PHILIPS

Data handbook

Electronic components and materials

Semiconductors

Part 6 April 1982

R.F. power transistors and modules

SEMICONDUCTORS

PART 6 - APRIL 1982

R.F. POWER TRANSISTORS AND MODULES

DATA HANDBOOK SYSTEM

Our Data Handbook System is a comprehensive source of information on electronic components, sub-assemblies and materials; it is made up of four series of handbooks each comprising several parts.

ELECTRON TUBES	BLUE
SEMICONDUCTORS	RED
INTEGRATED CIRCUITS	PURPLE
COMPONENTS AND MATERIALS	GREEN

The several parts contain all pertinent data available at the time of publication, and each is revised and reissued periodically.

Where ratings or specifications differ from those published in the preceding edition they are pointed out by arrows. Where application information is given it is advisory and does not form part of the product specification.

If you need confirmation that the published data about any of our products are the latest available, please contact our representative. He is at your service and will be glad to answer your inquiries.

ELECTRON TUBES (BLUE SERIES)

The blue series of data handbooks is comprised of the following parts:

T1 **Tubes for r.f. heating**

T2 **Transmitting tubes for communications**

T3 **Klystrons, travelling-wave tubes, microwave diodes**

ET3 **Special Quality tubes, miscellaneous devices** (will not be reprinted)

T4 **Magnetrons**

T5 **Cathode-ray tubes**
Instrument tubes, monitor and display tubes, C.R. tubes for special applications

T6 **Geiger-Müller tubes**

T7 **Gas-filled tubes**
Segment indicator tubes, indicator tubes, dry reed contact units, thyratrons, industrial rectifying tubes, ignitrons, high-voltage rectifying tubes, associated accessories

T8 **Picture tubes and components**
Colour TV picture tubes, black and white TV picture tubes, colour monitor tubes for data graphic display, monochrome monitor tubes for data graphic display, components for colour television, components for black and white television and monochrome data graphic display

T9 **Photo and electron multipliers**
Photomultiplier tubes, phototubes, single channel electron multipliers, channel electron multiplier plates

T10 **Camera tubes and accessories, image intensifiers**

T11* **Microwave components and assemblies**

* Will become available in the course of 1982.

SEMICONDUCTORS (RED SERIES)

The red series of data handbooks is comprised of the following parts:

S1 **Diodes**
Small-signal germanium diodes, small-signal silicon diodes, voltage regulator diodes(< 1,5 W), voltage reference diodes, tuner diodes, rectifier diodes

S2 **Power diodes, thyristors, triacs**
Rectifier diodes, voltage regulator diodes (> 1,5 W), rectifier stacks, thyristors, triacs

S3 **Small-signal transistors**

S4 **Low-frequency power transistors and hybrid IC modules**

S5 **Field-effect transistors**

S6 **R.F. power transistors and modules**

S7 **Microminiature semiconductors for hybrid circuits**

S8 **Devices for optoelectronics**
Photosensitive diodes and transistors, light-emitting diodes, displays, photocouplers, infrared sensitive devices, photoconductive devices.

S9 Taken into handbook T11 of the blue series

S10 **Wideband transistors and wideband hybrid IC modules**

INTEGRATED CIRCUITS (PURPLE SERIES)

The purple series of data handbooks is comprised of the following parts:

IC1 **Bipolar ICs for radio and audio equipment**

IC2 **Bipolar ICs for video equipment**

IC3* **Digital ICs for radio, audio and video equipment**

IC4 **Digital integrated circuits**
LOCMOS HE4000B family

IC5 **Digital integrated circuits – ECL**
ECL10 000 (GX family), ECL100 000 (HX family), dedicated designs

IC6* **Professional analogue integrated circuits**

IC7 **Signetics bipolar memories**

IC8 **Signetics analogue circuits**

IC9* **Signetics TTL circuits**

* These handbooks will be available in the course of 1982.

COMPONENTS AND MATERIALS (GREEN SERIES)

The green series of data handbooks is comprised of the following parts:

C1 **Assemblies for industrial use**
PLC modules, PC20 modules, HNIL FZ/30 series, NORbits 60-, 61-, 90-series, input devices, hybrid ICs, peripheral devices

C2 **FM tuners, television tuners, video modulators, surface acoustic wave filters**

C3 **Loudspeakers**

C4 **Ferroxcube potcores, square cores and cross cores**

C5 **Ferroxcube for power, audio/video and accelerators**

C6 **Electric motors and accessories**
Permanent magnet synchronous motors, stepping motors, direct current motors

CM7a **Assemblies** (will not be reprinted)
Circuit blocks 40-series and CSA70(L), counter modules 50-series, input/output devices

C8 **Variable mains transformers**

C9 **Piezoelectric quartz devices**
Quartz crystal units, temperature compensated crystal oscillators, compact integrated oscillators, quartz crystal cuts for temperature measurements

C10 **Connectors**

C11 **Non-linear resistors**
Voltage dependent resistors (VDR), light dependent resistors (LDR), negative temperature coefficient thermistors (NTC), positive temperature coefficient thermistors (PTC)

C12 **Variable resistors and test switches**

C13 **Fixed resistors**

C14 **Electrolytic and solid capacitors**

C15 **Film capacitors, ceramic capacitors, variable capacitors**

C16 **Piezoelectric ceramics, permanent magnet materials**

INDEX OF TYPE NUMBERS

Data Handbooks S1 to S10

The inclusion of a type number in this publication does not necessarily imply its availability.

type no.	book	section	type no.	book	section	type no.	book	section
AA119	S1	PC	BAS21	S7	Mm	BB110G	S1	T
AAZ13	S1	GB	BAT17	S7	Mm	BB119	S1	T
AAZ15	S1	GB	BAT18	S7	Mm	BB204B	S1	T
AAZ17	S1	GB	BAV10	S1	WD	BB204G	S1	T
AAZ18	S1	GB	BAV18	S1	WD	BB212	S1	T
BA182	S1	T	BAV19	S1	WD	BB405B	S1	T
BA220	S1	WD	BAV20	S1	WD	BB405G	S1	T
BA221	S1	WD	BAV21	S1	WD	BBY31	S7	Mm
BA223	S1	T	BAV45	S1	Sp	BBY40	S7	Mm
BA243	S1	T	BAV70	S7	Mm	BC107	S3	Sm
BA244	S1	T	BAV99	S7	Mm	BC108	S3	Sm
BA280	S1	T	BAW56	S7	Mm	BC109	S3	Sm
BA314	S1	Vrg	BAW62	S1	WD	BC140	S3	Sm
BA315	S1	Vrg	BAX12	S1	WD	BC141	S3	Sm
BA316	S1	WD	BAX12A	S1	WD	BC146	S3	Sm
BA317	S1	WD	BAX13	S1	WD	BC147	S3	Sm
BA318	S1	WD	BAX14A	S1	WD	BC148	S3	Sm
BA379	S1	T	BAX16	S1	WD	BC149	S3	Sm
BA482	S1	T	BAX17	S1	WD	BC157	S3	Sm
BA483	S1	T	BAX18A	S1	WD	BC158	S3	Sm
BAS11	S1	WD	BB105B	S1	T	BC159	S3	Sm
BAS16	S7	Mm	BB105G	S1	T	BC160	S3	Sm
BAS17	S7	Mm	BB106	S1	T	BC161	S3	Sm
BAS19	S7	Mm	BB109G	S1	T	BC177	S3	Sm
BAS20	S7	Mm	BB110B	S1	T	BC178	S3	Sm

GB = Germanium gold bonded diodes
Mm = Microminiature semiconductors for hybrid circuits
PC = Germanium point contact diodes
Sm = Small-signal transistors
Sp = Special diodes
T = Tuner diodes
Vrg = Voltage regulator diodes
WD = Silicon whiskerless diodes

INDEX

* = series
FET = Field-effect transistors
Mm = Microminiature semiconductors for hybrid circuits
P = Low-frequency power transistors
Sm = Small-signal transistors

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type no.	book	section	type no.	book	section	type no.	book	section
BF569	S7	Mm	BFQ43	S6	RFP	BFT93;R	S7	Mm
BF579	S7	Mm	BFQ51	S10	WBT	BFW10	S5	FET
BF622	S7	Mm	BFQ52	S10	WBT	BFW11	S5	FET
BF623	S7	Mm	BFQ53	S10	WBT	BFW12	S5	FET
BF660;R	S7	Mm	BFQ63	S10	WBT	BFW13	S5	FET
BF767	S7	Mm	BFQ68	S10	WBT	BFW16A	S10	WBT
BF819	S4	P	BFR29	S5	FET	BFW17A	S10	WBT
BF857	S4	P	BFR30	S7	Mm	BFW30	S10	WBT
BF858	S4	P	BFR31	S7	Mm	BFW61	S5	FET
BF859	S4	P	BFR49	S10	WBT	BFW92	S10	WBT
BF869	S4	P	BFR53;R	S7	Mm	BFW93	S10	WBT
BF870	S4	P	BFR54	S3	Sm	BFX29	S3	Sm
BF871	S4	P	BFR64	S10	WBT	BFX30	S3	Sm
BF872	S4	P	BFR65	S10	WBT	BFX34	S3	Sm
BF926	S3	Sm	BFR84	S5	FET	BFX84	S3	Sm
BF936	S3	Sm	BFR90	S10	WBT	BFX85	S3	Sm
BF939	S3	Sm	BFR90A	S10	WBT	BFX86	S3	Sm
BF960	S5	FET	BFR91	S10	WBT	BFX87	S3	Sm
BF967	S3	Sm	BFR91A	S10	WBT	BFX88	S3	Sm
BF970	S3	Sm	BFR92;R	S7	Mm	BFX89	S10	WBT
BF979	S3	Sm	BFR93;R	S7	Mm	BFY50	S3	Sm
BF981	S5	FET	BFR94	S10	WBT	BFY51	S3	Sm
BFQ10	S5	FET	BFR95	S10	WBT	BFY52	S3	Sm
BFQ11	S5	FET	BFR96	S10	WBT	BFY55	S3	Sm
BFQ12	S5	FET	BFR96S	S10	WBT	BFY90	S10	WBT
BFQ13	S5	FET	BFS17;R	S7	Mm	BGY22	S6	RFP
BFQ14	S5	FET	BFS18;R	S7	Mm	BGY22A	S6	RFP
BFQ15	S5	FET	BFS19;R	S7	Mm	BGY23	S6	RFP
BFQ16	S5	FET	BFS20;R	S7	Mm	BGY23A	S6	RFP
BFQ17	S7	Mm	BFS21	S5	FET	BGY32	S6	RFP
BFQ18A	S7	Mm	BFS21A	S5	FET	BGY33	S6	RFP
BFQ19	S7	Mm	BFS22A	S6	RFP	BGY35	S6	RFP
BFQ22	S10	WBT	BFS23A	S6	RFP	BGY36	S6	RFP
BFQ22S	S10	WBT	BFS28	S5	FET	BGY40A	S6	RFP
BFQ23	S10	WBT	BFT24	S10	WBT	BGY40B	S6	RFP
BFQ24	S10	WBT	BFT25;R	S7	Mm	BGY41A	S6	RFP
BFQ32	S10	WBT	BFT44	S3	Sm	BGY41B	S6	RFP
BFQ33	S10	WBT	BFT45	S3	Sm	BGY43	S6	RFP
BFQ34	S10	WBT	BFT46	S7	Mm	BGY50	S10	WBM
BFQ42	S6	RFP	BFT92;R	S7	Mm	BGY51	S10	WBM

FET = Field-effect transistors
Mm = Microminiature semiconductors for hybrid circuits
P = Low-frequency power transistors
RFP = R.F. power transistors and modules
Sm = Small-signal transistors
WBM = Wideband hybrid IC modules
WBT = Wideband transistors

INDEX

type no.	book	section
BGY52	S10	WBM
BGY53	S10	WBM
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BGY55	S10	WBM
BGY56	S10	WBM
BGY57	S10	WBM
BGY58	S10	WBM
BGY59	S10	WBM
BGY60	S10	WBM
BGY74	S10	WBM
BGY75	S10	WBM
BLV10	S6	RFP
BLV11	S6	RFP
BLV20	S6	RFP
BLV21	S6	RFP
BLV25	S6	RFP
BLV30	S6	RFP
BLV31	S6	RFP
BLV32F	S6	RFP
BLV33	S6	RFP
BLV33F	S6	RFP
BLV36	S6	RFP
BLV57	S6	RFP
BLW29	S6	RFP
BLW31	S6	RFP
BLW32	S6	RFP
BLW33	S6	RFP
BLW34	S6	RFP
BLW50F	S6	RFP
BLW60	S6	RFP
BLW60C	S6	RFP
BLW64	S6	RFP
BLW75	S6	RFP
BLW76	S6	RFP
BLW77	S6	RFP
BLW78	S6	RFP
BLW79	S6	RFP
BLW80	S6	RFP
BLW81	S6	RFP
BLW82	S6	RFP
BLW83	S6	RFP
BLW84	S6	RFP
BLW85	S6	RFP
BLW86	S6	RFP
BLW87	S6	RFP
BLW89	S6	RFP
BLW90	S6	RFP
BLW91	S6	RFP
BLW95	S6	RFP
BLW96	S6	RFP
BLW98	S6	RFP
BLX13	S6	RFP
BLX13C	S6	RFP
BLX14	S6	RFP
BLX15	S6	RFP
BLX39	S6	RFP
BLX65	S6	RFP
BLX66	S6	RFP
BLX67	S6	RFP
BLX68	S6	RFP
BLX69A	S6	RFP
BLX91A	S6	RFP
BLX92A	S6	RFP
BLX93A	S6	RFP
BLX94A	S6	RFP
BLX94C	S6	RFP
BLX95	S6	RFP
BLX96	S6	RFP
BLX97	S6	RPP
BLX98	S6	RFP
BLY33	S6	RFP
BLY34	S6	RFP
BLY35	S6	RFP
BLY36	S6	RFP
BLY83	S6	RFP
BLY84	S6	RFP
BLY85	S6	RFP
BLY87A	S6	RFP
BLY87C	S6	RFP
BLY88A	S6	RFP
BLY88C	S6	RFP
BLY89A	S6	RFP
BLY89C	S6	RFP
BLY90	S6	RFP
BLY91A	S6	RFP
BLY91C	S6	RFP
BLY92A	S6	RFP
BLY92C	S6	RFP
BLY93A	S6	RFP
BLY93C	S6	RFP
BLY94	S6	RFP
BLY97	S6	RFP
BPW22A	S8	PDT
BPW44	S8	PDT
BPW45	S8	PDT
BPW50	S8	PDT
BPX25	S8	PDT
BPX29	S8	PDT
BPX40	S8	PDT
BPX41	S8	PDT
BPX42	S8	PDT
BPX47B/18	S8	PDT
BPX47B/20	S8	PDT
BPX47C/36	S8	PDT
BPX70	S8	PDT
BPX71	S8	PDT
BPX72	S8	PDT
BPX95C	S8	PDT
BR100/03	S2	Th
BR101	S3	Sm
BRY39P	S3	Sm
BRY39S	S3	Sm
BRY39T	S2	Th
BRY39T	S3	Sm
BRY56	S3	Sm
BRY61	S7	Mm
BSR12;R	S7	Mm
BSR13;R	S7	Mm
BSR14;R	S7	Mm
BSR15;R	S7	Mm

Mm = Microminiature semiconductors for hybrid circuits
PDT = Photodiodes or transistors
RFP = R.F. power transistors and modules
Sm = Small-signal transistors
Th = Thyristors
WBM = Wideband hybrid IC modules

* = series
FET = Field-effect transistors
Mm = Microminiature semiconductors for hybrid circuits
P = Low-frequency power transistors
R = Rectifier diodes
Sm = Small-signal transistors
Th = Thyristors
Tri = Triacs

* = series
D = Displays
FET = Field-effect transistors
GB = Germanium gold bonded diodes
I = Infrared devices
LED = Light-emitting diodes
Mm = Microminiature semiconductors for hybrid circuits
P = Low-frequency power transistors
PC = Germanium point contact diodes
Ph = Photoconductive devices

type no.	book	section	type no.	book	section	type no.	book	section
CQX56	S8	LED	OM323	S10	WBM	RPY86	S8	I
CQX57	S8	LED	OM323A	S10	WBM	RPY87	S8	I
CQX58	S8	LED	OM335	S10	WBM	RPY88	S8	I
CQX60	S8	LED	OM336	S10	WBM	RPY89	S8	I
CQX61	S8	LED	OM337	S10	WBM	RPY90*	S8	I
CQX62	S8	LED	OM337A	S10	WBM	RPY91*	S8	I
CQX63	S8	LED	OM339	S10	WBM	RPY93	S8	I
CQX64	S8	LED	OM345	S10	WBM	RPY96	S8	I
CQX65	S8	LED	OM350	S10	WBM	SD205	S5	FET
CQX66	S8	LED	OM360	S10	WBM	SD210	S5	FET
CQX67	S8	LED	OM361	S10	WBM	SD211	S5	FET
CQX68	S8	LED	OM370	S10	WBM	SD212	S5	FET
CQX74	S8	LED	OM931	S4	P	SD213	S5	FET
CQX75	S8	LED	OM961	S4	P	SD214	S5	FET
CQX76	S8	LED	ORP60	S8	Ph	SD215	S5	FET
CQX77	S8	LED	ORP61	S8	Ph	SD217	S5	FET
CQX78	S8	LED	ORP62	S8	Ph	SD220	S5	FET
CQY11B	S8	LED	ORP66	S8	Ph	SD222	S5	FET
CQY11C	S8	LED	ORP68	S8	Ph	SD226	S5	FET
CQY24B	S8	LED	ORP69	S8	Ph	SD304	S5	FET
CQY49B	S8	LED	OSB9110	S2	St	SD306	S5	FET
CQY49C	S8	LED	OSB9210	S2	St	1N821	S1	Vrf
CQY50	S8	LED	OSB9310	S2	St	1N823	S1	Vrf
CQY52	S8	LED	OSB9410	S2	St	1N825	S1	Vrf
CQY54	S8	LED	OSM9110	S2	St	1N827	S1	Vrf
CQY58A	S8	LED	OSM9210	S2	St	1N829	S1	Vrf
CQY89A	S8	LED	OSM9310	S2	St	1N914	S1	WD
CQY94	S8	LED	OSM9410	S2	St	1N916	S1	WD
CQY95	S8	LED	OSM9510	S2	St	1N3879	S2	R
CQY96	S8	LED	OSM9511	S2	St	1N3880	S2	R
CQY97	S8	LED	OSM9512	S2	St	1N3881	S2	R
OA47	S1	GB	OSS9110	S2	St	1N3882	S2	R
OA90	S1	PC	OSS9210	S2	St	1N3889	S2	R
OA91	S1	PC	OSS9310	S2	St	1N3890	S2	R
OA95	S1	PC	OSS9410	S2	St	1N3891	S2	R
OA200	S1	WD	PH2369	S3	Sm	1N3892	S2	R
OA202	S1	WD	RPY58A	S8	Ph	1N3899	S2	R
OM320	S10	WBM	RPY82	S8	Ph	1N3900	S2	R
OM321	S10	WBM	RPY84	S8	Ph	1N3901	S2	R
OM322	S10	WBM	RPY85	S8	Ph	1N3902	S2	R

PhC = Photocouplers
R = Rectifier diodes
Sm = Small-signal transistors
St = Rectifier stacks
TS = Transient suppressor diodes
Vrf = Voltage reference diodes
Vrg = Voltage regulator diodes
WBM = Wideband hybrid IC modules
WD = Silicon whiskerless diodes

A = Accessories
DH = Diecast heatsinks
FET = Field-effect transistors
HE = Heatsink extrusions
I = Infrared devices
PDT = Photodiodes or transistors
R = Rectifier diodes
RFP = R.F. power transistors and modules
Sm = Small-signal transistors
WBT = Wideband transistors
WD = Silicon whiskerless diodes

A = Accessories

MAINTENANCE TYPE LIST

The type numbers listed below are included in this handbook.

BLW64
BLW75

TYPE NUMBER SURVEY
SELECTION GUIDE
LINE-UPS

In this alphanumeric list we present all transmitting transistors and modules mentioned in this handbook together with the most important data.

type number	envelope	mode of operation	V_{CE} V	frequency MHz	output power W	power gain dB
BFQ42	TO-39	c.w. class-B	13,5	175	2	11
BFQ43	TO-39	c.w. class-B	13,5	175	4	12
BFS22A	TO-39	c.w. class-B	13,5	175	4	8
BFS23A	TO-39	c.w. class-B	28	175	4	10
BGY22	SOT-75A	c.w.	13,5	380-512	2,5	17
BGY22A	SOT-75A	c.w.	12,5	420-480	2,5	17
BGY23	SOT-75A	c.w.	13,5	380-480	7	4,5
BGY23A	SOT-75A	c.w.	12,5	420-480	7	4,5
BGY32	SOT-132B	c.w.	12,5	68- 88	18	22,6
BGY33	SOT-132B	c.w.	12,5	80-108	18	22,6
BGY35	SOT-132B	c.w.	12,5	132-156	18	20,8
BGY36	SOT-132B	c.w.	12,5	148-174	18	20,8
BGY40A	SOT-132C	c.w.	12,5	400-440	7,5	20
BGY40B	SOT-132C	c.w.	12,5	440-470	13	19,4
BGY41A	SOT-132C	c.w.	12,5	400-440	7,5	18,8
BGY41B	SOT-132C	c.w.	12,5	440-470	13	19,4
BGY43	SOT-132B	c.w.	12,5	148-174	13	19,4
BLV10	SOT-123	c.w. class-B	13,5	175	8	9
BLV11	SOT-123	c.w. class-B	13,5	175	15	8
BLV20	SOT-123	c.w. class-B	28	175	8	12
BLV21	SOT-123	c.w. class-B	28	175	15	10
BLV25	SOT-119	c.w. class-B	28	108	175	10,5
BLV30	SOT-122	class-A	25	224,25	1,5 (note 1)	18
BLV31	SOT-122	class-A	25	224,25	5 (note 1)	15
BLV32F	SOT-160	class-A	25	224,25	10 (note 2)	16
BLV33	SOT-147	class-A	25	224,25	19 (note 2)	9
		class-AB	28	224,25	90	6,5
BLV33F	SOT-119	class-A	25	224,25	16 (note 2)	13,5
		class-AB	28	224,25	85	10,5
BLV36	SOT-161	c.w. class-AB	28	224,25	120	10
BLV57	SOT-161	class-A	25	860	6 (note 2)	8
		class-AB	25	860	38	6,5
BLW29	SOT-120	c.w. class-B	13,5	175	15	10
BLW31	SOT-120	c.w. class-B	13,5	175	28	9
BLW32	SOT-122	class-A	25	860	0,5 (note 1)	11
BLW33	SOT-122	class-A	25	860	1,0 (note 1)	10
BLW34	SOT-122	class-A	25	860	1,8 (note 1)	9
BLW50F	SOT-123	s.s.b. class-A	45	1,6-28	0-16 (note 3)	19,5
		s.s.b. class-AB	50	1,6-28	10-65 (note 4)	18

Notes
1. P_o sync at $d_{im} < -60$ dB.
2. P_o sync at $d_{im} < -55$ dB.
3. P.E.P. at $d_3 < -40$ dB.
4. P.E.P. at d_3 typ. -30 dB.

type number	envelope	mode of operation	V_{CE} V	frequency MHz	output power W	power gain dB
BLW60	SOT-56	c.w. class-B	12,5	175	45	5
		s.s.b. class-AB	12,5	1,6-28	3-30 (note 4)	19,5
BLW60C	SOT-120	c.w. class-B	12,5	175	45	5
		s.s.b. class-AB	12,5	1,6-28	3-30 (note 4)	19,5
BLW64	SOT-56	class-A	25	224,25	10 (note 2)	9,5
BLW75	SOT-105	class-A	25	224,25	14 (note 2)	8
BLW76	SOT-121	s.s.b. class-AB	28	1,6-28	8-80 (note 4)	13
		c.w. class-B	28	108	80	7,9
BLW77	SOT-121	s.s.b. class-AB	28	1,6-28	15-130 (note 4)	12
		c.w. class-B	28	87,5	130	7,5
BLW78	SOT-121	c.w. class-B	28	150	100	6
		s.s.b. class-A	26	28	35 (note 3)	19,5
		s.s.b. class-AB	28	28	100 (note 4)	19,0
BLW79	SOT-122	c.w. class-B	12,5	470	2	9
		c.w. class-B	12,5	175	2	13,5
BLW80	SOT-122	c.w. class-B	12,5	470	4	8
		c.w. class-B	12,5	175	4	15
BLW81	SOT-122	c.w. class-B	12,5	470	10	6
		c.w. class-B	12,5	175	10	13,5
BLW82	SOT-119	c.w. class-B	12,5	470	30	5
		c.w. class-B	13,5	470	30	6,1
BLW83	SOT-123	s.s.b. class-A	26	1,6-28	0-10	20
		s.s.b. class-AB	28	1,6-28	3-30	21
BLW84	SOT-123	c.w. class-B	28	175	25	9
BLW85	SOT-123	c.w. class-B	12,5	175	45	4,5
		s.s.b. class-AB	12,5	1,6-28	3-30 (note 4)	19,5
BLW86	SOT-123	c.w. class-B	28	175	45	7,5
		s.s.b. class-AB	28	1,6-28	5-47,5 (note 4)	19
		s.s.b. class-A	26	1,6-28	17 (note 3)	22
BLW87	SOT-123	c.w. class-B	13,5	175	25	6
BLW89	SOT-122	c.w. class-B	28	470	2	12
BLW90	SOT-122	c.w. class-B	28	470	4	11
BLW91	SOT-122	c.w. class-B	28	470	10	9
BLW95	SOT-121	s.s.b. class-AB	50	1,6-28	20-160 (note 4)	14
BLW96	SOT-121	s.s.b. class-AB	50	1,6-28	25-200 (note 4)	13,5
		c.w. class-B	50	108	200	6,5
		s.s.b. class-A	40	28	50 (note 3)	19
BLW98	SOT-122	class-A	25	860	3,5 (note 1)	6,5
BLX13	SOT-56	s.s.b. class-A	26	28	0-8 (note 3)	18
		s.s.b. class-AB	28	28	25 (note 4)	18
		c.w. class-B	28	70	25	17
BLX13C	SOT-120	s.s.b. class-A	26	1,6-28	0-8 (note 3)	20
		s.s.b. class-AB	28	1,6-28	3-25 (note 4)	21

Notes
1. P_o sync at $d_{im} < -60$ dB.
2. P_o sync at $d_{im} < -55$ dB.
3. P.E.P. at $d_3 < -40$ dB.
4. P.E.P. at d_3 typ. -30 dB.

type number	envelope	mode of operation	V_{CE} V	frequency MHz	output power W	power gain dB
BLX14	SOT-55	s.s.b. class-A	28	1,6-28	15 (note 3)	13
		s.s.b. class-AB	28	1,6-28	7,5-50 (note 4)	13
		c.w. class-B	28	70	50	7,5
		c.w. class-B	28	30	50	16
BLX15	SOT-55	s.s.b. class-AB	50	1,6-28	20-150 (note 4)	14
		s.s.b. class-A	40	1,6-28	30 (note 3)	14
		c.w. class-B	50	70	150	10
		c.w. class-B	50	108	150	7,5
BLX39	SOT-120	c.w. class-B	28	175	45	7,5
		s.s.b. class-AB	28	1,6-28	5-42,5 (note 4)	19
		s.s.b. class-A	26	1,6-28	15 (note 3)	20
BLX65	TO-39	c.w. class-B	12,5	470	2	6
		c.w. class-B	12,5	175	2	12
BLX66	SOT-48	c.w. class-B	12,5	470	2,5	8,5
		c.w. class-B	12,5	175	3	20
BLX67	SOT-48	c.w. class-B	12,5	470	2,5	8,5
		c.w. class-B	12,5	175	3	20
BLX68	SOT-48	c.w. class-B	12,5	470	7	5
		c.w. class-B	12,5	175	7,2	12,6
BLX69A	SOT-48	c.w. class-B	13,5	470	20	4
BLX91A	SOT-48	c.w. class-B	28	470	1	11
BLX92A	SOT-48	c.w. class-B	28	470	2,5	11
BLX93A	SOT-48	c.w. class-B	28	470	7	8,5
BLX94A	SOT-48	c.w. class-B	28	470	25	6
BLX94C	SOT-122	c.w. class-B	28	470	25	6,5
BLX95	SOT-56	c.w. class-B	28	470	40	4,5
BLX96	SOT-48	class-A	25	860	0,5 (note 1)	6
BLX97	SOT-48	class-A	25	860	1,0 (note 1)	5,5
BLX98	SOT-48	class-A	25	860	3,5 (note 1)	5
BLY33	TO-39	c.w. class-B	28	175	3	8,8
BLY34	TO-39	c.w. class-B	13,8	175	3	7
BLY35	TO-60	c.w. class-B	24	175	13	9,8
BLY36	TO-60	c.w. class-B	13,8	175	7	7,6
BLY83	SOT-48	c.w. class-B	24	175	13	9,8
BLY84	SOT-48	c.w. class-B	13,8	175	7	7,6
BLY85	SOT-48	c.w. class-B	13,8	175	4	10
BLY87A	SOT-48	c.w. class-B	13,5	175	8	9
BLY87C	SOT-120	c.w. class-B	13,5	175	8	12
BLY88A	SOT-48	c.w. class-B	13,5	175	15	7,5
BLY88C	SOT-120	c.w. class-B	13,5	175	15	8
BLY89A	SOT-56	c.w. class-B	13,5	175	25	6
BLY89C	SOT-120	c.w. class-B	13,5	175	25	6
BLY90	SOT-55	c.w. class-B	12,5	175	50	5
BLY91A	SOT-48	c.w. class-B	28	175	8	12
BLY91C	SOT-120	c.w. class-B	28	175	8	12

Notes

1. P_o sync at $d_{im} < -60$ dB.
3. P.E.P. at $d_3 < -40$ dB.
4. P.E.P. at d_3 typ. -30 dB.

type number	envelope	mode of operation	V_{CE} V	frequency MHz	output power W	power gain dB
BLY92A	SOT-48	c.w. class-B	28	175	15	10
BLY92C	SOT-120	c.w. class-B	28	175	15	10
BLY93A	SOT-56	c.w. class-B	28	175	25	9
BLY93C	SOT-120	c.w. class-B	28	175	25	9
BLY94	SOT-55	c.w. class-B	28	175	50	7
BLY97	SOT-48	c.w. class-B	24	175	4	13
2N3375	TO-60	c.w. class-B	28	100	7,5	8,8
		c.w. class-B	28	400	3	4,8
2N3553	TO-39	c.w. class-B	28	175	2,5	10
2N3632	TO-60	c.w. class-B	28	175	13,5	5,9
2N3866	TO-39	c.w. class-B	28	400	1	10
2N3924	TO-39	c.w. class-B	13,5	175	4	6
2N3926	TO-60	c.w. class-B	13,5	175	7	5,4
2N3927	TO-60	c.w. class-B	13,5	175	12	4,8
2N4427	TO-39	c.w. class-B	12	175	1	10

In this list we present a survey of all transmitting transistors and modules grouped in accordance with the main r.f. power application area together with the most important data.

	type number	envelope	V_{CE} V	P_L (P.E.P.) W	G_p dB
s.s.b. class-AB; f = 28 MHz; d_3; d_5 < −30 dB	BLY92A	SOT-48	28	10	20
	BLY92C	SOT-120	28	10	20
	BLV21	SOT-123	28	10	20
	BLX13	SOT-56	28	25	18
	BLX13C	SOT-120	28	25	18
	BLW83	SOT-123	28	25	18
	BLX39	SOT-120	28	40	17
	BLW86	SOT-123	28	45	17
	BLX14	SOT-55	28	50	13
	BLW76	SOT-121	28	80	13
	BLW78	SOT-121	28	100	19
	BLW77	SOT-121	28	130	12
	BLW50F	SOT-123	50	50	18
	BLX15	SOT-55	50	150	14
	BLW95	SOT-121	50	160	14
	BLW96	SOT-121	50	200	13,5
s.s.b. class-A; f = 28 MHz; d_3; d_5 < −40 dB	BLY91A	SOT-48	26	1,3	20
	BLY91C	SOT-120	26	1,3	20
	BLV20	SOT-123	26	1,3	20
	BLY92A	SOT-48	26	2,5	20
	BLY92C	SOT-120	26	2,5	20
	BLV21	SOT-123	26	2,5	20
	BLX13	SOT-56	26	8	18
	BLX13C	SOT-120	26	8	20
	BLW83	SOT-123	26	10	20
	BLX39	SOT-120	26	15	18
	BLW86	SOT-123	26	17	20
	BLW78	SOT-121	26	30	18
	BLW50F	SOT-123	45	16	19,5
	BLW96	SOT-121	40	40	18
s.s.b. class-AB; f = 28 MHz; d_3; d_5 < −30 dB	BLY88A	SOT-48	13,5	10	18
	BLY88C	SOT-120	13,5	10	18
	BLV11	SOT-123	13,5	10	18
	BLY89A	SOT-56	13,5	15	18
	BLY89C	SOT-120	13,5	15	18
	BLW87	SOT-123	13,5	15	18
	BLW60	SOT-56	12,5	30	18
	BLW60C	SOT-120	12,5	30	18
	BLW85	SOT-123	12,5	30	18

s.s.b. class-A; f = 28 MHz; d_3; d_5 < −40 dB

type number	envelope	V_{CE} V	P_L (P.E.P.) W	G_p dB
BLY87A	SOT-48	12	1	18
BLY87C	SOT-120	12	1	18
BLV10	SOT-123	12	1	18
BLY88A	SOT-48	12	2	18
BLY88C	SOT-120	12	2	18
BLV11	SOT-123	12	2	18
BLY89A	SOT-56	12	6	18
BLY89C	SOT-120	12	6	18
BLW87	SOT-123	12	6	18

v.h.f. base stations; class-B operation

v.h.f. mobile transmitters; class-B operation (continued on next page)

type number	envelope	V_{CE} V	f MHz	P_L W	G_p dB
2N3866	TO-39	28	175	1	15
BFS23A	TO-39	28	175	4	10
BLY91A	SOT-48	28	175	8	12
BLY91C	SOT-120	28	175	8	12
BLV20	SOT-123	28	175	8	12
BLY92A	SOT-48	28	175	15	10
BLY92C	SOT-120	28	175	15	10
BLV21	SOT-123	28	175	15	10
BLY93A	SOT-56	28	175	25	9
BLY93C	SOT-120	28	175	25	9
BLW84	SOT-123	28	175	25	9
BLX39	SOT-120	28	175	45	7,5
BLW86	SOT-123	28	175	45	7,5
BLY94	SOT-55	28	175	50	7
BLW76	SOT-121	28	108	80	8
BLW78	SOT-121	28	150	100	6
BLW77	SOT-121	28	87,5	130	7,5
BLX15	SOT-55	50	108	150	7,5
BLW95	SOT-121	50	108	160	7,0
BLW96	SOT-121	50	108	200	6,5
2N4427	TO-39	12	175	1	10
BFQ42	TO-39	13,5	175	2	11
BFS22A	TO-39	13,5	175	4	8
BFQ43	TO-39 ▲	13,5	175	4	12
BLY87A	SOT-48	13,5	175	8	9
BLY87C	SOT-120	13,5	175	8	12
BLV10	SOT-123	13,5	175	8	9
BLW29	SOT-120	13,5	175	15	10
BLY88A	SOT-48	13,5	175	15	7,5
BLY88C	SOT-120	13,5	175	15	7,5
BLV11	SOT-123	13,5	175	15	7,5
BLY89A	SOT-56	13,5	175	25	6
BLY89C	SOT-120	13,5	175	25	6
BLW87	SOT-123	13,5	175	25	6

▲ Emitter connected to case.

	type number	envelope	V_{CE} V	f MHz	P_L W	G_p dB
v.h.f. mobile transmitters; class-B operation (continued)	BLW31	SOT-120	13,5	175	28	9
	BLW60	SOT-56	12,5	175	45	5
	BLW60C	SOT-120	12,5	175	45	5
	BLW85	SOT-123	12,5	175	45	4,5
	BLY90	SOT-55	12,5	175	50	5

	type number	envelope	V_B V	f MHz	P_L W	G_p dB
v.h.f. modules for mobile transmitters	BGY43	SOT-132B	12,5	148-174	13	19,4
	BGY32	SOT-132B	12,5	68- 88	18	22,6
	BGY33	SOT-132B	12,5	80-108	18	22,6
	BGY35	SOT-132B	12,5	132-156	18	20,8
	BGY36	SOT-132B	12,5	148-174	18	20,8
u.h.f. modules for mobile transmitters	BGY22	SOT-75A	13,5	380-512	2,5	17
	BGY22A	SOT-75A	12,5	420-480	2,5	17
	BGY23	SOT-75A	13,5	380-480	7,0	4,5
	BGY23A	SOT-75A	12,5	420-480	7,0	4,5
	BGY40A	SOT-132C	12,5	400-440	7,5	18,8
	BGY40B	SOT-132C	12,5	440-470	7,5	18,8
	BGY41A	SOT-132C	12,5	400-440	13	19,4
	BGY41B	SOT-132C	12,5	440-470	13	19,4

	type number	envelope	V_{CE} V	f MHz	P_L W	G_p dB
u.h.f. base stations class-B operation	2N3866	TO-39	28	470	1	7
	BLX91A	SOT-48	28	470	1	11
	BLW89	SOT-122	28	470	2	12
	BLX92A	SOT-48	28	470	2,5	11
	BLW90	SOT-122	28	470	4	11
	BLX93A	SOT-48	28	470	7	8,5
	BLW91	SOT-122	28	470	10	9
	BLX94A	SOT-48	28	470	25	6
	BLX94C	SOT-122	28	470	25	6,5
	BLX95	SOT-56	28	470	40	4,5
u.h.f. mobile transmitters class-B operation	BLX65	TO-39	12,5	470	2	6
	BLW79	SOT-122	12,5	470	2	9
	BLX66	SOT-48 ▲	12,5	470	2,5	8,5
	BLX67	SOT-48	12,5	470	2,5	8,5
	BLW80	SOT-122	12,5	470	4	8
	BLX68	SOT-48	12,5	470	7	5
	BLW81	SOT-122	12,5	470	10	6
	BLX69A	SOT-48	13,5	470	20	4
	BLW82	SOT-119	12,5	470	30	5

▲ Without stud.

	type number	envelope	V_{CE} V	f MHz	P_L W	G_p dB
f.m. broadcast transmitters; class-B operation	2N3866	TO-39	28	87,5 – 108	1	18
	BLW90	SOT-122	28	87,5 – 108	4	20
	BLV21	SOT-123	28	87,5 – 108	15	15
	BLX39	SOT-120	28	87,5 – 108	45	11
	BLW86	SOT-123	28	87,5 – 108	45	11
	BLW78	SOT-121	28	87,5 – 108	100	8
	BLV25	SOT-119	28	87,5 – 108	175	10,5

	type number	envelope	f MHz	$P_{o\ sync}$ W	d_{im} dB	G_p dB	V_{CE} V	I_C mA
TV transposer circuits; band III; class-A operation	BGY55 ●	SOT-115	225	0,25 0,45	–60 –55	17	24	200
	BLV30	SOT-122	225	1,5	–60	18	25	460
	BLV31	SOT-122	225	5	–58	15	25	800
	BLV32F	SOT-160	225	10	–55	16	25	1600
	BLV33F	SOT-119	225	16	–55	13,5	25	3200
	BLV33	SOT-147	225	19	–55	9	25	3200
	BLV36	SOT-161	225	30	–55	14	25	2 x 2600
TV transmitter circuits; band III; class-AB operation	BLV33F	SOT-119	225	85 *		10,5	28	4250
	BLV33	SOT-147	225	90 *		6,5	28	4460
	BLV36	SOT-161	225	120 *		10	28	2 x 3900
TV transposer circuits; band IV-V; class-A operation	BFR96S ●	SOT-37	860	0,12	–60	10	10	70
	BFQ34 ●	SOT-122	860	0,3	–60	11	15	120
	BLW32	SOT-122	860	0,5	–60	11	25	150
	BFQ68 ●	SOT-122	860	0,7	–60	10	15	240
	BLW33	SOT-122	860	1,0	–60	10	25	300
	BLW34	SOT-122	860	1,8	–60	9	25	600
	BLW98	SOT-122	860	3,5	–60	6,5	25	850
	BLV57	SOT-161	860	6	–60	8	25	2 x 850
TV transmitter circuits; band IV-V; class-AB operation	BLV57	SOT-161	860	38 *		6,5	25	2 x 1100

* At 1 dB power gain compression.
● See handbook S10.

In this section we present information on recommended circuit line-ups in the main r.f. power application areas. A comprehensive range of output power levels is indicated together with our recommended types in the particular line-up configuration. The necessary drive power level for each line-up is indicated in the first column.

More detailed application information as well as computer aided design parameters are available on request.

S.S.B. TRANSMITTERS (1,5 MHz – 30 MHz)

input power mW	1st stage		2nd stage	3rd stage	P_L (P.E.P.) W	V_{CE} V	stud S flange F
30	BLY87C	*	2 x BLY89C		30	13	S
30	BLV10	*	2 x BLW87		30	13	F
50	BLY88C	*	2 x BLW60C		50	13	S
50	BLV11	*	2 x BLW85		50	13	F
100	BLY89C	*	4 x BLW60C		100	13	S
100	BLW87	*	4 x BLW85		100	13	F
50	BLY91C	*	2 x BLX13C		50	28	S
50	BLV20	*	2 x BLW83		50	28	F
150	BLW83	*	2 x BLW76		150	28	F
250	2 x BLW83	*	2 x BLW77		250	28	F
500	2 x BLW86	*	4 x BLW77		450	28	F
300	2 x BLX13C	**	2 x BLX15		250	50	S
300	2 x BLW83	**	2 x BLW96		350	50	F
600	2 x BLX39	**	4 x BLX15		500	50	S
600	2 x BLW50F	*	4 x BLW95		500	50	F
40	BLY91C	**	2 x BLW78 **	8 x BLX15	1000	50	S/F
40	BLV20	**	4 x BLW50F	8 x BLW96	1200	50	F

MILITARY COMMUNICATION TRANSMITTERS (25 MHz – 80 MHz)

Input power mW	1st stage		2nd stage	3rd stage	P_L W	V_{CE} V	stud S flange F
5	BFR96 ●	*	2 x BFQ42		2	7,5	–
15	2N4427	*	2 x BLW80		6	13	S
50	BLW79	*	2 x BLW29		25	13	S
50	BLW89	*	2 x BLY92C		25	28	S
20	2N3866	*	2 x BLY91C	2 x BLX39	90	28	S
20	2N3866	*	2 x BLV20	2 x BLW86	90	28	F

● See handbook S10.
* Class-A operation.
** 28 V supply voltage; class-A operation.

MOBILE TRANSMITTERS (68 MHz – 87,5 MHz)

input power mW	1st stage	2nd stage		P_L W	V_{CE} V	stud S flange F
20	2N4427	BLY87C		8	13	S
20	2N4427	BLV10		8	13	F
35	2N4427	BLW29		14	13	S
10	BSX19 ●	BGY32		18	13	F
70	BFQ42	BLW31		28	13	S
160	BFQ43	BLW60C		45	13	S
160	BFQ43	BLW85		45	13	F

BASE STATIONS (68 MHz – 87,5 MHz)

input power mW	1st stage	2nd stage	3rd stage	P_L W	V_{CE} V	stud S flange F
65	BFS23A	BLY93C		25	28	S
65	BFS23A	BLW84		25	28	F
125	BLX92A	BLX39		50	28	S
15	2N3866	BLV21	BLW78	100	28	F
50	2N3866 **	BLY93C **	BLX15	150	50	S
50	2N3866 **	BLW84 **	BLW95	150	50	F

F.M. BROADCAST TRANSMITTERS (87,5 MHz – 108 MHz)

input power mW	1st stage	2nd stage	3rd stage	P_L W	V_{CE} V	stud S flange F
100	BLW90	BLX39		50	28	S
40	2N3866	BLV21	BLW78	100	28	F
100	BLW90	BLW86	2 x BLV25	300	28	F
500	BLV21	BLW78	4 x BLV25	550	28	F
600	BLV21	BLV25	8 x BLV25	1000	28	F

A.M. AIRCRAFT TRANSMITTERS (118 MHz – 136 MHz)

input power mW	1st stage	2nd stage	3rd stage	$P_{L(carr)}$ W	V_{CE} V	stud S flange F
110	BLX92A	BLY93C		6	13/28	S
240	BLY91C	BLX39		12	13/28	S
240	BLV20	BLW86		12	13/28	F
100	BLX92A	BLY93C	BLW78	25	13/28	S/F
100	BLX92A	BLW84	BLW78	25	13/28	S/F

● See Handbook S3.
** 28 V supply voltage.

PORTABLE AND MOBILE TRANSMITTERS (132 MHz — 174 MHz)

input power mW	1st stage	2nd stage	3rd stage		P_L W	V_{CE} V	stud S flange F
40	2N4427	BFQ43			2	7,5	–
100	2N4427	BLY87C			8	13	S
100	2N4427	BLV10			8	13	F
125	BFQ42	BLW29			14	13	S
150	BGY36				18	13	F
250	BFQ43	BLW31			28	13	S
120	BFQ42	BLW29	BLW60C		45	13	S
150	BGY36	BLW85			45	13	F

BASE STATIONS (132 MHz — 174 MHz)

input power mW	1st stage	2nd stage	3rd stage		P_L W	V_{CE} V	stud S flange F
200	BLY91C	BLY93C			25	28	S
200	BLV20	BLW84			25	28	F
25	2N3866	BLY91C	BLX39		50	28	S
25	2N3866	BLV20	BLW86		50	28	F
200	BFS23A	BLY93C	2 x BLX39		100	28	S
200	BFS23A	BLW84	2 x BLW86		100	28	F

TV TRANSPOSERS (Band III: 174 MHz — 230 MHz)

input power mW	1st stage	2nd stage	3rd stage	4th stage	P_o sync W	P_o sat W	V_{CE} V
6	BGY55 ●	2 x BLV31			10	10	25
7	BLV30	2 x BLV32F			20	20	25
3	BGY55 ●	2 x BLV31	2 x BLV33		30	40	25
6	BLV30	2 x BLV33F	4 x BLV33		60	75	25
2	BGY55 ●	2 x BLV31	4 x BLV33	8 x BLV33	100	140	25

TV TRANSMITTERS (Band III: 174 MHz — 230 MHz)

input power mW	1st stage	2nd stage	3rd stage		P_o sync W		V_{CE} V
8	BGY55 ●	2 x BLV31	2 x BLV33F		130		28
10	BLV30	2 x BLV32F	2 x BLV36		250		28
35	BLV30	2 x BLV33F	4 x BLV36		470		28
75	2 x BLV30	4 x BLV33F	8 x BLV36		900		28

● See handbook S10.

PORTABLE AND MOBILE TRANSMITTERS (400 MHz – 470 MHz)

input power mW	1st stage	2nd stage	3rd stage		P_L W	V_{CE} V	stud S flange F
15	BFR96 ●	BLW79	BLW80		2	7,5	S
100	BGY40A BGY40B				7,5	12,5	F
50	BLW79	BLW80	BLW81		10	13	S
150	BGY41A BGY41B				13	12,5	F
220	BLW79	BLW81	BLX69A		18	13	S
100	BGY41A BGY41B	BLW82			30	13	F

BASE STATIONS (400 MHz – 470 MHz)

input power mW	1st stage	2nd stage	3rd stage	4th stage	P_L W	V_{CE} V	stud S flange F
45	BLX91A	BLW91	BLX94C		25	28	S
250	BLW90	BLX94C	BLX95		40	28	S
45	BLX91A	BLW91	BLX94C	2 x BLX95	70	28	S

TV TRANSPOSERS (Band IV/V: 470 MHz – 860 MHz)

input power mW	1st stage	2nd stage	3rd stage	4th stage	P_o sync W	P_o sat W	V_{CE} V
5	BFQ34 ●	BFQ68 ●	2 x BFQ68●		1,4	1,4	15
6	BLW32	BLW33	2 x BLW34		4,4	5,7	25
2	BLW32	BLW33	2 x BLW34	2 x BLW98	8	8	25
3	BLW32	BLW33	2 x BLW34	2 x BLV57	13	15	25
10	BFQ68 ●	2 x BLW34	2 x BLW98	4 x BLV57	23	30	25
14	BFQ68 ●	2 x BLW34	2 x BLV57	8 x BLV57	38	60	25

TV TRANSMITTERS (Band IV/V: 470 MHz – 860 MHz)

input power mW	1st stage	2nd stage	3rd stage	4th stage	P_o sync W		V_{CE} V
12	BFR96S ●	BFQ68 ●	2 x BLW34	2 x BLV57	45		28
30	BFQ34 ●	2 x BLW33	2 x BLV57	4 x BLV57	85		28
80	BFQ68 ●	2 x BLW34	4 x BLV57	8 x BLV57	165		28

● See handbook S10.

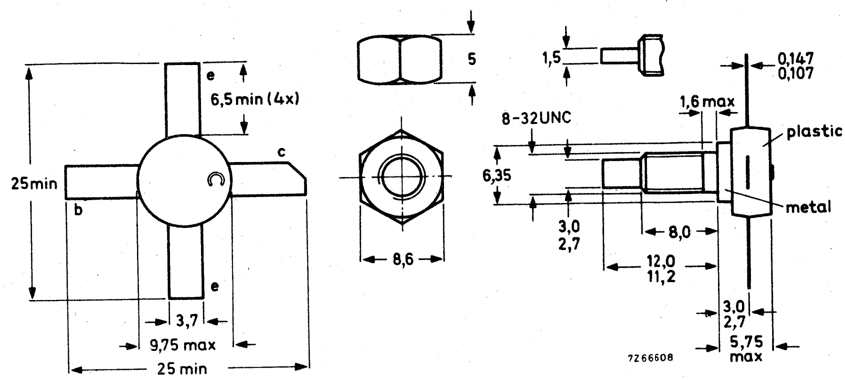
Notes

1. For TV transposers and transmitters, the input powers quoted relate to the peak sync levels.
2. $P_{o\ sync}$ for transposers is the peak sync output power for a three-tone intermodulation distortion of −54 dB (vision carrier −8 dB, sound carrier −7 dB, sideband signal −16 dB) without pre-correction.
3. $P_{o\ sync}$ is the peak sync output power of a transposer before the sound carrier has been added. After addition of the sound carrier the peak output power will be approximately twice $P_{o\ sync}$. In transposers with pre-correction the intermodulation distortion is reduced and therefore $P_{o\ sync}$ can be increased. However there is a limit formed by the saturated output power of the transistor. Taking this into account $P_{o\ sat}$ is the maximum value of $P_{o\ sync}$ in pre-corrected systems.
4. In the transmitter line-ups the output stage operates in class-AB, the driver stages in class-A.
5. $P_{o\ sync}$ for transmitters is the peak sync output power at 1 dB power gain compression.

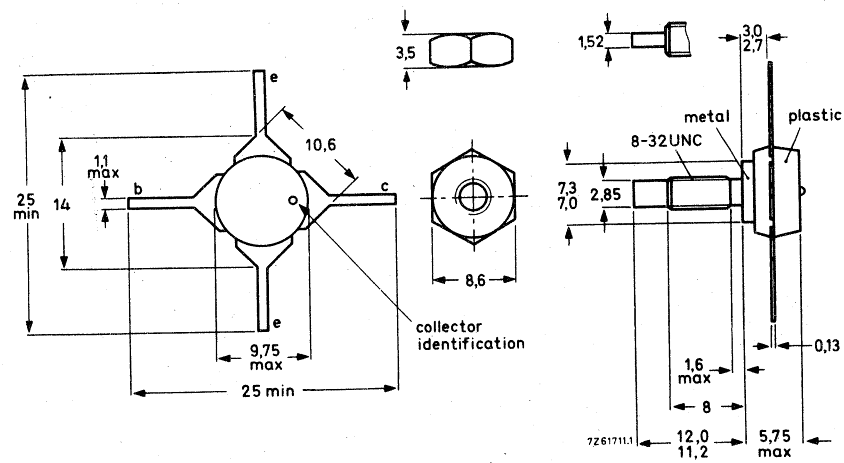
MECHANICAL DATA

Dimensions in mm

SOT-48



SOT-48

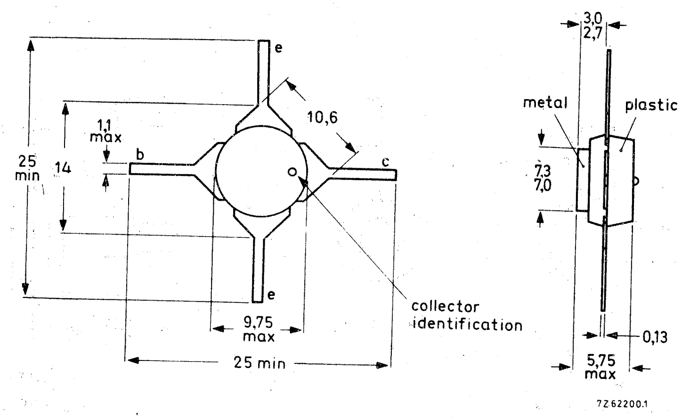


This envelope is also supplied with different collector identification (bevelled collector lead).

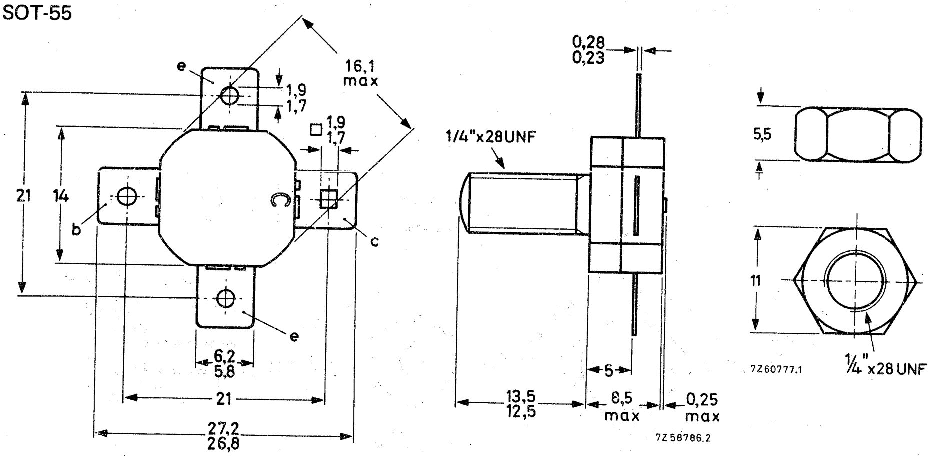
MECHANICAL DATA

Dimensions in mm

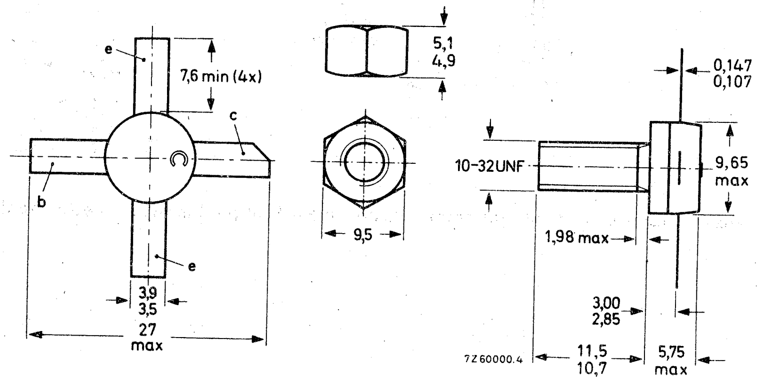
SOT-48



SOT-55



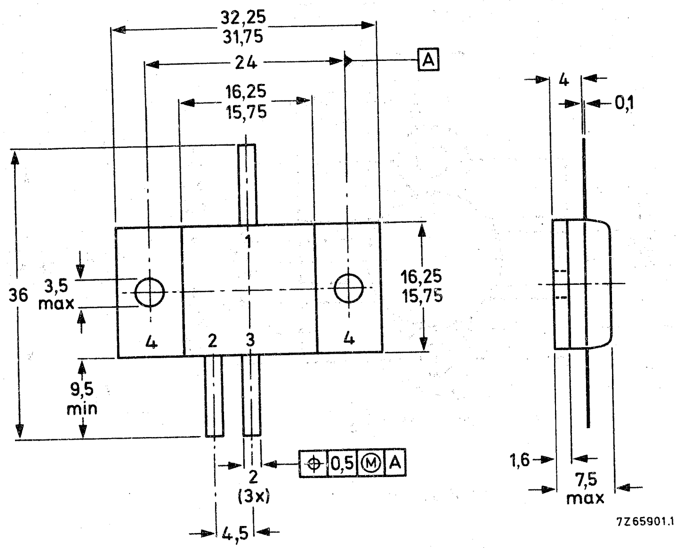
SOT-56



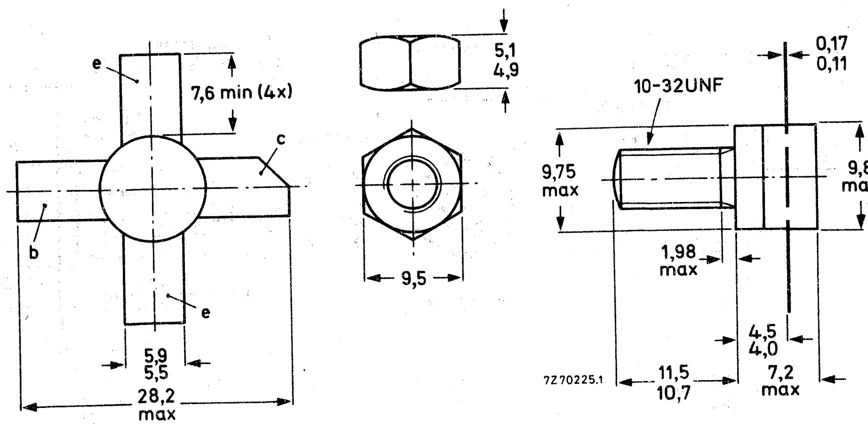
MECHANICAL DATA

Dimensions in mm

SOT-75A



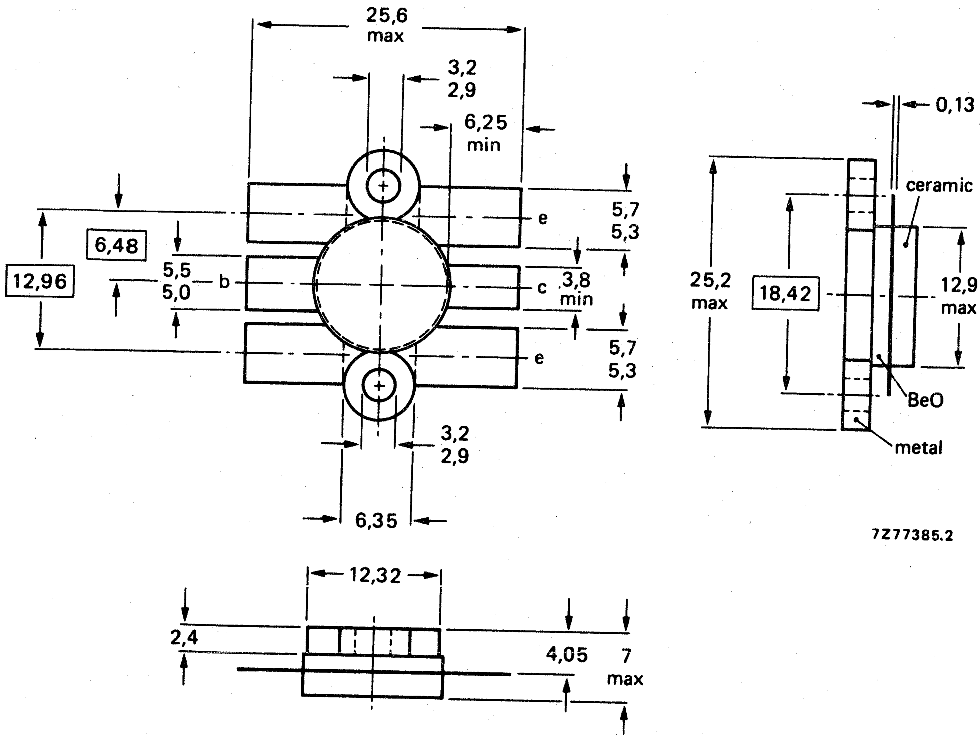
SOT-105



MECHANICAL DATA

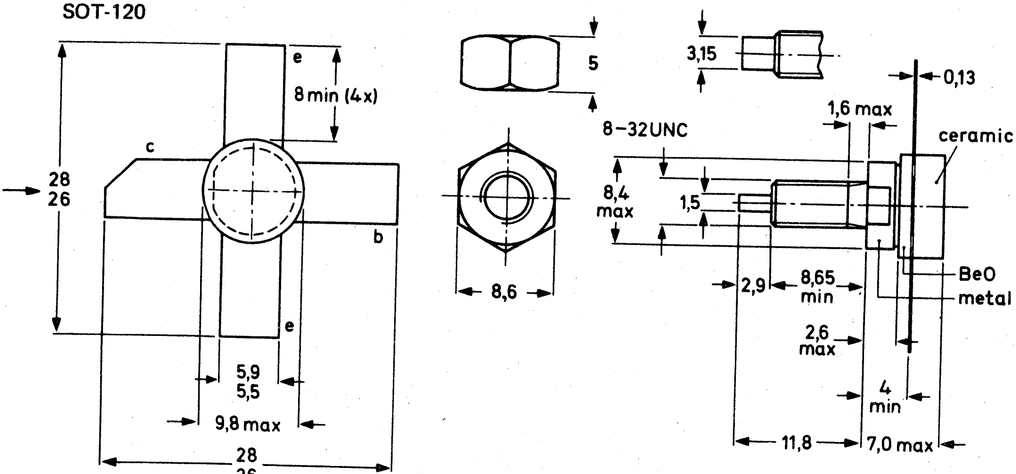
Dimensions in mm

SOT-119



7Z77385.2

SOT-120

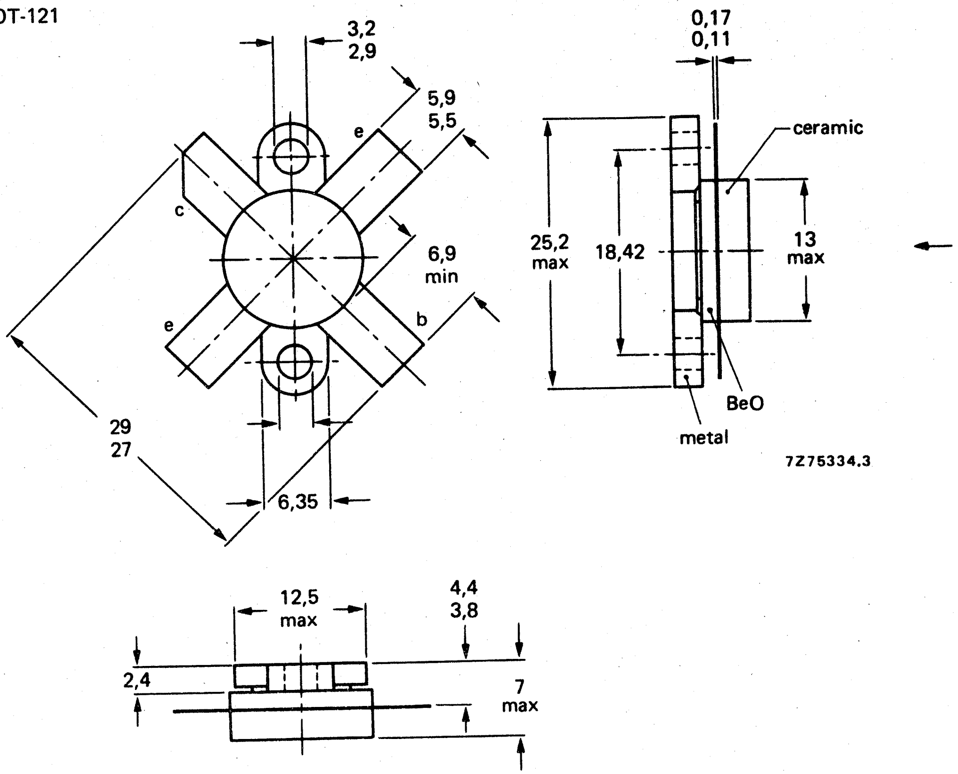


7Z69881.2

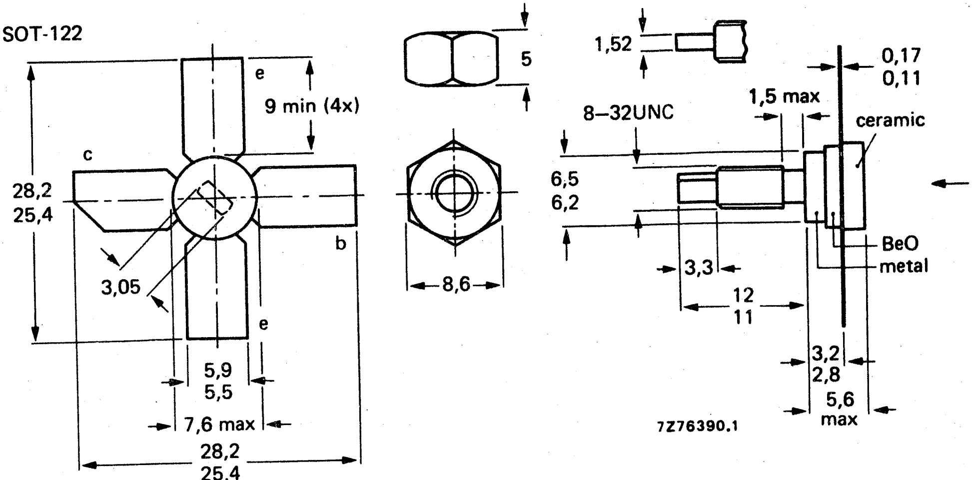
MECHANICAL DATA

Dimensions in mm

SOT-121



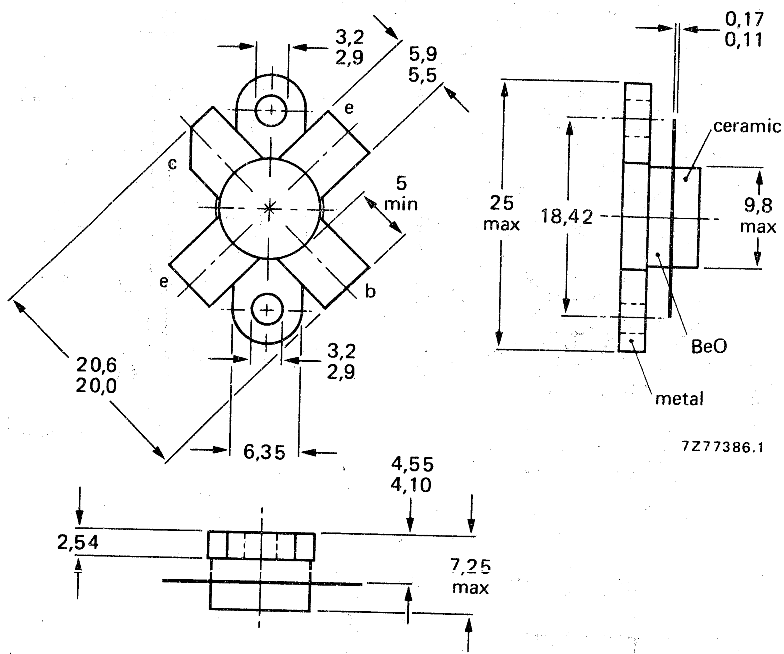
SOT-122



MECHANICAL DATA

SOT-123

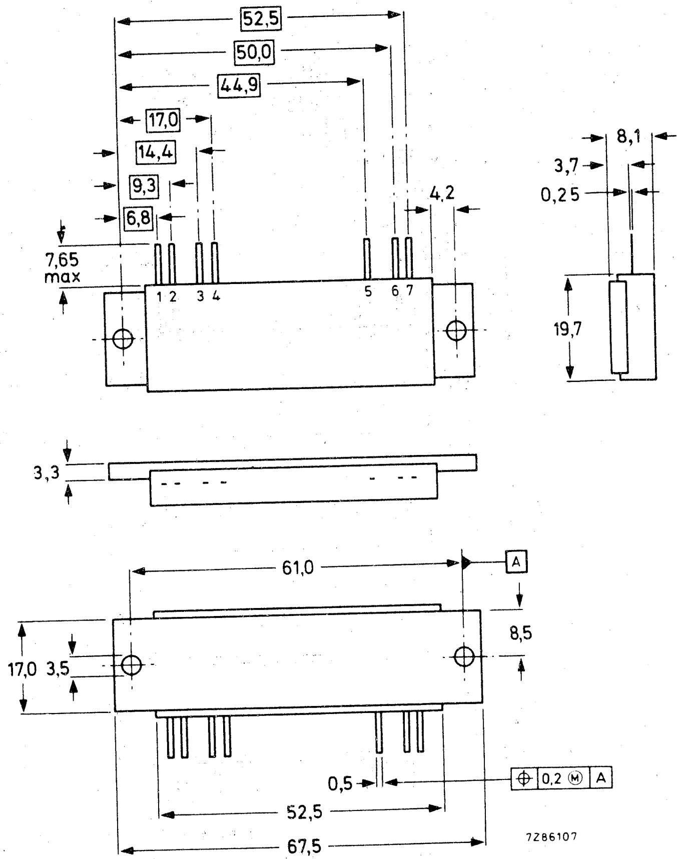
Dimensions in mm



Dimensions in mm

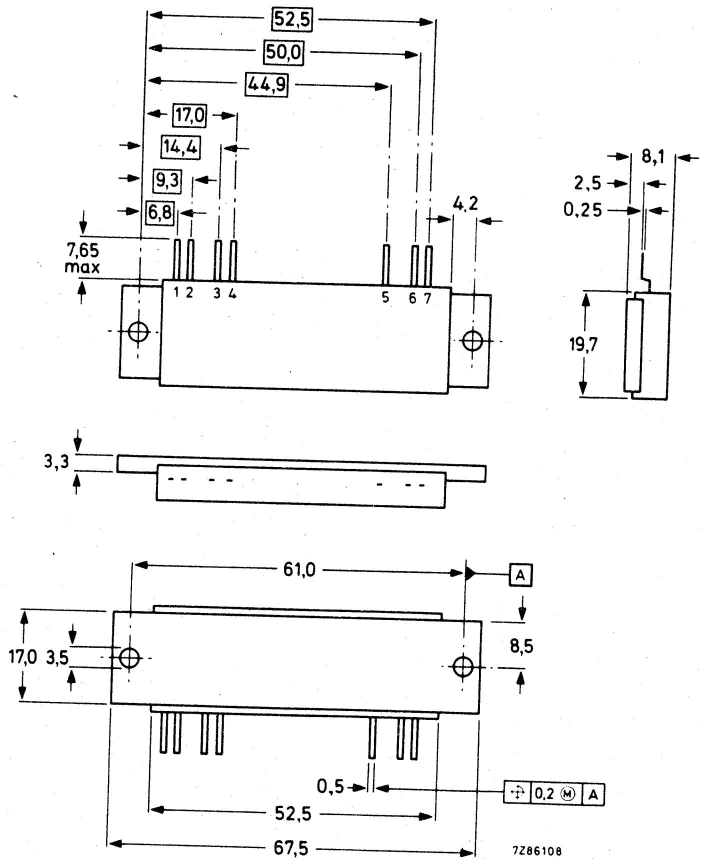
MECHANICAL DATA

SOT-132B



MECHANICAL DATA
SOT-132C

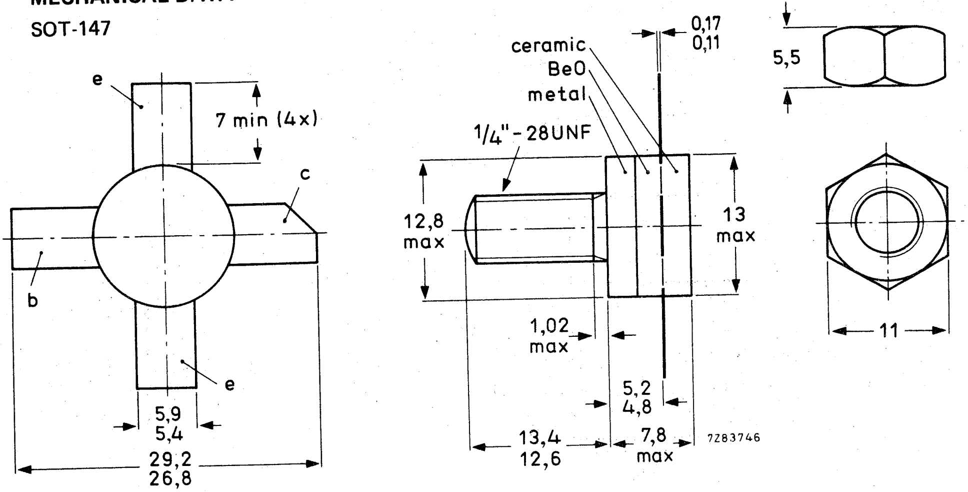
Dimensions in mm



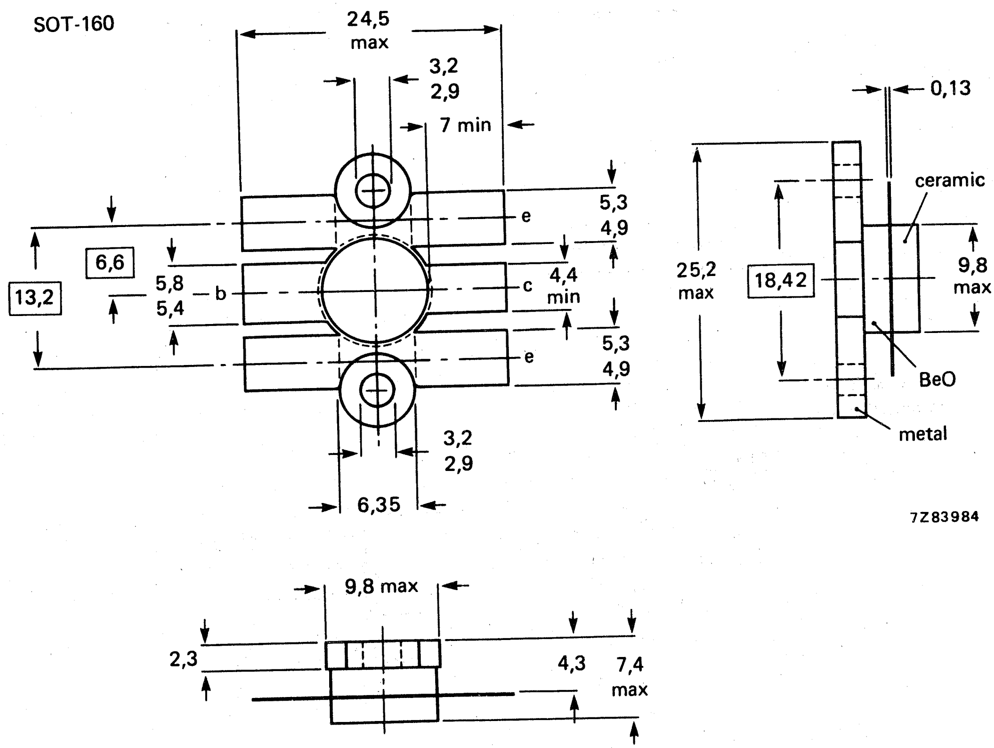
MECHANICAL DATA

Dimensions in mm

SOT-147



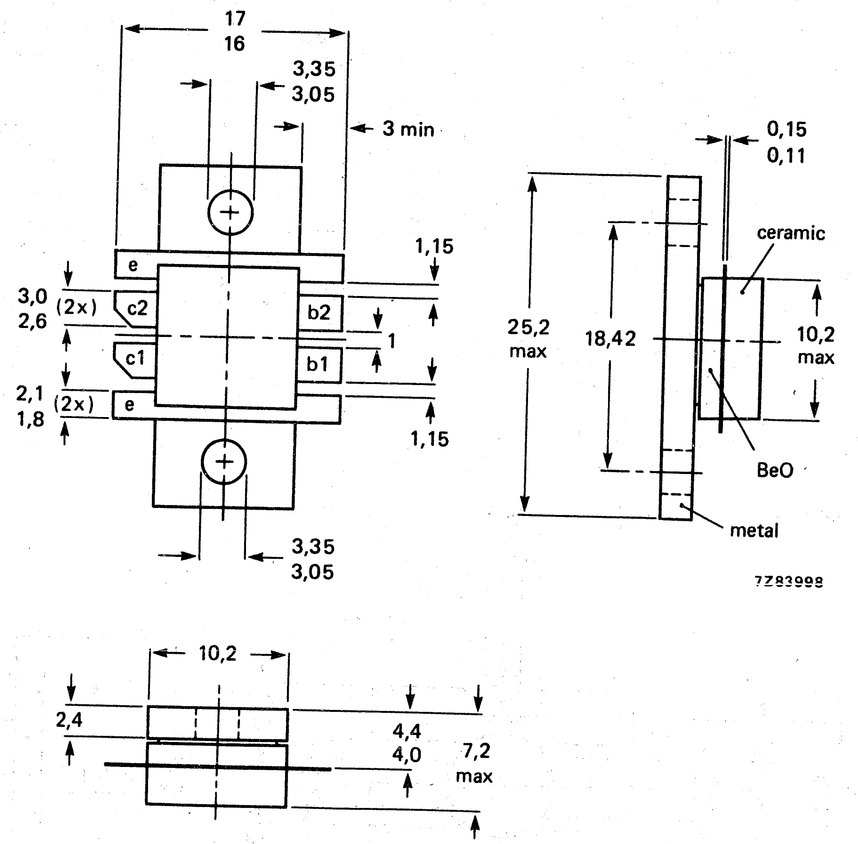
SOT-160



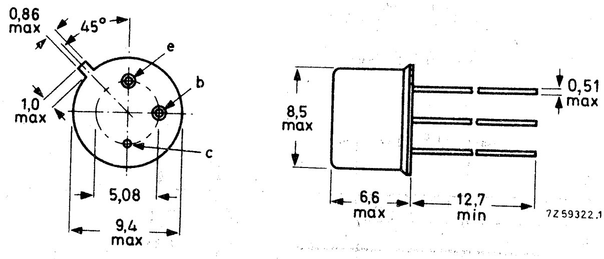
MECHANICAL DATA

SOT-161

Dimensions in mm



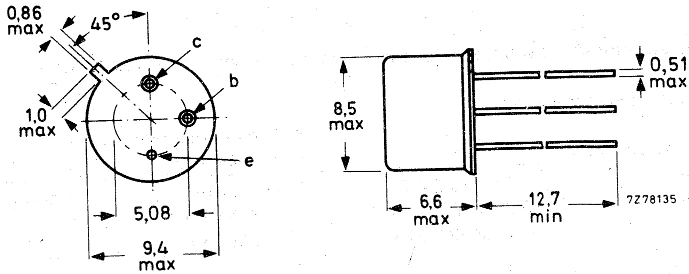
TO-39; collector connected to case.



Dimensions in mm

MECHANICAL DATA

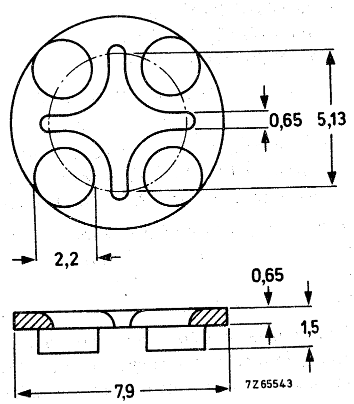
TO-39; emitter connected to case.



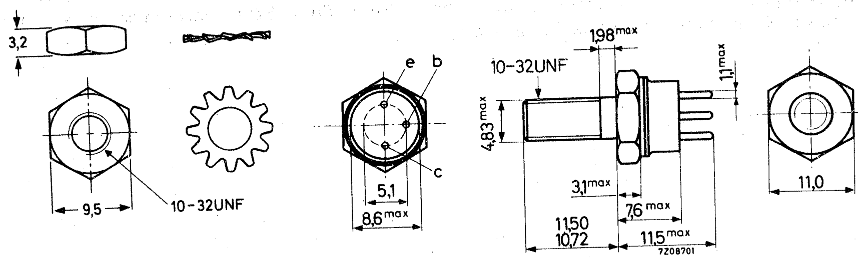
56245 (distance disc) for TO-39.

Insulating material.

Maximum permissible temperature 100 °C.



TO-60



RECOMMENDATIONS FOR MOUNTING ¼", ⅜" AND ½" CAPSTAN HEADERS AS USED FOR R.F. POWER TRANSISTORS

A nickel plated brass nut is supplied with each transistor for securing it to a heatsink.

Screw threads, diameter and nuts:

mounting base diameter	thread	maximum diameter of threaded stud	nut thickness
¼"	8-32UNC-2A(B)	4,14 mm	3,5 and 5 mm
⅜"	10-32UNF-2A(B)	4,80 mm	5 mm
½"	¼" x 28UNF-2A(B)	6,33 mm	5,5 mm

To ensure optimum heat transfer and to avoid damage to the threaded stud of the transistor the following recommendations should be observed.

– Diameter of the mounting hole in the heatsink:
  - ¼" stud diameter 4,15 +0,05; –0 mm
  - ⅜" stud diameter 4,85 +0,05; –0 mm
  - ½" stud diameter 6,35 +0,05; –0 mm

  Heatsink surfaces at the mounting hole to be flat, parallel, and free of burrs or oxidation.

– Mounting nut torque:
  - ¼" nut minimum 0,75 Nm (7,5 kg cm) maximum 0,85 Nm (8,5 kg cm)
  - ⅜" nut minimum 1,5 Nm (15 kg cm) maximum 1,7 Nm (17 kg cm)
  - ½" nut minimum 2,3 Nm (23 kg cm) maximum 2,7 Nm (27 kg cm)

– Recommended distance from the surface of the heatsink to the top surface of the printed-circuit board:
  - ¼" capstan header 2,9 + 0; –0,2 mm
  - ⅜" capstan header 3,8 + 0; –0,2 mm
  - ½" capstan header 4,8 + 0; –0,2 mm

  It is important that the above maximum printed-circuit board mounting heights are not exceeded in order to prevent stress being applied to the encapsulation. Upward lead bending, in particular, can damage the encapsulation and impair the sealing of the header.

– Solder the leads to the connection pads with resin-cored tin-lead solder, using and iron of normal temperature. Soldering iron temperatures as high as 350 °C are safely tolerable, the transistor can withstand an internal temperature of 250 °C for about ten minutes.

– The leads may be tinned, if required, by dipping them into a solder bath at about 230 °C; each lead may be dipped up to its full length. A flux of the quality of Super-Safe is recommended; after tinning, surplus flux should be rinsed away in tap water.

RECOMMENDATIONS FOR MOUNTING FLANGE R.F. POWER TRANSISTORS

Flange r.f. transistors are easy to mount but for optimum performance we offer the following recommendations:

- Holes or tapped holes in the heatsink should be free from burrs and spaced at 18,42 mm (+ 0,05; –0,05) between centres. They must have a depth of at least 6 mm.
  Recommended screw: for SOT-119, SOT-121 and SOT-161 cheese-head 4-40 UNC/2A, for SOT-123 and SOT-160 also M3. A washer to spread the joint pressure is also recommended.
- For transistors dissipating up to 80 W the heatsink thickness should be at least 3 mm copper (> 99,9%, ETP-Cu) or 5 mm aluminium (> 99,0% Al). For transistors dissipating more power, the thickness should be increased proportionally.
- The flatness of the heatsink mounting surface must be < 0,02 mm with a surface roughness $R_a < 0,5$ μm (preferably by grinding or lapping).
- The sparing use of evenly distributed heatsink compound on the transistor flange is recommended. Suitable heatsink compound brands are: Dow Corning 340, Eccotherm TC-5 (E&C), Wakefield 120.
- The screws through the flange holes should first both be tightened to 0,05 Nm (finger tight), and then tightened to 0,6 to 0,75 Nm, to achieve the published thermal resistance between the mounting base and heatsink.
- When a transistor is removed from the heatsink, the flange will almost certainly have been distorted by the joint pressure. Grinding or lapping of the flange according to the information above is necessary if the transistor is remounted.

GENERAL

Type designation
Rating systems
Letter symbols
s-parameters

PRO ELECTRON TYPE DESIGNATION CODE FOR SEMICONDUCTOR DEVICES

This type designation code applies to discrete semiconductor devices – as opposed to integrated circuits –, multiples of such devices and semiconductor chips.

A basic type number consists of:

TWO LETTERS FOLLOWED BY A SERIAL NUMBER

FIRST LETTER

The first letter gives information about the material used for the active part of the devices.

A. GERMANIUM or other material with band gap of 0,6 to 1,0 eV.
B. SILICON or other material with band gap of 1,0 to 1,3 eV.
C. GALLIUM-ARSENIDE or other material with band gap of 1,3 eV or more.
R. COMPOUND MATERIALS (e.g. Cadmium-Sulphide).

SECOND LETTER

The second letter indicates the function for which the device is primarily designed.

A. DIODE; signal, low power
B. DIODE; variable capacitance
C. TRANSISTOR; low power, audio frequency ($R_{th\ j\text{-}mb} > 15\ ^{o}C/W$)
D. TRANSISTOR; power, audio frequency ($R_{th\ j\text{-}mb} \leqslant 15\ ^{o}C/W$)
E. DIODE; tunnel
F. TRANSISTOR; low power, high frequency ($R_{th\ j\text{-}mb} > 15\ ^{o}C/W$)
G. MULTIPLE OF DISSIMILAR DEVICES – MISCELLANEOUS; e.g. oscillator
H. DIODE; magnetic sensitive
L. TRANSISTOR; power, high frequency ($R_{th\ j\text{-}mb} \leqslant 15\ ^{o}C/W$)
N. PHOTO-COUPLER
P. RADIATION DETECTOR; e.g. high sensitivity phototransistor
Q. RADIATION GENERATOR; e.g. light-emitting diode (LED)
R. CONTROL AND SWITCHING DEVICE; e.g. thyristor, low power ($R_{th\ j\text{-}mb} > 15\ ^{o}C/W$)
S. TRANSISTOR; low power, switching ($R_{th\ j\text{-}mb} > 15\ ^{o}C/W$)
T. CONTROL AND SWITCHING DEVICE; e.g. thyristor, power ($R_{th\ j\text{-}mb} \leqslant 15\ ^{o}C/W$)
U. TRANSISTOR; power, switching ($R_{th\ j\text{-}mb} \leqslant 15\ ^{o}C/W$)
X. DIODE: multiplier, e.g. varactor, step recovery
Y. DIODE; rectifying, booster
Z. DIODE; voltage reference or regulator (transient suppressor diode, with third letter W)

SERIAL NUMBER

Three figures, running from 100 to 999, for devices primarily intended for consumer equipment.
One letter (Z, Y, X, etc.) and two figures, running from 10 to 99, for devices primarily intended for industrial/professional equipment.
This letter has no fixed meaning except W, which is used for transient suppressor diodes.

VERSION LETTER

It indicates a minor variant of the basic type either electrically or mechanically. The letter never has a fixed meaning, except letter R, indicating reverse voltage, e.g. collector to case or anode to stud.

SUFFIX

Sub-classification can be used for devices supplied in a wide range of variants called associated types.
Following sub-coding suffixes are in use:

1. VOLTAGE REFERENCE and VOLTAGE REGULATOR DIODES: *ONE LETTER and ONE NUMBER*
   The LETTER indicates the nominal tolerance of the Zener (regulation, working or reference) voltage
   A. 1% (according to IEC 63: series E96)
   B. 2% (according to IEC 63: series E48)
   C. 5% (according to IEC 63: series E24)
   D. 10% (according to IEC 63: series E12)
   E. 20% (according to IEC 63: series E6)
   The number denotes the typical operating (Zener) voltage related to the nominal current rating for the whole range.
   The letter 'V' is used instead of the decimal point.

2. TRANSIENT SUPPRESSOR DIODES: *ONE NUMBER*
   The NUMBER indicates the maximum recommended continuous reversed (stand-off) voltage V_R. The letter 'V' is used as above.

3. CONVENTIONAL and CONTROLLED AVALANCHE RECTIFIER DIODES and THYRISTORS: *ONE NUMBER*
   The NUMBER indicates the rated maximum repetitive peak reverse voltage (V_{RRM}) or the rated repetitive peak off-state voltage (V_{DRM}), whichever is the lower. Reversed polarity is indicated by letter R, immediately after the number.

4. RADIATION DETECTORS: *ONE NUMBER,* preceded by a hyphen (–)
   The NUMBER indicates the depletion layer in μm. The resolution is indicated by a version LETTER.

5. ARRAY OF RADIATION DETECTORS and GENERATORS: *ONE NUMBER,* preceded by a stroke (/).
   The NUMBER indicates how many basic devices are assembled into the array.

RATING SYSTEMS

The rating systems described are those recommended by the International Electrotechnical Commission (IEC) in its Publication 134.

DEFINITIONS OF TERMS USED

Electronic device. An electronic tube or valve, transistor or other semiconductor device.

Note
This definition excludes inductors, capacitors, resistors and similar components.

Characteristic. A characteristic is an inherent and measurable property of a device. Such a property may be electrical, mechanical, thermal, hydraulic, electro-magnetic, or nuclear, and can be expressed as a value for stated or recognized conditions. A characteristic may also be a set of related values, usually shown in graphical form.

Bogey electronic device. An electronic device whose characteristics have the published nominal values for the type. A bogey electronic device for any particular application can be obtained by considering only those characteristics which are directly related to the application.

Rating. A value which establishes either a limiting capability or a limiting condition for an electronic device. It is determined for specified values of environment and operation, and may be stated in any suitable terms.

Note
Limiting conditions may be either maxima or minima.

Rating system. The set of principles upon which ratings are established and which determine their interpretation.

Note
The rating system indicates the division of responsibility between the device manufacturer and the circuit designer, with the object of ensuring that the working conditions do not exceed the ratings.

ABSOLUTE MAXIMUM RATING SYSTEM

Absolute maximum ratings are limiting values of operating and environmental conditions applicable to any electronic device of a specified type as defined by its published data, which should not be exceeded under the worst probable conditions.

These values are chosen by the device manufacturer to provide acceptable serviceability of the device, taking no responsibility for equipment variations, environmental variations, and the effects of changes in operating conditions due to variations in the characteristics of the device under consideration and of all other electronic devices in the equipment.

The equipment manufacturer should design so that, initially and throughout life, no absolute maximum value for the intended service is exceeded with any device under the worst probable operating conditions with respect to supply voltage variation, equipment component variation, equipment control adjustment, load variations, signal variation, environmental conditions, and variations in characteristics of the device under consideration and of all other electronic devices in the equipment.

DESIGN MAXIMUM RATING SYSTEM

Design maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electronic device of a specified type as defined by its published data, and should not be exceeded under the worst probable conditions.

These values are chosen by the device manufacturer to provide acceptable serviceability of the device, taking responsibility for the effects of changes in operating conditions due to variations in the characteristics of the electronic device under consideration.

The equipment manufacturer should design so that, initially and throughout life, no design maximum value for the intended service is exceeded with a bogey device under the worst probable operating conditions with respect to supply voltage variation, equipment component variation, variation in characteristics of all other devices in the equipment, equipment control adjustment, load variation, signal variation and environmental conditions.

DESIGN CENTRE RATING SYSTEM

Design centre ratings are limiting values of operating and environmental conditions applicable to a bogey electronic device of a specified type as defined by its published data, and should not be exceeded under normal conditions.

These values are chosen by the device manufacturer to provide acceptable serviceability of the device in average applications, taking responsibility for normal changes in operating conditions due to rated supply voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all electronic devices.

The equipment manufacturer should design so that, initially, no design centre value for the intended service is exceeded with a bogey electronic device in equipment operating at the stated normal supply voltage.

LETTER SYMBOLS FOR TRANSISTORS AND SIGNAL DIODES

based on IEC Publication 148

LETTER SYMBOLS FOR CURRENTS, VOLTAGES AND POWERS

Basic letters

The basic letters to be used are:

I, i = current
V, v = voltage
P, p = power.

Lower-case basic letters shall be used for the representation of instantaneous values which vary with time.
In all other instances upper-case basic letters shall be used.

Subscripts

A, a	Anode terminal
(AV), (av)	Average value
B, b	Base terminal, for MOS devices: Substrate
(BR)	Breakdown
C, c	Collector terminal
D, d	Drain terminal
E, e	Emitter terminal
F, f	Forward
G, g	Gate terminal
K, k	Cathode terminal
M, m	Peak value
O, o	As third subscript: The terminal not mentioned is open circuited
R, r	As first subscript: Reverse. As second subscript: Repetitive. As third subscript: With a specified resistance between the terminal not mentioned and the reference terminal.
(RMS), (rms)	R.M.S. value
S, s	As first or second subscript: Source terminal (for FETS only) As second subscript: Non-repetitive (not for FETS) As third subscript: Short circuit between the terminal not mentioned and the reference terminal
X, x	Specified circuit
Z, z	Replaces R to indicate the actual working voltage, current or power of voltage reference and voltage regulator diodes.

Note: No additional subscript is used for d.c. values.

Upper-case subscripts shall be used for the indication of:

a) continuous (d.c.) values (without signal)

Example I_B

b) instantaneous total values

Example i_B

c) average total values

Example $I_{B(AV)}$

d) peak total values

Example I_{BM}

e) root-mean-square total values

Example $I_{B(RMS)}$

Lower-case subscripts shall be used for the indication of values applying to the varying component alone:

a) instantaneous values

Example i_b

b) root-mean-square values

Example $I_{b(rms)}$

c) peak values

Example I_{bm}

d) average values

Example $I_{b(av)}$

Note: If more than one subscript is used, subscript for which both styles exist shall either be all upper-case or all lower-case.

Additional rules for subscripts

Subscripts for currents

Transistors: If it is necessary to indicate the terminal carrying the current, this should be done by the first subscript (conventional current flow from the external circuit into the terminal is positive).

Examples: I_B, i_B, i_b, I_{bm}

Diodes: To indicate a forward current (conventional current flow into the anode terminal) the subscript F or f should be used; for a reverse current (conventional current flow out of the anode terminal) the subscript R or r should be used.

Examples: I_F, I_R, i_F, $I_{f(rms)}$

Subscripts for voltages

Transistors: If it is necessary to indicate the points between which a voltage is measured, this should be done by the first two subscripts. The first subscript indicates the terminal at which the voltage is measured and the second the reference terminal or the circuit node. Where there is no possibility of confusion, the second subscript may be omitted.

Examples: V_{BE}, v_{BE}, v_{be}, V_{bem}

Diodes: To indicate a forward voltage (anode positive with respect to cathode), the subscript F or f should be used; for a reverse voltage (anode negative with respect to cathode) the subscript R or r should be used.

Examples: V_F, V_R, v_F, V_{rm}

Subscripts for supply voltages or supply currents

Supply voltages or supply currents shall be indicated by repeating the appropriate terminal subscript.

Examples: V_{CC}, I_{EE}

Note: If it is necessary to indicate a reference terminal, this should be done by a third subscript

Example : V_{CCE}

Subscripts for devices having more than one terminal of the same kind

If a device has more than one terminal of the same kind, the subscript is formed by the appropriate letter for the terminal followed by a number; in the case of multiple subscripts, hyphens may be necessary to avoid misunderstanding.

Examples: I_{B2} = continuous (d.c.) current flowing into the second base terminal

V_{B2-E} = continuous (d.c.) voltage between the terminals of second base and emitter

Subscripts for multiple devices

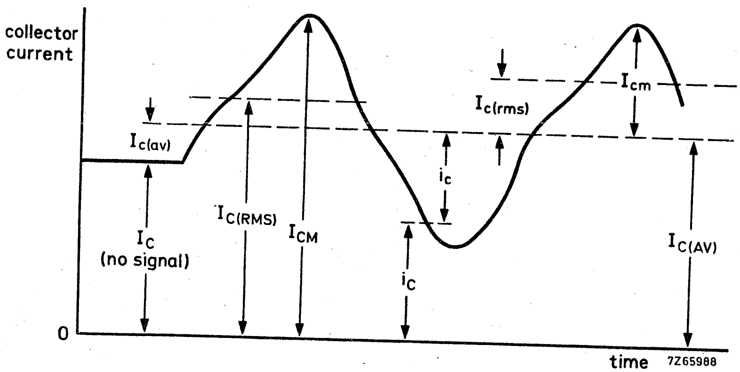
For multiple unit devices, the subscripts are modified by a number preceding the letter subscript; in the case of multiple subscripts, hyphens may be necessary to avoid misunderstanding.

Examples: I_{2C} = continuous (d.c.) current flowing into the collector terminal of the second unit

V_{1C-2C} = continuous (d.c.) voltage between the collector terminals of the first and the second unit.

Application of the rules

The figure below represents a transistor collector current as a function of time. It consists of a continuous (d.c.) current and a varying component.



LETTER SYMBOLS FOR ELECTRICAL PARAMETERS

Definition

For the purpose of this Publication, the term "electrical parameter" applies to four-pole matrix parameters, elements of electrical equivalent circuits, electrical impedances and admittances, inductances and capacitances.

Basic letters

The following is a list of the most important basic letters used for electrical parameters of semiconductor devices.

B, b = susceptance; imaginary part of an admittance

C = capacitance

G, g = conductance; real part of an admittance

H, h = hybrid parameter

L = inductance

R, r = resistance; real part of an impedance

X, x = reactance; imaginary part of an impedance

Y, y = admittance;

Z, z = impedance;

Upper-case letters shall be used for the representation of:

a) electrical parameters of external circuits and of circuits in which the device forms only a part;

b) all inductances and capacitances.

Lower-case letters shall be used for the representation of electrical parameters inherent in the device (with the exception of inductances and capacitances).

Subscripts

General subscripts

The following is a list of the most important general subscripts used for electrical parameters of semiconductor devices:

F, f = forward; forward transfer
I, i (or 1) = input
L, 1 = load
O, o (or 2) = output
R, r = reverse; reverse transfer
S, s = source

Examples: Z_S, h_f, h_F

The upper-case variant of a subscript shall be used for the designation of static (d.c.) values.

Examples : h_{FE} = static value of forward current transfer ratio in common-emitter configuration (d.c. current gain)

R_E = d.c. value of the external emitter resistance.

Note: The static value is the slope of the line from the origin to the operating point on the appropriate characteristic curve, i.e. the quotient of the appropriate electrical quantities at the operating point.

The lower-case variant of a subscript shall be used for the designation of small-signal values.

Examples: h_{fe} = small-signal value of the short-circuit forward current transfer ratio in common-emitter configuration

$Z_e = R_e + jX_e$ = small-signal value of the external impedance

Note: If more than one subscript is used, subscripts for which both styles exist shall either be all upper-case or all lower-case

Examples: h_{FE}, y_{RE}, h_{fe}

Subscripts for four-pole matrix parameters

The first letter subscript (or double numeric subscript) indicates input, output, forward transfer or reverse transfer

Examples: h_i (or h_{11})
h_o (or h_{22})
h_f (or h_{21})
h_r (or h_{12})

A further subscript is used for the identification of the circuit configuration. When no confusion is possible, this further subscript may be omitted.

Examples: h_{fe} (or h_{21e}), h_{FE} (or h_{21E})

Distinction between real and imaginary parts

If it is necessary to distinguish between real and imaginary parts of electrical parameters, no additional subscripts should be used. If basic symbols for the real and imaginary parts exist, these may be used.

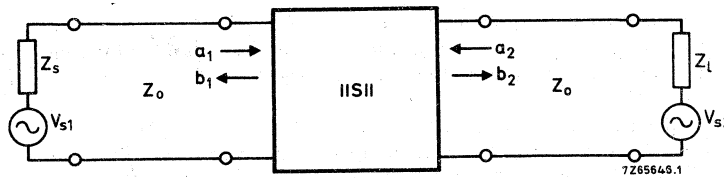
Examples: $Z_i = R_i + jX_i$
$y_{fe} = g_{fe} + jb_{fe}$

If such symbols do not exist or if they are not suitable, the following notation shall be used:

Examples: Re (h_{ib}) etc. for the real part of h_{ib}
Im (h_{ib}) etc. for the imaginary part of h_{ib}

SCATTERING PARAMETERS

In distinction to the conventional h, y and z-parameters, s-parameters relate to travelling wave conditions. The figure below shows a two-port network with the incident and reflected waves a_1, b_1, a_2 and b_2.



$$a_1 = \frac{V_{i1}}{\sqrt{Z_o}} \qquad a_2 = \frac{V_{i2}}{\sqrt{Z_o}}$$

$$b_1 = \frac{V_{r1}}{\sqrt{Z_o}} \qquad b_2 = \frac{V_{r2}}{\sqrt{Z_o}} \qquad ^{1)}$$

Z_o = characteristic impedance of the transmission line in which the two-port is connected.

V_i = incident voltage

V_r = reflected (generated) voltage

The four-pole equations for s-parameters are:

$$b_1 = s_{11}a_1 + s_{12}a_2$$

$$b_2 = s_{21}a_1 + s_{22}a_2$$

Using the subscripts i for 11, r for 12, f for 21 and o for 22, it follows that:

$$s_i = s_{11} = \left.\frac{b_1}{a_1}\right|_{a_2 = 0}$$

$$s_r = s_{12} = \left.\frac{b_1}{a_2}\right|_{a_1 = 0}$$

$$s_f = s_{21} = \left.\frac{b_2}{a_1}\right|_{a_2 = 0}$$

$$s_o = s_{22} = \left.\frac{b_2}{a_2}\right|_{a_1 = 0}$$

1) The squares of these quantities have the dimension of power.

The s-parameters can be named and expressed as follows:

$s_i = s_{11}$ = Input reflection coefficient.
The complex ratio of the reflected wave and the incident wave at the input, under the conditions $Z_1 = Z_o$ and $V_{s2} = 0$.

$s_r = s_{12}$ = Reverse transmission coefficient.
The complex ratio of the generated wave at the input and the incident wave at the output, under the conditions $Z_s = Z_o$ and $V_{s1} = 0$.

$s_f = s_{21}$ = Forward transmission coefficient.
The complex ratio of the generated wave at the output and the incident wave at the input, under the conditions $Z_1 = Z_o$ and $V_{s2} = 0$

$s_o = s_{22}$ = Output reflection coefficient.
The complex ratio of the reflected wave and the incident wave at the output, under the conditions $Z_s = Z_o$ and $V_{s1} = 0$.

DEVICE DATA

V.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor intended for use in class-A, B or C operated mobile transmitters with a nominal supply voltage of 13,5 V. The transistor is resistance stabilized and is guaranteed to withstand severe load mismatch conditions with a supply over-voltage to 16,5 V. The BFQ42 is especially suited as a driver transistor for the BLW29 in a two-stage wideband or semi-wide-band v.h.f. amplifier delivering 15 W output power.

It has a TO-39 metal envelope with the collector connected to the case.

QUICK REFERENCE DATA

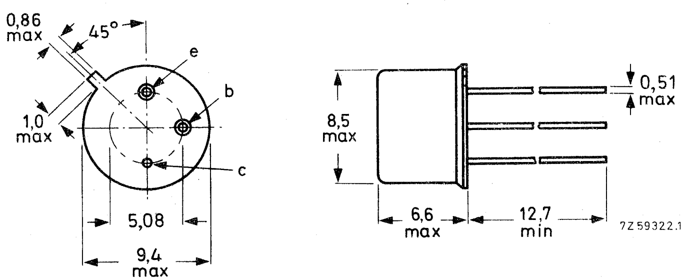
R.F. performance up to T_{amb} = 25 °C; $R_{th\ c\text{-}a}$ = 32 K/W

mode of operation	V_{CE} V	f MHz	P_L W	G_p dB	η %	$\bar{z_i}$ Ω	$\bar{Y_L}$ mA/V
c.w. class-B	**13,5**	**175**	**2**	**> 11**	**> 60**	**7,8 – j4,6**	**22 – j18**
c.w. class-B	12,5	175	2	typ. 10,5	typ. 65	—	—

MECHANICAL DATA

Dimensions in mm

Fig. 1 TO-39; collector connected to case.



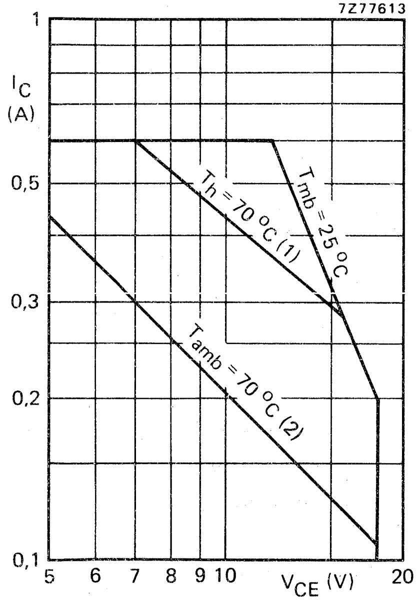
Maximum lead diameter is guaranteed only for 12,7 mm.

Accessories: 56245 (distance disc).

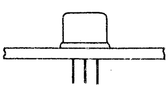
RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage (V_{BE} = 0) peak value	V_{CESM}	max.	36	V
Collector-emitter voltage (open base)	V_{CEO}	max.	18	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4	V
Collector current (average)	$I_{C(AV)}$	max.	0,6	A
Collector current (peak value); f > 1 MHz	I_{CM}	max.	1,8	A
Total power dissipation up to T_{mb} = 25 °C	P_{tot}	max.	7,2	W
Storage temperature	T_{stg}		−65 to + 200	°C
Junction temperature	T_j	max.	200	°C



(1) Mounted on a heatsink.



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(2) Free-air operation; using a spring cooling clip.

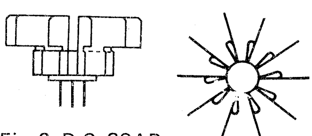
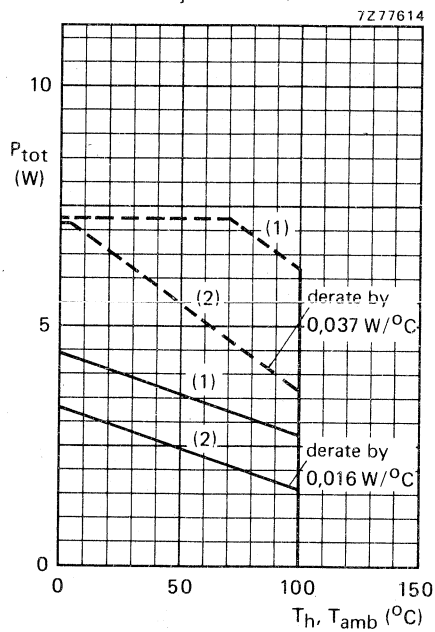


Fig. 2 D.C. SOAR.



(1) Short-time r.f. operation during mismatch; $R_{th\ mb\text{-}h}$ = 3 °C/W; $R_{th\ c\text{-}a}$ = 32 °C/W; f ⩾ 1 MHz.

(2) Continuous d.c. and r.f. operation; $R_{th\ mb\text{-}h}$ = 3 °C/W; $R_{th\ c\text{-}a}$ = 32 °C/W.

Fig. 3 Total power dissipation; V_{CE} ⩽ 16,5 V.
— — — Mounted on a heatsink.
——— Free-air operation; using a spring cooling clip having a thermal resistance of 32 °C/W.

THERMAL RESISTANCE

From junction to mounting base	$R_{th\ j\text{-}mb}$	=	24 °C/W
From junction to case	$R_{th\ j\text{-}c}$	=	29 °C/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	3 °C/W

CHARACTERISTICS

$T_j = 25\ ^oC$

Collector-emitter breakdown voltage $V_{BE} = 0$; $I_C = 2$ mA	$V_{(BR)CES}$	>	36 V
Collector-emitter breakdown voltage open base; $I_C = 25$ mA	$V_{(BR)CEO}$	>	18 V
Emitter-base breakdown voltage open collector; $I_E = 1$ mA	$V_{(BR)EBO}$	>	4 V
Collector cut-off current $V_{BE} = 0$; $V_{CE} = 18$ V	I_{CES}	<	1 mA
Second breakdown energy; L = 25 mH; f = 50 Hz open base	E_{SBO}	>	0,5 mJ
$R_{BE} = 10\ \Omega$	E_{SBR}	>	0,5 mJ
D.C. current gain * $I_C = 0{,}25$ A; $V_{CE} = 5$ V	h_{FE}		typ. 30 10 to 60
Collector-emitter saturation voltage* $I_C = 0{,}75$ A; $I_B = 0{,}15$ A	V_{CEsat}		typ. 0,9 V
Transition frequency at f = 100 MHz * $-I_E = 0{,}25$ A; $V_{CB} = 13{,}5$ V	f_T		typ. 750 MHz
$-I_E = 0{,}75$ A; $V_{CB} = 13{,}5$ V	f_T		typ. 625 MHz
Collector capacitance at f = 1 MHz $I_E = I_e = 0$; $V_{CB} = 13{,}5$ V	C_c		typ. 8,6 pF
Feedback capacitance at f = 1 MHz $I_C = 20$ mA; $V_{CE} = 13{,}5$ V	C_{re}		typ. 3,8 pF

* Measured under pulse conditions: $t_p \leqslant 200\ \mu s$; $\delta \leqslant 0{,}02$.

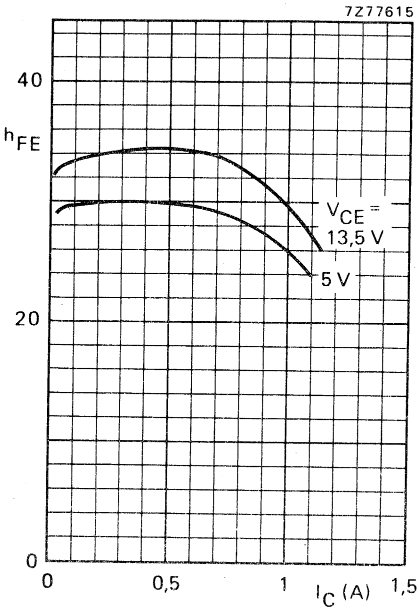


Fig. 4 Typical values; T_j = 25 °C.

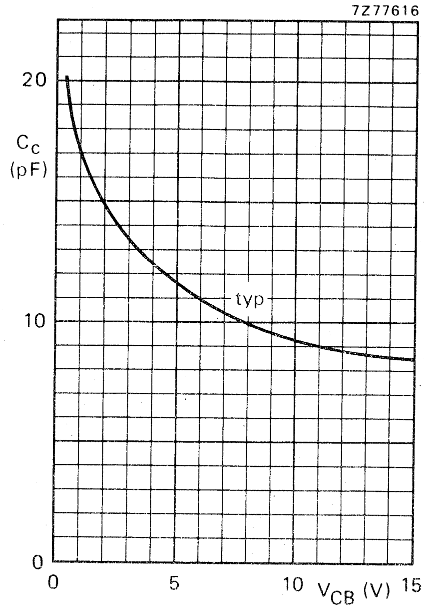


Fig. 5 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

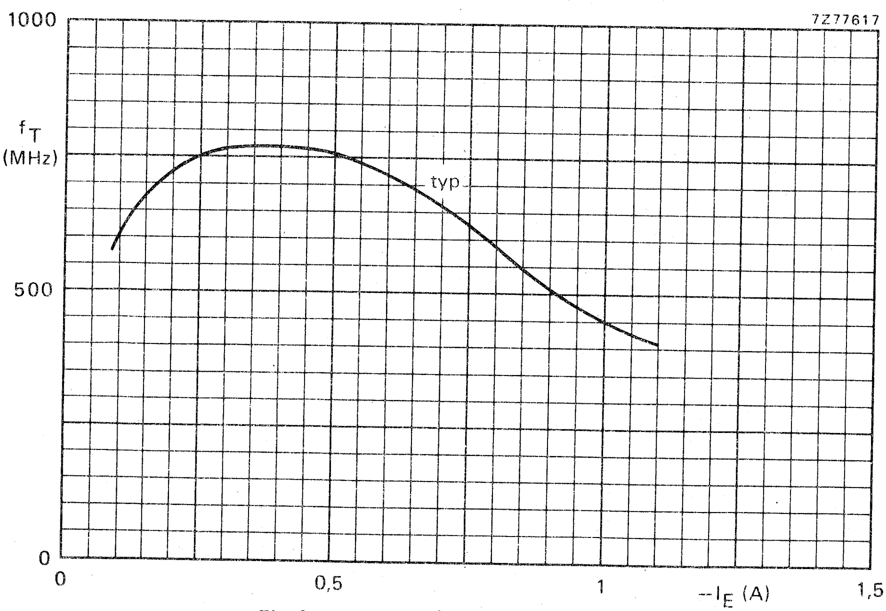


Fig. 6 V_{CB} = 13,5 V; f = 100 MHz; T_j = 25 °C.

APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit)

T_{amb} = 25 °C; $R_{th\ c\text{-}a}$ = 32 °C/W

f (MHz)	V_{CE} (V)	P_L (W)	P_S (W)	G_p (dB)	I_C (A)	η (%)	$\overline{z_i}$ (Ω)	$\overline{Y_L}$ (mA/V)
175	**13,5**	**2**	**< 0,16**	**> 11**	**< 0,25**	**> 60**	**7,8 − j4,6**	**22 − j18**
175	12,5	2	—	typ. 10,5		typ. 65	—	—

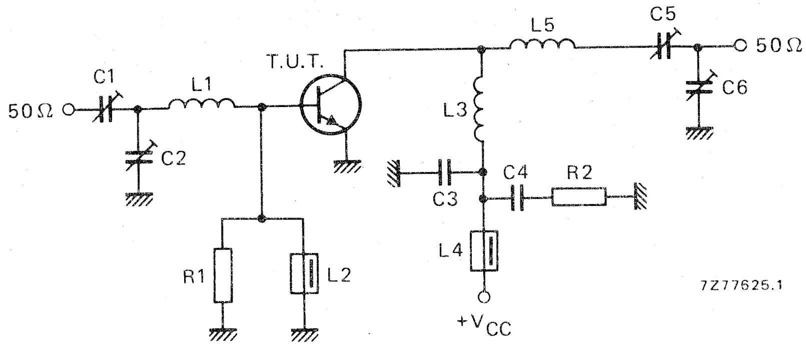


Fig. 7 Test circuit; c.w. class-B.

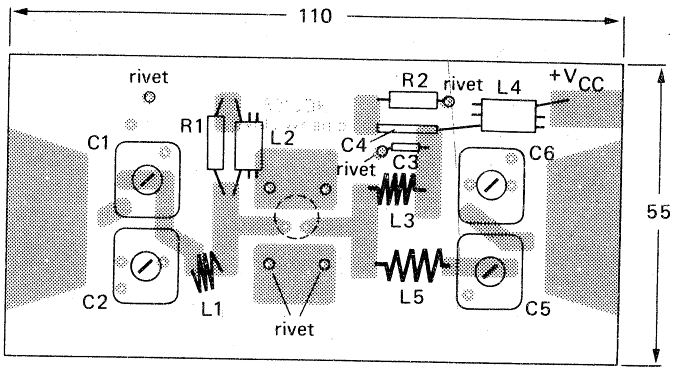
List of components:
C1 = C2 = C5 = 4 to 40 pF film dielectric trimmer (cat. no. 2222 809 07008)
C3 = 100 pF ceramic capacitor
C4 = 100 nF polyester capacitor
C6 = 2,5 to 20 pF film dielectric trimmer (cat. no. 2222 809 07004)

L1 = 3 turns enamelled Cu wire (1,0 mm); int. dia. 4,0 mm; length 4 mm; leads 2 x 5 mm
L2 = L4 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L3 = L5 = 4 turns Cu wire (1,0 mm); int. dia. 6,0 mm; length 6 mm; leads 2 x 5 mm

R1 = 220 Ω carbon resistor
R2 = 10 Ω carbon resistor

Component layout and printed-circuit board for 175 MHz test circuit are shown in Fig. 8.

APPLICATION INFORMATION (continued)



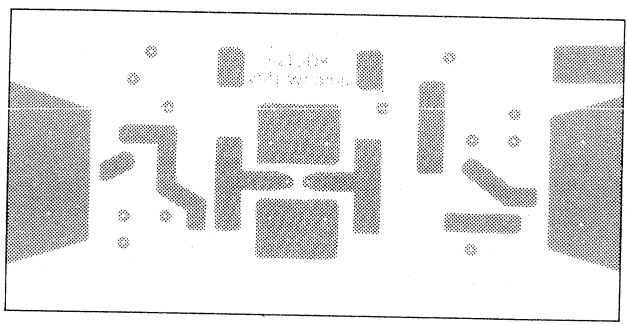


Fig. 8 Component layout and printed-circuit board for 175 MHz test circuit.

The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets.

Material of printed-circuit board: 1,6 mm epoxy fibre-glass.

The length of the external emitter lead is 1,2 mm.

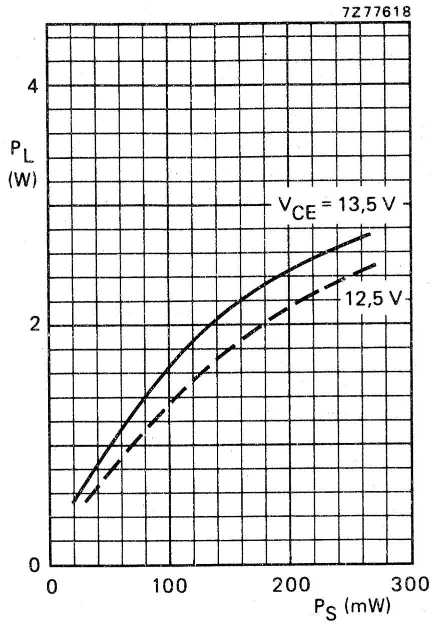


Fig. 9 Typical values; f = 175 MHz; T_{amb} = 25 °C; $R_{th\ c\text{-}a}$ = 32 °C/W.

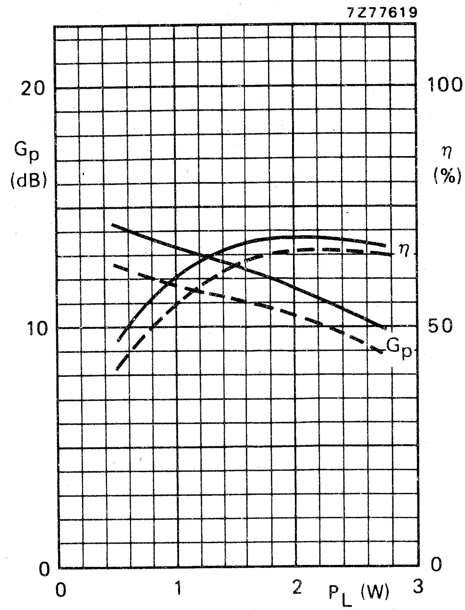


Fig. 10 Typical values; f = 175 MHz; T_{amb} = 25 °C; —— V_{CE} = 13,5 V; – – – V_{CE} = 12,5 V; $R_{th\ c\text{-}a}$ = 32 °C/W.

APPLICATION INFORMATION (continued)

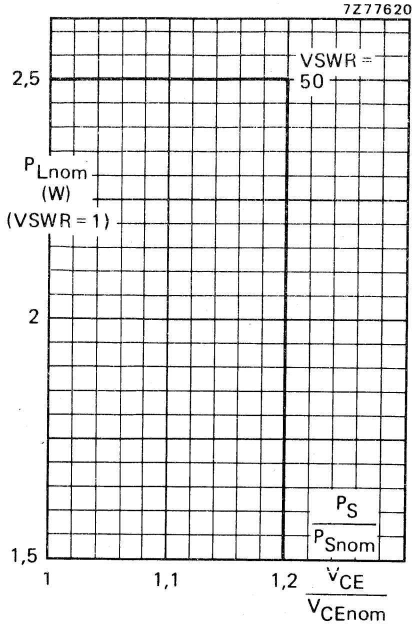


Fig. 11 R.F. SOAR (short-time operation during mismatch); f = 175 MHz; T_h = 70 °C; $R_{th\ mb\text{-}h}$ = 3 °C/W; V_{CEnom} = 13,5 V or 12,5 V; P_S = P_{Snom} at V_{CEnom} and VSWR = 1.

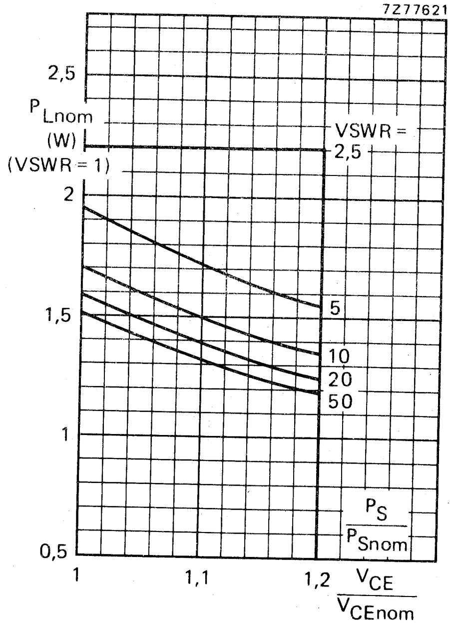


Fig. 12 R.F. SOAR (short-time operation during mismatch); f = 175 °C; T_{amb} = 70 °C; $R_{th\ c\text{-}a}$ = 32 °C/W; V_{CEnom} = 13,5 V or 12,5 V; P_S = P_{Snom} at V_{CEnom} and VSWR = 1.

Note to Figs 11 and 12:

The transistor has been developed for use with unstabilized supply voltages. As the output power and drive power increase with the supply voltage, the nominal output power must be derated in accordance with the graph for safe operation at supply voltages other than the nominal. The graph shows the permissible output power under nominal conditions (VSWR = 1), as a function of the expected supply over-voltage ratio with VSWR as parameter.

The graph applies to the situation in which the drive (P_S/P_{Snom}) increases linearly with supply over-voltage ratio.

OPERATING NOTE Below 100 MHz a base-emitter resistor of 22 Ω is recommended to avoid oscillation. This resistor must be effective for r.f. only.

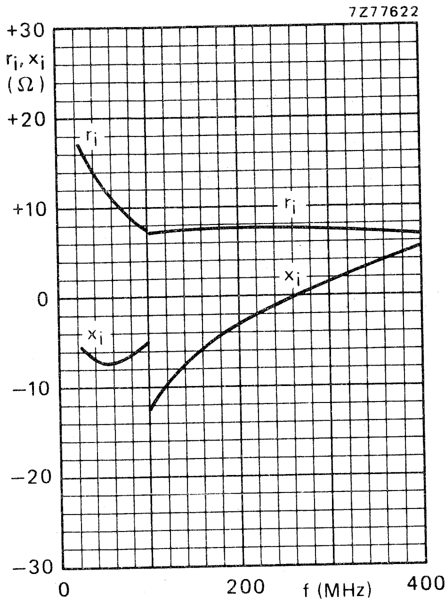


Fig. 13.

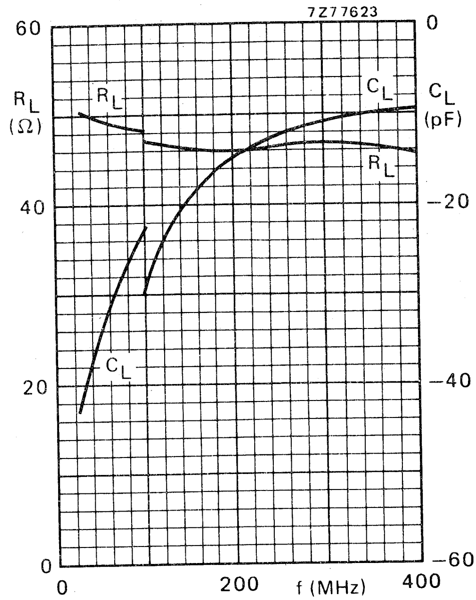
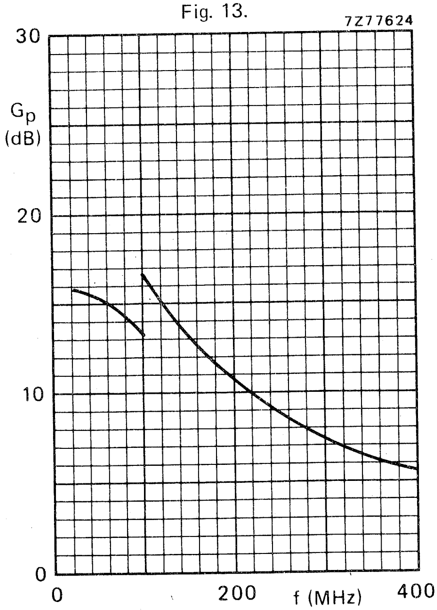


Fig. 14.



Conditions for Figs 13, 14 and 15:

Typical values; V_{CE} = 13,5 V; P_L = 2 W;
T_{amb} = 25 °C; $R_{th\ c\text{-}a}$ = 32 °C/W.

Fig. 15.

V.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor intended for use in class-A, B or C operated mobile transmitters with a nominal supply voltage of 13,5 V. The transistor is resistance stabilized and is guaranteed to withstand severe load mismatch conditions with a supply over-voltage to 16,5 V. The BFQ43 is especially suited as a driver transistor for the BLW31 in a two-stage wideband or semi-wideband v.h.f. amplifier delivering 28 W output power.

It has a TO-39 metal envelope with the emitter connected to the case, which enables excellent heatsinking and emitter grounding.

QUICK REFERENCE DATA

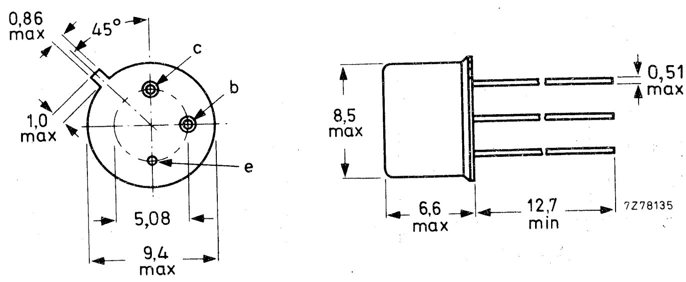
R.F. performance up to T_h = 25 °C

mode of operation	V_{CE} V	f MHz	P_L W	G_p dB	η %	$\overline{z_i}$ Ω	$\overline{Y_L}$ mA/V
c.w. class-B	**13,5**	**175**	**4**	**> 12**	**> 55**	**3,2 + j0,03**	**53 – j29**
c.w. class-B	12,5	175	4	typ. 12	typ. 60	—	—

MECHANICAL DATA

Dimensions in mm

Fig. 1 TO-39; emitter connected to case.



Maximum lead diameter is guaranteed only for 12,7 mm.

Accessories: 56245 (distance disc).

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage (V_{BE} = 0) peak value	V_{CESM}	max.	36	V
Collector-emitter voltage (open base)	V_{CEO}	max.	18	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4	V
Collector current (average)	$I_{C(AV)}$	max.	1,25	A
Collector current (peak value); f > 1 MHz	I_{CM}	max.	3,75	A
Total power dissipation up to T_{mb} = 25 °C	P_{tot}	max.	12	W
Storage temperature	T_{stg}		−65 to + 150	°C
Operating junction temperature	T_j	max.	200	°C

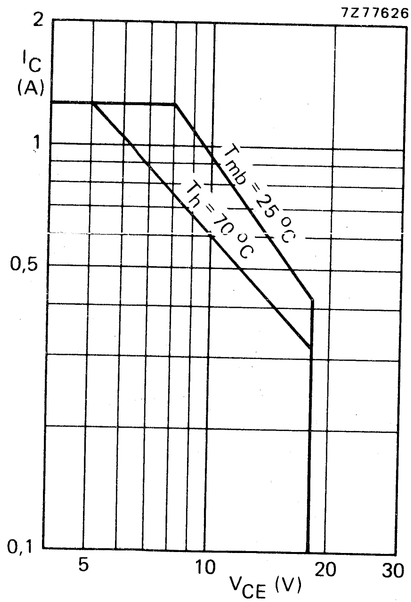
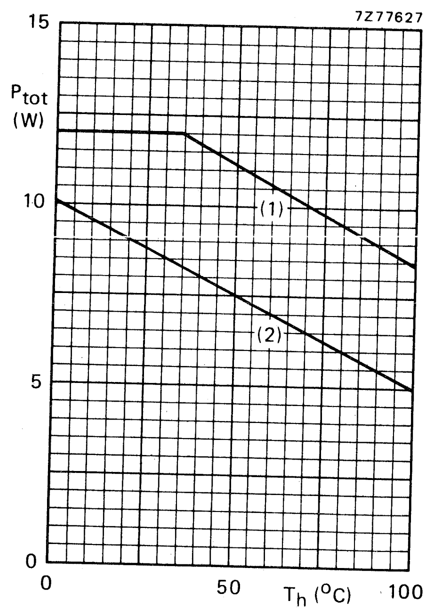


Fig. 2 D.C. SOAR.



(1) Short-time r.f. operation during mismatch; f ⩾ 1 MHz.

(2) Continuous d.c. and r.f. operation; derate by 0,05 W/°C.

Fig. 3 Total power dissipation; V_{CE} ⩽ 16,5 V.

THERMAL RESISTANCE (dissipation = 4 W; T_{mb} = 82 °C, i.e. T_h = 70 °C)

From junction to mounting base	$R_{th\ j\text{-}mb}$	=	18 °C/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	3 °C/W

CHARACTERISTICS

$T_j = 25\ ^oC$

Collector-emitter breakdown voltage $V_{BE} = 0$; $I_C = 5$ mA	$V_{(BR)CES}$	>	36	V
Collector-emitter breakdown voltage open base; $I_C = 50$ mA	$V_{(BR)CEO}$	>	18	V
Emitter-base breakdown voltage open collector; $I_E = 2$ mA	$V_{(BR)EBO}$	>	4	V
Collector cut-off current $V_{BE} = 0$; $V_{CE} = 18$ V	I_{CES}	<	2	mA
Second breakdown energy; L = 25 mH; f = 50 Hz open base	E_{SBO}	>	0,5	mJ
$R_{BE} = 10\ \Omega$	E_{SBR}	>	0,5	mJ
D.C. current gain * $I_C = 0,5$ A; $V_{CE} = 5$ V	h_{FE}	typ.	40 10 to 80	
Collector-emitter saturation voltage * $I_C = 1,5$ A; $I_B = 0,3$ A	V_{CEsat}	typ.	0,9	V
Transition frequency at f = 100 MHz * $-I_E = 0,5$ A; $V_{CB} = 13,5$ V	f_T	typ.	750	MHz
$-I_E = 1,5$ A; $V_{CB} = 13,5$ V	f_T	typ.	625	MHz
Collector capacitance at f = 1 MHz $I_E = I_e = 0$; $V_{CB} = 13,5$ V	C_c	typ.	15	pF
Feedback capacitance at f = 1 MHz $I_C = 20$ mA; $V_{CE} = 13,5$ V	C_{re}	typ.	7,3	pF

* Measured under pulse conditions: $t_p \leqslant 200\ \mu s$; $\delta \leqslant 0,02$.

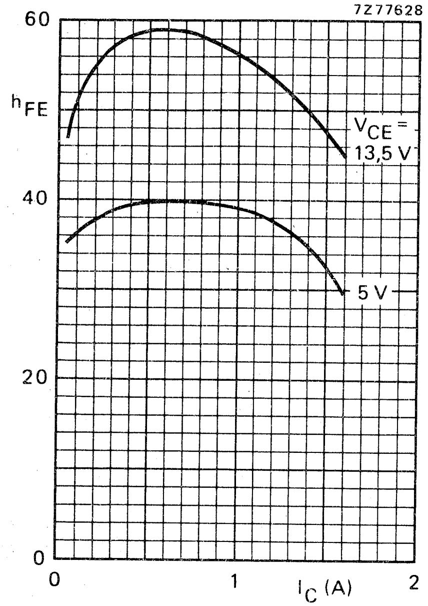


Fig. 4 Typical values; T_j = 25 °C.

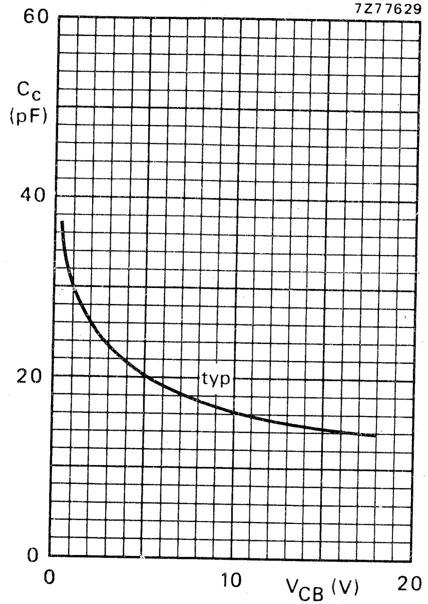


Fig. 5 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

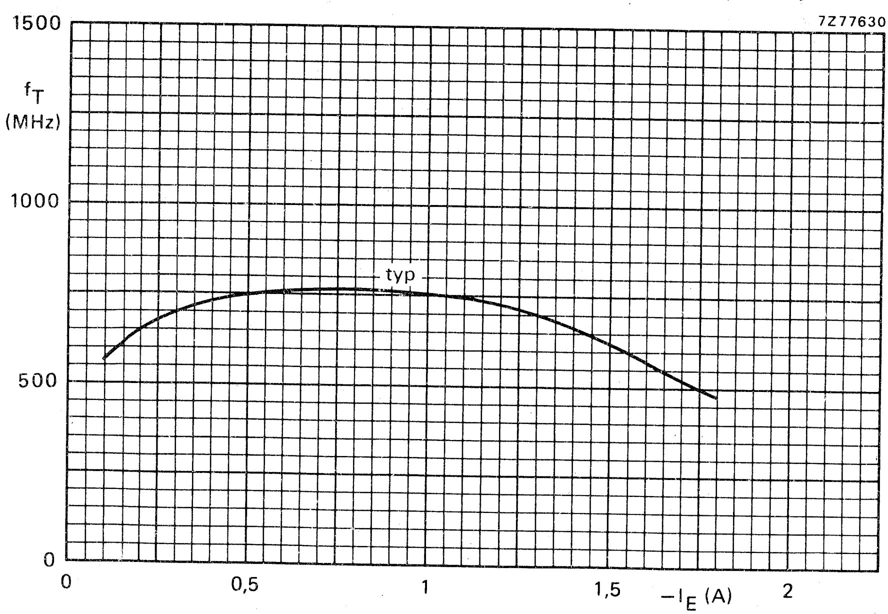


Fig. 6 V_{CB} = 13,5 V; f = 100 MHz; T_j = 25 °C.

APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit)

T_h = 25 °C

f (MHz)	V_{CE} (V)	P_L (W)	P_S (W)	G_p (dB)	I_C (A)	η (%)	$\overline{z_i}$ (Ω)	$\overline{Y_L}$ (mA/V)
175	**13,5**	**4**	**< 0,25**	**> 12**	**< 0,54**	**> 55**	**3,2 + j0,03**	**53 – j29**
175	12,5	4	–	typ. 12	–	typ. 60	–	–

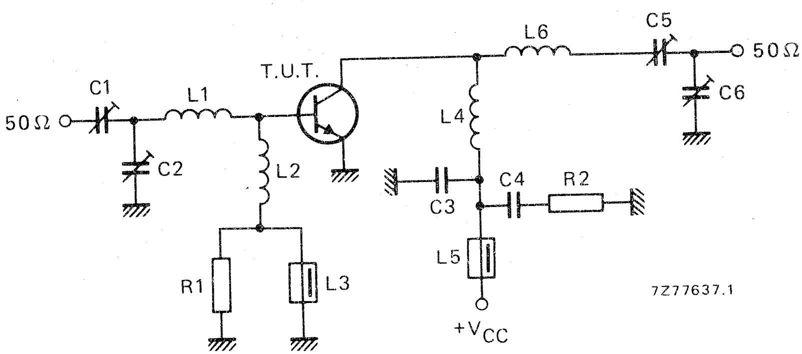


Fig. 7 Test circuit; c.w. class-B.

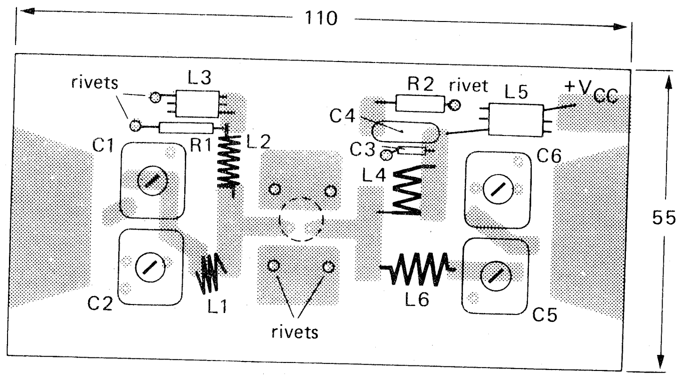
List of components:
C1 = C5 = 2,5 to 20 pF film dielectric trimmer (cat. no. 2222 809 07004)
C2 = C6 = 4 to 40 pF film dielectric trimmer (cat. no. 2222 809 07008)
C3 = 100 pF ceramic capacitor
C4 = 100 nF polyester capacitor

L1 = 2 turns Cu wire (1,0 mm); int. dia. 4,0 mm; length 3 mm; leads 2 x 5 mm
L2 = 7 turns enamelled Cu wire (0,5 mm); int. dia. 3,0 mm; length 4 mm; leads 2 x 5 mm
L3 = L5 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L4 = 4 turns enamelled Cu wire (1,0 mm); int. dia. 5,5 mm; length 5 mm; leads 2 x 5 mm
L6 = 5 turns enamelled Cu wire (1,0 mm); int. dia. 5,5 mm; length 7,5 mm; leads 2 x 5 mm

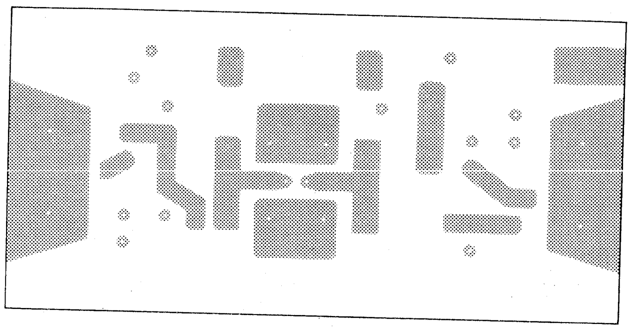
R1 = R2 = 10 Ω carbon resistor

Component layout and printed-circuit board for 175 MHz test circuit are shown in Fig. 8.

APPLICATION INFORMATION (continued)



7Z77575.1



7Z77576

Fig. 8 Component layout and printed-circuit board for 175 MHz test circuit.

The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets.

Material of printed-circuit board: 1,6 mm epoxy fibre-glass.

The case is directly grounded on the printed-circuit board.

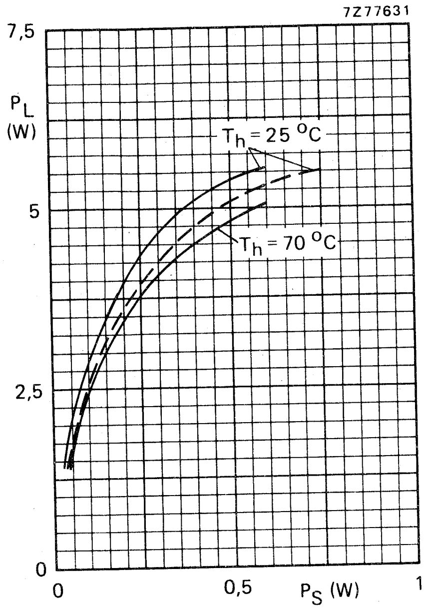


Fig. 9 Typical values; f = 175 MHz;
—— V_{CE} = 13,5 V; – – – V_{CE} = 12,5 V.

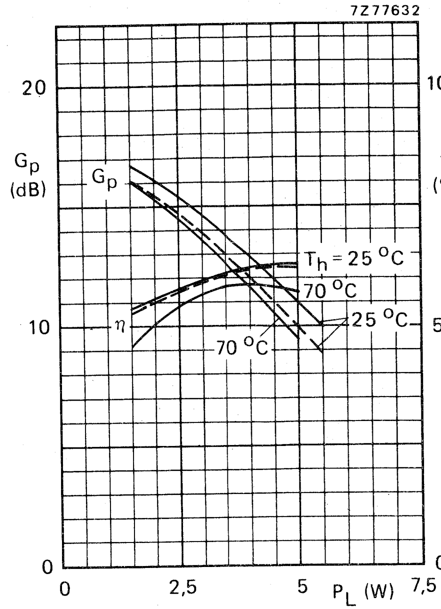


Fig. 10 Typical values; f = 175 MHz;
—— V_{CE} = 13,5 V; – – – V_{CE} = 12,5 V.

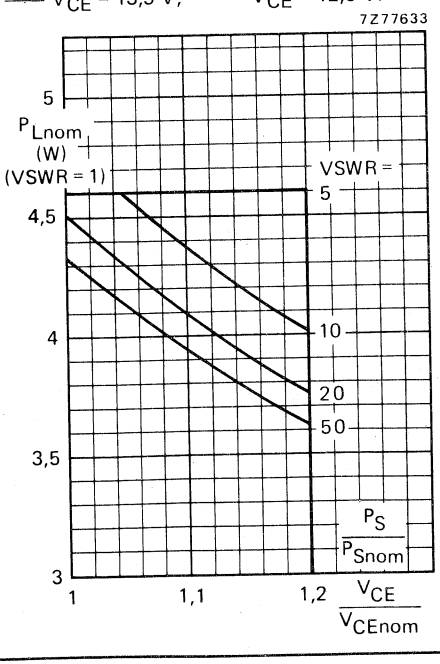


Fig. 11 R.F. SOAR (short-time operation during mismatch); f = 175 MHz; T_h = 70 °C.
$R_{th\ mb\text{-}h}$ = 3 °C/W; V_{CEnom} = 13,5 or 12,5 V;
$P_S = P_{Snom}$ at V_{CEnom} and VSWR = 1.

The transistor has been developed for use with unstabilized supply voltages. As the output power and drive power increase with the supply voltage, the nominal output power must be derated in accordance with the graph for safe operation at supply voltages other than the nominal. The graph shows the permissible output power under nominal conditions (VSWR = 1), as a function of the expected supply over-voltage ratio with VSWR as parameter.

The graph applies to the situation in which the drive (P_S/P_{Snom}) increases linearly with supply over-voltage ratio.

OPERATING NOTE Below 140 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation. This resistor must be effective for r.f. only.

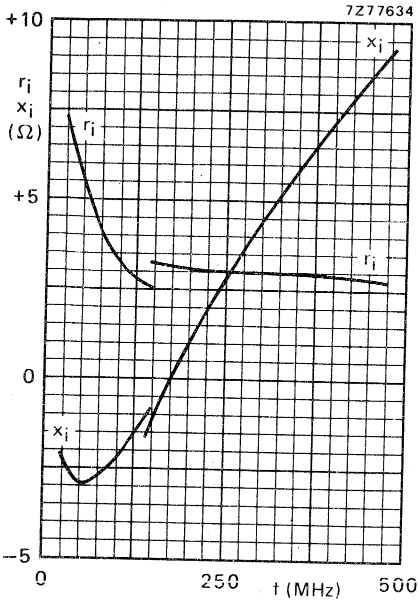


Fig. 12.

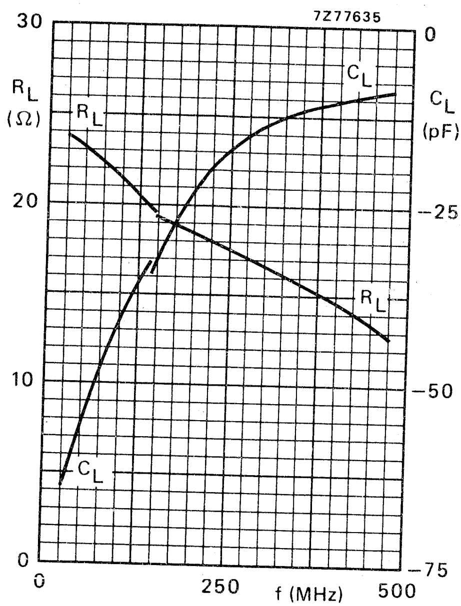
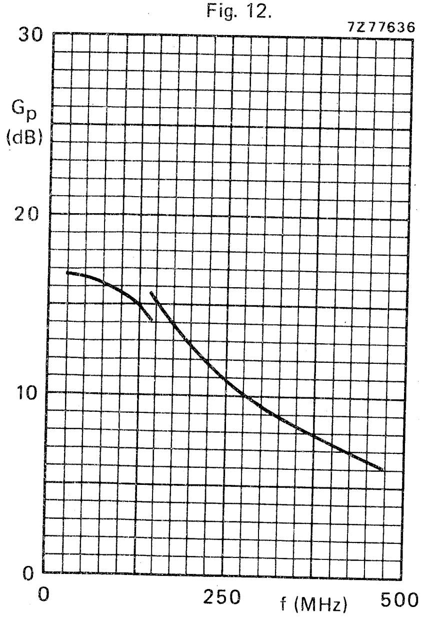


Fig. 13.



Conditions for Figs 12, 13 and 14:

Typical values; V_{CE} = 13,5 V; P_L = 4 W; T_h = 25 °C.

Fig. 14.

V.H.F. POWER TRANSISTOR

N-P-N epitaxial planar transistor intended for use in class-A, B and C operated mobile, industrial and military transmitters with a supply voltage of 13,5 V. The transistor is resistance stabilized. Every transistor is tested under severe load mismatch conditions with a supply over-voltage to 16,5 V.

It has a TO-39 metal envelope with the collector connected to the case.

QUICK REFERENCE DATA

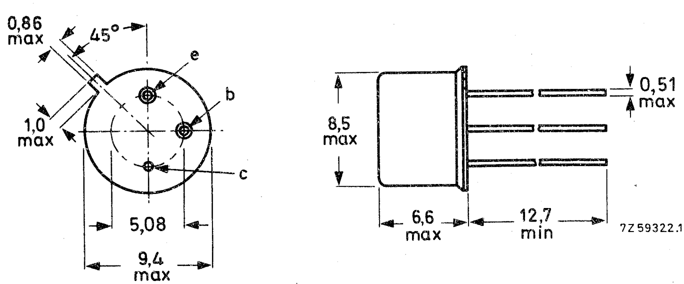
R.F. performance up to T_{mb} = 25 °C in an unneutralized common-emitter class-B circuit

mode of operation	V_{CE} V	f MHz	P_L W	G_p dB	η %	$\overline{z_i}$ Ω	$\overline{Y_L}$ mA/V
c.w.	13,5	175	4	> 8	> 60	3,9 + j2,2	37 – j22
c.w.	12,5	175	4	typ. 8	typ. 60	–	–

MECHANICAL DATA

Dimensions in mm

Fig. 1 TO-39; collector connected to case.



Maximum lead diameter is guaranteed only for 12,7 mm.

Accessories: 56245 (distance disc).

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC 134)

Voltages

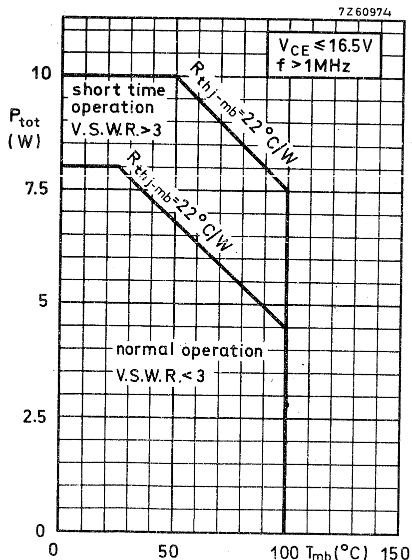
Collector-base voltage (open emitter) peak value	V_{CBOM}	max.	36	V
Collector-emitter voltage (open base)	V_{CEO}	max.	18	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4	V

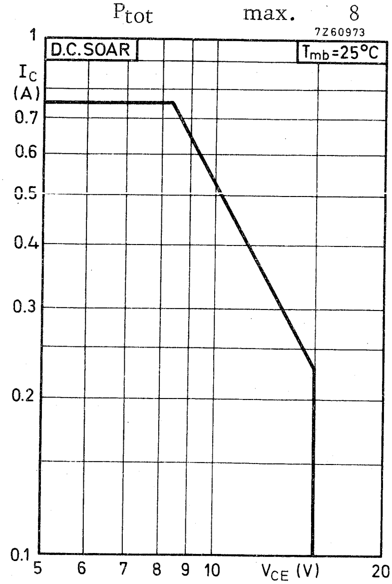
Currents

Collector current (average)	$I_{C(AV)}$	max.	0.75	A
Collector current (peak value) f > 1 MHz	I_{CM}	max.	2.25	A

Power dissipation

Total power dissipation up to T_{mb} = 25 °C f > 1 MHz	P_{tot}	max.	8	W





Temperature

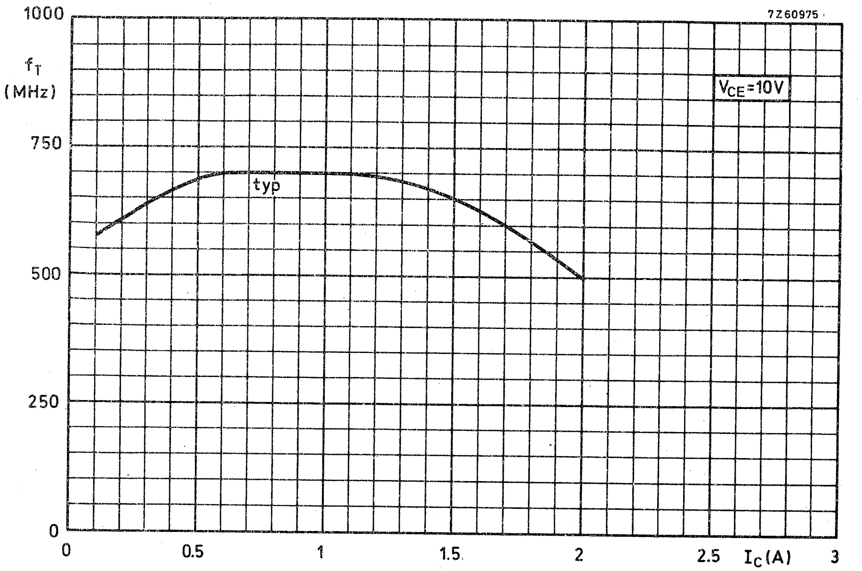
Storage temperature	T_{stg}		-65 to +200	°C
Operating junction temperature	T_j	max.	200	°C

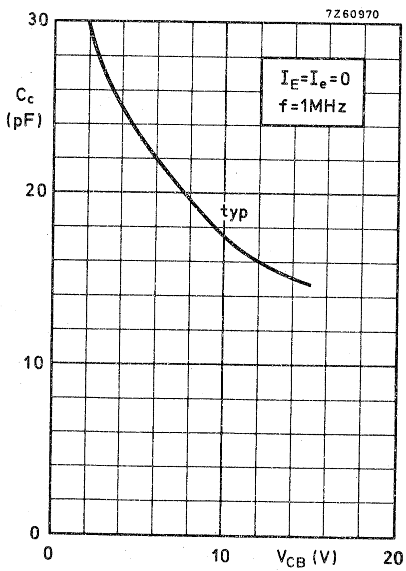
THERMAL RESISTANCE

From junction to mounting base	$R_{th\ j-mb}$	=	22	°C/W
From mounting base to heatsink with a boron nitride washer for electrical insulation	$R_{th\ mb-h}$	=	2.5	°C/W

CHARACTERISTICS $T_j = 25\ ^oC$ unless otherwise specified

Collector cut-off current				
$I_B = 0$; $V_{CE} = 14$ V	I_{CEO}	<	5	mA
Breakdown voltages				
Collector-base voltage, open emitter, $I_C = 1$ mA	$V_{(BR)CBO}$	>	36	V
Collector-emitter voltage, open base, $I_C = 10$ mA	$V_{(BR)CEO}$	>	18	V
Emitter-base voltage, open collector, $I_E = 1$ mA	$V_{(BR)EBO}$	>	4	V
Transient energy				
$L = 25$ mH; $f = 50$ Hz; open base	E	>	0.5	mWs
$L = 25$ mH; $f = 50$ Hz; $-V_{BE} = 1.5$ V; $R_{BE} = 33\ \Omega$	E	>	0.5	mWs
D.C. current gain				
$I_C = 500$ mA; $V_{CE} = 5$ V	h_{FE}	>	5	
Transition frequency				
$I_C = 350$ mA; $V_{CE} = 10$ V	f_T	typ.	700	MHz
Collector capacitance at f = 1 MHz				
$I_E = I_e = 0$; $V_{CB} = 15$ V	C_c	typ.	15	pF
		<	20	pF
Feedback capacitance at f = 1 MHz				
$I_C = 50$ mA; $V_{CE} = 15$ V	C_{re}	typ.	11	pF


7Z60975
f_T
(MHz)
1000
750
500
250
0
V_{CE}=10V
typ
0
0.5
1
1.5
2
2.5
I_C (A)
3


7Z60970
C_c
(pF)
30
20
10
0
I_E=I_e=0
f=1MHz
typ
0
10
V_{CB} (V)
20

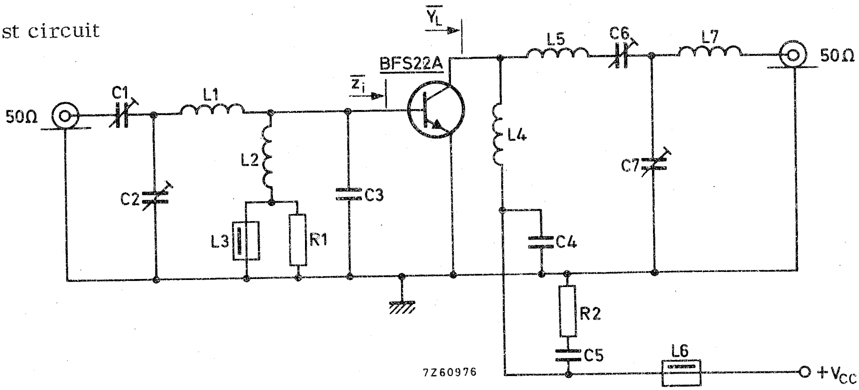
APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralised common-emitter class B circuit)

f = 175 MHz; T_{mb} up to 25 °C

V_{CC}(V)	P_S(W)	P_L(W)	I_C(A)	G_p(dB)	η(%)	$\overline{z_i}$ (Ω)	$\overline{Y_L}$(mA/V)
13.5	< 0.63	4	< 0.49	> 8	> 60	3.9+j2.2	37−j22
12.5	typ. 0.63	4	typ. 0.53	typ. 8	typ. 60	−	−

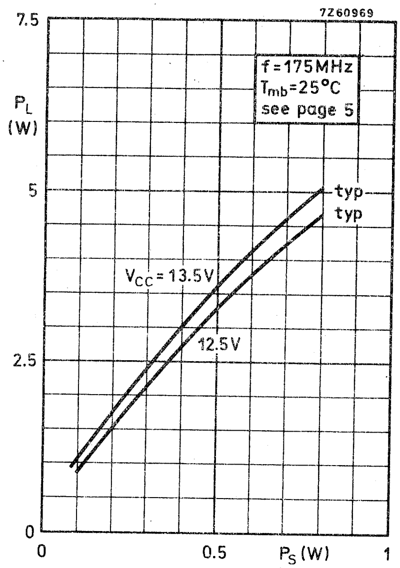
Test circuit

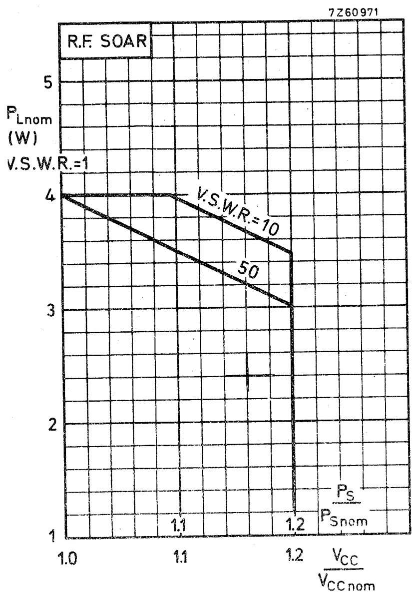


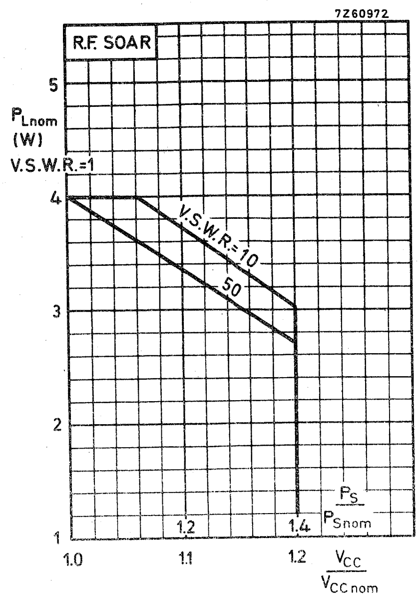
C1 = C6 = 4 to 29 pF air trimmer with insulated rotor
C2 = C7 = 4 to 29 pF air trimmer with non-insulated rotor
C3 = 39 pF ceramic
C4 = 100 pF ceramic
C5 = 15 nF polyester

L1 = 1 turn enamelled Cu wire (1.0 mm); int. diam. 10 mm; leads 2 x 10 mm
L2 = 6 turns enamelled Cu wire (0.7 mm); int. diam. 4 mm; leads 2 x 10 mm
L3 = L6 = ferroxcube choke (code number 4312 020 36640)
L4 = 8 turns enamelled Cu wire (0.7 mm); int. diam. 4 mm; leads 2 x 10 mm
L5 = 5 turns enamelled Cu wire (1.0 mm); winding pitch 1.0 mm; int. diam. 8 mm; leads 2 x 10 mm
L7 = 7 turns enamelled Cu wire (1.0 mm); winding pitch 1.0 mm; int. diam. 6 mm; leads 2 x 5 mm

R1 = R2 = 10 Ω carbon


7Z60969
f = 175 MHz
T_{mb} = 25 °C
see page 5
P_L
(W)
7.5
5
2.5
0
typ
typ
V_{CC} = 13.5 V
12.5 V
0
0.5
P_S (W)
1





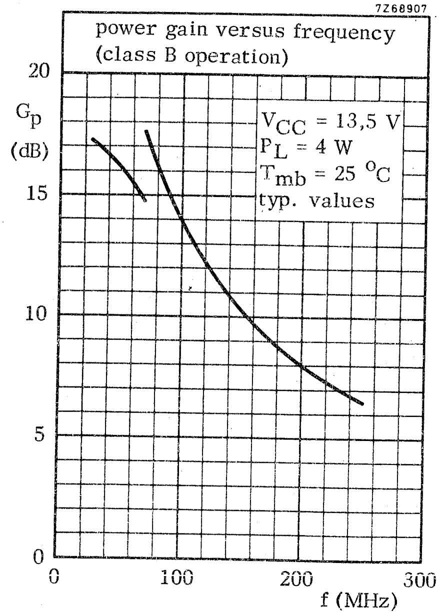
Conditions for R.F. SOAR:

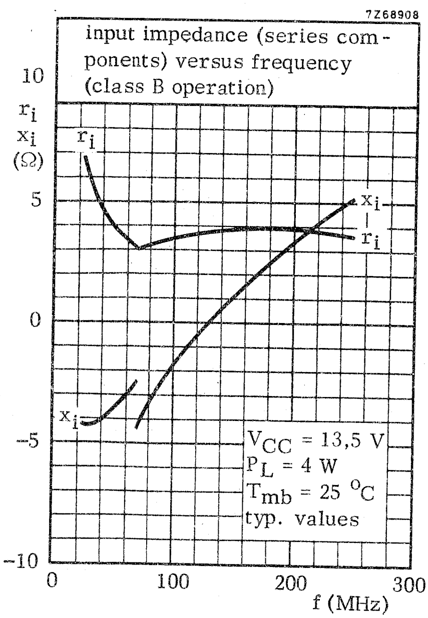
f = 175 MHz
T_{mb} = 70 °C
V_{CCnom} = 12.5 or 13.5 V

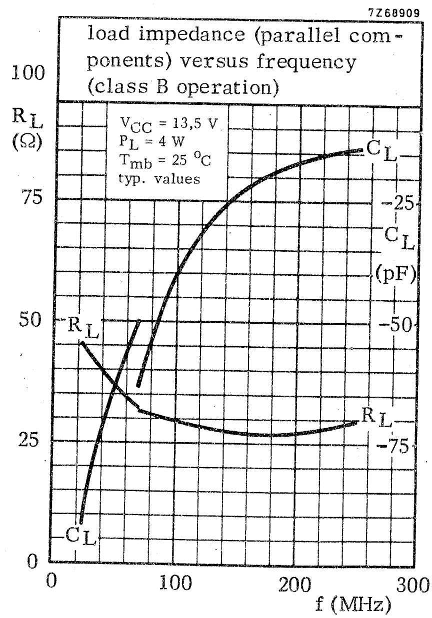
$P_{Snom} = P_S$ at $V_{CC} = V_{CCnom}$ and V.S.W.R. = 1
see also page 5

The transistor has been developed for use with unstabilized supply voltages. As the output power and drive power increase with the supply voltage, the nominal output power must be derated in accordance with the graphs above for safe operation at supply voltages other than the nominal. The graphs show the allowable output power under nominal conditions, as a function of the supply overvoltage ratio, with V. S. W. R. as parameter.
The left hand graph applies to the situation in which the drive (P_S/P_{Snom}) increases linearly with supply overvoltage ratio.
The right hand graph shows the derating factor to be applied when the drive (P_S/P_{Snom}) increases as the square of the supply overvoltage ratio (V_{CC}/V_{CCnom}).
Depending on the operating conditions, the appropriate derating factor may lie in the region between the linear and the square-law functions.

OPERATING NOTE Below 70 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation. This resistor must be effective for both d.c. and r.f.







V.H.F. POWER TRANSISTOR

N-P-N epitaxial planar transistor intended for use in class-A, B and C operated mobile, industrial and military transmitters with a supply voltage of 28 V. The transistor is resistance stabilized. Every transistor is tested under severe load mismatch conditions.

It has a TO-39 metal envelope with the collector connected to the case.

QUICK REFERENCE DATA

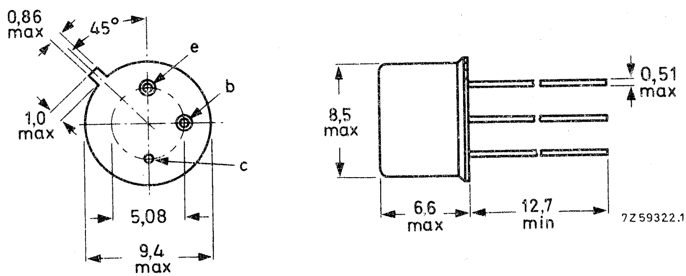
R.F. performance up to T_{mb} = 25 °C in an unneutralized common-emitter class-B circuit

mode of operation	V_{CE} V	f MHz	P_L W	G_p dB	η %	$\overline{z_i}$ Ω	$\overline{Y_L}$ mA/V
c.w.	28	175	4	> 10	> 65	2,3 + j1,6	8,9 − j18,1

MECHANICAL DATA

Dimensions in mm

Fig. 1 TO-39; collector connected to case.



Maximum lead diameter is guaranteed only for 12,7 mm.

Accessories: 56245 (distance disc).

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC 134)

Voltages

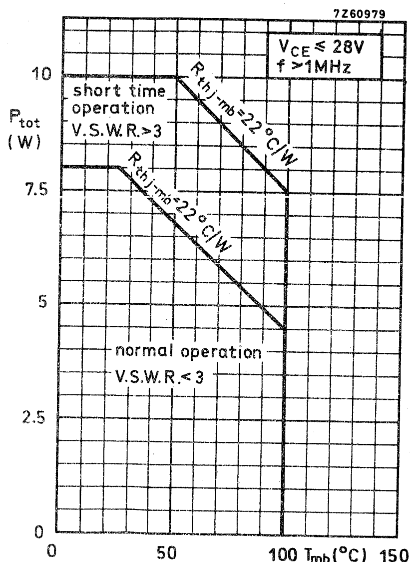
Collector-base voltage (open emitter) peak value	V_{CBOM}	max.	65	V
Collector-emitter voltage (open base)	V_{CEO}	max.	36	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4	V

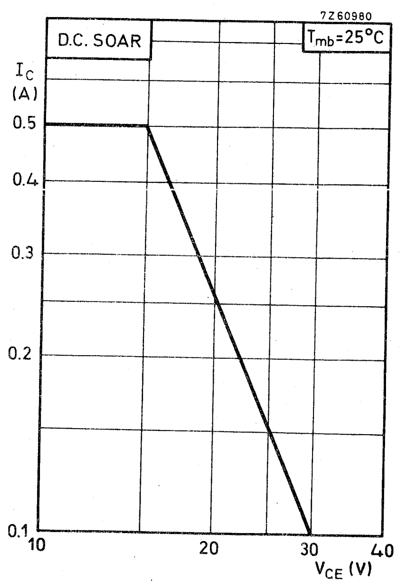
Currents

Collector current (average)	$I_{C(AV)}$	max.	0.5	A
Collector current (peak value) f > 1 MHz	I_{CM}	max.	1.5	A

Power dissipation

Total power dissipation up to T_{mb} = 25 °C f > 1 MHz	P_{tot}	max.	8	W





Temperature

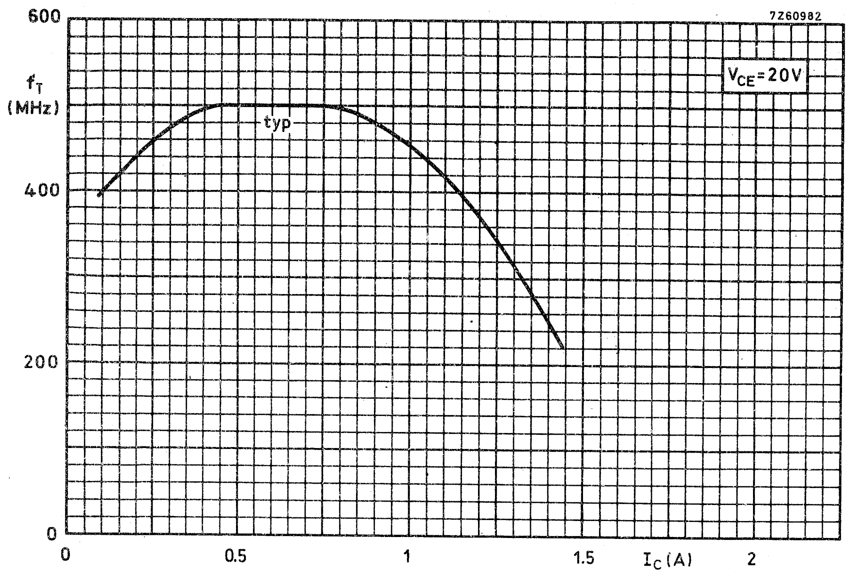
Storage temperature	T_{stg}	−65 to	+200	°C
Operating junction temperature	T_j	max.	200	°C

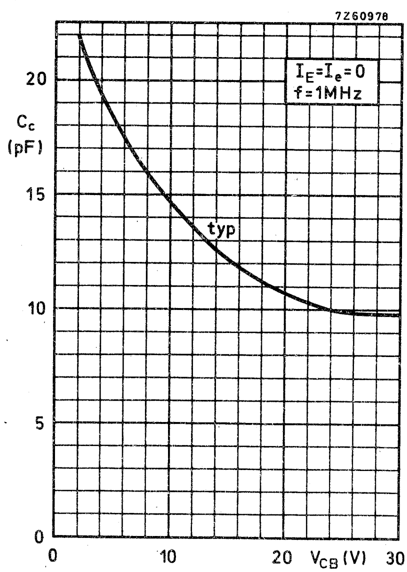
THERMAL RESISTANCE

From junction to mounting base	$R_{th\,j-mb}$	=	22	°C/W
From mounting base to heatsink with a boron nitride washer for electrical insulation	$R_{th\,mb-h}$	=	2.5	°C/W

CHARACTERISTICS $T_j = 25\ ^oC$ unless otherwise specified

Collector cut-off current				
$I_B = 0$; $V_{CE} = 28$ V	I_{CEO}	<	5	mA
Breakdown voltages				
Collector-base voltage open emitter, $I_C = 1$ mA	$V_{(BR)CBO}$	>	65	V
Collector-emitter voltage open base, $I_C = 10$ mA	$V_{(BR)CEO}$	>	36	V
Emitter-base voltage open collector; $I_E = 1$ mA	$V_{(BR)EBO}$	>	4	V
Transient energy				
L = 25 mH; f = 50 Hz				
open base	E	>	0.5	mWs
$-V_{BE} = 1.5$ V; $R_{BE} = 33\ \Omega$	E	>	0.5	mWs
D.C. current gain				
$I_C = 500$ mA; $V_{CE} = 5$ V	h_{FE}	>	5	
Transition frequency				
$I_C = 400$ mA; $V_{CE} = 20$ V	f_T	typ.	500	MHz
Collector capacitance at f = 1 MHz				
$I_E = I_e = 0$; $V_{CB} = 30$ V	C_c	typ.	10	pF
		<	15	pF
Feedback capacitance at f = 1 MHz				
$I_C = 25$ mA; $V_{CE} = 30$ V	C_{re}	typ.	7.5	pF


7Z60982
600
400
200
0
f_T
(MHz)
V_{CE}=20V
typ
0
0.5
1
1.5
I_C (A)
2


7Z60978
20
15
10
5
0
C_c
(pF)
I_E=I_e=0
f=1MHz
typ
0
10
20
V_{CB} (V)
30

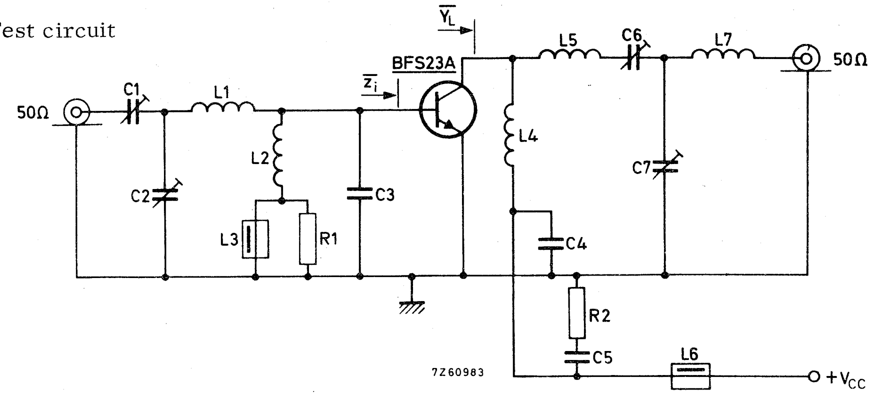
APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralised common-emitter class B circuit)

V_{CC} = 28 V; T_{mb} up to 25 °C

f(MHz)	P_S (W)	P_L (W)	I_C (A)	G_p (dB)	η (%)	$\overline{z_i}$ (Ω)	$\overline{Y_L}$ (mA/V)
175	< 0.40	4	< 0.22	> 10	> 65	2.3+j1.6	8.9 − j18.1

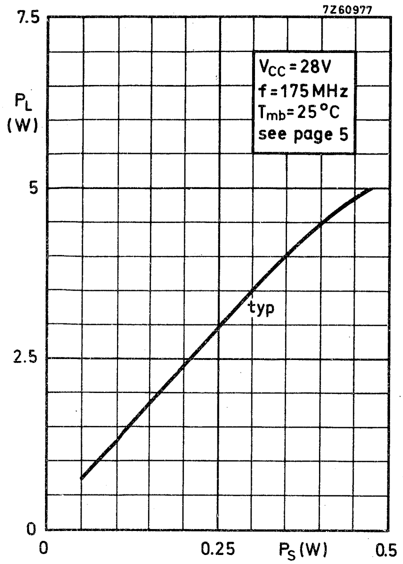
Test circuit

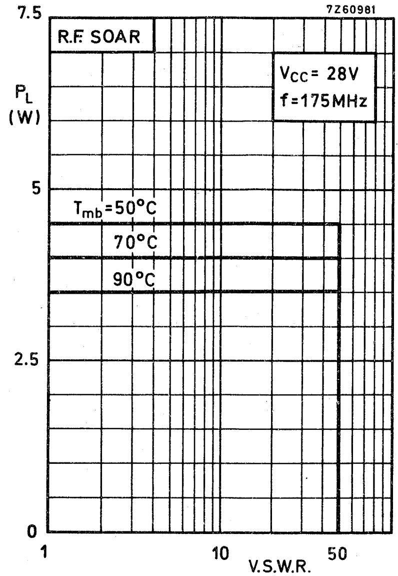


C1 = C6 = 4 to 29 pF air trimmer with insulated rotor
C2 = C7 = 4 to 29 pF air trimmer with non-insulated rotor
C3 = 39 pF ceramic
C4 = 100 pF ceramic
C5 = 15 nF polyester

L1 = 1 turn enamelled Cu wire (1.0 mm); int. diam. 10 mm; leads 2 x 10 mm
L2 = 6 turns enamelled Cu wire (0.7 mm); int. diam. 4 mm; leads 2 x 10 mm
L3 = L6 = ferroxcube choke (code number 4312 020 36640)
L4 = 8 turns enamelled Cu wire (0.7 mm); int. diam. 4 mm; leads 2 x 10 mm
L5 = 5 turns enamelled Cu wire (1.0 mm); winding pitch 1.0 mm; int. diam. 8 mm; leads 2 x 10 mm
L7 = 4 turns enamelled Cu wire (1.0 mm); winding pitch 1.0 mm; int. diam. 6 mm; leads 2 x 5 mm

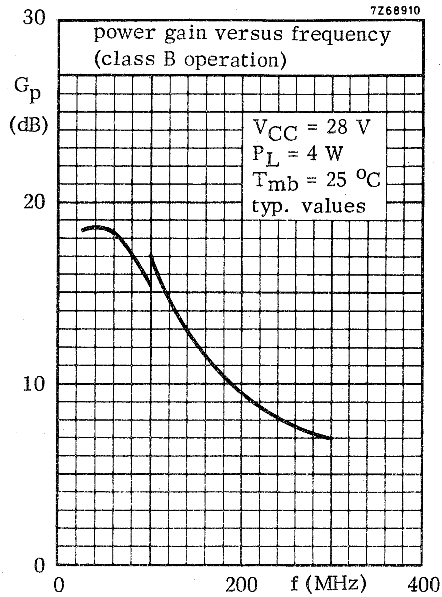
R1 = R2 = 10 Ω carbon

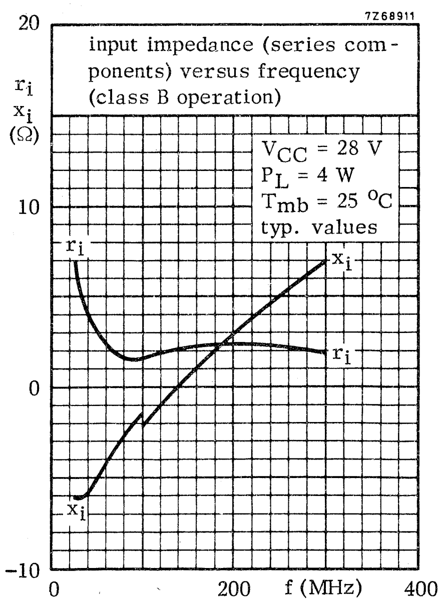


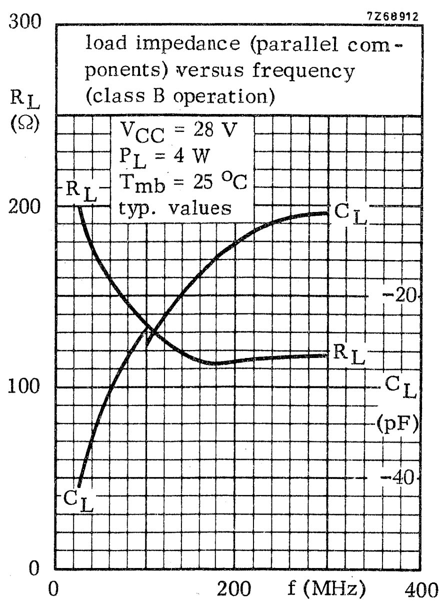


For high voltage operation, a stabilized power supply is generally used.
The graph shows the allowable output power under nominal conditions as a function of the V.S.W.R., with heat-sink temperature as parameter.

OPERATING NOTE Below 100 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation. This resistor must be effective for both d.c. and r.f.







U.H.F. POWER AMPLIFIER MODULES

Broadband amplifier modules primarily designed for mobile applications operating directly from 12 V vehicle electrical systems. The module will produce 2,5 W output into a 50 Ω load over the bands 380 to 512 MHz for the BGY22, and 420 to 480 MHz for the BGY22A.

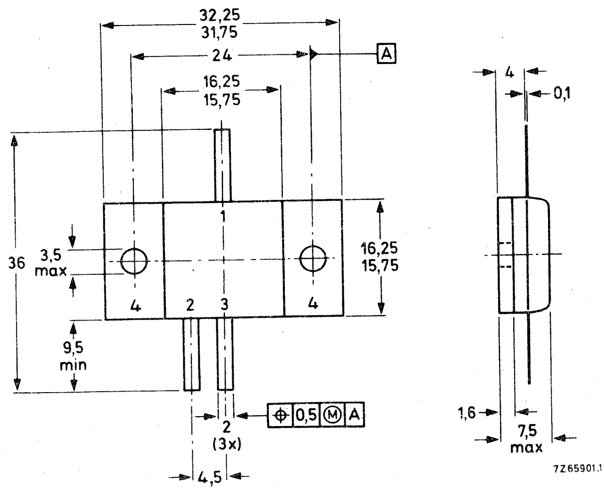
QUICK REFERENCE DATA

type number	mode of operation	freq. range MHz	V_B V	P_D mW	P_L W	η %	$Z_S = Z_L$ Ω
BGY22	c.w.	380 to 512	13,5	50	> 2,5 typ. 2,9	> 40 typ. 50	50
BGY22A	c.w.	420 to 480	12,5	50	> 2,5	> 40	50

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-75A.



Lead reference

1 = Input
2 = $+V_B$
3 = Output
4 = Earth

To ensure good thermal contact between mounting base and heatsink, burrs or thickening at the edges of the heatsink holes should be removed and the package bolted down onto a flat surface.

Devices may be soldered directly into a circuit with a soldering iron at a maximum iron temperature of 245 °C for 10 seconds at least 1 mm from the plastic.

CAUTION These devices incorporate beryllium oxide, the dust of which is toxic. The devices are entirely safe provided that the BeO disc is not damaged.

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC 134)

D.C. voltages (with respect to flange)

Supply terminal	V_B	max.	18	V
Input terminal	$\pm V_I$	max.	25	V
Output terminal	$\pm V_O$	max.	25	V

Current

Supply current (d.c.)	I_{tot}	max.	800	mA

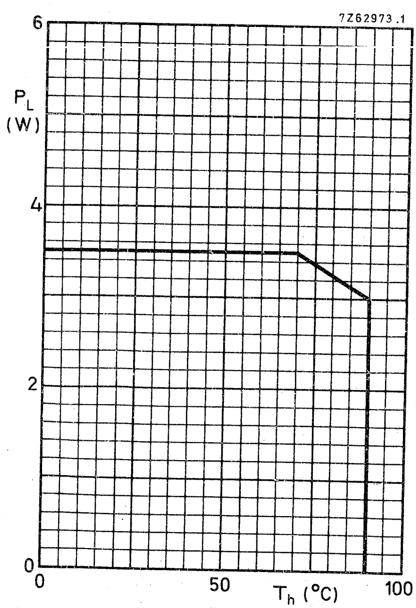
Drive power

V_B = 13,5 V; Z_L = 50 Ω	P_D	max.	150	mW

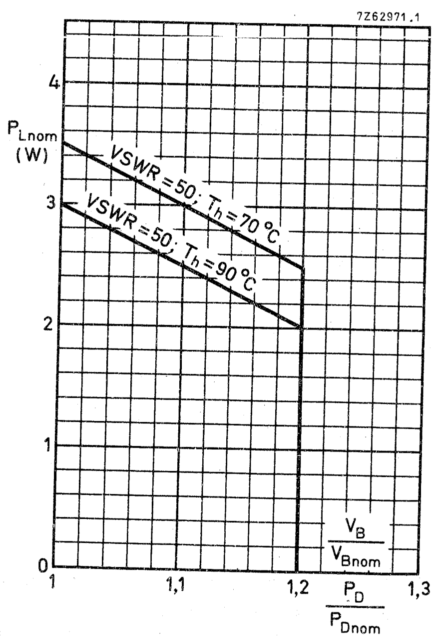
Temperatures

Storage temperature	T_{stg}	−40 to +100		°C
Operating heatsink temperature	T_h	max.	90	°C

P_L for normal operation



P_L for fault condition



Where P_{Lnom} = P_L at V_B = 13,5 V; Z_L = 50 Ω (BGY22)
and P_{Lnom} = P_L at V_B = 12,5 V; Z_L = 50 Ω (BGY22A)

CHARACTERISTICS T_h = 25 °C unless otherwise specified

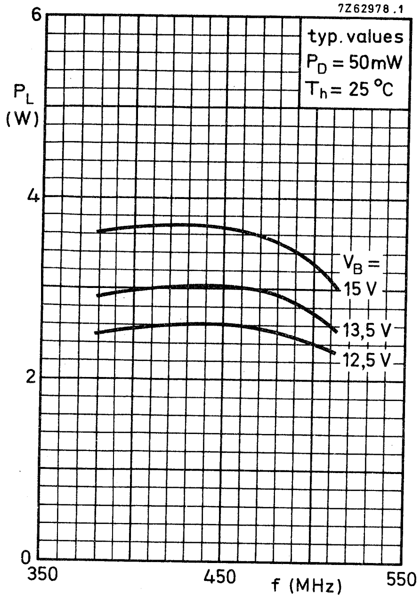
Reference planes at r.f. input and output terminals are 1 mm from the plastic encapsulation.

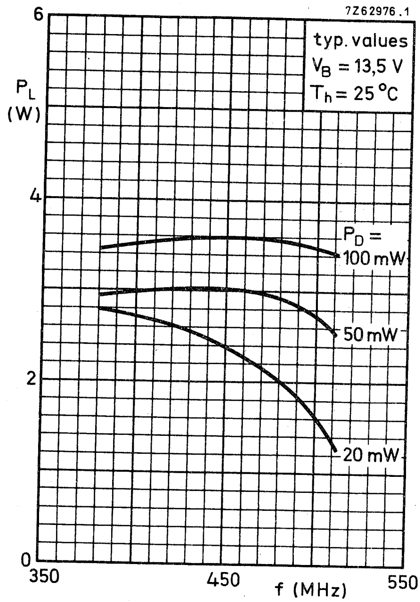
Frequency range 380-512 MHz; V_B = 13,5 V (BGY22)
Frequency range 420-480 MHz; V_B = 12,5 V (BGY22A)

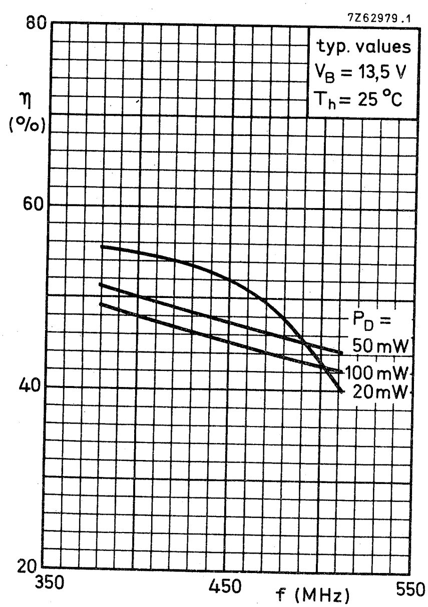
Quiescent current			
P_D = 0	I_{BQ}	4,0 to 12,0	mA
Load power			
P_D = 50 mW	P_L	2,5 to 3,5	W
Efficiency			
P_D = 50 mW	η	> 40	%
Supply current			
P_D = 50 mW	I_{tot}	typ. 475	mA
Harmonic content			
P_D = 50 mW	Any harmonic is at least 20 dB down relative to carrier		
Input VSWR with respect to 50 Ω			
P_D = 50 mW	VSWR	< 2	
Temperature coefficient of P_L			
P_D = 50 mW; T_h = 25 to 70 °C		typ. −10	mW/°C

Stability

V_B = 10,5 to 15 V; P_D = 10 mW to 100 mW
T_h = −40 to +90 °C
Output load VSWR ≤ 3, all phases — No instabilities
Output load VSWR ≤ 10, all phases — No appreciable instabilities


7Z62978.1
typ. values
P_D = 50mW
T_h = 25 °C
P_L
(W)
6
4
2
0
V_B =
15 V
13,5 V
12,5 V
350
450
f (MHz)
550


7Z62976.1
typ. values
V_B = 13,5 V
T_h = 25 °C
P_L
(W)
6
4
2
0
P_D =
100 mW
50 mW
20 mW
350
450
f (MHz)
550


7Z62979.1
typ. values
V_B = 13,5 V
T_h = 25 °C
η
(%)
80
60
40
20
P_D =
50 mW
100 mW
20 mW
350
450
f (MHz)
550

APPLICATION INFORMATION

R.F. performance in c.w. operation; $T_h = 25\ ^oC$

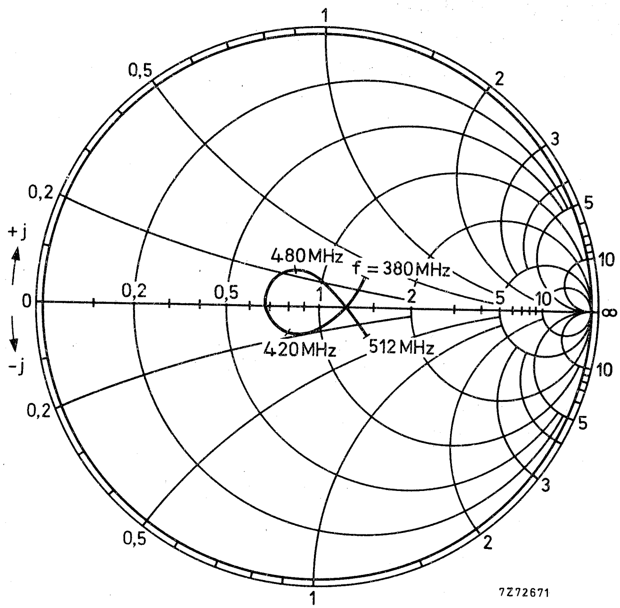
Drive source and load impedance $Z_S = Z_L = 50\ \Omega$

type number	f MHz	V_B V	P_D mW	P_L W	η %
BGY22	380 to 512	15,0	50	typ. 3,5	typ. 47
		13,5		> 2,5	> 40
		13,5		typ. 2,9	typ. 47
		12,5		typ. 2,5	typ. 47
BGY22A	420 to 480	12,5	50	> 2,5	> 40

The modules are designed to withstand full load mismatch under the following conditions:

$P_D = P_{Dnom} + 20\%$; $T_h = 70\ ^oC$
$V_B = 16,5$ V **(BGY22)**
$V_B = 15,0$ V **(BGY22A)**
VSWR = 50 at any phase

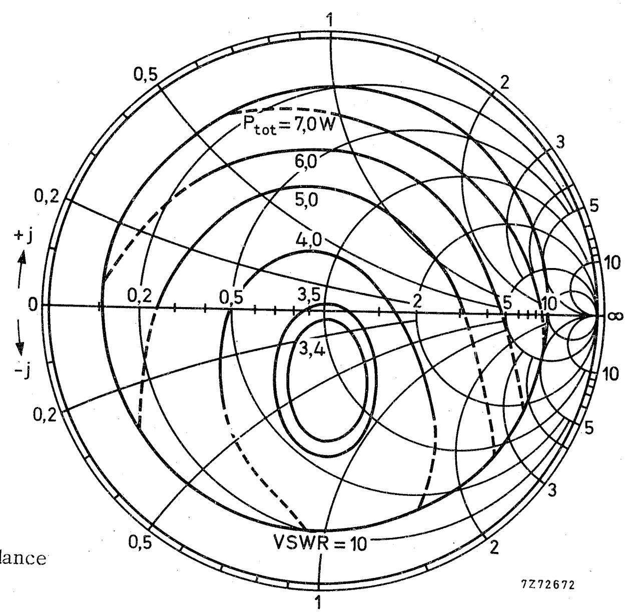
where $P_{Dnom} = P_D$ for 2,5 W module output under nominal conditions.



Typical variation of input impedance with frequency

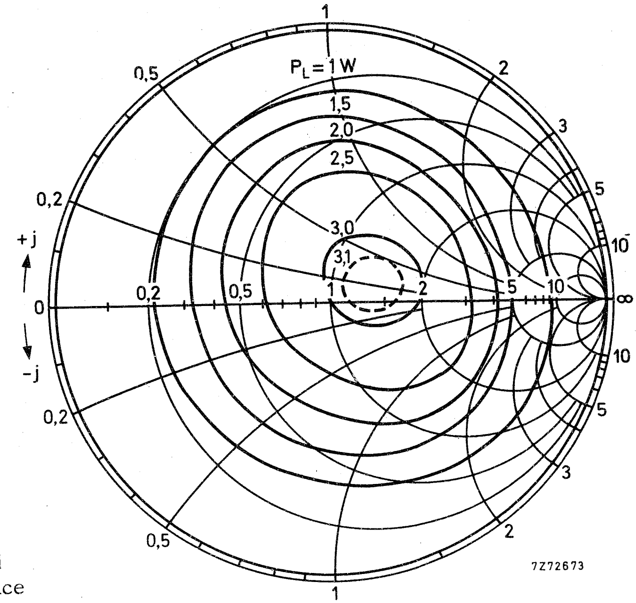
V_B = 13,5 V

f = 470 MHz



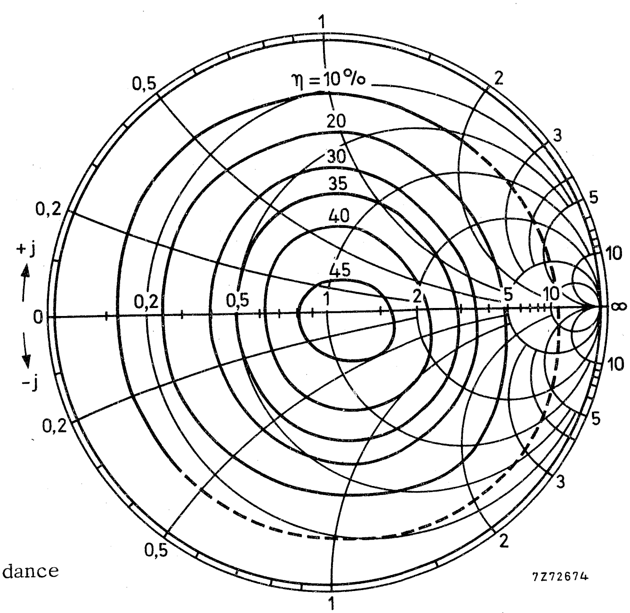
Typical variation of power dissipation with load impedance

V_B = 13, 5 V
P_D = 50 mW
f = 470 MHz



Typical variation of load power with load impedance

V_B = 13, 5 V
P_D = 50 mW
f = 470 MHz



Typical variation of efficiency with load impedance

U.H.F. POWER AMPLIFIER MODULES

Broadband amplifier modules primarily designed for mobile applications operating directly from 12 V vehicle electrical systems. The modules are suitable for driving directly from the BGY22 and BGY22A respectively, and when so driven will produce 7 W output into a 50 Ω load over the band 380 to 480 MHz for the BGY23, and 7 W over the band 420 to 480 MHz for the BGY23A.

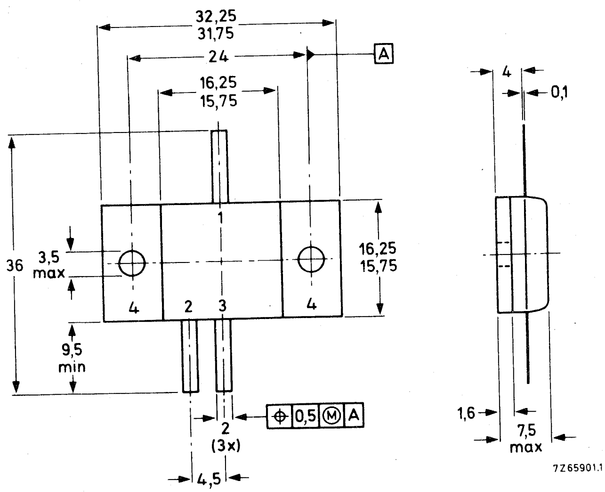
QUICK REFERENCE DATA

type number	mode of operation	freq. range MHz	V_B V	P_D W	P_L W	η %	$Z_S = Z_L$ Ω
BGY23	c.w.	380 to 480	13,5	2,5	> 7,0	> 60	50
		380 to 480			typ. 8,3	typ. 71	
		480 to 512			typ. 7,5	typ. 69	
BGY23A	c.w.	420 to 480	12,5	2,5	> 7,0	> 60	50

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-75A.



Lead reference

1 = Input
2 = $+V_B$
3 = Output
4 = Earth

To ensure good thermal contact between mounting base and heatsink, burrs or thickening at the edges of the heatsink holes should be removed and the package bolted down onto a flat surface.

Devices may be soldered directly into a circuit with a soldering iron at a maximum iron temperature of 245 °C for 10 seconds at least 1 mm from the plastic.

CAUTION These devices incorporate beryllium oxide, the dust of which is toxic. The devices are entirely safe provided that the BeO disc is not damaged.

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC 134)

D.C. voltages (with respect to flange)

Supply terminal	V_B	max.	18	V
Input terminal (no external d.c. connection)	$\pm V_I$	max.	0,5	V
Output terminal	$\pm V_O$	max.	25	V

Current

Supply current (d.c.)	I_{tot}	max.	1,7	A

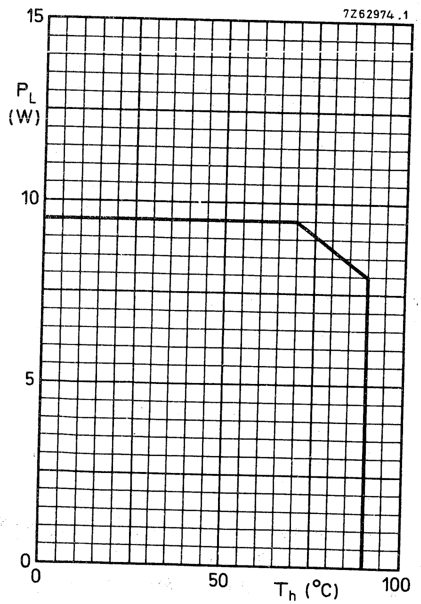
Drive power

V_B = 13,5 V; Z_L = 50 Ω	P_D	max.	3,5	W

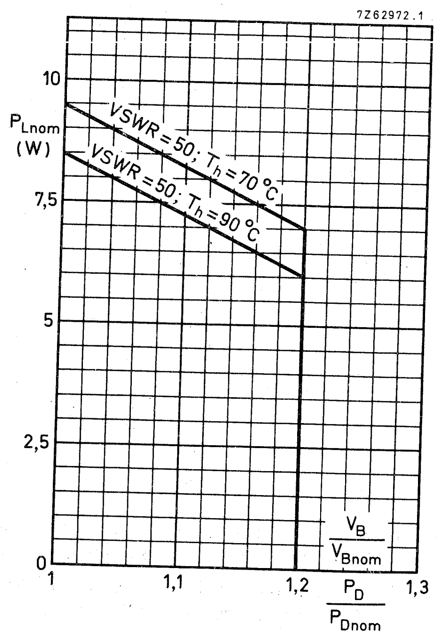
Temperatures

Storage temperature	T_{stg}	−40 to +100		°C
Operating heatsink temperature	T_h	max.	90	°C

P_L for normal operation



P_L for fault condition



Where P_{Lnom} = P_L at V_B = 13,5 V; Z_L = 50 Ω (BGY23)
and P_{Lnom} = P_L at V_B = 12,5 V; Z_L = 50 Ω (BGY23A)

CHARACTERISTICS T_h = 25 °C unless otherwise specified

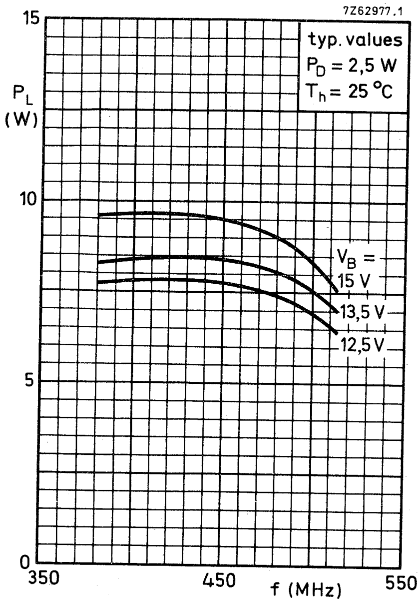
Reference planes at r.f. input and output terminals are 1 mm from the plastic encapsulation.

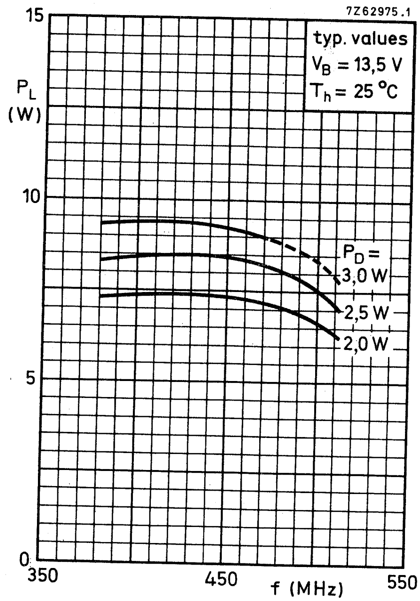
Frequency range 380-512 MHz; V_B = 13,5 V (BGY23)
Frequency range 420-480 MHz; V_B = 12,5 V (BGY23A)

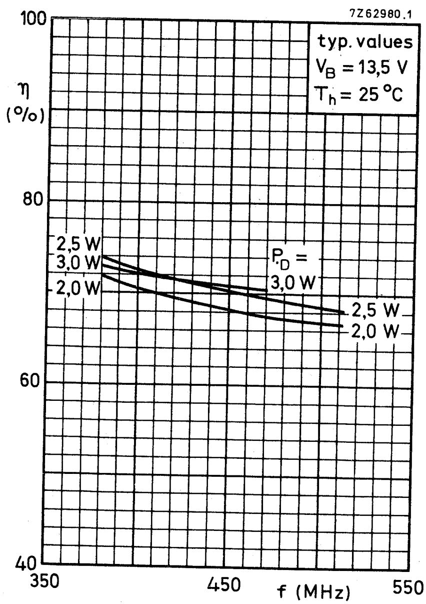
Quiescent current					
P_D = 0		I_{BQ}	<	5,0	mA
Load power					
P_D = 2,5 W; f = 380-480 MHz	BGY23	P_L		7,0 to 9,5	W
P_D = 2,5 W; f = 480-512 MHz	BGY23	P_L	typ.	7,5	W
P_D = 2,5 W; f = 420-480 MHz	BGY23A	P_L		7,0 to 9,5	W
Efficiency					
P_D = 2,5 W		η	>	60	%
Supply current					
P_D = 2,5 W		I_{tot}	typ.	900	mA
Harmonic content					
P_D = 2,5 W		Any harmonic is at least 20 dB down relative to carrier			
Input VSWR with respect to 50 Ω					
P_D = 2,5 W		VSWR	<	2	
Temperature coefficient of P_L					
P_D = 2,5 W; T_h = 25 to 70 °C			typ.	−20	mW/°C

Stability

V_B = 10,5 V to 15 V; P_D = 1 W to 3,5 W
T_h = −40 °C to +90 °C
Output load VSWR ≤ 3, all phases — No instabilities
Output load VSWR ≤ 10, all phases — No appreciable instabilities


7Z62977.1
typ. values
P_D = 2,5 W
T_h = 25 °C
P_L (W)
15
10
5
0
V_B =
15 V
13,5 V
12,5 V
350
450
f (MHz)
550


7Z62975.1
typ. values
V_B = 13,5 V
T_h = 25 °C
P_L (W)
15
10
5
0
P_D =
3,0 W
2,5 W
2,0 W
350
450
f (MHz)
550


7Z62980.1
typ. values
V_B = 13,5 V
T_h = 25 °C
η (%)
100
80
60
40
2,5 W
3,0 W
2,0 W
P_D =
3,0 W
2,5 W
2,0 W
350
450
f (MHz)
550

APPLICATION INFORMATION

R.F. performance in c.w. operation; T_h = 25 °C

Drive source and load impedance $Z_S = Z_L$ = 50 Ω

Type number	f (MHz)	V_B (V)	P_D (W)	P_L (W)	η (%)
BGY23	380 to 512	15,0	2,5	typ. 9,0	typ. 65
BGY23	380 to 480	13,5	2,5	> 7,0	> 60
BGY23	380 to 480	13,5	2,5	typ. 8,3	typ. 71
BGY23	480 to 512	13,5	2,5	typ. 7,5	typ. 69
BGY23	380 to 512	12,5	2,5	typ. 7,4	typ. 70
BGY23A	420 to 480	12,5	2,5	> 7,0	> 60

Connection of the BGY22/BGY22A to the BGY23/BGY23A respectively can be either by 50 Ω transmission line or directly with a total lead length not greater than 2 mm.

The modules are designed to withstand full load mismatch under the following conditions:

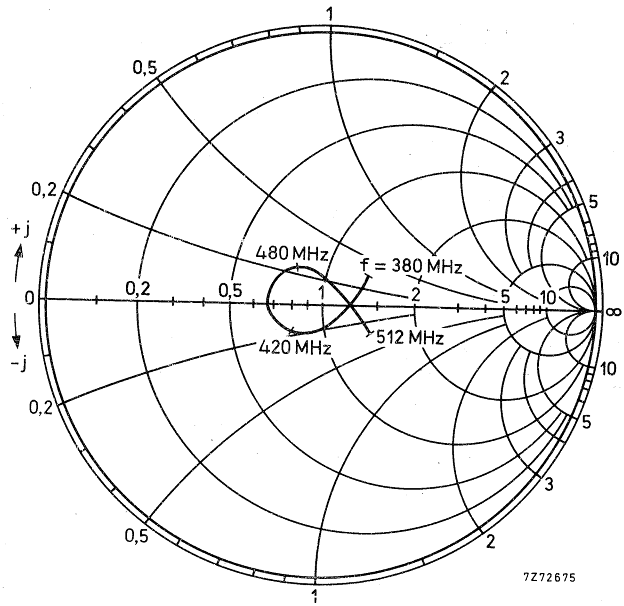
$P_D = P_{Dnom}$ + 20%; T_h = 70 °C

V_B = 16,5 V (BGY23)

V_B = 15,0 V (BGY23A)

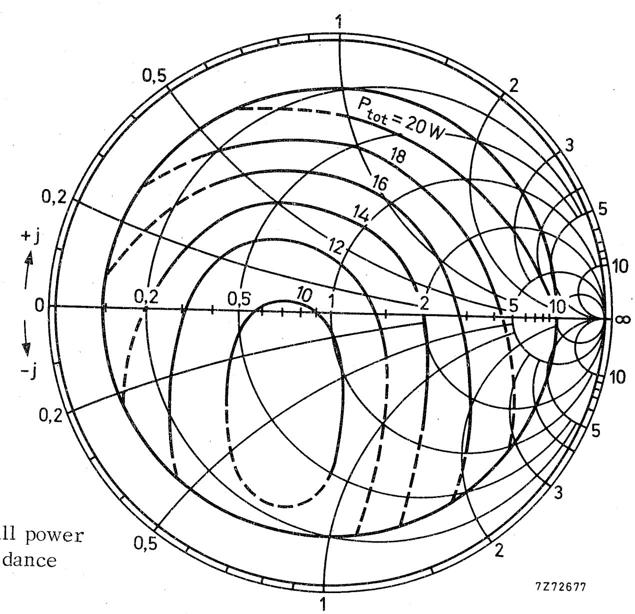
VSWR = 50 at any phase

where $P_{Dnom} = P_D$ for 7,0 W module output under nominal conditions.



Typical variation of input impedance with frequency

V_B = 13,5 V
f = 470 MHz



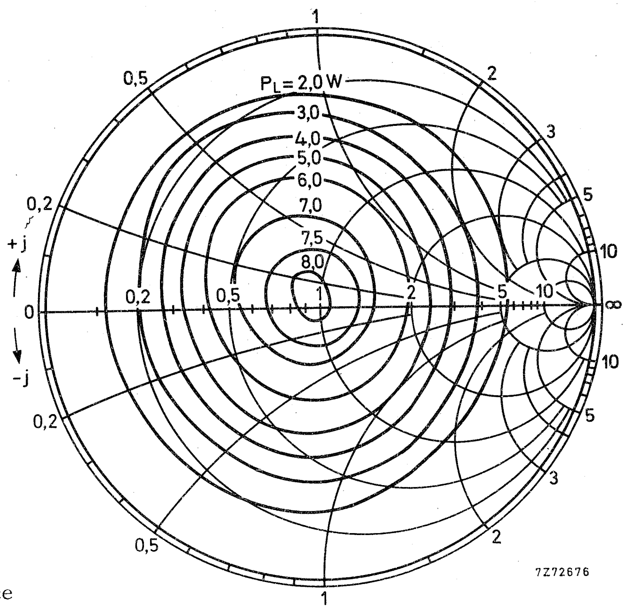
BGY22/23 or
BGY22A/23A
cascaded amplifier

Typical variation of overall power dissipation with load impedance

V_B = 13, 5 V

f = 470 MHz

BGY22/23 or
BGY22A/23A
cascaded amplifier

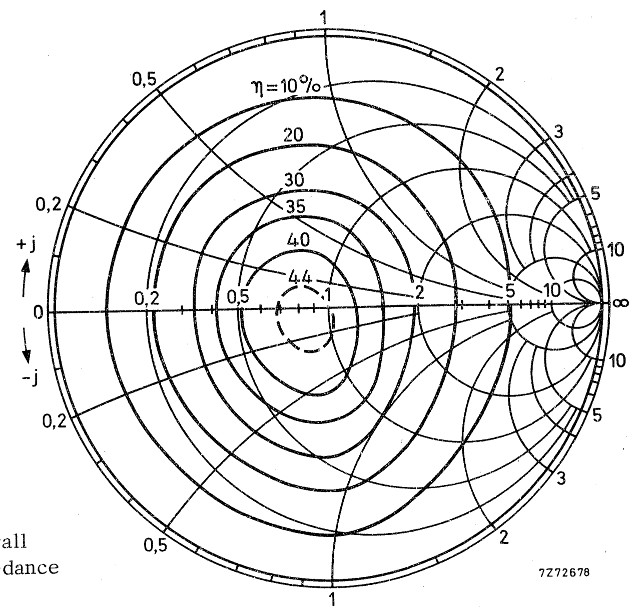


Typical variation of load power with load impedance

V_B = 13, 5 V

f = 470 MHz

BGY22/23 or
BGY22A/23A
cascaded amplifier



Typical variation of overall efficiency with load impedance

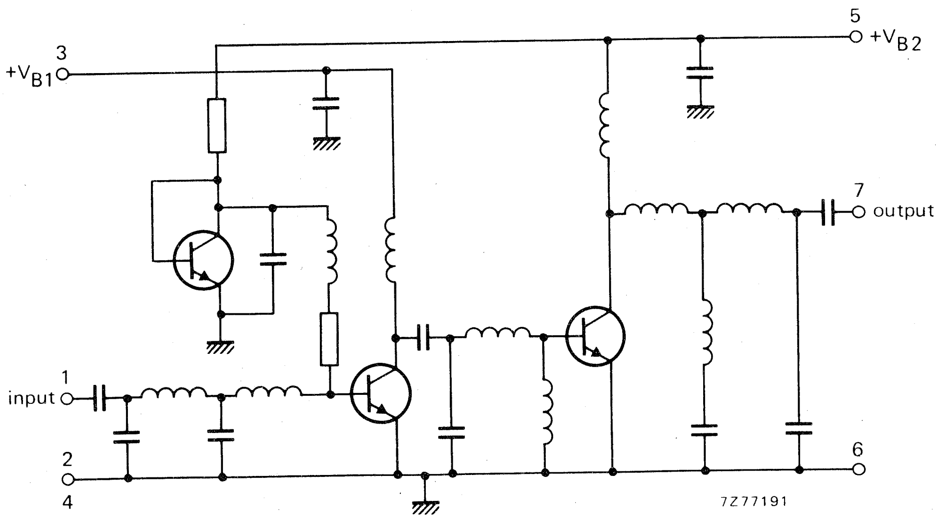
V.H.F. POWER AMPLIFIER MODULES

A range of broadband amplifier modules designed for mobile communications equipments, operating directly from 12 V vehicle electrical systems. The devices will produce 18 W output into a 50 Ω load. The modules consist of a two stage r.f. amplifier using n-p-n transistor chips, together with lumped-element matching components.

QUICK REFERENCE DATA

type number	mode of operation	frequency range f (MHz)	nominal supply voltages $V_{B1} = V_{B2}$ (V)	drive power P_D (mW)	load power P_L (W)	nominal input impedance z_i (Ω)	nominal load impedance Z_L (Ω)
BGY32	c.w.	68 to 88	12,5	100	> 18 typ 23	50	50
BGY33	c.w.	80 to 108	12,5	100	> 18 typ 22	50	50
BGY35	c.w.	132 to 156	12,5	150	> 18 typ 22	50	50
BGY36	c.w.	148 to 174	12,5	150	> 18 typ 21	50	50

CIRCUIT DIAGRAM

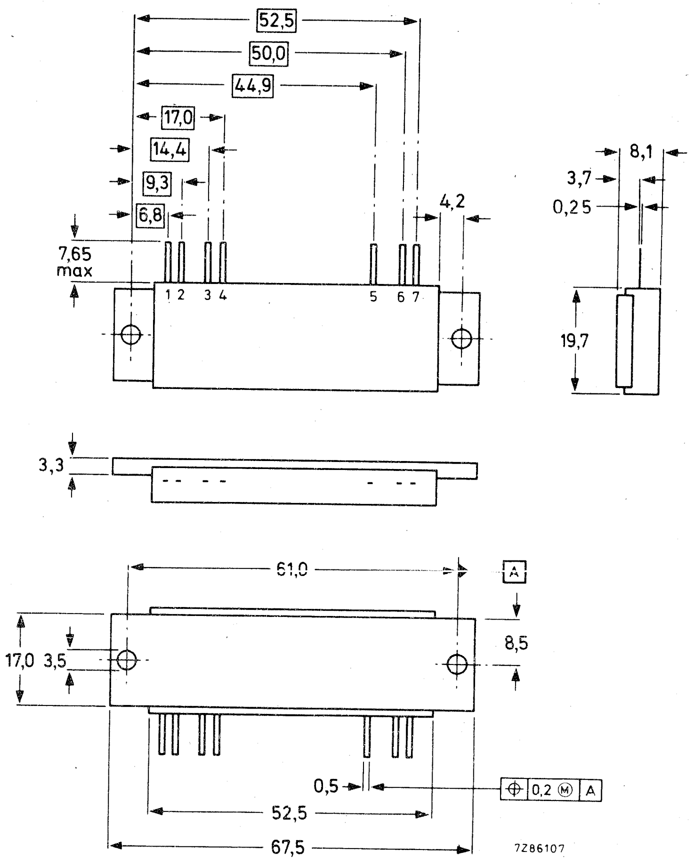


CAUTION These devices incorporate beryllium oxide, the dust of which is toxic. The devices are entirely safe provided that they are not dismantled.

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-132B.



Lead reference

1 = Input
2 = Earth
3 = Supply $+V_{B1}$
4 = Earth
5 = Supply $+V_{B2}$
6 = Earth
7 = Output

Mounting and soldering recommendations

To ensure good thermal transfer the module should be mounted using heatsink compound onto a heatsink with a flat surface; if an isolation washer is used heatsink compound should be used on both sides of the insulator. Burrs and thickening of the holes in the heatsink should be removed and 3 mm bolts tightened to torques of 0,5 Nm minimum.

Devices may be soldered directly into a circuit with a soldering iron at maximum iron temperature of 245 °C for 10 seconds at least 1 mm from the plastic.

RATINGS

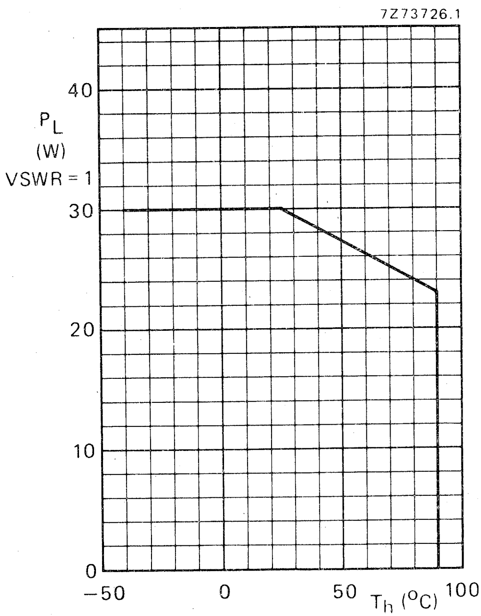
Limiting values in accordance with the Absolute Maximum System (IEC 134)

D.C. voltages (with respect to flange)

D.C. supply terminals	V_{B1} and V_{B2}	max	15	V
R.F. input terminal	$\pm V_I$	max	25	V
R.F. output terminal	$\pm V_O$	max	25	V

Power

Input drive power BGY32 and BGY33	P_D	max	200	mW
Input drive power BGY35 and BGY36	P_D	max	300	mW
Load power	P_L	max	30	W



Temperatures

Storage temperature	T_{stg}		−40 to 100	°C
Operating heatsink temperature	T_h	max	90	°C

CHARACTERISTICS

T_h = 25 °C

	Symbol		BGY32	BGY33	BGY35	BGY36	
Quiescent current $V_{B1} = V_{B2}$ = 12,5 V; P_D = 0; $R_S = R_L$ = 50 Ω	I_{BQ1}	typ	6	6	6	6	mA
	I_{BQ2}	typ	13	13	13	13	mA
Frequency range	f	>	68	80	132	148	MHz
		<	88	108	156	174	MHz
Load power $V_{B1} = V_{B2}$ = 12,5 V; $R_S = R_L$ = 50 Ω; **BGY32** and **BGY33**; P_D = 100 mW	P_L	>	18	18	–	–	W
		typ	23	22			W
	η	>	40	40	–	–	%
		typ	50	50			%
BGY35 and **BGY36**; P_D = 150 mW	P_L	>	–	–	18	18	W
		typ			22	21	W
	η	>	–	–	40	40	%
		typ			50	50	%

Harmonic output

Any single harmonic will be at least 25 dB down relative to carrier

Input VSWR with respect to 50 Ω — typ 1,5

Stability

The module is stable with load VSWR up to 3 (all phases) when operated with matched output power greater than 6 W.

Ruggedness

The modules are capable of withstanding load mismatch of up to 50 VSWR for short period overload conditions, with P_D, V_{B1} and V_{B2} at maximum values providing the combination does not result in the matched r.f. output power rating being exceeded.

APPLICATION INFORMATION

Supply

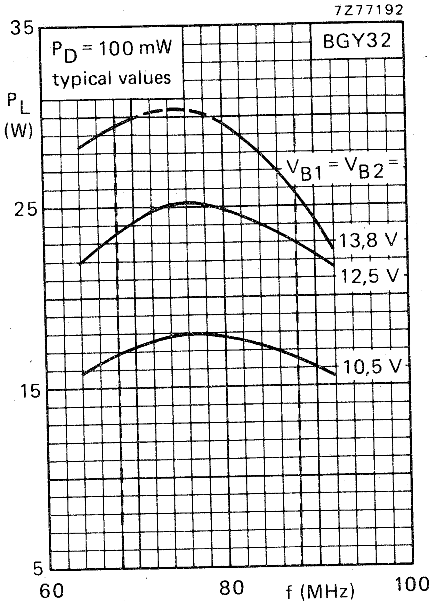
An electrolytic capacitor of 10 μF (25 V), in parallel with a polyester capacitor of 100 nF to earth, is recommended as decoupling arrangement for each power supply pin.

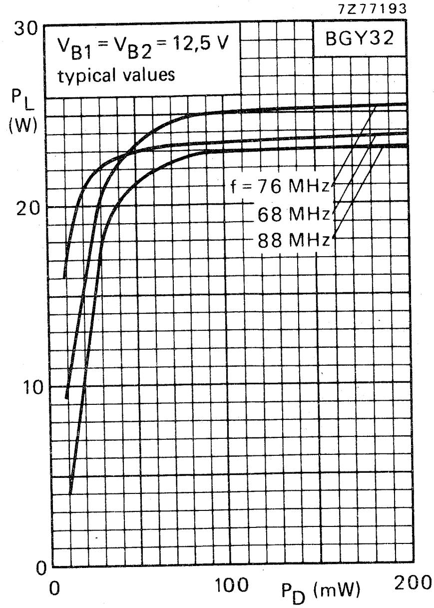
Power rating

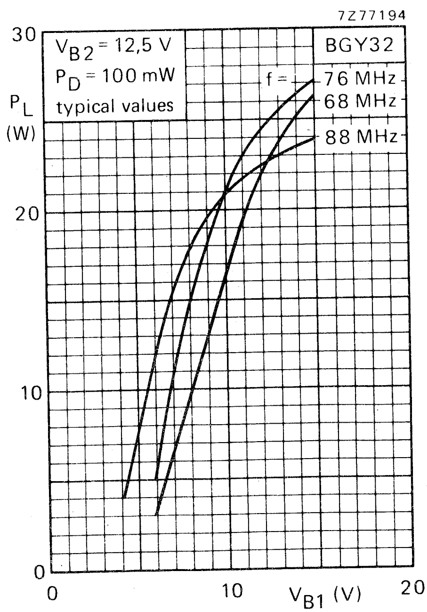
In general it is recommended that the output power from the module under nominal design conditions should not exceed 23 W in order to provide adequate safety margin under fault conditions.

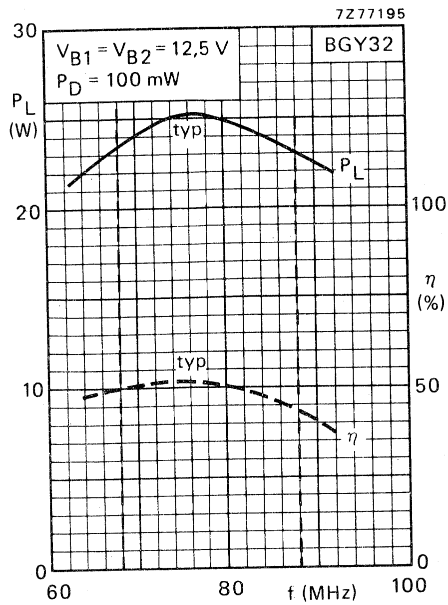
Gain control

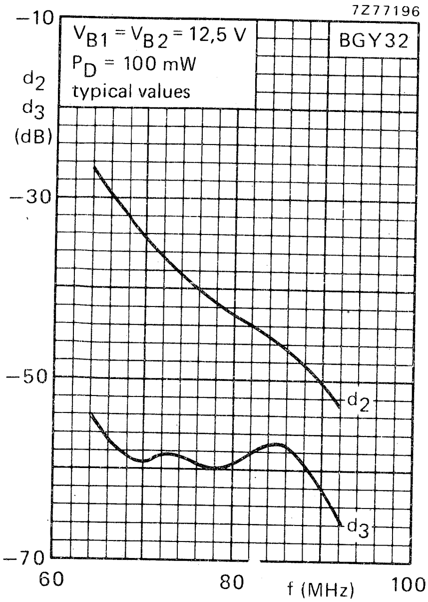
Power output can be controlled by variation of the driver stage supply voltage V_{B1}. The supply required is a voltage regulator with a current rating of 0,75 A, and an output voltage range of 3 V to 12 V.

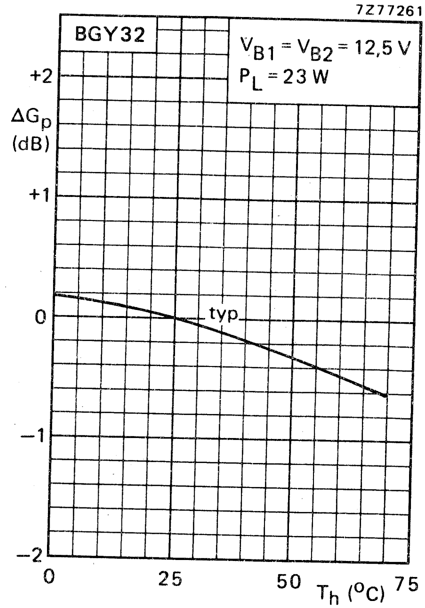

7Z77192
BGY32
P_D = 100 mW
typical values
P_L (W)
$V_{B1} = V_{B2}$ =
13,8 V
12,5 V
10,5 V
35
25
15
5
60
80
100
f (MHz)

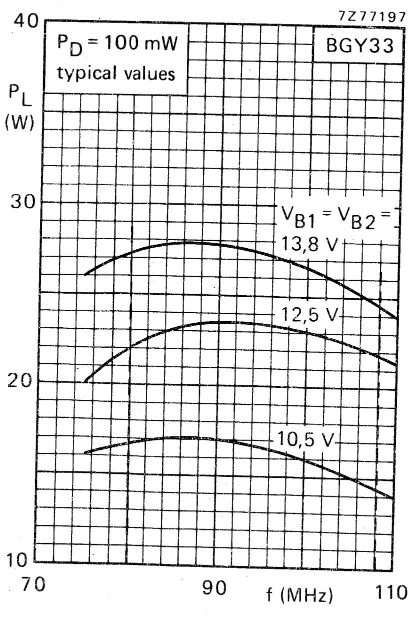

7Z77193
BGY32
$V_{B1} = V_{B2}$ = 12,5 V
typical values
P_L (W)
f = 76 MHz
68 MHz
88 MHz
30
20
10
0
0
100
200
P_D (mW)

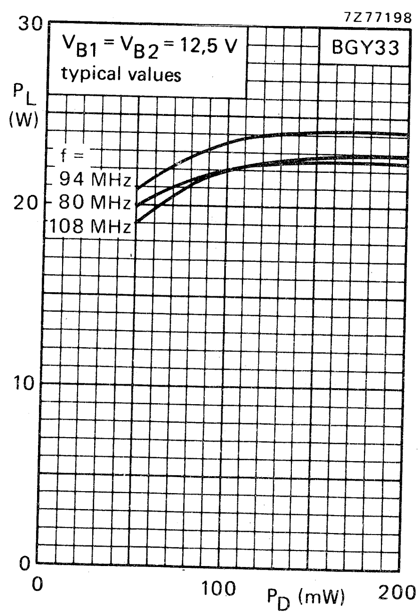

7Z77194
BGY32
V_{B2} = 12,5 V
P_D = 100 mW
typical values
P_L (W)
f = 76 MHz
68 MHz
88 MHz
30
20
10
0
0
10
20
V_{B1} (V)

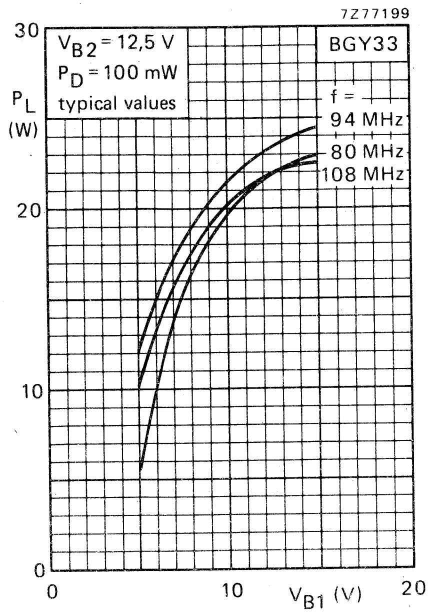

7Z77195
BGY32
$V_{B1} = V_{B2}$ = 12,5 V
P_D = 100 mW
P_L (W)
typ
P_L
typ
η
η (%)
30
20
10
0
100
50
0
60
80
100
f (MHz)

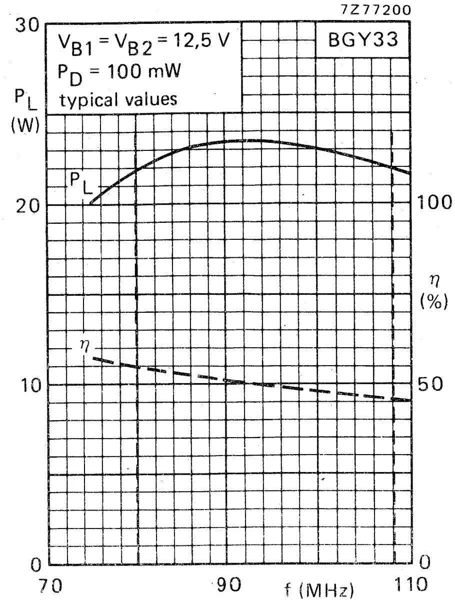

7Z77196
$V_{B1} = V_{B2} = 12,5$ V
P_D = 100 mW
typical values
BGY32
d_2
d_3
(dB)
−10
−30
−50
−70
60
80
f (MHz)
100
d_2
d_3

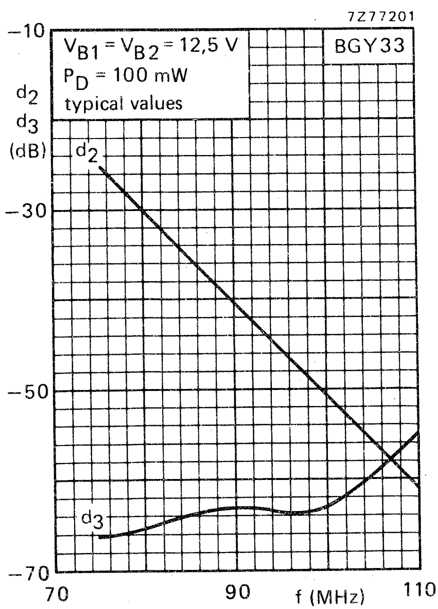

7Z77261
BGY32
$V_{B1} = V_{B2} = 12,5$ V
P_L = 23 W
ΔG_p
(dB)
+2
+1
0
−1
−2
typ
0
25
50
T_h (°C)
75

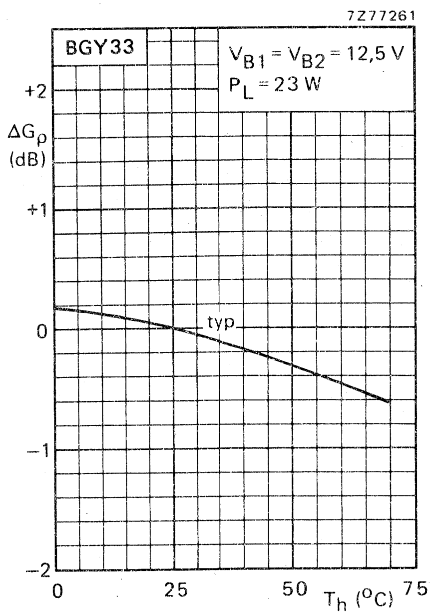

7Z77197
P_D = 100 mW
typical values
BGY33
P_L
(W)
40
30
20
10
$V_{B1} = V_{B2} =$
13,8 V
12,5 V
10,5 V
70
90
f (MHz)
110

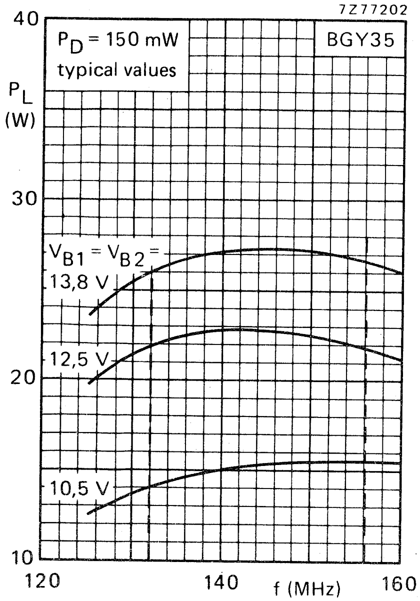

7Z77198
$V_{B1} = V_{B2} = 12,5$ V
typical values
BGY33
P_L
(W)
30
20
10
0
f =
94 MHz
80 MHz
108 MHz
0
100
P_D (mW)
200

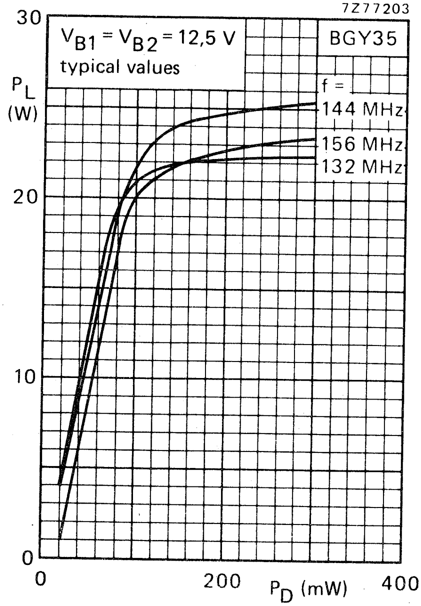

7Z77199
V_{B2} = 12,5 V
P_D = 100 mW
typical values
BGY33
f =
94 MHz
80 MHz
108 MHz
P_L
(W)
30
20
10
0
0
10
V_{B1} (V)
20

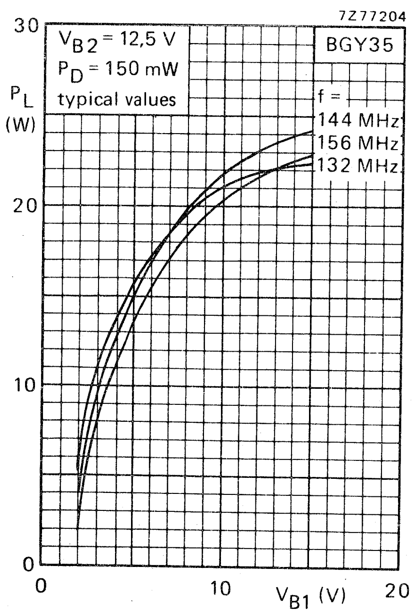

7Z77200
V_{B1} = V_{B2} = 12,5 V
P_D = 100 mW
typical values
BGY33
P_L
(W)
P_L
η
η
(%)
30
20
10
0
100
50
0
70
90
f (MHz)
110

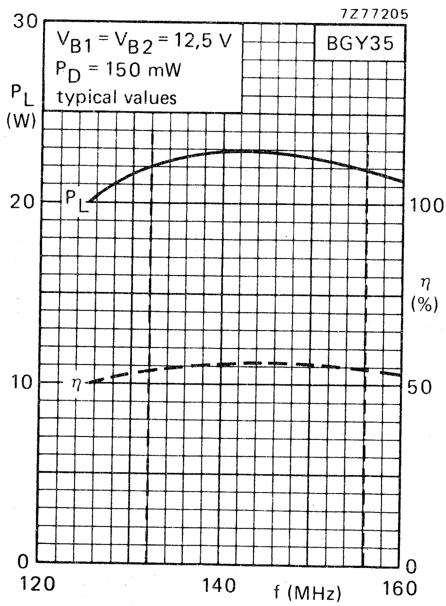

7Z77201
V_{B1} = V_{B2} = 12,5 V
P_D = 100 mW
typical values
BGY33
d_2
d_3
(dB)
d_2
d_3
−10
−30
−50
−70
70
90
f (MHz)
110

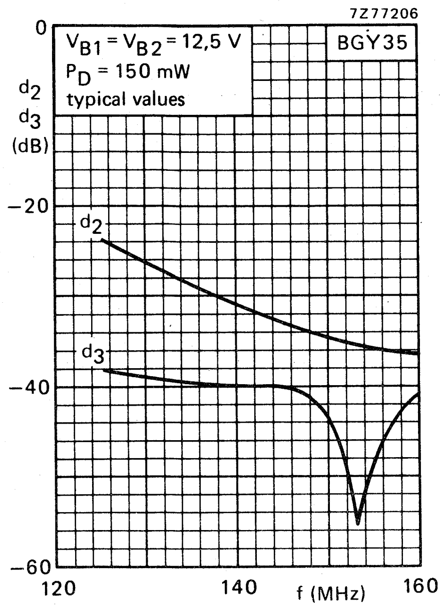

7Z77261
BGY33
V_{B1} = V_{B2} = 12,5 V
P_L = 23 W
ΔG_p
(dB)
typ
+2
+1
0
−1
−2
0
25
50
T_h (°C)
75

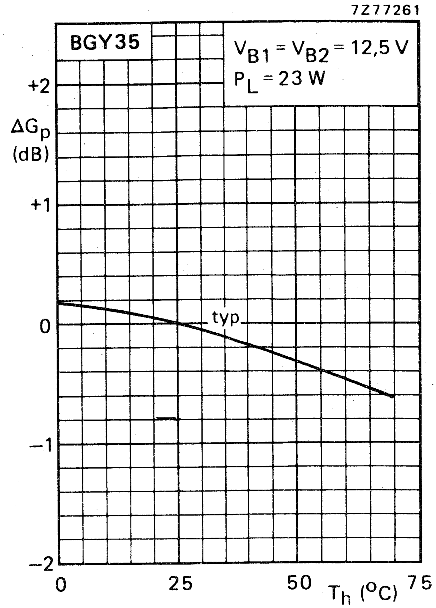

7Z77202
P_D = 150 mW
typical values
BGY35
P_L
(W)
$V_{B1} = V_{B2}$ =
13,8 V
12,5 V
10,5 V
40
30
20
10
120
140
f (MHz)
160

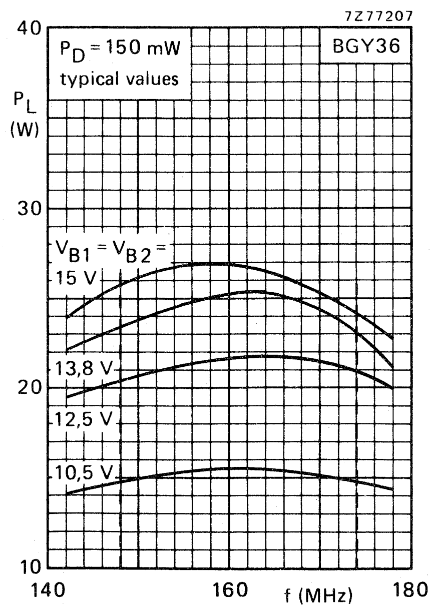

7Z77203
$V_{B1} = V_{B2}$ = 12,5 V
typical values
BGY35
P_L
(W)
f =
144 MHz
156 MHz
132 MHz
30
20
10
0
0
200
P_D (mW)
400

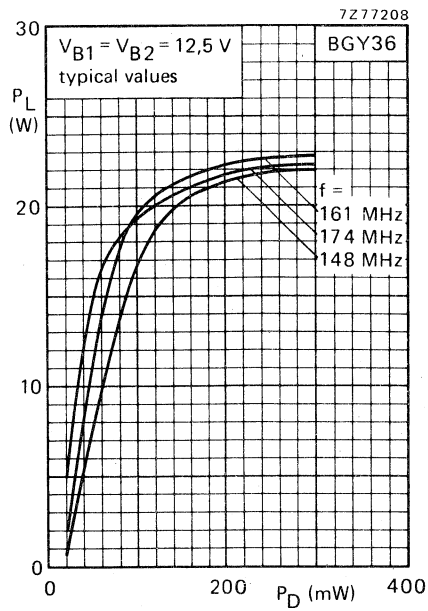

7Z77204
V_{B2} = 12,5 V
P_D = 150 mW
typical values
BGY35
P_L
(W)
f =
144 MHz
156 MHz
132 MHz
30
20
10
0
0
10
V_{B1} (V)
20

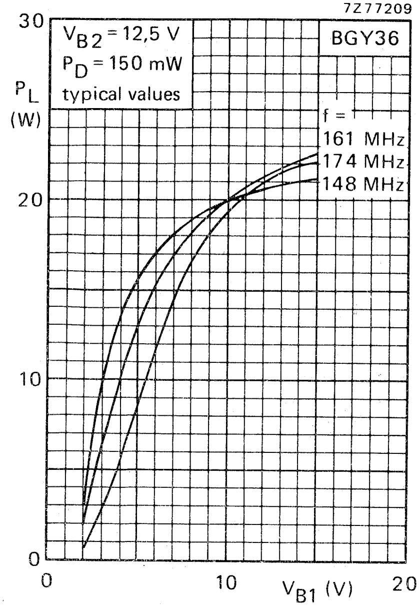

7Z77205
$V_{B1} = V_{B2}$ = 12,5 V
P_D = 150 mW
typical values
BGY35
P_L
(W)
P_L
η
η
(%)
30
20
10
0
100
50
0
120
140
f (MHz)
160

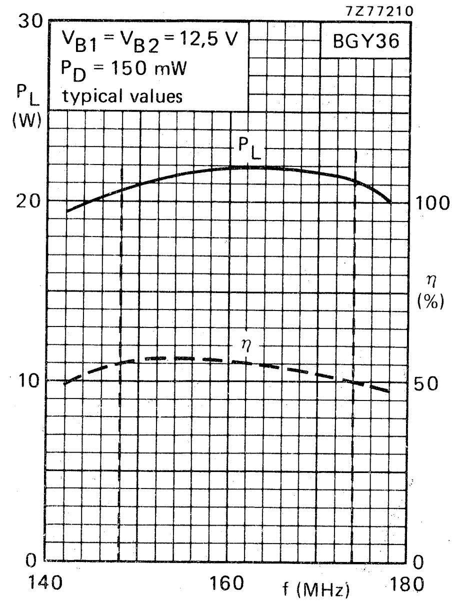

7Z77206
$V_{B1} = V_{B2} = 12,5$ V
$P_D = 150$ mW
typical values
BGY35
d_2
d_3
(dB)
0
−20
−40
−60
120
140
160
f (MHz)

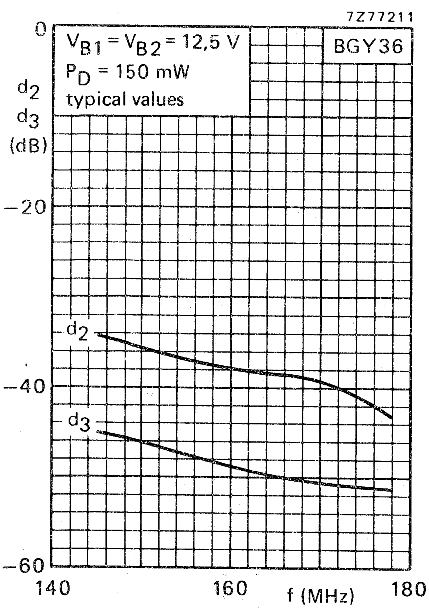

7Z77261
BGY35
$V_{B1} = V_{B2} = 12,5$ V
$P_L = 23$ W
ΔG_p
(dB)
+2
+1
0
−1
−2
typ
0
25
50
75
T_h (°C)

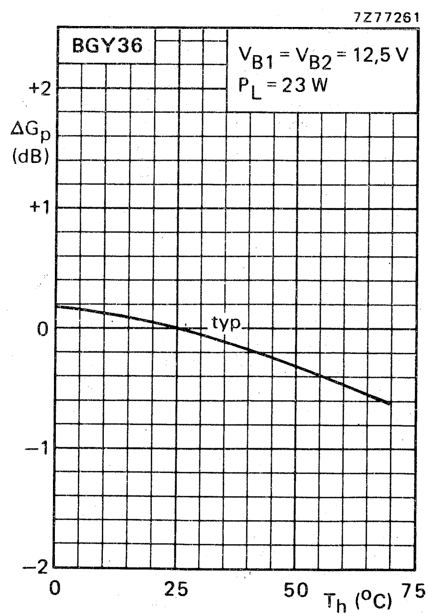

7Z77207
$P_D = 150$ mW
typical values
BGY36
P_L
(W)
40
30
20
10
$V_{B1} = V_{B2} =$
15 V
13,8 V
12,5 V
10,5 V
140
160
180
f (MHz)


7Z77208
$V_{B1} = V_{B2} = 12,5$ V
typical values
BGY36
P_L
(W)
30
20
10
0
f =
161 MHz
174 MHz
148 MHz
0
200
400
P_D (mW)


7Z77209
V_{B2} = 12,5 V
P_D = 150 mW
typical values
BGY36
P_L
(W)
f =
161 MHz
174 MHz
148 MHz
30
20
10
0
0
10
V_{B1} (V)
20


7Z77210
V_{B1} = V_{B2} = 12,5 V
P_D = 150 mW
typical values
BGY36
P_L
(W)
P_L
η
η
(%)
30
20
10
0
100
50
0
140
160
f (MHz)
180


7Z77211
V_{B1} = V_{B2} = 12,5 V
P_D = 150 mW
typical values
BGY36
d_2
d_3
(dB)
d_2
d_3
0
−20
−40
−60
140
160
f (MHz)
180


7Z77261
BGY36
V_{B1} = V_{B2} = 12,5 V
P_L = 23 W
ΔG_p
(dB)
typ
+2
+1
0
−1
−2
0
25
50
T_h (°C)
75

U.H.F. POWER AMPLIFIER MODULES

A range of broadband u.h.f. modules, primarily designed for mobile communication equipment, operating directly from 12 V electrical systems.
The BGY40,41 series produce minimum output powers of 7.5 W and 13 W respectively in the u.h.f. communications bands, the 'A' types covering 400 to 440 MHz and the 'B' types covering 440 to 470 MHz.
The modules consist of a three-stage r.f. amplifier using n-p-n transistor chips with lumped element matching components in a plastic stripline encapsulation.
The negative supply is internally connected to the flange.

QUICK REFERENCE DATA

Mode of operation			c.w.	
Supply voltages	V_{S1}, V_{S2}	nom.	12.5	V
Input impedance	Z_i	nom.	50	Ω
Output load impedance	Z_L	nom.	50	Ω

R.f. performance

		BGY40A	BGY41A	BGY40B	BGY41B	
Frequency of operation	f	400 to 440		440 to 470		MHz
Typical drive power	P_D	75	150	100	150	mW
Typical load power	P_L	11.5	15.6	10	15	W
Typical efficiency	η	40	40	40	40	%

MECHANICAL DATA (see Fig. 15)

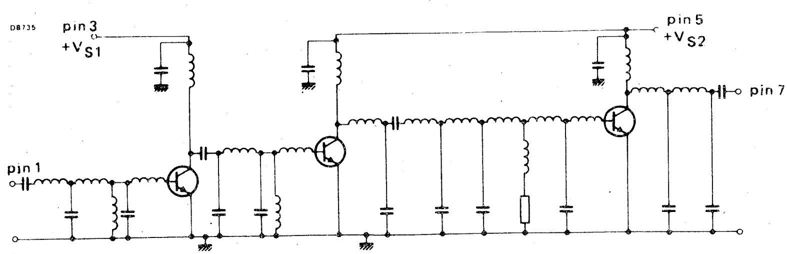


Fig. 1 Circuit of the u.h.f. modules.

CAUTION **These devices incorporate beryllium oxide, the dust of which is toxic. The devices are entirely safe provided that they are not dismantled.**

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC134)

Voltages (with respect to flange)					
D.C. supply terminals		V_{S1} and V_{S2}	max.	16.5	V
R.F. input terminal		$\pm V_{in}$	max.	25	V
R.F. output terminal		$\pm V_{out}$	max.	25	V
Power					
Load power (see Fig.2)	BGY40A, 40B	P_L	max.	12	W
	BGY41A, 41B	P_L	max.	16.5	W
Input drive power	BGY40A, 40B	P_D	max.	150	mW
	BGY41A, 41B	P_D	max.	200	mW
Temperature					
Storage temperature range		T_{stg}		−40 to +100	°C
Operating heatsink temperature		T_h	max.	90	°C

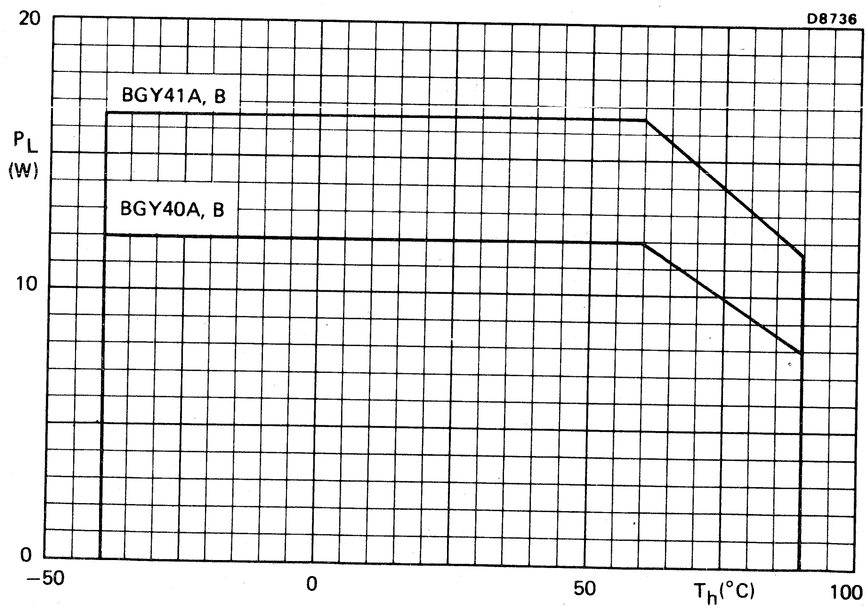


Fig.2 Load power derating; VSWR = 1

CHARACTERISTICS

T_h = 25 °C unless otherwise specified;

$V_{S1} = V_{S2}$ = 12.5 V; R_S = 50 Ω; R_L = 50 Ω

		BGY40A	BGY41A	BGY40B	BGY41B	
Frequency of operation	f	400 to 440		440 to 470		MHz
Minimum load power	P_L	7.5	13	7.5	13	W
Nominal drive power	P_D	100	150	100	150	mW
Minimum efficiency	η	35	35	35	35	%
Typical load power	P_L	11.5	15.6	10	15	W
Typical drive power	P_D	75	150	100	150	mW
Typical efficiency	η	40	40	40	40	%

Harmonic output Any single harmonic will be at least 40 dB down from the carrier.

Input VSWR (with respect to 50 Ω) typ. 1.5

Stability

The modules are stable with load VSWR up to 3 (all phases) when operated within the following limits:

BGY40A, BGY40B	BGY41A, BGY41B
P_D = 30 to 150 mW	P_D = 30 to 200 mW
$V_{S1} = V_{S2}$ = 8 to 16.5 V	$V_{S1} = V_{S2}$ = 8 to 16.5 V
P_L = 5 to 12 W	P_L = 5 to 16.5 W

Ruggedness

The modules will withstand load VSWR of 50 (all phases) for short period overload conditions with P_D, V_{S1} and V_{S2} at maximum values, providing the combination does not result in the matched r.f. output power rating being exceeded.

Mounting

To ensure good thermal transfer, the module should be mounted onto a heatsink with a flat surface, with heat conducting compound between module and heatsink. If an isolation washer is used, heatsink compound should be applied to both sides of the washer. Burrs and thickening of the holes in the heatsink should be removed and 3 mm bolts tightened to a torque of 0.5 Nm.

Devices may be soldered directly into a circuit using a soldering iron with a maximum temperature of 245 °C for not more than 10 seconds at a distance of at least 1 mm from the plastic.

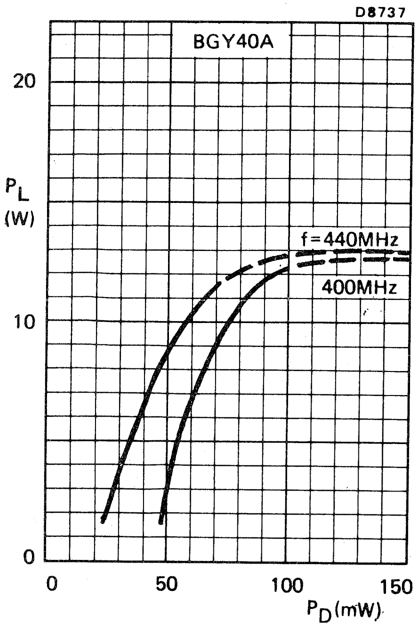


Fig.3 Typical values; $V_{S1} = V_{S2} = 12.5$ V

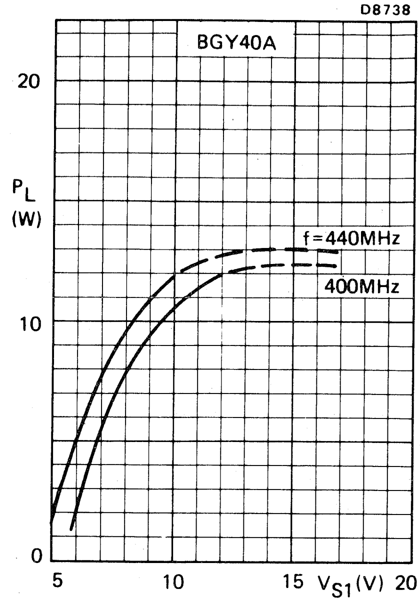


Fig.4 Typical values; $V_{S2} = 12.5$ V; $P_D = 100$ mW

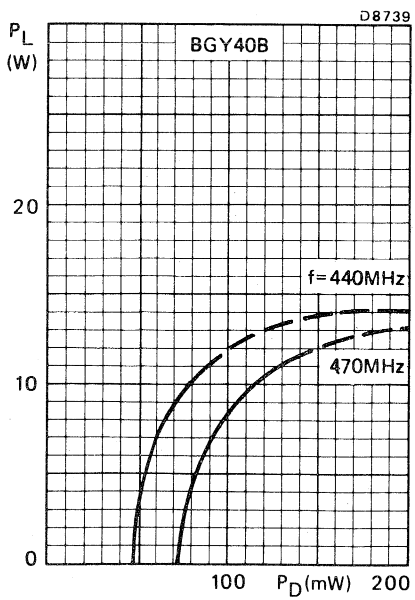


Fig.5 Typical values; $V_{S1} = V_{S2} = 12.5$ V

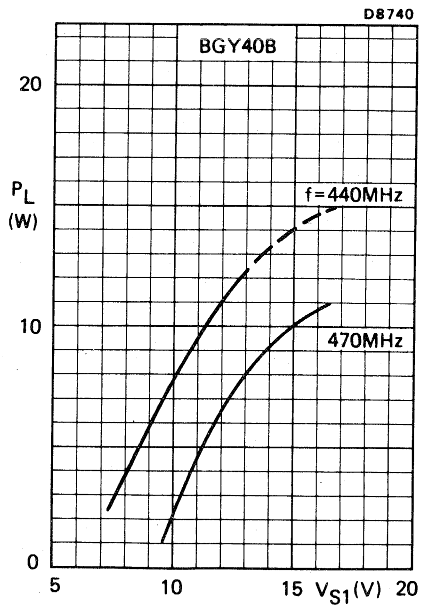


Fig.6 Typical values; $V_{S2} = 12.5$ V; $P_D = 100$ mW

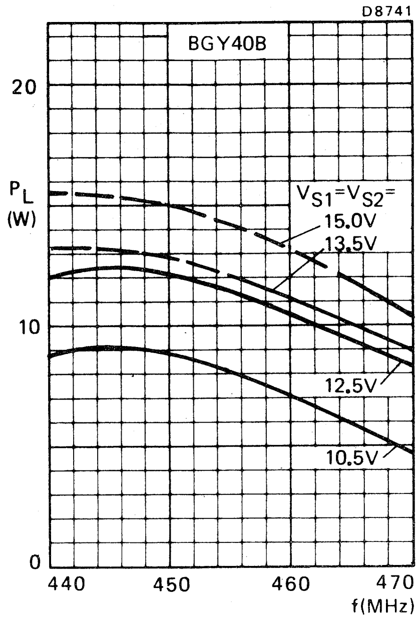


Fig.7 Typical values; P_D = 100 mW

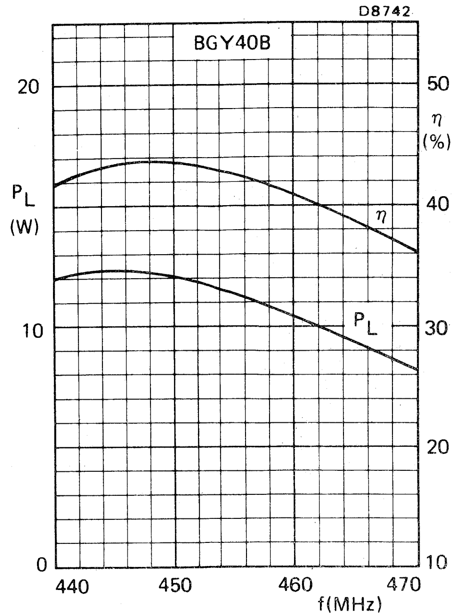


Fig.8 Typical values; V_{S1} = V_{S2} = 12.5 V; P_D = 100 mW

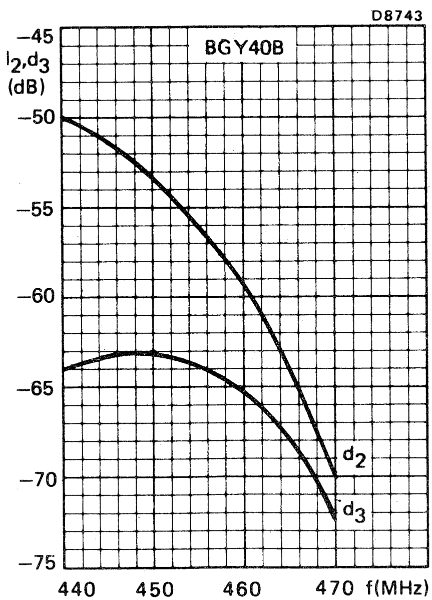


Fig.9 Typical values; V_{S1} = V_{S2} = 12.5 V; P_D = 100 mW

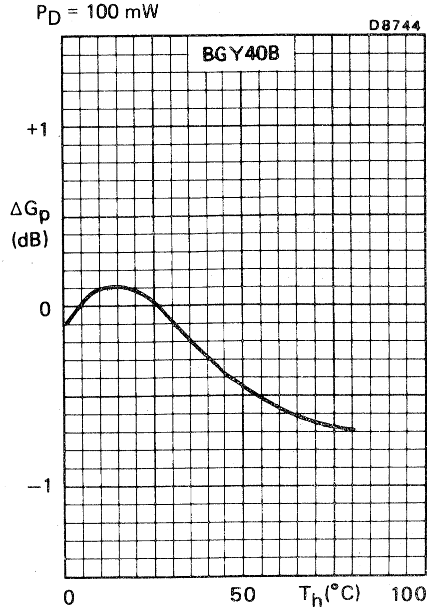


Fig.10 Typical values; V_{S1} = V_{S2} = 12.5 V; P_D = 100 mW

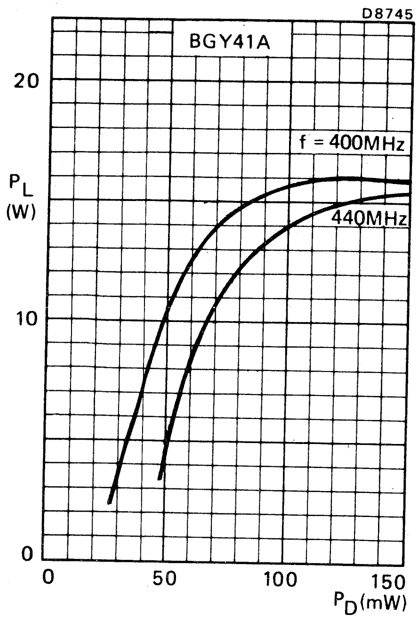


Fig. 11 Typical values; $V_{S1} = V_{S2} = 12.5$ V

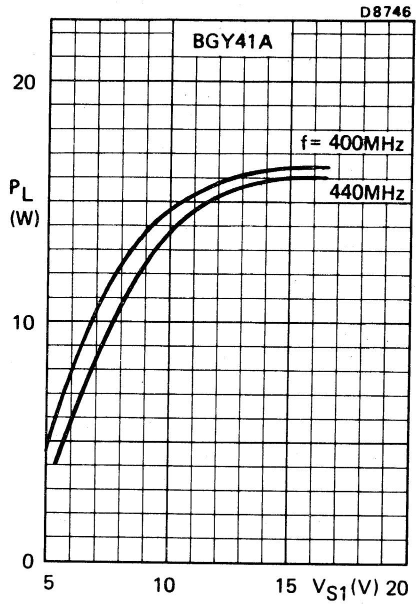


Fig. 12 Typical values; $V_{S2} = 12.5$ V; $P_D = 150$ mW

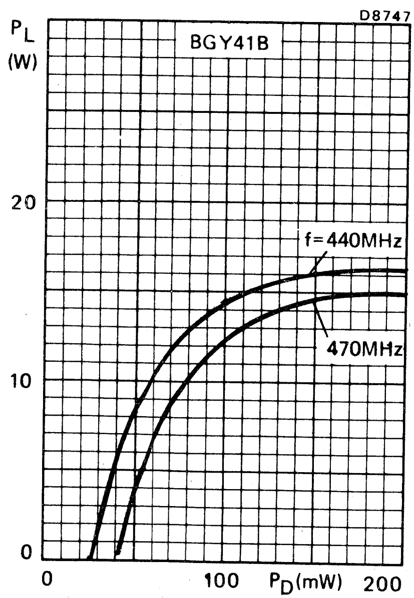


Fig. 13 Typical values; $V_{S1} = V_{S2} = 12.5$ V

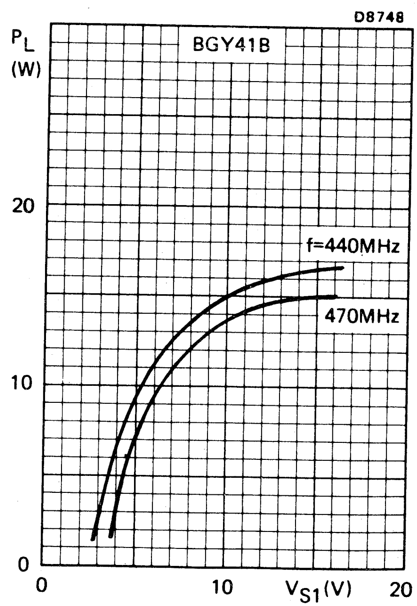
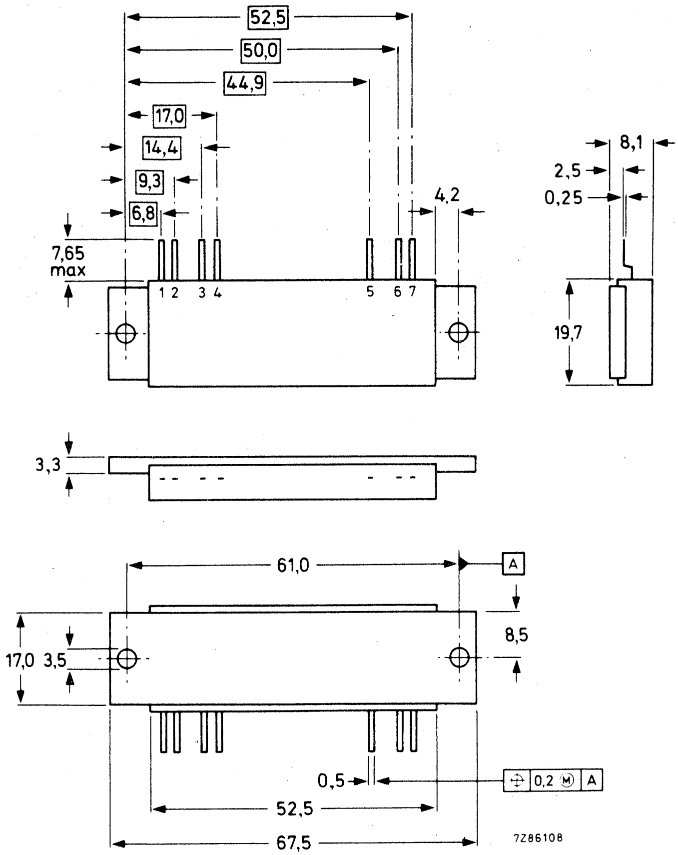


Fig. 14 Typical values; $V_{S2} = 12.5$ V; $P_D = 150$ mW

MECHANICAL DATA

Dimensions in mm

Fig. 15 SOT-132C.



Lead reference

1 = Input
2 = Earth
3 = V_{S1}
4 = Earth
5 = V_{S2}
6 = Earth
7 = Output

V.H.F. POWER AMPLIFIER MODULE

A broadband v.h.f. amplifier module primarily designed for mobile communications equipment, operating directly from 12 V electrical systems. The module will produce a minimum output of 13 W into a 50 Ω load over the frequency range 148 to 174 MHz.
The module consists of a two stage r.f. amplifier using n-p-n transistor chips with lumped-element matching components in a plastic stripline encapsulation. The negative supply is internally connected to the flange.

QUICK REFERENCE DATA

Mode of operation			c.w.	
Frequency range	f		148 to 174	MHz
Drive power	P_D	max.	150	mW
	P_D	typ.	80	mW
Load power	P_L	>	13	W
Supply voltages	V_{S1} and V_{S2}	nom.	12.5	V
Input impedance	z_i	nom.	50	Ω
Output load impedance	Z_L	nom.	50	Ω

MECHANICAL DATA (see Fig. 10)

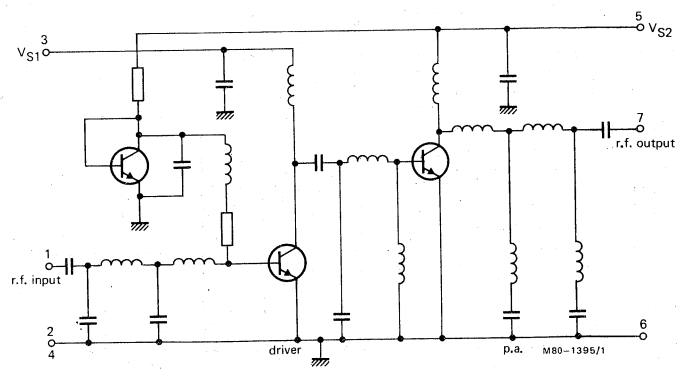


Fig. 1 Circuit of the v.h.f. module.

CAUTION This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC134)

Voltages (with respect to flange)

D.C. supply terminals	V_{S1} and V_{S2}	max.	16.5	V
R.F. input terminal	$\pm V_i$	max.	25	V
R.F. output terminal	$\pm V_o$	max.	25	V

Power

Load power (see below)	P_L	max.	18	W
Input drive power	P_D	max.	300	mW

Temperature

Storage temperature range	T_{stg}		−40 to +100	°C
Operating heatsink temperature	T_h	max.	90	°C

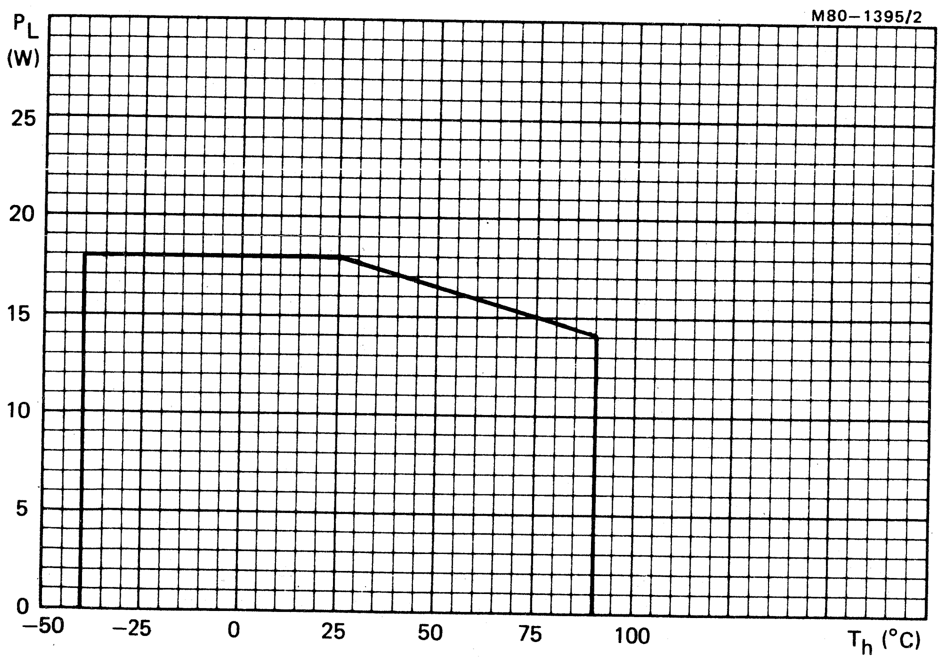


Fig.2 Load power derating; VSWR = 1

CHARACTERISTICS

T_h = 25 °C unless otherwise specified

$V_{S1} = V_{S2}$ = 12.5 V; R_S = 50 Ω; frequency range 148 to 174 MHz; R_L = 50 Ω

Quiescent currents				
$P_D = 0$	I_{Q1}	typ.	5	mA
	I_{Q2}	typ.	15	mA
R.F. drive power				
P_L = 13 W	P_D	<	150	mW
	P_D	typ.	80	mW
Efficiency				
P_L = 13 W	η	>	40	%
	η	typ.	48	%
Harmonic output	Any single harmonic will be at least 25 dB down from the carrier, with typical rejection of 34 dB.			
Input VSWR (with respect to 50 Ω)		typ.	1.5	

Stability

The module is stable with load VSWR up to 3 (all phases) when operated with:

$V_{S1} = V_{S2}$ = 10 to 16.5 V; f = 148 to 174 MHz; P_D = 30 to 300 mW; $P_L \leqslant$ 18 W (matched)

Ruggedness

The modules will withstand load VSWR of 50 for short period overload conditions, with P_D, V_{S1} and V_{S2} at maximum values, providing the combination does not result in the matched r.f. output power rating being exceeded.

Mounting

To ensure good thermal transfer the module should be mounted onto a heatsink with a flat surface, with heat conducting compound between module and heatsink. If an isolation washer is used, heatsink compound should be applied to both sides of the washer. Burrs and thickening of the holes in the heatsink should be removed and 3 mm bolts tightened to a torque of 0.5 Nm.
Devices may be soldered directly into a circuit using a soldering iron with a maximum temperature of 245 °C for not more than 10 seconds at a distance of at least 1 mm from the plastic.

APPLICATION INFORMATION

A technical publication (M80–0056) entitled 'Transmitter design using v.h.f. broadband amplifier modules' is available on request.

Power rating

In general it is recommended that the output power from the module under nominal conditions should not exceed 16 W in order to provide adequate safety margin under fault conditions.

Gain control

Power output can be controlled by variation of the driver stage supply voltage V_{S1}. The supply required is a voltage regulator with a current rating of 0.75 A, and an output voltage range of 3 V to 12 V.

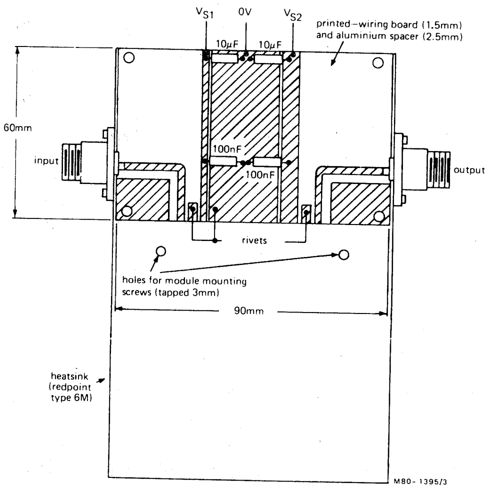


Fig.3 Test jig for v.h.f. modules

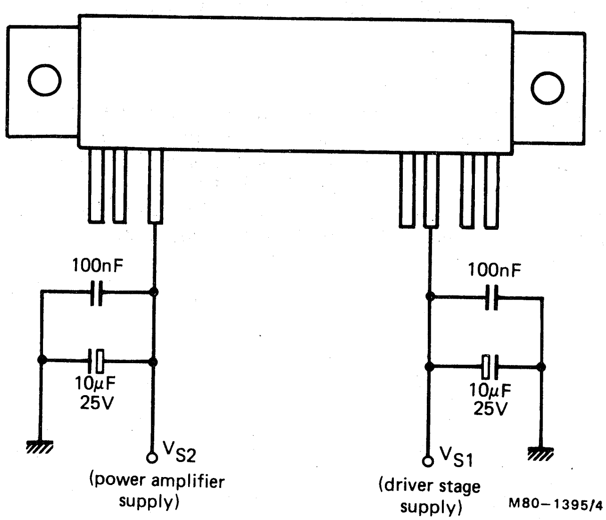


Fig.4 Recommended decoupling arrangement

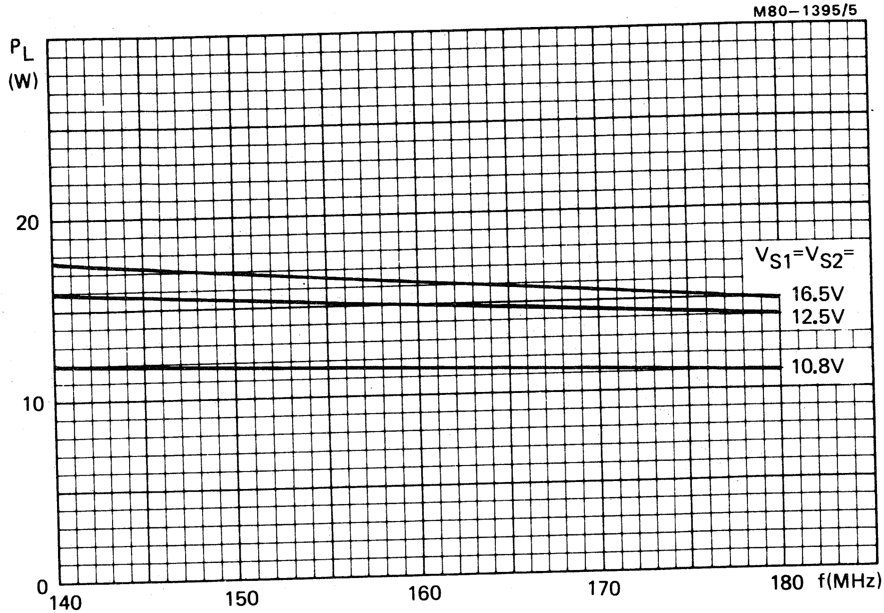


Fig.5 Typical values; P_D = 150 mW

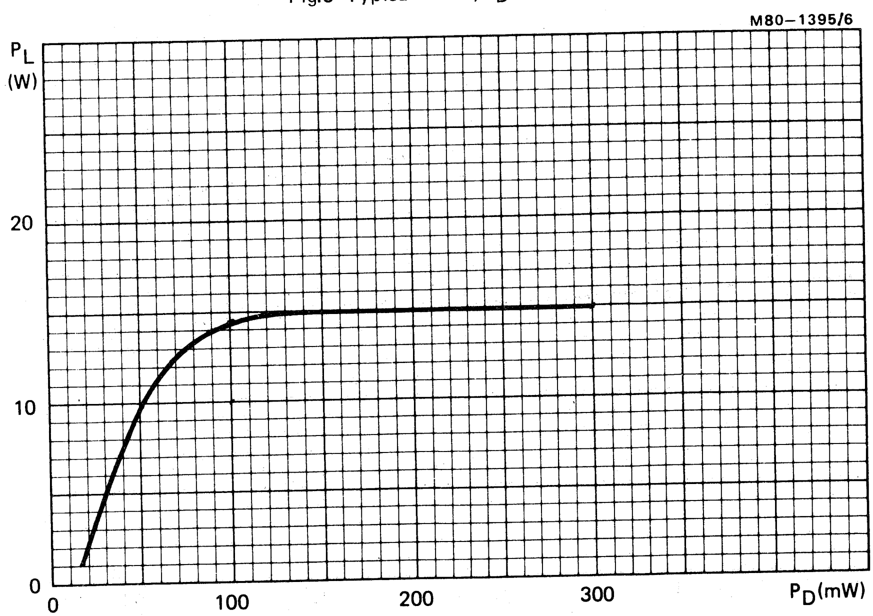


Fig.6 Typical values; $V_{S1} = V_{S2}$ = 12.5 V; f = 160 MHz

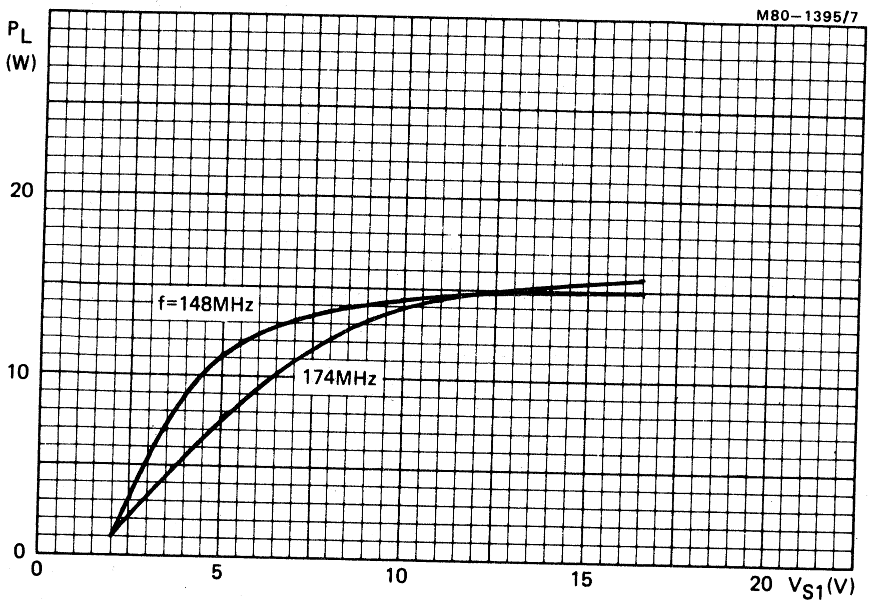


Fig.7 Typical values; V_{S2} = 12.5 V; P_D = 150 mW

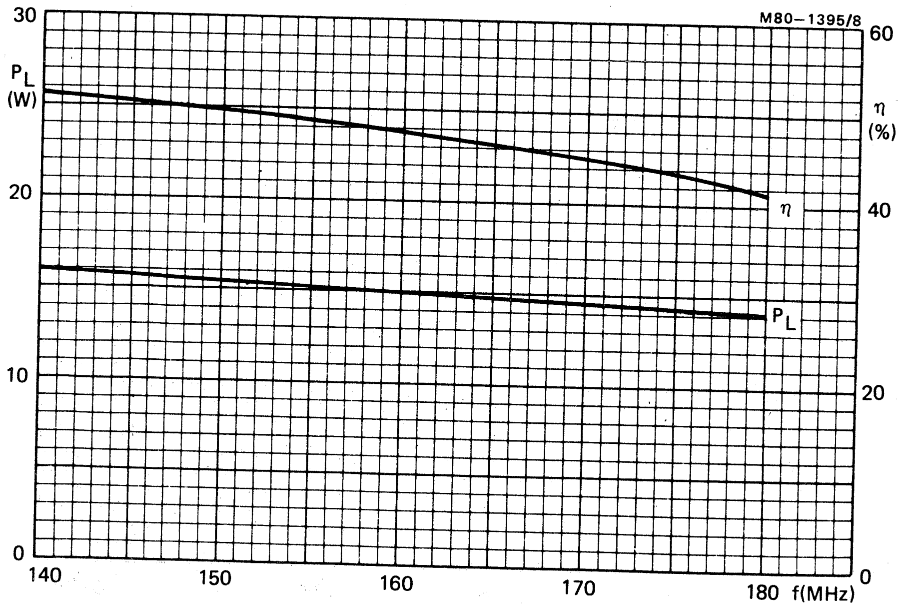


Fig.8 Typical values; V_{S1} = V_{S2} = 12.5 V; P_D = 150 mW

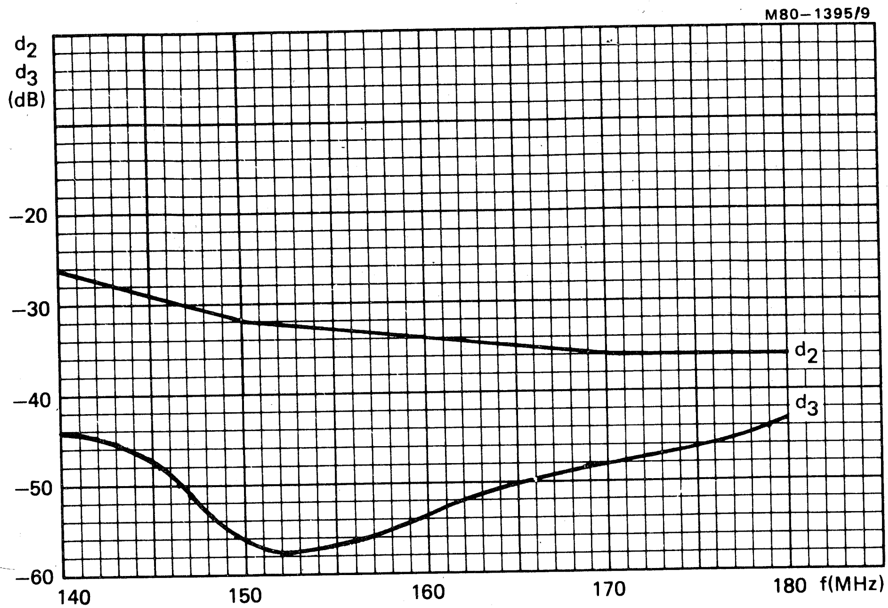
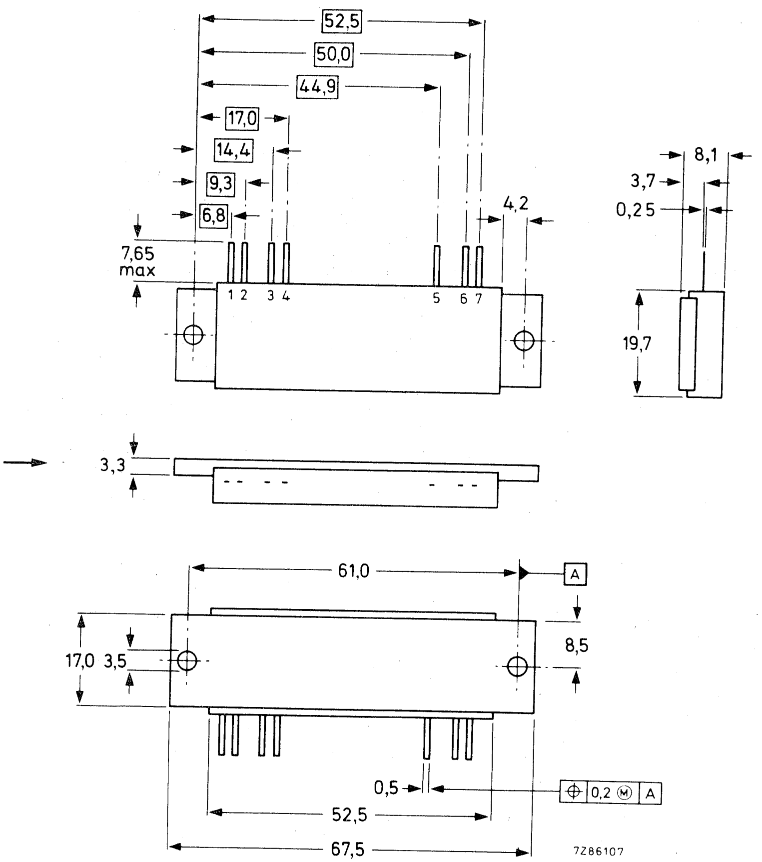


Fig.9 Typical values; $V_{S1} = V_{S2} = 12.5$ V; $P_D = 150$ mW

MECHANICAL DATA

Dimensions in mm

Fig. 10 SOT-132B.



Lead reference

1 = Input
2 = Earth
3 = V_{S1}
4 = Earth
5 = V_{S2}
6 = Earth
7 = Output

V.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor intended for use in class-A, B and C operated mobile, h.f. and v.h.f. transmitters with a nominal supply voltage of 13,5 V. The transistor is resistance stabilized and is guaranteed to withstand severe load mismatch conditions with a supply over-voltage to 16,5 V.

It has a 3/8" flange envelope with a ceramic cap. All leads are isolated from the flange.

QUICK REFERENCE DATA

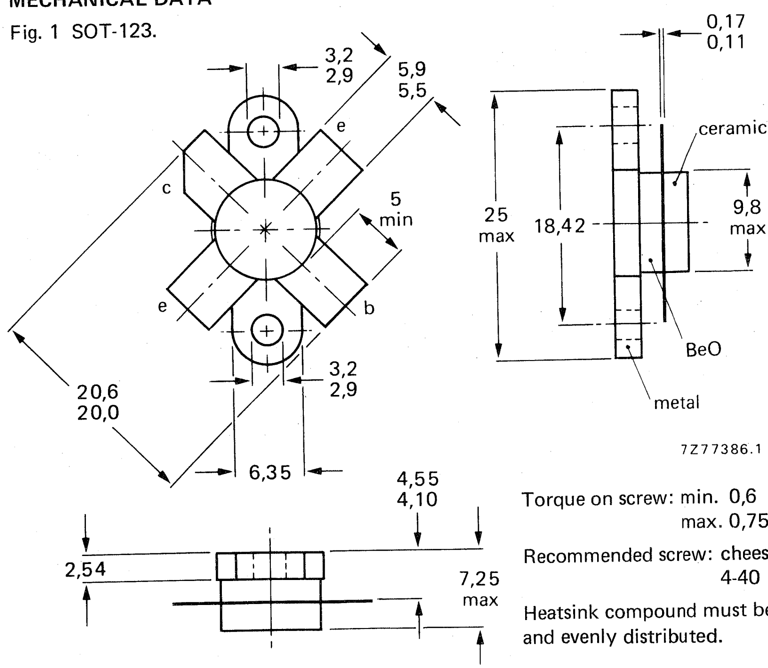
R.F. performance up to T_h = 25 °C in an unneutralized common-emitter class-B circuit

mode of operation	V_{CE} V	f MHz	P_L W	G_p dB	η %	$\overline{z_i}$ Ω	$\overline{Y_L}$ mA/V
c.w.	**13,5**	**175**	**8**	**> 9,0**	**> 70**	**2,8 + j1,2**	**76 − j16**
c.w.	12,5	175	8	typ. 10,5	typ. 75	—	—

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-123.



Torque on screw: min. 0,6 Nm (6 kg cm)
max. 0,75 Nm (7,5 kg cm)

Recommended screw: cheese-head 4-40 UNC/2A

Heatsink compound must be applied sparingly and evenly distributed.

CAUTION This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage (V_{BE} = 0) peak value	V_{CESM}	max.	36 V
Collector-emitter voltage (open base)	V_{CEO}	max.	18 V
Emitter-base voltage (open collector)	V_{EBO}	max.	4 V
Collector current (average)	$I_{C(AV)}$	max.	1,5 A
Collector current (peak value); f > 1 MHz	I_{CM}	max.	4,0 A
R.F. power dissipation (f > 1 MHz); T_{mb} = 25 °C	P_{rf}	max.	20 W
Storage temperature	T_{stg}		−65 to + 150 °C
Operating junction temperature	T_j	max.	200 °C

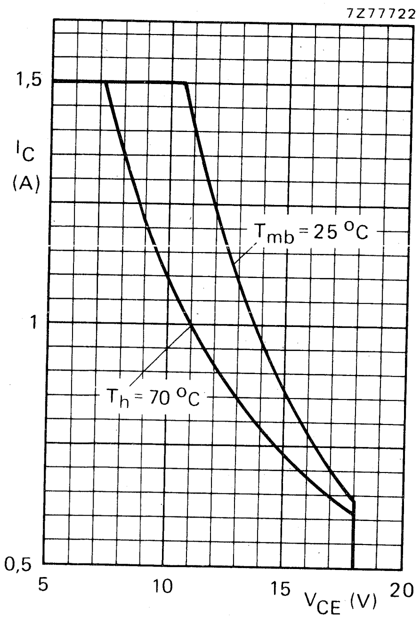


Fig. 2 D.C. SOAR.

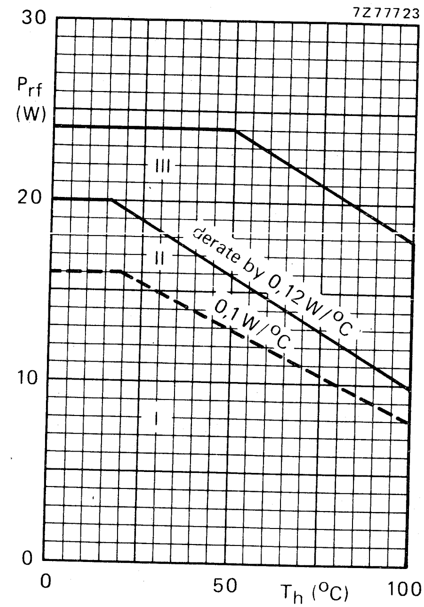


Fig. 3 R.F. power dissipation; $V_{CE} \leqslant 16,5$ V; f > 1 MHz.
I Continuous d.c. operation
II Continuous r.f. operation
III Short-time operation during mismatch

THERMAL RESISTANCE (dissipation = 8 W; T_{mb} = 72,4 °C, i.e. T_h = 70 °C)

From junction to mounting base (d.c. dissipation)	$R_{th\ j\text{-}mb(dc)}$	=	10,7 °C/W
From junction to mounting base (r.f. dissipation)	$R_{th\ j\text{-}mb(rf)}$	=	8,6 °C/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,3 °C/W

CHARACTERISTICS

$T_j = 25\ ^oC$

Collector-emitter breakdown voltage $V_{BE} = 0$; $I_C = 5$ mA	$V_{(BR)CES}$	>	36 V
Collector-emitter breakdown voltage open base; $I_C = 25$ mA	$V_{(BR)CEO}$	>	18 V
Emitter-base breakdown voltage open collector; $I_E = 1$ mA	$V_{(BR)EBO}$	>	4 V
Collector cut-off current $V_{BE} = 0$; $V_{CE} = 18$ V	I_{CES}	<	2 mA
Second breakdown energy; L = 25 mH; f = 50 Hz open base	E_{SBO}	>	0,5 mJ
$R_{BE} = 10\ \Omega$	E_{SBR}	>	0,5 mJ
D.C. current gain * $I_C = 0{,}75$ A; $V_{CE} = 5$ V	h_{FE}	typ.	40 10 to 100
Collector-emitter saturation voltage * $I_C = 2$ A; $I_B = 0{,}4$ A	V_{CEsat}	typ.	0,85 V
Transition frequency at f = 100 MHz * $-I_E = 0{,}75$ A; $V_{CB} = 13{,}5$ V	f_T	typ.	950 MHz
$-I_E = 2$ A; $V_{CB} = 13{,}5$ V	f_T	typ.	850 MHz
Collector capacitance at f = 1 MHz $I_E = I_e = 0$; $V_{CB} = 13{,}5$ V	C_c	typ.	16,5 pF
Feedback capacitance at f = 1 MHz $I_C = 100$ mA; $V_{CE} = 13{,}5$ V	C_{re}	typ.	12 pF
Collector-flange capacitance	C_{cf}	typ.	2 pF

* Measured under pulse conditions: $t_p \leqslant 200\ \mu s$; $\delta \leqslant 0{,}02$.

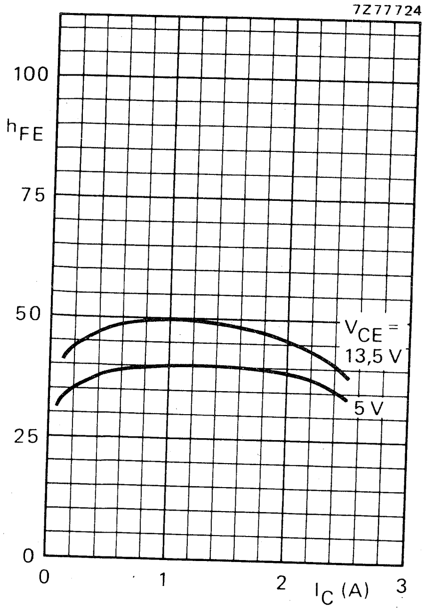


Fig. 4 Typical values; T_j = 25 °C.

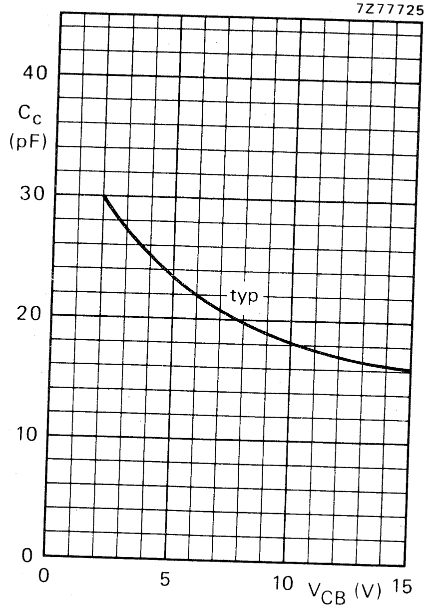


Fig. 5 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

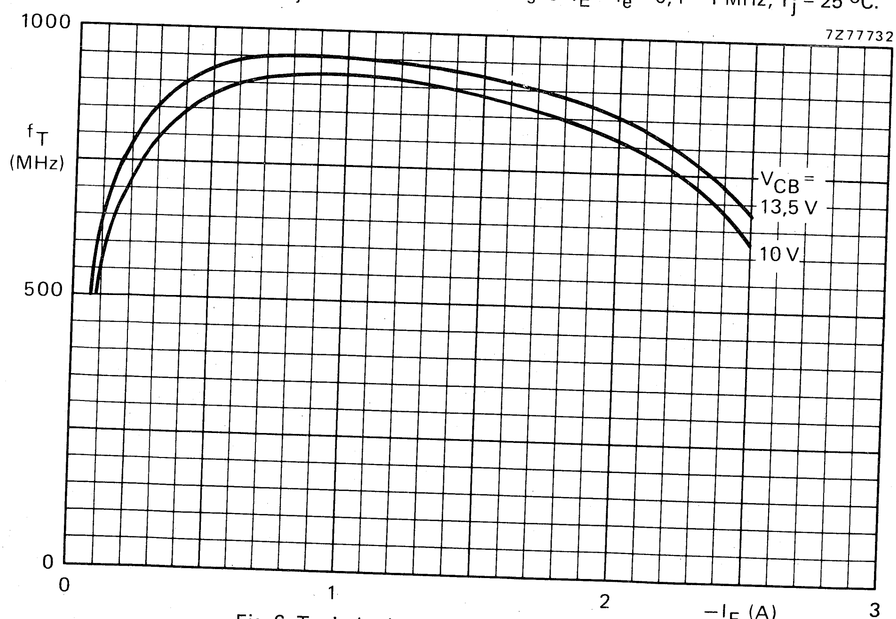


Fig. 6 Typical values; f = 100 MHz; T_j = 25 °C.

APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit)

T_h = 25 °C

f (MHz)	V_{CE} (V)	P_L (W)	P_S (W)	G_p (dB)	I_C (A)	η (%)	$\overline{z_i}$ (Ω)	$\overline{Y_L}$ (mA/V)
175	**13,5**	**8**	**< 1,0**	**> 9,0**	**< 0,85**	**> 70**	**2,8 + j1,2**	**76 – j16**
175	12,5	8	–	typ. 10,5	–	typ. 75	–	–

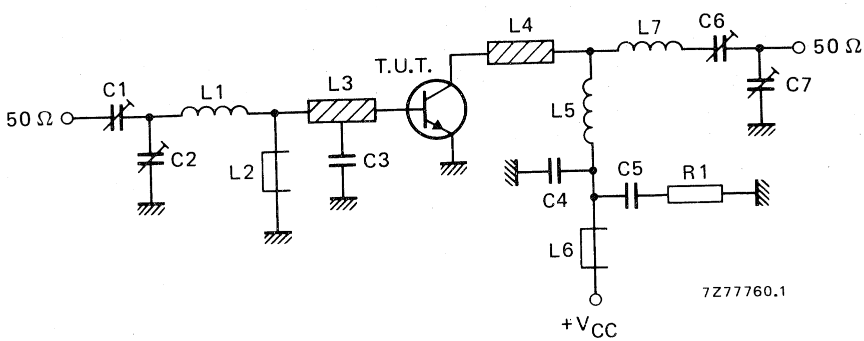


Fig. 7 Test circuit; c.w. class-B.

List of components:

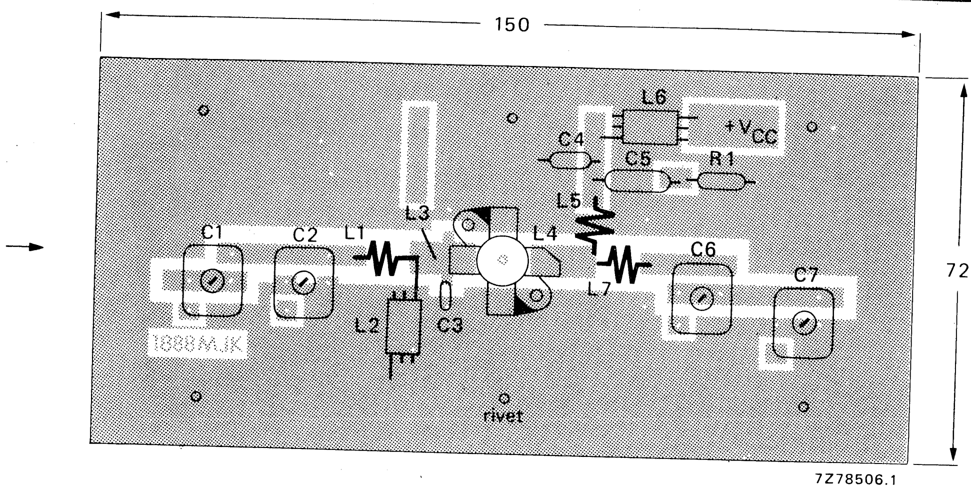
C1 = 2,5 to 20 pF film dielectric trimmer (cat. no. 2222 809 07004)
C2 = C6 = 4 to 40 pF film dielectric trimmer (cat. no. 2222 809 07008)
C3 = 47 pF ceramic capacitor (500 V)
C4 = 120 pF ceramic capacitor (500 V)
C5 = 100 nF polyester capacitor
C7 = 5 to 60 pF film dielectric trimmer (cat. no. 2222 809 07011)

L1 = 2 turns Cu wire (1,6 mm); int. dia. 4,5 mm; length 5,7 mm; leads 2 x 5 mm
L2 = L6 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L3 = L4 = strip (12 mm x 6 mm); tap for C3 at 5 mm from transistor
L5 = 3 turns Cu wire (1,6 mm); int. dia. 7,5 mm; length 7,5 mm; leads 2 x 5 mm
L7 = 3 turns Cu wire (1,6 mm); int. dia. 6,5 mm; length 7,4 mm; leads 2 x 5 mm

L3 and L4 are strips on a double Cu-clad printed-circuit board with epoxy fibre-glass dielectric, thickness 1/16".

R1 = 10 Ω carbon resistor

Component layout and printed-circuit board for 175 MHz test circuit see Fig. 8.



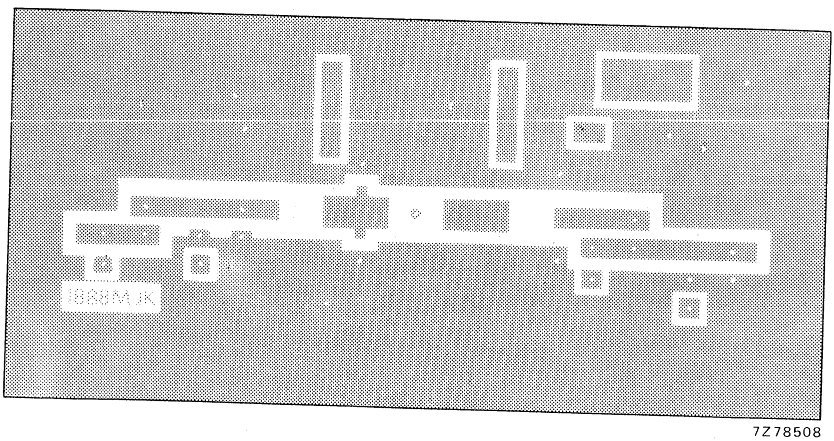


Fig. 8 Component layout and printed-circuit board for 175 MHz test circuit.

The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets, whilst under the emitter leads Cu straps are used for a direct contact between upper and lower sheets.

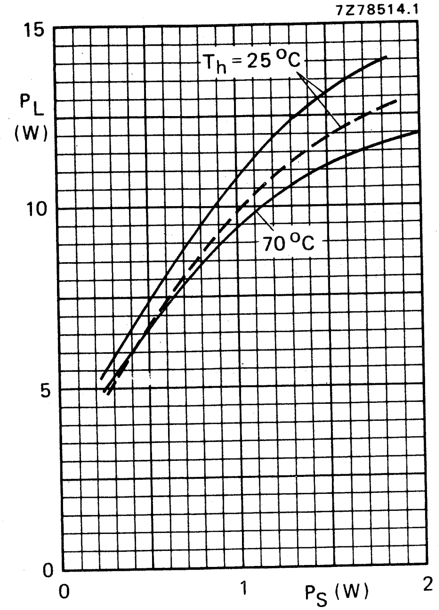


Fig. 9 Typical values; f = 175 MHz;
——— V_{CE} = 13,5 V; – – – V_{CE} = 12,5 V.

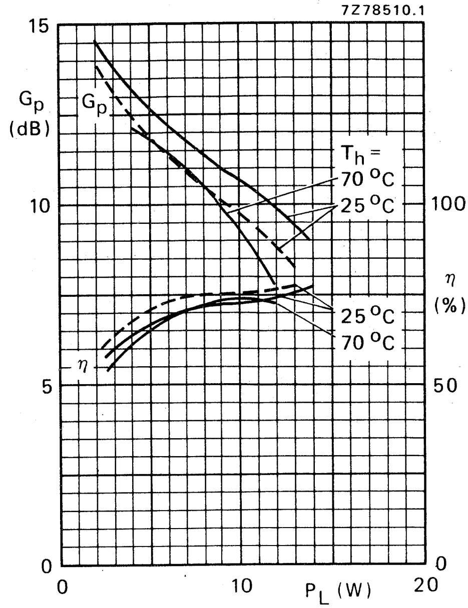


Fig. 10 Typical values; f = 175 MHz;
——— V_{CE} = 13,5 V; – – – V_{CE} = 12,5 V.

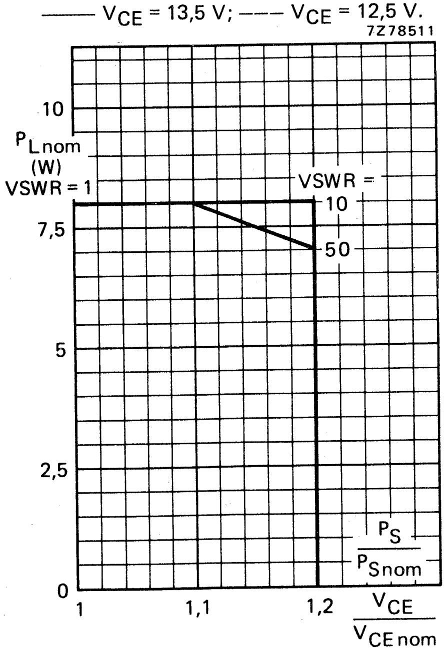


Fig. 11 R.F. SOAR (short-time operation during mismatch); f = 175 MHz; T_h = 70 °C; $R_{th\ mb\text{-}h}$ = 0,3 °C/W; V_{CEnom} = 13,5 V or 12,5 V; $P_S = P_{Snom}$ at V_{CEnom} and VSWR = 1.

Note to Fig. 11:
The transistor has been developed for use with unstabilized supply voltages. As the output power and drive power increase with the supply voltage, the nominal output power must be derated in accordance with the graph for safe operation at supply voltages other than the nominal. The graph shows the permissible output power under nominal conditions (VSWR = 1), as a function of the expected supply over-voltage ratio with VSWR as parameter.

The graph applies to the situation in which the drive (P_S/P_{Snom}) increases linearly with supply over-voltage ratio.

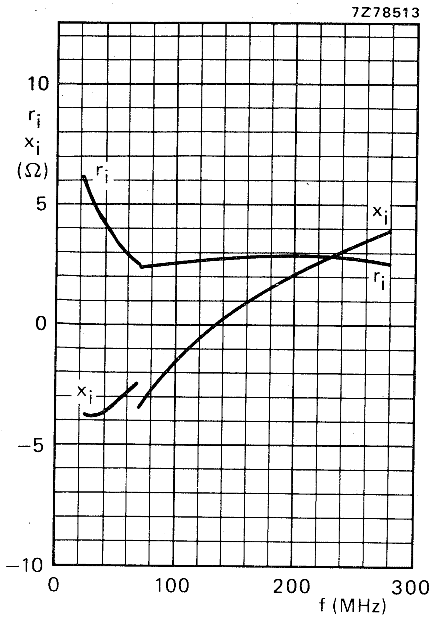


Fig. 12 Input impedance (series components).

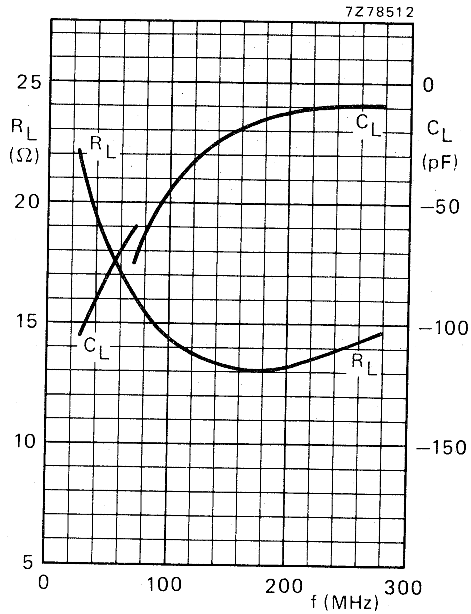


Fig. 13 Load impedance (parallel components).

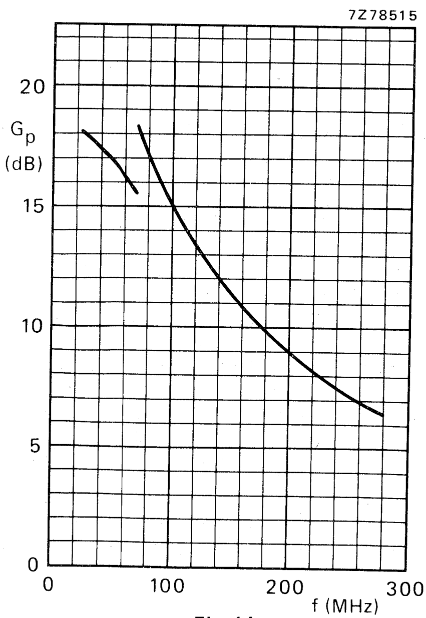


Fig. 14.

Conditions for Figs 12, 13 and 14:

Typical values; V_{CE} = 13,5 V; P_L = 8 W;
T_h = 25 °C.

OPERATING NOTE

Below 70 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation.
This resistor must be effective for r.f. only.

V.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor intended for use in class-A, B and C operated mobile, h.f. and v.h.f. transmitters with a nominal supply voltage of 13,5 V. The transistor is resistance stabilized and is guaranteed to withstand severe load mismatch conditions with a supply over-voltage to 16,5 V.

It has a 3/8" flange envelope with a ceramic cap. All leads are isolated from the flange.

QUICK REFERENCE DATA

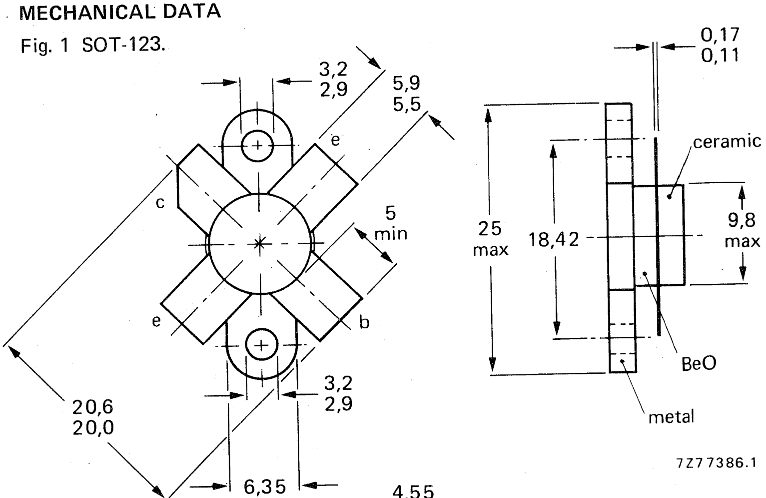
R.F. performance up to T_h = 25 °C in an unneutralized common-emitter class-B circuit

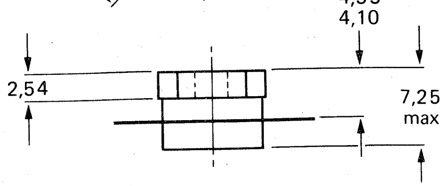
mode of operation	V_{CE} V	f MHz	P_L W	G_p dB	η %	$\overline{z_i}$ Ω	$\overline{Y_L}$ mA/V
c.w.	**13,5**	**175**	**15**	**> 8,0**	**> 60**	**2,3 + j2,2**	**130 – j4,4**
c.w.	12,5	175	15	typ. 7,5	typ. 67	–	–

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-123.





Torque on screw: min. 0,6 Nm (6 kg cm)
max. 0,75 Nm (7,5 kg cm)

Recommended screw: cheese-head 4-40 UNC/2A

Heatsink compound must be applied sparingly and evenly distributed.

CAUTION This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage (V_{BE} = 0) peak value	V_{CESM}	max.	36	V
Collector-emitter voltage (open base)	V_{CEO}	max.	18	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4	V
Collector current (average)	$I_{C(AV)}$	max.	3	A
Collector current (peak value); f > 1 MHz	I_{CM}	max.	8	A
R.F. power dissipation (f > 1 MHz); T_{mb} = 25 °C	P_{rf}	max.	36	W
Storage temperature	T_{stg}		−65 to + 150	°C
Operating junction temperature	T_j	max.	200	°C

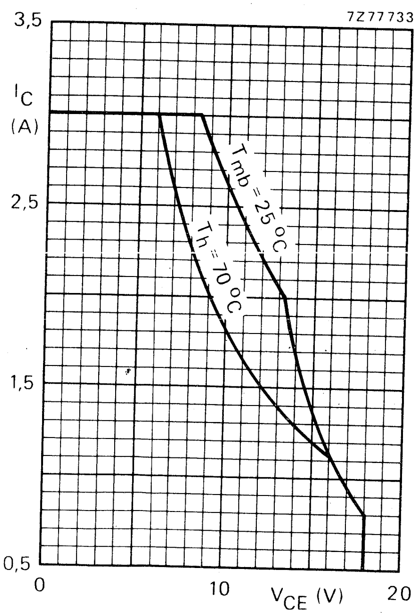


Fig. 2 D.C. SOAR.

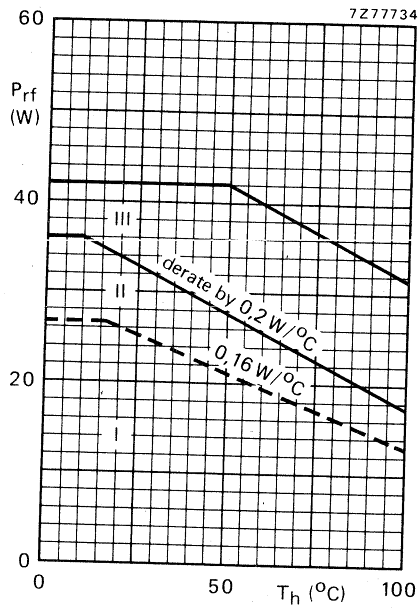


Fig. 3 R.F. power dissipation; $V_{CE} \leqslant$ 16,5 V; f > 1 MHz.
I Continuous d.c. operation
II Continuous r.f. operation
III Short-time operation during mismatch

THERMAL RESISTANCE (dissipation = 15 W; T_{mb} = 74,5 °C, i.e. T_h = 70 °C)

From junction to mounting base (d.c. dissipation)	$R_{th\ j\text{-}mb(dc)}$	=	6,55	°C/W
From junction to mounting base (r.f. dissipation)	$R_{th\ j\text{-}mb(rf)}$	=	4,95	°C/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,3	°C/W

CHARACTERISTICS

$T_j = 25\ ^oC$

Collector-emitter breakdown voltage $V_{BE} = 0$; $I_C = 10$ mA	$V_{(BR)CES}$	>	36 V
Collector-emitter breakdown voltage open base; $I_C = 50$ mA	$V_{(BR)CEO}$	>	18 V
Emitter-base breakdown voltage open collector; $I_E = 4$ mA	$V_{(BR)EBO}$	>	4 V
Collector cut-off current $V_{BE} = 0$; $V_{CE} = 18$ V	I_{CES}	<	4 mA
Second breakdown energy; L = 25 mH; f = 50 Hz open base	E_{SBO}	>	2,5 mJ
$R_{BE} = 10\ \Omega$	E_{SBR}	>	2,5 mJ
D.C. current gain * $I_C = 1,5$ A; $V_{CE} = 5$ V	h_{FE}	typ.	40 10 to 100
Collector-emitter saturation voltage * $I_C = 4,5$ A; $I_B = 0,9$ A	V_{CEsat}	typ.	1,0 V
Transition frequency at f = 100 MHz * $-I_E = 1,5$ A; $V_{CB} = 13,5$ V	f_T	typ.	850 MHz
$-I_E = 4,5$ A; $V_{CB} = 13,5$ V	f_T	typ.	800 MHz
Collector capacitance at f = 1 MHz $I_E = I_e = 0$; $V_{CB} = 13,5$ V	C_c	typ.	32 pF
Feedback capacitance at f = 1 MHz $I_C = 200$ mA; $V_{CE} = 13,5$ V	C_{re}	typ.	23 pF
Collector-flange capacitance	C_{cf}	typ.	2 pF

* Measured under pulse conditions: $t_p \leqslant 200\ \mu s$; $\delta \leqslant 0,02$.

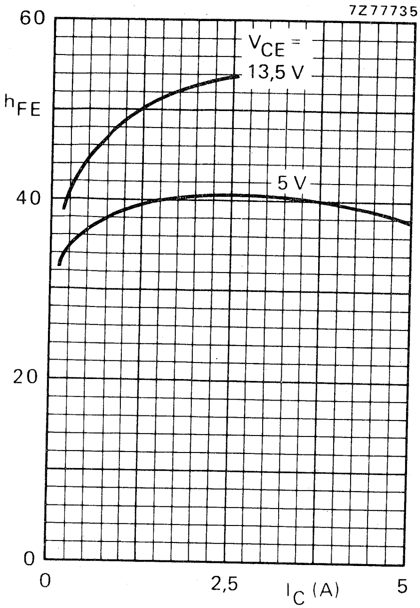


Fig. 4 Typical values; T_j = 25 °C.

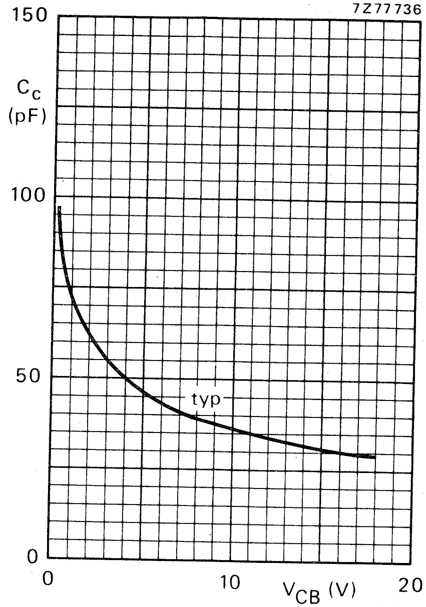


Fig. 5 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

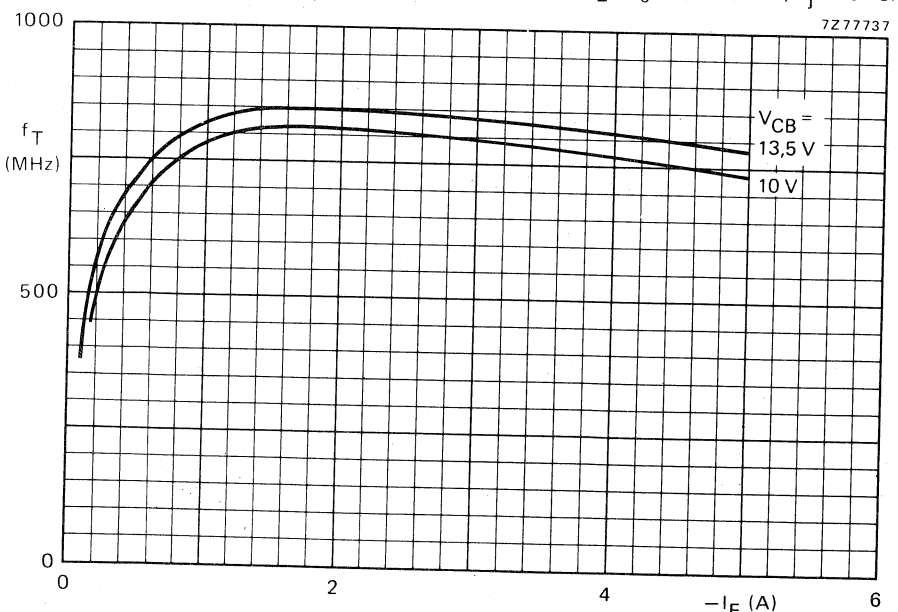


Fig. 6 Typical values; f = 100 MHz; T_j = 25 °C .

APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit)

T_h = 25 °C

f (MHz)	V_{CE} (V)	P_L (W)	P_S (W)	G_p (dB)	I_C (A)	η (%)	$\bar{z_i}$ (Ω)	$\overline{Y_L}$ (mA/V)
175	**13,5**	**15**	**< 2,4**	**> 8,0**	**< 1,85**	**> 60**	**2,3 + j2,2**	**130 – j4,4**
175	12,5	15	–	typ. 7,5	–	typ. 67	–	–

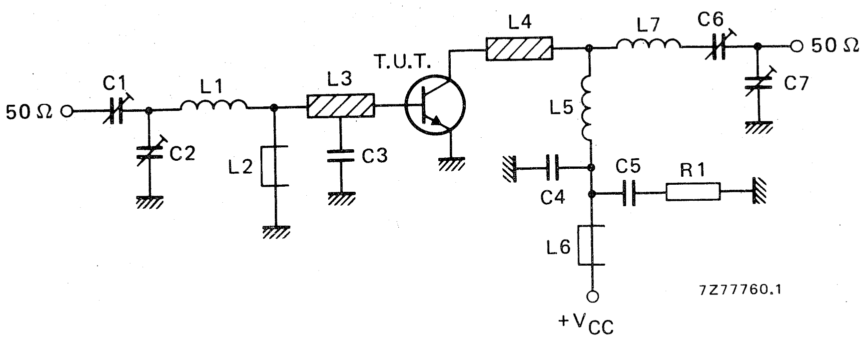


Fig. 7 Test circuit; c.w. class-B.

List of components:

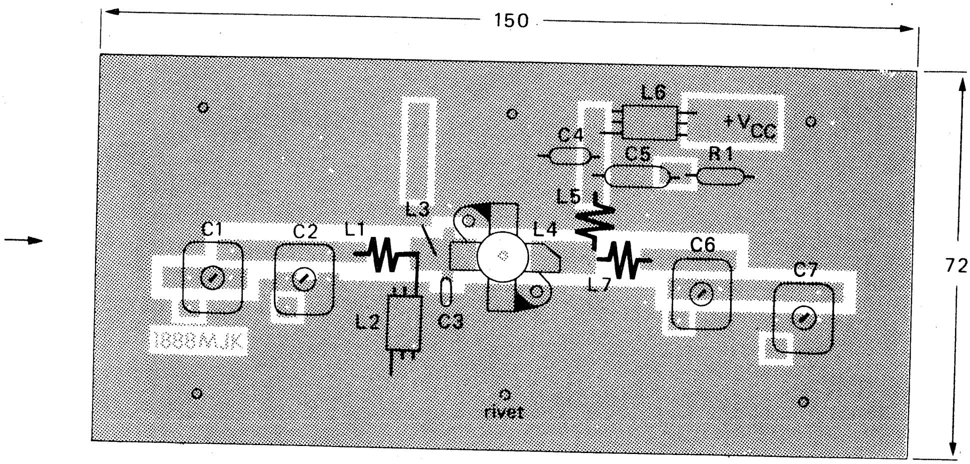
C1 = 2,5 to 20 pF film dielectric trimmer (cat. no. 2222 809 07004)
C2 = C6 = 4 to 40 pF film dielectric trimmer (cat. no. 2222 809 07008)
C3 = 47 pF ceramic capacitor (500 V)
C4 = 120 pF ceramic capacitor (500 V)
C5 = 100 nF polyester capacitor
C7 = 5 to 60 pF film dielectric trimmer (cat. no. 2222 809 07011)

L1 = 2 turns Cu wire (1,6 mm); int. dia. 4,5 mm; length 5,7 mm; leads 2 x 5 mm
L2 = L6 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L3 = L4 = strip (12 mm x 6 mm); tap for C3 at 5 mm from transistor
L5 = 3 turns Cu wire (1,6 mm); int. dia. 7,5 mm; length 7,5 mm; leads 2 x 5 mm
L7 = 3 turns Cu wire (1,6 mm); int. dia. 6,5 mm; length 7,4 mm; leads 2 x 5 mm

L3 and L4 are strips on a double Cu-clad printed-circuit board with epoxy fibre-glass dielectric, thickness 1/16".

R1 = 10 Ω carbon resistor

Component layout and printed-circuit board for 175 MHz test circuit see Fig. 8.



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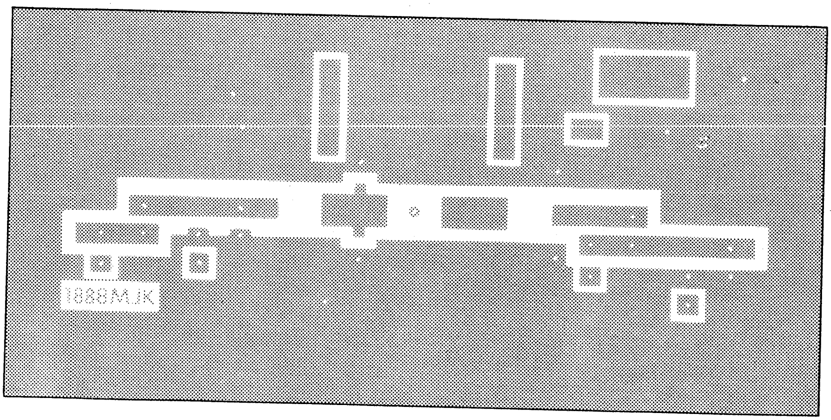


7Z78508

Fig. 8 Component layout and printed-circuit board for 175 MHz test circuit.

The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets, whilst under the emitter leads Cu straps are used for a direct contact between upper and lower sheets.

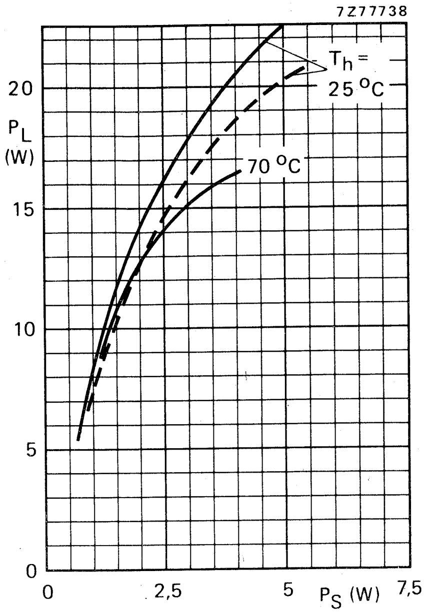


Fig. 9 Typical values; f = 175 MHz;
—— V_{CE} = 13,5 V; – – – V_{CE} = 12,5 V.

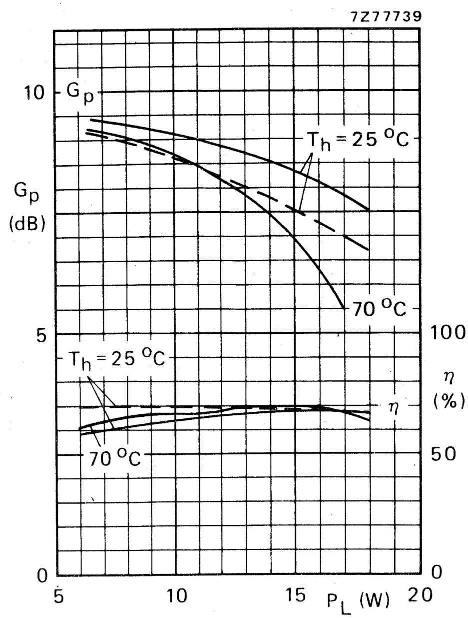


Fig. 10 Typical values; f = 175 MHz;
—— V_{CE} = 13,5 V; – – – V_{CE} = 12,5 V.

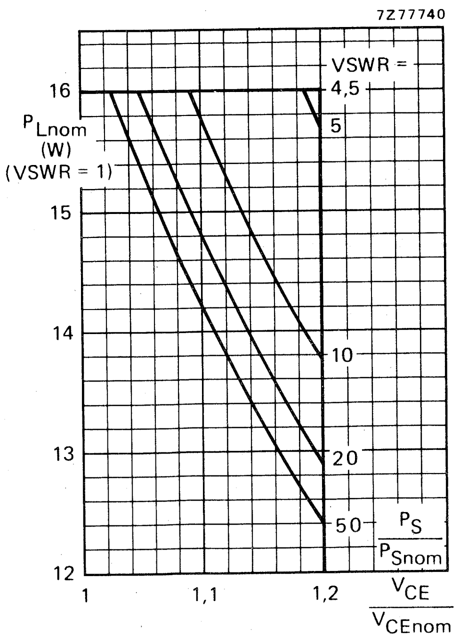


Fig. 11 R.F. SOAR (short-time operation during mismatch); f = 175 MHz; T_h = 70 °C; $R_{th\ mb\text{-}h}$ = 0,3 °C/W; V_{CEnom} = 13,5 V or 12,5 V; $P_S = P_{Snom}$ at V_{CEnom} and VSWR = 1.

Note to Fig. 11:
The transistor has been developed for use with unstabilized supply voltages. As the output power and drive power increase with the supply voltage, the nominal output power must be derated in accordance with the graph for safe operation at supply voltages other than the nominal. The graph shows the permissible output power under nominal conditions (VSWR = 1), as a function of the expected supply over-voltage ratio with VSWR as parameter.

The graph applies to the situation in which the drive (P_S/P_{Snom}) increases linearly with supply over-voltage ratio.

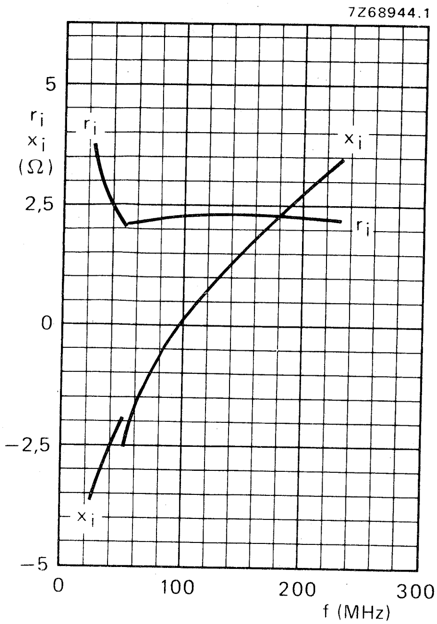


Fig. 12 Input impedance (series components).

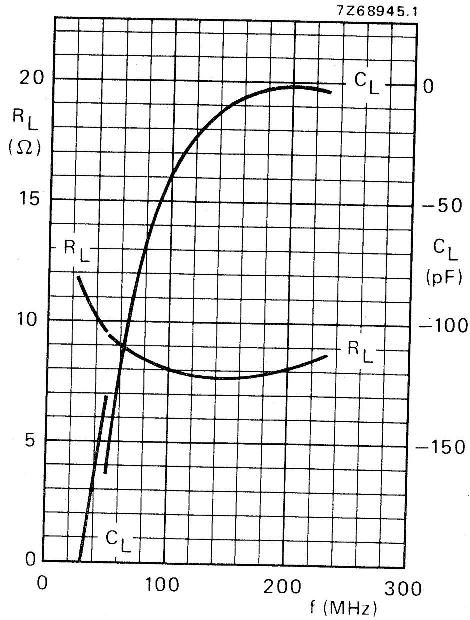


Fig. 13 Load impedance (parallel components).

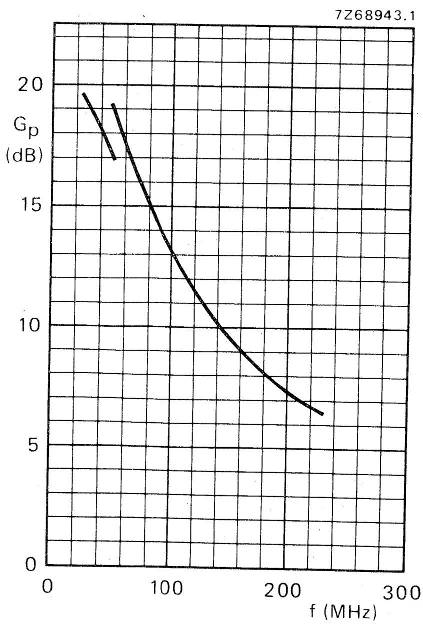


Fig. 14.

Conditions for Figs 12, 13 and 14:

Typical values: V_{CE} = 13,5 V; P_L = 15 W; T_h = 25 °C.

OPERATING NOTE

Below 50 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation.
This resistor must be effective for r.f. only.

V.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor intended for use in class-A, B and C operated h.f. and v.h.f. transmitters with a nominal supply voltage of 28 V. The transistor is resistance stabilized and is guaranteed to withstand severe load mismatch conditions.

It has a 3/8" flange envelope with a ceramic cap. All leads are isolated from the flange.

QUICK REFERENCE DATA

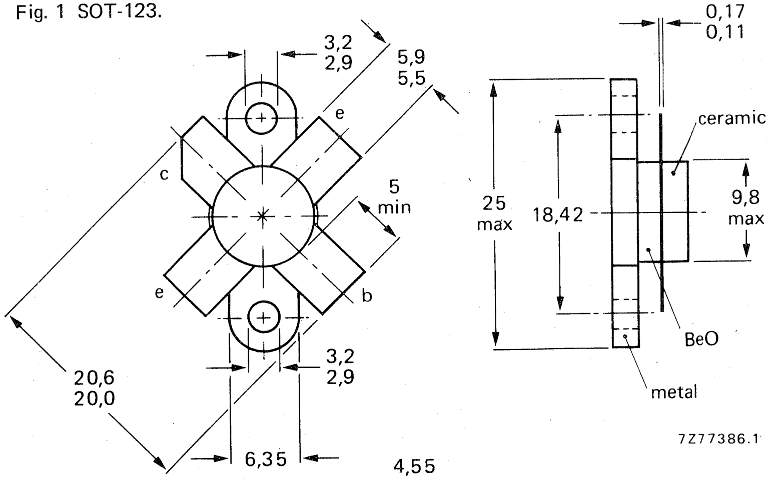
R.F. performance up to T_h = 25 °C in an unneutralized common-emitter class-B circuit

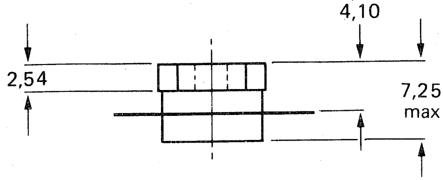
mode of operation	V_{CE} V	f MHz	P_L W	G_p dB	η %	$\overline{z_i}$ Ω	$\overline{Y_L}$ mA/V
c.w.	28	175	8	> 12	> 65	1,8 + j0,7	18 – j20

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-123.





Torque on screw: min. 0,6 Nm (6 kg cm)
max. 0,75 Nm (7,5 kg cm)

Recommended screw: cheese head
4-40 UNC/2A

Heatsink compound must be applied sparingly and evenly distributed.

CAUTION This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage ($V_{BE} = 0$) peak value	V_{CESM}	max.	65 V
Collector-emitter voltage (open base)	V_{CEO}	max.	36 V
Emitter-base voltage (open collector)	V_{EBO}	max.	4 V
Collector current (average)	$I_{C(AV)}$	max.	0,9 A
Collector current (peak value); f > 1 MHz	I_{CM}	max.	2,5 A
R.F. power dissipation (f > 1 MHz); T_{mb} = 25 °C	P_{rf}	max.	20 W
Storage temperature	T_{stg}		−65 to + 150 °C
Operating junction temperature	T_j	max.	200 °C

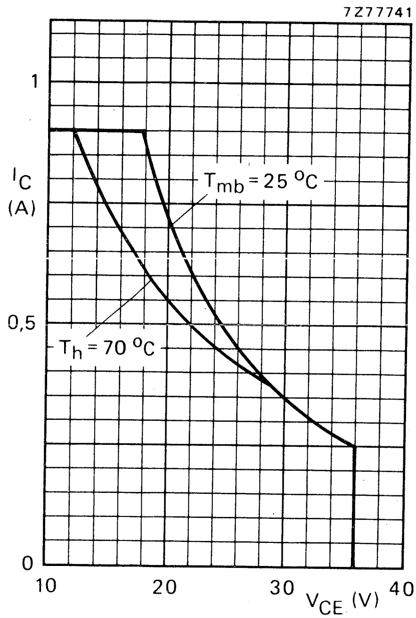


Fig. 2 D.C. SOAR.

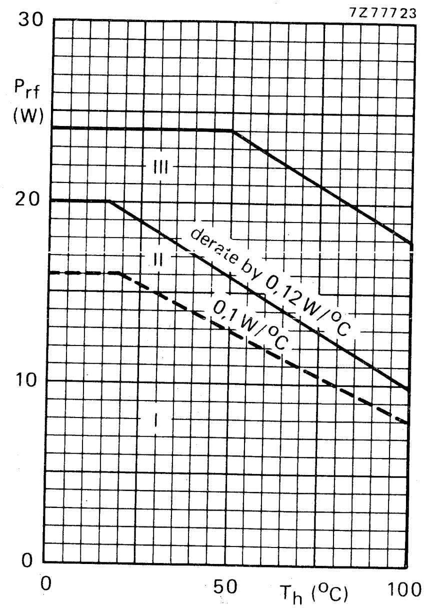


Fig. 3 R.F. power dissipation; $V_{CE} \leqslant 28$ V; f > 1 MHz.
I Continuous d.c. operation
II Continuous r.f. operation
III Short-time operation during mismatch

THERMAL RESISTANCE (dissipation = 8 W; T_{mb} = 72,4 °C, i.e. T_h = 70 °C)

From junction to mounting base (d.c. dissipation)	$R_{th\ j\text{-}mb(dc)}$	=	10,7 °C/W
From junction to mounting base (r.f. dissipation)	$R_{th\ j\text{-}mb(rf)}$	=	8,6 °C/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,3 °C/W

CHARACTERISTICS

$T_j = 25\ ^oC$

Collector-emitter breakdown voltage $V_{BE} = 0$; $I_C = 2$ mA	$V_{(BR)CES}$	>	65 V
Collector-emitter breakdown voltage open base; $I_C = 10$ mA	$V_{(BR)CEO}$	>	36 V
Emitter-base breakdown voltage open collector; $I_E = 1$ mA	$V_{(BR)EBO}$	>	4 V
Collector cut-off current $V_{BE} = 0$; $V_{CE} = 36$ V	I_{CES}	<	1 mA
Second breakdown energy; L = 25 mH; f = 50 Hz open base	E_{SBO}	>	0,5 mJ
$R_{BE} = 10\ \Omega$	E_{SBR}	>	0,5 mJ
D.C. current gain * $I_C = 0,4$ A; $V_{CE} = 5$ V	h_{FE}	typ.	50 10 to 100
Collector-emitter saturation voltage * $I_C = 1,25$ A; $I_B = 0,25$ A	V_{CEsat}	typ.	0,8 V
Transition frequency at f = 100 MHz * $-I_E = 0,4$ A; $V_{CB} = 28$ V	f_T	typ.	600 MHz
$-I_E = 1,25$ A; $V_{CB} = 28$ V	f_T	typ.	520 MHz
Collector capacitance at f = 1 MHz $I_E = I_e = 0$; $V_{CB} = 28$ V	C_c	typ.	10 pF
Feedback capacitance at f = 1 MHz $I_C = 50$ mA; $V_{CE} = 28$ V	C_{re}	typ.	7,1 pF
Collector-flange capacitance	C_{cf}	typ.	2 pF

* Measured under pulse conditions: $t_p \leqslant 200\ \mu s$; $\delta \leqslant 0,02$.

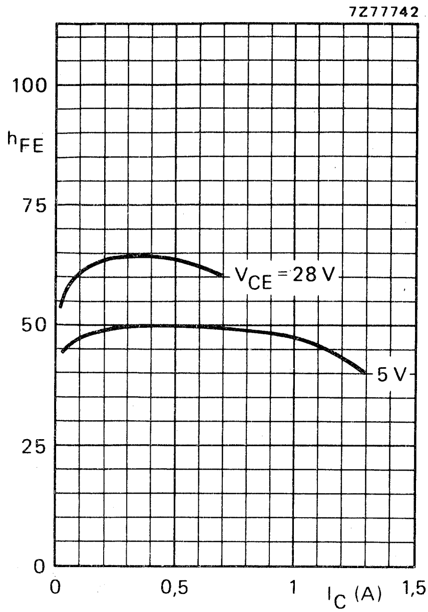


Fig. 4 Typical values; T_j = 25 °C.

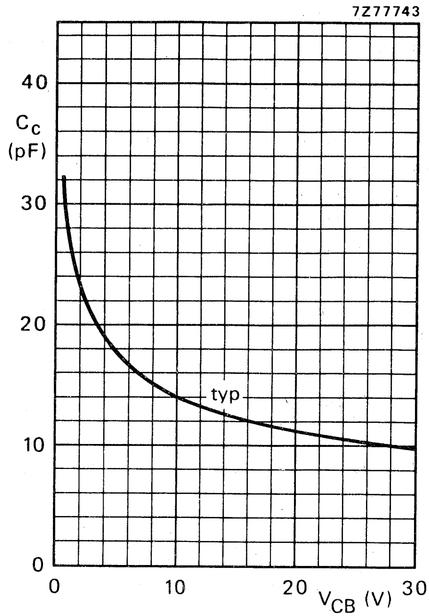


Fig. 5 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

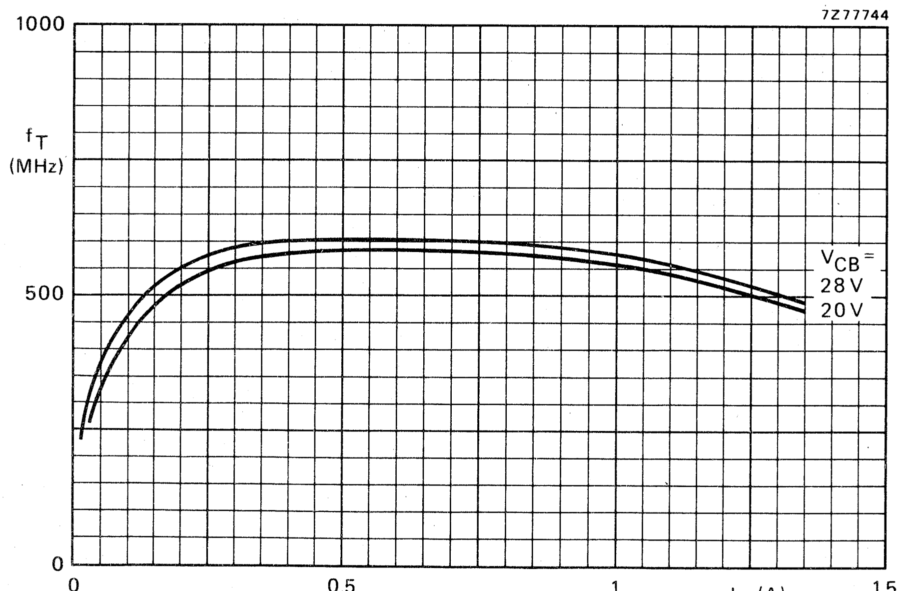


Fig. 6 Typical values; f = 100 MHz; T_j = 25 °C.

APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit)

T_h = 25 °C

f (MHz)	V_{CE} (V)	P_L (W)	P_S (W)	G_p (dB)	I_C (A)	η (%)	$\overline{z_i}$ (Ω)	$\overline{Y_L}$ (mA/V)
175	28	8	< 0,5	> 12	< 0,44	> 65	1,8 + j0,7	18 − j20

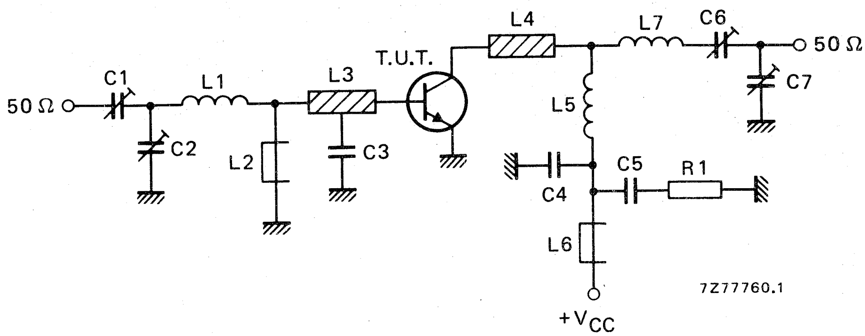


Fig. 7 Test circuit; c.w. class-B.

List of components:

C1 = 2,5 to 20 pF film dielectric trimmer (cat. no. 2222 809 07004)
C2 = C6 = 4 to 40 pF film dielectric trimmer (cat. no. 2222 809 07008)
C3 = 47 pF ceramic capacitor (500 V)
C4 = 120 pF ceramic capacitor (500 V)
C5 = 100 nF polyester capacitor
C7 = 5 to 60 pF film dielectric trimmer (cat. no. 2222 809 07011)

L1 = 2 turns Cu wire (1,6 mm); int. dia. 4,5 mm; length 5,7 mm; leads 2 x 5 mm
L2 = L6 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L3 = L4 = strip (12 mm x 6 mm); tap for C3 at 5 mm from transistor
L5 = 3 turns Cu wire (1,6 mm); int. dia. 7,5 mm; length 7,5 mm; leads 2 x 5 mm
L7 = 3 turns Cu wire (1,6 mm); int. dia. 6,5 mm; length 7,4 mm; leads 2 x 5 mm

L3 and L4 are strips on a double Cu-clad printed-circuit board with epoxy fibre-glass dielectric, thickness 1/16″.

R1 = 10 Ω carbon resistor

Component layout and printed-circuit board for 175 MHz test circuit see Fig. 8.

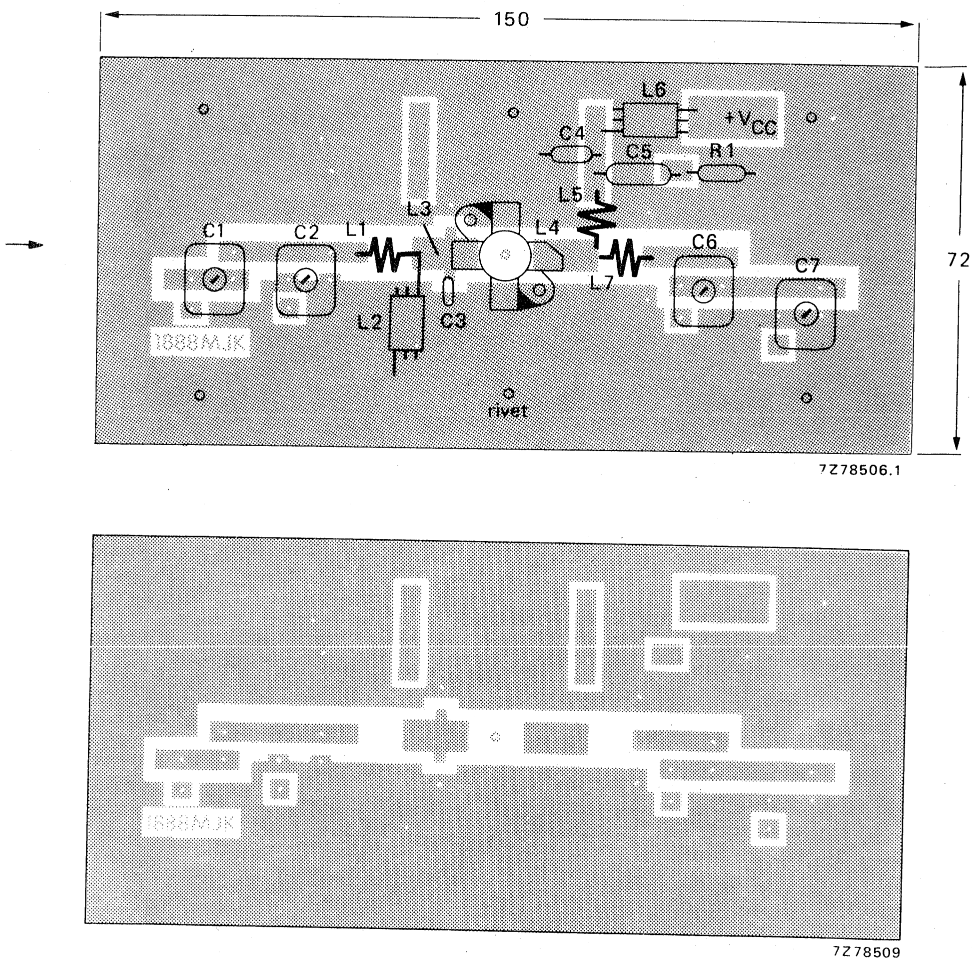


Fig. 8 Component layout and printed-circuit board for 175 MHz test circuit.

The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets, whilst under the emitter leads Cu straps are used for a direct contact between upper and lower sheets.

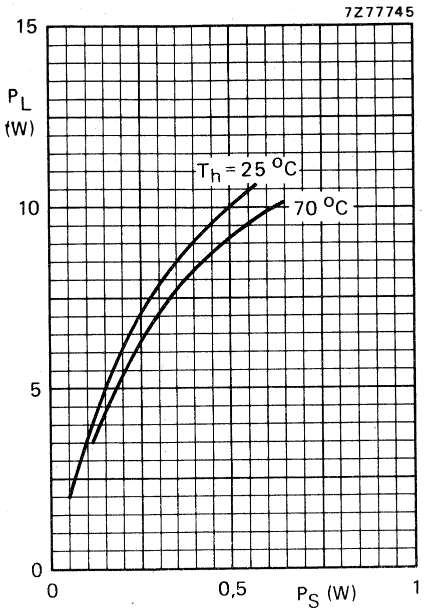


Fig. 9 Typical values; V_{CE} = 28 V; f = 175 MHz.

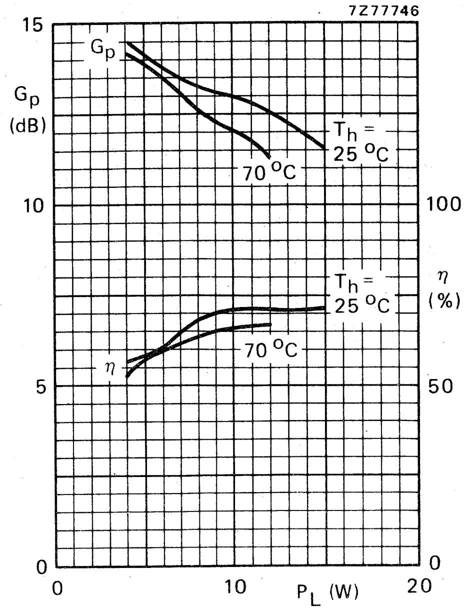


Fig. 10 Typical values; V_{CE} = 28 V; f = 175 MHz.

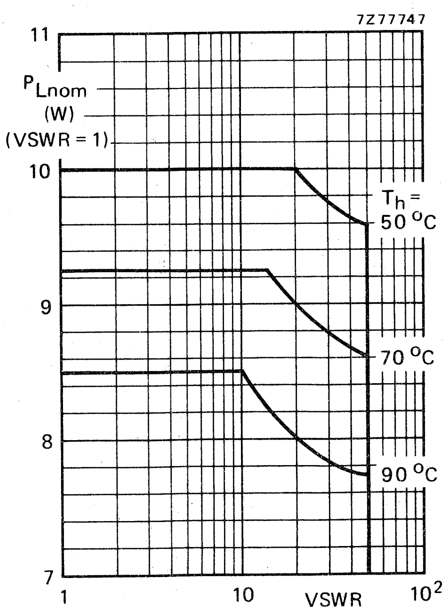


Fig. 11 R.F. SOAR; c.w. class-B operation; f = 175 MHz; V_{CE} = 28 V; $R_{th\ mb-h}$ = 0,3 °C/W. The graph shows the permissible output power under nominal conditions (VSWR = 1) as a function of the expected VSWR during short-time mismatch conditions with heatsink temperatures as parameter.

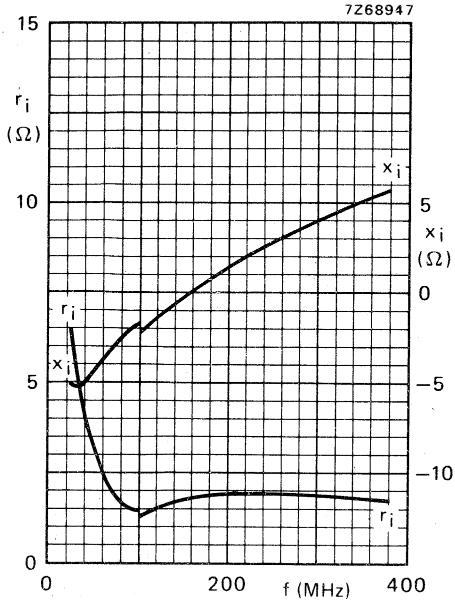


Fig. 12 Input impedance (series components).

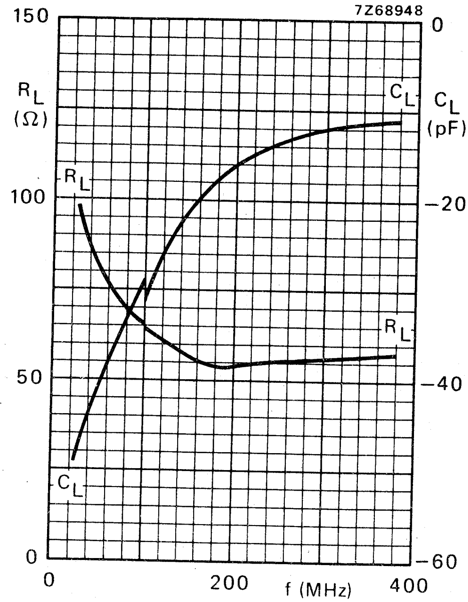


Fig. 13 Load impedance (parallel components).

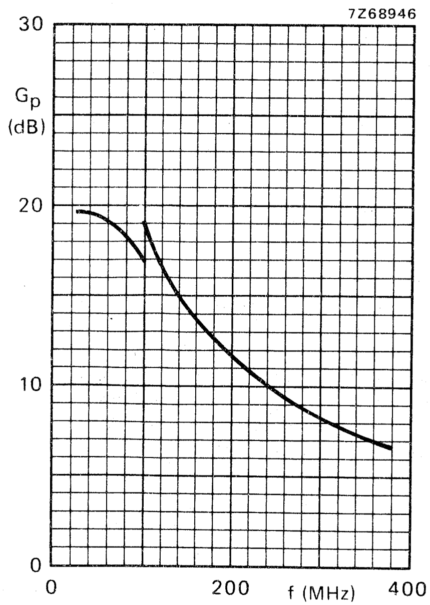


Fig. 14.

Conditions for Figs 12, 13 and 14.

Typical values; V_{CE} = 28 V; P_L = 8 W; T_h = 25 °C.

OPERATING NOTE

Below 100 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation.
This resistor must be effective for r.f. only.

V.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor intended for use in class-A, B and C operated h.f. and v.h.f. transmitters with a nominal supply voltage of 28 V. The transistor is resistance stabilized and is guaranteed to withstand severe load mismatch conditions.

It has a 3/8" flange envelope with a ceramic cap. All leads are isolated from the flange.

QUICK REFERENCE DATA

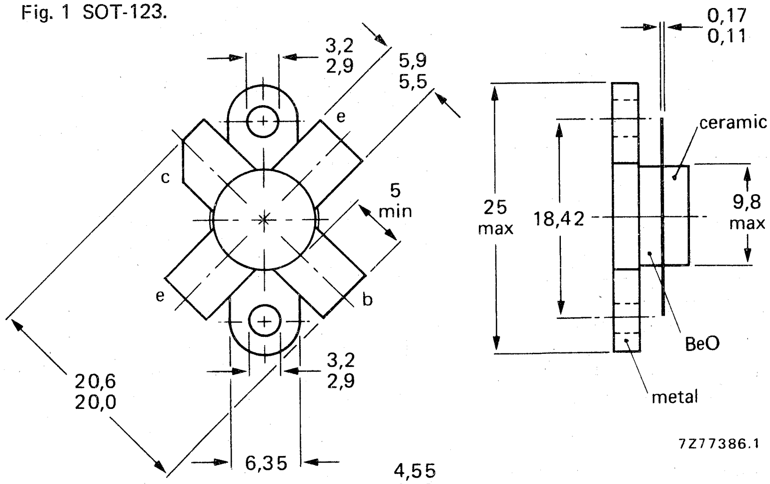
R.F. performance up to T_h = 25 °C in an unneutralized common-emitter class-B circuit

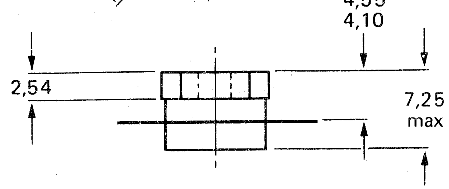
mode of operation	V_{CE} V	f MHz	P_L W	G_p dB	η %	$\overline{z_i}$ Ω	$\overline{Y_L}$ mA/V
c.w.	28	175	15	> 10	> 65	1,4 + j1,85	33 − j27,5

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-123.





Torque on screw: min. 0,6 Nm (6 kg cm)
max. 0,75 Nm (7,5 kg cm)

Recommended screw: cheese-head
4-40 UNC/2A

Heatsink compound must be applied sparingly and evenly distributed.

CAUTION This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage (V_{BE} = 0) peak value	V_{CESM}	max.	65	V
Collector-emitter voltage (open base)	V_{CEO}	max.	36	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4	V
Collector current (average)	$I_{C(AV)}$	max.	1,75	A
Collector current (peak value); f > 1 MHz	I_{CM}	max.	5,0	A
R.F. power dissipation (f > 1 MHz); T_{mb} = 25 °C	P_{rf}	max.	36	W
Storage temperature	T_{stg}		−65 to + 150	°C
Operating junction temperature	T_j	max.	200	°C

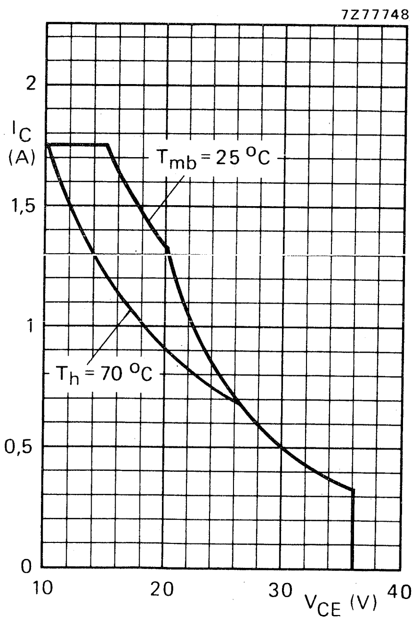


Fig. 2 D.C. SOAR.

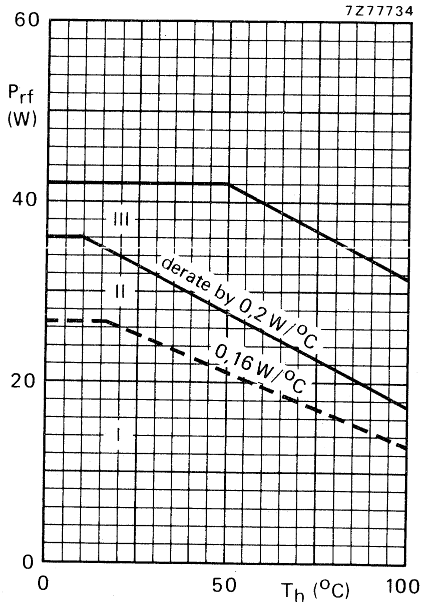


Fig. 3 R.F. power dissipation; $V_{CE} \leqslant 28$ V; f > 1 MHz.
I Continuous d.c. operation
II Continuous r.f. operation
III Short-time operation during mismatch

THERMAL RESISTANCE (dissipation = 15 W; T_{mb} = 74,5 °C, i.e. T_h = 70 °C)

From junction to mounting base (d.c. dissipation)	$R_{th\ j\text{-}mb(dc)}$	=	6,55	°C/W
From junction to mounting base (r.f. dissipation)	$R_{th\ j\text{-}mb(rf)}$	=	4,95	°C/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,3	°C/W

CHARACTERISTICS

T_j = 25 °C

Collector-emitter breakdown voltage V_{BE} = 0; I_C = 5 mA	$V_{(BR)CES}$	>	65 V
Collector-emitter breakdown voltage open base; I_C = 25 mA	$V_{(BR)CEO}$	>	36 V
Emitter-base breakdown voltage open collector; I_E = 2 mA	$V_{(BR)EBO}$	>	4 V
Collector cut-off current V_{BE} = 0; V_{CE} = 36 V	I_{CES}	<	2 mA
Second breakdown energy; L = 25 mH; f = 50 Hz open base	E_{SBO}	>	2,5 mJ
R_{BE} = 10 Ω	E_{SBR}	>	2,5 mJ
D.C. current gain * I_C = 0,7 A; V_{CE} = 5 V	h_{FE}	typ.	50 10 to 100
Collector-emitter saturation voltage * I_C = 2 A; I_B = 0,4 A	V_{CEsat}	typ.	0,65 V
Transition frequency at f = 100 MHz * $-I_E$ = 0,7 A; V_{CB} = 28 V	f_T	typ.	650 MHz
$-I_E$ = 2 A; V_{CB} = 28 V	f_T	typ.	625 MHz
Collector capacitance at f = 1 MHz I_E = I_e = 0; V_{CB} = 28 V	C_c	typ.	18 pF
Feedback capacitance at f = 1 MHz I_C = 100 mA; V_{CE} = 28 V	C_{re}	typ.	12,8 pF
Collector-flange capacitance	C_{cf}	typ.	2 pF

* Measured under pulse conditions: $t_p \leq 200\ \mu s$; $\delta \leq 0,02$.

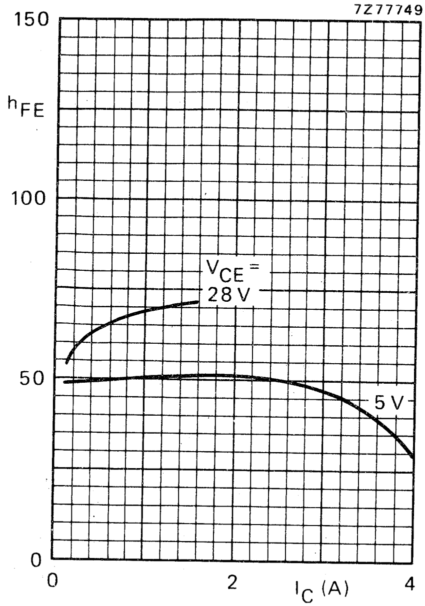


Fig. 4 Typical values; T_j = 25 °C.

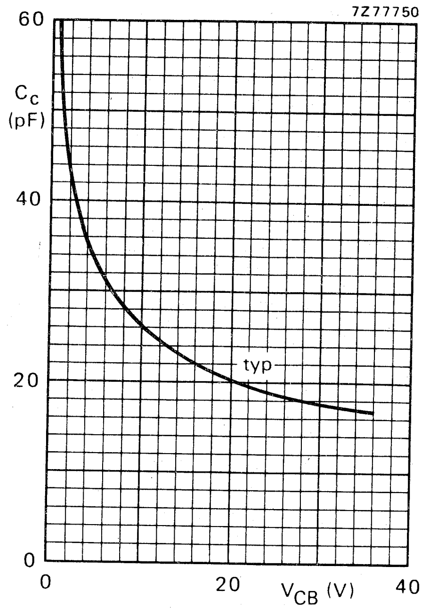


Fig. 5 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

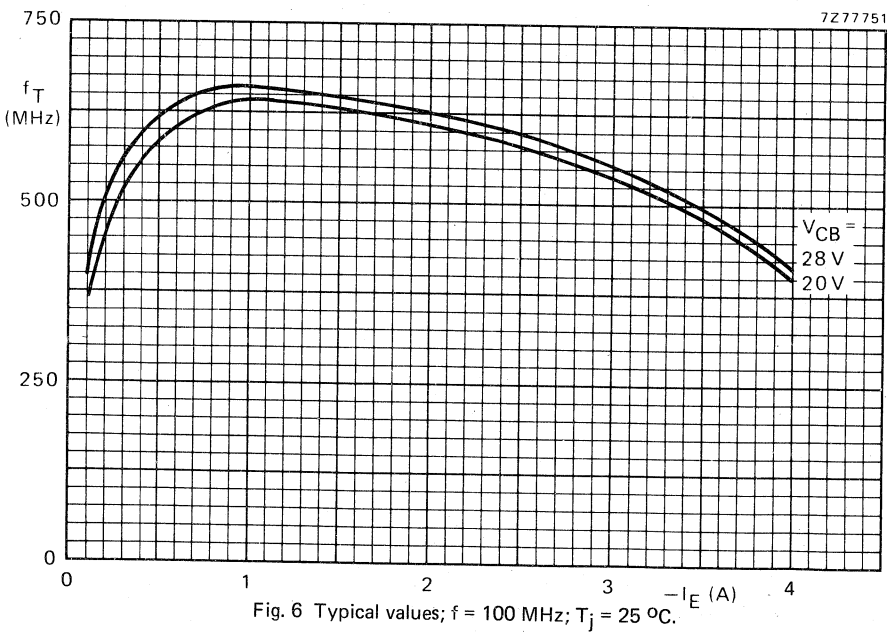


Fig. 6 Typical values; f = 100 MHz; T_j = 25 °C.

APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit)

T_h = 25 °C

f (MHz)	V_{CE} (V)	P_L (W)	P_S (W)	G_p (dB)	I_C (A)	η (%)	$\overline{z_i}$ (Ω)	$\overline{Y_L}$ (mA/V)
175	28	15	< 1,5	> 10	< 0,83	> 65	1,4 + j1,85	33 − j27,5

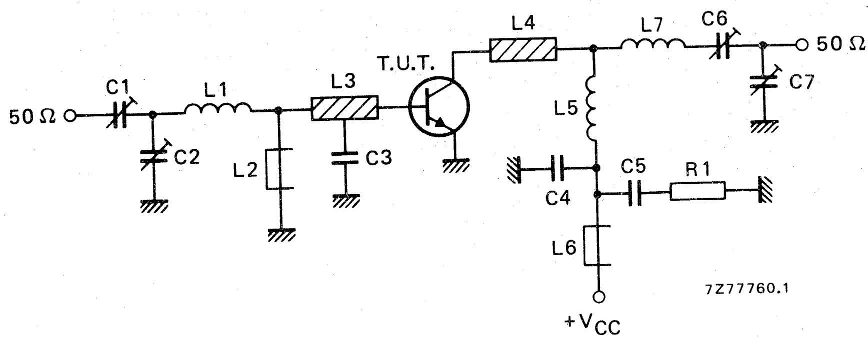


Fig. 7 Test circuit; c.w. class-B.

List of components:

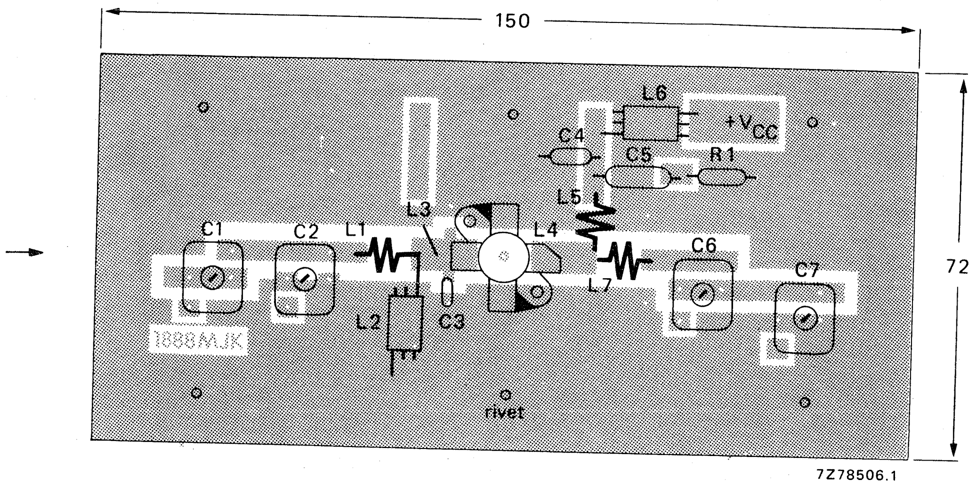
C1 = 2,5 to 20 pF film dielectric trimmer (cat. no. 2222 809 07004)
C2 = C6 = 4 to 40 pF film dielectric trimmer (cat. no. 2222 809 07008)
C3 = 47 pF ceramic capacitor (500 V)
C4 = 120 pF ceramic capacitor (500 V)
C5 = 100 nF polyester capacitor
C7 = 5 to 60 pF film dielectric trimmer (cat. no. 2222 809 07011)

L1 = 2 turns Cu wire (1,6 mm); int. dia. 4,5 mm; length 5,7 mm; leads 2 x 5 mm
L2 = L6 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L3 = L4 = strip (12 mm x 6 mm); tap for C3 at 5 mm from transistor
L5 = 3 turns Cu wire (1,6 mm); int. dia. 7,5 mm; length 7,5 mm; leads 2 x 5 mm
L7 = 3 turns Cu wire (1,6 mm); int. dia. 6,5 mm; length 7,4 mm; leads 2 x 5 mm

L3 and L4 are strips on a double Cu-clad printed-circuit board with epoxy fibre-glass dielectric, thickness 1/16".

R1 = 10 Ω carbon resistor

Component layout and printed-circuit board for 175 MHz test circuit see Fig. 8.



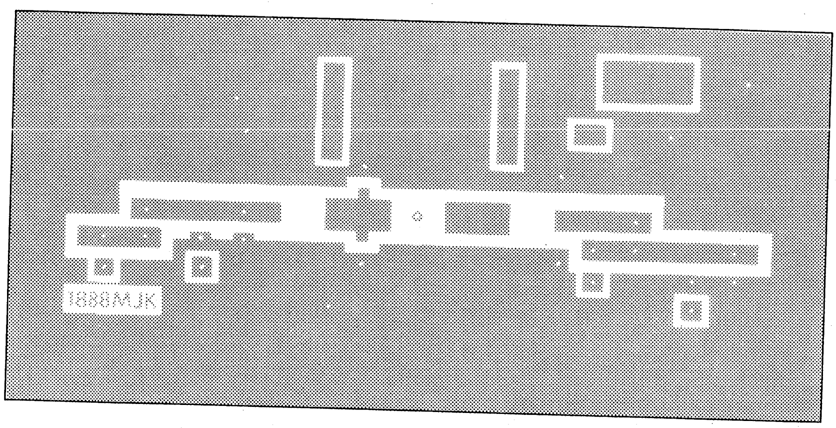


Fig. 8 Component layout and printed-circuit board for 175 MHz test circuit.

The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets, whilst under the emitter leads Cu straps are used for a direct contact between upper and lower sheets.

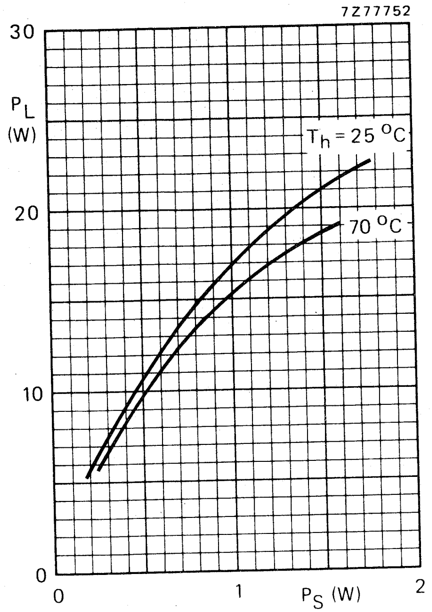


Fig. 9 Typical values; V_{CE} = 28 V;
f = 175 MHz.

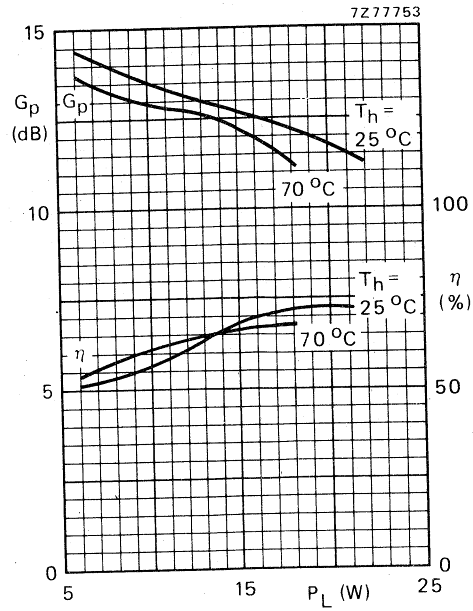


Fig. 10 Typical values; V_{CE} = 28 V;
f = 175 MHz.

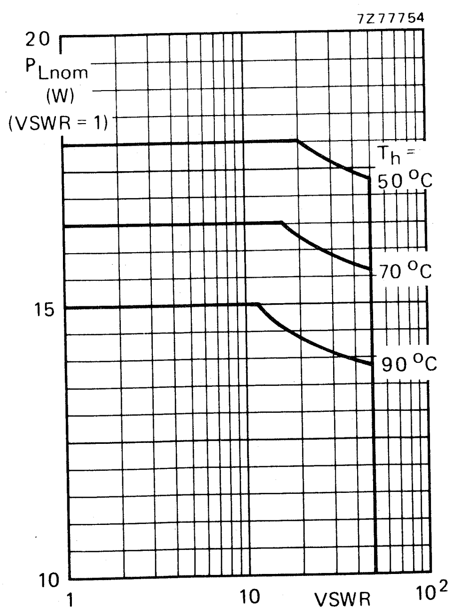


Fig. 11 R.F. SOAR; c.w. class-B operation;
f = 175 MHz; V_{CE} = 28 V; $R_{th\ mb\text{-}h}$ = 0,3 °C/W.
The graph shows the permissible output power under nominal conditions (VSWR = 1) as a function of the expected VSWR during short-time mismatch conditions with heatsink temperatures as parameter.

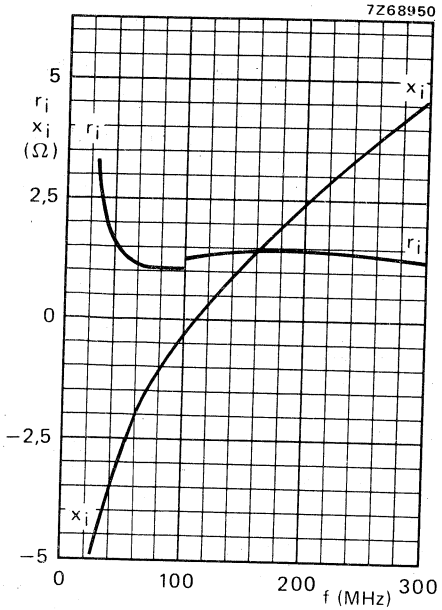


Fig. 12 Input impedance (series components).

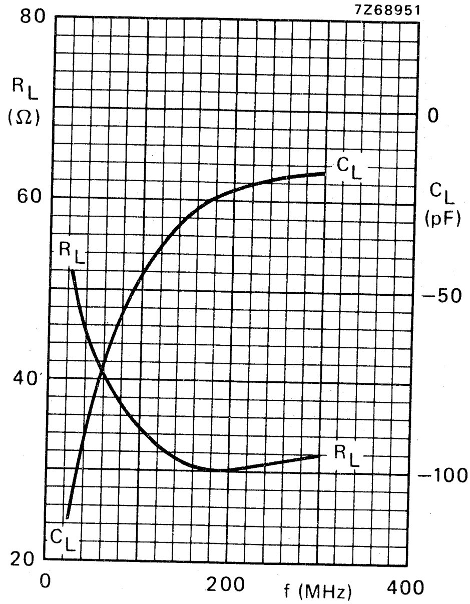


Fig. 13 Load impedance (parallel components).

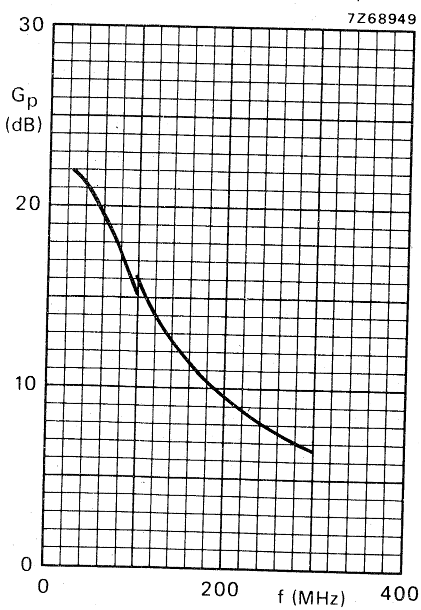


Fig. 14.

Conditions for Figs 12, 13 and 14.

Typical values; V_{CE} = 28 V; P_L = 15 W;
T_h = 25 °C.

OPERATING NOTE

Below 100 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation.
This resistor must be effective for r.f. only.

V.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor primarily for use in v.h.f.-f.m. broadcast transmitters.

Features:
- internally matched input for wideband operation and high power gain;
- multi-base structure and diffused emitter ballasting resistors for an optimum temperature profile;
- gold metallization ensures excellent reliability.

The transistor has a ½" 6-lead flange envelope with a ceramic cap. All leads are isolated from the flange.

QUICK REFERENCE DATA

R.F. performance up to T_h = 25 °C in an unneutralized common-emitter class-B circuit

mode of operation	V_{CE} V	f MHz	P_L W	P_S W	G_p dB	η %
narrow band; c.w.	28	108	175	typ. 15,6	typ. 10,5	typ. 70

MECHANICAL DATA

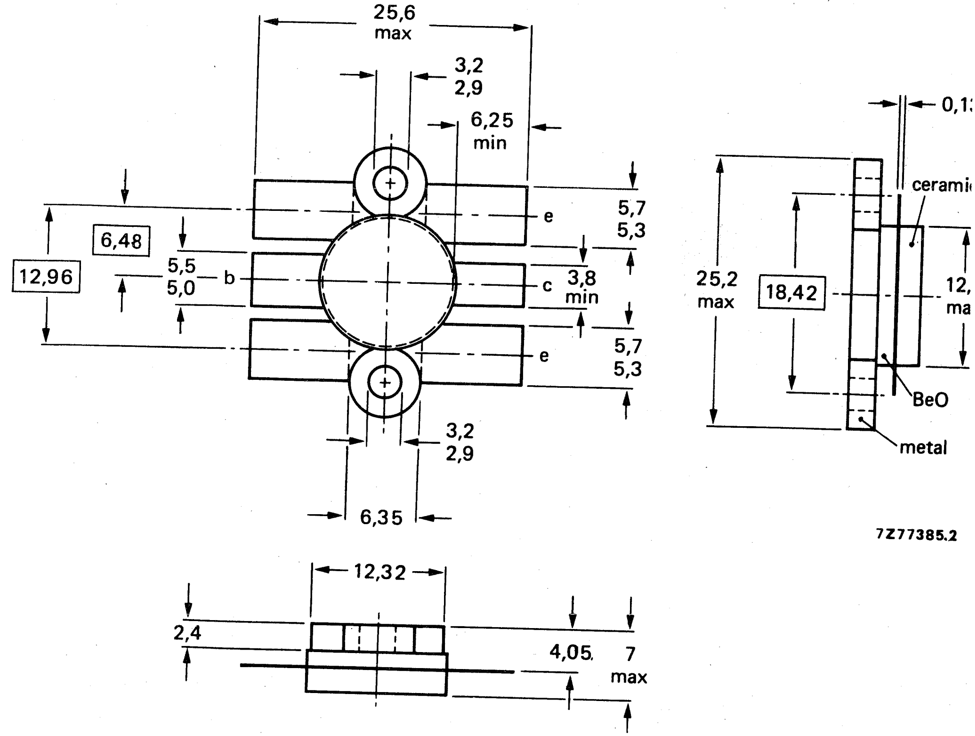
SOT-119 (see Fig. 1).

CAUTION This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

MECHANICAL DATA

Fig. 1 SOT-119.

Dimensions in mm



Torque on screw: min. 0,6 Nm (6 kg cm)
max. 0,75 Nm (7,5 kg cm)

Recommended screw: cheese-head 4-40 UNC/2A

Heatsink compound must be applied sparingly and evenly distributed.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage			
(peak value); $V_{BE} = 0$	V_{CESM}	max.	65 V
open base	V_{CEO}	max.	33 V
Emitter-base voltage (open collector)	V_{EBO}	max.	4 V
Collector current			
d.c. or average	I_C; $I_{C(AV)}$	max.	17,5 A
(peak value); f > 1 MHz	I_{CM}	max.	35 A
Total power dissipation at $T_{mb} = 25\ ^oC$	P_{tot}	max.	250 W
R.F. power dissipation (f > 1 MHz); $T_{mb} = 25\ ^oC$	P_{rf}	max.	340 W
R.F. power dissipation (f > 1 MHz); $T_h = 70\ ^oC$	P_{rf}	max.	135 W
Storage temperature	T_{stg}	−65 to +	150 ^oC
Operating junction temperature	T_j	max.	200 ^oC

THERMAL RESISTANCE (dissipation = 100 W; $T_{mb} = 90\ ^oC$, i.e. $T_h = 70\ ^oC$)

From junction to mounting base (d.c. dissipation)	$R_{th\ j\text{-}mb(dc)}$	=	0,85 K/W*
From junction to mounting base (r.f. dissipation)	$R_{th\ j\text{-}mb(rf)}$	=	0,60 K/W*
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,2 K/W*

* K/W is SI unit for $^oC/W$.

CHARACTERISTICS

$T_j = 25\ ^oC$

Collector-emitter breakdown voltage			
$V_{BE} = 0$; $I_C = 25$ mA	$V_{(BR)CES}$	>	65 V
open base; $I_C = 200$ mA	$V_{(BR)CEO}$	>	33 V
Emitter-base breakdown voltage			
open collector; $I_E = 20$ mA	$V_{(BR)EBO}$	>	4 V
Collector cut-off current			
$V_{BE} = 0$; $V_{CE} = 33$ V	I_{CES}	<	10 mA
Second breakdown energy; L = 25 mH; f = 50 Hz			
open base	E_{SBO}	>	20 mJ
$R_{BE} = 10\ \Omega$	E_{SBR}	>	20 mJ
D.C. current gain*			
$I_C = 8{,}5$ A; $V_{CE} = 5$ V	h_{FE}	typ.	30
			10 to 80
Collector-emitter saturation voltage*			
$I_C = 20$ A; $I_B = 2{,}0$ A	V_{CEsat}	typ.	2,0 V
Transition frequency at f = 100 MHz**			
$-I_E = 8{,}5$ A; $V_{CB} = 25$ V	f_T	typ.	600 MHz
$-I_E = 20$ A; $V_{CB} = 25$ V	f_T	typ.	600 MHz
Collector capacitance at f = 1 MHz			
$I_E = I_e = 0$; $V_{CB} = 25$ V	C_c	typ.	275 pF
Feedback capacitance at f = 1 MHz			
$I_C = 100$ mA; $V_{CE} = 25$ V	C_{re}	typ.	155 pF
Collector-flange capacitance	C_{cf}	typ.	3 pF

* Measured under pulse conditions: $t_p \leqslant 300\ \mu s$; $\delta \leqslant 0{,}02$.
** Measured under pulse conditions: $t_p \leqslant 50\ \mu s$; $\delta \leqslant 0{,}01$.

V.H.F. LINEAR POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor primarily intended for use in linear v.h.f. amplifiers for television transmitters and transposers. Diffused emitter ballasting resistors and the application of **gold sandwich metallization** ensure an optimum temperature profile and excellent reliability properties.

The transistor has a ¼" capstan envelope with ceramic cap. All leads are isolated from the stud.

QUICK REFERENCE DATA

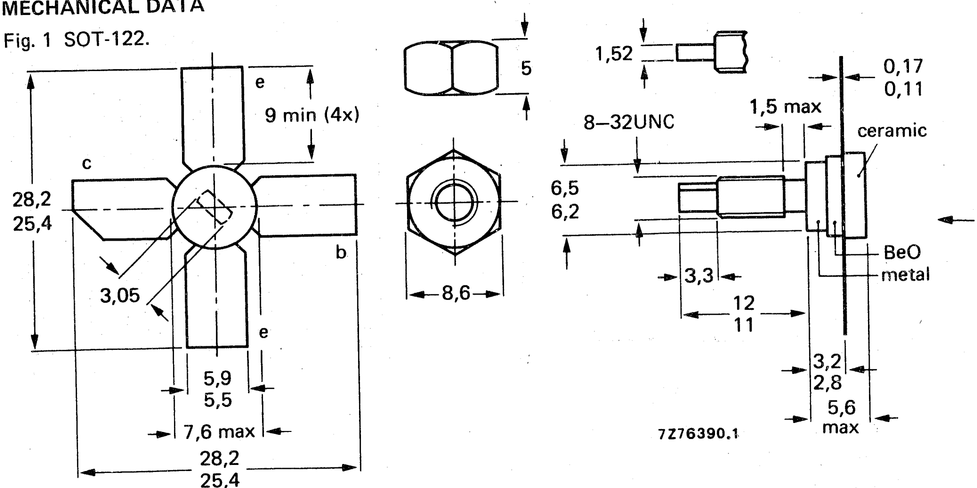
R.F. performance mode of operation	f_{vision} MHz	V_{CE} V	I_C A	T_h °C	d_{im}* dB	$P_{o\,sync}$* W	G_p dB
class-A; linear amplifier	224,25 224,25	25 25	0,46 0,46	70 25	−60 −60	> 1,5 typ. 1,7	> 18 typ. 20

* Three-tone test method (vision carrier −8 dB, sound carrier −7 dB, sideband signal −16 dB), zero dB corresponds to peak sync level.

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-122.



Torque on nut: min. 0,75 Nm (7,5 kg cm)
max. 0,85 Nm (8,5 kg cm)

Diameter of clearance hole in heatsink: max. 4,2 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

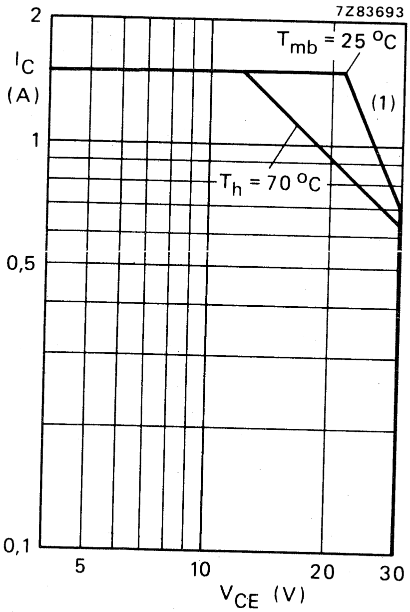
When locking is required an adhesive is preferred instead of a lock washer.

CAUTION This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage			
(peak value); $V_{BE} = 0$	V_{CESM}	max.	60 V
open base	V_{CEO}	max.	30 V
Emitter-base voltage (open collector)	V_{EBO}	max.	4 V
Collector current			
d.c. or average	I_C; $I_{C(AV)}$	max.	1,5 A
(peak value); f > 1 MHz	I_{CM}	max.	3,5 A
Total power dissipation at T_{mb} = 25 °C	P_{tot}	max.	32,5 W
Storage temperature	T_{stg}		−65 to + 150 °C
Operating junction temperature	T_j	max.	200 °C



(1) Second breakdown limit (independent of temperature).

Fig. 2 D.C. SOAR.

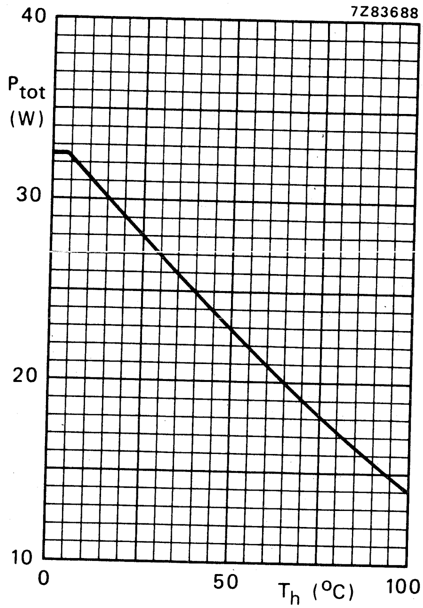


Fig. 3 Power derating curve vs. temperature.

THERMAL RESISTANCE (see Fig. 4)

From junction to mounting base (dissipation = 12 W; T_{mb} = 77 °C; i.e. T_h = 70 °C)	$R_{th\ j\text{-}mb}$	=	5,6 K/W*
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,6 K/W*

* K/W is SI unit for °C/W.

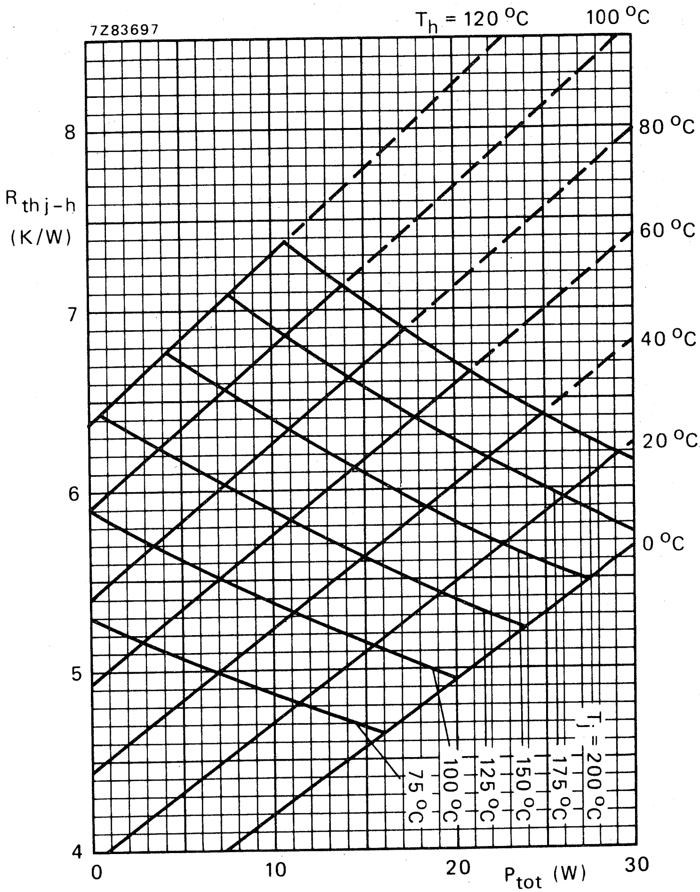


Fig. 4 Maximum thermal resistance from junction to heatsink as a function of power dissipation, with heatsink and junction temperature as parameters. ($R_{th\,mb\text{-}h}$ = 0,6 K/W).

Example

Nominal class-A operation; V_{CE} = 25 V; I_C = 0,46 A; T_h = 70 °C.

Fig. 4 shows:	$R_{th\,j\text{-}h}$	max.	6,13 K/W
	T_j	max.	140,5 °C
Typical device:	$R_{th\,j\text{-}h}$	typ.	5,45 K/W
	T_j	typ.	133 °C

CHARACTERISTICS

$T_j = 25\ ^oC$

Collector-emitter breakdown voltage			
$V_{BE} = 0$; $I_C = 10$ mA	$V_{(BR)CES}$	>	60 V
open base; $I_C = 50$ mA	$V_{(BR)CEO}$	>	30 V
Emitter-base breakdown voltage			
open collector; $I_E = 4$ mA	$V_{(BR)EBO}$	>	4 V
Collector cut-off current			
$V_{BE} = 0$; $V_{CE} = 30$ V	I_{CES}	<	4 mA
Second breakdown energy; L = 25 mH; f = 50 Hz			
open base	E_{SBO}	>	2 mJ
$R_{BE} = 10\ \Omega$	E_{SBR}	>	2 mJ
D.C. current gain *			
$I_C = 0{,}5$ A; $V_{CE} = 25$ V	h_{FE}	typ.	65
			15 to 120
Collector-emitter saturation voltage *			
$I_C = 1{,}0$ A; $I_B = 0{,}1$ A	V_{CEsat}	typ.	0,8 V
Transition frequency at f = 500 MHz **			
$-I_E = 0{,}5$ A; $V_{CB} = 25$ V	f_T	typ.	1,20 GHz
$-I_E = 1{,}0$ A; $V_{CB} = 25$ V	f_T	typ.	1,15 GHz
Collector capacitance at f = 1 MHz			
$I_E = I_e = 0$; $V_{CB} = 25$ V	C_c	typ.	18 pF
Feedback capacitance at f = 1 MHz			
$I_C = 20$ mA; $V_{CE} = 25$ V	C_{re}	typ.	9,2 pF
Collector-stud capacitance	C_{cs}	typ.	2 pF

* Measured under pulse conditions: $t_p \leqslant 300\ \mu s$; $\delta \leqslant 0{,}02$.

** Measured under pulse conditions: $t_p \leqslant 50\ \mu s$; $\delta \leqslant 0{,}01$.

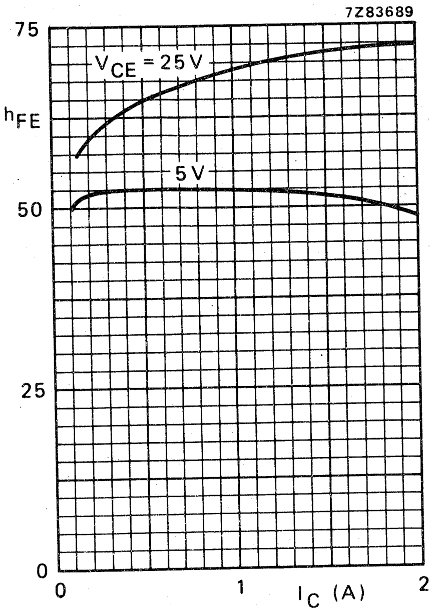


Fig. 5 Typical values; T_j = 25 °C.

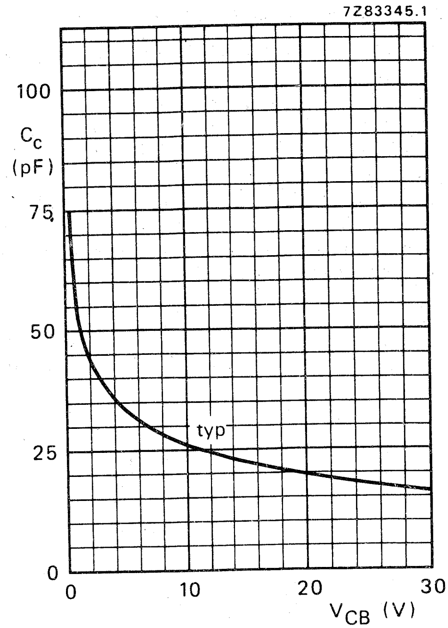


Fig. 6 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

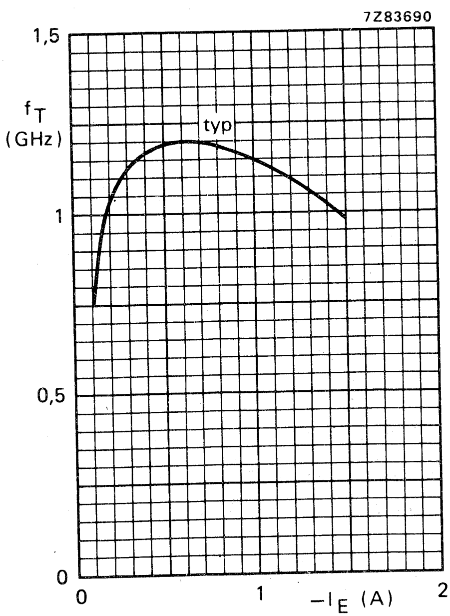


Fig. 7 V_{CB} = 25 V; f = 500 MHz; T_j = 25 °C.

APPLICATION INFORMATION

R.F. performance in v.h.f. class-A operation (linear power amplifier)

f_{vision} (MHz)	V_{CE} (V)	I_C (A)	T_h (°C)	d_{im} (dB) *	$P_{o\,sync}$ (W) *	G_p (dB)
224,25	25	0,46	70	−60	> 1,5	> 18
224,25	25	0,46	70	−60	typ. 1,7	typ. 19,5
224,25	25	0,46	25	−60	typ. 1,8	typ. 20

* Three-tone test method (vision carrier −8 dB, sound carrier −7 dB, sideband signal −16 dB), zero dB corresponds to peak sync level.

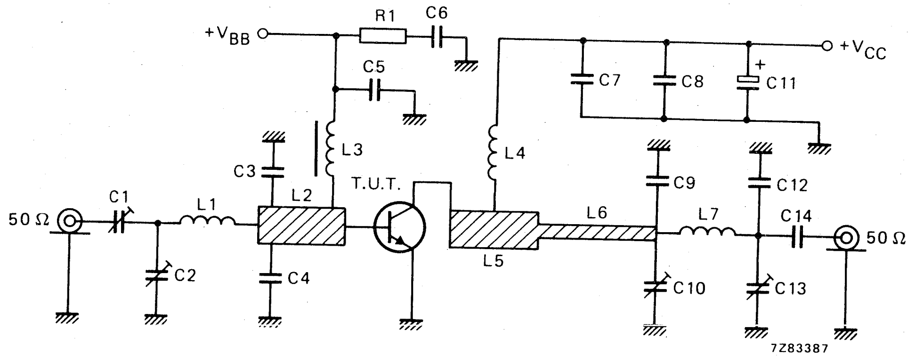


Fig. 8 Test circuit at f_{vision} = 224,25 MHz.

List of components:

C1 = 1,8 to 10 pF film dielectric trimmer (cat. no. 2222 809 05002)
C2 = 2 to 9 pF film dielectric trimmer (cat. no. 2222 809 09002)
C3 = C4 = 82 pF multilayer ceramic chip capacitor (ATC▲), placed 7 mm from transistor edge
C5 = C7 = C14 = 680 pF (50 V) multilayer ceramic chip capacitor (cat. no. 2222 852 13681)
C6 = C8 = 330 nF polyester capacitor
C9 = 43 pF (500 V) multilayer ceramic chip capacitor (ATC▲)
C10 = C13 = 2 to 18 pF film dielectric trimmer (cat. no. 2222 809 09003)
C11 = 10 μF/40 V solid aluminium electrolytic capacitor
C12 = 18 pF (500 V) multilayer ceramic chip capacitor (ATC▲)

L1 = 49 nH; 4 turns enamelled Cu wire (1,0 mm); int. dia. 3,6 mm; length 6,3 mm; leads 2 x 5 mm
L2 = L5 = 30 Ω stripline (10,0 mm x 6,0 mm)
L3 = 0,1 μH; microchoke (cat. no. 4322 057 01070)
L4 = 130 nH; 6 turns enamelled Cu wire (1,0 mm); int. dia. 6,0 mm; length 10,7 mm; leads 2 x 5 mm
L6 = 60 Ω stripline (50,5 mm x 2,0 mm)
L7 = 30 nH; 4 turns enamelled Cu wire (1,0 mm); int. dia. 3,0 mm; length 7,9 mm; leads 2 x 5 mm

L2, L5 and L6 are striplines on a double Cu-clad printed-circuit board with epoxy fibre-glass dielectric ($\epsilon_r \approx 4{,}5$); thickness 1/16".

R1 = 10 Ω carbon resistor

▲ ATC means American Technical Ceramics.

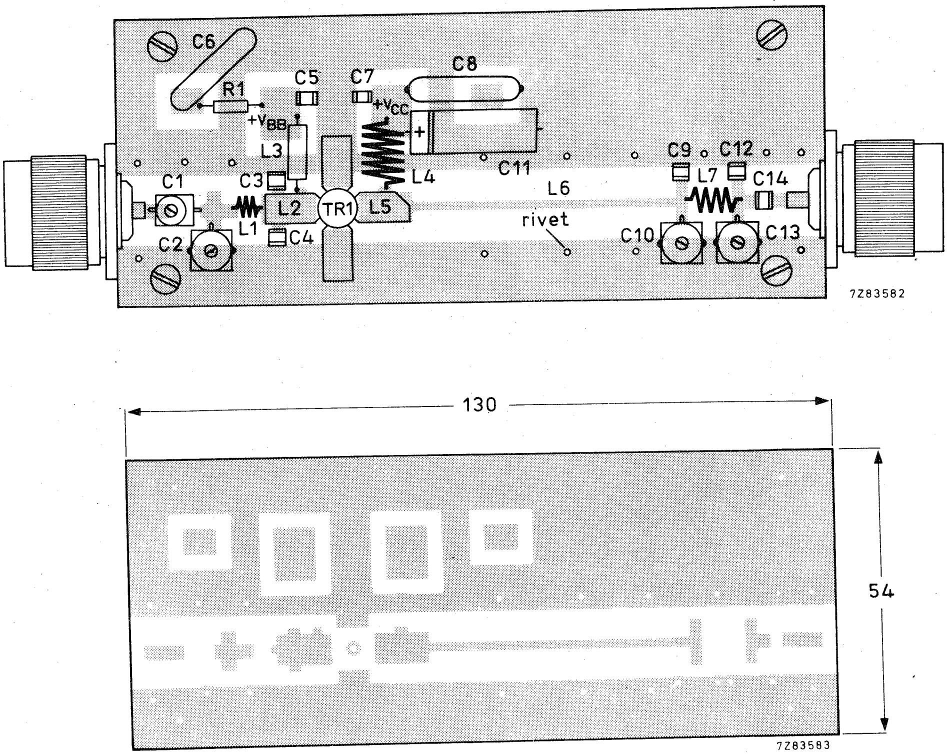


Fig. 9 Component layout and printed-circuit board for 224,25 MHz test circuit.

The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets, whilst under the emitter leads Cu straps are used for a direct contact between upper and lower sheets.

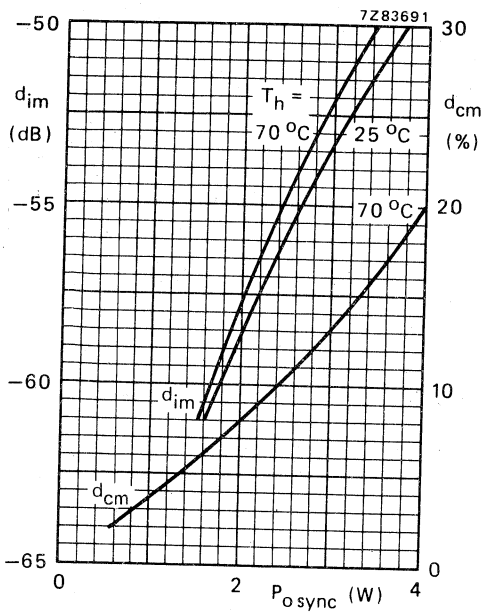


Fig. 10 intermodulation distortion (d_{im}*) and cross-modulation distortion (d_{cm}**) as a function of output power.

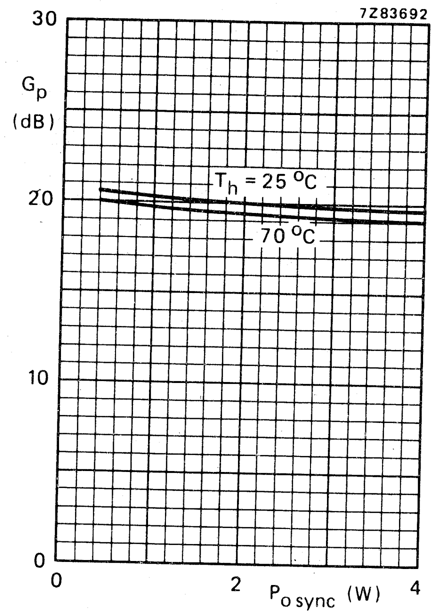


Fig. 11 Power gain as a function of output power.

Conditions for Figs 10 and 11:

Typical values; V_{CE} = 25 V; I_C = 0,46 A; f_{vision} = 224,25 MHz.

* Three-tone test method (vision carrier −8 dB, sound carrier −7 dB, sideband signal −16 dB), zero dB corresponds to peak sync level.
Intermodulation distortion of input signal ⩽ −75 dB.

** Two-tone test method (vision carrier 0 dB, sound carrier −7 dB), zero dB corresponds to peak sync level.
Cross-modulation distortion (d_{cm}) is the voltage variation (%) of sound carrier when vision carrier is switched from 0 dB to −20 dB.

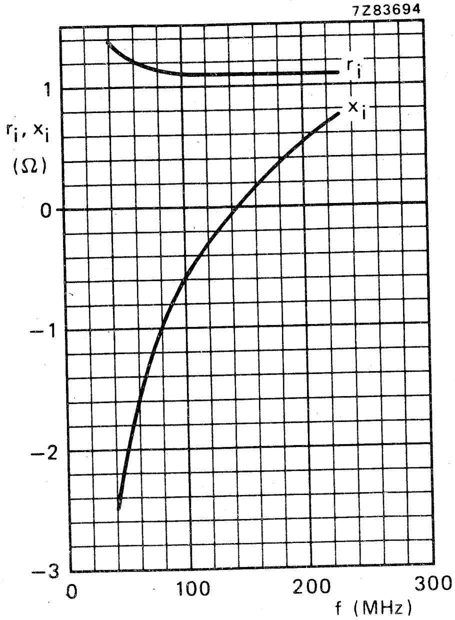


Fig. 12 Input impedance (series components).

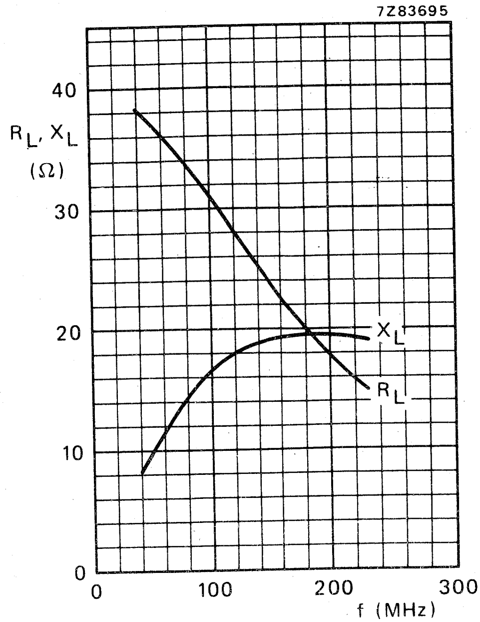


Fig. 13 Load impedance (series components).

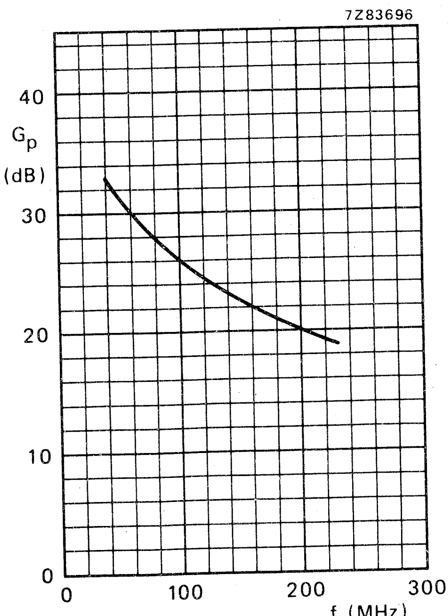


Fig. 14.

Conditions for Figs 12, 13 and 14:

Typical values; V_{CE} = 25 V; I_C = 0,46 A; T_h = 70 °C.

V.H.F. LINEAR POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor primarily intended for use in linear v.h.f. amplifiers for television transmitters and transposers. Diffused emitter ballasting resistors and the application of **gold sandwich metallization** ensure an optimum temperature profile and excellent reliability properties. The transistor has a ¼" capstan envelope with ceramic cap. All leads are isolated from the stud.

QUICK REFERENCE DATA

R.F. performance

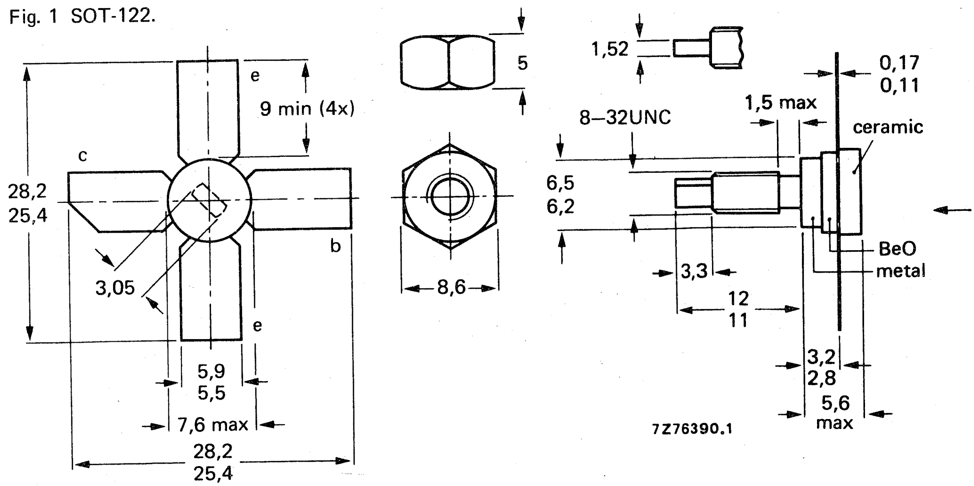
mode of operation	f_{vision} MHz	V_{CE} V	I_C A	T_h °C	d_{im}* dB	$P_{o\ sync}$* W	G_p dB
class-A; linear amplifier	224,25	25	0,8	70	−58	> 5	> 15
	224,25	25	0,8	25	−58	typ. 7	typ. 16,5

* Three-tone test method (vision carrier −8 dB, sound carrier −7 dB, sideband signal −16 dB), zero dB corresponds to peak sync level.

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-122.



Torque on nut: min. 0,75 Nm (7,5 kg cm)
max. 0,85 Nm (8,5 kg cm)

Diameter of clearance hole in heatsink: max. 4,2 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

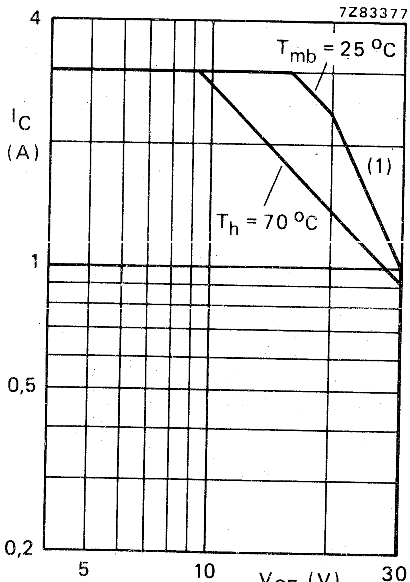
When locking is required an adhesive is preferred instead of a lock washer.

CAUTION This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage			
(peak value); $V_{BE} = 0$	V_{CESM}	max.	60 V
open base	V_{CEO}	max.	30 V
Emitter-base voltage (open collector)	V_{EBO}	max.	4 V
Collector current			
d.c. or average	I_C; $I_{C(AV)}$	max.	3 A
(peak value); f > 1 MHz	I_{CM}	max.	6 A
Total power dissipation at T_{mb} = 25 °C	P_{tot}	max.	48 W
Storage temperature	T_{stg}		−65 to + 150 °C
Operating junction temperature	T_j	max.	200 °C



(1) Second breakdown limit (independent of temperature).

Fig. 2 D.C. SOAR.

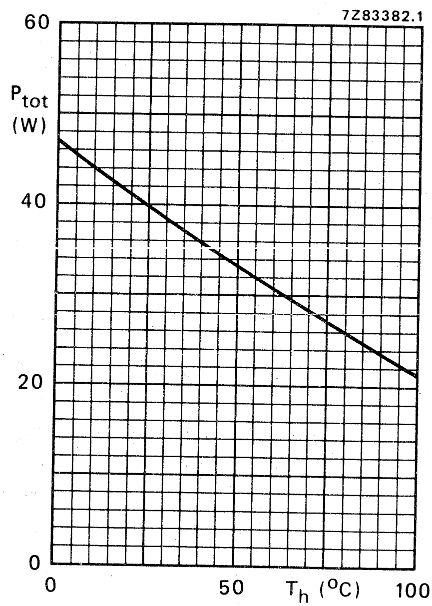


Fig. 3 Power derating curve vs. temperature.

THERMAL RESISTANCE (see Fig. 4)

From junction to mounting base (dissipation = 20 W; T_{mb} = 82 °C; i.e. T_h = 70 °)	$R_{th\ j\text{-}mb}$	=	3,45 K/W*
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,6 K/W*

* K/W is SI unit for °C/W.

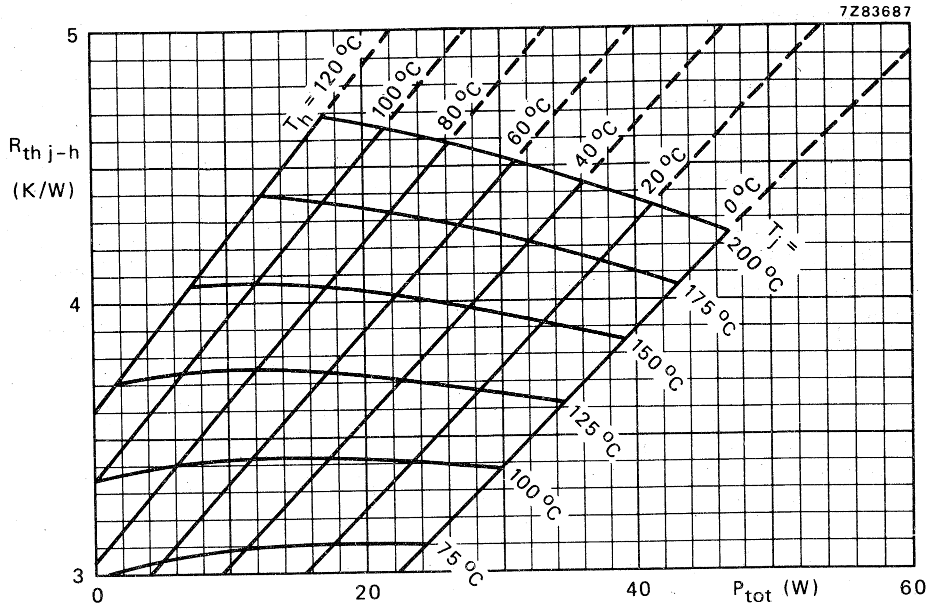


Fig. 4 Maximum thermal resistance from junction to heatsink as a function of power dissipation, with heatsink and junction temperature as parameters. ($R_{th\ mb-h}$ = 0,6 K/W.)

Example

Nominal class-A operation: V_{CE} = 25 V; I_C = 0,8 A; T_h = 70 °C.

Fig. 4 shows:	$R_{th\ j-h}$	max.	4,05 K/W
	T_j	max.	151 °C
Typical device:	$R_{th\ j-h}$	typ.	3,80 K/W
	T_j	typ.	146 °C

CHARACTERISTICS

$T_j = 25\ ^oC$ unless otherwise specified

Collector-emitter breakdown voltage			
$V_{BE} = 0$; $I_C = 25$ mA	$V_{(BR)CES}$	>	60 V
open base; $I_C = 100$ mA	$V_{(BR)CEO}$	>	30 V
Emitter-base breakdown voltage			
open collector; $I_E = 10$ mA	$V_{(BR)EBO}$	>	4 V
Collector cut-off current			
$V_{BE} = 0$; $V_{CE} = 30$ V	I_{CES}	<	10 mA
Second breakdown energy; L = 25 mH; f = 50 Hz			
open base	E_{SBO}	>	3 mJ
$R_{BE} = 10\ \Omega$	E_{SBR}	>	3 mJ
D.C. current gain *			
$I_C = 0{,}8$ A; $V_{CE} = 25$ V	h_{FE}	typ.	75
			15 to 120
Collector-emitter saturation voltage *			
$I_C = 2{,}0$ A; $I_B = 0{,}2$ A	V_{CEsat}	typ.	1,0 V
Transition frequency at f = 500 MHz **			
$-I_E = 0{,}8$ A; $V_{CB} = 25$ V	f_T	typ.	1,0 GHz
$-I_E = 2{,}0$ A; $V_{CB} = 25$ V	f_T	typ.	1,1 GHz
Collector capacitance at f = 1 MHz			
$I_E = I_e = 0$; $V_{CB} = 25$ V	C_c	typ.	35 pF
Feedback capacitance at f = 1 MHz			
$I_C = 100$ mA; $V_{CE} = 25$ V	C_{re}	typ.	20 pF
Collector-stud capacitance	C_{cs}	typ.	2 pF

* Measured under pulse conditions: $t_p \leqslant 300\ \mu s$; $\delta \leqslant 0{,}02$.
** Measured under pulse conditions: $t_p \leqslant 50\ \mu s$; $\delta \leqslant 0{,}01$.

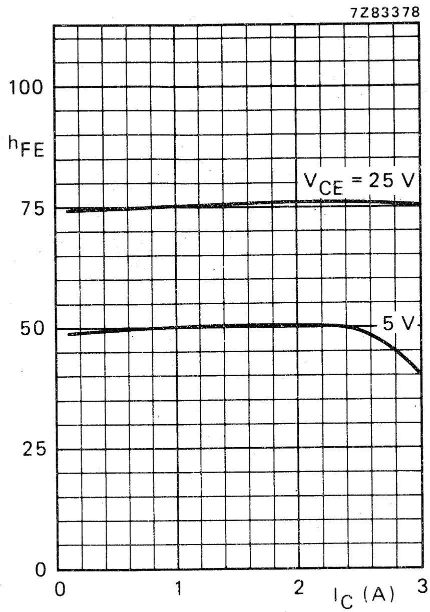


Fig. 5 Typical values; T_j = 25 °C.

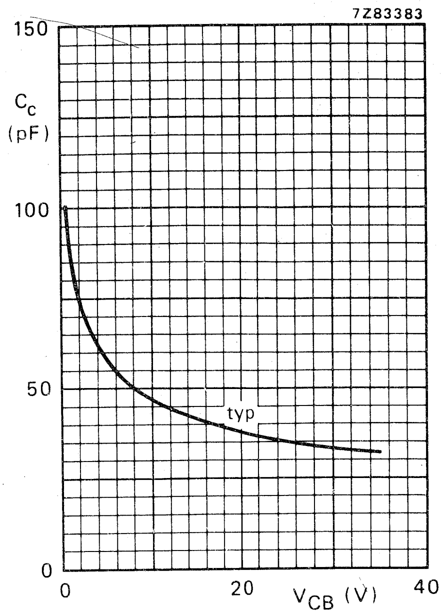


Fig. 6 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

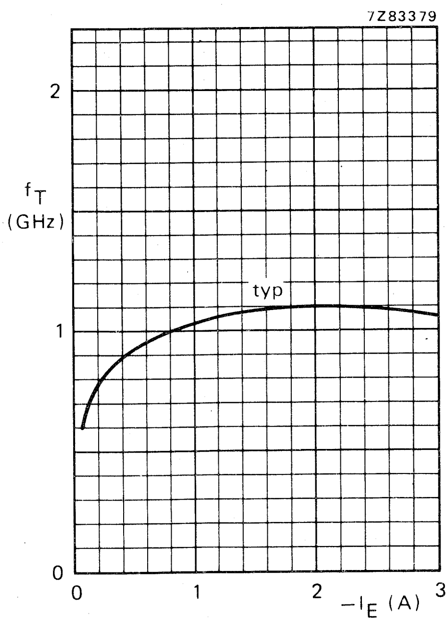


Fig. 7 V_{CB} = 25 V; f = 500 MHz; T_j = 25 °C.

APPLICATION INFORMATION

R.F. performance in v.h.f. class-A operation (linear power amplifier)

f_{vision} (MHz)	V_{CE} (V)	I_C (A)	T_h (°C)	d_{im} (dB)*	$P_{o\ sync}$ (W)*	G_p (dB)
224,25	25	0,8	70	−58	> 5	> 15
224,25	25	0,8	70	−58	typ. 5,8	typ. 16,2
224,25	25	0,8	25	−58	typ. 7	typ. 16,5

* Three-tone test method (vision carrier −8 dB, sound carrier −7 dB, sideband signal −16 dB), zero dB corresponds to peak sync level.

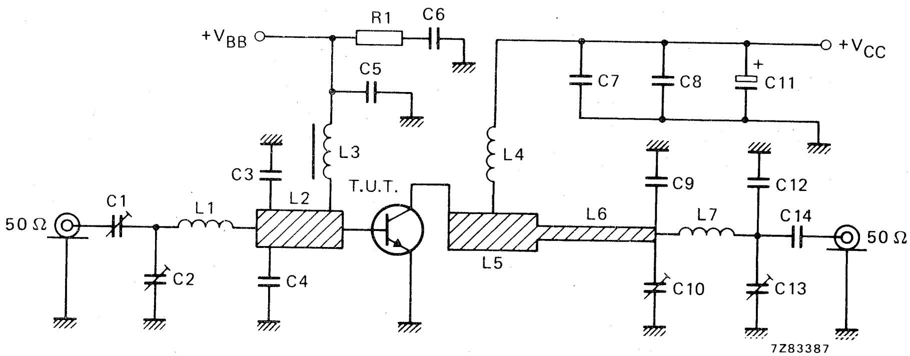


Fig. 8 Test circuit at f_{vision} = 224,25 MHz.

List of components:

C1 = 1,8 to 10 pF film dielectric trimmer (cat. no. 2222 809 05002)
C2 = 2 to 9 pF film dielectric trimmer (cat. no. 2222 809 09002)
C3 = C4 = 82 pF multilayer ceramic chip capacitor (ATC▲), placed 7 mm from transistor edge
C5 = C7 = C14 = 680 pF (50 V) multilayer ceramic chip capacitor (cat. no. 2222 852 13681)
C6 = C8 = 330 nF polyester capacitor
C9 = 43 pF (500 V) multilayer ceramic chip capacitor (ATC▲)
C10 = C13 = 2 to 18 pF film dielectric trimmer (cat. no. 2222 809 09003)
C11 = 10 μF/40 V solid aluminium electrolytic capacitor
C12 = 18 pF (500 V) multilayer ceramic chip capacitor (ATC▲)

L1 = 49 nH; 4 turns enamelled Cu wire (1,0 mm); int. dia. 3,6 mm; length 6,3 mm; leads 2 x 5 mm
L2 = L5 = 30 Ω stripline (10,0 mm x 6,0 mm)
L3 = 0,1 μH; microchoke (cat. no. 4322 057 01070)
L4 = 130 nH; 6 turns enamelled Cu wire (1,0 mm); int. dia. 6,0 mm; length 10,7 mm; leads 2 x 5 mm
L6 = 60 Ω stripline (50,5 mm x 2,0 mm)
L7 = 30 nH; 4 turns enamelled Cu wire (1,0 mm); int. dia. 3,0 mm; length 7,9 mm; leads 2 x 5 mm

L2, L5 and L6 are striplines on a double Cu-clad printed-circuit board with epoxy fibre-glass dielectric ($\epsilon_r \approx 4,5$); thickness 1/16″.

R1 = 10 Ω carbon resistor

▲ ATC means American Technical Ceramics.

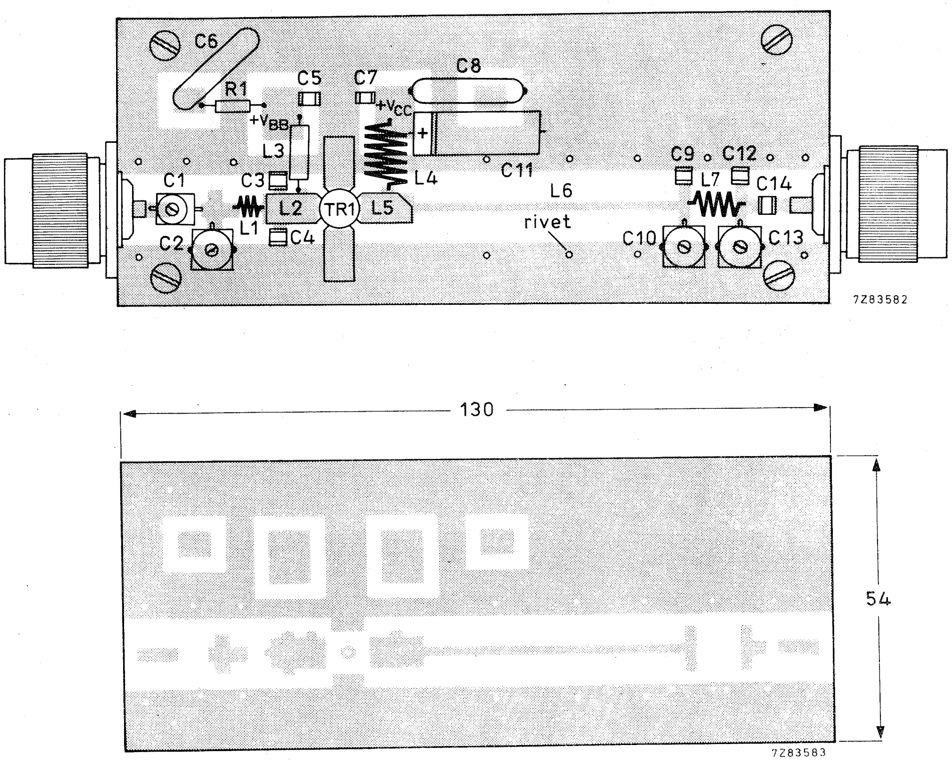


Fig. 9 Component layout and printed-circuit board for 224,25 MHz test circuit.

The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets, whilst under the emitter leads Cu straps are used for a direct contact between upper and lower sheets.

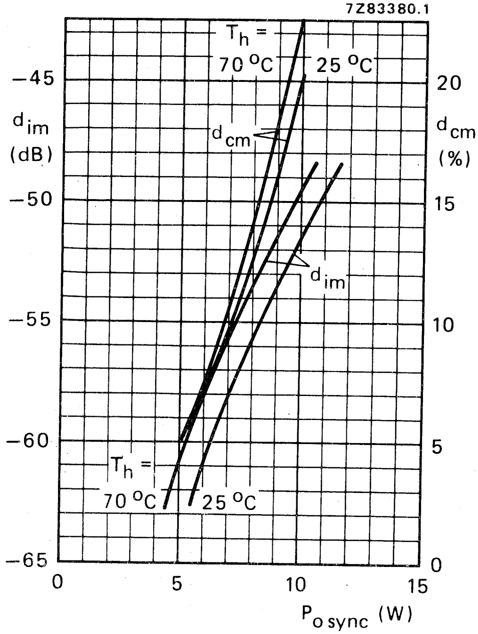


Fig. 10 Intermodulation distortion (d_{im}*) and cross-modulation distortion (d_{cm}**) as a function of output power.

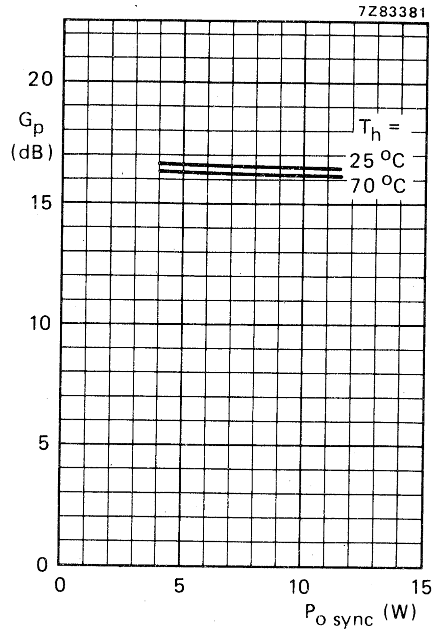


Fig. 11 Power gain as a function of output power.

Conditions for Figs 10 and 11:

Typical values; V_{CE} = 25 V; I_C = 0,8 A; f_{vision} = 224,25 MHz.

* Three-tone test method (vision carrier −8 dB, sound carrier −7 dB, sideband signal −16 dB), zero dB corresponds to peak sync level.
Intermodulation distortion of input signal ⩽ −75 dB.

** Two-tone test method (vision carrier 0 dB, sound carrier −7 dB), zero dB corresponds to peak sync level.
Cross-modulation distortion (d_{cm}) is the voltage variation (%) of sound carrier when vision carrier is switched from 0 dB to −20 dB.

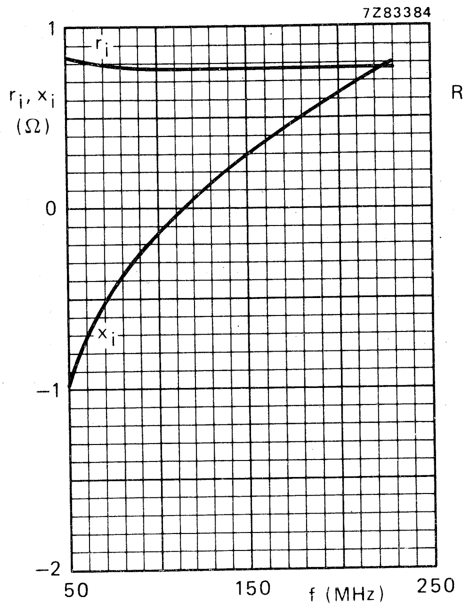


Fig. 12 Input impedance (series components).

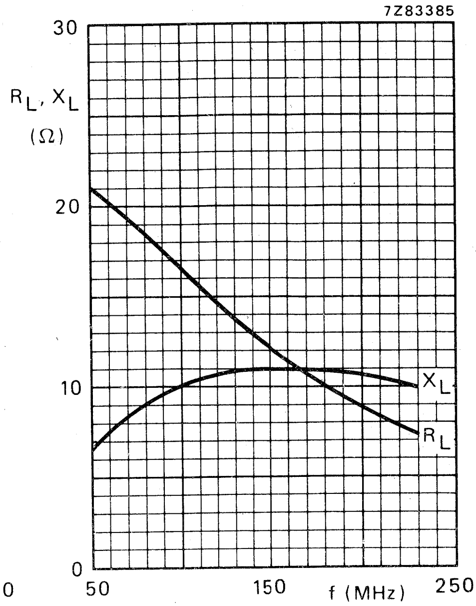


Fig. 13 Load impedance (series components).

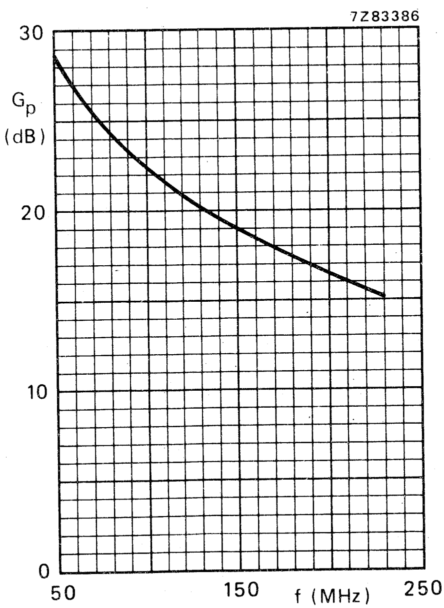


Fig. 14.

Conditions for Figs 12, 13 and 14:

Typical values; V_{CE} = 25 V; I_C = 0,8 A;
T_h = 70 °C.

V.H.F. LINEAR POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor primarily intended for use in linear v.h.f. amplifiers of television transmitters and transposers.

Features:

- diffused emitter ballasting resistors for an optimum temperature profile;
- gold metallization ensures excellent reliability.

The transistor has a 3/8" 6-lead flange envelope with a ceramic cap. All leads are isolated from the flange.

QUICK REFERENCE DATA

R.F. performance in linear amplifier

mode of operation	f_{vision} MHz	V_{CE} V	I_C A	T_h °C	d_{im}* dB	$P_{o\ sync}$* W	G_p dB
class-A	224,25	25	1,6	70	−55	> 10	> 16
class-A	224,25	25	1,6	25	−55	typ. 12,5	typ. 17,2

* Three-tone test method (vision carrier −8 dB, sound carrier −7 dB, sideband signal −16 dB), zero dB corresponds to peak sync level.

MECHANICAL DATA

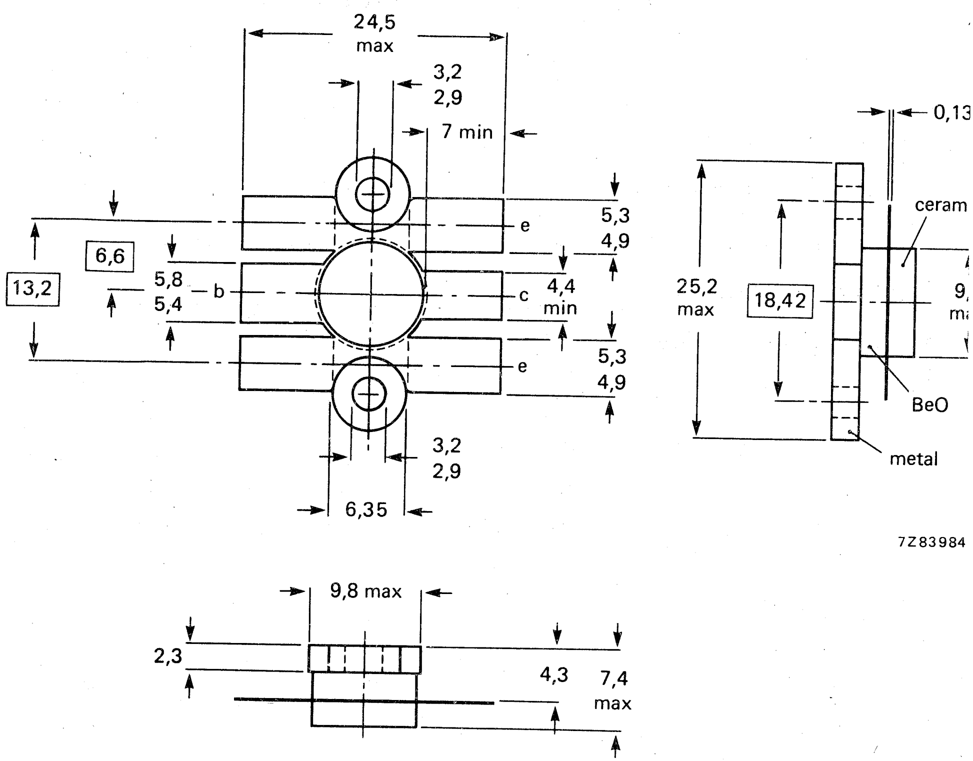
SOT-160 (see Fig. 1).

CAUTION This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

MECHANICAL DATA

Fig. 1 SOT-160.

Dimensions in mm



Torque on screw: min. 0,6 Nm (6 kg cm)
max. 0,75 Nm (7,5 kg cm)

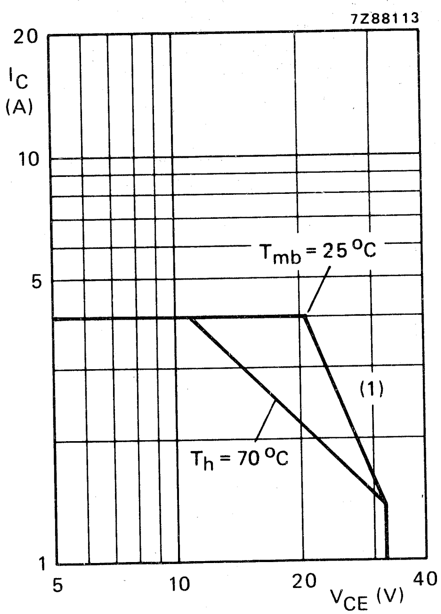
Recommended screw: cheese-head 4-40 UNC/2A

Heatsink compound must be applied sparingly and evenly distributed.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage			
(peak value); $V_{BE} = 0$	V_{CESM}	max.	60 V
open base	V_{CEO}	max.	32 V
Emitter-base voltage (open collector)	V_{EBO}	max.	4 V
Collector current			
d.c. or average	I_C; $I_{C(AV)}$	max.	4 A
(peak value); f > 1 MHz	I_{CM}	max.	12 A
Total power dissipation at $T_{mb} = 25\ ^oC$	P_{tot}	max.	82 W
R.F. power dissipation (f > 1 MHz); $T_{mb} = 25\ ^oC$	P_{rf}	max.	100 W
Storage temperature	T_{stg}	−65 to + 150	°C
Operating junction temperature	T_j	max.	200 °C



(1) Second breakdown limit (independent of temperature).

Fig. 2 D.C. SOAR.

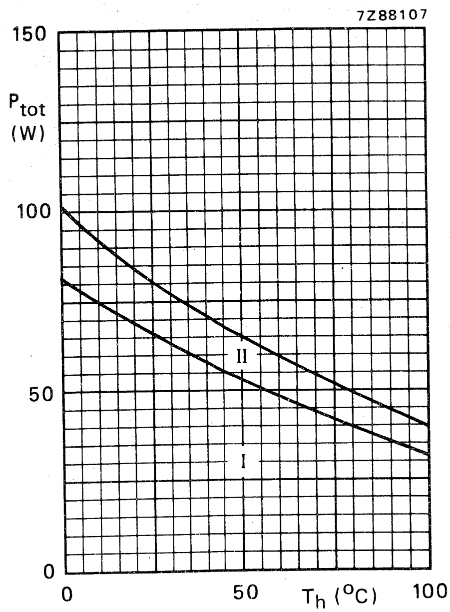


Fig. 3 Power derating curves vs. temperature.
I Continuous d.c. (including r.f. class-A) operation
II Continuous r.f. operation

THERMAL RESISTANCE (dissipation = 40 W; $T_{mb} = 82\ ^oC$, i.e. $T_h = 70\ ^oC$)

From junction to mounting base (d.c. dissipation)	$R_{th\ j\text{-}mb(dc)}$	=	2,66 K/W*
From junction to mounting base (r.f. dissipation)	$R_{th\ j\text{-}mb(rf)}$	=	2,18 K/W*
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,3 K/W*

* K/W is SI unit for °C/W.

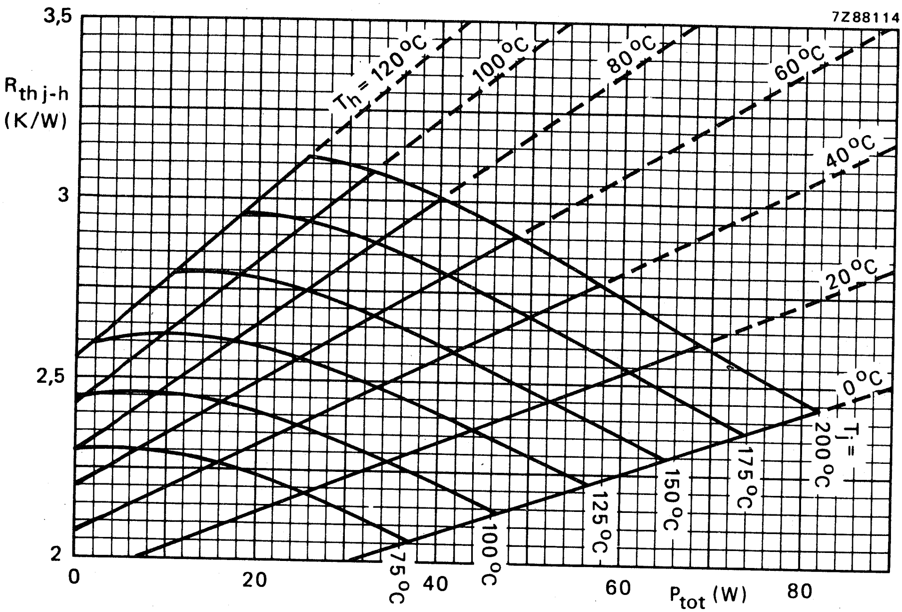


Fig. 4 Maximum thermal resistance from junction to heatsink as a function of power dissipation, with heatsink and junction temperature as parameters. ($R_{th\ mb\text{-}h}$ = 0,3 K/W.)

Example

Nominal class-A operation (without r.f. signal): V_{CE} = 25 V; I_C = 1,6 A; T_h = 70 °C.

Fig. 4 shows: $R_{th\ j\text{-}h}$ max. 2,90 K/W
T_j max. 186 °C

Typical device: $R_{th\ j\text{-}h}$ typ. 2,34 K/W
T_j typ. 164 °C

CHARACTERISTICS

$T_j = 25\ ^oC$

Collector-emitter breakdown voltage			
$V_{BE} = 0$; $I_C = 15$ mA	$V_{(BR)CES}$	>	60 V
open base; $I_C = 100$ mA	$V_{(BR)CEO}$	>	32 V
Emitter-base breakdown voltage			
open collector; $I_E = 10$ mA	$V_{(BR)EBO}$	>	4 V
Collector cut-off current			
$V_{BE} = 0$; $V_{CE} = 32$ V	I_{CES}	<	5 mA
Second breakdown energy; L = 25 mH; f = 50 Hz			
open base	E_{SBO}	>	4,5 mJ
$R_{BE} = 10\ \Omega$	E_{SBR}	>	4,5 mJ
D.C. current gain*			
$I_C = 1{,}6$ A; $V_{CE} = 25$ V	h_{FE}	typ.	50
			20 to 120
Collector-emitter saturation voltage*			
$I_C = 3{,}5$ A; $I_B = 0{,}35$ A	V_{CEsat}	typ.	1,4 V
Transition frequency at f = 500 MHz**			
$-I_E = 1{,}6$ A; $V_{CB} = 25$ V	f_T	typ.	2 GHz
$-I_E = 3{,}5$ A; $V_{CB} = 25$ V	f_T	typ.	2 GHz
Collector capacitance at f = 1 MHz			
$I_E = I_e = 0$; $V_{CB} = 25$ V	C_c	typ.	50 pF
Feedback capacitance at f = 1 MHz			
$I_C = 50$ mA; $V_{CE} = 25$ V	C_{re}	typ.	31 pF
Collector-flange capacitance	C_{cf}	typ.	2 pF

* Measured under pulse conditions: $t_p \leqslant 300\ \mu s$; $\delta \leqslant 0{,}02$.

** Measured under pulse conditions: $t_p \leqslant 50\ \mu s$; $\delta \leqslant 0{,}01$.

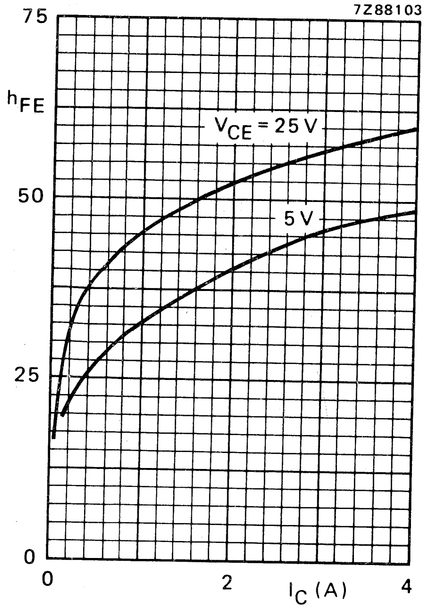


Fig. 5 Typical values; T_j = 25 °C.

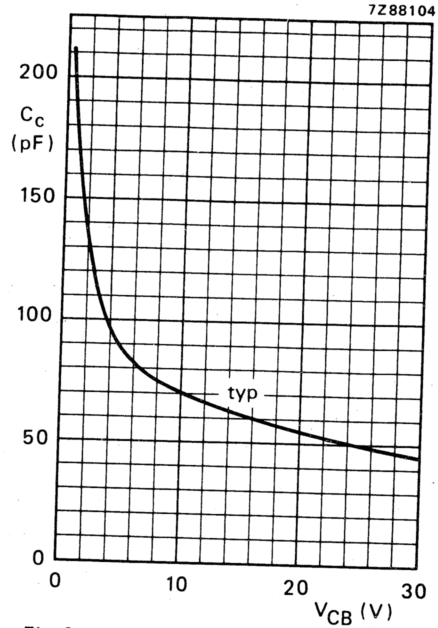


Fig. 6 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

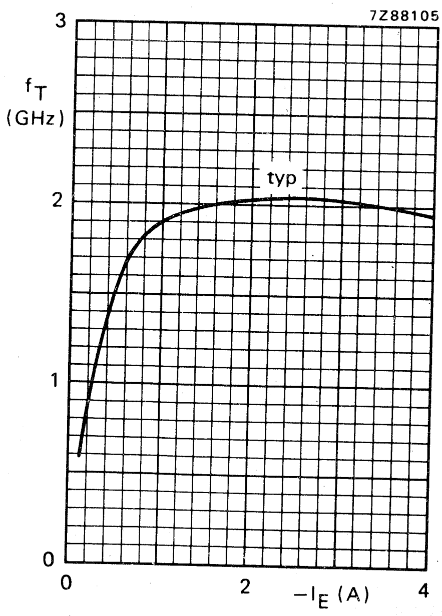


Fig. 7 V_{CB} = 25 V; f = 500 MHz; T_j = 25 °C.

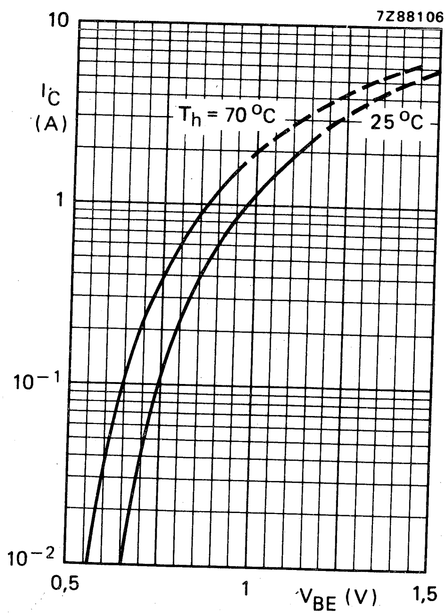


Fig. 8 Typical values; V_{CE} = 25 V.

APPLICATION INFORMATION

R.F. performance in v.h.f. class-A operation (linear power amplifier)

f_{vision} (MHz)	V_{CE} (V)*	I_C (A)	T_h (°C)	d_{im} (dB)**	$P_{o\,sync}$ (W)**	G_p (dB)
224,25	25	1,6	70	−55	> 10	> 16
			70	−55	typ. 11	typ. 16,8
			70	−52	typ. 13	typ. 16,8
			25	−55	typ. 12,5	typ. 17,2

* The transistor is capable of operating up to 28 V.

** Three-tone test method (vision carrier −8 dB, sound carrier −7 dB, sideband signal −16 dB), zero dB corresponds to peak sync level.

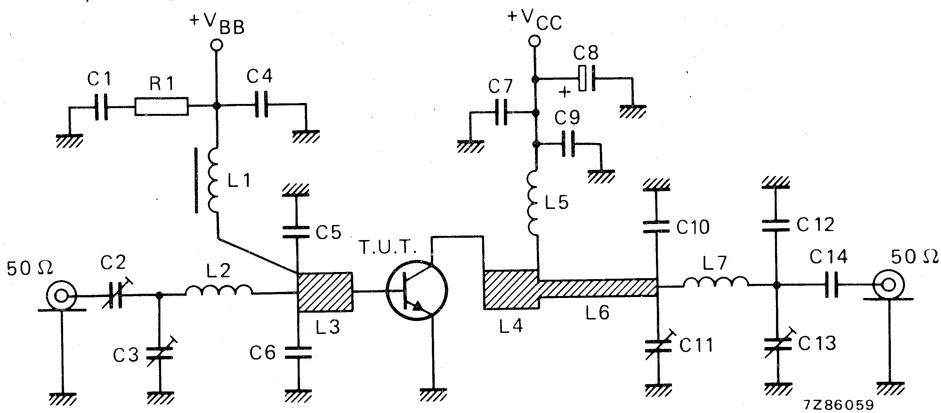


Fig. 9 Class-A test circuit at f_{vision} = 224,25 MHz.

List of components:

C1 = C9 = 330 nF polyester capacitor
C2 = 2 to 18 pF film dielectric trimmer (cat. no. 2222 809 05003)
C3 = C11 = C13 = 2 to 18 pF film dielectric trimmer (cat. no. 2222 809 09003)
C4 = C7 = C14 = 680 pF (50 V) multilayer ceramic chip capacitor (cat. no. 2222 852 13681)
C5 = C6 = 68 pF (500 V) multilayer ceramic chip capacitor (ATC▲)
C8 = 10 μF/63 V solid tantalum capacitor
C10 = 82 pF (500 V) multilayer ceramic chip capacitor (ATC▲)
C12 = 30 pF (500 V) multilayer ceramic chip capacitor (ATC▲)

L1 = 1 μH microchoke (cat. no. 4322 057 01080)
L2 = 3 turns enamelled Cu wire (1,6 mm); int. dia. 4,5 mm; length 14,0 mm; leads 2 x 3 mm
L3 = L4 = 32 Ω stripline (6,0 mm x 10,0 mm)
L5 = 4 turns enamelled Cu wire (1,6 mm); int. dia. 5,5 mm; length 10,0 mm; leads 2 x 2 mm
L6 = 62 Ω stripline (2,0 mm x 22,5 mm)
L7 = 2 turns enamelled Cu wire (1,6 mm); int. dia. 4,5 mm; length 4,0 mm; leads 2 x 3 mm

L3, L4 and L6 are striplines on a double Cu-clad printed-circuit board with epoxy fibre-glass dielectric ($\epsilon_r \approx 4,5$); thickness 1/16″.

R1 = 27 Ω carbon resistor

▲ ATC means American Technical Ceramics.

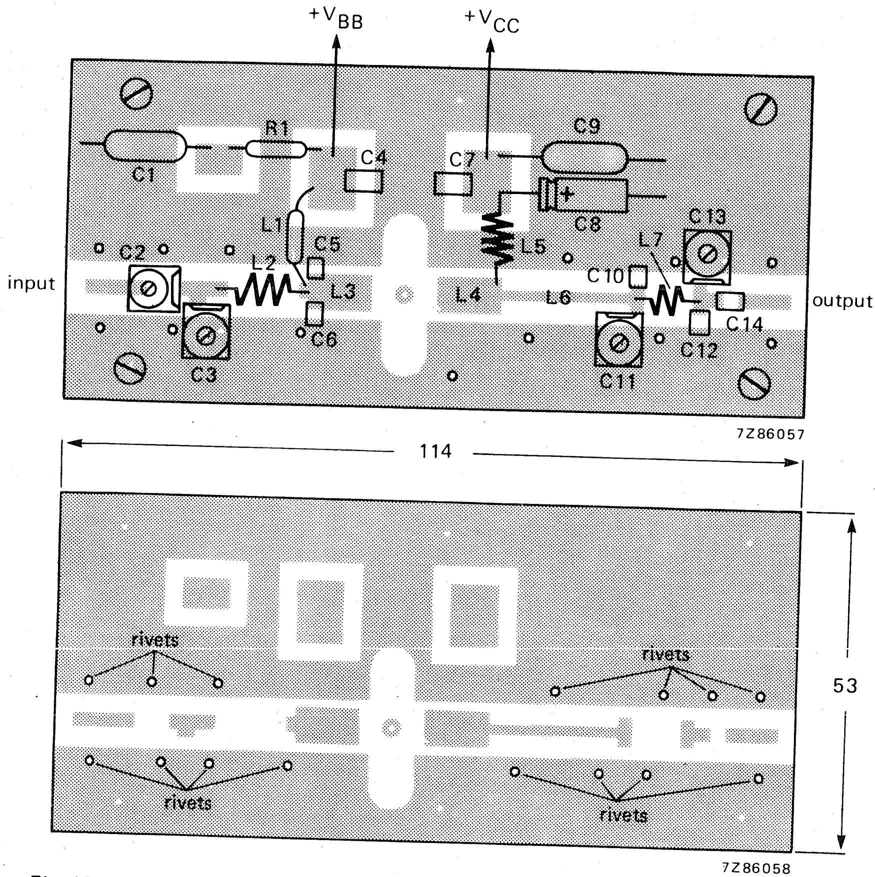


Fig. 10 Component layout and printed-circuit board for 224,25 MHz class-A test circuit.

The circuit and the components are on one side of the epoxy fibre-glass board, the other side is unetched copper to serve as a ground-plane. Earth connections are made by hollow rivets. Additionally copper straps are used under the emitters and at the input and output to provide direct contact between the copper on the component side and the ground-plane.

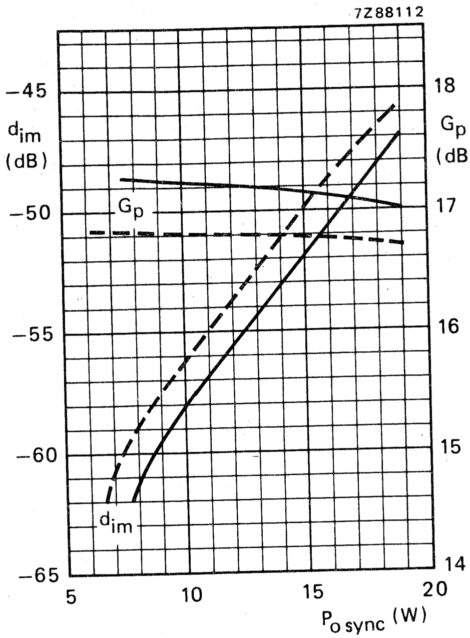


Fig. 11 Intermodulation distortion (d_{im})* and power gain as a function of output power.

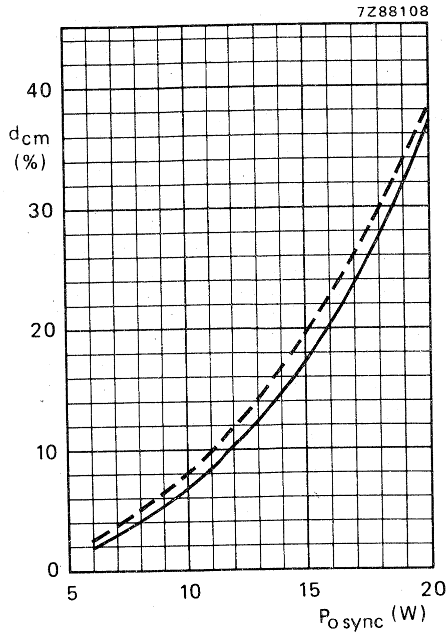


Fig. 12 Cross-modulation distortion (d_{cm})** as a function of output power.

Conditions for Figs 11 and 12:

Typical values; V_{CE} = 25 V; I_C = 1,6 V; ——— T_h = 25 °C; – – – T_h = 70 °C; f_{vision} = 224,25 MHz.

Ruggedness in class-A operation

The BLV32F is capable of withstanding full load mismatch (VSWR = 50 through all phases) up to 15 W (r.m.s. value) or 20 W (P.E.P.) under the following conditions:
V_{CE} = 25 V; I_C = 1,6 A; T_h = 70 °C; f = 224,25 MHz; $R_{th\,mb\text{-}h}$ = 0,3 K/W.

* Three-tone test method (vision carrier −8 dB, sound carrier −7 dB, sideband signal −16 dB), zero dB corresponds to peak sync level.
Intermodulation distortion of input signal ⩽ −70 dB.

** Two-tone test method (vision carrier 0 dB, sound carrier −7 dB), zero dB corresponds to peak sync level.
Cross-modulation distortion (d_{cm}) is the voltage variation (%) of sound carrier when vision carrier is switched from 0 dB to −20 dB.

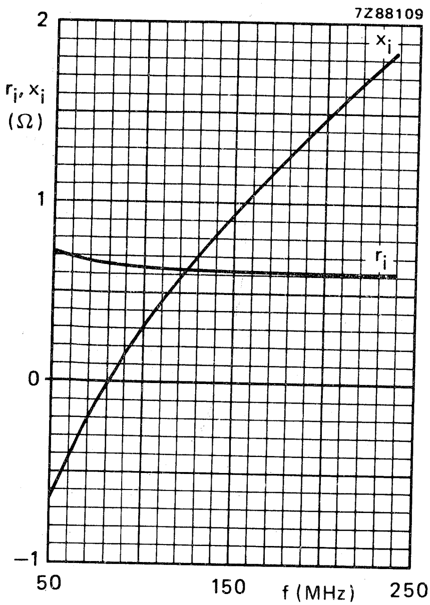


Fig. 13 Input impedance (series components).

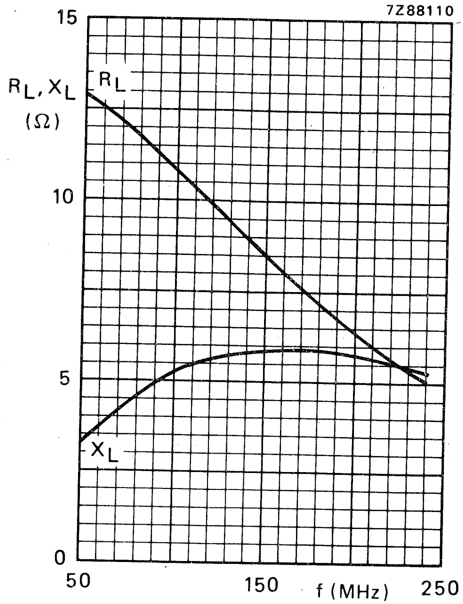


Fig. 14 Load impedance (series components).

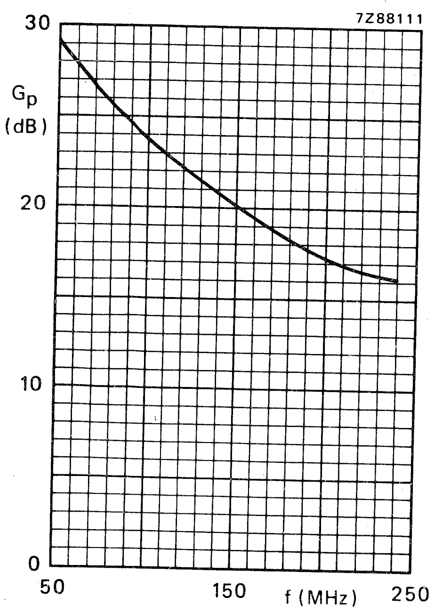


Fig. 15.

Conditions for Figs 13, 14 and 15:

Typical values; V_{CE} = 25 V; I_C = 1,6 A; class-A operation; T_h = 70 °C.

V.H.F. LINEAR POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor primarily intended for use in linear v.h.f. amplifiers for television transmitters and transposers. Diffused emitter ballasting resistors and the application of **gold sandwich metallization** ensure an optimum temperature profile and excellent reliability properties.

The transistor has a ½″ capstan envelope with ceramic cap. All leads are isolated from the stud.

QUICK REFERENCE DATA

R.F. performance in linear amplifier

mode of operation	f_{vision} MHz	V_{CE} V	I_C $I_{C(ZS)}$ A	T_h °C	d_{im}* dB	$P_{o\ sync}$* W	G_p dB	sync compr.** sync in (%)/sync out (%)
class-A	224,25	25	3,20	70	−55	> 19	> 9	
				25	−55	typ. 26	typ. 9,7	
class-AB	224,25	28	0,10	70		typ. 90	typ. 6,5	30/25

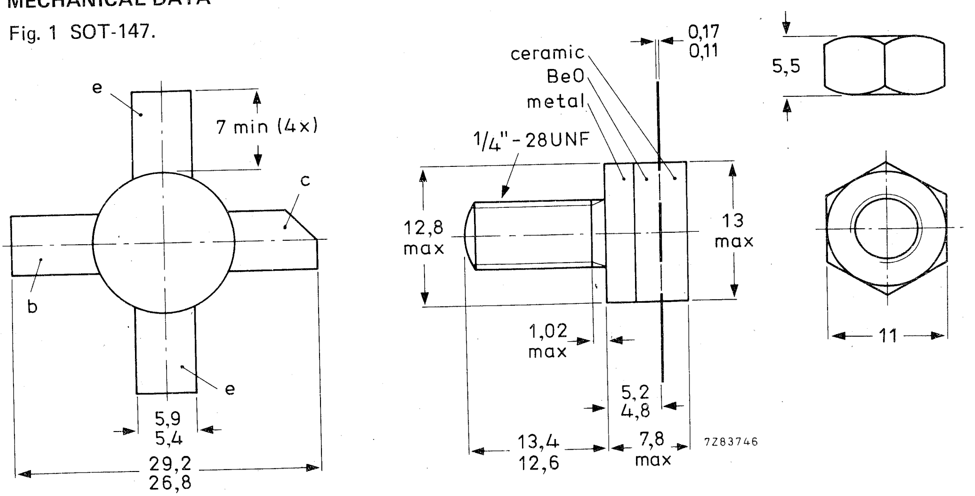
* Three-tone test method (vision carrier −8 dB, sound carrier −7 dB, sideband signal −16 dB), zero dB corresponds to peak sync level.

** Television service (negative modulation, C.C.I.R. system).

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-147.



Torque on nut: min. 2,3 Nm (23 kg cm)
max. 2,7 Nm (27 kg cm)

Diameter of clearance hole in heatsink: max. 6,4 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

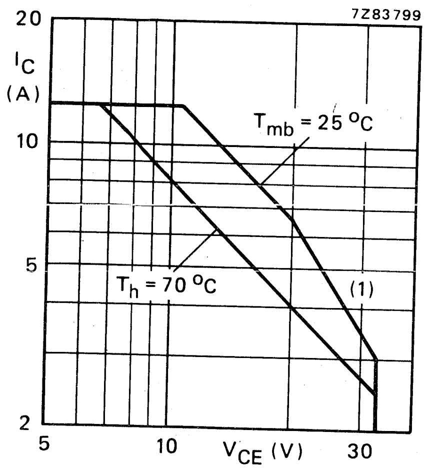
When locking is required an adhesive is preferred instead of a lock washer.

CAUTION This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage (peak value); $V_{BE} = 0$	V_{CESM}	max.	65	V
open base	V_{CEO}	max.	33	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4	V
Collector current d.c. or average	I_C; $I_{C(AV)}$	max.	12,5	A
(peak value); f > 1 MHz	I_{CM}	max.	20	A
Total power dissipation at $T_{mb} = 25\ ^oC$	P_{tot}	max.	132	W
R.F. power dissipation (f > 1 MHz); $T_{mb} = 25\ ^oC$	P_{rf}	max.	165	W
Storage temperature	T_{stg}		−65 to + 150	^oC
Operating junction temperature	T_j	max.	200	^oC



(1) Second breakdown limit (independent of temperature).

Fig. 2 D.C. SOAR.

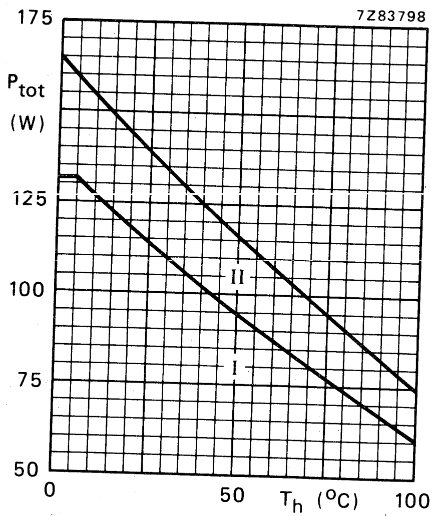


Fig. 3 Power derating curve vs. temperature.

I Continuous d.c. (including r.f. class-A) operation

II Continuous r.f. operation

THERMAL RESISTANCE (dissipation = 80 W; $T_{mb} = 82\ ^oC$, i.e. $T_h = 70\ ^oC$)

From junction to mounting base (d.c. dissipation)	$R_{th\ j\text{-}mb(dc)}$	=	1,46 K/W*
From junction to mounting base (r.f. dissipation)	$R_{th\ j\text{-}mb(rf)}$	=	1,17 K/W*
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,15 K/W*

* K/W is SI unit for $^oC/W$.

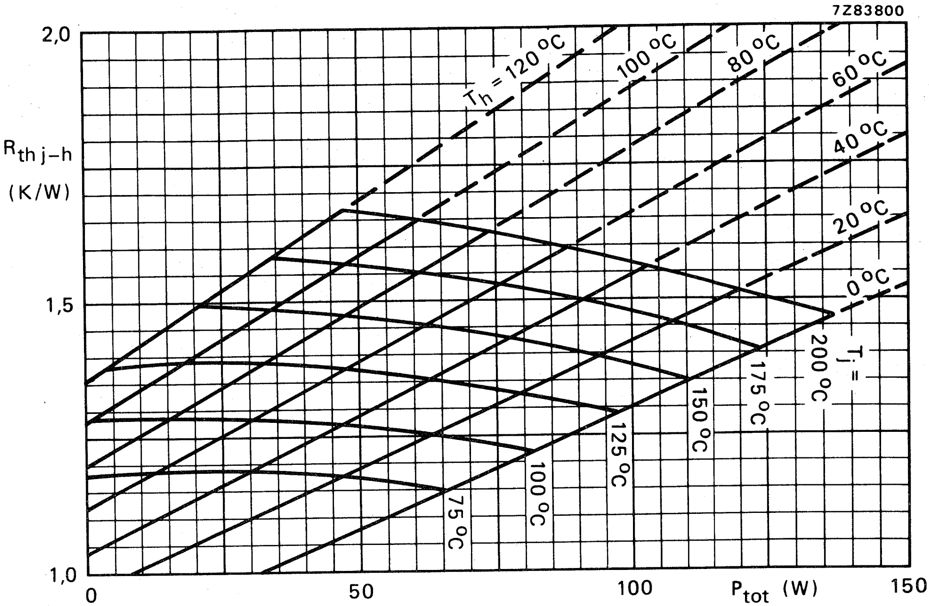


Fig. 4 Maximum thermal resistance from junction to heatsink as a function of power dissipation, with heatsink and junction temperature as parameters. ($R_{th\ mb-h}$ = 0,15 K/W.)

Example

Nominal class-A operation: V_{CE} = 25 V; I_C = 3,2 A; T_h = 70 °C.

Fig. 4 shows:	$R_{th\ j-h}$	max.	1,60 K/W
	T_j	max.	198 °C
Typical device:	$R_{th\ j-h}$	typ.	1,50 K/W
	T_j	typ.	190 °C

CHARACTERISTICS

$T_j = 25\ ^oC$

Collector-emitter breakdown voltage			
$V_{BE} = 0$; $I_C = 25$ mA	$V_{(BR)CES}$	>	65 V
open base; $I_C = 100$ mA	$V_{(BR)CEO}$	>	33 V
Emitter-base breakdown voltage			
open collector; $I_E = 10$ mA	$V_{(BR)EBO}$	>	4 V
Collector cut-off current			
$V_{BE} = 0$; $V_{CE} = 30$ V	I_{CES}	<	10 mA
Second breakdown energy; L = 25 mH; f = 50 Hz			
open base	E_{SBO}	>	12,5 mJ
$R_{BE} = 10\ \Omega$	E_{SBR}	>	12,5 mJ
D.C. current gain*			
$I_C = 3{,}0$ A; $V_{CE} = 25$ V	h_{FE}	typ.	50
			15 to 100
Collector-emitter saturation voltage*			
$I_C = 6{,}0$ A; $I_B = 0{,}6$ A	V_{CEsat}	typ.	0,75 V
Transition frequency at f = 100 MHz**			
$-I_E = 3{,}0$ A; $V_{CB} = 25$ V	f_T	typ.	680 MHz
$-I_E = 6{,}0$ A; $V_{CB} = 25$ V	f_T	typ.	750 MHz
Collector capacitance at f = 1 MHz			
$I_E = I_e = 0$; $V_{CB} = 25$ V	C_c	typ.	155 pF
Feedback capacitance at f = 1 MHz			
$I_C = 100$ mA; $V_{CE} = 25$ V	C_{re}	typ.	88 pF
Collector-stud capacitance	C_{cs}	typ.	3 pF

* Measured under pulse conditions: $t_p \leqslant 300\ \mu s$; $\delta \leqslant 0{,}02$.
** Measured under pulse conditions: $t_p \leqslant 50\ \mu s$; $\delta \leqslant 0{,}01$.

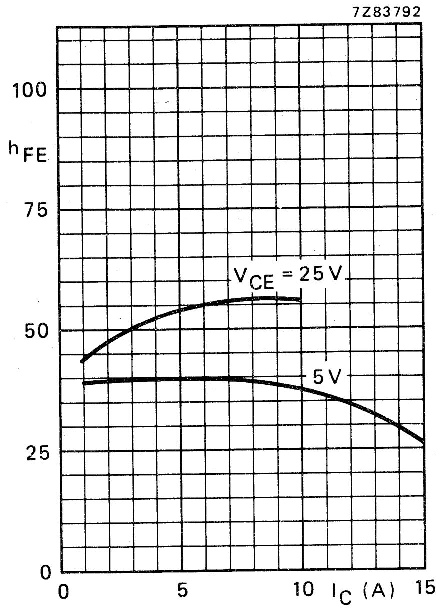


Fig. 5 Typical values; T_j = 25 °C.

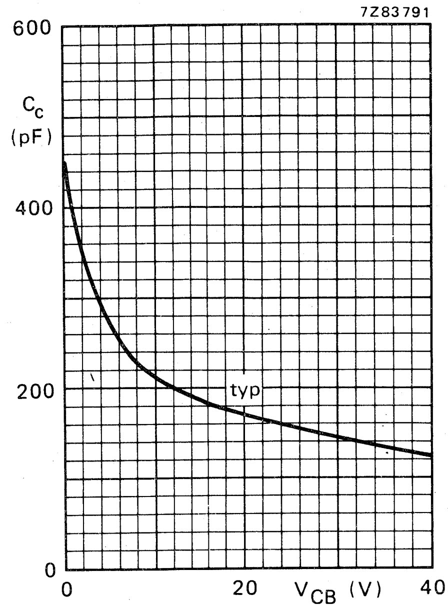


Fig. 6 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

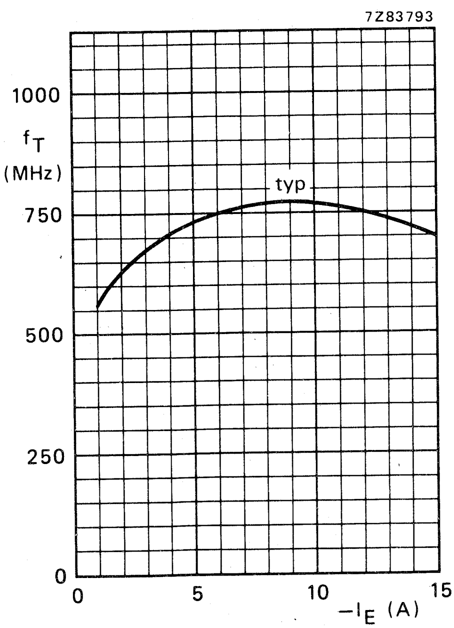


Fig. 7 V_{CB} = 25 V; f = 100 MHz; T_j = 25 °C.

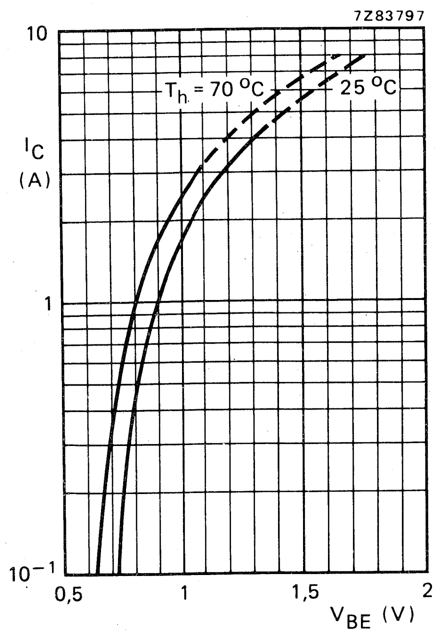


Fig. 8 Typical values; V_{CE} = 25 V.

APPLICATION INFORMATION

R.F. performance in v.h.f. class-A operation (linear power amplifier)

f_{vision} (MHz)	V_{CE} (V)	I_C (A)	T_h (°C)	d_{im} (dB)*	P_o sync (W)*	G_p (dB)
224,25	25	3,2	70	−55	> 19	> 9
			70	−55	typ. 22	typ. 9,3
			70	−52	typ. 26,5	typ. 9,3
			25	−55	typ. 26	typ. 9,7

* Three-tone test method (vision carrier −8 dB, sound carrier −7 dB, sideband signal −16 dB), zero dB corresponds to peak sync level.

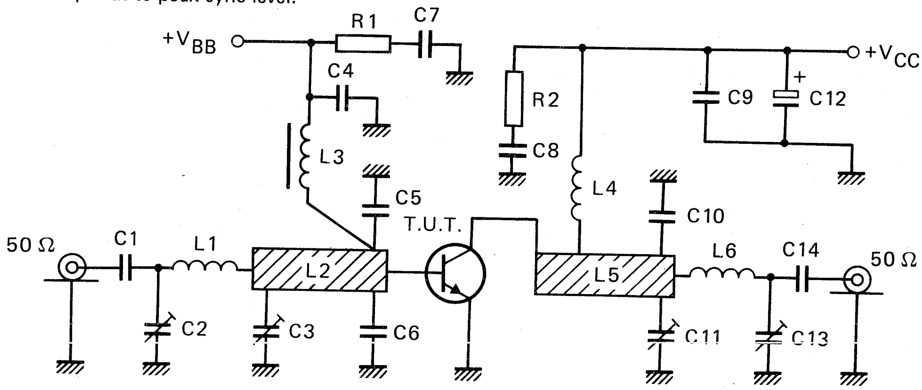


Fig. 9 Class-A test circuit at f_{vision} = 224,25 MHz.

List of components:

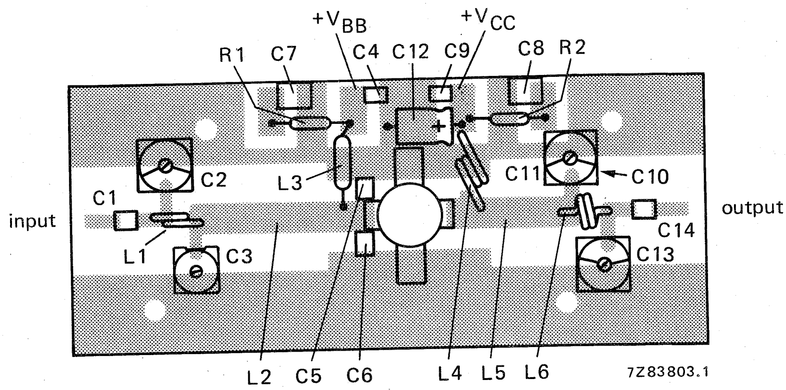
C1 = C14 = 680 pF (500 V) multilayer ceramic chip capacitor (ATC▲)
C2 = C11 = C13 = 4 to 40 pF film dielectric trimmer (cat. no. 2222 809 08002)
C3 = 2 to 18 pF film dielectric trimmer (cat. no. 2222 809 09003)
C4 = C9 = 680 pF (50 V) multilayer ceramic chip capacitor (cat. no. 2222 852 13681)
C5 = C6 = 68 pF (500 V) multilayer ceramic chip capacitor (ATC▲), placed 2 mm from transistor edge
C7 = C8 = 470 nF (50 V) multilayer ceramic chip capacitor (cat. no. 2222 856 48474)
C10 = 24 pF (500 V) multilayer ceramic chip capacitor (ATC▲), positioned under C11
C12 = 10 μF/40 V solid aluminium electrolytic capacitor

L1 = 1½ turns closely wound enamelled Cu wire (1,6 mm); int. dia. 4,5 mm; leads 2 x 3 mm
L2 = 30 Ω stripline (6,0 mm x 32,7 mm)
L3 = 1 μH microchoke (cat. no. 4322 057 01080)
L4 = 27 nH; 2 turns enamelled Cu wire (1,1 mm); int. dia; 4,5 mm; length 2,9 mm; leads 2 x 5 mm
L5 = 30 Ω stripline (6,0 mm x 24,0 mm)
L6 = 19 nH; 2 turns enamelled Cu wire (1,1 mm); int. dia. 3,5 mm; length 3,5 mm; leads 2 x 5 mm

L2 and L5 are striplines on a double Cu-clad printed-circuit board with epoxy fibre-glass dielectric ($\epsilon_r \approx 4,5$); thickness 1/16″.

R1 = R2 = 10 Ω carbon resistor

▲ ATC means American Technical Ceramics.



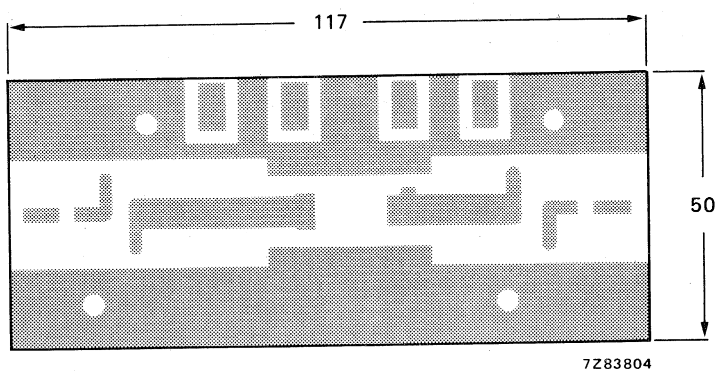


Fig. 10 Component layout and printed-circuit board for 224,25 MHz class-A test circuit.

The circuit and the components are on one side of the epoxy fibre-glass board, the other side is un-etched copper to serve as earth. Earth connections are made by hollow rivets. Additionally copper straps are used under the emitters and at the input and output to provide direct contact between the copper on the component side and the ground-plane.

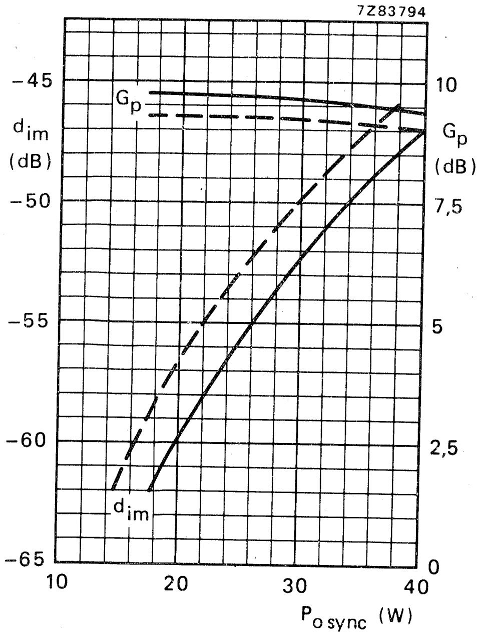


Fig. 11 Intermodulation distortion (d_{im})* and power gain as a function of output power.

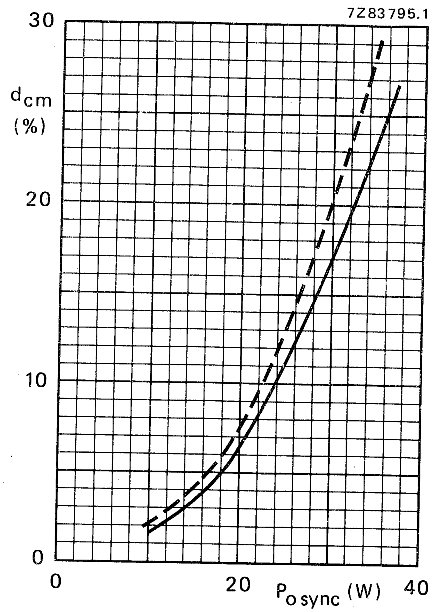


Fig. 12 Cross-modulation distortion (d_{cm})** as a function of output power.

Conditions for Figs 11 and 12:

Typical values; V_{CE} = 25 V; I_C = 3,2 A; ——— T_h = 25 °C; – – – T_h = 70 °C; f_{vision} = 224,25 MHz.

Ruggedness in class-A operation

The BLV33 is capable of withstanding full load mismatch (VSWR = 50 through all phases) up to 30 W (r.m.s. value) or 40 W (P.E.P.) under the following conditions:
V_{CE} = 25 V; I_C = 3,2 A; T_h = 70 °C; f = 224,25 MHz; $R_{th\ mb\text{-}h}$ = 0,15 K/W.

* Three-tone test method (vision carrier −8 dB, sound carrier −7 dB, sideband signal −16 dB), zero dB corresponds to peak sync level.
Intermodulation distortion of input signal ≤ −70 dB.

** Two-tone test method (vision carrier 0 dB, sound carrier −7 dB), zero dB corresponds to peak sync level.
Cross-modulation distortion (d_{cm}) is the voltage variation (%) of sound carrier when vision carrier is switched from 0 dB to −20 dB.

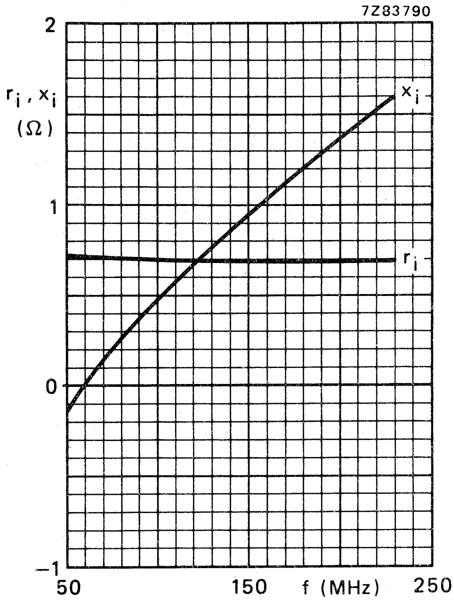


Fig. 13 Input impedance (series components).

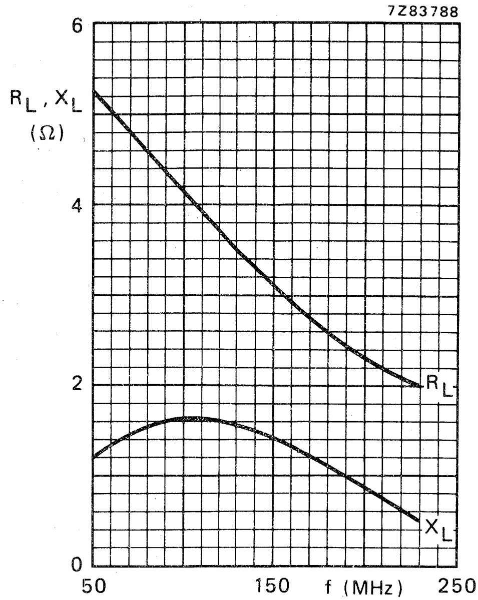


Fig. 14 Load impedance (series components).

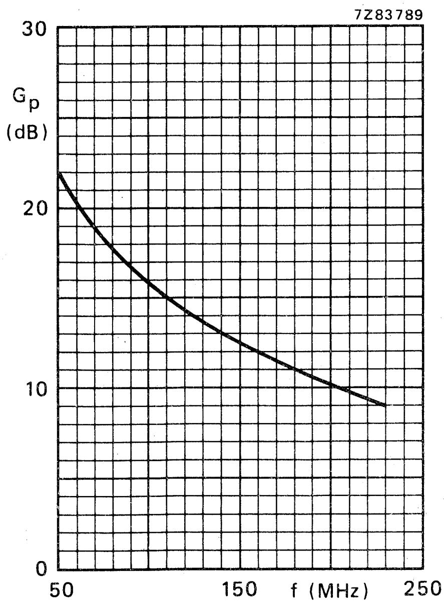


Fig. 15.

Conditions for Figs 13, 14 and 15:

Typical values; V_{CE} = 25 V; I_C = 3,2 A; class-A operation; T_h = 70 °C.

APPLICATION INFORMATION

R.F. performance in v.h.f. class-AB operation (c.w.)

f_{vision} (MHz)	V_{CE} (V)	$I_{C(ZS)}$ (A)	T_h (°C)	P_L (W)	I_C (A)	η (%)	G_p (dB)*
224,25	28	0,1	70	40	typ. 2,60	typ. 55	typ. 7,5
				90	typ. 4,46	typ. 72	typ. 6,5

* Gain compression point of 1 dB is at typical 90 W (minimum 80 W). Using a 3rd-order amplitude transfer characteristic, 1 dB compression corresponds with 30% sync input/25% sync output compression in television service (negative modulation, C.C.I.R. system).

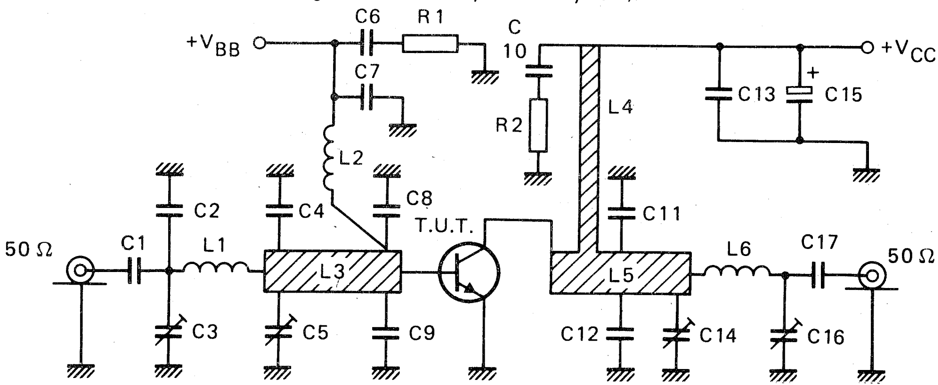


Fig. 16 Class-AB test circuit at f_{vision} = 224,25 MHz. 7Z83802

List of components:

C1 = C17 = 680 pF (500 V) multilayer ceramic chip capacitor (ATC▲)
C2 = 39 pF (500 V) multilayer ceramic chip capacitor (ATC▲)
C3 = C16 = 2 to 18 pF film dielectric trimmer (cat. no. 2222 809 09003)
C4 = 43 pF (500 V) multilayer ceramic chip capacitor (ATC▲)
C5 = 4 to 40 pF film dielectric trimmer (cat. no. 2222 809 08002)
C6 = C10 = 330 nF polyester capacitor
C7 = C13 = 680 pF (50 V) multilayer ceramic chip capacitor (cat. no. 2222 852 13681)
C8 = C9 = 68 pF (500 V) multilayer ceramic chip capacitor (ATC▲); placed 2,5 mm from transistor edge
C11 = C12 = 27 pF (500 V) multilayer ceramic chip capacitor (ATC▲); placed 7 mm from transistor edge
C14 = 5 to 60 pF film dielectric trimmer (cat. no. 2222 809 08003)
C15 = 10 μF/40 V solid aluminium electrolytic capacitor

L1 = 25 nH; 2 turns enamelled Cu wire (1,6 mm); int. dia. 4,3 mm; length 3,4 mm; leads 2 x 5 mm
L2 = 120 nH; 4 turns closely wound enamelled Cu wire (1,1 mm); int. dia. 6,0 mm; leads 2 x 5 mm
L3 = 30 Ω stripline (6,0 mm x 48,8 mm)
L4 = 48 Ω stripline (3,0 mm x 27,0 mm) at 3 mm from transistor edge
L5 = 30 Ω stripline (6,0 mm x 42,9 mm)
L6 = 24 nH; 2 turns enamelled Cu wire (1,6 mm); int. dia. 4,0 mm; length 3,4 mm; leads 2 x 5 mm

L3, L4 and L5 are striplines on a double Cu-clad printed-circuit board with epoxy fibre-glass dielectric ($\epsilon_r \approx 4{,}5$); thickness 1/16″.

R1 = R2 = 10 Ω carbon resistor

▲ ATC means American Technical Ceramics.

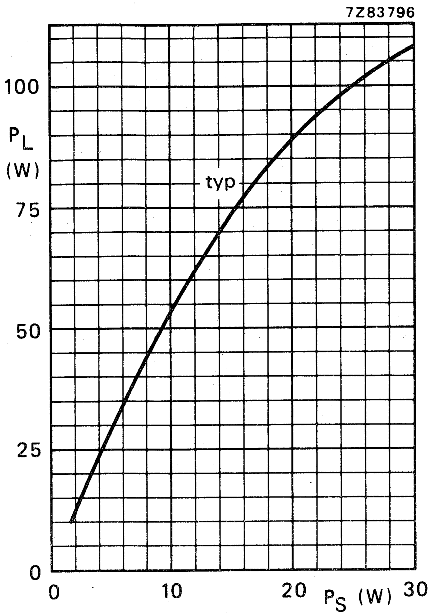


Fig. 17 V_{CE} = 28 V; $I_{C(ZS)}$ = 0,1 A; T_h = 70 ^oC; f_{vision} = 224,25 MHz.

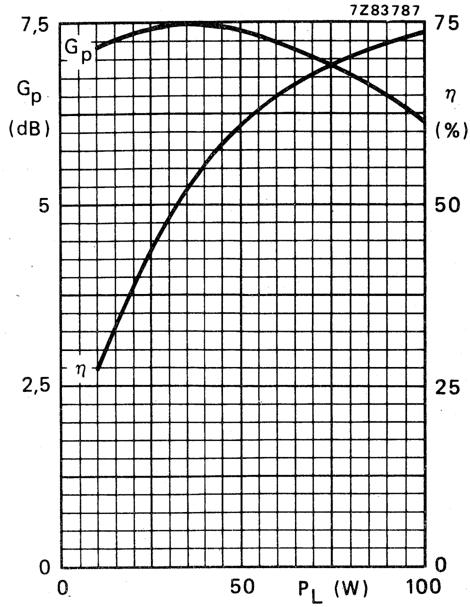


Fig. 18 V_{CE} = 28 V; $I_{C(ZS)}$ = 0,1 A; T_h = 70 ^oC; f_{vision} = 224,25 MHz; typical values.

Ruggedness in class-AB operation

The BLV33 is capable of withstanding a load mismatch (VSWR $\leqslant$ 2 through all phases) up to 60 W (r.m.s. value) and 90 W (P.E.P.) under the following conditions:
V_{CE} = 28 V; T_h = 70 ^oC; f = 224,25 MHz; $R_{th\ mb\text{-}h}$ = 0,15 K/W.

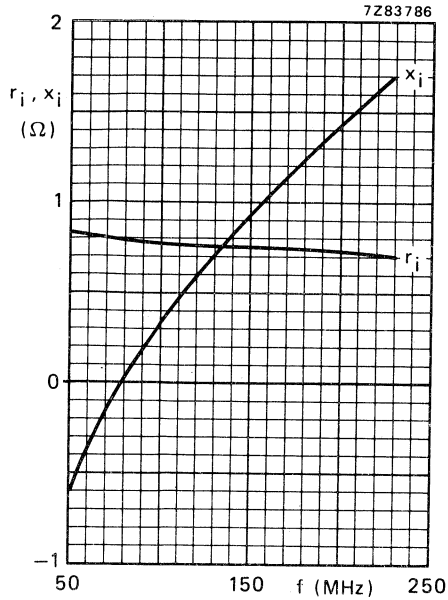


Fig. 19 Input impedance (series components).

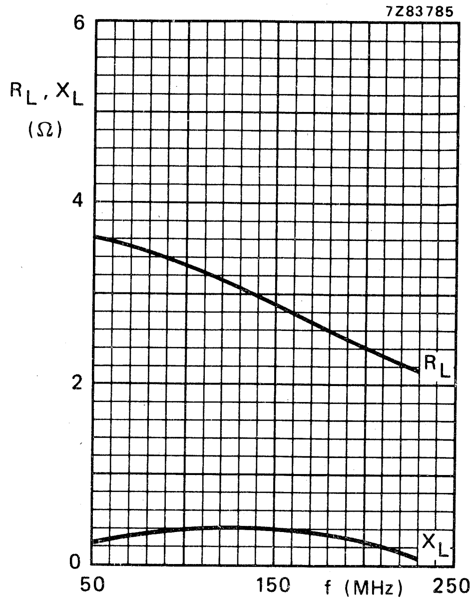


Fig. 20 Load impedance (series components).

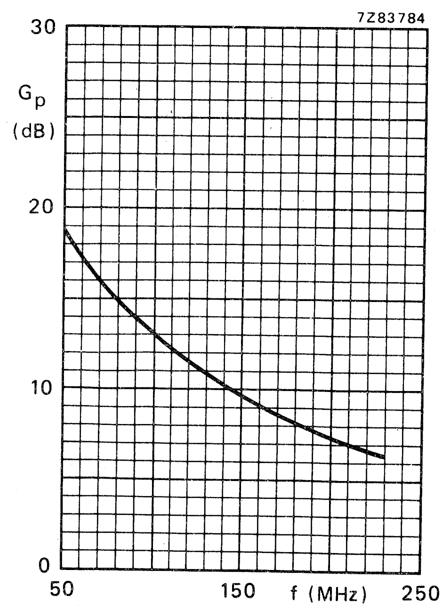


Fig. 21.

Conditions for Figs 19, 20 and 21:

Typical values; V_{CE} = 28 V; P_L = 80 W (P.E.P.); class-AB operation; T_h = 70 °C.

V.H.F. LINEAR POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor primarily intended for use in linear v.h.f. amplifiers for television transmitters and transposers.

Features of this product:
- internally matched input for wideband operation and high power gain;
- diffused emitter ballasting resistors for an optimum temperature profile;
- gold metallization ensures excellent reliability.

The transistor has a ½" 6-lead flange envelope with a ceramic cap. All leads are isolated from the flange.

QUICK REFERENCE DATA

R.F. performance in linear amplifier

mode of operation	f_{vision} MHz	V_{CE} V	I_C $I_{C(ZS)}$ A	T_h °C	d_{im}* dB	$P_{o\ sync}$* W	G_p dB	sync compr.** sync in (%)/sync out (%)
class-A	224,25	25	3,20	70	−55	> 16	> 13,5	
				25	−55	typ. 22	typ. 14,8	
class-AB	224,25	28	0,20	70		typ. 85	typ. 10,5	30/25

* Three-tone test method (vision carrier −8 dB, sound carrier −7 dB, sideband signal −16 dB), zero dB corresponds to peak sync level.

** Television service (negative modulation, C.C.I.R. system).

MECHANICAL DATA

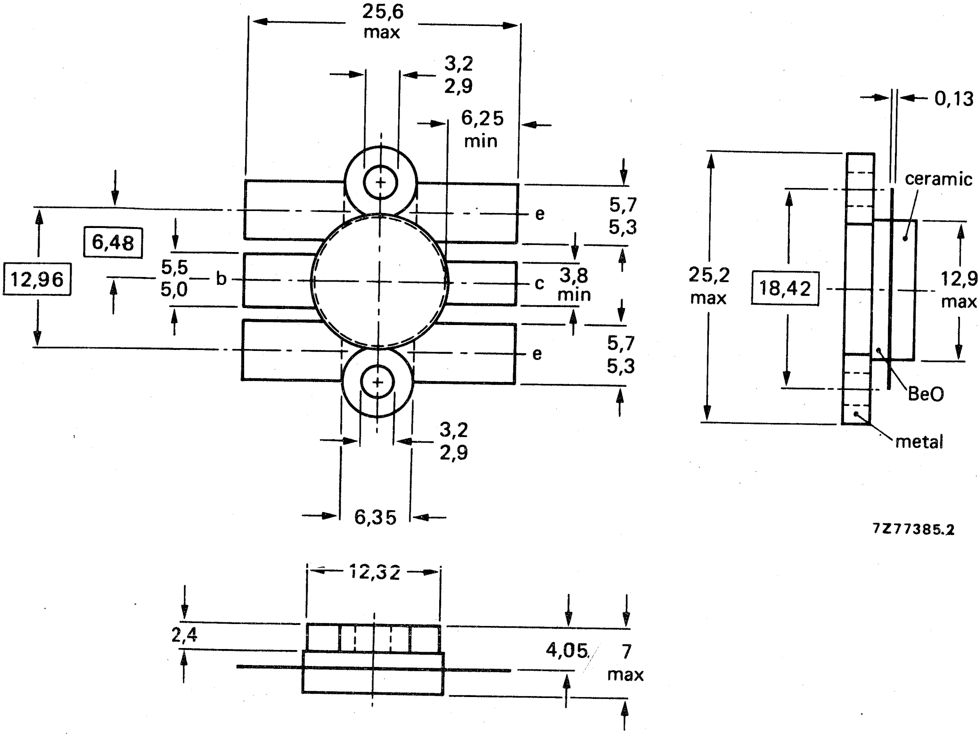
SOT-119 (see Fig. 1).

CAUTION This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-119.



Torque on screw: min. 0,6 Nm (6 kg cm)
max. 0,75 Nm (7,5 kg cm)

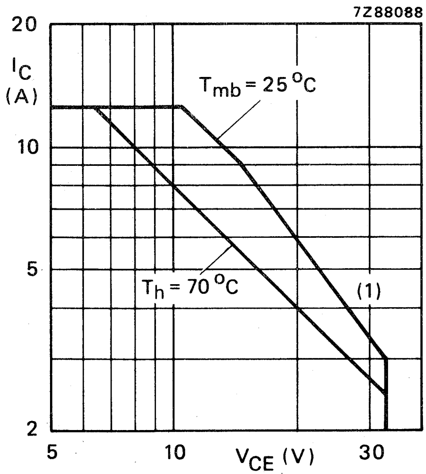
Recommended screw: cheese-head 4-40 UNC/2A

Heatsink compound must be applied sparingly and evenly distributed.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage			
(peak value); $V_{BE} = 0$	V_{CESM}	max.	65 V
open base	V_{CEO}	max.	33 V
Emitter-base voltage (open collector)	V_{EBO}	max.	4 V
Collector current			
d.c. or average	I_C; $I_{C(AV)}$	max.	12,5 A
(peak value); f > 1 MHz	I_{CM}	max.	20 A
Total power dissipation at T_{mb} = 25 °C	P_{tot}	max.	133 W
R.F. power dissipation (f > 1 MHz); T_{mb} = 25 °C	P_{rf}	max.	162 W
Storage temperature	T_{stg}		−65 to + 150 °C
Operating junction temperature	T_j	max.	200 °C



(1) Second breakdown limit (independent of temperature).

Fig. 2 D.C. SOAR.

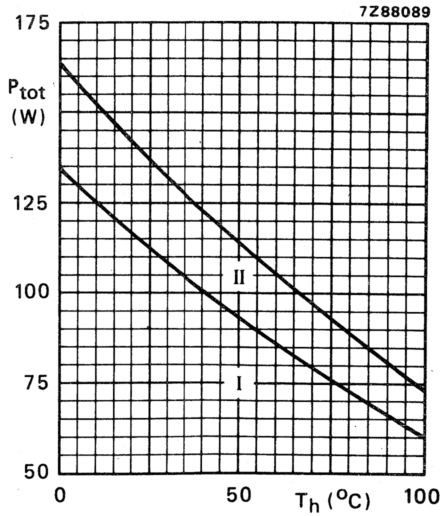


Fig. 3 Power derating curve vs. temperature.

I Continuous d.c. (including r.f. class-A) operation
II Continuous r.f. operation

THERMAL RESISTANCE (dissipation = 80 W; T_{mb} = 86 °C, i.e. T_h = 70 °C)

From junction to mounting base (d.c. dissipation)	$R_{th\ j\text{-}mb(dc)}$	=	1,43 K/W*
From junction to mounting base (r.f. dissipation)	$R_{th\ j\text{-}mb(rf)}$	=	1,17 K/W*
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,2 K/W*

* K/W is SI unit for °C/W.

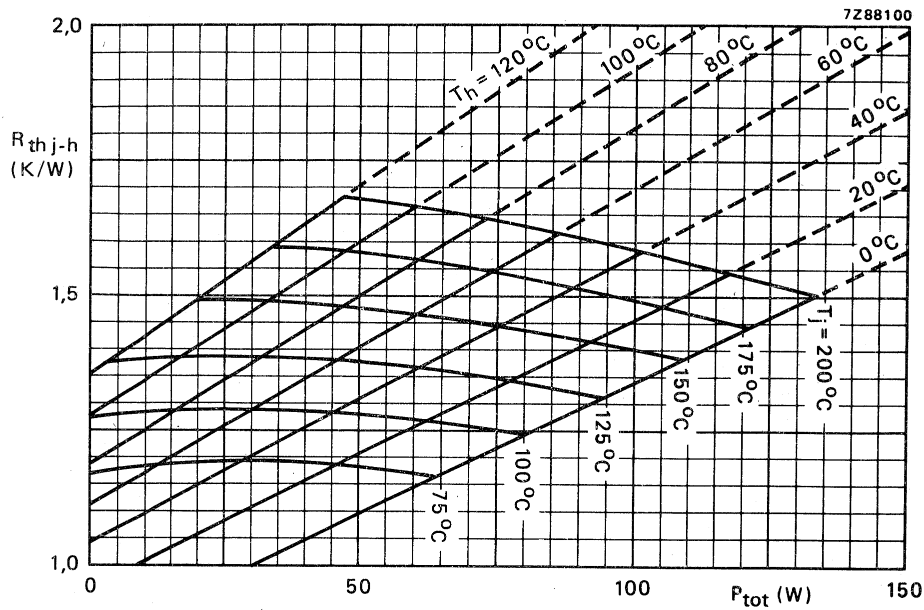


Fig. 4 Maximum thermal resistance from junction to heatsink as a function of power dissipation, with heatsink and junction temperature as parameters. ($R_{th\ mb\text{-}h}$ = 0,2 K/W.)

Example

Nominal class-A operation (without r.f. signal): V_{CE} = 25 V; I_C = 3,2 A; T_h = 70 °C.

Fig. 4 shows:	$R_{th\ j\text{-}h}$	max.	1,63 K/W
	T_j	max.	200 °C
Typical device:	$R_{th\ j\text{-}h}$	typ.	1,53 K/W
	T_j	typ.	192 °C

CHARACTERISTICS

$T_j = 25\ ^oC$

Collector-emitter breakdown voltage			
$V_{BE} = 0$; $I_C = 25$ mA	$V_{(BR)CES}$	>	65 V
open base; $I_C = 100$ mA	$V_{(BR)CEO}$	>	33 V
Emitter-base breakdown voltage			
open collector; $I_E = 10$ mA	$V_{(BR)EBO}$	>	4 V
Collector cut-off current			
$V_{BE} = 0$; $V_{CE} = 30$ V	I_{CES}	<	10 mA
Second breakdown energy; L = 25 mH; f = 50 Hz			
open base	E_{SBO}	>	12,5 mJ
$R_{BE} = 10\ \Omega$	E_{SBR}	>	12,5 mJ
D.C. current gain*			
$I_C = 3,0$ A; $V_{CE} = 25$ V	h_{FE}	typ.	50
			15 to 100
Collector-emitter saturation voltage*			
$I_C = 6,0$ A; $I_B = 0,6$ A	V_{CEsat}	typ.	0,75 V
Transition frequency at f = 100 MHz**			
$-I_E = 3,0$ A; $V_{CB} = 25$ V	f_T	typ.	680 MHz
$-I_E = 6,0$ A; $V_{CB} = 25$ V	f_T	typ.	750 MHz
Collector capacitance at f = 1 MHz			
$I_E = I_e = 0$; $V_{CB} = 25$ V	C_c	typ.	155 pF
Feedback capacitance at f = 1 MHz			
$I_C = 50$ mA; $V_{CE} = 25$ V	C_{re}	typ.	88 pF
Collector-flange capacitance	C_{cf}	typ.	3 pF

* Measured under pulse conditions: $t_p \leqslant 300\ \mu s$; $\delta \leqslant 0,02$.
** Measured under pulse conditions: $t_p \leqslant 50\ \mu s$; $\delta \leqslant 0,01$.

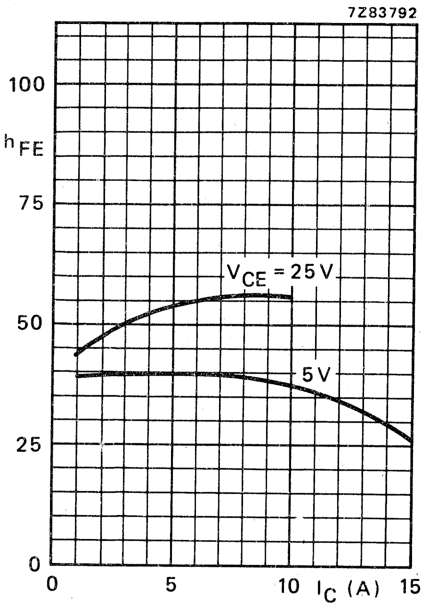


Fig. 5 Typical values; T_j = 25 °C.

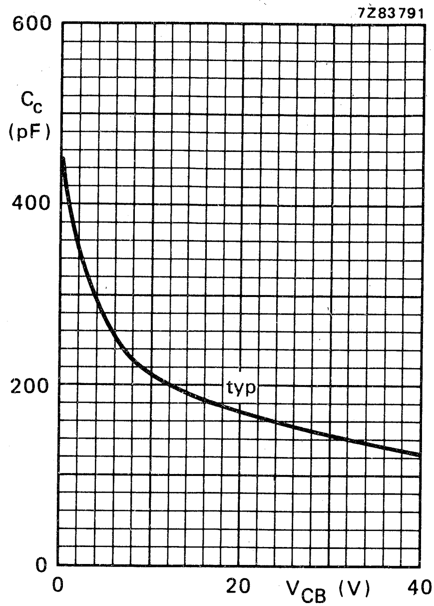


Fig. 6 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

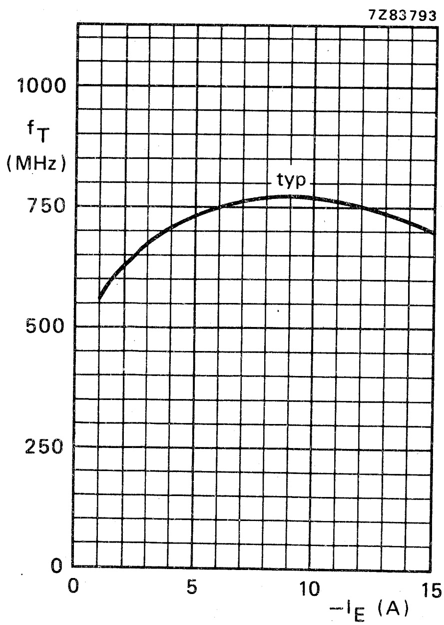


Fig. 7 V_{CB} = 25 V; f = 100 MHz; T_j = 25 °C.

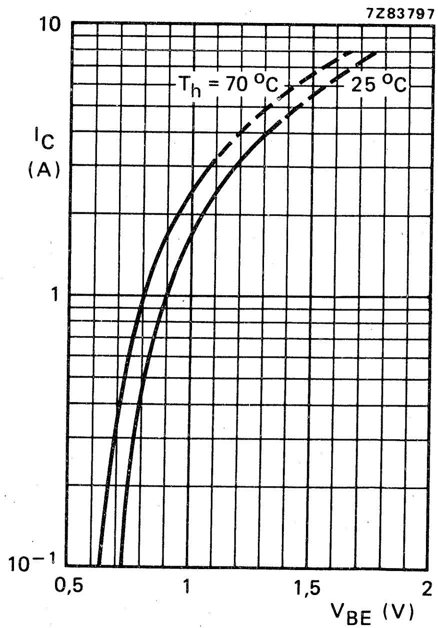


Fig. 8 Typical values; V_{CE} = 25 V.

APPLICATION INFORMATION

R.F. performance in v.h.f. class-A operation (linear power amplifier)

f_{vision} (MHz)	V_{CE} (V)	I_C (A)	T_h (^oC)	d_{im} (dB)*	$P_{o\ sync}$ (W)*	G_p (dB)
224,25	25	3,2	70	−55	> 16	> 13,5
			70	−55	typ. 17,5	typ. 14,5
			70	−52	typ. 22	typ. 14,5
			25	−55	typ. 22	typ. 14,8

* Three-tone test method (vision carrier −8 dB, sound carrier −7 dB, sideband signal −16 dB), zero dB corresponds to peak sync level.

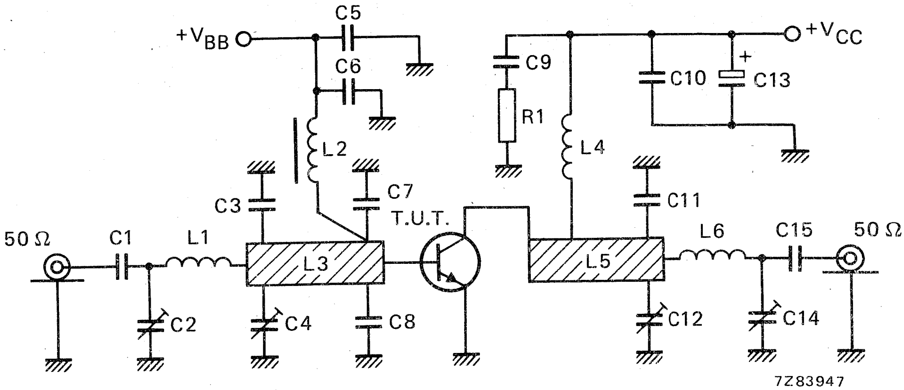


Fig. 9 Class-A test circuit at f_{vision} = 224,25 MHz.

List of components:

C1 = C15 = 560 pF (500 V) multilayer ceramic chip capacitor (ATC▲)
C2 = C4 = C12 = C14 = 4 to 40 pF film dielectric trimmer (cat. no. 2222 809 08002)
C3 = 10 pF (500 V) multilayer ceramic chip capacitor (ATC▲)
C5 = 470 nF (50 V) multilayer ceramic chip capacitor (cat. no. 2222 856 48474)
C6 = C10 = 680 pF (50 V) multilayer ceramic chip capacitor (cat. no. 2222 852 13681)
C7 = C8 = 47 pF (500 V) multilayer ceramic chip capacitor (ATC▲); placed 8 mm from transistor edge
C9 = 330 nF polyester capacitor
C11 = 68 pF (500 V) multilayer ceramic chip capacitor (ATC▲)
C13 = 6,8 μF/35 V solid tantalum capacitor

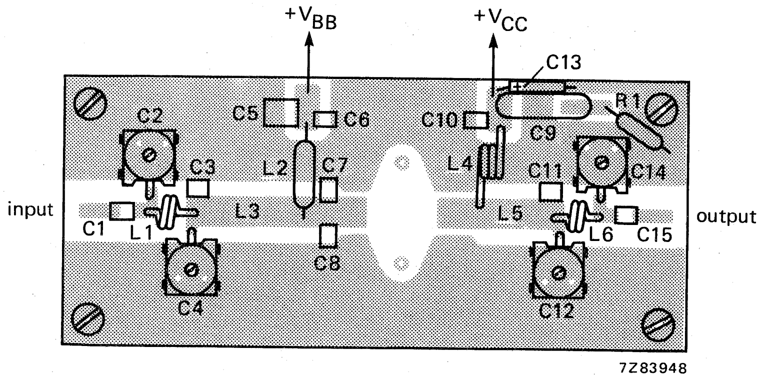
L1 = 2 turns enamelled Cu wire (1,6 mm); int. dia. 5,0 mm; length 5,0 mm; leads 2 x 3 mm
L2 = 1 μH microchoke (cat. no. 4322 057 01080)
L3 = 30 Ω stripline (6,0 mm x 32,7 mm)
L4 = 2 turns closely wound enamelled Cu wire (1,0 mm); int. dia. 5,0 mm; leads 2 x 10 mm
L5 = 30 Ω stripline (6,0 mm x 24,0 mm)
L6 = 2 turns enamelled Cu wire (1,6 mm); int. dia. 4,0 mm; length 4,5 mm; leads 2 x 3 mm

L3 and L5 are striplines on a double Cu-clad printed-circuit board with epoxy fibre-glass dielectric ($\epsilon_r \approx 4,5$); thickness 1/16".

R1 = 10 Ω carbon resistor

Component layout and printed-circuit board for 224,25 MHz class-A test circuit are shown in Fig. 10.

▲ ATC means American Technical Ceramics.



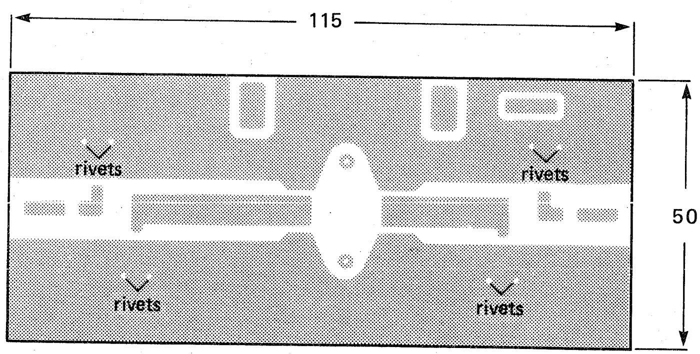


Fig. 10 Component layout and printed-circuit board for 224,25 MHz class-A test circuit.

The circuit and the components are on one side of the epoxy fibre-glass board, the other side is unetched copper to serve as earth. Earth connections are made by hollow rivets. Additionally copper straps are used under the emitters and at the input and output to provide direct contact between the copper on the component side and the ground-plane.

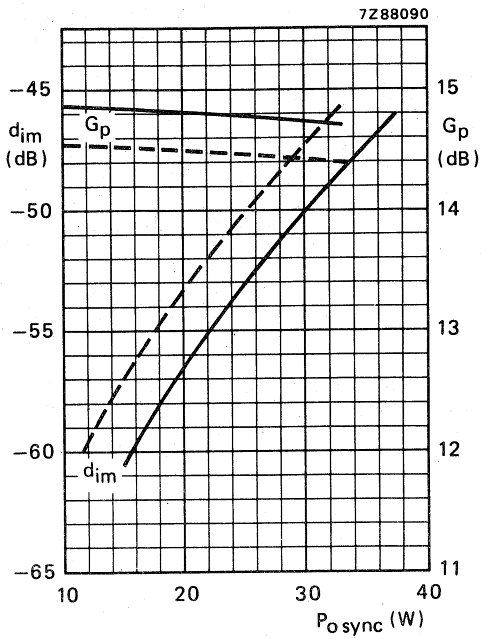


Fig. 11 Intermodulation distortion (d_{im})* and power gain as a function of output power.

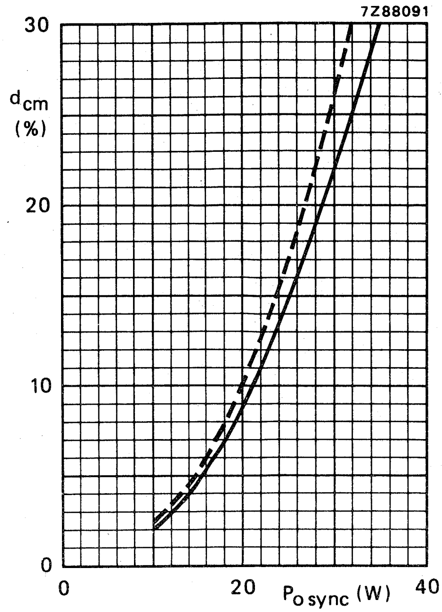


Fig. 12 Cross-modulation distortion (d_{cm})** as a function of output power.

Conditions for Figs 11 and 12:

Typical values; V_{CE} = 25 V; I_C = 3,2 A; —— T_h = 25 °C; – – – T_h = 70 °C; f_{vision} = 224,25 MHz.

Ruggedness in class-A operation

The BLV33F is capable of withstanding full load mismatch (VSWR = 50 through all phases) up to 30 W (r.m.s. value) or 40 W (P.E.P.) under the following conditions:
V_{CE} = 25 V; I_C = 3,2 A; T_h = 70 °C; f = 224,25 MHz; $R_{th\ mb\text{-}h}$ = 0,2 K/W.

* Three-tone test method (vision carrier −8 dB, sound carrier −7 dB, sideband signal −16 dB), zero dB corresponds to peak sync level.
Intermodulation distortion of input signal ⩽ −70 dB.

** Two-tone test method (vision carrier 0 dB, sound carrier −7 dB), zero dB corresponds to peak sync level.
Cross-modulation distortion (d_{cm}) is the voltage variation (%) of sound carrier when vision carrier is switched from 0 dB to −20 dB.

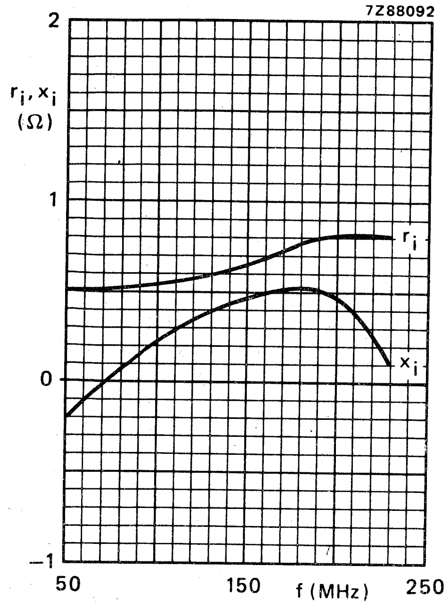


Fig. 13 Input impedance (series components).

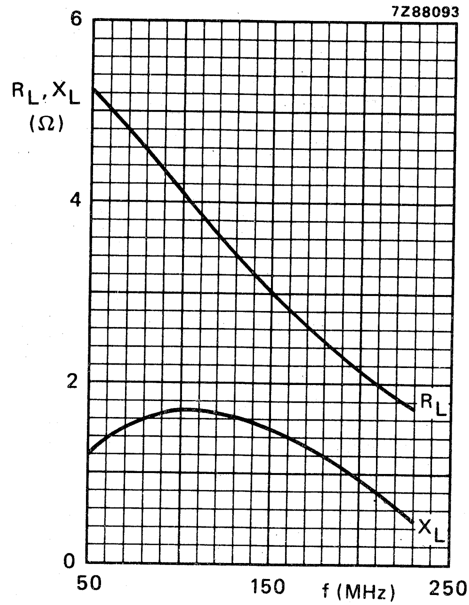


Fig. 14 Load impedance (series components).

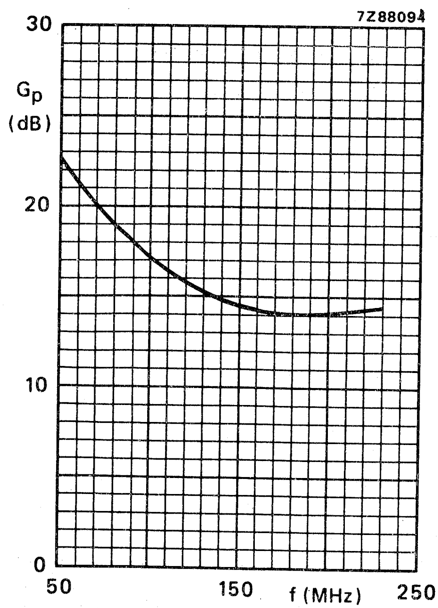


Fig. 15.

Conditions for Figs 13, 14 and 15:

Typical values; V_{CE} = 25 V; I_C = 3,2 A; class-A operation; T_h = 70 °C.

APPLICATION INFORMATION

R.F. performance in v.h.f. class-AB operation (c.w.)

f_{vision} (MHz)	V_{CE} (V)	$I_{C(ZS)}$ (A)	T_h (°C)	P_L (W)	I_C (A)	η (%)	G_p (dB)*
224,25	28	0,2	70	40	typ. 2,75	typ. 52	typ. 11,5
				85	typ. 4,25	typ. 71	typ. 10,5

* Gain compression point of 1 dB is at typical 85 W (minimum 75 W). Using a 3rd-order amplitude transfer characteristic, 1 dB compression corresponds with 30% sync input/25% sync output compression in television service (negative modulation, C.C.I.R. system).

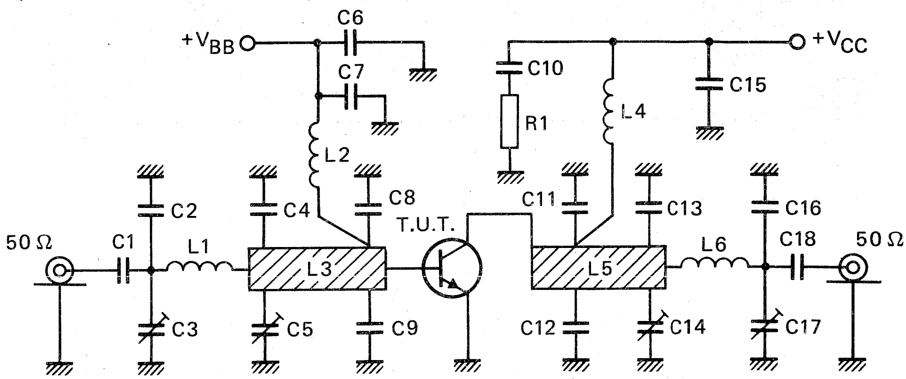


Fig. 16 Class-AB test circuit at f_{vision} = 224,25 MHz. 7Z83946

List of components (component layout and p.c.b. class-AB test circuit see Fig. 17):

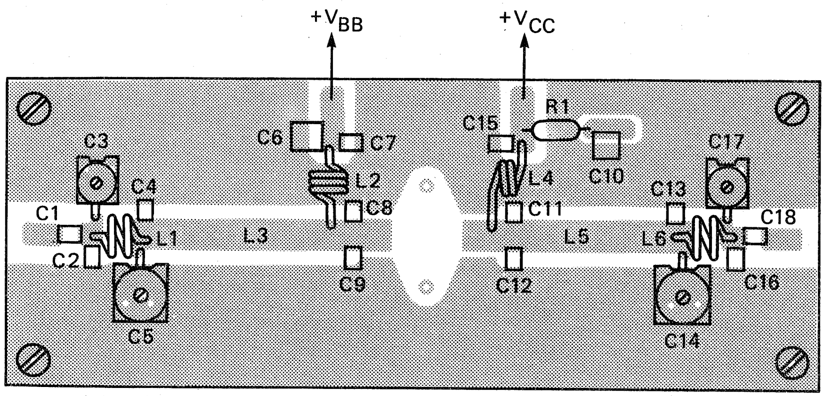
C1 = C18 = 620 pF (100 V) multilayer ceramic chip capacitor (ATC▲)
C2 = 27 pF (500 V) multilayer ceramic chip capacitor (ATC▲)
C3 = 2 to 18 pF film dielectric trimmer (cat. no. 2222 809 09003)
C4 = 30 pF (500 V) multilayer ceramic chip capacitor (ATC▲)
C5 = C14 = 4 to 40 pF film dielectric trimmer (cat. no. 2222 809 08002)
C6 = C10 = 470 nF (50 V) multilayer ceramic chip capacitor (cat. no. 2222 856 48474)
C7 = C15 = 680 pF (50 V) multilayer ceramic chip capacitor (2222 852 13681)
C8 = C9 = 68 pF (500 V) multilayer ceramic chip capacitor (ATC▲); placed 6,4 mm from transistor edge
C11 = C12 = 43 pF (500 V) multilayer ceramic chip capacitor (ATC▲); placed 10 mm from transistor edge
C13 = 39 pF (500 V) multilayer ceramic chip capacitor (ATC▲)
C16 = 3,3 pF (500 V) multilayer ceramic chip capacitor (ATC▲)
C17 = 1,4 to 5,5 pF film dielectric trimmer (cat. no. 2222 809 09001)

L1 = 2 turns enamelled Cu wire (1,6 mm); int. dia. 4,5 mm; length 4,0 mm; leads 2 x 4 mm
L2 = 3 turns closely wound enamelled Cu wire (1,0 mm); int. dia. 5,0 mm; leads 2 x 7 mm
L3 = 30 Ω stripline (6,0 mm x 47,8 mm)
L4 = 2 turns closely wound enamelled Cu wire (1,0 mm); int. dia. 5,0 mm; leads 2 x 8 mm
L5 = 30 Ω stripline (6,0 mm x 42,9 mm)
L6 = 2 turns enamelled Cu wire (1,6 mm); int. dia. 4,0 mm; length 4,0 mm; leads 2 x 3 mm

L3 and L5 are striplines on a double Cu-clad printed-circuit board with epoxy fibre-glass dielectric ($\epsilon_r \approx 4,5$); thickness 1/16".

R1 = 10 Ω carbon resistor

▲ ATC means American Technical Ceramics.



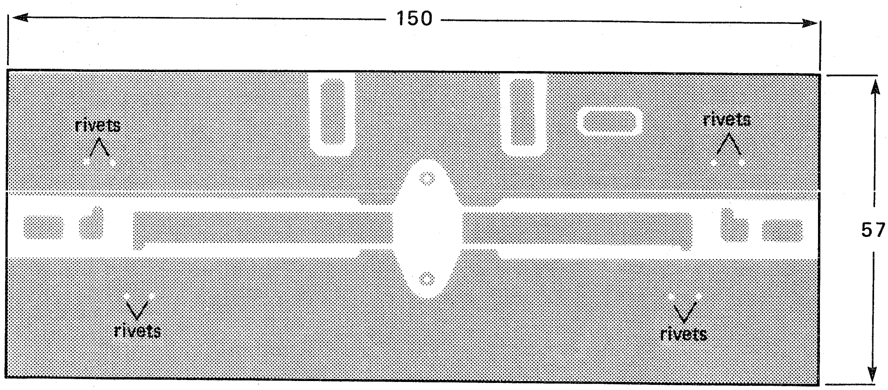


Fig. 17 Component layout and printed-circuit board for 224,25 MHz class-AB test circuit.

The circuit and the components are on one side of the epoxy fibre-glass board, the other side is unetched copper to serve as earth. Earth connections are made by hollow rivets. Additionally copper straps are used under the emitters and at the input and output to provide direct contact between the copper on the component side and the ground-plane.

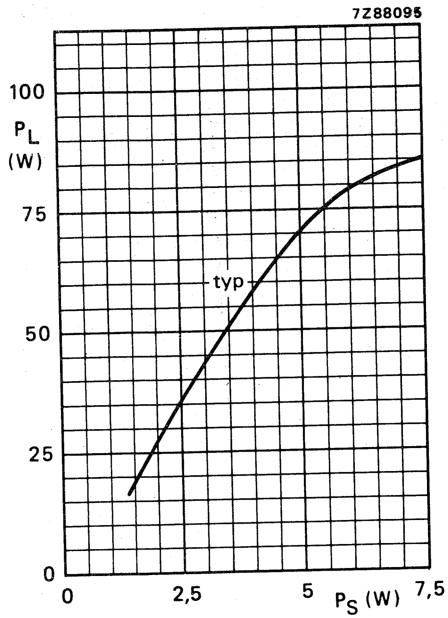


Fig. 18 V_{CE} = 28 V; $I_{C(ZS)}$ = 0,2 A; T_h = 70 °C; f_{vision} = 224,25 MHz.

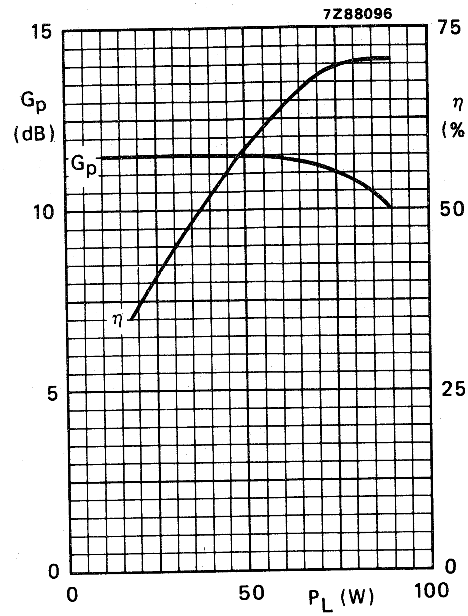


Fig. 19 V_{CE} = 28 V; $I_{C(ZS)}$ = 0,2 A; T_h = 70 °C; f_{vision} = 224,25 MHz; typical values.

Ruggedness in class-AB operation

The BLV33F is capable of withstanding a load mismatch (VSWR ⩽ 2 through all phases) up to 60 W (r.m.s. value) and 85 W (P.E.P.) under the following conditions:
V_{CE} = 28 V; T_h = 70 °C; f = 224,25 MHz; $R_{th\ mb\text{-}h}$ = 0,2 K/W.

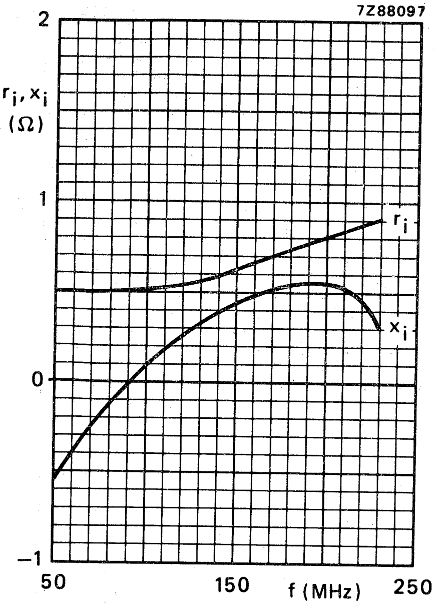


Fig. 20 Input impedance (series components).

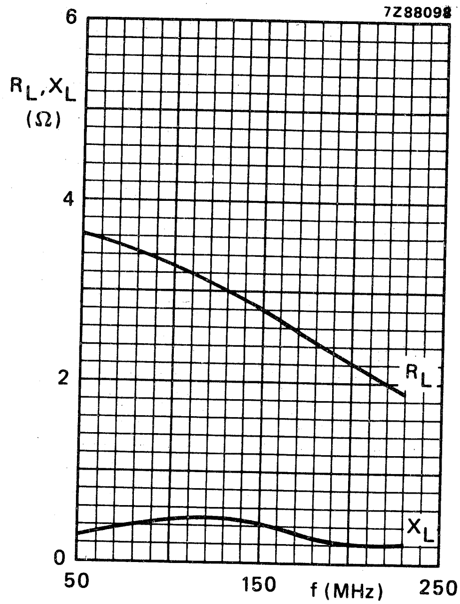


Fig. 21 Load impedance (series components).

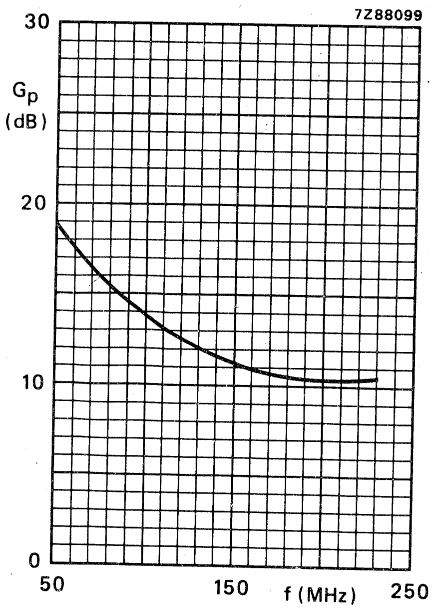


Fig. 22.

Conditions for Figs 20, 21 and 22:

Typical values; V_{CE} = 28 V; P_L = 80 W (P.E.P.); class-AB operation; T_h = 70 °C.

V.H.F. LINEAR PUSH-PULL POWER TRANSISTOR

Two n-p-n silicon planar epitaxial transistor sections in one envelope to be used as push-pull amplifier, primarily intended for use in linear v.h.f. television transmitters and transposers.

Features:

- internally matched input for wideband operation and high power gain;
- internal midpoint (r.f. ground) reduces negative feedback and improves power gain;
- increased input and output impedances (compared with single-ended transistors) simplify wideband matching;
- diffused emitter ballasting resistors for an optimum temperature profile;
- gold metallization ensures excellent reliability.

The envelope is an 8-lead flange type with a ceramic cap. All leads are isolated from the flange.

QUICK REFERENCE DATA

R.F. performance in linear push-pull amplifier

mode of operation	f_{vision} MHz	V_{CE} V	$I_{C(ZS)}$ A	T_h °C	P_L W	$I_{C1} = I_{C2}$ A	η %	G_p dB
class-AB	224,25	28	2 x 0,15	70	70	< 3,1	> 40	> 11
					120	< 3,9	> 55	> 10 *
				25	70	typ. 2,8	typ. 45	typ. 12,5
					140	typ. 3,9	typ. 65	typ. 11,5 *

* Specified values are based on 1 dB gain compression. Assuming a 3rd order amplitude transfer characteristic, 1 dB compression corresponds with 30% sync input/25% sync output compression in television service (negative modulation, C.C.I.R. system).

MECHANICAL DATA

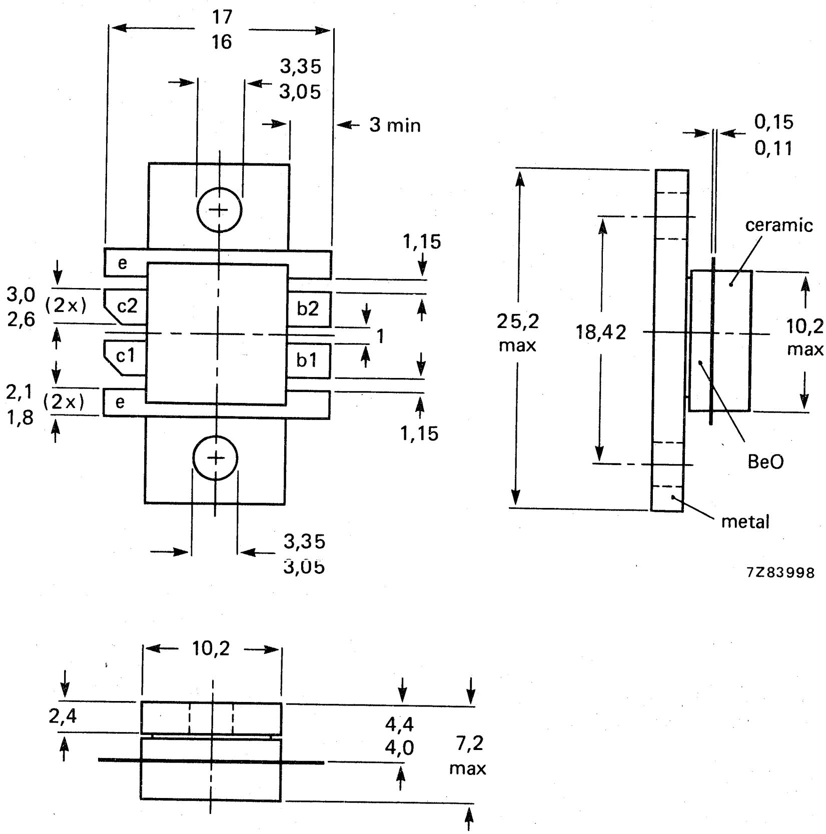
SOT-161 (see Fig. 1).

CAUTION This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

MECHANICAL DATA

Fig. 1 SOT-161

Dimensions in mm



Torque on screw: min. 0,6 Nm (6 kg cm)
max. 0,75 Nm (7,5 kg cm)

Recommended screw: cheese-head 4-40 UNC/2A

Heatsink compound must be applied sparingly and evenly distributed.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage			
(peak value); $V_{BE} = 0$	V_{CESM}	max.	65 V
open base	V_{CEO}	max.	33 V
Emitter-base voltage (open collector)	V_{EBO}	max.	4 V
Collector current per transistor section			
d.c. or average	I_C; $I_{C(AV)}$	max.	10 A
(peak value); f > 1 MHz	I_{CM}	max.	20 A
Total power dissipation at T_{mb} = 25 °C	P_{tot}	max.	285 W*
R.F. power dissipation (f > 1 MHz)			
T_{mb} = 25 °C	P_{rf}	max.	395 W*
T_h = 70 °C	P_{rf}	max.	148 W*
Storage temperature	T_{stg}		–65 to + 150 °C
Operating junction temperature	T_j	max.	200 °C

THERMAL RESISTANCE (dissipation = 100 W; T_{mb} = 95 °C, i.e. T_h = 70 °C)

From junction to mounting base (d.c. dissipation)	$R_{th\ j\text{-}mb(dc)}$	=	0,80 K/W**
From junction to mounting base (r.f. dissipation)	$R_{th\ j\text{-}mb(rf)}$	=	0,56 K/W**
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,25 K/W**

DEVELOPMENT SAMPLE DATA

* Dissipation of either transistor section should not exceed half rated dissipation.
** K/W is SI unit for °C/W.

CHARACTERISTICS apply to either transistor section unless otherwise specified

$T_j = 25\ ^oC$

Collector-emitter breakdown voltage			
$V_{BE} = 0$; $I_C = 25$ mA	$V_{(BR)CES}$	>	65 V
open base; $I_C = 100$ mA	$V_{(BR)CEO}$	>	33 V
Emitter-base breakdown voltage			
open collector; $I_E = 10$ mA	$V_{(BR)EBO}$	>	4 V
Collector cut-off current			
$V_{BE} = 0$; $V_{CE} = 33$ V	I_{CES}	<	10 mA
Second breakdown energy; L = 25 mH; f = 50 Hz			
open base	E_{SBO}	>	12,5 mJ
$R_{BE} = 10\ \Omega$	E_{SBR}	>	12,5 mJ
D.C. current gain*			
$I_C = 4$ A; $V_{CE} = 25$ V	h_{FE}	typ.	50
			15 to 100
D.C. current gain ratio of transistor sections			
$I_C = 4$ A; $V_{CE} = 25$ V			0,67 to 1,5
Collector-emitter saturation voltage*			
$I_C = 12$ A; $I_B = 2,4$ A	V_{CEsat}	typ.	1,7 V
Transition frequency at f = 100 MHz**			
$-I_E = 4$ A; $V_{CB} = 25$ V	f_T	typ.	750 MHz
$-I_E = 12$ A; $V_{CB} = 25$ V	f_T	typ.	750 MHz
Collector capacitance at f = 1 MHz			
$I_E = i_e = 0$; $V_{CB} = 25$ V	C_c	typ.	155 pF
Feedback capacitance at f = 1 MHz			
$I_C = 50$ mA; $V_{CE} = 25$ V	C_{re}	typ.	88 pF
Collector-flange capacitance	C_{cf}	typ.	2 pF

* Measured under pulse conditions: $t_p \leqslant 300\ \mu s$; $\delta \leqslant 0,02$.
** Measured under pulse conditions: $t_p \leqslant 50\ \mu s$; $\delta \leqslant 0,01$.

APPLICATION INFORMATION

R.F. performance in v.h.f. class-AB operation (c.w.)

f_{vision} (MHz)	V_{CE} (V)	$I_{C(ZS)}$ (A)	T_h (°C)	P_L (W)	$I_{C1} = I_{C2}$ (A)	η (%)	G_p (dB)
224,25	28	2 x 0,15	70	70	< 3,1	> 40	> 11
				120	< 3,9	> 55	> 10 *
			25	70	typ. 2,8	typ. 45	typ. 12,5
				140	typ. 3,9	typ. 65	typ. 11,5 *

* Specified values are based on 1 dB gain compression. Assuming a 3rd order amplitude transfer characteristic, 1 dB compression corresponds with 30% sync input/25% sync output compression in television service (negative modulation, C.C.I.R. system).

DEVELOPMENT SAMPLE DATA

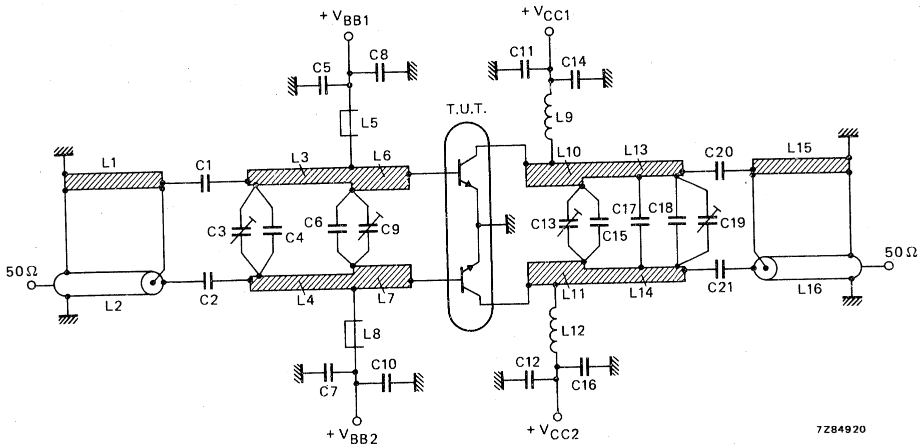


Fig. 2 Class-AB test circuit at f_{vision} = 225 MHz.

List of components:

C1 = C2 = C20 = C21 = 68 pF (500 V) multilayer ceramic chip capacitor (ATC▲)
C3 = C9 = C13 = C19 = 4 to 40 pF film dielectric trimmer (cat. no. 2222 809 08002)
C4 = 33 pF (500 V) multilayer ceramic chip capacitor (ATC▲)
C5 = C7 = C14 = C16 = 100 nF multilayer ceramic chip capacitor (cat. no. 2222 855 48104)
C6 = 2 x 47 pF (500 V) multilayer ceramic chip capacitors (ATC▲) in parallel
C8 = C10 = C11 = C12 = 470 pF multilayer ceramic chip capacitor (cat. no. 2222 852 13471)
C15 = 3 x 24 pF (500 V) multilayer ceramic chip capacitors (ATC▲) in parallel
C17 = 2 x 16 pF (500 V) multilayer ceramic chip capacitors (ATC▲) in parallel, placed 27 mm from transistor edge
C18 = 5,6 pF (500 V) multilayer ceramic chip capacitor (ATC▲)

▲ATC means American Technical Ceramics.

List of components (continued):

L1 = L15 = 50 Ω stripline (2,8 mm x 91,3 mm)
L2 = L16 = 50 Ω semi-rigid cable; outer diameter 2,2 mm; outer conductor length 91,3 mm.
These cables are soldered on 50 Ω striplines (2,8 mm x 91,3 mm).
L3 = L4 = L13 = L14 = 60 Ω stripline (2,0 mm x 27,9 mm)
L5 = L8 = Ferroxcube wide-band h.f. choke, grade 3 B (cat. no. 4312 020 36640)
L6 = L7 = L10 =L11 = 48 Ω stripline (3,0 mm x 14,6 mm)
L9 = L12 = 20,5 nH; 2 turns enamelled Cu wire (1,0 mm); int. dia. 4,5 mm; length 3 mm; leads 2 x 10 mm; connected at 3 mm from transistor edge

L1, L3, L4, L6, L7, L10, L11, L13, L14 and L15 are striplines on a double Cu-clad printed-circuit board with epoxy fibre-glass dielectric ($\epsilon_r \approx 4,5$); thickness 1/16".

U.H.F. LINEAR PUSH-PULL POWER TRANSISTOR

Two n-p-n silicon planar epitaxial transistor sections in one envelope to be used as push-pull amplifier, primarily intended for use in linear u.h.f. television transmitters and transposers.

Features:

- internally matched input for wideband operation and high power gain;
- internal midpoint (r.f. ground) reduces negative feedback and improves power gain;
- increased input and output impedances (compared with single-ended transistors) simplify wideband matching;
- length of the external emitter leads is not critical;
- diffused emitter ballasting resistors for an optimum temperature profile;
- gold metallization ensures excellent reliability.

The envelope is an 8-lead flange type with a ceramic cap. All leads are isolated from the flange.

QUICK REFERENCE DATA

R.F. performance in linear amplifier

mode of operation	f_{vision} MHz	V_{CE} V	$I_{C1} = I_{C2}$ A	$I_{C(ZS)}$ A	T_h °C	d_{im}* dB	$P_{o\ sync}$* W	P_L W	G_p dB
class-A	860	25	0,85	–	70 25	−60 −55	> 6 typ. 12	–	> 8,0 typ. 9,0
class-AB	860	25	1,25	2 x 0,1	25	–	–	typ. 38**	typ. 6,5**

* Three-tone test method (vision carrier −8 dB, sound carrier −7 dB, sideband signal −16 dB), zero dB corresponds to peak sync level.

** Power gain compression is 1 dB.

MECHANICAL DATA

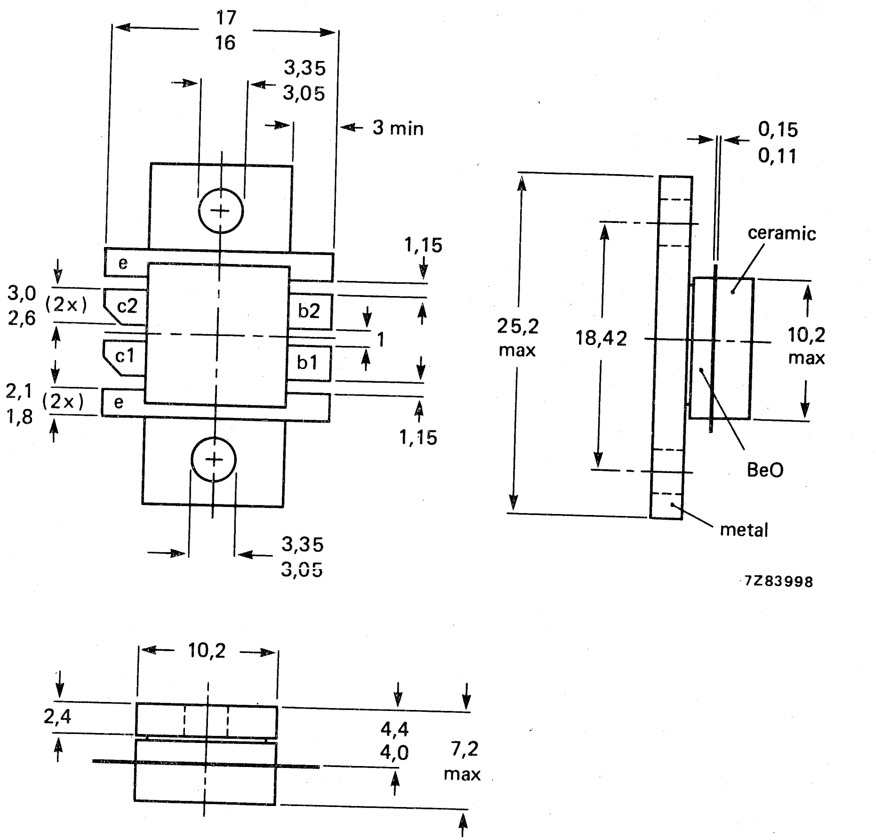
SOT-161 (see Fig. 1).

CAUTION This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

MECHANICAL DATA

Fig. 1 SOT-161.

Dimensions in mm



Torque on screw: min. 0,6 Nm (6 kg cm)
max. 0,75 Nm (7,5 kg cm)

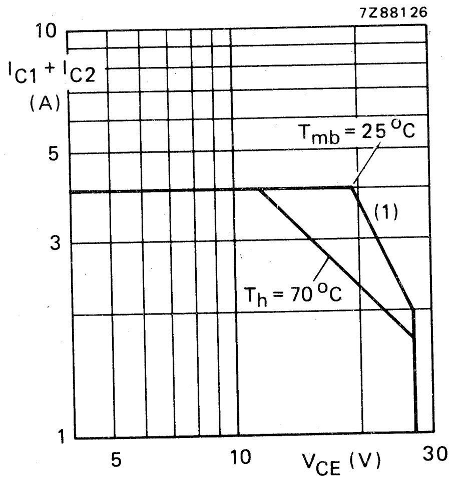
Recommended screw: cheese-head 4-40 UNC/2A

Heatsink compound must be applied sparingly and evenly distributed.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage (peak value); $V_{BE} = 0$	V_{CESM}	max.	50 V
open base	V_{CEO}	max.	27 V
Emitter-base voltage (open collector)	V_{EBO}	max.	3,5 V
Collector current per transistor section d.c. or average	I_C; $I_{C(AV)}$	max.	2 A
(peak value); f > 1 MHz	I_{CM}	max.	4 A
Total power dissipation at $T_{mb} = 25\ ^oC$	P_{tot}	max.	77 W*
R.F. power dissipation (f > 1 MHz); $T_{mb} = 25\ ^oC$	P_{rf}	max.	93 W*
Storage temperature	T_{stg}		−65 to + 150 °C
Operating junction temperature	T_j	max.	200 °C



(1) Second breakdown limit (independent of temperature).

Fig. 2 D.C. SOAR.*

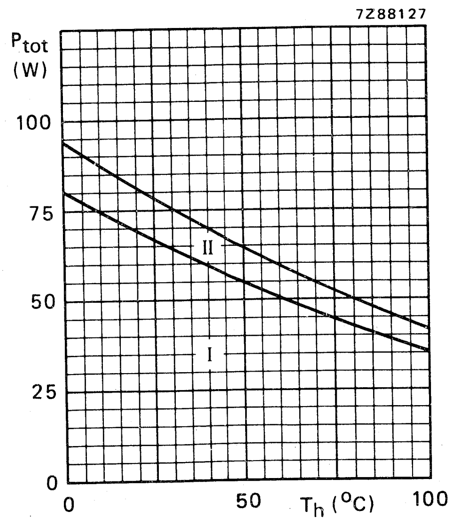


Fig. 3 Power derating curves vs. temperature.*

I Continuous d.c. (including r.f. class-A) operation

II Continuous r.f. operation

THERMAL RESISTANCE (dissipation = 42 W; $T_{mb} = 80,5\ ^oC$, i.e. $T_h = 70\ ^oC$)

From junction to mounting base (d.c. dissipation)	$R_{th\ j-mb(dc)}$	=	2,43 K/W**
From junction to mounting base (r.f. dissipation)	$R_{th\ j-mb(rf)}$	=	1,91 K/W**
From mounting base to heatsink	$R_{th\ mb-h}$	=	0,25 K/W**

* Dissipation of either transistor section should not exceed half rated dissipation.

** K/W is SI unit for °C/W.

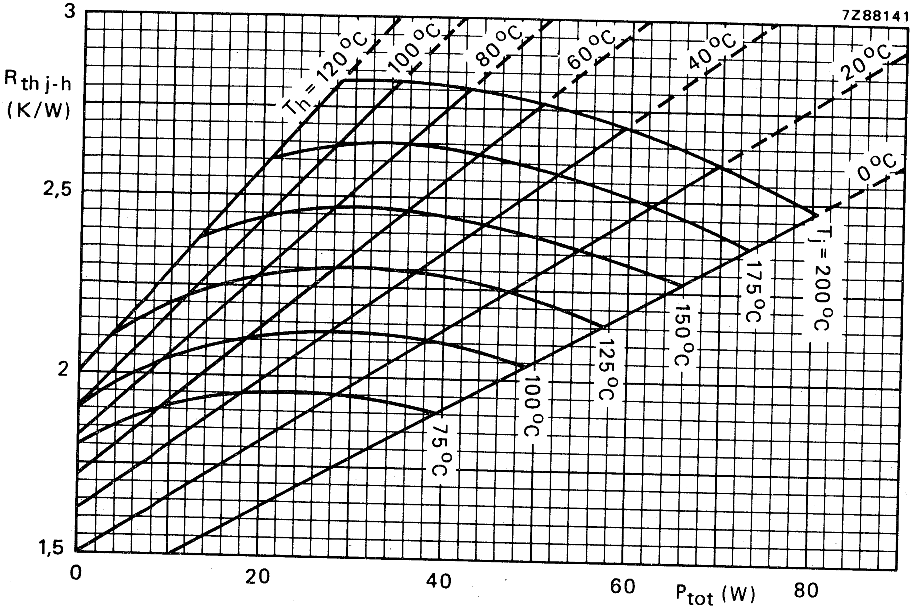


Fig. 4 Maximum thermal resistance from junction to heatsink as a function of power dissipation, with heatsink and junction temperature as parameters. ($R_{th\ mb\text{-}h}$ = 0,25 K/W.)

Example

Nominal class-A push-pull operation (without r.f. signal): V_{CE} = 25 V; I_{C1} = I_{C2} = 0,85 A; T_h = 70 °C.

Fig. 4 shows:	$R_{th\ j-h}$	max.	2,68 K/W
	T_j	max.	184 °C
Typical device:	$R_{th\ j-h}$	typ.	2,28 K/W
	T_j	typ.	167 °C

CHARACTERISTICS apply to either transistor section unless otherwise specified

$T_j = 25\ ^oC$

Collector-emitter breakdown voltage			
$V_{BE} = 0$; $I_C = 10$ mA	$V_{(BR)CES}$	>	50 V
open base; $I_C = 25$ mA	$V_{(BR)CEO}$	>	27 V
Emitter-base breakdown voltage			
open collector; $I_E = 5$ mA	$V_{(BR)EBO}$	>	3,5 V
Collector cut-off current			
$V_{BE} = 0$; $V_{CE} = 27$ V	I_{CES}	<	10 mA
Second breakdown energy; L = 25 mH; f = 50 Hz			
open base	E_{SBO}	>	2 mJ
$R_{BE} = 10\ \Omega$	E_{SBR}	>	2 mJ
D.C. current gain*		>	15
$I_C = 0,85$ A; $V_{CE} = 25$ V	h_{FE}	typ.	40
D.C. current gain ratio of transistor sections			
$I_C = 0,85$ A; $V_{CE} = 25$ V		0,67 to 1,5	
Collector-emitter saturation voltage*			
$I_C = 1,7$ A; $I_B = 0,17$ A	V_{CEsat}	typ.	0,75 V
Transition frequency at f = 100 MHz**			
$-I_E = 0,85$ A; $V_{CB} = 25$ V	f_T	typ.	2,5 GHz
$-I_E = 1,7$ A; $V_{CB} = 25$ V	f_T	typ.	2,5 GHz
Collector capacitance at f = 1 MHz		typ.	24 pF
$I_E = I_e = 0$; $V_{CB} = 25$ V	C_c	<	30 pF
Feedback capacitance at f = 1 MHz			
$I_C = 50$ mA; $V_{CE} = 25$ V	C_{re}	typ.	15 pF
Collector-flange capacitance	C_{cf}	typ.	2 pF

DEVELOPMENT SAMPLE DATA

* Measured under pulse conditions: $t_p \leq 300\ \mu s$; $\delta \leq 0,02$.
** Measured under pulse conditions: $t_p \leq 50\ \mu s$; $\delta \leq 0,01$.

The graphs apply to either transistor section.

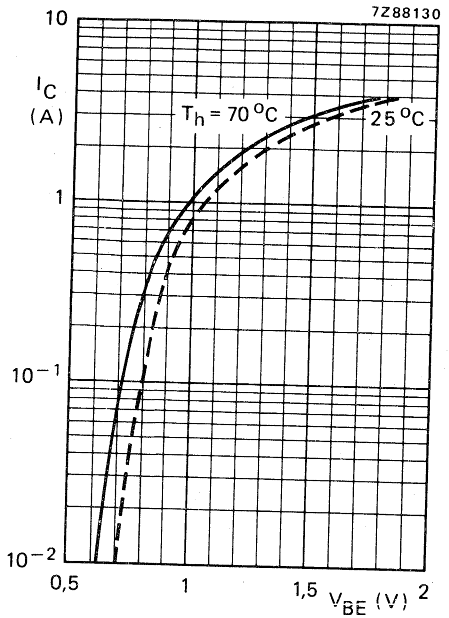


Fig. 5 Typical values; V_{CE} = 25 V.

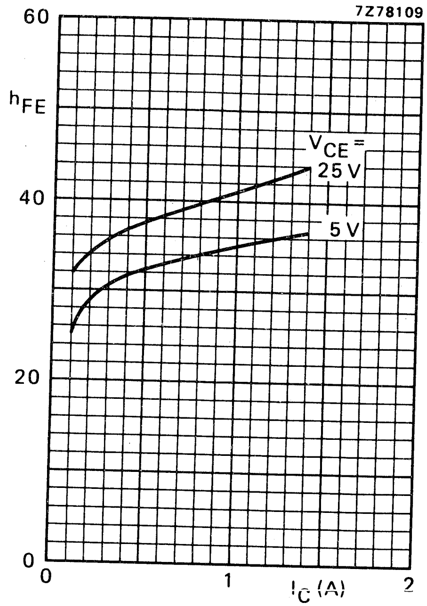


Fig. 6 Typical values; T_j = 25 °C.

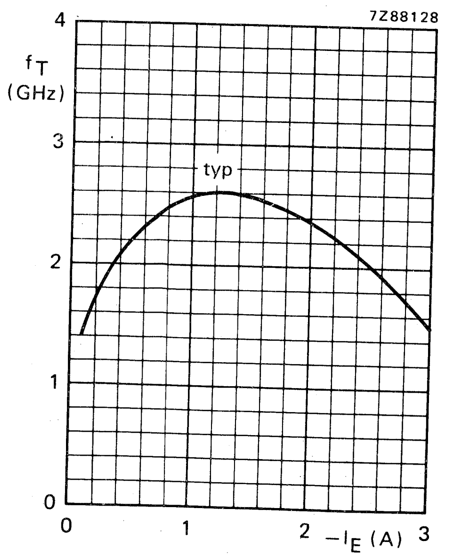


Fig. 7 V_{CB} = 25 V; f = 500 MHz; T_j = 25 °C.

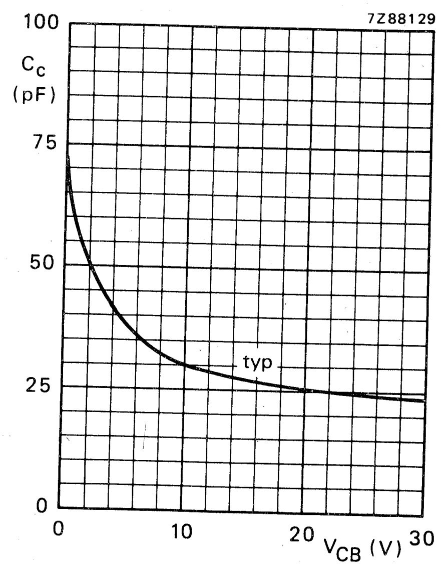


Fig. 8 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

APPLICATION INFORMATION

R.F. performance in u.h.f. class-A operation (linear push-pull power amplifier)

f_{vision} (MHz)	V_{CE} (V)	$I_{C1} = I_{C2}$ (A)	T_h (°C)	d_{im}* (dB)	$P_{o\ sync}$* (W)	G_p (dB)
860	25	0,85	70	−60	> 6	> 8,0
			70	−60	typ. 7,5	typ. 8,5
			70	−55	typ. 10	typ. 8,5
			25	−55	typ. 12	typ. 9,0

* Three-tone test method (vision carrier −8 dB, sound carrier −7 dB, sideband signal −16 dB), zero dB corresponds to peak sync level.

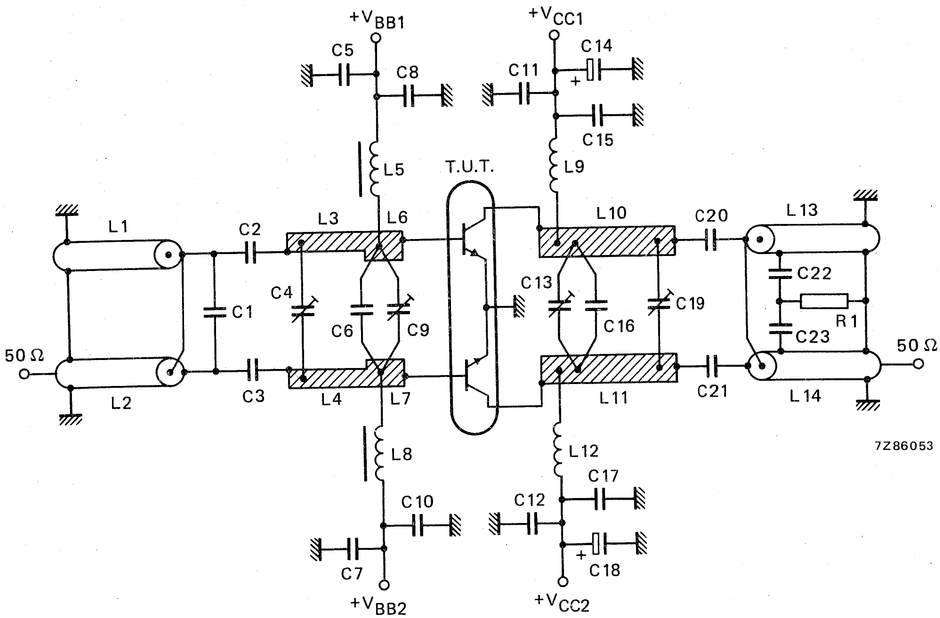


Fig. 9 Class-A test circuit at f_{vision} = 860 MHz.

List of components:

C1 = C6 = C16 = 4,7 pF (500 V) multilayer ceramic chip capacitor (ATC▲)
C2 = C3 = C20 = C21 = 33 pF multilayer ceramic chip capacitor (cat. no. 2222 851 13339)
C4 = C9 = C13 = C19 = 1,2 to 3,5 pF film dielectric trimmer (cat. no. 2222 809 05001)
C5 = C7 = C15 = C17 = 100 nF multilayer ceramic chip capacitor (cat. no. 2222 852 59104)
C8 = C10 = C11 = C12 = 220 pF multilayer ceramic chip capacitor (cat. no. 2222 852 13221)
C14 = C18 = 6,8 μF/40 V solid aluminium electrolytic capacitor
C22 = C23 = 1 pF (500 V) multilayer ceramic chip capacitor (ATC▲)

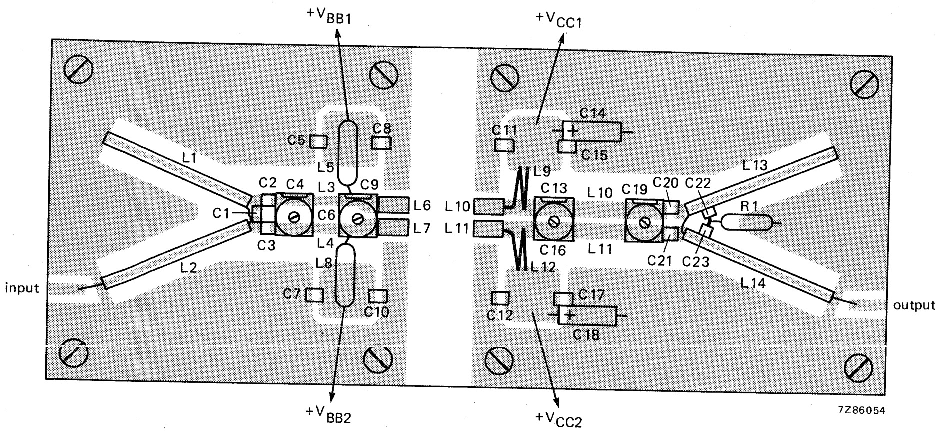
C9 and C13 are placed 8,0 and 14,0 mm from transistor edge, respectively.

▲ ATC means American Technical Ceramics.

L1 = L2 = L13 = L14 = 50 Ω semi-rigid cable; outer diameter 2,2 mm; length 29,0 mm. These cables are soldered on 75 Ω striplines (1,1 mm x 28,0 mm). The centre conductors of the cables L1 and L13 are not connected.
L3 = L4 = 52 Ω stripline (2,0 mm x 16,5 mm)
L5 = L8 = 470 nH microchoke
L6 = L7 = 39 Ω stripline (3,1 mm x 8,0 mm)
L9 = L12 = 1 turn Cu wire (1,0 mm); int. dia. 5,5 mm; leads 2 x 3,5 mm
L10 = L11 = 39 Ω stripline (3,1 mm x 34,0 mm)

L3, L4, L6, L7, L10 and L11 are striplines on a double Cu-clad printed-circuit board with PTFE fibre-glass dielectric (ϵ_r = 2,74); thickness 1/32".

R1 = 10 Ω carbon resistor



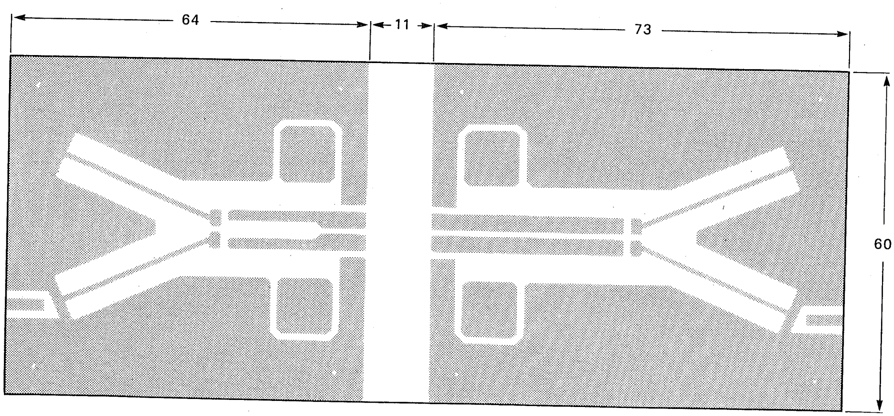


Fig. 10 Component layout and printed-circuit board for 860 MHz class-A test circuit.

The circuit and the components are on one side of the PTFE fibre-glass board, the other side is unetched copper to serve as a ground-plane. Earth connections are made by means of bolts. Additionally copper straps are used under the emitters and at the input and output to provide direct contact between the copper on the component side and the ground-plane.

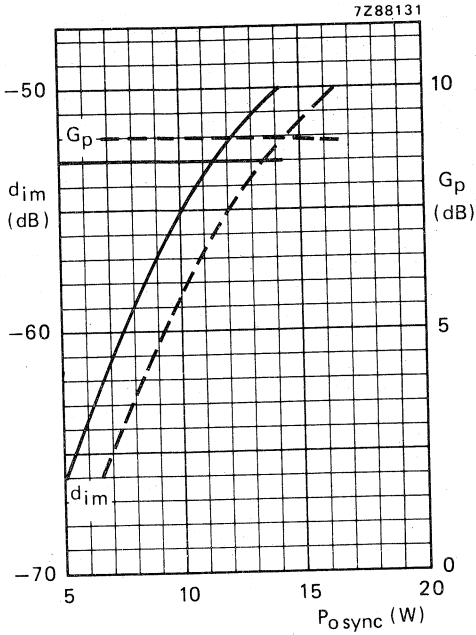


Fig. 11 Intermodulation distortion (d_{im})* and power gain as a function of output power.

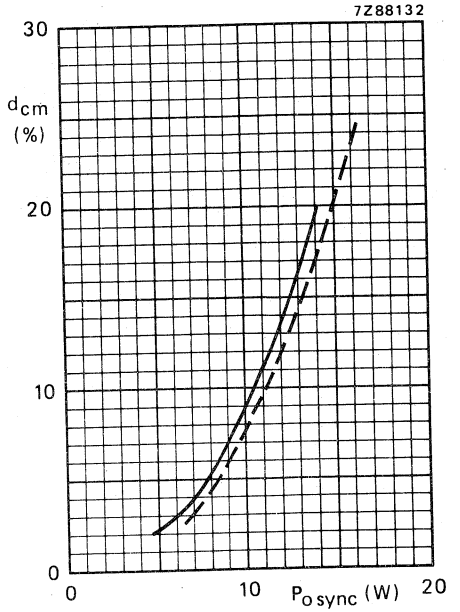


Fig. 12 Cross-modulation distortion (d_{cm})** as a function of output power.

Conditions for Figs 11 and 12:

Typical values; V_{CE} = 25 V; I_C = 2 x 0,85 A; – – – T_h = 25 °C; —— T_h = 70 °C; f_{vision} = 860 MHz.

Ruggedness in push-pull class-A operation

The BLV57 is capable of withstanding full load mismatch (VSWR = 50 through all phases) under the following conditions:
V_{CE} = 25 V; I_C = 2 x 0,85 A; T_h = 70 °C; $P_{o\ sync}$* ⩽ 12,5 W; f = 860 MHz; $R_{th\ mb\text{-}h}$ = 0,25 K/W.
At any other composition of the output signal: P_L (r.m.s. value) ⩽ 5 W.

* Three-tone test method (vision carrier −8 dB, sound carrier −7 dB, sideband signal −16 dB), zero dB corresponds to peak sync level.
Intermodulation distortion of input signal ⩽ −70 dB.

** Two-tone test method (vision carrier 0 dB, sound carrier −7 dB), zero dB corresponds to peak sync level.
Cross-modulation distortion (d_{cm}) is the voltage variation (%) of sound carrier when vision carrier is switched from 0 dB to −20 dB.

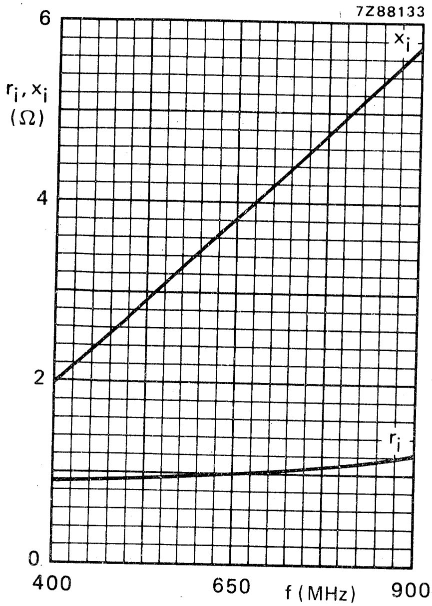


Fig. 13 Input impedance (series components).

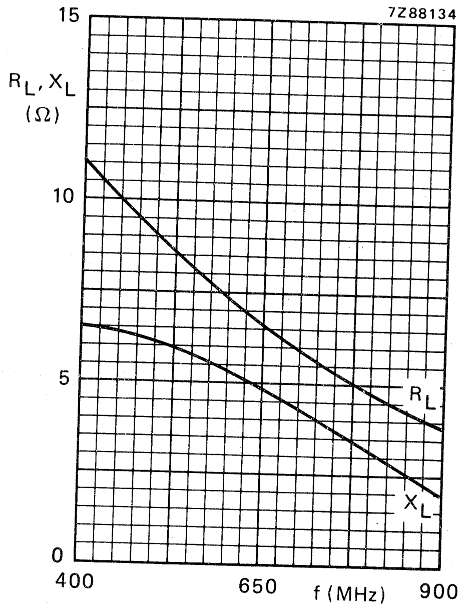


Fig. 14 Load impedance (series components).

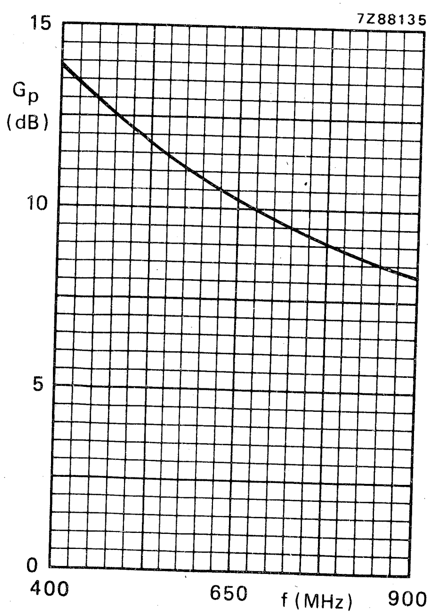


Fig. 15.

Conditions for Figs 13, 14 and 15:

The graphs apply to either transistor section assuming class-A push-pull operation.
Typical values; V_{CE} = 25 V; I_C = 0,85 A; T_h = 70 °C.

DEVELOPMENT SAMPLE DATA

APPLICATION INFORMATION

R.F. performance in u.h.f. class-AB operation (c.w.)

f_{vision} (MHz)	V_{CE} (V)	$I_{C(ZS)}$ (A)	T_h (°C)	P_L (W)	$I_{C1} = I_{C2}$ (A)	η (%)	G_p* (dB)
860	25	2 x 0,1	25	12,5 38	typ. 1,25	typ. 60	typ. 7,5 typ. 6,5
860	25	2 x 0,1	70	12,5 30	typ. 1,10	typ. 55	typ. 7,0 typ. 6,0

* Typical values are based on 1 dB gain compression. Using a 3rd order amplitude transfer characteristic, 1 dB compression corresponds with 30% sync input/25% sync output compression in television service (negative modulation, C.C.I.R. system).

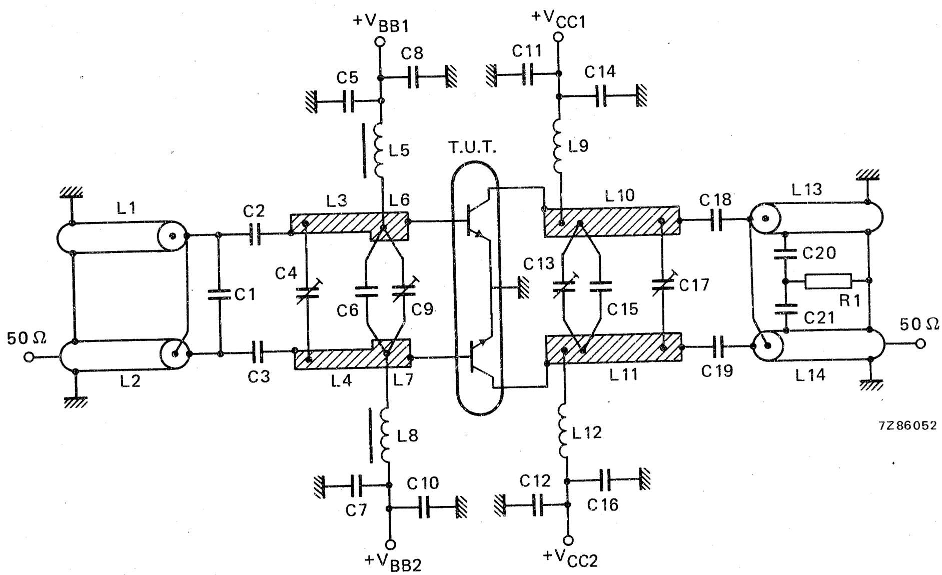


Fig. 16 Class-AB test circuit at f_{vision} = 860 MHz.

List of components:

C1 = C6 = C15 = 4,7 pF (500 V) multilayer ceramic chip capacitor (ATC▲)
C2 = C3 = C18 = C19 = 33 pF multilayer ceramic chip capacitor (cat. no. 2222 851 13339)
C4 = C9 = C13 = C17 = 1,2 to 3,5 pF film dielectric trimmer (cat. no. 2222 809 05001)
C5 = C7 = C14 = C16 = 100 nF multilayer ceramic chip capacitor (cat. no. 2222 852 59104)
C8 = C10 = C11 = C12 = 220 pF multilayer ceramic chip capacitor (cat. no. 2222 852 13221)
C20 = C21 = 1 pF (500 V) multilayer ceramic chip capacitor (ATC▲)

C9 and C13 are placed 8,0 and 14,0 mm from transistor edge, respectively.

▲ ATC means American Technical Ceramics.

L1 = L2 = L13 = L14 = 50 Ω semi-rigid cable; outer diameter 2,2 mm; length 29,0 mm. These cables are soldered on 75 Ω striplines (1,1 mm x 28,0 mm). The centre conductors of the cables L1 and L13 are not connected.
L3 = L4 = 52 Ω stripline (2,0 mm x 16,5 mm)
L5 = L8 = 470 nH microchoke
L6 = L7 = 39 Ω stripline (3,1 mm x 8,0 mm)
L9 = L12 = 1 turn Cu wire (1,0 mm); int. dia. 5,5 mm; leads 2 x 3,5 mm
L10 = L11 = 39 Ω stripline (3,1 mm x 34,0 mm)

L3, L4, L6, L7, L10 and L11 are striplines on a double Cu-clad printed-circuit board with PTFE fibre-glass dielectric (ϵ_r = 2,74); thickness 1/32″.

R1 = 10 Ω carbon resistor

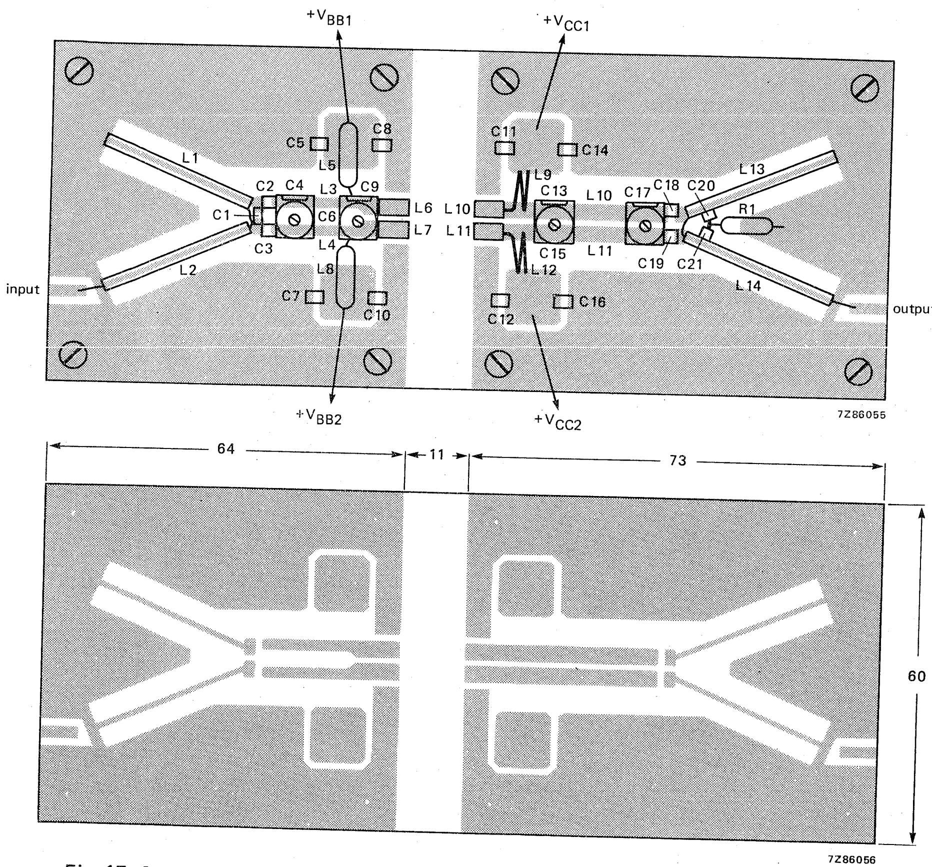


Fig. 17 Component layout and printed-circuit board for 860 MHz class-AB test circuit.

The circuit and the componenets are on one side of the PTFE fibre-glass board, the other side is unetched copper to serve as a ground-plane. Earth connections are made by means of bolts. Additionally copper straps are used under the emitters and at the input and output to provide direct contact between the copper on the component side and the ground-plane.

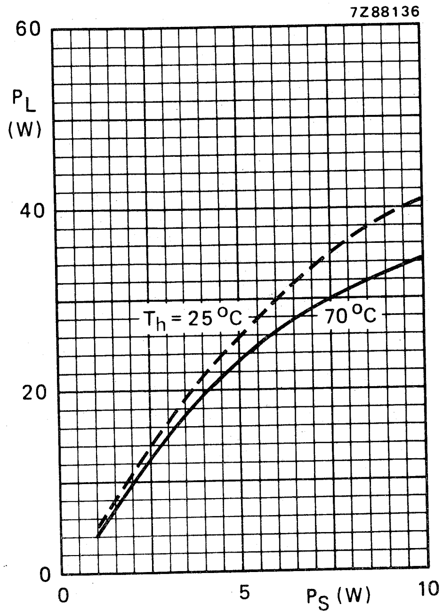


Fig. 18 Typical values; V_{CE} = 25 V; $I_{C(ZS)}$ = 2 x 0,1 A; f_{vision} = 860 MHz.

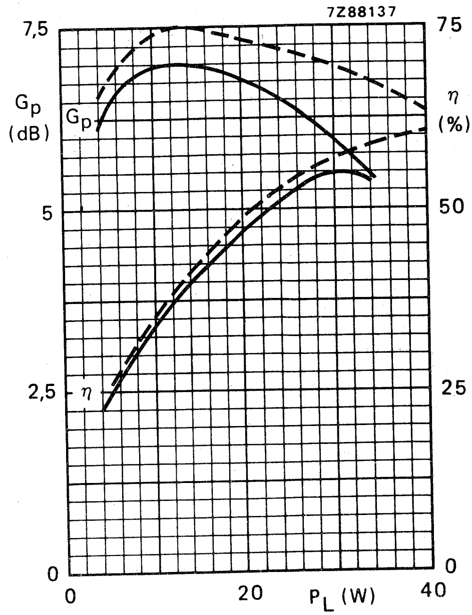


Fig. 19 Typical values; V_{CE} = 25 V; $I_{C(ZS)}$ = 2 x 0,1 A; — — — T_h = 25 °C; ——— T_h = 70 °C; f_{vision} = 860 MHz.

Ruggedness in class-AB operation

The BLV57 is capable of withstanding a load mismatch (VSWR ⩽ 2 through all phases) up to 30 W (r.m.s. value) or (VSWR ⩽ 50 through all phases) up to 19 W under the following conditions: V_{CE} = 25 V; T_h = 70 °C; f = 860 MHz; $R_{th\ mb-h}$ = 0,25 K/W.

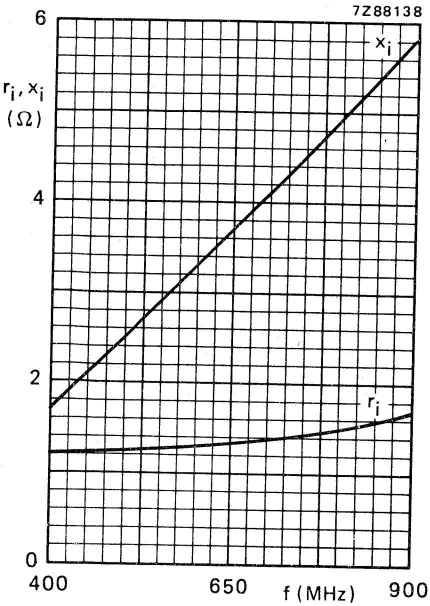


Fig. 20 Input impedance (series components).

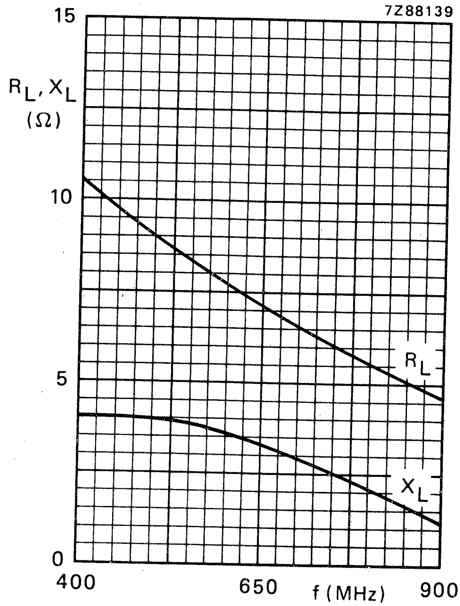


Fig. 21 Load impedance (series components).

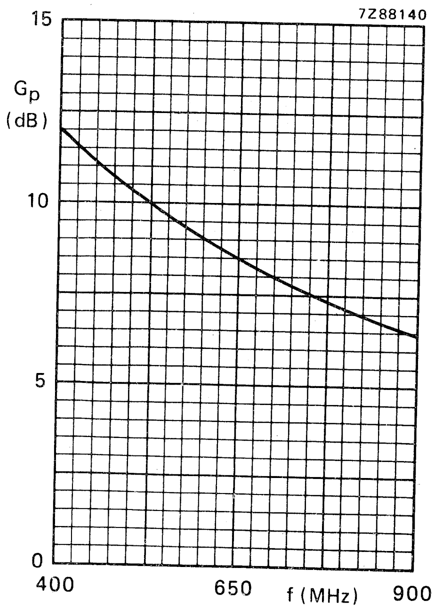


Fig. 22.

Conditions for Figs 20; 21 and 22:

The graphs apply to either transistor section assuming class-AB push-pull operation.
Typical values; V_{CE} = 25 V; $I_{C(ZS)}$ = 0,1 A; P_L = 17,5 W (P.E.P.); T_h = 70 °C.

V.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor intended for use in class-A, B or C operated mobile transmitters with a nominal supply voltage of 13,5 V. Because of the high gain and excellent power handling capability, the transistor is especially suited for design of wide-band and semi-wide-band v.h.f. amplifiers. Together with a BFQ42 driver stage, the chain can deliver 15 W with a maximum drive power of 120 mW at 175 MHz. The transistor is resistance stabilized and is guaranteed to withstand severe load mismatch conditions with a supply over-voltage to 16,5 V.

It has a 3/8″ capstan envelope with a ceramic cap. All leads are isolated from the stud.

QUICK REFERENCE DATA

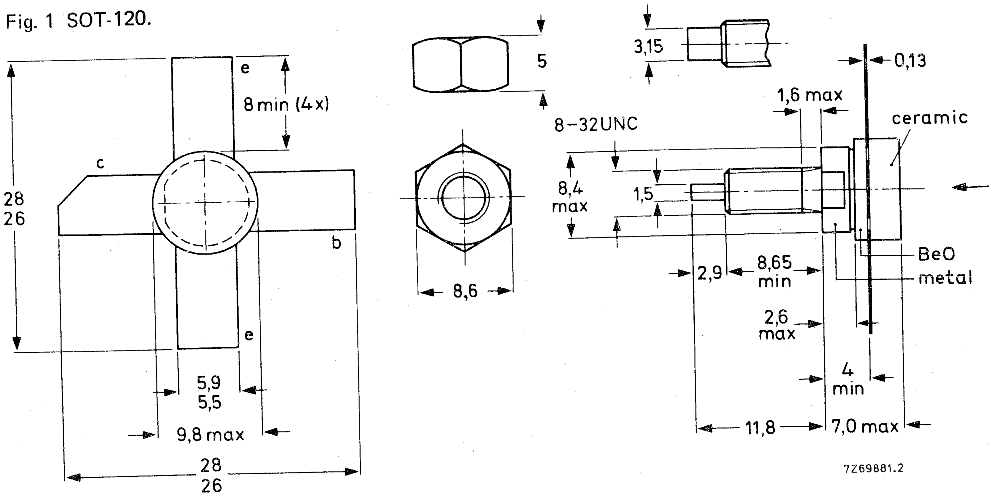
R.F. performance up to T_h = 25 °C

mode of operation	V_{CE} V	f MHz	P_L W	G_p dB	η %	$\overline{z_i}$ Ω	$\overline{Y_L}$ mA/V
c.w. class-B	**13,5**	**175**	**15**	**> 10**	**> 60**	**1,3 + j0,68**	**180 − j54**
c.w. class-B	12,5	175	15	typ. 10,5	typ. 67	−	−

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-120.



Torque on nut: min. 0,75 Nm (7,5 kg cm)
max. 0,85 Nm (8,5 kg cm)

Diameter of clearance hole in heatsink: max. 4,2 mm. Mounting hole to have no burrs at either end. De-burring must leave surface flat; do not chamfer or countersink either end of hole.

When locking is required an adhesive is preferred instead of a lock washer.

CAUTION This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage (V_{BE} = 0) peak value	V_{CESM}	max.	36 V
Collector-emitter voltage (open base)	V_{CEO}	max.	18 V
Emitter-base voltage (open collector)	V_{EBO}	max.	4 V
Collector current (average)	$I_{C(AV)}$	max.	2,75 A
Collector current (peak value); f > 1 MHz	I_{CM}	max.	8 A
R.F. power dissipation (f > 1 MHz); T_{mb} = 25 °C	P_{rf}	max.	53 W
Storage temperature	T_{stg}		−65 to + 150 °C
Operating junction temperature	T_j	max.	200 °C

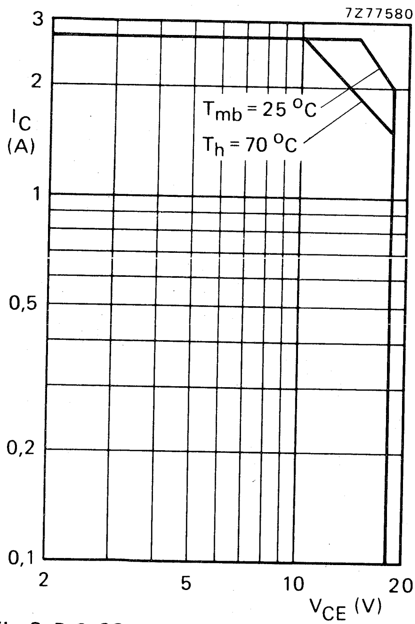


Fig. 2 D.C. SOAR.

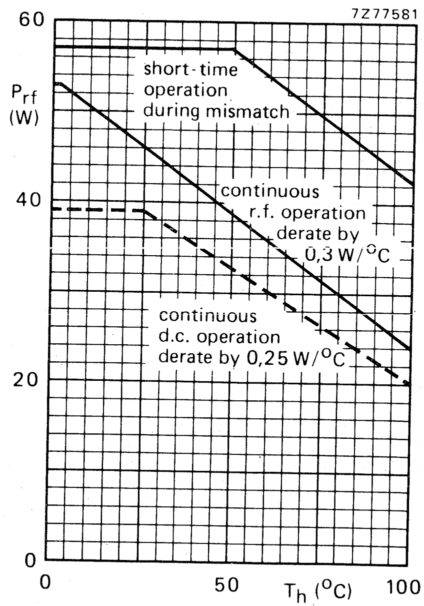


Fig. 3 R.F. power dissipation; V_{CE} ≤ 16,5 V; f ≥ 1 MHz.

THERMAL RESISTANCE (dissipation = 15 W; T_{mb} = 77 °C, i.e. T_h = 70 °C)

From junction to mounting base (d.c. dissipation)	$R_{th\ j\text{-}mb(dc)}$	=	3,7 °C/W
From junction to mounting base (r.f. dissipation)	$R_{th\ j\text{-}mb(rf)}$	=	3,05 °C/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,45 °C/W

CHARACTERISTICS

$T_j = 25\ ^oC$

Collector-emitter breakdown voltage $V_{BE} = 0$; $I_C = 15$ mA	$V_{(BR)CES}$	>	36 V
Collector-emitter breakdown voltage open base; $I_C = 100$ mA	$V_{(BR)CEO}$	>	18 V
Emitter-base breakdown voltage open collector; $I_E = 5$ mA	$V_{(BR)EBO}$	>	4 V
Collector cut-off current $V_{BE} = 0$; $V_{CE} = 18$ V	I_{CES}	<	5 mA
Second breakdown energy; L = 25 mH; f = 50 Hz open base	E_{SBO}	>	4 mJ
$R_{BE} = 10\ \Omega$	E_{SBR}	>	4 mJ
D.C. current gain* $I_C = 1,75$ A; $V_{CE} = 5$ V	h_{FE}	typ.	40
			10 to 80
Collector-emitter saturation voltage* $I_C = 5$ A; $I_B = 1$ A	V_{CEsat}	typ.	1,5 V
Transition frequency at f = 100 MHz* $-I_E = 1,75$ A; $V_{CB} = 13,5$ V	f_T	typ.	900 MHz
$-I_E = 5$ A; $V_{CB} = 13,5$ V	f_T	typ.	825 MHz
Collector capacitance at f = 1 MHz $I_E = I_e = 0$; $V_{CB} = 13,5$ V	C_c	typ.	43 pF
Feedback capacitance at f = 1 MHz $I_C = 100$ mA; $V_{CE} = 13,5$ V	C_{re}	typ.	27 pF
Collector-stud capacitance	C_{cs}	typ.	2 pF

* Measured under pulse conditions: $t_p \leqslant 200\ \mu s$; $\delta \leqslant 0,02$.

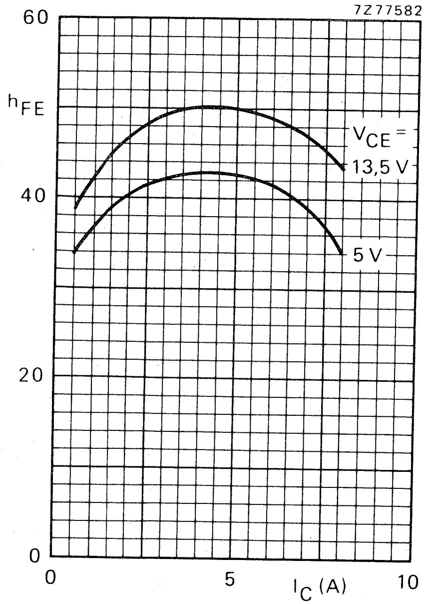


Fig. 4 Typical values; T_j = 25 °C.

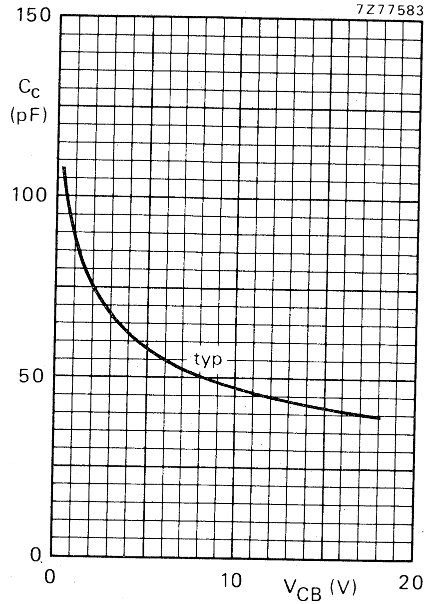


Fig. 5 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

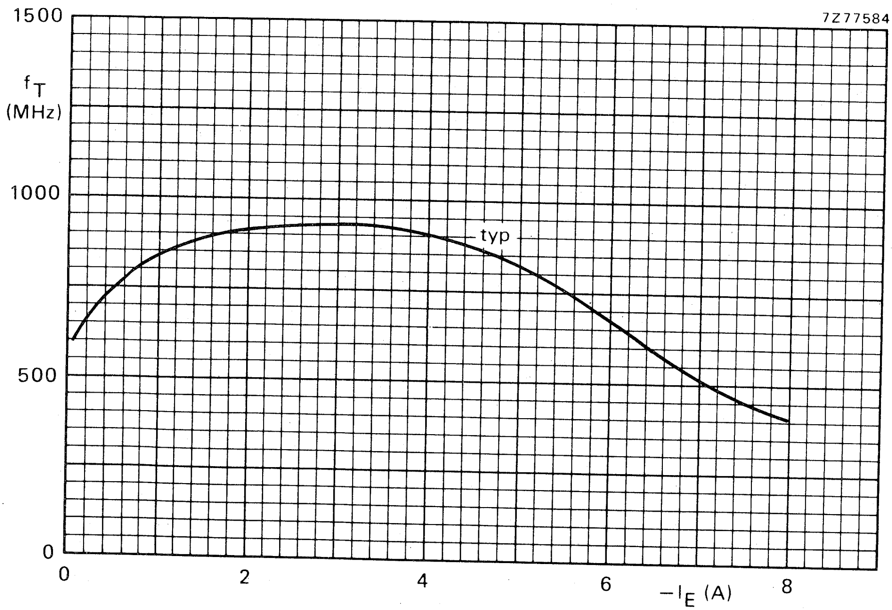


Fig. 6 V_{CB} = 13,5 V; f = 100 MHz; T_j = 25 °C.

APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit)

T_h = 25 °C

f (MHz)	V_{CE} (V)	P_L (W)	P_S (W)	G_p (dB)	I_C (A)	η (%)	$\overline{z_i}$ (Ω)	$\overline{Y_L}$ (mA/V)
175	**13,5**	**15**	**< 1,5**	**> 10**	**< 1,85**	**> 60**	**1,3 + j0,68**	**180 – j54**
175	12,5	15	typ. 1,34	typ. 10,5	typ. 1,8	typ. 67	–	–

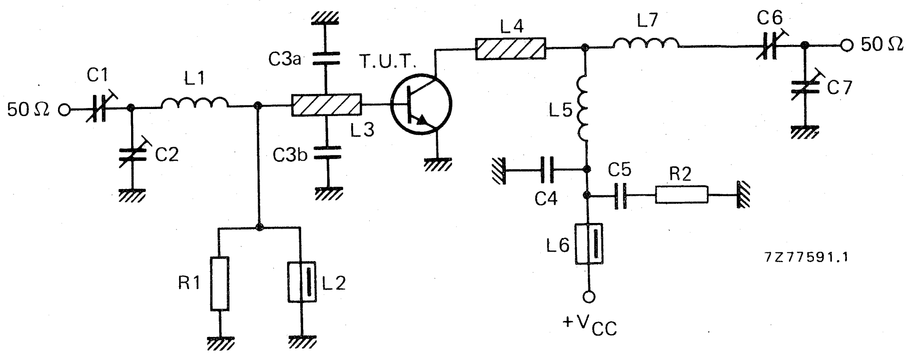


Fig. 7 Test circuit; c.w. class-B.

List of components:

C1 = 2,5 to 20 pF film dielectric trimmer (cat. no. 2222 809 07004)
C2 = C6 = C7 = 4 to 40 pF film dielectric trimmer (cat. no. 2222 809 07008)
C3a = C3b = 47 pF ceramic capacitor (500 V)
C4 = 1 nF ceramic capacitor
C5 = 100 nF polyester capacitor

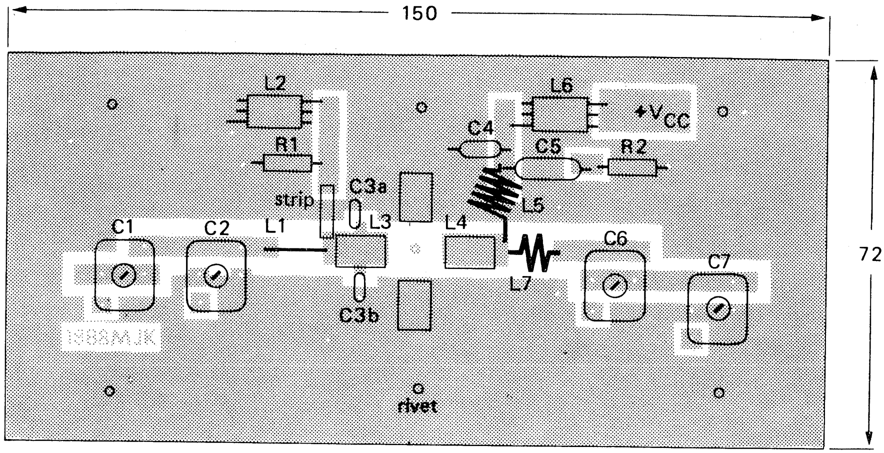
L1 = ½ turn Cu wire (1,6 mm); int. dia. 6,0 mm; leads 2 x 5 mm
L2 = L6 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L3 = L4 = strip (12 mm x 6 mm); taps for C3a and C3b at 5 mm from transistor
L5 = 4½ turns closely wound enamelled Cu wire (1,6 mm); int. dia. 6,0 mm; leads 2 x 5 mm
L7 = 2 turns closely wound enamelled Cu wire (1,6 mm); int. dia. 6,0 mm; leads 2 x 5 mm

L3 and L4 are strips on a double Cu-clad printed-circuit board with epoxy fibre-glass dielectric, thickness 1/16".

R1 = R2 = 10 Ω carbon resistor

Component layout and printed-circuit board for 175 MHz test circuit are shown in Fig. 8.

APPLICATION INFORMATION (continued)



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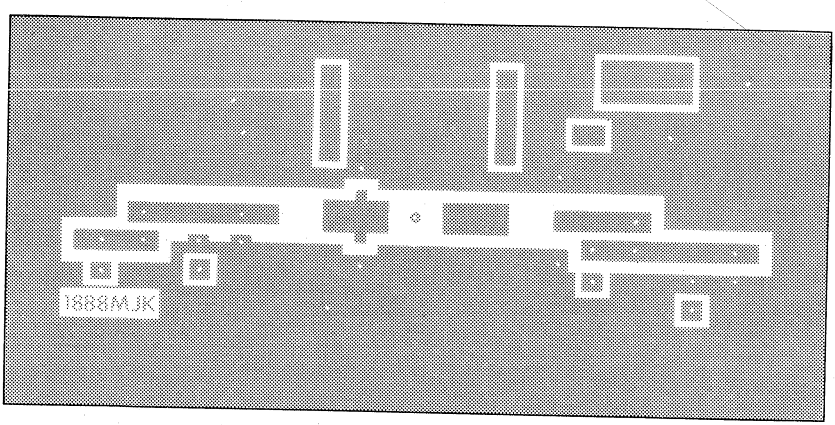


7Z77572

Fig. 8 Component layout and printed-circuit board for 175 MHz test circuit.

The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets, whilst under the emitter leads Cu straps are used for a direct contact between upper and lower sheets.

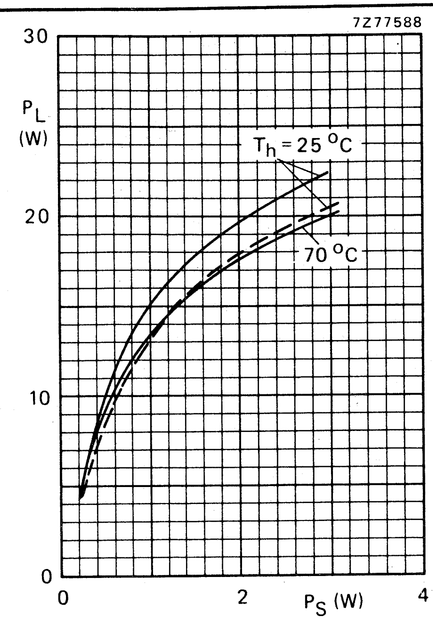


Fig. 9 Typical values; f = 175 MHz;
—— V_{CE} = 13,5 V; – – – V_{CE} = 12,5 V.

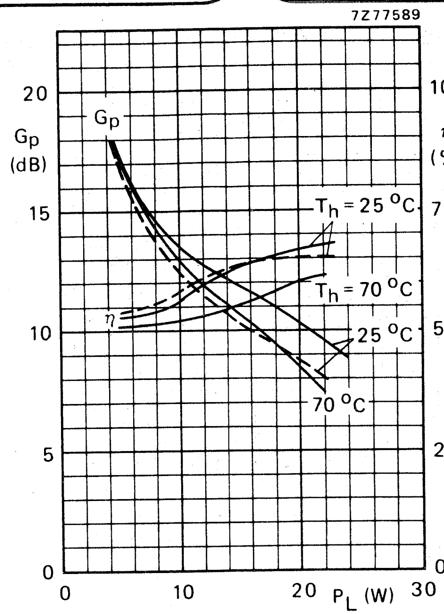


Fig. 10 Typical values; f = 175 MHz;
—— V_{CE} = 13,5 V; – – – V_{CE} = 12,5 V.

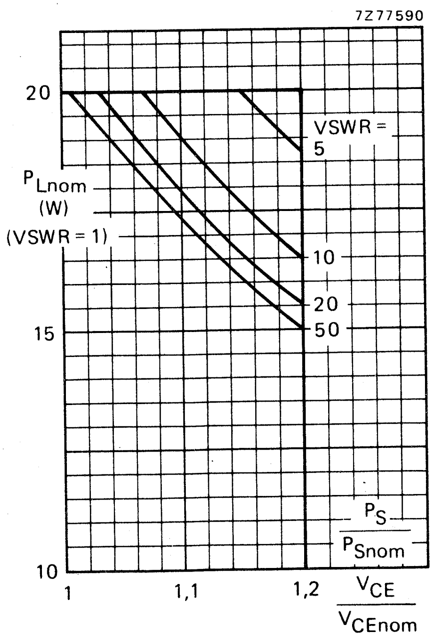


Fig. 11 R.F. SOAR (short-time operation during mismatch); f = 175 MHz; T_h = 70 °C; $R_{th\ mb\text{-}h}$ = 0,45 °C/W; V_{CEnom} = 13,5 V or 12,5 V; P_S = P_{Snom} at V_{CEnom} and VSWR = 1 (see page 5).

The transistor has been developed for use with unstabilized supply voltages. As the output power and drive power increase with the supply voltage, the nominal output power must be derated in accordance with the graph for safe operation at supply voltages other than the nominal. The graph shows the permissible output power under nominal conditions (VSWR = 1), as a function of the expected supply over-voltage ratio with VSWR as parameter.

The graph applies to the situation in which the drive (P_S/P_{Snom}) increases linearly with supply over-voltage ratio.

OPERATING NOTE Below 70 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation. This resistor must be effective for r.f. only.

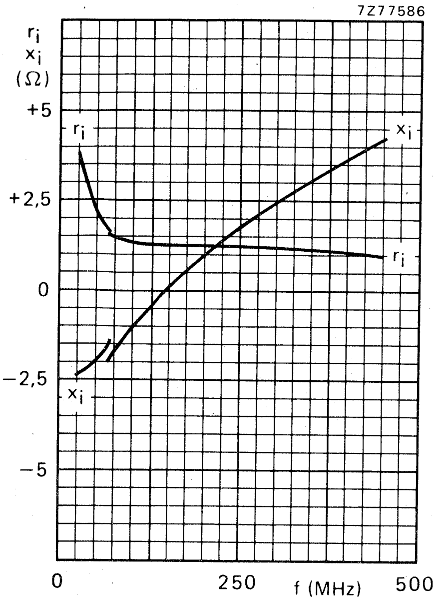


Fig. 12.

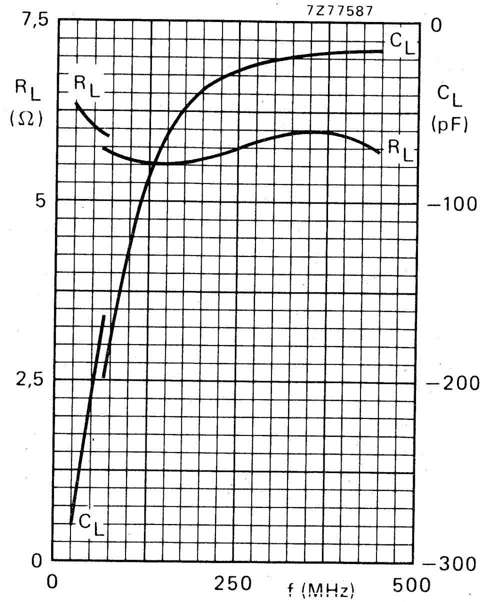
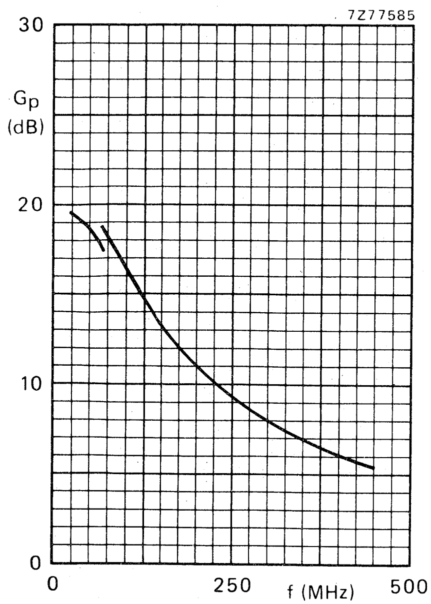


Fig. 13.



Conditions for Figs 12, 13 and 14:

Typical values; V_{CE} = 13,5 V; P_L = 15 W; T_h = 25 °C.

Fig. 14.

V.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor intended for use in class-A, B or C operated mobile transmitters with a nominal supply voltage of 13,5 V. Because of the high gain and excellent power handling capability, the transistor is especially suited for design of wide-band and semi-wide-band v.h.f. amplifiers. Together with a BFQ43 driver stage, the chain can deliver 28 W with a maximum drive power of 250 mW at 175 MHz. The transistor is resistance stabilized and is guaranteed to withstand severe load mismatch conditions with a supply over-voltage to 16,5 V.

It has a 3/8″ capstan envelope with a ceramic cap. All leads are isolated from the stud.

QUICK REFERENCE DATA

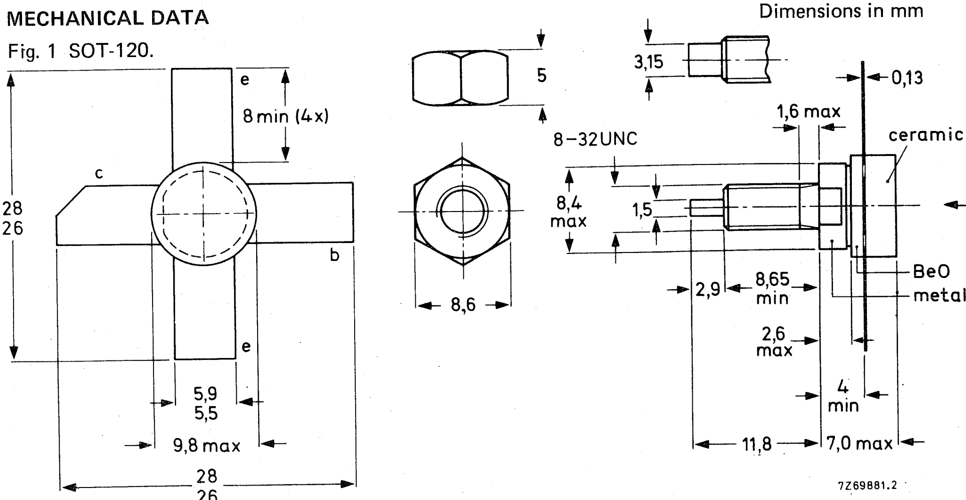
R.F. performance up to T_h = 25 °C

mode of operation	V_{CE} V	f MHz	P_L W	G_p dB	η %	$\overline{z_i}$ Ω	$\overline{Y_L}$ mA/V
c.w. class-B	**13,5**	**175**	**28**	**> 9**	**> 60**	**0,9 + j0,9**	**380 + j40**
c.w. class-B	12,5	175	28	typ. 9,5	typ. 70	—	—

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-120.



Torque on nut: min. 0,75 Nm
(7,5 kg cm)
max. 0,85 Nm
(8,5 kg cm)

Diameter of clearance hole in heatsink: max. 4,2 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

When locking is required an adhesive is preferred instead of a lock washer.

CAUTION This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage (V_{BE} = 0) peak value	V_{CESM}	max.	36	V
Collector-emitter voltage (open base)	V_{CEO}	max.	18	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4	V
Collector current (average)	$I_{C(AV)}$	max.	6	A
Collector current (peak value); f > 1 MHz	I_{CM}	max.	15	A
R.F. power dissipation (f > 1 MHz); T_{mb} = 25 °C	P_{rf}	max.	96	W
Storage temperature	T_{stg}		−65 to + 150	°C
Operating junction temperature	T_j	max.	200	°C

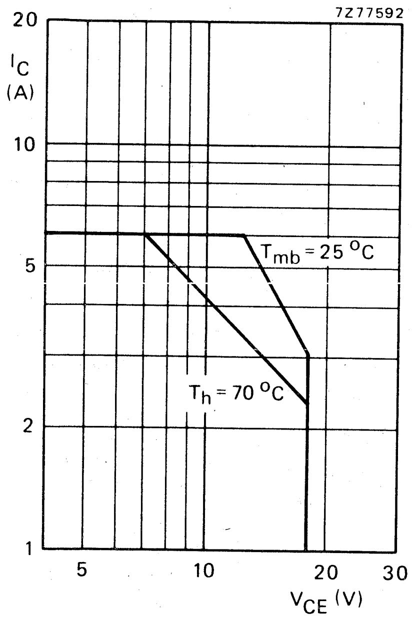


Fig. 2 D.C. SOAR.

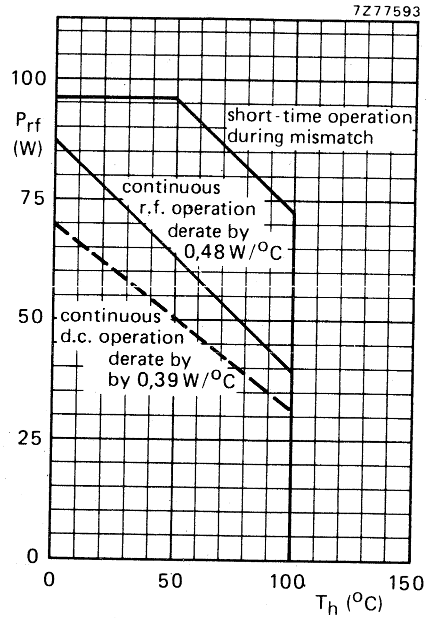


Fig. 3 R.F. power dissipation; $V_{CE} \leqslant 16,5$ V; f ⩾ 1 MHz.

THERMAL RESISTANCE (dissipation = 25 W; T_{mb} = 81 °C, i.e. T_h = 70 °C)

From junction to mounting base (d.c. dissipation)	$R_{th\ j\text{-}mb(dc)}$	=	2,4 °C/W
From junction to mounting base (r.f. dissipation)	$R_{th\ j\text{-}mb(rf)}$	=	1,85 °C/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,45 °C/W

CHARACTERISTICS

$T_j = 25\ ^oC$

Collector-emitter breakdown voltage $V_{BE} = 0$; $I_C = 25$ mA	$V_{(BR)CES}$	>	36 V
Collector-emitter breakdown voltage open base; $I_C = 100$ mA	$V_{(BR)CEO}$	>	18 V
Emitter-base breakdown voltage open collector; $I_E = 10$ mA	$V_{(BR)EBO}$	>	4 V
Collector cut-off current $V_{BE} = 0$; $V_{CE} = 18$ V	I_{CES}	<	10 mA
Second breakdown energy; L = 25 mH; f = 50 Hz open base	E_{SBO}	>	8 mJ
$R_{BE} = 10\ \Omega$	E_{SBR}	>	8 mJ
D.C. current gain* $I_C = 3,5$ A; $V_{CE} = 5$ V	h_{FE}	typ.	40
			10 to 80
Collector-emitter saturation voltage* $I_C = 10$ A; $I_B = 2$ A	V_{CEsat}	typ.	1,8 V
Transition frequency at f = 100 MHz* $-I_E = 3,5$ A; $V_{CB} = 13,5$ V	f_T	typ.	850 MHz
$-I_E = 10$ A; $V_{CB} = 13,5$ V	f_T	typ.	700 MHz
Collector capacitance at f = 1 MHz $I_E = I_e = 0$; $V_{CB} = 13,5$ V	C_c	typ.	92 pF
Feedback capacitance at f = 1 MHz $I_C = 100$ mA; $V_{CE} = 13,5$ V	C_{re}	typ.	58 pF
Collector-stud capacitance	C_{cs}	typ.	2 pF

* Measured under pulse conditions: $t_p \leqslant 200\ \mu s$; $\delta \leqslant 0,02$.

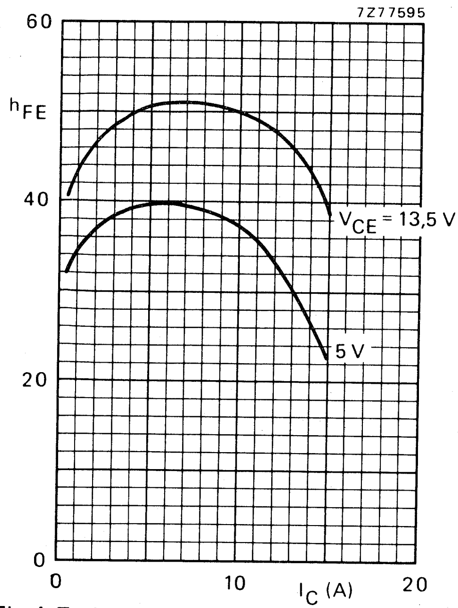


Fig. 4 Typical values; T_j = 25 °C.

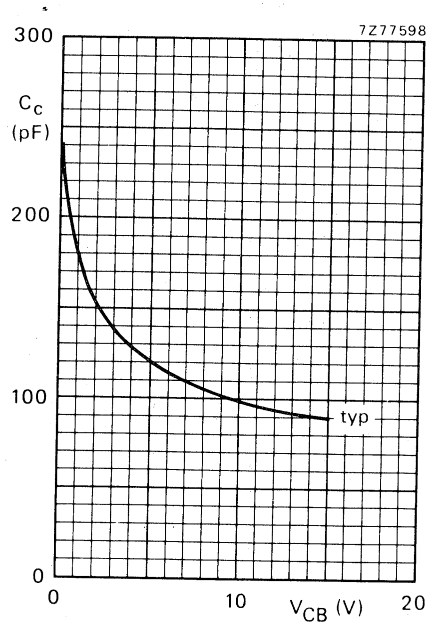


Fig. 5 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

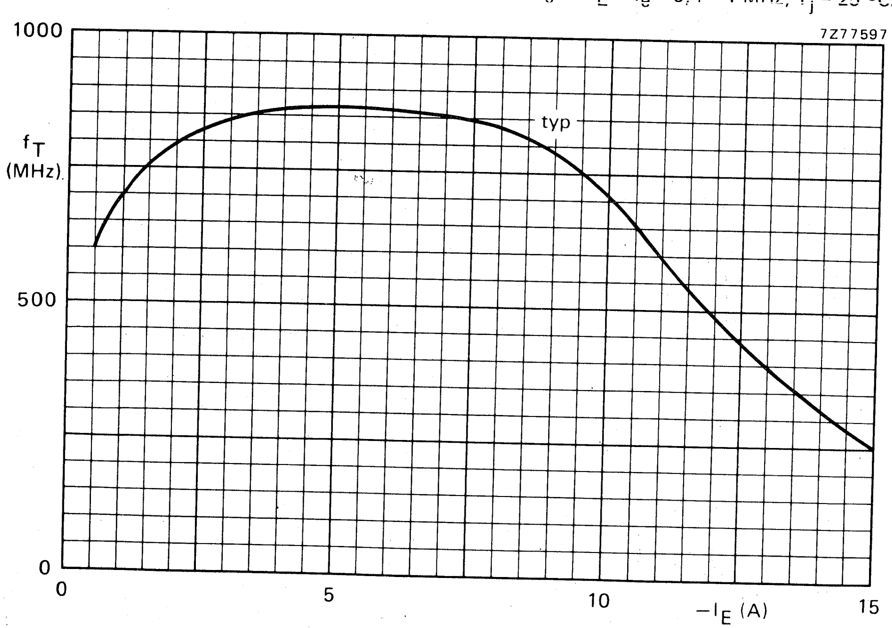


Fig. 6 V_{CB} = 13,5 V; f = 100 MHz; T_j = 25 °C.

APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit)

T_h = 25 °C

f (MHz)	V_{CE} (V)	P_L (W)	P_S (W)	G_p (dB)	I_C (A)	η (%)	$\overline{z_i}$ (Ω)	$\overline{Y_L}$ (mA/V)
175	**13,5**	**28**	**< 3,5**	**> 9**	**< 3,45**	**> 60**	**0,9 + j0,9**	**380 + j40**
175	12,5	28	typ. 3,15	typ. 9,5	typ. 3,2	typ. 70	–	–

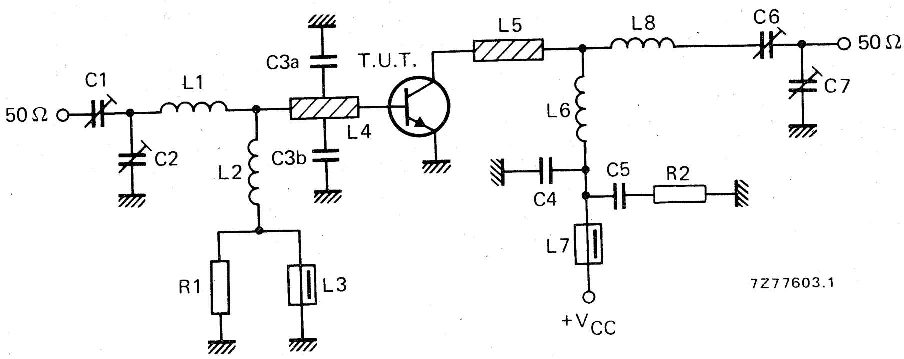


Fig. 7 Test circuit; c.w. class-B.

List of components:

C1 = 2,5 to 20 pF film dielectric trimmer (cat. no. 2222 809 07004)
C2 = C7 = 4 to 40 pF film dielectric trimmer (cat. no. 2222 809 07008)
C3a = C3b = 47 pF ceramic capacitor (500 V)
C4 = 120 pF ceramic capacitor
C5 = 100 nF polyester capacitor
C6 = 7 to 100 pF film dielectric trimmer (cat. no. 2222 809 07015)

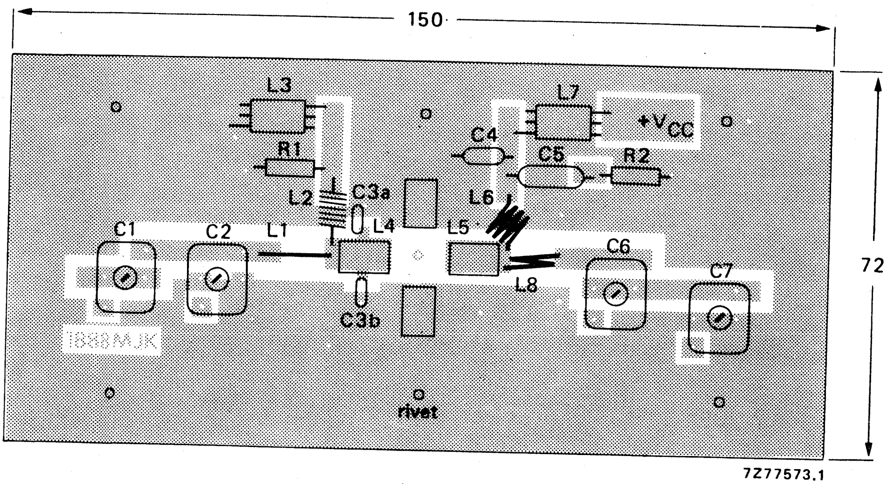
L1 = ½ turn Cu wire (1,6 mm); int. dia. 6,0 mm; leads 2 x 5 mm
L2 = 100 nH; 7 turns closely wound enamelled Cu wire (0,5 mm); int. dia. 3 mm; leads 2 x 5 mm
L3 = L7 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L4 = L5 = strip (12 mm x 6 mm); taps for C3a and C3b at 5 mm from transistor
L6 = 3½ turns closely wound enamelled Cu wire (1,6 mm) int. dia. 6,0 mm; leads 2 x 5 mm
L8 = 1 turn Cu wire (1,6 mm) int. dia. 6,0 mm; leads 2 x 5 mm

L4 and L5 are strips on a double Cu-clad printed-circuit board with epoxy fibre-glass dielectric, thickness 1/16".

R1 = R2 = 10 Ω carbon resistor

Component layout and printed-circuit board for 175 MHz test circuit are shown in Fig. 8.

APPLICATION INFORMATION (continued)



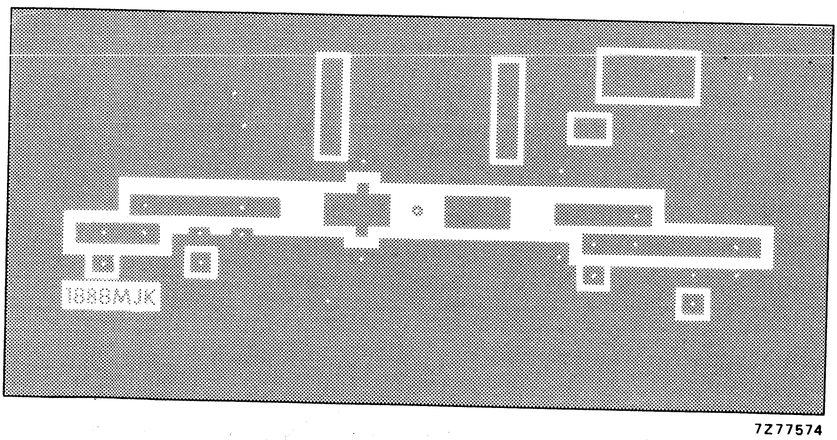


Fig. 8 Component layout and printed-circuit board for 175 MHz test circuit.

The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets, whilst under the emitter leads Cu straps are used for a direct contact between upper and lower sheets.

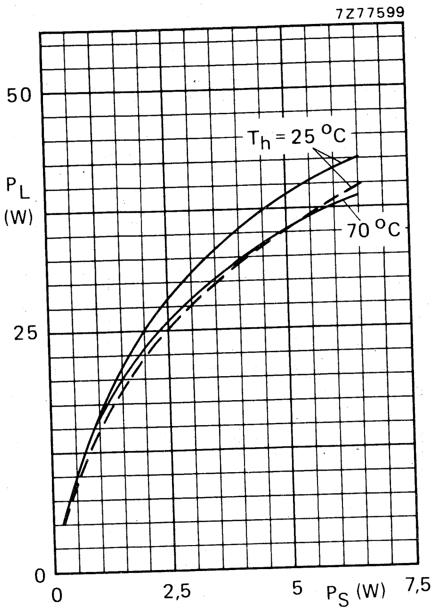


Fig. 9 Typical values; f = 175 MHz;
—— V_{CE} = 13,5 V; – – – V_{CE} = 12,5 V.

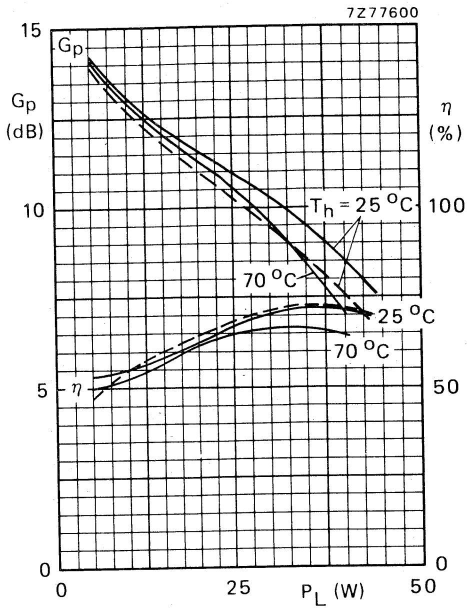


Fig. 10 Typical values; f = 175 MHz;
—— V_{CE} = 13,5 V; – – – V_{CE} = 12,5 V.

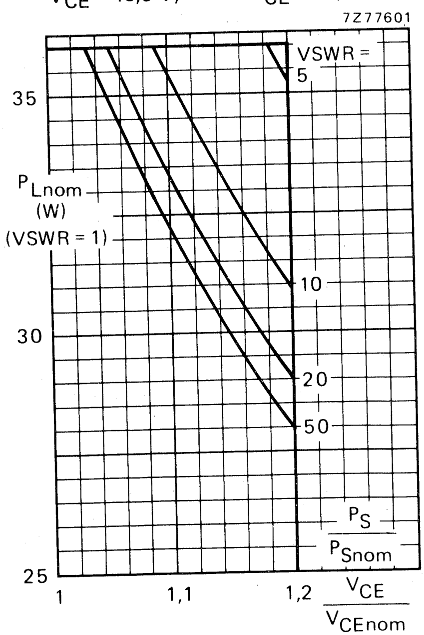


Fig. 11 R.F. SOAR (short-time operation during mismatch); f = 175 MHz; T_h = 70 °C; $R_{th\ mb-h}$ = 0,45 °C/W; V_{CEnom} = 13,5 V or 12,5 V; P_S = P_{Snom} at V_{CEnom} and VSWR = 1 (see page 5).

The transistor has been developed for use with unstabilized supply voltages. As the output power and drive power increase with the supply voltage, the nominal output power must be derated in accordance with the graph for safe operation at supply voltages other than the nominal. The graph shows the permissible output power under nominal conditions (VSWR = 1), as a function of the expected supply over-voltage ratio with VSWR as parameter.

The graph applies to the situation in which the drive (P_S/P_{Snom}) increases linearly with supply over-voltage ratio.

OPERATING NOTE Below 50 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation. This resistor must be effective for r.f. only.

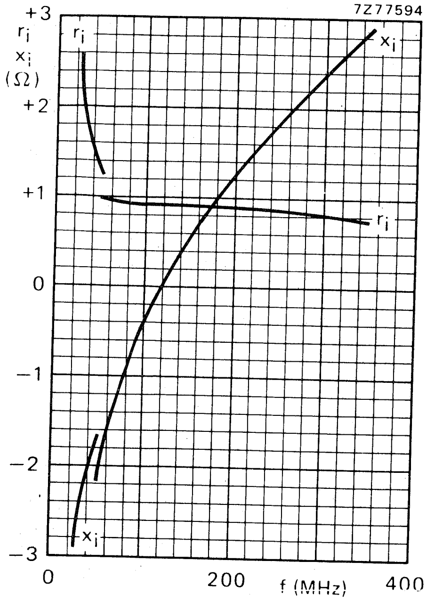


Fig. 12.

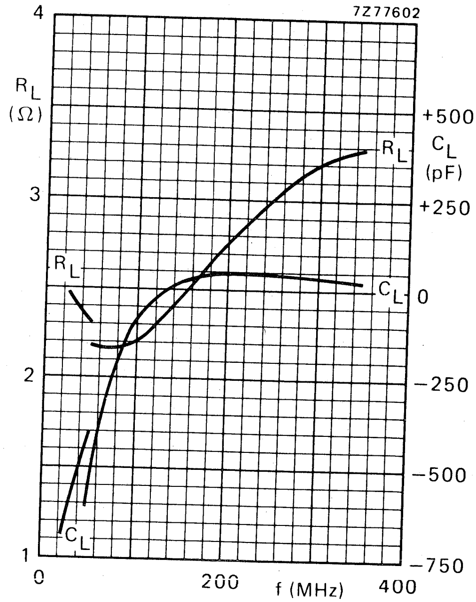
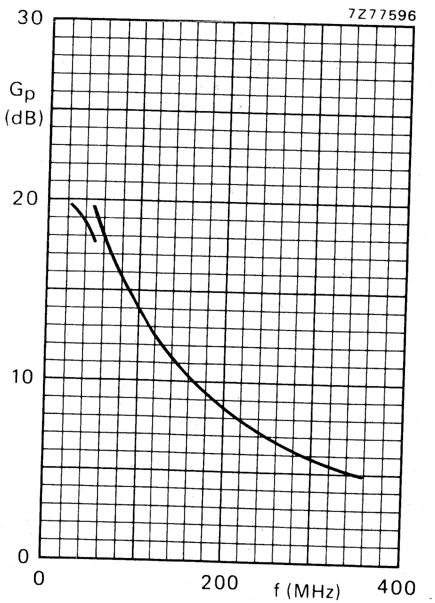


Fig. 13.



Conditions for Figs 12, 13 and 14:

Typical values; V_{CE} = 13,5 V; P_L = 28 W; T_h = 25 °C.

Fig. 14.

U.H.F. LINEAR POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor primarily intended for use in **linear u.h.f. amplifiers** for television transmitters and transposers. The **excellent d.c. dissipation properties** for class-A operation are obtained by means of diffused emitter ballasting resistors and a multi-base structure, providing an optimum temperature profile on the crystal area. The combination of optimum thermal design and the application of **gold sandwich metallization** realizes excellent reliability properties.

The transistor has a ¼" capstan envelope with ceramic cap.

QUICK REFERENCE DATA

R.F. performance

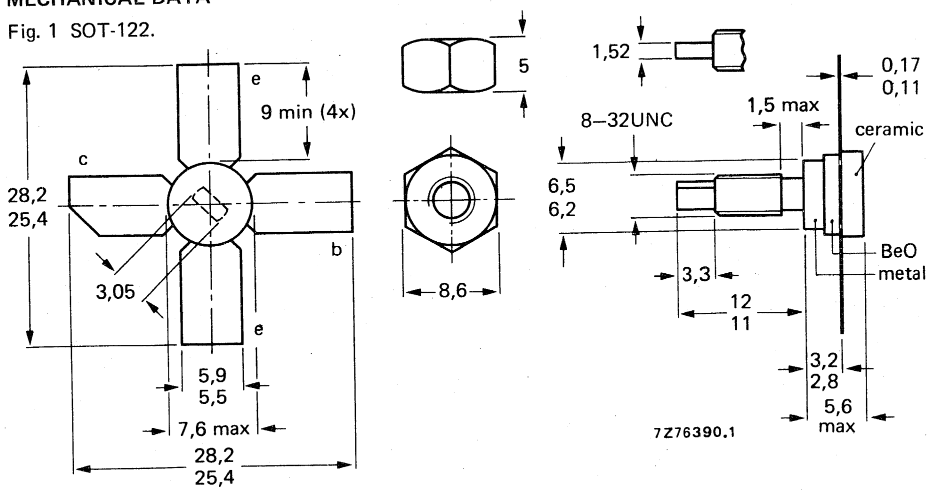
mode of operation	f_{vision} MHz	V_{CE} V	I_C mA	T_h °C	d_{im} * dB	$P_{o\ sync}$ * W	G_p dB
class-A; linear amplifier	860	25	150	70	−60	> 0,5	> 11
	860	25	150	25	−60	typ. 0,63	typ. 12,2

* Three-tone test method (vision carrier −8 dB, sound carrier −7 dB, sideband signal −16 dB), zero dB corresponds to peak sync level.

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-122.



Torque on nut: min. 0,75 Nm
(7,5 kg cm)
max. 0,85 Nm
(8,5 kg cm)

Diameter of clearance hole in heatsink: max. 4,2 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

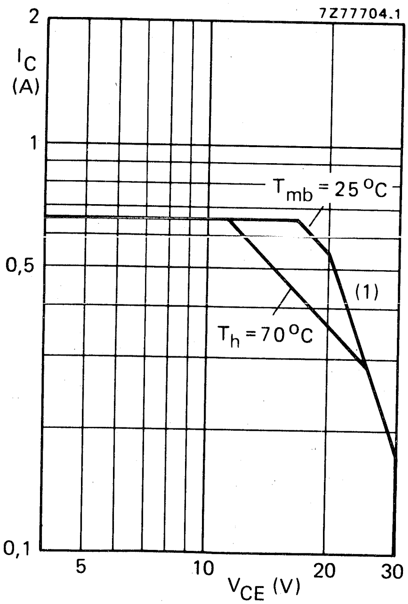
When locking is required an adhesive is preferred instead of a lock washer.

CAUTION This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage			
(peak value); $V_{BE} = 0$	V_{CESM}	max.	50 V
open base	V_{CEO}	max.	30 V
Emitter-base voltage (open collector)	V_{EBO}	max.	4 V
Collector current			
d.c. or average	I_C	max.	650 mA
(peak value); f > 1 MHz	I_{CM}	max.	1000 mA
Total power dissipation up to T_{mb} = 25 °C	P_{tot}	max.	10,8 W
Storage temperature	T_{stg}		−65 to +150 °C
Operating junction temperature	T_j	max.	200 °C



(1) Second breakdown limit (independent of temperature).

Fig. 2 D.C. SOAR.

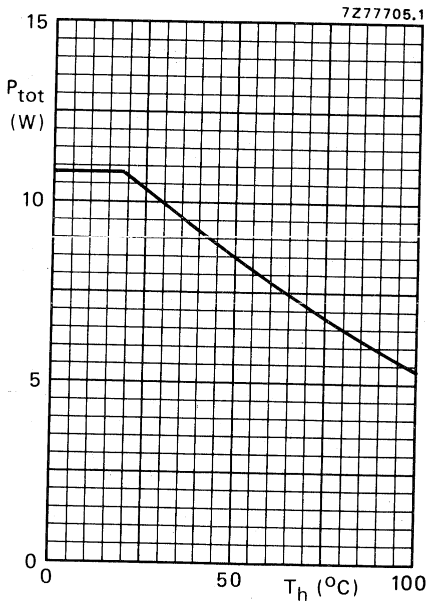


Fig. 3 Power derating curve vs. temperature.

THERMAL RESISTANCE (see Fig. 4)

From junction to mounting base (dissipation = 3,75 W; T_{mb} = 72,3 °C; i.e. T_h = 70 °C)	$R_{th\ j\text{-}mb}$	=	15,0 K/W*
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,6 K/W*

* K/W is SI unit for °C/W.

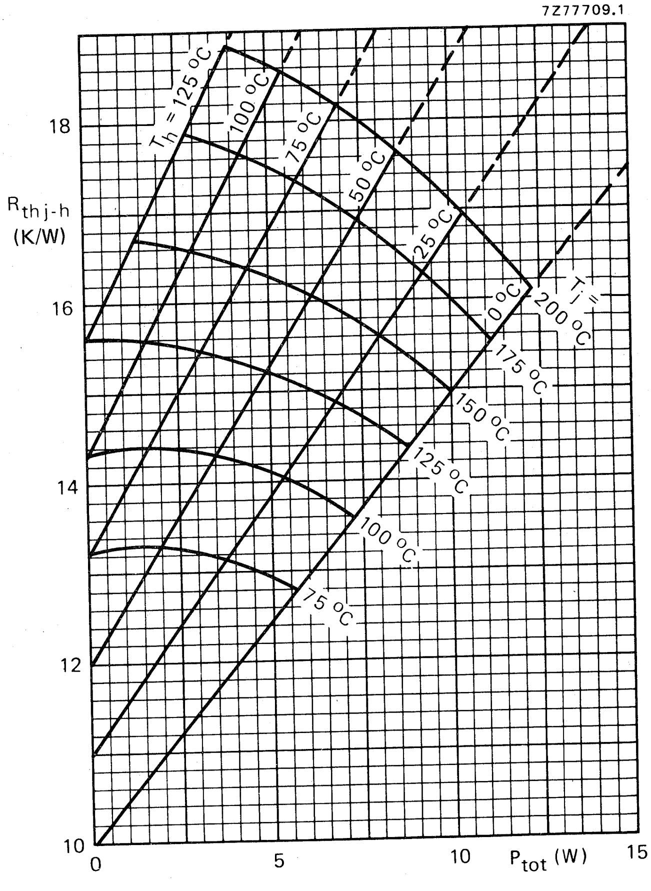


Fig. 4 Maximum thermal resistance from junction to heatsink as a function of power dissipation, with heatsink and junction temperature as parameters. ($R_{th\,mb\text{-}h}$ = 0,6 K/W.)

Example

Nominal class-A operation: V_{CE} = 25 V; I_C = 150 mA; T_h = 70 °C.

Fig. 4 shows:	$R_{th\,j\text{-}h}$	max.	15,6 K/W
	T_j	max.	130 °C
Typical device:	$R_{th\,j\text{-}h}$	typ.	13,5 K/W
	T_j	typ.	120 °C

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector-emitter breakdown voltage			
V_{BE} = 0; I_C = 2 mA	$V_{(BR)CES}$	>	50 V
open base; I_C = 15 mA	$V_{(BR)CEO}$	>	30 V
Emitter-base breakdown voltage			
open collector; I_E = 1 mA	$V_{(BR)EBO}$	>	4 V
Collector cut-off current			
V_{BE} = 0; V_{CE} = 30 V	I_{CES}	<	0,5 mA
V_{BE} = 0; V_{CE} = 30 V; T_j = 175 °C	I_{CES}	<	1,2 mA
D.C. current gain *			
I_C = 150 mA; V_{CE} = 25 V	h_{FE}	>	20
		typ.	40
I_C = 150 mA; V_{CE} = 25 V; T_j = 175 °C	h_{FE}	<	120
Collector-emitter saturation voltage *			
I_C = 300 mA; I_B = 30 mA	V_{CEsat}	typ.	500 mV
Transition frequency at f = 500 MHz **			
$-I_E$ = 150 mA; V_{CB} = 25 V	f_T	typ.	3,5 GHz
$-I_E$ = 300 mA; V_{CB} = 25 V	f_T	typ.	3,4 GHz
Collector capacitance at f = 1 MHz			
I_E = I_e = 0; V_{CB} = 25 V	C_c	typ.	3,7 pF
Feedback capacitance at f = 1 MHz			
I_C = 10 mA; V_{CE} = 25 V	C_{re}	typ.	1,9 pF
Collector-stud capacitance	C_{cs}	typ.	2 pF

* Measured under pulse conditions: $t_p \leqslant 300\ \mu s$; $\delta \leqslant 0,02$.
** Measured under pulse conditions: $t_p \leqslant 50\ \mu s$; $\delta \leqslant 0,01$.

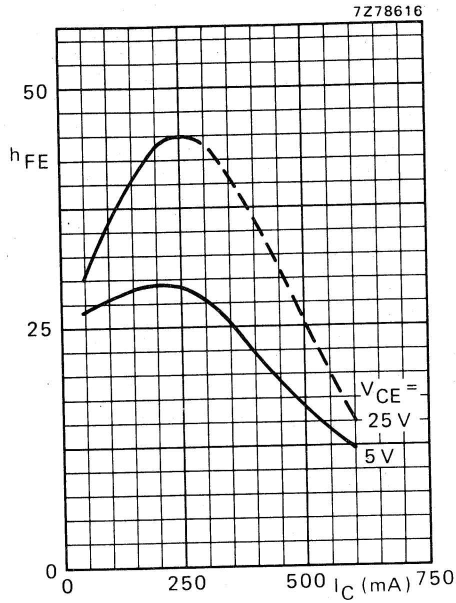


Fig. 5 Typical values; T_j = 25 °C.

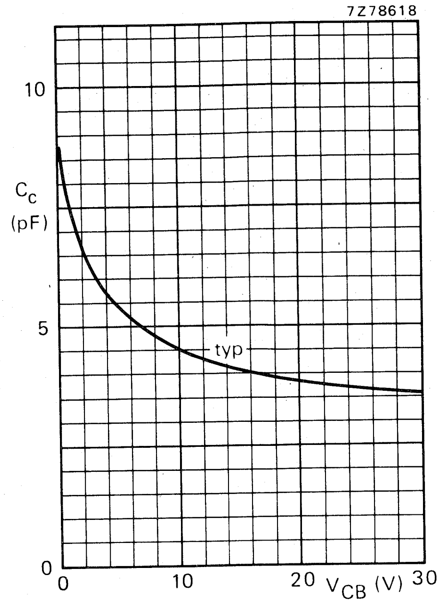


Fig. 6 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

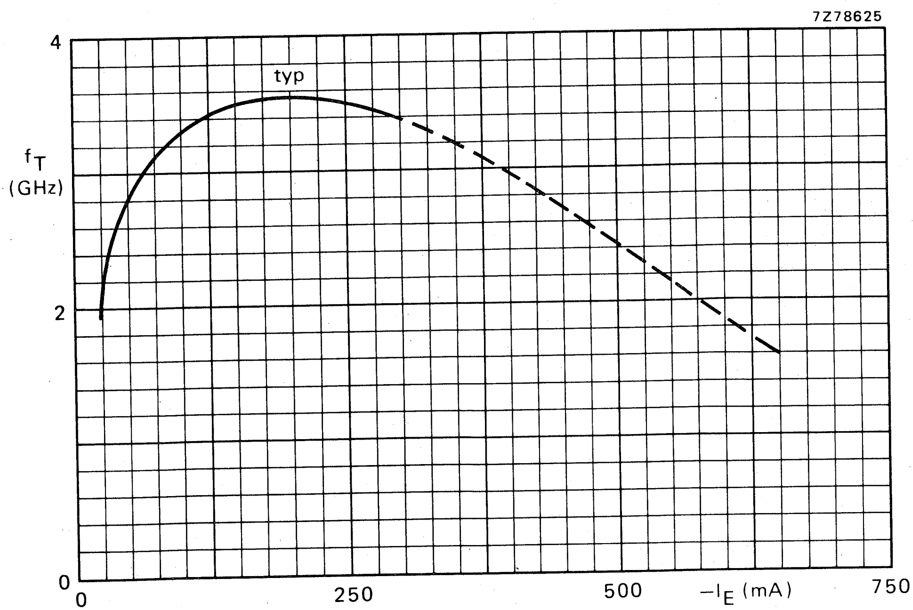


Fig. 7 V_{CB} = 25 V; f = 500 MHz; T_j = 25 °C.

APPLICATION INFORMATION

f_{vision} (MHz)	V_{CE} (V)	I_C (mA)	T_h (°C)	d_{im} (dB) *	$P_{o\ sync}$ (W) *	G_p (dB)
860	25	150	70	−60	> 0,5	> 11
860	25	150	70	−60	typ. 0,58	typ. 12,2
860	25	150	25	−60	typ. 0,63	typ. 12,2

* Three-tone test method (vision carrier −8 dB, sound carrier −7 dB, sideband signal −16 dB), zero dB corresponds to peak sync level.

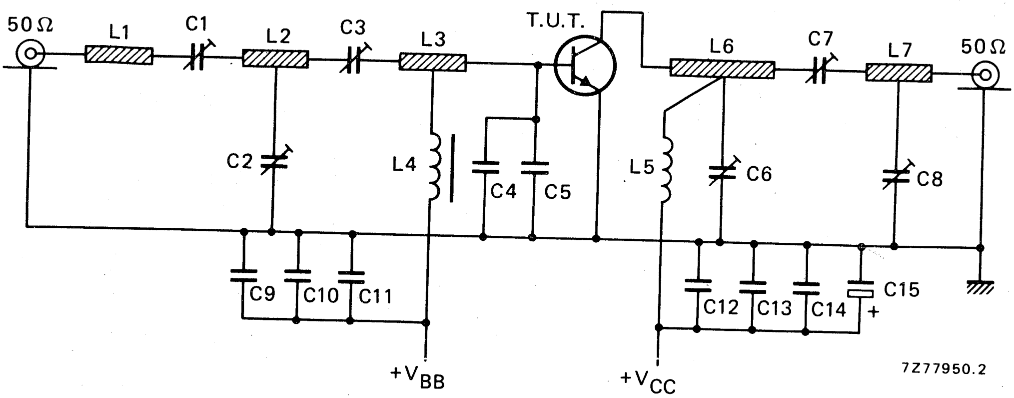


Fig. 8 Test circuit at f_{vision} = 860 MHz.

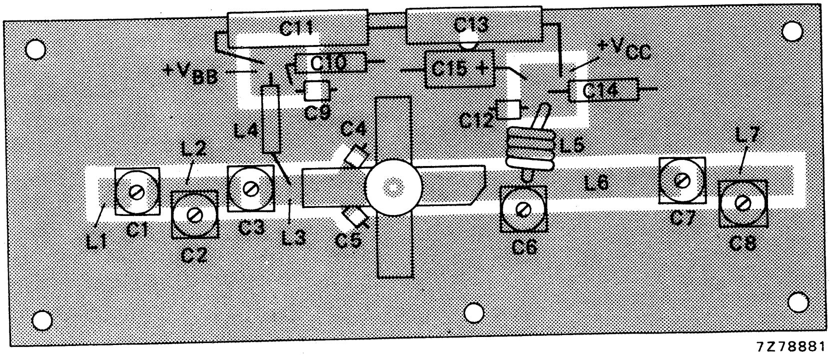
List of components:

C1 = C7 = 2 to 18 pF film dielectric trimmer (cat. no. 2222 809 05003)
C2 = C6 = C8 = 1 to 3,5 pF film dielectric trimmer (cat. no. 2222 809 05001) placed 24 mm, 17 mm and 45 mm respectively from transistor edge
C3 = 1,8 to 10 pF film dielectric trimmer (cat. no. 2222 809 05002)
C4 = C5 = 3 pF multilayer chip capacitor (ATC 100A-3RO-C-PX-50)
C9 = C12 = 1 nF chip capacitor
C10 = 100 nF polyester capacitor
C11 = C13 = 470 nF polyester capacitor
C14 = 10 nF polyester capacitor
C15 = 3,3 μF/40 V solid aluminium electrolytic capacitor

L1 = stripline (5,0 mm x 4,5 mm)
L2 = stripline (13,2 mm x 4,5 mm)
L3 = stripline (15,0 mm x 4,5 mm)
L4 = micro choke 0,47 μH (cat. no. 4322 057 04770)
L5 = 4 turns closely wound enamelled Cu wire (1,0 mm); int. dia. 5,5 mm; leads 2 x 4 mm
L6 = stripline (37,0 mm x 4,5 mm)
L7 = stripline (13,5 mm x 4,5 mm)

L1; L2; L3; L6 and L7 are striplines on a double Cu-clad printed-circuit board with PTFE fibre-glass dielectric (ϵ_r = 2,74); thickness 1/16″.

Component layout and printed-circuit board for 860 MHz test circuit are shown in Fig. 9. For bias circuit see Fig. 10.



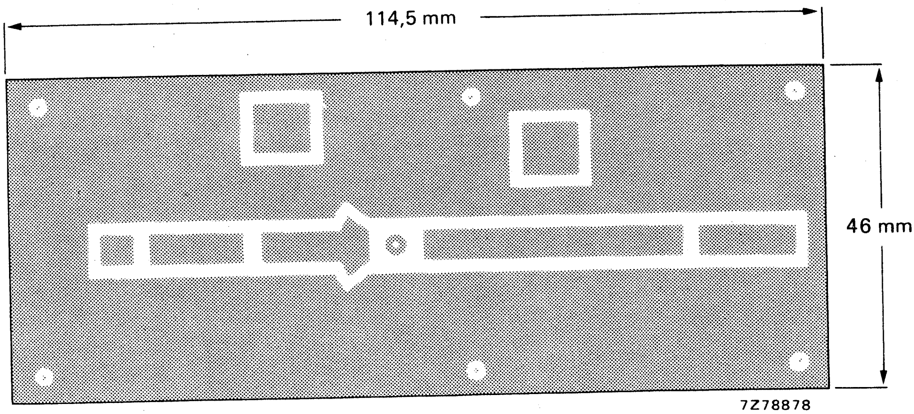
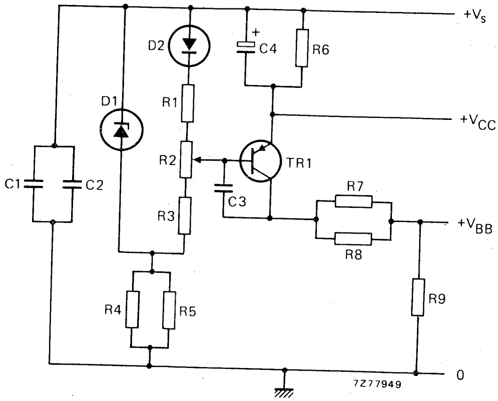


Fig. 9 Component layout and printed-circuit board for 860 MHz test circuit.

The circuit and the components are situated on one side of the PTFE fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets, whilst under the emitter leads Cu straps are used for a direct contact between upper and lower sheets.



List of components:

C1 = 100 pF ceramic capacitor
C2 = C3 = 100 nF polyester capacitor
C4 = 10 μF/25 V solid aluminium electrolytic capacitor
R1 = 150 Ω carbon resistor (0,25 W)
R2 = 100 Ω preset potentiometer (0,1 W)
R3 = 82 Ω carbon resistor (0,25 W)
R4 = R5 = 2,2 kΩ carbon resistor (0,25 W)
R6 = 12 Ω carbon resistor (0,5 W)
R7 = R8 = 820 Ω carbon resistor (0,25 W)
R9 = 33 Ω carbon resistor (0,25 W)

D1 = BZY88-C3V3
D2 = BY206
TR1 = BD136

Fig. 10 Bias circuit for class-A amplifier at f_{vision} = 860 MHz.

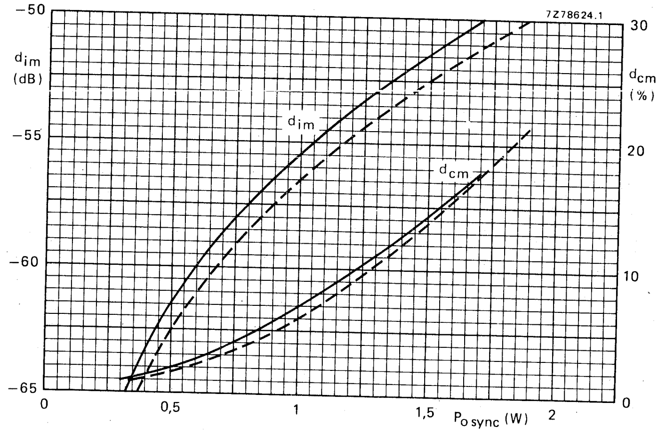


Fig. 11 Intermodulation distortion (d_{im})* and cross-modulation distortion (d_{cm})** as a function of output power. Typical values; V_{CE} = 25 V; I_C = 150 mA; f_{vision} = 860 MHz; ––– T_h = 25 °C; —— T_h = 70 °C.

Information for wideband application from 470 to 860 MHz available on request.

* Three-tone test method (vision carrier −8 dB, sound carrier −7 dB, sideband signal −16 dB), zero dB corresponds to peak sync level.
Intermodulation distortion of input signal ⩽ −75 dB.

** Two-tone test method (vision carrier 0 dB, sound carrier −7 dB), zero dB corresponds to peak sync level.
Cross-modulation distortion (d_{cm}) is the voltage variation (%) of sound carrier when vision carrier is switched from 0 dB to −20 dB.

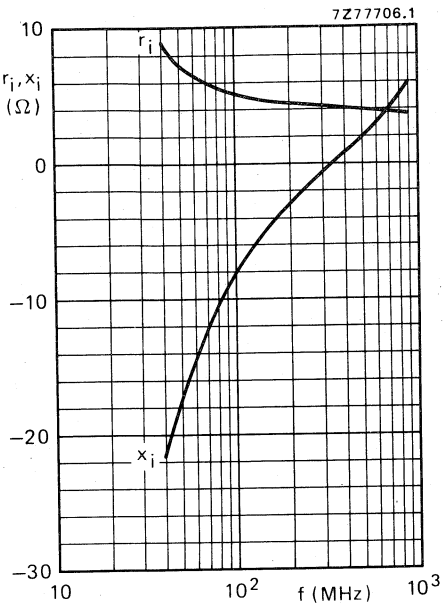


Fig. 12 Input impedance (series components).

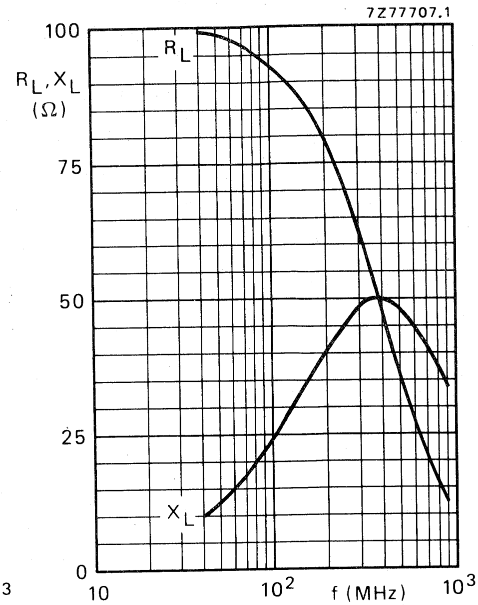


Fig. 13 Load impedance (series components).

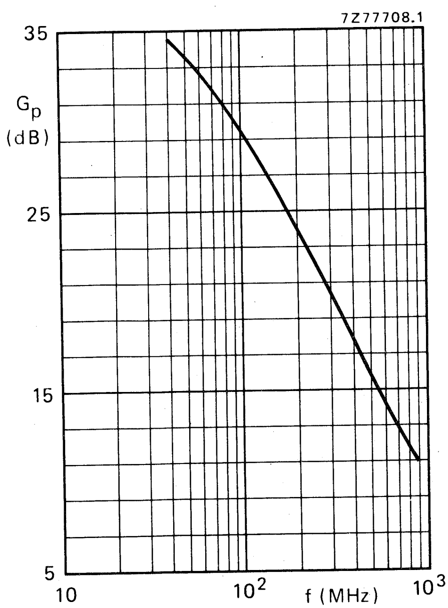


Fig. 14.

Conditions for Figs 12, 13 and 14:

Typical values; V_{CE} = 25 V; I_C = 150 mA;
T_h = 70 °C.

Ruggedness

The BLW32 is capable of withstanding a load mismatch (VSWR = 50 through all phases) under the following conditions:

f = 860 MHz; V_{CE} = 25 V; I_C = 150 mA;
T_h = 70 °C and P_L = 1 W.

U.H.F. LINEAR POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor primarily intended for use in **linear u.h.f. amplifiers** for television transmitters and transposers. The **excellent d.c. dissipation properties** for class-A operation are obtained by means of diffused emitter ballasting resistors and a multi-base structure, providing an optimum temperature profile on the crystal area. The combination of optimum thermal design and the application of **gold sandwich metallization** realizes excellent reliability properties.

The transistor has a ¼" capstan envelope with ceramic cap.

QUICK REFERENCE DATA

R.F. performance

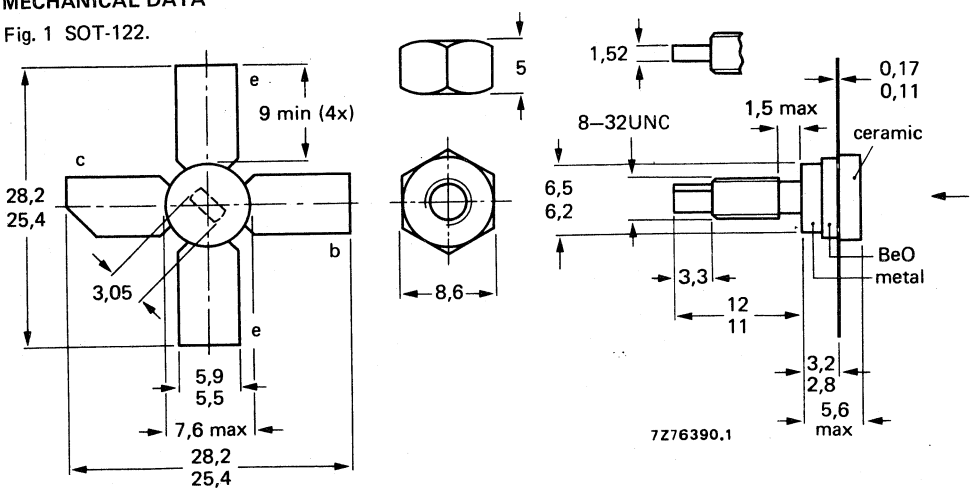
mode of operation	f_{vision} MHz	V_{CE} V	I_C mA	T_h °C	d_{im} * dB	$P_{o\ sync}$ * W	G_p dB
class-A; linear amplifier	860 860	25 25	300 300	70 25	−60 −60	> 1,0 typ. 1,15	> 10,0 typ. 10,5

* Three-tone test method (vision carrier −8 dB, sound carrier −7 dB, sideband signal −16 dB), zero dB corresponds to peak sync level.

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-122.



Torque on nut: min. 0,75 Nm (7,5 kg cm)
max. 0,85 Nm (8,5 kg cm)

Diameter of clearance hole in heatsink: max. 4,2 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

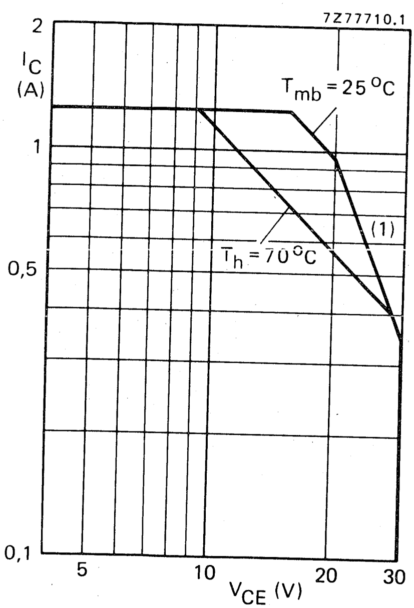
When locking is required an adhesive is preferred instead of a lock washer.

CAUTION This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage (peak value); $V_{BE} = 0$	V_{CESM}	max.	50 V
open base	V_{CEO}	max.	30 V
Emitter-base voltage (open collector)	V_{EBO}	max.	4 V
Collector current d.c. or average	I_C	max.	1,25 A
(peak value); f > 1 MHz	I_{CM}	max.	1,9 A
Total power dissipation up to $T_{mb} = 25\,^oC$	P_{tot}	max.	19,3 W
Storage temperature	T_{stg}		−65 to +150 ^oC
Operating junction temperature	T_j	max.	200 ^oC



(1) Second breakdown limit (independent of temperature).

Fig. 2 D.C. SOAR.

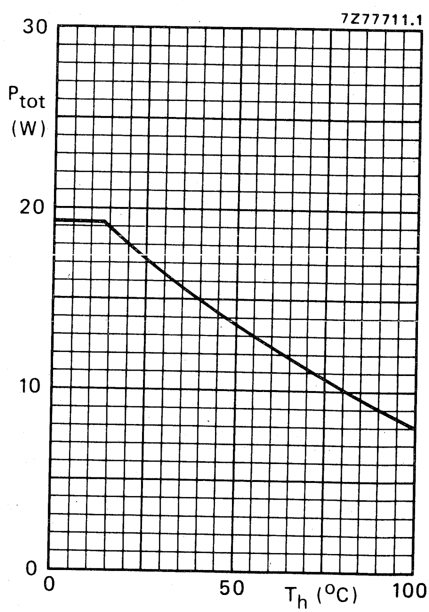


Fig. 3 Power derating curve vs. temperature.

THERMAL RESISTANCE (see Fig. 4)

From junction to mounting base (dissipation = 7,5 W; $T_{mb} = 74,5\,^oC$; i.e. $T_h = 70\,^oC$)	$R_{th\ j\text{-}mb}$	=	10,1 K/W*
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,6 K/W*

* K/W is SI unit for $^oC/W$.

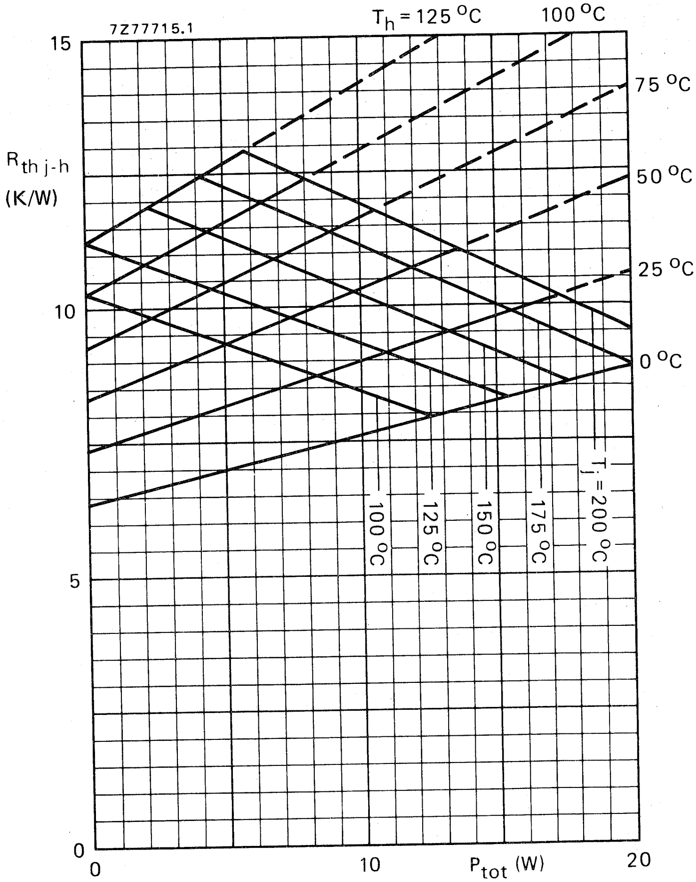


Fig. 4 Maximum thermal resistance from junction to heatsink as a function of power dissipation, with heatsink and junction temperature as parameters. ($R_{th\ mb\text{-}h}$ = 0,6 K/W.)

Example

Nominal class-A operation: V_{CE} = 25 V; I_C = 300 mA; T_h = 70 °C.

Fig. 4 shows:	$R_{th\ j\text{-}h}$	max.	10,7 K/W
	T_j	max.	150 °C
Typical device:	$R_{th\ j\text{-}h}$	typ.	8,25 K/W
	T_j	typ.	132 °C

CHARACTERISTICS

$T_j = 25\ ^oC$ unless otherwise specified

Collector-emitter breakdown voltage			
$V_{BE} = 0$; $I_C = 4$ mA	$V_{(BR)CES}$	>	50 V
open base; $I_C = 30$ mA	$V_{(BR)CEO}$	>	30 V
Emitter-base breakdown voltage			
open collector; $I_E = 2$ mA	$V_{(BR)EBO}$	>	4 V
Collector cut-off current			
$V_{BE} = 0$; $V_{CE} = 30$ V	I_{CES}	<	1,0 mA
$V_{BE} = 0$; $V_{CE} = 30$ V; $T_j = 175\ ^oC$	I_{CES}	<	2,5 mA
D.C. current gain			
$I_C = 300$ mA; $V_{CE} = 25$ V	h_{FE}	>	20
		typ.	40
$I_C = 300$ mA; $V_{CE} = 25$ V; $T_j = 175\ ^oC$	h_{FE}	<	120
Collector-emitter saturation voltage *			
$I_C = 600$ mA; $I_B = 60$ mA	V_{CEsat}	typ.	450 mV
Transition frequency at f = 500 MHz **			
$-I_E = 300$ mA; $V_{CB} = 25$ V	f_T	typ.	3,4 GHz
$-I_E = 600$ mA; $V_{CB} = 25$ V	f_T	typ.	3,1 GHz
Collector capacitance at f = 1 MHz			
$I_E = I_e = 0$; $V_{CB} = 25$ V	C_c	typ.	6,6 pF
Feedback capacitance at f = 1 MHz			
$I_C = 20$ mA; $V_{CE} = 25$ V	C_{re}	typ.	3,5 pF
Collector-stud capacitance	C_{cs}	typ.	2 pF

* Measured under pulse conditions: $t_p \leqslant 300\ \mu s$; $\delta \leqslant 0{,}02$.

** Measured under pulse conditions: $t_p \leqslant 50\ \mu s$; $\delta \leqslant 0{,}01$.

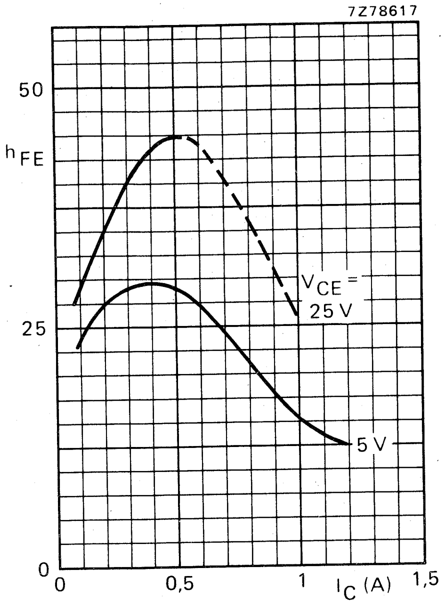


Fig. 5 Typical values; T_j = 25 °C.

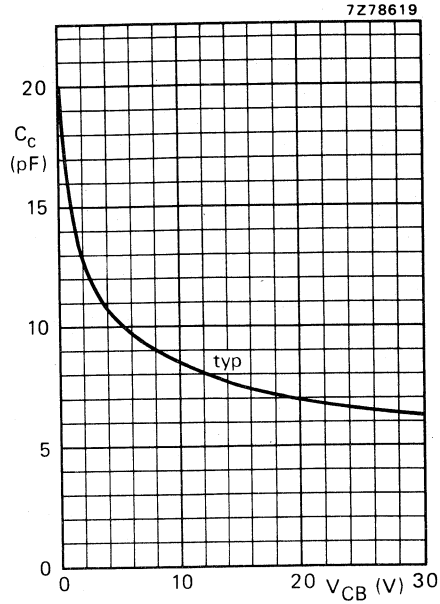


Fig. 6 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

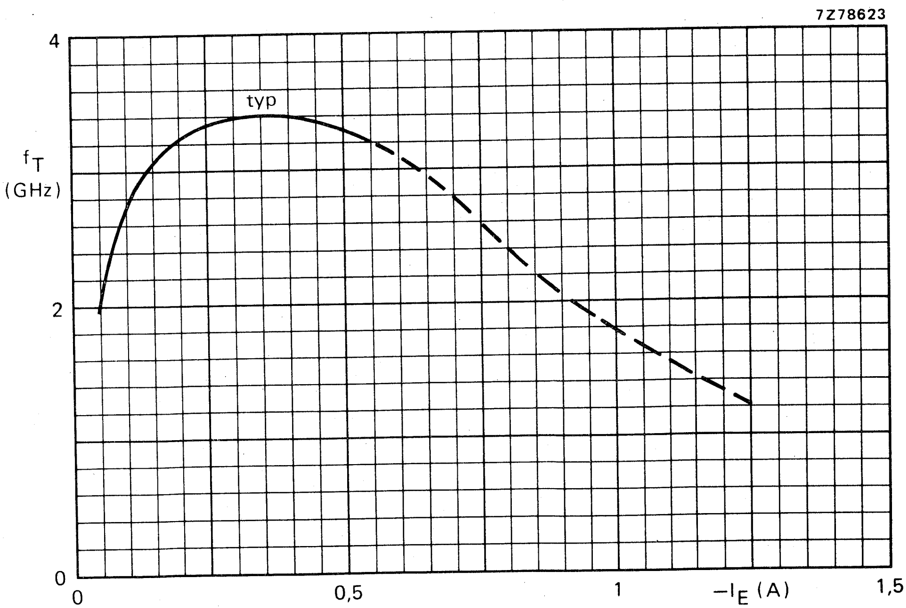


Fig. 7 V_{CB} = 25 V; f = 500 MHz; T_j = 25 °C.

APPLICATION INFORMATION

f_{vision} (MHz)	V_{CE} (V)	I_C (mA)	T_h (°C)	d_{im} (dB) *	$P_{o\,sync}$ (W) *	G_p (dB)
860	25	300	70	−60	> 1,0	> 10
860	25	300	70	−60	typ. 1,07	typ. 10,5
860	25	300	25	−60	typ. 1,15	typ. 10,5

* Three-tone test method (vision carrier −8 dB, sound carrier −7 dB, sideband signal −16 dB), zero dB corresponds to peak sync level.

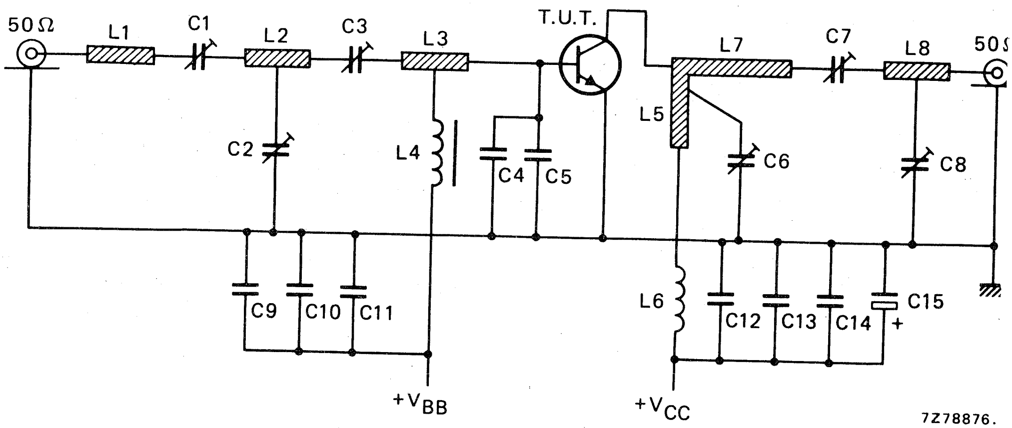


Fig. 8 Test circuit at f_{vision} = 860 MHz.

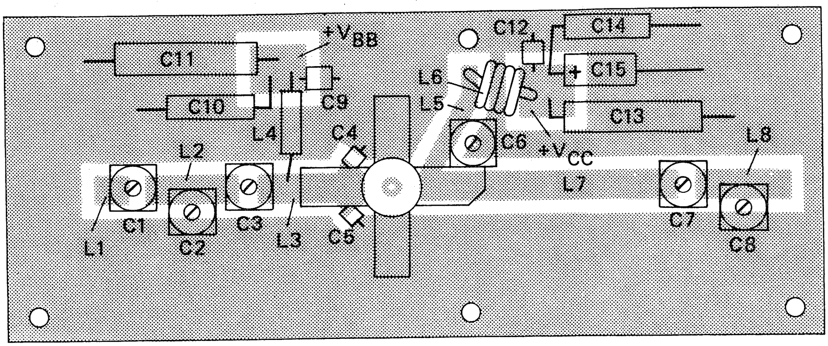
List of components:

C1 = C3 = 2 to 18 pF film dielectric trimmer (cat. no. 2222 809 05003)
C2 = C6 = C8 = 1 to 3,5 pF film dielectric trimmer (cat. no. 2222 809 05001) placed 24 mm, 8 mm and 46 mm respectively from transistor edge
C4 = C5 = 4,3 pF multilayer chip capacitor (ATC 100A-4R3-C-PX-50)
C7 = 1,8 to 10 pF film dielectric trimmer (cat. no. 2222 809 05002)
C9 = C12 = 1 nF chip capacitor
C10 = 100 nF polyester capacitor
C11 = C13 = 470 nF polyester capacitor
C14 = 10 nF polyester capacitor
C15 = 3,3 μF/40 F solid aluminium electrolytic capacitor

L1 = stripline (5,2 mm x 4,5 mm)
L2 = stripline (13,2 mm x 4,5 mm)
L3 = stripline (15,0 mm x 4,5 mm)
L4 = micro choke 0,47 μH (cat. no. 4322 057 04770)
L5 = stripline (see Fig. 9 printed-circuit board layout)
L6 = 4 turns closely wound enamelled Cu wire (1,0 mm); int. dia. 5,5 mm; leads 2 x 4 mm
L7 = stripline (37,0 mm x 4,5 mm)
L8 = stripline (13,5 mm x 4,5 mm)

L1; L2; L3; L5; L7 and L8 are striplines on a double Cu-clad printed-circuit board with PTFE fibre-glass dielectric (ϵ_r = 2,74); thickness 1/16″.

For bias circuit see Fig. 10.



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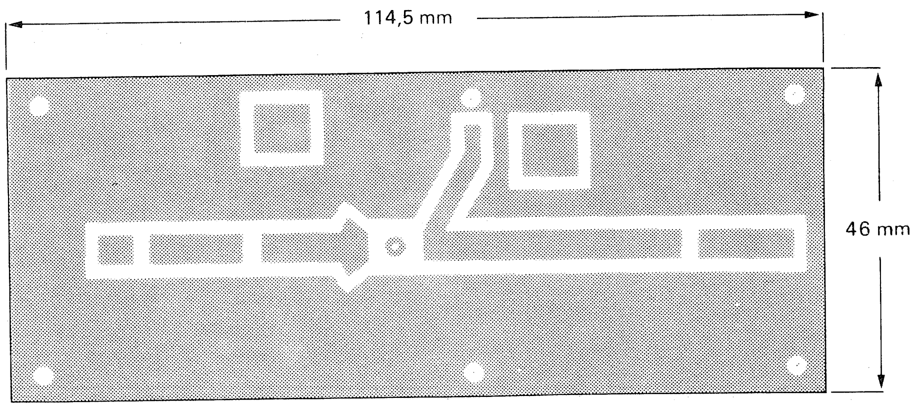

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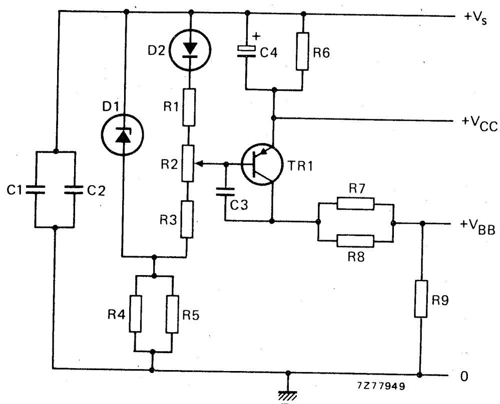
Fig. 9 Component layout and printed-circuit board for 860 MHz test circuit.

The circuit and the components are situated on one side of the PTFE fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets, whilst under the emitter leads Cu straps are used for a direct contact between upper and lower sheets.



List of components:

C1 = 100 pF ceramic capacitor
C2 = C3 = 100 nF polyester capacitor
C4 = 10 μF/25 V solid aluminium electrolytic capacitor
R1 = 150 Ω carbon resistor (0,25 W)
R2 = 100 Ω preset potentiometer (0,1 W)
R3 = 82 Ω carbon resistor (0,25 W)
R4 = R5 = 2,2 kΩ carbon resistor (0,25 W)
R6 = 6 Ω; parallel connection of 2 x 12 Ω carbon resistors (0,5 W each)
R7 = R8 = 820 Ω carbon resistor (0,25 W)
R9 = 33 Ω carbon resistor (0,25 W)

D1 = BZY88-C3V3
D2 = BY206
TR1 = BD136

Fig. 10 Bias circuit for class-A linear amplifier at f_{vision} = 860 MHz.

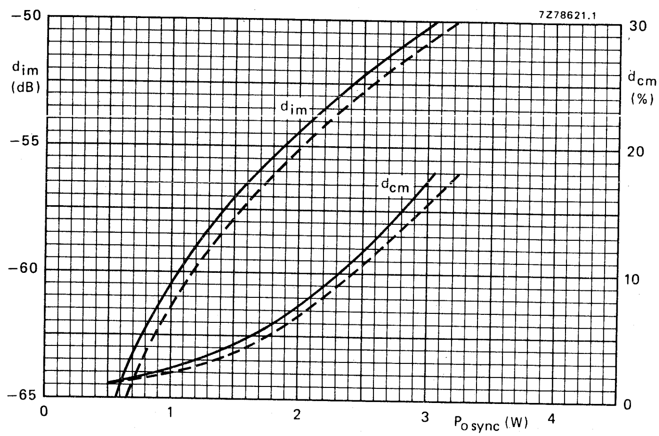


Fig. 11 Intermodulation distortion (d_{im})* and cross-modulation distortion (d_{cm})** as a function of output power. Typical values; V_{CE} = 25 V; I_C = 300 mA; f_{vision} = 860 MHz; ––– T_h = 25 °C; —— T_h = 70 °C.

Information for wideband application from 470 to 860 MHz available on request.

* Three-tone test method (vision carrier −8 dB, sound carrier −7 dB, sideband signal −16 dB), zero dB corresponds to peak sync level.
Intermodulation distortion of input signal ⩽ −75 dB.

** Two-tone test method (vision carrier 0 dB, sound carrier −7 dB), zero dB corresponds to peak sync level.
Cross-modulation distortion (d_{cm}) is the voltage variation (%) of sound carrier when vision carrier is switched from 0 dB to −20 dB.

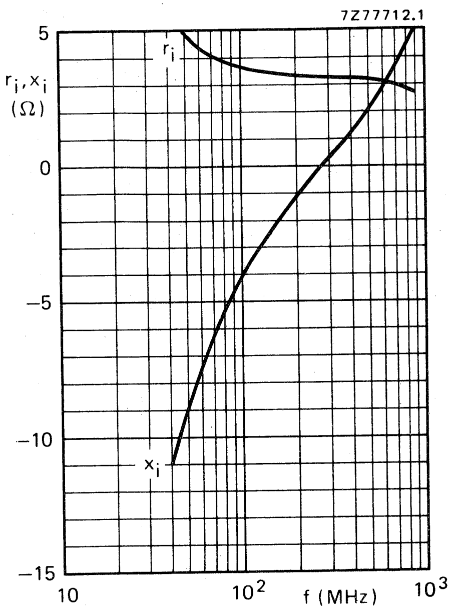


Fig. 12 Input impedance (series components).

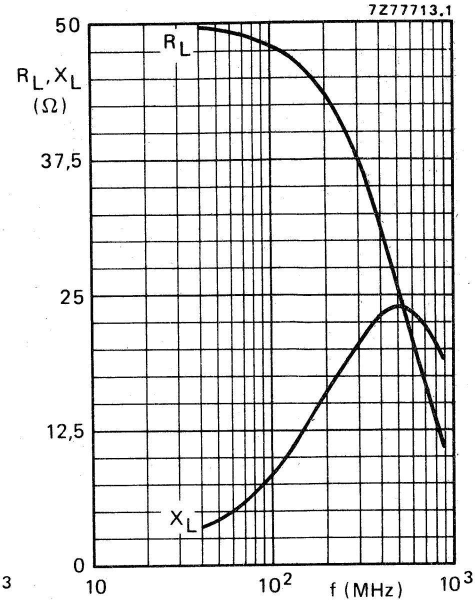


Fig. 13 Load impedance (series components).

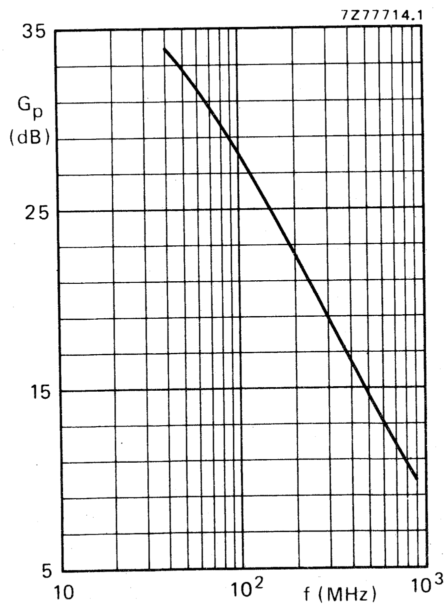


Fig. 14.

Conditions for Figs 12, 13 and 14:

Typical values; V_{CE} = 25 V; I_C = 300 mA; T_h = 70 °C.

Ruggedness

The BLW33 is capable of withstanding a load mismatch (VSWR = 50 through all phases) under the following conditions:

f = 860 MHz; V_{CE} = 25 V; I_C = 300 mA; T_h = 70 °C and P_L = 2 W.

U.H.F. LINEAR POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor primarily intended for use in **linear u.h.f. amplifiers** for television transmitters and transposers. The **excellent d.c. dissipation properties** for class-A operation are obtained by means of diffused emitter ballasting resistors and a multi-base structure, providing an optimum temperature profile on the crystal area. The combination of optimum thermal design and the application of **gold sandwich metallization** realizes excellent reliability properties.

The transistor has a ¼" capstan envelope with ceramic cap.

QUICK REFERENCE DATA

R.F. performance

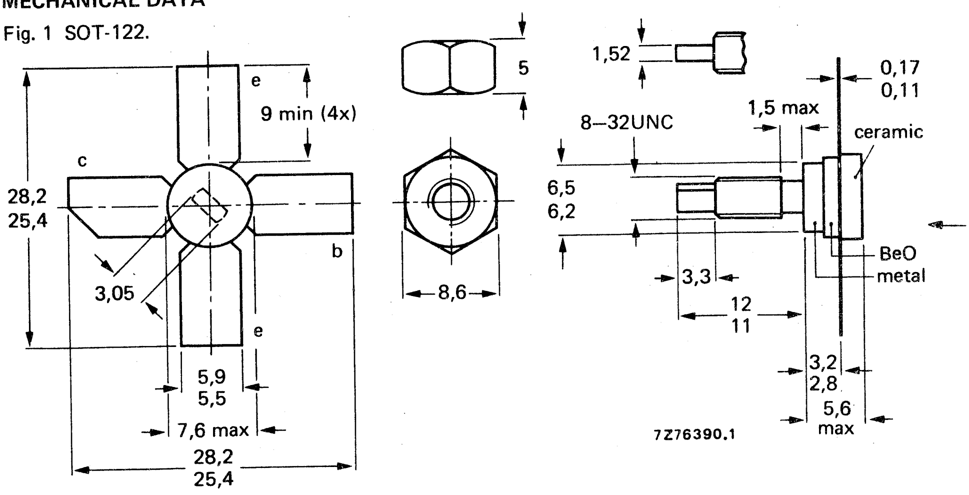
mode of operation	f_{vision} MHz	V_{CE} V	I_C mA	T_h °C	d_{im} * dB	$P_{o\ sync}$ * W	G_p dB
class-A; linear amplifier	860	25	600	70	−60	> 1,8	> 9
	860	25	600	25	−60	typ. 2,15	typ. 10,2

* Three-tone test method (vision carrier −8 dB, sound carrier −7 dB, sideband signal −16 dB), zero dB corresponds to peak sync level.

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-122.



Torque on nut: min. 0,75 Nm (7,5 kg cm)
max. 0,85 Nm (8,5 kg cm)

Diameter of clearance hole in heatsink: max. 4,2 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

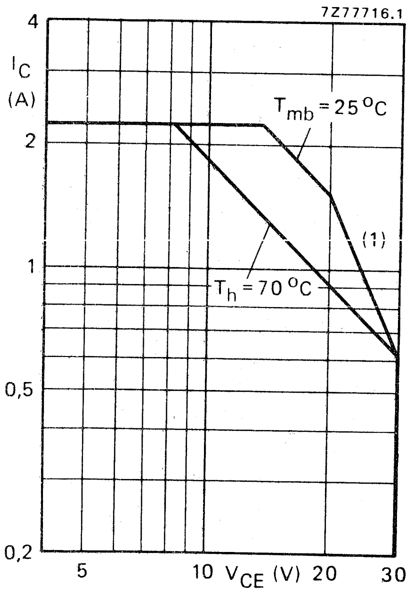
When locking is required an adhesive is preferred instead of a lock washer.

CAUTION This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage			
(peak value); $V_{BE} = 0$	V_{CESM}	max.	50 V
open base	V_{CEO}	max.	30 V
Emitter-base voltage (open collector)	V_{EBO}	max.	4 V
Collector current			
d.c. or average	I_C	max.	2,25 A
(peak value); f > 1 MHz	I_{CM}	max.	3,5 A
Total power dissipation at T_{mb} = 25 °C	P_{tot}	max.	31 W
Storage temperature	T_{stg}		−65 to +150 °C
Operating junction temperature	T_j	max.	200 °C



(1) Second breakdown limit (independent of temperature).

Fig. 2 D.C. SOAR.

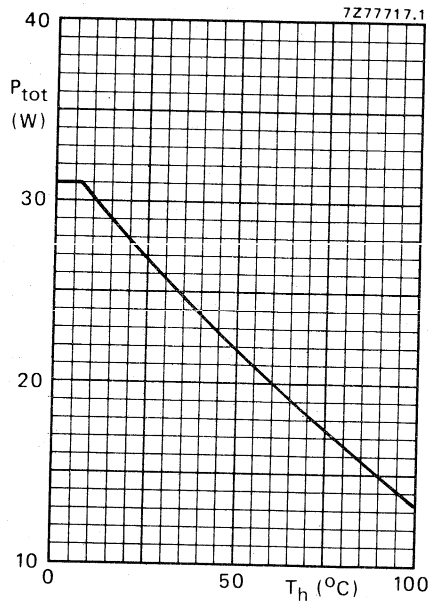


Fig. 3 Power derating curve vs. temperature.

THERMAL RESISTANCE (see Fig. 4)

From junction to mounting base (dissipation = 15 W; T_{mb} = 79 °C; i.e. T_h = 70 °C)	$R_{th\ j\text{-}mb}$	=	6,2 K/W*
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,6 K/W*

* K/W is SI unit for °C/W.

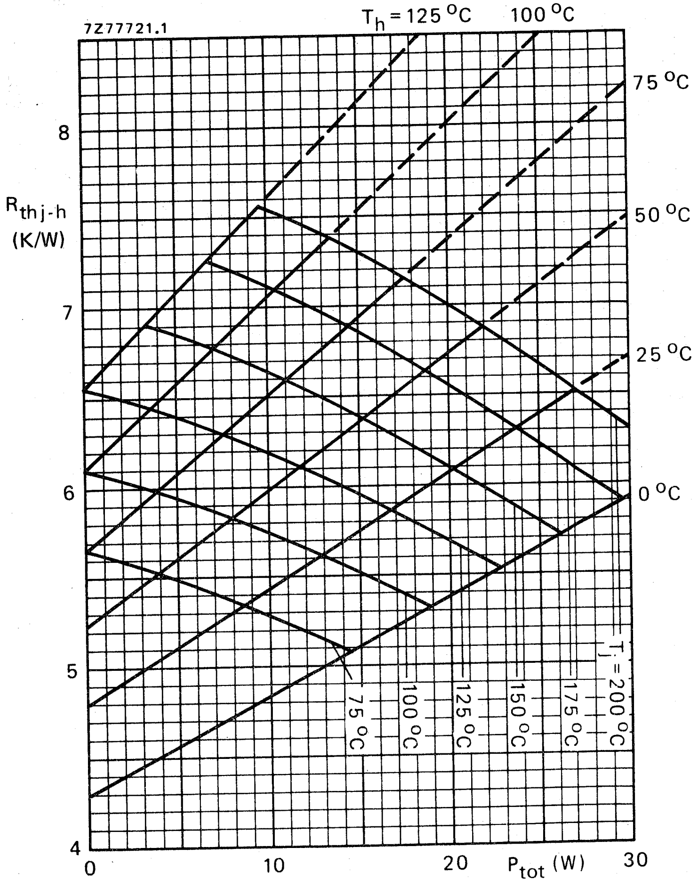


Fig. 4 Maximum thermal resistance from junction to heatsink as a function of power dissipation, with heatsink and junction temperature as parameters. ($R_{th\ mb\text{-}h}$ = 0,6 K/W.)

Example

Nominal class-A operation: V_{CE} = 25 V; I_C = 600 mA; T_h = 70 °C.

Fig. 4 shows:	$R_{th\ j\text{-}h}$	max.	6,75	K/W
	T_j	max.	170	°C
Typical device:	$R_{th\ j\text{-}h}$	typ.	5,45	K/W
	T_j	typ.	152	°C

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector-emitter breakdown voltage			
$V_{BE} = 0$; I_C = 8 mA	$V_{(BR)CES}$	>	50 V
open base; I_C = 60 mA	$V_{(BR)CEO}$	>	30 V
Emitter-base breakdown voltage			
open collector; I_E = 4 mA	$V_{(BR)EBO}$	>	4 V
Collector cut-off current			
$V_{BE} = 0$; V_{CE} = 30 V	I_{CES}	<	2,0 mA
$V_{BE} = 0$; V_{CE} = 30 V; T_j = 175 °C	I_{CES}	<	5,0 mA
D.C. current gain			
I_C = 600 mA; V_{CE} = 25 V	h_{FE}	>	20
		typ.	40
I_C = 600 mA; V_{CE} = 25 V; T_j = 175 °C	h_{FE}	<	120
Collector-emitter saturation voltage *			
I_C = 1,2 A; I_B = 0,12 A	V_{CEsat}	typ.	450 mV
Transition frequency at f = 500 MHz **			
$-I_E$ = 0,6 A; V_{CB} = 25 V	f_T	typ.	3,3 GHz
$-I_E$ = 1,2 A; V_{CB} = 25 V	f_T	typ.	3,0 GHz
Collector capacitance at f = 1 MHz			
$I_E = I_e = 0$; V_{CB} = 25 V	C_c	typ.	13,5 pF
Feedback capacitance at f = 1 MHz			
I_C = 40 mA; V_{CE} = 25 V	C_{re}	typ.	8,4 pF
Collector-stud capacitance	C_{cs}	typ.	2 pF

* Measured under pulse conditions: $t_p \leq 300\ \mu s$; $\delta \leq 0,02$.
** Measured under pulse conditions: $t_p \leq 50\ \mu s$; $\delta \leq 0,01$.

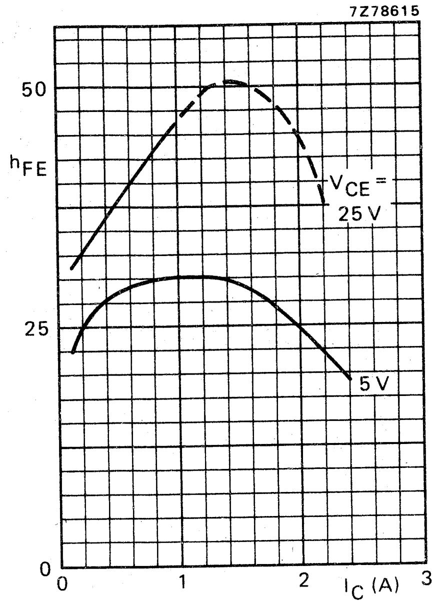


Fig. 5 Typical values; T_j = 25 °C.

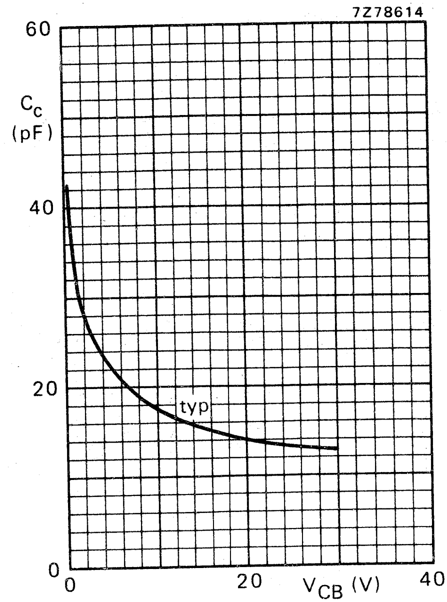


Fig. 6 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

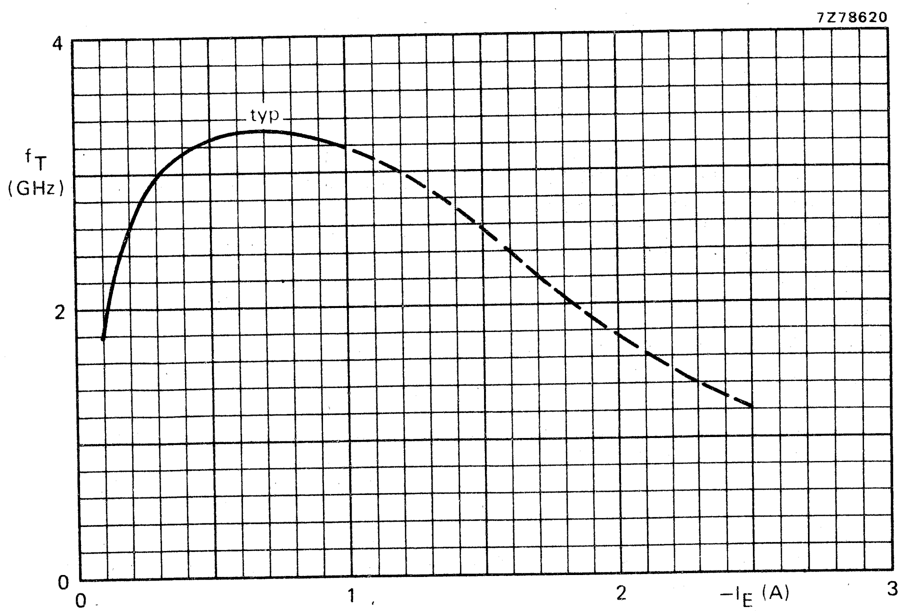


Fig. 7 V_{CB} = 25 V; f = 500 MHz; T_j = 25 °C

APPLICATION INFORMATION

f_{vision} (MHz)	V_{CE} (V)	I_C (mA)	T_h (°C)	d_{im} (dB) *	$P_{o\,sync}$ (W) *	G_p (dB)
860	25	600	70	−60	> 1,8	> 9
860	25	600	70	−60	typ. 1,9	typ. 10,2
860	25	600	25	−60	typ. 2,15	typ. 10,2

* Three-tone test method (vision carrier −8 dB, sound carrier −7 dB, sideband signal −16 dB), zero dB corresponds to peak sync level.

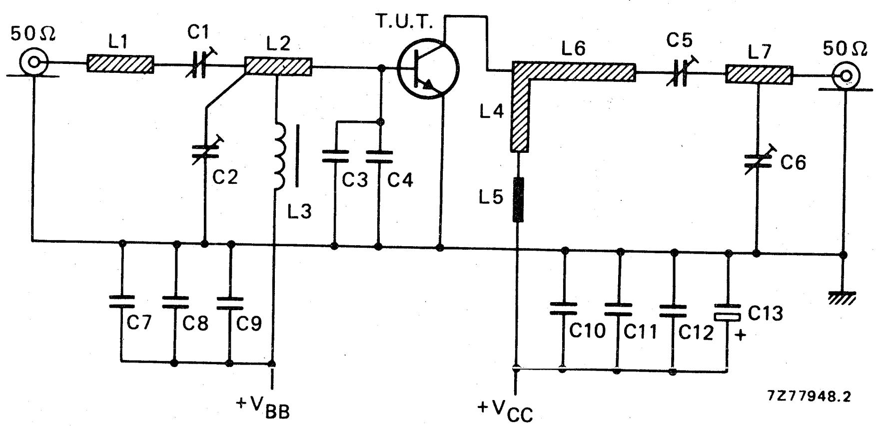


Fig. 8 Test circuit at f_{vision} = 860 MHz.

List of components:

C1 = C5 = 1,8 to 10 pF film dielectric trimmer (cat. no. 2222 809 05002)
C2 = C6 = 1 to 3,5 pF film dielectric trimmer (cat. no. 2222 809 05001) placed 13,5 mm and 46 mm respectively from transistor edge
C3 = C4 = 2 pF multilayer chip capacitor (ATC 100A-2RO-C-PX-50)
C7 = C10 = 1 nF chip capacitor
C8 = 100 nF polyester capacitor
C9 = C12 = 470 nF polyester capacitor
C11 = 10 nF polyester capacitor
C13 = 3,3 μF/40 V solid aluminium electrolytic capacitor

L1 = stripline (9,2 mm x 7,0 mm)
L2 = stripline (14,2 mm x 7,0 mm)
L3 = micro choke 0,47 μH (cat. no. 4322 057 04770)
L4 = stripline (see Fig. 9 printed-circuit board layout)
L5 = 34 mm straight Cu wire (1,0 mm); height above print 3,3 mm
L6 = stripline (41,0 mm x 7,0 mm)
L7 = stripline (8,7 mm x 7,0 mm)

L1; L2; L4; L6 and L7 are striplines on a double Cu-clad printed-circuit board with PTFE fibre-glass dielectric (ϵ_r = 2,74); thickness 1/16".

Component layout and printed-circuit board for 860 MHz test circuit are shown in Fig. 9. For bias circuit see Fig. 10.

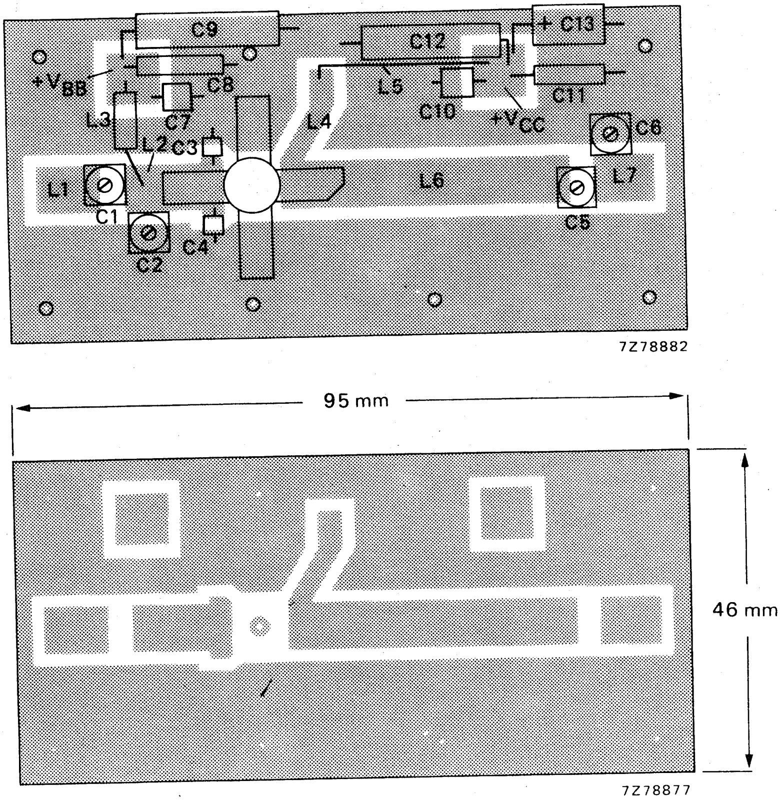
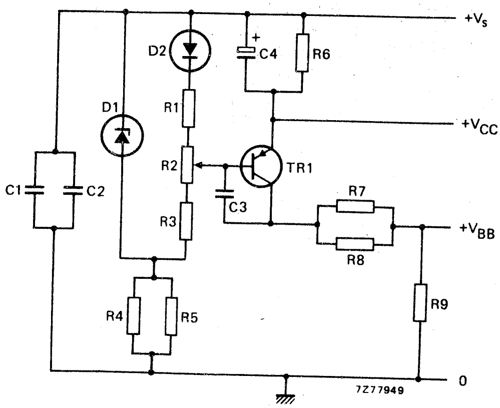


Fig. 9 Component layout and printed-circuit board for 860 MHz test circuit.

The circuit and the components are situated on one sode of the PTFE fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets, whilst under the emitter leads Cu straps are used for a direct contact between upper and lower sheets.



List of components:

C1 = 100 pF ceramic capacitor
C2 = C3 = 100 nF polyester capacitor
C4 = 10 μF/25 V solid aluminium electrolytic capacitor
R1 = 150 Ω carbon resistor (0,25 W)
R2 = 100 Ω preset potentiometer (0,1 W)
R3 = 82 Ω carbon resistor (0,25 W)
R4 = R5 = 2,2 kΩ carbon resistor (0,25 W)
R6 = 2,8 Ω; parallel connection of 2 x 5,6 Ω carbon resistors (0,5 W each)
R7 = R8 = 820 Ω carbon resistor (0,25 W)
R9 = 33 Ω carbon resistor (0,25 W)
D1 = BZY88-C3V3
D2 = BY206
TR1 = BD136

Fig. 10 Bias circuit for class-A linear amplifier at f_{vision} = 860 MHz.

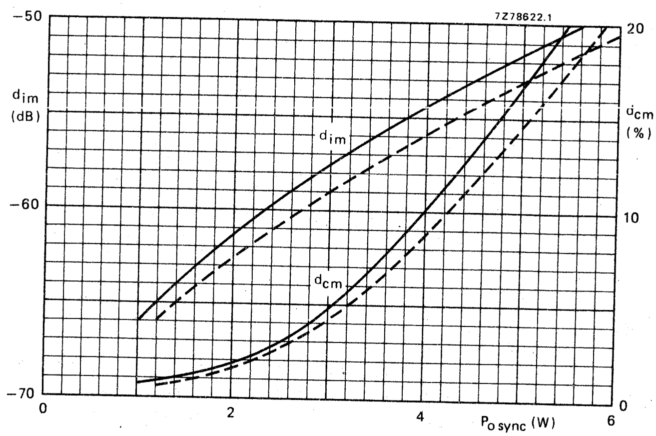


Fig. 11 Intermodulation distortion (d_{im})* and cross-modulation distortion (d_{cm})** as a function of output power. Typical values; V_{CE} = 25 V; I_C = 600 mA; f_{vision} = 860 MHz; ---- T_h = 25 °C; —— T_h = 70 °C.

Information for wideband application from 470 to 860 MHz available on request.

* Three-tone test method (vision carrier −8 dB, sound carrier −7 dB, sideband signal −16 dB), zero dB corresponds to peak sync level.
Intermodulation distortion of input signal ⩽ −75 dB.

** Two-tone test method (vision carrier 0 dB, sound carrier −7 dB), zero dB corresponds to peak sync level.
Cross-modulation distortion (d_{cm}) is the voltage variation (%) of sound carrier when vision carrier is switched from 0 dB to −20 dB.

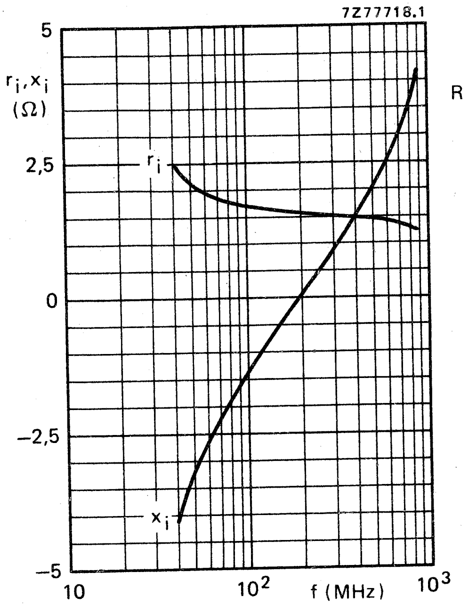


Fig. 12 Input impedance (series components).

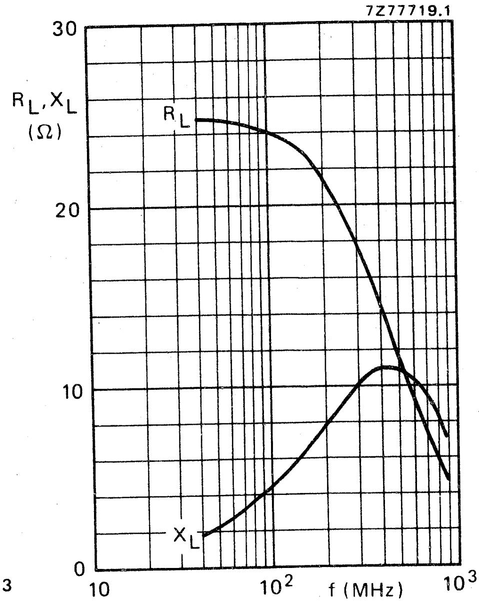


Fig. 13 Load impedance (series components).

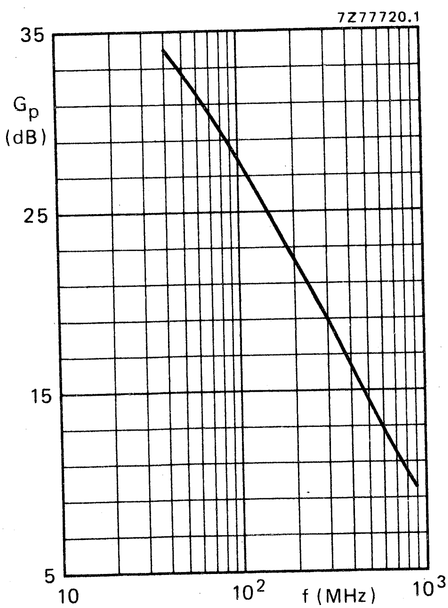


Fig. 14.

Conditions for Figs 12, 13 and 14:

Typical values; V_{CE} = 25 V; I_C = 600 mA; T_h = 70 °C.

Ruggedness

The BLW34 is capable of withstanding a load mismatch (VSWR = 50 through all phases) under the following conditions:

f = 860 MHz; V_{CE} = 25 V; I_C = 600 mA; T_h = 70 °C and P_L = 4 W.

H.F./V.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor primarily intended for use in class-A, AB and B operated, industrial and military transmitters in the h.f. and v.h.f. band. Resistance stabilization provides protection against device damage at severe load mismatch conditions. Matched h_{FE} groups are available on request.

It has a 3/8" flange envelope with a ceramic cap. All leads are isolated from the flange.

QUICK REFERENCE DATA

R.F. performance

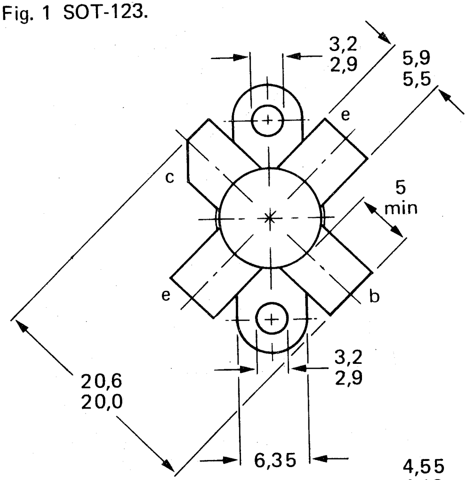
mode of operation	V_{CE} V	f MHz	P_L W	G_p dB	η_{dt} %	I_C A	$I_{C(ZS)}$ mA	d_3 dB	T_h °C
s.s.b. (class-A)	45	1,6 - 28	0 - 16 (P.E.P.)	> 19,5	–	1,2	–	< –40	70
s.s.b. (class-AB)	50	1,6 - 28	10 - 65 (P.E.P.)	typ. 18	typ. 45*	1,45	50	typ. –30	25

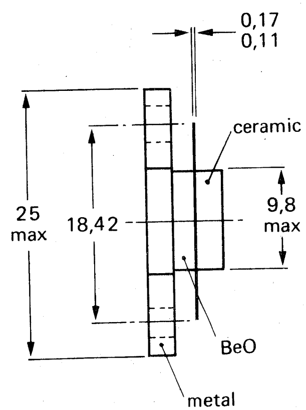
* At 65W P.E.P.

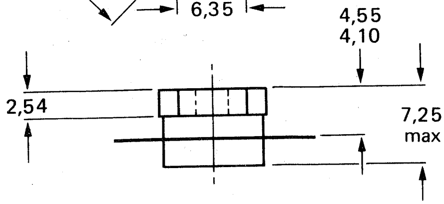
MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-123.







Torque on screw: min. 0,6 Nm (6 kg cm)
max. 0,75 Nm (7,5 kg cm)

Recommended screw: cheese-head 4-40 UNC/2A

Heatsink compound must be applied sparingly and evenly distributed.

CAUTION This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage (V_{BE} = 0) peak value	V_{CESM}	max.	110 V
Collector-emitter voltage (open base)	V_{CEO}	max.	55 V
Emitter-base voltage (open collector)	V_{EBO}	max.	4 V
Collector current (average)	$I_{C(AV)}$	max.	2,5 A
Collector current (peak value); f > 1 MHz	I_{CM}	max.	7,5 A
D.C. and r.f. (f > 1 MHz) power dissipation; T_{mb} = 25 °C	P_{tot}; P_{rf}	max.	94 W
Storage temperature	T_{stg}		−65 to + 150 °C
Operating junction temperature	T_j	max.	200 °C

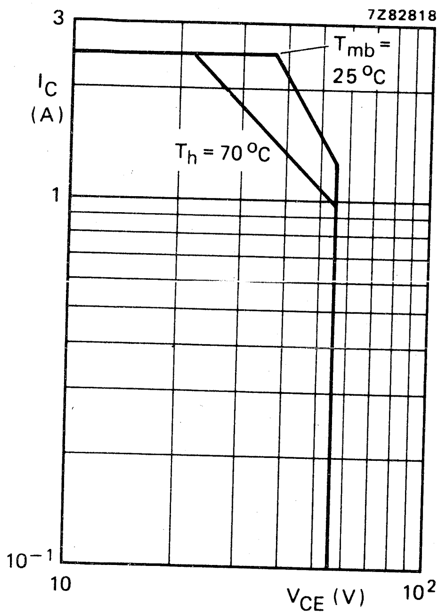


Fig. 2 D.C. SOAR.

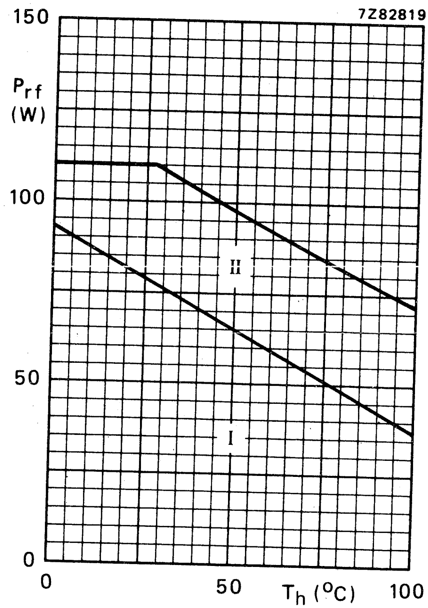


Fig. 3 Power derating curves vs. temperature.
I Continuous d.c. and r.f. operation
II Short-time operation during mismatch

THERMAL RESISTANCE (dissipation = 54 W; T_{mb} = 86 °C, i.e. T_h = 70 °C)

From junction to mounting base (d.c. and r.f. dissipation)	$R_{th\ j\text{-}mb}$	=	2,1 K/W*
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,3 K/W*

* K/W is SI unit for °C/W.

CHARACTERISTICS

$T_j = 25\ ^oC$

Collector-emitter breakdown voltage $V_{BE} = 0$; $I_C = 25$ mA	$V_{(BR)CES}$	>	110 V
Collector-emitter breakdown voltage open base; $I_C = 100$ mA	$V_{(BR)CEO}$	>	55 V
Emitter-base breakdown voltage open collector; $I_E = 10$ mA	$V_{(BR)EBO}$	>	4 V
Collector cut-off current $V_{BE} = 0$; $V_{CE} = 55$ V	I_{CES}	<	10 mA
Second breakdown energy; L = 25 mH; f = 50 Hz open base	E_{SBO}	>	8 mJ
$R_{BE} = 10\ \Omega$	E_{SBR}	>	8 mJ
D.C. current gain* $I_C = 1,2$ A; $V_{CE} = 5$ V	h_{FE}	typ.	25
			15 to 100
D.C. current gain ratio of matched devices* $I_C = 1,2$ A; $V_{CE} = 5$ V	h_{FE1}/h_{FE2}	<	1,2
Collector-emitter saturation voltage* $I_C = 3,0$ A; $I_B = 0,6$ A	V_{CEsat}	typ.	1,2 V
Transition frequency at f = 100 MHz* $-I_E = 1,2$ A; $V_{CB} = 45$ V	f_T	typ.	490 MHz
$-I_E = 4,0$ A; $V_{CB} = 45$ V	f_T	typ.	540 MHz
Collector capacitance at f = 1 MHz $I_E = I_e = 0$; $V_{CB} = 45$ V	C_c	typ.	53 pF
Feedback capacitance at f = 1 MHz $I_C = 50$ mA; $V_{CE} = 45$ V	C_{re}	typ.	35 pF
Collector-flange capacitance	C_{cf}	typ.	2 pF

* Measured under pulse conditions: $t_p \leqslant 200\ \mu s$; $\delta \leqslant 0,02$.

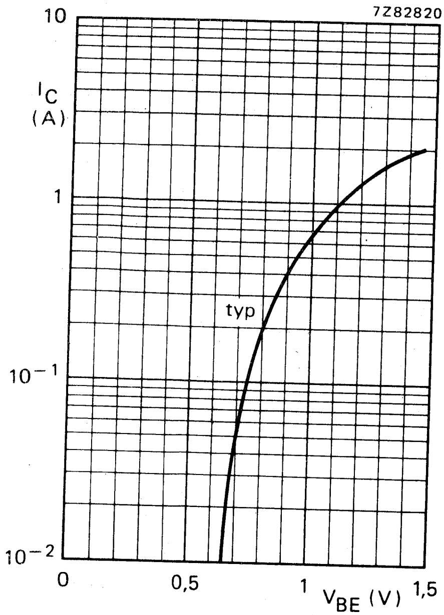


Fig. 4 V_{CE} = 40 V; T_{mb} = 25 °C.

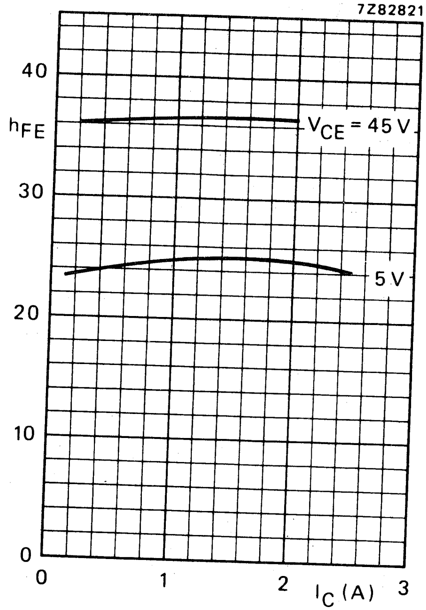


Fig. 5 Typical values; T_j = 25 °C.

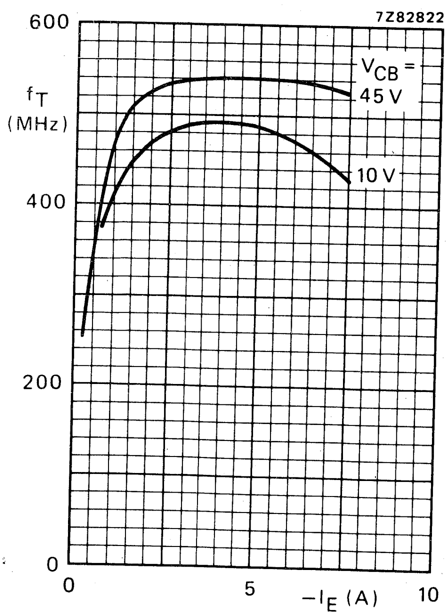


Fig. 6 Typical values; f = 100 MHz; T_j = 25 °C.

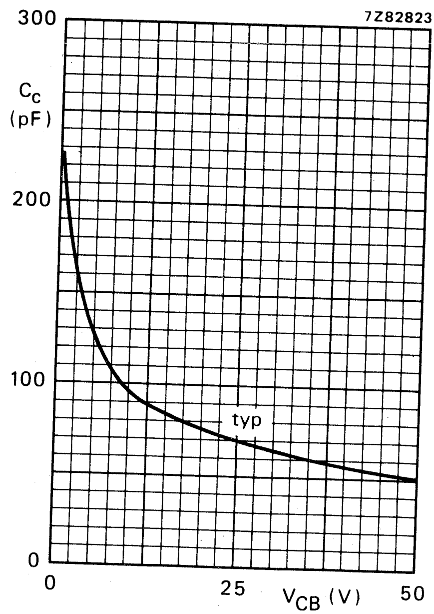


Fig. 7 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

APPLICATION INFORMATION

R.F. performance in s.s.b. class-A operation (linear power amplifier)

V_{CE} = 45 V; f_1 = 28,000 MHz; f_2 = 28,001 MHz

output power W	G_p dB	I_C A	d_3* dB	d_5* dB	T_h °C
> 16 (P.E.P.)	> 19,5	1,2	−40	< −40	70
typ. 17 (P.E.P.)	typ. 20,5	1,2	−40	< −40	70

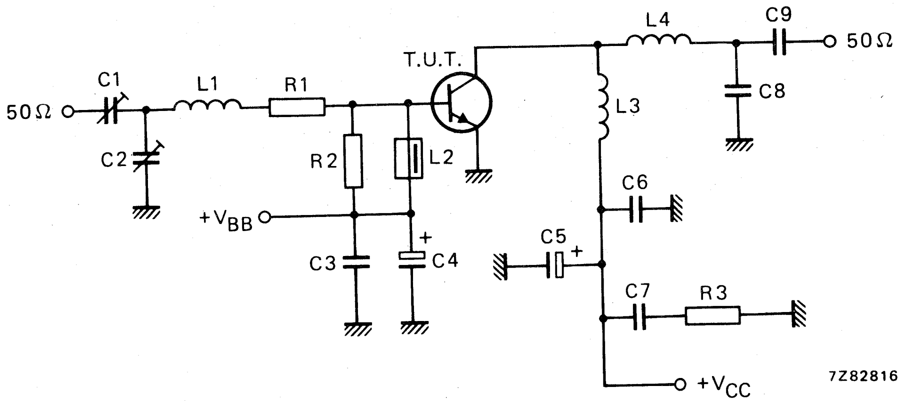


Fig. 8 Test circuit; s.s.b. class-A.

List of components in Fig. 8:

C1 = C2 = 10 to 780 pF film dielectric trimmer
C3 = 22 nF ceramic capacitor (63 V)
C4 = 4,7 μF/16 V electrolytic capacitor
C5 = 1 μF/75 V solid tantalum capacitor
C6 = C7 = 47 nF polyester capacitor (100 V)
C8 = 68 pF ceramic capacitor (500 V)
C9 = 3,9 nF ceramic capacitor

L1 = 3 turns closely wound enamelled Cu wire (1,0 mm); int. dia. 9,0 mm; leads 2 x 5 mm
L2 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L3 = 1,05 μH; 15 turns enamelled Cu wire (1,0 mm); int. dia. 10,0 mm; length 17,4 mm; leads 2 x 5 mm
L4 = 162 nH; 6 turns enamelled Cu wire (1,0 mm); int. dia. 7,0 mm; length 11,6 mm; leads 2 x 5 mm

R1 = 1,6 Ω; parallel connection of 3 x 4,7 Ω carbon resistors (± 5%; 0,125 W)
R2 = 47 Ω carbon resistor (± 5%; 0,25 W)
R3 = 4,7 Ω carbon resistor (± 5%; 0,25 W)

* Stated intermodulation distortion figures are referred to the according level of either of the equal amplified tones. Relative to the according peak envelope powers these figures should be increased by 6 dB.

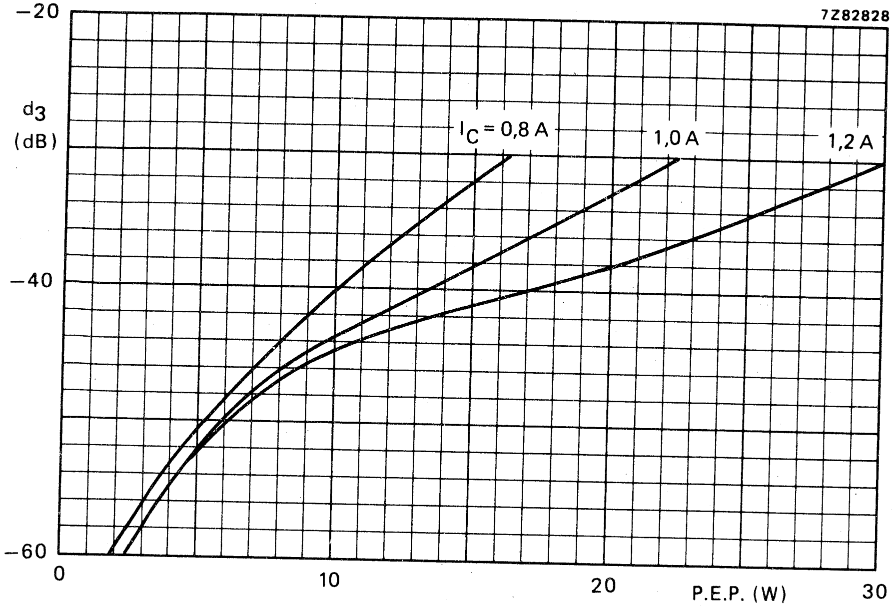


Fig. 9 Intermodulation distortion (see note on page 5) as a function of output power. Typical values; V_{CE} = 45 V; f_1 = 28,000 MHz; f_2 = 28,001 MHz; T_h = 70 °C.

R.F. performance in s.s.b. class-AB operation (linear power amplifier)

V_{CE} = 50 V; f_1 = 28,000 MHz; f_2 = 28,001 MHz

output power W	G_p dB	η_{dt} (%) at 65 W P.E.P.	I_C (A) at 65 W P.E.P.	d_3* dB	d_5* dB	$I_{C(ZS)}$ mA	T_h °C
10 to 65 (P.E.P.)	typ. 18	typ. 45	typ. 1,45	typ. −30	< −30	50	25

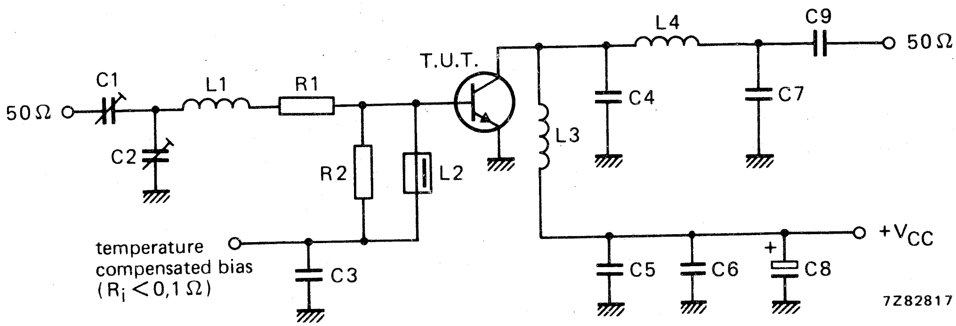


Fig. 10 Test circuit; s.s.b. class-AB.

List of components:

C1 = C2 = 10 to 780 pF film dielectric trimmer
C3 = C5 = C6 = 220 nF polyester capacitor
C4 = 120 pF ceramic capacitor (500 V)
C7 = 150 pF ceramic capacitor (500 V)
C8 = 47 μF/63 V electrolytic capacitor
C9 = 3,9 nF ceramic capacitor

L1 = 4 turns closely wound enamelled Cu wire (1,6 mm); int. dia. 7,0 mm; leads 2 x 5 mm
L2 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L3 = 9 turns enamelled Cu wire (1,0 mm); int. dia. 10 mm; length 14,5 mm; leads 2 x 5 mm
L4 = 6 turns enamelled Cu wire (1,0 mm); int. dia. 6,5 mm; length 11,0 mm; leads 2 x 5 mm

R1 = 2,4 Ω; parallel connection of 2 x 4,7 Ω carbon resistors
R2 = 39 Ω carbon resistor

* Stated intermodulation distortion figures are referred to the according level of either of the equal amplified tones. Relative to the according peak envelope powers these figures should be increased by 6 dB.

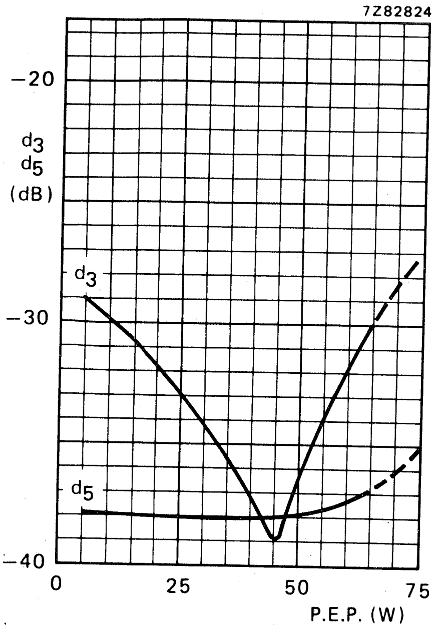


Fig. 11 Intermodulation distortion as a function of output power*.

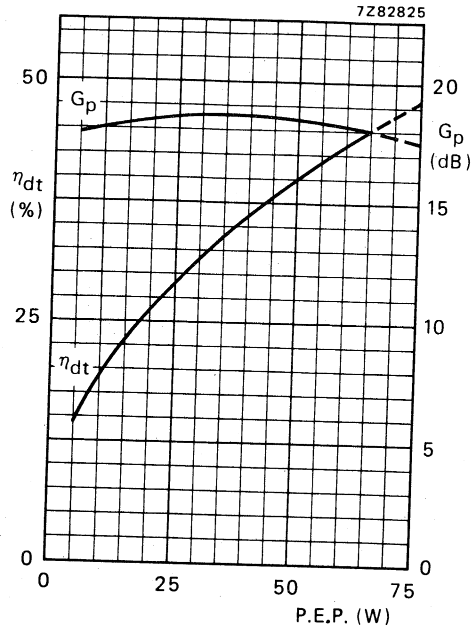


Fig. 12 Double-tone efficiency and power gain as a function of output power.

Conditions for Figs 11 and 12:

V_{CE} = 50 V; $I_{C(ZS)}$ = 50 mA; f_1 = 28,000 MHz; f_2 = 28,001 MHz; T_h = 25 °C; typical values.

Ruggedness in s.s.b. operation

The BLW50F is capable of withstanding full load mismatch (VSWR = 50 through all phases) up to 45 W (P.E.P.) under the following conditions:
V_{CE} = 50 V; f_1 = 28,000 MHz; f_2 = 28,001 MHz; T_h = 70 °C; $R_{th\ mb-h}$ = 0,3 K/W.

* See note on page 7.

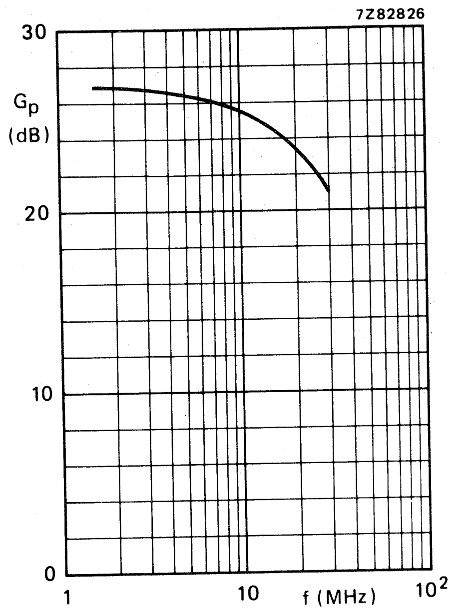


Fig. 13 Power gain as a function of frequency.

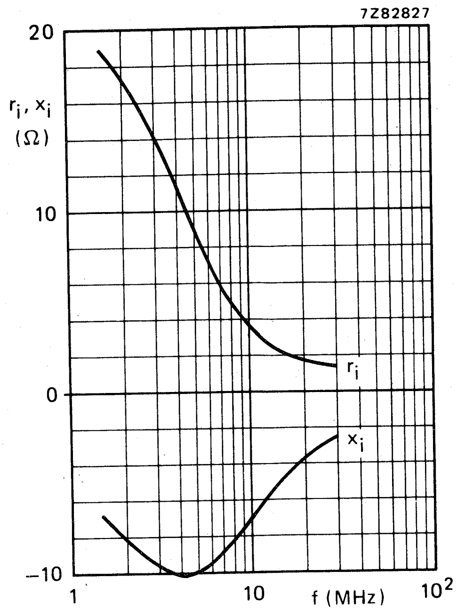


Fig. 14 Input impedance (series components) as a function of frequency.

Figs 13 and 14 are typical curves and hold for an unneutralized amplifier in s.s.b. class-AB operation.

Conditions for Figs 13 and 14:

V_{CE} = 50 V; $I_{C(ZS)}$ = 50 mA; P_L = 60 W; T_h = 25 °C; Z_L = 16 Ω.

V.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor intended for use in class-A, B and C operated mobile, industrial and military transmitters with a nominal supply voltage of 12,5 V. The transistor is resistance stabilized. Every transistor is tested under severe load mismatch conditions with a supply over-voltage to 15 V. Matched h_{FE} groups are available on request.

It has a plastic encapsulated stripline package. All leads are isolated from the stud.

QUICK REFERENCE DATA

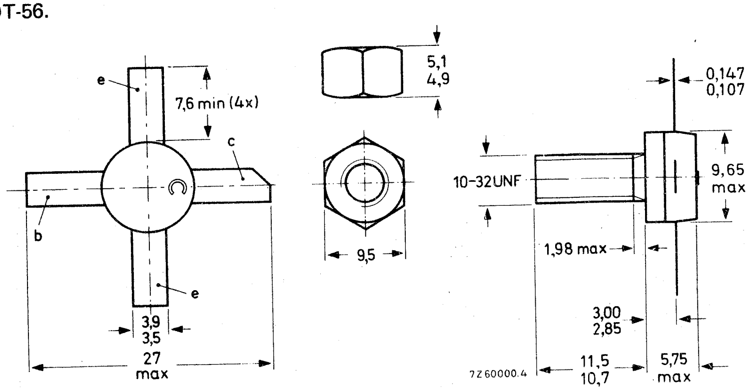
R.F. performance up to T_h = 25 °C

mode of operation	V_{CE} V	f MHz	P_L W	G_p dB	η %	$\overline{z_i}$ Ω	$\overline{Z_L}$ Ω	d_3 dB
c.w. (class-B)	12,5	175	45	> 5,0	> 75	1,2 + j1,4	2,6 − j1,2	−
s.s.b. (class-AB)	12,5	1,6–28	3–30 (P.E.P.)	typ. 19,5	typ. 35	−	−	typ. −33

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-56.



When locking is required an adhesive is preferred instead of a lock washer.

Torque on nut: min. 1,5 Nm
(15 kg cm)
max. 1,7 Nm
(17 kg cm)

Diameter of clearance hole in heatsink: max. 4,9 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

CAUTION This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC134)

Voltages

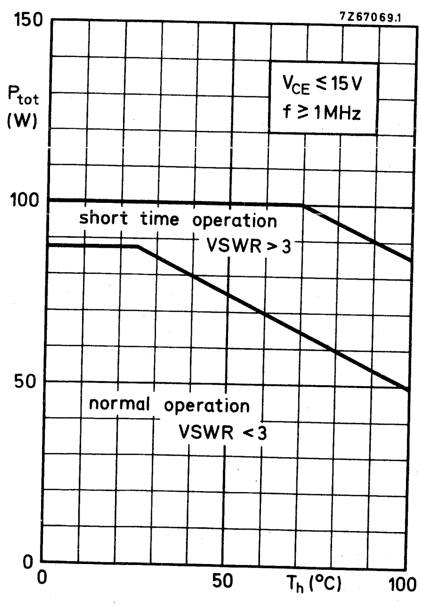
Collector-base voltage (open emitter) peak value	V_{CBOM}	max.	36	V
Collector-emitter voltage (open base)	V_{CEO}	max.	18	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4	V

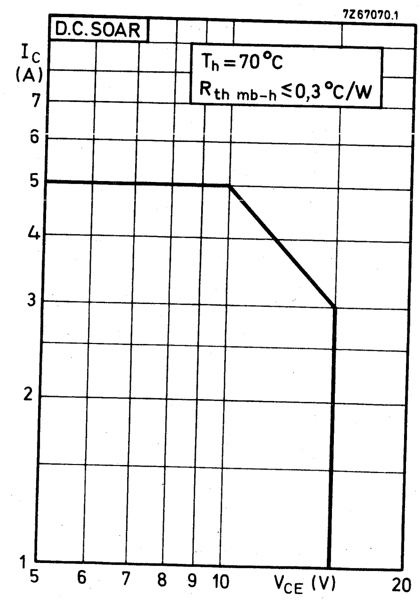
Currents

Collector current (average)	$I_{C(AV)}$	max.	8	A
Collector current (peak value); f ≥ 1MHz	I_{CM}	max.	20	A

Power dissipation

Total power dissipation at T_h = 70 °C
f ≥ 1 MHz; V_{CE} ≤ 15 V; $R_{th\ mb-h}$ ≤ 0,3 °C/W
Derate by 0,5 W/°C for 50 °C ≤ T_h ≤ 100 °C — P_{tot} max. 65 W





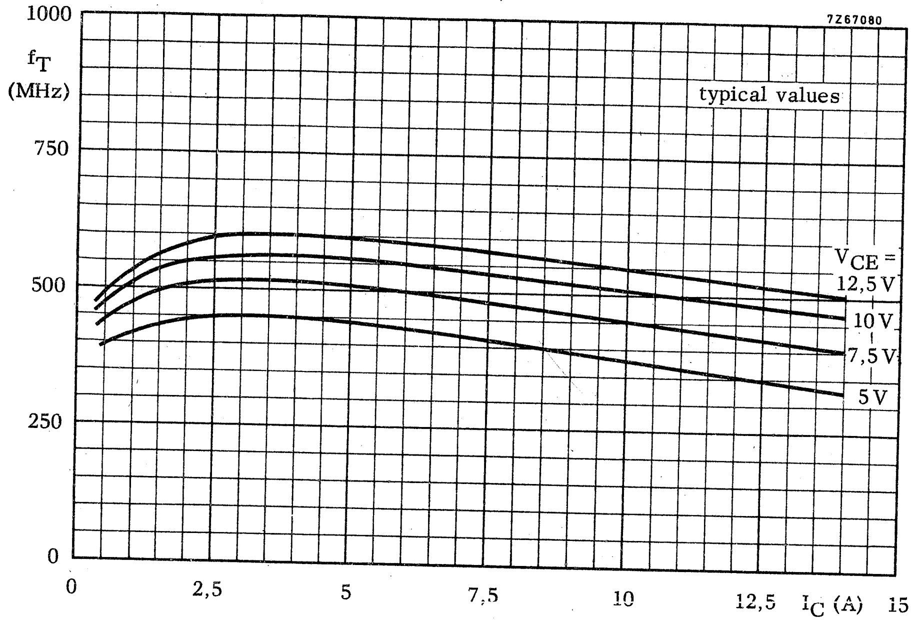
Temperature

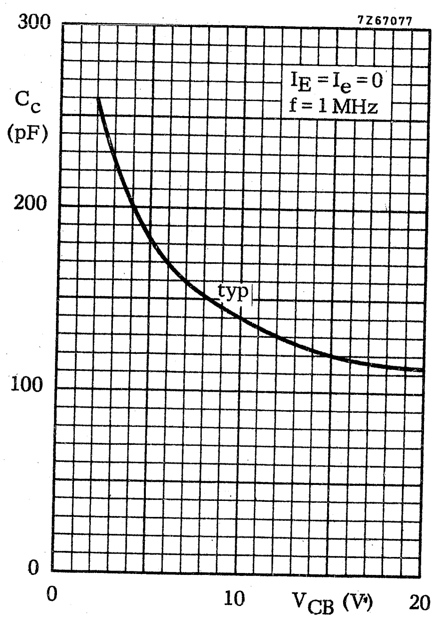
Storage temperature — T_{stg} −65 to +200 °C

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Breakdown voltages				
Collector-base voltage open emitter; I_C = 100 mA	$V_{(BR)CBO}$	>	36	V
Collector-emitter voltage open base; I_C = 100 mA	$V_{(BR)CEO}$	>	18	V
Emitter-base voltage open collector; I_E = 25 mA	$V_{(BR)EBO}$	>	4	V
Transient energy				
L = 25 mH; f = 50 Hz				
open base	E	>	8	mWs
$-V_{BE}$ = 1, 5 V; R_{BE} = 33 Ω	E	>	8	mWs
D.C. current gain				
I_C = 1 A; V_{CE} = 5 V	h_{FE}		20 to 100	
D.C. current gain ratio of matched devices				
I_C = 1 A; V_{CE} = 5 V	h_{FE1}/h_{FE2}	<	1, 2	
Transition frequency				
I_C = 6 A; V_{CE} = 10 V	f_T	typ.	550	MHz
Collector capacitance at f = 1 MHz				
$I_E = I_e$ = 0; V_{CB} = 15 V	C_c	typ.	120	pF
		<	160	pF
Feedback capacitance				
I_C = 200 mA; V_{CE} = 15 V	C_{re}	typ.	80	pF
Collector-stud capacitance	C_{cs}	typ.	2	pF


7Z67080
typical values
f_T (MHz)
1000
750
500
250
0
0
2,5
5
7,5
10
12,5
I_C (A)
15
V_{CE} =
12,5 V
10 V
7,5 V
5 V


7Z67077
$I_E = I_e = 0$
f = 1 MHz
C_c (pF)
300
200
100
0
0
10
V_{CB} (V)
20
typ

APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit)

T_h = 25 °C

f MHz	V_{CE} V	P_L W	P_S W	G_p dB	I_C A	η %	$\overline{z_i}$ Ω	$\overline{Z_L}$ Ω
175	12,5	45	< 14,2	> 5,0	< 4,8	> 75	1,2 + j1,4	2,6 − j1,2

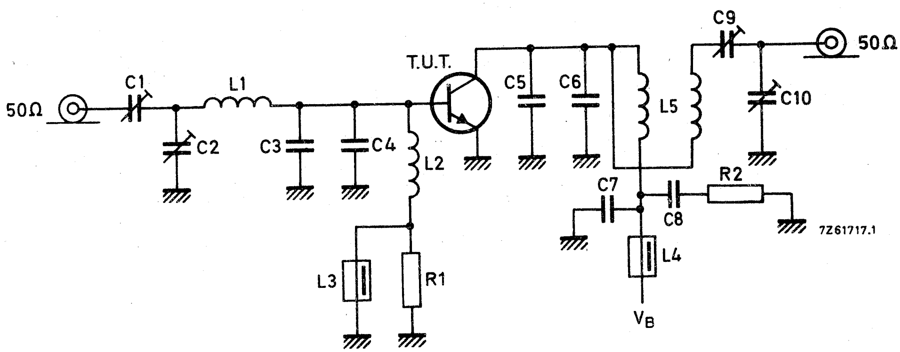


Fig. 6 Test circuit; c.w. class-B.

List of components:

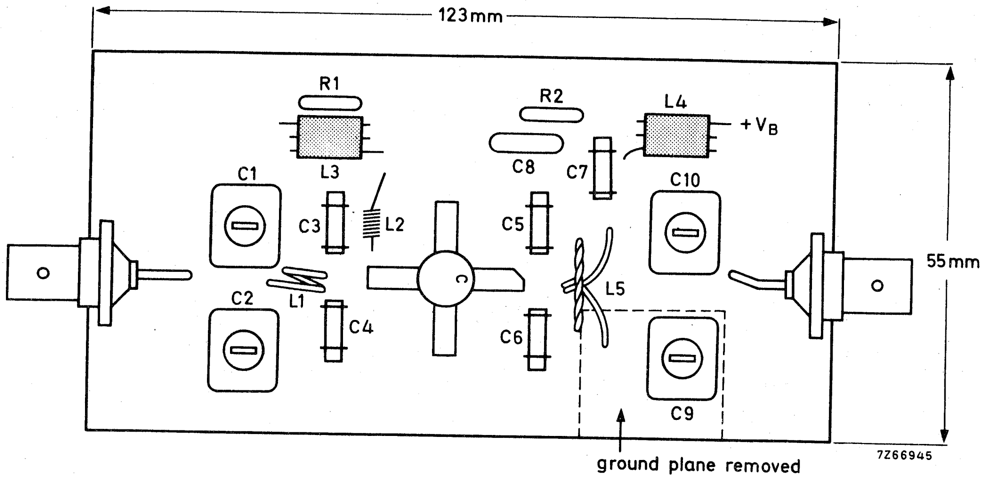
C1 = 2 to 20 pF film dielectric trimmer
C2 = 4 to 40 pF film dielectric trimmer
C3 = C4 = C5 = C6 = 56 pF ceramic capacitor
C7 = 100 pF ceramic capacitor
C8 = 100 nF polyester capacitor
C9 = 4 to 80 pF film dielectric trimmer
C10 = 4 to 60 pF film dielectric trimmer

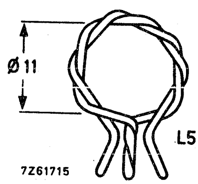
L1 = 1½ turns enamelled Cu wire (1,6 mm); int. dia. 6,0 mm; length 4 mm; leads 2 x 5 mm
L2 = 7 turns closely wound enamelled Cu wire (0,5 mm); int. dia. 3,0 mm; leads 2 x 5 mm
L3 = L4 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L5 = bifilar wound enamelled Cu wire (1,0 mm); see figure on page 6

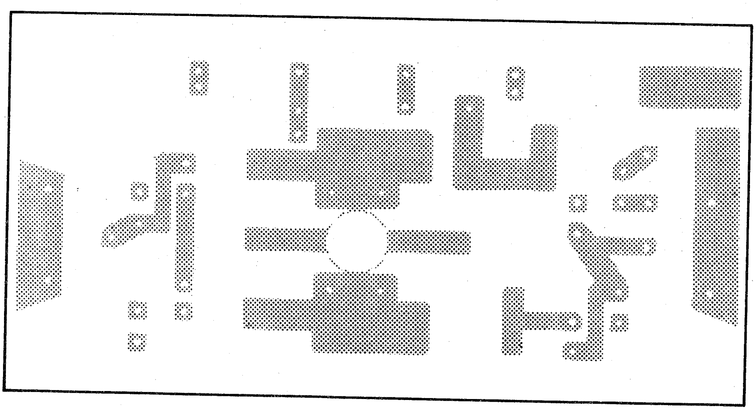
R1 = 10 Ω carbon resistor
R2 = 4,7 Ω carbon resistor

Component layout and printed-circuit board for 175 MHz test circuit on page 6.

APPLICATION INFORMATION (continued)

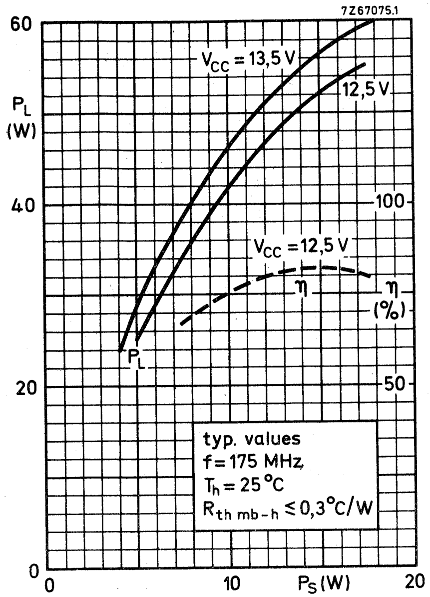




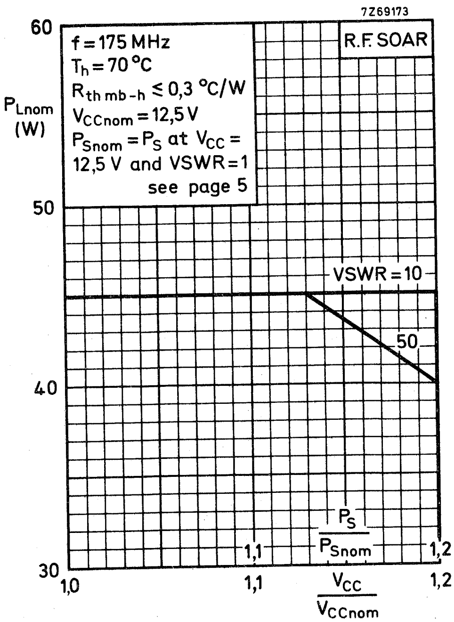


7Z66943

The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets.



At P_L = 45 W and V_{CC} = 12,5 V, the output power at heatsink temperatures between 25 °C and 70 °C relative to that at 25 °C is diminished by 60 mW/°C.



The transistor has been developed for use with unstabilized supply voltages. As the output power and drive power increase with the supply voltage, the nominal output power (P_{Lnom}) must be derated in accordance with the adjacent graph for safe operation at supply voltages other than nominal.
The graph shows the allowable output power under nominal conditions as a function of the supply overvoltage ratio with VSWR as parameter. The graph applies to the situation in which the drive (P_S/P_{Snom}) increases linearly with supply overvoltage ratio (V_{CC}/V_{CCnom}).

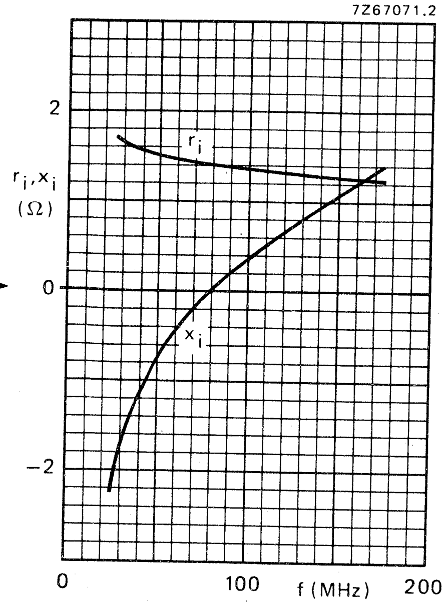


Fig. 10 Input impedance (series components).

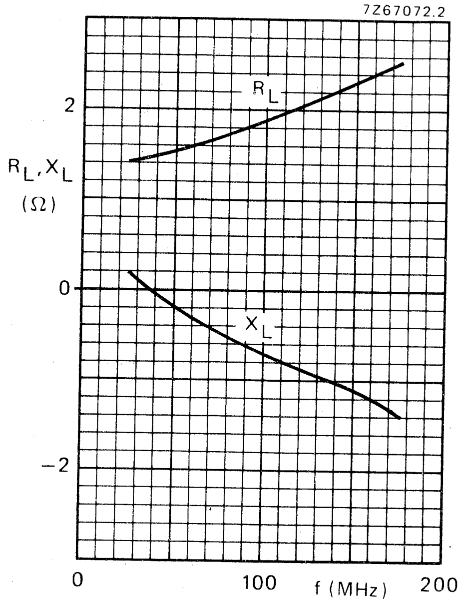


Fig. 11 Load impedance (series components).

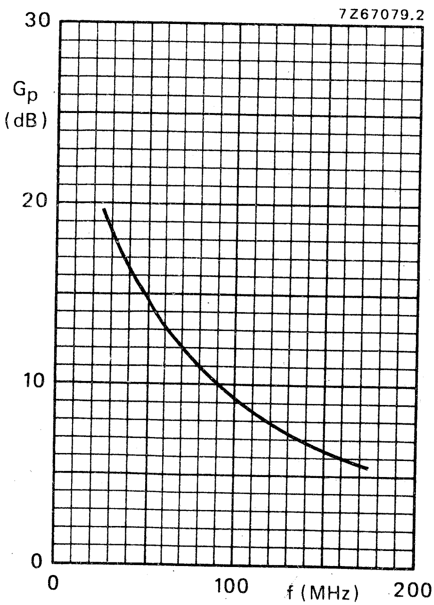


Fig. 12.

Conditions for Figs 10, 11 and 12:

Typical values; V_{CE} = 12,5 V; P_L = 45 W; T_h = 25 °C.

APPLICATION INFORMATION (continued)

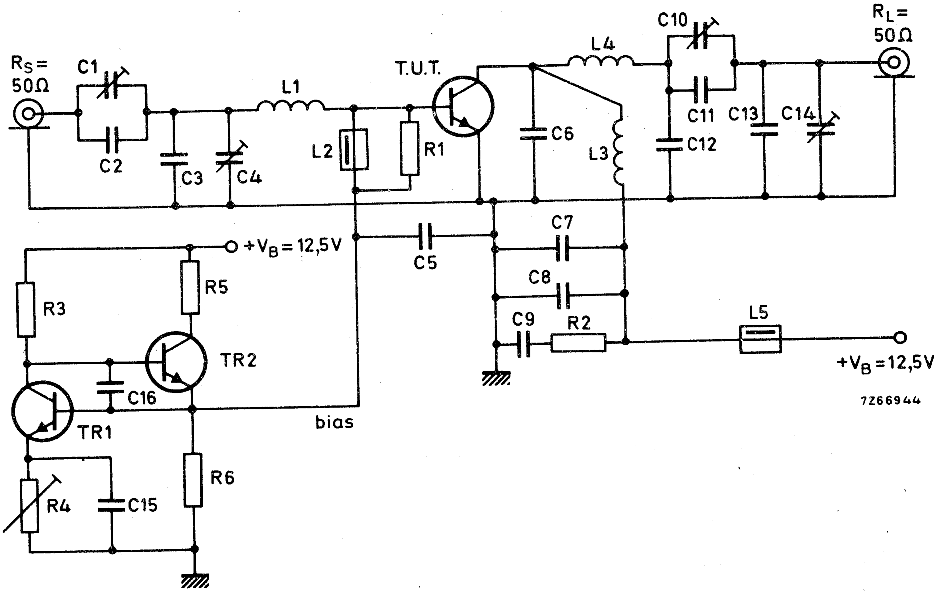
R.F. performance in s.s.b. class-AB operation

V_{CE} = 12,5 V; T_h up to 25 °C; $R_{th\ mb\text{-}h} \leqslant$ 0,3 °C/W

f_1 = 28,000 MHz; f_2 = 28,001 MHz

output power W	G_p dB	η_{dt} %	d_3 dB *	d_5 dB *	$I_{C(ZS)}$ mA
3 to 30 (P.E.P.)	typ. 19,5	typ. 35	typ. −33	typ. −36	25

Test circuit; s.s.b. class-AB.



List of components on page 10.

* Stated intermodulation distortion figures are referred to the according level of either of the equal amplified tones. Relative to the according peak envelope powers these figures should be increased by 6 dB.

APPLICATION INFORMATION (continued)

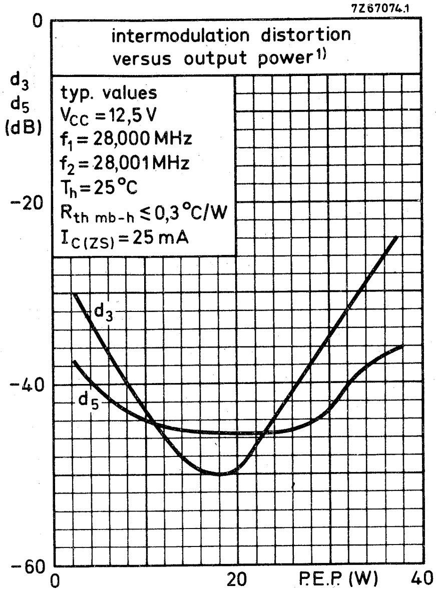
List of components:

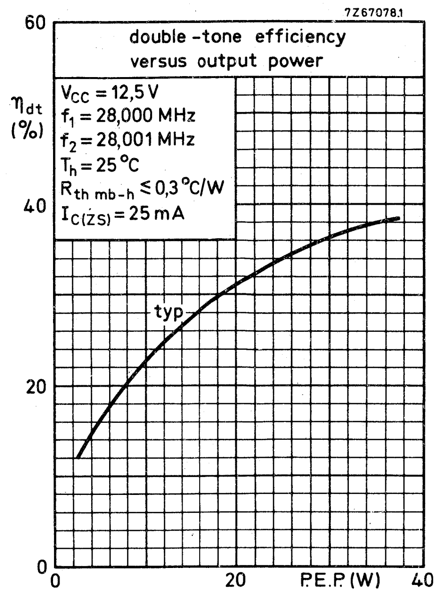
Tr1 = Tr2 = BD137

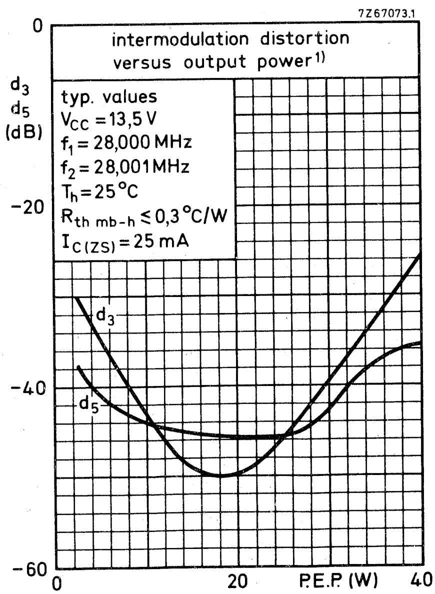
C1 = 100 pF air dielectric capacitor (single insulated rotor)
C2 = 27 pF ceramic capacitor
C3 = 180 pF ceramic capacitor
C4 = 100 pF air dielectric capacitor (single non-insulated rotor)
C5 = C7 = 3,9 nF polyester capacitor (±10%)
C6 = 2 x 270 pF polystyrene capacitors in parallel
C8 = C15 = C16 = 100 nF polyester capacitor (±10%)
C9 = 2,2 µF moulded metallized polyester capacitor
C10 = 2 x 385 pF film dielectric trimmers in parallel
C11 = 68 pF ceramic capacitor
C12 = 2 x 82 pF ceramic capacitors in parallel
C13 = 47 pF ceramic capacitor
C14 = 385 pF film dielectric trimmer

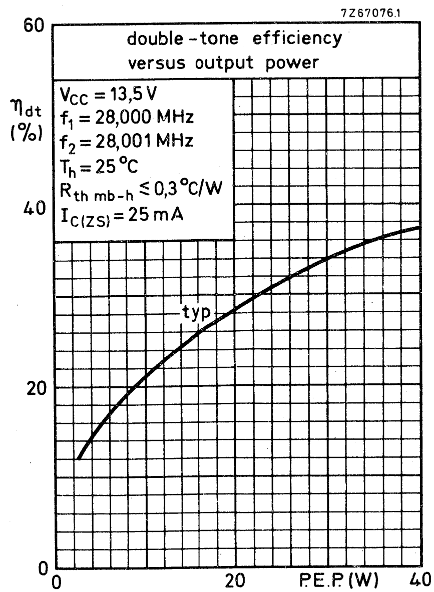
L1 = 88 nH; 3 turns Cu wire (1,0 mm); internal diameter 9 mm; coil length 6,1 mm; leads 2 x 5 mm
L2 = L5 = ferroxcube bead, grade 3B (code number 4312 020 36640)
L3 = 68 nH; 3 turns enamelled Cu wire (1,6 mm); internal diameter 8 mm; coil length 8,3 mm; leads 2 x 5 mm
L4 = 96 nH; 3 turns enamelled Cu wire (1,6 mm); internal diameter 10 mm; coil length 7,6 mm; leads 2 x 5 mm

R1 = 27 Ω carbon resistor (±5%)
R2 = 4,7 Ω carbon resistor (±5%)
R3 = 1,5 kΩ carbon resistor (±5%)
R4 = 10 Ω wire-wound potentiometer (3 W)
R5 = 47 Ω wire-wound resistor (5,5 W)
R6 = 150 Ω carbon resistor (±5%)

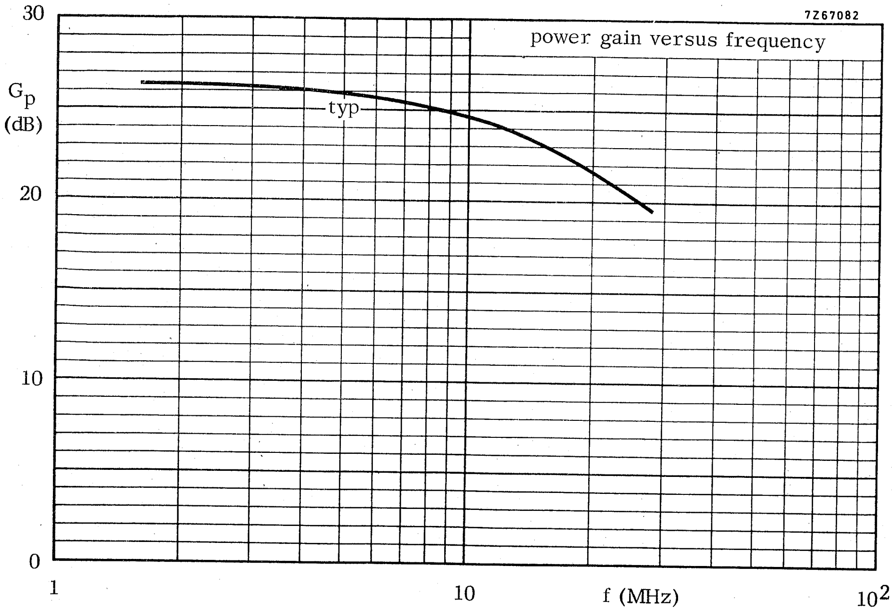








1) Stated intermodulation distortion figures are referred to the according level of either of the equal amplified tones. Relative to the according peak envelope powers these figures should be increased by 6 dB.

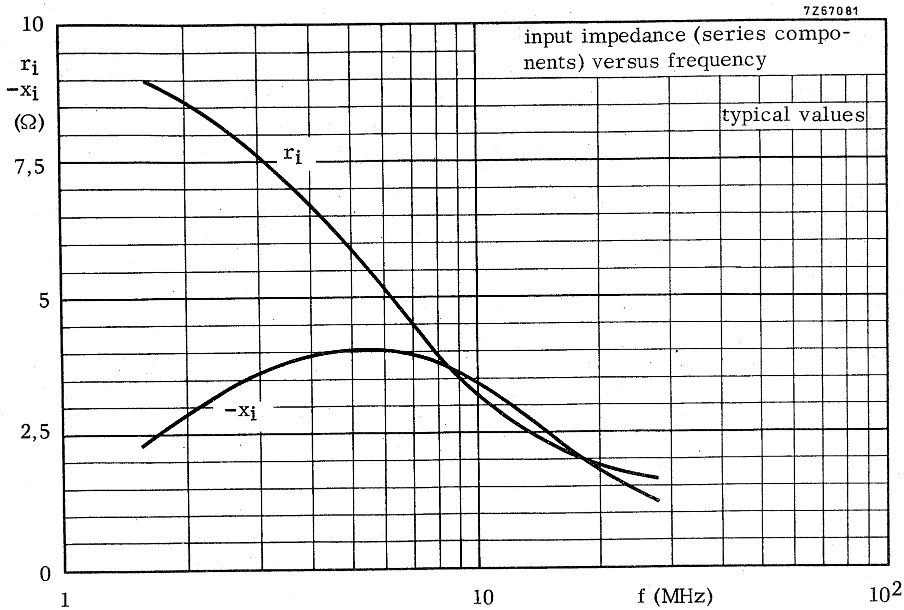


S.S.B. class AB operation

Conditions:

P_L = 30 W (PEP)		P_L = 35 W (PEP)	
V_{CC} = 12,5 V		V_{CC} = 13,5 V	
$I_{C(ZS)}$ = 25 mA		$I_{C(ZS)}$ = 25 mA	
T_h = 25 °C		T_h = 25 °C	
$R_{th\ mb-h}$ ≤ 0,3 °C/W		$R_{th\ mb-h}$ ≤ 0,3 °C/W	
Z_L = 1,9 Ω		Z_L = 1,9 Ω	

The curve (both conditions) holds for an unneutralized amplifier.



S.S.B. class AB operation

Conditions:

P_L	= 30	W (PEP)	P_L	= 35	W (PEP)
V_{CC}	= 12,5	V	V_{CC}	= 13,5	V
$I_{C(ZS)}$	= 25	mA	$I_{C(ZS)}$	= 25	mA
T_h	= 25	°C	T_h	= 25	°C
$R_{th\ mb\text{-}h}$	≤ 0,3	°C/W	$R_{th\ mb\text{-}h}$	≤ 0,3	°C/W
Z_L	= 1,9	Ω	Z_L	= 1,9	Ω

The curve (both conditions) holds for an unneutralized amplifier.

V.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor intended for use in class-A, B and C operated mobile, industrial and military transmitters with a nominal supply voltage of 12,5 V. The transistor is resistance stabilized and is guaranteed to withstand severe load mismatch conditions with a supply over-voltage to 16,5 V. Matched h_{FE} groups are available on request.

It has a 3/8" capstan envelope with a ceramic cap. All leads are isolated from the stud.

QUICK REFERENCE DATA

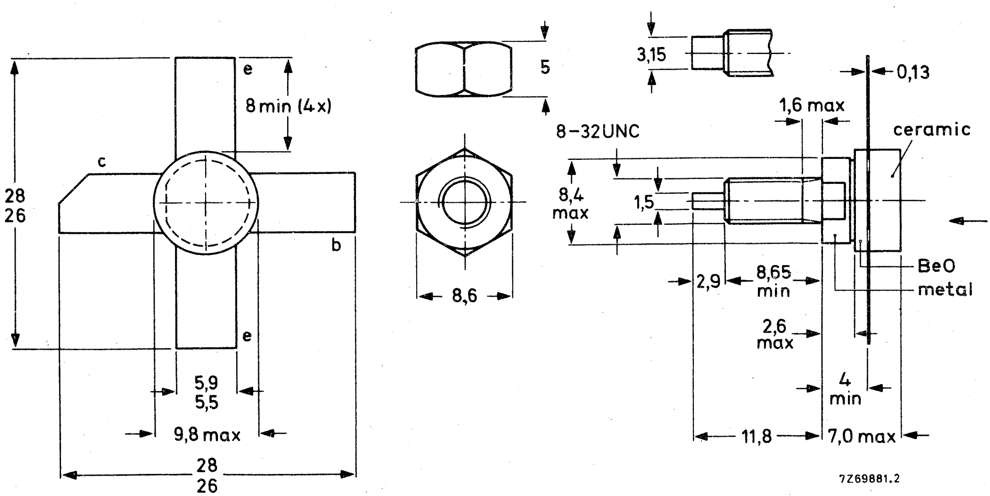
R.F. performance up to T_h = 25 °C

mode of operation	V_{CC} V	f MHz	P_L W	G_p dB	η %	$\bar{z}_i$ Ω	$\bar{Z}_L$ Ω	d_3 dB
c.w. (class-B)	**12,5**	**175**	**45**	> **5,0**	> **75**	**1,2 + j1,4**	**2,6 − j1,2**	—
s.s.b. (class-AB)	12,5	1,6–28	3–30 (P.E.P.)	typ. 19,5	typ. 35	—	—	typ. −33

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-120.



Torque on nut: min. 0,75 Nm
(7,5 kg cm)
max. 0,85 Nm
(8,5 kg cm)

Diameter of clearance hole in heatsink: max. 4,2 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

When locking is required an adhesive is preferred instead of a lock washer.

CAUTION This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage (V_{BE} = 0) peak value	V_{CESM}	max.	36	V
Collector-emitter voltage (open base)	V_{CEO}	max.	18	V
Emitter-base voltage (open-collector)	V_{EBO}	max.	4	V
Collector current (average)	$I_{C(AV)}$	max.	9	A
Collector current (peak value); f > 1 MHz	I_{CM}	max.	22	A
R.F. power dissipation (f > 1 MHz); T_{mb} = 25 °C	P_{rf}	max.	100	W
Storage temperature	T_{stg}		−65 to + 150	°C
Operating junction temperature	T_j	max.	200	°C

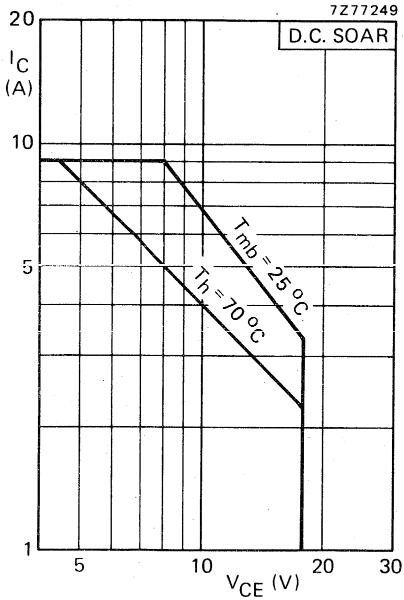


Fig. 2 D.C. SOAR.

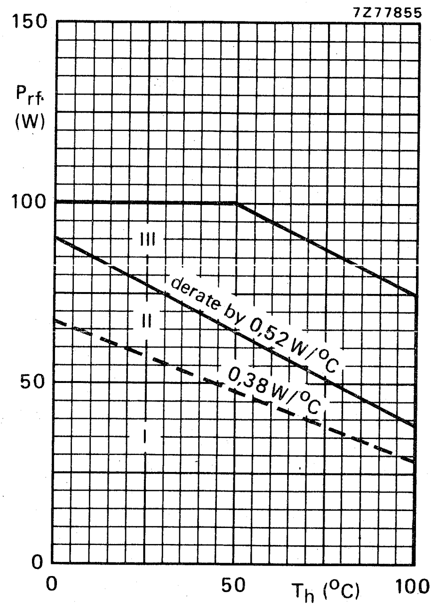


Fig. 3 R.F. power dissipation; V_{CE} ⩽ 16,5 V; f > 1 MHz.

I Continuous d.c. operation

II Continuous r.f. operation

III Short-time operation during mismatch

THERMAL RESISTANCE (dissipation = 40 W; T_{mb} = 88 °C, i.e. T_h = 70 °C)

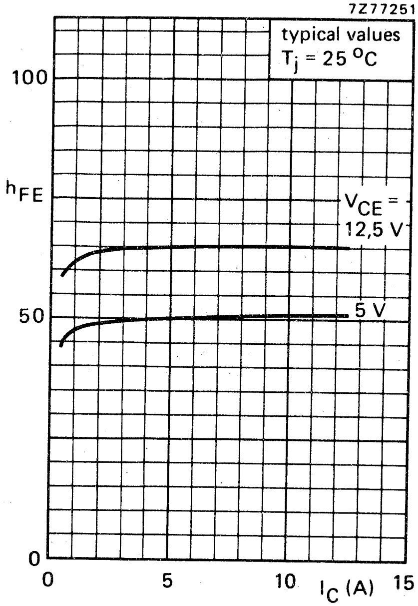
From junction to mounting base (d.c. dissipation)	$R_{th\ j\text{-}mb(dc)}$	=	2,8	°C/W
From junction to mounting base (r.f. dissipation)	$R_{th\ j\text{-}mb(rf)}$	=	2,05	°C/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,45	°C/W

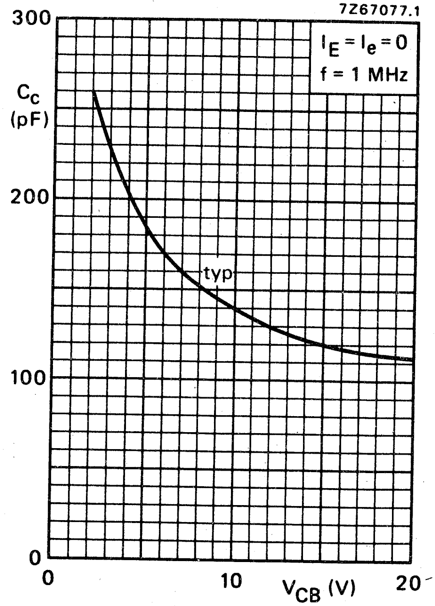
CHARACTERISTICS

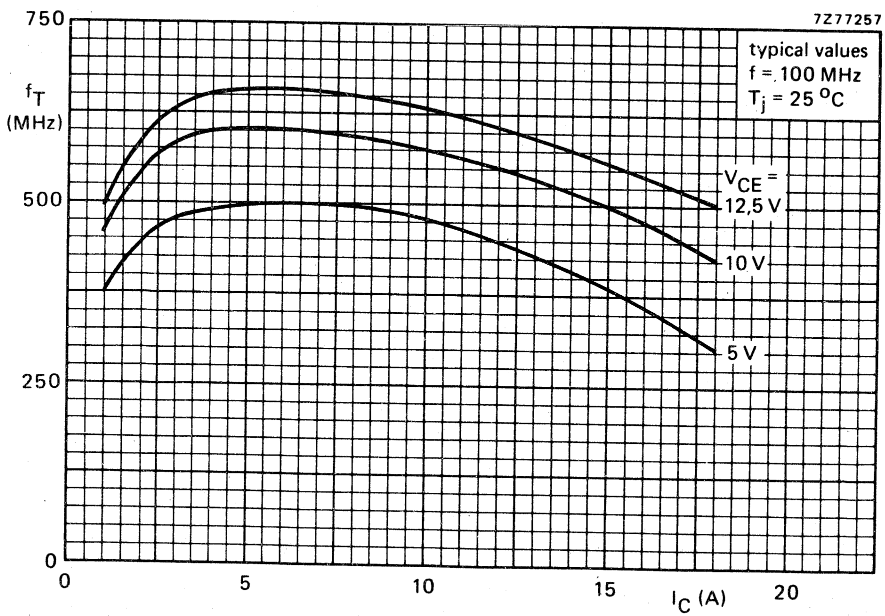
$T_j = 25\ ^oC$

Breakdown voltage			
Collector-emitter voltage $V_{BE} = 0$; $I_C = 50$ mA	$V_{(BR)CES}$	>	36 V
Collector-emitter voltage open base; $I_C = 100$ mA	$V_{(BR)CEO}$	>	18 V
Emitter-base voltage open collector; $I_E = 25$ mA	$V_{(BR)EBO}$	>	4 V
Collector cut-off current			
$V_{BE} = 0$; $V_{CE} = 15$ V	I_{CES}	<	25 mA
Transient energy			
$L = 25$ mH; $f = 50$ Hz			
open base	E	>	8 mWs
$-V_{BE} = 1,5$ V; $R_{BE} = 33\ \Omega$	E	>	8 mWs
D.C. current gain *			
$I_C = 4$ A; $V_{CE} = 5$ V	h_{FE}	typ	50
			10 to 80
D.C. current gain ratio of matched devices *			
$I_C = 4$ A; $V_{CE} = 5$ V	h_{FE1}/h_{FE2}	<	1,2
Collector-emitter saturation voltage *			
$I_C = 12,5$ A; $I_B = 2,5$ A	V_{CEsat}	typ	1,5 V
Transition frequency at f = 100 MHz *			
$I_C = 4$ A; $V_{CE} = 12,5$ V	f_T	typ	650 MHz
$I_C = 12,5$ A; $V_{CE} = 12,5$ V	f_T	typ	600 MHz
Collector capacitance at f = 1 MHz			
$I_E = I_e = 0$; $V_{CB} = 15$ V	C_c	typ	120 pF
		<	160 pF
Feedback capacitance at f = 1 MHz			
$I_C = 200$ mA; $V_{CE} = 15$ V	C_{re}	typ	80 pF
Collector-stud capacitance	C_{cs}	typ	2 pF

* Measured under pulse conditions: $t_p \leqslant 200\ \mu s$; $\delta \leqslant 0,02$.


7Z77251
typical values
T_j = 25 °C
100
h_{FE}
50
0
V_{CE} =
12,5 V
5 V
0
5
10
I_C (A)
15


7Z67077.1
300
C_c
(pF)
200
100
0
$I_E = I_e = 0$
f = 1 MHz
typ
0
10
V_{CB} (V)
20


7Z77257
750
f_T
(MHz)
500
250
0
typical values
f = 100 MHz
T_j = 25 °C
V_{CE} =
12,5 V
10 V
5 V
0
5
10
15
I_C (A)
20

APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit)

$T_h = 25\ ^oC$

f (MHz)	V_{CC} (V)	P_L (W)	P_S (W)	G_p (dB)	I_C (A)	η (%)	$\overline{z_i}$ (Ω)	$\overline{Z_L}$ (Ω)
175	**12,5**	**45**	**< 14,2**	**> 5,0**	**< 4,8**	**> 75**	**1,2 + j1,4**	**2,6 − j1,2**
175	13,5	45	–	typ. 6,0	–	typ. 75	–	–

Test circuit for 175 MHz

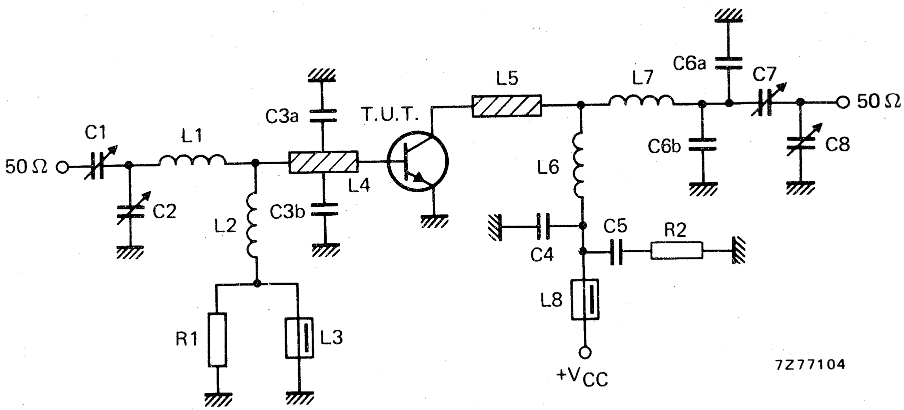


Fig. 7 Class-B test circuit at f = 175 MHz.

List of components:

C1 = 2,5 to 20 pF film dielectric trimmer (cat. no. 2222 809 07004)
C2 = C8 = 4 to 40 pF film dielectric trimmer (cat. no. 2222 809 07008)
C3a = C3b = 47 pF ceramic capacitor (500 V)
C4 = 120 pF ceramic capacitor
C5 = 100 nF polyester capacitor
C6a = C6b = 8,2 pF ceramic capacitor (500 V)
C7 = 5 to 60 pF film dielectric trimmer (cat. no. 2222 809 07011)

L1 = 1 turn Cu wire (1,6 mm); int. dia. 9,0 mm; leads 2 x 5 mm
L2 = 100 nH; 7 turns closely wound enamelled Cu wire (0,5 mm); int. dia. 3 mm; leads 2 x 5 mm
L3 = L8 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L4 = L5 = strip (12 mm x 6 mm); taps for C3a and C3b at 5 mm from transistor
L6 = 2 turns enamelled Cu wire (1,6 mm); int. dia. 5,0 mm; length 6,0 mm; leads 2 x 5 mm
L7 = 2 turns enamelled Cu wire (1,6 mm); int. dia. 4,5 mm; length 6,0 mm; leads 2 x 5 mm

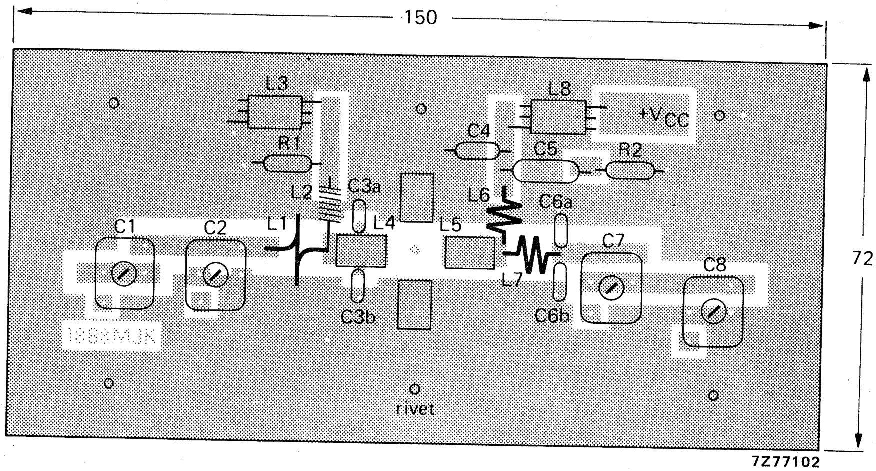
L4 and L5 are strips on a double Cu-clad printed-circuit board with epoxy fibre-glass dielectric, thickness 1/16″.

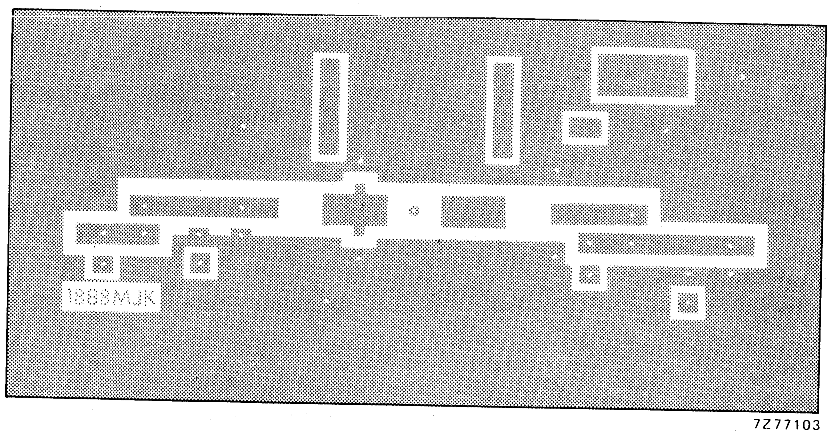
R1 = 10 Ω (±10%) carbon resistor
R2 = 4,7 Ω (±5%) carbon resistor

Component layout and printed-circuit board for 175 MHz test circuit on page 6.

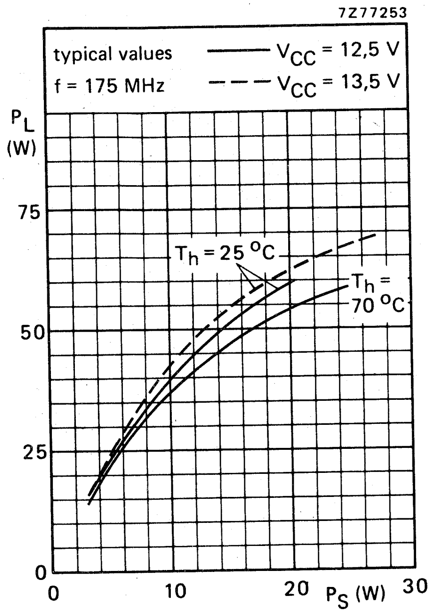
APPLICATION INFORMATION (continued)

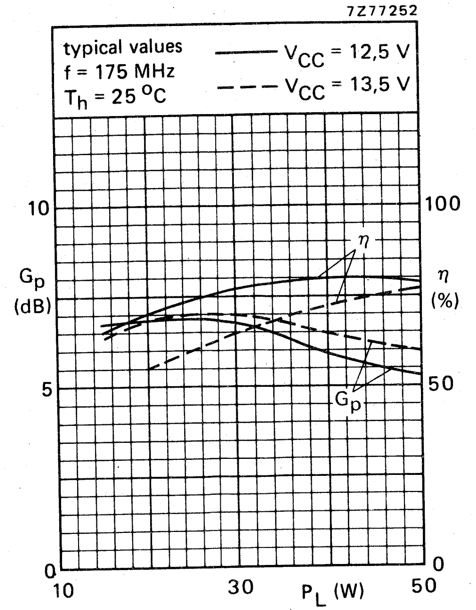
Component layout and printed-circuit board for 175 MHz test circuit.

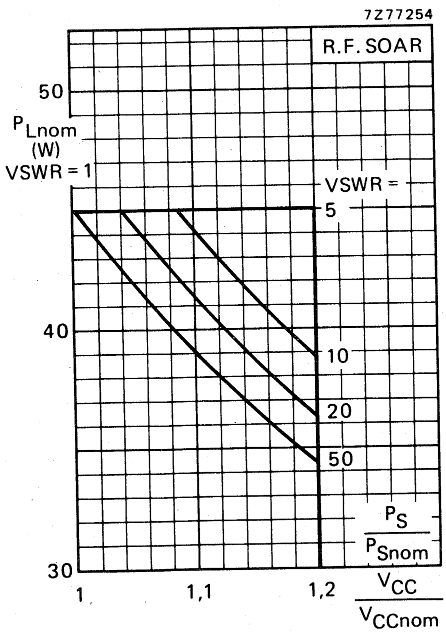




The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets, whilst under the emitter leads Cu straps are used for a direct contact between upper and lower sheets.







Conditions for R.F. SOAR

$f = 175$ MHz
$T_h = 70$ °C
$R_{th\ mb\text{-}h} = 0{,}45$ °C/W
$V_{CCnom} = 12{,}5$ V or $13{,}5$ V
$P_S = P_{Snom}$ at V_{CCnom} and VSWR = 1
see page 5

The transistor has been developed for use with unstabilized supply voltages. As the output power and drive power increase with the supply voltage, the nominal output power must be derated in accordance with the graph for safe operation at supply voltages other than the nominal. The graph shows the permissible output power under nominal conditions (VSWR = 1), as a function of the expected supply over-voltage ratio with VSWR as parameter.

The graph applies to the situation in which the drive (P_S/P_{Snom}) increases linearly with supply over-voltage ratio.

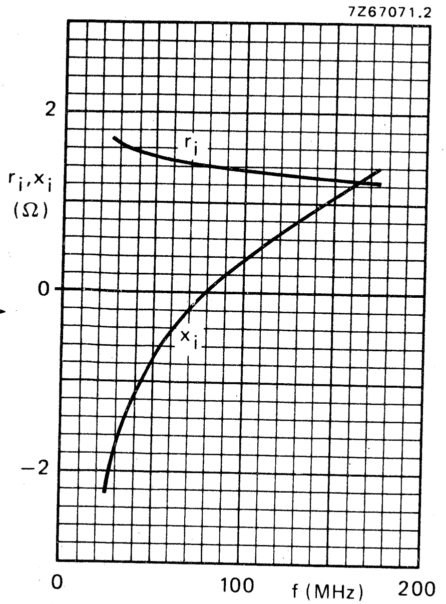


Fig. 12 Input impedance (series components).

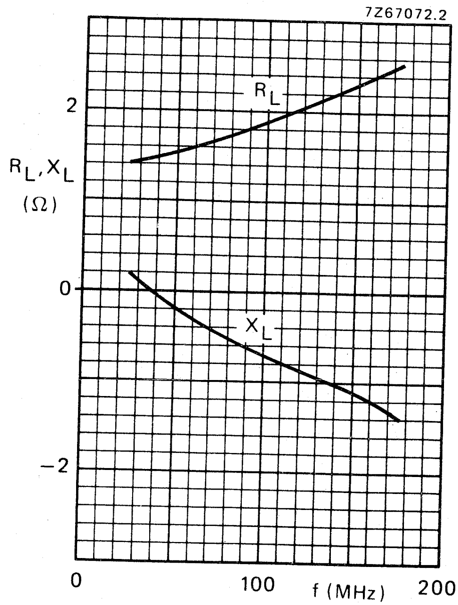


Fig. 13 Load impedance (series components).

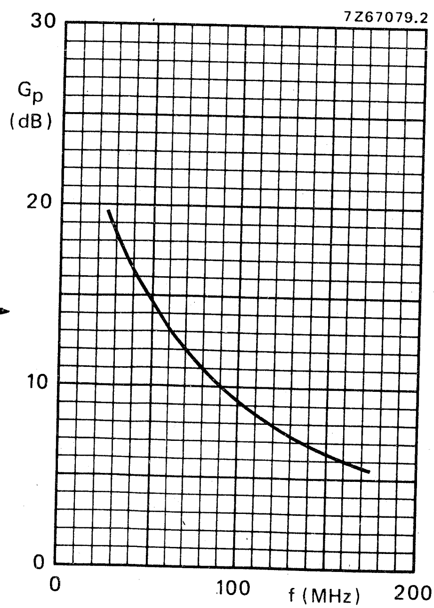


Fig. 14.

Conditions for Figs 12, 13 and 14:

Typical values; V_{CE} = 12,5 V; P_L = 45 W; class-B operation; T_h = 25 °C.

APPLICATION INFORMATION (continued)

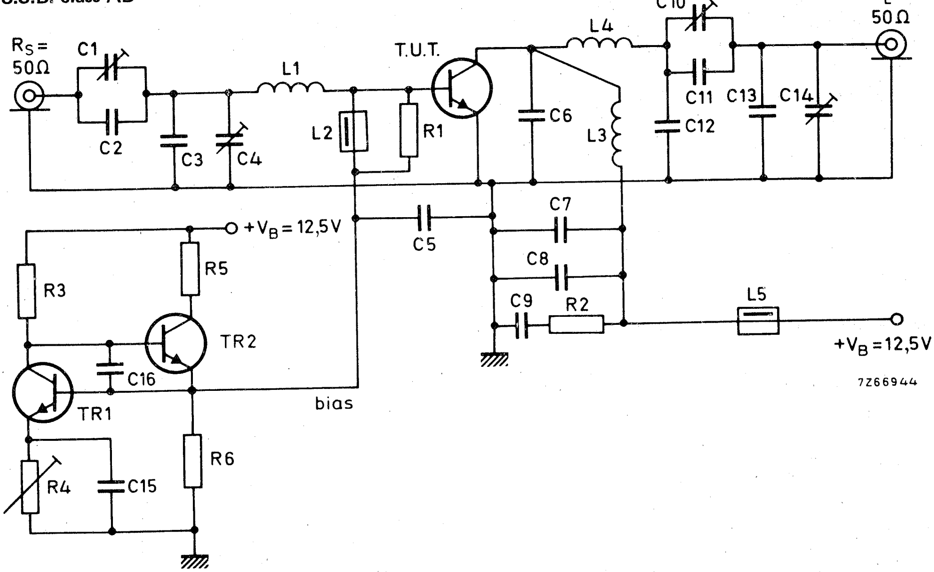
R.F. performance in s.s.b. class-AB operation

V_{CE} = 12,5 V; T_h up to 25 °C; $R_{th\ mb-h} \leq$ 0,45 °C/W
f_1 = 28,000 MHz; f_2 = 28,001 MHz

output power W	G_p dB	η_{dt} %	d_3 dB *	d_5 dB *	$I_{C(ZS)}$ mA
3 to 30 (P.E.P.)	typ 19,5	typ 35	typ −33	typ −36	25

Test circuit

S.S.B. class-AB



List of components:

TR1 = TR2 = BD137

C1 = 100 pF air dielectric trimmer (single insulated rotor type)
C2 = 27 pF ceramic capacitor
C3 = 180 pF ceramic capacitor
C4 = 100 pF air dielectric trimmer (single non-insulated rotor type)
C5 = C7 = 3,9 nF polyester capacitor
C6 = 2 x 270 pF polystyrene capacitors in parallel
C8 = C15 = C16 = 100 nF polyester capacitor
C9 = 2,2 μF moulded metallized polyester capacitor
C10 = 2 x 385 pF film dielectric trimmer
C11 = 68 pF ceramic capacitor

* Stated intermodulation distortion figures are referred to the according level of either of the equal amplified tones. Relative to the according peak envelope powers these figures should be increased by 6 dB.

APPLICATION INFORMATION (continued)

List of components (continued)

C12 = 2 x 82 pF ceramic capacitors in parallel
C13 = 47 pF ceramic capacitor
C14 = 385 pF film dielectric trimmer

L1 = 88 nH; 3 turns Cu wire (1,0 mm); int. dia. 9 mm; length 6,1 mm; leads 2 x 5 mm
L2 = L5 = Ferroxcube choke coil (cat. no. 4312 020 36640)
L3 = 68 nH; 3 turns enamelled Cu wire (1,6 mm); int. dia. 8 mm; length 8,3 mm; leads 2 x 5 mm
L4 = 96 nH; 3 turns enamelled Cu wire (1,6 mm); int. dia. 10 mm; length 7,6 mm; leads 2 x 5 mm

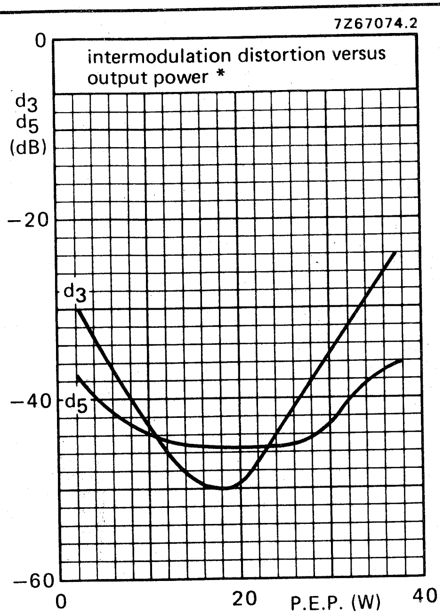
R1 = 27 Ω (±5%) carbon resistor
R2 = 4,7 Ω (±5%) carbon resistor
R3 = 1,5 kΩ (±5%) carbon resistor
R4 = 10 Ω wirewound potentiometer (3 W)
R5 = 47 Ω wirewound resistor (5,5 W)
R6 = 150 Ω (±5%) carbon resistor

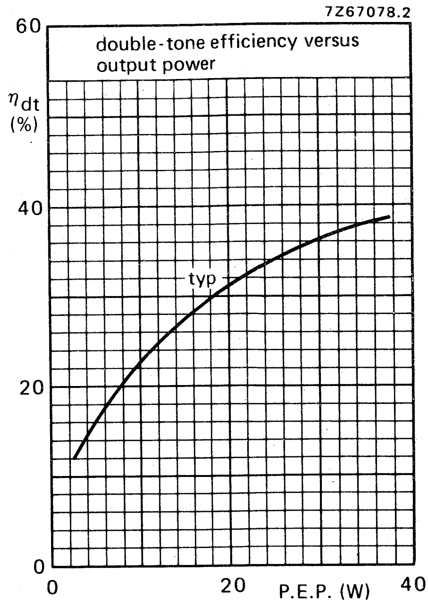
Measuring conditions for the upper graphs on page 11

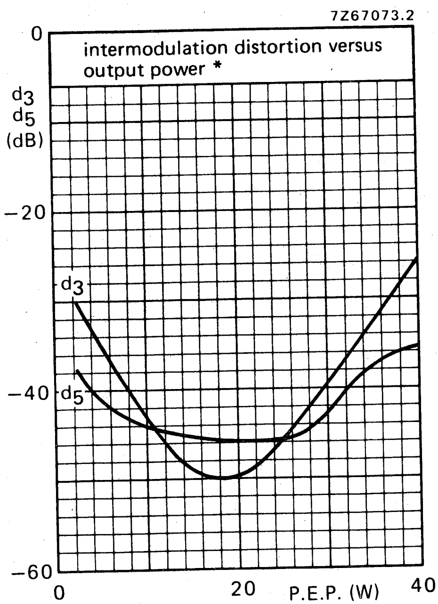
V_{CC} = 12,5 V
f_1 = 28,000 MHz
f_2 = 28,001 MHz
T_h = 25 °C
$R_{th\ mb\text{-}h} \leq$ 0,45 °C/W
$I_{C(ZS)}$ = 25 mA
typical values

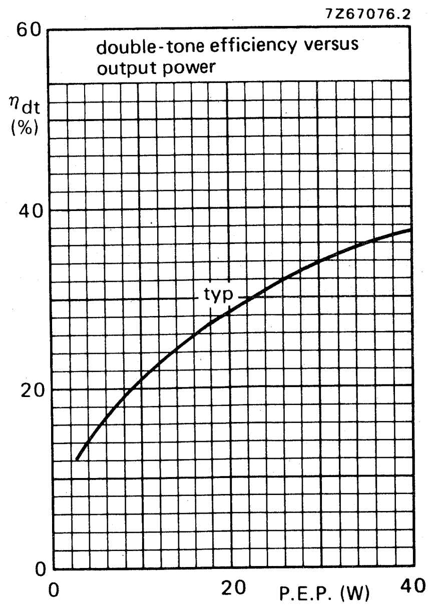
Measuring conditions for the lower graphs on page 11

V_{CC} = 13,5 V
f_1 = 28,000 MHz
f_2 = 28,001 MHz
T_h = 25 °C
$R_{th\ mb\text{-}h} \leq$ 0,45 °C/W
$I_{C(ZS)}$ = 25 mA
typical values

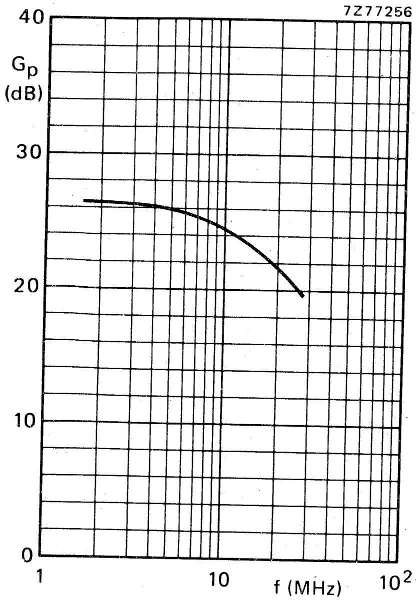


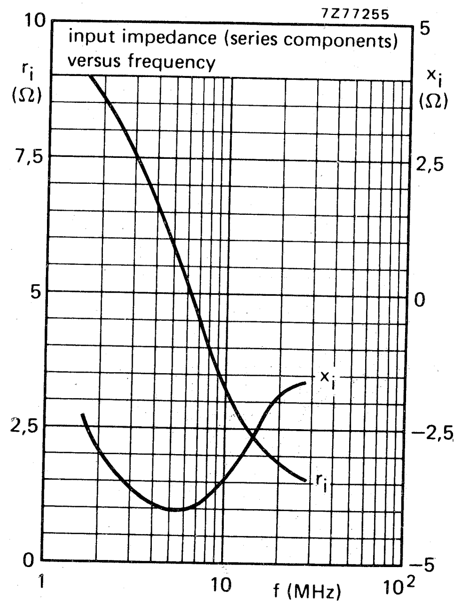






* Stated intermodulation distortion figures are referred to the according level of either of the equal amplified tones. Relative to the according peak envelope powers these figures should be increased by 6 dB.





S.S.B. class-AB operation

Conditions for the graphs above:

V_{CC} = 12,5 V
P_L = 30 W (P.E.P.)
T_h = 25 °C
$R_{th\ mb\text{-}h} \leqslant$ 0,45 °C/W
$I_{C(ZS)}$ = 25 mA
Z_L = 1,9 Ω

V_{CC} = 13,5 V
P_L = 35 W (P.E.P.)
T_h = 25 °C
$R_{th\ mb\text{-}h} \leqslant$ 0,45 °C/W
$I_{C(ZS)}$ = 25 mA
Z_L = 1,9 Ω

The typical curves (both conditions) hold for an unneutralized amplifier.

V.H.F. LINEAR POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor assembled in a plastic encapsulated stripline package all leads of which are isolated from the stud. Excellent d.c. dissipation properties have been obtained by means of internal emitter-ballasting resistors and gold metallization. Detailed information is presented for application of this device in preamplifiers for television transposers and transmitters in band III.

QUICK REFERENCE DATA

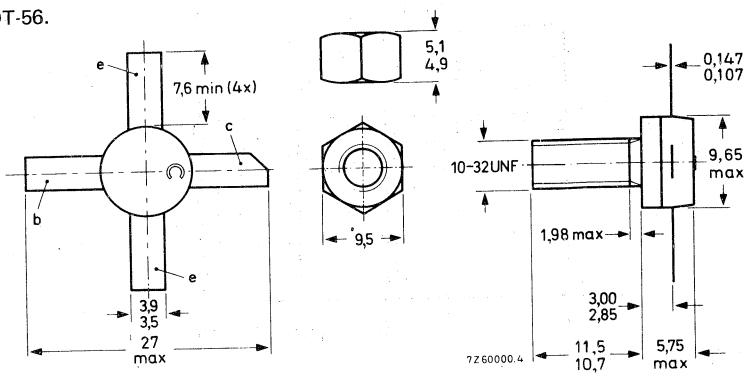
Collector-base voltage (open emitter; peak value)	V_{CBOM}	max.	60	V
Collector-emitter voltage (open base)	V_{CEO}	max.	32	V
Collector current (average)	$I_{C(AV)}$	max.	3	A
D.C. power dissipation up to T_h = 70 °C	P_{tot}	max.	40	W
Thermal resistance from junction to mounting base	$R_{th\ j\text{-}mb}$	=	3,0	°C/W
Transition frequency				
I_C = 4,0 A; V_{CE} = 25 V	f_T	typ.	900	MHz
Output power at f_{vision} = 224,25 MHz *				
I_C = 1,6 A; V_{CE} = 25 V; T_h = 70 °C; d_{im} = −55 dB	$P_{o\ sync}$	>	10,0	W
I_C = 1,6 A; V_{CE} = 25 V; T_h = 70 °C; d_{im} = −52 dB	$P_{o\ sync}$	typ.	13,5	W
Power gain at f_{vision} = 224,25 MHz				
I_C = 1,6 A; V_{CE} = 25 V; T_h = 70 °C	G_p	>	9,5	dB

* Three-tone test method (vision carrier −8 dB, sound carrier −7 dB, sideband signal −16 dB), zero dB corresponds to peak sync level.

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-56.



When locking is required an adhesive is preferred instead of a lock washer.

Torque on nut: min. 1,5 Nm
(15 kg cm)
max. 1,7 Nm
(17 kg cm)

Diameter of clearance hole in heatsink: max. 4,9 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC134)

Voltages

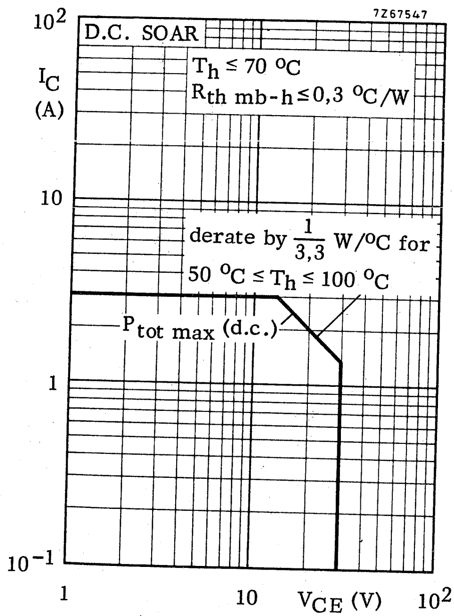
Collector-base voltage (open emitter) peak value	V_{CBOM}	max.	60	V
Collector-emitter voltage (R_{BE} = 10 Ω) peak value	V_{CERM}	max.	60	V
Collector-emitter voltage (open base)	V_{CEO}	max.	32	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4	V

Currents

Collector current (average)	$I_{C(AV)}$	max.	3,0	A
Collector current (peak value) f > 1 MHz	I_{CM}	max.	9,0	A

Power dissipation

D.C. power dissipation up to T_h = 70 °C	P_{tot}	max.	40	W



Temperatures

Storage temperature	T_{stg}		−65 to +200	°C
Junction temperature	T_j	max.	200	°C

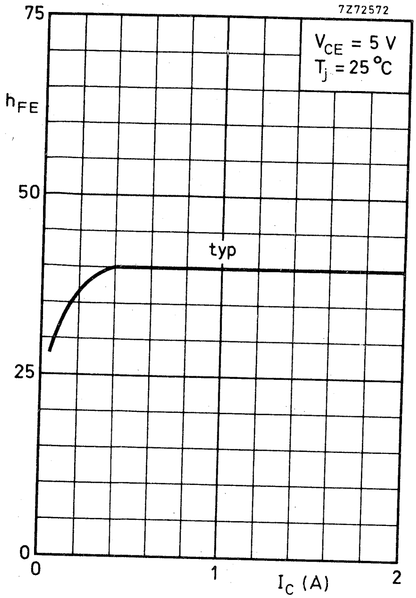
THERMAL RESISTANCE

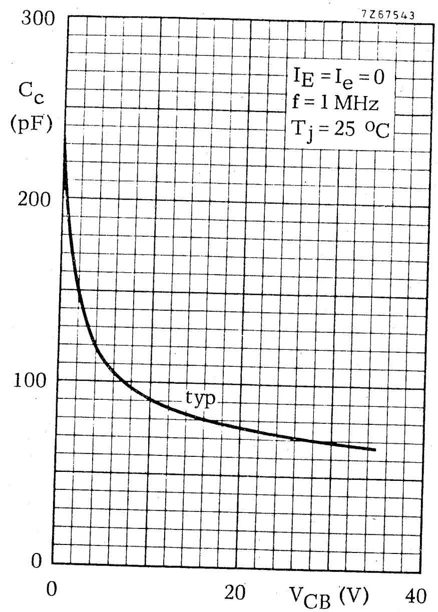
From junction to mounting base	$R_{th\ j-mb}$	=	3,0	°C/W
From mounting base to heatsink	$R_{th\ mb-h}$	=	0,3	°C/W

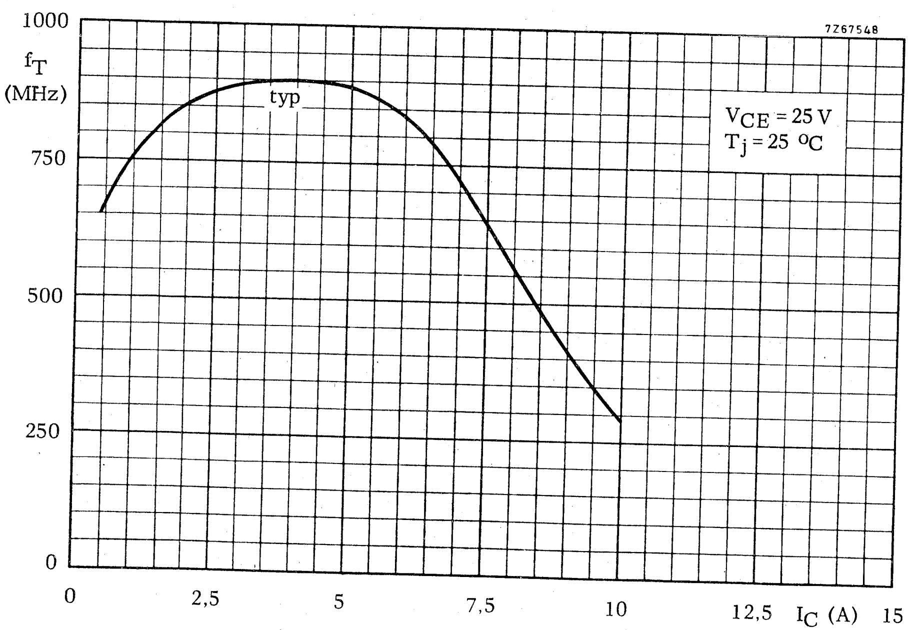
CHARACTERISTICS

$T_j = 25\ ^oC$ unless otherwise specified

Breakdown voltages				
Collector-base voltage open emitter, $I_C = 50$ mA	$V_{(BR)CBO}$	>	60	V
Collector-emitter voltage $R_{BE} = 10\ \Omega$, $I_C = 50$ mA	$V_{(BR)CER}$	>	60	V
Collector-emitter voltage open base, $I_C = 50$ mA	$V_{(BR)CEO}$	>	32	V
Emitter-base voltage open collector, $I_E = 10$ mA	$V_{(BR)EBO}$	>	4	V
Transient energy				
$L = 25$ mH; $f = 50$ Hz open base	E	>	4,5	mWs
$-V_{BE} = 1,5$ V; $R_{BE} = 33\ \Omega$	E	>	4,5	mWs
D.C. current gain				
$I_C = 1,0$ A; $V_{CE} = 5$ V	h_{FE}	> typ.	25 40	
Transition frequency				
$I_C = 4$ A; $V_{CE} = 25$ V	f_T	typ.	900	MHz
Collector capacitance at f = 1 MHz				
$I_E = I_e = 0$; $V_{CB} = 30$ V	C_c	typ. <	68 80	pF pF
Feedback capacitance at f = 1 MHz				
$I_C = 200$ mA; $V_{CE} = 30$ V	C_{re}	typ.	39	pF
Collector-stud capacitance	C_{cs}	typ.	2	pF


7Z72572
V_{CE} = 5 V
T_j = 25 °C
h_{FE}
75
50
25
0
typ
0
1
2
I_C (A)


7Z67543
$I_E = I_e = 0$
f = 1 MHz
T_j = 25 °C
C_c
(pF)
300
200
100
0
typ
0
20
V_{CB} (V)
40

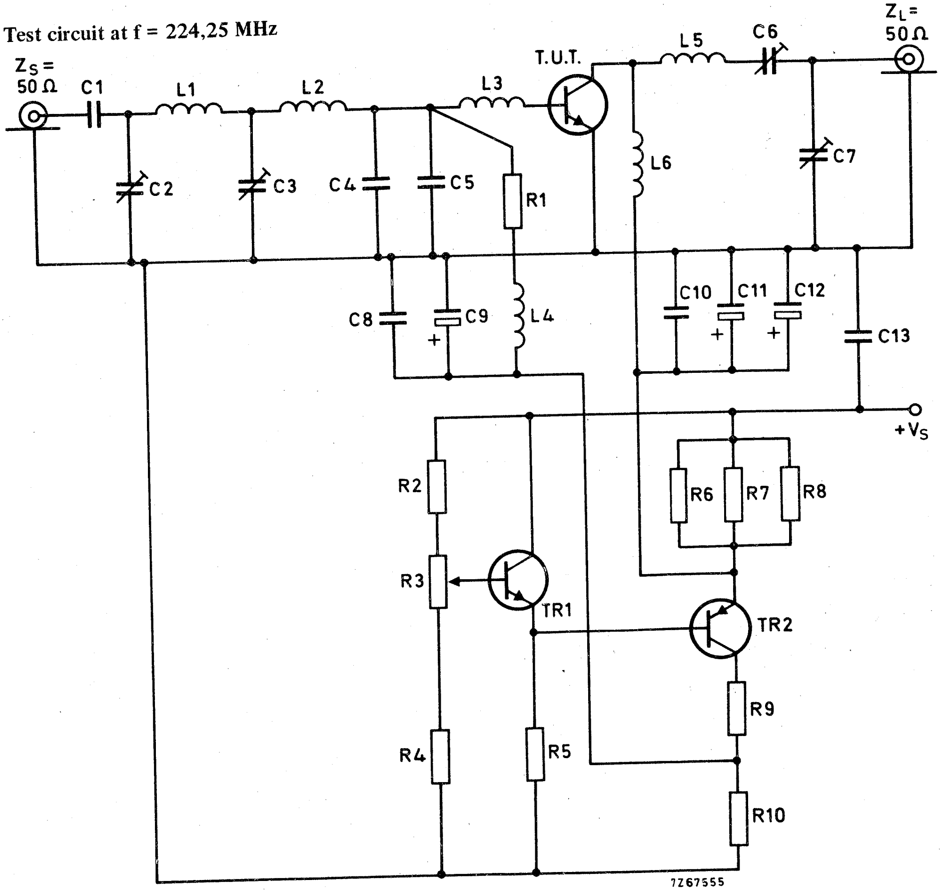

7Z67548
f_T
(MHz)
1000
750
500
250
0
typ
V_{CE} = 25 V
T_j = 25 °C
0
2,5
5
7,5
10
12,5
I_C (A)
15

APPLICATION INFORMATION

d_{im} *) (dB)	f_{vision} (MHz)	V_{CE} (V)	I_C (A)	G_p (dB)	$P_{o\ sync}$ *) (W)	T_h (°C)	$R_{th\ mb-h}$ (°C/W)
-55	224, 25	25	1, 6	> 9, 5	> 10, 0	70	≤ 0, 3
-52	224, 25	25	1, 6	> 9, 5	typ. 13, 5	70	≤ 0, 3

*) Three-tone test method (vision carrier -8 dB, sound carrier -7 dB, side band signal -16 dB), zero dB corresponds to peak sync level.

Test circuit at f = 224,25 MHz



List of components: see page 6.

Component lay-out and printed circuit board for f = 224,25 MHz test circuit on page 7.

APPLICATION INFORMATION (continued)

List of components:

Tr 1 = BD135
Tr 2 = BD136

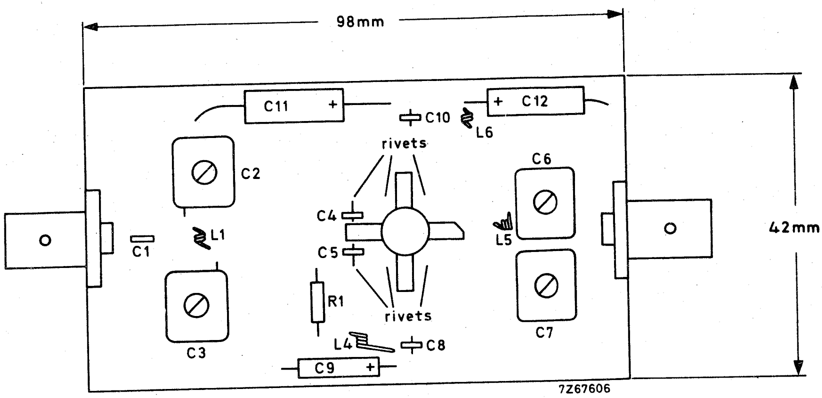
C1 = 330 pF chip capacitor
C2 = 4 to 40 pF film dielectric trimmer
C3 = 4 to 60 pF film dielectric trimmer
C4 = C5 = 82 pF chip capacitor, placed 5 mm from transistor edge
C6 = 4 to 100 pF film dielectric trimmer
C7 = 4 to 60 pF film dielectric trimmer
C8 = C10 = 820 pF chip capacitor
C9 = 47 μF electrolytic capacitor 6, 3 V
C11 = 22 μF electrolytic capacitor 40 V
C12 = 47 μF electrolytic capacitor 40 V
C13 = 100 nF polyester capacitor

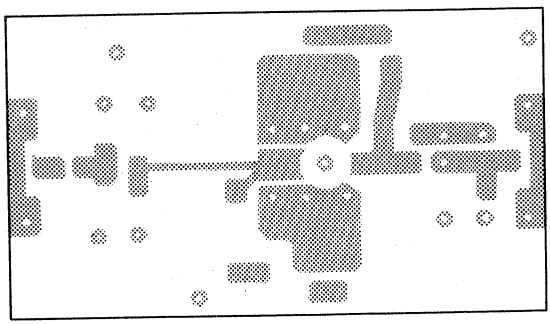
L1 = 24, 7 nH; 1, 5 turns closely wound enamelled Cu wire (0, 7 mm); int. diam. 4, 5 mm; leads 2 x 5 mm.
L2 = 8, 3 nH formed by metallization on printed board.
L3 = formed by metallization on printed board.
L4 = 100 nH; 3, 5 turns closely wound enamelled Cu wire (0, 7 mm); int. diam. 5, 5 mm; leads 2 x 5 mm.
L5 = 22 nH; 1, 5 turns closely wound enamelled Cu wire (1, 6 mm); int. diam. 4, 5 mm; leads 2 x 8 mm.
L6 = 36 nH; 1, 5 turns closely wound enamelled Cu wire (1, 6 mm); int. diam. 4, 0 mm; leads 2 x 10 mm.

R1 = 4, 7 Ω carbon resistor
R2 = 330 Ω
R3 = 470 Ω potentiometer
R4 = 4, 7 kΩ
R5 = 2, 7 kΩ
R6 = R7 = R8 = 4, 7 Ω (5, 5 W)
R9 = 180 Ω (5, 5 W)
R10 = 68 Ω

APPLICATION INFORMATION (continued)

Component lay-out and printed circuit board for f = 224,25 MHz test circuit.

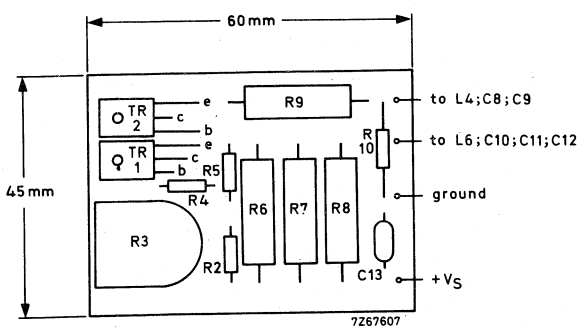


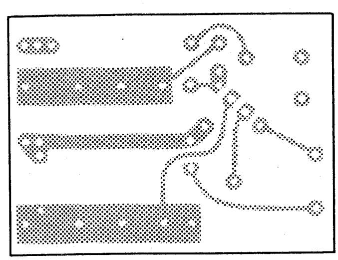


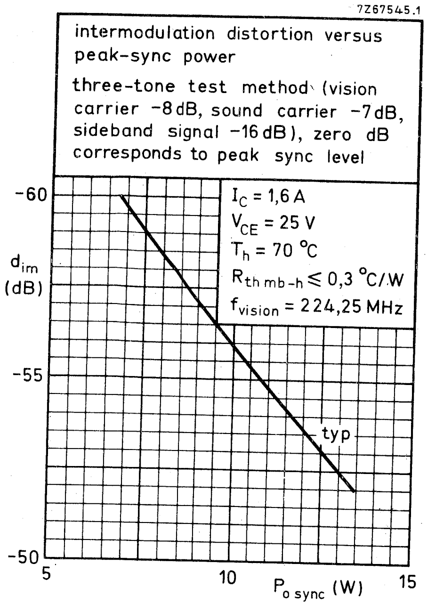
Thickness: 1,6 mm

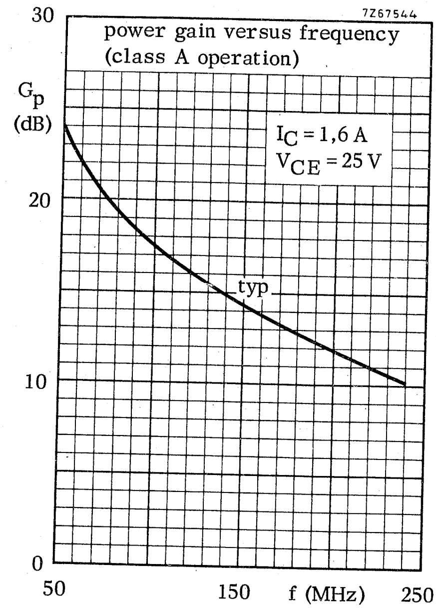
The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets.

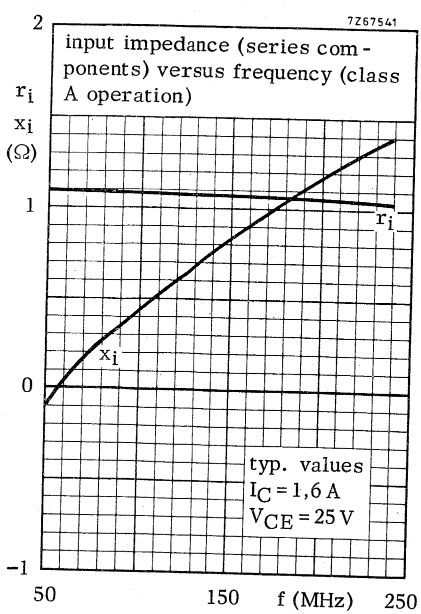
Component lay-out and printed circuit board for bias circuit.

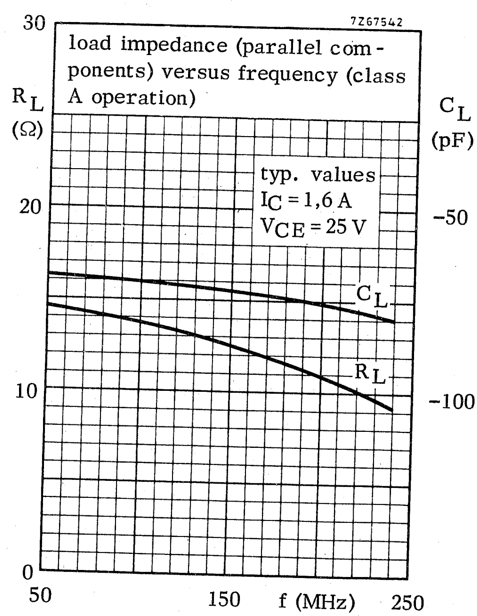





7Z67545.1
intermodulation distortion versus peak-sync power
three-tone test method (vision carrier −8 dB, sound carrier −7 dB, sideband signal −16 dB), zero dB corresponds to peak sync level
I_C = 1,6 A
V_{CE} = 25 V
T_h = 70 °C
$R_{th\,mb\text{-}h}$ ≤ 0,3 °C/W
f_{vision} = 224,25 MHz
typ
d_{im} (dB)
−60
−55
−50
5
10
15
$P_{o\,sync}$ (W)


7Z67544
power gain versus frequency (class A operation)
I_C = 1,6 A
V_{CE} = 25 V
typ
G_p (dB)
30
20
10
0
50
150
f (MHz)
250


7Z67541
input impedance (series components) versus frequency (class A operation)
r_i
x_i
(Ω)
2
1
0
−1
typ. values
I_C = 1,6 A
V_{CE} = 25 V
50
150
f (MHz)
250


7Z67542
load impedance (parallel components) versus frequency (class A operation)
R_L (Ω)
C_L (pF)
typ. values
I_C = 1,6 A
V_{CE} = 25 V
30
20
10
0
−50
−100
50
150
f (MHz)
250

V.H.F. LINEAR POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor assembled in a stripline package with a ceramic cap. All leads are isolated from the stud. Excellent d.c. dissipation properties have been obtained by means of internal emitter-ballasting resistors and gold metallization. Detailed information is presented for application of this device in preamplifiers for television transposers and transmitters in band III.

QUICK REFERENCE DATA

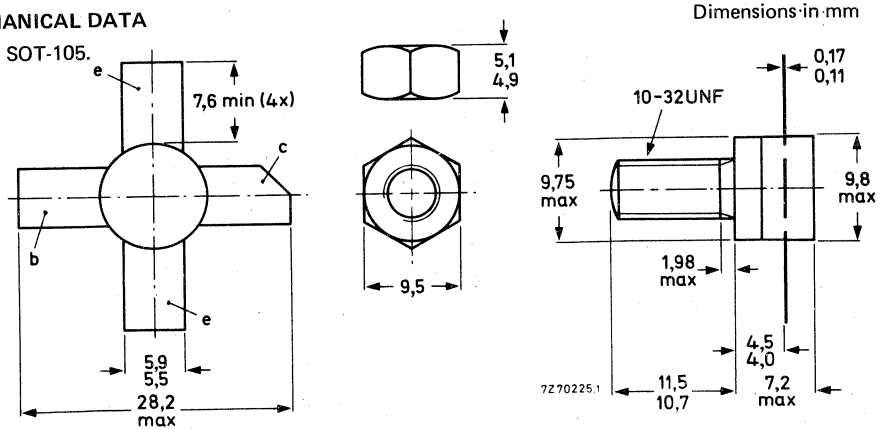
Collector-base voltage (open emitter; peak value)	V_{CBOM}	max.	60	V
Collector-emitter voltage (open base)	V_{CEO}	max.	32	V
Collector current (average)	$I_{C(AV)}$	max.	4	A
D.C. power dissipation at T_h = 70 °C	P_{tot}	max.	60	W
Thermal resistance from junction to mounting base	$R_{th\ j\text{-}mb}$	=	1,9	°C/W
Transition frequency				
I_C = 6,0 A; V_{CE} = 25 V	f_T	typ.	800	MHz
Output power at f_{vision} = 224,25 MHz *				
I_C = 2,4 A; V_{CE} = 25 V; T_h = 70 °C; d_{im} = −55 dB	$P_{o\ sync}$	>	14,0	W
I_C = 2,4 A; V_{CE} = 25 V; T_h = 70 °C; d_{im} = −52 dB	$P_{o\ sync}$	typ.	19,5	W
Power gain at f_{vision} = 224,25 MHz				
I_C = 2,4 A; V_{CE} = 25 V; T_h = 70 °C	G_p	>	8,0	dB

* Three-tone test method (vision carrier −8 dB, sound carrier −7 dB, sideband signal −16 dB), zero dB corresponds to peak sync level.

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-105.



When locking is required an adhesive is preferred instead of a lock washer.

Torque on nut: min. 1,5 Nm
(15 kg cm)
max. 1,7 Nm
(17 kg cm)

Diameter of clearance hole in heatsink: max. 4,9 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC134)

Voltages

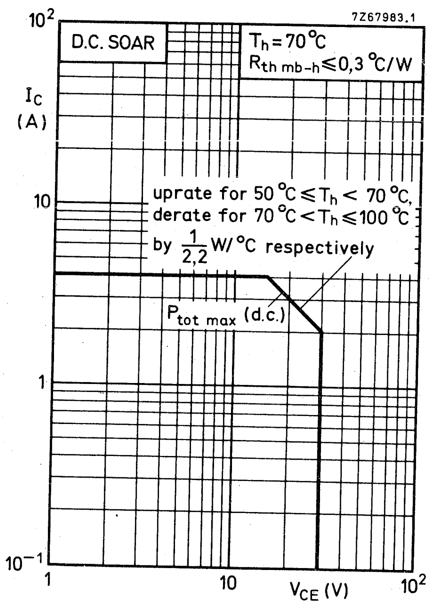
Collector-base voltage (open emitter) peak value	V_{CBOM}	max.	60	V
Collector-emitter voltage (R_{BE} = 10 Ω) peak value	V_{CERM}	max.	60	V
Collector-emitter voltage (open base)	V_{CEO}	max.	32	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4	V

Currents

Collector current (average)	$I_{C(AV)}$	max.	4,0	A
Collector current (peak value) f > 1 MHz	I_{CM}	max.	12,0	A

Power dissipation

D.C. power dissipation at T_h = 70 °C	P_{tot}	max.	60	W



Temperatures

Storage temperature	T_{stg}	–65 to +125		°C
Operating junction temperature	T_j	max.	200	°C

THERMAL RESISTANCE

From junction to mounting base	$R_{th\ j\text{-}mb}$	=	1,9	°C/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,3	°C/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Breakdown voltages

Collector-base voltage open emitter, I_C = 50 mA	$V_{(BR)CBO}$	>	60	V
Collector-emitter voltage R_{BE} = 10 Ω, I_C = 50 mA	$V_{(BR)CER}$	>	60	V
Collector-emitter voltage open base, I_C = 50 mA	$V_{(BR)CEO}$	>	32	V
Emitter-base voltage open collector, I_E = 10 mA	$V_{(BR)EBO}$	>	4	V

Transient energy

L = 25 mH; f = 50 Hz				
open base	E	>	8,0	mWs
$-V_{BE}$ = 1,5 V; R_{BE} = 33 Ω	E	>	8,0	mWs

D.C. current gain

I_C = 2,0 A; V_{CE} = 25 V	h_{FE}	>	20	
		typ.	45	

Transition frequency

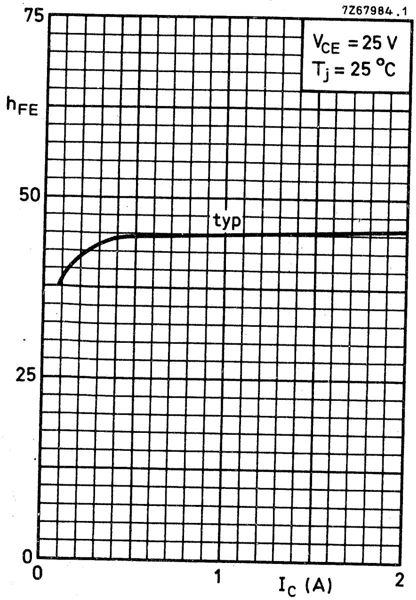
I_C = 6,0 A; V_{CE} = 25 V	f_T	typ.	800	MHz

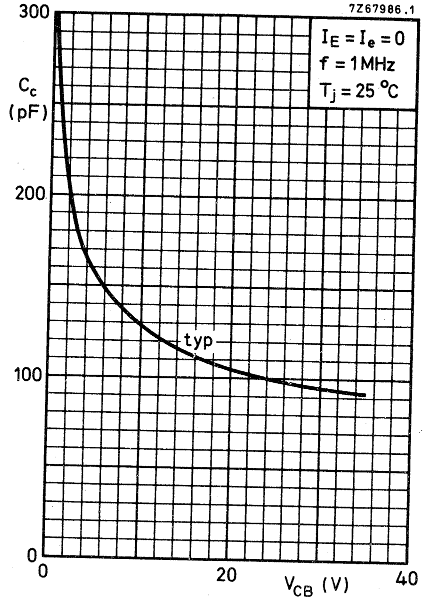
Collector capacitance at f = 1 MHz

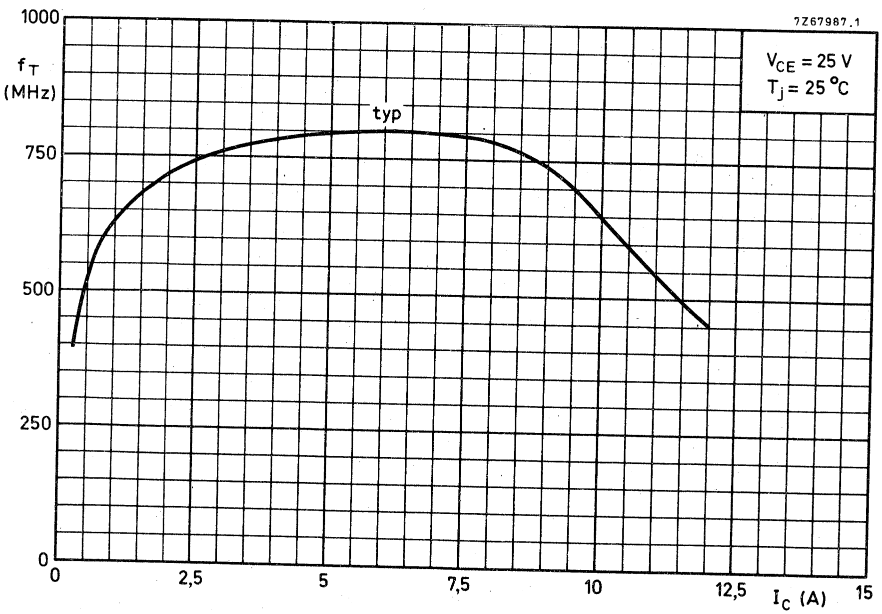
$I_E = I_e$ = 0; V_{CB} = 30 V	C_c	typ.	95	pF
		<	120	pF

Feedback capacitance at f = 1 MHz

I_C = 0,2 A; V_{CE} = 30 V	C_{re}	typ.	55	pF
Collector-stud capacitance	C_{cs}	typ.	2	pF


7Z67984.1
V_{CE} = 25 V
T_j = 25 °C
h_{FE}
75
50
25
0
typ
0
1
2
I_C (A)


7Z67986.1
I_E = I_e = 0
f = 1 MHz
T_j = 25 °C
C_c
(pF)
300
200
100
0
typ
0
20
40
V_{CB} (V)

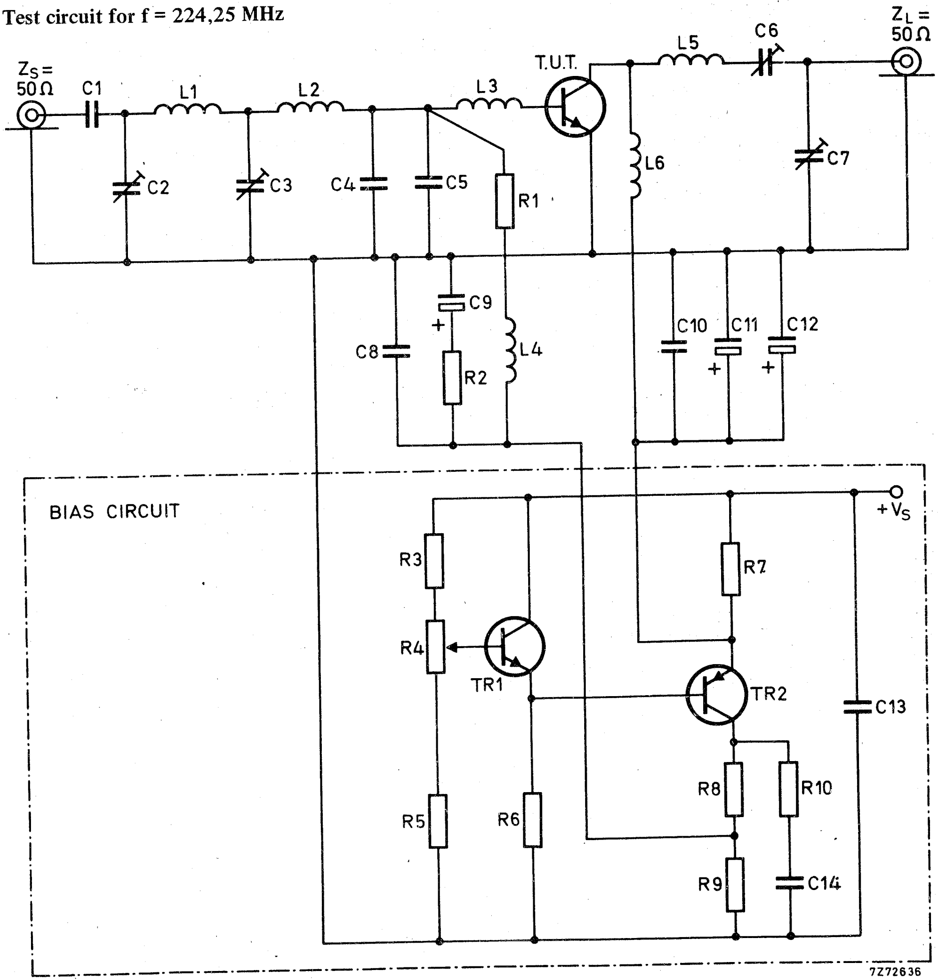

7Z67987.1
V_{CE} = 25 V
T_j = 25 °C
f_T
(MHz)
1000
750
500
250
0
typ
0
2,5
5
7,5
10
12,5
15
I_C (A)

APPLICATION INFORMATION

d_{im} *) (dB)	f_{vision} (MHz)	V_{CE} (V)	I_C (A)	G_p (dB)	P_o sync *) (W)	T_h (°C)	$R_{th\ mb-h}$ (°C/W)
−55	224, 25	25	2, 4	> 8, 0	> 14, 0	70	≤ 0, 3
−52	224, 25	25	2, 4	> 8, 0	typ. 19, 5	70	≤ 0, 3

*) Three-tone test method (vision carrier −8 dB, sound carrier −7 dB, sideband signal −16 dB), zero dB corresponds to peak sync level.

Test circuit for f = 224,25 MHz



List of components: see page 6.

Component layout and printed-circuit board for f = 224, 25 MHz test circuit on page 7.

APPLICATION INFORMATION (continued)

List of components:

TR1 = BD135
TR2 = BD136

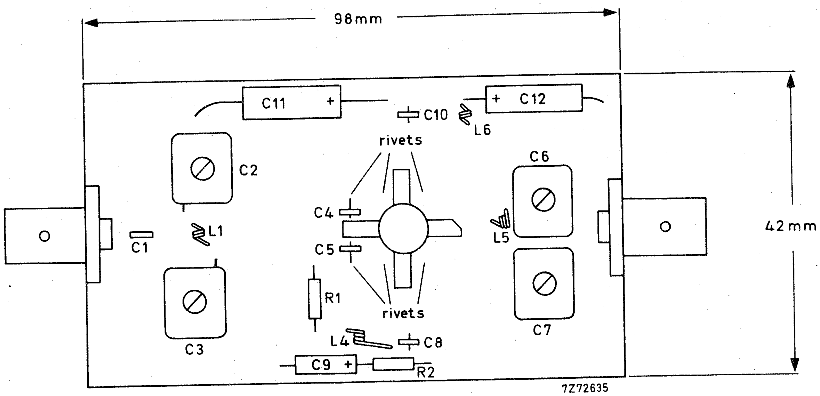
C1 = 220 pF ceramic plate capacitor
C2 = 4 to 40 pF film dielectric trimmer
C3 = 5 to 60 pF film dielectric trimmer
C4 = C5 = 82 pF chip capacitor, placed 1 mm from transistor edge
C6 = 7 to 100 pF film dielectric trimmer
C7 = 4 to 40 pF film dielectric trimmer
C8 = C10 = 820 pF chip capacitor
C9 = 220 μF electrolytic capacitor 10 V
C11 = 47 μF electrolytic capacitor 40 V
C12 = 47 μF electrolytic capacitor 40 V
C13 = 100 nF polyester capacitor
C14 = 33 nF polyester capacitor

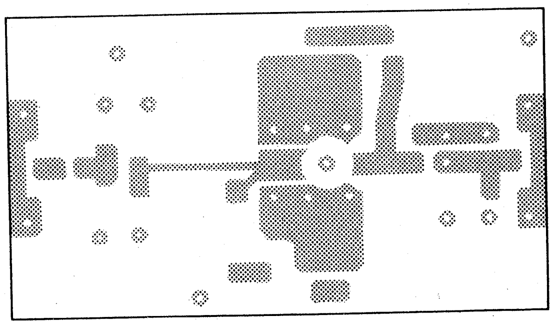
L1 = 24,7 nH; 1,5 turns closely wound enamelled Cu wire (0,7 mm); int. dia. 4,5 mm; leads 2 x 5 mm.
L2 = 8,3 nH formed by metallization on printed-circuit board
L3 = 0,7 nH formed by metallization on printed-circuit board
L4 = 100 nH; 3,5 turns closely wound enamelled Cu wire (0,7 mm); int. dia. 5,5 mm; leads 2 x 5 mm.
L5 = 15,0 nH; 1 turn enamelled Cu wire (1,6 mm); int. dia. 4,5 mm; leads 2 x 8 mm.
L6 = 26,4 nH; 1,5 turns closely wound enamelled Cu wire (1,6 mm); int. dia. 5,1 mm; leads 2 x 10 mm.

R1 = 4,7 Ω carbon resistor
R2 = 15 Ω carbon resistor
R3 = 180 Ω carbon resistor (1 W)
R4 = 470 Ω potentiometer
R5 = 4,7 kΩ carbon resistor
R6 = 2,7 kΩ carbon resistor
R7 = 4 x 4,7 Ω (2 W); in parallel
R8 = 150 Ω (5,5 W)
R9 = 68 Ω carbon resistor (1 W)
R10 = 10 Ω carbon resistor

APPLICATION INFORMATION (continued)

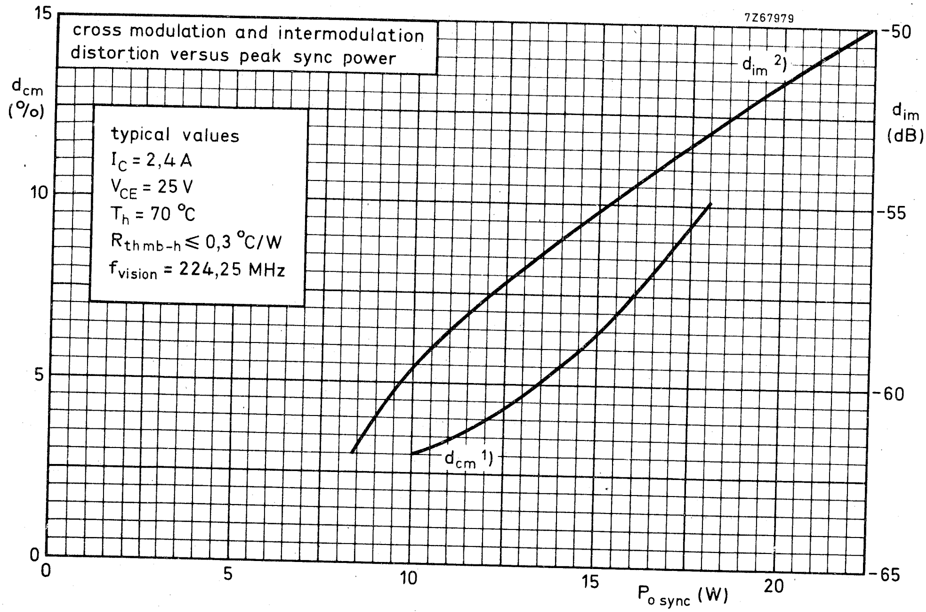
Component layout and printed-circuit board for f = 224, 25 MHz test circuit without bias circuit.





Thickness: 1, 6 mm

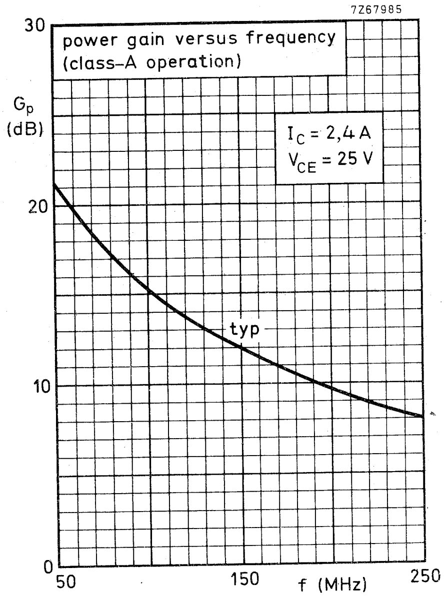
The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets.

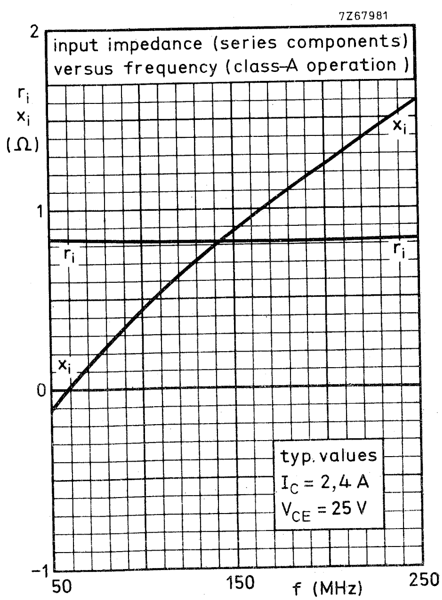


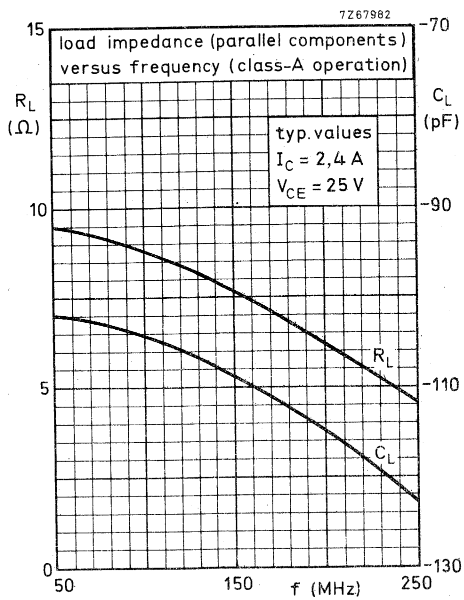
1) Two-tone test method (vision carrier 0 dB, sound carrier −7 dB), zero dB corresponds to peak sync level.

2) Three-tone test method (vision carrier −8 dB, sound carrier −7 dB, sideband signal −16 dB), zero dB corresponds to peak sync level.

In the application information a collector-emitter voltage V_{CE} = 25 V and collector current I_C = 2,4 A are recommended.
If a higher collector voltage (within the limiting values) is used, precautions must be taken to ensure that the impedance presented to the collector circuit does not vary excessively with frequency. This is especially important in wideband circuits where a relatively wide variation of load impedance over the frequency band may be expected. Tuning of the output circuit at high level should be avoided or, if essential, it should be performed very carefully, otherwise very high load impedances may occur during which the maximum ratings of the transistor can be exceeded.


7Z67985
power gain versus frequency
(class-A operation)
G_p
(dB)
I_C = 2,4 A
V_{CE} = 25 V
typ
30
20
10
0
50
150
f (MHz)
250


7Z67981
input impedance (series components)
versus frequency (class-A operation)
r_i
x_i
(Ω)
x_i
r_i
r_i
x_i
typ. values
I_C = 2,4 A
V_{CE} = 25 V
2
1
0
−1
50
150
f (MHz)
250


7Z67982
load impedance (parallel components)
versus frequency (class-A operation)
R_L
(Ω)
C_L
(pF)
typ. values
I_C = 2,4 A
V_{CE} = 25 V
R_L
C_L
15
10
5
0
−70
−90
−110
−130
50
150
f (MHz)
250

H.F./V.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor intended for use in class-AB or class-B operated high power transmitters in the h.f. and v.h.f. bands. The transistor presents excellent performance as a linear amplifier in the h.f. band. It is resistance stabilized and is guaranteed to withstand severe load mismatch conditions. Transistors are delivered in matched h_{FE} groups.

The transistor has a ½" flange envelope with a ceramic cap. All leads are isolated from the flange.

QUICK REFERENCE DATA

R.F. performance up to T_h = 25 °C

mode of operation	V_{CE} V	$I_{C(ZS)}$ A	f MHz	P_L W	G_p dB	η %	d_3 dB
s.s.b. (class-AB)	**28**	**0,05**	**1,6–28**	**8–80 (P.E.P.)**	**> 13**	**> 35***	**< –30**
c.w. (class-B)	28	–	108	80	typ. 7,9	typ. 70	–

* At 80 W P.E.P.

MECHANICAL DATA

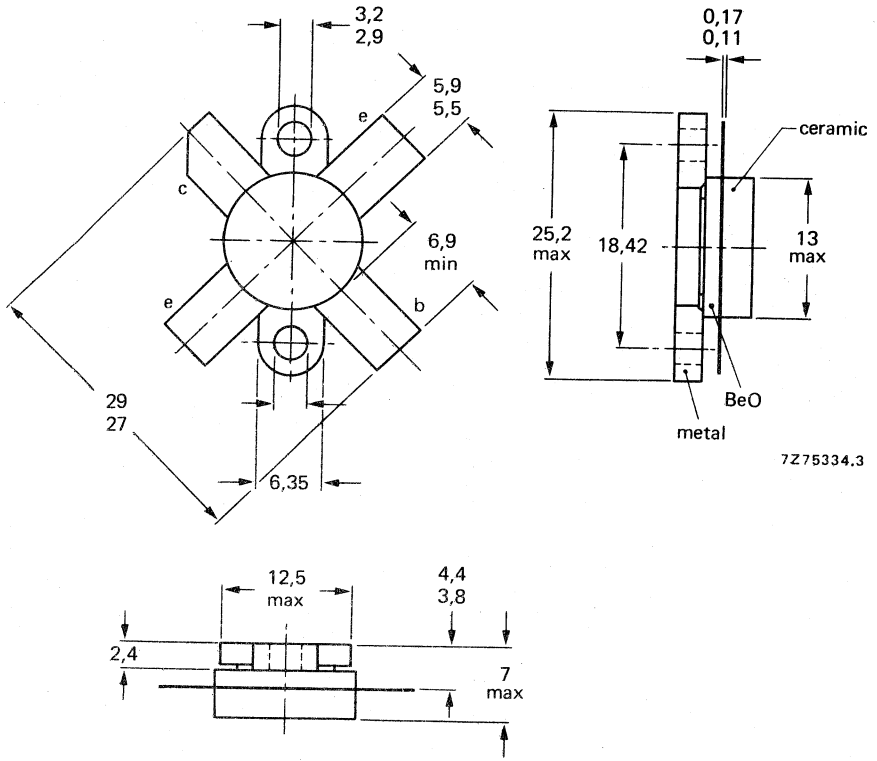
SOT-121 (see Fig.1).

CAUTION This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-121.



Torque on screw: min. 0,6 Nm (6 kg cm)
max. 0,75 Nm (7,5 kg cm)

Recommended screw: cheese-head 4-40 UNC/2A

Heatsink compound must be applied sparingly and evenly distributed.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage (V_{BE} = 0) peak value	V_{CESM}	max.	70	V
Collector-emitter voltage (open base)	V_{CEO}	max.	35	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4	V
Collector current (average)	$I_{C(AV)}$	max.	8	A
Collector current (peak value); f > 1 MHz	I_{CM}	max.	20	A
R.F. power dissipation (f > 1 MHz); T_{mb} = 25 °C	P_{rf}	max.	140	W
Storage temperature	T_{stg}		−65 to + 150	°C
Operating junction temperature	T_j	max.	200	°C

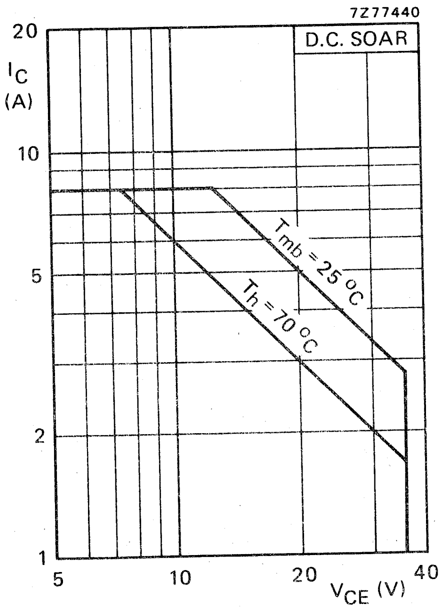


Fig. 2 D.C. SOAR.

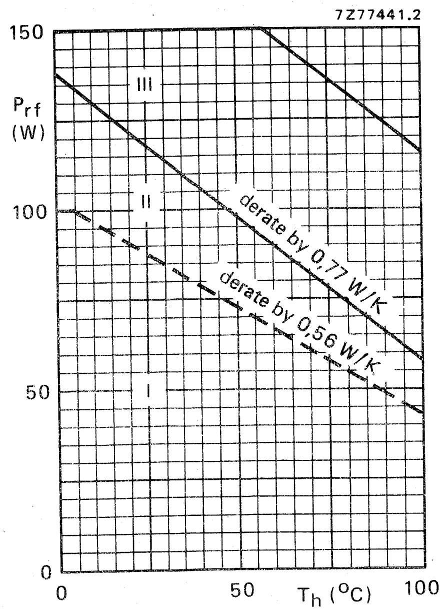


Fig. 3 R.F. power dissipation; $V_{CE} \leq 28$ V; f > 1 MHz.
I Continuous d.c. operation
II Continuous r.f. operation
III Short-time operation during mismatch

THERMAL RESISTANCE (dissipation = 60 W; T_{mb} = 82 °C, i.e. T_h = 70 °C)

From junction to mounting base (d.c. dissipation)	$R_{th\ j\text{-}mb(dc)}$	=	1,92	K/W*
From junction to mounting base (r.f. dissipation)	$R_{th\ j\text{-}mb(rf)}$	=	1,33	K/W*
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,2	K/W*

*K/W is SI unit for °C/W.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector-emitter breakdown voltage V_{BE} = 0; I_C = 50 mA	$V_{(BR)CES}$	>	70 V
Collector-emitter breakdown voltage open base; I_C = 50 mA	$V_{(BR)CEO}$	>	35 V
Emitter-base breakdown voltage open collector; I_E = 10 mA	$V_{(BR)EBO}$	>	4 V
Collector cut-off current V_{BE} = 0; V_{CE} = 35 V	I_{CES}	<	10 mA
D.C. current gain* I_C = 4 A; V_{CE} = 5 V	h_{FE}		15 to 80
D.C. current gain ratio of matched devices* I_C = 4 A; V_{CE} = 5 V	h_{FE1}/h_{FE2}	<	1,2
Collector-emitter saturation voltage* I_C = 12,5 A; I_B = 2,5 A	V_{CEsat}	typ.	2,5 V
Transition frequency at f = 100 MHz** $-I_E$ = 4 A; V_{CB} = 28 V	f_T	typ.	315 MHz
$-I_E$ = 12,5 A; V_{CB} = 28 V	f_T	typ.	305 MHz
Collector capacitance at f = 1 MHz $I_E = I_e$ = 0; V_{CB} = 28 V	C_c	typ.	125 pF
Feedback capacitance at f = 1 MHz I_C = 50 mA; V_{CE} = 28 V	C_{re}	typ.	85 pF
Collector-flange capacitance	C_{cf}	typ.	3 pF

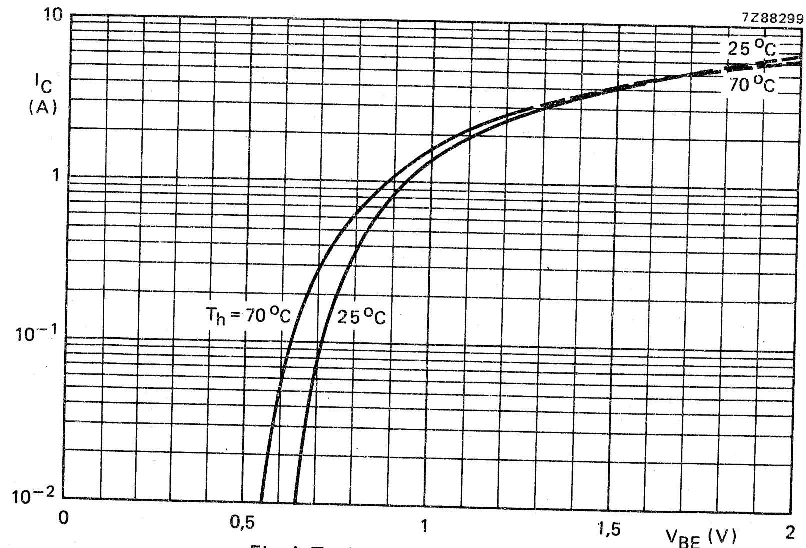


Fig. 4 Typical values; V_{CE} = 20 V.

* Measured under pulse conditions: $t_p \leqslant 300\ \mu s$; $\delta \leqslant 0{,}02$.
** Measured under pulse conditions: $t_p \leqslant 50\ \mu s$; $\delta \leqslant 0{,}01$.

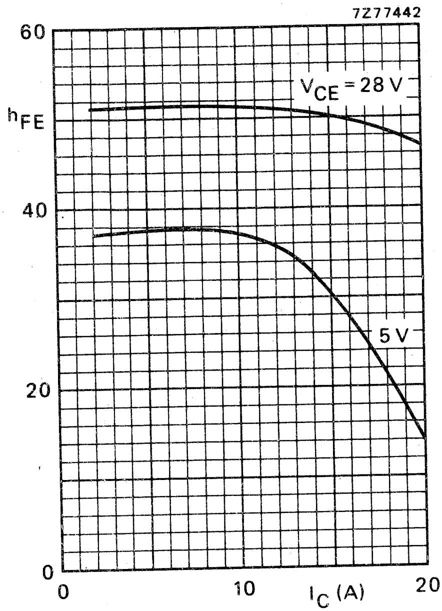


Fig. 5 Typical values; T_j = 25 °C.

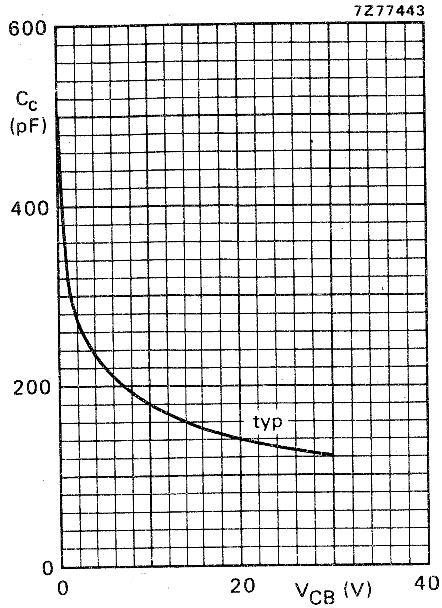


Fig. 6 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

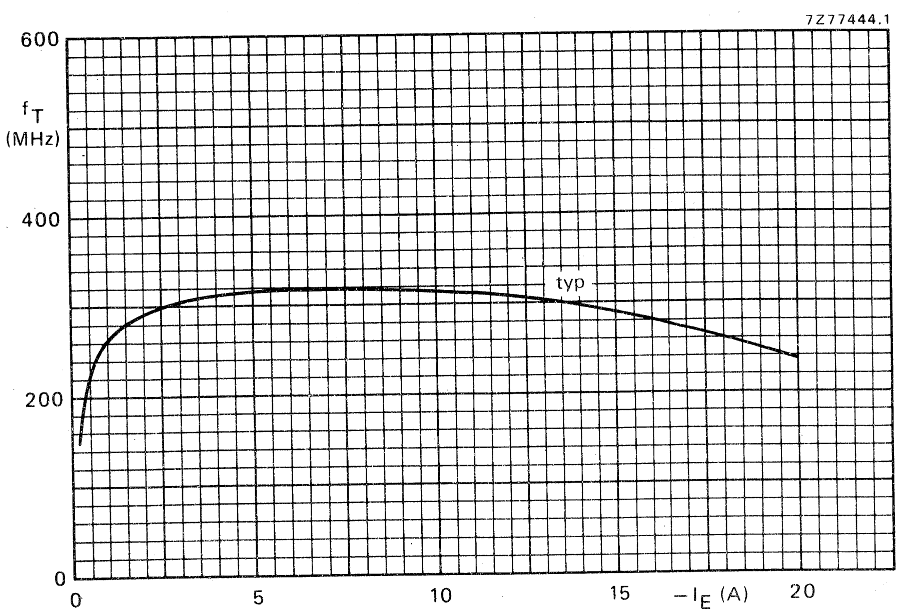


Fig. 7 V_{CB} = 28 V; f = 100 MHz; T_j = 25 °C.

APPLICATION INFORMATION

R.F. performance in s.s.b. class-AB operation (linear power amplifier)

V_{CE} = 28 V; T_h = 25 °C; f_1 = 28,000 MHz; f_2 = 28,001 MHz

output power W	G_p dB	η_{dt} (%) at 80 W P.E.P.	I_C(A) at 80 W P.E.P.	d_3 dB	d_5 dB	$I_{C(ZS)}$ A
8 to 80 (P.E.P.)	> **13**	> **35**	< **4,1**	< **–30**	< **–30**	**0,05**

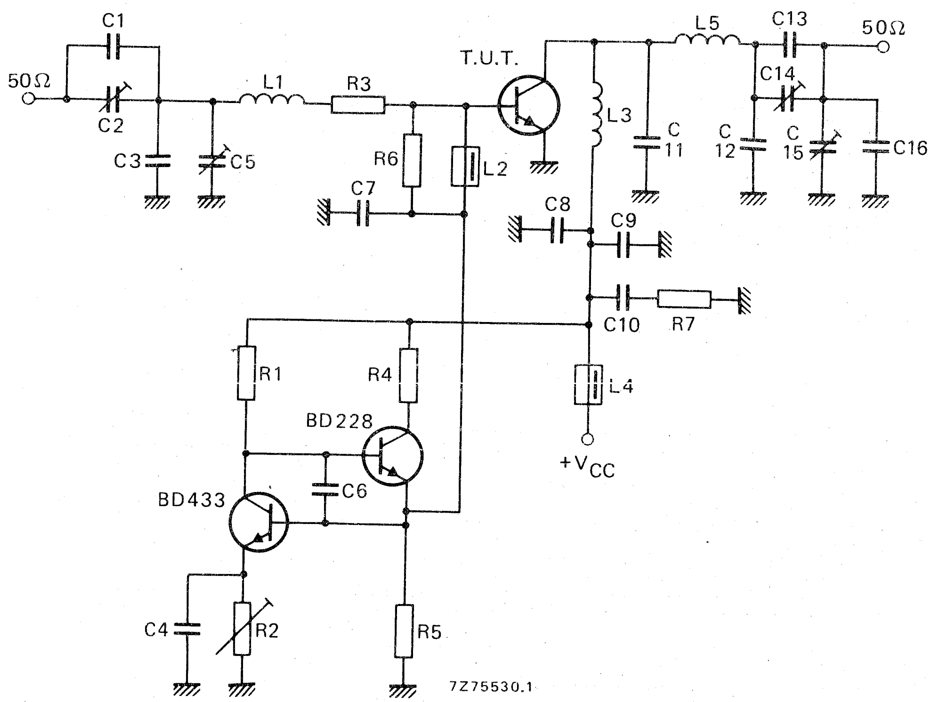


Fig. 8 Test circuit; s.s.b. class-AB.

List of components:

C1 = 27 pF ceramic capacitor (500 V)
C2 = 100 pF air dielectric trimmer (single insulated rotor type)
C3 = 100 pF polystyrene capacitor
C4 = C6 = C9 = 100 nF polyester capacitor
C5 = 280 pF air dielectric trimmer (single non-insulated rotor type)
C7 = C8 = 3,9 nF ceramic capacitor
C10 = 2,2 μF moulded metallized polyester capacitor
C11 = 180 pF polystyrene capacitor
C12 = 2 x 68 pF ceramic capacitors in parallel (500 V)
C13 = 120 pF polystyrene capacitor

C14 = C15 = 280 pF air dielectric trimmer (single insulated rotor type)
C16 = 56 pF ceramic capacitor (500 V)

L1 = 108 nH; 4 turns Cu wire (1,6 mm); int. dia. 8,7 mm; length 11,2 mm; leads 2 x 7 mm
L2 = L4 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L3 = 88 nH; 3 turns Cu wire (1,6 mm); int. dia. 8,0 mm; length 8,0 mm; leads 2 x 7 mm
L5 = 120 nH; 4 turns Cu wire (1,6 mm); int. dia. 9,3 mm; length 11,2 mm; leads 2 x 7 mm

R1 = 1,5 kΩ (± 5%) carbon resistor (0,5 W)
R2 = 10 Ω wirewound potentiometer (3 W)
R3 = 0,9 Ω; parallel connection of 2 x 1,8 Ω carbon resistors (± 5%; 0,5 W each)
R4 = 60 Ω; parallel connection of 2 x 120 Ω wirewound resistors (5,5 W each)
R5 = 56 Ω (± 5%) carbon resistor (0,5 W)
R6 = 33 Ω (± 5%) carbon resistor (0,5 W)
R7 = 4,7 Ω (± 5%) carbon resistor (0,5 W)

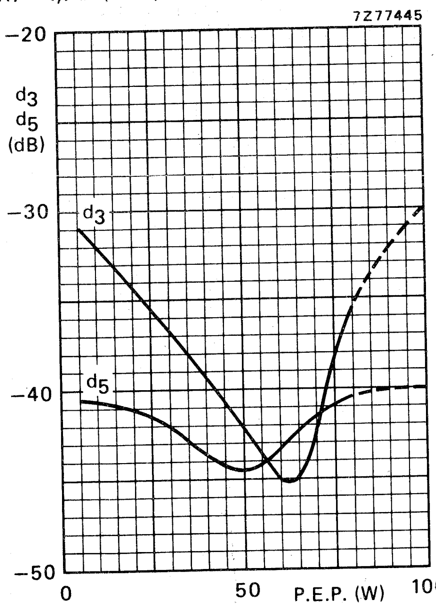


Fig. 9 Intermodulation distortion as a function of output power.*

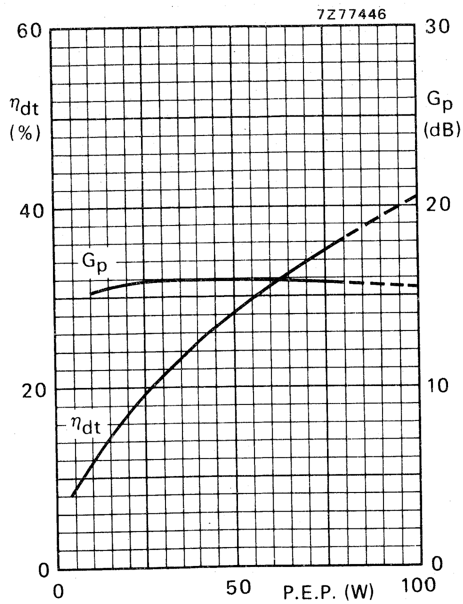


Fig. 10 Double-tone efficiency and power gain as a function of output power.

Conditions for Figs 9 and 10:
V_{CE} = 28 V; $I_{C(ZS)}$ = 50 mA; f_1 = 28,000 MHz; f_2 = 28,001 MHz; T_h = 25 °C; typical values.

* Stated intermodulation distortion figures are referred to the according level of either of the equal amplified tones. Relative to the according peak envelope powers these figures should be increased by 6 dB.

APPLICATION INFORMATION (continued)

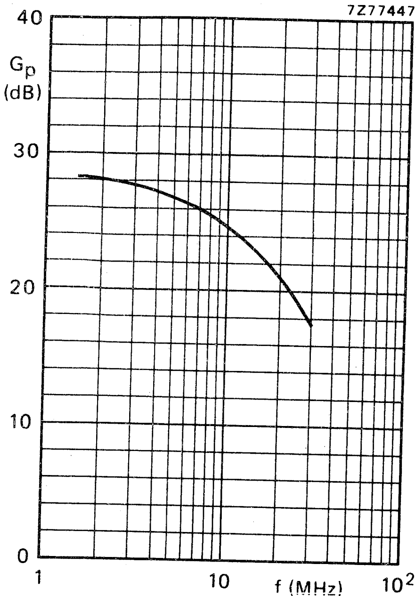


Fig. 11 Power gain as a function of frequency.

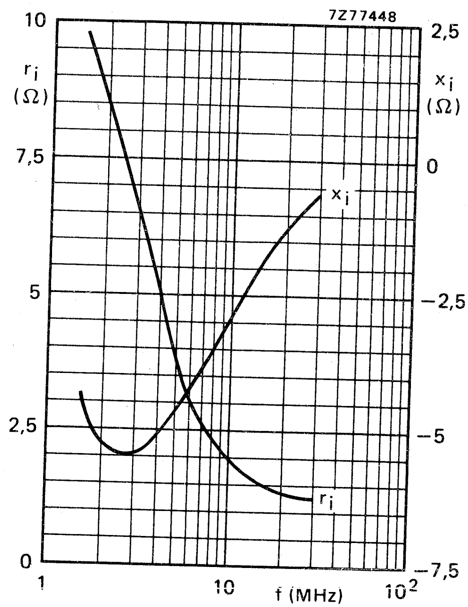


Fig. 12 Input impedance (series components) as a function of frequency.

Figs 11 and 12 are typical curves and hold for an unneutralized amplifier in s.s.b. class-AB operation.
Conditions:
V_{CE} = 28 V; $I_{C(ZS)}$ = 50 mA; P_L = 80 W; T_h = 25 °C; Z_L = 3,9 Ω.

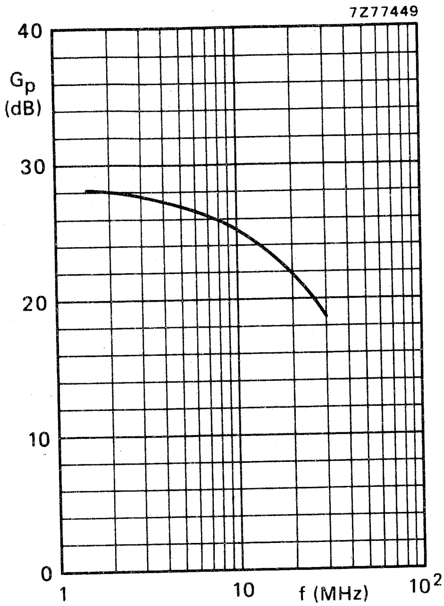


Fig. 13 Power gain as a function of frequency.

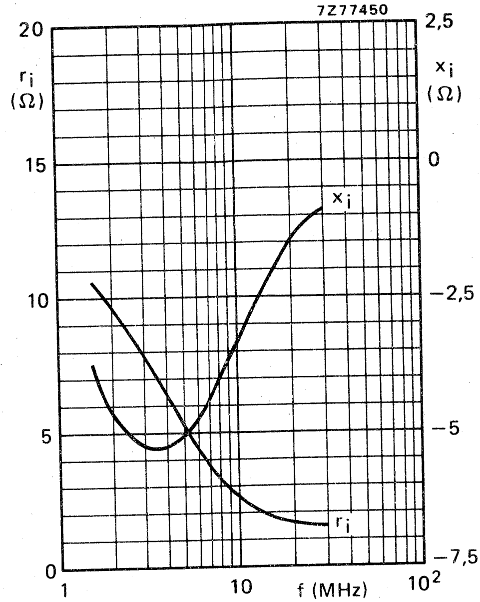


Fig. 14 Input impedance (series components) as a function of frequency.

Figs 13 and 14 are typical curves and hold for a push-pull amplifier with cross-neutralization in s.s.b. class-AB operation.

Conditions:
V_{CE} = 28 V; $I_{C(ZS)}$ = 50 mA; P_L = 80 W; T_h = 25 °C; Z_L = 3,9 Ω; neutralizing capacitor: 68 pF.

APPLICATION INFORMATION (continued)

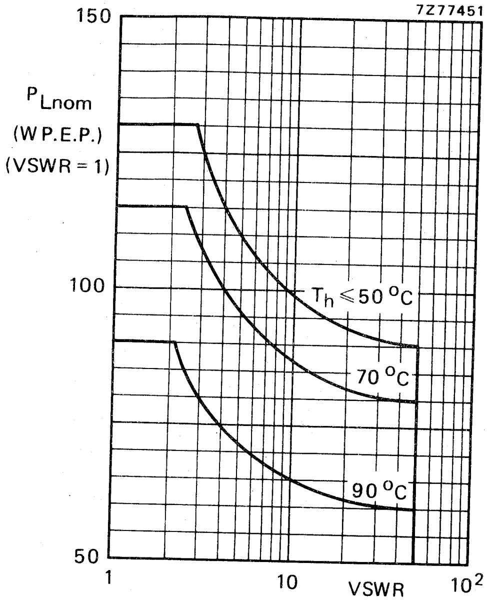


Fig. 15 R.F. SOAR; s.s.b. class-AB operation; f_1 = 28,000 MHz; f_2 = 28,001 MHz; V_{CE} = 28 V; $R_{th\ mb-h}$ = 0,2 K/W.
The graph shows the permissible output power under nominal conditions (VSWR = 1) as a function of the expected VSWR during short-time mismatch conditions with heatsink temperatures as parameter.

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit)
T_h = 25 °C

f (MHz)	V_{CE} (V)	P_L (W)	P_S (W)	G_p (dB)	I_C (A)	η (%)	$\overline{z_i}$ (Ω)	$\overline{Y_L}$ (mA/V)
108	**28**	**80**	typ. **13**	typ. **7,9**	typ. **4,1**	typ. **70**	**0,85 + j1,0**	**174 – j40**

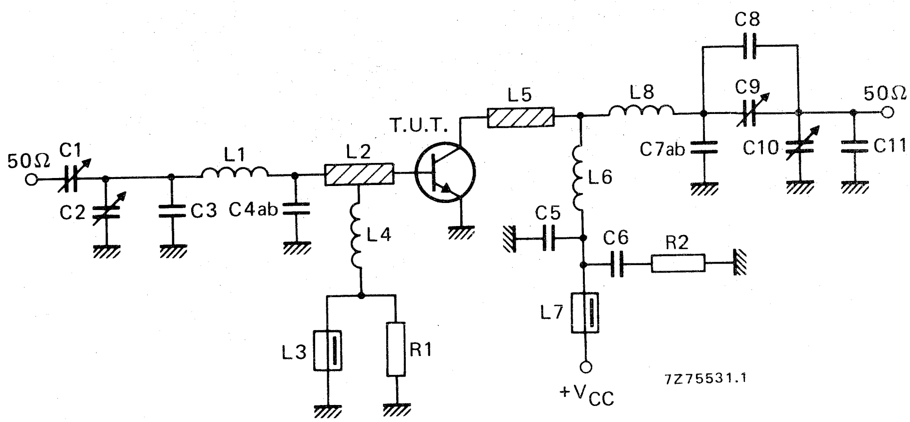


Fig. 16 Test circuit; c.w. class-B.

List of components:

C1 = C9 = C10 = 4 to 40 pF film dielectric trimmer (cat. no. 2222 809 07008)
C2 = 5 to 60 pF film dielectric trimmer (cat. no. 2222 809 07011)
C3 = 22 pF ceramic capacitor (500 V)
C4ab = 2 x 82 pF ceramic capacitors in parallel (500 V)
C5 = 270 pF polystyrene capacitor
C6 = 100 nF polyester capacitor
C7a = 8,2 pF ceramic capacitor (500 V)
C7b = 10 pF ceramic capacitor (500 V)
C 8 = 5,6 pF ceramic capacitor (500 V)
C11 = 10 pF ceramic capacitor (500 V)

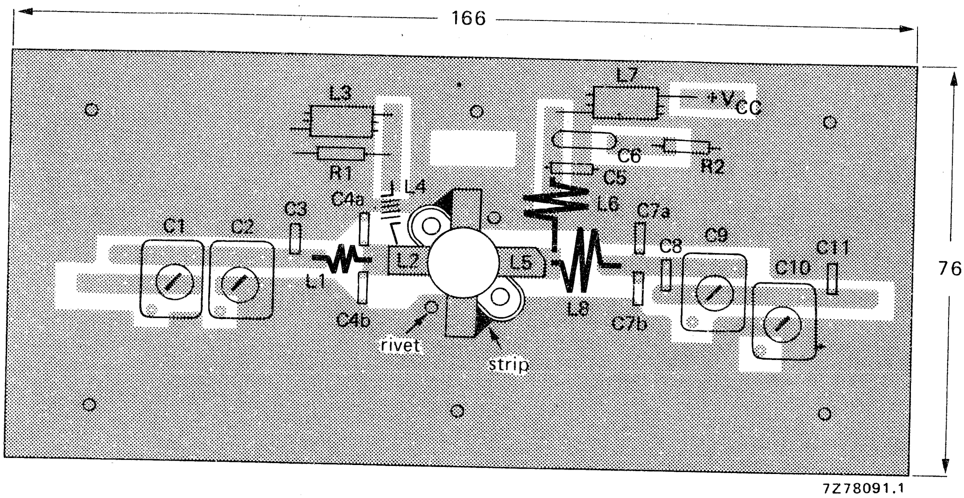
L1 = 21 nH; 2 turns Cu wire (1,0 mm); int. dia. 4,0 mm; length 3,5 mm; leads 2 x 5 mm
L2 = L5 = 2,4 nH; strip (12 mm x 6 mm); tap for L4 at 6 mm from transistor
L3 = L 7 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L4 = 100 nH; 7 turns closely wound enamelled Cu wire (0,5 mm); int. dia. 3 mm; leads 2 x 5 mm
L6 = 49 nH; 2 turns Cu wire (1,6 mm); int. dia. 9,0 mm; length 4,7 mm; leads 2 x 5 mm
L8 = 56 nH; 2 turns Cu wire (1,6 mm); int. dia. 10,0 mm; length 4,5 mm; leads 2 x 5 mm

L2 and L5 are strips on a double Cu-clad printed-circuit board with epoxy fibre-glass dielectric.

R1 = R2 = 10 Ω (± 10%) carbon resistor

Component layout and printed-circuit board for 108 MHz test circuit are shown in Fig. 17.

APPLICATION INFORMATION (continued)



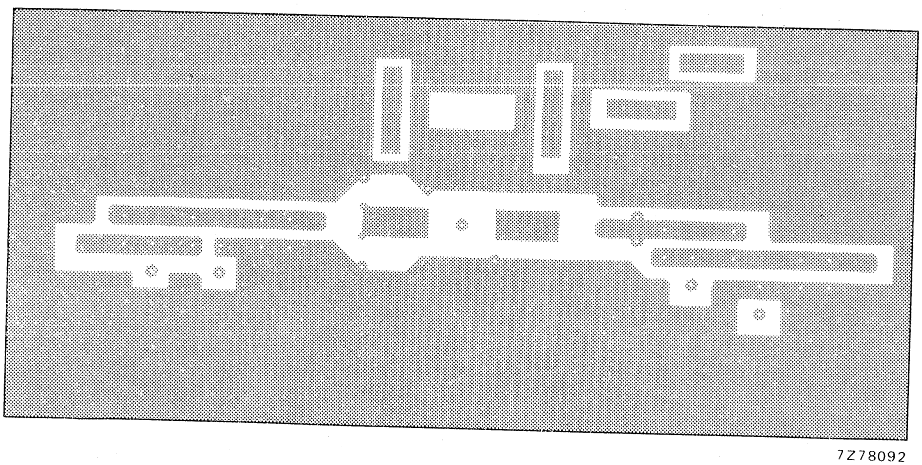


Fig. 17 Component layout and printed-circuit board for 108 MHz test circuit.

The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets, whilst under the emitter leads Cu straps are used for a direct contact between upper and lower sheets.

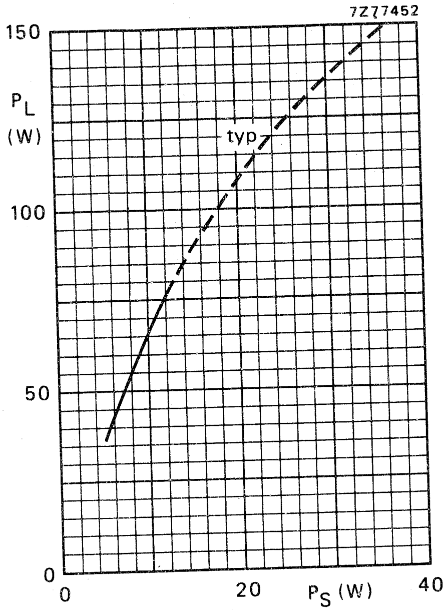


Fig. 18 V_{CE} = 28 V; f = 108 MHz; T_h = 25 °C.

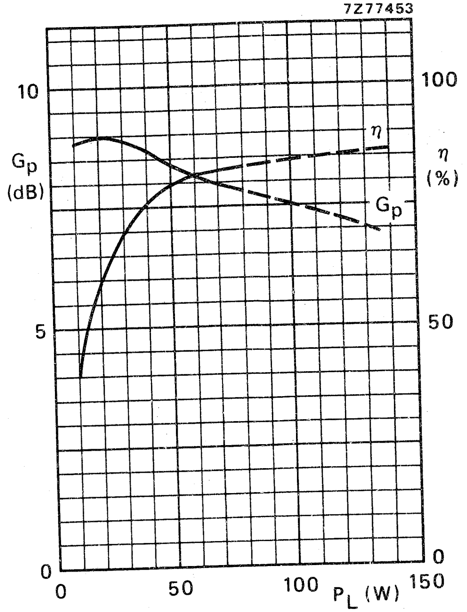


Fig. 19 V_{CE} = 28 V; f = 108 MHz; T_h = 25 °C; typical values.

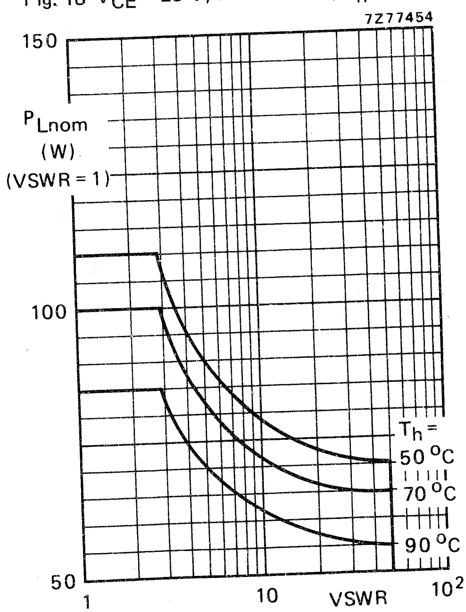


Fig. 20 R.F. SOAR; c.w. class-B operation; f = 108 MHz; V_{CE} = 28 V; $R_{th\ mb\text{-}h}$ = 0,2 K/W. The graph shows the permissible output power under nominal conditions (VSWR = 1) as a function of the expected VSWR during short-time mismatch conditions with heatsink temperatures as parameter.

APPLICATION INFORMATION (continued)

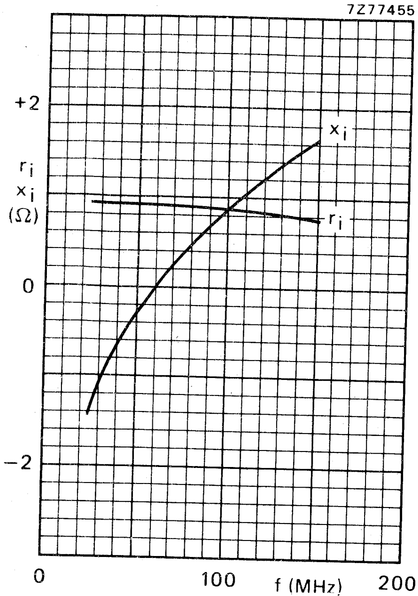


Fig. 21 V_{CE} = 28 V; P_L = 80 W; T_h = 25 °C typical values.

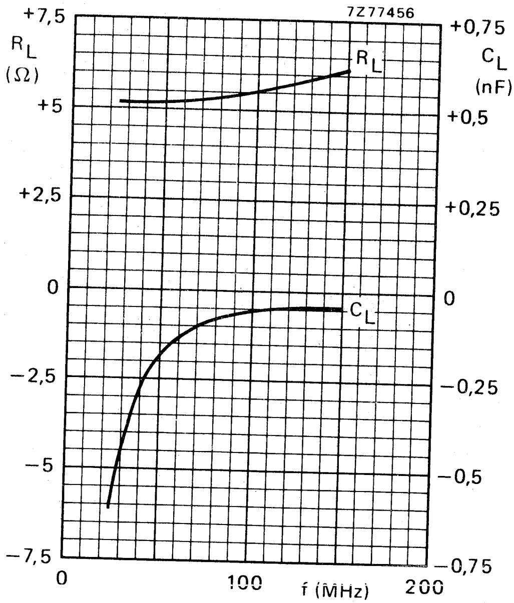


Fig. 22 V_{CE} = 28 V; P_L = 80 W; T_h = 25 °C; typical values.

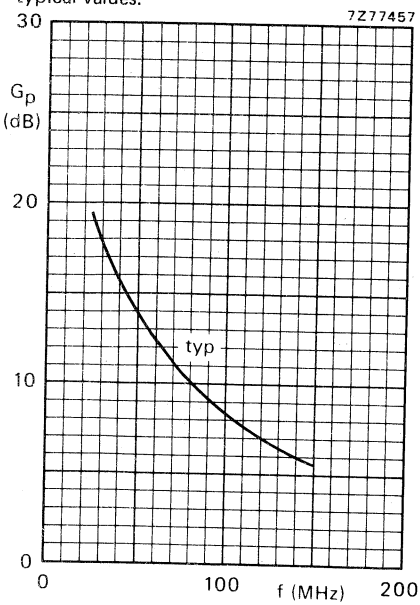


Fig. 23 V_{CE} = 28 V; P_L = 80 W; T_h = 25 °C.

H.F./V.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor intended for use in class-AB or class-B operated high power transmitters in the h.f. and v.h.f. bands. The transistor presents excellent performance as a linear amplifier in the h.f. band. It is resistance stabilized and is guaranteed to withstand severe load mismatch conditions. Transistors are delivered in matched h_{FE} groups.

The transistor has a ½″ flange envelope with a ceramic cap. All leads are isolated from the flange.

QUICK REFERENCE DATA

R.F. performance up to T_h = 25 °C

mode of operation	V_{CE} V	$I_{C(ZS)}$ A	f MHz	P_L W	G_p dB	η %	d_3 dB
s.s.b. (class-AB)	**28**	**0,1**	**1,6–28**	**15–130** (P.E.P.)	**> 12**	**> 37,5***	**< −30**
c.w. (class-B)	28	–	87,5	130	typ. 7,5	typ. 75	–

* At 130 W P.E.P.

MECHANICAL DATA

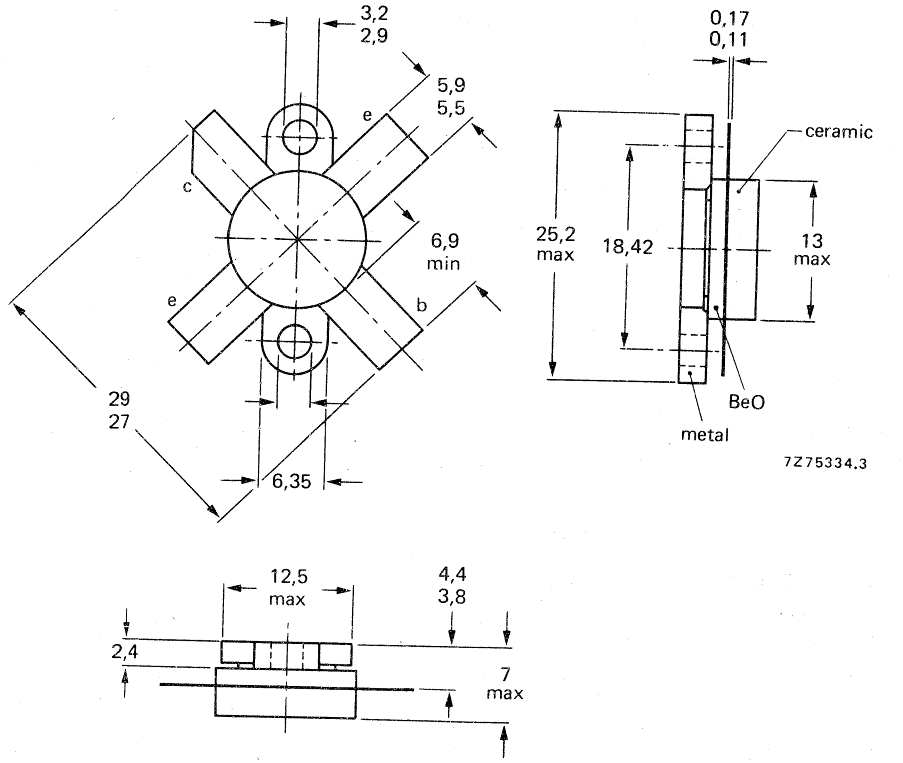
SOT-121 (see Fig. 1).

CAUTION This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-121.



Torque on screw: min. 0,6 Nm (6 kg cm)
max. 0,75 Nm (7,5 kg cm)

Recommended screw: cheese-head 4-40 UNC/2A

Heatsink compound must be applied sparingly and evenly distributed.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage ($V_{BE} = 0$) peak value	V_{CESM}	max.	70 V
Collector-emitter voltage (open base)	V_{CEO}	max.	35 V
Emitter-base voltage (open collector)	V_{EBO}	max.	4 V
Collector current (average)	$I_{C(AV)}$	max.	12 A
Collector current (peak value); f > 1 MHz	I_{CM}	max.	30 A
R.F. power dissipation (f > 1 MHz); $T_{mb} = 25$ °C	P_{rf}	max.	245 W
Storage temperature	T_{stg}		−65 to + 150 °C
Operating junction temperature	T_j	max.	200 °C

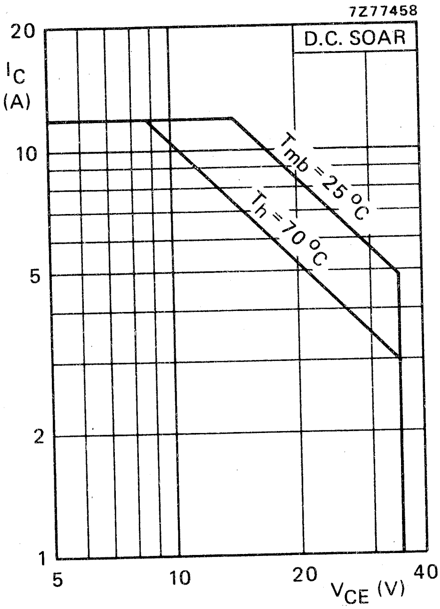


Fig. 2 D.C. SOAR.

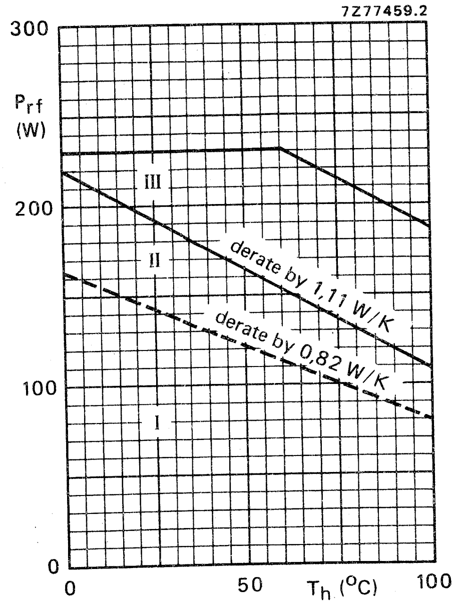


Fig. 3 R.F. power dissipation; $V_{CE} \leq 28$ V; f ≥ 1 MHz.

I Continuous d.c. operation

II Continuous r.f. operation

III Short-time operation during mismatch

THERMAL RESISTANCE (dissipation = 100 W; $T_{mb} = 90$ °C, i.e. $T_h = 70$ °C)

From junction to mounting base (d.c. dissipation)	$R_{th\ j\text{-}mb(dc)}$	=	1,03 K/W*
From junction to mounting base (r.f. dissipation)	$R_{th\ j\text{-}mb(rf)}$	=	0,71 K/W*
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,2 K/W*

* K/W is SI unit for °C/W.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector-emitter breakdown voltage $V_{BE} = 0$; I_C = 50 mA	$V_{(BR)CES}$	>	70 V
Collector-emitter breakdown voltage open base; I_C = 100 mA	$V_{(BR)CEO}$	>	35 V
Emitter-base breakdown voltage open collector; I_E = 20 mA	$V_{(BR)EBO}$	>	4 V
Collector cut-off current $V_{BE} = 0$; V_{CE} = 35 V	I_{CES}	<	20 mA
D.C. current gain* I_C = 7 A; V_{CE} = 5 V	h_{FE}		15 to 80
D.C. current gain ratio of matched devices* I_C = 7 A; V_{CE} = 5 V	h_{FE1}/h_{FE2}	<	1,2
Collector-emitter saturation voltage* I_C = 20 A; I_B = 4 A	V_{CEsat}	typ.	2 V
Transition frequency at f = 100 MHz** $-I_E$ = 7 A; V_{CB} = 28 V	f_T	typ.	320 MHz
$-I_E$ = 20 A; V_{CB} = 28 V	f_T	typ.	300 MHz
Collector capacitance at f = 1 MHz $I_E = I_e = 0$; V_{CB} = 28 V	C_c	typ.	255 pF
Feedback capacitance at f = 1 MHz I_C = 100 mA; V_{CE} = 28 V	C_{re}	typ.	175 pF
Collector-flange capacitance	C_{cf}	typ.	3 pF

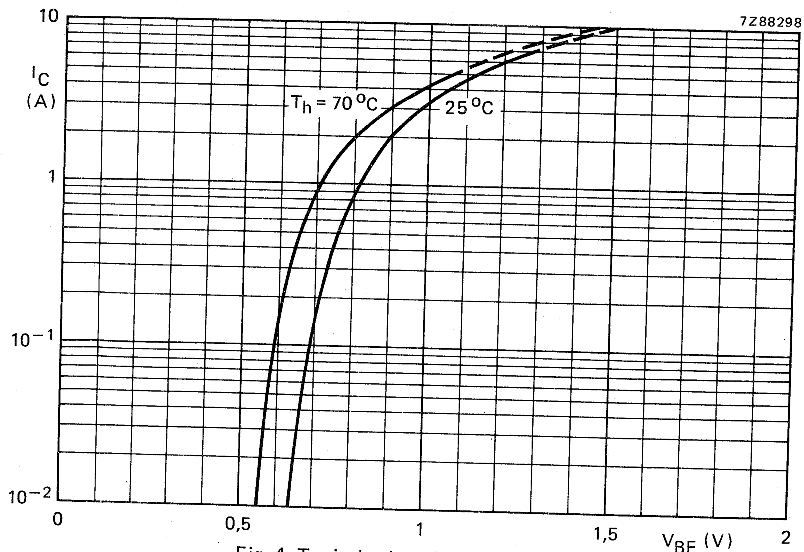


Fig. 4 Typical values; V_{CE} = 20 V.

* Measured under pulse conditions: $t_p \leq 300\ \mu s$; $\delta \leq 0,02$.
** Measured under pulse conditions: $t_p \leq 50\ \mu s$; $\delta \leq 0,01$.

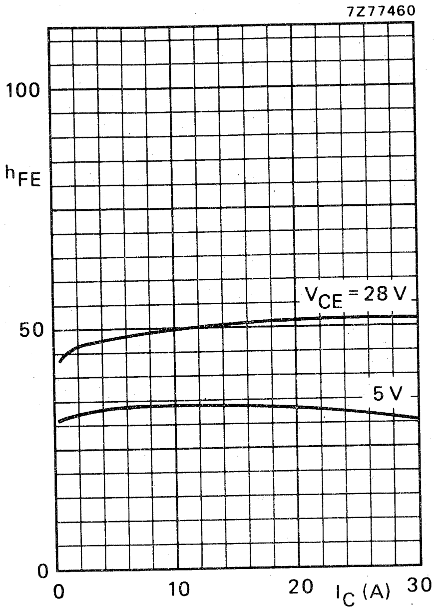


Fig. 5 Typical values; T_j = 25 °C.

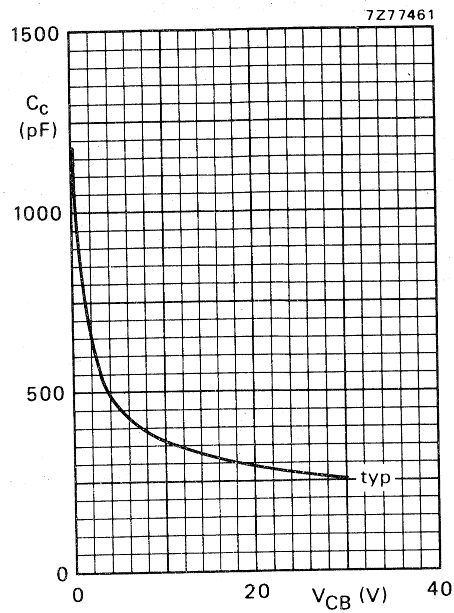


Fig. 6 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

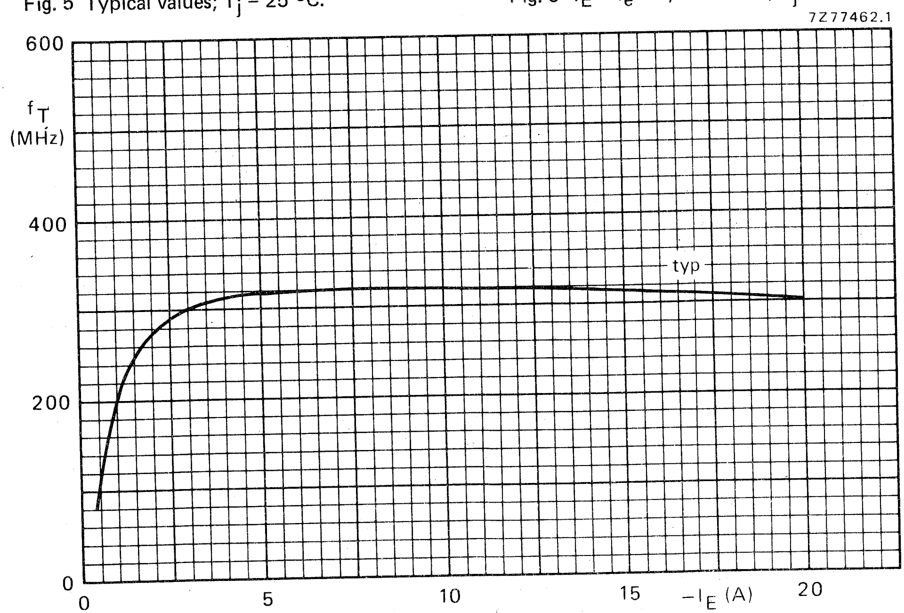


Fig. 7 V_{CB} = 28 V; f = 100 MHz; T_j = 25 °C.

APPLICATION INFORMATION

R.F. performance in s.s.b. class-AB operation (linear power amplifier)

V_{CE} = 28 V; T_h = 25 °C; f_1 = 28,000 MHz; f_2 = 28,001 MHz

output power W	G_p dB	η_{dt} (%) at 130 W P.E.P.	I_C (A) at 130 W P.E.P.	d_3 dB	d_5 dB	$I_{C(ZS)}$ A
15 to 130 (P.E.P.)	**> 12**	**> 37,5**	**< 6,2**	**< −30**	**< −30**	**0,1**

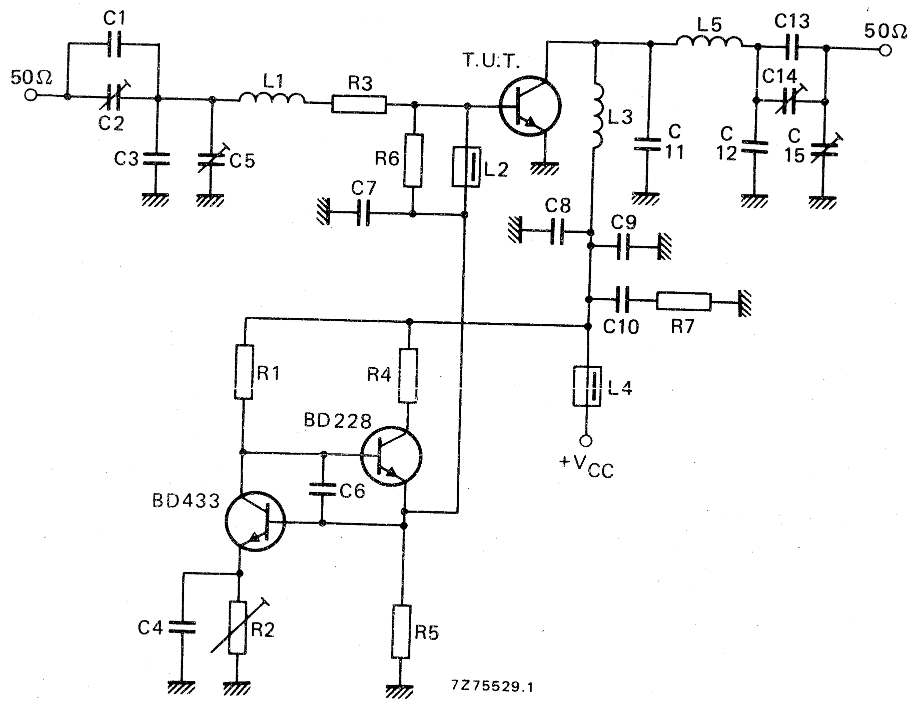


Fig. 8 Test circuit; s.s.b. class-AB.

List of components:

C1 = 27 pF ceramic capacitor (500 V)
C2 = 100 pF air dielectric trimmer (single insulated rotor type)
C3 = 180 pF polystyrene capacitor
C4 = C6 = C9 = 100 nF polyester capacitor
C5 = 100 pF air dielectric trimmer (single non-insulated rotor type)
C7 = C8 = 3,9 nF ceramic capacitor
C10 = 2,2 μF moulded metallized polyester capacitor
C11 = 2 x 180 pF polysterene capacitors in parallel
C12 = 3 x 56 pF and 33 pF ceramic capacitors in parallel (500 V)
C13 = 4 x 56 pF and 68 pF ceramic capacitors in parallel (500 V)

C14 = 360 pF air dielectric trimmer (single insulated rotor type)
C15 = 360 pF air dielectric trimmer (single non-insulated rotor type)

L1 = 88 nH; 3 turns Cu wire (1,0 mm); int. dia. 9,0 mm; length 6,1 mm; leads 2 x 7 mm
L2 = L4 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L3 = L5 = 80 nH; 2,5 turns closely wound enamelled Cu wire (1,6 mm); int. dia. 10,0 mm; leads 2 x 7 mm

R1 = 470 Ω wirewound resistor (5,5 W)
R2 = 4,7 Ω wirewound potentiometer (3 W)
R3 = 0,55 Ω; parallel connection of 4 x 2,2 Ω carbon resistors (± 5%; 0,5 W each)
R4 = 45 Ω; parallel connection of 4 x 180 Ω wirewound resistors (5,5 W each)
R5 = 56 Ω (± 5%) carbon resistor (0,5 W)
R6 = 27 Ω (± 5%) carbon resistor (0,5 W)
R7 = 4,7 Ω (± 5%) carbon resistor (0,5 W)

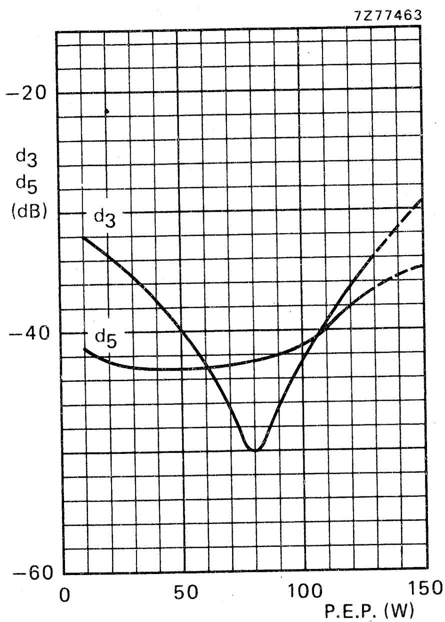


Fig. 9 Intermodulation distortion as a function of output power.*

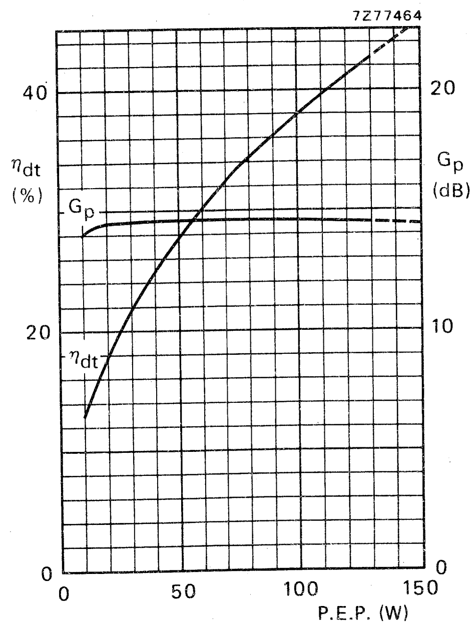


Fig. 10 Double-tone efficiency and power gain as a function of output power.

Conditions for Figs 9 and 10:

V_{CE} = 28 V; $I_{C(ZS)}$ = 100 mA; f_1 = 28,000 MHz; f_2 = 28,001 MHz; T_h = 25 °C; typical values.

* Stated intermodulation distortion figures are referred to the according level of either of the equal amplified tones. Relative to the according peak envelope powers these figures should be increased by 6 dB.

APPLICATION INFORMATION (continued)

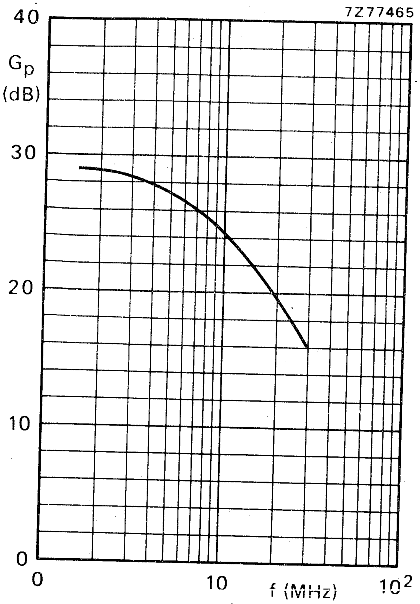


Fig. 11 Power gain as a function of frequency.

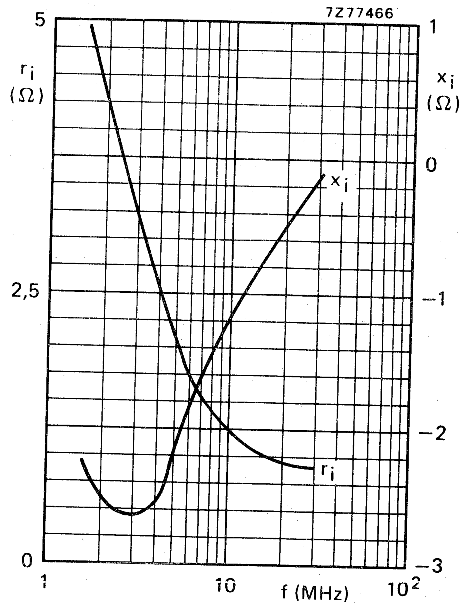


Fig. 12 Input impedance (series components) as a function of frequency.

Figs 11 and 12 are typical curves and hold for an unneutralized amplifier in s.s.b. class-AB operation.
Conditions:
V_{CE} = 28 V; $I_{C(ZS)}$ = 100 mA; P_L = 130 W; T_h = 25 °C; Z_L = 2,5 Ω.

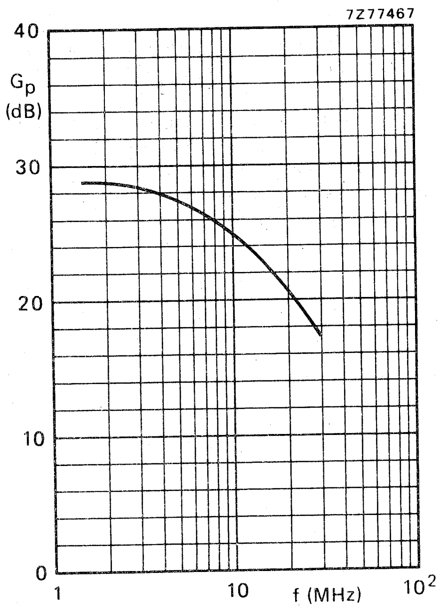


Fig. 13 Power gain as a function of frequency.

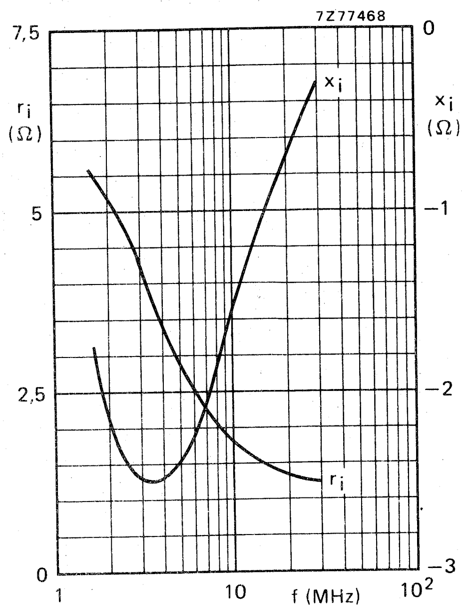


Fig. 14 Input impedance (series components) as a function of frequency.

Figs 13 and 14 are typical curves and hold for a push-pull amplifier with cross-neutralization in s.s.b class-AB operation.

Conditions:
V_{CE} = 28 V; $I_{C(ZS)}$ = 100 mA; P_L = 130 W; T_h = 25 °C; Z_L = 2,5 Ω; neutralizing capacitor: 150 pF.

APPLICATION INFORMATION (continued)

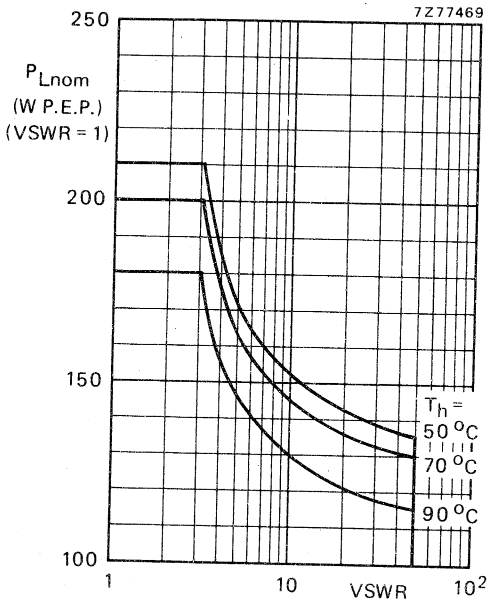


Fig. 15 R.F. SOAR; s.s.b. class-AB operation; f_1 = 28,000 MHz; f_2 = 28,001 MHz; V_{CE} = 28 V; $R_{th\ mb\text{-}h}$ = 0,2 K/W.
The graph shows the permissible output power under nominal conditions (VSWR = 1) as a function of the expected VSWR during short-time mismatch conditions with heatsink temperatures as parameter.

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit)
T_h = 25 °C

f (MHz)	V_{CE} (V)	P_L (W)	P_S (W)	G_p (dB)	I_C (A)	η (%)	$\bar{z_i}$ (Ω)	$\overline{Y_L}$ (mA/V)
87,5	**28**	**130**	typ. **23,2**	typ. **7,5**	typ. **6,2**	typ. **75**	**0,62 + j0,73**	**273 − j42**

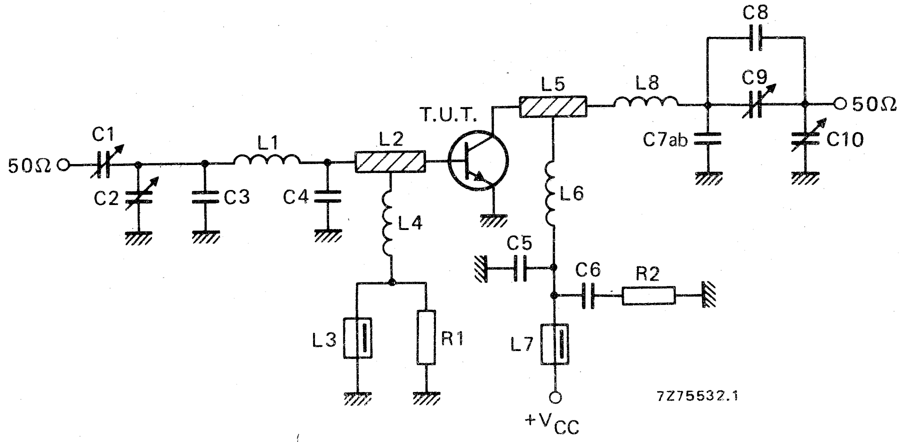


Fig. 16 Test circuit; c.w. class-B.

List of components:

C1 = 4 to 40 pF film dielectric trimmer (cat. no. 2222 809 07008)
C2 = C9 = C10 = 7 to 100 pF film dielectric trimmer (cat. no. 2222 809 07015)
C3 = C8 = 22 pF ceramic capacitor (500 V)
C4 = 4 x 82 pF ceramic capacitors in parallel (500 V)
C5 = 390 pF polystyrene capacitor
C6 = 220 nF polyester capacitor
C7a = 2 x 10 pF ceramic capacitors in parallel (500 V)
C7b = 2 x 8,2 pF ceramic capacitors in parallel (500 V)

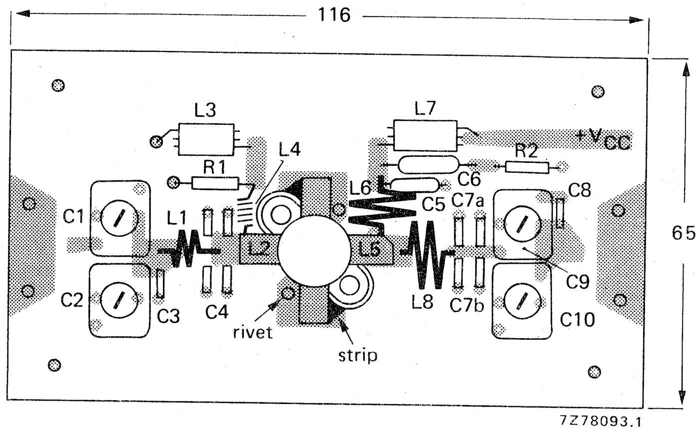
L1 = 25 nH; 2 turns Cu wire (1,6 mm); int. dia. 5,0 mm; length 4,6 mm; leads 2 x 5 mm
L2 = L5 = 2,4 nH; strip (12 mm x 6 mm); tap for L4 and L6 at 5 mm from transistor
L3 = L7 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L4 = 100 nH; 7 turns closely wound enamelled Cu wire (0,5 mm); int. dia. 3 mm; leads 2 x 5 mm
L6 = 46 nH; 2 turns Cu wire (2,0 mm); int. dia. 9,0 mm; length 6,0 mm; leads 2 x 5 mm
L8 = 44 nH; 2 turns Cu wire (2,0 mm); int. dia. 9,0 mm; length 6,7 mm; leads 2 x 5 mm

L2 and L5 are strips on a double Cu-clad printed-circuit board with epoxy fibre-glass dielectric.

R1 = 10 Ω (± 10%) carbon resistor
R2 = 4,7 Ω (± 10%) carbon resistor

Component layout and printed-circuit board for 87,5 MHz test circuit are shown in Fig. 17.

APPLICATION INFORMATION (continued)



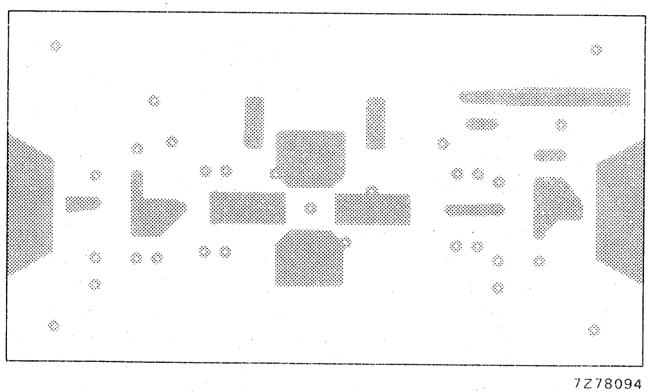


Fig. 17 Component layout and printed-circuit board for 87,5 MHz test circuit.

The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets, whilst under the emitter leads Cu straps are used for a direct contact between upper and lower sheets.

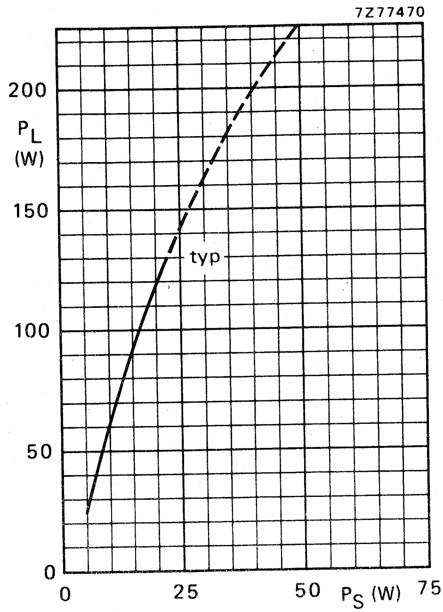


Fig. 18 V_{CE} = 28 V; f = 87,5 MHz; T_h = 25 °C.

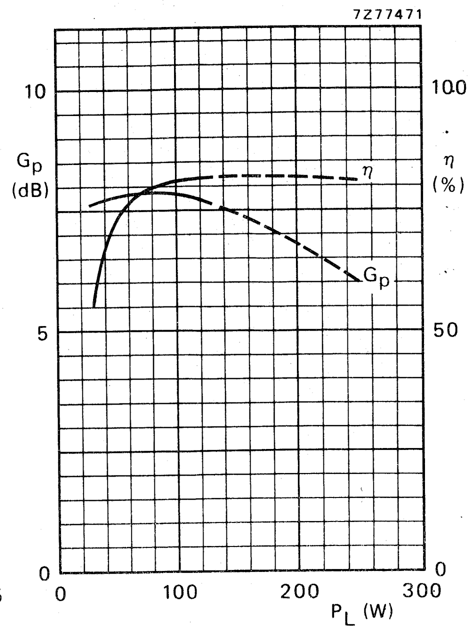


Fig. 19 V_{CE} = 28 V; f = 87,5 MHz; T_h = 25 °C; typical values.

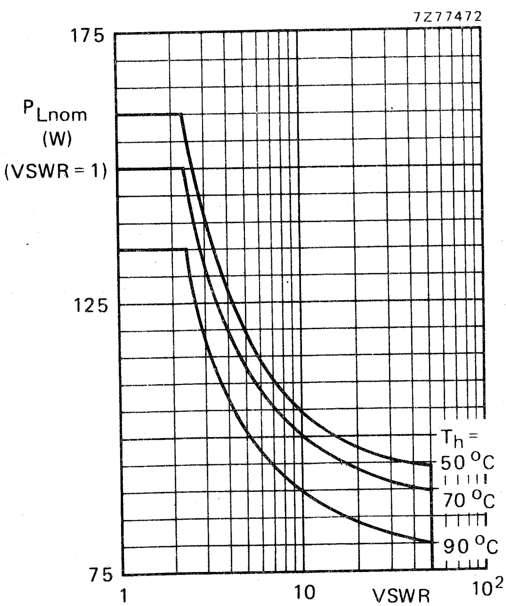


Fig. 20 R.F. SOAR; c.w. class-B operation; f = 87,5 MHz; V_{CE} = 28 V; $R_{th\ mb-h}$ = 0,2 K/W. The graph shows the permissible output power under nominal conditions (VSWR = 1) as a function of the expected VSWR during short-time mismatch conditions with heatsink temperatures as parameter.

APPLICATION INFORMATION (continued)

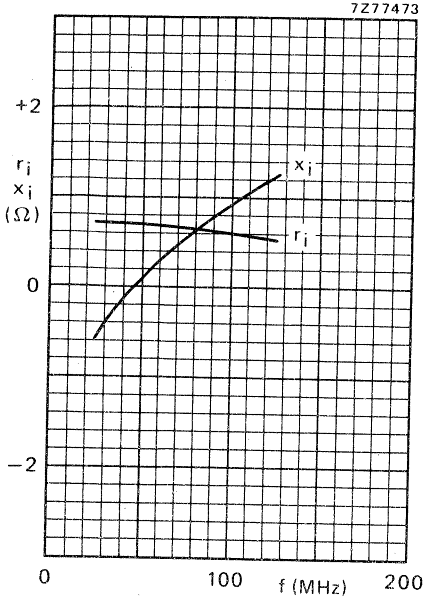


Fig. 21 V_{CE} = 28 V; P_L = 130 W; T_h = 25 °C; typical values.

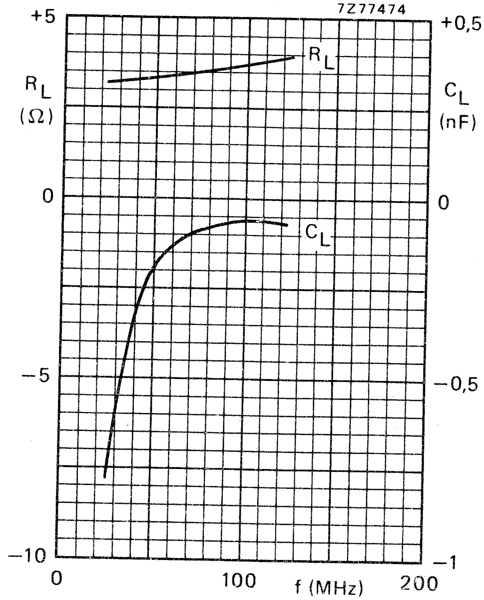


Fig. 22 V_{CE} = 28 V; P_L = 130 W; T_h = 25 °C; typical values.

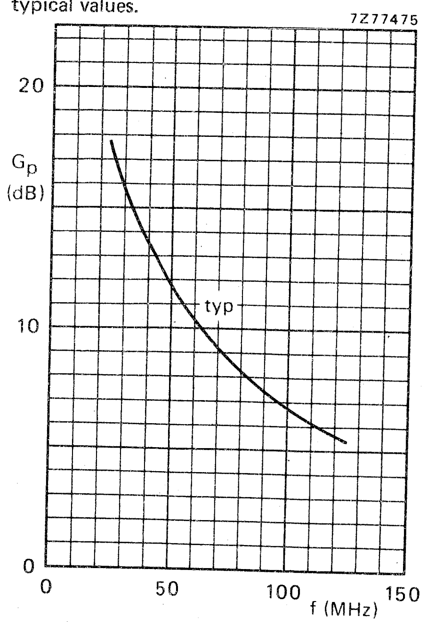


Fig. 23 V_{CE} = 28 V; P_L = 130 W; T_h = 25 °C.

H.F./V.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor intended for use in class-A, AB or B operated mobile, industrial and military transmitters in the h.f. and v.h.f. bands. It is resistance stabilized and is guaranteed to withstand severe load mismatch conditions.

It has a ½" flange envelope with a ceramic cap. All leads are isolated from the flange.

QUICK REFERENCE DATA

R.F. performance up to T_h = 25 °C

mode of operation	V_{CE} V	I_C $I_{C(ZS)}$ A	f MHz	P_L W	G_p dB	η %	d_3* dB
c.w. (class-B)	**28**	–	**150**	**100**	> **6**	> **70**	–
s.s.b. (class-A)	26	3	28	35 (P.E.P.)	typ. 19,5	–	typ. –40
s.s.b. (class-AB)	28	0,05	28	100 (P.E.P.)	typ. 19,0	typ. 42	typ. –30

* Stated intermodulation distortion figures are referred to the according level of either of the equal amplified tones. Relative to the according peak envelope powers these figures should be increased by 6 dB.

MECHANICAL DATA

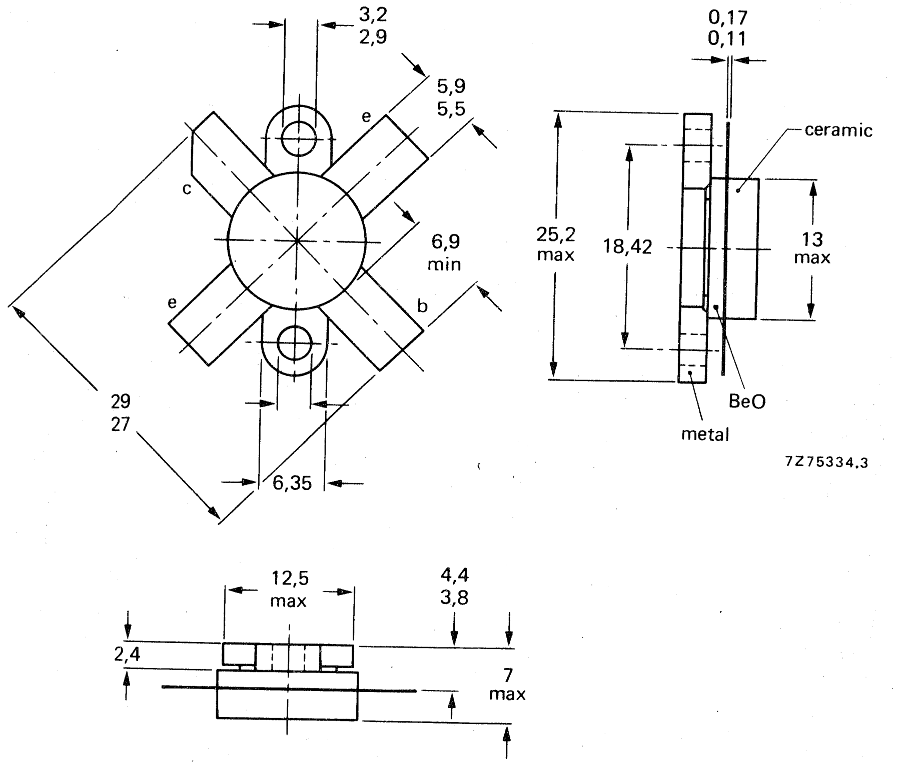
SOT-121 (see Fig. 1).

CAUTION This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-121.



Torque on screw: min. 0,6 Nm (6 kg cm)
max. 0,75 Nm (7,5 kg cm)

Recommended screw: cheese-head 4-40 UNC/2A

Heatsink compound must be applied sparingly and evenly distributed.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage ($V_{BE} = 0$) peak value	V_{CESM}	max.	70	V
Collector-emitter voltage (open base)	V_{CEO}	max.	35	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4	V
Collector current (average)	$I_{C(AV)}$	max.	10	A
Collector current (peak value); f > 1 MHz	I_{CM}	max.	25	A
R.F. power dissipation (f > 1 MHz); T_{mb} = 25 °C	P_{rf}	max.	160	W
Storage temperature	T_{stg}		−65 to +150	°C
Operating junction temperature	T_j	max.	200	°C

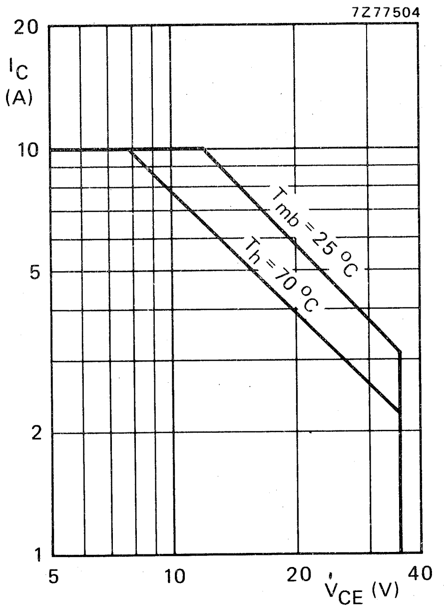


Fig. 2 D.C. SOAR.

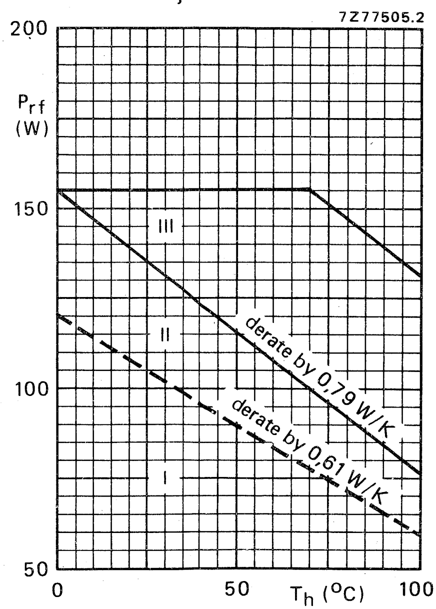


Fig. 3 R.F. power dissipation; $V_{CE} \leq 28$ V; f > 1 MHz.
I Continuous d.c. operation
II Continuous r.f. operation
III Short-time operation during mismatch

THERMAL RESISTANCE (dissipation = 80 W; T_{mb} = 86 °C; i.e. T_h = 70 °C)

From junction to mounting base (d.c. dissipation)	$R_{th\ j\text{-}mb(dc)}$	=	1,45	K/W*
From junction to mounting base (r.f. dissipation)	$R_{th\ j\text{-}mb(rf)}$	=	1,06	K/W*
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,2	K/W*

* K/W is SI unit for °C/W.

CHARACTERISTICS

$T_j = 25\ ^oC$

Collector-emitter breakdown voltage $V_{BE} = 0$; $I_C = 50$ mA	$V_{(BR)CES}$	> 70 V
Collector-emitter breakdown voltage open base; $I_C = 100$ mA	$V_{(BR)CEO}$	> 35 V
Emitter-base breakdown voltage open collector; $I_E = 5$ mA	$V_{(BR)EBO}$	> 4 V
Collector cut-off current $V_{BE} = 0$; $V_{CE} = 35$ V	I_{CES}	< 5 mA
D.C. current gain* $I_C = 5$ A; $V_{CE} = 5$ V	h_{FE}	20 to 85
Collector-emitter saturation voltage $I_C = 15$ A; $I_B = 3$ A	V_{CEsat}	typ. 2 V
Transition frequency at f = 100 MHz** $-I_E = 5$ A; $V_{CB} = 28$ V	f_T	typ. 370 MHz
$-I_E = 15$ A; $V_{CB} = 28$ V	f_T	typ. 350 MHz
Collector capacitance at f = 1 MHz $I_E = I_e = 0$; $V_{CB} = 28$ V	C_c	typ. 155 pF
Feedback capacitance at f = 1 MHz $I_C = 100$ mA; $V_{CE} = 28$ V	C_{re}	typ. 102 pF
Collector-flange capacitance	C_{cf}	typ. 3 pF

* Measured under pulse conditions: $t_p \leqslant 300\ \mu s$; $\delta \leqslant 0,02$.
** Measured under pulse conditions: $t_p \leqslant 50\ \mu s$; $\delta \leqslant 0,01$.

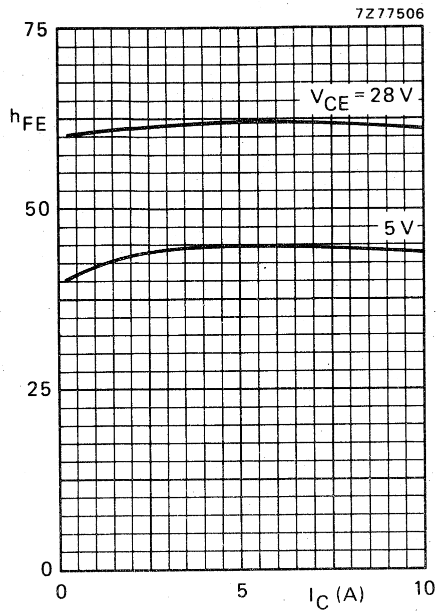


Fig. 4 Typical values; T_j = 25 °C.

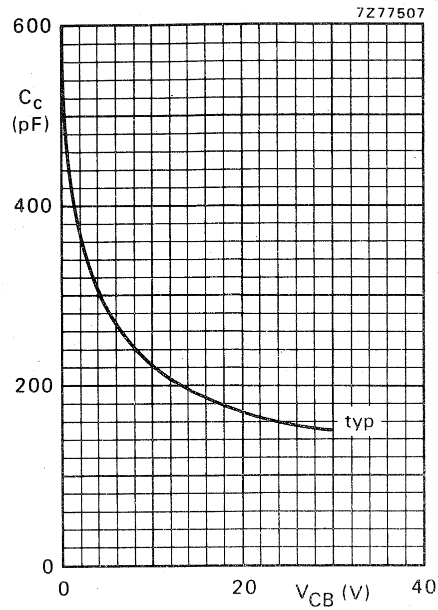


Fig. 5 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

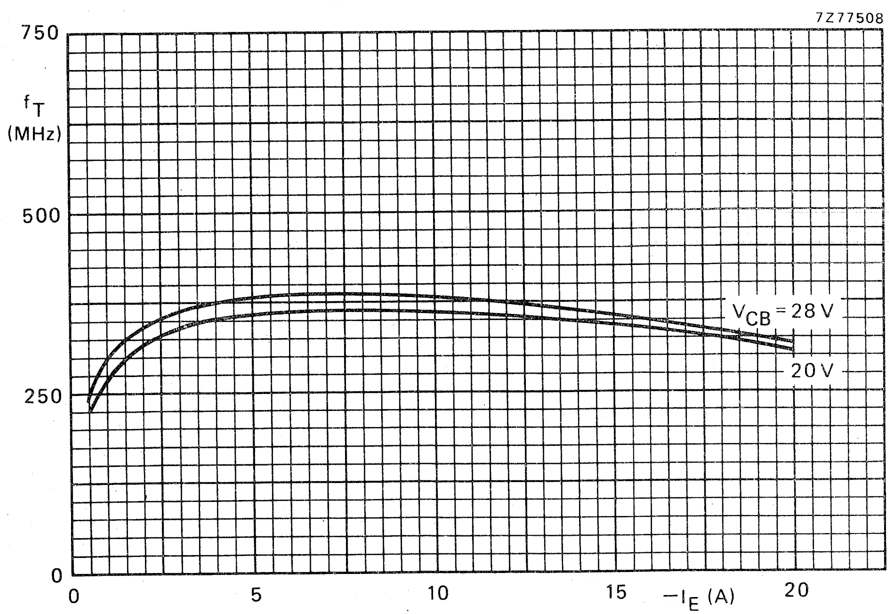


Fig. 6 Typical values; f = 100 MHz; T_j = 25 °C.

APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit); T_h = 25 °C

f (MHz)	V_{CE} (V)	P_L (W)	P_D (W)	η (%)	$\bar{z}_i$ (Ω)	$\bar{Z}_L$ (Ω)
150	**28**	**100**	**≤ 25**	**≥ 70**	**0,74 + j1,35**	**4,30 + j0,60**

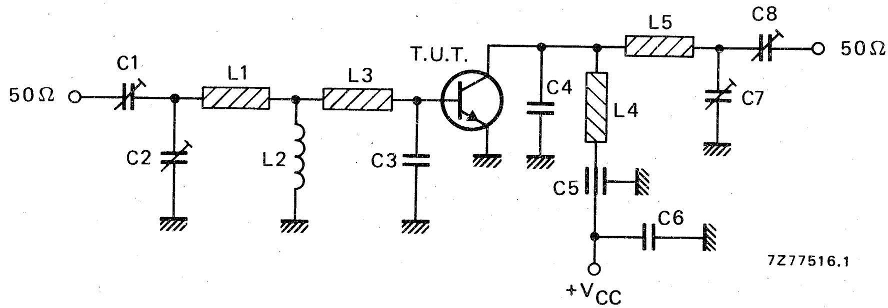


Fig. 7 Test circuit; c.w. class-B; f = 150 MHz.

List of components:

C1 = C2 = C7 = C8 = 5 to 100 pF film dielectric trimmer
C3 = 203 pF; 2 x 82 pF and 39 pF multilayer ceramic chip capacitors (500 V, ATC▲) in parallel
C4 = 39 pF multilayer ceramic chip capacitor (500 V, ATC▲)
C5 = 1 nF feed-through capacitor
C6 = 100 nF polyester capacitor

L1 = strip (30 mm x 8 mm); bent to form inverted 'U' shape with top 15 mm above heatsink, and bottom 5 mm above heatsink
L2 = 1 μH r.f. choke
L3 = strip; shape as shown in Fig. 8; 5 mm above heatsink
L4 = strip (40 mm x 8 mm); bent in form __┌‾‾‾, 25 mm at 15 mm above heatsink, 5 mm at 5 mm above heatsink
L5 = strip (75 mm long; width 8 mm); 5 mm above base

L1, L3, L4, and L5 are copper strips with a thickness of 0,6 mm.

Heatsink: aluminium; 0,9 K/W

At P_L = 100 W and V_{CE} = 28 V, the output power at heatsink temperatures between 25 °C and 90 °C relative to that at 25 °C is diminished by typ. 0,12 W/K.

Component layout on an aluminium heatsink for 150 MHz test circuit is shown in Fig. 8.

▲ ATC means American Technical Ceramics.

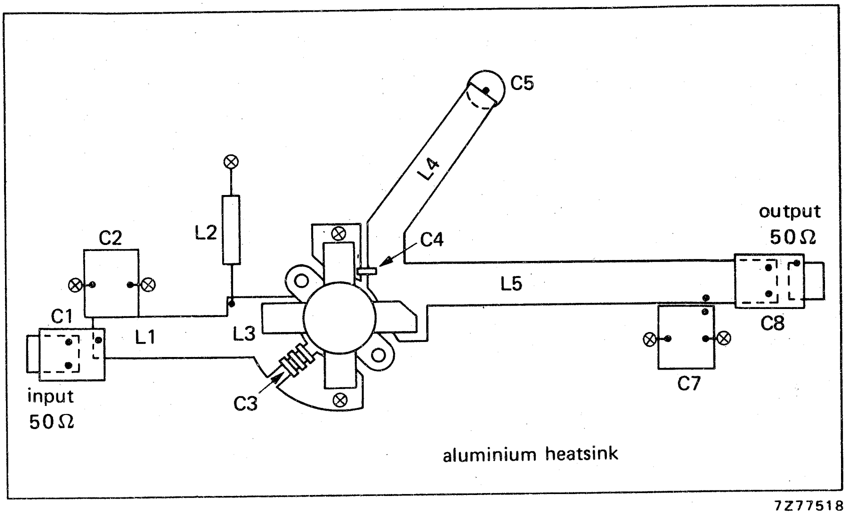


Fig. 8 Component layout on an aluminium heatsink for 150 MHz test circuit. ⊗ Earthing bolts.

APPLICATION INFORMATION (continued)

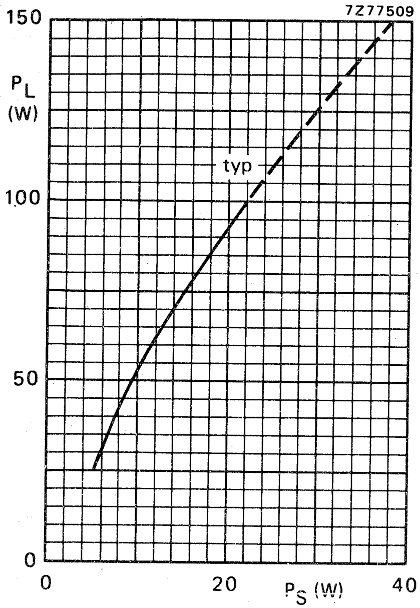


Fig. 9 V_{CE} = 28 V; f = 150 MHz; T_h = 25 °C.

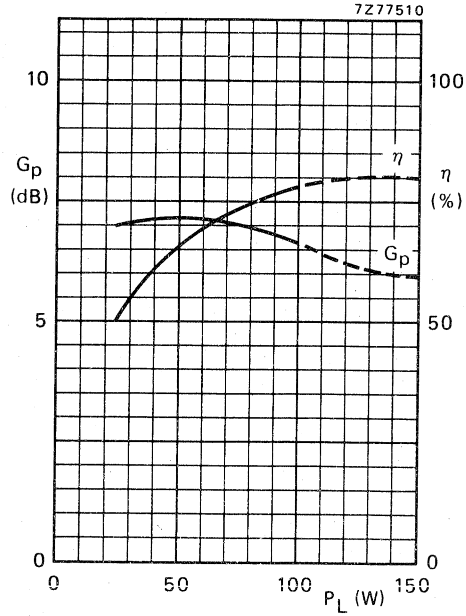


Fig. 10 V_{CE} = 28 V; f = 150 MHz; T_h = 25 °C; typical values.

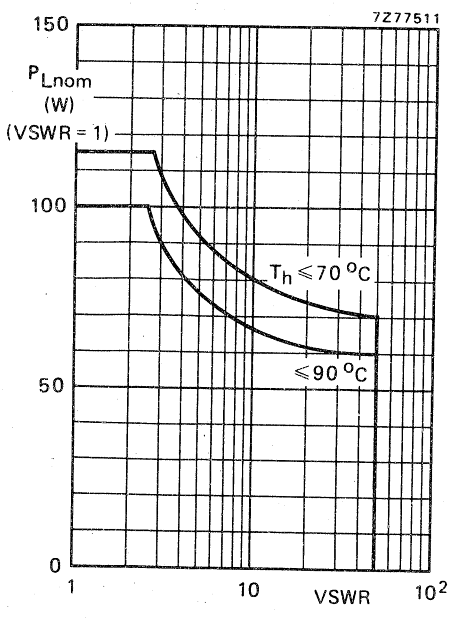


Fig. 11 R.F. SOAR; c.w. class-B operation; f = 150 MHz; V_{CE} = 28 V; $R_{th\ mb\text{-}h}$ = 0,2 K/W. The graph shows the permissible output power under nominal conditions (VSWR = 1) as a function of the expected VSWR during short-time mismatch conditions with heatsink temperatures as parameter.

OPERATING NOTE Below 50 MHz a base-emitter resistor of 4,7 Ω is recommended to avoid oscillation. This resistor must be effective for r.f. only.

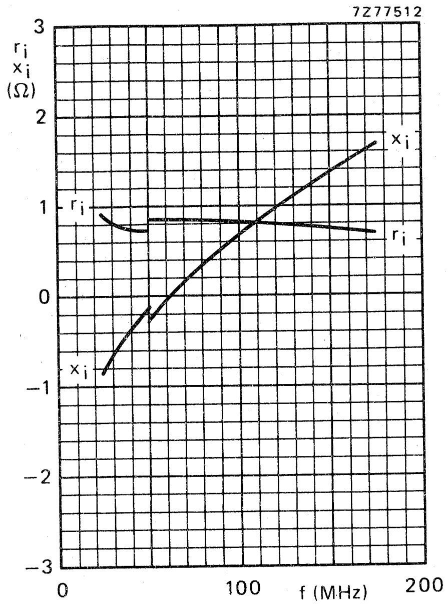


Fig. 12 Input impedance (series components).

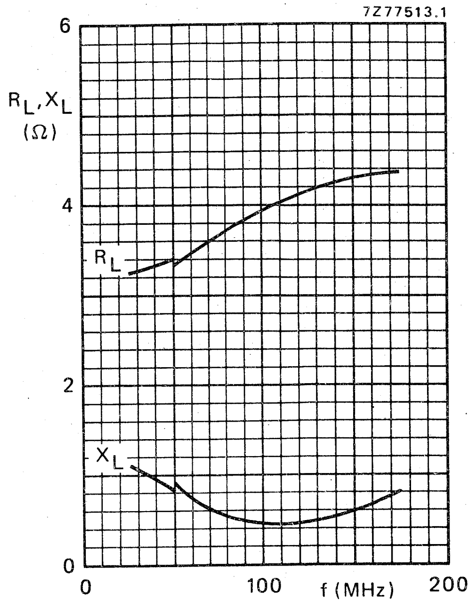


Fig. 13 Load impedance (series components).

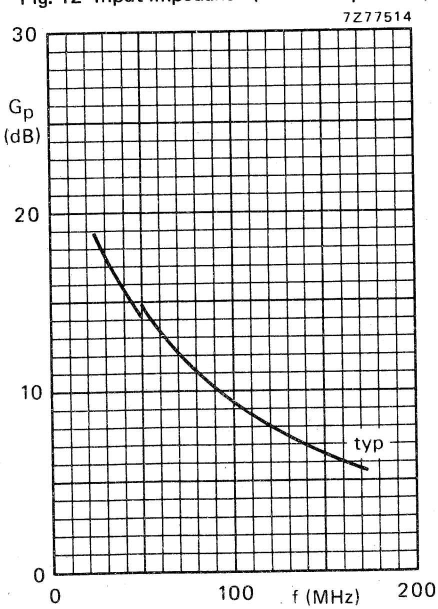


Fig. 14.

Conditions for Figs 12, 13 and 14:
V_{CE} = 28 V; P_L = 100 W; T_h = 25 °C;
typical values; class-B operation.

APPLICATION INFORMATION (continued)

R.F. performance in s.s.b. class-A operation

V_{CE} = 26 V; T_h = 40 °C; f_1 = 28,000 MHz; f_2 = 28,001 MHz

output power W	G_p dB	I_C A	d_3 dB
35 (P.E.P.)	typ. 19,5	3	typ. –40

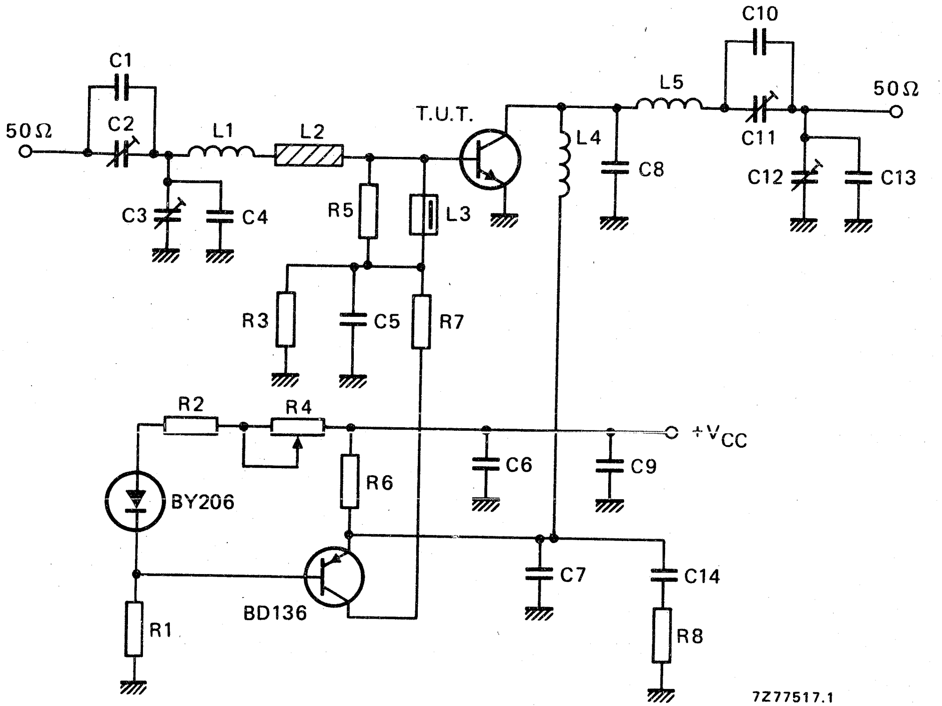


Fig. 15 Test circuit; s.s.b. class-A; f = 28 MHz.

List of components:

C1 = 33 pF ceramic capacitor (500 V)
C2 = 100 pF air dielectric trimmer (single insulated rotor type)
C3 = 280 pF air dielectric trimmer (single non-insulated rotor type)
C4 = 180 pF polystyrene capacitor
C5 = C6 = C7 = 3,9 nF ceramic capacitor
C8 = 2 x 33 pF ceramic capacitors in parallel (500 V)
C9 = 330 nF polyester capacitor
C10 = 82 pF ceramic capacitor (500 V)
C11 = 100 pF air dielectric trimmer (single insulated rotor type)
C12 = 180 pF air dielectric trimmer (single non-insulated rotor type)
C13 = 150 pF polystyrene capacitor
C14 = 390 nF polyester capacitor

List of components in Fig. 15 (continued):

L1 = 72 nH; 3 turns Cu wire (1,0 mm); int. dia. 7 mm; length 4,8 mm; leads 2 x 5 mm
L2 = Cu strip (28 mm x 5 mm x 0,2 mm); 18 mm at 3 mm above printed-circuit board
L3 = Ferroxcube choke coil (cat. no. 4312 020 36640)
L4 = 300 nH; 6 turns Cu wire (1,5 mm); int. dia. 12 mm; length 16 mm; leads 2 x 5 mm
L5 = 330 nH; 7 turns Cu wire (1,5 mm); int. dia. 12 mm; length 20,8 mm; leads 2 x 5 mm

R1 = 1,5 kΩ (± 5%) carbon resistor (0,5 W)
R2 = 100 Ω (± 5%) carbon resistor (0,5 W)
R3 = 68 Ω (± 5%) carbon resistor (0,5 W)
R4 = 100 Ω wirewound potentiometer
R5 = 33 Ω (± 5%) carbon resistor (0,5 W)
R6 = 0,68 Ω (± 10%) wirewound resistor (7 W)
R7 = 120 Ω wirewound resistor (8 W)
R8 = 10 Ω (± 10%) carbon resistor (0,5 W)

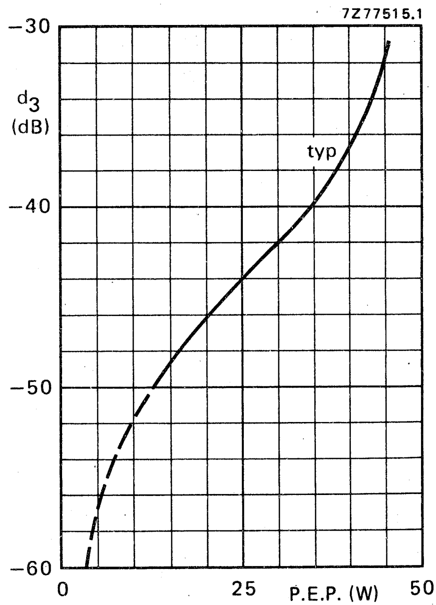


Fig. 16 Intermodulation distortion as a function of output power; V_{CE} = 26 V; I_C = 3 A; f_1 = 28,000 MHz; f_2 = 28,001 MHz; T_h = 40 °C.

APPLICATION INFORMATION (continued)

→ R.F. performance in s.s.b. class-AB operation (linear power amplifier)

V_{CE} = 28 V; T_h = 25 °C; f_1 = 28,000 MHz; f_2 = 28,001 MHz

output power W	G_p dB	η_{dt} %	I_C A	d_3* dB	d_5* dB	$I_{C(ZS)}$ mA
100 (P.E.P.)	typ. 19	typ. 42	typ. 4,3	typ. −30	typ. −37	50

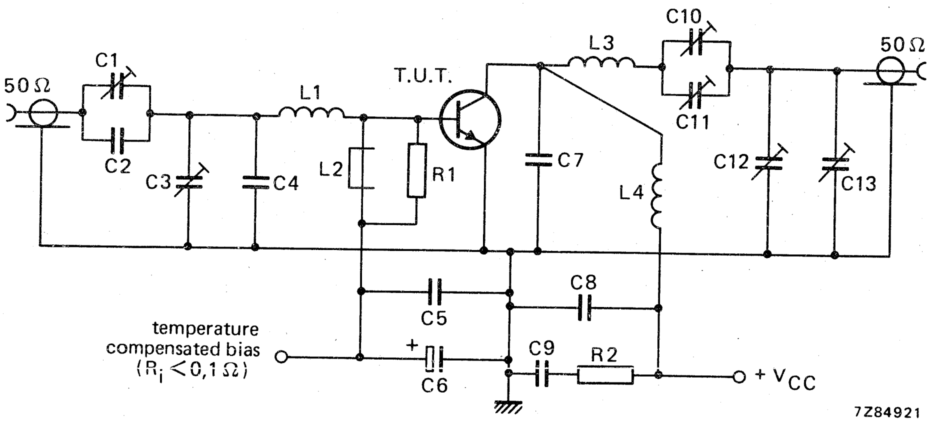


Fig. 17 Test circuit; s.s.b. class-AB; f = 28 MHz.

List of components:

C1 = C11 = 150 pF air dielectric trimmer (single insulated rotor type)
C2 = 27 pF ceramic capacitor (500 V)
C3 = C12 = 150 pF air dielectric trimmer (single non-insulated rotor type)
C4 = 180 pF ceramic capacitor (500 V)
C5 = C8 = 3,9 nF ceramic capacitor
C6 = 150 μF/6 V solid tantalum capacitor
C7 = 150 pF ceramic capacitor (500 V)
C9 = 100 nF polyester capacitor
C10 = 750 pF mica dielectric trimmer (single insultated rotor type)
C13 = 750 pF mica dielectric trimmer (single non-insulated rotor type)

L1 = 3 turns enamelled Cu wire (1,0 mm); int. dia. 12 mm; length 12 mm
L2 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L3 = 3 turns enamelled Cu wire (2,0 mm); int. dia. 12 mm; length 12 mm
L4 = 2 turns enamelled Cu wire (2,0 mm); int. dia. 12 mm; length 8 mm

R1 = 27 Ω (± 10%) carbon resistor (0,5 W)
R2 = 4,7 Ω (± 10%) carbon resistor (0,5 W)

* Stated intermodulation distortion figures are referred to the according level of either of the equal amplified tones. Relative to the according peak envelope powers these figures should be increased by 6 dB.

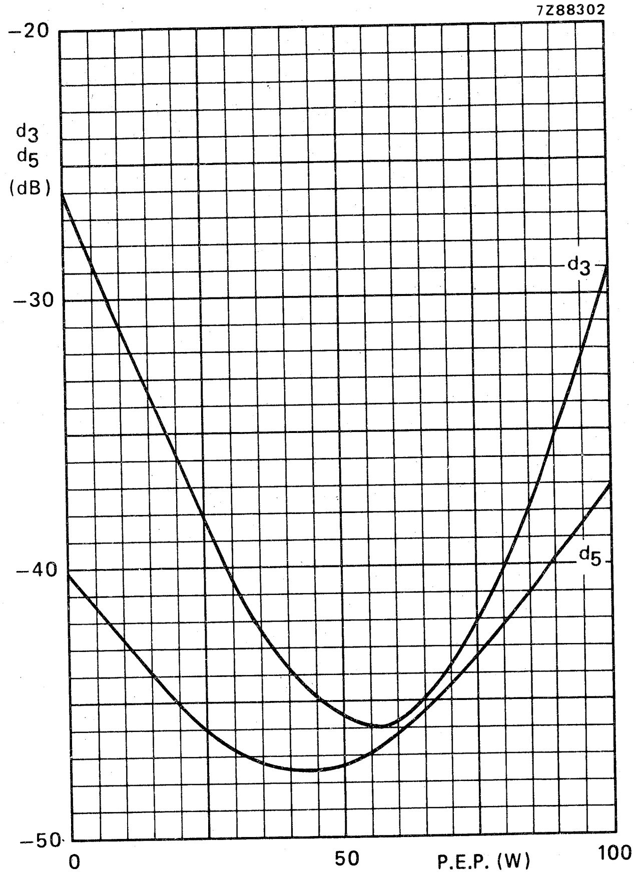


Fig. 18 Intermodulation distortion* as a function of output power.
Typical values; V_{CE} = 28 V; $I_{C(ZS)}$ = 50 mA; f_1 = 28,000 MHz; f_2 = 28,001 MHz; T_h = 25 °C.

* See note on page 12.

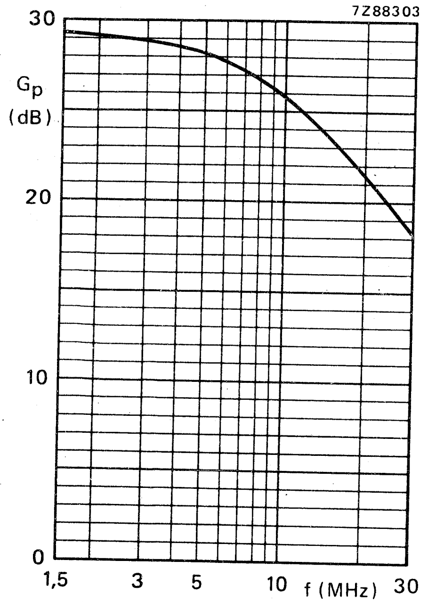


Fig. 19 Power gain as a function of frequency.

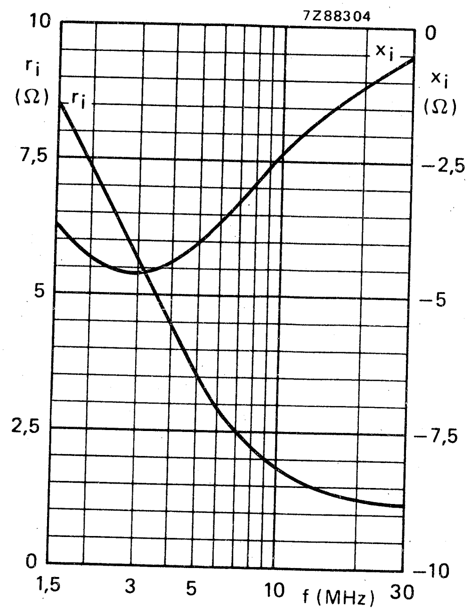


Fig. 20 Input impedance (series components).

Figs 19 and 20 are typical curves and hold for an unneutralized amplifier in s.s.b. class-AB operation.
Conditions:
V_{CE} = 28 V; $I_{C(ZS)}$ = 50 mA; P_L = 100 W (P.E.P.); T_h = 25 °C; Z_L = 2,7 Ω.

U.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor intended for transmitting applications in class-A, B or C in the u.h.f. and v.h.f. range for nominal supply voltages up to 13,5 V. The resistance stabilization of the transistor provides protection against device damage at severe load mismatch conditions.
The transistor is housed in a ¼" capstan envelope with a ceramic cap.

QUICK REFERENCE DATA

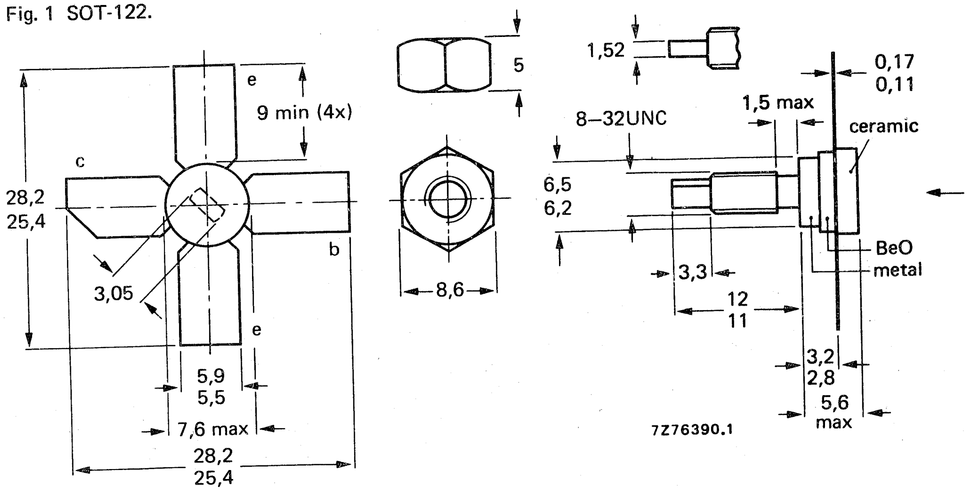
R.F. performance up to T_h = 25 °C in an unneutralized common-emitter class-B circuit

mode of operation	V_{CC} V	f MHz	P_L W	G_p dB	η %	$\overline{z_i}$ Ω	$\overline{Y_L}$ mA/V
c.w.	**12,5**	**470**	**2**	**> 9,0**	**> 60**	**3,5 + j0,4**	**28 − j38**
c.w.	12,5	175	2	typ. 13,5	typ. 60	4,2 − j3,4	25 − j24

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-122.



Torque on nut: min. 0,75 Nm
(7,5 kg cm)
max. 0,85 Nm
(8,5 kg cm)

Diameter of clearance hole in heatsink: max. 4,2 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

When locking is required an adhesive is preferred instead of a lock washer.

CAUTION This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC134)

Voltages

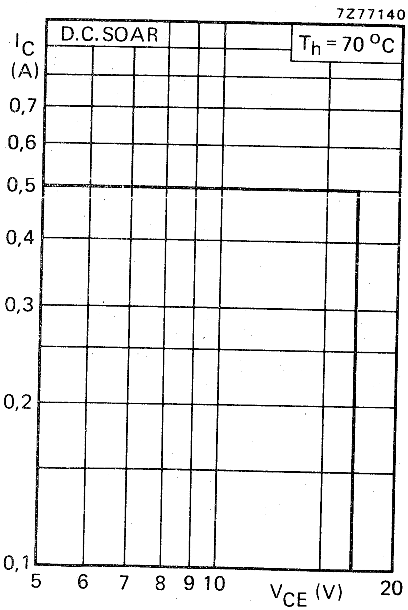
Collector-emitter voltage (V_{BE} = 0) peak value	V_{CESM}	max	36 V
Collector-emitter voltage (open base)	V_{CEO}	max	17 V
Emitter-base voltage (open collector)	V_{EBO}	max	4 V

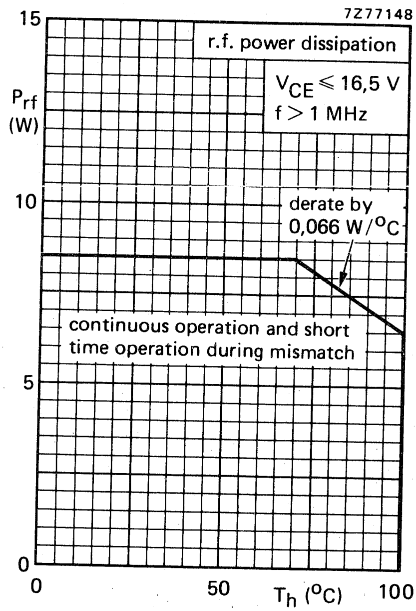
Currents

Collector current (d.c.)	I_C	max	0,5 A
Collector current (peak value); f > 1 MHz	I_{CM}	max	1,5 A

Power dissipation

Total power dissipation (d.c. and r.f.) up to T_h = 70 °C	P_{tot}	max	8,5 W





Temperatures

Storage temperature	T_{stg}	−65 to +150	°C
Operating junction temperature	T_j	max 200	°C

THERMAL RESISTANCE

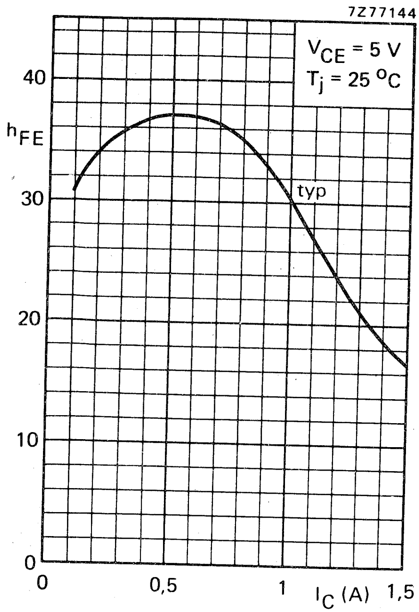
From junction to mounting base	$R_{th\ j\text{-}mb}$	=	14,5 °C/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,6 °C/W

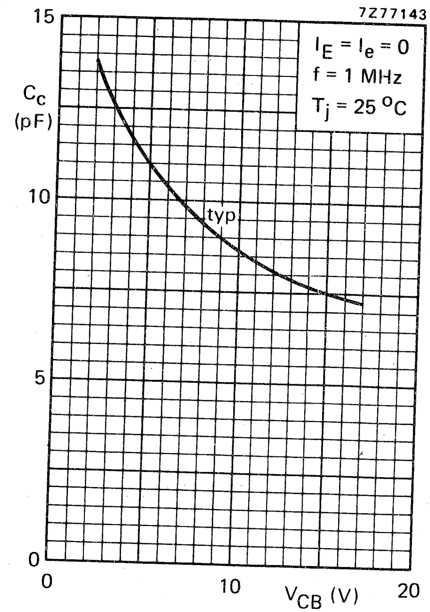
CHARACTERISTICS

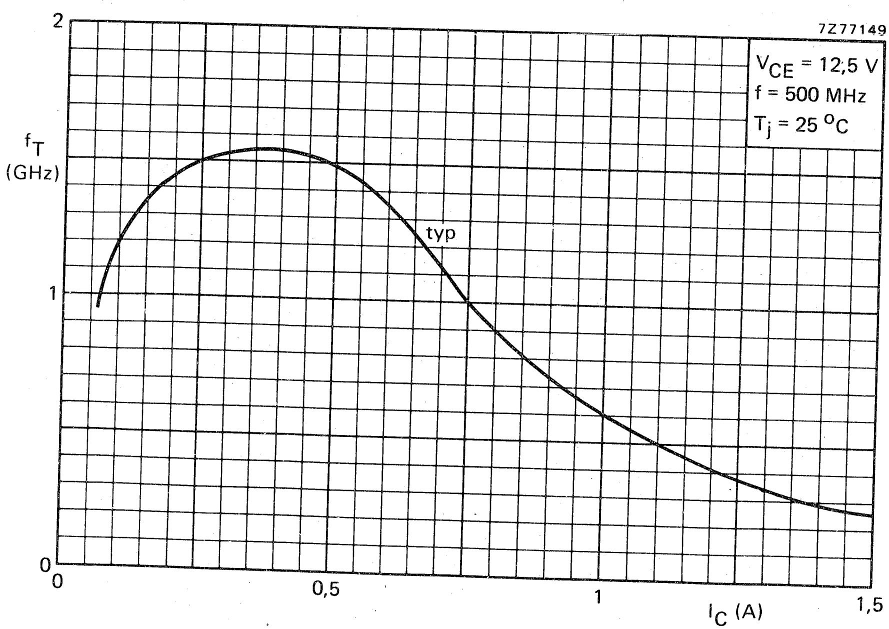
$T_j = 25\ ^oC$

Breakdown voltages			
Collector-emitter voltage $V_{BE} = 0$; $I_C = 5$ mA	$V_{(BR)CES}$	>	36 V
Collector-emitter voltage open base; $I_C = 25$ mA	$V_{(BR)CEO}$	>	17 V
Emitter-base voltage open collector; $I_E = 2$ mA	$V_{(BR)EBO}$	>	4 V
Collector cut-off current $V_{BE} = 0$; $V_{CE} = 17$ V	I_{CES}	<	2 mA
D.C. current gain * $I_C = 250$ mA; $V_{CE} = 5$ V	h_{FE}	> typ	10 35
Collector-emitter saturation voltage * $I_C = 750$ mA; $I_B = 150$ mA	V_{CEsat}	typ	0,6 V
Transition frequency at f = 500 MHz *			
$I_C = 250$ mA; $V_{CE} = 12,5$ V	f_T	typ	1,5 GHz
$I_C = 750$ mA; $V_{CE} = 12,5$ V	f_T	typ	1,0 GHz
Collector capacitance at f = 1 MHz $I_E = I_e = 0$; $V_{CB} = 12,5$ V	C_c	typ	8 pF
Feedback capacitance at f = 1 MHz $I_C = 20$ mA; $V_{CE} = 12,5$ V	C_{re}	typ	3,6 pF
Collector-stud capacitance	C_{cs}	typ	2 pF

* Measured under pulse conditions: $t_p \leqslant 200\ \mu s$; $\delta \leqslant 0,02$.


7Z77144
VCE = 5 V
Tj = 25 °C
hFE
typ
40
30
20
10
0
0
0,5
1
IC (A)
1,5


7Z77143
IE = Ie = 0
f = 1 MHz
Tj = 25 °C
Cc
(pF)
typ
15
10
5
0
0
10
VCB (V)
20


7Z77149
VCE = 12,5 V
f = 500 MHz
Tj = 25 °C
fT
(GHz)
typ
2
1
0
0
0,5
1
IC (A)
1,5

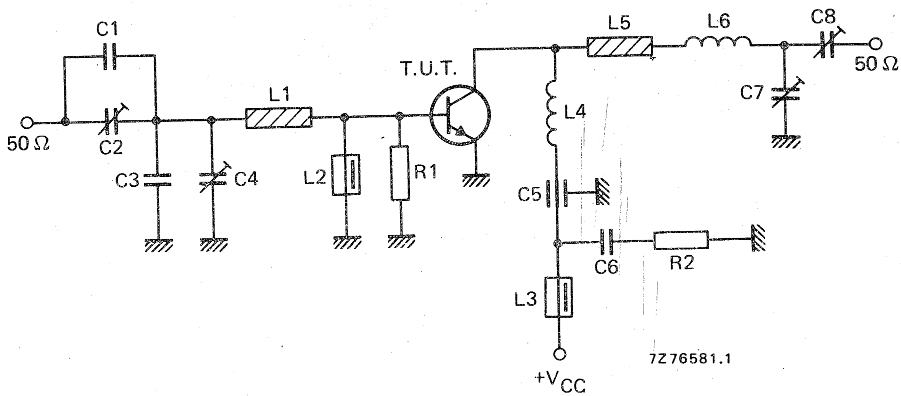
APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit)

T_h = 25 °C

f (MHz)	V_{CE} (V)	P_L (W)	P_S (W)	G_p (dB)	I_C (A)	η (%)	$\overline{z_i}$ (Ω)	$\overline{Y_L}$ (mA/V)
470	**12,5**	**2**	**< 0,25**	**> 9,0**	**< 0,27**	**> 60**	**3,5 + j0,4**	**28 – j38**
470	13,5	2	–	typ 10,5	–	typ 70	–	–
175	12,5	2	–	typ 13,5	–	typ 60	4,2 – j3,4	25 – j24

Test circuit for 470 MHz



List of components:

C1 = 2,2 pF (± 0,25 pF) ceramic capacitor
C2 = C4 = C7 = 1,4 to 5,5 pF film dielectric trimmer (cat. no. 2222 809 09001)
C3 = 3,3 pF (± 0,25 pF) ceramic capacitor
C5 = 100 pF ceramic feed-through capacitor
C6 = 100 nF polyester capacitor
C8 = 2 to 18 pF film dielectric trimmer (cat. no. 2222 809 09003)

L1 = stripline (35,6 mm x 6,0 mm)
L2 = L3 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L4 = 178 nH; 4 turns Cu wire (1 mm); int. dia. 6 mm; length 7 mm; leads 2 x 5 mm
L5 = stripline (10,0 mm x 6,0 mm)
L6 = 28 nH; ½ turn Cu wire (1 mm); int. dia. 10 mm

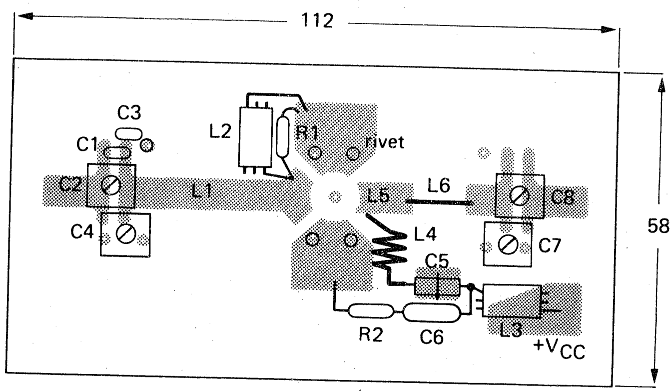
L1 and L5 are striplines on a double Cu-clad printed-circuit board with PTFE fibre-glass dielectric (ϵ_r = 2,74); thickness 1/16″.

R1 = 100 Ω (± 5%) carbon resistor
R2 = 10 Ω (± 5%) carbon resistor

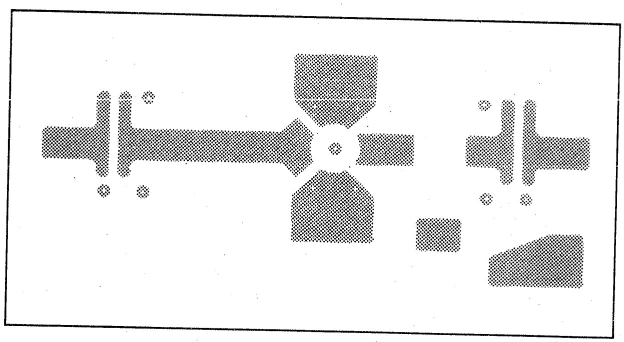
Component layout and printed-circuit board for 470 MHz test circuit see page 6.

APPLICATION INFORMATION (continued)

Component layout and printed-circuit board for 470 MHz test circuit.

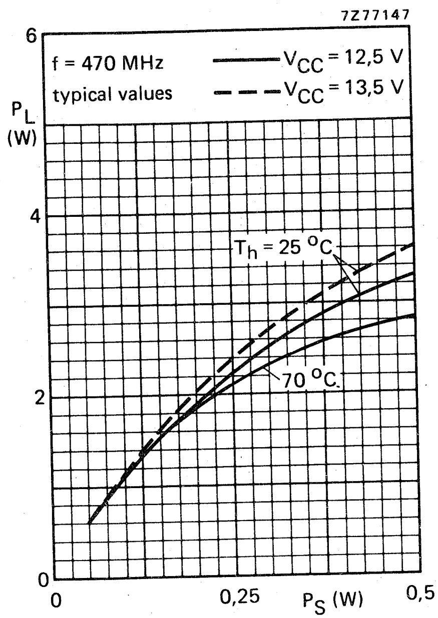


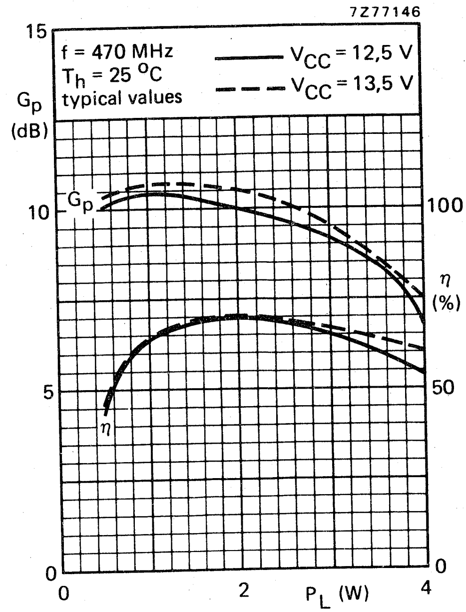
7Z76579

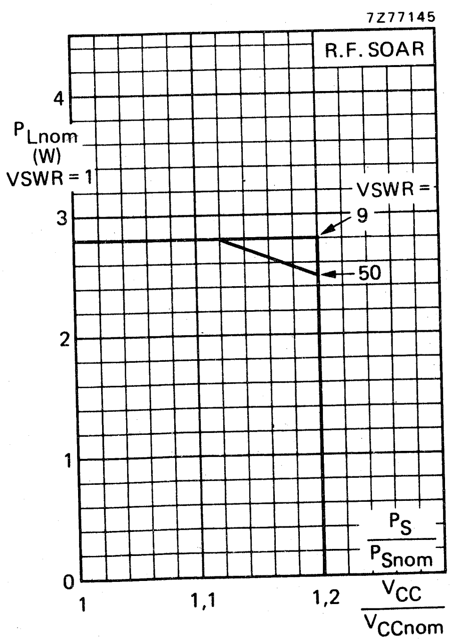


7Z76580

The circuit and the components are situated on one side of the PTFE fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets.







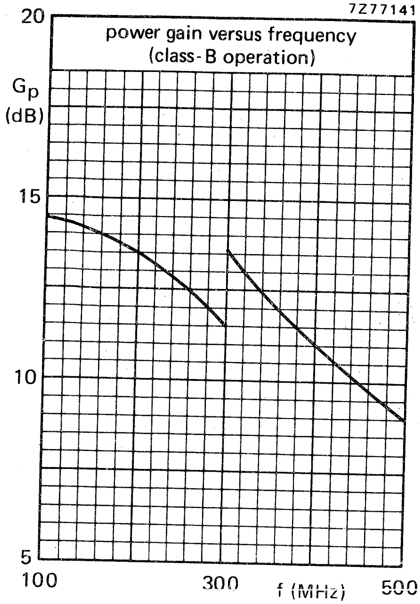
Conditions for R.F. SOAR

f = 470 MHz
T_h = 70 °C
$R_{th\ mb-h}$ = 0,6 °C/W
V_{CCnom} = 12,5 V or 13,5 V
$P_S = P_{Snom}$ at V_{CCnom} and VSWR = 1
see page 5

The transistor has been developed for use with unstabilized supply voltages. As the output power and drive power increase with the supply voltage, the nominal output power must be derated in accordance with the graph for safe operation at supply voltages other than the nominal. The graph shows the permissible output power under nominal conditions (VSWR = 1), as a function of the expected supply over-voltage ratio, with VSWR as parameter.

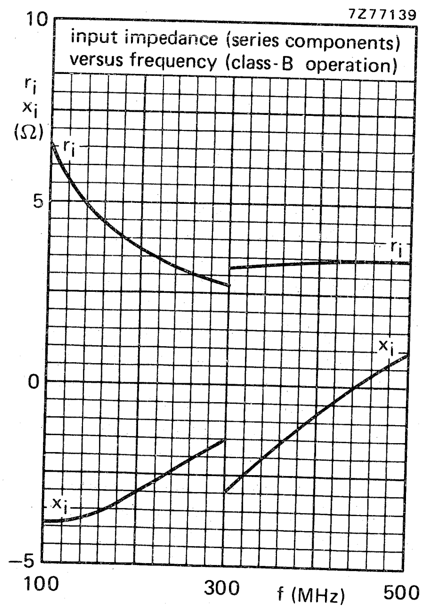
The graph applies to the situation in which the drive (P_S/P_{Snom}) increases linearly with supply over-voltage ratio.

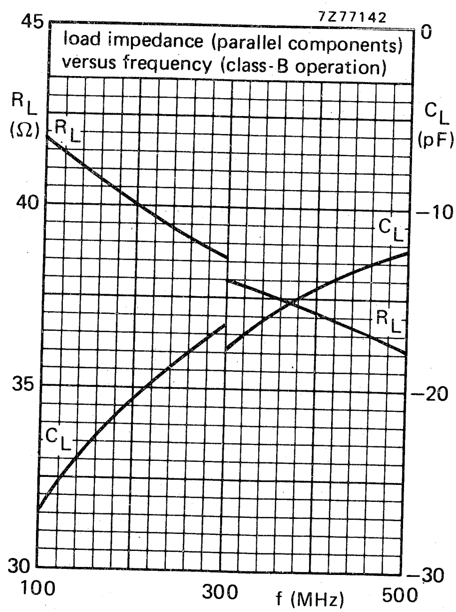
OPERATING NOTE Below 300 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation. This resistor must be effective for r.f. only.



Measuring conditions for the graphs on this page

V_{CC} = 12,5 V
P_L = 2 W
T_h = 25 °C
typical values





U.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor intended for transmitting applications in class-A, B or C in the u.h.f. and v.h.f. range for nominal supply voltages up to 13,5 V.
The resistance stabilization of the transistor provides protection against device damage at severe load mismatch conditions.
The transistor is housed in a ¼" capstan envelope with a ceramic cap.

QUICK REFERENCE DATA

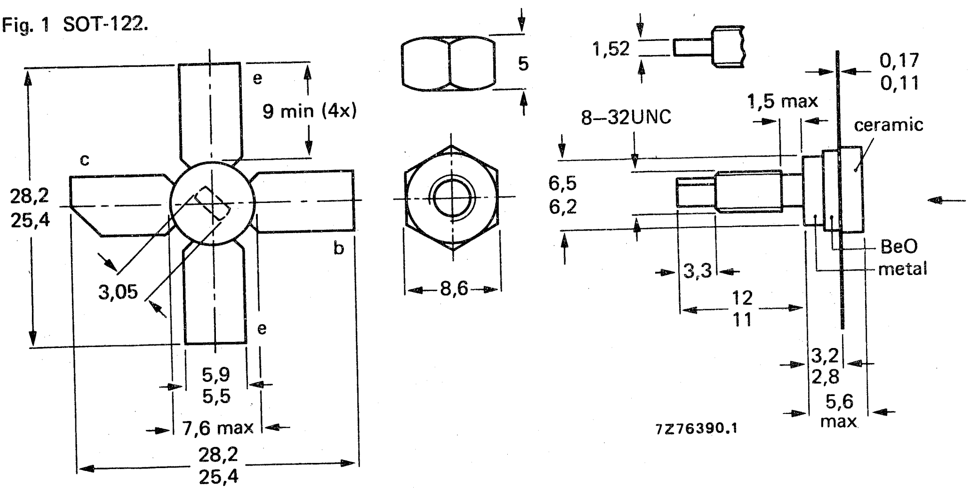
R.F. performance up to T_h = 25 °C in an unneutralized common-emitter class-B circuit

mode of operation	V_{CC} V	f MHz	P_L W	G_p dB	η %	$\overline{z_i}$ Ω	$\overline{Y_L}$ mA/V
c.w.	**12,5**	**470**	**4**	**> 8,0**	**> 60**	**2,1 + j2,3**	**57 − j56**
c.w.	12,5	175	4	typ. 15,0	typ. 60	2,0 − j2,2	51 − j48

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-122.



Torque on nut: min. 0,75 Nm
(7,5 kg cm)
max. 0,85 Nm
(8,5 kg cm)

Diameter of clearance hole in heatsink: max. 4,2 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

When locking is required an adhesive is preferred instead of a lock washer.

CAUTION This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC134)

Voltages

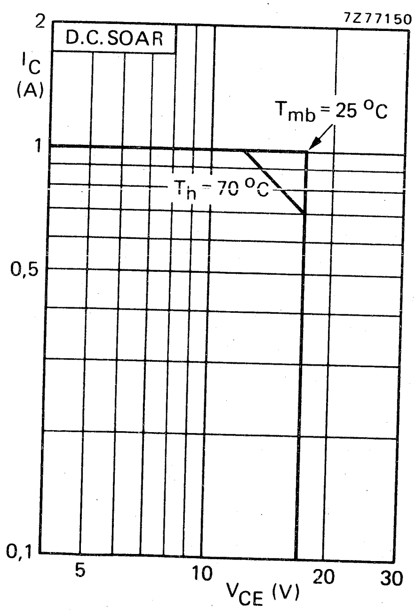
Collector-emitter voltage (V_{BE} = 0) peak value	V_{CESM}	max	36 V
Collector-emitter voltage (open base)	V_{CEO}	max	17 V
Emitter-base voltage (open collector)	V_{EBO}	max	4 V

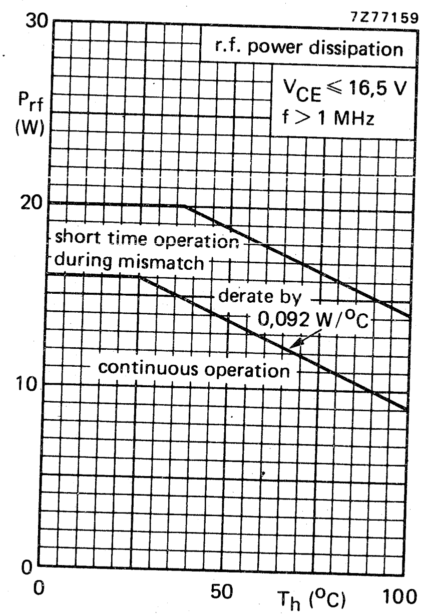
Currents

Collector current (d.c.)	I_C	max	1 A
Collector current (peak value); f > 1 MHz	I_{CM}	max	3 A

Power dissipation

Total power dissipation (d.c. and r.f.) up to T_{mb} = 25 °C	P_{tot}	max	17 W





Temperatures

Storage temperature	T_{stg}		−65 to +150 °C
Operating junction temperature	T_j	max	200 °C

THERMAL RESISTANCE

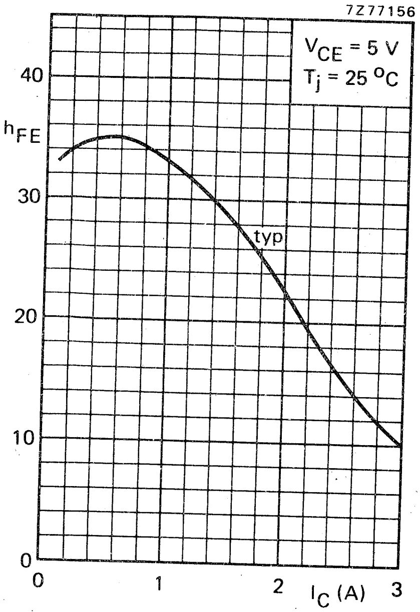
From junction to mounting base	$R_{th\ j\text{-}mb}$	=	10,3 °C/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,6 °C/W

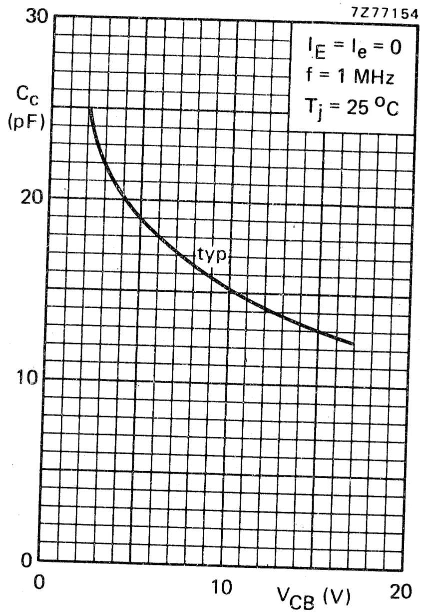
CHARACTERISTICS

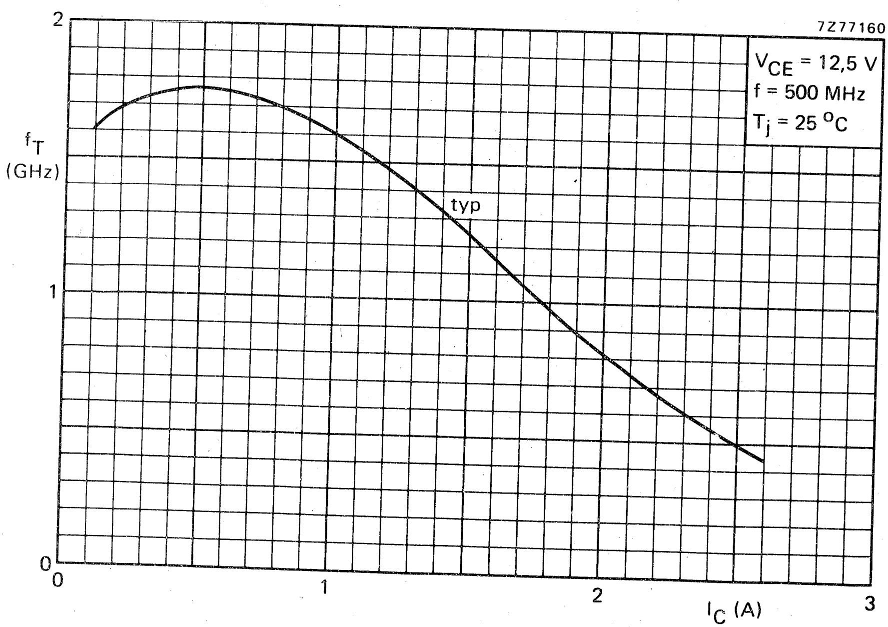
$T_j = 25\ ^oC$

Breakdown voltages			
Collector-emitter voltage $V_{BE} = 0$; $I_C = 10$ mA	$V_{(BR)CES}$	>	36 V
Collector-emitter voltage open base; $I_C = 50$ mA	$V_{(BR)CEO}$	>	17 V
Emitter-base voltage open collector; $I_E = 4$ mA	$V_{(BR)EBO}$	>	4 V
Collector cut-off current $V_{BE} = 0$; $V_{CE} = 17$ V	I_{CES}	<	4 mA
D.C. current gain * $I_C = 0,5$ A; $V_{CE} = 5$ V	h_{FE}	>	10
		typ	35
Collector-emitter saturation voltage * $I_C = 1,5$ A; $I_B = 0,3$ A	V_{CEsat}	typ	0,75 V
Transition frequency at f = 500 MHz *			
$I_C = 0,5$ A; $V_{CE} = 12,5$ V	f_T	typ	1,75 GHz
$I_C = 1,5$ A; $V_{CE} = 12,5$ V	f_T	typ	1,25 GHz
Collector capacitance at f = 1 MHz $I_E = I_e = 0$; $V_{CB} = 12,5$ V	C_c	typ	14 pF
Feedback capacitance at f = 1 MHz $I_C = 40$ mA; $V_{CE} = 12,5$ V	C_{re}	typ	7,1 pF
Collector-stud capacitance	C_{cs}	typ	2 pF

* Measured under pulse conditions: $t_p \leqslant 200\ \mu s$; $\delta \leqslant 0,02$.


7Z77156
V_{CE} = 5 V
T_j = 25 °C
h_{FE}
typ
I_C (A)
0
1
2
3
10
20
30
40


7Z77154
I_E = I_e = 0
f = 1 MHz
T_j = 25 °C
C_c
(pF)
typ
V_{CB} (V)
0
10
20
30


7Z77160
V_{CE} = 12,5 V
f = 500 MHz
T_j = 25 °C
f_T
(GHz)
typ
I_C (A)
0
1
2
3

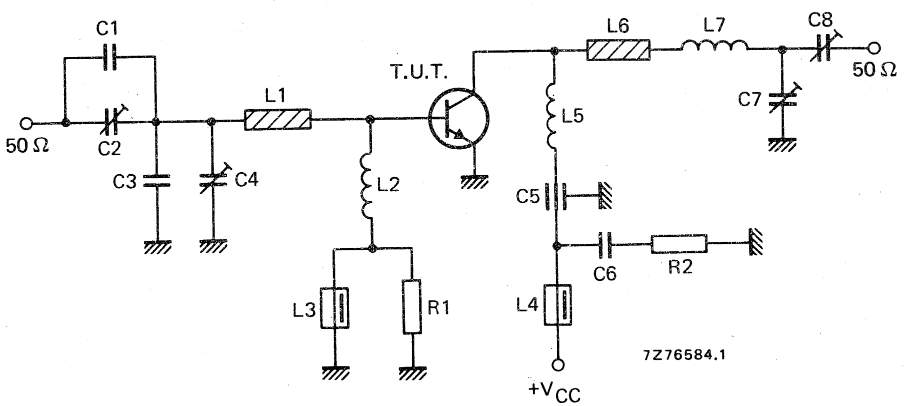
APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit)

T_h = 25 °C

f (MHz)	V_{CE} (V)	P_L (W)	P_S (W)	G_p (dB)	I_C (A)	η (%)	$\overline{z_i}$ (Ω)	$\overline{Y_L}$ (mA/V)
470	**12,5**	**4**	**< 0,63**	**> 8,0**	**< 0,53**	**> 60**	**2,1 + j2,3**	**57 – j56**
470	13,5	4	–	typ 9,5	–	typ 65	–	–
175	12,5	4	–	typ 15,0	–	typ 60	2,0 – j2,2	51 – j48

Test circuit for 470 MHz



List of components:

C1 = 2,2 pF (± 0,25 pF) ceramic capacitor
C2 = C7 = C8 = 1,4 to 5,5 pF film dielectric trimmer (cat. no. 2222 809 09001)
C3 = 5,6 pF (± 0,25 pF) ceramic capacitor
C4 = 2 to 9 pF film dielectric trimmer (cat. no. 2222 809 09002)
C5 = 100 pF ceramic feed-through capacitor
C6 = 100 nF polyester capacitor

L1 = stripline (22,5 mm x 6,0 mm)
L2 = 13 turns closely wound enamelled Cu wire (0,5 mm); int. dia. 4 mm; leads 2 x 5 mm
L3 = L4 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L5 = 51 nH; 3,5 turns Cu wire (1 mm); int. dia. 6 mm; coil length 7 mm; leads 2 x 5 mm
L6 = stripline (10,0 mm x 6,0 mm)
L7 = 15 nH; 1 turn Cu wire (1 mm); int. dia. 5 mm; leads 2 x 5 mm

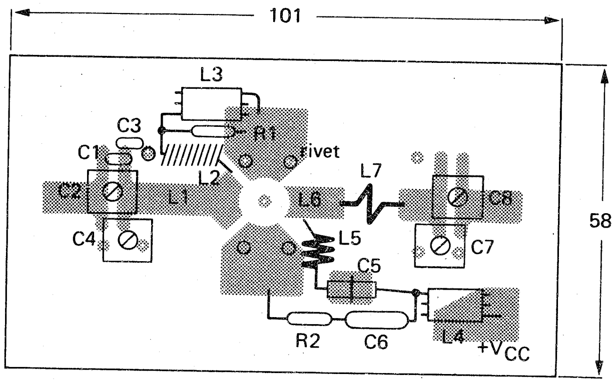
L1 and L6 are striplines on a double Cu-clad printed-circuit board with PTFE fibre-glass dielectric (ϵ_r = 2,74); thickness 1/16".

R1 = R2 = 10 Ω (± 5%) carbon resistor

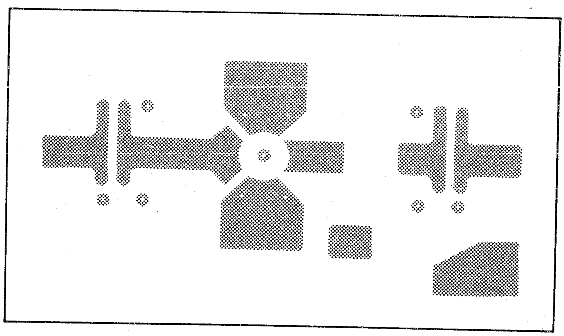
Component layout and printed-circuit board for 470 MHz test circuit see page 6.

APPLICATION INFORMATION (continued)

Component layout and printed-circuit board for 470 MHz test circuit.

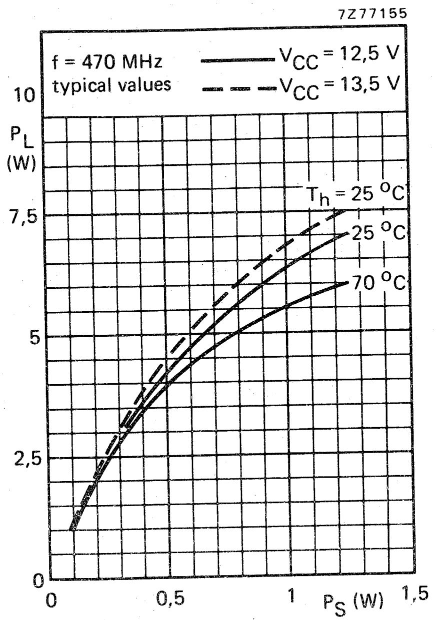


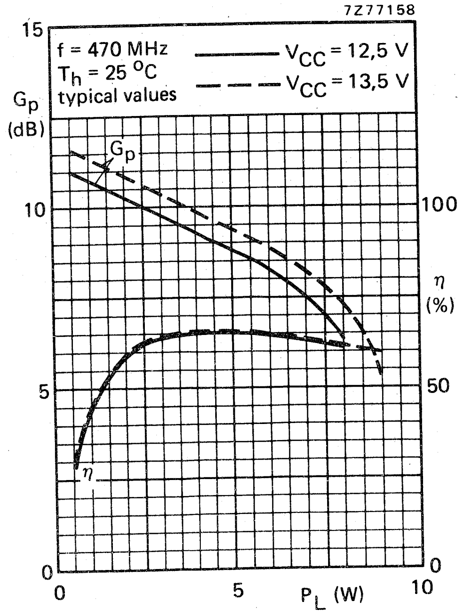
7Z76582

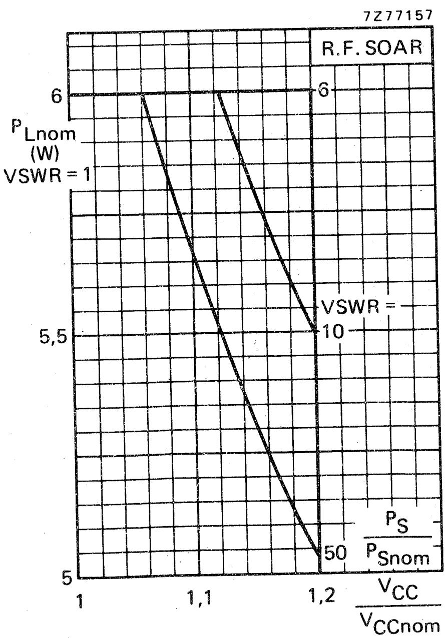


7Z76583

The circuit and the components are situated on one side of the PTFE fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets.







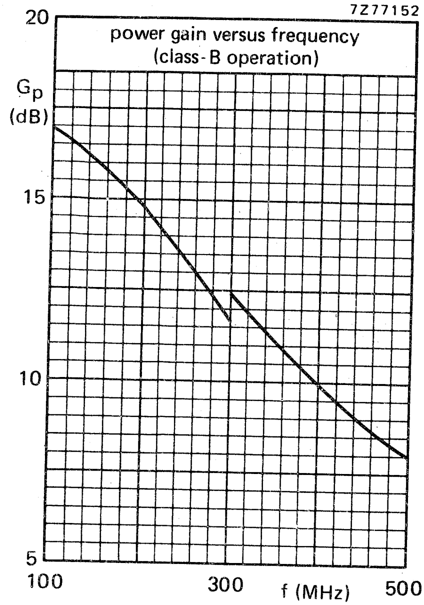
Conditions for R.F. SOAR

f = 470 MHz
T_h = 70 °C
$R_{th\ mb\text{-}h}$ = 0,6 °C/W
V_{CCnom} = 12,5 V or 13,5 V
$P_S = P_{Snom}$ at V_{CCnom} and VSWR = 1
see page 5

The transistor has been developed for use with unstabilized supply voltages. As the output power and drive power increase with the supply voltage, the nominal output power must be derated in accordance with the graph for safe operation at supply voltages other that the nominal. The graph shows the permissible output power under nominal conditions (VSWR = 1), as a function of the expected supply over-voltage ratio, with VSWR as parameter.

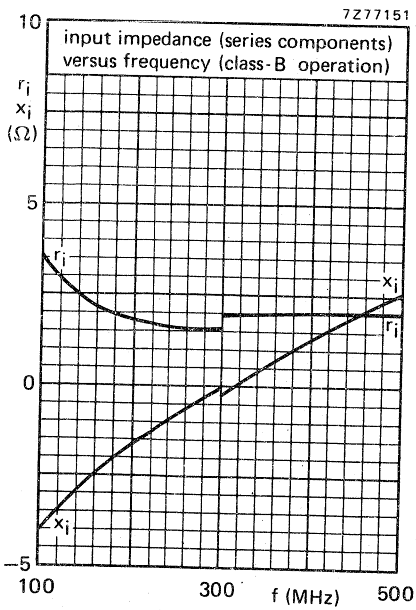
The graph applies to the situation in which the drive (P_S/P_{Snom}) increases linearly with supply over-voltage ratio.

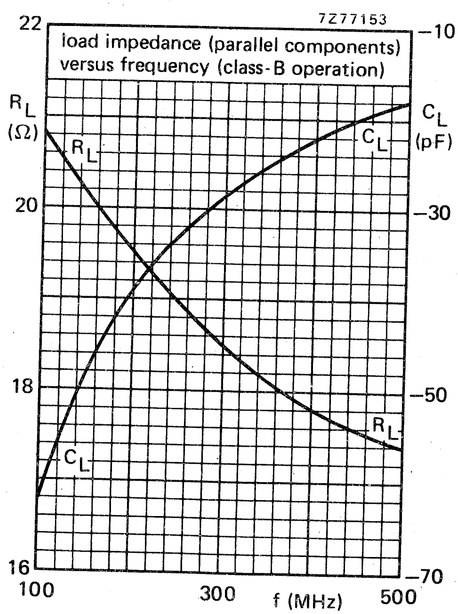
OPERATING NOTE Below 300 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation. This resistor must be effective for r.f. only.



Measuring conditions for the graphs on this page

V_{CC} = 12,5 V
P_L = 4 W
T_h = 25 °C
typical values





U.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor intended for transmitting applications in class-A, B or C in the u.h.f. and v.h.f. range for nominal supply voltages up to 13,5 V.
The resistance stabilization of the transistor provides protection against device damage at severe load mismatch conditions.
The transistor is housed in a ¼" capstan envelope with a ceramic cap.

QUICK REFERENCE DATA

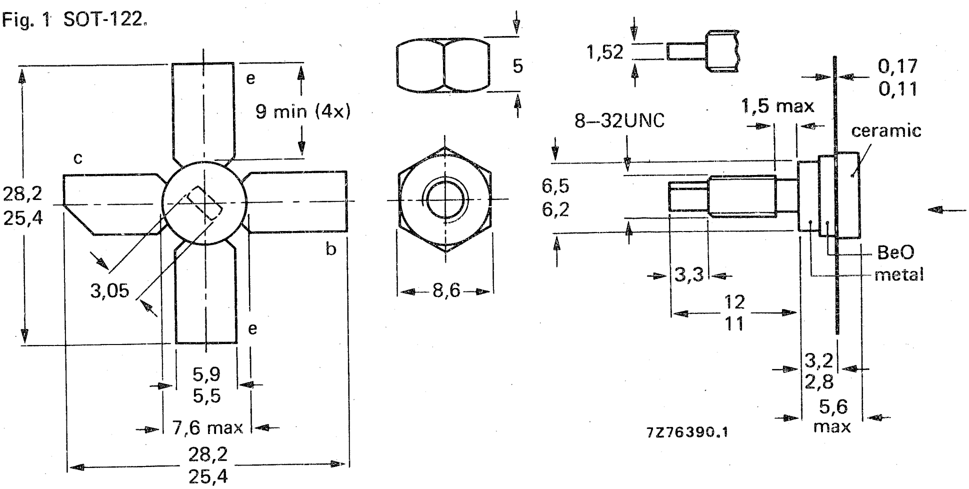
R.F. performance up to T_h = 25 °C in an unneutralized common-emitter class-B circuit

mode of operation	V_{CC} V	f MHz	P_L W	G_p dB	η %	$\overline{z_i}$ Ω	$\overline{Y_L}$ mA/V
c.w.	**12,5**	**470**	**10**	**> 6,0**	**> 60**	**1,3 + j2,5**	**150 − j66**
c.w.	12,5	175	10	typ. 13,5	typ. 60	1,2 − j0,6	140 − j80

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-122.



Torque on nut: min. 0,75 Nm (7,5 kg cm)
max. 0,85 Nm (8,5 kg cm)

Diameter of clearance hole in heatsink: max. 4,2 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

When locking is required an adhesive is preferred instead of a lock washer.

CAUTION This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC134)

Voltages

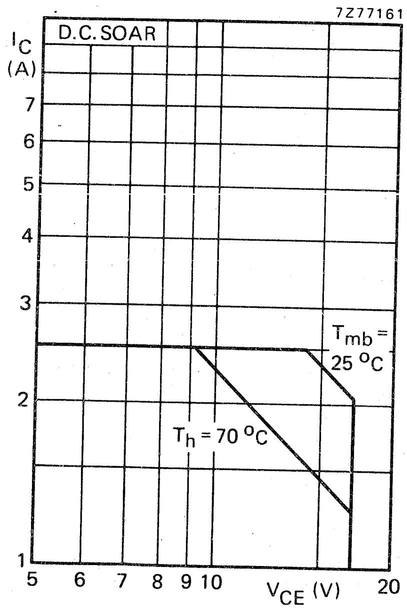
Collector-emitter voltage (V_{BE} = 0) peak value	V_{CESM}	max	36 V
Collector-emitter voltage (open base)	V_{CEO}	max	17 V
Emitter-base voltage (open collector)	V_{EBO}	max	4 V

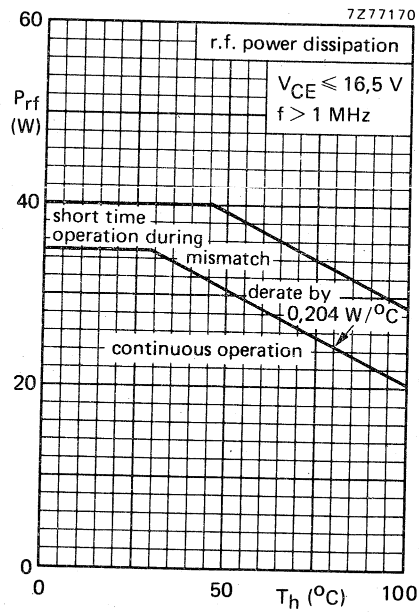
Currents

Collector current (d.c. or average)	I_C	max	2,5 A
Collector current (peak value); f > 1 MHz	I_{CM}	max	7,5 A

Power dissipation

R.F. power dissipation (f > 1 MHz); T_{mb} = 25 °C	P_{tot}	max	40 W





Temperatures

Storage temperature	T_{stg}	−65 to +150	°C
Operating junction temperature	T_j	max 200	°C

THERMAL RESISTANCE

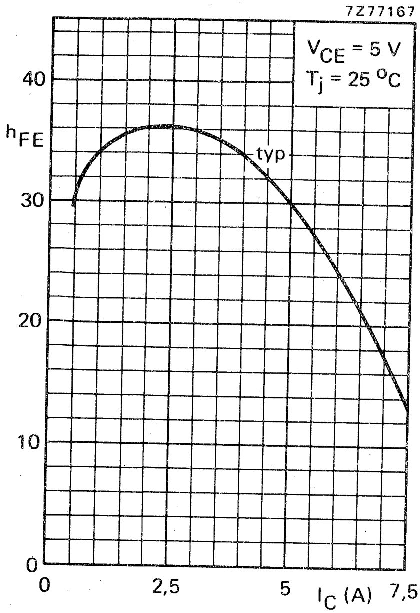
From junction to mounting base	$R_{th\ j\text{-}mb}$	=	4,3 °C/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,6 °C/W

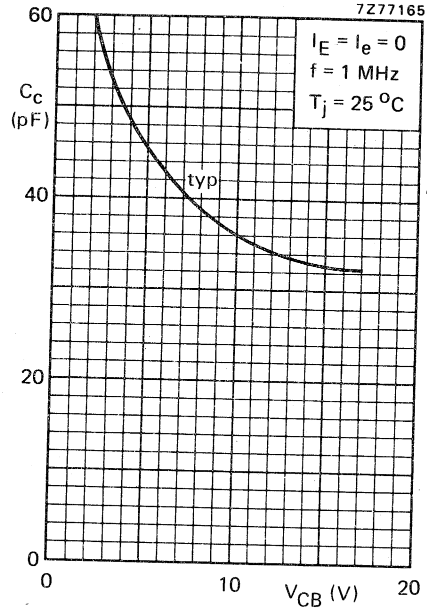
CHARACTERISTICS

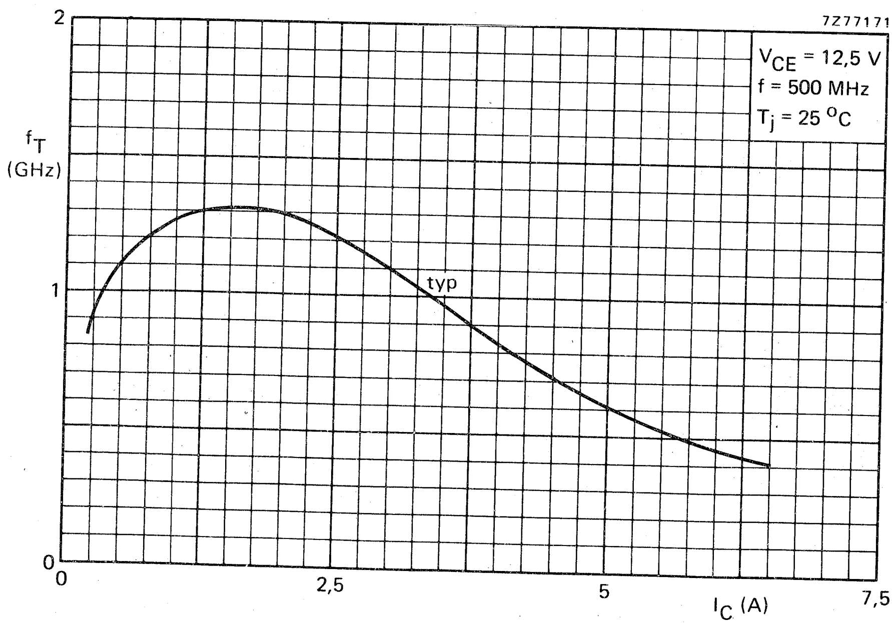
$T_j = 25\ ^oC$

Breakdown voltages			
Collector-emitter voltage $V_{BE} = 0$; $I_C = 25$ mA	$V_{(BR)CES}$	>	36 V
Collector-emitter voltage open base; $I_C = 100$ mA	$V_{(BR)CEO}$	>	17 V
Emitter-base voltage open collector; $I_E = 10$ mA	$V_{(BR)EBO}$	>	4 V
Collector cut-off current $V_{BE} = 0$; $V_{CE} = 17$ V	I_{CES}	<	10 mA
D.C. current gain * $I_C = 1,25$ A; $V_{CE} = 5$ V	h_{FE}	> typ	10 35
Collector-emitter saturation voltage * $I_C = 3,75$ A; $I_B = 0,75$ A	V_{CEsat}	typ	0,75 V
Transition frequency at f = 500 MHz *			
$I_C = 1,25$ A; $V_{CE} = 12,5$ V	f_T	typ	1,3 GHz
$I_C = 3,75$ A; $V_{CE} = 12,5$ V	f_T	typ	0,9 GHz
Collector capacitance at f = 1 MHz $I_E = I_e = 0$; $V_{CB} = 12,5$ V	C_c	typ	34 pF
Feedback capacitance at f = 1 MHz $I_C = 100$ mA; $V_{CE} = 12,5$ V	C_{re}	typ	18 pF
Collector-stud capacitance	C_{cs}	typ	2 pF

* Measured under pulse conditions: $t_p \leqslant 200\ \mu s$; $\delta \leqslant 0,02$.


7Z77167
V_{CE} = 5 V
T_j = 25 °C
h_{FE}
typ
40
30
20
10
0
0
2,5
5
I_C (A)
7,5


7Z77165
$I_E = I_e = 0$
f = 1 MHz
T_j = 25 °C
C_c
(pF)
typ
60
40
20
0
0
10
V_{CB} (V)
20


7Z77171
V_{CE} = 12,5 V
f = 500 MHz
T_j = 25 °C
f_T
(GHz)
typ
2
1
0
0
2,5
5
I_C (A)
7,5

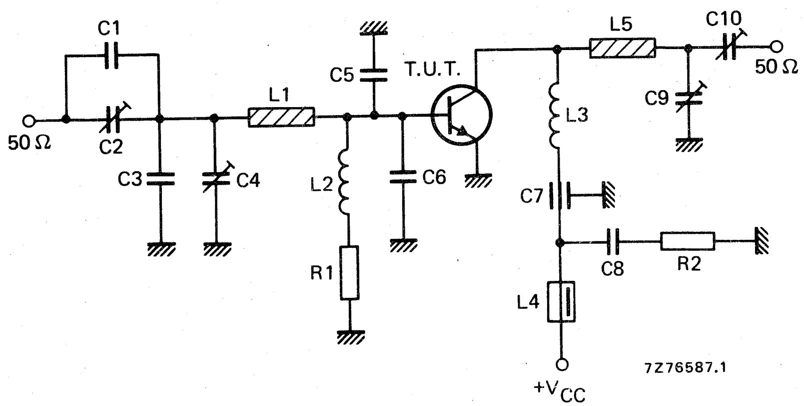
APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit)

T_h = 25 °C

f (MHz)	V_{CE} (V)	P_L (W)	P_S (W)	G_p (dB)	I_C (A)	η (%)	$\overline{z_i}$ (Ω)	$\overline{Y_L}$ (mA/V)
470	**12,5**	**10**	**< 2,5**	**> 6,0**	**< 1,33**	**> 60**	**1,3 + j2,5**	**150 − j66**
470	13,5	10	typ 1,9	typ 7,2	−	typ 75	−	−
175	12,5	10	typ 0,45	typ 13,5	−	typ 60	1,2 − j0,6	140 − j80

Test circuit for 470 MHz



List of components:

C1 = 2,2 pF (± 0,25 pF) ceramic capacitor
C2 = C9 = C10 = 2 to 18 pF film dielectric trimmer (cat. no. 2222 809 09003)
C3 = 3,9 pF (± 0,25 pF) ceramic capacitor
C4 = 1,4 to 5,5 pF film dielectric trimmer (cat. no. 2222 809 09001)
C5 = C6 = 15 pF ceramic chip capacitor (cat. no. 2222 851 13159)
C7 = 100 pF ceramic feed-through capacitor
C8 = 100 nF polyester capacitor

L1 = stripline (27,9 mm x 6,0 mm)
L2 = 13 turns closely wound enamelled Cu wire (0,5 mm); int. dia. = 4 mm; leads 2 x 5 mm
L3 = 17 nH; 1½ turns enamelled Cu wire (1 mm); spacing 1 mm; int. dia. = 6 mm; leads 2 x 5 mm
L4 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L5 = stripline (45,8 mm x 6,0 mm)

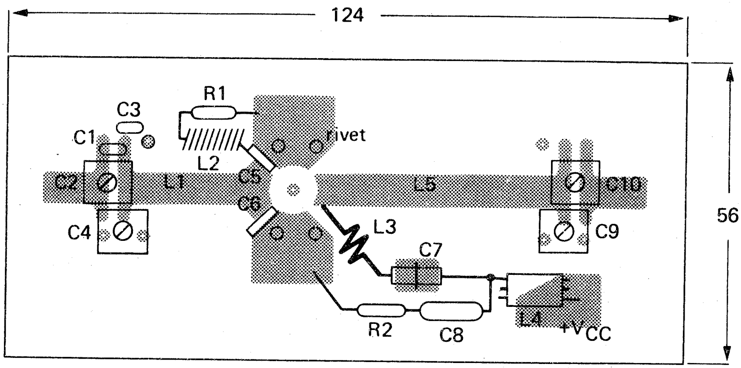
L1 and L5 are striplines on a double Cu-clad printed-circuit board with PTFE fibre-glass dielectric (ϵ_r = 2,74); thickness 1/16".

R1 = 1 Ω (± 5%) carbon resistor
R2 = 10 Ω (± 5%) carbon resistor

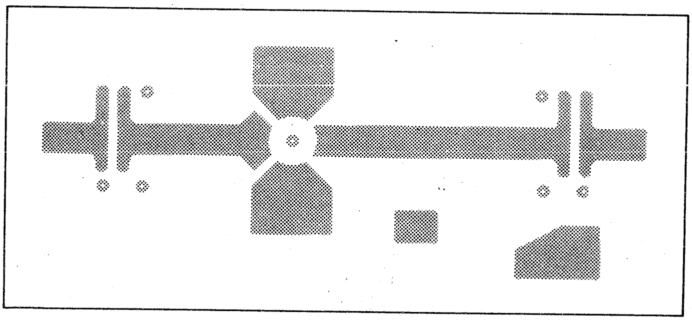
Component layout and printed-circuit board for 470 MHz test circuit see page 6.

APPLICATION INFORMATION (continued)

Component layout and printed-circuit board for 470 MHz test circuit.

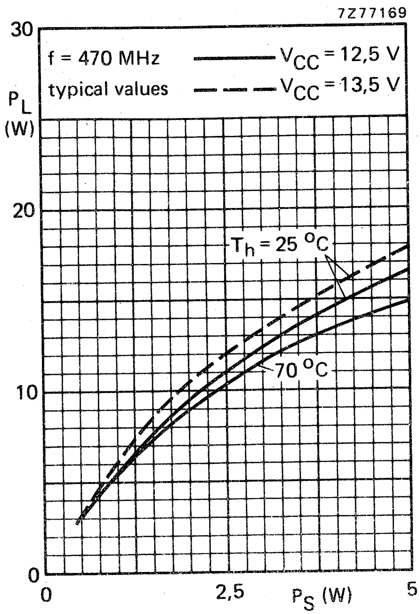


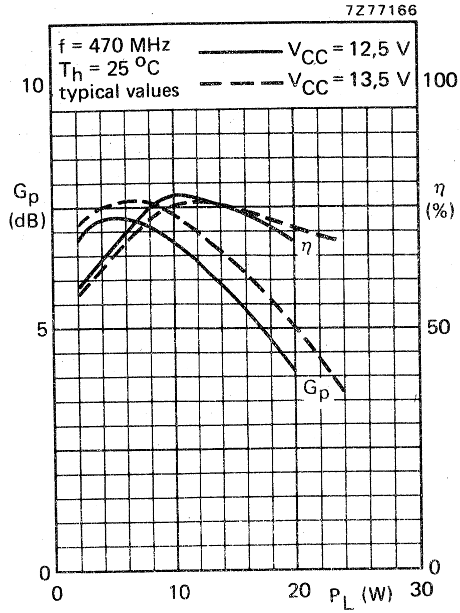
7Z76585

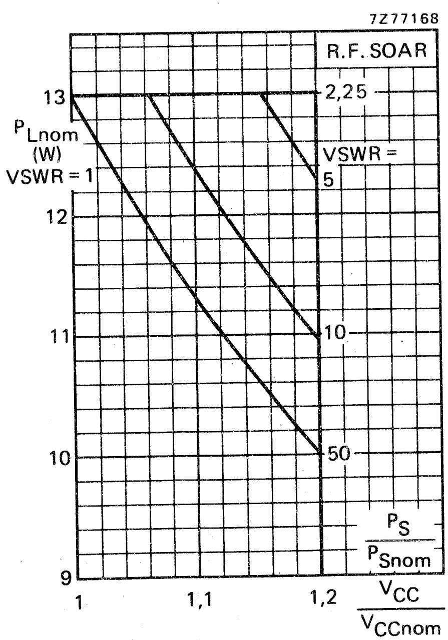


7Z76586

The circuit and the components are situated on one side of the PTFE fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets.







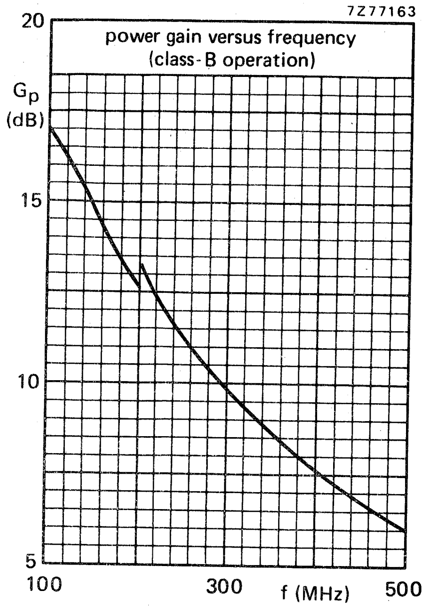
Measuring conditions for R.F. SOAR

f = 470 MHz
T_h = 70 °C
$R_{th\ mb-h}$ = 0,6 °C/W
V_{CCnom} = 12,5 V or 13,5 V
$P_S = P_{Snom}$ at V_{CCnom} and VSWR = 1
see page 5

The transistor has been developed for use with unstabilized supply voltages. As the output power and drive power increase with the supply voltage, the nominal output power must be derated in accordance with the graph for safe operation at supply voltages other than the nominal. The graph shows the permissible output power under nominal conditions (VSWR = 1), as a function of the expected supply over-voltage ratio, with VSWR as parameter.

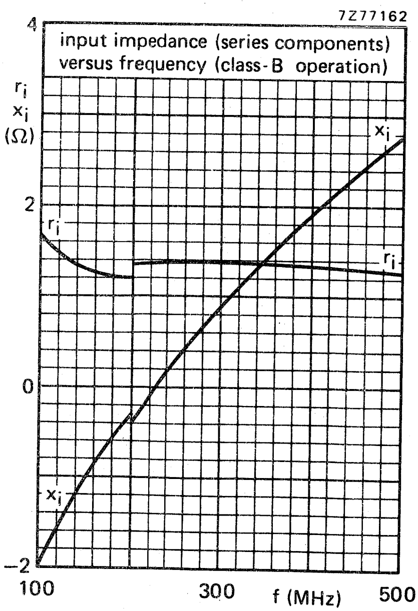
The graph applies to the situation in which the drive (P_S/P_{Snom}) increases linearly with supply over-voltage ratio.

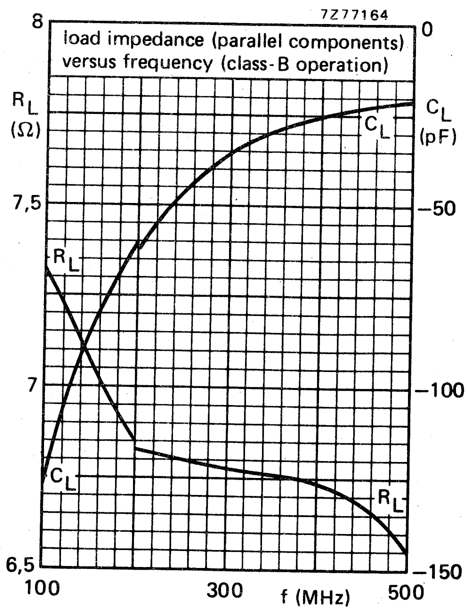
OPERATING NOTE Below 200 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation. This resistor must be effective for r.f. only.



Measuring conditions for the graphs on this page

V_{CC} = 12,5 V
P_L = 10 W
T_h = 25 °C
typical values





U.H.F. POWER TRANSISTOR

Internally matched n-p-n silicon planar epitaxial transistor intended for use in **high-power wide-band** and **semi-wide-band u.h.f. amplifiers** with a nominal supply voltage of 12,5 V. The transistor is resistance stabilized and is guaranteed to withstand severe load mismatch conditions with a supply overvoltage to 16,5 V. Diffused emitter-ballasting resistors and the application of a **gold sandwich metallization** give optimum features of ruggedness and reliability.

The transistor is especially suited as **add-on-final stage** for low-power modules.

The transistor has a ½″ 6-lead flange envelope with a ceramic cap. All leads are isolated from the flange.

QUICK REFERENCE DATA

R.F. performance up to T_h = 25 °C in an unneutralized common-emitter class-B circuit

mode of operation	V_{CE} V	f MHz	P_L W	G_p dB	η %	$\overline{z_i}$ Ω	$\overline{Y_L}$ mA/V
c.w.	**12,5**	**470**	**30**	**> 5**	**> 60**	**1,4 + j3,0**	**250 + j200**
c.w.	13,5	470	30	typ. 6,1	typ. 65	—	—

MECHANICAL DATA

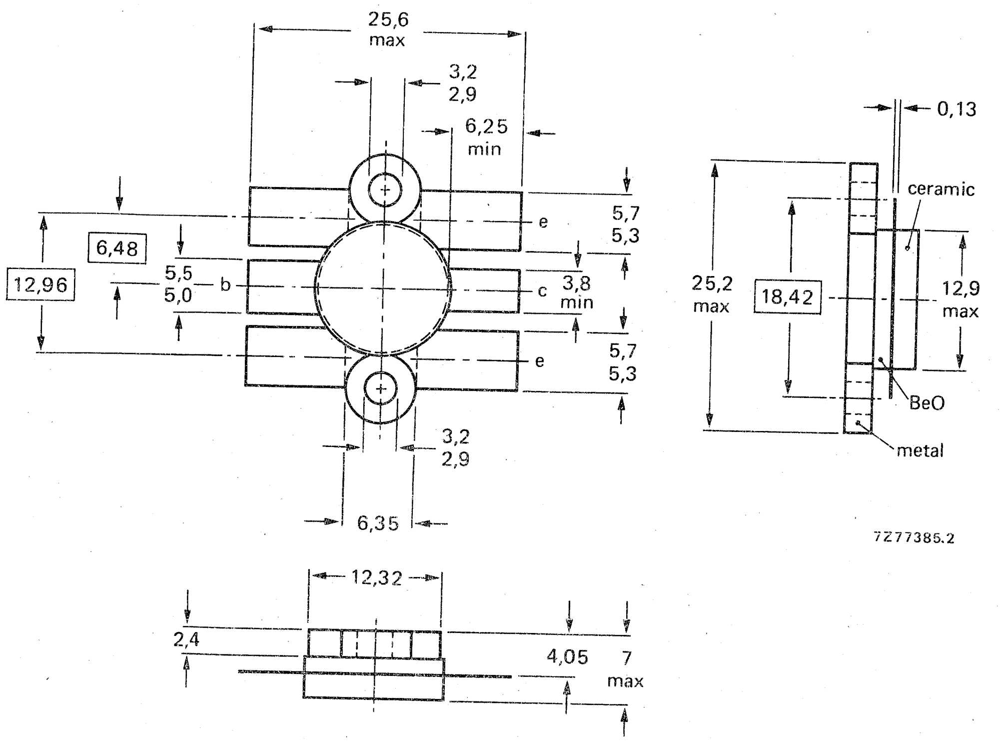
SOT-119 (see page 2).

CAUTION This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

MECHANICAL DATA

Fig. 1 SOT-119.

Dimensions in mm



Torque on screw: min. 0,6 Nm (6 kg cm)
max. 0,75 Nm (7,5 kg cm)

Recommended screw: cheese-head 4-40 UNC/2A

Heatsink compound must be applied sparingly and evenly distributed.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage (V_{BE} = 0) peak value	V_{CESM}	max.	36 V
Collector-emitter voltage (open base)	V_{CEO}	max.	17 V
Emitter-base voltage (open collector)	V_{EBO}	max.	4 V
Collector current (average)	$I_{C(AV)}$	max.	7 A
Collector current (peak value); f > 1 MHz	I_{CM}	max.	18 A
R.F. power dissipation (f > 1 MHz); T_{mb} = 25 °C	P_{rf}	max.	100 W
Storage temperature	T_{stg}		−65 to + 150 °C
Operating junction temperature	T_j	max.	200 °C

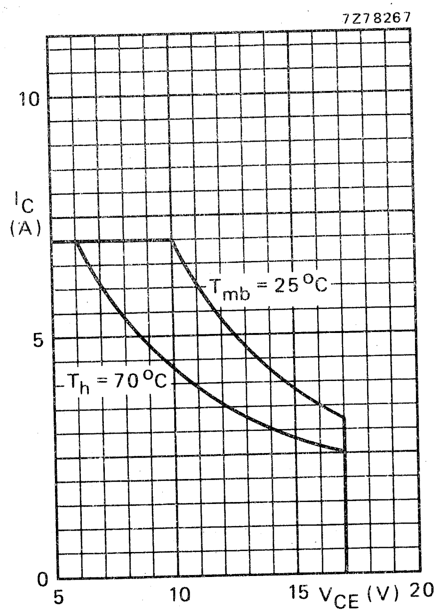


Fig. 2 D.C. SOAR.

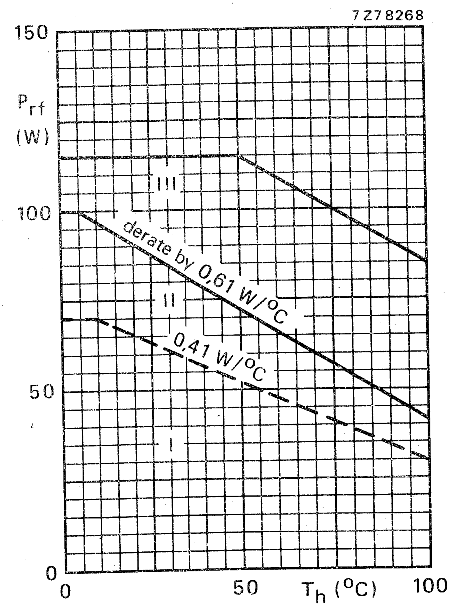


Fig. 3 R.F. power dissipation; V_{CE} ≤ 16,5 V; f > 1 MHz.
I Continuous d.c. operation
II Continuous r.f. operation
III Short-time operation during mismatch

THERMAL RESISTANCE (dissipation = 40 W; T_{mb} = 78 °C, i.e. T_h = 70 °C)

From junction to mounting base (d.c. dissipation)	$R_{th\ j\text{-}mb(dc)}$	=	2,8 °C/W
From junction to mounting base (r.f. dissipation)	$R_{th\ j\text{-}mb(rf)}$	=	1,95 °C/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,2 °C/W

CHARACTERISTICS

T_j = 25 °C

Collector-emitter breakdown voltage V_{BE} = 0; I_C = 50 mA	$V_{(BR)CES}$	>	36 V
Collector-emitter breakdown voltage open base; I_C = 100 mA	$V_{(BR)CEO}$	>	17 V
Emitter-base breakdown voltage open collector; I_E = 20 mA	$V_{(BR)EBO}$	>	4 V
Collector cut-off current V_{BE} = 0; V_{CE} = 17 V	I_{CES}	<	20 mA
Second breakdown energy; L = 25 mH; f = 50 Hz open base	E_{SBO}	>	4,5 mJ
R_{BE} = 10 Ω	E_{SBR}	>	4,5 mJ
D.C. current gain * I_C = 4 A; V_{CE} = 5 V	h_{FE}	typ.	40 10 to 80
Collector-emitter saturation voltage * I_C = 12 A; I_B = 2,4 A	V_{CEsat}	typ.	1,4 V
Transition frequency at f = 500 MHz * $-I_E$ = 4 A; V_{CB} = 12,5 V	f_T	typ.	2,2 GHz
$-I_E$ = 12 A; V_{CB} = 12,5 V	f_T	typ.	1,5 GHz
Collector capacitance at f = 1 MHz $I_E = I_e$ = 0; V_{CB} = 12,5 V	C_c	typ.	88 pF
Feedback capacitance at f = 1 MHz I_C = 200 mA; V_{CE} = 12,5 V	C_{re}	typ.	56 pF
Collector-flange capacitance	C_{cf}	typ.	3 pF

* Measured under pulse conditions: $t_p \leqslant 200\ \mu s$; $\delta \leqslant 0,02$.

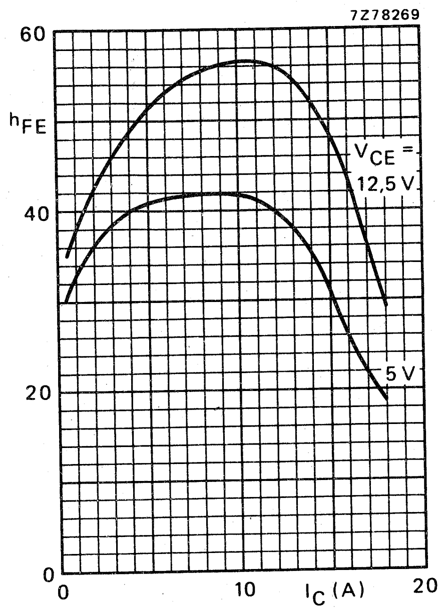


Fig. 4 Typical values; T_j = 25 ^oC.

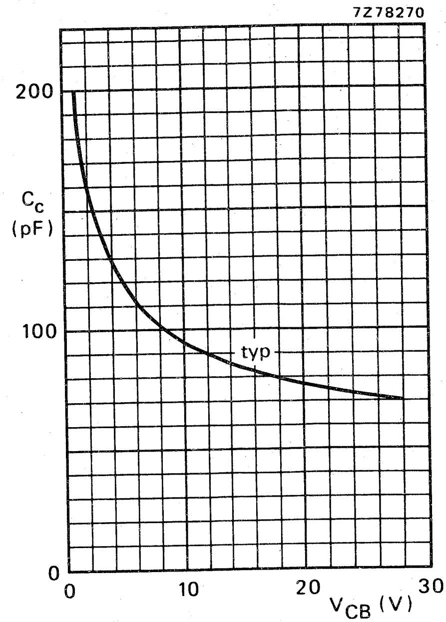


Fig. 5 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 ^oC.

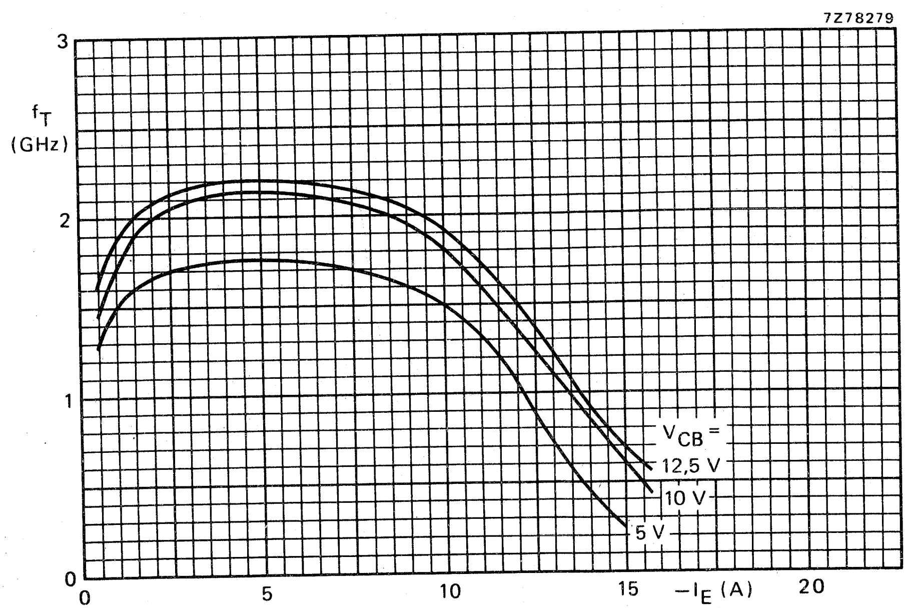


Fig. 6 Typical values; f = 500 MHz; T_j = 25 ^oC.

APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit)

T_h = 25 °C

f (MHz)	V_{CE} (V)	P_L (W)	P_S (W)	G_p (dB)	I_C (A)	η (%)	$\overline{z_i}$ (Ω)	$\overline{Y_L}$ (mA/V)
470	**12,5**	**30**	**< 9,5**	**> 5**	**< 4**	**> 60**	**1,4 + j3,0**	**250 + j200**
470	13,5	30	–	typ. 6,1	–	typ. 65	–	–

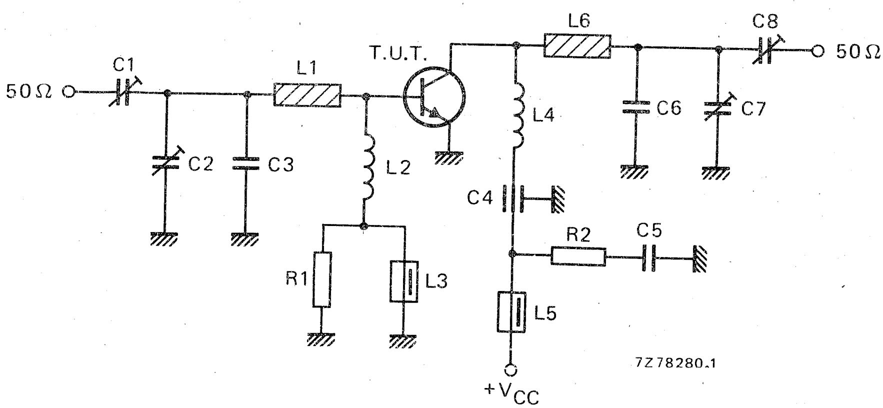


Fig. 7 Test circuit; c.w. class-B.

List of components:

C1 = C2 = C7 = C8 = 2 to 9 pF film dielectric trimmer (cat. no. 2222 809 09002)
C3 = C6 = 3,9 pF ceramic capacitor (500 V)
C4 = 100 pF feed-through capacitor
C5 = 100 nF polyester capacitor

L1 = stripline (24,0 mm x 6,7 mm)
L2 = 10 turns closely wound enamelled Cu wire (0,4 mm); int. dia. 4 mm
L3 = 2 turns enamelled Cu wire (0,6 mm); Ferroxcube tube core, grade 3B5 (cat. no. 4313 020 15170)
L4 = 12,6 nH; 2,5 turns enamelled Cu wire (0,7 mm); int. dia. 4 mm; length 3 mm; leads 2 x 5 mm
L5 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L6 = stripline (28,4 mm x 6,7 mm)

L1 and L6 are striplines on a double Cu-clad printed-circuit board with PTFE fibre-glass dielectric (ϵ_r = 2,74); thickness 1/16".

R1 = R2 = 10 Ω carbon resistor

Component layout and printed-circuit board for 470 MHz test circuit are shown in Fig. 8.

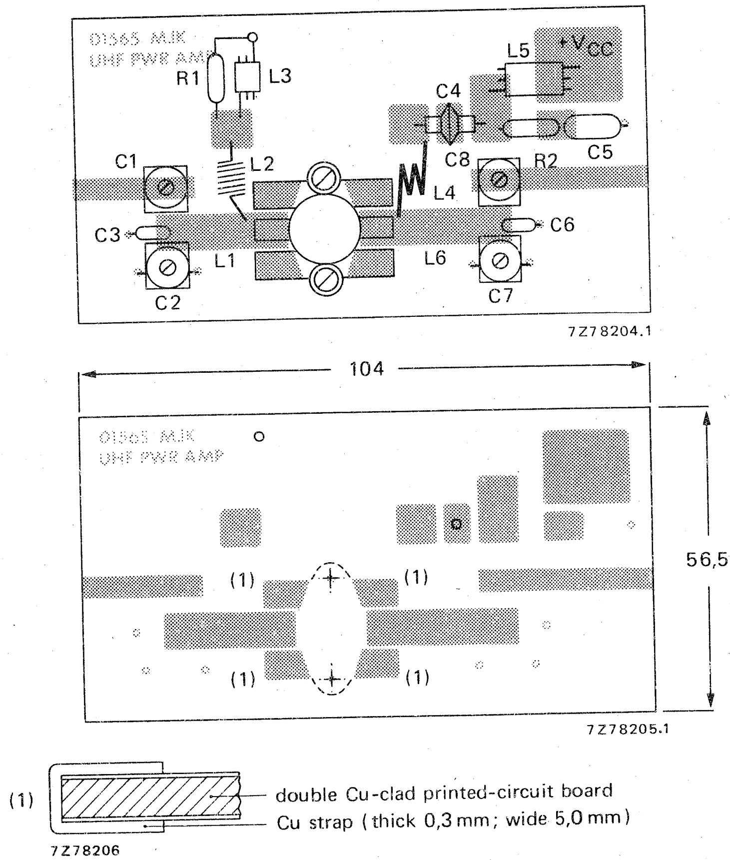


Fig. 8 Component layout and printed-circuit board for 470 MHz test circuit.

The circuit and the components are situated on one side of the PTFE fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets, whilst under the emitter leads Cu straps are used for a direct contact between upper and lower sheets.

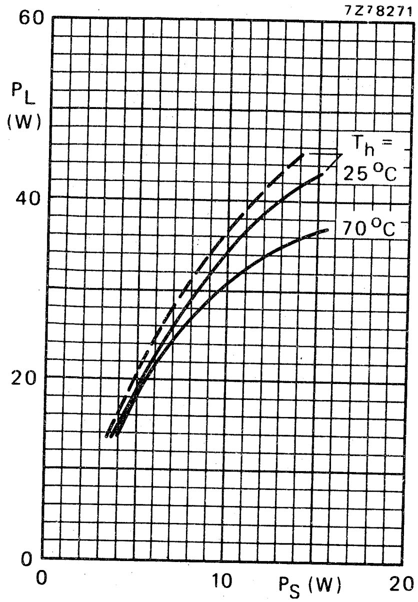


Fig. 9.

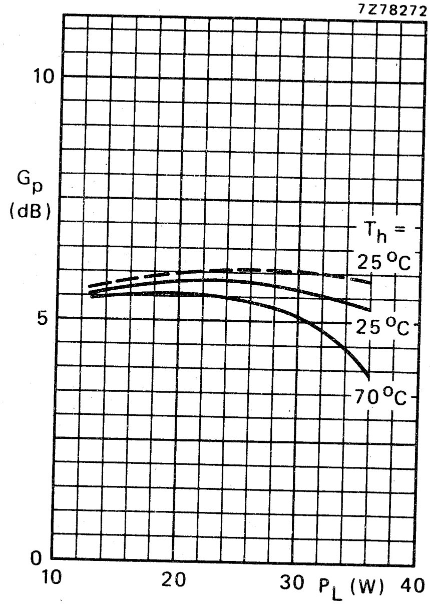


Fig. 10.

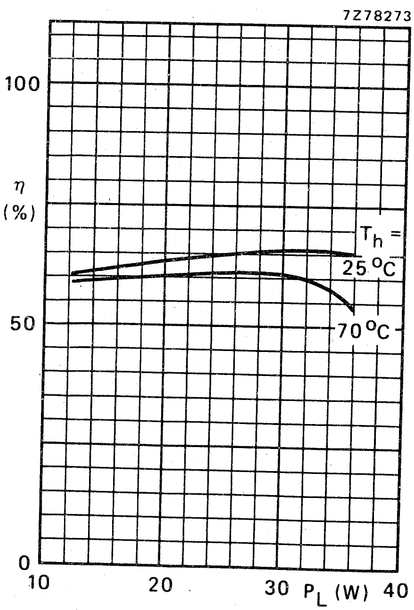


Fig. 11.

Conditions for Figs 9, 10 and 11:
Typical values; f = 470 MHz;
—— V_{CE} = 12,5 V; ---- V_{CE} = 13,5 V.

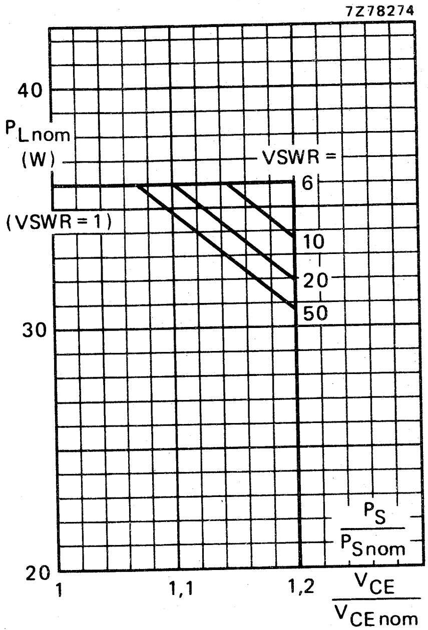


Fig. 12 R.F. SOAR (short-time operation during mismatch); f = 470 MHz; T_h = 70 °C; $R_{th\ mb-h}$ = 0,2 °C/W; V_{CEnom} = 12,5 V; $P_S = P_{Snom}$ at V_{CEnom} and VSWR = 1.

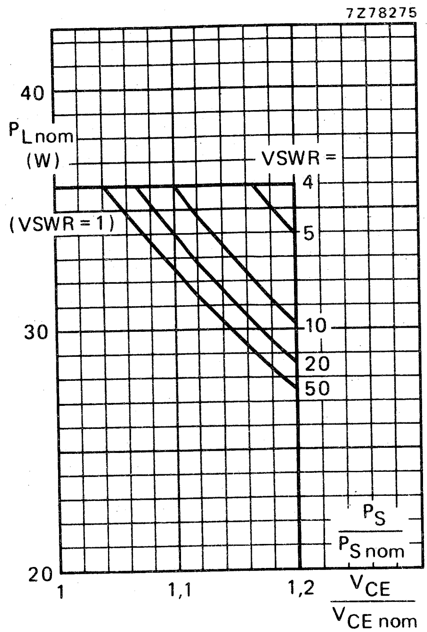


Fig. 13 R.F. SOAR (short-time operation during mismatch); f = 470 MHz; T_h = 70 °C; $R_{th\ mb-h}$ = 0,2 °C/W; V_{CEnom} = 13,5 V; $P_S = P_{Snom}$ at V_{CEnom} and VSWR = 1.

Note to Figs 12 and 13:
The transistor has been developed for use with unstabilized supply voltages. As the output power and drive power increase with the supply voltage, the nominal output power must be derated in accordance with the graph for safe operation at supply voltages other than the nominal. The graph shows the permissible output power under nominal conditions (VSWR = 1), as a function of the expected supply over-voltage ratio with VSWR as parameter.

The graph applies to the situation in which the drive (P_S/P_{Snom}) increases linearly with supply over-voltage ratio.

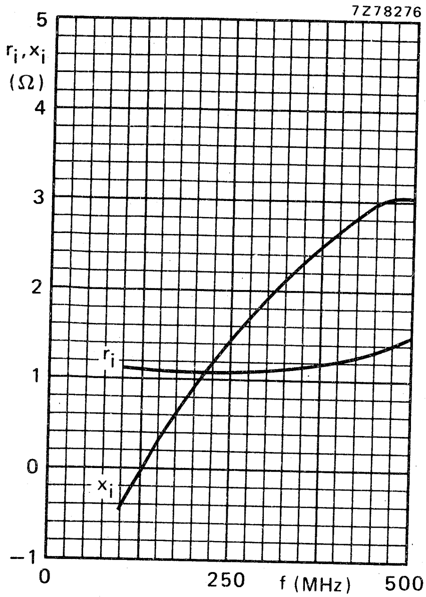


Fig. 14 Input impedance (series components).

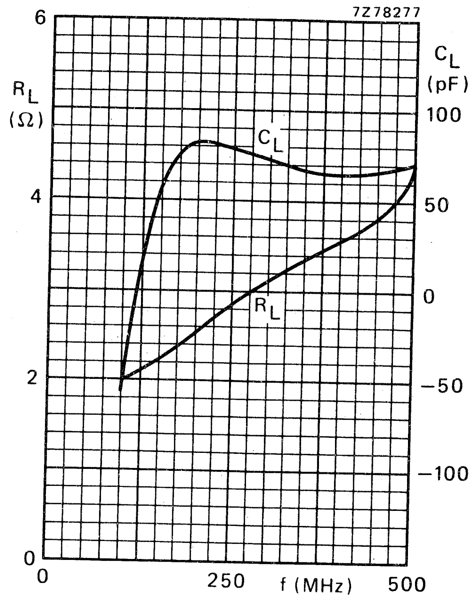


Fig. 15 Load impedance (parallel components).

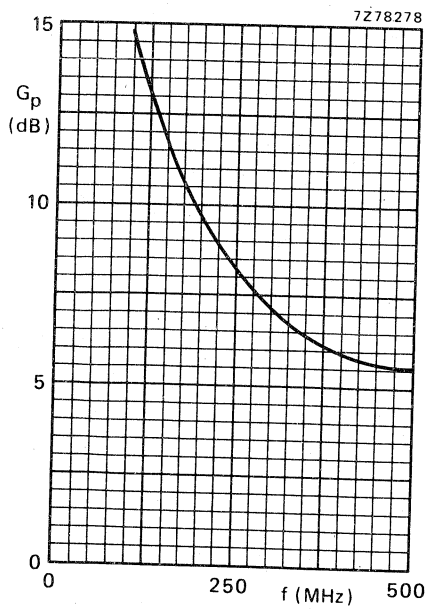


Fig. 16.

Conditions for Figs 14, 15 and 16:
Typical values; V_{CE} = 12,5 V; P_L = 30 W; T_h = 25 °C.

H.F./V.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor for use in transmitting amplifiers operating in the h.f. and v.h.f. bands, with a nominal supply voltage of 28 V. The transistor is specified for s.s.b. applications as linear amplifier in class-A and AB. The device is resistance stabilized and is guaranteed to withstand severe load mismatch conditions.

Matched h_{FE} groups are available on request.

It has a 3/8" flange envelope with a ceramic cap. All leads are isolated from the flange.

QUICK REFERENCE DATA

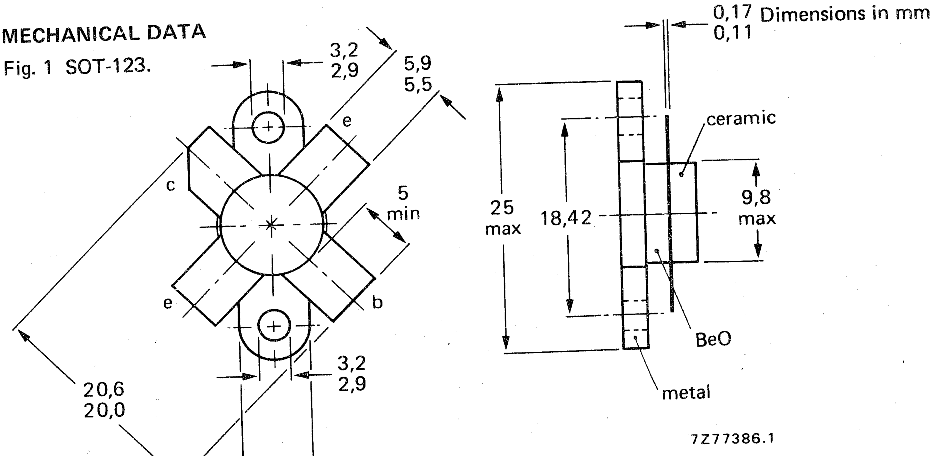
R.F. performance

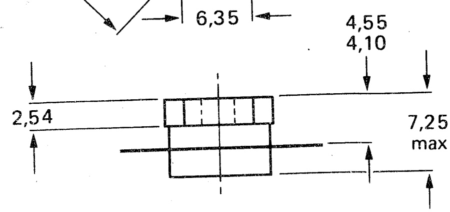
mode of operation	V_{CE} V	f MHz	P_L W	G_p dB	η_{dt} %	I_C A	d_3 dB	T_h °C
s.s.b. (class-A)	**26**	**1,6 – 28**	**0 – 10** (P.E.P.)	> **20**	–	**1,35**	< **–40**	**70**
s.s.b. (class-AB)	28	1,6 – 28	3 – 30 (P.E.P.)	typ. 21	typ. 40	typ. 1,34	typ. –30	25

MECHANICAL DATA

Fig. 1 SOT-123.

Dimensions in mm





Torque on screw: min. 0,6 Nm (6 kg cm)
max. 0,75 Nm (7,5 kg cm)

Recommended screw: cheese-head
4-40 UNC/2A

Heatsink compound must be applied sparingly and evenly distributed.

CAUTION This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage ($V_{BE} = 0$) peak value	V_{CESM}	max.	65 V
Collector-emitter voltage (open base)	V_{CEO}	max.	36 V
Emitter-base voltage (open-collector)	V_{EBO}	max.	4 V
Collector current (average)	$I_{C(AV)}$	max.	3 A
Collector current (peak value); f > 1 MHz	I_{CM}	max.	9 A
R.F. power dissipation (f > 1 MHz); T_{mb} = 25 °C	P_{rf}	max.	76 W
Storage temperature	T_{stg}		−65 to +150 °C
Operating junction temperature	T_j	max.	200 °C

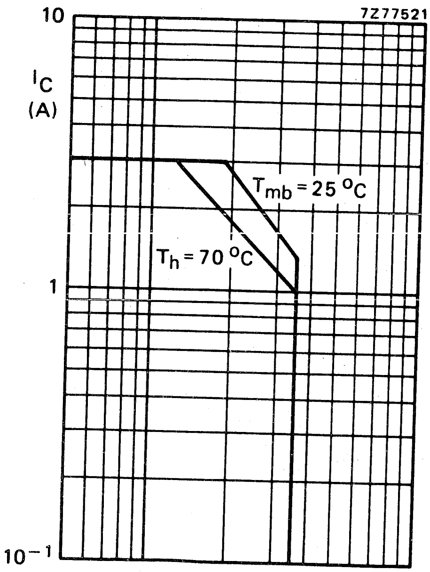


Fig. 2 D.C. SOAR.

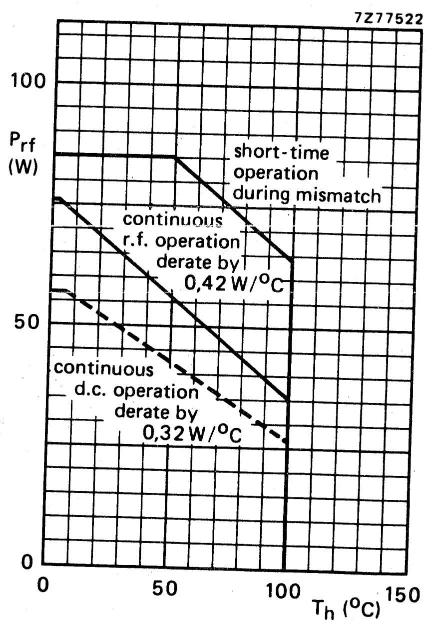


Fig. 3 R.F. power dissipation; $V_{CE} \leq 28$ V; $f \geq 1$ MHz.

THERMAL RESISTANCE (dissipation = 35 W; T_{mb} = 80 °C, i.e. T_h = 70 °C)

From junction to mounting base (d.c. dissipation)	$R_{th\ j\text{-}mb(dc)}$	=	3,15 °C/W
From junction to mounting base (r.f. dissipation)	$R_{th\ j\text{-}mb(rf)}$	=	2,35 °C/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,3 °C/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector-emitter breakdown voltage $V_{BE} = 0$; I_C = 10 mA	$V_{(BR)CES}$	>	65 V
Collector-emitter breakdown voltage open base; I_C = 50 mA	$V_{(BR)CEO}$	>	36 V
Emitter-base breakdown voltage open collector; I_E = 10 mA	$V_{(BR)EBO}$	>	4 V
Collector cut-off current $V_{BE} = 0$; V_{CE} = 36 V	I_{CES}	<	4 mA
Second breakdown energy; L = 25 mH; f = 50 Hz open base	E_{SBO}	>	8 mJ
$R_{BE} = 10\ \Omega$	E_{SBR}	>	8 mJ
D.C. current gain* I_C = 1,25 A; V_{CE} = 5 V	h_{FE}	typ.	50 10 to 100
D.C. current gain ratio of matched devices* I_C = 1,25 A; V_{CE} = 5 V	h_{FE1}/h_{FE2}	<	1,2
Collector-emitter saturation voltage* I_C = 3,75 A; I_B = 0,75 A	V_{CEsat}	typ.	1,5 V
Transition frequency at f = 100 MHz* $-I_E$ = 1,25 A; V_{CB} = 28 V	f_T	typ.	530 MHz
$-I_E$ = 3,75 A; V_{CB} = 28 V	f_T	typ.	530 MHz
Collector capacitance at f = 1 MHz $I_E = I_e = 0$; V_{CB} = 28 V	C_c	typ.	50 pF
Feedback capacitance at f = 1 MHz I_C = 100 mA; V_{CE} = 28 V	C_{re}	typ.	31 pF
Collector-flange capacitance	C_{cf}	typ.	2 pF

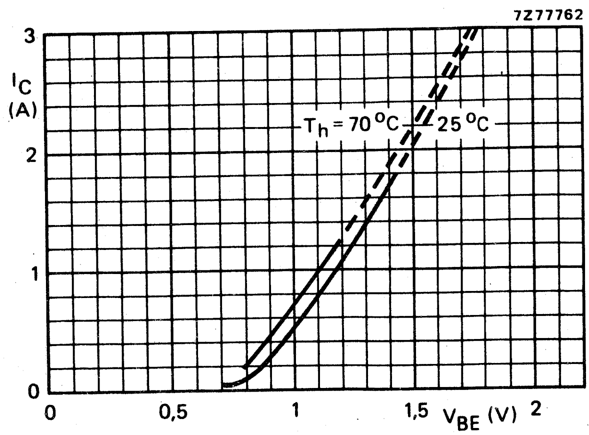


Fig. 4 Typical values; V_{CE} = 28 V.

* Measured under pulse conditions: $t_p \leq 200\ \mu s$; $\delta \leq 0,02$.

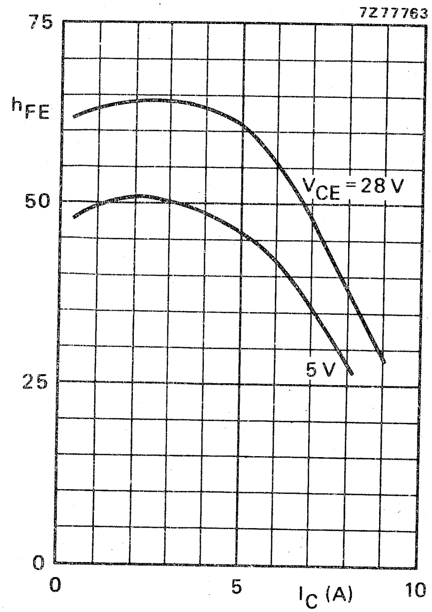


Fig. 5 Typical values; T_j = 25 °C.

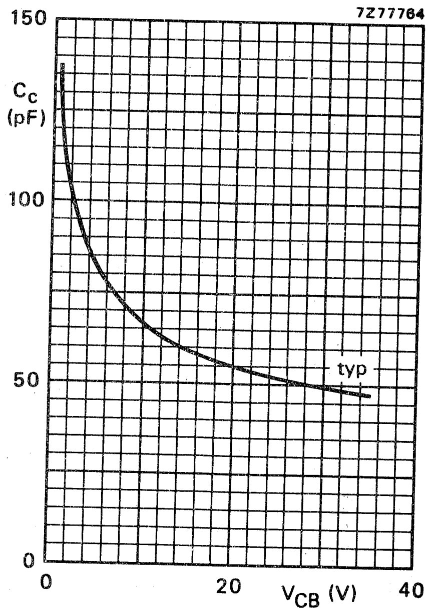


Fig. 6 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

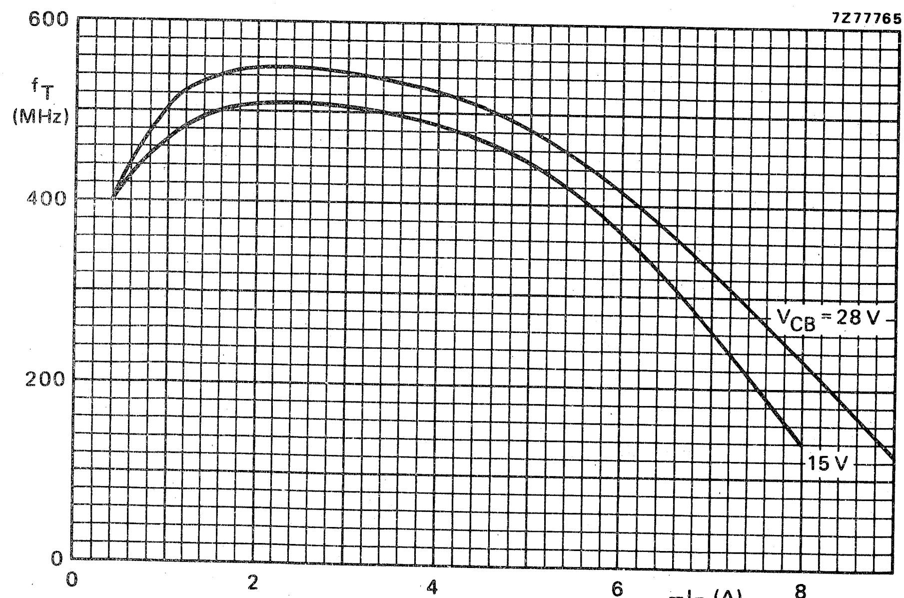


Fig. 7 Typical values; f = 100 MHz; T_j = 25 °C.

APPLICATION INFORMATION

R.F. performance in s.s.b. class-A operation (linear power amplifier)

V_{CE} = 26 V; f_1 = 28,000 MHz; f_2 = 28,001 MHz

output power W	G_p dB	I_C A	d_3 dB*	d_5 dB*	T_h °C
> 10 (P.E.P.) typ. 11 (P.E.P.)	> 20	1,35	−40	< −40	70
typ. 12 (P.E.P.)	typ. 24	1,35	−40	< −40	25

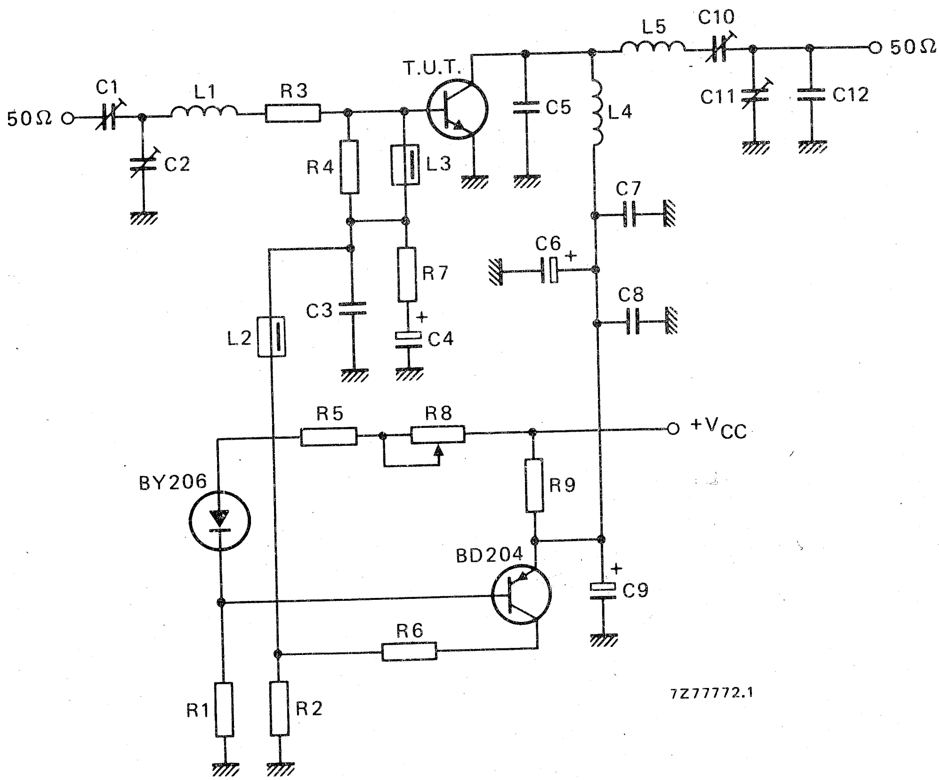


Fig. 8 Test circuit; s.s.b. class-A.

List of components on page 6.

* Stated intermodulation distortion figures are referred to the according level of either of the equal amplified tones. Relative to the according peak envelope powers these figures should be increased by 6 dB.

List of components in Fig. 8:

C1 = C2 = 10 to 780 pF film dielectric trimmer
C3 = 22 nF ceramic capacitor (63 V)
C4 = 47 μF/10 V electrolytic capacitor
C5 = 56 pF ceramic capacitor (500 V)
C6 = 47 μF/35 V electrolytic capacitor
C7 = C8 = 220 nF polyester capacitor
C9 = 10 μF/35 V electrolytic capacitor
C10 = C11 = 7 to 100 pF film dielectric trimmer
C12 = 82 pF ceramic capacitor (500 V)

L1 = 3 turns closely wound enamelled Cu wire (1,6 mm); int. dia. 9,0 mm; leads to 2 x 5 mm
L2 = L3 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L4 = 11 turns closely wound enamelled Cu wire (1,6 mm); int. dia. 11,0 mm
L5 = 14 turns closely wound enamelled Cu wire (1,6 mm); int. dia. 11,0 mm

R1 = 600 Ω; parallel connection of 2 x 1,2 kΩ carbon resistors (±5%; 0,5 W each)
R2 = 15 Ω carbon resistor (±5%; 0,25 W)
R3 = 1,2 Ω; parallel connection of 4 x 4,7 Ω carbon resistors (±5%; 0,125 W each)
R4 = 33 Ω carbon resistor (±5%; 0,25 W)
R5 = 18 Ω carbon resistor (±5%; 0,25 W)
R6 = 120 Ω wirewound resistor (±5%; 5,5 W)
R7 = 1 Ω carbon resistor (±5%; 0,125 W)
R8 = 47 Ω wirewound potentiometer (3 W)
R9 = 1,57 Ω; parallel connection of 3 x 4,7 Ω wirewound resistors (±5%; 5,5 W each)

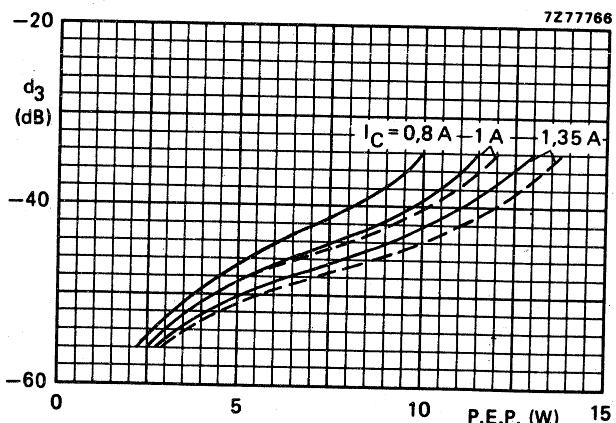


Fig. 9 Intermodulation distortion as a function of output power.
Typical values; V_{CE} = 26 V; —— T_h = 70 °C; ---- T_h = 25 °C.

R.F. performance in s.s.b. class-AB operation (linear power amplifier)

V_{CE} = 28 V; f_1 = 28,000 MHz; f_2 = 28,001 MHz

output power W	G_p dB	η_{dt} (%) at 30 W P.E.P.	I_C (A) at 30 W P.E.P.	d_3 dB*	d_5 dB*	$I_{C(ZS)}$ mA	T_h °C
3 to 30 (P.E.P.)	typ. 21	typ. 40	typ. 1,34	typ. −30	< −30	25	25
3 to 25 (P.E.P.)	typ. 21	—	—	typ. −30	< −30	25	70

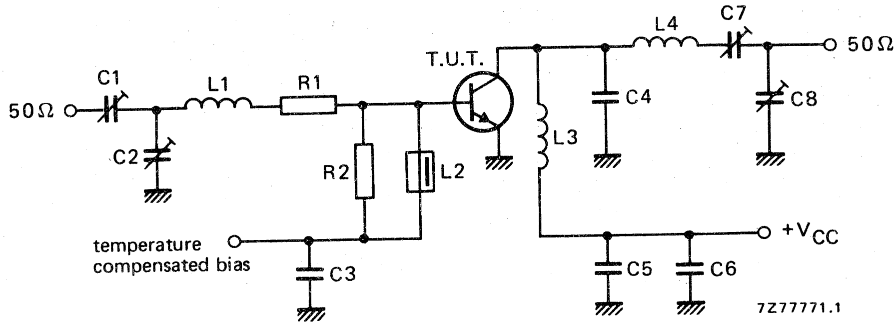


Fig. 10 Test circuit; s.s.b. class-AB.

List of components:

C1 = C2 = 10 to 780 pF film dielectric trimmer
C3 = C5 = C6 = 220 nF polyester capacitor
C4 = 56 pF ceramic capacitor (500 V)
C7 = C8 = 15 to 575 pF film dielectric trimmer

L1 = 4 turns closely wound enamelled Cu wire (1,6 mm); int. dia. 7,0 mm; leads 2 x 5 mm
L2 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L3 = 4 turns enamelled Cu wire (1,6 mm); int. dia. 10 mm; length 9,4 mm; leads 2 x 5 mm
L4 = 7 turns enamelled Cu wire (1,6 mm); int. dia. 12 mm; length 17,2 mm; leads 2 x 5 mm

R1 = 1,2 Ω; parallel connection of 4 x 4,7 Ω carbon resistors
R2 = 39 Ω carbon resistor

* Stated intermodulation distortion figures are referred to the according level of either of the equal amplified tones. Relative to the according peak envelope powers these figures should be increased by 6 dB.

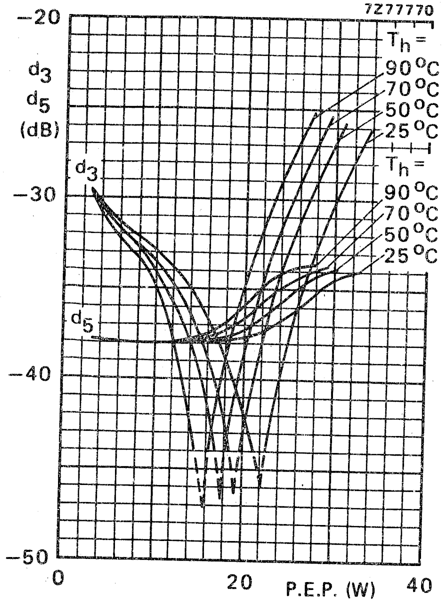


Fig. 11 Intermodulation distortion as a function of output power.*

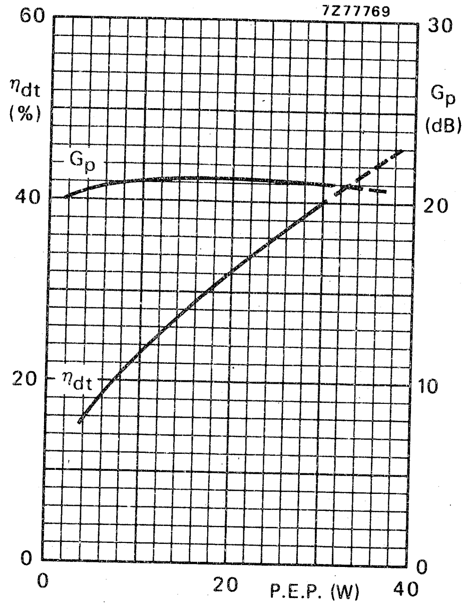


Fig. 12 Double-tone efficiency and power gain as a function of output power.

Conditions for Fig. 11:

V_{CE} = 28 V; $I_{C(ZS)}$ = 25 mA; f_1 = 28,000 MHz; f_2 = 28,001 MHz; typical values.

Conditions for Fig. 12:

V_{CE} = 28 V; $I_{C(ZS)}$ = 25 mA; f_1 = 28,000 MHz; f_2 = 28,001 MHz; T_h = 25 °C; typical values.

* See note on page 7.

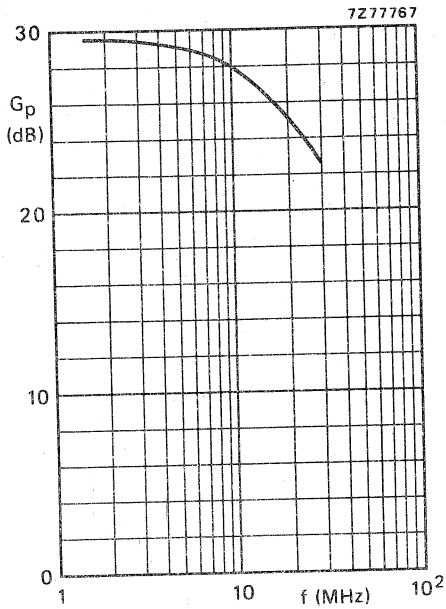


Fig. 13 Power gain as a function of frequency.

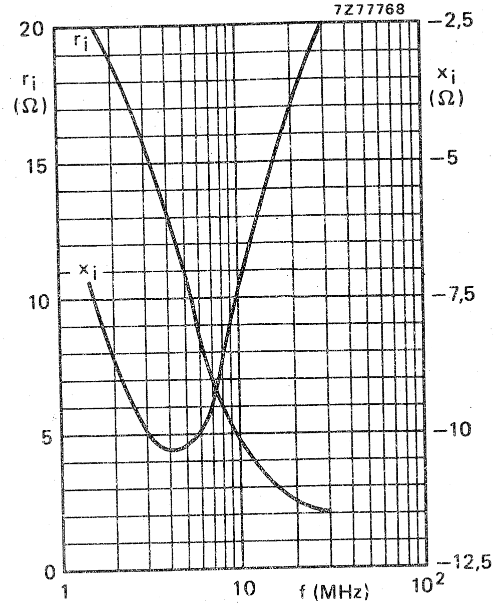


Fig. 14 Input impedance (series components) as a function of frequency.

Figs 13 and 14 are typical curves and hold for an unneutralized amplifier in s.s.b. class-AB operation.

Conditions:

V_{CE} = 28 V; $I_{C(ZS)}$ = 25 mA; P_L = 30 W; T_h = 25 °C; Z_L = 9,5 Ω.

Ruggedness in s.s.b. operation

The BLW83 is capable of withstanding a load mismatch (VSWR = 50) under the following conditions: f_1 = 28,000 MHz; f_2 = 28,001 MHz; V_{CE} = 28 V; T_h = 70 °C and P_{Lnom} = 35 W (P.E.P.).

V.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor intended for use in class-A, B and C operated v.h.f. transmitters with a nominal supply voltage of 28 V. The transistor is resistance stabilized and is guaranteed to withstand severe load mismatch conditions.

It has a 3/8" flange envelope with a ceramic cap. All leads are isolated from the flange.

QUICK REFERENCE DATA

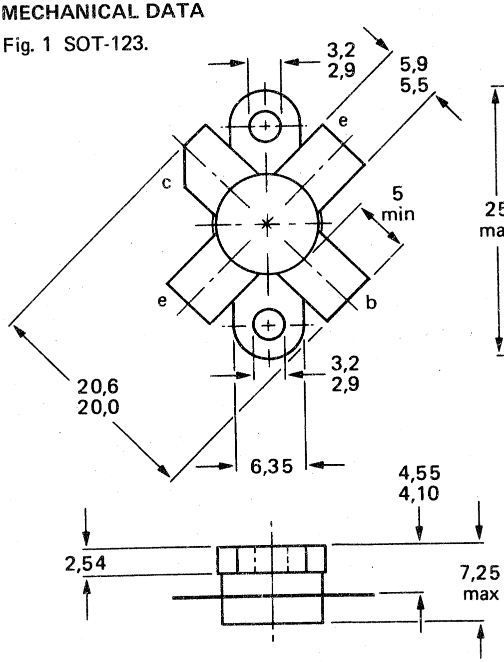
R.F. performance up to T_h = 25 °C in an unneutralized common-emitter class-B circuit

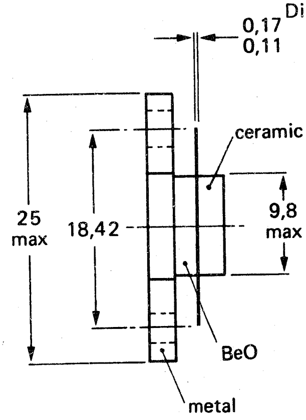
mode of operation	V_{CE} V	f MHz	P_L W	G_p dB	η %	$\overline{z_i}$ Ω	$\overline{Y_L}$ mA/V
c.w.	28	175	25	> 9	> 60	1,0 + j1,2	59 – j54

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-123.





7Z77386.1

Torque on screw: min. 0,6 Nm (6 kg cm)
max. 0,75 Nm (7,5 kg cm)

Recommended screw: cheese-head
4–40 UNC/2A

Heatsink compound must be applied sparingly and evenly distributed.

CAUTION This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage (V_{BE} = 0) peak value	V_{CESM}	max.	65 V
Collector-emitter voltage (open base)	V_{CEO}	max.	36 V
Emitter-base voltage (open collector)	V_{EBO}	max.	4 V
Collector current (average)	$I_{C(AV)}$	max.	3 A
Collector current (peak value); f > 1 MHz	I_{CM}	max.	9 A
R.F. power dissipation (f > 1 MHz); T_{mb} = 25 °C	P_{rf}	max.	76 W
Storage temperature	T_{stg}	−65 to + 150 °C	
Operating junction temperature	T_j	max.	200 °C

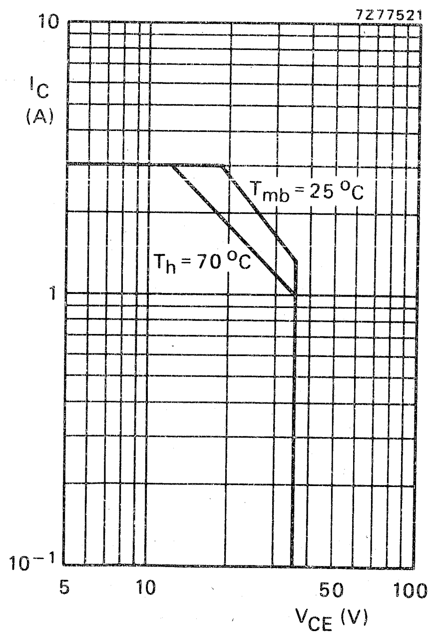


Fig. 2 D.C. SOAR.

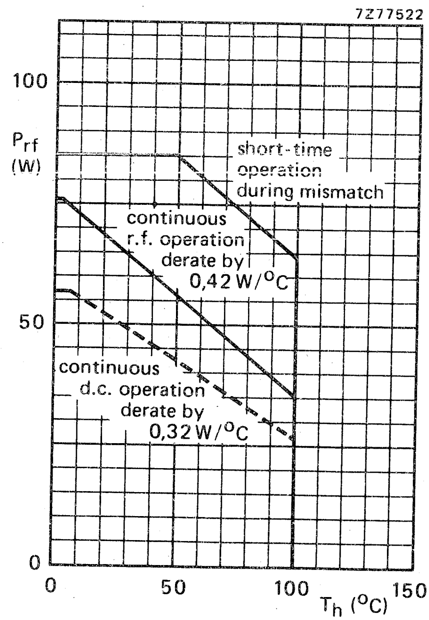


Fig. 3 R.F. power dissipation; $V_{CE} \leqslant 28$ V; f ⩾ 1 MHz.

THERMAL RESISTANCE (dissipation = 20 W; T_{mb} = 76 °C, i.e. T_h = 70 °C)

From junction to mounting base (d.c. dissipation)	$R_{th\ j\text{-}mb\ (dc)}$	=	3,0 °C/W
From junction to mounting base (r.f. dissipation)	$R_{th\ j\text{-}mb\ (rf)}$	=	2,25 °C/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,3 °C/W

CHARACTERISTICS

$T_j = 25\ ^oC$

Collector-emitter breakdown voltage $V_{BE} = 0$; $I_C = 10$ mA	$V_{(BR)CES}$	>	65 V
Collector-emitter breakdown voltage open base; $I_C = 50$ mA	$V_{(BR)CEO}$	>	36 V
Emitter-base breakdown voltage open collector; $I_E = 10$ mA	$V_{(BR)EBO}$	>	4 V
Collector cut-off current $V_{BE} = 0$; $V_{CE} = 36$ V	I_{CES}	<	4 mA
Second breakdown energy; L = 25 mH; f = 50 Hz open base	E_{SBO}	>	8 mJ
$R_{BE} = 10\ \Omega$	E_{SBR}	>	8 mJ
D.C. current gain * $I_C = 1,25$ A; $V_{CE} = 5$ V	h_{FE}	typ.	45 10 to 100
Collector-emitter saturation voltage * $I_C = 3,75$ A; $I_B = 0,75$ A	V_{CEsat}	typ.	1,5 V
Transition frequency at f = 100 MHz * $-I_E = 1,25$ A; $V_{CB} = 28$ V	f_T	typ.	650 MHz
$-I_E = 3,75$ A; $V_{CB} = 28$ V	f_T	typ.	650 MHz
Collector capacitance at f = 1 MHz $I_E = I_e = 0$; $V_{CB} = 28$ V	C_c	typ.	45 pF
Feedback capacitance at f = 1 MHz $I_C = 100$ mA; $V_{CE} = 28$ V	C_{re}	typ.	28 pF
Collector-flange capacitance	C_{cf}	typ.	2 pF

* Measured under pulse conditions: $t_p \leqslant 200\ \mu s$; $\delta \leqslant 0,02$.

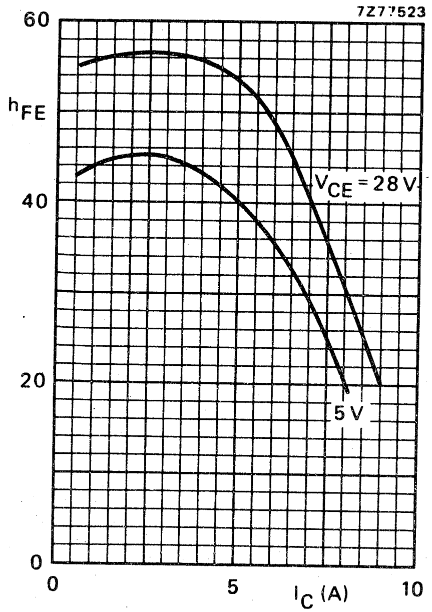


Fig. 4 Typical values; T_j = 25 °C.

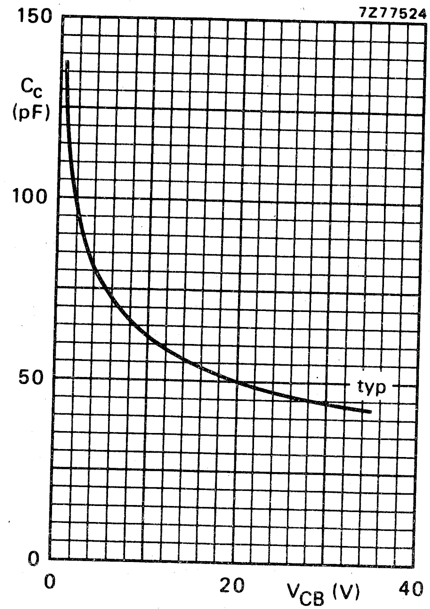


Fig. 5 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

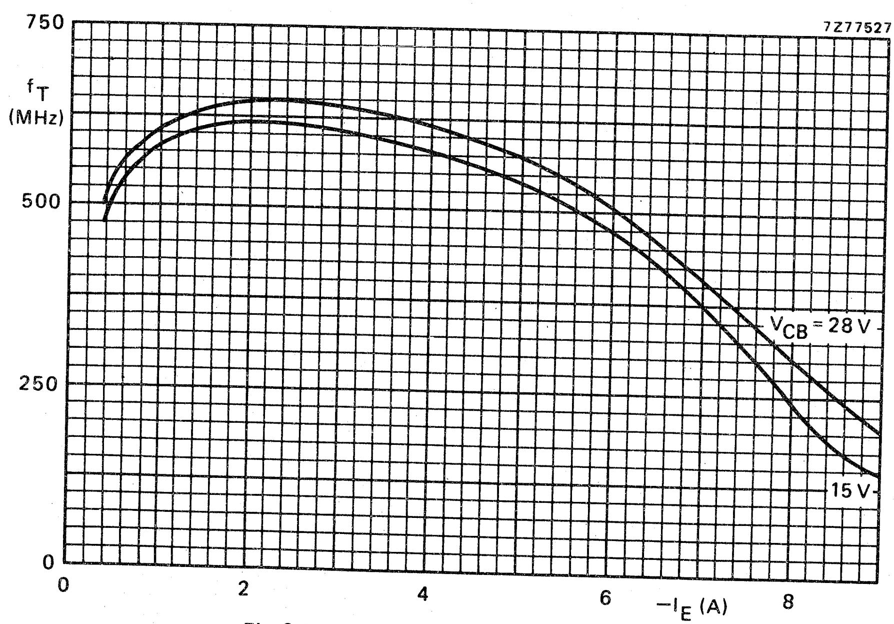


Fig. 6 Typical values; f = 100 MHz; T_j = 25 °C.

APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit)

T_h = 25 °C

f (MHz)	V_{CE} (V)	P_L (W)	P_S (W)	G_p (dB)	I_C (A)	η (%)	$\overline{z_i}$ (Ω)	$\overline{Y_L}$ (mA/V)
175	**28**	**25**	**< 3,15**	**> 9**	**< 1,49**	**> 60**	**1,0 + j1,2**	**59−j54**

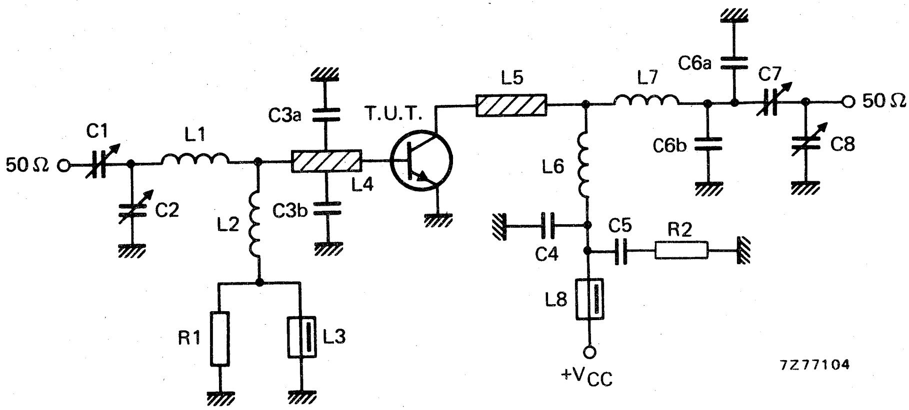


Fig. 7 Test circuit; c.w. class-B.

List of components
C1 = C7 = 2,5 to 20 pF film dielectric trimmer (cat. no. 2222 809 07004)
C2 = 5 to 60 pF film dielectric trimmer (cat. no. 2222 809 07011)
C3a = C3b = 47 pF ceramic capacitor (500 V)
C4 = 120 pF ceramic capacitor (500 V)
C5 = 100 nF (± 10%) polyester capacitor
C6a = 2,2 pF ceramic capacitor (500 V)
C6b = 1,8 pF ceramic capacitor (500 V)
C8 = 4 to 40 pF film dielectric trimmer (cat. no. 2222 809 07008)

L1 = 14 nH; 1 turn enamelled Cu wire (1,6 mm); int. dia. 7,7 mm; leads 2 x 5 mm
L2 = 100 nH; 7 turns closely wound enamelled Cu wire (0,5 mm); int. dia. 3 mm; leads 2 x 5 mm
L3 = L8 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L4 = L5 = strip (12 mm x 6 mm); taps for C3a and C3b at 5 mm from transistor
L6 = 80 nH; 3 turns enamelled Cu wire (1,6 mm); int. dia. 9,0 mm; length 8,0 mm; leads 2 x 5 mm
L7 = 62 nH; 3 turns enamelled Cu wire (1,6 mm); int. dia. 7,5 mm; length 8,1 mm; leads 2 x 5 mm

L4 and L5 are strips on a double Cu-clad printed-circuit board with epoxy fibre-glass dielectric, thickness 1/16".

R1 = R2 = 10 Ω (± 10%) carbon resistor (0,25 W)

Component layout and printed-circuit board for 175 MHz test circuit are shown in Fig. 8.

APPLICATION INFORMATION (continued)

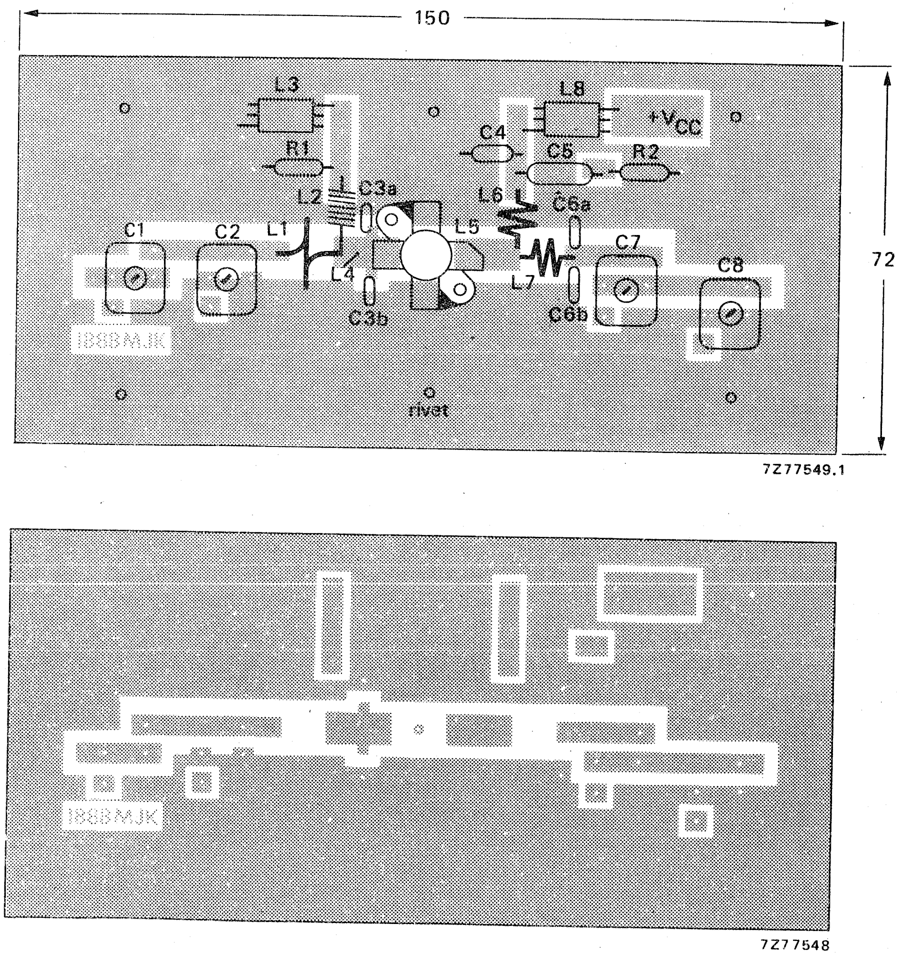


Fig. 8 Component layout and printed-circuit board for 175 MHz test circuit.

The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets, whilst under the emitter leads Cu straps are used for a direct contact between upper and lower sheets.

To minimize the dielectric losses, the ground plane under the interconnection of L7 and C7 has been removed.

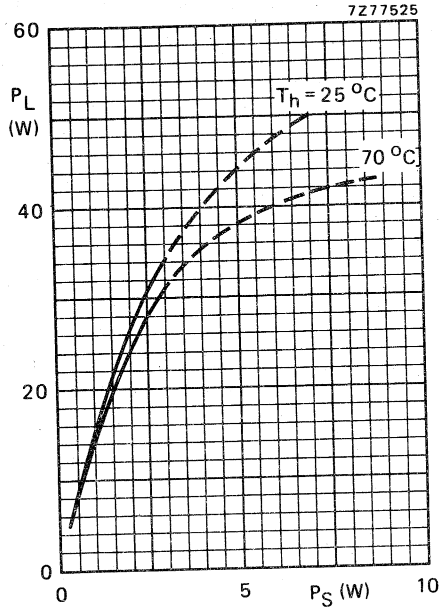


Fig. 9 $V_{CE} = 28$ V; f = 175 MHz; typical values.

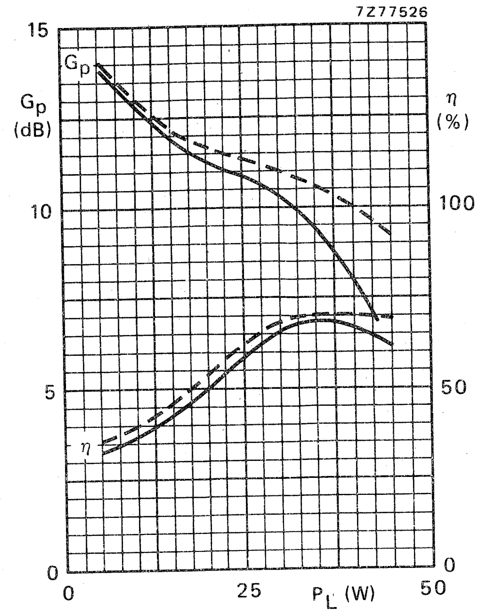


Fig. 10 $V_{CE} = 28$ V; f = 175 MHz; typical values;
– – – $T_h = 25\ ^oC$; ——— $T_h = 70\ ^oC$.

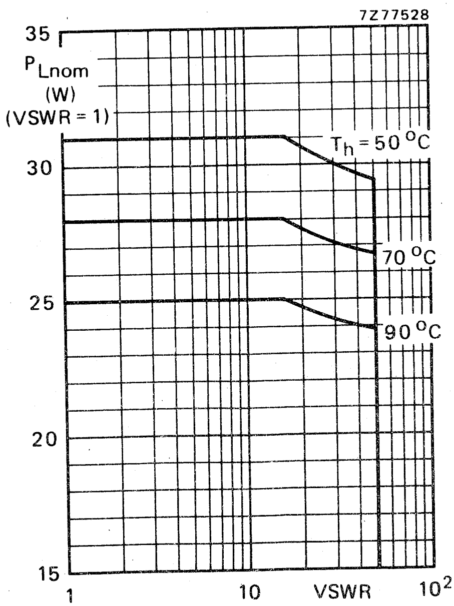


Fig. 11 R.F. SOAR; c.w. class-B operation;
f = 175 MHz; $V_{CE} = 28$ V; $R_{th\ mb-h} = 0{,}3\ ^oC/W$.

The graph shows the permissible output power under nominal conditions (VSWR = 1) as a function of the expected VSWR during short-time mismatch conditions with heatsink temperatures as parameter.

OPERATING NOTE Below 70 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation. This resistor must be effective for r.f. only.

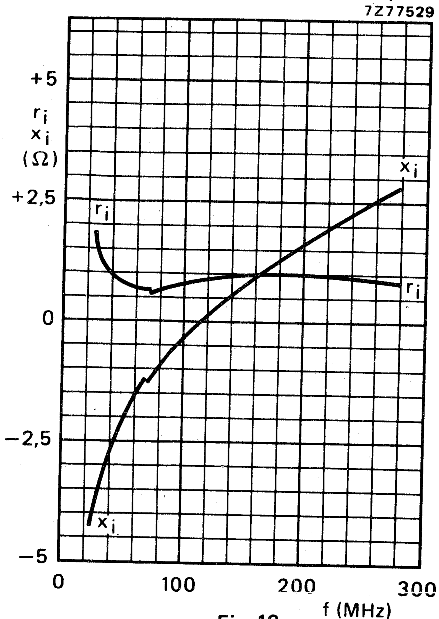


Fig. 12.

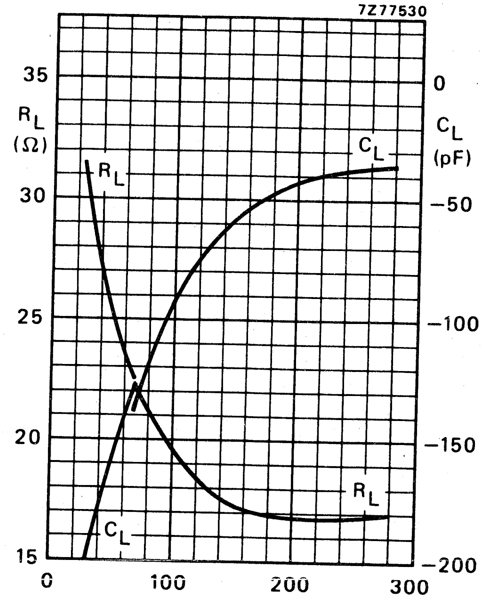
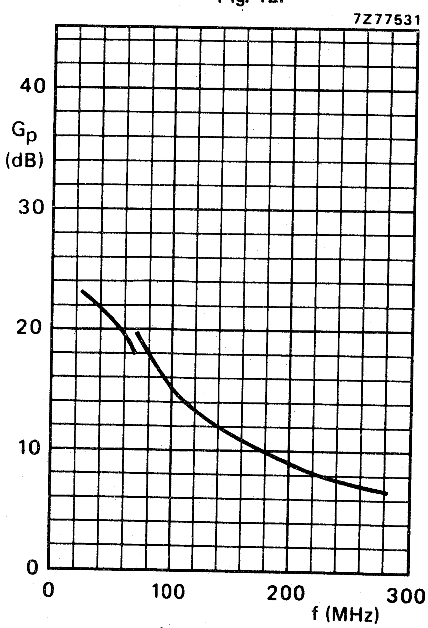


Fig. 13.



Conditions for Figs 12, 13 and 14:

Typical values; V_{CE} = 28 V; P_L = 25 W; T_h = 25 °C.

Fig. 14.

H.F./V.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor intended for use in class-A, B and C operated mobile h.f. and v.h.f. transmitters with a nominal supply voltage of 12,5 V. The transistor is resistance stabilized and is guaranteed to withstand severe load mismatch conditions with a supply over-voltage to 16,5 V. Matched h_{FE} groups are available on request.

It has a 3/8" flange envelope with a ceramic cap. All leads are isolated from the flange.

QUICK REFERENCE DATA

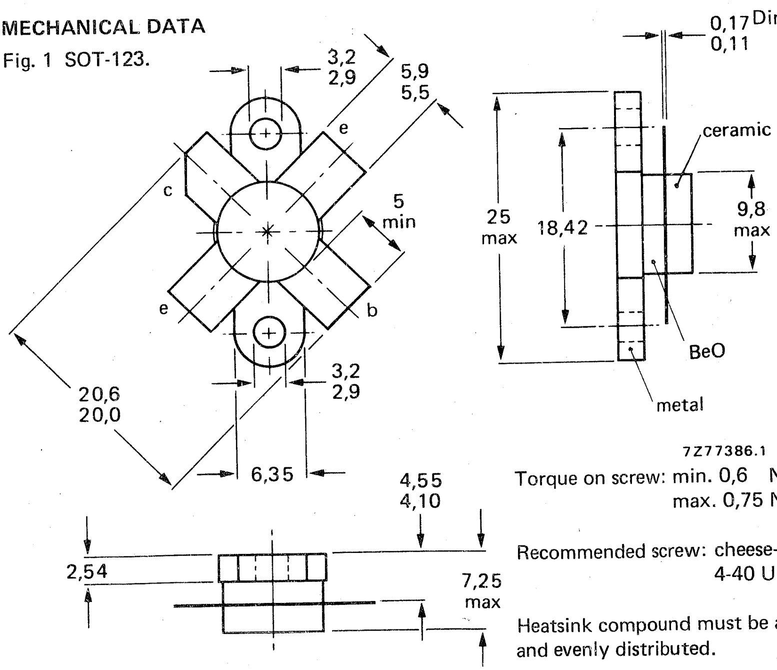
R.F. performance up to T_h = 25 °C

mode of operation	V_{CE} V	f MHz	P_L W	G_p dB	η %	$\overline{z_i}$ Ω	$\overline{Z_L}$ Ω	d_3 dB
c.w. (class-B)	**12,5**	**175**	**45**	**> 4,5**	**> 75**	**1,4 + j1,5**	**2,7 − j1,3**	–
s.s.b. (class-AB)	12,5	1,6–28	3–30 (P.E.P.)	typ. 19,5	typ. 35	–	–	typ. −33

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-123.



Torque on screw: min. 0,6 Nm (6 kg cm)
max. 0,75 Nm (7,5 kg cm)

Recommended screw: cheese-head 4-40 UNC/2A

Heatsink compound must be applied sparingly and evenly distributed.

CAUTION This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage ($V_{BE} = 0$) peak value	V_{CESM}	max.	36	V
Collector-emitter voltage (open base)	V_{CEO}	max.	18	V
Emitter-base voltage (open-collector)	V_{EBO}	max.	4	V
Collector current (average)	$I_{C(AV)}$	max.	9	A
Collector current (peak value); f > 1 MHz	I_{CM}	max.	22	A
R.F. power dissipation (f > 1 MHz); T_{mb} = 25 °C	P_{rf}	max.	105	W
Storage temperature	T_{stg}		− 65 to + 150	°C
Operating junction temperature	T_j	max.	200	°C

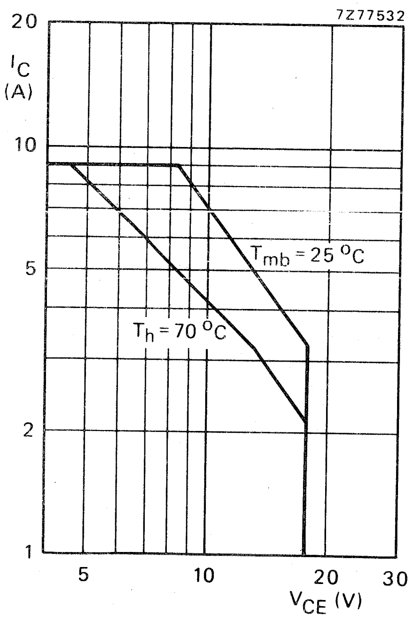


Fig. 2 D.C. SOAR.

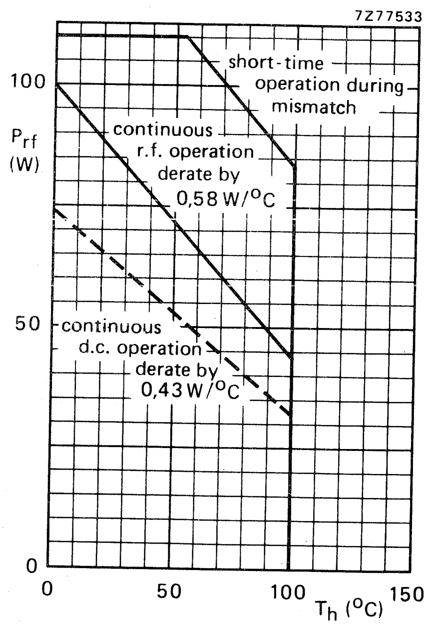


Fig. 3 R.F. power dissipation; $V_{CE} \leqslant 16{,}5$ V; f ⩾ 1 MHz.

THERMAL RESISTANCE (dissipation = 30 W; T_{mb} = 79 °C, i.e. T_h = 70 °C)

From junction to mounting base (d.c. dissipation)	$R_{th\ j\text{-}mb(dc)}$	=	2,5 °C/W
From junction to mounting base (r.f. dissipation)	$R_{th\ j\text{-}mb(rf)}$	=	1,8 °C/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,3 °C/W

CHARACTERISTICS

$T_j = 25\ ^oC$

Collector-emitter breakdown voltage $V_{BE} = 0$; $I_C = 50$ mA	$V_{(BR)CES}$	>	36 V
Collector-emitter breakdown voltage open base; $I_C = 100$ mA	$V_{(BR)CEO}$	>	18 V
Emitter-base breakdown voltage open collector; $I_E = 25$ mA	$V_{(BR)EBO}$	>	4 V
Collector cut-off current $V_{BE} = 0$; $V_{CE} = 18$ V	I_{CES}	<	25 mA
Second breakdown energy; L = 25 mH; f = 50 Hz open base	E_{SBO}	>	8 mJ
$R_{BE} = 10\ \Omega$	E_{SBR}	>	8 mJ
D.C. current gain* $I_C = 4$ A; $V_{CE} = 5$ V	h_{FE}	typ.	50 10 to 80
D.C. current gain ratio of matched devices* $I_C = 4$ A; $V_{CE} = 5$ V	h_{FE1}/h_{FE2}	<	1,2
Collector-emitter saturation voltage* $I_C = 12,5$ A; $I_B = 2,5$ A	V_{CEsat}	typ.	1,5 V
Transition frequency at f = 100 MHz* $-I_E = 4$ A; $V_{CB} = 12,5$ V	f_T	typ.	650 MHz
$-I_E = 12,5$ A; $V_{CB} = 12,5$ V	f_T	typ.	600 MHz
Collector capacitance at f = 1 MHz $I_E = I_e = 0$; $V_{CB} = 15$ V	C_c	typ.	120 pF
Feedback capacitance at f = 1 MHz $I_C = 200$ mA; $V_{CE} = 15$ V	C_{re}	typ.	82 pF
Collector-flange capacitance	C_{cf}	typ.	2 pF

* Measured under pulse conditions: $t_p \leqslant 200\ \mu s$; $\delta \leqslant 0,02$.

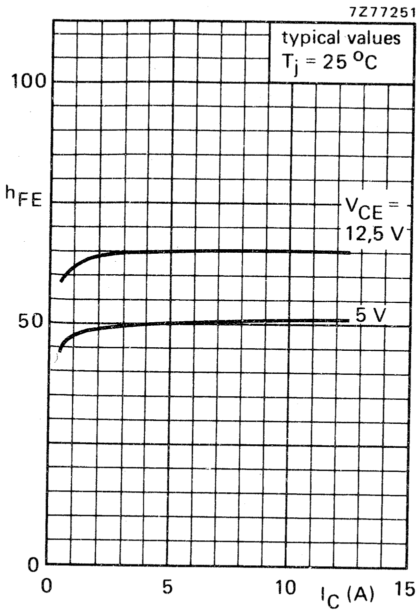


Fig. 4.

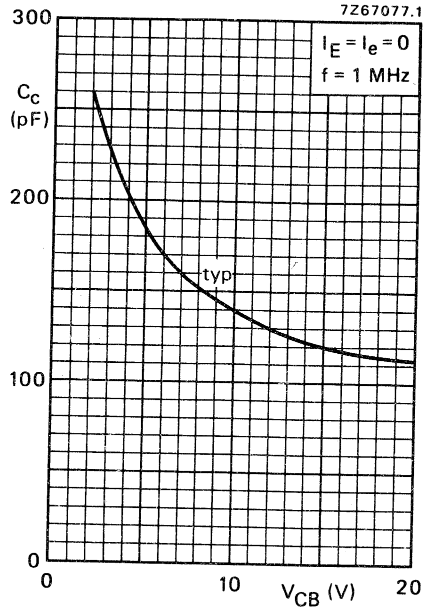


Fig. 5 T_j = 25 °C.

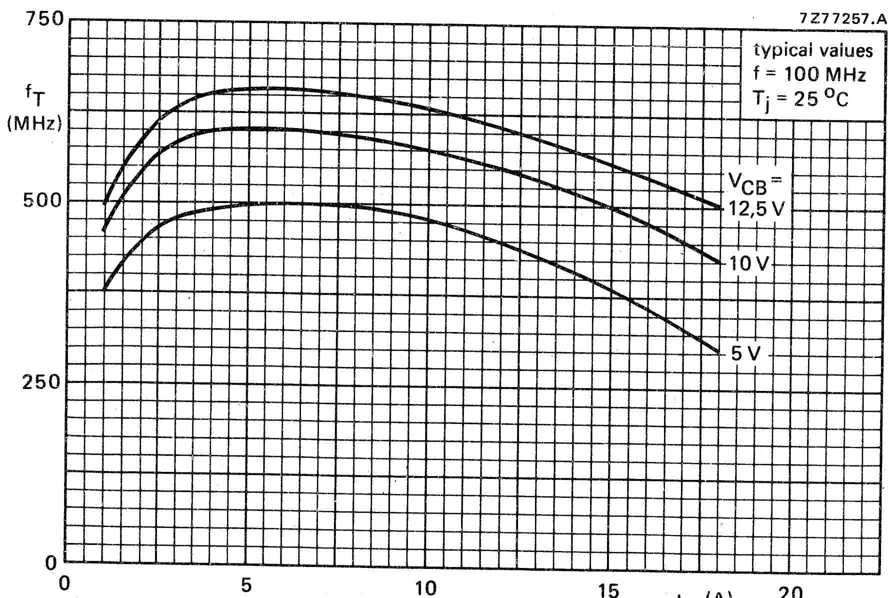


Fig. 6.

APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit)

T_h = 25 °C

f (MHz)	V_{CE} (V)	P_L (W)	P_S (W)	G_p (dB)	I_C (A)	η (%)	$\overline{z_i}$ (Ω)	$\overline{Z_L}$ (Ω)
175	**12,5**	**45**	**< 16**	**> 4,5**	**< 4,8**	**> 75**	**1,4 + j1,5**	**2,7 − j1,3**
175	13,5	45	–	typ. 6,0	–	typ. 75	–	–

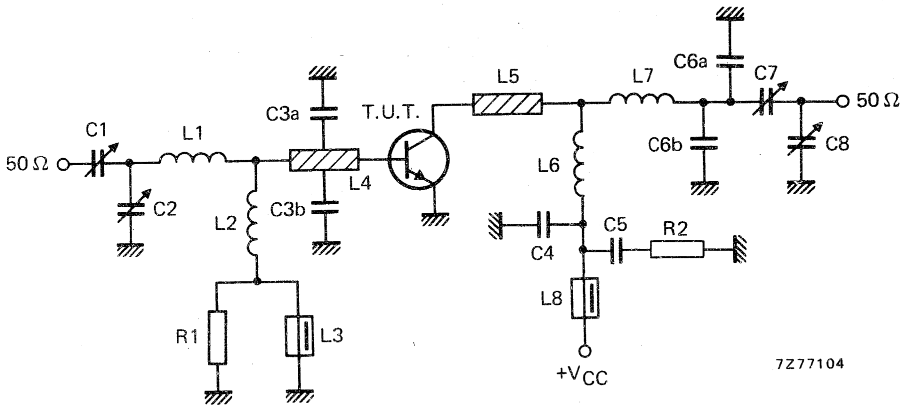


Fig. 7 Test circuit; c.w. class-B.

List of components:

C1 = 2,5 to 20 pF film dielectric trimmer (cat. no. 2222 809 07004)
C2 = C8 = 4 to 40 pF film dielectric trimmer (cat. no. 2222 809 07008)
C3a = C3b = 47 pF ceramic capacitor (500 V)
C4 = 120 pF ceramic capacitor (500 V)
C5 = 100 nF polyester capacitor
C6a = C6b = 8,2 pF ceramic capacitor (500 V)
C7 = 5 to 60 pF film dielectric trimmer (cat. no. 2222 809 07011)

L1 = 1 turn Cu wire (1,6 mm); int. dia. 9,0 mm; leads 2 x 5 mm
L2 = 100 nH; 7 turns closely wound enamelled Cu wire (0,5 mm); int. dia. 3 mm; leads 2 x 5 mm
L3 = L8 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L4 = L5 = strip (12 mm x 6 mm); taps for C3a and C3b at 5 mm from transistor
L6 = 2 turns enamelled Cu wire (1,6 mm); int. dia. 5,0 mm; length 6,0 mm; leads 2 x 5 mm
L7 = 2 turns enamelled Cu wire (1,6 mm); int. dia. 4,5 mm; length 6,0 mm; leads 2 x 5 mm

L4 and L5 are strips on a double Cu-clad printed-circuit board with epoxy fibre-glass dielectric, thickness 1/16".

R1 = 10 Ω (±10%) carbon resistor (0,25 W)
R2 = 4,7 Ω (±5%) carbon resistor (0,25 W)

Component layout and printed-circuit board for 175 MHz test circuit are shown in Fig. 8.

APPLICATION INFORMATION (continued)

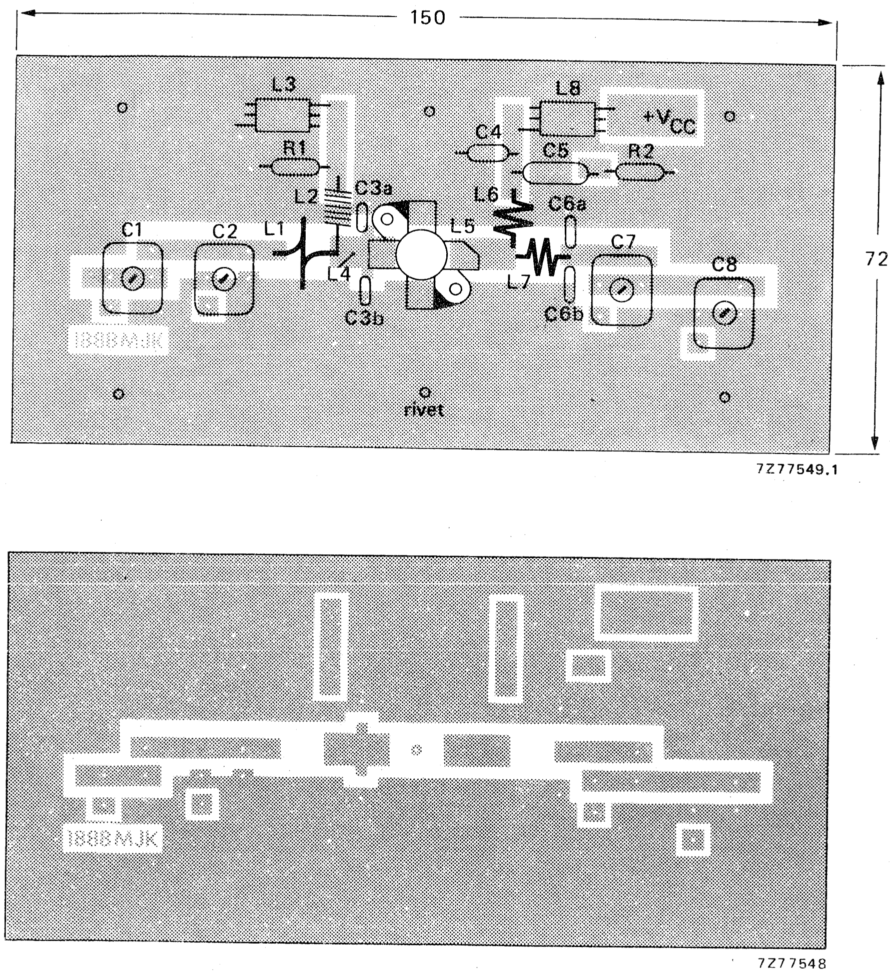


Fig. 8 Component layout and printed-circuit board for 175 MHz test circuit.

The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets, whilst under the emitter leads Cu straps are used for a direct contact between upper and lower sheets.

To minimize the dielectric losses, the ground plane under the interconnection of L7 and C7 has been removed.

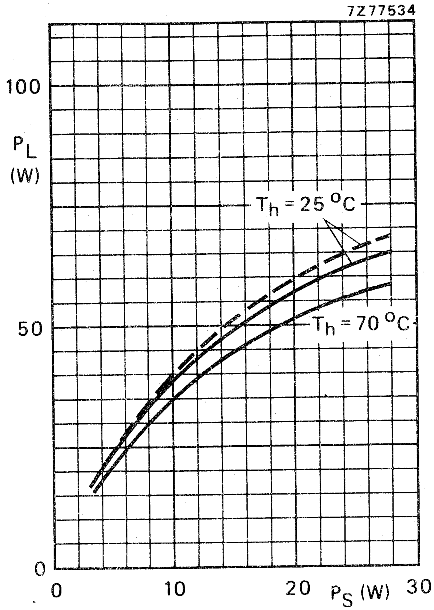


Fig. 9 Typical values; f = 175 MHz;
—— V_{CE} = 12,5 V; – – – V_{CE} = 13,5 V.

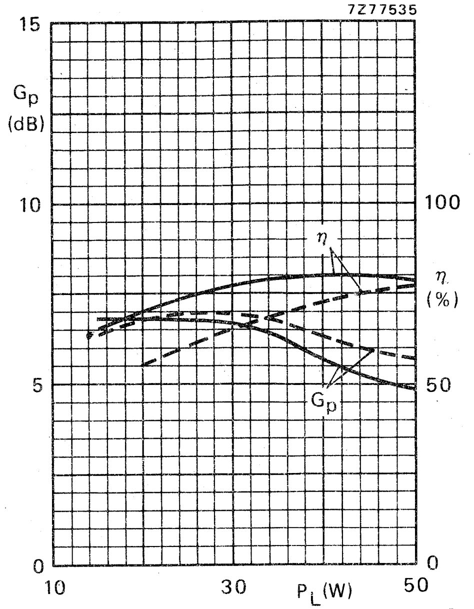


Fig. 10 Typical values; f = 175 MHz; T_h = 25 °C;
—— V_{CE} = 12,5 V; – – – V_{CE} = 13,5 V.

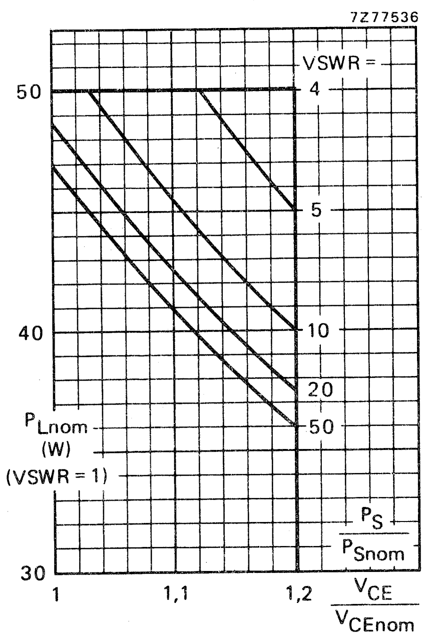


Fig. 11 R.F. SOAR (short-time operation during mismatch); f = 175 MHz; T_h = 70 °C;
$R_{th\ mb-h}$ = 0,3 °C/W; V_{CEnom} = 12,5 V or 13,5 V;
$P_S = P_{Snom}$ at V_{CEnom} and VSWR = 1 (see page 5).

The transistor has been developed for use with unstabilized supply voltages. As the output power and drive power increase with the supply voltage, the nominal output power must be derated in accordance with the graph for safe operation at supply voltages other than the nominal. The graph shows the permissible output power under nominal conditions (VSWR = 1), as a function of the expected supply over-voltage ratio with VSWR as parameter.

The graph applies to the situation in which the drive (P_S/P_{Snom}) increases linearly with supply over-voltage ratio.

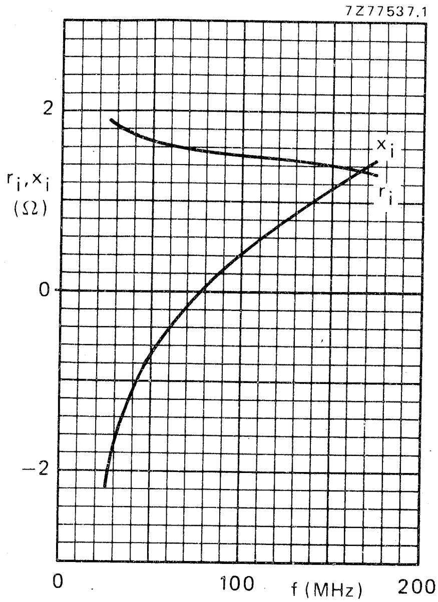


Fig. 12 Input impedance (series components).

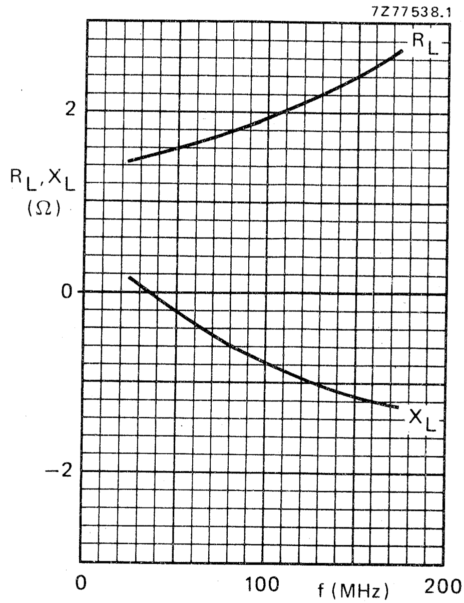


Fig. 13 Load impedance (series components).

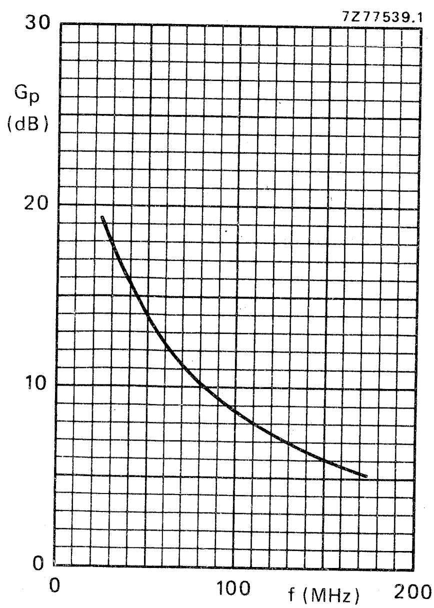


Fig. 14.

Conditions for Figs 12, 13 and 14:

Typical values; V_{CE} = 12,5 V; P_L = 45 W; class-B operation; T_h = 25 °C.

R.F. performance in s.s.b. class-AB operation

V_{CE} = 12,5 V; T_h up to 25 °C; $R_{th\ mb-h}$ ≤ 0,3 °C/W
f_1 = 28,000 MHz; f_2 = 28,001 MHz

output power W	G_p dB	η_{dt} %	d_3 dB*	d_5 dB*	$I_{C(ZS)}$ mA
3 to 30 (P.E.P.)	typ. 19,5	typ. 35	typ. −33	typ. −36	25

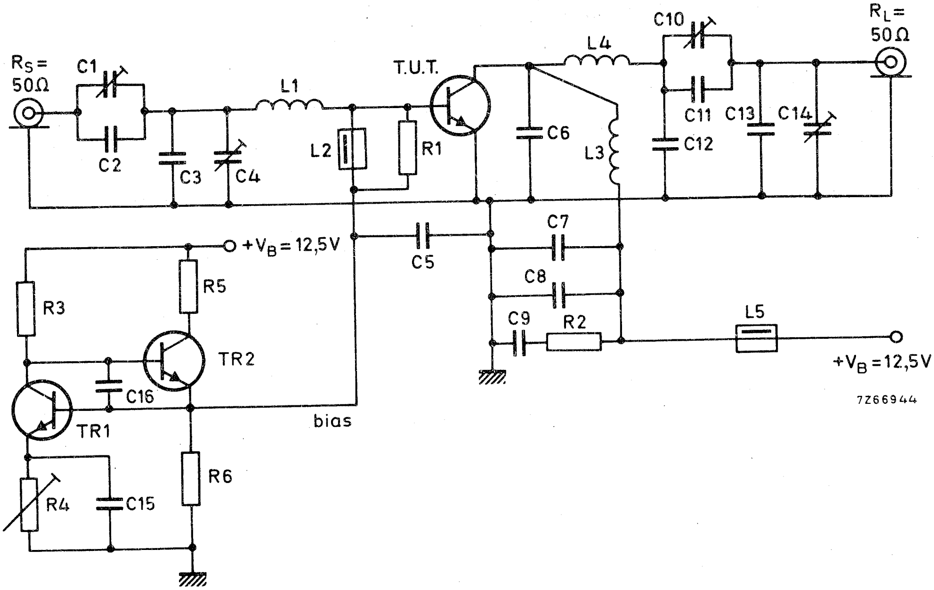


Fig. 15 Test circuit; s.s.b. class-AB.

List of components:

TR1 = TR2 = BD137

C1 = 100 pF air dielectric trimmer (single insulated rotor type)
C2 = 27 pF ceramic capacitor (500 V)
C3 = 180 pF polystyrene capacitor
C4 = 100 pF air dielectric trimmer (single non-insulated rotor type)
C5 = C7 = 3,9 nF polyester capacitor
C6 = 2 x 270 pF polystyrene capacitors in parallel
C8 = C15 = C16 = 100 nF polyester capacitor
C9 = 2,2 μF moulded metallized polyester capacitor
C10 = 2 x 385 pF (sections in parallel) film dielectric trimmer
C11 = 68 pF ceramic capacitor (500 V)

* Stated intermodulation distortion figures are referred to the according level of either of the equal amplified tones. Relative to the according peak envelope powers these figures should be increased by 6 dB.

APPLICATION INFORMATION (continued)

List of components (continued)

C12 = 2 x 82 pF ceramic capacitors in parallel (500 V)
C13 = 47 pF ceramic capacitor (500 V)
C14 = 385 pF film dielectric trimmer

L1 = 88 nH; 3 turns Cu wire (1,0 mm); int. dia. 9 mm; length 6,1 mm; leads 2 x 5 mm
L2 = L5 = Ferroxcube choke coil (cat. no. 4312 020 36640)
L3 = 68 nH; 3 turns enamelled Cu wire (1,6 mm); int. dia. 8 mm; length 8,3 mm; leads 2 x 5 mm
L4 = 96 nH; 3 turns enamelled Cu wire (1,6 mm); int. dia. 10 mm; length 7,6 mm; leads 2 x 5 mm

R1 = 27 Ω (±5%) carbon resistor (0,5 W)
R2 = 4,7 Ω (±5%) carbon resistor (0,25 W)
R3 = 1,5 kΩ (±5%) carbon resistor (0,5 W)
R4 = 10 Ω wirewound potentiometer (3 W)
R5 = 47 Ω wirewound resistor (5,5 W)
R6 = 150 Ω (±5%) carbon resistor (0,25 W)

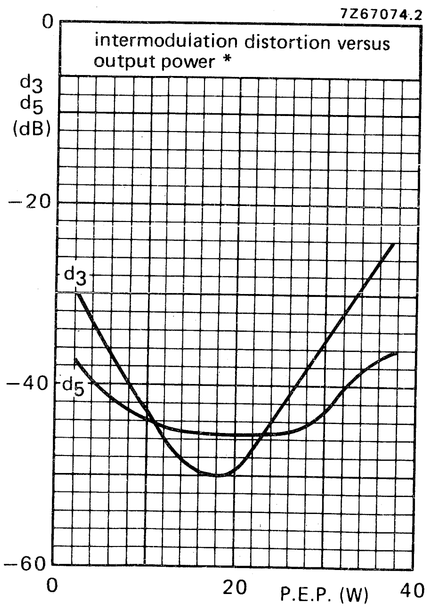


Fig. 16.

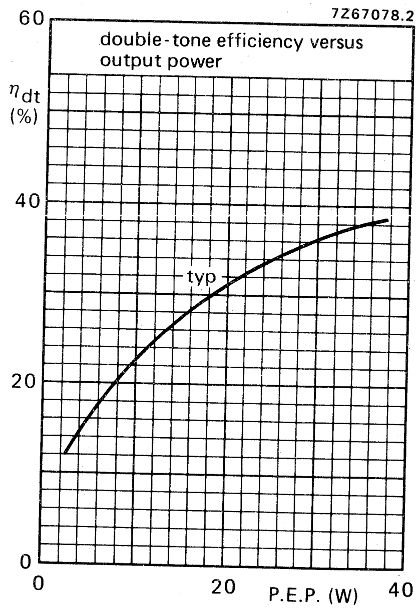


Fig. 17.

Conditions for Figs 16 and 17:

V_{CE} = 12,5 V; f_1 = 28,000 MHz; f_2 = 28,001 MHz; T_h = 25 °C; $R_{th\ mb\text{-}h} \leq 0{,}3$ °C/W; $I_{C(ZS)}$ = 25 mA; typical values.

* See page 11.

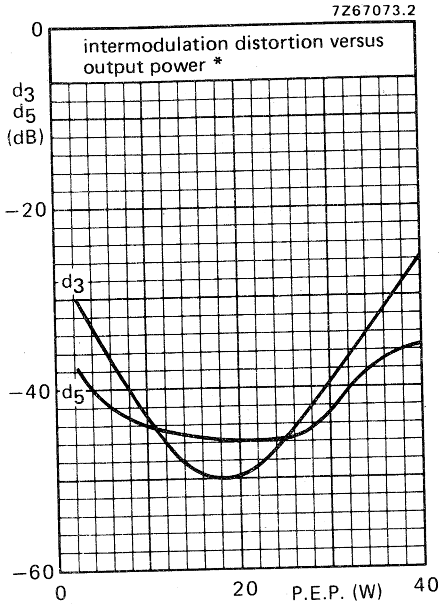


Fig. 18.

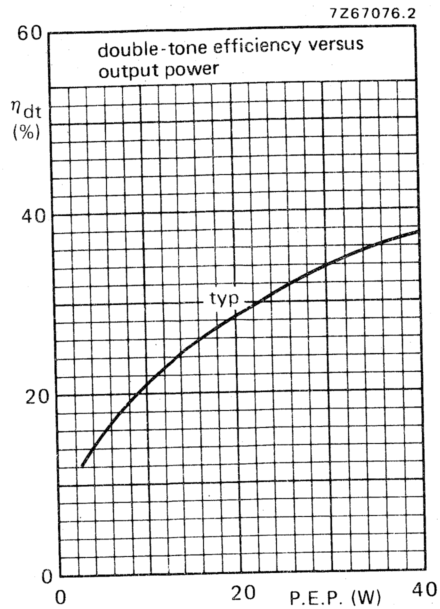


Fig. 19.

Conditions for Figs 18 and 19:
V_{CE} = 13,5 V; f_1 = 28,000 MHz; f_2 = 28,001 MHz; T_h = 25 °C; $R_{th\ mb\text{-}h}$ ≤ 0,3 °C/W; $I_{C(ZS)}$ = 25 mA; typical values.

* Stated intermodulation distortion figures are referred to the according level of either of the equal amplified tones. Relative to the according peak envelope powers these figures should be increased by 6 dB.

APPLICATION INFORMATION (continued)

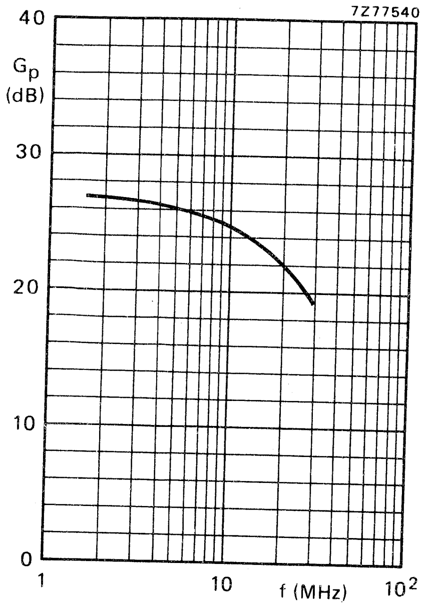


Fig. 20 Power gain as a function of frequency.

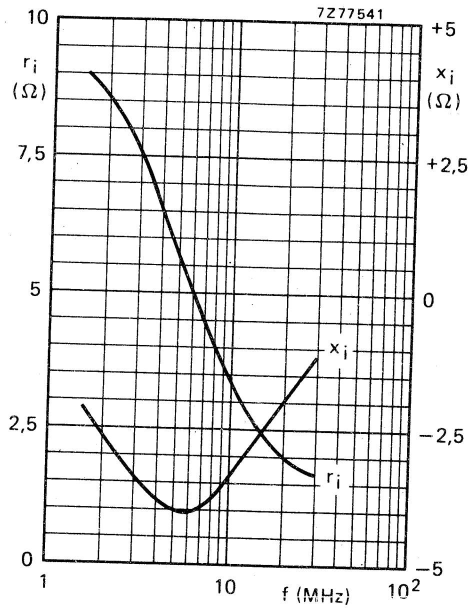


Fig. 21 Input impedance (series components) as a function of frequency.

Fig. 20 and 21 are typical curves and hold for an unneutralized amplifier in s.s.b. class-AB operation.

Conditions:

V_{CE} = 12,5 V
P_L = 30 W (P.E.P.)
T_h = 25 °C
$R_{th\ mb-h} \leq$ 0,3 °C/W
$I_{C(ZS)}$ = 25 mA
Z_L = 1,8 Ω

V_{CE} = 13,5 V
P_L = 35 W (P.E.P.)
T_h = 25 °C
$R_{th\ mb-h} \leq$ 0,3 °C/W
$I_{C(ZS)}$ = 25 mA
Z_L = 1,8 Ω

H.F./V.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor intended for use in class-A, AB and B operated h.f. and v.h.f. transmitters with a nominal supply voltage of 28 V. The transistor is resistance stabilized and is guaranteed to withstand severe load mismatch conditions. Matched h_{FE} groups are available on request.

It has a 3/8" flange envelope with a ceramic cap. All leads are isolated from the flange.

QUICK REFERENCE DATA

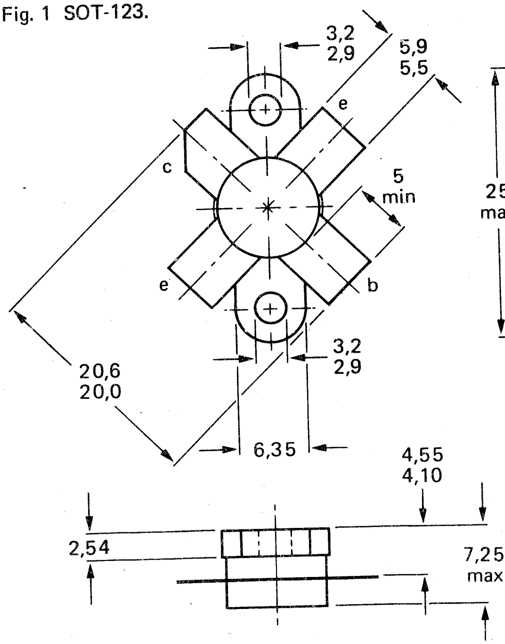
R.F. performance up to T_h = 25 °C

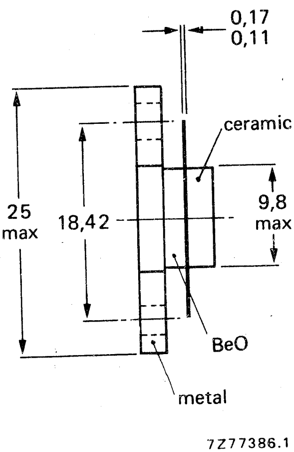
mode of operation	V_{CE} V	f MHz	P_L W	G_p dB	η %	$\overline{z_i}$ Ω	$\overline{Y_L}$ mA/V	d_3 dB
c.w. (class-B)	**28**	**175**	**45**	**> 7,5**	**> 70**	**0,7 + j1,3**	**110 − j62**	−
s.s.b. (class-AB)	28	1,6 − 28	5−47,5(P.E.P.)	typ. 19	typ. 45	−	−	typ. −30
s.s.b. (class-A)	26	1,6 − 28	17(P.E.P.)	typ. 22	−	−	−	typ. −42

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-123.





Torque on screw: min. 0,6 Nm (6 kg cm)
max. 0,75 Nm (7,5 kg cm)

Recommended screw: cheese-head
4-40 UNC/2A

Heatsink compound must be applied sparingly and evenly distributed.

CAUTION This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage (V_{BE} = 0) peak value	V_{CESM}	max.	65	V
Collector-emitter voltage (open base)	V_{CEO}	max.	36	V
Emitter-base voltage (open-collector)	V_{EBO}	max.	4	V
Collector current (average)	$I_{C(AV)}$	max.	4	A
Collector current (peak value); f > 1 MHz	I_{CM}	max.	12	A
R.F. power dissipation (f > 1 MHz); T_{mb} = 25 °C	P_{rf}	max.	105	W
Storage temperature	T_{stg}		−65 to +150	°C
Operating junction temperature	T_j	max.	200	°C

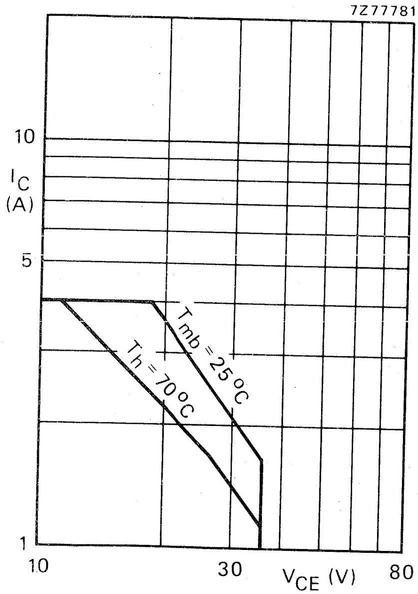


Fig. 2 D.C. SOAR.

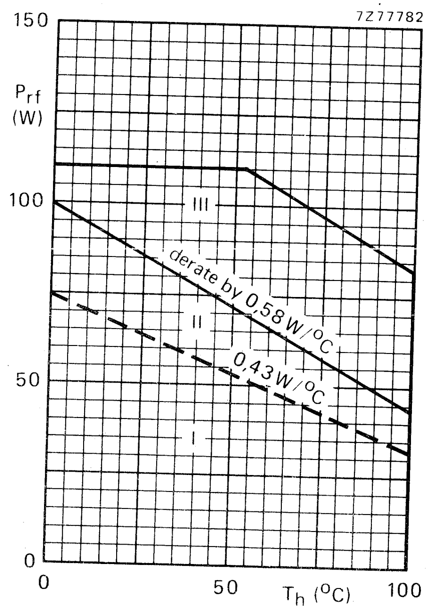


Fig. 3 R.F. power dissipation; $V_{CE} \leq 28$ V; f > 1 MHz.

I Continuous d.c. operation

II Continuous r.f. operation

III Short-time operation during mismatch

THERMAL RESISTANCE (dissipation = 45 W; T_{mb} = 83,5 °C, i.e. T_h = 70 °C)

From junction to mounting base (d.c. dissipation)	$R_{th\ j\text{-}mb(dc)}$	=	2,65 °C/W
From junction to mounting base (r.f. dissipation)	$R_{th\ j\text{-}mb(rf)}$	=	1,95 °C/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,3 °C/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector-emitter breakdown voltage V_{BE} = 0; I_C = 25 mA	$V_{(BR)CES}$	>	65 V
Collector-emitter breakdown voltage open base; I_C = 100 mA	$V_{(BR)CEO}$	>	36 V
Emitter-base breakdown voltage open collector; I_E = 10 mA	$V_{(BR)EBO}$	>	4 V
Collector cut-off current V_{BE} = 0; V_{CE} = 36 V	I_{CES}	<	10 mA
Second breakdown energy; L = 25 mH; f = 50 Hz open base	E_{SBO}	>	8 mJ
R_{BE} = 10 Ω	E_{SBR}	>	8 mJ
D.C. current gain* I_C = 2,5 A; V_{CE} = 5 V	h_{FE}	typ.	45
			10 to 80
D.C. current gain ratio of matched devices* I_C = 2,5 A; V_{CE} = 5 V	h_{FE1}/h_{FE2}	<	1,2
Collector-emitter saturation voltage* I_C = 7,5 A; I_B = 1,5 A	V_{CEsat}	typ.	1,5 V
Transition frequency at f = 100 MHz* $-I_E$ = 2,5 A; V_{CB} = 28 V	f_T	typ.	570 MHz
$-I_E$ = 7,5 A; V_{CB} = 28 V	f_T	typ.	570 MHz
Collector capacitance at f = 1 MHz I_E = I_e = 0; V_{CB} = 28 V	C_c	typ.	82 pF
Feedback capacitance at f = 1 MHz I_C = 100 mA; V_{CE} = 28 V	C_{re}	typ.	54 pF
Collector-flange capacitance	C_{cf}	typ.	2 pF

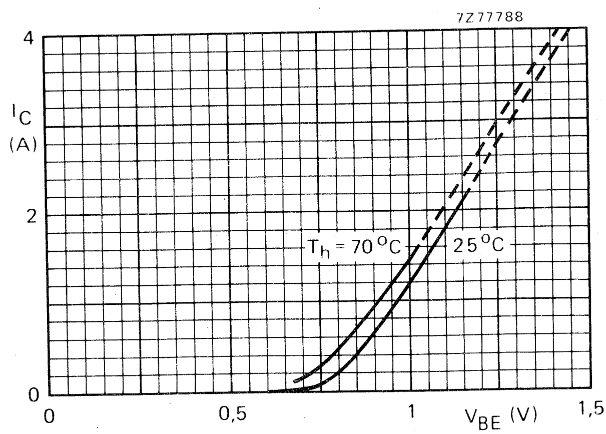


Fig. 4 Typical values; V_{CE} = 28 V.

* Measured under pulse conditions: $t_p \leq 200\ \mu s$; $\delta \leq 0{,}02$.

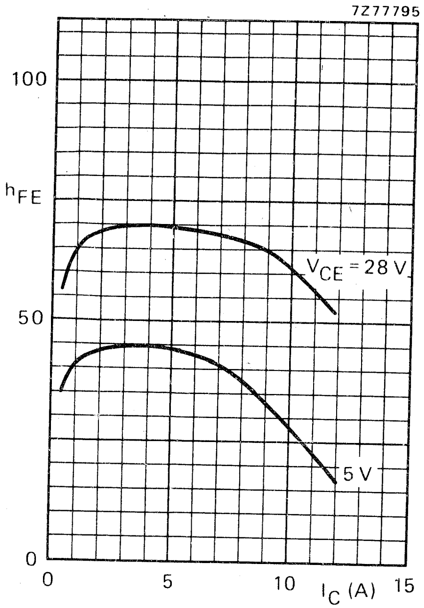


Fig. 5 Typical values; T_j = 25 °C.

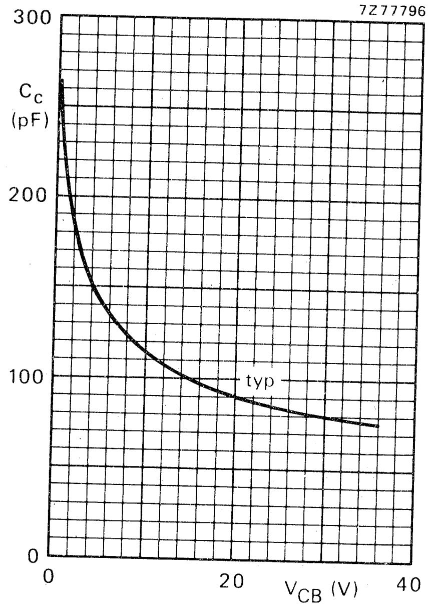


Fig. 6 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

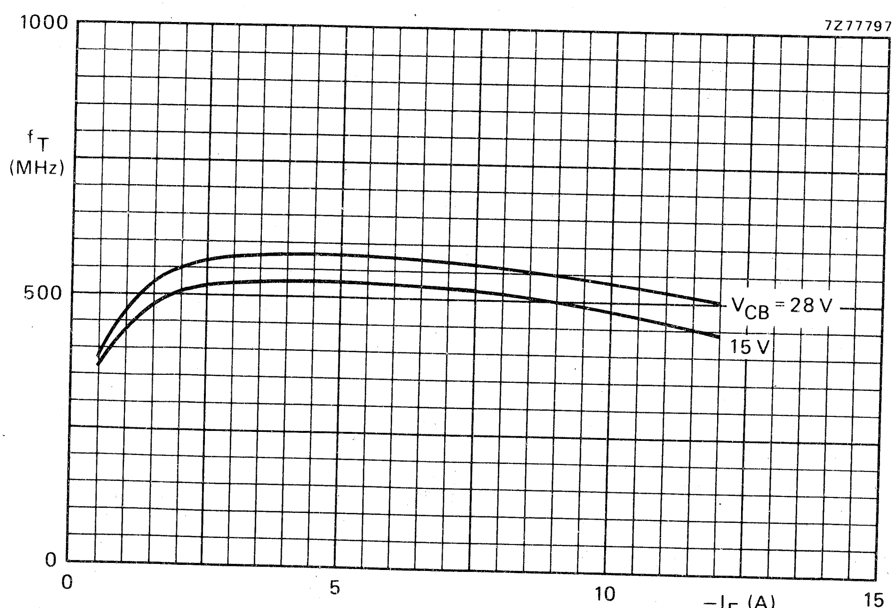


Fig. 7 Typical values; f = 100 MHz; T_j = 25 °C.

APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit)

T_h = 25 °C

f (MHz)	V_{CE} (V)	P_L (W)	P_S (W)	G_p (dB)	I_C (A)	η (%)	$\overline{z_i}$ (Ω)	$\overline{Y_L}$ (mA/V)
175	28	45	< 8	> 7,5	< 2,47	> 70	0,7 + j1,3	110 – j62

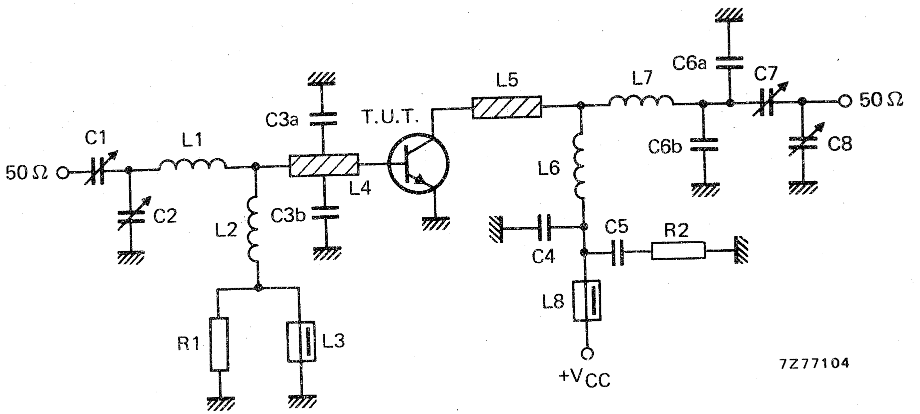


Fig. 8 Test circuit; c.w. class-B.

List of components:

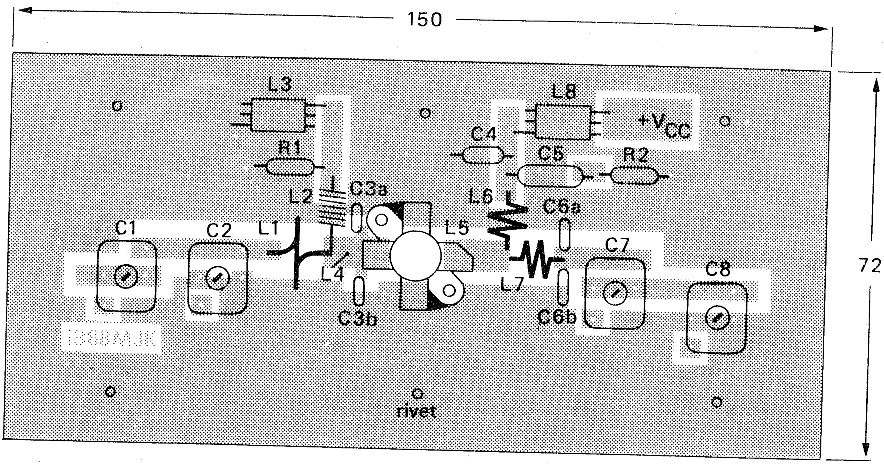
C1 = C7 = 2,5 to 20 pF film dielectric trimmer (cat. no. 2222 809 07004)
C2 = 5 to 60 pF film dielectric trimmer (cat. no. 2222 809 07011)
C3a = C3b = 47 pF ceramic capacitor (500 V)
C4 = 120 pF ceramic capacitor
C5 = 100 nF polyester capacitor
C6a = 2,2 pF ceramic capacitor (500 V)
C6b = 1,8 pF ceramic capacitor (500 V)
C8 = 4 to 40 pF film dielectric trimmer (cat. no. 2222 809 07008)

L1 = 14 nH; 1 turn Cu wire (1,6 mm); int. dia. 7,7 mm; leads 2 x 5 mm
L2 = 100 nH; 7 turns closely wound enamelled Cu wire (0,5 mm); int. dia. 3 mm; leads 2 x 5 mm
L3 = L8 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L4 = L5 = strip (12 mm x 6 mm); taps for C3a and C3b at 5 mm from transistor
L6 = 80 nH; 3 turns Cu wire (1,6 mm); int. dia. 9,0 mm; length 8,0 mm; leads 2 x 5 mm
L7 = 62 nH; 3 turns Cu wire (1,6 mm); int. dia. 7,5 mm; length 8,1 mm; leads 2 x 5 mm

L4 and L5 are strips on a double Cu-clad printed-circuit board with epoxy fibre-glass dielectric, thickness 1/16".

R1 = R2 = 10 Ω carbon resistor

Component layout and printed-circuit board for 175 MHz test circuit see Fig. 9.



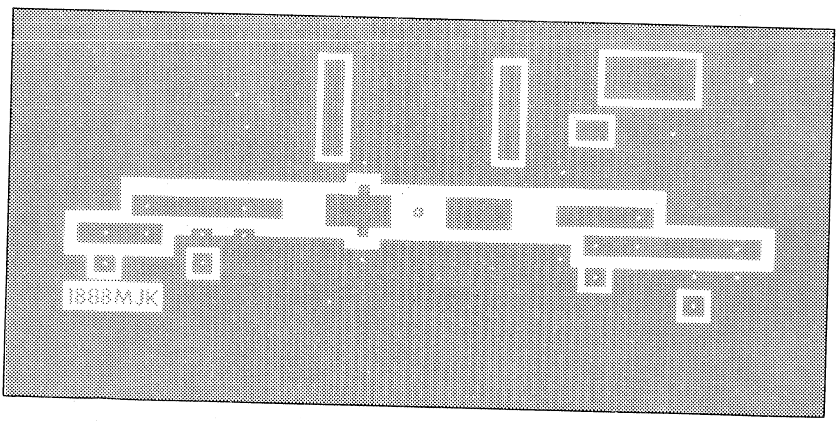


Fig. 9 Component layout and printed-circuit board for 175 MHz test circuit.

The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets, whilst under the emitter leads Cu straps are used for a direct contact between upper and lower sheets.

To minimize the dielectric losses, the ground plane under the interconnection of L7 and C7 has been removed.

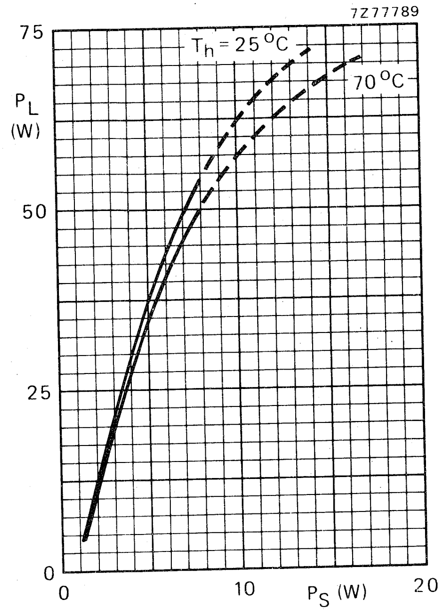


Fig. 10 Typical values; V_{CE} = 28 V; f = 175 MHz.

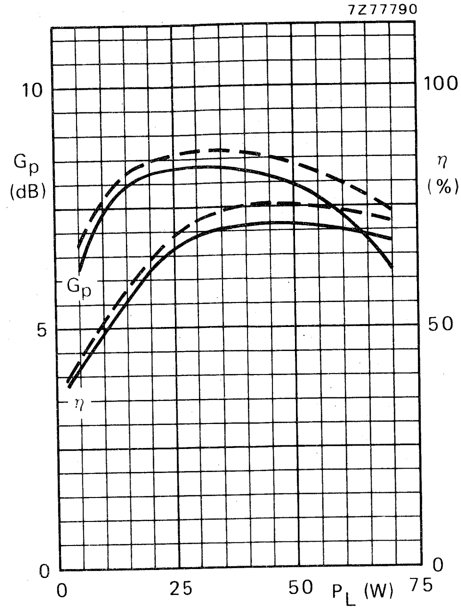


Fig. 11 Typical values; V_{CE} = 28 V; f = 175 MHz; ––– T_h = 25 °C; —— T_h = 70 °C.

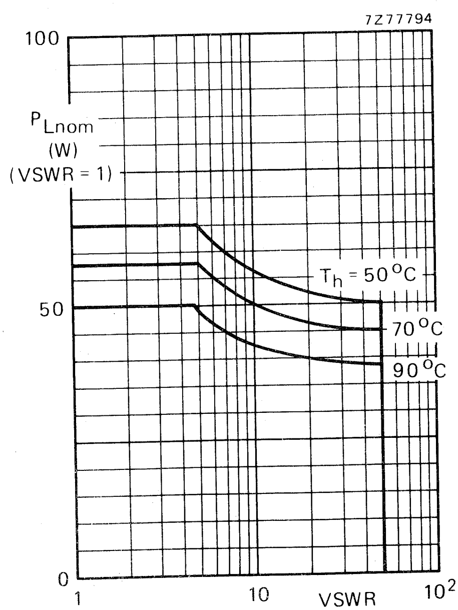


Fig. 12 R.F. SOAR; c.w. class-B operation; f = 175 MHz; V_{CE} = 28 V; $R_{th\ mb\text{-}h}$ = 0,3 °C/W. The graph shows the permissible output power under nominal conditions (VSWR = 1) as a function of the expected VSWR during short-time mismatch conditions with heatsink temperatures as parameter.

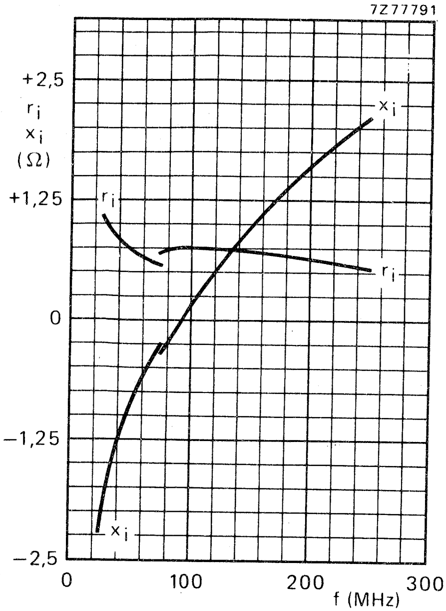


Fig. 13 Input impedance (series components).

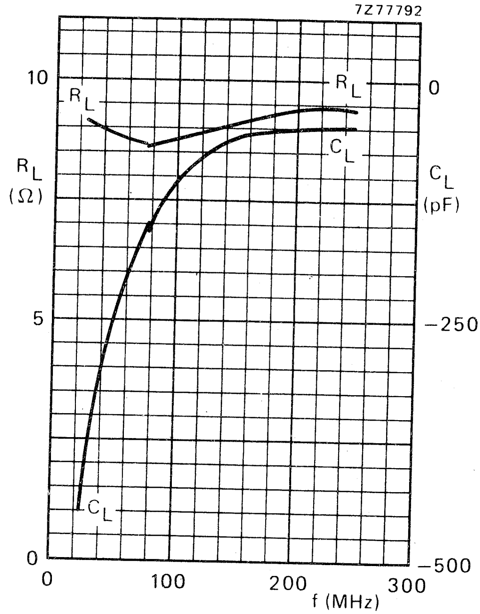


Fig. 14 Load impedance (parallel components).

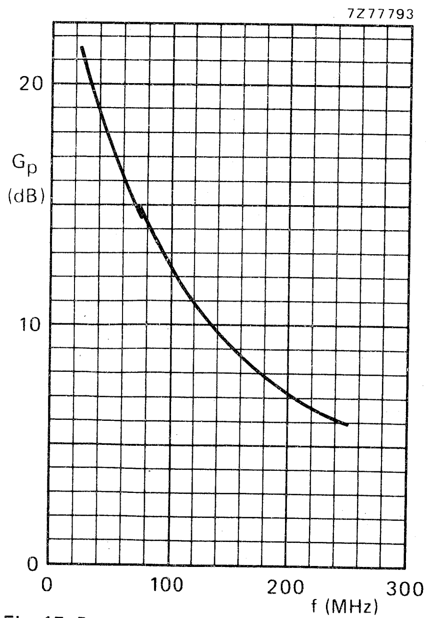


Fig. 15 Power gain versus frequency.

OPERATING NOTE

Below 75 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation. This resistor must be effective for r.f. only.

Conditions for Figs 13; 14 and 15.

Typical values; V_{CE} = 28 V; P_L = 45 W; T_h = 25 °C.

R.F. performance in s.s.b. class-AB operation (linear power amplifier)

V_{CE} = 28 V; f_1 = 28,000 MHz; f_2 = 28,001 MHz

output power W	G_p dB	η_{dt} (%) at 47,5 W (P.E.P.)	I_C (A) at 47,5 W (P.E.P.)	d_3 dB*	d_5 dB*	$I_{C(ZS)}$ mA	T_h °C
5 to 47,5 (P.E.P.)	typ. 19	typ. 45	typ. 1,9	typ. –30	< –30	50	25
5 to 42,5 (P.E.P.)	typ. 19	–	–	typ. –30	< –30	50	70

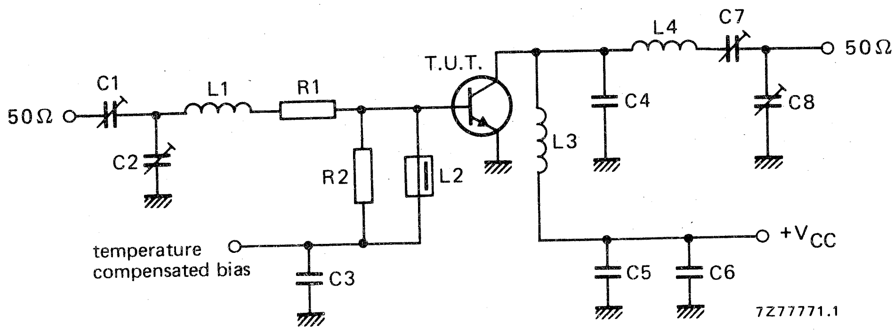


Fig. 16 Test circuit; s.s.b. class-AB.

List of components:

C1 = C2 = 10 to 780 pF film dielectric trimmer
C3 = C5 = C6 = 220 nF polyester capacitor
C4 = 56 pF ceramic capacitor (500 V)
C7 = C8 = 15 to 575 pF film dielectric trimmer

L1 = 4 turns closely wound enamelled Cu wire (1,6 mm); int. dia. 7,0 mm; leads 2 x 5 mm
L2 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L3 = 4 turns enamelled Cu wire (1,6 mm); int. dia. 10 mm; length 9,4 mm; leads 2 x 5 mm
L4 = 7 turns enamelled Cu wire (1,6 mm); int. dia. 12 mm; length 17,2 mm; leads 2 x 5 mm

R1 = 1,2 Ω; parallel connection of 4 x 4,7 Ω carbon resistors
R2 = 39 Ω carbon resistor

* Stated intermodulation distortion figures are referred to the according level of either of the equal amplified tones. Relative to the according peak envelope powers these figures should be increased by 6 dB.

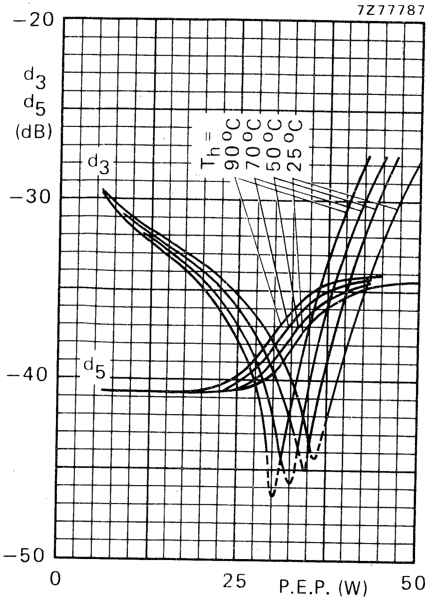


Fig. 17 Intermodulation distortion as a function of output power.*

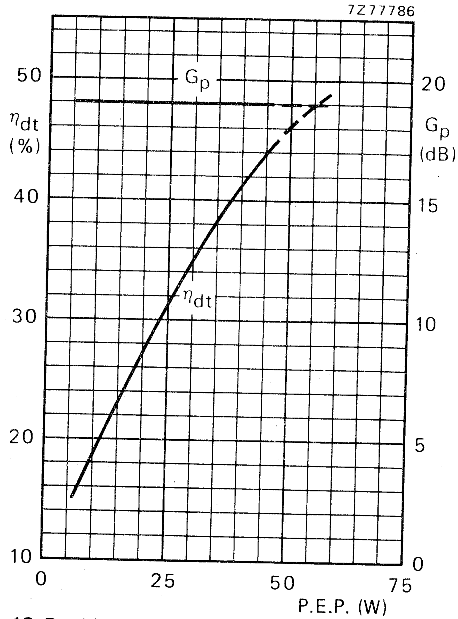


Fig. 18 Double-tone efficiency and power gain as a function of output power.

Conditions for Fig. 17:

V_{CE} = 28 V; $I_{C(ZS)}$ = 50 mA; f_1 = 28,000 MHz; f_2 = 28,001 MHz; typical values.

Conditions for Fig. 18:

V_{CE} = 28 V; $I_{C(ZS)}$ = 50 mA; f_1 = 28,000 MHz; f_2 = 28,001 MHz; T_h = 25 °C; typical values.

* See note on page 9.

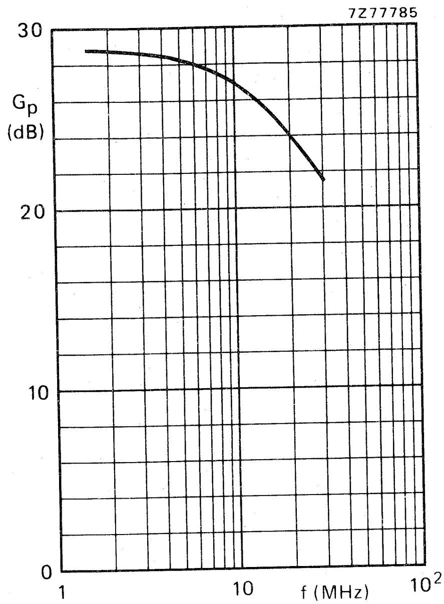


Fig. 19 Power gain as a function of frequency.

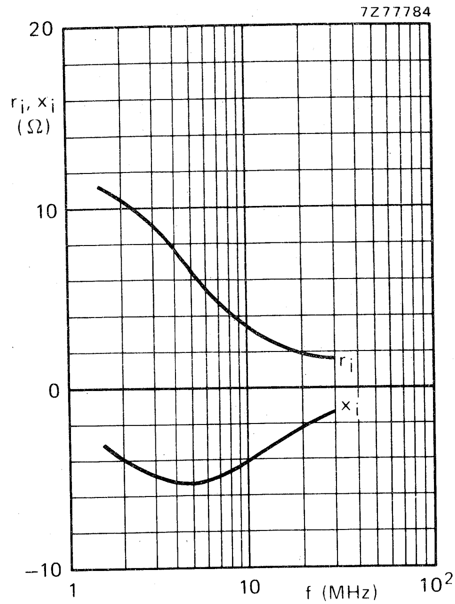


Fig. 20 Input impedance (series components) as a function of frequency.

Figs 19 and 20 are typical curves and hold for an unneutralized amplifier in s.s.b. class-AB operation.

Conditions:

V_{CE} = 28 V; $I_{C(ZS)}$ = 50 mA; P_L = 47,5 W; T_h = 25 °C; Z_L = 6,4 Ω.

Ruggedness in s.s.b. operation

The BLW86 is capable of withstanding a load mismatch (VSWR = 50) under the following conditions: class-AB operation; f_1 = 28,000 MHz; f_2 = 28,001 MHz; V_{CE} = 28 V; T_h = 70 °C and P_{Lnom} = 50 W P.E.P.

R.F. performance in s.s.b. class-A operation (linear power amplifier)

V_{CE} = 26 V; f_1 = 28,000 MHz; f_2 = 28,001 MHz

output power W	G_p dB	I_C A	d_3 dB*	d_5 dB*	T_h °C
17 (P.E.P.)	typ. 22	1,7	typ. –40	< –40	70
17 (P.E.P.)	typ. 22	1,7	typ. –42	< –40	25

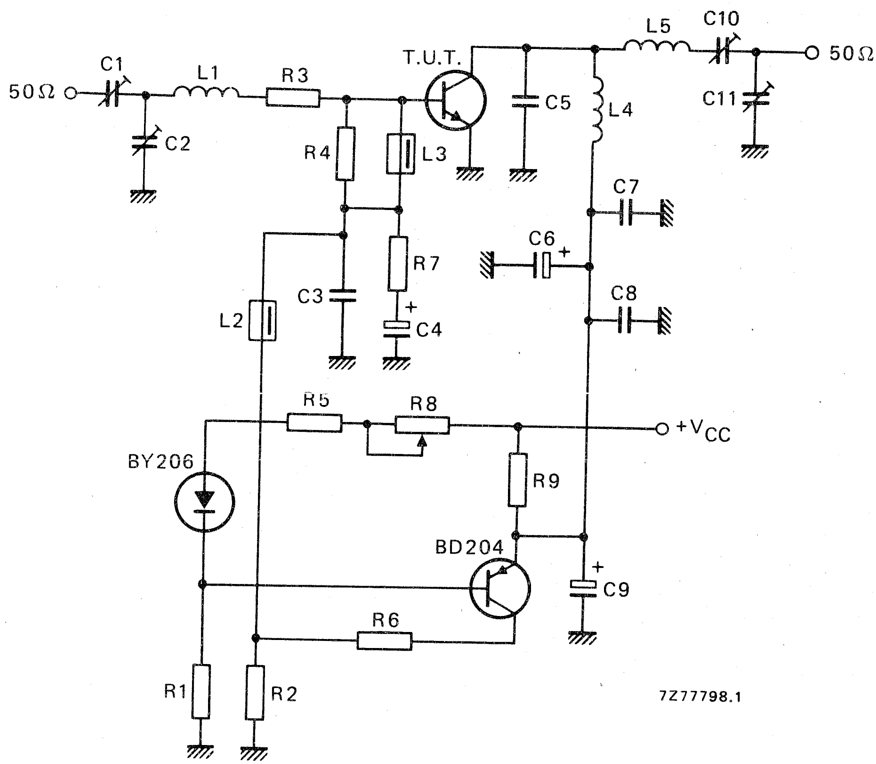


Fig. 21 Test circuit; s.s.b. class-A.

* Stated intermodulation distortion figures are referred to the according level of either of the equal amplified tones. Relative to the according peak envelope powers these figures should be increased by 6 dB.

List of components in Fig. 21:

C1 = C2 = 10 to 780 pF film dielectric trimmer
C3 = 22 nF ceramic capacitor (63 V)
C4 = 47 μF/10 V electrolytic capacitor
C5 = 56 pF ceramic capacitor (500 V)
C6 = 47 μF/35 V electrolytic capacitor
C7 = C8 = 220 nF polyester capacitor
C9 = 10 μF/35 V electrolytic capacitor
C10 = 10 to 210 pF film dielectric trimmer
C11 = 15 to 575 pF film dielectric trimmer

L1 = 3 turns closely wound enamelled Cu wire (1,6 mm); int. dia. 9,0 mm; leads 2 x 5 mm
L2 = L3 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L4 = 11 turns closely wound enamelled Cu wire (1,6 mm); int. dia. 11,0 mm
L5 = 14 turns closely wound enamelled Cu wire (1,6 mm); int. dia. 11,0 mm

R1 = 600 Ω; parallel connection of 2 x 1,2 kΩ carbon resistors (±5%; 0,5 W each)
R2 = 15 Ω carbon resistor (±5%; 0,25 W)
R3 = 1,2 Ω; parallel connection of 4 x 4,7 Ω carbon resistors (±5%; 0,125 W each)
R4 = 33 Ω carbon resistor (±5%; 0,25 W)
R5 = 18 Ω carbon resistor (±5%; 0,25 W)
R6 = 120 Ω wirewound resistor (±5%; 5,5 W)
R7 = 1 Ω carbon resistor (±5%; 0,125 W)
R8 = 47 Ω wirewound potentiometer (3 W)
R9 = 1,57 Ω; parallel connection of 3 x 4,7 Ω wirewound resistors (±5%; 5,5 W each)

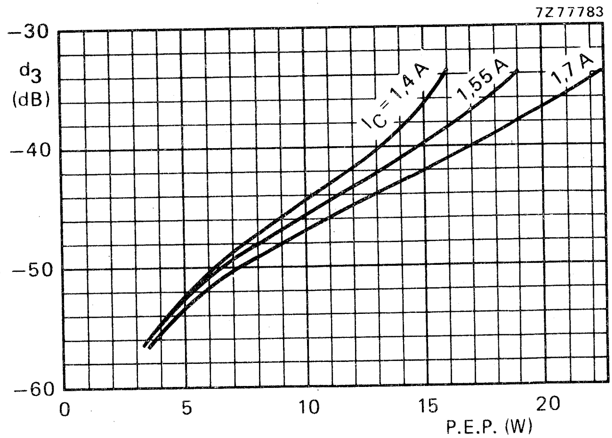


Fig. 22 Intermodulation distortion as a function of output power.
Typical values; V_{CE} = 26 V; T_h = 70 °C; f_1 = 28,000 MHz; f_2 = 28,001 MHz.

V.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor intended for use in class-A, B and C operated mobile h.f. and v.h.f. transmitters with a nominal supply voltage of 13,5 V. The transistor is resistance stabilized and is guaranteed to withstand severe load mismatch conditions with a supply over-voltage to 16,5 V.

It has a 3/8" flange envelope with a ceramic cap. All leads are isolated from the flange.

QUICK REFERENCE DATA

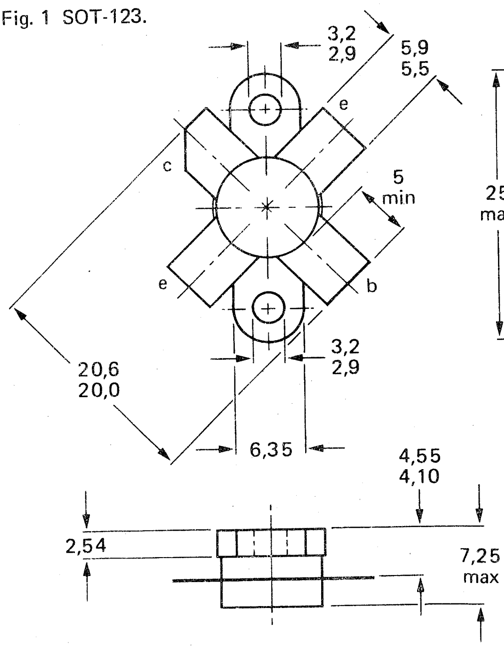
R.F. performance up to T_h = 25 °C in an unneutralized common-emitter class-B circuit

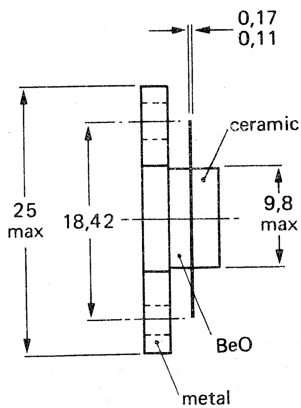
mode of operation	V_{CE} V	f MHz	P_L W	G_p dB	η %	$\overline{z_i}$ Ω	$\overline{Y_L}$ mA/V
c.w.	13,5	175	25	> 6	> 70	1,6 + j1,4	210 + j5,5

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-123.





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Torque on screw: min. 0,6 Nm (6 kg cm)
max. 0,75 Nm (7,5 kg cm)

Recommended screw: cheese-head 4-40 UNC/2A

Heatsink compound must be applied sparingly and evenly distributed.

CAUTION This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage ($V_{BE} = 0$) peak value	V_{CESM}	max.	36 V
Collector-emitter voltage (open base)	V_{CEO}	max.	18 V
Emitter-base voltage (open collector)	V_{EBO}	max.	4 V
Collector current (average)	$I_{C(AV)}$	max.	6 A
Collector current (peak value); f > 1 MHz	I_{CM}	max.	12 A
R.F. power dissipation (f > 1 MHz); T_{mb} = 25 °C	P_{rf}	max.	76 W
Storage temperature	T_{stg}		− 65 to + 150 °C
Operating junction temperature	T_j	max.	200 °C

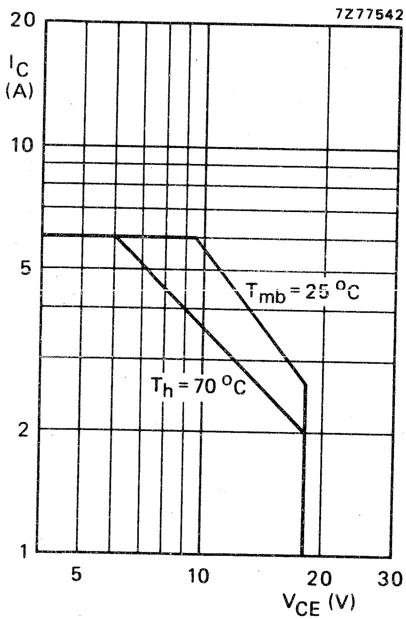


Fig. 2 D.C. SOAR.

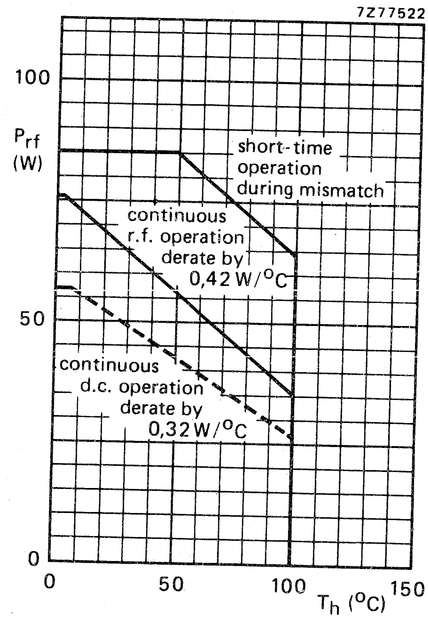


Fig. 3 R.F. power dissipation; $V_{CE} \leqslant 16,5$ V; f ⩾ 1 MHz.

THERMAL RESISTANCE (dissipation = 20 W; T_{mb} = 76 °C; i.e. T_h = 70 °C)

From junction to mounting base (d.c. dissipation)	$R_{th\ j\text{-}mb(dc)}$	=	3,0 °C
From junction to mounting base (r.f. dissipation)	$R_{th\ j\text{-}mb(rf)}$	=	2,25 °C/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,3 °C/W

CHARACTERISTICS

$T_j = 25\ ^oC$

Collector-emitter breakdown voltage $V_{BE} = 0$; $I_C = 25$ mA	$V_{(BR)CES}$	>	36	V
Collector-emitter breakdown voltage open base; $I_C = 50$ mA	$V_{(BR)CEO}$	>	18	V
Emitter-base breakdown voltage open collector; $I_E = 10$ mA	$V_{(BR)EBO}$	>	4	V
Collector cut-off current $V_{BE} = 0$; $V_{CE} = 18$ V	I_{CES}	<	10	mA
Second breakdown energy; L = 25 mH; f = 50 Hz open base	E_{SBO}	>	8	mJ
$R_{BE} = 10\ \Omega$	E_{SBR}	>	8	mJ
D.C. current gain* $I_C = 2{,}5$ A; $V_{CE} = 5$ V	h_{FE}	typ.	50 10 to 80	
Collector-emitter saturation voltage* $I_C = 7{,}5$ A; $I_B = 1{,}5$ A	V_{CEsat}	typ.	1,7	V
Transition frequency at f = 100 MHz* $-I_E = 2{,}5$ A; $V_{CB} = 13{,}5$ V	f_T	typ.	800	MHz
$-I_E = 7{,}5$ A; $V_{CB} = 13{,}5$ V	f_T	typ.	750	MHz
Collector capacitance at f = 1 MHz $I_E = I_e = 0$; $V_{CB} = 15$ V	C_c	typ.	65	pF
Feedback capacitance at f = 1 MHz $I_C = 100$ mA; $V_{CE} = 15$ V	C_{re}	typ.	41	pF
Collector-flange capacitance	C_{cf}	typ.	2	pF

* Measured under pulse conditions: $t_p \leqslant 200\ \mu s$; $\delta \leqslant 0{,}02$.

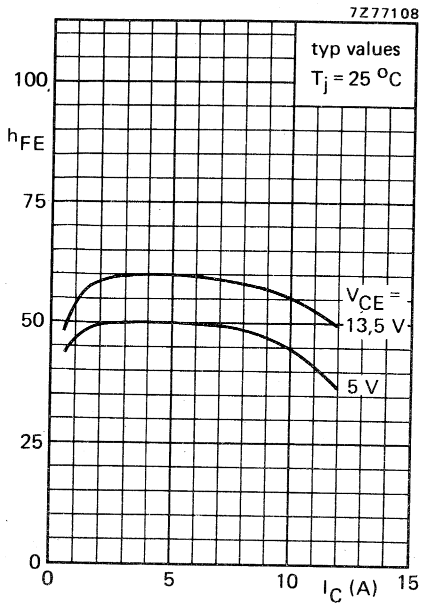


Fig. 4.

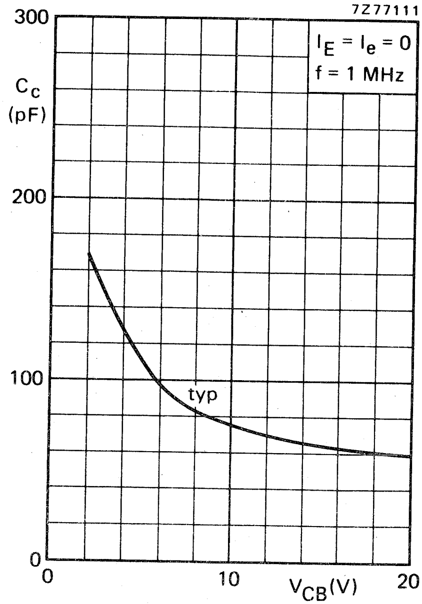


Fig. 5 T_j = 25 °C.

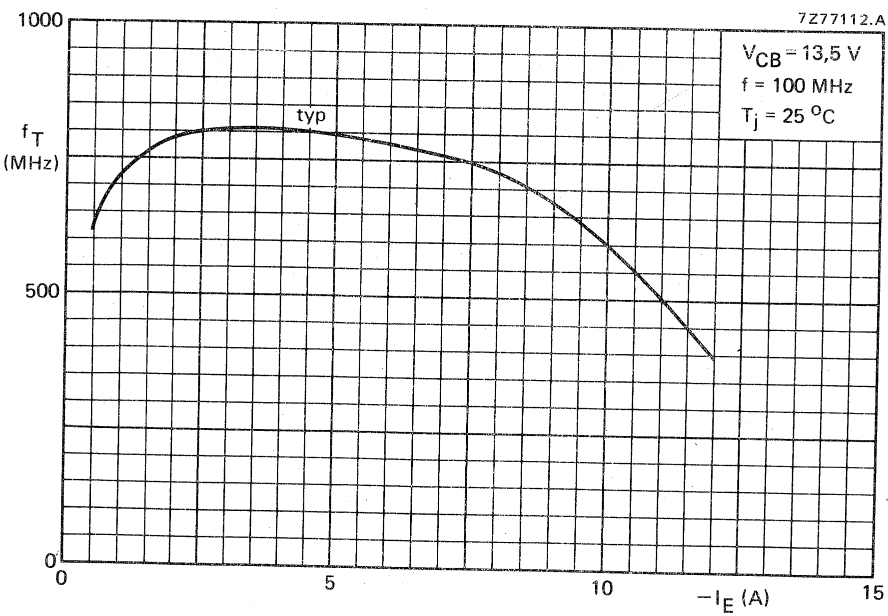


Fig. 6.

APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit)

T_h = 25 °C

f (MHz)	V_{CE} (V)	P_L (W)	P_S (W)	G_p (dB)	I_C (A)	η (%)	$\overline{z_i}$ (Ω)	$\overline{Y_L}$ (mA/V)
175	**13,5**	**25**	**< 6,25**	**> 6**	**< 2,64**	**> 70**	**1,6 + j1,4**	**210 + j5,5**
175	12,5	25	–	typ. 6,6	–	typ. 75	–	–

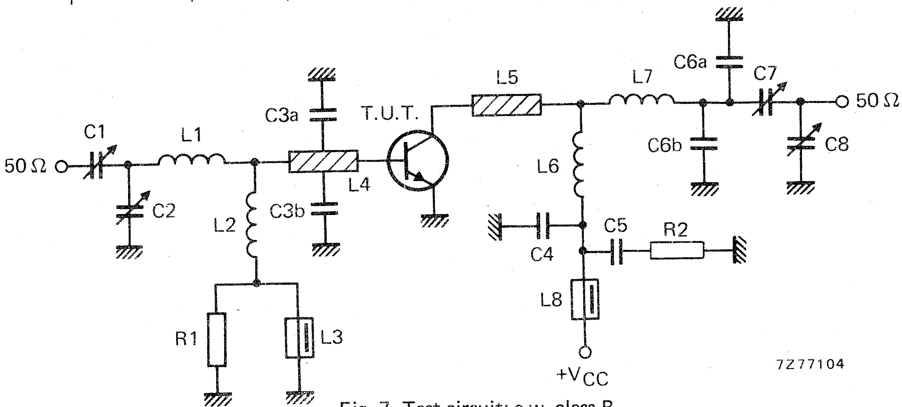


Fig. 7 Test circuit; c.w. class-B.

List of components:

C1 = 2,5 to 20 pF film dielectric trimmer (cat. no. 2222 809 07004)
C2 = C8 = 4 to 40 pF film dielectric trimmer (cat. no. 2222 809 07008)
C3a = C3b = 47 pF ceramic capacitor (500 V)
C4 = 120 pF ceramic capacitor (500 V)
C5 = 100 nF polyester capacitor
C6a = C6b = 8,2 pF ceramic capacitor (500 V)
C7 = 5 to 60 pF film dielectric trimmer (cat. no. 2222 809 07011)

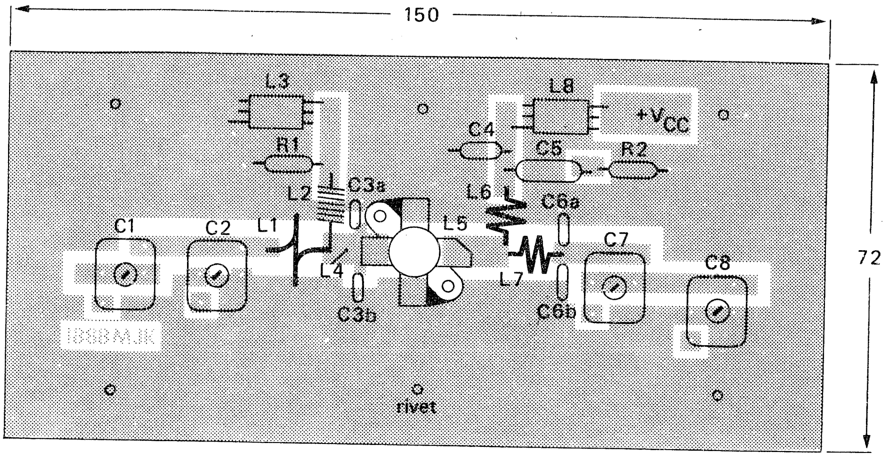
L1 = 1 turn Cu wire (1,6 mm); int. dia. 9,0 mm; leads 2 x 5 mm
L2 = 100 nH; 7 turns closely wound enamelled Cu wire (0,5 mm); int. dia. 3 mm; leads 2 x 5 mm
L3 = L8 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L4 = L5 = strip (12 mm x 6 mm); taps for C3a and C3b at 5 mm from transistor
L6 = 2 turns Cu wire (1,6 mm); int. dia. 5,0 mm; length 6,0 mm; leads 2 x 5 mm
L7 = 2 turns Cu wire (1,6 mm); int. dia. 4,5 mm; length 6,0 mm; leads 2 x 5 mm

L4 and L5 are strips on a double Cu-clad printed-circuit board with epoxy fibre-glass dielectric, thickness 1/16".

R1 = 10 Ω (± 10%) carbon resistor (0,25 W)
R2 = 4,7 Ω (± 5%) carbon resistor (0,25 W)

Component layout and printed-circuit board for 175 MHz test circuit are shown in Fig. 8.

APPLICATION INFORMATION (continued)



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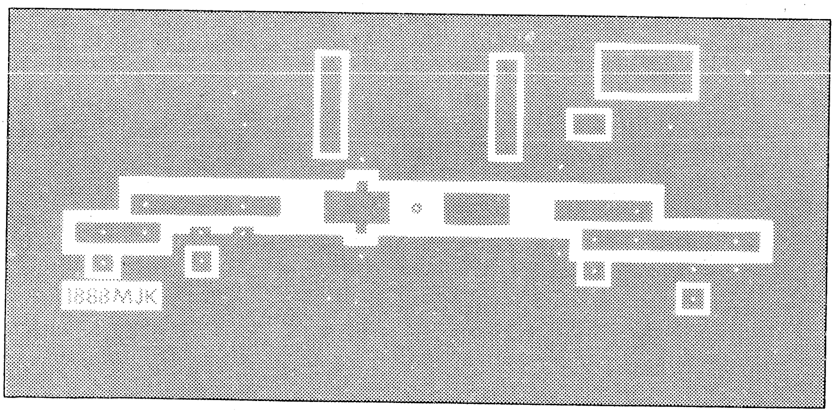

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Fig. 8 Component layout and printed-circuit board for 175 MHz test circuit.

The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets, whilst under the emitter leads Cu straps are used for a direct contact between upper and lower sheets.

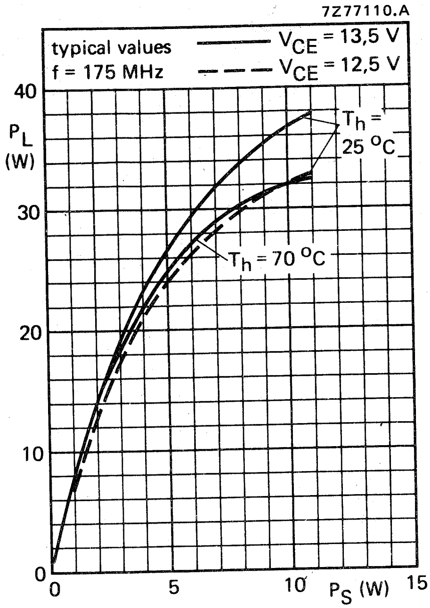


Fig. 9.

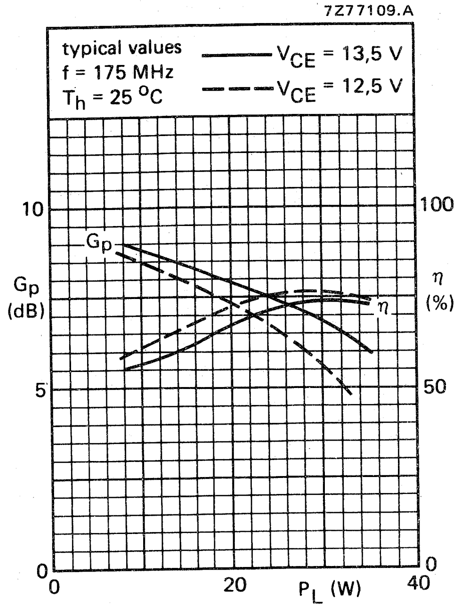


Fig. 10.

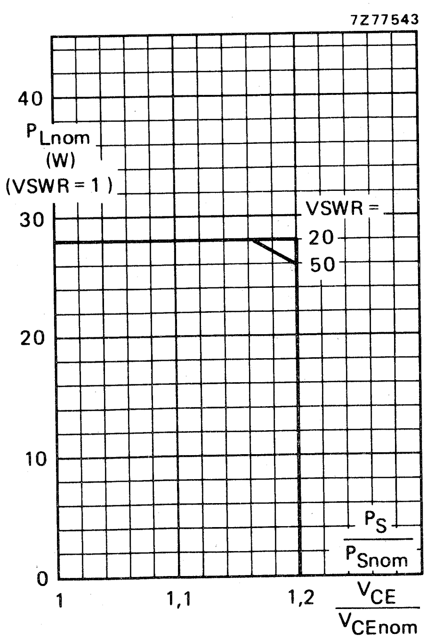


Fig. 11 R.F. SOAR (short-time operation during mismatch); f = 175 MHz; T_h = 70 °C; $R_{th\ mb-h}$ = 0,3 °C/W; V_{CEnom} = 13,5 V or 12,5 V; $P_S = P_{Snom}$ at V_{CEnom} and VSWR = 1 (see page 5).

The transistor has been developed for use with unstabilized supply voltages. As the output power and drive power increase with the supply voltage, the nominal output power must be derated in accordance with the graph for safe operation at supply voltages other than the nominal. The graph shows the permissible output power under nominal conditions (VSWR = 1), as a function of the expected supply over-voltage ratio with VSWR as parameter.

The graph applies to the situation in which the drive (P_S/P_{Snom}) increases linearly with supply over-voltage ratio.

OPERATING NOTE Below 50 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation. This resistor must be effective for r.f. only.

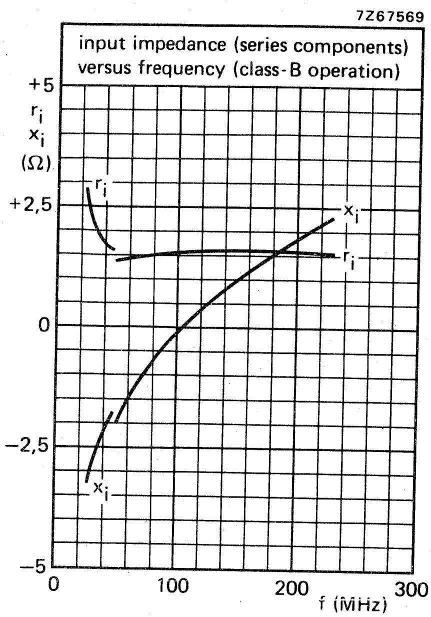


Fig. 12.

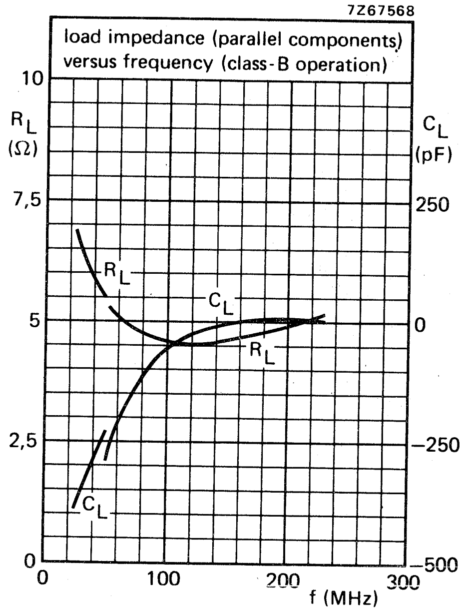
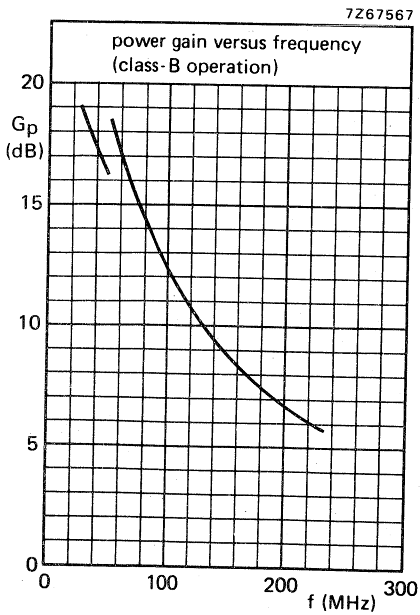


Fig. 13.



Conditions for Figs 12, 13 and 14:

Typical values; V_{CE} = 13,5 V; P_L = 25 W; T_h = 25 °C.

Fig. 14.

U.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor suitable for transmitting applications in class-A, B or C in the u.h.f. and v.h.f. range for a nominal supply voltage of 28 V. The transistor is resistance stabilized and is guaranteed to withstand infinite VSWR at rated output power. High reliability is ensured by a **gold sandwich metallization.**

The transistor is housed in a ¼" capstan envelope with a ceramic cap. All leads are isolated from the stud.

QUICK REFERENCE DATA

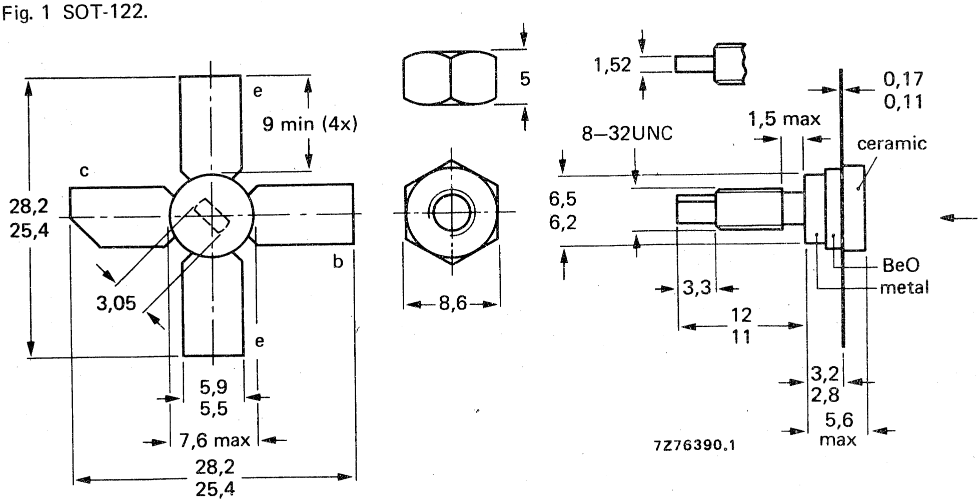
R.F. performance up to T_h = 25 °C in an unneutralized common-emitter class-B circuit

mode of operation	V_{CE} V	f MHz	P_L W	G_p dB	η %
c.w.	28	470	2	> 12	> 50

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-122.



Torque on nut: min. 0,75 Nm
(7,5 kg cm)
max. 0,85 Nm
(8,5 kg cm)

Diameter of clearance hole in heatsink: max. 4,2 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

When locking is required an adhesive is preferred instead of a lock washer.

CAUTION This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage (peak value); $V_{BE} = 0$	V_{CESM}	max.	60 V
open base	V_{CEO}	max.	30 V
Emitter-base voltage (open collector)	V_{EBO}	max.	4 V
Collector current d.c. or average	I_C; $I_{C(AV)}$	max.	0,32 A
(peak value); f > 1 MHz	I_{CM}	max.	1,0 A
Total power dissipation (d.c. and r.f.) up to T_{mb} = 50 °C	P_{tot}	max.	9,6 W
Storage temperature	T_{stg}		−65 to + 150 °C
Operating junction temperature	T_j	max.	200 °C

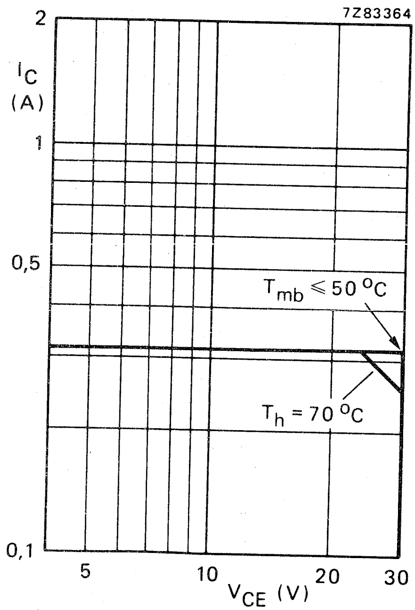


Fig. 2 D.C. SOAR.

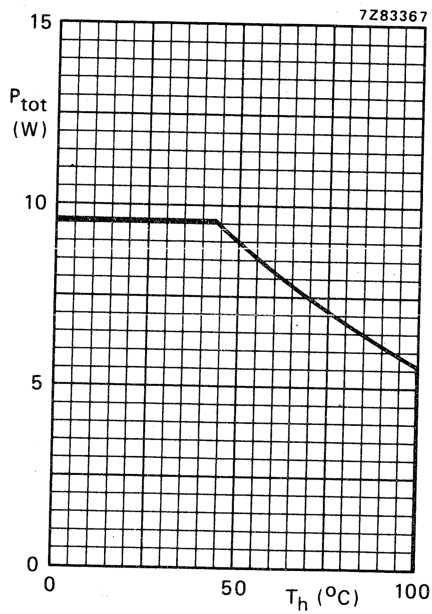


Fig. 3 Power derating curve vs. temperature.

THERMAL RESISTANCE (dissipation = 3,5 W; T_{mb} = 72 °C, i.e. T_h = 70 °C)

From junction to mounting base (d.c. and r.f. dissipation)	$R_{th\ j\text{-}mb}$	=	13,0 K/W*
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,6 K/W*

* K/W is SI unit for °C/W.

CHARACTERISTICS

$T_j = 25\ ^oC$

Collector-emitter breakdown voltage $V_{BE} = 0$; $I_C = 2$ mA	$V_{(BR)CES}$	>	60 V
Collector-emitter breakdown voltage open base; $I_C = 10$ mA	$V_{(BR)CEO}$	>	30 V
Emitter-base breakdown voltage open collector; $I_E = 1$ mA	$V_{(BR)EBO}$	>	4 V
Collector cut-off current $V_{BE} = 0$; $V_{CE} = 30$ V	I_{CES}	<	1 mA
Second breakdown energy; L = 25 mH; f = 50 Hz open base	E_{SBO}	>	0,5 mJ
$R_{BE} = 10\ \Omega$	E_{SBR}	>	0,5 mJ
D.C. current gain * $I_C = 0,15$ A; $V_{CE} = 5$ V	h_{FE}	typ.	40 10 to 100
Collector-emitter saturation voltage * $I_C = 0,5$ A; $I_B = 0,1$ A	V_{CEsat}	typ.	0,9 V
Transition frequency at f = 500 MHz * $-I_E = 0,15$ A; $V_{CB} = 28$ V	f_T	typ.	1,20 GHz
$-I_E = 0,50$ A; $V_{CB} = 28$ V	f_T	typ.	0,85 GHz
Collector capacitance at f = 1 MHz $I_E = I_e = 0$; $V_{CB} = 28$ V	C_c	typ.	5,5 pF
Feedback capacitance at f = 1 MHz $I_C = 10$ mA; $V_{CE} = 28$ V	C_{re}	typ.	2 pF
Collector-stud capacitance	C_{cs}	typ.	2 pF

* Measured under pulse conditions: $t_p \leqslant 200\ \mu s$; $\delta \leqslant 0,02$.

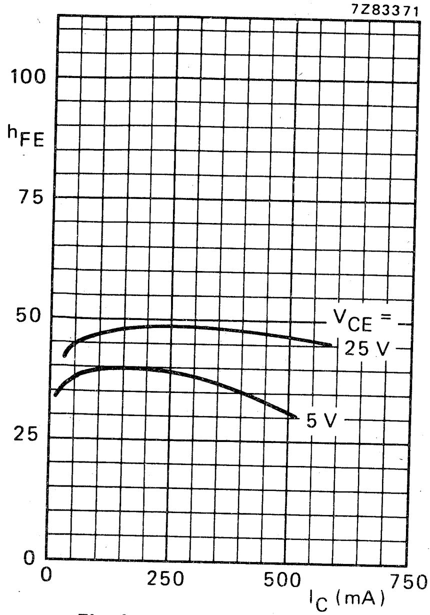


Fig. 4 Typical values; T_j = 25 °C.

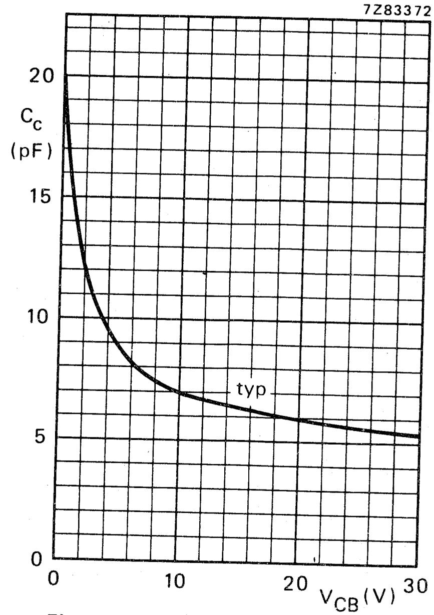


Fig. 5 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

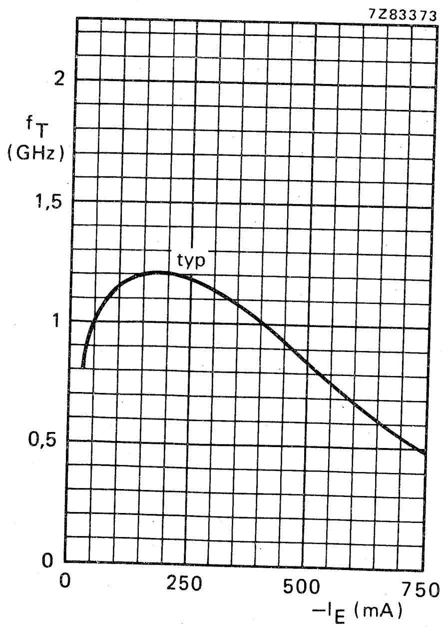


Fig. 6 V_{CB} = 28 V; f = 500 MHz; T_j = 25 °C.

APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit)

T_h = 25 °C

f (MHz)	V_{CE} (V)	P_L (W)	P_S (W)	G_p (dB)	I_C (A)	η (%)	$\overline{z_i}$ (Ω)	$\overline{Z_L}$ (Ω)
470	28	2	< 0,13	> 12	< 0,145	> 50	3,0 − j0,4	12 + j45
470	28	2	typ. 0,09	typ. 13,5	typ. 0,135	typ. 53	−	−

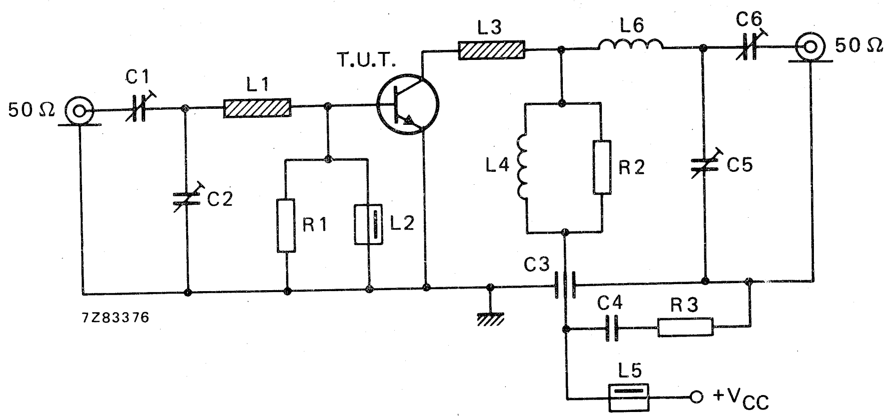


Fig. 7 Test circuit; c.w. class-B.

List of components:

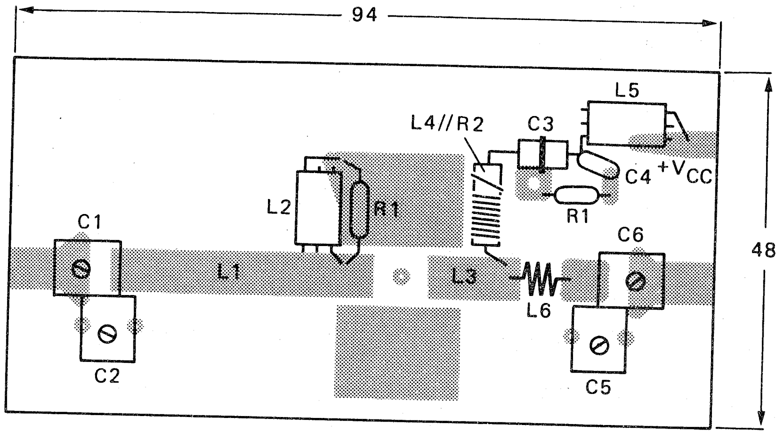
C1 = C5 = C6 = 1,4 to 5,5 pF film dielectric trimmer (cat. no. 2222 809 09001)
C2 = 2 to 9 pF film dielectric trimmer (cat. no. 2222 809 09002)
C3 = 100 pF ceramic feed-through capacitor
C4 = 100 nF polyester capacitor

L1 = stripline (34,8 mm x 6,0 mm)
L2 = L5 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L3 = stripline (12,0 mm x 6,0 mm)
L4 = 220 nH; 10 turns enamelled Cu wire (0,35 mm) closely wound around R2
L6 = 29 nH; 3 turns closely wound enamelled Cu wire (1,0 mm); int. dia. 3,5 mm; leads 2 x 4 mm

L1 and L3 are striplines on a double Cu-clad printed-circuit board with PTFE fibre-glass dielectric (ϵ_r = 2,74); thickness 1/16"

R1 = 100 Ω carbon resistor
R2 = 10 kΩ carbon resistor (style CR37)
R3 = 10 Ω carbon resistor

Component layout and printed-circuit board for 470 MHz test circuit are shown in Fig. 8.



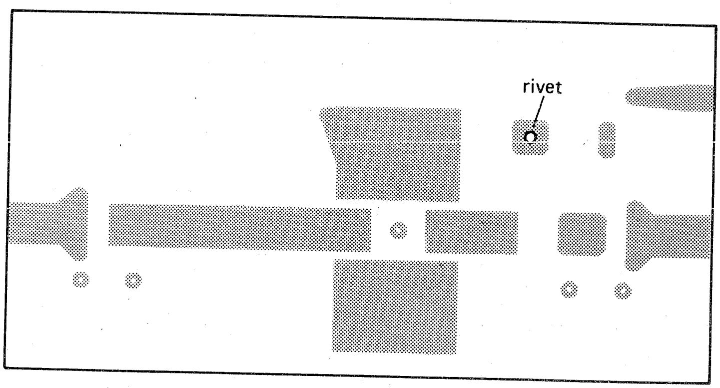


Fig. 8 Component layout and printed-circuit board for 470 MHz test circuit.

The circuit and the components are situated on one side of the PTFE fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets, whilst under the emitter leads Cu straps are used for a direct contact between upper and lower sheets.

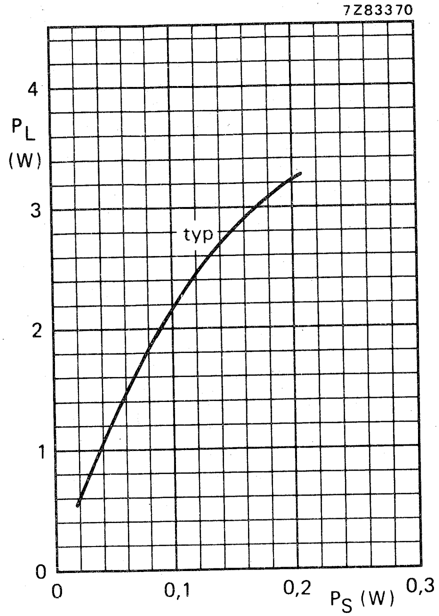


Fig. 9 V_{CE} = 28 V; f = 470 MHz; T_h = 25 °C.

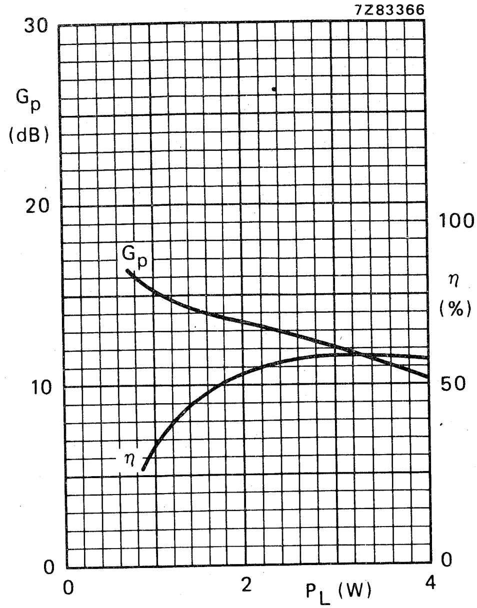


Fig. 10 Typical values; V_{CE} = 28 V; f = 470 MHz; T_h = 25 °C.

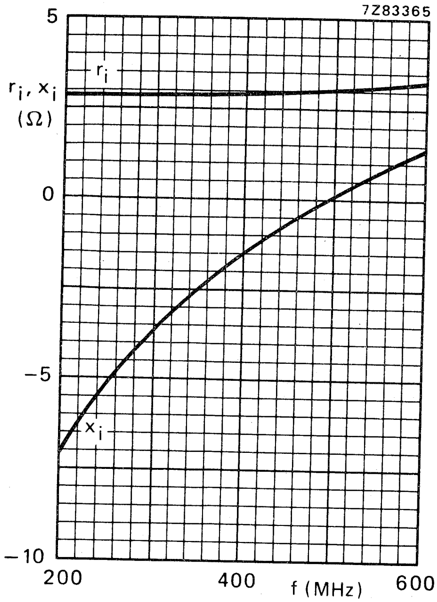


Fig. 11 Input impedance (series components).

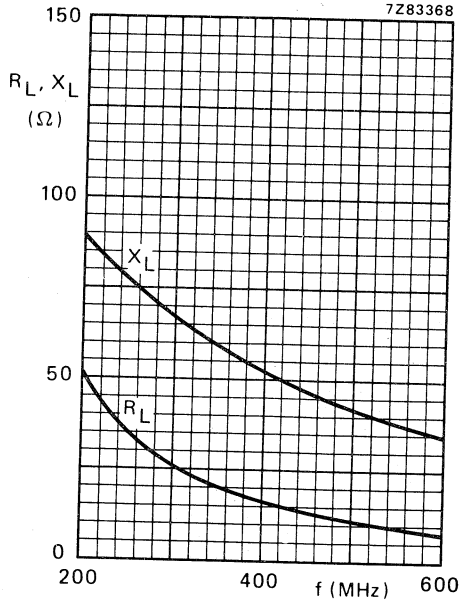


Fig. 12 Load impedance (series components).

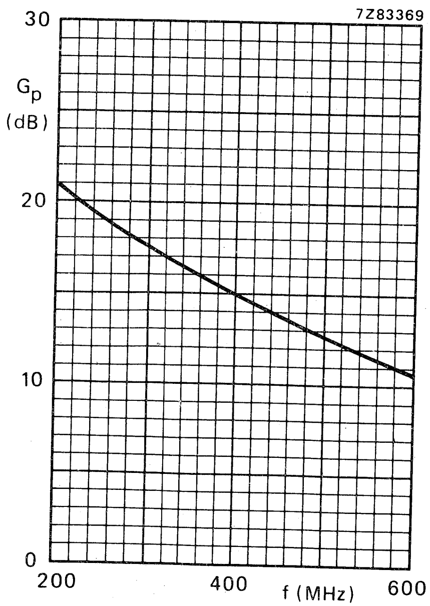


Fig. 13.

Conditions for Figs 11, 12 and 13:

Typical values; V_{CE} = 28 V; P_L = 2 W; T_h = 25 °C.

Ruggedness

The BLW89 is capable of withstanding full load mismatch (VSWR = 50 through all phases) up to 2 W under the following conditions:

V_{CE} = 28 V; f = 470 MHz; T_h = 70 °C; $R_{th\ mb\text{-}h}$ = 0,6 K/W.

U.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor suitable for transmitting applications in class-A, B or C in the u.h.f. and v.h.f. range for a nominal supply voltage of 28 V. The transistor is resistance stabilized and is guaranteed to withstand infinite VSWR at rated output power. High reliability is ensured by a **gold sandwich metallization.**

The transistor is housed in a ¼" capstan envelope with a ceramic cap. All leads are isolated from the stud.

QUICK REFERENCE DATA

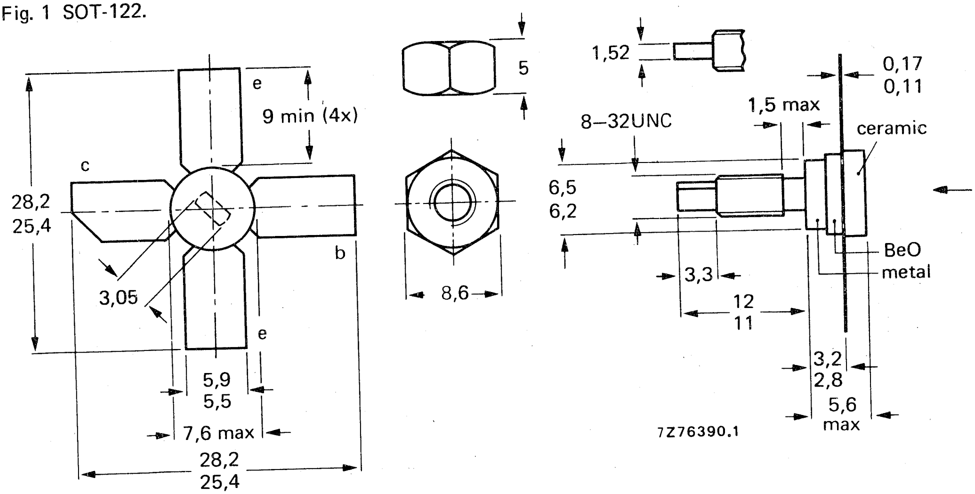
R.F. performance up to T_h = 25 °C in an unneutralized common-emitter class-B circuit

mode of operation	V_{CE} V	f MHz	P_L W	G_p dB	η %
c.w.	28	470	4	> 11	> 55

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-122.



Torque on nut: min. 0,75 Nm (7,5 kg cm)
max. 0,85 Nm (8,5 kg cm)

Diameter of clearance hole in heatsink: max. 4,2 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

When locking is required an adhesive is preferred instead of a lock washer.

CAUTION This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage			
(peak value); $V_{BE} = 0$	V_{CESM}	max.	60 V
open base	V_{CEO}	max.	30 V
Emitter-base voltage (open collector)	V_{EBO}	max.	4 V
Collector current			
d.c. or average	I_C; $I_{C(AV)}$	max.	0,62 A
(peak value); f > 1 MHz	I_{CM}	max.	2,0 A
Total power dissipation (d.c. and r.f.) up to T_{mb} = 25 °C	P_{tot}	max.	18,6 W
Storage temperature	T_{stg}		−65 to + 150 °C
Operating junction temperature	T_j	max.	200 °C

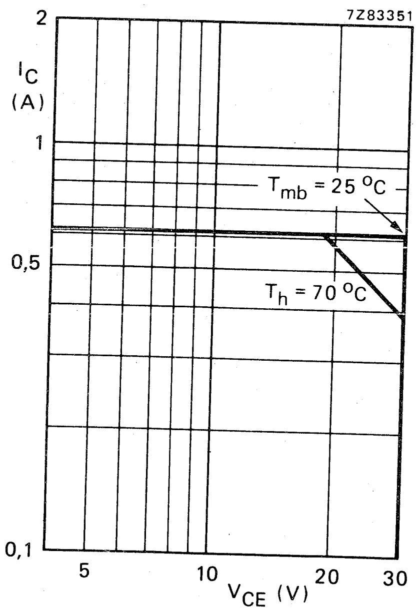


Fig. 2 D.C. SOAR.

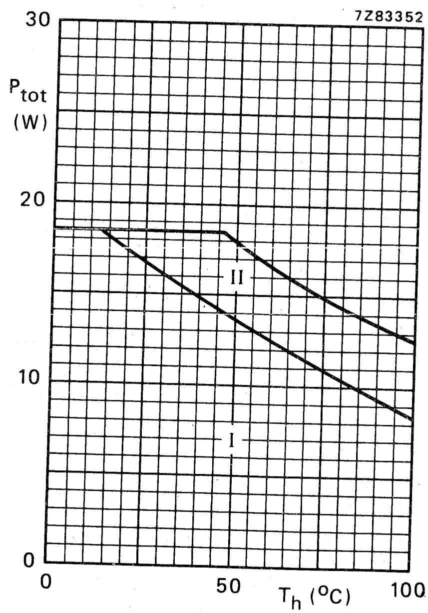


Fig. 3 Power derating curves vs. temperature.
I Continuous d.c. and r.f. operation
II Short-time operation during mismatch

THERMAL RESISTANCE (dissipation = 6 W; T_{mb} = 73,6 °C, i.e. T_h = 70 °C)

From junction to mounting base (d.c. and r.f. dissipation)	$R_{th\ j\text{-}mb}$	=	9,0 K/W*
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,6 K/W*

* K/W is SI unit for °C/W.

CHARACTERISTICS

$T_j = 25\ ^oC$

Collector-emitter breakdown voltage $V_{BE} = 0$; $I_C = 4$ mA	$V_{(BR)CES}$	>	60 V
Collector-emitter breakdown voltage open base; $I_C = 20$ mA	$V_{(BR)CEO}$	>	30 V
Emitter-base breakdown voltage open collector; $I_E = 2$ mA	$V_{(BR)EBO}$	>	4 V
Collector cut-off current $V_{BE} = 0$; $V_{CE} = 30$ V	I_{CES}	<	2 mA
Second breakdown energy; L = 25 mH; f = 50 Hz open base	E_{SBO}	>	1 mJ
$R_{BE} = 10\ \Omega$	E_{SBR}	>	1 mJ
D.C. current gain * $I_C = 0{,}3$ A; $V_{CE} = 5$ V	h_{FE}	typ.	40
			10 to 100
Collector-emitter saturation voltage * $I_C = 1{,}0$ A; $I_B = 0{,}2$ A	V_{CEsat}	typ.	0,9 V
Transition frequency at f = 500 MHz * $-I_E = 0{,}3$ A; $V_{CB} = 28$ V	f_T	typ.	1,2 GHz
$-I_E = 1{,}0$ A; $V_{CB} = 28$ V	f_T	typ.	0,9 GHz
Collector capacitance at f = 1 MHz $I_E = I_e = 0$; $V_{CB} = 28$ V	C_c	typ.	8,4 pF
Feedback capacitance at f = 1 MHz $I_C = 20$ mA; $V_{CE} = 28$ V	C_{re}	typ.	3,6 pF
Collector-stud capacitance	C_{cs}	typ.	2 pF

* Measured under pulse conditions: $t_p \leqslant 200\ \mu s$; $\delta \leqslant 0{,}02$.

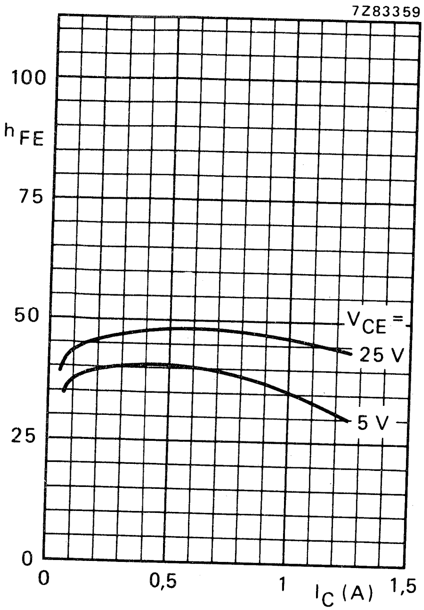


Fig. 4 Typical values; T_j = 25 °C.

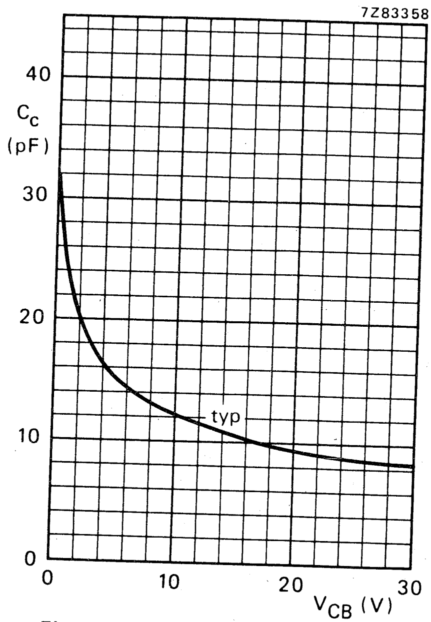


Fig. 5 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

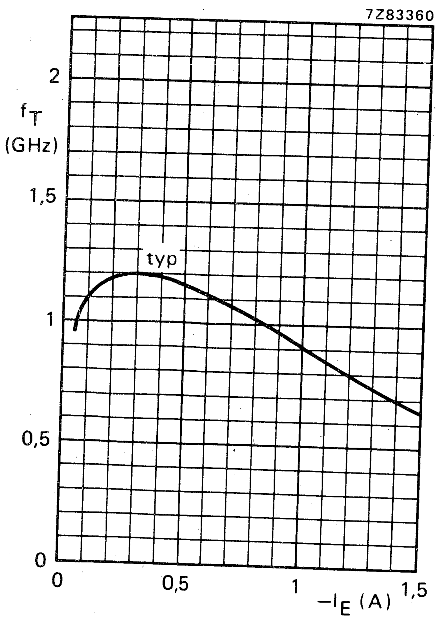


Fig. 6 V_{CB} = 28 V; f = 500 MHz; T_j = 25 °C.

APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit)

T_h = 25 °C

f (MHz)	V_{CE} (V)	P_L (W)	P_S (W)	G_p (dB)	I_C (A)	η (%)	$\overline{z_i}$ (Ω)	$\overline{Z_L}$ (Ω)
470	**28**	**4**	< **0,32**	> **11**	< **0,26**	> **55**	**1,7 + j1,8**	**8 + j26**
470	28	4	typ. 0,23	typ. 12,5	typ. 0,25	typ. 58	–	–

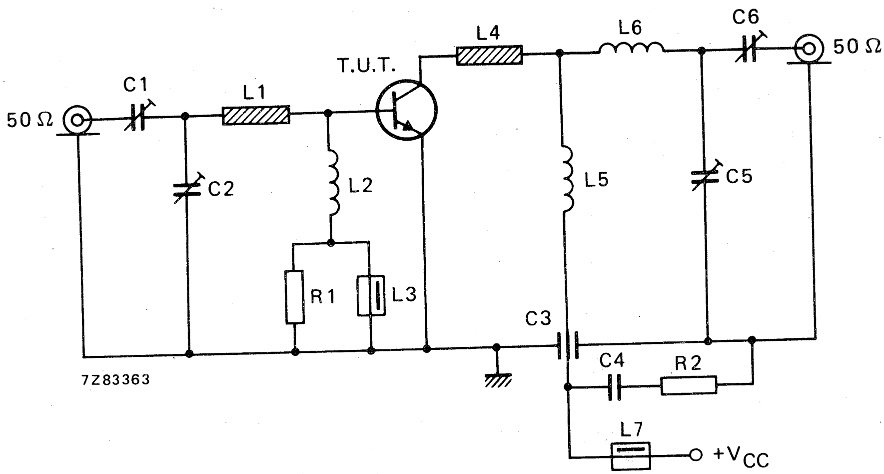


Fig. 7 Test circuit; c.w. class-B.

List of components:

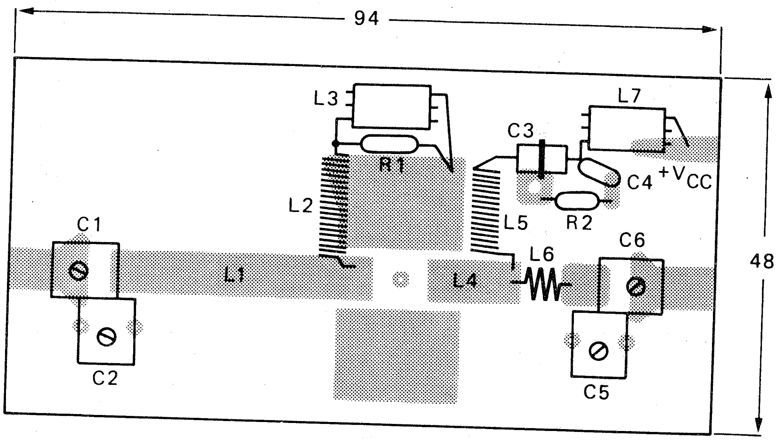
C1 = C5 = C6 = 1,4 to 5,5 pF film dielectric trimmer (cat. no. 2222 809 09001)
C2 = 2 to 9 pF film dielectric trimmer (cat. no. 2222 809 09002)
C3 = 100 pF feed-through capacitor
C4 = 100 nF polyester capacitor

L1 = stripline (34,8 mm x 6,0 mm)
L2 = 320 nH; 13 turns closely wound enamelled Cu wire (0,5 mm); int. dia. 4 mm; leads 2 x 4 mm
L3 = L7 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L4 = stripline (12,0 mm x 6,0 mm)
L5 = 265 nH; 13 turns closely wound enamelled Cu wire (0,35 mm); int. dia. 3,5 mm; leads 2 x 4 mm
L6 = 29 nH; 3 turns closely wound enamelled Cu wire (1 mm); int. dia. 3,5 mm; leads 2 x 4 mm

L1 and L4 are striplines on a double Cu-clad printed-circuit board with PTFE fibre-glass dielectric (ϵ_r = 2,74); thickness 1/16".

R1 = 100 Ω carbon resistor
R2 = 10 Ω carbon resistor

Component layout and printed-circuit board for 470 MHz test circuit are shown in Fig. 8.



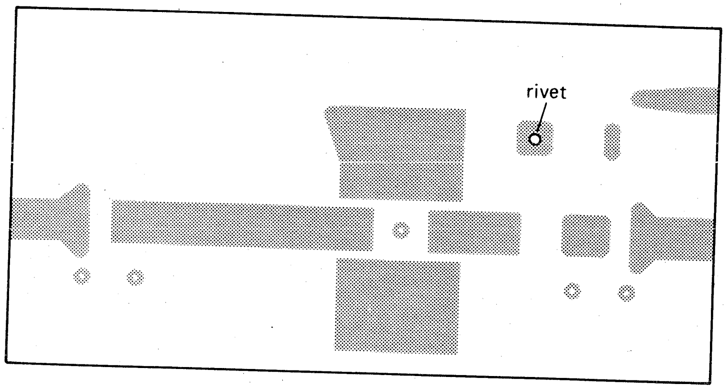


Fig. 8 Component layout and printed-circuit board for 470 MHz test circuit.

The circuit and the components are situated on one side of the PTFE fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets, whilst under the emitter leads Cu straps are used for a direct contact between upper and lower sheets.

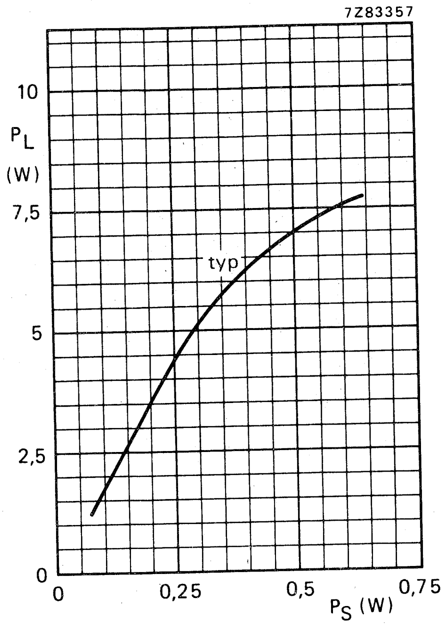


Fig. 9 V_{CE} = 28 V; f = 470 MHz; T_h = 25 °C.

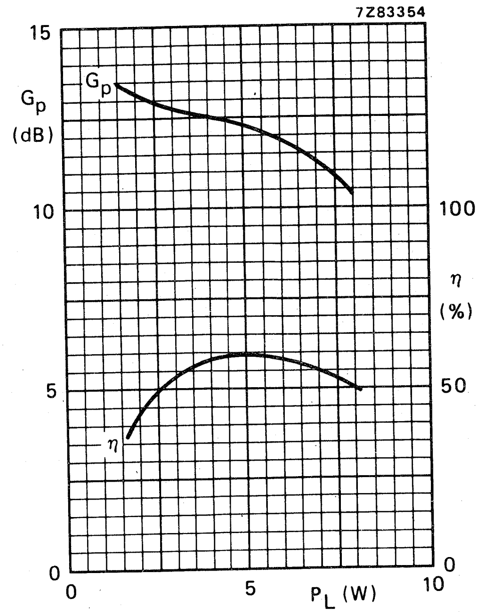


Fig. 10 Typical values; V_{CE} = 28 V; f = 470 MHz; T_h = 25 °C.

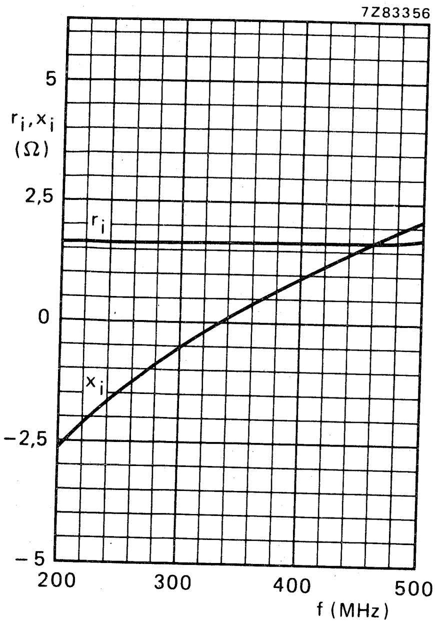


Fig. 11 Input impedance (series components).

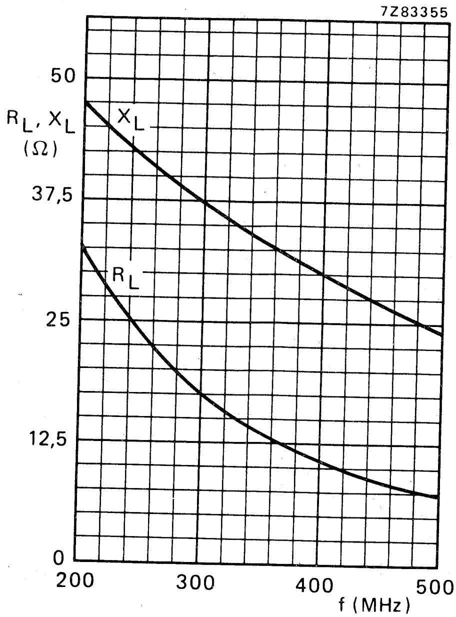


Fig. 12 Load impedance (series components).

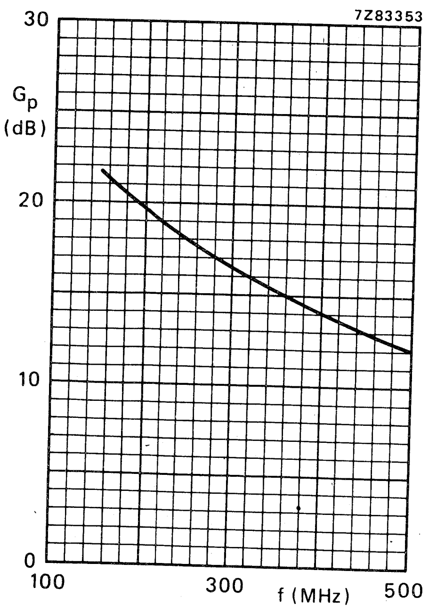


Fig. 13.

Conditions for Figs 11, 12 and 13:

Typical values; V_{CE} = 28 V; P_L = 4 W; T_h = 25 °C.

Ruggedness

The BLW90 is capable of withstanding full load mismatch (VSWR = 50 through all phases) up to 4 W under the following conditions:

V_{CE} = 28 V; f = 470 MHz; T_h = 70 °C; $R_{th\ mb\text{-}h}$ = 0,6 K/W.

U.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor suitable for transmitting applications in class-A, B or C in the u.h.f. and v.h.f. range for a nominal supply voltage of 28 V. The transistor is resistance stabilized and is guaranteed to withstand infinite VSWR at rated output power. High reliability is ensured by a **gold sandwich metallization.**

The transistor is housed in a ¼" capstan envelope with a ceramic cap. All leads are isolated from the stud.

QUICK REFERENCE DATA

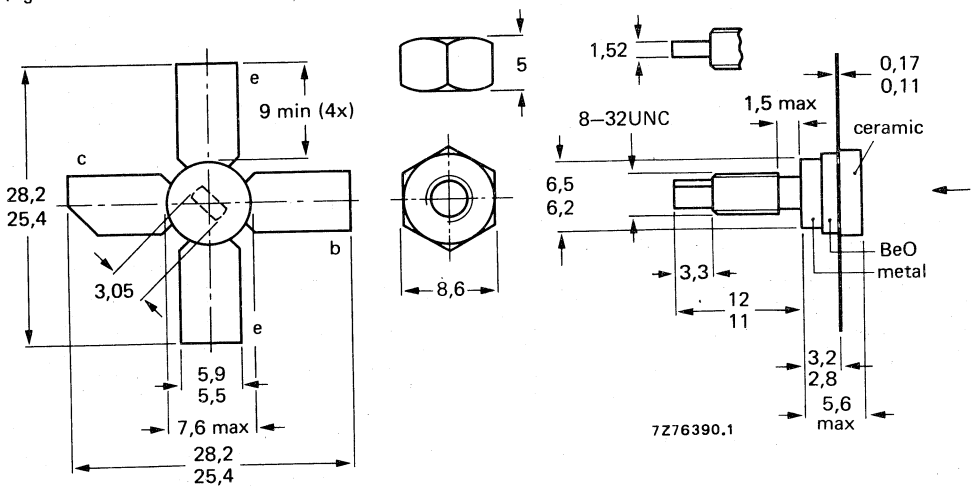
R.F. performance up to T_h = 25 °C in an unneutralized common-emitter class-B circuit

mode of operation	V_{CE} V	f MHz	P_L W	G_p dB	η %
c.w.	28	470	10	> 9	> 60

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-122.



Torque on nut: min. 0,75 Nm (7,5 kg cm)
max. 0,85 Nm (8,5 kg cm)

Diameter of clearance hole in heatsink: max. 4,2 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

When locking is required an adhesive is preferred instead of a lock washer.

CAUTION This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage			
(peak value); $V_{BE} = 0$	V_{CESM}	max.	60 V
open base	V_{CEO}	max.	30 V
Emitter-base voltage (open collector)	V_{EBO}	max.	4 V
Collector current			
d.c. or average	I_C; $I_{C(AV)}$	max.	1,5 A
(peak value); f > 1 MHz	I_{CM}	max.	3,5 A
Total power dissipation up to $T_{mb} = 35\ ^oC$	P_{tot}	max.	30 W
R.F. power dissipation (f > 1 MHz); $T_{mb} = 25\ ^oC$	P_{rf}	max.	32,5 W
Storage temperature	T_{stg}		−65 to + 150 ^oC
Operating junction temperature	T_j	max.	200 ^oC

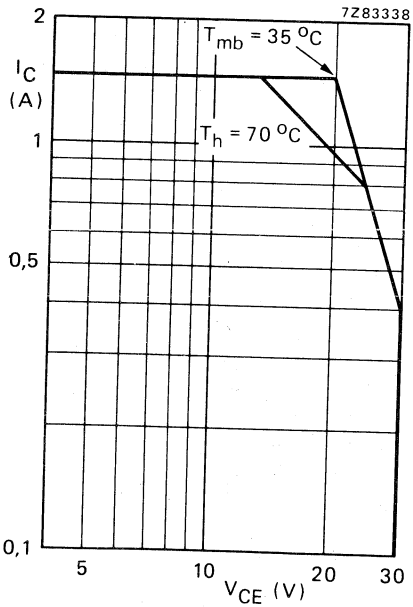


Fig. 2 D.C. SOAR.

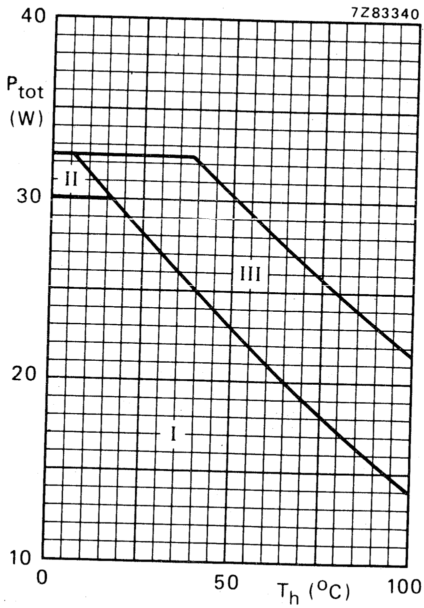


Fig. 3 Power derating curves vs. temperature.
I Continuous d.c. operation
II Continuous r.f. operation
III Short-time operation during mismatch

THERMAL RESISTANCE (dissipation = 10 W; $T_{mb} = 76\ ^oC$, i.e. $T_h = 70\ ^oC$)

From junction to mounting base (d.c. and r.f. dissipation)	$R_{th\ j\text{-}mb}$	=	6,2 K/W*
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,6 K/W*

* K/W is SI unit for $^oC/W$.

CHARACTERISTICS

$T_j = 25\ ^oC$

Collector-emitter breakdown voltage $V_{BE} = 0$; $I_C = 10$ mA	$V_{(BR)CES}$	>	60 V
Collector-emitter breakdown voltage open base; $I_C = 50$ mA	$V_{(BR)CEO}$	>	30 V
Emitter-base breakdown voltage open collector; $I_E = 4$ mA	$V_{(BR)EBO}$	>	4 V
Collector cut-off current $V_{BE} = 0$; $V_{CE} = 30$ V	I_{CES}	<	4 mA
Second breakdown energy; L = 25 mH; f = 50 Hz open base	E_{SBO}	>	2 mJ
$R_{BE} = 10\ \Omega$	E_{SBR}	>	2 mJ
D.C. current gain * $I_C = 0{,}6$ A; $V_{CE} = 5$ V	h_{FE}	typ.	40 10 to 100
Collector-emitter saturation voltage * $I_C = 2{,}0$ A; $I_B = 0{,}4$ A	V_{CEsat}	typ.	1,0 V
Transition frequency at f = 500 MHz * $-I_E = 0{,}6$ A; $V_{CB} = 28$ V	f_T	typ.	1,2 GHz
$-I_E = 2{,}0$ A; $V_{CB} = 28$ V	f_T	typ.	1,0 GHz
Collector capacitance at f = 1 MHz $I_E = I_e = 0$; $V_{CB} = 28$ V	C_c	typ.	17 pF
Feedback capacitance at f = 1 MHz $I_C = 20$ mA; $V_{CE} = 28$ V	C_{re}	typ.	8,5 pF
Collector-stud capacitance	C_{cs}	typ.	2 pF

* Measured under pulse conditions: $t_p \leqslant 200\ \mu s$; $\delta \leqslant 0{,}02$.

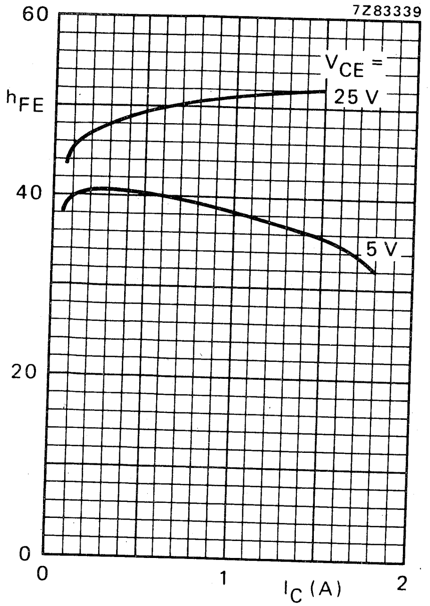


Fig. 4 Typical values; T_j = 25 °C.

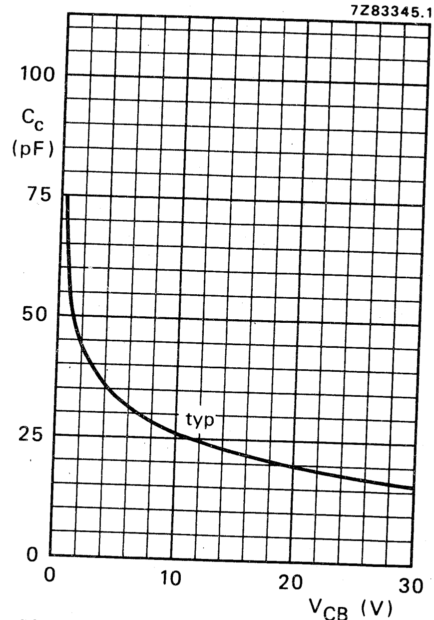


Fig. 5 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

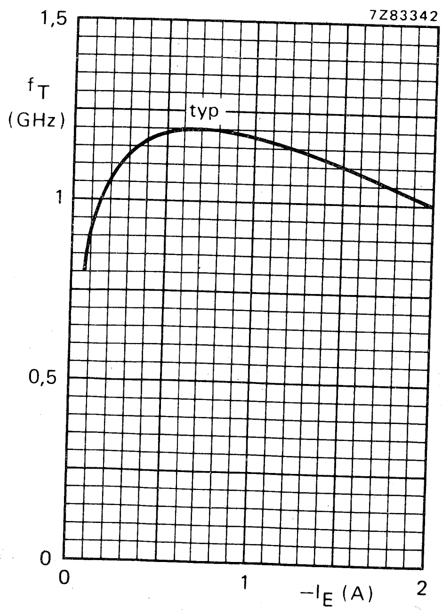


Fig. 6 V_{CB} = 28 V; f = 500 MHz; T_j = 25 °C.

APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit)

T_h = 25 °C

f (MHz)	V_{CE} (V)	P_L (W)	P_S (W)	G_p (dB)	I_C (A)	η (%)	$\overline{z_i}$ (Ω)	$\overline{Z_L}$ (Ω)
470	**28**	**10**	< **1,26**	> **9**	< **0,6**	> **60**	**1,0 + j2,1**	**4,9 + j11**
470	28	10	typ. 0,9	typ. 10,5	typ. 0,56	typ. 63	–	–

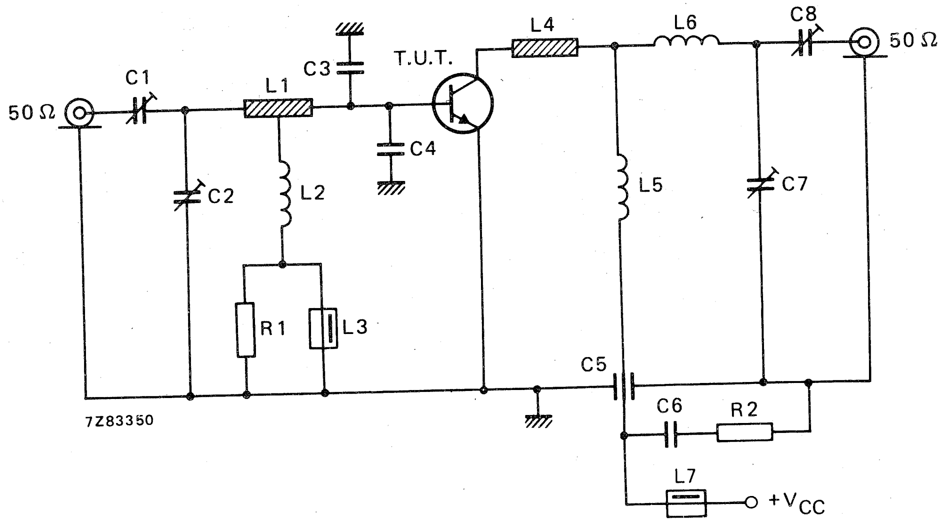


Fig. 7 Test circuit; c.w. class-B. For component layout and p.c.b. see Fig. 8.

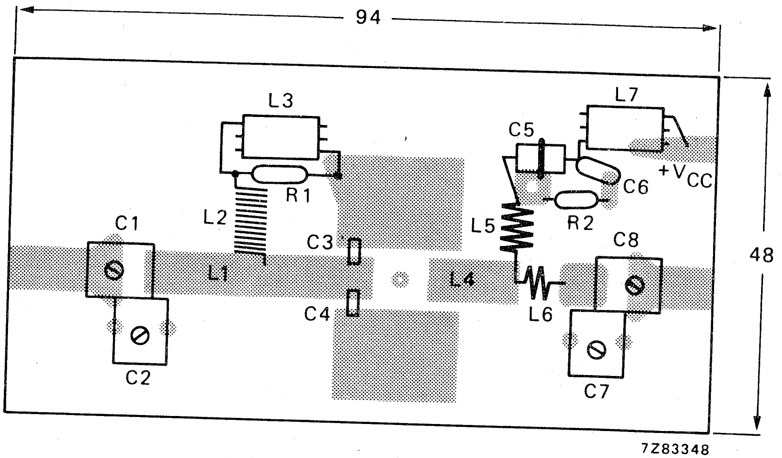
List of components:

C1 = C7 = C8 = 1,4 to 5,5 pF film dielectric trimmer (cat. no. 2222 809 09001)
C2 = 2 to 9 pF film dielectric trimmer (cat. no. 2222 809 09002)
C3 = C4 = 15 pF multilayer ceramic chip capacitor (cat. no. 2222 851 13159), middle of capacitor 3 mm from transistor edge
C5 = 100 pF feed-through capacitor
C6 = 100 nF polyester capacitor

L1 = stripline (30,4 mm x 6,0 mm); tap for L2 placed 11 mm from transistor edge
L2 = 320 nH; 13 turns closely wound enamelled Cu wire (0,5 mm); int. dia. 4 mm; leads 2 x 4 mm
L3 = L7 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L4 = stripline (12,0 mm x 6,0 mm)
L5 = 78 nH; 5 turns enamelled Cu wire (1,0 mm); int. dia. 5 mm; length 9,3 mm; leads 2 x 5 mm
L6 = 22 nH; 2 turns enamelled Cu wire (1,0 mm); int. dia. 4 mm; length 3,2 mm; leads 2 x 5 mm

L1 and L4 are striplines on a double Cu-clad printed-circuit board with PTFE fibre-glass dielectric (ϵ_r = 2,74); thickness 1/16″.

R1 = R2 = 10 Ω carbon resistor



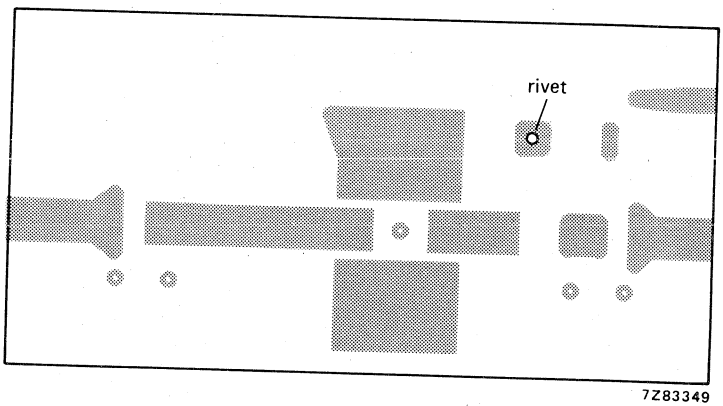


Fig. 8 Component layout and printed-circuit board for 470 MHz test circuit.

The circuit and the components are situated on one side of the PTFE fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets, whilst under the emitter leads Cu straps are used for a direct contact between upper and lower sheets.

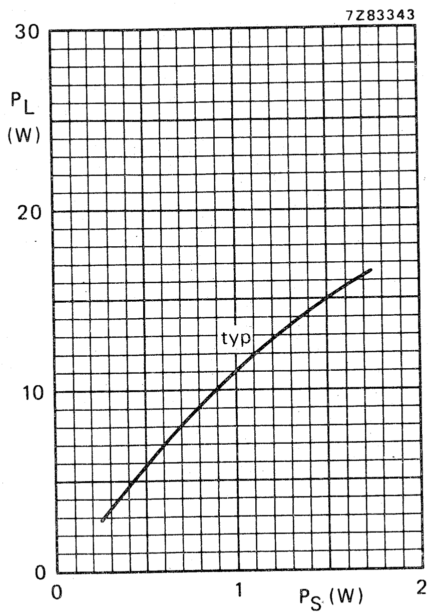


Fig. 9 V_{CE} = 28 V; f = 470 MHz; T_h = 25 °C.

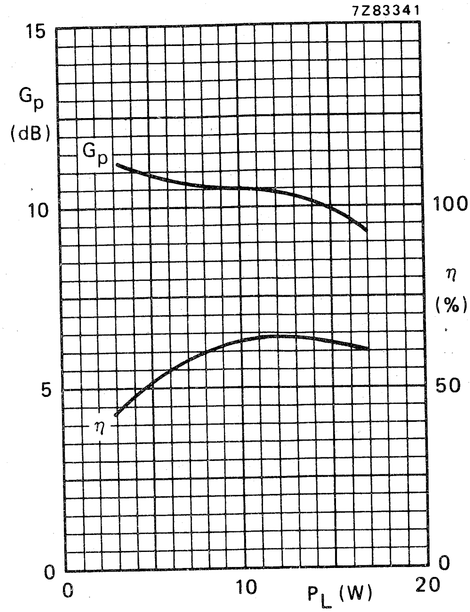


Fig. 10 Typical values; V_{CE} = 28 V; f = 470 MHz; T_h = 25 °C.

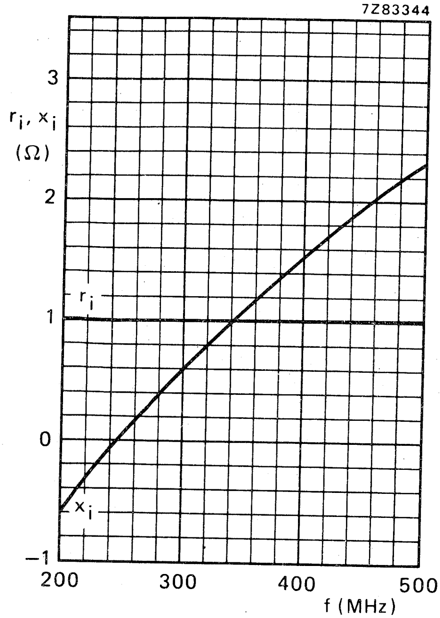


Fig. 11 Input impedance (series components).

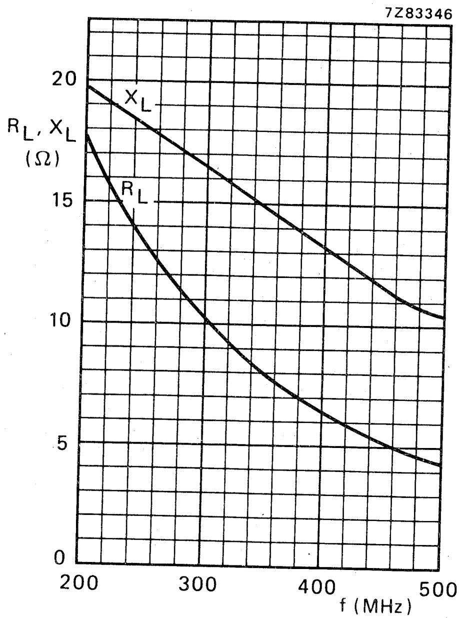
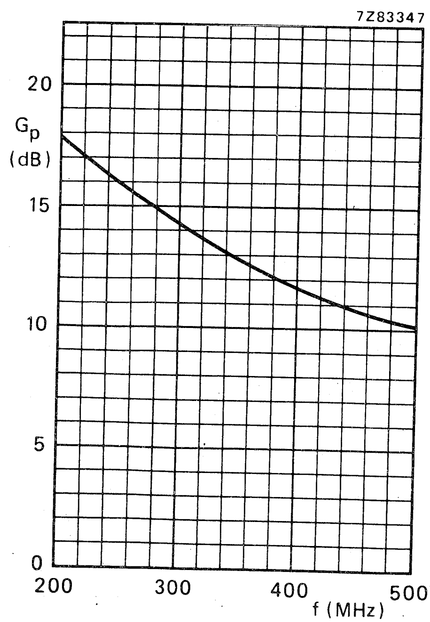


Fig. 12 Load impedance (series components).



Conditions for Figs 11, 12 and 13:

Typical values; V_{CE} = 28 V; P_L = 10 W; T_h = 25 °C.

Ruggedness

The BLW91 is capable of withstanding full load mismatch (VSWR = 50 through all phases) up to 10 W under the following conditions:

V_{CE} = 28 V; f = 470 MHz; T_h = 70 °C; $R_{th\ mb\text{-}h}$ = 0,6 K/W.

H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor intended for use in class-AB operated high power industrial and military transmitting equipment in the h.f. band. The transistor presents excellent performance as a linear amplifier in s.s.b. applications. It is resistance stabilized and is guaranteed to withstand severe load mismatch conditions. Matched h_{FE} groups are available on request.

The transistor has a ½" flange envelope with a ceramic cap. All leads are isolated from the flange.

QUICK REFERENCE DATA

R.F. performance up to T_h = 25 °C

mode of operation	V_{CE} V	$I_{C(ZS)}$ A	f MHz	P_L W	G_p dB	η_{dt} %	d_3 dB
s.s.b. (class-AB)	50	0,1	1,6 – 28	20 – 160 (P.E.P.)	> 14	> 40*	< –30

* At 160 W P.E.P.

MECHANICAL DATA

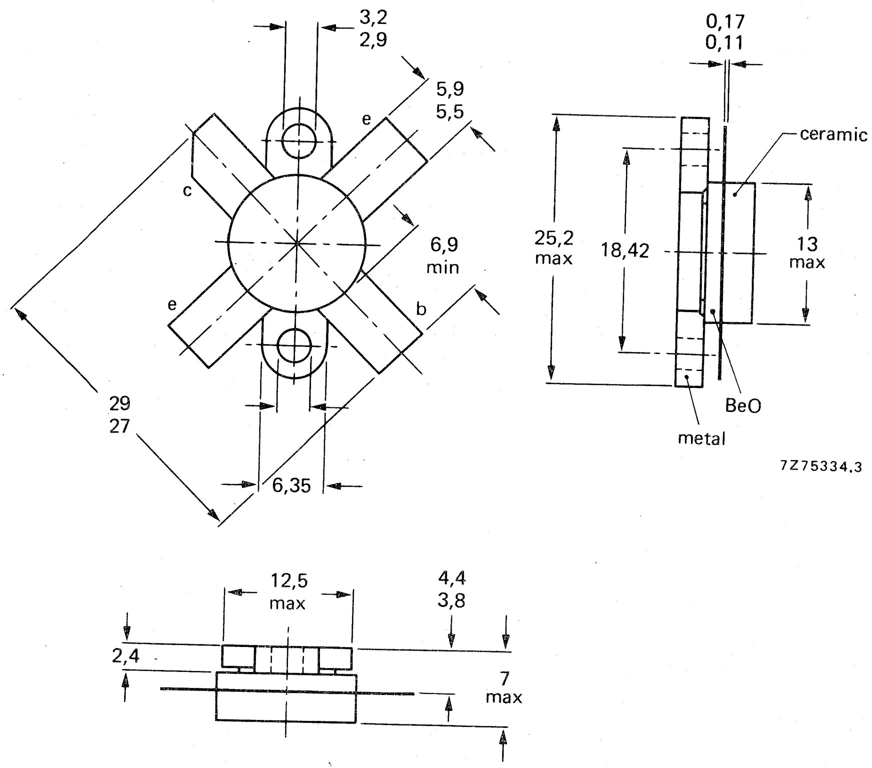
SOT-121 (see page 2)

CAUTION This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

MECHANICAL DATA

Fig. 1 SOT-121.

Dimensions in mm



Torque on screw: min. 0,6 Nm (6 kg cm)
max. 0,75 Nm (7,5 kg cm)

Recommended screw: cheese-head 4-40 UNC/2A

Heatsink compound must be applied sparingly and evenly distributed.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage ($V_{BE} = 0$) peak value	V_{CESM}	max.	110 V
Collector-emitter voltage (open base)	V_{CEO}	max.	53 V
Emitter-base voltage (open collector)	V_{EBO}	max.	4 V
Collector current (average)	$I_{C(AV)}$	max.	8 A
Collector current (peak value); f > 1 MHz	I_{CM}	max.	20 A
R.F. power dissipation (f > 1 MHz); T_{mb} = 25 °C	P_{rf}	max.	245 W
Storage temperature	T_{stg}		−65 to + 150 °C
Operating junction temperature	T_j	max.	200 °C

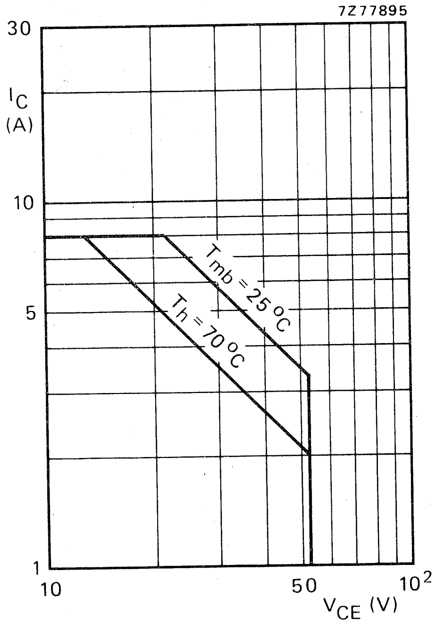


Fig. 2 D.C. SOAR.

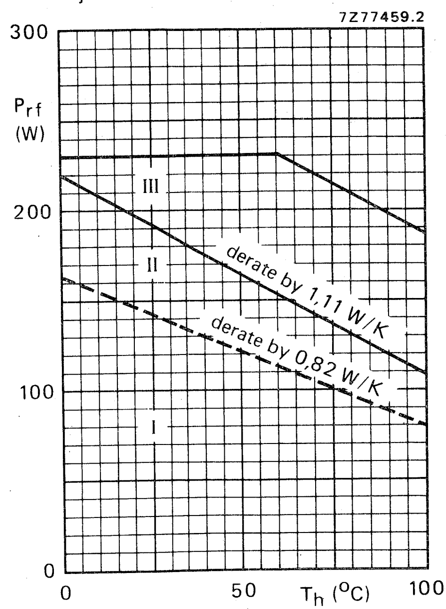


Fig. 3 R.F. power dissipation; $V_{CE} \leq 50$ V; f ≥ 1 MHz.
I Continuous d.c. operation
II Continuous r.f. operation
III Short-time operation during mismatch

THERMAL RESISTANCE (dissipation = 100 W; T_{mb} = 90 °C, i.e. T_h = 70 °C)

From junction to mounting base (d.c. dissipation)	$R_{th\ j\text{-}mb(dc)}$	=	1,0 K/W*
From junction to mounting base (r.f. dissipation)	$R_{th\ j\text{-}mb(rf)}$	=	0,7 K/W*
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,2 K/W*

* K/W is SI unit for °C/W.

CHARACTERISTICS

T_j = 25 °C

Collector-emitter breakdown voltage V_{BE} = 0; I_C = 25 mA	$V_{(BR)CES}$	>	110 V
Collector-emitter breakdown voltage open base; I_C = 100 mA	$V_{(BR)CEO}$	>	53 V
Emitter-base breakdown voltage open collector; I_E = 20 mA	$V_{(BR)EBO}$	>	4 V
Collector cut-off current V_{BE} = 0; V_{CE} = 53 V	I_{CES}	<	10 mA
Second breakdown energy; L = 25 mH; f = 50 Hz open base	E_{SBO}	>	12,5 mJ
R_{BE} = 10 Ω	E_{SBR}	>	12,5 mJ
D.C. current gain * I_C = 4 A; V_{CE} = 5 V	h_{FE}	typ.	30 15 to 50
D.C. current gain ratio of matched devices * I_C = 4 A; V_{CE} = 5 V	h_{FE1}/h_{FE2}	≤	1,2
Collector-emitter saturation voltage * I_C = 12,5 A; I_B = 2,5 A	V_{CEsat}	typ.	2,2 V
Transition frequency at f = 100 MHz * $-I_E$ = 4 A; V_{CB} = 40 V	f_T	typ.	270 MHz
$-I_E$ = 12,5 A; V_{CB} = 40 V	f_T	typ.	285 MHz
Collector capacitance at f = 1 MHz $I_E = I_e$ = 0; V_{CB} = 50 V	C_c	typ.	185 pF
Feedback capacitance at f = 1 MHz I_C = 150 mA; V_{CE} = 50 V	C_{re}	typ.	115 pF
Collector-flange capacitance	C_{cf}	typ.	3 pF

* Measured under pulse conditions: $t_p \leq 200$ μs; $\delta \leq 0{,}02$.

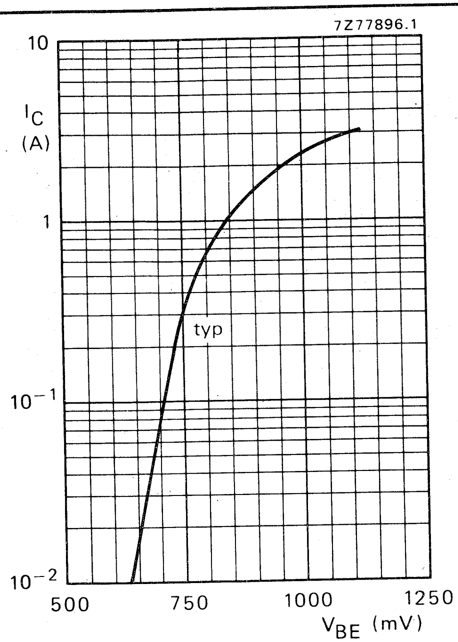


Fig. 4 V_{CE} = 40 V; T_h = 25 °C.

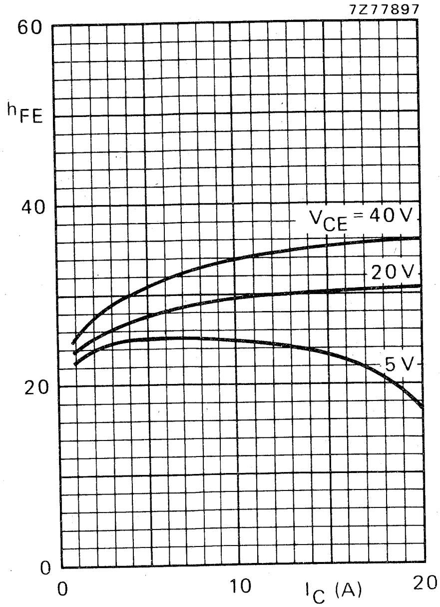


Fig. 5 Typical values; T_j = 25 °C.

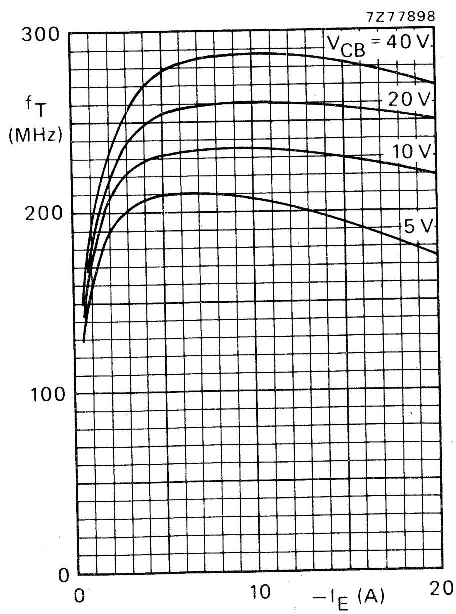


Fig. 6 Typical values; f = 100 MHz; T_j = 25 °C.

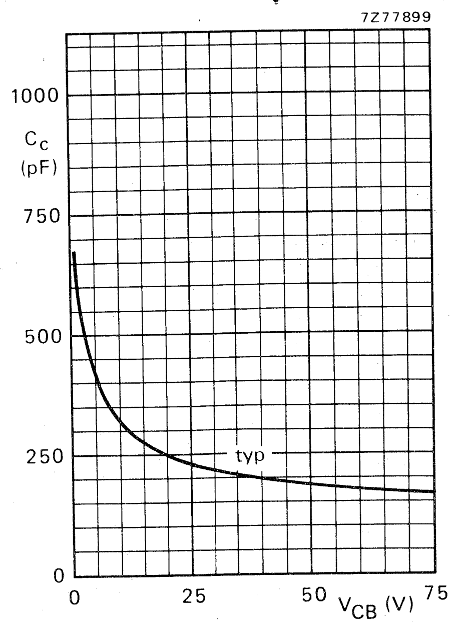


Fig. 7 I_E = I_e = 0; f = 1 MHz; T_j = 25 °C.

APPLICATION INFORMATION

R.F. performance in s.s.b. class-AB operation (linear power amplifier)

V_{CE} = 50 V; T_h = 25 °C; f_1 = 28,000 MHz; f_2 = 28,001 MHz

output power W	G_p dB	η_{dt} (%) at 160 W (P.E.P.)	I_C (A) at 160 W (P.E.P.)	d_3 dB *	d_5 dB *	$I_{C(ZS)}$ A
20 to 160 (P.E.P.)	> 14	> 40	< 4,0	< −30	< −30	0,1

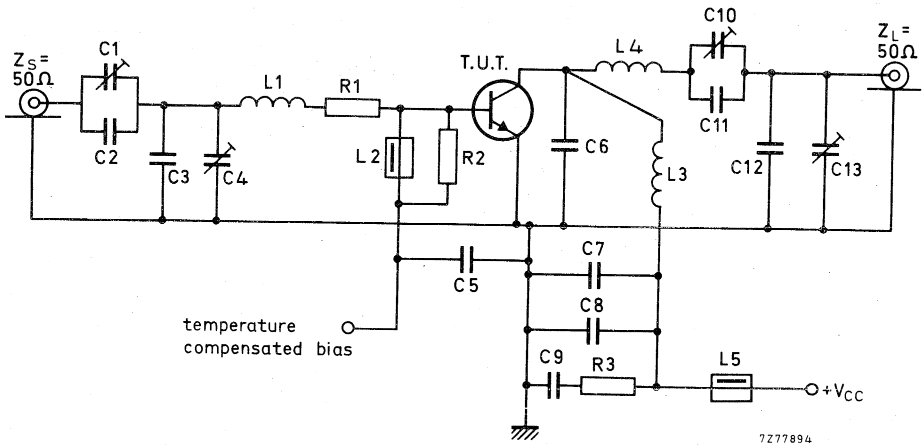


Fig. 8 Test circuit; s.s.b. class-AB.

List of components:

C1 = C10 = 100 pF film dielectric trimmer
C2 = C6 = 27 pF ceramic capacitor (500 V)
C3 = 220 pF polystyrene capacitor
C4 = C13 = 100 pF film dielectric trimmer
C5 = C7 = 3,9 nF ceramic capacitor
C8 = 100 nF polyester capacitor
C9 = 2,2 μF moulded metallized polyester capacitor
C11 = 68 pF ceramic capacitor (500 V)
C12 = 220 pF polystyrene capacitor

L1 = 88 nH; 3 turns Cu wire (1,0 mm); int. dia. 9,0 mm; length 6,1 mm; leads 2 x 5 mm
L2 = L5 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L3 = 180 nH; 4 turns enamelled Cu wire (1,6 mm); int. dia. 12,0 mm; length 9,9 mm; leads 2 x 10 mm
L4 = 350 nH; 7 turns enamelled Cu wire (1,6 mm); int. dia. 12,0 mm; length 19,1 mm; leads 2 x 10 mm

R1 = 0,66 Ω; parallel connection of 5 x 3,3 Ω carbon resistors (± 5%; 0,5 W each)
R2 = 27 Ω carbon resistor (± 5%; 0,5 W)
R3 = 4,7 Ω carbon resistor (± 5%; 0,5 W)

* Stated intermodulation distortion figures are referred to the according level of either of the equal amplified tones. Relative to the according peak envelope powers these figures should be increased by 6 dB.

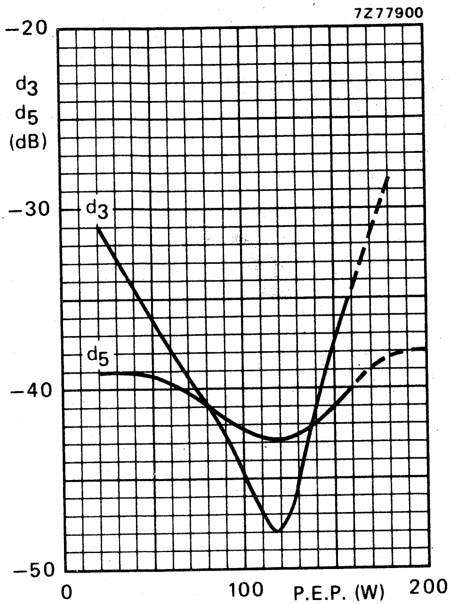


Fig. 9 Intermodulation distortion as a function of output power.*

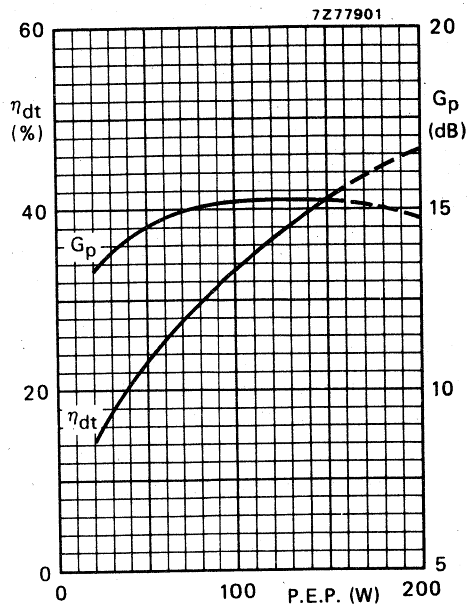


Fig. 10 Double-tone efficiency and power gain as a function of output power.

Conditions for Figs 9 and 10:

V_{CE} = 50 V; $I_{C(ZS)}$ = 0,1 A; f_1 = 28,000 MHz; f_2 = 28,001 MHz; T_h = 25 °C; typical values.

Ruggedness

The BLW95 is capable of withstanding full load mismatch (VSWR = 50) up to 150 W (P.E.P.) under the following conditions:

V_{CE} = 45V; f = 28 MHz; T_h = 70 °C; $R_{th\ mb\text{-}h}$ = 0,2 K/W.

* See note on page 6.

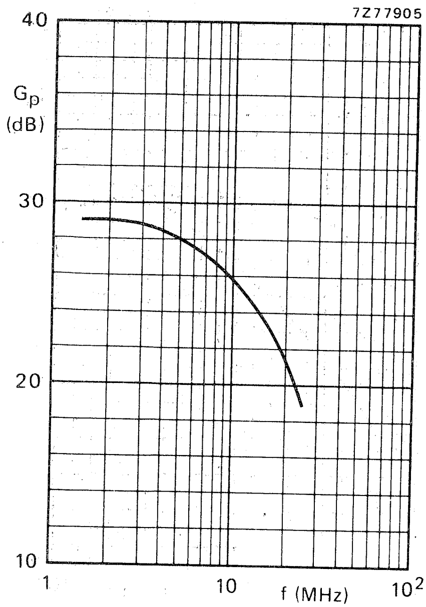


Fig. 11 Power gain as a function of frequency.

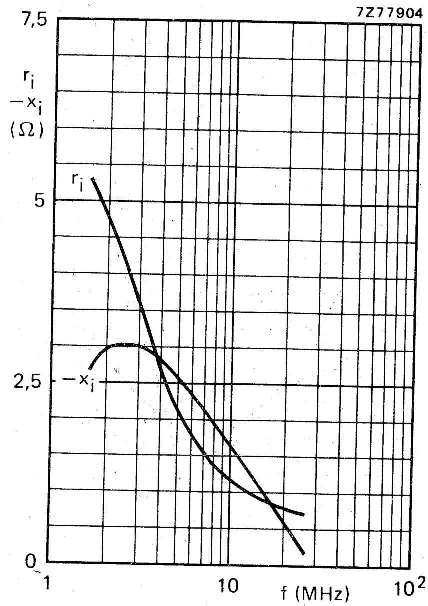


Fig. 12 Input impedance (series components) as a function of frequency.

Figs 11 and 12 are typical curves and hold for an unneutralized amplifier in s.s.b. class-AB operation.
Conditions:
V_{CE} = 50 V; $I_{C(ZS)}$ = 0,1 A; P_L = 160 W (P.E.P.); T_h = 25 °C; Z_L = 6,25 Ω in series with 7,3 nH (in parallel with −188 pF).

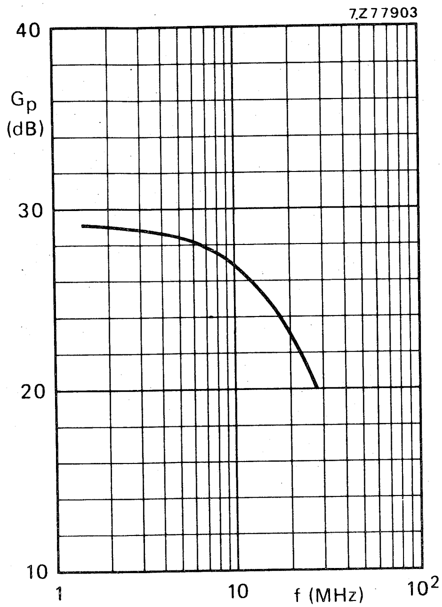


Fig. 13 Power gain as a function of frequency.

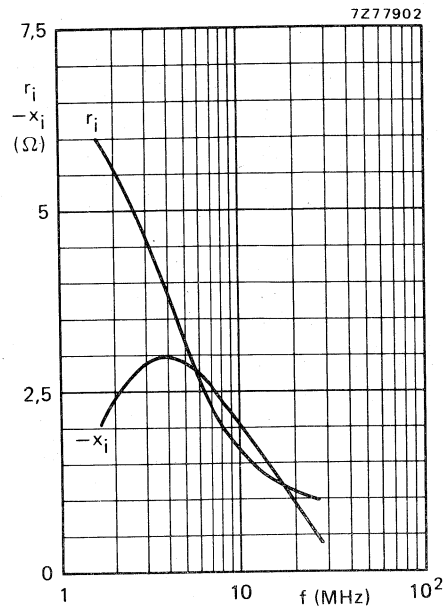


Fig. 14 Input impedance (series components) as a function of frequency.

Figs 13 and 14 are typical curves and hold for one transistor of a push-pull amplifier with cross-neutralization in s.s.b. class-AB operation.

Conditions:
V_{CE} = 50 V; $I_{C(ZS)}$ = 0,1 A; P_L = 160 W (P.E.P.); T_h = 25 °C; Z_L = 6,25 Ω in series with 10,4 nH (in parallel with −267 pF); neutralizing capacitor: 82 pF.

H.F./V.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor intended for use in class-A, AB and B operated high power industrial and military transmitting equipment in the h.f. and v.h.f. band. The transistor presents excellent performance as a linear amplifier in s.s.b. applications. It is resistance stabilized and is guaranteed to withstand severe load mismatch conditions. Transistors are supplied in matched h_{FE} groups.

The transistor has a ½" flange envelope with a ceramic cap. All leads are isolated from the flange.

QUICK REFERENCE DATA

R.F. performance up to T_h = 25 °C

mode of operation	V_{CE} V	f MHz	P_L W	G_p dB	η %	d_3 dB	d_5 dB	$I_{C(ZS)}$ (I_C) A
s.s.b. (class-AB)	**50**	**1,6 – 28**	**25 – 200 (P.E.P.)**	**> 13,5**	**> 40***	**< –30**	**< –30**	**0,1**
c.w. (class-B)	50	108	200	typ. 6,5	typ. 67	–	–	(6)
s.s.b. (class-A)	40	28	50 (P.E.P.)	typ. 19	–	typ. –40	< –40	(4)

* η_{dt} at 200 W P.E.P.

MECHANICAL DATA

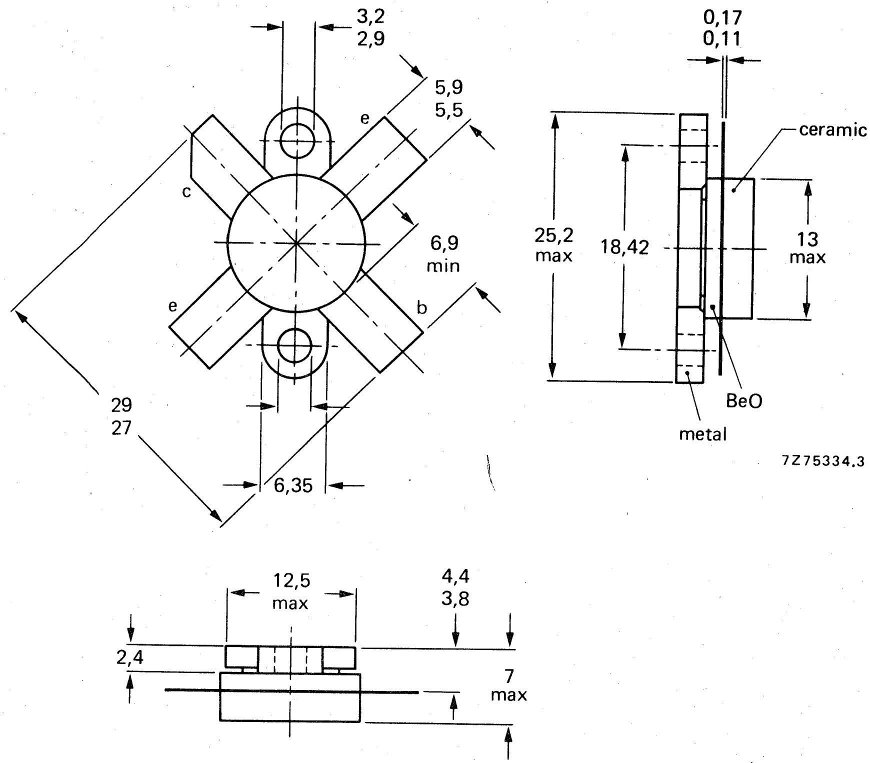
SOT-121 (see Fig. 1).

CAUTION This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

MECHANICAL DATA

Fig. 1 SOT-121.

Dimensions in mm



Torque on screw: min. 0,6 Nm (6 kg cm)
max. 0,75 Nm (7,5 kg cm)

Recommended screw: cheese-head 4-40 UNC/2A

Heatsink compound must be applied sparingly and evenly distributed.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage (V_{BE} = 0) peak value	V_{CESM}	max.	110	V
Collector-emitter voltage (open base)	V_{CEO}	max.	55	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4	V
Collector current (average)	$I_{C(AV)}$	max.	12	A
Collector current (peak value); f > 1 MHz	I_{CM}	max.	40	A
R.F. power dissipation (f > 1 MHz); T_{mb} = 45 °C	P_{rf}	max.	340	W
Storage temperature	T_{stg}		−65 to + 150	°C
Operating junction temperature	T_j	max.	200	°C

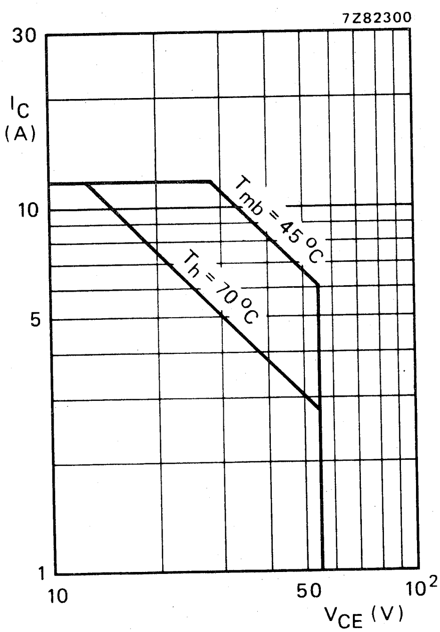


Fig. 2 D.C. SOAR.

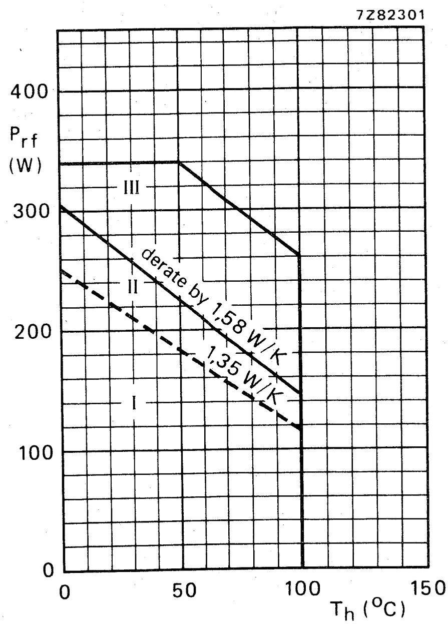


Fig. 3 Power/temperature derating curves.
I Continuous d.c. operation
II Continuous r.f. operation; f > 1 MHz
III Short-time operation during mismatch; f > 1 MHz

THERMAL RESISTANCE (dissipation = 150 W; T_{mb} = 100 °C, i.e. T_h = 70 °C)

From junction to mounting base (d.c. dissipation)	$R_{th\ j\text{-}mb(dc)}$	=	0,63	K/W*
From junction to mounting base (r.f. dissipation)	$R_{th\ j\text{-}mb(rf)}$	=	0,45	K/W*
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,2	K/W*

* K/W is SI unit for °C/W.

CHARACTERISTICS

$T_j = 25\ ^oC$

Collector-emitter breakdown voltage $V_{BE} = 0$; $I_C = 50$ mA	$V_{(BR)CES}$	>	110 V
Collector-emitter breakdown voltage open base; $I_C = 200$ mA	$V_{(BR)CEO}$	>	55 V
Emitter-base breakdown voltage open collector; $I_E = 20$ mA	$V_{(BR)EBO}$	>	4 V
Collector cut-off current $V_{BE} = 0$; $V_{CE} = 55$ V	I_{CES}	<	10 mA
Second breakdown energy; L = 25 mH; f = 50 Hz open base	E_{SBO}	>	20 mJ
$R_{BE} = 10\ \Omega$	E_{SBR}	>	20 mJ
D.C. current gain* $I_C = 7$ A; $V_{CE} = 5$ V	h_{FE}	typ.	30 15 to 50
D.C. current gain ratio of matched devices* $I_C = 7$ A; $V_{CE} = 5$ V	h_{FE1}/h_{FE2}	⩽	1,2
Collector-emitter saturation voltage* $I_C = 20$ A; $I_B = 4$ A	V_{CEsat}	typ.	1,9 V
Transition frequency at f = 100 MHz** $-I_E = 7$ A; $V_{CB} = 45$ V	f_T	typ.	235 MHz
$-I_E = 20$ A; $V_{CB} = 45$ V	f_T	typ.	245 MHz
Collector capacitance at f = 1 MHz $I_E = I_e = 0$; $V_{CB} = 50$ V	C_c	typ.	280 pF
Feedback capacitance at f = 1 MHz $I_C = 150$ mA; $V_{CE} = 50$ V	C_{re}	typ.	170 pF
Collector-flange capacitance	C_{cf}	typ.	4,4 pF

* Measured under pulse conditions: $t_p \leqslant 300\ \mu s$; $\delta \leqslant 0{,}02$.
** Measured under pulse conditions: $t_p \leqslant 50\ \mu s$; $\delta \leqslant 0{,}01$.

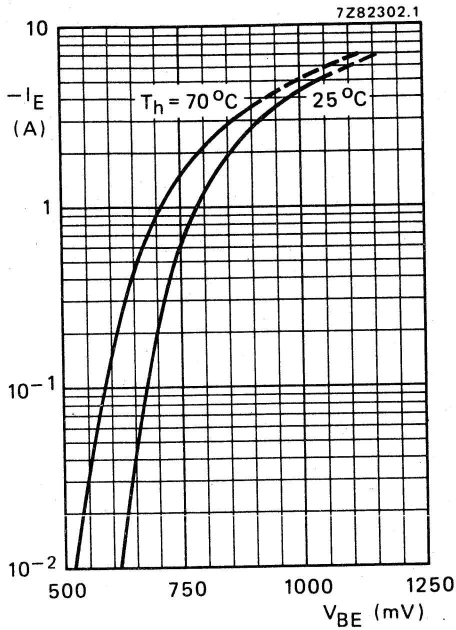


Fig. 4 Typical values; $V_{CE} = 40$ V.

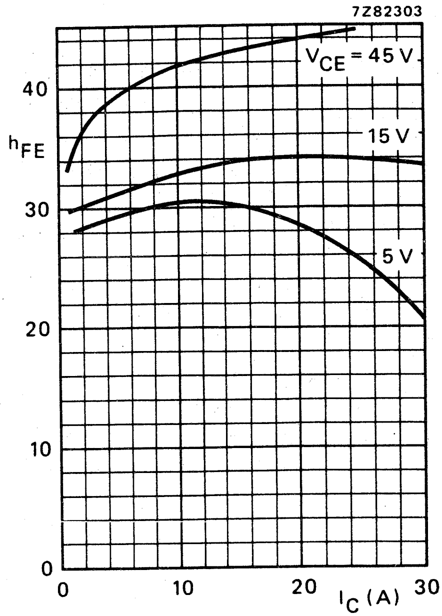


Fig. 5 Typical values; $T_j = 25\ ^oC$.

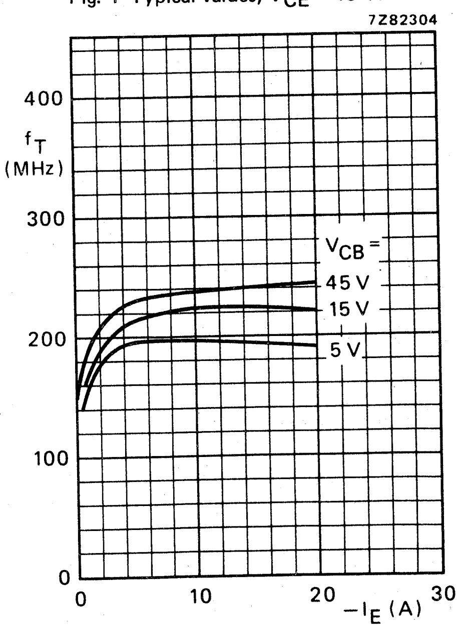


Fig. 6 Typical values; f = 100 MHz; $T_j = 25\ ^oC$.

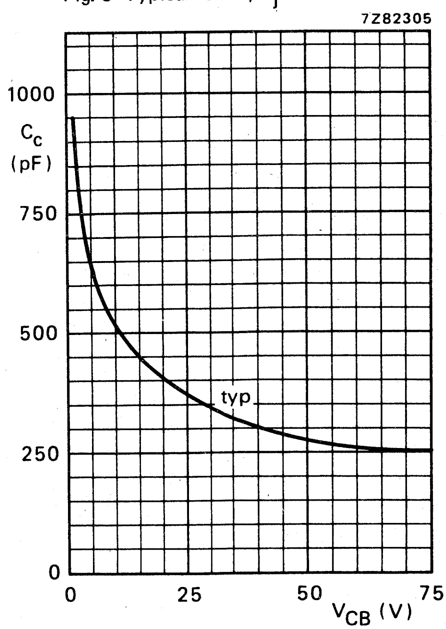


Fig. 7 $I_E = I_e = 0$; f = 1 MHz; $T_j = 25\ ^oC$.

APPLICATION INFORMATION

R.F. performance in s.s.b. class-AB operation (linear power amplifier)

V_{CE} = 50 V; T_h = 25 °C; f_1 = 28,000 MHz; f_2 = 28,001 MHz

output power W	G_p dB	η_{dt}(%) at 200 W (P.E.P.)	I_C (A) at 200 W (P.E.P.)	d_3 * dB	d_5 * dB	$I_{C(ZS)}$ A
25 to 200 (P.E.P.)	> 13,5	> 40	< 5,0	< –30	< –30	0,1

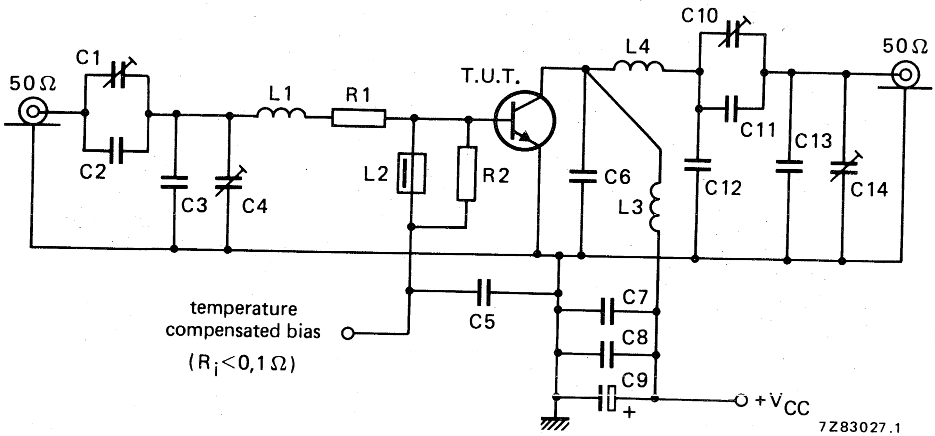


Fig. 8 Test circuit; s.s.b. class-AB.

List of components:

C1 = C4 = C10 = C14 = 100 pF film dielectric trimmer
C2 = 27 pF ceramic capacitor (500 V)
C3 = 270 pF polysterene capacitor (630 V)
C5 = C7 = C8 = 220 nF multilayer ceramic chip capacitor
C6 = 27 pF multilayer ceramic chip capacitor (500 V; ATC▲)
C9 = 47 µF/63 V electrolytic capacitor
C11 = 2 x 36 pF multilayer ceramic chip capacitors (500 V; ATC▲) in parallel
C12 = 2 x 43 pF multilayer ceramic chip capacitors (500 V; ATC▲) in parallel
C13 = 43 pF multilayer ceramic chip capacitor (500 V; ATC▲)

L1 = 88 nH; 3 turns Cu wire (1,0 mm); int. dia. 9,0 mm; length 6,1 mm; leads 2 x 5 mm
L2 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L3 = 150 nH; 5 turns Cu wire (2,0 mm); int. dia. 10,0 mm; length 18,7 mm; leads 2 x 5 mm
L4 = 197 nH; 5 turns Cu wire (2,0 mm); int. dia. 12,0 mm; length 18,6 mm; leads 2 x 5 mm

R1 = 0,66 Ω; parallel connection of 5 x 3,3 Ω metal film resistors (PR37; ± 5%; 1,6 W each)
R2 = 27 Ω carbon resistor (± 5%; 0,5 W)

* Stated intermodulation distortion figures are referred to the according level of either of the equal amplified tones. Relative to the according peak envelope powers these figures should be increased by 6 dB.

▲ ATC means American Technical Ceramics.

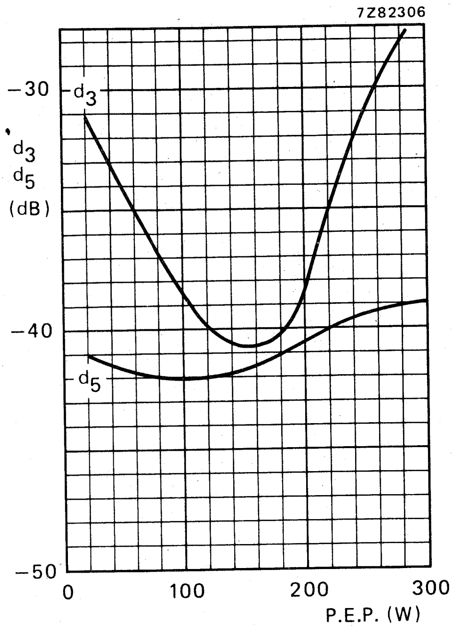


Fig. 9 Intermodulation distortion as a function of output power.*

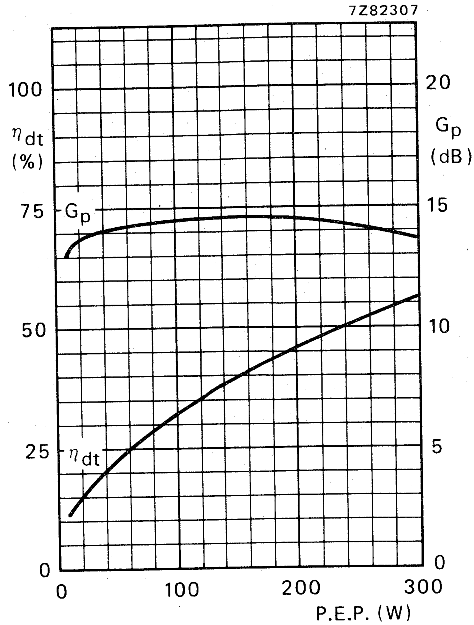


Fig. 10 Double-tone efficiency and power gain as a function of output power.

Conditions for Figs 9 and 10:

V_{CE} = 50 V; $I_{C(ZS)}$ = 0,1 A; f_1 = 28,000 MHz; f_2 = 28,001 MHz; T_h = 25 °C; typical values.

Ruggedness

The BLW96 is capable of withstanding full load mismatch (VSWR = 50 through all phases) up to 150 W (P.E.P.) or a load mismatch (VSWR = 5 through all phases) up to 200 W (P.E.P.) under the following conditions:

V_{CE} = 45 V; f = 28 MHz; T_h = 70 °C; $R_{th\ mb\text{-}h}$ = 0,2 K/W.

* See note on page 6.

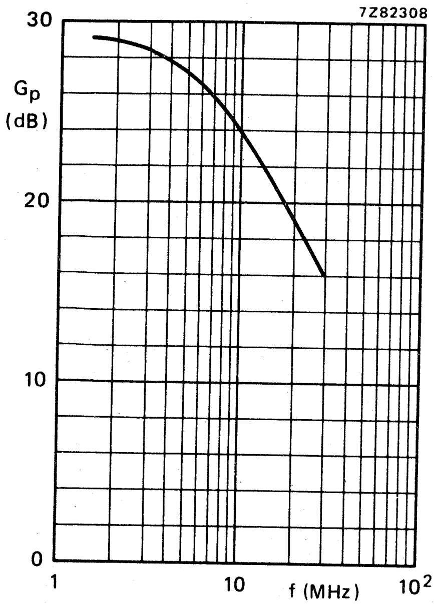


Fig. 11 Power gain as a function of frequency.

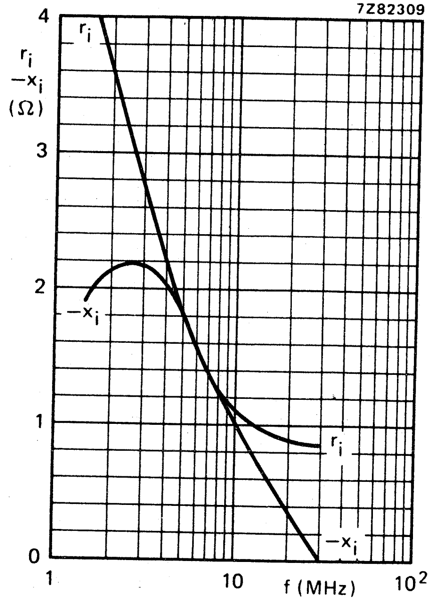


Fig. 12 Input impedance (series components) as a function of frequency.

Figs 11 and 12 are typical curves and hold for one transistor of a push-pull amplifier with cross-neutralization in s.s.b. class-AB operation.

Conditions:
V_{CE} = 50 V; $I_{C(ZS)}$ = 0,1 A; P_L = 200 W (P.E.P.); T_h = 25 °C; Z_L = 5 Ω; neutralizing capacitor: 47 pF.

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit)

T_h = 25 °C

f (MHz)	V_{CE} (V)	P_L (W)	P_S (W)	G_p (dB)	I_C (A)	η (%)
108	50	200	typ. 45	typ. 6,5	typ. 6	typ. 67

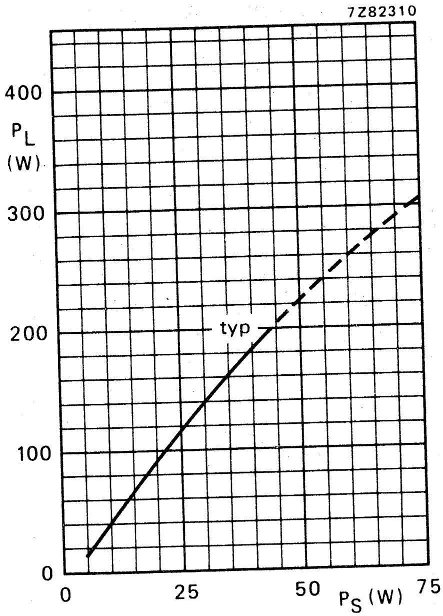


Fig. 13 V_{CE} = 50 V; f = 108 MHz; T_h = 25 °C.

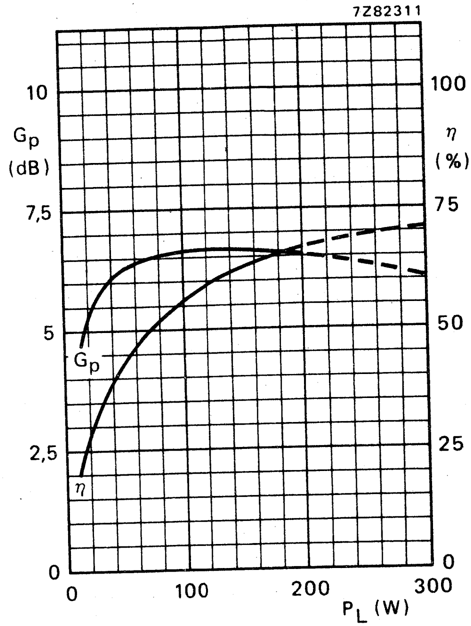


Fig. 14 V_{CE} = 50 V; f = 108 MHz; T_h = 25 °C; typical values.

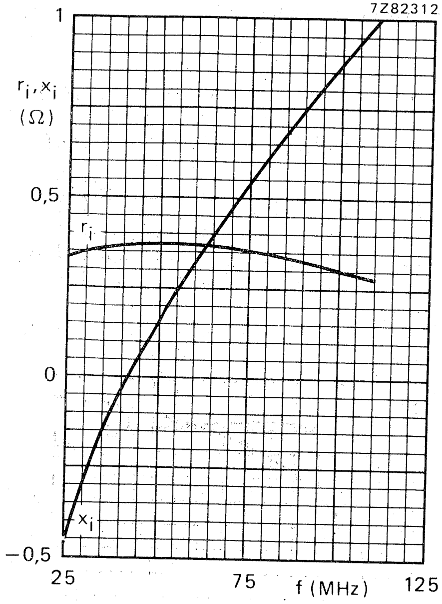


Fig. 15 Input impedance (series components).

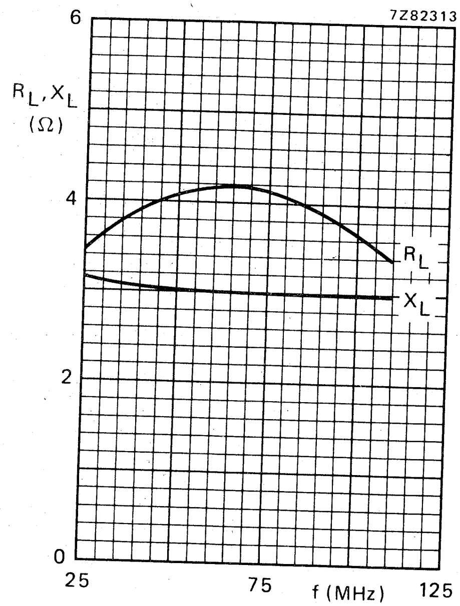


Fig. 16 Load impedance (series components).

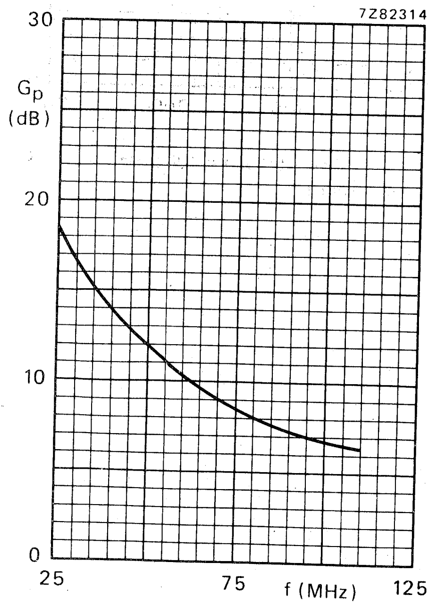


Fig. 17.

Conditions for Figs 15, 16 and 17:

Typical values; V_{CE} = 50 V; P_L = 200 W;
T_h = 25 °C; class-B operation.

R.F. performance in s.s.b. class-A operation (linear power amplifier)

V_{CE} = 40 V; T_h = 25 °C; f_1 = 28,000 MHz; f_2 = 28,001 MHz

output power W	G_p dB	I_C A	d_3* dB	d_5* dB
typ. 50 (P.E.P.)	typ. 19	4	typ. −40	< −40

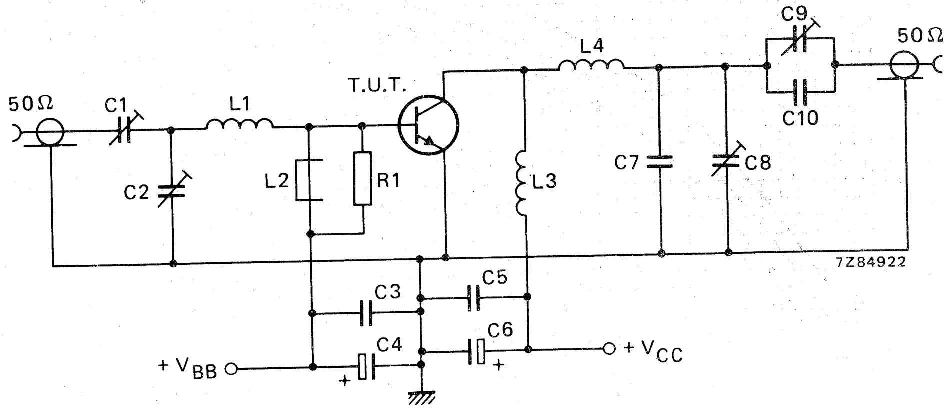


Fig. 18 Test circuit; s.s.b. class-A.

List of components:

C1 = C2 = 10 to 780 pF film dielectric trimmer
C3 = 220 nF polyester capacitor (100 V)
C4 = 100 μF/4 V electrolytic capacitor
C5 = 2 x 330 nF polyester capacitors (100 V) in parallel
C6 = 47 μF/63 V electrolytic capacitor
C7 = C10 = 2 x 82 pF ceramic capacitors (500 V) in parallel
C8 = C9 = 10 to 150 pF air dielectric trimmer

L1 = 45 nH; 2 turns enamelled Cu wire (1,6 mm); int. dia. 8,0 mm; length 4,0 mm; leads 2 x 3 mm
L2 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L3 = 110 nH; 4 turns enamelled Cu wire (2,0 mm); int. dia. 10,0 mm; length 8,0 mm; leads 2 x 2 mm
L4 = 210 nH; 5 turns enamelled Cu wire (2,0 mm); int. dia. 12,0 mm; length 10,0 mm; leads 2 x 2 mm

R1 = 27 Ω carbon resistor (± 5%; 0,5 W)

* Stated intermodulation distortion figures are referred to the according level of either of the equal amplified tones. Relative to the according peak envelope powers these figures should be increased by 6 dB.

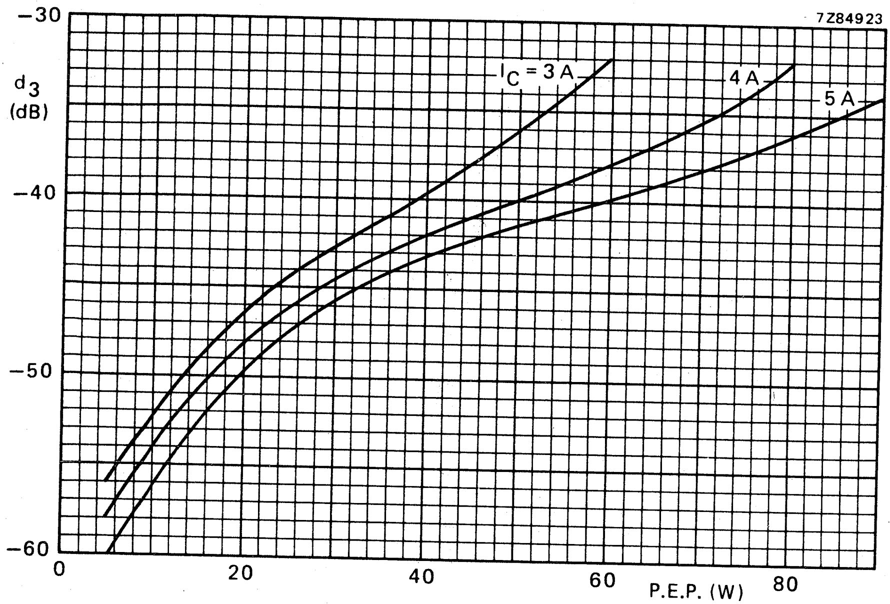


Fig. 19 Third order intermodulation distortion as a function of output power.*
Typical values; V_{CE} = 40 V; T_h = 25 °C; f_1 = 28,000 MHz; f_2 = 28,001 MHz.

* Stated intermodulation distortion figures are referred to the according level of either of the equal amplified tones. Relative to the according peak envelope powers these figures should be increased by 6 dB.

U.H.F. LINEAR POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor primarily intended for use in linear u.h.f. amplifiers of TV transposers and transmitters in band IV-V, as well as for driver stages in tube systems.

Features:
- diffused emitter ballasting resistors for an optimum temperature profile;
- gold sandwich metallization ensures excellent reliability.

The transistor has a ¼" capstan envelope with ceramic cap. All leads are isolated from the stud.

QUICK REFERENCE DATA

R.F. performance in linear amplifier

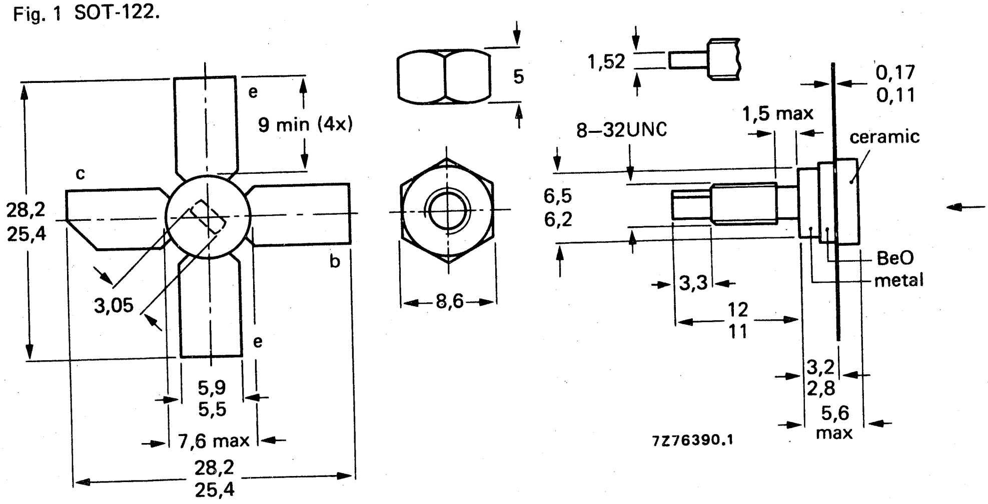
mode of operation	f_{vision} MHz	V_{CE} V	I_C mA	T_h °C	d_{im}* dB	$P_{o\ sync}$* W	G_p dB
class-A	860	25	850	70	−60	> 3,5	> 6,5
class-A	860	25	850	25	−60	typ. 4,4	typ. 7,0

* Three-tone test method (vision carrier −8 dB, sound carrier −7 dB, sideband signal −16 dB), zero dB corresponds to peak sync level.

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-122.



Torque on nut: min. 0,75 Nm (7,5 kg cm)
max. 0,85 Nm (8,5 kg cm)

Diameter of clearance hole in heatsink: max. 4,2 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

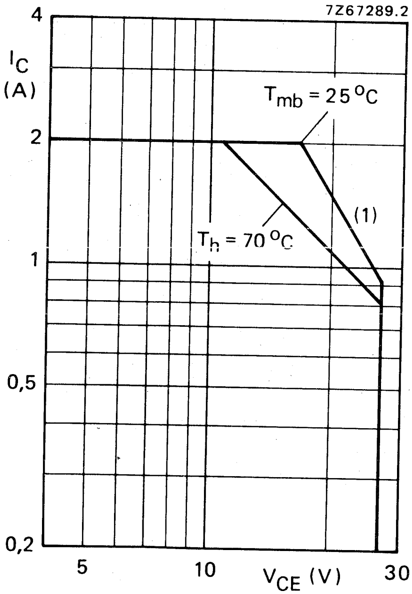
When locking is required an adhesive is preferred instead of a lock washer.

CAUTION This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage				
(peak value); $V_{BE} = 0$	V_{CESM}	max.	50	V
open base	V_{CEO}	max.	27	V
Emitter-base voltage (open collector)	V_{EBO}	max.	3,5	V
Collector current				
d.c.	I_C	max.	2	A
(peak value); f > 1 MHz	I_{CM}	max.	4	A
Total power dissipation at $T_h = 70\ ^oC$	P_{tot}	max.	21,5	W
Storage temperature	T_{stg}	−65 to + 150		^oC
Operating junction temperature	T_j	max.	200	^oC



(1) Second breakdown limit (independent of temperature).

Fig. 2 D.C. SOAR.

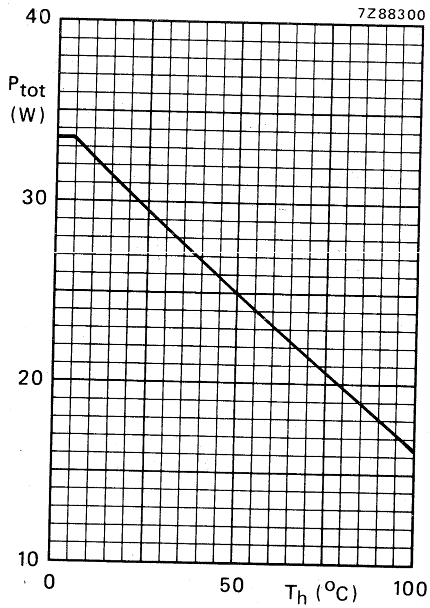


Fig. 3 Power derating curve vs. temperature.

THERMAL RESISTANCE (dissipation = 21,25 W; $T_{mb} = 82{,}75\ ^oC$, $T_h = 70\ ^oC$)

From junction to mounting base	$R_{th\ j\text{-}mb}$	=	5,45	K/W*
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,6	K/W*

* K/W is SI unit for $^oC/W$.

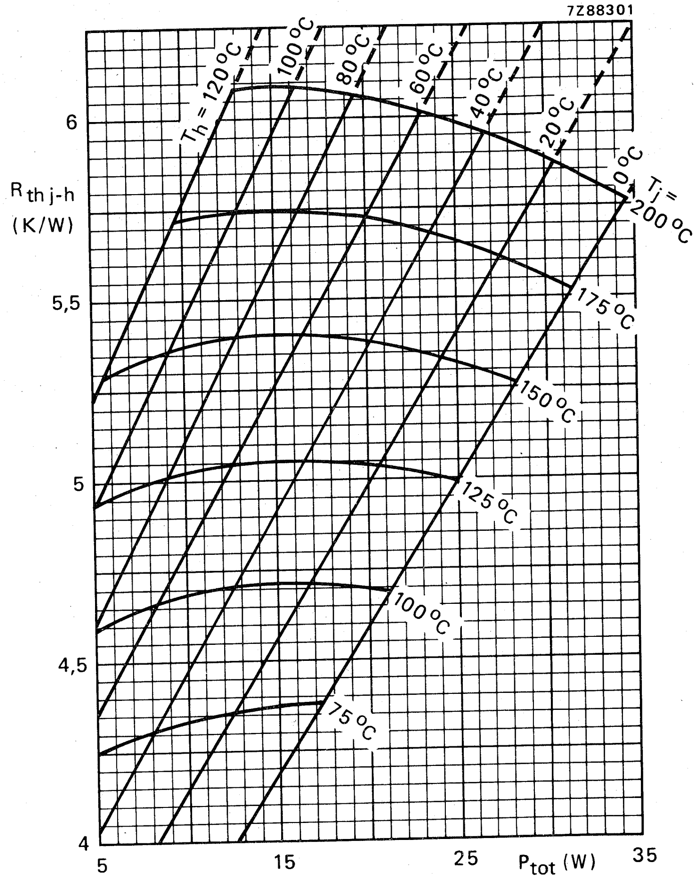


Fig. 4 Maximum thermal resistance from junction to heatsink as a function of power dissipation, with heatsink and junction temperature as parameters. ($R_{th\ mb\text{-}h}$ = 0,6 K/W.)

Example

Nominal class-A operation (without r.f. signal): V_{CE} = 25 V; I_C = 850 mA; T_h = 70 °C.

Fig. 4 shows:	$R_{th\ j\text{-}h}$	max.	6,05 K/W
	T_j	max.	200 °C
Typical device:	$R_{th\ j\text{-}h}$	typ.	5,35 K/W
	T_j	typ.	183 °C

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector-emitter breakdown voltage				
→ V_{BE} = 0; I_C = 10 mA	$V_{(BR)CES}$	>	50	V
open base, I_C = 25 mA	$V_{(BR)CEO}$	>	27	V
Emitter-base breakdown voltage				
open collector, I_E = 5 mA	$V_{(BR)EBO}$	>	3,5	V
D.C. current gain*				
I_C = 850 mA; V_{CE} = 25 V	h_{FE}	>	15	
		typ.	40	
Collector-emitter saturation voltage*				
I_C = 500 mA; I_B = 100 mA	V_{CEsat}	typ.	0,25	V
Transition frequency at f = 500 MHz**				
$-I_E$ = 850 mA; V_{CB} = 25 V	f_T	typ.	2,5	GHz
Collector capacitance at f = 1 MHz				
$I_E = I_e$ = 0; V_{CB} = 25 V	C_c	typ.	24	pF
		<	30	pF
Feedback capacitance at f = 1 MHz				
I_C = 50 mA; V_{CE} = 25 V	C_{re}	typ.	15	pF
Collector-stud capacitance	C_{cs}	typ.	2	pF

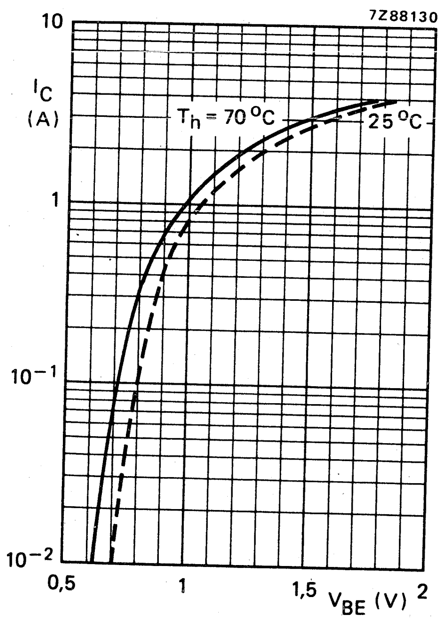


Fig. 5 Typical values; V_{CE} = 25 V.

* Measured under pulse conditions: $t_p \leqslant 300\ \mu s$; $\delta \leqslant 0{,}02$.

** Measured under pulse conditions: $t_p \leqslant 50\ \mu s$; $\delta \leqslant 0{,}01$.

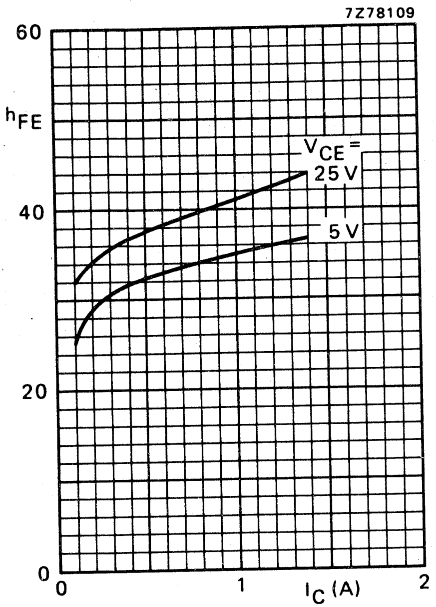


Fig. 6 Typical values; T_j = 25 °C.

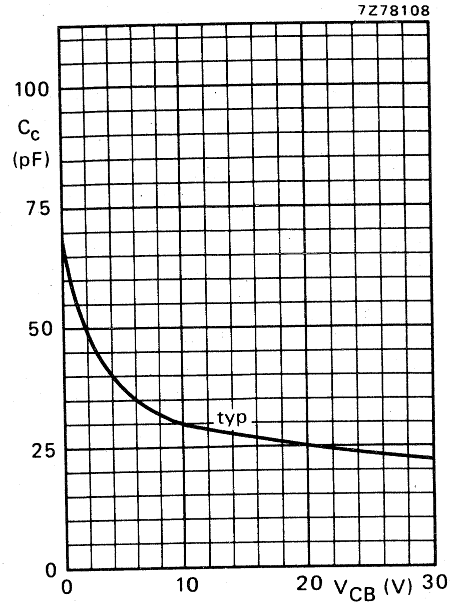


Fig. 7 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

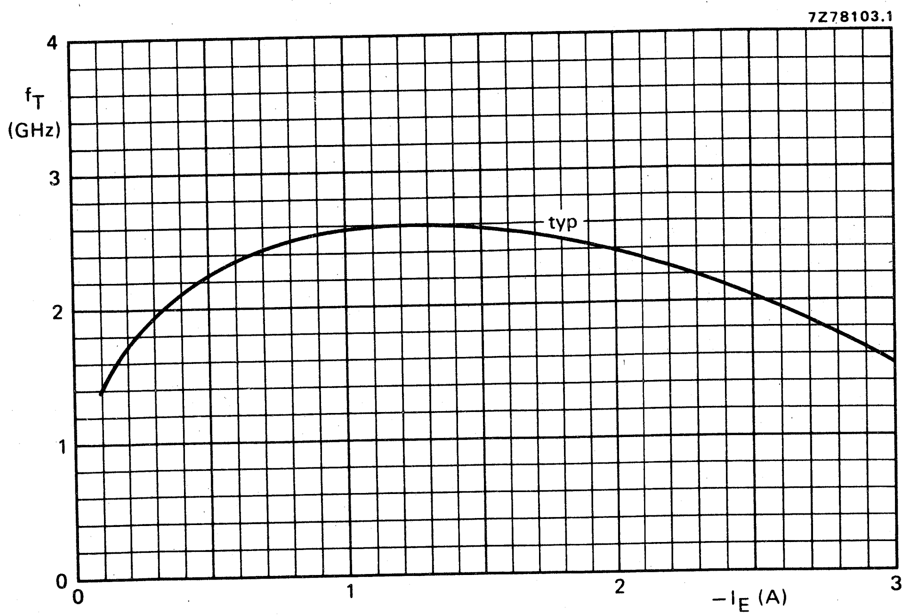


Fig. 8 V_{CB} = 25 V; f = 500 MHz; T_j = 25 °C.

APPLICATION INFORMATION

R.F. performance in u.h.f. class-A operation (linear power amplifier)

f_{vision} (MHz)	V_{CE} (V)	I_C (mA)	T_h (°C)	d_{im} (dB)*	$P_{o\ sync}$ (W)*	G_p (dB)
860	25	850	70	−60	> 3,5	> 6,5
860	25	850	70	−60	typ. 3,8	typ. 7,0
860	25	850	25	−60	typ. 4,4	typ. 7,0

* Three-tone test method (vision carrier −8 dB, sound carrier −7 dB, sideband signal −16 dB), zero dB corresponds to peak sync level.

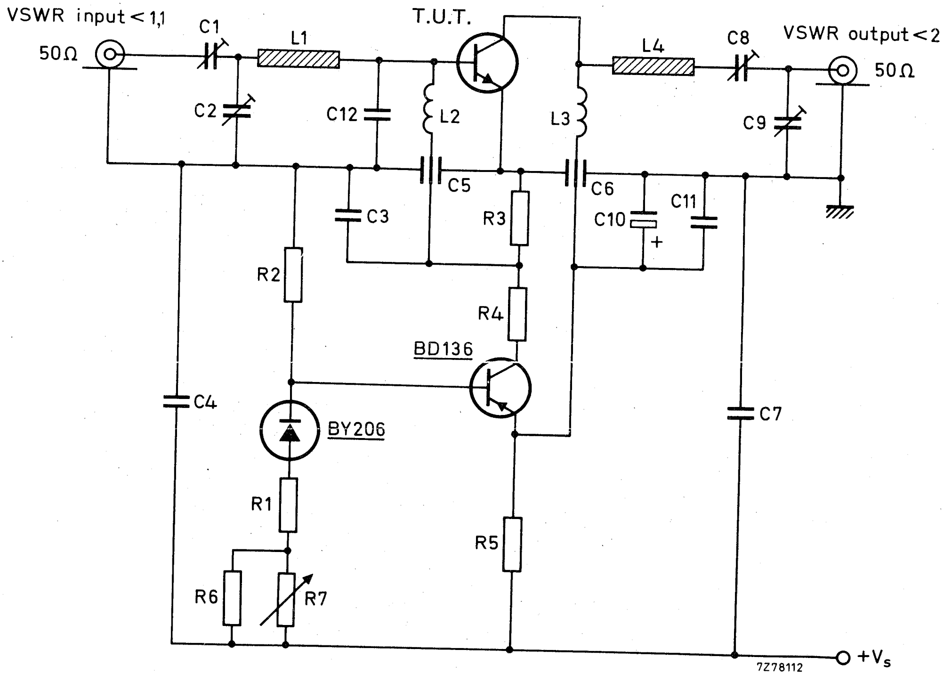


Fig. 9 Class-A test circuit at f_{vision} = 860 MHz.

List of components:

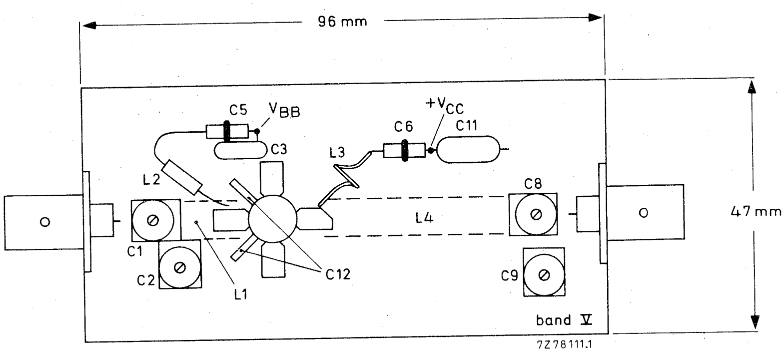
C1 = C2 = 1,4 to 5,5 pF film dielectric trimmer (cat. no. 2222 809 09001)
C3 = C4 = 100 nF polyester capacitor
C5 = C6 = 1 nF feed-through capacitor
C7 = 5,6 pF ceramic capacitor
C8 = 2 to 18 pF film dielectric trimmer (cat. no. 2222 809 09003)
C9 = 2 to 9 pF film dielectric trimmer (cat. no. 2222 809 09002)
C10 = 10 μF/40 V solid aluminium electrolytic capacitor
C11 = 470 nF polyester capacitor
C12 = 2 x 3,3 pF chip capacitors (in parallel)

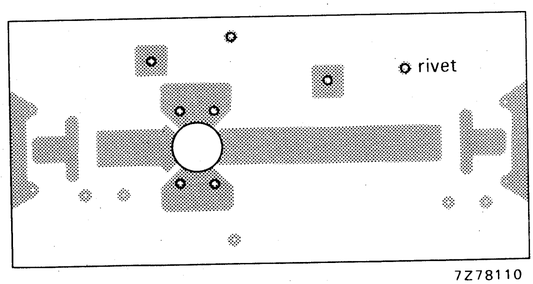
List of components: (continued)

R1 = 150 Ω carbon resistor (0,25 W)
R2 = 1,8 kΩ carbon resistor (0,5 W)
R3 = 33 Ω carbon resistor (0,5 W)
R4 = 220 Ω carbon resistor (1 W)
R5 = 4 x 12 Ω carbon resistors in parallel (1 W each)
R6 = 1 kΩ carbon resistor (0,25 W)
R7 = 220 Ω carbon potentiometer (0,25 W)

L1 = stripline (13,6 mm x 6,9 mm)
L2 = microchoke 0,47 μH (cat. no. 4322 057 04770)
L3 = 1 turn Cu wire (1 mm); internal diameter 5,5 mm; leads 2 x 5 mm
L4 = stripline (40,8 mm x 6,9 mm)

L1 and L4 are striplines on a double Cu-clad printed-circuit board with PTFE fibre-glass dielectric (ϵ_r = 2,74); thickness 1,5 mm.





Note
Hole in printed-circuit board: ϕ 9,7 mm.

Fig. 10 Component layout and printed circuit board for 860 MHz class-A test circuit.

The circuit and the components are on one side of the PTFE fibre-glass board, the other side is unetched copper to serve as a ground-plane. Earth connections are made by hollow rivets. Additionally copper straps are used under the emitters and at the input and output to provide direct contact between the copper on the component side and the ground-plane.

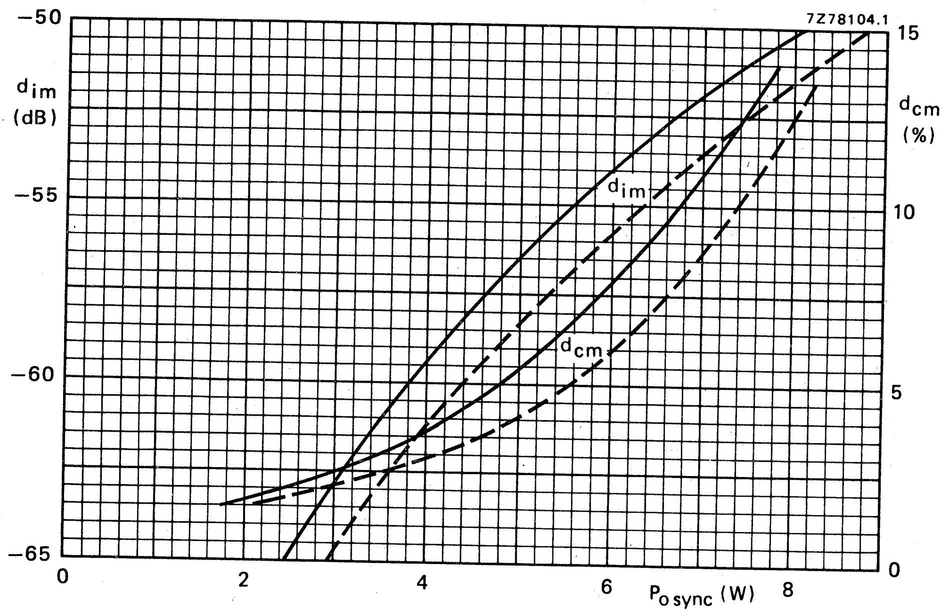


Fig. 11 Intermodulation distortion (d_{im})* and cross-modulation distortion (d_{cm})** as a function of $P_{o\ sync}$. Typical values; V_{CE} = 25 V; I_C = 850 mA;- - - T_h = 25 °C;—— T_h = 70 °C; f_{vision} = 860 MHz.

* Three-tone test method (vision carrier −8 dB, sound carrier −7 dB, sideband signal −16 dB), zero dB corresponds to peak sync level.
Intermodulation distortion of input signal ≤ −75 dB.

** Two-tone test method (vision carrier 0 dB, sound carrier −7 dB), zero dB corresponds to peak sync level.
Cross-modulation distortion (d_{cm}) is the voltage variation (%) of sound carrier when vision carrier is switched from 0 dB to −20 dB.

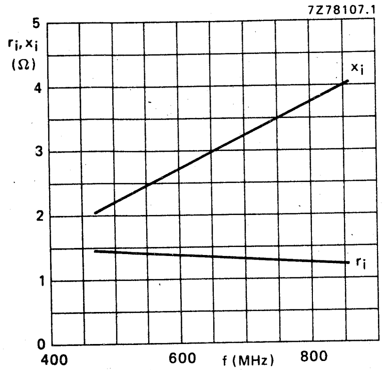


Fig. 12 Input impedance (series components).

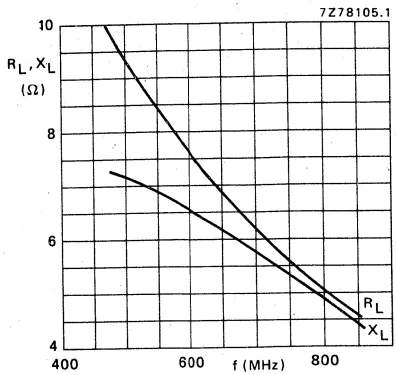


Fig. 13 Load impedance (series components).

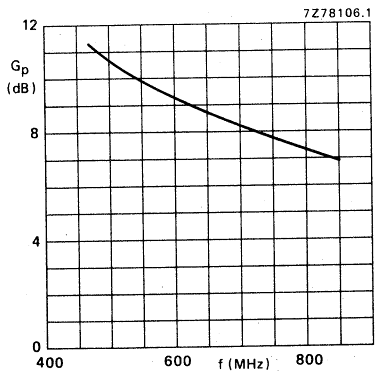


Fig. 14.

Conditions for Figs 12, 13 and 14:

Typical values; V_{CE} = 25 V; I_C = 850 mA; class-A operation; T_h = 70 °C.

H.F./V.H.F. POWER TRANSISTOR

N-P-N epitaxial planar transistor intended for s.s.b. in class-A and AB and in f.m. transmitting applications in class-C with a supply voltage up to 28 V. The transistor is resistance stabilized and tested under severe load mismatch conditions. It has a ¼" capstan envelope with a moulded cap. All leads are isolated from the stud.

QUICK REFERENCE DATA

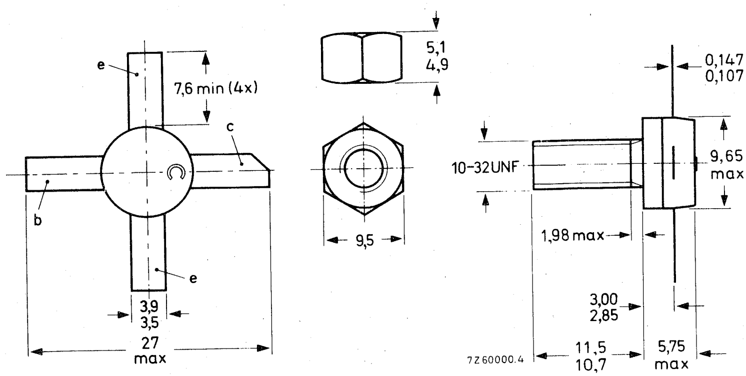
mode of operation	V_{CE} V	f_1 MHz	f_2 MHz	P_L W	G_p dB	d_3 dB	I_C A	η_{dt} %
s.s.b. (class-A)	26	28,000	28,001	0-8(P.E.P.)	> 18	< −40	< 1,2	–
s.s.b. (class-AB)	28	28,000	28,001	25(P.E.P.)	> 18	typ. −35	typ. 1,28	typ. 35

mode of operation	V_{CE} V	f MHz	P_S W	P_L W	G_p dB	I_C A	η %	$\overline{z_i}$ Ω	$\overline{Y_L}$ mA/V
c.w. (class-B)	28	70	typ. 0,5	25	typ. 17	typ. 1,49	typ. 60	0,53 − j1,4	42,5 − j54

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-56.



Torque on nut: min. 1,5 Nm (15 kg cm)
max. 1,7 Nm (17 kg cm)

Diameter of clearance hole in heatsink: max. 4,9 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

When locking is required an adhesive is preferred instead of a lock washer.

CAUTION This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC 134)

Voltages

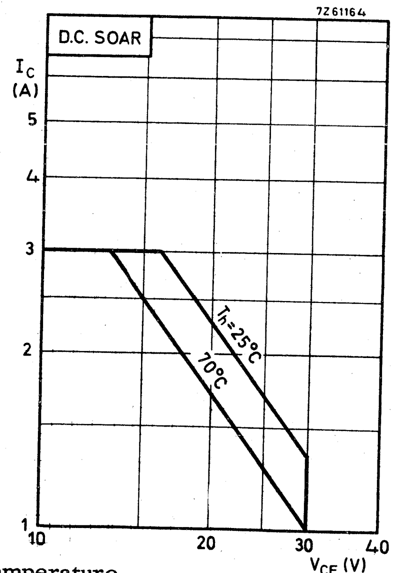
Collector-base voltage (open emitter) peak value	V_{CBOM}	max.	65	V
Collector-emitter voltage (open base)	V_{CEO}	max.	36	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4.0	V

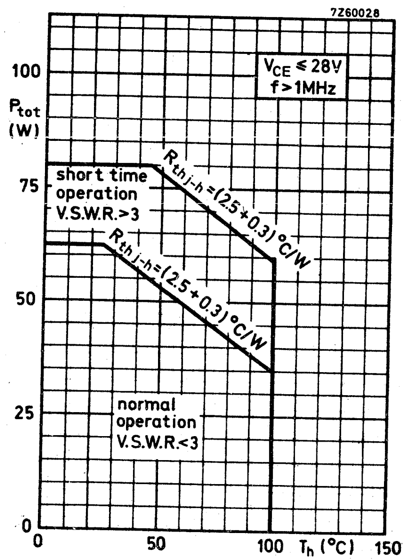
Currents

Collector current (average)	$I_{C(AV)}$	max.	3.0	A
Collector current (peak value) f > 1 MHz	I_{CM}	max.	6	A

Power dissipation

Total power dissipation up to T_h = 25 °C f > 1 MHz	P_{tot}	max.	62.5	W





Temperature

Storage temperature	T_{stg}	−30 to +200		°C
Operating junction temperature	T_j	max.	200	°C

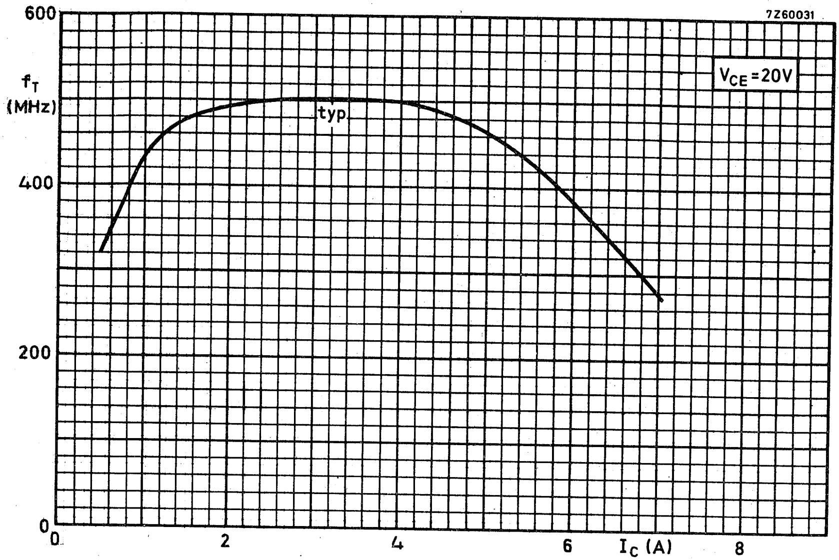
THERMAL RESISTANCE

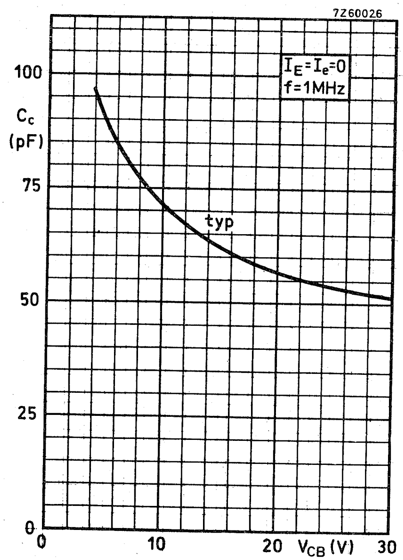
From junction to mounting base	$R_{th\ j\text{-}mb}$	=	2.5	°C/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0.3	°C/W

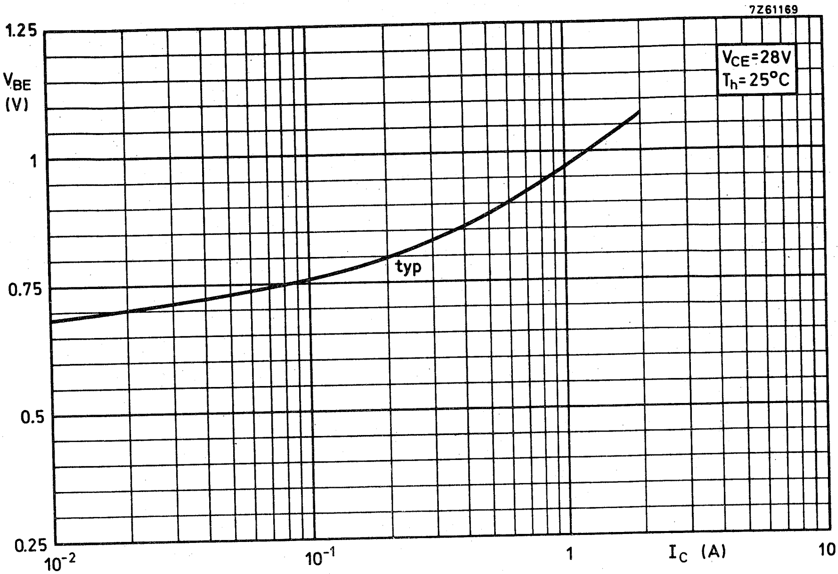
CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Breakdown voltages				
Collector-base voltage open emitter; I_C = 50 mA	$V_{(BR)CBO}$	>	65	V
Collector-emitter voltage open base; I_C = 50 mA	$V_{(BR)CEO}$	>	36	V
Emitter-base voltage open collector; I_E = 10 mA	$V_{(BR)EBO}$	>	4.0	V
Transient energy				
L = 25 mH; f = 50 Hz open base	E	>	8	mWs
$-V_{BE}$ = 1.5 V; R_{BE} = 33 Ω	E	>	8	mWs
D.C. current gain				
I_C = 1.0 A; V_{CE} = 5 V	h_{FE}	typ.	50	
		10	to 100	
Transition frequency				
I_C = 3.0 A; V_{CE} = 20 V	f_T	typ.	500	MHz
Collector capacitance at f = 1 MHz				
$I_E = I_e$ = 0; V_{CB} = 30 V	C_c	typ.	50	pF
		<	65	pF
Feedback capacitance				
I_C = 100 mA; V_{CE} = 30 V	C_{re}	typ.	31	pF
Collector-stud capacitance	C_{cs}	typ.	2	pF


7Z60031
600
f_T
(MHz)
400
200
0
typ
V_{CE} = 20V
0
2
4
6
I_C (A)
8


7Z60026
100
C_c
(pF)
75
50
25
0
$I_E = I_e = 0$
f = 1MHz
typ
0
10
20
V_{CB} (V)
30


7Z61169
1.25
V_{BE}
(V)
1
0.75
0.5
0.25
10^{-2}
10^{-1}
1
I_C (A)
10
V_{CE}=28V
T_h=25°C
typ

APPLICATION INFORMATION

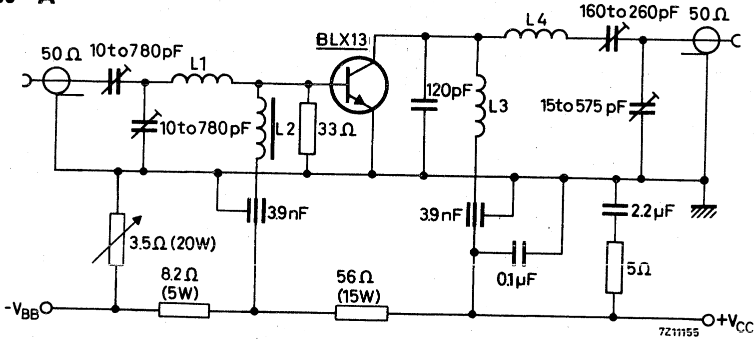
R.F. performance in S.S.B. operation (linear power amplifier)

V_{CE} = 26 V; T_h up to 25 °C
f_1 = 28.000 MHz; f_2 = 28.001 MHz

output power (W)	G_p (dB)	d_3 (dB) [1]	I_C (A)	Class
0-8 (PEP)	> 18	< −40	< 1.2	A

Test circuit:

S.S.B.
class A



L1 = 3 turns enamelled Cu wire (1.5 mm); winding pitch 2.5 mm; int. diam. 7 mm leads 50 mm totally
L2 = 7 turns enamelled Cu wire (0.7 mm) on 3H1 toroid; 60 μH (code number of 3H1: 4322 020 36620)
L3 = 4 turns enamelled Cu wire (1.5 mm); winding pitch 2.5 mm; int. diam. 10 mm
L4 = 7 turns enamelled Cu wire (1.5 mm); winding pitch 2.5 mm; int. diam. 12 mm

---

Detailed information for a wide band application
1.6 to 28 MHz available on request

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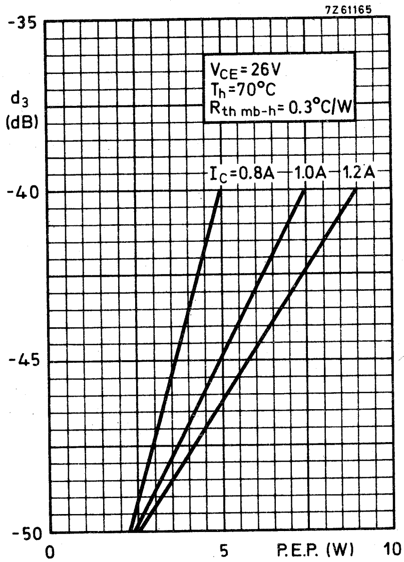
[1]) Stated figures are maxima encountered at any driving level between the specified values of PEP and are referred to the according level of either of the equal ampl. tones. Relative to the according peak envelope power these figures should be increased by 6 dB.


7Z61165
-35
d3
(dB)
VCE = 26V
Th = 70°C
Rth mb-h = 0.3°C/W
IC = 0.8A
1.0A
1.2A
-40
-45
-50
0
5
P.E.P. (W)
10

APPLICATION INFORMATION

R.F. performance in s.s.b. class-AB operation (linear power amplifier)

V_{CE} = 28 V; f_1 = 28,000 MHz; f_2 = 28,001 MHz

output power W	Gp dB	η_{dt} %	I_C A	d_3* dB	$I_{C(ZS)}$ mA	T_h °C
25 (P.E.P.)	> 18	typ. 35	typ. 1,28	typ. −35	25	25

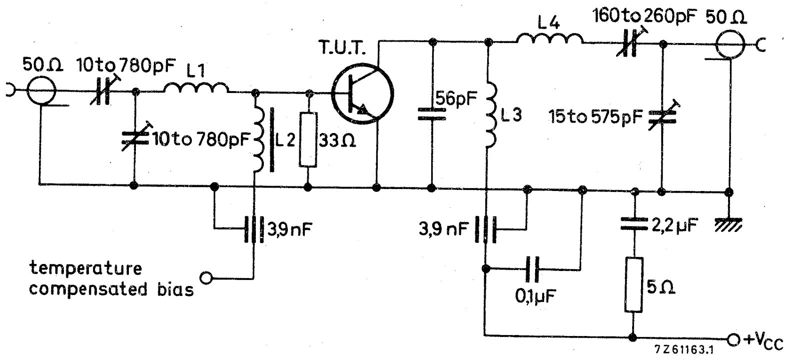
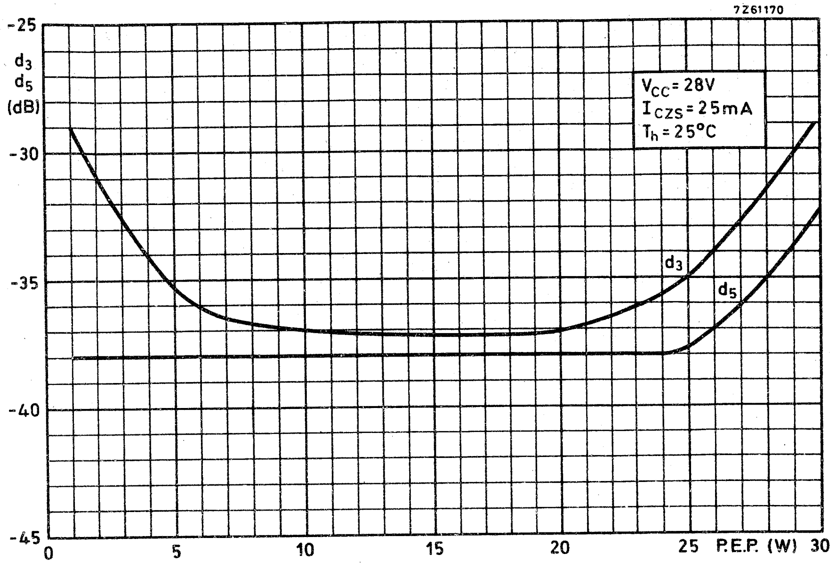


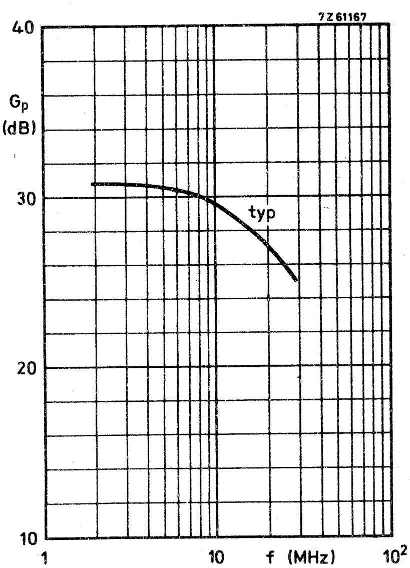
Fig. 9 Test circuit; s.s.b. class-AB.

List of components:

L1 = 3 turns enamelled Cu wire (1,5 mm); winding pitch 2,5 mm; int. dia. 7,0 mm; leads 50 mm (total)
L2 = 7 turns enamelled Cu wire (0,7 mm) on 3H1 toroid; 60 μH (cat. no. of 3H1: 4322 020 36620)
L3 = 4 turns enamelled Cu wire (1,5 mm); winding pitch 2,5 mm; int. dia. 10 mm
L4 = 7 turns enamelled Cu wire (1,5 mm); winding pitch 2,5 mm; int. dia. 12 mm

* Stated intermodulation distortion figures are referred to the according level of either of the equal amplified tones. Relative to the according peak envelope powers these figures should be increased by 6 dB.





Conditions:

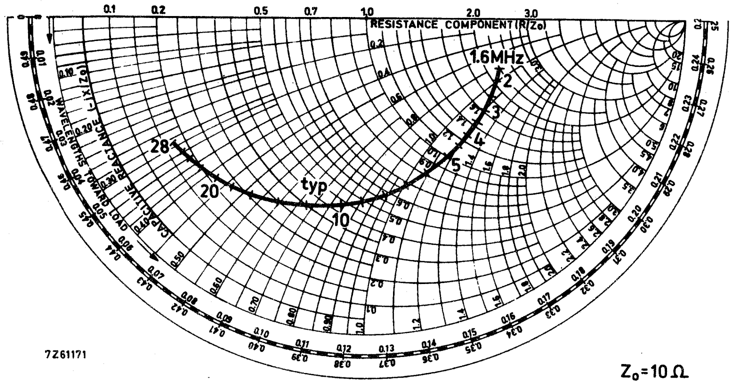
P_L = 25 W PEP

V_{CC} = 28 V

I_{CZS} = 25 mA

Z_L = 12.5 Ω

T_h = 25 °C



Conditions:

P_L = 25 W PEP

V_{CC} = 28 V

I_{CZS} = 25 mA

Z_L = 12.5 Ω

T_h = 25 ^oC

APPLICATION INFORMATION

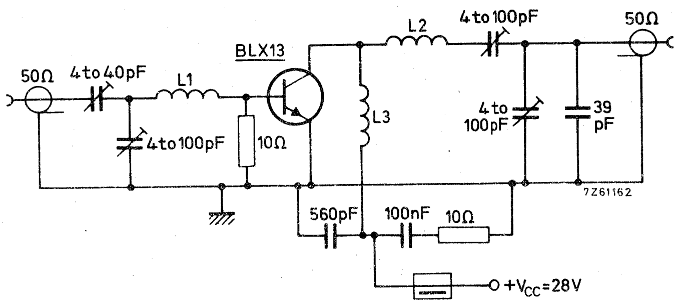
R.F. performance in c.w. operation (class B)

V_{CC} = 28 V; T_h up to 25 °C

f (MHz)	P_S (W)	P_L (W)	I_C (A)	G_p (dB)	η (%)	$\overline{z}_i$ (Ω)	$\overline{Y}_L$ (mA/V)
70	typ. 0.5	25	typ. 1.49	typ. 17	typ. 60	0.53-j1.4	42.5-j54

Test circuit:

C.W. class B

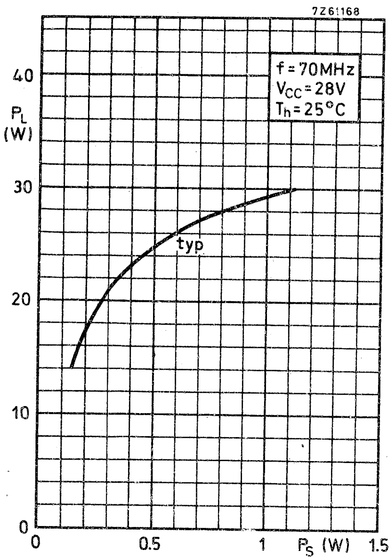


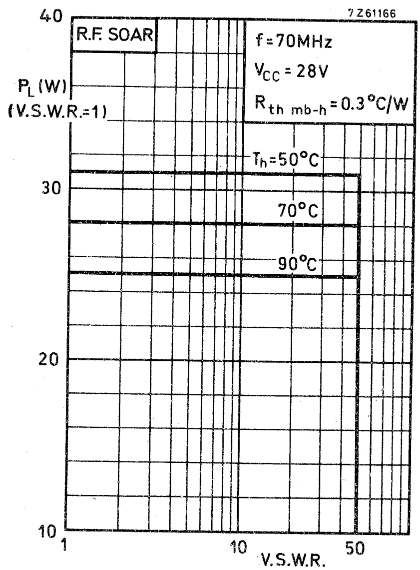
L1 = 93 nH; 3 turns enamelled Cu wire (1.5 mm); int. diam. 10 mm; length 8 mm; leads 2 x 5 mm

L2 = 147 nH; 5 turns enamelled Cu wire (1.5 mm); int. diam. 9 mm; length 14 mm; leads 2 x 5 mm

L3 = 118 nH; 4 turns enamelled Cu wire (1.5 mm); int. diam. 9 mm; length 10.5 mm; leads 2 x 5 mm

L4 = FXC choke (code number 4312 020 36640)





For high voltage operation, a stabilized power supply is generally used.
The graph shows the allowable output power under nominal conditions as a function of the V.S.W.R., with heat-sink temperature as parameter.

H.F./V.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor for use in transmitting amplifiers operating in the h.f. and v.h.f. bands, with a nominal supply voltage of 28 V. The transistor is specified for s.s.b. applications as linear amplifier in class-A and AB. The device is resistance stabilized and is guaranteed to withstand severe load mismatch conditions.

Matched h_{FE} groups are available on request.

It has a 3/8" capstan envelope with a ceramic cap. All leads are isolated from the stud.

QUICK REFERENCE DATA

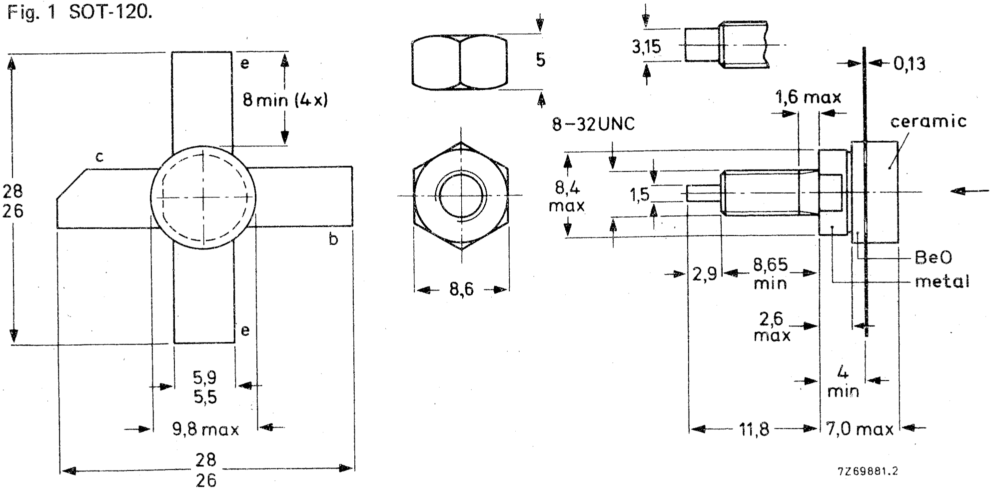
R.F. performance

mode of operation	V_{CE} V	f MHz	P_L W	G_p dB	η_{dt} %	I_C A	d_3 dB	T_h °C
s.s.b. (class-A)	**26**	**1,6 – 28**	**0 – 8 (P.E.P.)**	**> 20**	**–**	**1,25**	**< –40**	**70**
s.s.b. (class-AB)	28	1,6 – 28	3 – 25 (P.E.P.)	typ. 21	typ. 45	typ. 1,0	typ. –30	25

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-120.



Torque on nut: min. 0,75 Nm (7,5 kg cm)
max. 0,85 Nm (8,5 kg cm)

Diameter of clearance hole in heatsink: max. 4,2 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

When locking is required an adhesive is preferred instead of a lock washer.

CAUTION This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage ($V_{BE} = 0$) peak value	V_{CESM}	max.	65	V
Collector-emitter voltage (open base)	V_{CEO}	max.	36	V
Emitter-base voltage (open-collector)	V_{EBO}	max.	4	V
Collector current (average)	$I_{C(AV)}$	max.	3	A
Collector current (peak value); f > 1 MHz	I_{CM}	max.	9	A
R.F. power dissipation (f > 1 MHz); T_{mb} = 25 °C	P_{rf}	max.	73	W
Storage temperature	T_{stg}	−65 to + 150		°C
Operating junction temperature	T_j	max.	200	°C

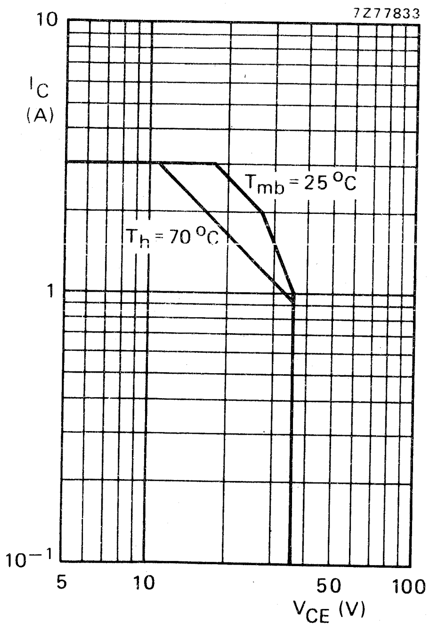


Fig. 2 D.C. SOAR.

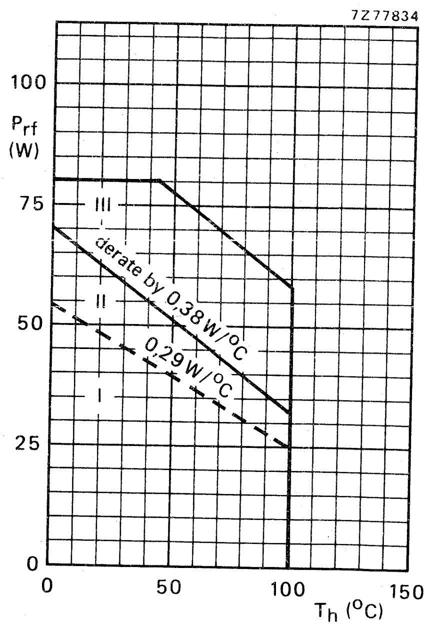


Fig. 3 R.F. power dissipation; $V_{CE} \leq 28$ V; f ≥ 1 MHz.

I Continuous d.c. operation

II Continuous r.f. operation

III Short-time operating during mismatch

THERMAL RESISTANCE (dissipation = 32,5 W; T_{mb} = 85 °C, i.e. T_h = 70 °C)

From junction to mounting base (d.c. dissipation)	$R_{th\ j\text{-}mb(dc)}$	=	3,55 °C/W
From junction to mounting base (r.f. dissipation)	$R_{th\ j\text{-}mb(rf)}$	=	2,65 °C/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,45 °C/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector-emitter breakdown voltage V_{BE} = 0; I_C = 10 mA	$V_{(BR)CES}$	>	65 V
Collector-emitter breakdown voltage open base; I_C = 50 mA	$V_{(BR)CEO}$	>	36 V
Emitter-base breakdown voltage open collector; I_E = 10 mA	$V_{(BR)EBO}$	>	4 V
Collector cut-off current V_{BE} = 0; V_{CE} = 36 V	I_{CES}	<	4 mA
Second breakdown energy; L = 25 mH; f = 50 Hz open base	E_{SBO}	>	8 mJ
R_{BE} = 10 Ω	E_{SBR}	>	8 mJ
D.C. current gain * I_C = 1,25 A; V_{CE} = 5 V	h_{FE}	typ.	50
			10 to 100
D.C. current gain ratio of matched devices * I_C = 1,25 A; V_{CE} = 5 V	h_{FE1}/h_{FE2}	<	1,2
Collector-emitter saturation voltage * I_C = 3,75 A; I_B = 0,75 A	V_{CEsat}	typ.	1,5 V
Transition frequency at f = 100 MHz * $-I_E$ = 1,25 A; V_{CB} = 28 V	f_T	typ.	530 MHz
$-I_E$ = 3,75 A; V_{CB} = 28 V	f_T	typ.	530 MHz
Collector capacitance at f = 1 MHz I_E = I_e = 0; V_{CB} = 28 V	C_c	typ.	50 pF
Feedback capacitance at f = 1 MHz I_C = 100 mA; V_{CE} = 28 V	C_{re}	typ.	31 pF
Collector-stud capacitance	C_{cs}	typ.	2 pF

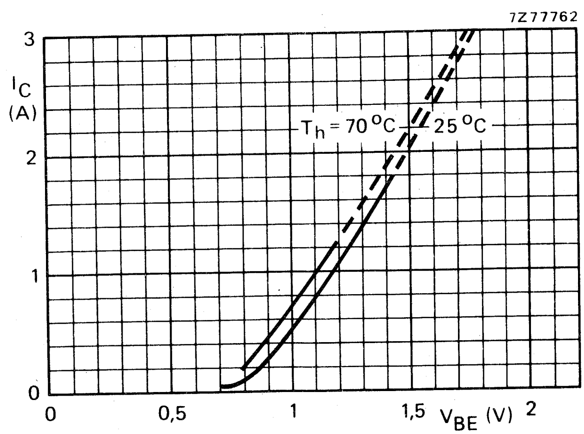


Fig. 4 Typical values; V_{CE} = 28 V.

* Measured under pulse conditions: $t_p \leqslant 200\ \mu s$; $\delta \leqslant 0{,}02$.

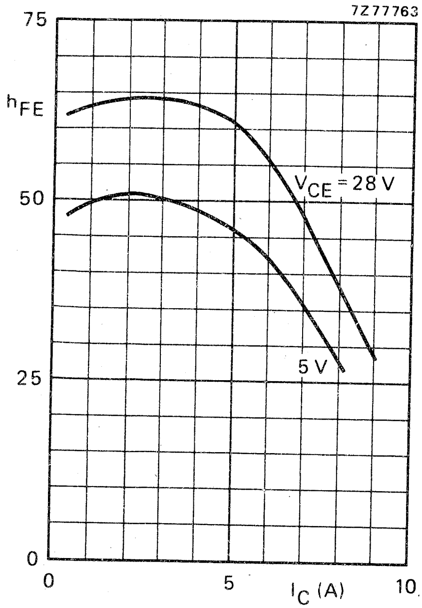


Fig. 5 Typical values; T_j = 25 °C.

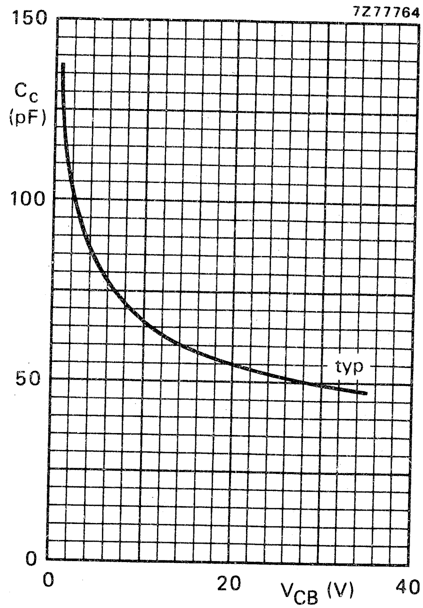


Fig. 6 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

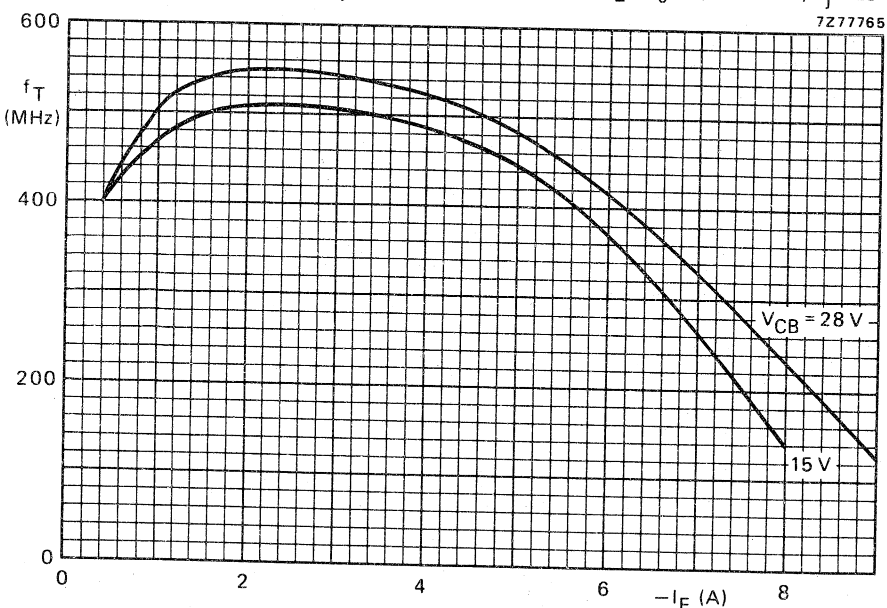


Fig. 7 Typical values; f = 100 MHz; T_j = 25 °C.

APPLICATION INFORMATION

R.F. performance in s.s.b. class-A operation (linear power amplifier)

V_{CE} = 26 V; f_1 = 28,000 MHz; f_2 = 28,001 MHz

output power W	G_p dB	I_C A	d_3 dB *	d_5 dB *	T_h °C
> 8 (P.E.P.)	> 20	1,25	−40	< −40	70
typ. 10 (P.E.P.)	typ. 24	1,25	−40	< −40	25

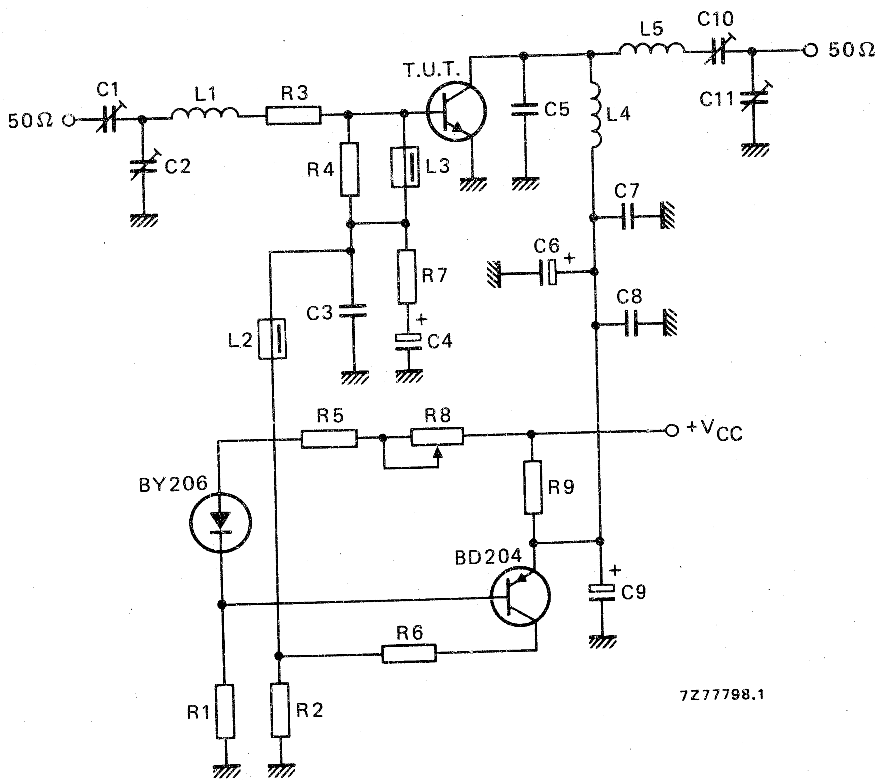


Fig. 8 Test circuit; s.s.b. class-A.

List of components on page 6.

* Stated intermodulation distortion figures are referred to the according level of either of the equal amplified tones. Relative to the according peak envelope powers these figures should be increased by 6 dB.

List of components in Fig. 8:

C1 = C2 = 10 to 780 pF film dielectric trimmer
C3 = 22 nF ceramic capacitor (63 V)
C4 = 47 μF/10 V electrolytic capacitor
C5 = 56 pF ceramic capacitor (500 V)
C6 = 47 μF/35 V electrolytic capacitor
C7 = C8 = 220 nF polyester capacitor
C9 = 10 μF/35 V electrolytic capacitor
C10 = 10 to 210 pF film dielectric trimmer
C11 = 15 to 575 film dielectric trimmer

L1 = 3 turns closely wound enamelled Cu wire (1,6 mm); int. dia. 9,0 mm; leads 2 x 5 mm
L2 = L3 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L4 = 11 turns closely wound enamelled Cu wire (1,6 mm); int. dia. 11,0 mm
L5 = 14 turns closely enamelled Cu wire (1,6 mm); int. dia. 11,0 mm

R1 = 600 Ω; parallel connection of 2 x 1,2 kΩ carbon resistors (± 5%; 0,5 W each)
R2 = 15 Ω carbon resistor (± 5%; 0,25 W)
R3 = 1,2 Ω parallel connection of 4 x 4,7 Ω carbon resistors (± 5%; 0,125 W each)
R4 = 33 Ω carbon resistor (± 5%; 0,25 W)
R5 = 18 Ω carbon resistor (± 5%; 0,25 W)
R6 = 120 Ω wirewound resistor (± 5%; 5,5 W)
R7 = 1 Ω carbon resistor (± 5%; 0,125 W)
R8 = 47 Ω wirewound potentiometer (3 W)
R9 = 1,57 Ω; parallel connection of 3 x 4,7 Ω wirewound resistors (± 5%; 5,5 W each)

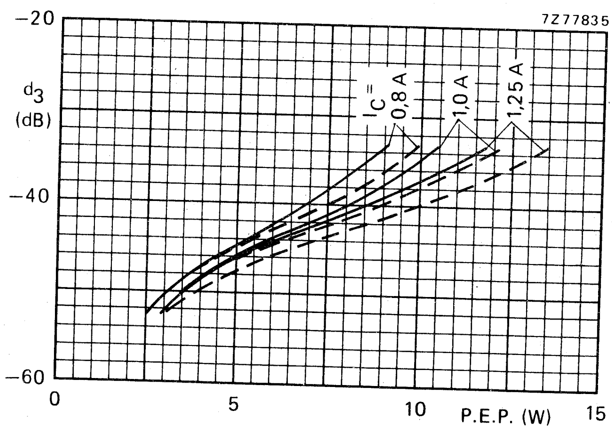


Fig. 9 Intermodulation distortion as a function of output power. Typical values; V_{CE} = 26 V; f_1 = 28,000 MHz; f_2 = 28,001 MHz; —— T_h = 70 °C; – – – T_h = 25 °C.

R.F. performance in s.s.b. class-AB operation (linear power amplifier)

V_{CE} = 28 V; f_1 = 28,000 MHz; f_2 = 28,001 MHz

output power W	G_p dB	η_{dt} (%) at 25 W P.E.P.	I_C (A) at 25 W P.E.P.	d_3 dB *	d_5 dB *	$I_{C(ZS)}$ mA	T_h °C
3 to 25 (P.E.P.)	typ. 21	typ. 45	typ. 1,0	typ. −30	< −30	25	25
3 to 22 (P.E.P.)	typ. 21	—	—	typ. −30	< −30	25	70

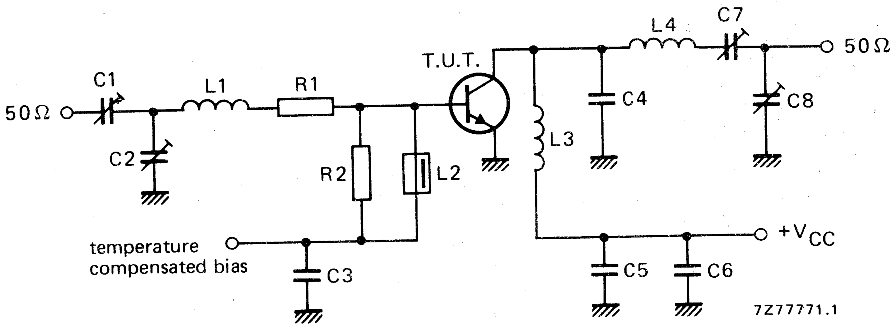


Fig. 10 Test circuit; s.s.b. class-AB.

List of components:

C1 = C2 = 10 to 780 pF film dielectric trimmer
C3 = C5 = C6 = 220 nF polyester capacitor
C4 = 56 pF ceramic capacitor (500 V)
C7 = C8 = 15 to 575 pF film dielectric trimmer

L1 = 4 turns closely wound enamelled Cu wire (1,6 mm); int. dia. 7,0 mm; leads 2 x 5 mm
L2 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L3 = 4 turns enamelled Cu wire (1,6 mm); int. dia. 10 mm; length 9,4 mm; leads 2 x 5 mm
L4 = 7 turns enamelled Cu wire (1,6 mm); int. dia. 12 mm; length 17,2 mm; leads 2 x 5 mm

R1 = 1,2 Ω; parallel connection of 4 x 4,7 Ω carbon resistors
R2 = 39 Ω carbon resistor

* Stated intermodulation distortion figures are referred to the according level of either of the equal amplified tones. Relative to the according peak envelope powers these figures should be increased by 6 dB.

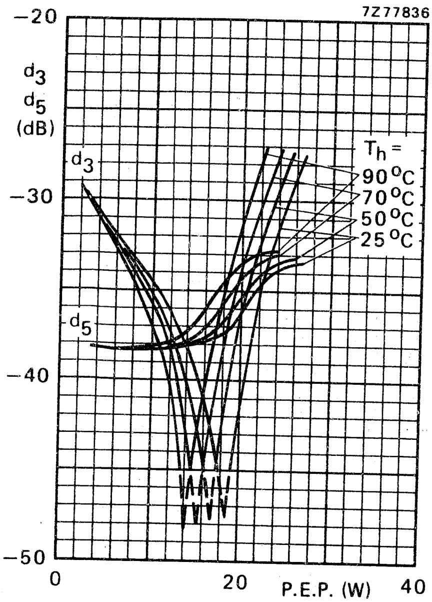


Fig. 11 Intermodulation distortion as a function of output power. *

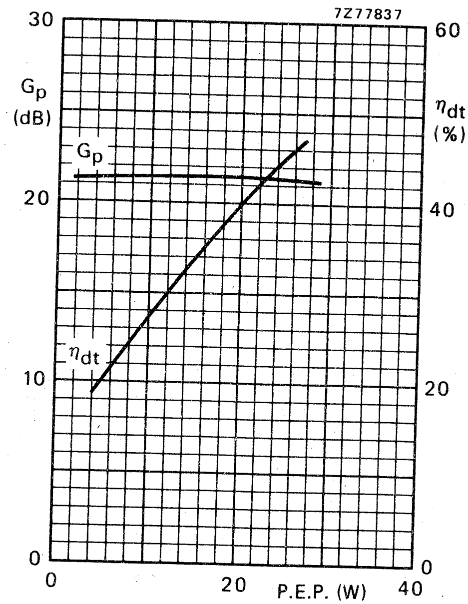


Fig. 12 Double-tone efficiency and power gain as a function of output power.

Conditions for Fig. 11:

V_{CE} = 28 V; $I_{C(ZS)}$ = 25 mA; f_1 = 28,000 MHz; f_2 = 28,001 MHz; typical values.

Conditions for Fig. 12:

V_{CE} = 28 V; $I_{C(ZS)}$ = 25 mA; f_1 = 28,000 MHz; f_2 = 28,001 MHz; T_h = 25 °C; typical values.

* See note on page 7.

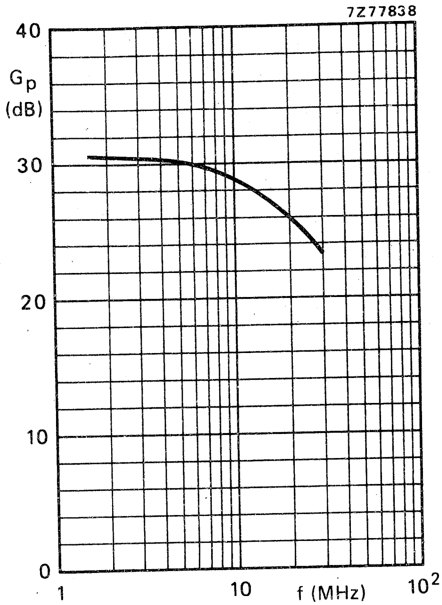


Fig. 13 Power gain as a function of frequency.

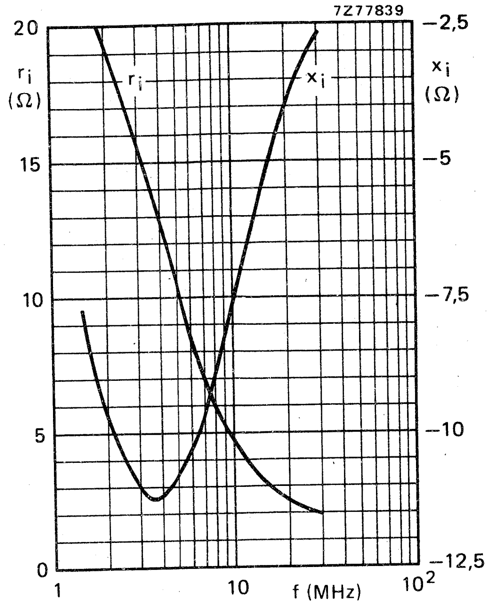


Fig. 14 Input impedance (series components) as a function of frequency.

Figs 13 and 14 are typical curves and hold for an unneutralized amplifier in s.s.b. class-AB operation.

Conditions:

V_{CE} = 28 V; $I_{C(ZS)}$ = 25 mA; P_L = 25 W; T_h = 25 °C; Z_L = 12 Ω.

Ruggedness in s.s.b. operation

The BLX13C is capable of withstanding a load mismatch (VSWR = 50) under the following conditions: f_1 = 28,000 MHz; f_2 = 28,001 MHz; V_{CE} = 28 V; T_h = 70 °C and P_L = 30 W (P.E.P.).

H.F./V.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor for use in class-A, AB and B operated transmitting equipment in the h.f. and v.h.f. band.

- rated for 50 W P.E.P. at 1,6 MHz to 28 MHz (intermodulation distortion better than −30 dB); full load mismatch permissible at stud temperatures up to 70 °C
- rated at 50 W for frequencies up to 70 MHz in c.w. operation
- supply voltage 28 V
- plastic stripline package

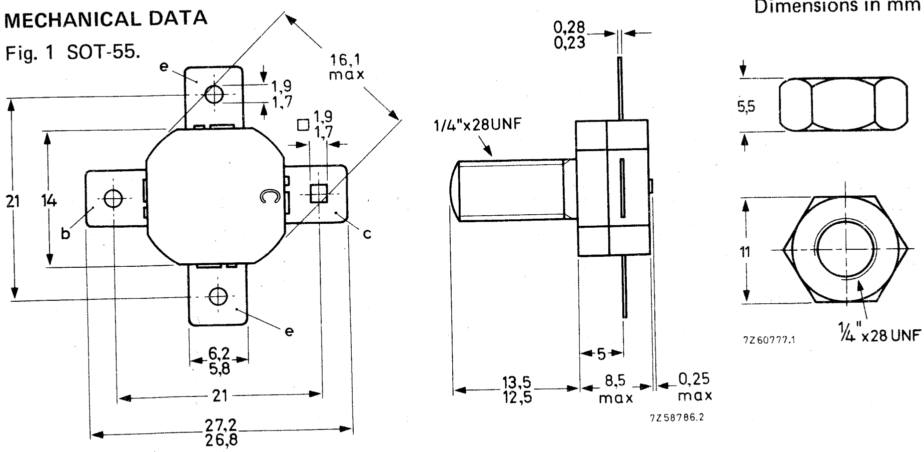
QUICK REFERENCE DATA

mode of operation	V_{CE} V	f MHz	P_L W	G_p dB	d_3 dB	$I_{C(ZS)}$ A
s.s.b. (class-A)	28	1,6 to 28	15 (P.E.P.)	> 13	typ. −40	2,0
s.s.b. (class-AB)	28	1,6 to 28	7,5-50 (P.E.P.)	> 13	< −30	0,1
c.w. (class-B)	28	70	50	> 7,5		
c.w. (class-B)	28	30	50	typ. 16		

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-55.



Torque on nut: min. 2,3 Nm (23 kg cm)
max. 2,7 Nm (27 kg cm)

Diameter of clearance hole in heatsink: max. 6,4 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

When locking is required an adhesive is preferred instead of a lock washer.

CAUTION This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC 134)

Voltages

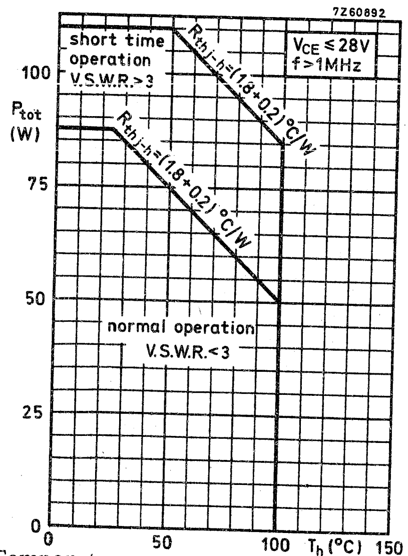
Collector-base voltage (open emitter) peak value	V_{CBOM}	max.	85	V
Collector-emitter voltage (R_{BE} = 10 Ω) peak value	V_{CERM}	max.	85	V
Collector-emitter voltage (open base)	V_{CEO}	max.	36	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4.0	V

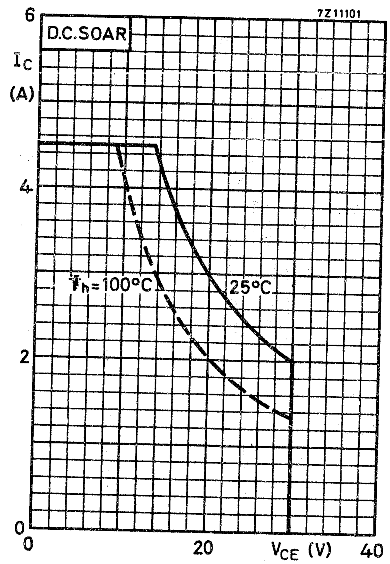
Currents

Collector current (average)	I_{CAV}	max.	4.0	A
Collector current (peak value) f > 1 MHz	I_{CM}	max.	12	A

Power dissipation

Total power dissipation up to T_h = 25 °C f > 1 MHz	P_{tot}	max.	88	W





Temperature

Storage temperature	T_{stg}		−65 to +200	°C
Operating junction temperature	T_j	max.	+200	°C

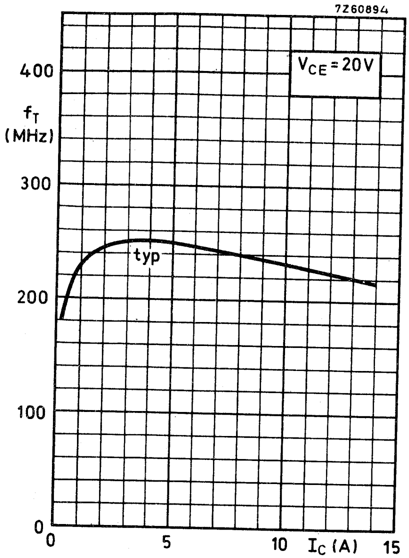
THERMAL RESISTANCE

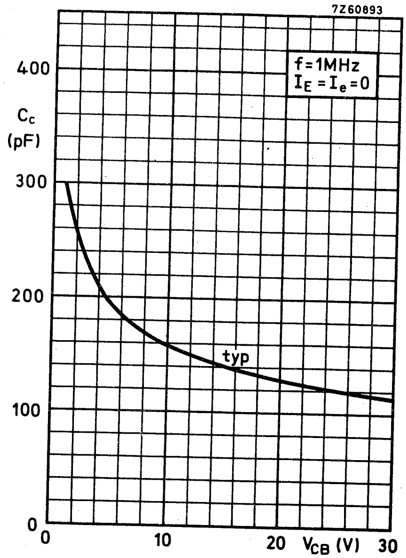
From junction to mounting base	$R_{th\,j-mb}$	=	1.8	°C/W
From mounting base to heatsink	$R_{th\,mb-h}$	=	0.2	°C/W

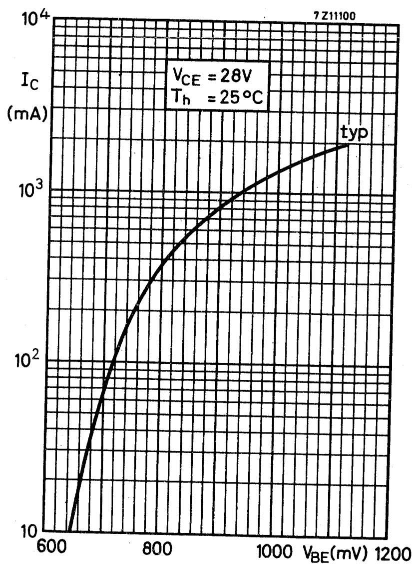
CHARACTERISTICS

$T_j = 25\ ^oC$

Collector-base breakdown voltage open emitter; $I_C = 25$ mA	$V_{(BR)CBO}$	>	85	V
Collector-emitter breakdown voltage $R_{BE} = 10\ \Omega$; $I_C = 25$ mA	$V_{(BR)CER}$	>	85	V
open base; $I_C = 50$ mA	$V_{(BR)CEO}$	>	36	V
Emitter-base breakdown voltage open collector; $I_E = 10$ mA	$V_{(BR)EBO}$	>	4,0	V
Collector-emitter saturation voltage $I_C = 0,7$ A; $I_B = 0,14$ A	V_{CEsat}	<	1,0	V
Second breakdown energy; L = 25 mH; f = 50 Hz open base	E_{SBO}	>	8	mJ
$R_{BE} = 33\ \Omega$	E_{SBR}	>	8	mJ
D.C. current gain $I_C = 1,4$ A; $V_{CE} = 6$ V	h_{FE}		15 to 100	
Transition frequency $I_C = 3,0$ A; $V_{CE} = 20$ V	f_T	typ.	250	MHz ←
Collector capacitance at f = 1 MHz $I_E = I_e = 0$; $V_{CB} = 30$ V	C_c	typ.	115	pF
		<	125	pF
Feedback capacitance at f = 1 MHz $I_C = 100$ mA; $V_{CE} = 30$ V	C_{re}	typ.	90	pF
Collector-stud capacitance	C_{cs}	typ.	3,5	pF


7Z60894
400
f_T
(MHz)
300
200
100
0
$V_{CE} = 20V$
typ
0
5
10
I_C (A)
15


7Z60893
400
C_c
(pF)
300
200
100
0
f = 1MHz
$I_E = I_e = 0$
typ
0
10
20
V_{CB} (V)
30


7Z11100
10^4
I_C
(mA)
10^3
10^2
10
$V_{CE} = 28V$
$T_h = 25°C$
typ
600
800
1000
V_{BE}(mV)
1200

R.F. performance in s.s.b. class-AB operation (linear power amplifier)

V_{CE} = 28 V; f_1 = 28,000 MHz; f_2 = 28,001 MHz

output power W	Gp dB	η_{dt} %	I_C A	d_3* dB	d_5* dB	$I_{C(ZS)}$ A	T_h °C
7,5 to 50 (P.E.P.)	> 13	> 35	< 2,55	< −30	< −30	0,1	25

At temperatures up to 90 °C the output power relative to that at 25 °C is diminished by −40 mW/K.

The transistor is designed to withstand a full load mismatch operating under 50 W P.E.P. at V_{CE} = 28 V and T_h = 70 °C.

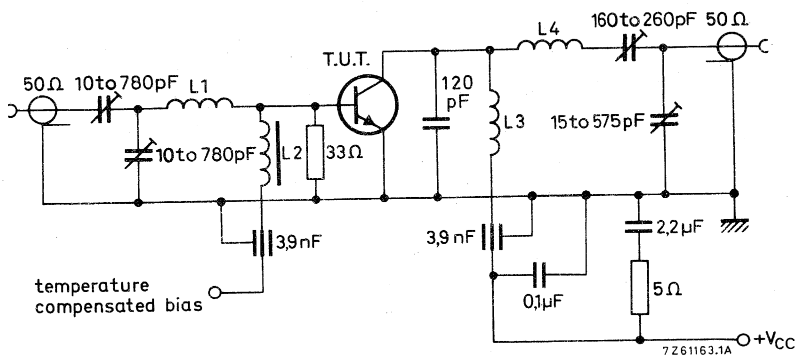
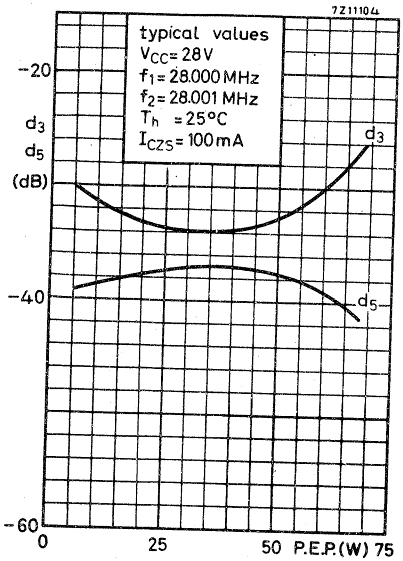


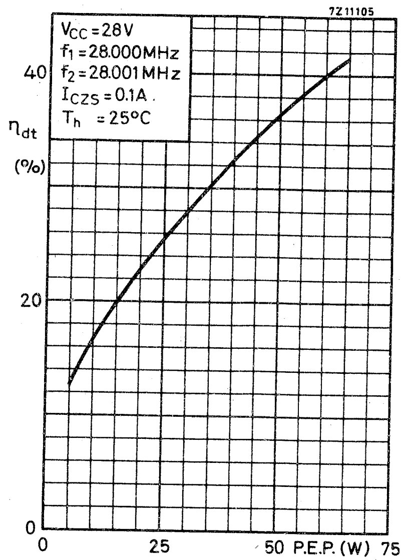
Fig. 7 Test circuit; s.s.b. class-AB.

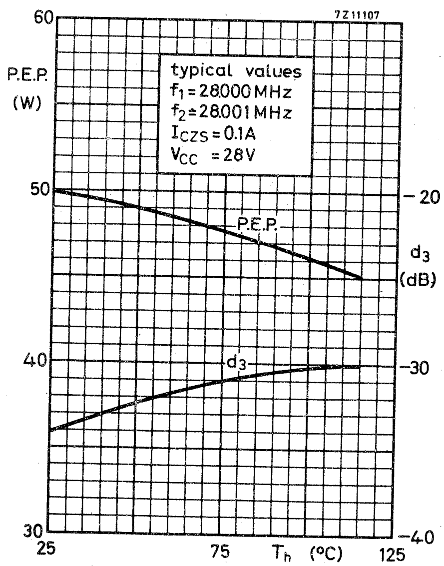
List of components:

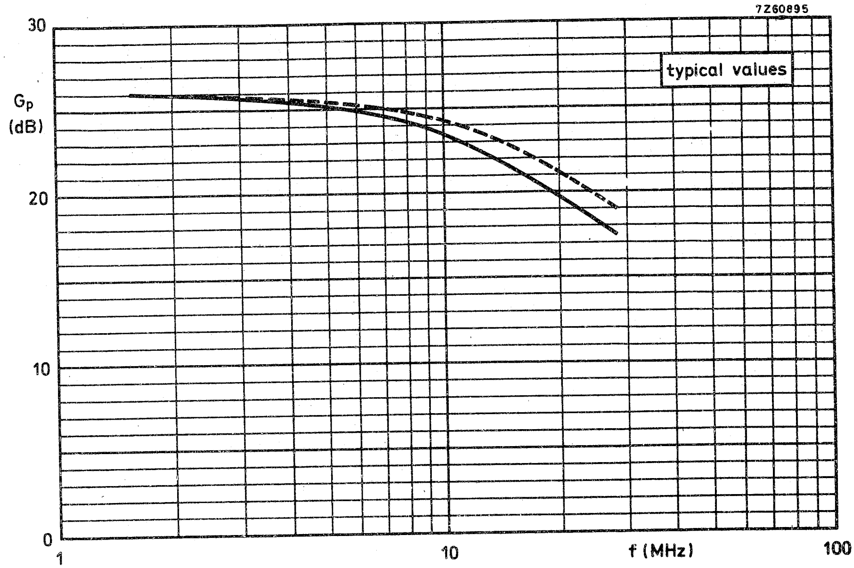
L1 = 3 turns enamelled Cu wire (1,5 mm); winding pitch 2,5 mm; int. dia. 7,0 mm; leads 50 mm (total)
L2 = 7 turns enamelled Cu wire (0,7 mm) on 3H1 toroid; 60 µH (cat. no. of 3H1 4322 020 36620)
L3 = 4 turns enamelled Cu wire (1,5 mm); winding pitch 2,5 mm; int. dia. 10 mm
L4 = 7 turns enamelled Cu wire (1,5 mm); winding pitch 2,5 mm; int. dia. 12 mm

* Stated intermodulation distortion figures are referred to the according level of either of the equal amplified tones. Relative to the according peak envelope powers these figures should be increased by 6 dB.


7Z11104
typical values
V_{CC}= 28 V
f_1= 28.000 MHz
f_2= 28.001 MHz
T_h = 25 °C
I_{CZS}= 100 mA
d_3
d_5
(dB)
-20
-40
-60
0
25
50
P.E.P. (W)
75
d_3
d_5


7Z11105
V_{CC} = 28 V
f_1 = 28.000 MHz
f_2 = 28.001 MHz
I_{CZS} = 0.1 A
T_h = 25 °C
η_{dt}
(%)
40
20
0
0
25
50
P.E.P. (W)
75


7Z11107
typical values
f_1 = 28.000 MHz
f_2 = 28.001 MHz
I_{CZS} = 0.1 A
V_{CC} = 28 V
P.E.P.
(W)
60
50
40
30
25
75
T_h (°C)
125
P.E.P.
d_3
d_3
(dB)
-20
-30
-40

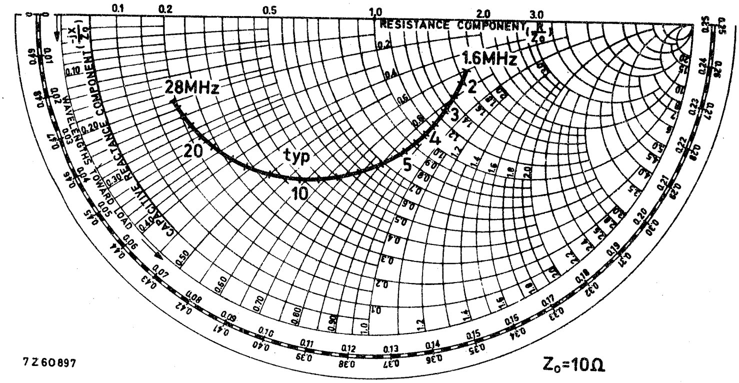


S.S.B. class AB operation

P_L = 50 W PEP
V_{CC} = 28 V
I_C = 100 mA
Z_L = 6.25 Ω
T_h = 25 °C

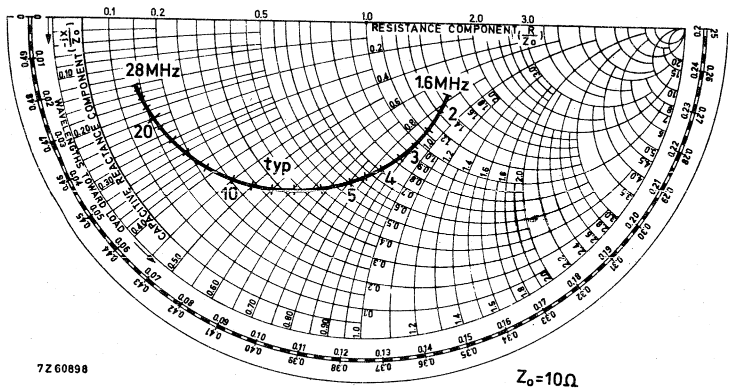
The drawn curve holds for an unneutralized amplifier.

The dashed curve holds for a push-pull amplifier with cross neutralization.
Collector-base neutralizing capacitor: 82 pF



7Z60897

$Z_o = 10\Omega$



7Z60898

$Z_o = 10\Omega$

S.S.B. class AB operation

P_L = 50 W PEP
V_{CC} = 28 V
I_C = 100 mA
Z_L = 6.25 Ω
T_h = 25 °C

The upper graph holds for a push-pull amplifier with cross neutralization. Collector-base neutralizing capacitor: 82 pF

The lower graph holds for an unneutralized amplifier.

APPLICATION INFORMATION (continued)

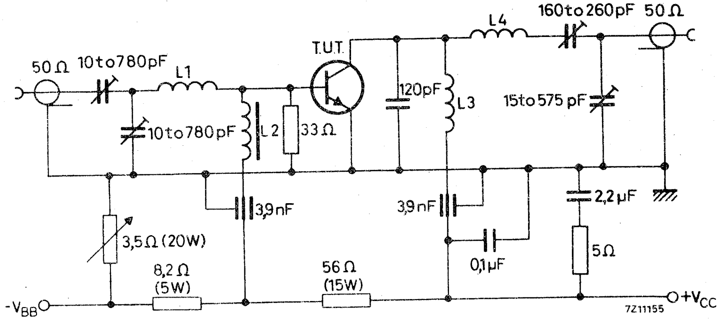
R.F. performance in s.s.b. operation (linear power amplifier)

V_{CC} = 28 V; T_h up to 25 °C
f_1 = 28,000 MHz; f_2 = 28,001 MHz

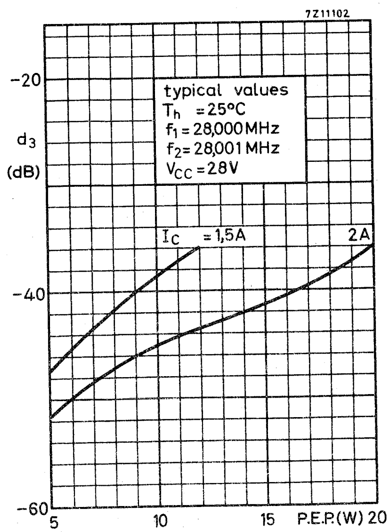
output power (W)	G_p (dB)	d_3 (dB) [1]	d_5 (dB) [1]	I_C (A)	Class
15 PEP	> 13	typ. −40	typ. −45	2,0	A

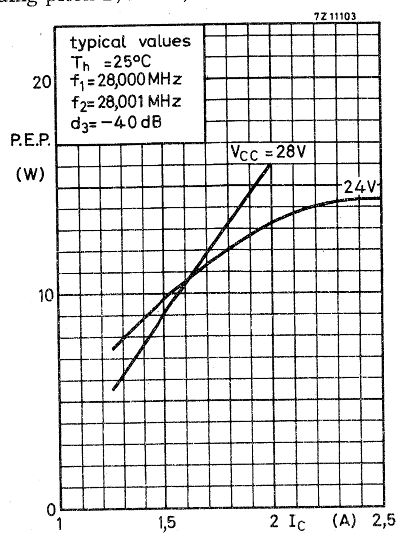
Test circuit:

S.S.B. class-A



L1 = 3 turns enamelled Cu wire (1,5 mm); winding pitch 2,5 mm; int. dia. 7 mm
leads 50 mm totally
L2 = 7 turns enamelled Cu wire (0,7 mm) on 3H1 toroid; 60 µH
(code number of 3H1: 4322 020 36620)
L3 = 4 turns enamelled Cu wire (1,5 mm); winding pitch 2,5 mm; int. dia. 10 mm
L4 = 7 turns enamelled Cu wire (1,5 mm); winding pitch 2,5 mm; int. dia. 12 mm





APPLICATION INFORMATION

R.F. performance in c.w. operation (class B)

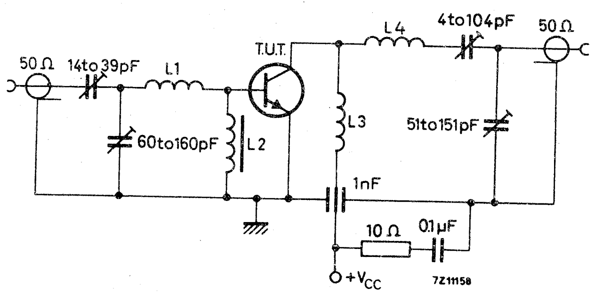
V_{CC} = 28 V; T_h up to 25 °C

f (MHz)	P_S (W)	P_L (W)	I_C (A)	G_p (dB)	η (%)	$\overline{z_i}$ (Ω)	$\overline{Y_L}$ (mA/V)
70	< 8.9	50	< 3.25	> 7.5	> 55	1.0+j0.2	120 − j75
50	typ. 4	50	typ. 3.25	typ. 11	typ. 55	–	–
30	typ. 1.2	50	typ. 3.25	typ. 16	typ. 55	–	–

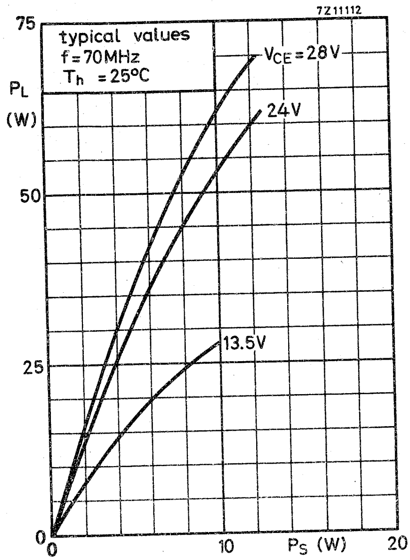
At temperatures up to 90 °C the output power relative to that at 25 °C is diminished by a factor −40 mW/°C.

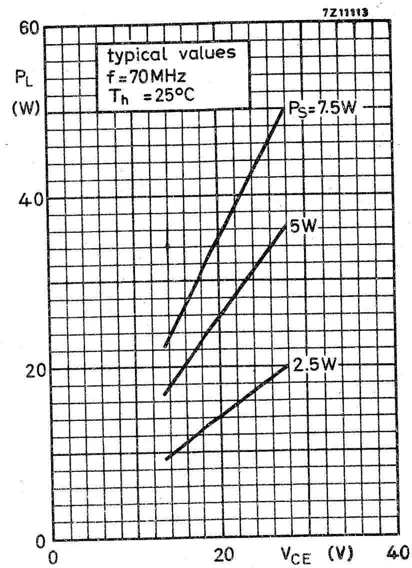
Test circuit :

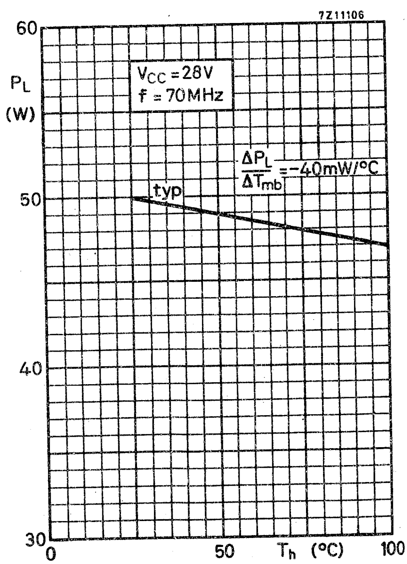
C.W.
70 MHz

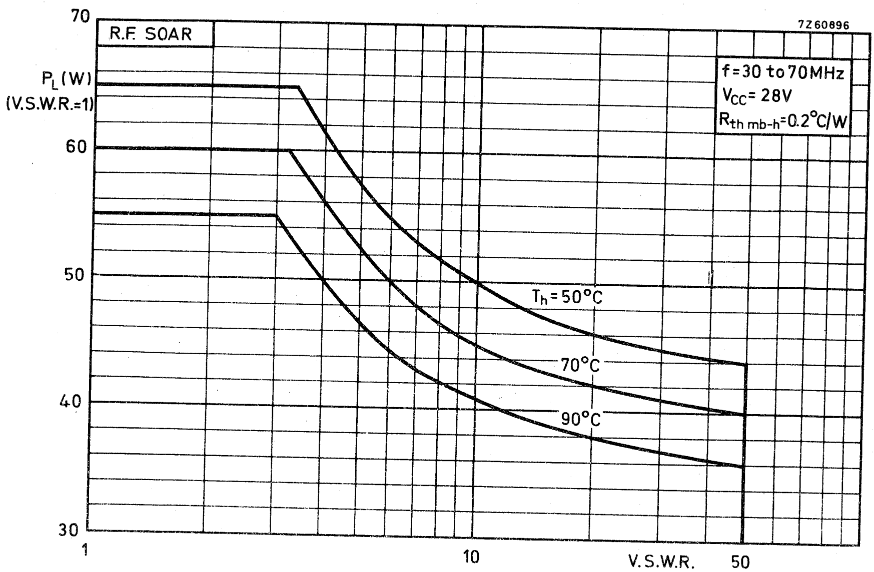


L1 = 60 mm straight enamelled Cu wire (1.5 mm); 9 mm above chassis
L2 = FXC choke coil (code number 4322 020 36640)
L3 = 2 turns enamelled Cu wire (1.5 mm); winding pitch 2 mm; internal diam. 10 mm; leads 55 mm totally
L4 = 3 turns enamelled Cu wire (1.5 mm); winding pitch 2.5 mm; internal diam. 10 mm; leads 50 mm totally


7Z11112
typical values
f = 70MHz
Th = 25°C
PL
(W)
VCE = 28V
24V
13.5V
75
50
25
0
0
10
PS (W)
20

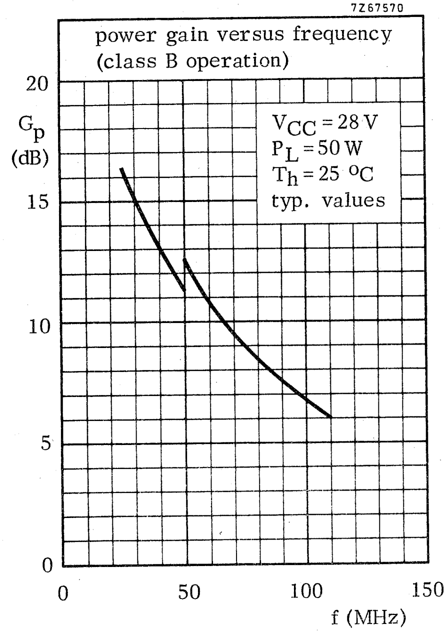

7Z11113
typical values
f = 70MHz
Th = 25°C
PL
(W)
PS = 7.5W
5W
2.5W
60
40
20
0
0
20
VCE (V)
40

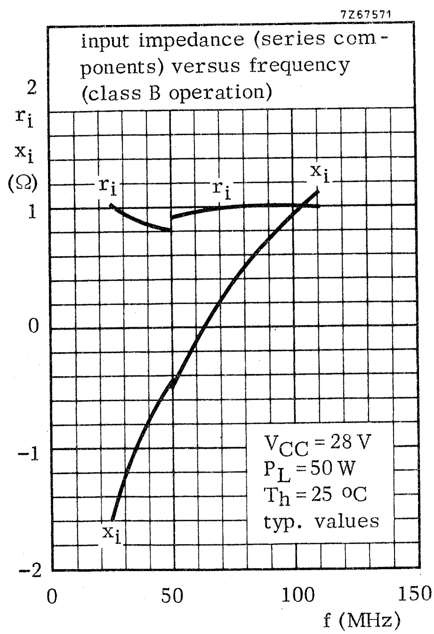

7Z11106
VCC = 28V
f = 70MHz
PL
(W)
ΔPL/ΔTmb = -40mW/°C
typ
60
50
40
30
0
50
Th (°C)
100

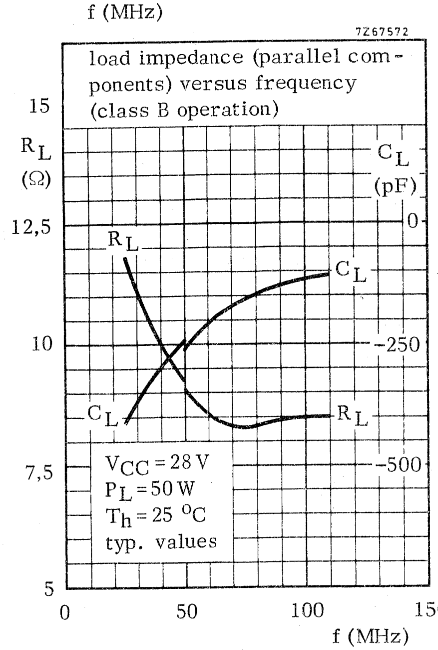


For high voltage operation, a stabilized power supply is generally used. The graph shows the allowable output power under nominal conditions as a function of the V.S.W.R., with heatsink temperature as parameter.

OPERATING NOTE Below 50 MHz a base-emitter resistor of 6,8 Ω is recommended to avoid oscillation. This resistor must be effective for both d.c. and r.f.







H.F./V.H.F. POWER TRANSISTOR

Silicon n-p-n power transistor for use in industrial and military s.s.b. and c.w. equipment operating in the h.f. and v.h.f. band:

- rated for 150 W P.E.P. at 1,6 MHz to 28 MHz (intermodulation distortion better than 30 dB down)
- rated at 150 W output power for frequencies up to 108 MHz in c.w. operation
- supply voltage up to 50 V
- plastic encapsulated stripline package
- delivered in matched h_{FE} groups

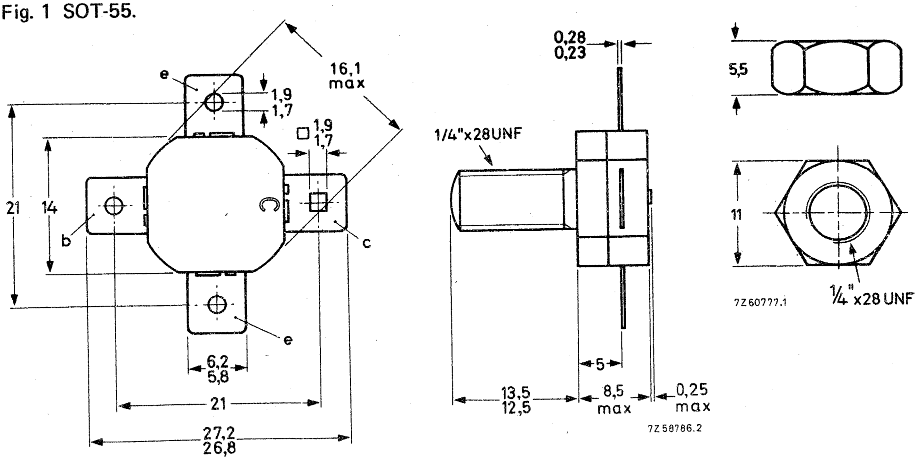
QUICK REFERENCE DATA

mode of operation	V_{CE} V	f MHz	P_L W	G_p dB	d_3 dB	$I_{C(ZS)}$ A
s.s.b. (class-AB)	50	1,6 to 28	20 to 150 (P.E.P.)	> 14	< −30	0,10
s.s.b. (class-A)	40	1,6 to 28	typ. 30 (P.E.P.)	> 14	< −40	2,5
c.w. (class-B)	50	70	150	> 10	–	–
c.w. (class-B)	50	108	150	typ. 7,4	–	–

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-55.



When locking is required an adhesive is preferred instead of a lock washer.

Torque on nut: min. 2,3 Nm (23 kg cm)
max. 2,7 Nm (27 kg cm)

Diameter of clearance hole in heatsink: max. 6,4 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

CAUTION This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC134)

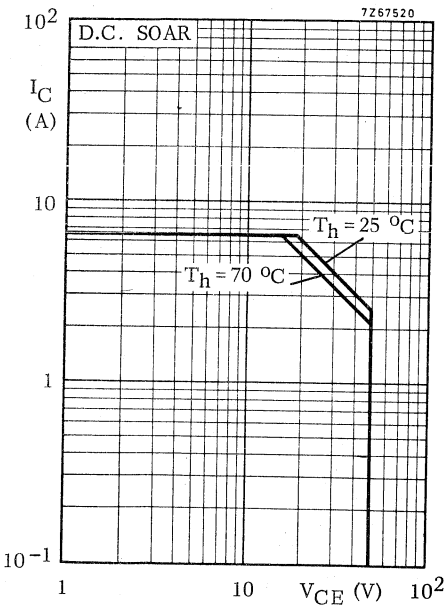
Voltages

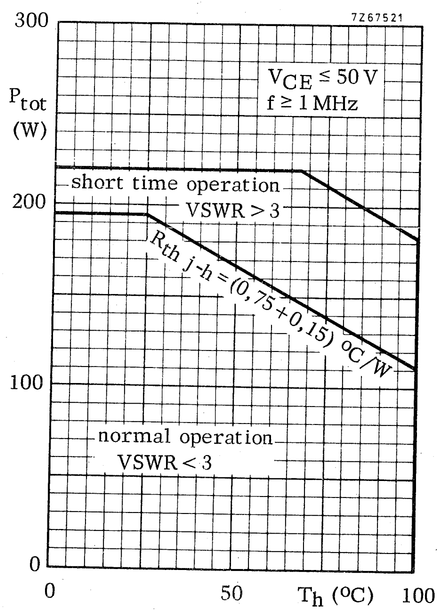
Collector-base voltage (open emitter) peak value	V_{CBOM}	max.	110	V
Collector-emitter voltage ($R_{BE} = 10\,\Omega$) peak value	V_{CERM}	max.	110	V
Collector-emitter voltage (open base)	V_{CEO}	max.	53	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4,0	V

Currents

Collector current (average)	$I_{C(AV)}$	max.	6,5	A
Collector current (peak value) f > 1 MHz	I_{CM}	max.	20	A

Power dissipation





Temperatures

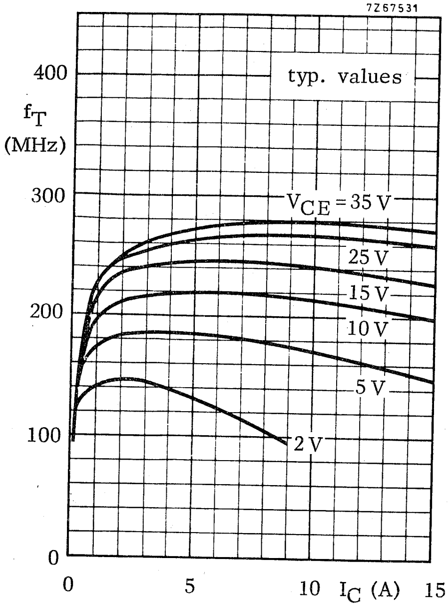
Storage temperature	T_{stg}		−65 to +200	°C
Junction temperature	T_j	max.	200	°C

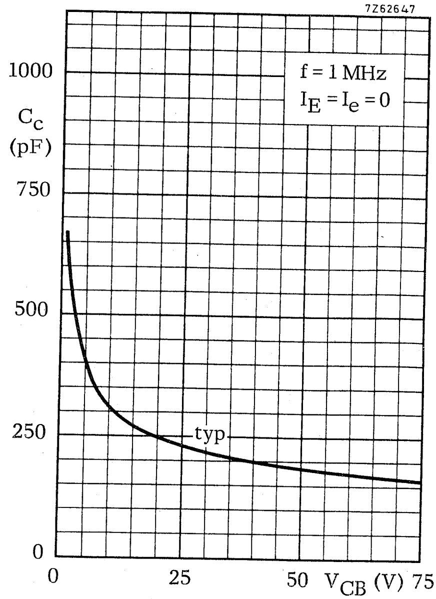
THERMAL RESISTANCE

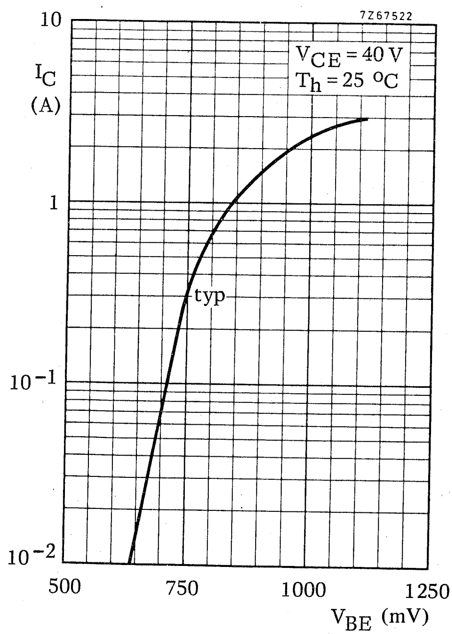
From junction to mounting base	$R_{th\ j-mb}$	=	0,75	°C/W
From mounting base to heatsink	$R_{th\ mb-h}$	=	0,15	°C/W

CHARACTERISTICS T_j = 25 °C unless otherwise specified

Breakdown voltages				
Collector-base voltage open emitter ; I_C = 100 mA	$V_{(BR)CBO}$	>	110	V
Collector-emitter voltage R_{BE} = 5 Ω ; I_C = 100 mA	$V_{(BR)CER}$	>	110	V
Collector-emitter voltage open base ; I_C = 100 mA	$V_{(BR)CEO}$	>	53	V
Emitter-base voltage open collector; I_E = 20 mA	$V_{(BR)EBO}$	>	4,0	V
Transient energy				
L = 25 mH; f = 50 Hz				
open base	E	>	12,5	mWs
$-V_{BE}$ = 1,5 V; R_{BE} = 33 Ω	E	>	12,5	mWs
D.C. current gain I_C = 1,4 A ; V_{CE} = 6 V	h_{FE}		15 to 50	
D.C. current gain ratio of matched devices I_C = 1,4 A ; V_{CE} = 6 V	h_{FE1}/h_{FE2}	<	1,2	
Transition frequency I_C = 6,0 A ; V_{CE} = 35 V	f_T	typ.	275	MHz
Collector capacitance at f = 1 MHz $I_E = I_e = 0$; V_{CB} = 50 V	C_c	typ. <	185 220	pF pF
Feedback capacitance at f = 1 MHz I_C = 150 mA; V_{CE} = 50 V	C_{re}	typ.	115	pF
Collector-stud capacitance	C_{cs}	typ.	3,5	pF


7Z67531
typ. values
400
300
200
100
0
f_T
(MHz)
V_{CE} = 35 V
25 V
15 V
10 V
5 V
2 V
0
5
10
15
I_C (A)


7Z62647
f = 1 MHz
$I_E = I_e = 0$
1000
750
500
250
0
C_c
(pF)
typ
0
25
50
75
V_{CB} (V)


7Z67522
V_{CE} = 40 V
T_h = 25 °C
10
1
10^{-1}
10^{-2}
I_C
(A)
typ
500
750
1000
1250
V_{BE} (mV)

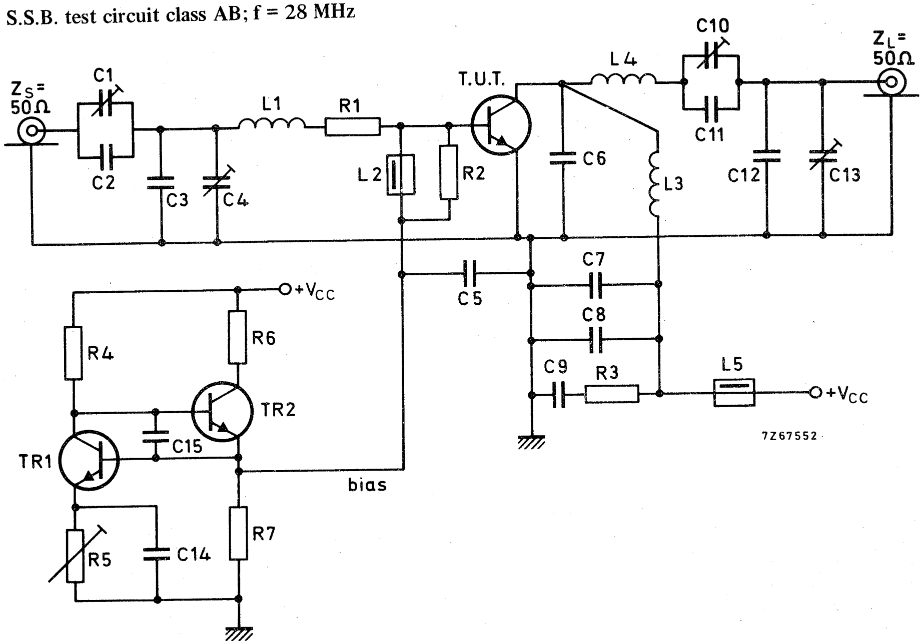
APPLICATION INFORMATION

R.F. performance in s.s.b. operation (linear power amplifier)

T_h up to 25 °C
f_1 = 28,000 MHz; f_2 = 28,001 MHz

output power (W)	G_p (dB)	η_{dt} (%)	d_3 (dB) 1)	d_5 (dB) 1)	I_{CZS} (A)	I_C (A)	V_{CE} (V)	Class
20 to 150 (PEP)	> 14	> 37,5	< −30	< −30	0,10	< 4	50	AB
typ. 30 (PEP)	> 14	typ. 15	< −40	< −40	2,5	–	40	A

S.S.B. test circuit class AB; f = 28 MHz



List of components: see page 6.

1) Stated figures are maxima encountered at any driving level between the specified values of PEP and are referred to the according level of either of the equal amplified tones. Relative to the according peak envelope power these figures should be increased by 6 dB.

APPLICATION INFORMATION (continued)

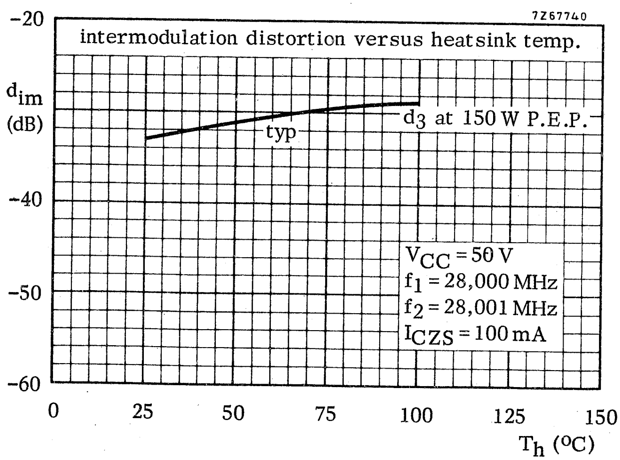
List of components:

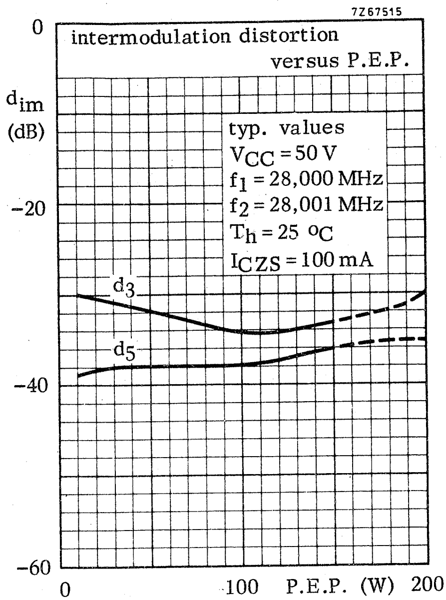
Tr1 = BD135
Tr2 = BD228

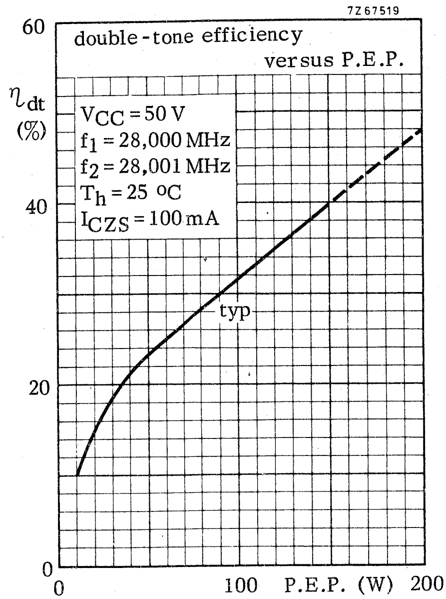
C1 = C10 = 100 pF air dielectric capacitor (single insulated rotor type)
C2 = C6 = 27 pF ceramic capacitor
C3 = 180 pF ceramic capacitor
C4 = C13 = 100 pF air dielectric capacitor (single non-insulated rotor)
C5 = C7 = 3,9 nF polyester capacitor (±10%)
C8 = C14 = C15 = 100 nF polyester capacitor (±10%)
C9 = 2,2 μF moulded metallized polyester capacitor
C11 = 68 pF ceramic capacitor
C12 = 220 pF ceramic capacitor

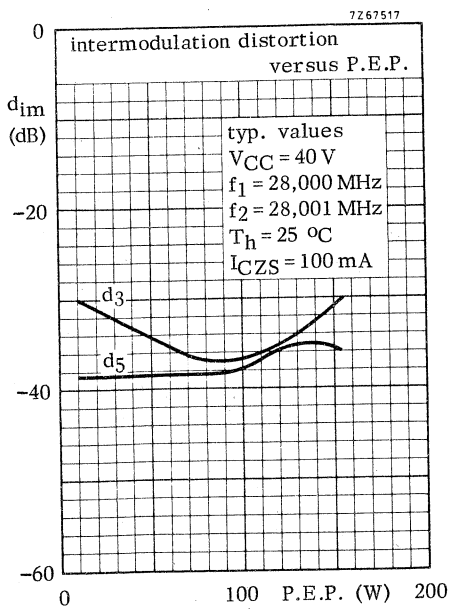
L1 = 88 nH; 3 turns Cu wire (1,0 mm); internal diameter 9 mm; coil length 6,1 mm; leads 2 x 5 mm
L2 = L5 = ferroxcube bead, grade 3B (code number 4312 020 36640)
L3 = 180 nH; 4 turns enamelled Cu wire (1,5 mm); internal diameter 12 mm; coil length 9,9 mm; leads 2 x 10 mm
L4 = 350 nH; 7 turns enamelled Cu wire (1,5 mm); internal diameter 12 mm; coil length 19,1 mm; leads 2 x 10 mm

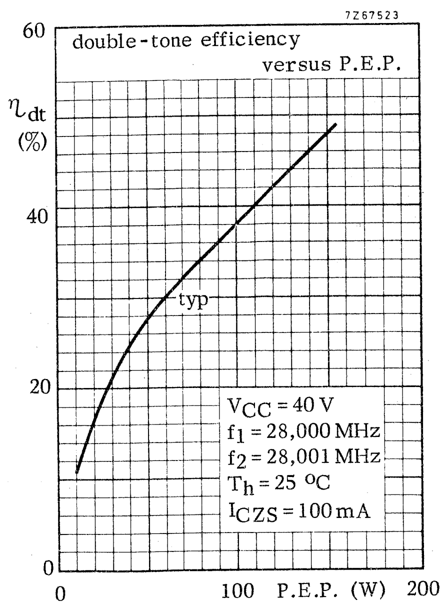
R1 = 0,66 Ω parallel connection of 5 x 3,3 Ω carbon resistors (±5%; 0,5 W each)
R2 = 27 Ω carbon resistor (±5%; 0,5 W)
R3 = 4,7 Ω carbon resistor (±5%; 0,5 W)
R4 = 5,6 kΩ carbon resistor (±5%; 1 W)
R5 = 15 Ω wire-wound potentiometer (3W)
R6 = 157 Ω parallel connection of 3 x 470 Ω wire-wound resistors (5,5W each)
R7 = 68 Ω carbon resistor (±5%; 0,5 W)

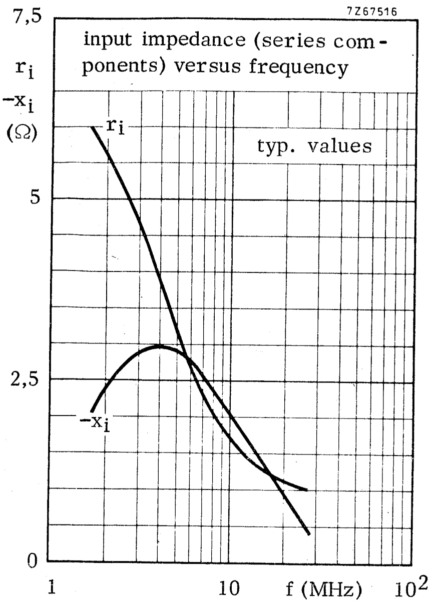


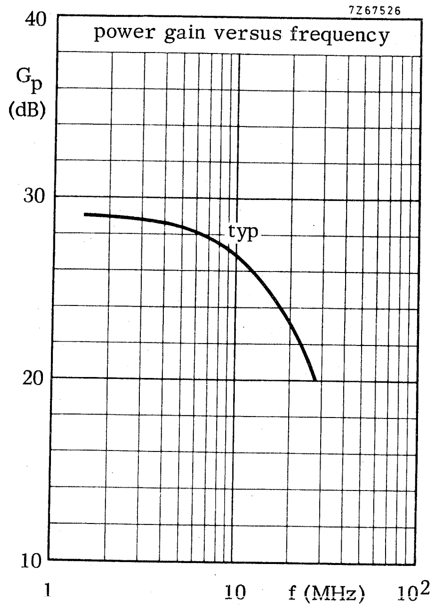

7Z67515
intermodulation distortion
versus P.E.P.
d_{im}
(dB)
typ. values
V_{CC} = 50 V
f_1 = 28,000 MHz
f_2 = 28,001 MHz
T_h = 25 °C
I_{CZS} = 100 mA
d_3
d_5
0
−20
−40
−60
0
100
P.E.P. (W)
200


7Z67519
double-tone efficiency
versus P.E.P.
η_{dt}
(%)
V_{CC} = 50 V
f_1 = 28,000 MHz
f_2 = 28,001 MHz
T_h = 25 °C
I_{CZS} = 100 mA
typ
60
40
20
0
0
100
P.E.P. (W)
200


7Z67517
intermodulation distortion
versus P.E.P.
d_{im}
(dB)
typ. values
V_{CC} = 40 V
f_1 = 28,000 MHz
f_2 = 28,001 MHz
T_h = 25 °C
I_{CZS} = 100 mA
d_3
d_5
0
−20
−40
−60
0
100
P.E.P. (W)
200


7Z67523
double-tone efficiency
versus P.E.P.
η_{dt}
(%)
typ
V_{CC} = 40 V
f_1 = 28,000 MHz
f_2 = 28,001 MHz
T_h = 25 °C
I_{CZS} = 100 mA
60
40
20
0
0
100
P.E.P. (W)
200

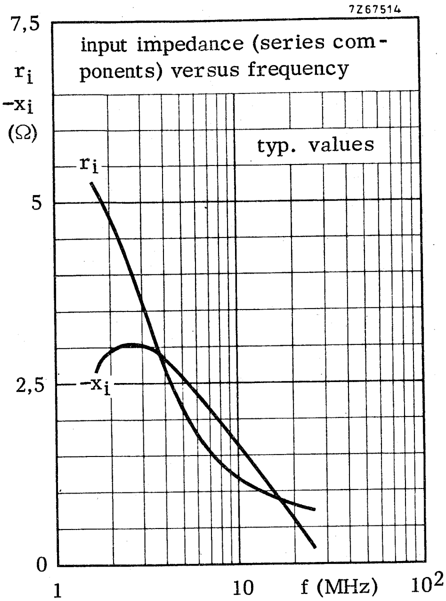


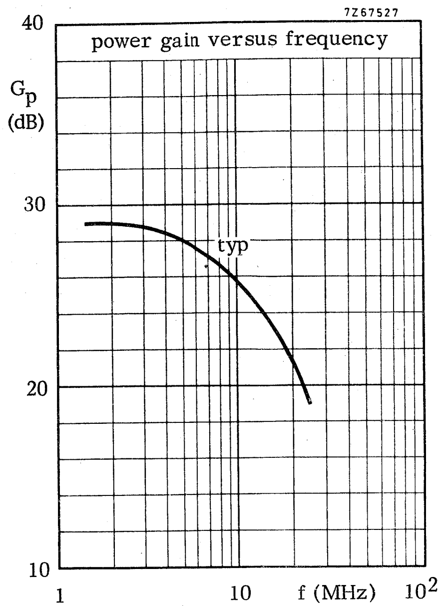


S.S.B. class AB operation

P_L = 150 W (PEP)
V_{CC} = 50 V
I_{CZS} = 100 mA
T_h = 25 °C
Z_L = 6,25 Ω in series with 10,4 nH (in parallel with −267 pF)

The graphs hold for one transistor of a push-pull amplifier with cross neutralization; collector (Tr1) - base (Tr2), neutralizing capacitor: 82 pF.





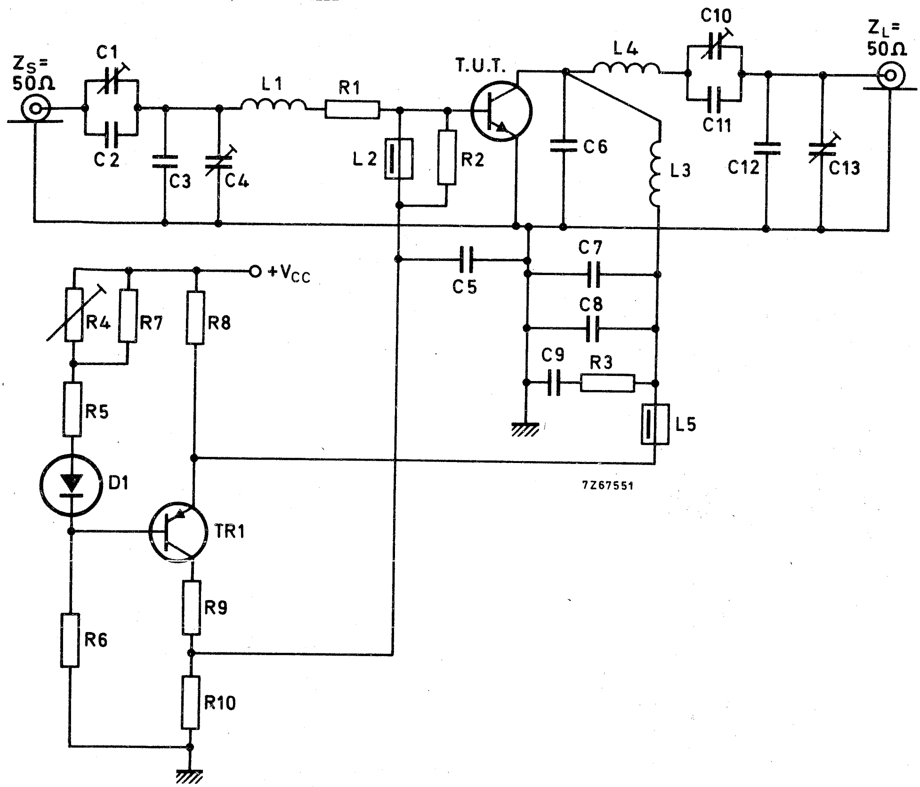
S.S.B. class AB operation

P_L = 150 W (PEP)
V_{CC} = 50 V
I_{CZS} = 100 mA
T_h = 25 °C
Z_L = 6,25 Ω in series with 7,3 nH (in parallel with −188 pF)

The graphs hold for an unneutralized amplifier.

APPLICATION INFORMATION (continued)

S.S.B. test circuit class-A; f = 28 MHz



List of components: (see also page 11)

D1 = BY206
TR1 = BD204

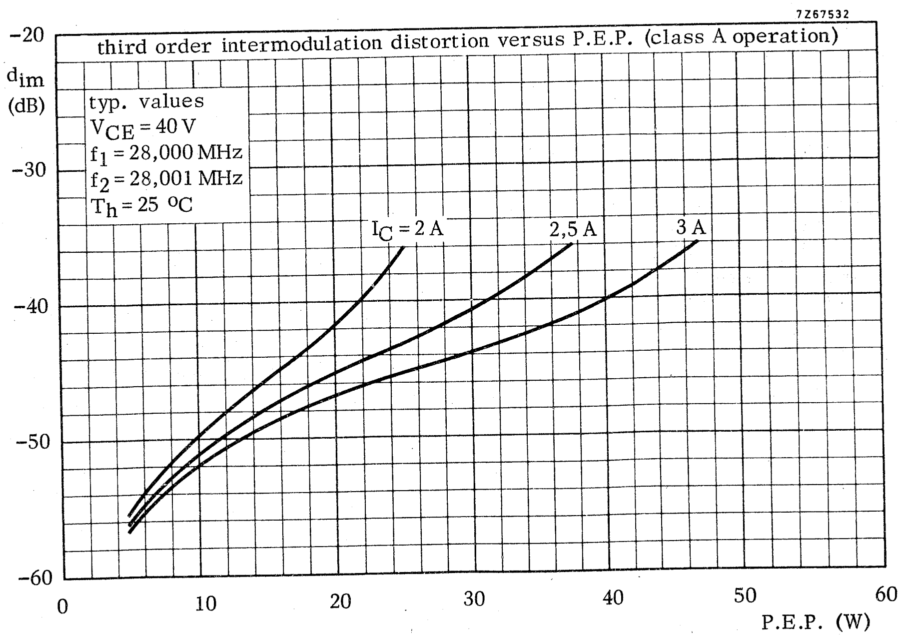
C1 = C10 = 100 pF air dielectric capacitor (single insulated rotor type)
C2 = C6 = 27 pF ceramic capacitor
C3 = 180 pF ceramic capacitor
C4 = C13 = 100 pF air dielectric capacitor (single non-insulated rotor)
C5 = C7 = 3,9 nF polyester capacitor (±10%)
C8 = 100 nF polyester capacitor (±10%)
C9 = 2,2 μF moulded metallized polyester capacitor
C11 = 68 pF ceramic capacitor
C12 = 220 pF ceramic capacitor

APPLICATION INFORMATION (continued)

List of components: (continued)

L1 = 88 nH; 3 turns Cu wire (1,0 mm); internal diameter 9 mm; coil length 6,1 mm; leads 2 x 5 mm
L2 = L5 = ferroxcube bead, grade 3B (code number 4312 020 36440)
L3 = 180 nH; 4 turns enamelled Cu wire (1,5 mm); internal diameter 12 mm; coil length 9,9 mm; leads 2 x 10 mm
L4 = 350 nH; 7 turns enamelled Cu wire (1,5 mm); internal diameter 12 mm; coil length 19,1 mm; leads 2 x 10 mm

R1 = 0,66 Ω parallel connection of 5 x 3,3 Ω carbon resistors (±5%; 0,5 W each)
R2 = 27 Ω carbon resistor (±5%; 0,5 W)
R3 = 4,7 Ω carbon resistor (±5%; 0,5 W)
R4 = 50 Ω wire-wound potentiometer (1 W)
R5 = 10 Ω carbon resistor (±5%; 1 W)
R6 = 560 Ω enamelled wire-wound resistor (5,5 W)
R7 = 270 Ω carbon resistor (±5%; 1 W)
R8 = 0,6 Ω parallel connection of 3 x 1,8 Ω wire-wound resistors (8 W each)
R9 = 90 Ω parallel connection of 3 x 270 Ω enamelled wire-wound resistor (5,5 W each)
R10 = 12 Ω carbon resistor (±5%; 1 W)



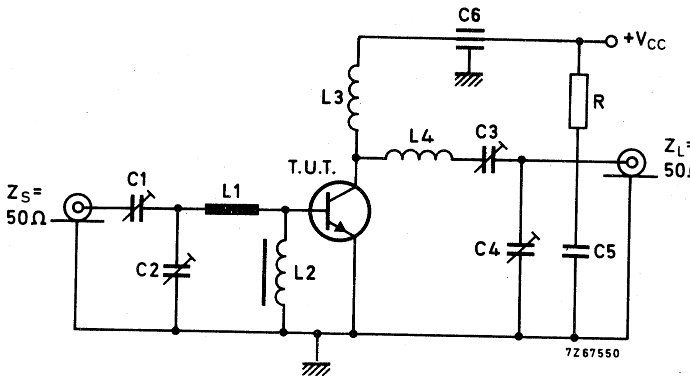
APPLICATION INFORMATION (continued)

R.F. performance in c.w. operation (class-B circuit)

V_{CE} = 50 V; T_h up to 25 °C

f (MHz)	P_S (W)	P_L (W)	I_C (A)	G_p (dB)	η (%)
70	< 15	150	< 4,6	> 10	> 65
→ 108	typ. 27	150	typ. 4,0	typ. 7,4	typ. 75

Test circuit: 70 MHz; c.w. class-B.



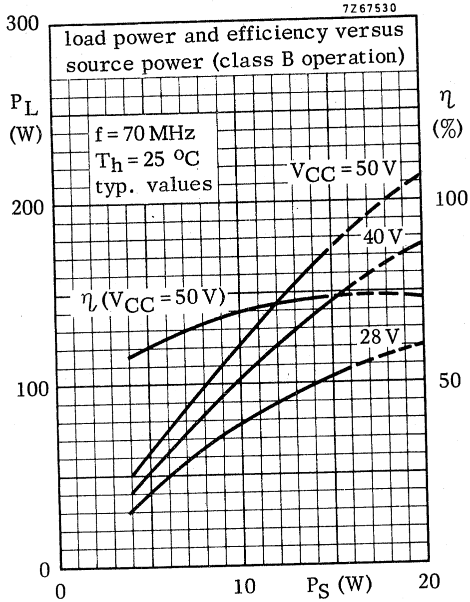
List of components:

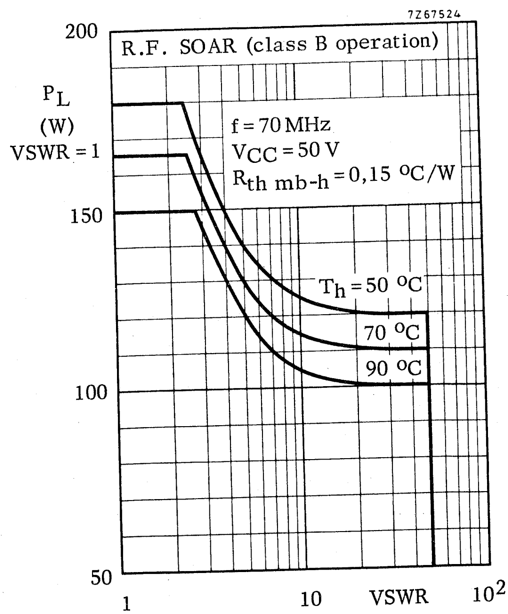
L1 = 60 mm straight enamelled Cu wire (1,6 mm); 9 mm above chassis
L2 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L3 = 18 turns enamelled Cu wire (1,6 mm); internal diameter 10 mm; pitch 2 mm; leads 55 mm totally
L4 = 3 turns enamelled Cu wire (1,6 mm); internal diameter 10 mm; pitch 2,5 mm; leads 50 mm totally

C1 = 4 to 29 pF concentric air trimmer in parallel with 10 pF ceramic capacitor
C2 = 4 to 104 pF film dielectric trimmer in parallel with 56 pF ceramic capacitor
C3 = 4 to 104 pF film dielectric trimmer
C4 = 4 to 104 pF film dielectric trimmer in parallel with 47 pF ceramic capacitor
C5 = 100 nF polyester capacitor (± 10%)
C6 = 1 nF ceramic feed-through capacitor

R = 10 Ω carbon resistor (0,5 W)

At P_L = 150 W and V_{CE} = 50 V, the output power at heatsink temperatures between 25 °C and 75 °C relative to that at 25 °C is diminished by 100 mW/K.



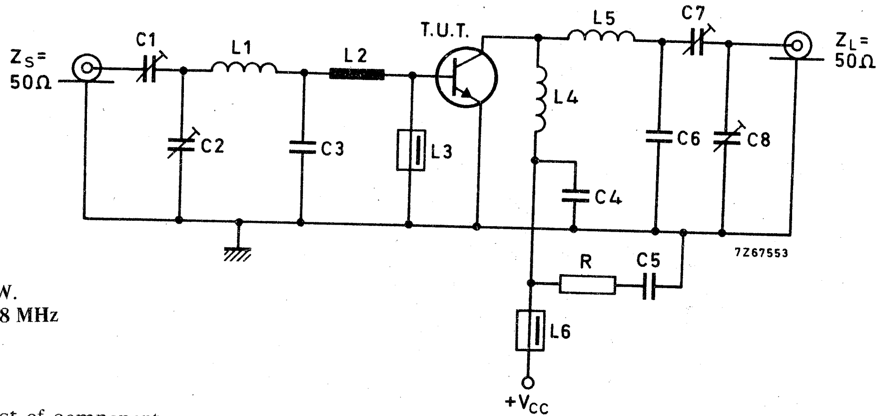


Indicated load power as a function of overload.

The graph has been derived from an evaluation of the performance of transistors matched up to 180 W load power in the test amplifier on page 12 and subsequently subjected to various mismatch conditions at 50 V with VSWR up to 50 and elevated heatsink temperatures.
This indicates a restriction to the load power matched under nominal conditions in the recommended test configuration.

APPLICATION INFORMATION (continued)

Test circuit:



C.W.
108 MHz

List of components:

C1 = C2 = 40 pF film dielectric trimmer
C3 = 400 pF parallel connection of 4 x 100 pF ceramic capacitors
C4 = 270 pF ceramic capacitor
C5 = 100 nF polyester capacitor (±10%)
C6 = 20 pF parallel connection of 2 x 10 pF ceramic capacitors
C7 = C8 = 60 pF film dielectric trimmer

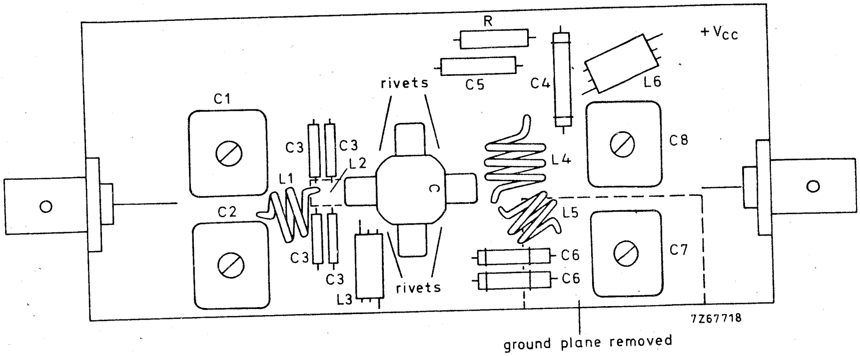
L1 = 49 nH; 2 turns enamelled Cu wire (1,5 mm); internal diameter 9 mm; coil length 4,8 mm; leads 2 x 5 mm
L2 = strip-line (7,7 mm x 6 mm); tap for C3 is 7,5 mm from transistor edge
L3 = L6 = ferroxcube bead, grade 3B (code number 4312 020 36640)
L4 = 67 nH; 3 turns enamelled Cu wire (1,5 mm); internal diameter 8 mm; coil length 8,3 mm; leads 2 x 5 mm
L5 = 57 nH; 2 turns enamelled Cu wire (1,5 mm); internal diameter 10 mm; coil length 4,5 mm; leads 2 x 5 mm

R = 10 Ω carbon resistor (0,5 W)

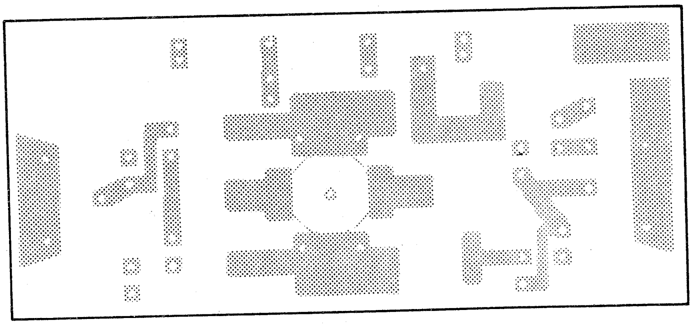
Component lay-out for 108 MHz test circuit see page 15.

APPLICATION INFORMATION (continued)

Component lay-out and printed circuit board for 108 MHz test circuit.

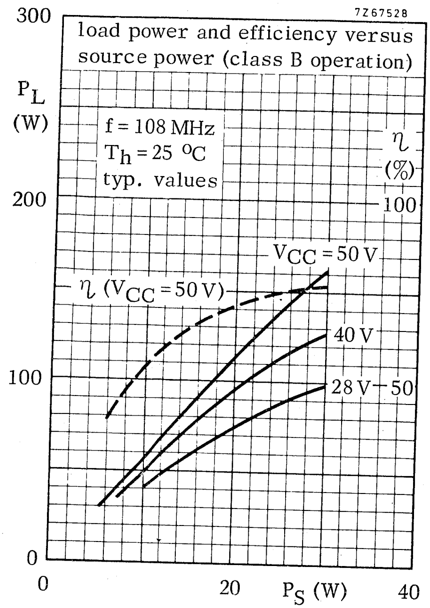


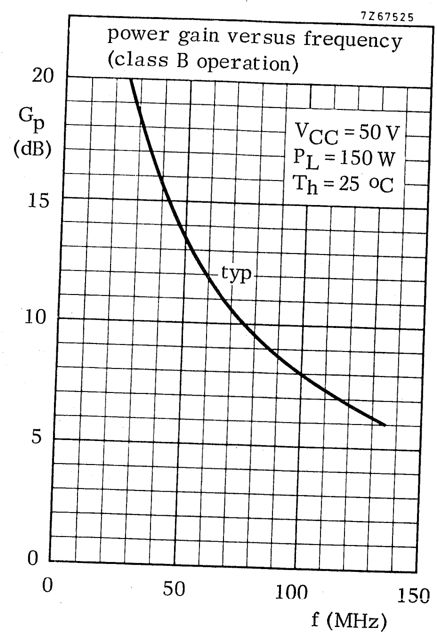
Dimensions of printed circuit board 123 mm x 55 mm.

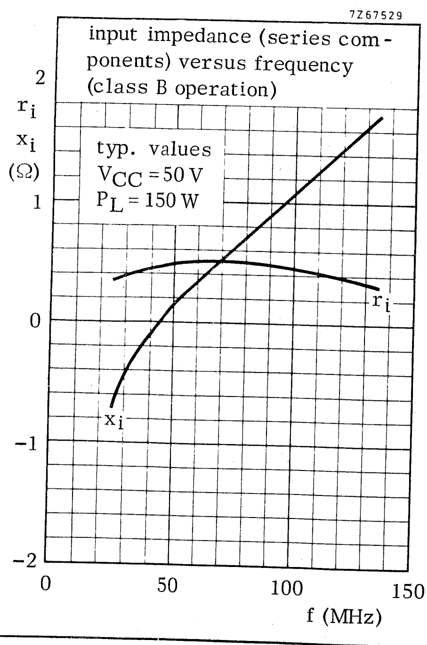


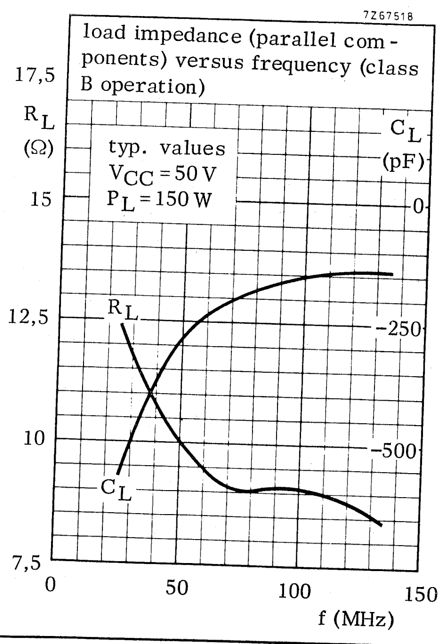
7Z67664

The circuit has been built on epoxy fibre-glass double copper clad printed circuit board (thickness 1/16"). To minimize the dielectric losses, the ground plane under the interconnection of L5, C6 and C7 has been removed.


7Z67528
load power and efficiency versus source power (class B operation)
P_L (W)
f = 108 MHz
Th = 25 °C
typ. values
η (%)
300
200
100
0
100
50
V_CC = 50 V
η (V_CC = 50 V)
40 V
28 V
0
20
P_S (W)
40


7Z67525
power gain versus frequency (class B operation)
G_p (dB)
V_CC = 50 V
P_L = 150 W
Th = 25 °C
typ
20
15
10
5
0
0
50
100
150
f (MHz)


7Z67529
input impedance (series components) versus frequency (class B operation)
r_i
x_i
(Ω)
typ. values
V_CC = 50 V
P_L = 150 W
r_i
x_i
2
1
0
−1
−2
0
50
100
150
f (MHz)


7Z67518
load impedance (parallel components) versus frequency (class B operation)
R_L (Ω)
C_L (pF)
typ. values
V_CC = 50 V
P_L = 150 W
R_L
C_L
17,5
15
12,5
10
7,5
0
−250
−500
0
50
100
150
f (MHz)

H.F./V.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor intended for use in class-A, B and C operated h.f. and v.h.f. transmitters with a nominal supply voltage of 28 V. The transistor is resistance stabilized and is guaranteed to withstand severe load mismatch conditions. Matched h_{FE} groups are available on request.

It has a 3/8" capstan envelope with a ceramic cap. All leads are isolated from the stud.

QUICK REFERENCE DATA

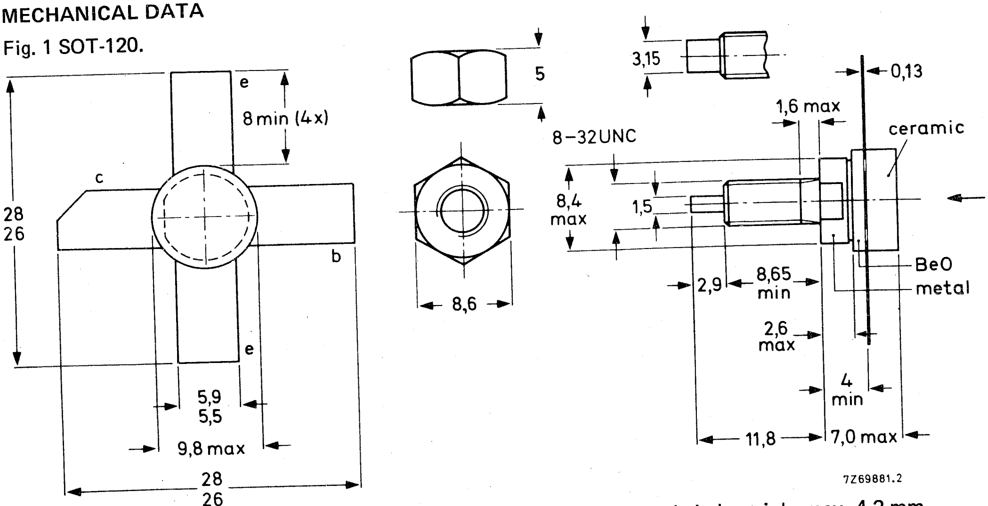
R.F. performance up to T_h = 25 °C

mode of operation	V_{CE} V	f MHz	P_L W	G_p dB	η %	$\overline{z_i}$ Ω	$\overline{Y_L}$ mA/V	d_3 dB
c.w. (class-B)	28	175	45	> 7,5	> 70	0,7 + j1,3	110 − j62	–
s.s.b. (class-AB)	28	1,6–28	5–42,5(P.E.P)	typ. 19	typ. 50	–	–	typ. −30
s.s.b. (class-A)	26	1,6–28	15 (P.E.P)	typ. 20	–	–	–	typ. −42

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-120.



Torque on nut: min. 0,75 Nm (7,5 kg cm)
max. 0,85 Nm (8,5 kg cm)

Diameter of clearance hole in heatsink: max. 4,2 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

When locking is required an adhesive is preferred instead of a lock washer.

CAUTION This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage (V_{BE} = 0) peak value	V_{CESM}	max.	65	V
Collector-emitter voltage (open base)	V_{CEO}	max.	36	V
Emitter-base voltage (open-collector)	V_{EBO}	max.	4	V
Collector current (average)	$I_{C(AV)}$	max.	4	A
Collector current (peak value); f > 1 MHz	I_{CM}	max.	12	A
R.F. power dissipation (f > 1 MHz); T_{mb} = 25 °C	P_{rf}	max.	100	W
Storage temperature	T_{stg}		− 65 to + 150	°C
Operating junction temperature	T_j	max.	200	°C

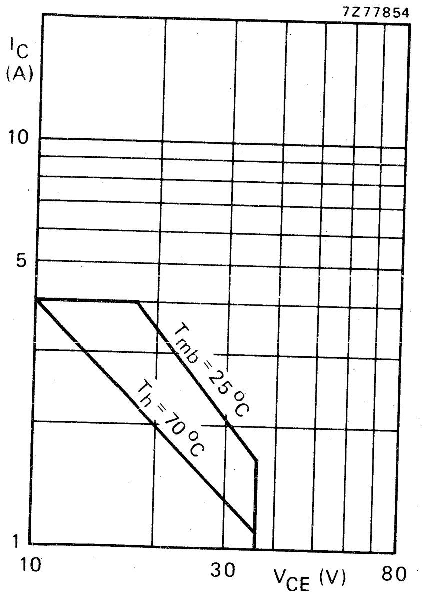


Fig. 2 D.C. SOAR.

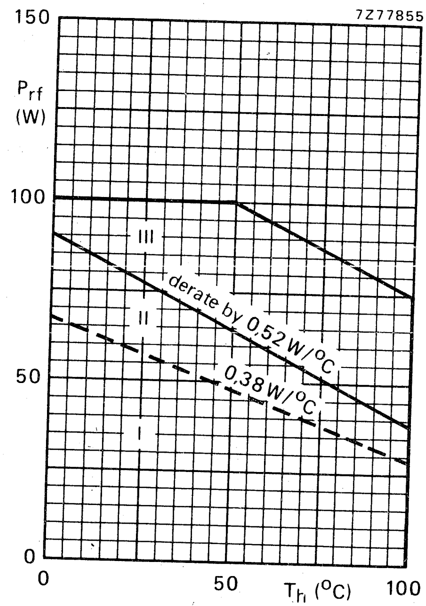


Fig. 3 R.F. power dissipation; $V_{CE} \leq 28$ V; f > 1 MHz.

I Continuous d.c. operation
II Continuous r.f. operation
III Short-time operation during mismatch

THERMAL RESISTANCE (dissipation = 40 W; T_{mb} = 88 °C, i.e. T_h = 70 °C)

From junction to mounting base (d.c. dissipation)	$R_{th\ j\text{-}mb(dc)}$	=	2,8 °C/W
From junction to mounting base (r.f. dissipation)	$R_{th\ j\text{-}mb(rf)}$	=	2,05 °C/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,45 °C/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector-emitter breakdown voltage V_{BE} = 0; I_C = 25 mA	$V_{(BR)CES}$	>	65 V
Collector-emitter breakdown voltage open base; I_C = 100 mA	$V_{(BR)CEO}$	>	36 V
Emitter-base breakdown voltage open collector; I_E = 10 mA	$V_{(BR)EBO}$	>	4 V
Collector cut-off current V_{BE} = 0; V_{CE} = 36 V	I_{CES}	<	10 mA
Second breakdown energy; L = 25 mH; f = 50 Hz open base	E_{SBO}	>	8 mJ
R_{BE} = 10 Ω	E_{SBR}	>	8 mJ
D.C. current gain * I_C = 2,5 A; V_{CE} = 5 V	h_{FE}	typ.	45
			10 to 80
D.C. current gain ratio of matched devices * I_C = 2,5 A; V_{CE} = 5 V	h_{FE1}/h_{FE2}	<	1,2
Collector-emitter saturation voltage * I_C = 7,5 A; I_B = 1,5 A	V_{CEsat}	typ.	1,5 V
Transition frequency at f = 100 MHz * $-I_E$ = 2,5 A; V_{CB} = 28 V	f_T	typ.	570 MHz
$-I_E$ = 7,5 A; V_{CB} = 28 V	f_T	typ.	570 MHz
Collector capacitance at f = 1 MHz $I_E = I_e$ = 0; V_{CB} = 28 V	C_c	typ.	82 pF
Feedback capacitance at f = 1 MHz I_C = 100 mA; V_{CE} = 28 V	C_{re}	typ.	54 pF
Collector-stud capacitance	C_{cs}	typ.	2 pF

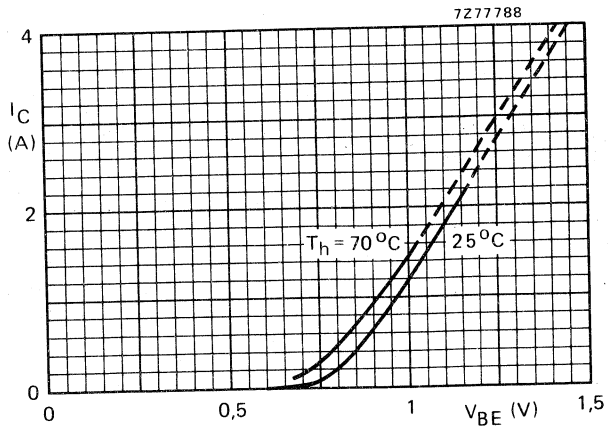


Fig. 4 Typical values; V_{CE} = 28 V.

* Measured under pulse conditions: $t_p \leq 200\ \mu s$; $\delta \leq 0{,}02$.

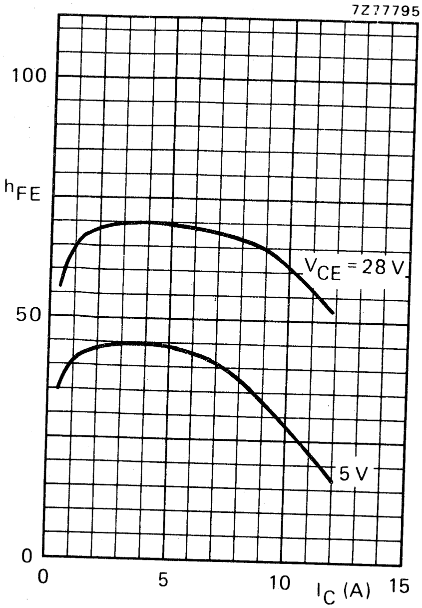


Fig. 5 Typical values; T_j = 25 °C.

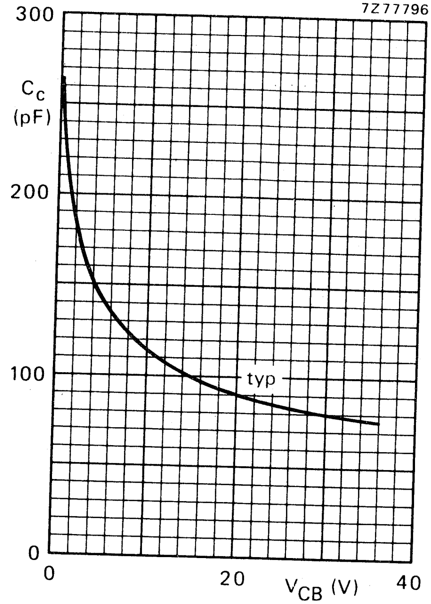


Fig. 6 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

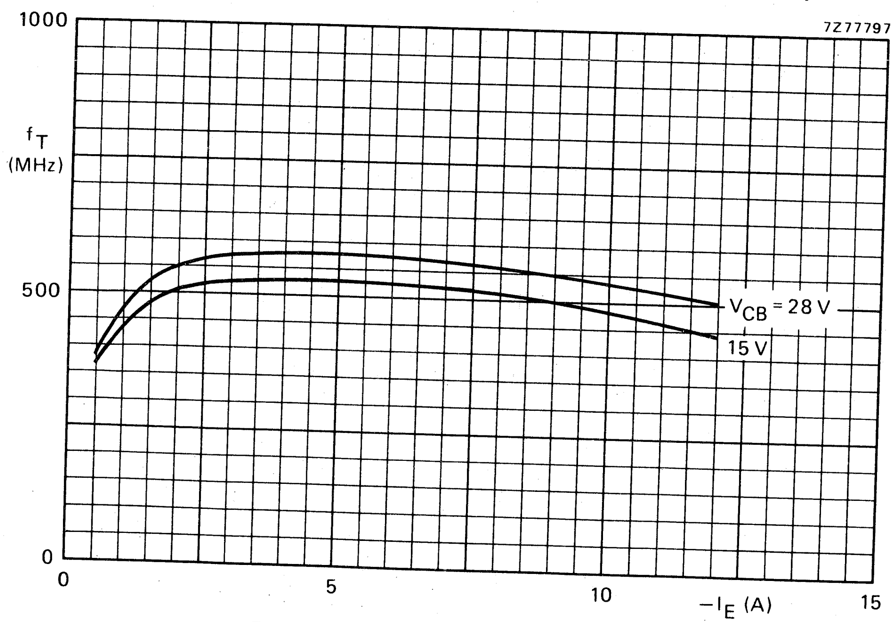


Fig. 7 Typical values; f = 100 MHz; T_j = 25 °C.

APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit)

T_h = 25 °C

f (MHz)	V_{CE} (V)	P_L (W)	P_S (W)	G_p (dB)	I_C (A)	η (%)	$\overline{z_i}$ (Ω)	$\overline{Y_L}$ (mA/V)
175	28	45	< 8	> 7,5	< 2,47	> 70	0,7 + j1,3	110 − j62

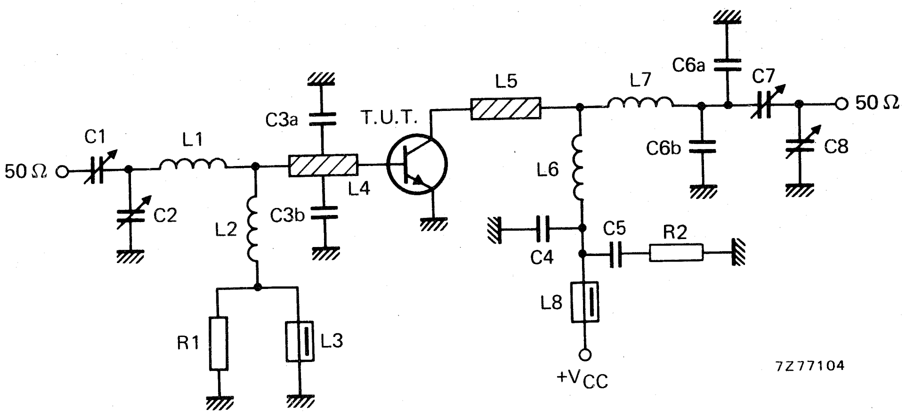


Fig. 8 Test circuit; c.w. class-B.

List of components:

C1 = C7 = 2,5 to 20 pF film dielectric trimmer (cat. no. 2222 809 07004)
C2 = 5 to 60 pF film dielectric trimmer (cat. no. 2222 809 07011)
C3a = C3b = 47 pF ceramic capacitor (500 V)
C4 = 120 pF ceramic capacitor (500 V)
C5 = 100 nF polyester capacitor
C6a = 2,2 pF ceramic capacitor (500 V)
C6b = 1,8 pF ceramic capacitor (500 V)
C8 = 4 to 40 pF film dielectric trimmer (cat. no. 2222 809 07008)

L1 = 14 nH; 1 turn Cu wire (1,6 mm); int. dia. 7,7 mm; leads 2 x 5 mm
L2 = 100 nH; 7 turns closely wound enamelled Cu wire (0,5 mm); int. dia. 3 mm; leads 2 x 5 mm
L3 = L8 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L4 = L5 = strip (12 mm x 6 mm); taps for C3a and C3b at 5 mm from transistor
L6 = 80 nH; 3 turns Cu wire (1,6 mm); int. dia. 9,0 mm; length 8,0 mm; leads 2 x 5 mm
L7 = 62 nH; 3 turns Cu wire (1,6 mm); int. dia. 7,5 mm; length 8,1 mm; leads 2 x 5 mm

L4 and L5 are strips on a double Cu-clad printed-circuit board with epoxy fibre-glass dielectric, thickness 1/16".

R1 = R2 = 10 Ω carbon resistor.

Component layout and printed-circuit board for 175 MHz test circuit see Fig. 9.

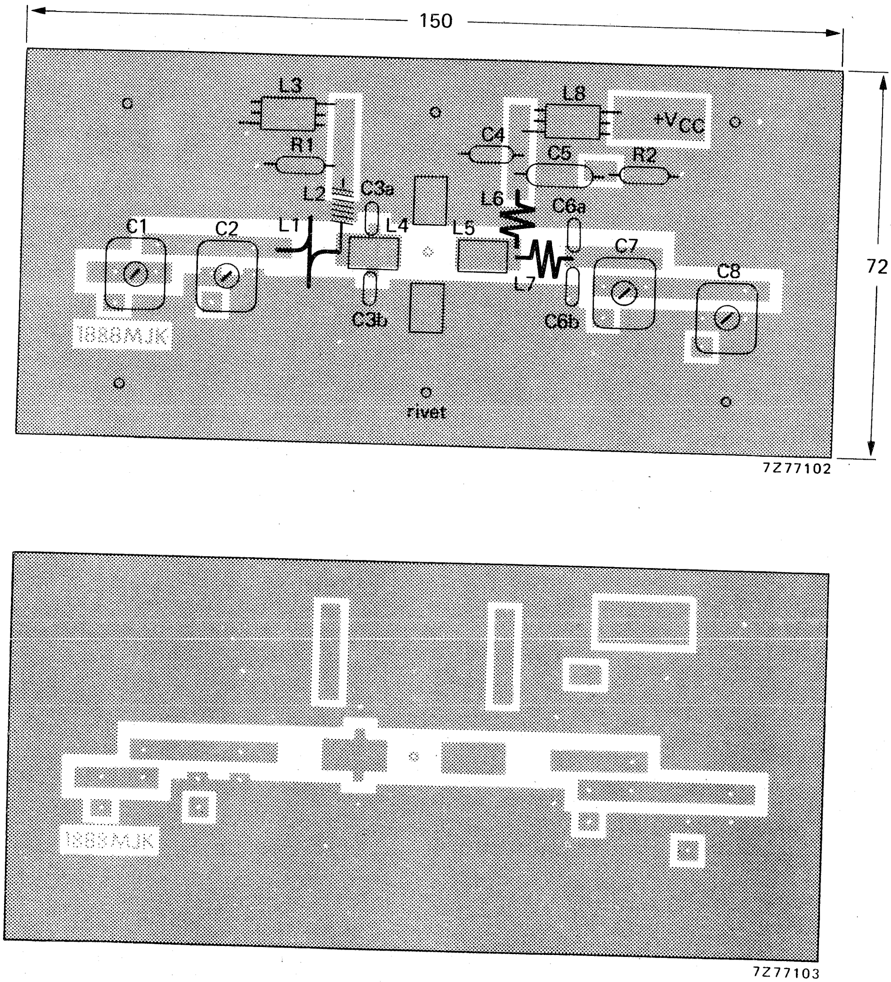


Fig. 9 Component layout and printed-circuit board for 175 MHz test circuit.

The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets, whilst under the emitter leads Cu straps are used for a direct contact between upper and lower sheets.

To minimize the dielectric losses, the ground plane under the interconnection of L7 and C7 has been removed.

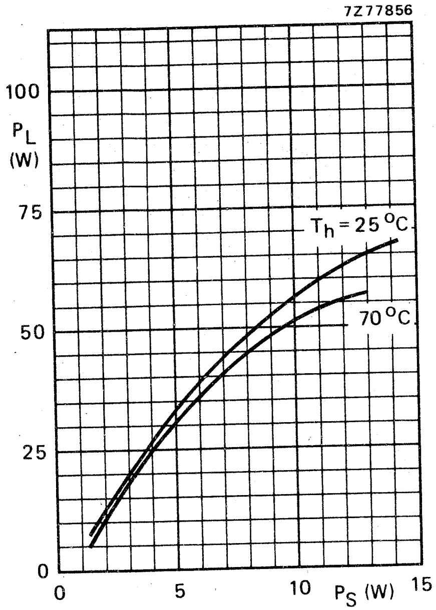


Fig. 10 Typical values; V_{CE} = 28 V; f = 175 MHz.

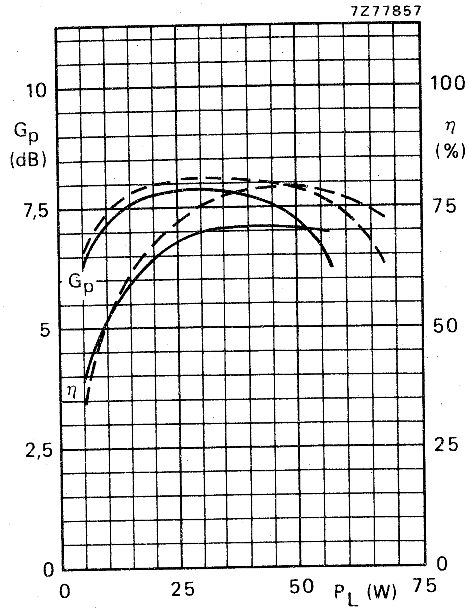


Fig. 11 Typical values; V_{CE} = 28 V; f = 175 MHz;
– – – T_h = 25 ^oC; —— T_h = 70 ^oC.

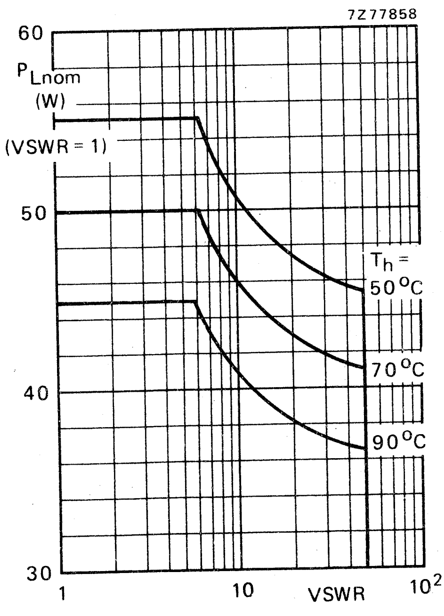


Fig. 12 R.F. SOAR; c.w. class-B operation;
f = 175 MHz; V_{CE} = 28 V; $R_{th\ mb\text{-}h}$ = 0,45 $^oC/W$.
The graph shows the permissible output power under nominal conditions (VSWR = 1) as a function of the expected VSWR during short-time mismatch conditions with heatsink temperatures as parameter.

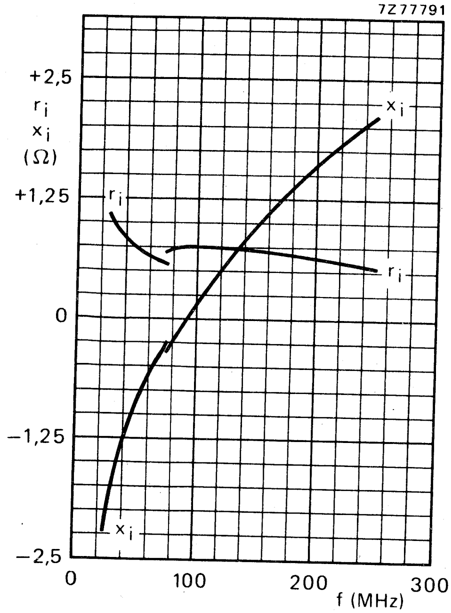


Fig. 13 Input impedance (series components).

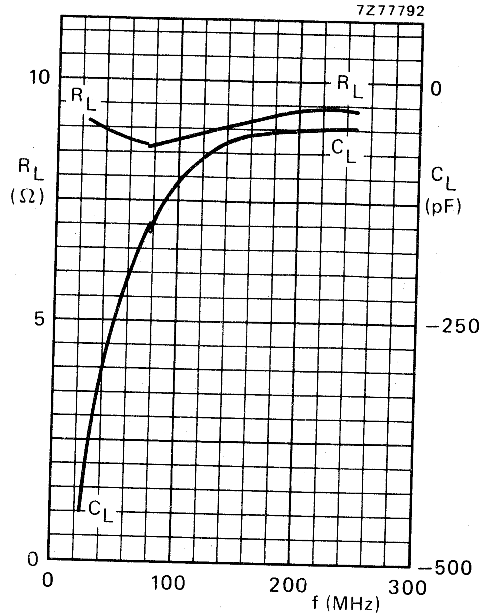


Fig. 14 Load impedance (parallel components).

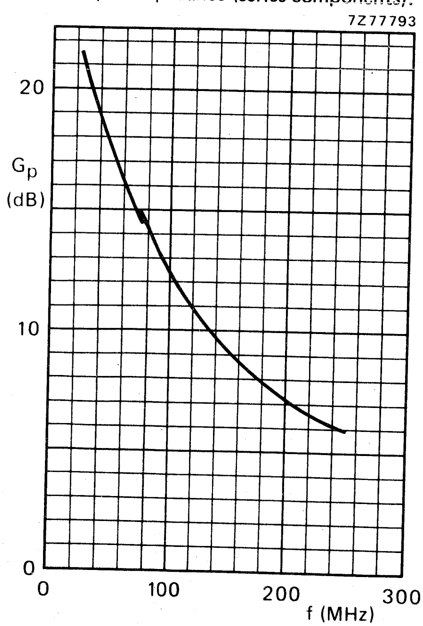


Fig. 15 Power gain versus frequency.

OPERATING NOTE

Below 75 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation. This resistor must be effective for r.f. only.

Conditions for Figs 13; 14 and 15.

Typical values; V_{CE} = 28 V; P_L = 45 W; T_h = 25 °C.

R.F. performance in s.s.b. class-AB operation (linear power amplifier)

V_{CE} = 28 V; f_1 = 28,000 MHz; f_2 = 28,001 MHz

output power W	G_p dB	η_{dt}(%) at 42,5 W (P.E.P)	I_C (A) at 42,5 W (P.E.P)	d_3 dB*	d_5 dB*	$I_{C(ZS)}$ mA	T_h °C
5 to 42,5(P.E.P)	typ. 19	typ. 50	typ. 1,52	typ. −30	< −30	50	25
5 to 37,5(P.E.P)	typ. 19	—	—	typ. −30	< −30	50	70

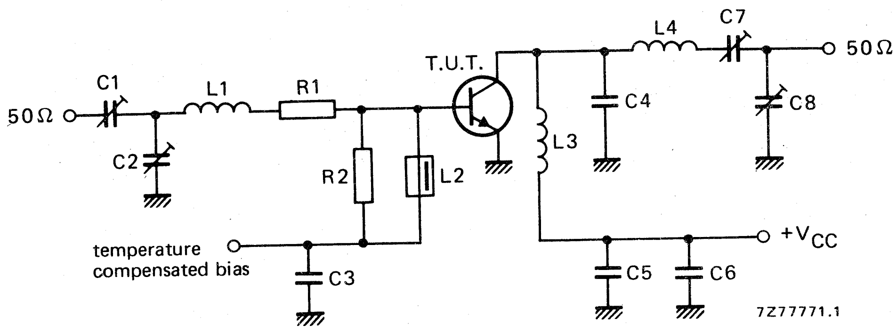


Fig. 16 Test circuit; s.s.b. class-AB.

List of components:

C1 = C2 = 10 to 780 pF film dielectric trimmer
C3 = C5 = C6 = 220 nF polyester capacitor
C4 = 56 pF ceramic capacitor (500 V)
C7 = C8 = 15 to 575 pF film dielectric capacitor

L1 = 4 turns closely wound enamelled Cu wire (1,6 mm); int. dia. 7,0 mm; leads 2 x 5 mm
L2 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L3 = 4 turns enamelled Cu wire (1,6 mm); int. dia. 10 mm; length 9,4 mm; leads 2 x 5 mm
L4 = 7 turns enamelled Cu wire (1,6 mm); int. dia. 12 mm; length 17,2 mm; leads 2 x 5 mm

R1 = 1,2 Ω; parallel connection of 4 x 4,7 Ω carbon resistors
R2 = 39 Ω carbon resistor

* Stated intermodulation distortion figures are referred to the according level of either of the equal amplified tones. Relative to the according peak envelope powers these figures should be increased by 6 dB.

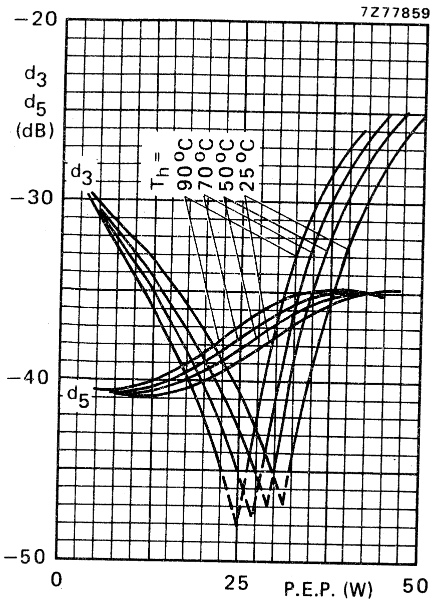


Fig. 17 Intermodulation distortion as a function of output power.*

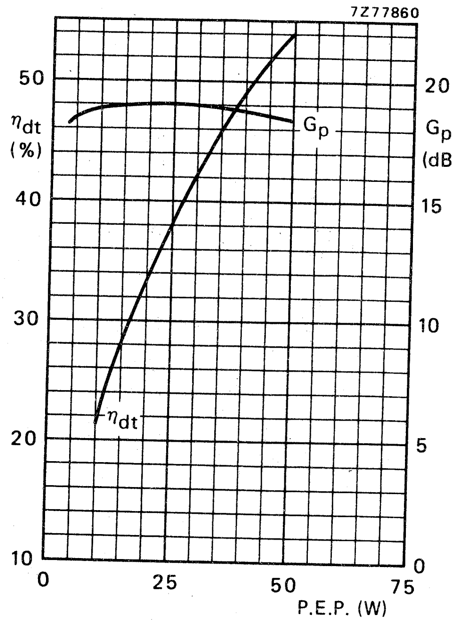


Fig. 18 Double-tone efficiency and power gain as a function of output power.

Conditions for Fig. 17:

V_{CE} = 28 V; $I_{C(ZS)}$ = 50 mA; f_1 = 28,000 MHz; f_2 = 28,001 MHz; typical values.

Conditions for Fig. 18:

V_{CE} = 28 V; $I_{C(ZS)}$ = 50 mA; f_1 = 28,000 MHz; f_2 = 28,001 MHz; T_h = 70 °C; typical values.

* See note on page 9.

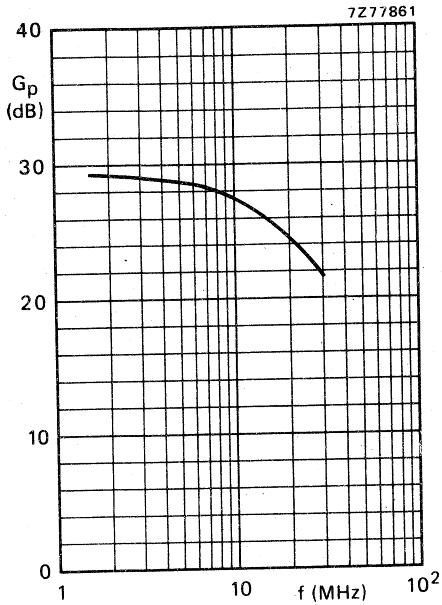


Fig. 19 Power gain as a function of frequency.

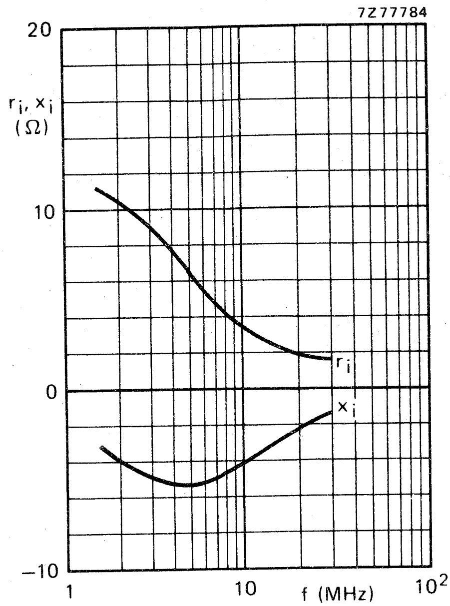


Fig. 20 Input impedance (series components) as a function of frequency.

Figs 19 and 20 are typical curves and hold for an unneutralized amplifier in s.s.b. class-AB operation.

Conditions:

V_{CE} = 28 V; $I_{C(ZS)}$ = 50 mA; P_L = 42,5 W; T_h = 25 ^oC; Z_L = 7,4 Ω.

Ruggedness in s.s.b. operation

The BLX39 is capable of withstanding a load mismatch (VSWR = 50) under the following conditions:
Class-AB operation; f_1 = 28,000 MHz; f_2 = 28,001 MHz; V_{CE} = 28 V; T_h = 70 ^oC and P_{Lnom} = 45 W P.E.P.

R.F. performance in s.s.b. class-A operation (linear power amplifier)

V_{CE} = 26 V; T_h = 70 °C; f_1 = 28,000 MHz; f_2 = 28,001 MHz

output power W	G_p dB	I_C A	d_3 dB *	d_5 dB *
15 (P.E.P)	typ. 20	1,55	typ. −42	< −40

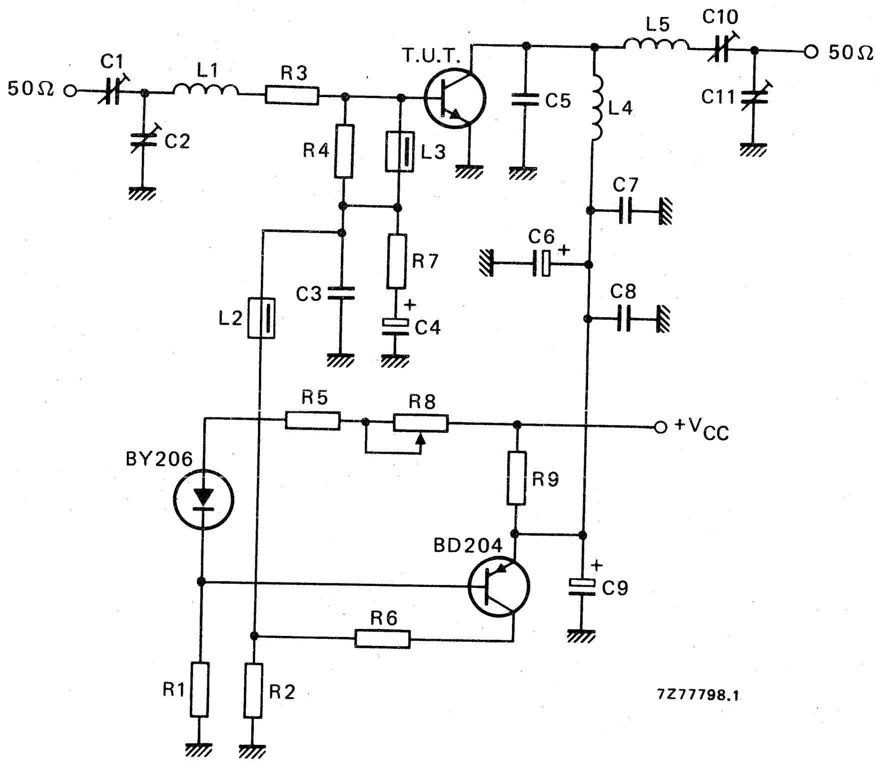


Fig. 21 Test circuit; s.s.b. class-A.

* Stated intermodulation distortion figures are referred to the according level of either of the equal amplified tones. Relative to the according peak envelope powers these figures should be increased by 6 dB.

List of components in Fig. 21:

C1 = C2 = 10 to 780 pF film dielectric trimmer
C3 = 22 nF ceramic capacitor (63 V)
C4 = 47 μF/10 V electrolytic capacitor
C5 = 56 pF ceramic capacitor (500 V)
C6 = 47 μF/35 V electrolytic capacitor
C7 = C8 = 220 nF polyester capacitor
C9 = 10 μF/35 V electrolytic capacitor
C10 = 10 to 210 pF film dielectric trimmer
C11 = 15 to 575 pF film dielectric trimmer

L1 = 3 turns closely wound enamelled Cu wire (1,6 mm); int. dia. 9,0 mm; leads 2 x 5 mm
L2 = L3 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L4 = 11 turns closely wound enamelled Cu wire (1,6 mm); int. dia. 11,0 mm
L5 = 14 turns closely wound enamelled Cu wire (1,6 mm); int. dia. 11,0 mm

R1 = 600 Ω; parallel connection of 2 x 1,2 kΩ carbon resistors (± 5% ; 0,5 W each)
R2 = 15 Ω carbon resistor (± 5% ; 0,25 W)
R3 = 1,2 Ω; parallel connection of 4 x 4,7 Ω carbon resistors (± 5% ; 0,125 W each)
R4 = 33 Ω carbon resistor (± 5% ; 0,25 W)
R5 = 18 Ω carbon resistor (± 5% ; 0,25 W)
R6 = 120 Ω wirewound resistor (± 5% ; 5,5 W)
R7 = 1 Ω carbon resistor (± 5% ; 0,125 W)
R8 = 47 Ω wirewound potentiometer (3 W)
R9 = 1,57 Ω; parallel connection of 3 x 4,7 Ω wirewound resistors (± 5% ; 5,5 W each)

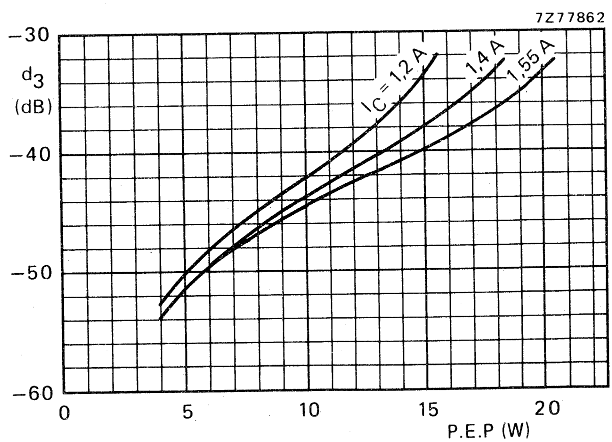


Fig. 22 Intermodulation distortion as a function of output power. Typical values; V_{CE} = 26 V; T_h = 70 °C; f_1 = 28,000 MHz; f_2 = 28,001 MHz.

U.H.F./V.H.F. TRANSMITTING TRANSISTOR

N-P-N transistor intended for use in class-B and C operated mobile, industrial and military transmitters with a supply voltage of 13,8 V. It has a TO-39 metal envelope with the collector connected to the case.

QUICK REFERENCE DATA

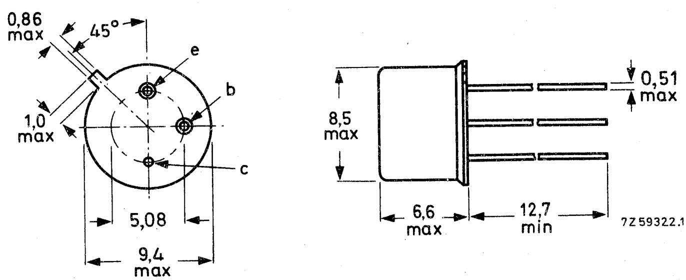
R.F. performance up to T_{case} = 25 °C in an unneutralized common-emitter class-B circuit

mode of operation	V_{CE} V	f MHz	P_S W	P_L W	I_C A	G_p dB	η %	$\overline{z_i}$ Ω	$\overline{Y_L}$ mA/V
c.w.	13,8	470	typ. 0,4	2,0	typ. 0,22	typ. 7	typ. 66	5 + j11	17 − j19
c.w.	12,5	470	< 0,5	2,0	< 0,25	> 6	> 65	–	–
c.w.	12,5	175	typ. 0,12	2,0	typ. 0,21	typ. 12	typ. 75	–	–

MECHANICAL DATA

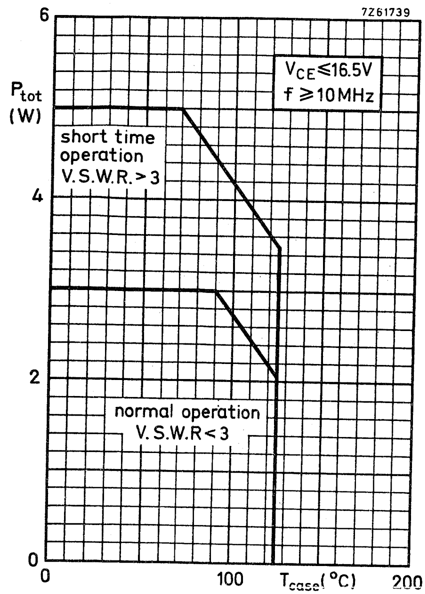
Dimensions in mm

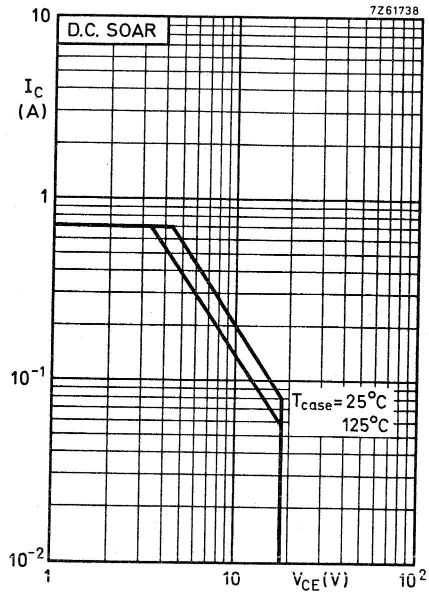
Fig. 1 TO-39; collector connected to case.



Maximum lead diameter is guaranteed only for 12,7 mm.

Accessories: 56245 (distance disc).


7Z61739
P_{tot} (W)
$V_{CE} \leqslant 16.5V$
$f \geqslant 10 MHz$
short time operation V.S.W.R. > 3
normal operation V.S.W.R < 3
T_{case} (°C)
0
2
4
6
0
100
200


7Z61738
D.C. SOAR
I_C (A)
T_{case} = 25°C
125°C
V_{CE} (V)
10
1
10^{-1}
10^{-2}
1
10
10^{2}

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC134)

Voltages

Collector-base voltage (open emitter) peak value	V_{CBOM}	max.	36	V
Collector-emitter voltage (V_{BE} = 0) peak value	V_{CESM}	max.	36	V
Collector-emitter voltage (open base)	V_{CEO}	max.	18	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4	V

Currents

Collector current (average)	$I_{C(AV)}$	max.	0.7	A
Collector current (peak value) f > 1 MHz	I_{CM}	max.	2.0	A

Power dissipation

Total power dissipation up to T_{case} = 90 ^oC f > 10 MHz	P_{tot}	max.	3.0	W

Temperatures

Storage temperature	T_{stg}	−65 to +150		^oC
Operating junction temperature	T_j	max	165	^oC

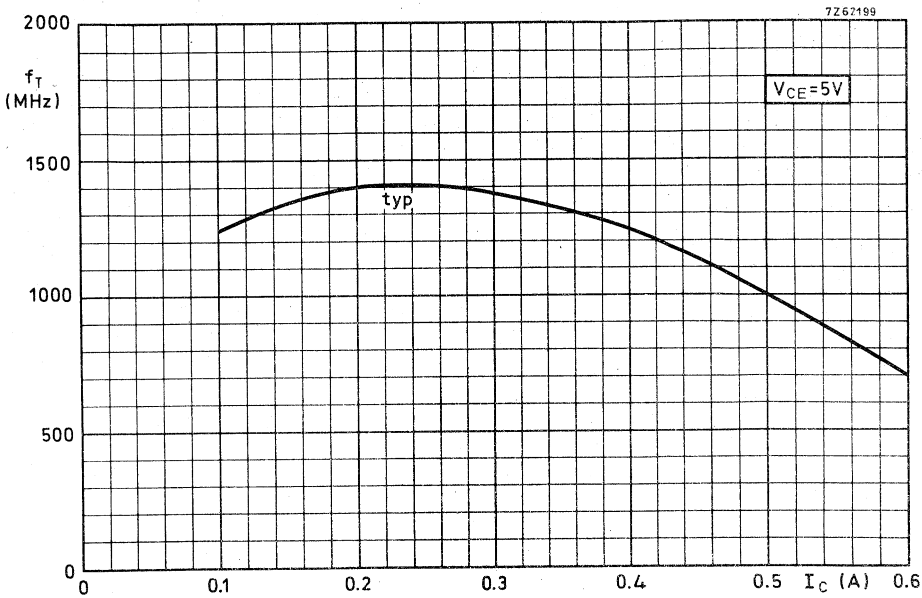
THERMAL RESISTANCE

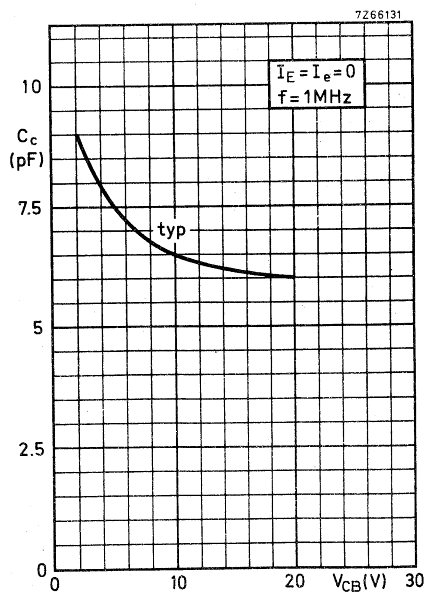
From junction to case	$R_{th\ j-c}$	=	25	$^oC/W$
From mounting base to heatsink with a boron nitride washer for electrical insulation	$R_{th\ mb-h}$	=	2.5	$^oC/W$

CHARACTERISTICS

$T_j = 25\ ^oC$ unless otherwise specified

Breakdown voltages				
Collector-base voltage open emitter, $I_C = 10$ mA	$V_{(BR)CBO}$	>	36	V
Collector-emitter voltage $V_{BE} = 0$; $I_C = 10$ mA	$V_{(BR)CES}$	>	36	V
Collector-emitter voltage open base, $I_C = 25$ mA	$V_{(BR)CEO}$	>	18	V
Emitter-base voltage open collector, $I_E = 1.0$ mA	$V_{(BR)EBO}$	>	4	V
Collector-emitter saturation voltage				
$I_C = 100$ mA; $I_B = 20$ mA	V_{CEsat}	typ.	0.1	V
D.C. current gain				
$I_C = 100$ mA; $V_{CE} = 5$ V	h_{FE}	> typ.	10 40	
Transition frequency				
$I_C = 200$ mA; $V_{CE} = 5$ V; f = 500 MHz	f_T	typ.	1400	MHz
Collector capacitance at f = 1 MHz				
$I_E = I_e = 0$; $V_{CB} = 10$ V	C_c	typ. <	6.5 9.0	pF pF
Feedback capacitance at f = 1 MHz				
$I_C = 20$ mA; $V_{CE} = 10$ V	C_{re}	typ.	4.8	pF


7Z62199
2000
f_T
(MHz)
1500
1000
500
0
V_{CE}=5V
typ
0
0.1
0.2
0.3
0.4
0.5
I_C (A)
0.6


7Z66131
10
C_c
(pF)
7.5
5
2.5
0
I_E=I_e=0
f=1MHz
typ
0
10
20
V_{CB}(V)
30

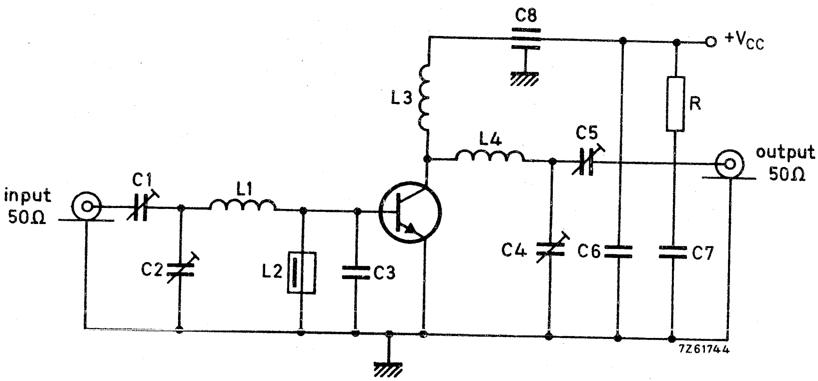
APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralized common-emitter class B circuit)

T_{case} up to 25 °C

f (MHz)	V_{CC} (V)	P_S (W)	P_L (W)	I_C (A)	G_p (dB)	η (%)	$\overline{z_i}$ (Ω)	$\overline{Y_L}$ (mA/V)
470	13.8	typ. 0.4	2.0	typ. 0.22	typ. 7	typ. 66	5 + j11	17 − j19
470	12.5	< 0.5	2.0	< 0.25	< 6	> 65	–	–
175	12.5	typ. 0.12	2.0	typ. 0.21	typ. 12	typ. 75	–	–

Test circuit:



To obtain optimum gain performance the emitter lead length should not exceed 1.6 mm

C1 = C2 = C4 = C5 = 1.8 to 18 pF film dielectric trimmer
C3 = 22 pF disc ceramic capacitor
C6 = 10 nF ceramic capacitor
C7 = 0.1 µF polyester capacitor
C8 = 4 nF feed-through capacitor

L1 = 1 turn Cu wire (1 mm); int. diam. 5 mm, max. lead length 1 mm
L2 = 0.22 µH choke
L3 = 1 turn Cu wire (1 mm); int. diam. 7 mm; lead length 2 mm
L4 = 1 turn Cu wire (1 mm); int. diam. 5 mm; lead length 2 mm

R = 10 Ω carbon

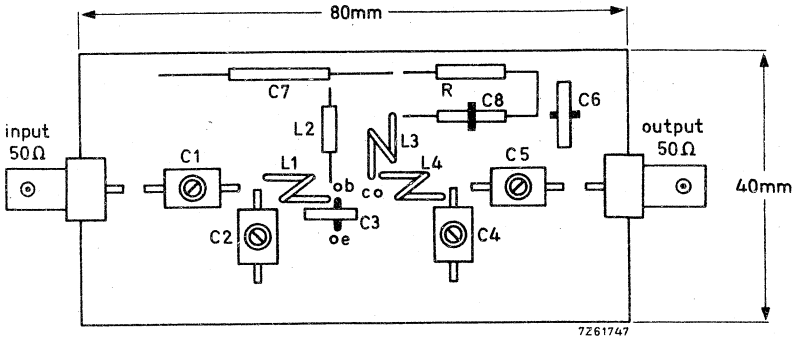
At P_L = 2.0 W and V_{CC} = 12.5 V the output power at case temperatures between 25 °C and 90 °C relative to that at 25 °C is diminished by typ. 5 mW/°C.

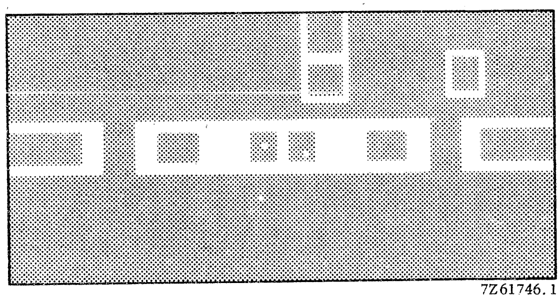
The transistor is designed to withstand full load mismatch in the test circuit under the following conditions: V_{CC} = 16.5 V; f = 470 MHz; T_{case} = 70 °C
V.S.W.R. = 50 : 1 through all phases; $P_S = P_{Snom}$ + 20 %
where $P_{Snom} = P_S$ for 1.4 W transistor output into 50 Ω load at V_{CC} = 13.8 V.

Component lay-out for 470 MHz see page 7.

APPLICATION INFORMATION (continued)

Component lay-out and printed circuit board for 470 MHz test circuit.



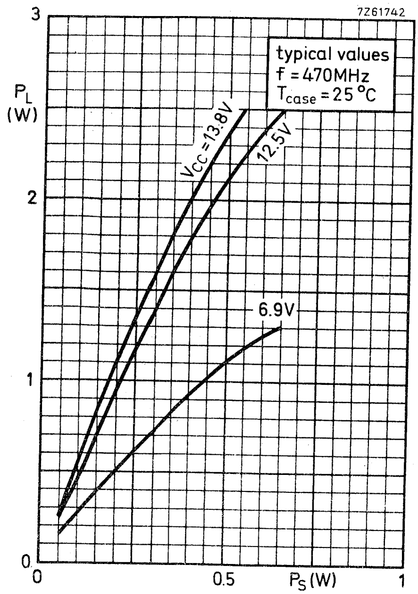


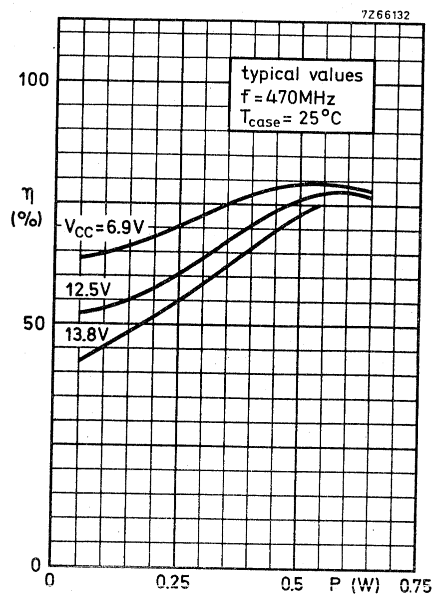
7Z61746.1

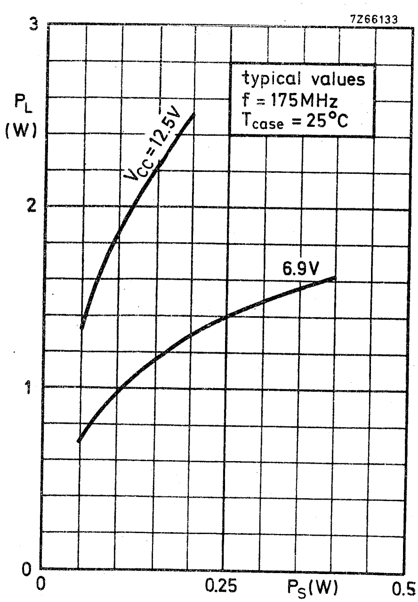
Shaded area copper

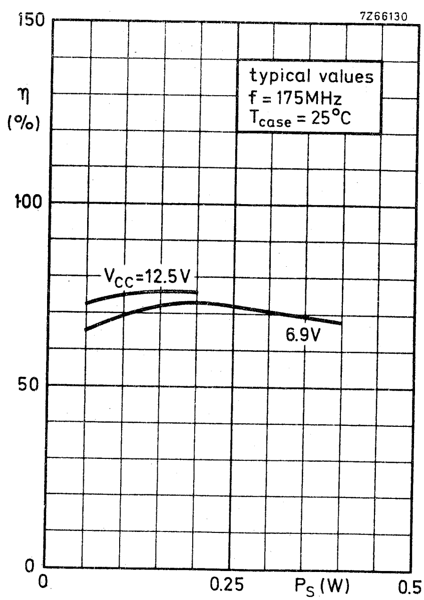
Back area not metalized

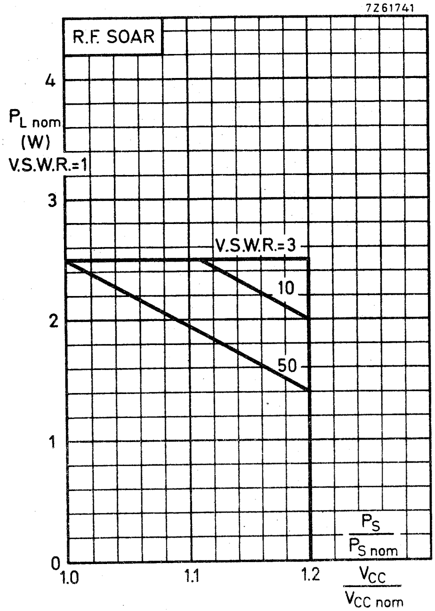
Material of printed circuit board: 1.5 mm epoxy fibre-glass


7Z61742
typical values
f = 470MHz
T_{case} = 25 °C
P_L (W)
V_{CC}=13.8V
12.5V
6.9V
P_S (W)
0
0.5
1
2
3


7Z66132
typical values
f = 470MHz
T_{case} = 25 °C
η (%)
V_{CC}=6.9V
12.5V
13.8V
P (W)
0
0.25
0.5
0.75
50
100


7Z66133
typical values
f = 175MHz
T_{case} = 25°C
P_L (W)
V_{CC}=12.5V
6.9V
P_S (W)
0
0.25
0.5
1
2
3


7Z66130
typical values
f = 175MHz
T_{case} = 25°C
η (%)
V_{CC}=12.5V
6.9V
P_S (W)
0
0.25
0.5
50
100
150



Conditions for R.F. SOAR

f = 470 MHz

T_{case} = 70 °C

V_{CCnom} = 13.8 V

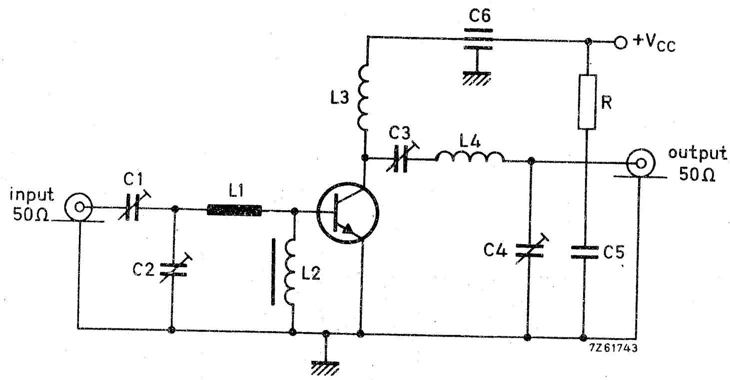
$P_{Snom} = P_S$ at $V_{CC} = V_{CCnom}$ and V.S.W.R. = 1

see also page 6

The transistor was developed for use with unstabilized supply voltage V_{CC}. The above graph is based on its measured performance in the circuit given on page 6. Supply voltage was varied from V_{CCnom} to 1.2 V_{CCnom}, and V.S.W.R. from 1 to 50. It shows the maximum allowable output power under nominal conditions in order not to exceed the maximum allowable power dissipation under conditions of supply overvoltage ($V_{CC} > V_{CCnom}$) and load mismatch (V.S.W.R. > 1). It is assumed that the drive power increases linearly with the supply voltage; i.e. $P_S/P_{Snom} = V_{CC}/V_{CCnom}$.

APPLICATION INFORMATION (continued)

Test circuit for 175 MHz



To obtain optimum gain performance the emitter lead length should not exceed 1.6 mm

C1 = C4 = 60 pF concentric air trimmer
C2 = C3 = 30 pF concentric air trimmer
C5 = 0.25 μF polyester capacitor
C6 = 4 nF feed-through capacitor

L1 = 25 mm straight Cu wire (1.2 mm); height above print 3 mm
L2 = 3 turns Cu wire (0.5 mm) on ferrite FX1115, d = 2 mm, D = 4 mm, l = 5 mm, material 3B (code number 3113 991 16740)
L3 = 5 turns closely wound Cu wire (1.2 mm); int. diam. 10 mm; lead length 5 mm
L4 = 3 turns closely wound Cu wire (1.2 mm); int. diam. 10 mm; lead length 5 mm

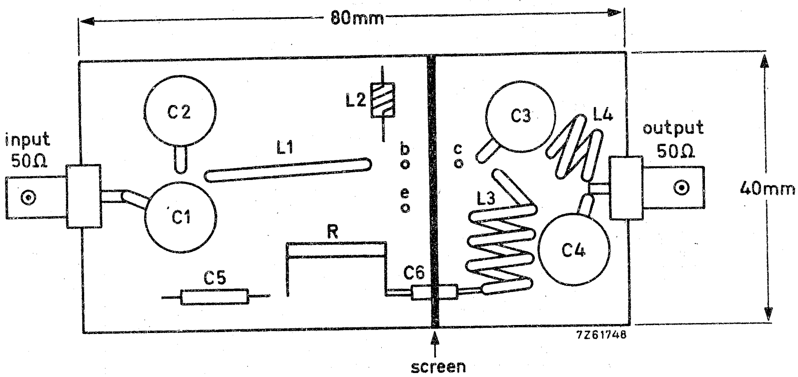
R = 10 Ω carbon

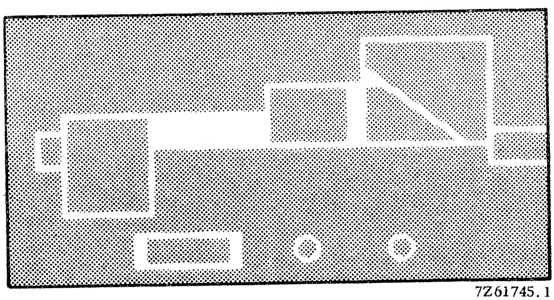
Graphs (P_L versus P_S and η versus P_S) for 175 MHz on page 8.

Component lay-out for 175 MHz on page 11.

APPLICATION INFORMATION (continued)

Component lay-out and printed cicuit board for 175 MHz test circuit:



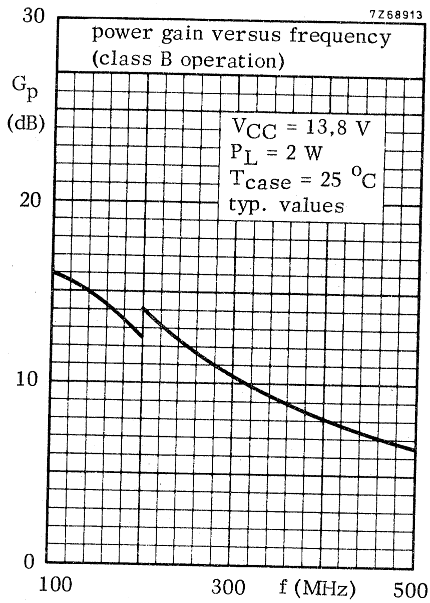

7Z61745.1

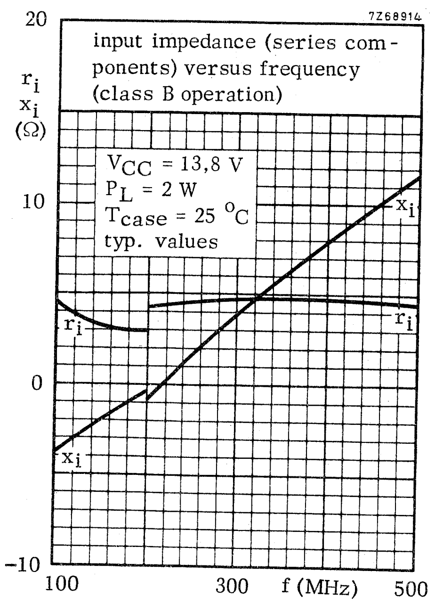
Shaded area copper

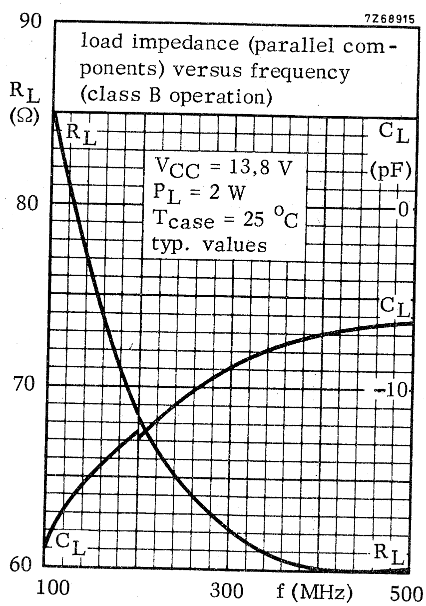
Back area not metallized

Material of printed circuit board: 1.5 mm epoxy fibre-glass

OPERATING NOTE Below 200 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation. This resistor must be effective for both d.c. and r.f.







U.H.F./V.H.F. TRANSMITTING TRANSISTOR

N-P-N transistor intended for use in class-B and C operated mobile, industrial and military transmitters with a supply voltage of 13,8 V. It has a capstan envelope with a moulded cap. All leads are isolated from the stud.

QUICK REFERENCE DATA

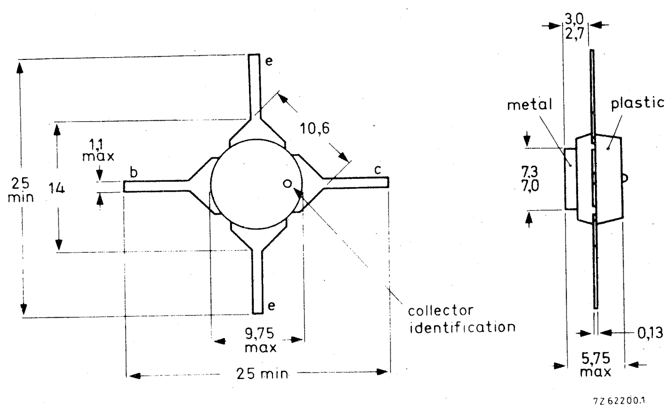
R.F. performance up to T_{mb} = 25 °C in an unneutralized common-emitter class-B circuit

mode of operation	V_{CE} V	f MHz	P_S W	P_L W	I_C A	G_p dB	η %	$\overline{z_i}$ Ω	$\overline{Y_L}$ mA/V
c.w.	13,8	470	typ. 0,15	1,5	typ. 0,17	typ. 10	typ. 65	–	–
c.w.	13,8	470	typ. 0,28	2,5	typ. 0,24	typ. 9,5	typ. 75	2,6 + j4,8	23 – j23
c.w.	12,5	470	< 0,35	2,5	< 0,31	> 8,5	> 65	–	–
c.w.	12,5	175	typ. 0,03	3,0	typ. 0,29	typ. 20	typ. 84	–	–

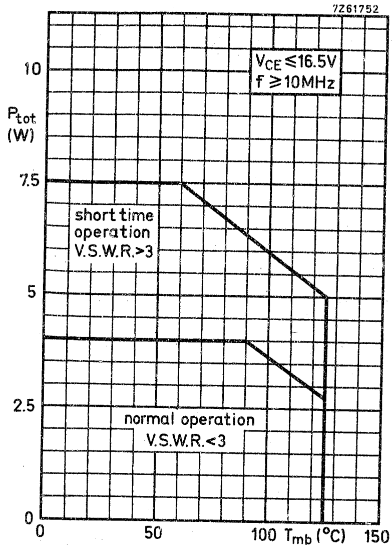
MECHANICAL DATA

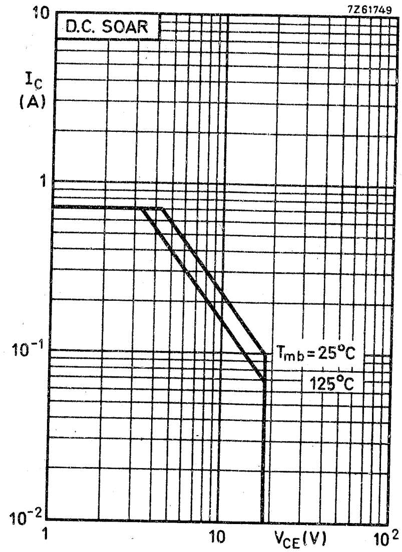
Dimensions in mm

Fig. 1 SOT-48 (without stud).



CAUTION This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.


7Z61752
V_{CE} ≤ 16.5V
f ≥ 10MHz
P_{tot} (W)
10
7.5
5
2.5
0
short time operation V.S.W.R.>3
normal operation V.S.W.R.<3
0
50
100
T_{mb} (°C)
150


7Z61749
D.C. SOAR
I_C (A)
10
1
10^{-1}
10^{-2}
T_{mb} = 25°C
125°C
1
10
V_{CE} (V)
10^2

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC 134)

Voltages				
Collector-base voltage (open emitter) peak value	V_{CBOM}	max.	36	V
Collector-emitter voltage (R_{BE} = 0) peak value	V_{CESM}	max.	36	V
Collector-emitter voltage (open base)	V_{CEO}	max.	18	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4	V
Currents				
Collector current (average)	$I_{C(AV)}$	max.	0.7	A
Collector current (peak value) f > 1 MHz	I_{CM}	max.	2.0	A
Power dissipation				
Total power dissipation up to T_{mb} = 90 °C f > 10 MHz	P_{tot}	max.	4.0	W
Temperatures				
Storage temperature	T_{stg}		−65 to +150	°C
Junction temperature	T_j	max.	150	°C

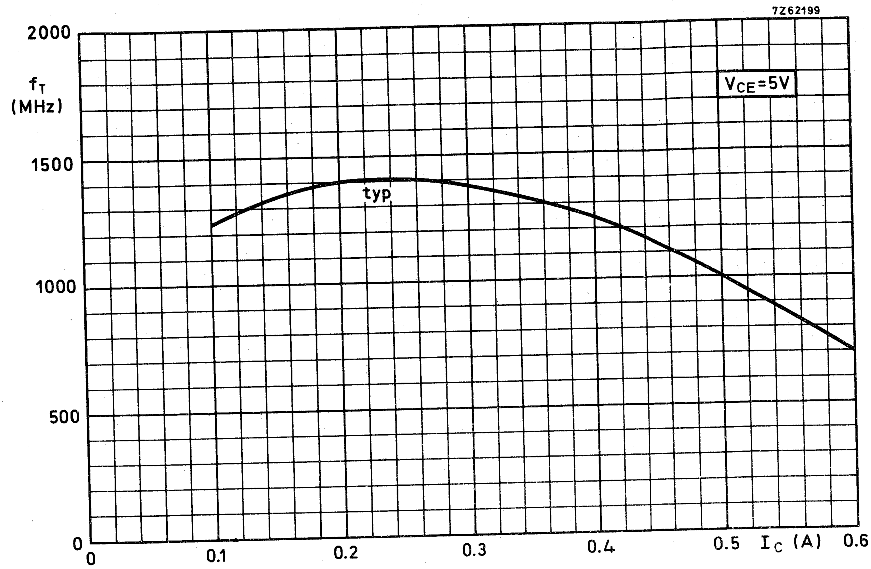
THERMAL RESISTANCE

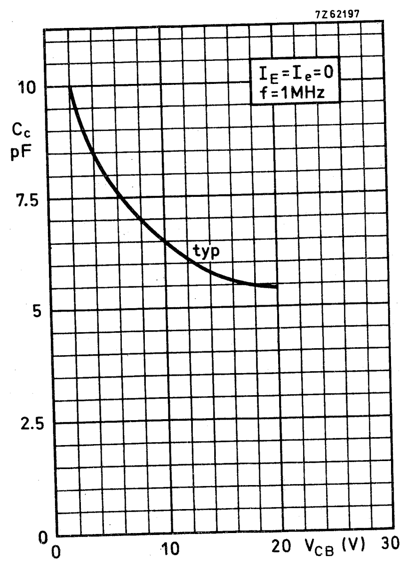
From junction to mounting base	$R_{th\ j\text{-}mb}$	=	12	°C/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Breakdown voltages				
Collector-base voltage open emitter, I_C = 10 mA	$V_{(BR)CBO}$	>	36	V
Collector-emitter voltage V_{BE} = 0; I_C = 10 mA	$V_{(BR)CES}$	>	36	V
Collector-emitter voltage open base, I_C = 25 mA	$V_{(BR)CEO}$	>	18	V
Emitter-base voltage open collector, I_E = 1,0 mA	$V_{(BR)EBO}$	>	4	V
Collector-emitter saturation voltage				
I_C = 100 mA; I_B = 20 mA	V_{CEsat}	typ.	0,1	V
D.C. current gain				
I_C = 100 mA; V_{CE} = 5 V	h_{FE}	>	10	
		typ.	40	
Transition frequency				
I_C = 200 mA; V_{CE} = 5 V; f = 500 MHz	f_T	typ.	1400	MHz
Collector capacitance at f = 1 MHz				
I_E = I_e = 0; V_{CB} = 10 V	C_c	typ.	6,5	pF
		<	9,0	pF
Feedback capacitance at f = 1 MHz				
I_C = 20 mA; V_{CE} = 10 V	C_{re}	typ.	4,8	pF
Collector-stud capacitance	C_{cs}	typ.	2	pF


7Z62199
2000
f_T
(MHz)
1500
1000
500
0
0
0.1
0.2
0.3
0.4
0.5
I_C (A)
0.6
V_{CE}=5V
typ


7Z62197
10
C_c
pF
7.5
5
2.5
0
0
10
20
V_{CB} (V)
30
I_E=I_e=0
f=1MHz
typ

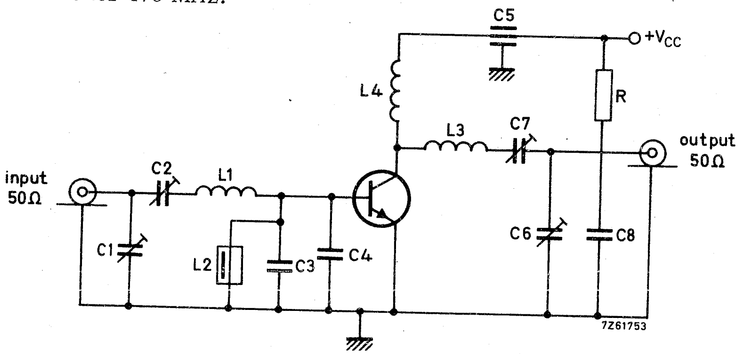
APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralized common-emitter class B circuit)

T_{mb} = 25 °C

f (MHz)	V_{CC} (V)	P_S (W)	P_L (W)	I_C (A)	G_p (dB)	η (%)	$\bar{z}_i$ (Ω)	$\bar{Y}_L$ (mA/V)
470	13.8	typ. 0.15	1.5	typ. 0.17	typ. 10	typ. 65	-	-
470	13.8	typ. 0.28	2.5	typ. 0.24	typ. 9.5	typ. 75	2.6 + j4.8	23 − j23
470	12.5	< 0.35	2.5	< 0.31	> 8.5	> 65	-	-
175	12.5	typ. 0.03	3.0	typ. 0.29	typ. 20	typ. 84	-	-

Test circuit for 470 MHz:



C1 = C2 = C6 = C7 = 1.8 to 18 pF film dielectric trimmer
C3 = C4 = 18 pF disc ceramic capacitor
C5 = 4 nF feed-through capacitor
C8 = 0.1 μF polyester capacitor

L1 = 1 turn Cu wire (1.2 mm); int. diam. 6 mm; max. lead length 1 mm.
L2 = 1 μH choke
L3 = 30 mm straight Cu wire (2 mm); height above print 2 mm.
L4 = 2 turns closely wound Cu wire (0.5 mm); int. diam. 3 mm; max. lead length 8 mm.

R = 10 Ω carbon

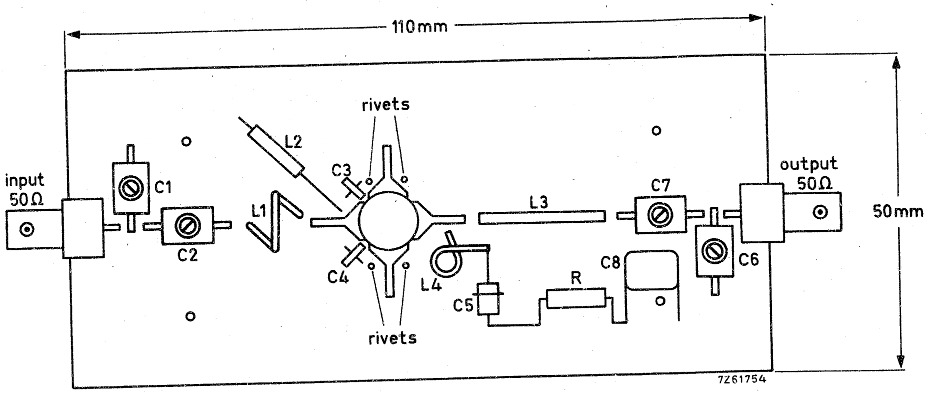
At P_L = 2.5 W and V_{CC} = 12.5 V the output power at mounting-base temperatures between 25 °C and 90 °C relative to that at 25 °C is diminished by typ. 5 mW/°C

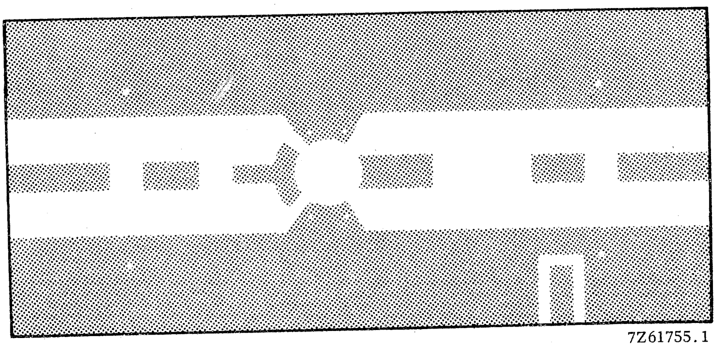
The transistor is designed to withstand full load mismatch in the test circuit under the following conditions: V_{CC} = 16.5 V; f = 470 MHz; T_{mb} = 70 °C; V.S.W.R. = 50 : 1 through all phases; P_S = P_{Snom} + 20 %
where P_{Snom} = P_S for 2.5 W transistor output into 50 Ω load at V_{CC} = 13.8 V

Component lay-out for 470 MHz see page 7

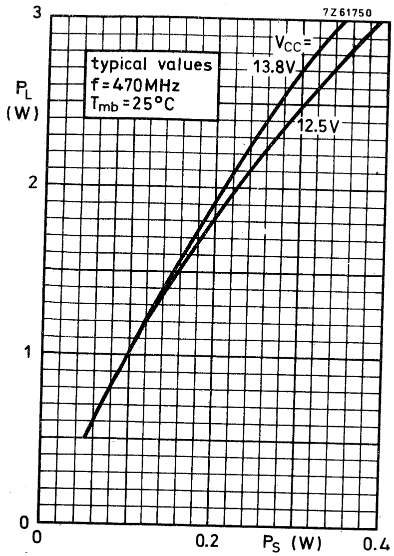
APPLICATION INFORMATION (continued)

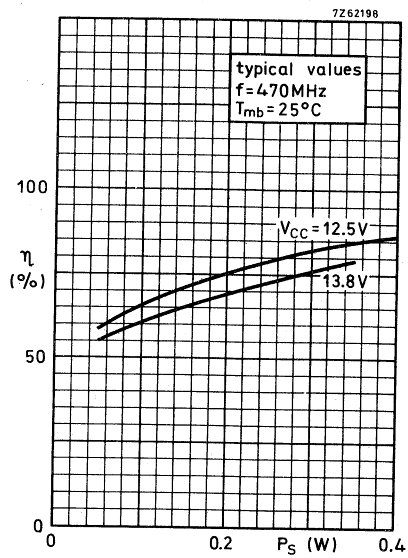
Component lay-out and printed circuit board for 470 MHz test circuit.

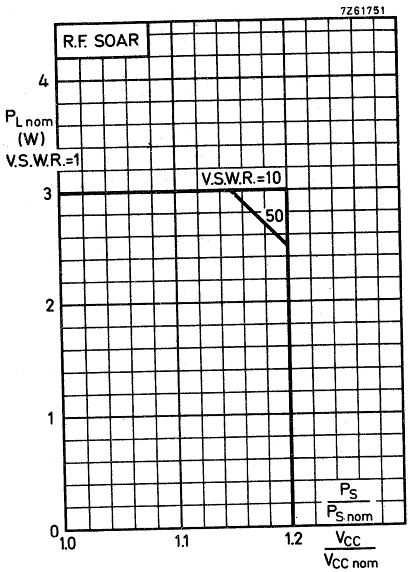




Shaded area copper
Back area completely copper clad
Material of printed circuit board: 1.5 mm epoxy fibre glass


7Z61750
typical values
f = 470 MHz
T_{mb} = 25 °C
P_L (W)
V_{CC} = 13.8 V
12.5 V
3
2
1
0
0
0.2
P_S (W)
0.4


7Z62198
typical values
f = 470 MHz
T_{mb} = 25 °C
η (%)
V_{CC} = 12.5 V
13.8 V
100
50
0
0
0.2
P_S (W)
0.4



Conditions for R.F. SOAR

f = 470 MHz

T_{mb} = 70 °C

V_{CCnom} = 13.8 V

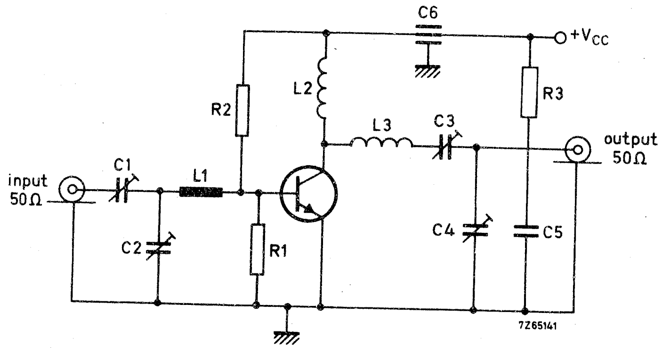
$P_{Snom} = P_S$ at $V_{CC} = V_{CCnom}$ and V.S.W.R. = 1

see also page 6

The transistor was developed for use with unstabilized supply voltage V_{CC}.
The above graph is based on its measured performance in the circuit given on page 6. Supply voltage was varied from V_{CCnom} to 1.2 V_{CCnom}, and V.S.W.R. from 1 to 50. It shows the max. allowable output power under nominal conditions in order not to exceed the max. allowable power dissipation under conditions of supply overvoltage ($V_{CC} > V_{CCnom}$) and load mismatch (V.S.W.R. > 1).
It is assumed that the drive power increases linearly with the supply voltage; i.e. $P_S/P_{Snom} = V_{CC}/V_{CCnom}$.

APPLICATION INFORMATION (continued)

Test circuit for 175 MHz:



C1 = C3 = C4 = 30 pF concentric air trimmer
C2 = 60 pF concentric air trimmer
C5 = 0.25 μF polyester capacitor
C6 = 4 nF feed-through capacitor

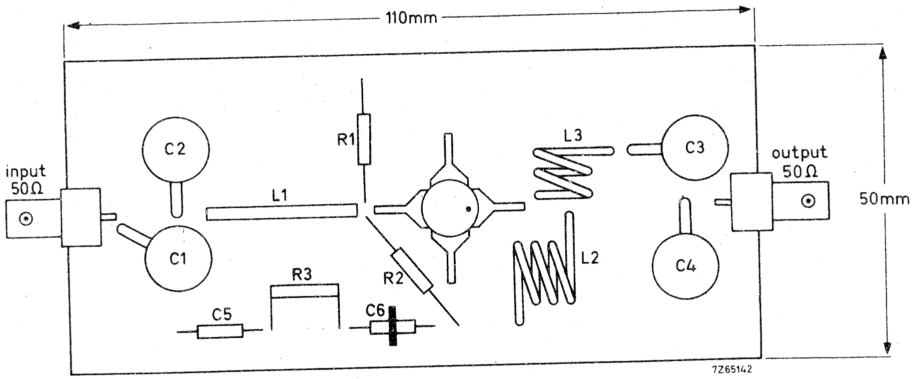
L1 = 25 mm straight Cu wire (1.2 mm); height above print max. 3 mm
L2 = 3 turns closely wound Cu wire (1.2 mm); int. diam. 10 mm; max. lead lenght 5 mm
L3 = 2 turns closely wound Cu wire (1.7 mm); int. diam. 12 mm; max. lead lenght 5 mm

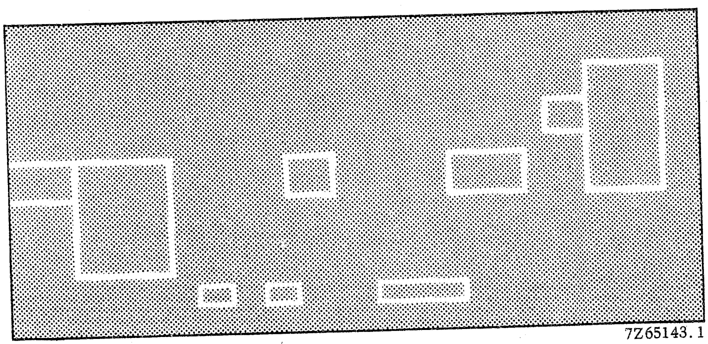
R1 = 50 Ω carbon
R2 = 1.2 kΩ carbon
R3 = 5 Ω carbon

Component lay-out for 175 MHz see page 11.

APPLICATION INFORMATION (continued)

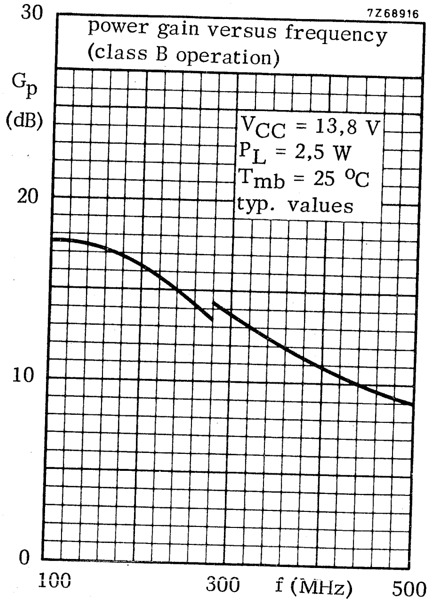
Component lay-out and printed circuit board for 175 MHz test circuit.

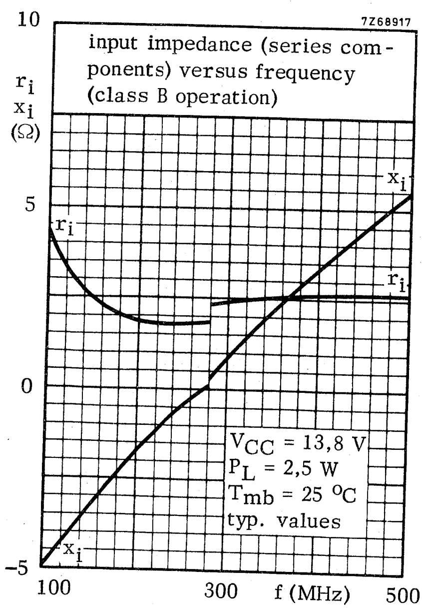


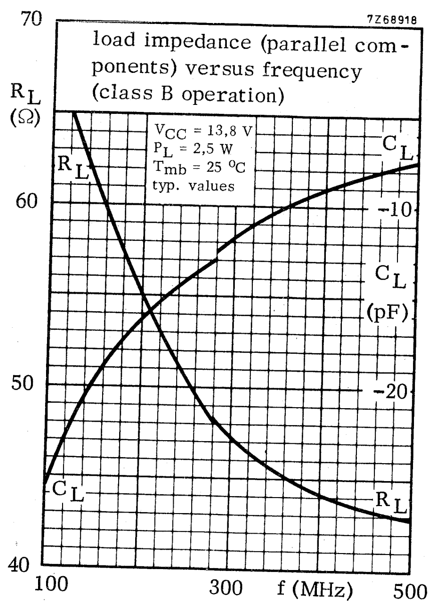


Shaded area copper
Back area not metallized
Material of printed circuit board: 1.5 mm epoxy fibre glass

OPERATING NOTE Below 280 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation. This resistor must be effective for both d.c. and r.f.







U.H.F./V.H.F. POWER TRANSISTOR

N-P-N silicon transistor for use in class-B and C operated mobile, industrial and military transmitters with a supply voltage of 13,8 V.

It has a capstan envelope with a moulded cap. All leads are isolated from the stud.

QUICK REFERENCE DATA

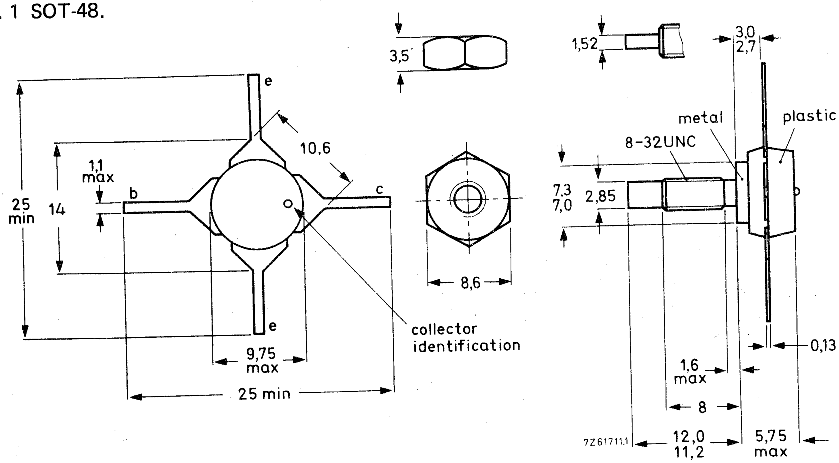
R.F. performance up to T_h = 25 °C in an unneutralized common-emitter class-B circuit

mode of operation	V_{CE} V	f MHz	P_S W	P_L W	I_C A	G_p dB	η %	$\overline{z_i}$ Ω	$\overline{Y_L}$ mA/V
c.w.	13,8	470	typ. 0,15	1,5	typ. 0,17	typ. 10	typ. 65	–	–
c.w.	13,8	470	typ. 0,35	3,0	typ. 0,28	typ. 9,3	typ. 79	2,9 + j5,1	27 – j21
c.w.	12,5	470	< 0,35	2,5	< 0,31	> 8,5	> 65	–	–
c.w.	12,5	175	typ. 0,03	3,0	typ. 0,29	typ. 20	typ. 84	–	–

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-48.

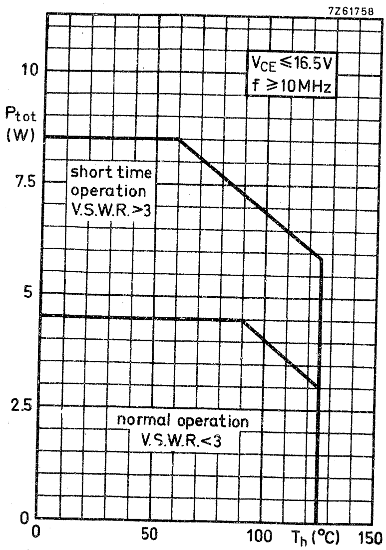


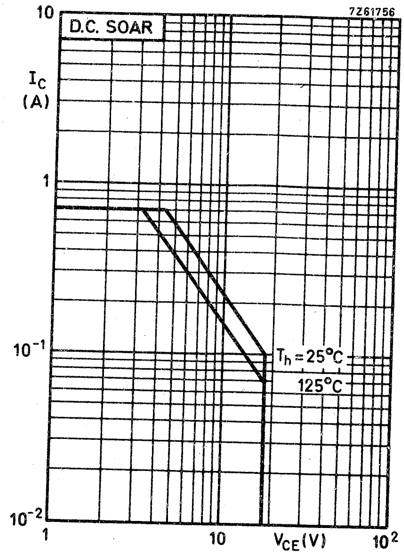
Torque on nut: min. 0,75 Nm
(7,5 kg cm)
max. 0,85 Nm
(8,5 kg cm)

Diameter of clearance hole in heatsink: max. 4,2 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

When locking is required an adhesive is preferred instead of a lock washer.

CAUTION This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.


7Z61758
P_{tot} (W)
$V_{CE} \leq 16.5V$
$f \geq 10MHz$
short time operation V.S.W.R.>3
normal operation V.S.W.R.<3
T_h (°C)
0
2.5
5
7.5
10
0
50
100
150


7Z61756
D.C. SOAR
I_C (A)
$T_h = 25°C$
125°C
V_{CE} (V)
10^{-2}
10^{-1}
1
10
1
10
10^2

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC134)

Voltages

Collector-base voltage (open emitter) peak value	V_{CBOM}	max.	36	V
Collector-emitter voltage ($R_{BE} = 0$) peak value	V_{CESM}	max.	36	V
Collector-emitter voltage (open base)	V_{CEO}	max.	18	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4	V

Currents

Collector current (average)	$I_{C(AV)}$	max.	0.7	A
Collector current (peak value) f > 1 MHz	I_{CM}	max.	2.0	A

Power dissipation

Total power dissipation up to $T_h = 90$ °C f > 10 MHz	P_{tot}	max.	4.5	W

Temperature

Storage temperature	T_{stg}		−65 to +150	°C
Junction temperature	T_j	max.	150	°C

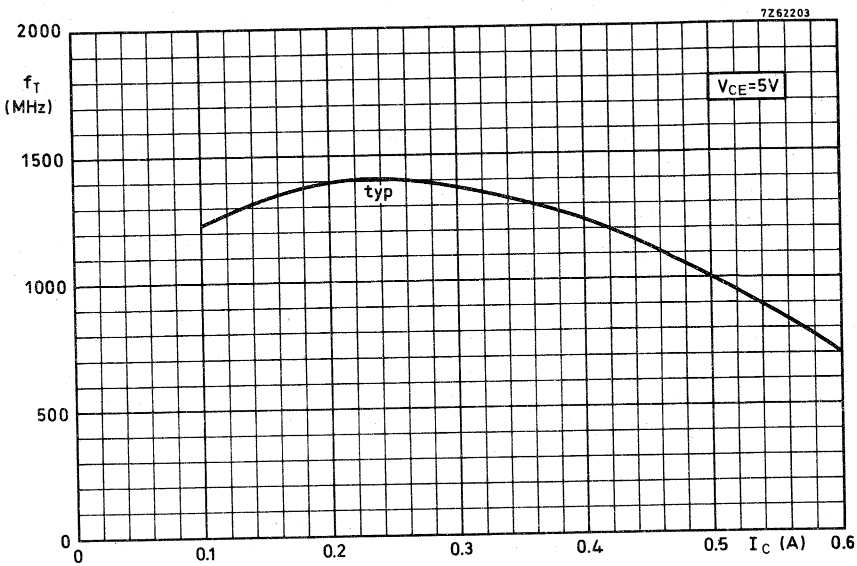
THERMAL RESISTANCE

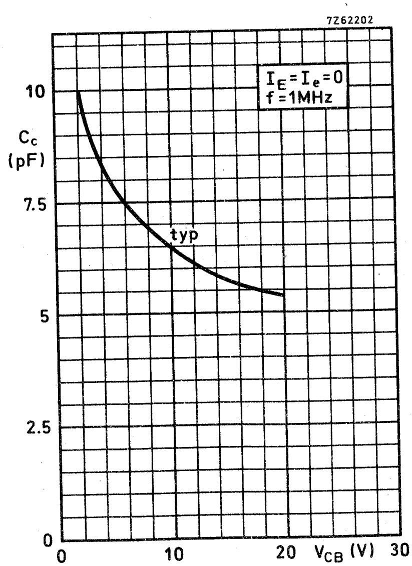
From junction to mounting base	$R_{th\ j\text{-}mb}$ =	12	°C/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$ =	0.6	°C/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Breakdown voltages				
Collector-base voltage open emitter, I_C = 10 mA	$V_{(BR)CBO}$	>	36	V
Collector-emitter voltage V_{BE} = 0; I_C = 10 mA	$V_{(BR)CES}$	>	36	V
Collector-emitter voltage open base, I_C = 25 mA	$V_{(BR)CEO}$	>	18	V
Emitter-base voltage open collector, I_E = 1,0 mA	$V_{(BR)EBO}$	>	4	V
Collector-emitter saturation voltage				
I_C = 100 mA; I_B = 20 mA	V_{CEsat}	typ.	0,1	V
D.C. current gain				
I_C = 100 mA; V_{CE} = 5 V	h_{FE}	>	10	
		typ.	40	
Transition frequency				
I_C = 0,2 A; V_{CE} = 5 V; f = 500 MHz	f_T	typ.	1400	MHz
Collector capacitance at f = 1 MHz				
I_E = I_e = 0; V_{CB} = 10 V	C_c	typ.	6,5	pF
		<	9,0	pF
Feedback capacitance at f = 1 MHz				
I_C = 20 mA; V_{CE} = 10 V	C_{re}	typ.	4,8	pF
Collector-stud capacitance	C_{cs}	typ.	2	pF


7Z62203
2000
f_T
(MHz)
1500
1000
500
0
0
0.1
0.2
0.3
0.4
0.5
I_C (A)
0.6
V_{CE}=5V
typ


7Z62202
10
C_c
(pF)
7.5
5
2.5
0
0
10
20
V_{CB} (V)
30
$I_E = I_e = 0$
f = 1MHz
typ

APPLICATION INFORMATION

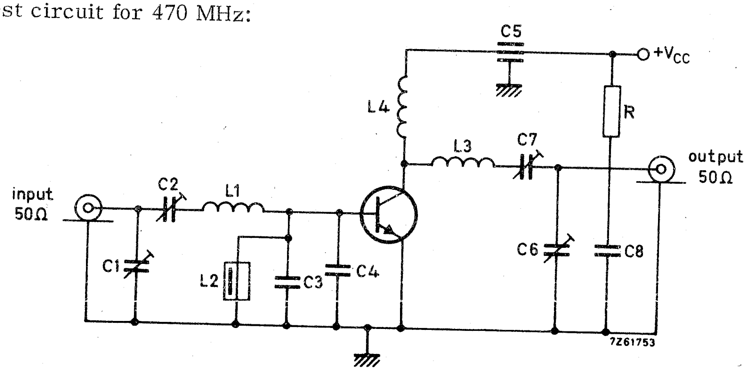
T_j = 25 °C unless otherwise specified

R.F. performance in c.w. operation (unneutralized common-emitter class B circuit)

T_h up to 25 °C

f (MHz)	V_{CC} (V)	P_S (W)	P_L (W)	I_C (A)	G_p (dB)	η (%)	$\bar{z}_i$ (Ω)	$\bar{Y}_L$ (mA/V)
470	13.8	typ. 0.15	1.5	typ. 0.17	typ. 10	typ. 65	-	-
470	13.8	typ. 0.35	3.0	typ. 0.28	typ. 9.3	typ. 79	2.9 + j5.1	27 − j21
470	12.5	< 0.35	2.5	< 0.31	> 8.5	> 65	-	-
175	12.5	typ. 0.03	3.0	typ. 0.29	typ. 20	typ. 84	-	-

Test circuit for 470 MHz:



C1 = C2 = C6 = C7 = 1.8 to 18 pF film dielectric trimmer
C3 = C4 = 18 pF disc ceramic capacitor
C5 = 4 nF feed-through capacitor
C8 = 0.1 µF polyester capacitor

L1 = 1 turn Cu wire (1.2 mm); int. diam. 6 mm; max. lead length 1 mm
L2 = 1 µH choke
L3 = 30 mm straight Cu wire (2 mm); height above print 2 mm
L4 = 2 turns closely wound Cu wire (0.5 mm); int. diam. 3 mm; max. lead length 8 mm

R = 10 Ω carbon

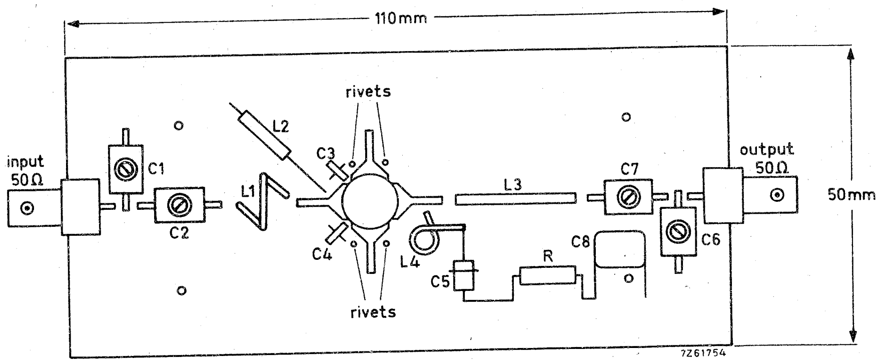
At P_L = 2.5 W and V_{CC} = 12.5 V, the output power at heatsink temperatures between 25 °C and 90 °C relative to that at 25 °C is diminished by typ. 5 mW/°C.

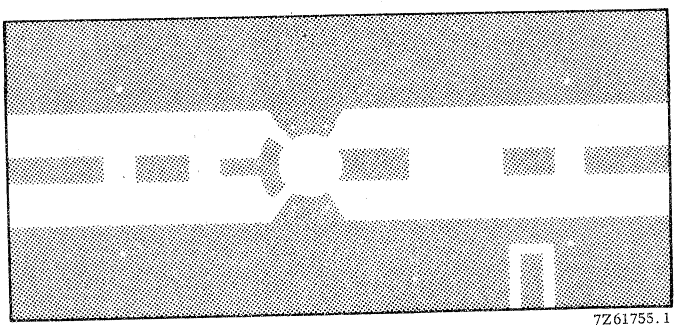
The transistor is designed to withstand full load mismatch in the test circuit under the following conditions: V_{CC} = 16.5 V; f = 470 MHz; T_h = 70 °C; V.S.W.R. = 50 : 1 through all phases; $P_S = P_{Snom}$ + 20 %
where $P_{Snom} = P_S$ for 2.5 W transistor output into 50 Ω load and V_{CC} = 13.8 V

Component lay-out for 470 MHz see page 7

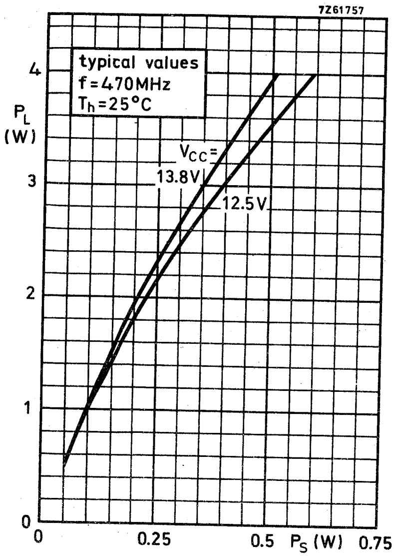
APPLICATION INFORMATION (continued)

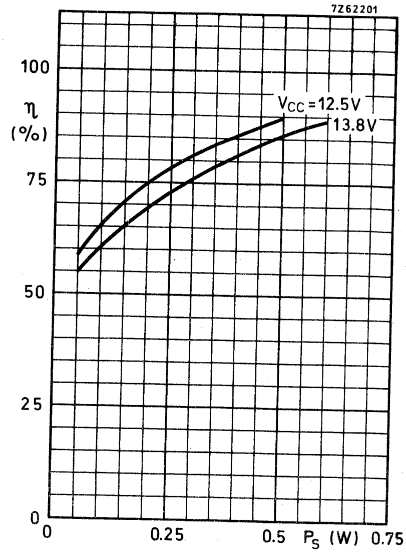
Component lay-out and printed circuit board for 470 MHz test circuit.

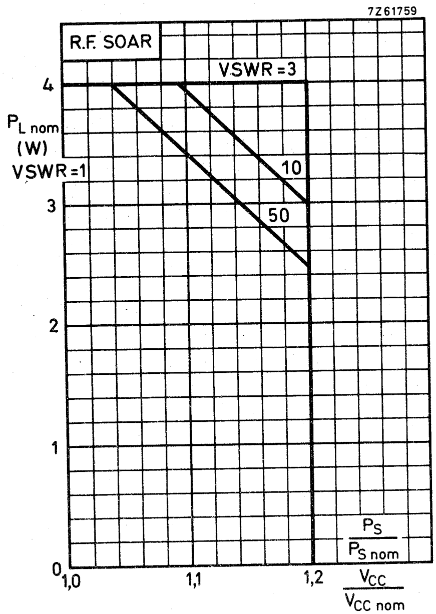




Shaded area copper
Back area completely copper clad.
Material of printed circuit board: 1,5 mm epoxy fibre glass.


7Z61757
typical values
f = 470 MHz
Th = 25 °C
PL
(W)
4
3
2
1
0
VCC =
13.8V
12.5V
0
0.25
0.5
PS (W)
0.75


7Z62201
η
(%)
100
75
50
25
0
VCC = 12.5V
13.8V
0
0.25
0.5
PS (W)
0.75



Conditions for R.F. SOAR

f = 470 MHz

T_h = 70 °C

V_{CCnom} = 13, 8 V

$P_{Snom} = P_S$ at $V_{CC} = V_{CCnom}$ and VSWR = 1

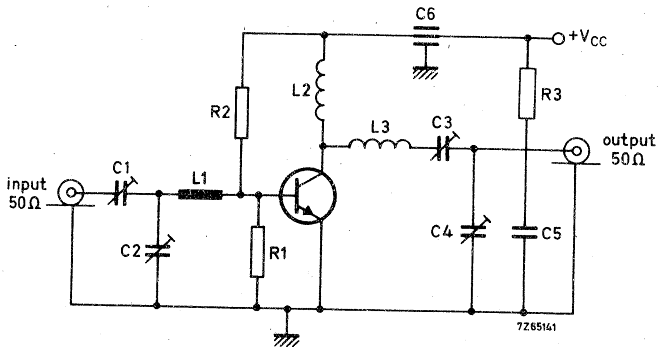
$R_{th\ mb-h}$ = 0, 6 °C/W

see also page 6

The transistor was developed for use with unstabilized supply voltage V_{CC}.
The above graph is based on its measured performance in the circuit given on page 6.
Supply voltage was varied from V_{CCnom} to 1,2 V_{CCnom}, and VSWR from 1 to 50.
It shows the max. permissible output power under nominal conditions in order not to exceed the max. permissible power dissipation under conditions of supply over-voltage ($V_{CC} > V_{CCnom}$) and load mismatch (VSWR > 1).
It is assumed that the drive power increases linearly with the supply voltage; i.e. $P_S/P_{Snom} = V_{CC}/V_{CCnom}$.

APPLICATION INFORMATION (continued)

Test circuit for 175 MHz:



C1 = C3 = C4= 30 pF concentric air trimmer
C2 = 60 pF concentric air trimmer
C5 = 0.25 μF ceramic capacitor
C6 = 4 nF polyester capacitor

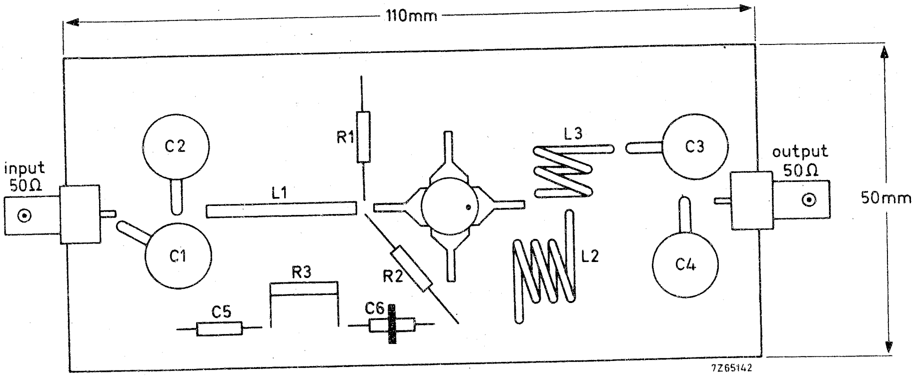
L1 = 25 mm straight Cu wire (1.2 mm); height above print max. 3 mm
L2 = 3 turns closely wound Cu wire (1.2 mm); int. diam. 10 mm; lead length 5 mm
L3 = 2 turns closely wound Cu wire (1.7 mm); int. diam. 12 mm; lead length 5 mm

R1 = 50 Ω carbon
R2 = 1.2 kΩ carbon
R3 = 5 Ω carbon

Component lay-out for 175 MHz see page 11.

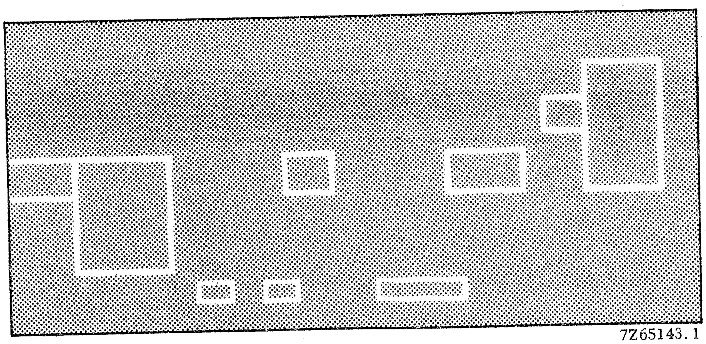
APPLICATION INFORMATION (continued)

Component lay-out and printed circuit board for 175MHz test circuit.



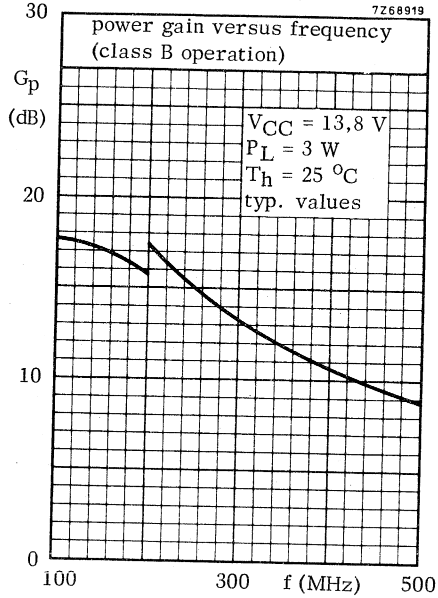
7Z65142

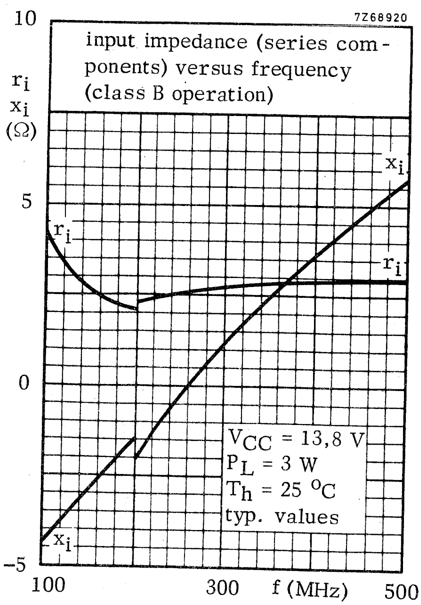
Shaded area copper
Back area not metalized
Material of pcb : 1.5 mm epoxy fibre glass

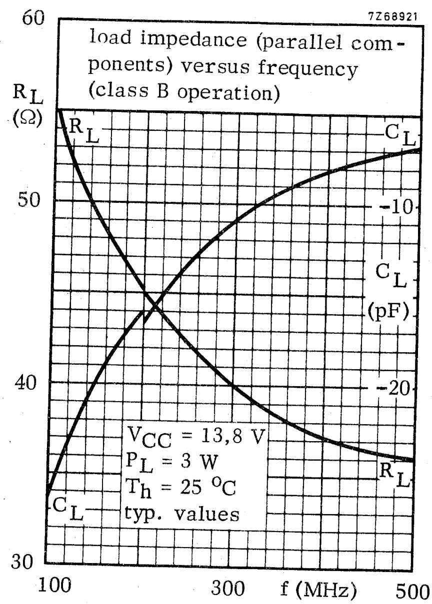


7Z65143.1

OPERATING NOTE Below 200 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation. This resistor must be effective for both d.c. and r.f.







U.H.F./V.H.F. POWER TRANSISTOR

N-P-N silicon transistor for use in class-B and C operated mobile, industrial and military transmitters with a supply voltage of 13,8 V.

It has a capstan envelope with a moulded cap. All leads are isolated from the stud.

QUICK REFERENCE DATA

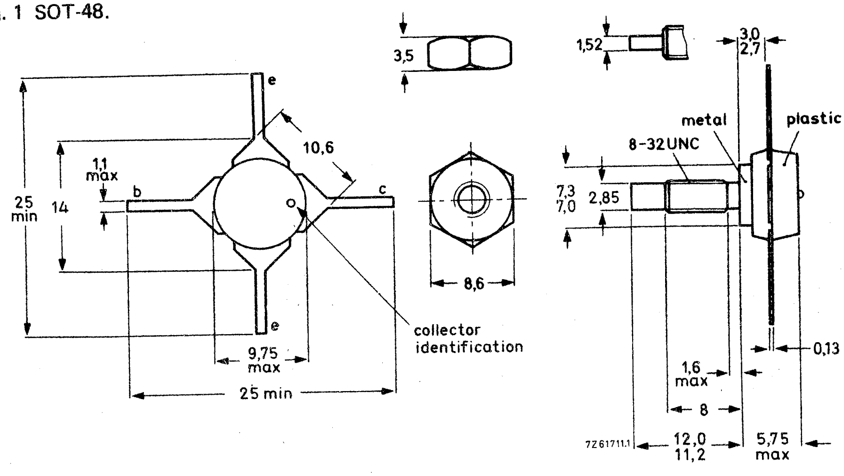
R.F. performance up to T_h = 25 °C in an unneutralized common-emitter class-B circuit.

mode of operation	V_{CE} V	f MHz	P_S W	P_L W	I_C A	G_p dB	η %	$\overline{z_i}$ Ω	$\overline{Y_L}$ mA/V
c.w.	13,8	470	< 2,0	7,0	< 0,78	> 5,4	> 65	–	–
c.w.	13,8	470	typ. 2,0	7,8	typ. 0,81	typ. 5,9	typ. 70	2,4 + j6,7	60 – j20
c.w.	12,5	470	< 2,2	7,0	< 0,86	> 5,0	> 65	–	–
c.w.	12,5	175	typ. 0,4	7,2	typ. 0,87	typ.12,6	typ. 66	–	–

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-48.



Torque on nut: min. 0,75 Nm (7,5 kg cm)
max. 0,85 Nm (8,5 kg cm)

Diameter of clearance hole in heatsink: max. 4,2 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

When locking is required an adhesive is preferred instead of a lock washer.

CAUTION This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC 134)

Voltages

Collector-base voltage (open emitter) peak value	V_{CBOM}	max.	36	V
Collector-emitter voltage (R_{BE} = 0) peak value	V_{CESM}	max.	36	V
Collector-emitter voltage (open base)	V_{CEO}	max.	18	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4	V

Currents

Collector current (average)	$I_{C(AV)}$	max.	1.0	A
Collector current (peak value) f > 1 MHz	I_{CM}	max.	4.0	A

Power dissipation

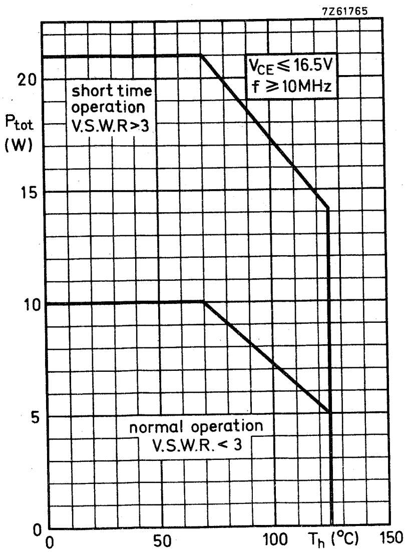
Total power dissipation up to T_h = 70 °C f > 10 MHz	P_{tot}	max.	10	W

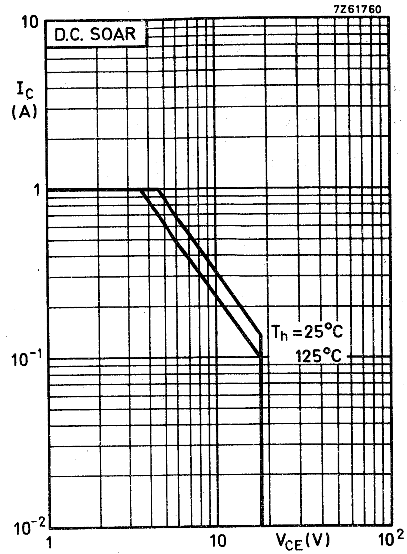
Temperatures

Storage temperature	T_{stg}	-65 to +150		°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

From junction to mounting base	$R_{th\ j\text{-}mb}$	=	7.0	°C/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0.6	°C/W

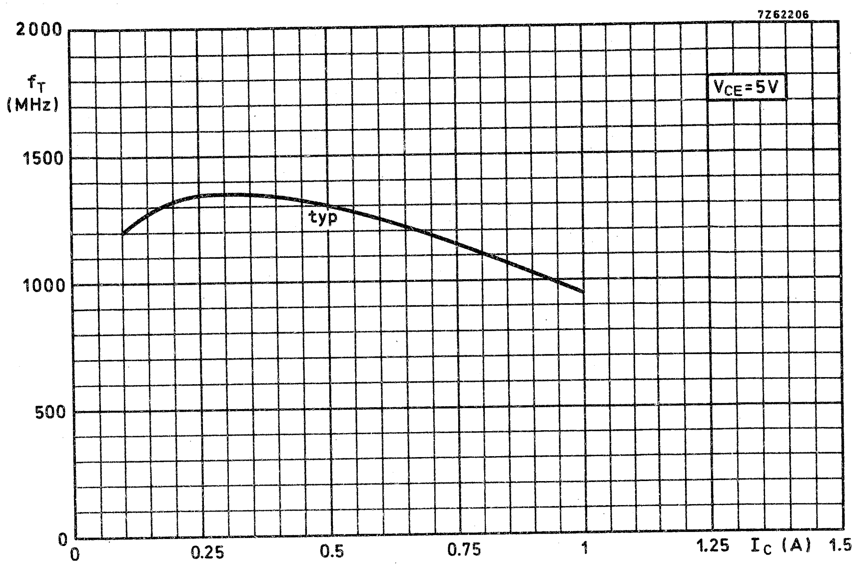

7Z61765
20
15
10
5
0
P_{tot}
(W)
short time
operation
V.S.W.R>3
$V_{CE} \leqslant 16.5V$
$f \geqslant 10MHz$
normal operation
V.S.W.R. < 3
0
50
100
T_h (°C)
150

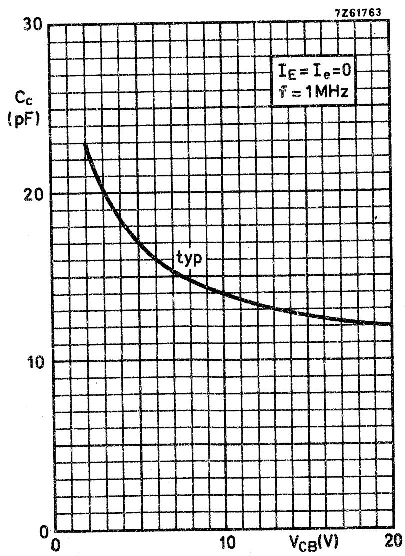

7Z61760
D.C. SOAR
10
1
10^{-1}
10^{-2}
I_C
(A)
$T_h = 25°C$
125°C
1
10
V_{CE} (V)
10^2

CHARACTERISTICS

$T_j = 25\ ^oC$ unless otherwise specified

Breakdown voltages				
Collector-base voltage open emitter, $I_C = 10$ mA	$V_{(BR)CBO}$	>	36	V
Collector-emitter voltage $V_{BE} = 0$; $I_C = 10$ mA	$V_{(BR)CES}$	>	36	V
Collector-emitter voltage open base, $I_C = 25$ mA	$V_{(BR)CEO}$	>	18	V
Emitter-base voltage open collector, $I_E = 1.0$ mA	$V_{(BR)EBO}$	>	4	V
Collector-emitter saturation voltage				
$I_C = 500$ mA; $I_B = 100$ mA	V_{CEsat}	typ.	0.2	V
D.C. current gain				
$I_C = 500$ mA; $V_{CE} = 5$ V	h_{FE}	>	10	
		typ.	40	
Transition frequency				
$I_C = 500$ mA; $V_{CE} = 5$ V; f = 500 MHz	f_T	typ.	1300	MHz
Collector capacitance at f = 1 MHz				
$I_E = I_e = 0$; $V_{CB} = 10$ V	C_c	typ.	14	pF
		<	20	pF
Emitter capacitance at f = 1 MHz				
$I_C = I_c = 0$; $V_{EB} = 0$	C_e	typ.	65	pF
Feedback capacitance at f = 1 MHz				
$I_C = 50$ mA; $V_{CE} = 10$ V	C_{re}	typ.	10.5	pF
Collector-stud capacitance	C_{cs}	typ.	2	pF


7Z62206
2000
f_T
(MHz)
1500
1000
500
0
V_{CE}=5V
typ
0
0.25
0.5
0.75
1
1.25
I_C (A)
1.5


7Z61763
30
C_c
(pF)
20
10
0
I_E = I_e=0
f = 1MHz
typ
0
10
V_{CB}(V)
20

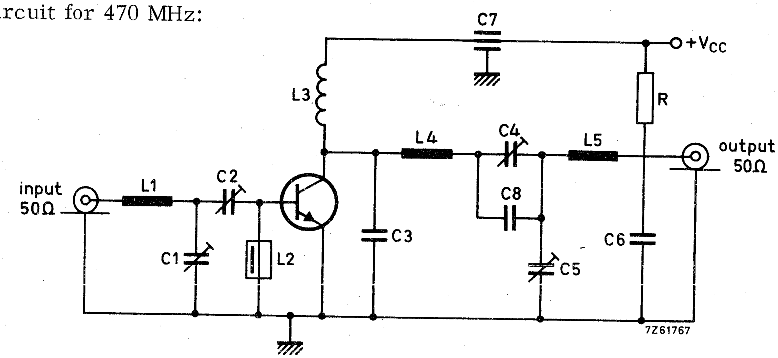
APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralized common-emitter class B circuit)

T_h up to 25 °C

f (MHz)	V_{CC} (V)	P_S (W)	P_L (W)	I_C (A)	G_p (dB)	η (%)	$\bar{z}_i$ (Ω)	$\bar{Y}_L$ (mA/V)
470	13.8	< 2.0	7.0	< 0.78	> 5.4	> 65	–	–
470	13.8	typ. 2.0	7.8	typ. 0.81	typ. 5.9	typ. 70	2.4+j6.7	60 – j20
470	12.5	< 2.2	7.0	< 0.86	> 5.0	> 65	–	–
175	12.5	typ. 0.4	7.2	typ. 0.87	typ. 12.6	typ. 66	–	–

Test circuit for 470 MHz:



C1 = C2 = C4 = C5 = 1.8 to 18 pF film dielectric trimmer
C3 = 6.8 pF ceramic capacitor
C6 = 0.1 µF polyester capacitor
C7 = 4 nF feed-through capacitor
C8 = 10 pF ceramic capacitor

L1 = L4 = L5 = 20 mm straight Cu wire (1.2 mm); height above print 12 mm
L2 = 0.47 µH choke
L3 = 1 turn Cu wire (1.7 mm); int. diam. 10 mm; max. lead length 5 mm

R = 10 Ω carbon

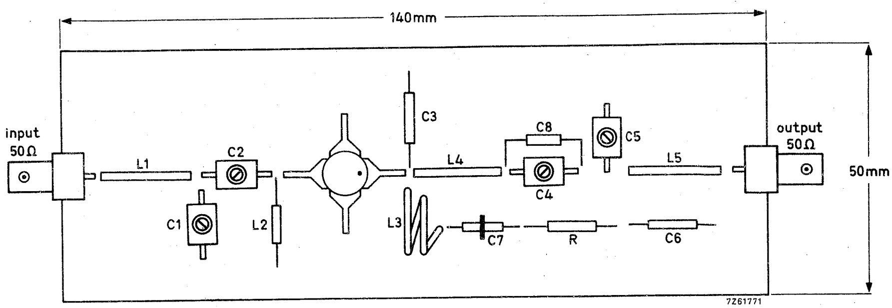
At P_L = 7.0 W and V_{CC} = 12.5 V the output power at heatsink temperatures between 25 °C and 90 °C relative to that at 25 °C is diminished by typ. 10 mW/°C

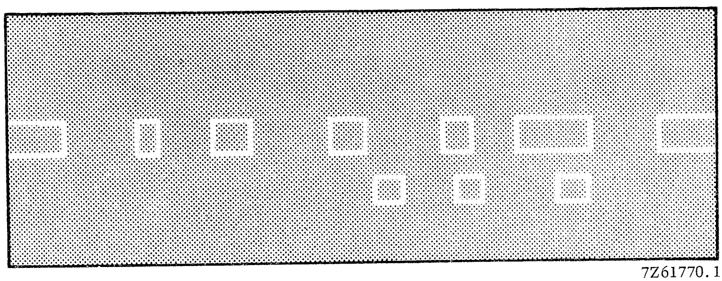
The transistor is designed to withstand full load mismatch in the test circuit under the following conditions: V_{CC} = 16.5 V; f = 470 MHz; T_h = 70 °C;
V.S.W.R. = 50 : 1 through all phases; $P_S = P_{Snom}$ + 20 %
where $P_{Snom} = P_S$ for 7.0 W transistor output into 50 Ω load at V_{CC} = 13.8 V

Component lay-out for 470 MHz see page 7

APPLICATION INFORMATION (continued)

Component lay-out and printed circuit board for 470 MHz test circuit.



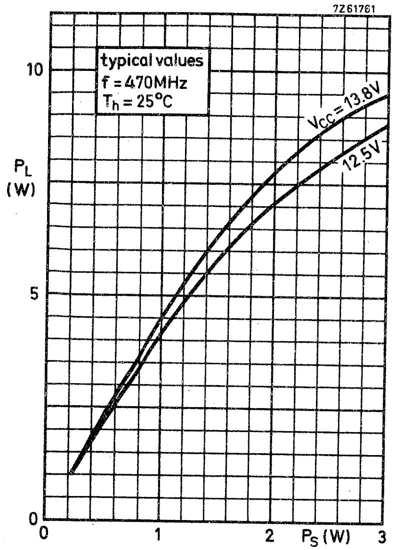


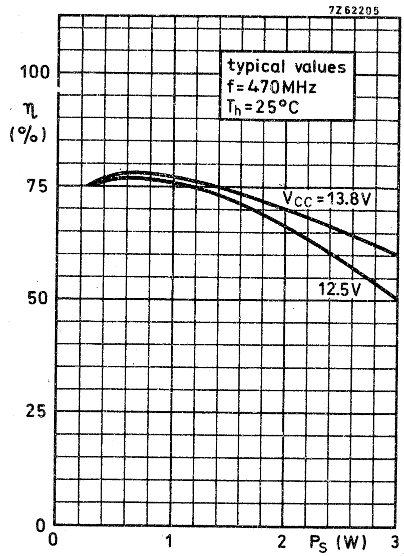
7Z61770.1

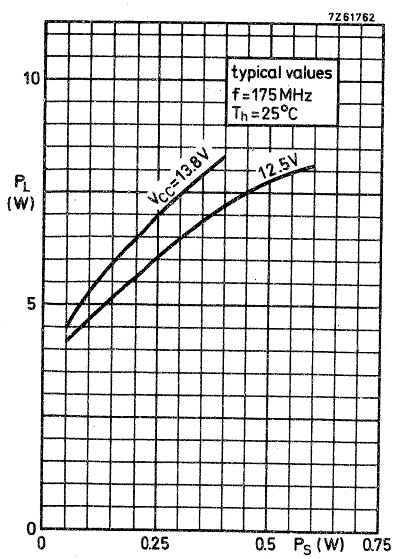
Shaded area copper

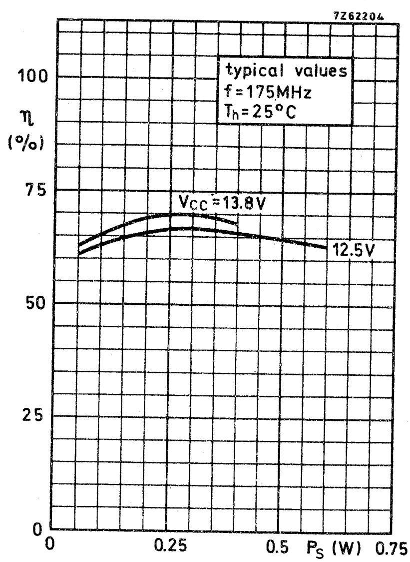
Back area completely copper clad

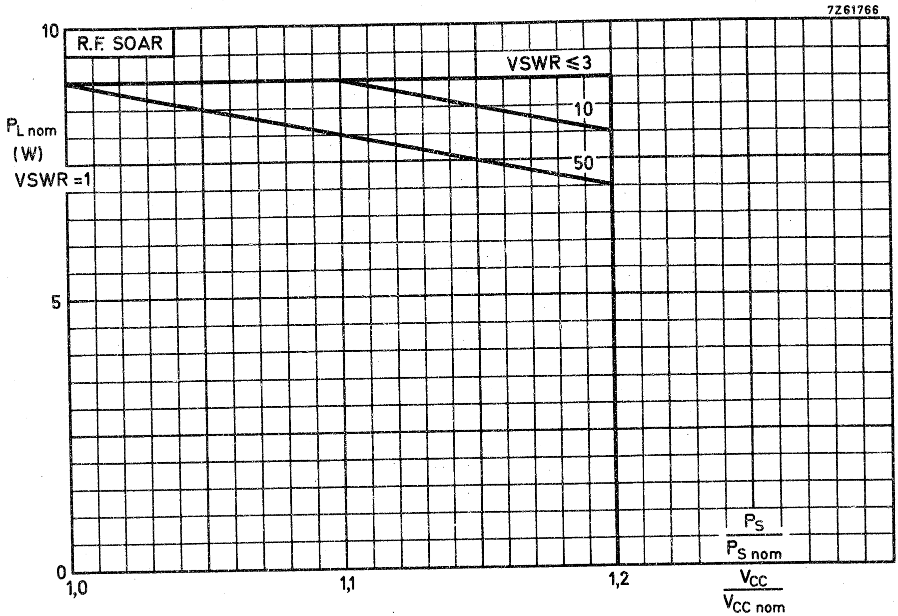
Material of printed circuit board: 1.5 mm epoxy fibre glass


7Z61761
typical values
f = 470MHz
Th = 25°C
PL
(W)
VCC = 13.8V
12.5V
10
5
0
0
1
2
PS (W)
3


7Z62205
typical values
f = 470MHz
Th = 25°C
η
(%)
VCC = 13.8V
12.5V
100
75
50
25
0
0
1
2
PS (W)
3


7Z61762
typical values
f = 175MHz
Th = 25°C
PL
(W)
VCC = 13.8V
12.5V
10
5
0
0
0.25
0.5
PS (W)
0.75


7Z62204
typical values
f = 175MHz
Th = 25°C
η
(%)
VCC = 13.8V
12.5V
100
75
50
25
0
0
0.25
0.5
PS (W)
0.75



Conditions for R.F. SOAR :

f = 470 MHz

T_h = 70 °C

V_{CCnom} = 13,8 V

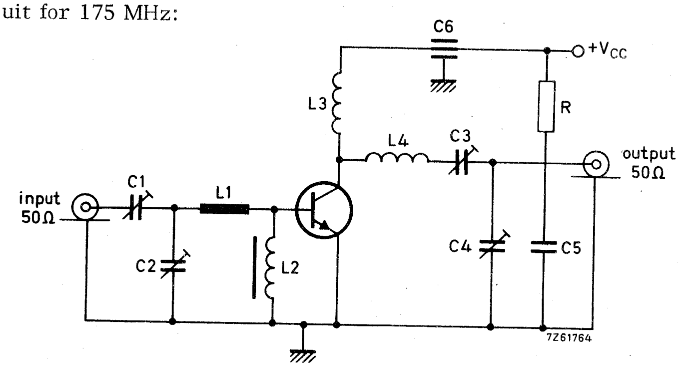
$P_{Snom} = P_S$ at $V_{CC} = V_{CCnom}$ and VSWR = 1

see also page 6

The transistor was developed for use with unstabilized supply voltage V_{CC}. The above graph is based on its measured performance in the circuit given on page 6. Supply voltage was varied from V_{CCnom} to 1,2 V_{CCnom}, and VSWR from 1 to 50. It shows the max. permissible output power under nominal conditions in order not to exceed the max. permissible power dissipation under conditions of supply over-voltage ($V_{CC} > V_{CCnom}$) and load mismatch (VSWR > 1). It is assumed that the drive power increases linearly with the supply voltage; i.e. $P_S/P_{Snom} = V_{CC}/V_{CCnom}$.

APPLICATION INFORMATION (continued)

Test circuit for 175 MHz:



C1 = C3 = C4 = 30 pF concentric air trimmer
C2 = 60 pF concentric air trimmer
C5 = 0.25 μF polyester capacitor
C6 = 4.0 nF feed-through capacitor

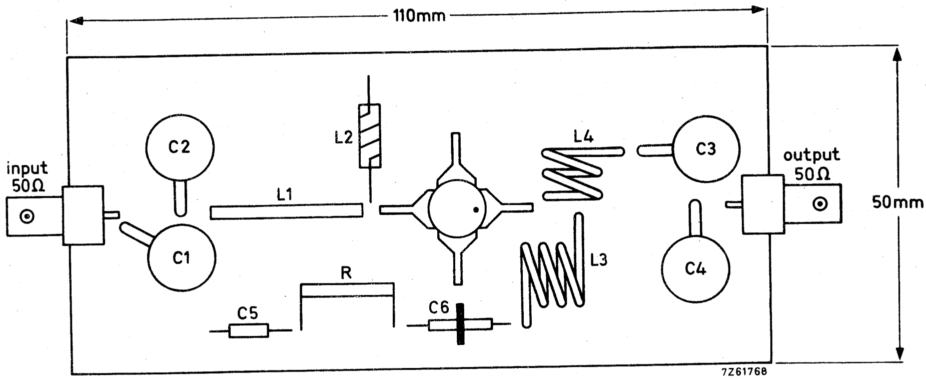
L1 = 25 mm straight Cu wire (1.2 mm); height above print 3 mm
L2 = 3 turns Cu wire (0.5 mm) on Ferrite FX1115, d = 2 mm, D = 4 mm, l = 5 mm material 3B (code number 3113 991 16740)
L3 = 5 turns closely wound Cu wire (1.2 mm); int. diam. 10 mm; lead length 5 mm
L4 = 3 turns closely wound Cu wire (1.2 mm); int. diam. 10 mm; lead length 5 mm

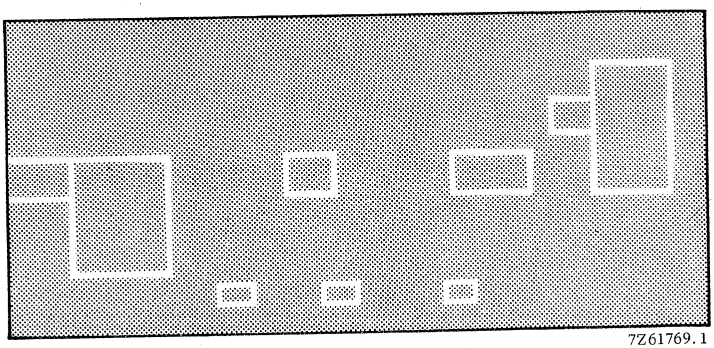
R = 10 Ω carbon

Graphs (P_L versus P_S and η versus P_S) for 175 MHz on page 8.
Component lay-out for 175 MHz on page 11.

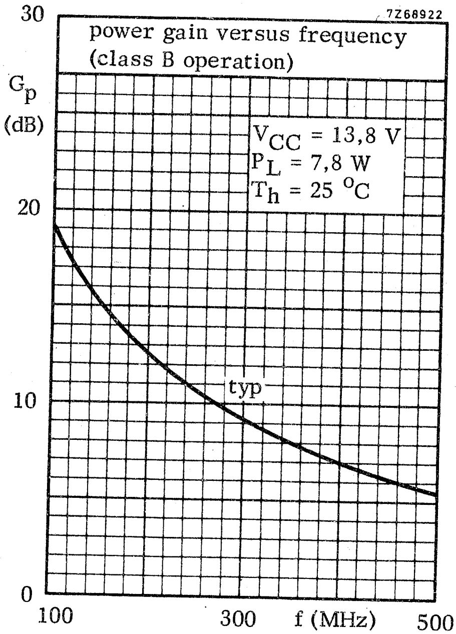
APPLICATION INFORMATION (continued)

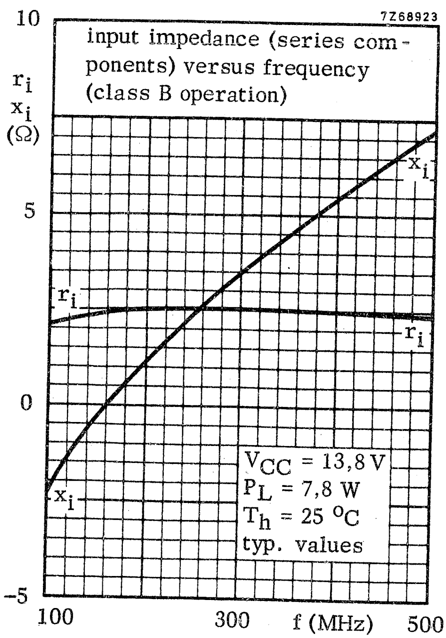
Component lay-out and printed circuit board for 175 MHz test circuit

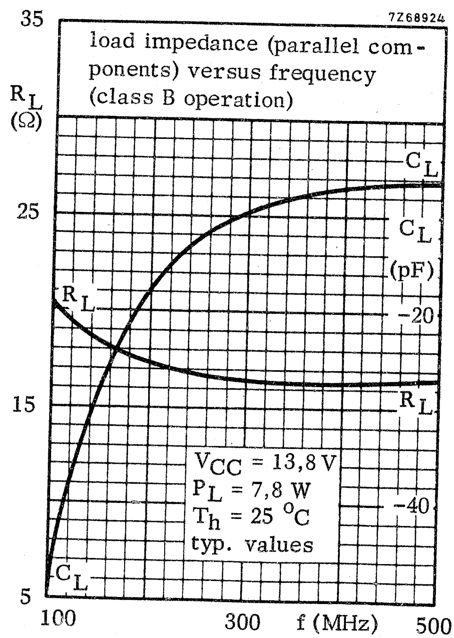




Shaded area copper
Back area not metalized
Material of printed circuit board: 1.5 mm epoxy fibre glass


7Z68922
power gain versus frequency
(class B operation)
Gp
(dB)
30
20
10
0
VCC = 13,8 V
PL = 7,8 W
Th = 25 °C
typ
100
300
f (MHz)
500


7Z68923
input impedance (series components) versus frequency
(class B operation)
ri
xi
(Ω)
10
5
0
−5
xi
ri
ri
xi
VCC = 13,8 V
PL = 7,8 W
Th = 25 °C
typ. values
100
300
f (MHz)
500


7Z68924
load impedance (parallel components) versus frequency
(class B operation)
RL
(Ω)
35
25
15
5
CL
CL
(pF)
−20
RL
RL
−40
CL
VCC = 13,8 V
PL = 7,8 W
Th = 25 °C
typ. values
100
300
f (MHz)
500

U.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor for use in class-A, B and C operated mobile, industrial and military transmitters with a supply voltage of 13,5 V. The transistor is resistance stabilized and is guaranteed to withstand severe load mismatch conditions with a supply over-voltage to 16,5 V. Gold metallization ensures extremely high reliability.

It has a capstan envelope with a moulded cap. All leads are isolated from the stud.

QUICK REFERENCE DATA

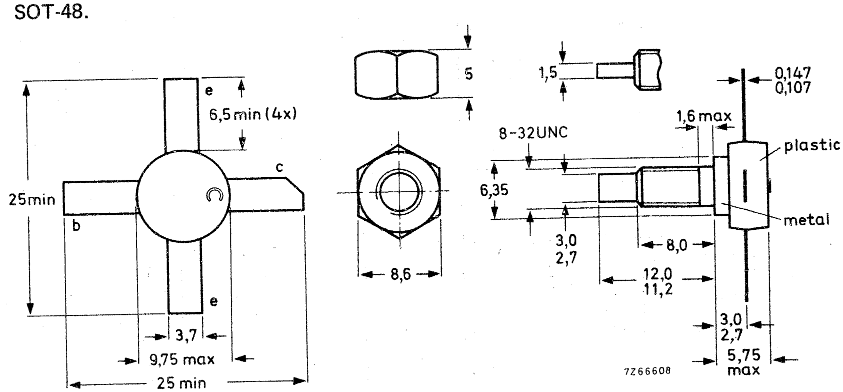
R.F. performance up to T_{mb} = 25 °C in an unneutralized common-emitter class-B circuit

mode of operation	V_{CE} V	f MHz	P_S W	P_L W	I_C A	G_p dB	η %	$\overline{z_i}$ Ω	$\overline{Y_L}$ mA/V
c.w.	13,5	470	< 8,0	20	< 2,28	> 4	> 65	1,2 + j4,5	163 – j35
c.w.	12,5	470	< 6,8	17	< 2,09	> 4	> 65	–	–

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-48.



Torque on nut: min. 0,75 Nm (7,5 kg cm)
max. 0,85 Nm (8,5 kg cm)

Diameter of clearance hole in heatsink: max. 4,2 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

When locking is required an adhesive is preferred instead of a lock washer.

CAUTION This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC 134)

Voltages

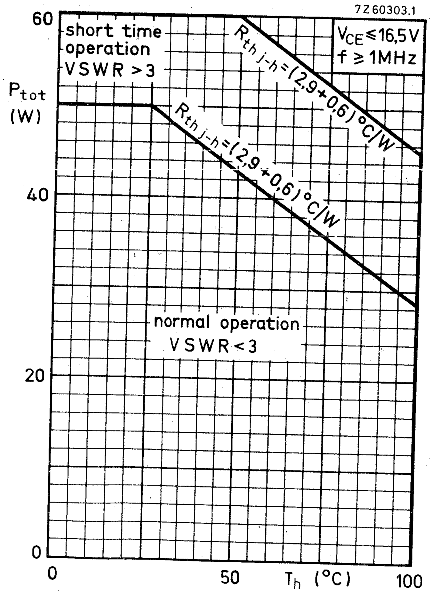
Collector-base voltage (open emitter) peak value	V_{CBOM}	max.	36	V
Collector-emitter voltage (open base)	V_{CEO}	max.	18	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4	V

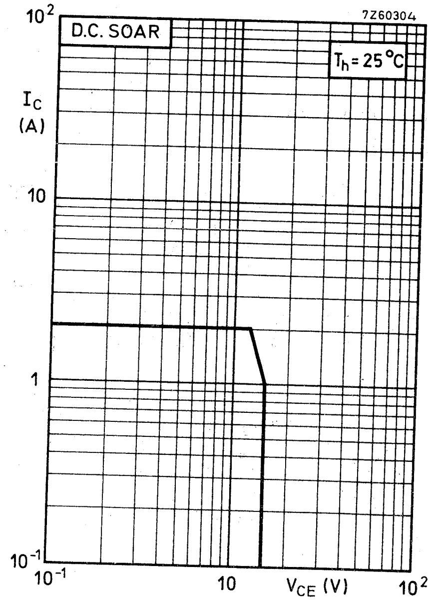
Currents

Collector current (average)	$I_{C(AV)}$	max.	3,5	A
Collector current (peak value) f > 1 MHz	I_{CM}	max.	10	A

Power dissipation

Total power dissipation up to T_h = 25 °C f ≥ 1 MHz	P_{tot}	max.	50	W





Temperatures

Storage temperature	T_{stg}		−65 to +200	°C
Junction temperature	T_j	max.	200	°C

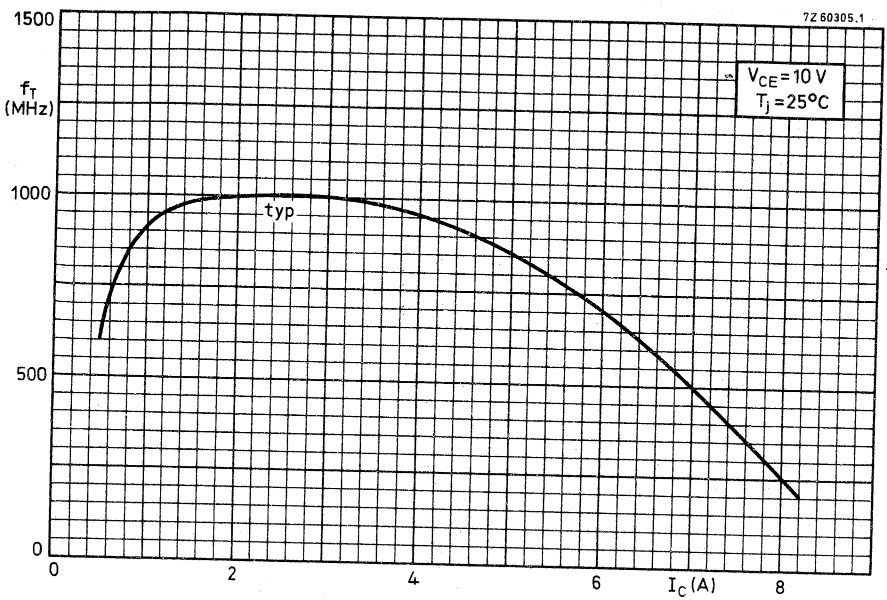
THERMAL RESISTANCE

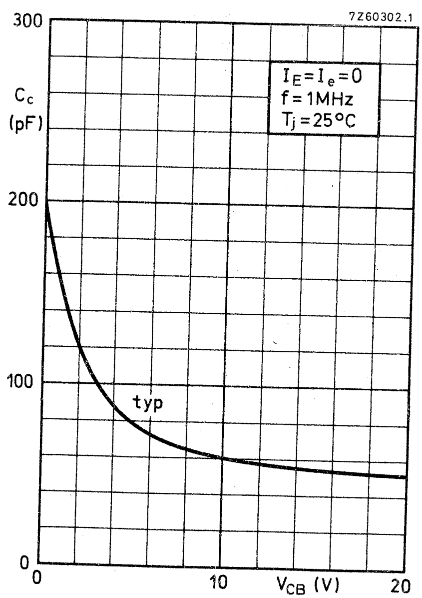
From junction to mounting base	$R_{th\ j-mb}$	=	2,9	°C/W
From mounting base to heatsink	$R_{th\ mb-h}$	=	0,6	°C/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Breakdown voltages				
Collector-base voltage open emitter ; I_C = 25 mA	$V_{(BR)CBO}$	>	36	V
Collector-emitter voltage open base ; I_C = 25 mA	$V_{(BR)CEO}$	>	18	V
Emitter-base voltage open collector ; I_E = 10 mA	$V_{(BR)EBO}$	>	4	V
Transient energy				
L = 25 mH; f = 50 Hz open base	E	>	3,1	mWs
$-V_{BE}$ = 1,5 V; R_{BE} = 33 Ω	E	>	3,1	mWs
D.C. current gain				
I_C = 1 A; V_{CE} = 5 V	h_{FE}	>	10	
		typ.	30	
Transition frequency				
I_C = 2 A; V_{CE} = 10 V	f_T	typ.	1,0	GHz
Collector capacitance at f = 1 MHz				
$I_E = I_e$ = 0; V_{CB} = 15 V	C_c	typ.	55	pF
		<	70	pF
Feedback capacitance				
I_C = 100 mA; V_{CE} = 15 V	C_{re}	typ.	32	pF
Collector-stud capacitance	C_{cs}	typ.	2	pF


7Z 60305.1
1500
f_T
(MHz)
1000
500
0
0
2
4
6
8
I_C (A)
V_{CE} = 10 V
T_j = 25°C
typ


7Z60302.1
300
C_c
(pF)
200
100
0
0
10
20
V_{CB} (V)
$I_E = I_e = 0$
f = 1MHz
T_j = 25°C
typ

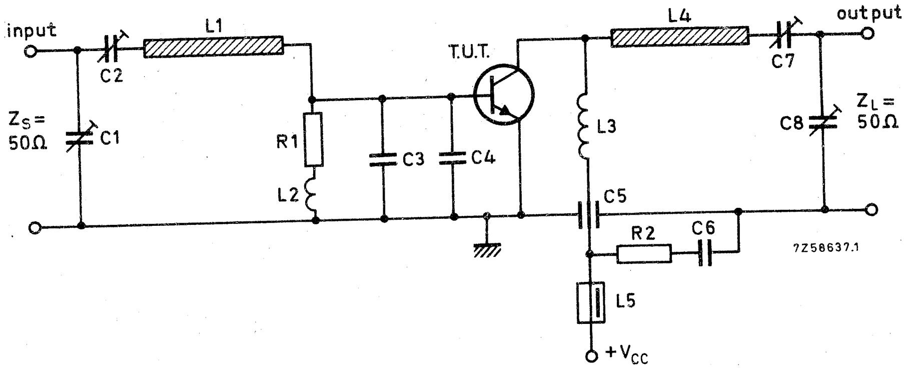
APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit)

T_{mb} up to 25 °C

f (MHz)	V_{CE} (V)	P_S (W)	P_L (W)	I_C (A)	G_p (dB)	η (%)	$\overline{z_i}$ (Ω)	$\overline{Y_L}$ (mA/V)
470	13,5	< 8,00	20	< 2,28	> 4	> 65	1,2 + j4,5	163 − j35
470	12,5	< 6,80	17	< 2,09	> 4	> 65	−	−
175	12,5	typ. 1,35	17	typ. 2,30	typ. 11	typ. 60	−	−

Test circuit: 470 MHz; c.w. class-B.



List of components:

C1 = C2 = C7 = C8 = 2,0 to 9,0 pF film dielectric trimmer (cat. no. 2222 809 09002)
C3 = C4 = 15 pF chip capacitor
C5 = 100 pF feed-through capacitor
C6 = 33 nF polyester capacitor

R1 = 1 Ω carbon resistor
R2 = 10 Ω carbon resistor

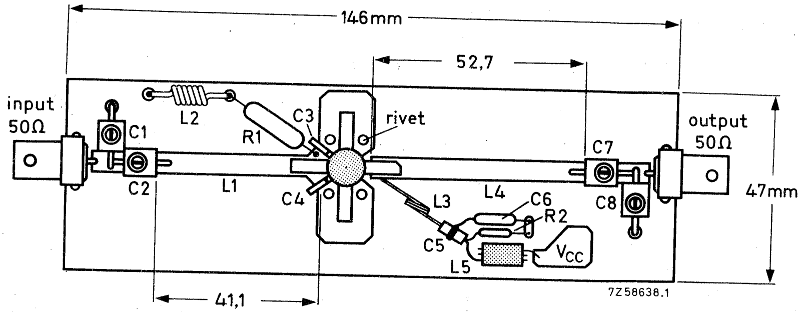
L1 = stripline (41,1 mm x 5,0 mm)
L2 = 13 turns closely wound enamelled Cu wire (0,5 mm); int. dia. 4,0 mm (0,32 μH)
L3 = 2 turns Cu wire (1 mm); winding pitch 1,5 mm; int. dia. 4 mm; leads 2 x 5 mm
L4 = stripline (52,7 mm x 5,0 mm)
L5 = Ferroxcube choke coil. Z (at f = 50 MHz) = 750 Ω ± 20% (cat. no. 4312 020 36640)

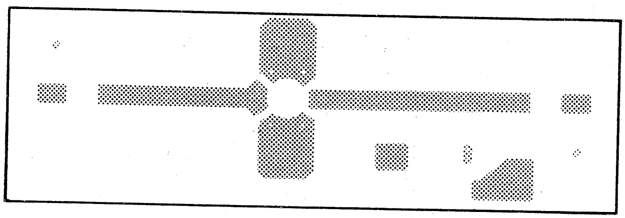
L1 and L4 are striplines on a double Cu-clad print plate with PTFE fibre-glass dielectric. (ϵ_r = 2,74); thickness 1,45 mm.

Component layout and printed-circuit board for 470 MHz test circuit see page 6.

APPLICATION INFORMATION (continued)

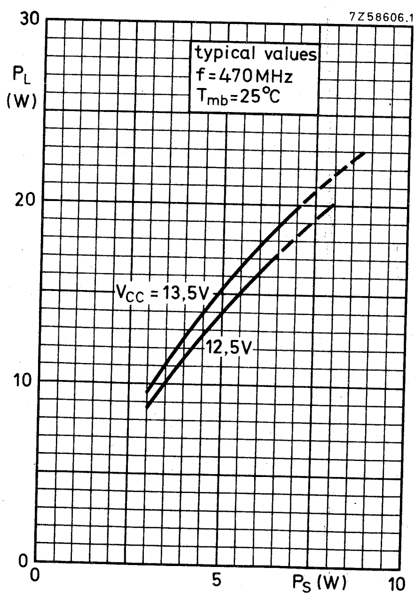
Component layout and printed-circuit board for 470 MHz test circuit.

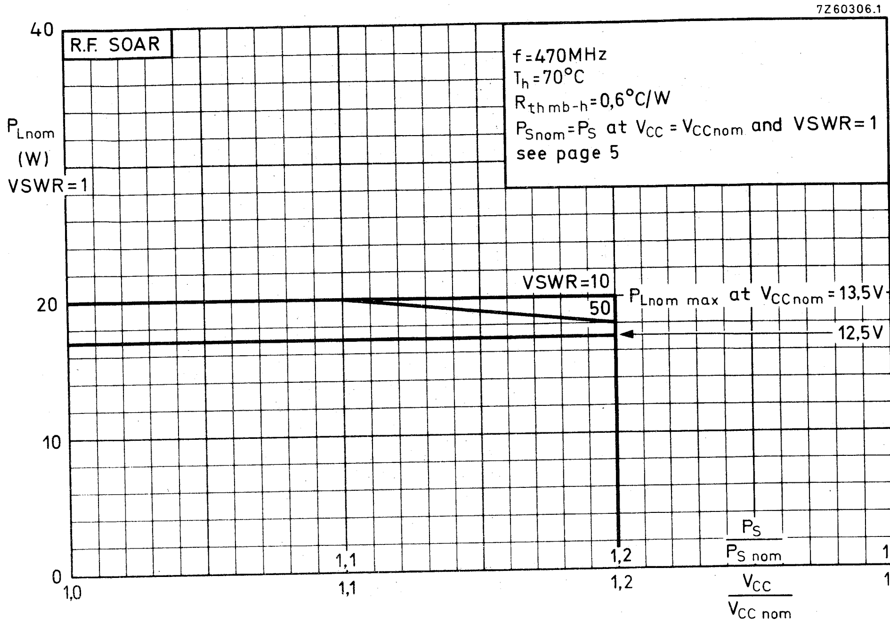




7Z66443.1

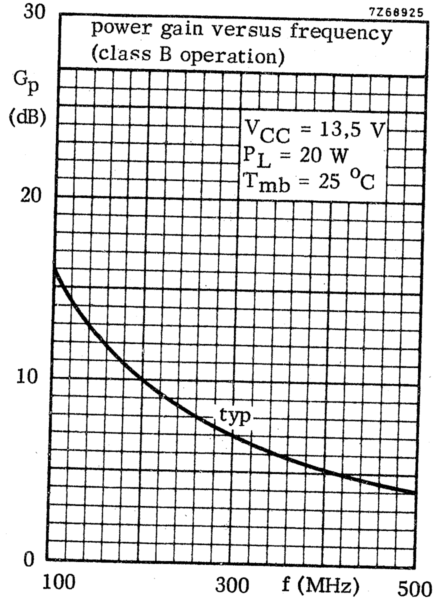
The circuit and the components are situated on one side of the PTFE fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets.

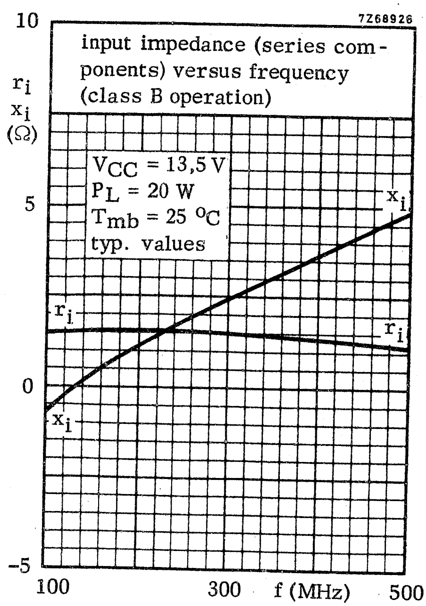


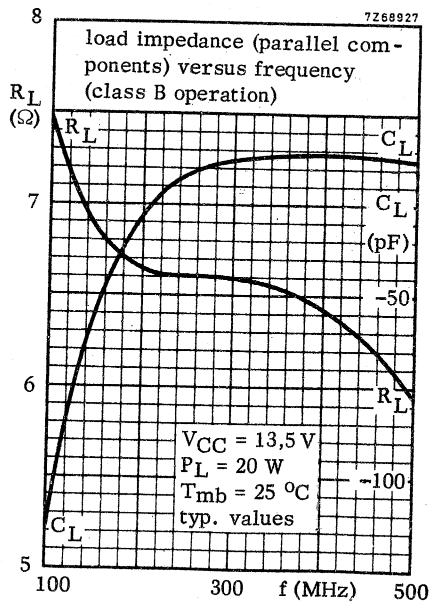


The transistor has been developed for use with unstabilized supply voltages. As the output power and drive power increase with the supply voltage, the nominal output power must be derated in accordance with the graph above for safe operation at supply voltages other than the nominal. The graph shows the allowable output power, under nominal conditions, as a function of the supply overvoltage ratio, with VSWR as parameter.
The graph applies to the situation in which the drive (P_S/P_{Snom}) increases linearly with the supply overvoltage ratio.

The horizontal line at 20 W applies at V_{CCnom} = 13,5 V.
For V_{CCnom} = 12,5 V, P_L should be derated to 17 W.


7Z68925
power gain versus frequency
(class B operation)
30
Gp
(dB)
20
10
0
VCC = 13,5 V
PL = 20 W
Tmb = 25 °C
typ
100
300
f (MHz)
500


7Z68926
input impedance (series components) versus frequency
(class B operation)
10
ri
xi
(Ω)
5
0
-5
VCC = 13,5 V
PL = 20 W
Tmb = 25 °C
typ. values
xi
ri
ri
xi
100
300
f (MHz)
500


7Z68927
load impedance (parallel components) versus frequency
(class B operation)
8
RL
(Ω)
7
6
5
RL
CL
CL
(pF)
-50
RL
-100
CL
VCC = 13,5 V
PL = 20 W
Tmb = 25 °C
typ. values
100
300
f (MHz)
500

U.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor intended for transmitting applications in class-A, B or C with a supply voltage up to 28 V. The transistor is resistance stabilized and is guaranteed to withstand severe load mismatch conditions. Gold metallization ensures extremely high reliability.

It has a capstan envelope with a moulded cap. All leads are isolated from the stud.

QUICK REFERENCE DATA

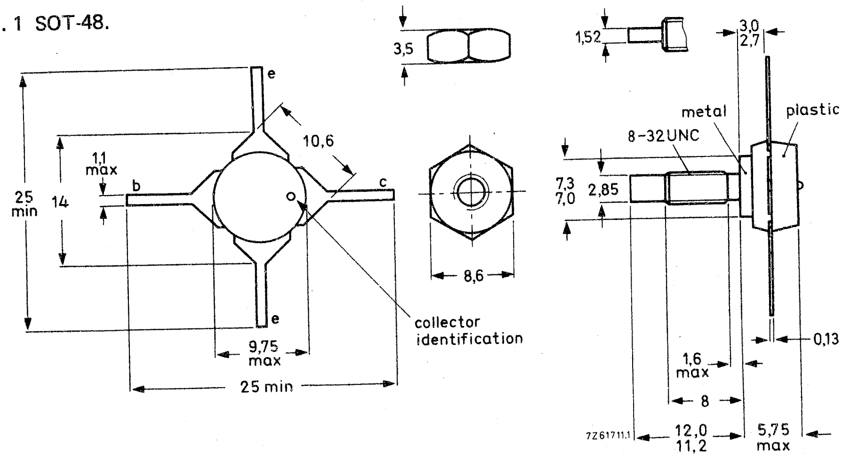
R.F. performance up to T_h = 25 °C in an unneutralized common-emitter class-B circuit

mode of operation	V_{CE} V	f MHz	P_S mW	P_L W	I_C mA	G_p dB	η %	$\overline{z_i}$ Ω	$\overline{Y_L}$ mA/V
c.w.	24	470	typ. 50	0,85	typ. 67	typ. 12,3	typ. 53	–	–
c.w.	28	470	< 80	1,0	< 71	> 11,0	> 50	–	–
c.w.	28	470	typ. 80	1,45	typ. 86	typ. 12,6	typ. 60	2,5 + j0,2	3,4 – j16
c.w.	28	1000	typ. 400	1,4	typ.100	typ. 5,4	typ. 50	–	–

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-48.



Torque on nut: min. 0,75 Nm (7,5 kg cm)
max. 0,85 Nm (8,5 kg cm)

Diameter of clearance hole in heatsink: max. 4,2 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

When locking is required an adhesive is preferred instead of a lock washer.

CAUTION This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC134)

Voltages

Collector-base voltage (open emitter) peak value	V_{CBOM}	max.	65	V
Collector-emitter voltage (V_{BE} = 0) peak value	V_{CESM}	max.	65	V
Collector-emitter voltage (open base)	V_{CEO}	max.	33	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4,0	V

Currents

Collector current (d.c.)	I_C	max.	400	mA
Collector current (peak value); f ≥ 10 MHz	I_{CM}	max.	800	mA

Power dissipation

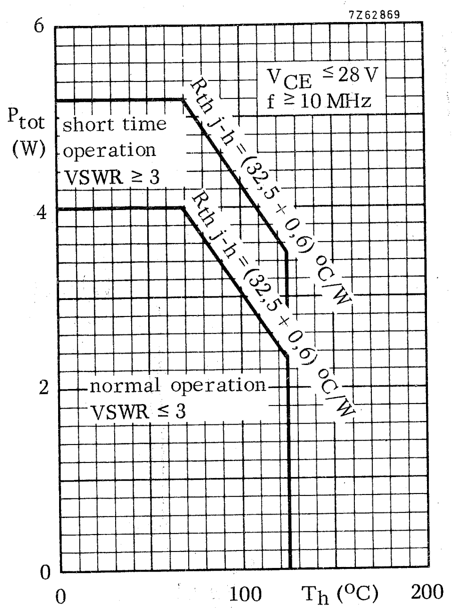
Total power dissipation up to T_h = 70 °C f ≥ 10 MHz (see also page 3)	P_{tot}	max.	4,0	W

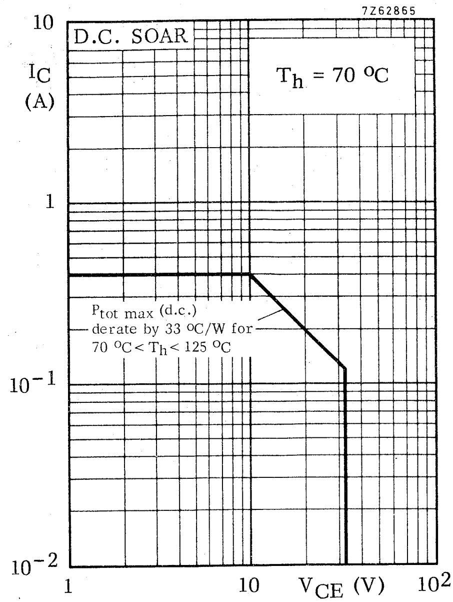
Temperatures

Storage temperature	T_{stg}	-65 to +150		°C
Operating junction temperature	T_j	max.	200	°C

THERMAL RESISTANCE

From junction to mounting base	$R_{th\ j\text{-}mb}$	=	32,5	°C/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,6	°C/W

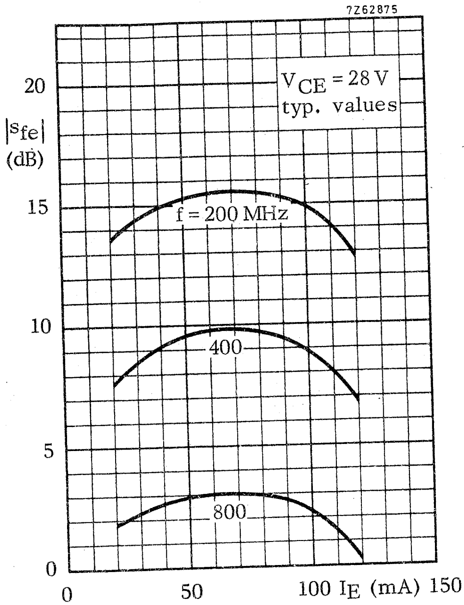

7Z62869
Ptot (W)
short time operation VSWR ≥ 3
VCE ≤ 28 V
f ≥ 10 MHz
Rth j-h = (32,5 + 0,6) °C/W
Rth j-h = (32,5 + 0,6) °C/W
normal operation VSWR ≤ 3
Th (°C)
0
2
4
6
100
200

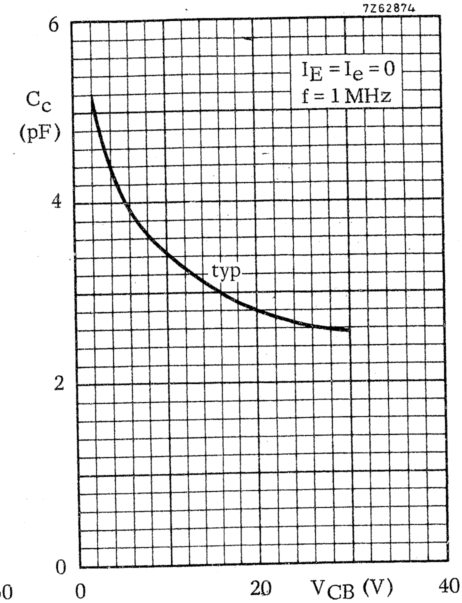

7Z62865
D.C. SOAR
Th = 70 °C
IC (A)
Ptot max (d.c.)
derate by 33 °C/W for
70 °C < Th < 125 °C
VCE (V)
10
1
10⁻¹
10⁻²
1
10
10²

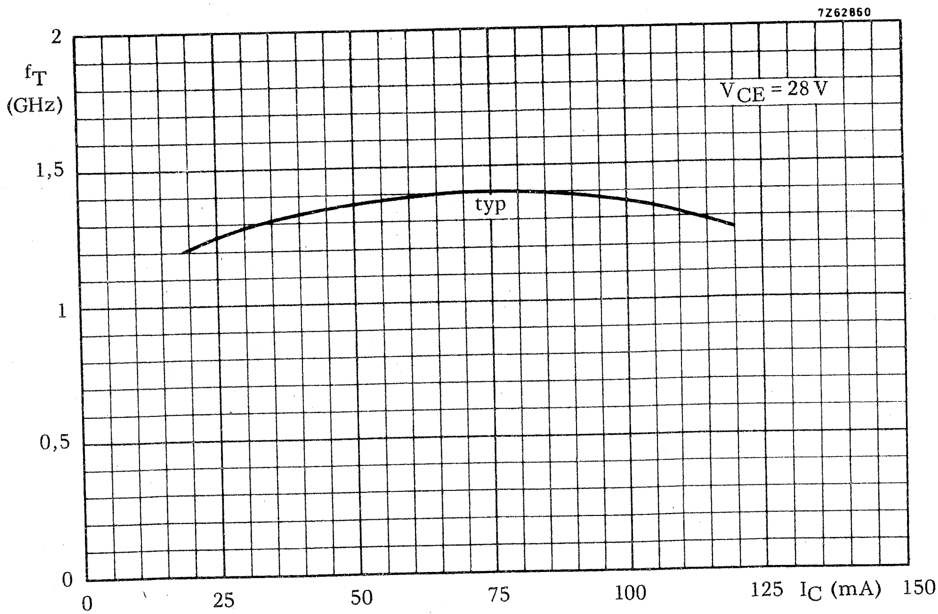
CHARACTERISTICS

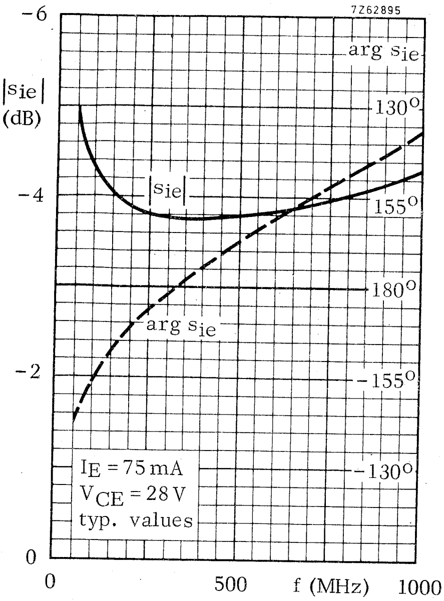
T_j = 25 °C unless otherwise specified

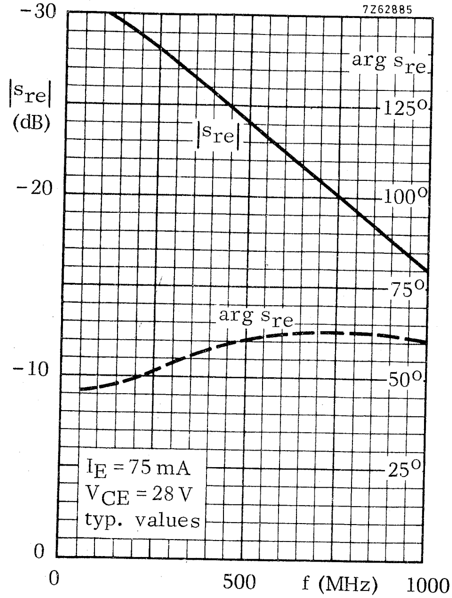
Breakdown voltages				
Collector-base voltage open emitter, I_C = 10 mA	$V_{(BR)CBO}$	>	65	V
Collector-emitter voltage V_{BE} = 0, I_C = 10 mA	$V_{(BR)CES}$	>	65	V
Collector-emitter voltage open base, I_C = 25 mA	$V_{(BR)CEO}$	>	33	V
Emitter-base voltage open collector, I_E = 1,0 mA	$V_{(BR)EBO}$	>	4,0	V
D.C. current gain				
I_C = 100 mA; V_{CE} = 5,0 V	h_{FE}	> typ.	10 35	
Transition frequency				
I_C = 50 mA; V_{CE} = 5,0 V	f_T	typ.	1,2	GHz
Collector capacitance at f = 1 MHz				
I_E = I_e = 0; V_{CB} = 10 V	C_c	typ.	3,5	pF
Emitter capacitance at f = 1 MHz				
I_C = I_c = 0; V_{EB} = 0	C_e	typ.	11	pF
Feedback capacitance at f = 1 MHz				
I_C = 5 mA; V_{CE} = 10 V	C_{re}	typ.	2,5	pF
Collector-stud capacitance	C_{cs}	typ.	2,0	pF

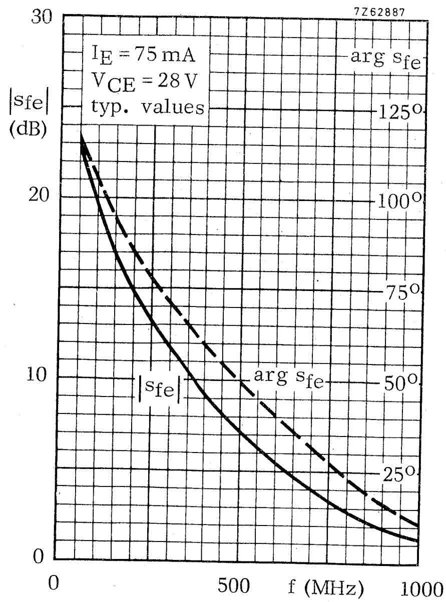

7Z62875
20
15
10
5
0
|sfe|
(dB)
VCE = 28 V
typ. values
f = 200 MHz
400
800
0
50
100 IE (mA) 150

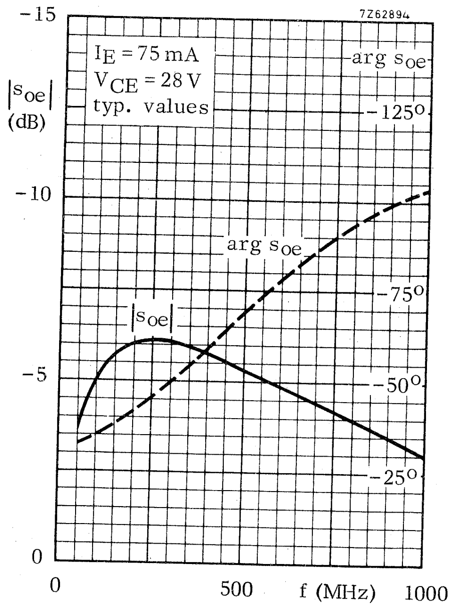

7Z62874
6
4
2
0
Cc
(pF)
IE = Ie = 0
f = 1 MHz
typ
0
20
VCB (V)
40


7Z62860
2
1,5
1
0,5
0
fT
(GHz)
VCE = 28 V
typ
0
25
50
75
100
125 IC (mA) 150


7Z62895
|sie| (dB)
arg sie
|sie|
arg sie
-6
-4
-2
0
130°
155°
180°
-155°
-130°
IE = 75 mA
VCE = 28 V
typ. values
0
500
f (MHz)
1000


7Z62885
|sre| (dB)
arg sre
|sre|
arg sre
-30
-20
-10
0
125°
100°
75°
50°
25°
IE = 75 mA
VCE = 28 V
typ. values
0
500
f (MHz)
1000


7Z62887
|sfe| (dB)
arg sfe
|sfe|
arg sfe
30
20
10
0
125°
100°
75°
50°
25°
IE = 75 mA
VCE = 28 V
typ. values
0
500
f (MHz)
1000


7Z62894
|soe| (dB)
arg soe
|soe|
arg soe
-15
-10
-5
0
-125°
-75°
-50°
-25°
IE = 75 mA
VCE = 28 V
typ. values
0
500
f (MHz)
1000

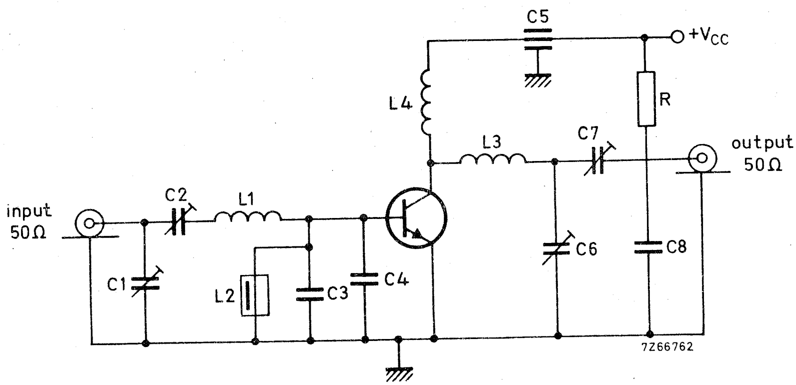
APPLICATION INFORMATION

R.F. performance in c.w. operation (Unneutralized common-emitter class-B circuit)

T_h = 25 °C

V_{CC} (V)	f (MHz)	P_S (mW)	P_L (W)	I_C (mA)	G_p (dB)	η (%)	$\overline{z_i}$ (Ω)	$\overline{Y_L}$ (mA/V)
24	470	typ. 50	0,85	typ. 67	typ. 12,3	typ. 53	–	–
28	470	< 80	1,0	< 71	> 11,0	> 50	–	–
28	470	typ. 80	1,45	typ. 86	typ. 12,6	typ. 60	2,5 + j0,2	3,4 – j16
28	1000	typ. 400	1,4	typ. 100	typ. 5,4	typ. 50	–	–

Test circuit for 470 MHz:



C1 = C2 = C7 = 1,8 to 18 pF film dielectric trimmer
C3 = C4 = 18 pF disc ceramic capacitor
C5 = 1 nF feed-through capacitor
C6 = 1,0 to 9,0 pF film dielectric trimmer
C8 = 0,1 μF polyester capacitor

L1 = 1 turn Cu wire (1,2 mm); int. dia. 5 mm; lead length = 2 mm
L2 = 0,47 μH choke
L3 = 4 turns closely wound enamelled Cu wire (1,2 mm); int. dia. 6,5 mm; lead length = 4 mm
L4 = 5 turns closely wound enamelled Cu wire (0,5 mm); int. dia. 4 mm; lead length = 5 mm

R = 10 Ω carbon

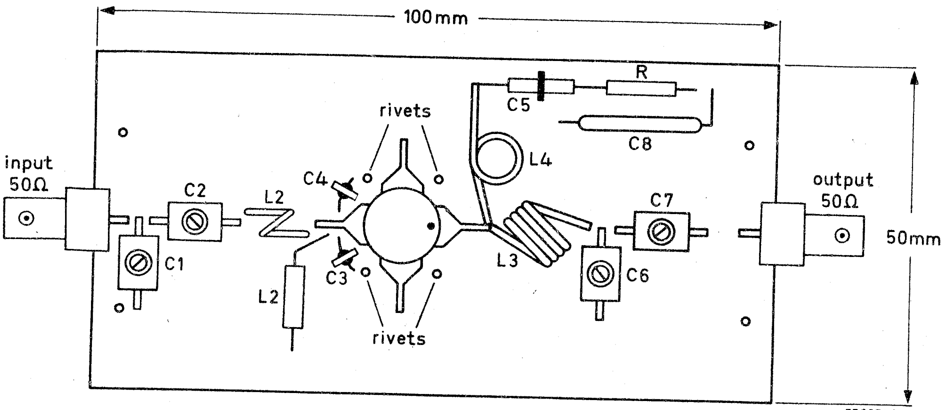
At P_L = 1,0 W and V_{CC} = 28 V, the output power at heatsink temperatures between 25 °C and 90 °C relative to that at 25 °C is diminished by typ. 2 mW/°C.

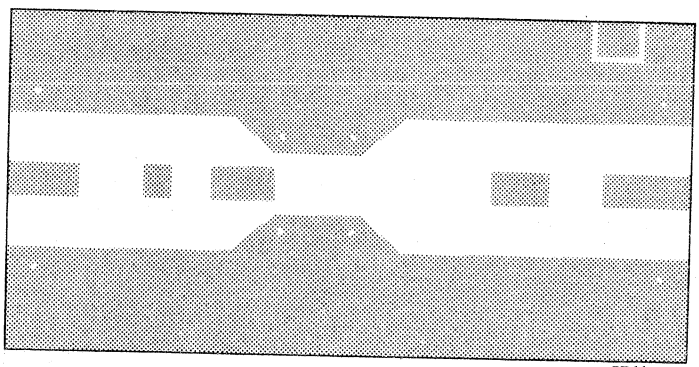
The transistor is designed to withstand full load mismatch in the test circuit under the following conditions: V_{CC} = 28 V; f = 470 MHz; T_h = 90 °C.
VSWR = 50 : 1 through all phases; P_L = 1,2 W.

Component layout for 470 MHz test circuit see page 8.

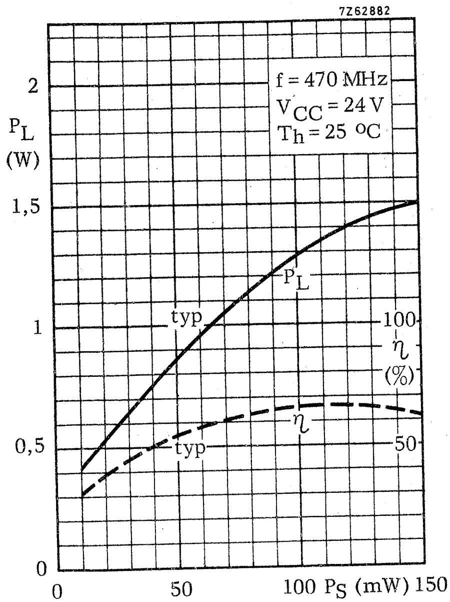
APPLICATION INFORMATION (continued)

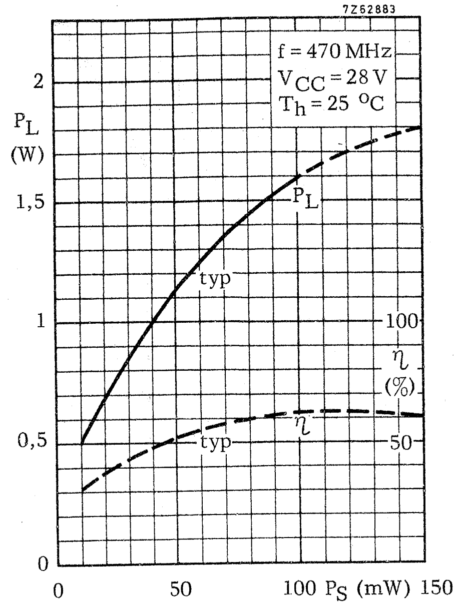
Component layout and printed-circuit board for 470 MHz test circuit.

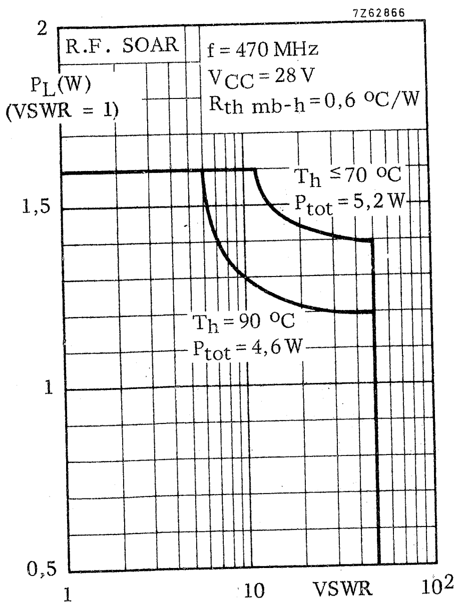




Shaded area copper
Back area completely copper clad
Material of printed-circuit board: 1,5 mm epoxy fibre-glass



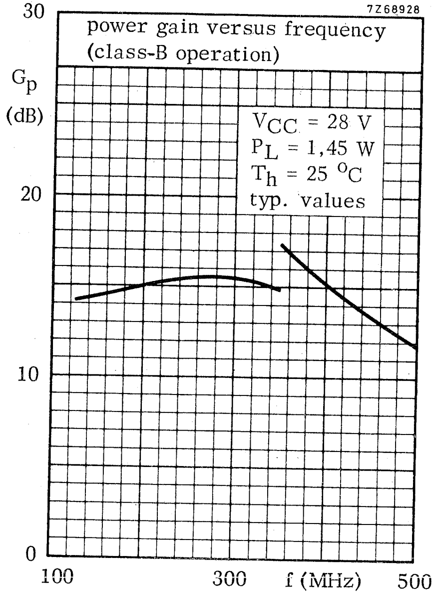


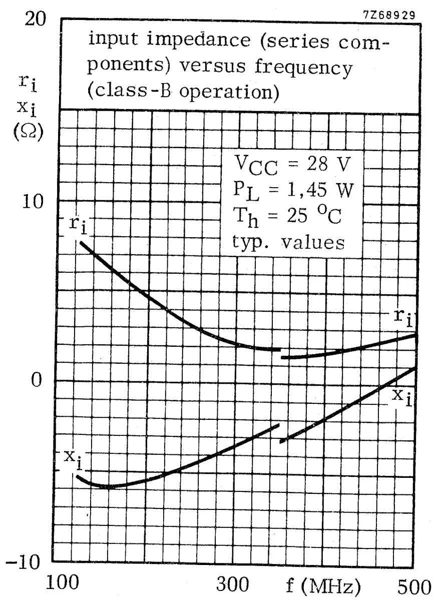


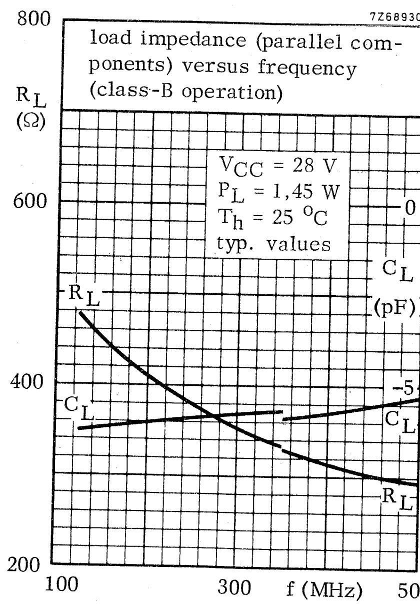
Indicated load power as a function of overload

The graph has been derived from an evaluation of the performance of transistors matched up to 1,6 W load power in the test amplifier on page 7 and subsequently subjected to various mismatch conditions at 28 V with VSWR up to 50 and elevated heatsink temperatures.
This indicates a restriction to the load power matched under nominal conditions in the recommended test configuration.

OPERATING NOTE Below 350 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation. This resistor must be effective for both d.c. and r.f.







U.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor intended for transmitting applications in class-A, B or C with a supply voltage up to 28 V. The transistor is resistance stabilized and is guaranteed to withstand severe load mismatch conditions. Gold metallization ensures extremely high reliability.

It has a capstan envelope with a moulded cap. All leads are isolated from the stud.

QUICK REFERENCE DATA

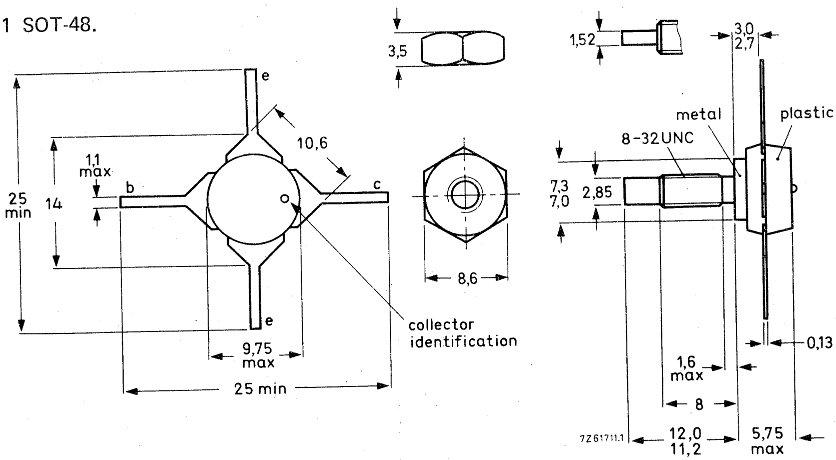
R.F. performance up to T_h = 25 °C in an unneutralized common-emitter class-B circuit

mode of operation	V_{CE} V	f MHz	P_S W	P_L W	I_C mA	G_P dB	η %	$\overline{z_i}$ Ω	$\overline{Y_L}$ mA/V
c.w.	24	470	typ. 0,2	2,4	typ. 143	typ. 10,8	typ. 70	–	–
c.w.	28	470	< 0,2	2,5	< 149	> 11,0	> 60	–	–
c.w.	28	470	typ. 0,2	3,0	typ. 162	typ. 11,7	typ. 66	1,8 + j2,8	7,2 – j24
c.w.	28	1000	typ. 0,7	2,5	typ. 179	typ. 5,5	typ. 50	–	–

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-48.



Torque on nut: min. 0,75 Nm (7,5 kg cm)
max. 0,85 Nm (8,5 kg cm)

Diameter of clearance hole in heatsink: max. 4,2 mm. Mounting hole to have no burrs at either end. De-burring must leave surface flat; do not chamfer or countersink either end of hole.

When locking is required an adhesive is preferred instead of a lock washer.

CAUTION This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC134)

Voltages

Collector-base voltage (open emitter) peak value	V_{CBOM}	max.	65	V
Collector-emitter voltage (V_{BE} = 0) peak value	V_{CESM}	max.	65	V
Collector-emitter voltage (open base)	V_{CEO}	max.	33	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4,0	V

Currents

Collector current (d.c.)	I_C	max.	0,7	A
Collector current (peak value) f ≥ 10 MHz	I_{CM}	max.	2,0	A

Power dissipation

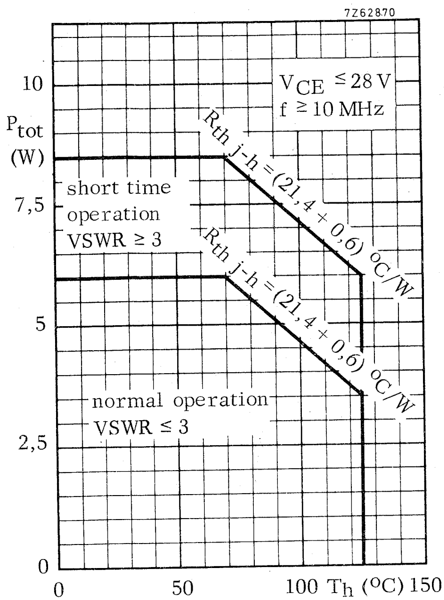
Total power dissipation up to T_h = 70 °C f ≥ 10 MHz (see also page 3)	P_{tot}	max.	6,0	W

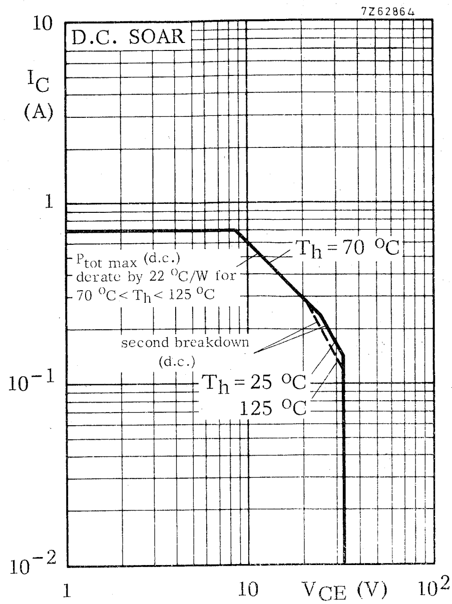
Temperatures

Storage temperature	T_{stg}		−65 to +150	°C
Operating junction temperature	T_j	max.	200	°C

THERMAL RESISTANCE

From junction to mounting base	$R_{th\ j\text{-}mb}$	=	21,4	°C/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,6	°C/W

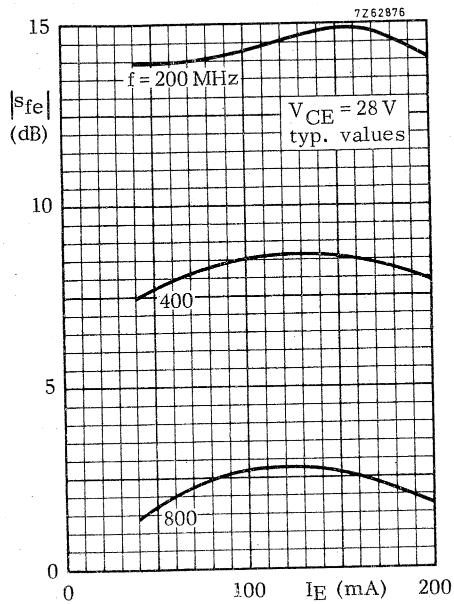

7Z62870
Ptot (W)
10
7,5
5
2,5
0
VCE ≤ 28 V
f ≥ 10 MHz
Rth j-h = (21,4 + 0,6) °C/W
short time operation
VSWR ≥ 3
Rth j-h = (21,4 + 0,6) °C/W
normal operation
VSWR ≤ 3
0
50
100 Th (°C) 150

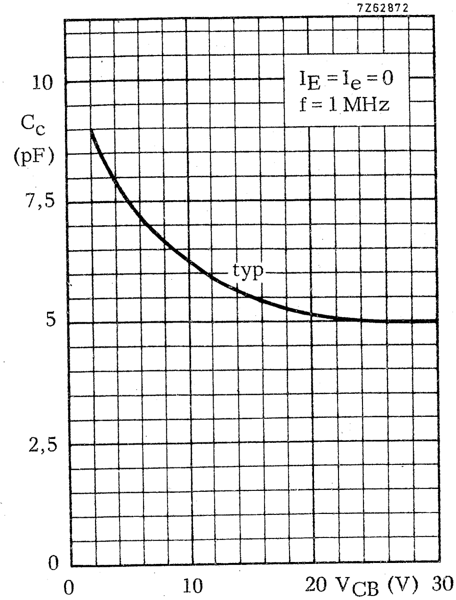

7Z62864
10
D.C. SOAR
IC (A)
1
Th = 70 °C
Ptot max (d.c.)
derate by 22 °C/W for
70 °C < Th < 125 °C
second breakdown
(d.c.)
10−1
Th = 25 °C
125 °C
10−2
1
10
VCE (V)
10²

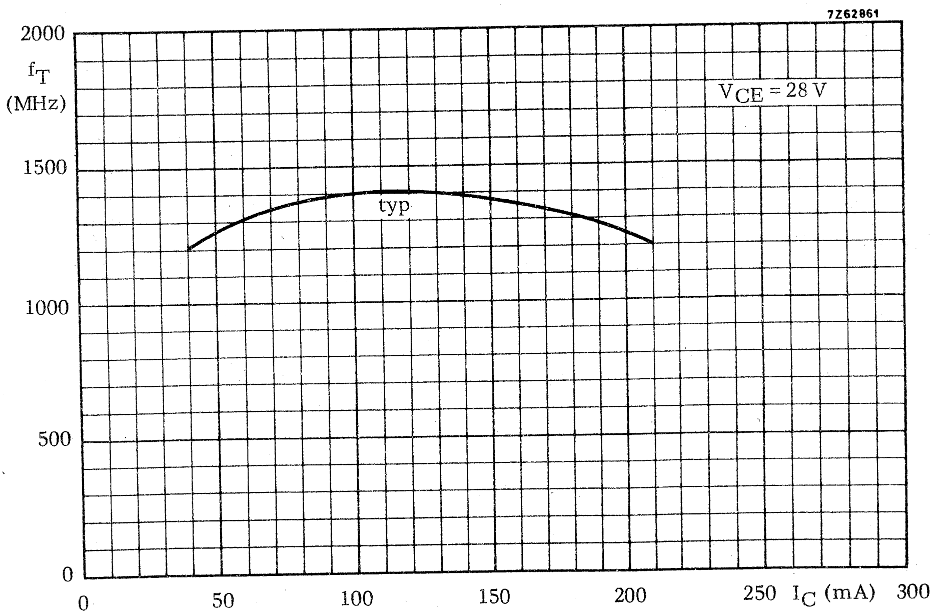
CHARACTERISTICS

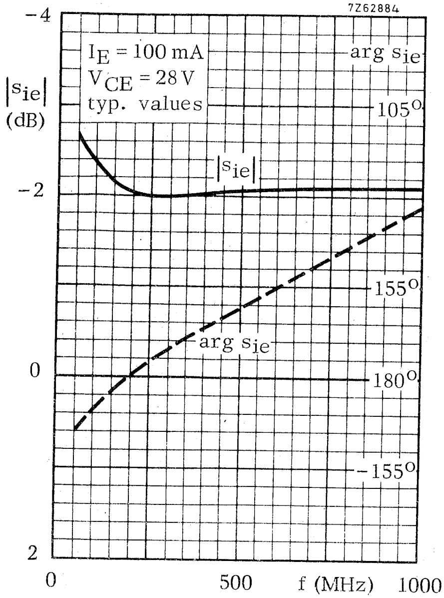
T_j = 25 °C unless otherwise specified

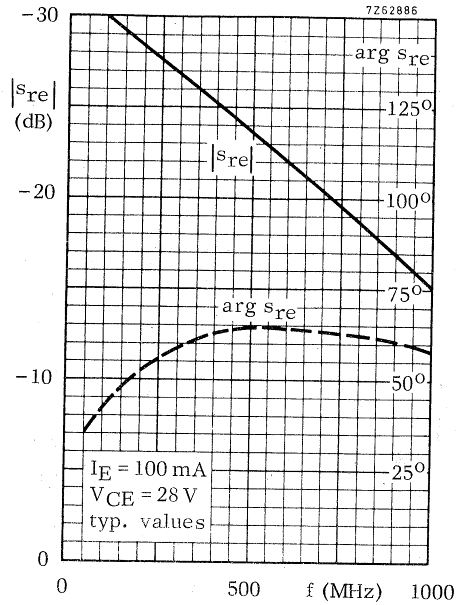
Breakdown voltages				
Collector-base voltage open emitter, I_C = 10 mA	$V_{(BR)CBO}$	>	65	V
Collector-emitter voltage V_{BE} = 0, I_C = 10 mA	$V_{(BR)CES}$	>	65	V
Collector-emitter voltage open base, I_C = 25 mA	$V_{(BR)CEO}$	>	33	V
Emitter-base voltage open collector, I_E = 1,0 mA	$V_{(BR)EBO}$	>	4,0	V
Collector-emitter saturation voltage				
I_C = 100 mA; I_B = 20 mA	V_{CEsat}	typ.	0,17	V
D.C. current gain				
I_C = 100 mA; V_{CE} = 5,0 V	h_{FE}	> typ.	10 40	
Transition frequency				
I_C = 100 mA; V_{CE} = 5,0 V	f_T	typ.	1,2	GHz
Collector capacitance at f = 1 MHz				
$I_E = I_e$ = 0; V_{CB} = 10 V	C_c	typ.	6,5	pF
Emitter capacitance at f = 1 MHz				
$I_C = I_c$ = 0; V_{EB} = 0	C_e	typ.	25	pF
Feedback capacitance at f = 1 MHz				
I_C = 10 mA; V_{CE} = 10 V	C_{re}	typ.	4,8	pF
Collector-stud capacitance	C_{cs}	typ.	2,0	pF

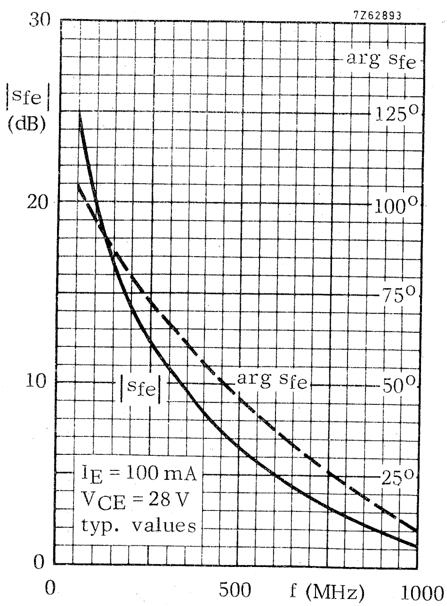

7Z62876
15
10
5
0
|sfe|
(dB)
f = 200 MHz
VCE = 28 V
typ. values
400
800
0
100
IE (mA)
200

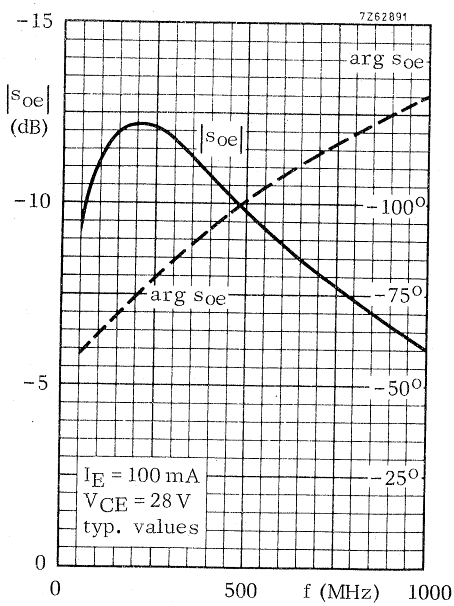

7Z62872
10
7,5
5
2,5
0
Cc
(pF)
IE = Ie = 0
f = 1 MHz
typ
0
10
20 VCB (V) 30


7Z62861
2000
1500
1000
500
0
fT
(MHz)
VCE = 28 V
typ
0
50
100
150
200
250 IC (mA) 300


7Z62884
I_E = 100 mA
V_{CE} = 28 V
typ. values
$|s_{ie}|$ (dB)
arg s_{ie}
$|s_{ie}|$
arg s_{ie}
-4
-2
0
2
105°
155°
180°
-155°
0
500
f (MHz)
1000


7Z62886
$|s_{re}|$ (dB)
arg s_{re}
$|s_{re}|$
arg s_{re}
I_E = 100 mA
V_{CE} = 28 V
typ. values
-30
-20
-10
0
125°
100°
75°
50°
25°
0
500
f (MHz)
1000


7Z62893
$|s_{fe}|$ (dB)
arg s_{fe}
$|s_{fe}|$
arg s_{fe}
I_E = 100 mA
V_{CE} = 28 V
typ. values
30
20
10
0
125°
100°
75°
50°
25°
0
500
f (MHz)
1000


7Z62891
$|s_{oe}|$ (dB)
arg s_{oe}
$|s_{oe}|$
arg s_{oe}
I_E = 100 mA
V_{CE} = 28 V
typ. values
-15
-10
-5
0
-100°
-75°
-50°
-25°
0
500
f (MHz)
1000

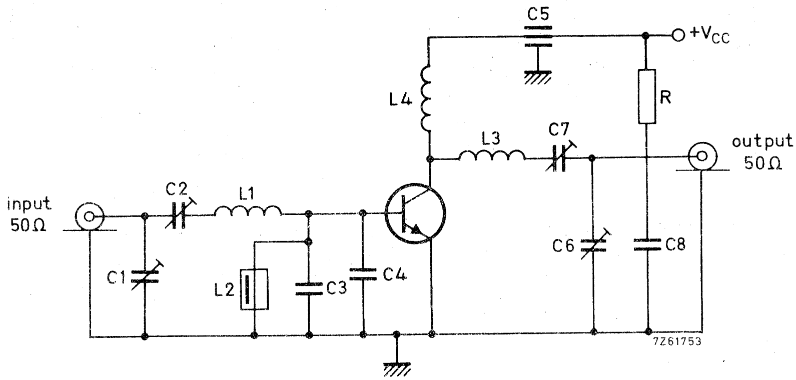
APPLICATION INFORMATION

R.F. performance in c.w. operation (Unneutralized common-emitter class-B circuit)

T_h = 25 °C

V_{CC} (V)	f (MHz)	P_S (W)	P_L (W)	I_C (mA)	G_p (dB)	η (%)	$\overline{z_i}$ (Ω)	$\overline{Y_L}$ (mA/V)
24	470	typ. 0,2	2,4	typ. 143	typ. 10,8	typ. 70	–	–
28	470	< 0,2	2,5	< 149	> 11,0	> 60	–	–
28	470	typ. 0,2	3,0	typ. 162	typ. 11,7	typ. 66	1,8 + j2,8	7,2 – j24
28	1000	typ. 0,7	2,5	typ. 179	typ. 5,5	typ. 50	–	–

Test circuit for 470 MHz:



C1 = C2 = 1,8 to 18 pF film dielectric trimmer
C3 = C4 = 18 pF disc ceramic capacitor
C5 = 1 nF feed-through capacitor
C6 = C7 = 1,0 to 9,0 pF film dielectric trimmer
C8 = 0,1 μF polyester capacitor

L1 = 1 turn Cu wire (1,2 mm); int. dia. 5 mm; lead length = 2 mm
L2 = 0,47 μH choke
L3 = 2 turns closely wound enamelled Cu wire (1,2 mm); int. dia. 6,5 mm; lead length = 4 mm
L4 = 3 turns closely wound enamelled Cu wire (0,5 mm); int. dia. 4,0 mm; lead length = 5 mm

R = 10 Ω carbon

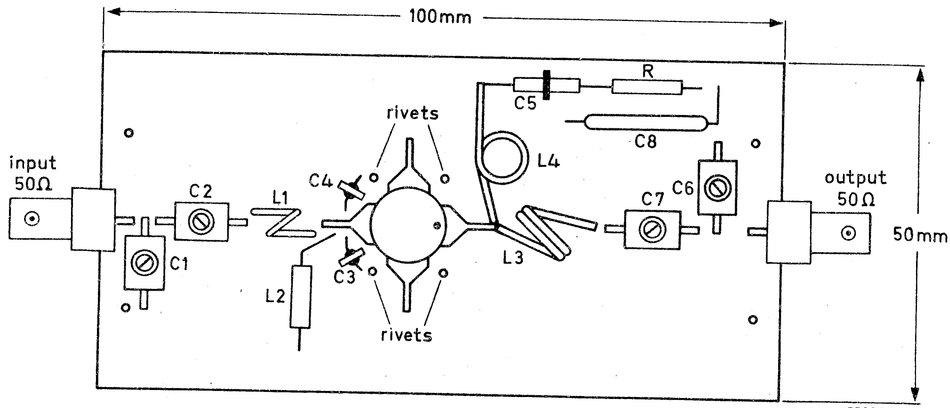
At P_L = 2,5 W and V_{CC} = 28 V, the output power at heatsink temperatures between 25 °C and 90 °C relative to that at 25 °C is diminished by typ. 5 mW/°C.

The transistor is designed to withstand full load mismatch in the test circuit under the following conditions: V_{CC} = 28 V; f = 470 MHz; T_h = 90 °C.
VSWR = 50 : 1 through all phases; P_L = 2,5 W.

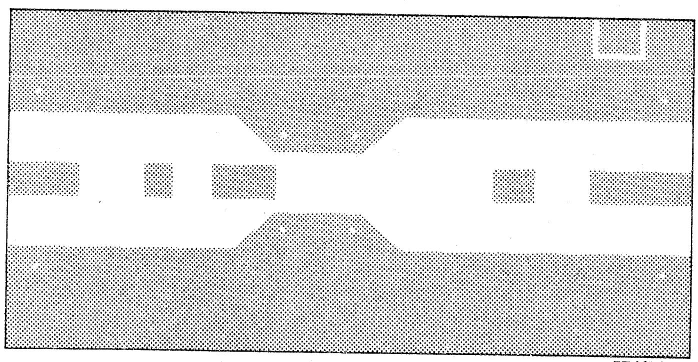
Component layout for 470 MHz test circuit see page 8.

APPLICATION INFORMATION (continued)

Component layout and printed-circuit board for 470 MHz test circuit.

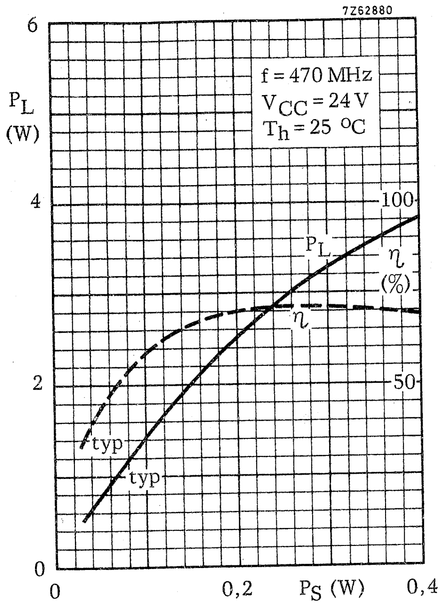


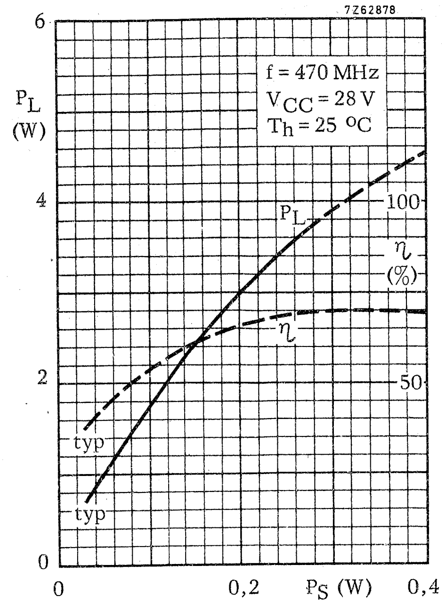
7Z66740

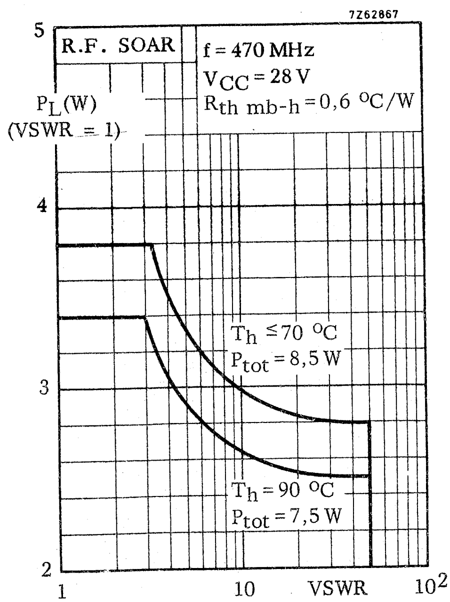


7Z66741.1

Shade area copper
Back area completely copper clad
Material of printed-circuit board: 1,5 mm epoxy fibre-glass



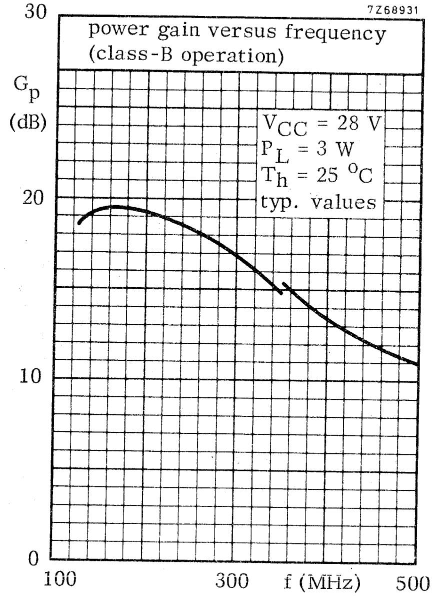


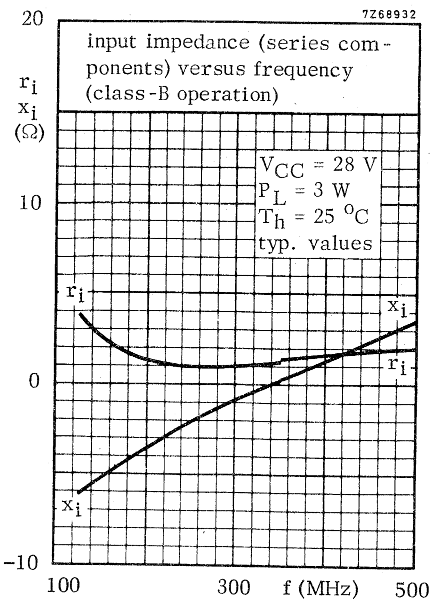


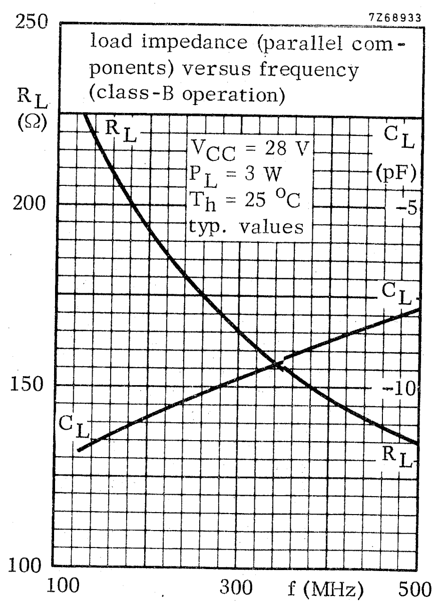
Indicated load power as a function of overload

The graph has been derived from an evaluation of the performance of transistors matched up to 3,8 W load power in the test amplifier on page 7 and subsequently subjected to various **mismatch conditions at 28 V with VSWR up to 50 and elevated heatsink temperatures.** This indicates a restriction to the load power matched under nominal conditions in the recommended test configuration.

OPERATING NOTE Below 350 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation. This resistor must be effective for both d.c. and r.f.







U.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor intended for transmitting applications in class-A, B or C with a supply voltage up to 28 V. The transistor is resistance stabilized and is guaranteed to withstand severe load mismatch conditions. Gold metallization ensures extremely high reliability.

It has a capstan envelope with a moulded cap. All leads are isolated from the stud.

QUICK REFERENCE DATA

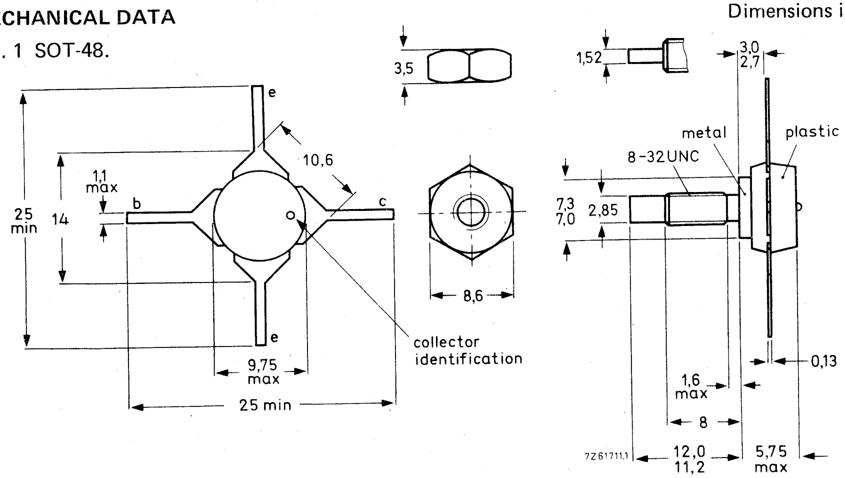
R.F. performance up to T_h = 25 °C in an unneutralized common-emitter class-B circuit

mode of operation	V_{CE} V	f MHz	P_S W	P_L W	I_C A	G_p dB	η %	$\overline{z_i}$ Ω	$\overline{Y_L}$ mA/V
c.w.	24	470	typ. 1,0	7,0	typ. 0,42	typ. 8,5	typ. 70	–	–
c.w.	28	470	< 1,0	7,0	< 0,42	> 8,5	> 60	–	–
c.w.	28	470	typ. 1,0	8,0	typ. 0,38	typ. 9,0	typ. 75	1,8 + j5,3	19 – j32
c.w.	28	1000	typ. 1,5	5,0	typ. 0,40	typ. 5,2	typ. 45	–	–

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-48.



Torque on nut: min. 0,75 Nm (7,5 kg cm)
max. 0,85 Nm (8,5 kg cm)

Diameter of clearance hole in heatsink: max. 4,2 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

When locking is required an adhesive is preferred instead of a lock washer.

CAUTION This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC134)

Voltages

Collector-base voltage (open emitter) peak value	V_{CBOM}	max.	65	V
Collector-emitter voltage (V_{BE} = 0) peak value	V_{CESM}	max.	65	V
Collector-emitter voltage (open base)	V_{CEO}	max.	33	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4,0	V

Currents

Collector current (d.c.)	I_C	max.	1,0	A
Collector current (peak value) f ≥ 10 MHz	I_{CM}	max.	3,0	A

Power dissipation

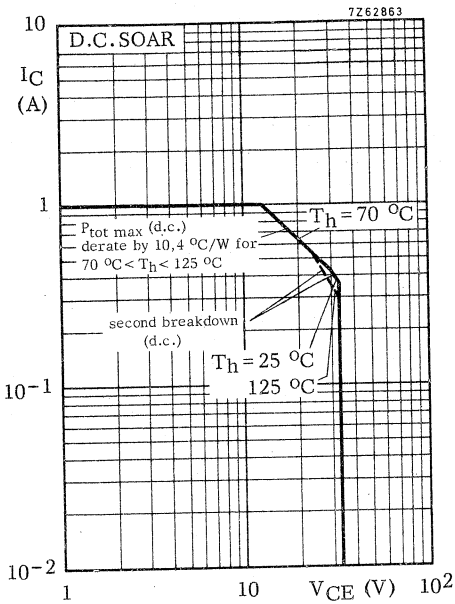
Total power dissipation up to T_h = 70 °C f ≥ 10 MHz (see also page 3)	P_{tot}	max.	12,5	W

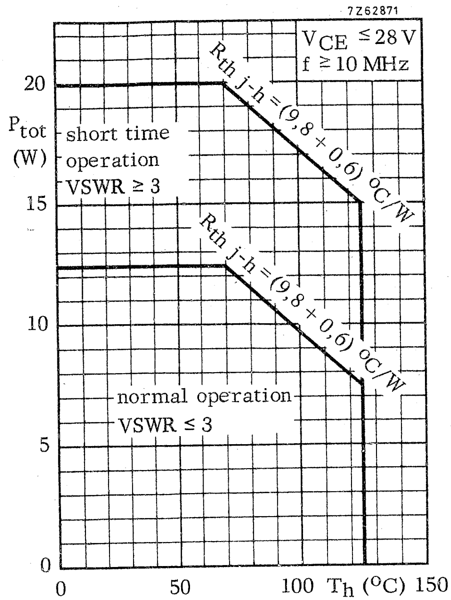
Temperatures

Storage temperature	T_{stg}	-65 to +150		°C
Operating junction temperature	T_j	max.	200	°C

THERMAL RESISTANCE

From junction to mounting base	$R_{th\ j\text{-}mb}$	=	9,8	°C/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,6	°C/W

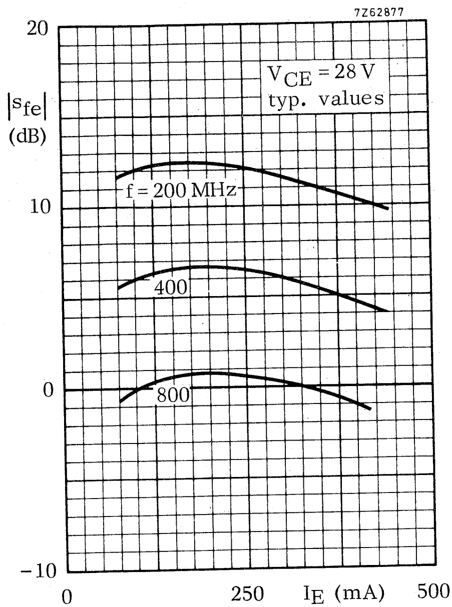

7Z62863
D.C.SOAR
10
1
10^{-1}
10^{-2}
I_C (A)
$P_{tot\ max}$ (d.c.)
derate by 10,4 °C/W for
70 °C < T_h < 125 °C
T_h = 70 °C
second breakdown (d.c.)
T_h = 25 °C
125 °C
1
10
V_{CE} (V)
10^2

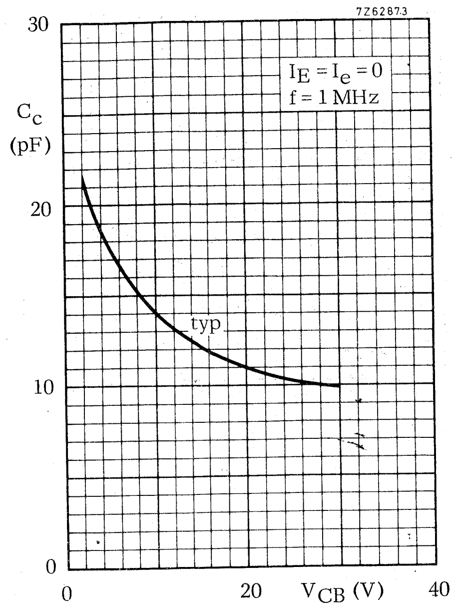

7Z62871
V_{CE} ≤ 28 V
f ≥ 10 MHz
P_{tot} (W)
20
15
10
5
0
short time
operation
VSWR ≥ 3
$R_{th\ j\text{-}h}$ = (9,8 + 0,6) °C/W
$R_{th\ j\text{-}h}$ = (9,8 + 0,6) °C/W
normal operation
VSWR ≤ 3
0
50
100
T_h (°C)
150

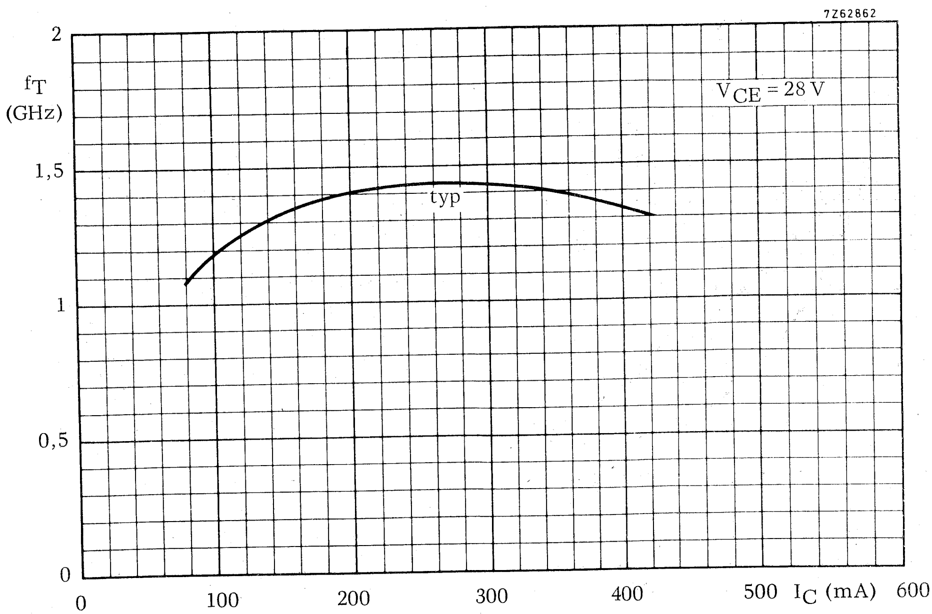
CHARACTERISTICS

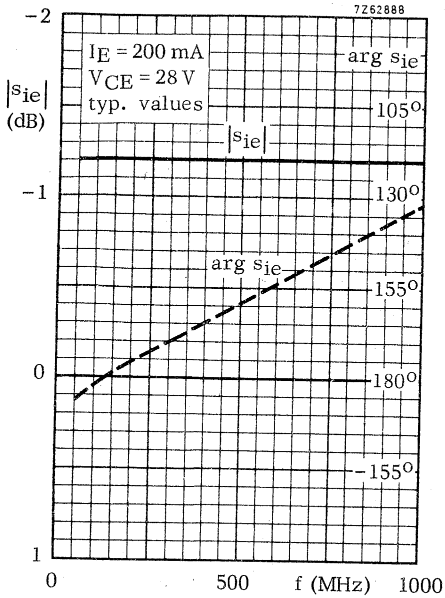
T_j = 25 °C unless otherwise specified

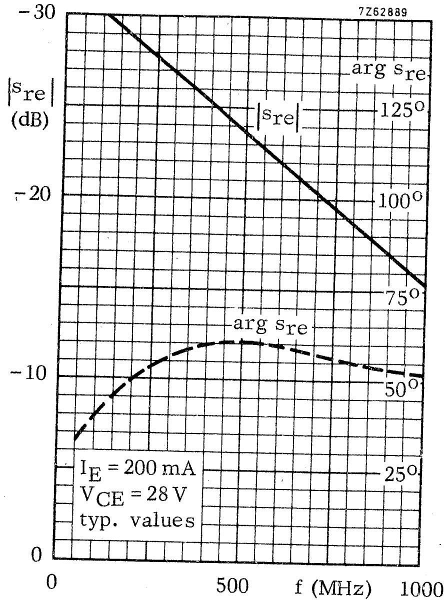
Breakdown voltages				
Collector-base voltage open emitter, I_C = 10 mA	$V_{(BR)CBO}$	>	65	V
Collector-emitter voltage open base, I_C = 10 mA	$V_{(BR)CES}$	>	65	V
Collector-emitter voltage open base, I_C = 25 mA	$V_{(BR)CEO}$	>	33	V
Emitter-base voltage open collector, I_E = 1,0 mA	$V_{(BR)EBO}$	>	4,0	V
D.C. current gain				
I_C = 100 mA; V_{CE} = 5,0 V	h_{FE}	> typ.	10 35	
Transition frequency				
I_C = 200 mA; V_{CE} = 5,0 V	f_T	typ.	1,2	GHz
Collector capacitance at f = 1 MHz				
$I_E = I_e = 0$; V_{CB} = 10 V	C_c	typ.	14	pF
Emitter capacitance at f = 1 MHz				
$I_C = I_c = 0$; $V_{EB} = 0$	C_e	typ.	60	pF
Feedback capacitance at f = 1 MHz				
I_C = 20 mA; V_{CE} = 10 V	C_{re}	typ.	10	pF
Collector-stud capacitance	C_{cs}	typ.	2,0	pF

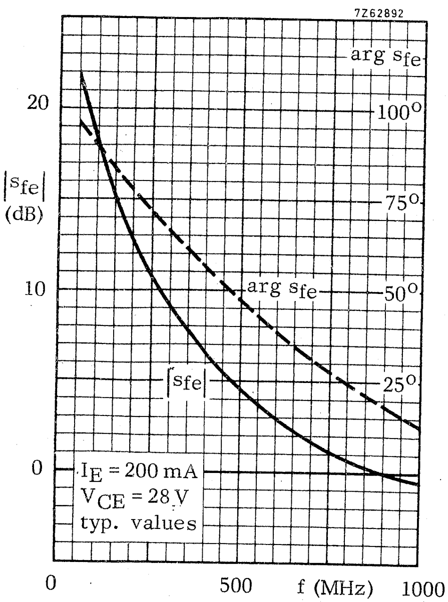

7Z62877
20
10
0
−10
|s_fe|
(dB)
V_CE = 28 V
typ. values
f = 200 MHz
400
800
0
250
I_E (mA)
500

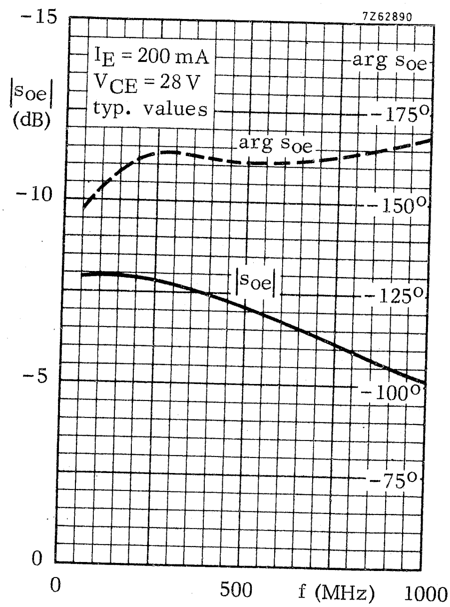

7Z62873
30
20
10
0
C_c
(pF)
I_E = I_e = 0
f = 1 MHz
typ
0
20
V_CB (V)
40


7Z62862
2
1,5
1
0,5
0
f_T
(GHz)
V_CE = 28 V
typ
0
100
200
300
400
500
I_C (mA)
600


7Z62888
I_E = 200 mA
V_{CE} = 28 V
typ. values
arg s_{ie}
$|s_{ie}|$ (dB)
$|s_{ie}|$
arg s_{ie}
−2
−1
0
1
105°
130°
155°
180°
−155°
0
500
f (MHz)
1000


7Z62889
arg s_{re}
$|s_{re}|$ (dB)
$|s_{re}|$
arg s_{re}
I_E = 200 mA
V_{CE} = 28 V
typ. values
−30
−20
−10
0
125°
100°
75°
50°
25°
0
500
f (MHz)
1000


7Z62892
arg s_{fe}
$|s_{fe}|$ (dB)
arg s_{fe}
$|s_{fe}|$
I_E = 200 mA
V_{CE} = 28 V
typ. values
20
10
0
100°
75°
50°
25°
0
500
f (MHz)
1000


7Z62890
I_E = 200 mA
V_{CE} = 28 V
typ. values
arg s_{oe}
$|s_{oe}|$ (dB)
arg s_{oe}
$|s_{oe}|$
−15
−10
−5
0
−175°
−150°
−125°
−100°
−75°
0
500
f (MHz)
1000

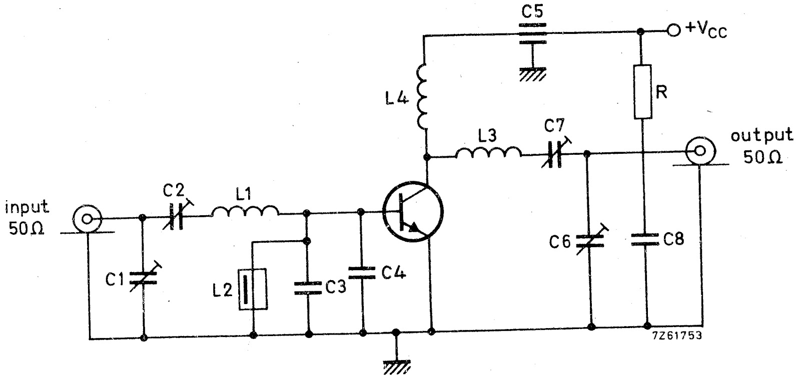
APPLICATION INFORMATION

R.F. performance in c.w. operation (Unneutralized common-emitter class-B circuit)

T_h = 25 °C

V_{CC} (V)	f (MHz)	P_S (W)	P_L (W)	I_C (A)	G_p (dB)	η (%)	$\overline{z_i}$ (Ω)	$\overline{Y_L}$ (mA/V)
24	470	typ. 1,0	7,0	typ. 0,42	typ. 8,5	typ. 70	–	–
28	470	< 1,0	7,0	< 0,42	> 8,5	> 60	–	–
28	470	typ. 1,0	8,0	typ. 0,38	typ. 9,0	typ. 75	1,8 + j5,3	19 – j32
28	1000	typ. 1,5	5,0	typ. 0,40	typ. 5,2	typ. 45	–	–

Test circuit for 470 MHz:



C1 = C2 = 1,8 to 18 pF film dielectric trimmer
C3 = C4 = 18 pF disc ceramic capacitor
C5 = 1 nF feed-through capacitor
C6 = C7 = 1,0 to 9,0 pF film dielectric trimmer
C8 = 0,1 μF polyester capacitor

L1 = 1 turn Cu wire (1,2 mm); int. dia. 5 mm; lead length = 2 mm
L2 = 0,47 μH choke
L3 = 2 turns closely wound enamelled Cu wire (1,2 mm); int. dia. 6,5 mm; lead length = 4 mm
L4 = 3 turns closely wound enamelled Cu wire (0,5 mm); int. dia. 4,0 mm; lead length = 5 mm

R = 10 Ω carbon

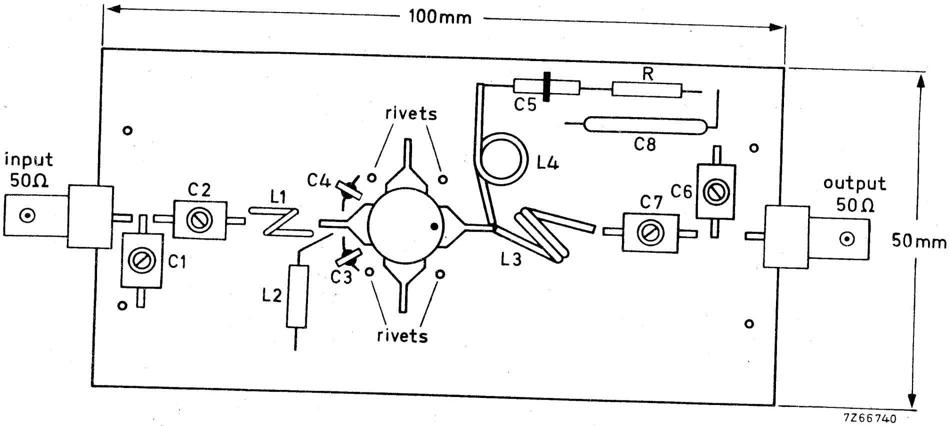
At P_L = 7,0 W and V_{CC} = 28 V, the output power at heatsink temperatures between 25 °C and 90 °C relative to that at 25 °C is diminished by typ. 10 mW/°C.

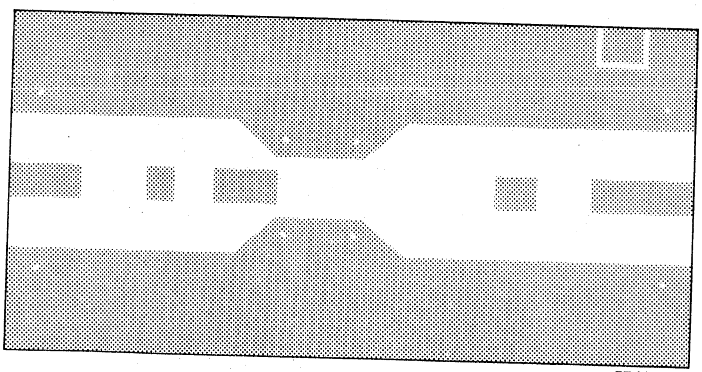
The transistor is designed to withstand full load mismatch in the test circuit under the following conditions: V_{CC} = 28 V; f = 470 MHz; T_h = 90 °C.
VSWR = 50 : 1 through all phases; P_L = 7,0 W.

Component layout for 470 MHz test circuit see page 8.

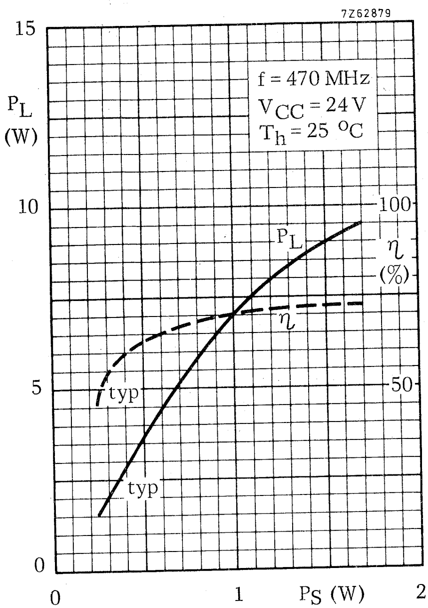
APPLICATION INFORMATION (continued)

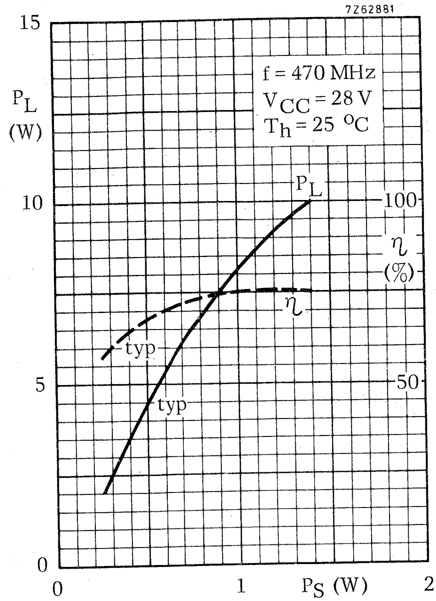
Component layout and printed-circuit board for 470 MHz test circuit.

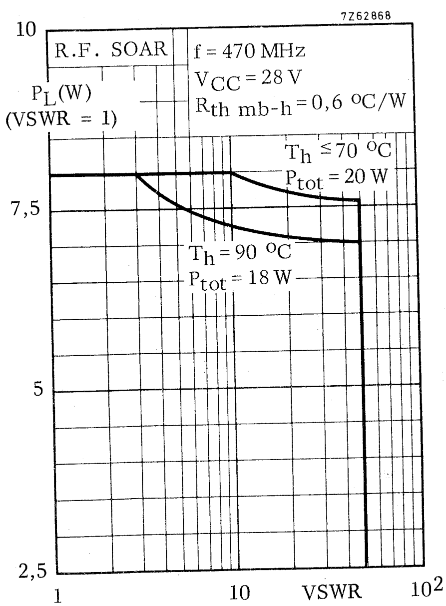




Shaded area copper
Back area completely copper clad
Material of printed-circuit board: 1,5 mm epoxy fibre-glass



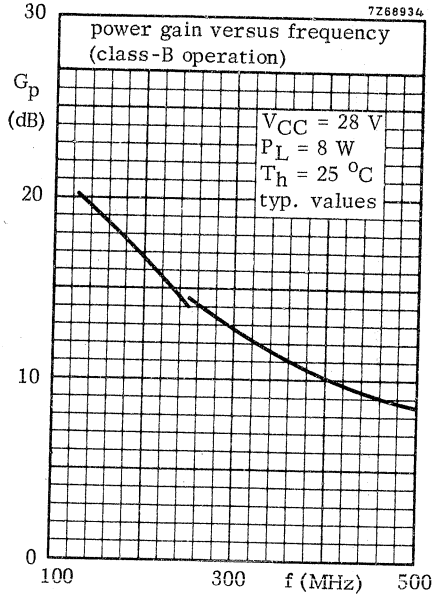


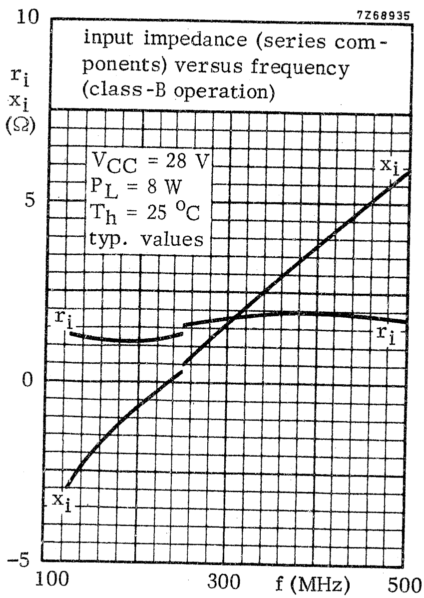


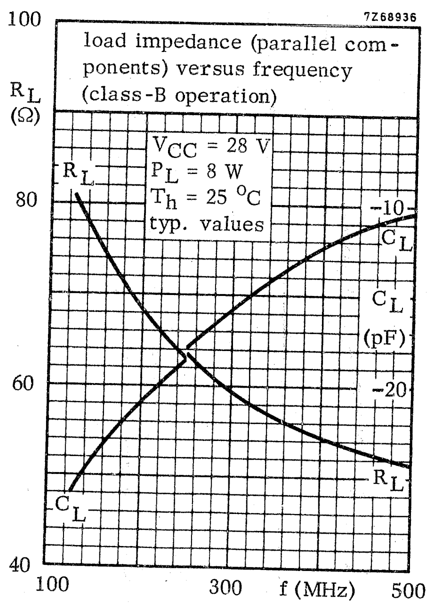
Indicated load power as a function of overload

The graph has been derived from an evaluation of the performance of transistors matched up to 8 W load power in the test amplifier on page 7 and subsequently subjected to various mismatch conditions at 28 V with VSWR up to 50 and elevated heatsink temperatures. This indicates a restriction to the load power matched under nominal conditions in the recommended test configuration.

OPERATING NOTE Below 250 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation. This resistor must be effective for both d.c. and r.f.







U.H.F. POWER TRANSISTORS

N-P-N silicon planar epitaxial transistors suitable for transmitting applications in class-A, B or C in the u.h.f. range for a nominal supply voltage up to 28 V. The transistors are resistance stabilized and tested under severe load mismatch conditions. Diffused emitter-ballasting resistors and gold sandwich metallization ensure excellent reliability properties.

These transistors are housed in capstan envelopes with ¼" studs, the **BLX94A** has a transfer-moulded cap and the **BLX94C** a ceramic cap.

All leads are isolated from the stud.

QUICK REFERENCE DATA

R.F. performance at T_h = 25 °C in an unneutralized common-emitter class-B circuit

type number	mode of operation	V_{CE} V	f MHz	P_L W	G_p dB	η %
BLX94A	c.w.	28	470	25	> 6	> 55
BLX94C	c.w.	28	470	25	> 6,5	> 55

MECHANICAL DATA

SOT-48 (see Fig. 1a)
SOT-122 (see Fig. 1b)

MECHANICAL DATA

Fig. 1a SOT-48 (**BLX94A**).

Dimensions in mm

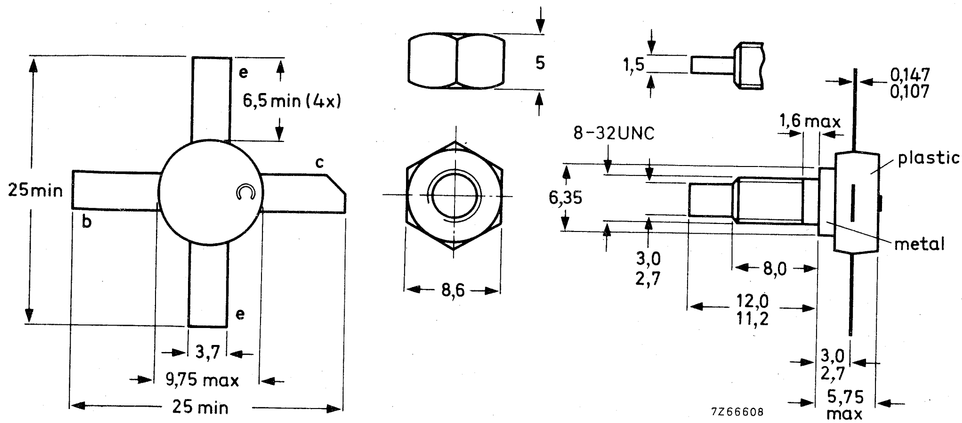
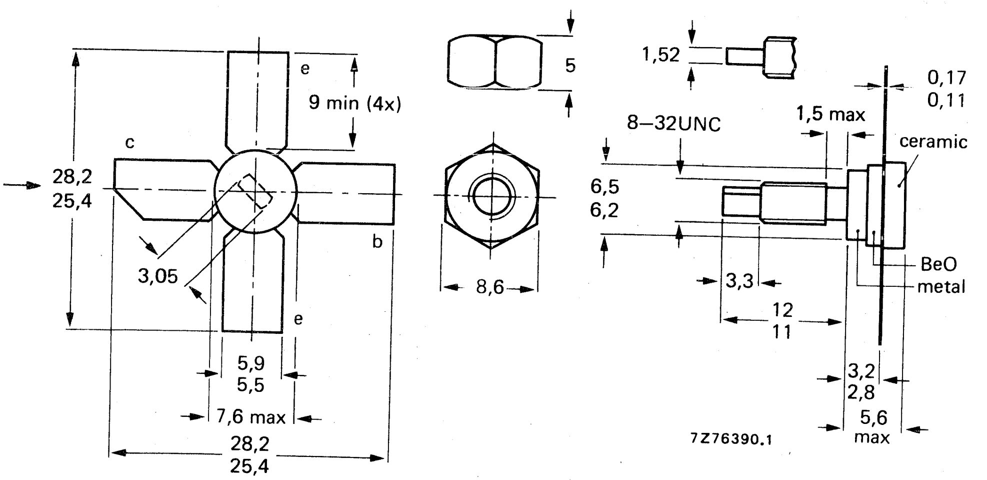


Fig. 1b SOT-122 (**BLX94C**).



Torque on nut: min. 0,75 Nm (7,5 kg cm)
max. 0,85 Nm (8,5 kg cm)

Diameter of clearance hole in heatsink: max. 4,2 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

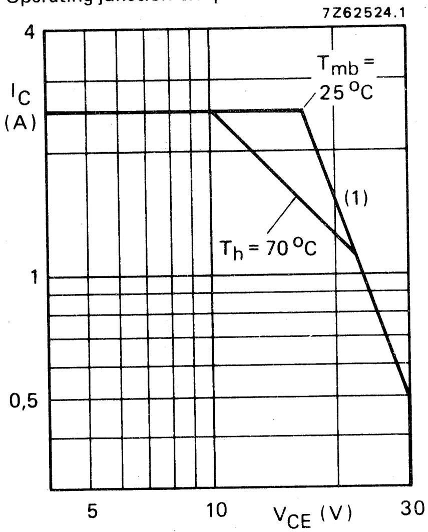
When locking is required an adhesive is preferred instead of a lock washer.

CAUTION These devices incorporate beryllium oxide, the dust of which is toxic. The devices are entirely safe provided that the BeO disc is not damaged.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage				
(peak value); $V_{BE} = 0$		V_{CESM}	max.	65 V
open base		V_{CEO}	max.	30 V
Emitter-base voltage (open collector)		V_{EBO}	max.	4 V
Collector current				
d.c. or average		I_C; $I_{C(AV)}$	max.	2,5 A
(peak value); f > 1 MHz		I_{CM}	max.	6,0 A
R.F. power dissipation (f > 1 MHz); $T_{mb} = 25$ °C		P_{rf}	max.	60 W
Storage temperature	**BLX94A**	T_{stg}		−65 to +200 °C
	BLX94C	T_{stg}		−65 to +150 °C
Operating junction temperature		T_j	max.	200 °C



(1) Second breakdown limit (independent of temperature).

Fig. 2 D.C. SOAR.

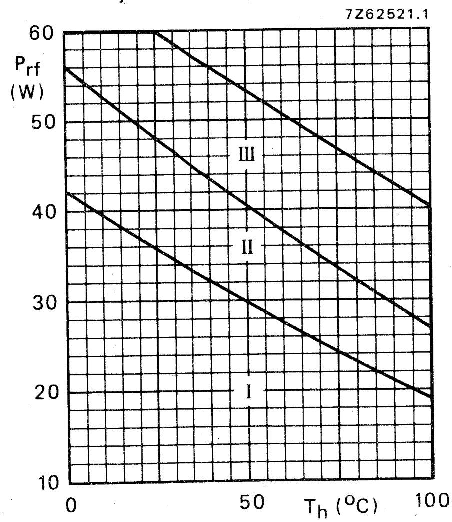


Fig. 3 Power derating curve vs. temperature.
I Continuous d.c. operation
II Continuous r.f. operation
III Short-time operation during mismatch

THERMAL RESISTANCE (dissipation = 20 W; $T_{mb} = 82$ °C, i.e. $T_h = 70$ °C)

From junction to mounting base (d.c. dissipation)	$R_{th\ j\text{-}mb(dc)}$	=	4,0 K/W*
From junction to mounting base (r.f. dissipation)	$R_{th\ j\text{-}mb(rf)}$	=	2,7 K/W*
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,6 K/W*

* K/W is SI unit for °C/W.

CHARACTERISTICS

$T_j = 25\ ^oC$

Collector-emitter breakdown voltage $V_{BE} = 0$; $I_C = 25$ mA	$V_{(BR)CES}$	>	65 V
Collector-emitter breakdown voltage open base; $I_C = 100$ mA	$V_{(BR)CEO}$	>	30 V
Emitter-base breakdown voltage open collector; $I_E = 10$ mA	$V_{(BR)EBO}$	>	4 V
Collector cut-off current $V_{BE} = 0$; $V_{CE} = 30$ V	I_{CES}	<	10 mA
Second breakdown energy; L = 25 mH; f = 50 Hz open base	E_{SBO}	>	3 mJ
$R_{BE} = 10\ \Omega$	E_{SBR}	>	3 mJ
D.C. current gain * $I_C = 1,5$ A; $V_{CE} = 5$ V	h_{FE}	>	15
		typ.	50
Collector-emitter saturation voltage * $I_C = 4,0$ A; $I_B = 0,8$ A	V_{CEsat}	typ.	1,5 V
Transition frequency at f = 500 MHz * $-I_E = 1,5$ A; $V_{CB} = 28$ V	f_T	typ.	1,1 GHz
$-I_E = 4,0$ A; $V_{CB} = 28$ V	f_T	typ.	0,75 GHz
Collector capacitance at f = 1 MHz $I_E = I_e = 0$; $V_{CB} = 28$ V	C_c	typ.	33 pF
Feedback capacitance at f = 1 MHz $I_C = 20$ mA; $V_{CE} = 28$ V	C_{re}	typ.	18 pF
Collector-stud capacitance	C_{cs}	typ.	2 pF

* Measured under pulse conditions: $t_p \leqslant 200\ \mu s$; $\delta \leqslant 0,02$.

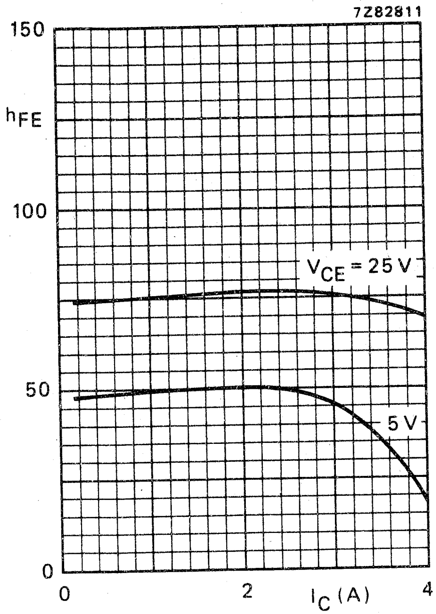


Fig. 4 Typical values; T_j = 25 °C.

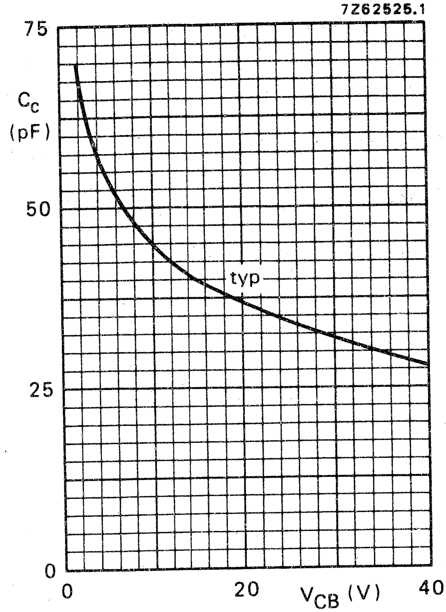


Fig. 5 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

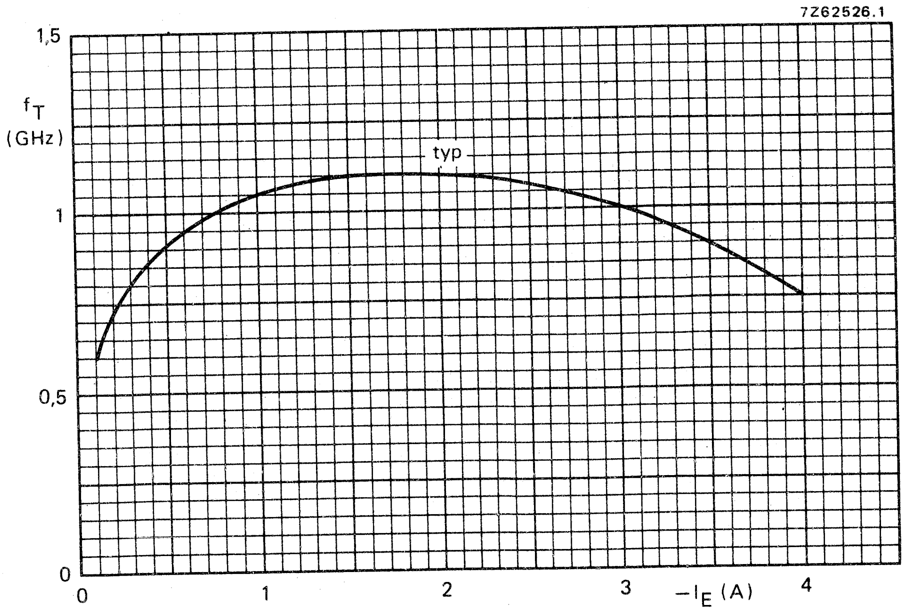


Fig. 6 V_{CB} = 28 V; T_j = 25 °C.

APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit)
f = 470 MHz; T_h = 25 °C

type number	V_{CE} (V)	P_L (W)	P_S (W)	G_p (dB)	I_C (A)	η (%)	$\bar{z}_i$ (Ω)	$\bar{Z}_L$ (Ω)
BLX94A	28	25	< 6,25	> 6	< 1,62	> 55	–	–
	28	25	typ. 5,6	typ. 6,5	typ. 1,49	typ. 60	0,9 + j4,1	6,6 + j6,4
BLX94C	28	25	< 5,6	> 6,5	< 1,62	> 55	–	–
	28	25	typ. 4,7	typ. 7,25	typ. 1,54	typ. 58	0,7 + j2,6	5,8 + j6,3

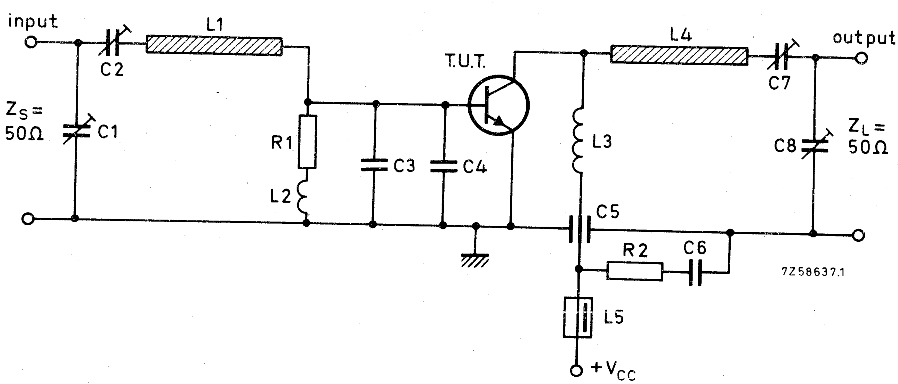


Fig. 7 470 MHz test circuit; c.w. class-B. For component layout and p.c.b. see Fig. 8.

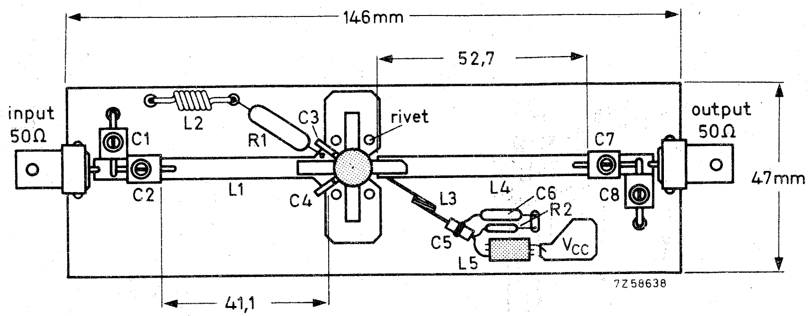
List of components:

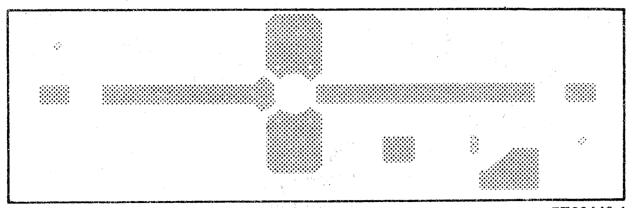
C1 = C2 = C8 = 2 to 9 pF film dielectric trimmer (cat. no. 2222 809 09002)
C3 = C4 = 15 pF chip capacitor
C5 = 100 pF feed-through capacitor
C6 = 33 nF polyester capacitor
C7 = 2 to 18 pF film dielectric trimmer (cat. no. 2222 809 09003)

R1 = 1 Ω carbon resistor
R2 = 10 Ω carbon resistor

L1 = stripline (41,1 mm x 5,0 mm)
L2 = 13 turns closely wound enamelled Cu wire (0,5 mm); int. dia. 4,0 mm
L3 = 2 turns Cu wire (1 mm); winding pitch 1,5 mm; int. dia. 4 mm; leads 2 x 5 mm
L4 = stripline (52,7 mm x 5,0 mm)
L5 = Ferroxcube choke coil. Z (at f = 50 MHz) = 750 Ω ± 20% (cat. no. 4312 020 36640)

L1 and L4 are striplines on a double Cu-clad print plate with PTFE fibre-glass dielectric. (ϵ_r = 2,74); thickness 1,45 mm.





7Z66443.1

Fig. 8 Component layout and printed-circuit board for 470 MHz test circuit.

The circuit and the components are situated on one side of the PTFE fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets.

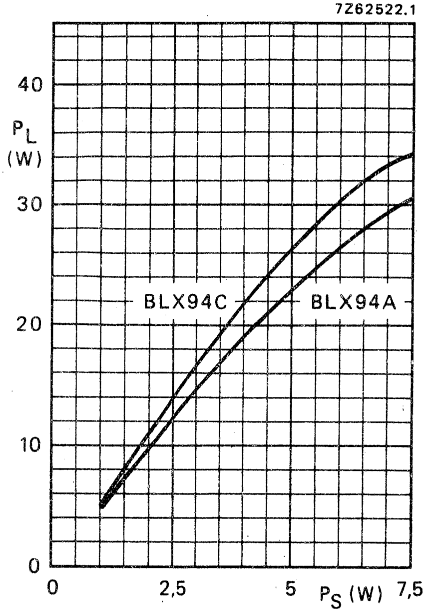


Fig. 9 V_{CE} = 28 V; f = 470 MHz; T_h = 25 °C; typical values.

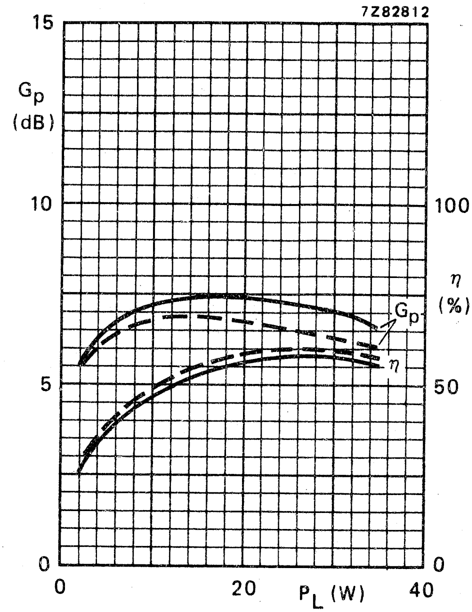


Fig. 10 V_{CE} = 28 V; f = 470 MHz; T_h = 25 °C; typ. values; —— **BLX94A**; —— **BLX94C.**

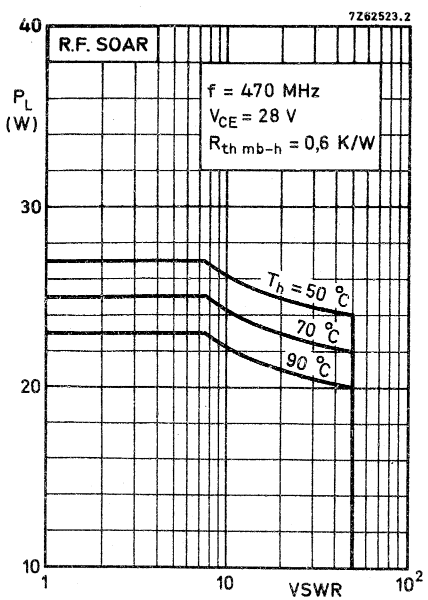


Fig. 11 For high voltage operation, a stabilized power supply is generally used. The graph shows the permissible output power under nominal conditions as a function of the VSWR, with heatsink temperature as parameter.

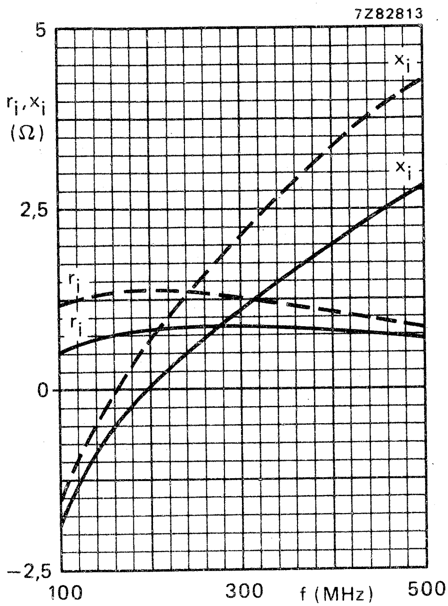


Fig. 12 Input impedance (series components).

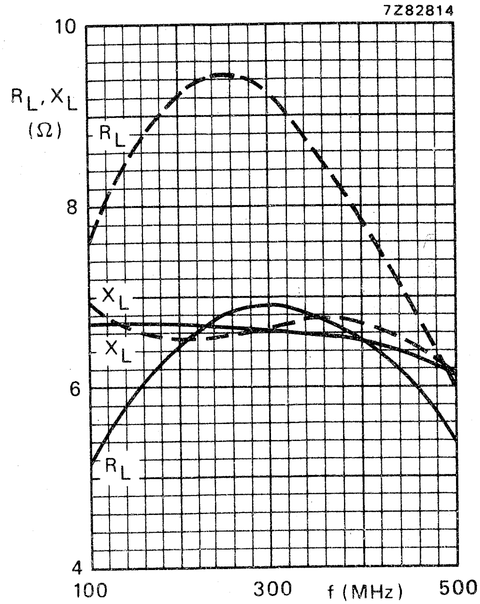


Fig. 13 Load impedance (series components).

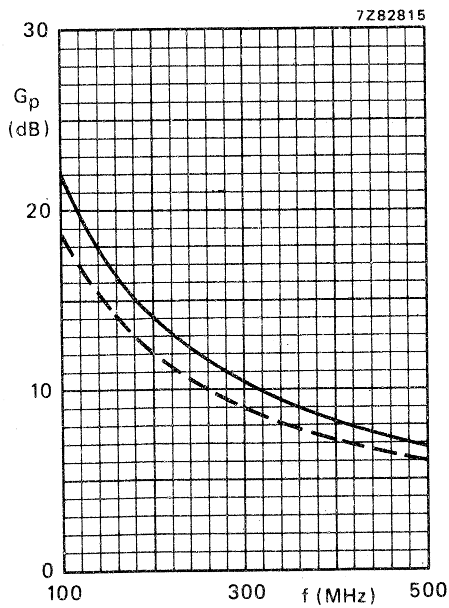


Fig. 14.

Conditions for Figs 12, 13 and 14:

Typical values; V_{CE} = 28 V; P_L = 25 W;
T_h = 25 °C; class-B operation;
– – – **BLX94A**; —— **BLX94C**.

U.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor intended for transmitting applications in class-A, B or C in the u.h.f. frequency range for supply voltages up to 28 V. The transistor is resistance stabilized and is tested under severe load mismatch conditions. Due to a gold metallization excellent reliability properties have been obtained. The transistor is housed in a capstan envelope with a moulded cap. All leads are isolated from the stud.

QUICK REFERENCE DATA

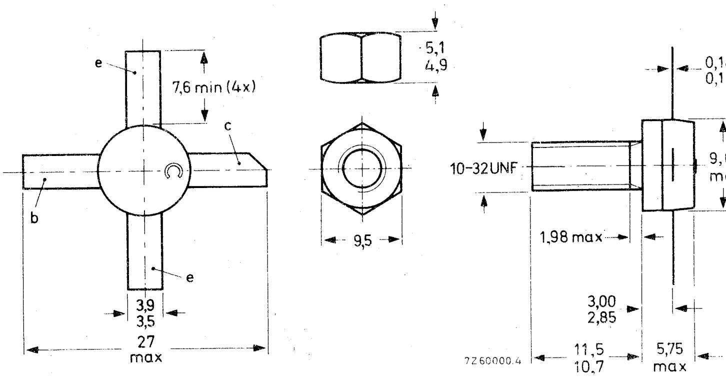
R.F. performance up to T_h = 25 °C in an unneutralized common-emitter class-B circuit

mode of operation	V_{CE} V	f MHz	P_S W	P_L W	I_C A	G_p dB	η %
c.w.	28	470	< 14,2	40	< 2,4	< 4,5	> 60
c.w.	28	175	typ. 3,2	40	typ. 1,9	typ. 11	typ. 75

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-56.



Torque on nut: min. 1,5 Nm
(15 kg cm)
max. 1,7 Nm
(17 kg cm)

Diameter of clearance hole in heatsink: max. 4,9 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

When locking is required an adhesive is preferred instead of a lock washer.

CAUTION This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC134)

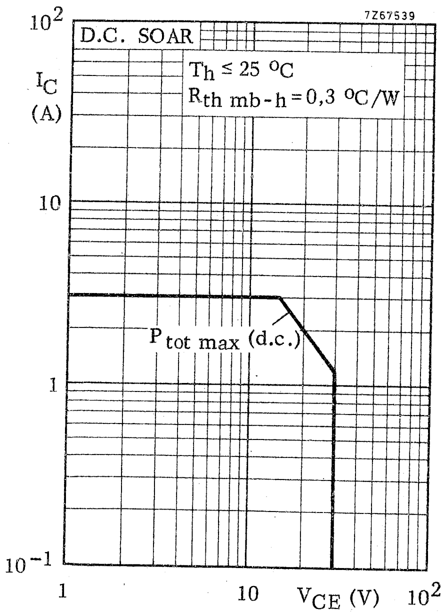
Voltages

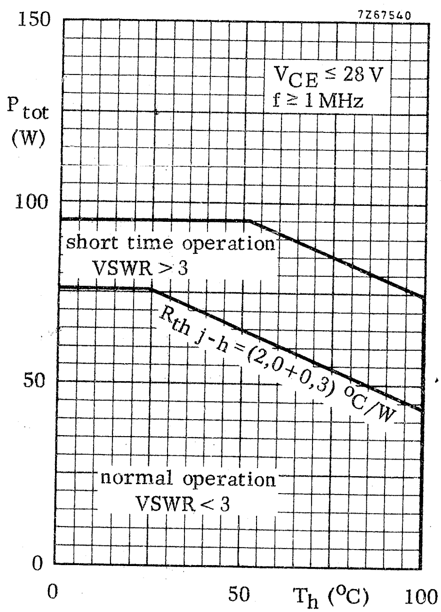
Collector-base voltage (open emitter) peak value	V_{CBOM}	max.	65	V
Collector-emitter voltage ($R_{BE} = 10\,\Omega$) peak value	V_{CERM}	max.	65	V
Collector-emitter voltage (open base)	V_{CEO}	max.	30	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4	V

Currents

Collector current (average)	$I_{C(AV)}$	max.	3,0	A
Collector current (peak value) f > 1 MHz	I_{CM}	max.	10,0	A

Power dissipation





Temperatures

Storage temperature	T_{stg}		−65 to +200	°C
Junction temperature	T_j	max.	200	°C

THERMAL RESISTANCE

From junction to mounting base	$R_{th\ j\text{-}mb}$	=	2,0	°C/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,3	°C/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Breakdown voltages

Collector-base voltage open emitter, I_C = 50 mA	$V_{(BR)CBO}$	>	65	V
Collector-emitter voltage R_{BE} = 10 Ω, I_C = 50 mA	$V_{(BR)CER}$	>	65	V
Collector-emitter voltage open base, I_C = 50 mA	$V_{(BR)CEO}$	>	30	V
Emitter-base voltage open collector, I_E = 10 mA	$V_{(BR)EBO}$	>	4	V

Transient energy

L = 25 mH; f = 50 Hz

open base	E	>	4,5	mWs
$-V_{BE}$ = 1,5 V; R_{BE} = 33 Ω	E	>	4,5	mWs

D.C. current gain

I_C = 1,0 A; V_{CE} = 5 V	h_{FE}	25 to 100		

Transition frequency

I_C = 4 A; V_{CE} = 25 V	f_T	typ.	900	MHz

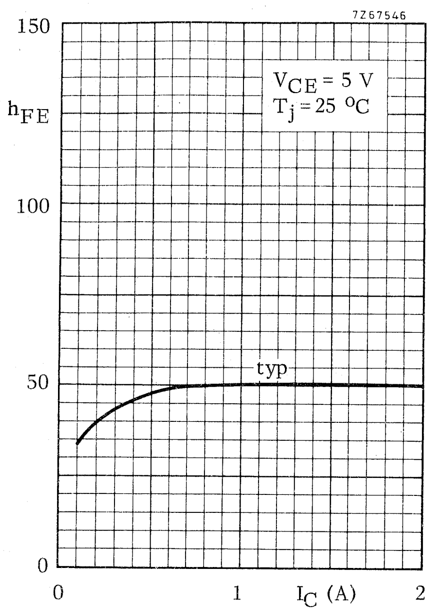
Collector capacitance at f = 1 MHz

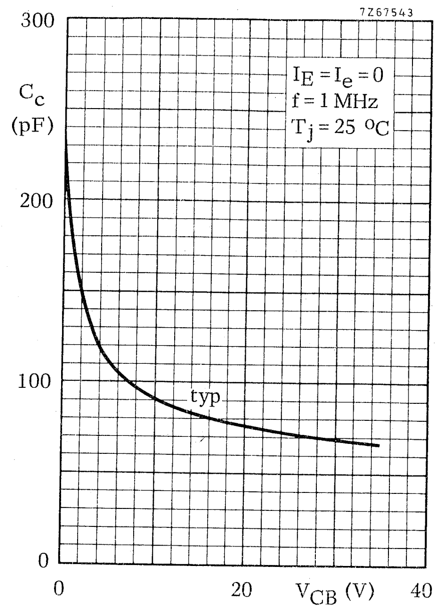
$I_E = I_e$ = 0; V_{CB} = 30 V	C_c	typ.	68	pF
		<	80	pF

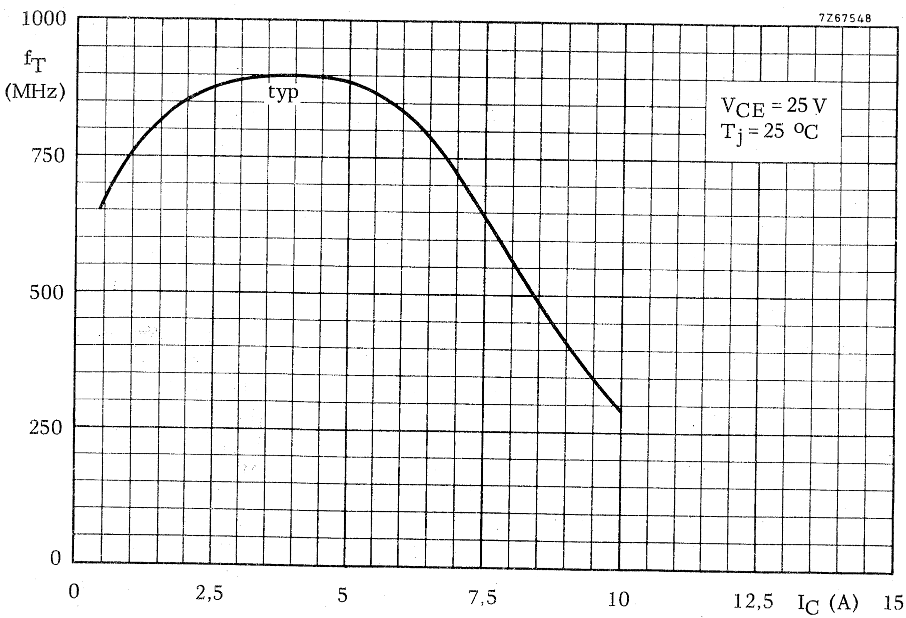
Feedback capacitance at f = 1 MHz

I_C = 200 mA; V_{CE} = 30 V	C_{re}	typ.	39	pF

Collector-stud capacitance	C_{cs}	typ.	2	pF


7Z67546
150
100
50
0
h_{FE}
V_{CE} = 5 V
T_j = 25 °C
typ
0
1
I_C (A)
2


7Z67543
300
200
100
0
C_c
(pF)
I_E = I_e = 0
f = 1 MHz
T_j = 25 °C
typ
0
20
V_{CB} (V)
40


7Z67548
1000
750
500
250
0
f_T
(MHz)
typ
V_{CE} = 25 V
T_j = 25 °C
0
2,5
5
7,5
10
12,5
I_C (A)
15

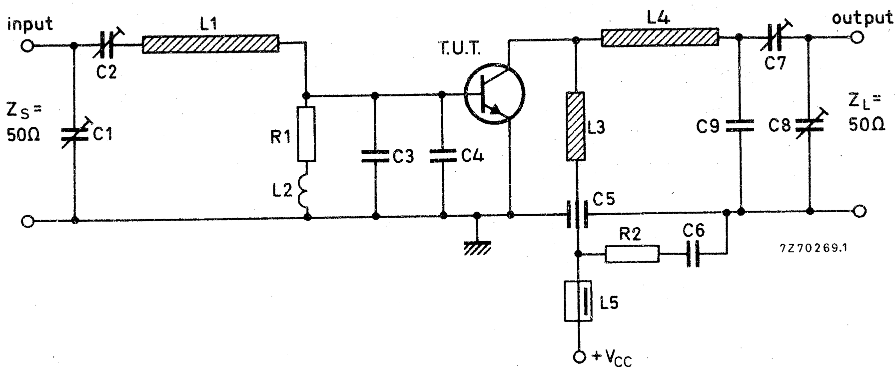
APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit)

V_{CE} = 28 V; T_h up to 25 °C

f (MHz)	P_S (W)	P_L (W)	I_C (A)	G_p (dB)	η (%)
470	< 14,2	40	< 2,4	> 4,5	> 60
175	typ. 3,2	40	typ. 1,9	typ. 11	typ. 75

Test circuit: 470 MHz; c.w. class-B.



List of components:

C1 = C7 = C8 = 2 to 18 pF film dielectric trimmer (cat. no. 2222 809 09003)
C2 = 1,8 to 9 pF film dielectric trimmer (cat. no. 2222 809 09002)
C3 = C4 = 18 pF chip capacitor
C5 = 100 pF feed-through capacitor
C6 = 33 nF polyester capacitor
C9 = 2 x 3,3 pF miniature ceramic plate capacitors (in parallel)

R1 = 1 Ω carbon resistor (0,25 W)
R2 = 10 Ω carbon resistor (0,25 W)

L1 = stripline (21,4 mm x 5,3 mm)
L2 = 13 turns closely wound enamelled Cu wire (0,5 mm); internal diameter 4,0 mm
L3 = stripline (43,8 mm x 3,0 mm)
L4 = stripline (45,5 mm x 5,3 mm)
L5 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)

L1; L3; L4 are striplines on a double Cu-clad print plate with PTFE fibre-glass dielectric. (ϵ_r = 2,74); thickness 1/32".

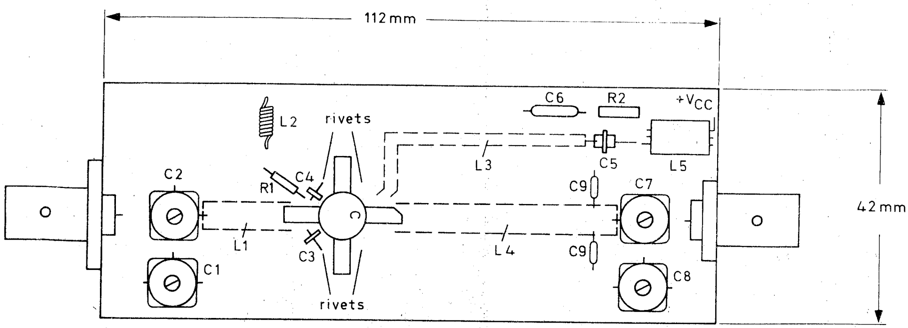
At P_L = 40 W and V_{CE} = 28 V, the output power at heatsink temperatures between 25 °C and 70 °C relative to that at 25 °C is diminished by typ. 50 mW/°C.

The transistor is designed to withstand full load mismatch in the test circuit under the following conditions: V_{CE} = 28 V; f = 470 MHz; T_h = 70 °C.
VSWR = 50 through all phases; P_L = 36 W.

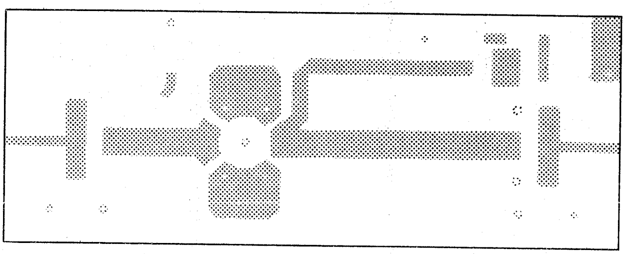
Component layout and printed-circuit board for 470 MHz test circuit see page 6.

APPLICATION INFORMATION (continued)

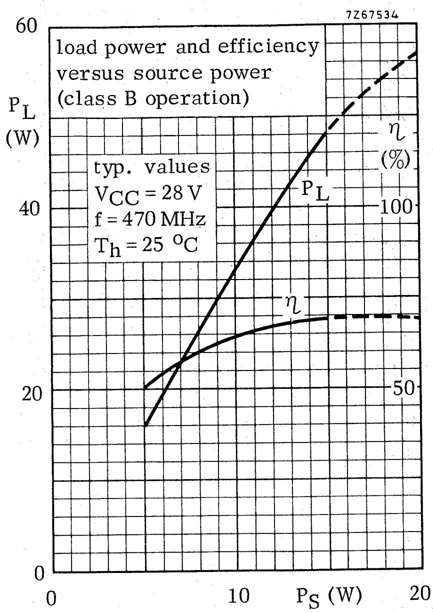
Component layout and printed-circuit board for 470 MHz test circuit.

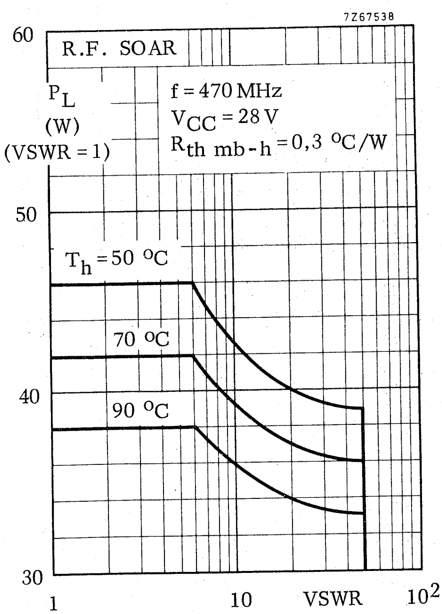


7Z67605.1



The circuit and the components are situated on one side of the PTFE fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets.



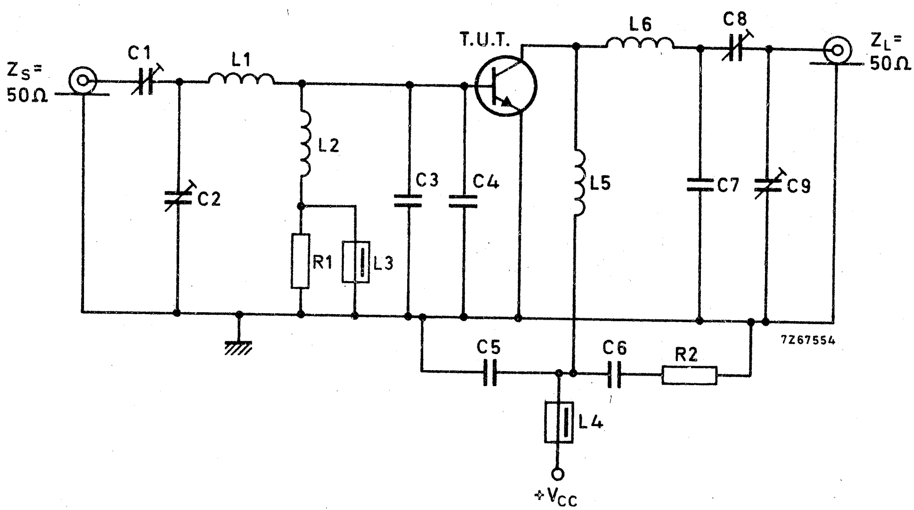


Indicated load power as a function of overload.

The graph has been derived from an evaluation of the performance of transistors matched up to 46 W load power in the test amplifier on page 5 and subsequently subjected to various mismatch conditions at 28 V with VSWR up to 50 and elevated heatsink temperatures.
This indicates a restriction to the load power matched under nominal conditions in the recommended test configuration.

APPLICATION INFORMATION (continued)

Test circuit for 175 MHz:



List of components:

C1 = 2,5 to 20 pF film dielectric trimmer (code number 2222 809 07004)
C2 = 4 to 40 pF film dielectric trimmer (code number 2222 809 07008)
C3 = C4 = 47 pF ceramic capacitor
C5 = 100 pF ceramic capacitor
C6 = 100 nF polyester capacitor
C7 = 6,8 pF ceramic capacitor
C8 = 4 to 60 pF film dielectric trimmer (code number 2222 809 07011)
C9 = 4 to 100 pF film dielectric trimmer (code number 2222 809 07015)

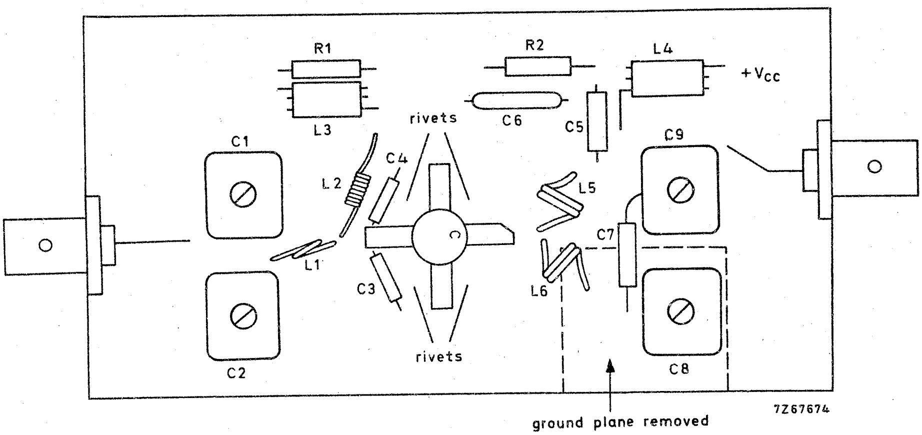
L1 = 0,5 turn enamelled Cu wire (1,5 mm); int. diam. 6 mm; lead length 2 x 6 mm
L2 = 100 nH; 7 turns closely wound enamelled Cu wire (0,5 mm); int. diam. 3 mm; lead length 2 x 5 mm
L3 = L4 = ferroxcube choke coil (code number 4312 020 36640)
L5 = 53 nH; 2 turns enamelled Cu wire (1,5 mm); int. diam. 10 mm; coil length 5,2 mm; lead length 2 x 5 mm
L6 = 46 nH; 2 turns enamelled Cu wire (1,5 mm); int. diam. 9 mm; coil length 5,4 mm; lead length 2 x 5 mm

R1 = R2 = 10 Ω carbon resistor (0,25 W)

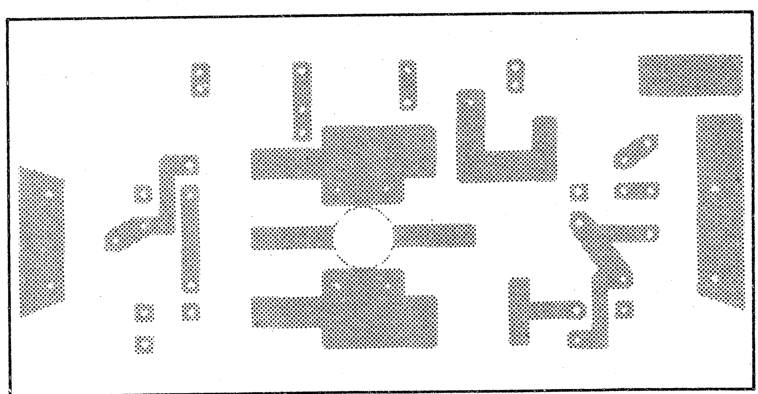
Component lay-out for 175 MHz test circuit see page 9.

APPLICATION INFORMATION (continued)

Component lay-out and printed circuit board for 175 MHz test circuit.

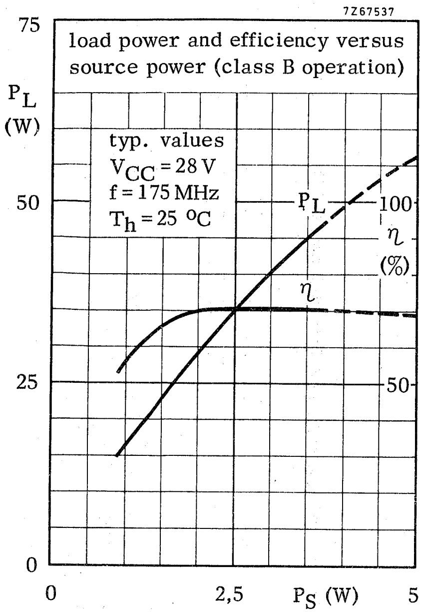


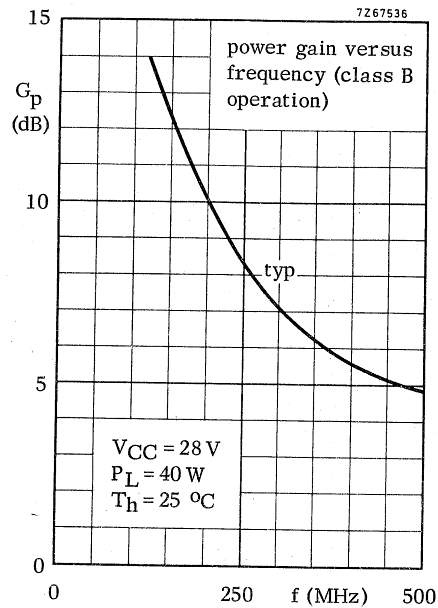
Dimensions of printed circuit board 123 mm x 55 mm.

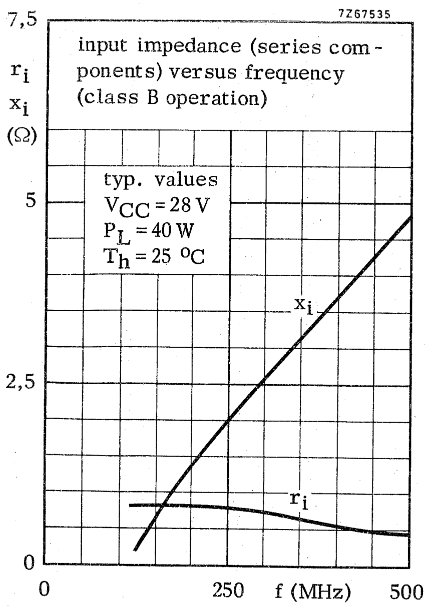


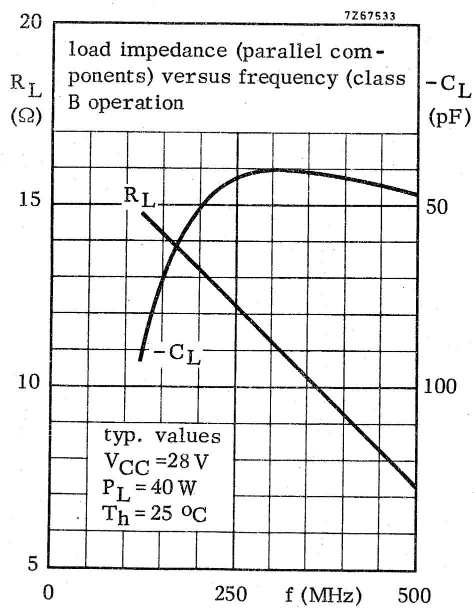
7Z66943

The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets.


7Z67537
load power and efficiency versus source power (class B operation)
P_L (W)
typ. values
V_{CC} = 28 V
f = 175 MHz
T_h = 25 °C
P_L
η
100
η (%)
50
75
50
25
0
0
2,5
P_S (W)
5


7Z67536
power gain versus frequency (class B operation)
G_p (dB)
typ
V_{CC} = 28 V
P_L = 40 W
T_h = 25 °C
15
10
5
0
0
250
f (MHz)
500


7Z67535
input impedance (series components) versus frequency (class B operation)
r_i
x_i
(Ω)
typ. values
V_{CC} = 28 V
P_L = 40 W
T_h = 25 °C
x_i
r_i
7,5
5
2,5
0
0
250
f (MHz)
500


7Z67533
load impedance (parallel components) versus frequency (class B operation
R_L (Ω)
$-C_L$ (pF)
R_L
$-C_L$
typ. values
V_{CC} = 28 V
P_L = 40 W
T_h = 25 °C
20
15
10
5
50
100
0
250
f (MHz)
500

U.H.F. LINEAR POWER TRANSISTOR

N-P-N multi-emitter silicon planar epitaxial transistor primarily for use in linear u.h.f. amplifiers for television transposers and transmitters.

Features:
- guaranteed low intermodulation figures;
- gold metallization ensures excellent reliability.

The transistor has a ¼" capstan envelope with a moulded cap. All leads are isolated from the stud.

QUICK REFERENCE DATA

R.F. performance in linear amplifier

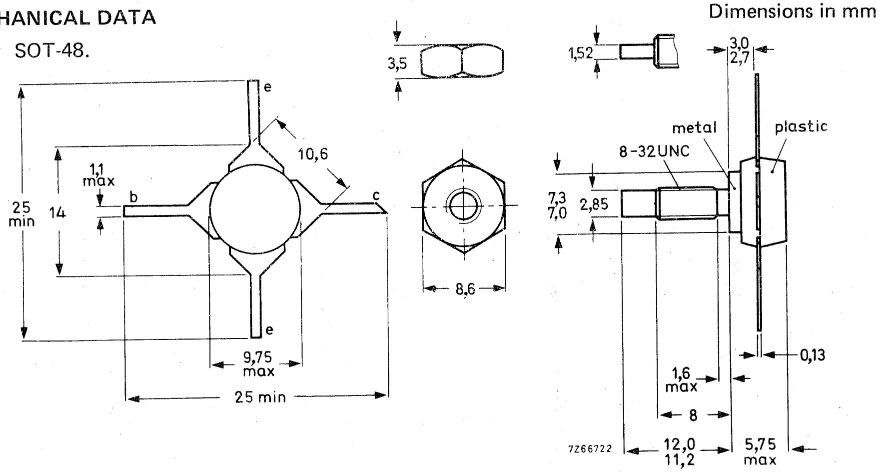
mode of operation	f_{vision} MHz	V_{CE} V	I_C mA	T_h °C	d_{im}* dB	$P_{o\ sync}$* W	G_p dB
class-A	860	25	250	25	−60	> 0,5	> 6
class-A	860	25	250	25	−60	typ. 0,6	typ. 7

* Three-tone test method (vision carrier −8 dB, sound carrier −7 dB, sideband signal −16 dB), zero dB corresponds to peak sync level.

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-48.



Torque on nut: min. 0,75 Nm (7,5 kg cm)
max. 0,85 Nm (8,5 kg cm)

Diameter of clearance hole in heatsink: max. 4,2 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

When locking is required an adhesive is preferred instead of a lock washer.

CAUTION This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC134)

Voltages

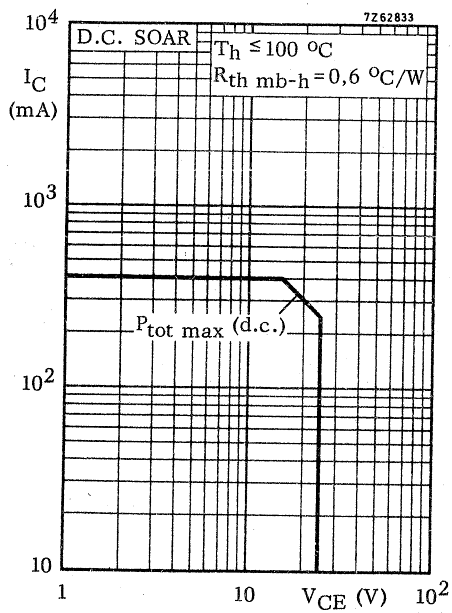
Collector-base voltage (open emitter; peak value)	V_{CBOM}	max.	40	V
Collector-emitter voltage (R_{BE} = 10 Ω; peak value)	V_{CERM}	max.	40	V
Collector-emitter voltage (open base)	V_{CEO}	max.	27	V
Emitter-base voltage (open collector)	V_{EBO}	max.	3,5	V

Currents

Collector current (d.c.)	I_C	max.	0,4	A
Collector current (peak value) f > 1 MHz	I_{CM}	max.	1	A

Power dissipation

Total power dissipation up to T_h = 100 °C	P_{tot}	max.	6,25	W



Temperatures

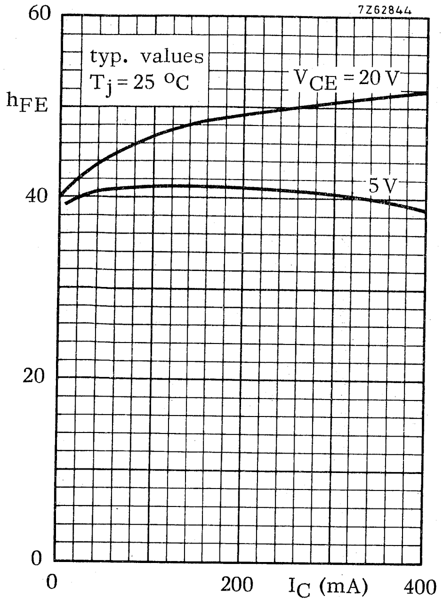
Storage temperature	T_{stg}	−65 to +200	°C
Junction temperature	T_j	max. 200	°C

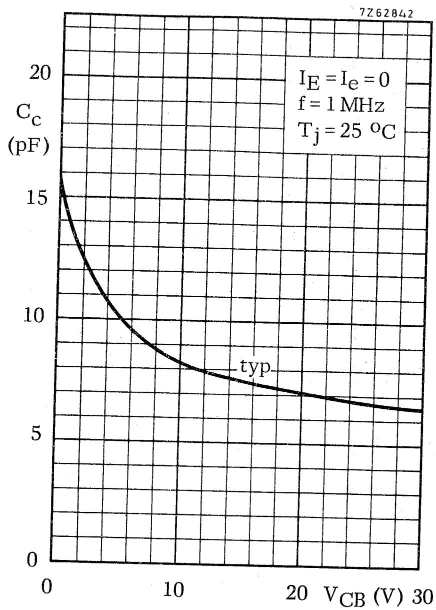
THERMAL RESISTANCE

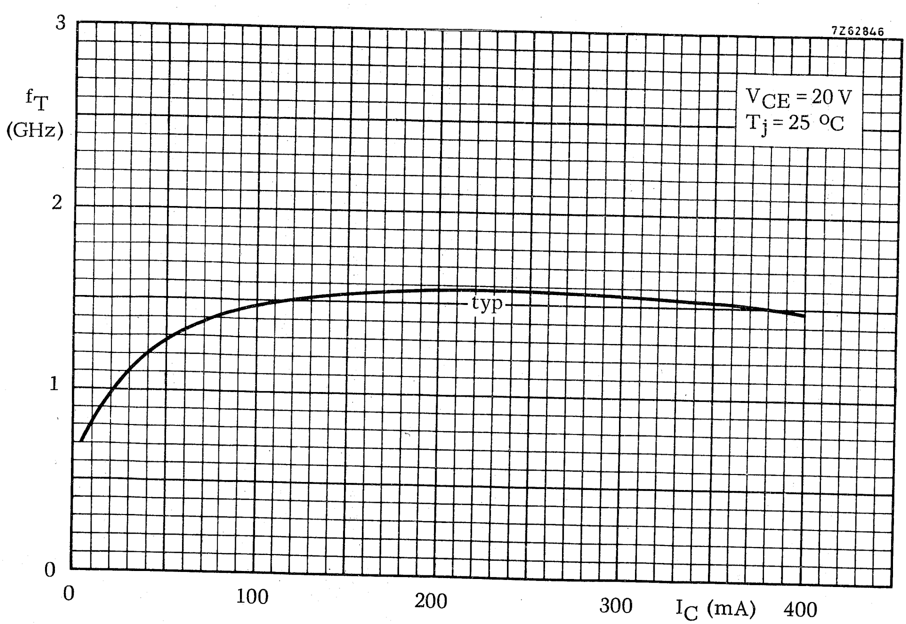
From junction to mounting base	$R_{th\ j-mb}$	=	15	°C/W
From mounting base to heatsink	$R_{th\ mb-h}$	=	0,6	°C/W

CHARACTERISTICS — $T_j = 25\ ^oC$ unless otherwise specified

Collector cut-off current				
$I_E = 0$; $V_{CB} = 20$ V	I_{CBO}	<	100	μA
Breakdown voltages				
Collector-base voltage open emitter; $I_C = 1$ mA	$V_{(BR)CBO}$	>	40	V
Collector-emitter voltage $R_{BE} = 10\ \Omega$; $I_C = 5$ mA	$V_{(BR)CER}$	>	40	V
open base; $I_C = 5$ mA	$V_{(BR)CEO}$	>	27	V
Emitter-base voltage open collector; $I_E = 1$ mA	$V_{(BR)EBO}$	>	3,5	V
Saturation voltage				
$I_C = 200$ mA; $I_B = 20$ mA	V_{CEsat}	<	0,75	V
D.C. current gain				
$I_C = 200$ mA; $V_{CE} = 20$ V	h_{FE}	>	30	
$I_C = 400$ mA; $V_{CE} = 20$ V	h_{FE}	>	20	
Transition frequency				
$I_C = 200$ mA; $V_{CE} = 20$ V	f_T	>	1,2	GHz
$I_C = 350$ mA; $V_{CE} = 20$ V	f_T	>	1,0	GHz
Collector capacitance at f = 1 MHz				
$I_E = I_e = 0$; $V_{CB} = 20$ V	C_c	<	10	pF
Feedback capacitance at f = 1 MHz				
$I_C = 10$ mA; $V_{CE} = 20$ V; $T_{mb} = 25\ ^oC$	C_{re}	typ.	3,5	pF
Collector-stud capacitance	C_{cs}	typ.	2	pF


7Z62844
typ. values
$T_j = 25\ ^oC$
h_{FE}
$V_{CE} = 20\ V$
5 V
60
40
20
0
0
200
I_C (mA)
400


7Z62842
$I_E = I_e = 0$
f = 1 MHz
$T_j = 25\ ^oC$
C_c
(pF)
typ
20
15
10
5
0
0
10
20
V_{CB} (V)
30

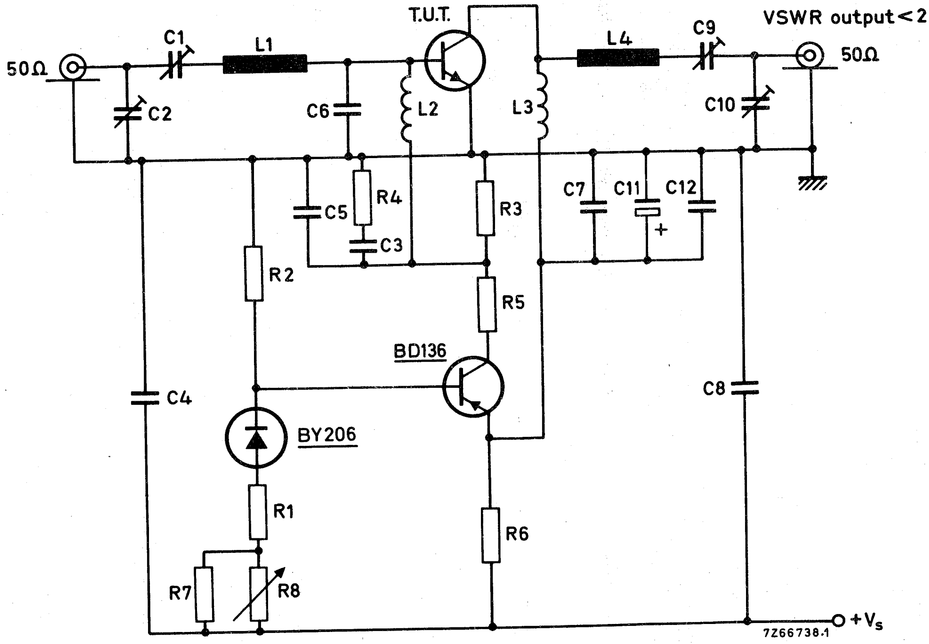

7Z62846
f_T
(GHz)
$V_{CE} = 20\ V$
$T_j = 25\ ^oC$
typ
3
2
1
0
0
100
200
300
I_C (mA)
400

APPLICATION INFORMATION

d_{im}(dB) *)	f_{vision} (MHz)	V_{CE} (V)	I_C (mA)	G_p (dB)	$P_{o\ sync}$ (W) *)	T_h (°C)
−60	860	25	250	> 6	> 0,5	25
−60	860	25	250	typ. 7	typ. 0,6	25

*) Three-tone test method (vision carrier −8 dB, sound carrier −7 dB, sideband signal −16 dB), zero dB corresponds to peak sync level.

Test circuit at f_{vision} = 860 MHz



List of components: (see also page 6)

C1 = C2 = C10 = 2 to 9 pF film dielectric trimmers
C3 = C4 = C12 = 100 nF polyester capacitors
C5 = C7 = C8 = 100 pF feed-through capacitors
C6 = 2 x 2,7 pF in parallel, chip capacitors
C9 = 2 to 18 pF film dielectric trimmer
C11 = 10 μF/40 V solid aluminium electrolytic capacitor

R1 = 220 Ω
R2 = 4,7 kΩ
R3 = 100 Ω
R4 = 10 Ω

R5 = 470 Ω (1 W)
R6 = 3 x 22 Ω in parallel; (1 W)
R7 = 12 kΩ
R8 = 1 kΩ

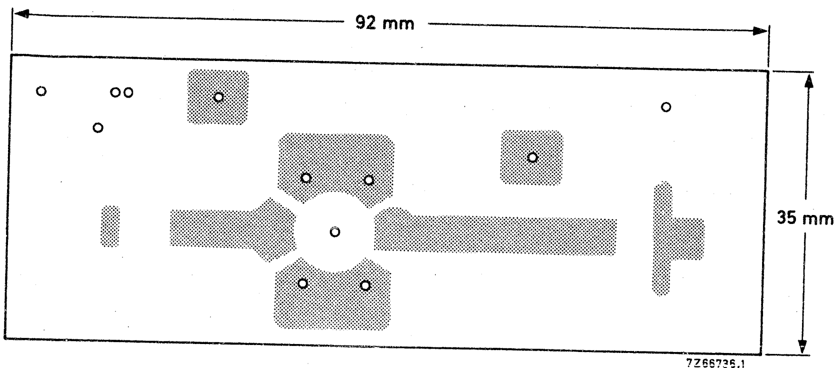
APPLICATION INFORMATION (continued)

List of components: (continued)

L1 = stripline (14,8 mm x 4,3 mm)
L2 = 7 turns closely wound enamelled Cu wire (0,5 mm); int. dia. 3 mm
L3 = 2 turns Cu wire (1 mm); winding pitch 1,5 mm; int. dia. 4,5 mm; leads 2 x 5 mm
L4 = stripline (29,5 mm x 4,3 mm)

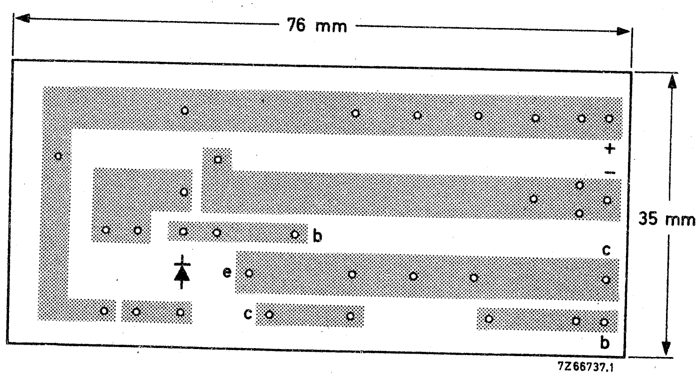
L1 and L4 are striplines on a double Cu-clad print plate with PTFE fibre-glass dielectric (ϵ_r = 2,74); thickness 1,45 mm.

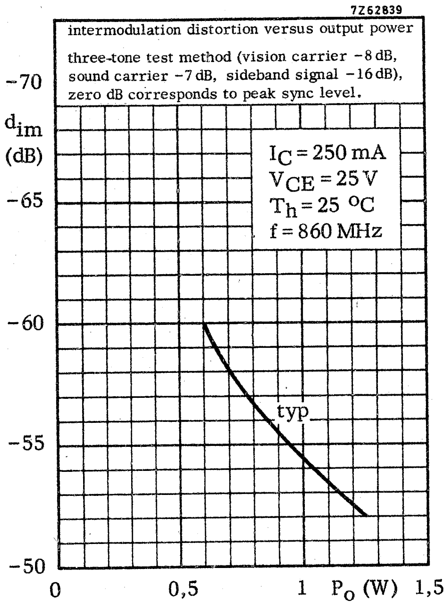
Layout of printed-circuit board for 860 MHz test circuit.

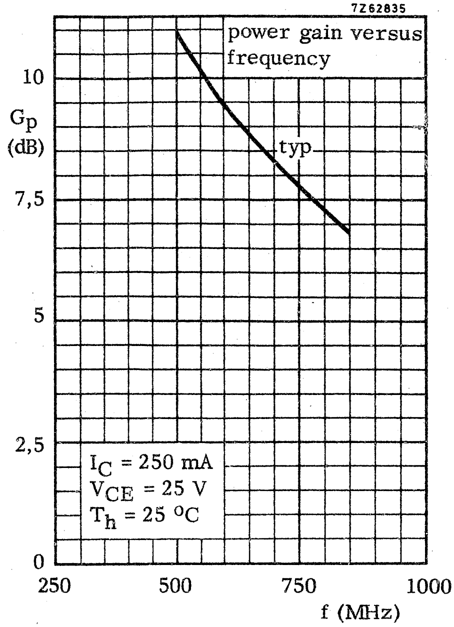


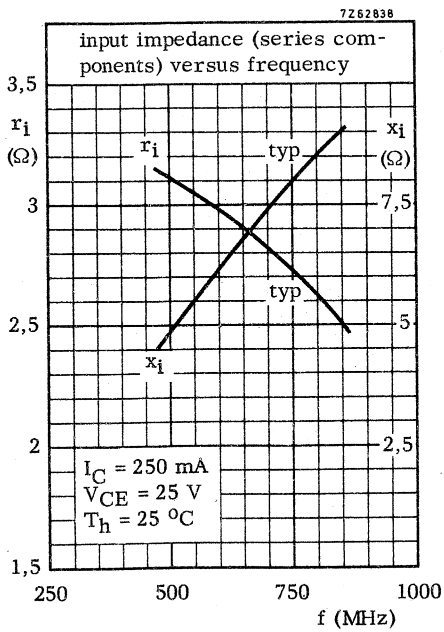
The circuit and the components are situated on one side of the PTFE fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets.

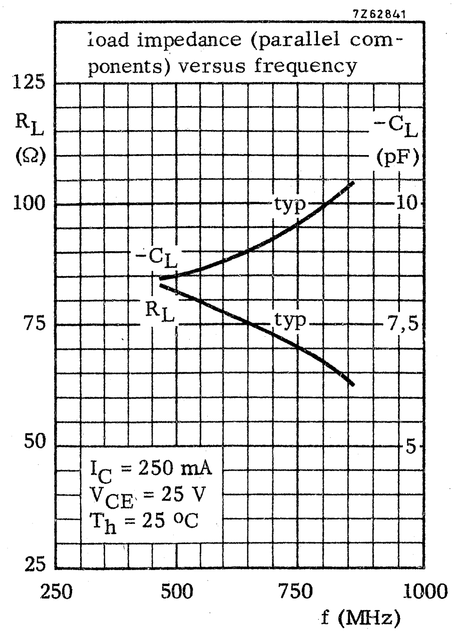
Layout of printed board bias circuit.




7Z62839
intermodulation distortion versus output power
three-tone test method (vision carrier −8 dB, sound carrier −7 dB, sideband signal −16 dB), zero dB corresponds to peak sync level.
I_C = 250 mA
V_{CE} = 25 V
T_h = 25 °C
f = 860 MHz
typ
d_{im} (dB)
−70
−65
−60
−55
−50
0
0,5
1
P_o (W)
1,5


7Z62835
power gain versus frequency
typ
I_C = 250 mA
V_{CE} = 25 V
T_h = 25 °C
G_p (dB)
10
7,5
5
2,5
0
250
500
750
1000
f (MHz)


7Z62838
input impedance (series components) versus frequency
r_i
x_i
typ
typ
I_C = 250 mA
V_{CE} = 25 V
T_h = 25 °C
r_i (Ω)
3,5
3
2,5
2
1,5
x_i (Ω)
7,5
5
2,5
250
500
750
1000
f (MHz)


7Z62841
load impedance (parallel components) versus frequency
$-C_L$
R_L
typ
typ
I_C = 250 mA
V_{CE} = 25 V
T_h = 25 °C
R_L (Ω)
125
100
75
50
25
$-C_L$ (pF)
10
7,5
5
250
500
750
1000
f (MHz)

U.H.F. LINEAR POWER TRANSISTOR

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Features:

- guaranteed low intermodulation figures;
- gold metallization ensures excellent reliability.

The transistor has a ¼" capstan envelope with a moulded cap. All leads are isolated from the stud.

QUICK REFERENCE DATA

R.F. performance in linear amplifier

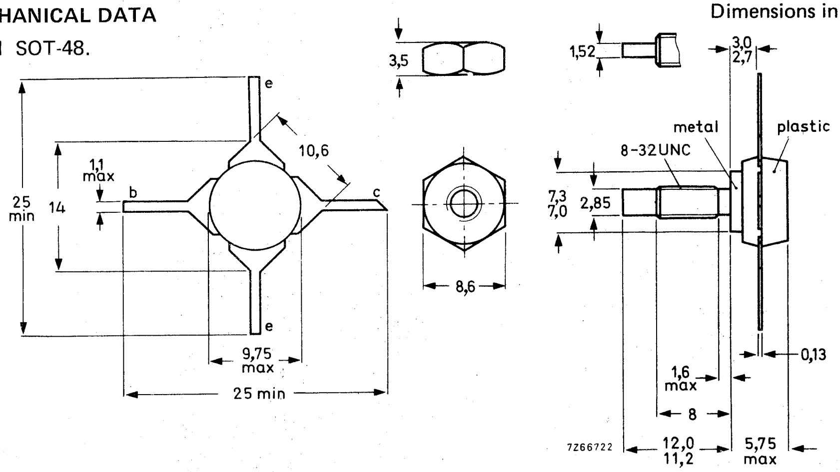
mode of operation	f_{vision} MHz	V_{CE} V	I_C mA	T_h °C	d_{im}* dB	$P_{o\ sync}$* W	G_p dB
class-A	860	25	500	25	−60	> 1,0	> 5,5
class-A	860	25	500	25	−60	typ. 1,1	typ. 6,5

* Three-tone test method (vision carrier −8 dB, sound carrier −7 dB, sideband signal −16 dB), zero dB corresponds to peak sync level.

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-48.



Torque on nut: min. 0,75 Nm (7,5 kg cm)
max. 0,85 Nm (8,5 kg cm)

Diameter of clearance hole in heatsink: max. 4,2 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

When locking is required an adhesive is preferred instead of a lock washer.

CAUTION This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC134)

Voltages

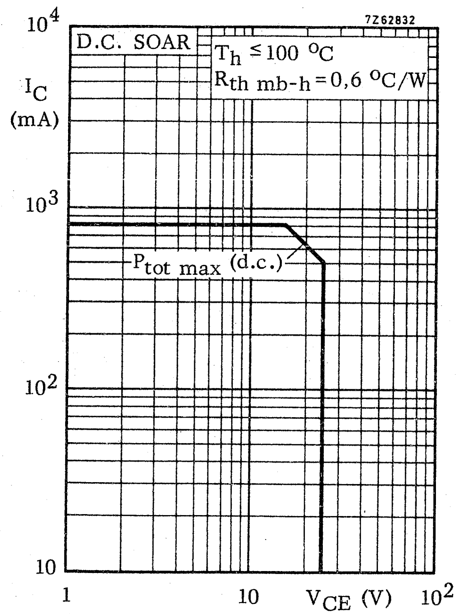
Collector-base voltage (open emitter; peak value)	V_{CBOM}	max.	40	V
Collector-emitter voltage ($R_{BE} = 10\ \Omega$; peak value)	V_{CERM}	max.	40	V
Collector-emitter voltage (open base)	V_{CEO}	max.	27	V
Emitter-base voltage (open collector)	V_{EBO}	max.	3,5	V

Currents

Collector current (d.c.)	I_C	max.	0,8	A
Collector current (peak value) f > 1 MHz	I_{CM}	max.	2	A

Power dissipation

Total power dissipation up to T_h = 100 °C	P_{tot}	max.	12,5	W



Temperatures

Storage temperature	T_{stg}		−65 to +200	°C
Junction temperature	T_j	max.	200	°C

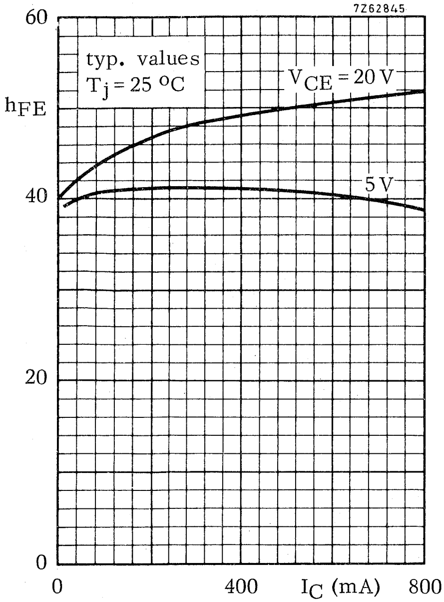
THERMAL RESISTANCE

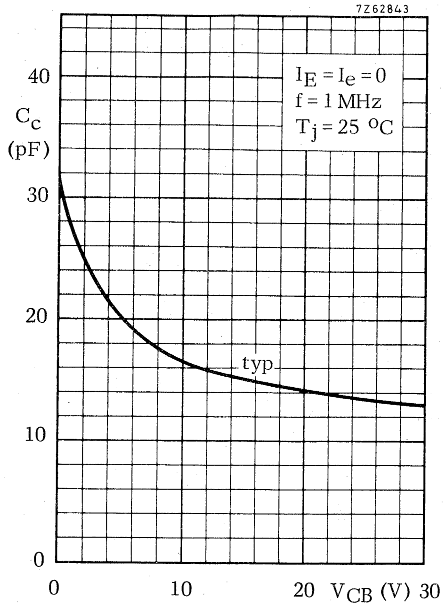
From junction to mounting base	$R_{th\ j-mb}$	=	7,5	°C/W
From mounting base to heatsink	$R_{th\ mb-h}$	=	0,6	°C/W

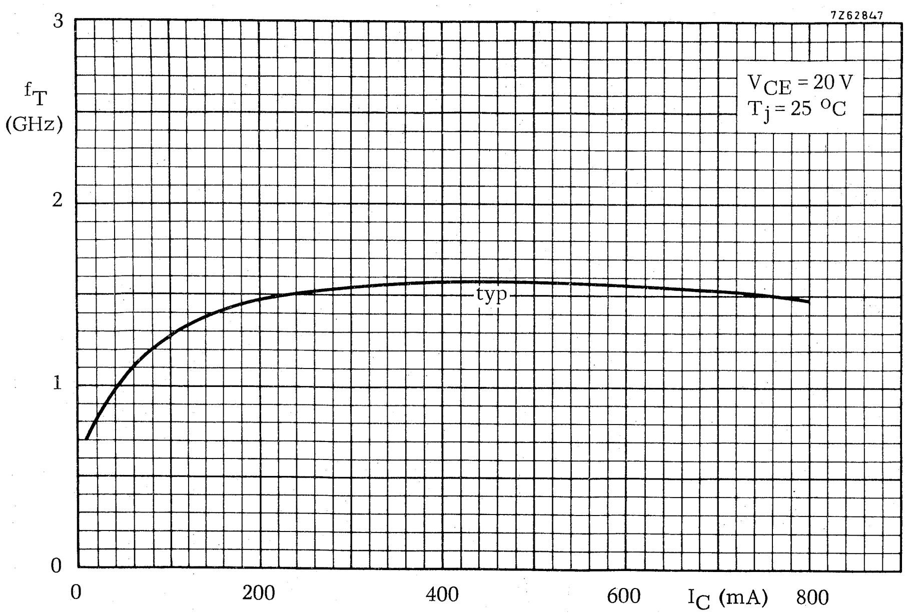
CHARACTERISTICS

$T_j = 25\ ^oC$ unless otherwise specified

Collector cut-off current				
$I_E = 0$; $V_{CB} = 20$ V	I_{CBO}	<	200	μA
Breakdown voltages				
Collector-base voltage				
open emitter; $I_C = 2$ mA	$V_{(BR)CBO}$	>	40	V
Collector-emitter voltage				
$R_{BE} = 10\ \Omega$; $I_C = 10$ mA	$V_{(BR)CER}$	>	40	V
open base; $I_C = 10$ mA	$V_{(BR)CEO}$	>	27	V
Emitter-base voltage				
open collector; $I_E = 2$ mA	$V_{(BR)EBO}$	>	3, 5	V
Saturation voltage				
$I_C = 400$ mA; $I_B = 40$ mA	V_{CEsat}	<	0, 75	V
D.C. current gain				
$I_C = 400$ mA; $V_{CE} = 20$ V	h_{FE}	>	30	
$I_C = 800$ mA; $V_{CE} = 20$ V	h_{FE}	>	20	
Transition frequency				
$I_C = 400$ mA; $V_{CE} = 20$ V	f_T	>	1, 2	GHz
$I_C = 700$ mA; $V_{CE} = 20$ V	f_T	>	1, 0	GHz
Collector capacitance at f = 1 MHz				
$I_E = I_e = 0$; $V_{CB} = 20$ V	C_c	<	20	pF
Feedback capacitance at f = 1 MHz				
$I_C = 20$ mA; $V_{CE} = 20$ V; $T_{mb} = 25\ ^oC$	C_{re}	typ.	7	pF
Collector-stud capacitance	C_{cs}	typ.	2	pF


7Z62845
typ. values
T_j = 25 °C
V_{CE} = 20 V
5 V
h_{FE}
60
40
20
0
0
400
I_C (mA)
800


7Z62843
I_E = I_e = 0
f = 1 MHz
T_j = 25 °C
C_c
(pF)
typ
40
30
20
10
0
0
10
20
V_{CB} (V)
30

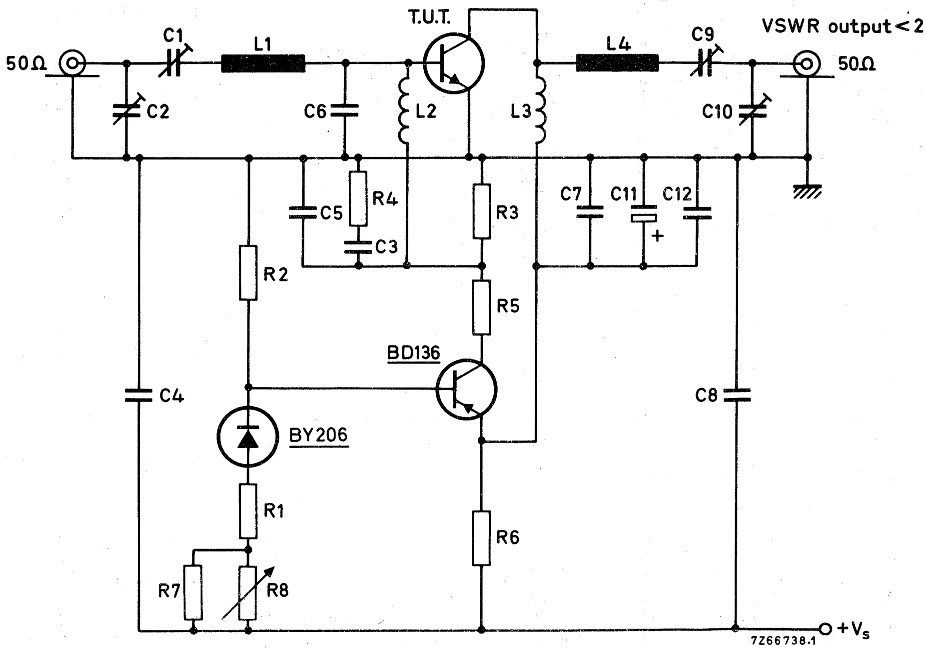

7Z62847
V_{CE} = 20 V
T_j = 25 °C
f_T
(GHz)
typ
3
2
1
0
0
200
400
600
I_C (mA)
800

APPLICATION INFORMATION

d_{im} (dB) *)	f_{vision} (MHz)	V_{CE} (V)	I_C (mA)	G_p (dB)	$P_{o\ sync}$ (W) *)	T_h (°C)
−60	860	25	500	> 5,5	> 1,0	25
−60	860	25	500	typ. 6,5	typ. 1,1	25

*) Three-tone test method (vision carrier −8 dB, sound carrier −7 dB, sideband signal −16 dB), zero dB corresponds to peak sync level.

Test circuit at f_{vision} = 860 MHz



List of components: (see also page 6)

C1 = C2 = C10 = 2 to 9 pF film dielectric trimmers
C3 = C4 = C12 = 100 nF polyester capacitors
C5 = C7 = C8 = 100 pF feed-through capacitors
C6 = 2 x 2,7 pF in parallel, chip capacitors
C9 = 2 to 18 pF film dielectric trimmer
C11 = 10 μF/40 V solid aluminium electrolytic capacitor

R1 = 220 Ω
R2 = 4,7 kΩ
R3 = 100 Ω
R4 = 10 Ω
R5 = 470 Ω (1 W)
R6 = 3 x 22 Ω in parallel; (1 W)
R7 = 12 kΩ
R8 = 1 kΩ

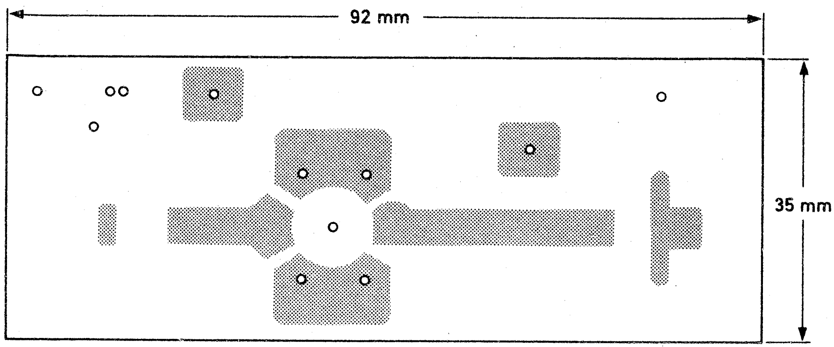
APPLICATION INFORMATION (continued)

List of components: (continued)

L1 = stripline (14,8 mm x 4,3 mm)
L2 = 7 turns closely wound enamelled Cu wire (0,5 mm); int. dia. 3 mm
L3 = 2 turns Cu wire (1 mm); winding pitch 1,5 mm; int. dia. 4,5 mm; leads 2 x 5 mm
L4 = stripline (29,5 mm x 4,3 mm)

L1 and L4 are striplines on a double Cu-clad print plate with PTFE fibre-glass dielectric (ϵ_r = 2,74); thickness 1,45 mm.

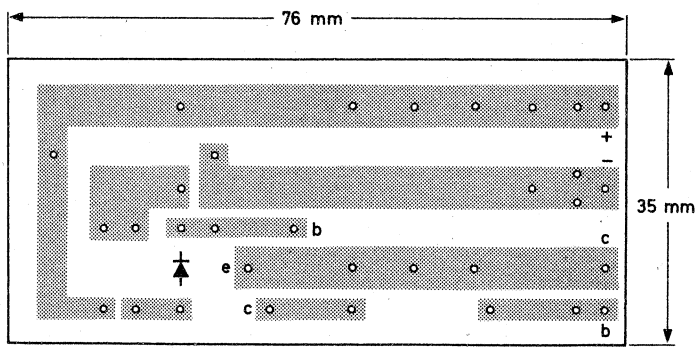
Layout of printed-circuit board for 860 MHz test circuit.



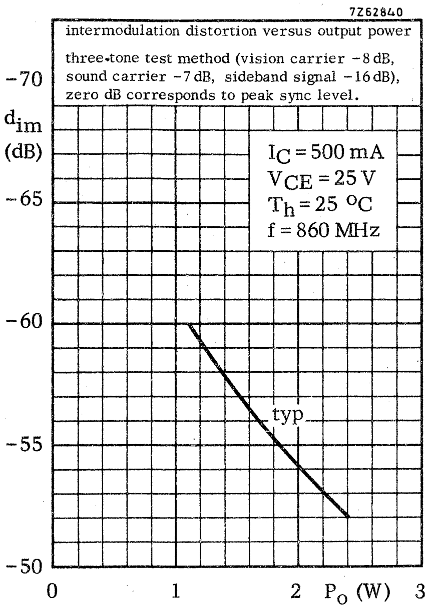
7Z66736.1

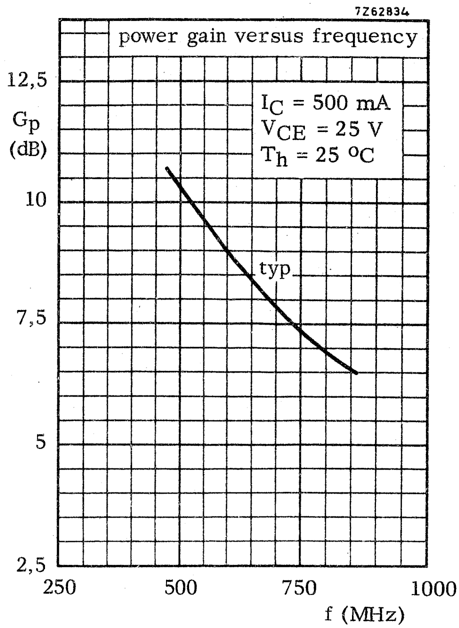
The circuit and the components are situated on one side of the PTFE fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets.

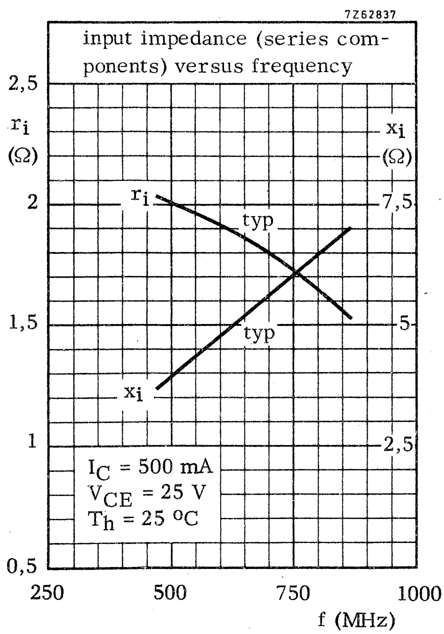
Layout of printed board bias circuit.

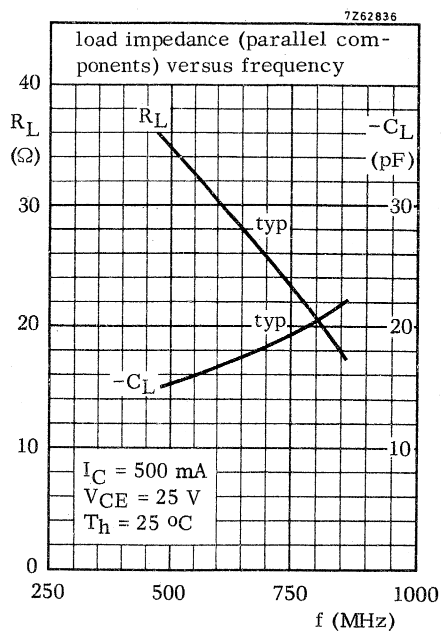


7Z66737.1


7Z62840
intermodulation distortion versus output power
three-tone test method (vision carrier −8 dB, sound carrier −7 dB, sideband signal −16 dB), zero dB corresponds to peak sync level.
d_{im} (dB)
−70
−65
−60
−55
−50
I_C = 500 mA
V_{CE} = 25 V
T_h = 25 °C
f = 860 MHz
typ
0
1
2
P_o (W)
3


7Z62834
power gain versus frequency
G_p (dB)
12,5
10
7,5
5
2,5
I_C = 500 mA
V_{CE} = 25 V
T_h = 25 °C
typ
250
500
750
1000
f (MHz)


7Z62837
input impedance (series components) versus frequency
r_i (Ω)
x_i (Ω)
2,5
2
1,5
1
0,5
7,5
5
2,5
r_i
x_i
typ
typ
I_C = 500 mA
V_{CE} = 25 V
T_h = 25 °C
250
500
750
1000
f (MHz)


7Z62836
load impedance (parallel components) versus frequency
R_L (Ω)
$-C_L$ (pF)
40
30
20
10
0
30
20
10
R_L
$-C_L$
typ
typ
I_C = 500 mA
V_{CE} = 25 V
T_h = 25 °C
250
500
750
1000
f (MHz)

U.H.F. LINEAR POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor primarily intended for use in linear u.h.f. amplifiers of television transposers and transmitters in band IV-V.

Features:

- diffused emitter ballasting resistors for an optimum temperature profile;
- gold metallization ensures excellent reliability.

The transistor has a ¼″ capstan envelope with a moulded cap. All leads are isolated from the stud.

QUICK REFERENCE DATA

R.F. performance in linear amplifier

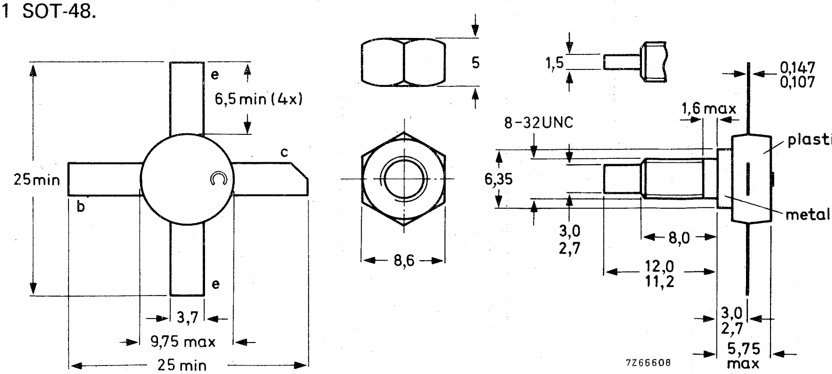
mode of operation	f_{vision} MHz	V_{CE} V	I_C mA	T_h °C	d_{im}* dB	$P_{o\,sync}$* W	G_p dB
class-A	860	25	850	70	−60	> 3,5	> 5,0
class-A	860	25	850	70	−60	typ. 4,0	typ. 5,5

* Three-tone test method (vision carrier −8 dB, sound carrier −7 dB, sideband signal −16 dB), zero dB corresponds to peak sync level.

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-48.



Torque on nut: min. 0,75 Nm (7,5 kg cm)
max. 0,85 Nm (8,5 kg cm)

Diameter of clearance hole in heatsink: max. 4,2 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

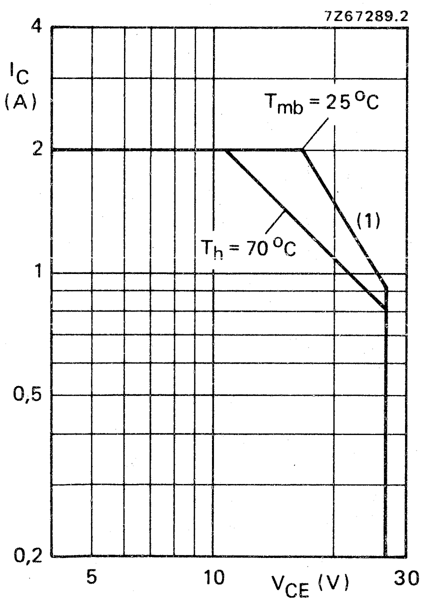
When locking is required an adhesive is preferred instead of a lock washer.

CAUTION This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage			
→ (peak value); $V_{BE} = 0$	V_{CESM}	max.	50 V
open base	V_{CEO}	max.	27 V
Emitter-base voltage (open collector)	V_{EBO}	max.	3,5 V
Collector current			
d.c.	I_C	max.	2 A
(peak value); f > 1 MHz	I_{CM}	max.	4 A
Total power dissipation at $T_h = 70\ ^oC$	P_{tot}	max.	21,5 W
Storage temperature	T_{stg}	−65 to + 200	^oC
Junction temperature	T_j	max.	200 ^oC



(1) Second breakdown limit (independent of temperature.

Fig. 2 D.C. SOAR.

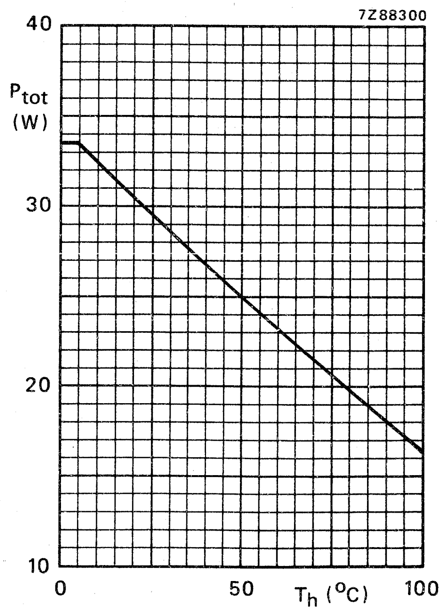


Fig. 3 Power derating curve vs. temperature.

→ **THERMAL RESISTANCE** (dissipation = 21,25 W; T_{mb} = 82,75 ^oC, i.e. T_h = 70 ^oC.

From junction to mounting base	$R_{th\ j\text{-}mb}$	=	5,45 K/W*
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,6 K/W*

* K/W is SI unit for ^oC/W.

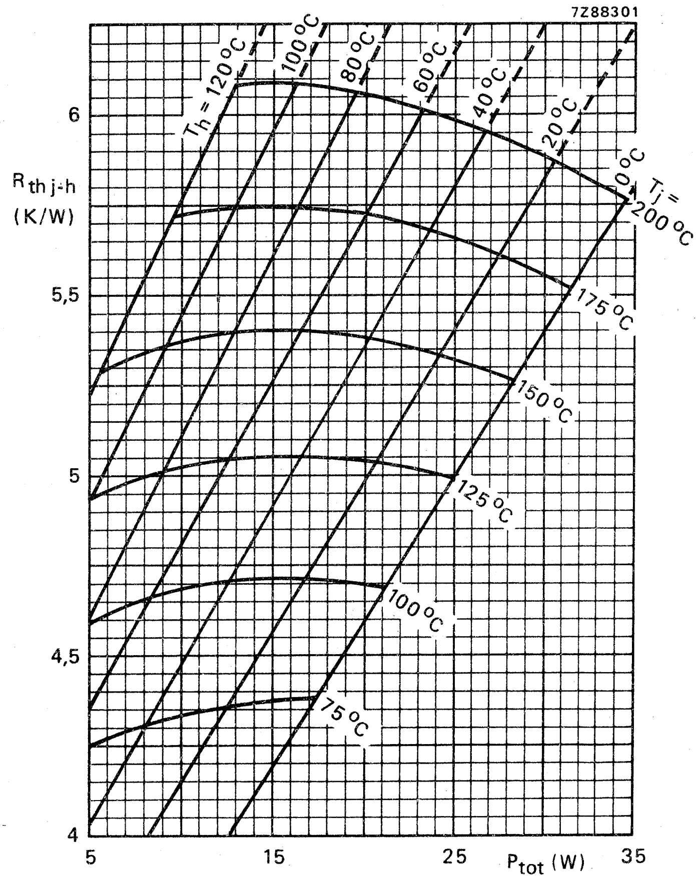


Fig. 4 Maximum thermal resistance from junction to heatsink as a function of power dissipation, with heatsink and junction temperature as parameters. ($R_{th\ mb\text{-}h}$ = 0,6 K/W.)

Example

Nominal class-A operation (without r.f. signal): V_{CE} = 25 V; I_C = 850 mA; T_h = 70 °C.

Fig. 4 shows: $R_{th\ j\text{-}h}$ max. 6,05 K/W
T_j max. 200 °C

Typical device: $R_{th\ j\text{-}h}$ typ. 5,35 K/W
T_j typ. 183 °C

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector-emitter breakdown voltage			
→ V_{BE} = 0; I_C = 10 mA	$V_{(BR)CES}$	>	50 V
open base; I_C = 25 mA	$V_{(BR)CEO}$	>	27 V
Emitter-base breakdown voltage			
open collector; I_E = 5 mA	$V_{(BR)EBO}$	>	3,5 V
→ D.C. current gain*			
I_C = 850 mA; V_{CE} = 25 V	h_{FE}	>	15
		typ.	40
Collector-emitter saturation voltage*			
→ I_C = 500 mA; I_B = 100 mA	V_{CEsat}	typ.	0,25 V
Transition frequency at f = 500 MHz**			
→ $-I_E$ = 850 mA; V_{CB} = 25 V	f_T	typ.	2,5 GHz
Collector capacitance at f = 1 MHz			
$I_E = I_e = 0$; V_{CB} = 25 V	C_c	typ.	24 pF
		<	30 pF
Feedback capacitance at f = 1 MHz			
I_C = 50 mA; V_{CE} = 25 V	C_{re}	typ.	15 pF
Collector-stud capacitance	C_{cs}	typ.	2 pF

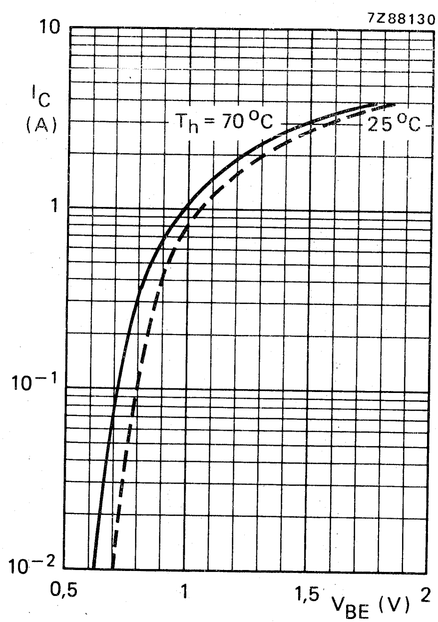


Fig. 5 Typical values; V_{CE} = 25 V.

* Measured under pulse conditions: $t_p \leq 300\ \mu s$; $\delta \leq 0{,}02$.

** Measured under pulse conditions: $t_p \leq 50\ \mu s$; $\delta \leq 0{,}01$.

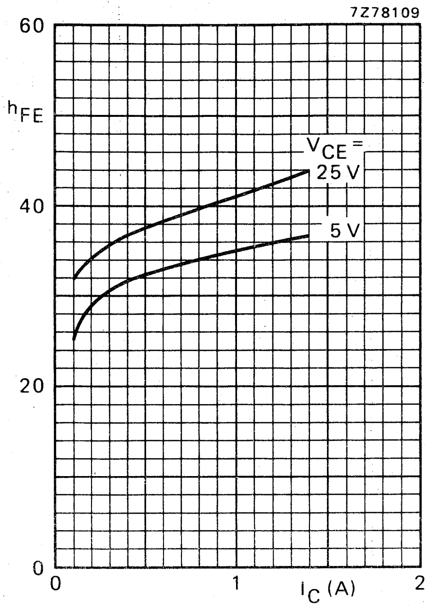


Fig. 6 Typical values; T_j = 25 °C.

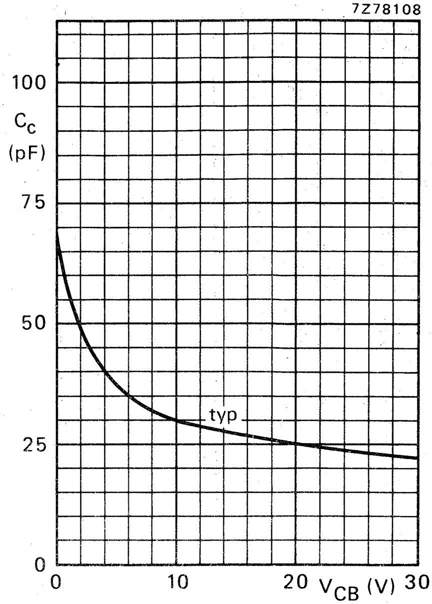


Fig. 7 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

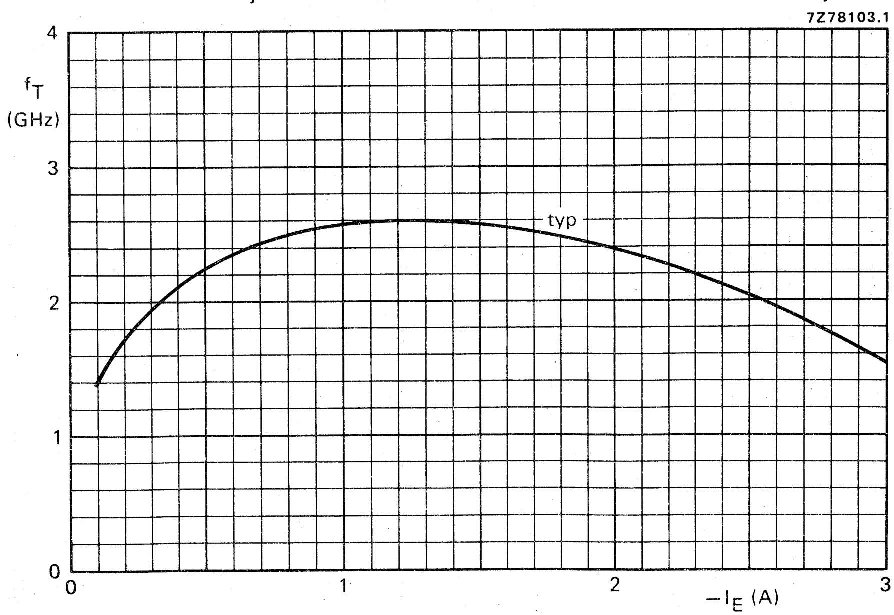


Fig. 8 V_{CB} = 25 V; f = 500 MHz; T_j = 25 °C.

APPLICATION INFORMATION

R.F. performance in u.h.f. class-A operation (linear power amplifier)

f_{vision} (MHz)	V_{CE} (V)	I_C (mA)	T_h (°C)	d_{im} (dB)*	$P_{o\,sync}$ (W)*	G_p (dB)
860	25	850	70	−60	> 3,5	> 5,0
860	25	850	70	−60	typ. 4,0	typ. 5,5

* Three-tone test method (vision carrier −8 dB, sound carrier −7 dB, sideband signal −16 dB), zero dB corresponds to peak sync level.

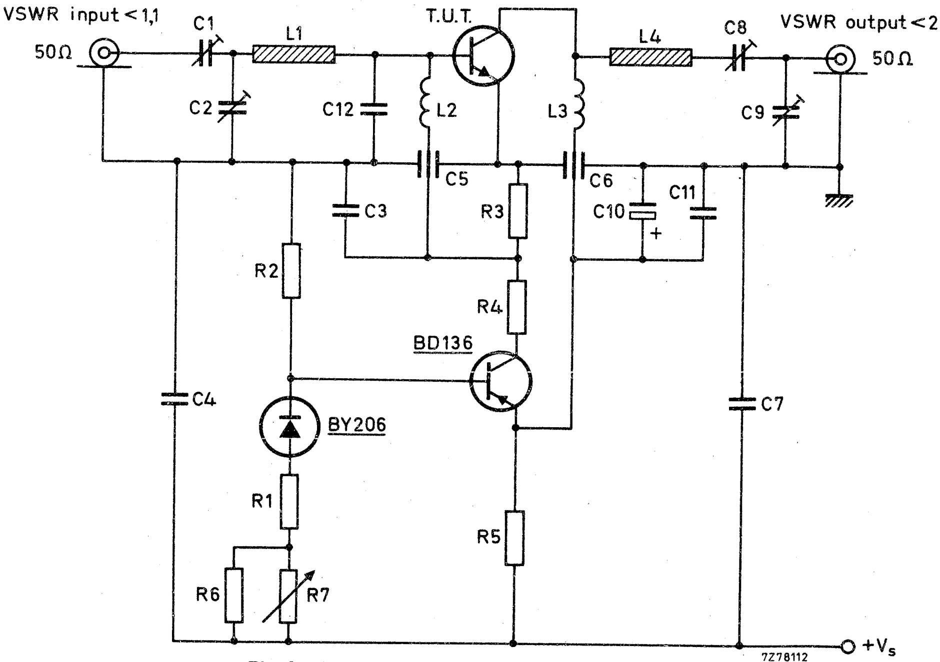


Fig. 9 Class-A test circuit at f_{vision} = 860 MHz.

List of components:

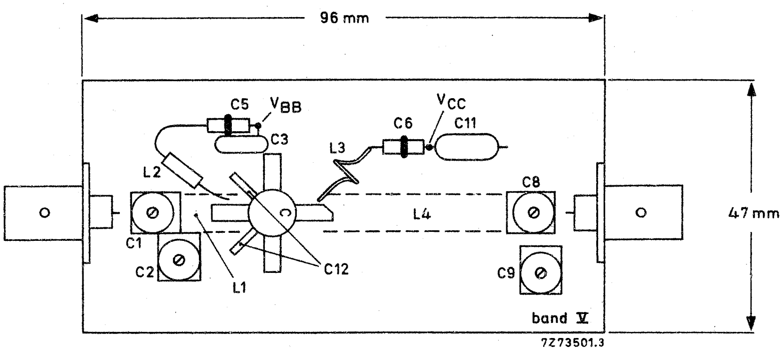
C1 = C2 = 1,4 to 5,5 pF film dielectric trimmer (cat.no. 2222 809 09001)
C3 = C4 = 100 nF polyester capacitor
C5 = C6 = 1 nF feed-through capacitor
C7 = 5,6 pF ceramic capacitor
C8 = 2 to 18 pF film dielectric trimmer (cat. no. 2222 809 09003)
C9 = 2 to 9 pF film dielectric trimmer (cat. no. 2222 809 09002)
C10 = 10 μF/40 V solid aluminium electrolytic capacitor
C11 = 470 nF polyester capacitor
C12 = 2 x 3,3 pF chip capacitors (in parallel)

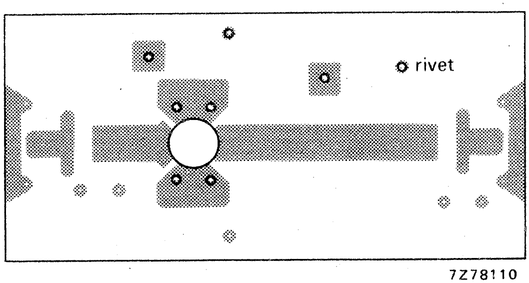
List of components: (continued)

R1 = 150 Ω carbon resistor (0,25 W)
R2 = 1,8 kΩ carbon resistor (0,5 W)
R3 = 33 Ω carbon resistor (0,5 W)
R4 = 220 Ω carbon resistor (1 W)
R5 = 4 x 12 Ω carbon resistors in parallel (1 W each)
R6 = 1 kΩ carbon resistor (0,25 W)
R7 = 220 Ω carbon potentiometer (0,25 W)

L1 = stripline (13,6 mm x 6,9 mm)
L2 = microchoke 0,47 μH (cat. no. 4322 057 04770)
L3 = 1 turn Cu wire (1 mm); internal diameter 5,5 mm; leads 2 x 5 mm
L4 = stripline (40,8 mm x 6,9 mm)

L1 and L4 are striplines on a double Cu-clad printed-circuit board with PTFE fibre-glass dielectric (ϵ_r = 2,74); thickness 1,5 mm.





Note
Hole in printed-circuit board: ϕ 9,7 mm.

Fig. 10 Component layout and printed-circuit board for 860 MHz class-A test circuit.

The circuit and the components are on one side of the PTFE fibre-glass board, the other side is unetched copper to serve as a ground-plane. Earth connections are made by hollow rivets. Additionally copper straps are used under the emitters and at the input and output to provide direct contact between the copper on the component side and the ground-plane.

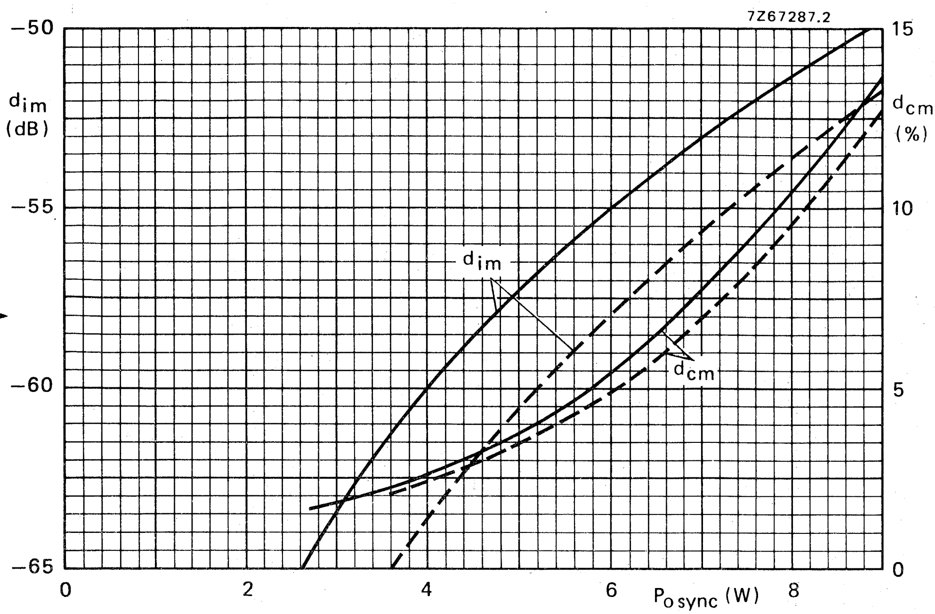


Fig. 11 Intermodulation distortion (d_{im})* and cross-modulation distortion (d_{cm})** as a function of $P_{o\,sync}$. Typical values; V_{CE} = 25 C; I_C = 850 mA; — — — T_h = 25 °C; —— T_h = 70 °C; f_{vision} = 860 MHz.

* Three-tone test method (vision carrier −8 dB, sound carrier −7 dB, sideband signal −16 dB), zero dB corresponds to peak sync level.
Intermodulation distortion of input signal ⩽ −75 dB.

** Two-tone test method (vision carrier 0 dB, sound carrier −7 dB), zero dB corresponds to peak sync level.
Cross-modulation distortion (d_{cm}) is the voltage variation (%) of sound carrier when vision carrier is switched from 0 dB to −20 dB.

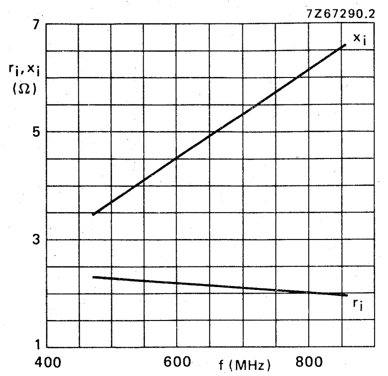


Fig. 12 Input impedance (series components).

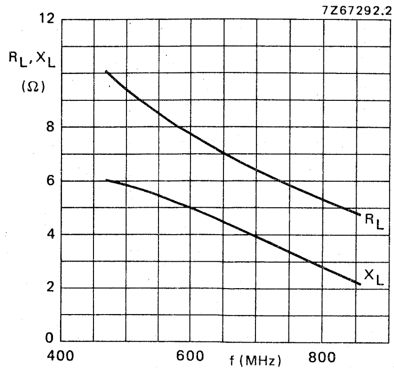


Fig. 13 Load impedance (series components).

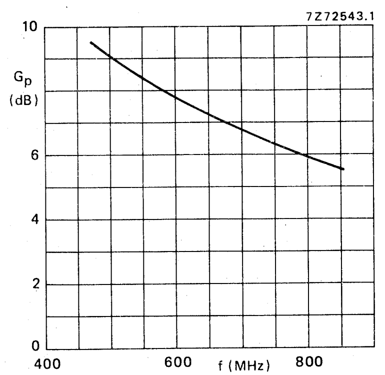


Fig. 14.

Conditions for Figs 12, 13 and 14:

Typical values; V_{CE} = 25 V; I_C = 850 mA; class-A operation; T_h = 70 °C.

V.H.F. POWER TRANSISTORS

Silicon planar n-p-n high frequency medium power transistors primarily intended for class-B operation in v.h.f. amplifiers. The collector is electrically connected to the case.

QUICK REFERENCE DATA

			BLY33	BLY34	
Collector-emitter voltage					
(peak r.f. ⩾ 1 MHz); V_{BE} = 0	V_{CESM}	max.	66	40	V
open base	V_{CEO}	max.	33	20	V
Collector current (peak r.f. ⩾ 1 MHz)	I_{CM}	max.	1,5	1,5	A
Total power dissipation up to T_{case} = 100 °C	P_{tot}	max.	2,0	2,0	W
Junction temperature	T_j	max.	150	150	°C
Transition frequency at f = 100 MHz	f_T	>	250	250	MHz

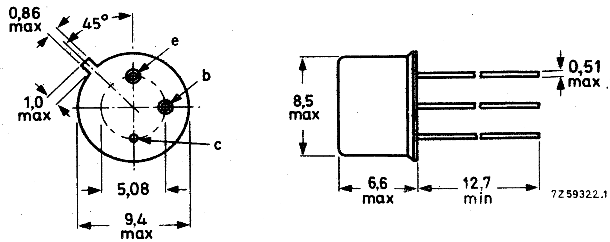
R.F. performance in a 175 MHz common-emitter amplifier

type number	mode of operation	V_{CC} V	P_o W	G_p dB	η %
BLY33	a.m.	13,8	2,0	typ. 8,0	typ. 80
BLY34	f.m.	13,8	3,0	typ. 8,0	typ. 80

MECHANICAL DATA

Dimensions in mm

Fig. 1 TO-39; collector connected to case.



Maximum lead diameter is guaranteed only for 12,7 mm.
Accessories: 56245 (distance disc).

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

			BLY33	BLY34	
Collector-emitter voltage					
(peak r.f. ⩾ 1 MHz); $V_{BE} = 0$	V_{CESM}	max.	66	40	V
open base	V_{CEO}	max.	33	20	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4,0		V
Collector current					
d.c.	I_C	max.	0,5		A
(peak value); f < 1 MHz	I_{CM}	max.	0,5		A
(peak value); f ⩾ 1 MHz	I_{CM}	max.	1,5		A
Total power dissipation (see also Figs 4, 5 and 6)					
f < 1 MHz; T_{case} = 25 °C	P_{tot}	max.	4,0		W
f ⩾ 1 MHz; T_{case} = 25 °C	P_{tot}	max.	5,0		W
Storage temperature	T_{stg}		−65 to +150		°C
Junction temperature					
continuous operation	T_j	max.	150		°C
intermittent operation, total duration 200 hours	T_j	max.	200		°C

THERMAL RESISTANCE

From junction to case	$R_{th\ j\text{-}c}$	=	25	K/W*

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current				
$V_{BE} = 0$; $V_{CE} = V_{CEOmax}$	I_{CES}	typ.	0,02	mA
		<	0,5	mA
$V_{BE} = 0$; $V_{CE} = V_{CESMmax}$	I_{CES}	typ.	0,10	mA
		<	5,0	mA
Emitter cut-off current				
$I_C = 0$; V_{EB} = 4,0 V	I_{EBO}	typ.	0,2	µA
		<	0,5	mA
D.C. current gain				
I_C = 0,2 A; V_{CE} = 5,0 V	h_{FE}	>	10	
		typ.	60	
Transition frequency at f = 100 MHz				
I_C = 0,2 A; V_{CE} = 5,0 V; T_{amb} = 25 °C	f_T	>	250	MHz
		typ.	450	MHz
Collector capacitance at f = 0,5 MHz				
$I_E = I_e = 0$; V_{CB} = 10 V	C_c	typ.	11	pF
		<	15	pF
Emitter capacitance at f = 0,5 MHz				
$I_C = I_c = 0$; $V_{EB} = 0$	C_e	typ.	65	pF
			45 to 90	pF

* K/W is SI unit for °C/W.

RECOMMENDED OPERATING CONDITIONS

As a medium power amplifier for the output stage of a small transmitter, or as a driver for larger output stages.

f = 175 MHz			BLY33		BLY34	
	mode of operation		a.m.	f.m.	f.m.	
Supply voltage	V_{CC}	nom.	13,8	28	13,8	V
		<	16,5	32	16,5	V
Base bias voltage	V_B		0	0	0	V
Output power	P_o		2,0	3,0	3,0	W
Input power	P_i	typ.	0,32	0,28	0,5	W
		<	0,40	0,40	0,6	W
Supply current	I_{CC}	typ.	180	160	270	mA
Efficiency	η	typ.	80	65	80	%

Notes

1. For a.m. telephony, collector modulation of the output and driver stages is recommended.
2. A heatsink of thermal resistance 20 K/W is recommended for operation in ambient temperatures up to 65 °C. At temperatures > 65 °C, derating is necessary.
3. Under the recommended a.m. operating condition and without modulation, the transistor can withstand any load mismatch. With modulation applied, operation into an extreme mismatch may adversely affect the life of the transistor and care should be excercized to keep the device within its ratings.

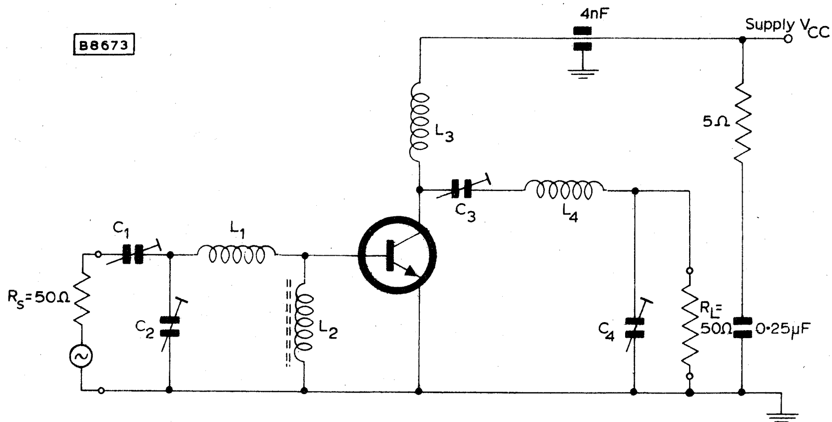


Fig. 2 Basic v.h.f. amplifier circuit.

Component values for 175 MHz amplifier circuit:

C_1 to C_4 = 30 pF concentric trimmer capacitors

L_1 = 1" of straight 18 s.w.g.
L_2 = 3 turns of 24 s.w.g. on ferrite FX1115
L_3 = 5 turns of 18 s.w.g.; internal diameter 3/8"; length 3/8"
L_4 = 3 turns of 18 s.w.g.; internal diameter 3/8"; length 3/8"

Note

To obtain optimum gain performance the emitter lead length should not exceed 1,6 mm.

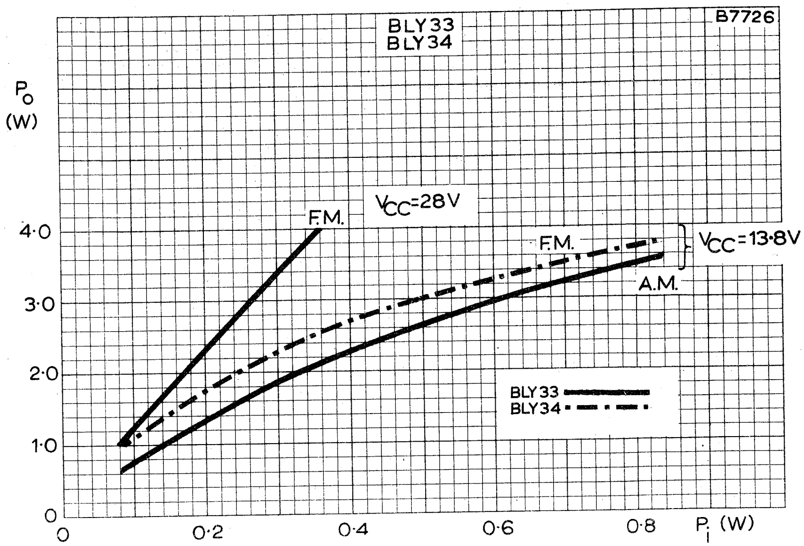


Fig. 3 Typical variation of output power with input power for v.h.f. amplifier (see recommended operating conditions on page 3).

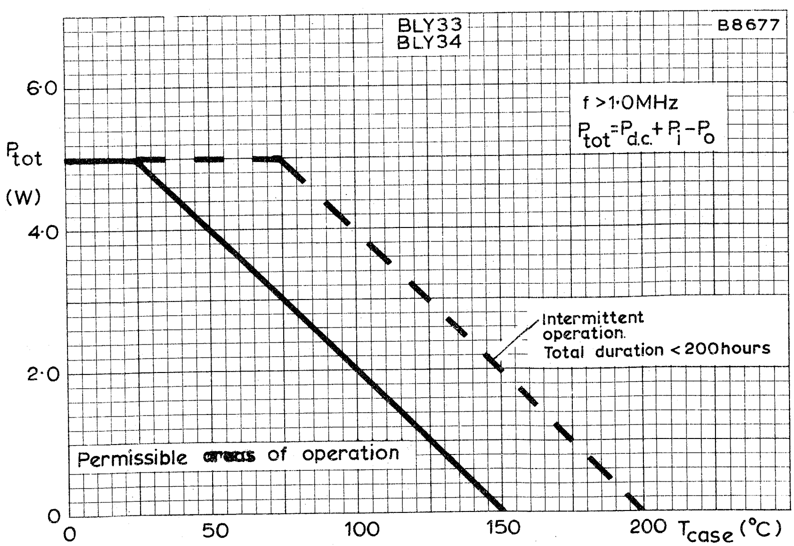


Fig. 4 Maximum permissible power dissipation plotted against case temperature for frequencies > 1,0 MHz.

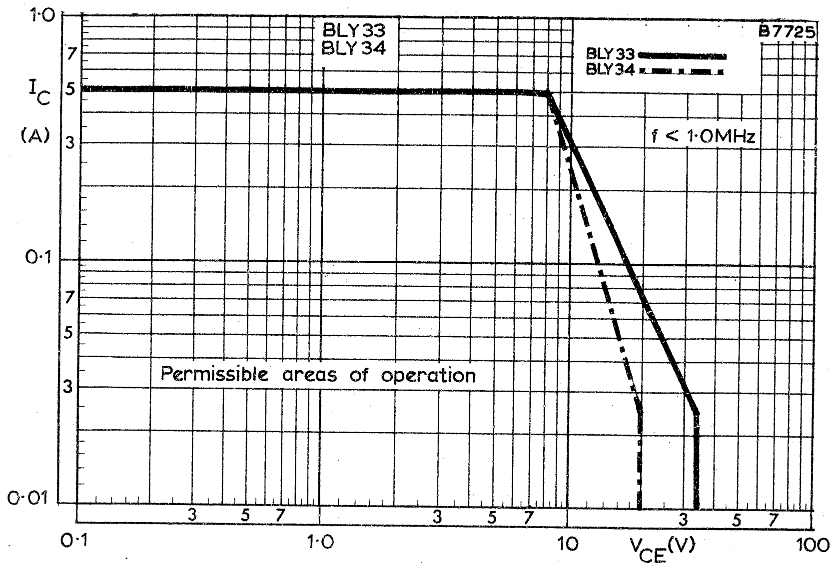


Fig. 5 Permissible areas of operation for frequencies < 1,0 MHz.

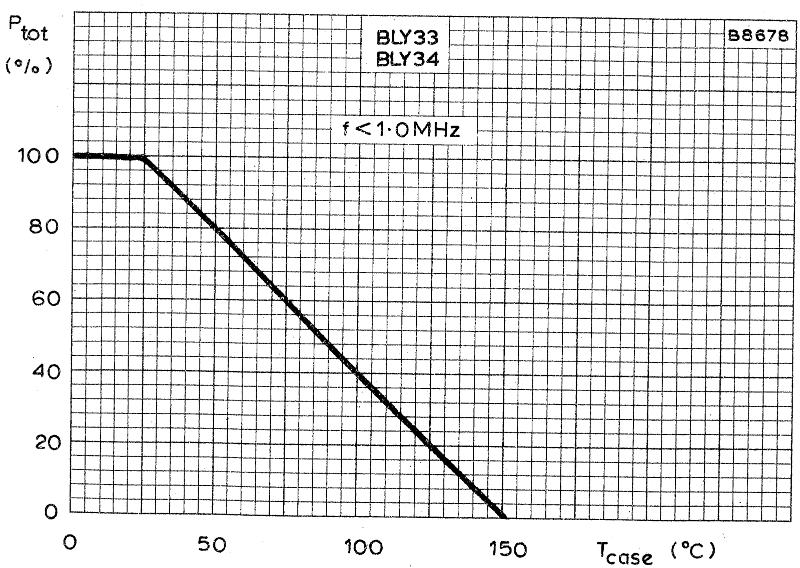


Fig. 6 Percentage power derating plotted against case temperature for frequencies < 1,0 MHz.

V.H.F. POWER TRANSISTORS

Silicon planar n-p-n transistors for v.h.f. mobile operation in class-B. The BLY35 is mounted in a TO-60 envelope and the BLY83 is mounted in a plastic, capstan stripline encapsulation.

The transistors are primarily intended for a.m. operation at 13,8 V but are also suitable for f.m. operation at 24 V.

QUICK REFERENCE DATA

mode of operation	V_{CC} V	f MHz	P_L (carrier) W	P_L into 50 Ω W	η %	m %	d_{tot} %
a.m. class-B	13,8	175	typ. 7,0	–	typ. 77	80	< 5
a.m. class-B	13,8	80	typ. 7,5	–	typ. 77	80	< 5
c.w. class-B	24	175	–	typ. 13	typ. 65	–	–

MECHANICAL DATA

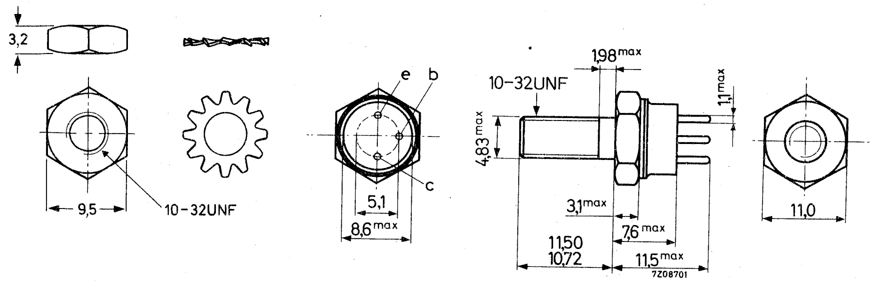
TO-60 (BLY35) (see Fig. 1a)
(BLY83) (see Fig. 1b)

CAUTION These devices incorporate beryllium oxide, the dust of which is toxic. The devices are entirely safe provided that the BeO disc is not damaged.

MECHANICAL DATA

Dimensions in mm

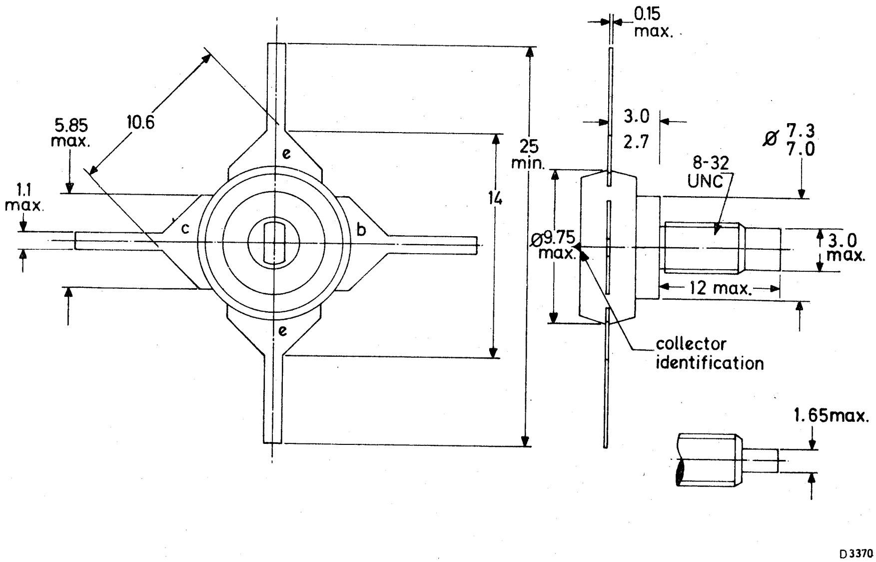
Fig. 1a TO-60 (**BLY35**).



Accessories: Nut and lock washer supplied with device.

Torque on nut: min. 0,8 Nm (8 kg cm)
max. 1,7 Nm (17 kg cm)

Fig. 1b (**BLY83**).



Accessories: Nut and lock washer supplied with device.

Torque on nut: min. 0,75 Nm (7,5 kg cm)
max. 0,85 Nm (8,5 kg cm)

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter) peak value		V_{CBOM}	max.	66	V
Collector-emitter voltage peak value; $V_{BE} = 0$		V_{CESM}	max.	66	V
open base		V_{CEO}	max.	33	V
Emitter-base voltage (open collector)		V_{EBO}	max.	4,0	V
Collector current d.c.		I_C	max.	2,5	A
(peak value); f < 1 MHz		I_{CM}	max.	2,5	A
(peak value); f ⩾ 1 MHz		I_{CM}	max.	7,5	A
Total power dissipation up to T_h = 90 °C (f ⩾ 1 MHz)		P_{tot}	max.	12	W
Storage temperature	**BLY35**	T_{stg}		−65 to + 200	°C
	BLY83	T_{stg}		−65 to + 150	°C

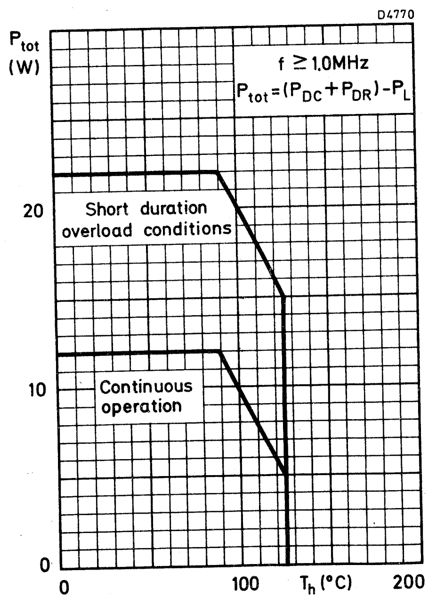


Fig. 2 Maximum permissible power dissipation plotted against heatsink temperature for frequencies ⩾ 1,0 MHz.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector-base breakdown voltage open emitter; I_C = 10 mA	$V_{(BR)CBO}$	>	66	V
Collector-emitter breakdown voltage V_{BE} = 0; I_C = 10 mA	$V_{(BR)CES}$	>	66	V
open base; I_C = 50 mA	$V_{(BR)CEO}$	>	33	V
Emitter-base breakdown voltage open collector; I_E = 1,0 mA	$V_{(BR)EBO}$	>	4,0	V
D.C. current gain I_C = 1,0 A; V_{CE} = 5,0 V	h_{FE}		10 to 220	
		typ.	60	
Transition frequency at f = 100 MHz I_C = 1,0 A; V_{CE} = 5,0 V; T_{amb} = 25 °C	f_T	>	250	MHz
		typ.	450	MHz
Collector capacitance at f = 1 MHz I_E = I_e = 0; V_{CB} = 10 V	C_c	typ.	34	pF
		<	45	pF
Emitter capacitance at f = 1 MHz I_C = I_c = 0; V_{EB} = 0	C_e	>	100	pF
		typ.	155	pF

APPLICATION INFORMATION

R.F. performance in a 7,0 W a.m. transmitter at f = 175 MHz, $f_{mod.}$ = 1 kHz

V_{CC} V	P_{DR} W	P_L (carrier) W	I_C (driver) A	I_C (amplifier) A	G_p dB	η %	m %	d_{tot} %
13,8	0,35	typ. 7,0	typ. 0,22	typ. 0,66	13	typ. 77	80	< 5

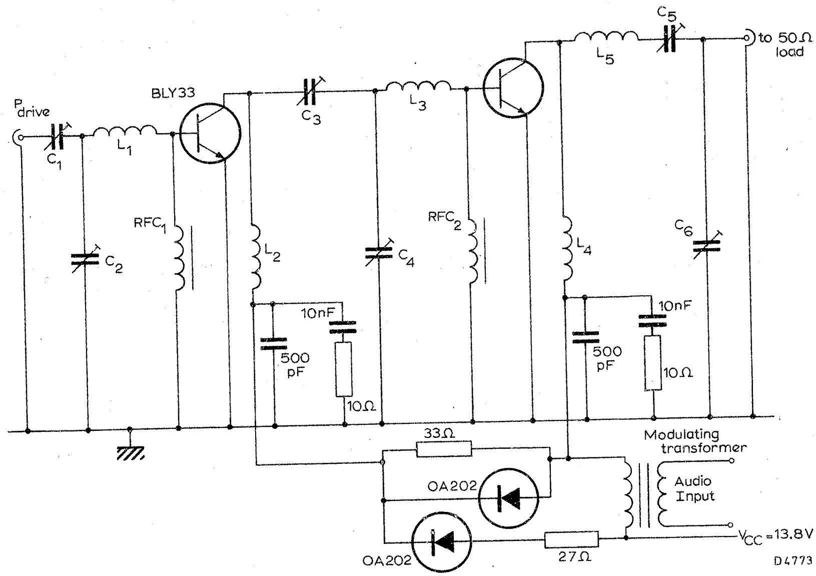


Fig. 3 175 MHz transmitter circuit.

Component values for 175 MHz transmitter circuit:

C_1 to C_6 = 4 to 29 pF concentric trimmer capacitors

$L_1 = L_3$ = 3 turns of 1,2 mm enamelled Cu wire; int. dia. = 6,4 mm; length = 5,0 mm
$L_2 = L_4$ = 5 turns of 1,2 mm enamelled Cu wire; int. dia. = 6,4 mm; length = 10 mm
L_5 = 3 turns of 1,7 mm enamelled Cu wire, int. dia. = 10 mm; length = 10 mm
$RFC_1 = RFC_2$ = 2 turns of 0,4 mm enamelled Cu wire on ferrite FX1115

R.F. performance in a 7,0 W a.m. transmitter at f = 80 MHz, $f_{mod.}$ = 1 kHz

V_{CC} V	P_{DR} W	P_L (carrier) W	I_C (driver) A	I_C (amplifier) A	G_p dB	η %	m %	d_{tot} %
13,8	0,06	typ. 7,5	typ. 0,06	typ. 0,7	21	typ. 70	80	< 5

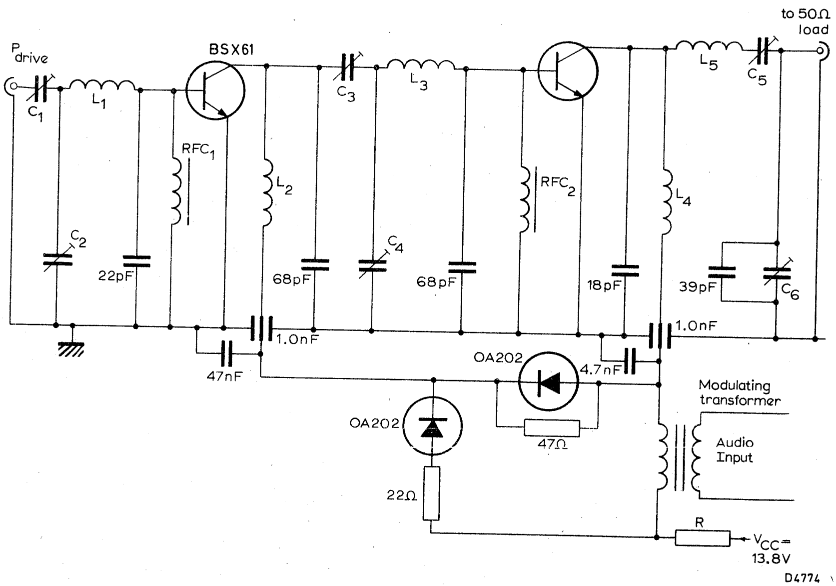


Fig. 4 80 MHz transmitter circuit.

Component values for 80 MHz transmitter circuit:

C_1 to C_6 = 4 to 29 pF concentric trimmer capacitors

L_1 = L_3 = 5 turns of 1,2 mm enamelled Cu wire; int. dia. = 6,3 mm; length = 9,0 mm
L_2 = L_4 = 3 turns of 1,2 mm enamelled Cu wire; int. dia. = 7,0 mm; length = 6,0 mm
L_5 = 6 turns of 2,0 mm enamelled Cu wire; int. dia. = 10 mm; length = 13 mm
RFC_1 = RFC_2 = 1 turn of 0,4 mm enamelled Cu wire on ferrite FX1115

R This resistor is incorporated to reduce the carrier level to 8 W or below.

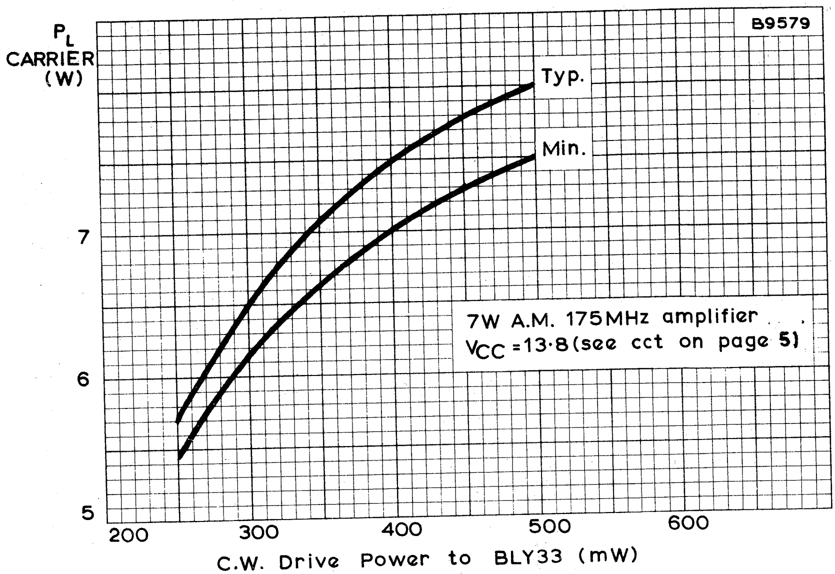


Fig. 5 Aerial carrier power plotted against c.w. drive power for the 7 W a.m. 175 MHz amplifier (see page 5).

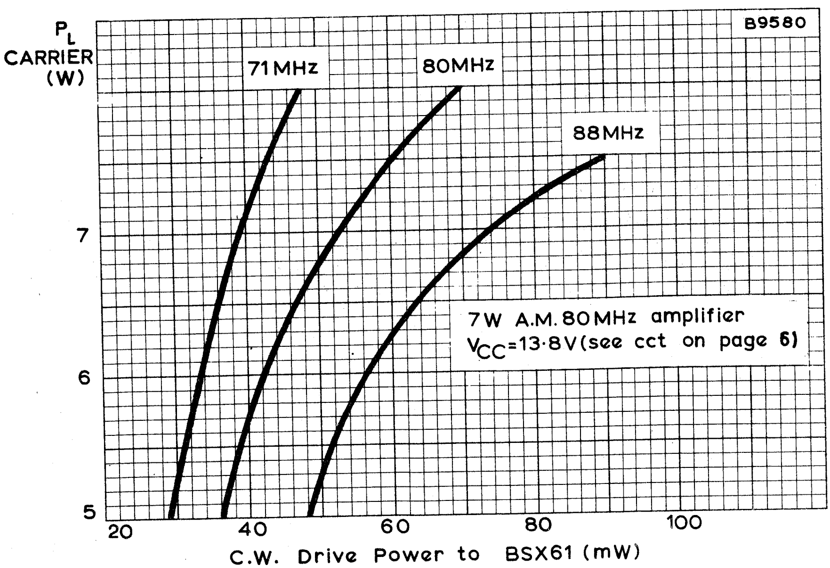


Fig. 6 Aerial carrier power plotted against c.w. drive power for the 7 W a.m. 80 MHz amplifier (see page 6).

R.F. performance in c.w. operation at f = 175 MHz, T_h up to 40 °C

V_{CC} V	P_{DR} W	P_L into 50 Ω W	η %	G_p dB
24	1,35	typ. 13	typ. 65	9,8
13,8	1,35	typ. 7,5		

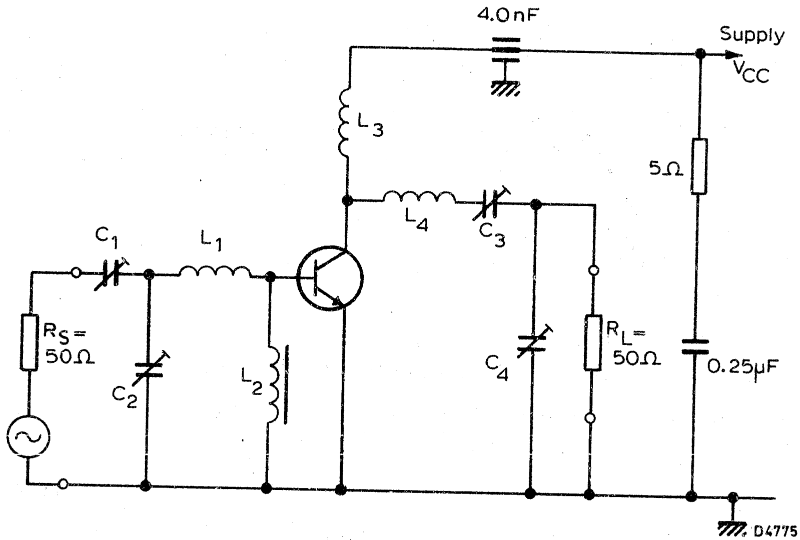


Fig. 7 175 MHz amplifier circuit.

Component values for 175 MHz amplifier circuit:

$C_1 = C_3 = C_4$ = 30 pF max. concentric trimmer capacitors
C_2 = 60 pF max. concentric trimmer capacitor
L_1 = 25,4 mm of straight 1,7 mm Cu wire
L_2 = 3 turns of 0,5 mm Cu wire on ferrite FX1115
L_3 = 3 turns of 1,7 mm Cu wire; int. dia. = 9,5 mm; length = 9,5 mm
L_4 = 2 turns of 2,0 mm Cu wire; int. dia. = 12,7 mm; length = 9,5 mm

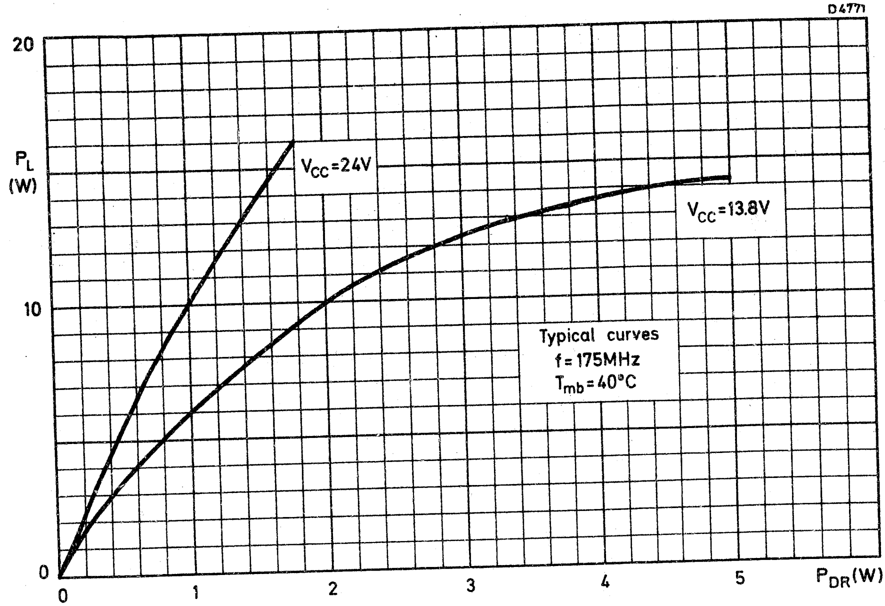


Fig. 8 Load power plotted against drive power.

R.F. performance in c.w. operation at f = 80 MHz up to T_h = 40 °C.

V_{CC} V	P_{DR} W	P_L into 50 Ω W
13,8	0,5	typ. 12,5
6,9	0,5	typ. 5,0

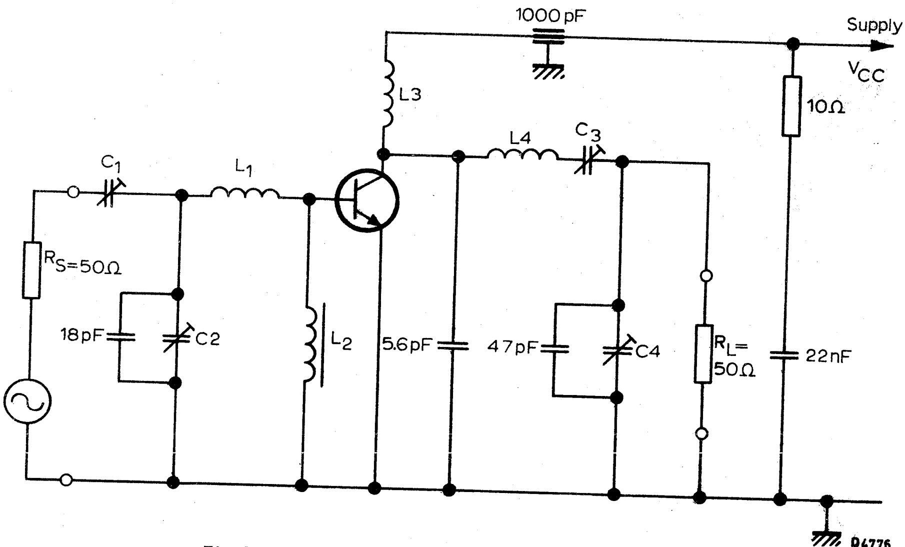


Fig. 9 80 MHz amplifier circuit.

Component values for 80 MHz amplifier circuit:

C_1 to C_4 = 4 to 29 pF concentric trimmer capacitors

L_1 = 4 turns of 1,2 mm Cu wire; int. dia. 6,3 mm; length 8,0 mm
L_2 = 2 turns of 0,35 mm Cu wire on ferrite FX1115
L_3 = 5 turns of 1,2 mm Cu wire; int. dia. 6,3 mm; close wound
L_4 = 5 turns of 1,7 mm Cu wire; int. dia. 9,6 mm; length 12 mm

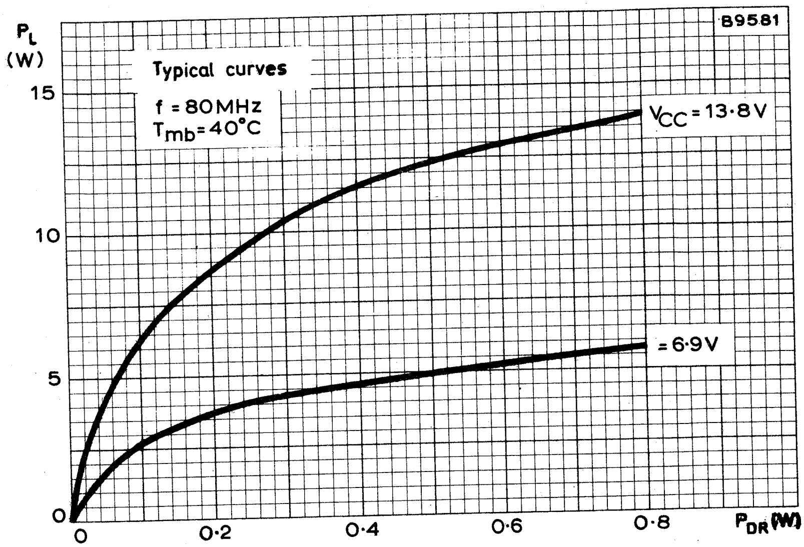


Fig. 10 Load power plotted against drive power.

V.H.F. POWER TRANSISTORS

Silicon planar n-p-n transistors for v.h.f. mobile operation in class-B. The BLY36 is mounted in a TO-60 envelope and the BLY84 is mounted in a plastic, capstan stripline encapsulation.

The transistors are primarily intended for f.m. operation at 13,8 V.

QUICK REFERENCE DATA

R.F. performance in an unneutralized common-emitter class-B circuit

V_{CC} V	f MHz	P_{DR} W	P_L into 50 Ω W	η %
13,8	175	1,2	typ. 7,0	typ. 77
13,8	175	3,4	typ. 13,2	typ. 79
13,8	80	0,5	typ. 13,5	typ. 80

MECHANICAL DATA

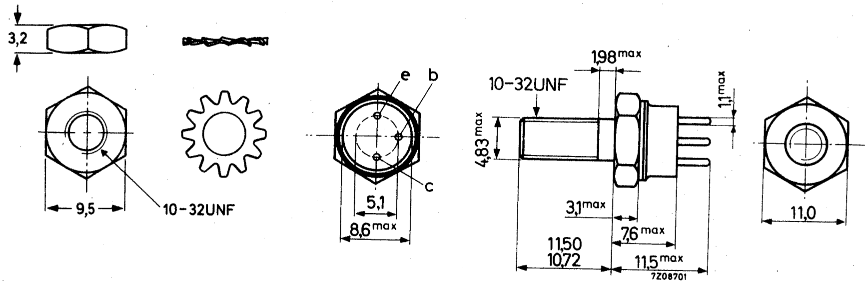
TO-60 (BLY36) (see Fig. 1a)
(BLY84) (see Fig. 1b)

CAUTION These devices incorporate beryllium oxide, the dust of which is toxic. The devices are entirely safe provided that the BeO disc is not damaged.

MECHANICAL DATA

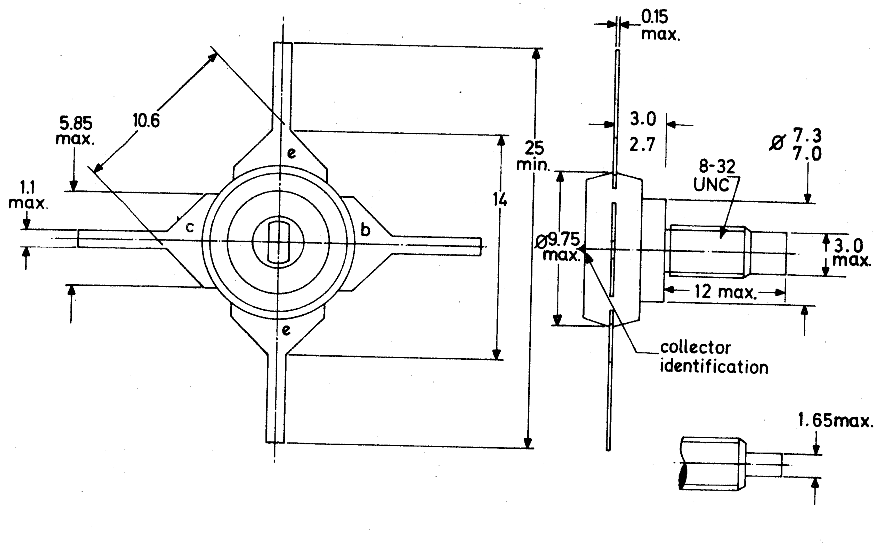
Dimensions in mm

Fig. 1a TO-60 (**BLY36**).



Accessories: Nut and lock washer supplied with device.
Torque on nut: min. 0,8 Nm (8 kg cm)
max. 1,7 Nm (17 kg cm)

Fig. 1b (**BLY84**).



Accessories: Nut and lock washer supplied with device.
Torque on nut: min. 0,75 Nm (7,5 kg cm)
max. 0,85 Nm (8,5 kg cm)

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter) peak value		V_{CBOM}	max.	40	V
Collector-emitter voltage					
peak value; $V_{BE} = 0$		V_{CESM}	max.	40	V
open base		V_{CEO}	max.	20	V
Emitter-base voltage (open collector)		V_{EBO}	max.	4,0	V
Collector current					
d.c.		I_C	max.	2,5	A
(peak value); f < 1 MHz		I_{CM}	max.	2,5	A
(peak value); f ≥ 1 MHz		I_{CM}	max.	7,5	A
Total power dissipation up to T_h = 90 °C (f ≥ 1 MHz)		P_{tot}	max.	12	W
Storage temperature	BLY36	T_{stg}		−65 to + 200	°C
	BLY84	T_{stg}		−65 to + 150	°C

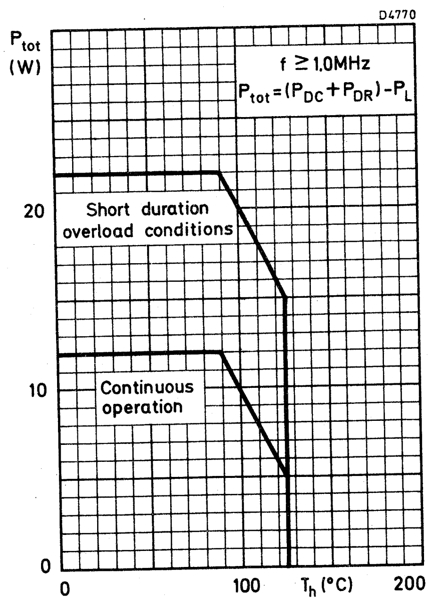


Fig. 2 Maximum permissible power dissipation plotted against heatsink temperature for frequencies ≥ 1 MHz.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector-base breakdown voltage open emitter; I_C = 10 mA	$V_{(BR)CBO}$	>	40	V
Collector-emitter breakdown voltage V_{BE} = 0; I_C = 10 mA	$V_{(BR)CES}$	>	40	V
open base; I_C = 50 mA	$V_{(BR)CEO}$	>	20	V
Emitter-base breakdown voltage open collector; I_E = 1,0 mA	$V_{(BR)EBO}$	>	4,0	V
D.C. current gain I_C = 1,0 A; V_{CE} = 5,0 V	h_{FE}	>	10	
		typ.	60	
Transition frequency at f = 100 MHz I_C = 1,0 A; V_{CE} = 5,0 V; T_{amb} = 25 °C	f_T	>	250	MHz
		typ.	450	MHz
Collector capacitance at f = 1 MHz I_E = I_e = 0; V_{CB} = 10 V	C_c	typ.	37	pF
		<	45	pF
Emitter capacitance at f = 1 MHz I_C = I_c = 0; V_{EB} = 0	C_e	>	100	pF
		typ.	155	pF

APPLICATION INFORMATION

R.F. performance in c.w. operation at f = 175 MHz up to T_h = 40 °C

V_{CC} V	P_{DR} W	P_L into 50 Ω W	η %	G_p dB
13,8	1,2	typ. 7,0	typ.77	7,6
13,8	3,4	typ. 13,2	typ.79	5,8

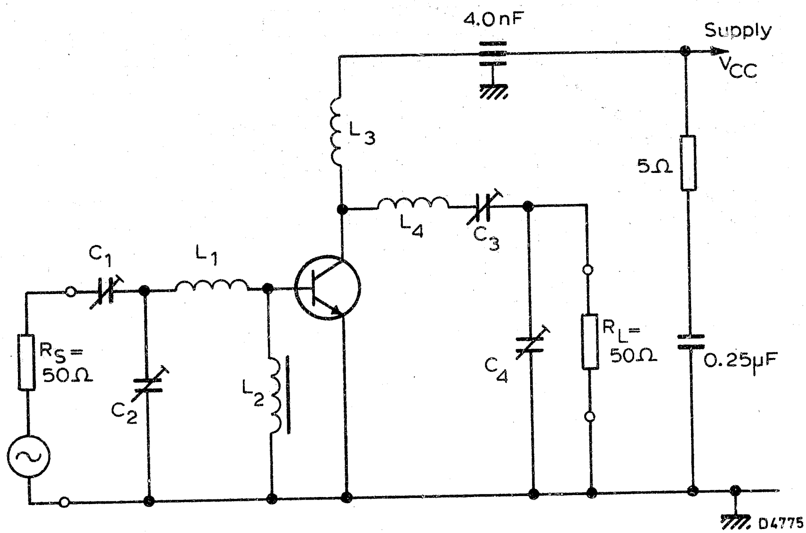


Fig. 3 175 MHz amplifier circuit.

Component values for 175 MHz amplifier circuit:

$C_1 = C_3 = C_4$ = 30 pF max. concentric trimmer capacitors
C_2 = 60 pF max. concentric trimmer capacitor

L_1 = 25,4 mm of straight 1,7 mm Cu wire
L_2 = 3 turns of 0,5 mm Cu wire on ferrite FX1115
L_3 = 3 turns of 1,7 mm Cu wire; int. dia. 9,5 mm; length 9,5 mm
L_4 = 2 turns of 2,0 mm Cu wire; int. dia. 12,7 mm; length 9,5 mm

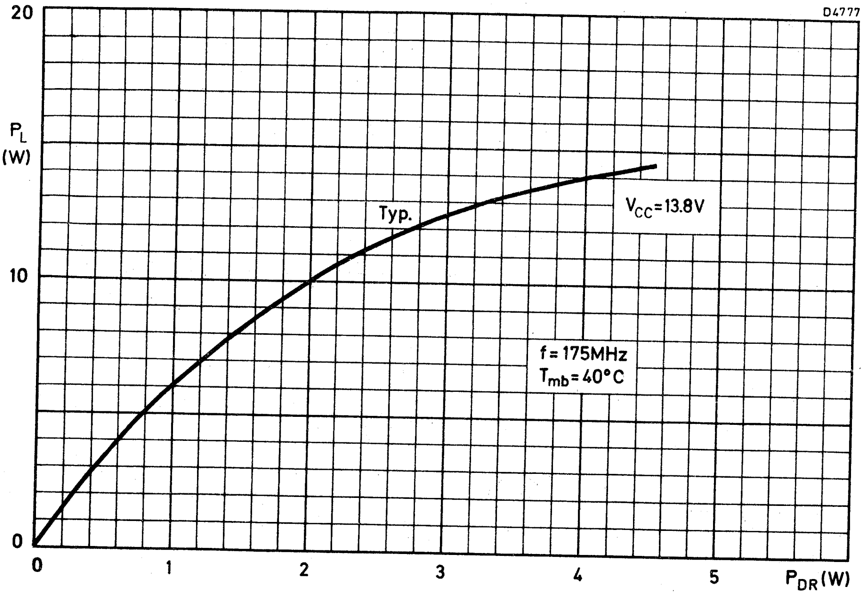


Fig. 4 Load power plotted against drive power.

R.F. performance in c.w. operation at f = 80 MHz up to T_h = 40 °C

V_{CC} V	P_{DR} W	P_L into 50 Ω W	η %	G_p dB
13,8	0,5	typ. 13,5	typ. 80	14,2
6,9	0,5	typ. 5,5	typ. 80	10,3

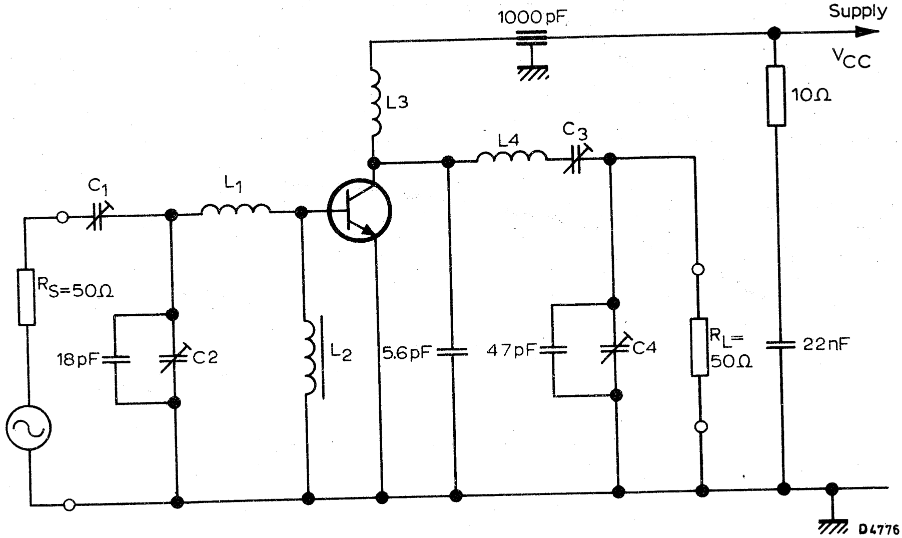


Fig. 5 80 MHz amplifier circuit.

Component values for 80 MHz amplifier circuit:

C_1 to C_4 = 4 to 29 pF concentric trimmer capacitors

L_1 = 4 turns of 1,2 mm Cu wire; int. dia. 6,3 mm; length 8,0 mm
L_2 = 2 turns of 0,35 mm Cu wire on ferrite FX1115
L_3 = 5 turns of 1,2 mm Cu wire; int. dia. 6,3 mm; close wound
L_4 = 5 turns of 1,7 mm Cu wire; int. dia. 9,6 mm; length 12 mm

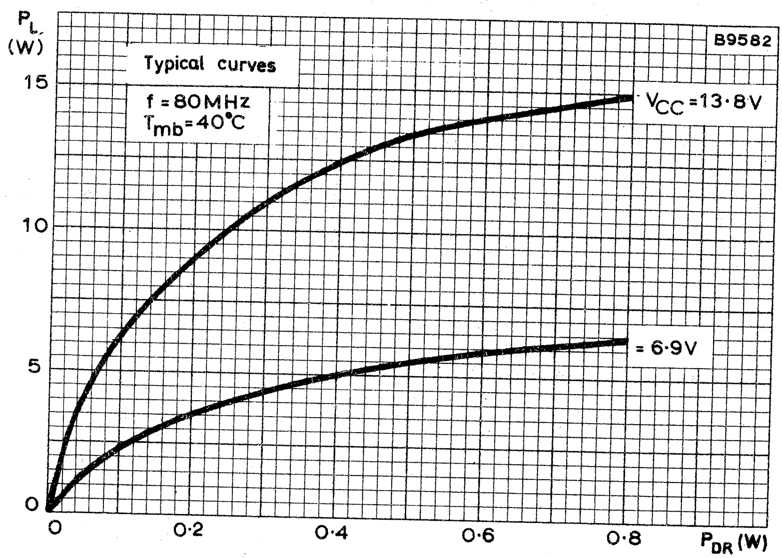


Fig. 6 Load power plotted against drive power.

N-P-N SILICON PLANAR V.H.F. TRANSISTORS

For data of these transistors please refer to types BLY35, BLY36 respectively.

V.H.F. POWER TRANSISTORS

The BLY85 and BLY97 are silicon planar n-p-n transistors primarily intended for class-B operation in the v.h.f. driver stages of mobile transmitters. The BLY85 is designed for 4 W f.m. operation at 13,8 V supply and the BLY97 for 4 W f.m. operation at 24 V supply.

QUICK REFERENCE DATA

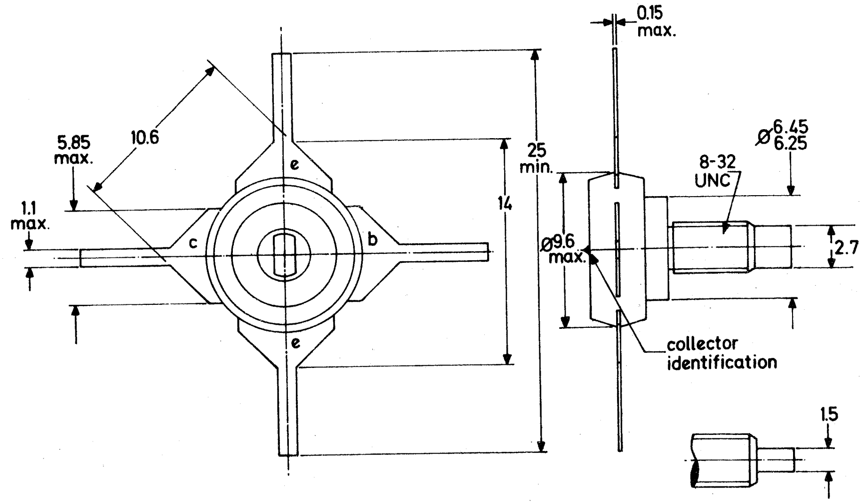
Typical c.w. performance up to T_{mb} = 40 °C

type number	V_{CC} V	f MHz	P_{DR} W	P_L W	η %
BLY85	13,8	175	0,2	4,0	64
BLY97	24	175	0,14	4,0	52

MECHANICAL DATA

Dimensions in mm

Fig. 1.



Accessories: Nut and lock washer supplied with device.

Torque on nut: min. 0,75 Nm (7,5 kg cm)
max. 0,85 Nm (8,5 kg cm)

CAUTION These devices incorporate beryllium oxide, the dust of which is toxic. The devices are entirely safe provided that the BeO disc is not damaged.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

			BLY85	BLY97	
Collector-emitter voltage					
peak value (f ⩾ 1 MHz); $V_{BE} = 0$	V_{CESM}	max.	40	66	V
open base	V_{CEO}	max.	20	33	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4,0		V
Collector current					
d.c.	I_C	max.	1,0		A
(peak value); f < 1 MHz	I_{CM}	max.	1,0		A
(peak value); f ⩾ 1 MHz	I_{CM}	max.	3,0		A
Total power dissipation up to T_{mb} = 25 °C					
f < 1 MHz	P_{tot}	max.	8,0		W
f ⩾ 1 MHz	P_{tot}	max.	10		W
Storage temperature	T_{stg}		−30 to + 150		°C
Junction temperature					
continuous operation	T_j	max.	150		°C
short duration overload conditions	T_j	max.	200		°C

THERMAL RESISTANCE

From junction to mounting base	$R_{th\ j\text{-}mb}$	=	12,5	K/W*

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current				
$V_{BE} = 0$; $V_{CE} = 20$ V	I_{CES}	<	0,5	mA
$V_{BE} = 0$; $V_{CE} = V_{CESM}$ max	I_{CES}	<	5,0	mA
Emitter cut-off current				
$I_C = 0$; $V_{EB} = 4,0$ V	I_{EBO}	<	0,5	mA
D.C. current gain				
$I_C = 0,2$ A; $V_{CE} = 5,0$ V	h_{FE}	>	10	
Transition frequency at f = 100 MHz				
$I_C = 0,2$ A; $V_{CE} = 5,0$ V; T_{amb} = 25 °C	f_T	>	250	MHz
Collector capacitance at f = 0,5 MHz				
$I_E = I_e = 0$; $V_{CB} = 10$ V	C_c	<	15	pF
Emitter capacitance at f = 0,5 MHz				
$I_C = I_c = 0$; $V_{EB} = 0$	C_e		45 to 90	pF

* K/W is SI unit for °C/W.

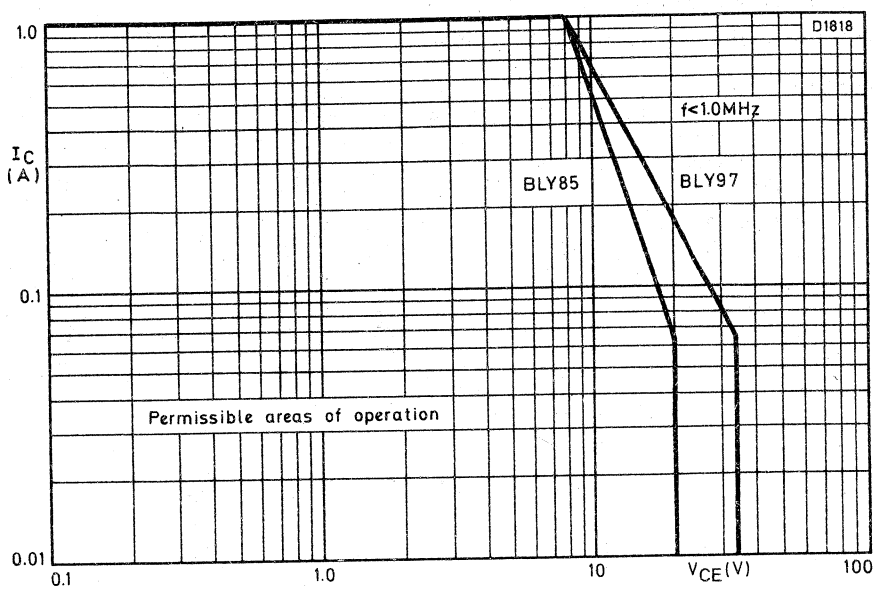


Fig. 2.

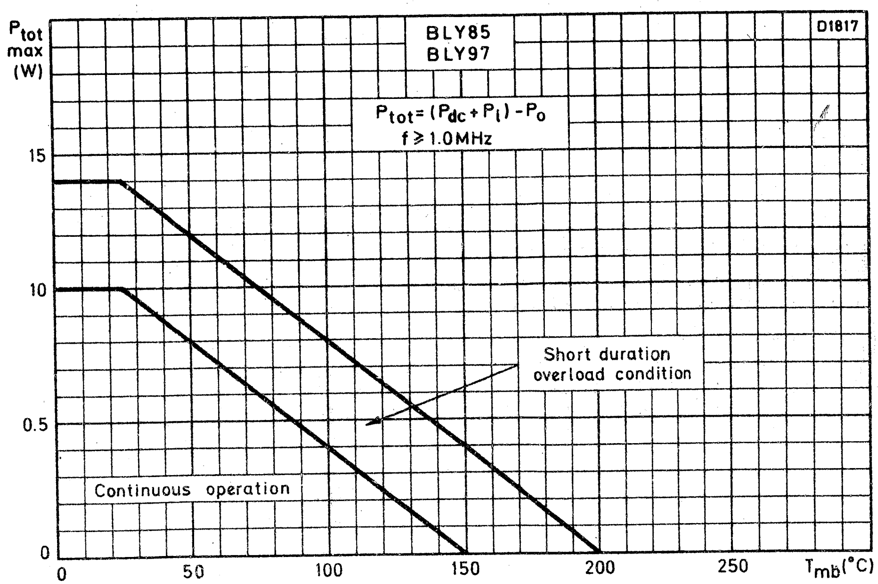


Fig. 3 Maximum permissible power dissipation plotted against mounting base temperature for frequencies ⩾ 1 MHz.

APPLICATION INFORMATION

R.F. performance in c.w. operation up to T_{mb} = 40 °C

type number	V_{CC} V	f MHz	P_{DR} W	P_L W	I_C mA	G_p dB	η %
BLY85	nom. 13,8 max. 16,5	175	0,4	4,0	< 480	> 10	> 60
BLY97	nom. 24 max. 28	175	0,2	4,0	< 278	> 13	> 50

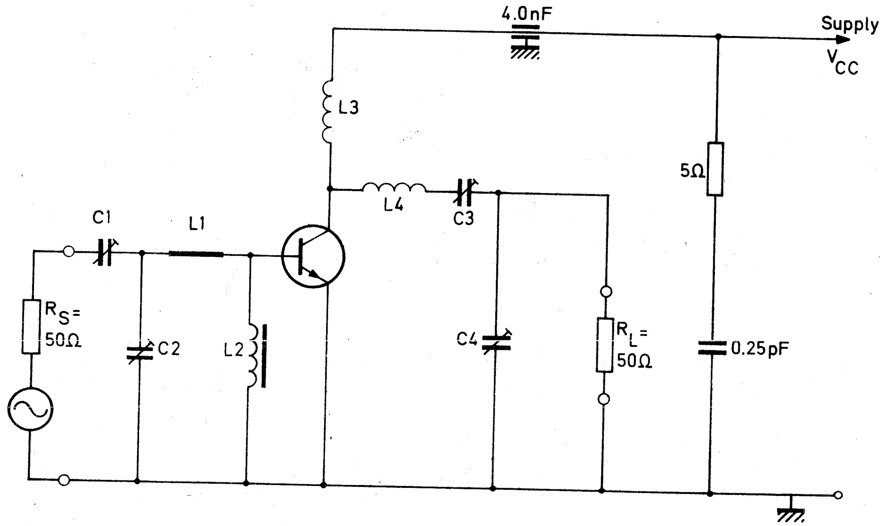


Fig. 4 Basic v.h.f. amplifier circuit.

Component values for 175 MHz amplifier circuit:

C1 = C3 = C4 = 30 pF max. concentric trimmer capacitors
C2 = 60 pF max. concentric trimmer capacitor

L1 = 1″ of straight 18 s.w.g.
L2 = 3 turns of 24 s.w.g. on ferrite FX1115
L3 = 5 turns of 18 s.w.g.; d = 3/8″; length 3/8″
L4 = 3 turns of 18 s.w.g.; d = 3/8″; length 3/8″

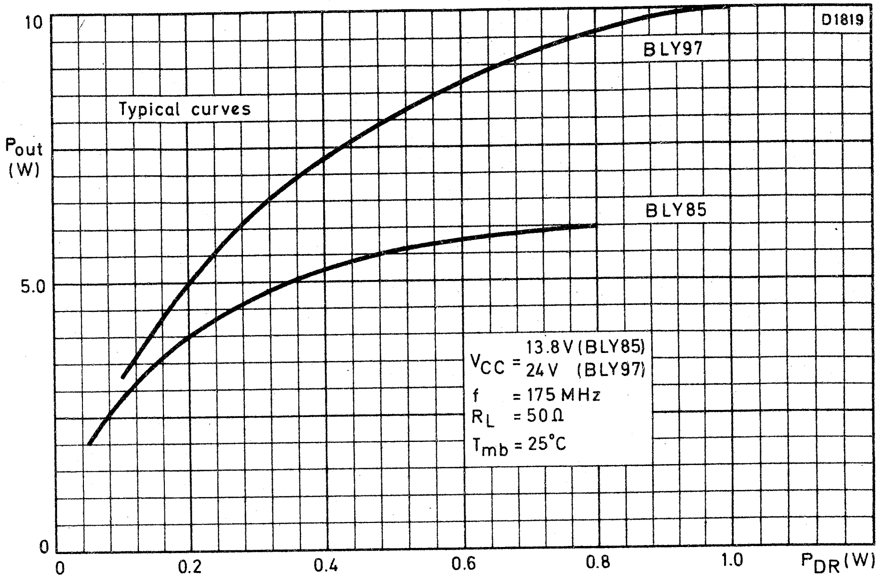


Fig. 5 Output power plotted against drive power.

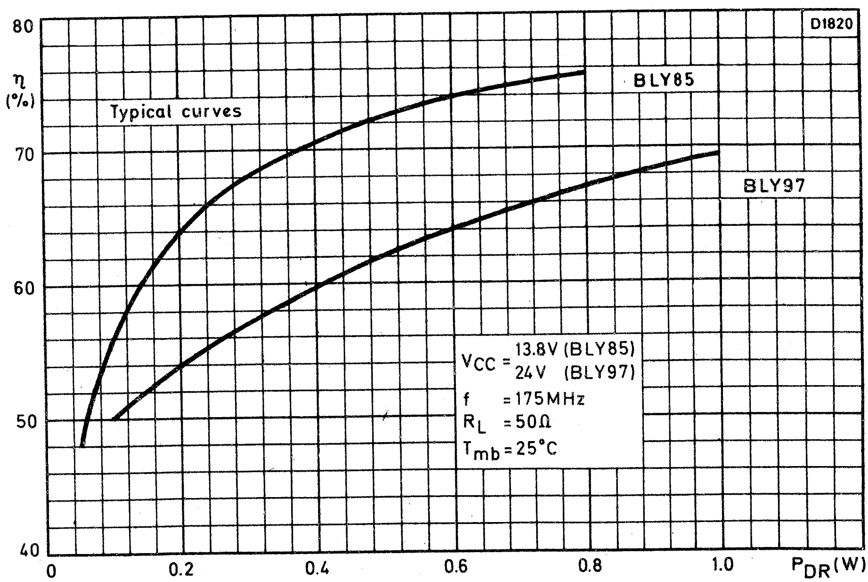


Fig. 6 Efficiency plotted against drive power.

V.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor for use in class-A, B and C operated mobile and military transmitters with a supply voltage of 13,5 V. The transistor is resistance stabilized and is guaranteed to withstand severe load mismatch conditions with a supply over-voltage to 16,5 V.

It has a ¼" capstan envelope with a moulded cap. All leads are isolated from the stud.

QUICK REFERENCE DATA

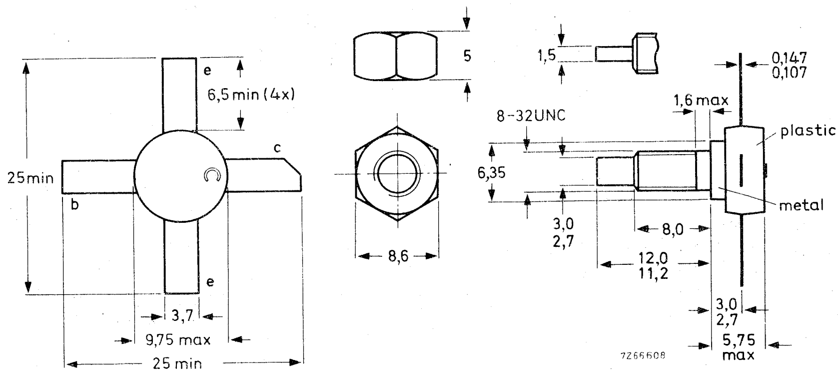
R.F. performance up to T_{mb} = 25 °C in an unneutralized common-emitter class-B circuit.

mode of operation	V_{CE} V	f MHz	P_L W	G_p dB	η %	$\overline{z_i}$ Ω	$\overline{Y_L}$ mA/V
c.w.	**13,5**	**175**	**8**	> **9**	> **70**	**2,8 + j1,2**	**76 − j16**
c.w.	12,5	175	8	typ. 9	typ. 70	—	—

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-48.



Torque on nut: min. 0,75 Nm
(7,5 kg cm)
max. 0,85 Nm
(8,5 kg cm)

Diameter of clearance hole in heatsink: max. 4,2 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

When locking is required an adhesive is preferred instead of a lock washer.

CAUTION This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC 134)

Voltages

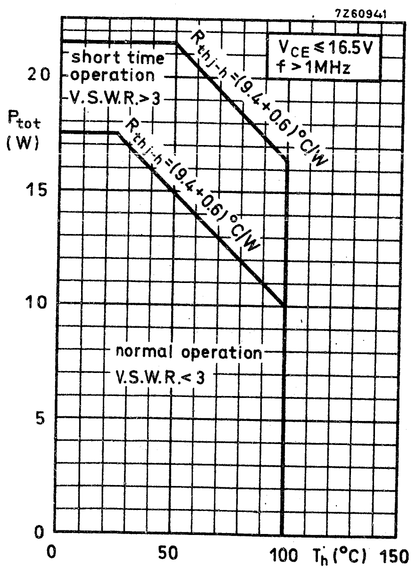
Collector-base voltage (open emitter) peak value	V_{CBOM}	max.	36	V
Collector-emitter voltage (open base)	V_{CEO}	max.	18	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4	V

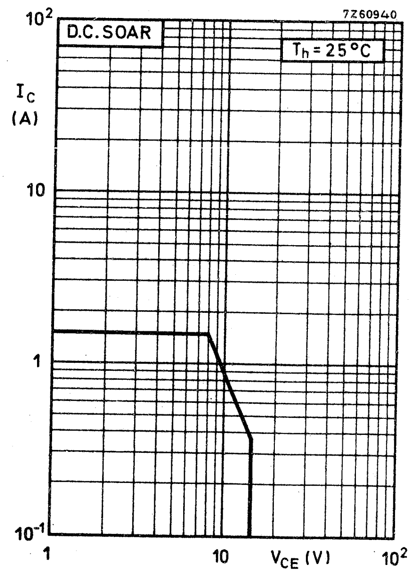
Currents

Collector current (average)	$I_{C(AV)}$	max.	1.25	A
Collector current (peak value) f > 1 MHz	I_{CM}	max.	3.75	A

Power dissipation

Total power dissipation up to T_h = 25 °C f > 1 MHz	P_{tot}	max.	17.5	W





Temperature

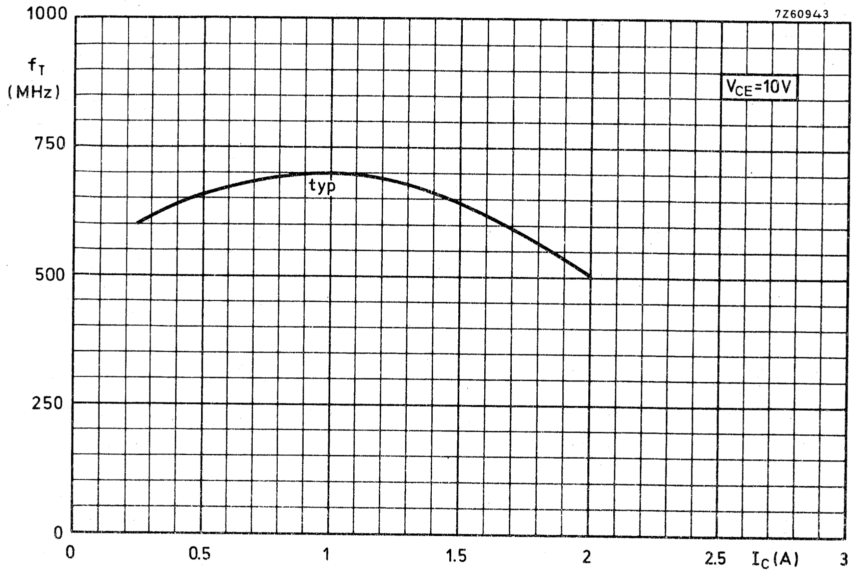
Storage temperature	T_{stg}		−30 to +200	°C
Operating junction temperature	T_j	max.	200	°C

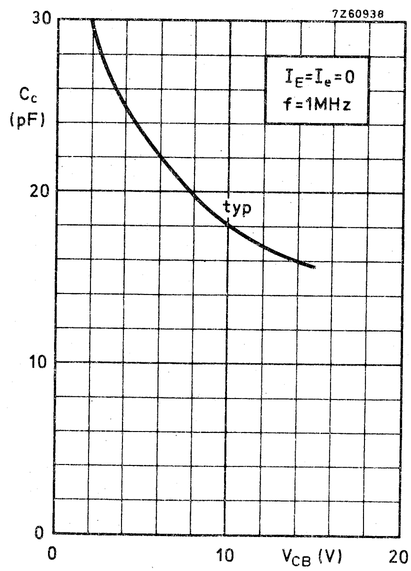
THERMAL RESISTANCE

From junction to mounting base	$R_{th\,j-mb}$	=	9.4	°C/W
From mounting base to heatsink	$R_{th\,mb-h}$	=	0.6	°C/W

CHARACTERISTICS $T_j = 25\,^{o}C$ unless otherwise specified

Collector cut-off current				
$I_B = 0$; $V_{CE} = 14\,V$	I_{CEO}	<	5	mA
Breakdown voltages				
Collector-base voltage open emitter, $I_C = 1\,mA$	$V_{(BR)CBO}$	>	36	V
Collector-emitter voltage open base, $I_C = 10\,mA$	$V_{(BR)CEO}$	>	18	V
Emitter-base voltage open collector, $I_E = 1\,mA$	$V_{(BR)EBO}$	>	4	V
Transient energy				
$L = 25\,mH$; $f = 50\,Hz$				
open base	E	>	0.5	mWs
$-V_{BE} = 1.5\,V$; $R_{BE} = 33\,\Omega$	E	>	0.5	mWs
D.C. current gain				
$I_C = 500\,mA$; $V_{CE} = 5\,V$	h_{FE}	>	5	
Transition frequency				
$I_C = 500\,mA$; $V_{CE} = 10\,V$	f_T	typ.	700	MHz
Collector capacitance at f = 1 MHz				
$I_E = I_e = 0$; $V_{CB} = 15\,V$	C_c	typ.	15	pF
		<	20	pF
Feedback capacitance at f = 1 MHz				
$I_C = 100\,mA$; $V_{CE} = 15\,V$	C_{re}	typ.	11	pF
Collector-stud capacitance	C_{cs}	typ.	2	pF


7Z60943
1000
f_T
(MHz)
750
500
250
0
V_{CE}=10V
typ
0
0.5
1
1.5
2
2.5
I_C (A)
3


7Z60938
30
C_c
(pF)
20
10
0
$I_E=I_e=0$
f=1MHz
typ
0
10
V_{CB} (V)
20

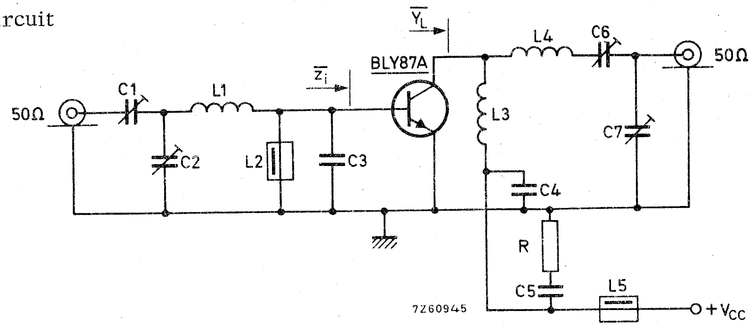
APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralised common-emitter class B circuit)

f = 175 MHz; T_{mb} up to 25 °C

V_{CC}(V)	P_S(W)	P_L(W)	I_C (A)	G_p(dB)	η(%)	$\overline{z_i}$ (Ω)	$\overline{Y_L}$(mA/V)
13.5	< 1.0	8	< 0.85	> 9	> 70	2.8 + j1.2	76 − j16
12.5	typ. 1.0	8	typ. 0.91	typ. 9	typ. 70	–	–

Test circuit



C1 = 2.5 to 20 pF film dielectric trimmer (code number 2222 809 07004)
C2 = C6 = C7 = 4 to 40 pF film dielectric trimmer (code number 2222 809 07008)
C3 = 47 pF ceramic
C4 = 100 pF ceramic
C5 = 150 nF polyester

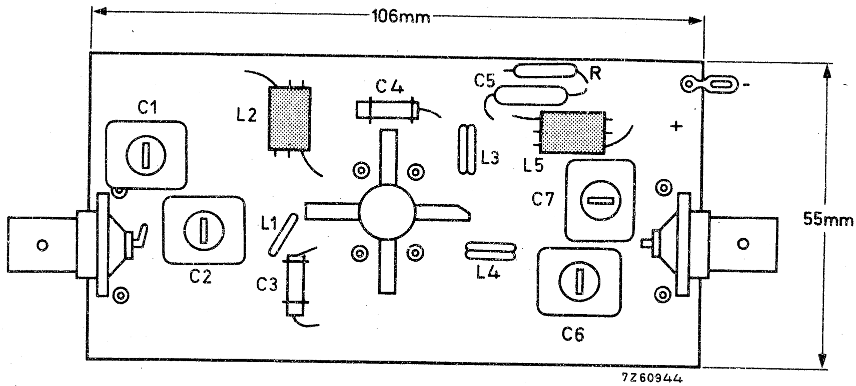
L1 = 0.5 turn enamelled Cu wire (1.5 mm); int. diam. 6 mm; leads 2 x 10 mm
L2 = L5 = ferroxcube choke (code number 4312 020 36640)
L3 = 2.5 turns closely wound enamelled Cu wire (1.5 mm); int. diam. 6 mm; leads 2 x 10 mm
L4 = 4.5 turns enamelled Cu wire (1.5 mm); int. diam. 6 mm; leads 2 x 10 mm

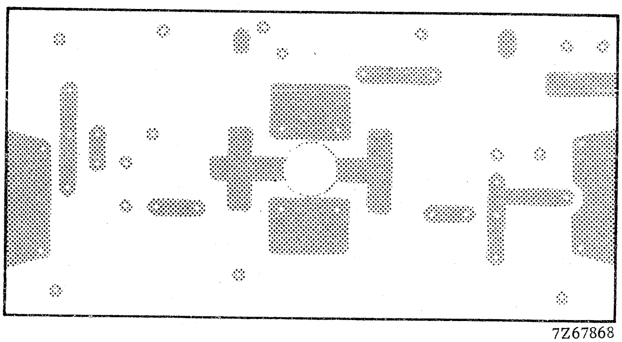
R = 10 Ω carbon

Component lay-out for 175 MHz test circuit see page 6

APPLICATION INFORMATION (continued)

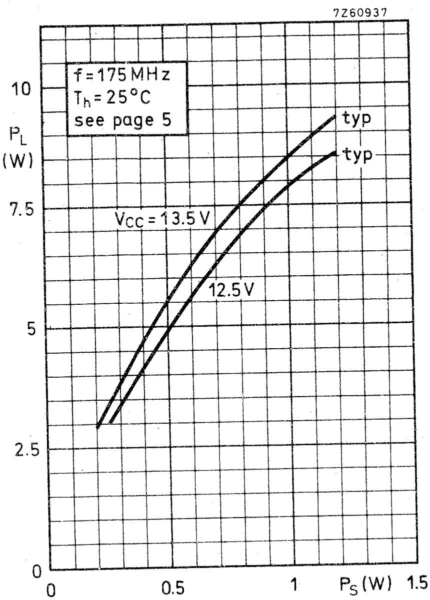
Component lay-out and printed circuit board for 175 MHz test circuit.

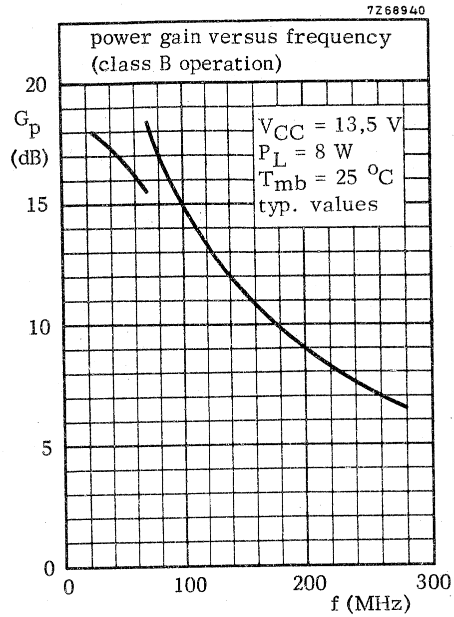


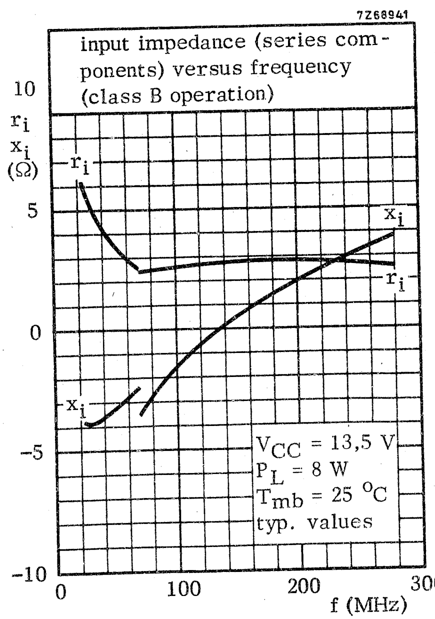


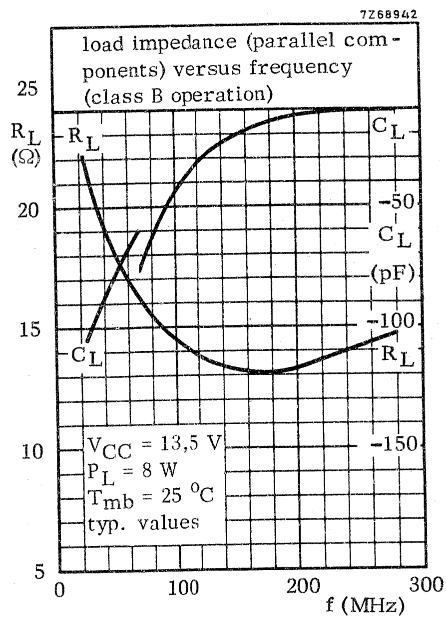
The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallised to serve as earth. Earth connections are made by means of hollow rivets.

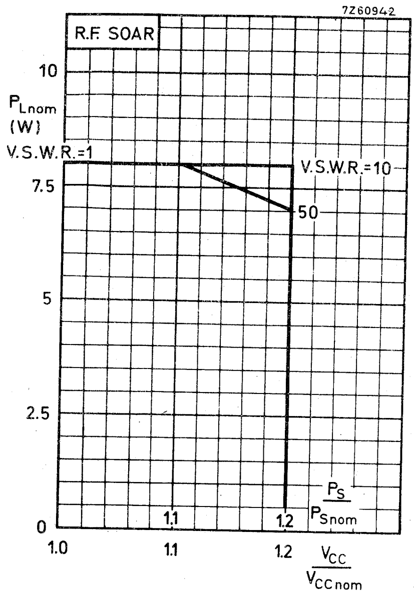
OPERATING NOTE Below 70 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation. This resistor must be effective for both d.c. and r.f.

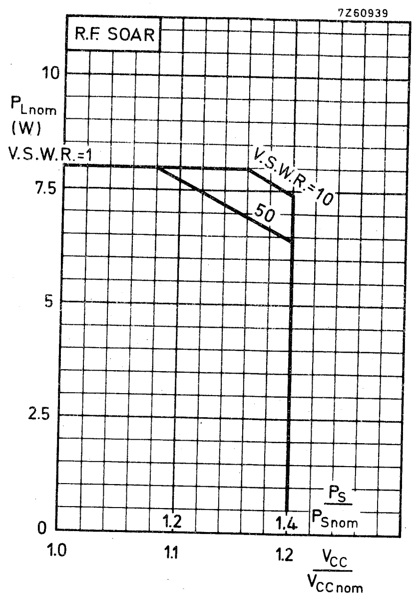












Conditions for R.F. SOAR:

f	= 175 MHz	$P_{Snom} = P_S$ at $V_{CC} = V_{CCnom}$ and V.S.W.R. = 1
T_h	= 70 °C	$R_{th\ mb-h} = 0.6$ °C/W
V_{CCnom}	= 12.5 or 13.5 V	see also page 5

The transistor has been developed for use with unstabilized supply voltages. As the output power and drive power increase with the supply voltage, the nominal output power must be derated in accordance with the graphs above for safe operation at supply voltages other than the nominal. The graphs show the allowable output power under nominal conditions, as a function of the supply overvoltage ratio, with V.S.W.R. as parameter.
The left hand graph applies to the situation in which the drive (P_S/P_{Snom}) increases linearly with supply overvoltage ratio.
The right hand graph shows the derating factor to be applied when the drive (P_S/P_{Snom}) increases as the square of the supply overvoltage ratio (V_{CC}/V_{CCnom}).
Depending on the operating conditions, the appropriate derating factor may lie in the region between the linear and the square-law functions.

V.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor intended for use in class-A, B and C operated mobile, h.f. and v.h.f. transmitters with a nominal supply voltage of 13,5 V. The transistor is resistance stabilized and is guaranteed to withstand severe load mismatch conditions with a supply over-voltage to 16,5 V.

It has a 3/8" capstan envelope with a ceramic cap. All leads are isolated from the stud.

QUICK REFERENCE DATA

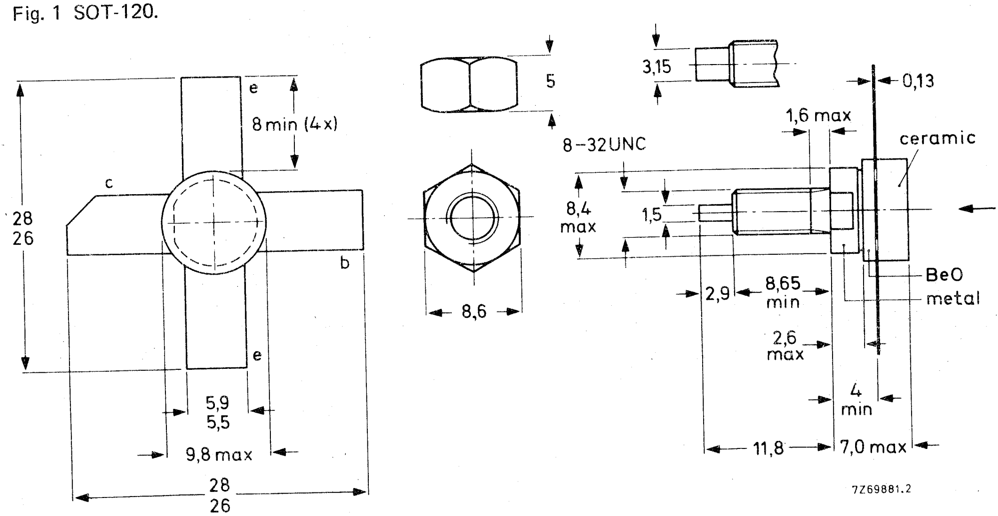
R.F. performance up to T_h = 25 °C in an unneutralized common-emitter class-B circuit

mode of operation	V_{CE} V	f MHz	P_L W	G_p dB	η %	$\overline{z_i}$ Ω	$\overline{Y_L}$ mA/V
c.w.	13,5	175	8	> 12,0	> 60	2,2 + j0,4	96 – j28
c.w.	12,5	175	8	typ. 11,5	typ. 65	–	–

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-120.



Torque on nut: min. 0,75 Nm
(7,5 kg cm)
max. 0,85 Nm
(8,5 kg cm)

Diameter of clearance hole in heatsink: max. 4,2 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

When locking is required an adhesive is preferred instead of a lock washer.

CAUTION This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage (V_{BE} = 0) peak value	V_{CESM}	max.	36 V
Collector-emitter voltage (open base)	V_{CEO}	max.	18 V
Emitter-base voltage (open collector)	V_{EBO}	max.	4 V
Collector current (average)	$I_{C(AV)}$	max.	1,5 A
Collector current (peak value); f > 1 MHz	I_{CM}	max.	4,0 A
R.F. power dissipation (f > 1 MHz); T_{mb} = 25 °C	P_{rf}	max.	20 W

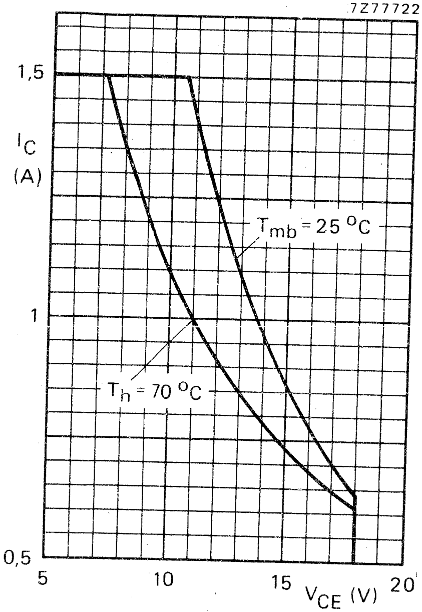


Fig. 2 D.C. SOAR.

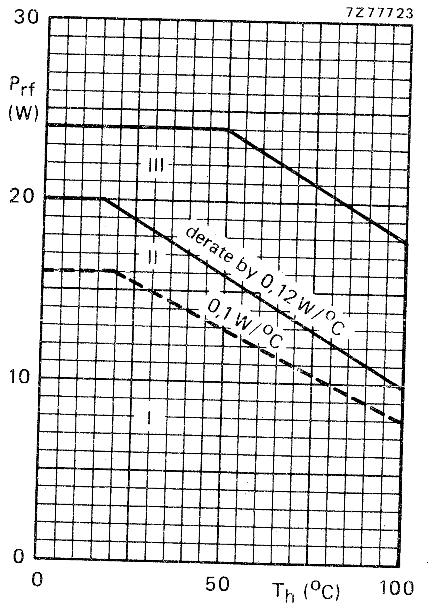


Fig. 3 R.F. power dissipation; $V_{CE} \leq$ 16,5 V; f > 1 MHz.
I Continuous d.c. operation
II Continuous r.f. operation
III Short-time operation during mismatch

Storage temperature	T_{stg}	−65 to + 150	°C
Operating junction temperature	T_j	max. 200	°C

THERMAL RESISTANCE (dissipation = 8 W; T_{mb} = 73,5 °C, i.e. T_h = 70 °C)

From junction to mounting base (d.c. dissipation)	$R_{th\ j\text{-}mb(dc)}$	=	10,7 °C/W
From junction to mounting base (r.f. dissipation)	$R_{th\ j\text{-}mb(rf)}$	=	8,6 °C/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,45 °C/W

CHARACTERISTICS

$T_j = 25\ ^oC$

Collector-emitter breakdown voltage $V_{BE} = 0$; $I_C = 5$ mA	$V_{(BR)CES}$	>	36 V
Collector-emitter breakdown voltage open base; $I_C = 25$ mA	$V_{(BR)CEO}$	>	18 V
Emitter-base breakdown voltage open collector; $I_E = 1$ mA	$V_{(BR)EBO}$	>	4 V
Collector cut-off current $V_{BE} = 0$; $V_{CE} = 18$ V	I_{CES}	<	2 mA
Second breakdown energy; L = 25 mH; f = 50 Hz open base	E_{SBO}	>	0,5 mJ
$R_{BE} = 10\ \Omega$	E_{SBR}	>	0,5 mJ
D.C. current gain * $I_C = 0{,}75$ A; $V_{CE} = 5$ V	h_{FE}	typ.	40 10 to 100
Collector-emitter saturation voltage * $I_C = 2$ A; $I_B = 0{,}4$ A	V_{CEsat}	typ.	0,85 V
Transition frequency at f = 100 MHz * $-I_E = 0{,}75$ A; $V_{CB} = 13{,}5$ V	f_T	typ.	950 MHz
$-I_E = 2$ A; $V_{CB} = 13{,}5$ V	f_T	typ.	850 MHz
Collector capacitance at f = 1 MHz $I_E = I_e = 0$; $V_{CB} = 13{,}5$ V	C_c	typ.	16,5 pF
Feedback capacitance at f = 1 MHz $I_C = 100$ mA; $V_{CE} = 13{,}5$ V	C_{re}	typ.	12 pF
Collector-stud capacitance	C_{cs}	typ.	2 pF

* Measured under pulse conditions: $t_p \leqslant 200\ \mu s$; $\delta \leqslant 0{,}02$.

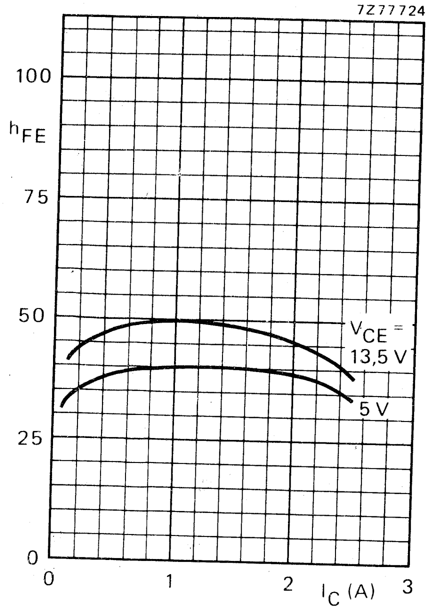


Fig. 4 Typical values; T_j = 25 °C.

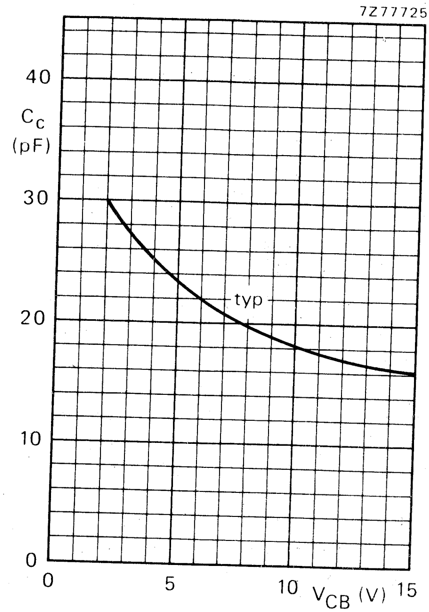


Fig. 5 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

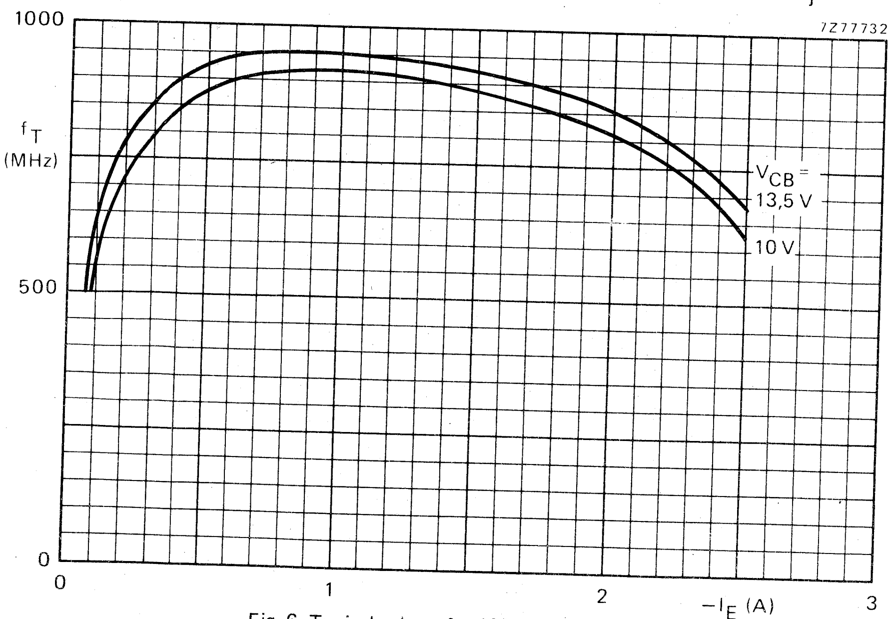


Fig. 6 Typical values; f = 100 MHz; T_j = 25 °C.

APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit)

$T_h = 25\ ^oC$

f (MHz)	V_{CE} (V)	P_L (W)	P_S (W)	G_p (dB)	I_C (A)	η (%)	$\overline{z_i}$ (Ω)	$\overline{Y_L}$ (mA/V)
175	**13,5**	**8**	**< 0,5**	**> 12,0**	**< 0,99**	**> 60**	**2,2 + j0,4**	**96 – j28**
175	12,5	8	–	typ. 11,5	–	typ. 65	–	–

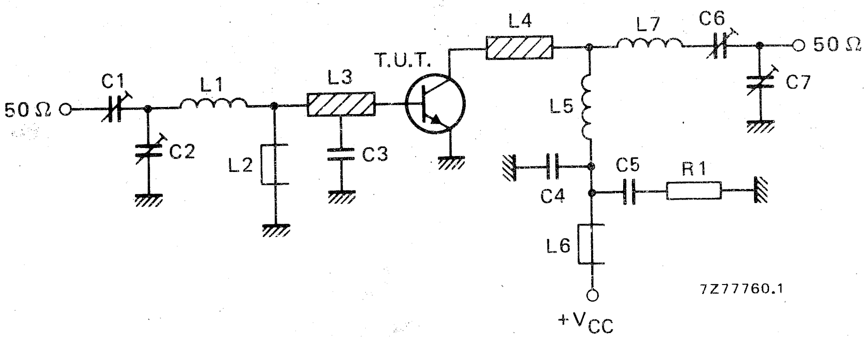


Fig. 7 Test circuit; c.w. class-B.

List of components:

C1 = 2,5 to 20 pF film dielectric trimmer (cat. no. 2222 809 07004)
C2 = C6 = 4 to 40 pF film dielectric trimmer (cat. no. 2222 809 07008)
C3 = 47 pF ceramic capacitor (500 V)
C4 = 120 pF ceramic capacitor (500 V)
C5 = 100 nF polyester capacitor
C7 = 5 to 60 pF film dielectric trimmer (cat. no. 2222 809 07011)

L1 = 2 turns Cu wire (1,6 mm); int. dia. 4,5 mm; length 5,7 mm; leads 2 x 5 mm
L2 = L6 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L3 = L4 = strip (12 mm x 6 mm); tap for C3 at 5 mm from transistor
L5 = 3 turns Cu wire (1,6 mm); int. dia. 7,5 mm; length 7,5 mm; leads 2 x 5 mm
L7 = 3 turns Cu wire (1,6 mm); int. dia. 6,5 mm; length 7,4 mm; leads 2 x 5 mm

L3 and L4 are strips on a double Cu-clad printed-circuit board with epoxy fibre-glass dielectric, thickness 1/16″.

R1 = 10 Ω carbon resistor

Component layout and printed-circuit board for 175 MHz test circuit see Fig. 8.

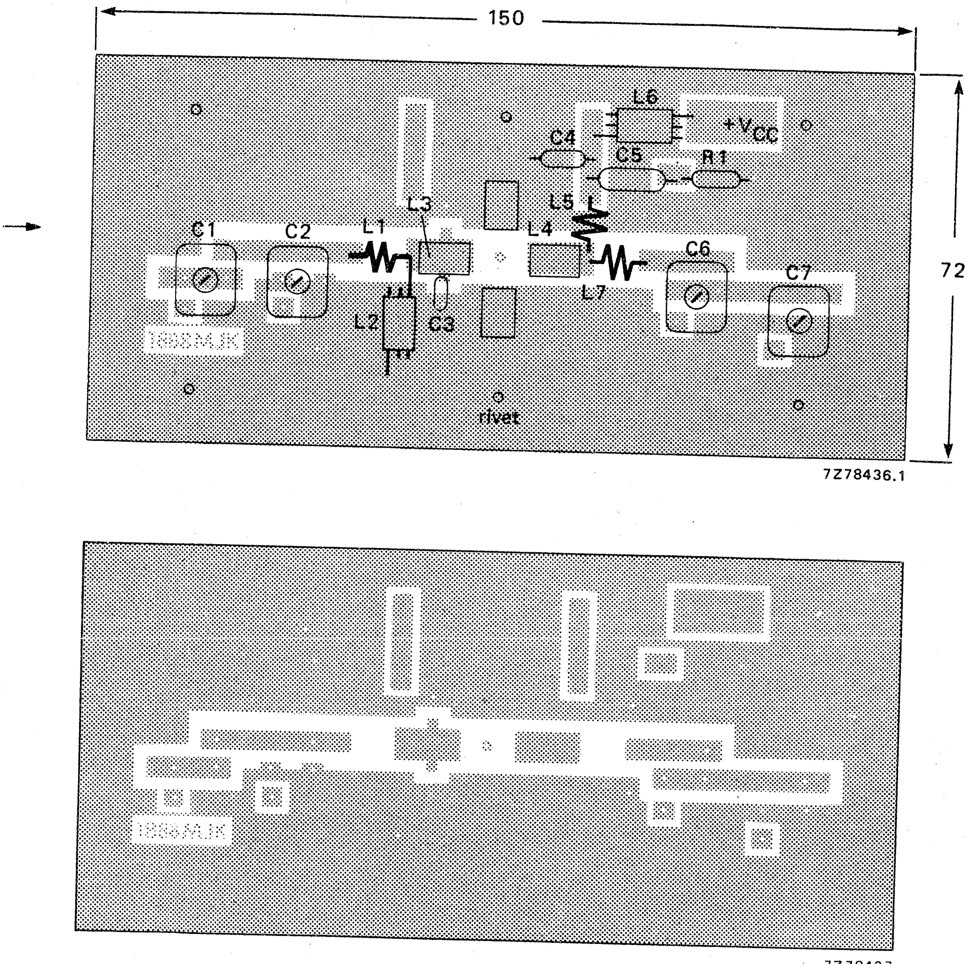


Fig. 8 Component layout and printed-circuit board for 175 MHz test circuit.

The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets, whilst under the emitter leads Cu straps are used for a direct contact between upper and lower sheets.

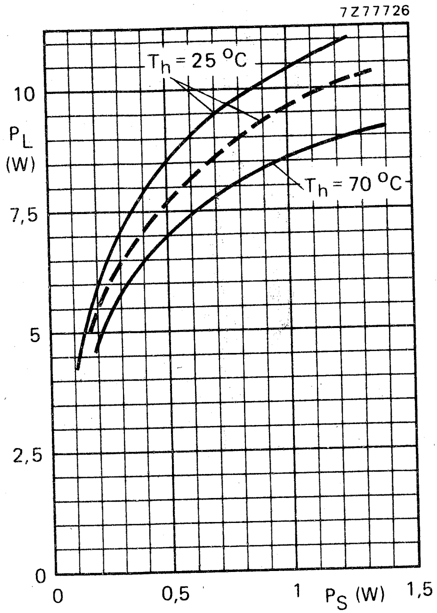


Fig. 9 Typical values; f = 175 MHz;
—— V_{CE} = 13,5 V; – – – V_{CE} = 12,5 V.

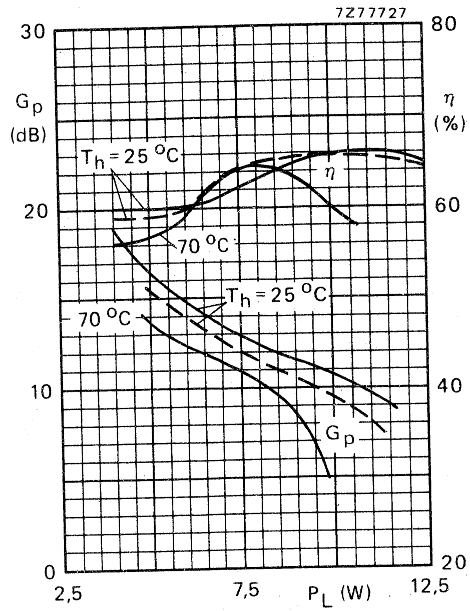


Fig. 10 Typical values; f = 175 MHz;
—— V_{CE} = 13,5 V; – – – V_{CE} = 12,5 V.

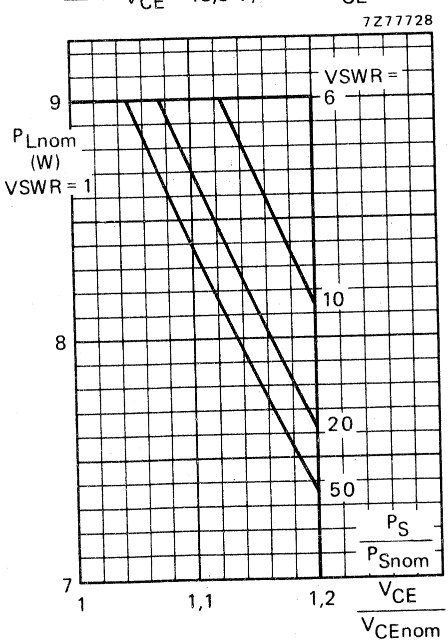


Fig. 11 R.F. SOAR (short-time operation during mismatch); f = 175 MHz; T_h = 70 °C; $R_{th\ mb\text{-}h}$ = 0,45 °C/W; V_{CEnom} = 13,5 V or 12,5 V; P_S = P_{Snom} at V_{CEnom} and VSWR = 1.

Note to Fig. 11:

The transistor has been developed for use with unstabilized supply voltages. As the output power and drive power increase with the supply voltage, the nominal output power must be derated in accordance with the graph for safe operation at supply voltages other than the nominal. The graph shows the permissible output power under nominal conditions (VSWR = 1), as a function of the expected supply over-voltage ratio with VSWR as parameter.

The graph applies to the situation in which the drive (P_S/P_{Snom}) increases linearly with supply over-voltage ratio.

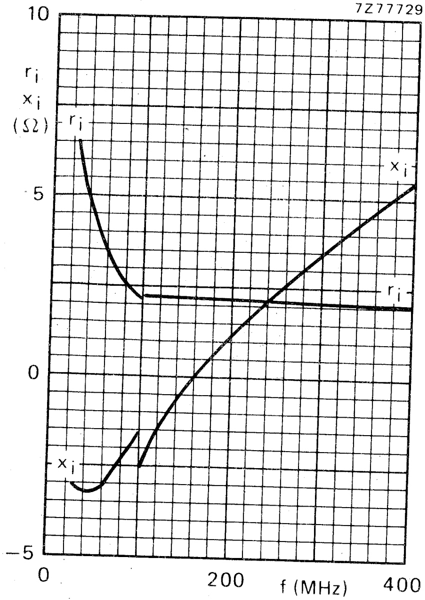


Fig. 12 Input impedance (series components).

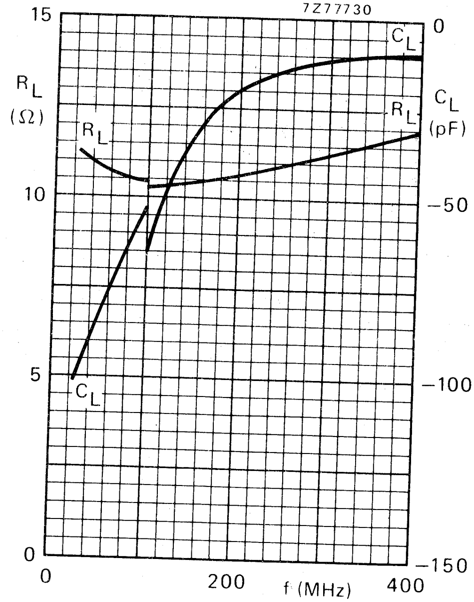


Fig. 13 Load impedance (parallel components).

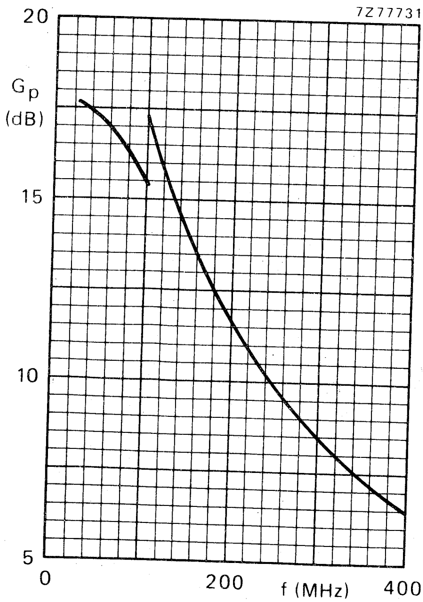


Fig. 14.

Conditions for Figs 12, 13 and 14:

Typical values; V_{CE} = 13,5 V; P_L = 8 W;
T_h = 25 °C.

OPERATING NOTE

Below 100 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation.
This resistor must be effective for r.f. only.

V.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor for use in class-A, B and C operated mobile, industrial and military transmitters with a supply voltage of 13,5 V. The transistor is resistance stabilized and is guaranteed to withstand severe load mismatch conditions with a supply over-voltage to 16,5 V.

It has a ¼" capstan envelope with a moulded cap. All leads are isolated from the stud.

QUICK REFERENCE DATA

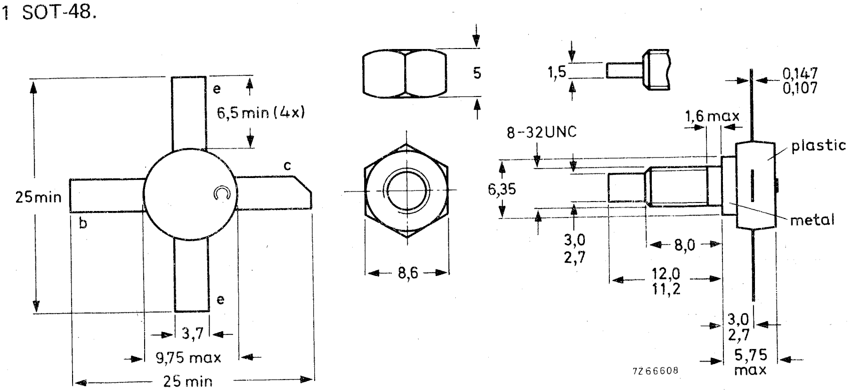
R.F. performance up to T_{mb} = 25 °C in an unneutralized common-emitter class-B circuit.

mode of operation	V_{CE} V	f MHz	P_L W	G_p dB	η %	$\overline{z_i}$ Ω	$\overline{Y_L}$ mA/V
c.w.	**13,5**	**175**	**15**	**> 7,5**	**> 65**	**2,3 + j2,2**	**128 − j4,4**
c.w.	12,5	175	15	typ. 7,5	typ. 65	−	−

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-48.



Torque on nut: min. 0,75 Nm (7,5 kg cm)
max. 0,85 Nm (8,5 kg cm)

Diameter of clearance hole in heatsink: max. 4,2 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

When locking is required an adhesive is preferred instead of a lock washer.

CAUTION This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC 134)

Voltages

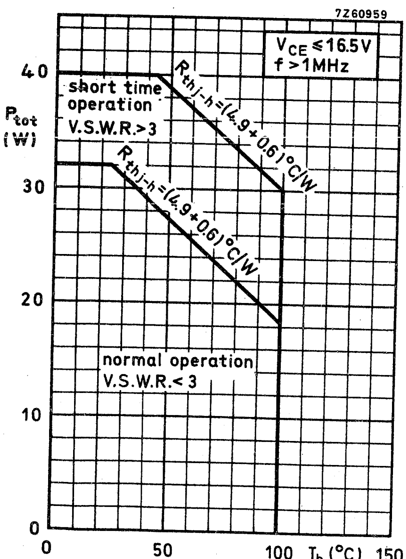
Collector-base voltage (open emitter) peak value	V_{CBOM}	max.	36	V
Collector-emitter voltage (open base)	V_{CEO}	max.	18	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4	V

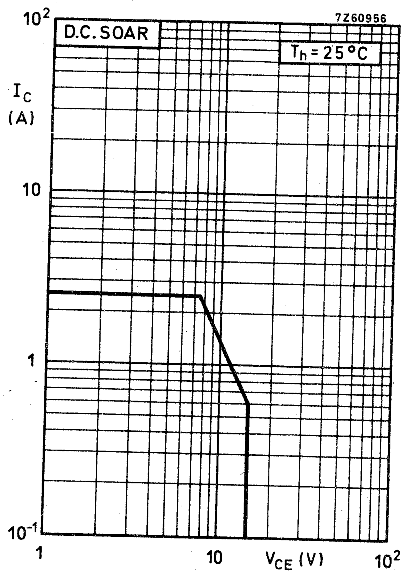
Currents

Collector current (average)	$I_{C(AV)}$	max.	2.5	A
Collector (peak value) f > 1 MHz	I_{CM}	max.	7.5	A

Power dissipation

Total power dissipation up to T_h = 25 °C f > 1 MHz	P_{tot}	max.	32	W





Temperature

Storage temperature	T_{stg}	−30 to +200	°C
Operating junction temperature	T_j	max. 200	°C

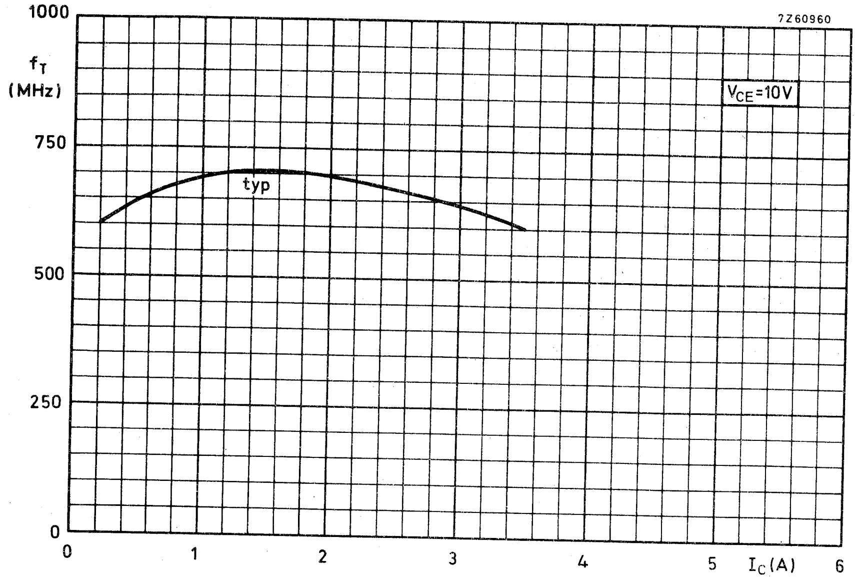
THERMAL RESISTANCE

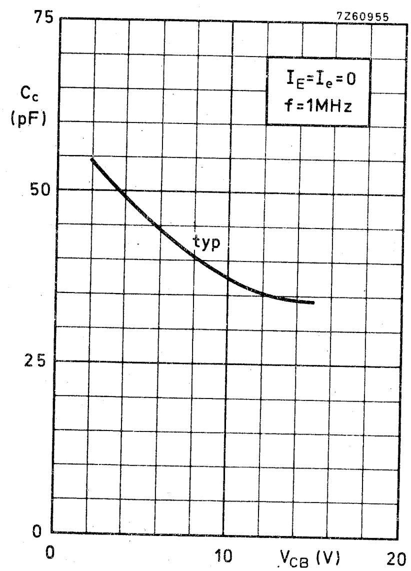
From junction to mounting base	$R_{th\ j\text{-}mb}$	=	4.9	°C/W
From mounting base to heatsink	$R_{mb\text{-}h}$	=	0.6	°C/W

CHARACTERISTICS

$T_j = 25\,^oC$ unless otherwise specified

Collector cut-off current				
$I_B = 0$; $V_{CE} = 14$ V	I_{CEO}	<	10	mA
Breakdown voltages				
Collector-base voltage open emitter, $I_C = 3$ mA	$V_{(BR)CBO}$	>	36	V
Collector-emitter voltage open base, $I_C = 25$ mA	$V_{(BR)CEO}$	>	18	V
Emitter-base voltage open collector; $I_E = 3$ mA	$V_{(BR)EBO}$	>	4	V
Transient energy				
L = 25 mH; f = 50 Hz				
open base	E	>	2.0	mWs
$-V_{BE} = 1.5$ V; $R_{BE} = 33\,\Omega$	E	>	4.5	mWs
D.C. current gain				
$I_C = 500$ mA; $V_{CE} = 5$ V	h_{FE}	>	5	
Transition frequency				
$I_C = 1$ A; $V_{CE} = 10$ V	f_T	typ.	700	MHz
Collector capacitance at f = 1 MHz				
$I_E = I_e = 0$; $V_{CB} = 15$ V	C_c	typ.	34	pF
		<	40	pF
Feedback capacitance at f = 1 MHz				
$I_C = 100$ mA; $V_{CE} = 15$ V	C_{re}	typ.	25	pF
Collector-stud capacitance	C_{cs}	typ.	2	pF


7Z60960
1000
fT
(MHz)
750
500
250
0
VCE=10V
typ
0
1
2
3
4
5
IC (A)
6


7Z60955
75
Cc
(pF)
50
25
0
IE=Ie=0
f=1MHz
typ
0
10
VCB (V)
20

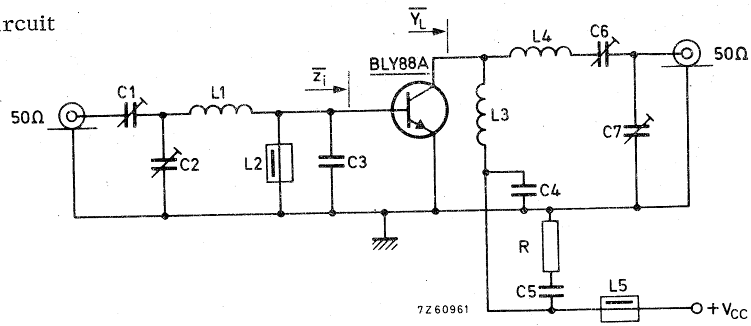
APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralised common-emitter class B circuit)

f = 175 MHz; T_{mb} up to 25 °C

V_{CC}(V)	P_S(W)	P_L(W)	I_C(A)	G_p(dB)	η(%)	$\overline{z_i}$(Ω)	$\overline{Y_L}$(mA/V)
13.5	< 2.65	15	< 1.71	> 7.5	> 65	2.3+j2.2	128−j4.4
12.5	typ. 2.65	15	typ. 1.85	typ. 7.5	typ. 65	−	−

Test circuit



C1= 2.5 to 20 pF film dielectric trimmer (code number 2222 809 07004)
C2=C6=C7= 4 to 40 pF film dielectric trimmer (code number 2222 809 07008)
C3= 47 pF ceramic
C4= 100 pF ceramic
C5= 150 nF polyester

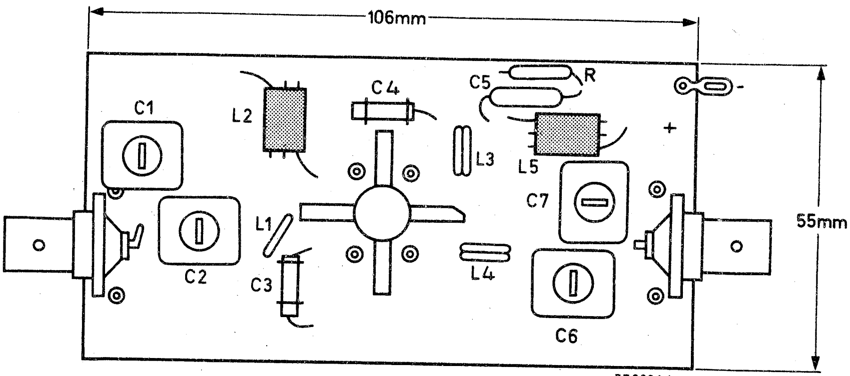
L1= 0.5 turn enamelled Cu wire (1.5 mm); int. diam. 6 mm; leads 2 x 10 mm
L2=L5= ferroxcube choke (code number 4312 020 36640)
L3= 2.5 turns closely wound enamelled Cu wire (1.5 mm); int. diam. 6 mm; leads 2 x 10 mm
L4= 2.5 turns enamelled Cu wire (1.5 mm); int. diam. 6 mm; leads 2 x 10 mm

R = 10 Ω carbon

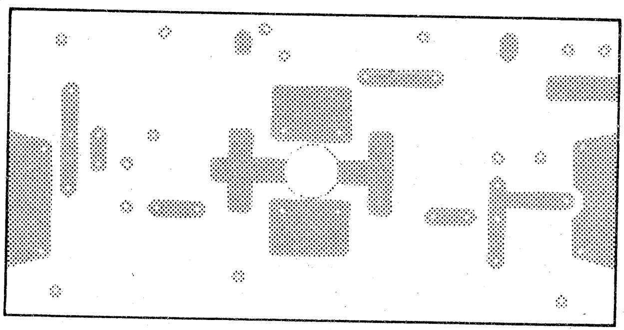
Component lay-out for 175 MHz test circuit see page 6.

APPLICATION INFORMATION (continued)

Component lay-out and printed circuit board for 175 MHz test circuit.



7Z60944

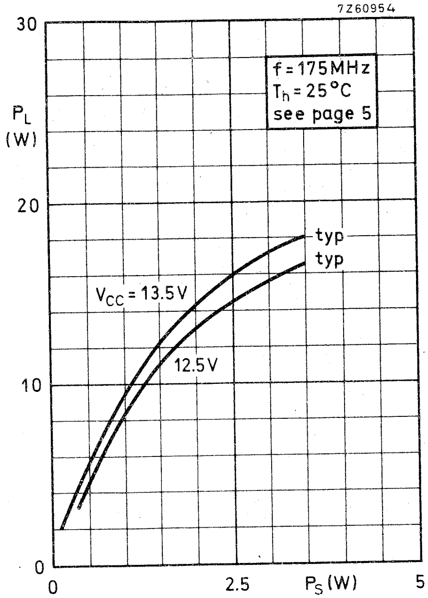


7Z67868

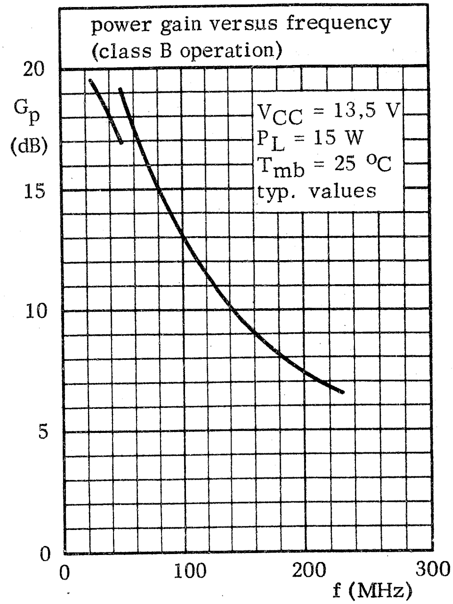
The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallised to serve as earth. Earth connections are made by means of hollow rivets.

OPERATING NOTE Below 50 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation. This resistor must be effective for both d.c. and r.f.

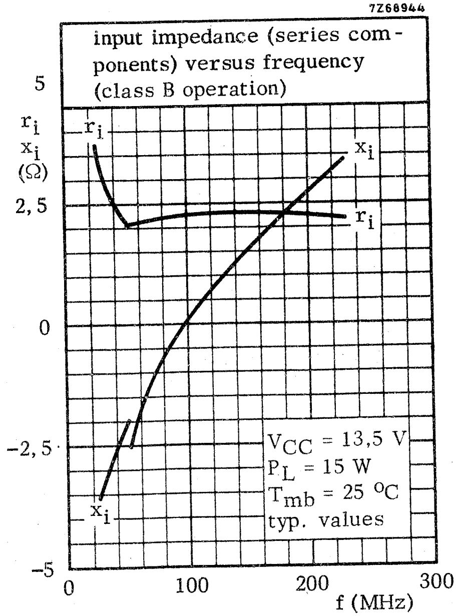
7Z60954



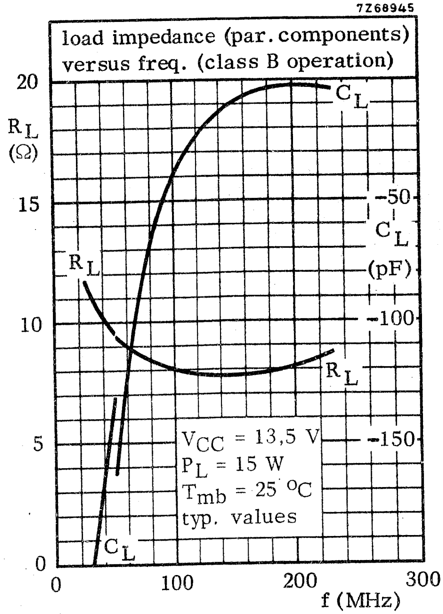
7Z68943

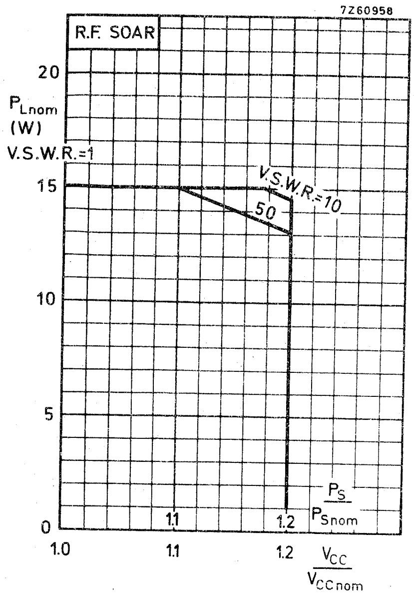


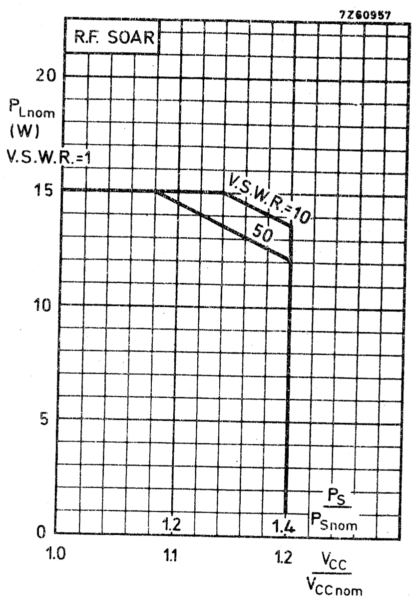
7Z68944



7Z68945







Conditions for R.F. SOAR:

f = 175 MHz
T_h = 70 °C
V_{CCnom} = 12.5 or 13.5 V

$P_{Snom} = P_S$ at $V_{CC} = V_{CCnom}$ and V.S.W.R. = 1
$R_{th\ mb\text{-}h}$ = 0.6 °C/W
see also page 5

The transistor has been developed for use with unstabilized supply voltages. As the output power and drive power increase with the supply voltage, the nominal output power must be derated in accordance with the graphs above for safe operation at supply voltages other than the nominal. The graphs show the allowable output power under nominal conditions, as a function of the supply overvoltage ratio, with V.S.W.R. as parameter.
The left hand graph applies to the situation in which the drive (P_S/P_{Snom}) increases linearly with supply overvoltage ratio.
The right hand graph shows the derating factor to be applied when the drive (P_S/P_{Snom}) increases as the square of the supply overvoltage ratio (V_{CC}/V_{CCnom}).
Depending on the operating conditions, the appropriate derating factor may lie in the region between the linear and the square-law functions.

V.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor intended for use in class-A, B and C operated mobile, h.f. and v.h.f. transmitters with a nominal supply voltage of 13,5 V. The transistor is resistance stabilized and is guaranteed to withstand severe load mismatch conditions with a supply over-voltage to 16,5 V.

It has a 3/8" capstan envelope with a ceramic cap. All leads are isolated from the stud.

QUICK REFERENCE DATA

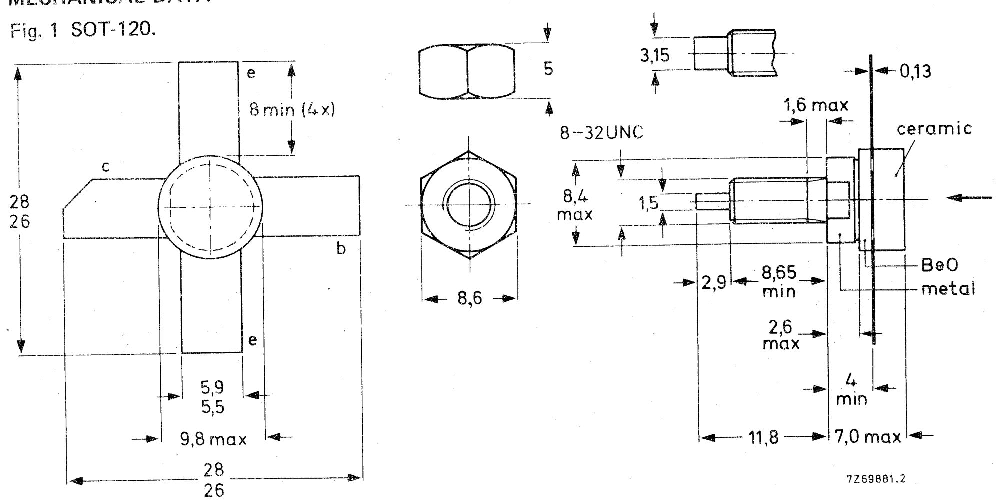
R.F. performance up to T_h = 25 °C in an unneutralized common-emitter class-B circuit

mode of operation	V_{CE} V	f MHz	P_L W	G_p dB	η %	$\overline{z_i}$ Ω	$\overline{Y_L}$ mA/V
c.w.	13,5	175	15	> 8,0	> 60	2,3 + j2,2	130 − j4,4
c.w.	12,5	175	15	typ. 7,5	typ. 67	—	—

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-120.



Torque on nut: min. 0,75 Nm (7,5 kg cm)
max. 0,85 Nm (8,5 kg cm)

Diameter of clearance hole in heatsink: max. 4,2 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

When locking is required an adhesive is preferred instead of a lock washer.

CAUTION This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage (V_{BE} = 0) peak value	V_{CESM}	max.	36	V
Collector-emitter voltage (open base)	V_{CEO}	max.	18	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4	V
Collector current (average)	$I_{C(AV)}$	max.	3	A
Collector current (peak value); f > 1 MHz	I_{CM}	max.	8	A
R.F. power dissipation (f > 1 MHz); T_{mb} = 25 °C	P_{rf}	max.	36	W
Storage temperature	T_{stg}		−65 to +150	°C
Operating junction temperature	T_j	max.	200	°C

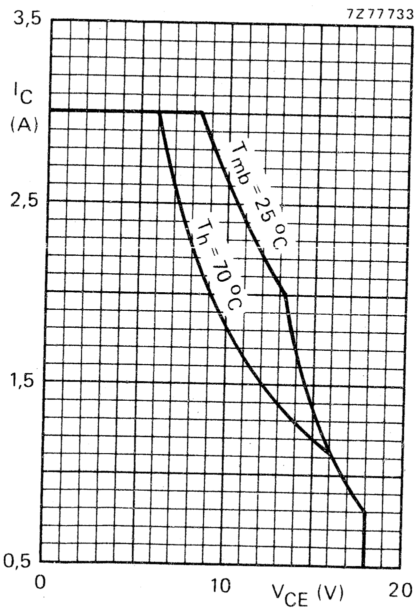


Fig. 2 D.C. SOAR.

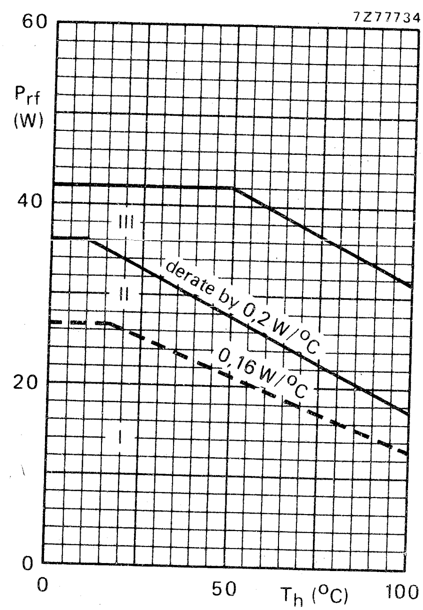


Fig. 3 R.F. power dissipation; $V_{CE} \leq$ 16,5 V; f > 1 MHz.
I Continuous d.c. operation
II Continuous r.f. operation
III Short-time operation during mismatch

THERMAL RESISTANCE (dissipation = 15 W; T_{mb} = 77 °C, i.e. T_h = 70 °C)

From junction to mounting base (d.c. dissipation)	$R_{th\ j\text{-}mb(dc)}$	= 6,55 °C/W
From junction to mounting base (r.f. dissipation)	$R_{th\ j\text{-}mb(rf)}$	= 4,95 °C/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	= 0,45 °C/W

CHARACTERISTICS

T_j = 25 °C

Collector-emitter breakdown voltage V_{BE} = 0; I_C = 10 mA	$V_{(BR)CES}$	>	36 V
Collector-emitter breakdown voltage open base; I_C = 50 mA	$V_{(BR)CEO}$	>	18 V
Emitter-base breakdown voltage open collector; I_E = 4 mA	$V_{(BR)EBO}$	>	4 V
Collector cut-off current V_{BE} = 0; V_{CE} = 18 V	I_{CES}	<	4 mA
Second breakdown energy; L = 25 mH; f = 50 Hz open base	E_{SBO}	>	2,5 mJ
R_{BE} = 10 Ω	E_{SBR}	>	2,5 mJ
D.C. current gain* I_C = 1,5 A; V_{CE} = 5 V	h_{FE}	typ.	40
			10 to 100
Collector-emitter saturation voltage* I_C = 4,5 A; I_B = 0,9 A	V_{CEsat}	typ.	1,0 V
Transition frequency at f = 100 MHz* $-I_E$ = 1,5 A; V_{CB} = 13,5 V	f_T	typ.	850 MHz
$-I_E$ = 4,5 A; V_{CB} = 13,5 V	f_T	typ.	800 MHz
Collector capacitance at f = 1 MHz I_E = I_e = 0; V_{CB} = 13,5 V	C_c	typ.	32 pF
Feedback capacitance at f = 1 MHz I_C = 200 mA; V_{CE} = 13,5 V	C_{re}	typ.	23 pF
Collector-stud capacitance	C_{cs}	typ.	2 pF

* Measured under pulse conditions: $t_p \leq 200\ \mu s$; $\delta \leq 0{,}02$.

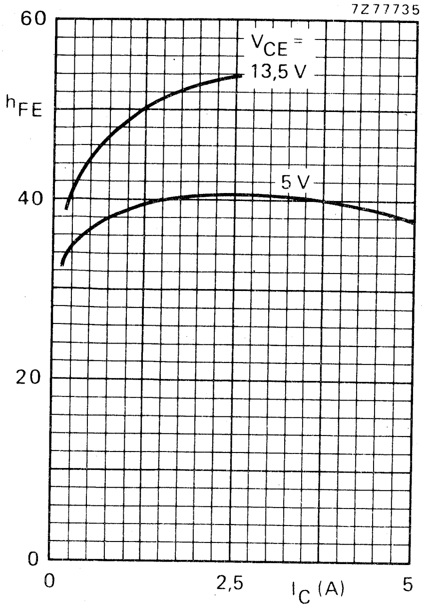


Fig. 4 Typical values; T_j = 25 °C.

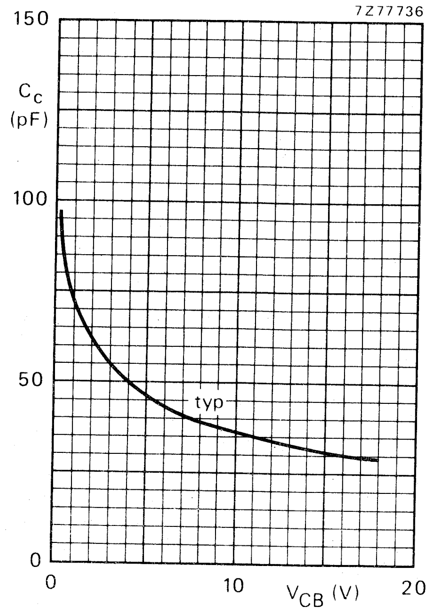


Fig. 5 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

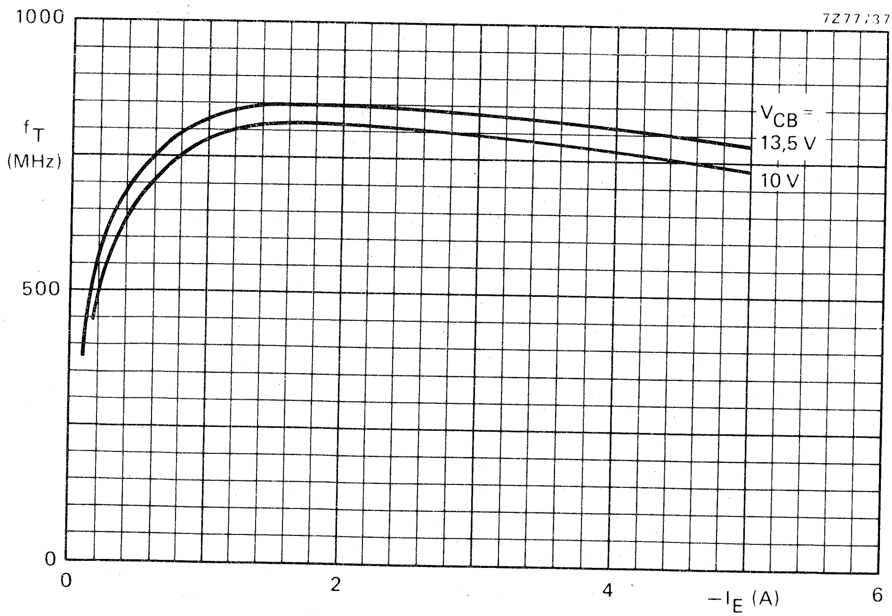


Fig. 6 Typical values; f = 100 MHz; T_j = 25 °C.

APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit)

T_h = 25 °C

f (MHz)	V_{CE} (V)	P_L (W)	P_S (W)	G_p (dB)	I_C (A)	η (%)	$\overline{z_i}$ (Ω)	$\overline{Y_L}$ (mA/V)
175	13,5	15	< 2,4	> 8,0	< 1,85	> 60	2,3 + j2,2	130 − j4,4
175	12,5	15	−	typ. 7,5	−	typ. 67	−	−

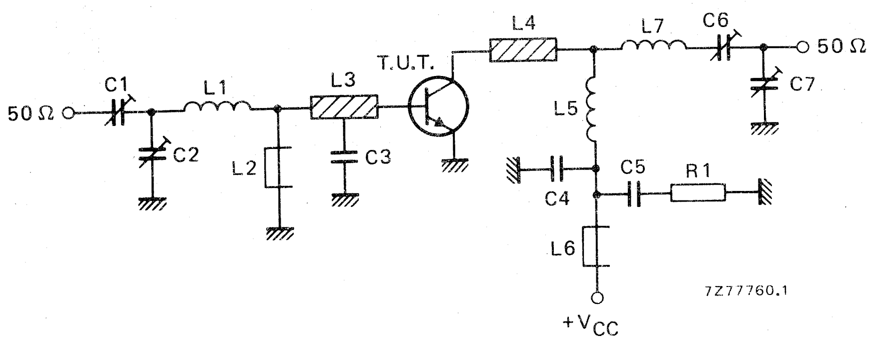


Fig. 7 Test circuit; c.w. class-B.

List of components:

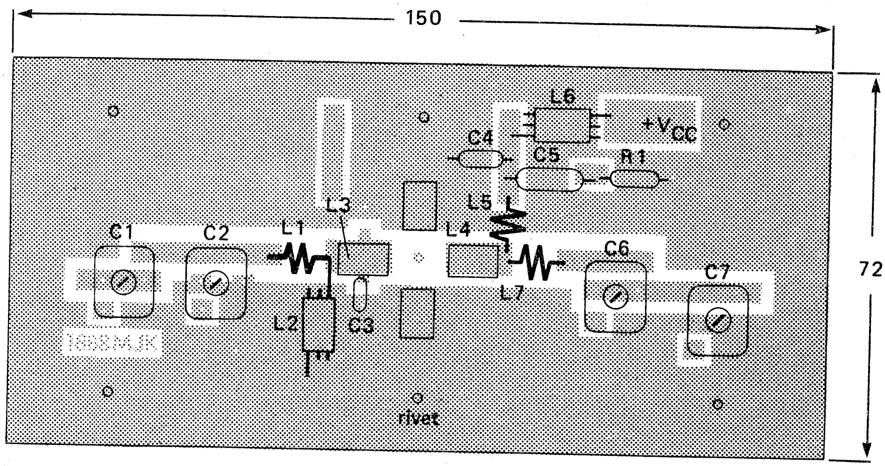
C1 = 2,5 to 20 pF film dielectric trimmer (cat. no. 2222 809 07004)
C2 = C6 = 4 to 40 pF film dielectric trimmer (cat. no. 2222 809 07008)
C3 = 47 pF ceramic capacitor (500 V)
C4 = 120 pF ceramic capacitor (500 V)
C5 = 100 nF polyester capacitor
C7 = 5 to 60 pF film dielectric trimmer (cat. no. 2222 809 07011)

L1 = 2 turns Cu wire (1,6 mm); int. dia. 4,5 mm; length 5,7 mm; leads 2 x 5 mm
L2 = L6 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L3 = L4 = strip (12 mm x 6 mm); tap for C3 at 5 mm from transistor
L5 = 3 turns Cu wire (1,6 mm); int. dia. 7,5 mm; length 7,5 mm; leads 2 x 5 mm
L7 = 3 turns Cu wire (1,6 mm); int. dia. 6,5 mm; length 7,4 mm; leads 2 x 5 mm

L3 and L4 are strips on a double Cu-clad printed-circuit board with epoxy fibre-glass dielectric, thickness 1/16″.

R1 = 10 Ω carbon resistor

Component layout and printed-circuit board for 175 MHz test circuit see Fig. 8.



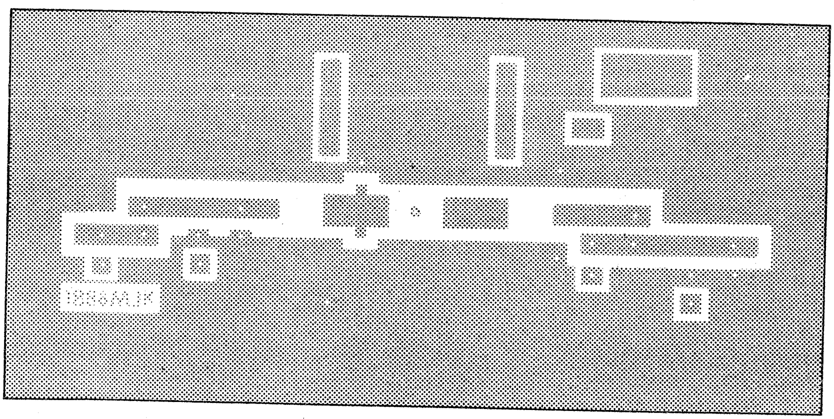


Fig. 8 Component layout and printed-circuit board for 175 MHz test circuit.

The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets, whilst under the emitter leads Cu straps are used for a direct contact between upper and lower sheets.

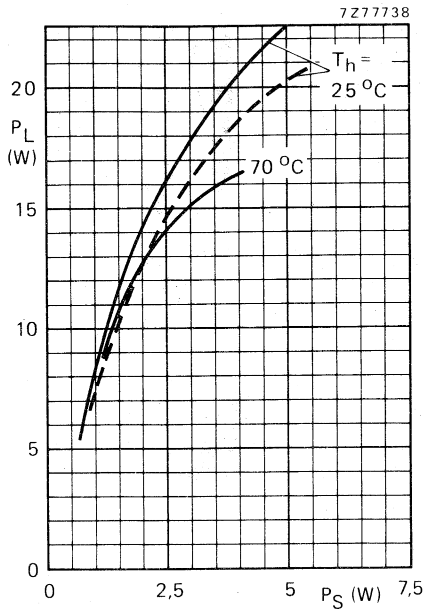


Fig. 9 Typical values; f = 175 MHz;
——— V_{CE} = 13,5 V; – – – – V_{CE} = 12,5 V.

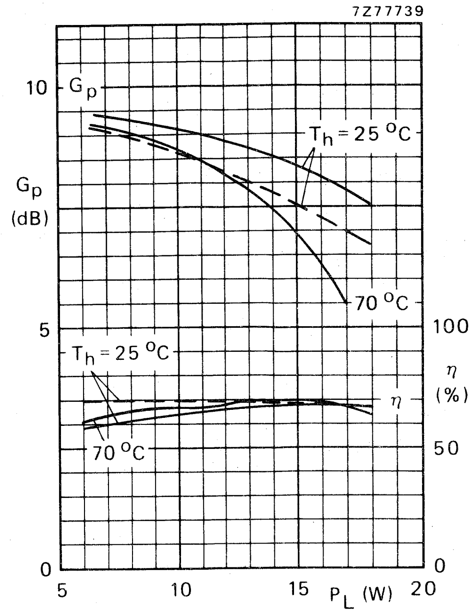


Fig. 10 Typical values; f = 175 MHz;
——— V_{CE} = 13,5 V; – – – – V_{CE} = 12,5 V.

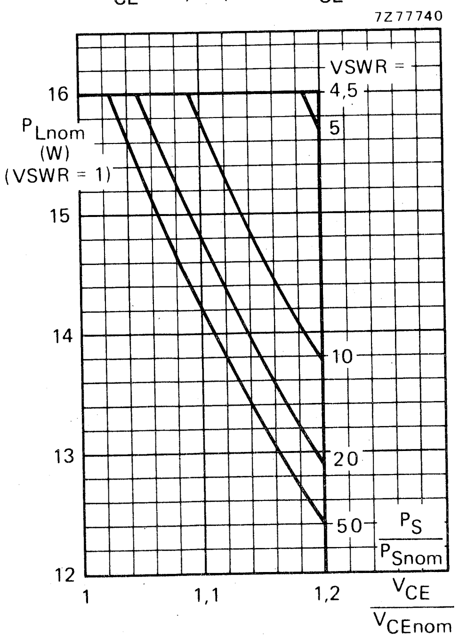


Fig. 11 R.F. SOAR (short-time operation during mismatch); f = 175 MHz; T_h = 70 °C; $R_{th\ mb\text{-}h}$ = 0,45 °C/W; V_{CEnom} = 13,5 V or 12,5 V; $P_S = P_{Snom}$ at V_{CEnom} and VSWR = 1.

Note to Fig. 11:

The transistor has been developed for use with unstabilized supply voltages. As the output power and drive power increase with the supply voltage, the nominal output power must be derated in accordance with the graph for safe operation at supply voltages other than the nominal. The graph shows the permissible output power under nominal conditions (VSWR = 1), as a function of the expected supply over-voltage ratio with VSWR as parameter.

The graph applies to the situation in which the drive (P_S/P_{Snom}) increases linearly with supply over-voltage ratio.

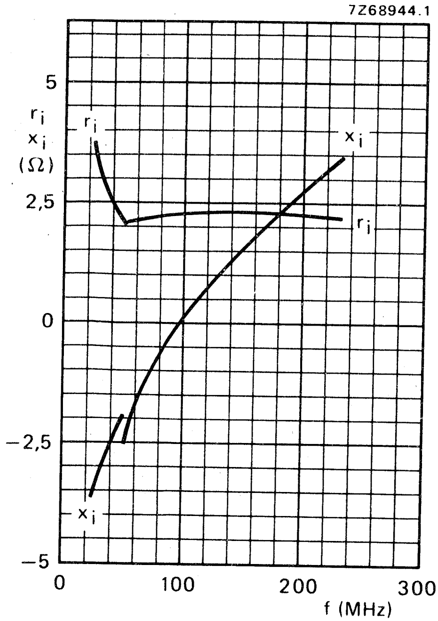


Fig. 12 Input impedance (series components).

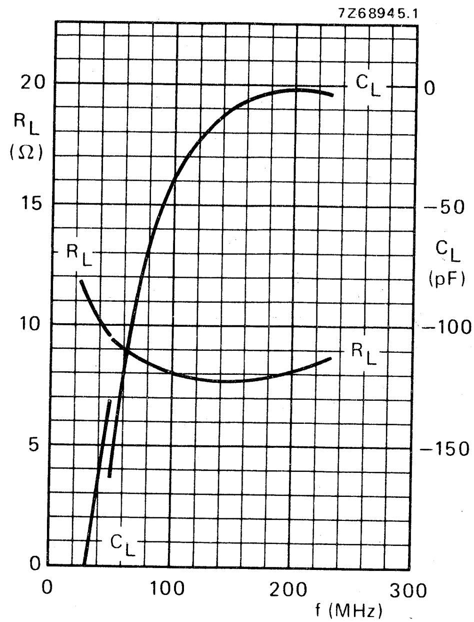


Fig. 13 Load impedance (parallel components).

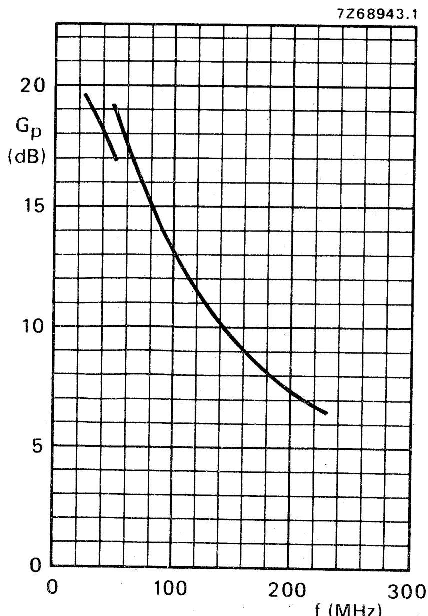


Fig. 14.

Conditions for Figs 12, 13 and 14:

Typical values: V_{CE} = 13,5 V; P_L = 15 W;
T_h = 25 °C.

OPERATING NOTE

Below 50 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation. This resistor must be effective for r.f. only.

V.H.F. POWER TRANSISTOR

N-P-N epitaxial planar transistor intended for use in class-A, B and C operated mobile, industrial and military transmitters with a supply voltage of 13,5 V. The transistor is resistance stabilized. Every transistor is tested under severe load mismatch conditions with a supply over-voltage to 16,5 V. It has a ¼" capstan envelope with a moulded cap. All leads are isolated from the stud.

QUICK REFERENCE DATA

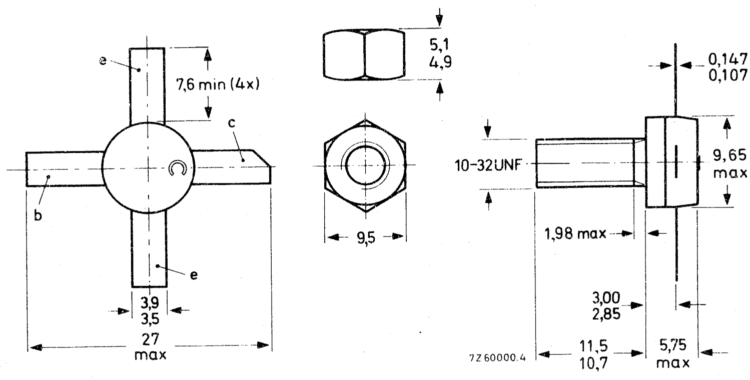
R.F. performance up to T_{mb} = 25 °C in an unneutralized common-emitter class-B circuit

mode of operation	V_{CE} V	f MHz	P_S W	P_L W	I_C A	G_p dB	η %	$\overline{z_i}$ Ω	$\overline{Y_L}$ mA/V
c.w.	13,5	175	< 6,25	25	< 2,64	> 6	> 70	1,6 + j1,4	213 + j5,5

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-56.



Torque on nut: min. 1,5 Nm (15 kg cm)
max. 1,7 Nm (17 kg cm)

Diameter of clearance hole in heatsink: max. 4,9 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

When locking is required an adhesive is preferred instead of a lock washer.

CAUTION This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC 134)

Voltages

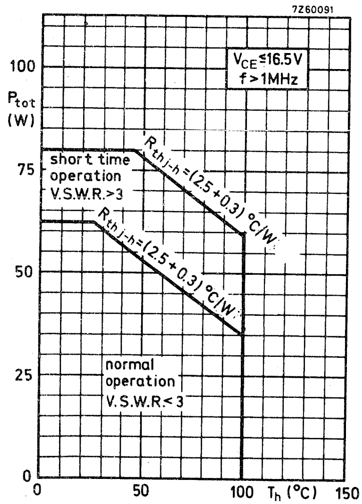
Collector-base voltage (open emitter) peak value	V_{CBOM}	max.	36	V
Collector-emitter voltage (open base)	V_{CEO}	max.	18	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4	V

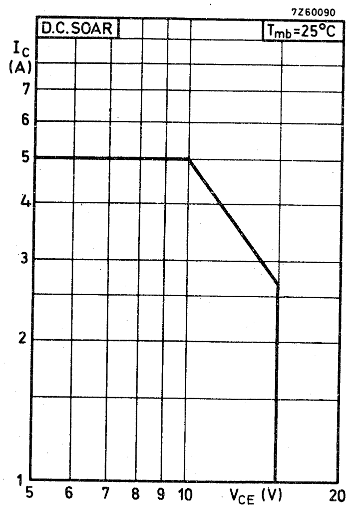
Currents

Collector current (average)	$I_{C(AV)}$	max.	5	A
Collector current (peak value) f > 1 MHz	I_{CM}	max.	10	A

Power dissipation

Total power dissipation up to T_{mb} = 25 °C f > 1 MHz	P_{tot}	max.	70	W





Temperature

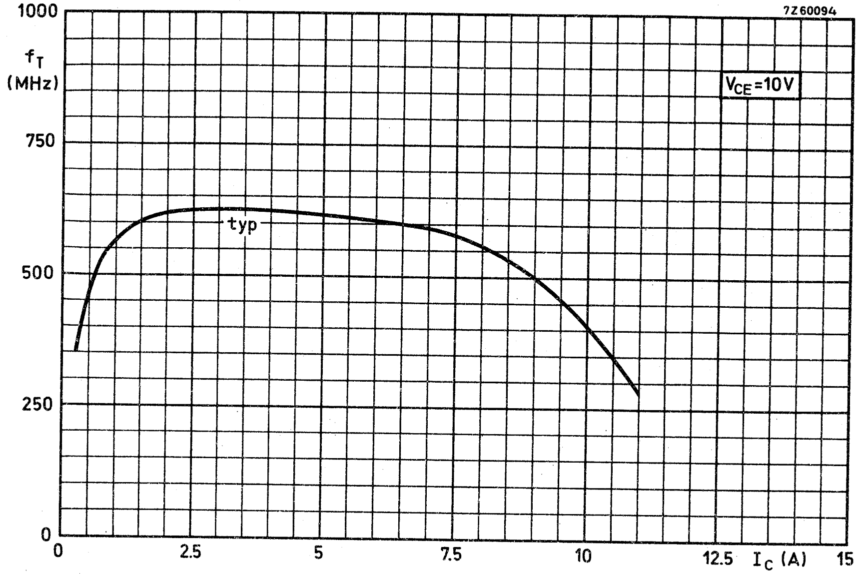
Storage temperature	T_{stg}		−30 to +200	°C
Operating junction temperature	T_j	max.	200	°C

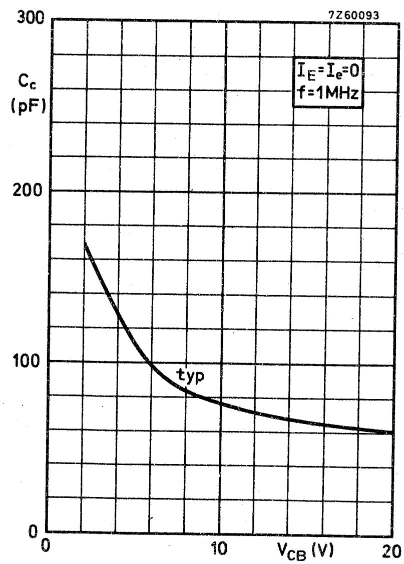
THERMAL RESISTANCE

From junction to mounting base	$R_{th\ j-mb}$	=	2.5	°C/W
From mounting base to heatsink	$R_{th\ mb-h}$	=	0.3	°C/W

CHARACTERISTICS $T_j = 25\ ^oC$ unless otherwise specified

Breakdown voltages				
Collector-base voltage open emitter, $I_C = 50$ mA	$V_{(BR)CBO}$	>	36	V
Collector-emitter voltage open base, $I_C = 50$ mA	$V_{(BR)CEO}$	>	18	V
Emitter-base voltage open collector; $I_E = 10$ mA	$V_{(BR)EBO}$	>	4	V
Transient energy				
$L = 25$ mH; $f = 50$ Hz, open base	E	>	8	mWs
$L = 25$ mH; $f = 50$ Hz, $-V_{BE} = 1.5$ V; $R_{BE} = 33\ \Omega$	E	>	8	mWs
D.C. current gain				
$I_C = 1$ A; $V_{CE} = 5$ V	h_{FE}	typ.	50	
		10 to	120	
Transition frequency				
$I_C = 4$ A; $V_{CE} = 10$ V	f_T	typ.	650	MHz
Collector capacitance at f = 1 MHz				
$I_E = I_e = 0$; $V_{CB} = 15$ V	C_c	typ.	65	pF
		<	90	pF
Feedback capacitance at f = 1 MHz				
$I_C = 100$ mA; $V_{CE} = 15$ V	C_{re}	typ.	41	pF
Collector-stud capacitance	C_{cs}	typ.	2	pF


7Z60094
1000
f_T
(MHz)
750
500
250
0
typ
V_{CE}=10V
0
2.5
5
7.5
10
12.5
I_C (A)
15


7Z60093
300
C_c
(pF)
200
100
0
I_E=I_e=0
f=1MHz
typ
0
10
V_{CB} (V)
20

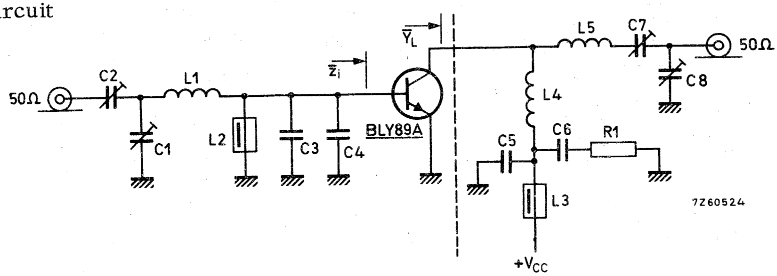
APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralised common-emitter class B circuit)

V_{CC} = 13.5 V; T_{mb} up to 25 °C

f(MHz)	P_S (W)	P_L (W)	I_C (A)	G_p (dB)	η (%)	$\bar{z}_i$ (Ω)	$\bar{Y}_L$ (mA/V)
175	< 6.25	25	< 2.64	> 6	> 70	1.6+j1.4	213 + j5.5

Test circuit



C1 = 4 to 44 pF film dielectric trimmer (code number 2222 809 07008)
C2 = 2 to 22 pF film dielectric trimmer (code number 2222 809 07004)
C3 = C4 = 47 pF ceramic
C5 = 100 pF ceramic
C6 = 150 nF polyester
C7 = 4 to 104 pF film dielectric trimmer (code number 2222 809 07015)
C8 = 4 to 64 pF film dielectric trimmer (code number 2222 809 07011)

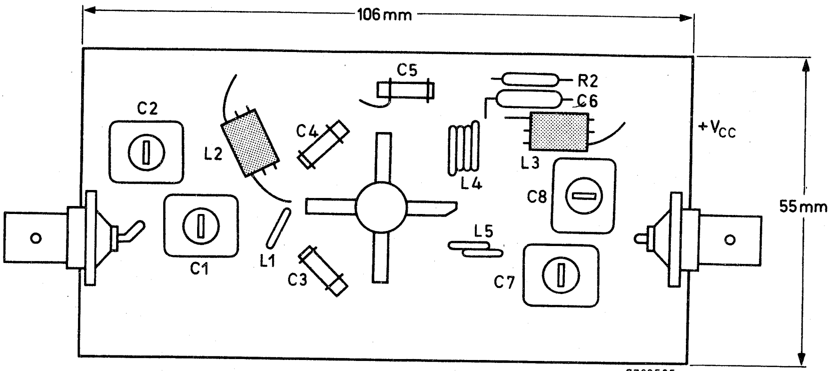
L1 = 0.5 turn enamelled Cu wire (1.5 mm); int.diam. 6 mm; leads 2x6 mm
L2 = L3 = ferroxcube choke (code number 4312 020 36640)
L4 = 3.5 turns closely wound enamelled Cu wire (1.5 mm); int.diam. 6 mm; leads 2x6 mm
L5 = 1 turn enamelled Cu wire (1.5 mm); int.diam. 6 mm; leads 2x6 mm

R1 = 10 Ω carbon

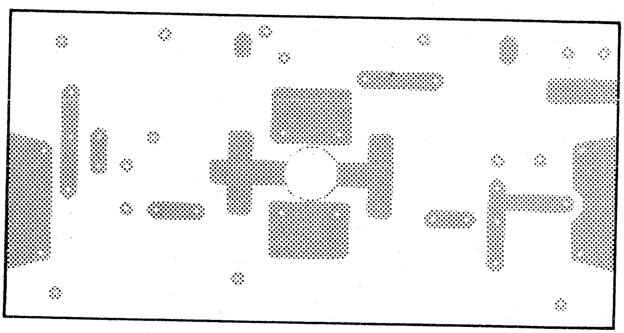
Component lay-out for 175 MHz see page 6.

APPLICATION INFORMATION (continued)

Component lay-out and printed circuit board for 175 MHz test circuit.

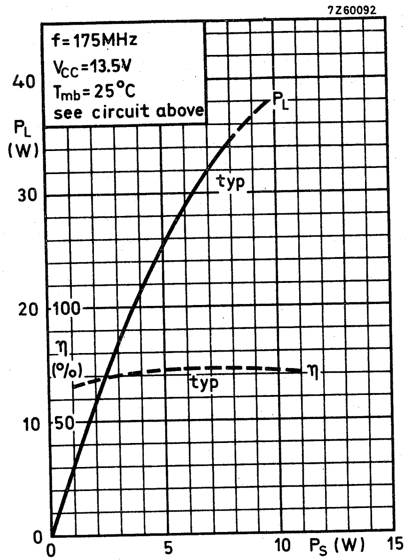


7Z60525



7Z67868

The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallised to serve as earth. Earth connections are made by means of hollow rivets.

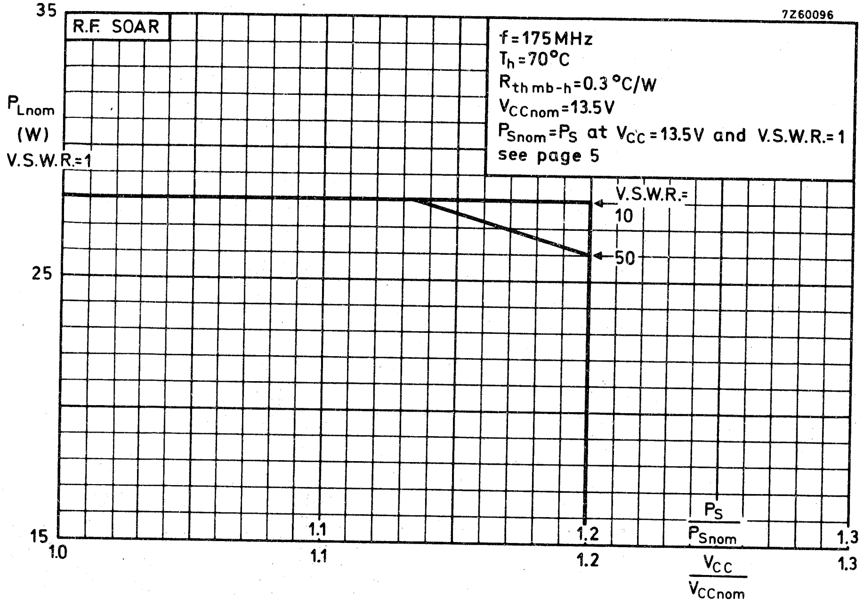


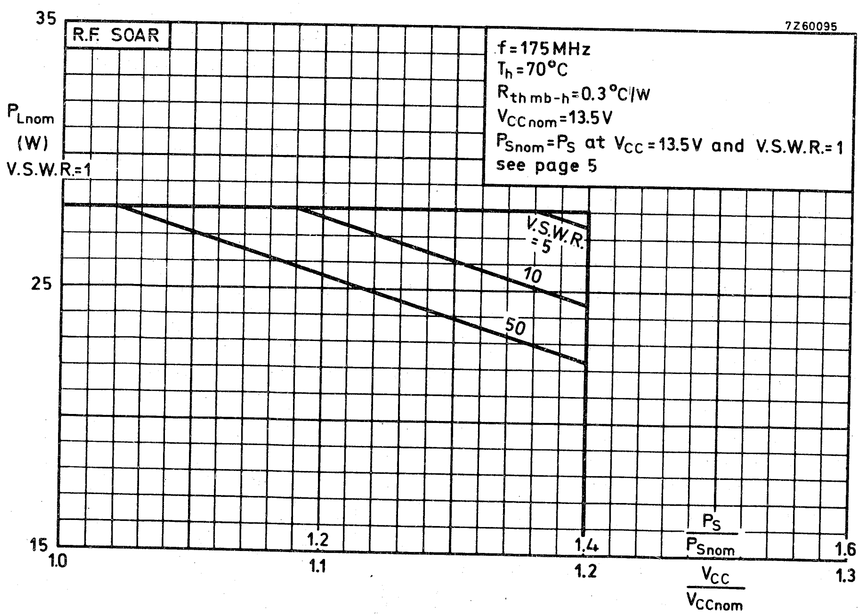
The transistor has been developed for use with unstabilized supply voltages. As the output power and drive power increase with the supply voltage, the nominal output power must be derated in accordance with the graphs on page 8 for safe operation at supply voltages other than the nominal. The graphs show the allowable output power under nominal conditions, as a function of the supply overvoltage ratio, with V.S.W.R. as parameter

The upper graph applies to the situation in which the drive (P_S/P_{Snom}) increases linearly with supply overvoltage ratio.

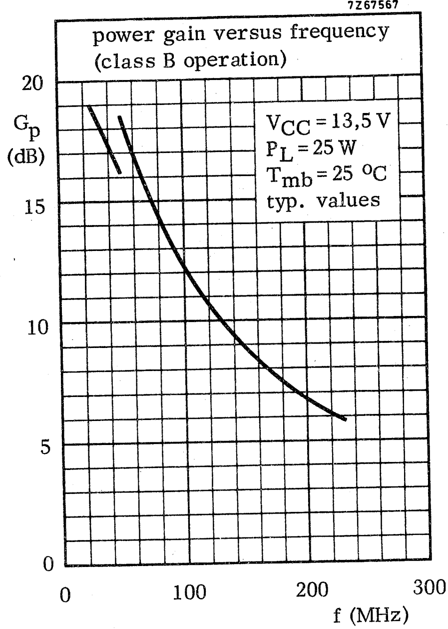
The lower graph shows the derating factor to be applied when the drive (P_S/P_{Snom}) increases as the square of the supply overvoltage ratio (V_{CC}/V_{CCnom}).

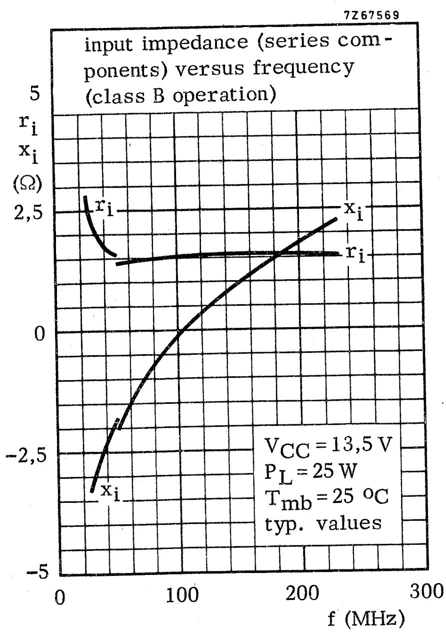
Depending on the operating conditions, the appropriate derating factor may lie in the region between the linear and the square-law functions.

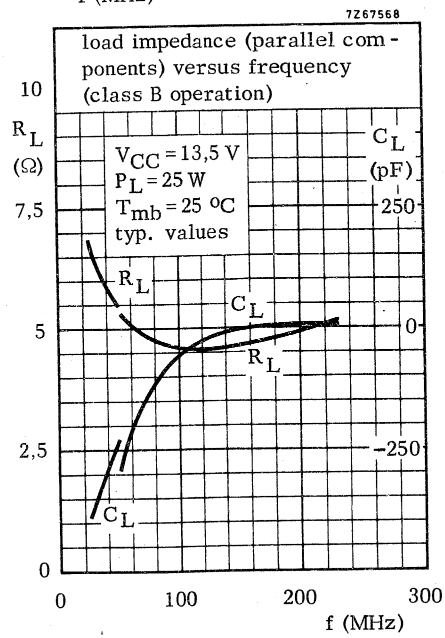

7Z60096
R.F. SOAR
f = 175 MHz
T_h = 70 °C
$R_{th\,mb-h}$ = 0.3 °C/W
V_{CCnom} = 13.5 V
$P_{Snom} = P_S$ at V_{CC} = 13.5 V and V.S.W.R. = 1
see page 5
P_{Lnom} (W) V.S.W.R. = 1
V.S.W.R. = 10
50
35
25
15
1.0
1.1
1.2
1.3
$\frac{P_S}{P_{Snom}}$
$\frac{V_{CC}}{V_{CCnom}}$


7Z60095
R.F. SOAR
f = 175 MHz
T_h = 70 °C
$R_{th\,mb-h}$ = 0.3 °C/W
V_{CCnom} = 13.5 V
$P_{Snom} = P_S$ at V_{CC} = 13.5 V and V.S.W.R. = 1
see page 5
P_{Lnom} (W) V.S.W.R. = 1
V.S.W.R. = 5
10
50
35
25
15
1.0
1.2
1.1
1.4
1.2
1.6
1.3
$\frac{P_S}{P_{Snom}}$
$\frac{V_{CC}}{V_{CCnom}}$

OPERATING NOTE Below 50 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation. This resistor must be effective for both d.c. and r.f.







V.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor intended for use in class-A, B and C operated mobile, industrial and military transmitters with a nominal supply voltage of 13,5 V. The transistor is resistance stabilized and is guaranteed to withstand severe load mismatch conditions with a supply over-voltage to 16,5 V. It has a 3/8" capstan envelope with a ceramic cap. All leads are isolated from the stud.

QUICK REFERENCE DATA

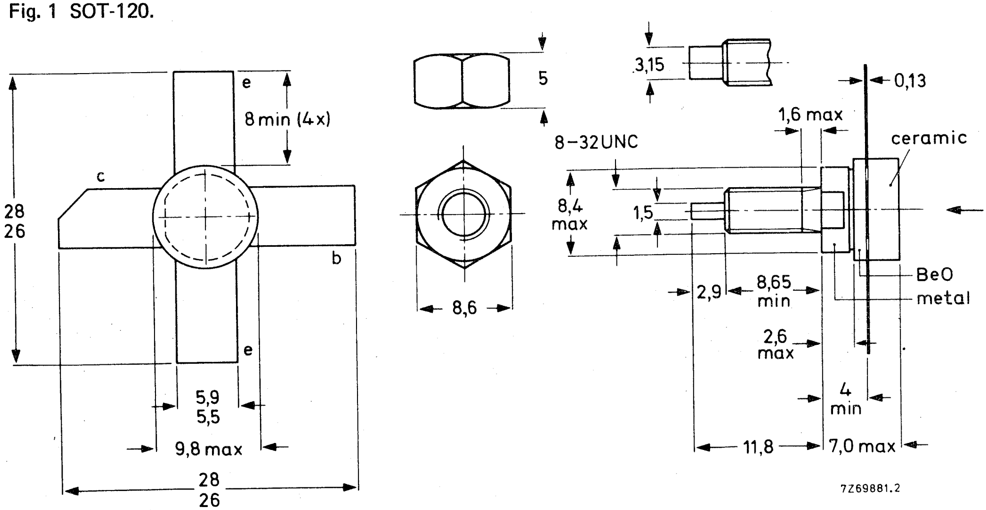
R.F. performance up to T_h = 25 °C in an unneutralized common-emitter class-B circuit

mode of operation	V_{CC} V	f MHz	P_L W	G_p dB	η %	$\overline{z_i}$ Ω	$\overline{Y_L}$ mA/V
c.w.	13,5	175	25	> 6	> 70	1,6 + j1,4	210 + j5,5

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-120.



Torque on nut: min 0,75 Nm
(7,5 kg cm)
max 0,85 Nm
(8,5 kg cm)

Diameter of clearance hole in heatsink:
max 4,2 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

When locking is required an adhesive is preferred instead of a lock washer.

CAUTION This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC134)

Voltages

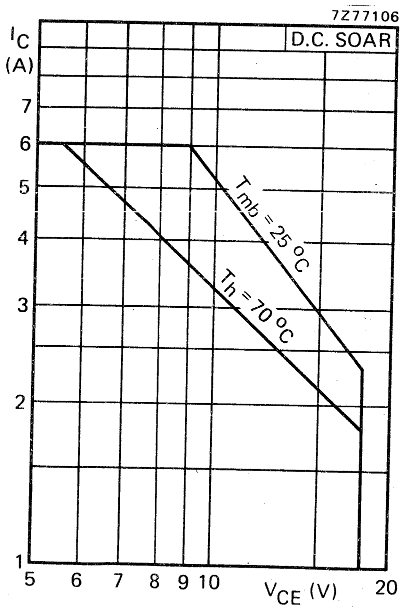
Collector-emitter voltage ($V_{BE} = 0$) peak value	V_{CESM}	max	36 V
Collector-emitter voltage (open base)	V_{CEO}	max	18 V
Emitter-base voltage (open collector)	V_{EBO}	max	4 V

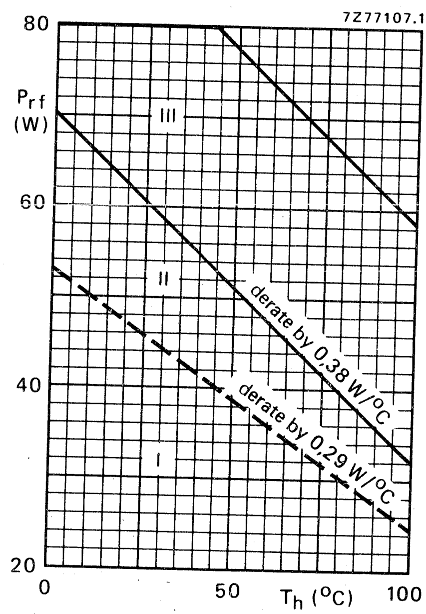
Currents

Collector current (average)	$I_{C(AV)}$	max	6 A
Collector current (peak value); f > 1 MHz	I_{CM}	max	12 A

Power dissipation

R.F. power dissipation (f > 1 MHz); $T_{mb} = 25\ ^oC$	P_{rf}	max	73 W





R.F. power dissipation; $V_{CE} \leqslant 16,5$ V; f > 1 MHz.
I Continuous d.c. operation
II Continuous r.f. operation
III Short-time operation during mismatch

THERMAL RESISTANCE (dissipation 20 W; $T_{mb} = 79\ ^oC$, i.e. $T_h = 70\ ^oC$)

From junction to mounting base (d.c. dissipation)	$R_{th\ j\text{-}mb(dc)}$	=	3,1 °C/W
From junction to mounting base (r.f. dissipation)	$R_{th\ j\text{-}mb(rf)}$	=	2,3 °C/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,45 °C/W

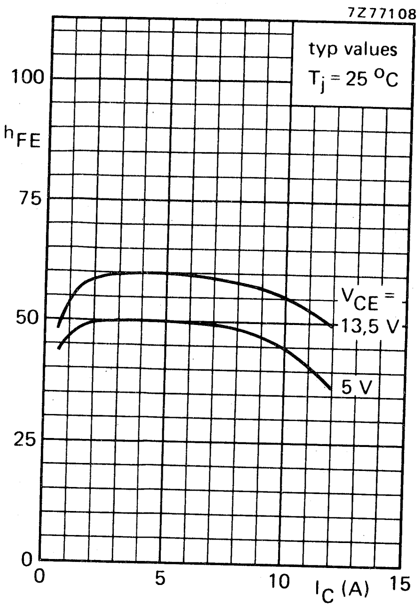
CHARACTERISTICS

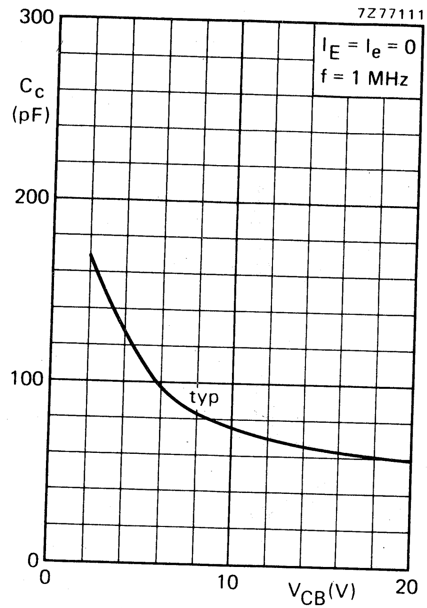
T_j = 25 °C

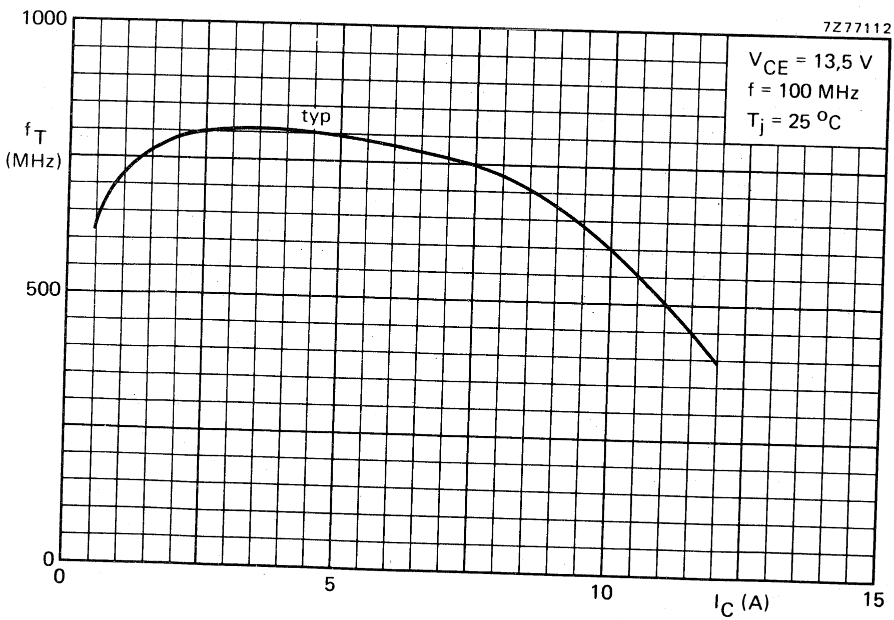
Breakdown voltage

Collector-emitter voltage V_{BE} = 0; I_C = 25 mA	$V_{(BR)CES}$	>	36 V
Collector-emitter voltage open base; I_C = 50 mA	$V_{(BR)CEO}$	>	18 V
Emitter-base voltage open collector; I_E = 10 mA	$V_{(BR)EBO}$	>	4 V
Collector cut-off current V_{BE} = 0; V_{CE} = 18 V	I_{CES}	<	10 mA
Transient energy L = 25 mH; f = 50 Hz			
open base	E	>	8 mWs
$-V_{BE}$ = 1,5 V; R_{BE} = 33 Ω	E	>	8 mWs
D.C. current gain* I_C = 2,5 A; V_{CE} = 5 V	h_{FE}	typ	50
			10 to 80
Collector-emitter saturation voltage* I_C = 7,5 A; I_B = 1,5 A	V_{CEsat}	typ	1,7 V
Transition frequency at f = 100 MHz*			
I_C = 2,5 A; V_{CE} = 13,5 V	f_T	typ	800 MHz
I_C = 7,5 A; V_{CE} = 13,5 V	f_T	typ	750 MHz
Collector capacitance at f = 1 MHz I_E = I_e = 0; V_{CB} = 15 V	C_c	typ	65 pF
		<	90 pF
Feedback capacitance at f = 1 MHz I_C = 100 mA; V_{CE} = 15 V	C_{re}	typ	41 pF
Collector-stud capacitance	C_{cs}	typ	2 pF

* Measured under pulse conditions: $t_p \leqslant 200\ \mu s$; $\delta \leqslant 0{,}02$.


7Z77108
typ values
T_j = 25 °C
h_{FE}
100
75
50
25
0
0
5
10
15
I_C (A)
V_{CE} =
13,5 V
5 V


7Z77111
$I_E = I_e = 0$
f = 1 MHz
C_c
(pF)
300
200
100
0
0
10
20
V_{CB}(V)
typ


7Z77112
V_{CE} = 13,5 V
f = 100 MHz
T_j = 25 °C
f_T
(MHz)
1000
500
0
0
5
10
15
I_C (A)
typ

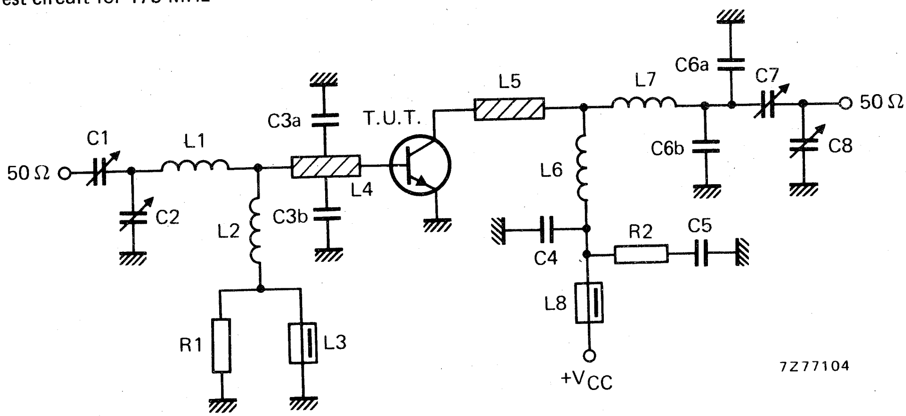
APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit)

T_h = 25 °C

f (MHz)	V_{CC}(V)	P_L(W)	P_S(W)	G_p(dB)	I_C(A)	η (%)	$\overline{z_i}$(Ω)	$\overline{Y_L}$(mA/V)
175	13,5	25	<6,25	> 6	<2,64	> 70	1,6 + j1,4	210 + j5,5
175	12,5	25	–	typ 6,6	–	typ 75	–	–

Test circuit for 175 MHz



List of components:

C1 = 2,5 to 20 pF film dielectric trimmer (cat. no. 2222 809 07004)
C2 = C8 = 4 to 40 pF film dielectric trimmer (cat. no. 2222 809 07008)
C3a = C3b = 47 pF ceramic capacitor (500 V)
C4 = 120 pF ceramic capacitor
C5 = 100 nF polyester capacitor
C6a = C6b = 8,2 pF ceramic capacitor (500 V)
C7 = 5 to 60 pF film dielectric trimmer (cat. no. 2222 809 07011)

L1 = 1 turn enamelled Cu wire (1,6 mm); int. dia. 9,0 mm; leads 2 x 5 mm
L2 = 100 nH; 7 turns closely wound enamelled Cu wire (0,5 mm); int. dia. 3 mm; leads 2 x 5 mm
L3 = L8 = Ferroxcube choke coil (cat. no. 4312 020 36640)
L4 = L5 = strip (12 mm x 6 mm); taps for C3a and C3b at 5 mm from transistor
L6 = 2 turns enamelled Cu wire (1,6 mm); int. dia. 5,0 mm; length 6,0 mm; leads 2 x 5 mm
L7 = 2 turns enamelled Cu wire (1,6 mm); int. dia. 4,5 mm; length 6,0 mm; leads 2 x 5 mm

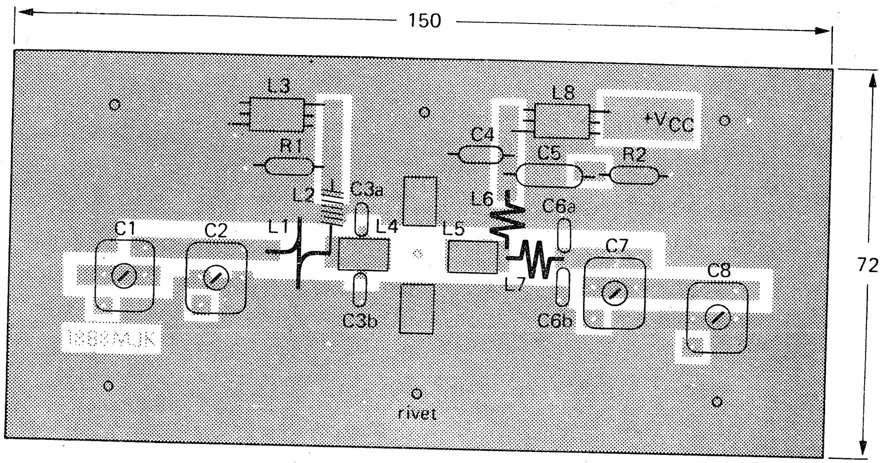
L4 and L5 are strips on a double Cu-clad printed-circuit board with epoxy fibre-glass dielectric, thickness 1/16".

R1 = 10 Ω (±10%) carbon resistor
R2 = 4,7 Ω (±5%) carbon resistor

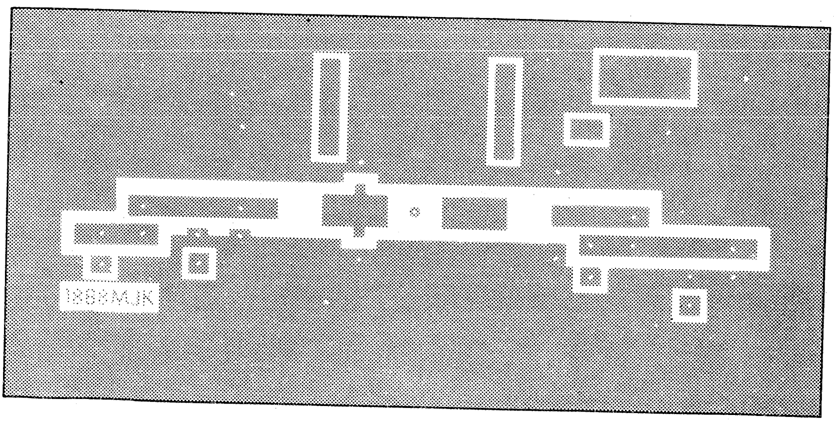
Component layout and printed-circuit board for 175 MHz test circuit on page 6.

APPLICATION INFORMATION (continued)

Component layout and printed-circuit board for 175 MHz test circuit.

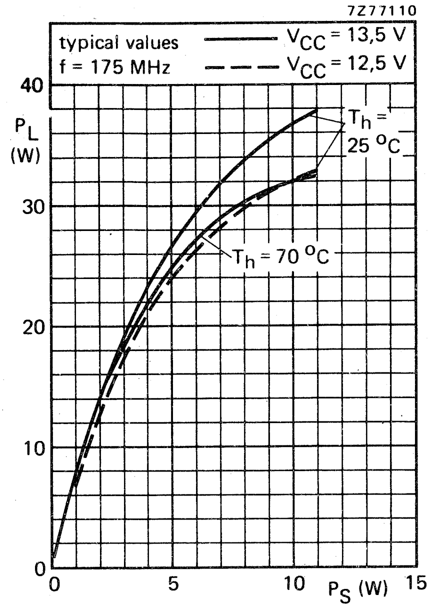


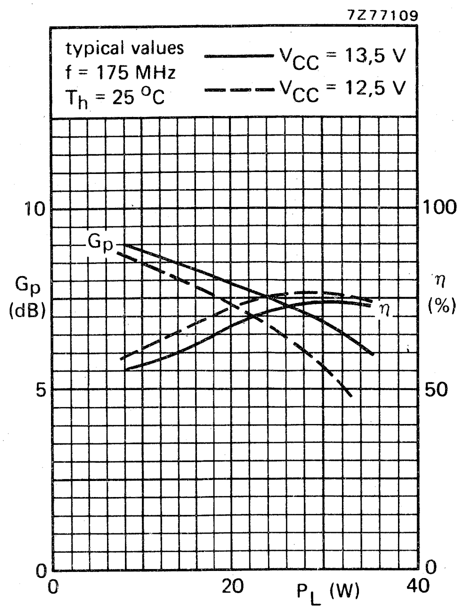
7Z77102

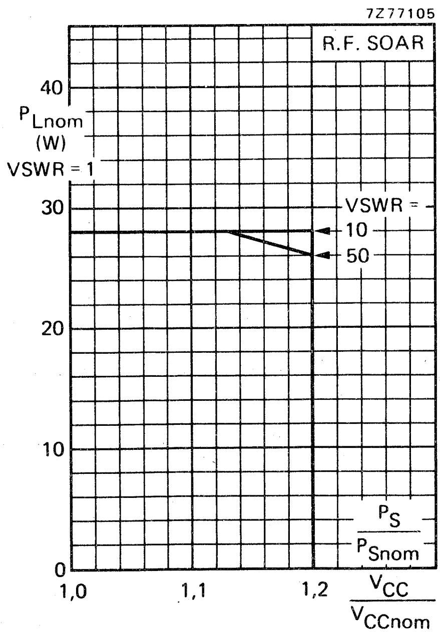


7Z77103

The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets, whilst under the emitter leads Cu straps are used for a direct contact between upper and lower sheets.







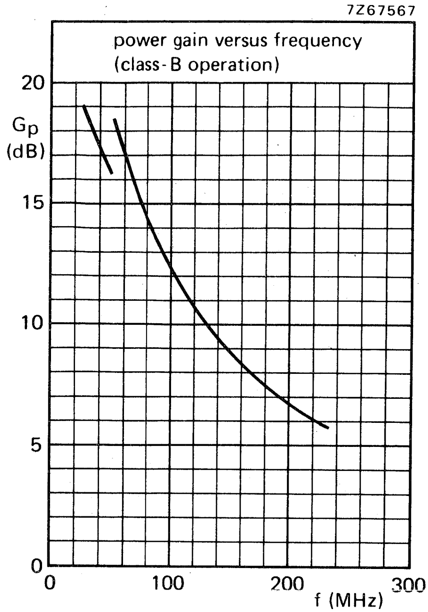
Conditions for R.F. SOAR

f = 175 MHz
T_h = 70 °C
$R_{th\ mb-h}$ = 0,45 °C/W
V_{CCnom} = 13,5 V
$P_S = P_{Snom}$ at V_{CCnom} = 13,5 V and VSWR = 1
see page 5

The transistor has been developed for use with unstabilized supply voltages. As the output power and drive power increase with the supply voltage, the nominal output power must be derated in accordance with the graph for safe operation at supply voltages other than the nominal. The graph shows the permissible output power under nominal conditions (VSWR = 1), as a function of the expected supply over-voltage ratio with VSWR as parameter.

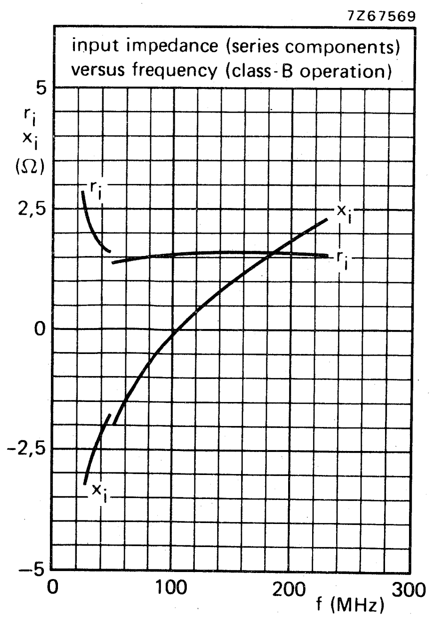
The graph applies to the situation in which the drive (P_S/P_{Snom}) increases linearly with supply over-voltage ratio.

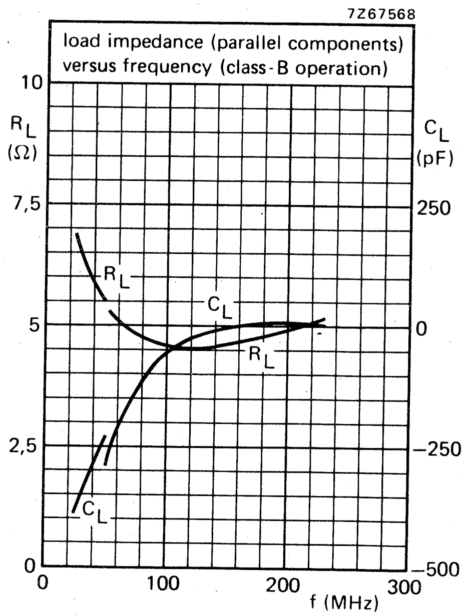
OPERATING NOTE Below 50 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation. This resistor must be effective for r.f. only.



Measuring conditions for the graphs on this page

V_{CC} = 13,5 V
P_L = 25 W
T_h = 25 °C
typical values





V.H.F. POWER TRANSISTOR

N-P-N epitaxial planar transistor intended for use in class-A, B and C operated mobile, industrial and military transmitters with a supply voltage of 12,5 V. The transistor is resistance stabilized. Every transistor is tested under severe load mismatch conditions with a supply over-voltage to 15 V. It has a plastic encapsulated stripline package. All leads are isolated from the stud.

QUICK REFERENCE DATA

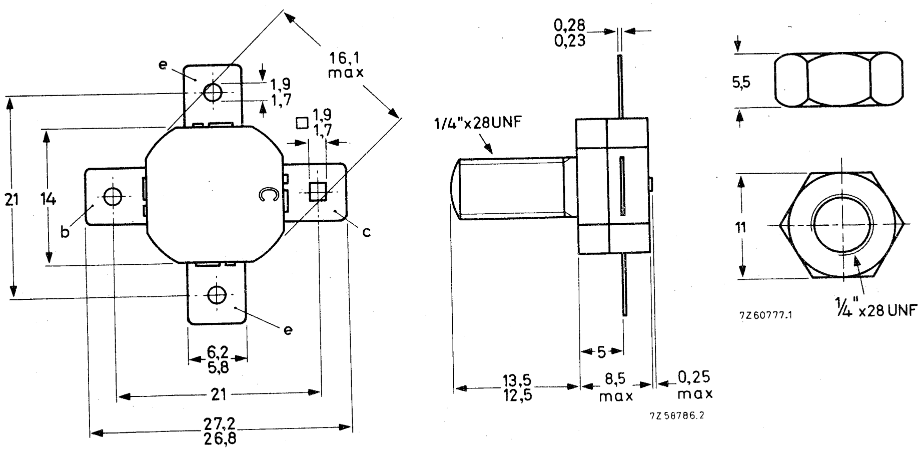
R.F. performance up to T_h = 25 °C in an unneutralized common-emitter class-B circuit

mode of operation	V_{CE} V	f MHz	P_S W	P_L W	I_C A	G_p dB	η %	$\overline{z_i}$ Ω	$\overline{Y_L}$ mA/V
c.w.	12,5	175	< 15,8	50	< 5,33	> 5,0	> 75	1,3 + j1,6	270 + j170

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-55.



Torque on nut: min. 2,3 Nm (23 kg cm)
max. 2,7 Nm (27 kg cm)

Diameter of clearance hole in heatsink: max. 6,4 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

When locking is required an adhesive is preferred instead of a lock washer.

CAUTION This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC 134)

Voltages

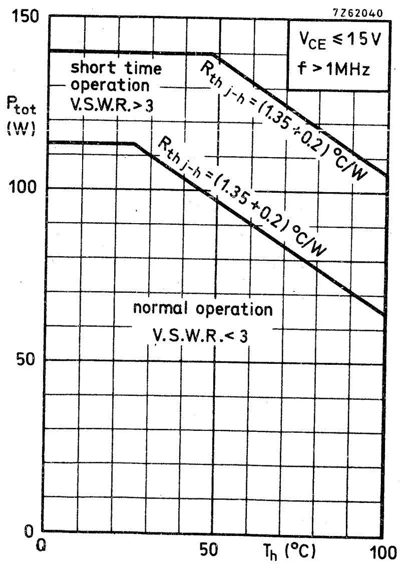
Collector-base voltage (open emitter) peak value	V_{CBOM}	max.	36	V
Collector-emitter voltage (open base)	V_{CEO}	max.	18	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4	V

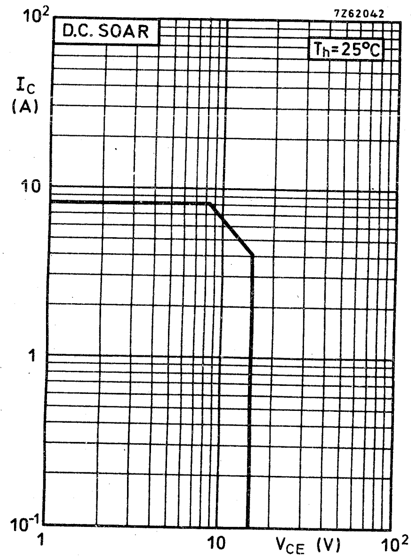
Currents

Collector current (average)	$I_{C(AV)}$	max.	8	A
Collector current (peak value) f > 1 MHz	I_{CM}	max.	20	A

Power dissipation

Total power dissipation up to T_{mb} = 25 °C f > 1 MHz	P_{tot}	max.	130	W





Temperature

Storage temperature	T_{stg}		−65 to +200	°C
Operating junction temperature	T_j	max.	200	°C

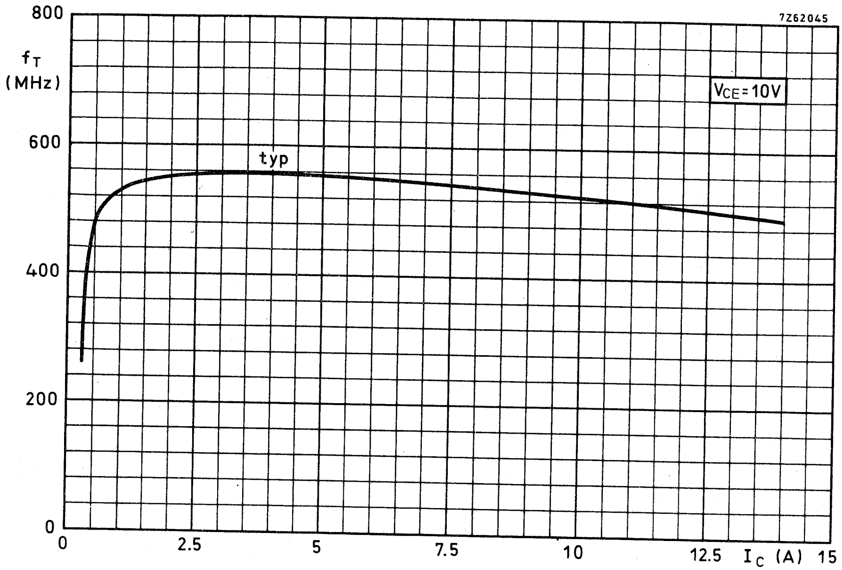
THERMAL RESISTANCE

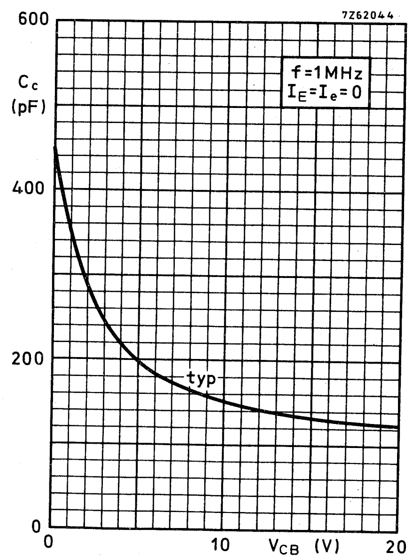
From junction to mounting base	$R_{th\ j\text{-}mb}$	=	1.35	°C/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0.2	°C/W

CHARACTERISTICS

$T_j = 25\ ^oC$ unless otherwise specified

Breakdown voltages				
Collector-base voltage, open emitter, $I_C = 100$ mA	$V_{(BR)CBO}$	>	36	V
Collector-emitter voltage, open base, $I_C = 100$ mA	$V_{(BR)CEO}$	>	18	V
Emitter-base voltage, open collector, $I_E = 25$ mA	$V_{(BR)EBO}$	>	4	V
Transient energy				
$L = 25$ mH; $f = 50$ Hz; open base	E	>	8	mWs
$L = 25$ mH; $f = 50$ Hz; $-V_{BE} = 1.5$ V; $R_{BE} = 33\ \Omega$	E	>	8	mWs
D.C. current gain				
$I_C = 1$ A; $V_{CE} = 5$ V	h_{FE}	>	10	
		typ.	50	
Transition frequency				
$I_C = 6$ A; $V_{CE} = 10$ V	f_T	typ.	550	MHz
Collector capacitance at f = 1 MHz				
$I_E = I_e = 0$; $V_{CB} = 15$ V	C_c	typ.	130	pF
		<	160	pF
Feedback capacitance				
$I_C = 200$ mA; $V_{CE} = 15$ V	C_{re}	typ.	82	pF
Collector-stud capacitance	C_{cs}	typ.	3.5	pF


7Z62045
f_T
(MHz)
800
600
400
200
0
$V_{CE} = 10V$
typ
0
2.5
5
7.5
10
12.5
I_C (A)
15


7Z62044
C_c
(pF)
600
400
200
0
f = 1 MHz
$I_E = I_e = 0$
typ
0
10
V_{CB} (V)
20

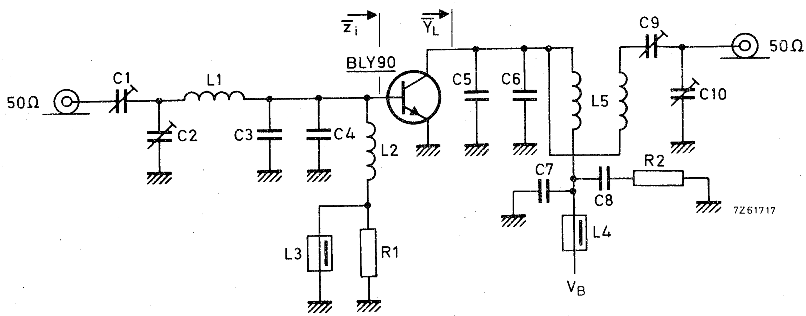
APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit)

f = 175 MHz; T_h up to 25 °C

V_{CC} (V)	P_S (W)	P_L (W)	I_C (A)	G_p (dB)	η (%)	$\overline{z_i}$ (Ω)	$\overline{Y_L}$ (mA/V)
12,5	< 15,8	50	< 5,33	> 5,0	> 75	1,3 + j 1,6	270+ j 170

Test circuit for 175 MHz:



C1 = 2 to 20 pF film dielectric trimmer
C2 = 4 to 40 pF film dielectric trimmer
C3 = C4 = 27 pF ceramic capacitor
C5 = C6 = 56 pF ceramic capacitor
C7 = 100 pF ceramic capacitor
C8 = 100 nF polyester capacitor
C9 = 4 to 80 pF film dielectric trimmer
C10 = 4 to 60 pF film dielectric trimmer

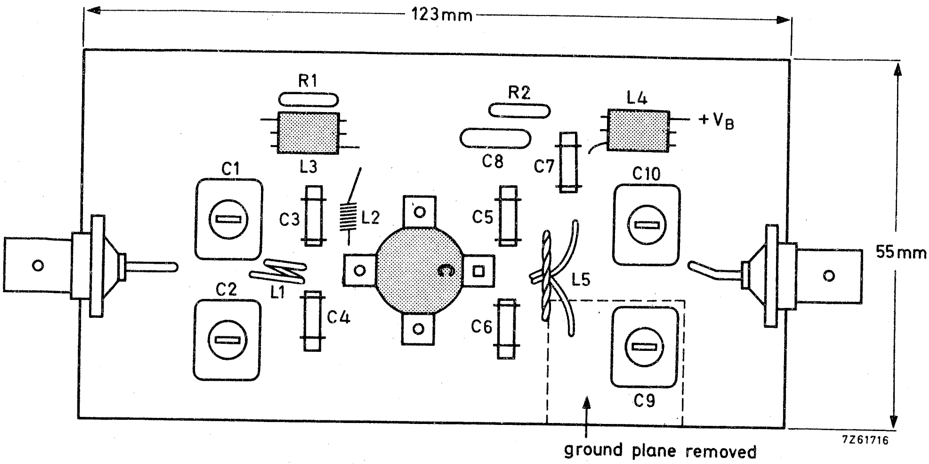
L1 = 1,5 turns enamelled Cu wire (1,5 mm); int. dia. 6 mm; length 4 mm; leads 2 x 5 mm
L2 = 7 turns closely wound enamelled Cu wire (0,5 mm); int. dia. 3 mm; leads 2 x 5 mm
L3 = L4 = Ferroxcube choke (code number 4312 020 36640)
L5 = bifilar wound enamelled Cu wire (1,0 mm); see figure on page 6

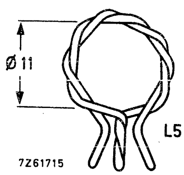
R1 = 10 Ω carbon resistor
R2 = 4,7 Ω carbon resistor

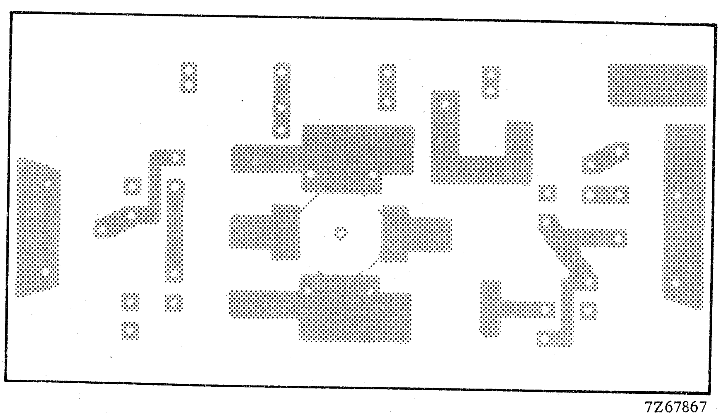
Component layout and printed-circuit board for 175 MHz test circuit see page 6.

APPLICATION INFORMATION (continued)

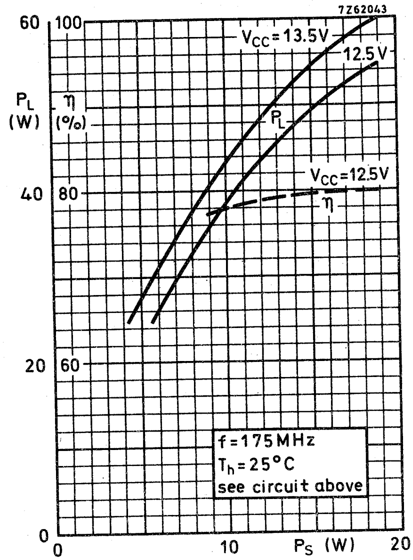
Component lay-out and printed circuit board for 175 MHz test circuit.

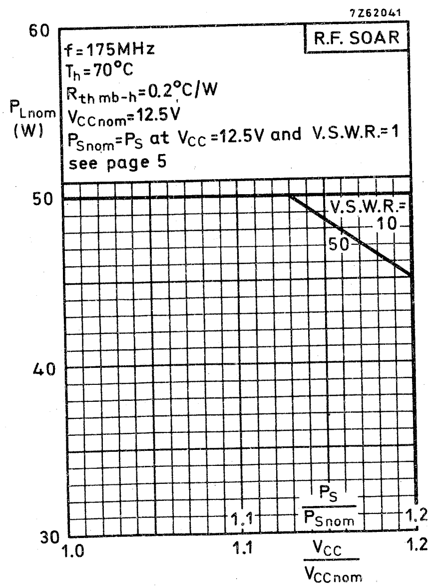




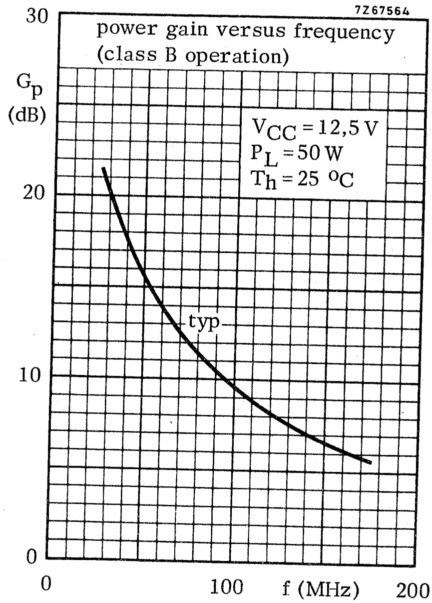


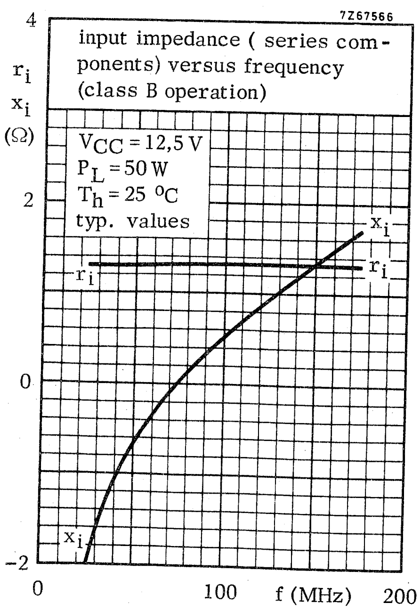
The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets.

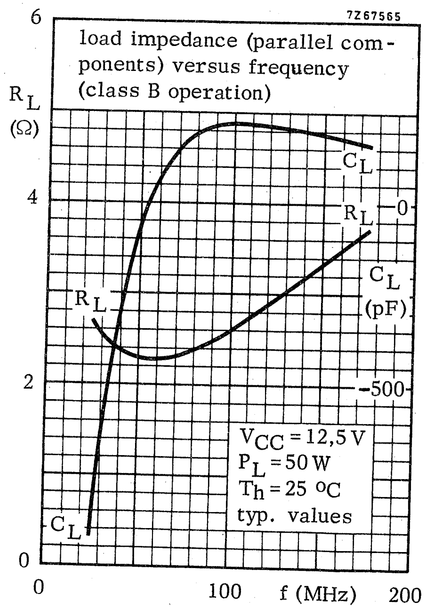




The transistor has been developed for use with unstabilized supply voltages. As the output power and drive power increase with the supply voltage, the nominal output power (P_{Lnom}) must be derated in accordance with the adjacent graph for safe operation at supply voltage other than the nominal. The graph shows the allowable output power under nominal conditions, as a function of the supply overvoltage ratio with V.S.W.R. as parameter. The graph applies to the situation in which the drive (P_S/P_{Snom}) increases linearly with supply overvoltage ratio (V_{CC} / V_{CCnom}).


7Z67564
power gain versus frequency
(class B operation)
Gp
(dB)
V_{CC} = 12,5 V
P_L = 50 W
T_h = 25 °C
typ
30
20
10
0
0
100
f (MHz)
200


7Z67566
input impedance (series components) versus frequency
(class B operation)
r_i
x_i
(Ω)
V_{CC} = 12,5 V
P_L = 50 W
T_h = 25 °C
typ. values
x_i
r_i
r_i
x_i
4
2
0
−2
0
100
f (MHz)
200


7Z67565
load impedance (parallel components) versus frequency
(class B operation)
R_L
(Ω)
C_L
R_L
0
C_L
(pF)
R_L
−500
V_{CC} = 12,5 V
P_L = 50 W
T_h = 25 °C
typ. values
C_L
6
4
2
0
0
100
f (MHz)
200

V.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor for use in class-A, B and C operated mobile, industrial and military transmitters with a nominal supply voltage of 28 V. The transistor is resistance stabilized and is guaranteed to withstand severe load mismatch conditions.

It has a ¼" capstan envelope with a moulded cap. All leads are isolated from the stud.

QUICK REFERENCE DATA

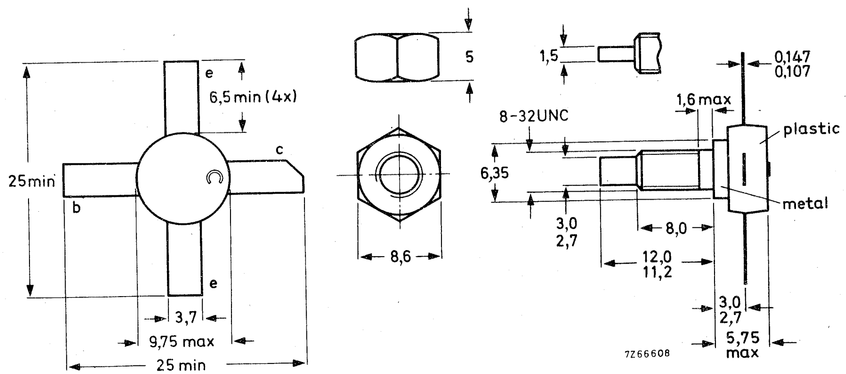
R.F. performance up to T_{mb} = 25 °C in an unneutralized common-emitter class-B circuit

mode of operation	V_{CE} V	f MHz	P_L W	G_p dB	η %	$\overline{z_i}$ Ω	$\overline{Y_L}$ mA/V
c.w.	28	175	8	> 12	> 65	1,8 + j0,7	18 − j20

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-48



Torque on nut: min. 0,75 Nm
(7,5 kg cm)
max. 0,85 Nm
(8,5 kg cm)

Diameter of clearance hole in heatsink: max. 4,2 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

When locking is required an adhesive is preferred instead of a lock washer.

CAUTION This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC 134)

Voltages

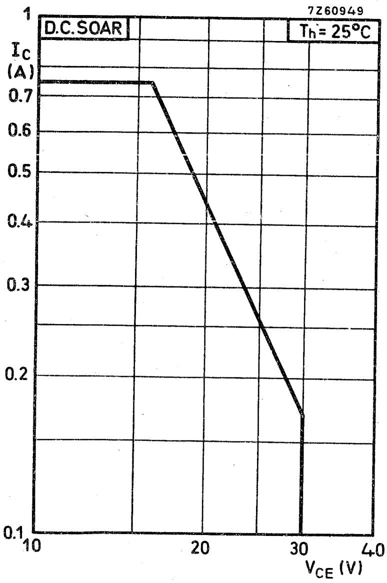
Collector-base voltage (open emitter) peak value	V_{CBOM}	max.	65	V
Collector-emitter voltage (open base)	V_{CEO}	max.	36	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4	V

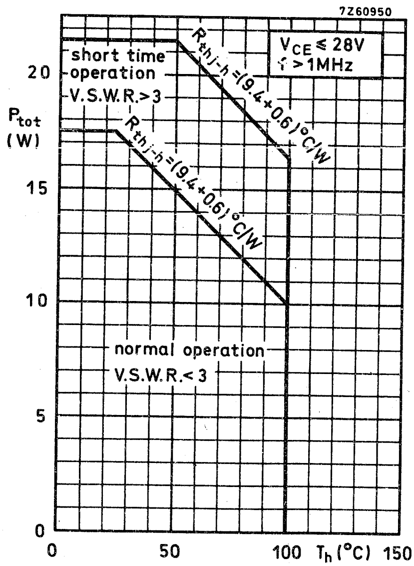
Currents

Collector current (average)	$I_{C(AV)}$	max.	0.75	A
Collector current (peak value) f > 1 MHz	I_{CM}	max.	2.25	A

Power dissipation

Total power dissipation up to T_h = 25 °C f > 1 MHz	P_{tot}	max.	17.5	W





Temperatures

Storage temperature	T_{stg}	−30 to +200		°C
Operating junction temperature	T_j	max.	200	°C

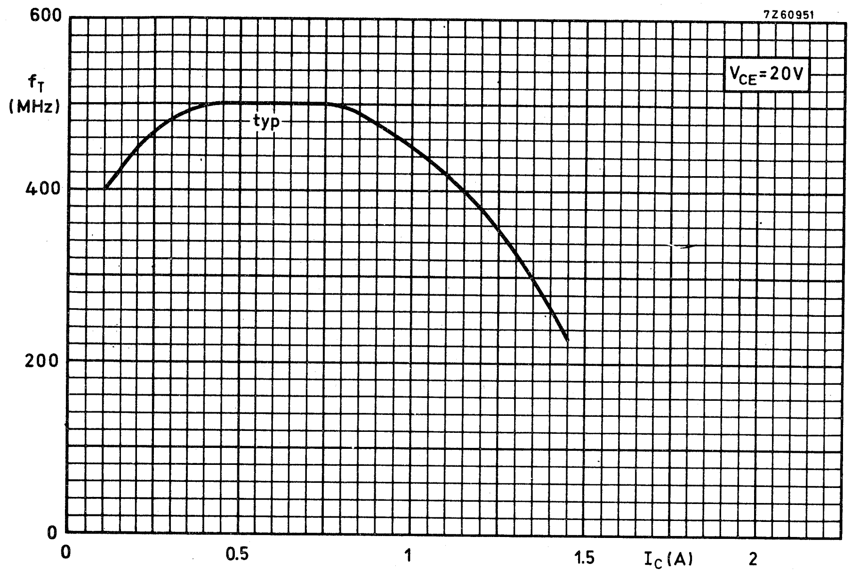
THERMAL RESISTANCE

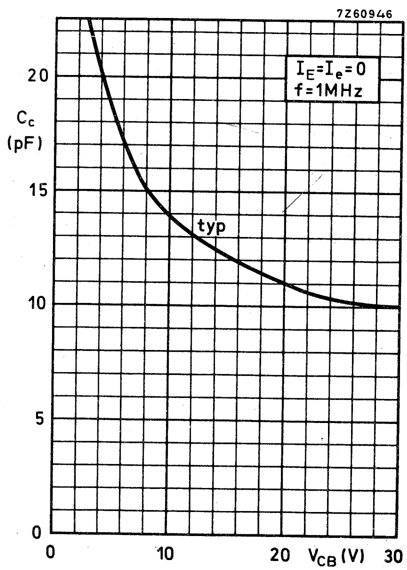
From junction to mounting base	$R_{th\ j\text{-}mb}$	=	9.4	°C/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0.6	°C/W

CHARACTERISTICS

$T_j = 25\ ^oC$ unless otherwise specified

Collector cut-off current				
$I_B = 0$; $V_{CE} = 28$ V	I_{CEO}	<	5	mA
Breakdown voltages				
Collector-base voltage open emitter; $I_C = 1$ mA	$V_{(BR)CBO}$	>	65	V
Collector-emitter voltage open base, $I_C = 10$ mA	$V_{(BR)CEO}$	>	36	V
Emitter-base voltage open collector; $I_E = 1$ mA	$V_{(BR)EBO}$	>	4	V
Transient energy				
L = 25 mH; f = 50 Hz				
open base	E	>	0.5	mWs
$-V_{BE} = 1.5$ V; $R_{BE} = 33\ \Omega$	E	>	0.5	mWs
D.C. current gain				
$I_C = 500$ mA; $V_{CE} = 5$ V	h_{FE}	>	5	
Transition frequency				
$I_C = 400$ mA; $V_{CE} = 20$ V	f_T	typ.	500	MHz
Collector capacitance at f = 1 MHz				
$I_E = I_e = 0$; $V_{CB} = 30$ V	C_c	typ.	10	pF
		<	15	pF
Feedback capacitance at f = 1 MHz				
$I_C = 50$ mA; $V_{CE} = 30$ V	C_{re}	typ.	7.5	pF
Collector-stud capacitance	C_{cs}	typ.	2	pF


7Z60951
600
400
200
0
f_T (MHz)
V_{CE}=20V
typ
0
0.5
1
1.5
I_C (A)
2


7Z60946
20
15
10
5
0
C_c (pF)
I_E=I_e=0
f=1MHz
typ
0
10
20
V_{CB} (V)
30

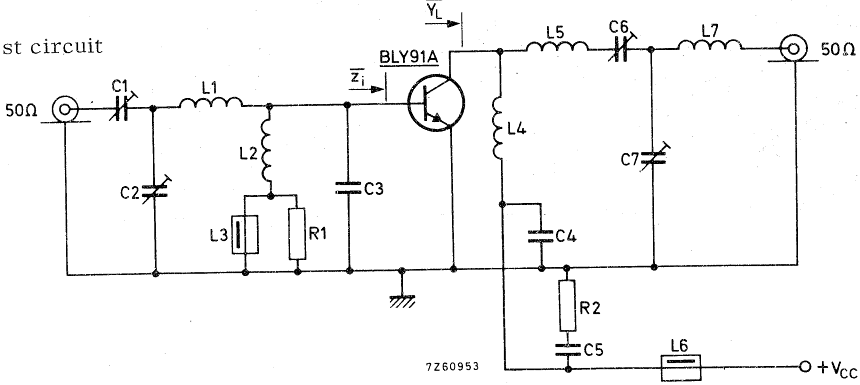
APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralised common-emitter class B circuit)

V_{CC} = 28 V; T_{mb} up to 25 °C

f(MHz)	P_S (W)	P_L (W)	I_C (A)	G_p (dB)	η (%)	$\overline{z_i}$ (Ω)	$\overline{Y_L}$ (mA/V)
175	< 0.50	8	< 0.44	> 12	> 65	1.8+j0.7	18−j20

Test circuit



C1 = 2.5 to 20 pF film dielectric trimmer (code number 2222 809 07004)
C2 = C6 = C7 = 4 to 40 pF film dielectric trimmer (code number 2222 809 07008)
C3 = 47 pF ceramic
C4 = 100 pF ceramic
C5 = 150 nF polyester

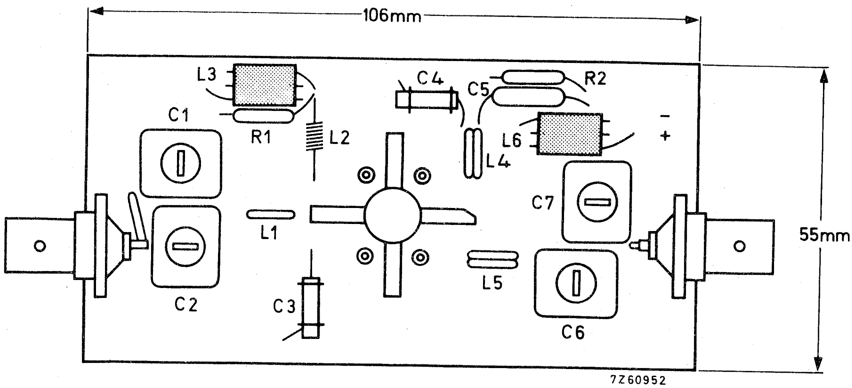
L1 = 0.5 turn enamelled Cu wire (1.5 mm); int. diam. 6 mm; leads 2 x 10 mm
L2 = 6.5 turns closely wound enamelled Cu wire (0.7 mm); int. diam. 4 mm; leads 2 x 5 mm
L3 = L6 = ferroxcube choke (code number 4312 020 36640)
L4 = 7.5 turns enamelled Cu wire (0.7 mm); int. diam. 4 mm; leads 2 x 5 mm
L5 = 4.5 turns enamelled Cu wire (0.7 mm); int. diam. 6 mm; leads 2 x 7 mm
L7 = 3.5 turns enamelled Cu wire (0.7 mm); int. diam. 6 mm; leads 2 x 7 mm

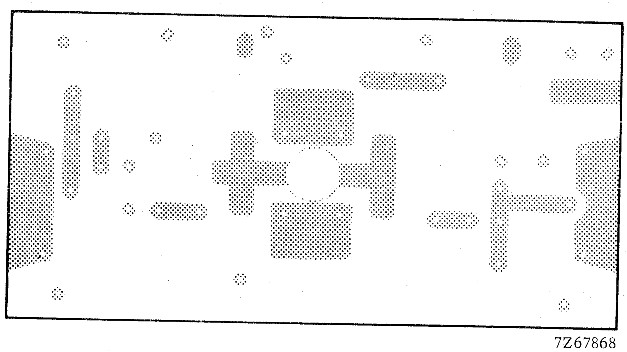
R1 = R2 = 10 Ω carbon

Component lay-out for 175 MHz test circuit see page 6.

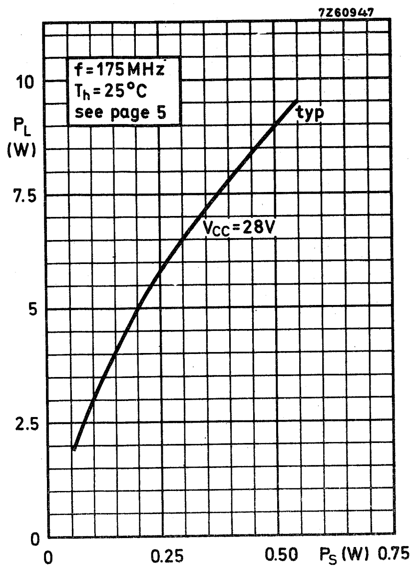
APPLICATION INFORMATION (continued)

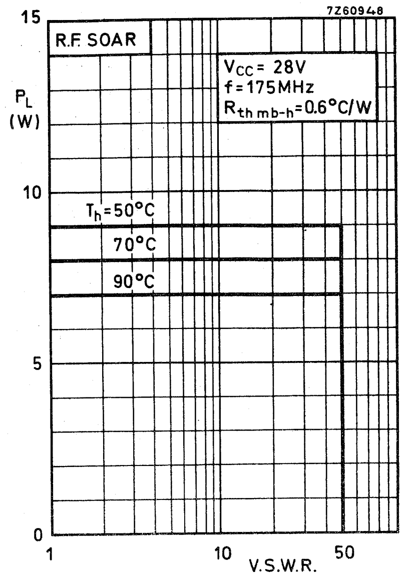
Component lay-out and printed circuit board for 175 MHz test circuit.





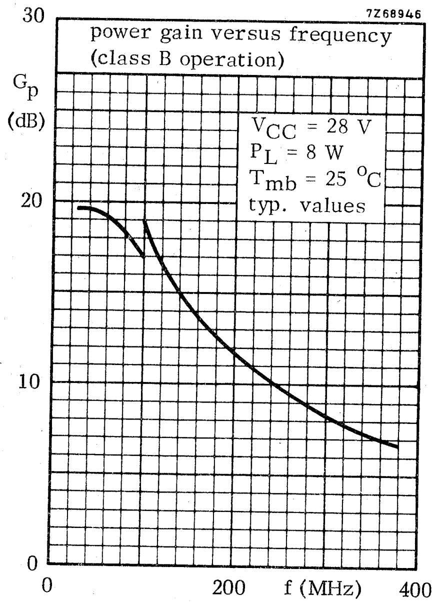
The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallised to serve as earth. Earth connections are made by means of hollow rivets.

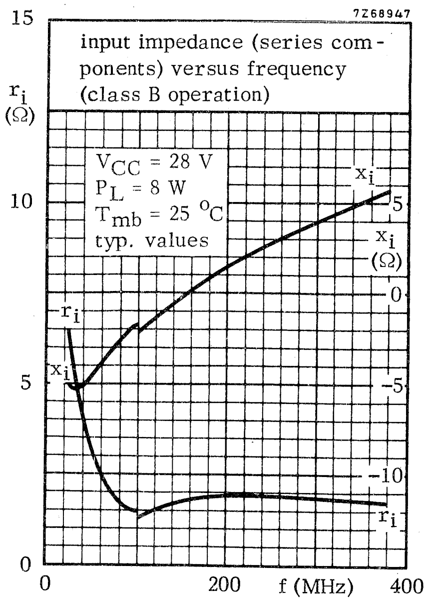


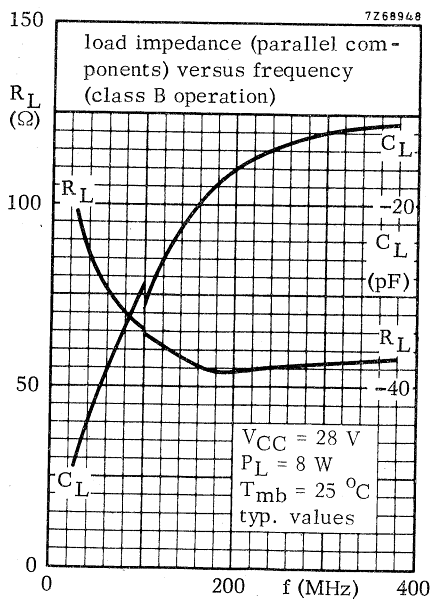


For high voltage operation, a stabilized power supply is generally used.
The graph shows the allowable output power under nominal conditions as a function of the V.S.W.R., with heat-sink temperature as parameter.

OPERATING NOTE Below 100 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation. This resistor must be effective for both d.c. and r.f.







V.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor intended for use in class-A, B and C operated h.f. and v.h.f. transmitters with a nominal supply voltage of 28 V. The transistor is resistance stabilized and is guaranteed to withstand severe load mismatch conditions.

It has a 3/8" capstan envelope with a ceramic cap. All leads are isolated from the stud.

QUICK REFERENCE DATA

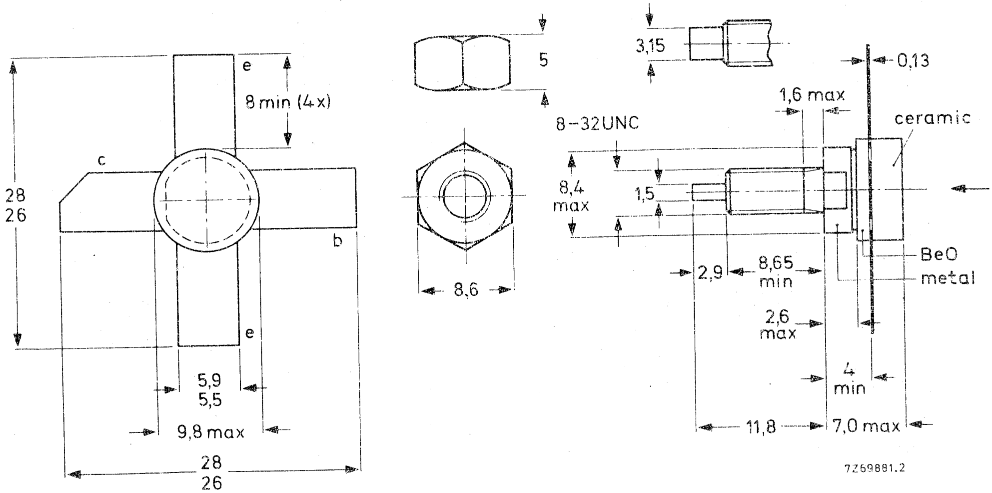
R.F. performance up to T_h = 25 °C in an unneutralized common-emitter class-B circuit.

mode of operation	V_{CE} V	f MHz	P_L W	G_p dB	η %	$\overline{z_i}$ Ω	$\overline{Y_L}$ mA/V
c.w.	28	175	8	> 12	> 65	1,8 + j0,7	18 – j20

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-120.



Torque on nut: min. 0,75 Nm (7,5 kg cm)
max. 0,85 Nm (8,5 kg cm)

Diameter of clearance hole in heatsink: max. 4,2 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

When locking is required an adhesive is preferred instead of a lock washer.

CAUTION This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage ($V_{BE} = 0$) peak value	V_{CESM}	max.	65	V
Collector-emitter voltage (open base)	V_{CEO}	max.	36	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4	V
Collector current (average)	$I_{C(AV)}$	max.	0,9	A
Collector current (peak value); f > 1 MHz	I_{CM}	max.	2,5	A
R.F. power dissipation (f > 1 MHz); T_{mb} = 25 °C	P_{rf}	max.	20	W
Storage temperature	T_{stg}		−65 to + 150	°C
Operating junction temperature	T_j	max.	200	°C

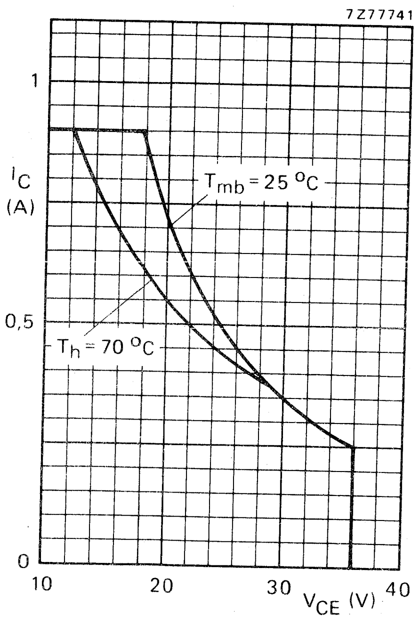


Fig. 2 D.C. SOAR.

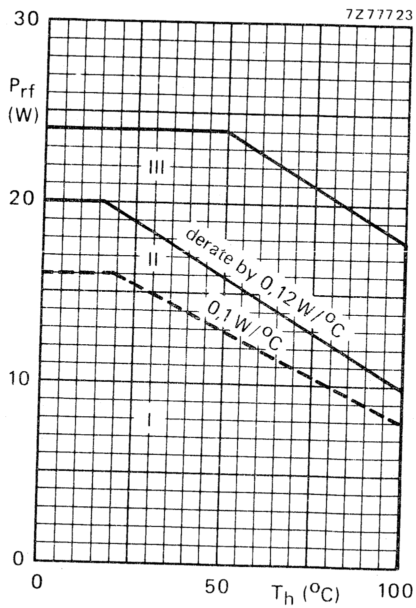


Fig. 3 R.F. power dissipation; $V_{CE} \leq 28$ V; f > 1 MHz.
I Continuous d.c operation
II Continuous r.f. operation
III Short-time operation during mismatch

THERMAL RESISTANCE (dissipation = 8 W; T_{mb} = 73,6 °C, i.e. T_h = 70 °C)

From junction to mounting base (d.c. dissipation)	$R_{th\ j\text{-}mb(dc)}$	=	10,7 °C/W
From junction to mounting base (r.f. dissipation)	$R_{th\ j\text{-}mb(rf)}$	=	8,6 °C/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,45 °C/W

CHARACTERISTICS

$T_j = 25\ ^oC$

Collector-emitter breakdown voltage $V_{BE} = 0$; $I_C = 2$ mA	$V_{(BR)CES}$	>	65 V
Collector-emitter breakdown voltage open base; $I_C = 10$ mA	$V_{(BR)CEO}$	>	36 V
Emitter-base breakdown voltage open collector; $I_E = 1$ mA	$V_{(BR)EBO}$	>	4 V
Collector cut-off current $V_{BE} = 0$; $V_{CE} = 36$ V	I_{CES}	<	1 mA
Second breakdown energy; L = 25 mH; f = 50 Hz open base	E_{SBO}	>	0,5 mJ
$R_{BE} = 10\ \Omega$	E_{SBR}	>	0,5 mJ
D.C. current gain * $I_C = 0,4$ A; $V_{CE} = 5$ V	h_{FE}	typ.	50 10 to 100
Collector-emitter saturation voltage* $I_C = 1,25$ A; $I_B = 0,25$ A	V_{CEsat}	typ.	0,8 V
Transition frequency at f = 100 MHz* $-I_E = 0,4$ A; $V_{CB} = 28$ V	f_T	typ.	600 MHz
$-I_E = 1,25$ A; $V_{CB} = 28$ V	f_T	typ.	525 MHz
Collector capacitance at f = 1 MHz $I_E = I_e = 0$; $V_{CB} = 28$ V	C_c	typ.	10 pF
Feedback capacitance at f = 1 MHz $I_C = 50$ mA; $V_{CE} = 28$ V	C_{re}	typ.	7,1 pF
Collector-stud capacitance	C_{cs}	typ.	2 pF

* Measured under pulse conditions: $t_p \leqslant 200\ \mu s$; $\delta \leqslant 0,02$.

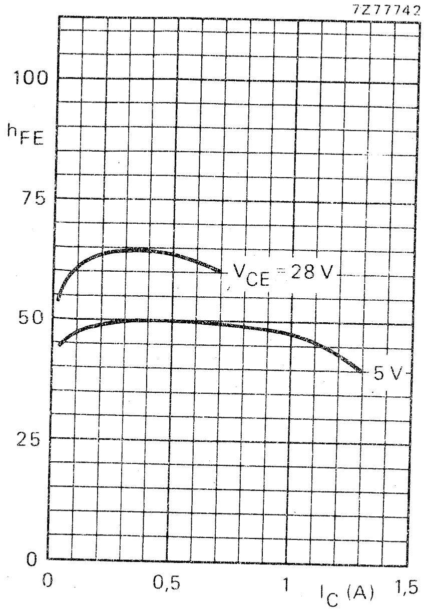


Fig.4 Typical values; T_j = 25 °C.

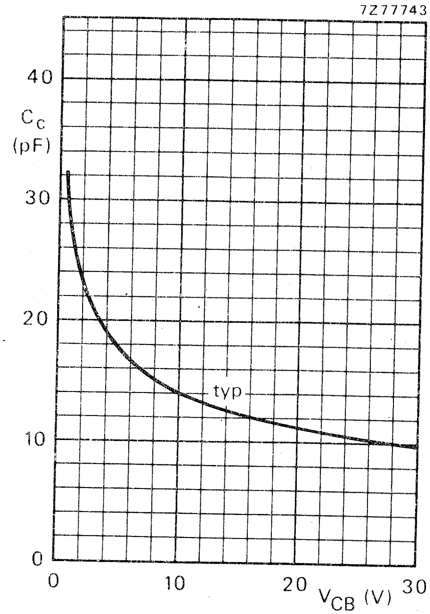


Fig. 5 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

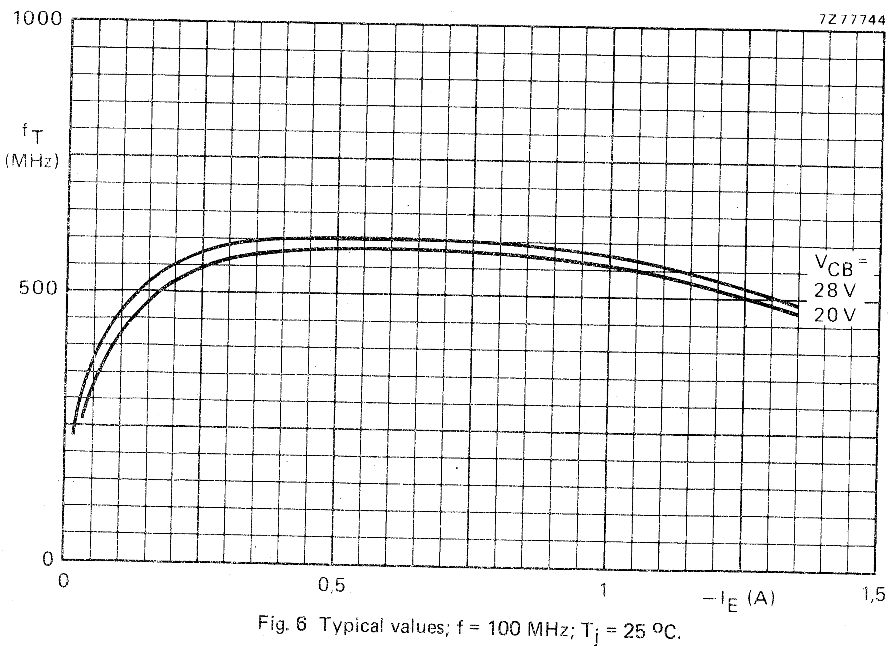


Fig. 6 Typical values; f = 100 MHz; T_j = 25 °C.

APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit)

T_h = 25 °C

f (MHz)	V_{CE} (V)	P_L (W)	P_S (W)	G_p (dB)	I_C (A)	η (%)	$\overline{z_i}$ (Ω)	$\overline{Y_L}$ (mA/V)
175	28	8	< 0,5	> 12	< 0,44	> 65	1,8 + j0,7	18 − j20

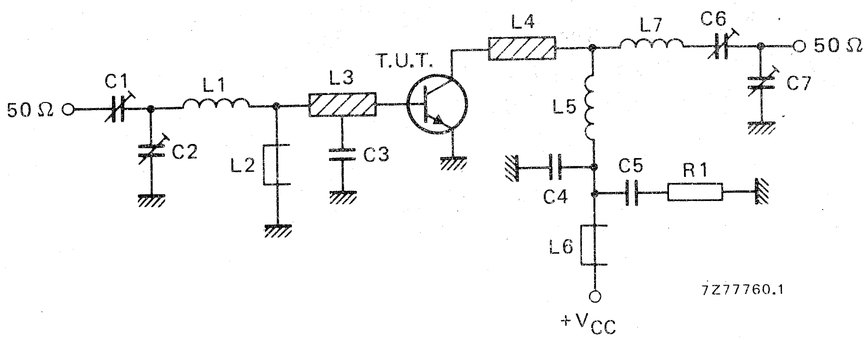


Fig. 7 Test circuit; c.w. class-B.

List of components:

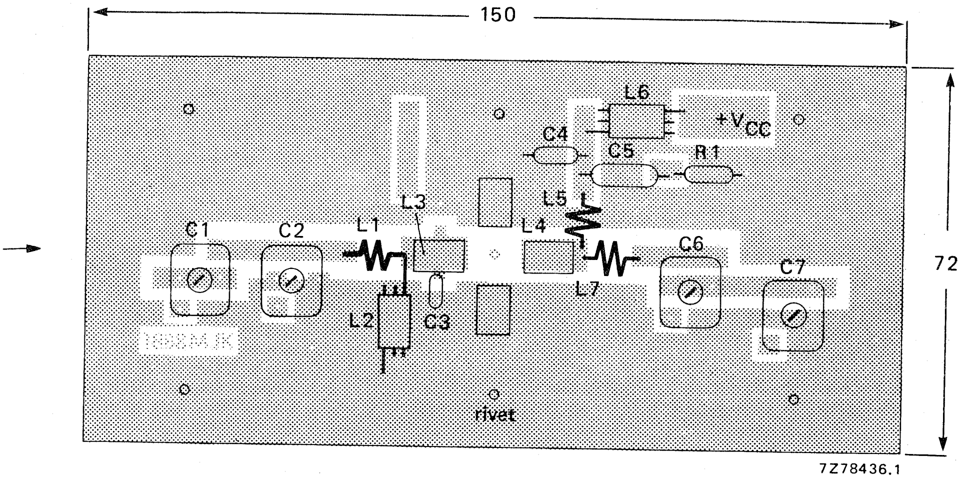
C1 = 2,5 to 20 pF film dielectric trimmer (cat. no. 2222 809 07004)
C2 = C6 = 4 to 40 pF film dielectric trimmer (cat. no. 2222 809 07008)
C3 = 47 pF ceramic capacitor (500 V)
C4 = 120 pF ceramic capacitor (500 V)
C5 = 100 nF polyester capacitor
C7 = 5 to 60 pF film dielectric trimmer (cat. no. 2222 809 07011)

L1 = 2 turns Cu wire (1,6 mm); int. dia. 4,5 mm; length 5,7 mm; leads 2 x 5 mm
L2 = L6 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L3 = L4 = strip (12 mm x 6 mm); tap for C3 at 5 mm from transistor
L5 = 3 turns Cu wire (1,6 mm); int. dia. 7,5 mm; length 7,5 mm; leads 2 x 5 mm
L7 = 3 turns Cu wire (1,6 mm); int. dia. 6,5 mm; length 7,4 mm; leads 2 x 5 mm

L3 and L4 are strips on a double Cu-clad printed-circuit board with epoxy fibre-glass dielectric, thickness 1/16".

R1 = 10 Ω carbon resistor

Component layout and printed-circuit board for 175 MHz test circuit see Fig. 8.



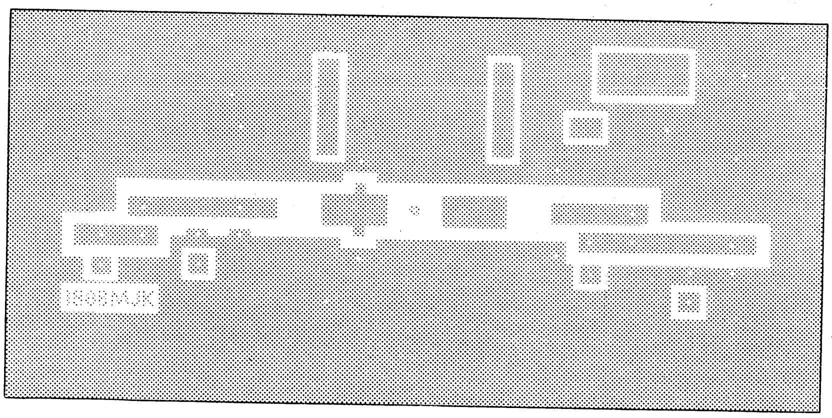


Fig. 8 Component layout and printed-circuit board for 175 MHz test circuit.

The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets, whilst under the emitter leads Cu straps are used for a direct contact between upper and lower sheets.

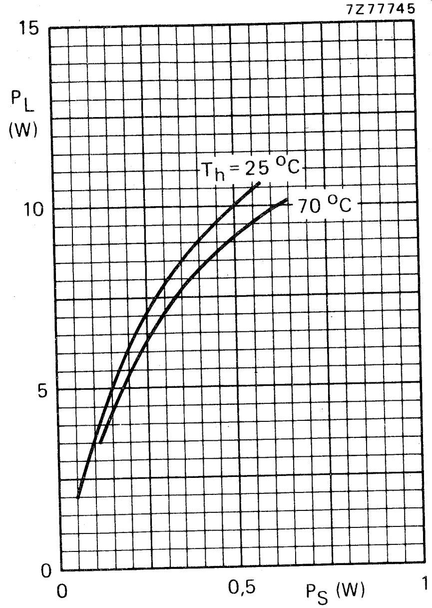


Fig. 9 Typical values; V_{CE} = 28 V; f = 175 MHz.

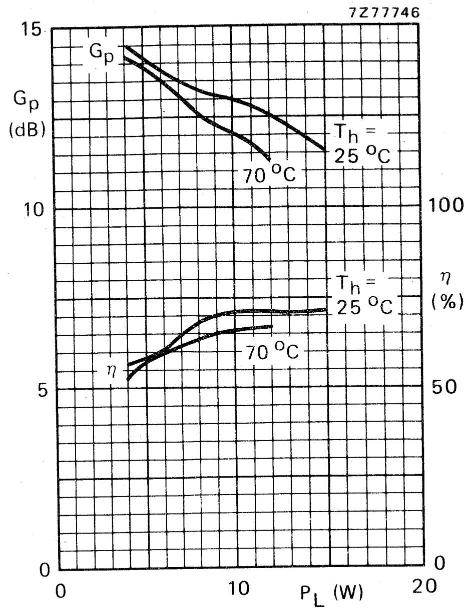


Fig. 10 Typical values; V_{CE} = 28 V; f = 175 MHz.

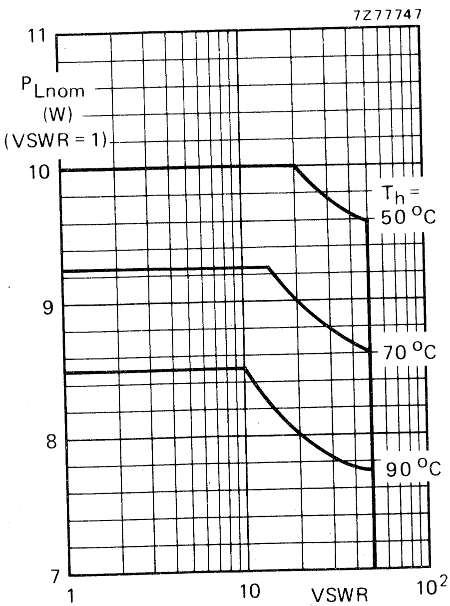


Fig. 11 R.F. SOAR; c.w. class-B operation; f = 175 MHz; V_{CE} = 28 V; $R_{th\ mb\text{-}h}$ = 0,45 °C/W. The graph shows the permissible output power under nominal conditions (VSWR = 1) as a function of the expected VSWR during short-time mismatch conditions with heatsink temperatures as parameter.

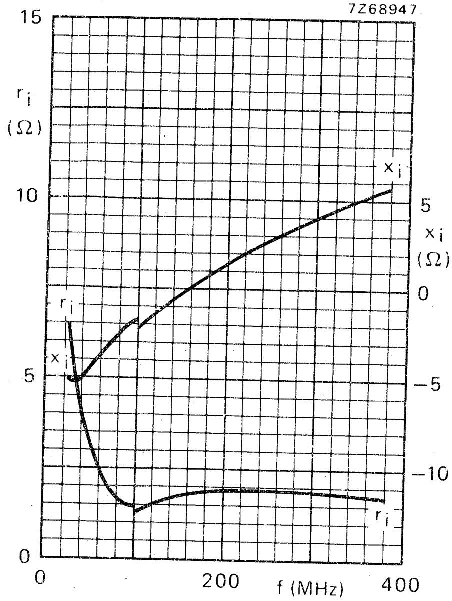


Fig. 12 Input impedance (series components).

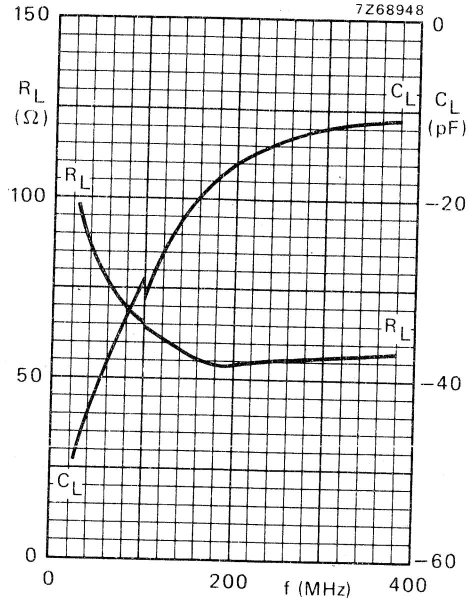


Fig. 13 Load impedance (parallel components).

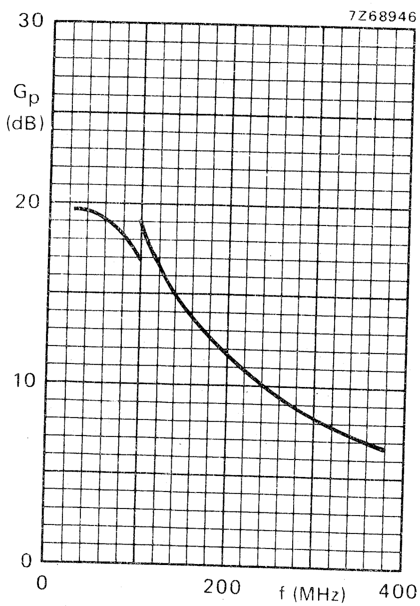


Fig. 14.

Conditions for Figs 12, 13 and 14.

Typical values; V_{CE} = 28 V; P_L = 8 W; T_h = 25 °C.

OPERATING NOTE

Below 100 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation. This resistor must be effective for r.f. only.

V.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor for use in class-A, B and C operated mobile, industrial and military transmitters with a nominal supply voltage of 28 V. The transistor is resistance stabilized and is guaranteed to withstand severe load mismatch conditions.

It has a ¼" capstan envelope with a moulded cap. All leads are isolated from the stud.

QUICK REFERENCE DATA

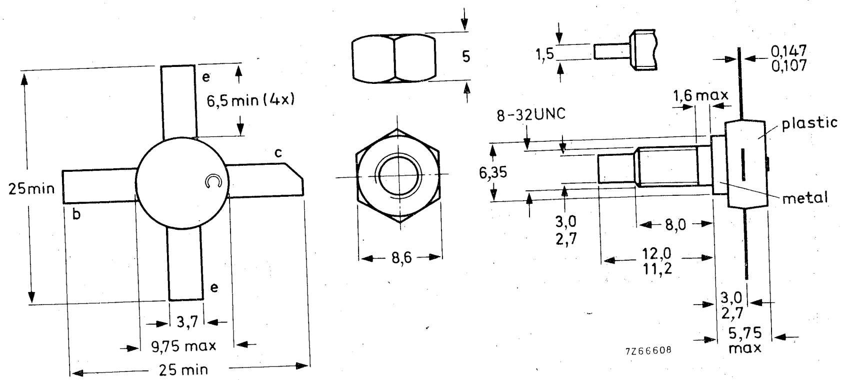
R.F. performance up to T_{mb} = 25 °C in an unneutralized common-emitter class-B circuit

Mode of operation	V_{CE} V	f MHz	P_L W	G_p dB	η %	$\overline{z_i}$ Ω	$\overline{Y_L}$ mA/V
c.w.	28	175	15	> 10	> 65	1,4 + j1,85	33 − j27,5

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-48.



Torque on nut: min. 0,75 Nm (7,5 kg cm)
max. 0,85 Nm (8,5 kg cm)

Diameter of clearance hole in heatsink: max. 4,2 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

When locking is required an adhesive is preferred instead of a lock washer.

CAUTION This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC 134)

Voltages

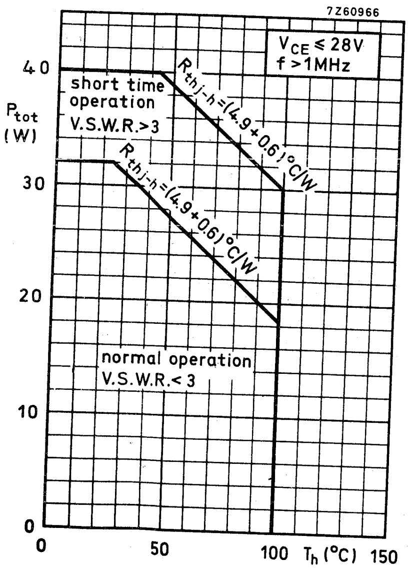
Collector-base voltage (open emitter) peak value	V_{CBOM}	max.	65	V
Collector-emitter voltage (open base)	V_{CEO}	max.	36	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4	V

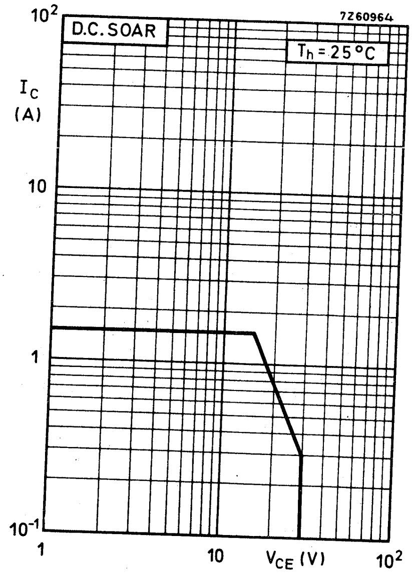
Currents

Collector current (average)	$I_{C(AV)}$	max.	1.5	A
Collector current (peak value) f > 1 MHz	I_{CM}	max.	4.5	A

Power dissipation

Total power dissipation up to T_h = 25 °C f > 1 MHz	P_{tot}	max.	32	W





Temperatures

Storage temperature	T_{stg}	−30 to +200		°C
Operating junction temperature	T_j	max.	200	°C

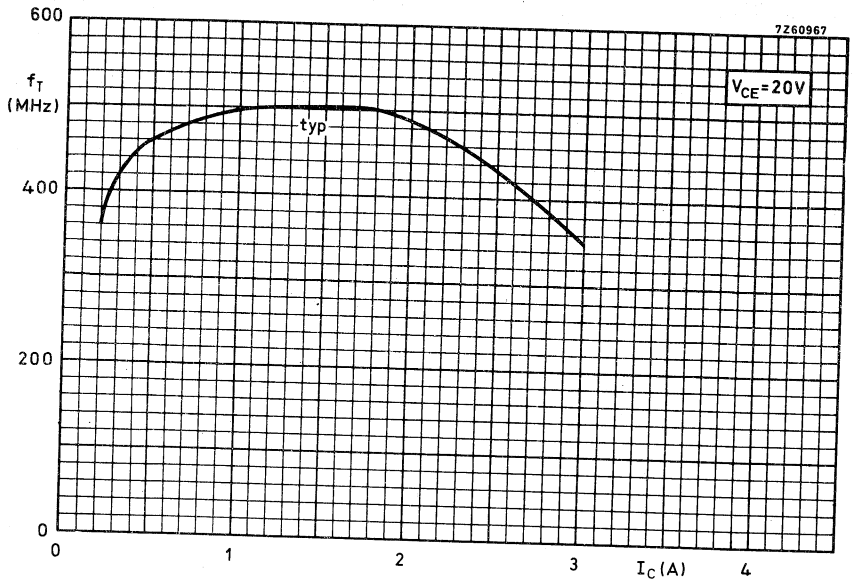
THERMAL RESISTANCE

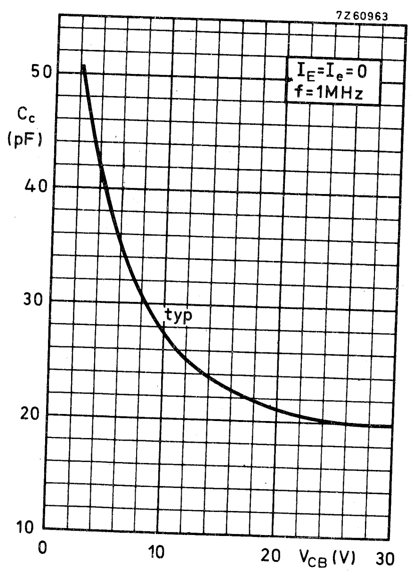
From junction to mounting base	$R_{th\ j-mb}$	=	4.9	°C/W
From mounting base to heatsink	$R_{th\ mb-h}$	=	0.6	°C/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current				
$I_B = 0$; $V_{CE} = 28$ V	I_{CEO}	<	10	mA
Breakdown voltages				
Collector-base voltage open emitter, $I_C = 3$ mA	$V_{(BR)CBO}$	>	65	V
Collector-emitter voltage open base, $I_C = 25$ mA	$V_{(BR)CEO}$	>	36	V
Emitter-base voltage open collector; $I_E = 3$ mA	$V_{(BR)EBO}$	>	4	V
Transient energy				
L = 25 mH; f = 50 Hz				
open base	E	>	2.0	mWs
$-V_{BE} = 1.5$ V; $R_{BE} = 33\,\Omega$	E	>	4.5	mWs
D.C. current gain				
$I_C = 500$ mA; $V_{CE} = 5$ V	h_{FE}	>	5	
Transition frequency				
$I_C = 600$ mA; $V_{CE} = 20$ V	f_T	typ.	500	MHz
Collector capacitance at f = 1 MHz				
$I_E = I_e = 0$; $V_{CB} = 30$ V	C_c	typ.	20	pF
		<	30	pF
Feedback capacitance at f = 1 MHz				
$I_C = 100$ mA; $V_{CE} = 30$ V	C_{re}	typ.	15	pF
Collector-stud capacitance	C_{cs}	typ.	2	pF


7Z60967
600
400
200
0
f_T
(MHz)
V_{CE}=20V
typ
0
1
2
3
4
I_C (A)


7Z60963
50
40
30
20
10
C_c
(pF)
I_E=I_e=0
f=1MHz
typ
0
10
20
30
V_{CB} (V)

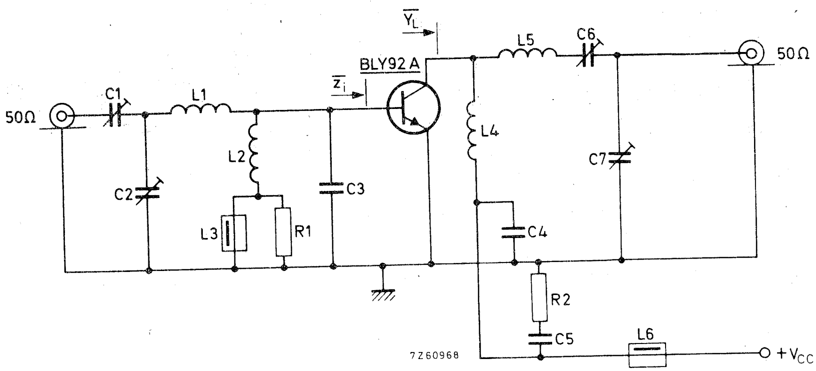
APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit)

V_{CE} = 28 V; T_{mb} up to 25 °C

f (MHz)	P_S (W)	P_L (W)	I_C (A)	G_p (dB)	η (%)	$\overline{z_i}$ (Ω)	$\overline{Y_L}$ (mA/V)
175	< 1,5	15	< 0,83	> 10	> 65	1,4 + j1,85	33 − j27,5

Test circuit: 175 MHz; c.w. class-B.



C1 = 2,5 to 20 pF film dielectric trimmer (cat. no. 2222 809 07004)
C2 = C6 = C7 = 4 to 40 pF film dielectric trimmer (cat. no. 2222 809 07008)
C3 = 47 pF ceramic capacitor
C4 = 100 pF ceramic capacitor
C5 = 150 nF polyester capacitor

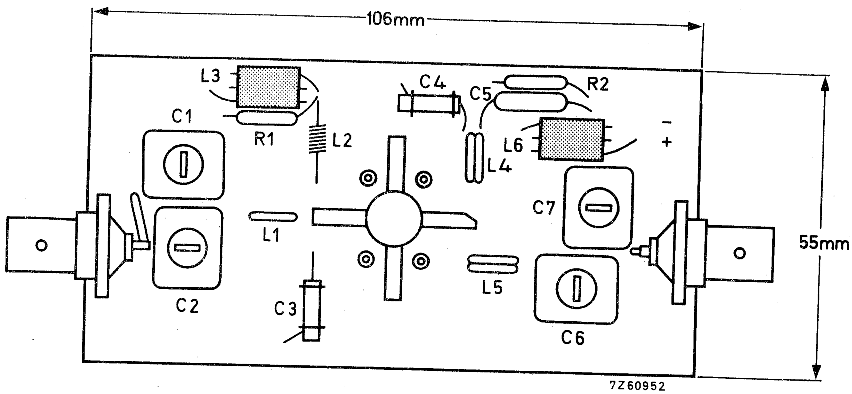
L1 = 0,5 turn enamelled Cu wire (1,6 mm); int. dia. 6 mm; leads 2 x 10 mm
L2 = 6,5 turns closely wound enamelled Cu wire (0,7 mm); int. dia. 4 mm; leads 2 x 5 mm
L3 = L5 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L4 = 2,5 turns enamelled Cu wire (0,7 mm); int. dia. 6 mm; leads 2 x 7 mm
L6 = 4,5 turns enamelled Cu wire (0,7 mm); int. dia. 6 mm; leads 2 x 7 mm

R1 = R2 = 10 Ω carbon resistor

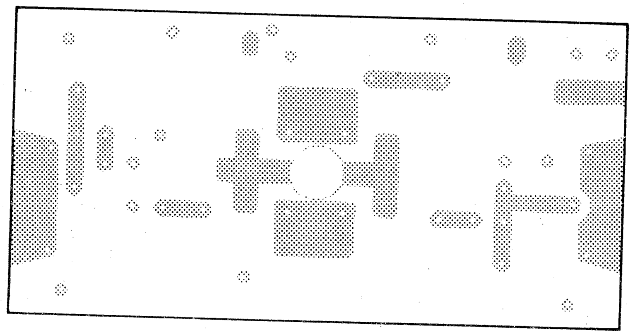
Component layout and printed-circuit board for 175 MHz test circuit see page 6.

APPLICATION INFORMATION (continued)

Component lay-out and printed circuit board for 175 MHz test circuit.

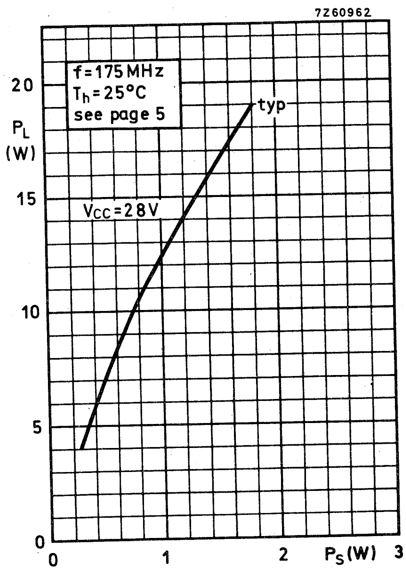


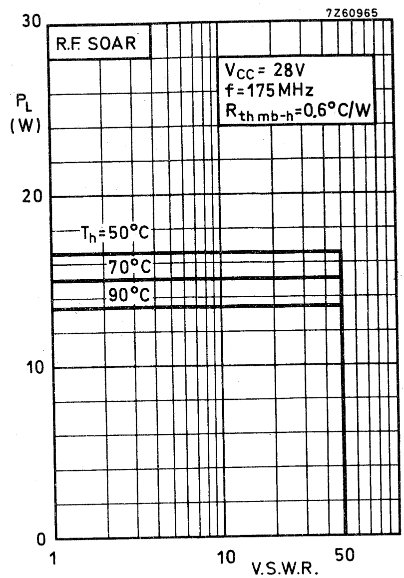
7Z60952



7Z67868

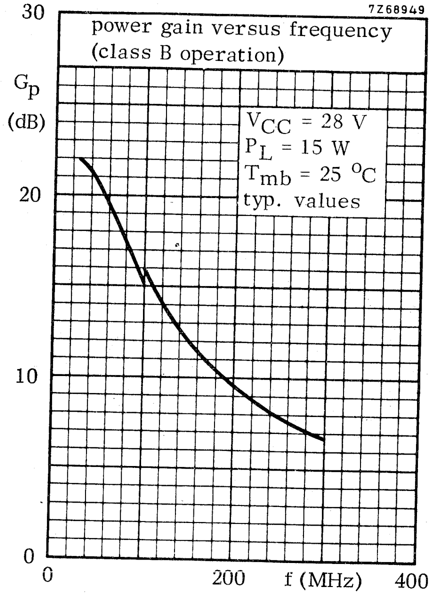
The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallised to serve as earth. Earth connections are made by means of hollow rivets.

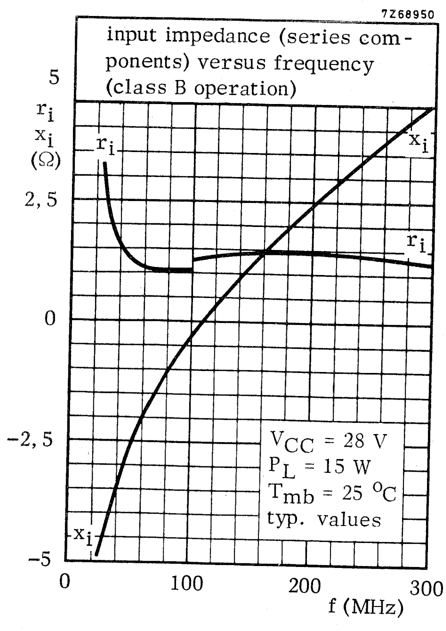


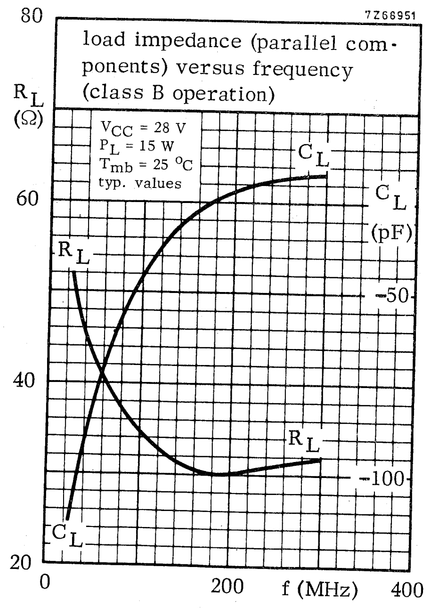


For high voltage operation, a stabilized power supply is generally used.
The graph shows the allowable output power under nominal conditions as a function of the V.S.W.R., with heat-sink temperature as parameter.

OPERATING NOTE Below 100 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation. This resistor must be effective for both d.c. and r.f.







V.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor intended for use in class-A, B and C operated h.f. and v.h.f. transmitters with a nominal supply voltage of 28 V. The transistor is resistance stabilized and is guaranteed to withstand severe load mismatch conditions.

It has a 3/8" capstan envelope with a ceramic cap. All leads are isolated from the stud.

QUICK REFERENCE DATA

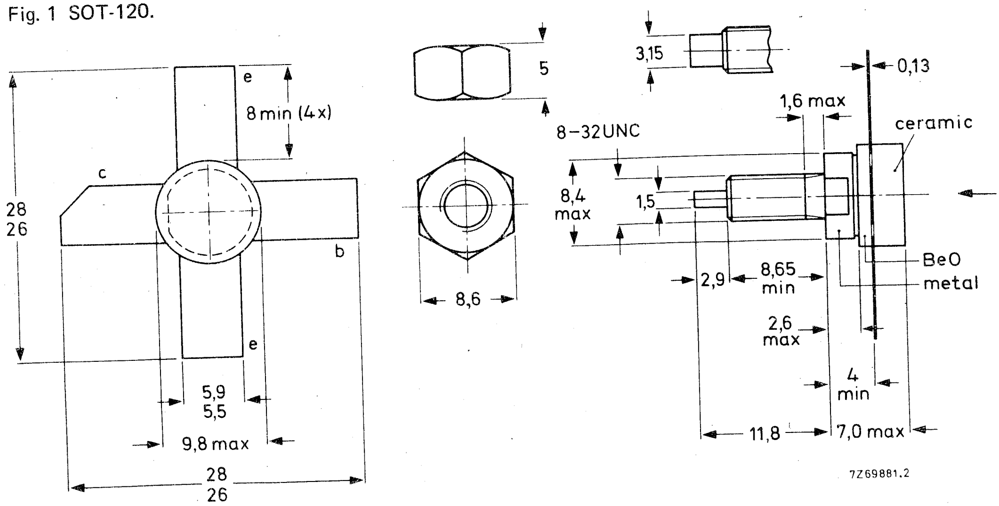
R.F. performance up to T_h = 25 °C in an unneutralized common-emitter class-B circuit

mode of operation	V_{CE} V	f MHz	P_L W	G_p dB	η %	$\overline{z_i}$ Ω	$\overline{Y_L}$ mA/V
c.w.	28	175	15	> 10	> 65	1,4 + j1,85	33 – j27,5

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-120.



Torque on nut: min. 0,75 Nm
(7,5 kg cm)
max. 0,85 Nm
(8,5 kg cm)

Diameter of clearance hole in heatsink: max. 4,2 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

When locking is required an adhesive is preferred instead of a lock washer.

CAUTION This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage (V_{BE} = 0) peak value	V_{CESM}	max.	65 V
Collector-emitter voltage (open base)	V_{CEO}	max.	36 V
Emitter-base voltage (open collector)	V_{EBO}	max.	4 V
Collector current (average)	$I_{C(AV)}$	max.	1,75 A
Collector current (peak value); f > 1 MHz	I_{CM}	max.	5,0 A
R.F. power dissipation (f > 1 MHz); T_{mb} = 25 °C	P_{rf}	max.	36 W
Storage temperature	T_{stg}		−65 to + 150 °C
Operating junction temperature	T_j	max.	200 °C

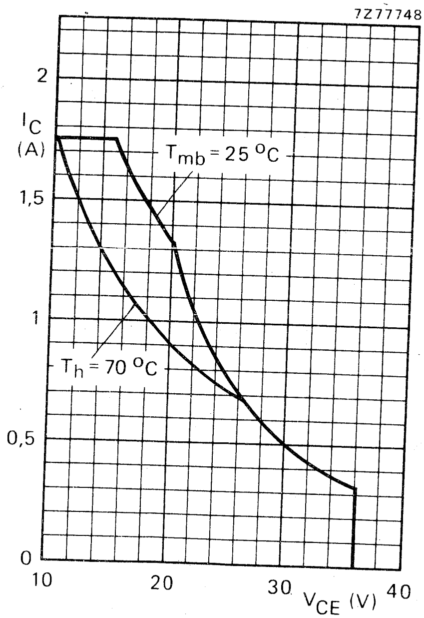


Fig. 2 D.C. SOAR.

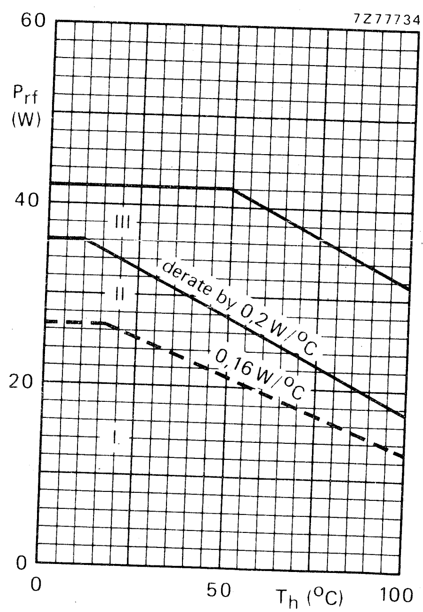


Fig. 3 R.F. power dissipation; $V_{CE} \leq 28$ V; f > 1 MHz.
I Continuous d.c. operation
II Continuous r.f. operation
III Short-time operation during mismatch

THERMAL RESISTANCE (dissipation = 15 W; T_{mb} = 77 °C, i.e. T_h = 70 °C)

From junction to mounting base (d.c. dissipation)	$R_{th\ j\text{-}mb(dc)}$	=	6,55 °C/W
From junction to mounting base (r.f. dissipation)	$R_{th\ j\text{-}mb(rf)}$	=	4,95 °C/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,45 °C/W

CHARACTERISTICS

T_j = 25 °C

Collector-emitter breakdown voltage $V_{BE} = 0$; $I_C = 5$ mA	$V_{(BR)CES}$	>	65 V
Collector-emitter breakdown voltage open base; $I_C = 25$ mA	$V_{(BR)CEO}$	>	36 V
Emitter-base breakdown voltage open collector; $I_E = 2$ mA	$V_{(BR)EBO}$	>	4 V
Collector cut-off current $V_{BE} = 0$; $V_{CE} = 36$ V	I_{CES}	<	2 mA
Second breakdown energy; L = 25 mH; f = 50 Hz			
open base	E_{SBO}	>	2,5 mJ
$R_{BE} = 10\ \Omega$	E_{SBR}	>	2,5 mJ
D.C. current gain* $I_C = 0,7$ A; $V_{CE} = 5$ V	h_{FE}	typ.	50
			10 to 100
Collector-emitter saturation voltage* $I_C = 2$ A; $I_B = 0,4$ A	V_{CEsat}	typ.	0,65 V
Transition frequency at f = 100 MHz*			
$-I_E = 0,7$ A; $V_{CB} = 28$ V	f_T	typ.	650 MHz
$-I_E = 2$ A; $V_{CB} = 28$ V	f_T	typ.	625 MHz
Collector capacitance at f = 1 MHz $I_E = I_e = 0$; $V_{CB} = 28$ V	C_c	typ.	18 pF
Feedback capacitance at f = 1 MHz $I_C = 100$ mA; $V_{CE} = 28$ V	C_{re}	typ.	12,8 pF
Collector-stud capacitance	C_{cs}	typ.	2 pF

* Measured under pulse conditions: $t_p \leq 200\ \mu s$; $\delta \leq 0,02$.

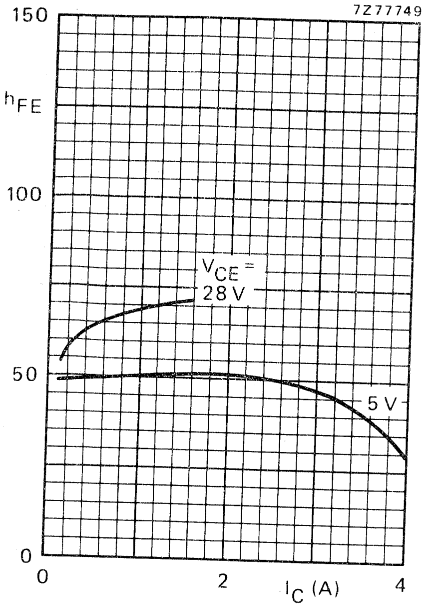


Fig. 4 Typical values; T_j = 25 °C.

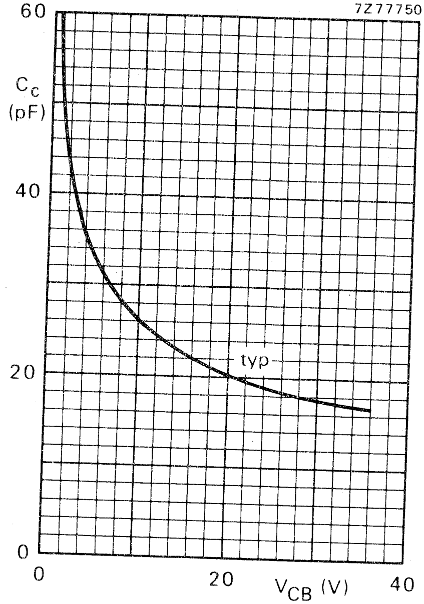


Fig. 5 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

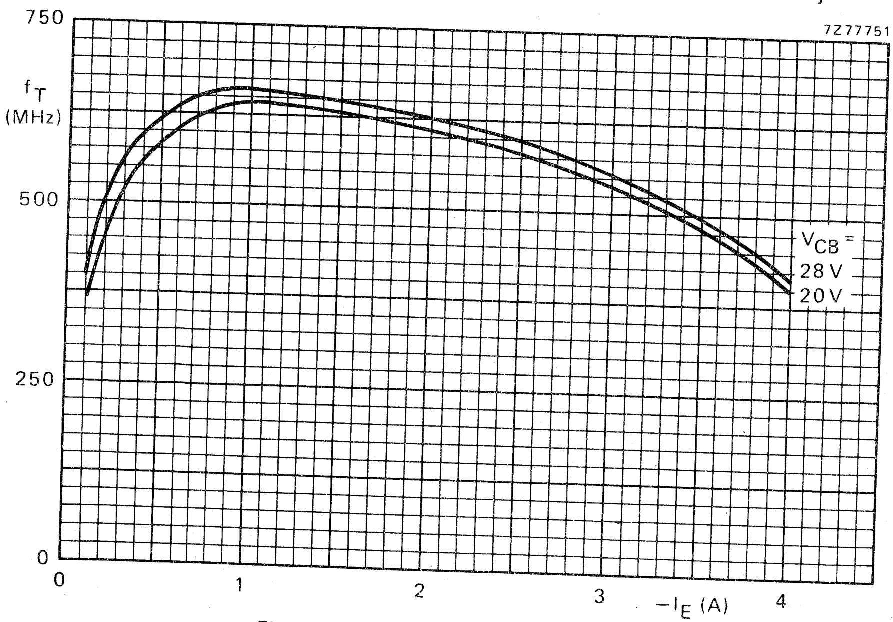


Fig. 6 Typical values; f = 100 MHz; T_j = 25 °C.

APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit)

T_h = 25 °C

f (MHz)	V_{CE} (V)	P_L (W)	P_S (W)	G_p (dB)	I_C (A)	η (%)	$\overline{z_i}$ (Ω)	$\overline{Y_L}$ (mA/V)
175	28	15	< 1,5	> 10	< 0,83	> 65	1,4 + j1,85	33 – j27,5

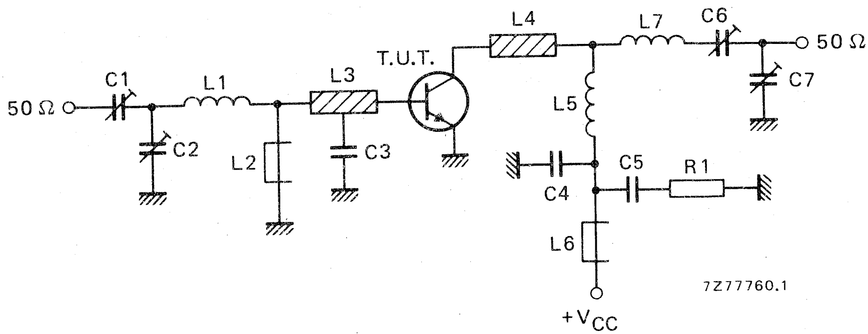


Fig. 7 Test circuit; c.w. class-B.

List of components:

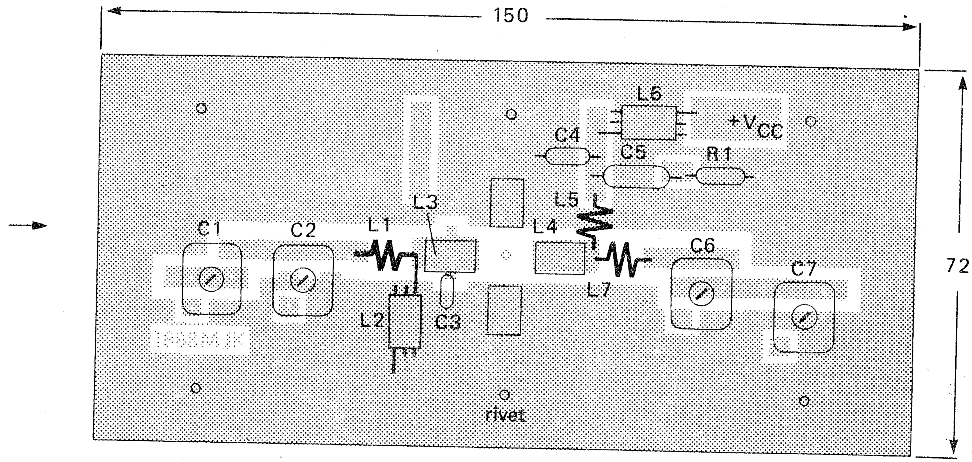
C1 = 2,5 to 20 pF film dielectric trimmer (cat. no. 2222 809 07004)
C2 = C6 = 4 to 40 pF film dielectric trimmer (cat. no. 2222 809 07008)
C3 = 47 pF ceramic capacitor (500 V)
C4 = 120 pF ceramic capacitor (500 V)
C5 = 100 nF polyester capacitor
C7 = 5 to 60 pF film dielectric trimmer (cat. no. 2222 809 07011)

L1 = 2 turns Cu wire (1,6 mm); int. dia. 4,5 mm; length 5,7 mm; leads 2 x 5 mm
L2 = L6 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L3 = L4 = strip (12 mm x 6 mm); tap for C3 at 5 mm from transistor
L5 = 3 turns Cu wire (1,6 mm); int. dia. 7,5 mm; length 7,5 mm; leads 2 x 5 mm
L7 = 3 turns Cu wire (1,6 mm); int. dia. 6,5 mm; length 7,4 mm; leads 2 x 5 mm

L3 and L4 are strips on a double Cu-clad printed-circuit board with epoxy fibre-glass dielectric, thickness 1/16".

R1 = 10 Ω carbon resistor

Component layout and printed-circuit board for 175 MHz test circuit see Fig. 8.



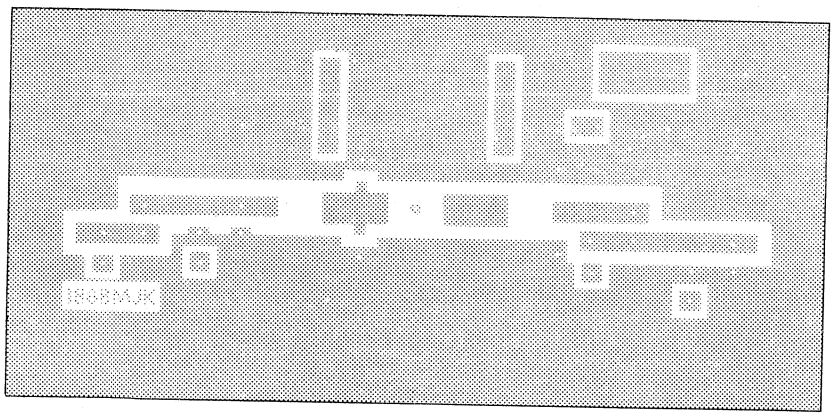


Fig. 8 Component layout and printed-circuit board for 175 MHz test circuit.

The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets, whilst under the emitter leads Cu straps are used for a direct contact between upper and lower sheets.

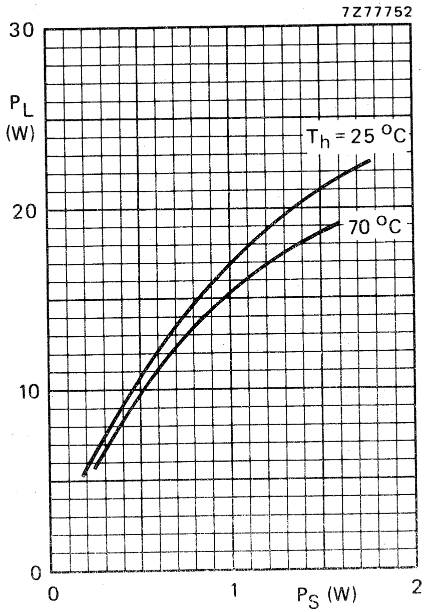


Fig. 9 Typical values; V_{CE} = 28 V; f = 175 MHz.

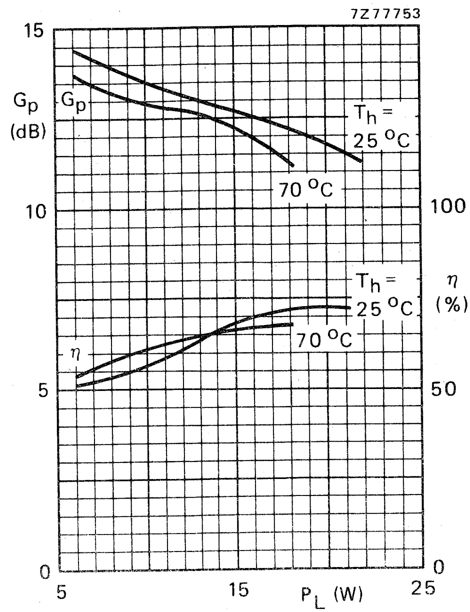


Fig. 10 Typical values; V_{CE} = 28 V; f = 175 MHz.

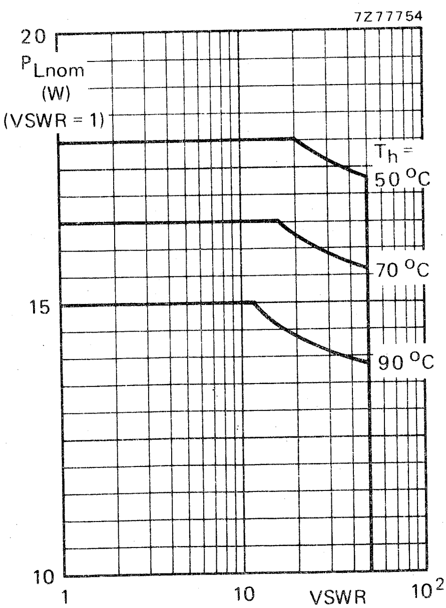


Fig. 11 R.F. SOAR; c.w. class-B operation; f = 175 MHz; V_{CE} = 28 V; $R_{th\ mb\text{-}h}$ = 0,45 °C/W. The graph shows the permissible output power under nominal conditions (VSWR = 1) as a function of the expected VSWR during short-time mismatch conditions with heatsink temperatures as parameter.

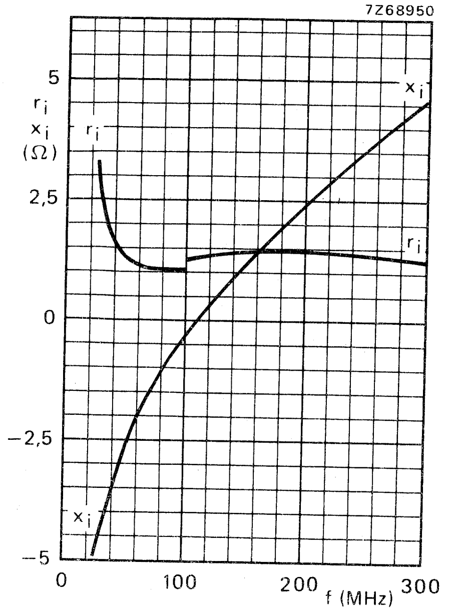


Fig. 12 Input impedance (series components).

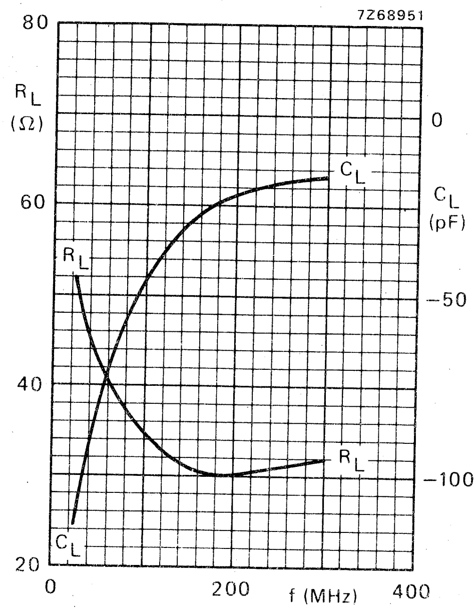


Fig. 13 Load impedance (parallel components).

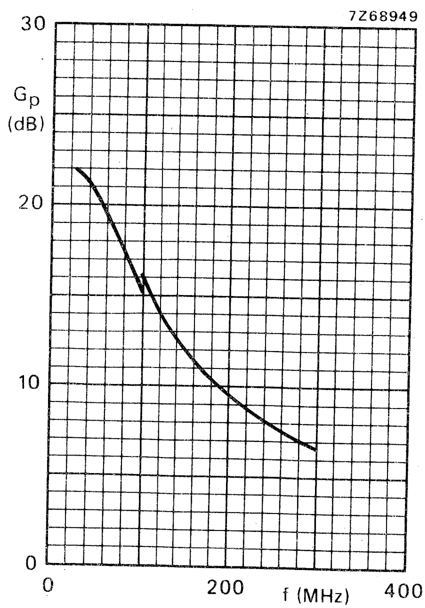


Fig. 14.

Conditions for Figs 12, 13 and 14.

Typical values; V_{CE} = 28 V; P_L = 15 W; T_h = 25 °C.

OPERATING NOTE

Below 100 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation. This resistor must be effective for r.f. only.

V.H.F. POWER TRANSISTOR

N-P-N epitaxial planar transistor intended for use in class-A, B and C operated mobile, industrial and military transmitters with a supply voltage of 28 V. The transistor is resistance stabilized. Every transistor is tested under severe load mismatch conditions. It has a ¼" capstan envelope with a moulded cap. All leads are isolated from the stud.

QUICK REFERENCE DATA

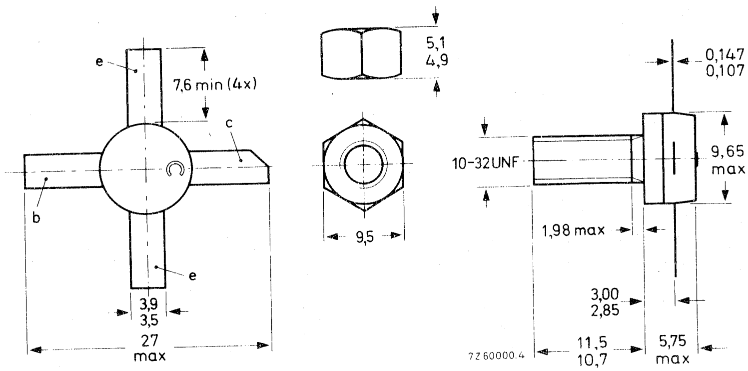
R.F. performance up to T_{mb} = 25 °C in an unneutralized common-emitter class-B circuit

mode of operation	V_{CE} V	f MHz	P_S W	P_L W	I_C A	G_p dB	η %	$\overline{z_i}$ Ω	$\overline{Y_L}$ mA/V
c.w.	28	175	< 3,1	25	< 1,5	> 9	> 60	1,0 + j1,2	58,8 − j53,8

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-56.



Torque on nut: min. 1,5 Nm (15 kg cm)
max. 1,7 Nm (17 kg cm)

Diameter of clearance hole in heatsink: max. 4,9 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

When locking is required an adhesive is preferred instead of a lock washer.

CAUTION This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC134)

Voltages

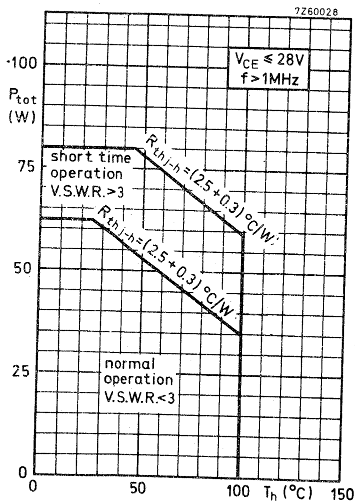
Collector-base voltage (open emitter) peak value	V_{CBOM}	max.	65	V
Collector-emitter voltage (open base)	V_{CEO}	max.	36	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4	V

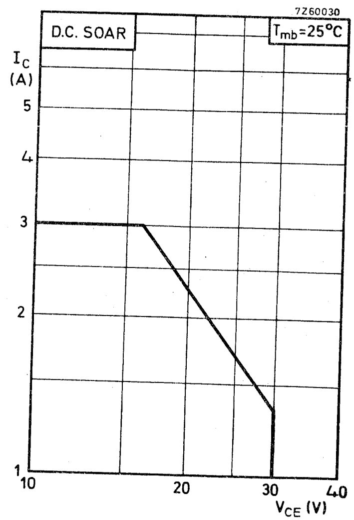
Currents

Collector current (average)	$I_{C(AV)}$	max.	3	A
Collector current (peak value) f > 1 MHz	I_{CM}	max.	9	A

Power dissipation

Total power dissipation up to T_{mb} = 25 °C f > 1 MHz	P_{tot}	max.	70	W





Temperature

Storage temperature	T_{stg}		−30 to +200	°C
Operating junction temperature	T_j	max.	200	°C

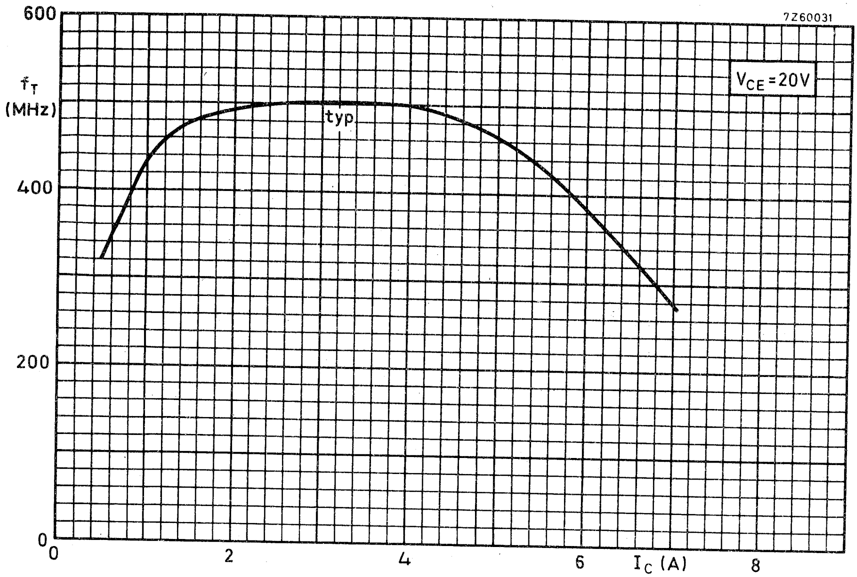
THERMAL RESISTANCE

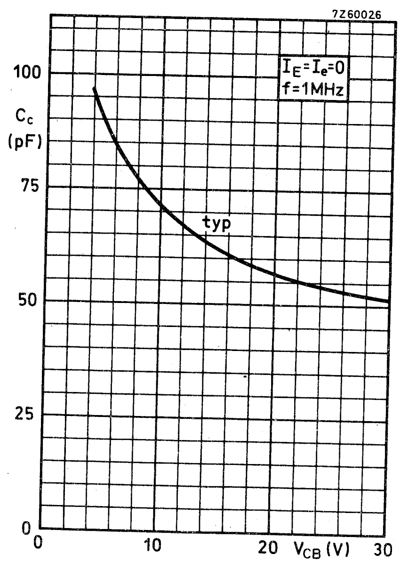
From junction to mounting base	$R_{th\ j-mb}$	=	2.5	°C/W
From mounting base to heatsink	$R_{th\ mb-h}$	=	0.3	°C/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Breakdown voltages				
Collector-base voltage, open emitter, I_C = 50 mA	$V_{(BR)CBO}$	>	65	V
Collector-emitter voltage, open base, I_C = 50 mA	$V_{(BR)CEO}$	>	36	V
Emitter-base voltage, open collector; I_E = 10 mA	$V_{(BR)EBO}$	>	4	V
Transient energy				
L = 25 mH; f = 50 Hz, open base	E	>	8	mWs
L = 25 mH; f = 50 Hz, $-V_{BE}$ = 1.5 V; R_{BE} = 33 Ω	E	>	8	mWs
D.C. current gain				
I_C = 1 A; V_{CE} = 5 V	h_{FE}	typ.	50	
			10 to 120	
Transition frequency				
I_C = 3 A; V_{CE} = 20 V	f_T	typ.	500	MHz
Collector capacitance at f = 1 MHz				
I_E = I_e = 0; V_{CB} = 30 V	C_c	typ.	50	pF
		<	65	pF
Feedback capacitance at f = 1 MHz				
I_C = 100 mA; V_{CE} = 30 V	C_{re}	typ.	31	pF
Collector-stud capacitance	C_{cs}	typ.	2	pF


7Z60031
600
f_T
(MHz)
400
200
0
0
2
4
6
I_C (A)
8
V_{CE} = 20V
typ


7Z60026
100
C_c
(pF)
75
50
25
0
0
10
20
V_{CB} (V)
30
$I_E = I_e = 0$
f = 1MHz
typ

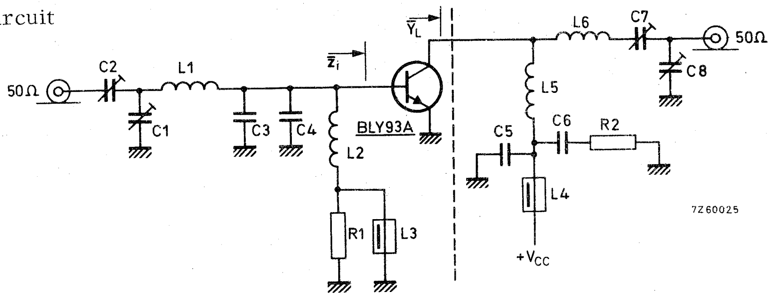
APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralised common-emitter class B circuit)

V_{CC} = 28 V; T_{mb} = 25 °C

f(MHz)	P_S (W)	P_L (W)	I_C (A)	G_p (dB)	η (%)	$\overline{z}_i$ (Ω)	$\overline{Y}_L$ (mA/V)
175	< 3.1	25	< 1.5	> 9	> 60	1.0+j1.2	58.8−j53.8

Test circuit



C1 = 4 to 44 pF film dielectric trimmer (code number 2222 809 07008)
C2 = 2 to 22 pF film dielectric trimmer (code number 2222 809 07004)
C3 = C4 = 47 pF ceramic
C5 = 100 pF ceramic
C6 = 150 nF polyester
C7 = 4 to 104 pF film dielectric trimmer (code number 2222 809 07015)
C8 = 4 to 64 pF film dielectric trimmer (code number 2222 809 07011)

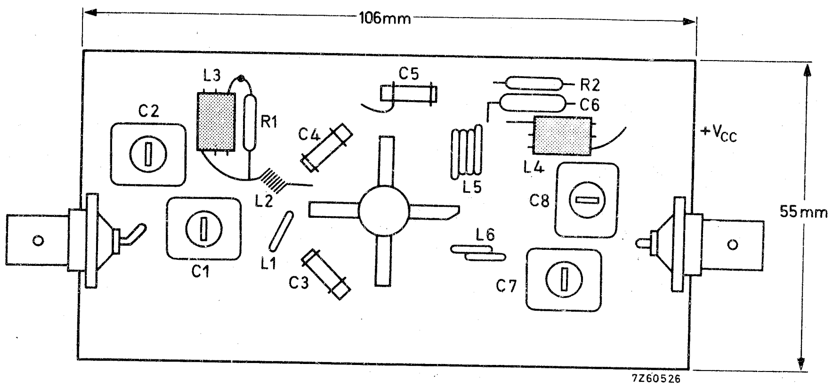
L1 = 0.5 turn enamelled Cu wire (1.5 mm); int.diam.6 mm; leads 2x6 mm
L2 = 6 turns closely wound enamelled Cu wire (0.7 mm); int.diam.4 mm; leads 2x4 mm
L3 = L4 = ferroxcube choke (code number 4312 020 36640)
L5 = 3.5 turns enamelled Cu wire (1.5 mm); int.diam. 6 mm; leads 2x6 mm
L6 = 1.5 turns enamelled Cu wire (1.5 mm); int.diam. 6 mm; leads 2x6 mm

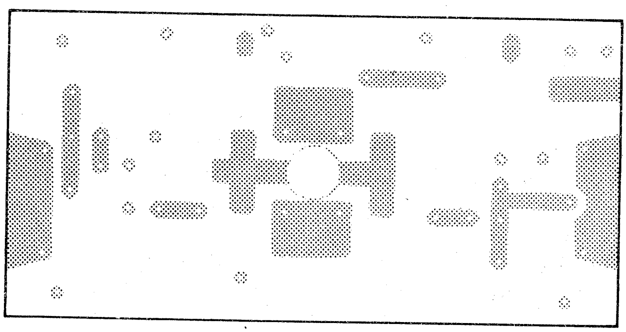
R1 = R2 = 10 Ω carbon

Component lay-out for 175 MHz see page 6.

APPLICATION INFORMATION (continued)

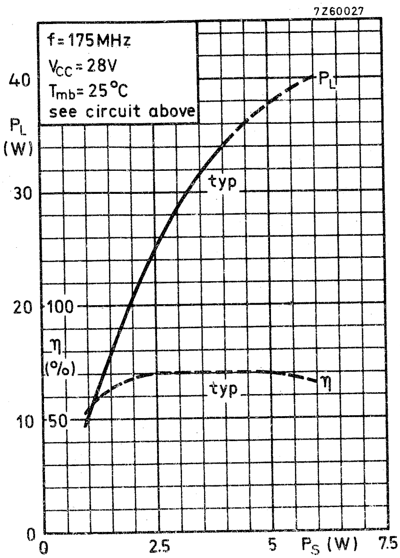
Component lay-out and printed circuit board for 175 MHz test circuit.

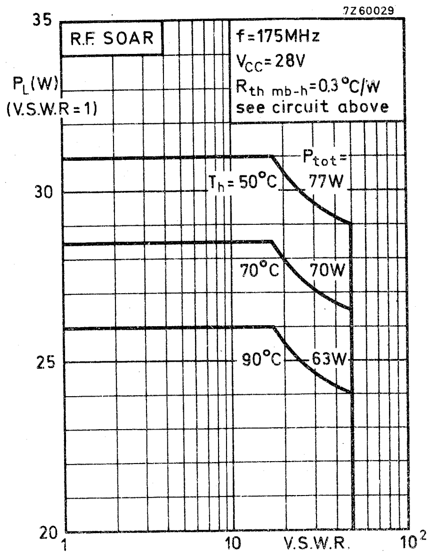




7Z67868

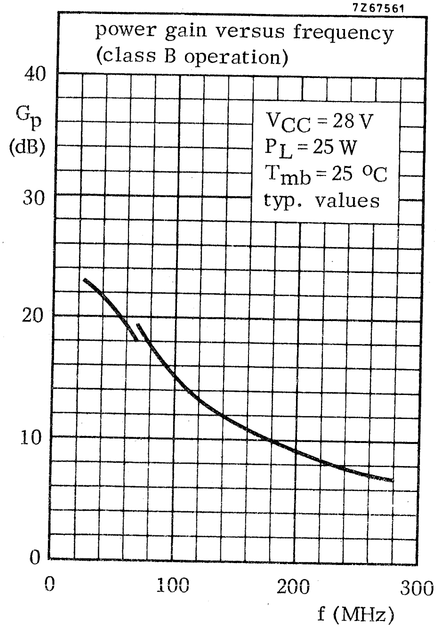
The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallised to serve as earth. Earth connections are made by means of hollow rivets.

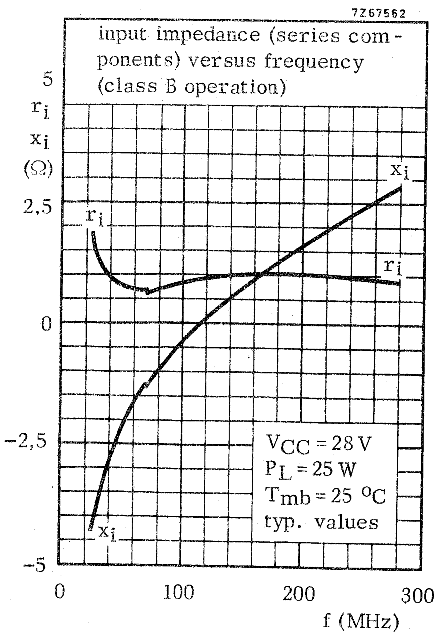


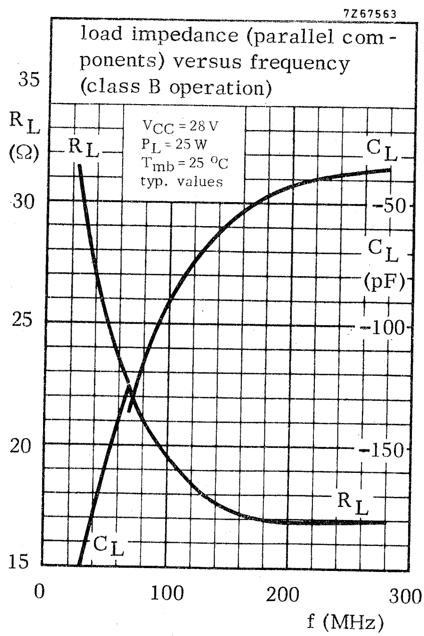


For high voltage operation, a stabilized power supply is generally used.
The graph shows the allowable output power under nominal conditions as a function of the V.S.W.R., with heat-sink temperature as parameter.

OPERATING NOTE Below 70 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation. This resistor must be effective for both d.c. and r.f.







V.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor intended for use in class-A, B and C operated h.f. and v.h.f. transmitters with a nominal supply voltage of 28 V. The transistor is resistance stabilized and is guaranteed to withstand severe load mismatch conditions.

It has a 3/8" capstan envelope with a ceramic cap. All leads are isolated from the stud.

QUICK REFERENCE DATA

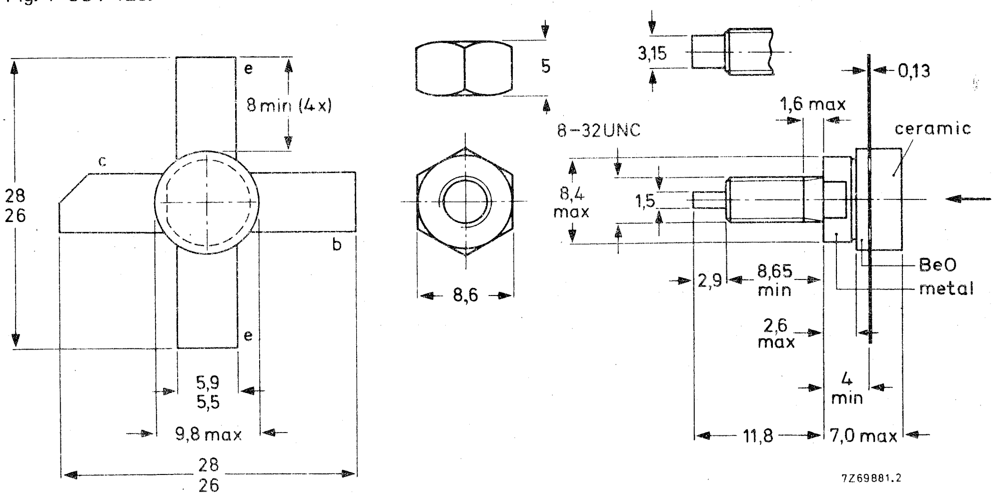
R.F. performance up to T_h = 25 °C in an unneutralized common-emitter class-B circuit

mode of operation	V_{CE} V	f MHz	P_L W	G_p dB	η %	$\overline{z_i}$ Ω	$\overline{Y_L}$ mA/V
c.w.	28	175	25	> 9	> 60	1,0 + j1,2	59–j54

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-120.



Torque on nut: min. 0,75 Nm
(7,5 kg cm)
max. 0,85 Nm
(8,5 kg cm)

Diameter of clearance hole in heatsink: max. 4,2 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

When locking is required an adhesive is preferred instead of a lock washer.

CAUTION This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage (V_{BE} = 0) peak value	V_{CESM}	max.	65 V
Collector-emitter voltage (open base)	V_{CEO}	max.	36 V
Emitter-base voltage (open collector)	V_{EBO}	max.	4 V
Collector current (average)	$I_{C(AV)}$	max.	3 A
Collector current (peak value); f > 1 MHz	I_{CM}	max.	9 A
R.F. power dissipation (f > 1 MHz); T_{mb} = 25 °C	P_{rf}	max.	70 W
Storage temperature	T_{stg}		−65 to + 150 °C
Operating junction temperature	T_j	max.	200 °C

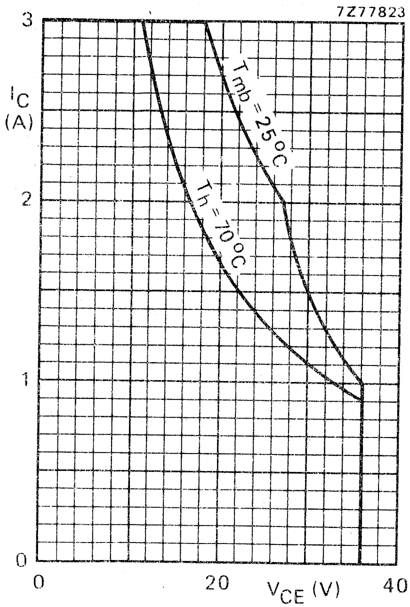


Fig. 2 D.C. SOAR.

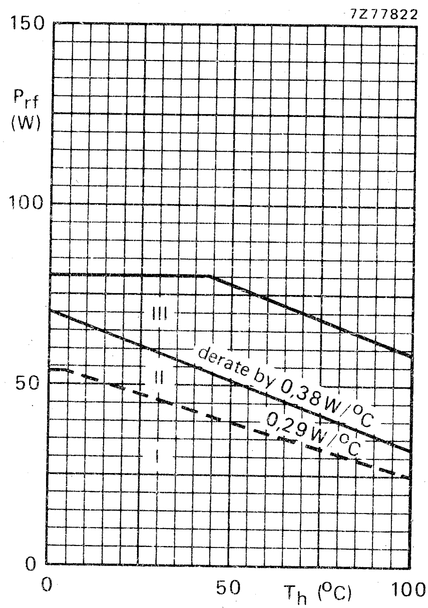


Fig. 3 R.F. power dissipation; $V_{CE} \leqslant 28$ V; f ⩾ 1 MHz.
I Continuous d.c. operation
II Continuous r.f. operation
III Short-time operation during mismatch

THERMAL RESISTANCE (dissipation = 20 W; T_{mb} = 79 °C, i.e. T_h = 70 °C)

From junction to mounting base (d.c. dissipation)	$R_{th\ j\text{-}mb\ (dc)}$	=	3,1 °C/W
From junction to mounting base (r.f. dissipation)	$R_{th\ j\text{-}mb\ (rf)}$	=	2,3 °C/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,45 °C/W

CHARACTERISTICS

T_j = 25 °C

Collector-emitter breakdown voltage V_{BE} = 0; I_C = 10 mA	$V_{(BR)CES}$	>	65 V
Collector-emitter breakdown voltage open base; I_C = 50 mA	$V_{(BR)CEO}$	>	36 V
Emitter-base breakdown voltage open collector; I_E = 10 mA	$V_{(BR)EBO}$	>	4 V
Collector cut-off current V_{BE} = 0; V_{CE} = 36 V	I_{CES}	<	4 mA
Second breakdown energy; L = 25 mH; f = 50 Hz open base	E_{SBO}	>	8 mJ
R_{BE} = 10 Ω	E_{SBR}	>	8 mJ
D.C. current gain * I_C = 1,25 A; V_{CE} = 5 V	h_{FE}	typ.	45 10 to 100
Collector-emitter saturation voltage * I_C = 3,75 A; I_B = 0,75 A	V_{CEsat}	typ.	1,5 V
Transition frequency at f = 100 MHz * $-I_E$ = 1,25 A; V_{CB} = 28 V	f_T	typ.	625 MHz
$-I_E$ = 3,75 A; V_{CB} = 28 V	f_T	typ.	625 MHz
Collector capacitance at f = 1 MHz I_E = I_e = 0; V_{CB} = 28 V	C_c	typ.	45 pF
Feedback capacitance at f = 1 MHz I_C = 100 mA; V_{CE} = 28 V	C_{re}	typ.	28 pF
Collector-stud capacitance	C_{cs}	typ.	2 pF

* Measured under pulse conditions: $t_p \leq 200\ \mu s$; $\delta \leq 0{,}02$.

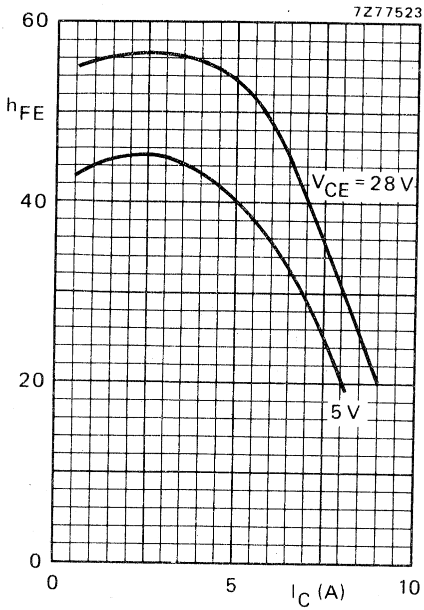


Fig. 4 Typical values; T_j = 25 °C.

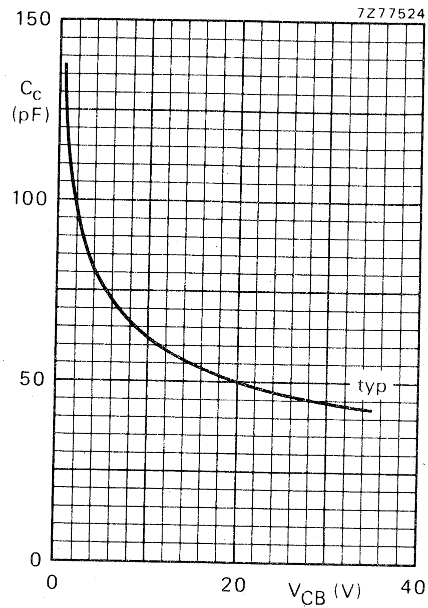


Fig. 5 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

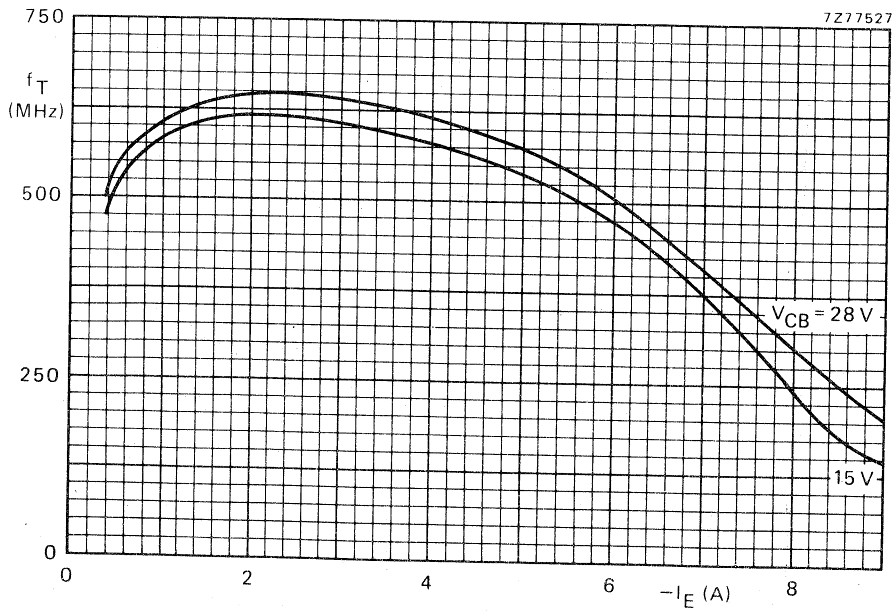


Fig. 6 Typical values; f = 100 MHz; T_j = 25 °C.

APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit)

T_h = 25 °C

f (MHz)	V_{CE} (V)	P_L (W)	P_S (W)	G_p (dB)	I_C (A)	η (%)	$\overline{z_i}$ (Ω)	$\overline{Y_L}$ (mA/V)
175	28	25	< 3,15	> 9	< 1,5	> 60	1,0 + j1,2	59–j54

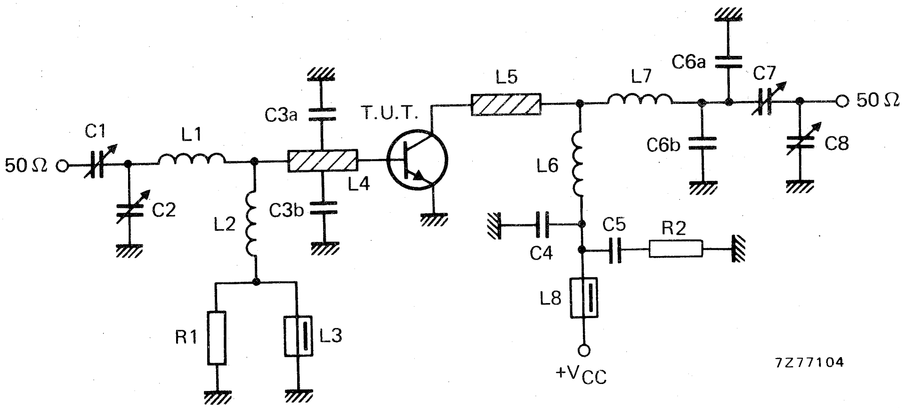


Fig. 7 Test circuit; c.w. class-B.

List of components
C1 = C7 = 2,5 to 20 pF film dielectric trimmer (cat. no. 2222 809 07004)
C2 = 5 to 60 pF film dielectric trimmer (cat. no. 2222 809 07011)
C3a = C3b = 47 pF ceramic capacitor (500 V)
C4 = 120 pF ceramic capacitor
C5 = 100 nF polyester capacitor
C6a = 2,2 pF ceramic capacitor (500 V)
C6b = 1,8 pF ceramic capacitor (500 V)
C8 = 4 to 40 pF film dielectric trimmer (cat. no. 2222 809 07008)

L1 = 14 nH; 1 turn Cu wire (1,6 mm); int. dia. 7,7 mm; leads 2 x 5 mm
L2 = 100 nH; 7 turns closely wound enamelled Cu wire (0,5 mm); int. dia. 3 mm; leads 2 x 5 mm
L3 = L8 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L4 = L5 = strip (12 mm x 6 mm); taps for C3a and C3b at 5 mm from transistor
L6 = 80 nH; 3 turns Cu wire (1,6 mm); int. dia. 9,0 mm; length 8,0 mm; leads 2 x 5 mm
L7 = 62 nH; 3 turns Cu wire (1,6 mm); int. dia. 7,5 mm; length 8,1 mm; leads 2 x 5 mm

L4 and L5 are strips on a double Cu-clad printed-circuit board with epoxy fibre-glass dielectric, thickness 1/16".

R1 = R2 = 10 Ω carbon resistor (0,25 W)

Component layout and printed-circuit board for 175 MHz test circuit see Fig. 8.

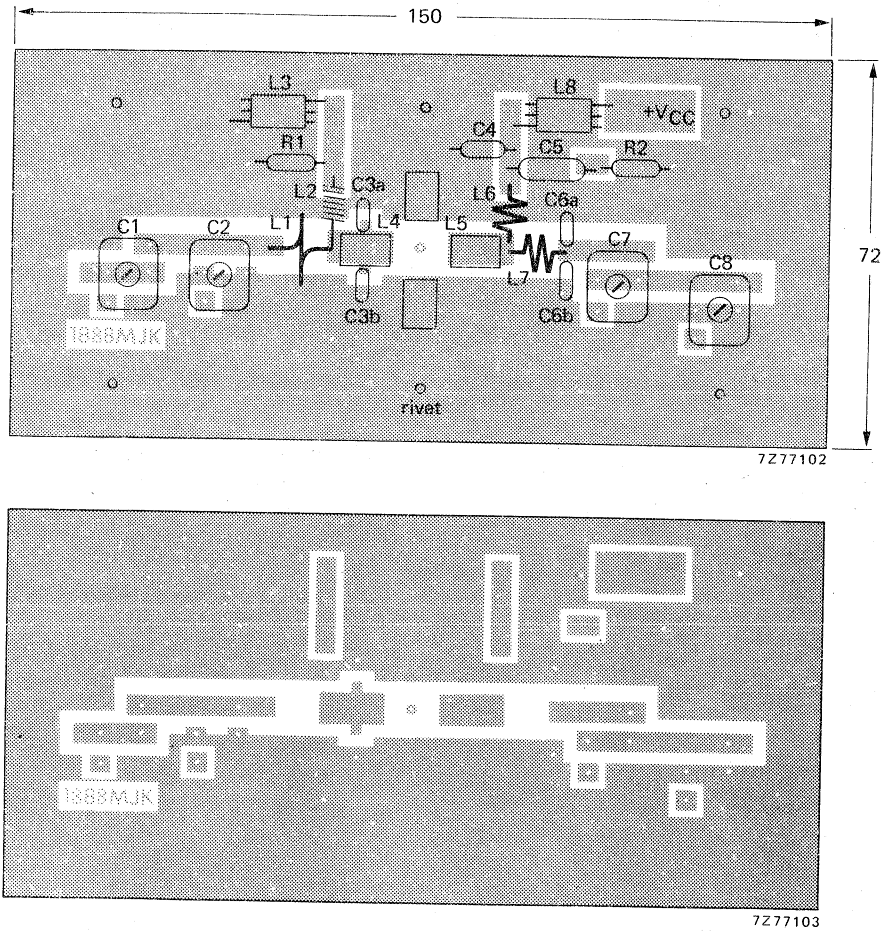


Fig. 8 Component layout and printed-circuit board for 175 MHz test circuit.

The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets, whilst under the emitter leads Cu straps are used for a direct contact between upper and lower sheets.

To minimize the dielectric losses, the ground plane under the interconnection of L7 and C7 has been removed.

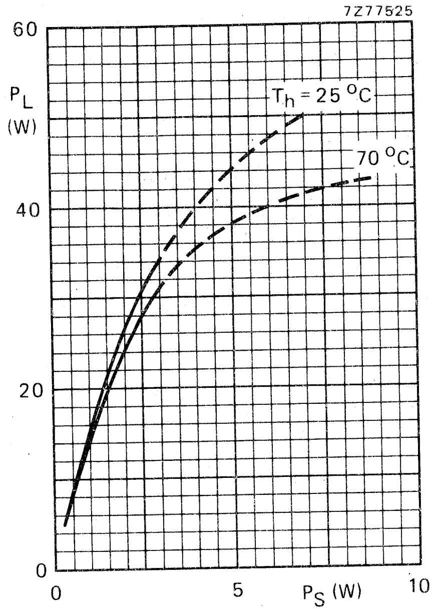


Fig. 9 V_{CE} = 28 V; f = 175 MHz; typical values.

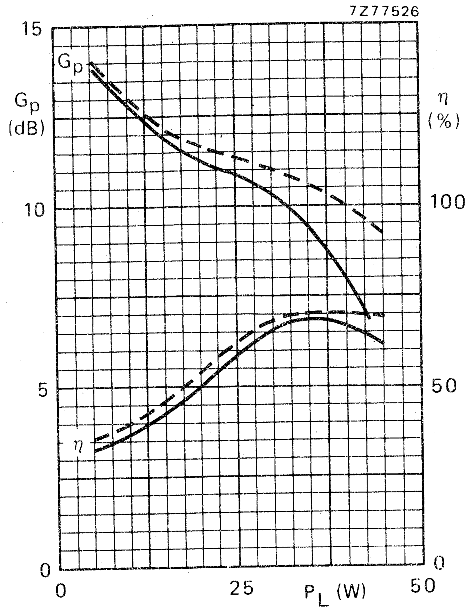


Fig. 10 V_{CE} = 28 V; f = 175 MHz; typical values;
– – – T_h = 25 °C; ——— T_h = 70 °C.

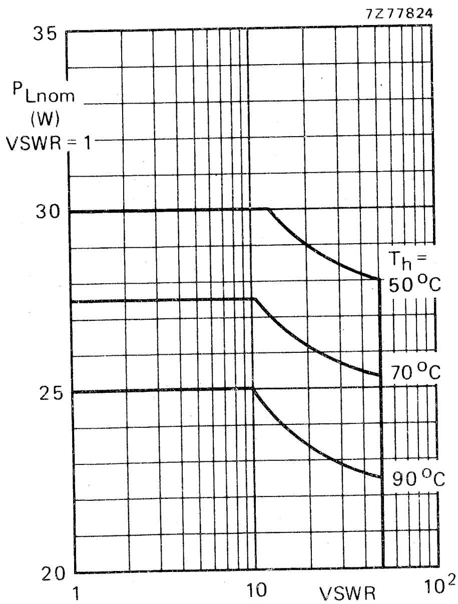


Fig. 11 R.F. SOAR; c.w. class-B operation;
f = 175 MHz; V_{CE} = 28 V; $R_{th\ mb\text{-}h}$ = 0,45 °C/W.
The graph shows the permissible output power under nominal conditions (VSWR = 1) as a function of the expected VSWR during short-time mismatch conditions with heatsink temperatures as parameter.

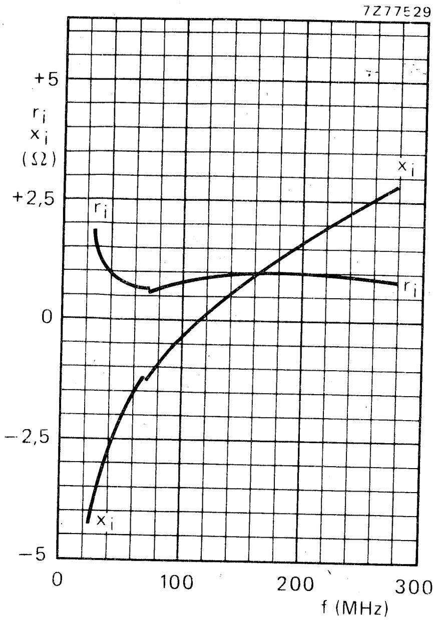


Fig. 12 Input impedance (series components).

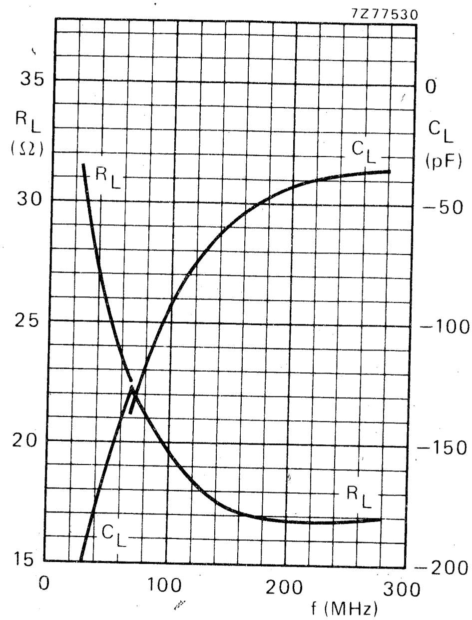


Fig. 13 Load impedance (parallel components).

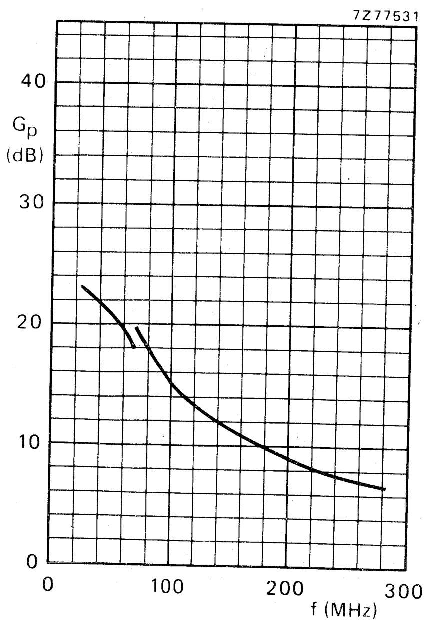


Fig. 14 Power gain versus frequency.

OPERATING NOTE

Below 70 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation. This resistor must be effective for r.f. only.

Conditions for Figs 12, 13 and 14:

Typical values; V_{CE} = 28 V; P_L = 25 W; T_h = 25 °C.

V.H.F. POWER TRANSISTOR

N-P-N planar epitaxial transistor intended for use in class-A, B and C operated mobile, industrial and military transmitters with a supply voltage of 28 V. The transistor is resistance stabilized. Every transistor is tested under severe load mismatch conditions. It has a plastic encapsulated stripline package. All leads are isolated from the stud.

QUICK REFERENCE DATA

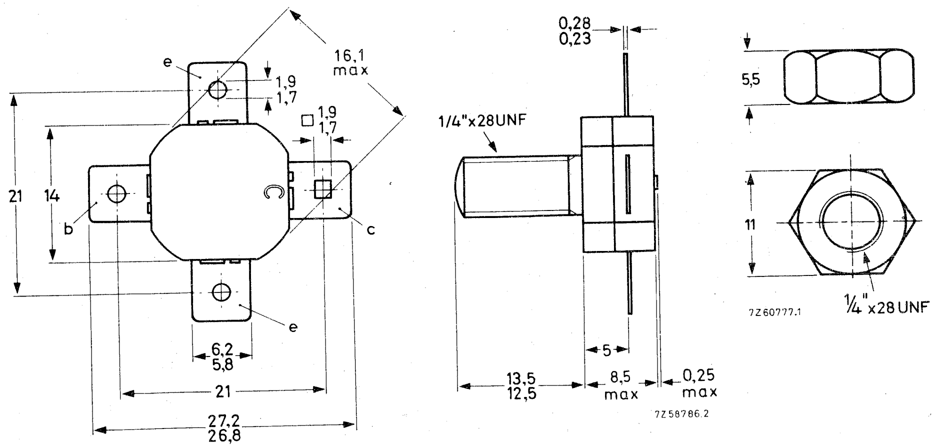
R.F. performance up to T_{mb} = 25 ^oC in an unneutralized common-emitter class-B circuit

mode of operation	V_{CE} V	f MHz	P_S W	P_L W	I_C A	G_p dB	η %	$\overline{z_i}$ Ω	$\overline{Y_L}$ mA/V
c.w.	28	175	< 10	50	< 2,75	> 7	> 65	0,8 + j1,45	125 – j66

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-55.



Torque on nut: min. 2,3 Nm (23 kg cm)
max. 2,7 Nm (27 kg cm)

Diameter of clearance hole in heatsink: max. 6,4 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

When locking is required an adhesive is preferred instead of a lock washer.

CAUTION This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC 134)

Voltages

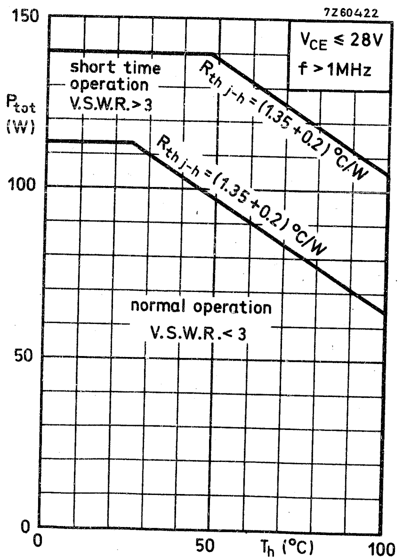
Collector-base voltage (open emitter) peak value	V_{CBOM}	max.	65	V
Collector-emitter voltage (open base)	V_{CEO}	max.	36	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4	V

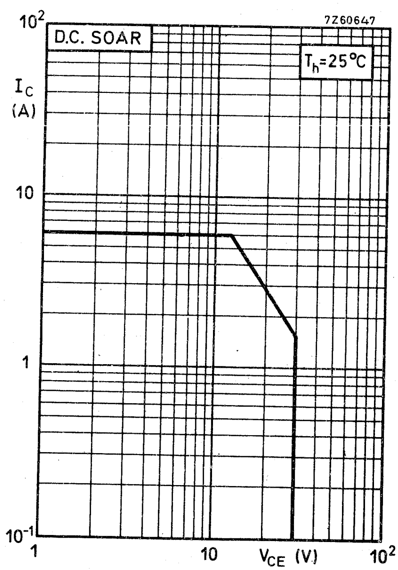
Currents

Collector current (average)	$I_{C(AV)}$	max.	6	A
Collector current (peak value) f > 1 MHz	I_{CM}	max.	12	A

Power dissipation

Total power dissipation up to T_{mb} = 25 °C f > 1 MHz	P_{tot}	max.	130	W





Temperature

Storage temperature	T_{stg}	−65 to +200	°C
Operating junction temperature	T_j	max. 200	°C

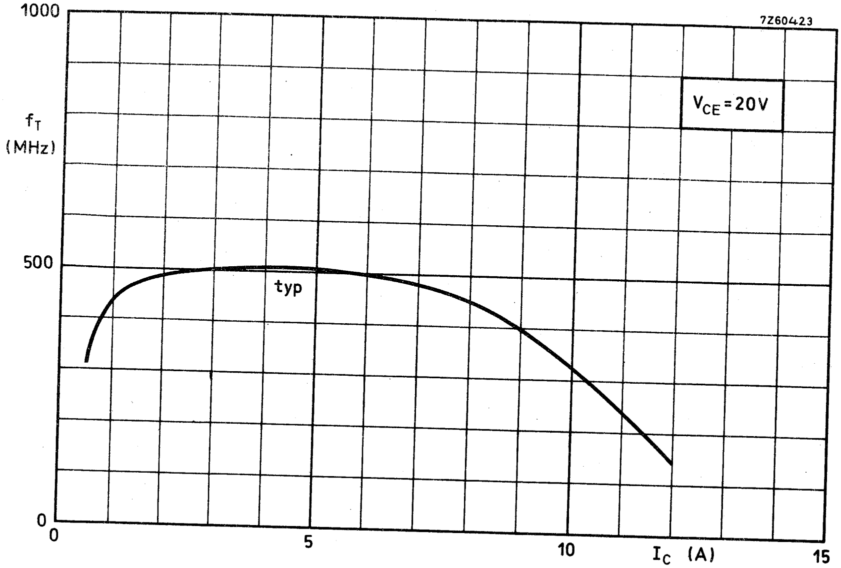
THERMAL RESISTANCE

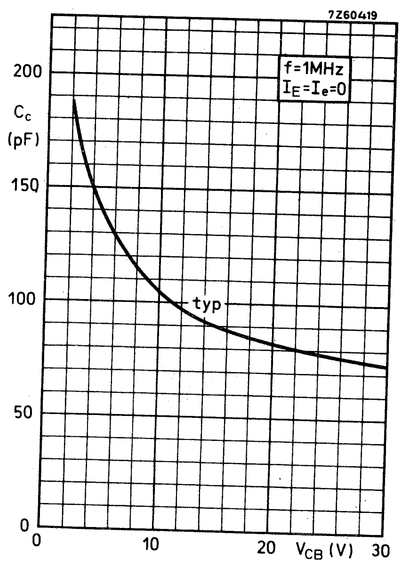
From junction to mounting base	$R_{th\ j-mb}$	=	1.35	°C/W
From mounting base to heatsink	$R_{th\ mb-h}$	=	0.2	°C/W

CHARACTERISTICS

$T_j = 25\,^oC$ unless otherwise specified

Breakdown voltages				
Collector-base voltage open emitter, $I_C = 100$ mA	$V_{(BR)CBO}$	>	65	V
Collector-emitter voltage open base, $I_C = 100$ mA	$V_{(BR)CEO}$	>	36	V
Emitter-base voltage open collector; $I_E = 25$ mA	$V_{(BR)EBO}$	>	4	V
Transient energy				
$L = 25$ mH; $f = 50$ Hz open base	E	>	8	mWs
$-V_{BE} = 1.5$ V; $R_{BE} = 33\ \Omega$	E	>	8	mWs
D.C. current gain				
$I_C = 1$ A; $V_{CE} = 5$ V	h_{FE}	10 to 120		
Transition frequency				
$I_C = 6$ A; $V_{CE} = 20$ V	f_T	typ.	500	MHz
Collector capacitance at $f = 1$ MHz				
$I_E = I_e = 0$; $V_{CB} = 30$ V	C_c	typ.	75	pF
		<	130	pF
Feedback capacitance				
$I_C = 100$ mA; $V_{CE} = 30$ V	C_{re}	typ.	47	pF
Collector-stud capacitance	C_{cs}	typ.	3.5	pF


7Z60423
1000
500
0
f_T (MHz)
V_{CE} = 20V
typ
0
5
10
I_C (A)
15


7Z60419
200
150
100
50
0
C_c (pF)
f = 1MHz
$I_E = I_e = 0$
typ
0
10
20
V_{CB} (V)
30

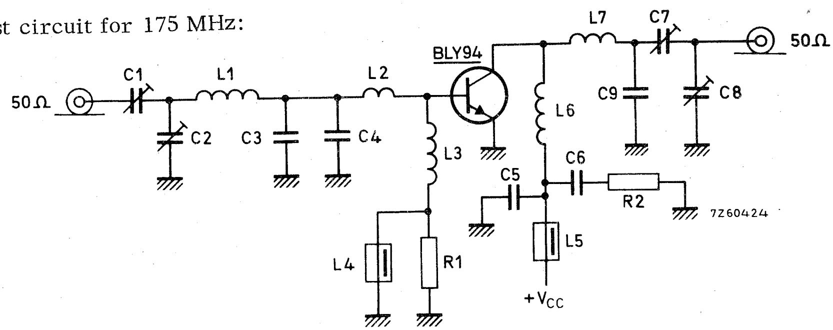
APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralised common-emitter class B circuit)

f = 175 MHz; T_{mb} up to 25 °C

V_{CC} (V)	P_S (W)	P_L (W)	I_C (A)	G_p (dB)	η (%)	$\overline{z_i}$ (Ω)	$\overline{Y_L}$ (mA/V)
28	< 10	50	< 2.75	> 7	> 65	0.8+j1.45	125 − j66

Test circuit for 175 MHz:



List of components:

C1 =	2 to 20 pF film dielectric trimmer (code number 2222 809 07004)
C2 =	4 to 40 pF film dielectric trimmer (code number 2222 809 07008)
C3 = C4 =	56 pF ceramic
C5 =	100 pF ceramic
C6 =	100 nF polyester
C7 =	4 to 60 pF film dielectric trimmer (code number 2222 809 07011)
C8 =	4 to 100 pF film dielectric trimmer (code number 2222 809 07015)
C9 =	6.8 pF ceramic

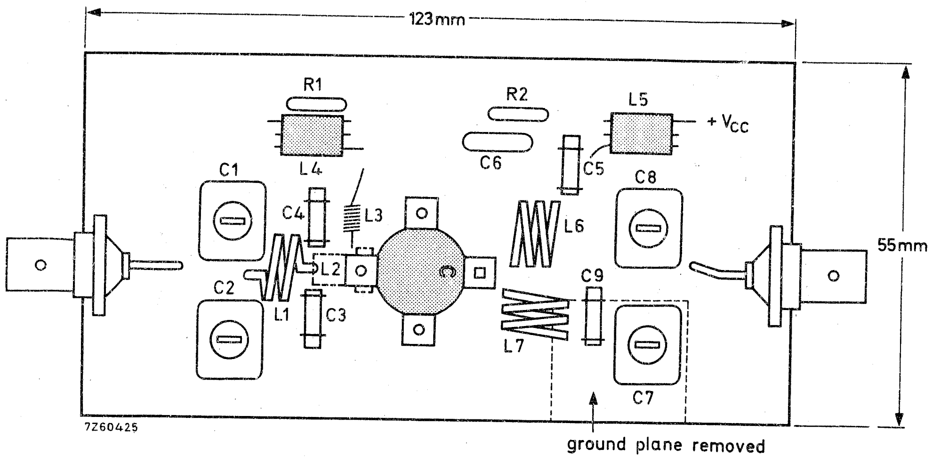
L1 =	36 nH; 2 turns enamelled Cu wire (1.5 mm); int. diam. 7 mm; length 5 mm; lead length 2 x 5 mm
L2 =	formed by the metallization on the p.c. board; see component lay-out
L3 =	100 nH; 7 turns closely wound enamelled Cu wire (0.5 mm); int. diam 3 mm; lead length 2 x 5 mm
L4 = L5 =	ferroxcube choke (code number 4312 020 36640)
L6	53 nH; 2 turns enamelled Cu wire (1.5 mm); int. diam. 10 mm; length 5.2 mm; lead length 2 x 5 mm
L7 =	46 nH; 2 turns enamelled Cu wire (1.5 mm); int. diam. 9 mm; length 5.4 mm; lead length 2 x 5 mm

R1 = R2 = 10 Ω carbon

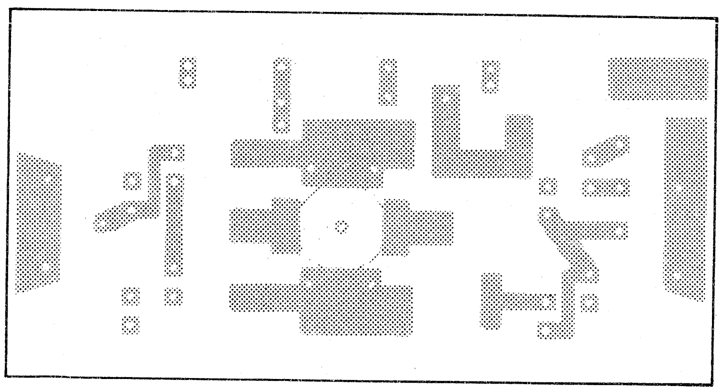
Component lay-out see page 6

APPLICATION INFORMATION (continued)

Component lay-out and printed circuit board for 175 MHz test circuit.

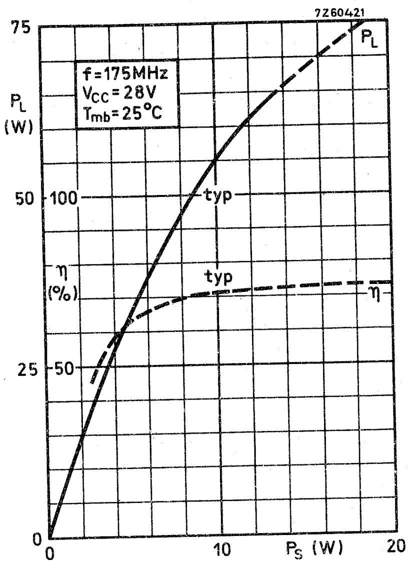


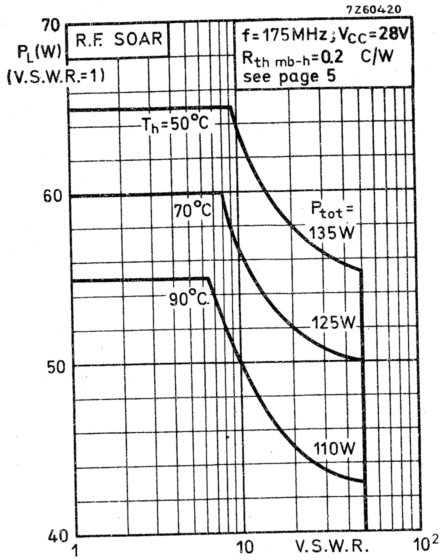
7Z60425



7Z67867

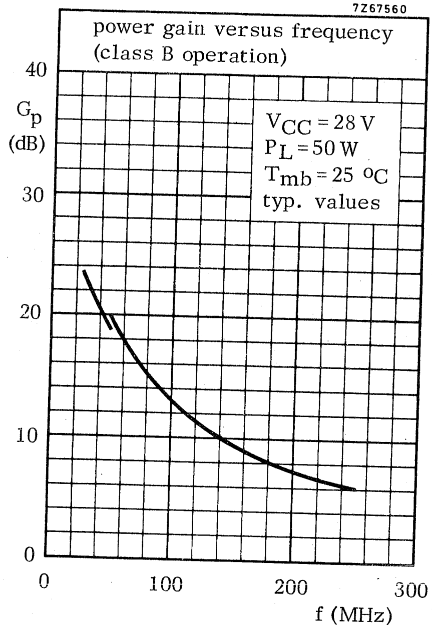
The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallised to serve as earth. Earth connections are made by means of hollow rivets.

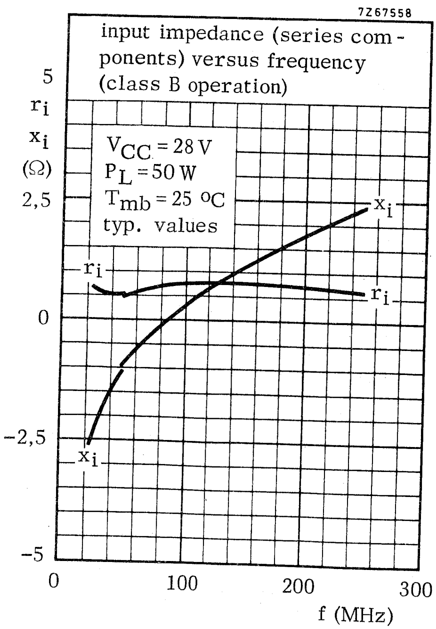


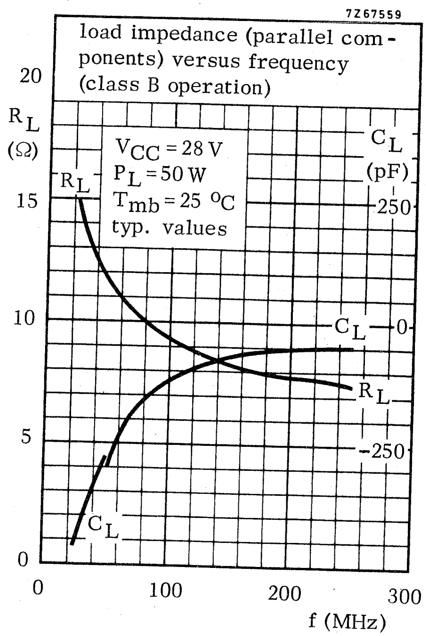


For high voltage operation, a stabilized power supply is generally used.
The graph shows the allowable output power under nominal conditions as a function of the V.S.W.R., with heat-sink temperature as parameter.

OPERATING NOTE Below 50 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation. This resistor must be effective for both d.c. and r.f.







N-P-N SILICON PLANAR V.H.F. TRANSISTOR

For data of this transistor please refer to type BLY85.

SILICON EPITAXIAL PLANAR OVERLAY TRANSISTORS

The **2N3553** is an n-p-n overlay transistor in a TO-39 metal envelope with the collector connected to the case. The **2N3375** and the **2N3632** are n-p-n overlay transistors in TO-60 metal envelopes with the electrodes insulated from the studs.
The **2N3553** and the **2N3375** are intended for v.h.f./u.h.f. and the **2N3632** for v.h.f. transmitting applications.

QUICK REFERENCE DATA

			2N3553	2N3375	2N3632	
Collector-emitter voltage $-V_{BE}$ = 1,5 V	V_{CEX}	max.	65	65	65	V
Collector-emitter voltage (open base)	V_{CEO}	max.	40	40	40	V
Collector current (peak value)	I_{CM}	max.	1,0	1,5	3,0	A
Total power dissipation up to T_{mb} = 25 °C	P_{tot}	max.	7	11,6	23	W
Junction temperature	T_j	max.	200	200	200	°C
Transition frequency I_C = 125 mA; V_{CE} = 28 V	f_T	typ.	500	500	—	MHz
I_C = 250 mA; V_{CE} = 28 V	f_T	typ.	—	—	400	MHz

R.F. performance at V_{CE} = 28 V

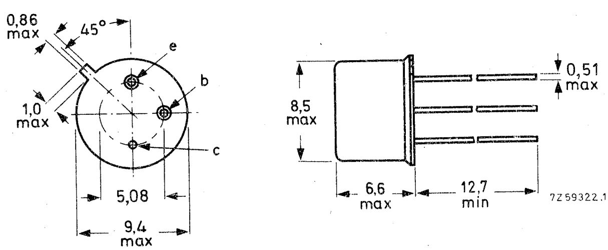
type number	f (MHz)	P_o (W)	P_i (W)	η (%)
2N3553	175	2,5	< 0,25	> 50
2N3375	100	7,5	< 1	> 65
2N3375	400	> 3	1	> 40
2N3632	175	> 13,5	3,5	> 70

MECHANICAL DATA

Dimensions in mm

Fig. 1a TO-39; collector connected to case.

2N3553



Maximum lead diameter is guaranteed only for 12,7 mm.

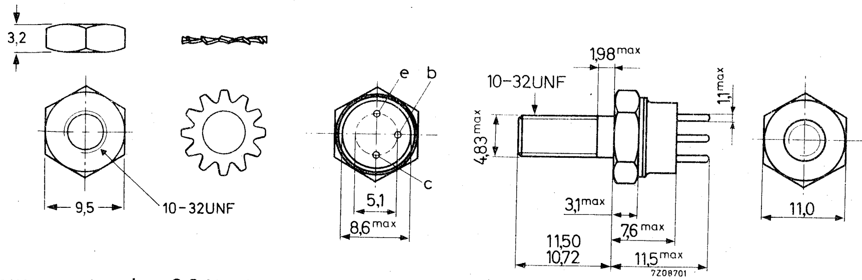
Accessories: 56245 (distance disc).

MECHANICAL DATA (continued)

Dimensions in mm

Fig. 1b TO-60 (**2N3375** and **2N3632**).

The top pins should not be bent.



Torque on nut: min. 0,8 Nm (8 kg cm)
max. 1,7 Nm (17 kg cm)

Diameter of clearance hole in heatsink: 4,8 mm to 5,2 mm.

→ **CAUTION These devices incorporate beryllium oxide, the dust of which is toxic. The devices are entirely safe provided that the BeO disc is not damaged.**

→ **RATINGS** see also pages 8 and 9

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter)	V_{CBO}	max.		65		V
Collector-emitter voltage						
$I_C \leq 200$ mA; $-V_{BE} = 1,5$ V	V_{CEX}	max.		65		V
(open base); $I_C \leq 200$ mA	V_{CEO}	max.		40		V
Emitter-base voltage (open collector)	V_{EBO}	max.		4		V
			2N3553	**2N3375**	**2N3632**	
Collector current						
d.c.	I_C	max.	0,35	0,5	1	A
peak value	I_{CM}	max.	1,0	1,5	3	A
Total power dissipation up to $T_{mb} = 25$ °C	P_{tot}	max.	7	11,6	23	W
Storage temperature	T_{stg}			−65 to +200		°C
Junction temperature	T_j	max.		200		°C

THERMAL RESISTANCE

			2N3553	2N3375	2N3632	
From junction to mounting base	$R_{th\ j\text{-}mb}$	=	25	15	7.5	$^oC/W$
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=		0.6	0.6	$^oC/W$

CHARACTERISTICS

$T_j = 25\ ^oC$ unless otherwise specified

			2N3553	2N3375	2N3632	
Collector cut-off current						
$I_B = 0$; $V_{CE} = 30$ V	I_{CEO}	<	100	100	250	μA
Breakdown voltages						
$I_E = 0$; $I_C = 250\ \mu A$	$V_{(BR)CBO}$	>	65	65	65	V
I_C up to 200 mA; $-V_{BE} = 1.5$ V; $R_B = 33\ \Omega$ [1]	$V_{(BR)CEX}$	>	65	65	65	V
I_C up to 200 mA; $I_B = 0$ [1]	$V_{(BR)CEO}$	>	40	40	40	V
$I_C = 0$; $I_E = 250\ \mu A$	$V_{(BR)EBO}$	>	4	4	4	V
Base-emitter voltage						
$I_C = 250$ mA; $V_{CE} = 5$ V	V_{BE}	<	1.5			V
$I_C = 500$ mA; $V_{CE} = 5$ V	V_{BE}	<		1.5		V
$I_C = 1000$ mA; $V_{CE} = 5$ V	V_{BE}	<			1.5	V
Saturation voltage						
$I_C = 250$ mA; $I_B = 50$ mA	V_{CEsat}	<	1.0			V
$I_C = 500$ mA; $I_B = 100$ mA	V_{CEsat}	<		1.0		V
$I_C = 1000$ mA; $I_B = 200$ mA	V_{CEsat}	<			1.0	V

[1]) Pulsed through an inductor of 25 mH; $\delta = 0.5$; f = 50 Hz

CHARACTERISTICS (continued)

T_j = 25 °C unless otherwise specified

			2N3553	2N3375	2N3632	
D.C. current gain						
I_C = 125 mA; V_{CE} = 5 V	h_{FE}	>	15	15		
		<	200	200		
I_C = 250 mA; V_{CE} = 5 V	h_{FE}	>	10	10	10	
		<	100	100	150	
I_C = 1000 mA; V_{CE} = 5 V	h_{FE}	>			5	
		<			110	
Collector capacitance at f = 1 MHz						
$I_E = I_e = 0$; V_{CB} = 28 V	C_c	<	10	10	20	pF
Collector-case capacitance		<		6	6	pF
Transition frequency						
I_C = 125 mA; V_{CE} = 28 V	f_T	typ.	500	500		MHz
I_C = 250 mA; V_{CE} = 28 V	f_T	typ.			400	MHz
Real part of input impedance at f = 200 MHz						
I_C = 125 mA; V_{CE} = 28 V	$Re(h_{ie})$	<	20	20		Ω
I_C = 250 mA; V_{CE} = 28 V	$Re(h_{ie})$	<			20	Ω

R.F. performance at V_{CE} = 28 V

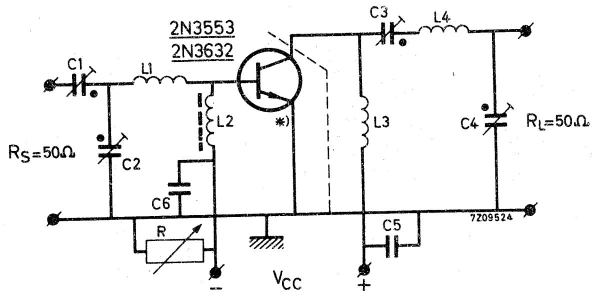
	f (MHz)	P_o (W)	P_i (W)	I_C (mA)	η %	Test circuit at page
2N3553	175	2.5	< 0.25	< 180	> 50	5
2N3375	100	7.5	< 1	< 410	> 65	6
2N3375	400	> 3	1	270	> 40	7
2N3632	175	> 13.5	3.5	690	> 70	5

NOTE

The transistors can withstand an output V.S.W.R. of 3:1 varied through all phases under conditions mentioned in the table above.

CHARACTERISTICS (continued)

Test circuit with the 2N3553 or the 2N3632 at f = 175 MHz



*) The length of the external emitter wire of the 2N3553 is 1.6 mm.
The emitter of the 2N3632 should be connected to the case as short as possible.

Components

C1 = C2 = C3 = C4 =	4 to 29 pF	air trimmer
C5 =	10 nF	polyester
C6 =	100 pF	ceramic

L1 = 1 turn Cu wire (1.0 mm); int. diam. 10 mm; leads 2 x 10 mm

L2 = Ferroxcube choke coil. Z (at f = 175 MHz) = 550 Ω ± 20% (code number 4312 020 36640)

L3 = 15 turns closely wound enamelled Cu wire (0.7 mm); int. diam. 4 mm

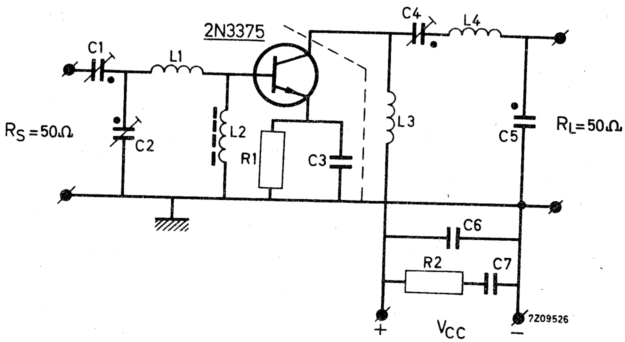
L4 = 3 turns closely wound enamelled Cu wire (1.5 mm); int. diam. 12 mm; leads 2 x 20 mm

R = 0 for the 2N3553

R = 0 to 2 Ω for the 2N3632

CHARACTERISTICS (continued)

Test circuit with the 2N3375 at f = 100 MHz



Components

C1 = C2 =	3.5 to 61.5 pF	air trimmer
C3 =	10 nF	polyester
C4 = C5 =	4 to 29 pF	air trimmer
C6 =	330 pF	ceramic
C7 =	10 nF	polyester

L1 = 2 turns closely wound enamelled Cu wire (1.5 mm); int. diam. 10 mm; leads 2 x 10 mm

L2 = Ferroxcube choke coil. Z (at f = 100 MHz) = 700 Ω ± 20% (code number 4312 020 36640)

L3 = 23 turns closely wound enamelled Cu wire (0.7 mm); int. diam. 6 mm

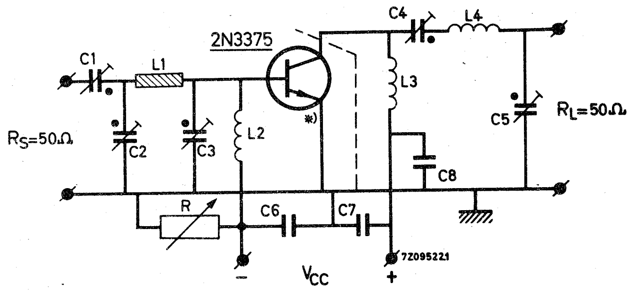
L4 = 5 turns closely wound enamelled Cu wire (1.5 mm); int. diam. 12 mm; leads 2 x 10 mm

R1 = 1.35 Ω carbon

R2 = 10 Ω carbon

CHARACTERISTICS (continued)

Test circuit with the 2N3375 at f = 400 MHz



*) The emitter should be connected to the case as short as possible.

Components

C1 = C2 =	0.7 to 6.7 pF	ceramic trimmer
C3 =	0.5 to 3.5 pF	ceramic trimmer
C4 = C5 =	3 to 19 pF	air trimmer
C6 = C7 =	15 pF	ceramic
C8 =	4700 pF	ceramic

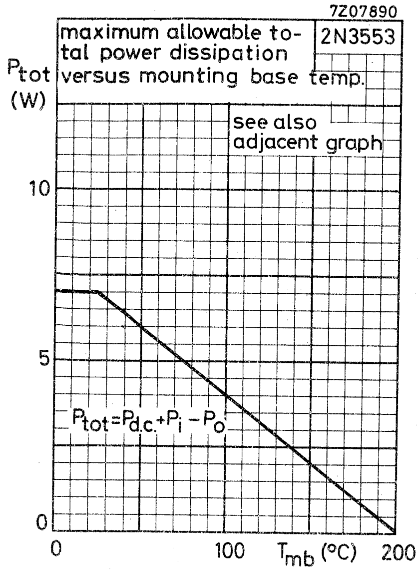
L1 = 20 mm straight Cu wire; diam. 1.5 mm; spaced 8 mm from chassis

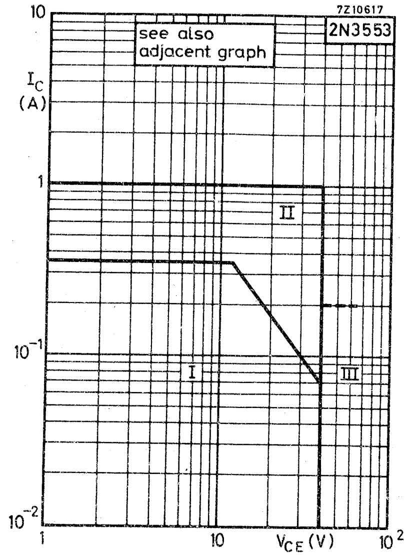
L2 = 17 turns closely wound enamelled Cu wire (0.5 mm); int. diam. 3 mm

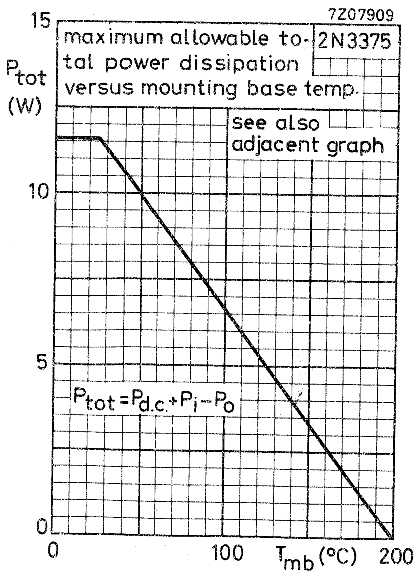
L3 = 7 turns closely wound enamelled Cu wire (0.5 mm); int. diam. 3 mm

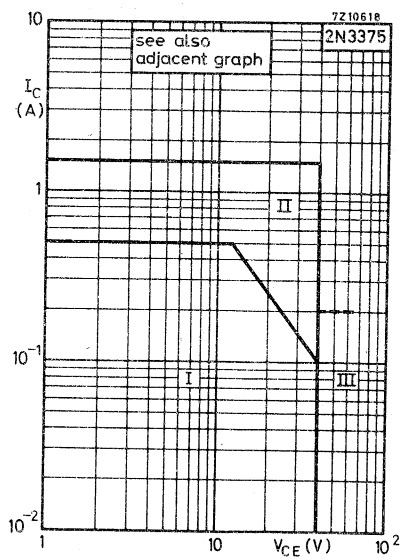
L4 = 1 turn Cu wire (1.5 mm); int. diam. 10 mm; leads 2 x 5 mm

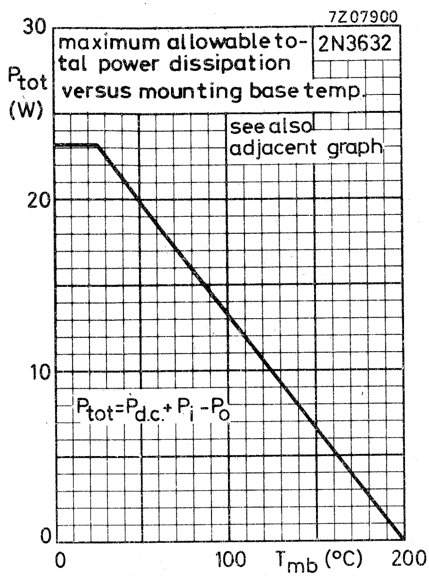
R = 0 to 5 Ω

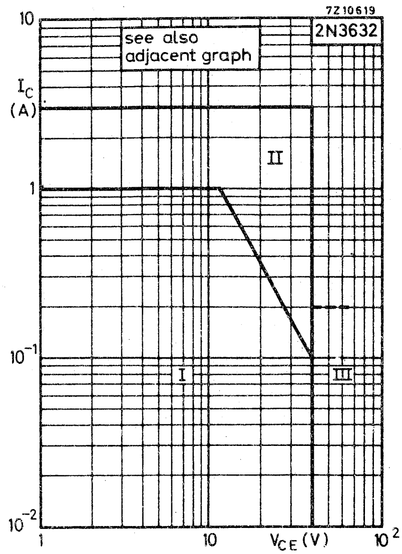

7Z07890
maximum allowable total power dissipation versus mounting base temp.
2N3553
Ptot (W)
see also adjacent graph
Ptot=Pd.c.+Pi −Po
10
5
0
0
100
Tmb (°C)
200


7Z10617
2N3553
see also adjacent graph
IC (A)
10
1
10−1
10−2
II
I
III
1
10
VCE (V)
10 2


7Z07909
maximum allowable total power dissipation versus mounting base temp.
2N3375
Ptot (W)
see also adjacent graph
Ptot=Pd.c.+Pi−Po
15
10
5
0
0
100
Tmb (°C)
200


7Z10618
2N3375
see also adjacent graph
IC (A)
10
1
10−1
10−2
II
I
III
1
10
VCE (V)
10 2

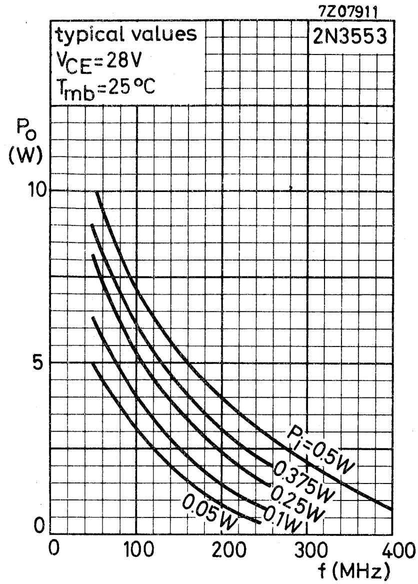


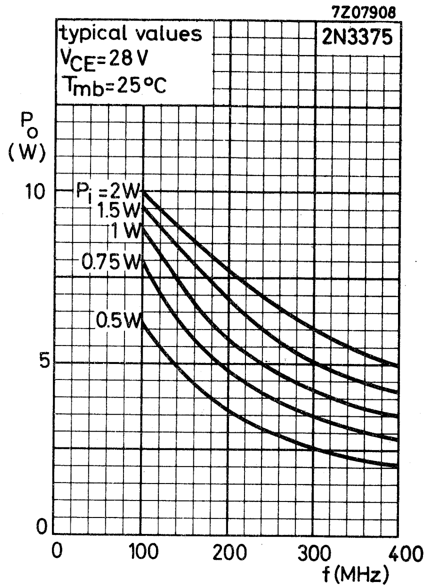


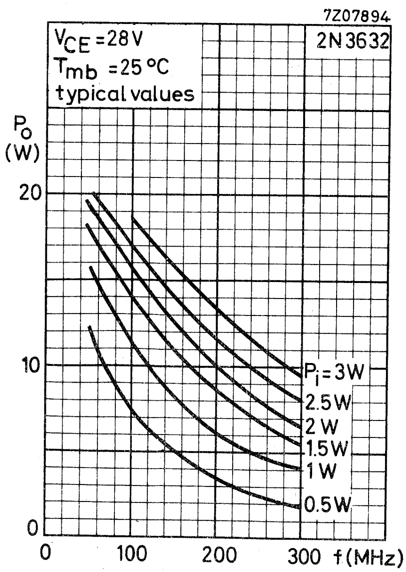
I Region of permissible operation under all base-emitter conditions and at all frequencies, including d.c.

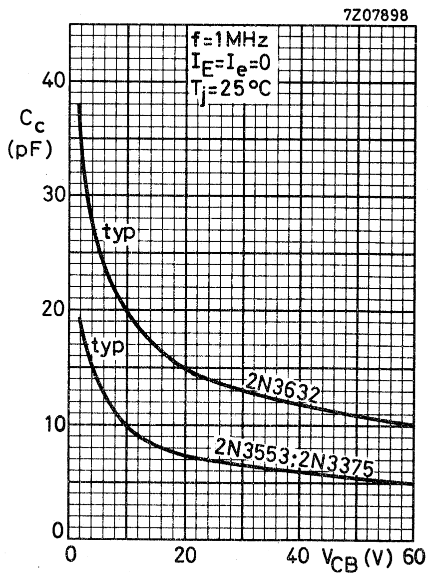
II Additional region of operation at $f \geq 1$ MHz.
Care must be taken to reduce the d.c. adjustment to region I before removing the a.c. signal. This may be achieved by an appropriate bias in class A, B or C.

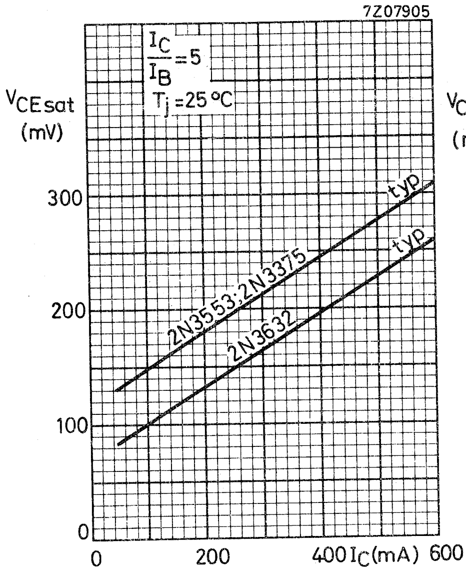
III Operating during switching off in this region is allowed, provided the transistor is cut-off with $-V_{BB} \leq 1.5$ V and $R_{BE} \geq 33\ \Omega$, $I_C \leq 200$ mA and the transient energy does not exceed 0.5 mWs.

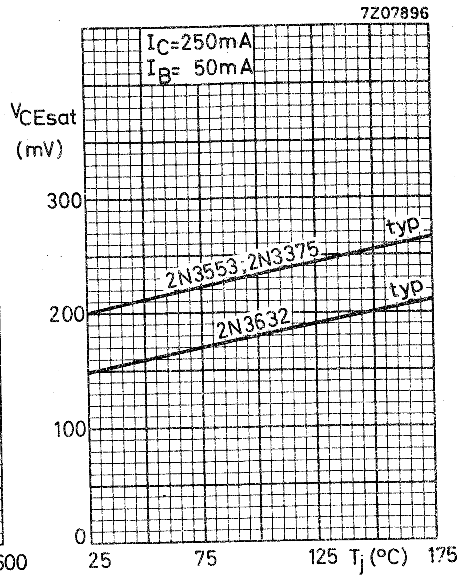

7Z07911
typical values
VCE=28V
Tmb=25°C
2N3553
Po
(W)
10
5
0
0
100
200
300
400
f (MHz)
Pi=0.5W
0.375W
0.25W
0.1W
0.05W

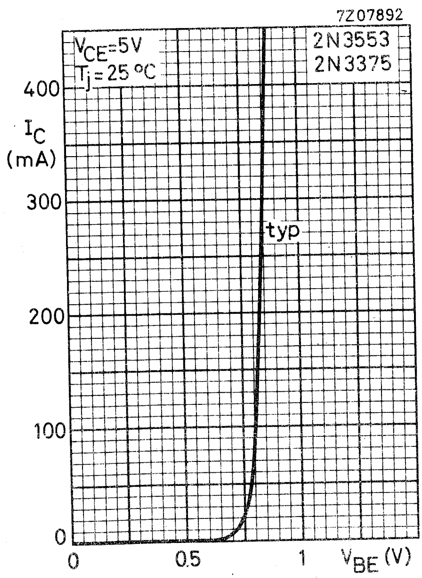

7Z07908
typical values
VCE=28V
Tmb=25°C
2N3375
Po
(W)
10
5
0
Pi=2W
1.5W
1W
0.75W
0.5W
0
100
200
300
400
f(MHz)

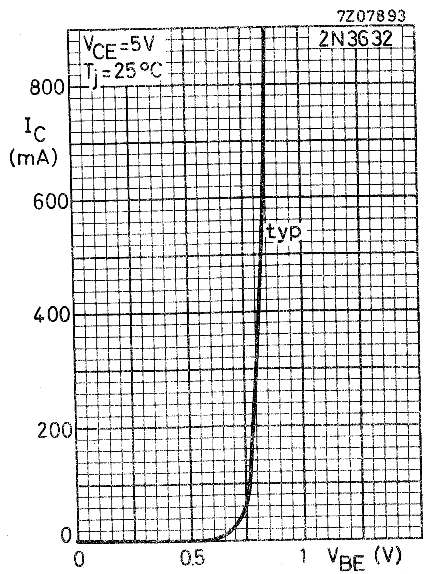

7Z07894
VCE=28V
Tmb=25°C
typical values
2N3632
Po
(W)
20
10
0
Pi=3W
2.5W
2W
1.5W
1W
0.5W
0
100
200
300
f(MHz)

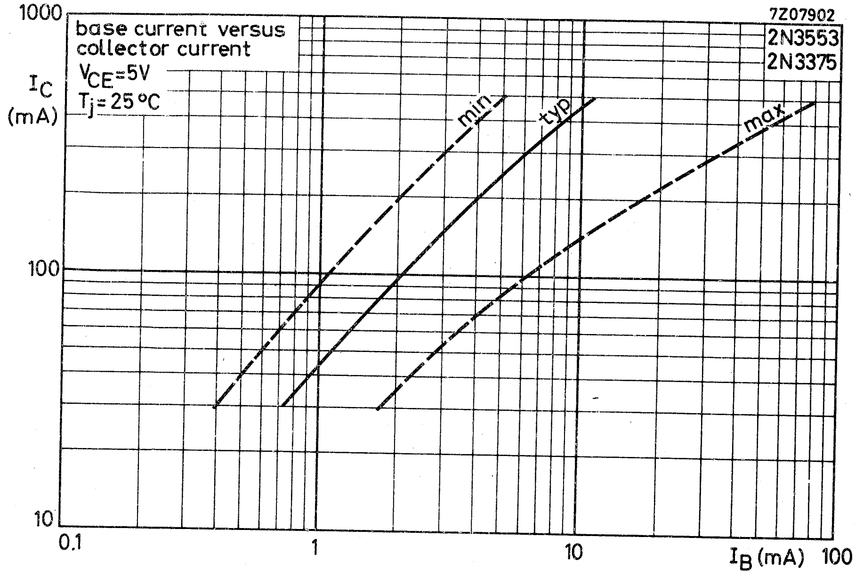

7Z07898
f=1MHz
IE=Ie=0
Tj=25°C
Cc
(pF)
40
30
20
10
0
typ
typ
2N3632
2N3553;2N3375
0
20
40
VCB (V)
60

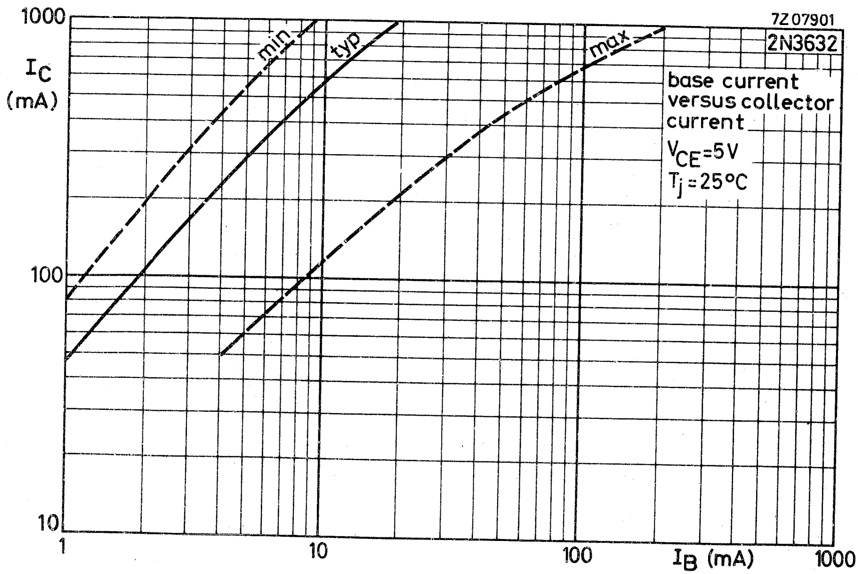

7Z07905
$\frac{I_C}{I_B}=5$
$T_j=25\,°C$
V_{CEsat} (mV)
300
200
100
0
0
200
400 I_C (mA) 600
typ
typ
2N3553;2N3375
2N3632

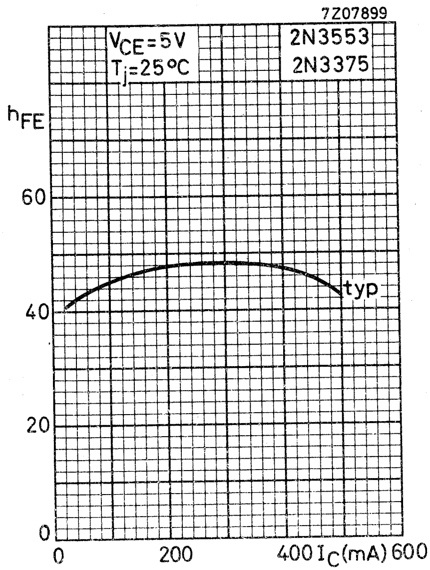

7Z07896
$I_C=250\,mA$
$I_B=50\,mA$
V_{CEsat} (mV)
300
200
100
0
25
75
125 T_j (°C) 175
typ
typ
2N3553;2N3375
2N3632

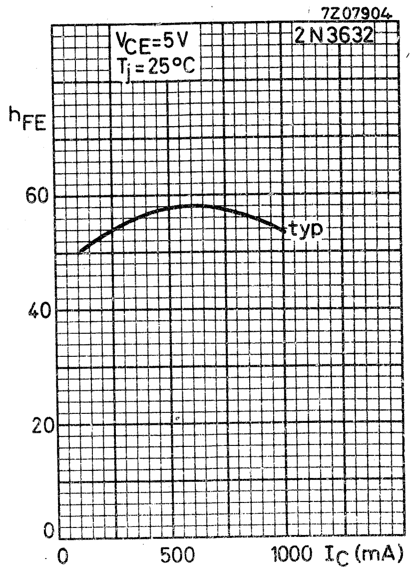

7Z07892
$V_{CE}=5\,V$
$T_j=25\,°C$
2N3553
2N3375
I_C (mA)
400
300
200
100
0
0
0.5
1 V_{BE} (V)
typ

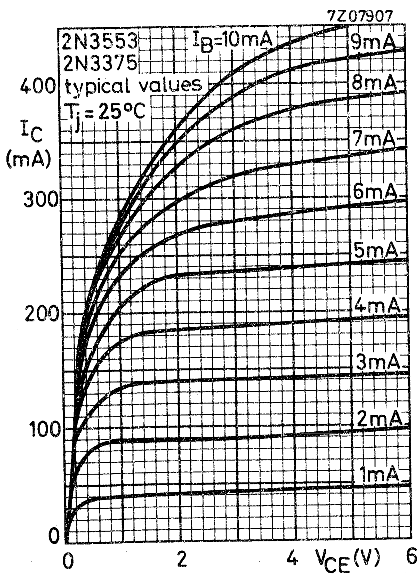

7Z07893
$V_{CE}=5\,V$
$T_j=25\,°C$
2N3632
I_C (mA)
800
600
400
200
0
0
0.5
1 V_{BE} (V)
typ

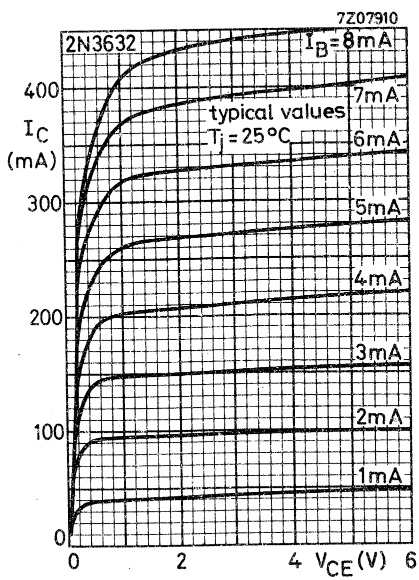

7Z07902
2N3553
2N3375
base current versus collector current
V_{CE}=5V
T_j=25 °C
I_C (mA)
1000
100
10
0.1
1
10
100
I_B (mA)
min
typ
max

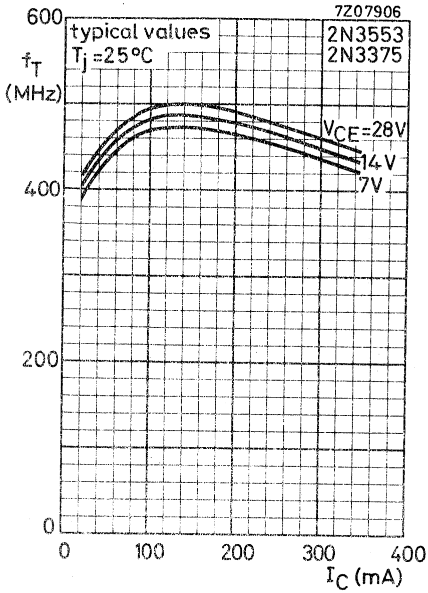

7Z07901
2N3632
base current versus collector current
V_{CE}=5V
T_j=25°C
I_C (mA)
1000
100
10
1
10
100
1000
I_B (mA)
min
typ
max

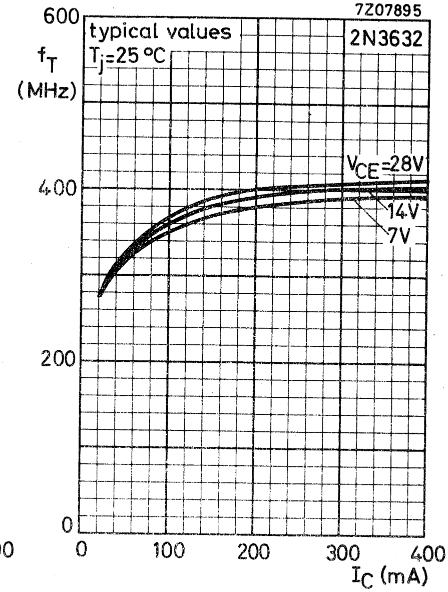

7Z07899
V_{CE}=5V
T_j=25°C
2N3553
2N3375
h_{FE}
60
40
20
0
typ
0
200
400 I_C(mA) 600

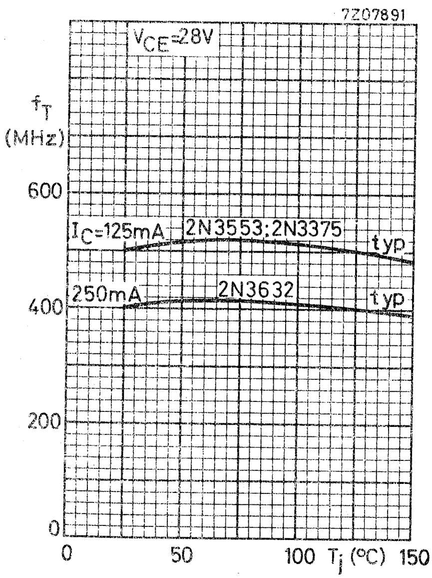

7Z07904
V_{CE}=5V
T_j=25°C
2N3632
h_{FE}
60
40
20
0
typ
0
500
1000 I_C (mA)

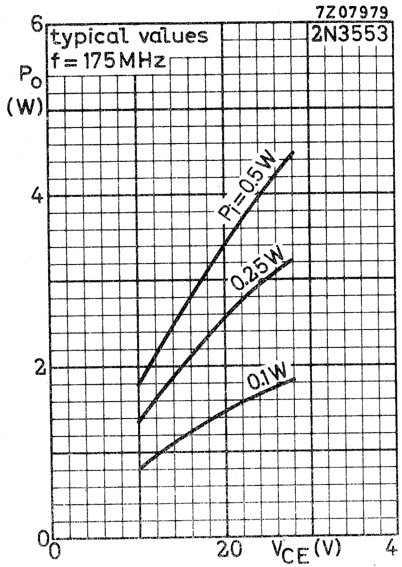

7Z07907
2N3553
2N3375
typical values
T_j=25°C
I_B=10mA
9mA
8mA
7mA
6mA
5mA
4mA
3mA
2mA
1mA
I_C
(mA)
400
300
200
100
0
0
2
4 V_{CE}(V) 6

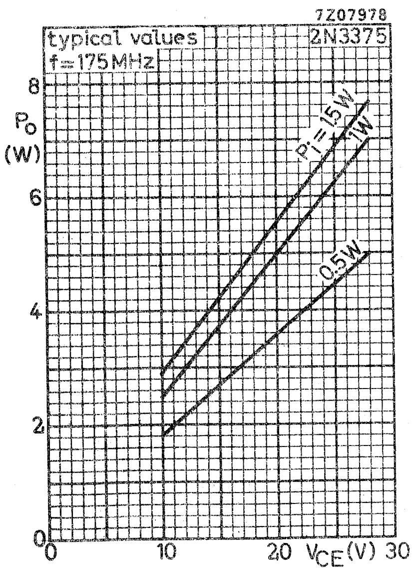

7Z07910
2N3632
I_B=8mA
7mA
6mA
5mA
4mA
3mA
2mA
1mA
typical values
T_j=25°C
I_C
(mA)
400
300
200
100
0
0
2
4 V_{CE} (V) 6

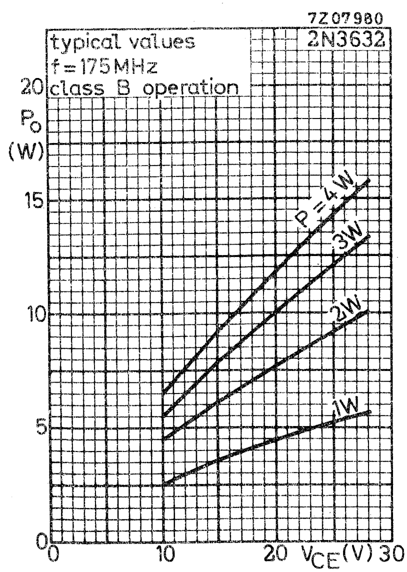

7Z07906
typical values
T_j = 25 °C
2N3553
2N3375
f_T (MHz)
600
400
200
0
V_{CE} = 28V
14V
7V
0
100
200
300
400
I_C (mA)


7Z07895
typical values
T_j = 25 °C
2N3632
f_T (MHz)
600
400
200
0
V_{CE} = 28V
14V
7V
0
100
200
300
400
I_C (mA)


7Z07891
V_{CE} = 28V
f_T (MHz)
600
400
200
0
I_C = 125mA
2N3553; 2N3375
typ
250mA
2N3632
typ
0
50
100
T_j (°C)
150


7Z07979
typical values
f = 175 MHz
2N3553
Po
(W)
6
4
2
0
0
20
VCE (V)
4
Pi = 0.5 W
0.25 W
0.1 W


7Z07978
typical values
f = 175 MHz
2N3375
Po
(W)
8
6
4
2
0
0
10
20
VCE (V)
30
Pi = 1.5 W
1 W
0.5 W


7Z07980
typical values
f = 175 MHz
class B operation
2N3632
Po
(W)
20
15
10
5
0
0
10
20
VCE (V)
30
Pi = 4 W
3 W
2 W
1 W

SILICON PLANAR EPITAXIAL OVERLAY TRANSISTORS

N-P-N overlay transistors in TO-39 metal envelopes with the collector connected to the case. The devices are primarily intended for class-A, B or C amplifiers, frequency multiplier and oscillator circuits. The transistors are suitable in output, driver or pre-driver stages in v.h.f. and u.h.f. equipment.

QUICK REFERENCE DATA

			2N3866	2N4427	
Collector-emitter voltage R_{BE} = 10 Ω	V_{CER}	max.	55	40	V
Collector-emitter voltage (open base)	V_{CEO}	max.	30	20	V
Collector current (d.c. or averaged over any 20 ms period)	I_C	max.	0,4	0,4	A
Total power dissipation up to T_{mb} = 25 °C	P_{tot}	max.	5	3,5	W
Junction temperature	T_j	max.	200	200	°C
Transition frequency I_C = 25 mA; V_{CE} = 15 V; f = 100 MHz	f_T	typ.	700	—	MHz
I_C = 25 mA; V_{CE} = 10 V; f = 100 MHz	f_T	typ.	—	700	MHz

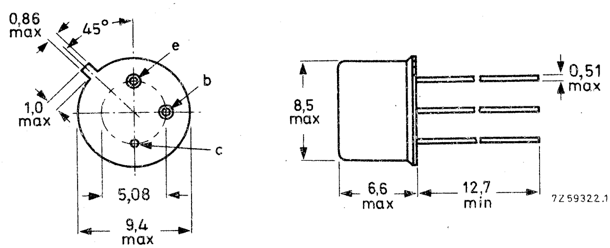
R.F. performance

type number	f (MHz)	V_{CE} (V)	P_o (W)	P_i (W)	η (%)
2N3866	400	28	1	< 0,1	> 45
2N4427	175	12	1	< 0,1	> 50

MECHANICAL DATA

Dimensions in mm

Fig. 1 TO-39; collector connected to case.



Maximum lead diameter is guaranteed only for 12,7 mm.

Accessories: 56245 (distance disc).

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC134)

			2N3866	2N4427	
Voltages [1]					
Collector-base voltage (open emitter)	V_{CBO}	max.	55	40	V
Collector-emitter voltage R_{BE} = 10 Ω	V_{CER}	max.	55	40	V
Collector-emitter voltage (open base)	V_{CEO}	max.	30	20	V
Emitter-base voltage (open collector)	V_{EBO}	max.	3.5	2.0	V
Currents [1]					
Collector current (d.c. or averaged over any 20 ms period)	I_C	max.	0.4	0.4	A
Collector current (peak value)	I_{CM}	max.	0.4	0.4	A
Power dissipation [1]					
Total power dissipation up to T_{mb} = 25 °C	P_{tot}	max.	5	3.5	W

Temperatures

Storage temperature	T_{stg}		−65 to +200	°C
Junction temperature	T_j	max.	200	°C

THERMAL RESISTANCE

From junction to ambient in free air	$R_{th\ j-a}$	=	200	°C/W
From junction to mounting base	$R_{th\ j-mb}$	=	35	°C/W

[1]) See also areas of permissible operation on page 6 .

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

			2N3866	2N4427	
Collector cut-off current					
$I_B = 0$; $V_{CE} = 28$ V	I_{CEO}	<	20		μA
$I_B = 0$; $V_{CE} = 12$ V	I_{CEO}	<		20	μA
Breakdown voltages					
$I_E = 0$; $I_C = 100$ μA	$V_{(BR)CBO}$	>	55	40	V
$I_C = 5$ mA; $R_{BE} = 10$ Ω	$V_{(BR)CER}$	>	55	40	V
$I_B = 0$; $I_C = 5$ mA	$V_{(BR)CEO}$	>	30	20	V
$I_C = 0$; $I_E = 100$ μA	$V_{(BR)EBO}$	>	3.5	2	V
Collector-emitter saturation voltage					
$I_C = 100$ mA; $I_B = 20$ mA	V_{CEsat}	<	1.0	0.5	V
D.C. current gain					
$I_C = 50$ mA; $V_{CE} = 5$ V	h_{FE}		10 to 200		
$I_C = 100$ mA; $V_{CE} = 5$ V	h_{FE}			10 to 200	
$I_C = 360$ mA; $V_{CE} = 5$ V	h_{FE}	>	5	5	
Transition frequency					
$I_C = 25$ mA; $V_{CE} = 15$ V; f = 100 MHz	f_T	typ.	700		MHz
$I_C = 25$ mA; $V_{CE} = 10$ V; f = 100 MHz	f_T	typ.		700	MHz
Collector capacitance					
$V_{CB} = 28$ V; $I_E = I_e = 0$; f = 1 MHz	C_c	<	3		pF
$V_{CB} = 12$ V; $I_E = I_e = 0$; f = 1 MHz	C_c	<		4	pF

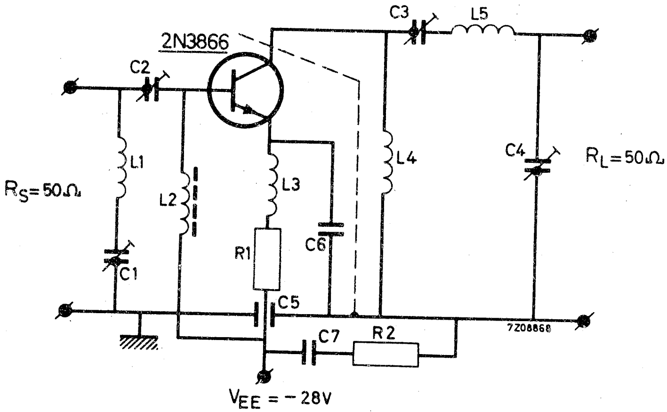
R.F. performance at T_{mb} = 25 °C

	f (MHz)	V_{CE} (V)	P_o (W)	P_i (W)	I_C (mA)	η (%)	Test circuit on page
2N3866	100	28	1.8	0.05	< 107	> 60	
2N3866	250	28	1.5	0.1	< 107	> 50	
2N3866	400	28	1.0	< 0.1	< 79	> 45	4 *
2N4427	175	12	1.0	< 0.1	< 167	> 50	5 *
2N4427	470	12	0.4	0.1	67	50	

*) The transistor can withstand an output V.S.W.R. of 3:1 varied through all phases for conditions, mentioned in the table above.

CHARACTERISTICS (continued)

Test circuit with the 2N3866 at f = 400 MHz

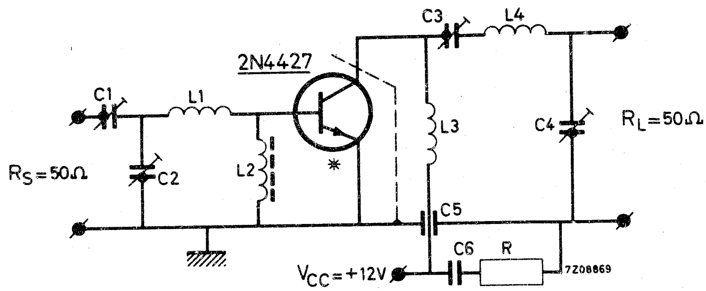


C1 = C2 = C3 =	4 to 29 pF	air trimmer
C4 =	4 to 14 pF	air trimmer
C5 =	1 nF	feed through
C6 =	12 pF	
C7 =	12 nF	
R1 =	5.6 Ω	
R2 =	10 Ω	

L1 = 2 turns Cu wire (1 mm); int. diam. 6 mm; winding pitch 3 mm
L2 = Ferroxcube choke coil; Z (at f = 250 MHz) = 450 Ω (code number 4312 020 36690)
L3 = L4 = 6 turns enamelled Cu wire (0.5 mm); int. diam. 3.5 mm (100 nH)
L5 = 2 turns Cu wire (1 mm); int. diam. 7 mm; winding pitch 2.5 mm; leads 2x15 mm.

CHARACTERISTICS (continued)

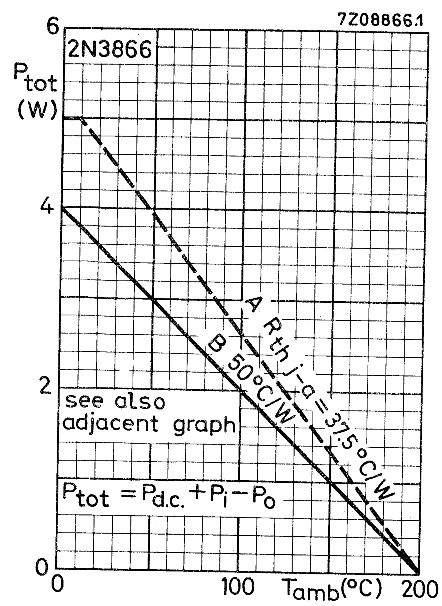
Test circuit with the 2N4427 at f = 175 MHz

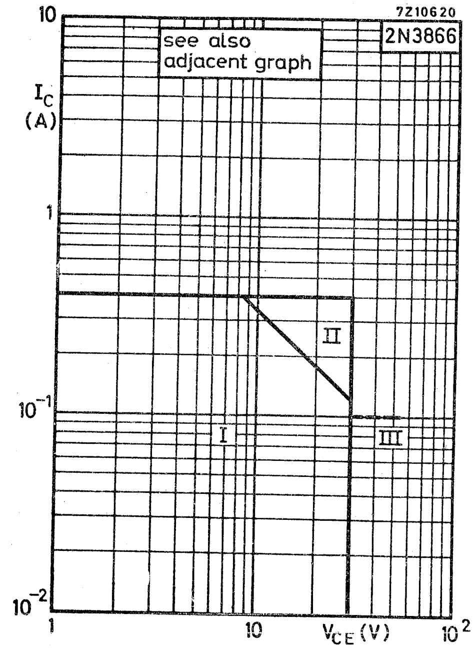


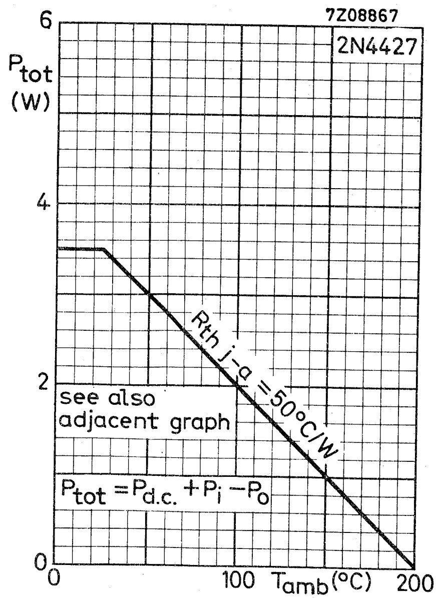
*) The length of the external emitter wire is 1.6 mm

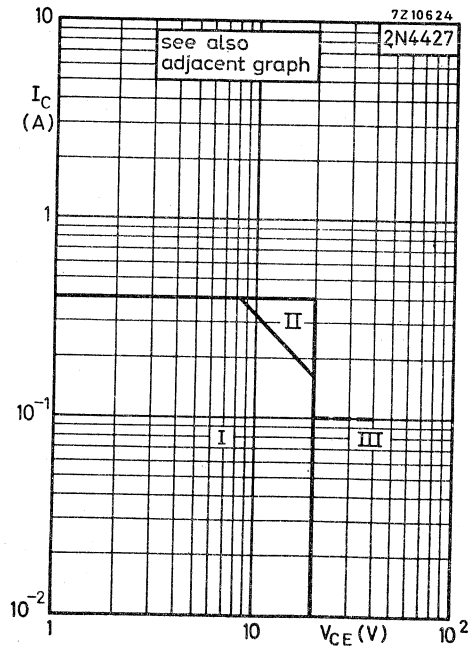
C1 = C2 = C3 = C4 =	4 to 29 pF	air trimmer
C5 =	1 nF	feed through
C6 =	12 nF	
R =	10 Ω	

L1 = 2 turns Cu wire (1 mm); int. diam. 6 mm; winding pitch 2 mm; leads 2x10 mm
L2 = Ferroxcube choke coil; Z (at f = 175 MHz) = 550 Ω (code number 4312 020 36640)
L3 = 2 turns Cu wire (1 mm); int. diam. 5 mm; winding pitch 2 mm; leads 2x10 mm
L4 = 3 turns Cu wire (1.5 mm); int. diam. 10 mm; winding pitch 2 mm; leads 2x15 mm


7Z08866.1
2N3866
Ptot (W)
6
4
2
0
0
100
Tamb(°C)
200
A Rth j-a = 37.5 °C/W
B 50°C/W
see also adjacent graph
Ptot = Pd.c. + Pi − Po


7Z10620
2N3866
see also adjacent graph
IC (A)
10
1
10^-1
10^-2
1
10
VCE (V)
10^2
I
II
III

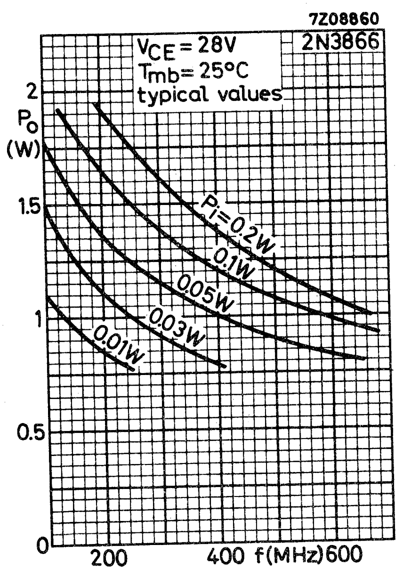

7Z08867
2N4427
Ptot (W)
6
4
2
0
0
100
Tamb(°C)
200
Rth j-a = 50°C/W
see also adjacent graph
Ptot = Pd.c. + Pi − Po

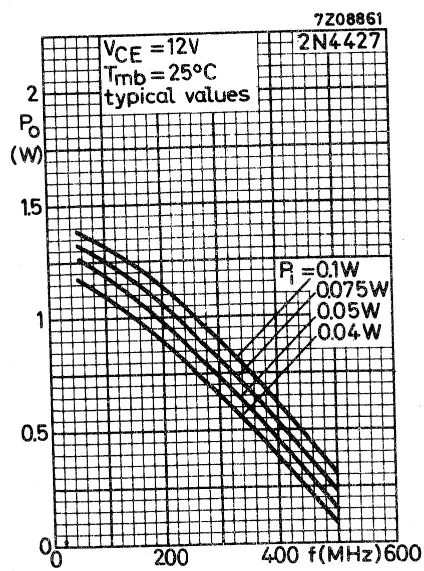

7Z10624
2N4427
see also adjacent graph
IC (A)
10
1
10^-1
10^-2
1
10
VCE (V)
10^2
I
II
III

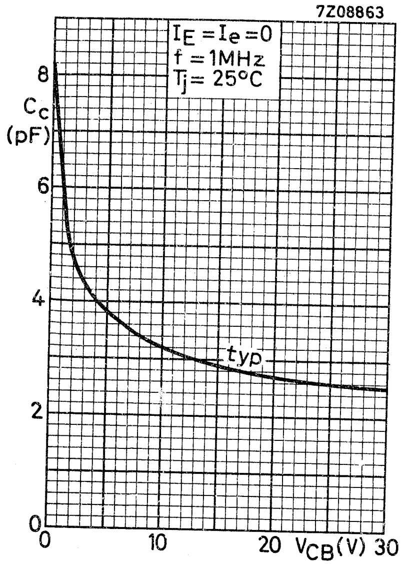
I Region of permissible operation under all base-emitter conditions and at all frequencies, including d.c.

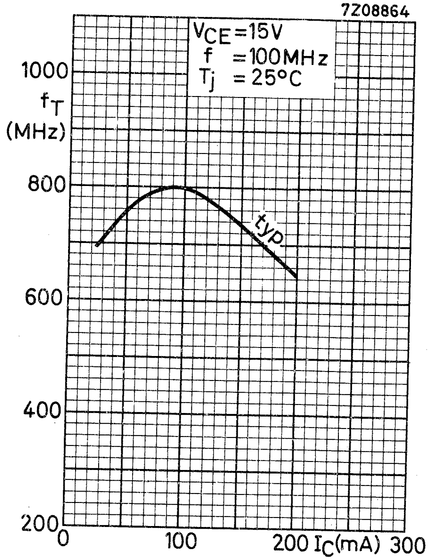
II Additional region of operation at f ≥ 1 MHz.
Care must be taken to reduce the d.c. adjustment to region I before removing the a.c. signal. This may be achieved by an appropriate bias in class A, B or C.

III Operating during switching off in this region is allowed, provided the transistor is cut-off with $-V_{BB} \leq 1.5$ V and $R_{BE} \geq 33\ \Omega$, $I_C \leq 100$ mA and the transient energy does not exceed 0.125 mWs.

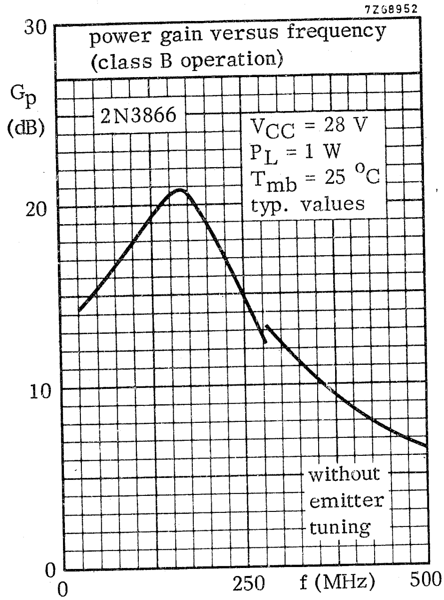


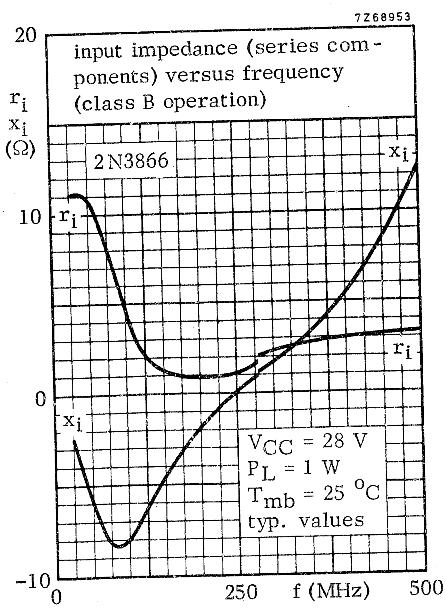


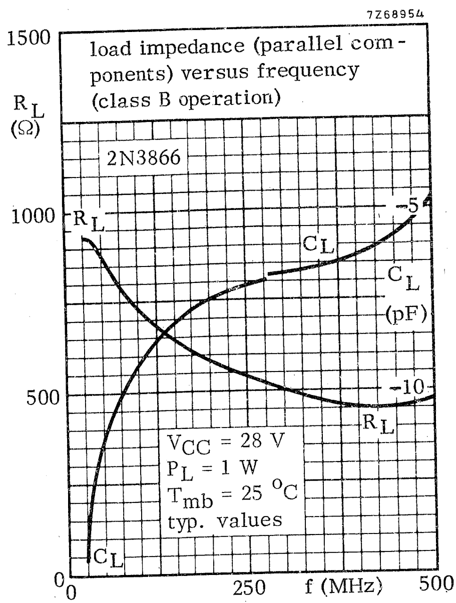

7Z08863
$I_E = I_e = 0$
f = 1MHz
T_j = 25°C
8
C_c
(pF)
6
4
2
0
0
10
20
V_{CB}(V) 30
typ


7Z08864
V_{CE} = 15V
f = 100MHz
T_j = 25°C
1000
f_T
(MHz)
800
600
400
200
0
100
200
I_C(mA) 300
typ

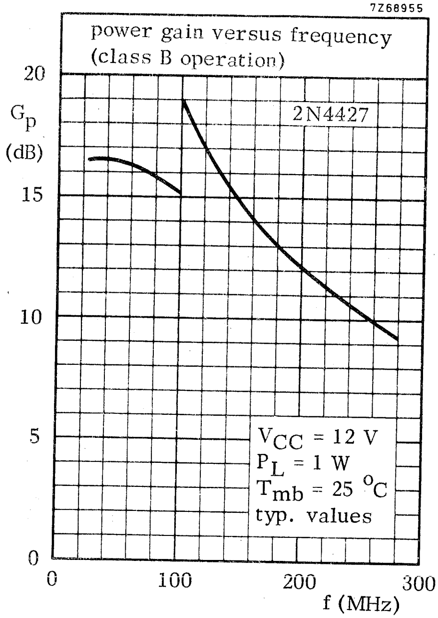
OPERATING NOTE Below 280 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation. This resistor must be effective for both d.c. and r.f.

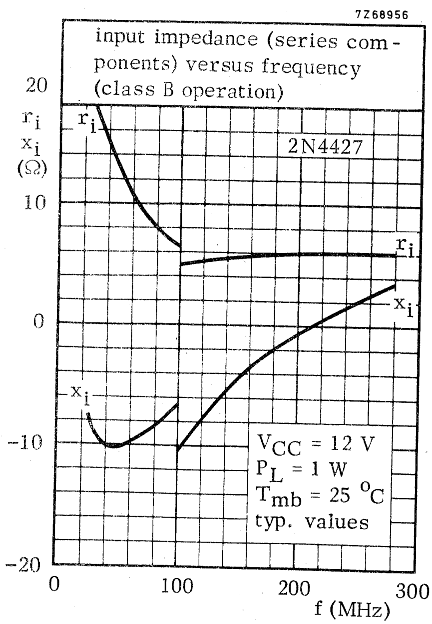


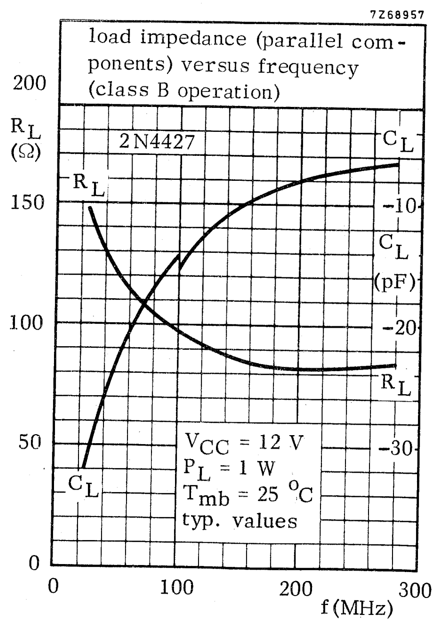




OPERATING NOTE Below 100 MHz a base-emitter resistor of 22 Ω is recommended to avoid oscillation. This resistor must be effective for both d.c. and r.f.







SILICON PLANAR EPITAXIAL OVERLAY TRANSISTORS

The **2N3924** is an n-p-n overlay transistor in a TO-39 metal envelope with the collector connected to the case.
The **2N3926** and the **2N3927** are n-p-n overlay transistors in TO-60 metal envelopes with the emitter connected to the case.
The transistors are intended for v.h.f. transmitting applications.

QUICK REFERENCE DATA

			2N3924	2N3926	2N3927	
Collector-emitter voltage $-V_{BE}$ = 1,5 V	V_{CEX}	max.	36	36	36	V
Collector-emitter voltage (open base)	V_{CEO}	max.	18	18	18	V
Collector current (peak value)	I_{CM}	max.	1,5	3,0	4,5	A
Total power dissipation up to T_{mb} = 25 °C	P_{tot}	max.	7	11,6	23	W
Junction temperature	T_j	max.	200	200	200	°C
Transition frequency I_C = 100 mA; V_{CE} = 13,5 V	f_T	>	250	250	–	MHz
I_C = 200 mA; V_{CE} = 13,5 V	f_T	>	–	–	200	MHz

R.F. performance at V_{CE} = 13,5 V; f = 175 MHz

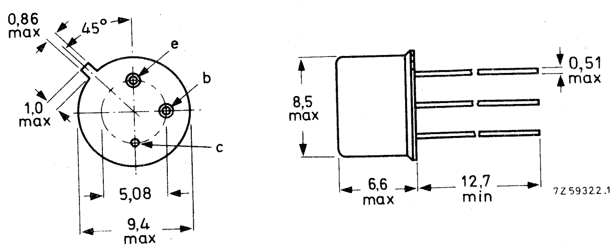
type number	P_o (W)	P_i (W)	η (%)
2N3924	4	< 1	> 70
2N3926	7	< 2	> 70
2N3927	12	< 4	> 80

MECHANICAL DATA

Dimensions in mm

Fig. 1a TO-39; collector connected to case.

2N3924



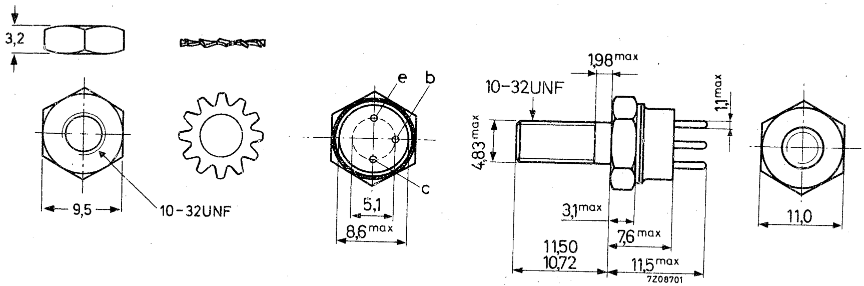
Maximum lead diameter is guaranteed only for 12,7 mm.
Accessories: 56245 (distance disc).

MECHANICAL DATA (continued)

Dimensions in mm

Fig. 1b TO-60 (**2N3926** and **2N3927**).

Emitter connected to case.
The top pins should not be bent.



Torque on nut: min. 0,8 Nm (8 kg cm)
max. 1,7 Nm (17 kg cm)

Diameter of clearance hole in heatsink: 4,8 mm to 5,2 mm.

→ **CAUTION These devices incorporate beryllium oxide, the dust of which is toxic. The devices are entirely safe provided that the BeO disc is not damaged.**

RATINGS see also pages 8 and 9

Limiting values in accordance with the Absolute Maximum System (IEC 134)

			2N3924	2N3926	2N3927	
Collector-base voltage (open emitter)	V_{CBO}	max.		36		V
Collector-emitter voltage						
$I_C \leqslant 400$ mA; $-V_{BE} = 1,5$ V	V_{CEX}	max.		36		V
(open base); $I_C \leqslant 400$ mA	V_{CEO}	max.		18		V
Emitter-base voltage (open collector)	V_{EBO}	max.		4		V
Collector current						
d.c.	I_C	max.	0,5	1,0	1,5	A
peak value	I_{CM}	max.	1,5	3,0	4,5	A
Total power dissipation up to $T_{mb} = 25$ °C	P_{tot}	max.	7	11,6	23	W
Storage temperature	T_{stg}			−65 to +200		°C
Junction temperature	T_j	max.		200		°C

THERMAL RESISTANCE

			2N3924	2N3926	2N3927	
From junction to mounting base	$R_{th\ j\text{-}mb}$	=	25	15	7.5	°C/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=		0.6	0.6	°C/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

			2N3924	2N3926	2N3927	
Collector cut-off current						
$I_E = 0$; $V_{CB} = 15$ V	I_{CBO}	<	100	100	250	μA
$I_E = 0$; $V_{CB} = 15$ V; $T_j = 150$ °C	I_{CBO}	<	5	5	10	mA
Breakdown voltages						
$I_E = 0$; $I_C = 250$ μA	$V_{(BR)CBO}$	>	36	36	36	V
I_C up to 400 mA						
$-V_{BE} = 1.5$ V; $R_B = 33\ \Omega$ 1)	$V_{(BR)CEX}$	>	36	36	36	V
$I_B = 0$ 1)	$V_{(BR)CEO}$	>	18	18	18	V
$I_C = 0$; $I_E = 250$ μA	$V_{(BR)EBO}$	>	4	4	4	V
Base-emitter voltage						
I_C = 250 mA; V_{CE} = 5 V	V_{BE}	<	1.5			V
I_C = 500 mA; V_{CE} = 5 V	V_{BE}	<		1.5		V
I_C = 1000 mA; V_{CE} = 5 V	V_{BE}	<			1.5	V
Saturation voltage						
I_C = 250 mA; I_B = 50 mA	V_{CEsat}	<	0.75			V
I_C = 500 mA; I_B = 100 mA	V_{CEsat}	<		0.75		V
I_C = 1000 mA; I_B = 200 mA	V_{CEsat}	<			1.0	V

1) Pulsed through an inductor of 25 mH; $\delta = 0.5$; f = 50 Hz

CHARACTERISTICS (continued)

T_j = 25 °C unless otherwise specified

			2N3924	2N3926	2N3927	
D.C. current gain						
I_C = 250 mA; V_{CE} = 5 V	h_{FE}	>	10			
		<	150			
I_C = 500 mA; V_{CE} = 5 V	h_{FE}	>		5		
		<		150		
I_C = 1000 mA; V_{CE} = 5 V	h_{FE}	>			5	
		<			150	
Collector capacitance at f = 1 MHz						
$I_E = I_e = 0$; V_{CB} = 13.5 V	C_c	<	20	20	45	pF
Transition frequency						
I_C = 100 mA; V_{CE} = 13.5 V	f_T	>	250	250		MHz
I_C = 200 mA; V_{CE} = 13.5 V	f_T	>			200	MHz
Real part of input impedance at f = 200 MHz						
I_C = 100 mA; V_{CE} = 13.5 V	$Re(h_{ie})$	<	20	20		Ω
I_C = 200 mA; V_{CE} = 13.5 V	$Re(h_{ie})$	<			20	Ω

R.F. performance at V_{CE} = 13.5 V; f = 175 MHz

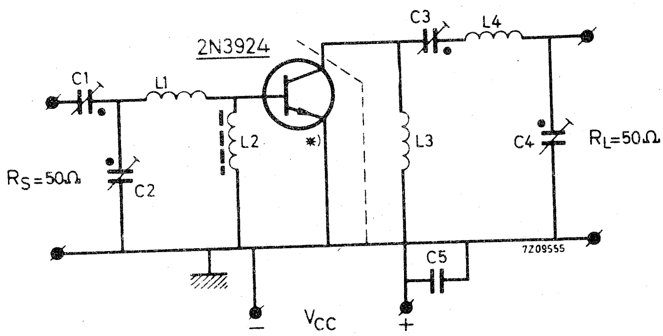
	P_o (W)	P_i (W)	I_C (mA)	η %	Test circuit at page
2N3924	4	< 1	< 420	> 70	5
2N3926	7	< 2	< 740	> 70	6
2N3927	12	< 4	< 1100	> 80	6

NOTE

The transistors can withstand an output V.S.W.R. of 3:1 varied through all phases under conditions mentioned in the table above.

CHARACTERISTICS (continued)

Test circuit with the 2N3924 at f = 175 MHz



*) The length of the external emitter wire of the 2N3924 is 1.6 mm.

Components

C1 = C2 = C3 = C4 =	4 to 29 pF	air trimmer
C5 =	10 nF	polyester

L1 = 1 turn Cu wire (1.0 mm); int. diam. 10 mm; leads 2 x 10 mm

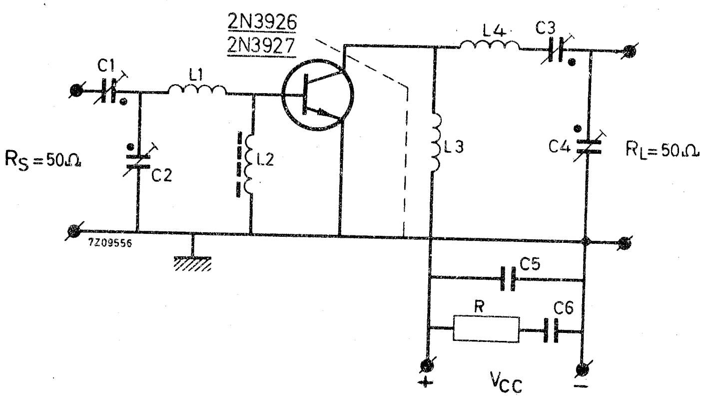
L2 = Ferroxcube choke coil. Z (at f = 175 MHz) = 550 Ω ± 20%
(code number 4312 020 **36640**)

L3 = 15 turns closely wound enamelled Cu wire (0.7 mm); int. diam. 4 mm

L4 = 3 turns closely wound enamelled Cu wire (1.5 mm); int. diam. 12 mm; leads 2 x 20 mm

CHARACTERISTICS (continued)

Test circuit with the 2N3926 or 2N3927 at f = 175 MHz



Components

C1 = C2 = C3 = C4 =	4 to 29 pF	air trimmer
C5 =	100 pF	ceramic
C6 =	10 nF	polyester

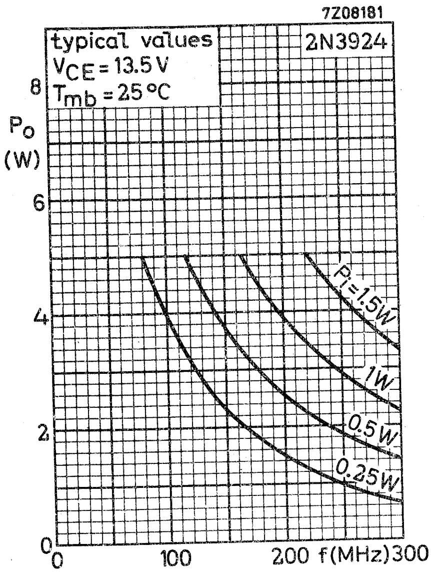
L1 = 1 turn Cu wire (1.0 mm); int. diam. 10 mm; leads 2 x 10 mm

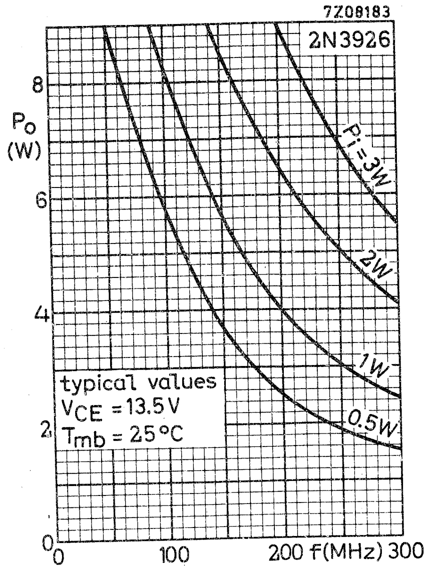
L2 = Ferroxcube choke coil. Z (at f = 175 MHz) = 550 Ω ± 20%
(code number 4312 020 36640)

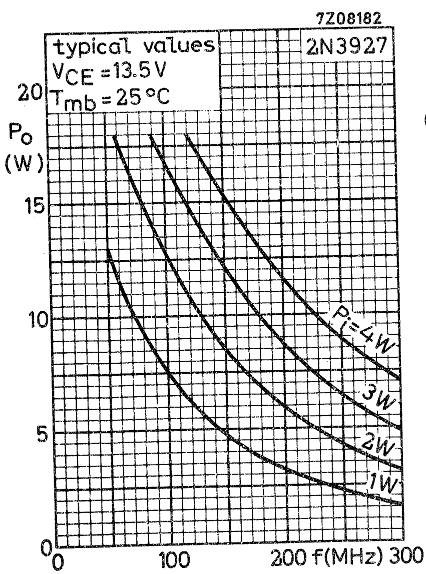
L3 = 15 turns closely wound enamelled Cu wire (0.7 mm); int. diam. 4 mm

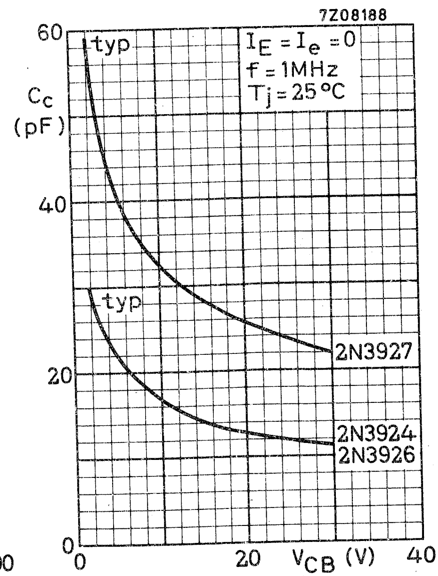
L4 = 2 turns closely wound enamelled Cu wire (1.5 mm); int. diam. 8.5 mm; leads 2 x 20 mm

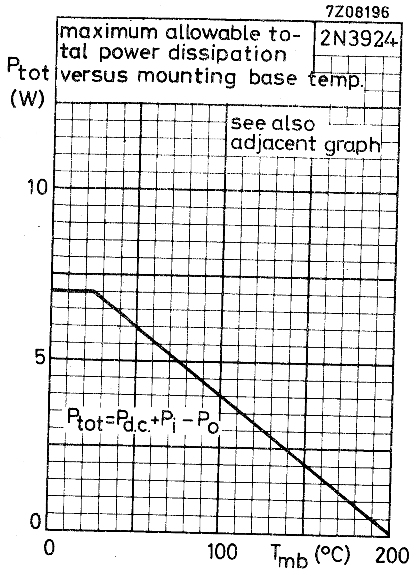
R = 10 Ω carbon

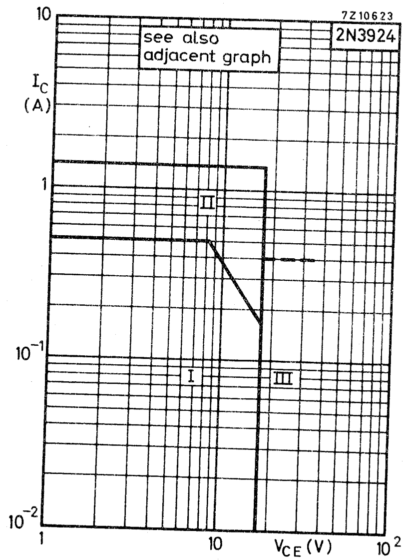

7Z08181
typical values
V_{CE} = 13.5 V
T_{mb} = 25 °C
2N3924
P_o
(W)
P_i = 1.5 W
1 W
0.5 W
0.25 W
f (MHz)

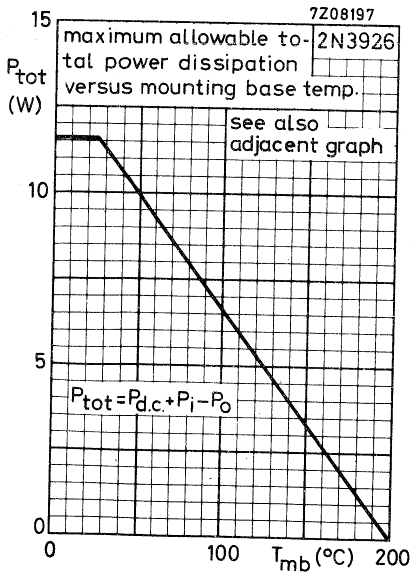

7Z08183
2N3926
P_o
(W)
P_i = 3 W
2 W
1 W
0.5 W
typical values
V_{CE} = 13.5 V
T_{mb} = 25 °C
f (MHz)

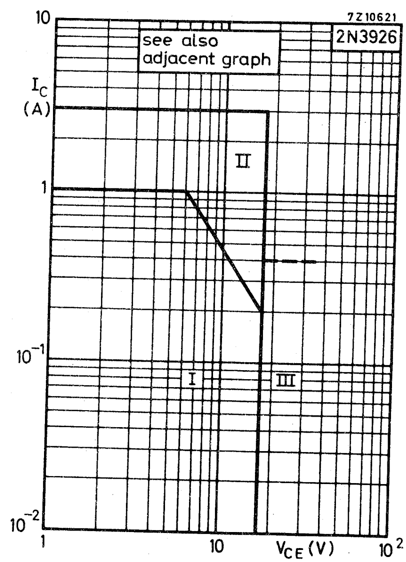

7Z08182
typical values
V_{CE} = 13.5 V
T_{mb} = 25 °C
2N3927
P_o
(W)
P_i = 4 W
3 W
2 W
1 W
f (MHz)

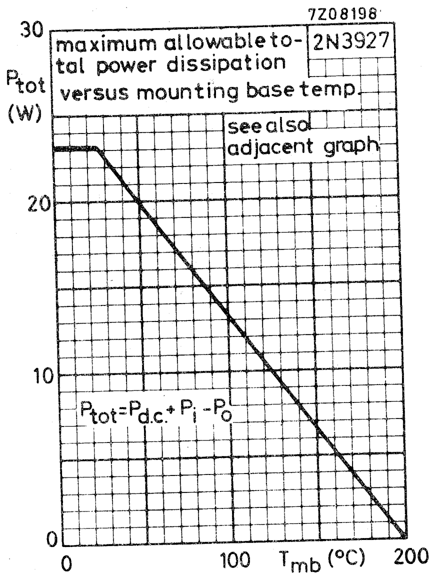

7Z08188
typ
$I_E = I_e = 0$
f = 1 MHz
T_j = 25 °C
C_c
(pF)
typ
2N3927
2N3924
2N3926
V_{CB} (V)

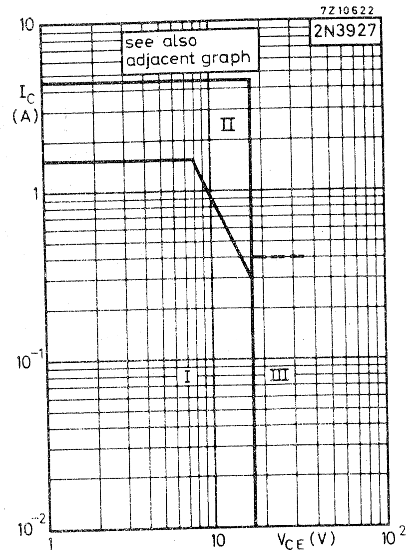

7Z08196
maximum allowable total power dissipation versus mounting base temp.
2N3924
P_{tot} (W)
see also adjacent graph
$P_{tot}=P_{d.c.}+P_i-P_o$
0
5
10
0
100
T_{mb} (°C)
200


7Z10623
2N3924
see also adjacent graph
I_C (A)
10
1
10^{-1}
10^{-2}
I
II
III
1
10
V_{CE} (V)
10^2


7Z08197
maximum allowable total power dissipation versus mounting base temp.
2N3926
P_{tot} (W)
see also adjacent graph
$P_{tot}=P_{d.c.}+P_i-P_o$
15
10
5
0
0
100
T_{mb} (°C)
200


7Z10621
2N3926
see also adjacent graph
I_C (A)
10
1
10^{-1}
10^{-2}
I
II
III
1
10
V_{CE} (V)
10^2

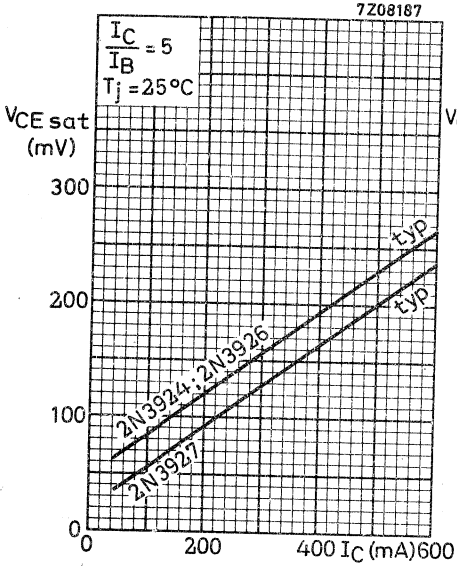


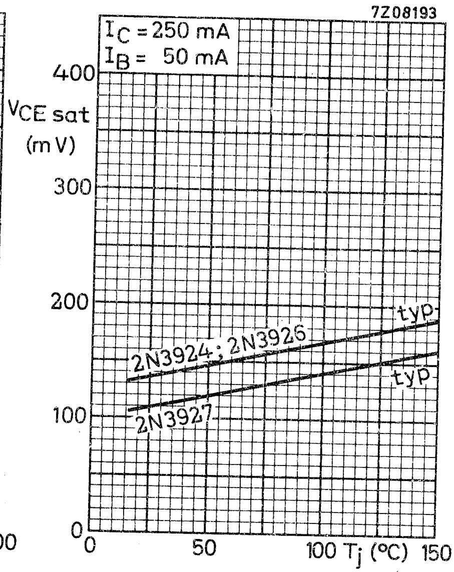


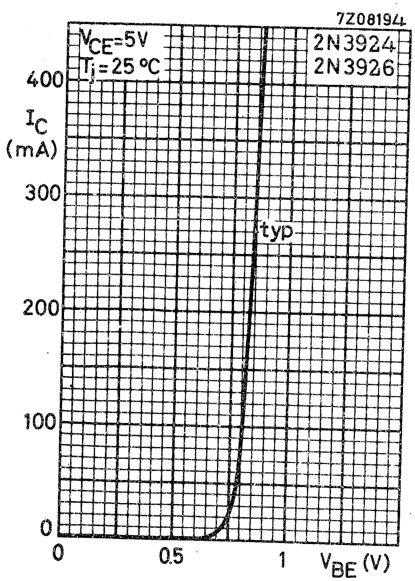
I Region of permissible operation under all base-emitter conditions and at all frequencies, including d.c.

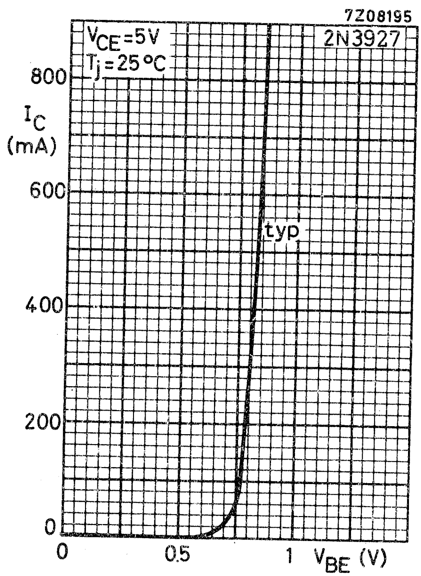
II Additional region of operation at f $\geq$ 1 MHz.
Care must be taken to reduce the d.c. adjustment to region I before removing the a.c. signal. This may be achieved by an appropriate bias in class A, B or C.

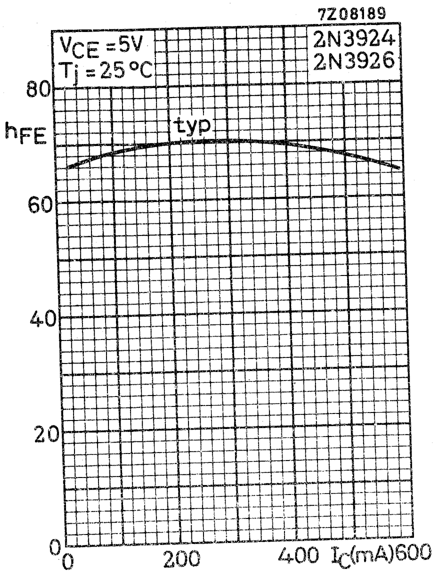
III Operating during switching off in this region is allowed, provided the transistor is cut-off with $-V_{BB} \leq 1.5$ V and $R_{BE} \geq 33\ \Omega$, $I_C \leq 400$ mA and the transient energy does not exceed 2 mWs.

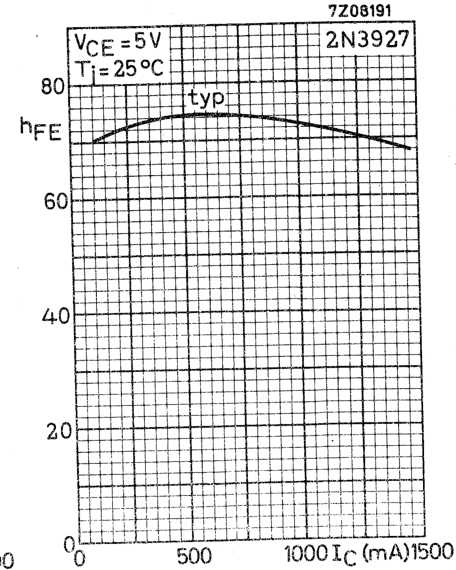

7Z08187
$I_C/I_B = 5$
$T_j = 25\,°C$
$V_{CE\,sat}$ (mV)
2N3924; 2N3926
2N3927
typ
typ
I_C (mA)
0
100
200
300
0
200
400
600

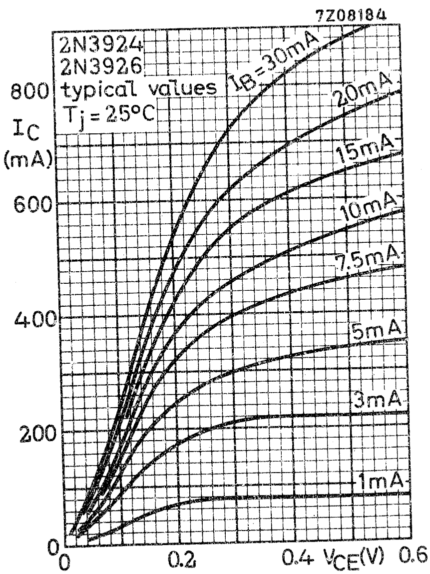

7Z08193
$I_C = 250$ mA
$I_B = 50$ mA
$V_{CE\,sat}$ (mV)
2N3924; 2N3926
2N3927
typ
typ
T_j (°C)
0
100
200
300
400
0
50
100
150

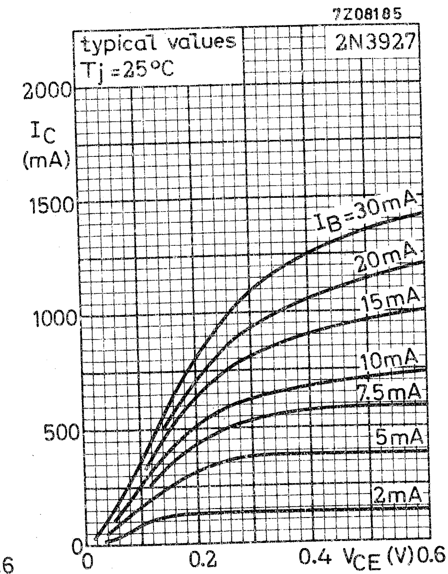

7Z08194
$V_{CE} = 5$ V
$T_j = 25\,°C$
2N3924
2N3926
I_C (mA)
typ
V_{BE} (V)
0
100
200
300
400
0
0.5
1

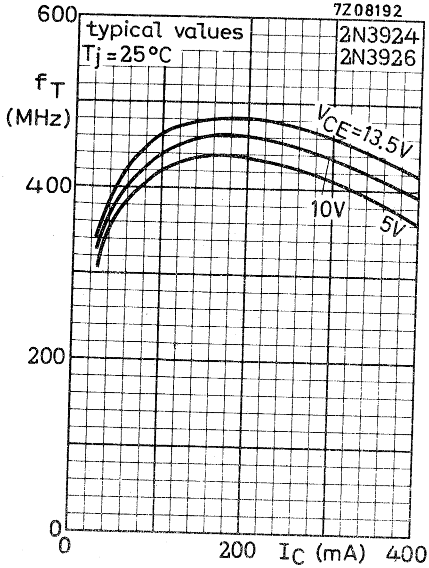

7Z08195
$V_{CE} = 5$ V
$T_j = 25\,°C$
2N3927
I_C (mA)
typ
V_{BE} (V)
0
200
400
600
800
0
0.5
1

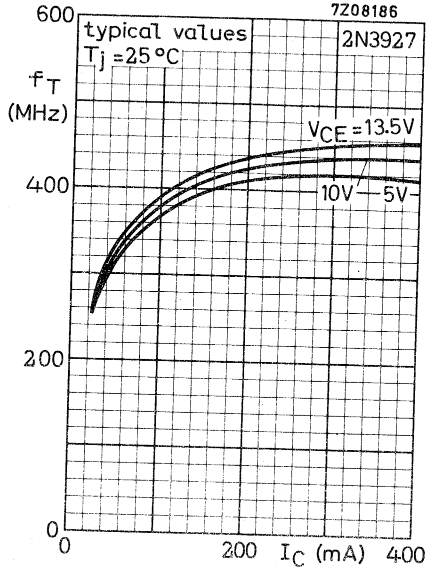

7Z08189
VCE = 5V
Tj = 25 °C
2N3924
2N3926
typ
hFE
80
60
40
20
0
0
200
400
IC(mA)600

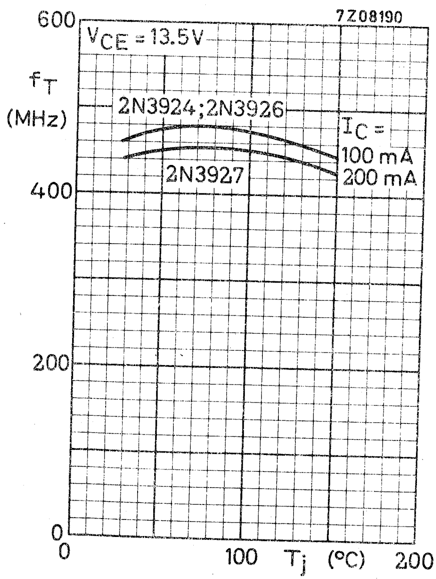

7Z08191
VCE = 5 V
Tj = 25 °C
2N3927
typ
hFE
80
60
40
20
0
0
500
1000 IC (mA) 1500


7Z08184
2N3924
2N3926
typical values
Tj = 25°C
IB=30mA
20mA
15mA
10mA
7.5mA
5mA
3mA
1mA
800
IC
(mA)
600
400
200
0
0
0.2
0.4 VCE(V) 0.6


7Z08185
typical values
Tj = 25°C
2N3927
2000
IC
(mA)
1500
1000
500
0
0
0.2
0.4 VCE (V) 0.6
IB=30mA
20mA
15mA
10mA
7.5mA
5mA
2mA


7Z08192
typical values
Tj = 25 °C
2N3924
2N3926
fT
(MHz)
600
400
200
0
VCE=13.5V
10V
5V
0
200
IC (mA)
400


7Z08186
typical values
Tj = 25 °C
2N3927
fT
(MHz)
600
400
200
0
VCE = 13.5V
10V
5V
0
200
IC (mA)
400


7Z08190
VCE = 13.5V
fT
(MHz)
600
400
200
0
2N3924;2N3926
2N3927
IC =
100 mA
200 mA
0
100
Tj (°C)
200

SILICON EPITAXIAL PLANAR OVERLAY TRANSISTOR

For data of this transistor please refer to type 2N3866

NOTES

NOTES

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