No.	Picture tube cm	Used with convergence unit	Used with linearity control	Application
AT1027/19	66 (26 in.)	AT4046 Series	AT4042/02	90°
AT1029/19	49, 56 (19 in., 22 in.)	AT4046 Series	AT4042/02	90°

Line coil inductance	– parallel connected	2.95mH
Field coil resistance	– series connected	56 Ω
	– parallel connected	14 Ω + 6 Ω thermistor in parallel with 12 Ω resistor
Deflection current with edge to edge scan (at 25 kV)		
	–line (parallel)	2.6 Ap-p
	–field (parallel)	0.415 Ap-p

Note: These deflection coils are normally supplied with integral convergence units (see below).

Type No.	Picture tube cm	Used with	Application
AT1062/01	66 (26 in.)	AT4046 (convergence units) and	110°
AT1063/01	56 (22 in.)	AT4042/08 (linearity control unit)	110°
AT1080	66 (26 in.)	AT4042/18 (linearity control unit) and AT1081 (multipole unit) AT2076 diode split or AT1080 LOPT	110°
AT1083	56 (22 in.)	" " "	110°
AT1085	47/51 (18/20 in.)	" " "	110°

		AT1062/01, AT1063/01	AT1080	AT1083	AT1085
Line coil inductance	– parallel	1.2mH	1.11mH	1.14mH	1.14mH
	– series	4.8mH			
Field coil resistance	– parallel	3.6Ω			
	– series	14.2+2x4Ω thermistor	3.0Ω	3.36Ω	3.36Ω
Deflection current with edge to edge scan (at 25kV)					
	– line (parallel)	6Ap-p	6.35Ap-p	6.2Ap-p	6.2Ap-p
	– field (parallel)	2.4Ap-p	3.4Ap-p	3.4Ap-p	3.4Ap-p

combined deflection coils and convergence units (colour)

Type No. (combination)	Deflection coil	Convergence unit	Application
AT1027/15	**AT1027/19**	**AT4046/15**	90°
AT1029/15	**AT1029/19**	**AT4046/15**	90°

Details of other deflection coil and convergence unit combinations are available upon request.

blue lateral units (colour)

Type No.	Inductance parallel	Inductance series	Resistance Ω parallel	Resistance Ω series	Application
AT1025/05	0.63mH	3.2mH	9	36	90°
AT1025/06	–	0.062mH	–	0.5	90°
AT1025/08	0.3mH	–	3.2	–	110°

Television assemblies

line output transformers (colour) book 3 part 5

Type No.	Drive	E.H.T. kV	E.H.T. generation	H.T. line V	Mounting	Application
AT2055	PL509	25	Tripler	295	Chassis	90°
AT2055/02	PL509	25	Tripler	295	Printed board	90°
AT2063/03	BU208	25	Tripler	185	Printed board	110°
AT2080/10	BU208 A	25	Tripler	148	Printed board	110°
AT2080/15	BU208 A	25	Tripler	148	Printed board	110°
AT2076/10	BU208 A	25	Diode split	148	Printed board	110°
AT2076/15	BU208 A	25	Diode split	148	Printed board	110°
AT2076/55	BU208 A	25	Diode split	148	Printed board	110°

raster correction transducers (colour)

Type No.	V_{p-p} line	V_{p-p} field	Deflection coil connection line	Deflection coil connection field	Used with North-South phase coil	Application
AT4041/37	1400	55	parallel	parallel	**AT4040/50**	90°
	1400	110	parallel	series	**AT4040/55**	
AT4041/40	400	210	parallel	series	**AT4040/87**	110°

bridge coils (colour)

Type No.	Primary inductance μH	Maximum current Ap-p	Application
AT4043/38	425	6.7	110°
AT4043/86	285	6	110°
DT4044/14	385	–	110°

correction adjustment coils (colour)

AT4040 Series

This range has been designed for use with other Mullard television components and assemblies as correction (waveform realignment) and adjustment (waveform balancing) coils in colour television circuits. Full details may be obtained from the appropriate data sheet in Mullard Technical Handbook.

tolerance adjustment coils (colour)

Type No.	Description	Inductance	Application
AT4043/34	Twist compensating unit	7.3mH ± 10%	20AX
AT4044/20	East-West loading coil	1 to 5.3mH	20AX
AT4044/26	Balancing coil	110 to 30μH; 30 to 110μH	20AX
AT4044/27	Four pole adjustment coil	33 to 150μH; 150 to 33μH	20AX

Television assemblies

multipole units (colour)

Type No.	Description	Application
AT1081	For purity, static convergence, horizontal symmetry adjustment	20AX

filter coils (colour)

Type No.	Description	Inductance	Application
AT4043/35	Class D field time base	220μH ± 10%	Phase 2 and 20AX

line driver transformers (colour)

Type No.	Description	Inductance	Application
AT4043/03	Power supply driver	350mH ± 12%	Switched mode
AT4043/29	Line driver	370mH ± 12%	Phase 2 and 20AX

delay lines (colour)

Type No.	Phase delay time μs	Insertion loss dB	Unwanted reflections relative to 1 τ signal (dB)		Temperature range
			3τ	others	
DL50	63.943	8	−22 max.	−30 max	−20 to +70°C
DL60	63.943	9	−22 max	−30 max	−20 to +70°C

switched mode power supply output transformer

Type No.	Primary inductance mH	Primary resistance Ω	Max. temp.	Application
AT2095	5 ± 10%	0.63 ± 10%	115°C	20AX

Information on deflection assemblies for camera tubes will be found in Book 2, Part 2 of the Mullard Technical Handbook and in the VALVES AND TUBES section of this Quick Reference Guide (page 148).

Solid state control elements

Norbit 2 series

book 3 part 6

Type No.	Description	Function	Colour
2NOR60	Twin NOR	Basic logic elements	Black
4NOR	Quadruple NOR	Basic logic elements	Black
21A60	Twin inverter amplifier (or low power output)	High fan-out amplifier (100MA output unit)	Blue or black
2LPA60	Twin low power output	100mA each output	Blue or black
GLD60	Grounded load driver	Output unit	Black
UPA61	Universal power output unit – see 61 series		Black
HPA60	High power output	2.5A output unit	Black
2ASF60	Twin output switch filter with inverter amplifiers	Interference suppression	Black
TU60	Timer	Time delay	Red or black
PS90	Pulse shaper	Input unit	Green or black
FF90	Flip-flop	Counter/shift register	Red or black
PSU61	Power supply	500mA at 24V d.c.; 25mA at 100V d.c.	

Dimensions (mm): 50.8 x 25.4 x 14 except HPA60 which is 50.8 x 63.5 x 16.5 and PSU61 which is 146 x 80 x 76

Power supply: Single rail unstabilised +24 d.c. ± 25% Temperature range: –10 to +85°C Operating speed: 10kHz

thyristor trigger and control modules, 61 series

Type No.	Description	Function
TT61	Trigger transformer	Interface, giving two isolated outputs for use between thyristor or triac gates and control sections.
UPA61	Universal power amplifier	(a) Pulse generator for driving TT61 (b) 1.0A output unit (c) Other circuit functions.
RSA61	Rectifier and synchroniser	Provides power supplies and synchronising signals.

Dimensions (mm): 50.8 x 25.4 x 14

Colour: Black

Maximum working temperature: +70°C

For details of mounting accessories for Norbit 2 and 61 series please refer to the Mullard functional unit price list or Mullard House.

input devices

Type No.	Description	Temperature range	Speed of operation	Working range	Power supply	Dimensions mm
MVSO	Miniature vane switched detector	25 to + 85°C	3kHz	–	12V ± 5% 24V ± 25%	41 x 19 x 15
PSD12 PSD24	Proximity switched detector (PSD)	–25 to + 85°C	100Hz	10 mm	12V ± 5% 24V ± 25%	102.5 x 31 x 31
EPD60	Miniature version of PSD	–25 to +70°C	1kHz	–	12V ± 5% 24V ± 25%	50 x 30 x 17.6

MVSD connector Plug-in connector with cable – total length 2000 mm

programmable logic controller (P.L.C.) modules

Type No.		Description
IM10	D.C. input module	16 isolated input channels each for 24Vdc ± 25%
IM11	A.C. input module	16 isolated input channels each for 24Vac ± 25%
LX10	Load external module	Input module for 16 x 8 bit words, provides isolation. 24Vdc ± 25% or 5Vdc ± 5% input
OM10	Output module	16 isolated output channels each providing up to 30Vdc 100mA
OM12	Output module	8 isolated output channels each providing up to 30Vdc at 2A. Short circuit protected.
MM10	Program memory	1024 word non-volatile core memory
MM11	Program memory	2048 word uv erasable PROM based memory with facility for programming from MM10
MM12	Program memory	2048 word uv erasable PROM based memory for pre-programme
CP10	Central processor	With 32 x 8 bit registers
CP11	Central processor	Without registers
PI10	Punch & teletype interface	Enables hard copy of interface to be produced.
PU10	Programming unit	Manual or tape programming plus system monitoring

Max. capacity	512 + outputs in total 4096 lines of program memory
Construction	Double Eurocard
Power supply	Single rail 5Vdc ± 5%
Temperature range	0 to +60°C

For information concerning mounting chassis for PLC modules please refer to the Mullard functional unit price list or to Mullard House.

Hybrid v.h.f./u.h.f. wideband amplifiers

book 3 part 1

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. DC power requirements 24V ± 10%. Source and load impedance 75 ohms.

Types of VHF/UHF hybrid wideband amplifiers – 40 MHz to 860 MHz

	type	stages	gain (dB)	min. $V_{o(rms)}$ (dBμV)		noise figure (db)	VSWR (note 3)		Dimensions mm
				–60dB IMD (note 1)	1dB comp. (note 2)				
low output	OM320	2	15,5	92	111	5,5	2,2	2,5	30 x 12 x 6
	OM321	2	15,5	98	113	6,0	2,5	2,0	30 x 12 x 6
	OM335	3	27	98	115	5,5	1,9	3,2	30 x 12 x 6
medium output	OM322	2	15	103	119	7,0	1,7	1,7	40 x 22 x 6
	OM336	3	22	105	122	7,0	1,4	1,6	30 x 19 x 6
high output	OM323	2	15	113	127	9,0	1,9	2,3	30 x 18 x 15
	OM337	3	26	112	126	9,8	2,3	1,8	30 x 18 x 15

Notes:
1. Measured at –60dB intermodulation distortion to DIN 45 004.
2. Measured at saturation for 1dB gain compression.
3. Typical maximum values.

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 ± 1dB except OM335 which is typically ± 1.6 dB and OM322 which is typically ± 0.3 dB.

linear ferrite materials

Ferroxcube cores are produced mainly in the following material grades:

For use in pot cores and RM cores:

Grade A8 A high permeability material suitable for pulse applications, where the pulse repetition frequency is less than about 500 kHz, and for wideband applications where the lowest frequency to be transmitted is less than 1MHz.

Grade A10 This is a low loss high stability material for use at frequencies between 200kHz and 2 MHz.

Grade A13 A low loss, high permeability, high stability material. It is used in the form of pot cores for inductors operating at frequencies up to 300kHz and for transformers where the lowest frequency to be transmitted is less than 10MHz.

Grade A14 A new material in pre-production stage, offering very low loss together with closely-controlled temperature factor. It will be available in the RM-core configuration for use in inductors operating in the 100kHz region.

Grade B10 A low loss high stability material for use in the frequency range 1 to 15MHz. It is normally available in the form of pot cores for inductor and transformer applications.

For use in television, switched-mode power supplies and inverters:

Grade A9 Suitable for low frequency power applications where a high operating flux density and low total core loss is required to be maintained at elevated temperatures, e.g. tv line output transformers and inverters. This material can be used at frequencies up to 100kHz and is normally available in U-core form.

Grade A16 This material has similar properties to grade A9 but has lower losses.

For use in yoke rings in television scanning assemblies:

Grade A3 Exclusively for the manufacture of yoke rings used in television scanning assemblies.

For use in suppression filters

Grade A19 Exclusively for the manufacture of toroids use in suppression filters.

cores for power applications

For use in television

Type No.	Shape	Electrical Specification measured at ⩽ 50Hz for a pair of cores		Dimensions mm length	height	width	Other features and applications
FX2527	E core	$\hat{B}$(mT) ⩾320 $\hat{H}$ (A/m)	255 at 85°C	56	16	19	Round centre leg
FX3560	E core	$\hat{B}$(mT) ⩾315 $\hat{H}$ (A/m)	250 at 100°C	56	18	19	Round centre leg
FX3567	E core	$\hat{B}$(mT) ⩾315 $\hat{H}$ (A/m)	250 at 100°C	44	18	19	Round centre leg
FX3308	30mm pot core	$\hat{B}$(mT) ⩾290 $\hat{H}$ (A/m)	230 at 85°C	ϕ30	9.5	–	
FX3550	RM10 core	$\hat{B}$(mT) ⩾250 $\hat{H}$ (A/m)	200 at 85°C	□24	9.4	–	
FX2507	U core	$\hat{B}$(mT) ⩾320 $\hat{H}$ (A/m)	255 at 85°C	60	29	16	
FX3558	U core	$\hat{B}$(mT) ⩾320 $\hat{H}$ (A/m)	250 at 100°C	60	29	16	
FX3187/88	U and I combination	$\hat{B}$(mT) ⩾320 $\hat{H}$ (A/m)	255 at 85°C	67	71	19	
FX3619	E core	–		56	18	19	Gapped centre pole

For use in television

Type No.	Shape	Electrical Specification measured at 16kHz for a pair of cores		Dimensions mm length	height	width	Other features and applications
FX3583/3584	U and I combination	$\hat{B}$(mT) ⩾330 $\hat{H}$ (A/m)	250 at 100°C	58	58	16	Octagonal leg
FX3604	U core	" " "	"	15	11	6	Rectangular section
FX3605	U core	" " "	"	20	16	7	" "
FX3606	U core	" " "	"	25	20	13	" "
FX3837	U core	$\hat{B}$(mT) ⩾335 $\hat{H}$ (A/m)	400 at 100°C	32	25.5	16	" "
FX3662	U core	$\hat{B}$(mT) ⩾330 $\hat{H}$ (A/m)	250 at 100°C	32	25.5	16	" "
FX3809	U core	" " "	"	32	25.5	16	" "
FX3607	E core	" " "	"	42	21	20	" "
FX3608	E core	" " "	"	55	28	21	" "
FX3808	E core	–		55	28	21	Gapped centre pole
FX3609	E core	$\hat{B}$(mT)⩾330 $\hat{H}$ (A/m)	250 at 100°C	55	28	25	Rectangular section

cores for power applications (cont.)

Yoke rings

Type No.	Application For scanning coils in television picture tubes	Dimensions mm o.d.	i.d.	height
FX3565	110° (colour)	122	53	46
FX3160	90° (colour)	108	49	50
FX3251	110° (mono)	57	40	26
FX3532	110° (mono)	53.2	30.6	26.5
FX3572	110° (mono)	53.2	31.6	26.5

For use in switched-mode power supplies and inverters

Type No.	Shape	Coil former type no.	Solder tag	Electrical Specification measured at 00Hz for a pair of cores	Dimensions mm length	height	width	Other features and applications
FX3560	E core	–	–	$\hat{B}$(mT)≥315 $\hat{H}$ (A/m) 250 at 100°C	56	18	19	Round centre leg
FX3720	E core	DT2720	DT2700	$\hat{B}$(mT)≥230 $\hat{H}$ (A/m) 180 at 100°C	34.5	17.3	9.5	Round centre leg
FX3721	E core	DT2720	DT2700	–	34.5	17.3	9.5	Gapped centre pole
FX3730	E core	DT2730	DT2700	$\hat{B}$(mT)≥230 $\hat{H}$ (A/m) 180 at 100°C	40.6	19.5	11.6	Round centre leg
FX3731	E core	DT2730	DT2700	–	40.6	19.5	11.6	Gapped centre pole
FX3740	E core	DT2740	DT2700	$\hat{B}$(mT)≥230 $\hat{H}$ (A/m) 180 at 100°C	52.2	24.2	13.4	Round centre leg
FX3741	E core	DT2740	DT2700	–	52.2	24.2	13.4	Gapped centre pole
FX3750	E core	DT2750	DT2700	$\hat{B}$(mT)≥230 $\hat{H}$ (A/m) 180 at 100°C	70.0	34.5	16.4	Round centre leg
FX3751	E core	DT2750	DT2700	–	70.0	34.5	16.4	Gapped centre pole
FX3550	RM10 core	–	–	$\hat{B}$(mT)≥250 $\hat{H}$ (A/m) 200 at 85°C	24	9.4	–	–
FX3234	U core	–	–	$\hat{B}$(mT)≥320 $\hat{H}$ (A/m) 255 at 85°C	60	35	15	–
FX3235	U core	–	–	" " " "	60	55	15	–
FX3573	I core	–	–	–	41	28	9	–
FX3574	E core	–	–	–	41	44	9	–
FX3579	E core	–	–	$\hat{B}$(mT)≥300 $\hat{H}$ (A/m) 240 at 85°C	34	26	9	–
FX3590	E core	–	–	–	25	19	12.7	–
FX3591	E core	–	–	$\hat{B}$(mT)≥320 $\hat{H}$ (A/m) 255 at 85°C	25	19	6	–
FX3619	E core	DT2571	–	–	56	18	19	Gapped centre pole
Suitable for power applications usi single ended and push-pull drive systems.				Electrical Specification measured at 16kHz for a pair of cores				
FX3604	U core			$\hat{B}$(mT)≥315 $\hat{H}$ (A/m) 250 at 100°C	15	11	6	Rectangular section
FX3605	U core			" " " "	20	16	7	"
FX3606	U core			" " " "	25	20	13	"
FX3837	U core			$\hat{B}$(mT)≥335 $\hat{H}$ (A/m) 400 at 100°C	32	25.5	16	"
FX3845	E core			$\hat{B}$(mT)≥315 $\hat{H}$ (A/m) 250 at 100°C	65	32.8	27.4	"
FX3607	E core			" " " "	42	21	20	"
FX3608	E core			" " " "	55	28	21	"
FX3808	E core			–	55	28	21	Gapped centre pole
FX3609	E core			$\hat{B}$(mT)≥330 $\hat{H}$ (A/m) 250 at 100°C	55	28	25	Rectangular section

Bobbins to DIN Standards are suitable for use with these cores.

cores for small signal applications

book 3 part 2

E and I cores

Type No.		Minimum effective permeability (μ_e) for two 'E' cores at 25°C	Dimensions mm for two E cores or an E and I combination		
E core	I core		length	height	width
FX1052	FX1053	900 (700 for E and I)	13	13 (2, E's) 10 (E and I)	3
FX1652		1020	20	19	5
FX1238		1100	25	19	6
FX1007	FX1107	1150 (1150 for E and I)	41	44 (2, E's) 28 (E and I)	9
FX1239		1150	34	26	8
FX1818		1150	42	35	9
FX1314		1150	52	60	12
FX1819	FX2318	1150 (1150 for E and I)	56	58 (2, E's) 42 (E and I)	13
FX1073		1150	34	20	12
FX1105		1150	30	25	12
FX1653		1150	90	63	24
FX1315		1150	40	48	15

H core assemblies

Type No.	Minimum effective permeability (μ_e) at 25°C	Dimensions mm			
		length	width	height	No. of pins
*LA1366 (H7)	3000	7.5	10	4.8	6
*LA1246 (H10)	3820	12.4	11.2	6.1	8
*LA1302 (H20)	3850	20	20	15.2	8

*Available for current production; not intended for new designs

Pot and RM transformer cores

Designation	Dimensions mm		Design types A13		A8			
	size	height	Type No.	A_L min.	Type No.	$A_L \pm 25\%$		
10mm	ϕ 10	7	FX2501	1205	FX3280	3325	–	–
12mm	ϕ 12	8	FX2502	900	–	–		
RM6-S	□ 14.4	12.4	FX3432	1930	FX3437	4400	–	–
					LA1522	5500		
RM6-R	□ 14.4	12.4	FX3433	2000	FX3438	4750	–	–
14mm	ϕ 14	9	FX2236	950	–	–		
RM7	□ 16.9	13.4	FX3434	2230	FX3439	5600	–	–
18mm	ϕ 18	11	FX2238	1150	–	–		
RM8	□ 19.4	16.4	FX3435	2400	FX3440	6300	–	–
21mm	ϕ 21	14	FX2239	1150	–	–		
RM10	□ 24.1	18.6	FX3436	3260	FX3441	8600	–	–
25mm	ϕ 25	16	FX2240	1200	–	–		
30mm	ϕ 30	19	FX2241	5815	FX3286	15 000	–	–
35mm	ϕ 35	23	FX2242	6950	FX3287	17 800	–	–
45mm	ϕ 45	29	FX2243	8830	FX3288	20 000	–	–

Accessories: Accessories are available. Please refer to Mullard Technical Handbook for details.

cores for small signal applications (cont.)

Cross cores

Type No.	Minimum effective permeability (μ_e) at 25°C	Dimensions mm			
		length	width	height (pair)	centre hole
FX2856 (X 22)	1440	21.3	21.3	14.2	ϕ3
FX2857 (X 30)	1525	29.6	29.6	23.6	ϕ4.5
FX2858 (X 35)	1580	34.6	34.6	28	ϕ5.5

Screening beads

Ferroxcube beads with 1, 2 or 6 holes can be used to introduce, in a simple way, additional impedance for the suppression of unwanted parasitic oscillations, or to provide screening.

Type No.	No. of holes	Dimensions mm			Minimum suppression frequency MHz	Type No.	No. of holes	Dimensions mm			Minimum suppression frequency MHz
		Maximum diameter	Maximum length	Minimum hole diameter				Maximum diameter	Maximum length	Minimum hole diameter	
FX1115	1	4.2	5.5	1.8	1	**FX1156**	2	5.9	12.4	0.7	10
FX1242	1	4.1	5.7	1.3	10	**FX1898**	6	6.3	10.5	0.6	10

Radio interference suppression beads

FX4000 Series

Material grade	Type number	Dimensions D x d x ℓ		Minimum Z (Ω) at different frequencies				
		mm	1 MHz	3 MHz	10MHz	30MHz	100MHz	300 MHz
3S1	**FX4000**	3 x 0.7 x 4	24	38	39	31	26	23
	FX4001	3 x 0.7 x 10	58	95	97	77	66	58
	FX4002	3 x 1.0 x 4	18	29	30	24	20	18
	FX4003	3 x 1.0 x 10	44	72	73	59	50	44
	FX4004	5 x 0.7 x 4	32	52	53	42	36	32
	FX4005	5 x 0.7 x 10	79	128	131	105	89	79
	FX4006	5 x 1.5 x 4	20	31	32	26	22	20
	FX4007	5 x 1.5 x 10	48	78	80	64	55	48
	FX4008	5 x 2.0 x 4	15	24	24	20	17	15
	FX4009	5 x 2.0 x 10	37	60	61	49	42	37
3S2	**FX4010**	3 x 0.7 x 4	4	12	25	32	42	27
	FX4011	3 x 0.7 x 10	9	20	63	81	104	67
	FX4012	3 x 1.0 x 4	3	9	19	25	32	20
	FX4013	3 x 1.0 x 10	7	23	48	61	79	51
	FX4014	5 x 0.7 x 4	5	16	24	44	57	37
	FX4015	5 x 0.7 x 10	12	40	85	110	142	91
	FX4016	5 x 1.5 x 4	3	10	21	27	35	22
	FX4017	5 x 1.5 x 10	7	25	52	68	87	55
	FX4018	5 x 2.0 x 4	2	8	16	20	26	17
	FX4019	5 x 2.0 x 10	6	19	40	51	66	43
	FX4020	8 x 1.5 x 4	4	14	29	38	48	31
	FX4021	8 x 1.5 x 10	10	34	72	93	120	77
	FX4022	8 x 2.0 x 4	4	11	24	31	40	26
	FX4023	8 x 2.0 x 10	9	28	60	77	100	64
	FX4024	8 x 3.0 x 4	2	8	17	22	28	18
	FX4025	8 x 3.0 x 10	6	20	42	55	71	45
4S3	**FX4026**	3 x 0.7 x 4	1	3	11	27	50	57
	FX4027	3 x 0.7 x 10	2	9	28	67	126	140
	FX4028	3 x 1.0 x 4	1	3	9	20	38	43
	FX4029	3 x 1.0 x 10	2	8	21	50	95	107
	FX4030	5 x 0.7 x 4	2	5	16	36	68	77
	FX4031	5 x 0.7 x 10	4	12	38	90	170	190
	FX4032	5 x 1.5 x 4	1	3	9	22	41	47
	FX4033	5 x 1.5 x 10	2	7	23	55	104	116
	FX4034	5 x 2.0 x 4	1	2	7	17	32	36
	FX4035	5 x 2.0 x 10	2	6	18	42	80	89
	FX4036	8 x 1.5 x 4	1	4	13	31	57	65
	FX4037	8 x 1.5 x 10	3	10	32	77	145	161
	FX4038	8 x 2.0 x 4	1	3	11	26	49	55
	FX4039	8 x 2.0 x 10	2	9	27	64	121	134
	FX4040	8 x 3.0 x 4	1	3	8	18	34	38
	FX4041	8 x 3.0 x 10	2	6	19	45	85	95

R.F.I. suppression beads A range kit of the FX4000 Series of suppression beads is available for development and laboratory use.

cores for small signal applications (cont.)

book 3 part 2

Single and double aperture cores

Type No.		Minimum effective permeability (μ_e) at 25°C	Colour mark	Dimensions mm				
				diameter	length	width	height	aperture
FX2431	Single aperture	500	–	8	–	–	6	ϕ2
FX2633	Single aperture	1500	–	8	–	–	6	ϕ2
FX2049	Double aperture	200	white	–	13	8	6	ϕ3
FX2249	Double aperture	500	white	–	10.8	5.4	10.9	□2
***FX2634**	Double aperture	1500	red	–	10.8	5.4	10.9	□2
FX2754	Double aperture	1400	red	–	13	8	6	ϕ3
FX2837	Double aperture	3000	yellow	–	10.8	5.4	10.9	□2
FX3316	Double aperture	3000	–	–	10.8	5.4	6	□2
FX3391	Double aperture	1400	–	–	10.8	5.4	6	□2

* Available for current production, not intended for new designs (replaced by FX3316).

Rods and tubes

A *wide range* of Ferroxcube rods and tubes is available.
Data sheets listing the full range of types can be obtained on application to Technical Publications Dept. (see page 168)

Toroids

Type No.	Material grade	Dimensions mm		
		o.d.	i.d.	w
	Uncoated types			
FX2073	A5	5	2.9	1.2
FX1886	B5	5.2	3.1	1
FX1593	A4	12.7	6.3	3.2
FX1594	B1	12.7	6.3	3.2
FX1595	B2	12.7	6.3	3.2
FX1598	B5	12.7	6.3	3.2
FX2691	A5	12.7	6.3	3.2
FX3311	A8	12.7	6.4	3.2
FX2395	A4	38.1	25.4	19
	** Coated types			
FX3008	A4	12.7	6.3	3.2
FX3009	A5	12.7	6.3	3.2
FX3012	B2	12.7	6.3	3.2
FX3850	4C6	6	4	2

Type No.	Material grade	Dimensions mm		
		o.d.	i.d.	w
	Uncoated types			
FX1582	A4	25.4	19	4.8
FX3312	A8	25.4	19	4.8
FX1586	A4	38.1	25.4	6.3
FX1587	B1	38.1	25.4	6.3
FX1588	B2	38.1	25.4	6.3
FX1589	B3	38.1	25.4	6.3
FX1590	B4	38.1	25.4	6.3
FX3313	A8	38.1	25.4	6.3
FX1076	A4	108	70	12.7
	** Coated types			
FX3851	4C6	9	6	3
FX3852	4C6	14	9	5
FX3853	4C6	23	14	7
FX3854	4C6	36	23	15

4C6 is a nickel-zinc ferrite suitable for operation at frequencies up to 30 MHz. Typical applications are in wide band matching transformers for communications.

**Uncoated dimensions

Toroids for radio interference suppression filters

Type No.	Material grade	Dimensions mm		
		o.d.	i.d.	w
	** Coated types			
FX3830	A19	25	15	10
FX3831	A19	31.5	19	12.5
FX3832	A19	40	24	16

Type No.	Material grade	Dimensions mm		
		o.d.	i.d	w
	** Coated types			
FX3836	A19	26	14.5	20
FX3843	A19	25	15	19

** Uncoated dimensions.

RM inductor cores

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.

	Violet range			Red range		
Size	Type No.	Inductance factor A_L (nH)	Standard adjuster	Type No.	Inductance factor A_L (nH)	Standard adjuster
*RM5	LA4045	400	LA1557	LA4028	100	LA1494
	LA4046	250	LA1519	LA4029	63	LA1493
	LA4047	160	LA1495	LA4031	40	LA1492
	LA4048	100	LA1494	–	–	–
RM6-R	LA4145	400	LA1501	LA4128	100	LA1500
	LA4146	250	LA1429	LA4129	63	LA1500
	LA4147	160	LA1429	LA4130	40	LA1500
	LA4148	100	LA1500	–	–	–
RM7	LA4245	400	LA1400	LA4228	100	LA1427
	LA4246	250	LA1399	LA4229	63	LA1427
	LA4247	160	LA1399	LA4230	40	LA1427
	LA4248	100	LA1427	–	–	–
RM8	LA4344	630	LA1430	LA4328	100	LA1431
	LA4345	400	LA1424	LA4329	63	LA1431
	LA4346	250	LA1424	–	–	–
	LA4347	160	LA1431	–	–	–
	LA4348	100	LA1431	–	–	–
RM10	LA4543	1000	LA1433	LA4528	100	LA1432
	LA4544	630	LA1428	LA4529	63	LA1432
	LA4545	400	LA1428	–	–	–
	LA4546	250	LA1432	–	–	–
	LA4547	160	LA1432	–	–	–

*RM5 – These cores have a "moulded-in nut" type of adjustment mechanism.

RM inductor cores (cont.)

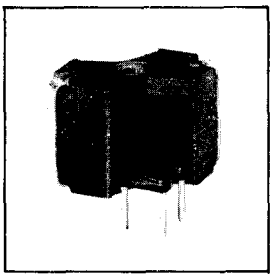
Accessories

Size	Coil formers			clip	Non-magnetic screwdriver
	1 section	No. of pins	2 section		
RM5	DT2602	6	–	†DT2601	–
RM6-R	DT2467	4	–	DT2398	DT2452
	DT2517	6	DT2477	†DT2498	
RM7	DT2468	4	–	DT2387	DT2452
	*DT2391	5	*DT2522	†DT2487	
	DT2392	8	DT2523		
RM8	DT2470	4	–	DT2396	DT2410
	DT2480	8	DT2481	†DT2496	
RM10	DT2534	5	*DT2538	DT2406	DT2410
	DT2535	8	DT2539	†DT2506	

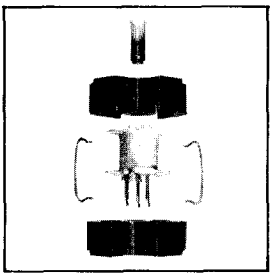
*Available for current production, not intended for new designs

†With earthing tag

RM inductor cores



RM inductor cores



Vinkor pot cores (to BS4061 range 1)

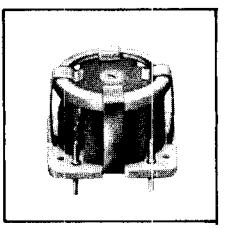
book 3 part 3

Size mm	Violet range			Red range			Blue range		
	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	"	63				**LA1379**	"	32.0
	LA1423	"	40				**LA1380**	"	30.0
12	***LA1418**	"	100						
	***LA1419**	"	63						
	***LA1420**	"	40						
14	***LA1228**	**LA1505**	250	***LA1157**	**LA1506**	63	**LA1375**	**LA1526**	55.0
	***LA1229**	"	160	***LA1158**	"	40	**LA1376**	"	45.7
	***LA1230**	"	100				**LA1377**	"	37.0
	***LA1417**	**LA1506**	63						
18	***LA1225**	**LA1502**	250	***LA1161**	**LA1503**	63	**LA1372**	**LA1525**	76.2
	***LA1226**	"	160	***LA1162**	"	40	**LA1373**	"	59.4
	***LA1227**	"	100	***LA1163**	"	25	**LA1374**	"	45.4
	***LA1416**	**LA1503**	63						
21	***LA1222**	**LA1502**	250	***LA1164**	"	63			
	***LA1223**	"	160	***LA1165**	"	40			
	***LA1224**	"	100	***LA1166**	"	25			
	***LA1415**	**LA1503**	63						
25	***LA1218**	**LA1428**	400	***LA1167**	**LA1432**	63			
	***LA1219**	"	250	***LA1168**	"	40			
	***LA1220**	"	160	***LA1169**	"	25			
	***LA1221**	"	100						
	***LA1414**	**LA1432**	63						
30	**LA1214**	**LA1428**	400	***LA1170**	**LA1428**	63			
	LA1215	"	250	***LA1171**	**LA1432**	40			
	LA1216	"	160	***LA1172**	"	25			
	LA1217	"	100						
	LA1413	"	63						
35	**LA1210**	**LA1362**	400	***LA1173**	**LA1428**	63			
	LA1211	"	250	***LA1174**	**LA1432**	40			
	LA1212	"	160	**LA1175**	**LA1432**	25			
	LA1213	**LA1428**	100						
	LA1412	"	63						
45	**LA1409**	**LA1362**	250						
	LA1410	"	160						
	LA1411	"	100						

The Mullard BLUE RANGE is supplied with specially adjusted AL values to avoid ntegral turn problems at low inductance values.

*Available for current production, for new designs see RM inductor cores.
Accessories are available. Please refer to Mullard Technical Handbook for details.

Vinkor pot cores



PXE piezoelectric ceramic components

Piezoelectricity is 'pressure' electricity, a property of certain crystalline materials and of man-made polycrystalline 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

book 3 part 2

Material		PXE5	PXE7	PXE21	PXE41	PXE42	PXE43	PXE52	Unit
Thermal and mechanical data									
Curie point θc		285	320	270	315	325	300	170	°C
Mass density ρm		7.60	7.75	7.75	7.90	7.80	7.7	7.9	10^3 kg/m^3
Mechanical quality factor for radial mode	QM^E	≃80	≃80	≃80 *	≃1000	≃750	≃1000	≃50	–
Frequency constants	$N_P{}^E$	2000	2200	2000	2200	2250	2350	2000	Hzm or m/s
	$N_3{}^D$	1850	2000	1900	2000	2015	2050	1920	
	$N_1{}^E$	1460	1640	–	1620	–	–	–	
	$N_5{}^E$	930	970	–	1020	–	–	–	
Electrical data									
Relative permittivity	$\epsilon_r = \epsilon_{33}{}^T/\epsilon_0$	1800	700	1750	1200	1300	1000	3300	–
Dielectric loss factor tan δ		16	20	16	2.5	2.5	2.0	22	10^{-3}
Electro-mechanical data									
Coupling factors	kp	0.58	0.52	0.62	0.56	0.55	0.5	0.63	–
	k_{33}	0.70	0.70	0.72	0.68	0.68	0.63	0.73	
	k_{31}	0.34	0.31	0.37	0.33	0.32	0.3	0.37	
	k_{15}	0.66	0.66	–	0.66	–	–	–	
Piezoelectric charge constants	d_{33}	384	220	385	268	285	210	550	10^{-12} C/N or m/V
	d_{31}	−169	−86	−180	−119	−120	–	−250	
	d_{15}	515	370	–	335	–	–	–	
Piezoelectric voltage constants	g_{33}	24.2	35.4	25.0	25.2	25.0	25.0	17.8	10^{-3} Vm/N or m^2/C
	g_{31}	−10.7	−14.0	−11.6	−11.2	−10.4	−10.7	−8.6	
	g_{15}	32.5	42.0	–	33.5	–	–	–	

PXE piezoelectric ceramic components

preferred types

book 3 part 2

Type No.	PXE	Dimensions mm		
Ignition		dia.	length	
MB1113	41	6.35	15	
MB1086, MB1114	21.41	6.35	16	
MB1126	21	9	17	
MB1129	21	–	4 x 2.25 x 2.25 (square rod).	
Ultrasonic cleaning and welding		o.d.	i.d.	thickness
MB1122	42	38.1	–	6.35
MB2023	42	38.1	12.7	6.35
MB2024	42	50	20	6
MB1109	41	50	–	3
MB1130	43	50	20	6
Echo sounders		dia.	approx. length (depends on frequency)	
MB1082 (operating frequency 151 kHz)	41	31.8	14	
MB1121 (operating frequency 200 kHz)	41	25.4	10	
Pick-up and air transducer elements		length	width	thickness
MB8009 multimorph	5	9.6	1.6	0.68
MB8001 multimorph	5	12.7	1.6	0.68
MB8000 multimorph	5	15.5	1.6	0.68
MB8004 multimorph	5	70	1.6	0.68
MB7010 bimorph	5	8	8	0.6
Delay line transducers		length	width	approx. thickness (depends on frequency)
MB3019 (operating frequency 4.1 MHz)	7	29	7.5	0.24
Feedback discs		dia.		thickness
MB1000, MB1001	5	16		1.1

General application

rods and discs

Dia. mm.	Thickness/length mm.	PXE
3	0.5	5
5	0.2 to 2	5
6.35	2	21
10	0.2 to 5	5
16	0.2 to 3	5 and 52
25.4	0.5 to 2	5

plates

Type No.	Dimensions mm	PXE
MB3011	12 x 6 x 0.5	5
MB3010	12 x 6 x 1	5
MB3004	16 x 12 x 1	5
MB3020	6 x 4 x 0.5	5

Where more than one MB type number is shown, it indicates that the component is made in more than one material but has the same physical size. Type numbers refer respectively to the materials shown.

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 metal (TICONAL) and ceramic (MAGNADUR) magnets to customers' specialised requirements, a range of shapes and sizes is also available, including segments, rings, discs, rods, tubes, blocks and bars.
Please consult Mullard House for your requirements.

material properties — magnadur and ticonal

book 3 part 2

Material	(BH) max		Br		HcB	
	kilojoules/ metre^3	megagauss -oersted	millitesla	gauss	kiloamperes/ metre	oersted
Ticonal 600	47.8	6.0	1310	13 100	54.1	680
Ticonal 570	45.4	5.7	1320	13 200	51.7	650
Ticonal 550	43.8	5.5	900	9000	123	1550
Ticonal 500	40.6	5.1	1250	12 500	52.5	660
Ticonal 440	35.0	4.4	1160	11 600	55.7	700
Magnadur 300	28.7	3.6	400	4000	143	1800
Magnadur 370	27.9	3.5	385	3850	235	2950
Magnadur 330	25.5	3.2	370	3700	239	3000
Magnadur 280	22.3	2.8	350	3500	239	3000
Magnadur 270	21.5	2.7	340	3400	255	3200
*Magnadur 100	7.6	0.95	220	2200	135	1650

*These materials in their unmagnetised state, have no preferred direction of magnetic axis (i.e. isotropic).

Conversion factors: 10 gauss = 1 millitesla (mT)
1 oersted = 79.6 amperes per metre (A/m)
1 gauss oersted = 79.6×10^{-4} joules per metre^3 (J/m^3) which is equivalent to the expression tesla amperes per metre (TA/m)

Mosaic printers

20 characters per line printers

book 3 part 6

Type No.	Paper	Characters per line	Printing speed	Dimensions mm
60SA	Self-action	20	50 characters per second 1 line of a max. of 20 characters per second	221 x 148 x 80
60SR	Plain, ink ribbon	20	50 characters per second 1 line of a max. of 20 characters per second	240 x 148 x 80

The above printers should be used with the following character module:

Type No.	Characters	TTL compatible input	Dimensions mm
CM64	Full alpha numeric (64 characters)	6 bits ASCII	Two boards 117 x 110

40 characters per line printer

Type No.	Paper	Characters per line	Printing speed	Dimensions mm
115DR	Ink, ribbon	40	33 characters per second 1 line in 1.2 seconds	251 x 250 x 106

Mullard
Valves & Tubes

Picture tubes

colour picture tubes (in-line) book 2 part 1

All types: Shadow mask. 3-gun. Push-through super square presentation. Vh=6.3V. B12-246 base, except A51-570X which has B12-262 base. Quick heating (5 seconds).

Type No.	Deflection Angle	Screen diagonal (cm)	(in)	Final Anode Voltage* Max. (kV)	Min. (kV)	Typical Operating Conditions V_{a1} (V)	$-V_g$ (V)	Focusing Electrode (V)	I_h (mA)	Light Transmission (%)	Neck Diameter (mm)
A47-500X	110°	47	18	27.5	20	212 to 495	100	4000 to 4800	730	56	36.5
A51-500X	110°	51	20	27.5	20	212 to 495	100	4000 to 4800	730	52	36.5
A56-500X	110°	56	22	27.5	20	212 to 495	100	4000 to 4800	730	55	36.5
A66-510X	110°	66	26	27.5	20	212 to 495	100	4000 to 4800	730	53	36.5
A51-570X	90°	51	20	27.5	20	250 to 450	100	4700 to 5500	685	69	29.1

Hi-Bri Soft-Flash narrow neck 90° pre-aligned combination.

monochrome picture tubes

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

Type No.	Screen diagonal (cm)	(in)	Max. Final Anode Voltage* (kV)	Typical Operating Conditions** V_{a1} (V)	$+V_k$ (V)	Focusing Electrode (V)	V_h (V)	I_h (mA)	Light Transmission (%)	Neck Diameter (mm)	Base
†**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.

Electro-optical devices

*Plumbicon camera tubes book 2 part 2

Basic Type No.	Quality Grade	Application		Spectral Response Cut-off (min)	Loading	Max. Overall Length (mm)
17.7mm dia. Plumbicon tube (95mA 6.3V Heater)						
XQ1427	Broadcast	B/W	RGB	850	Rear	112
XQ1428	Industrial	B/W	RGB	850	Rear	112
25.4mm dia. Plumbicon tubes—standard range (95mA 6.3V Heater)						
†XQ1070	Broadcast	B/W	LRGB	650	Front	172
†XQ1071	Industrial	B/W	RGB	650	Front	172
XQ1072	Medical		–	650	Front	172
†XQ1073	Broadcast	B/W	R	900	Front	172
†XQ1074	Industrial	B/W	R	900	Front	172
‡XQ1075	Broadcast	B/W	R	750	Front	172
‡XQ1076	Industrial	B/W	R	750	Front	172
25.4mm dia. Plumbicon tubes—technically advanced range (95mA 6.3V Heater)						
XQ1080	Broadcast	B/W	LRGB	650	Rear	170
XQ1081	Industrial	B/W	RGB	650	Rear	170
XQ1083	Broadcast	B/W	R	900	Rear	170
XQ1084	Industrial	B/W	R	900	Rear	170
‡XQ1085	Broadcast	B/W	R	750	Rear	170
‡XQ1086	Industrial	B/W	R	750	Rear	170
XQ1090	Broadcast	B/W	LRGB	650	Front	170
XQ1091	Industrial	B/W	RGB	650	Front	170
XQ1093	Broadcast	B/W	R	900	Front	170
XQ1094	Industrial	B/W	R	900	Front	170
‡XQ1095	Broadcast	B/W	R	750	Front	170
‡XQ1096	Industrial	B/W	R	750	Front	170
25.4mm dia. High resolution types with A.C.T. (190mA 6.3V Heater)						
XQ1500	Broadcast	B/W	LRGB	650	Rear	170
XQ1501	Industrial	B/W	RGB	650	Rear	170
XQ1503	Broadcast	B/W	R	900	Rear	170
XQ1504	Industrial	B/W	R	900	Rear	170
XQ1505	Broadcast	B/W	R	750	Rear	170
XQ1506	Industrial	B/W	R	750	Rear	170
30mm dia. Plumbicon tubes—standard range (300mA 6.3V Heater)						
XQ1020	Broadcast	B/W	LRGB	650	Rear	220
XQ1021	Industrial	B/W	RGB	650	Rear	220
XQ1022	Medical		–	650	Rear	220
XQ1023	Broadcast	B/W	LR	850	Rear	220
XQ1024	Industrial	B/W	R	850	Rear	220
‡XQ1025	Broadcast	B/W	LR	750	Rear	220
‡XQ1026	Industrial	B/W	R	750	Rear	220
30mm dia. Plumbicon tubes—technically advanced range (300mA 6.3V Heater)						
XQ1410	Broadcast	B/W	LRGB	650	Rear	220
XQ1411	Industrial	B/W	RGB	650	Rear	220
XQ1413	Broadcast	B/W	LR	900	Rear	220
XQ1414	Industrial	B/W	R	850	Rear	220
‡XQ1415	Broadcast	B/W	LR	750	Rear	220
‡XQ1416	Industrial	B/W	R	750	Rear	220
30mm dia. High resolution with A.C.T. (190mA 6.3V Heater)						
XQ1520	Broadcast	B/W	LRGB	650	Rear	220
XQ1521	Industrial	B/W	RGB	650	Rear	220
XQ1523	Broadcast	B/W	R	900	Rear	220
XQ1524	Industrial	B/W	R	900	Rear	220
XQ1525	Broadcast	B/W	R	750	Rear	220
XQ1526	Industrial	B/W	R	750	Rear	220

*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.

Electro-optical devices

vidicon camera tubes

Type No.	Application and description		Min. Resolution Capability (TV lines)	Length (mm)
17.7mm dia. vidicon tubes				
XQ1270	General purpose	Integral mesh. For high definition, low cost miniature cameras.	400	108
XQ1271	General purpose	Separate mesh. For high definition miniature cameras	550	108
XQ1272	General purpose	Separate mesh. With electrostatic focus for miniature cameras.	500	108
25mm dia. vidicon tubes				
XQ1240	Industrial, medical and broadcast	Separate mesh. For high definition monochrome and colour.	1000	159
XQ1241	General purpose			
XQ1032	Industrial and general purpose	Integral mesh. For low cost cameras.	600	130
25mm dia. silicon vidicon tubes				
XQ1400	Low light level	Separate mesh vidicon with mosaic silicon diode array.	600	159
XQ1401	broadcast and			
XQ1402	industrial			

Note:— All vidicon and Plumbicon tubes are focused and deflected magnetically with the exception of the XQ1272 which has electrostatic focusing and magnetic deflection.

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.

*Newvicon camera tubes

17.7mm dia. Newvicon tubes				
XQ1274	Security and surveillance	High sensitivity. Separate mesh for miniature cameras.	550	108
XQ1275	Security and surveillance	High sensitivity. Separate mesh and electrostatic focusing.	500	108
XQ1276	Security and surveillance	Extended red response	550	108
25mm dia. Newvicon tube				
XQ1440	Security and surveillance	High sensitivity. Separate mesh. High resolution.	650	159
XQ1442	Security and surveillance	Equipped with fibre optic faceplate.	550	160

camera tube deflection assemblies

Type No.	Tube size (mm)	Loading	Tube	Typical operating parameters: Line Deflection Current (mAp-p)	Frame Deflection Current (mAp-p)	Focus Current (mA)	Alignment Current at 2 gauss (mA)	Tube Electrode Voltages (V)	
AT1102/01	25	Front	Vidicon	170	24	17	—	V_g4=300	
AT1106	17.7	Front	Plumbicon	230	48	135	—	V_g3=440	
AT1113/01	30	Rear	Plumbicon	225	35	100	±5	V_g2=600	
AT1113/03	30	3 AT1113/01 assemblies with matched electrical parameters							
AT1115/01	25	3 AT1119/01 assemblies with matched electrical parameters							
AT1116	25	Front	Plumbicon	330	48	105	—	V_g3=600	V_g4=960
AT1116/06	25	Front	Plumbicon	300	43	105	—	V_g3=600	V_g4=960
AT1117	15.9	Rear	Plumbicon	140	25	—	7.5	$V_g2,4$=300	V_g5=600
AT1119/01	25	Rear	Plumbicon	295	36	32	7.5	V_g3=475	V_g4=750
AT1132/01	30	Rear	Plumbicon	225	35	25	±5	V_g3=600	
KV12	17.7	Refer to data sheets							
KV198	17.7	Refer to data sheets							

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

*Registered trade mark for television camera tubes.

Electro-optical devices

image intensifier tubes

book 2 part 2

All devices have S25 photocathodes and fibre optic windows unless stated otherwise.

Extended red performance is available. Lower cost tubes for use in industrial applications may be available on request.

Type No.	Image Dia. (mm)	Input Dia. (mm)	Description and Operation	Typical Photocathode Sensitivity at 2856K (μA/lm)	Typical Luminance Gain	Typical Resolution at Screen Centre (line prs./mm)
Electrostatically focused inverter types						
XX1060/01	25	25	3-stage with integral high voltage multiplier. ABC characteristic. External oscillator required	275	70 000	30
XX1063	25	25	3-stage with integral converter/high voltage multiplier. Full ABC characteristic	275	60 000	30
Electrostatically focused inverter micro-channel-plate types						
All devices have integral converter and high voltage multipliers and incorporate Automatic Gain Control and Bright Source protection.						
XX1306	18	18	Supply voltage 2.6V	225	<46 000	30
F23XX	18	18	Supply voltage 2.5V	240	<15 000	28
18XX	30	30	Supply voltage 2.6V Glass output window	225	<25 000	45
XX1332	40	50	Supply voltage 6.5V	225	<30 000	20

intensified silicon vidicon tv camera tube

Type No.	Description	Photocathode Type	Gain	Typical Resolution (tv lines)
S70XQ	16mm target, intensified silicon vidicon	S20	>1500	600

pyroelectric vidicon tv camera tube

Type No.	Description	Typical sensitivity (nA/°C)	Minimum resolvable temperature (°C at 200 tv lines)
S58XQ	18mm target, thermal imaging tv camera tube	4	0.5

Type No.	Description or Application	Screen Dia. (cm)	Screen Dia. (in)	Deflection Sensitivity (V/cm) Sy	Deflection Sensitivity (V/cm) Sx	Abs. Max. Final Anode Voltage (kV)	Operation y-plates	Operation x-plates	Post Defl. Acc.	Ih at 6.3V (mA)	Base
DH3-91	Simple oscilloscopes General purpose monitor	3	1	45 (Va1 + a3 +y"= 500V)	53	1.0	Asym.	Sym.	None	300	B8G
D7-190GH	Inexpensive oscilloscopes Monitoring devices	7	3	12 (Va1 + a3 = 1.0kV)	29	2.2	Sym.	Sym.	None	300	Special 14-pin 55566
D7-220GH	Inexpensive oscilloscopes Monitoring devices	7 (Rectangular)	2¾x2	21 (Va1 + a3 = 1.0kV)	13	2.2	Sym.	Sym.	None	300	B12-246
D7-221GH	Low consumption heater version										
DG7-31 **DG7-32**	General purpose monitors	7	3	21.8 (Va1 + a3 = 500V)	37.8	0.8	Sym.	Asym. Sym.	None	300	B12A
D10-160GH	Inexpensive oscilloscopes Read-out devices	10	4	14 (Va1 + a3 = 1.5kV)	33	2.2	Sym.	Sym.	None	300	Special 14-pin 55566
D13-480GH	Inexpensive oscilloscopes Read-out devices	13	5	15 (Va1 + a3 = 2.0kV)	31	2.2	Sym.	Sym.	None	300	Special 14-pin 55566
D14-120GH	Short length High sensitivity	14 (Rectangular)	4½x4	4.2 (Va1 + a3 = 1.5kV Va4 = 10kV)	15.5	11	Sym.	Sym.	Yes	300	Special 14-pin 55566
D14-121GH	As D14-120GH except for side connections to x and y plates	14 (Rectangular)	4½x4	4.2 (Va1 + a3 = 1.5kV Va4 = 10kV)	15.5	11	Sym.	Sym.	Yes	300	Special 14-pin 55566
D14-162GH/ 09	High sensitivity medium-band oscilloscopes Internal graticule with external picture rotation coil assembly	14 (Rectangular)	4½x4	4.2 (Va1 + a3 = 1.5kV Va4 = 10kV)	15.5	13	Sym.	Sym.	Yes	300	Special 14-pin 55566
D14-250GH	Inexpensive oscilloscopes. Medical applications	14 (Rectangular)	4½x4	13.5 (Va1 + a3 = 2.0kV)	24	2.2	Sym.	Sym.	None	300	Special 14-pin 55566
D14-251GH	Low consumption heater version									95	
D14-262GH	General purpose oscilloscopes 0 to 20MHz	14 (Rectangular)	4½x4	9.5 (Va1 + a3 = 2.0kV) Va4 = 4.0kV)	20	5.0	Sym.	Sym.	Yes	240	Special 14-pin 55566
D14-261GH	Low consumption heater version									95	
E14-100GH	Dual trace	14 (Rectangular)	4½x4	9.0 (Va1 + a3 = 1.5kV Va4 = 10kV)	13.5	13	Dual Sym.	Sym.	Yes	240	Special 14-pin 55566

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	–
W	W	White	–	–	P4
YA	Y	Yellowish-orange	Yellowish-orange	Medium	–

* Used in projection tubes

Electro-optical devices

flying spot scanner tubes

book 2 part 1

Type No.	Description	Screen Dia. (cm)	(in)	Resolution (Lines)	V_a (kV)	$-V_g$ (V)	I_h at 6.3V (mA)	Base
Q7-100GU	Inexpensive tube for Super-8 scanning applications. White phosphor	7	3	400	16	32 to 85	300	B8H
Q13-110BA	Magnetic tube with metal-backed screen and purplish-blue phosphor.	13	5	>1000	25	50 to 100	300	B12A
Q13-110GU	Magnetic tube for colour television. Metal backed screen and white phosphor.							

projection tubes

Type No.	Description	Fluorescence	Screen Dia. (cm)	(in)	V_a (kV)	I_a(pk) (mA)	$-V_g$ (V)	I_h at 6.3V (mA)	Base
MG13-38 **MU13-38** **MW13-38** **MY13-38**	Projection tubes with metal-backed screen for high brightness large area displays	Green Blue White Red	13	5	50	2.5	100 to 170	660	B12A

television monitor tubes

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

Type No.	Description	Screen diagonal (cm)	(in)	Deflection Angle (deg.)	Typical Operating Conditions: Max. Final Anode Voltage (kV)	V_{a1} (kV)	$-V_g$ (V)	Focusing Electrode (V)	V_h (V)	I_h (mA)	Base
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
M24-101W	Precision television studio monitor with reinforced envelope	24	9½	90	16	600	32 to 85	0 to +400	6.3	300	B8H
M31-131W	Precision television studio monitor with reinforced envelope	31	12	90	16	600	32 to 85	0 to +400	6.3	300	B8H
M38-121W	Precision television studio monitor with reinforced envelope	38	15	110	18	400	40 to 85	0 to +400	6.3	300	B8H

data display tubes

Preferred screen variants of the preceding television monitor tube types are available for data display applications.

Type No.	Description	Photocathode Diameter (mm)	Photocathode Type	No. of Stages	Average cathode sensitivity White Light (μA/lm)	Average cathode sensitivity Mono-chromatic * (mA/W)	Anode sensitivity or gain Sensitivity (A/lm) or (kA/W)	Anode sensitivity or gain Gain	V_b (kV)	Rise Time (ns)
PM1910	Intended for scintillation counting under limited dimensional conditions	14	A(S11)	10	60	60	30kA/W	–	1.40	2.5
PM1912	12 stage version of PM1910 with flying leads and bi-alkali cathode	14	D	12		75		10^7	1.70	2.5
XP1110	Replaced by PM1910	14								
PM1920	Intended for optical measurements and industrial applications under limited dimensional conditions	14	A(S11)	6	60	60	0.2	–	0.80	2.0
XP1113	Replaced by PM1920	14								
XP1116	Rugged construction suitable for industrial equipment	14	C(S1)	10	20	1.6	10	–	1.65	3.5
XP1117	Rugged construction suitable for laser applications	14	T(S20)	9	140	13	30	–	1.52	3.5
PM1918	Intended for optical measurements and industrial applications in the UV region; replaces XP1118	14	U(S13)	10	60	60	30	–	1.40	3.5
PM1982	Bi-alkali photocathode	22	D	11		80	250kA/W	–	1.45	2.5
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	10	–	1.60	3.5
PM2018B	Intended for UV spectrophotonic applications. Replaces 150UVP	32	U(S13)	10	85	75	60	–	1.50	3.5
PM2012B	Intended for use in X-ray and γ spectrometry and other applications requiring low background noise and/or dark current	32	D	10	–	77	60kA/W	–	1.35	3.5
XP1011	Rugged tube for scintillation counting and optical measurements	32	super A	10	90	80	60	–	1.50	3.5
PM2013B	General purpose tube for low light level use in the visible spectrum. Replaces XP1016	32	T(S20)	10	160	16	60	–	1.50	3.5
XP1017	Extended-red response version of XP1016	32	S20R	10	210	6.5	60	–	1.47	3.5
XP2008	Intended for applications such as scintillation counting, laboratory and industrial photometry	32	super A	10	80	70	60	–	1.18	3.5
PM2060B	Short version of XP2008	32	super A	10	90	80	60	–	1.18	3.5
XP2010	Intended for X-ray and γ spectrometry	32	super A	10	90	80	60	–	1.18	3.5

continued

* At wavelength γ :– 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. Tubes numbered with PM prefix will be given Pro-Electron designations (XP———) during 1978/9.
2. The letters VB (in No. of stages column) indicate Venetian Blind.
3. The suffix B in the type description denotes blue plastic base version.

Photosensitive devices

photomultipliers (cont.)

Type No.	Description	Photocathode Diameter (mm)	Photocathode Type	No. of Stages	Average cathode sensitivity White Light (μA/lm)	Average cathode sensitivity Mono-chromatic * (mA/W)	Anode sensitivity or gain Sensitivity (A/lm) or (kA/W)	Anode sensitivity or gain Gain	V_b (kV)	Rise Time (ns)
56AVP	High gain, fast tube for use in nuclear physics	44	A(S11)	14	60	60	–	3.10^7	1.80	2.1
56CVP	Intended for optical applications such as laser detection and pollution monitoring; red and infra-red response	44	C(S1)	10	20	1.4	10	–	1.80	2.1
56DVP	For spectrometry with very low luminous flux. Ultraviolet response	44	D	14	–	80	–	3.10^7	1.90	2.1
56DUVP	Replaced by XP2020Q									
56TVP	Intended for use where high sensitivity in the visible and ultraviolet regions is required; also suitable for laser applications	44	T(S20)	14	150	15	–	3.10^7	2.05	2.1
56TUVP	As 56TVP but with fused silica (quartz) window	44	TU	14	150	15	–	3.10^7	2.05	2.1
PM2232 **PM2232B**	Intended for use in nuclear physics where number of photons to be detected is very low. Especially useful in high energy physics experiments such as Cerenkov counting	44	D	12	–	80	–	3.10^7	1.90	2.2
PM2202 **PM2202B**	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
PM2212 **PM2212B**	12 stage version of PM2202 with high gain	44	D	12	–	75	–	3.10^7	1.90	4.0
XP1230	High gain tube intended for spectrometry and liquid scintillation counting of ^{14}C and ^{3}H	44	D	12	–	85	–	3.10^7	2.30	1.6
XP1002	Intended for low light level measurements of visible part of spectrum	44	T(S20)	10	165	16	60	–	1.46	4.0
XP1003	Intended for optical applications where high sensitivity from ultra-violet to near infra-red is required. CuBe dynode offers high stability	44	TU	10	165	16	60	–	1.46	4.0
XP1004	For spectrophotometry; high sensitivity in UV part of spectrum	44	U(S13)	10	80	70	60	–	1.45	4.0
XP2000	Intended for detection/measurement of nuclear radiation	44	D	10VB	–	90	10kA/W	–	1.25	9.0
XP2020	Intended for applications requiring good time resolution	44	D	12	–	85	–	3.10^7	2.20	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 start time characteristics	44	D	12	–	90	–	3.10^7	2.30	1.6

* At wavelength γ :– 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. Tubes numbered with PM prefix will be given Pro-Electron designations (XP–––––) during 1978/9.
2. The letters VB (in No. of stages column) indicate Venetian Blind.
3. The suffix B in the type description denotes blue plastic base version.

Photosensitive devices

photomultipliers (cont.)

Type No.	Description	Photocathode Diameter (mm)	Photocathode Type	No. of Stages	Average cathode sensitivity White Light (μA/lm)	Average cathode sensitivity Mono-chromatic * (mA/W)	Anode sensitivity or gain Sensitivity (A/lm) or (kA/W)	Anode sensitivity or gain Gain	V_b (kV)	Rise Time (ns)
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
XP2030	Intended for detection/measurement of nuclear radiation	68	D	10VB	–	105	10kA/W	–	1.22	10
XP2040	Useful where number of photons to be detected is low and where good time characteristics are required : Cerenkov counters	110	A(S11)	14	70	70	–	3.10^7	2.00	2.0
XP2041	Bi-alkali cathode version of XP2040; both tubes may be supplied with plano-concave quartz adaptor enabling transmission at $\lambda > 200$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	110	D	10VB	–	95	10kA/W	–	1.22	16
60DVP	Useful where high time resolution is required and number of photons is low, i.e. scintillation counting. This tube may be supplied with plano-concave plastic adaptor in metal housing as 60DVP/H	200	D	12	–	70	–	3.10^7	3.00	2.1

* At wavelength γ :–

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. Tubes numbered with PM prefix will be given Pro-Electron designations (XP–––––) during 1978/9.
2. The letters VB (in No. of stages column) indicate Venetian Blind.
3. The suffix B in the type description denotes blue plastic base version.

HIGH CURRENT LASER DETECTORS

Type No.	Photocathode Spectral Response	Average Sensitivity White Light (μA/lm)	Anode Voltage Max. (kV)	Minimum Dark Current at 2.5kV (nA)	Rise Time Min. (ns)	Tube Dia. (mm)	Tube Length (mm)
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
UVHC20	S5 145 to 700nm	30	4.0	5	0.2	35	33
UVL20	UV 105 to 190nm	35mA/W at *122nm	4.0	0.5	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 (μA/lm)	Sensitive Surface Area (cm^2)	Dark Current at V_a = IV (pA)	Rise Time Min. (ns)	Tube Dia. (mm)	Tube Length (mm)
150TV	T(S20) 300 to 800nm	150	5.3	<5	14	39.5	85
150AV	A blue (S11) 300 to 600nm	70	7.0	<2	14	39.5	85
150CV	S1 near infra-red	20	5.3	<20	14	39.5	85
150UV	U(S13) UV200 to 650nm	60	7.0	<2	14	40.0	110

GENERAL INDUSTRIAL APPLICATIONS

Type No.	Description	Photocathode Projected Surface Area (cm^2)		Sensitivity† (μA/lm) at (V)		Max. Anode Supply Voltage (V)	Max. Cathode Current (μA)	Max. Dark Current (μA)	Max. Dark Current at Anode Supply Voltage (V)	Base
92AV (CV2132)	Vacuum	2.1	Caesium antimony	45	85	100	25 nA/mm^2	0.05	85	B7G
92AG (CV2270)	Gasfilled	2.1	Caesium antimony	130	85	90	12.5 nA/mm^2	0.1	85	B7G
90CV (CV2134)	Vacuum	3.0	Caesium on oxidised silver	20	50	250	10	0.05	100	B7G
90CG (CV2133)	Gasfilled	3.0	Caesium on oxidised silver	125	90	90	2.0	0.1	90	B7G

†Sensitivity measured with the whole cathode area illuminated by a lamp of colour temperature 2700K and with a series resistor 1MΩ
Note: Caesium/antimony cathode is particularly sensitive to daylight and bluish light. Caesium/oxidised silver cathode is particularly sensitive to incandescent light and near infrared radiation.

Particle and radiation detectors

high current G-M tubes

book 2 part 2

Type No.	Gamma Sensitivity at 10mR/h ^{60}Co Source (counts/min)	Wall Thickness (mg/cm^2)	Recommended Working Voltage (V)	Max* Background (counts/min)	Dead Time (approx.) (μs)
ZP1300	250	80 to 100	550	1	11
ZP1310†	1200	80 to 100	575	2	15
ZP1320	6000	32 to 40	575	12	50

*Shielded with 50mm lead and 3mm aluminium;
†This tube is available on request in an energy compensated filter and is numbered ZP1311.

liquid sample G-M tubes

Type No.	Liquid Capacity (ml)	Wall Thickness (mg/cm^2)	Recommended Working Voltage (V)	Max* Background (counts/min)	Dead Time (approx.) (μs)
ZP1520	9 to 10	30	450	50	100
ZP1530	5 nom	15 nom	450	30	110

*Shielded with 50mm lead and 3mm aluminium.

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 to 3	500	10	90
ZP1481	17	2.5 to 3	430	30	120
ZP1480	17	2.5 to 3	430	30	120
ZP1442	19.8	2 to 3	600	8	65
ZP1410	19.8	1.5 to 2	575	15	175
ZP1470	24.1	1.5 to 2.5	600	25	70
ZP1430	27.8	1.5 to 2.5	575	25	190
ZP1452	27.8	2 to 3	600	18	60
ZP1460	51	3.5 to 4	900	45	45

*Shielded with 50mm lead and 3mm aluminium.

Particle and radiation detectors

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)
ZP1430	27.8	1.5 to 2.5	575	25	190
ZP1441	19.8	1.5 to 2.0	600	5†	65
ZP1451	27.8	1.5 to 2.0	600	9†	60

*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 (counts/min)	Recommended Working Voltage (V)	Max.* Background (counts/min)	Dead Time (approx.) (μs)
ZP1200	1 300‡	500	10	90
ZP1210	6 800‡	430	40	200
ZP1220	13 000‡	430	75	210

*Shielded with 50mm lead and 3mm aluminium.
‡At 1.0mR/h Radium source.

X-ray counter tubes

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 1850	–	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.

Particle and radiation detectors

channel electron multipliers book 2 part 2

Type No.	Description	Max. Operating Voltage (kV)	Output	Nominal Resistance (Ω)	Nominal Gain	†Nominal Background Pulse 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 **B318BL/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
B330AL/01 **B330BL/01**	C-shaped tube of internal diameter 1.25mm	4.0	Open-ended Closed	$3x10^9$	$1.5x10^8$ at 2.5kV	0.1 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 **B419BL/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

†Above an equivalent threshold of $2x10^7$ electrons. ‡At a modal gain of 10^8 and 1000 pulse/s.
All the above channel electron multipliers can be vacuum baked to 400°C and will replace the types without the suffix/01.

channel electron multiplier plates

Type No.	Description	Channel Diameter (μm)	Diameter of Disc (mm)	Thickness of Disc (mm)	Current Gain at 1kV	Max. Current Output at 1kV (μA)	Resistance (Ω)	Channel Pitch (μm)
G25-25	An array of channel electron multipliers fused into the shape of a disc	25	27.1	1.0	1000	1.0	approx. $5x10^7$	31
G25-50		25	53	1.0	1000	*	approx. $1x10^7$	31
G25-70		25	70	1.0	1000	*	approx. $5x10^6$	31
G25-20x50	An array of channel electron multipliers fused into the shape of a rectangle.	25	20x50 (rectangle)	1.0	1000	0.2	approx. $3.5x10^7$	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, G25-50/A and G25-70/A.

Special quality and industrial receiving valves

Type No.	Description		g_m (mA/V)	μ	V_a (V)	V_{g2} (V)	$-V_{g1}$ (V)	I_a (mA)	I_{g2} (mA)	V_h (V)	I_h (mA)	Base
E80CC (CV5989)	Double triode		2.7	27	250	–	–	6	–	6.3 12.6	600 300	B9A
E80CF	Triode pentode	T P	5 6.2	18 40	100 170	– 170	– –	14 10	– 2.8	6.3	330	B9A
E80F (CV2729)	Amplifying pentode		1.85	25	250	100	–	3	0.65	6.3	300	B9A
E80L	Output pentode		9	21.5	200	200	4.4	30	4.1	6.3	750	B9A
E81L	Output pentode		11	36	210	210	–	20	5.3	6.3	375	B9A
E82CC	Double triode		2.2	17	250	–	–	10.5	–	6.3 12.6	300 150	B9A
E83F (CV9933)	High slope pentode		9	34	210	120	–	10	2.1	6.3	300	B9A
E84L (CV2975)	Output pentode		11.3	19	250	250	–	48	5.5	6.3	760	B9A
E86C	U.H.F. triode		14	68	185	–	–	12	–	6.3	165	B9A
E88C (CV9155)	U.H.F. triode		13.5	70	160	–	1.25	12.5	–	6.3	155	B9A
E88CC (CV2492) **E88CC/01** (CV2493)	Double triodes		12.5	33	90	–	1.2	15	–	6.3	300	B9A
E90CC (CV5214)	Double triode		6	27	100	–	2.1	8.5	–	6.3	400	B7G
E90F	Sharp cut-off pentode		4	48	250	150	6.5	7.4	2.9	6.3	150	B7G
E92CC	Double triode		6	45	150	–	1.7	8.5	–	6.3	400	B7G
E99F	R.f. pentode		3.4	25	250	100	20	9.2	3.3	6.3	150	B7G
E180CC (CV8431)	Double triode		6.4	46	150	–	1.85	8.5	–	6.3 12.6	400 200	B9A
E180F (CV3998)	Wideboard r.f. pentode		16.5	50	180	150	1.25	13	3.3	6.3	300	B9A
E182CC (CV5766)	Double triode		15	24	120	–	2	36	–	6.3 12.6	640 320	B9A
E186F (CV8667)	Wideband high slope amplifier pentode		16.5	53	180	150	1.25	13	3.3	6.3	320	B9A
E188CC (CV5354)	Double triode		12.5	33	90	–	1.2	15	–	6.3	335	B9A
E280F	Wideband pentode		24.5	60	180	150	–	17	5.1	6.3	315	B9A
E288CC	Double triode		20	25	100	–	1.5	30	–	6.3	475	B9A
E810F (CV5809)	Wideband high slope amplifier pentode		50	57	120	150	1.9	35	5	6.3	340	B9A
ECC2000	Double triode	input output	16.5 22	28 32	90 90	– –	1.2 1.2	27 27	– –	6.3	335	B10B
EF91 (CV138) **M8083/** CV4014	R.f. pentode		7.6	70	250	250	2	10	2.6	6.3	300	B7G
EF92 (CV131) **M8161/** CV4015	Vari-mu r.f. pentode		2.45	30	200	200	2.5	8.25	2.1	6.3	200	B7G
EF95 (CV850) **M8100/** CV4010	Low noise r.f. pentode		5.1	35	180	120	2	7.7	2.4	6.3	175	B7G
EL821 (CV2127)	Video output pentode		13	26	250	200	2.5	40	6.5	6.3	750	B9A
EL822 (CV2382)	Video output pentode		12.2	23	250	200	5.0	37.5	4.8	6.3	750	B9A
EY84 (CV2235)	Half wave rectifier		data available on request							6.3	1000	B9A

continued

Special quality and industrial receiving valves (cont.)

Type No.	Description	g_m (mA/V)	μ	V_a (V)	V_{g2} (V)	$-V_{g1}$ (V)	I_a (mA)	I_{g2} (mA)	V_h (V)	I_h (mA)	Base
M8079/ CV4025	Double diode	data available on request							6.3	300	B7G
M8083/ CV4014	R.F. pentode	see EF91									
M8091/ CV4044	Half wave rectifier	data available on request							6.3	1150	B9A
M8100/ CV4010	Low noise r.f. pentode	see EF95									
M8136/ CV4003 **ECC82** (CV491)	Low μ double triode	2.2	17	250	–	8.5	10.5	–	6.3 12.6	300 150	B9A
M8137/ CV4004 **ECC83** (CV492)	High μ double triode	1.6	90	250	–	2	1.25	–	6.3 12.6	300 150	B9A
M8161/ CV4015	Vari-mu r.f. pentode	see EF92									
M8162/ CV4024 **ECC81** (CV455)	Double triode	5.5	60	250	–	2	10	–	6.3 12.6	300 150	B9A
M8212/ CV4007	Double diode	data available on request							6.3	300	B7G
M8248/ CV5311	U.H.F. triode	13.5	50	150	–	1.35	13.5	–	6.3	400	B7G
6AS6/ (CV2522)	Dual control pentode	3.2	–	120	120	2	5.1	3.5	6.3	175	B7G
12AT7WA	Double triode	see M8162									
12AX7S	Double triode	see M8137									
5654	Wideband amplifier	5	–	120	120	2	7.5	2.5	6.3	175	B7G
MIL-5654	Wideband amplifier	see 5654									
6189	Double triode	see M8136									
6201/ CV3508	Double triode	see M8162									
18042	Pentode	9	38	210	120	–	10	2.1	18	100	B9A
18045	Output pentode	11	36	210	210	–	20	5.3	18	130	B9A
18046	Output pentode	11	36	210	210	–	20	5.3	20	135	B9A
CV5377	R.F. pentode	see EF91									

S.Q. valve wallchart available from Mullard Ltd,

Gasfilled devices

WARNING – Operating conditions and precautions relating to the Health & Safety at Work Act (1974) are included in the General Operational Recommendations – see Book 2 part 1.

indicators — neon filled

Type No.	Description	Characters Displayed	Character Height (mm)	Minimum Supply Voltage (V)	Maintaining Voltage (V)	Recommended Cathode Current (mA)	Base
DESIGN TYPES							
ZM1550	In-line, 7 segment dual indicator tube	Numbers 0–9	15	165	137*	0.5*	Dual in-line pinning to fit standard 2.5mm P.C.B.
ZM1551	As ZM1550, but with ±1 in left digit						
		* per segment					
MAINTENANCE TYPES							
ZM1040/ Z522M	In line, side-viewing indication Incorporates a red filter	Numbers 0–9	30	170	140	4.5	B13B
ZM1041	In line, side-viewing indication Incorporates a red filter	Signs –, +	20	170	140	4.5	B13B
ZM1042	As ZM1040 but without red filter						

rectifiers — high voltage half wave — maintenance types

Type No.	Description	D.C.* output (A)	P.I.V. max. (kV)	Ik(av) max. (A)	Full load* (kV)	Vf (V)	If (A)	Base
DCG4/1000ED	Mercury vapour	0.5	10	0.25	3.1	2.5	5	M.E.S.
DCG4/1000G	Mercury vapour	0.5	10	0.25	3.1	2.5	5	B4G
DCX4/1000	Inert gas	0.5	10	0.25	3.1	2.5	5	B4G
		1.0	5	0.5	1.5			
DCX4/5000	Inert gas	2.5	10	1.25	3.1	5	7	B4F
RG4-3000	Mercury vapour	6	15**	3	4.8	5	11.5	B4D

*Two tubes in single phase full wave circuit. **At condensed mercury temperature 25 to 55°C.

thyratrons — inert gas and mercury vapour — maintenance types

Type No. No.	Description	Ik(av) max. (A)	Max. peak anode voltage (kV) forward	inverse	Vf (V)	If (A)	Base
EN32	Inert gas tetrode	0.3	0.65	1.3	6.3	0.95	IO
EN91/2D21	Inert gas tetrode	0.1	0.65	1.3	6.3	0.6	B7G
EN92	Inert gas tetrode	0.025	0.5	0.5	6.3	0.15	B7G
XG1-2500	Mercury vapour triode	2.5	1	1.5	5	4.5	B4G
XG5-500	Mercury vapour triode	0.5	2.5	5	2.5	5	B4G
XGQ2-6400	Mercury vapour triode	6.4	2.5	2.5	5	10	B4D
XRI-3200	Inert gas triode	3.2	1.5	1.5	2.5	12	B4D
XRI-6400	Inert gas triode	6.4	1.5	1.5	2.5	21	B4D

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. (W)	V_a max. (kV)	V_{g2} max. (V)	I_a max. (mA)	V_f or V_h (V)	I_f or I_h (A)	Base
QV05-25 (807)	Radiation cooled	0.08	80	125	25	0.75	0.3	125	6.3	0.9	5pin
QV06-20 (6146)	Radiation cooled	0.082	60	175	20	0.6	0.25	130	6.3	1.25	IO
QY2-100	Radiation cooled	0.275	30	120	100	2.0	0.4	200	10	5.0	7pin
YL1370 (6146B)	Radiation cooled	0.15	125	175	35	0.75	0.25	220	6.3	1.1	IO
YL1590	Forced-air cooled	1.2	860	1000	1500	4.5	1.0	750	3.5	50	–
QY3-65 (CV6122)	Radiation cooled	0.23	150	250	63	3.0	600	150	6	3.5	B7A
QV08-100	Radiation cooled	0.29	30	–	100	1.0	300	400	6.3	3.9	B5F
QY3-125 (CV2130)	Radiation cooled	0.375	120	200	125	3.0	400	300	5.0	6.5	B5F
QY4-500A	External anode Forced-air cooled	0.93	110	220	500	4.0	500	440	5.0	13.5	Special
QY4-250 (CV2131)	Forced-air cooled	1.0	75	120	250	4.0	600	420	5.0	14.1	B5F
QY4-400 (CV5959)	Forced-air cooled	1.1	110	–	400	4.0	600	420	5.0	14.5	B5F
YL1540	Forced-air cooled	1.1	260	175	2000	4.2	750	1200	4.2	53	Coaxial
QY5-500	Radiation cooled	1.76	75	110	500	5.0	700	600	10	9.9	B5K
YL1440	Forced-air cooled Ceramic/metal	2.4	250	–	1500	4.0	600	1200	4.2	55	Coaxial
QY5-3000A (CV5219)	Forced-air cooled	4.1	75	220	3000	5.0	800	1300	6.3	32.5	Special
QY5-3000W	Water cooled										
YL1560	Forced-air cooled	6.0	860	1000	6000	6.0	1000	2500	5.0	130	Coaxial
YL1420	Forced-air cooled Ceramic/metal	8.6	260	–	6000	6.0	1000	4500	6.3	120	Coaxial
YL1470	Forced-air cooled Ceramic/metal	11	110	–	6000	7.0	1000	4500	6.3	120	Coaxial
YL1580	Forced-air cooled	12	860	1000	7200	2.7	1000	2500	7.0	130	Coaxial
YL1430	Forced-air cooled Ceramic/metal	18.4	250	–	12000	8.0	1000	8500	8.0	120	Coaxial
YL1520	External anode Forced-air cooled Ceramic/metal	27.5	250	–	18000	9.0	1000	9000	11.5	120	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_{g2} 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
QQV03-20A	48	200	400	2x10	600	250	2x50	6.3 12.6	1.3 0.65	B7A
QQV06-40A (CV2797)	90	200	500	2x20	600	300	2x120	6.3 12.6	1.8 0.9	B7A
QQV07-50 (CV5847)	103	200	500	2x25	750	300	2x150	6.3 12.6	1.8 0.9	B7A

telecommunications power triodes

book 2 part 4

Type No.	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)	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 **TY4-400C**	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) **TY6-5000W** **TY6-5000H**	6.9	75	220	5.0 6.0 6.0	6.0	1.85	12.6	33	–
TY7-6000A (CV5239) **TY7-6000W** **TY7-6000H**	10	30	–	6.0	7.2	2.8	12.6	33	–
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)	Intermodulation Product (dB)
YD1300	Amplifier	35	20.0	1.0	300	2.0	200	–52
YD1302	Amplifier	55	19.0	1.0	325	2.0	250	–54
YD1304	Amplifier	55	19.0	1.0	325	2.0	250	–56
YD1330	Amplifier	220	16.5	1.0	1800	3.5	700	–52
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)	Intermodulation Product (dB)
YL1440	Amplifier	0.55	15	260	1.5	4.0	0.73	–52
YL1560	Amplifier	2.20	16	1000	6.0	6.0	1.5	–55
YL1420	Amplifier	2.50	15	260	6.0	6.5	1.0	–52
YL1430	Amplifier	7.0	15	260	12	9.0	1.2	–52
YL1520	Amplifier	10.5	16	260	18	9.0	1.8	–55

Transmitting tubes

ceramic triodes for industrial heating

book 2 part 4

Ceramic/metal construction range of high efficiency external anode power triodes. Coaxial connections

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	4.5	85	2.5	7.2	1.1	6.3	33
YD1152	Water (helix)							
YD1160	Forced-air	8.8	120	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	100	80	15	19	12.2	250
YD1203	Vapour cooled							
YD1212	Water (integral jacket)	240	100	120	16.8	25	12.6	380
YD1213	Vapour cooled							
YD1342	Water (integral jacket)	480	30	240	19.2	45	14	555
YD1343	Vapour cooled							

u.h.f. disc-seal triodes

Type No.	Description	Typical power output (W)	atf (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

triodes for industrial heating

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	0.21	6.3	5.4	B5F
TY4-350 (8330)	R.F. Power Triode for general purpose industrial heating applications	1.4	30	400	4.0	0.6	10	10	–
TY4-400	Radiation cooled Triode for pre-heating, plastic welding and induction heating equipment	0.90	100	0.4	3.8	0.36	5.0	14.1	B5F
TY4-400C	Radiation cooled Triode for pre-heating, plastic welding and induction heating equipment	0.90	100	0.4	3.8	0.36	5.0	14.1	B5F
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	–
TY12-20W	External anode Power Triode for general purpose industrial heating applications	39	30	20	13	6.3	8.0	130	–
TYS5-3000	Power trade with silica envelope for general purpose industrial heating	10	12	3.5	6.0	2.8	20.5	26	–

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

magnetically beamed triodes

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)	V_f or V_h (V)	I_f or I_h (A)	Base
YD1350S **YD1352S**	Forced-air Water (helix)	3.0	30 5.0	1.2 2.0	4.5	0.725	5.0	6.1	–
YD1412S	Water	21.2	5.0	12	12	3.0	7.0	12	–

communications travelling wave tubes

book 2 part 4

Type No.	Description	Frequency Range (GHz)	Min. Power Output (sat.) (W)	Typical Operation as Amplifier					Mount Type No.
				Noise Factor (dB)	Power Gain (dB)	Helix Voltage (kV)	Collector Voltage (kV)	Collector Current (mA)	
LB6-10A	Power amplifier	5.9 to 6.5	10	25	35	2.65	1.7	40	P6L4
LB6-25	Power amplifier	5.9 to 6.5	25	28	38	3.4	2.0	45	P6L11
LB6-25A	Power amplifier	6.4 to 7.2	20	28	38	3.5	2.0	45	P6L11A

u.h.f. high power klystrons — c.w. operation

Type No.	Description	Frequency Range (MHz)	Power Output (kW)	Gain (dB)	Cooling	Focusing System	Beam Voltage (kV)	Beam Current (A)
YK1210	Multi-cavity Amplifier	11 800 to 12 200	1.15	43	Air	Permanent magnet	10.5	0.4
YK1151	Multi-cavity Amplifier	470 to 860	23	40	Air	Permanent magnet	20 to 24	3.6 to 3.0
YK1190	Multi-cavity Amplifier	470 to 610	45	44	Vapour	Electromagnet	20.5 to 22	5.7 to 6.3
YK1191		590 to 720	45					

S.band high power klystron — pulse operation

Type No.	Description	Power Output (mW)	Frequency Range (MHz)	Cooling	Focusing System	Beam Voltage (kV)	Beam Current (A)
YK1110	Pulsed Multi-cavity Amplifier	6.0*	2993 to 3003	Water	Electromagnet	210*	100*

*Peak values Pulse duration 2.2μs Pulse repetition rate 50 pulse/s.

heating magnetrons

Type No.	Frequency range (GHz)	Power output (kW)	Anode voltage (kV)	Anode current (mA)	Pre-heat time (s)	Cooling
YJ1510	2.45 ± 0.015	0.3	3.8	140	0	Forced air
YJ1500	2.45 ± 0.015	1.1	4	380	0	Forced air
YJ1481	2.45 ± 0.025	1.5	6	370	7	Forced air
YJ1441	2.45 ± 0.025	2.5	5.7	680	7	Forced air
YJ1442	2.45 ± 0.025	3	6	800	10	Water and forced air
YJ1443	2.375 ± 0.025	3	6	800	10	Water and forced air
YJ1193	2.45 ± 0.02	6	7.3	1250	45	Water and forced air
YJ1194	2.375 ± 0.02	6	7.3	1250	45	Water and forced air

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Book 3	(green)	Components, materials and assemblies

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