Semiconductors

Book S10 1985

Wideband transistors and

Wideband hybrid IC modules

WIDEBAND TRANSISTORS AND WIDEBAND HYBRID IC MODULES

DATA HANDBOOK SYSTEM

Our Data Handbook System comprises more than 60 books with specifications on electronic components, subassemblies and materials. It is made up of four series of handbooks:

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

The contents of each series are listed on pages iv to viii.

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

When ratings or specifications differ from those published in the preceding edition they are indicated with arrows in the page margin. Where application information is given it is advisory and does not form part of the product specification.

Condensed data on the preferred products of Philips Electronic Components and Materials Division is given in our Preferred Type Range catalogue (issued annually).

Information on current Data Handbooks and on how to obtain a subscription for future issues is available from any of the Organizations listed on the back cover.
Product specialists are at your service and enquiries will be answered promptly.

ELECTRON TUBES (BLUE SERIES)

The blue series of data handbooks comprises:

T1	**Tubes for r.f. heating**
T2a	**Transmitting tubes for communications, glass types**
T2b	**Transmitting tubes for communications, ceramic types**
T3	**Klystrons**
T4	**Magnetrons for microwave heating**
T5	**Cathode-ray tubes** Instrument tubes, monitor and display tubes, C.R. tubes for special applications
T6	**Geiger-Müller tubes**
T7	**Gas-filled tubes** (will not be reprinted)
T8	**Colour display systems** Colour TV picture tubes, colour data graphic display tube assemblies, deflection units
T9	**Photo and electron multipliers**
T10	**Plumbicon camera tubes and accessories**
T11	**Microwave semiconductors and components**
T12	**Vidicon and Newvicon camera tubes**
T13	**Image intensifiers**
T14	**Infrared detectors**
T15	**Dry reed switches**
T16	**Monochrome tubes and deflection units** Black and white TV picture tubes, monochrome data graphic display tubes, deflection units

(T13–T15:) Data collations on these subjects are available now. Data Handbooks will be published in 1985.

SEMICONDUCTORS (RED SERIES)

The red series of data handbooks comprises:

INTEGRATED CIRCUITS (PURPLE SERIES)

The purple series of data handbooks comprises:

EXISTING SERIES		Superseded by:
IC1	**Bipolar ICs for radio and audio equipment**	IC01N
IC2	**Bipolar ICs for video equipment**	IC02Na and IC02Nb
IC3	**ICs for digital systems in radio, audio and video equipment**	IC01N, IC02Na and IC02Nb
IC4	**Digital integrated circuits** CMOS HE4000B family	
IC5	**Digital integrated circuits – ECL** ECL10 000 (GX family), ECL100 000 (HX family), dedicated designs	IC08N
IC6	**Professional analogue integrated circuits**	
IC7	**Signetics bipolar memories**	
IC8	**Signetics analogue circuits**	IC11N
IC9	**Signetics TTL logic**	IC09N and IC15N
IC10	**Signetics Integrated Fuse Logic (IFL)**	IC13N
IC11	**Microprocessors, microcomputers and peripheral circuitry**	

NEW SERIES

IC01N	**Radio, audio and associated systems** Bipolar, MOS	(published 1985)
IC02Na	**Video and associated systems** Bipolar, MOS Types MAB8031AH to TDA1524A	(published 1985)
IC02Nb	**Video and associated systems** Bipolar, MOS Types TDA2501 to TEA1002	(published 1985)
IC03N	**Integrated circuits for telephony**	(published 1985)
IC04N	**HE4000B logic family** CMOS	
IC05N	**HE4000B logic family — uncased ICs** CMOS	(published 1984)
IC06N	**High-speed CMOS; PC54/74HC/HCT/HCU** Logic family	(published 1985)
IC07N	**High-speed CMOS; PC54/74HC/HCT/HCU — uncased ICs** Logic family	
IC08N	**ECL 10K and 100K logic families**	(published 1984)
IC09N	**TTL logic series**	(published 1984)
IC10N	**Memories** MOS, TTL, ECL	
IC11N	**Linear LSI**	(published 1985)
IC12N	**Semi-custom gate arrays & cell libraries** ISL, ECL, CMOS	
IC13N	**Semi-custom** Integrated Fuse Logic	(published 1985)
IC14N	**Microprocessors, microcontrollers & peripherals** Bipolar, MOS	
IC15N	**FAST TTL logic series**	(published 1984)

Note

Books available in the new series are shown with their date of publication.

COMPONENTS AND MATERIALS (GREEN SERIES)

The green series of data handbooks comprises:

C1 **Programmable controller modules**
PLC modules, PC20 modules

C2 **Television tuners, coaxial aerial input assemblies, surface acoustic wave filters**

C3 **Loudspeakers**

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

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

C6 **Synchronous motors and gearboxes**

C7 **Variable capacitors**

C8 **Variable mains transformers**

C9 **Piezoelectric quartz devices**

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 **Potentiometers, encoders and switches**

C13 **Fixed resistors**

C14 **Electrolytic and solid capacitors**

C15 **Ceramic capacitors**

C16 **Permanent magnet materials**

C17 **Stepping motors and associated electronics**

C18 **Direct current motors**

C19 **Piezoelectric ceramics**

C20 **Wire-wound components for TVs and monitors**

C21* **Assemblies for industrial use**
HNIL FZ/30 series, NORbits 60-, 61-, 90-series, input devices

C22 **Film capacitors**

* Will be issued in 1985.

SELECTION GUIDE

This table shows the most preferred types of n-p-n transistors and their complements for wideband applications. It shows the types *in sequence of linear output voltage* capability in each type of envelope. The values of V_o, ITO and PL1 are only given as a typical reference.

For detailed information see relevant data sheet.

Wideband transistors (f_T = 5 GHz)

envelope	polarity n-p-n	polarity p-n-p										
			I_C (mA) / V_{CE} (V)		14 / 10	30 / 8	70 / 10	80 / 10	90 / 10	120 / 15	240 / 15	600 / 18
			V_o* (mV)		150	425	700		1000	1200	1600	2200
			ITO (dBm)		27	36	40			45	47	
			PL1 (dBm)		8	17	21			26	28	
SOT-37	●			BFT24	BFR90A	BFR91A	BFR96S		BFQ34T			
		●			BFQ51	BFQ23	BFQ32S					
SOT-23**	●			BFT25	BFR92A	BFR93A						
		●			BFT92	BFT93						
SOT-89	●						BFQ19	BFQ18A				
SOT-122	●									BFQ34	BFQ68	BFQ136
SOT-103	●				BFG90A	BFG91A	BFG96		BFG34			
SOT-173	●				BFP90A	BFP91A	BFP96					
TO-72	●				BFQ53	BFQ22S	BFQ63					
		●			BFQ52	BFQ24						

Wideband transistors (f_T = 7,5 GHz)

envelope	n-p-n	p-n-p							
			I_C (mA) / V_{CE} (V)		15 / 8				
SOT-37	●				BFQ65				
SOT-23**	●				BFQ67				
SOT-103	●				BFG65				
SOT-143**	●				BFG67				
SOT-173	●				BFQ66				

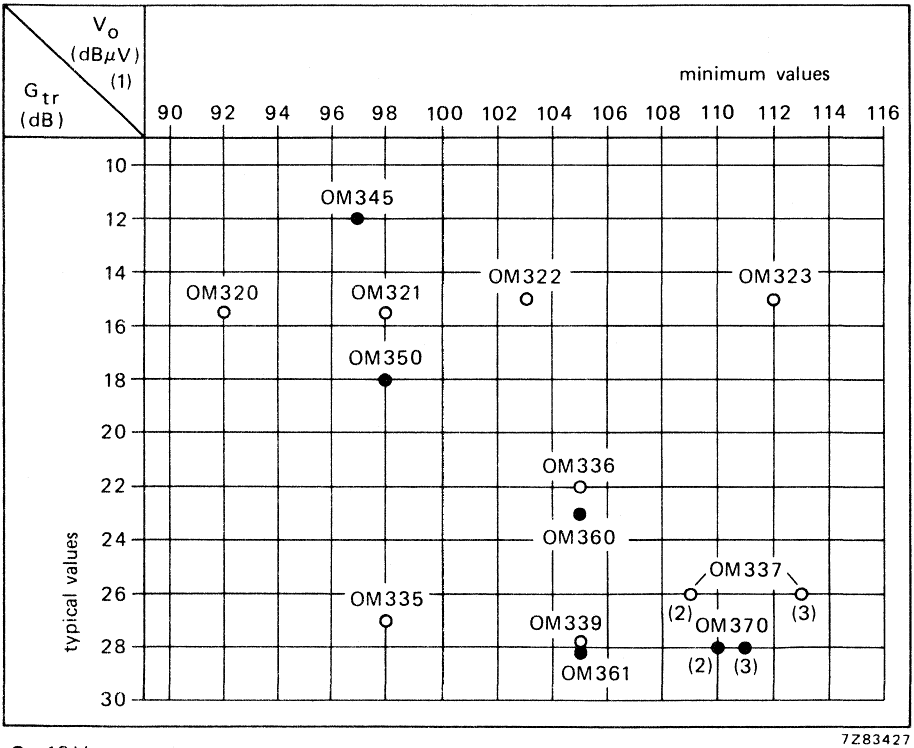
* Typical output voltage at d_{im} = –60 dB (DIN45004B, par. 6.3: 3-tone).

** See Handbook Surface Mounted Semiconductors.

type number	frequency range MHz	power gain (dB) at f = 50 MHz	application	page
BGY61	5 - 200	13,0 ± 0,5	reverse amplifiers	461
BGY65		18,5 ± 0,5		465
BGY67		22,5 ± 0,5		469
BGY67A		24,0 ± 0,5		473
BGY50	40 - 300	12,5 ± 0,4	preamplifier	429
BGY51			post amplifier	429
BGY52	40 - 300	16,4 ± 0,4	preamplifier	433
BGY53			post amplifier	433
BGY54	40 - 300	17,0 ± 0,4	preamplifier	437
BGY55			post amplifier	437
BGY56	40 - 300	22,0 ± 0,6	preamplifier	441
BGY57			post amplifier	441
BGY58	40 - 300	33,0 ± 1,0	line extender	445
BGY58A	40 - 300	34,0 ± 1,0	line extender	449
BGY59	40 - 300	38,5 ± 1,0	line extender	453
BGY60	40 - 300	33,5 ± 1,0	interstage amplifier (2 x 17 dB)	457
BGD102	40 - 450	18,5 ± 0,5	power doubler	421
BGD104		20,0 ± 0,5	amplifiers	421
BGD102E	40 - 450	18,5 ± 0,5	power doubler	425
BGD104E		20,0 ± 0,5	amplifiers	425
BGY70	40 - 450	12,5 ± 0,4	preamplifier	477
BGY71			post amplifier	477
BGY74	40 - 450	17,0 ± 0,4	preamplifier	481
BGY75			post amplifier	481
BGY78	40 - 450	34,0 ± 1,0	line extender	485
BGY84	40 - 450	17,0 ± 0,5	preamplifier	489
BGY85			post amplifier	489
BGY84A	40 - 450	18,4 ± 0,4	preamplifier	493
BGY85A			post amplifier	493

All modules normally operate at V_B = 24 V, but are able to withstand supply transients up to 30 V.

HYBRID ICs FOR WIDE-BAND AMPLIFIERS



● 12 V types

○ 24 V types

(1) At −60 dB intermodulation distortion (DIN 45004, par. 6.3: 3-tone).

(2) UHF.

(3) VHF.

Fig. 1 Type/performance in matrix survey.

The matrix survey (Fig. 1) and the tables next page show both the 12 V and 24 V ranges.

Note that the modules are available in the combination of high gain- high output voltage.

12 V supply voltage

	type	stages	gain (dB)	$V_{o(rms)}$ (dBμV) −60 dB IMD (note 1) min. values	noise figure (dB)	max. VSWR typ. values (note 2) input	output	supply current (mA)	page
low	OM345	1	12	97	5,5	2,0	1,4	11,5	547
medium	OM350	2	18	98	6,0	1,5	1,9	18	553
medium	OM360	3	23	105	7,0	1,3	1,5	55	559
output	OM361	3	28	105	6,0	1,5	1,7	50	565
high output	OM370	3	28	111	7,0	2,3	1,9	105	571

24 V supply voltage

	type	stages	gain (dB)	$V_{o(rms)}$ (dBμV) −60 dB IMD (note 1) min. values	noise figure (dB)	max. VSWR typ. values (note 2) input	output	supply current (mA)	page
low output	OM320	2	15,5	92	5,5	2,2	2,5	33	501
	OM321	2	15,5	98	6,0	2,5	2,0	33	507
	OM335	3	27	98	5,5	1,9	3,2	35	525
medium output	OM322	2	15	103	7,0	1,7	1,7	60	513
	OM336	3	22	105	7,0	1,4	1,6	65	531
	OM339	3	28	105	6,0	1,5	1,5	66	543
high output	OM323*	2	15	112	9,0	1,9	2,3	100	519
	OM337*	3	26	113	9,8	2,3	1,8	115	535

* Also available in A-version for external coil and output capacitor.

Notes

1. Measured at −60 dB intermodulation distortion to DIN45004, par. 6.3: 3-tone, f = 470 MHz.
2. The typical maximum VSWR occurring in the frequency range 40-860 MHz, for a sample connected to a 75 Ω line.

TYPE NUMBER SURVEY

type number	n-p-n or p-n-p	envelope	RATINGS V_{CEO} V	I_C mA	P_{tot} mW	CHARACTERISTICS (typical values unless otherwise specified) f_T GHz	F dB	at f MHz	G_{UM} dB	at f MHz	V_o* mV	PL1** dBm	ITO** dBm	I_C mA	V_{CE} V	page
BF689K	n	TO-92	15	25	360	1,8	3	200	16	200						35
BF763	n	TO-92	15	25	500	1,8	5	800	—	—						37
BFG23	n	SOT-103	12	35	180	5	3,7	800	14,5	800	400			30	8	39
BFG32	n	SOT-103	12	75	700	4,5	4,3	800	13	800	500			70	10	45
BFG34	n	SOT-103	18	150	1000	3,7	2,3	800	14	800	750	22	41	90	10	51
BFG51	p	SOT-103	15	25	180	5	3,4	800	17	800	150			14	10	57
BFG65	n	SOT-103	10	300	300	7,5	3	2000	10,5	2000	—					65
BFG90A	n	SOT-103	15	25	180	5	2,4	800	19	800	150	8	27	14	10	71
BFG91A	n	SOT-103	12	35	300	6	2,3	800	17	800	425	17	36	30	8	79
BFG96	n	SOT-103	15	150	700	5			15	800	700	21	40	70	10	87
BFP90A	n	SOT-173	15	30	250	5	2,4	800	19	800						95
BFP91A	n	SOT-173	12	50	350	6	2,3	800	18	800						103
BFP96	n	SOT-173	15	100	500	4,5	2,5	800	15	800						109
BFQ22S	n	TO-72	12	35	150	5	1,9	500	16	500	300			30	5	115
BFQ23	p	SOT-37	12	35	180	5	2,4	500	16,5	500	300			30	5	119
BFQ23C	p	SOT-173	12	50	350	5	3,7	800	19	500						125
BFQ24	p	TO-72	12	35	150	5	2,4	500	15	500	300			30	5	133
BFQ32	p	SOT-173	15	75	500	4,2	3,75	500	14	500	500			50	10	127
BFQ32C	p	SOT-37	15	100	500	4,5	—	—	—	—						141
BFQ32S	p	SOT-37	15	100	700	4,5	—	—	—	—	600			70	10	149
BFQ33	n	SOT-100	7	20	140	12	2,5	2000	13	2000				14	5	155
BFQ34	n	SOT-122	18	150	2250	3,9	8	500	16,3	500	1200	26	45	120	15	161
BFQ34T	n	SOT-37	18	150	1000	3,7	—	—	20	300	750			90	10	171
BFQ51	p	SOT-37	15	25	180	5	2,7	500	19	500	150			14	10	181
BFQ51C	p	SOT-173	15	30	250	5	3,5	800	17	800						187

* Typical reference value at $d_{im} = -60$ dB.
** Typical reference values.

type number	n-p-n or p-n-p	envelope	RATINGS V_{CEO} V	I_C mA	P_{tot} mW	CHARACTERISTICS (typical values unless otherwise specified) f_T GHz	F dB	at f MHz	G_{UM} dB	at f MHz	V_o* mV	PL1** dBm	ITO** dBm	I_C mA	V_{CE} V	page
BFQ52	p	TO-72	15	25	150	5	2,7	500	19	500	150			14	10	195
BFQ53	n	TO-72	15	25	150	5	2,4	500	18	500	150			14	10	199
BFQ63	n	TO-72	15	75	250	4,5	<3,0	200	11,5	500	500			50	10	203
BFQ65	n	SOT-37	10	50	300	7,5	3	2000	8	2000						207
BFQ66	n	SOT-173	10	50	350	7,5	3	2000	12,5	2000						211
BFQ68	n	SOT-122	18	300	4500	4	–	–	13	800	1600	28	47	240	15	217
BFQ136	n	SOT-122	18	600	9000	4	–	–	12,5	800	2200			500	15	227
BFR49	n	SOT-100	15	25	180	5	2,5	1000	17	1000				14	10	235
BFR64	n	SOT-48	25	200	3500	1	6	200								241
BFR65	n	SOT-48	25	400	5000	>1	–	–								249
BFR90	n	SOT-37	15	25	180	5	2,4	500	19,5	500	150			14	10	257
BFR90A	n	SOT-37	15	25	180	5	1,8	800	20	500	150	8	27	14	10	265
BFR91	n	SOT-37	12	35	180	5	1,9	500	18	500	300			30	5	279
BFR91A	n	SOT-37	12	35	300	6	1,6	800	14	800	425	17	36	30	8	287
BFR94	n	SOT-48	25	150	3500	3,5	5	500	13,5	500	700			90	20	299
BFR95	n	TO-39	25	150	1500	3,5	9	200			1000			80	18	309
BFR96	n	SOT-37	15	75	500	5	3,3	500	15,2	500	500			50	10	313
BFR96S	n	SOT-37	15	100	700	5	4	800	11,5	800	700	21	40	70	10	321
BFT24	n	SOT-37	5	2,5	30	2,3	3,8	500	17	500						333
BFW16A	n	TO-39	25	150	1500	1,2	<6	200								341
BFW17A	n	TO-39	25	150	1500	1,1	–	–								351
BFW30	n	TO-72	10	50	250	1,6	<5	500			100			30	6	359
BFW92	n	SOT-37	15	25	190	1,6	4	500								365
BFW92A	n	SOT-37	15	25	200	2,8	2,5	800	13	800	150			14	10	373
BFW93	n	SOT-37	10	50	190	1,7	<5	500	10,5	800	100			30	5	377
BFX89	n	TO-72	15	25	200	1,2	3,3	200								387
BFY90	n	TO-72	15	25	200	1,4	2,5	200								399
2N918	n	TO-72	15	50	200	<0,9	<6	60	36	200						415

* Typical reference value at $d_{im} = -60$ dB.
** Typical reference values.

type	frequency range MHz	power gain dB	page
BGD102	40 - 450	18,5 ± 0,5	421
BGD102E	40 - 450	18,5 ± 0,5	425
BGD104	40 - 450	20,0 ± 0,5	421
BGD104E	40 - 450	20,0 ± 0,5	425
BGY50	40 - 300	12,5 ± 0,4	429
BGY51	40 - 300	12,5 ± 0,4	429
BGY52	40 - 300	16,4 ± 0,4	433
BGY53	40 - 300	16,4 ± 0,4	433
BGY54	40 - 300	17,0 ± 0,4	437
BGY55	40 - 300	17,0 ± 0,4	437
BGY56	40 - 300	22,0 ± 0,6	441
BGY57	40 - 300	22,0 ± 0,6	441
BGY58	40 - 300	33,0 ± 1,0	445
BGY58A	40 - 330	34,0 ± 1,0	449
BGY59	40 - 300	38,5 ± 1,0	453
BGY60	40 - 300	33,5 ± 1,0	457
BGY61	5 - 200	13,0 ± 0,5	461
BGY65	5 - 200	18,5 ± 0,5	465
BGY67	5 - 200	22,5 ± 0,5	469
BGY67A	5 - 200	24,0 ± 0,5	473
BGY70	40 - 450	12,5 ± 0,4	477
BGY71	40 - 450	12,5 ± 0,4	477
BGY74	40 - 450	17,0 ± 0,4	481
BGY75	40 - 450	17,0 ± 0,4	481
BGY78	40 - 450	34,0 ± 1,0	485
BGY84	40 - 450	17,0 ± 0,5	489
BGY84A	40 - 450	18,4 ± 0,4	493
BGY85	40 - 450	17,0 ± 0,5	489
BGY85A	40 - 450	18,4 ± 0,4	493

TYPE NUMBER SURVEY

type	frequency range MHz	transducer gain dB	output voltage at d_{im} = −60 dB dBμV	supply voltage V	page
OM320	40 - 860	15,5	⩾ 92	24	501
OM321	40 - 860	15,5	⩾ 98	24	507
OM322	40 - 860	15	⩾ 103	24	513
OM323	40 - 860	15	⩾ 112	24	519
OM323A	40 - 860	15	⩾ 112	24	519
OM335	40 - 860	27	⩾ 98	24	525
OM336	40 - 860	22	⩾ 105	24	531
OM337	40 - 860	26	⩾ 113	24	535
OM337A	40 - 860	26	⩾ 113	24	535
OM339	40 - 860	28	⩾ 105	24	543
OM345	40 - 860	12	⩾ 97	12	547
OM350	40 - 860	18	⩾ 98	12	553
OM360	40 - 860	23	⩾ 105	12	559
OM361	40 - 860	28	⩾ 105	12	565
OM370	40 - 860	28	⩾ 111	12	571

GENERAL

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.

"Although not all type numbers accord with the Pro Electron system, the following explanation is given for the ones that do."

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 ($R_{th\ j\text{-}mb} > 15$ K/W)
D. TRANSISTOR; power, audio frequency ($R_{th\ j\text{-}mb} \leqslant 15$ K/W)
E. DIODE; tunnel
F. TRANSISTOR; low power, high frequency ($R_{th\ j\text{-}mb} > 15$ K/W)
G. MULTIPLE OF DISSIMILAR DEVICES – MISCELLANEOUS; e.g. oscillator
H. DIODE; magnetic sensitive
L. TRANSISTOR; power, high frequency ($R_{th\ j\text{-}mb} \leqslant 15$ K/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 ($R_{th\ j\text{-}mb} > 15$ K/W)
S. TRANSISTOR; low power, switching ($R_{th\ j\text{-}mb} > 15$ K/W)
T. CONTROL AND SWITCHING DEVICE; e.g. thyristor, power ($R_{th\ j\text{-}mb} \leqslant 15$ K/W)
U. TRANSISTOR; power, switching ($R_{th\ j\text{-}mb} \leqslant 15$ K/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.

* When these serial numbers are exhausted the serial number for consumer types may be extended to four figures, and that for industrial types to three figures.

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

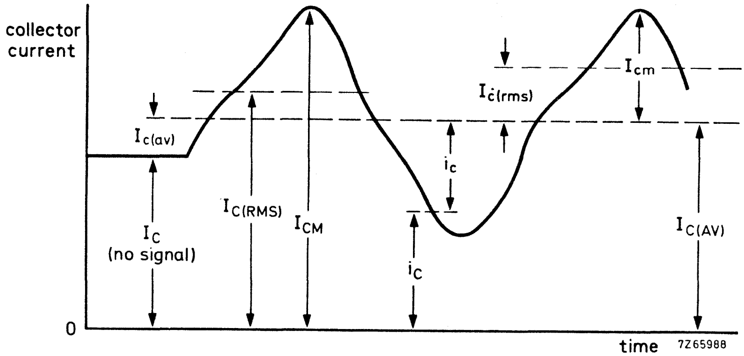
For multiple unit devices, the subscripts are modified by a number preceding the letter subscript; in the case of multiple subscripts, hyphens may be necessary to avoid misunderstanding.

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, l	=	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.

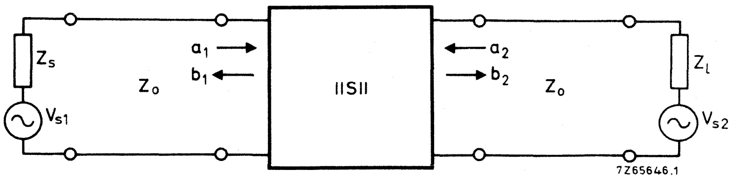
Examples: $Z_i = R_i + jX_i$
$y_{fe} = g_{fe} + jb_{fe}$

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.



$$a_1 = \frac{V_{i1}}{\sqrt{Z_o}} \qquad a_2 = \frac{V_{i2}}{\sqrt{Z_o}} \qquad {}^{1)}$$

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

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 $Z_l = Z_o$ 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 $Z_l = Z_o$ and $V_{s2} = 0$

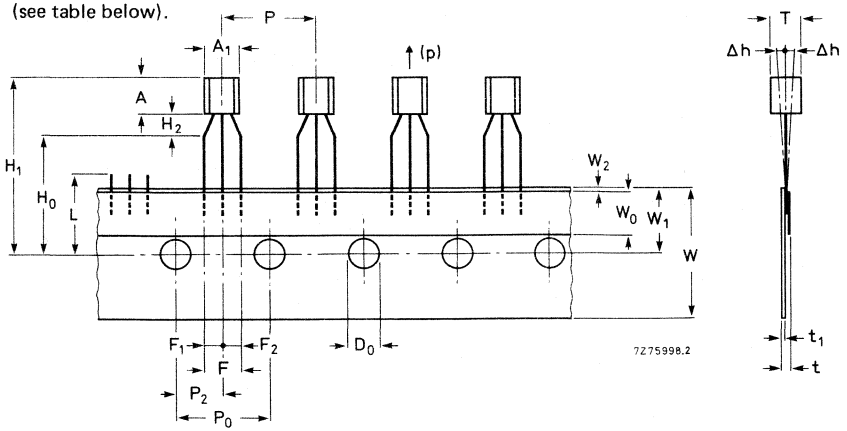
$s_o = s_{22}$ = Output reflection coefficient.
The complex ratio of the reflected wave and the incident wave at the output, under the conditions $Z_s = Z_o$ and $V_{s1} = 0$.

TO-92 VARIANT TRANSISTORS ON TAPE

MECHANICAL DATA

Dimensions in mm

Fig. 1 (see table below).



Item	Symbol	Specifications				Remarks
		min.	nom.	max.	tol.	
Body width	A_1	4,0		4,8		
Body height	A	4,8		5,2		
Body thickness	T	3,9		4,2		
Pitch of component	P		12,7		± 1	
Feed hole pitch	P_o		12,7		± 0,3	Cumulative pitch error 1,0 mm/20 pitch
Feed hole centre to component centre	P_2		6,35		± 0,4	To be measured at bottom of clinch
Distance between outer leads	F		5,08		+ 0,6 −0,2	
Component alignment	Δh		0	1		At top of body
Tape width	W		18		± 0,5	
Hold-down tape width	W_o		6		± 0,2	
Hole position	W_1		9		+ 0,7 −0,5	
Hold-down tape position	W_2		0,5		± 0,2	
Lead wire clinch height	H_o		16		± 0,5	
Component height	H_1			32,25		
Length of snipped leads	L			11,0		
Feed hole diameter	D_o		4		± 0,2	
Total tape thickness	t			1,2		t_1 0,3-0,6
Lead-to-lead distance	F_1, F_2		2,54		+ 0,4 −0,1	
Clinch height	H_2			3		
Pull-out force	(p)	6N				

PACKING

The transistors are supplied on tape in boxes (ammopack) or on reels. The number per reel is 1600 and per ammobox 2000*.

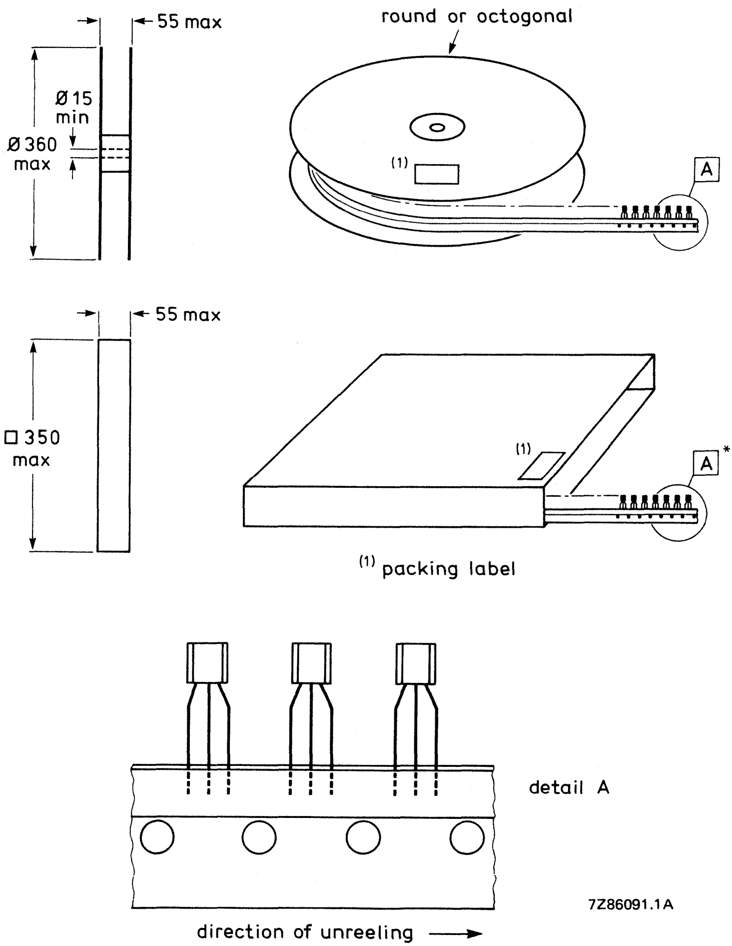


Fig. 2 Dimensions (in mm) of reel and box.

DROPOUTS

A maximum of 0,5% of the specified number of transistors in each packing may be missing. Up to 3 consecutive components may be missing provided the gap is followed by 6 consecutive components.

TAPE SPLICING

Slice the carrier tape on the back and/or front so that the feed hole pitch (P_O) is maintained (see Fig. 3).

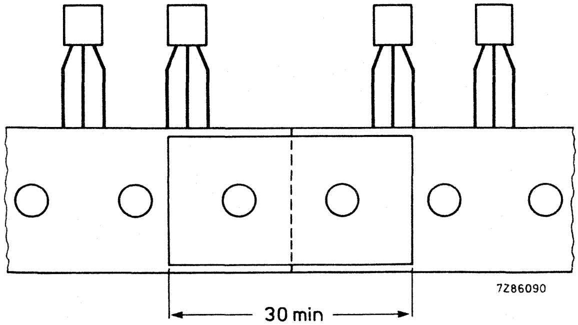


Fig. 3 Jointing tape with splicing patch.

* The ammobox has 80 layers of 25 transistors each.
Each layer contains 25 transistors plus one empty position in order to fold the layer correctly.
The ammobox is accessible from both sides enabling the user to choose between "normal" (see Fig. 2) and "reverse" tape.

SOLDERING RECOMMENDATIONS SOT-37 AND SOT-103

Transistors in SOT-37 and SOT-103 envelopes may be mounted with leads flat (Fig. 1) or bent (Figs 2 and 3). Different soldering procedures apply for the different styles of mounting.

FLAT-LEAD MOUNTING

Soldering by hand

Avoid putting any force on the leads during or just after soldering.

Solder the three leads one at a time, *not* simultaneously.

Proceed from one lead to the adjacent lead, *not* to the opposite one.

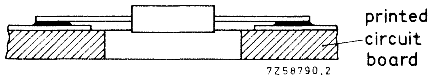


Fig. 1

Solder temperature	max.	300 °C
Soldering time	max.	5 s
Solder-to-case distance	min.	2 mm

BENT-LEAD MOUNTING

If leads are bent, all three may be soldered simultaneously if desired.

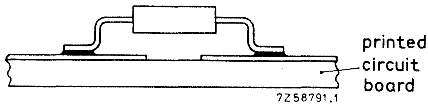


Fig. 2

Solder temperature	max.	300 °C
Soldering time	max.	10 s

DIP OR WAVE SOLDERING

When dip or wave soldering, the maximum allowable temperature of the solder is 260 °C. This temperature must not be in contact with the joint for more than 5 seconds. The total contact time of successive solder waves must not exceed 5 seconds. The device may be mounted up to the lead projections, but the temperature of the body must not exceed the specified storage maximum.

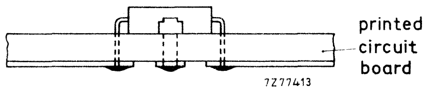


Fig. 3

Solder temperature	max.	260 °C
Soldering time	max.	5 s

RECOMMENDATIONS FOR MOUNTING ¼" CAPSTAN ENVELOPES

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

Screw thread, diameter and nuts:

stud diameter	thread	maximum diameter of threaded stud	nut thickness
¼"	8-32UNC-2A(B)	4,14 mm	3,5 mm SOT-48 5,0 mm SOT-122

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

1. Diameter of the mounting hole in the heatsink 4,15 + 0,05; –0 mm (max. 4,2 mm).
2. Heatsink surfaces at the mounting hole to be flat, parallel, and free of burrs or oxydation.
3. Torque on nut: minimum 0,75 Nm (7,5 kgcm), maximum 0,85 Nm (8,5 kgcm).
4. Recommended distance from the top surface of the heatsink to surface of printed-circuit board: 2,9 + 0; –0,2 mm.

Tension in the transistor leads sets the limit on spacing between heatsink and printed-circuit board; in general, the leads can withstand more pull in the downward direction than in the upward direction.

Solder the leads to the connection pads with resin-cored tin-lead solder, using an iron of normal temperature. Soldering iron temperatures as high as 350 ^{o}C are safely tolerable; the transistor can withstand an interior temperature of 250 ^{o}C for about ten minutes.

The leads may be tinned, if required, by dipping them into a solder bath at about 230 ^{o}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 with tap water.

DEVICE DATA

Wideband transistors

SILICON PLANAR EPITAXIAL TRANSISTOR

N-P-N transistor in a TO-92 envelope intended for application as an amplifier or oscillator in the v.h.f. and u.h.f. range.

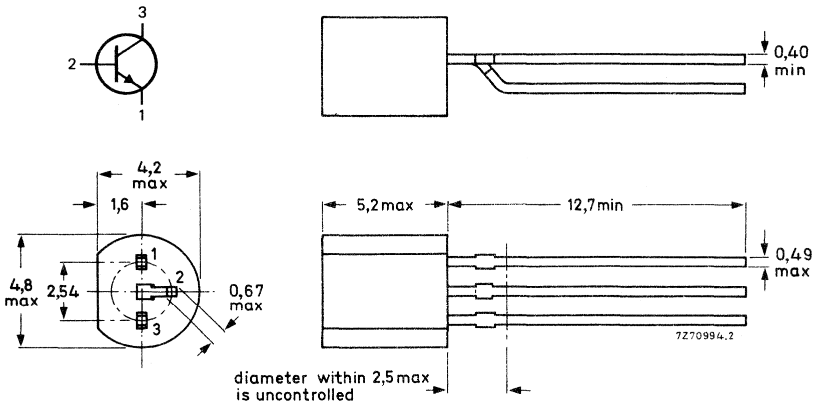
QUICK REFERENCE DATA

Collector-base voltage (open emitter)	V_{CBO}	max.	25	V
Collector-emitter voltage (open base)	V_{CEO}	max.	15	V
Collector current (d.c.)	I_C	max.	25	mA
Total power dissipation up to T_{amb} = 60 °C	P_{tot}	max.	360	mW
D.C. current gain I_C = 2 mA; V_{CE} = 5 V I_C = 20 mA; V_{CE} = 5 V	h_{FE}	> 35 to	20 70	
Transition frequency at f = 500 MHz I_C = 15 mA; V_{CE} = 5 V	f_T	typ.	1,8	GHz

MECHANICAL DATA

Dimensions in mm

Fig. 1 TO-92 variant.



RATINGS

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

Collector-base voltage (open emitter)	V_{CBO}	max.	25	V
Collector-emitter voltage				
$R_{BE} \leq 50\ \Omega$	V_{CER}	max.	25	V
$I_B = 0$	V_{CEO}	max.	15	V
Emitter-base voltage (open collector)	V_{EBO}	max.	3,5	V
Collector current				
average	I_{CAV}	max.	25	mA
peak value; $t_{on} < 1\ \mu s$	I_{CM}	max.	50	mA
Total power dissipation up to $T_{amb} = 60\ ^oC$	P_{tot}	max.	360	mW
Junction temperature	T_j	max.	150	^oC
Storage temperature	T_{stg}	−55 to +150		^oC

THERMAL RESISTANCE

From junction to ambient in free air	$R_{th\ j\text{-}a}$	max.	250	K/W

CHARACTERISTICS

$T_j = 25\ ^oC$ unless otherwise specified

Collector cut-off current				
$V_{CB} = 15$ V; $I_E = 0$	I_{CBO}	max.	50	nA
Emitter cut-off current				
$V_{EB} = 2$ V; $I_C = 0$	I_{EBO}	max.	1	μA
Saturation voltages				
$I_C = 25$ mA; $I_B = 1{,}25$ mA	V_{CEsat}	max.	1	V
	V_{BEsat}	max.	1	V
D.C. current gain				
$I_C = 2$ mA; $V_{CE} = 5$ V	h_{FE}	min.	20	
$I_C = 20$ mA; $V_{CE} = 5$ V	h_{FE}	35 to	70	
Transition frequency at f = 500 MHz				
$I_C = 15$ mA; $V_{CE} = 5$ V	f_T	typ.	1,8	GHz
Feedback capacitance				
$I_C = 2$ mA; $V_{CE} = 5$ V	C_{re}	typ.	1,1	pF
Noise figure at f = 100 MHz				
$I_C = 2$ mA; $V_{CE} = 5$ V; $R_S = 60\ \Omega$	F	typ.	4	dB
Noise figure at f = 200 MHz				
$I_C = 2$ mA; $V_{CE} = 5$ V; $R_S = 60\ \Omega$	F	typ.	3	dB
Power gain at f = 100 MHz				
$I_C = 2$ mA; $V_{CE} = 5$ V; $R_S = 60\ \Omega$; $R_L = 2\ k\Omega$	G_P	typ.	16	dB
Power gain at f = 200 MHz				
$I_C = 2$ mA; $V_{CE} = 5$ V; $R_S = 60\ \Omega$; $R_L = 920\ \Omega$	G_P	typ.	16	dB

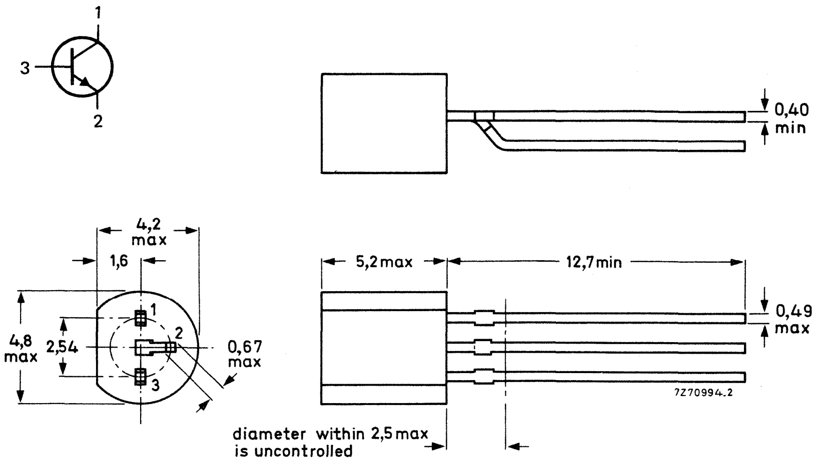
H.F. SILICON PLANAR EPITAXIAL TRANSISTOR

N-P-N transistor in a TO-92 envelope. It is primarily intended for use in H.F. amplifiers and u.h.f. oscillators.

QUICK REFERENCE DATA

Collector-emitter breakdown voltage	$V_{(BR)CEO}$	max.	15	V
Collector-base breakdown voltage	$V_{(BR)CBO}$	max.	25	V
Collector current (d.c.)	I_C	max.	25	mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	500	mW
Junction temperature	T_j	max.	150	°C
D.C. current gain I_C = 5 mA; V_{CE} = 10 V	h_{FE}	min. max.	25 250	
Transition frequency at f = 100 MHz I_C = 5 mA; V_{CE} = 10 V	f_T	typ.	1,8	GHz
Noise figure at R_G = 60 Ω I_C = 5 mA; V_{CE} = 10 V; f = 800 MHz	F	typ.	5	dB

Fig. 1 TO-92var. Dimensions in mm



RATINGS

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

Collector-emitter voltage	V_{CEO}	max.	15	V
Collector-base voltage	V_{CBO}	max.	25	V
Collector current (d.c.)	I_C	max.	25	mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	500	mW
Junction temperature	T_j	max.	150	°C
Storage temperature	T_s	−65 to +	150	°C

THERMAL RESISTANCE

From junction to ambient	$R_{th\ j\text{-}a}$	<	250	K/W

CHARACTERISTICS

Collector-emitter breakdown voltage I_C = 1 mA; I_B = 0	$V_{(BR)CEO}$	max.	15	V
Collector-base breakdown voltage I_C = 10 mA; I_E = 0	$V_{(BR)CBO}$	max.	25	V
Collector cut-off current I_E = 0; V_{CB} = 10 V	I_{CBO}	max.	50	nA
D.C. current gain I_C = 5 mA; V_{CE} = 10 V	h_{FE}	min.	25	
		max.	250	
Collector-emitter saturation voltage I_C = 10 mA; I_B = 1 mA	V_{CEsat}	max.	0,5	V
Transition frequency at f = 100 MHz I_C = 5 mA; V_{CE} = 10 V	f_T	typ.	1,8	GHz
Noise figure at R_G = 60 Ω I_C = 5 mA; V_{CE} = 10 V; f = 800 MHz	F	typ.	5	dB

SILICON WIDEBAND TRANSISTOR

Silicon-epitaxial p-n-p transistor in a four-lead dual emitter plastic envelope (SOT-103). This device is designed for application in linear wideband amplifiers up to 2 GHz.

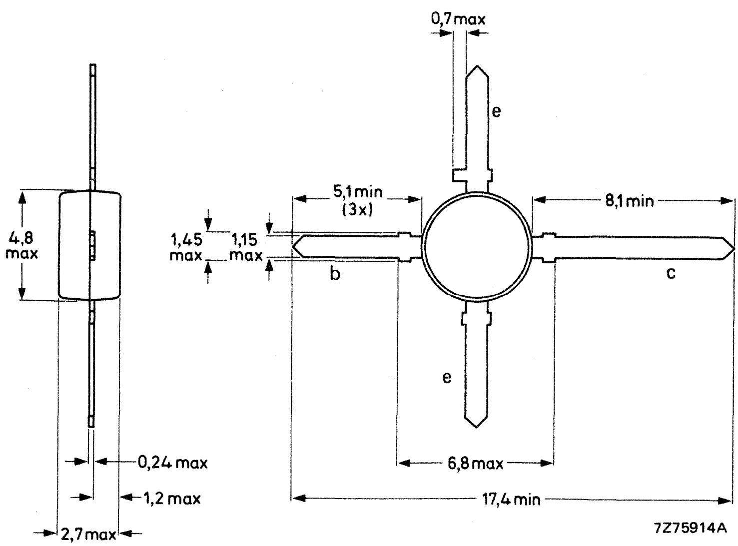
QUICK REFERENCE DATA

Collector-base voltage (open emitter)	$-V_{CBO}$	max.	15 V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	12 V
Collector current (d.c.)	$-I_C$	max.	35 mA
Total power dissipation up to T_{amb} = 60 °C	P_{tot}	max.	180 mW
Junction temperature	T_j	max.	150 °C
Transition frequency at f = 500 MHz $-I_C$ = 30 mA; $-V_{CE}$ = 5 V	f_T	typ.	5 GHz
Feedback capacitance at f = 1 MHz $-I_C$ = 0; $-V_{CE}$ = 10 V	C_{re}	typ.	0,8 pF
Noise figure at optimum source impedance $-I_C$ = 30 mA; $-V_{CE}$ = 8 V; f = 800 MHz	F	typ.	3,7 dB

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-103.



RATINGS

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

Collector-base voltage (open emitter)	$-V_{CBO}$	max.	15	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	12	V
Emitter-base voltage (open collector)	$-V_{EBO}$	max.	2,0	V
Collector current				
d.c.	$-I_C$	max.	35	mA
peak value; f > 1 MHz	$-I_{CM}$	max.	50	mA
Total power dissipation up to T_{amb} = 60 °C	P_{tot}	max.	180	mW
Storage temperature	T_{stg}		−65 to +150	°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

From junction to ambient (free air) mounted on a fibre-glass print (see Fig. 2)	$R_{th\ j\text{-}a}$		500	K/W

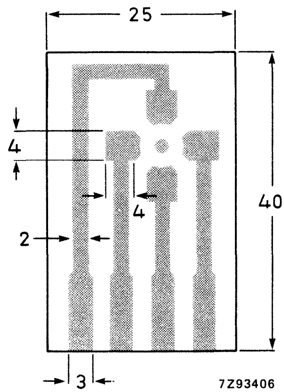


Fig. 2 Requirements for fibre-glass print (dimensions in mm). Single-sided 35 μm Cu-clad epoxy fibre-glass print, thickness 1,5 mm. Tracks are fully tin-lead plated. Shaded area is Cu.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current $I_E = 0$; $-V_{CB}$ = 5 V	$-I_{CBO}$	max.	50	nA
D.C. current gain * $-I_C$ = 30 mA; $-V_{CE}$ = 5 V	h_{FE}	min.	20	
Transition frequency at f = 500 MHz * $-I_C$ = 30 mA; $-V_{CE}$ = 5 V	f_T	typ.	5,0	GHz
Noise figure at optimum source impedance and $-V_{CE}$ = 8 V; f = 800 MHz; T_{amb} = 25 °C				
at $-I_C$ = 4 mA	F	typ.	2,3	dB
at $-I_C$ = 30 mA	F	typ.	3,7	dB

* Measured under pulse conditions.

Collector capacitance at f = 1 MHz $I_E = i_e = 0$; $-V_{CB} = 5$ V	C_c	typ.	1,35 pF
Emitter capacitance at f = 1 MHz $I_C = i_c = 0$; $-V_{EB} = 0{,}5$ V	C_e	typ.	1,8 pF
Feedback capacitance at f = 1 MHz $I_C = 0$; $-V_{CE} = 10$ V	C_{re}	typ.	0,8 pF
Maximum unilateral power gain at $T_{amb} = 25\ ^oC$ $G_{UM}\ (\text{in dB}) = 10 \log \dfrac{\lvert s_{fe}\rvert^2}{[1-\lvert s_{ie}\rvert^2][1-\lvert s_{oe}\rvert^2]}$ $-I_C = 30$ mA; $V_{CE} = 5$ V; f = 800 MHz $-I_C = 30$ mA; $V_{CE} = 5$ V; f = 2 GHz	G_{UM}	typ. typ.	14,5 dB 6,5 dB
Intermodulation distortion (see Fig. 3) $-I_C = 30$ mA; $-V_{CE} = 8$ V; $R_L = 75\ \Omega$; VSWR < 2; $T_{amb} = 25\ ^oC$ $V_p = V_o = 400$ mV at $f_p = 795{,}25$ MHz $V_q = V_o - 6$ dB at $f_q = 803{,}25$ MHz $V_r = V_o - 6$ dB at $f_r = 805{,}25$ MHz measured at $f_{(p+q-r)} = 793{,}25$ MHz	d_{im}	typ.	−60 dB
Second harmonic distortion (see Fig. 3) $-I_C = 30$ mA; $-V_{CE} = 8$ V; $R_L = 75\ \Omega$; VSWR < 2; $T_{amb} = 25\ ^oC$ $V_p = V_o = 60$ mV at $f_p = 250$ MHz $V_q = V_o = 60$ mV at $f_q = 560$ MHz measured at $f_{(p+q)} = 810$ MHz	d_2	typ.	−50 dB

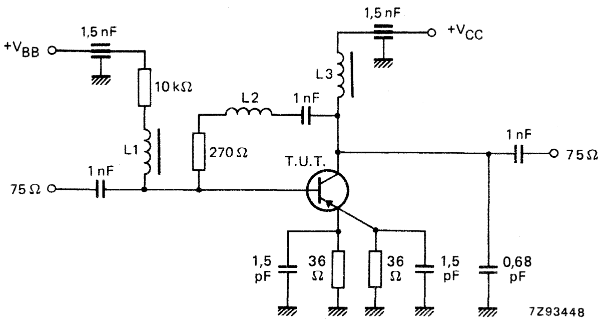


Fig. 3 Intermodulation distortion and second harmonic distortion MATV test circuit.

L1 = L3 = 5 μH micro-choke

L2 = 3 turns Cu wire (0,4 mm), internal diameter 3 mm, winding pitch 1 mm

s-parameters (common emitter) at V_{CE} = 5 V

I_C mA	f MHz	s_{ie}	s_{fe}	s_{re}	s_{oe}	G_{UM} dB
	40	0,54/ −29,5°	12,28/168,4°	0,02/ 78,6°	0,97/ −11,8°	36,1
	100	0,56/ −64,9°	11,14/149,9°	0,04/ 65,3°	0,89/ −27,2°	29,3
	200	0,61/−103,7°	8,87/130,0°	0,07/ 50,0°	0,73/ −44,8°	24,3
5	500	0,65/−154,8°	4,54/ 97,4°	0,09/ 34,6°	0,42/ −69,9°	16,4
	800	0,66/−171,6°	3,06/ 82,9°	0,10/ 34,4°	0,41/ −80,1°	13,0
	1000	0,68/−179,6°	2,51/ 73,4°	0,11/ 34,2°	0,42/ −89,7°	11,6
	2000	0,67/ 144,3°	1,28/ 49,7°	0,15/ 49,5°	0,29/−115,8°	5,1
	40	0,31/ −53,6°	17,95/165,0°	0,01/ 76,2°	0,95/ −16,1°	35,6
	100	0,43/ −98,5°	15,36/144,0°	0,03/ 61,9°	0,82/ −36,2°	29,5
	200	0,56/−131,6°	11,30/123,0°	0,05/ 49,0°	0,63/ −57,4°	24,9
10	500	0,65/−169,0°	5,25/ 94,1°	0,07/ 43,5°	0,33/ −86,7°	17,3
	800	0,66/ 178,8°	3,49/ 81,7°	0,08/ 46,8°	0,33/ −95,0°	13,8
	1000	0,67/ 172,7°	2,81/ 72,7°	0,09/ 47,6°	0,35/−104,4°	12,1
	2000	0,67/ 140,0°	1,47/ 51,5°	0,15/ 58,5°	0,22/−133,4°	6,2
	40	0,21/−116,7°	22,60/162,0°	0,01/ 73,9°	0,91/ −20,1°	35,1
	100	0,42/−134,0°	18,46/138,9°	0,02/ 61,2°	0,75/ −44,0°	29,8
	200	0,57/−154,2°	12,68/118,0°	0,03/ 52,4°	0,55/ −67,8°	25,3
20	500	0,66/−178,3°	5,75/ 92,1°	0,05/ 54,5°	0,29/−101,8°	18,0
	800	0,66/ 173,0°	3,77/ 79,9°	0,07/ 57,8°	0,29/−108,3°	14,4
	1000	0,66/ 168,7°	3,00/ 72,0°	0,09/ 57,6°	0,31/−116,7°	12,5
	2000	0,68/ 137,5°	1,56/ 52,1°	0,16/ 63,8°	0,20/−150,2°	6,8
	40	0,29/−147,1°	23,95/161,0°	0,01/ 72,2°	0,88/ −21,8°	34,6
	100	0,47/−151,7°	19,33/137,4°	0,02/ 62,0°	0,72/ −47,2°	29,9
	200	0,59/−162,6°	12,97/116,4°	0,03/ 56,1°	0,51/ −72,0°	25,4
30	500	0,68/ 177,7°	5,74/ 91,3°	0,05/ 60,1°	0,27/−107,9°	18,2
	800	0,66/ 170,0°	3,77/ 79,3°	0,07/ 62,5°	0,27/−113,2°	14,4
	1000	0,67/ 166,6°	3,00/ 71,6°	0,08/ 61,8°	0,30/−121,1°	12,5
	2000	0,70/ 136,5°	1,56/ 52,0°	0,16/ 65,9°	0,20/−156,2°	6,9

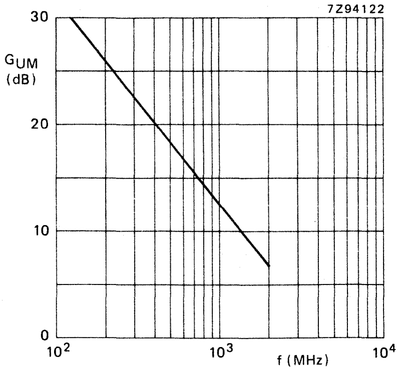


Fig. 4 V_{CE} = 5 V; I_C = 30 mA; T_{amb} = 25 °C.

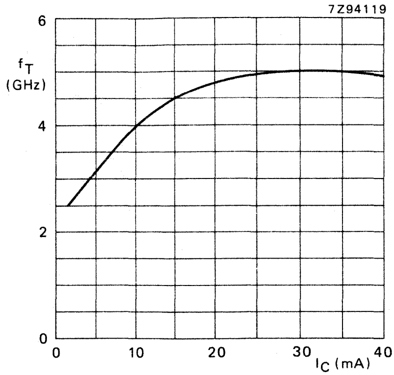


Fig. 5 V_{CE} = 5 V; f = 500 MHz; T_{amb} = 25 °C.

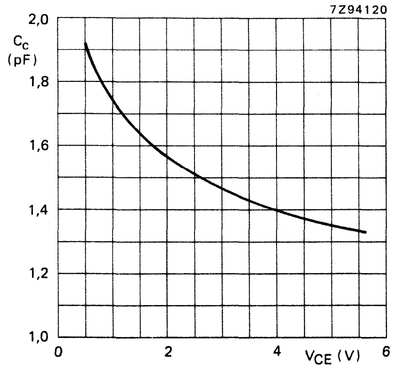


Fig. 6 $I_E = i_e = 0$; f = 1 MHz; T_j = 25 °C.

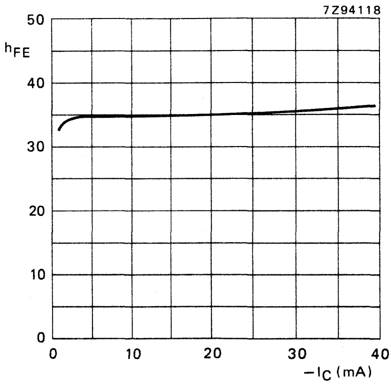


Fig. 7.

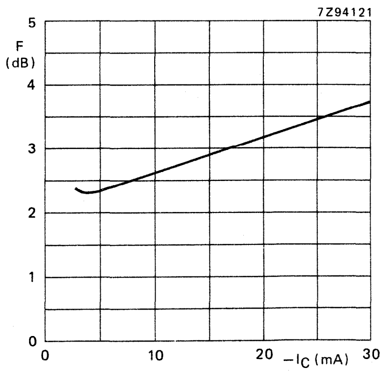


Fig. 8 V_{CE} = 8 V; f = 800 MHz; Z_S = opt.; T_{amb} = 25 °C.

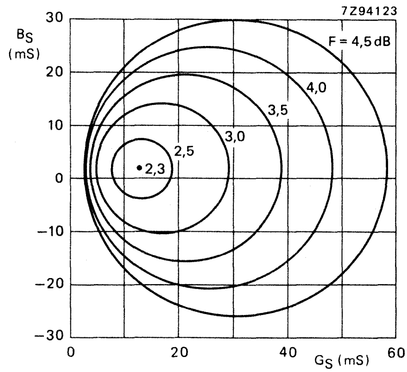


Fig. 9 V_{CE} = 8 V; I_C = 4 mA; f = 800 MHz.

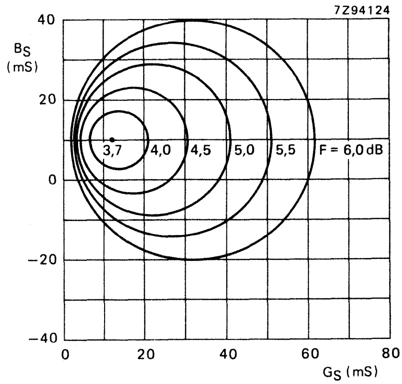


Fig. 10 V_{CE} = 8 V; I_C = 30 mA; f = 800 MHz.

SILICON PLANAR TRANSISTOR

Silicon-epitaxial p-n-p transistor in a four-lead dual emitter plastic envelope (SOT-103). The device is designed for application in linear wideband amplifiers up to 2 GHz.

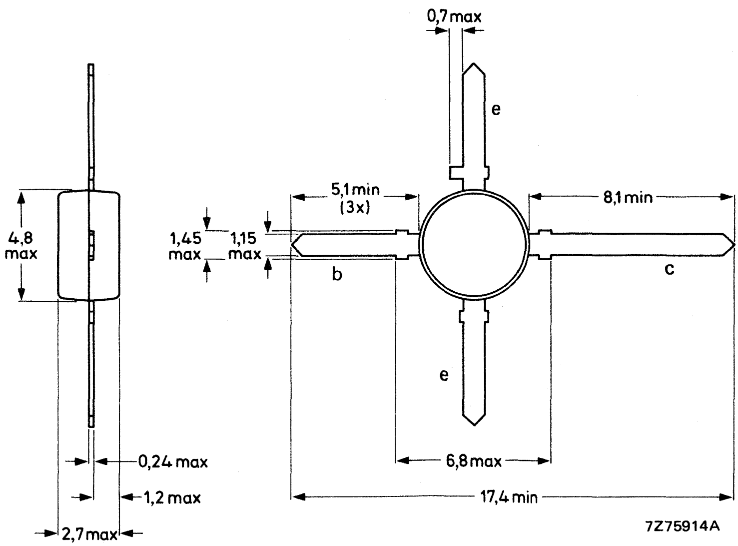
QUICK REFERENCE DATA

Collector-base voltage (open emitter)	$-V_{CBO}$	max.	20 V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	15 V
Collector current (d.c.)	$-I_C$	max.	75 mA
Total power dissipation up to T_{amb} = 70 °C	P_{tot}	max.	700 mW
Junction temperature	T_j	max.	175 °C
Transition frequency at f = 500 MHz $-I_C$ = 50 mA; $-V_{CE}$ = 10 V	f_T	typ.	4,5 GHz
Feedback capacitance at f = 1 MHz $-I_C$ = 0; $-V_{CE}$ = 10 V	C_{re}	typ.	1,4 pF
Noise figure at optimum source impedance $-I_C$ = 50 mA; $-V_{CE}$ = 10 V; f = 800 MHz	F	typ.	4,3 dB

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-103.



RATINGS

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

Collector-base voltage (open emitter)	$-V_{CBO}$	max.	20	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	15	V
Emitter-base voltage (open collector)	$-V_{EBO}$	max.	3,0	V
Collector current				
d.c.	$-I_C$	max.	75	mA
peak value; > 1 MHz	$-I_{CM}$	max.	150	mA
Total power dissipation up to T_{amb} = 70 °C mounted on print (see Fig. 2)	P_{tot}	max.	700	mW
Storage temperature	T_{stg}		−65 to +175	°C
Junction temperature	T_j	max.	175	°C

THERMAL RESISTANCE

From junction to ambient (free air) mounted on a fibre-glass print (see Fig. 2)	$R_{th\ j\text{-}a}$	150	K/W
	$R_{th\ j\text{-}c}$	75	K/W

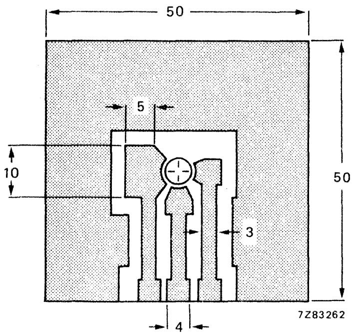


Fig. 2 Requirements for fibre-glass print (dimensions in mm). Single-sided 35 μm Cu-clad epoxy fibre-glass print, thickness 1,5 mm. Tracks are fully tin-lead plated. Shaded area is Cu.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current $I_E = 0$; $-V_{CB} = 10$ V	$-I_{CBO}$	max.	100	nA
D.C. current gain * $-I_C = 50$ mA; $-V_{CE} = 10$ V	h_{FE}	min.	20	
Transition frequency at f = 500 MHz * $-I_C = 50$ mA; $-V_{CE} = 10$ V	f_T	typ.	4,5	GHz
Noise figure at optimum source impedance and $-I_C = 50$ mA; $-V_{CE} = 10$ V; f = 800 MHz; T_{amb} = 25 °C	F	typ.	4,3	dB

* Measured under pulse conditions

Collector capacitance at f = 1 MHz			
$I_E = i_e = 0; -V_{CB} = 10$ V	C_c	typ.	2,0 pF
Emitter capacitance at f = 1 MHz			
$I_C = i_c = 0; -V_{EB} = 0,5$ V	C_e	typ.	5,0 pF
Feedback capacitance at f = 1 MHz			
$I_C = 0; -V_{CE} = 10$ V	C_{re}	typ.	1,4 pF
Maximum unilateral power gain at $T_{amb} = 25\ ^oC$			
$G_{UM} = 10 \log \frac{\lvert s_{fe} \rvert^2}{[1 - \lvert s_{ie} \rvert^2][1 - \lvert s_{oe} \rvert^2]}$			
$-I_C = 50$ mA; $-V_{CE} = 10$ V; f = 800 MHz	G_{UM}	typ.	13,0 dB
$-I_C = 50$ mA; $-V_{CE} = 10$ V; f = 2 GHz	G_{UM}	typ.	6,0 dB
Intermodulation distortion (see Fig. 3)			
$-I_C = 70$ mA; $-V_{CE} = 10$ V; $R_L = 75\ \Omega$; VSWR < 2; $T_{amb} = 25\ ^oC$			
$V_p = V_o = 500$ mV at $f_p = 795,25$ MHz			
$V_q = V_o - 6$ dB at $f_q = 803,25$ MHz			
$V_r = V_o - 6$ dB at $f_r = 805,25$ MHz			
measured at $f_{(p+q-r)} = 793,25$ MHz	d_{im}	typ.	−60 dB
Second harmonic distortion (see Fig. 3)			
$-I_C = 70$ mA; $-V_{CE} = 10$ V; $R_L = 75\ \Omega$; VSWR < 2; $T_{amb} = 25\ ^oC$			
$V_p = V_o = 150$ mV at $f_p = 250$ MHz			
$V_q = V_o = 150$ mV at $f_q = 560$ MHz			
measured at $f_{(p+q)} = 810$ MHz	d_2	typ.	−50 dB

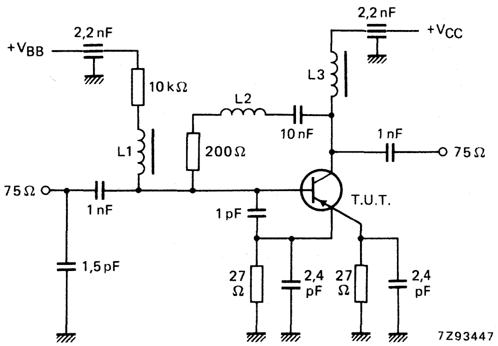


Fig. 3 Intermodulation distortion and second harmonic distortion test circuit.

L1 = L3 = 5 μH micro-choke
L2 = 1,5 turns Cu wire (0,4 mm), internal diameter 3 mm, winding pitch 1 mm

s-parameters (common emitter) at V_{CE} = 10 V

I_C mA	f MHz	s_{ie}	s_{fe}	s_{re}	s_{oe}	G_{UM} dB
	40	0,75/ −42,7°	13,76/159,7°	0,03/ 70,9°	0,93/ −20,1°	35,4
	100	0,74/ −90,7°	10,76/133,3°	0,06/ 49,2°	0,74/ −41,9°	27,5
	200	0,75/−128,8°	6,95/112,1°	0,08/ 33,6°	0,52/ −59,2°	21,8
5	500	0,74/−167,7°	2,99/ 83,6°	0,09/ 25,1°	0,32/ −79,5°	13,4
	800	0,74/−178,7°	2,01/ 69,0°	0,10/ 26,8°	0,37/ −89,3°	10,1
	1000	0,74/−172,2°	1,62/ 59,3°	0,11/ 27,7°	0,41/ −99,6°	8,4
	2000	0,76/ 139,8°	0,80/ 33,3°	0,14/ 47,5°	0,40/−139,1°	2,6
	40	0,61/ −63,4°	22,06/153,0°	0,03/ 65,7°	0,88/ −30,7°	35,3
	100	0,67/−115,6°	15,20/124,9°	0,05/ 44,3°	0,62/ −61,2°	28,4
	200	0,73/−146,7°	8,95/106,0°	0,06/ 34,0°	0,41/ −85,1°	23,1
10	500	0,74/−176,1°	3,76/ 83,3°	0,07/ 36,2°	0,25/−117,2°	15,3
	800	0,73/ 173,2°	2,46/ 70,5°	0,09/ 40,5°	0,28/−119,4°	11,5
	1000	0,73/ 168,5°	1,95/ 62,1°	0,10/ 41,8°	0,33/−126,0°	9,6
	2000	0,75/ 137,4°	1,01/ 38,2°	0,16/ 53,3°	0,31/−159,4°	4,1
	40	0,50/ −93,5°	30,50/146,0°	0,02/ 60,6°	0,81/ −43,2°	35,5
	100	0,66/−138,4°	18,73/118,4°	0,03/ 42,7°	0,53/ −82,0°	29,4
	200	0,72/−160,8°	10,50/101,8°	0,04/ 38,9°	0,38/−111,9°	24,3
20	500	0,74/ 178,5°	4,30/ 83,3°	0,06/ 48,9°	0,28/−148,3°	16,5
	800	0,73/ 168,9°	2,78/ 71,6°	0,08/ 52,5°	0,30/−147,7°	12,6
	1000	0,73/ 165,2°	2,22/ 63,3°	0,09/ 52,3°	0,54/−150,6°	10,7
	2000	0,75/ 135,5°	1,16/ 42,2°	0,17/ 57,5°	0,30/ 176,9°	5,3
	40	0,48/−111,8°	34,57/142,5°	0,02/ 58,6°	0,76/ −50,3°	35,7
	100	0,67/−148,2°	20,08/115,3°	0,03/ 43,8°	0,50/ −93,2°	29,9
	200	0,73/−166,2°	10,99/ 99,9°	0,03/ 43,7°	0,38/−124,1°	24,8
30	500	0,74/ 175,8°	4,50/ 83,2°	0,05/ 55,4°	0,32/−158,2°	17,0
	800	0,73/ 168,4°	2,08/ 72,1°	0,08/ 57,7°	0,32/−157,9°	13,0
	1000	0,73/ 164,3°	2,32/ 64,2°	0,09/ 56,6°	0,35/−159,8°	11,2
	2000	0,75/ 134,8°	1,21/ 44,0°	0,17/ 59,2°	0,32/ 167,5°	5,8
	40	0,49/−131,2°	38,80/139,8°	0,01/ 57,1°	0,70/ −58,7°	35,9
	100	0,69/−157,6°	21,05/112,6°	0,02/ 46,5°	0,48/−104,7°	30,3
	200	0,73/−171,3°	11,50/ 98,3°	0,03/ 49,5°	0,39/−134,9°	25,2
50	500	0,75/ 174,1°	4,60/ 82,4°	0,05/ 61,6°	0,35/−165,6°	17,4
	800	0,73/ 166,8°	2,97/ 71,5°	0,08/ 62,0°	0,34/−165,3°	13,4
	1000	0,73/ 162,7°	2,37/ 64,1°	0,09/ 59,9°	0,37/−166,8°	11,4
	2000	0,76/ 134,0°	1,24/ 45,3°	0,18/ 60,9°	0,34/ 160,9°	6,2

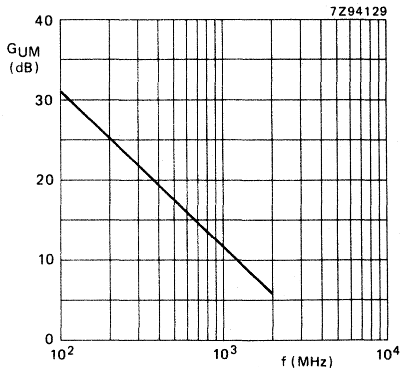


Fig. 4 V_{CE} = 10 V; I_C = 50 mA; T_{amb} = 25 °C

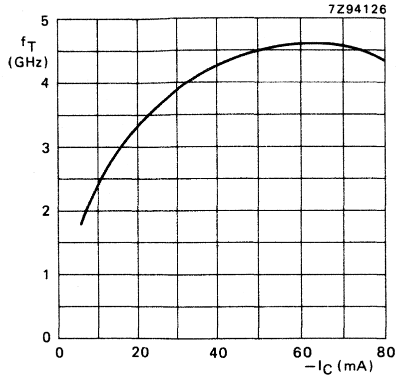


Fig. 5 V_{CE} = 10 V; f = 500 MHz; T_{amb} = 25 °C.

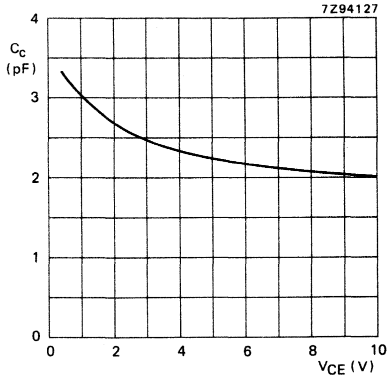


Fig. 6 $I_E = i_e = 0$; f = 1 MHz; T_j = 25 °C.

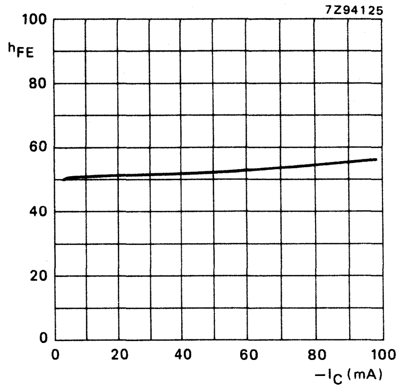


Fig. 7.

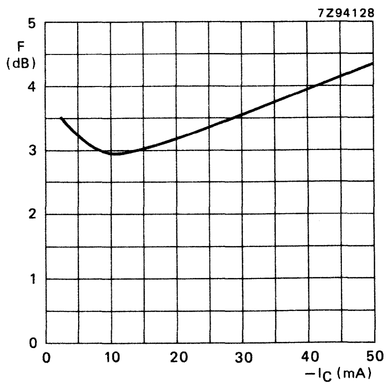


Fig. 8 V_{CE} = 10 V; f = 800 MHz; Z_S = opt.; T_{amb} = 25 °C.

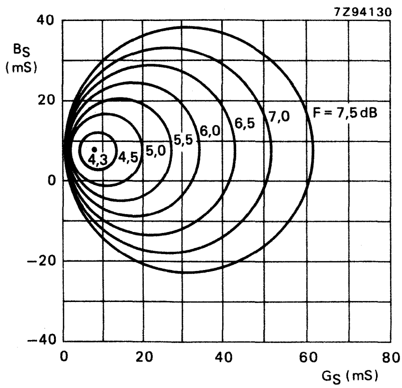


Fig. 9 V_{CE} = 10 V; I_C = 50 mA; f = 800 MHz.

SILICON WIDEBAND TRANSISTOR

Silicon epitaxial n-p-n transistor in a four-lead dual-emitter plastic envelope (SOT-103). This device is designed for wideband application in CATV and MATV amplifier systems and features high output voltage capabilities.

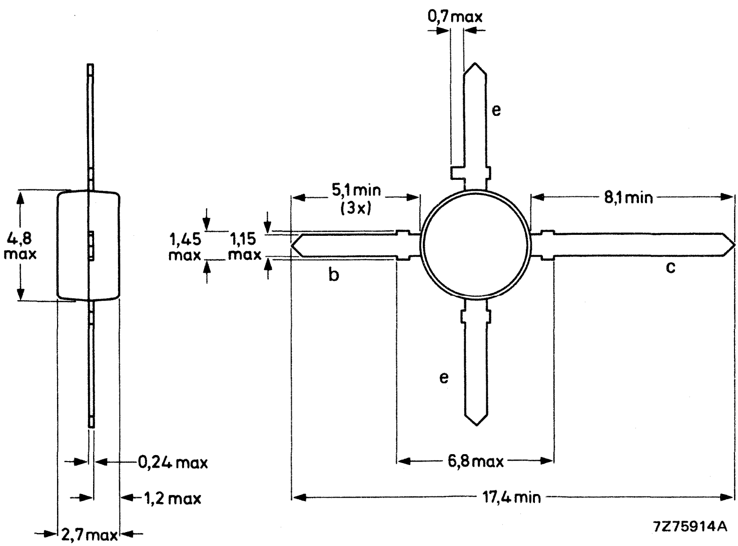
QUICK REFERENCE DATA

Collector-base voltage (open emitter)	V_{CBO}	max.	25 V
Collector-emitter voltage (open base)	V_{CEO}	max.	18 V
Collector current (d.c.)	I_C	max.	150 mA
Total power dissipation up to T_{amb} = 45 °C	P_{tot}	max.	1 W
Junction temperature	T_j	max.	175 °C
D.C. current gain I_C = 100 mA; V_{CE} = 10 V	h_{FE}	min.	25
Transition frequency at f = 500 MHz I_C = 100 mA; V_{CE} = 10 V	f_T	typ.	3,7 GHz
Noise figure at optimum source impedance I_C = 20 mA; V_{CE} = 10 V; f = 800 MHz	F	typ.	2,3 dB
Output power at 1 dB gain compression V_{CE} = 10 V; I_C = 90 mA; f = 800 MHz	P_{L1}	typ.	+22 dBm
Third order intercept point V_{CE} = 10 V; I_C = 90 mA; f = 800 MHz	ITO	typ.	+41 dBm

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-103.



RATINGS

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

Collector-base voltage (open emitter)	V_{CBO}	max.	25	V
Collector-emitter voltage (open base)	V_{CEO}	max.	18	V
Emitter-base voltage (open collector)	V_{EBO}	max.	2	V
Collector current (d.c.)	I_C	max.	150	mA
Total power dissipation up to T_{amb} = 45 °C mounted on a fibre-glass p.c.b. (see Fig. 2)	P_{tot}	max.	1	W
Storage temperature	T_{stg}		−65 to +175	°C
Junction temperature	T_j	max.	175	°C

THERMAL RESISTANCE

From junction to ambient mounted on a glass-fibre p.c.b. (see Fig. 2)	$R_{th\ j\text{-}a}$	=	130	K/W
	$R_{th\ j\text{-}c}$	=	50	K/W

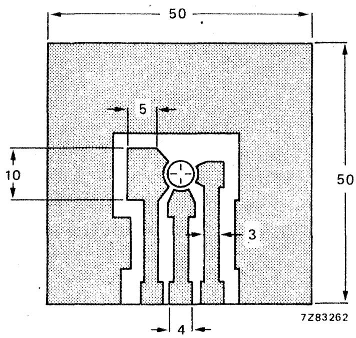


Fig. 2 Requirements for fibre-glass print (dimensions in mm). Single-sided 35 μm Cu-clad epoxy fibre-glass print, thickness 1,5 mm. Tracks are fully tin-lead plated. Shaded area is Cu.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current $I_E = 0$; V_{CB} = 10 V	I_{CBO}	max.	200	nA
D.C. current gain * I_C = 100 mA; V_{CE} = 10 V	h_{FE}	min.	25	
Transition frequency at f = 500 MHz * I_C = 100 mA; V_{CE} = 10 V	f_T	typ.	3,7	GHz
Collector output capacitance at f = 1 MHz $I_E = i_e = 0$; V_{CB} = 10 V	C_c	typ.	2,3	pF
Emitter capacitance at f = 1 MHz $I_C = i_e = 0$; V_{EB} = 0,5 V	C_e	typ.	10	pF
Feedback capacitance at f = 1 MHz $I_E = 0$; V_{CB} = 10 V	C_{re}	typ.	1,2	pF

* Measured under pulse conditions.

Maximum unilateral power gain at T_{amb} = 25 °C

$$G_{UM}\ (\text{in dB}) = 10 \log \frac{|s_{fe}|^2}{[1-|s_{ie}|^2][1-|s_{oe}|^2]}$$

I_C = 100 mA; V_{CB} = 10 V; f = 800 MHz	G_{UM}	typ.	14 dB
I_C = 100 mA; V_{CE} = 10 V; f = 2 GHz		typ.	7 dB
Noise figure at optimum source impedance			
I_C = 20 mA; V_{CE} = 10 V; f = 800 MHz	F	typ.	2,3 dB
Output power at 1 dB gain compression			
V_{CE} = 10 V; I_C = 90 mA; f = 800 MHz	P_{L1}	typ.	+22 dBm
V_{CE} = 10 V; I_C = 100 mA; f = 300 MHz		typ.	+24 dBm
Third order intercept point			
V_{CE} = 10 V; I_C = 90 mA; f = 800 MHz	ITO	typ.	+41 dBm
V_{CE} = 10 V; I_C = 100 mA; f = 300 MHz		typ.	+43 dBm

Intermodulation distortion (see Fig. 3)
I_C = 100 mA; V_{CE} = 10 V; R_L = 75 Ω;
VSWR < 2; T_{amb} = 25 °C

$V_p = V_o$ at d_{im} = −60 dB, f_p = 795,25 MHz
$V_q = V_o - 6$ dB at f_q = 803,25 MHz
$V_r = V_o - 6$ dB at f_r = 805,25 MHz

measured at $f_{(p+q-r)}$ = 793,25 MHz — V_o typ. 750 mV

Second harmonic distortion (see Fig. 3)
I_C = 100 mA; V_{CE} = 10 V; R_L = 75 Ω;
VSWR < 2; T_{amb} = 25 °C

$V_p = V_o$ = 316 mV at f_p = 250 MHz
$V_q = V_o$ = 316 mV at f_q = 560 MHz

measured at $f_{(p+q)}$ = 810 MHz — d_2 typ. −55 dB

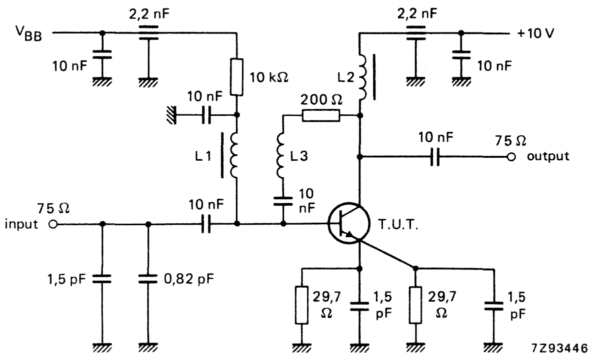


Fig. 3 Intermodulation distortion and second harmonic distortion test circuit.

L1 = L2 = 5 μH Ferroxcube choke
L3 = 2 turns Cu wire (0,5 mm), internal diameter 4 mm, winding pitch 2 mm

s-parameters (common emitter) at V_{CE} = 10 V

I_C mA	f MHz	s_{ie}	s_{fe}	s_{re}	s_{oe}	G_{UM} dB
	40	0,91/ −40,7°	13,50/156,6°	0,03/ 69,3°	0,95/ −16,4°	40,1
	100	0,95/ −87,6°	10,34/131,2°	0,05/ 46,6°	0,77/ −32,1°	29,6
	200	0,85/−126,7°	6,59/109,7°	0,07/ 30,2°	0,59/ −42,3°	22,9
5	500	0,78/−167,3°	2,81/ 79,9°	0,07/ 20,9°	0,45/ −58,1°	14,1
	800	0,78/ 177,2°	1,84/ 64,7°	0,07/ 27,3°	0,51/ −73,6°	10,7
	1000	0,78/ 169,7°	1,47/ 54,6°	0,07/ 33,5°	0,56/ −86,6°	9,1
	1200	0,82/ 162,2°	1,14/ 48,7°	0,07/ 45,7°	0,52/−101,5°	7,4
	2000	0,82/ 140,5°	0,67/ 27,6°	0,12/ 71,3°	0,42/−138,0°	2,2
	40	0,85/ −48,2°	20,90/154,7°	0,03/ 66,3°	0,92/ −23,3°	40,2
	100	0,80/ −98,7°	14,77/126,7°	0,05/ 43,6°	0,68/ −45,0°	30,6
	200	0,78/−135,7°	3,99/106,9°	0,06/ 30,4°	0,47/ −58,5°	24,1
10	500	0,76/−171,8°	3,78/ 81,8°	0,06/ 28,6°	0,30/ −74,9°	15,7
	800	0,76/ 175,0°	2,49/ 68,5°	0,07/ 36,9°	0,36/ −85,8°	12,2
	1000	0,76/ 168,4°	1,97/ 58,8°	0,07/ 41,3°	0,41/ −97,4°	10,4
	1200	0,79/ 161,2°	1,56/ 53,9°	0,08/ 51,0°	0,38/−111,8°	8,8
	2000	0,80/ 140,6°	0,96/ 30,6°	0,14/ 66,8°	0,36/−142,8°	4,6
	40	0,81/ −56,5°	28,50/151,5°	0,02/ 63,0°	0,89/ −31,3°	40,6
	100	0,76/−108,9°	19,04/122,8°	0,04/ 41,7°	0,60/ −59,9°	31,4
	200	0,75/ 143,2°	11,19/104,7°	0,05/ 31,7°	0,39/ −80,3°	25,3
20	500	0,74/−175,9°	4,65/ 82,7°	0,06/ 36,2°	0,23/−107,6°	17,0
	800	0,73/ 172,5°	3,00/ 70,7°	0,07/ 44,3°	0,27/−110,2°	13,2
	1000	0,74/ 166,8°	2,41/ 62,2°	0,08/ 47,6°	0,31/−118,3°	11,5
	1200	0,78/ 159,0°	1,94/ 58,9°	0,09/ 55,1°	0,29/−133,5°	10,2
	2000	0,77/ 140,3°	1,23/ 35,4°	0,14/ 63,7°	0,28/−155,5°	6,1
	40	0,79/ −61,1°	32,71/149,4°	0,02/ 61,8°	0,87/ −35,7°	40,7
	100	0,75/−113,4°	21,13/121,0°	0,04/ 40,7°	0,58/ −68,2°	31,8
	200	0,74/−146,2°	12,12/104,0°	0,05/ 32,5°	0,38/ −92,8°	25,8
30	500	0,73/−177,0°	5,04/ 83,7°	0,06/ 39,5°	0,23/−127,4°	17,6
	800	0,73/ 172,0°	3,25/ 72,0°	0,07/ 47,2°	0,25/−126,8°	13,9
	1000	0,73/ 166,9°	2,62/ 63,9°	0,08/ 49,8°	0,29/−132,4°	12,1
	1200	0,77/ 158,6°	2,11/ 61,1°	0,09/ 56,7°	0,28/−147,9°	10,8
	2000	0,76/ 140,0°	1,35/ 38,3°	0,15/ 62,3°	0,24/−165,7°	6,6
	40	0,78/ −64,6°	36,69/147,3°	0,02/ 60,0°	0,86/ −40,3°	41,0
	100	0,73/−118,1°	22,91/119,4°	0,04/ 39,7°	0,56/ −76,5°	32,2
	200	0,73/−148,9°	12,99/102,6°	0,04/ 33,2°	0,37/−104,5°	26,3
50	500	0,73/−178,1°	5,34/ 94,3°	0,06/ 42,6°	0,25/−142,7°	18,1
	800	0,72/ 170,5°	3,48/ 73,1°	0,07/ 49,4°	0,25/−142,0°	14,3
	1000	0,72/ 165,2°	2,72/ 64,8°	0,08/ 51,5°	0,30/−145,6°	12,3
	1200	0,76/ 157,5°	2,25/ 63,0°	0,09/ 58,0°	0,29/−161,1°	11,2
	2000	0,75/ 139,9°	1,44/ 40,5°	0,15/ 60,8°	0,24/−177,2°	7,0

s-parameters (common emitter) at V_{CE} = 10 V

I_C mA	f MHz	s_{ie}	s_{fe}	s_{re}	s_{oe}	G_{UM} dB
75	40	0,78/ −67,3°	38,41/146,4°	0,02/ 59,1°	0,84/ −42,8°	41,1
	100	0,74/−112,0°	23,45/118,2°	0,04/ 39,3°	0,55/ −81,1°	32,4
	200	0,73/−151,1°	13,29/102,3°	0,04/ 33,9°	0,37/−110,4°	26,4
	500	0,72/−178,4°	5,47/ 84,4°	0,06/ 43,8°	0,27/−149,1°	18,3
	800	0,72/ 170,2°	3,52/ 73,1°	0,07/ 50,3°	0,27/−148,8°	14,4
	1000	0,72/ 164,6°	2,75/ 65,6°	0,09/ 52,1°	0,30/−151,7°	12,4
	1200	0,76/ 157,8°	2,28/ 63,8°	0,09/ 58,3°	0,30/−166,8°	11,3
	2000	0,75/ 139,5°	1,48/ 41,7°	0,16/ 59,7°	0,24/ 175,2°	7,2
100	40	0,78/ −68,3°	38,86/145,2°	0,02/ 58,2°	0,83/ −44,4°	41,0
	100	0,74/−121,6°	23,45/117,2°	0,04/ 38,8°	0,54/ −83,1°	23,3
	200	0,73/−151,6°	13,13/101,3°	0,04/ 33,7°	0,37/−112,7°	26,4
	500	0,73/−179,4°	5,40/ 83,8°	0,06/ 44,3°	0,27/−151,3°	18,2
	800	0,73/ 170,6°	3,52/ 73,4°	0,07/ 50,6°	0,27/−150,9°	14,5
	1000	0,72/ 165,3°	2,75/ 65,4°	0,09/ 52,2°	0,30/−153,4°	12,4
	1200	0,77/ 157,3°	2,25/ 64,1°	0,09/ 58,3°	0,30/−168,6°	11,3
	2000	0,75/ 139,4°	1,46/ 41,9°	0,15/ 59,7°	0,24/ 175,2°	7,1

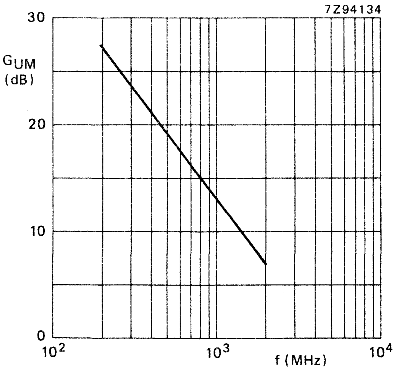


Fig. 4 V_{CE} = 10 V; I_C = 100 mA; T_{amb} = 25 °C

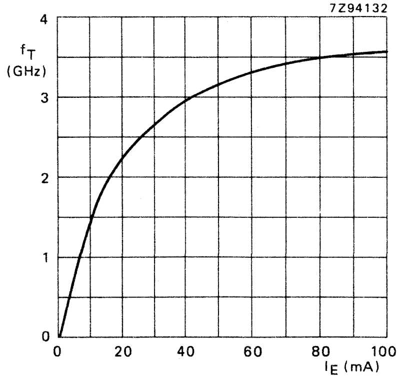


Fig. 5 V_{CE} = 10 V; f = 500 MHz; T_{amb} = 25 °C.

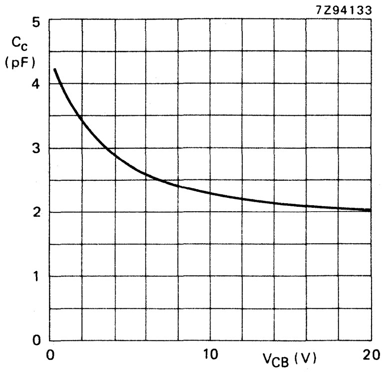


Fig. 6 $I_E = i_e = 0$; f = 1 MHz; T_j = 25 °C.

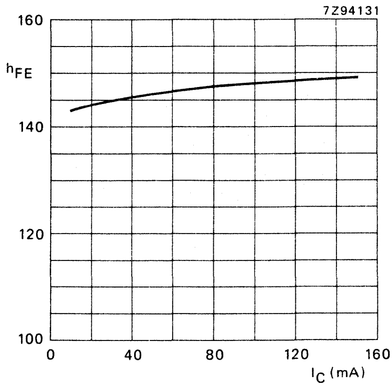


Fig. 7 V_{CE} = 10 V; T_{amb} = 25 °C.

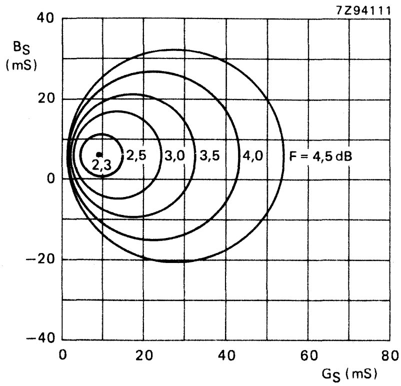


Fig. 8 V_{CE} = 10 V; I_C = 20 mA; f = 800 MHz.

SILICON WIDEBAND TRANSISTOR

Silicon-epitaxial p-n-p transistor in a four-lead dual emitter plastic envelope (SOT-103). This device is designed for application in wideband amplifiers, such as in CATV and MATV systems, up to 2 GHz.

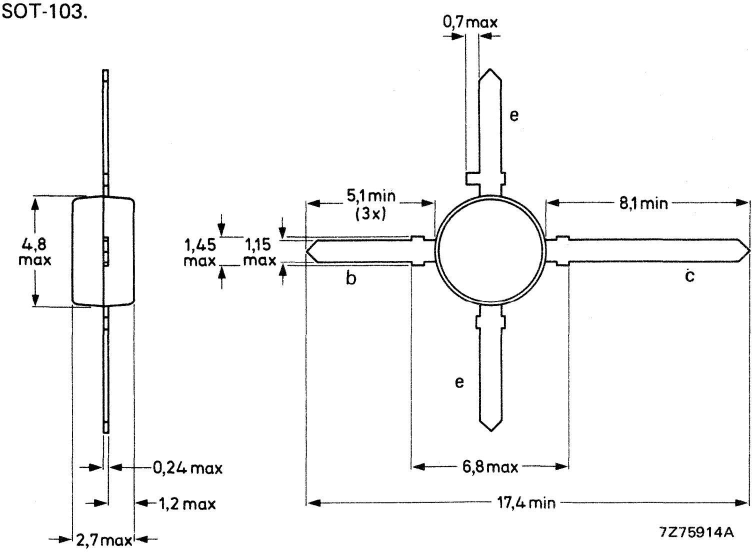
QUICK REFERENCE DATA

Collector-base voltage (open emitter)	$-V_{CBO}$	max.	20	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	15	V
Collector current (d.c.)	$-I_C$	max.	25	mA
Total power dissipation up to T_{amb} = 60 °C	P_{tot}	max.	180	mW
Junction temperature	T_j	max.	150	°C
D.C. current gain $-I_C$ = 14 mA; $-V_{CE}$ = 10 V	h_{FE}	min.	50	
Transition frequency at f = 500 MHz $-I_C$ = 14 mA; $-V_{CE}$ = 10 V	f_T	typ.	5	GHz
Feedback capacitance at f = 1 MHz $-I_C$ = 0; $-V_{CE}$ = 10 V	C_{re}	typ.	0,45	pF
Noise figure at optimum source impedance $-I_C$ = 14 mA; $-V_{CE}$ = 10 V; f = 800 MHz	F	typ.	3,4	dB

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-103.



RATINGS

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

Collector-base voltage (open emitter)	$-V_{CBO}$	max.	20	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	15	V
Emitter-base voltage (open collector)	$-V_{EBO}$	max.	2,0	V
Collector current				
d.c.	$-I_C$	max.	25	mA
peak value; f > 1 MHz	$-I_{CM}$	max.	35	mA
Total power dissipation up to T_{amb} = 60 °C	P_{tot}	max.	180	mW
Storage temperature	T_{stg}		−65 to +150	°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

From junction to ambient (free air) mounted on a fibre-glass print (see Fig. 2)	$R_{th\ j\text{-}a}$	500	K/W

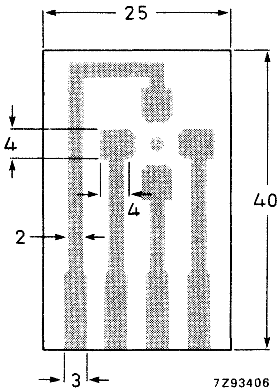


Fig. 2 Requirements for fibre-glass print (dimensions in mm). Single-sided 35 μm Cu-clad epoxy fibre-glass print, thickness 1,5 mm. Tracks are fully tin-lead plated. Shaded area is Cu.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current				
I_E = 0; $-V_{CB}$ = 10 V	$-I_{CBO}$	max.	50	nA
D.C. current gain *				
$-I_C$ = 14 mA; $-V_{CE}$ = 10 V	h_{FE}	min.	50	
Transition frequency at f = 500 MHz *				
$-I_C$ = 14 mA; $-V_{CE}$ = 10 V	f_T	typ.	5,0	GHz
Noise figure at optimum source impedance and $-V_{CE}$ = 10 V; f = 800 MHz; T_{amb} = 25 °C				
at $-I_C$ = 4 mA	F	typ.	2,4	dB
at $-I_C$ = 14 mA	F	typ.	3,4	dB

* Measured under pulse conditions

Collector capacitance at f = 1 MHz $I_E = i_e = 0$; $-V_{CB} = 10$ V	C_c	typ.	0,9 pF
Emitter capacitance at f = 1 MHz $I_C = i_c = 0$; $-V_{EB} = 0{,}5$ V	C_e	typ.	1,1 pF
Feedback capacitance at f = 1 MHz $I_C = 0$; $-V_{CE} = 10$ V	C_{re}	typ.	0,45 pF
Maximum unilateral power gain at $T_{amb} = 25\,^oC$ (s_{re} assumed to be zero) G_{UM} (in dB) $= 10 \log \dfrac{\lvert s_{fe}\rvert^2}{[1-\lvert s_{ie}\rvert^2]\,[1-\lvert s_{oe}\rvert^2]}$			
$-I_C = 14$ mA; $V_{CE} = 10$ V; f = 800 MHz	G_{UM}	typ.	17,0 dB
$-I_C = 14$ mA; $V_{CE} = 10$ V; f = 2 GHz	G_{UM}	typ.	8,0 dB
Intermodulation distortion (see Fig. 3) $-I_C = 14$ mA; $-V_{CE} = 10$ V; $R_L = 75\ \Omega$; VSWR < 2; $T_{amb} = 25\,^oC$ $V_p = V_o = 150$ mV at $f_p = 795{,}25$ MHz $V_q = V_o - 6$ dB at $f_q = 803{,}25$ MHz $V_r = V_o - 6$ dB at $f_r = 805{,}25$ MHz measured at $f_{(p+q+r)} = 793{,}25$ MHz	d_{im}	typ.	−60 dB
Second harmonic distortion (see Fig. 3) $-I_C = 14$ mA; $-V_{CE} = 10$ V; $R_L = 75\ \Omega$; VSWR < 2; $T_{amb} = 25\,^oC$ $V_p = V_o = 150$ mV at $f_p = 250$ MHz $V_q = V_o = 150$ mV at $f_q = 560$ MHz measured at $f_{(p+q)} = 810$ MHz	d_2	typ.	−50 dB

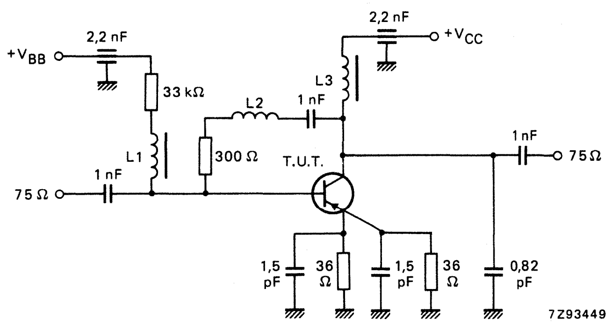


Fig. 3 Intermodulation distortion and second harmonic distortion MATV test circuit.

L1 = L3 = 5 μH micro-choke
L2 = 3 turns Cu wire (0,4 mm), internal diameter 3 mm, winding pitch 1 mm

s-parameters (common emitter) at V_{CE} = 10 V

I_C mA	f MHz	s_{ie}	s_{fe}	s_{re}	s_{oe}	G_{UM} dB
	40	0,66/ 67,4°	13,07/132,5°	0,04/ 48,85°	0,98/ 81,6°	38,4
	100	0,65/ 41,0°	12,29/131,7°	0,04/ 63,68°	0,96/ 49,7°	35,6
	200	0,63/ −25,4°	10,44/136,5°	0,05/ 64,05°	0,82/ 2,7°	27,5
	500	0,50/ −61,8°	6,51/105,8°	0,08/ 44,83°	0,58/−19,6°	19,3
5	800	0,48/−173,2°	4,74/ 87,7°	0,10/ 46,88°	0,49/−29,3°	15,9
	1000	0,46/−170,1°	3,73/ 81,1°	0,10/ 44,70°	0,43/−33,1°	13,4
	1200	0,47/ 178,4°	3,00/ 77,4°	0,11/ 44,80°	0,38/−46,5°	11,3
	1500	0,54/ 169,8°	2,83/ 57,0°	0,13/ 51,10°	0,34/−48,1°	11,1
	2000	0,46/ 144,6°	1,99/ 22,4°	0,15/ 3,95°	0,31/−89,8°	7,4
	40	0,44/ 60,2°	19,40/137,8°	0,04/ 34,23°	0,96/ 79,6°	37,9
	100	0,45/ 24,4°	17,77/129,8°	0,04/ 58,58°	0,91/ 43,5°	33,6
	200	0,47/ −49,4°	14,33/127,2°	0,05/ 57,93°	0,73/ −4,7°	27,5
	500	0,46/ 92,9°	7,69/ 97,6°	0,07/ 48,35°	0,46/−25,9°	19,7
10	800	0,47/−176,4°	5,41/ 82,6°	0,09/ 53,75°	0,38/−30,9°	16,4
	1000	0,48/−179,6°	4,15/ 77,1°	0,09/ 52,53°	0,33/−35,6°	14,0
	1200	0,48/ 167,7°	3,31/ 75,6°	0,10/ 53,53°	0,29/−45,9°	11,9
	1500	0,53/ 159,7°	3,27/ 57,5°	0,12/ 58,70°	0,27/−48,7°	12,0
	2000	0,48/ 137,2°	2,18/ −3,9°	0,15/ 11,33°	0,24/−91,2°	8,1
	40	0,34/ 53,8°	22,33/136,9°	0,04/ 34,05°	0,95/ 78,2°	37,4
	100	0,37/ 11,9°	19,87/131,0°	0,03/ 54,68°	0,88/ 41,3°	33,1
	200	0,42/ −64,7°	15,87/123,1°	0,04/ 57,33°	0,69/ −8,5°	27,6
	500	0,46/ 160,6°	7,89/ 96,8°	0,06/ 51,98°	0,40/−26,8°	19,7
14	800	0,47/−174,4°	5,52/ 81,7°	0,08/ 56,68°	0,34/−32,1°	16,4
	1000	0,48/ 175,9°	4,24/ 75,7°	0,08/ 54,88°	0,30/−37,0°	14,1
	1200	0,50/ 164,4°	3,42/ 74,5°	0,09/ 56,43°	0,27/−44,1°	12,3
	1500	0,55/ 158,1°	3,22/ 54,6°	0,11/ 62,38°	0,24/−45,1°	12,0
	2000	0,49/ 134,9°	2,21/ −5,4°	0,14/ 13,43°	0,22/−90,9°	8,3

s-parameters (common emitter) at V_{CE} = 5 V

I_C MH	f MHz	s_{ie}	s_{fe}	s_{re}	s_{oe}	G_{UM} dB
	40	0,15/ 3,5°	21,70/136,8°	0,04/ 28,08°	0,91/ 75,5°	34,6
	100	0,31/ −46,9°	18,44/142,5°	0,04/ 64,85°	0,80/ 35,6°	30,2
	200	0,45/ −83,8°	14,16/120,9°	0,04/ 56,45°	0,59/ −15,5°	25,8
	500	0,55/−175,0°	6,59/ 94,1°	0,06/ 52,28°	0,32/ −34,4°	18,4
20	800	0,58/ 177,2°	4,62/ 79,2°	0,08/ 58,35°	0,27/ −36,0°	15,4
	1000	0,57/ 170,3°	3,54/ 73,8°	0,08/ 58,05°	0,24/ −41,3°	12,9
	1200	0,59/ 159,5°	2,82/ 72,9°	0,09/ 59,28°	0,21/ −47,7°	11,1
	1500	0,54/ 150,9°	2,15/ 56,0°	0,11/ 67,55°	0,18/ −36,0°	8,3
	2000	0,58/ 132,1°	1,88/ −6,2°	0,14/ 16,03°	0,19/−108,6°	7,4
	40	0,15/ −27,1°	21,97/138,1°	0,04/ 33,98°	0,90/ 75,4°	34,0
	100	0,32/ −61,0°	18,72/131,1°	0,03/ 64,88°	0,78/ 34,3°	30,1
	200	0,45/ −80,4°	14,08/119,5°	0,04/ 54,00°	0,56/ −15,9°	25,6
	500	0,57/−179,4°	6,43/ 92,4°	0,06/ 53,93°	0,31/ −34,4°	18,3
25	800	0,57/ 174,6°	4,51/ 78,9°	0,08/ 59,20°	0,26/ −35,4°	15,1
	1000	0,59/ 167,5°	3,44/ 73,1°	0,08/ 58,33°	0,23/ −40,1°	12,8
	1200	0,61/ 157,3°	2,76/ 71,8°	0,08/ 61,78°	0,21/ −48,5°	11,1
	1500	0,56/ 151,1°	2,15/ 75,3°	0,10/ 68,93°	0,18/ −24,3°	8,4
	2000	0,60/ 131,8°	1,83/ −6,7°	0,14/ 17,58°	0,19/ −96,0°	7,4
	40	0,19/ −46,2°	21,90/138,3°	0,04/ 28,33°	0,88/ 74,7°	33,3
	100	0,34/ −73,1°	18,18/129,2°	0,03/ 63,73°	0,77/ 30,6°	29,6
	200	0,47/ −67,1°	13,92/118,9°	0,04/ 56,80°	0,55/ −16,8°	25,5
	500	0,58/−176,6°	6,23/ 92,5°	0,05/ 56,93°	0,29/ −30,8°	18,1
30	800	0,59/ 167,6°	4,33/ 77,7°	0,08/ 60,30°	0,26/ −35,6°	14,9
	1000	0,60/ 167,4°	3,32/ 72,7°	0,08/ 59,93°	0,23/ −37,6°	12,6
	1200	0,63/ 157,3°	2,66/ 70,8°	0,09/ 63,13°	0,21/ −45,9°	10,9
	1500	0,57/ 156,7°	2,16/ 49,2°	0,11/ 70,55°	0,19/ −45,4°	8,6
	2000	0,63/ 130,5°	1,80/ −8,2°	0,14/ 19,23°	0,20/ −95,7°	7,5

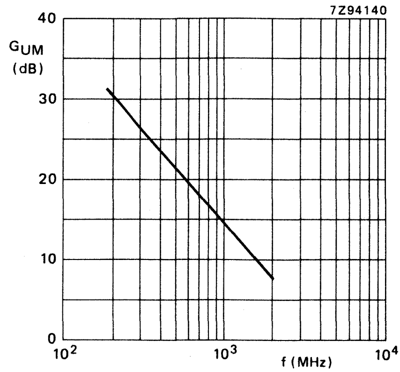


Fig. 4 V_{CE} = 10 V; I_C = 14 mA; T_{amb} = 25 °C.

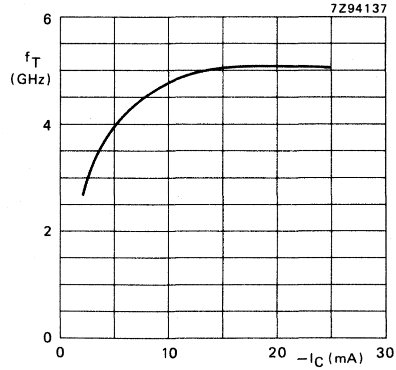


Fig. 5 V_{CE} = 10 V; f = 500 MHz; T_{amb} = 25 °C.

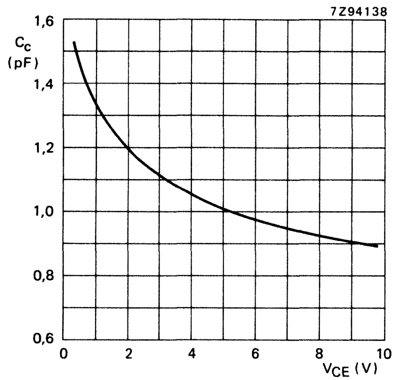


Fig. 6 $I_E = i_e = 0$; f = 1 MHz; T_j = 25 °C.

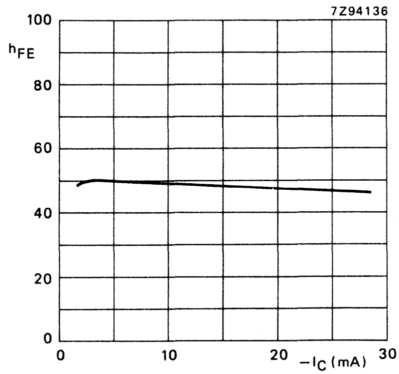


Fig. 7.

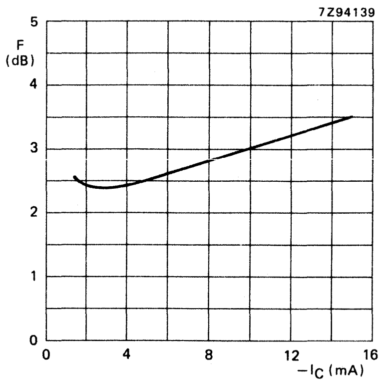


Fig. 8 V_{CE} = 8 V; f = 800 MHz; Z_S = opt.; T_{amb} = 25 °C.

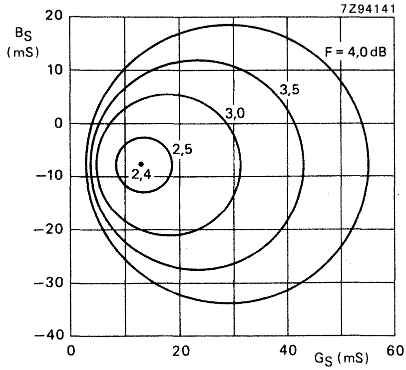


Fig. 9 V_{CE} = 10 V; I_C = 4 mA; f = 800 MHz.

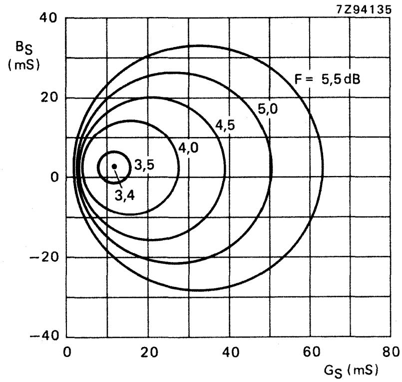


Fig. 10 V_{CE} = 10 V; I_C = 14 mA; f = 800 MHz.

N-P-N 2 GHz WIDEBAND TRANSISTOR

Silicon epitaxial n-p-n transistor in a four-lead dual-emitter plastic envelope (SOT-103). This device is designed for wideband application in the GHz range.

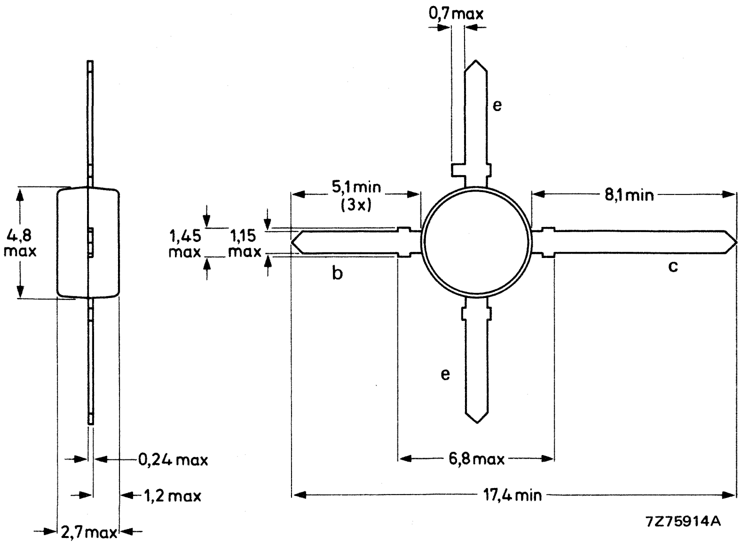
QUICK REFERENCE DATA

Collector-base voltage (open emitter)	V_{CBO}	max.	20 V
Collector-emitter voltage (open base)	V_{CEO}	max.	10 V
Collector current (d.c.)	I_C	max.	50 mA
Total power dissipation up to T_{amb} = 60 °C	P_{tot}	max.	300 mW
Junction temperature	T_j	max.	150 °C
D.C. current gain I_C = 15 mA; V_{CE} = 5 V	h_{FE}	min.	60
Transition frequency at f = 500 MHz I_C = 15 mA; V_{CE} = 8 V	f_T	typ.	7,5 GHz
Noise figure at Z_S = 60 Ω; I_C = 15 mA; V_{CE} = 8 V; f = 2 GHz	F	typ.	3,0 dB

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-103.



RATINGS

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

Collector-base voltage (open emitter)	V_{CBO}	max.	20 V
Collector-emitter voltage (open base)	V_{CEO}	max.	10 V
Emitter-base voltage (open collector)	V_{EBO}	max.	2,5 V
Collector current (d.c.)	I_C	max.	50 mA
Total power dissipation up to T_{amb} = 60 °C mounted on a fibre-glass p.c.b. (see Fig. 2)	P_{tot}	max.	300 mW
Storage temperature	T_{stg}		−65 to +150 °C
Junction temperature	T_j	max.	150 °C

THERMAL RESISTANCE

From junction to ambient (free air) mounted on a glass-fibre p.c.b. (see Fig. 2)	$R_{th\ j-a}$	=	300 K/W

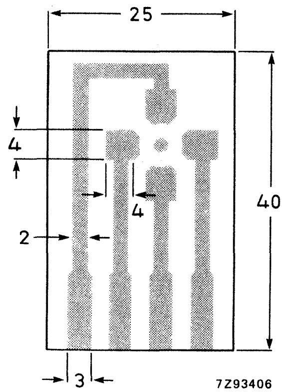


Fig. 2 Requirements for fibre-glass print (dimensions in mm). Single-sided 35 μm Cu-clad epoxy fibre-glass print, thickness 1,5 mm. Tracks are fully tin-lead plated. Shaded area is Cu.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current $I_E = 0$; $V_{CB} = 5$ V	I_{CBO}	max.	50 nA
D.C. current gain * $I_C = 15$ mA; $V_{CE} = 5$ V	h_{FE}	typ.	100
Transition frequency at f = 500 MHz * $I_C = 15$ mA; $V_{CE} = 8$ V	f_T	typ.	7,5 GHz
Collector capacitance at f = 1 MHz $I_E = i_e = 0$; $V_{CB} = 8$ V	C_c	typ.	1,1 pF
Emitter capacitance at f = 2 MHz $I_C = i_e = 0$; $V_{EB} = 0,5$ V	C_e	typ.	1,3 pF
Feedback capacitance at f = 1 MHz $I_E = 0$; $V_{CB} = 8$ V	C_{re}	typ.	0,5 pF

* Measured under pulse conditions.

Maximum unilateral power gain at $T_{amb} = 25\ ^oC$

$$G_{UM}\ (\text{in dB}) = 10 \log \frac{|s_{fe}|^2}{[1-|s_{ie}|^2][1-|s_{oe}|^2]}$$

$I_C = 15$ mA; $V_{CB} = 8$ V; f = 2 GHz	G_{UM}	typ.	10,5 dB
Noise figure at optimum source impedance and $V_{CE} = 8$ V; f = 800 MHz; $T_{amb} = 25\ ^oC$;			
$I_C = 5$ mA	F	typ.	0,8 dB
$I_C = 15$ mA	F	typ.	1,5 dB
Noise figure at $Z_S = 60\ \Omega$ and $V_{CE} = 8$ V; f = 2 GHz; $T_{amb} = 25\ ^oC$;			
$I_C = 5$ mA	F	typ.	2,5 dB
$I_C = 15$ mA	F	typ.	3,0 dB

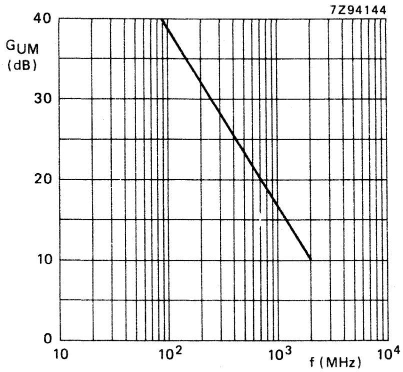


Fig. 3 $V_{CE} = 8$ V; $I_C = 15$ mA; $T_{amb} = 25\ ^oC$

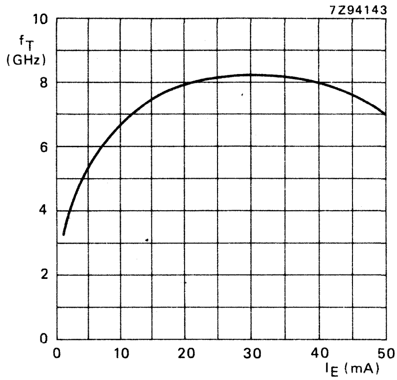


Fig. 4 $V_{CE} = 8$ V; pulsed condition.

s-parameters (common emitter) at V_{CE} = 8 V

I_C mA	f MHz	s_{ie}	s_{fe}	s_{re}	s_{oe}	G_{UM} dB
	40	0,87/ −12,9°	15,83/171,2°	0,01/ 82,0°	0,98/ −6,5°	45,8
	100	0,81/ −31,0°	14,92/155,8°	0,02/ 74,8°	0,93/−15,7°	37,4
	200	0,69/ −54,6°	12,40/138,3°	0,04/ 67,0°	0,83/−25,9°	29,8
5	500	0,42/−105,7°	7,12/104,9°	0,07/ 59,1°	0,59/−40,4°	19,7
	800	0,34/−128,7°	4,89/ 91,3°	0,10/ 63,0°	0,58/−49,1°	16,1
	1000	0,35/−142,8°	4,13/ 83,2°	0,12/ 63,7°	0,58/−58,0°	14,6
	2000	0,25/ 128,0°	2,08/ 56,8°	0,20/ 67,8°	0,38/−63,3°	7,3
	40	0,75/ −19,1°	26,88/165,6°	0,01/ 80,0°	0,96/−10,2°	43,8
	100	0,65/ −43,3°	23,08/144,9°	0,02/ 71,7°	0,86/−22,1°	35,5
	200	0,49/ −70,7°	16,71/125,2°	0,03/ 66,4°	0,70/−31,6°	28,6
10	500	0,28/−126,5°	8,21/ 96,9°	0,06/ 66,4°	0,48/−40,0°	19,8
	800	0,24/−136,7°	5,39/ 86,8°	0,10/ 70,8°	0,50/−48,9°	16,1
	1000	0,26/−147,8°	4,49/ 79,9°	0,12/ 70,5°	0,51/−58,9°	14,6
	2000	0,22/ 114,8°	2,28/ 56,5°	0,21/ 68,8°	0,32/−61,8°	7,8
	40	0,67/ −23,8°	34,23/161,4°	0,01/ 78,3°	0,94/−12,6°	42,9
	100	0,54/ −51,8°	27,41/138,1°	0,02/ 71,0°	0,80/−25,5°	34,7
	200	0,39/ −80,0°	18,52/118,7°	0,03/ 68,4°	0,63/−33,2°	28,2
15	500	0,22/−130,3°	8,47/ 93,5°	0,06/ 70,2°	0,44/−38,8°	19,7
	800	0,20/−140,8°	5,57/ 84,9°	0,10/ 73,6°	0,47/−48,4°	16,2
	1000	0,22/ 147,5°	4,64/ 78,4°	0,12/ 72,9°	0,48/−59,0°	14,7
	2000	0,21/ 109,8°	2,34/ 56,2°	0,22/ 68,7°	0,31/−61,0°	8,0
	40	0,61/ −27,4°	39,76/158,4°	0,01/ 76,8°	0,92/−14,2°	42,4
	100	0,47/ −58,0°	30,05/133,7°	0,02/ 70,4°	0,75/−27,5°	34,2
	200	0,32/ −86,2°	19,38/114,7°	0,03/ 70,4°	0,58/−33,5°	28,0
20	500	0,19/−136,8°	8,65/ 92,0°	0,06/ 72,4°	0,41/−37,5°	19,7
	800	0,18/−145,1°	5,62/ 83,5°	0,10/ 75,3°	0,46/−47,9°	16,1
	1000	0,20/−151,9°	4,63/ 77,7°	0,12/ 74,1°	0,47/−58,8°	14,6
	2000	0,21/−107,3°	2,37/ 55,7°	0,22/ 69,0°	0,30/−60,6°	8,1
	40	0,51/ −33,2°	46,18/154,6°	0,01/ 75,6°	0,89/−16,4°	41,4
	100	0,37/ −67,3°	32,56/128,1°	0,02/ 70,6°	0,69/−29,1°	33,7
	200	0,26/ −97,3°	20,04/110,7°	0,03/ 72,3°	0,53/−32,7°	27,8
30	500	0,17/−151,6°	8,64/ 89,7°	0,06/ 74,6°	0,39/−35,6°	19,6
	800	0,16/−152,2°	5,61/ 82,1°	0,10/ 76,7°	0,44/−46,9°	16,0
	1000	0,19/−157,7°	4,62/ 76,4°	0,12/ 75,1°	0,46/−58,3°	14,5
	2000	0,22/−106,4°	2,37/ 55,0°	0,23/ 69,3°	0,29/−60,0°	8,1

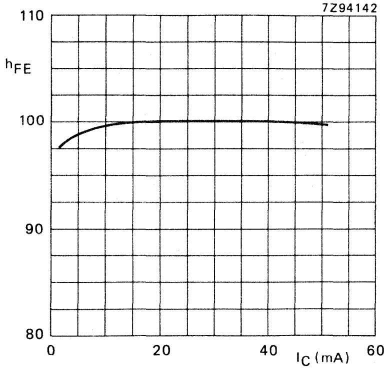


Fig. 5 V_{CE} = 5 V; T_j = 25 °C.

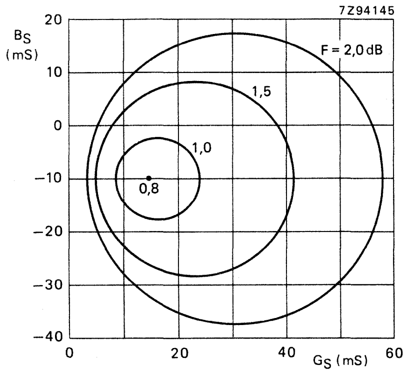


Fig. 6 V_{CE} = 8 V; I_C = 5 mA; f = 800 MHz.

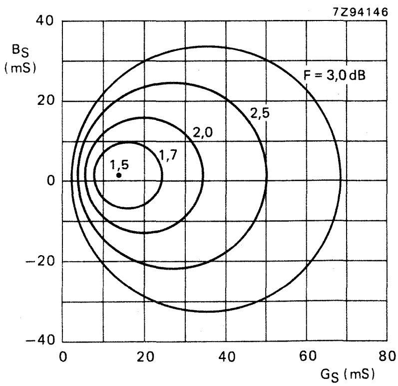


Fig. 7 V_{CE} = 8 V; I_C = 15 mA; f = 800 MHz.

SILICON PLANAR EPITAXIAL TRANSISTOR

Silicon epitaxial n-p-n transistor in a four-lead dual-emitter plastic envelope (SOT-103). This device is designed for wideband application in CATV and MATV systems up to 2 GHz.

QUICK REFERENCE DATA

Collector-base voltage (open emitter)	V_{CBO}	max.	20	V
Collector-emitter voltage (open base)	V_{CEO}	max.	15	V
Collector current (d.c.)	I_C	max.	25	mA
Total power dissipation up to T_{amb} = 60 °C	P_{tot}	max.	180	mW
Junction temperature	T_j	max.	150	°C
D.C. current gain I_C = 14 mA; V_{CE} = 10 V	h_{FE}	min.	40	
Transition frequency at f = 500 MHz I_C = 14 mA; V_{CE} = 10 V	f_T	typ.	5	GHz
Feedback capacitance at f = 1 MHz I_C = 0; V_{CE} = 10 V	C_{re}	typ.	0,35	pF
Noise figure at Z_S = opt.; T_{amb} = 25 °C; I_C = 14 mA; V_{CE} = 10 V; f = 800 MHz	F	typ.	2,4	dB
Maximum unilateral power gain at f = 800 MHz I_C = 14 mA; V_{CE} = 10 V	G_{UM}	typ.	19	dB
Output power at 1 dB gain compression V_{CE} = 10 V; I_C = 14 mA; f = 800 MHz	P_{L1}	typ.	+8	dBm
Third order intercept point V_{CE} = 10 V; I_C = 14 mA; f = 800 MHz	ITO	typ.	+27	dBm

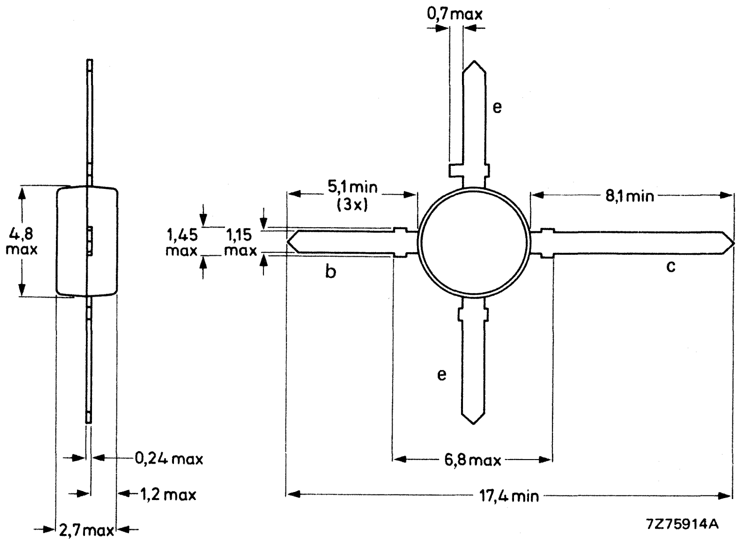
MECHANICAL DATA

SOT-103 (see Fig. 1).

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-103.



RATINGS

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

Collector-base voltage (open emitter)	V_{CBO}	max.	20	V
Collector-emitter voltage (open base)	V_{CEO}	max.	15	V
Emitter-base voltage (open collector)	V_{EBO}	max.	2	V
Collector current (d.c.)	I_C	max.	25	mA
Total power dissipation up to T_{amb} = 60 °C	P_{tot}	max.	180	mW
Storage temperature	T_{stg}		−65 to +150	°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

From junction to ambient in free air mounted on glass-fibre p.c.b. (see Fig. 2)	$R_{th\ j\text{-}a}$	=	500 K/W

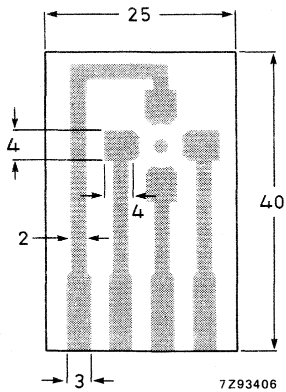


Fig. 2 Requirements for fibre-glass print (dimensions in mm). Single-sided 35 μm Cu-clad epoxy fibre-glass print, thickness 1,5 mm. Tracks are fully tin-lead plated. Shaded area is Cu.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current $I_E = 0$; $V_{CB} = 10$ V	I_{CBO}	max.	50 nA
D.C. current gain * $I_C = 14$ mA; $V_{CE} = 10$ V	h_{FE}	min. typ.	40 90
Transition frequency at f = 500 MHz * $I_C = 14$ mA; $V_{CE} = 10$ V	f_T	typ.	5 GHz
Collector capacitance at f = 1 MHz $I_E = i_e = 0$; $V_{CB} = 10$ V	C_c	typ.	0,7 pF
Emitter capacitance at f = 1 MHz $I_C = i_c = 0$; $V_{EB} = 0{,}5$ V	C_e	typ.	1,2 pF
Feedback capacitance at f = 1 MHz $I_C = 0$; $V_{CE} = 10$ V	C_{re}	typ.	0,35 pF

Maximum unilateral power gain at T_{amb} = 25 °C

$$G_{UM} \text{ (in dB)} = 10 \log \frac{|s_{fe}|^2}{[1-|s_{ie}|^2]\,[s_{oe}|^2]}$$

$I_C = 14$ mA; $V_{CE} = 10$ V; f = 800 MHz $I_C = 14$ mA; $V_{CE} = 10$ V; f = 2 GHz	G_{UM}	typ. typ.	19,0 dB 12,0 dB

Noise figure at T_{amb} = 25 °C

$I_C = 4$ mA; $V_{CE} = 10$ V; f = 800 MHz; Z_S = opt.	F	typ.	1,7 dB
$I_C = 14$ mA; $V_{CE} = 10$ V; f = 800 MHz; Z_S = opt.	F	typ.	2,4 dB
$I_C = 4$ mA; $V_{CE} = 10$ V; f = 2 GHz; $R_S = 600\ \Omega$	F	typ.	3,6 dB

* Measured under pulse conditions.

Output power at 1 dB gain compression I_C = 14 mA; V_{CE} = 10 V; T_{amb} = 25 °C; R_L = 75 Ω; measured at f = 800 MHz	P_{L1}	typ.	+8 dBm
Third order intercept point (see Fig. 3) I_C = 14 mA; V_{CE} = 10 V; R_L = 75 Ω; T_{amb} = 25 °C; P_p = ITO − 6 dB; f_p = 800 MHz; P_q = ITO − 6 dB; f_q = 801 MHz; measured at $f_{(2q-p)}$ = 802 MHz and at $f_{(2p-q)}$ = 799 MHz	ITO	typ.	+27 dBm
Intermodulation distortion (see Fig. 3) (DIN 45004B, par. 6.3: 3 tone) I_C = 14 mA; V_{CE} = 10 V; R_L = 75 Ω; VSWR < 2; T_{amb} = 25 °C V_p = V_o = 150 mV at f_p = 795,25 MHz V_q = V_o − 6 dB at f_q = 803,25 MHz V_r = V_o − 6 dB at f_r = 805,25 MHz measured at $f_{(p+q-r)}$ = 793,25 MHz	d_{im}	typ.	−60 dB
Second harmonic distortion (see Fig. 3) I_C = 14 mA; V_{CE} = 10 V; R_L = 75 Ω; VSWR < 2; T_{amb} = 25 °C V_p = V_o = 60 mV at f_p = 250 MHz V_q = V_o = 60 mV at f_q = 560 MHz measured at $f_{(p+q)}$ = 810 MHz	d_2	typ.	−50 dB

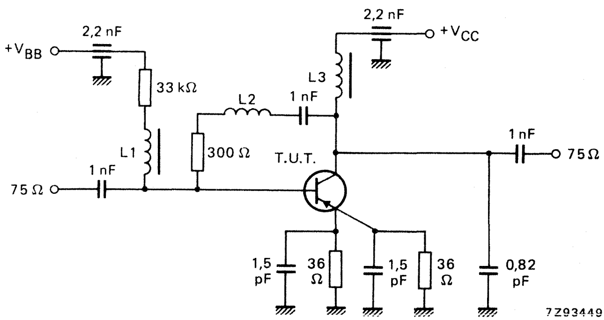


Fig. 3 Intermodulation distortion and second harmonic distortion MATV test circuit.

L1 = L3 = 5 μH Ferroxcube choke
L2 = 3 turns Cu wire (0,4 mm), internal diameter 3 mm, winding pitch 1 mm

s-parameters (common emitter) at V_{CE} = 10 V

I_C mA	f MHz	s_{ie}	s_{fe}	s_{re}	s_{oe}	G_{UM} dB
	40	0,85/ −12,7°	15,11/172,8°	0,01/ 81,8°	1,00/ −5,1°	67,5
	100	0,81/ −29,7°	14,74/160,7°	0,02/ 74,6°	0,97/−11,6°	39,7
	200	0,75/ −54,4°	13,07/145,5°	0,03/ 64,8°	0,90/−19,4°	33,2
5	500	0,57/−109,4°	8,19/112,2°	0,05/ 49,0°	0,69/−33,0°	22,7
	800	0,54/−134,4°	5,82/ 98,5°	0,06/ 49,4°	0,67/−40,5°	19,4
	1000	0,54/−148,3°	4,82/ 90,2°	0,07/ 49,7°	0,65/−47,4°	17,6
	2000	0,57/ 161,5°	2,55/ 64,5°	0,08/ 32,5°	0,48/−61,9°	11,0
	40	0,74/ −18,3°	25,36/169,2°	0,01/ 79,5°	0,99/ −7,33°	48,6
	100	0,69/ −42,7°	23,32/152,8°	0,01/ 70,3°	0,92/−16,1°	38,5
	200	0,61/ −74,4°	18,68/134,7°	0,02/ 60,6°	0,81/−24,9°	32,1
10	500	0,47/−131,0°	10,05/103,8°	0,04/ 53,1°	0,58/−35,6°	22,9
	800	0,46/−151,0°	6,80/ 92,6°	0,05/ 57,5°	0,58/−40,8°	19,4
	1000	0,48/−161,0°	5,63/ 85,5°	0,06/ 59,3°	0,57/−47,9°	17,9
	2000	0,58/ 152,8°	3,00/ 63,0°	0,07/ 41,2°	0,40/−61,3°	12,1
	40	0,67/ −22,3°	30,84/167,5°	0,01/ 77,7°	0,98/ −8,6°	47,4
	100	0,62/ −51,2°	27,70/148,7°	0,01/ 68,3°	0,90/−18,5°	38,0
	200	0,55/ −85,3°	21,21/129,6°	0,02/ 59,3°	0,76/−26,9°	31,8
14	500	0,45/−140,8°	10,63/100,5°	0,03/ 56,1°	0,54/−34,0°	23,0
	800	0,43/−158,2°	7,11/ 90,3°	0,05/ 61,4°	0,54/−40,2°	19,5
	1000	0,45/−165,5°	5,82/ 83,9°	0,06/ 63,0°	0,55/−47,7°	17,8
	2000	0,58/ 150,0°	3,11/ 62,3°	0,07/ 44,7°	0,38/−60,8°	12,3

s-parameters (common emitter) at V_{CE} = 5 V

I_C mA	f MHz	s_{ie}	s_{fe}	s_{re}	s_{oe}	G_{UM} dB
	40	0,50/ 51,8°	36,30/137,5°	0,04/ 24,95°	0,96/ 78,0°	43,0
	100	0,49/ 7,8°	30,70/127,3°	0,03/ 41,73°	0,84/ 44,1°	36,5
	200	0,44/ −66,0°	22,16/117,8°	0,03/ 50,90°	0,66/ 1,4°	30,3
	500	0,45/ 163,2°	10,17/ 94,5°	0,04/ 56,43°	0,49/ −4,3°	22,3
20	800	0,44/−177,2°	7,07/ 81,6°	0,06/ 62,48°	0,48/−13,3°	19,1
	1000	0,46/ 177,0°	5,43/ 76,7°	0,06/ 64,80°	0,45/−16,7°	16,7
	1200	0,48/ 164,6°	4,32/ 75,9°	0,07/ 66,40°	0,44/−27,0°	14,8
	1500	0,46/ 165,0°	3,28/ 76,1°	0,07/ 78,93°	0,41/−36,0°	12,1
	2000	0,46/ 138,1°	2,83/ −0,7°	0,10/ 28,73°	0,37/−78,4°	10,8
	40	0,39/ 29,7°	39,21/136,2°	0,04/ 27,95°	0,90/ 76,2°	39,7
	100	0,42/ −24,3°	29,02/119,3°	0,03/ 39,25°	0,75/ 45,8°	33,7
	200	0,44/ −84,6°	18,43/110,5°	0,03/ 44,18°	0,61/ 8,9°	28,3
	500	0,50/−176,3°	7,77/ 90,5°	0,04/ 63,35°	0,54/ −0,1°	20,5
30	800	0,49/ 176,8°	5,33/ 79,5°	0,06/ 69,50°	0,52/ −6,7°	17,1
	1000	0,52/ 171,2°	4,17/ 76,0°	0,06/ 70,78°	0,52/−14,8°	15,1
	1200	0,54/ 161,3°	3,36/ 73,8°	0,06/ 70,50°	0,51/−26,1°	13,4
	1500	0,49/ 159,4°	2,52/ 75,9°	0,07/ 84,08°	0,46/−25,0°	10,2
	2000	0,54/ 134,0°	2,17/ −1,4°	0,10/ 34,28°	0,42/−80,7°	9,1

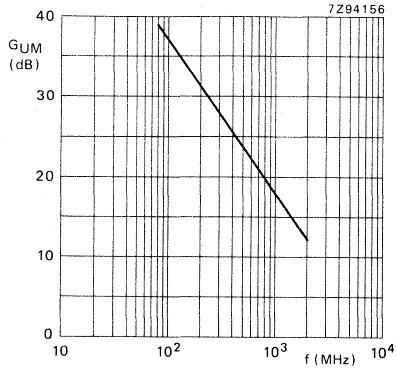


Fig. 4 V_{CE} = 10 V; I_C = 14 mA; T_{amb} = 25 °C.

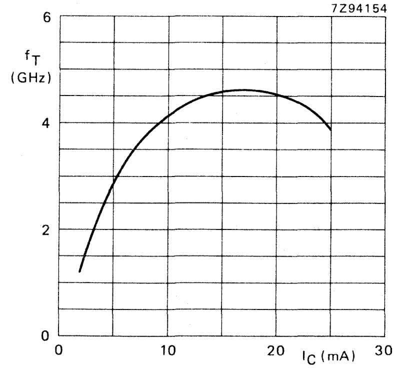


Fig. 5 V_{CE} = 10 V; f = 500 MHz; T_{amb} = 25 °C.

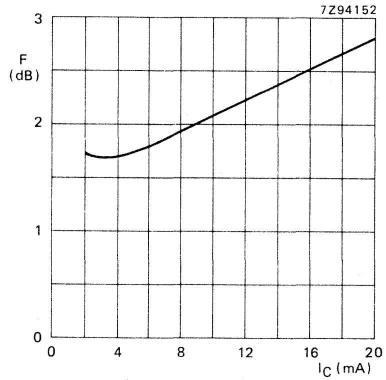


Fig. 6 V_{CE} = 10 V; f = 800 MHz; Z_S = opt.; T_{amb} = 25 °C.

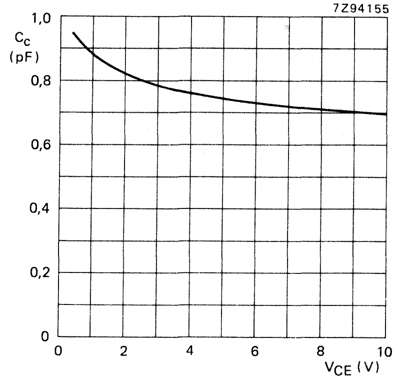


Fig. 7 $I_E = i_e = 0$; f = 1 MHz; T_j = 25 °C.

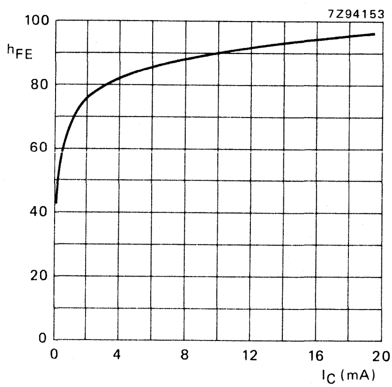


Fig. 8 V_{CE} = 5 V.

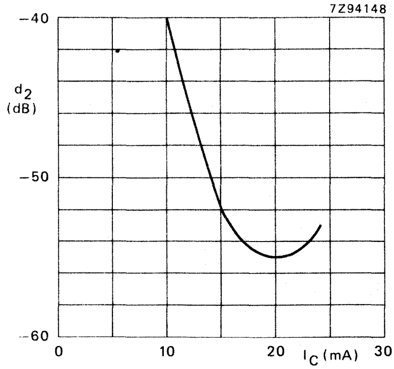


Fig. 9 V_{CE} = 10 V; V_o = 60 mV; $f_{(p+q)}$ = 810 MHz; T_{amb} = 25 °C.

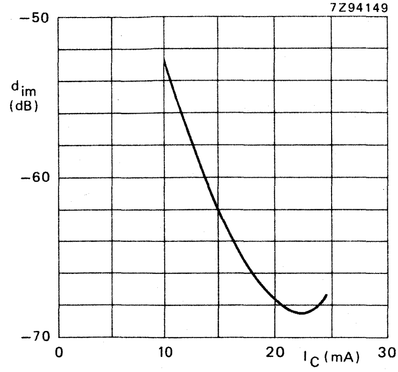


Fig. 10 V_{CE} = 10 V; V_o = 150 mV; $f_{(p+q-r)}$ = 793,25 MHz; T_{amb} = 25 °C.

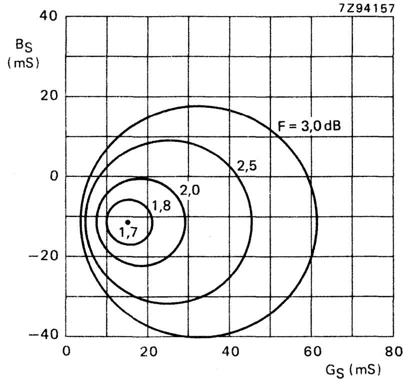


Fig. 11 Circle of constant noise figure; I_C = 4 mA; V_{CE} = 10 V; f = 800 MHz.

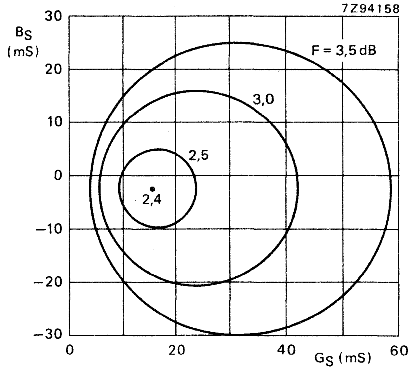


Fig. 12 Circle of constant noise figure; I_C = 14 mA; V_{CE} = 10 V; f = 800 MHz.

CLASS-B OPERATION

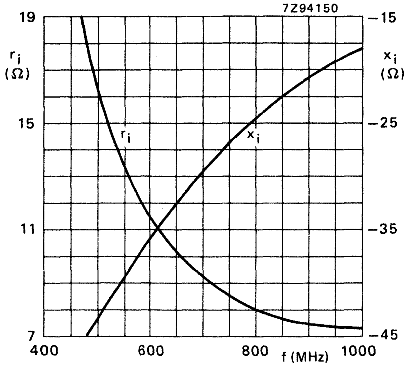


Fig. 13 Input impedance (series components).

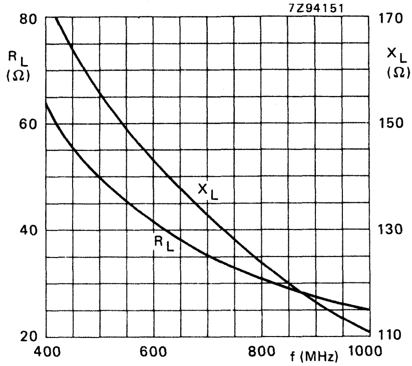


Fig. 14 Load impedance (series components).

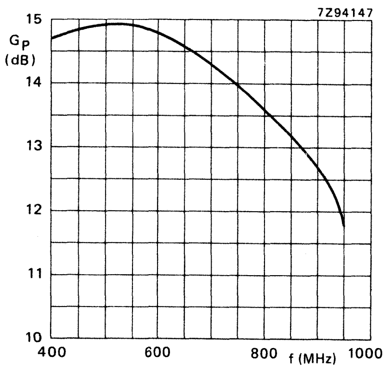


Fig. 15 Power gain versus frequency.

Conditions for Figs 13 to 15:

V_{CE} = 10 V; P_L = 100 mW; T_{amb} = 25 °C.

OPERATING NOTE for Figs 13 to 15:

A base-emitter resistor of 82 Ω is recommended to avoid oscillation. This resistor must be effective for r.f. only.

SILICON PLANAR EPITAXIAL TRANSISTOR

Silicon epitaxial n-p-n transistor in a four-lead dual-emitter plastic envelope (SOT-103). This device is designed for wideband application in CATV and MATV systems up to 2 GHz.

QUICK REFERENCE DATA

Collector-base voltage (open emitter)	V_{CBO}	max.	15	V
Collector-emitter voltage (open base)	V_{CEO}	max.	12	V
Collector current (d.c.)	I_C	max.	35	mA
Total power dissipation up to T_{amb} = 60 °C	P_{tot}	max.	300	mW
Junction temperature	T_j	max.	150	°C
D.C. current gain I_C = 30 mA; V_{CE} = 5 V	h_{FE}	min.	40	
Transition frequency at f = 500 MHz I_C = 30 mA; V_{CE} = 5 V	f_T	typ.	6	GHz
Feedback capacitance at f = 1 MHz I_C = 0; V_{CE} = 4 V	C_{re}	typ.	0,5	pF
Noise figure at optimum source impedance I_C = 30 mA; V_{CE} = 8 V; f = 800 MHz	F	typ.	2,3	dB
Maximum unilateral power gain at f = 800 MHz I_C = 30 mA; V_{CE} = 8 V	G_{UM}	typ.	16,5	dB
Output power at 1 dB gain compression V_{CE} = 8 V; I_C = 30 mA; f = 800 MHz	P_{L1}	typ.	+17	dBm
Third order intercept point V_{CE} = 8 V; I_C = 30 mA; f = 800 MHz	ITO	typ.	+36	dBm

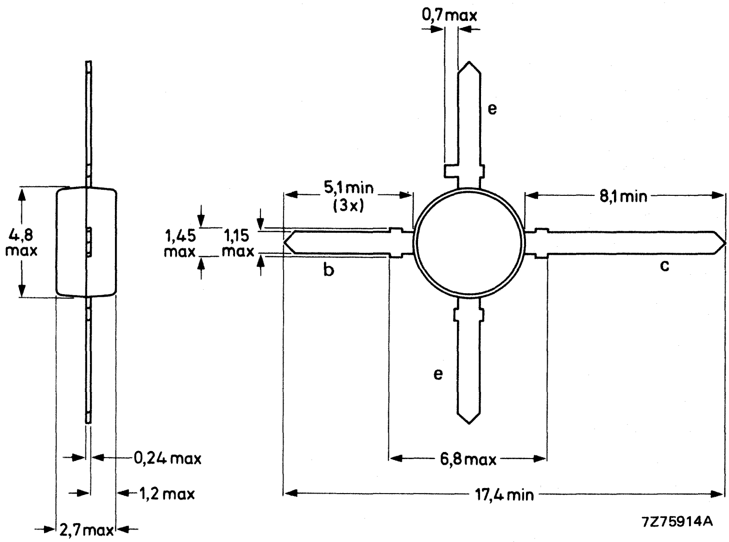
MECHANICAL DATA

SOT-103 (see Fig. 1).

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-103.



RATINGS

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

Collector-base voltage (open emitter)	V_{CBO}	max.	15	V
Collector-emitter voltage (open base)	V_{CEO}	max.	12	V
Emitter-base voltage (open collector)	V_{EBO}	max.	2	V
Collector current				
d.c.	I_C	max.	35	mA
peak value; f > 1 MHz	I_{CM}	max.	50	mA
Total power dissipation up to T_{amb} = 60 °C	P_{tot}	max.	300	mW
Storage temperature	T_{stg}		−65 to +150	°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

From junction to ambient in free air mounted on glass-fibre p.c.b. (see Fig. 2) $R_{th\ j-a}$ = 300 K/W

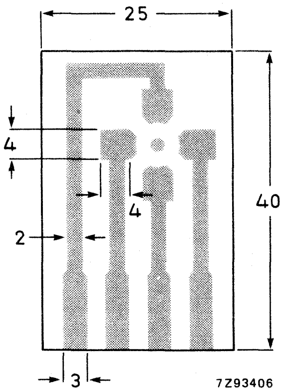


Fig. 2 Requirements for fibre-glass print (dimensions in mm). Single-sided 35 μm Cu-clad epoxy fibre-glass print, thickness 1,5 mm. Tracks are fully tin-lead plated. Shaded area is Cu.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current $I_E = 0$; $V_{CB} = 5$ V	I_{CBO}	max.	50 nA
D.C. current gain * $I_C = 30$ mA; $V_{CE} = 5$ V	h_{FE}	min. typ.	40 90
Transition frequency at f = 500 MHz * $I_C = 30$ mA; $V_{CE} = 5$ V	f_T	typ.	6 GHz
Collector output capacitance at f = 1 MHz $I_E = i_e = 0$; $V_{CB} = 5$ V	C_{oe}	typ.	0,9 pF
Emitter capacitance at f = 1 MHz $I_C = i_e = 0$; $V_{CB} = 0,5$ V	C_e	typ.	2,5 pF
Feedback capacitance at f = 1 MHz $I_E = 0$; $V_{CE} = 4$ V	C_{re}	typ.	0,5 pF

Maximum unilateral power gain at T_{amb} = 25 °C

$$G_{UM}\ (\text{in dB}) = 10 \log \frac{|s_{fe}|^2}{[1-|s_{ie}|^2]\,[1-|s_{oe}|^2]}$$

$I_C = 30$ mA; $V_{CE} = 8$ V; f = 800 MHz $I_C = 30$ mA; $V_{CE} = 8$ V; f = 2 GHz	G_{UM}	typ. typ.	16,5 dB 8,0 dB

Noise figure at optimum source impedance
$V_{CE} = 8$ V; f = 800 MHz; T_{amb} = 25 °C

I_C = 4 mA I_C = 30 mA	F	typ. typ.	1,6 dB 2,3 dB

* Measured under pulse conditions.

Output power at 1 dB gain compression V_{CE} = 8 V; I_C = 30 mA; T_{amb} = 25 °C; R_L = 75 Ω; measured at f = 800 MHz	P_{L1}	typ.	+17 dBm
Third order intercept point (see Fig. 3) I_C = 30 mA; V_{CE} = 8 V; R_L = 75 Ω; T_{amb} = 25 °C; P_p = ITO − 6 dB; f_p = 800 MHz; P_q = ITO − 6 dB; f_q = 801 MHz; measured at $f_{(2q-p)}$ = 802 MHz and at $f_{(2p-q)}$ = 799 MHz	ITO	typ.	+36 dBm
Intermodulation distortion (see Fig. 3) (DIN 45004B, par. 6.3: 3 tone) V_{CE} = 8 V; I_C = 30 mA; R_L = 75 Ω; VSWR < 2; T_{amb} = 25 °C V_p = V_o = 425 mV at f_p = 795,25 MHz V_q = V_o − 6 dB at f_q = 803,25 MHz V_r = V_o − 6 dB at f_r = 805,25 MHz measured at $f_{(p+q-r)}$ = 793,25 MHz	d_{im}	typ.	−60 dB
Second harmonic distortion (see Fig. 3) V_{CE} = 8 V; I_C = 30 mA; R_L = 75 Ω; VSWR < 2; T_{amb} = 25 °C V_p = V_o = 200 mV at f_p = 250 MHz V_q = V_o = 200 mV at f_q = 560 MHz measured at $f_{(p+q)}$ = 810 MHz	d_2	typ.	−50 dB

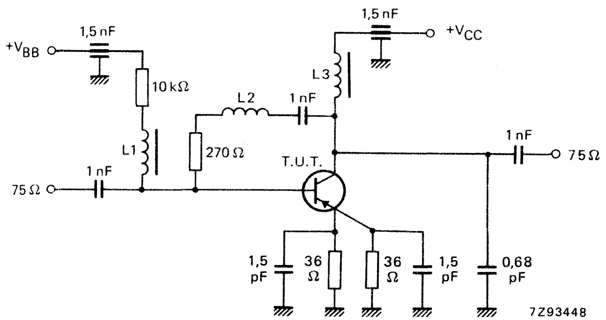


Fig. 3 Intermodulation distortion and second harmonic distortion MATV test circuit.

L1 = L3 = 5 μH Ferroxcube choke
L2 = 3 turns Cu wire (0,4 mm), internal diameter 3 mm, winding pitch 1 mm

s-parameters (common emitter) at V_{CE} = 8 V

I_C mA	f MHz	s_{ie}	s_{fe}	s_{re}	s_{oe}	G_{UM} dB
	40	0,90/ −14,5°	7,12/173,2°	0,01/ 81,7°	1,00/ −4,3°	49,1
	100	0,88/ −36,4°	6,86/159,1°	0,03/ 71,4°	0,97/−10,1°	35,8
	200	0,84/ −66,1°	6,06/143,2°	0,05/ 58,0°	0,91/−17,1°	28,6
2	500	0,73/−125,1°	3,69/108,6°	0,07/ 34,0°	0,74/−29,5°	18,1
	800	0,73/−153,5°	2,65/ 93,0°	0,08/ 28,6°	0,72/−37,9°	15,0
	1000	0,74/−168,6°	2,20/ 83,2°	0,08/ 26,8°	0,72/−45,7°	13,5
	1200	0,72/−176,7°	1,77/ 75,3°	0,07/ 28,6°	0,64/−51,2°	10,5
	2000	0,68/ 166,5°	1,01/ 51,8°	0,06/ 53,9°	0,65/−50,8°	5,2
	40	0,77/ −21,9°	15,58/169,8°	0,01/ 79,4°	0,99/ −7,4°	44,6
	100	0,74/ −51,1°	14,29/152,3°	0,02/ 66,4°	0,93/−16,8°	35,1
	200	0,71/ −87,4°	11,42/133,7°	0,04/ 52,6°	0,80/−26,4°	28,5
5	500	0,63/−145,5°	6,05/102,1°	0,05/ 38,3°	0,56/−35,6°	19,5
	800	0,64/−168,8°	4,12/ 89,4°	0,06/ 40,9°	0,55/−42,8°	16,2
	1000	0,65/−179,7°	3,37/ 81.3°	0,06/ 43,3°	0,54/−50,6°	14,4
	1200	0,67/ 166,6°	2,79/ 75,6°	0,06/ 48,6°	0,46/−53,6°	12,5
	2000	0,63/ 161,5°	1,52/ 54,0°	0,08/ 64,6°	0,48/−50,6°	7,0
	40	0,61/ −31,68°	26,14/165,8°	0,01/ 75,9°	0,98/−11,2°	43,5
	100	0,60/ −70,85°	22,34/144,7°	0,02/ 62,3°	0,86/−24,3°	34,6
	200	0,60/−110,6°	16,32/124,5°	0,03/ 50,4°	0,67/−34,9°	28,8
10	500	0,59/−161,7°	7,80/ 97,4°	0,04/ 47,2°	0,42/−40,1°	20,5
	800	0,59/−178,3°	5,12/ 86,6°	0,05/ 54,0°	0,42/−46,8°	16,9
	1000	0,60/ 172,9°	4,14/ 79,7°	0,06/ 57,1°	0,42/−55,3°	15,1
	1200	0,63/ 160,3°	3,42/ 75,7°	0,07/ 61,8°	0,34/−56,5°	13,4
	2000	0,59/ 157,8°	1,88/ 55,3°	0,09/ 68,9°	0,37/−51,8°	8,0
	40	0,44/ −49,2°	39,09/160,4°	0,01/ 72,2°	0,95/−16,1°	42,6
	100	0,49/ −97,6°	30,79/136,0°	0,02/ 59,1°	0,76/−42,6°	34,7
	200	0,53/−134,7°	20,31/116,6°	0,02/ 52,5°	0,54/−42,6°	29,1
20	500	0,57/−173,5°	9,05/ 33,9°	0,04/ 58,5°	0,32/−43,6°	21,3
	800	0,56/ 173,5°	5,88/ 84,6°	0,05/ 65,3°	0,33/−50,1°	17,5
	1000	0,57/ 167,0°	4,69/ 78,6°	0,06/ 67,0°	0,33/−59,9°	15,6
	1200	0,62/ 154,2°	3,88/ 74,9°	0,07/ 70,1°	0,24/−60,4°	14,2
	2000	0,57/ 155,0°	2,13/ 56,3°	0,10/ 71,5°	0,28/−54,2°	8,7
	40	0,36/ −64,5°	46,45/157,6°	0,01/ 71,7°	0,92/−18,6°	42,3
	100	0,46/−113,9°	34,54/132,0°	0,01/ 59,1°	0,70/−36,5°	34,8
	200	0,52/−145,9°	21,76/113,4°	0,02/ 55,9°	0,48/−45,5°	29,3
30	500	0,56/−178,5°	9,48/ 92,7°	0,03/ 63,8°	0,28/−44,2°	21,5
	800	0,55/−170,1°	6,15/ 84,2°	0,05/ 70,0°	0,30/−51,0°	17,8
	1000	0,57/−164,8°	4,19/ 78,6°	0,06/ 70,9°	0,30/−61,5°	15,9
	1200	0,62/−152,7°	4,07/ 75,8°	0,07/ 73,6°	0,21/−61,3°	14,4
	2000	0,57/−153,8°	2,22/ 56,3°	0,10/ 72,5°	0,25/−55,4°	8,9

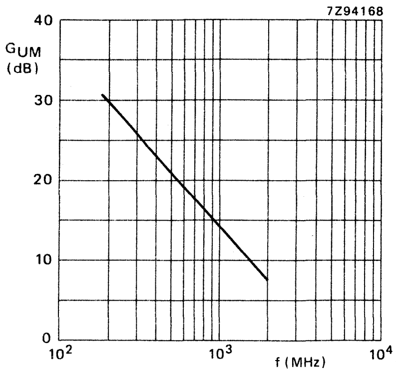


Fig. 4 V_{CE} = 8 V; I_C = 30 mA; T_{amb} = 25 °C.

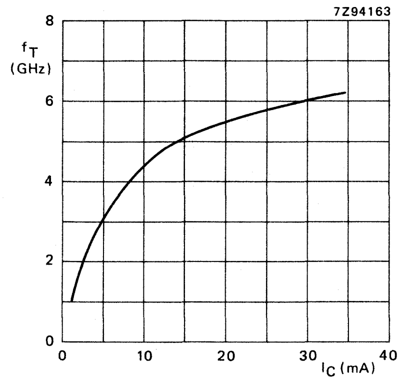


Fig. 5 V_{CE} = 8 V; f = 500 MHz; T_{amb} = 25 °C.

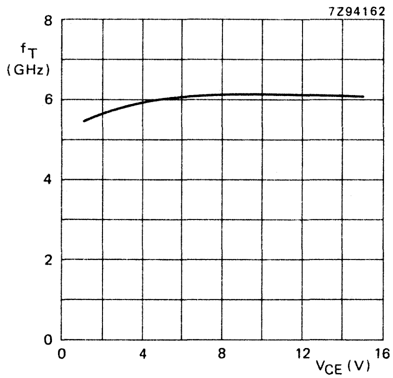


Fig. 6 I_C = 30 mA; f = 500 MHz; T_{amb} = 25 °C.

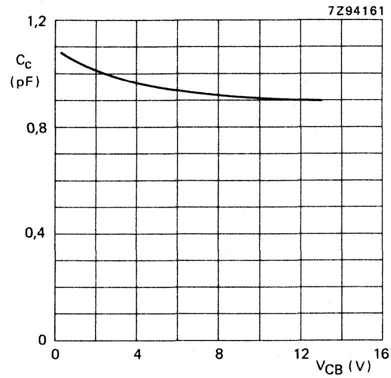


Fig. 7 $I_E = i_e$ = 0; f = 1 MHz; T_{amb} = 25 °C.

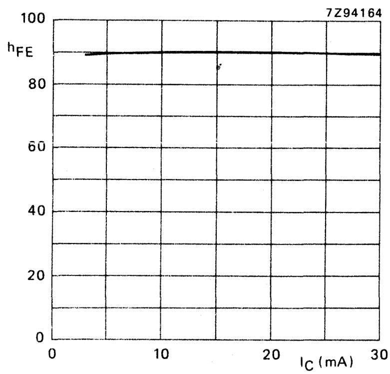


Fig. 8 V_{CE} = 5 V; T_{amb} = 25 °C.

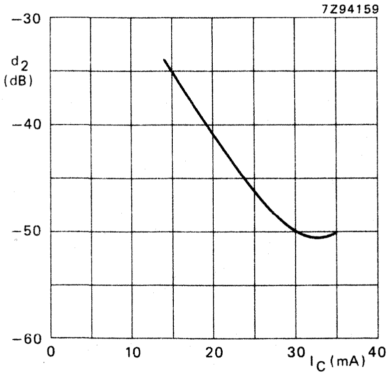


Fig. 9 V_{CE} = 8 V; V_o = 200 mV; $f_{(p+q)}$ = 810 MHz; T_{amb} = 25 °C.

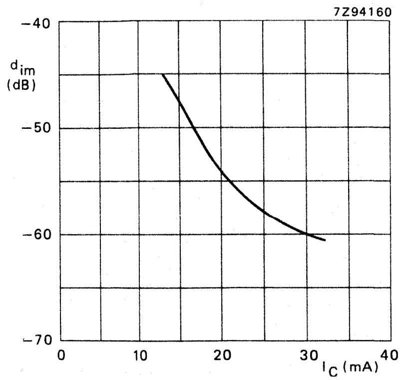


Fig. 10 V_{CE} = 8 V; V_o = 425 mV; $f_{(p+q-r)}$ = 793,25 MHz; T_{amb} = 25 °C.

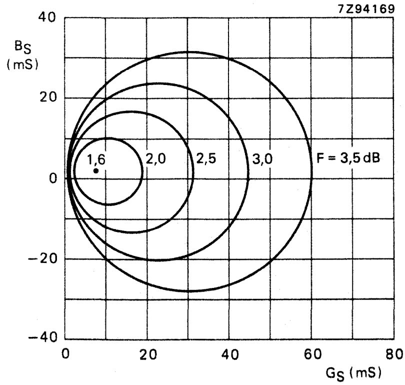


Fig. 11 Circle of constant noise figure; I_C = 4 mA; V_{CE} = 8 V; f = 800 MHz.

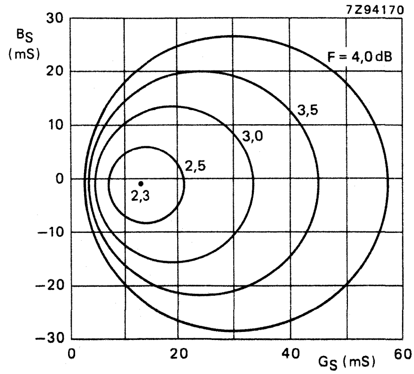


Fig. 12 Circle of constant noise figure; I_C = 30 mA; V_{CE} = 8 V; f = 800 MHz.

CLASS-B OPERATION

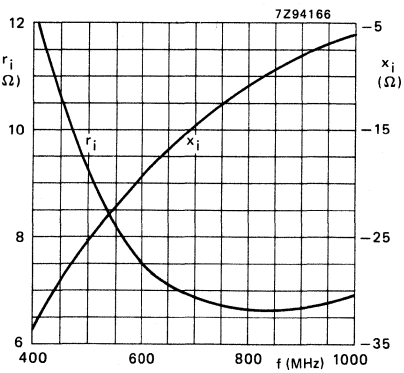


Fig. 13 Input impedance (series components).

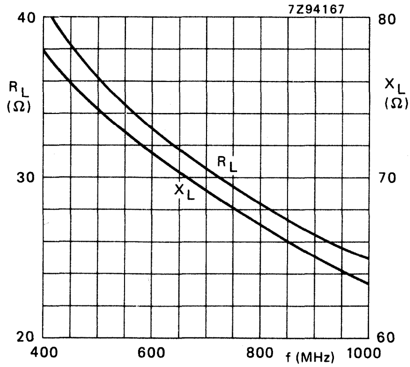


Fig. 14 Load impedance (series components).

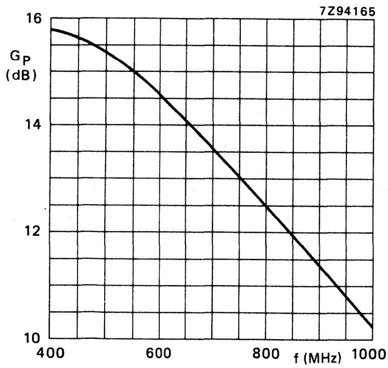


Fig. 15 Power gain versus frequency.

Conditions for Figs 13 to 15:

V_{CE} = 7,5 V; P_L = 160 mW; T_{amb} = 25 °C.

OPERATING NOTE for Figs 13 to 15:

A base-emitter resistor of 82 Ω is recommended to avoid oscillation. This resistor must be effective for r.f. only.

SILICON PLANAR EPITAXIAL TRANSISTOR

Silicon epitaxial n-p-n transistor in a four-lead dual-emitter plastic envelope (SOT-103). This device is designed for wideband application in CATV and MATV systems up to 2 GHz.

QUICK REFERENCE DATA

Collector-base voltage (open emitter)	V_{CBO}	max.	20	V
Collector-emitter voltage (open base)	V_{CEO}	max.	15	V
Collector current (d.c.)	I_C	max.	150	mA
Total power dissipation up to T_{amb} = 70 °C	P_{tot}	max.	700	mW
Junction temperature	T_j	max.	175	°C
D.C. current gain I_C = 50 mA; V_{CE} = 10 V	h_{FE}	min.	25	
Transition frequency at f = 500 MHz I_C = 50 mA; V_{CE} = 10 V	f_T	typ.	5	GHz
Feedback capacitance at f = 1 MHz I_C = 0; V_{CB} = 10 V	C_{re}	typ.	1,0	pF
Maximum unilateral power gain at f = 800 MHz I_C = 50 mA; V_{CE} = 10 V; T_{amb} = 25 °C	G_{UM}	typ.	17	dB
Output power at 1 dB gain compression V_{CE} = 10 V; I_C = 70 mA; f = 800 MHz	P_{L1}	typ.	+21	dBm
Third order intercept point V_{CE} = 10 V; I_C = 70 mA; f = 800 MHz	ITO	typ.	+40	dBm

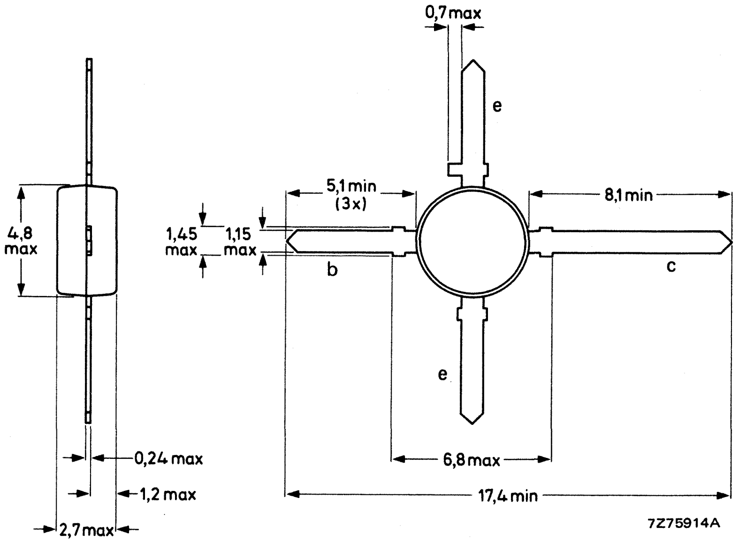
MECHANICAL DATA

SOT-103 (see Fig. 1).

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-103.



RATINGS

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

Collector-base voltage (open emitter)	V_{CBO}	max.	20	V
Collector-emitter voltage (open base)	V_{CEO}	max.	15	V
Emitter-base voltage (open collector)	V_{EBO}	max.	3	V
Collector current (d.c.)	I_C	max.	150	mA
Total power dissipation up to T_{amb} = 70 °C mounted on a p.c. board (see Fig. 2)	P_{tot}	max.	700	mW
Storage temperature	T_{stg}		−65 to +175	°C
Junction temperature	T_j	max.	175	°C

THERMAL RESISTANCE

From junction to ambient in free air mounted on glass-fibre p.c.b. (see Fig. 2)	$R_{th\ j\text{-}a}$	=	150 K/W
From junction to case	$R_{th\ j\text{-}c}$	=	75 K/W

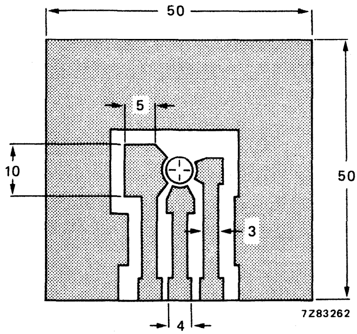


Fig. 2 Requirements for fibre-glass print (dimensions in mm). Single-sided 35 μm Cu-clad epoxy fibre-glass print, thickness 1,5 mm. Tracks are fully tin-lead plated. Shaded area is Cu.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current $I_E = 0$; $V_{CB} = 10$ V	I_{CBO}	max.	100 nA
D.C. current gain * $I_C = 50$ mA; $V_{CE} = 10$ V	h_{FE}	min. typ.	25 50
Transition frequency at f = 500 MHz * $I_C = 50$ mA; $V_{CE} = 10$ V	f_T	typ.	5 GHz
Collector capacitance at f = 1 MHz $I_E = i_e = 0$; $V_{CB} = 10$ V	C_c	typ.	1,5 pF
Emitter capacitance at f = 1 MHz $I_C = i_c = 0$; $V_{EB} = 0,5$ V	C_e	typ.	6,5 pF
Feedback capacitance at f = 1 MHz $I_C = 0$; $V_{CE} = 10$ V	C_{re}	typ.	1,0 pF

Maximum unilateral power gain at T_{amb} = 25 °C

$$G_{UM} \text{ (in dB)} = 10 \log \frac{|s_{fe}|^2}{[1-|s_{ie}|^2]\,[1-|s_{oe}|^2]}$$

$I_C = 50$ mA; $V_{CE} = 10$ V; f = 800 MHz $I_C = 50$ mA; $V_{CE} = 10$ V; f = 2 GHz	G_{UM}	typ. typ.	15,0 dB 8,0 dB

* Measured under pulse conditions.

Output power at 1 dB gain compression I_C = 70 mA; V_{CE} = 10 V; T_{amb} = 25 °C; R_L = 75 Ω; measured at f = 800 MHz	P_{L1}	typ.	+21 dBm
Third order intercept point (see Fig. 3) I_C = 70 mA; V_{CE} = 10 V; R_L = 75 Ω; T_{amb} = 25 °C; P_p = ITO − 6 dB; f_p = 800 MHz; P_q = ITO − 6 dB; f_q = 801 MHz; measured at $f_{(2q-p)}$ = 802 MHz and at $f_{(2p-q)}$ = 799 MHz	ITO	typ.	+40 dBm
Intermodulation distortion (see Fig. 3) (DIN 45004B, par. 6.3: 3 tone) I_C = 70 mA; V_{CE} = 10 V; R_L = 75 Ω; VSWR < 2; T_{amb} = 25 °C V_p = V_o = 700 mV at f_p = 795,25 MHz V_q = V_o − 6 dB at f_q = 803,25 MHz V_r = V_o − 6 dB at f_r = 805,25 MHz measured at $f_{(p+q-r)}$ = 793,25 MHz	d_{im}	typ.	−60 dB
Second harmonic distortion (see Fig. 3) I_C = 14 mA; V_{CE} = 10 V; R_L = 75 Ω; VSWR < 2; T_{amb} = 25 °C V_p = V_o = 316 mV at f_p = 250 MHz V_q = V_o = 316 mV at f_q = 560 MHz measured at $f_{(p+q)}$ = 810 MHz	d_2	typ.	−52 dB

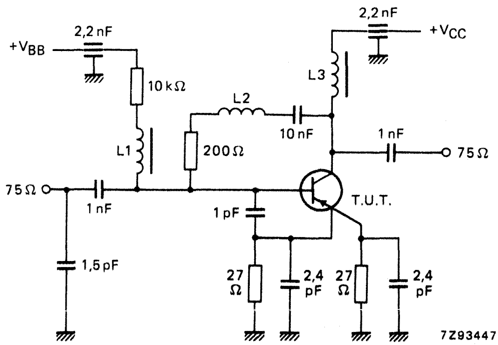


Fig. 3 Intermodulation distortion and second harmonic distortion MATV test circuit.

L1 = L3 = 5 μH micro-choke
L2 = 1,5 turns Cu wire (0,4 mm), internal diameter 3 mm, winding pitch 1 mm.

s-parameters (common emitter) at V_{CE} = 10 V

I_C mA	f MHz	s_{ie}	s_{fe}	s_{re}	s_{oe}	G_{UM} dB
	40	0,75/ 33,1°	25,61/136,3°	0,04/ 45,38°	0,91/ 50,9°	39,2
	100	0,72/ −17,9°	18,62/115,2°	0,04/ 40,38°	0,66/ 29,7°	31,0
	200	0,69/ −90,1°	12,47/105,3°	0,05/ 36,90°	0,45/ −21,4°	25,7
	500	0,71/ 176,5°	4,90/ 83,0°	0,06/ 38,38°	0,27/ −23,5°	17,1
10	800	0,72/ 171,3°	3,40/ 69,6°	0,08/ 48,45°	0,28/ −36,2°	14,1
	1000	0,71/ 166,8°	2,56/ 65,2°	0,08/ 49,95°	0,26/ −46,7°	11,5
	1200	0,74/ 155,3°	2,10/ 61,6°	0,08/ 55,93°	0,25/ −46,3°	10,2
	1500	0,78/ 145,4°	2,02/ 39,0°	0,10/ 61,78°	0,26/−159,4°	10,5
	2000	0,73/ 126,5°	1,34/ −6,1°	0,13/ 7,60°	0,26/−114,5°	6,2
	40	0,66/ 23,3°	34,19/132,7°	0,04/ 42,88°	0,88/ 45,6°	39,5
	100	0,67/ −26,5°	22,57/112,9°	0,04/ 38,10°	0,56/ 21,9°	31,3
	200	0,67/ −86,1°	14,26/102,0°	0,05/ 40,90°	0,36/ −33,4°	26,3
	500	0,70/ 176,3°	5,48/ 82,9°	0,06/ 45,18°	0,19/ −38,1°	17,9
15	800	0,71/ 168,4°	3,78/ 69,0°	0,08/ 55,43°	0,20/ −50,5°	14,8
	1000	0,72/ 164,6°	2,85/ 65,6°	0,08/ 57,48°	0,18/ −53,2°	12,4
	1200	0,74/ 152,8°	2,32/ 62,5°	0,09/ 60,28°	0,17/ −37,5°	10,8
	1500	0,77/ 146,1°	2,28/ 41,4°	0,10/ 65,25°	0,19/−123,1°	11,3
	2000	0,72/ 125,7°	1,51/ −5,0°	0,14/ 7,05°	0,20/−128,2°	7,0
	40	0,62/ 13,9°	40,59/131,8°	0,04/ 38,98°	0,83/ 39,1°	39,2
	100	0,65/ −37,5°	25,03/109,5°	0,04/ 36,05°	0,51/ 15,4°	31,7
	200	0,67/ −68,6°	15,43/100,8°	0,04/ 40,80°	0,31/ −42,1°	26,8
	500	0,70/ 176,1°	5,75/ 81,7°	0,06/ 49,53°	0,16/ −51,9°	18,2
20	800	0,72/ 166,2°	4,03/ 69,3°	0,08/ 55,80°	0,17/ −53,0°	15,4
	1000	0,69/ 164,1°	3,02/ 66,4°	0,08/ 59,05°	0,15/ −36,3°	12,5
	1200	0,73/ 150,9°	2,47/ 63,5°	0,09/ 62,18°	0,14/ 117,9°	11,2
	1500	0,75/ 145,1°	2,38/ 41,3°	0,11/ 66,45°	0,16/−126,5°	11,3
	2000	0,72/ 125,3°	1,59/ −5,0°	0,14/ 9,28°	0,17/−140,5°	7,3
	40	0,55/ −2,1°	50,00/128,5°	0,04/ 35,50°	0,78/ 32,5°	39,5
	100	0,64/ −40,8°	28,09/106,5°	0,03/ 34,85°	0,44/ 4,1°	32,2
	200	0,65/ 6,1°	16,77/ 97,9°	0,04/ 45,58°	0,25/ −54,3°	27,2
	500	0,69/−179,8°	6,15/ 81,8°	0,05/ 54,00°	0,15/ −55,1°	18,7
30	800	0,70/ 166,9°	4,25/ 70,1°	0,08/ 60,45°	0,16/ −1,9°	15,6
	1000	0,70/ 163,8°	3,21/ 67,2°	0,08/ 63,18°	0,13/ 165,1°	13,1
	1200	0,73/ 151,2°	2,61/ 64,2°	0,09/ 66,68°	0,12/−151,3°	11,7
	1500	0,75/ 141,4°	2,56/ 43,3°	0,12/ 67,53°	0,15/−142,5°	11,8
	2000	0,71/ 126,0°	1,69/ −4,1°	0,15/ 10,45°	0,16/−159,5°	7,8
	40	0,51/ −21,9°	59,01/124,0°	0,04/ 32,05°	0,69/ 25,6°	39,5
	100	0,64/ −36,4°	30,20/103,2°	0,03/ 38,98°	0,36/ −7,1°	32,5
	200	0,65/ 128,6°	17,42/ 95,4°	0,04/ 47,90°	0,22/ −67,7°	27,5
	500	0,70/ 178,8°	6,39/ 80,9°	0,05/ 62,15°	0,15/ 8,8°	19,1
50	800	0,72/ 166,9°	4,41/ 68,1°	0,08/ 64,15°	0,16/ 149,9°	16,2
	1000	0,69/ 162,0°	3,31/ 67,7°	0,08/ 65,10°	0,14/−164,5°	13,3
	1200	0,73/ 151,5°	2,72/ 65,2°	0,09/ 68,25°	0,13/−163,0°	12,0
	1500	0,75/ 144,3°	2,60/ 43,1°	0,12/ 69,60°	0,15/−158,3°	11,9
	2000	0,71/ 124,5°	1,76/ −2,2°	0,15/ 10,13°	0,16/−175,0°	8,1

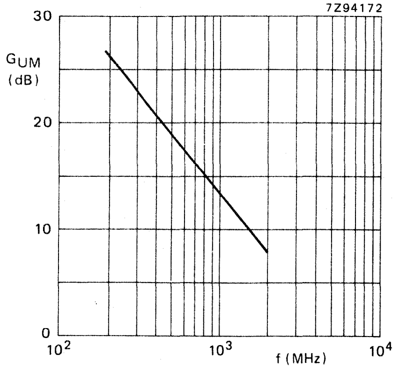


Fig. 4 V_{CE} = 10 V; I_C = 50 mA; T_{amb} = 25 °C.

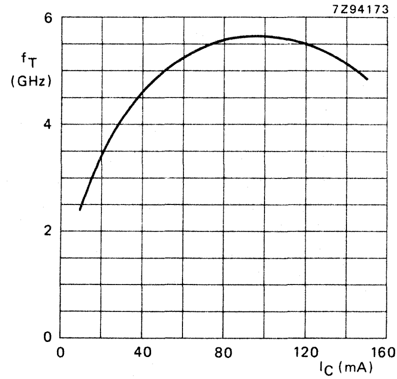


Fig. 5 V_{CE} = 10 V; f = 500 MHz; T_j = 25 °C

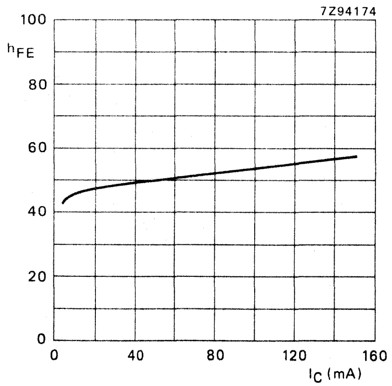


Fig. 6 V_{CE} = 10 V; T_{amb} = 25 °C.

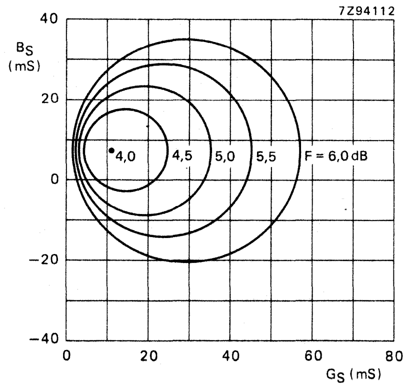


Fig. 7 Circle of constant noise figure I_C = 70 mA; V_{CE} = 10 V; f = 800 MHz.

CLASS-B OPERATION

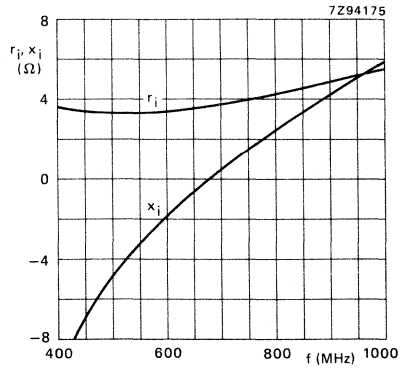


Fig. 8 Input impedance (series components).

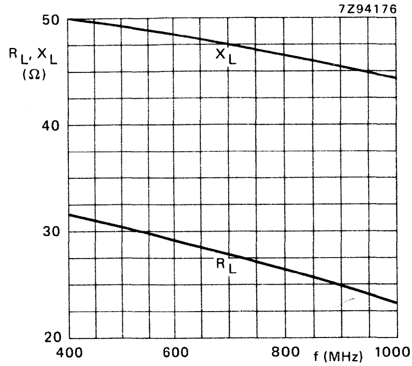


Fig. 9 Load impedance (series components).

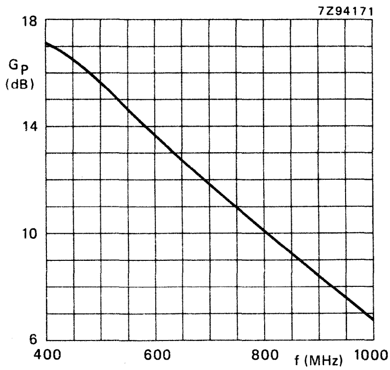


Fig. 10 Power gain versus frequency.

Conditions for Figs 8 to 10:
V_{CE} = 10 V; P_L = 700 mW; T_{amb} = 25 °C

OPERATING NOTE for Figs 8 to 10:
A resistance of 39 Ω between base and emitter is recommended to avoid oscillation. This resistance must be effective for r.f. only.

N-P-N 1 GHZ BROADBAND TRANSISTOR

Gold-metallized n-p-n transistor in a sub-miniature HERMETICALLY SEALED micro-stripline envelope. The BFP90A features low noise, high gain and low distortion figures.

This device is designed for v.h.f. and u.h.f. wideband amplifiers and applications in the GHz range.

QUICK REFERENCE DATA

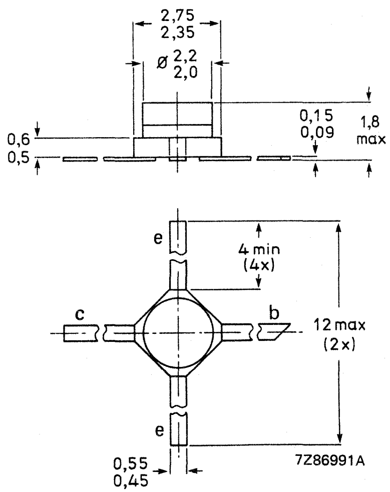
Collector-base voltage	V_{CBO}	max.	20 V
Collector-emitter voltage	V_{CEO}	max.	15 V
Collector current (d.c.)	I_C	max.	30 mA
Total power dissipation up to T_{amb} = 125 °C	P_{tot}	max.	250 mW
Junction temperature	T_j	max.	175 °C
D.C. current gain I_C = 14 mA; V_{CE} = 10 V	h_{FE}	min. typ.	40 90
Transition frequency at f = 500 MHz I_C = 14 mA; V_{CE} = 10 V	f_T	typ.	5,0 GHz
Maximum unilateral power gain I_C = 14 mA; V_{CE} = 10 V; T_{amb} = 25 °C at f = 500 MHz at f = 800 MHz	G_{UM}	typ. typ.	23 dB 19 dB

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-173.

Marking code: P0



RATINGS

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

Collector-base voltage (open emitter)	V_{CBO}	max.	20 V
Collector-emitter voltage (open base)	V_{CEO}	max.	15 V
Emitter-base voltage (open collector)	V_{EBO}	max.	2,0 V
Collector current (d.c.)	I_C	max.	30 mA
Total power dissipation up to T_{amb} = 125 °C mounted on a ceramic substrate of 0,7 mm x 10 cm²	P_{tot}	max.	250 mW
Storage temperature	T_{stg}	−65 to +150 °C	
Junction temperature	T_j	max.	175 °C

THERMAL RESISTANCE

From junction to ambient mounted on a ceramic substrate of 0,7 mm x 10 cm²	$R_{th\ j\text{-}a}$	200 K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current $I_E = 0$; V_{CB} = 10 V	I_{CBO}	max.	50 nA
D.C. current gain* I_C = 14 mA; V_{CE} = 10 V	h_{FE}	min.	40
		typ.	90
Transition frequency at f = 500 MHz* I_C = 14 mA; V_{CE} = 10 V	f_T	typ.	5,0 GHz
Collector capacitance at f = 1 MHz $I_E = i_e = 0$; V_{CB} = 10 V	C_c	typ.	0,5 pF
Emitter capacitance at f = 1 MHz $I_C = i_c = 0$; V_{EB} = 0,5 V	C_e	typ.	1,2 pF
Feedback capacitance at f = 1 MHz $I_C = 0$; V_{CE} = 10 V	C_{re}	typ.	0,3 pF

Maximum unilateral power gain (s_{re} assumed to be zero)

$$G_{UM}\ (\text{in dB}) = 10 \log \frac{|s_{fe}|^2}{[1 - |s_{ie}|^2]\ [1 - |s_{oe}|^2]}$$

at I_C = 14 mA; V_{CE} = 10 V; T_{amb} = 25 °C			
f = 500 MHz	G_{UM}	typ.	23 dB
f = 800 MHz		typ.	19 dB

Noise figure at f = 800 MHz; R_S = opt.; T_{amb} = 25 °C			
I_C = 4 mA; V_{CE} = 10 V	F	typ.	1,7 dB
I_C = 14 mA; V_{CE} = 10 V		typ.	2,4 dB

* Measured under pulse conditions.

s-parameters (common emitter) at V_{CE} = 10 V

I_C mA	f MHz	s_{ie}	s_{fe}	s_{re}	s_{oe}
	40	0,89/− 8,4°	7,0/174,9°	0,006/83,5°	0,99/− 2,3°
	100	0,88/− 20,8°	6,9/167,0°	0,015/79,6°	0,98/− 5,4°
	200	0,84/− 40,7°	6,6/154,0°	0,028/70,2°	0,95/−10,2°
2	500	0,72/− 87,4°	5,0/126,0°	0,053/51,7°	0,86/−19,6°
	800	0,64/−116,6°	3,7/107,3°	0,063/43,9°	0,81/−24,9°
	1000	0,59/−132,4°	3,1/ 98,1°	0,066/42,4°	0,79/−27,8°
	1200	0,56/−145,7°	2,7/ 90,6°	0,068/41,1°	0,77/−30,4°
	40	0,78/− 12,7°	14,8/172,3°	0,006/81,4°	0,98/− 3,7°
	100	0,76/− 30,9°	14,0/160,8°	0,014/75,3°	0,96/− 8,8°
	200	0,70/− 58,3°	12,4/144,1°	0,024/64,9°	0,89/−15,1°
5	500	0,58/−112,1°	7,8/114,7°	0,040/50,6°	0,74/−23,5°
	800	0,52/−138,8°	5,5/ 98,5°	0,048/50,1°	0,69/−26,4°
	1000	0,49/−153,6°	4,4/ 91,2°	0,052/51,7°	0,67/−28,5°
	1200	0,48/−163,4°	3,8/ 84,5°	0,056/53,2°	0,66/−30,5°
	40	0,65/− 18,3°	23,5/169,2°	0,005/79,9°	0,98/− 5,4°
	100	0,63/− 43,4°	21,5/154,2°	0,012/71,9°	0,93/−12,3°
	200	0,56/− 78,1°	17,4/134,5°	0,020/61,1°	0,82/−19,0°
10	500	0,49/−132,4°	9,5/107,0°	0,032/54,4°	0,65/−24,0°
	800	0,46/−154,9°	6,4/ 93,3°	0,041/58,0°	0,62/−26,1°
	1000	0,44/−167,1°	5,1/ 87,4°	0,047/60,6°	0,61/−27,6°
	1200	0,44/−174,8°	4,3/ 81,7°	0,052/62,5°	0,60/−29,7°
	40	0,52/− 28,1°	33,9/164,9°	0,005/77,6°	0,96/− 7,5°
	100	0,50/− 64,1°	29,3/145,4°	0,011/67,4°	0,88/−15,5°
	200	0,46/−104,5°	21,0/124,4°	0,016/59,7°	0,73/−20,8°
20	500	0,46/−150,2°	10,3/101,0°	0,026/61,4°	0,60/−22,1°
	800	0,44/−165,7°	6,7/ 89,7°	0,037/66,1°	0,58/−23,9°
	1000	0,44/−175,7°	5,4/ 84,2°	0,044/68,6°	0,58/−25,7°
	1200	0,44/+ 178,5°	4,5/ 79,6°	0,050/69,8°	0,57/−27,9°
	40	0,48/− 33,4°	36,8/162,7°	0,005/75,8°	0,95/− 8,2°
	100	0,47/− 72,9°	30,3/141,7°	0,010/65,2°	0,85/−16,2°
	200	0,45/−113,4°	21,0/121,1°	0,015/59,4°	0,71/−20,2°
25	500	0,45/−156,0°	9,9/ 99,1°	0,025/62,9°	0,60/−20,8°
	800	0,45/−170,1°	6,5/ 88,1°	0,036/67,9°	0,58/−23,1°
	1000	0,44/−179,1°	5,2/ 83,2°	0,043/69,9°	0,58/−25,0°
	1200	0,44/+ 175,4°	4,3/ 78,9°	0,050/71,2°	0,58/−27,4°

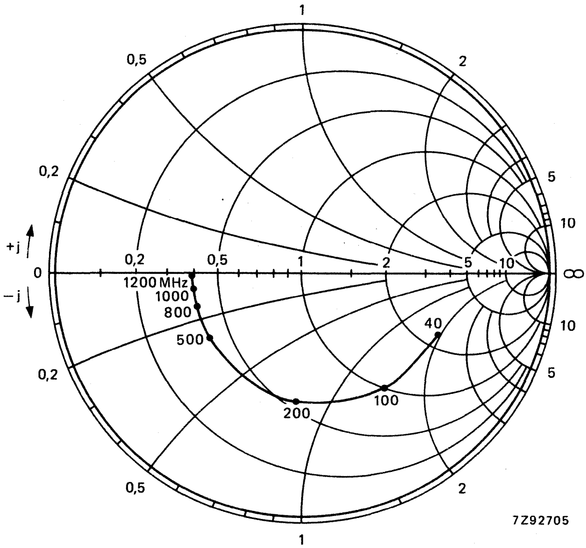


Fig. 2 Input impedance, derived from input reflection coefficient s_{ie} coordinates, in Ω x 50.

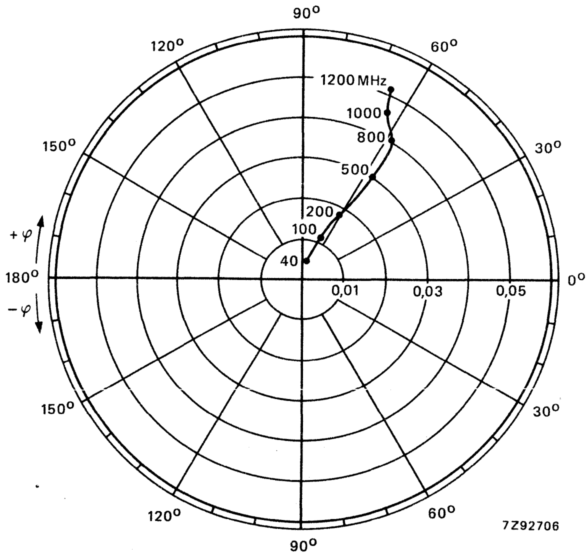


Fig. 3 Reverse transmission coefficient s_{re}.

Conditions for Figs 2 to 5: V_{CE} = 10 V; I_C = 14 mA; T_{amb} = 25 °C.

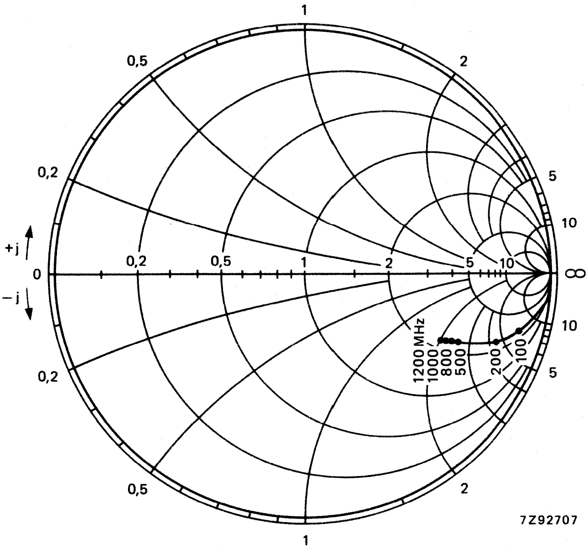


Fig. 4 Output impedance, derived from output reflection coefficient s_{oe} coordinates, in Ω x 50.

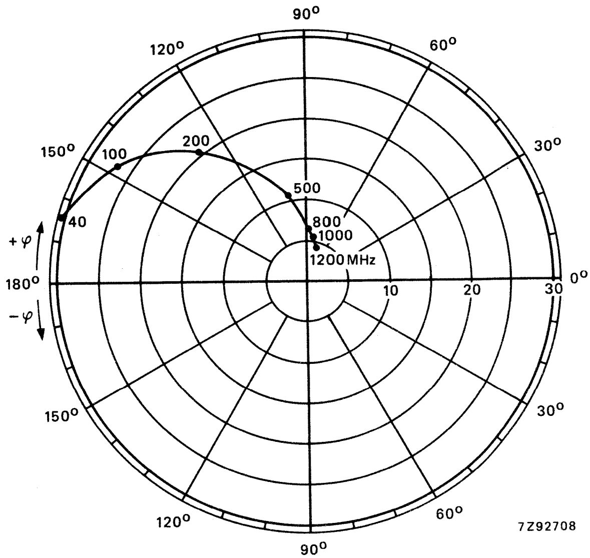


Fig. 5 Forward transmission coefficient s_{fe}.

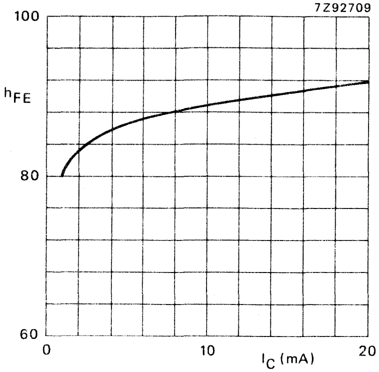


Fig. 6 V_{CE} = 10 V; T_j = 25 °C; typical values.

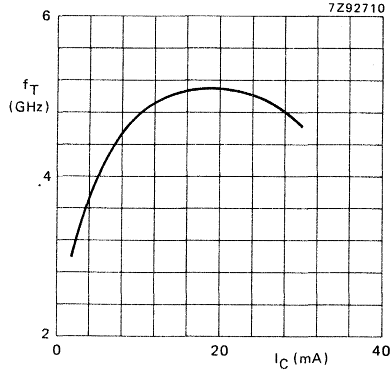


Fig. 7 V_{CE} = 10 V; f = 500 MHz; T_j = 25 °C; typical values.

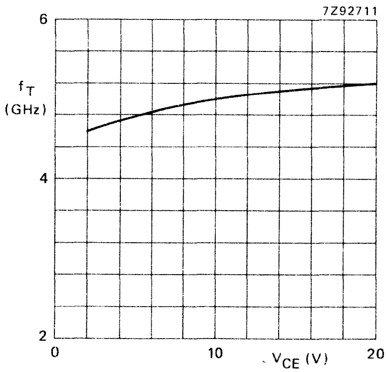


Fig. 8 I_C = 14 mA; f = 500 MHz; T_j = 25 °C; typical values.

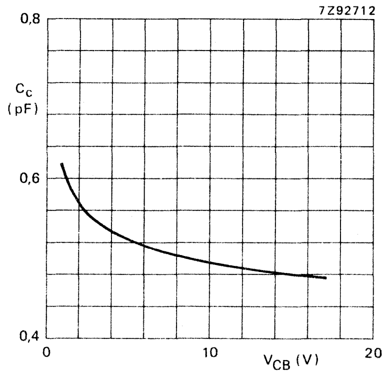


Fig. 9 I_E = i_e = 0; f = 1 MHz; T_j = 25 °C; typical values.

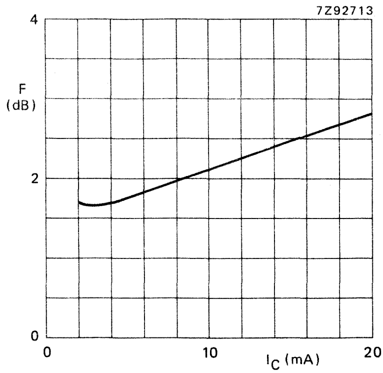


Fig. 10 V_{CE} = 10 V; f = 800 MHz; R_S = opt.; T_{amb} = 25 °C; typical values.

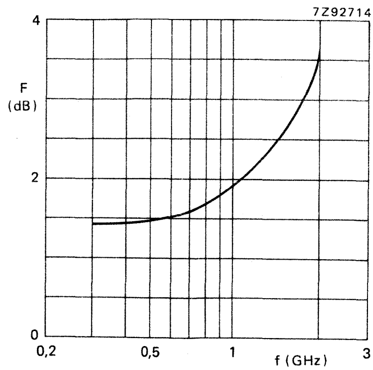


Fig. 11 V_{CE} = 10 V; I_C = 4 mA; R_S = opt.; T_{amb} = 25 °C; typical values.

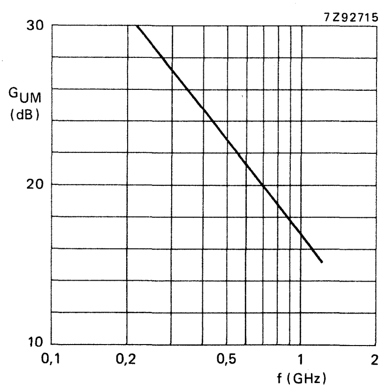


Fig. 12 V_{CE} = 10 V; I_C = 4 mA; T_{amb} = 25 °C; typical values.

N-P-N 1 GHz BROADBAND TRANSISTOR

Gold-metallized n-p-n transistor in a sub-miniature HERMETICALLY SEALED micro-stripline envelope. The BFP91A features low noise, high gain and low distortion figures.

This device is designed for v.h.f. and u.h.f. wideband amplifiers and applications in the GHz range.

QUICK REFERENCE DATA

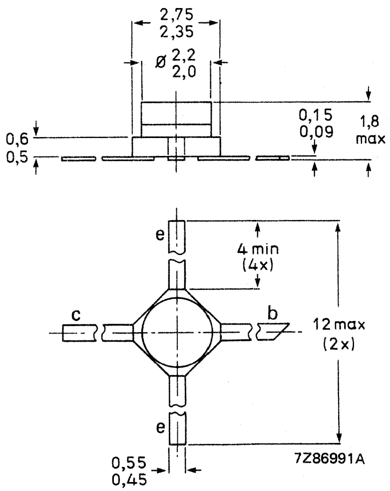
Collector-base voltage	V_{CBO}	max.	15	V
Collector-emitter voltage	V_{CEO}	max.	12	V
Collector current (d.c.)	I_C	max.	50	mA
Total power dissipation up to T_{amb} = 105 °C	P_{tot}	max.	350	mW
Junction temperature	T_j	max.	175	°C
D.C. current gain I_C = 30 mA; V_{CE} = 5 V	h_{FE}	min. typ.	40 90	
Transition frequency at f = 500 MHz I_C = 30 mA; V_{CE} = 5 V	f_T	typ.	6,0	GHz
Maximum unilateral power gain I_C = 30 mA; V_{CE} = 8 V; T_{amb} = 25 °C at f = 500 MHz at f = 800 MHz	G_{UM}	typ. typ.	22 18	dB dB

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-173.

Marking code: P1



RATINGS

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

Collector-base voltage (open emitter)	V_{CBO}	max.	15	V
Collector-emitter voltage (open base)	V_{CEO}	max.	12	V
Emitter-base voltage (open collector)	V_{EBO}	max.	2,0	V
Collector current (d.c.)	I_C	max.	50	mA
Total power dissipation up to T_{amb} = 105 °C mounted on a ceramic substrate of 0,7 mm x 10 cm^2	P_{tot}	max.	350	mW
Storage temperature	T_{stg}	−65 to +150		°C
Junction temperature	T_j	max.	175	°C

THERMAL RESISTANCE

From junction to ambient mounted on a ceramic substrate of 0,7 mm x 10 cm^2	$R_{th\ j\text{-}a}$	200	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current $I_E = 0$; $V_{CB} = 10$ V	I_{CBO}	max.	50	nA
D.C. current gain * $I_C = 30$ mA; $V_{CE} = 5$ V	h_{FE}	min.	40	
		typ.	90	
Transition frequency at f = 500 MHz * $I_C = 30$ mA; $V_{CE} = 5$ V	f_T	typ.	6,0	GHz
Collector capacitance at f = 1 MHz $I_E = i_e = 0$; $V_{CB} = 10$ V	C_c	typ.	0,7	pF
Emitter capacitance at f = 1 MHz $I_C = i_c = 0$; $V_{EB} = 0,5$ V	C_e	typ.	2,5	pF
Feedback capacitance at f = 1 MHz $I_C = 0$; $V_{CE} = 10$ V	C_{re}	typ.	0,5	pF

Maximum unilateral power gain (s_{re} assumed to be zero)

$$G_{UM}\ (\text{in dB}) = 10 \log \frac{|s_{fe}|^2}{[1 - |s_{ie}|^2]\ [1 - |s_{oe}|^2]}$$

at $I_C = 30$ mA; $V_{CE} = 8$ V; $T_{amb} = 25$ °C, f = 500 MHz	G_{UM}	typ.	22	dB
f = 800 MHz	G_{UM}	typ.	18	dB

Noise figure at f = 800 MHz; R_S = opt.; T_{amb} = 25 °C, $I_C = 4$ mA; $V_{CE} = 8$ V	F	typ.	1,6	dB
$I_C = 30$ mA; $V_{CE} = 8$ V	F	typ.	2,3	dB

* Measured under pulse conditions.

s-parameters (common emitter) at V_{CE} = 8 V

I_C mA	f MHz	s_{ie}	s_{fe}	s_{re}	s_{oe}
	40	0,92/− 13,6°	6,8/172,5°	0,011/81,7°	0,99/− 3,9°
	100	0,90/− 33,2°	6,8/160,7°	0,027/72,9°	0,97/− 9,0°
	200	0,86/− 62,0°	6,0/143,6°	0,048/59,0°	0,92/−15,6°
2	500	0,79/−117,3°	3,8/111,1°	0,075/35,5°	0,78/−26,8°
	800	0,73/−144,5°	2,6/ 93,6°	0,080/27,4°	0,73/−32,5°
	1000	0,71/−157,6°	2,1/ 85,2°	0,081/25,5°	0,72/−36,6°
	1200	0,71/−167,6°	1,8/ 77,8°	0,081/24,7°	0,72/−40,5°
	40	0,81/− 19,5°	16,0/169,4°	0,011/79,3°	0,98/− 6,9°
	100	0,79/− 46,6°	14,5/153,7°	0,024/67,7°	0,93/−15,8°
	200	0,74/− 82,4°	11,8/133,9°	0,040/52,9°	0,80/−25,4°
5	500	0,69/−136,4°	6,5/103,9°	0,056/36,1°	0,60/−35,3°
	800	0,66/−158,8°	4,3/ 89,5°	0,061/35,2°	0,55/−38,5°
	1000	0,65/−169,4°	3,5/ 82,7°	0,064/36,8°	0,54/−41,3°
	1200	0,65/−177,2°	2,9/ 76,7°	0,066/38,6°	0,53/−44,3°
	40	0,70/− 27,3°	26,2/165,5°	0,010/76,7°	0,97/−10,5°
	100	0,68/− 63,2°	22,8/146,5°	0,021/62,8°	0,86/−23,2°
	200	0,66/−102,8°	16,9/125,5°	0,032/49,2°	0,68/−34,3°
10	500	0,64/−150,7°	8,3/ 98,9°	0,043/40,6°	0,46/−41,9°
	1000	0,62/−176,9°	4,4/ 81,2°	0,056/47,4°	0,41/−45,2°
	1200	0,62/−176,9°	3,6/ 76,1°	0,061/49,9°	0,40/−47,6°
	40	0,55/− 40,8°	40,6/160,3°	0,009/73,3°	0,93/−15,8°
	100	0,57/− 86,4°	32,5/137,6°	0,017/58,1°	0,77/−32,6°
	200	0,59/−125,5°	21,6/117,0°	0,024/48,7°	0,54/−43,9°
20	500	0,62/−163,2°	9,9/ 94,4°	0,035/49,6°	0,34/−49,0°
	800	0,60/−176,3°	6,3/ 84,5°	0,046/55,5°	0,30/−49,2°
	1000	0,59/+ 175,8°	5,1/ 79,3°	0,053/58,1°	0,30/−49,9°
	1200	0,59/+ 171,1°	4,3/ 74,8°	0,061/59,7°	0,30/−52,0°
	40	0,48/− 50,4°	48,6/157,4°	0,008/71,2°	0,91/−18,7°
	100	0,53/− 99,7°	36,9/133,2°	0,015/56,5°	0,71/−37,4°
	200	0,57/−135,7°	23,3/113,3°	0,021/49,7°	0,48/−48,0°
30	500	0,60/−167,9°	10,4/ 93,1°	0,032/54,2°	0,29/−52,2°
	800	0,59/−180,0°	6,6/ 83,6°	0,044/59,9°	0,27/−52,0°
	1000	0,59/+ 173,4°	5,3/ 78,6°	0,053/61,8°	0,27/−52,2°
	1200	0,59/+ 169,2°	4,4/ 74,3°	0,060/62,8°	0,26/−54,3°

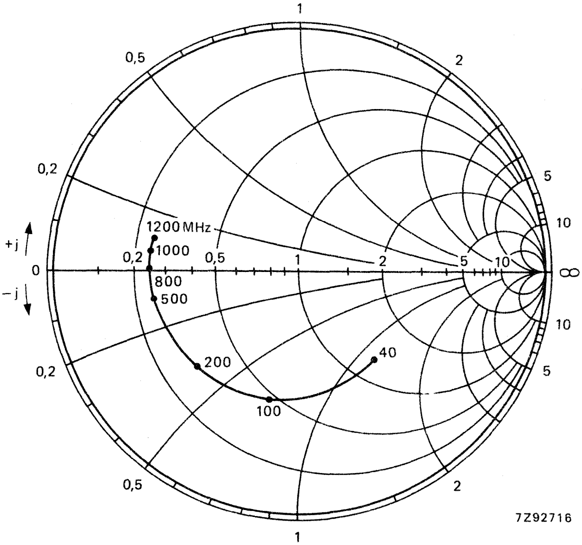


Fig. 2 Input impedance, derived from input reflection coefficient s_{ie} coordinates, in $\Omega \times 50$.

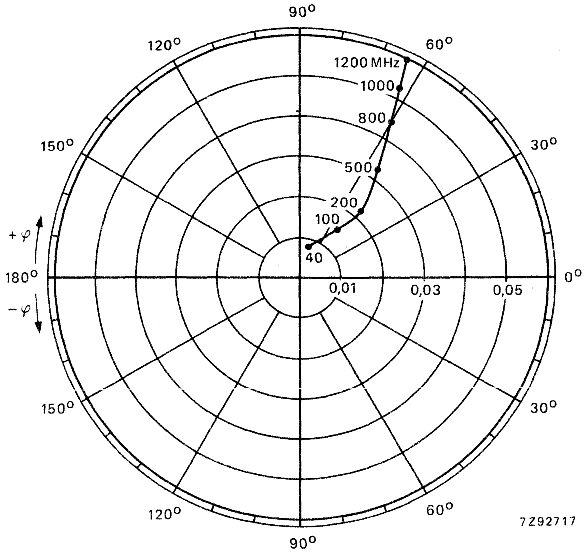


Fig. 3 Reverse transmission coefficient s_{re}.

Conditions for Figs 2 to 5: V_{CE} = 8 V; I_C = 30 mA; T_{amb} = 25 °C.

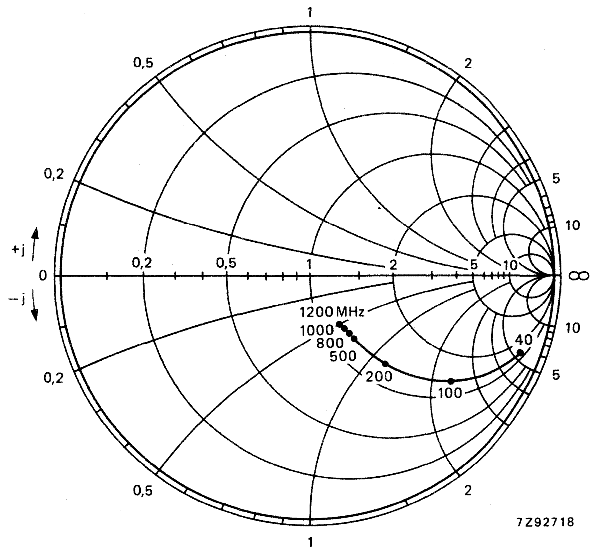


Fig. 4 Output impedance, derived from output reflection coefficient s_{oe} coordinates, in $\Omega \times 50$.

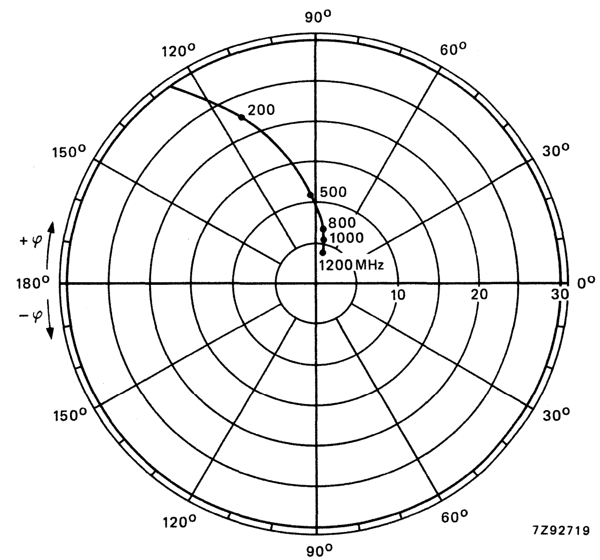


Fig. 5 Forward transmission coefficient s_{fe}.

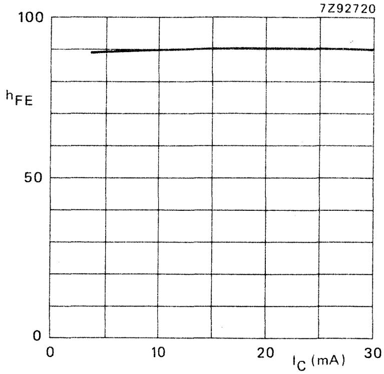


Fig. 6 V_{CE} = 5 V; T_j = 25 °C; typical values.

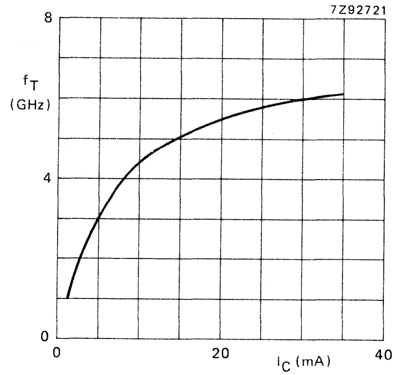


Fig. 7 V_{CE} = 5 V; f = 500 MHz; T_j = 25 °C; typical values.

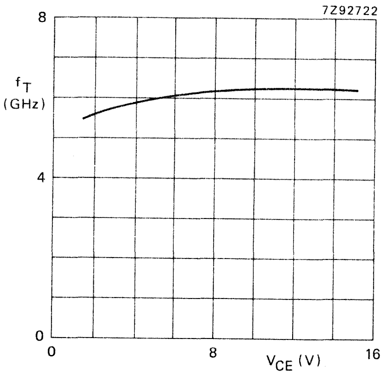


Fig. 8 I_C = 30 mA; f = 500 MHz; T_j = 25 °C; typical values.

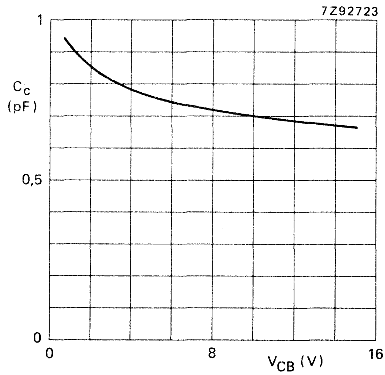


Fig. 9 $I_E = i_e = 0$; f = 1 MHz; T_j = 25 °C; typical values.

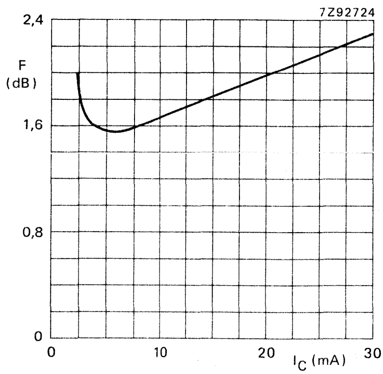


Fig. 10 V_{CE} = 8 V; f = 800 MHz; Z_S = opt.; T_{amb} = 25 °C; typical values.

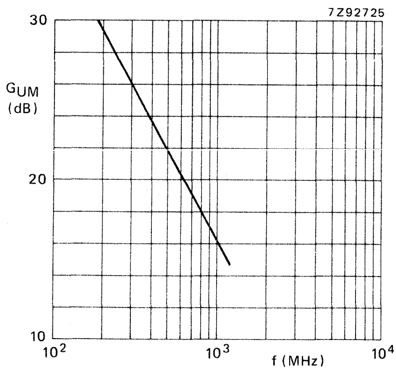


Fig. 11 V_{CE} = 8 V; I_C = 30 mA; T_{amb} = 25 °C.

N-P-N 1 GHz BROADBAND TRANSISTOR

Gold-metallized n-p-n transistor in a sub-miniature HERMETICALLY SEALED microstripline envelope. The BFP96 features low noise, high gain and low distortion figures.

This device is designed for v.h.f. and u.h.f. wideband amplifiers and applications in the GHz range.

QUICK REFERENCE DATA

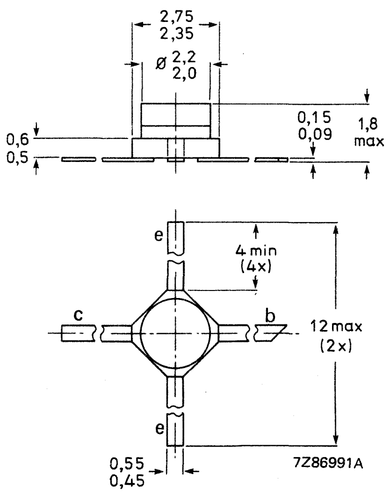
Collector-base voltage	V_{CBO}	max.	20 V
Collector-emitter voltage	V_{CEO}	max.	15 V
Collector current (d.c.)	I_C	max.	100 mA
Total power dissipation up to T_{amb} = 75 °C	P_{tot}	max.	500 mW
Junction temperature	T_j	max.	175 °C
D.C. current gain I_C = 50 mA; V_{CE} = 10 V	h_{FE}	min.	25
Transition frequency at f = 500 MHz I_C = 50 mA; V_{CE} = 10 V	f_T	typ.	5 GHz
Maximum unilateral power gain I_C = 50 mA; V_{CE} = 10 V; T_{amb} = 25 °C at f = 500 MHz	G_{UM}	typ.	19 dB
at f = 800 MHz	G_{UM}	typ.	15 dB

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-173.

Marking code: P6



RATINGS

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

Collector-base voltage (open emitter)	V_{CBO}	max.	20 V
Collector-emitter voltage (open base)	V_{CEO}	max.	15 V
Emitter-base voltage (open collector)	V_{EBO}	max.	3,0 V
Collector current (d.c.)	I_C	max.	100 mA
Total power dissipation up to T_{amb} = 75 °C mounted on a ceramic substrate of 0,7 mm x 10 cm^2	P_{tot}	max.	500 mW
Storage temperature	T_{stg}	−65 to +150 °C	
Junction temperature	T_j	max.	175 °C

THERMAL RESISTANCE

From junction to ambient mounted on a ceramic substrate of 0,7 mm x 10 cm^2	$R_{th\ j\text{-}a}$		200 K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current $I_E = 0$; V_{CB} = 10 V	I_{CBO}	max.	100 nA
D.C. current gain* I_C = 50 mA; V_{CE} = 10 V	h_{FE}	min.	25
Transition frequency at f = 500 MHz* I_C = 50 mA; V_{CE} = 10 V	f_T	typ.	5 GHz
Collector capacitance at f = 1 MHz $I_E = i_e = 0$; V_{CB} = 10 V	C_c	typ.	1,3 pF
Emitter capacitance at f = 1 MHz $I_C = i_c = 0$; V_{EB} = 0,5 V	C_e	typ.	5,5 pF
Feedback capacitance at f = 1 MHz $I_C = 0$; V_{CE} = 0,5 V	C_{re}	typ.	1,0 pF

Maximum unilateral power gain (s_{re} assumed to be zero)

$$G_{UM}\text{ (in dB)} = 10 \log \frac{|s_{fe}|^2}{[1-|s_{ie}|^2]\ [1-|s_{oe}|^2]}$$

at I_C = 50 mA; V_{CE} = 10 V; T_{amb} = 25 °C

f = 500 MHz	G_{UM}	typ.	19 dB
f = 800 MHz	G_{UM}	typ.	15 dB

Noise figure at f = 800 MHz; R_S = opt.; T_{amb} = 25 °C I_C = 50 mA; V_{CE} = 10 V	F	typ.	3,7 dB

* Measured under pulse conditions.

s-parameters (common emitter) at V_{CE} = 10 V

I_C mA	f MHz	s_{ie}	s_{fe}	s_{re}	s_{oe}
	40	0,83/− 36,0°	15,5/160,2°	0,022/72,1°	0,95/− 13,7°
	100	0,79/− 78,7°	12,3/136,8°	0,044/52,7°	0,80/− 27,7°
	200	0,75/−119,2°	8,1/114,6°	0,059/38,1°	0,60/− 36,1°
5	500	0,74/−159,9°	3,7/ 89,5°	0,070/29,8°	0,46/− 43,2°
	800	0,73/−174,0°	2,4/ 75,7°	0,078/33,4°	0,45/− 50,7°
	1000	0,72/ 179,0°	1,9/ 68,5°	0,083/37,4°	0,46/− 55,7°
	1200	0,72/ 173,5°	1,6/ 63,3°	0,087/40,3°	0,47/− 61,6°
	40	0,73/− 50,1°	26,3/153,9°	0,020/67,3°	0,90/− 22,1°
	100	0,72/− 99,3°	18,7/128,4°	0,036/47,4°	0,67/− 41,7°
	200	0,71/−136,2°	11,2/108,6°	0,045/37,3°	0,44/− 51,9°
10	500	0,71/−167,7°	4,8/ 88,2°	0,057/38,8°	0,29/− 58,8°
	800	0,71/−179,3°	3,1/ 75,9°	0,070/45,0°	0,29/− 63,8°
	1000	0,70/ 174,9°	2,5/ 71,1°	0,078/48,9°	0,29/− 66,8°
	1200	0,70/ 170,2°	2,1/ 65,5°	0,087/51,1°	0,30/− 71,5°
	40	0,61/− 79,4°	45,6/142,2°	0,016/59,2°	0,79/− 39,3°
	100	0,66/−128,6°	26,8/116,6°	0,025/43,9°	0,48/− 68,1°
	200	0,68/−155,2°	14,8/101,3°	0,031/43,0°	0,28/− 87,0°
30	500	0,70/−176,0°	6,1/ 86,1°	0,047/53,4°	0,17/−107,7°
	800	0,69/ 175,6°	3,9/ 76,3°	0,066/58,7°	0,16/−110,7°
	1000	0,68/ 170,5°	3,1/ 72,2°	0,079/60,9°	0,16/−109,9°
	1200	0,69/ 167,1°	2,6/ 67,2°	0,090/61,3°	0,16/−111,5°
	40	0,60/− 86,0°	49,9/139,5°	0,015/56,7°	0,75/− 44,1°
	100	0,65/−133,9°	28,1/114,3°	0,023/43,6°	0,44/− 74,8°
	200	0,67/−157,9°	15,3/100,0°	0,029/45,7°	0,26/− 96,4°
40	500	0,69/−176,7°	6,4/ 86,0°	0,047/56,1°	0,17/−120,3°
	800	0,68/ 175,3°	4,0/ 76,7°	0,067/60,7°	0,16/−123,3°
	1000	0,68/ 170,2°	3,2/ 72,6°	0,080/62,0°	0,15/−122,8°
	1200	0,68/ 167,2°	2,7/ 68,0°	0,091/62,2°	0,16/−124,1°
	40	0,58/− 91,5°	52,3/136,8°	0,015/56,4°	0,72/− 47,1°
	100	0,64/−137,0°	28,4/112,4°	0,022/44,8°	0,41/− 78,0°
	200	0,66/−159,6°	15,5/ 99,2°	0,028/47,9°	0,25/−100,3°
50	500	0,68/−176,9°	6,6/ 85,6°	0,048/57,9°	0,17/−124,8°
	800	0,68/−175,5°	4,2/ 76,1°	0,069/61,0°	0,16/−128,5°
	1000	0,68/ 170,4°	3,3/ 72,8°	0,082/62,4°	0,15/−128,1°
	1200	0,68/ 166,8°	2,8/ 66,8°	0,094/62,1°	0,16/−129,4°

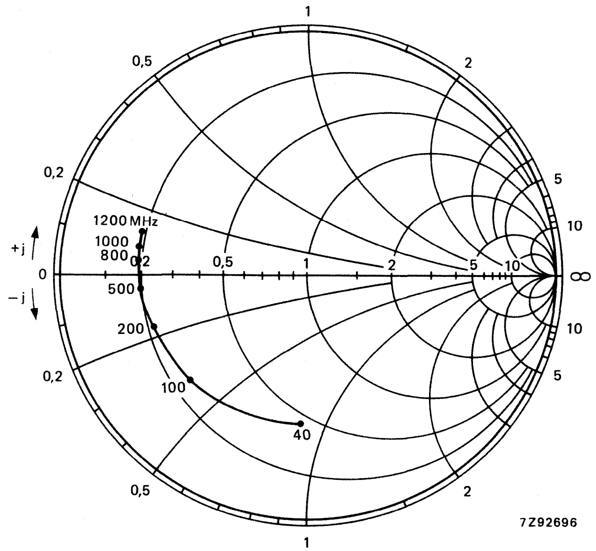


Fig. 2 Input impedance, derived from input reflection coefficient s_{ie} coordinates, in $\Omega \times 50$.

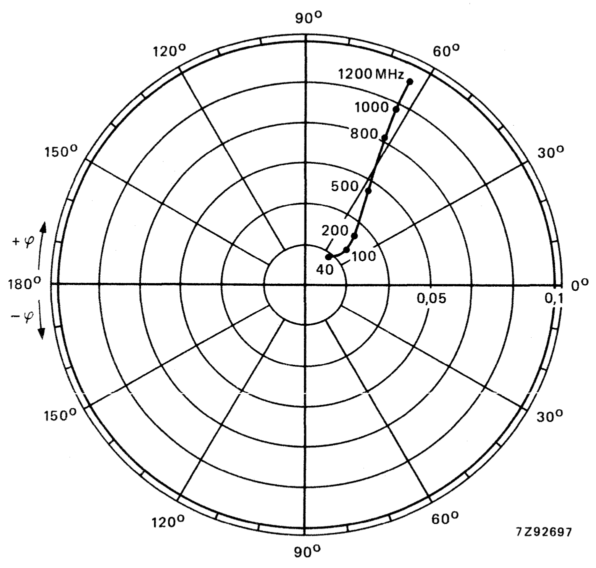


Fig. 3 Reverse transmission coefficient s_{re}.

Conditions for Figs 2 to 5: V_{CE} = 10 V; I_C = 50 mA; T_{amb} = 25 °C.

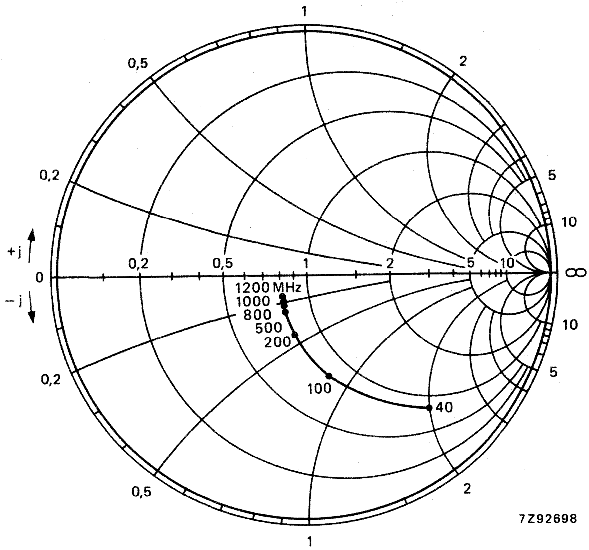


Fig. 4 Output impedance, derived from output reflection coefficient s_{oe} coordinates, in Ω x 50.

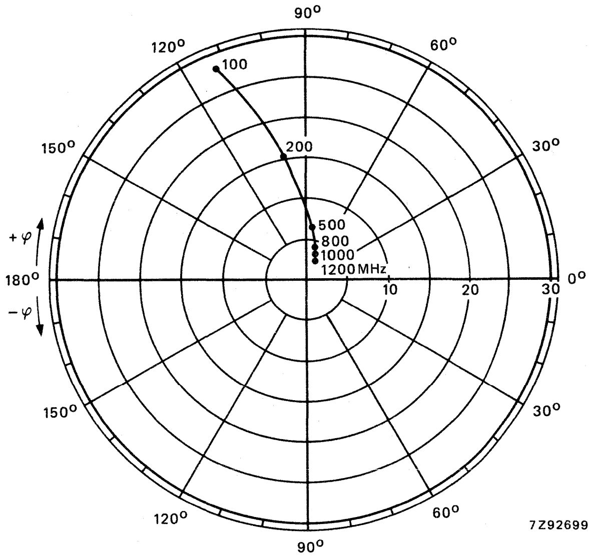


Fig. 5 Forward transmission coefficient s_{fe}.

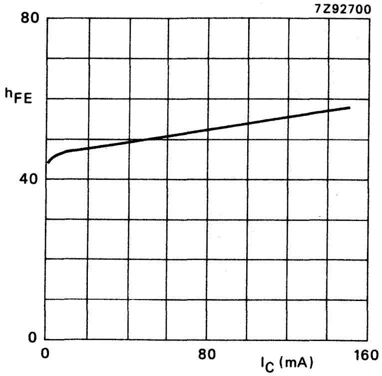


Fig. 6 V_{CE} = 10 V; T_j = 25 °C; typical values.

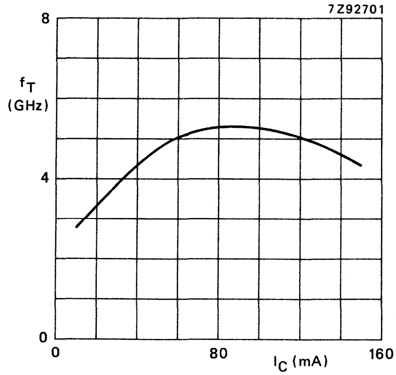


Fig. 7 V_{CE} = 10 V; f = 500 MHz; T_j = 25 °C; typical values.

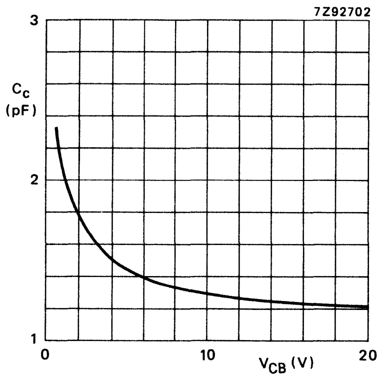


Fig. 8 $I_E = i_e$; f = 1 MHz; T_j = 25 °C; typical values.

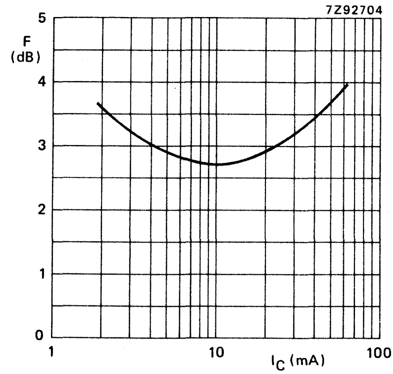


Fig. 9 V_{CE} = 10 V; f = 800 MHz; R_S = opt.; T_{amb} = 25 °C; typical values.

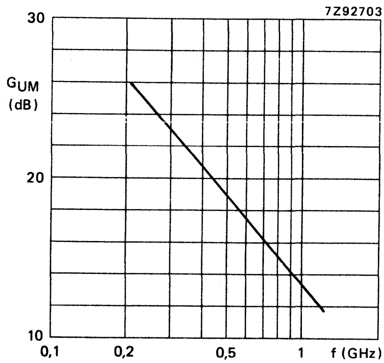


Fig. 10 V_{CE} = 10 V; I_C = 50 mA; T_{amb} = 25 °C; typical values.

SILICON PLANAR EPITAXIAL TRANSISTOR

N-P-N transistor in a TO-72 metal envelope with insulated electrodes and a shield lead connected to the case. It is primarily intended for use in u.h.f. and microwave aerial amplifiers, radar systems, oscilloscopes, spectrum analysers etc.

The transistor has extremely high power gain and good low noise performance.

P-N-P complement is BFQ24.

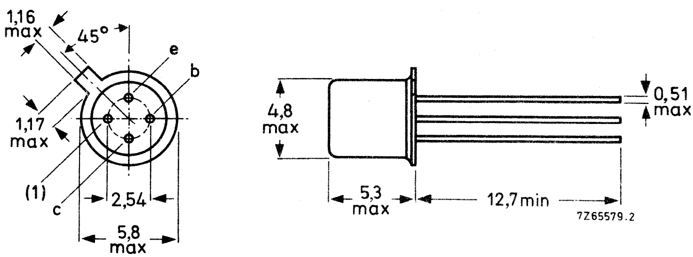
QUICK REFERENCE DATA

Collector-base voltage (open emitter)	V_{CBO}	max.	15	V
Collector-emitter voltage (open base)	V_{CEO}	max.	12	V
Collector current (d.c.)	I_C	max.	35	mA
Total power dissipation up to T_{amb} = 65 °C	P_{tot}	max.	150	mW
Junction temperature	T_j	max.	200	°C
Transition frequency at f = 500 MHz I_C = 30 mA; V_{CE} = 5 V	f_T	typ.	5	GHz
Feedback capacitance at f = 1 MHz I_C = 0; V_{CE} = 5 V	C_{re}	typ.	0,65	pF
Noise figure at optimum source impedance I_C = 2 mA; V_{CE} = 5 V; f = 500 MHz; T_{amb} = 25 °C	F	typ.	1,9	dB
Maximum unilateral power gain (see next page) I_C = 30 mA; V_{CE} = 5 V; f = 500 MHz; T_{amb} = 25 °C	G_{UM}	typ.	16,0	dB

MECHANICAL DATA

Dimensions in mm

Fig. 1 TO-72 with insulated electrodes.



(1) Shield lead connected to case.

Accessories: 56246 (distance disc).

RATINGS

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

Collector-base voltage (open emitter)	V_{CBO}	max.	15	V
Collector-emitter voltage (open base)	V_{CEO}	max.	12	V
Emitter-base voltage (open collector)	V_{EBO}	max.	2	V
Collector current (d.c.)	I_C	max.	35	mA
Collector current (peak value) at f > 1 MHz	I_{CM}	max.	50	mA
Total power dissipation up to T_{amb} = 65 °C	P_{tot}	max.	150	mW
Storage temperature	T_{stg}	–65 to + 200		°C
Junction temperature	T_j	max.	200	°C

THERMAL RESISTANCE (note 1)

From junction to ambient in free air	$R_{th\ j\text{-}a}$	=	900	K/W
From junction to case	$R_{th\ j\text{-}c}$	=	600	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current				
$I_E = 0$; V_{CB} = 5 V	I_{CBO}	<	50	nA
D.C. current gain (note 2)				
I_C = 10 mA; V_{CE} = 5 V	h_{FE}	50 to 150		
Transition frequency (notes 2 and 3)				
I_C = 30 mA; V_{CE} = 5 V; f = 500 MHz	f_T	typ.	5	GHz
Feedback capacitance (note 3)				
I_C = 0; V_{CE} = 5 V; f = 1 MHz; T_{amb} = 25 °C	C_{re}	typ.	0,65	pF
Noise figure at optimum source impedance (note 3)				
I_C = 2 mA; V_{CE} = 5 V; f = 500 MHz; T_{amb} = 25 °C	F	typ.	1,9	dB
I_C = 10 mA; V_{CE} = 5 V; f = 200 MHz; T_{amb} = 25 °C	F	<	2,5	dB

Maximum unilateral power gain (note 3)

s_{re} assumed to be zero

$$G_{UM}\ (\text{in dB}) = 10 \log \frac{|s_{fe}|^2}{(1 - |s_{ie}|^2)(1 - |s_{oe}|^2)}$$

I_C = 10 mA; V_{CE} = 5 V; f = 200 MHz; T_{amb} = 25 °C	G_{UM}	>	21,0	dB
I_C = 30 mA; V_{CE} = 5 V; f = 500 MHz; T_{amb} = 25 °C	G_{UM}	typ.	16,0	dB

Notes

1. K/W is SI unit for °C/W.
2. Measured under pulse conditions.
3. Shield lead grounded.

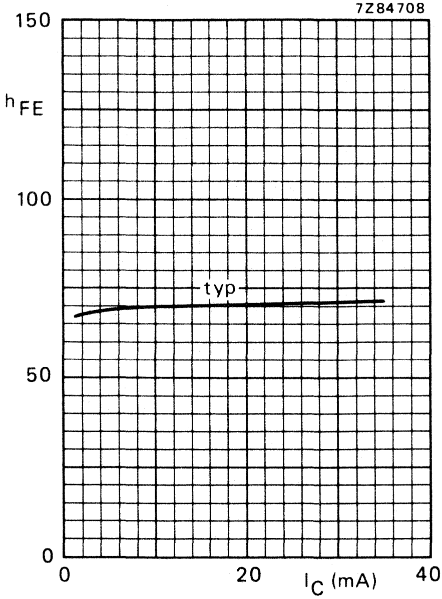


Fig. 2.

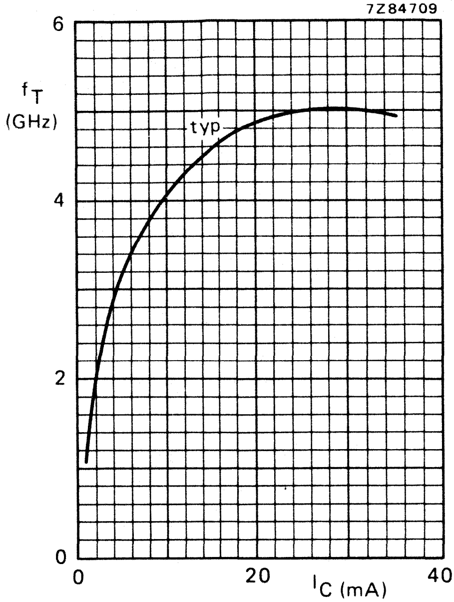


Fig. 3.

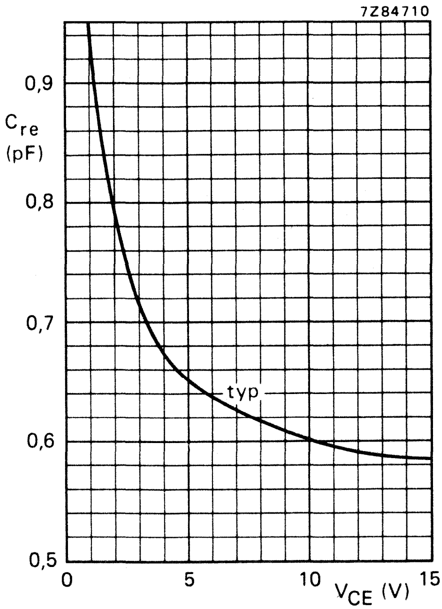


Fig. 4.

Conditions for Figs 2, 3 and 4:

Fig. 2 V_{CE} = 5 V; T_j = 25 °C.

Fig. 3 V_{CE} = 5 V; f = 500 MHz; T_j = 25 °C; shield lead grounded.

Fig. 4 I_C = 0; f = 1 MHz; T_{amb} = 25 °C; shield lead grounded.

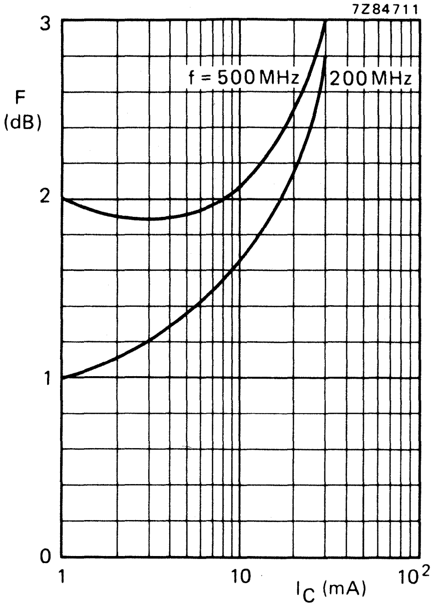


Fig. 5 V_{CE} = 5 V; Z_S = optimum; T_{amb} = 25 °C; typical values; shield lead grounded.

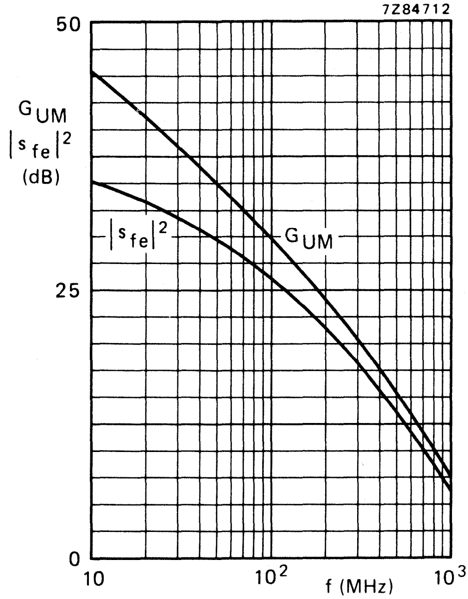


Fig. 6 V_{CE} = 5 V; I_C = 30 mA; T_{amb} = 25 °C; typical values; shield lead grounded.

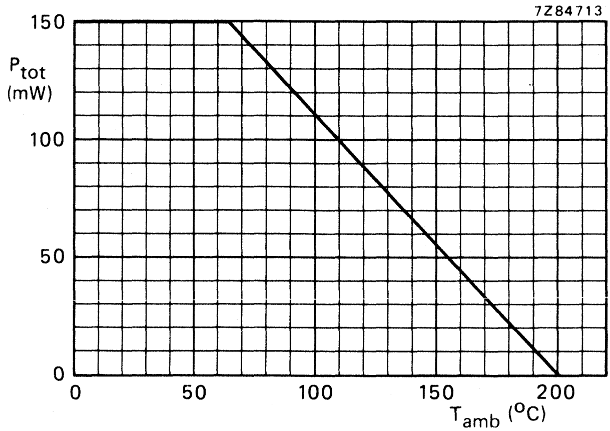


Fig. 7 Power derating curve versus ambient temperature.

SILICON WIDEBAND TRANSISTOR

P-N-P transistor in a subminiature plastic transfer-moulded T-package. It is primarily intended for use in u.h.f. and microwave amplifiers such as in aerial amplifiers, radar systems, oscilloscopes, spectrum analysers etc.

The transistor features low intermodulation distortion and high power gain; thanks to its very high transition frequency, it also has excellent wideband properties and low noise up to high frequencies.

N-P-N complements are BFR91 and BFR91A.

QUICK REFERENCE DATA

Collector-base voltage (open emitter)	$-V_{CBO}$	max.	15	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	12	V
Collector current (d.c.)	$-I_C$	max.	35	mA
Total power dissipation up to T_{amb} = 60 °C	P_{tot}	max.	180	mW
Junction temperature	T_j	max.	150	°C
Transition frequency at f = 500 MHz $-I_C$ = 30 mA; $-V_{CE}$ = 5 V	f_T	typ.	5	GHz
Feedback capacitance at f = 1 MHz $-I_C$ = 2 mA; $-V_{CE}$ = 5 V	C_{re}	typ.	0,8	pF
Noise figure at optimum source impedance $-I_C$ = 2 mA; $-V_{CE}$ = 5 V; f = 500 MHz	F	typ.	2,4	dB

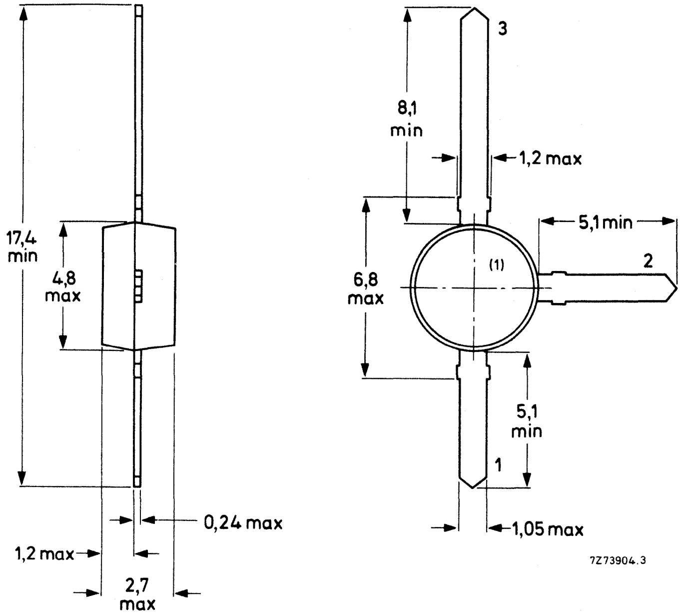
MECHANICAL DATA (see Fig. 1)

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-37.

Connections
1. Base
2. Emitter
3. Collector



(1) = type number marking.

RATINGS

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

Collector-base voltage (open emitter)	$-V_{CBO}$	max.	15	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	12	V
Emitter-base voltage (open collector)	$-V_{EBO}$	max.	2	V
Collector current (d.c.)	$-I_C$	max.	35	mA
Collector current (peak value) at f > 1 MHz	$-I_{CM}$	max.	50	mA
Total power dissipation up to T_{amb} = 60 °C	P_{tot}	max.	180	mW
Storage temperature	T_{stg}	−65 to + 150		°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

From junction to ambient in free air mounted on a fibre-glass print of 40 mm x 25 mm x 1 mm — $R_{th\ j\text{-}a}$ = 0,5 K/W

CHARACTERISTICS

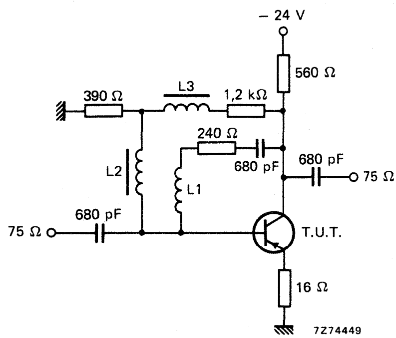
T_j = 25 °C unless otherwise specified

Collector cut-off current $I_E = 0$; $-V_{CB} = 5$ V	$-I_{CBO}$	<	50 nA	
D.C. current gain $-I_C = 30$ mA; $-V_{CE} = 5$ V	h_{FE}	>	20	*
Transition frequency f = 500 MHz; $-I_C = 30$ mA; $-V_{CE} = 5$ V	f_T	typ.	5 GHz	*
Collector capacitance f = 1 MHz; $I_E = I_e = 0$; $-V_{CB} = 5$ V	C_c	typ.	0,85 pF	
Emitter capacitance f = 1 MHz; $I_C = I_c = 0$; $-V_{EB} = 0{,}5$ V	C_e	typ.	1,8 pF	
Feedback capacitance f = 1 MHz; $-I_C = 2$ mA; $-V_{CE} = 5$ V	C_{re}	typ.	0,8 pF	
Noise figure at optimum source impedance $-I_C = 2$ mA; $-V_{CE} = 5$ V; f = 500 MHz	F	typ.	2,4 dB	

Maximum unilateral power gain
s_{re} assumed to be zero
$-I_C = 30$ mA; $-V_{CE} = 5$ V; f = 500 MHz

$$10 \log \frac{|s_{fe}|^2}{(1-|s_{ie}|^2)(1-|s_{oe}|^2)} = G_{UM} \quad \text{typ.} \quad 16{,}5 \text{ dB}$$

Intermodulation distortion* (see Fig. 2)
$-I_C = 30$ mA; $-V_{CE} = 5$ V; $R_L = 75\ \Omega$; VSWR < 2
$V_p = V_o = 300$ mV at f_p = 495,25 MHz
$V_q = V_o - 6$ dB at f_q = 503,25 MHz
$V_r = V_o - 6$ dB at f_r = 505,25 MHz
Measured at $f_{(p+q-r)}$ = 493,25 MHz — d_{im} typ. −60 dB



L1: 4 turns Cu wire (0,35); winding pitch 1 mm; internal diameter 4 mm.
L2 and L3: 5 μH (code number 3122 108 20150)

Fig. 2 Intermodulation distortion test circuit.

* Measured under pulse conditions.

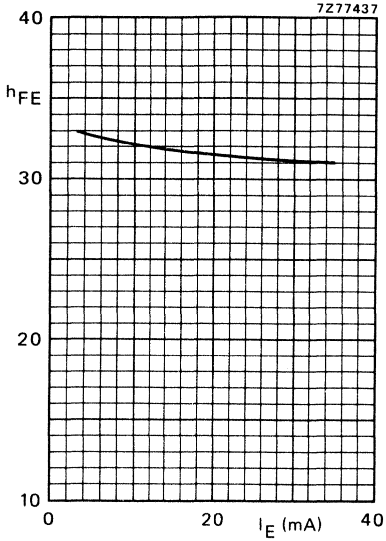


Fig. 3 Typical values; V_{CB} = 4 V.

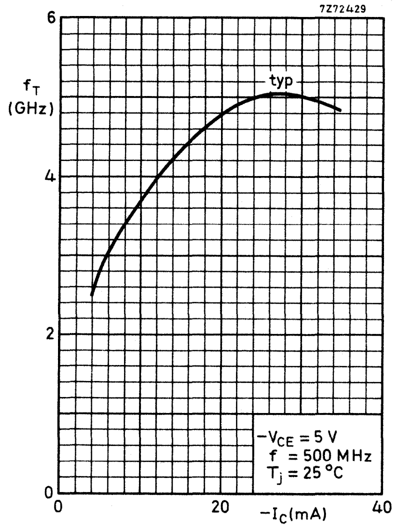


Fig. 4.

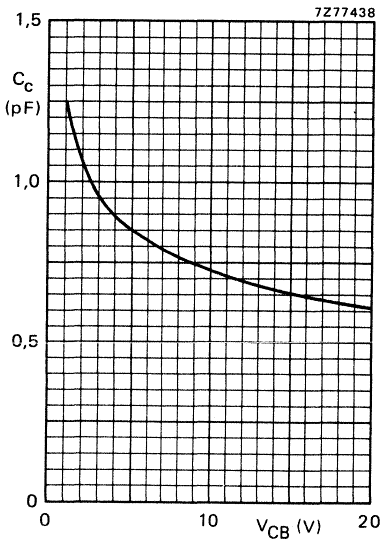


Fig. 5 Typical values; f = 1 MHz.

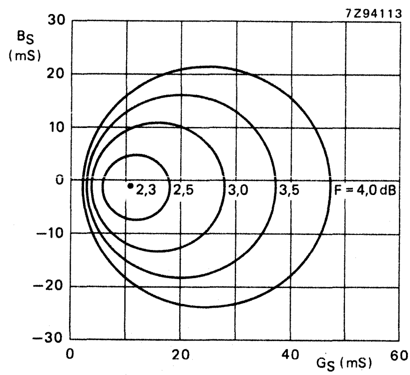


Fig. 6 Circles of constant noise figure.
V_{CE} = 8 V; I_C = 4 mA; f = 800 MHz.

s-parameters (common emitter) at V_{CE} = 5 V

I_C mA	f MHz	s_{ie}	s_{fe}	s_{re}	s_{oe}	G_{UM} dB
5	40	0,75/ 55,8°	14,24/136,2°	0,05/57,18°	0,96/ 68,5°	37,8
	100	0,75/ 54,2°	14,38/139,3°	0,05/60,18°	0,95/ 52,9°	37,2
	200	0,75/ 56,9°	14,24/136,1°	0,05/60,03°	0,96/ 68,1°	37,4
	500	0,75/ 52,7°	14,13/137,7°	0,05/57,28°	0,96/ 64,3°	37,7
	800	0,74/ 57,7°	14,49/140,2°	0,05/58,93°	0,95/ 65,2°	37,0
	1000	1,01/ 178,9°	1,11/ −1,0°	1,01/−1,00°	1,06/ 178,1°	28,7
	1200	0,44/−136,3°	5,10/ 99,5°	0,11/51,75°	0,39/ −60,3°	15,8
	1500	0,40/ 166,2°	2,29/ 63,4°	0,18/51,03°	0,25/ −48,9°	8,3
	2000	0,42/ 124,6°	1,34/ 33,4°	0,29/35,18°	0,18/−122,3°	3,6
10	40	0,56/ 45,4°	21,73/135,9°	0,05/50,18°	0,90/ 62,1°	35,6
	100	0,55/ 45,4°	21,92/136,1°	0,04/56,25°	0,91/ 47,4°	35,8
	200	0,55/ 45,6°	22,23/138,3°	0,04/52,88°	0,91/ 63,0°	36,1
	500	0,55/ 42,0°	21,89/137,2°	0,05/55,65°	0,91/ 59,2°	35,8
	800	0,56/ 47,8°	21,63/135,9°	0,05/51,00°	0,90/ 59,2°	35,3
	1000	1,00/ 178,5°	1,10/ −2,7°	1,00/ 0,85°	1,06/ 176,7°	31,7
	1200	0,38/−155,8°	5,92/ 94,3°	0,09/60,85°	0,28/ −73,3°	16,5
	1500	0,40/ 158,6°	2,52/ 63,9°	0,18/58,08°	0,17/ −38,5°	8,9
	2000	0,41/ 121,0°	1,42/ 34,3°	0,30/37,90°	0,13/−143,2°	3,9
15	40	0,42/ 36,2°	25,83/134,5°	0,04/48,78°	0,87/ 58,6°	35,2
	100	0,42/ 34,7°	26,23/134,7°	0,04/49,08°	0,86/ 44,0°	35,0
	200	0,42/ 36,1°	25,70/134,9°	0,04/52,05°	0,86/ 60,2°	34,8
	500	0,42/ 31,1°	26,10/136,2°	0,04/50,10°	0,87/ 55,2°	35,2
	800	0,42/ 37,6°	26,06/136,1°	0,04/52,15°	0,86/ 56,3°	35,1
	1000	1,00/−176,4°	1,15/ −2,7°	1,04/−0,40°	1,11/−179,7°	33,6
	1200	0,37/−165,8°	6,20/ 92,3°	0,09/65,95°	0,23/ −81,1°	16,7
	1500	0,41/ 155,7°	2,61/ 63,7°	0,19/60,73°	0,15/ 38,5°	9,2
	2000	0,40/ 115,4°	1,37/ 19,2°	0,30/51,63°	0,11/−162,2°	3,5
20	40	0,33/ 26,1°	28,68/135,2°	0,04/49,10°	0,83/ 56,6°	34,6
	100	0,33/ 24,3°	28,86/134,8°	0,04/52,38°	0,83/ 41,4°	34,7
	200	0,33/ 26,4°	28,38/134,7°	0,04/49,58°	0,83/ 56,9°	34,6
	500	0,32/ 22,2°	28,68/134,4°	0,04/47,18°	0,83/ 53,3°	34,8
	800	0,33/ 27,1°	28,58/135,5°	0,04/53,03°	0,83/ 53,6°	34,8
	1000	1,01/ 178,2°	1,11/ 1,4°	1,00/ 0,60°	1,11/ 178,8°	23,4
	1200	0,37/−171,6°	6,28/ 91,2°	0,08/69,08°	0,21/ −86,5°	16,8
	1500	0,41/ 152,7°	2,66/ 63,3°	0,19/62,48°	0,13/ 132,1°	9,4
	2000	0,40/ 109,9°	1,36/ 19,5°	0,31/30,85°	0,11/−171,6°	3,5
30	40	0,23/ 4,5°	30,84/133,1°	0,04/47,65°	0,77/ 54,7°	34,0
	100	0,22/ 2,4°	31,17/137,4°	0,04/48,13°	0,78/ 38,9°	34,1
	200	0,23/ 2,8°	30,93/136,6°	0,04/47,20°	0,77/ 54,7°	34,0
	500	0,23/ −1,7°	31,02/134,6°	0,04/44,65°	0,78/ 50,3°	34,1
	800	0,23/ 4,9°	30,97/133,5°	0,04/48,15°	0,77/ 51,4°	33,9
	1000	0,99/ 178,5°	1,18/ −1,8°	0,99/ 2,05°	1,15/ 177,5°	24,9
	1200	0,37/−178,2°	6,34/ 90,1°	0,08/72,60°	0,19/ −92,7°	16,9
	1500	0,42/ 151,4°	2,64/ 62,7°	0,19/64,38°	0,13/−172,2°	9,4
	2000	0,41/ 109,0°	1,36/ 19,3°	0,31/30,45°	0,12/−178,5°	3,6

SILICON PLANAR EPITAXIAL TRANSISTOR

Gold-metallized p-n-p transistor in a sub-miniature HERMETICALLY SEALED micro-stripline envelope. It is primarily intended for use in u.h.f. and microwave amplifiers such as aerial amplifiers, radar systems, oscilloscopes, spectrum analysers etc.

The transistor features low intermodulation distortion and high power gain due to its very high transition frequency, excellent wideband properties and low noise up to high frequencies.

N-P-N complement is BFP91A.

QUICK REFERENCE DATA

Collector-base voltage	$-V_{CBO}$	max.	20	V
Collector-emitter voltage	$-V_{CEO}$	max.	12	V
Collector current (d.c.)	$-I_C$	max.	50	mA
Total power dissipation up to T_{amb} = 105 °C	P_{tot}	max.	350	mW
Junction temperature	T_j	max.	175	°C
D.C. current gain $-I_C$ = 30 mA; $-V_{CE}$ = 5 V	h_{FE}	min.	20	
Transition frequency at f = 500 MHz $-I_C$ = 30 mA; $-V_{CE}$ = 5 V	f_T	typ.	5	GHz
Maximum unilateral power gain $-I_C$ = 30 mA; $-V_{CE}$ = 8 V; T_{amb} = 25 °C at f = 500 MHz at f = 800 MHz	G_{UM}	typ. typ.	19 15	dB dB

MECHANICAL DATA

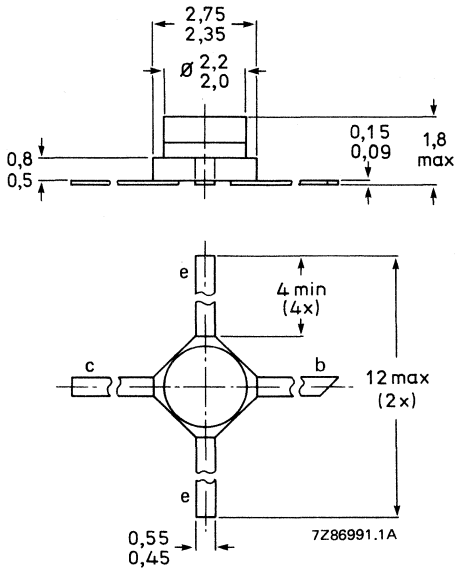
SOT-173 (see Fig. 1).

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-173.

Marking code: C3



RATINGS

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

Collector-base voltage (open emitter)	$-V_{CBO}$	max.	15	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	12	V
Emitter-base voltage (open collector)	$-V_{EBO}$	max.	2	V
Collector current (d.c.)	$-I_C$	max.	50	mA
Total power dissipation up to T_{amb} = 105 °C mounted on a ceramic substrate of 0,7 mm x 10 cm^2	P_{tot}	max.	350	mW
Storage temperature	T_{stg}		−65 to +150	°C
Junction temperature	T_j	max.	175	°C

THERMAL RESISTANCE

From junction to ambient mounted on a ceramic substrate of 0,7 mm x 10 cm^2	$R_{th\ j\text{-}a}$	200	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current $I_E = 0$; $-V_{CB} = 5$ V	$-I_{CBO}$	max.	50 nA
D.C. current gain $-I_C = 30$ mA; $-V_{CE} = 5$ V	h_{FE}	min.	20
Transition frequency at f = 500 MHz $-I_C = 30$ mA; $-V_{CE} = 5$ V	f_T	typ.	5 GHz
Collector capacitance at f = 1 MHz $I_E = I_e = 0$; $-V_{CB} = 10$ V	C_c	typ.	1 pF
Emitter capacitance at f = 1 MHz $I_C = I_c = 0$; $-V_{EB} = 0{,}5$ V	C_e	typ.	1,8 pF
Feedback capacitance at f = 1 MHz $I_C = 0$; $-V_{CE} = 10$ V;	C_{re}	typ.	0,8 pF

Maximum unilateral power gain (s_{re} assumed to be zero)

$$G_{UM}\,(\text{dB}) = 10 \log \frac{|s_{fe}|^2}{[1-|s_{ie}|^2]\,[1-|s_{oe}|^2]}$$

at $-I_C = 30$ mA; $-V_{CE} = 8$ V; f = 500 MHz	G_{UM}	typ.	19 dB
f = 800 MHz	G_{UM}	typ.	15 dB
Noise figures at f = 800 MHz; R_S = opt.; $-I_C = 4$ mA; $V_{CE} = 8$ V	F	typ.	2,3 dB
$-I_C = 30$ mA; $V_{CE} = 8$ V	F	typ.	3,7 dB

s-parameters (common emitter) at V_{CE} = 8 V; T_{amb} = 25 °C

I_C mA	f MHz	s_{ie}	s_{fe}	s_{re}	s_{oe}
	40	0,84/ −13,4°	6,6/172,9°	0,019/ 32,8°	0,99/ −5,7°
	100	0,83/ −32,3°	6,4/161,1°	0,047/ 73,3°	0,95/ −14,1°
	200	0,80/ −60,8°	5,7/143,8°	0,083/ 59,4°	0,87/ −25,7°
2	500	0,74/−114,6°	3,7/112,1°	0,136/ 35,8°	0,66/ −45,8°
	800	0,71/−142,7°	2,6/ 92,5°	0,149/ 25,7°	0,55/ −54,2°
	1000	0,68/−154,3°	2,1/ 83,3°	0,153/ 23,1°	0,52/ −58,0°
	1200	0,67/−164,3°	1,7/ 75,5°	0,153/ 20,8°	0,50/ −62,2°
	40	0,66/ −22,5°	13,5/169,4°	0,017/ 79,7°	0,97/ −10,2°
	100	0,66/ −52,0°	12,4/153,7°	0,039/ 67,5°	0,90/ −24,2°
	200	0,66/ −89,6°	10,1/132,9°	0,064/ 52,4°	0,74/ −41,3°
5	500	0,68/−141,5°	5,5/103,0°	0,091/ 34,5°	0,46/ −64,5°
	800	0,67/−162,7°	3,7/ 87,8°	0,100/ 31,9°	0,36/ −72,6°
	1000	0,66/−172,1°	3,0/ 80,6°	0,106/ 32,6°	0,34/ −75,4°
	1200	0,67/−179,7°	2,5/ 73,8°	0,111/ 33,0°	0,32/ −79,4°
	40	0,47/ −35,4°	20,4/165,5°	0,014/ 76,9°	0,93/ −14,9°
	100	0,52/ −76,4°	17,7/146,4°	0,032/ 62,8°	0,82/ −33,9°
	200	0,59/−115,9°	13,1/124,3°	0,048/ 49,2°	0,62/ −54,7°
10	500	0,65/−157,4°	6,4/ 97,9°	0,066/ 40,4°	0,35/ −80,0°
	800	0,65/−173,4°	4,2/ 84,7°	0,078/ 43,3°	0,27/ −89,0°
	1000	0,65/ 178,9°	3,4/ 78,8°	0,087/ 45,7°	0,24/ −91,3°
	1200	0,65/ 172,9°	2,9/ 72,9°	0,096/ 47,0°	0,23/ −94,9°
	40	0,29/ −63,8°	26,8/162,1°	0,012/ 74,1°	0,89/ −19,5°
	100	0,45/−108,1°	22,0/140,1°	0,025/ 59,7°	0,74/ −43,0°
	200	0,58/−139,5°	15,1/118,3°	0,036/ 49,0°	0,52/ −66,6°
20	500	0,65/−168,7°	7,0/ 94,6°	0,051/ 47,8°	0,29/ −95,4°
	800	0,66/−179,3°	4,5/ 82,9°	0,066/ 52,3°	0,22/−106,4°
	1000	0,66/ 173,0°	3,7/ 77,4°	0,077/ 54,7°	0,20/−109,3°
	1200	0,66/ 168,2°	3,1/ 72,0°	0,088/ 55,3°	0,19/−112,9°
	40	0,23/ −93,3°	29,3/160,2°	0,010/ 72,3°	0,86/ −21,6°
	100	0,45/−125,5°	23,5/137,3°	0,021/ 59,0°	0,70/ −47,1°
	200	0,58/−149,5°	15,5/115,7°	0,030/ 50,6°	0,48/ −71,6°
30	500	0,66/−173,2°	7,1/ 93,2°	0,046/ 52,8°	0,26/−101,2°
	800	0,66/ 176,4°	4,6/ 81,9°	0,062/ 57,4°	0,21/−112,3°
	1000	0,66/ 170,5°	3,7/ 76,5°	0,074/ 59,1°	0,19/−115,4°
	1200	0,66/ 165,8°	3,1/ 71,1°	0,085/ 59,5°	0,18/−118,5°

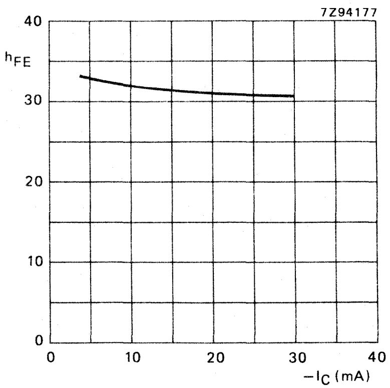


Fig. 2 $-V_{CE} = 5$ V; $T_j = 25$ °C.

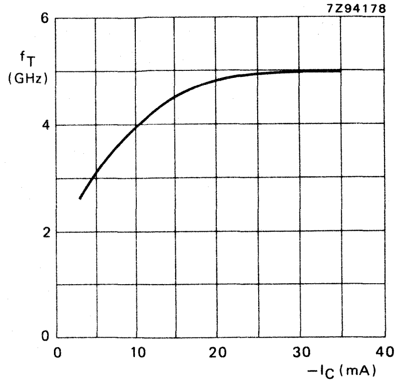


Fig. 3 $-V_{CE} = 5$ V; f = 500 MHz; $T_j = 25$ °C.

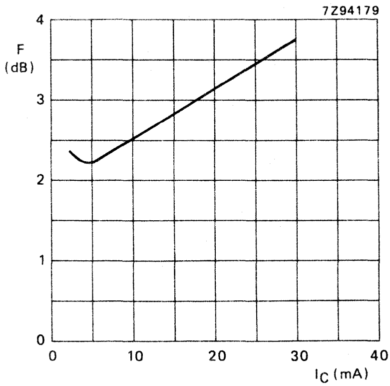


Fig. 4 $-V_{CE} = 8$ V; f = 800 MHz; $T_{amb} = 25$ °C; Z_s = optimum.

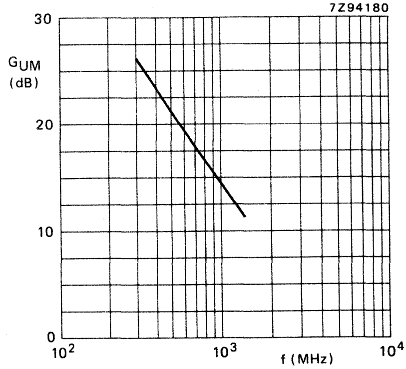


Fig. 5 $-V_{CE} = 8$ V; $-I_C = 30$ mA; $T_{amb} = 25$ °C.

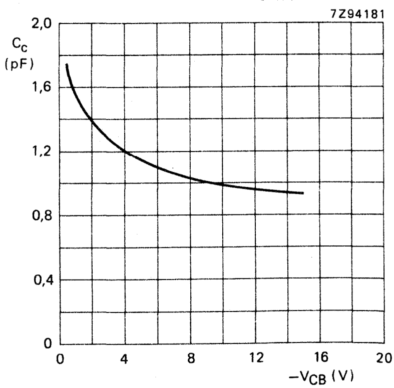
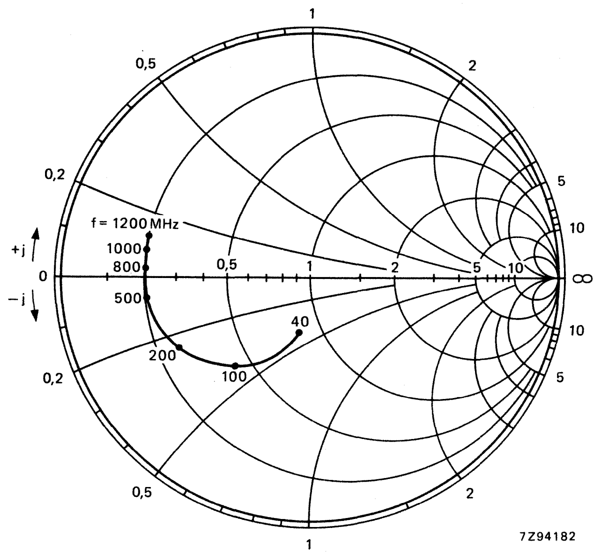


Fig. 6 $-I_E = -I_e = 0$; f = 1 MHz; $T_j = 25$ °C.

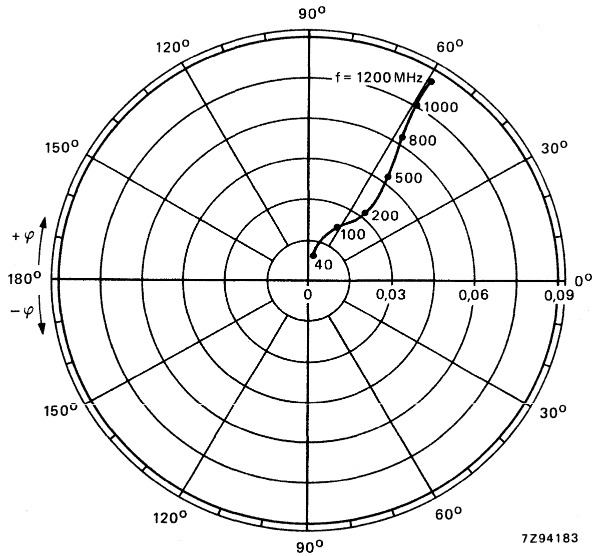
$-V_{CE}$ = 8 V
$-I_C$ = 30 mA
T_{amb} = 25 °C



Input impedance derived from input reflection coefficient s_{ie} co-ordinates in ohm x 50.

Fig. 7.

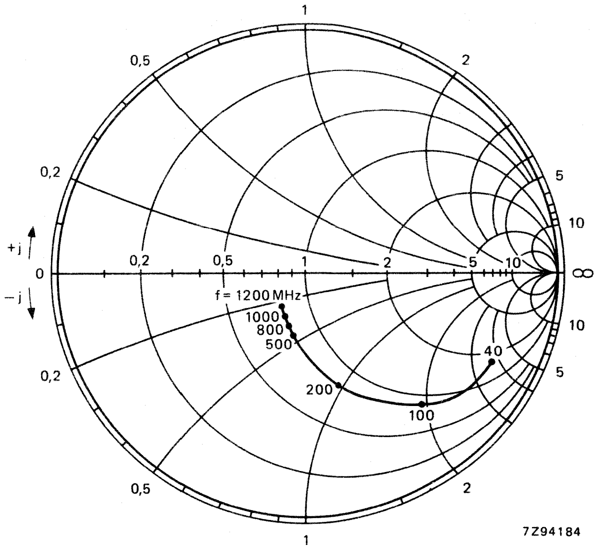
$-V_{CE}$ = 8 V
$-I_C$ = 30 mA
T_{amb} = 25 °C



Reverse transmission coefficient s_{re}.

Fig. 8.

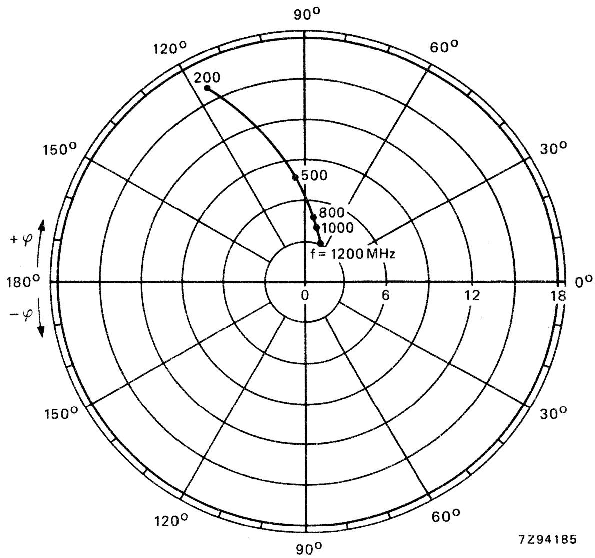
$-V_{CE}$ = 8 V
$-I_C$ = 30 mA
T_{amb} = 25 ^oC



Output impedance derived from output reflection coefficient s_{oe} co-ordinates on ohm x 50.

Fig. 9.

$-V_{CE}$ = 8 V
$-I_C$ = 30 mA
T_{amb} = 25 ^oC



Forward transmission coefficient s_{fe}.

Fig. 10.

SILICON PLANAR EPITAXIAL TRANSISTOR

P-N-P transistor in a TO-72 metal envelope with insulated electrodes and a shield lead connected to the case. It is primarily intended for use in u.h.f. and microwave amplifiers such as in aerial amplifiers, radar systems, oscilloscopes, spectrum analysers etc.

The transistor features extremely high power gain coupled with good low noise performance.

N-P-N complement is BFQ22S.

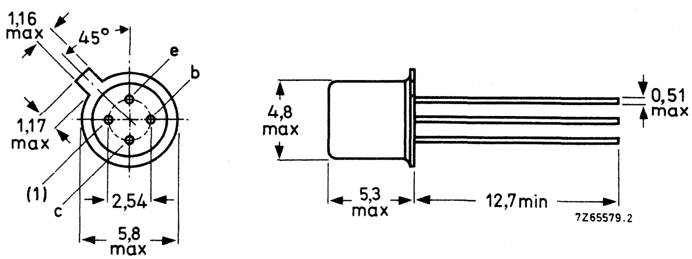
QUICK REFERENCE DATA

Collector-base voltage (open emitter)	$-V_{CBO}$	max.	15	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	12	V
Collector current (d.c.)	$-I_C$	max.	35	mA
Total power dissipation up to T_{amb} = 65 °C	P_{tot}	max.	150	mW
Junction temperature	T_j	max.	200	°C
Transition frequency at f = 500 MHz $-I_C$ = 30 mA; $-V_{CE}$ = 5 V	f_T	typ.	5	GHz
Feedback capacitance at f = 1 MHz I_C = 0; $-V_{CE}$ = 5 V; T_{amb} = 25 °C	C_{re}	typ.	0,8	pF
Noise figure at optimum source impedance $-I_C$ = 2 mA; $-V_{CE}$ = 5 V; f = 500 MHz; T_{amb} = 25 °C	F	typ.	2,4	dB
Maximum unilateral power gain (see next page) $-I_C$ = 30 mA; $-V_{CE}$ = 5 V; f = 500 MHz; T_{amb} = 25 °C	G_{UM}	typ.	15,0	dB

MECHANICAL DATA

Dimensions in mm

Fig. 1 TO-72 with insulated electrodes.



(1) shield lead connected to case.

Accessories: 56246 (distance disc).

RATINGS

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

Collector-base voltage (open emitter)	$-V_{CBO}$	max.	15	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	12	V
Emitter-base voltage (open collector)	$-V_{EBO}$	max.	2	V
Collector current (d.c.)	$-I_C$	max.	35	mA
Collector current (peak value) at f > 1 MHz	$-I_{CM}$	max.	50	mA
Total power dissipation up to T_{amb} = 65 °C	P_{tot}	max.	150	mW
Storage temperature	T_{stg}		−65 to +200	°C
Junction temperature	T_j	max.	200	°C

THERMAL RESISTANCE

From junction to ambient in free air	$R_{th\ j-a}$	=	0,9	K/mW
From junction to case	$R_{th\ j-c}$	=	0,6	K/mW

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current $I_E = 0; -V_{CB} = 5$ V	$-I_{CBO}$	<	50	nA
D.C. current gain (note 1) $-I_C = 30$ mA; $-V_{CE} = 5$ V	h_{FE}	> typ.	20 50	
Transition frequency (notes 1 and 2) $-I_C = 30$ mA; $-V_{CE} = 5$ V; f = 500 MHz	f_T	typ.	5	GHz
Collector capacitance (note 3) $I_E = I_e = 0; -V_{CB} = 5$ V; f = 1 MHz	C_c	typ.	1,2	pF
Emitter capacitance $I_C = I_c = 0; -V_{EB} = 0,5$ V; f = 1 MHz	C_e	typ.	2,5	pF
Feedback capacitance (note 2) $I_C = 0; -V_{CE} = 5$ V; f = 1 MHz; T_{amb} = 25 °C	C_{re}	typ.	0,8	pF
Noise figure at optimum source impedance (note 2) $-I_C = 2$ mA; $-V_{CE} = 5$ V; f = 500 MHz; T_{amb} = 25 °C	F	typ.	2,4	dB

Maximum unilateral power gain (note 2)

s_{re} assumed to be zero

$$G_{UM} \text{ (in dB)} = 10 \log \frac{|s_{fe}|^2}{(1 - |s_{ie}|^2)(1 - |s_{oe}|^2)}$$

$-I_C = 30$ mA; $-V_{CE} = 5$ V; f = 500 MHz; T_{amb} = 25 °C	G_{UM}	typ.	15,0	dB

Notes
1. Measured under pulse conditions.
2. Shield lead grounded.
3. Shield lead not connected.

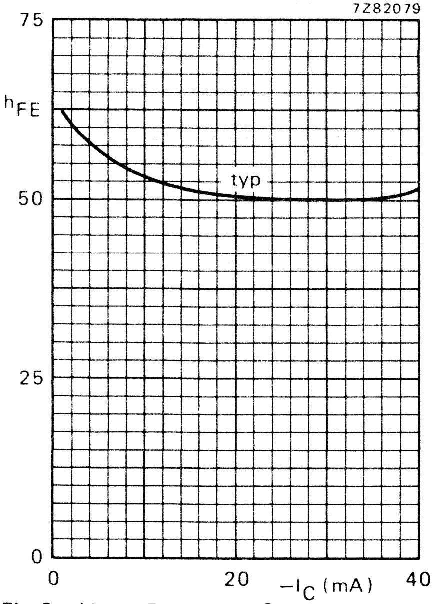


Fig. 2 $-V_{CE}$ = 5 V; T_j = 25 °C.

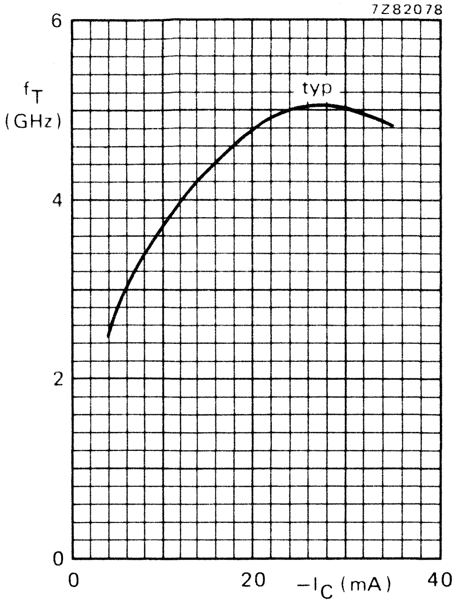


Fig. 3 $-V_{CE}$ = 5 V; f = 500 MHz; T_j = 25 °C; shield lead grounded.

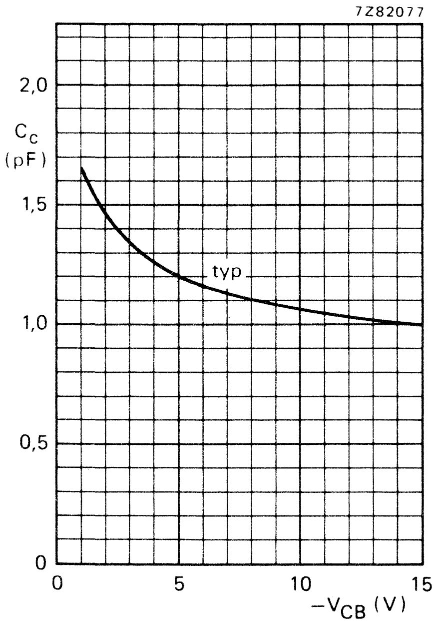


Fig. 4 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C; shield lead not connected.

SILICON PLANAR EPITAXIAL TRANSISTOR

P-N-P transistor in a subminiature plastic transfer-moulded T-package.

It is intended for use in u.h.f. applications such as broadband aerial amplifiers (30 MHz to 860 MHz) and in microwave amplifiers such as radar systems, spectrum analysers etc.

The BFQ32 offers a high transition frequency and a low intermodulation distortion figure over a wide current range.

QUICK REFERENCE DATA

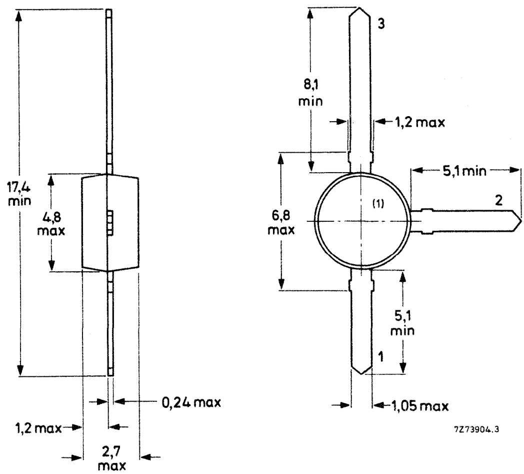
Collector-base voltage (open emitter)	$-V_{CBO}$	max	20	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max	15	V
Collector current (d.c.)	$-I_C$	max	75	mA
Total power dissipation up to T_{amb} = 60 °C	P_{tot}	max	500	mW
Junction temperature	T_j	max	175	°C
Transition frequency at f = 500 MHz $-I_C$ = 50 mA; $-V_{CE}$ = 10 V	f_T	>	3,6	GHz
Feedback capacitance at f = 1 MHz $-I_C$ = 10 mA; $-V_{CE}$ = 10 V	C_{re}	<	1,4	pF
Noise figure at optimum source impedance $-I_C$ = 50 mA; $-V_{CE}$ = 10 V; f = 500 MHz; T_{amb} = 25 °C	F	typ	3,75	dB
Intermodulation distortion at T_{amb} = 25 °C $-I_C$ = 50 mA; $-V_{CE}$ = 10 V; R_L = 75 Ω; V_o = 500 mV $f_{(p+q-r)}$ = 493,25 MHz	d_{im}	typ	−60	dB

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-37.

Connections
1. Base
2. Emitter
3. Collector



(1) = type number marking.

RATINGS

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

Collector-base voltage (open emitter)	$-V_{CBO}$	max	20	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max	15	V
Emitter-base voltage (open collector)	$-V_{EBO}$	max	3	V
Collector current (d.c.)	$-I_C$	max	75	mA
Collector current (peak value); f > 1 MHz	$-I_{CM}$	max	150	mA
Total power dissipation up to T_{amb} = 60 °C mounted on a fibre-glass print of 40 mm x 25 mm x 1 mm	P_{tot}		500	mW
Storage temperature	T_{stg}	−65 to + 175		°C
Junction temperature	T_j	max	175	°C

THERMAL RESISTANCE

From junction to ambient in free air mounted on a fibre-glass print of 40 mm x 25 mm x 1 mm	$R_{th\ j\text{-}a}$	=	0,23	°C/mW

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified

Collector cut-off current				
$I_E = 0$; $-V_{CB}$ = 10 V	$-I_{CBO}$	<	100	nA
D.C. current gain *				
$-I_C$ = 50 mA; $-V_{CE}$ = 10 V	h_{FE}	>	20	
$-I_C$ = 75 mA; $-V_{CE}$ = 10 V	h_{FE}	>	20	
Transition frequency at f = 500 MHz *				
$-I_C$ = 50 mA; $-V_{CE}$ = 10 V	f_T	>	3,6	GHz
		typ	4,2	GHz
$-I_C$ = 75 mA; $-V_{CE}$ = 10 V	f_T	>	4,0	GHz
		typ	4,6	GHz
Collector capacitance at f = 1 MHz				
$I_E = I_e = 0$; $-V_{CB}$ = 10 V	C_c	typ	1,3	pF
Emitter capacitance at f = 1 MHz				
$I_C = I_c = 0$; $-V_{EB}$ = 0,5 V	C_e	typ	6	pF
Feedback capacitance at f = 1 MHz				
$-I_C$ = 10 mA; $-V_{CE}$ = 10 V	C_{re}	<	1,4	pF
		typ	1,25	pF

* Measured under pulse conditions.

Noise figure at optimum source impedance			
$-I_C$ = 50 mA; $-V_{CE}$ = 10 V; f = 500 MHz	F	typ	3,75 dB
Maximum unilateral power gain (s_{re} assumed to be zero)			
G_{UM} (in dB) $= 10 \log \dfrac{\lvert s_{fe} \rvert^2}{(1-\lvert s_{ie} \rvert^2)(1-\lvert s_{oe} \rvert^2)}$			
$-I_C$ = 50 mA; $-V_{CE}$ = 10 V; f = 500 MHz	G_{UM}	typ	14 dB
Intermodulation distortion (see fig. 1)			
$-I_C$ = 50 mA; $-V_{CE}$ = 10 V; R_L = 75 Ω			
$V_p = V_o$ = 500 mV at f_p = 495,25 MHz			
$V_q = V_o$ −6 dB at f_q = 503,25 MHz			
$V_r = V_o$ −6 dB at f_r = 505,25 MHz			
Measured at $f_{(p+q-r)}$ = 493,25 MHz	d_{im}	typ	−60 dB

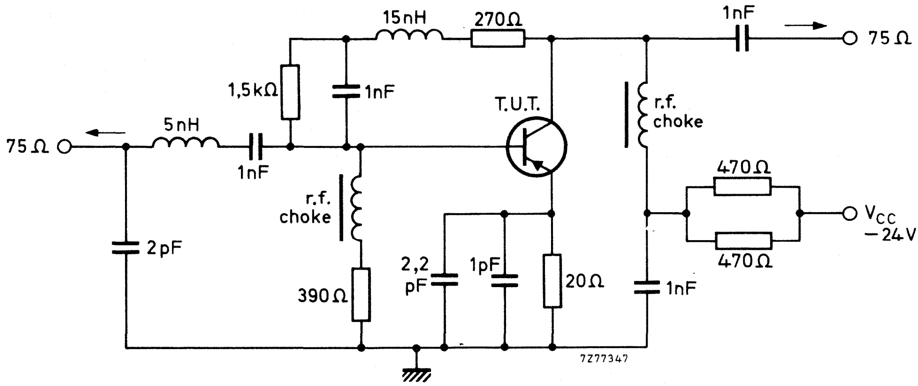
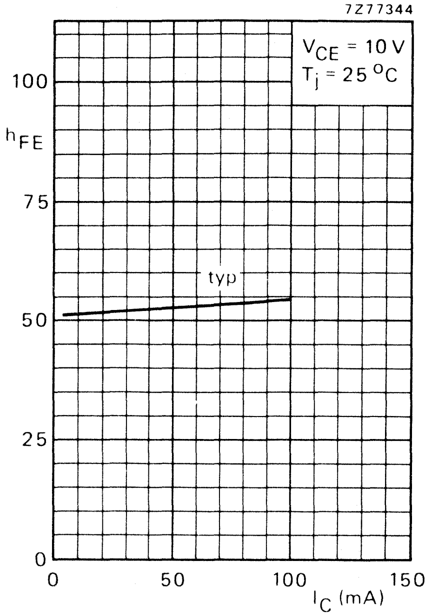
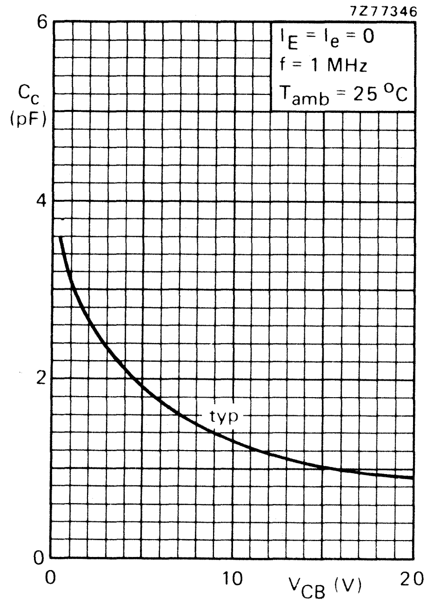
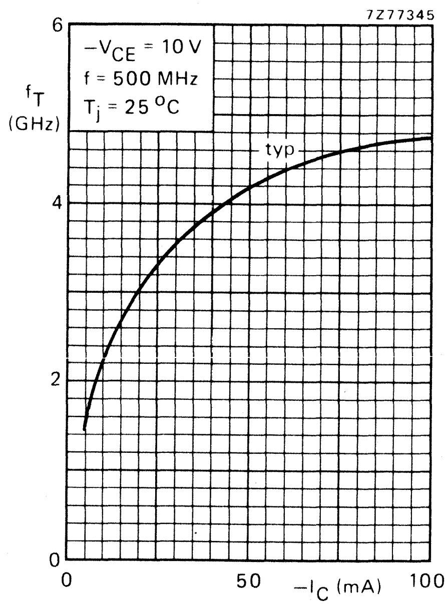


Fig. 1 Intermodulation test circuit.


7Z77344
V_{CE} = 10 V
T_j = 25 °C
h_{FE}
100
75
50
25
0
typ
0
50
100
150
I_C (mA)


7Z77346
I_E = I_e = 0
f = 1 MHz
T_{amb} = 25 °C
C_c
(pF)
6
4
2
0
typ
0
10
20
V_{CB} (V)


7Z77345
$-V_{CE}$ = 10 V
f = 500 MHz
T_j = 25 °C
f_T
(GHz)
6
4
2
0
typ
0
50
100
$-I_C$ (mA)

SILICON PLANAR EPITAXIAL TRANSISTOR

Gold-metallized p-n-p transistor in a sub-miniature HERMETICALLY SEALED micro-stripline envelope. It is intended for use in u.h.f. applications such as broadband aerial amplifiers. Microwave applications include radar systems, spectrum analysers etc.

The BFQ32C features a high transition frequency and a low intermodulation distortion figure over a wide current range.

QUICK REFERENCE DATA

Collector-base voltage	$-V_{CBO}$	max.	20	V
Collector-emitter voltage	$-V_{CEO}$	max.	15	V
Collector current (d.c.)	$-I_C$	max.	100	mA
Total power dissipation up to T_{amb} = 75 °C	P_{tot}	max.	500	mW
Junction temperature	T_j	max.	175	°C
D.C. current gain $-I_C$ = 50 mA; $-V_{CE}$ = 10 V	h_{FE}	min.	20	
Transition frequency at f = 500 MHz $-I_C$ = 50 mA; $-V_{CE}$ = 10 V	f_T	typ.	4,5	GHz
Maximum unlisted power gain $-I_C$ = 50 mA; $-V_{CE}$ = 10 V; T_{amb} = 25 °C at f = 500 MHz	G_{UM}	typ.	17	dB
at f = 800 MHz	G_{UM}	typ.	13	dB

MECHANICAL DATA

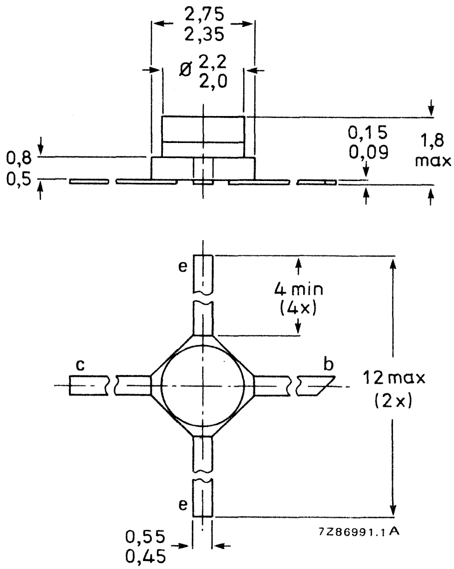
SOT-173 (see Fig. 1).

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-173.

Marking code: C2



RATINGS

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

Collector-base voltage (open emitter)	$-V_{CBO}$	max.	20 V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	15 V
Emitter-base voltage (open collector)	$-V_{EBO}$	max.	3 V
Collector current (d.c.)	$-I_C$	max.	100 mA
Total power dissipation up to T_{amb} = 75 °C mounted on a ceramic substrate of 0,7 mm x 10 cm^2	P_{tot}	max.	500 mW
Storage temperature	T_{stg}		−65 to +150 °C
Junction temperature	T_j	max.	175 °C

THERMAL RESISTANCE

From junction to ambient mounted on a ceramic substrate of 0,7 mm x 10 cm^2	$R_{th\ j\text{-}a}$	200 K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current			
$I_E = 0$; $-V_{CB} = 10$ V	$-I_{CBO}$	max.	100 nA
D.C. current gain			
$-I_C = 50$ mA; $-V_{CE} = 10$ V	h_{FE}	min.	20
Transition frequency at f = 500 MHz			
$-I_C = 50$ mA; $-V_{CE} = 10$ V	f_T	typ.	4,5 GHz
Collector capacitance at f = 1 MHz			
$I_E = I_e = 0$; $-V_{CB} = 10$ V	C_c	typ.	1,9 pF
Emitter capacitance at f = 1 MHz			
$I_C = I_c = 0$; $-V_{EB} = 0,5$ V	C_e	typ.	5 pF
Feedback capacitance at f = 1 MHz			
$I_C = 0$; $-V_{CE} = 10$ V;	C_{re}	typ.	1,4 pF

Maximum unilateral power gain (s_{re} assumed to be zero)

$$G_{UM}\,(\mathrm{dB}) = 10 \log \frac{|s_{fe}|^2}{[1-|s_{ie}|^2]\,[1-|s_{oe}|^2]}$$

at $-I_C = 50$ mA; $-V_{CE} = 10$ V			
f = 500 MHz	G_{UM}	typ.	17 dB
f = 800 MHz	G_{UM}	typ.	13 dB
Noise figures at f = 800 MHz; R_S = opt.;			
$-I_C = 50$ mA; $V_{CE} = 10$ V	F	typ.	4,3 dB

s-parameters (common emitter) at V_{CE} = 10 V; T_{amb} = 25 °C

I_C mA	f MHz	s_{ie}	s_{fe}	s_{re}	s_{oe}
	40	0,64/ −46,7°	13,4/158,5°	0,028/ 70,2°	0,93/ −17,5°
	100	0,69/ −94,4°	10,4/134,2°	0,055/ 49,2°	0,75/ −35,6°
	200	0,74/−132,7°	6,7/111,3°	0,070/ 32,7°	0,54/ −48,3°
5	500	0,77/−166,4°	3,0/ 85,7°	0,080/ 23,3°	0,38/ −60,4°
	800	0,77/−178,6°	1,9/ 71,5°	0,084/ 25,5°	0,38/ −69,9°
	1000	0,76/ 175,2°	1,6/ 64,7°	0,087/ 28,8°	0,39/ −76,7°
	1200	0,77/ 170,2°	1,3/ 57,9°	0,070/ 31,7°	0,41/ −84,4°
	40	0,49/ −69,3°	20,4/153,8°	0,023/ 66,3°	0,88/ −26,1°
	100	0,64/−117,9°	14,7/127,8°	0,042/ 45,4°	0,65/ −51,6°
	200	0,72/−148,5°	8,8/107,1°	0,051/ 33,3°	0,41/ −70,4°
10	500	0,76/−173,5°	3,8/ 85,3°	0,061/ 32,9°	0,26/ −88,9°
	800	0,76/ 176,5°	2,4/ 73,4°	0,071/ 38,7°	0,25/ −96,4°
	1000	0,76/ 171,4°	2,0/ 66,9°	0,079/ 42,5°	0,26/−100,5°
	1200	0,76/ 167,0°	1,7/ 60,7°	0,087/ 45,0°	0,27/−105,9°
	40	0,42/−120,4°	32,2/145,8°	0,016/ 61,2°	0,79/ −42,2°
	100	0,65/−148,4°	20,1/119,5°	0,025/ 44,4°	0,53/ −80,2°
	200	0,73/−165,5°	11,3/102,0°	0,031/ 41,5°	0,36/−111,0°
30	500	0,76/ 179,3°	4,7/ 84,6°	0,046/ 51,1°	0,27/−141,8°
	800	0,76/ 172,1°	3,0/ 74,7°	0,064/ 56,4°	0,26/−150,4°
	1000	0,76/ 167,5°	2,4/ 69,5°	0,077/ 58,5°	0,25/−153,6°
	1200	0,76/ 163,8°	2,0/ 64,5°	0,088/ 59,0°	0,25/−156,1°
	40	0,44/−131,3°	35,0/143,6°	0,014/ 60,0°	0,76/ −46,6°
	100	0,66/−153,8°	21,1/117,8°	0,022/ 44,9°	0,51/ −87,2°
	200	0,74/−168,5°	11,6/101,0°	0,028/ 44,6°	0,36/−119,3°
40	500	0,76/ 178,3°	4,9/ 84,4°	0,044/ 55,2°	0,29/−149,2°
	800	0,76/ 171,3°	3,1/ 74,8°	0,063/ 59,5°	0,27/−157,8°
	1000	0,76/ 167,0°	2,5/ 70,0°	0,076/ 60,9°	0,26/−161,4°
	1200	0,77/ 163,5°	2,1/ 64,9°	0,088/ 61,1°	0,26/−163,8°
	40	0,46/−137,3°	36,6/141,9°	0,013/ 58,9°	0,73/ −50,0°
	100	0,68/−157,1°	21,5/116,3°	0,020/ 45,6°	0,49/ −92,1°
	200	0,74/−170,4°	11,8/100,1°	0,026/ 46,9°	0,36/−124,6°
50	500	0,76/−177,5°	4,9/ 84,0°	0,043/ 57,7°	0,30/−153,4°
	800	0,76/ 171,0°	3,1/ 74,9°	0,063/ 61,4°	0,28/−161,8°
	1000	0,76/ 166,6°	2,5/ 69,8°	0,076/ 62,5°	0,27/−165,5°
	1200	0,76/ 162,9°	2,1/ 64,9°	0,089/ 62,4°	0,27/−168,1°

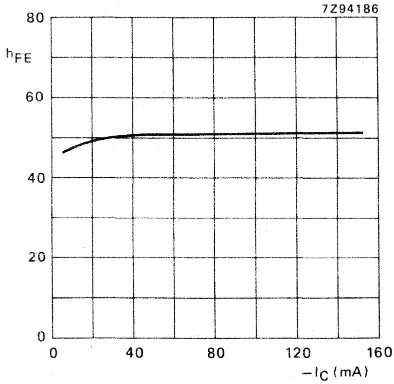


Fig. 2 $-V_{CE}$ = 10 V; T_j = 25 °C.

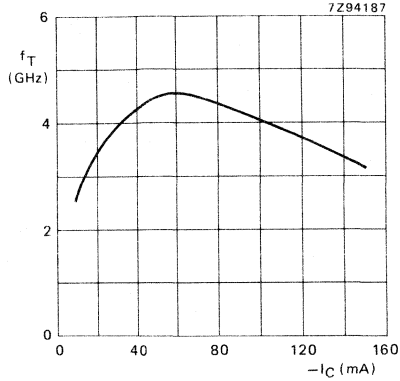


Fig. 3 $-V_{CE}$ = 10 V; f = 500 MHz; T_j = 25 °C.

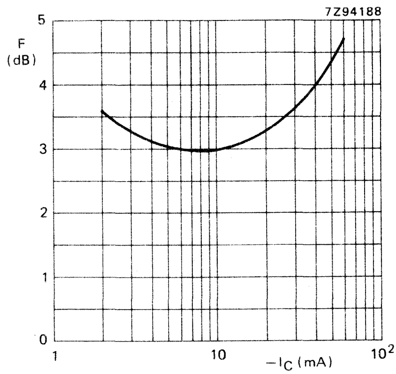


Fig. 4 $-V_{CE}$ = 10 V; f = 800 MHz;
T_{amb} = 25 °C; Z_s = optimum.

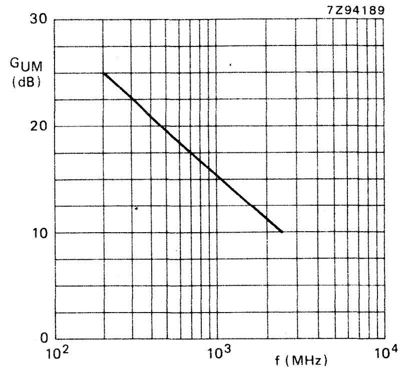


Fig. 5 $-V_{CE}$ = 8 V; $-I_C$ = 30 mA;
T_{amb} = 25 °C.

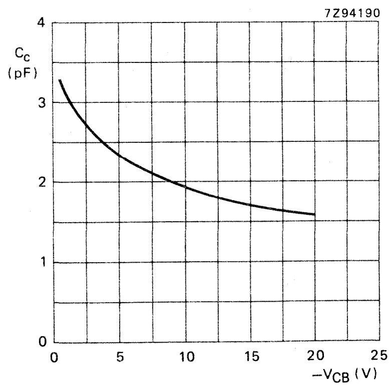


Fig. 6 $-I_E = -I_e = 0$; f = 1 MHz; T_j = 25 °C.

$-V_{CE}$ = 10 V
$-I_C$ = 50 mA
T_{amb} = 25 °C

Input impedance derived from input reflection coefficient s_{ie} co-ordinates in ohm x 50.

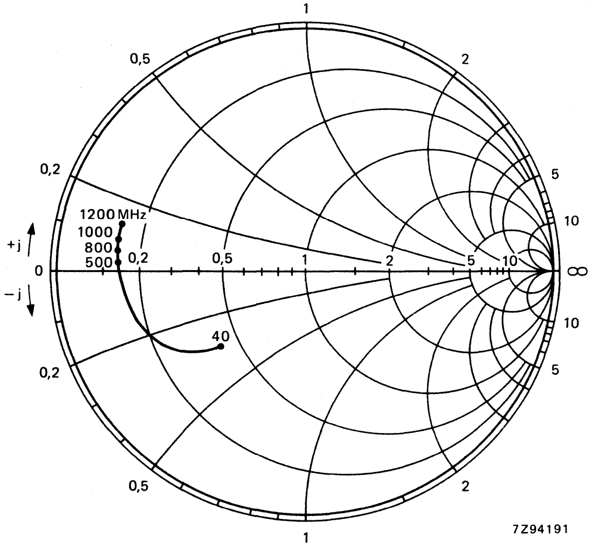


Fig. 7.

$-V_{CE}$ = 10 V
$-I_C$ = 50 mA
T_{amb} = 25 °C

Reverse transmission coefficient s_{re}.

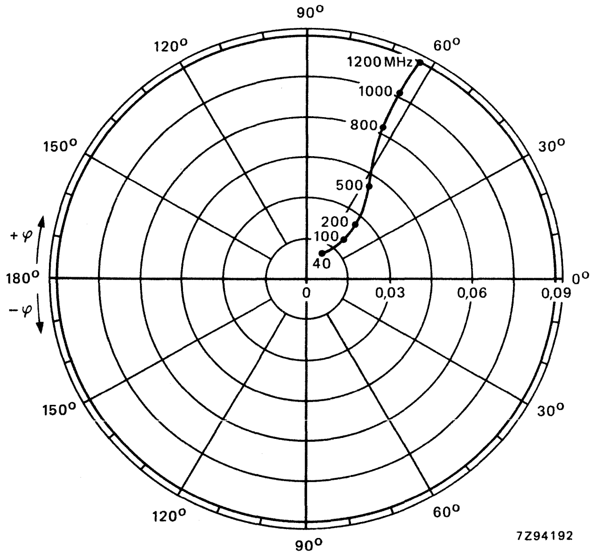
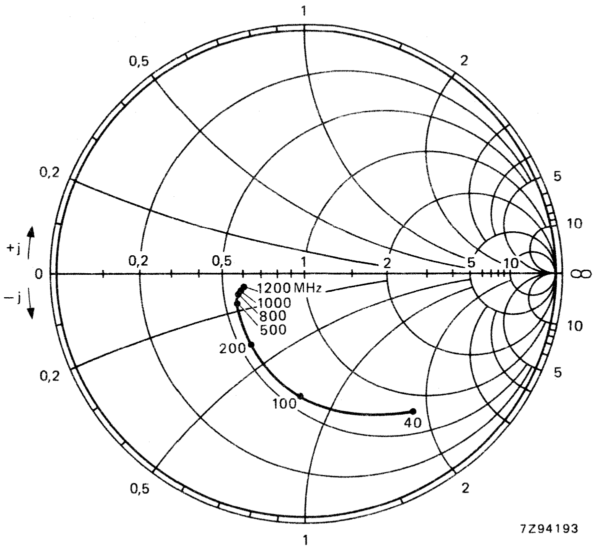


Fig. 8.

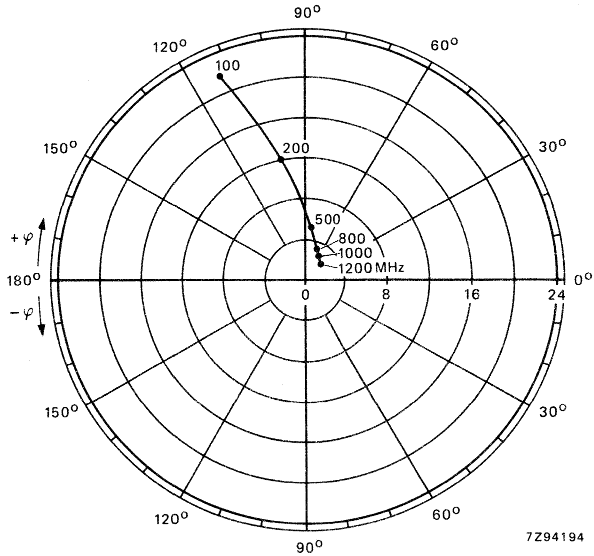
$-V_{CE}$ = 10 V
$-I_C$ = 50 mA
T_{amb} = 25 °C



Uotput impedance derived from output reflection coefficient s_{oe} co-ordinates on ohm x 50.

Fig. 9.

$-V_{CE}$ = 10 V
$-I_C$ = 50 mA
T_{amb} = 25 °C



Forward transmission coefficient s_{fe}.

Fig. 10.

SILICON PLANAR EPITAXIAL TRANSISTOR

P-N-P transistor in a subminiature plastic transfer-moulded T-package.

It is intended for use in u.h.f. applications such as braodcast aerial amplifiers and in microwave amplifiers such as radar systems, spectrum analysers etc.

The BFQ32S offers a high transition frequency and a low modulation distortion figure over a wide current range.

QUICK REFERENCE DATA

Collector-base voltage (open emitter)	$-V_{CBO}$	max.	20	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	15	V
Collector current (d.c.)	$-I_C$	max.	100	mA
Total power dissipation up to T_{amb} = 70 °C	P_{tot}	max.	700	mW
Junction temperature	T_j	max.	175	°C
Transition frequency at f = 500 MHz $-I_C$ = 70 mA; $-V_{CE}$ = 10 V	f_T	typ.	4,5	GHz
Intermodulation distortion at T_{amb} = 25 °C $-I_C$ = 70 mA; $-V_{CE}$ = 10 V $f_{(p + q - r)}$ = 793,25 MHz	d_{im}	typ.	−60	dB

MECHANICAL DATA (see Fig. 1)

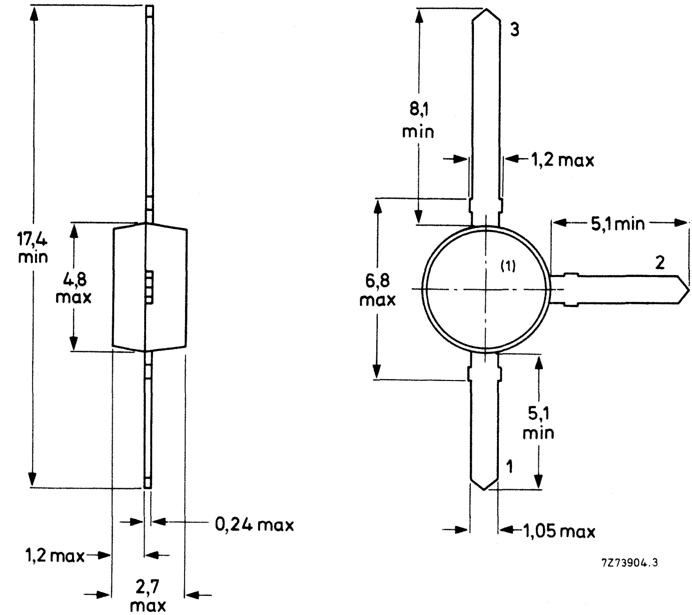
MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-37

Connections

1. Base
2. Emitter
3. Collector



(1) = type number marking.

RATINGS

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

Collector-base voltage (open emitter)	$-V_{CBO}$	max.	20	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	15	V
Emitter-base voltage (open collector)	$-V_{EBO}$	max.	3	V
Collector current (d.c.)	$-I_C$	max.	100	mA
Total power dissipation up to T_{amb} = 70 °C mounted on a fibre-glass print of 50 mm x 50 mm x 1,5 mm (see Fig. 2)	P_{tot}	max.	700	mW
Storage temperature	T_{stg}	−65 to + 175		°C
Junction temperature	T_j	max.	175	°C

THERMAL RESISTANCE

From junction to ambient in free air mounted on a fibre-glass print of 50 mm x 50 mm x 1,5 mm (see Fig. 2)	$R_{th\ j\text{-}a}$	=	150	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current $I_E = 0$; $-V_{CB} = 10$ V	$-I_{CBO}$	<	100 nA
D.C. current gain $-I_C = 70$ mA; $-V_{CE} = 10$ V	h_{FE}	>	20
Transition frequency at f = 500 MHz $-I_C = 70$ mA; $-V_{CE} = 10$ V	f_T	=	4,5 GHz
Collector capacitance at f = 1 MHz $I_E = 0$; $-V_{CB} = 10$ V	C_c	=	1,8 pF
Emitter capacitance at f = 1 MHz $I_C = 0$; $-V_{EB} = 0,5$ V	C_e	=	6 pF
Feedback capacitance at f = 1 MHz $-I_C = 0$; $-V_{CE} = 0$	C_{re}	typ.	1,3 pF
Intermodulation distortion $-I_C = 70$ mA; $-V_{CE} = 10$ V; $T_{amb} = 25$ °C $V_p = V_o = 600$ mV at $f_p = 795,25$ MHz $V_q = V_o - 6$ dB at $f_q = 803,25$ MHz $V_r = V_o - 6$ dB at $f_r = 805,25$ MHz Measured at $f_{(p+q-r)} = 793,25$ MHz	d_{im}	=	−60 dB

s-parameters (common emitter) at V_{CE} = 10 V; T_{amb} = 25 °C

I_C mA	f MHz	s_{ie}	s_{fe}	s_{re}	s_{oe}	G_{UM}
10	40	0,62/ 22,5°	21,91/134,4°	0,05/55,85°	0,84/ 50,5°	34,2
	100	0,61/ 19,9°	22,51/134,2°	0,05/54,55°	0,83/ 34,9°	34,2
	200	0,62/ 22,1°	22,15/136,0°	0,05/54,13°	0,84/ 50,4°	34,4
	500	0,61/ 17,6°	22,27/134,5°	0,05/55,40°	0,84/ 46,5°	34,3
	800	0,61/ 23,9°	22,44/134,3°	0,05/52,00°	0,84/ 46,3°	34,3
	1000	1,03/−178,8°	1,09/ 0,5°	1,03/−1,30°	1,06/ 179,9°	21,3
	1200	0,56/−173,5°	4,30/ 85,6°	0,09/54,63°	0,23/−103,0°	14,5
	1500	0,59/ 150,5°	1,79/ 53,4°	0,18/56,40°	0,23/−164,3°	7,1
	2000	0,62/ 115,7°	1,00/ 9,9°	0,29/29,45°	0,29/−162,5°	2,4
20	40	0,46/ −4,5°	30,13/130,6°	0,05/45,95°	0,74/ 37,9°	34,0
	100	0,45/ −5,0°	30,50/128,9°	0,05/49,93°	0,73/ 22,9°	34,0
	200	0,45/ −3,5°	30,79/127,2°	0,05/50,78°	0,74/ 37,5°	34,2
	500	0,45/ −8,3°	30,04/129,7°	0,05/49,95°	0,75/ 34,1°	34,1
	800	0,45/ −2,2°	30,55/128,3°	0,04/49,00°	0,75/ 34,0°	34,2
	1000	0,99/ 178,3°	1,13/ −0,9°	1,04/ 0,68°	1,11/ 177,3°	23,3
	1200	0,55/ 178,5°	4,81/ 84,6°	0,09/64,88°	0,23/−133,9°	15,4
	1500	0,59/ 150,2°	1,98/ 55,9°	0,19/59,10°	0,23/−162,1°	8,1
	2000	0,55/ 108,5°	1,06/ 11,1°	0,32/28,28°	0,27/ 179,2°	2,3
30	40	0,39/ −21,2°	33,66/125,8°	0,04/46,75°	0,68/ 31,7°	33,9
	100	0,40/ −23,2°	34,66/127,4°	0,05/49,53°	0,67/ 15,7°	34,1
	200	0,40/ −21,3°	33,92/127,7°	0,05/54,03°	0,68/ 31,4°	34,0
	500	0,39/ −25,4°	33,94/126,9°	0,05/45,90°	0,68/ 28,5°	34,1
	800	0,40/ −20,1°	33,65/126,6°	0,05/45,28°	0,68/ 29,3°	34,0
	1000	1,02/−178,6°	1,18/ 0,5°	1,02/ 0,08°	1,14/ 177,5°	20,6
	1200	0,54/ 175,4°	5,03/ 84,1°	0,09/69,00°	0,24/−145,5°	15,8
	1500	0,59/ 147,8°	2,07/ 56,2°	0,19/61,83°	0,25/−169,9°	8,5
	2000	0,58/ 107,9°	1,10/ 13,2°	0,33/27,68°	0,27/ 171,4°	3,0
50	40	0,38/ −40,9°	37,63/123,8°	0,04/46,70°	0,61/ 24,4°	34,2
	100	0,38/ −44,3°	37,01/122,4°	0,05/44,83°	0,61/ 9,2°	34,1
	200	0,38/ −42,7°	37,23/124,2°	0,04/42,95°	0,60/ 23,3°	34,0
	500	0,37/ −46,2°	37,00/124,3°	0,04/44,98°	0,61/ 19,9°	34,0
	800	0,38/ −40,3°	37,11/125,6°	0,04/45,50°	0,61/ 21,3°	34,1
	1000	1,01/ 179,2°	1,21/ −0,1°	1,01/−3,38°	1,19/ 177,8°	22,6
	1200	0,55/ 172,8°	5,14/ 83,6°	0,09/72,35°	0,26/−153,3°	16,1
	1500	0,60/ 148,3°	2,11/ 56,8°	0,20/62,43°	0,28/−174,8°	8,8
	2000	0,54/ 106,5°	1,13/ 14,0°	0,33/27,98°	0,28/ 165,0°	2,9
70	40	0,38/ −50,5°	37,89/122,3°	0,04/49,48°	0,56/ 20,5°	33,9
	100	0,38/ −51,8°	38,40/123,6°	0,04/49,93°	0,56/ 6,6°	34,0
	200	0,38/ −49,6°	38,10/124,1°	0,04/46,38°	0,56/ 22,8°	33,9
	500	0,38/ −54,7°	38,25/122,0°	0,04/42,23°	0,56/ 15,4°	34,0
	800	0,39/ −46,7°	37,71/124,0°	0,04/47,70°	0,56/ 16,2°	33,8
	1000	1,00/ 178,0°	1,23/ −2,6°	1,02/−3,63°	1,22/ 174,6°	30,1
	1200	0,55/ 171,7°	5,11/ 83,3°	0,09/73,90°	0,27/−157,1°	16,1
	1500	0,60/ 148,7°	2,10/ 56,6°	0,20/63,50°	0,29/−177,2°	8,7
	2000	0,64/ 106,1°	1,13/ 14,8°	0,33/26,88°	0,29/ 157,6°	3,7

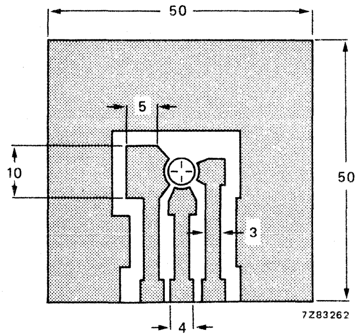


Fig. 2 Requirements for fibre-glass print (Dimensions in mm).
Single-sided 35 μm Cu-clad epoxy fibre-glass print, thickness 1,5 mm.
Tracks are fully tin-plated. Shaded area is Cu.

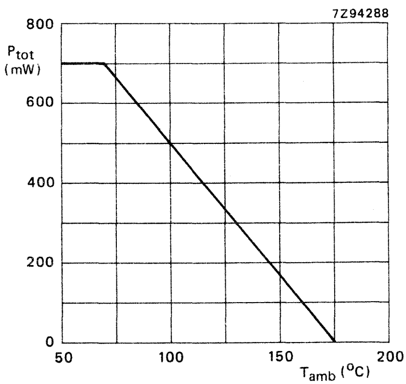


Fig. 3 Power dissipation.

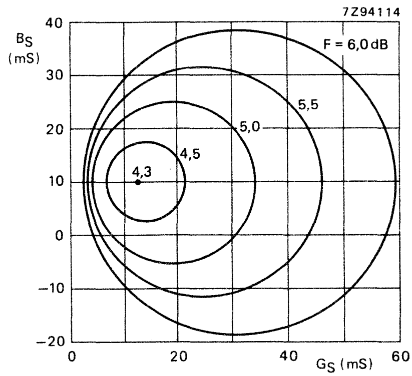


Fig. 4 Circles of constant noise figure.
V_{CE} = 10 V; I_C = 50 mA; f = 800 MHz.

N-P-N MICROWAVE TRANSISTOR

The BFQ33 is a small-signal silicon planar epitaxial transistor in a miniature hermetically sealed micro-stripline encapsulation, featuring an extremely high transition frequency and very low noise up to high frequencies.

It is primarily intended for use in microwave amplifier applications.

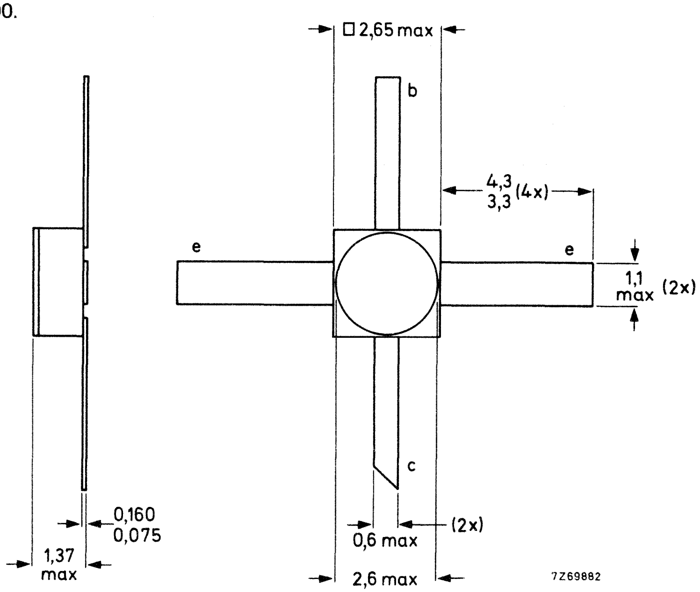
QUICK REFERENCE DATA

Collector-base voltage (open emitter)	V_{CBO}	max.	9	V
Collector-emitter voltage (open base)	V_{CEO}	max.	7	V
Collector current (d.c.)	I_C	max.	20	mA
Total power dissipation up to T_{amb} = 80 °C	P_{tot}	max.	140	mW
Transition frequency at f = 1,5 GHz I_C = 14 mA; V_{CE} = 5 V	f_T	typ.	12	GHz
Noise figure at optimum source impedance I_C = 5 mA; V_{CE} = 5 V; f = 2 GHz	F	typ.	2,5	dB
Maximum unilateral power gain I_C = 14 mA; V_{CE} = 5 V; f = 2 GHz; T_{amb} = 25 °C	G_{UM}	typ.	13,7	dB

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-100.



RATINGS

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

Collector-base voltage (open emitter)	V_{CBO}	max.	9	V
Collector-emitter voltage (open base)	V_{CEO}	max.	7	V
Emitter-base voltage (open collector)	V_{EBO}	max.	2	V
Collector current (d.c.)	I_C	max.	20	mA
Total power dissipation up to T_{amb} = 80 °C	P_{tot}	max.	140	mW
Storage temperature	T_{stg}	−65 to + 150		°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

From junction to ambient in free air mounted on a fibre-glass print of 40 mm x 25 mm x 1 mm	$R_{th\ j\text{-}a}$	=	500	K/W*

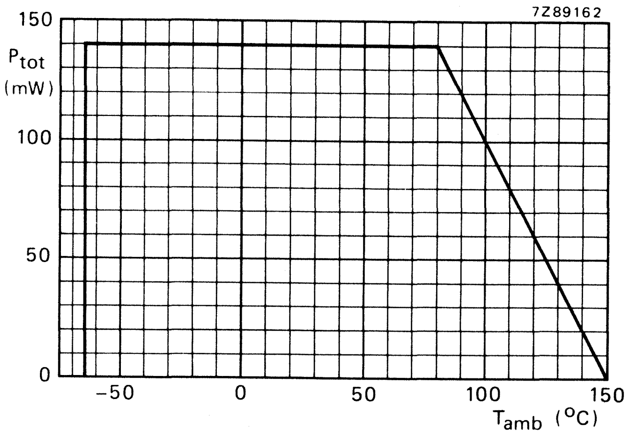


Fig. 2 Power derating curve versus ambient temperature.

* K/W is SI unit for °C/W.

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified

Collector cut-off current			
$I_E = 0$; $V_{CB} = 5$ V	I_{CBO}	<	50 nA
D.C. current gain*			
$I_C = 14$ mA; $V_{CE} = 5$ V	h_{FE}	>	25
Collector capacitance at f = 1 MHz			
$I_E = I_e = 0$; $V_{CB} = 5$ V	C_c	typ.	0,45 pF
Feedback capacitance at f = 1 MHz			
$I_C = 0$; $V_{CE} = 5$ V	C_{re}	typ.	0,2 pF
Transition frequency at f = 1,5 GHz*			
$I_C = 14$ mA; $V_{CE} = 5$ V	f_T	typ.	12 GHz
Noise figure at optimum source impedance			
$I_C = 5$ mA; $V_{CE} = 5$ V; f = 2 GHz	F	typ.	2,5 dB
$I_C = 5$ mA; $V_{CE} = 5$ V; f = 4 GHz	F	typ.	3,8 dB

Maximum unilateral power gain (s_{re} assumed to be zero)

$$G_{UM} \text{ (in dB)} = 10 \log \frac{|s_{fe}|^2}{(1-|s_{ie}|^2)(1-|s_{oe}|^2)}$$

$I_C = 14$ mA; $V_{CE} = 5$ V; f = 2 GHz	G_{UM}	typ.	13,7 dB
$I_C = 14$ mA; $V_{CE} = 5$ V; f = 4 GHz	G_{UM}	typ.	7,4 dB
s-parameters (common emitter)			
$I_C = 14$ mA; $V_{CE} = 5$ V; $R_S = R_L = 50\ \Omega$; f = 2 GHz			
Input reflection coefficient	s_{ie}	typ.	0,18/−155°
Reverse transmission coefficient	s_{re}	typ.	0,10/ +49°
Forward transmission coefficient	s_{fe}	typ.	4,3 / +75°
Output reflection coefficient	s_{oe}	typ.	0,43/ −56°
$I_C = 14$ mA; $V_{CE} = 5$ V; $R_S = R_L = 50\ \Omega$; f = 4 GHz			
Input reflection coefficient	s_{ie}	typ.	0,19/+171°
Reverse transmission coefficient	s_{re}	typ.	0,14/ +34°
Forward transmission coefficient	s_{fe}	typ.	2,0 / +48°
Output reflection coefficient	s_{oe}	typ.	0,50/ −89°

* Measured under pulse conditions.

Conditions for Figs 3 and 4:

V_{CE} = 5 V; I_C = 14 mA;
T_{amb} = 25 °C.

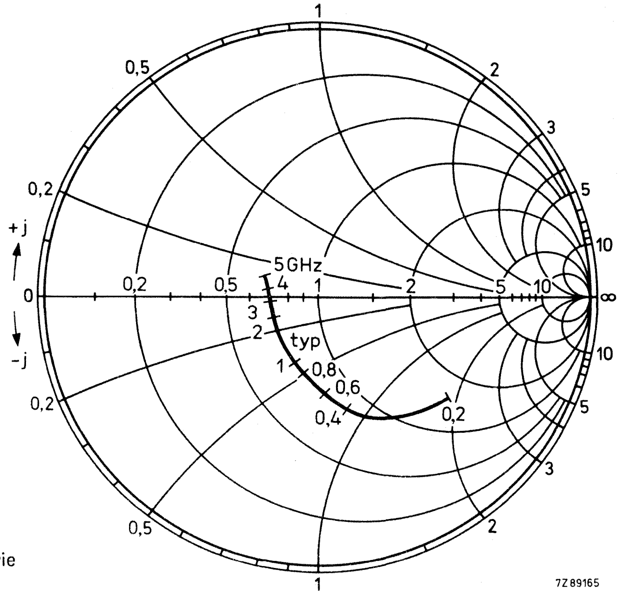


Fig. 3 Input impedance derived from input reflection coefficient s_{ie} co-ordinates in ohm x 50.

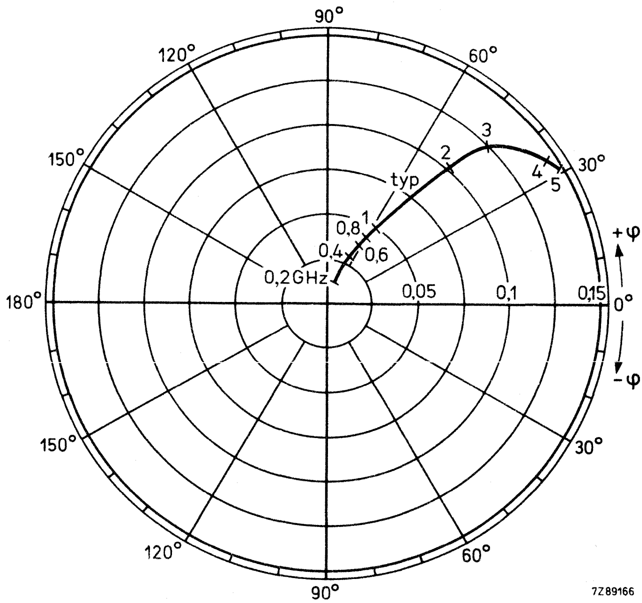


Fig. 4 Reverse transmission coefficient s_{re}.

Conditions for Figs 5 and 6:

V_{CE} = 5 V; I_C = 14 mA;
T_{amb} = 25 °C.

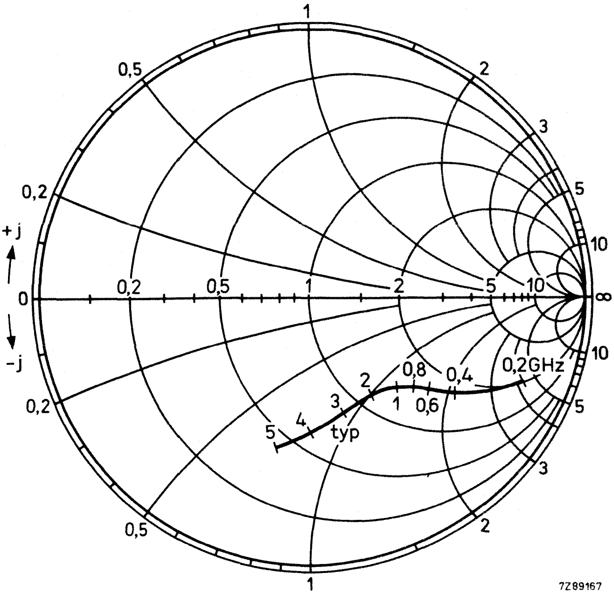


Fig. 5 Output impedance derived from output reflection coefficient s_{oe} co-ordinates in ohm x 50.

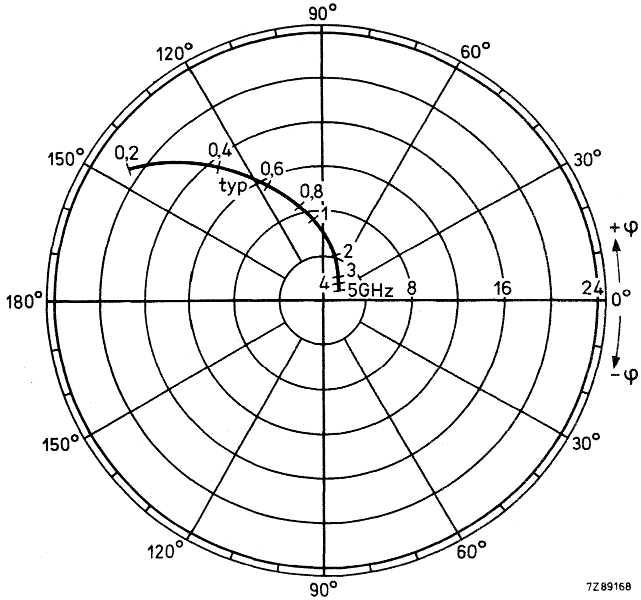


Fig. 6 Forward transmission coefficient s_{fe}.

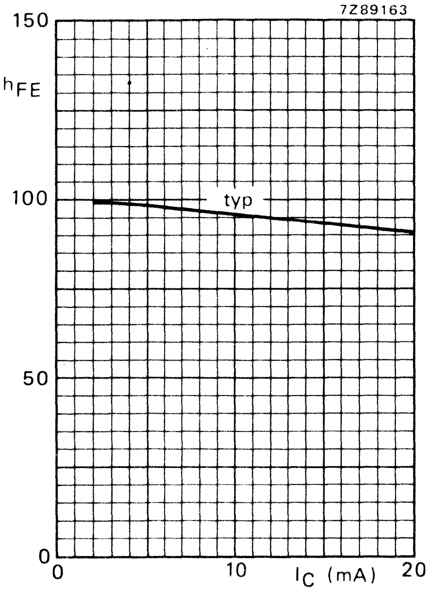


Fig. 7 V_{CE} = 5 V; T_j = 25 °C.

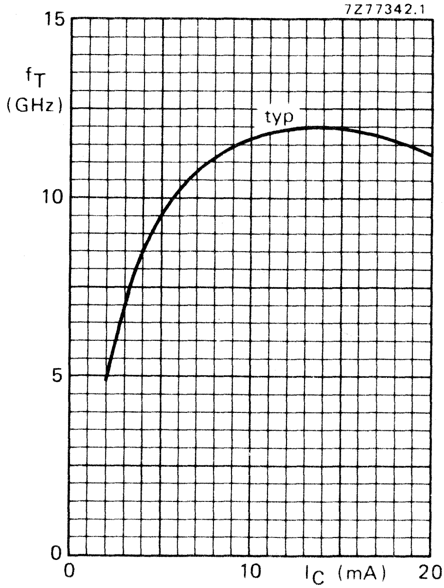


Fig. 8 V_{CE} = 5 V; f = 1,5 GHz; T_j = 25 °C.

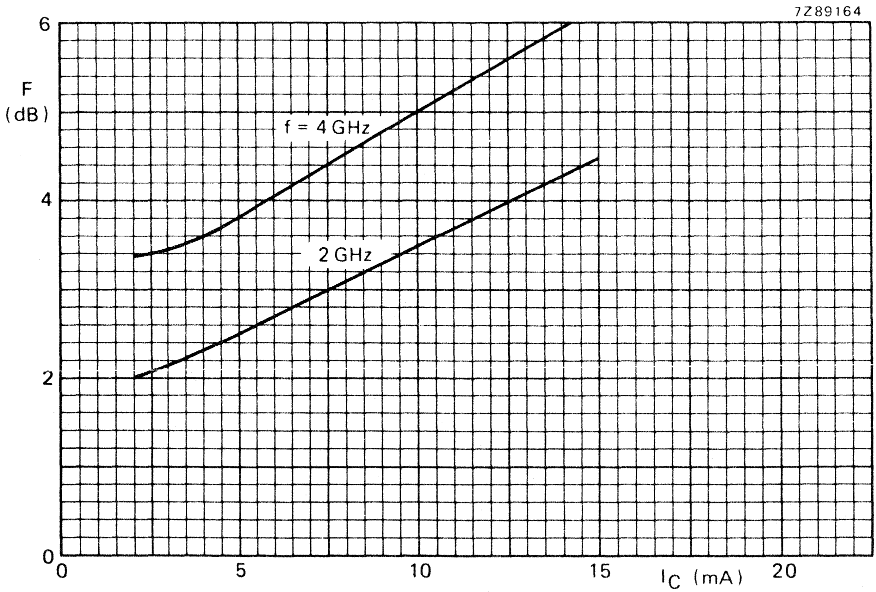


Fig. 9 V_{CE} = 5 V; Z_S = optimum; T_{amb} = 25 °C; typical values.

SILICON PLANAR EPITAXIAL TRANSISTOR

N-P-N transistor primarily intended for driver and final stages in MATV system amplifiers. This device is also suitable for use in low power band IV and V equipment. 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

Collector-base voltage (open emitter)	V_{CBO}	max.	25	V
Collector-emitter voltage (open base)	V_{CEO}	max.	18	V
Collector current (d.c.)	I_C	max.	150	mA
Total power dissipation (d.c.) up to T_{mb} = 125 °C	P_{tot}	max.	2,25	W
Operating junction temperature	T_j	max.	200	°C
Transition frequency at f = 500 MHz I_C = 150 mA; V_{CE} = 15 V; T_j = 25 °C	f_T	>	3,5	GHz
Output voltage at d_{im} = −60 dB (see Figs 2 and 4) I_C = 120 mA; V_{CE} = 15 V; R_L = 75 Ω; T_{amb} = 25 °C $f_{(p+q-r)}$ = 793,25 MHz	V_o	typ.	1,2	V
Output power at 1 dB gain compression	P_{L1}	typ.	+26	dBm ←
Third order intercept point	ITO	typ.	+45	dBm ←

MECHANICAL DATA

SOT-122 (see Fig. 1).

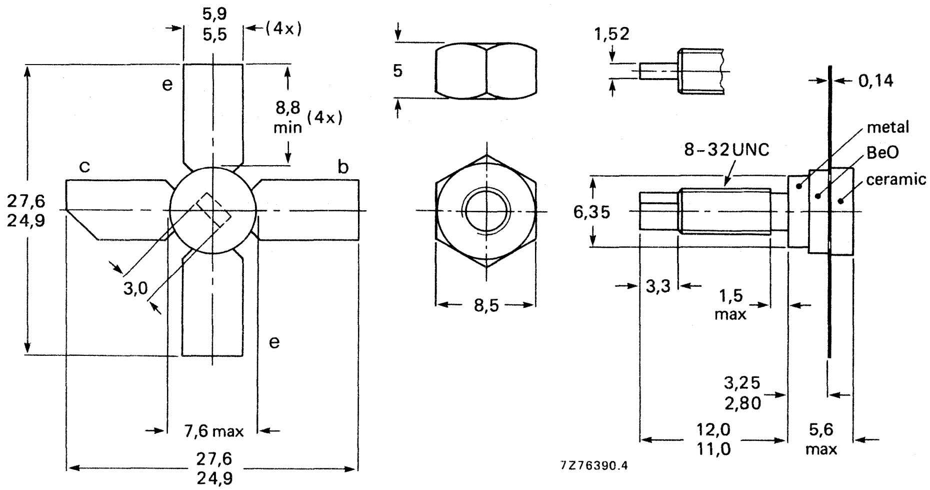
PRODUCT SAFETY

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-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.

RATINGS

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

Collector-base voltage (open emitter)	V_{CBO}	max.	25	V
Collector-emitter voltage (open base) (see Fig. 3)	V_{CEO}	max.	18	V
Emitter-base voltage (open collector)	V_{EBO}	max.	2	V
Collector current (d.c.)	I_C	max.	150	mA
Total power dissipation (d.c.) up to T_{mb} = 125 °C (see Fig. 3)	P_{tot}	max.	2,25	W
Storage temperature	T_{stg}		−65 to +150	°C
Operating junction temperature	T_j	max.	200	°C

THERMAL RESISTANCE

From junction to mounting base	$R_{th\ j\text{-}mb}$ =	15,0	K/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$ =	0,6	K/W

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified

Collector cut-off current			
$I_E = 0$; $V_{CB} = 15$ V	I_{CBO}	<	100 μA
D.C. current gain*			
$I_C = 75$ mA; $V_{CE} = 15$ V	h_{FE}	>	25
$I_C = 150$ mA; $V_{CE} = 15$ V	h_{FE}	>	25
Transition frequency at f = 500 MHz*			
$I_C = 75$ mA; $V_{CE} = 15$ V	f_T	> typ.	3,0 GHz 3,5 GHz
$I_C = 150$ mA; $V_{CE} = 15$ V	f_T	> typ.	3,5 GHz 4,0 GHz
Collector capacitance at f = 1 MHz			
$I_E = I_e = 0$; $V_{CB} = 15$ V	C_c	typ. <	2,0 pF 2,75 pF
Emitter capacitance at f = 1 MHz			
$I_C = I_c = 0$; $V_{EB} = 0,5$ V	C_e	typ.	11 pF
Feedback capacitance at f = 1 MHz			
$I_C = 10$ mA; $V_{CE} = 15$ V	C_{re}	typ. <	1,0 pF 1,35 pF
Collector-stud capacitance	C_{cs}	typ.	2 pF
Noise figure measured in MATV test circuit (see Fig. 2)			
$I_C = 120$ mA; $V_{CE} = 15$ V; f = 500 MHz	F	typ.	8 dB

Maximum unilateral power gain (s_{re} assumed to be zero)

$$G_{UM} \text{ (in dB)} = 10 \log \frac{|s_{fe}|^2}{(1 - |s_{ie}|^2)(1 - |s_{oe}|^2)}$$

$I_C = 120$ mA; $V_{CE} = 15$ V; f = 500 MHz	G_{UM}	typ.	16,3 dB

Output voltage at $d_{im} = -60$ dB (see Figs 2 and 4)
(DIN 45004B, par. 6.3.: 3-tone)
$I_C = 120$ mA; $V_{CE} = 15$ V; $R_L = 75\ \Omega$

$V_p = V_o$ at $d_{im} = -60$ dB; $f_p = 795,25$ MHz
$V_q = V_o - 6$ dB ; $f_q = 803,25$ MHz
$R_r = V_o - 6$ dB ; $f_r = 805,25$ MHz

measured at $f_{(p+q-r)}$ = 793,25 MHz	V_o	typ.	1,2 V

* Measured under pulse conditions.

→ Output power at 1 dB gain compression (see Fig. 2)
I_C = 120 mA; V_{CE} = 15 V
R_L = 75 Ω
measured at f = 800 MHz — P_{L1} typ. +26 dBm

→ Third order intercept point (see Fig. 2)
I_C = 120 mA; V_{CE} = 15 V
R_L = 75 Ω
P_p = ITO − 6 dB; f_p = 800 MHz
P_q = ITO − 6 dB; f_q = 801 MHz
measured at $f_{(2q-p)}$ = 802 MHz and at $f_{(2p-q)}$ = 799 MHz — ITO typ. +45 dBm

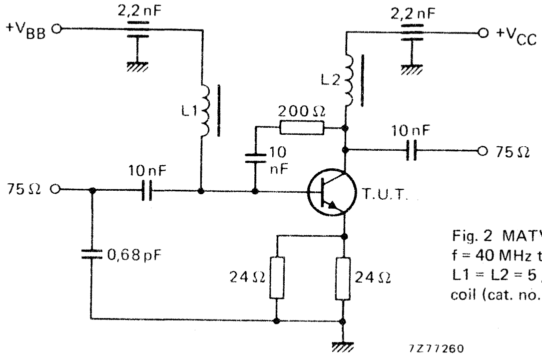


Fig. 2 MATV test circuit
f = 40 MHz to 860 MHz.
L1 = L2 = 5 μH Ferroxcube coil (cat. no. 3122 108 20153).

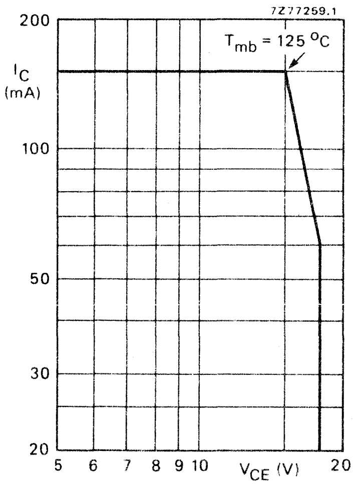


Fig. 3 D.C. SOAR.

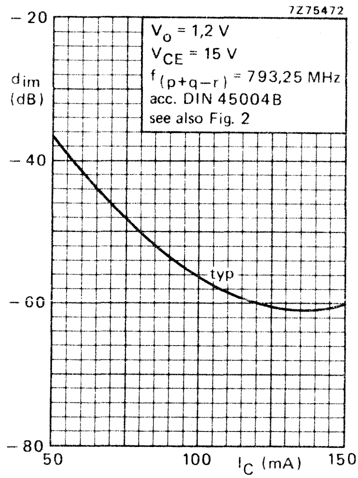


Fig. 4.

s-parameters (common emitter) at V_{CE} = 7,5 V.

I_C mA	f MHz	s_{ie}	s_{re}	s_{fe}	s_{oe}
50	40	0,47/ −72°	0,02/64°	30,5/147°	0,85/ −34°
	200	0,55/−154°	0,06/52°	11,3/101°	0,36/ −84°
	500	0,54/+ 177°	0,08/58°	4,9/ 78°	0,25/−104°
	800	0,52/+ 160°	0,12/58°	3,2/ 63°	0,25/−113°
	1000	0,50/+ 150°	0,15/57°	2,6/ 54°	0,26/−118°
	1200	0,48/+ 142°	0,18/54°	2,2/ 46°	0,28/−122°
75	40	0,45/ −76°	0,02/64°	32,1/144°	0,83/ −36°
	200	0,54/−156°	0,05/53°	11,6/100°	0,35/ −90°
	500	0,54/+ 176°	0,08/59°	5,0/ 78°	0,24/−112°
	800	0,51/+ 160°	0,13/59°	3,3/ 63°	0,24/−121°
	1000	0,49/+ 150°	0,16/57°	2,7/ 55°	0,24/−124°
	1200	0,46/+ 142°	0,18/54°	2,3/ 47°	0,26/−128°
100	40	0,44/ −79°	0,02/63°	33,0/145°	0,82/ −37°
	200	0,54/−157°	0,06/54°	11,8/100°	0,35/ −93°
	500	0,53/+ 175°	0,09/60°	5,1/ 78°	0,23/−117°
	800	0,51/+ 159°	0,13/59°	3,3/ 64°	0,23/−126°
	1000	0,49/+ 150°	0,16/57°	2,7/ 55°	0,24/−129°
	1200	0,46/+ 142°	0,19/54°	2,3/ 47°	0,26/−131°
120	40	0,43/ −81°	0,02/63°	33,5/145°	0,82/ −38°
	200	0,54/−157°	0,05/55°	11,9/ 99°	0,35/ −95°
	500	0,53/+ 175°	0,09/60°	5,1/ 77°	0,23/−119°
	800	0,51/+ 159°	0,13/59°	3,3/ 63°	0,23/−128°
	1000	0,48/+ 149°	0,16/56°	2,7/ 55°	0,24/−131°
	1200	0,46/+ 141°	0,19/53°	2,3/ 47°	0,25/−132°
150	40	0,43/ −82°	0,02/63°	33,6/145°	0,81/ −39°
	200	0,54/−158°	0,05/55°	11,8/ 99°	0,34/ −96°
	500	0,53/+ 175°	0,09/60°	5,1/ 77°	0,23/−121°
	800	0,51/+ 159°	0,13/59°	3,3/ 63°	0,23/−129°
	1000	0,49/+ 149°	0,16/56°	2,7/ 55°	0,24/−132°
	1200	0,47/+ 141°	0,19/53°	2,3/ 47°	0,25/−134°

s-parameters (common emitter) at V_{CE} = 15 V.

I_C mA	f MHz	s_{ie}	s_{re}	s_{fe}	s_{oe}
50	40	0,48/ −65°	0,02/62°	31,0/148°	0,83/ −30°
	200	0,53/−149°	0,04/52°	12,0/102°	0,37/ −73°
	500	0,52/+ 179°	0,08/58°	5,2/ 78°	0,25/ −89°
	800	0,50/+ 162°	0,12/59°	3,4/ 64°	0,26/ −99°
	1000	0,47/+ 152°	0,14/57°	2,8/ 55°	0,28/−104°
	1200	0,45/+ 144°	0,17/55°	2,3/ 47°	0,31/−109°
75	40	0,46/ −68°	0,02/62°	32,9/148°	0,82/ −32°
	200	0,52/−151°	0,04/53°	12,5/101°	0,36/ −79°
	500	0,51/+ 178°	0,08/59°	5,4/ 78°	0,24/ −97°
	800	0,48/+ 161°	0,12/59°	3,5/ 64°	0,24/−106°
	1000	0,46/+ 152°	0,15/57°	2,8/ 56°	0,26/−110°
	1200	0,44/+ 144°	0,17/55°	2,4/ 48°	0,28/−114°
100	40	0,47/ −69°	0,02/62°	33,9/147°	0,81/ −34°
	200	0,51/−151°	0,04/54°	12,6/101°	0,35/ −82°
	500	0,50/+ 178°	0,08/59°	5,5/ 78°	0,23/−101°
	800	0,48/+ 161°	0,12/59°	3,5/ 64°	0,23/−109°
	1000	0,45/+ 152°	0,15/57°	2,9/ 56°	0,25/−113°
	1200	0,43/+ 144°	0,18/54°	2,4/ 48°	0,27/−117°
120	40	0,47/ −69°	0,02/62°	34,6/146°	0,81/ −34°
	200	0,51/−151°	0,04/54°	12,7/101°	0,35/ −83°
	500	0,50/+ 178°	0,08/60°	5,5/ 78°	0,23/−103°
	800	0,48/+ 161°	0,12/59°	3,5/ 64°	0,23/−112°
	1000	0,45/+ 152°	0,15/57°	2,9/ 56°	0,24/−115°
	1200	0,43/+ 144°	0,18/54°	2,4/ 48°	0,26/−118°
150	40	0,49/ −70°	0,02/61°	34,8/146°	0,80/ −35°
	200	0,52/−152°	0,04/54°	12,6/100°	0,34/ −84°
	500	0,50/+ 178°	0,08/60°	5,4/ 78°	0,23/−103°
	800	0,48/+ 162°	0,12/59°	3,5/ 64°	0,23/−111°
	1000	0,46/+ 152°	0,15/57°	2,8/ 55°	0,24/−114°
	1200	0,44/+ 144°	0,18/54°	2,4/ 48°	0,27/−117°

Conditions for Figs 5 and 6:
V_{CE} = 15 V; I_C = 120 mA;
T_{amb} = 25 °C.

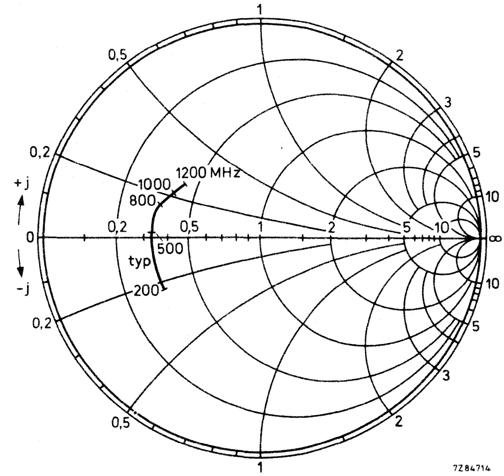


Fig. 5 Input impedance derived from input reflection coefficient s_{ie} co-ordinates in ohm x 50.

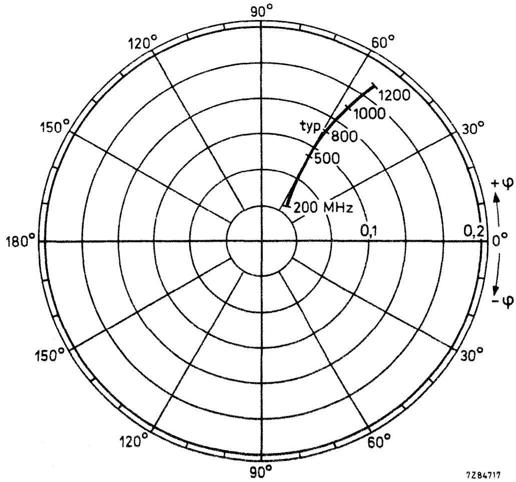


Fig. 6 Reverse transmission coefficient s_{re}.

Conditions for Figs 7 and 8:
V_{CE} = 15 V; I_C = 120 mA;
T_{amb} = 25 °C.

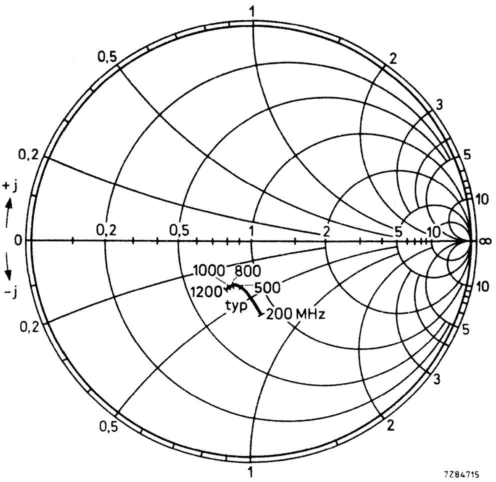


Fig. 7 Output impedance derived from output reflection coefficient s_{oe} co-ordinates in ohm x 50.

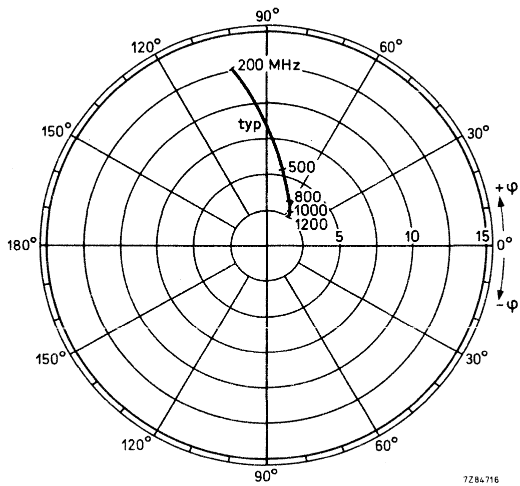


Fig. 8 Forward transmission coefficient s_{fe}.

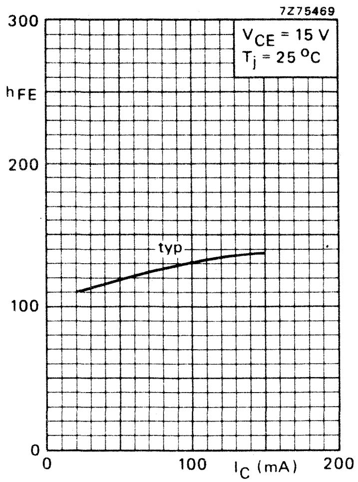


Fig. 9.

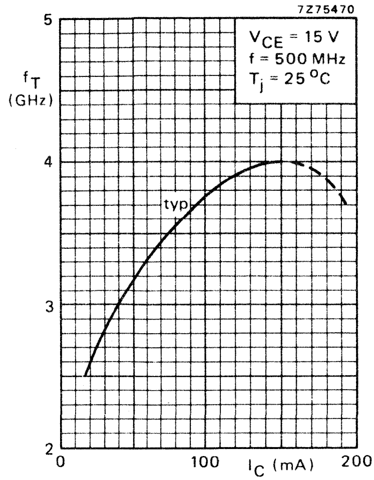


Fig. 10.

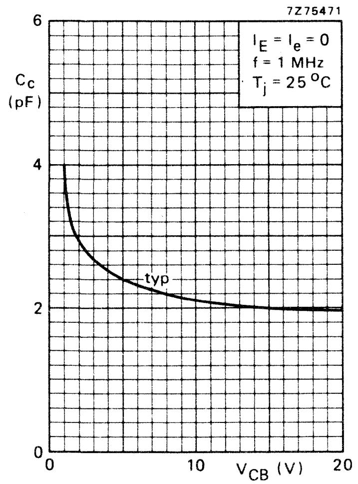


Fig. 11.

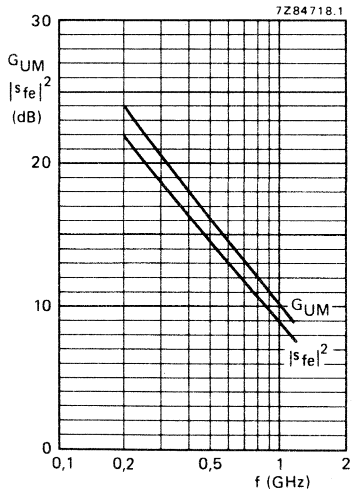


Fig. 12 V_{CE} = 15 V; I_C = 120 mA; T_{amb} = 25 °C; typical values

SILICON PLANAR EPITAXIAL TRANSISTOR

N-P-N transistor in plastic T-package, intended for wideband amplification applications. The device features high output voltage capabilities.

QUICK REFERENCE DATA

Collector-base voltage (open emitter)	V_{CBO}	max.	25	V
Collector-emitter voltage (open base)	V_{CEO}	max.	18	V
Collector current (d.c.)	I_C	max.	150	mA
Total power dissipation up to T_{amb} = 45 °C	P_{tot}	max.	1	W
Junction temperature	T_j	max.	175	°C
D.C. current gain I_C = 100 mA; V_{CE} = 10 V	h_{FE}	min.	25	
Transition frequency at f = 500 MHz I_C = 100 mA; V_{CE} = 10 V	f_T	typ.	3,7	GHz
Maximum power gain at f = 300 MHz; T_{amb} = 25 °C I_C = 100 mA; V_{CE} = 10 V	G_{PM}	typ.	20	dB
Output voltage at d_{im} = –60 dB (see Fig. 3) I_C = 100 mA; V_{CE} = 10 V; R_L = 75 Ω; $f_{(p+q-r)}$ = 285,25 MHz; T_{amb} = 25 °C	V_o	typ.	1	V
Output power at 1 dB gain compression V_{CE} = 10 V; I_C = 100 mA; f = 300 MHz	P_{L1}	typ.	+ 24	dBm ←
Third order intercept point V_{CE} = 10 V; I_C = 100 mA; f = 300 MHz	ITO	typ.	+ 43	dBm ←

MECHANICAL DATA

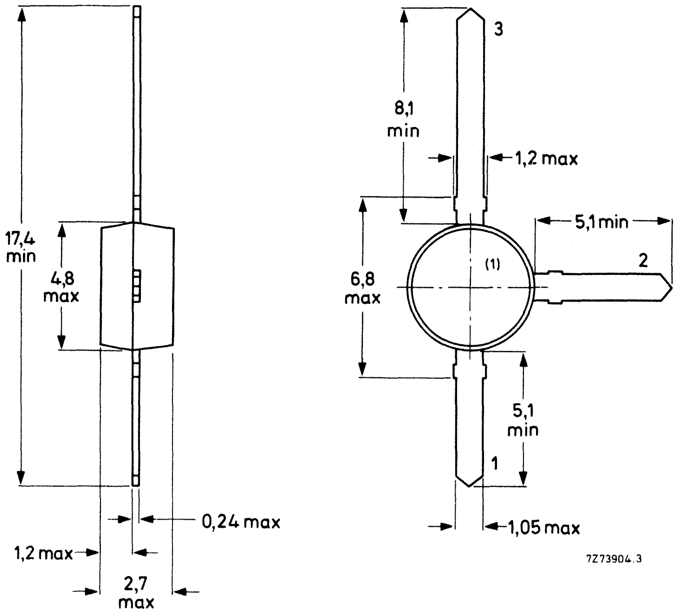
SOT-37 (see Fig. 1).

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-37.

Connections:
1. Base
2. Emitter
3. Collector



(1) = type number marking.

RATINGS

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

Collector-base voltage (open emitter)	V_{CBO}	max.	25 V
Collector-emitter voltage (open base)	V_{CEO}	max.	18 V
Emitter-base voltage (open collector)	V_{EBO}	max.	2 V
Collector current (d.c.)	I_C	max.	150 mA
Total power dissipation up to T_{amb} = 45 °C (see Fig. 2)	P_{tot}	max.	1 W
Storage temperature	T_{stg}	−65 to + 175 °C	
Junction temperature	T_j	max.	175 °C

THERMAL RESISTANCE

From junction to case	$R_{th\ j\text{-}c}$	=	50 K/W
From junction to ambient (free air) mounted on a fibre-glass print (see Fig. 2)	$R_{th\ j\text{-}a}$	=	130 K/W

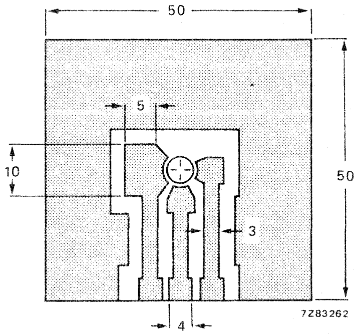


Fig. 2 Requirements for fibre-glass print (Dimensions in mm). Single-sided 35 μm Cu-clad epoxy fibre-glass print, thickness 1,5 mm. Tracks are fully tin-plated. Shaded area is Cu.

CHARACTERISTICS

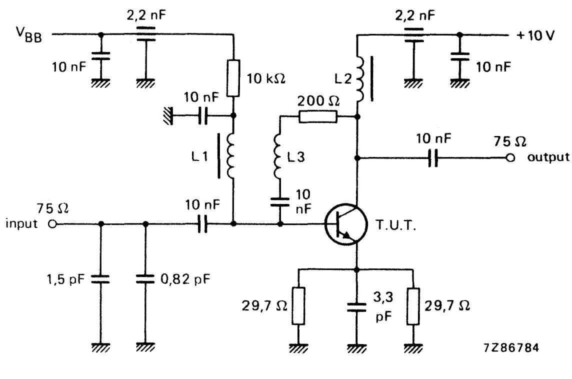
T_j = 25 °C unless otherwise specified

Collector cut-off current $I_E = 0$; V_{CB} = 15 V	I_{CBO}	max.	100 μA
D.C. current gain* I_C = 100 mA; V_{CE} = 10 V	h_{FE}	min.	25
Transition frequency at f = 500 MHz* I_C = 100 mA; V_{CE} = 10 V	f_T	typ.	3,7 GHz
Collector capacitance at f = 1 MHz $I_E = i_e = 0$; V_{CB} = 10 V	C_c	typ.	2,0 pF
Emitter capacitance at f = 1 MHz $I_C = i_c = 0$; V_{EB} = 0,5 V	C_e	typ.	10 pF
Feedback capacitance at f = 1 MHz $I_C = 0$; V_{CE} = 10 V	C_{re}	typ.	1,2 pF
Maximum power gain at f = 300 MHz; T_{amb} = 25 °C I_C = 100 mA; V_{CE} = 10 V	G_{UM}	typ.	20 dB
Second harmonic distortion (see Fig. 3) I_C = 100 mA; V_{CE} = 10 V; R_L = 75 Ω; T_{amb} = 25 °C $V_p = V_o$ = 316 mV = 50 dBmV; f_p = 66 MHz $V_q = V_o$ = 316 mV = 50 dBmV ; f_q = 144 MHz Measured at $f_{(p+q)}$ = 210 MHz	d_2	typ.	−55 dB

* Measured under pulse conditions.

CHARACTERISTICS (continued)

Output voltage at d_{im} = −60 dB (see Fig. 3) (DIN 45004B); T_{amb} = 25 °C; I_C = 100 mA; V_{CE} = 10 V; R_L = 75 Ω			
$V_p = V_o$ at d_{im} = −60 dB; f_p = 287,25 MHz			
$V_q = V_o$ −6 dB; f_q = 294,25 MHz			
$V_r = V_o$ −6 dB; f_r = 295,25 MHz			
Measured at $f_{(p+q-r)}$ = 285,25 MHz	V_o	typ.	1 V
Output voltage at d_{im} = −60 dB (see Fig. 3) (DIN 45004B); T_{amb} = 25 °C; I_C = 90 mA; V_{CE} = 10 V; R_L = 75 Ω			
$V_p = V_o$ at d_{im} = −60 dB; f_p = 797,25 MHz			
$V_q = V_o$ −6 dB; f_q = 803,25 MHz			
$V_r = V_o$ −6 dB; f_r = 805,25 MHz			
Measured at $f_{(p+q-r)}$ = 793,25 MHz	V_o	typ.	750 mV
→ Output power at 1 dB gain compression			
V_{CE} = 10 V; I_C = 100 mA; f = 300 MHz	P_{L1}	typ.	+ 24 dBm
V_{CE} = 10 V; I_C = 90 mA; f = 800 MHz	P_{L1}	typ.	+ 22 dBm
→ Third order intercept point			
V_{CE} = 10 V; I_C = 100 mA; f = 300 MHz	ITO	typ.	+ 43 dBm
V_{CE} = 10 V; I_C = 90 mA; f = 800 MHz	ITO	typ.	+ 41 dBm



BFQ34T

Fig. 3 Intermodulation distortion and second harmonic distortion MATV test circuit.

L1 = L2 = 5 μH Ferroxcube choke

L3 = 2 turns Cu wire (0,5 mm), internal diameter 4 mm, winding pitch 2 mm.

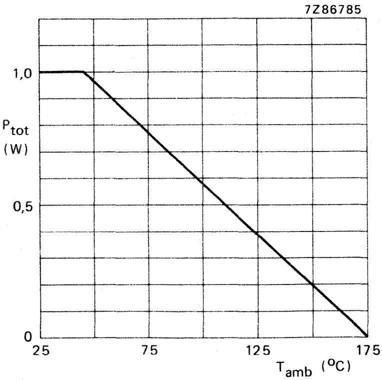


Fig. 4.

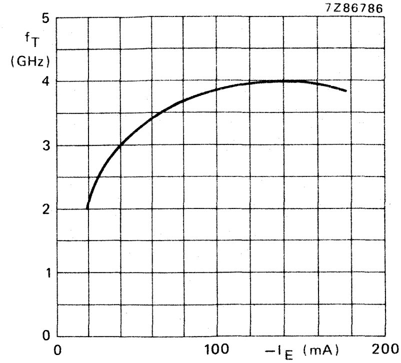


Fig. 5 V_{CE} = 10 V; f = 500 MHz.

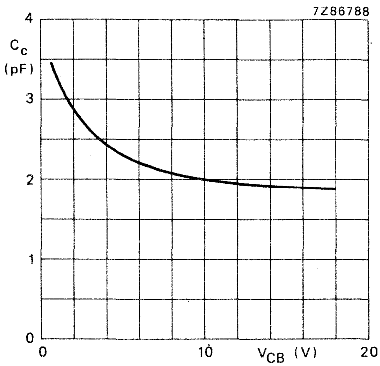


Fig. 6 I_E = 0; f = 1 MHz.

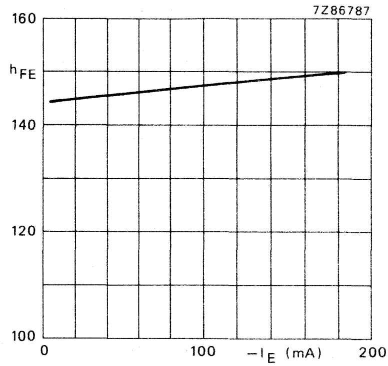


Fig. 7 V_{CE} = 10 V.

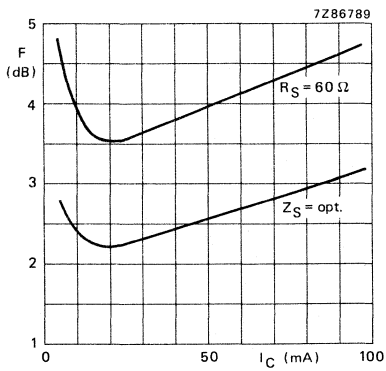


Fig. 8 V_{CE} = 10 V; f = 800 MHz.

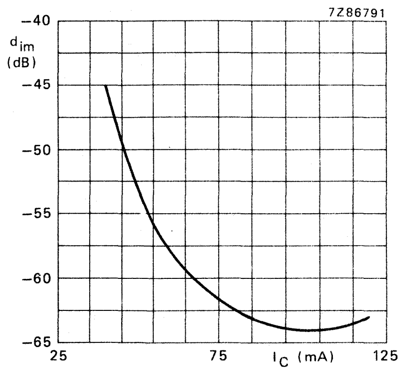


Fig. 9 V_{CE} = 10 V; V_o = 58 dBmV; $f_{(p+q-r)}$ = 285,25 MHz.

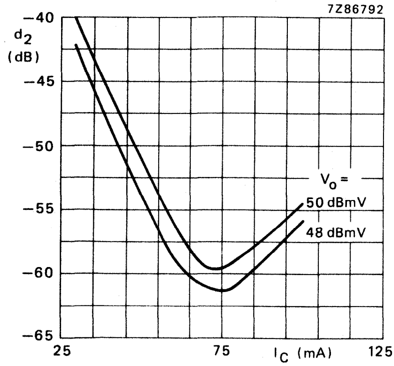


Fig. 10 V_{CE} = 10 V; f_p = 66 MHz; z. f_p = 144 MHz; $f_{(p+q)}$ = 210 MHz.

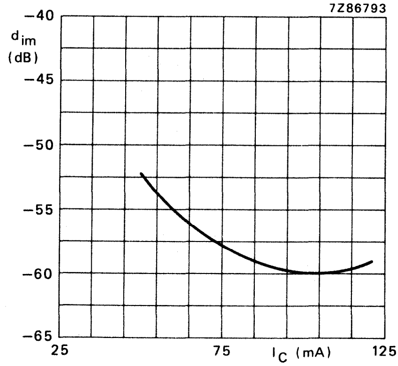


Fig. 11 V_{CE} = 19 V; V_o = 750 mV; $f_{(p+q-r)}$ = 793,25 MHz.

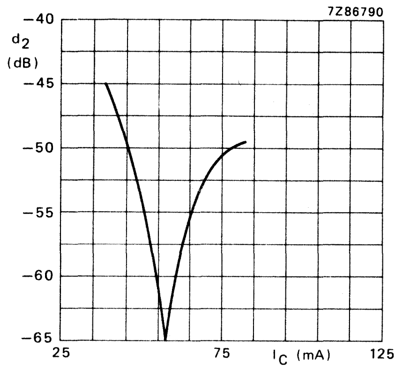


Fig. 12 V_{CE} = 10 V; V_o = 48 dBmV; f_p = 560 MHz; f_q = 250 MHz; $f_{(p+q)}$ = 810 MHz.

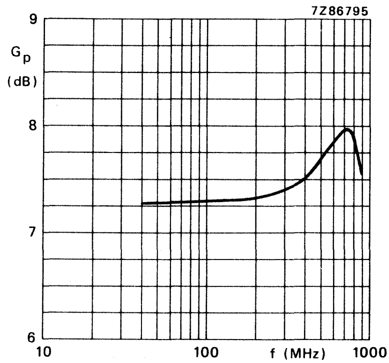


Fig. 13 Gain measured in test circuit (see Fig. 3).

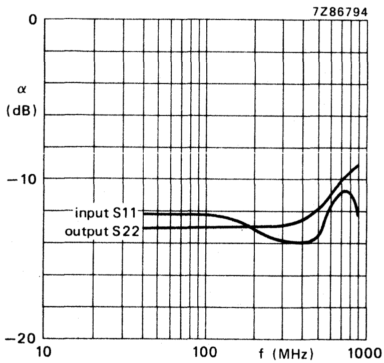


Fig. 14 Return losses measured in test circuit (see Fig. 3).

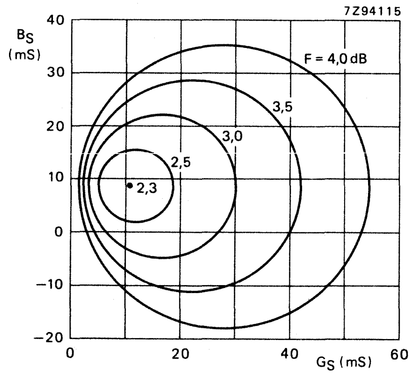


Fig. 15 Circles of constant noise figure. V_{CE} = 10 V; I_C = 20 mA; f = 800 MHz.

s-parameters (common emitter) at V_{CE} = 10 V

I_C mA	f MHz	s_{ie}	s_{fe}	s_{re}	s_{oe}	G_{UM} dB
10	40	0,81/ 30,7°	19,84/135,8°	0,05/50,18°	0,88/ 59,0°	37,2
	100	0,81/ 30,1°	19,83/136,6°	0,05/49,73°	0,88/ 43,2°	37,2
	200	0,81/ 31,0°	19,97/136,7°	0,05/52,60°	0,88/ 59,7°	37,3
	500	0,82/ 27,3°	19,94/135,5°	0,05/55,33°	0,88/ 54,9°	37,4
	800	0,81/ 32,8°	20,07/134,6°	0,05/52,90°	0,88/ 55,1°	37,3
	1000	1,00/ 178,3°	1,11/ −1,1°	1,01/−1,43°	1,05/ 178,8°	32,4
	1200	0,59/−166,4°	4,47/ 85,1°	0,07/51,60°	0,34/ −60,7°	15,4
	1500	0,63/ 156,7°	1,85/ 49,6°	0,14/67,25°	0,39/ −43,0°	8,3
	2000	0,61/ 111,1°	0,87/ 23,0°	0,30/66,70°	0,44/−153,3°	1,7
20	40	0,73/ 20,8°	28,61/132,4°	0,05/49,40°	0,84/ 48,8°	37,8
	100	0,75/ 20,9°	28,40/131,4°	0,05/50,28°	0,83/ 34,9°	37,7
	200	0,74/ 22,1°	28,61/133,4°	0,05/52,60°	0,84/ 51,5°	37,9
	500	0,74/ 15,8°	28,59/131,5°	0,05/53,60°	0,83/ 46,1°	37,8
	800	0,74/ 24,0°	28,38/133,3°	0,05/45,70°	0,83/ 46,4°	37,5
	1000	1,01/ 178,5°	1,12/ −0,4°	1,01/−2,20°	1,10/ 177,1°	23,7
	1200	0,54/−171,1°	5,35/ 85,3°	0,08/52,53°	0,25/ −80,4°	16,3
	1500	0,57/ 153,3°	2,20/ 53,5°	0,16/65,95°	0,28/ 19,4°	8,9
	2000	0,55/ 111,8°	1,10/ 7,6°	0,40/41,03°	0,35/−156,6°	3,0
50	40	0,67/ 13,0°	37,46/126,9°	0,05/47,55°	0,78/ 40,0°	38,2
	100	0,66/ 10,8°	37,31/128,7°	0,05/45,45°	0,78/ 25,4°	37,9
	200	0,67/ 14,9°	37,19/127,4°	0,05/45,65°	0,79/ 40,9°	38,2
	500	0,66/ 8,2°	37,21/129,1°	0,05/47,73°	0,79/ 36,4°	38,1
	800	0,67/ 13,6°	36,81/129,5°	0,05/44,08°	0,78/ 37,9°	38,0
	1000	1,02/ 177,3°	1,16/ 0,6°	1,00/ 0,33°	1,14/ 177,0°	20,3
	1200	0,50/−175,0°	6,06/ 85,4°	0,08/64,95°	0,21/−108,5°	17,1
	1500	0,54/ 151,4°	2,50/ 56,9°	0,17/63,83°	0,23/−166,0°	9,7
	2000	0,50/ 111,4°	1,27/ 11,9°	0,31/36,40°	0,29/−162,8°	3,7
70	40	0,64/ 11,9°	39,04/128,8°	0,05/47,53°	0,76/ 37,0°	37,9
	100	0,65/ 10,4°	38,98/126,9°	0,05/48,30°	0,77/ 23,3°	38,2
	200	0,65/ 11,7°	39,17/128,1°	0,05/47,50°	0,76/ 38,4°	38,0
	500	0,65/ 5,1°	38,92/127,8°	0,05/46,68°	0,77/ 33,0°	38,1
	800	0,64/ 12,5°	39,31/128,5°	0,05/51,75°	0,76/ 34,0°	38,0
	1000	1,02/−177,5°	1,19/ −0,4°	1,02/ 1,88°	1,18/−179,7°	19,5
	1200	0,49/−175,9°	6,13/ 85,3°	0,08/65,75°	0,20/−115,4°	17,1
	1500	0,53/ 154,7°	2,52/ 57,1°	0,18/63,40°	0,23/−159,9°	9,7
	2000	0,49/ 111,2°	1,29/ 12,4°	0,55/36,88°	0,28/−166,4°	3,8
100	40	0,64/ 10,2°	39,77/127,5°	0,05/46,05°	0,75/ 35,6°	37,8
	100	0,63/ 7,2°	40,30/127,2°	0,05/43,45°	0,75/ 21,7°	37,9
	200	0,64/ 7,6°	40,45/128,1°	0,05/45,53°	0,75/ 35,3°	38,0
	500	0,64/ 3,3°	39,82/127,9°	0,04/46,38°	0,75/ 31,2°	37,8
	800	0,64/ 10,1°	39,81/127,6°	0,05/46,15°	0,75/ 33,4°	37,8
	1000	1,02/ 179,4°	1,20/ 2,1°	1,02/ 0,53°	1,19/ 177,6°	18,6
	1200	0,49/−176,6°	6,13/ 85,1°	0,08/66,10°	0,20/−119,8°	17,1
	1500	0,53/ 152,9°	2,53/ 56,5°	0,18/62,05°	0,23/−159,5°	9,8
	2000	0,49/ 111,2°	1,30/ 12,7°	0,31/35,30°	0,28/−168,6°	3,8

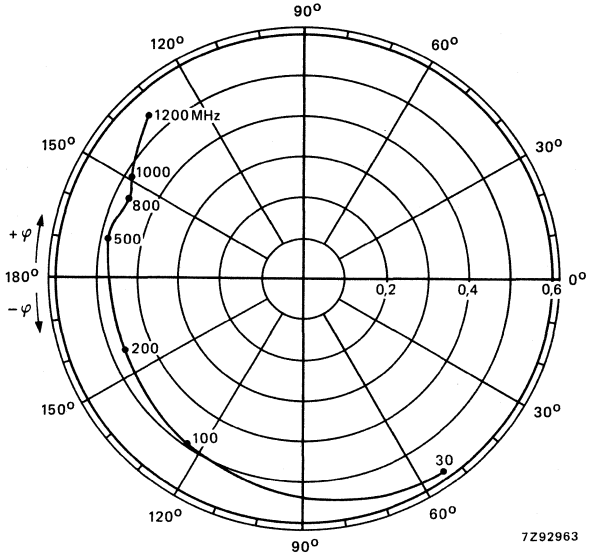


Fig. 16 Input reflection coefficient s_{ie}.

Conditions for Figs 16 and 17:
V_{CE} = 10 V; I_C = 100 mA; T_{amb} = 25 °C.

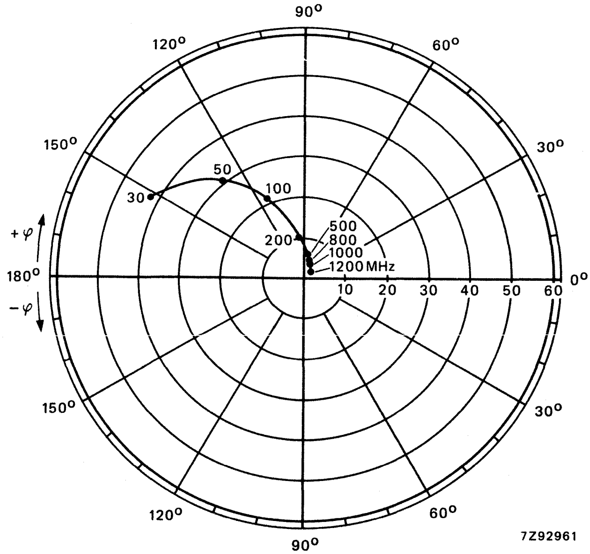


Fig. 17 Forward transmission coefficient s_{fe}.

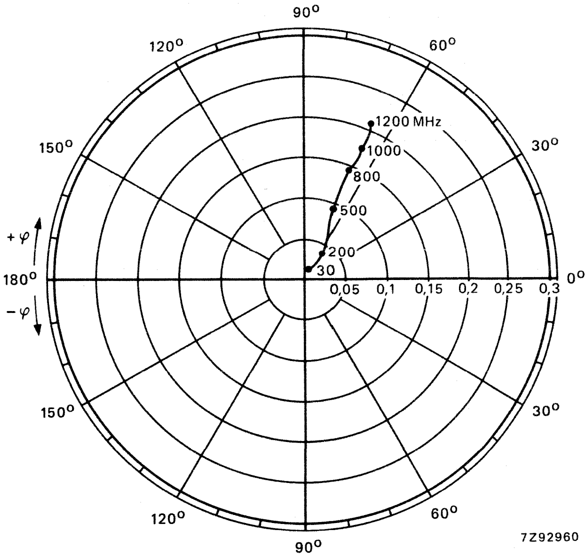


Fig. 18 Reverse transmission coefficient s_{re}.

Conditions for Figs 18 and 19:

V_{CE} = 10 V; I_C = 100 mA; T_{amb} = 25 °C.

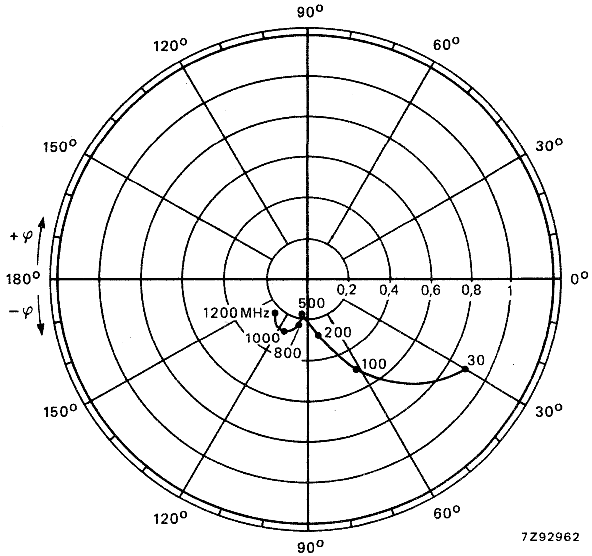


Fig. 19 Output reflection coefficient s_{oe}.

SILICON WIDEBAND TRANSISTOR

P-N-P transistor in a subminiature plastic transfer-moulded T-package. It is primarily intended for use in u.h.f. and microwave amplifiers such as in aerial amplifiers, radar systems, oscilloscopes, spectrum analysers etc.

The transistor features extremely high power gain coupled with good low noise performance.

N-P-N complements are BFR90 and BFR90A.

QUICK REFERENCE DATA

Collector-base voltage (open emitter)	$-V_{CBO}$	max.	20	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	15	V
Collector current (d.c.)	$-I_C$	max.	25	mA
Total power dissipation up to T_{amb} = 60 °C	P_{tot}	max.	180	mW
Junction temperature	T_j	max.	150	°C
Transition frequency at f = 500 MHz $-I_C$ = 14 mA; $-V_{CE}$ = 10 V	f_T	typ.	5	GHz
Feedback capacitance at f = 1 MHz I_C = 0; $-V_{CE}$ = 10 V; T_{amb} = 25 °C	C_{re}	typ.	0,45	pF
Noise figure at optimum source impedance $-I_C$ = 2 mA; $-V_{CE}$ = 10 V; f = 500 MHz; T_{amb} = 25 °C	F	typ.	2,7	dB

MECHANICAL DATA (see Fig. 1)

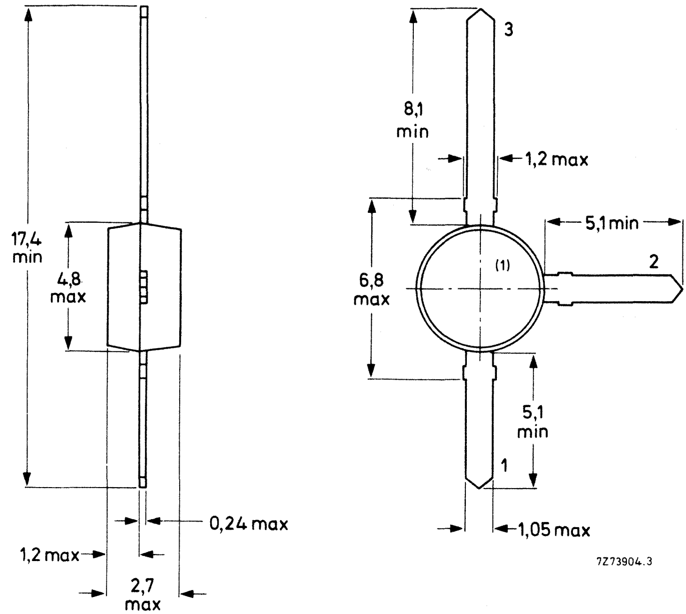
MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-37.

Connections

1. Base
2. Emitter
3. Collector



(1) = type number marking.

RATINGS

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

Collector-base voltage (open emitter)	$-V_{CBO}$	max.	20	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	15	V
Emitter-base voltage (open collector)	$-V_{EBO}$	max.	2	V
Collector current (d.c.)	$-I_C$	max.	25	mA
Collector current (peak value) at f > 1 MHz	$-I_{CM}$	max.	35	mA
Total power dissipation up to T_{amb} = 60 °C	P_{tot}	max.	180	mW
Storage temperature	T_{stg}		−65 to +150	°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

From junction to ambient in free air mounted on a fibre-glass print of 40 mm x 25 mm x 1 mm — $R_{th\ j\text{-}a}$ = 0,5 K/mW

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current $I_E = 0; -V_{CB} = 10$ V	$-I_{CBO}$	<	50 nA
D.C. current gain* $-I_C = 14$ mA; $-V_{CE} = 10$ V	h_{FE}	>	20
Transition frequency at f = 500 MHz* $-I_C = 14$ mA; $-V_{CE} = 10$ V	f_T	typ.	5 GHz
Collector capacitance at f = 1 MHz $I_E = I_e = 0; -V_{CB} = 10$ V	C_c	typ.	0,65 pF
Emitter capacitance at f = 1 MHz $I_C = I_c = 0; -V_{EB} = 0,5$ V	C_e	typ.	1,2 pF
Feedback capacitance at f = 1 MHz $I_C = 0; -V_{CE} = 10$ V; $T_{amb} = 25$ °C	C_{re}	typ.	0,45 pF
Noise figure at optimum source impedance $-I_C = 2$ mA; $-V_{CE} = 10$ V; f = 500 MHz; $T_{amb} = 25$ °C	F	typ.	2,7 dB
Maximum unilateral power gain (s_{re} assumed to be zero) G_{UM} (in dB) $= 10 \log \frac{\lvert s_{fe}\rvert^2}{(1-\lvert s_{ie}\rvert^2)(1-\lvert s_{oe}\rvert^2)}$ $I_C = 14$ mA; $V_{CE} = 10$ V; f = 500 MHz; $T_{amb} = 25$ °C	G_{UM}	typ.	19,0 dB

* Measured under pulse conditions.

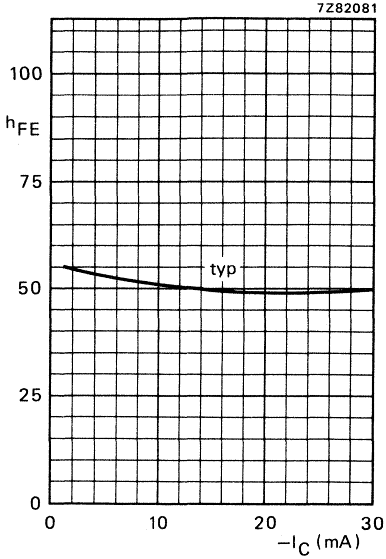


Fig. 2 $-V_{CE}$ = 10 V; T_j = 25 °C.

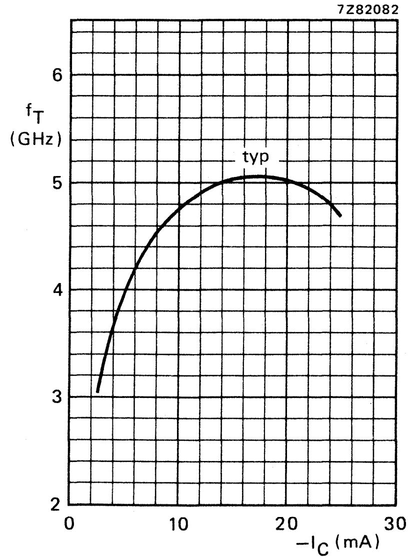


Fig. 3 $-V_{CE}$ = 10 V; f = 500 MHz; T_j = 25 °C.

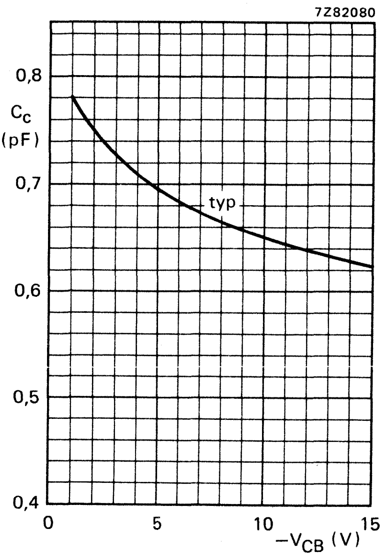


Fig. 4 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

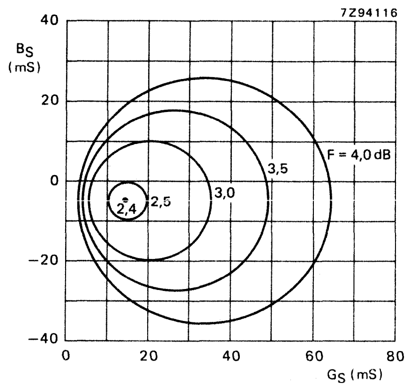


Fig. 5 Circles of constant noise figure.
V_{CE} = 10 V; I_C = 4 mA; f = 800 MHz.

s-parameters (common emitter) at V_{CE} = 10 V

I_C mA	f MHz	s_{ie}	s_{fe}	s_{re}	s_{oe}	G_{UM} dB
2	40	0,81/ 71,2°	6,30/121,7°	0,04/40,75°	1,00/ 79,3°	41,1
	100	0,81/ 70,2°	6,40/116,8°	0,04/39,88°	0,99/ 64,0°	38,6
	200	0,81/ 71,0°	6,42/123,9°	0,04/44,95°	0,99/ 80,2°	39,5
	500	0,81/ 66,5°	6,38/127,8°	0,04/42,20°	1,00/ 75,2°	43,7
	800	0,81/ 73,0°	6,37/116,5°	0,04/38,38°	0,99/ 76,3°	38,1
	1000	1,02/−179,8°	1,05/ −2,4°	1,03/−2,45°	1,02/ 175,1°	27,2
	1200	0,60/ −67,2°	4,29/128,5°	0,08/62,30°	0,80/ −24,1°	19,1
	1500	0,31/−160,2°	2,54/ 83,9°	0,13/53,65°	0,68/ −22,1°	11,2
	2000	0,26/ 133,3°	1,26/ 33,4°	0,17/50,25°	0,44/ −89,1°	3,3
5	40	0,60/ 66,8°	12,07/129,5°	0,04/33,95°	0,98/ 77,1°	38,4
	100	0,59/ 65,3°	12,11/132,3°	0,04/40,88°	0,98/ 62,1°	37,3
	200	0,60/ 67,0°	12,12/132,4°	0,04/40,45°	0,98/ 78,2°	37,2
	500	0,60/ 62,4°	12,17/135,3°	0,04/34,28°	0,98/ 73,4°	37,3
	800	0,60/ 68,4°	12,16/126,6°	0,04/45,60°	0,98/ 73,8°	37,5
	1000	1,01/−179,9°	1,07/ −1,4°	1,02/−2,13°	1,07/ 179,0°	27,5
	1200	0,34/ −91,1°	6,49/115,9°	0,06/66,53°	0,67/ −28,3°	19,4
	1500	0,19/−172,1°	3,17/ 78,3°	0,12/64,63°	0,56/ −18,9°	11,8
	2000	0,31/ 116,7°	1,53/ 33,4°	0,19/73,15°	0,37/ −92,1°	4,7
10	40	0,38/ 62,0°	17,24/143,1°	0,04/38,65°	0,96/ 74,7°	36,8
	100	0,38/ 60,4°	17,33/140,0°	0,04/39,65°	0,96/ 60,2°	36,3
	200	0,38/ 61,7°	17,28/140,8°	0,04/41,13°	0,96/ 75,6°	36,2
	500	0,38/ 57,4°	17,26/139,7°	0,04/33,58°	0,96/ 71,9°	37,0
	800	0,38/ 63,6°	17,36/139,5°	0,04/37,25°	0,96/ 72,2°	36,9
	1000	1,02/ 178,8°	1,15/ −1,4°	1,03/−0,30°	1,14/ 178,2°	20,4
	1200	0,21/−115,5°	7,45/108,5°	0,06/72,90°	0,58/ −28,8°	19,4
	1500	0,18/ 167,7°	3,42/ 75,4°	0,13/69,90°	0,51/ −19,8°	12,1
	2000	0,22/ 109,4°	1,73/ 32,3°	0,20/45,38°	0,34/−123,1°	5,5
14	40	0,27/ 59,0°	19,48/141,0°	0,04/38,43°	0,95/ 74,2°	36,1
	100	0,27/ 57,3°	19,51/140,1°	0,04/35,55°	0,94/ 59,1°	35,8
	200	0,27/ 59,2°	19,50/142,2°	0,04/27,75°	0,95/ 75,1°	36,1
	500	0,28/ 53,7°	19,64/141,0°	0,04/33,90°	0,95/ 70,9°	36,4
	800	0,28/ 60,0°	19,36/139,8°	0,04/31,23°	0,94/ 71,2°	35,8
	1000	1,01/ 178,9°	1,14/ 2,1°	1,00/−0,93°	1,12/−179,1°	22,8
	1200	0,17/−131,4°	7,71/106,0°	0,05/75,85°	0,55/ −28,4°	19,5
	1500	0,18/ 161,1°	3,46/ 74,5°	0,13/71,85°	0,49/ −17,0°	12,1
	2000	0,23/ 107,4°	1,99/ 30,8°	0,20/44,43°	0,33/−113,2°	6,7

SILICON PLANAR EPITAXIAL TRANSISTOR

Gold-metallized p-n-p transistor in a sub-miniature HERMETICALLY SEALED micro-stripline envelope. It is primarily intended for use in u.h.f. and microwave amplifiers such as aerial amplifiers, radar systems, oscilloscopes, spectrum analysers etc.

The transistor features extremely high power gain coupled with good low noise performance.

N-P-N complement is BFP90A.

QUICK REFERENCE DATA

Collector-base voltage	$-V_{CBO}$	max.	20	V
Collector-emitter voltage	$-V_{CEO}$	max.	15	V
Collector current (d.c.)	$-I_C$	max.	30	mA
Total power dissipation up to T_{amb} = 125 °C	P_{tot}	max.	250	mW
Junction temperature	T_j	max.	175	°C
D.C. current gain $-I_C$ = 14 mA; $-V_{CE}$ = 10 V	h_{FE}	min. max.	20 50	
Transition frequency at f = 500 MHz $-I_C$ = 14 mA; $-V_{CE}$ = 10 V	f_T	typ.	5	GHz
Maximum unlisted power gain $-I_C$ = 14 mA; $-V_{CE}$ = 10 V; T_{amb} = 25 °C at f = 500 MHz at f = 800 MHz	G_{UM}	typ. typ.	21 17	dB dB

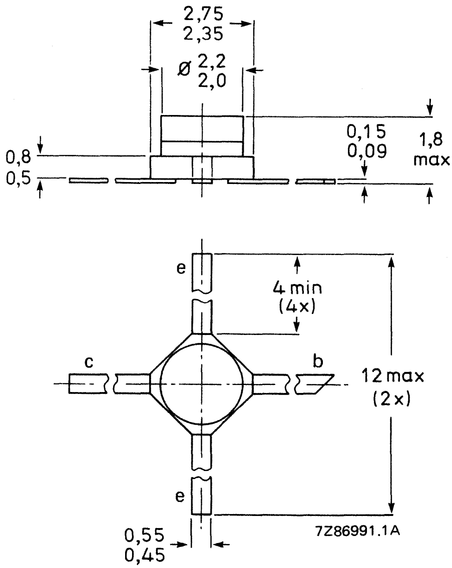
MECHANICAL DATA

SOT-173 (see Fig. 1).

MECHANICAL DATA Dimensions in mm

Fig. 1 SOT-173.

Marking code: C1



RATINGS

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

Collector-base voltage (open emitter)	$-V_{CBO}$	max.	20 V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	15 V
Emitter-base voltage (open collector)	$-V_{EBO}$	max.	2 V
Collector current (d.c.)	$-I_C$	max.	30 mA
Total power dissipation up to T_{amb} = 125 °C mounted on a ceramic substrate of 0,7 mm x 10 cm^2	P_{tot}	max.	250 mW
Storage temperature	T_{stg}		−65 to +150 °C
Junction temperature	T_j	max.	175 °C

THERMAL RESISTANCE

From junction to ambient mounted on a ceramic substrate of 0,7 mm x 10 cm^2	$R_{th\ j-a}$	200 K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current			
$I_E = 0$; $-V_{CB} = 10$ V	$-I_{CBO}$	max.	50 nA
D.C. current gain			
$-I_C = 14$ mA; $-V_{CE} = 10$ V	h_{FE}	min.	20
		typ.	50
Transition frequency at f = 500 MHz			
$-I_C = 14$ mA; $-V_{CE} = 10$ V	f_T	typ.	5 GHz
Collector capacitance at f = 1 MHz			
$I_E = I_e = 0$; $-V_{CB} = 10$ V	C_c	typ.	0,65 pF
Emitter capacitance at f = 1 MHz			
$I_C = I_c = 0$; $-V_{EB} = 0,5$ V	C_e	typ.	1,1 pF
Feedback capacitance at f = 1 MHz			
$I_C = 0$; $-V_{CE} = 10$ V	C_{re}	typ.	0,45 pF

Maximum unilateral power gain (s_{re} assumed to be zero)

$$G_{UM}\ (\text{dB}) = 10 \log \frac{|s_{fe}|^2}{[1-|s_{ie}|^2]\,[1-|s_{oe}|^2]}$$

at $-I_C = 14$ mA; $-V_{CE} = 10$ V			
f = 500 MHz	G_{UM}	typ.	21 dB
f = 800 MHz		typ.	17 dB
Noise figures at f = 800 MHz; R_S = opt.;			
$-I_C = 4$ mA; $V_{CE} = 10$ V	F	typ.	2,5 dB
$-I_C = 14$ mA; $V_{CE} = 10$ V		typ.	3,5 dB

s-parameters (common emitter) at V_{CE} = 10 V; T_{amb} = 25 °C

I_C mA	f MHz	s_{ie}	s_{fe}	s_{re}	s_{oe}
2	40	0,87/ 8,2°	6,4/174,8°	0,011/ 84,6°	0,99/ −3,5°
	100	0,85/ −20,5°	6,3/165,9°	0,026/ 79,1°	0,98/ −8,7°
	200	0,81/ −39,7°	5,9/151,5°	0,050/ 70,1°	0,93/−16,4°
	500	0,68/ −84,3°	4,4/122,4°	0,094/ 51,5°	0,79/−31,4°
	800	0,59/−112,1°	3,2/103,5°	0,116/ 43,6°	0,70/−38,8°
	1000	0,54/−125,2°	2,7/ 94,6°	0,124/ 41,0°	0,66/−42,3°
	1200	0,52/−137,2°	2,3/ 86,3°	0,133/ 20,0°	0,64/−45,7°
5	40	0,72/ −13,1°	12,9/172,0°	0,010/ 82,6°	0,98/ −5,8°
	100	0,69/ −32,2°	12,3/159,6°	0,023/ 74,9°	0,94/−14,1°
	200	0,64/ −60,2°	10,8/141,4°	0,041/ 64,1°	0,84/−24,9°
	500	0,54/−112,2°	6,7/111,8°	0,070/ 19,5°	0,62/ 39,7°
	800	0,50/−137,3°	4,6/ 95,5°	0,085/ 47,2°	0,53/−44,5°
	1000	0,47/−148,5°	3,7/ 88,1°	0,094/ 46,8°	0,50/−46,2°
	1200	0,46/−158,2°	3,1/ 81,5°	0,103/ 46,6°	0,49/−48,6°
10	40	0,55/ −19,4°	19,1/169,1°	0,009/ 80,3°	0,96/ −8,3°
	100	0,53/ −46,6°	17,7/153,6°	0,020/ 71,4°	0,89/−19,4°
	200	0,50/ −82,2°	14,4/133,1°	0,033/ 60,6°	0,74/−31,9°
	500	0,47/−133,7°	7,8/105,0°	0,054/ 51,9°	0,50/−44,1°
	800	0,46/−153,7°	5,2/ 90,9°	0,069/ 52,8°	0,42/−46,7°
	1000	0,45/ 162,5°	4,2/ 84,6°	0,079/ 53,3°	0,41/−47,4°
	1200	0,46/ 170,3°	3,5/ 78,7°	0,088/ 53,2°	0,39/−49,5°
14	40	0,46/ −24,2°	22,3/168,0°	0,008/ 79,0°	0,94/ −9,2°
	100	0,45/ −56,1°	20,1/151,0°	0,019/ 69,9°	0,86/−21,2°
	200	0,45/ −94,5°	15,6/130,6°	0,030/ 59,9°	0,70/−34,0°
	500	0,47/−142,0°	8,3/102,9°	0,049/ 54,1°	0,46/−44,4°
	800	0,48/−159,2°	5,4/ 89,6°	0,064/ 54,9°	0,39/−46,5°
	1000	0,47/−159,9°	4,4/ 83,9°	0,075/ 55,8°	0,38/−46,2°
	1200	0,47/ 174,6°	3,7/ 78,8°	0,084/ 55,8°	0,37/−47,5°
20	40	0,35/ −31,2°	25,1/166,3°	0,007/ 77,6°	0,93/−10,4°
	100	0,38/ −70,2°	22,3/148,0°	0,017/ 68,7°	0,83/−23,7°
	200	0,42/−110,1°	16,8/126,4°	0,027/ 59,8°	0,65/−36,5°
	500	0,47/−151,9°	8,5/100,4°	0,044/ 56,7°	0,42/−45,4°
	800	0,48/−166,0°	5,5/ 87,3°	0,060/ 58,4°	0,37/−46,6°
	1000	0,48/−173,2°	4,4/ 81,9°	0,070/ 58,8°	0,36/−46,8°
	1200	0,49/−179,4°	3,7/ 76,4°	0,079/ 58,4°	0,35/−48,8°
25	40	0,29/ −38,0°	26,4/165,4°	0,007/ 76,2°	0,91/−10,9°
	100	0,35/ −80,7°	23,2/146,6°	0,016/ 67,8°	0,81/−24,7°
	200	0,41/−119,2°	17,1/124,4°	0,025/ 60,1°	0,63/−37,1°
	500	0,48/−156,2°	8,5/ 99,0°	0,042/ 58,2°	0,41/−44,6°
	800	0,50/−168,8°	5,5/ 86,4°	0,057/ 60,0°	0,36/−45,4°
	1000	0,50/−175,2°	4,4/ 80,9°	0,067/ 60,2°	0,35/−45,5°

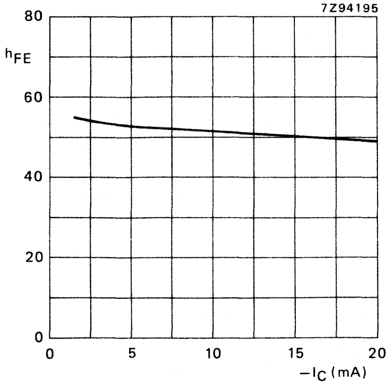


Fig. 2 $-V_{CE}$ = 10 V; T_j = 25 °C.

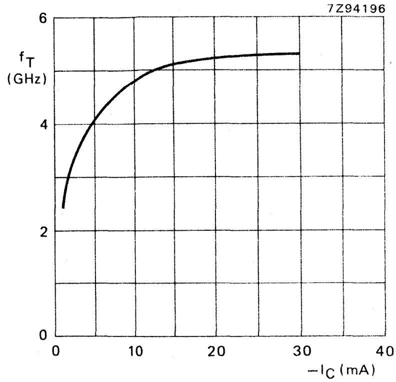


Fig. 3 $-V_{CE}$ = 10 V; f = 500 MHz; T_j = 25 °C.

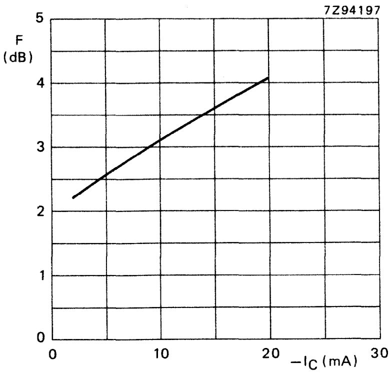


Fig. 4 $-V_{CE}$ = 10 V; f = 800 MHz; T_{amb} = 25 °C; Z_s = optimum.

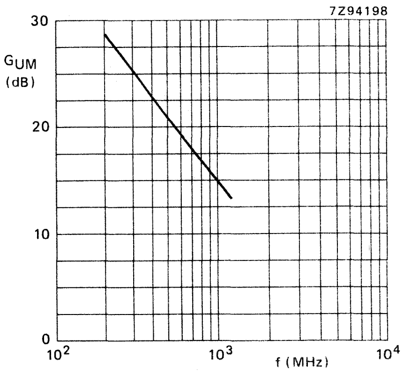


Fig 5 $-V_{CE}$ = 10 V; $-I_C$ = 14 mA; T_{amb} = 25 °C.

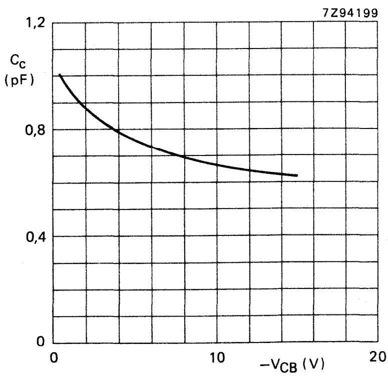
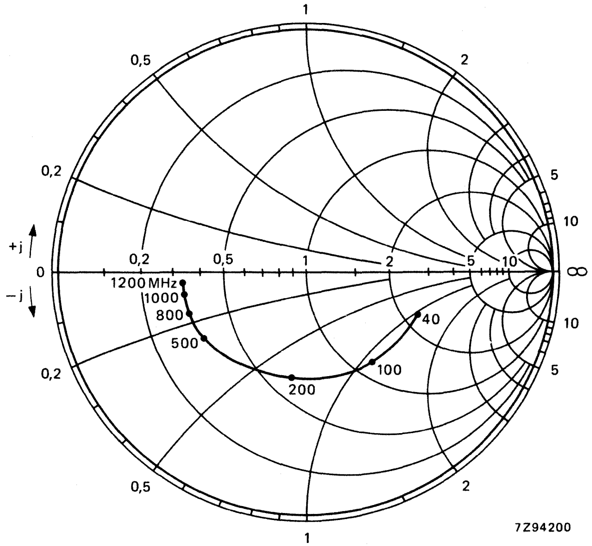


Fig. 6 $-I_E = -I_e = 0$; f = 1 MHz; T_j = 25 °C.

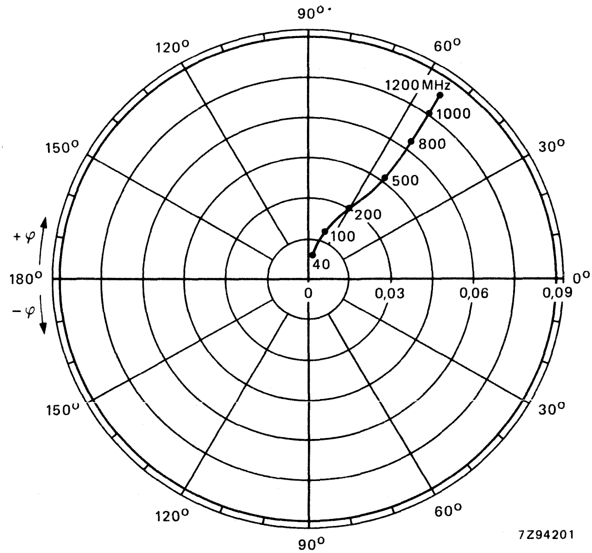
$-V_{CE}$ = 10 V
$-I_C$ = 14 mA
T_{amb} = 25 °C



Input impedance derived from input reflection coefficient s_{ie} co-ordinates in ohm x 50.

Fig. 7.

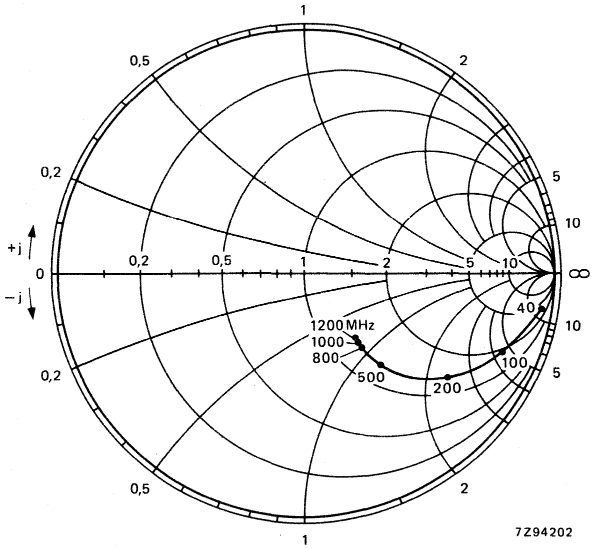
$-V_{CE}$ = 10 V
$-I_C$ = 14 mA
T_{amb} = 25 °C



Reverse transmission coefficient s_{re}.

Fig. 8.

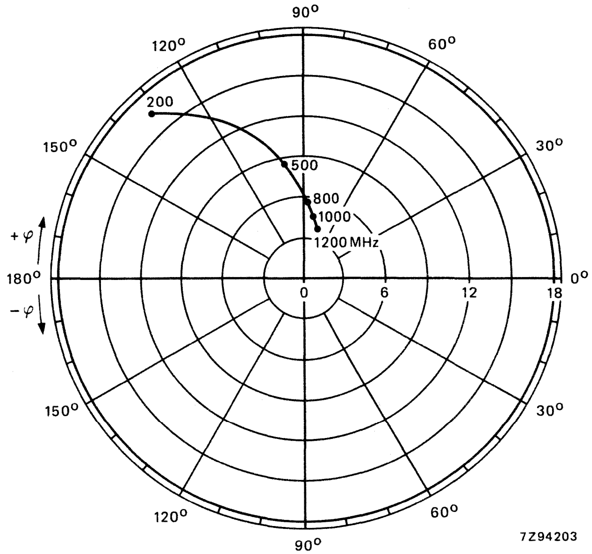
$-V_{CE}$ = 10 V
$-I_C$ = 14 mA
T_{amb} = 25 °C



Output impedance derived from output reflection coefficient s_{oe} co-ordinates on ohm x 50.

Fig. 9.

$-V_{CE}$ = 10 V
$-I_C$ = 14 mA
T_{amb} = 25 °C



Forward transmission coefficient s_{fe}.

Fig. 10.

SILICON PLANAR EPITAXIAL TRANSISTOR

P-N-P transistor in a TO-72 metal envelope with insulated electrodes and a shield lead connected to the case. It is primarily intended for use in u.h.f. and microwave amplifiers such as in aerial amplifiers, radar systems, oscilloscopes, spectrum analysers etc.

The transistor features extremely high power gain coupled with good low noise performance.

N-P-N complement is BFQ53.

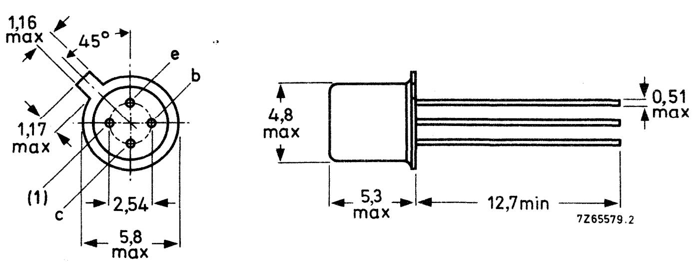
QUICK REFERENCE DATA

Collector-base voltage (open emitter)	$-V_{CBO}$	max.	20	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	15	V
Collector current (d.c.)	$-I_C$	max.	25	mA
Total power dissipation up to T_{amb} = 65 °C	P_{tot}	max.	150	mW
Junction temperature	T_j	max.	200	°C
Transition frequency at f = 500 MHz $-I_C$ = 14 mA; $-V_{CE}$ = 10 V	f_T	typ.	5	GHz
Feedback capacitance at f = 1 MHz I_C = 0; $-V_{CE}$ = 10 V; T_{amb} = 25 °C	C_{re}	typ.	0,5	pF
Noise figure at optimum source impedance $-I_C$ = 2 mA; $-V_{CE}$ = 10 V; f = 500 MHz; T_{amb} = 25 °C	F	typ.	2,7	dB
Maximum unilateral power gain $-I_C$ = 14 mA; $-V_{CE}$ = 10 V; f = 500 MHz; T_{amb} = 25 °C	G_{UM}	typ.	17,0	dB

MECHANICAL DATA

Dimensions in mm

Fig. 1 TO-72 with insulated electrodes.



(1) shield lead connected to case.

Accessories: 56246 (distance disc).

RATINGS

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

Collector-base voltage (open emitter)	$-V_{CBO}$	max.	20 V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	15 V
Emitter-base voltage (open collector)	$-V_{EBO}$	max.	2 V
Collector current (d.c.)	$-I_C$	max.	25 mA
Collector current (peak value) at f > 1 MHz	$-I_{CM}$	max.	35 mA
Total power dissipation up to T_{amb} = 65 °C	P_{tot}	max.	150 mW
Storage temperature	T_{stg}		−65 to +200 °C
Junction temperature	T_j	max.	200 °C

THERMAL RESISTANCE

From junction to ambient in free air	$R_{th\,j\text{-}a}$	=	0,9 K/mW
From junction to case	$R_{th\,j\text{-}c}$	=	0,6 K/mW

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current $I_E = 0$; $-V_{CB} = 10$ V	$-I_{CBO}$	<	50 nA
D.C. current gain (note 1) $-I_C = 14$ mA; $-V_{CE} = 10$ V	h_{FE}	> typ.	20 50
Transition frequency (notes 1 and 2) $-I_C = 14$ mA; $-V_{CE} = 10$ V; f = 500 MHz	f_T	typ.	5 GHz
Collector capacitance (note 3) $I_E = I_e = 0$; $-V_{CB} = 10$ V; f = 1 MHz	C_c	typ.	0,85 pF
Emitter capacitance $I_C = I_c = 0$; $-V_{EB} = 0,5$ V; f = 1 MHz	C_e	typ.	1,2 pF
Feedback capacitance (note 2) $I_C = 0$; $-V_{CE} = 10$ V; f = 1 MHz; T_{amb} = 25 °C	C_{re}	typ.	0,5 pF
Noise figure at optimum source impedance (note 2) $-I_C = 2$ mA; $-V_{CE} = 10$ V; f = 500 MHz; T_{amb} = 25 °C	F	typ.	2,7 dB

Maximum unilateral power gain (note 2)

s_{re} assumed to be zero

$$G_{UM} \text{ (in dB)} = 10 \log \frac{|s_{fe}|^2}{(1 - |s_{ie}|^2)(1 - |s_{oe}|^2)}$$

$-I_C = 14$ mA; $-V_{CE} = 10$ V; f = 500 MHz; T_{amb} = 25 °C	G_{UM}	typ.	17,0 dB

Notes

1. Measured under pulse conditions.
2. Shield lead grounded.
3. Shield lead not connected.

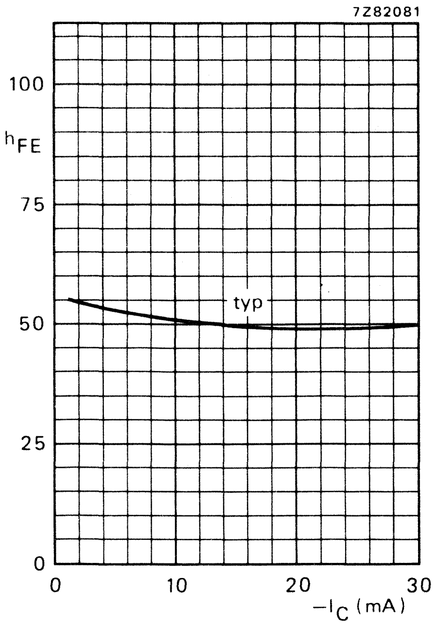


Fig. 2 $-V_{CE}$ = 10 V; T_j = 25 °C.

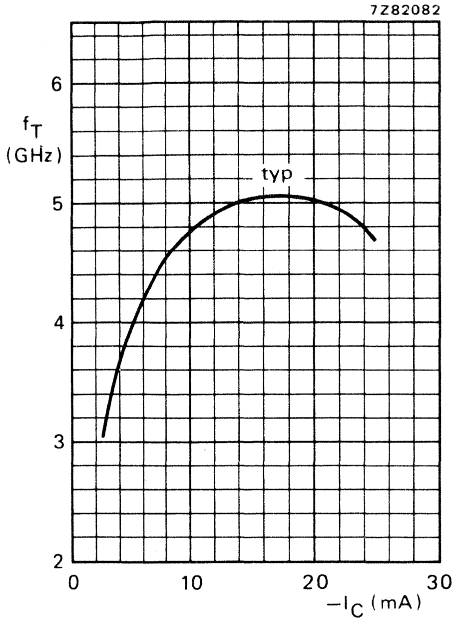


Fig. 3 $-V_{CE}$ = 10 V; f = 500 MHz; T_j = 25 °C; shield lead grounded.

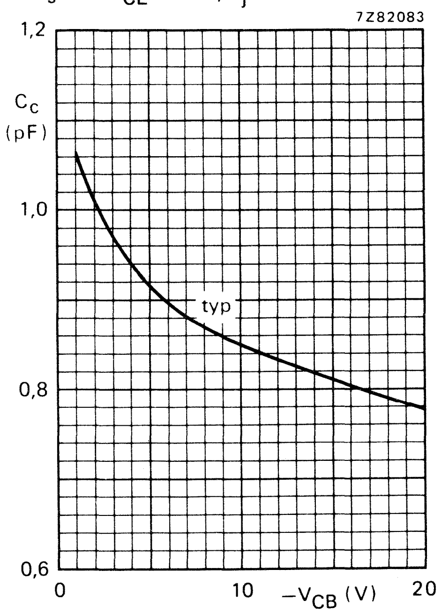


Fig. 4 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C; shield lead not connected.

SILICON PLANAR EPITAXIAL TRANSISTOR

N-P-N transistor in a TO-72 metal envelope with insulated electrodes and a shield lead connected to the case. It is primarily intended for use in u.h.f. and microwave amplifiers such as in aerial amplifiers, radar systems, oscilloscopes, spectrum analysers etc.

The transistor features extremely high power gain coupled with good low noise performance.

P-N-P complement is BFQ52.

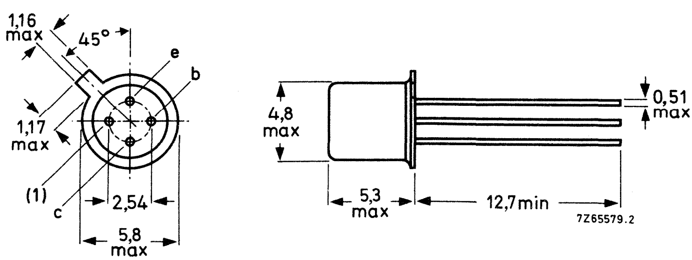
QUICK REFERENCE DATA

Collector-base voltage (open emitter)	V_{CBO}	max.	20	V
Collector-emitter voltage (open base)	V_{CEO}	max.	15	V
Collector current (d.c.)	I_C	max.	25	mA
Total power dissipation up to T_{amb} = 65 °C	P_{tot}	max.	150	mW
Junction temperature	T_j	max.	200	°C
Transition frequency at f = 500 MHz I_C = 14 mA; V_{CE} = 10 V	f_T	typ.	5	GHz
Feedback capacitance at f = 1 MHz I_C = 0; V_{CE} = 10 V; T_{amb} = 25 °C	C_{re}	typ.	0,45	pF
Noise figure at optimum source impedance I_C = 2 mA; V_{CE} = 10 V; f = 500 MHz; T_{amb} = 25 °C	F	typ.	2,4	dB
Maximum unilateral power gain I_C = 14 mA; V_{CE} = 10 V; f = 500 MHz; T_{amb} = 25 °C	G_{UM}	typ.	18,0	dB

MECHANICAL DATA

Dimensions in mm

Fig. 1 TO-72 with insulated electrodes.



(1) shield lead connected to case.

Accessories: 56246 (distance disc).

RATINGS

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

Collector-base voltage (open emitter)	V_{CBO}	max.	20	V
Collector-emitter voltage (open base)	V_{CEO}	max.	15	V
Emitter-base voltage (open collector)	V_{EBO}	max.	2	V
Collector current (d.c.)	I_C	max.	25	mA
Collector current (peak value) at f > 1 MHz	I_{CM}	max.	35	mA
Total power dissipation up to T_{amb} = 65 °C	P_{tot}	max.	150	mW
Storage temperature	T_{stg}	–65 to +200		°C
Junction temperature	T_j	max.	200	°C

THERMAL RESISTANCE

From junction to ambient in free air	$R_{th\ j\text{-}a}$	=	0,9	K/mW
From junction to case	$R_{th\ j\text{-}c}$	=	0,6	K/mW

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current $I_E = 0$; $V_{CB} = 10$ V	I_{CBO}	<	50	nA
D.C. current gain (note 1) $I_C = 14$ mA; $V_{CE} = 10$ V	h_{FE}	> typ.	25 50	
Transition frequency (notes 1 and 2) $I_C = 14$ mA; $V_{CE} = 10$ V; f = 500 MHz	f_T	typ.	5	GHz
Collector capacitance (note 3) $I_E = I_e = 0$; $V_{CB} = 10$ V; f = 1 MHz	C_c	typ.	0,75	pF
Emitter capacitance $I_C = I_c = 0$; $V_{EB} = 0,5$ V; f = 1 MHz	C_e	typ.	1,2	pF
Feedback capacitance (note 2) $I_C = 0$; $V_{CE} = 10$ V; f = 1 MHz; $T_{amb} = 25$ °C	C_{re}	typ.	0,45	pF
Noise figure at optimum source impedance (note 2) $I_C = 2$ mA; $V_{CE} = 10$ V; f = 500 MHz; $T_{amb} = 25$ °C	F	typ.	2,4	dB

Maximum unilateral power gain (note 2)

s_{re} assumed to be zero

$$G_{UM}\ (\text{in dB}) = \frac{|s_{fe}|^2}{(1 - |s_{ie}|^2)(1 - |s_{oe}|^2)}$$

$I_C = 14$ mA; $V_{CE} = 10$ V; f = 500 MHz; $T_{amb} = 25$ °C	G_{UM}	typ.	18,0	dB

Notes

1. Measured under pulse conditions.
2. Shield lead grounded.
3. Shield lead not connected.

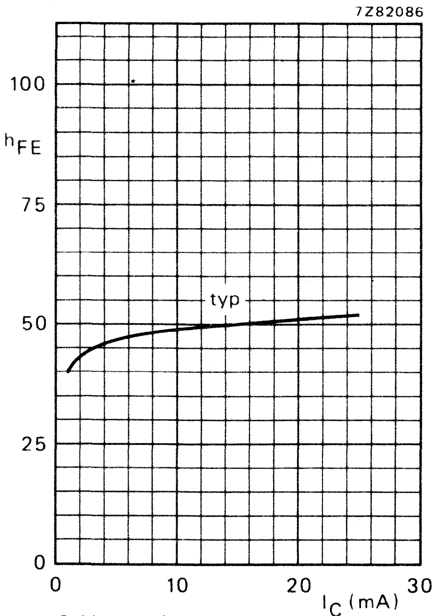


Fig. 2 V_{CE} = 10 V; T_j = 25 °C.

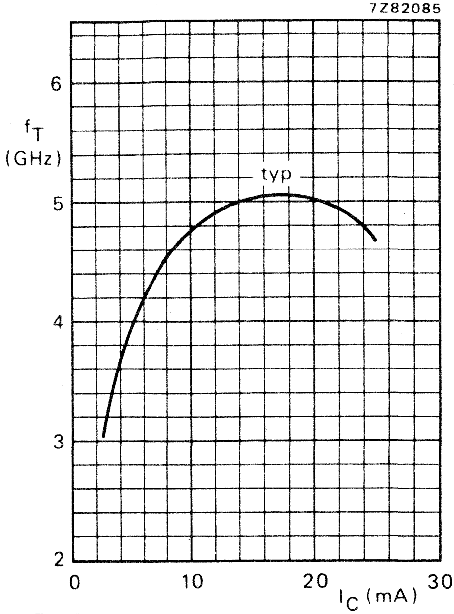


Fig. 3 V_{CE} = 10 V; f = 500 MHz; T_j = 25 °C; shield lead grounded.

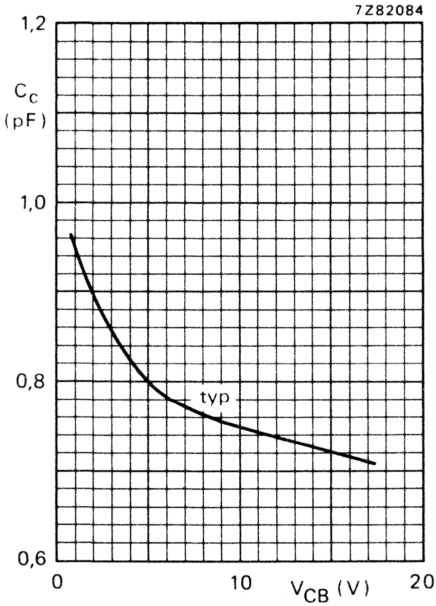


Fig. 4 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C; shield lead not connected.

SILICON PLANAR EPITAXIAL TRANSISTOR

N-P-N transistor in a TO-72 metal envelope with insulated electrodes and a shield lead connected to the case. It is primarily intended for use in u.h.f. and microwave amplifiers such as in aerial amplifiers, radar systems, oscilloscopes, spectrum analysers etc.

The transistor features the combination of high power gain, high transition frequency and low noise up to high frequencies.

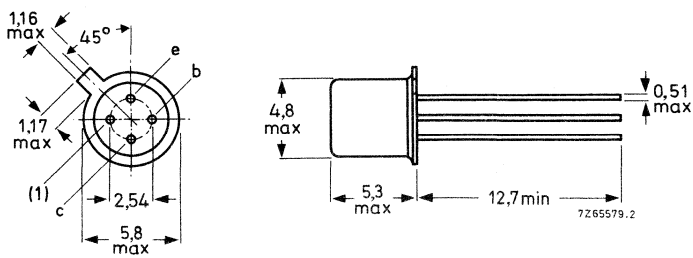
QUICK REFERENCE DATA

Collector-base voltage (open emitter)	V_{CBO}	max.	20	V
Collector-emitter voltage (open base)	V_{CEO}	max.	15	V
Collector current (d.c.)	I_C	max.	75	mA
Total power dissipation up to T_{amb} = 50 °C	P_{tot}	max.	250	mW
Junction temperature	T_j	max.	200	°C
Transition frequency at f = 500 MHz I_C = 50 mA; V_{CE} = 5 V	f_T	typ.	4,5	GHz
Feedback capacitance at f = 1 MHz I_C = 0; V_{CE} = 10 V; T_{amb} = 25 °C	C_{re}	typ.	1,0	pF
Noise figure at optimum source impedance I_C = 10 mA; V_{CE} = 5 V; f = 200 MHz; T_{amb} = 25 °C	F	<	3,0	dB
Maximum unilateral power gain I_C = 20 mA; V_{CE} = 5 V; f = 200 MHz; T_{amb} = 25 °C	G_{UM}	>	17,5	dB

MECHANICAL DATA

Dimensions in mm

Fig. 1 TO-72 with insulated electrodes.



(1) shield lead connected to case.

Accessories: 56246 (distance disc).

RATINGS

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

Collector-base voltage (open emitter)	V_{CBO}	max.	20 V
Collector-emitter voltage (open base)	V_{CEO}	max.	15 V
Emitter-base voltage (open collector)	V_{EBO}	max.	3 V
Collector current (d.c.)	I_C	max.	75 mA
Collector current (peak value) at f > 1 MHz	I_{CM}	max.	150 mA
Total power dissipation up to T_{amb} = 50 °C	P_{tot}	max.	250 mW
Storage temperature	T_{stg}		−65 to +200 °C
Junction temperature	T_j	max.	200 °C

THERMAL RESISTANCE

From junction to ambient in free air	$R_{th\ j\text{-}a}$	=	600 K/W
From junction to case	$R_{th\ j\text{-}c}$	=	350 K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current			
$I_E = 0$; V_{CB} = 10 V	I_{CBO}	<	100 nA
D.C. current gain (note 1)			
I_C = 20 mA; V_{CE} = 5 V	h_{FE}	> <	50 150
Transistion frequency (notes 1 and 2)			
I_C = 50 mA; V_{CE} = 5 V; f = 500 MHz	f_T	typ.	4,5 GHz
Collector capacitance (note 3)			
$I_C = 0$; V_{CB} = 5 V; f = 1 MHz	C_{cb}	typ.	1,3 pF
Feedback capacitance (note 2)			
$I_C = 0$; V_{CE} = 10 V; f = 1 MHz; T_{amb} = 25 °C	C_{re}	typ. <	1,0 pF 1,4 pF
Noise figure at optimum source impedance (note 2)			
I_C = 10 mA; V_{CE} = 5 V; f = 200 MHz; T_{amb} = 25 °C	F	<	3,0 dB
I_C = 10 mA; V_{CE} = 5 V; f = 500 MHz; T_{amb} = 25 °C	F	typ.	2,3 dB

Maximum unilateral power gain (note 2)

s_{re} assumed to be zero

$$G_{UM}\ (\text{in dB}) = 10 \log \frac{|s_{fe}|^2}{(1 - |s_{ie}|^2)(1 - |s_{oe}|^2)}$$

I_C = 20 mA; V_{CE} = 5 V; f = 200 MHz; T_{amb} = 25 °C	G_{UM}	>	17,5 dB
I_C = 50 mA; V_{CE} = 5 V; f = 500 MHz; T_{amb} = 25 °C	G_{UM}	typ.	11,5 dB

Notes

1. Measured under pulse conditions.
2. Shield lead grounded.
3. Shield lead and emitter lead connected to bridge earth.

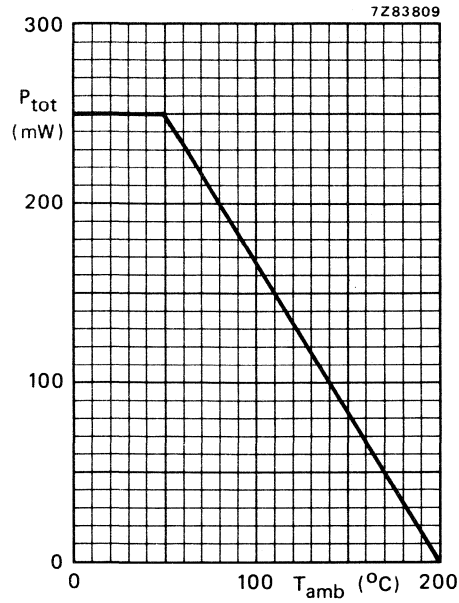


Fig. 2 Maximum permissible power dissipation in free air as a function of ambient temperature.

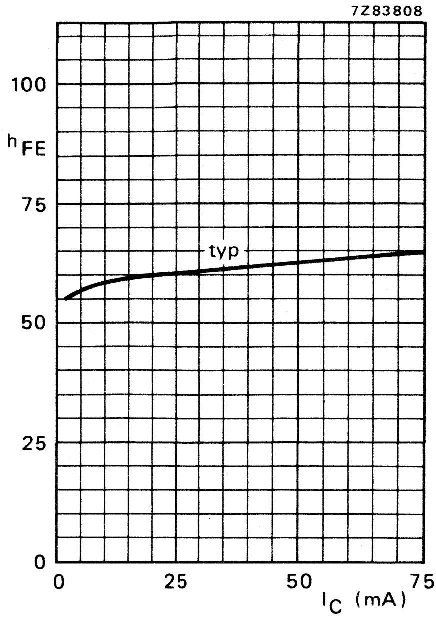


Fig. 3 V_{CE} = 5 V; T_j = 25 °C.

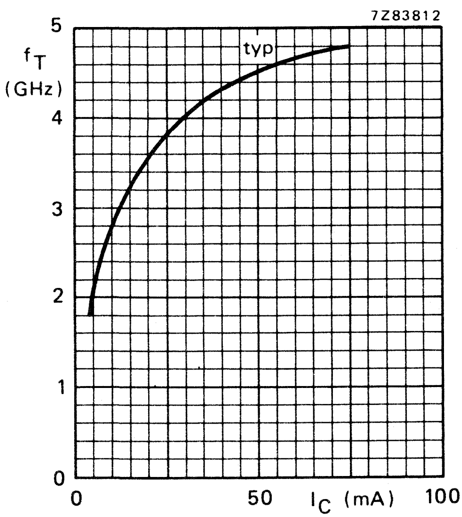


Fig. 4 V_{CE} = 5 V; f = 500 MHz; T_j = 25 °C; shield lead grounded.

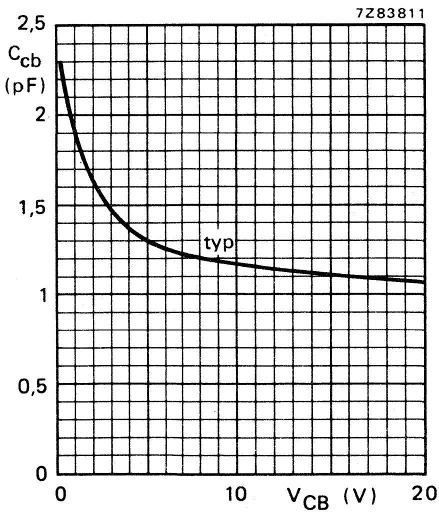


Fig. 5 I_C = 0; f = 1 MHz; T_j = 25 °C; shield lead and emitter lead connected to bridge earth.

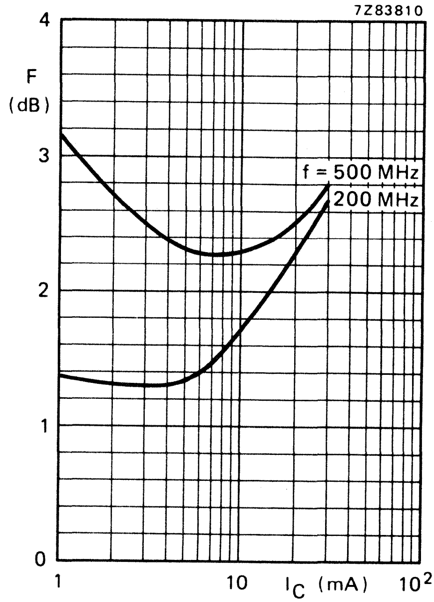


Fig. 6 V_{CE} = 5 V; Z_S = optimum; T_{amb} = 25 °C; typical values.

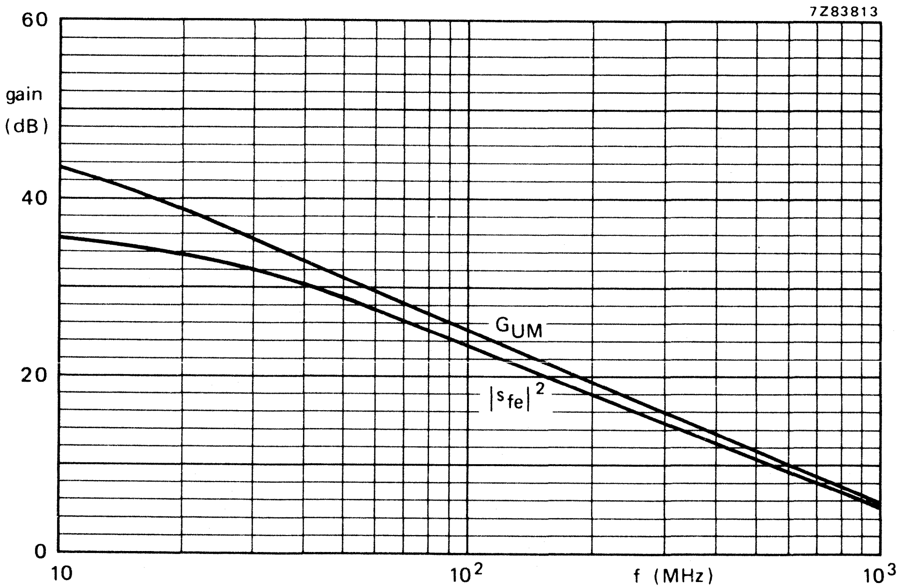


Fig. 7 V_{CE} = 5 V; I_C = 50 mA; T_{amb} = 25 °C; typical values.

N-P-N MICROWAVE TRANSISTOR

Small-signal planar epitaxial n-p-n transistor in plastic SOT-37 envelope and featuring a very high transition frequency and a very low noise figure up to high frequencies.

This device is designed for use in the GHz range.

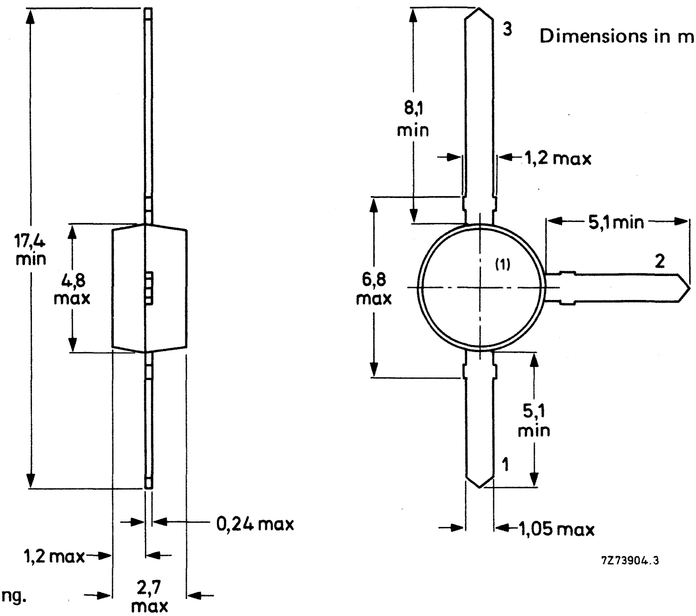
QUICK REFERENCE DATA

Collector-base voltage	V_{CBO}	max.	20	V
Collector-emitter voltage	V_{CEO}	max.	10	V
Collector current (d.c.)	I_C	max.	50	mA
Total power dissipation up to T_{amb} = 60 °C	P_{tot}	max.	300	mW
Junction temperature	T_j	max.	150	°C
D.C. current gain I_C = 15 mA; V_{CE} = 5 V	h_{FE}	min. typ.	60 100	
Transition frequency at f = 500 MHz I_C = 15 mA; V_{CE} = 8 V	f_T	typ.	7,5	GHz
Maximum unilateral power gain at f = 2 GHz I_C = 15 mA; V_{CE} = 8 V; T_{amb} = 25 °C	G_{UM}	typ.	8,0	dB

MECHANICAL DATA

Fig. 1 SOT-37.

Dimensions in mm



Connections:

1. Base
2. Emitter
3. Collector

(1) Type number marking.

RATINGS

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

Collector-base voltage (open emitter)	V_{CBO}	max.	20	V
Collector-emitter voltage (open base)	V_{CEO}	max.	10	V
Emitter-base voltage (open collector)	V_{EBO}	max.	2,5	V
Collector current (d.c.)	I_C	max.	50	mA
Total power dissipation up to T_{amb} = 60 °C mounted on a fibre-glass print of 40 mm x 25 mm x 1 mm	P_{tot}	max.	300	mW
Storage temperature	T_{stg}	−65 to + 150		°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

From junction to ambient mounted on a fibre-glass print of 40 mm x 25 mm x 1 mm	$R_{th\ j\text{-}a}$		300	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current $I_E = 0$; $V_{CB} = 10$ V	I_{CBO}	max.	50	nA
D.C. current gain $I_C = 15$ mA; $V_{CE} = 5$ V	h_{FE}	min. typ.	60 100	
Transition frequency at f = 500 MHz $I_C = 15$ mA; $V_{CE} = 8$ V	f_T	typ.	7,5	GHz
Collector capacitance at f = 1 MHz $I_E = i_e = 0$; $V_{CB} = 8$ V	C_c	typ.	0,8	pF
Emitter capacitance at f = 1 MHz $I_C = i_c = 0$; $V_{EB} = 0,5$ V	C_e	typ.	1,3	pF
Feedback capacitance $I_C = 0$; $V_{CE} = 8$ V	C_{re}	typ.	0,5	pF

Maximum unilateral power gain (s_{re} assumed to be zero)

$$G_{UM} \text{ (in dB)} = 10 \log \frac{|s_{fe}|^2}{[1-|s_{ie}|^2][1-|s_{oe}|^2]}$$

$I_C = 15$ mA; $V_{CE} = 8$ V; f = 2 GHz; $T_{amb} = 25$ °C	G_{UM}	typ.	8,0	dB
Noise figure at f = 2 GHz; $R_S = 60\ \Omega$; $T_{amb} = 25$ °C				
$I_C = 5$ mA; $V_{CE} = 8$ V	F	typ.	2,5	dB
$I_C = 15$ mA; $V_{CE} = 8$ V	F	typ.	3,0	dB

s-parameters (common emitter) at V_{CE} = 8 V

I_C mA	f MHz	s_{ie}	s_{fe}	s_{re}	s_{oe}	GUM dB
	40	0,87/ −12,9°	15,83/171,2°	0,01/82,0°	0,98/ −6,5°	45,3
	100	0,81/ −31,0°	14,92/155,8°	0,02/74,8°	0,93/−15,7°	37,1
	200	0,69/ −54,6°	12,40/138,3°	0,04/67,0°	0,83/−25,9°	29,8
5	500	0,42/−105,7°	7,12/104,9°	0,07/59,1°	0,59/−40,4°	19,7
	800	0,34/−128,7°	4,89/ 91,3°	0,10/63,0°	0,58/−49,1°	16,1
	1000	0,35/−142,8°	4,13/ 83,2°	0,12/63,7°	0,58/−58,0°	14,6
	2000	0,25/ 128,0°	2,08/ 56,8°	0,20/67,8°	0,38/−63,3°	7,3
	40	0,75/ −19,1°	26,88/165,6°	0,01/80,0°	0,96/−10,2°	43,8
	100	0,65/ −43,3°	23,08/144,9°	0,02/71,7°	0,86/−22,1°	35,5
	200	0,49/ −70,7°	16,71/125,2°	0,03/66,4°	0,70/−31,6°	28,6
10	500	0,28/−126,5°	8,21/ 96,9°	0,06/66,4°	0,48/−40,0°	19,8
	800	0,24/−136,7°	5,39/ 86,8°	0,10/70,8°	0,50/−48,9°	16,1
	1000	0,26/−147,8°	4,49/ 79,9°	0,12/70,5°	0,51/−58,9°	14,6
	2000	0,22/ 114,8°	2,28/ 56,5°	0,21/68,8°	0,32/−61,8°	7,8
	40	0,67/ −23,8°	34,23/161,4°	0,01/78,3°	0,94/−12,6°	42,9
	100	0,54/ −51,8°	27,41/138,1°	0,02/71,0°	0,80/−25,5°	34,7
	200	0,39/ −80,0°	18,52/118,7°	0,03/68,4°	0,63/−33,2°	28,2
15	500	0,22/−130,3°	8,47/ 93,5°	0,06/70,2°	0,44/−38,8°	19,7
	800	0,20/−140,8°	5,57/ 84,9°	0,10/73,6°	0,47/−48,4°	16,2
	1000	0,22/ 147,5°	4,64/ 78,4°	0,12/72,9°	0,48/−59,0°	14,7
	2000	0,21/ 109,8°	2,34/ 56,2°	0,22/68,7°	0,31/−61,0°	8,0
	40	0,61/ −27,4°	39,76/158,4°	0,01/76,8°	0,92/−14,2°	42,4
	100	0,47/ −58,0°	30,05/133,7°	0,02/70,4°	0,75/−27,5°	34,2
	200	0,32/ −86,2°	19,38/114,7°	0,03/70,4°	0,58/−33,5°	28,0
20	500	0,19/−136,8°	8,65/ 92,0°	0,06/72,4°	0,41/−37,5°	19,7
	800	0,18/−145,1°	5,62/ 83,5°	0,10/75,3°	0,46/−47,9°	16,1
	1000	0,20/−151,9°	4,63/ 77,7°	0,12/74,1°	0,47/−58,8°	14,6
	2000	0,21/−107,3°	2,37/ 55,7°	0,22/69,0°	0,30/−60,6°	8,1
	40	0,51/ −33,2°	46,18/154,6°	0,01/75,6°	0,89/−16,4°	41,4
	100	0,37/ −67,3°	32,56/128,1°	0,02/70,6°	0,69/−29,1°	33,7
	200	0,26/ −97,3°	20,04/110,7°	0,03/72,3°	0,53/−32,7°	27,8
30	500	0,17/−151,6°	8,64/ 89,7°	0,06/74,6°	0,39/−35,6°	19,6
	800	0,16/−152,2°	5,61/ 82,1°	0,10/76,7°	0,44/−46,9°	16,0
	1000	0,19/−157,7°	4,62/ 76,4°	0,12/75,1°	0,46/−58,3°	14,5
	2000	0,22/ 106,4°	2,37/ 55,0°	0,23/69,3°	0,29/−60,0°	8,1

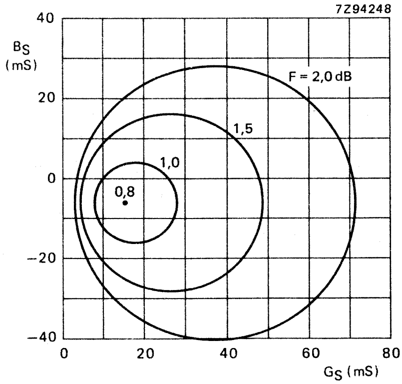


Fig. 2 Circles of constant noise figure; V_{CE} = 8 V; I_C = 5 mA; f = 800 MHz.

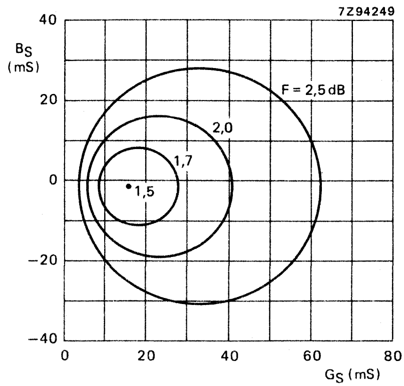


Fig. 3 Circles of constant noise figure; V_{CE} = 8 V; I_C = 15 mA; f = 800 MHz.

N-P-N 2 GHz BROADBAND TRANSISTOR

Small-signal planar epitaxial n-p-n transistor in HERMETICALLY SEALED microstripline envelope and designed for broadband amplifiers up to 2 GHz, and application in the 2 GHz range.

Features:

- hermetically sealed envelope
- gold-metallized crystals
- very high transition frequency and very low noise in the GHz range

QUICK REFERENCE DATA

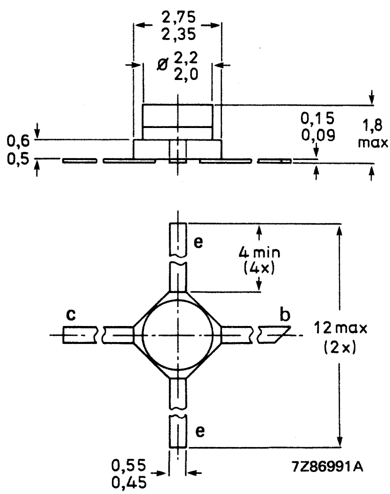
Collector-base voltage	V_{CBO}	max.	20	V
Collector-emitter voltage	V_{CEO}	max.	10	V
Collector current (d.c.)	I_C	max.	50	mA
Total power dissipation up to T_{amb} = 105 °C	P_{tot}	max.	350	mW
Junction temperature	T_j	max.	175	°C
D.C. current gain I_C = 15 mA; V_{CE} = 5 V	h_{FE}	min. / typ.	60 / 100	
Transition frequency at f = 500 MHz I_C = 15 mA; V_{CE} = 8 V	f_T	typ.	7,5	GHz
Maximum unilateral power gain at f = 2 GHz I_C = 15 mA; V_{CE} = 8 V; T_{amb} = 25 °C	G_{UM}	typ.	11,5	dB

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-173.

Marking code: Q6



RATINGS

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

Collector-base voltage (open emitter)	V_{CBO}	max.	20	V
Collector-emitter voltage (open base)	V_{CEO}	max.	10	V
Emitter-base voltage (open collector)	V_{EBO}	max.	2,5	V
Collector current (d.c.)	I_C	max.	50	mA
Total power dissipation up to T_{amb} = 105 °C mounted on a ceramic substrate of 0,7 mm x 10 cm²	P_{tot}	max.	350	mW
Storage temperature	T_{stg}	−65 to + 150		°C
Junction temperature	T_j	max.	175	°C

THERMAL RESISTANCE

From junction to ambient mounted on a ceramic substrate of 0,7 mm x 10 cm²	$R_{th\ j\text{-}a}$	200	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current $I_E = 0$; $V_{CB} = 5$ V	I_{CBO}	max.	50	nA
D.C. current gain* $I_C = 15$ mA; $V_{CE} = 5$ V	h_{FE}	min. typ.	60 100	
Transition frequency at f = 500 MHz* $I_C = 15$ mA; $V_{CE} = 8$ V	f_T	typ.	7,5	GHz
Collector capacitance at f = 1 MHz $I_E = i_e = 0$; $V_{CB} = 8$ V	C_c	typ.	0,7	pF
Emitter capacitance at f = 1 MHz $I_C = i_c = 0$; $V_{EB} = 0,5$ V	C_e	typ.	1,3	pF
Feedback capacitance $I_C = 0$; $V_{CE} = 8$ V	C_{re}	typ.	0,4	pF

Maximum unilateral power gain (s_{re} assumed to be ZERO)

$$G_{UM} \text{ (in dB)} = 10 \log \frac{|s_{fe}|^2}{[1-|s_{ie}|^2][1-|s_{oe}|^2]}$$

$I_C = 15$ mA; $V_{CE} = 8$ V; f = 2 GHz; $T_{amb} = 25$ °C	G_{UM}	typ.	11,5	dB

Noise figure at f = 2 GHz; $R_S = 60\ \Omega$; $T_{amb} = 25$ °C

$I_C = 5$ mA; $V_{CE} = 8$ V	F	typ.	2,5	dB
$I_C = 15$ mA; $V_{CE} = 8$ V	F	typ. max.	3,0 4,0	dB dB

* Measured under pulse conditions.

s-parameters (common emitter) at V_{CB} = 7 V and I_E = 5 mA and 15 mA resp.

I_E	f MHz	s_{ie}	s_{fe}	s_{re}	s_{oe}
5 mA	100	0,86/− 30,0°	15,8/160,5°	0,024/74,1°	0,97/− 16,1°
	200	0,79/− 56,5°	14,0/143,8°	0,043/62,5°	0,87/− 28,2°
	300	0,73/− 77,9°	11,8/130,6°	0,056/53,6°	0,76/− 37,0°
	400	0,68/− 95,3°	10,1/121,2°	0,064/48,0°	0,67/− 43,6°
	500	0,66/−108,1°	8,7/114,1°	0,070/44,8°	0,62/− 48,0°
	600	0,63/−119,0°	7,7/107,9°	0,074/42,7°	0,57/− 50,6°
	700	0,62/−127,8°	6,7/103,2°	0,079/41,6°	0,53/− 52,6°
	800	0,59/−135,8°	6,1/ 99,2°	0,081/40,8°	0,50/− 54,8°
	900	0,58/−141,0°	5,5/ 95,5°	0,084/40,8°	0,49/− 55,5°
	1000	0,57/−147,4°	5,0/ 92,0°	0,087/40,7°	0,46/− 56,5°
	1200	0,56/−157,0°	4,2/ 85,9°	0,092/41,2°	0,44/− 59,5°
	1500	0,53/−168,7°	3,4/ 77,5°	0,092/37,7°	0,44/− 60,6°
	2000	0,54/+ 171,9°	2,6/ 65,8°	0,103/40,6°	0,41/− 66,5°
	2500	0,54/+ 158,8°	2,2/ 57,8°	0,114/44,6°	0,39/− 75,2°
	3000	0,53/+ 144,8°	1,8/ 49,2°	0,129/48,1°	0,39/− 83,1°
	3500	0,55/+ 134,0°	1,6/ 41,9°	0,148/50,4°	0,37/− 96,2°
	4000	0,54/+ 120,2°	1,5/ 32,1°	0,170/49,9°	0,37/−109,0°

I_E	f MHz	s_{ie}	s_{fe}	s_{re}	s_{oe}
15 mA	100	0,68/− 54,8°	31,3/147,5°	0,020/65,8°	0,86/− 28,0°
	200	0,61/− 92,4°	23,3/126,6°	0,031/54,6°	0,67/− 43,8°
	300	0,57/−115,8°	17,5/114,4°	0,038/49,8°	0,52/− 51,5°
	400	0,55/−131,0°	13,9/106,8°	0,042/48,7°	0,44/− 56,5°
	500	0,55/−141,0°	11,5/101,6°	0,046/49,3°	0,40/− 59,3°
	600	0,53/−149,3°	9,8/ 96,7°	0,051/50,4°	0,36/− 60,2°
	700	0,54/−155,5°	8,5/ 93,3°	0,055/51,6°	0,34/− 61,2°
	800	0,54/−160,6°	7,5/ 90,4°	0,058/52,9°	0,32/− 62,4°
	900	0,52/−164,6°	6,7/ 87,8°	0,063/54,1°	0,31/− 62,3°
	1000	0,52/−169,1°	6,1/ 85,4°	0,067/55,1°	0,30/− 62,6°
	1200	0,51/−176,1°	5,1/ 80,3°	0,075/56,5°	0,28/− 64,7°
	1500	0,50/+ 171,5°	4,2/ 73,5°	0,081/55,8°	0,28/− 66,6°
	2000	0,52/+ 157,8°	3,2/ 63,8°	0,100/57,3°	0,26/− 68,2°
	2500	0,52/+ 148,1°	2,6/ 57,2°	0,120/58,6°	0,25/− 75,5°
	3000	0,51/+ 135,6°	2,2/ 49,1°	0,143/58,2°	0,25/− 81,8°
	3500	0,54/+ 127,6°	2,0/ 42,1°	0,167/57,5°	0,24/− 96,0°
	4000	0,52/+ 114,6°	1,8/ 33,4°	0,191/54,3°	0,24/−110,9°

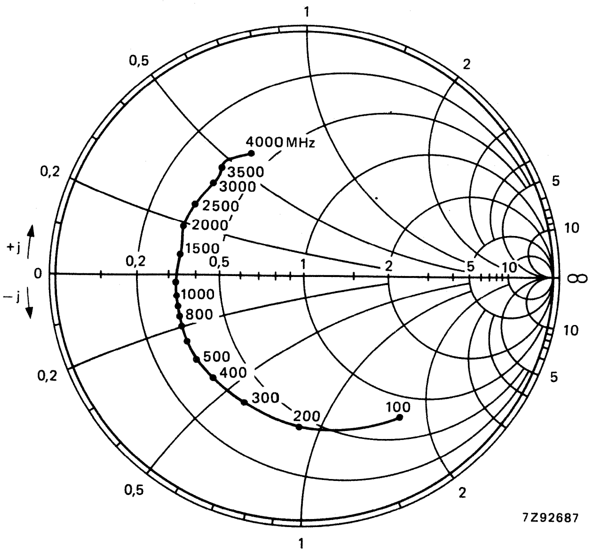


Fig. 2 Input impedance, derived from input reflection coefficient s_{ie} coordinates, in Ω x 50.

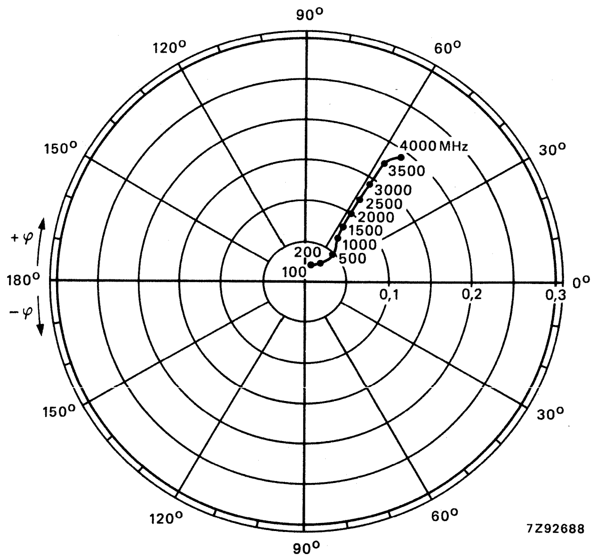


Fig. 3 Reverse transmission coefficient s_{re}.

Conditions for Figs 2 to 5: V_{CB} = 7 V; I_C = 15 mA; T_{amb} = 25 °C.

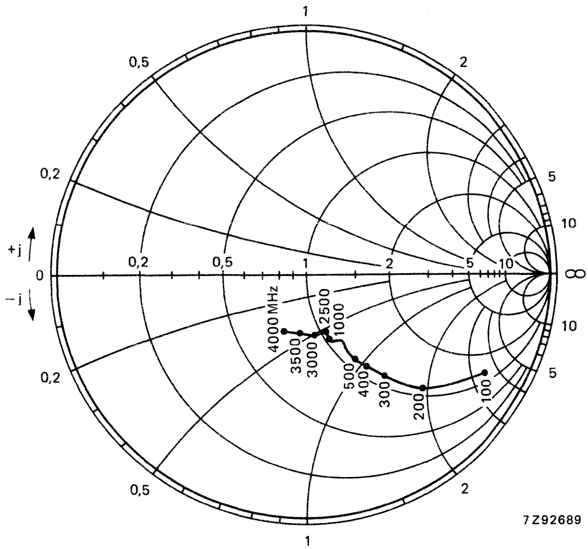


Fig. 4 Output impedance, derived from output reflection coefficient s_{oe} coordinates, in Ω x 50.

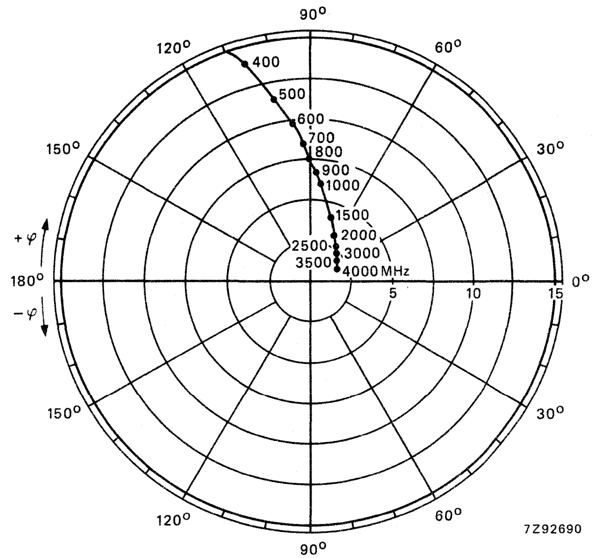


Fig. 5 Forward transmission coefficient s_{fe}.

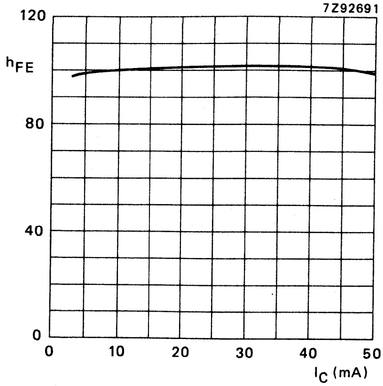


Fig. 6 V_{CE} = 5 V; T_j = 25 °C; typ. values.

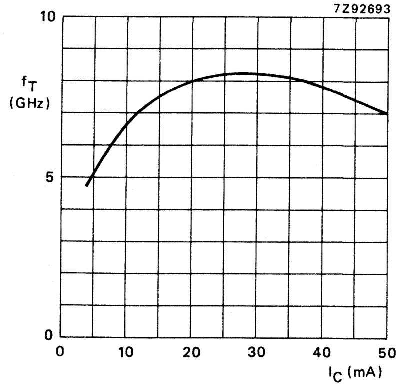


Fig. 7 V_{CE} = 8 V; f = 500 MHz; T_j = 25 °C; typ. values.

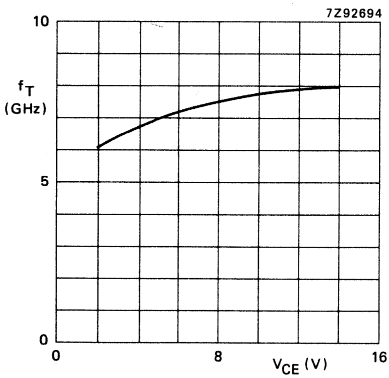


Fig. 8 I_C = 15 mA; f = 500 MHz; T_j = 25 °C; typ. values.

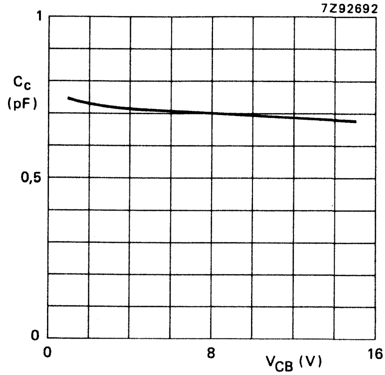


Fig. 9 $I_E = i_e$ = 0; f = 1 MHz; T_j = 25 °C; typ. values.

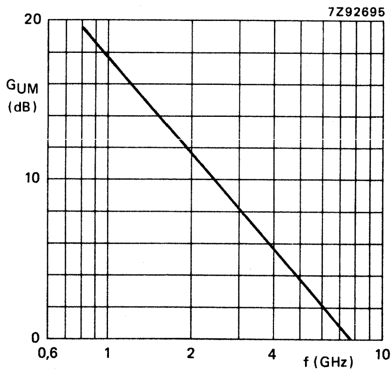


Fig. 10 V_{CB} = 7 V; I_C = 15 mA; T_j = 25 °C; typ. values.

SILICON PLANAR EPITAXIAL TRANSISTOR

N-P-N transistor primarily intended for final stages in MATV system amplifiers. This device is also suitable for use in low power band IV and V equipment. 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

Collector-base voltage (open emitter)	V_{CBO}	max.	25	V	
Collector-emitter voltage (open base)	V_{CEO}	max.	18	V	
Collector current (d.c.)	I_C	max.	300	mA	
Total power dissipation up to T_{mb} = 110 °C	P_{tot}	max.	4,5	W	
Operating junction temperature	T_j	max.	200	°C	
Transition frequency at f = 500 MHz I_C = 240 mA; V_{CE} = 15 V	f_T	typ.	4	GHz	
Output voltage at d_{im} = −60 dB (see Figs 2 and 12) I_C = 240 mA; V_{CE} = 15 V; R_L = 75 Ω; T_{amb} = 25 °C $f_{(p+q-r)}$ = 793,25 MHz	V_o	typ.	1,6	V	
Output power at 1 dB gain compression	P_{L1}	typ.	+28	dBm	←
Third order intercept point	ITO	typ.	+47	dBm	←

MECHANICAL DATA

SOT-122 (see Fig. 1).

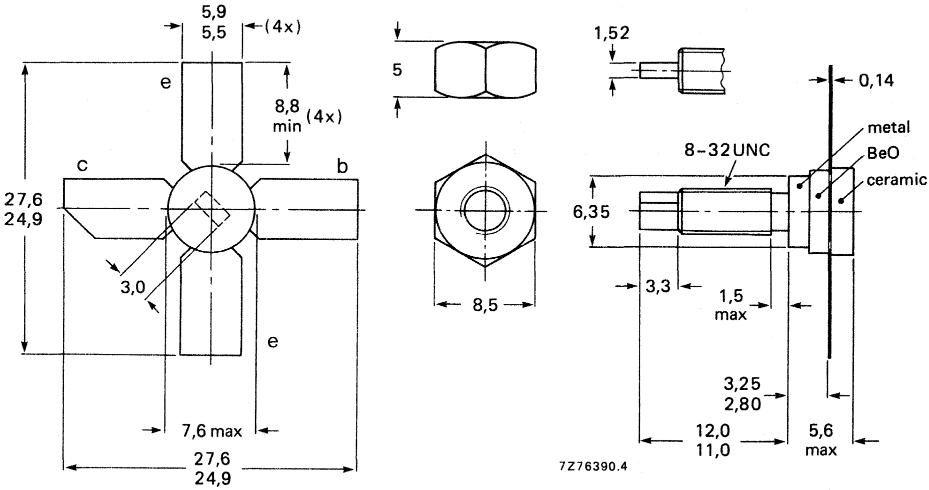
PRODUCT SAFETY

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-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.

RATINGS

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

Collector-base voltage (open emitter)	V_{CBO}	max.	25	V
Collector-emitter voltage (open base)	V_{CEO}	max.	18	V
Emitter-base voltage (open collector)	V_{EBO}	max.	2	V
Collector current (d.c.)	I_C	max.	300	mA
Total power dissipation up to T_{mb} = 110 °C (see Fig. 7)	P_{tot}	max.	4,5	W
Storage temperature	T_{stg}		−65 to +150	°C
Operating junction temperature	T_j	max.	200	°C

THERMAL RESISTANCE

From junction to mounting base	$R_{th\ j\text{-}mb}$	=	20,0	K/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,6	K/W

CHARACTERISTICS

T_{amb} = 25 °C

Collector cut-off current $I_E = 0$; V_{CB} = 15 V	I_{CBO}	<	50 μA
D.C. current gain* I_C = 240 mA; V_{CE} = 15 V	h_{FE}	>	25
Transition frequency at f = 500 MHz* I_C = 240 mA; V_{CE} = 15 V	f_T	typ.	4 GHz
Collector capacitance at f = 1 MHz $I_E = I_e = 0$; V_{CB} = 15 V	C_c	typ.	3,8 pF
Emitter capacitance at f = 1 MHz $I_C = I_c = 0$; V_{EB} = 0,5 V	C_e	typ.	20 pF
Feedback capacitance at f = 1 MHz $I_C = 0$; V_{CE} = 15 V	C_{re}	typ.	2,3 pF
Collector-stud capacitance**	C_{cs}	typ.	0,8 pF

Maximum unilateral power gain (s_{re} assumed to be zero)

$$G_{UM} \text{ (in dB)} = 10 \log \frac{|s_{fe}|^2}{(1-|s_{ie}|^2)(1-|s_{oe}|^2)}$$

I_C = 240 mA; V_{CE} = 15 V; f = 800 MHz	G_{UM}	typ.	13 dB

Output voltage at d_{im} = −60 dB (see Figs 2 and 12)
(DIN 45004B, par. 6.3: 3-tone)
I_C = 240 mA; V_{CE} = 15 V; R_L = 75 Ω

$V_p = V_o$ at d_{im} = −60 dB; f_p = 795,25 MHz
$V_q = V_o$ −6 dB ; f_q = 803,25 MHz
$V_r = V_o$ −6 dB ; f_r = 805,25 MHz

measured at $f_{(p+q-r)}$ = 793,25 MHz	V_o	typ.	1,6 V

* Measured under pulse conditions.
** Measured with emitter and base grounded.

→ Output power at 1 dB gain compression (see Fig. 2) I_C = 240 mA; V_{CE} = 15 V R_L = 75 Ω; measured at f = 800 MHz	P_{L1}	typ.	+28 dBm
→ Third order intercept point (see Fig. 2) I_C = 240 mA; V_{CE} = 15 V R_L = 75 Ω; P_p = ITO − 6 dB; f_p = 800 MHz P_q = ITO − 6 dB; f_q = 801 MHz measured at $f_{(2q-p)}$ = 802 MHz and at $f_{(2p-q)}$ = 799 MHz	ITO	typ.	+47 dBm

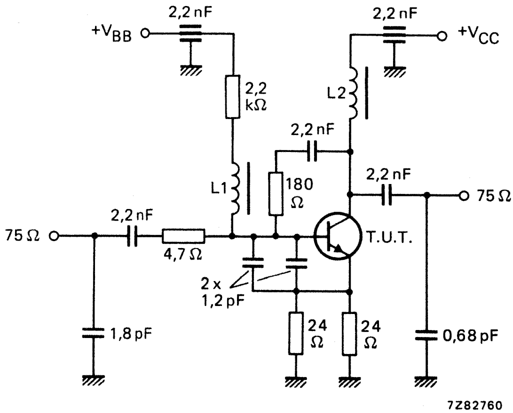


Fig. 2 Intermodulation distortion MATV test circuit. Power gain at f = 40 MHz to 860 MHz is typical 7 dB.

L1 = L2 = 5 μH micro choke.

s-parameters (common emitter) at V_{CE} = 7,5 V.

I_C mA	f MHz	s_{ie}	s_{re}	s_{fe}	s_{oe}
	40	0,66/−135,7°	0,02/41,1°	30,4/124,0°	0,64/ −79,0°
	100	0,77/−164,0°	0,03/33,6°	14,8/101,2°	0,45/−125,3°
	200	0,80/−176,3°	0,03/44,1°	7,7/ 89,1°	0,39/−147,9°
50	500	0,80/ 170,2°	0,06/55,3°	3,1/ 70,3°	0,38/−159,5°
	800	0,78/ 157,0°	0,09/60,5°	2,0/ 57,2°	0,42/−165,6°
	1000	0,78/ 152,4°	0,11/61,8°	1,6/ 48,1°	0,43/−167,6°
	1200	0,75/ 142,7°	0,13/59,9°	1,4/ 41,1°	0,46/−171,2°
	40	0,67/−146,1°	0,02/40,9°	33,5/121,5°	0,64/ −90,4°
	100	0,78/−167,5°	0,02/37,2°	15,6/100,4°	0,49/−134,4°
	200	0,80/−178,3°	0,03/47,0°	8,1/ 89,2°	0,45/−155,5°
100	500	0,79/ 168,9°	0,06/60,4°	3,4/ 72,0°	0,43/−170,5°
	800	0,77/ 156,1°	0,09/62,0°	2,2/ 59,5°	0,44/−174,5°
	1000	0,77/ 151,5°	0,11/61,9°	1,8/ 51,5°	0,44/−178,5°
	1200	0,74/ 141,8°	0,14/59,4°	1,5/ 44,0°	0,46/−178,5°
	40	0,68/−149,0°	0,02/40,8°	34,3/120,6°	0,64/ −94,6°
	100	0,78/−168,8°	0,02/38,8°	15,9/100,0°	0,50/−138,0°
	200	0,80/−179,0°	0,03/49,0°	8,2/ 89,2°	0,47/−158,2°
150	500	0,79/ 168,5°	0,06/61,6°	3,4/ 72,5°	0,45/−173,2°
	800	0,77/ 155,8°	0,09/62,5°	2,2/ 60,3°	0,46/−177,1°
	1000	0,76/ 151,2°	0,12/62,1°	1,8/ 52,5°	0,46/ 177,1°
	1200	0,73/ 141,6°	0,14/59,1°	1,5/ 45,1°	0,47/ 177,1°
	40	0,68/−150,7°	0,02/40,5°	34,7/120,0°	0,64/ −97,3°
	100	0,78/−169,7°	0,02/39,6°	15,9/ 99,7°	0,51/−140,4°
	200	0,80/−179,8°	0,03/50,1°	8,2/ 89,0°	0,49/−159,8°
200	500	0,79/ 168,2°	0,06/62,1°	3,4/ 72,6°	0,47/−174,8°
	800	0,77/ 155,6°	0,09/62,6°	2,2/ 60,5°	0,47/−178,6°
	1000	0,76/ 150,9°	0,12/62,1°	1,8/ 52,9°	0,46/ 175,5°
	1200	0,73/ 141,4°	0,14/59,0°	1,5/ 45,3°	0,47/ 174,6°
	40	0,69/−151,9°	0,02/40,1°	34,6/119,4°	0,63/ −99,4°
	100	0,79/−170,3°	0,02/39,9°	15,8/ 99,5°	0,52/−141,8°
	200	0,80/ 180,0°	0,03/51,0°	8,1/ 88,9°	0,49/−160,9°
250	500	0,80/ 168,0°	0,06/62,5°	3,4/ 72,6°	0,47/−175,6°
	800	0,78/ 155,4°	0,09/62,8°	2,2/ 60,6°	0,48/−179,5°
	1000	0,77/ 150,8°	0,12/62,1°	1,8/ 53,0°	0,47/ 174,5°
	1200	0,73/ 141,3°	0,14/58,9°	1,5/ 45,6°	0,47/ 173,9°
	40	0,69/−152,9°	0,02/39,7°	34,4/118,9°	0,62/−101,2°
	100	0,79/−170,8°	0,02/40,1°	15,5/ 99,2°	0,52/−143,2°
	200	0,80/ 179,6°	0,03/51,5°	8,0/ 88,8°	0,50/−161,7°
300	500	0,80/ 167,9°	0,06/62,8°	3,4/ 72,5°	0,48/−176,2°
	800	0,78/ 155,3°	0,09/62,9°	2,2/ 60,5°	0,48/+ 179,8°
	1000	0,77/ 150,6°	0,12/62,1°	1,8/ 53,0°	0,47/ 173,9°
	1200	0,74/ 141,1°	0,14/59,1°	1,5/ 45,5°	0,48/ 173,4°

s-parameters (common emitter) at V_{CE} = 15 V.

I_C mA	f. MHz	s_{ie}	s_{re}	s_{fe}	s_{oe}
	40	0,63/−132,3°	0,02/41,8°	33,5/126,6°	0,62/ −72,9°
	100	0,75/−161,1°	0,02/34,0°	16,4/103,0°	0,41/−115,2°
	200	0,78/−174,8°	0,03/40,7°	8,6/ 90,1°	0,34/−139,4°
50	500	0,78/ 169,9°	0,06/56,8°	3,6/ 71,4°	0,34/−153,8°
	800	0,77/ 157,5°	0,08/60,9°	2,3/ 57,6°	0,37/−157,4°
	1000	0,74/ 150,3°	0,10/61,8°	1,9/ 48,8°	0,40/−160,3°
	1200	0,73/ 143,2°	0,12/61,0°	1,5/ 41,2°	0,42/−162,9°
	40	0,63/−140,5°	0,02/41,6°	36,4/125,0°	0,61/ −82,0°
	100	0,76/−164,8°	0,02/37,3°	17,5/102,3°	0,44/−126,8°
	200	0,78/−176,8°	0,03/46,7°	9,1/ 90,3°	0,39/−149,8°
100	500	0,77/ 168,8°	0,06/60,3°	3,8/ 72,6°	0,38/−164,2°
	800	0,76/ 156,7°	0,09/62,1°	2,4/ 60,0°	0,39/−168,6°
	1000	0,73/ 149,6°	0,11/61,7°	2,0/ 51,2°	0,40/−170,8°
	1200	0,72/ 142,6°	0,13/60,2°	1,7/ 44,6°	0,42/−172,6°
	40	0,64/−143,2°	0,02/41,1°	37,6/123,9°	0,60/ −86,5°
	100	0,76/−166,0°	0,02/38,3°	17,9/101,8°	0,45/−131,0°
	200	0,78/−177,5°	0,03/48,1°	9,3/ 90,2°	0,41/−153,1°
150	500	0,77/ 168,2°	0,06/61,2°	3,9/ 73,1°	0,40/−167,7°
	800	0,76/ 156,3°	0,09/62,2°	2,5/ 60,6°	0,40/−172,0°
	1000	0,72/ 149,2°	0,11/61,5°	2,0/ 52,2°	0,41/−174,6°
	1200	0,72/ 142,2°	0,13/59,5°	1,7/ 45,3°	0,42/−176,1°
	40	0,65/−144,0°	0,02/40,6°	38,5/122,8°	0,60/ −90,2°
	100	0,76/−166,7°	0,02/39,0°	18,0/101,2°	0,46/−133,7°
	200	0,78/−177,9°	0,03/49,1°	9,3/ 89,9°	0,42/−155,2°
200	500	0,77/ 168,0°	0,06/61,6°	3,9/ 73,3°	0,41/−169,7°
	800	0,76/ 156,1°	0,09/62,3°	2,5/ 60,9°	0,41/−174,0°
	1000	0,72/ 149,1°	0,11/61,5°	2,1/ 52,8°	0,42/−175,7°
	1200	0,71/ 142,1°	0,13/59,2°	1,7/ 45,8°	0,42/−177,3°
	40	0,66/−144,9°	0,02/40,7°	38,6/122,1°	0,60/ −91,6°
	100	0,76/−167,0°	0,02/39,2°	18,0/100,8°	0,46/−135,4°
	200	0,78/−178,1°	0,03/49,5°	9,3/ 89,7°	0,43/−156,2°
250	500	0,77/ 167,8°	0,06/62,0°	3,9/ 73,2°	0,42/−170,3°
	800	0,76/ 156,1°	0,09/62,4°	2,5/ 61,0°	0,41/−174,8°
	1000	0,72/ 148,9°	0,11/61,5°	2,0/ 52,6°	0,41/−177,2°
	1200	0,72/ 141,8°	0,14/58,8°	1,7/ 45,7°	0,41/−178,3°
	40	0,67/−145,2°	0,02/40,1°	38,7/121,3°	0,59/ −93,3°
	100	0,77/−167,3°	0,02/39,0°	17,9/100,3°	0,46/−136,5°
	200	0,79/−178,2°	0,03/49,6°	9,2/ 89,4°	0,43/−156,8°
300	500	0,78/ 167,7°	0,06/62,0°	3,9/ 72,9°	0,42/−170,6°
	800	0,76/ 156,1°	0,09/62,4°	2,5/ 60,8°	0,41/−174,7°
	1000	0,73/ 148,8°	0,11/61,4°	2,0/ 52,5°	0,41/−177,4°
	1200	0,72/ 142,0°	0,14/59,2°	1,7/ 45,7°	0,42/+177,4°

Conditions for Figs 3 and 4:

V_{CE} = 15 V; I_C = 240 mA;
T_{amb} = 25 °C.

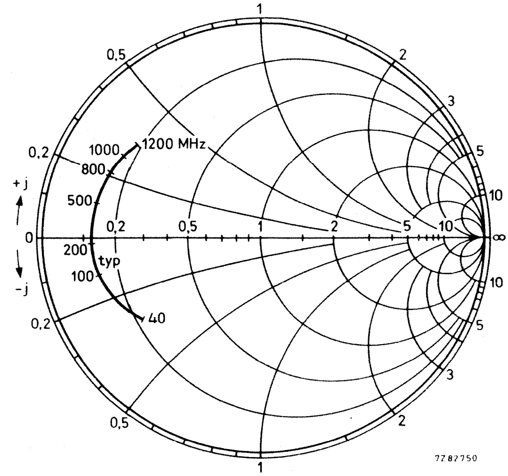


Fig. 3 Input impedance derived from input reflection coefficient s_{ie} co-ordinates in ohm x 50.

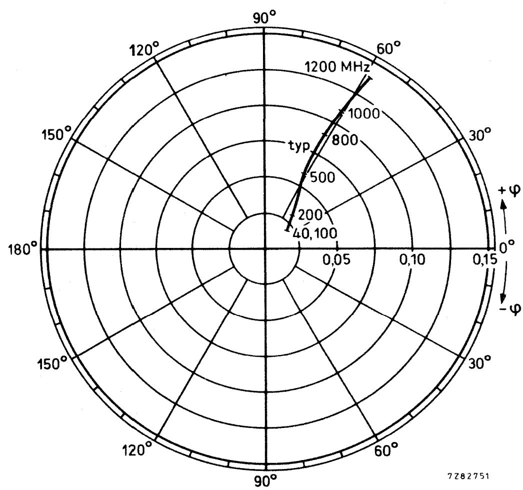


Fig. 4 Reverse transmission coefficient s_{re}.

Conditions for Figs 5 and 6:
V_{CE} = 15 V; I_C = 240 mA;
T_{amb} = 25 °C.

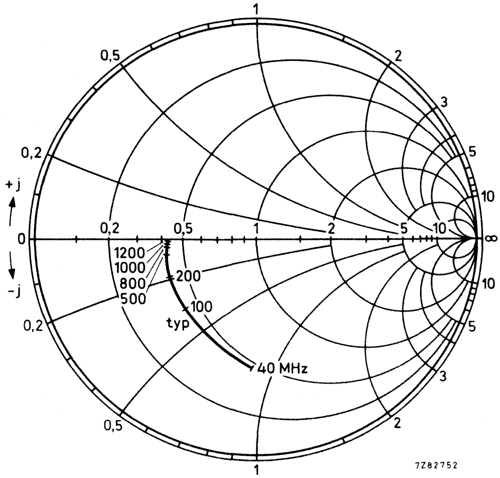


Fig. 5 output impedance derived from output reflection coefficient s_{oe} co-ordinates in ohm x 50.

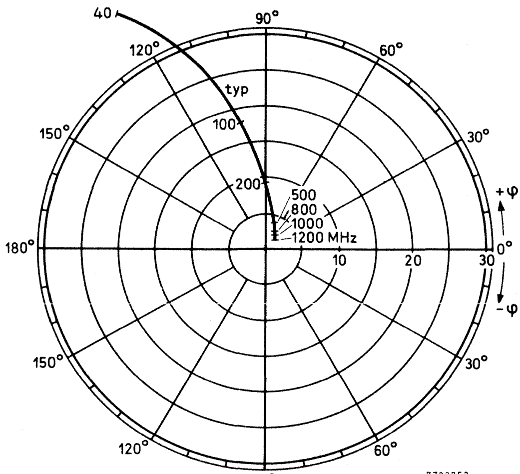


Fig. 6 Forward transmission coefficient s_{fe}.

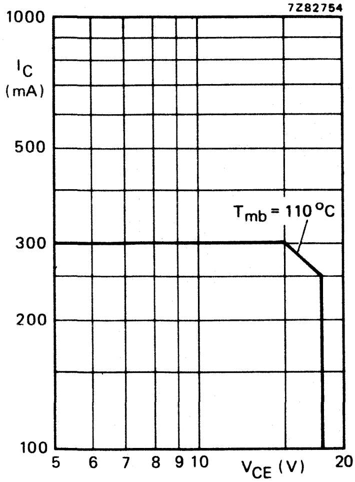


Fig. 7 D.C. SOAR.

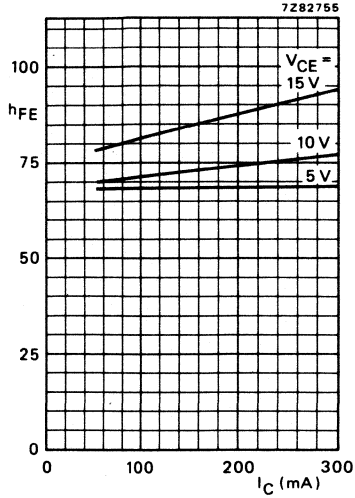


Fig. 8 T_j = 25 °C; typical values.

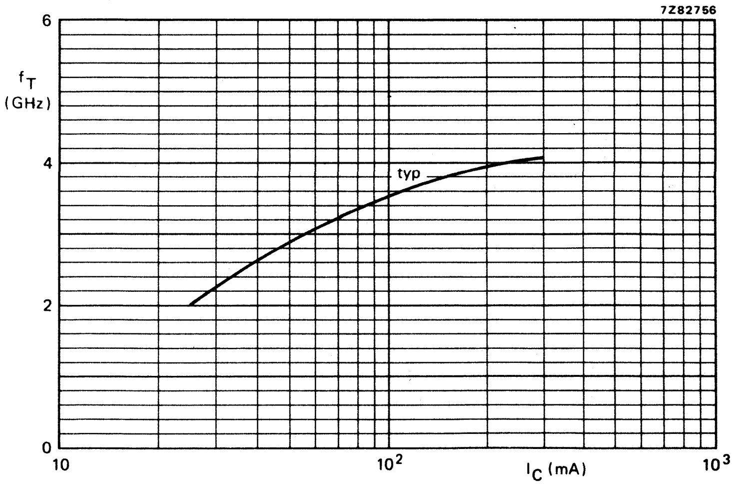


Fig. 9 V_{CE} = 15 V; f = 500 MHz; Tj = 25 °C

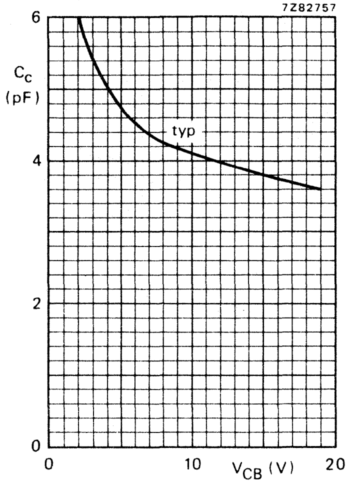


Fig. 10.

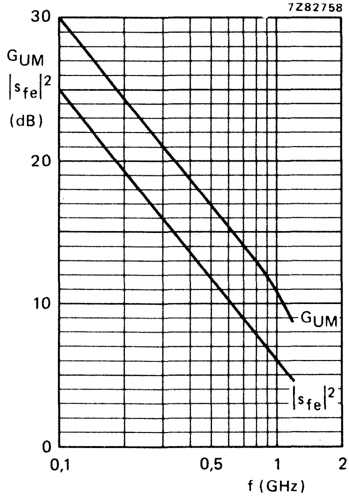


Fig. 11.

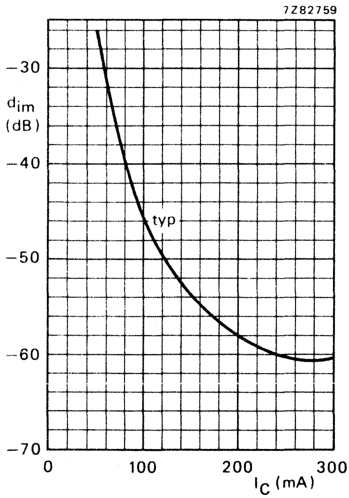


Fig. 12.

Conditions for Figs 10, 11 and 12:

Fig. 10 $I_E = I_e = 0$; $T_{amb} = 25\ ^oC$.

Fig. 11 $V_{CE} = 15$ V; $I_C = 240$ mA; $T_{amb} = 25\ ^oC$; typical values.

Fig. 12 $V_{CE} = 15$ V; $V_o = 1,6$ V; $f_{(p+q-r)} = 793,25$ MHz; $T_{amb} = 25\ ^oC$; measured in MATV test circuit (see Fig. 2).

SILICON PLANAR EPITAXIAL TRANSISTOR

N-P-N transistor primarily intended for final stages in MATV system amplifiers. The integrated diffused emitter ballasting resistors and application of gold sandwich metallization ensure an optimum temperature profile and excellent reliability properties.

QUICK REFERENCE DATA

Collector-base voltage, open emitter	V_{CBO}	max.	25	V
Collector-emitter voltage, open base	V_{CEO}	max.	18	V
Collector current (d.c.)	I_C	max.	600	mA
Total power dissipation up to T_{mb} = 110 °C	P_{tot}	max.	9	W
Junction temperature	T_j	max.	200	°C
Transition frequency at f = 500 MHz I_C = 500 mA; V_{CE} = 15 V	f_T	typ.	4	GHz
Maximum unilateral power gain at f = 800 MHz I_C = 500 mA; V_{CE} = 15 V; T_{amb} = 25 °C	G_{UM}	typ.	12,5	dB
Output voltage at d_{im} = −60 dB I_C = 500 mA; V_{CE} = 15 V; R_L = 75 Ω; T_{amb} = 25 °C; $f_{(p+q-r)}$ = 793,25 MHz	V_o	typ.	2,2	V

MECHANICAL DATA

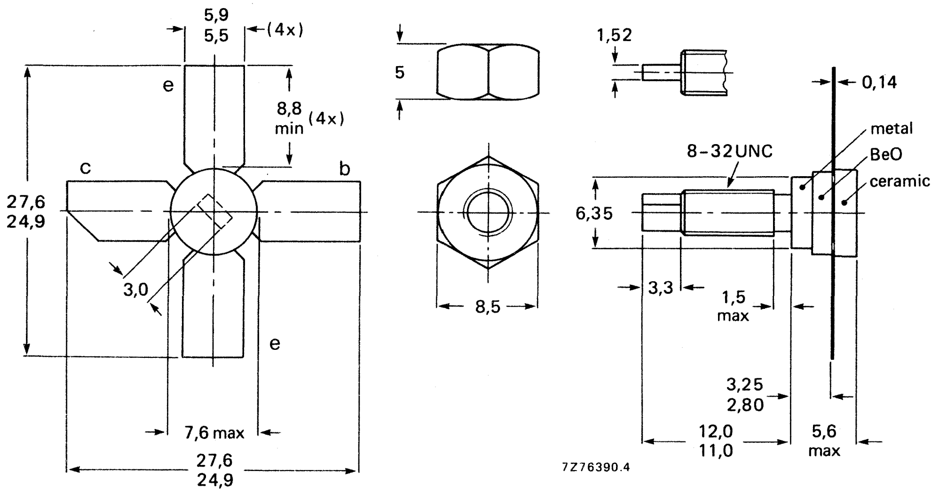
SOT-122 (see Fig. 1).

PRODUCT SAFETY. 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. 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: 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.

RATINGS

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

Collector-base voltage, open emitter	V_{CBO}	max.	25	V
Collector-emitter voltage, open base	V_{CEO}	max.	18	V
Emitter-base voltage, open collector	V_{EBO}	max.	2	V
Collector current (d.c.)	I_C	max.	600	mA
Total power dissipation up to T_{mb} = 110 °C*	P_{tot}	max.	9	W
Storage temperature	T_{stg}		−65 to + 150	°C
Junction temperature	T_j	max.	200	°C

THERMAL RESISTANCE*

From junction to mounting base	$R_{th\ j\text{-}mb}$	=	10	K/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,6	K/W

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified

Collector cut-off current $I_E = 0$; V_{CB} = 15 V	I_{CBO}	<	75	μA
D.C. current gain* I_C = 500 mA; V_{CE} = 15 V	h_{FE}	>	25	
Transition frequency at f = 500 MHz* I_C = 500 mA; V_{CE} = 15 V	f_T	typ.	4	GHz
Collector capacitance at f = 1 MHz $I_E = i_e = 0$; V_{CB} = 15 V	C_c	typ.	7	pF
Emitter capacitance at f = 1 MHz $I_C = i_c = 0$; V_{EB} = 0,5 V	C_e	typ.	35	pF
Feedback capacitance $I_C = 0$; V_{CE} = 15 V	C_{re}	typ.	4	pF
Collector-stud capacitance**	C_{cs}	typ.	0,8	pF

Maximum unilateral power gain (s_{re} assumed to be zero)

$$G_{UM} \text{ (in dB)} = 10 \log \frac{|s_{fe}|^2}{[1 - |s_{ie}|^2]\ [1 - |s_{oe}|^2]}$$

I_C = 500 mA; V_{CE} = 15 V; f = 800 MHz	G_{UM}	typ.	12,5	dB

Output voltage at d_{im} = −60 dB
I_C = 500 mA; V_{CE} = 15 V;
R_L = 75 Ω; T_{amb} = 25 °C

$V_p = V_o$ at d_{im} = −60 dB; f_p = 795,25 MHz
$V_q = V_o$ −6 dB ; f_q = 803,25 MHz
$V_r = V_o$ −6 dB ; f_r = 805,25 MHz

measured at $f_{(p+q-r)}$ = 795,25 MHz	V_o	typ.	2,2	V

* Measured under pulse conditions.
** Measured with emitter and base grounded.

DEVELOPMENT DATA

s-parameters (common emitter) at V_{CE} = 15 V

I_C mA	f MHz	s_{ie}	s_{fe}	s_{re}	s_{oe}
	40	0,87/−161,9°	27,9/104,8°	0,017/24,5°	0,60/−140,2°
	100	0,89/−174,2°	11,7/ 92,6°	0,019/29,3°	0,58/−163,7°
	200	0,90/+180,0°	5,8/ 85,8°	0,024/43,0°	0,58/−172,5°
100	500	0,89/ 171,6°	2,4/ 70,3°	0,044/59,9°	0,59/−178,3°
	800	0,89/ 167,7°	1,8/ 64,3°	0,056/63,3°	0,60/−179,7°
	1000	0,86/ 159,9°	1,2/ 51,7°	0,086/66,1°	0,60/+176,4°
	1200	0,86/ 155,6°	1,1/ 42,4°	0,105/63,7°	0,60/ 173,8°
	40	0,87/−165,2°	29,3/103,8°	0,014/26,2°	0,65/−146,8°
	100	0,90/−175,8°	12,1/ 92,7°	0,017/34,9°	0,65/−167,3°
	200	0,90/+179,1°	6,1/ 86,9°	0,023/49,7°	0,65/−175,5°
200	500	0,89/ 170,7°	2,5/ 72,7°	0,046/63,5°	0,65/+177,7°
	800	0,89/ 167,3°	1,9/ 68,1°	0,058/65,8°	0,65/ 175,6°
	1000	0,86/ 159,2°	1,3/ 55,3°	0,090/66,5°	0,63/ 170,6°
	1200	0,84/ 155,1°	1,2/ 48,9°	0,109/63,3°	0,62/ 167,8°
	40	0,88/−166,4°	29,6/103,2°	0,013/26,8°	0,67/−149,3°
	100	0,90/−176,1°	12,3/ 92,7°	0,016/36,2°	0,67/−168,5°
	200	0,90/+178,6°	6,2/ 86,9°	0,023/51,8°	0,67/−176,2°
300	500	0,89/ 171,0°	2,5/ 73,5°	0,046/69,6°	0,67/+176,6°
	800	0,89/ 167,2°	2,0/ 68,7°	0,059/66,4°	0,66/ 174,2°
	1000	0,86/ 159,5°	1,4/ 56,9°	0,091/66,7°	0,64/ 168,7°
	1200	0,85/ 154,5°	1,2/ 49,5°	0,110/63,3°	0,63/ 165,8°
	40	0,88/−166,8°	29,6/102,7°	0,013/26,8°	0,69/−150,8°
	100	0,90/−176,4°	12,1/ 92,4°	0,016/36,9°	0,68/ 169,2°
	200	0,90/+178,5°	6,1/ 87,1°	0,023/52,4°	0,68/−176,7°
400	500	0,89/ 170,7°	2,5/ 74,1°	0,047/65,2°	0,68/+176,0°
	800	0,89/ 167,2°	2,0/ 69,1°	0,059/66,7°	0,67/ 173,6°
	1000	0,86/ 159,0°	1,3/ 56,4°	0,092/66,7°	0,65/ 168,0°
	1200	0,85/ 154,6°	1,2/ 50,7°	0,111/63,1°	0,64/ 164,9°
	40	0,88/−167,0°	29,3/102,2°	0,013/27,0°	0,69/−151,8°
	100	0,90/−176,6°	12,1/ 92,2°	0,016/37,0°	0,69/−169,5°
	200	0,90/+178,6°	6,1/ 86,8°	0,023/52,8°	0,68/−176,8°
500	500	0,89/ 170,5°	2,5/ 73,5°	0,047/65,2°	0,68/+175,8°
	800	0,89/ 167,2°	1,9/ 68,5°	0,060/66,8°	0,68/ 173,5°
	1000	0,86/ 159,2°	1,3/ 56,6°	0,092/66,7°	0,65/ 167,7°
	1200	0,84/ 154,8°	1,2/ 50,6°	0,112/63,1°	0,64/ 164,7°

DEVELOPMENT DATA

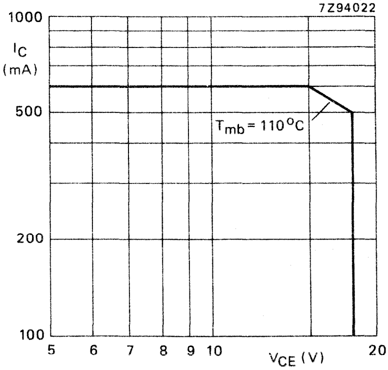


Fig. 2 D.C. SOAR.

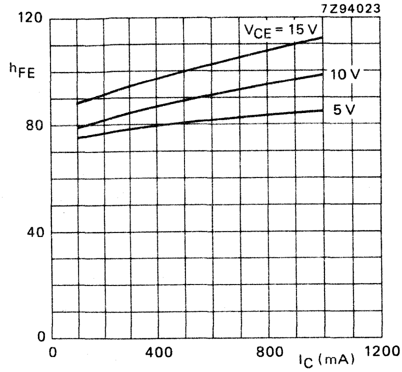


Fig. 3 T_j = 25 °C; typ. values.

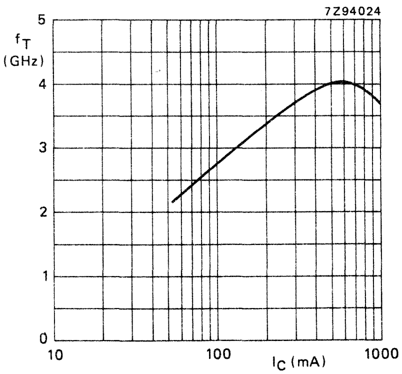


Fig. 4 V_{CE} = 15 V; f = 500 MHz;
T_j = 25 °C; typical values.

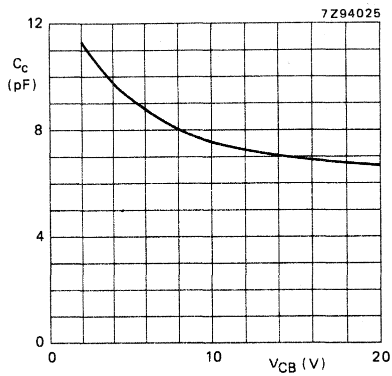


Fig. 5 Typical values.

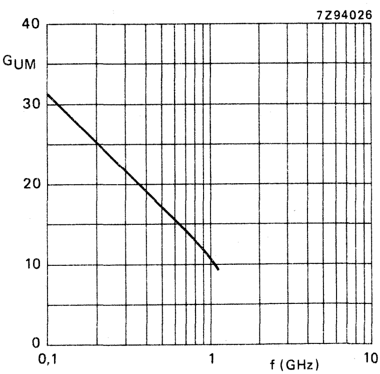
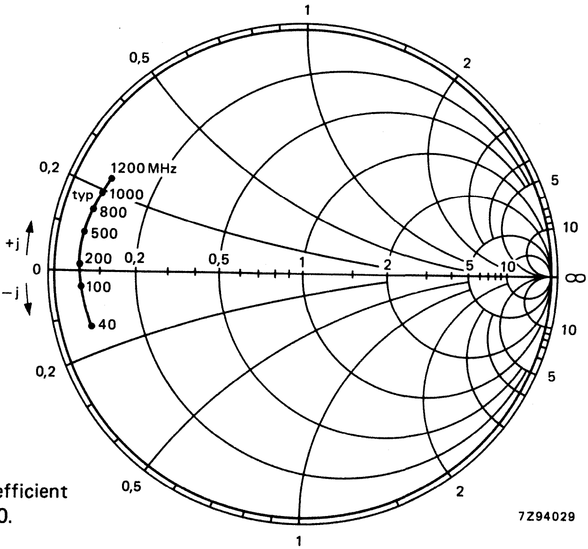


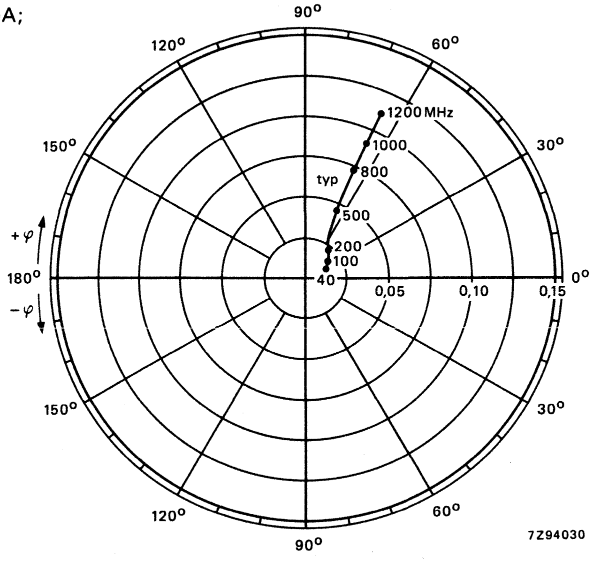
Fig. 6 V_{CE} = 15 V; I_C = 500 mA;
T_{amb} = 25 °C; typical values.



Input impedance derived from input reflection coefficient s_{ie} co-ordinates in Ω x 50.

Fig. 7.

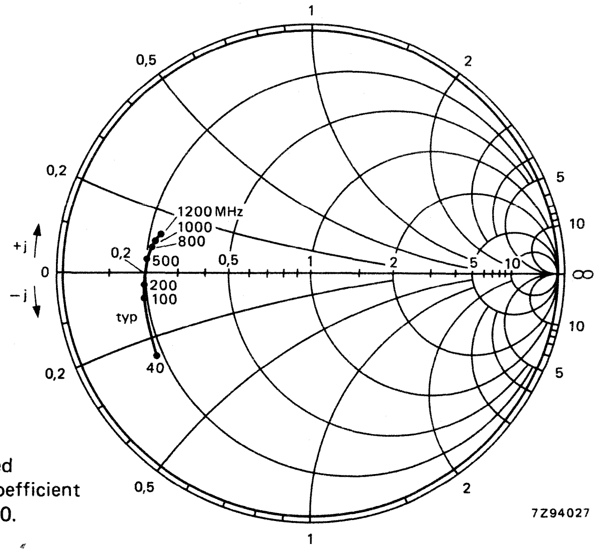
Conditions for Figs 7 and 8:
V_{CE} = 15 V; I_C = 500 mA;
T_{amb} = 25 °C.



Reverse transmission coefficient s_{re}.

Fig. 8.

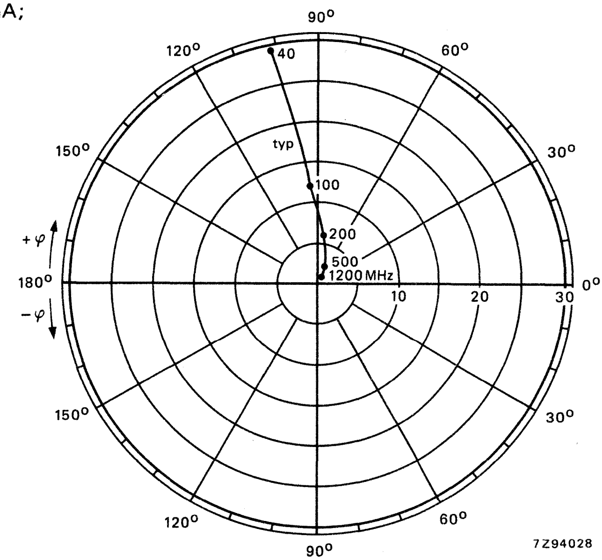
DEVELOPMENT DATA



Output impedance derived from output reflection coefficient s_{oe} co-ordinates in Ω x 50.

Fig. 9.

Conditions for Figs 9 and 10:
V_{CE} = 15 V; I_C = 500 mA;
T_{amb} = 25 °C.



Forward transmission coefficient s_{fe}.

Fig. 10.

N-P-N SILICON MICROWAVE TRANSISTOR

The BFR49 is a microwave transistor featuring a high transition frequency and low noise. A miniature ceramic encapsulation is used for compatibility with stripline and microwave circuits. It is suitable for amplifiers up to S-band frequencies in instrumentation and microwave systems.

QUICK REFERENCE DATA

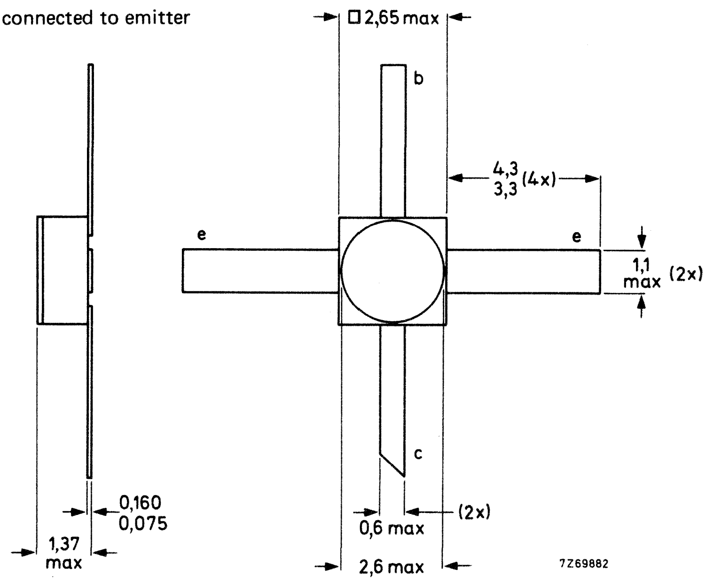
Collector-base voltage (open emitter)	V_{CBO}	max	20	V
Collector-emitter voltage (open base)	V_{CEO}	max	15	V
Collector current (d.c.)	I_C	max	25	mA
Total power dissipation up to T_{amb} = 110 °C	P_{tot}	max	180	mW
Transition frequency I_C = 14 mA; V_{CE} = 10 V	f_T	typ	5	GHz
Noise figure at optimum source impedance I_C = 2 mA; V_{CE} = 10 V; f = 1 GHz	F	typ	2,5	dB
Transducer power gain I_C = 14 mA; V_{CE} = 10 V; f = 1 GHz	$\|s_{fe}\|^2$	typ	15,5	dB

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-100.

Metallized lid connected to emitter



RATINGS

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

Collector-base voltage (open emitter; I_C = 10 μA)	V_{CBO}	max	20 V
Collector-emitter voltage (open base; I_C = 10 mA)	V_{CEO}	max	15 V
Emitter-base voltage (open collector; I_E = 10 μA)	V_{EBO}	max	2 V
Collector current (d.c.)	I_C	max	25 mA
Total power dissipation up to T_{amb} = 110 °C	P_{tot}	max	180 mW
Storage temperature	T_{stg}	−65 to + 200 °C	
Junction temperature	T_j	max	200 °C

THERMAL RESISTANCE

From junction to ambient in free air mounted on a fibre-glass print of 40 mm x 25 mm x 1 mm	$R_{th\ j\text{-}a}$	=	500 K/W

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified

Collector cut-off current			
$I_E = 0$; V_{CB} = 10 V	I_{CBO}	<	50 nA
D.C. current gain *			
I_C = 14 mA; V_{CE} = 10 V	h_{FE}	>	25
Transition frequency *			
I_C = 14 mA; V_{CE} = 10 V; f = 500 MHz	f_T	typ	5 GHz
Collector capacitance at f = 1 MHz			
$I_E = I_e = 0$; V_{CB} = 10 V	C_c	typ	0,35 pF
Emitter capacitance at f = 1 MHz			
$I_C = I_c = 0$; V_{EB} = 0,5 V	C_e	typ	1,1 pF
Feedback capacitance at f = 1 MHz			
I_C = 2 mA; V_{CE} = 10 V	C_{re}	typ	0,3 pF
Noise figure at optimum source impedance			
I_C = 2 mA; V_{CE} = 10 V; f = 1 GHz	F	typ	2,5 dB
I_C = 2 mA; V_{CE} = 10 V; f = 4 GHz	F	typ	6,5 dB

Maximum unilateral power gain (s_{re} assumed to be zero)

$$G_{UM} \text{ (in dB)} = 10 \log \frac{|s_{fe}|^2}{(1 - |s_{ie}|^2)(1 - |s_{oe}|^2)}$$

I_C = 14 mA; V_{CE} = 10 V; f = 1 GHz	G_{UM}	typ	17,0 dB
I_C = 14 mA; V_{CE} = 10 V; f = 4 GHz	G_{UM}	typ	6,5 dB
Transducer power gain			
I_C = 14 mA; V_{CE} = 10 V; f = 1 GHz	$\lvert s_{fe}\rvert^2$	typ	15,5 dB
I_C = 14 mA; V_{CE} = 10 V; f = 4 GHz	$\lvert s_{fe}\rvert^2$	typ	3,5 dB

* Measured under pulse conditions.

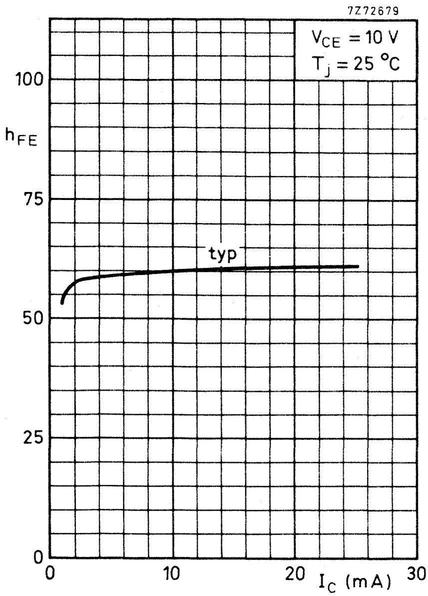


Fig. 2.

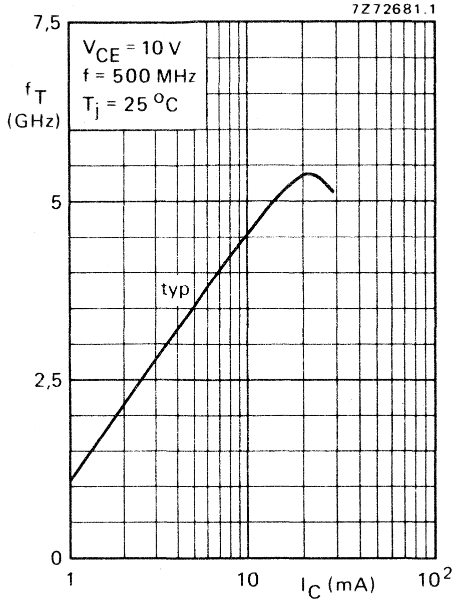


Fig. 3.

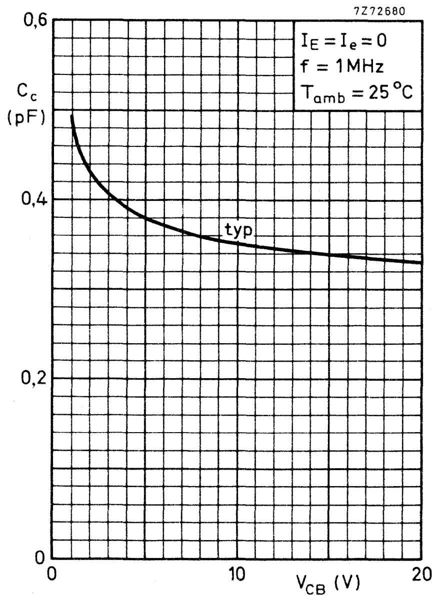


Fig. 4.

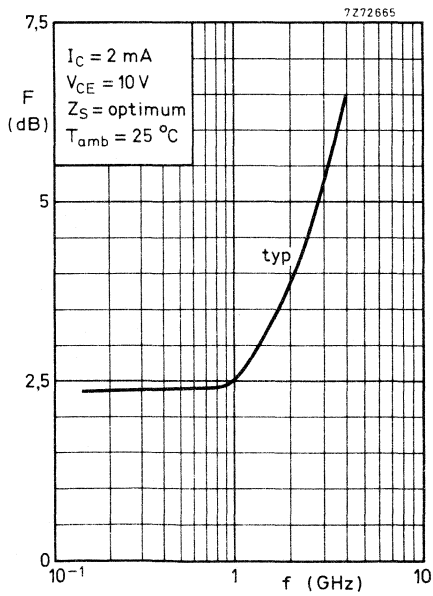


Fig. 5.

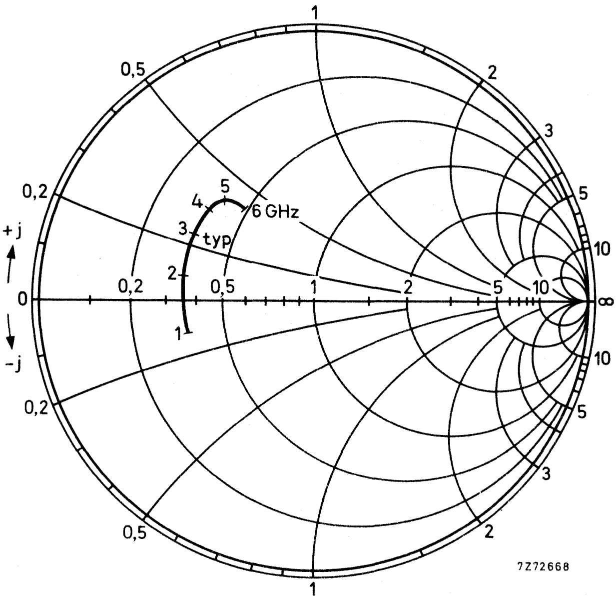


Fig. 6
V_{CE} = 10 V
I_C = 14 mA
T_{amb} = 25 °C.

Input impedance derived from input reflection coefficient s_{ie} co-ordinates in ohm x 50.

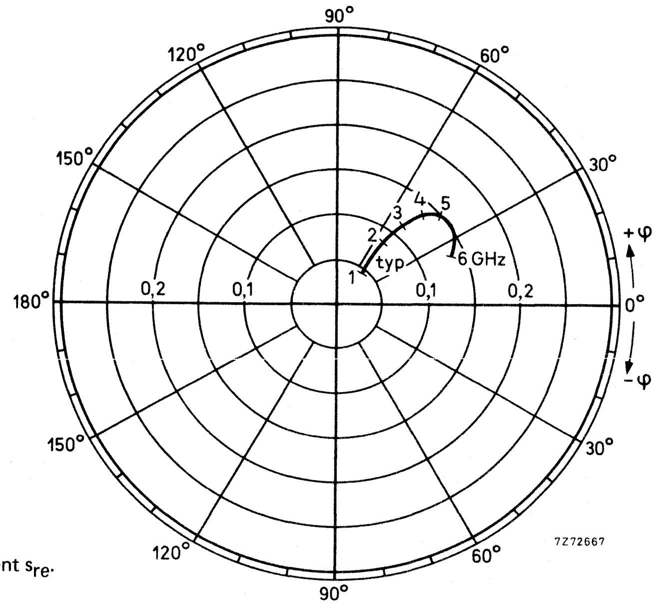


Fig. 7
V_{CE} = 10 V
I_C = 14 mA
T_{amb} = 25 °C.

Reverse transmission coefficient s_{re}.

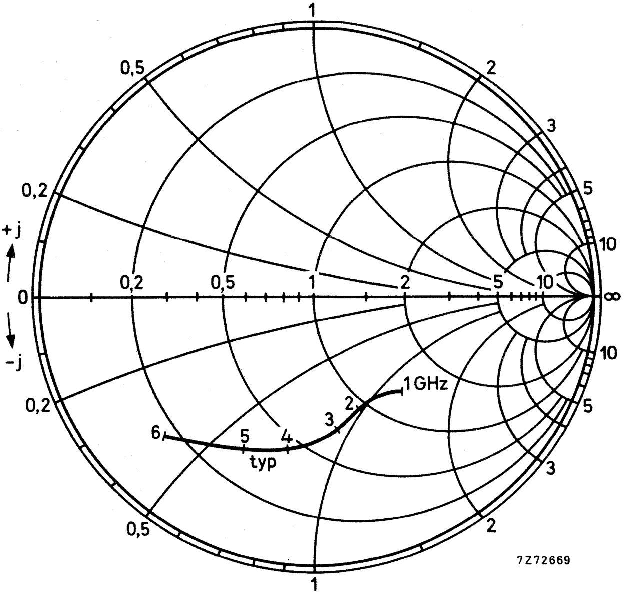


Fig. 8
V_{CE} = 10 V
I_C = 14 mA
T_{amb} = 25 °C.

Output impedance derived from output reflection coefficient s_{oe} co-ordinates in ohm x 50.

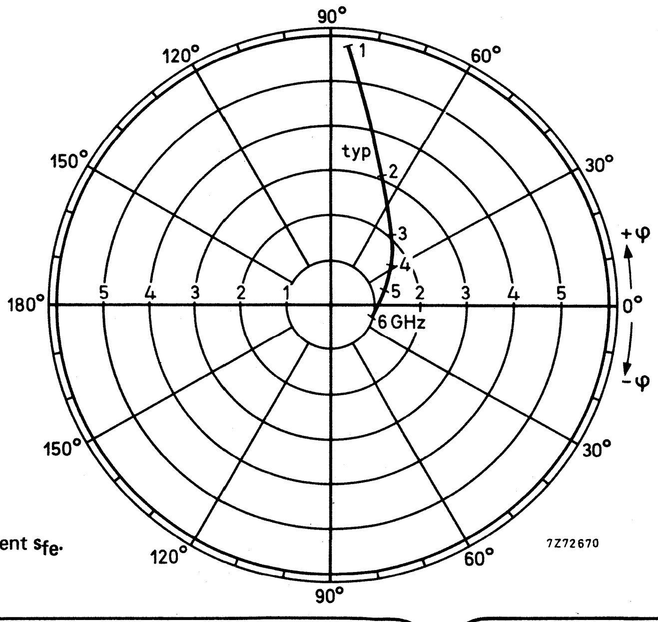


Fig. 9
V_{CE} = 10 V
I_C = 14 mA
T_{amb} = 25 °C.

Forward transmission coefficient s_{fe}.

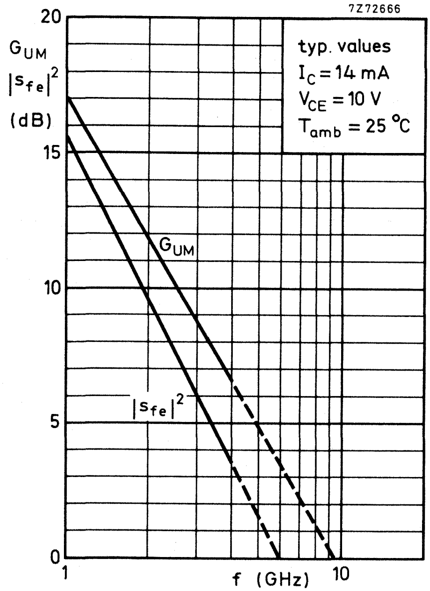

7Z72666
20
G_{UM}
$|s_{fe}|^2$
(dB)
15
10
5
0
1
f (GHz)
10
typ. values
$I_C = 14$ mA
$V_{CE} = 10$ V
$T_{amb} = 25$ °C
G_{UM}
$|s_{fe}|^2$

Fig. 10.

SILICON PLANAR EPITAXIAL TRANSISTOR

N-P-N multi-emitter transistor in a capstan envelope. The transistor has extremely good intermodulation properties and high power gain.

The device is primarily intended for:

a Final and driver stages of channel and band aerial amplifiers with high output power for band I, II, III and IV/V (40-860 MHz).
b Final and driver stages of wideband amplifiers (40-230 MHz).
c Final stages of the wideband vertical amplifier in high-speed oscilloscopes.
d Frequency multiplier and oscillator circuits.

QUICK REFERENCE DATA

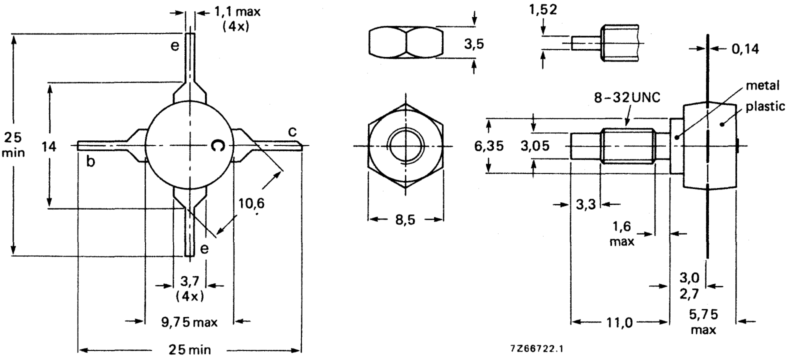
Collector-base voltage (open emitter; peak value)	V_{CBOM}	max.	40	V
Collector-emitter voltage (open base)	V_{CEO}	max.	25	V
Collector current (peak value)	I_{CM}	max.	500	mA
Total power dissipation up to T_{mb} = 60 °C; f ⩾ 1 MHz	P_{tot}	max.	3,5	W
Junction temperature	T_j	max.	150	°C
Transition frequency at f = 500 MHz I_C = 75 mA; V_{CE} = 20 V	f_T	>	1200	MHz
Output power at f = 200 MHz I_C = 70 mA; V_{CE} = 20 V; d_{im} = −30 dB	P_o	typ.	150	mW
Power gain at f = 200 MHz I_C = 70 mA; V_{CE} = 20 V	G_p	typ.	16	dB

MECHANICAL DATA (see next page)

PRODUCT SAFETY. 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

SOT-48



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

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. 4,17 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.	40	V	1)
Collector-emitter voltage (R_{BE} = 10 Ω; peak value)	V_{CERM}	max.	40	V	2)
Collector-emitter voltage (open base)	V_{CEO}	max.	25	V	2)
Emitter-base voltage (open collector)	V_{EBO}	max.	3,5	V	3)

Currents

Collector current (d.c.)	I_C	max.	200	mA
Collector current (peak value) f > 1 MHz	I_{CM}	max.	500	mA

Power dissipation (f > 1 MHz; see SOAR)

Total power dissipation up to T_{mb} = 60 °C	P_{tot}	max.	3,5	W

Temperatures

Storage temperature	T_{stg}	-40 to +150		°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

From junction to mounting base	$R_{th\ j-mb}$	=	25	°C/W
From mounting base to heatsink	$R_{th\ mb-h}$	=	0,5	°C/W

1) at I_C = 100 μA. 2) at I_C = 10 mA. 3) at I_E = 100 μA.

CHARACTERISTICS T_j = 25 °C unless otherwise specified

Collector cut-off current				
$I_E = 0$; $V_{CB} = 20$ V	I_{CBO}	<	10	μA
Saturation voltage				
$I_C = 100$ mA; $I_B = 10$ mA	V_{CEsat}	<	0,75	V
D.C. current gain				
$I_C = 50$ mA; $V_{CE} = 5$ V	h_{FE}	>	25	
$I_C = 150$ mA; $V_{CE} = 5$ V	h_{FE}	>	25	
Collector capacitance at f = 1 MHz				
$I_E = I_e = 0$; $V_{CB} = 20$ V	C_c	<	4,5	pF
Feedback capacitance at f = 1 MHz				
$I_C = 10$ mA; $V_{CE} = 20$ V; $T_{mb} = 25$ °C	C_{re}	typ.	1,7	pF
Noise figure at f = 200 MHz				
$I_C = 40$ mA; $V_{CE} = 20$ V; $R_S = 75\ \Omega$; $T_{mb} = 25$ °C	F	typ.	6	dB
Transition frequency at f = 500 MHz				
$I_C = 15$ mA; $V_{CE} = 20$ V	f_T	typ.	1000	MHz
$I_C = 75$ mA; $V_{CE} = 20$ V	f_T	>	1200	MHz
$I_C = 150$ mA; $V_{CE} = 20$ V	f_T	typ.	1200	MHz
Output power at f = 200 MHz; $T_{mb} = 25$ °C				
$I_C = 70$ mA; $V_{CE} = 20$ V; VSWR at output < 2 $f_p = 202$ MHz; $f_q = 205$ MHz; $d_{im} = -30$ dB measured at $f_{(2q-p)} = 208$ MHz (channel 9)	P_o	> typ.	130 150	mW mW
Output power at f = 800 MHz; $T_{mb} = 25$ °C				
$I_C = 70$ mA; $V_{CE} = 20$ V; VSWR at output < 2 $f_p = 798$ MHz; $f_q = 802$ MHz; $d_{im} = -30$ dB measured at $f_{(2q-p)} = 806$ MHz (channel 62)	P_o	> typ.	70 90	mW mW
Power gain (not neutralized) $T_{mb} = 25$ °C				
$I_C = 70$ mA; $V_{CE} = 20$ V; f = 200 MHz	G_p	> typ.	15 16	dB dB
$I_C = 70$ mA; $V_{CE} = 20$ V; f = 800 MHz	G_p	typ.	6,5	dB

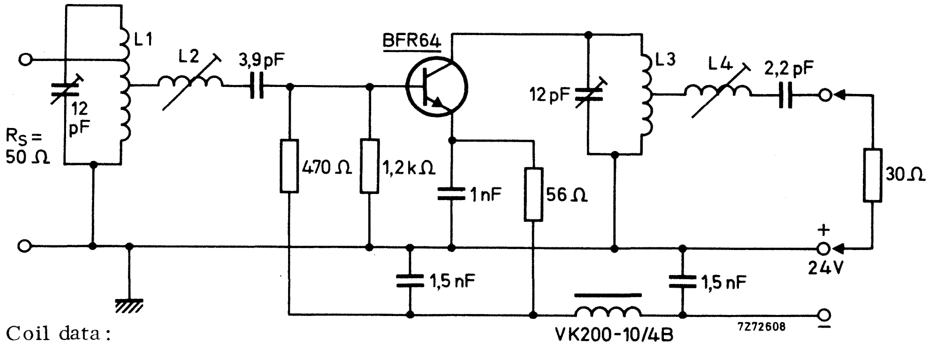
CHARACTERISTICS (continued)

Intermodulation characteristics

1. Output power at f = 200 MHz; T_{mb} = 25 °C

   I_C = 70 mA; V_{CE} = 20 V; VSWR at output < 2
   f_p = 202 MHz; f_q = 205 MHz; d_{im} = −30 dB
   measured at $f_{(2q-p)}$ = 208 MHz (channel 9)

Test circuit:



Coil data:

L1 = 3 turns silver-plated Cu wire (1, 4 mm); winding pitch 2, 7 mm; int. dia. 8 mm; taps at 0, 5 turn and 1, 5 turns from earth.
L2 = 5, 5 turns silver-plated Cu wire (1, 4 mm); winding pitch 2, 2 mm; int. dia. 8 mm
L3 = 3 turns silver-plated Cu wire (1, 4 mm); winding pitch 3, 3 mm; int. dia. 8 mm
L4 = 5, 5 turns silver-plated Cu wire (1, 4 mm); winding pitch 2, 2 mm; int. dia. 11 mm

CHARACTERISTICS (continued)

Basis of adjustment

The intermodulation at an intermodulation distortion of −30 dB is caused by h.f. output current-voltage clipping.
The maximum undistorted output power is realized, if

a. Current and voltage clipping take place concurrently.
   This occurs if

$$R_L = \frac{V_{CE} - V_{CEK}}{I_C},$$

   in which V_{CEK} is the high-frequency knee voltage.

b. The h.f. collector current is as small as possible.
   This is so if $-C_L = +C_{oe}$,
   in which C_{oe} is the output capacitance of the transistor at short-circuited input.

For maximum output power at an intermodulation distortion of −30 dB, the (experimentally found) values of R_L and C_L are:
$R_L = 220\ \Omega$; $C_L = -4$ pF.

Adjustment procedure

1. Remove the transistor and connect a dummy consisting of a 220 Ω resistor in parallel with a 4 pF capacitor between the collector and emitter connections of the output circuit.
2. Tune and match the output circuit for zero reflection at 205 MHz (VSWR = 1).
   After this adjustment, no further change may be made in the output circuit.
3. Replace the dummy by the transistor. Tune and match the input circuit for maximum power gain and good band-pass curve.
   The VSWR of the output will then, in most cases, be ≤ 2 over the whole channel.
   Corrections can be made by tuning L2; this will not disturb the band-pass curve.

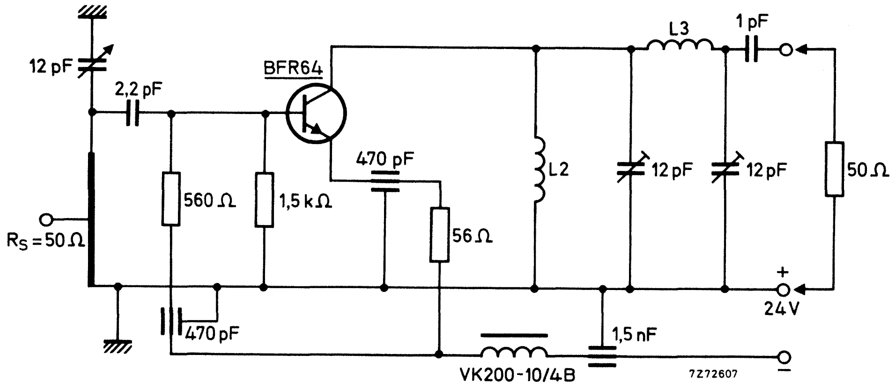
CHARACTERISTICS (continued)

Intermodulation characteristics

2. Output power at f = 800 MHz; T_{mb} = 25 °C

I_C = 70 mA; V_{CE} = 20 V; VSWR at output < 2
f_p = 798 MHz; f_q = 802 MHz; d_{im} = −30 dB
measured at $f_{(2q-p)}$ = 806 MHz (channel 62)

Test circuit:



Coil data:

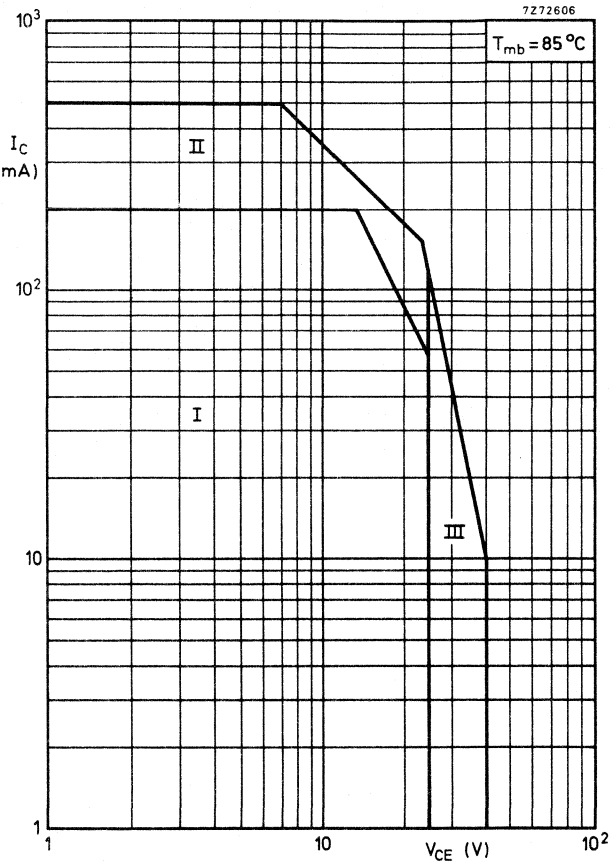
L1 = 25 mm x 7 mm x 0,85 mm silver-plated Cu strip
Tap of the input at 5 mm from earth.
L2 = 13 turns enamelled Cu wire (0,6 mm); int. dia. 8 mm
L3 = 1,5 turns Cu wire (1,3 mm); int. dia. 8 mm

Basis of adjustment

At 800 MHz no dummy can be used to adjust for optimum collector load because at these frequencies the impedance transformations of a dummy are too high. A small signal at the mid-channel frequency of 802 MHz is fed to the input and increased until clipping occurs; that is, until the output power no longer increases linearily with the input signal. This clipping can be eliminated by tuning the output circuit, thereby making the output power equal to

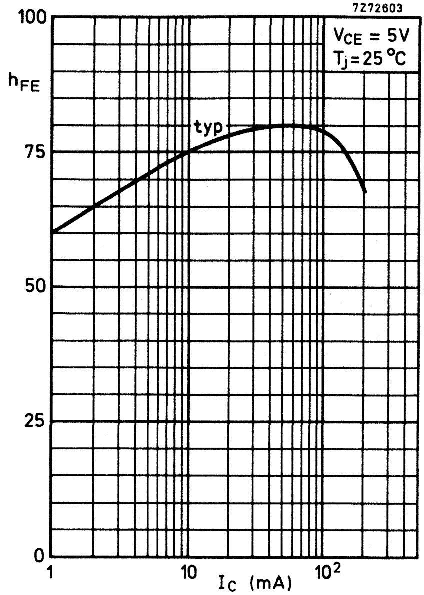
$$P_o = \frac{I_C(V_{CE} - V_{CEK})}{2} = 480 \text{ mW}.$$

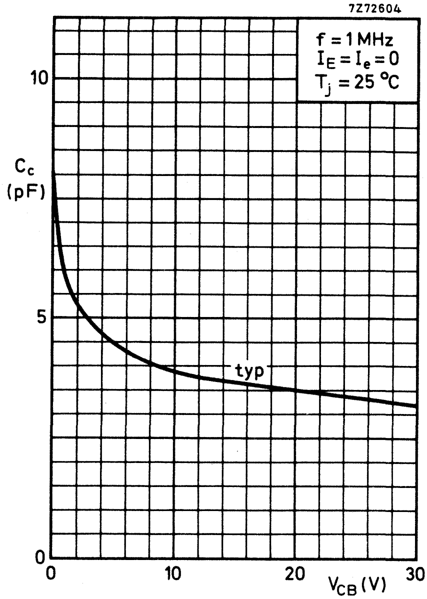
The output circuit is adjusted for minimum intermodulation if the input signal is as small as possible at P_o = 480 mW. With this adjusting method, care must be taken that the transistor is not damaged by second breakdown (the voltage swing may not exceed the rated V_{CER} value). Therefore as soon as clipping occurs, the increase of the input signal should be stopped until the clipping has been eliminated. After this adjustment has been made no further change may be made in the output circuit. Adjust the input circuit for maximum power gain and good band-pass curve. The VSWR of the output is then ≤ 2 over the whole channel.

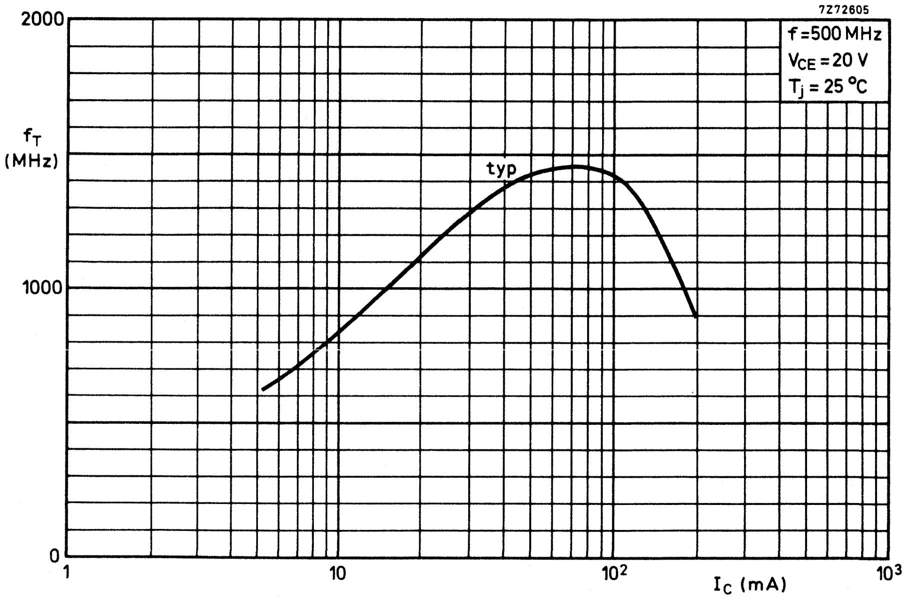


Safe Operating Area with the transistor forward biased

I Region of permissible d.c. operation
II Permissible extension for repetitive pulsed operation; f > 1 MHz
III Repetitive pulse operation in this region is allowable, provided $R_{BE} < 10\ \Omega$ and f > 1 MHz


7Z72603
100
75
50
25
0
hFE
typ
VCE = 5V
Tj = 25 °C
1
10
10²
IC (mA)


7Z72604
10
5
0
Cc
(pF)
typ
f = 1 MHz
IE = Ie = 0
Tj = 25 °C
0
10
20
30
VCB (V)


7Z72605
2000
1000
0
fT
(MHz)
typ
f = 500 MHz
VCE = 20 V
Tj = 25 °C
1
10
10²
10³
IC (mA)

SILICON PLANAR EPITAXIAL TRANSISTOR

N-P-N multi-emitter silicon transistor in a capstan envelope. The transistor has extremely good intermodulation properties and high power gain.

The device is primarily intended for channel amplifiers in aerial amplifier systems as well as other applications where an excellent f_T linearity and higher signal handling capabilities than available in existing devices are required.

QUICK REFERENCE DATA

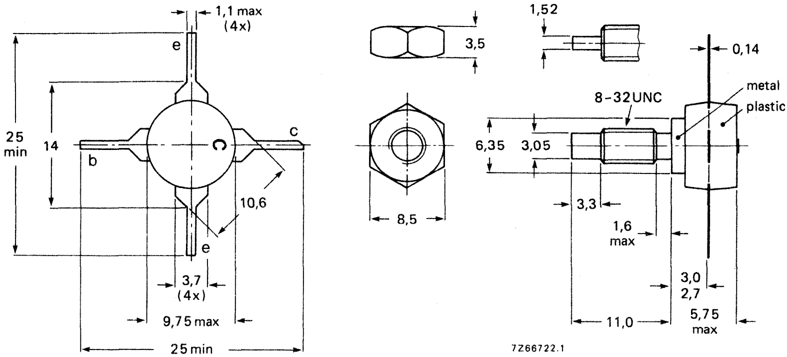
Collector-base voltage (open emitter; peak value)	V_{CBOM}	max.	40	V
Collector-emitter voltage (open base)	V_{CEO}	max.	25	V
Collector current (peak value)	I_{CM}	max.	1000	mA
Junction temperature	T_j	max.	200	°C
Thermal resistance from junction to mounting base	$R_{th\ j\text{-}mb}$	=	15	°C/W
Transition frequency at f = 500 MHz I_C = 200 mA; V_{CE} = 20 V	f_T	>	1200	MHz
Output power at f = 200 MHz I_C = 200 mA; V_{CE} = 20 V; d_{im} = −30 dB	P_o	typ.	450	mW
Power gain at f = 200 MHz I_C = 200 mA; V_{CE} = 20 V	G_p	typ.	19	dB

MECHANICAL DATA (see next page)

PRODUCT SAFETY. 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

SOT-48 Dimensions in mm



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

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

Diameter of clearance hole in heatsink: max. 4,17 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 (IEC 134)

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.	25	V
Emitter-base voltage (open collector)	V_{EBO}	max.	3,5	V
Collector current (d.c.)	I_C	max.	400	mA
Collector current (peak value) f > 1 MHz	I_{CM}	max.	1000	mA
Total power dissipation up to T_{mb} = 125 °C see also page 6	P_{tot}	max.	5	W
Storage temperature	T_{stg}	−65 to +200		°C
Junction temperature	T_j	max.	200	°C

THERMAL RESISTANCE

From junction to mounting base	$R_{th\ j\text{-}mb}$ =	15	°C/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$ =	0,5	°C/W

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

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	$V_{(BR)CEO}$	>	25	V
Emitter-base voltage open collector; $I_E = 1$ mA	$V_{(BR)EBO}$	>	3.5	V
Collector cut-off current				
$I_E = 0$; $V_{CB} = 20$ V	I_{CBO}	<	100	μA
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	
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
Transition frequency at f = 500 MHz				
$I_C = 200$ mA; $V_{CE} = 20$ V	f_T	>	1200	MHz
$I_C = 400$ mA; $V_{CE} = 20$ V	f_T	>	1000	MHz
Output power at f = 200 MHz; $T_{mb} = 25\ ^oC$				
$I_C = 200$ mA; $V_{CE} = 20$ V; V.S.W.R. at output < 2 $f_p = 202$ MHz; $f_q = 205$ MHz; $d_{im} = -30$ dB measured at $f_{(2q-p)} = 208$ MHz (channel 9)	P_o	typ.	450	mW
Power gain (not neutralized) $T_{mb} = 25\ ^oC$				
$I_C = 200$ mA; $V_{CE} = 20$ V; f = 200 MHz	G_p	>	15	dB
		typ.	19	dB
$I_C = 200$ mA; $V_{CE} = 20$ V; f = 800 MHz	G_p	typ.	4.5	dB

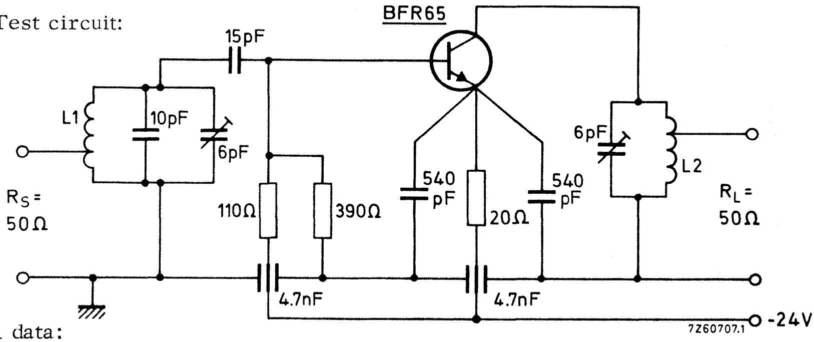
CHARACTERISTICS (continued)

Intermodulation characteristics

1. Output power at f = 200 MHz; T_{mb} = 25 °C

   I_C = 200 mA; V_{CE} = 20 V; V.S.W.R. at output < 2
   f_p = 202 MHz; f_q = 205 MHz; d_{im} = −30 dB
   measured at f $_{(2q-p)}$ = 208 MHz (channel 9)

   Test circuit:



Coil data:

L1 = 1 turn silver plated Cu wire (1.4 mm); int. diam. 8 mm; tap at 0.75 turn from earth.
L2 = 3 turns silver plated Cu wire (1.4 mm); int. diam. 8 mm; winding pitch 2.7 mm; tap at 2.5 turns from earth.

CHARACTERISTICS (continued)

Basis of adjustment

The intermodulation at an intermodulation distortion of −30 dB is caused by h.f. output current − voltage clipping.
The maximum undistorted output power is realised, if

a. Current and voltage clipping take place concurrently.
This occurs if

$$R_L = \frac{V_{CE} - V_{CEK}}{I_C},$$

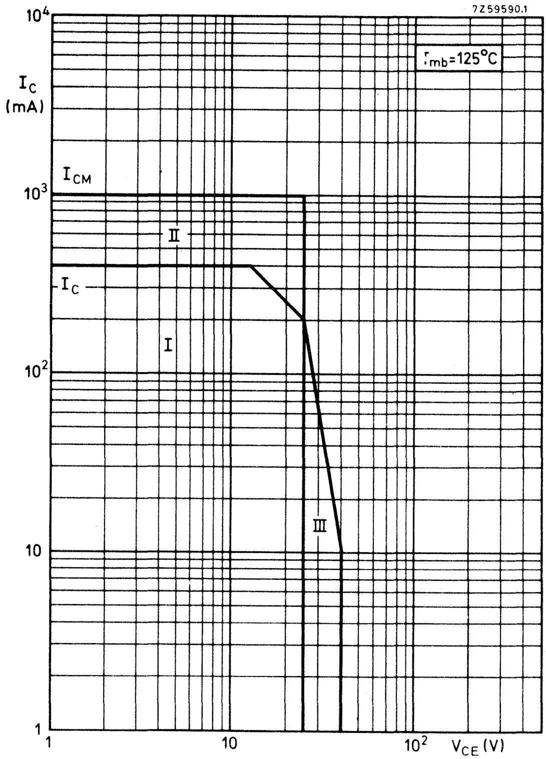
in which V_{CEK} is the high frequency knee voltage.

b. The h.f. collector current is as small as possible.
This is so if $-C_L = +C_{oe}$,
in which C_{oe} is the output capacitance of the transistor at short circuited input.

For maximum output power at an intermodulation distortion of −30 dB, the (experimentally found) values of R_L and C_L are:
$R_L = 91\ \Omega$; $C_L = -6.8$ pF.

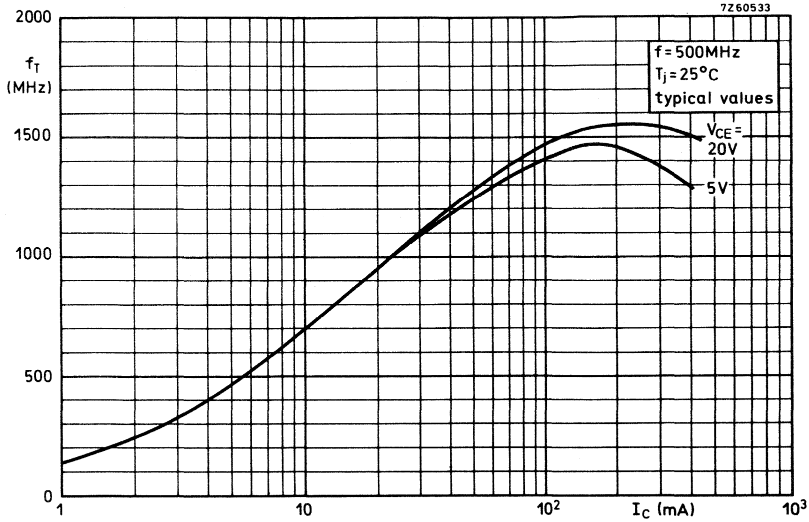
Adjustment procedure

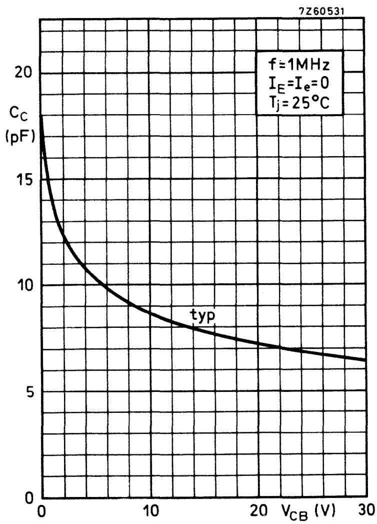
1. Remove the transistor and connect a dummy consisting of a 91 Ω resistor in parallel with a 6.8 pF capacitor between the collector and emitter connections of the output circuit.
2. Tune and match the output circuit for zero reflection at 205 MHz (V.S.W.R. = 1)
After this adjustment, no further change may be made in the output circuit.
3. Replace the dummy by the transistor. Tune and match the input circuit for maximum power gain and good band pass curve.
The V.S.W.R. of the output will then, in most cases, be ≤ 2 over the whole channel.

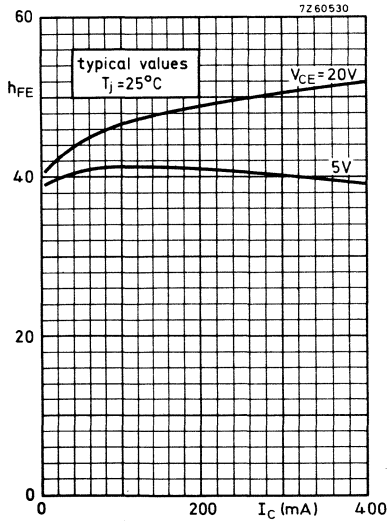


Safe Operating Area with the transistor forward biased

I Region of permissible d.c. operation
II Permissible extension for repetitive pulsed operation; f > 1 MHz
III Repetitive pulsed operation in this region is allowable, provided f > 1 MHz; R_{BE} < 10 Ω


7Z60533
2000
f_T
(MHz)
1500
1000
500
0
1
10
10^2
I_C (mA)
10^3
f = 500MHz
T_j = 25°C
typical values
V_{CE} =
20V
5V


7Z60531
20
C_c
(pF)
15
10
5
0
0
10
20
V_{CB} (V)
30
f = 1MHz
I_E = I_e = 0
T_j = 25°C
typ


7Z60530
60
h_{FE}
40
20
0
0
200
I_C (mA)
400
typical values
T_j = 25°C
V_{CE} = 20V
5V

SILICON PLANAR EPITAXIAL TRANSISTOR

N-P-N transistor in a subminiature plastic **transfer-moulded T-package.**
It is primarily intended for use in u.h.f. and microwave amplifiers such as in aerial amplifiers, radar systems, oscilloscopes, spectrum analysers etc.
The transistor features low intermodulation distortion and high power gain; thanks to its very high transition frequency, it also has excellent wideband properties and low noise up to high frequencies.

QUICK REFERENCE DATA

Collector-base voltage (open emitter)	V_{CBO}	max.	20	V
Collector-emitter voltage (open base)	V_{CEO}	max.	15	V
Collector current (d.c.)	I_C	max.	25	mA
Total power dissipation up to T_{amb} = 60 °C	P_{tot}	max.	180	mW
Junction temperature	T_j	max.	150	°C
Transition frequency at f = 500 MHz I_C = 14 mA; V_{CE} = 10 V	f_T	typ.	5	GHz
Feedback capacitance at f = 1 MHz I_C = 0; V_{CE} = 10 V; T_{amb} = 25 °C	C_{re}	typ.	0,4	pF
Noise figure at optimum source impedance I_C = 2 mA; V_{CE} = 10 V; f = 500 MHz; T_{amb} = 25 °C	F	typ.	2,4	dB
Max. unilateral power gain I_C = 14 mA; V_{CE} = 10 V; f = 500 MHz; T_{amb} = 25 °C	G_{UM}	typ.	19,5	dB
Intermodulation distortion at T_{amb} = 25 °C I_C = 14 mA; V_{CE} = 10 V; R_L = 75 Ω; V_o = 150 mV $f_{(p+q-r)}$ = 493,25 MHz	d_{im}	typ.	−60	dB

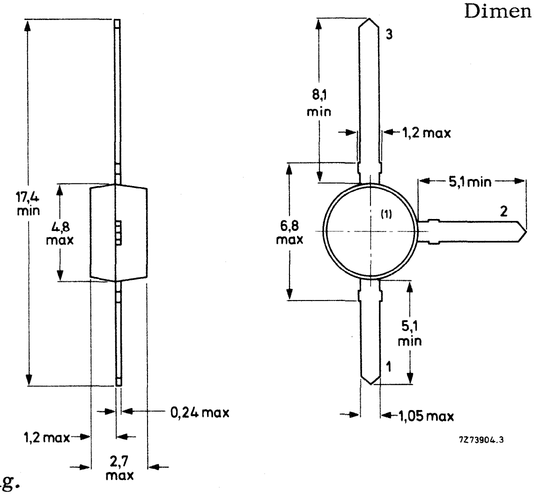
MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-37.

Connections

1. Base
2. Emitter
3. Collector



(1) = type number marking.

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

Voltages

Collector-base voltage (open emitter)	V_{CBO}	max.	20	V
Collector-emitter voltage (open base)	V_{CEO}	max.	15	V
Emitter-base voltage (open collector)	V_{EBO}	max.	2,0	V

Current

Collector current (d.c.)	I_C	max.	25	mA

Power dissipation

Total power dissipation up to T_{amb} = 60 °C	P_{tot}	max.	180	mW

Temperatures

Storage temperature	T_{stg}	−65 to +150		°C
Junction temperature	T_j	max.	150	°C

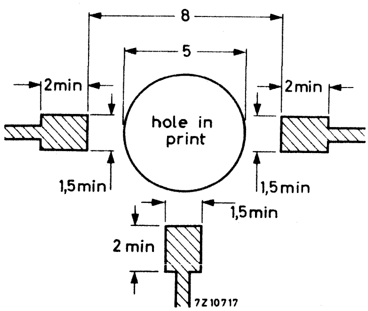
THERMAL RESISTANCE

From junction to ambient in free air

mounted on a glass-fibre print *) of 40 mm x 25 mm x 1 mm	$R_{th\,j-a}$	=	0,5	°C/mW

*) Requirements for glas-fibre print

(dimensions in mm)



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

Collector cut-off current				
$I_E = 0$; $V_{CB} = 10\,V$	I_{CBO}	<	50	nA
D.C. current gain [1]				
$I_C = 14\,mA$; $V_{CE} = 10\,V$	h_{FE}	>	40	
		typ.	90	
Transition frequency at f = 500 MHz [1]				
$I_C = 14\,mA$; $V_{CE} = 10\,V$	f_T	typ.	5	GHz
Collector capacitance at f = 1 MHz				
$I_E = I_e = 0$; $V_{CB} = 10\,V$	C_c	typ.	0,5	pF
Emitter capacitance at f = 1 MHz				
$I_C = I_c = 0$; $V_{EB} = 0{,}5\,V$	C_e	typ.	1,2	pF
Feedback capacitance at f = 1 MHz				
$I_C = 0$; $V_{CE} = 10\,V$; $T_{amb} = 25\,^oC$	C_{re}	typ.	0,4	pF
Noise figure at optimum source impedance				
$I_C = 2\,mA$; $V_{CE} = 10\,V$; f = 500 MHz; $T_{amb} = 25\,^oC$	F	typ.	2,4	dB
Max. unilateral power gain (s_{re} assumed to be zero)				
$I_C = 14\,mA$; $V_{CE} = 10\,V$; f = 500 MHz; $T_{amb} = 25\,^oC$	G_{UM}	typ.	19,5	dB

$$G_{UM}\ (\text{in dB}) = 10 \log \frac{|s_{fe}|^2}{(1 - |s_{ie}|^2)(1 - |s_{oe}|^2)}$$

[1]) Measured under pulse conditions.

CHARACTERISTICS (continued)

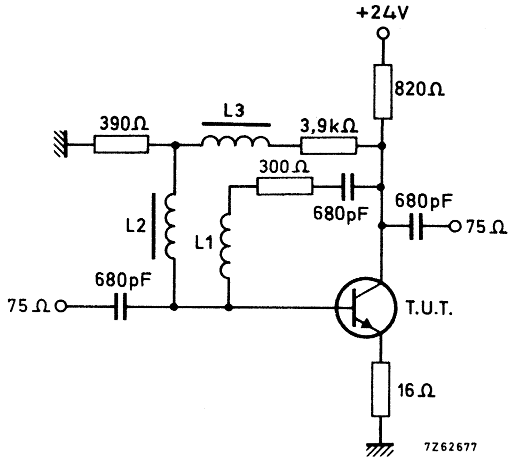
Intermodulation distortion at T_{amb} = 25 °C

I_C = 14 mA; V_{CE} = 10 V; R_L = 75 Ω; V.S.W.R. < 2

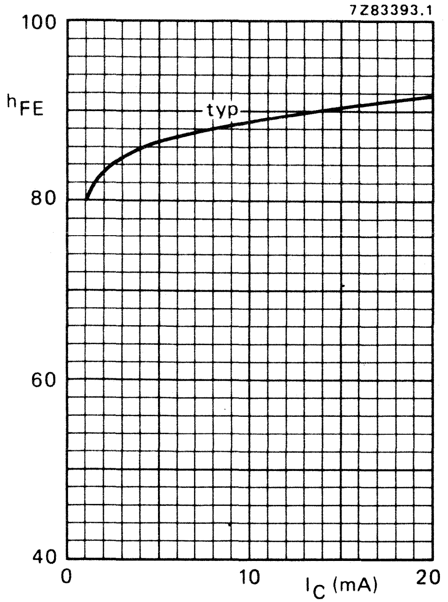
$V_p = V_o$ = 150 mV at f_p = 495, 25 MHz
$V_q = V_o$ − 6 dB at f_q = 503, 25 MHz
$V_r = V_o$ − 6 dB at f_r = 505, 25 MHz

Measured at $f_{(p+q-r)}$ = 493, 25 MHz	d_{im}	typ.	−60	dB

Intermodulation test circuit:



L1 = 4 turns Cu wire (0,35 mm); winding pitch 1 mm; int. diam. 4 mm
L2 and L3 5 μH (code number: 3122 108 20150)



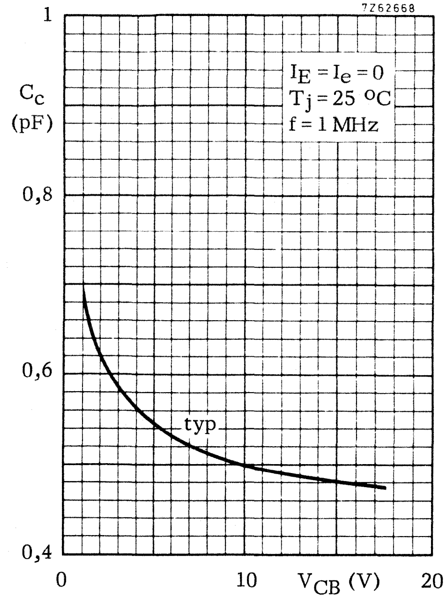
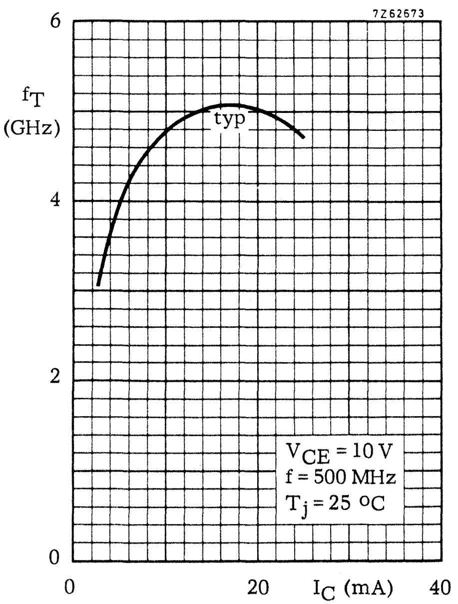
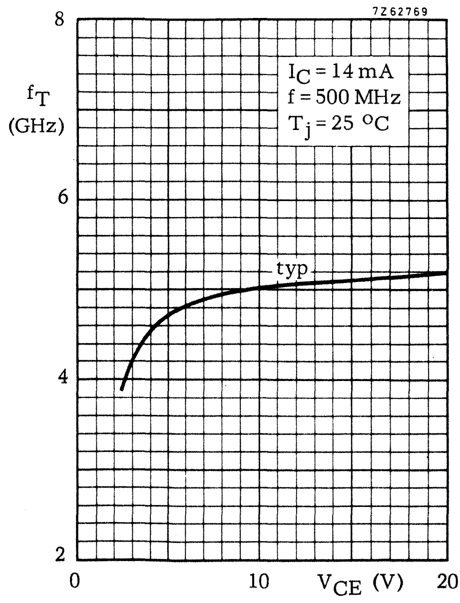
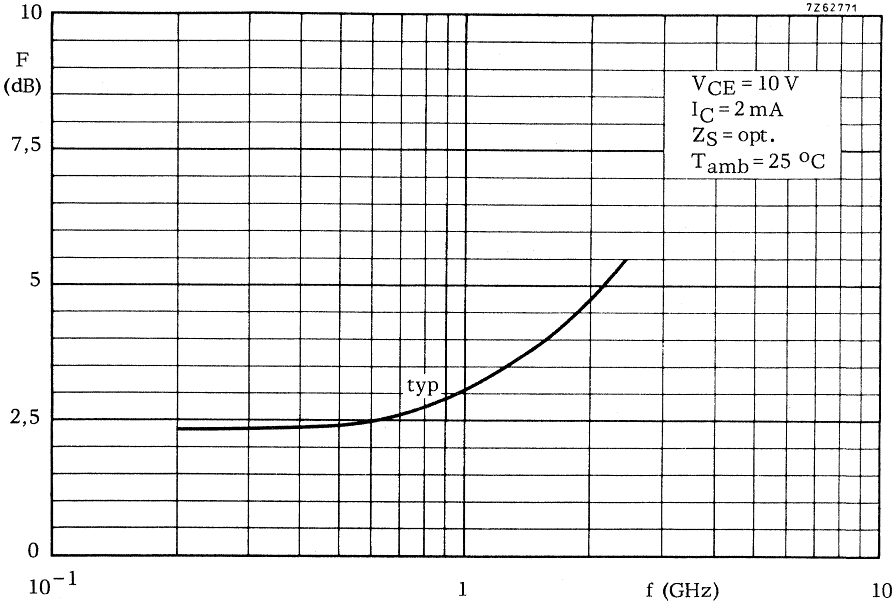
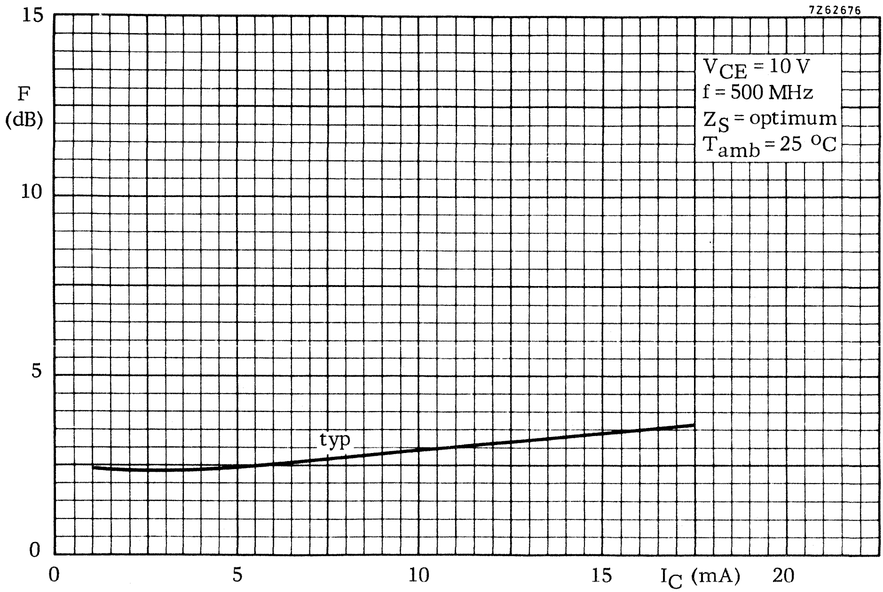


Fig. 4 V_{CE} = 10 V; T_j = 25 ^{o}C.






7Z62771
10
F
(dB)
7,5
5
2,5
0
10^{-1}
1
f (GHz)
10
V_{CE} = 10 V
I_C = 2 mA
Z_S = opt.
T_{amb} = 25 °C
typ


7Z62676
15
F
(dB)
10
5
0
0
5
10
15
I_C (mA)
20
V_{CE} = 10 V
f = 500 MHz
Z_S = optimum
T_{amb} = 25 °C
typ

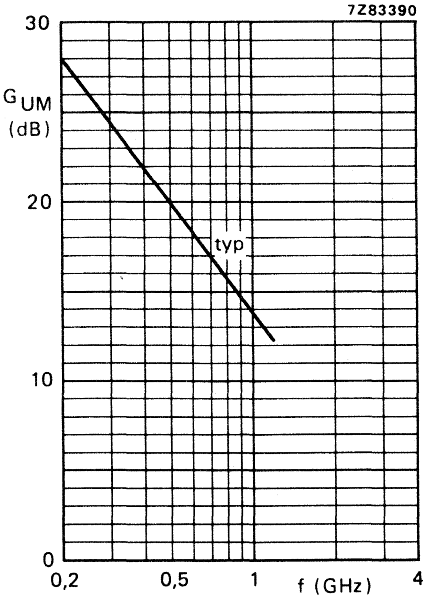
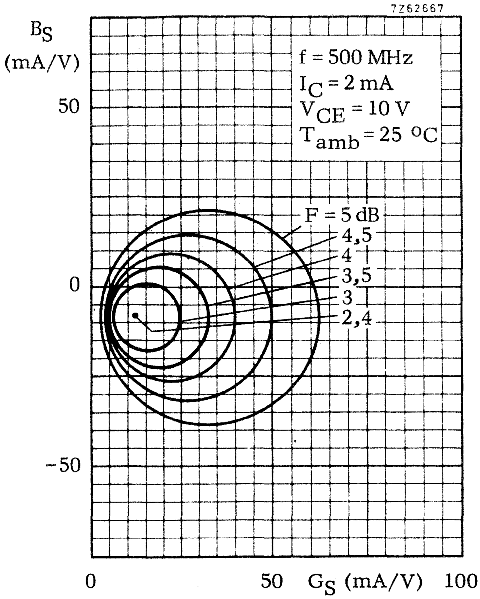


Fig. 10 V_{CE} = 10 V; I_C = 14 mA; T_{amb} = 25 °C.

circles of constant noise figure



SILICON PLANAR EPITAXIAL TRANSISTOR

N-P-N transistor in a subminiature plastic transfer-moulded T-package primarily intended for use in v.h.f. and u.h.f. wideband amplifiers.

Features of this product:

- low noise;
- low intermodulation distortion;
- high power gain;
- gold metallization.

QUICK REFERENCE DATA

Collector-base voltage (open emitter)	V_{CBO}	max.	20	V
Collector-emitter voltage (open-base)	V_{CEO}	max.	15	V
Collector current (d.c.)	I_C	max.	25	mA
Total power dissipation up to T_{amb} = 60 °C	P_{tot}	max.	180	mW
Junction temperature	T_j	max.	150	°C
Transition frequency at f = 500 MHz I_C = 14 mA; V_{CE} = 10 V	f_T	typ.	5	GHz
Feedback capacitance at f = 1 MHz I_C = 0; V_{CE} = 10 V; T_{amb} = 25 °C	C_{re}	typ.	0,35	pF
Noise figure at R_S = 60 Ω I_C = 4 mA; V_{CE} = 10 V; f = 800 MHz; T_{amb} = 25 °C	F	typ.	1,8	dB
Output voltage at d_{im} = −60 dB (see Fig. 3) I_C = 14 mA; V_{CE} = 10 V; R_L = 75 Ω; T_{amb} = 25 °C $f_{(p+q-r)}$ = 793,25 MHz	V_o	typ.	150	mV
Output power at 1 dB gain compression	P_{L1}	typ.	+ 8	dBm ←
Third order intercept point	ITO	typ.	+ 27	dBm ←

MECHANICAL DATA

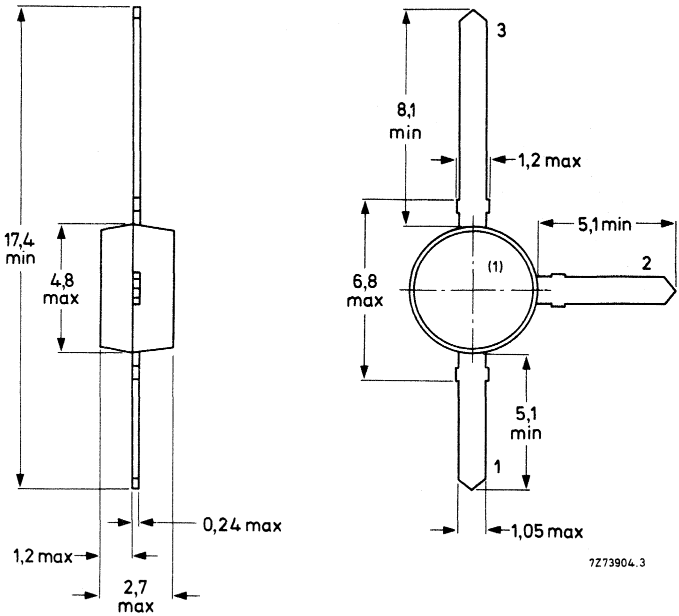
SOT-37 (see Fig. 1).

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-37.

Connections
1. Base
2. Emitter
3. Collector



(1) = type number marking.

RATINGS

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

Collector-base voltage (open emitter)	V_{CBO}	max.	20	V
Collector-emitter voltage (open base)	V_{CEO}	max.	15	V
Emitter-base voltage (open collector)	V_{EBO}	max.	2,0	V
Collector current (d.c.)	I_C	max.	25	mA
Total power dissipation up to T_{amb} = 60 °C	P_{tot}	max.	180	mW
Storage temperature	T_{stg}	−65 to + 150		°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

From junction to ambient in free air mounted on a fibre-glass print (see Fig. 2) of 40 mm x 25 mm x 1 mm	$R_{th\ j\text{-}a}$	=	500	K/W

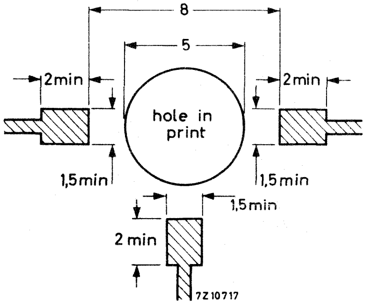


Fig. 2 Requirements for fibre-glass print. (Dimensions in mm.)

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current			
$I_E = 0$; $V_{CB} = 10$ V	I_{CBO}	<	50 nA
D.C. current gain *			
$I_C = 14$ mA; $V_{CE} = 10$ V	h_{FE}	>	40
		typ.	90
Transition frequency at f = 500 MHz *			
$I_C = 14$ mA; $V_{CE} = 10$ V	f_T	typ.	5 GHz
Collector capacitance at f = 1 MHz			
$I_E = I_e = 0$; $V_{CB} = 10$ V	C_c	typ.	0,6 pF
Emitter capacitance at f = 1 MHz			
$I_C = I_c = 0$; $V_{EB} = 0{,}5$ V	C_e	typ.	1,2 pF
Feedback capacitance at f = 1 MHz			
$I_C = 0$; $V_{CE} = 10$ V; $T_{amb} = 25$ °C	C_{re}	typ.	0,35 pF
Noise figure at $T_{amb} = 25$ °C			
$I_C = 4$ mA; $V_{CE} = 10$ V; $R_S = 60\ \Omega$; f = 800 MHz	F	typ.	1,8 dB
$I_C = 4$ mA; $V_{CE} = 10$ V; $Z_S = Z_{Sopt}$; f = 2 GHz	F	typ.	3,6 dB

* Measured under pulse conditions.

s-parameters (common emitter)

V_{CE} V	I_C mA	f MHz	s_{ie}	s_{re}	s_{fe}	s_{oe}
5	2	40	0,91/ −7,7°	0,01/84°	6,8/173°	1,00/ −2,7°
		200	0,79/ −37,3°	0,03/71°	6,5/143°	0,93/−12,5°
		500	0,52/ −81,0°	0,06/59°	4,6/116°	0,80/−22,5°
		800	0,34/−114,5°	0,08/58°	3,3/ 97°	0,73/−27,0°
		1000	0,26/−137,6°	0,09/59°	2,8/ 87°	0,70/−30,0°
		1200	0,22/−165,0°	0,10/61°	2,4/ 79°	0,67/−33,0°
5	5	40	0,80/ −11,7°	0,01/81°	14,4/169°	0,99/ −4,5°
		200	0,59/ −51,0°	0,03/68°	11,2/134°	0,85/−17,0°
		500	0,29/ −95,0°	0,05/66°	6,3/103°	0,70/−22,0°
		800	0,16/−130,0°	0,07/69°	4,2/ 88°	0,64/−26,0°
		1000	0,12/−162,0°	0,09/70°	3,4/ 81°	0,63/−28,0°
		1200	0,12/+ 158,0°	0,10/71°	2,9/ 74°	0,61/−31,0°
5	10	40	0,67/ −16,7°	0,01/80°	23,3/164°	0,97/ −6,6°
		200	0,39/ −63,0°	0,02/70°	14,5/122°	0,76/−18,0°
		500	0,15/−109,0°	0,05/73°	7,0/ 96°	0,64/−20,0°
		800	0,09/−152,0°	0,07/75°	4,6/ 84°	0,60/−24,0°
		1000	0,07/+ 155,0°	0,09/75°	3,7/ 77°	0,59/−26,0°
		1200	0,10/+ 124,0°	0,11/74°	3,1/ 72°	0,58/−29,0°
5	14	40	0,58/ −20,0°	0,01/79°	28,3/160°	0,96/ −7,8°
		200	0,30/ −71,0°	0,02/72°	15,5/117°	0,72/−18,0°
		500	0,11/−119,0°	0,05/75°	7,2/ 93°	0,62/−19,0°
		800	0,07/−177,0°	0,07/77°	4,6/ 82°	0,59/−23,0°
		1000	0,08/+ 138,0°	0,09/76°	3,8/ 76°	0,58/−25,0°
		1200	0,12/+ 118,0°	0,11/76°	3,2/ 71°	0,57/−28,0°
5	20	40	0,49/ −25,0°	0,01/78°	32,9/157°	0,94/ −9,0°
		200	0,22/ −82,0°	0,02/74°	15,9/112°	0,69/−17,0°
		500	0,09/−143,0°	0,05/78°	7,1/ 91°	0,61/−18,0°
		800	0,08/+ 160,0°	0,07/78°	4,5/ 80°	0,59/−22,0°
		1000	0,10/+ 130,0°	0,09/78°	3,7/ 75°	0,58/−24,0°
		1200	0,14/+ 115,0°	0,11/77°	3,1/ 69°	0,57/−28,0°
5	30	40	0,36/ −38,9°	0,01/76°	31,2/151°	0,90/−10,3°
		200	0,18/−122,0°	0,02/75°	14,0/106°	0,66/−14,0°
		500	0,15/−175,0°	0,05/80°	6,1/ 88°	0,61/−16,0°
		800	0,17/+ 148,0°	0,07/80°	3,9/ 78°	0,59/−21,0°
		1000	0,19/+ 131,0°	0,09/79°	3,1/ 72°	0,59/−24,0°
		1200	0,23/+ 119,0°	0,11/79°	2,7/ 67°	0,57/−28,0°

s-parameters (common emitter)

V_{CE} V	I_C mA	f MHz	s_{ie}	s_{re}	s_{fe}	s_{oe}
10	2	40	0,91/ −7,5°	0,01/84°	7,0/173°	1,00/ −2,6°
		200	0,81/ −36,0°	0,03/72°	6,3/149°	0,94/−12,0°
		500	0,54/ −78,0°	0,06/59°	4,6/118°	0,82/−21,0°
		800	0,35/−110,0°	0,08/58°	3,4/ 98°	0,74/−26,0°
		1000	0,27/−132,0°	0,08/59°	2,8/ 89°	0,72/−29,0°
		1200	0,22/−159,0°	0,09/61°	2,5/ 80°	0,69/−0,32°
10	5	40	0,81/ −11,1°	0,01/82°	14,4/169°	0,99/ −4,3°
		200	0,61/ −48,0°	0,03/69°	11,1/135°	0,86/−16,0°
		500	0,31/ −90,0°	0,05/66°	6,4/105°	0,71/−22,0°
		800	0,17/−120,0°	0,07/69°	4,3/ 90°	0,66/−25,0°
		1000	0,11/−148,0°	0,08/70°	3,5/ 82°	0,64/−27,0°
		1200	0,10/+ 167,0°	0,10/71°	3,0/ 76°	0,63/−30,0°
10	10	40	0,70/ −15,2°	0,01/80°	23,0/164°	0,97/ −6,1°
		200	0,42/ −58,0°	0,02/70°	14,8/124°	0,78/−17,0°
		500	0,17/ −95,0°	0,05/73°	7,3/ 97°	0,65/−20,0°
		800	0,07/−104,0°	0,07/75°	4,7/ 85°	0,62/−23,0°
		1000	0,04/−174,0°	0,09/75°	3,9/ 79°	0,61/−25,0°
		1200	0,07 + 120,0°	0,10/75°	3,3/ 73°	0,59/−28,0°
10	14	40	0,63/ −18,0°	0,01/79°	28,2/161°	0,96/ −7,2°
		200	0,34/ −63,0°	0,02/72°	15,9/119°	0,74/−17,0°
		500	0,13/ −98,0°	0,05/75°	7,5/ 95°	0,63/−19,0°
		800	0,05/−136,0°	0,07/77°	4,8/ 83°	0,61/−22,0°
		1000	0,04/+ 133,0°	0,09/76°	3,9/ 77°	0,60/−25,0°
		1200	0,08/+ 108,0°	0,10/76°	3,3/ 72°	0,58/−28,0°

Output voltage at d_{im} = −60 dB (see Figs 3 and 15)
(DIN 45004B, par. 6.3: 3-tone)
I_C = 14 mA; V_{CE} = 10 V; R_L = 75 Ω; VSWR < 2; T_{amb} = 25 °C
$V_p = V_o$ at d_{im} = −60 dB; f_p = 795,25 MHz
$V_q = V_o$ −6 dB ; f_q = 803,25 MHz
$V_r = V_o$ −6 dB ; f_r = 805,25 MHz
Measured at $f_{(p+q-r)}$ = 793,25 MHz — V_o typ. 150 mV

Second harmonic distortion (see Figs 3 and 16)
I_C = 14 mA; V_{CE} = 10 V; R_L = 75 Ω; VSWR < 2; T_{amb} = 25 °C
V_p = 60 mV at f_p = 250 MHz
V_q = 60 mV at f_q = 560 MHz
measured at $f_{(p+q)}$ = 810 MHz — d_2 typ. −50 dB

→ Output power at 1 dB gain compression (see Fig. 3)
I_C = 14 mA; V_{CE} = 10 V
R_L = 75 Ω; T_{amb} = 25 °C
measured at f = 800 MHz — P_{L1} typ. 8 dBm

→ Third order intercept point (see Fig. 3)
I_C = 14 mA; V_{CE} = 10 V
R_L = 75 Ω; T_{amb} = 25 °C
P_p = ITO − 6 dB; f_p = 800 MHz
P_q = ITO − 6 dB; f_q = 801 MHz
measured at $f_{(2q-p)}$ = 802 MHz and
at $f_{(2p-q)}$ = 799 MHz — ITO typ. 27 dBm

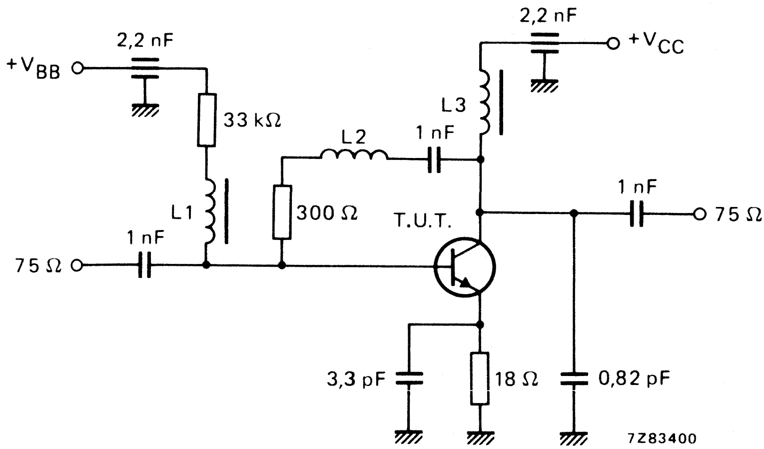


Fig. 3 Intermodulation distortion and second harmonic distortion test circuit.

L1 = L3 = 5 μH micro choke
L2 = 3 turns Cu wire (0,4 mm); internal diameter 3 mm; winding pitch 1 mm

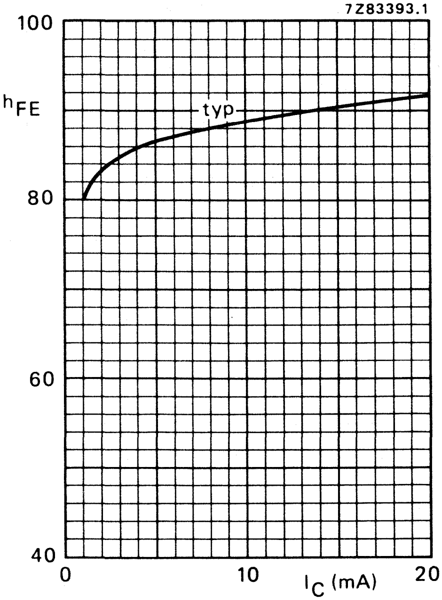


Fig. 4 V_{CE} = 10 V; T_j = 25 °C.

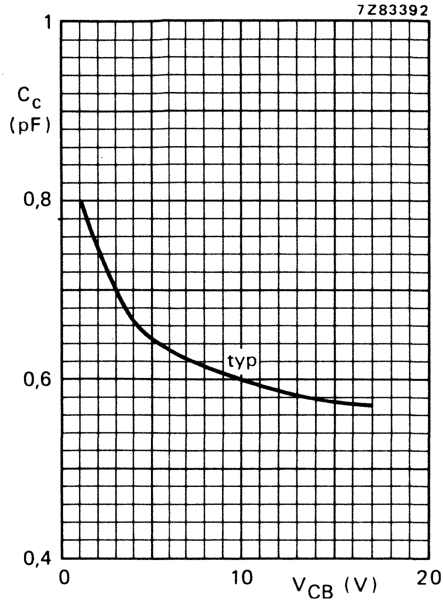


Fig. 5 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

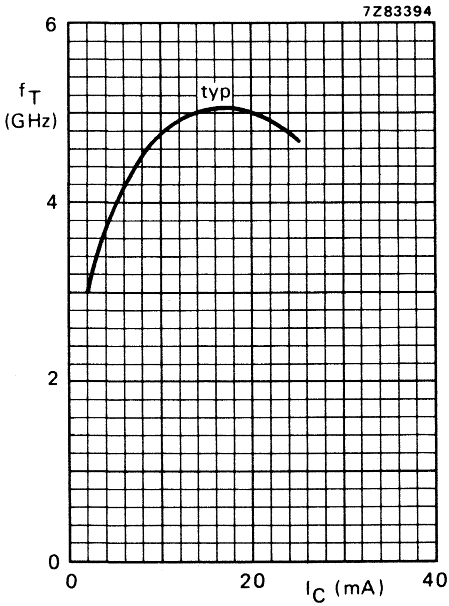


Fig. 6 V_{CE} = 10 V; f = 500 MHz; T_j = 25 °C.

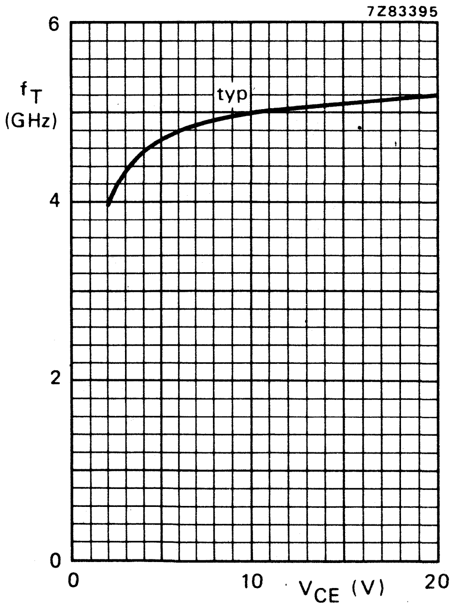


Fig. 7 I_C = 14 mA; f = 500 MHz; T_j = 25 °C.

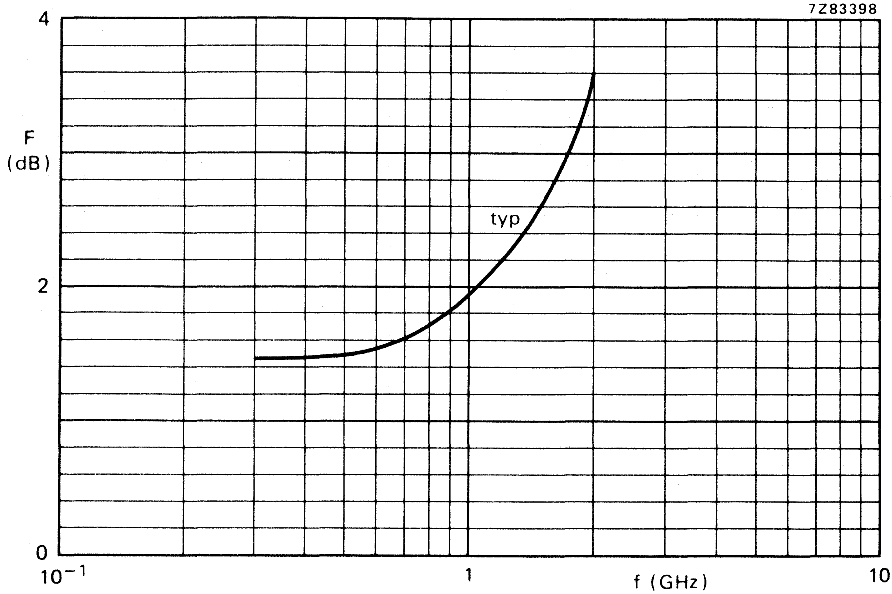


Fig. 8 V_{CE} = 10 V; I_C = 4 mA; Z_S = optimum; T_{amb} = 25 °C.

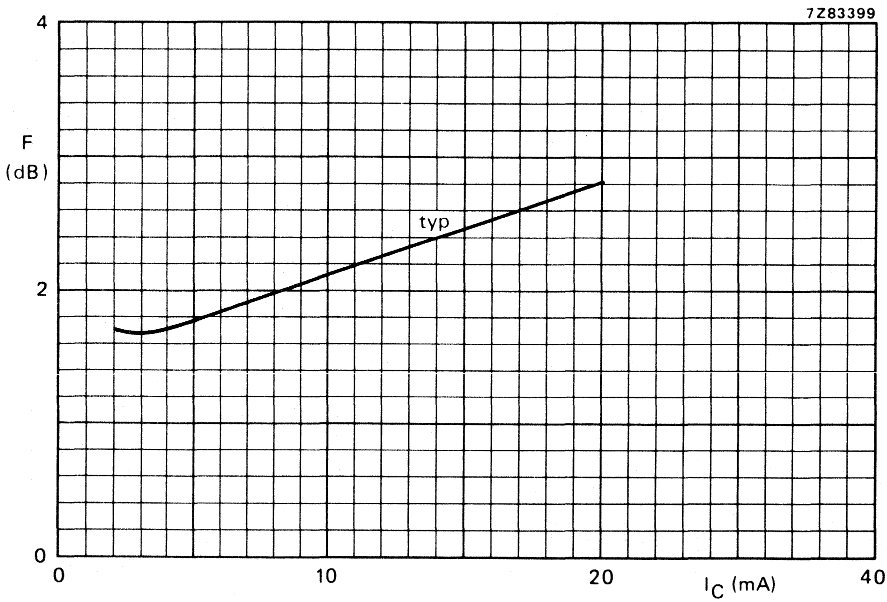


Fig. 9 V_{CE} = 10 V; f = 800 MHz; Z_S = optimum; T_{amb} = 25 °C.

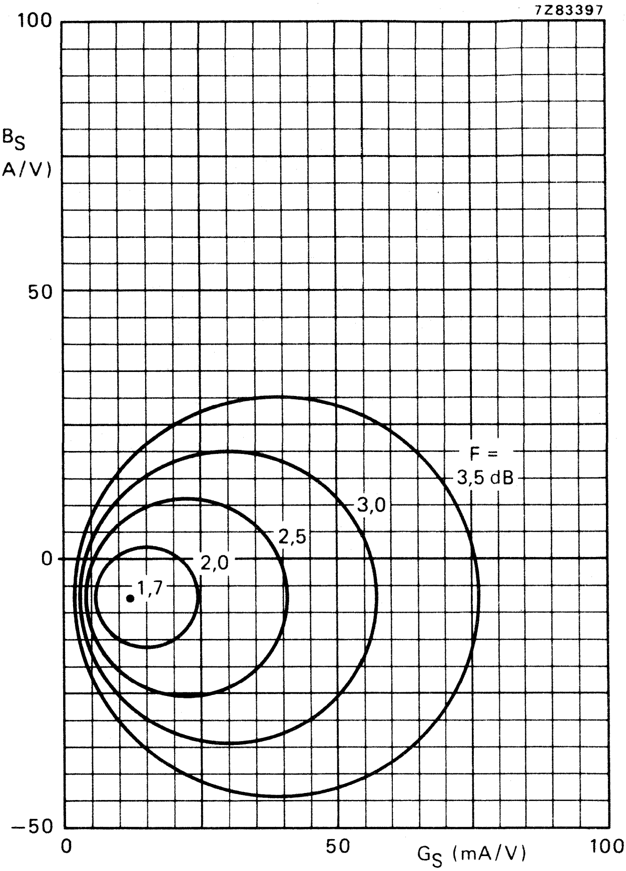


Fig. 10 Circles of constant noise figure.
V_{CE} = 10 V; I_C = 4 mA; f = 800 MHz; T_{amb} = 25 °C;
typical values.

Conditions for Figs 11 and 12:

V_{CE} = 10 V; I_C = 14 mA;
T_{amb} = 25 °C.

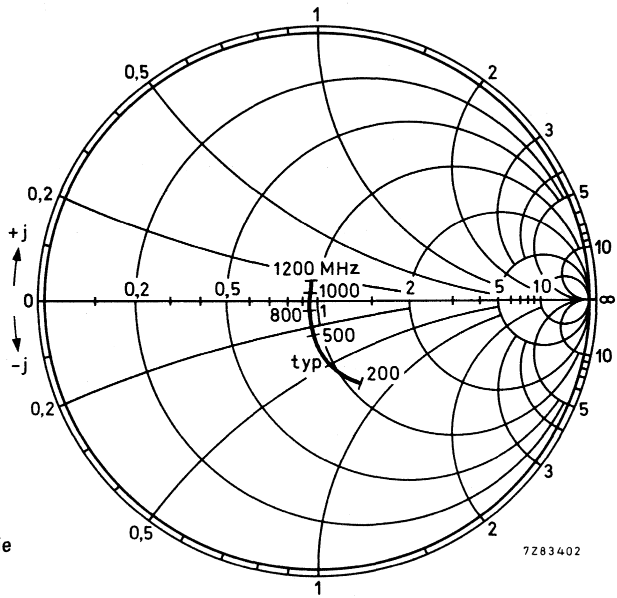


Fig. 11 Input impedance derived from input reflection coefficient s_{ie} co-ordinates in ohm x 50.

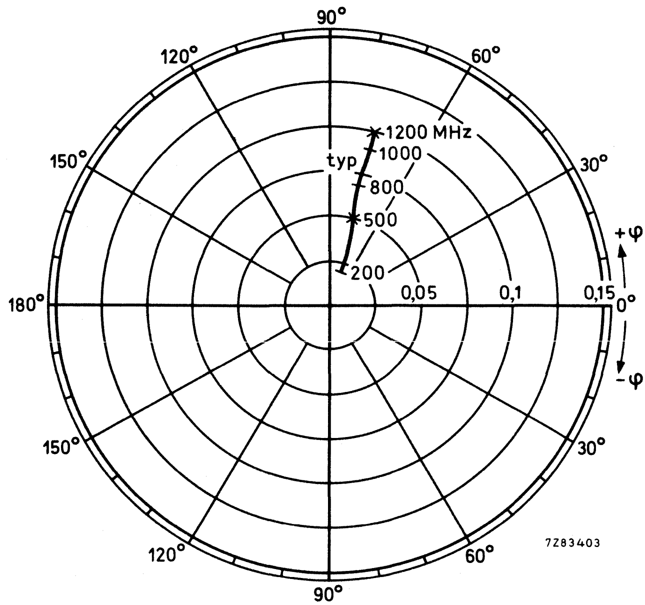


Fig. 12 Reverse transmission coefficient s_{re}.

Conditions for Figs 13 and 14:
V_{CE} = 10 V; I_C = 14 mA;
T_{amb} = 25 °C.

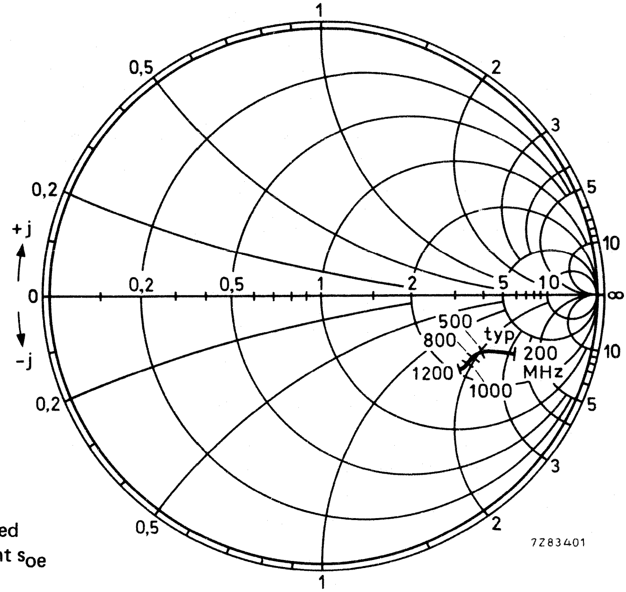


Fig. 13 Output impedance derived from output reflection coefficient s_{oe} co-ordinates in ohm x 50.

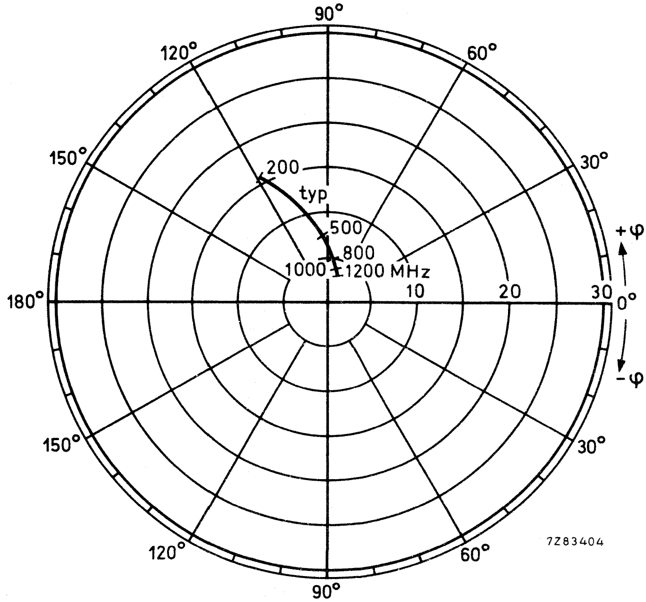


Fig. 14 Forward transmission coefficient s_{fe}.

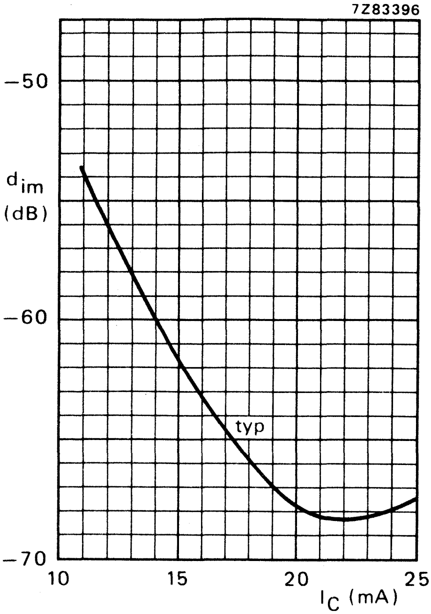


Fig. 15.

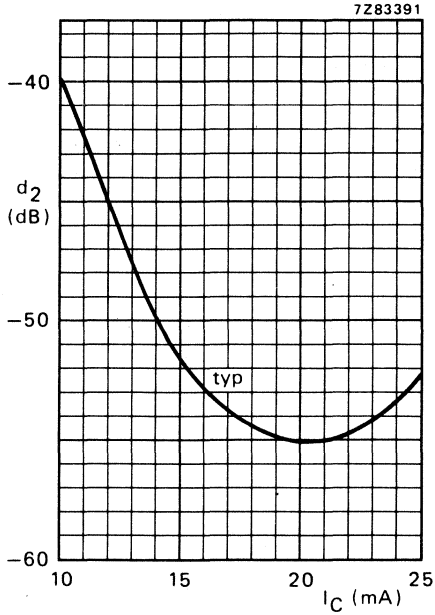


Fig. 16.

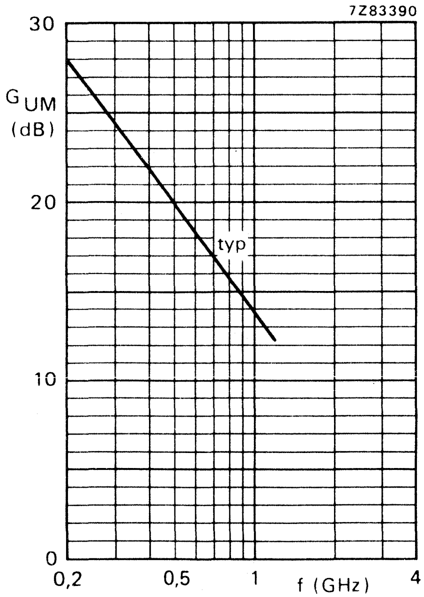


Fig. 17 V_{CE} = 10 V; I_C = 14 mA; T_{amb} = 25 °C.

Fig. 15 V_{CE} = 10 V; V_o = 43,5 dBmV = 150 mV; $f_{(p+q-r)}$ = 793,25 MHz; T_{amb} = 25 °C; measured in test circuit (see Fig. 3).

Fig. 16 V_{CE} = 10 V; V_o = 60 mV; $f_{(p+q)}$ = 810 MHz; T_{amb} = 25 °C; measured in test circuit (see Fig. 3).

CLASS-B OPERATION

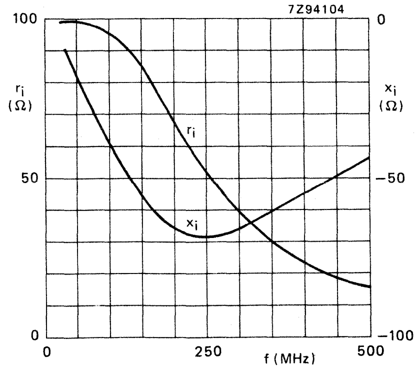


Fig. 18 Input impedance (series components).

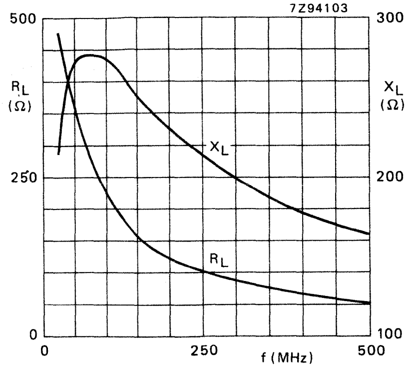


Fig. 19 Load impedance (series components).

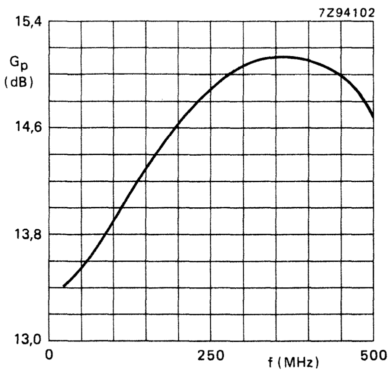


Fig. 20 Power gain versus frequency.

Conditions for Figs 18 to 20:

V_{CE} = 10 V; P_L = 100 mW; T_{amb} = 25 °C;

OPERATING NOTE for Figs 18 to 20:

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

SILICON PLANAR EPITAXIAL TRANSISTOR

N-P-N transistor in a subminiature plastic transfer-moulded T-package.
It is primarily intended for use in u.h.f. and microwave amplifiers such as in aerial amplifiers, radar systems, oscilloscopes, spectrum analysers etc.
The transistor features very low intermodulation distortion and high power gain; thanks to its very high transition frequency, it also has excellent wideband properties and low noise up to high frequencies.

QUICK REFERENCE DATA				
Collector-base voltage (open emitter)	V_{CBO}	max.	15	V
Collector-emitter voltage (open base)	V_{CEO}	max.	12	V
Collector current (d.c.)	I_C	max.	35	mA
Total power dissipation up to T_{amb} = 60 °C	P_{tot}	max.	180	mW
Junction temperature	T_j	max.	150	°C
Transition frequency at f = 500 MHz				
I_C = 30 mA; V_{CE} = 5 V	f_T	typ.	5	GHz
Feedback capacitance at f = 1 MHz				
I_C = 0; V_{CE} = 5 V; T_{amb} = 25 °C	C_{re}	typ.	0,8	pF
Noise figure at optimum source impedance				
I_C = 2 mA; V_{CE} = 5 V; f = 500 MHz; T_{amb} = 25 °C	F	typ.	1,9	dB
Max. unilateral power gain				
I_C = 30 mA; V_{CE} = 5 V; f = 500 MHz; T_{amb} = 25 °C	G_{UM}	typ.	18	dB
Intermodulation distortion at T_{amb} = 25 °C				
I_C = 30 mA; V_{CE} = 5 V; R_L = 75 Ω; V_o = 300 mV				
$f_{(p+q-r)}$ = 493,25 MHz	d_{im}	typ.	−60	dB

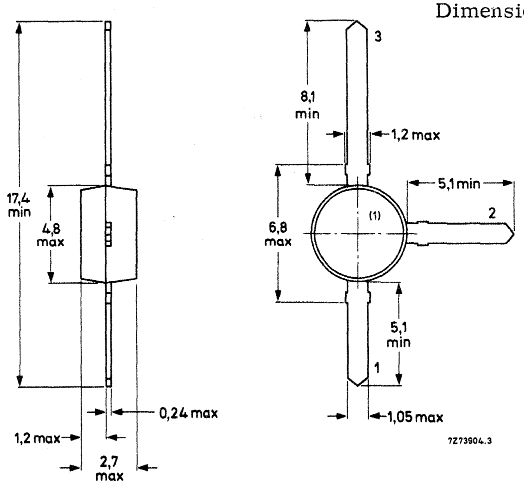
MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-37.

Connections

1. Base
2. Emitter
3. Collector



(1) = type number marking.

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

Voltages

Collector-base voltage (open emitter)	V_{CBO}	max.	15	V
Collector-emitter voltage (open base)	V_{CEO}	max.	12	V
Emitter-base voltage (open collector)	V_{EBO}	max.	2,0	V

Current

Collector current (d.c.)	I_C	max.	35	mA

Power dissipation

Total power dissipation up to T_{amb} = 60 °C	P_{tot}	max.	180	mW

Temperatures

Storage temperature	T_{stg}		−65 to +150	°C
Junction temperature	T_j	max.	150	°C

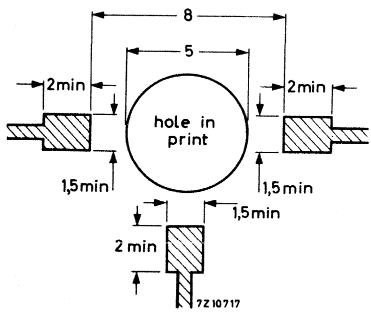
THERMAL RESISTANCE

From junction to ambient in free air

mounted on a glass-fibre print *) of 40 mm x 25 mm x 1 mm	$R_{th\ j-a}$	=	0,5	°C/mW

*) Requirements for glass-fibre print

(dimensions in mm)



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

Collector cut-off current				
$I_E = 0$; $V_{CB} = 5$ V	I_{CBO}	<	50	nA
D.C. current gain [1]				
$I_C = 30$ mA; $V_{CE} = 5$ V	h_{FE}	> typ.	40 90	
Transition frequency at f = 500 MHz [1]				
$I_C = 30$ mA; $V_{CE} = 5$ V	f_T	typ.	5	GHz
Collector capacitance at f = 1 MHz				
$I_E = I_e = 0$; $V_{CB} = 10$ V	C_c	typ.	0,7	pF
Emitter capacitance at f = 1 MHz				
$I_C = I_c = 0$; $V_{EB} = 0,5$ V	C_e	typ.	2,5	pF
Feedback capacitance at f = 1 MHz				
$I_C = 0$; $V_{CE} = 5$ V; $T_{amb} = 25\ ^oC$	C_{re}	typ.	0,8	pF
Noise figure at optimum source impedance				
$I_C = 2$ mA; $V_{CE} = 5$ V; f = 500 MHz; $T_{amb} = 25\ ^oC$	F	typ.	1,9	dB
Max. unilateral power gain (s_{re} assumed to be zero)				
G_{UM} (in dB) = $10 \log \dfrac{\lvert s_{fe}\rvert^2}{(1 - \lvert s_{ie}\rvert^2)(1 - \lvert s_{oe}\rvert^2)}$				
$I_C = 30$ mA; $V_{CE} = 5$ V; f = 500 MHz; $T_{amb} = 25\ ^oC$	G_{UM}	typ.	18	dB

[1]) Measured under pulse conditions.

CHARACTERISTICS (continued)

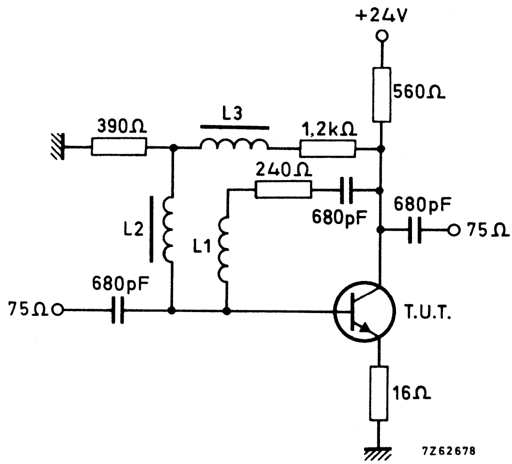
Intermodulation distortion at T_{amb} = 25 ^{o}C

I_C = 30 mA; V_{CE} = 5 V; R_L = 75 Ω; V.S.W.R. < 2

$V_p = V_o$ = 300 mV at f_p = 495,25 MHz
$V_q = V_o$ −6 dB at f_q = 503,25 MHz
$V_r = V_o$ −6 dB at f_r = 505,25 MHz

Measured at $f_{(p+q-r)}$ = 493,25 MHz	d_{im}	typ.	−60	dB

Intermodulation test circuit:



L1 = 4 turns Cu wire (0,35); winding pitch 1 mm; int. diam. 4 mm
L2 and L3 5 μH (code number: 3122 108 20150)

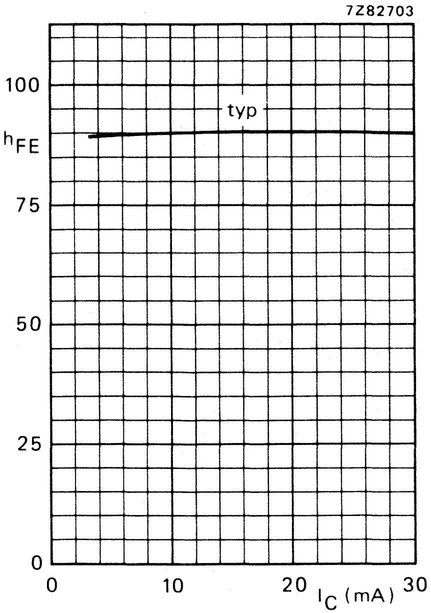
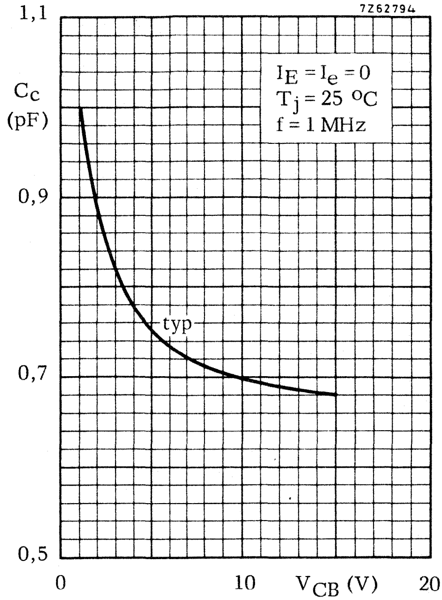
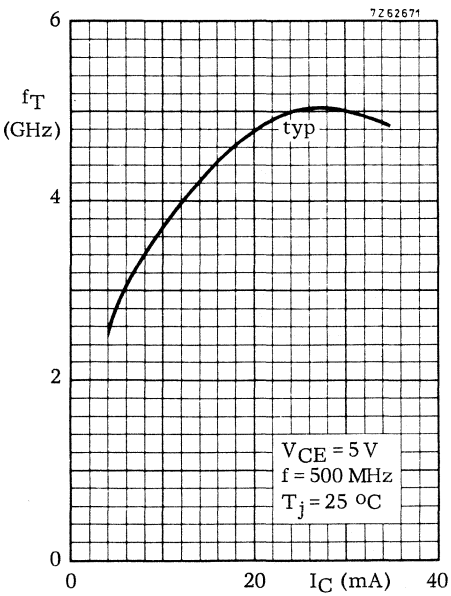
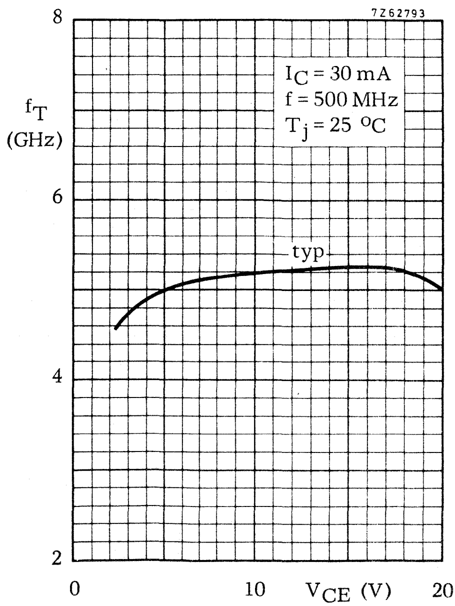
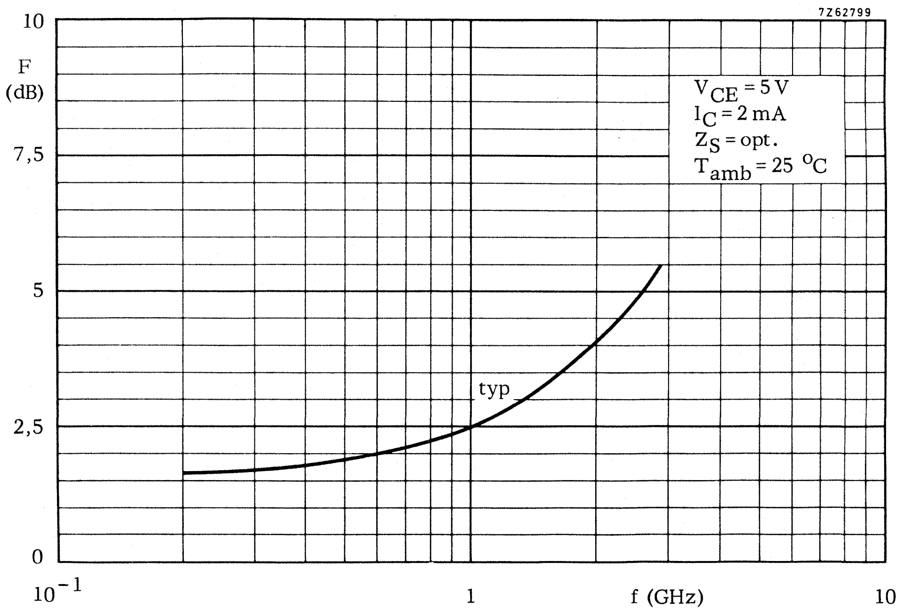


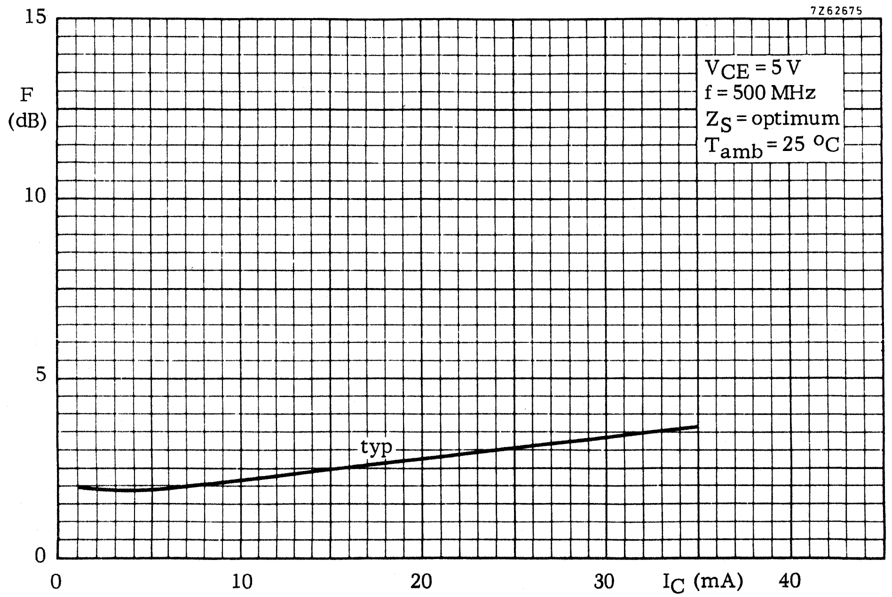
Fig. 4 V_{CE} = 5 V; T_j = 25 °C.








7Z62799
F
(dB)
10
7,5
5
2,5
0
V_{CE} = 5 V
I_C = 2 mA
Z_S = opt.
T_{amb} = 25 °C
typ
10^{-1}
1
f (GHz)
10


7Z62675
F
(dB)
15
10
5
0
V_{CE} = 5 V
f = 500 MHz
Z_S = optimum
T_{amb} = 25 °C
typ
0
10
20
30
I_C (mA)
40

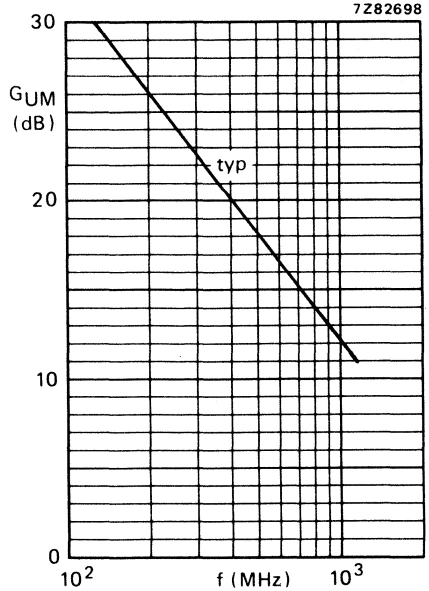
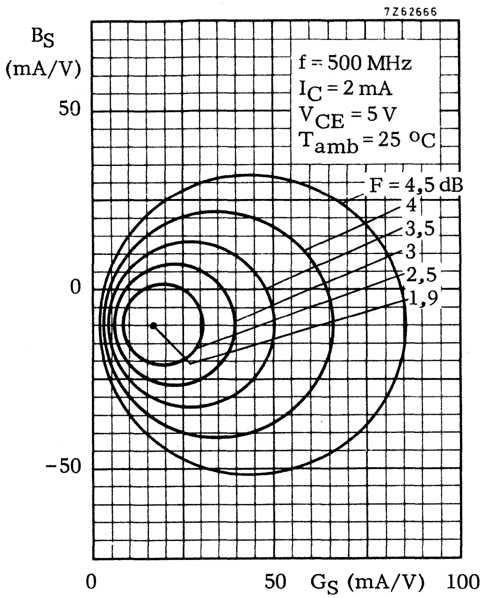


Fig. 10 V_{CE} = 5 V; I_C = 30 mA; T_{amb} = 25 °C.

circles of constant noise figure



SILICON PLANAR EPITAXIAL TRANSISTOR

N-P-N transistor in a subminiature plastic transfer-moulded T-package primarily intended for use in u.h.f. and microwave amplifiers.

Features of this product:

- low noise;
- very low intermodulation distortion;
- high power gain;
- gold metallization.

QUICK REFERENCE DATA

Collector-base voltage (open emitter)	V_{CBO}	max.	15	V
Collector-emitter voltage (open base)	V_{CEO}	max.	12	V
Collector current (d.c.)	I_C	max.	35	mA
Total power dissipation up to T_{amb} = 60 °C	P_{tot}	max.	300	mW
Junction temperature	T_j	max.	150	°C
Transition frequency at f = 500 MHz I_C = 30 mA; V_{CE} = 5 V	f_T	typ.	6	GHz
Feedback capacitance at f = 1 MHz I_C = 0; V_{CE} = 5 V; T_{amb} = 25 °C	C_{re}	typ.	0,6	pF
Noise figure at optimum source impedance I_C = 4 mA; V_{CE} = 8 V; f = 800 MHz	F	typ.	1,6	dB
Maximum unilateral power gain I_C = 30 mA; V_{CE} = 8 V; f = 800 MHz; T_{amb} = 25 °C	G_{UM}	typ.	14	dB
Output voltage at d_{im} = −60 dB (see Fig. 3) I_C = 30 mA; V_{CE} = 8 V; R_L = 75 Ω; T_{amb} = 25 °C $f_{(p+q-r)}$ = 793,25 MHz	V_o	typ.	425	mV
Output power at 1 dB gain compression	P_{L1}	typ.	+ 17	dBm ←
Third order intercept point	ITO	typ.	+ 36	dBm ←

MECHANICAL DATA

SOT-37 (see Fig. 1).

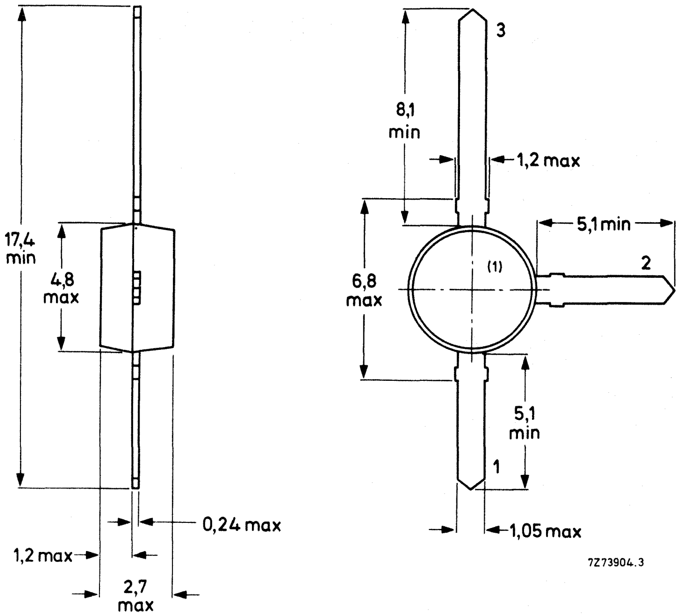
MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-37.

Connections

1. Base
2. Emitter
3. Collector



(1) = type number marking.

RATINGS

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

Collector-base voltage (open emitter)	V_{CBO}	max.	15	V
Collector-emitter voltage (open base)	V_{CEO}	max.	12	V
Emitter-base voltage (open collector)	V_{EBO}	max.	2,0	V
Collector current (d.c.)	I_C	max.	35	mA
Total power dissipation up to T_{amb} = 60 °C	P_{tot}	max.	300	mW
Storage temperature	T_{stg}	−65 to +	150	°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

From junction to ambient in free air mounted on a fibre-glass print (see Fig. 2) of 40 mm x 25 mm x 1 mm $R_{th\ j\text{-}a}$ = 300 K/W

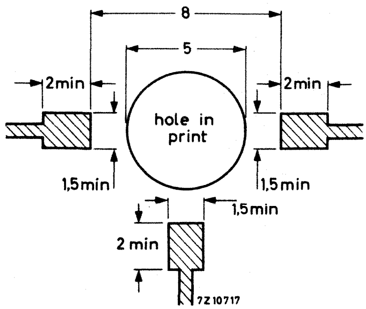


Fig. 2 Requirements for fibre-glass print. (Dimensions in mm.)

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current $I_E = 0$; $V_{CB} = 5$ V	I_{CBO}	<	50 nA
D.C. current gain* $I_C = 30$ mA; $V_{CE} = 5$ V	h_{FE}	> typ.	40 90
Transition frequency at f = 500 MHz* $I_C = 30$ mA; $V_{CE} = 5$ V	f_T	typ.	6 GHz
Collector capacitance at f = 1 MHz $I_E = I_e = 0$; $V_{CB} = 5$ V	C_c	typ.	0,9 pF
Emitter capacitance at f = 1 MHz $I_C = I_c = 0$; $V_{EB} = 0{,}5$ V	C_e	typ.	2,5 pF
Feedback capacitance at f = 1 MHz $I_C = 0$; $V_{CE} = 5$ V; $T_{amb} = 25$ °C	C_{re}	typ.	0,6 pF
Noise figure at optimum source impedance $I_C = 4$ mA; $V_{CE} = 8$ V; f = 800 MHz $I_C = 30$ mA; $V_{CE} = 8$ V; f = 800 MHz	F F	typ. typ.	1,6 dB 2,3 dB

Maximum unilateral power gain (s_{re} assumed to be zero)

$$G_{UM} \text{ (in dB)} = 10 \log \frac{|s_{fe}|^2}{(1-|s_{ie}|^2)\,(1-|s_{oe}|^2)}$$

$I_C = 30$ mA; $V_{CE} = 8$ V; f = 800 MHz; $T_{amb} = 25$ °C	G_{UM}	typ.	14 dB

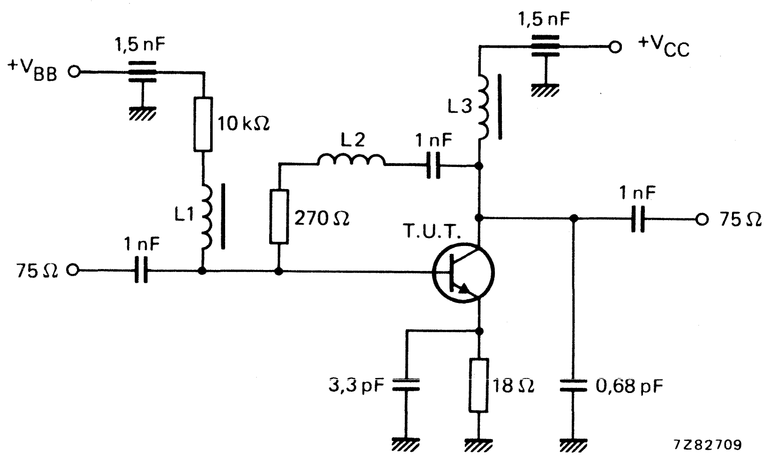
* Measured under pulse conditions.

Output voltage at d_{im} = −60 dB (see Figs 3 and 14)
(DIN 45004B, par. 6.3: 3-tone)
I_C = 30 mA; V_{CE} = 8 V; R_L = 75 Ω; T_{amb} = 25 °C
$V_p = V_o$ at d_{im} = −60 dB; f_p = 795,25 MHz
$V_q = V_o$ −6 dB ; f_q = 803,25 MHz
$V_r = V_o$ −6 dB ; f_r = 805,25 MHz
Measured at $f_{(p+q-r)}$ = 793,25 MHz — V_o typ. 425 mV

Output voltage at d_2 = −50 dB (see Figs 3 and 15)
I_C = 30 mA; V_{CE} = 8 V; R_L = 75 Ω; T_{amb} = 25 °C
$V_p = V_o$ at d_2 = −50 dB; f_p = 250 MHz
$V_q = V_o$ at d_2 = −50 dB; f_q = 560 MHz
measured at $f_{(p+q)}$ = 810 MHz — V_o typ. 200 mV

→ Output power at 1 dB gain compression (see Fig. 3)
I_C = 30 mA; V_{CE} = 8V
R_L = 75 Ω; T_{amb} = 25 °C — P_{L1} typ. + 17 dBm
measured at f = 800 MHz

→ Third order intercept point (see Fig. 3)
I_C = 30 mA; V_{CE} = 8 V
R_L = 75 Ω; T_{amb} = 25 °C
P_P = ITO − 6 dB; f_p = 800 MHz
P_q = ITO − 6 dB; f_q = 801 MHz
measured at $f_{(2q-p)}$ = 802 MHz and
at $f_{(2p-q)}$ = 799 MHz — ITO typ. + 36 dBm



→ Fig. 3 Intermodulation distortion and second harmonic distortion test circuit.

L1 = L3 = 5 μH micro choke
L2 = 3 turns Cu wire (0,4 mm); internal diameter 3 mm; winding pitch 1 mm

s-parameters (common emitter) at V_{CE} = 8 V.

The figures given in the tables below can also be used for operation at V_{CE} = 5 V. Only slight differences for the s-parameters may occur.

I_C mA	f MHz	s_{ie}	s_{re}	s_{fe}	s_{oe}
2	40	0,89/ −12,9°	0,01/75°	9,5/166°	0,97/ −6,1°
	100	0,85/ −30,7°	0,03/70,6°	8,7/155°	0,94/−13,5°
	200	0,75/ −57,1°	0,05/61,5°	7,4/138°	0,87/−22,5°
	500	0,48/−113°	0,08/50,9°	4,4/106°	0,72/−34,2°
	800	0,37/−153°	0,09/51,9°	3,0/ 86,3°	0,64/−40,0°
	1000	0,34/−178°	0,10/55,0°	2,6/ 77,0°	0,61/−47,8°
	1200	0,34/+ 159°	0,11/58,5°	2,2/ 68,0°	0,58/−53,9°
5	40	0,79/ −18,4°	0,01/74°	17,8/162°	0,94/ −9,1°
	100	0,71/ −42,1°	0,03/67,1°	15,2/146°	0,87/−19,5°
	200	0,57/ −72,8°	0,04/60,0°	11,5/126°	0,75/−28,7°
	500	0,31/−127°	0,07/60,1°	5,8/ 98,2°	0,59/−36,1°
	800	0,25/−168°	0,09/63,6°	3,8/ 82,0°	0,54/−41,0°
	1000	0,25/+ 165°	0,11/65,2°	3,2/ 74,4°	0,51/−46,7°
	1200	0,26/+ 141°	0,13/66,1°	2,7/ 66,7°	0,49/−52,2°
10	40	0,67/ −25,3°	0,01/71°	27,9/156°	0,90/−12,8°
	100	0,55/ −55,1°	0,02/65,1°	21,8/136°	0,78/−25,6°
	200	0,40/ −88,2°	0,04/62,4°	14,7/116°	0,62/−33,4°
	500	0,20/−141°	0,06/68,3°	6,7/ 93,0°	0,51/−35,9°
	800	0,16/+ 177°	0,09/70,0°	4,3/ 79,3°	0,48/−40,3°
	1000	0,18/+ 151°	0,12/69,7°	3,5/ 72,5°	0,46/−44,2°
	1200	0,21/+ 130°	0,14/68,9°	3,0/ 65,1°	0,43/−50,7°
20	40	0,51/ −34,7°	0,01/69°	39,7/149°	0,84/−17,4°
	100	0,38/ −70,5°	0,02/65,8°	27,7/126°	0,66/−29,5°
	200	0,26/−104°	0,03/68,0°	16,8/109°	0,51/−32,5°
	500	0,16/−158°	0,06/74,0°	7,3/ 89,3°	0,45/−33,4°
	800	0,14/+ 155°	0,10/73,6°	4,6/ 77,5°	0,42/−39,1°
	1000	0,17/+ 133°	0,12/72,3°	3,8/ 71,2°	0,41/−43,6°
	1200	0,21/+ 115°	0,14/70,5°	3,2/ 64,4°	0,39/−51,0°
30	40	0,46/ −36,5°	0,01/73°	43,3/150°	0,87/−16,9°
	100	0,32/ −73,7°	0,02/69,2°	29,1/124°	0,66/−27,2°
	200	0,20/−109°	0,03/72,0°	17,1/106°	0,50/−28,1°
	500	0,14/−174°	0,06/75,6°	7,4/ 87,2°	0,41/−31,7°
	800	0,15/+ 143°	0,10/74,7°	4,8/ 74,9°	0,39/−41,0°
	1000	0,17/+ 124°	0,12/72,9°	3,9/ 70,5°	0,38/−42,8°
	1200	0,21/+ 111°	0,15/71,0°	3,3/ 63,8°	0,37/−51,0°

Conditions for Figs 4 and 5:
V_{CE} = 8 V; I_C = 30 mA;
T_{amb} = 25 °C.

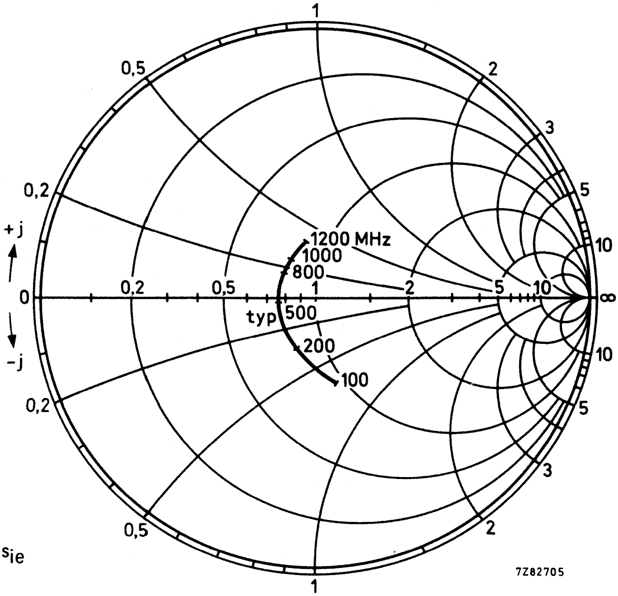


Fig. 4 Input impedance derived from input reflection coefficient s_{ie} co-ordinates in ohm x 50.

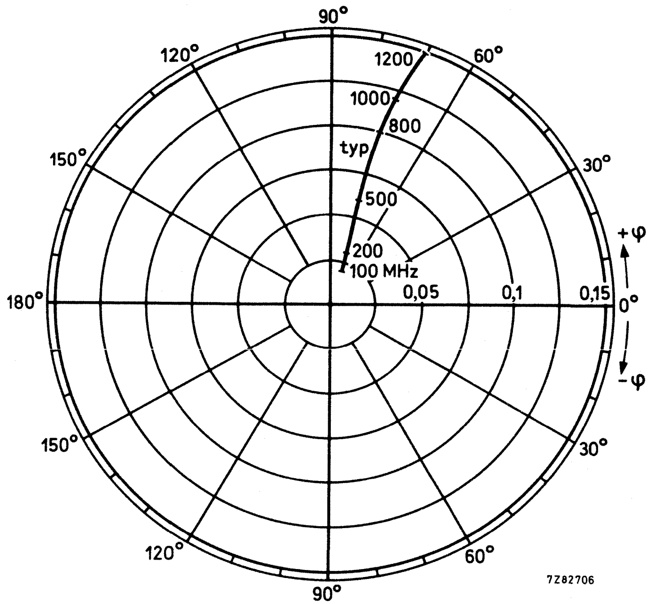


Fig. 5 Reverse transmission coefficient s_{re}.

Conditions for Figs 6 and 7:
V_{CE} = 8 V; I_C = 30 mA;
T_{amb} = 25 °C.

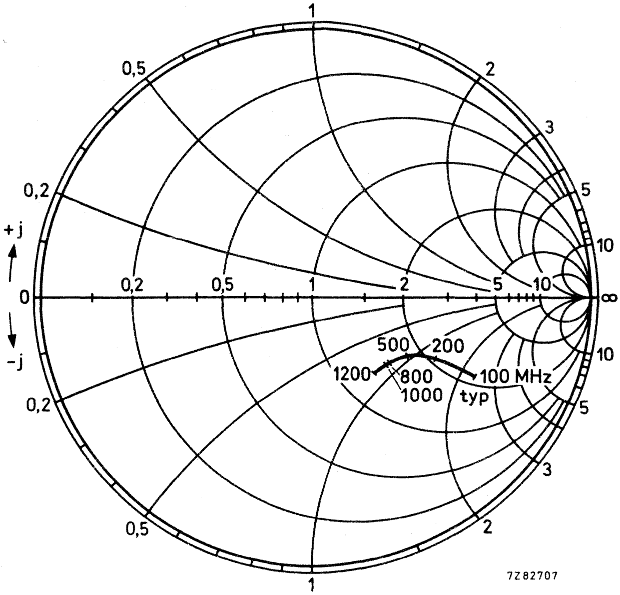


Fig. 6 Output impedance derived from output reflection coefficient s_{oe} co-ordinates in ohm x 50.

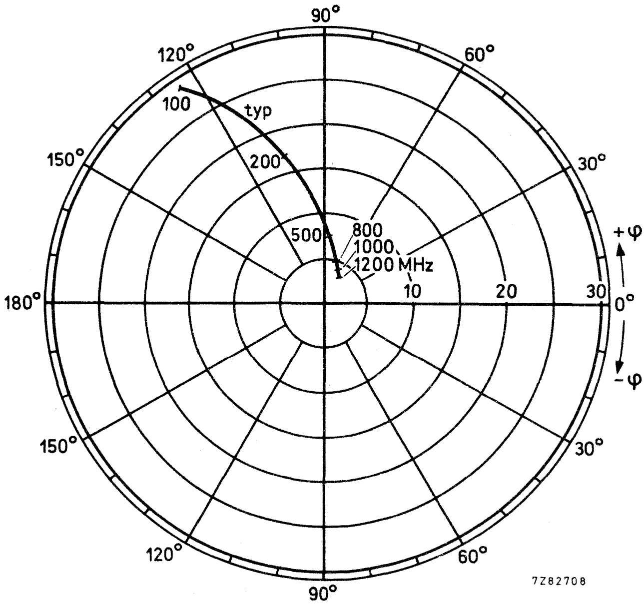


Fig. 7 Forward transmission coefficient s_{fe}.

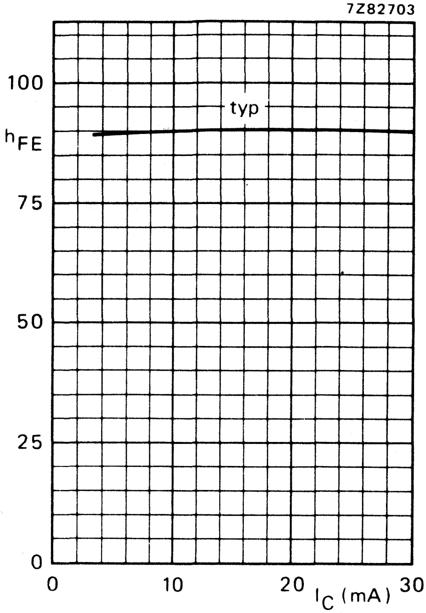


Fig. 8 V_{CE} = 5 V; T_j = 25 °C.

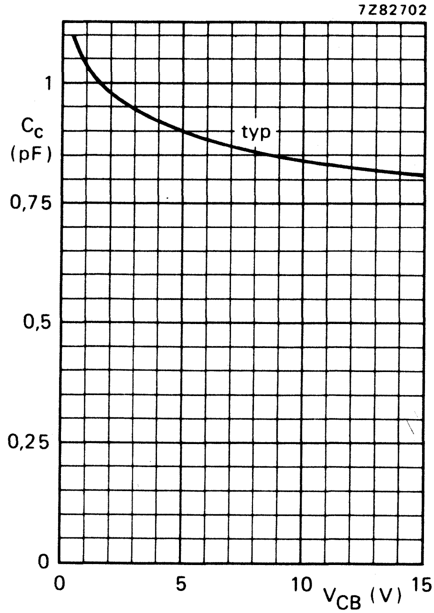


Fig. 9 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

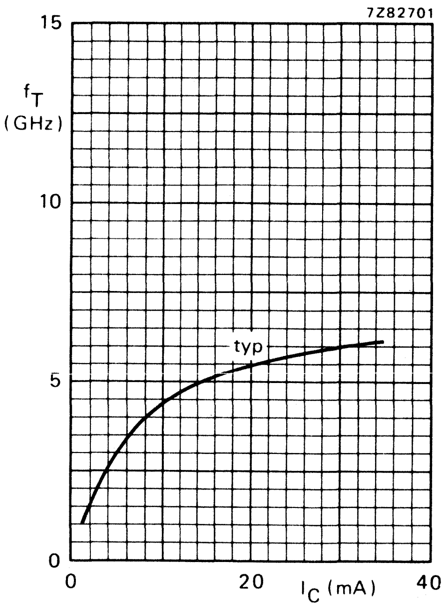


Fig. 10 V_{CE} = 5 V; f = 500 MHz; T_j = 25 °C.

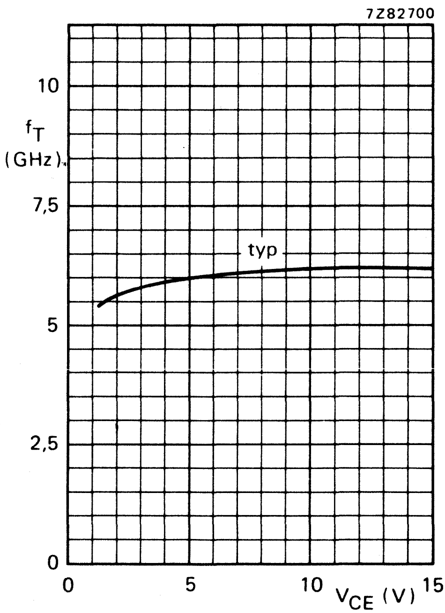


Fig. 11 I_C = 30 mA; f = 500 MHz; T_j = 25 °C.

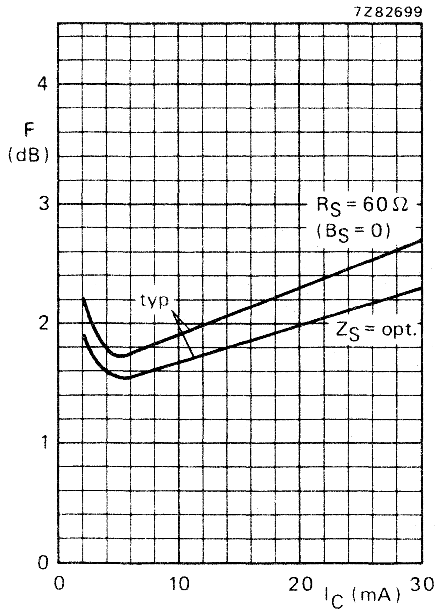


Fig. 12 V_{CE} = 8 V; f = 800 MHz; T_{amb} = 25 °C.

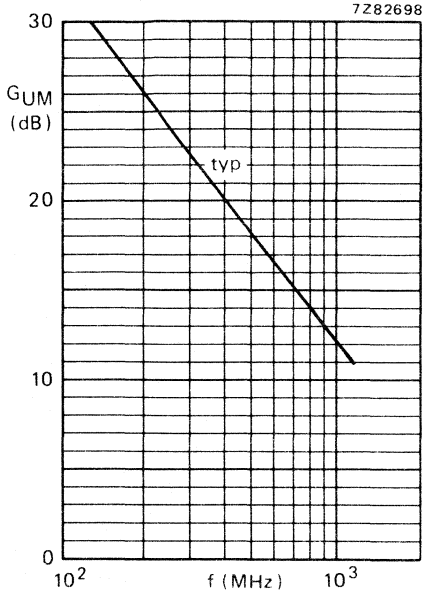


Fig. 13 V_{CE} = 8 V; I_C = 30 mA; T_{amb} = 25 °C.

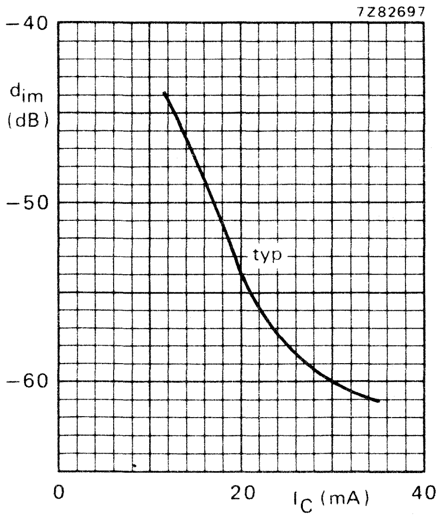


Fig. 14 V_{CE} = 8 V; V_o = 425 mV = 52,6 dBmV; $f_{(p+q-r)}$ = 793,25 MHz; T_{amb} = 25 °C; measured in test circuit (see Fig. 3).

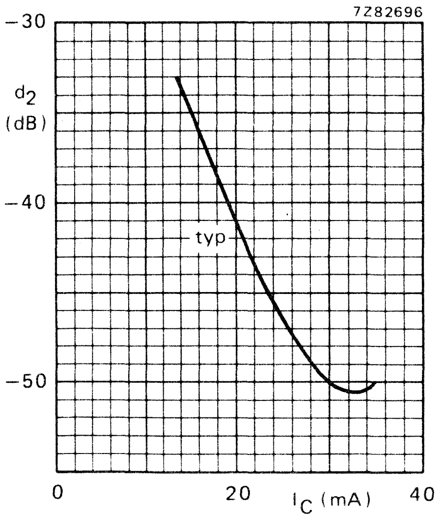


Fig. 15 V_{CE} = 8 V; V_o = 200 mV = 46 dBmV; $f_{(p+q)}$ = 810 MHz; T_{amb} = 25 °C; measured in test circuit (see Fig. 3).

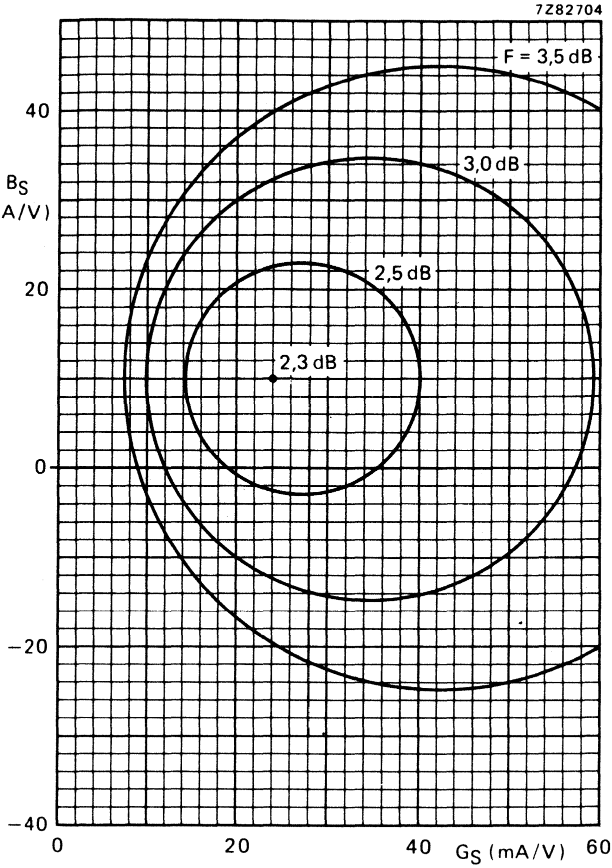


Fig. 16 Circles of constant noise figure.
V_{CE} = 8 V; I_C = 30 mA; f = 800 MHz;
T_{amb} = 25 °C; typical values.

CLASS-B OPERATION

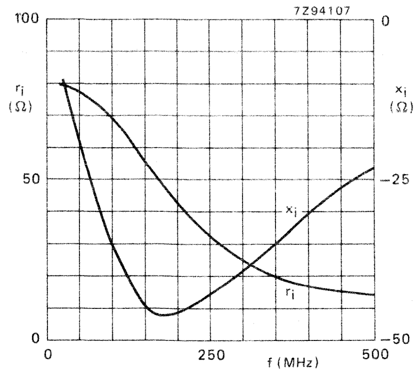


Fig. 17 Input impedance (series components).

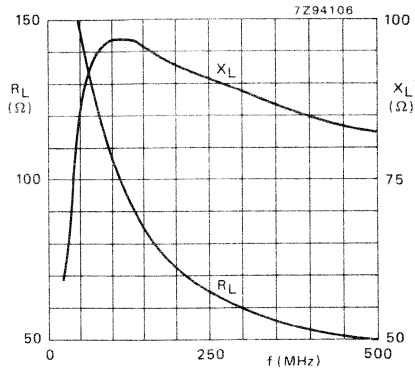


Fig. 18 Load impedance (series components).

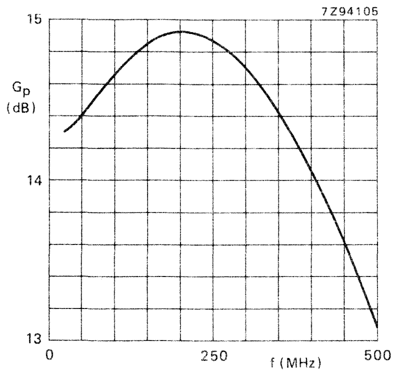


Fig. 19 Power gain versus frequency.

Conditions for Figs 17 to 19:

V_{CE} = 7,5 V; P_L = 160 mW; T_{amb} = 25 °C;

OPERATING NOTE for Figs 17 to 19:

A base-emitter resistor of 82 Ω is recommended to avoid oscillation. This resistor must be effective for r.f. only.

SILICON PLANAR EPITAXIAL TRANSISTOR

N-P-N resistance-stabilized transistor in a SOT-48 capstan envelope featuring extremely low cross modulation, intermodulation and second harmonic distortion. Thanks to its high transition frequency it has a high power gain in conjunction with good wideband properties and low noise up to high frequencies.

It is primarily intended for CATV and MATV applications.

QUICK REFERENCE DATA

Collector-base voltage (open emitter)	V_{CBO}	max.	30	V
Collector-emitter voltage (open base)	V_{CEO}	max.	25	V
Collector current (d.c.)	I_C	max.	150	mA
Total power dissipation up to T_h = 145 °C; f > 1 MHz	P_{tot}	max.	3,5	W
Junction temperature	T_j	max.	200	°C
Transition frequency at f = 500 MHz I_C = 90 mA; V_{CE} = 20 V	f_T	typ.	3,5	GHz
Cross modulation distortion (channel 13) I_C = 90 mA; V_{CE} = 20 V; V_o = 48 dBmV	d_{cm}	typ. <	−61 −57	dB dB
I_C = 90 mA; V_{CE} = 20 V; V_o = 32 dBmV	d_{cm}	typ. <	−93 −89	dB dB
Intermodulation distortion at $f_{(p+q-r)}$ = 194,25 MHz I_C = 90 mA; V_{CE} = 20 V; V_o = 60 dBmV	d_{im}	typ.	−63	dB
Broadband power gain I_C = 90 mA; V_{CE} = 20 V	G_p	> typ.	10 11	dB dB
Noise figure at f = 200 MHz I_C = 90 mA; V_{CE} = 20 V	F	typ. <	8 10	dB dB
2nd harmonic distortion at $f_p + f_q$ = 210 MHz I_C = 90 mA; V_{CE} = 20 V; V_o = 48 dBmV	d_2	<	−56	dB

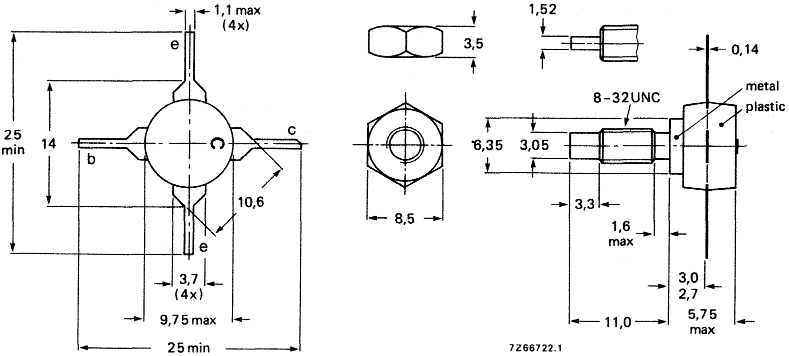
MECHANICAL DATA (see next page)

PRODUCT SAFETY. 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

SOT-48



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

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, 17 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)	V_{CBO}	max.	30	V
Collector-emitter voltage (R_{BE} = 10 Ω)	V_{CER}	max.	35	V
Collector-emitter voltage (open base)	V_{CEO}	max.	25	V
Emitter-base voltage (open collector)	V_{EBO}	max.	3	V

Currents

Collector current (d.c.)	I_C	max.	150	mA
Collector current (peak value); f > 1 MHz	I_{CM}	max.	300	mA

Power dissipation

Total power dissipation (d.c.) up to T_h = 160 °C	P_{tot}	max.	2, 5	W
Total power dissipation up to T_h = 145 °C; f > 1 MHz	P_{tot}	max.	3, 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	$R_{th\ j-mb}$	=	15	°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					
$I_E = 0$; $V_{CB} = 20$ V	I_{CBO}	<	50	μA	
D.C. current gain					
$I_C = 50$ mA; $V_{CE} = 20$ V	h_{FE}	>	30		1)
$I_C = 150$ mA; $V_{CE} = 20$ V	h_{FE}	>	30		1)
Transition frequency at f = 500 MHz					
$I_C = 90$ mA; $V_{CE} = 20$ V	f_T	typ.	3,5	GHz	1)
$I_C = 150$ mA; $V_{CE} = 20$ V	f_T	typ.	3,5	GHz	1)
Collector capacitance at f = 1 MHz					
$I_E = I_e = 0$; $V_{CB} = 20$ V	C_c	typ.	3,5	pF	
Emitter capacitance at f = 1 MHz					
$I_C = I_c = 0$; $V_{EB} = 0,5$ V	C_e	typ.	12	pF	
Feedback capacitance at f = 1 MHz					
$I_C = 10$ mA; $V_{CE} = 20$ V	C_{re}	typ.	1,3	pF	
Collector-stud capacitance at f = 1 MHz	C_{cs}	typ.	2	pF	
Noise figure at optimum source impedance					
$I_C = 90$ mA; $V_{CE} = 20$ V; f = 500 MHz; $T_{amb} = 25$ °C	F	typ.	5	dB	1)

Max. unilateral power gain (s_{re} assumed to be zero)

$$G_{UM} \text{ (in dB)} = 10 \log \frac{|s_{fe}|^2}{(1 - |s_{ie}|^2)(1 - |s_{oe}|^2)}$$

$I_C = 90$ mA; $V_{CE} = 20$ V; f = 500 MHz; $T_{amb} = 25$ °C	G_{UM}	typ.	13,5	dB	

1) Measured under pulse conditions.

CHARACTERISTICS (continued)

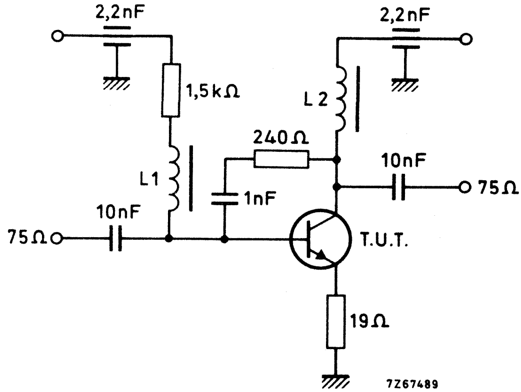
Intermodulation distortion at T_{amb} = 25 °C

I_C = 90 mA; V_{CE} = 20 V; R_L = 75 Ω

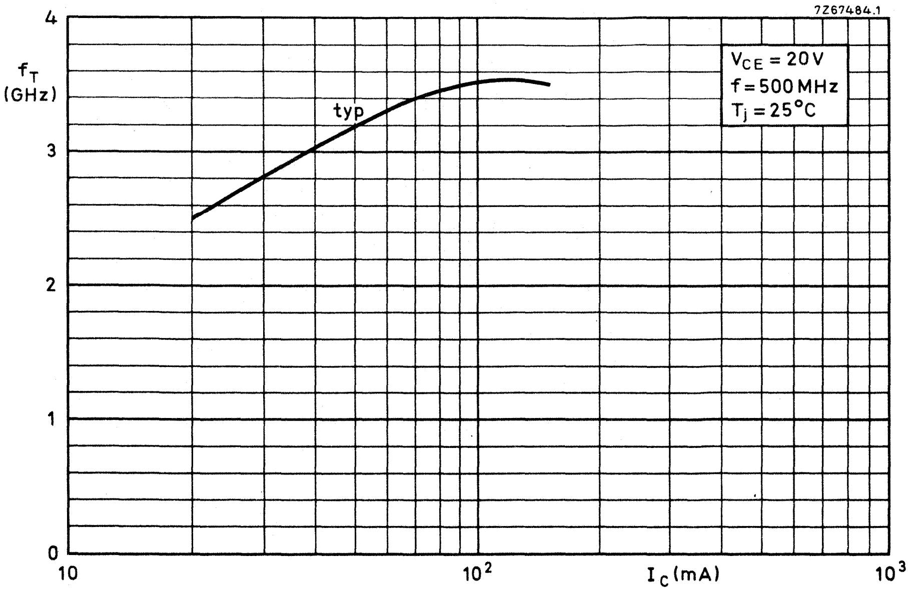
$V_p = V_o$ = 700 mV at f_p = 495, 25 MHz
$V_q = V_o$ −6 dB at f_q = 503, 25 MHz
$V_r = V_o$ −6 dB at f_r = 505, 25 MHz

Measured at $f_{(p+q-r)}$ = 493, 25 MHz | d_{im} typ. −60 dB

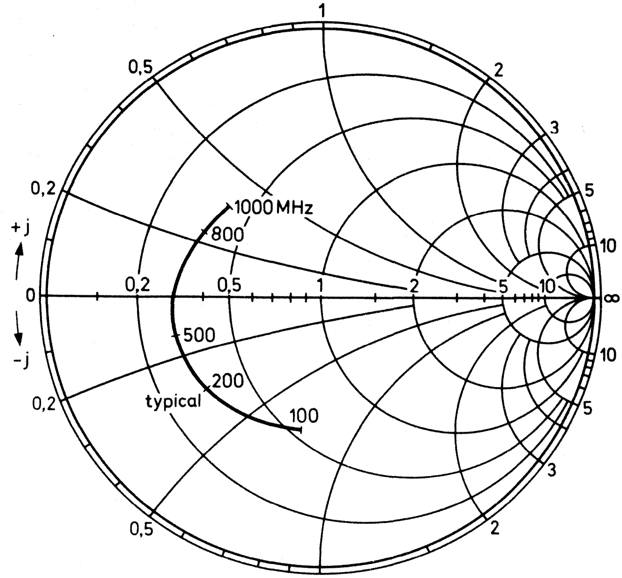
MATV test circuit



L1 = L2 = 5 μH ferroxcube coil (code number: 3122 108 20153)

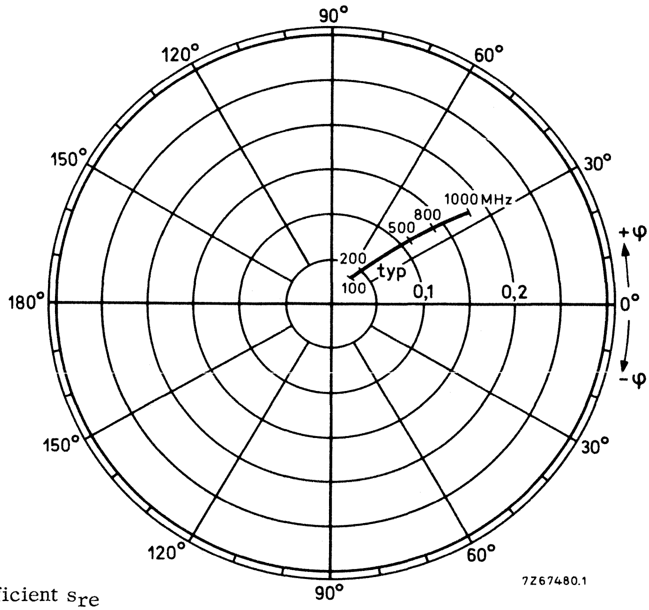

7Z67484.1
f_T (GHz)
4
3
2
1
0
typ
V_{CE} = 20 V
f = 500 MHz
T_j = 25 °C
10
10^2
I_C (mA)
10^3

V_{CE} = 20 V
I_C = 90 mA
T_{amb} = 25 °C



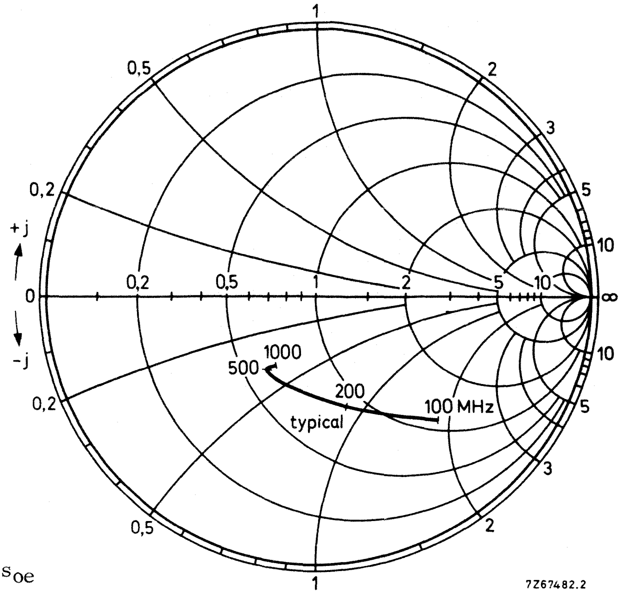
Input reflection coefficient s_{ie}

V_{CE} = 20 V
I_C = 90 mA
T_{amb} = 25 °C



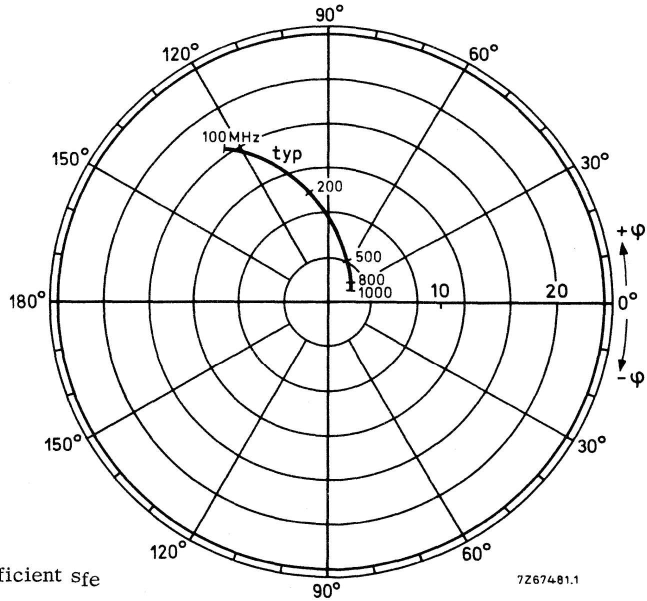
Reverse transmission coefficient s_{re}

V_{CE} = 20 V
I_C = 90 mA
T_{amb} = 25 °C



Output reflection coefficient s_{oe}

V_{CE} = 20 V
I_C = 90 mA
T_{amb} = 25 °C



Forward transmission coefficient s_{fe}

APPLICATION INFORMATION

T_{amb} = 25 °C unless otherwise specified

Cross modulation distortion (channel 13) [1])

I_C = 90 mA; V_{CE} = 20 V; V_o = 48 dBmV	d_{cm}	typ.	−61	dB
		<	−57	dB
I_C = 90 mA; V_{CE} = 20 V; V_o = 32 dBmV	d_{cm}	typ.	−93	dB
		<	−89	dB

Intermodulation distortion

I_C = 90 mA; V_{CE} = 20 V; R_L = 75 Ω

$V_p = V_o$ = 60 dBmV at f_p = 196,25 MHz
$V_q = V_o$ −6 dB at f_q = 203,25 MHz
$V_r = V_o$ −6 dB at f_r = 205,25 MHz

Measured at $f_{(p+q-r)}$ = 194,25 MHz	d_{im}	typ.	−63	dB

Broadband power gain

I_C = 90 mA; V_{CE} = 20 V	G_p	>	10	dB
		typ.	11	dB

Noise figure

I_C = 90 mA; V_{CE} = 20 V; f = 200 MHz	F	typ.	8	dB
		<	10	dB

2nd harmonic distortion

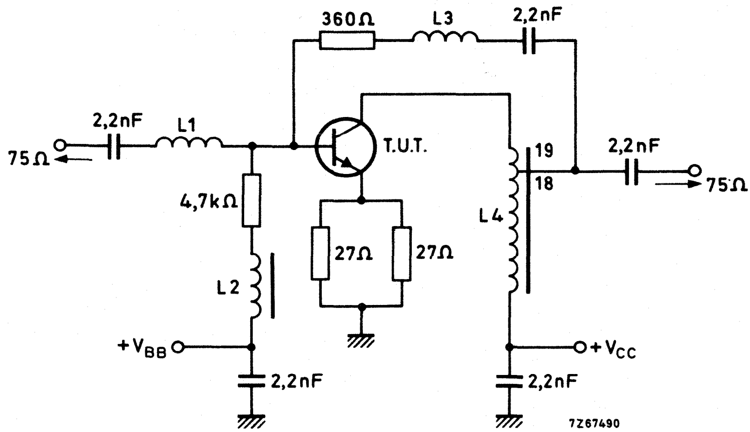
I_C = 90 mA; V_{CE} = 20 V

f_p = 66 MHz; f_q = 144 MHz; $f_p + f_q$ = 210 MHz; V_o = 48 dBmV	d_2	<	−56	dB

1) In 12-channel measuring equipment; channel 13 unmodulated.
V_o = output level/signal, according to NCTA measuring standard.

APPLICATION INFORMATION (continued)

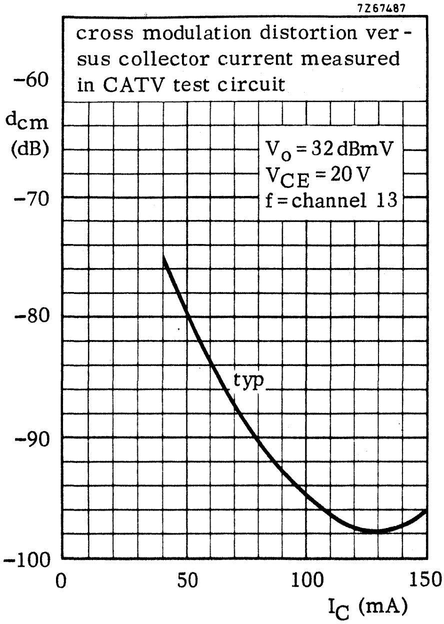
CATV test circuit

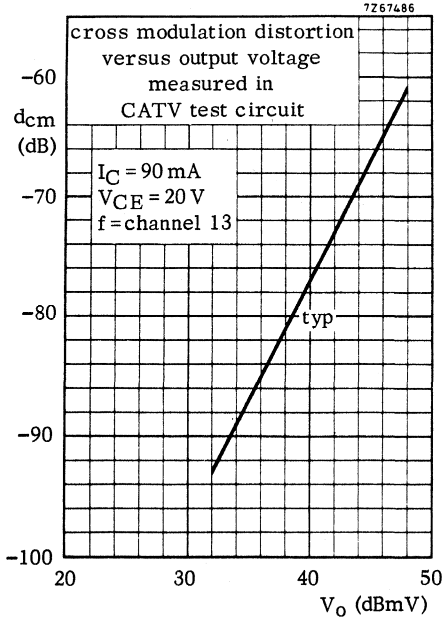


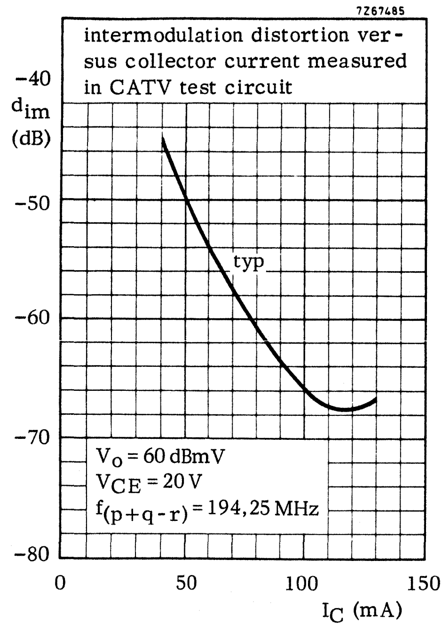
Frequency range 40 to 300 MHz (flatness gain ±0,2 dB)			
Return losses input and output		<	−16 dB
Power gain	G_p	typ.	11 dB

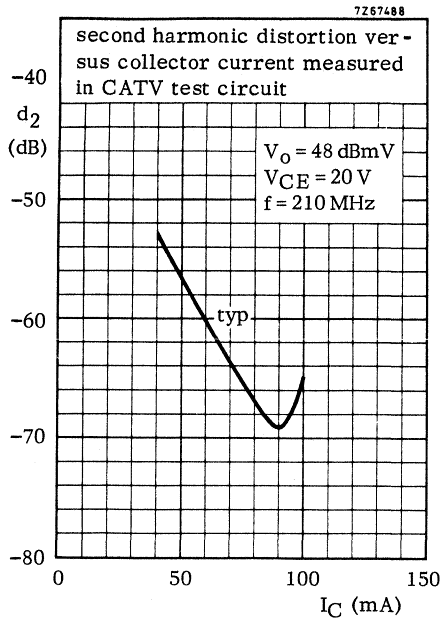
L1 = 2 turns closely wound enamelled Cu wire (0,7 mm); int. diam. 3 mm
L2 = 5 μH ferroxcube coil (code number 3122 108 20153)
L3 = 5 turns closely wound enamelled Cu wire (0,7 mm); int. diam. 4,7 mm
L4 = 19 turns enamelled Cu wire (0,3 mm) on ferroxcube core (code no. 4322 020 91001)

APPLICATION INFORMATION (continued)









SILICON PLANAR EPITAXIAL TRANSISTOR

N-P-N resistance stabilized transistor in a TO-39 metal envelope.

Due to very linear characteristics the transistor features low cross modulation, intermodulation and second harmonic distortion. Thanks to its high transition frequency it has a high power gain combined with excellent wideband properties and low noise up to high frequencies.

The BFR95 is primarily intended for CATV and MATV applications.

QUICK REFERENCE DATA

Collector-base voltage (open emitter)	V_{CBO}	max.	30	V
Collector-emitter voltage (open base)	V_{CEO}	max.	25	V
Collector current (d.c.)	I_C	max.	150	mA
Total power dissipation up to T_{mb} = 125 °C	P_{tot}	max.	1,5	W
Junction temperature	T_j	max.	200	°C
Transition frequency at f = 500 MHz I_C = 80 mA; V_{CE} = 20 V	f_T	typ.	3,5	GHz
Cross modulation distortion (channel 13) I_C = 80 mA; V_{CE} = 18 V; V_o = 48 dBmV	d_{cm}	typ. <	−61 −57	dB dB
I_C = 80 mA; V_{CE} = 18 V; V_o = 32 dBmV	d_{cm}	typ. <	−93 −89	dB dB
Intermodulation distortion at $f_{(p+q-r)}$ = 194,25 MHz I_C = 80 mA; V_{CE} = 18 V; V_o = 60 dBmV	d_{im}	typ.	−64	dB
Broadband power gain I_C = 80 mA; V_{CE} = 18 V	G_p	> typ.	8 9	dB dB
Noise figure at f = 200 MHz I_C = 80 mA; V_{CE} = 18 V	F	typ. <	9 10	dB dB
Second harmonic distortion at $f_{(p+q)}$ = 210 MHz I_C = 80 mA; V_{CE} = 18 V; V_o = 48 dBmV	d_2	typ.	−62	dB

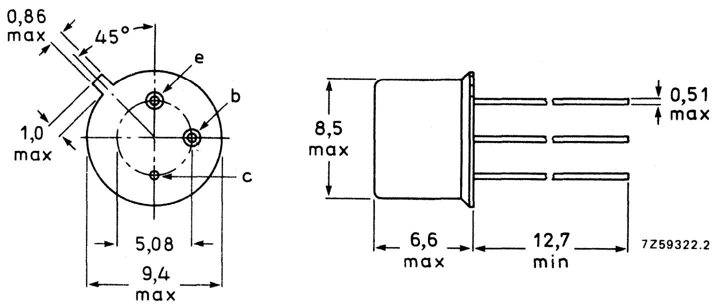
MECHANICAL DATA (see next page)

MECHANICAL DATA

Dimensions in mm

Fig. 1 TO-39

Collector connected to case



Maximum lead diameter guaranteed only for 12,7 mm.
Accessories: 56245 (distance disc).

RATINGS

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

Collector-base voltage (open emitter) note 1	V_{CBO}	max.	30	V
Collector-emitter voltage (R_{BE} = 10 Ω) note 2	V_{CER}	max.	35	V
Collector-emitter voltage (open base) note 2	V_{CEO}	max.	25	V
Emitter-base voltage (open collector) note 3	V_{EBO}	max.	3	V
Collector current (d.c.)	I_C	max.	150	mA
Collector current (peak value); f > 1 MHz	I_{CM}	max.	300	mA
Total power dissipation				
up to T_{amb} = 25 °C	P_{tot}	max.	0,7	W
up to T_{mb} = 125 °C	P_{tot}	max.	1,5	W
Storage temperature	T_{stg}	–65 to + 200		°C
Junction temperature	T_j	max.	200	°C

THERMAL RESISTANCE (note 4)

From junction to ambient in free air	$R_{th\ j\text{-}a}$	=	250	K/W
From junction to mounting base	$R_{th\ j\text{-}mb}$	=	50	K/W

Notes

1. At I_C = 100 μA.
2. At I_C = 10 mA.
3. At I_E = 100 μA.
4. K/W is SI unit for °C/W.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current			
I_E = 0; V_{CB} = 20 V	I_{CBO}	<	50 μA
D.C. current gain (note 1)			
I_C = 50 mA; V_{CE} = 20 V	h_{FE}	>	30
I_C = 150 mA; V_{CE} = 20 V	h_{FE}	>	30
Transition frequency at f = 500 MHz (note 1)			
I_C = 80 mA; V_{CE} = 20 V	f_T	typ.	3,5 GHz
I_C = 150 mA; V_{CE} = 20 V	f_T	typ.	3,5 GHz
Collector capacitance at f = 1 MHz			
$I_E = I_e = 0$; V_{CB} = 20 V	C_c	typ.	3,5 pF
Feedback capacitance at f = 1 MHz			
I_C = 10 mA; V_{CE} = 20 V	C_{re}	typ.	1,6 pF

APPLICATION INFORMATION

Measuring conditions: I_C = 80 mA; V_{CE} = 18 V; T_{amb} = 25 °C

Cross modulation (channel 13) (note 2)			
V_o = 48 dBmV	d_{cm}	typ.	−61 dB
		<	−57 dB
V_o = 32 dBmV	d_{cm}	typ.	−93 dB
		<	−89 dB
Intermodulation distortion			
$V_p = V_o$ = 60 dBmV at f_p = 196,25 MHz			
$V_q = V_o$ −6 dB at f_q = 203,25 MHz			
$V_r = V_o$ −6 dB at f_r = 205,25 MHz			
Measured at $f_{(p+q-r)}$ = 194,25 MHz	d_{im}	typ.	−64 dB
Broadband power gain	G_p	>	8 dB
		typ.	9 dB
Noise figure at f = 200 MHz	F	typ.	9 dB
		<	10 dB
2nd harmonic distortion at $f_{(p+q)}$ = 210 MHz			
f_p = 66 MHz; f_q = 144 MHz; V_o = 48 dBmV	d_2	typ.	−62 dB
		<	−56 dB

Notes

1. Measured under pulse conditions.
2. In 12-channel measuring equipment; channel 13 unmodulated.
   V_o = output level/signal, in accordance with NCTA measuring standard.

APPLICATION INFORMATION

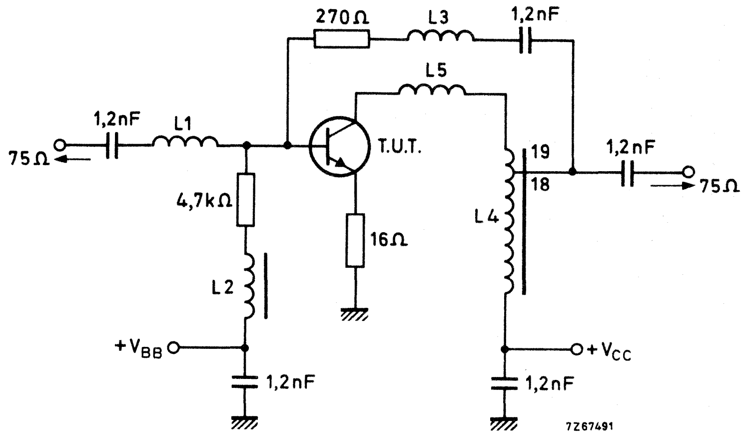


Fig. 2 CATV test circuit.
Frequency range 40 to 300 MHz
Power gain G_p typ. 9 dB

L1 = 2 turns closely wound enamelled Cu wire (0,7 mm); int. dia. 3 mm
L2 = 5 μH Ferroxcube coil (cat. no. 3122 108 20153)
L3 = 3 turns closely wound enamelled Cu wire (0,7 mm); int. dia. 4,7 mm
L4 = 19 turns enamelled Cu wire (0,3 mm) on Ferroxcube core (cat. no. 4322 020 91001)
L5 = 2 turns closely wound enamelled Cu wire (0,7 mm); int. dia. 3 mm.

SILICON PLANAR EPITAXIAL TRANSISTOR

N-P-N transistor in a subminiature plastic transfer-moulded T-package.
It is primarily intended for use in u.h.f. and microwave amplifiers such as in aerial amplifiers, radar systems, oscilloscopes, spectrum analysers, etc.
The transistor features very low intermodulation distortion and high power gain; thanks to its very high transition frequency, it also has excellent wideband properties and low noise up to high frequencies.

QUICK REFERENCE DATA

Collector-base voltage (open emitter)	V_{CBO}	max.	20	V
Collector-emitter voltage (open base)	V_{CEO}	max.	15	V
Collector current (d.c.)	I_C	max.	75	mA
Total power dissipation up to T_{amb} = 60 °C	P_{tot}	max.	500	mW
Junction temperature	T_j	max.	175	°C
Transition frequency at f = 500 MHz I_C = 50 mA; V_{CE} = 10 V	f_T	typ.	5	GHz
Feedback capacitance at f = 1 MHz I_C = 10 mA; V_{CE} = 10 V; T_{amb} = 25 °C	C_{re}	<	1,4	pF
Noise figure at optimum source impedance I_C = 50 mA; V_{CE} = 10 V; f = 500 MHz; T_{amb} = 25 °C	F	typ.	3,3	dB
Max. unilateral power gain I_C = 50 mA; V_{CE} = 10 V; f = 500 MHz; T_{amb} = 25 °C	G_{UM}	typ.	15,2	dB
Intermodulation distortion at T_{amb} = 25 °C I_C = 50 mA; V_{CE} = 10 V; R_L = 75 Ω; V_o = 500 mV $f_{(p+q-r)}$ = 493,25 MHz	d_{im}	typ.	−60	dB

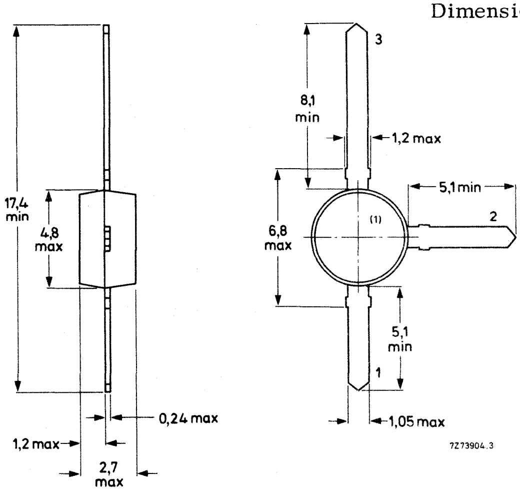
MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-37.

Connections

1. Base
2. Emitter
3. Collector



(1) = type number marking.

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

Voltages

Collector-base voltage (open emitter)	V_{CBO}	max.	20	V
Collector-emitter voltage (open base)	V_{CEO}	max.	15	V
Emitter-base voltage (open collector)	V_{EBO}	max.	3,0	V

Currents

Collector current (d.c.)	I_C	max.	75	mA
Collector current (peak value); f > 1 MHz	I_{CM}	max.	150	mA

Power dissipation

Total power dissipation up to T_{amb} = 60 °C mounted on a fibre-glass print of 40 mm x 35 mm x 1,5 mm	P_{tot}	max.	500	mW

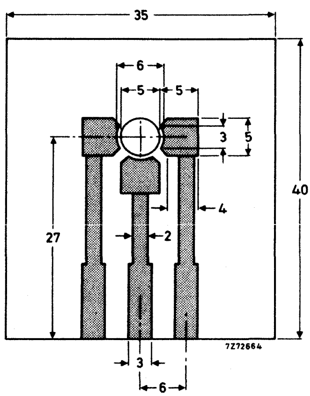
Temperatures

Storage temperature	T_{stg}	−65 to +175		°C
Junction temperature	T_j	max.	175	°C

THERMAL RESISTANCE

From junction to ambient in free air mounted on a fibre-glass print of 40 mm x 35 mm x 1,5 mm	$R_{th\ j-a}$	=	0,23	°C/mW

Requirements for fibre-glass print Dimensions in mm



Single-sided 35 µm Cu-clad epoxy fibre-glass print, thickness 1,5 mm.
Tracks are fully tin-lead plated.

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

Collector cut-off current				
$I_E = 0$; $V_{CB} = 10$ V	I_{CBO}	<	100	nA
D.C. current gain [1]				
$I_C = 50$ mA; $V_{CE} = 10$ V	h_{FE}	>	25	
		typ.	50	
$I_C = 75$ mA; $V_{CE} = 10$ V	h_{FE}	>	25	
		typ.	52	
Transition frequency at f = 500 MHz [1]				
$I_C = 50$ mA; $V_{CE} = 10$ V	f_T	>	4,0	GHz
		typ.	5,0	GHz
$I_C = 75$ mA; $V_{CE} = 10$ V	f_T	>	4,4	GHz
		typ.	5,5	GHz
Collector capacitance at f = 1 MHz				
$I_E = I_e = 0$; $V_{CB} = 10$ V	C_c	typ.	1,3	pF
Emitter capacitance at f = 1 MHz				
$I_C = I_c = 0$; $V_{EB} = 0,5$ V	C_e	typ.	6,5	pF
Feedback capacitance at f = 1 MHz				
$I_C = 10$ mA; $V_{CE} = 10$ V; $T_{amb} = 25\ ^oC$	C_{re}	typ.	1,0	pF
		<	1,4	pF
Noise figure at optimum source impedance				
$I_C = 50$ mA; $V_{CE} = 10$ V; f = 500 MHz; $T_{amb} = 25\ ^oC$	F	typ.	3,3	dB
$I_C = 50$ mA; $V_{CE} = 10$ V; f = 800 MHz; $T_{amb} = 25\ ^oC$	F	typ.	3,8	dB

Max. unilateral power gain (s_{re} assumed to be zero)

$$G_{UM}\ \text{(in dB)} = 10 \log \frac{|s_{fe}|^2}{(1 - |s_{ie}|^2)(1 - |s_{oe}|^2)}$$

$I_C = 50$ mA; $V_{CE} = 10$ V; f = 500 MHz; $T_{amb} = 25\ ^oC$	G_{UM}	typ.	15,2	dB

[1]) Measured under pulse conditions.

CHARACTERISTICS (continued)

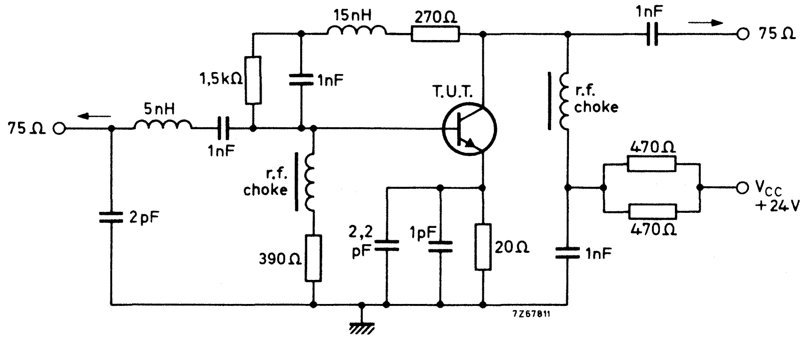
Intermodulation distortion at T_{amb} = 25 ^{o}C

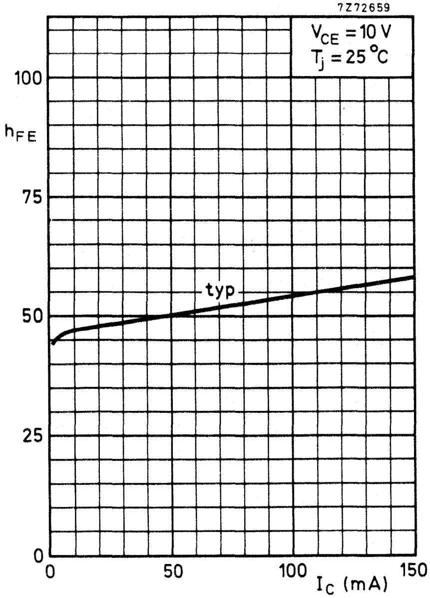
I_C = 50 mA; V_{CE} = 10 V; R_L = 75 Ω

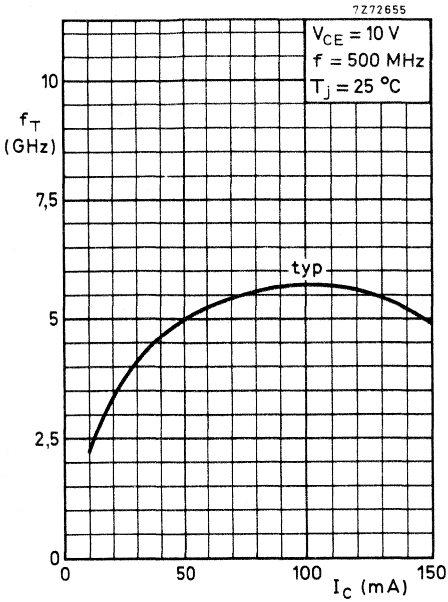
$V_p = V_o$ = 500 mV at f_p = 495,25 MHz
$V_q = V_o$ − 6 dB at f_q = 503,25 MHz
$V_r = V_o$ − 6 dB at f_r = 505,25 MHz

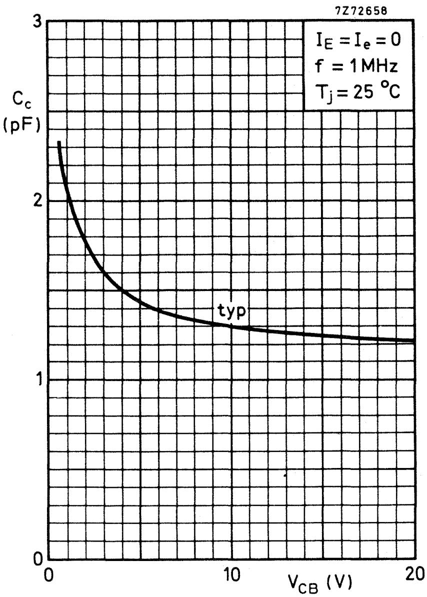
Measured at $f_{(p+q-r)}$ = 493,25 MHz — d_{im} typ. −60 dB

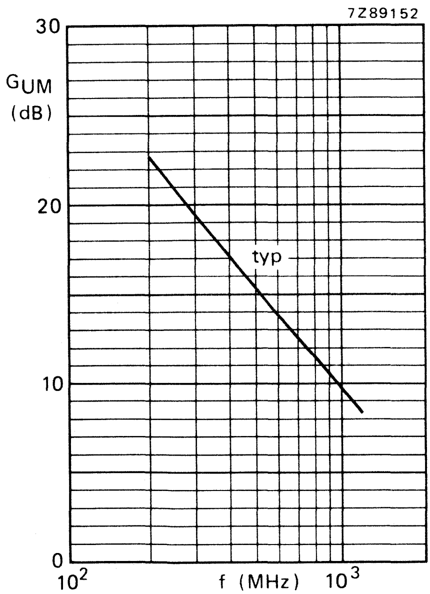
Intermodulation test circuit:





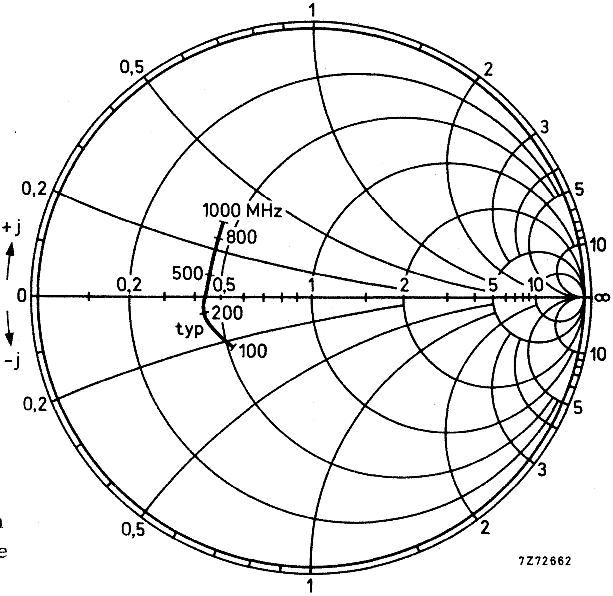






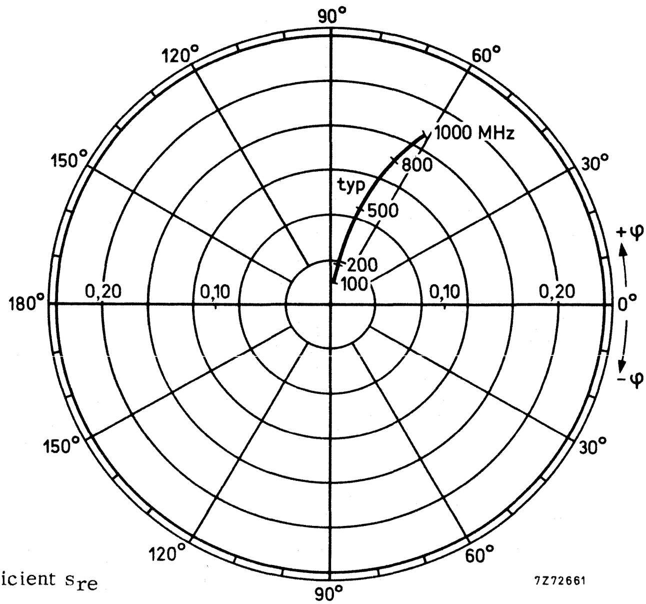
V_{CE} = 10 V; I_C = 50 mA; T_{amb} = 25 °C.

V_{CE} = 10 V
I_C = 50 mA
T_{amb} = 25 °C



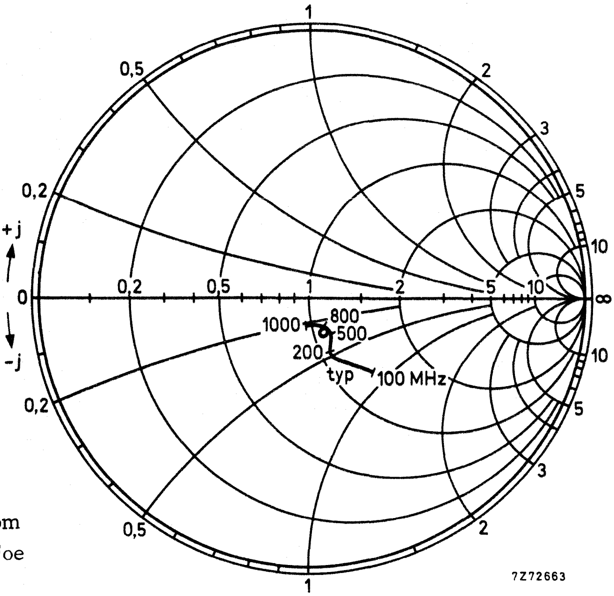
Input impedance derived from input reflection coefficient s_{ie} co-ordinates in ohm x 50

V_{CE} = 10 V
I_C = 50 mA
T_{amb} = 25 °C



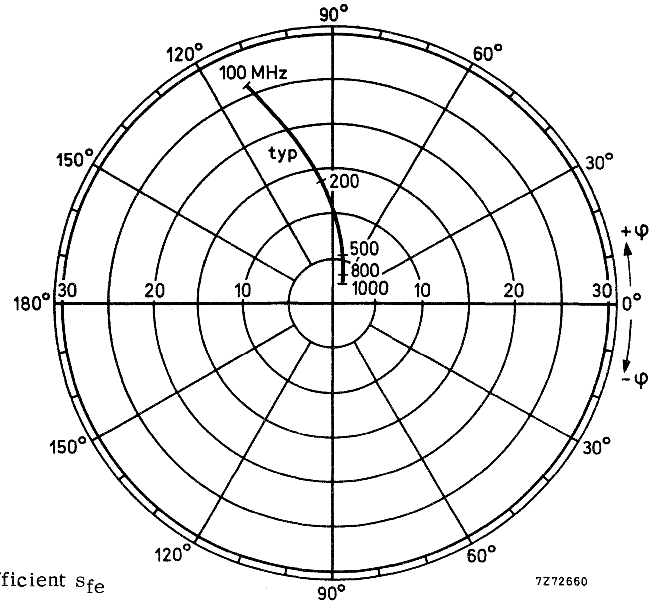
Reverse transmission coefficient s_{re}

V_{CE} = 10 V
I_C = 50 mA
T_{amb} = 25 °C

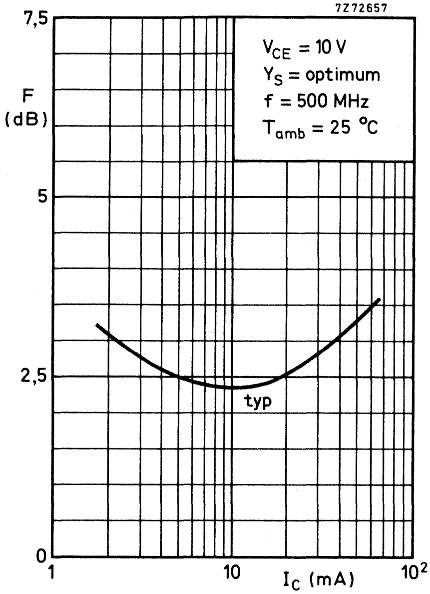


Output impedance derived from output reflection coefficient s_{oe} co-ordinates in ohm x 50

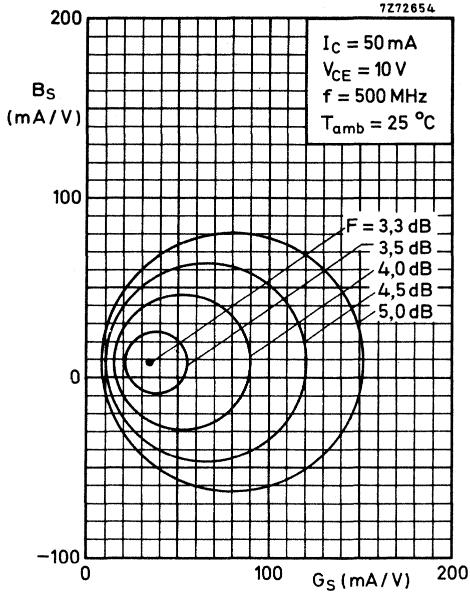
V_{CE} = 10 V
I_C = 50 mA
T_{amb} = 25 °C



Forward transmission coefficient s_{fe}



circles of constant noise figure



SILICON PLANAR EPITAXIAL TRANSISTOR

N-P-N transistor in a plastic T-package, primarily intended for MATV applications. The device features excellent output voltage capabilities.

QUICK REFERENCE DATA

Collector-base voltage (open emitter)	V_{CBO}	max.	20	V
Collector-emitter voltage (open base)	V_{CEO}	max.	15	V
Collector current (d.c.)	I_C	max.	100	mA
Total power dissipation up to T_{amb} = 70 °C	P_{tot}	max.	700	mW
Junction temperature	T_j	max.	175	°C
Transition frequency at f = 500 MHz I_C = 70 mA; V_{CE} = 10 V	f_T	typ.	5	GHz
Feedback capacitance at f = 1 MHz I_C = 0; V_{CE} = 10 V	C_{re}	typ.	1	pF
Noise figure at optimum source impedance I_C = 70 mA; V_{CE} = 10 V; f = 800 MHz; T_{amb} = 25 °C	F	typ.	4,0	dB
Maximum unilateral power gain I_C = 70 mA; V_{CE} = 10 V; f = 800 MHz; T_{amb} = 25 °C	G_{UM}	typ.	11,5	dB
Output voltage at d_{im} = −60 dB (see Fig. 3) I_C = 70 mA; V_{CE} = 10 V; R_L = 75 Ω; T_{amb} = 25 °C $f_{(p+q-r)}$ = 793,25 MHz	V_o	typ.	700	mV
Output power at 1 dB gain compression	P_{L1}	typ.	+ 21	dBm
Third order intercept point	ITO	typ.	+ 40	dBm

MECHANICAL DATA

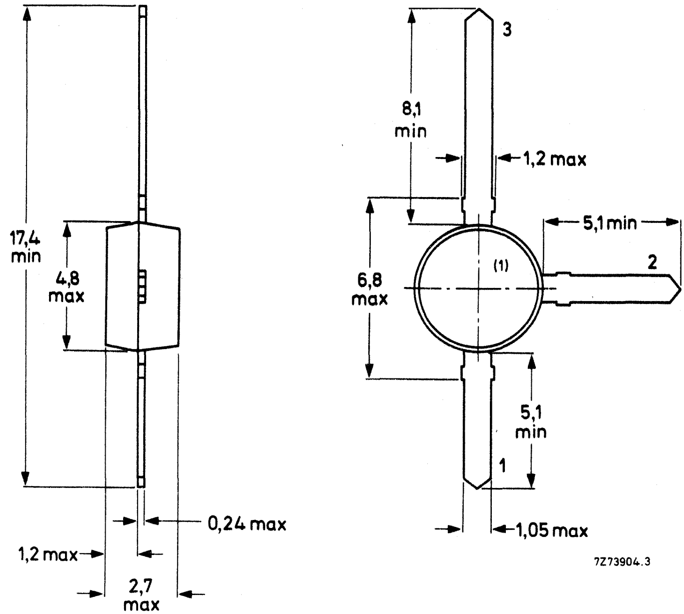
SOT-37 (see Fig. 1).

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-37.

Connections
1. Base
2. Emitter
3. Collector



(1) = type number marking.

RATINGS

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

Collector-base voltage (open emitter)	V_{CBO}	max.	20	V
Collector-emitter voltage (open base)	V_{CEO}	max.	15	V
Emitter-base voltage (open collector)	V_{EBO}	max.	3,0	V
Collector current (d.c.)	I_C	max.	100	mA
Total power dissipation up to T_{amb} = 70 ^oC mounted on a fibre-glass print (see Fig. 2) of 50 mm x 50 mm x 1,5 mm	P_{tot}	max.	700	mW
Storage temperature	T_{stg}	−65 to + 175		^oC
Junction temperature	T_j	max.	175	^oC

THERMAL RESISTANCE

From junction to ambient in free air mounted on a fibre-glass print (see Fig. 2) of 50 mm x 50 mm x 1,5 mm	$R_{th\ j\text{-}a}$	=	150	K/W

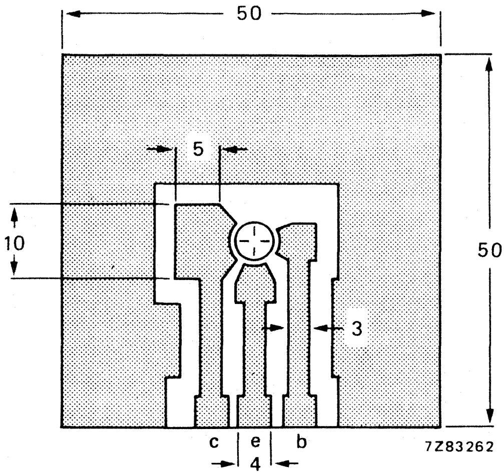


Fig. 2 Requirements for fibre-glass print. (Dimensions in mm.) Single-sided 35 μm Cu-clad epoxy fibre-glass print, thickness 1,5 mm. Tracks are fully tin-lead plated. Shaded area is Cu.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current			
$I_E = 0$; $V_{CB} = 10$ V	I_{CBO}	<	100 nA
D.C. current gain*			
$I_C = 70$ mA; $V_{CE} = 10$ V	h_{FE}	>	25
Transition frequency at f = 500 MHz			
$I_C = 70$ mA; $V_{CE} = 10$ V	f_T	typ.	5 GHz
Collector capacitance at f = 1 MHz			
$I_E = I_e = 0$; $V_{CB} = 10$ V	C_c	typ.	1,5 pF
Emitter capacitance at f = 1 MHz			
$I_C = I_c = 0$; $V_{EB} = 0,5$ V	C_e	typ.	6,5 pF
Feedback capacitance at f = 1 MHz			
$I_C = 0$; $V_{CE} = 10$ V; $T_{amb} = 25$ °C	C_{re}	typ.	1 pF
Noise figure at optimum source impedance			
$I_C = 70$ mA; $V_{CE} = 10$ V; f = 800 MHz; $T_{amb} = 25$ °C	F	typ.	4,0 dB

Maximum unilateral power gain (s_{re} assumed to be zero)

$$G_{UM} \text{ (in dB)} = 10 \log \frac{|s_{fe}|^2}{(1-|s_{ie}|^2)\,(1-|s_{oe}|^2)}$$

$I_C = 70$ mA; $V_{CE} = 10$ V; f = 800 MHz; $T_{amb} = 25$ °C	G_{UM}	typ.	11,5 dB

* Measured under pulse conditions.

s-parameters (common emitter) at V_{CE} = 5 V

I_C mA	f MHz	s_{ie}	s_{re}	s_{fe}	s_{oe}
5	40	0,75/ −41,5°	0,026/+ 69,1°	15,1/+ 155,2°	0,93/ −17,4°
	200	0,62/−128,1°	0,064/+ 41,9°	7,1/+ 106,9°	0,53/ −43,3°
	500	0,55/−174,6°	0,087/+ 47,0°	3,2/ + 79,8°	0,40/ −53,2°
	800	0,56/+ 158,7°	0,115/+ 56,5°	2,1/ + 65,0°	0,39/ −63,2°
	1000	0,58/+ 146,7°	0,135/+ 59,2°	1,7/ + 56,6°	0,39/ −72,5°
	1200	0,61/+ 135,5°	0,159/+ 61,7°	1,4/ + 48,9°	0,39/ −83,0°
10	40	0,60/ −59,1°	0,022/+ 64,1°	24,3/+ 147,2°	0,86/ −26,6°
	200	0,54/−146,1°	0,050/+ 49,4°	9,1/+ 100,7°	0,38/ −54,7°
	500	0,50/+ 175,8°	0,087/+ 59,3°	3,9/ + 78,6°	0,27/ −62,8°
	800	0,52/+ 152,4°	0,129/+ 63,7°	2,5/ + 65,8°	0,27/ −72,2°
	1000	0,53/+ 141,0°	0,157/+ 63,9°	2,1/ + 58,0°	0,27/ −80,7°
	1200	0,56/+ 130,7°	0,186/+ 63,3°	1,7/ + 51,2°	0,27/ −90,9°
30	40	0,39/−105,6°	0,015/+ 60,7°	39,6/+ 133,3°	0,69/ −44,1°
	200	0,44/−168,4°	0,041/+ 65,9°	11,1/ + 94,3°	0,23/ −78,2°
	500	0,46/+ 165,1°	0,094/+ 70,3°	4,7/ + 77,3°	0,16/ −88,4°
	800	0,48/+ 145,4°	0,146/+ 69,2°	3,0/ + 66,5°	0,16/ −98,3°
	1000	0,51/+ 135,6°	0,175/+ 66,6°	2,5/ + 60,1°	0,16/−109,3°
	1200	0,53/+ 126,2°	0,206/+ 64,2°	2,1/ + 54,0°	0,17/−119,7°
50	40	0,37/−129,3°	0,013/+ 63,4°	44,6/+ 127,8°	0,62/ −51,4°
	200	0,43/−174,7°	0,040/+ 71,5°	11,5/ + 92,5°	0,19/ −89,2°
	500	0,45/+ 162,4°	0,095/+ 72,7°	4,8/ + 76,8°	0,14/−101,5°
	800	0,48/+ 143,4°	0,151/+ 70,1°	3,1/ + 66,5°	0,14/−111,5°
	1000	0,50/+ 134,3°	0,182/+ 67,4°	2,5/ + 60,4°	0,14/−121,5°
	1200	0,52/+ 124,9°	0,215/+ 64,8°	2,1/ + 54,6°	0,15/−130,7°
70	40	0,38/−141,7°	0,011/+ 65,1°	46,9/+ 124,9°	0,57/ −55,8°
	200	0,43/−177,6°	0,040/+ 73,7°	11,6/ + 91,6°	0,18/ −96,3°
	500	0,46/+ 161,2°	0,095/+ 73,9°	4,9/ + 76,5°	0,13/−109,5°
	800	0,49/+ 143,1°	0,150/+ 70,6°	3,1/ + 66,4°	0,13/−120,7°
	1000	0,49/+ 133,5°	0,186/+ 67,7°	2,5/ + 60,2°	0,14/−126,2°
	1200	0,52/+ 124,1°	0,218/+ 65,0°	2,1/ + 54,6°	0,15/−135,3°

s-parameters (common emitter) at V_{CE} = 10 V

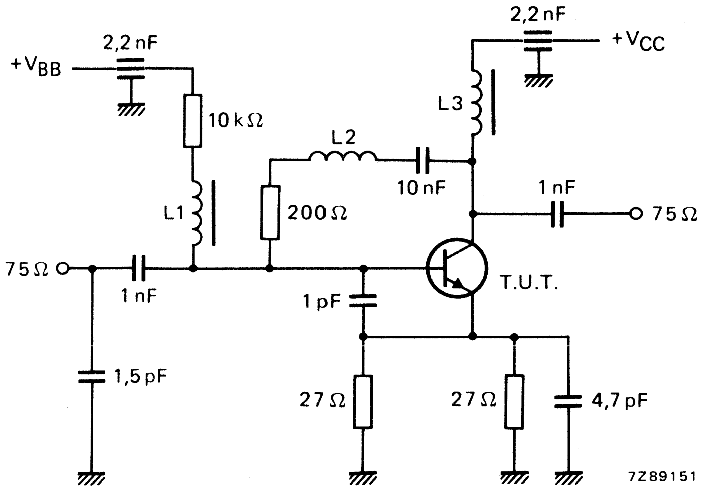
I_C mA	f MHz	s_{ie}	s_{re}	s_{fe}	s_{oe}
5	40	0,77/ −38,9°	0,023/+ 69,1°	15,2/+ 156,2°	0,93/ −15,4°
	200	0,62/−124,0°	0,059/+ 43,1°	7,4/+ 108,3°	0,57/ −38,0°
	500	0,54/−172,5°	0,081/+ 48,0°	3,4/ + 80,8°	0,45/ −46,8°
	800	0,55/+ 159,9°	0,106/+ 57,8°	2,2/ + 65,9°	0,43/ −57,1°
	1000	0,56/+ 147,2°	0,126/+ 61,5°	1,8/ + 57,5°	0,43/ −64,9°
	1200	0,58/+ 135,9°	0,150/+ 64,4°	1,5/ + 50,1°	0,42/ −74,7°
10	40	0,62/ −54,5°	0,020/+ 64,9°	24,5/+ 148,7°	0,87/ −23,5°
	200	0,53/−142,3°	0,046/+ 49,6°	9,6/+ 102,0°	0,42/ −47,8°
	500	0,48/+ 177,6°	0,080/+ 59,4°	4,2/ + 79,4°	0,31/ −54,2°
	800	0,50/+ 153,2°	0,118/+ 64,0°	2,7/ + 66,4°	0,31/ −63,5°
	1000	0,52/+ 142,3°	0,143/+ 64,1°	2,2/ + 59,1°	0,31/ −70,0°
	1200	0,54/+ 131,8°	0,168/+ 64,3°	1,8/ + 52,4°	0,30/ −79,5°
30	40	0,41/ −94,4°	0,014/+ 62,2°	40,9/+ 135,0°	0,72/ −39,2°
	200	0,42/−164,6°	0,039/+ 65,5°	11,8/ + 95,1°	0,25/ −64,5°
	500	0,42/+ 167,0°	0,087/+ 70,4°	4,9/ + 77,9°	0,19/ −71,1°
	800	0,45/+ 146,6°	0,136/+ 69,3°	3,2/ + 67,1°	0,18/ −79,1°
	1000	0,47/+ 136,6°	0,166/+ 67,2°	2,6/ + 60,6°	0,18/ −83,8°
	1200	0,49/+ 126,3°	0,196/+ 65,0°	2,2/ + 54,6°	0,17/ −95,1°
50	40	0,36/−114,4°	0,012/+ 62,7°	46,5/+ 129,6°	0,63/ −45,7°
	200	0,40/−171,0°	0,038/+ 70,4°	12,3/ + 93,1°	0,20/ −71,4°
	500	0,41/+ 163,9°	0,090/+ 72,4°	5,1/ + 77,1°	0,16/ −79,7°
	800	0,44/+ 144,7°	0,140/+ 70,1°	3,3/ + 66,7°	0,15/ −86,0°
	1000	0,47/+ 135,3°	0,168/+ 67,3°	2,7/ + 60,8°	0,14/ −95,3°
	1200	0,49/+ 125,2°	0,197/+ 65,0°	2,3/ + 55,2°	0,14/−106,6°
70	40	0,35/−125,4°	0,012/+ 63,6°	49,1/+ 125,7°	0,58/ −49,5°
	200	0,40/−173,7°	0,038/+ 72,7°	12,4/ + 92,0°	0,18/ −74,8°
	500	0,41/+ 162,6°	0,091/+ 73,2°	5,2/ + 76,7°	0,15/ −82,0°
	800	0,44/+ 144,1°	0,143/+ 70,2°	3,3/ + 66,4°	0,14/ −87,4°
	1000	0,46/+ 134,6°	0,175/+ 67,3°	2,7/ + 60,2°	0,13/ −95,3°
	1200	0,48/+ 124,1°	0,200/+ 64,8°	2,3/ + 54,6°	0,13/−109,5°

Output voltage at d_{im} = −60 dB (see Figs 3 and 5)
(DIN45004B, par. 6.3: 3-tone)
I_C = 70 mA; V_{CE} = 10 V; R_L = 75 Ω; T_{amb} = 25 °C
$V_p = V_o$ at d_{im} = −60 dB; f_p = 795,25 MHz
$V_q = V_o$ −6 dB; f_q = 803,25 MHz
$V_r = V_o$ −6 dB; f_r = 805,25 MHz
Measured at $f_{(p+q-r)}$ = 793,25 MHz — V_o typ. 700 mV

Second harmonic distortion (see Figs 3 and 6)
I_C = 70 mA; V_{CE} = 10 V; R_L = 75 Ω; T_{amb} = 25 °C
$V_p = V_o$ = 316 mV = 50 dBmV; f_p = 250 MHz
$V_q = V_o$ = 316 mV = 50 dBmV; f_q = 560 MHz
measured at $f_{(p+q)}$ = 810 MHz — d_2 typ. −52 dB

→ Output power at 1 dB gain compression (see Fig. 3)
I_C = 70 mA; V_{CE} = 10 V
R_L = 75 Ω; T_{amb} = 25 °C
measured at f = 800 MHz — P_{L1} typ. + 21 dBm

→ Third order intercept point (see Fig. 3)
I_C = 70 mA; V_{CE} = 10 V
R_L = 75 Ω; T_{amb} = 25 °C
P_p = ITO − 6 dB; f_p = 800 MHz
P_q = ITO − 6 dB; f_q = 801 MHz
and at $f_{(2p-q)}$ = 799 MHz — ITO typ. + 40 dBm



→ Fig. 3 Intermodulation distortion and second harmonic distortion test circuit.

L1 = L3 = 5 μH micro choke
L2 = 1½ turns Cu wire (0,4 mm); internal diameter 3,0 mm; winding pitch 1 mm

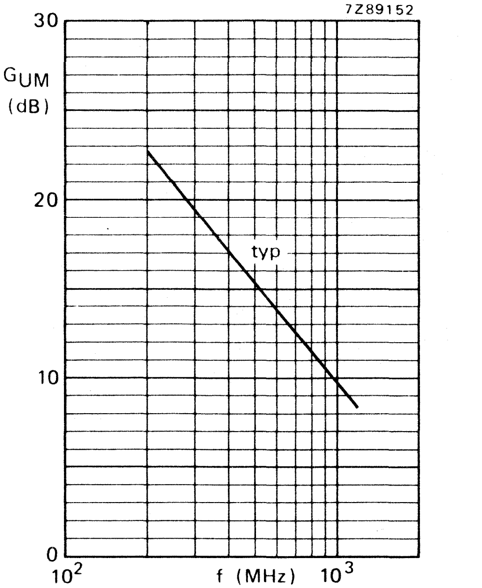


Fig. 4 V_{CE} = 10 V; I_C = 70 mA; T_{amb} = 25 °C.

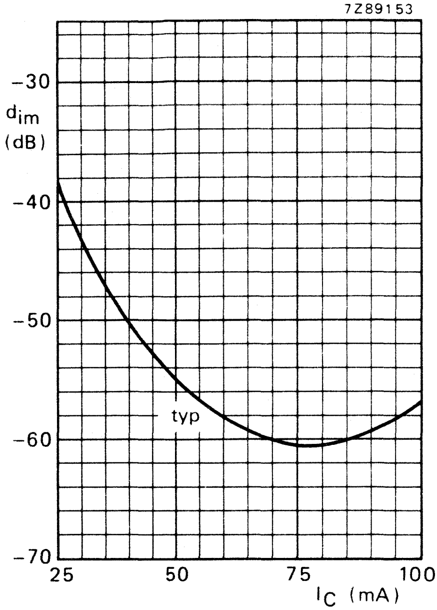


Fig. 5.

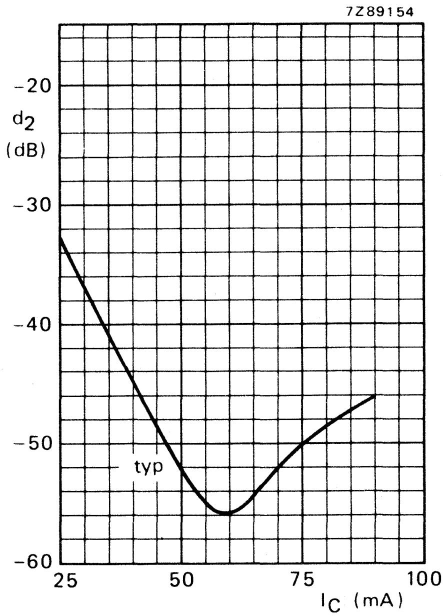


Fig. 6.

Intermodulation distortion (Fig. 5) and second harmonic distortion (Fig. 6) are measured in circuit (see Fig. 3).

Fig. 5 V_{CE} = 10 V; V_o = 700 mV = 56,9 dBmV; $f_{(p+q-r)}$ = 793,25 MHz; T_{amb} = 25 °C.

Fig. 6 V_{CE} = 10 V; V_o = 316 mV = 50 dBmV; $f_{(p+q)}$ = 810 MHz; T_{amb} = 25 °C.

Conditions for Figs 7 and 8:
$V_{CE} = 10$ V; $I_C = 70$ mA;
$T_{amb} = 25$ °C.

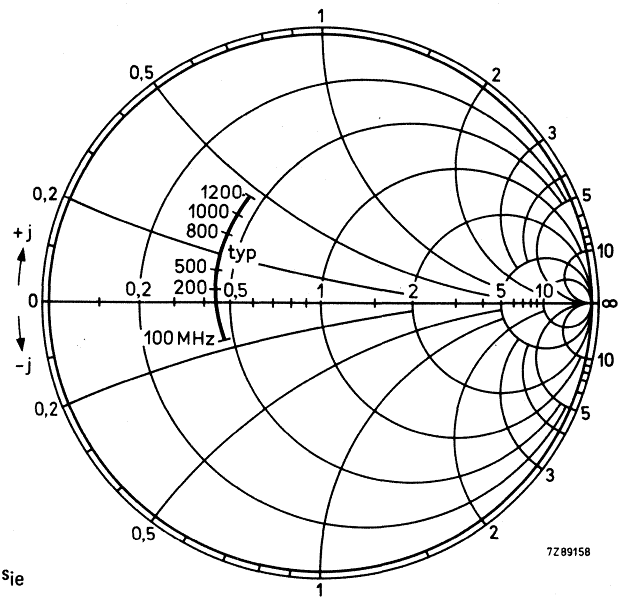


Fig. 7 Input impedance derived from input reflection coefficient s_{ie} co-ordinates in ohm x 50.

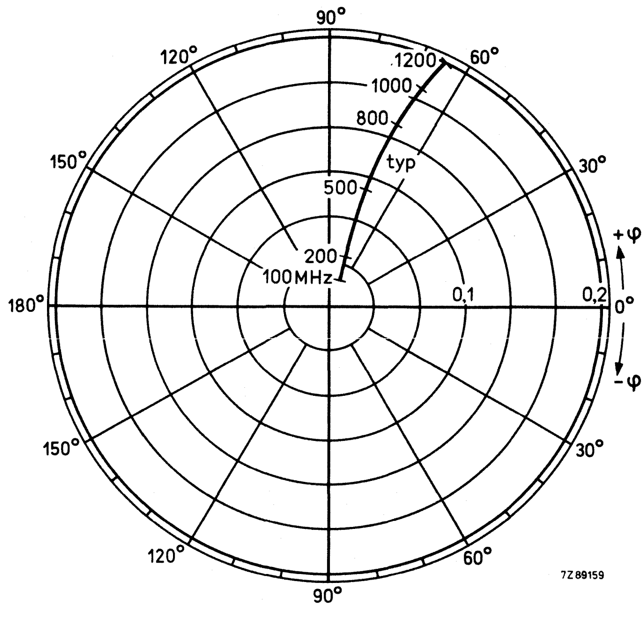


Fig. 8 Reverse transmission coefficient s_{re}.

Conditions for Figs 9 and 10:
V_{CE} = 10 V; I_C = 70 mA;
T_{amb} = 25 °C.

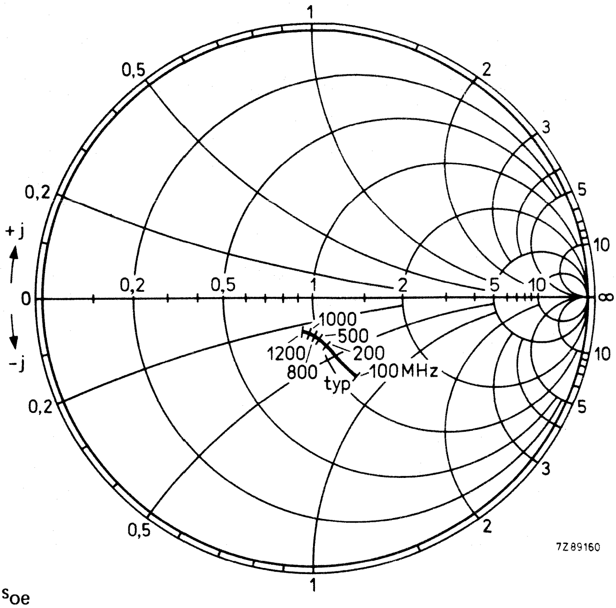


Fig. 9 Output impedance derived from output reflection coefficient s_{oe} co-ordinates in ohm x 50.

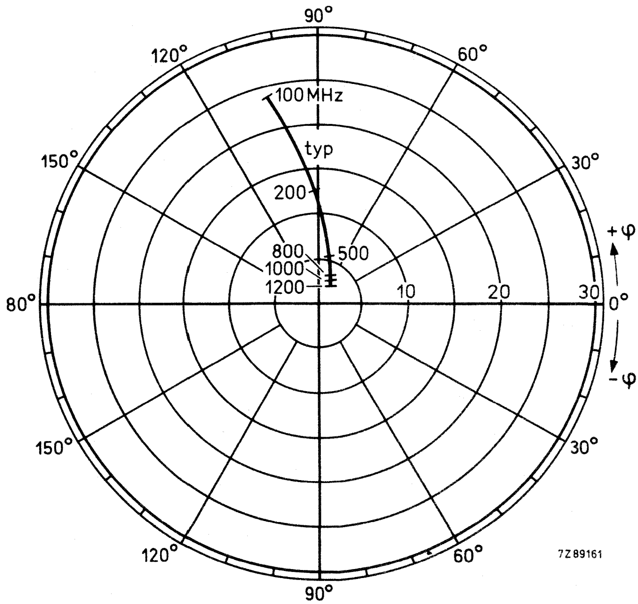


Fig. 10 Forward transmission coefficient s_{fe}.

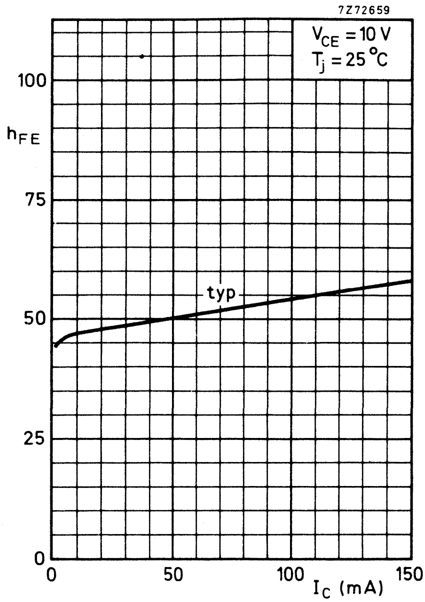


Fig. 11.

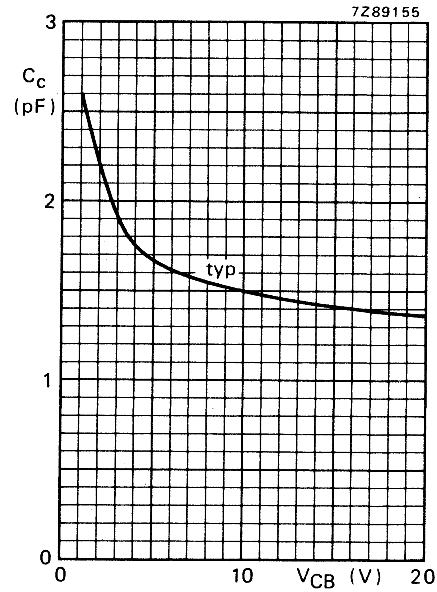


Fig. 12 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

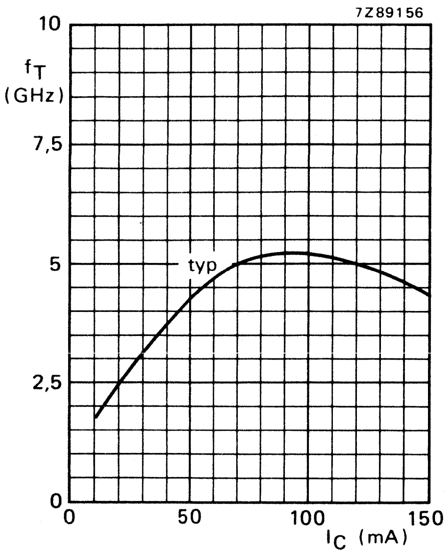


Fig. 13 V_{CE} = 10 V; f = 500 MHz; T_j = 25 °C.

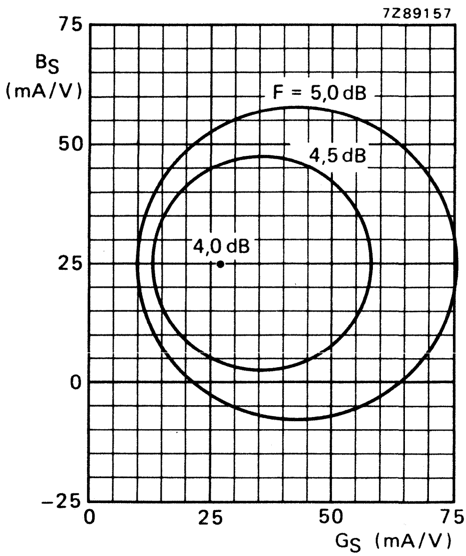


Fig. 14 Circles of constant noise figure.
V_{CE} = 10 V; I_C = 70 mA; f = 800 MHz;
T_{amb} = 25 °C; typical values.

CLASS-B OPERATION

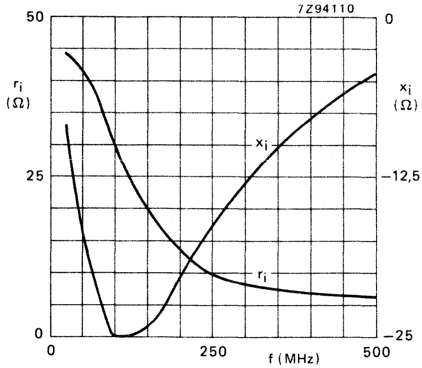


Fig. 15 Input impedance (series components).

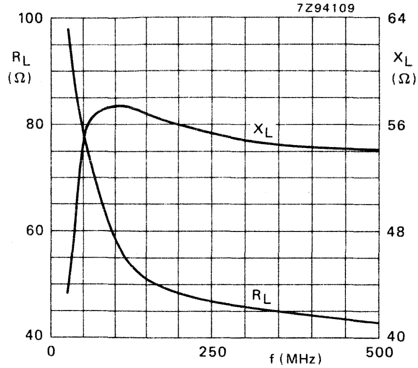


Fig. 16 Load impedance (series components).

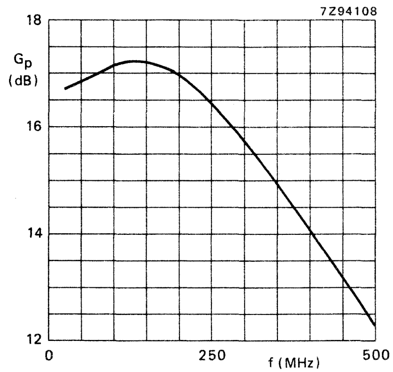


Fig. 17 Power gain versus frequency.

Conditions for Figs 15 to 17:

V_{CE} = 10 V; P_L = 500 mW; T_{amb} = 25 °C;

OPERATING NOTE for Figs 15 to 17:

A base-emitter resistor of 47 Ω is recommended to avoid oscillation. This resistor must be effective for r.f. only.

SILICON PLANAR EPITAXIAL TRANSISTOR

N-P-N transistor in a subminiature plastic transfer-moulded T-package.
It is primarily intended for use in u.h.f. low power amplifiers such as in pocket phones, paging systems, etc.
The transistor features low current consumption (100 μA - 1 mA); thanks to its high transition frequency, it also has excellent wideband properties and low noise up to high frequencies.

QUICK REFERENCE DATA

Collector-base voltage (open emitter)	V_{CBO}	max.	8	V
Collector-emitter voltage (open base)	V_{CEO}	max.	5	V
Collector current (d.c.)	I_C	max.	2,5	mA
Total power dissipation up to T_{amb} = 135 °C	P_{tot}	max.	30	mW
Junction temperature	T_j	max.	150	°C
Transition frequency at f = 500 MHz				
I_C = 1 mA; V_{CE} = 1 V	f_T	typ.	2,3	GHz
Feedback capacitance at f = 1 MHz				
I_C = 1 mA; V_{CE} = 1 V; T_{amb} = 25 °C	C_{re}	<	0,4	pF
Noise figure at optimum source impedance				
I_C = 1 mA; V_{CE} = 1 V; f = 500 MHz; T_{amb} = 25 °C	F	typ.	3,8	dB
Max. unilateral power gain				
I_C = 1 mA; V_{CE} = 1 V; f = 500 MHz; T_{amb} = 25 °C	G_{UM}	typ.	17	dB

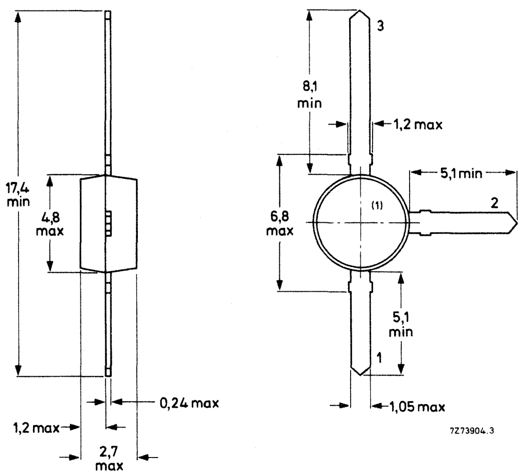
MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-37.

Connections

1. Base
2. Emitter
3. Collector



(1) = type number marking.

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

Voltages

Collector-base voltage (open emitter)	V_{CBO}	max.	8	V
Collector-emitter voltage (open base)	V_{CEO}	max.	5	V
Emitter-base voltage (open collector)	V_{EBO}	max.	2	V

Current

Collector current (d.c.)	I_C	max.	2,5	mA
Collector current (peak value; f > 1 MHz)	I_{CM}	max.	5,0	mA

Power dissipation

Total power dissipation up to T_{amb} = 135 °C	P_{tot}	max.	30	mW

Temperatures

Storage temperature	T_{stg}		−65 to +150	°C
Junction temperature	T_j	max.	150	°C

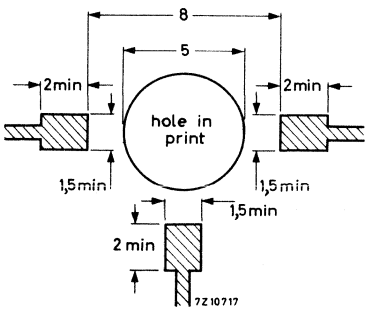
THERMAL RESISTANCE

From junction to ambient in free air

mounted on a glass-fibre print *) of 40 mm x 25 mm x 1 mm	$R_{th\ j\text{-}a}$	=	0,5	°C/mW

*) Requirements for glass-fibre print

(dimensions in mm)



CHARACTERISTICS

T_j = 25 °C unless otherwise specified

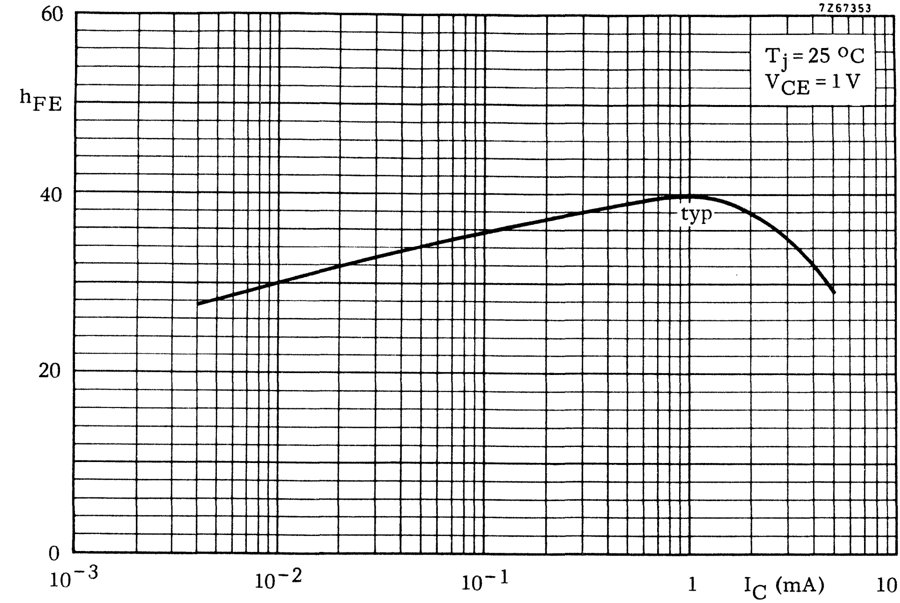
Collector cut-off current				
$I_E = 0$; $V_{CB} = 5$ V	I_{CBO}	<	50	nA
D.C. current gain [1]				
$I_C = 10\ \mu A$; $V_{CE} = 1$ V	h_{FE}	>	20	
		typ.	30	
$I_C = 1$ mA; $V_{CE} = 1$ V	h_{FE}	>	20	
		typ.	40	
Saturation voltages				
$I_C = 10\ \mu A$; $I_B = 1\ \mu A$	V_{CEsat}	<	**200**	mV
	V_{BEsat}	<	**750**	mV
$I_C = 1$ mA; $I_B = 0{,}1$ mA	V_{CEsat}	<	**175**	mV
	V_{BEsat}	<	**900**	mV
Transition frequency at f = 500 MHz [1]				
$I_C = 1$ mA; $V_{CE} = 1$ V	f_T	>	1,2	GHz
		typ.	2,3	GHz
Collector capacitance at f = 1 MHz				
$I_E = I_e = 0$; $V_{CB} = 0{,}5$ V	C_c	<	0,55	pF
Emitter capacitance at f = 1 MHz				
$I_C = I_c = 0$; $V_{EB} = 0$	C_e	<	0,45	pF
Feedback capacitance at f = 1 MHz				
$I_C = 1$ mA; $V_{CE} = 1$ V; $T_{amb} = 25$ °C	C_{re}	<	0,4	pF
Noise figure at optimum source impedance				
$I_C = 0{,}1$ mA; $V_{CE} = 1$ V; f = 500 MHz; $T_{amb} = 25$ °C	F	typ.	5,5	dB
$I_C = 1$ mA; $V_{CE} = 1$ V; f = 500 MHz; $T_{amb} = 25$ °C	F	typ.	3,8	dB

Max. unilateral power gain (s_{re} assumed to be zero)

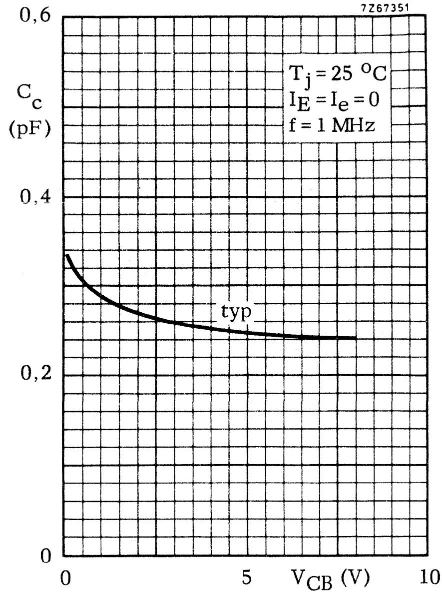
$$G_{UM}\ \text{(in dB)} = 10 \log \frac{|s_{fe}|^2}{(1 - |s_{ie}|^2)(1 - |s_{oe}|^2)}$$

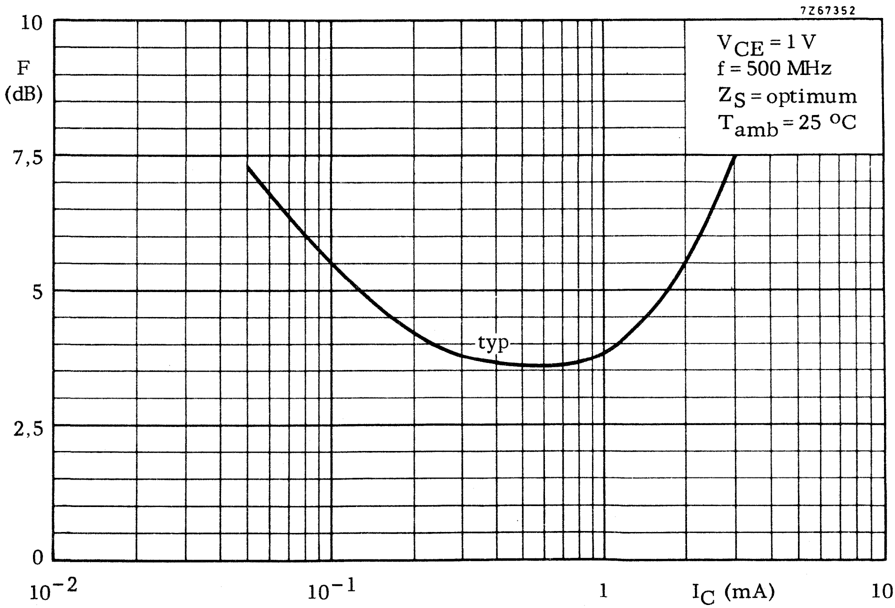
$I_C = 1$ mA; $V_{CE} = 1$ V; f = 200 MHz; $T_{amb} = 25$ °C	G_{UM}	typ.	24	dB
$I_C = 1$ mA; $V_{CE} = 1$ V; f = 500 MHz; $T_{amb} = 25$ °C	G_{UM}	typ.	17	dB
$I_C = 1$ mA; $V_{CE} = 1$ V; f = 800 MHz; $T_{amb} = 25$ °C	G_{UM}	typ.	11	dB

1) Measured under pulse conditions.

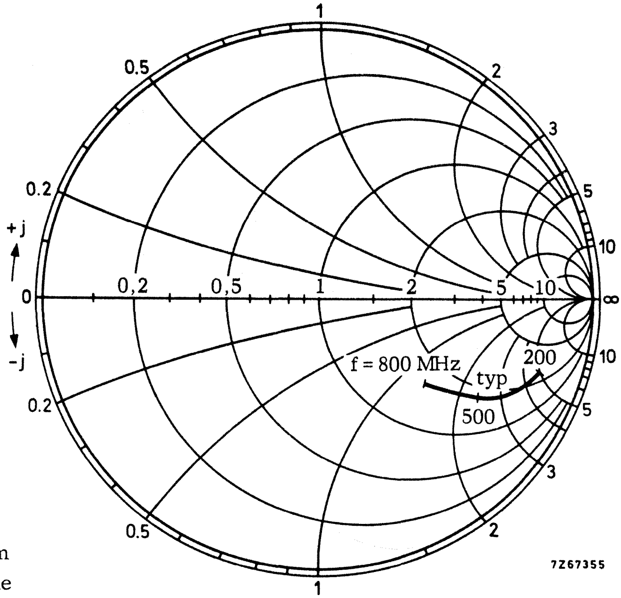

7Z67353
$T_j = 25\ ^oC$
$V_{CE} = 1\ V$
h_{FE}
60
40
20
0
typ
10^{-3}
10^{-2}
10^{-1}
1
I_C (mA)
10


7Z67354
$V_{CE} = 1\ V$
f = 500 MHz
$T_j = 25\ ^oC$
f_T
(GHz)
3
2
1
0
typ
0
500
1000
1500
I_C (μA)
2000


7Z67351
0,6
C_c
(pF)
0,4
0,2
0
$T_j = 25\ ^oC$
$I_E = I_e = 0$
f = 1 MHz
typ
0
5
V_{CB} (V)
10

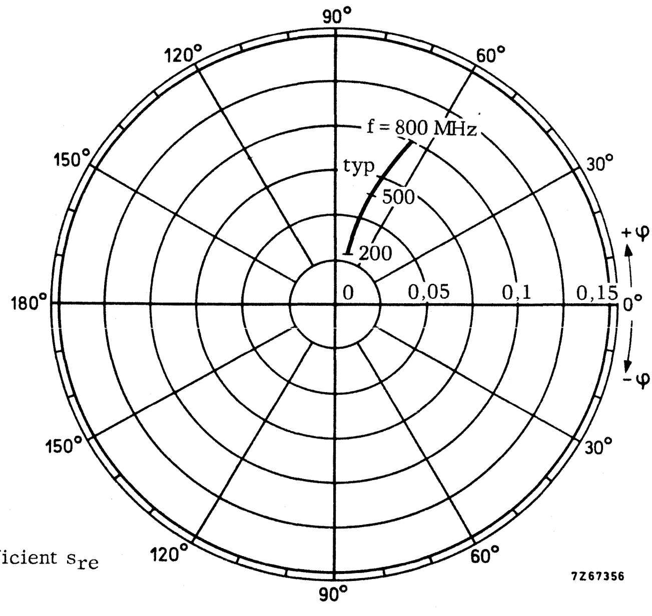

7Z67352
10
F
(dB)
7,5
5
2,5
0
$V_{CE} = 1$ V
f = 500 MHz
Z_S = optimum
$T_{amb} = 25\ ^oC$
typ
10^{-2}
10^{-1}
1
I_C (mA)
10

V_{CE} = 1 V
I_C = 1 mA
T_{amb} = 25 °C



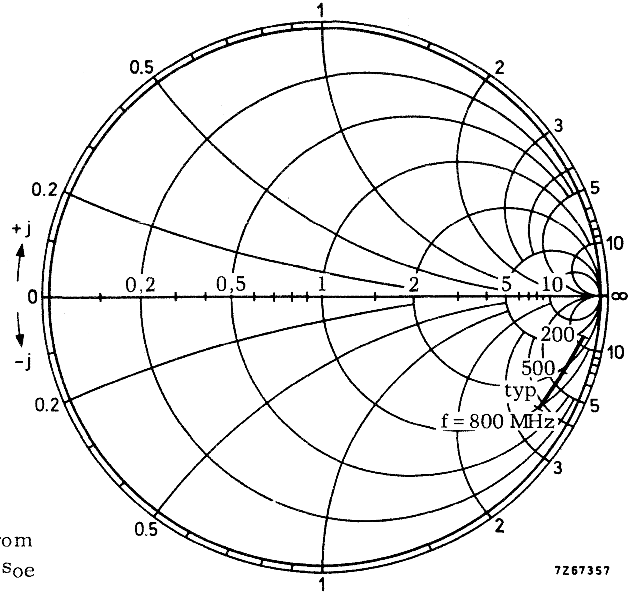
Input impedance derived from input reflection coefficient s_{ie} coordinates in ohm x 50

V_{CE} = 1 V
I_C = 1 mA
T_{amb} = 25 °C



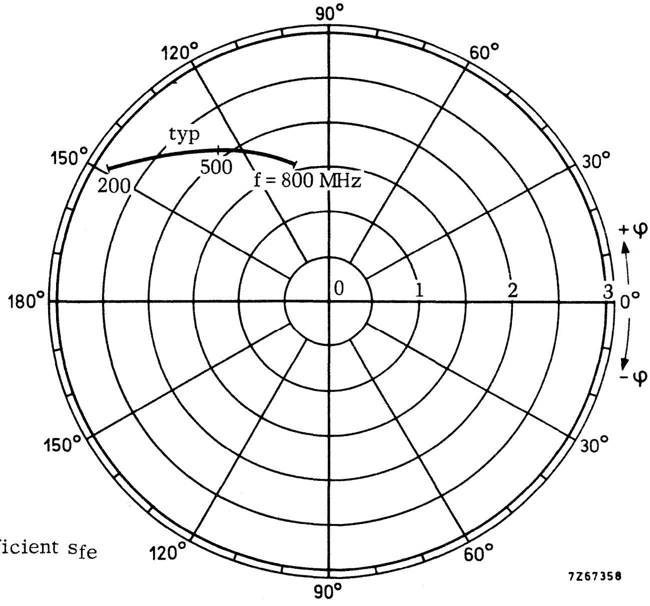
Reverse transmission coefficient s_{re}

V_{CE} = 1 V
I_C = 1 mA
T_{amb} = 25 °C



Output impedance derived from output reflection coefficient s_{oe} coordinates in ohm x 50

V_{CE} = 1 V
I_C = 1 mA
T_{amb} = 25 °C



Forward transmission coefficient s_{fe}

SILICON PLANAR EPITAXIAL TRANSISTOR

N-P-N multi-emitter transistor in a TO-39 metal envelope, with the collector connected to the case. The transistor has extremely good intermodulation properties and a high power gain. It is a ruggedized version of the BFW16, which it succeeds. It is primarily intended for:

- Final and driver stages of channel and band aerial amplifiers with high output power for bands I, II, III and IV/V (40–860 MHz).
- Final stage of the wideband vertical amplifier in high speed oscilloscopes.

QUICK REFERENCE DATA

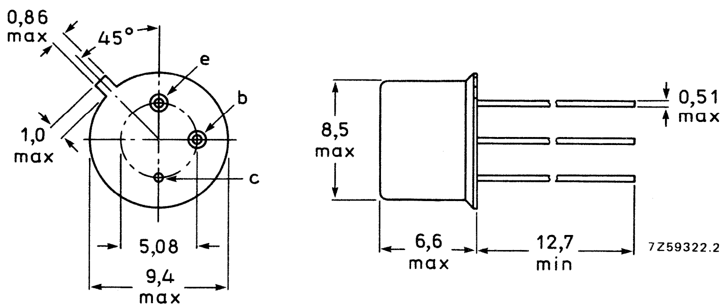
Collector-base voltage (open emitter; peak value)	V_{CBOM}	max.		40	V
Collector-emitter voltage (open base)	V_{CEO}	max.		25	V
Collector current (peak value; f > 1 MHz)	I_{CM}	max.		300	mA
Total power dissipation up to T_{mb} = 125 °C	P_{tot}	max.		1,5	W
Junction temperature	T_j	max.		200	°C
Feedback capacitance at f = 1 MHz I_C = 10 mA; V_{CE} = 15 V	C_{re}	typ.		1,7	pF
Transition frequency I_C = 150 mA; V_{CE} = 15 V; f = 500 MHz	f_T	typ.		1,2	GHz
			f = 200	800	MHz
Power gain (not neutralized) I_C = 70 mA; V_{CE} = 18 V	G_p	typ.	16	6,5	dB
Output power d_{im} = −30 dB; VSWR at output < 2; I_C = 70 mA; V_{CE} = 18 V	P_o	typ.	150	90	mW

MECHANICAL DATA

Dimensions in mm

Collector connected to case

Fig. 1 TO-39.



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.	40	V
Collector-emitter voltage ($R_{BE} \leq 50\ \Omega$) peak value	V_{CERM}	max.	40	V [1]
Collector-emitter voltage (open base)	V_{CEO}	max.	25	V [1]
Emitter-base voltage (open collector)	V_{EBO}	max.	2	V

Currents

Collector current (d.c.)	I_C	max.	150	mA
Collector current (peak value; f > 1 MHz)	I_{CM}	max.	300	mA

Power dissipation

Total power dissipation up to T_{mb} = 125 °C	P_{tot}	max.	1.5	W

Temperatures

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

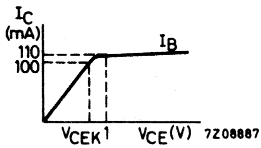
THERMAL RESISTANCE

From junction to ambient in free air	$R_{th\ j\text{-}a}$	=	250	°C/W
From junction to mounting base	$R_{th\ j\text{-}mb}$	=	50	°C/W
From mounting base to heatsink mounted with top clamping washer of 56218 and a boron nitride washer for electrical insulation	$R_{th\ mb\text{-}h}$	=	1.2	°C/W

[1] I_C = 10 mA.

CHARACTERISTICS T_j = 25 °C unless otherwise specified

Collector cut-off current				
$I_E = 0$; $V_{CB} = 20$ V; $T_j = 150$ °C	I_{CBO}	<	20	μA
Knee voltage				
$I_C = 100$ mA; I_B = value for which $I_C = 110$ mA at $V_{CE} = 1$ V	V_{CEK}	<	0.75	V



D.C. current gain				
$I_C = 50$ mA; $V_{CE} = 5$ V	h_{FE}	>	25	
$I_C = 150$ mA; $V_{CE} = 5$ V	h_{FE}	>	25	
Transition frequency				
$I_C = 150$ mA; $V_{CE} = 15$ V; f = 500 MHz	f_T	typ.	1.2	GHz
Collector capacitance at f = 1 MHz				
$I_E = I_e = 0$; $V_{CB} = 15$ V	C_c	<	4	pF
Feedback capacitance at f = 1 MHz				
$I_C = 10$ mA; $V_{CE} = 15$ V; $T_{amb} = 25$ °C	$-C_{re}$	typ.	1.7	pF
Noise figure at f = 200 MHz				
$I_C = 30$ mA; $V_{CE} = 15$ V; $R_S = 75\ \Omega$; $T_{amb} = 25$ °C	F	<	6	dB

Power gain (not neutralized)		f = 200	800	MHz
$I_C = 70$ mA; $V_{CE} = 18$ V; $T_{amb} = 25$ °C	G_p	typ. 16	6.5	dB

CHARACTERISTICS (continued)

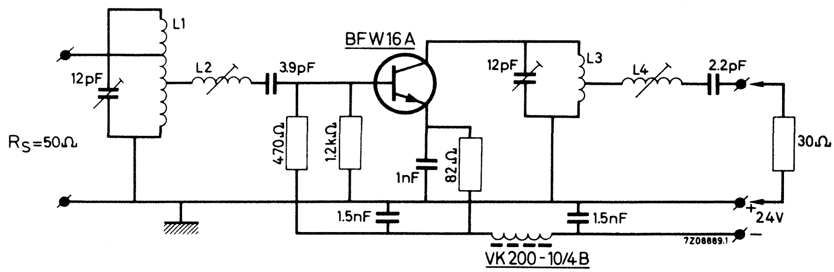
Intermodulation characteristics

1. Output power at f = 200 MHz; T_{amb} = 25 °C

I_C = 70 mA; V_{CE} = 18 V; V.S.W.R. at output < 2
f_p = 202 MHz; f_q = 205 MHz; d_{im} = −30 dB
measured at $f_{(2q-p)}$ = 208 MHz (Channel 9)

P_o	>	130	mW
	typ.	150	mW

Test circuit:



Coil data:

L1 = 3 turns silver plated Cu wire (1.4 mm); winding pitch 2.7 mm; int. diam. 8 mm; taps at 0.5 turn and 1.5 turns from earth.
L2 = 5.5 turns silver plated Cu wire (1.4 mm); winding pitch 2.2 mm; int. diam. 8 mm.
L3 = 3 turns silver plated Cu wire (1.4 mm); winding pitch 3.3 mm; int. diam. 8 mm.
L4 = 5.5 turns silver plated Cu wire (1.4 mm); winding pitch 2.2 mm; int. diam. 11 mm.

CHARACTERISTICS (continued)

Basis of adjustment

The intermodulation at an intermodulation distortion of −30 dB is caused by h.f. output current - voltage clipping.
The maximum undistorted output power is realised, if

a. Current and voltage clipping take place concurrently.
   This occurs if

$$R_L = \frac{V_{CE} - V_{CEK}}{I_C},$$

   in which V_{CEK} is the high frequency knee voltage.

b. The h.f. collector current is as small as possible.
   This is so if $-C_L = +C_{oe}$,
   in which C_{oe} is the output capacitance of the transistor at short circuited input.

For maximum output power at an intermodulation distortion of −30 dB, the (experimentally found) values of R_L and C_L are:
$R_L = 220\ \Omega$; $C_L = -5.6$ pF.

C_{oe} is found by 4 pF of the transistor and 1.6 pF by the mounting system concerning of a borium nitride washer between the envelope of the transistor and the chassis.

Adjustment procedure

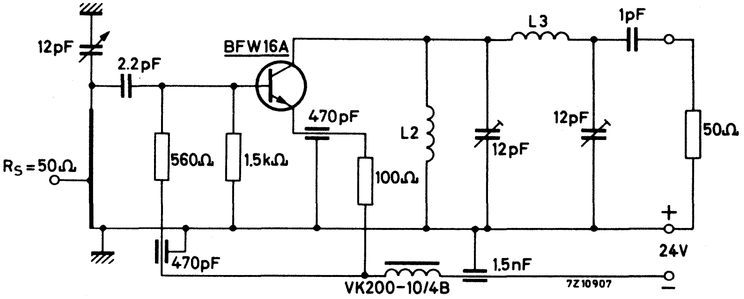
1. Remove the transistor and connect a dummy consisting of a 220 Ω resistor in parallel with a 5.6 pF capacitor between the collector and emitter connections of the output circuit.
2. Tune and match the output circuit for zero reflection at 205 MHz (V.S.W.R. = 1). After this adjustment, no further change may be made in the output circuit.
3. Replace the dummy by the transistor. Tune and match the input circuit for maximum power gain and good band pass curve.
   The V.S.W.R. of the output will then, in most cases, be ≤ 2 over the whole channel.
   Corrections can be made by tuning L2; this will not disturb the band pass curve.

CHARACTERISTICS (continued)

Intermodulation characteristics

2. Output power at f = 800 MHz; T_{amb} = 25 °C
   I_C = 70 mA; V_{CE} = 18 V; V.S.W.R. at output < 2
   f_p = 798 MHz; f_q = 802 MHz; d_{im} = −30 dB
   measured at $f_{(2q-p)}$ = 806 MHz (Channel 62) — P_o > 70 mW; typ. 90 mW

   Test circuit:



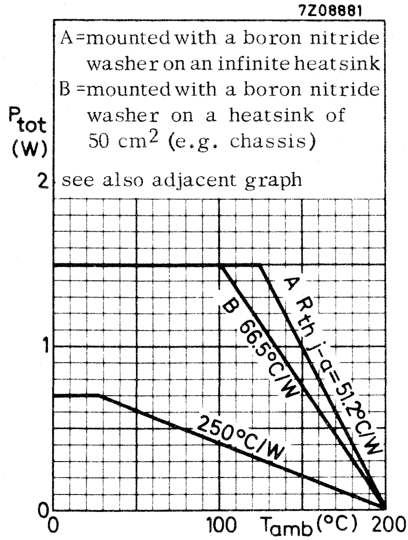
Coil data:
L1 = 25 mm x 7 mm x 0.85 mm silver plated Cu strip
Tap of the input at 5 mm from earth.
L2 = 13 turns enamelled Cu wire (0.6 mm); int. diam. 8 mm
L3 = 1.5 turns Cu wire (1.3 mm); int. diam. 8 mm

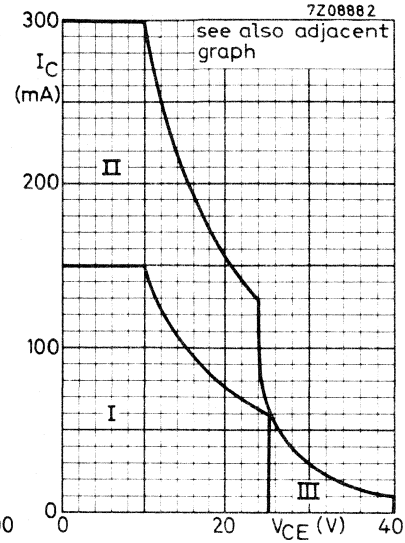
Basis of adjustment

At 800 MHz no dummy can be used to adjust for optimum collector load because at these frequencies the impedance transformations of a dummy are too high. A small signal at the mid-channel frequency of 802 MHz is fed to the input and increased until clipping occurs; that is, until the output power no longer increases linearly with the input signal. This clipping can be eliminated by tuning the output circuit, thereby making the output power equal to

$$P_o = \frac{I_C(V_{CE} - V_{CEK})}{2} = 480 \text{ mW}.$$

The output circuit is adjusted for minimum intermodulation if the input signal is as small as possible at P_o = 480 mW.
With this adjusting method care must be taken, that the transistor is not destructed by second breakdown (the voltage swing may not exceed the rated V_{CER} value). Therefore as soon as clipping occurs, the increase of the input signal should be stopped until the clipping has been eliminated. After this adjustment has been made no further change may be made in the output circuit.
Adjust the input circuit for maximum power gain and good band pass curve. The V.S.W.R. of the output is then ≤ 2 over the whole channel.

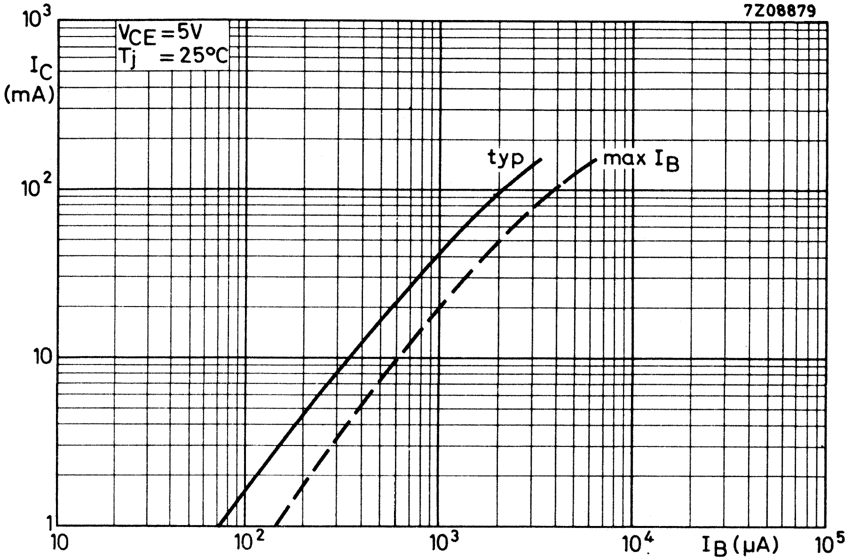


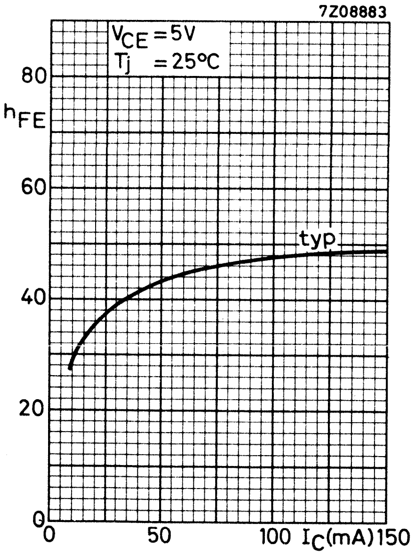


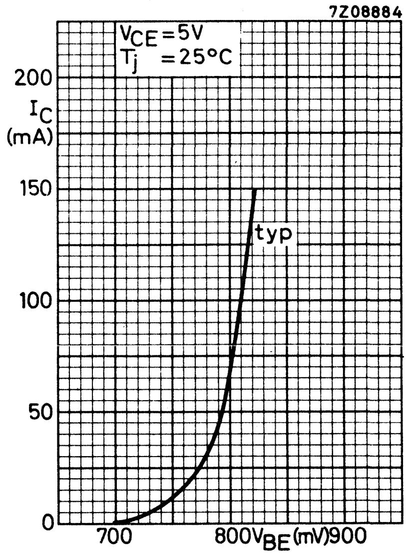
I = Region of permissible operation under all base-emitter conditions and at all frequencies, including d.c.

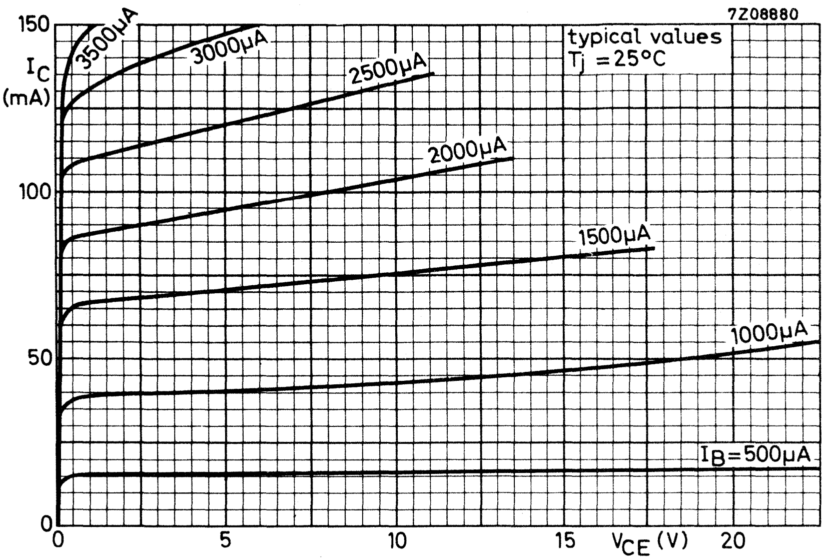
II = Additional region of operation at f $\geq$ 1 MHz.

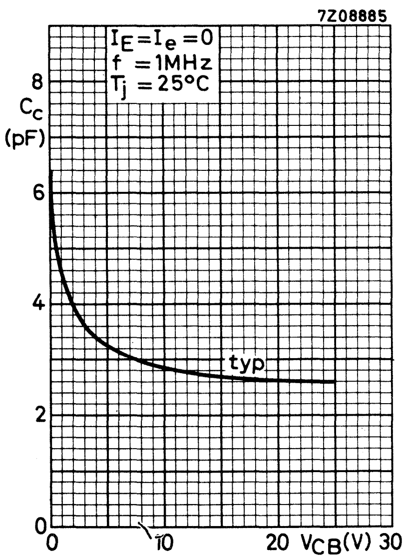
III = Operating under pulsed conditions is allowed, provided the transistor is cut-off with $R_{BE} \leq 50\ \Omega$ and f $\geq$ 1 MHz.

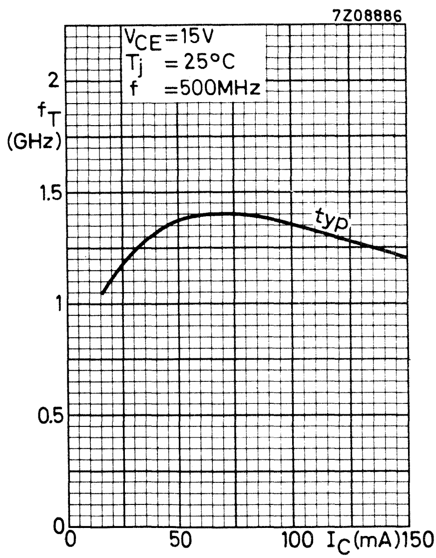

7Z08879
$V_{CE} = 5V$
$T_j = 25°C$
I_C (mA)
10^3
10^2
10
1
typ
max I_B
10
10^2
10^3
10^4
I_B (μA)
10^5


7Z08883
$V_{CE} = 5V$
$T_j = 25°C$
h_{FE}
80
60
40
20
0
typ
0
50
100
I_C(mA)
150


7Z08884
$V_{CE} = 5V$
$T_j = 25°C$
I_C (mA)
200
150
100
50
0
typ
700
800
V_{BE}(mV)
900


7Z08880
typical values
Tj =25°C
IC
(mA)
150
100
50
0
3500μA
3000μA
2500μA
2000μA
1500μA
1000μA
IB=500μA
0
5
10
15
VCE (V)
20


7Z08885
IE=Ie=0
f =1MHz
Tj =25°C
Cc
(pF)
8
6
4
2
0
typ
0
10
20
VCB(V)
30


7Z08886
VCE=15V
Tj =25°C
f =500MHz
fT
(GHz)
2
1.5
1
0.5
0
typ
0
50
100
IC(mA)
150

APPLICATION INFORMATION

Performance of channel- and band amplifiers [1])

Frequency range	channel 4 61-68	channel 9 202-209	channel 55 742-750	band I 47-68	band II 87.5-108	band III 174-230	MHz
Transistor used in							
final stage	BFW16A	BFW16A	BFW16A	BFW16A	BFW16A	BFW16A	
driver stage		BFW16A	BFW16A			BFW16A	
second stage			BFY90				
first stage	BFY90	BFY90	BFY90	BFY90	BFY90	BFY90	
Output power at							
d_{im} = −30 dB	150 [2])	150 [2])	100				mW
d_{im} = −50 dB					30		mW
d_{im} = −60 dB				10		10	mW
Power gain	50	44	26.5	51	43	39	dB
Noise figure	7	6	8	6.0-6.5	6.5	6.5	dB
V.S.W.R. over the whole channel or band							
for the input	< 2	< 2	< 2	< 2	< 2	< 2	
for the output	< 2	< 2	< 2	< 2	< 2	< 2	
Load impedance	30	30	50	30	30	30	Ω
Source impedance	60	60	50	60	60	60	Ω

[1]) Application information bulletins of all these amplifiers and a study of inter-modulation are available on request.

[2]) V_o = 2.2 V over R_L = 30 Ω or
V_o = 3 V over R_L = 60 Ω.

SILICON PLANAR EPITAXIAL TRANSISTOR

N-P-N multi-emitter transistor in a TO-39 metal envelope, with the collector connected to the case. The transistor has extremely good intermodulation properties and a high power gain. It is a ruggedized version of the BFW17, which it succeeds. It is primarily intended for final and driver stages of channel and band aerial amplifiers with high output power for bands I, II and III (40–230 MHz).

QUICK REFERENCE DATA

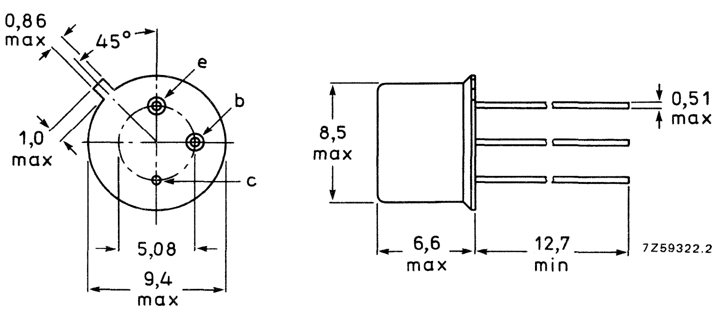
Collector-base voltage (open emitter; peak value)	V_{CBOM}	max.	40	V
Collector-emitter voltage (open base)	V_{CEO}	max.	25	V
Collector current (peak value; f > 1 MHz)	I_{CM}	max.	300	mA
Total power dissipation up to T_{mb} = 125 °C	P_{tot}	max.	1,5	W
Junction temperature	T_j	max.	200	°C
Feedback capacitance at f = 1 MHz I_C = 10 mA; V_{CE} = 15 V	C_{re}	typ.	1,7	pF
Transition frequency I_C = 150 mA; V_{CE} = 15 V; f = 500 MHz	f_T	typ.	1,1	GHz
Power gain (not neutralized) I_C = 70 mA; V_{CE} = 18 V; f = 200 MHz	G_p	typ.	16	dB
Output power d_{im} = −30 dB; VSWR at output < 2; I_C = 70 mA; V_{CE} = 18 V	P_o	typ.	150	mW

MECHANICAL DATA

Dimensions in mm

Collector connected to case

Fig. 1 TO-39.



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.	40	V	
Collector-emitter voltage ($R_{BE} \leq 50\ \Omega$) peak value	V_{CERM}	max.	40	V	1)
Collector-emitter voltage (open base)	V_{CEO}	max.	25	V	1)
Emitter-base voltage (open collector)	V_{EBO}	max.	2	V	

Currents

Collector current (d.c.)	I_C	max.	150	mA
Collector current (peak value; f > 1 MHz)	I_{CM}	max.	300	mA

Power dissipation

Total power dissipation up to T_{mb} = 125 °C	P_{tot}	max.	1.5	W

Temperatures

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

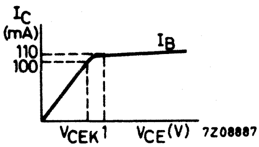
THERMAL RESISTANCE

From junction to ambient in free air	$R_{th\ j-a}$	=	250	°C/W
From junction to mounting base	$R_{th\ j-mb}$	=	50	°C/W
From mounting base to heatsink mounted with top clamping washer of 56218 and a boron nitride washer for electrical insulation	$R_{th\ mb-h}$	=	1.2	°C/W

1) I_C = 10 mA.

CHARACTERISTICS T_j = 25 °C unless otherwise specified

Collector cut-off current				
I_E = 0; V_{CB} = 20 V; T_j = 150 °C	I_{CBO}	<	20	μA
Knee voltage				
I_C = 100 mA; I_B = value for which I_C = 110 mA at V_{CE} = 1 V	V_{CEK}	<	0.75	V



D.C. current gain				
I_C = 50 mA; V_{CE} = 5 V	h_{FE}	>	25	
I_C = 150 mA; V_{CE} = 5 V	h_{FE}	>	25	
Transition frequency				
I_C = 150 mA; V_{CE} = 15 V; f = 500 MHz	f_T	typ.	1.1	GHz
Collector capacitance at f = 1 MHz				
I_E = I_e = 0; V_{CB} = 15 V	C_c	<	4	pF
Feedback capacitance at f = 1 MHz				
I_C = 10 mA; V_{CE} = 15 V; T_{amb} = 25 °C	$-C_{re}$	typ.	1.7	pF
Power gain (not neutralized)				
I_C = 70 mA; V_{CE} = 18 V; f = 200 MHz; T_{amb} = 25 °C	G_p	typ.	16	dB

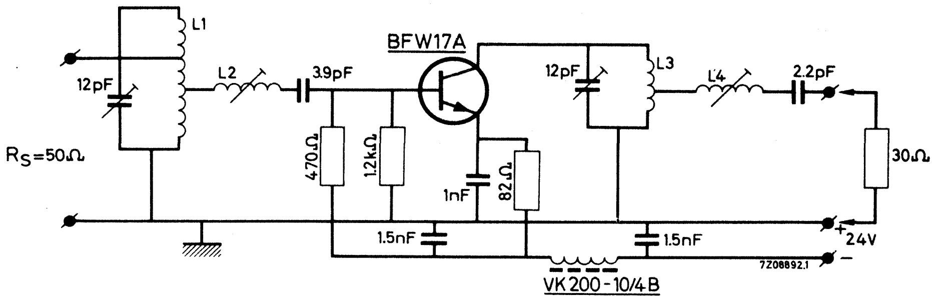
CHARACTERISTICS (continued)

Intermodulation characteristics

1. Output power at f = 200 MHz; T_{amb} = 25 °C

   I_C = 70 mA; V_{CE} = 18 V; V.S.W.R. at output < 2
   f_p = 202 MHz; f_q = 205 MHz; d_{im} = −30 dB
   measured at $f_{(2q-p)}$ = 208 MHz (Channel 9) — P_o typ. 150 mW

   Test circuit:



Coil data:

L1 = 3 turns silver plated Cu wire (1.4 mm); winding pitch 2.7 mm; int. diam. 8 mm; taps at 0.5 turn and 1.5 turns from earth.
L2 = 5.5 turns silver plated Cu wire (1.4 mm); winding pitch 2.2 mm; int. diam. 8 mm.
L3 = 3 turns silver plated Cu wire (1.4 mm); winding pitch 3.3 mm; int. diam. 8 mm.
L4 = 5.5 turns silver plated Cu wire (1.4 mm); winding pitch 2.2 mm; int. diam. 11 mm.

CHARACTERISTICS (continued)

Basis of adjustment

The intermodulation at an intermodulation distortion of −30 dB is caused by h.f. output current - voltage clipping.
The maximum undistorted output power is realised, if

a. Current and voltage clipping take place concurrently.
   This occurs if

$$R_L = \frac{V_{CE} - V_{CEK}}{I_C}$$

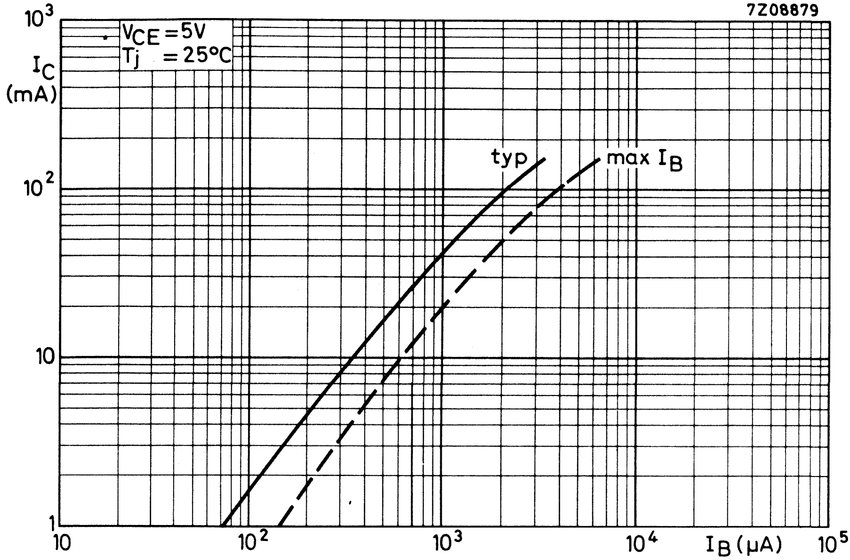
   in which V_{CEK} is the high frequency knee voltage.

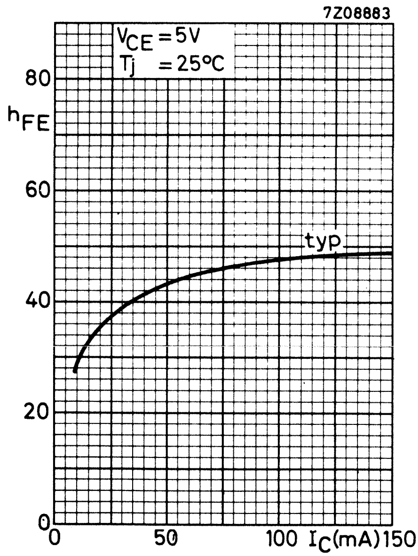
b. The h.f. collector current is as small as possible.
   This is so if $-C_L = +C_{oe}$,
   in which C_{oe} is the output capacitance of the transistor at short circuited input.

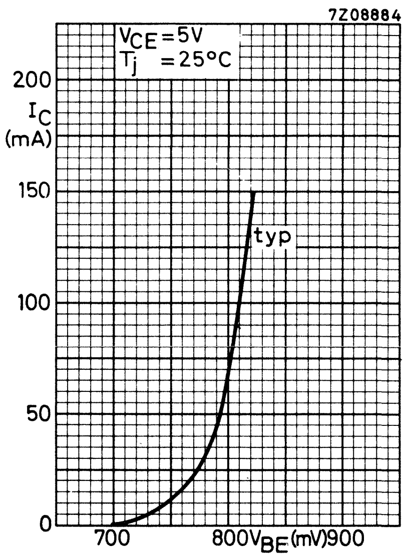
For maximum output power at an intermodulation distortion of −30 dB, the (experimentally found) values of R_L and C_L are:
$R_L = 220\ \Omega$; $C_L = -5.6$ pF.
C_{oe} is found by 4 pF of the transistor and 1.6 pF by the mounting system concerning of a borium nitride washer between the envelope of the transistor and the chassis.

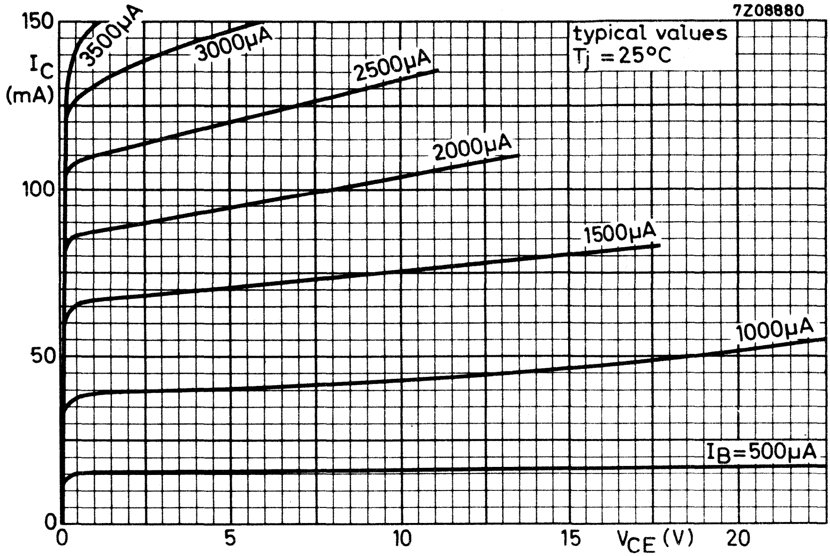
Adjustment procedure

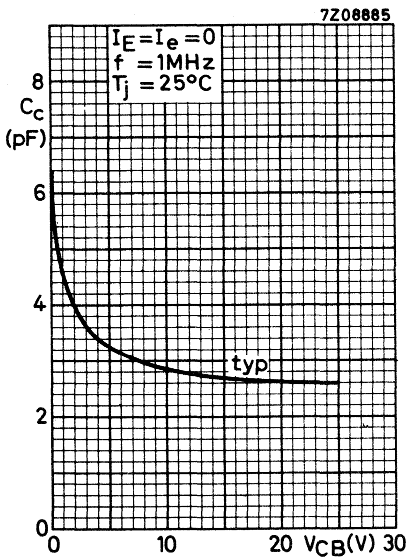
1. Remove the transistor and connect a dummy consisting of a 220 Ω resistor in parallel with a 5.6 pF capacitor between the collector and emitter connections of the output circuit.
2. Tune and match the output circuit for zero reflection at 205 MHz (V.S.W.R. = 1). After this adjustment, no further change may be made in the output circuit.
3. Replace the dummy by the transistor. Tune and match the input circuit for maximum power gain and good band pass curve.
   The V.S.W.R. of the output will then, in most cases, be ≤ 2 over the whole channel.
   Corrections can be made by tuning L2; this will not disturb the band pass curve.

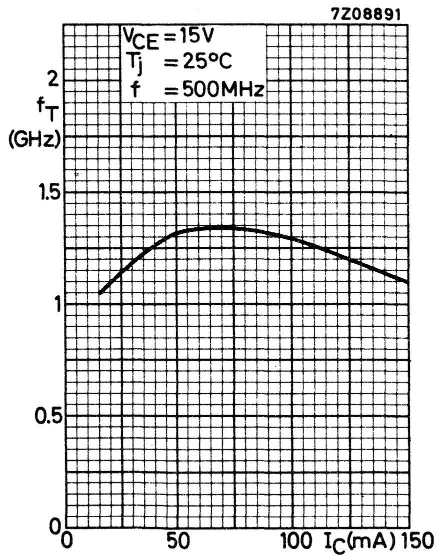

7Z08879
V_{CE} = 5V
T_j = 25°C
I_C (mA)
10^3
10^2
10
1
typ
max I_B
10
10^2
10^3
10^4
I_B (μA)
10^5

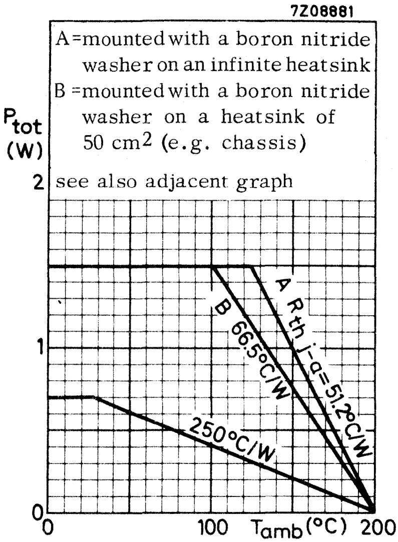

7Z08883
V_{CE} = 5V
T_j = 25°C
h_{FE}
80
60
40
20
0
typ
0
50
100
I_C (mA)
150

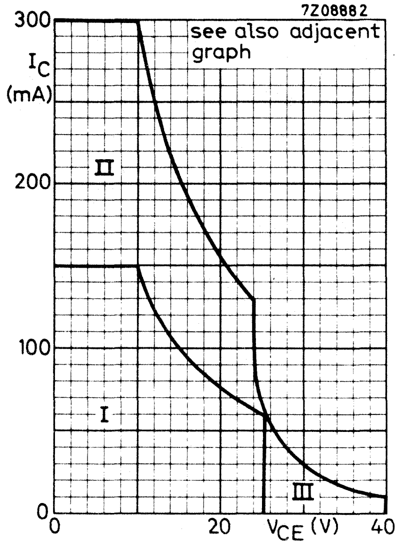

7Z08884
V_{CE} = 5V
T_j = 25°C
I_C (mA)
200
150
100
50
0
typ
700
800
V_{BE} (mV)
900


7Z08880
typical values
T_j = 25°C
I_C (mA)
150
100
50
0
3500μA
3000μA
2500μA
2000μA
1500μA
1000μA
I_B = 500μA
0
5
10
15
V_{CE} (V)
20


7Z08885
$I_E = I_e = 0$
f = 1MHz
T_j = 25°C
C_c (pF)
8
6
4
2
0
typ
0
10
20
V_{CB} (V)
30


7Z08891
V_{CE} = 15V
T_j = 25°C
f = 500MHz
f_T (GHz)
2
1.5
1
0.5
0
0
50
100
I_C (mA)
150





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

III = Operating under pulsed conditions is allowed, provided the transistor is cut-off with $R_{BE} \leq 50\ \Omega$ and f ≥ 1 MHz.

SILICON PLANAR EPITAXIAL TRANSISTOR

N-P-N multi-emitter transistor in a TO-72 metal envelope, with insulated electrodes and a shield lead connected to the case. The transistor has very low intermodulation distortion and very high power gain. It is primarily intended for:
- Wideband vertical amplifiers in high speed oscilloscopes.
- Wideband aerial amplifiers (40–860 MHz).
- Television distribution amplifiers.

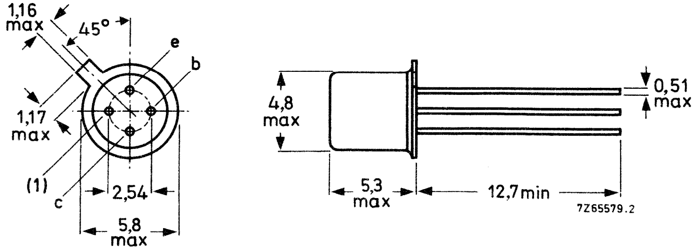
QUICK REFERENCE DATA

Collector-base voltage (open emitter; peak value)	V_{CBOM}	max.	20	V
Collector-emitter voltage (open base)	V_{CEO}	max.	10	V
Collector current (peak value; f > 1 MHz)	I_{CM}	max.	100	mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	250	mW
Junction temperature	T_j	max.	200	°C
Feedback capacitance at f = 1 MHz I_C = 2 mA; V_{CE} = 5 V	C_{re}	typ.	0,8	pF
Transition frequency I_C = 50 mA; V_{CE} = 5 V; f = 500 MHz	f_T	typ.	1,6	GHz
Power gain (not neutralized)			f = 200 | 800	MHz
I_C = 30 mA; V_{CE} = 5 V	G_p	typ.	21 | 7,5	dB
Intermodulation distortion I_C = 30 mA; V_{CE} = 6 V; R_L = 37,5 Ω; V_o = 100 mV at f_p = 183 MHz; V_o = 100 mV at f_q = 200 MHz; measured at $f_{(2q-p)}$ = 217 MHz	d_{im}	typ.	−60	dB

MECHANICAL DATA

Dimensions in mm

Fig. 1 TO-72.



(1) = shield lead (connected to case).

Accessories: 56246 (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.	20	V	
Collector-emitter voltage (open base)					
I_C = 10 mA	V_{CEO}	max.	10	V	2)
Emitter-base voltage (open collector)	V_{EBO}	max.	2.5	V	

Currents

Collector current (d.c.)	I_C	max.	50	mA
Collector current (peak value; f > 1 MHz)	I_{CM}	max.	100	mA

Power dissipation

Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	250	mW

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	$R_{th\ j-a}$	=	0.7	°C/mW
From junction to case	$R_{th\ j-c}$	=	0.5	°C/mW

CHARACTERISTICS T_j = 25 °C unless otherwise specified

Collector cut-off current				
$I_E = 0$; $V_{CB} = 10$ V	I_{CBO}	<	50	nA
D.C. current gain				
$I_C = 25$ mA; $V_{CE} = 5$ V	h_{FE}	>	25	
$I_C = 50$ mA; $V_{CE} = 5$ V	h_{FE}	>	25	
Transition frequency 1)				
$I_C = 50$ mA; $V_{CE} = 5$ V; f = 500 MHz	f_T	typ.	1.6	GHz
Collector capacitance at f = 1 MHz 2)				
$I_E = I_e = 0$; $V_{CB} = 5$ V	C_c	<	1.5	pF
Feedback capacitance at f = 1 MHz 1)				
$I_C = 2$ mA; $V_{CE} = 5$ V	$-C_{re}$	typ.	0.8	pF
Noise figure 1)				
$I_C = 2$ mA; $V_{CE} = 5$ V; f = 500 MHz; $R_S = 50\ \Omega$	F	<	5	dB

Power gain (not neutralized) 1)

$I_C = 30$ mA; $V_{CE} = 5$ V; $T_{amb} = 25$ °C

		f = 200	800	MHz
G_p	>	19		dB
	typ.	21	7.5	dB

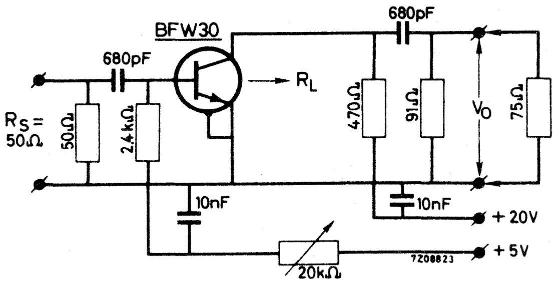
Intermodulation distortion 1)

$I_C = 30$ mA; $V_{CE} = 6$ V; $R_L = 37.5\ \Omega$; $T_{amb} = 25$ °C

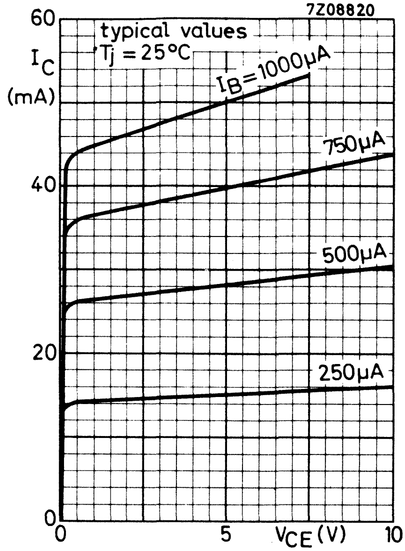
$V_o = 100$ mV at $f_p = 183$ MHz

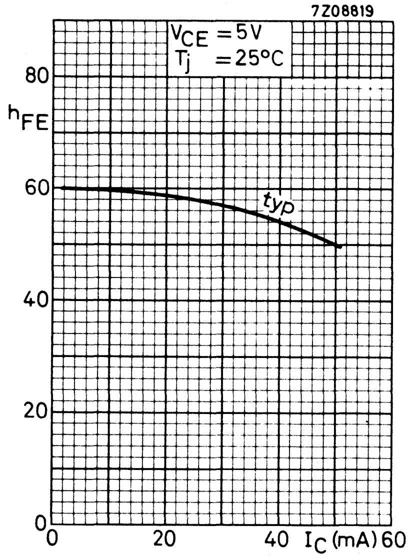
$V_o = 100$ mV at $f_q = 200$ MHz
measured at $f_{(2q-p)} = 217$ MHz — d_{im} typ. −60 dB

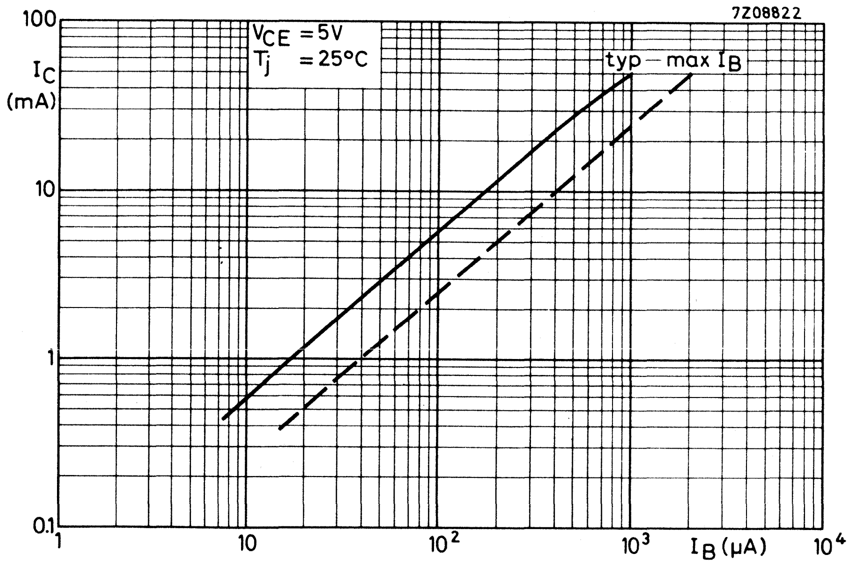
Test circuit

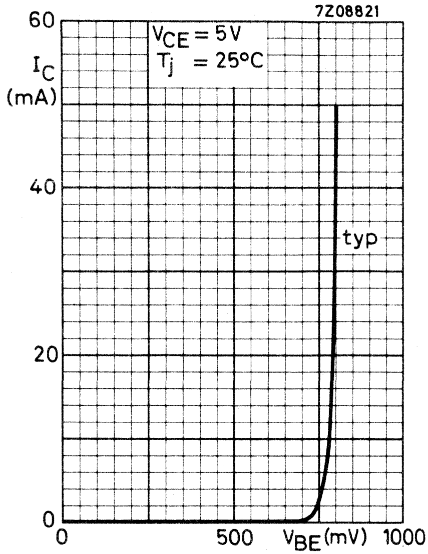


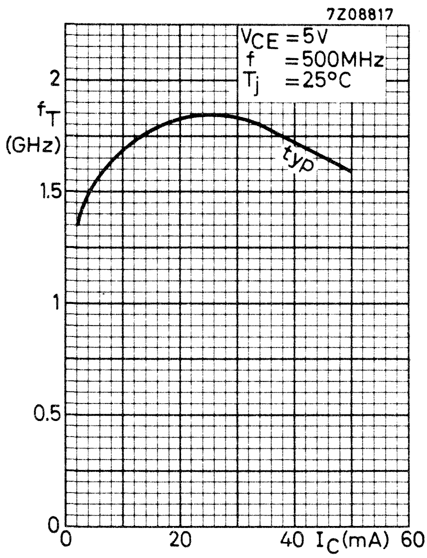
1) Shield lead grounded.
2) Shield lead not connected.

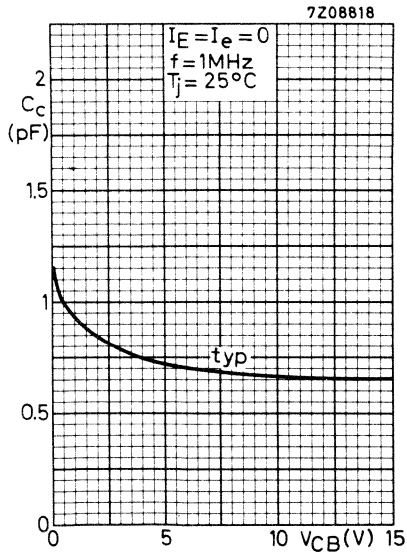

7Z08820
typical values
$T_j = 25°C$
I_C (mA)
$I_B = 1000 \mu A$
750µA
500µA
250µA
V_{CE} (V)
0
5
10
20
40
60


7Z08819
$V_{CE} = 5V$
$T_j = 25°C$
h_{FE}
typ
I_C (mA)
0
20
40
60
80


7Z08822
$V_{CE} = 5V$
$T_j = 25°C$
I_C (mA)
typ — max I_B
I_B (µA)
0.1
1
10
100
10^2
10^3
10^4


7Z08821
V_{CE} = 5 V
T_j = 25°C
I_C (mA)
60
40
20
0
typ
0
500
V_{BE} (mV)
1000


7Z08817
V_{CE} = 5 V
f = 500 MHz
T_j = 25°C
f_T (GHz)
2
1.5
1
0.5
0
typ
0
20
40
I_C (mA)
60


7Z08818
$I_E = I_e = 0$
f = 1 MHz
T_j = 25°C
C_c (pF)
2
1.5
1
0.5
0
typ
0
5
10
V_{CB} (V)
15

SILICON PLANAR EPITAXIAL TRANSISTOR

N-P-N transistor in a subminiature plastic T-package. It has a low noise over a wide current range, a very high power gain and good intermodulation properties.
It is primarily intended for:
- Wideband aerial amplifiers (40 - 860 MHz)
- Channel and band aerial amplifiers for band I, II, III and IV/V (40 - 860 MHz)
- Television distribution amplifiers
- Low noise wideband vertical amplifier in high speed oscilloscopes

QUICK REFERENCE DATA

Collector-base voltage (open emitter; peak value)	V_{CBOM}	max.	25		V
Collector-emitter voltage (open base)	V_{CEO}	max.	15		V
Collector current (peak value; f > 1 MHz)	I_{CM}	max.	50		mA
Total power dissipation up to T_{amb} = 73 °C	P_{tot}	max.	190		mW
Junction temperature	T_j	max.	150		°C
Transition frequency at f = 500 MHz I_C = 25 mA; V_{CE} = 5 V	f_T	typ.	1,6		GHz
Feedback capacitance at f = 1 MHz I_C = 2 mA; V_{CE} = 5 V	C_{re}	typ.	0,6		pF
Noise figure at f = 500 MHz I_C = 2 mA; V_{CE} = 5 V	F	typ.	4		dB
		f =	200	800	MHz
Power gain (not neutralized) I_C = 10 mA; V_{CE} = 10 V; T_{amb} = 25 °C	G_p	typ.	23	11	dB
Output power at d_{im} = −30 dB VSWR at output < 2; I_C = 10 mA; V_{CE} = 10 V	P_o	typ.	8	8	mW

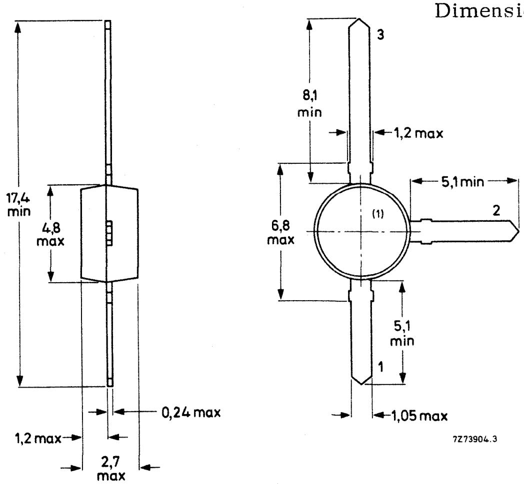
MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-37.

Connections

1. Base
2. Emitter
3. Collector



(1) = type number marking.

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

Voltages

Collector-base voltage (open emitter; peak value)	V_{CBOM}	max.	25	V
Collector-emitter voltage (open base)	V_{CEO}	max.	15	V [1]
Emitter-base voltage (open collector)	V_{EBO}	max.	2.5	V

Currents

Collector current (d.c.)	I_C	max.	25	mA
Collector current (peak value; f > 1 MHz)	I_{CM}	max.	50	mA

Power dissipation

Total power dissipation up to T_{amb} = 73 °C	P_{tot}	max.	190	mW

Temperatures

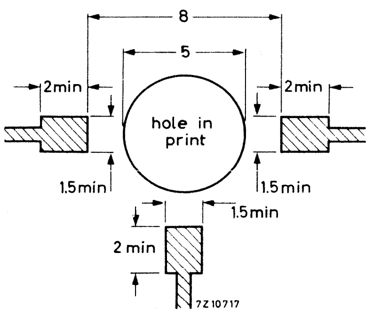
Storage temperature	T_{stg}	-65 to +150		°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

From junction to ambient in free air mounted on a glass-fibre print *) of 40 mm x 25 mm x 1 mm — $R_{th\ j\text{-}a}$ = 0.4 °C/mW

*) Requirements for glass-fibre print

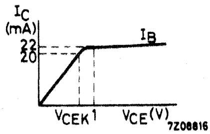
(dimensions in mm)



1) At I_C = 10 mA

CHARACTERISTICS T_j = 25 °C unless otherwise specified

Collector cut-off current				
$I_E = 0$; $V_{CB} = 10$ V	I_{CBO}	<	50	nA
Knee voltage [1]				
$I_C = 20$ mA; I_B = value for which $I_C = 22$ mA at $V_{CE} = 1$ V	V_{CEK}	<	0.75	V



D.C. current gain				
$I_C = 2$ mA; $V_{CE} = 1$ V	h_{FE}	> <	20 150	
$I_C = 25$ mA; $V_{CE} = 1$ V [1]	h_{FE}	>	20	
Transition frequency at f = 500 MHz				
$I_C = 2$ mA; $V_{CE} = 5$ V	f_T	typ.	1.0	GHz
$I_C = 25$ mA; $V_{CE} = 5$ V [1]	f_T	typ.	1.6	GHz
Collector capacitance at f = 1 MHz				
$I_E = I_e = 0$; $V_{CB} = 10$ V	C_c	typ.	0.7	pF
Emitter capacitance at f = 1 MHz				
$I_C = I_c = 0$; $V_{EB} = 0.5$ V	C_e	typ.	1.5	pF
Feedback capacitance at f = 1 MHz				
$I_C = 2$ mA; $V_{CE} = 5$ V; $T_{amb} = 25$ °C	$-C_{re}$	typ.	0.6	pF
Noise figure at f = 500 MHz				
$I_C = 2$ mA; $V_{CE} = 5$ V; $R_S = 50\,\Omega$; $T_{amb} = 25$ °C	F	typ.	4.0	dB

			f = 200	800	MHz
Power gain (not neutralized)					
$I_C = 10$ mA; $V_{CE} = 10$ V; $T_{amb} = 25$ °C	G_p	typ.	23	11	dB

[1]) Measured under pulsed conditions.

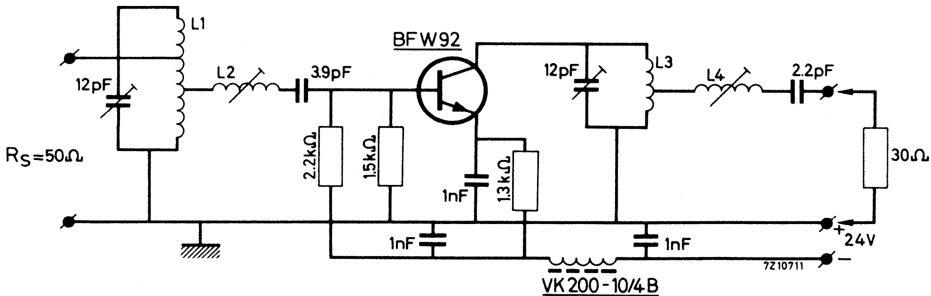
CHARACTERISTICS (continued) T_j = 25 °C unless otherwise specified

Intermodulation characteristics

1. Output power at f = 200 MHz; T_{amb} = 25 °C

I_C = 10 mA; V_{CE} = 10 V; V.S.W.R. at output < 2
f_p = 202 MHz; f_q = 205 MHz; d_{im} = −30 dB
measured at $f_{(2q-p)}$ = 208 MHz (Channel 9) P_o typ. 8 mW

Test circuit:



Coil data:

L1 = 3 turns silver plated Cu wire (1.4 mm); winding pitch 2.7 mm; int. diam. 8 mm; taps at 0.5 turn and 1.5 turns from earth.
L2 = 5.5 turns silver plated Cu wire (1.4 mm); winding pitch 2.2 mm; int. diam. 8 mm.
L3 = 3 turns silver plated Cu wire (1.4 mm); winding pitch 3.3 mm; int. diam. 8 mm.
L4 = 5.5 turns silver plated Cu wire (1.4 mm); winding pitch 2.2 mm; int. diam. 11 mm.

CHARACTERISTICS (continued)

Basis of adjustment

The intermodulation at an intermodulation distortion of −30 dB is caused by h.f. output current - voltage clipping.
The maximum undistorted output power is realised, if

a. Current and voltage clipping take place concurrently.
This occurs if

$$R_L = \frac{V_{CE} - V_{CEK}}{I_C},$$

in which V_{CEK} is the high frequency knee voltage.

b. The h.f. collector current is as small as possible.
This is so if $-C_L = +C_{oe}$,
in which C_{oe} is the output capacitance of the transistor at short circuited input.

For maximum output power at an intermodulation distortion of −30 dB, the (experimentally found) values of R_L and C_L are:
R_L = 820 Ω; C_L = −1.0 pF

Adjustment procedure

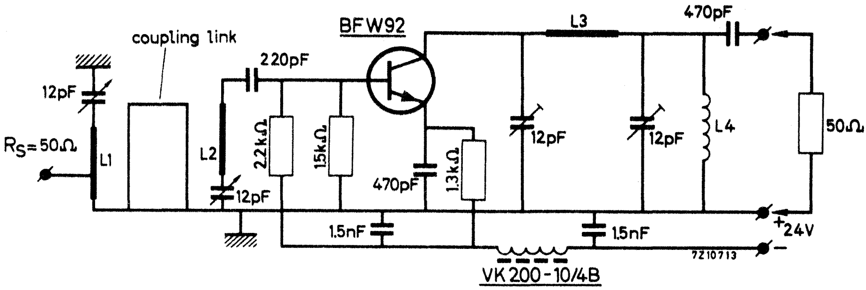
1. Remove the transistor and connect a dummy consisting of a 820 Ω resistor in parallel with a 1.0 pF capacitor between the collector and emitter connections of the output circuit.
2. Tune and match the output circuit for zero reflection at 205 MHz (V.S.W.R. = 1). After this adjustment, no further change may be made in the output circuit.
3. Replace the dummy by the transistor. Tune and match the input circuit for maximum power gain and good band pass curve.
The V.S.W.R. of the output will then, in most cases, be ≤ 2 over the whole channel.
Corrections can be made by tuning L2; this will not disturb the band pass curve.

CHARACTERISTICS (continued) T_j = 25 °C unless otherwise specified

Intermodulation characteristics

2. Output power at f = 800 MHz; T_{amb} = 25 °C

I_C = 10 mA; V_{CE} = 10 V; V.S.W.R. at output < 2
f_p = 798 MHz; f_q = 802 MHz; d_{im} = −30 dB
measured at $f_{(2q-p)}$ = 806 MHz (Channel 62) P_o typ. 8 mW



Coil data:
L1 = 24 mm x 6 mm x 0.5 mm silver plated Cu strip.
Tap of the input at 5 mm from earth.
L2 = 15 mm x 6 mm x 0.5 mm silver plated Cu strip.
L3 = 20 mm x 8 mm x 0.5 mm silver plated Cu strip.
L4 = 4 turns enamelled Cu wire (0.5mm); winding pitch 1.5mm; int. diam. 4mm
Coupling link: 42 mm silver plated Cu wire (1 mm).

Basis of adjustment

At 800 MHz no dummy can be used to adjust for optimum collector load because at these frequencies the impedance transformations of a dummy are too high. A small signal at the mid-channel frequency of 802 MHz is fed to the input and increased until clipping occurs; that is, until the output power no longer increases linearily with the input signal. This clipping can be eliminated by tuning the output circuit, thereby making the output power equal to

$$P_o = \frac{I_C (V_{CE} - V_{CEK})}{2} = 40 \text{ mW}$$

The output circuit is adjusted for minimum intermodulation if the input signal is as small as possible at P_o = 40 mW.
After this adjustment has been made no further change may be made in the output circuit.
Adjust the input circuit for maximum power gain and good band pass curve.
The V.S.W.R. of the output is then ≤ 2 over the whole channel.

CHARACTERISTICS (continued)

Intermodulation characteristics

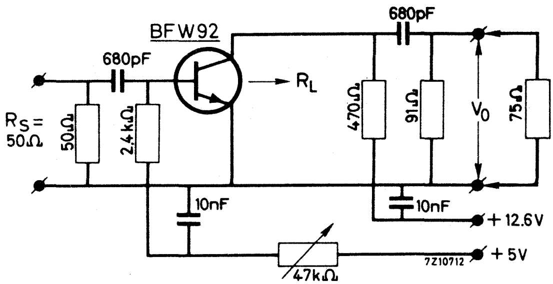
3. Intermodulation distortion

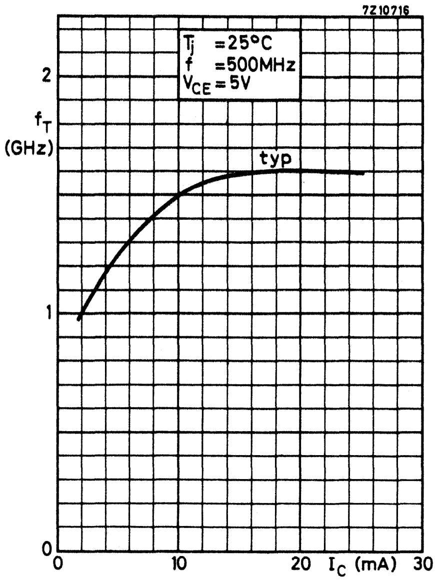
I_C = 10 mA; V_{CE} = 6 V; R_L = 37.5 Ω; T_{amb} = 25 °C

V_0 = 100 mV at f_p = 183 MHz

V_0 = 100 mV at f_q = 200 MHz
measured at $f_{(2q-p)}$ = 217 MHz | d_{im} typ. −45 dB

Test circuit:




7Z10716
T_j = 25°C
f = 500MHz
V_{CE} = 5V
f_T (GHz)
typ
I_C (mA)
0
1
2
0
10
20
30

SILICON PLANAR EPITAXIAL TRANSISTOR

N-P-N transistor in a subminiature T-package primarily intended for use in amplifiers in the 40-860 MHz range. The BFW92A is the successor to the BFW92 and offers higher power gain and improved noise behaviour.

QUICK REFERENCE DATA

Collector-base voltage (open emitter)	V_{CBO}	max.	25	V
Collector-emitter voltage (open base)	V_{CEO}	max.	15	V
Collector current (d.c.)	I_C	max.	25	mA
Total power dissipation up to T_{amb} = 70 °C	P_{tot}	max.	200	mW
Junction temperature	T_j	max.	150	°C
Transition frequency at f = 500 MHz I_C = 25 mA; V_{CE} = 5 V	f_T	typ.	2,8	GHz
Feedback capacitance at f = 1 MHz I_C = 0; V_{CE} = 5 V	C_{re}	typ.	0,45	pF
Noise figure at f = 800 MHz I_C = 2 mA; V_{CE} = 5 V; R_S = 60 Ω	F	typ.	2,5	dB
Maximum unilateral power gain at f = 800 MHz I_C = 14 mA; V_{CE} = 10 V	G_{UM}	typ.	13	dB
Output voltage at d_{im} = –60 dB (see Fig. 3) I_C = 14 mA; V_{CE} = 10 V; R_L = 75 Ω $f_{(p+q-r)}$ = 793,25 MHz	V_O	typ.	150	mV

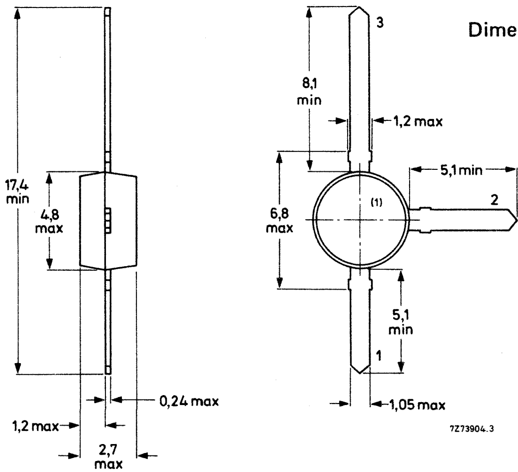
MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-37.

Connections

1. Base
2. Emitter
3. Collector



(1) Type number marking.

RATINGS

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

Collector-base voltage (open emitter)	V_{CBO}	max.	25 V
Collector-emitter voltage (open base)	V_{CEO}	max.	15 V
Emitter-base voltage (open collector)	V_{EBO}	max.	2,5 V
Collector current (d.c.)	I_C	max.	25 mA
Collector current (peak)	I_{CM}	max.	50 mA
Total power dissipation up to T_{amb} = 70 °C	P_{tot}	max.	200 mW
Storage temperature	T_{stg}	−65 to + 150 °C	
Junction temperature	T_j	max.	150 °C

THERMAL RESISTANCE

From junction to ambient in free air mounted on a fibre-glass print (see Fig. 2) of 40 mm x 25 mm x 1 mm — $R_{th\ j\text{-}a}$ = 400 K/W*

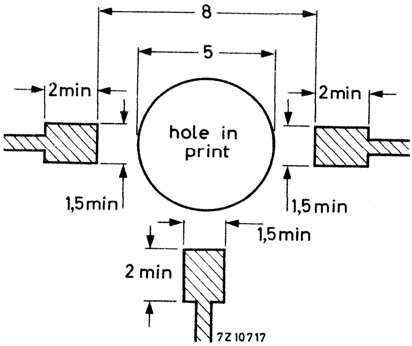


Fig. 2 Requirements for fibre-glass print (dimensions in mm).

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current			
$I_E = 0$; V_{CB} = 10 V	I_{CBO}	<	50 nA
D.C. current gain			
I_C = 2 mA; V_{CE} = 1 V	h_{FE}	>	20
		<	150
I_C = 25 mA; V_{CE} = 1 V	h_{FE}	>	20

* K/W is SI unit for °C/W.

Transition frequency at f = 500 MHz I_C = 25 mA; V_{CE} = 5 V	f_T	typ.	2,8 GHz
Collector capacitance at f = 1 MHz I_E = 0; V_{CB} = 10 V	C_c	typ.	0,8 pF
Emitter capacitance at f = 1 MHz I_C = 0; V_{EB} = 0,5 V	C_e	typ.	1,4 pF
Feedback capacitance at f = 1 MHz I_C = 0; V_{CE} = 5 V	C_{re}	typ.	0,45 pF
Noise figure at f = 800 MHz and T_{amb} = 25 °C I_C = 2 mA; V_{CE} = 5 V; R_S = 60 Ω	F	typ.	2,5 dB
Output voltage at d_{im} = −60 dB (see Fig. 3) I_C = 14 mA; V_{CE} = 10 V; R_L = 75 Ω $V_p = V_o$ at d_{im} = −60 dB; f_p = 795,25 MHz $V_q = V_o$ −6 dB ; f_q = 803,25 MHz $V_r = V_o$ −6 dB ; f_r = 805,25 MHz Measured at $f_{(p+q-r)}$ = 793,25 MHz	V_o	typ.	150 mV
Maximum unilateral power gain at f = 800 MHz I_C = 14 mA; V_{CE} = 10 V	G_{UM}	typ.	13 dB

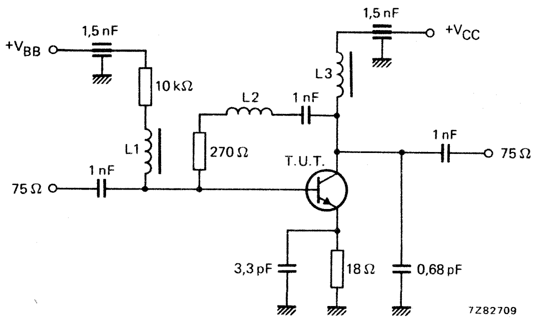


Fig. 3 Intermodulation distortion and second harmonic distortion MATV test circuit.

L1 = L3 = 5 μH microchoke
L2 = 3 turns Cu wire (0,4 mm); internal diameter 3 mm; winding pitch 1 mm

S-parameters (common emitter) at I_C = 14 mA; V_{CE} = 10 V

f MHz	s_{ie}	s_{re}	s_{fe}	s_{oe}
40	0,56/ −30°	0,01/76°	27,5/156°	0,94/ 10°
100	0,42/ −64°	0,02/69°	20,4/131°	0,81/−17°
200	0,28/−100°	0,03/68°	12,7/109°	0,70/−19°
500	0,18/−161°	0,05/74°	5,7/ 87°	0,63/−23°
800	0,18/+163°	0,08/75°	3,6/ 74°	0,63/−31°
1000	0,19/+145°	0,10/75°	2,9/ 66°	0,62/−36°

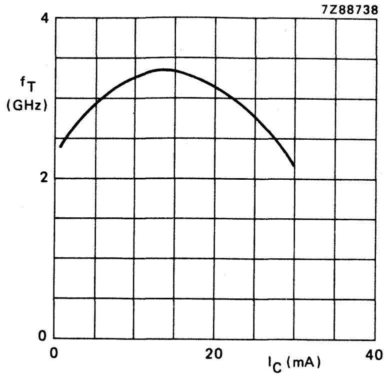


Fig. 4 V_{CE} = 5 V; f = 500 MHz; T_j = 25 ^oC.

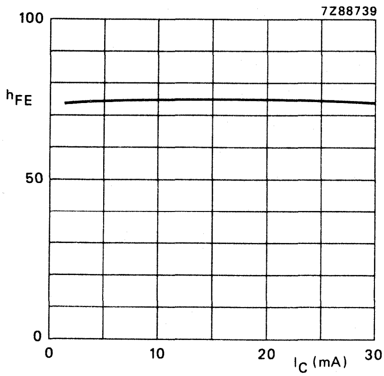


Fig. 5 V_{CE} = 5 V; T_j = 25 ^oC.

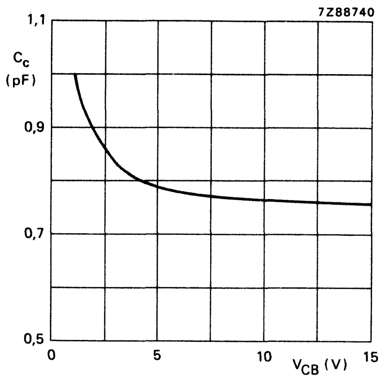


Fig. 6 T_j = 25 ^oC.

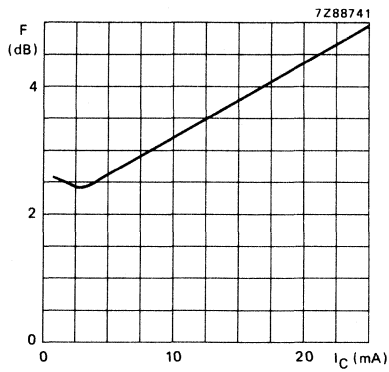


Fig. 7 V_{CE} = 5 V; T_{amb} = 25 ^oC; f = 800 MHz; R_S = 60 Ω.

SILICON PLANAR EPITAXIAL TRANSISTOR

N-P-N transistor in a subminiature plastic transfer-moulded T-package.
The device is intended for use in v.h.f. - u.h.f. applications, primarily wideband aerial amplifiers 40 - 800 MHz.
It is intended for mounting on miniature printed-circuit boards.

QUICK REFERENCE DATA				
Collector-base voltage (open emitter)	V_{CBO}	max.	18	V
Collector-emitter voltage (open base)	V_{CEO}	max.	10	V
Collector current (peak value; f > 1 MHz)	I_{CM}	max.	100	mA
Total power dissipation up to T_{amb} = 73 °C	P_{tot}	max.	190	mW
Junction temperature	T_j	max.	150	°C
Feedback capacitance at f = 1 MHz				
I_C = 2 mA; V_{CE} = 5 V; T_{amb} = 25 °C	C_{re}	typ.	0,6	pF
Transition frequency at f = 500 MHz				
I_C = 50 mA; V_{CE} = 5 V	f_T	typ.	1,7	GHz
Max. unilateral power gain				
I_C = 30 mA; V_{CE} = 5 V; f = 200 MHz; T_{amb} = 25 °C	G_{UM}	typ.	22	dB
I_C = 30 mA; V_{CE} = 5 V; f = 800 MHz; T_{amb} = 25 °C	G_{UM}	typ.	10,5	dB
Intermodulation distortion at T_{amb} = 25 °C				
I_C = 30 mA; V_{CE} = 5 V; R_L = 37,5 Ω				
V_O = 100 mV at f_p = 183 MHz				
V_O = 100 mV at f_q = 200 MHz				
measured at $f_{(2q-p)}$ = 217 MHz	d_{im}	typ.	−60	dB

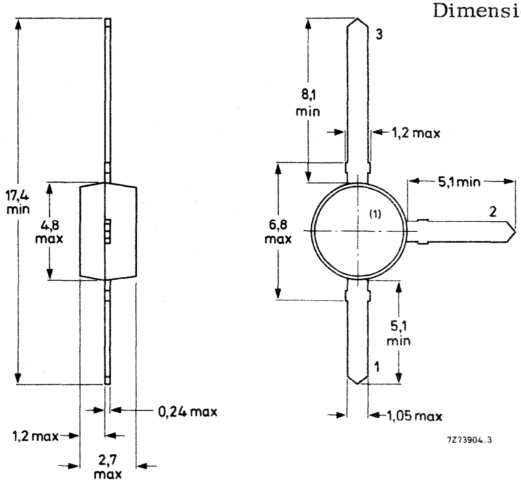
MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-37.

Connections

1. Base
2. Emitter
3. Collector



(1) = type number marking.

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

Voltages

Collector-base voltage (open emitter)	V_{CBO}	max.	18	V
Collector-emitter voltage (open base)	V_{CEO}	max.	10	V
Emitter-base voltage (open collector)	V_{EBO}	max.	2.5	V

Currents

Collector current (d.c.)	I_C	max.	50	mA
Collector current (peak value; f > 1 MHz)	I_{CM}	max.	100	mA

Power dissipation

Total power dissipation up to T_{amb} = 73 °C	P_{tot}	max.	190	mW

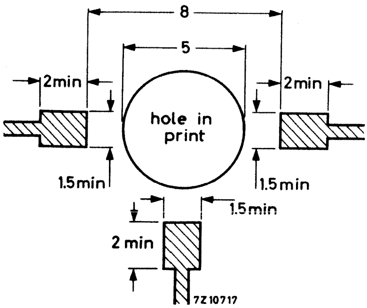
Temperatures

Storage temperature	T_{stg}	-65 to +150		°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

From junction to ambient in free air mounted on a glass-fibre print of 40 mm x 25 mm x 1 mm — $R_{th\ j-a}$ = 0.4 °C/mW

Requirements for glass-fibre print (dimensions in mm)



CHARACTERISTICS

$T_j = 25\ ^oC$ unless otherwise specified

Collector cut-off current				
$I_E = 0$; $V_{CB} = 10$ V	I_{CBO}	<	50	nA
D.C. current gain [1]				
$I_C = 25$ mA; $V_{CE} = 5$ V	h_{FE}	>	25	
$I_C = 50$ mA; $V_{CE} = 5$ V	h_{FE}	>	25	
Transition frequency at f = 500 MHz [1]				
$I_C = 50$ mA; $V_{CE} = 5$ V	f_T	typ.	1.7	GHz
Collector capacitance at f = 1 MHz				
$I_E = I_e = 0$; $V_{CB} = 5$ V	C_c	typ.	0.7	pF
Emitter capacitance at f = 1 MHz				
$I_C = I_c = 0$; $V_{EB} = 0.5$ V	C_e	typ.	1.5	pF
Feedback capacitance at f = 1 MHz				
$I_C = 2$ mA; $V_{CE} = 5$ V; $T_{amb} = 25\ ^oC$	$-C_{re}$	typ.	0.6	pF
Noise figure at f = 500 MHz				
$I_C = 2$ mA; $V_{CE} = 5$ V; $G_S = 20$ mA/V; B_S is tuned; $T_{amb} = 25\ ^oC$	F	<	5	dB

Max. unilateral power gain (s_{re} assumed to be zero)

$$G_{UM}\ (\text{in dB}) = 10 \log \frac{|s_{fe}|^2}{(1 - |s_{ie}|^2)(1 - |s_{oe}|^2)}$$

$I_C = 30$ mA; $V_{CE} = 5$ V; f = 200 MHz; $T_{amb} = 25\ ^oC$	G_{UM}	typ.	22	dB
$I_C = 30$ mA; $V_{CE} = 5$ V; f = 800 MHz; $T_{amb} = 25\ ^oC$	G_{UM}	typ.	10.5	dB

[1] Measured under pulse conditions.

CHARACTERISTICS (continued)

Intermodulation distortion at T_{amb} = 25 °C

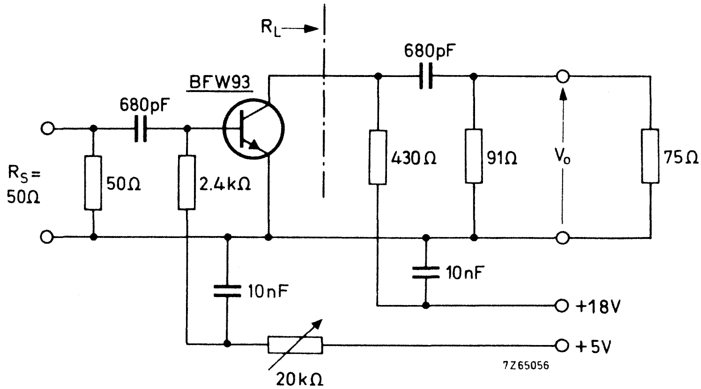
I_C = 30 mA; V_{CE} = 5 V; R_L = 37.5 Ω

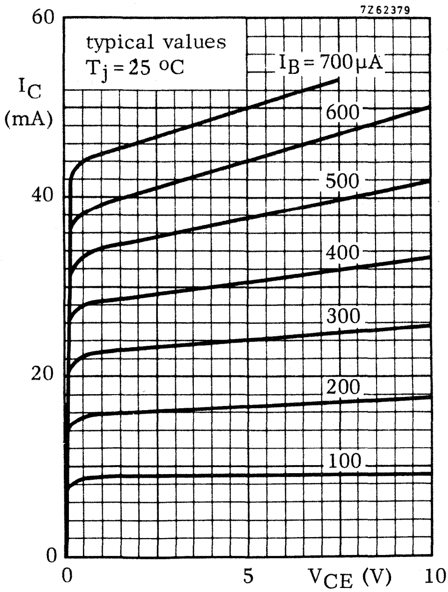
V_o = 100 mV at f_p = 183 MHz

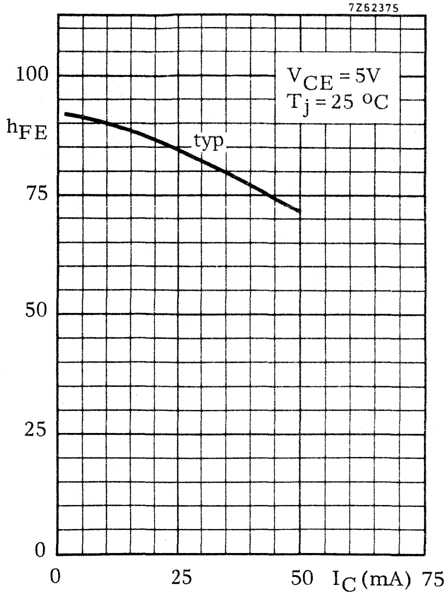
V_o = 100 mV at f_q = 200 MHz

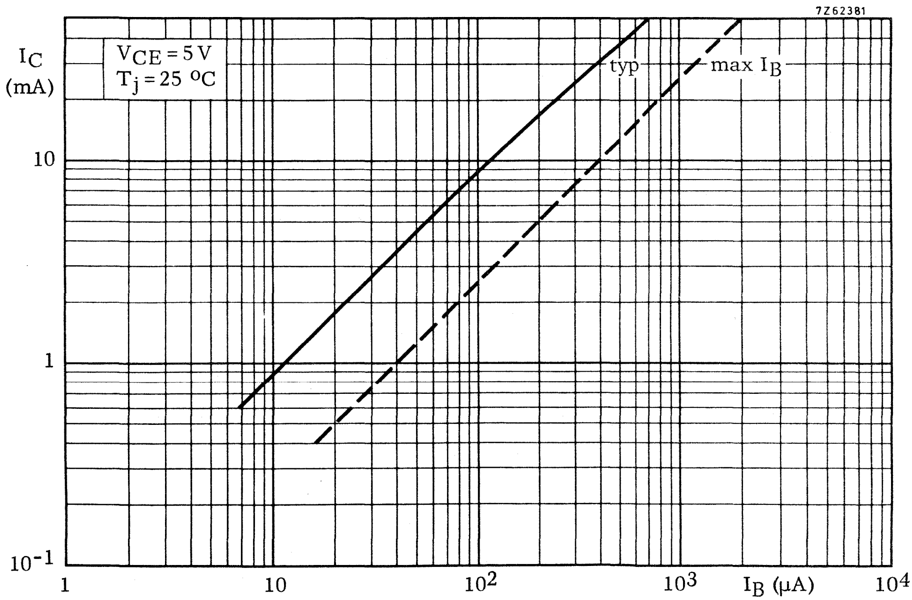
measured at $f_{(2q-p)}$ = 217 MHz | d_{im} | typ. | −60 | dB

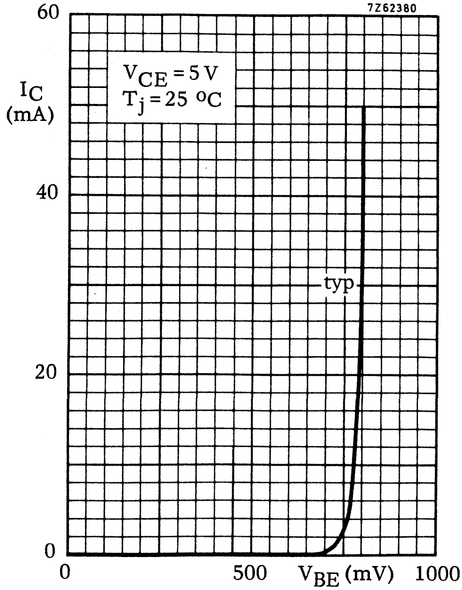
Test circuit:

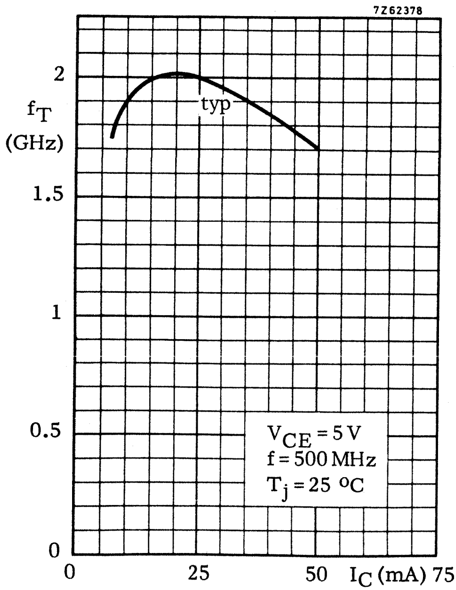


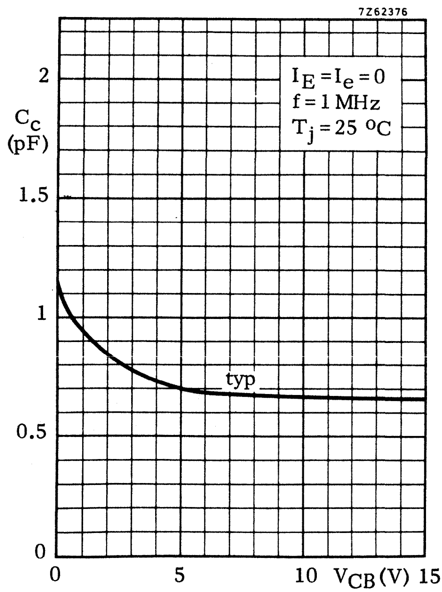

7Z62379
typical values
$T_j = 25\ ^oC$
$I_B = 700\ \mu A$
600
500
400
300
200
100
I_C (mA)
60
40
20
0
0
5
V_{CE} (V)
10


7Z62375
$V_{CE} = 5V$
$T_j = 25\ ^oC$
h_{FE}
typ
100
75
50
25
0
0
25
50
I_C (mA)
75

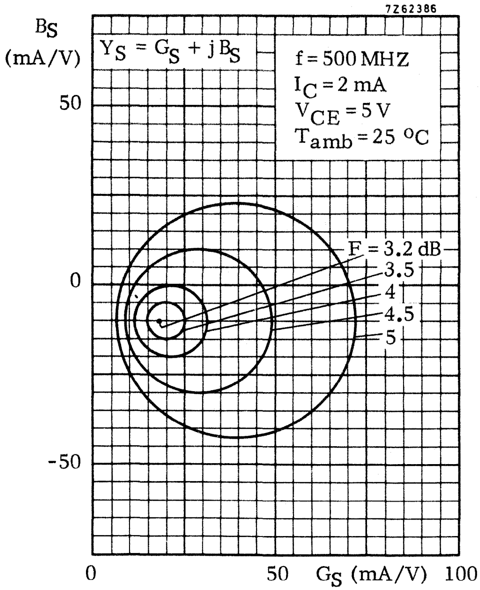

7Z62381
$V_{CE} = 5\ V$
$T_j = 25\ ^oC$
I_C (mA)
typ
max I_B
10
1
10^{-1}
1
10
10^2
10^3
I_B (μA)
10^4

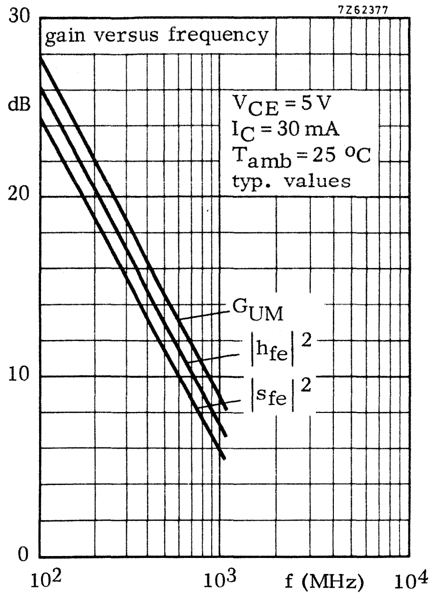

7Z62380
I_C (mA)
V_{CE} = 5 V
T_j = 25 °C
typ
0
20
40
60
0
500
V_{BE} (mV)
1000

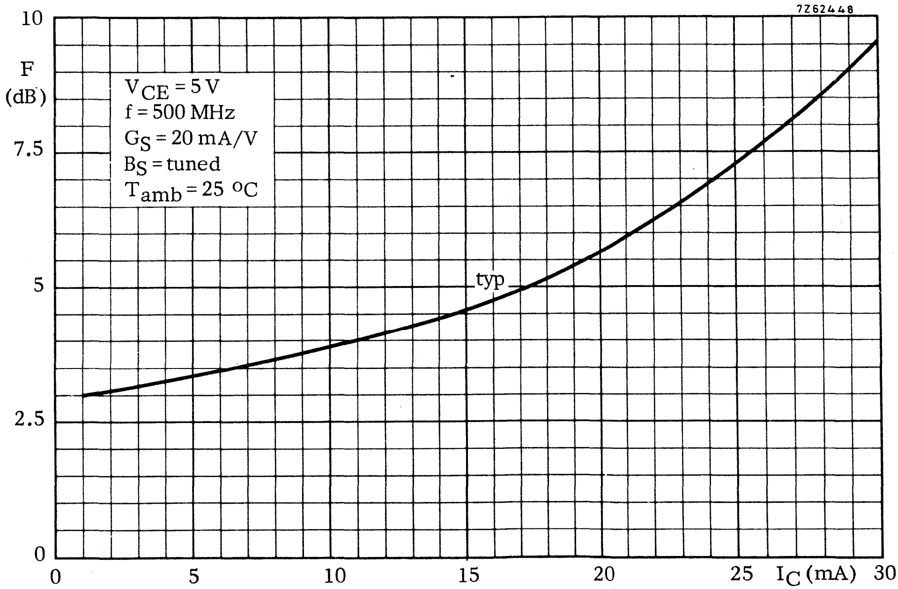

7Z62378
f_T (GHz)
typ
V_{CE} = 5 V
f = 500 MHz
T_j = 25 °C
0
0.5
1
1.5
2
0
25
50
I_C (mA)
75


7Z62376
C_c (pF)
$I_E = I_e = 0$
f = 1 MHz
T_j = 25 °C
typ
0
0.5
1
1.5
2
0
5
10
V_{CB} (V)
15

circles of constant noise figure



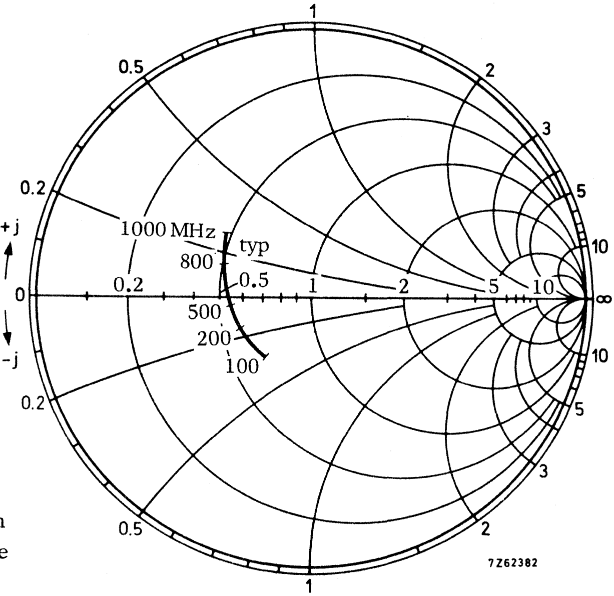




V_{CE} = 5 V

I_C = 30 mA

T_{amb} = 25 °C

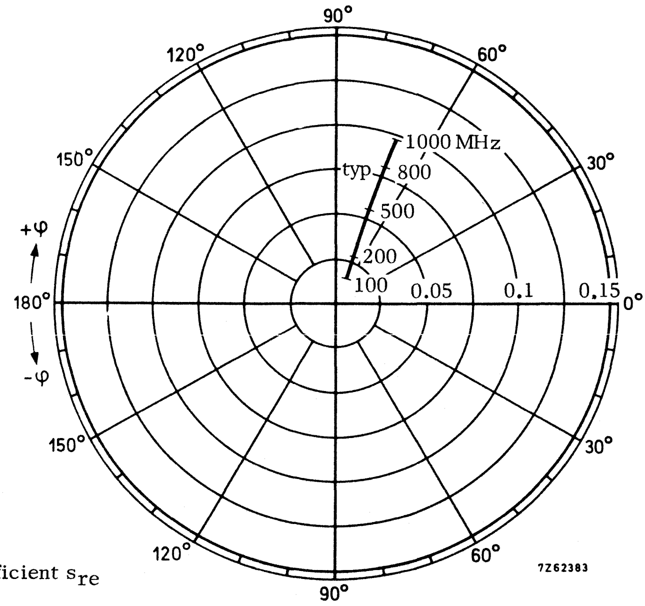


Input impedance derived from input reflection coefficient s_{ie} coordinates in ohm x 50

V_{CE} = 5 V

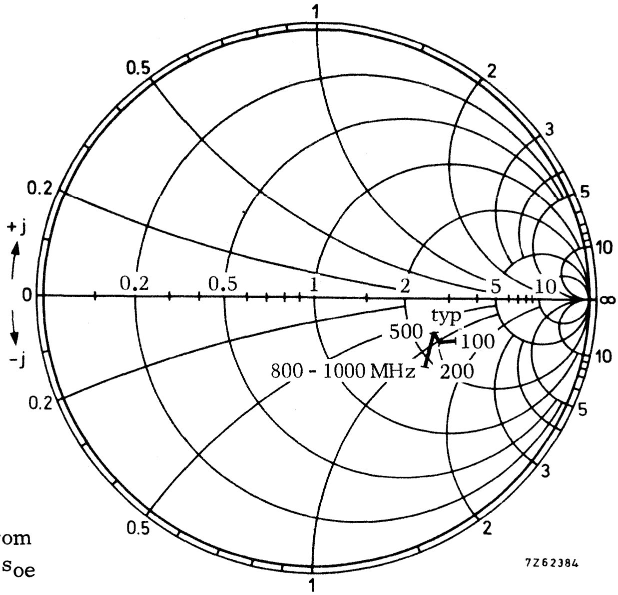
I_C = 30 mA

T_{amb} = 25 °C



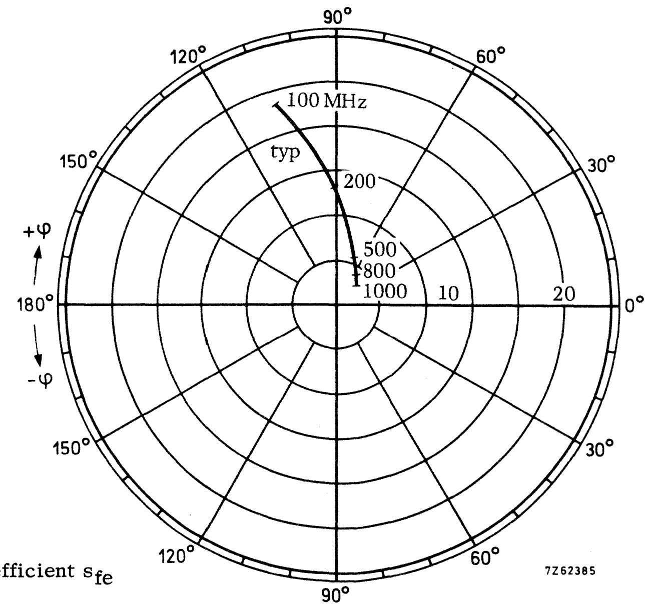
Reverse transmission coefficient s_{re}

V_{CE} = 5 V
I_C = 30 mA
T_{amb} = 25 °C



Output impedance derived from output reflection coefficient s_{oe} coordinates in ohm x 50

V_{CE} = 5 V
I_C = 30 mA
T_{amb} = 25 °C



Forward transmission coefficient s_{fe}

SILICON PLANAR EPITAXIAL TRANSISTOR

N-P-N transistor in a TO-72 metal envelope, with insulated electrodes and a shield lead connected to the case. The transistor has a low noise, a very high power gain and good intermodulation properties. It is primarily intended for:
- Channel aerial amplifiers for bands I, II, III and IV/V (40–860 MHz).
- Wideband aerial amplifiers (40–860 MHz).

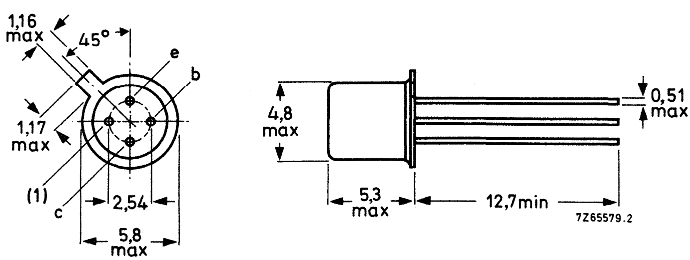
QUICK REFERENCE DATA

Collector-base voltage (open emitter; peak value)	V_{CBOM}	max.	30		V
Collector-emitter voltage (open base)	V_{CEO}	max.	15		V
Collector current (peak value; f > 1 MHz)	I_{CM}	max.	50		mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	200		mW
Junction temperature	T_j	max.	200		°C
Transition frequency I_C = 25 mA; V_{CE} = 5 V; f = 500 MHz	f_T	typ.	1,2		GHz
Feedback capacitance I_C = 2 mA; V_{CE} = 5 V; f = 1 MHz	C_{re}	typ.	0,6		pF
			f = 200	800	MHz
Noise figure at optimum source impedance I_C = 2 mA; V_{CE} = 5 V	F	typ.	3,3	7	dB
Power gain (not neutralized) I_C = 8 mA; V_{CE} = 10 V	G_p	typ.	22	7	dB
Output power d_{im} = −30 dB; VSWR at output < 2; I_C = 8 mA; V_{CE} = 10 V	P_o	typ.	6	6	mW

MECHANICAL DATA

Dimensions in mm

Fig. 1 TO-72.



(1) = shield lead (connected to case).

Accessories: 56246 (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.	30	V
Collector-emitter voltage (peak value) $R_{BE} \leq 50\ \Omega$	V_{CERM}	max.	30	V [1]
Collector-emitter voltage (open base)	V_{CEO}	max.	15	V [1]
Emitter-base voltage (open collector)	V_{EBO}	max.	2.5	V

Currents

Collector current (d.c.)	I_C	max.	25	mA
Collector current (peak value; f > 1 MHz)	I_{CM}	max.	50	mA

Power dissipation

Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	200	mW

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	$R_{th\ j\text{-}a}$	=	0.88	°C/mW
From junction to case	$R_{th\ j\text{-}c}$	=	0.58	°C/mW

[1] I_C = 10 mA.

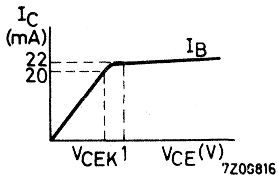
CHARACTERISTICS T_j = 25 °C unless otherwise specified

Collector cut-off current

$I_E = 0$; $V_{CB} = 15$ V	I_{CBO}	<	10	nA

Knee voltage

$I_C = 20$ mA; I_B = value for which $I_C = 22$ mA at $V_{CE} = 1$ V	V_{CEK}	<	0.75	V



D.C. current gain

$I_C = 2$ mA; $V_{CE} = 1$ V	h_{FE}	20 to 150
$I_C = 25$ mA; $V_{CE} = 1$ V	h_{FE}	20 to 125

Transition frequency [1]

$I_C = 2$ mA; $V_{CE} = 5$ V; f = 500 MHz	f_T	typ. 1.0	GHz
$I_C = 25$ mA; $V_{CE} = 5$ V; f = 500 MHz	f_T	typ. 1.2	GHz

Collector capacitance at f = 1 MHz [2]

$I_E = I_e = 0$; $V_{CB} = 10$ V	C_c	<	1.7	pF

Feedback capacitance at f = 1 MHz [1]

$I_C = 2$ mA; $V_{CE} = 5$ V	$-C_{re}$	typ. 0.6	pF

Noise figure [1]

$I_C = 2$ mA; $V_{CE} = 5$ V

f = 200 MHz; optimum source impedance	F	<	4	dB
f = 500 MHz; $R_S = 50\ \Omega$	F	<	6.5	dB
f = 800 MHz; optimum source impedance	F	typ.	7.0	dB

Power gain (not neutralized) [1]

			f = 200	800	MHz
$I_C = 8$ mA; $V_{CE} = 10$ V; $T_{amb} = 25$ °C	G_p	>	19	–	dB
		typ.	22	7	dB

[1]) Shield lead grounded.
[2]) Shield lead not connected.

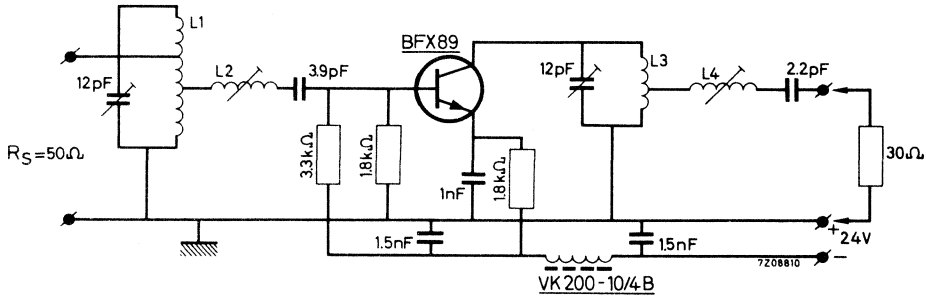
CHARACTERISTICS (continued) T_j = 25 °C unless otherwise specified

Intermodulation characteristics [1]

1. Output power at f = 200 MHz; T_{amb} = 25 °C

I_C = 8 mA; V_{CE} = 10 V; V.S.W.R. at output < 2
f_p = 202 MHz; f_q = 205 MHz; d_{im} = −30 dB
measured at $f_{(2q-p)}$ = 208 MHz (Channel 9) P_o typ. 6 mW

Test circuit:



Coil data:

L1 = 3 turns silver plated Cu wire (1.4 mm); winding pitch 2.7 mm;
int. diam. 8 mm; taps at 0.5 turn and 1.5 turns from earth.
L2 = 5.5 turns silver plated Cu wire (1.4 mm); winding pitch 2.2 mm;
int. diam. 8 mm.
L3 = 3 turns silver plated Cu wire (1.4 mm) winding pitch 3.3 mm;
int. diam. 8 mm.
L4 = 5.5 turns silver plated Cu wire (1.4 mm) winding pitch 2.2 mm;
int. diam. 11 mm.

[1]) Shield lead grounded.

CHARACTERISTICS (continued)

Basis of adjustment

The intermodulation at an intermodulation distortion of −30 dB is caused by h.f. output current - voltage clipping.
The maximum undistorted output power is realised, if

a. Current and voltage clipping take place concurrently.
   This occurs if

$$R_L = \frac{V_{CE} - V_{CEK}}{I_C},$$

   in which V_{CEK} is the high frequency knee voltage.

b. The h.f. collector current is as small as possible.
   This is so if $-C_L = +C_{oe}$,
   in which C_{oe} is the output capacitance of the transistor at short circuited input.

For maximum output power at an intermodulation distortion of −30 dB, the (experimentally found) values of R_L and C_L are:
$R_L = 1\ k\Omega$; $C_L = -1.8$ pF

Adjustment procedure

1. Remove the transistor and connect a dummy consisting of a 1 kΩ resistor in parallel with a 1.8 pF capacitor between the collector and emitter connections of the output circuit.
2. Tune and match the output circuit for zero reflection at 205 MHz (V.S.W.R. = 1). After this adjustment, no further change may be made in the output circuit.
3. Replace the dummy by the transistor. Tune and match the input circuit for maximum power gain and good band pass curve.
   The V.S.W.R. of the output will then, in most cases, be ≤ 2 over the whole channel.
   Corrections can be made by tuning L2; this will not disturb the band pass curve.

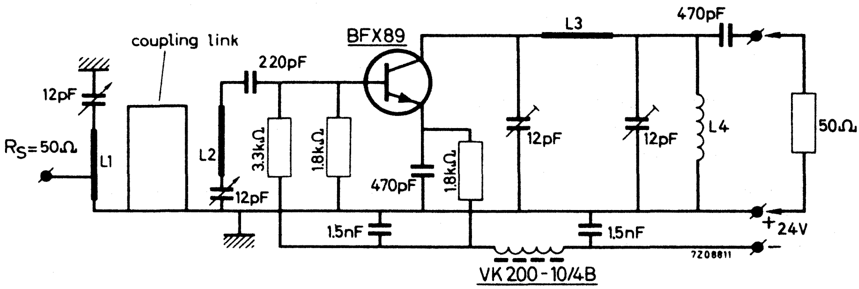
CHARACTERISTICS (continued) T_j = 25 °C unless otherwise specified

Intermodulation characteristics [1])

2. Output power at f = 800 MHz; T_{amb} = 25 °C

I_C = 8 mA; V_{CE} = 10 V; V.S.W.R. at output < 2
f_p = 798 MHz; f_q = 802 MHz; d_{im} = −30 dB
measured at $f_{(2q-p)}$ = 806 MHz (Channel 62) P_o typ. 6 mW

Test circuit:



Coil data:

L1 = 24 mm x 6 mm x 0.5 mm silver plated Cu strip.
Tap of the input at 5 mm from earth.
L2 = 15 mm x 6 mm x 0.5 mm silver plated Cu strip.
L3 = 20 mm x 8 mm x 0.5 mm silver plated Cu strip.
L4 = 4 turns enamelled Cu wire (0.5 mm); winding pitch 1.5 mm; int. diam. 4 mm.
Coupling link: 42 mm silver plated Cu wire (1 mm).

Basis of adjustment

At 800 MHz no dummy can be used to adjust for optimum collector load because at these frequencies the impedance transformations of a dummy are too high. A small signal at the mid-channel frequency of 802 MHz is fed to the input and increased until clipping occurs; that is, until the output power no longer increases linearily with the input signal. This clipping can be eliminated by tuning the output circuit, thereby making the output power equal to

$$P_o = \frac{I_C (V_{CE} - V_{CEK})}{2} = 35 \text{ mW}$$

The output circuit is adjusted for minimum intermodulation if the input signal is as small as possible at P_o = 35 mW.
After this adjustment has been made no further change may be made in the output circuit.
Adjust the input circuit for maximum power gain and good band pass curve.
The V.S.W.R. of the output is then ≤ 2 over the whole channel.

[1]) Shield lead grounded

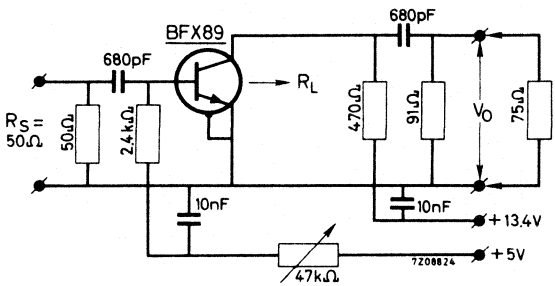
CHARACTERISTICS (continued) T_j = 25 °C unless otherwise specified

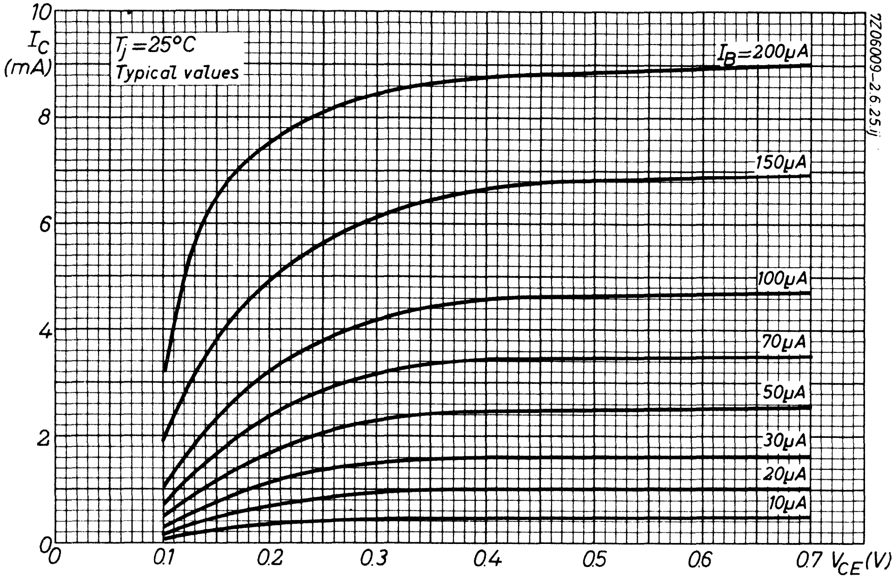
Intermodulation characteristics [1])

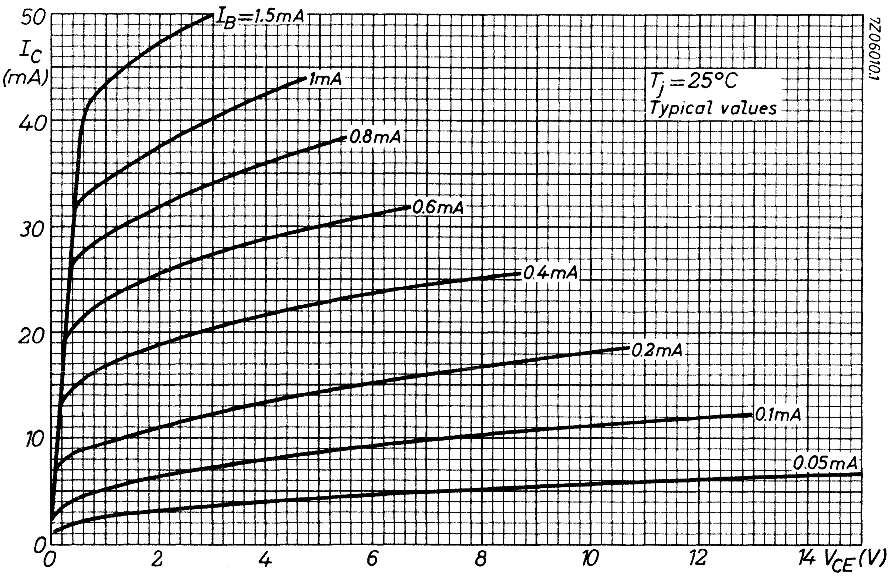
3. Intermodulation distortion

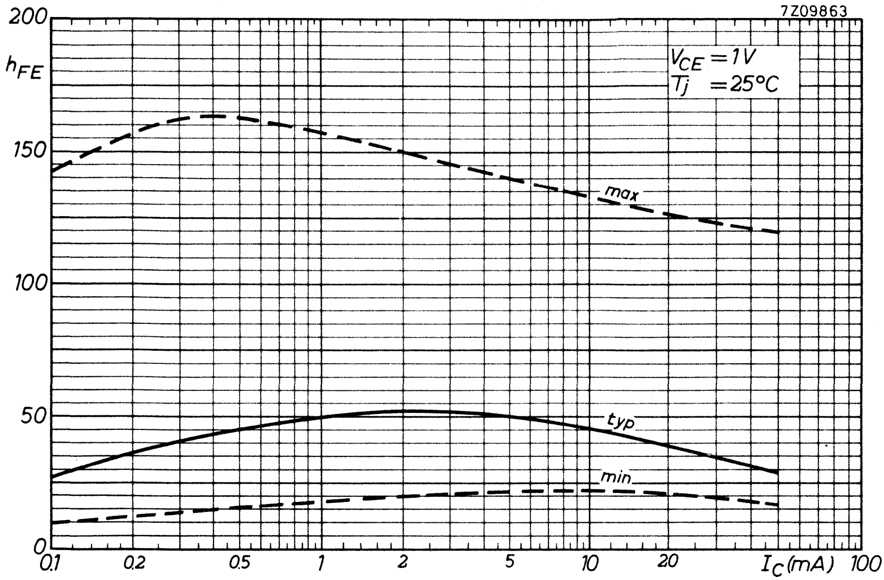
I_C = 8 mA; V_{CE} = 6 V; R_L = 37.5 Ω; T_{amb} = 25 °C
V_o = 100 mV at f_p = 183 MHz
V_o = 100 mV at f_q = 200 MHz
measured at $f_{(2q-p)}$ = 217 MHz d_{im} typ. −40 dB

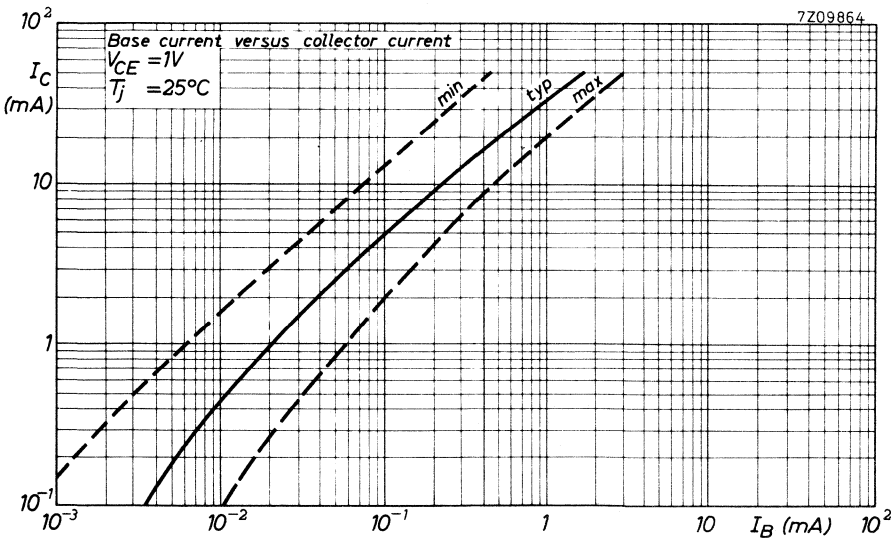
Test circuit:

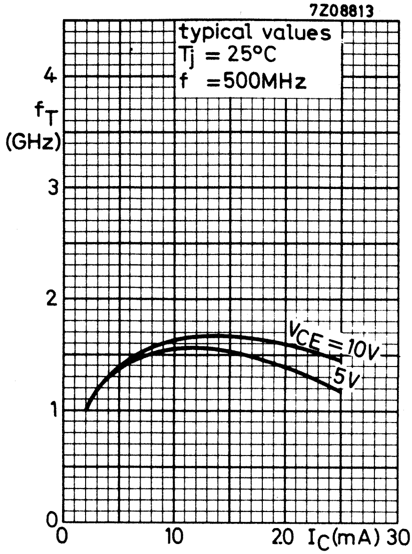


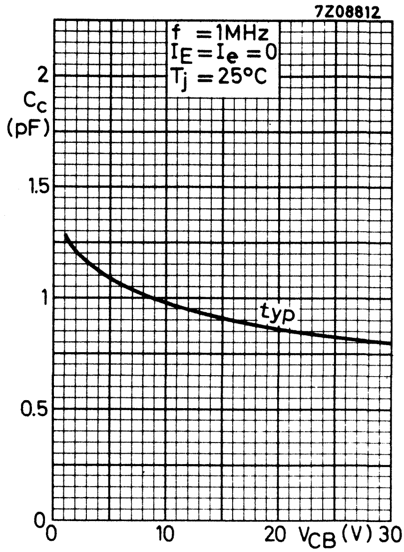

7Z06009–2.6.25.jj
I_C (mA)
$T_j = 25°C$
Typical values
$I_B = 200 μA$
150μA
100μA
70μA
50μA
30μA
20μA
10μA
10
8
6
4
2
0
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7 V_{CE} (V)

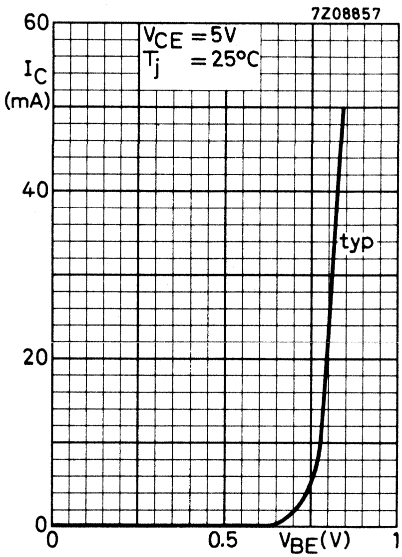

7Z06010.1
I_C (mA)
$T_j = 25°C$
Typical values
$I_B = 1.5 mA$
1mA
0.8mA
0.6mA
0.4mA
0.2mA
0.1mA
0.05mA
50
40
30
20
10
0
0
2
4
6
8
10
12
14 V_{CE} (V)

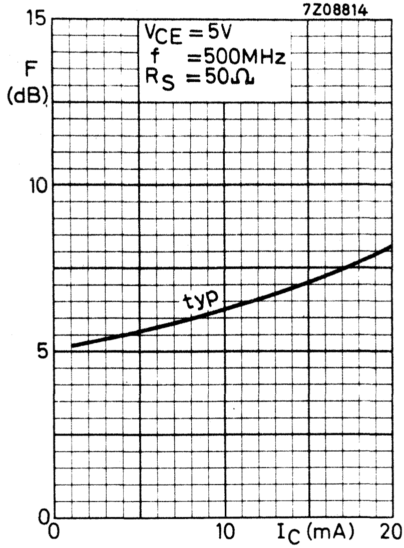

7Z09863
200
150
100
50
0
h_{FE}
$V_{CE} = 1V$
$T_j = 25°C$
max
typ
min
0.1
0.2
0.5
1
2
5
10
20
100
I_C (mA)

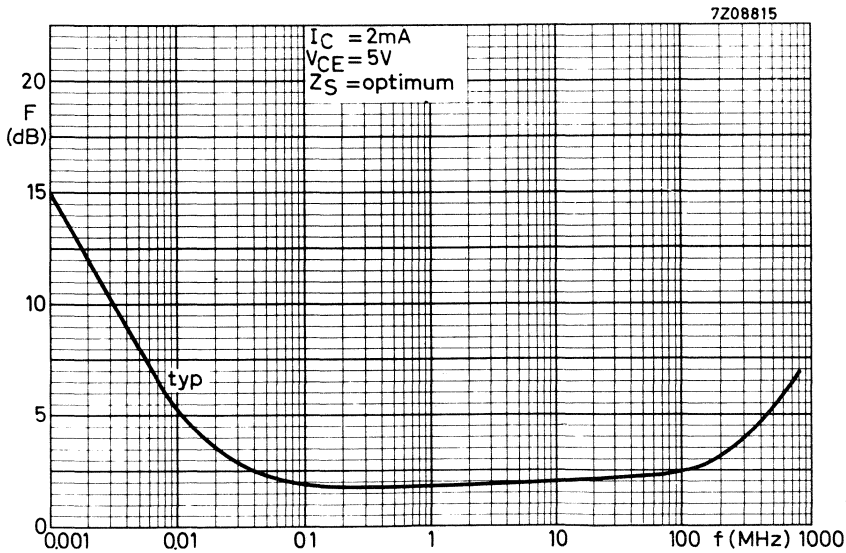

7Z09864
Base current versus collector current
$V_{CE} = 1V$
$T_j = 25°C$
10^2
10
1
10^{-1}
I_C
(mA)
min
typ
max
10^{-3}
10^{-2}
10^{-1}
1
10
10^2
I_B (mA)


7Z08813
typical values
T_j = 25°C
f = 500MHz
f_T (GHz)
V_{CE} = 10V
5V
I_C (mA)
0
1
2
3
4
10
20
30


7Z08812
f = 1MHz
$I_E = I_e = 0$
T_j = 25°C
C_c (pF)
typ
V_{CB} (V)
0
0.5
1
1.5
2
10
20
30


7Z08857
V_{CE} = 5V
T_j = 25°C
I_C (mA)
typ
V_{BE} (V)
0
20
40
60
0.5
1


7Z08814
V_{CE} = 5V
f = 500MHz
R_S = 50Ω
F (dB)
15
10
5
0
typ
0
10
I_C (mA)
20


7Z08815
I_C = 2mA
V_{CE} = 5V
Z_S = optimum
F (dB)
20
15
10
5
0
typ
0.001
0.01
0.1
1
10
100
f (MHz)
1000

SILICON PLANAR EPITAXIAL TRANSISTOR

N-P-N transistor in a TO-72 metal envelope with insulated electrodes and a shield lead connected to the case.
The transistor has very low noise over a wide current range, a very high power gain and excellent intermodulation properties.
It is primarily intended for:
- Channel- and band aerial amplifiers for band I, II, III and IV/V (40-860 MHz)
- Wide band aerial amplifiers (40-860 MHz)
- Television distribution amplifiers
- Low noise wide band vertical amplifier in high speed oscilloscopes

It is also suitable for military- and industrial applications, such as:
- R.F. amplifiers and mixers for communication equipment
- **Microwave telephony link systems, wide band i.f. amplifiers**
- Large bandwidth radar i.f. amplifiers

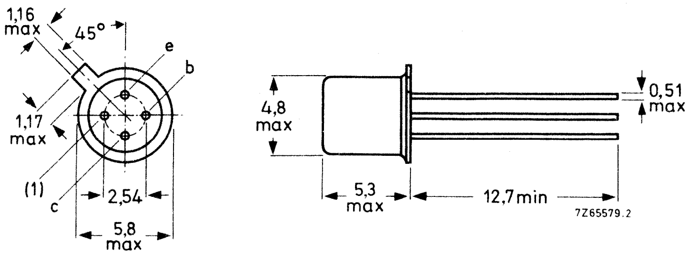
QUICK REFERENCE DATA					
Collector-base voltage (open emitter; peak value)	V_{CBOM}	max.	30		V
Collector-emitter voltage (open base)	V_{CEO}	max.	15		V
Collector current (peak value; f > 1 MHz)	I_{CM}	max.	50		mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	200		mW
Junction temperature	T_j	max.	200		°C
Transition frequency I_C = 25 mA; V_{CE} = 5 V; f = 500 MHz	f_T	typ.	1.4		GHz
Feedback capacitance at f = 1 MHz I_C = 2 mA; V_{CE} = 5 V	C_{re}	typ.	0.6		pF
Noise figure at optimum source impedance		f =	200	800	MHz
I_C = 2 mA; V_{CE} = 5 V	F	typ.	2.5	5.5	dB
Power gain (not neutralized) I_C = 14 mA; V_{CE} = 10 V	G_p	typ.	23	8	dB
Output power d_{im} = −30 dB; V.S.W.R. at output < 2 I_C = 14 mA; V_{CE} = 10 V	P_o	typ.	12	12	mW

MECHANICAL DATA (see next page)

MECHANICAL DATA

Dimensions in mm

Fig. 1 TO-72.



(1) = shield lead (connected to case).

Accessories: 56246 (distance disc).

RATINGS

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

Collector-base voltage (open emitter; peak value)	V_{CBOM}	max.	30	V
Collector-emitter voltage (peak value) $R_{BE} \leqslant 50\,\Omega$; $I_C = 10$ mA	V_{CERM}	max.	30	V
Collector-emitter voltage (open base); $I_C = 10$ mA	V_{CEO}	max.	15	V
Emitter-base voltage (open collector)	V_{EBO}	max.	2,5	V
Collector current (d.c.)	I_C	max.	25	mA
Collector current (peak value; f > 1 MHz)	I_{CM}	max.	50	mA
Total power dissipation up to $T_{amb} = 25$ °C	P_{tot}	max.	200	mW
Storage temperature	T_{stg}	−65 to +	200	°C
Junction temperature	T_j	max.	200	°C

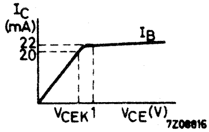
THERMAL RESISTANCE

From junction to ambient in free air	$R_{th\ j\text{-}a}$	=	880	K/W*
From junction to case	$R_{th\ j\text{-}c}$	=	580	K/W*

* K/W is SI unit for °C/W.

CHARACTERISTICS T_j = 25 °C unless otherwise specified

Collector cut-off current				
$I_E = 0$; $V_{CB} = 15$ V	I_{CBO}	<	10	nA
Knee voltage				
$I_C = 20$ mA; I_B = value for which $I_C = 22$ mA at $V_{CE} = 1$ V	V_{CEK}	<	0.75	V



D.C. current gain				
$I_C = 2$ mA; $V_{CE} = 1$ V	h_{FE}	25 to 150		
$I_C = 25$ mA; $V_{CE} = 1$ V	h_{FE}	20 to 125		
Transition frequency [1]				
$I_C = 2$ mA; $V_{CE} = 5$ V; f = 500 MHz	f_T	>	1.0	GHz
		typ.	1.1	GHz
$I_C = 25$ mA; $V_{CE} = 5$ V; f = 500 MHz	f_T	>	1.3	GHz
		typ.	1.4	GHz
Collector capacitance at f = 1 MHz [2]				
$I_E = I_e = 0$; $V_{CB} = 10$ V	C_c	<	1.5	pF
Feedback capacitance at f = 1 MHz [1]				
$I_C = 2$ mA; $V_{CE} = 5$ V	$-C_{re}$	typ.	0.6	pF
		<	0.8	pF
Noise figure [1]				
$I_C = 2$ mA; $V_{CE} = 5$ V				
f = 100 kHz; optimum source resistance	F	<	4	dB
f = 200 MHz; optimum source impedance	F	<	3.5	dB
f = 500 MHz; $R_S = 50\ \Omega$	F	<	5	dB
f = 800 MHz; optimum source impedance	F	typ.	5.5	dB

Power gain (not neutralized) [1]
$I_C = 14$ mA; $V_{CE} = 10$ V; $T_{amb} = 25$ °C

		f = 200	800	MHz
G_p	>	21		dB
	typ.	23	8	dB

1) Shield lead grounded.

2) Shield lead not connected.

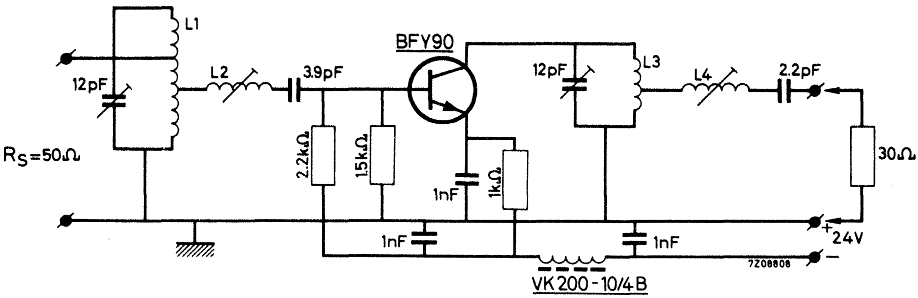
CHARACTERISTICS (continued) T_j = 25 °C unless otherwise specified

Intermodulation characteristics [1])

1. Output power at f = 200 MHz; T_{amb} = 25 °C

I_C = 14 mA; V_{CE} = 10 V; V.S.W.R. at output < 2
f_p = 202 MHz; f_q = 205 MHz; d_{im} = −30 dB
measured at $f_{(2q-p)}$ = 208 MHz (Channel 9) | P_o | > 10 mW, typ. 12 mW

Test circuit:



Coil data:

L1 = 3 turns silver plated Cu wire (1.4 mm); winding pitch 2.7 mm; int. diam. 8 mm; taps at 0.5 turn and 1.5 turns from earth.
L2 = 5.5 turns silver plated Cu wire (1.4 mm); winding pitch 2.2 mm; int. diam. 8 mm.
L3 = 3 turns silver plated Cu wire (1.4 mm); winding pitch 3.3 mm; int. diam. 8 mm.
L4 = 5.5 turns silver plated Cu wire (1.4 mm); winding pitch 2.2 mm; int. diam. 11 mm.

[1]) Shield lead grounded

CHARACTERISTICS (continued)

Basis of adjustment

The intermodulation at an intermodulation distortion of −30 dB is caused by h.f. output current - voltage clipping.
The maximum undistorted output power is realised, if

a. Current and voltage clipping take place concurrently.
This occurs if

$$R_L = \frac{V_{CE} - V_{CEK}}{I_C},$$

in which V_{CEK} is the high frequency knee voltage.

b. The h.f. collector current is as small as possible.
This is so if $-C_L = +C_{oe}$,
in which C_{oe} is the output capacitance of the transistor at short circuited input.

For maximum output power at an intermodulation distortion of −30 dB, the (experimentally found) values of R_L and C_L are:
$R_L = 560\ \Omega$; $C_L = -1.8$ pF

Adjustment procedure

1. Remove the transistor and connect a dummy consisting of a 560 Ω resistor in parallel with a 1.8 pF capacitor between the collector and emitter connections of the output circuit.
2. Tune and match the output circuit for zero reflection at 205 MHz (V.S.W.R. = 1). After this adjustment, no further change may be made in the output circuit.
3. Replace the dummy by the transistor. Tune and match the input circuit for maximum power gain and good band pass curve.
The V.S.W.R. of the output will then, in most cases, be ≤ 2 over the whole channel.
Corrections can be made by tuning L2; this will not disturb the band pass curve.

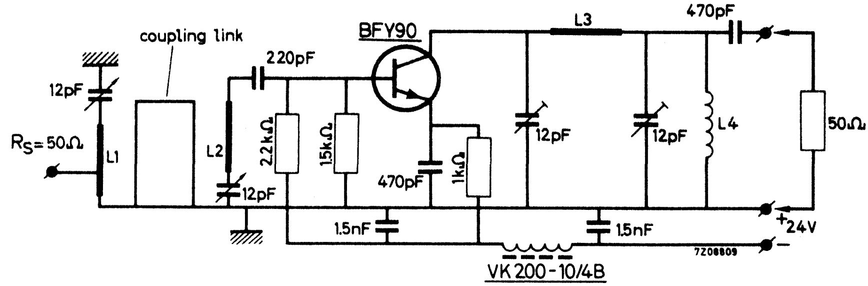
CHARACTERISTICS (continued) T_j = 25 °C unless otherwise specified

Intermodulation characteristics [1])

2. Output power at f = 800 MHz; T_{amb} = 25 °C

   I_C = 14 mA; V_{CE} = 10 V; V.S.W.R. at output < 2
   f_p = 798 MHz; f_q = 802 MHz; d_{im} = −30 dB
   measured at $f_{(2q-p)}$ = 806 MHz (Channel 62) P_o typ. 12 mW

   Test circuit:



Coil data:
L1 = 24 mm x 6 mm x 0.5 mm silver plated Cu strip.
Tap of the input at 5 mm from earth.
L2 = 15 mm x 6 mm x 0.5 mm silver plated Cu strip.
L3 = 20 mm x 8 mm x 0.5 mm silver plated Cu strip.
L4 = 4 turns enamelled Cu wire (0.5 mm); winding pitch 1.5 mm; int. diam. 4 mm
Coupling link: 42 mm silver plated Cu wire (1 mm).

Basis of adjustment.

At 800 MHz no dummy can be used to adjust for optimum collector load because at these frequencies the impedance transformations of a dummy are too high. A small signal at the mid-channel frequency of 802 MHz is fed to the input and increased until clipping occurs; that is, until the output power no longer increases linearily with the input signal. This clipping can be eliminated by tuning the output circuit, thereby making the output power equal to

$$P_o = \frac{I_C\,(V_{CE} - V_{CEK})}{2} = 60 \text{ mW}$$

The output circuit is adjusted for minimum intermodulation if the input signal is as small as possible at P_o = 60 mW.
After this adjustment has been made no further change may be made in the output circuit.
Adjust the input circuit for maximum power gain and good band pass curve.
The V.S.W.R. of the output is then ≤ 2 over the whole channel.

[1]) Shield lead grounded

CHARACTERISTICS (continued) $T_j = 25\ ^oC$ unless otherwise specified

Intermodulation characteristics [1]

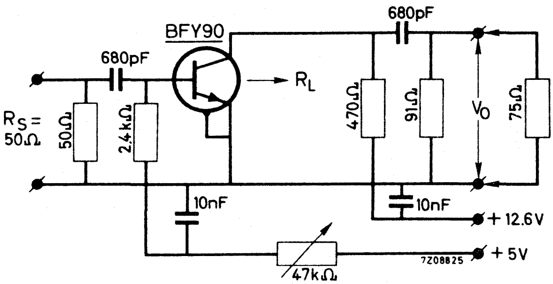
3. Intermodulation distortion

$I_C = 14$ mA; $V_{CE} = 6$ V; $R_L = 37.5\ \Omega$; $T_{amb} = 25\ ^oC$

$V_o = 100$ mV at $f_p = 183$ MHz

$V_o = 100$ mV at $f_q = 200$ MHz
measured at $f_{(2q-p)} = 217$ MHz — d_{im} typ. −50 dB

Test circuit:



y parameters at f = 500 MHz (common emitter) [1]

$I_C = 2$ mA; $V_{CE} = 5$ V

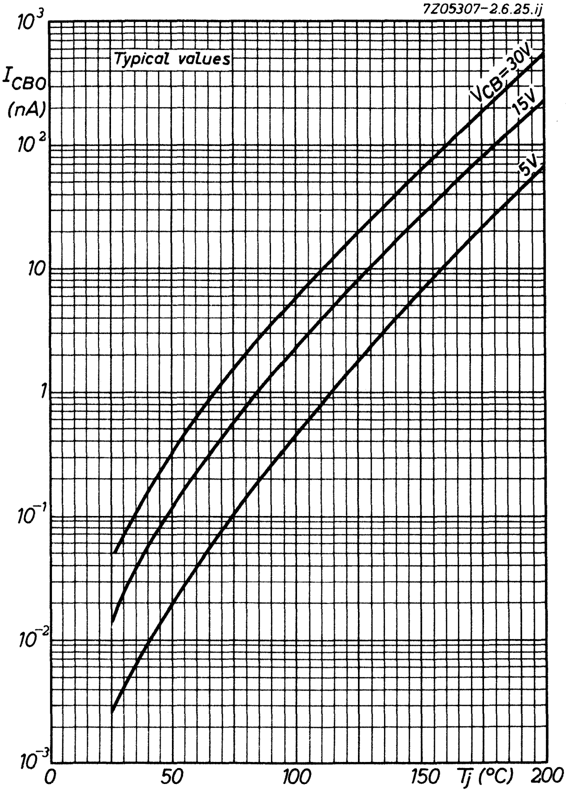
Input conductance	g_{ie}	typ.	16	$m\Omega^{-1}$
Input capacitance	C_{ie}	typ.	3.75	pF
Feedback admittance	$\|y_{re}\|$	typ.	1.55	$m\Omega^{-1}$
Phase angle of feedback admittance	φ_{re}	typ.	258°	
Transfer admittance	$\|y_{fe}\|$	typ.	45	$m\Omega^{-1}$
Phase angle of transfer admittance	φ_{fe}	typ.	285°	
Output conductance	g_{oe}	typ.	0.19	$m\Omega^{-1}$
Output capacitance	C_{oe}	typ.	1.9	pF

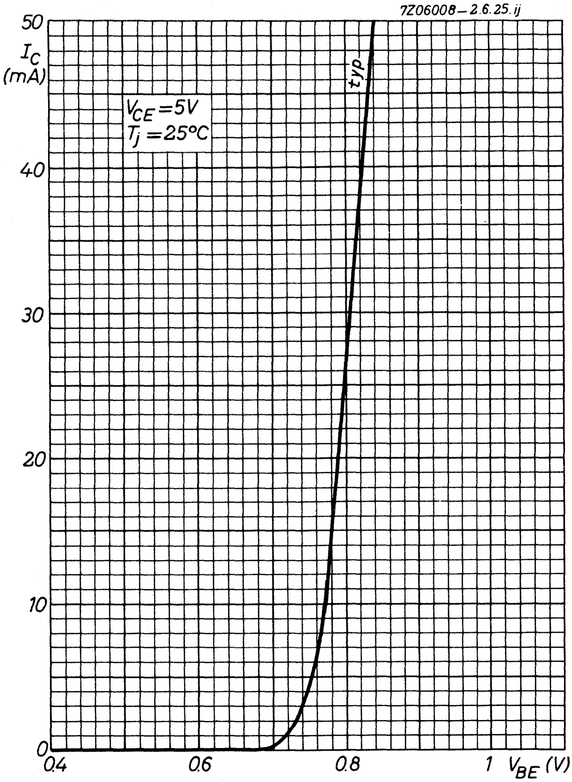
Maximum unilateralised power gain

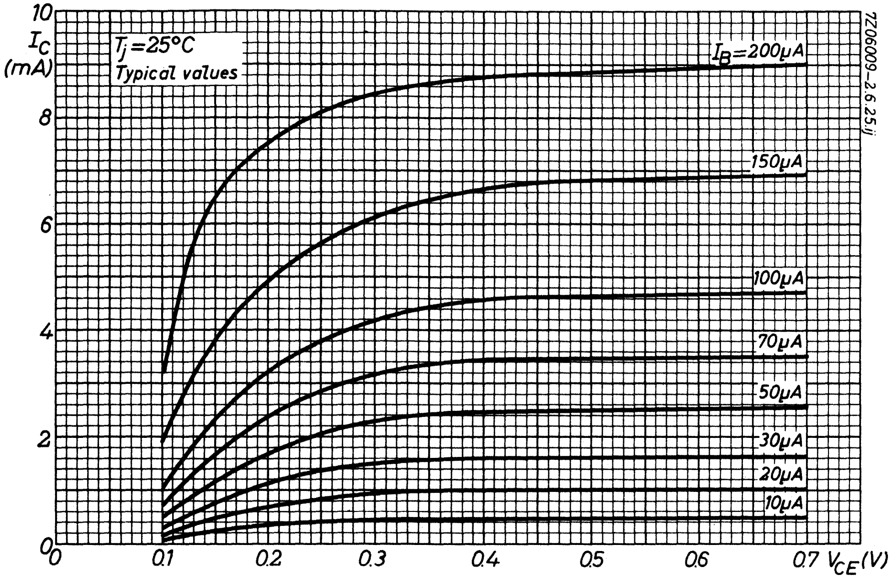
$$G_{UM} = \frac{|y_{fe}|^2}{4 g_{ie} g_{oe}}$$

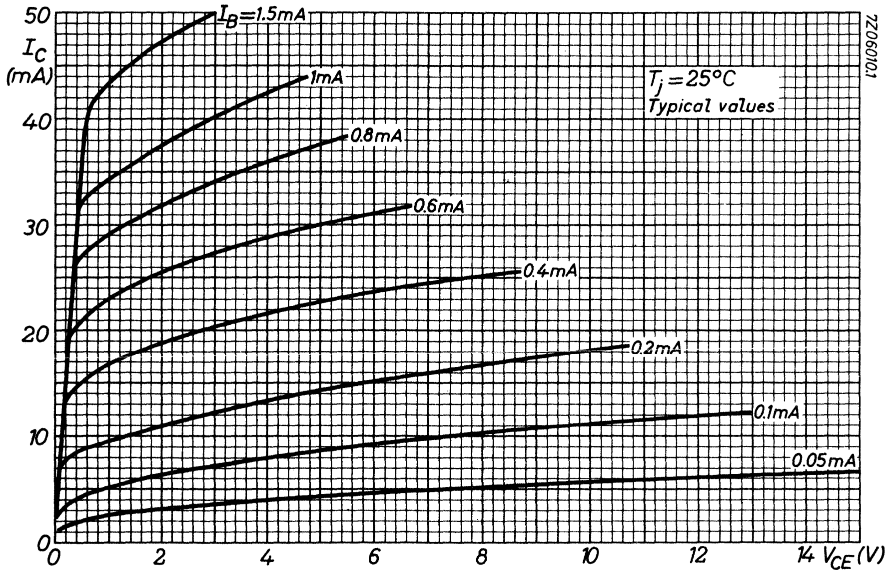
$I_C = 2$ mA; $V_{CE} = 5$ V; f = 500 MHz — G_{UM} typ. 22 dB

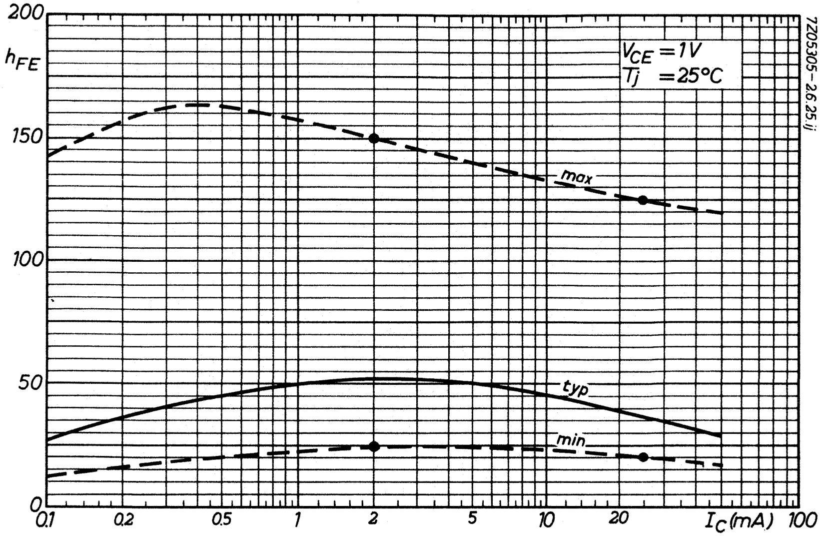
[1]) Shield lead grounded

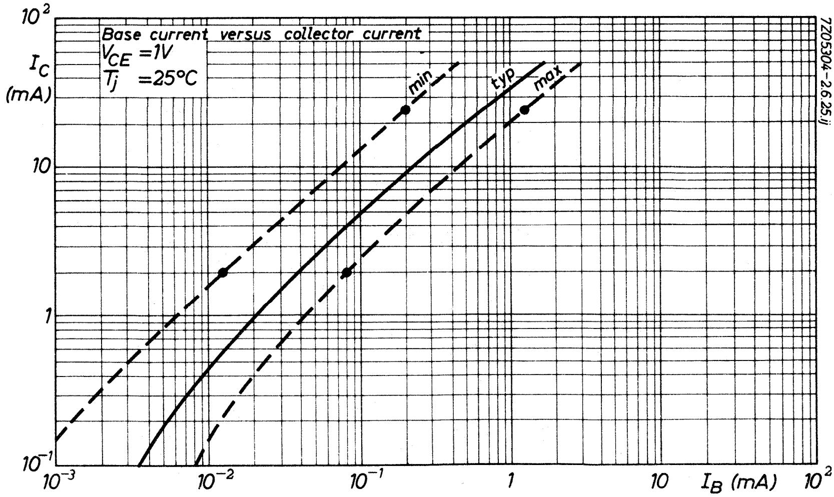

7Z05307-2.6.25.ij
Typical values
I_{CBO} (nA)
10^3
10^2
10
1
10^{-1}
10^{-2}
10^{-3}
0
50
100
150
200
T_j (°C)
V_{CB}=30V
15V
5V

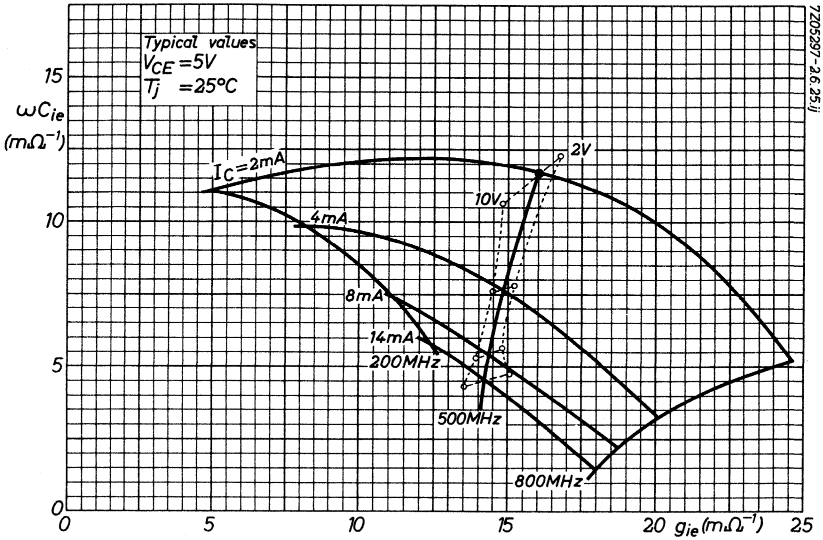

7Z06008 – 2.6.25. ij
50
I_C
(mA)
V_{CE} = 5V
T_j = 25°C
typ
40
30
20
10
0
0.4
0.6
0.8
1
V_{BE} (V)

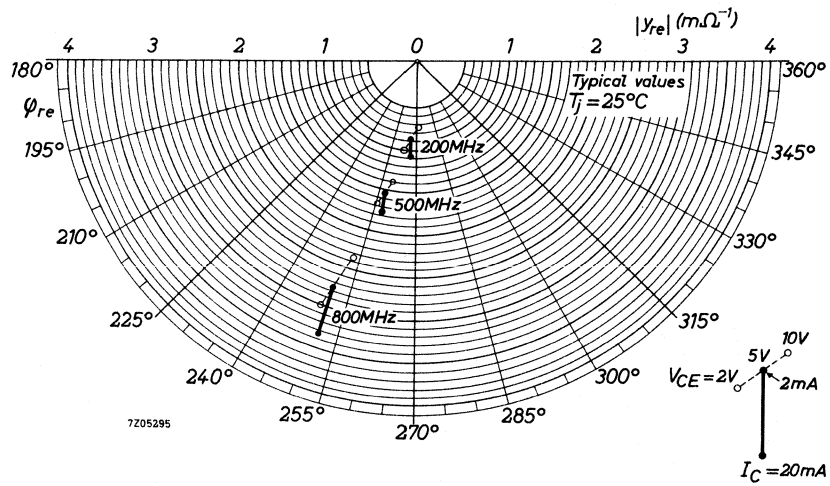

10
I_C
(mA)
$T_j = 25°C$
Typical values
$I_B = 200\mu A$
150µA
100µA
70µA
50µA
30µA
20µA
10µA
8
6
4
2
0
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7 V_{CE} (V)
7Z06009-2.6.25.ij

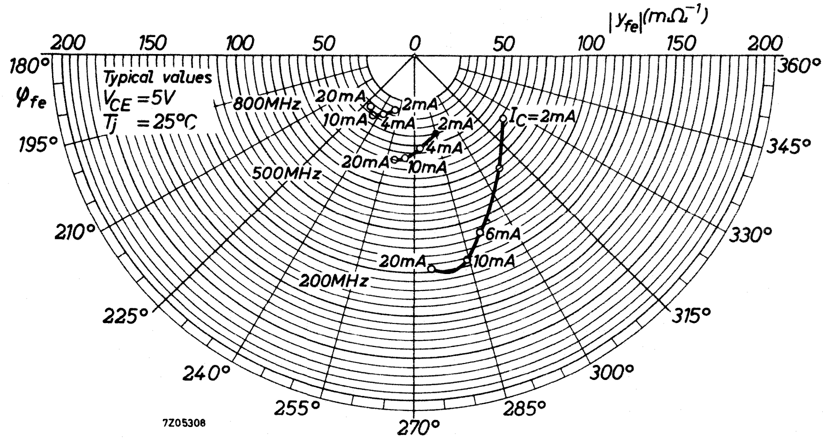

50
I_C
(mA)
40
30
20
10
0
$I_B = 1.5mA$
1mA
0.8mA
0.6mA
0.4mA
0.2mA
0.1mA
0.05mA
$T_j = 25°C$
Typical values
0
2
4
6
8
10
12
14 V_{CE} (V)
7Z06010.1


200
h_{FE}
150
100
50
0
V_{CE} = 1V
T_j = 25°C
max
typ
min
0.1
0.2
0.5
1
2
5
10
20
I_C (mA)
100
7Z05305-2.6.25.ij

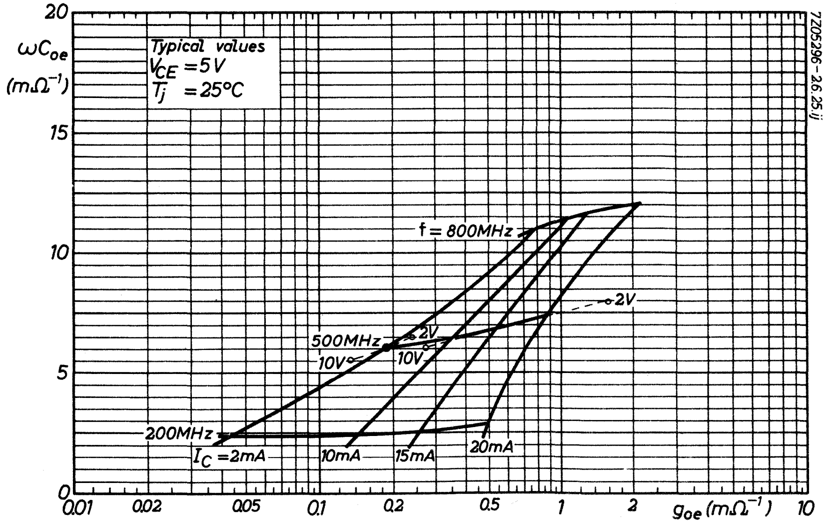

Base current versus collector current
V_{CE} = 1V
T_j = 25°C
I_C (mA)
10^2
10
1
10^{-1}
10^{-3}
10^{-2}
10^{-1}
1
10
I_B (mA)
10^2
min
typ
max
7Z05304-2.6.25.ij


Typical values
V_{CE} = 5V
T_j = 25°C
ωC_ie (mΩ⁻¹)
g_ie (mΩ⁻¹)
I_C = 2mA
4mA
8mA
14mA
200MHz
500MHz
800MHz
10V
2V
7Z05297-2.6.25.IJ

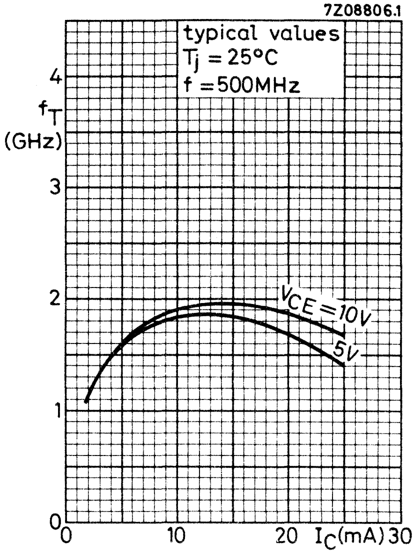

|y_re| (mΩ⁻¹)
φ_re
Typical values
T_j = 25°C
200MHz
500MHz
800MHz
10V
5V
V_CE = 2V
2mA
I_C = 20mA
7Z05295

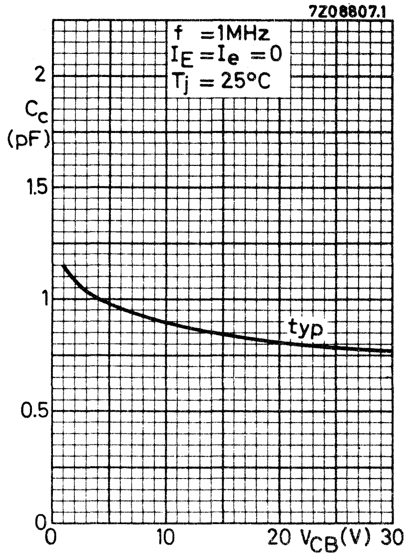


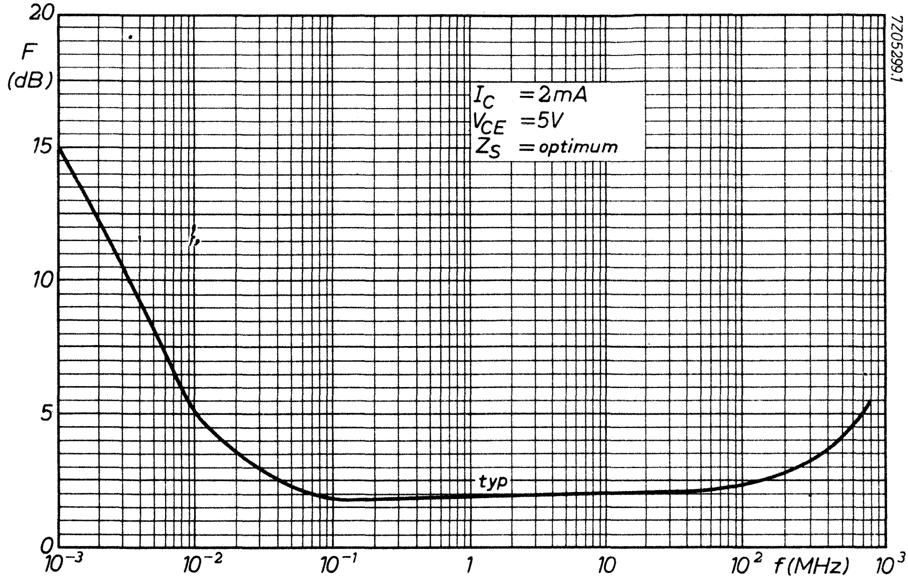
|yfe| (mΩ⁻¹)
200 150 100 50 0 50 100 150 200
φfe
180° 195° 210° 225° 240° 255° 270° 285° 300° 315° 330° 345° 360°
Typical values
VCE = 5V
Tj = 25°C
800MHz
500MHz
200MHz
IC = 2mA
2mA
4mA
6mA
10mA
20mA
7Z05308

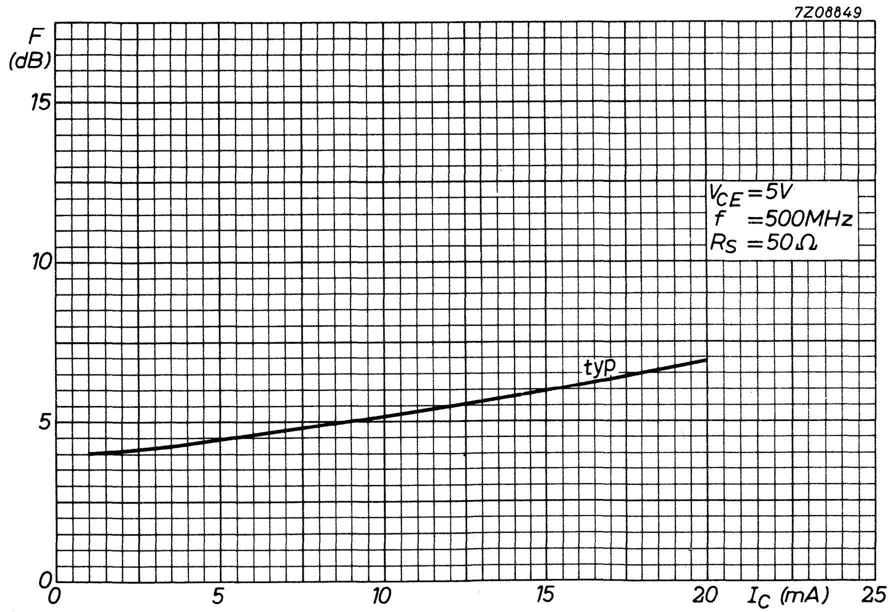


ωCoe (mΩ⁻¹)
Typical values
VCE = 5V
Tj = 25°C
f = 800MHz
500MHz
200MHz
2V
10V
IC = 2mA
10mA
15mA
20mA
goe (mΩ⁻¹)
0 5 10 15 20
0.01 0.02 0.05 0.1 0.2 0.5 1 2 10
7Z05296 - 26.25.ij


7Z08806.1
typical values
$T_j = 25°C$
f = 500MHz
f_T (GHz)
$V_{CE} = 10V$
5V
I_C (mA)


7Z08807.1
f = 1MHz
$I_E = I_e = 0$
$T_j = 25°C$
C_c (pF)
typ
V_{CB} (V)


7Z05299.1
20
F
(dB)
15
10
5
0
I_C = 2mA
V_{CE} = 5V
Z_S = optimum
typ
10^{-3}
10^{-2}
10^{-1}
1
10
10^2
f (MHz)
10^3


7Z08849
F
(dB)
15
10
5
0
V_{CE} = 5V
f = 500MHz
R_S = 50 Ω
typ
0
5
10
15
20
I_C (mA)
25

SILICON PLANAR EPITAXIAL TRANSISTOR

N-P-N transistor in TO-72 metal envelope with insulated electrodes and a shield lead connected to the case. The 2N918 is primarily intended for low power amplifiers and oscillators in the v.h.f. and u.h.f. ranges for industrial service.

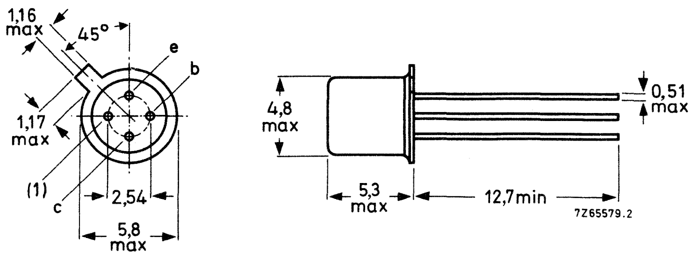
QUICK REFERENCE DATA

Collector-base voltage (open emitter)	V_{CBO}	max.	30	V
Collector-emitter voltage (open base)	V_{CEO}	max.	15	V
Collector current (d.c.)	I_C	max.	50	mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	200	mW
Junction temperature	T_j	max.	200	°C
Transition frequency I_C = 6 mA; V_{CE} = 10 V	f_T	>	900	MHz
Maximum unilateralized power gain I_C = 6 mA; V_{CE} = 12 V; f = 200 MHz	G_{UM}	typ.	36	dB
Noise figure at f = 60 MHz I_C = 1 mA; V_{CE} = 6 V; R_S = 400 Ω	F	<	6	dB

MECHANICAL DATA

Dimensions in mm

Fig. 1 TO-72.



(1) = shield lead (connected to case).

Accessories: 56246 (distance disc).

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

Voltages

Collector-base voltage (open emitter)	V_{CBO}	max.	30	V
Collector-emitter voltage (open base) I_C = 3 mA	V_{CEO}	max.	15	V
Emitter-base voltage (open collector)	V_{EBO}	max.	3	V

Currents

Collector current (d.c.)	I_C	max.	50	mA

Power dissipation

Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	200	mW

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	$R_{th\ j-a}$	=	0.88	°C/mW
From junction to case	$R_{th\ j-c}$	=	0.58	°C/mW

CHARACTERISTICS T_j = 25 °C unless otherwise specified
All measurements taken with ungrounded shield lead

Collector cut-off current			
$I_E = 0$; $V_{CB} = 15$ V	I_{CBO}	< 10	nA
$I_E = 0$; $V_{CB} = 15$ V; $T_j = 150$ °C	I_{CBO}	< 1	μA
Saturation voltages			
$I_C = 10$ mA; $I_B = 1$ mA	V_{CEsat}	< 0.4	V
	V_{BEsat}	< 1	V
D.C. current gain			
$I_C = 3$ mA; $V_{CE} = 1$ V	h_{FE}	> 20	
Collector capacitance at f = 140 kHz			
$I_E = I_e = 0$; $V_{CB} = 10$ V	C_c	< 1.7	pF
$I_E = I_e = 0$; $V_{CB} = 0$	C_c	< 3.0	pF
Emitter capacitance at f = 140 kHz			
$I_C = I_c = 0$; $V_{EB} = 0.5$ V	C_e	< 2.0	pF
Transition frequency			
$I_C = 6$ mA; $V_{CE} = 10$ V [1])	f_T	> 900	MHz
Noise figure at f = 60 MHz			
$I_C = 1$ mA; $V_{CE} = 6$ V; $R_S = 400\ \Omega$	F	< 6	dB
Oscillator power output at f = 500 MHz			
$-I_E = 8$ mA; $V_{CB} = 15$ V	P_o	> 30	mW
Maximum unilateralised power gain			
$G_{UM} = \frac{\lvert y_{fe}\rvert^2}{4 g_{ie} g_{oe}}$			
$I_C = 6$ mA; $V_{CE} = 12$ V; f = 200 MHz	G_{UM}	typ. 36	dB

1) JEDEC registration: $I_C = 4$ mA; $V_{CE} = 10$ V, $f_T > 600$ MHz.

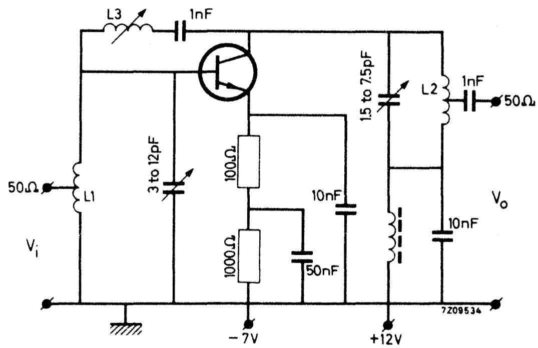
CHARACTERISTICS (continued) $T_j = 25\ ^oC$

Available power gain at f = 200 MHz

I_C = 6 mA G_p > 15 dB

Basic circuit for measuring the available neutralised power gain

Grounded shield lead



L1 = 3.5 turns tinned Cu wire, 1.3 mm
d = 8 mm; length = 11 mm

Tap at ≈ 2 turns from earth side

L2 = 8 turns tinned Cu wire, 1.3 mm
d = 3 mm; length = 22 mm

Tap at 1 turn from earth side

L3 = 0.4 to 0.65 μH

DEVICE DATA

CATV amplifier modules

type number	frequency range MHz	power gain (dB) at f = 50 MHz	application	page
BGY61 BGY65 BGY67 BGY67A	5 - 200	13,0 ± 0,5 18,5 ± 0,5 22,5 ± 0,5 24,0 ± 0,5	reverse amplifiers	461 465 469 473
BGY50 BGY51	40 - 300	12,5 ± 0,4	preamplifier post amplifier	429 429
BGY52 BGY53	40 - 300	16,4 ± 0,4	preamplifier post amplifier	433 433
BGY54 BGY55	40 - 300	17,0 ± 0,4	preamplifier post amplifier	437 437
BGY56 BGY57	40 - 300	22,0 ± 0,6	preamplifier post amplifier	441 441
BGY58	40 - 300	33,0 ± 1,0	line extender	445
BGY58A	40 - 300	34,0 ± 1,0	line extender	449
BGY59	40 - 300	38,5 ± 1,0	line extender	453
BGY60	40 - 300	33,5 ± 1,0	interstage amplifier (2 x 17 dB)	457
BGD102 BGD104	40 - 450	18,5 ± 0,5 20,0 ± 0,5	power doubler amplifiers	421 421
BGD102E BGD104E	40 - 450	18,5 ± 0,5 20,0 ± 0,5	power doubler amplifiers	425 425
BGY70 BGY71	40 - 450	12,5 ± 0,4	preamplifier post amplifier	477 477
BGY74 BGY75	40 - 450	17,0 ± 0,4	preamplifier post amplifier	481 481
BGY78	40 - 450	34,0 ± 1,0	line extender	485
BGY84 BGY85	40 - 450	17,0 ± 0,5	preamplifier post amplifier	489 489
BGY84A BGY85A	40 - 450	18,4 ± 0,4	preamplifier post amplifier	493 493

All modules normally operate at V_B = 24 V, but are able to withstand supply transients up to 30 V.

CATV POWER-DOUBLER AMPLIFIER MODULES

Power-doubler amplifier modules for CATV systems operating at frequencies up to 450 MHz.

BGD102: 18,5 dB gain;
BGD104: 20,0 dB gain.

Features:

- excellent linearity;
- high output level;
- optimal reliability ensured by TiPtAu metallized crystals, silicon nitride passivation and rugged construction.

QUICK REFERENCE DATA

			BGD102	BGD104	
Frequency range	f		40 to 450	40 to 450	MHz
Source impedance and load impedance	$Z_S = Z_L$	=	75	75	Ω
Power gain at f = 50 MHz	G_P		18,5 ±0,5	20,0 ±0,5	dB
Slope cable equivalent f = 40 MHz to 450 MHz	S_L		0,5 to 2,5	0,5 to 2,5	dB
Flatness of frequency response f = 40 MHz to 450 MHz	F_L	⩽	±0,3	±0,3	dB
Return losses at input and output f = 40 MHz to 450 MHz	$S_{11\text{-}22}$	⩾	18	18	dB
2nd order distortion V_o = 46 dBmV	d_2	⩽	−73	−73	dB
Composite triple beat; 60 channels V_o = 46 dBmV	CTB	⩽	−65	−64	dB
Cross modulation V_o = 46 dBmV at 60 channels	X_{mod}	⩽	−67	−66	dB
Noise figure f = 40 MHz to 450 MHz	F	⩽	7	7	dB
D.C. supply voltage	$+V_B$	=	24	24	V*
Total d.c. current consumption at V_B = +24 V	I_{tot}	⩽	435	435	mA

MECHANICAL DATA

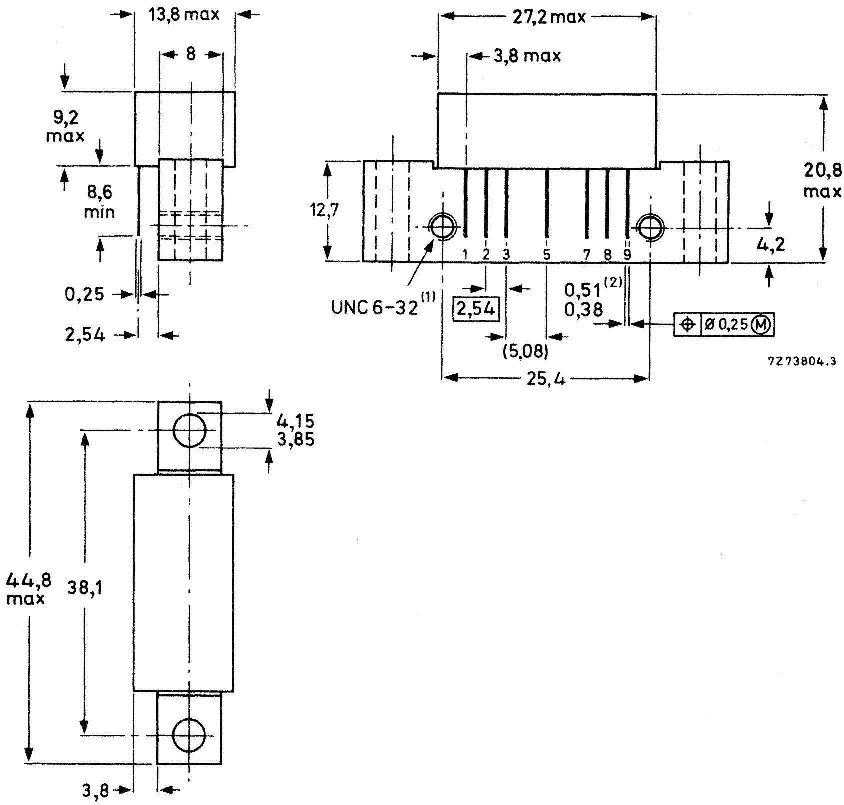
SOT-115 (see Fig. 1).

* The modules normally operate at V_B = 24 V, but are able to withstand supply transients up to 30 V.

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-115.



(1) Screw 6-32UNC-2A available upon request (see "Accessories")
(2) Gold-plated leads.

Soldering recommendations

The maximum permissible temperature of the soldering iron is 260 °C for a contact time of maximum 3 s, when the soldered joints are 3 mm or more from the module.

RATINGS

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

R.F. input voltage	V_i	max.	65 dBmV
Storage temperature	T_{stg}		−40 to +100 °C
Operating mounting base temperature	T_{mb}		−20 to +100 °C

CHARACTERISTICS

Supply voltage V_B = +24 V; T_{mb} = 35 °C

			BGD102	BGD104	
Power gain at f = 50 MHz	G_P		18,5 ±0,5	20,0 ±0,5	dB
Power gain at f = 450 MHz	G_P		19,2–21,2	20,5–22,5	dB
Slope cable equivalent f = 40 MHz to 450 MHz	S_L		0,5 to 2,5	0,5 to 2,5	dB
Flatness of frequency response f = 40 MHz to 450 MHz	F_L	⩽	±0,3	±0,3	dB
Return losses at input and output $Z_S = Z_L = 75\ \Omega$; f = 40 MHz to 450 MHz	$S_{11\text{-}22}$	⩾	18	18	dB
2nd order distortion V_o = 46 dBmV; channel 2 V_o = 46 dBmV; channel H5 Measured at channel H14	d_2	⩽	−73	−73	dB
Composite triple beat at 60 channels V_o = 46 dBmV; tested in channel H22	CTB	⩽	−65	−64	dB
Cross modulation at 60 channels V_o = 46 dBmV; tested in channel 2	X_{mod}	⩽	−67	−66	dB ←
Noise figure f = 40 MHz to 450 MHz	F	⩽	7	7	dB
Total d.c. current consumption	I_{tot}	⩽	435	435	mA

CATV POWER-DOUBLER AMPLIFIER MODULES

Power-doubler amplifier modules for CATV systems operating at frequencies up to 450 MHz.

BGD102E: 18,5 dB gain;
BGD104E: 20,0 dB gain.

Features:

- excellent linearity;
- high output level;
- optimal reliability ensured by TiPtAu metallized crystals, silicon nitride passivation and rugged construction.

QUICK REFERENCE DATA

			BGD102E	BGD104E	
Frequency range	f		40 to 450	40 to 450	MHz
Source impedance and load impedance	$Z_S=Z_L$	=	75	75	Ω
Power gain at f = 50 MHz	G_P		18,5 ±0,5	20,0 ±0,5	dB
Slope cable equivalent f = 40 MHz to 450 MHz	S_L		0,5 to 2,5	0,5 to 2,5	dB
Flatness of frequency response f = 40 MHz to 450 MHz	F_L	⩽	±0,3	±0,3	dB
Return losses at input and output at f = 40 MHz	$S_{11\text{-}22}$	⩾	20	20	dB
at f = 450 MHz	$S_{11\text{-}22}$	⩾	18	18	dB
Output voltage at d_{im} = –60 dB f(p+q–r)= 438,25 MHz (DIN 45004B, par.6.3: 3-tone)	V_o	⩾	65,0	64,5	dBmV
2nd order distortion V_o = 46 dBmV	d_2	⩽	–73	–73	dB
Noise figure f = 40 MHz to 450 MHz	F	⩽	7	7	dB
D.C. supply voltage	$+V_B$	=	24	24	V*
Total d.c. current consumption at V_B = +24 V	I_{tot}	⩽	435	435	mA

MECHANICAL DATA

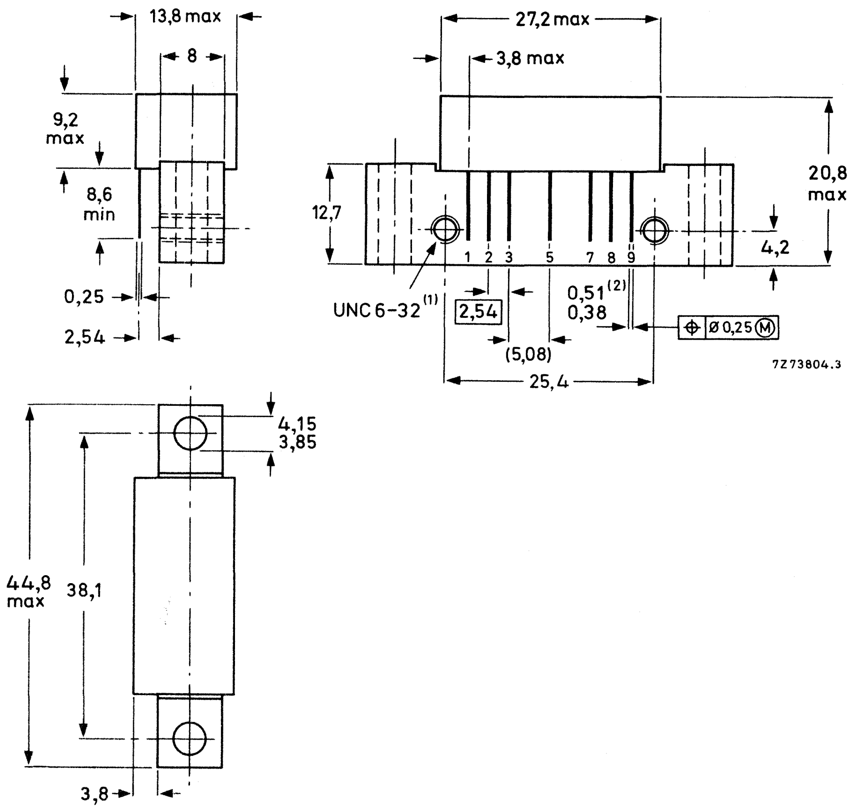
SOT-115 (see Fig. 1).

* The modules normally operate at V_B = 24 V, but are able to withstand supply transients up to 30 V.

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-115.



(1) Screw 6-32UNC-2A available upon request (see "Accessories").
(2) Gold-plated leads.

Soldering recommendations

The maximum permissible temperature of the soldering iron is 260 °C for a contact time of maximum 3 s, when the soldered joints are 3 mm or more from the module.

RATINGS

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

R.F. input voltage	V_i	max.	65 dBmV
Storage temperature	T_{stg}	−40 to +100	°C
Operating mounting base temperature	T_{mb}	−20 to +100	°C

CHARACTERISTICS

Supply voltage V_B = +24 V; T_{mb} = 35 °C

			BGD102E	BGD104E	
Power gain at f = 50 MHz	G_P		18,5 ±0,5	20,0 ±0,5	dB
Power gain at f = 450 MHz	G_P		19,2–21,2	20,5–22,5	dB
Slope cable equivalent f = 40 MHz to 450 MHz	S_L		0,5 to 2,5	0,5 to 2,5	dB
Flatness of frequency response f = 40 MHz to 450 MHz	F_L	⩽	±0,3	±0,3	dB
Return losses at input and output at $Z_S = Z_L$ = 75 Ω;					
f = 40 MHz to 80 MHz	$S_{11\text{-}22}$	⩾	20	20	dB
f = 80 MHz to 160 MHz	$S_{11\text{-}22}$	⩾	19	19	dB
f = 160 MHz to 450 MHz	$S_{11\text{-}22}$	⩾	18	18	dB
Output voltage at d_{im} = −60 dB (DIN 45004B,6.3: 3-tone) $V_p = V_o$; f_p = 440,25 MHz $V_q = V_o$ −6 dB; f_q = 447,25 MHz $V_r = V_o$ −6 dB; f_r = 449,25 MHz Measured at $f_{(p+q\text{-}r)}$ = 438,25 MHz	V_o	⩾	65,0	64,5	dBmV
2nd order distortion V_o = 46 dBmV; channel 2 V_o = 46 dBmV; channel H5 Measured at channel H14	d_2	⩽	−73	−73	dB
Noise figure f = 40 MHz to 450 MHz	F	⩽	7	7	dB
Total d.c. current consumption	I_{tot}	⩽	435	435	mA

HYBRID V.H.F. PUSH-PULL AMPLIFIER MODULES

Hybrid amplifier modules intended for CATV systems.

QUICK REFERENCE DATA

			BGY50	BGY51	
Frequency range	f		40 to 300	40 to 300	MHz
Source impedance and load impedance	$Z_S = Z_L$	=	75	75	Ω
Power gain at f = 50 MHz	G_p		12,5 ± 0,4	12,5 ± 0,4	dB
Slope cable equivalent f = 40 MHz to 300 MHz			+0,2 to +0,8	+0,2 to +0,8	dB
Flatness of frequency response f = 40 MHz to 300 MHz		≤	0,2	0,2	dB
Return losses at input and output f = 40 MHz to 300 MHz		≥	18	18	dB
Output voltage at d_{im} = −60 dB (DIN 45004, par. 6.3: 3-tone)	V_o	≥	61	63,5	dBmV
2nd harmonic distortion at V_o = 50 dBmV	d_2	≤	−68	−70	dB
Noise figure f = 40 MHz to 300 MHz	F	≤	7	8	dB
D.C. supply voltage	$+V_B$	=	24	24	V *
Total d.c. current consumption at V_B = +24 V	I_{tot}	typ.	160	200	mA
Operating mounting base temperature	T_{mb}		−20 to +90	−20 to +90	°C

MECHANICAL DATA

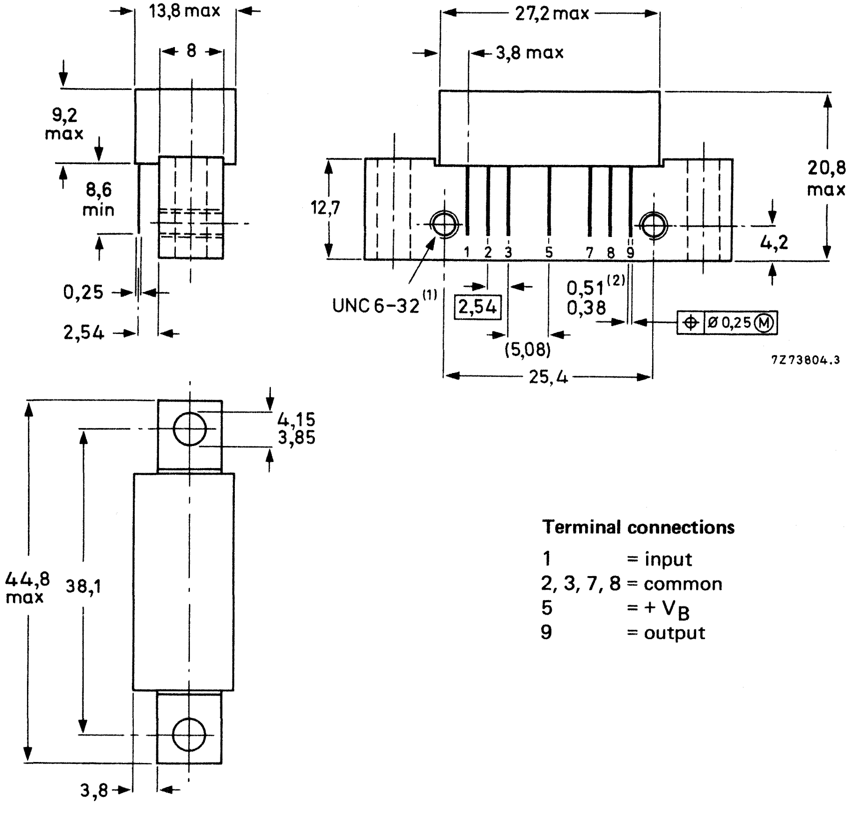
SOT-115 (see Fig. 1).

* The modules are able to withstand incidental short peaks in the supply voltage up to a maximum of 30 V.

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-115.



Terminal connections

1	= input
2, 3, 7, 8	= common
5	= + V_B
9	= output

(1) Screw 6-32UNC-2A available upon request (see "Accessories").

(2) Tin-plated leads.

Soldering recommendations

The maximum permissible temperature of the soldering iron is 260 °C for a contact time of maximum 3 s, when the soldered joints are 3 mm or more from the module.

RATINGS

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

R.F. input voltage	V_i	max.	67 dBmV
Storage temperature	T_{stg}	−40 to +100	°C
Operating mounting base temperature	T_{mb}	−20 to +90	°C

CHARACTERISTICS

Supply voltage V_B = + 24 V; T_{amb} = 25 °C

			BGY50	BGY51	
Power gain at f = 50 MHz	G_p		12,5 ± 0,4	12,5 ± 0,4	dB
Slope cable equivalent f = 40 MHz to 300 MHz			+0,2 to +0,8	+0,2 to +0,8	dB
Flatness of frequency response f = 40 MHz to 300 MHz		⩽	0,2	0,2	dB
Return losses at input and output $Z_S = Z_L$ = 75 Ω; f = 40 MHz to 300 MHz		⩾	18	18	dB
Output voltage at d_{im} = −60 dB (DIN 45004, par. 6.3: 3-tone) $V_p = V_o$; f_p = 287,25 MHz $V_q = V_o$ −6 dB; f_q = 294,25 MHz $V_r = V_o$ −6 dB; f_r = 296,25 MHz Measured at $f_{(p+q-r)}$ = 285,25 MHz	V_o	⩾	61	63,5	dBmV
2nd harmonic distortion $V_p = V_o$ = 50 dBmV; f_p = 66 MHz $V_q = V_o$ = 50 dBmV; f_q = 144 MHz Measured at $f_{(p+q)}$ = 210 MHz	d_2	⩽	−68	−70	dB
Noise figure f = 40 MHz to 300 MHz	F	⩽	7	8	dB
Total d.c. current consumption	I_{tot}	typ.	160	200	mA
		⩽	180	220	mA

HYBRID V.H.F. PUSH-PULL AMPLIFIER MODULES

Hybrid amplifier modules intended for CATV systems.

QUICK REFERENCE DATA

			BGY52	BGY53	
Frequency range	f		40 to 300	40 to 300	MHz
Source impedance and load impedance	$Z_S = Z_L$	=	75	75	Ω
Power gain at f = 50 MHz	G_p		16,4 ± 0,4	16,4 ± 0,4	dB
Slope cable equivalent f = 40 MHz to 300 MHz			0 to + 1,0	0 to + 1,0	dB
Flatness of frequency response f = 40 MHz to 300 MHz		⩽	0,1	0,1	dB
Return losses at input and output f = 40 MHz to 300 MHz		⩾	18	18	dB
Output voltage at d_{im} = −60 dB (DIN 45004, par. 6.3: 3-tone)	V_o	⩾	61	63,5	dBmV
2nd harmonic distortion at V_o = 50 dBmV	d_2	⩽	−68	−70	dB
Noise figure f = 40 MHz to 300 MHz	F	⩽	6	7	dB
D.C. supply voltage	$+V_B$	=	24	24	V *
Total d.c. current consumption at V_B = + 24 V	I_{tot}	typ.	160	200	mA
Operating mounting base temperature	T_{mb}		−20 to + 90	−20 to + 90	°C

MECHANICAL DATA

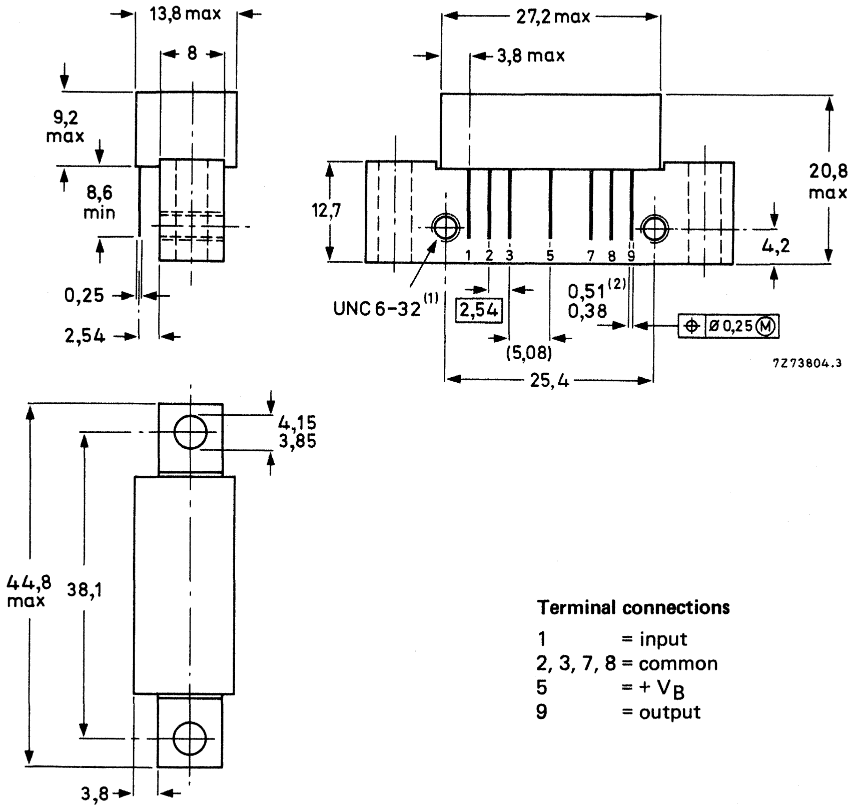
SOT-115 (see Fig. 1).

* The modules are able to withstand incidental short peaks in the supply voltage up to a maximum of 30 V.

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-115.



Terminal connections

1	= input
2, 3, 7, 8	= common
5	= + V_B
9	= output

(1) Screw 6-32UNC-2A available upon request (see "Accessories").

(2) Gold-plated leads.

Soldering recommendations

The maximum permissible temperature of the soldering iron is 260 °C for a contact time of maximum 3 s, when the soldered joints are 3 mm or more from the module.

RATINGS

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

R.F. input voltage	V_i	max.	65 dBmV
Storage temperature	T_{stg}	−40 to +100	°C
Operating mounting base temperature	T_{mb}	−20 to +90	°C

CHARACTERISTICS

Supply voltage V_B = + 24 V; T_{amb} = 25 °C

			BGY52	BGY53	
Power gain at f = 50 MHz	G_p		16,4 ± 0,4	16,4 ± 0,4	dB
Slope cable equivalent f = 40 MHz to 300 MHz			0 to + 1,0	0 to + 1,0	dB
Flatness of frequency response f = 40 MHz to 300 MHz		⩽	0,1	0,1	dB
Return losses at input and output $Z_S = Z_L$ = 75 Ω; f = 40 MHz to 300 MHz		⩾	18	18	dB
Output voltage at d_{im} = −60 dB (DIN 45004, par. 6.3: 3-tone) $V_p = V_o$; f_p = 287,25 MHz $V_q = V_o$ −6 dB; f_q = 294,25 MHz $V_r = V_o$ −6 dB; f_r = 296,25 MHz Measured at $f_{(p+q-r)}$ = 285,25 MHz	V_o	⩾	61	63,5	dBmV
2nd harmonic distortion $V_p = V_o$ = 50 dBmV; f_p = 66 MHz $V_q = V_o$ = 50 dBmV; f_q = 144 MHz Measured at $f_{(p+q)}$ = 210 MHz	d_2	⩽	−68	−70	dB
Noise figure f = 40 MHz to 300 MHz	F	⩽	6	7	dB
Total d.c. current consumption	I_{tot}	typ.	160	200	mA
		⩽	180	220	mA

CATV AMPLIFIER MODULES

Hybrid amplifier modules for CATV systems operating at frequencies up to 300 MHz.

BGY54: 17 dB input amplifier module;
BGY55: 17 dB output amplifier module.

Features:

- excellent linearity;
- extremely low noise;
- optimal reliability ensured by TiPtAu metallized crystals, silicon nitride passivation and rugged construction.

QUICK REFERENCE DATA

			BGY54	BGY55	
Frequency range	f		40 to 300	40 to 300	MHz
Source impedance and load impedance	$Z_S = Z_L$	=	75	75	Ω
Power gain at f = 50 MHz	G_p		17,0 ± 0,4	17,0 ± 0,4	dB
Slope cable equivalent f = 40 MHz to 300 MHz			0 to 1,0	0 to 1,0	dB
Flatness of frequency response f = 40 MHz to 300 MHz		⩽	± 0,1	± 0,1	dB
Return losses at input and output f = 40 MHz to 300 MHz		⩾	20	20	dB
Output voltage at d_{im} = –60 dB (DIN 45004, par. 6.3: 3-tone)	V_o	⩾	61	63,5	dBmV
2nd order distortion at channel R V_o = 50 dBmV on channel 2 and 13	d_2	⩽	–71	–73	dB
Composite triple beat 32 channels V_o = 46 dBmV		⩽	–65	–67	dB
Output capability X_{mod} = –57 dB; 32 channels flat	V_o	⩾	47,5	50	dBmV
Noise figure f = 40 MHz to 300 MHz	F	⩽	6	6,5	dB
D.C. supply voltage	$+V_B$	=	24	24	V*
Total d.c. current consumption at V_B = + 24 V	I_{tot}	typ.	160	200	mA
Operating mounting base temperature	T_{mb}		–20 to + 90	–20 to + 90	°C

MECHANICAL DATA

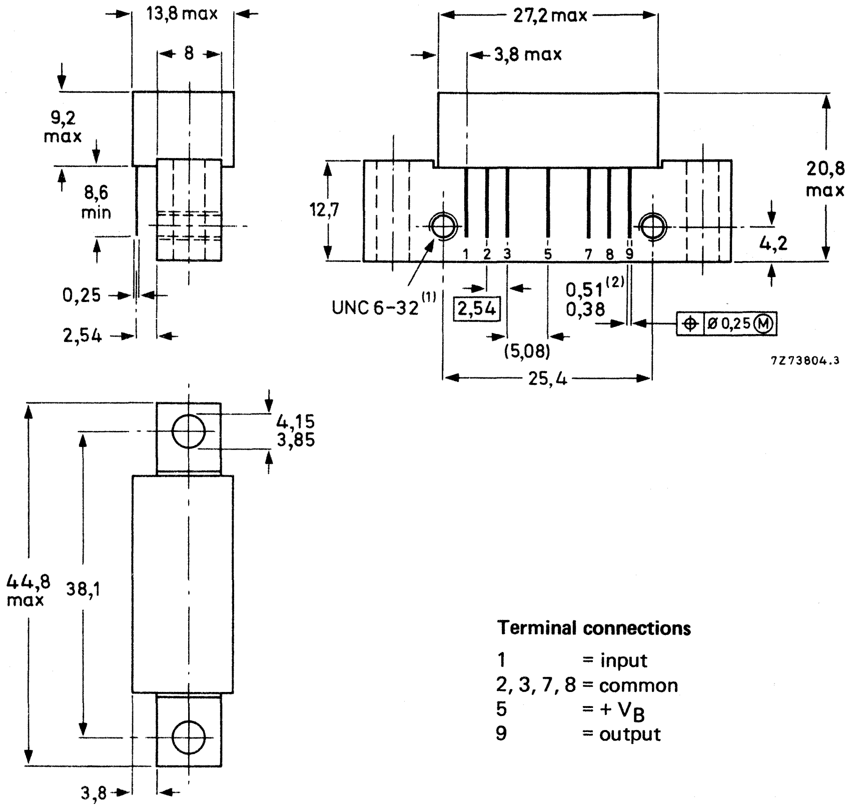
SOT-115 (see Fig. 1).

* The modules normally operate at V_B = 24 V, but are able to withstand supply transients up to 30 V.

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-115.



Terminal connections

1 = input
2, 3, 7, 8 = common
5 = + V_B
9 = output

(1) Screw 6-32UNC-2A available upon request (see "Accessories").
(2) Gold-plated leads.

Soldering recommendations

The maximum permissible temperature of the soldering iron is 260 °C for a contact time of maximum 3 s, when the soldered joints are 3 mm or more from the module.

RATINGS

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

R.F. input voltage	V_i	max. 65	dBmV
Storage temperature	T_{stg}	−40 to + 100	°C
Operating mounting base temperature	T_{mb}	−20 to + 90	°C

CHARACTERISTICS

Supply voltage V_B = + 24 V; T_{amb} = 25 °C

			BGY54	BGY55	
Power gain at f = 50 MHz	G_p		17,0 ± 0,4	17,0 ± 0,4	dB
Slope cable equivalent f = 40 MHz to 300 MHz			0 to 1,0	0 to 1,0	dB
Flatness of frequency response f = 40 MHz to 300 MHz		⩽	± 0,1	± 0,1	dB
Return losses at input and output $Z_S = Z_L = 75\ \Omega$; f = 40 MHz to 300 MHz		⩾	20	20	dB
Output voltage at d_{im} = −60 dB (DIN 45004, 6.3: 3-tone) $V_p = V_o$; f_p = 287,25 MHz $V_q = V_o$−6 dB; f_q = 294,25 MHz $V_r = V_o$−6 dB; f_r = 296,25 MHz Measured at $f_{(p+q-r)}$ = 285,25 MHz	V_o	⩾	61	63,5	dBmV
2nd order distortion V_o = 50 dBmV; channel 2 V_o = 50 dBmV; channel 13 Measured at channel R	d_2	⩽	−71	−73	dB
Composite triple beat 32 channels V_o = 46 dBmV; channel W		⩽	−65	−67	dB
Output capability on channel W X_{mod} = −57 dB; 32 channels flat	V_o	⩾	47,5	50	dBmV
Noise figure f = 40 MHz to 300 MHz	F	⩽	6	6,5	dB
Total d.c. current consumption	I_{tot}	typ.	160	200	mA
		⩽	180	220	mA

HYBRID V.H.F. PUSH-PULL AMPLIFIER MODULES

Hybrid amplifier modules intended for CATV systems.

QUICK REFERENCE DATA

			BGY56	BGY57	
Frequency range	f		40 to 300	40 to 300	MHz
Source impedance and load impedance	$Z_S = Z_L$	=	75	75	Ω
Power gain at f = 50 MHz	G_p		22,0 ± 0,6	22,0 ± 0,6	dB
Slope cable equivalent f = 40 MHz to 300 MHz			0 to + 1,0	0 to + 1,0	dB
Flatness of frequency response f = 40 MHz to 300 MHz		≤	± 0,2	± 0,2	dB
Return losses at input and output f = 40 MHz to 300 MHz		≥	20	20	dB
Output voltage at d_{im} = −60 dB (DIN 45004, par. 6.3: 3-tone)	V_o	≥	61,5	64	dBmV
2nd harmonic distortion at V_o = 50 dBmV	d_2	≤	−64	−66	dB
Noise figure f = 40 MHz to 300 MHz	F	≤	6	7	dB
D.C. supply voltage	$+V_B$	=	24	24	V *
Total d.c. current consumption at V_B = + 24 V	I_{tot}	typ.	160	200	mA
Operating mounting base temperature	T_{mb}		−20 to + 90	−20 to + 90	°C

MECHANICAL DATA

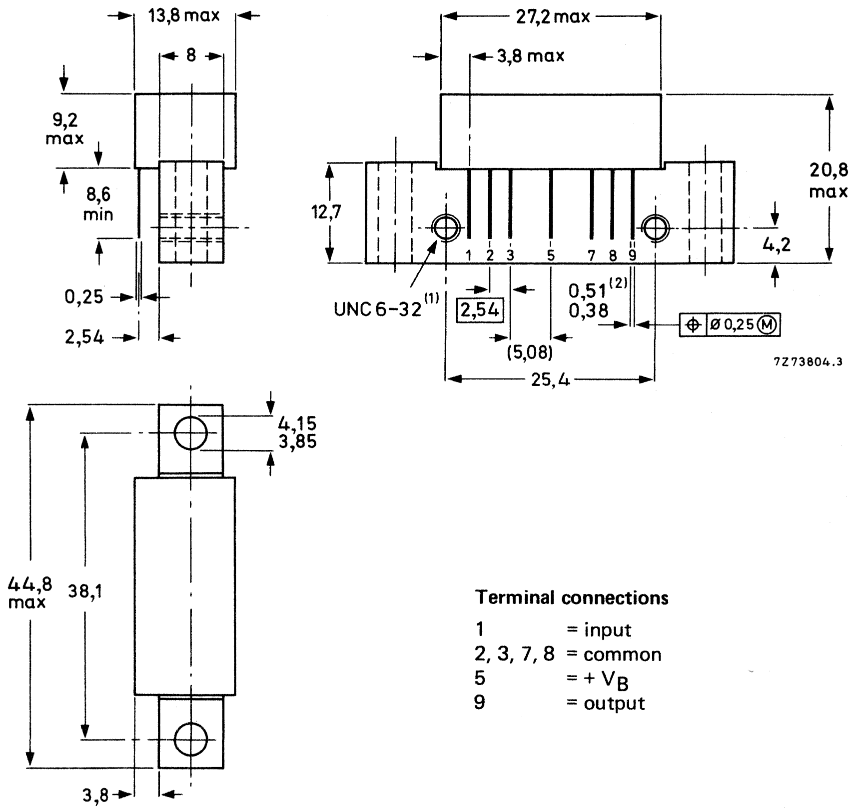
SOT-115 (see Fig. 1).

* The modules are able to withstand incidental short peaks in the supply voltage up to a maximum of 30 V.

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-115.



Terminal connections

1	= input
2, 3, 7, 8	= common
5	= + V_B
9	= output

(1) Screw 6-32UNC-2A available upon request (see "Accessories").

(2) Leads available in gold-plated and tin-plated execution.

Soldering recommendations

The maximum permissible temperature of the soldering iron is 260 °C for a contact time of maximum 3 s, when the soldered joints are 3 mm or more from the module.

RATINGS

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

R.F. input voltage	V_i	max.	63 dBmV
Storage temperature	T_{stg}	−40 to +100	°C
Operating mounting base temperature	T_{mb}	−20 to +90	°C

CHARACTERISTICS

Supply voltage V_B = + 24 V; T_{amb} = 25 °C

			BGY56	BGY57	
Power gain at f = 50 MHz	G_p		22,0 ± 0,6	22,0 ± 0,6	dB
Slope cable equivalent f = 40 MHz to 300 MHz			0 to + 1,0	0 to + 1,0	dB
Flatness of frequency response f = 40 MHz to 300 MHz		⩽	± 0,2	± 0,2	dB
Return losses at input and output $Z_S = Z_L$ = 75 Ω; f = 40 MHz to 300 MHz		⩾	20	20	dB
Output voltage at d_{im} = −60 dB (DIN 45004 par. 6.3: 3-tone) $V_p = V_o$; f_p = 287,25 MHz $V_q = V_o$ −6 dB; f_q = 294,25 MHz $V_r = V_o$ −6 dB; f_r = 296,25 MHz Measured at $f_{(p+q-r)}$ = 285,25 MHz	V_o	⩾	61,5	64	dBmV
2nd harmonic distortion $V_p = V_o$ = 50 dBmV; f_p = 66 MHz $V_q = V_o$ = 50 dBmV; f_q = 144 MHz Measured at $f_{(p+q)}$ = 210 MHz	d_2	⩽	−64	−66	dB
Noise figure f = 40 MHz to 300 MHz	F	⩽	6	7	dB
Total d.c. current consumption	I_{tot}	typ.	160	200	mA
		⩽	180	220	mA

HYBRID V.H.F. PUSH-PULL AMPLIFIER MODULE

Hybrid amplifier module intended for CATV systems.

QUICK REFERENCE DATA

Frequency range	f		40 to 300	MHz
Source impedance and load impedance	$Z_S = Z_L$	=	75	Ω
Power gain at f = 50 MHz	G_p		33,0 ± 1,0	dB
Slope cable equivalent f = 40 MHz to 300 MHz			+ 0,5 to + 1,5	dB
Flatness of frequency response f = 40 MHz to 300 MHz		⩽	± 0,3	dB
Return losses at input and output f = 40 MHz to 300 MHz		⩾	20	dB
Output voltage at d_{im} = −60 dB (DIN 45004, par. 6.3: 3-tone)	V_o	⩾	64	dBmV
2nd harmonic distortion at V_o = 50 dBmV	d_2	⩽	−68	dB
Noise figure f = 40 MHz to 300 MHz	F	⩽	6	dB
D.C. supply voltage	$+V_B$	=	24	V*
Total d.c. current consumption at V_B = + 24 V	I_{tot}	typ.	320	mA
Operating mounting base temperature	T_{mb}		−20 to + 90	°C

MECHANICAL DATA

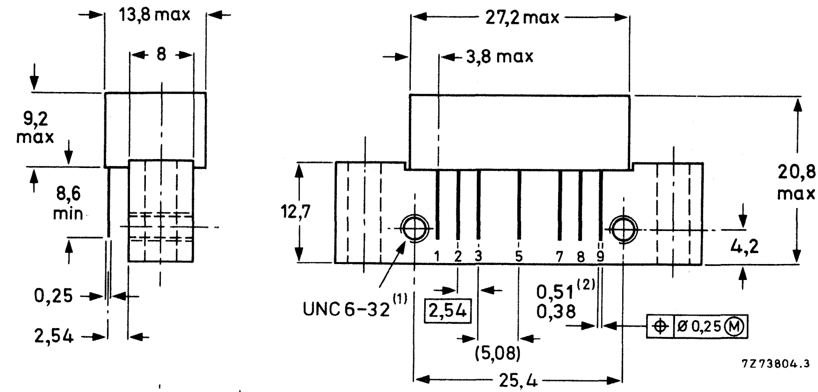
SOT-115 (see Fig. 1).

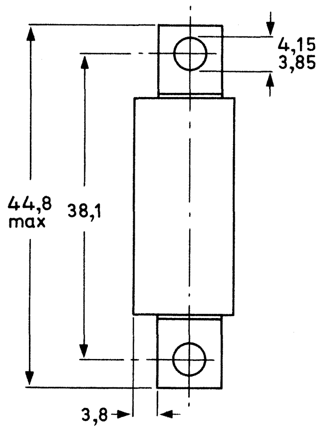
* The module is able to withstand incidental short peaks in the supply voltage up to a maximum of 30 V.

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-115.





Terminal connections

1	= input
2, 3, 7, 8	= common
5	= + V_B
9	= output

(1) Screw 6-32UNC-2A available upon request (see "Accessories").
(2) Leads available in gold-plated and tin-plated execution.

Soldering recommendations

The maximum permissible temperature of the soldering iron is 260 °C for a contact time of maximum 3 s, when the soldered joints are 3 mm or more from the module.

RATINGS

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

R.F. input voltage	V_i	max.	55 dBmV
Storage temperature	T_{stg}		−40 to +100 °C
Operating mounting base temperature	T_{mb}		−20 to +90 °C

CHARACTERISTICS

Supply voltage V_B = + 24 V; T_{amb} = 25 °C

Power gain at f = 50 MHz	G_p		33,0 ± 1,0 dB
Slope cable equivalent f = 40 MHz to 300 MHz			+ 0,5 to + 1,5 dB
Flatness of frequency response f = 40 MHz to 300 MHz		≤	± 0,3 dB
Return losses at input and output $Z_S = Z_L$ = 75 Ω; f = 40 MHz to 300 MHz		≥	20 dB
Output voltage at d_{im} = −60 dB (DIN 45004, par. 6.3: 3-tone) $V_p = V_o$; f_p = 287,25 MHz $V_q = V_o$ −6 dB; f_q = 294,25 MHz $V_r = V_o$ −6 dB; f_r = 296,25 MHz Measured at $f_{(p+q-r)}$ = 285,25 MHz	V_o	≥	64 dBmV
2nd harmonic distortion $V_p = V_o$ = 50 dBmV; f_p = 66 MHz $V_q = V_o$ = 50 dBmV; f_q = 144 MHz Measured at $f_{(p+q)}$ = 210 MHz	d_2	≤	−68 dB
Noise figure f = 40 MHz to 300 MHz	F	≤	6 dB
Total d.c. current consumption	I_{tot}	typ. ≤	320 mA 340 mA

CATV AMPLIFIER MODULE

Hybrid amplifier module for use as 34 dB line extender in CATV systems operating at frequencies up to 330 MHz.

Features:

- excellent linearity;
- extremely low noise;
- optimal reliability ensured by TiPtAu metallized crystals, silicon nitride passivation and rugged construction.

QUICK REFERENCE DATA

Frequency range	f		40 to 330	MHz
Source impedance and load impedance	$Z_S = Z_L$		75	Ω
Power gain at f = 50 MHz	G_p		34,0 ± 1,0	dB
Slope cable equivalent f = 40 MHz to 330 MHz			0,5 to 1,5	dB
Flatness of frequency response f = 40 MHz to 330 MHz		⩽	± 0,3	dB
Return losses at input and output f = 40 MHz to 330 MHz		⩾	20	dB
Output voltage at d_{im} = –60 dB (DIN 45004B, par. 6.3: 3-tone)	V_o	⩾	64	dBmV
2nd order distortion at channel R V_o = 50 dBmV on channel 2 and 13	d_2	⩽	–70	dB
Composite triple beat 32 channels V_o = 46 dBmV		⩽	–67	dB
Output capability X_{mod} = –57 dB; 32 channels flat	V_o	⩾	50	dBmV
Noise figure f = 40 MHz to 330 MHz	F	⩽	6	dB
D.C. supply voltage	$+V_B$	=	24	V*
Total d.c. current consumption at V_B = + 24 V	I_{tot}	typ.	320	mA
Operating mounting base temperature	T_{mb}		–20 to + 90	°C

MECHANICAL DATA

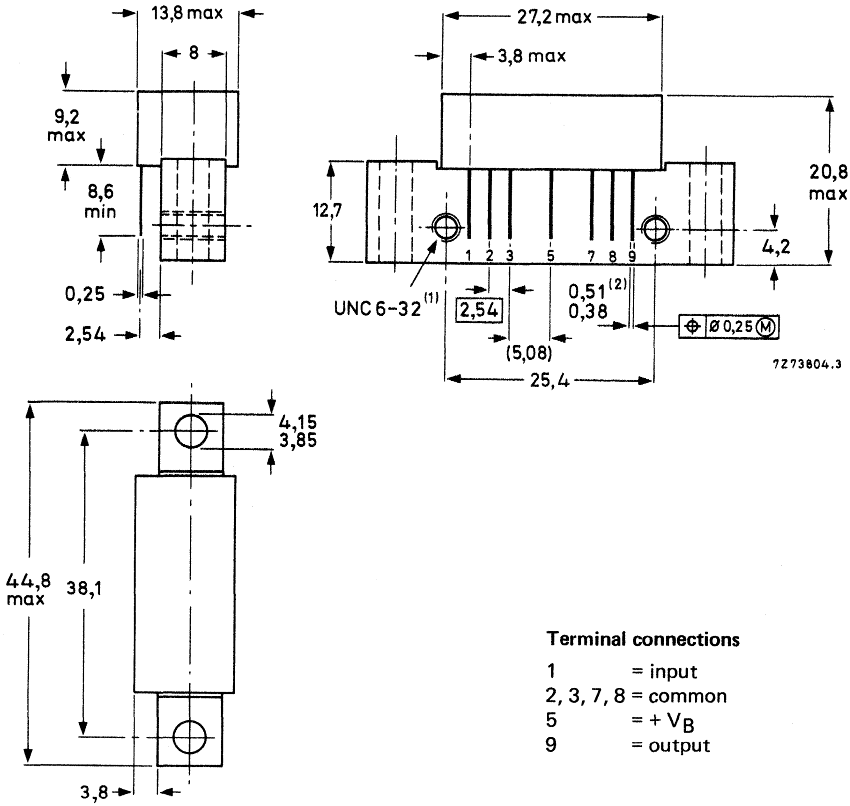
SOT-115 (see Fig. 1).

* The module normally operates at V_B = 24 V, but is able to withstand supply transients up to 30 V.

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-115.



Terminal connections

1 = input
2, 3, 7, 8 = common
5 = + V_B
9 = output

(1) Screw 6-32UNC-2A available upon request (see "Accessories").
(2) Leads available in gold-plated and tin-plated execution.

Soldering recommendations

The maximum permissible temperature of the soldering iron is 260 °C for a contact time of maximum 3 s, when the soldered joints are 3 mm or more from the module.

RATINGS

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

R.F. input voltage	V_i	max.	55 dBmV
Storage temperature	T_{stg}		−40 to + 100 °C
Operating mounting base temperature	T_{mb}		−20 to + 90 °C

←

CHARACTERISTICS

Supply voltage V_B = + 24 V; T_{amb} = 25 °C

Power gain at f = 50 MHz	G_p		34,0 ± 1,0 dB
Slope cable equivalent f = 40 MHz to 330 MHz			0,5 to 1,5 dB
Flatness of frequency response f = 40 MHz to 330 MHz		≤	± 0,3 dB
Return losses at input and output $Z_S = Z_L$ = 75 Ω; f = 40 MHz to 330 MHz		≥	20 dB
Output voltage at d_{im} = −60 dB (DIN 45004, 6.3: 3-tone) $V_p = V_o$; f_p = 287,25 MHz $V_q = V_o$−6 dB; f_q = 294,25 MHz $V_r = V_o$−6 dB; f_r = 296,25 MHz Measured at $f_{(p+q-r)}$ = 285,25 MHz	V_o	≥	64 dBmV
2nd order distortion V_o = 50 dBmV; channel 2 V_o = 50 dBmV; channel 13 Measured at channel R	d_2	≤	−70 dB
Composite triple beat 32 channels V_o = 46 dBmV; channel W		≤	−67 dB
Composite triple beat 40 channels V_o = 46 dBmV; channel W		≤	−63 dB
Output capability on channel W X_{mod} = −57 dB; 32 channels flat	V_o	≥	50 dBmV
X_{mod} = −57 dB; 40 channels flat	V_o	≥	49,5 dBmV
Noise figure f = 40 MHz to 330 MHz	F	≤	6 dB
Total d.c. current consumption	I_{tot}	typ. ≤	320 mA 340 mA

HYBRID V.H.F. PUSH-PULL AMPLIFIER MODULE

Hybrid amplifier module intended for CATV systems up to 300 MHz.

QUICK REFERENCE DATA

Frequency range	f		40 to 300	MHz
Source impedance and load impedance	$Z_S = Z_L$	=	75	Ω
Power gain at f = 50 MHz	G_p		38,5 ±1,0	dB
Slope cable equivalent f = 40 MHz to 300 MHz			0 to + 1,5	dB
Flatness of frequency response f = 40 MHz to 300 MHz		⩽	± 0,3	dB
Return losses at input and output f = 40 MHz to 300 MHz		⩾	18	dB
Output voltage at d_{im} = −60 dB (DIN45004B, par. 6,3: 3-tone)	V_o	⩾	64	dBmV
2nd harmonic distortion at V_o = 50 dBmV	d_2	⩽	−68	dB
Noise figure f = 40 MHz to 300 MHz	F	⩽	6	dB
D.C. supply voltage	$+V_B$	=	24	V*
Total d.c. current consumption at V_B = +24 V	I_{tot}	typ.	320	mA
Operating mounting base temperature	T_{mb}		−20 to +90	°C

MECHANICAL DATA

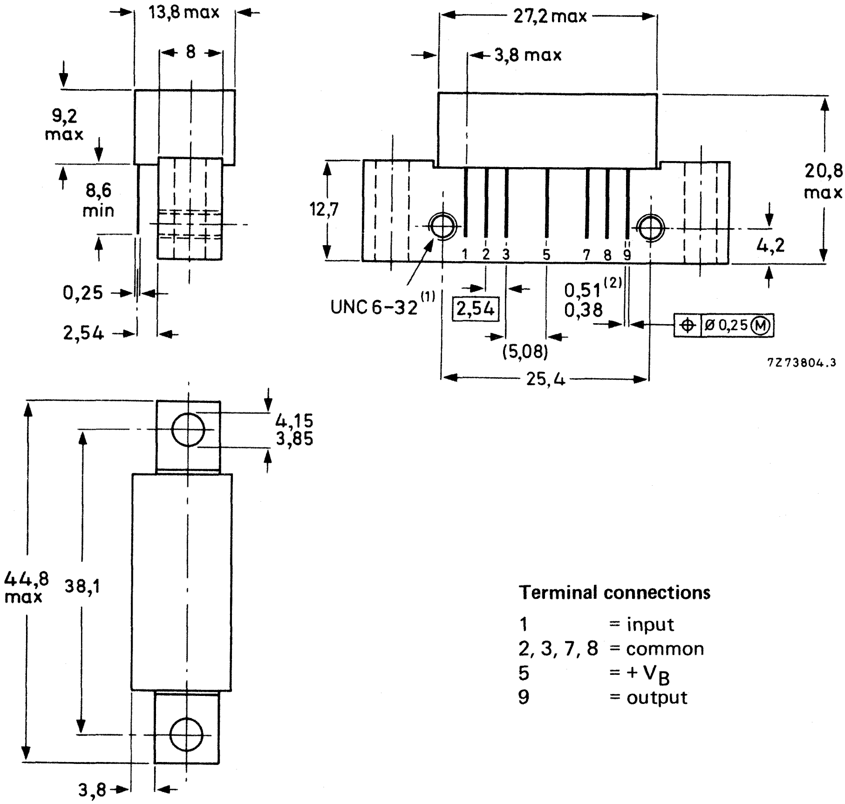
SOT-115 (see Fig. 1).

* The module normally operates at V_B = 24 V, but is able to withstand supply transients up to 30 V.

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-115.



Terminal connections

1	= input
2, 3, 7, 8	= common
5	= + V_B
9	= output

(1) Screw 6-32UNC-2A available upon request (see "Accessories").
(2) Leads tin-plated.

Soldering recommendations

The maximum permissible temperature of the soldering iron is 260 °C for a contact time of maximum 3 s, when the soldered joints are 3 mm or more from the module.

RATINGS

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

R.F. input voltage	V_i	max. 53 dBmV
Storage temperature	T_{stg}	−40 to +100 °C
Operating mounting base temperature	T_{mb}	−20 to +90 °C

CHARACTERISTICS

Supply voltage V_B = +24 V; T_{amb} = 25 °C

Power gain at f = 50 MHz	G_p		38,5 ± 1,0 dB
Slope cable equivalent f = 40 MHz to 300 MHz			0 to +1,5 dB
Flatness of frequency response f = 40 MHz to 300 MHz		≤	± 0,3 dB
Return losses at input and output $Z_S = Z_L$ = 75 Ω; f = 40 MHz to 300 MHz		≥	18 dB
Output voltage at d_{im} = −60 dB (DIN45004B, par. 6.3: 3-tone) $V_p = V_o$; f_p = 287,25 MHz $V_q = V_o$ −6 dB; f_q = 294,25 MHz $V_r = V_o$ −6 dB; f_r = 296,25 MHz Measured at $f_{(p+q-r)}$ = 285,25 MHz	V_o	≥	64 dBmV
2nd harmonic distortion $V_p = V_o$ = 50 dBmV; f_p = 66 MHz $V_q = V_o$ = 50 dBmV; f_q = 144 MHz Measured at $f_{(p+q)}$ = 210 MHz	d_2	≤	−68 dB
Noise figure f = 40 MHz to 300 MHz	F	≤	6 dB
Total d.c. current consumption	I_{tot}	typ. ≤	320 mA 340 mA

HYBRID V.H.F. PUSH-PULL AMPLIFIER MODULE

Interstage hybrid amplifier module intended for CATV systems up to 300 MHz. The inputs and outputs of the stages have been terminated separately.

QUICK REFERENCE DATA for total amplifier unless otherwise specified

Frequency range	f		40 to 300		MHz
Source impedance and load impedance	$Z_S = Z_L$	=	75		Ω
Power gain at f = 50 MHz	G_p		33,5 ± 1,0		dB
Slope cable equivalent f = 40 MHz to 300 MHz			+ 0,5 to + 1,5		dB
Flatness of frequency response f = 40 MHz to 300 MHz		⩽	± 0,3		dB
			pre-stage	**final stage**	
Return losses at input and output f = 40 MHz to 300 MHz	s_{11}	⩾	20	18	dB
	s_{22}	⩾	18	20	dB
Output voltage at d_{im} = −60 dB (DIN45004B, par. 6.3: 3-tone)	V_o	⩾	64		dBmV
2nd harmonic distortion at V_o = 50 dBmV	d_2	⩽	−66		dB
Noise figure f = 40 MHz to 300 MHz	F	⩽	6		dB
D.C. supply voltage	$+V_B$	=	24		V*
Total d.c. current consumption at V_B = +24 V	I_{tot}	typ.	320		mA
Operating mounting base temperature	T_{mb}		−20 to +90		°C

MECHANICAL DATA

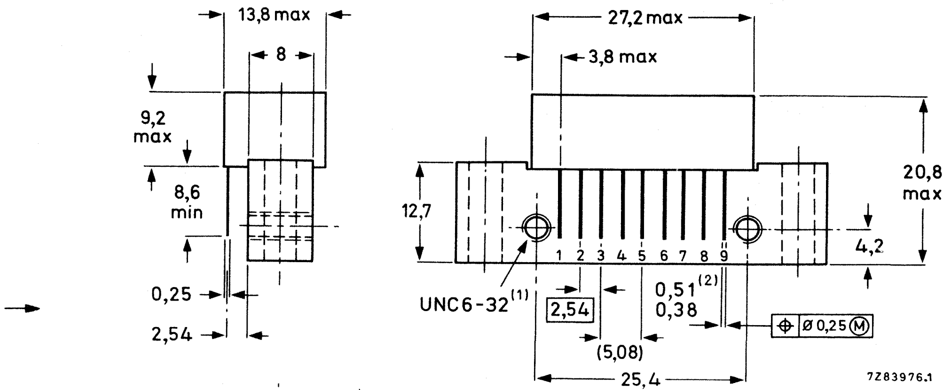
SOT-115 (see Fig. 1).

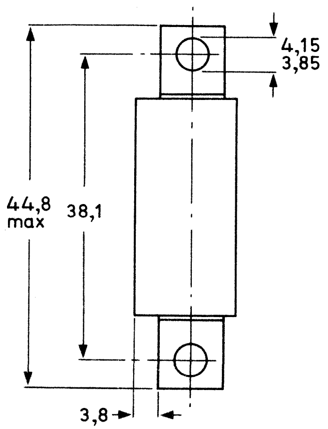
* The module normally operates at V_B = 24 V, but is able to withstand supply transients up to 30 V.

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-115.





Terminal connections

- 1 = input pre-stage
- 2, 3 = common
- 4 = output pre-stage
- 5 = $+V_B$
- 6 = input final stage
- 7, 8 = common
- 9 = output final stage

(1) Will become 6-32UNC-2B in the course of 1983. Screw 6-32UNC-2A available upon request (see "Accessories").

(2) Leads tin-plated.

Soldering recommendations

The maximum permissible temperature of the soldering iron is 260 °C for a contact time of maximum 3 s, when the soldered joints are 3 mm or more from the module.

RATINGS

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

R.F. input voltage total amplifier	V_i	max.	55 dB/mV
Storage temperature	T_{stg}	−40 to + 100	°C
Operating mounting base temperature	T_{mb}	−20 to +90	°C

CHARACTERISTICS for total amplifier unless otherwise specified.

Supply voltage V_B = + 24 V; T_{amb} = 25 °C

			pre-stage	final stage	
Power gain at f = 50 MHz	G_p		33,5 ± 1,0		dB
Slope cable equivalent f = 40 MHz to 300 MHz			+ 0,5 to + 1,5		dB
Flatness of frequency response f = 40 MHz to 300 MHz		⩽	± 0,3		dB
Return losses at input and output $Z_S = Z_L$ = 75 Ω; f = 40 MHz to 300 MHz	s_{11}	⩾	20	18	dB
	s_{22}	⩾	18	20	dB
Output voltage at d_{im} = −60 dB (DIN45004B, par. 6.3: 3-tone) $V_p = V_o$; f_p = 287,25 MHz $V_q = V_o$ −6 dB; f_q = 294,25 MHz $V_r = V_o$ −6 dB; f_r = 296,25 MHz Measured at $f_{(p+q-r)}$ = 285,25 MHz	V_o	⩾	64		dBmV
2nd harmonic distortion $V_p = V_o$ = 50 dBmV; f_p = 66 MHz $V_q = V_o$ = 50 dBmV; f_q = 144 MHz Measured at $f_{(p+q)}$ = 210 MHz	d_2	⩽	−66		dB
Noise figure f = 40 MHz to 300 MHz	F	⩽	6		dB
Total d.c. current consumption	I_{tot}	typ.	320		mA
		⩽	340		mA

CATV AMPLIFIER MODULE

Hybrid amplifier module for use in CATV systems and operating at frequencies from 5 MHz to 200 MHz. The device is intended as a reverse amplifier for use in two-way systems.

QUICK REFERENCE DATA

Frequency range	f		5 to 200	MHz
Source impedance and load impedance	$Z_S = Z_L$		75	Ω
Power gain at f = 10 MHz	G_p		13,0 ± 0,5	dB
Slope cable equivalent f = 5 MHz to 200 MHz	S_L		−0,2 to + 0,5	dB
Flatness of frequency response f = 5 MHz to 200 MHz	F_L	≤	± 0,2	dB
Return losses at input and output f = 5 MHz to 200 MHz	$S_{11\text{-}22}$	≥	20	dB
Output voltage at d_{im} = −60 dB; measured at 33,25 MHz (DIN 45004B, par. 6.3: 3-tone)	V_o	≥	67	dBmV
2nd-order distortion V_o = 50 dBmV	d_2	≤	−72	dB
Composite triple beat; 22 channels V_o = 50 dBmV	CTB	≤	−68	dB
Cross modulation at 22 channels V_o = 50 dBmV	X_{mod}	≤	−61	dB
Noise figure f = 200 MHz	F	≤	7	dB
D.C. supply voltage	$+V_B$	=	24	V*
Total d.c. current consumption V_B = + 24 V	I_{tot}	typ.	200	mA
Operating mounting base temperature	T_{mb}		−20 to + 90	°C

MECHANICAL DATA

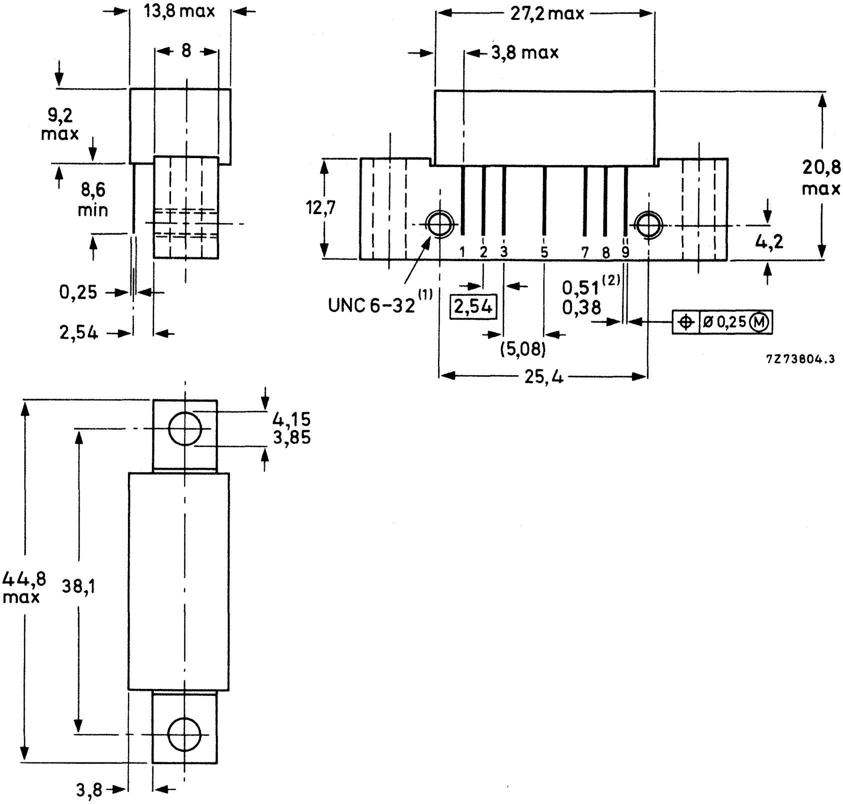
SOT-115 (see Fig. 1).

* The module normally operates at V_B = 24 V, but is able to withstand supply transient up to 30 V.

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-115.



(1) Screw 6-32UNC-2A available upon request (see "Accessories").
(2) Leads gold-plated.

Soldering recommendations

The maximum permissible temperature of the soldering iron is 260 °C for a contact time of maximum 3 s, when the soldered joints are 3 mm or more from the module.

RATINGS

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

R.F. input voltage	V_i	max.	67 dBmV
Storage temperature	T_{stg}	−40 to + 100	°C
Operating mounting base temperature	T_{mb}	−20 to + 90	°C

CHARACTERISTICS at T_{mb} = 30 °C unless otherwise specified

Supply voltage V_B = + 24 V

Power gain at f = 10 MHz	G_p		13,0 ± 0,5 dB
Slope cable equivalent f = 5 MHz to 200 MHz	S_L		−0,2 to + 0,5 dB
Flatness of frequency response f = 5 MHz to 200 MHz	F_L	⩽	± 0,2 dB
Return losses at input and output $Z_S = Z_L$ = 75 Ω; f = 5 MHz to 200 MHz	$S_{11\text{-}22}$	⩾	20 dB
Output voltage at d_{im} = −60 dB (DIN 45004B, par. 6.3: 3-tone) $V_p = V_o$; f_p = 35,25 MHz $V_q = V_o$ −6 dB; f_q = 42,25 MHz $V_r = V_o$ − 6 dB; f_r = 44,25 MHz Measured at $f_{(p+q-r)}$ = 33,25 MHz	V_o	⩾	67 dBmV
Output voltage at d_{im} = −60 dB (DIN 45004B, par. 6.3: 3-tone) $V_p = V_o$; f_p = 187,25 MHz $V_q = V_o$ −6 dB; f_q = 194,25 MHz $V_r = V_o$ −6 dB; f_r = 196,25 MHz Measured at $f_{(p+q-r)}$ = 185,25 MHz	V_o	⩾	64 dBmV
2nd-order distortion V_o = 50 dBmV; f_p = 90 MHz V_o = 50 dBmV; f_q = 100 MHz Measured at $f_{(p+q)}$ = 190 MHz	d_2	⩽	−72 dB
Composite triple beat on 22 channels V_o = 50 dBmV; measured in channel 7	CTB	⩽	−68 dB
Cross modulation at 22 channels V_o = 50 dBmV; measured in channel 2	X_{mod}	⩽	−61 dB
Noise figure f = 200 MHz	F	<	7,0 dB
Total d.c. current consumption	I_{tot}	typ. ⩽	200 mA 230 mA

CATV REVERSE AMPLIFIER MODULE

Hybrid amplifier module for use in CATV systems and operating at frequencies from 5 MHz to 200 MHz. This device is intended as a reverse amplifier for use in two-way systems.

QUICK REFERENCE DATA

Frequency range	f		5 to 200	MHz
Source impedance and load impedance	$Z_S = Z_L$		75	Ω
Power gain at f = 10 MHz	G_p		18,5 ± 0,5	dB
Slope cable equivalent f = 5 MHz to 200 MHz	S_L		−0,2 to + 0,5	dB
Flatness of frequency response f = 5 MHz to 200 MHz	F_L	⩽	± 0,2	dB
Return losses at input and output f = 5 MHz to 200 MHz	$S_{11\text{-}22}$	⩾	20	dB
Output voltage at d_{im} = −60 dB; measured at 33,25 MHz (DIN 45004B, par. 6.3: 3-tone)	V_o	⩾	67	dBmV
2nd-order distortion V_o = 50 dBmV	d_2	⩽	−72	dB
Composite triple beat; 22 channels V_o = 50 dBmV	CTB	⩽	−68	dB
Cross modulation at 22 channels V_o = 50 dBmV	X_{mod}	⩽	−61	dB
Noise figure f = 200 MHz	F	⩽	5,5	dB
D.C. supply voltage	$+V_B$	=	24	V*
Total d.c. current consumption V_B = + 24 V	I_{tot}	typ.	200	mA
Operating mounting base temperature	T_{mb}		−20 to + 90	°C

MECHANICAL DATA

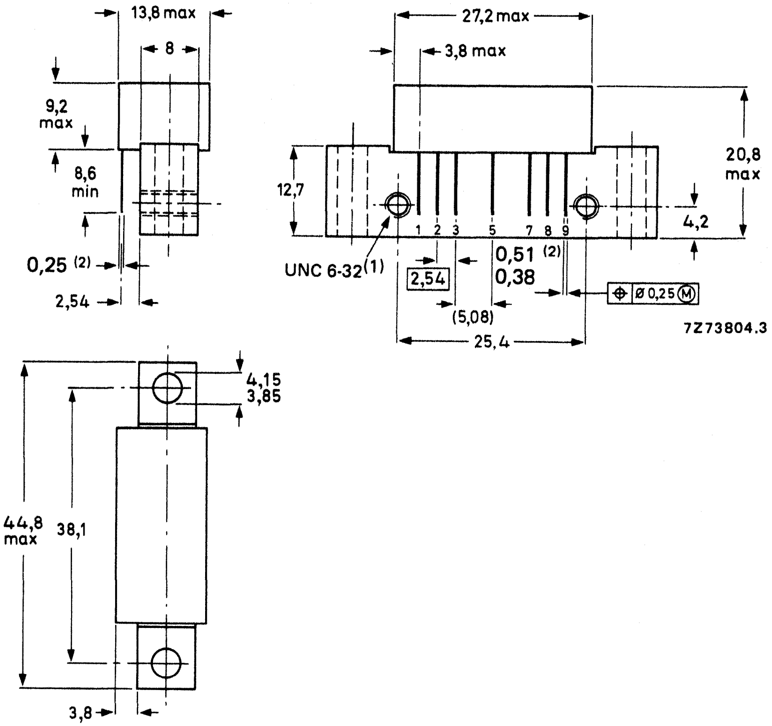
SOT-115 (see Fig. 1).

* The module normally operates at V_B = 24 V, but is able to withstand supply transients up to 30 V.

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-115.



(1) Screw 6-32UNC-2A available upon request (see "Accessories").
(2) Leads gold-plated.

Soldering recommendations

The maximum permissible temperature of the soldering iron is 260 °C for a contact time of maximum 3 s, when the soldered joints are 3 mm or more from the module.

RATINGS

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

R.F. input voltage	V_i	max.	65 dBmV
Storage temperature	T_{stg}	−40 to + 100	°C
Operating mounting base temperature	T_{mb}	−20 to + 90	°C*

CHARACTERISTICS

Supply voltage V_B = + 24 V at T_{mb} = 30 °C unless otherwise specified

Power gain at f = 10 MHz	G_p		18,5 ± 0,5	dB
Slope cable equivalent f = 5 MHz to 200 MHz	S_L		−0,2 to + 0,5	dB
Flatness of frequency response f = 5 MHz to 200 MHz	F_L	⩽	0,2	dB
Return losses at input and output $Z_S = Z_L$ = 75 Ω; f = 5 MHz to 200 MHz	$S_{11\text{-}22}$	⩾	20	dB
Output voltage at d_{im} = −60 dB (DIN 45004B; par. 6.3: 3-tone) $V_p = V_o$; f_p = 33,25 MHz $V_q = V_o$ −6 dB; f_q = 42,25 MHz $V_r = V_o$ −6 dB; f_r = 44,25 MHz Measured at $f_{(p+q)}$ = 33,25 MHz	V_o	⩾	67	dBmV
Output voltage at d_{im} = −60 dB (DIN 45004B; par. 6.3: 3-tone) $V_p = V_o$; f_p = 187,25 MHz $V_q = V_o$ −6 dB; f_q = 194,25 MHz $V_r = V_o$ −6 dB; f_r = 196,25 MHz Measured at $f_{(p+q-r)}$ = 185,25 MHz	V_o	⩾	64	dBmV
2nd-order distorion V_o = 50 dBmV; f_p = 90 MHz V_o = 50 dBmV; f_q = 100 MHz Measured at $f_{(p+q)}$ = 190 MHz	d_2	⩽	−72	dB
Composite triple beat at 22 channels V_o = 50 dBmV; measured in channel 7	CTB	⩽	−68	dB
Cross modulation at 22 channels V_o = 50 dBmV; measured in channel 2	X_{mod}	⩽	−61	dB
Noise figure f = 200 MHz	F	⩽	5,5	dB
Total d.c. current consumption	I_{tot}	typ. ⩽	200 230	mA mA

CATV REVERSE AMPLIFIER MODULE

Hybrid amplifier module for use in CATV systems and operating at frequencies from 5 MHz to 200 MHz. The device is intended as a reverse amplifier for use in two-way systems.

QUICK REFERENCE DATA

Frequency range	f		5 to 200	MHz
Source impedance and load impedance	$Z_S = Z_L$		75	Ω
Power gain at f = 10 MHz	G_p		22,0 ± 0,5	dB
Slope cable equivalent f = 5 MHz to 200 MHz	S_L		−0,2 to + 0,5	dB
Flatness of frequency response f = 5 MHz to 200 MHz	F_L	⩽	± 0,2	dB
Return losses at input and output f = 5 MHz to 200 MHz	$S_{11\text{-}22}$	⩾	20	dB
Output voltage at d_{im} = −60 dB; measured at 33,25 MHz (DIN 45004B, par. 6.3: 3-tone)	V_o	⩾	67	dBmV
2nd-order distortion V_o = 50 dBmV	d_2	⩽	−67	dB
Composite triple beat; 22 channels V_o = 50 dBmV	CTB	⩽	−67	dB
Cross modulation at 22 channels V_o = 50 dBmV	X_{mod}	⩽	−60	dB
Noise figure f = 200 MHz	F	⩽	5,5	dB
D.C. supply voltage	$+V_B$	=	24	V*
Total d.c. current consumption V_B = + 24 V	I_{tot}	typ.	200	mA
Operating mounting base temperature	T_{mb}		−20 to + 90	°C

MECHANICAL DATA

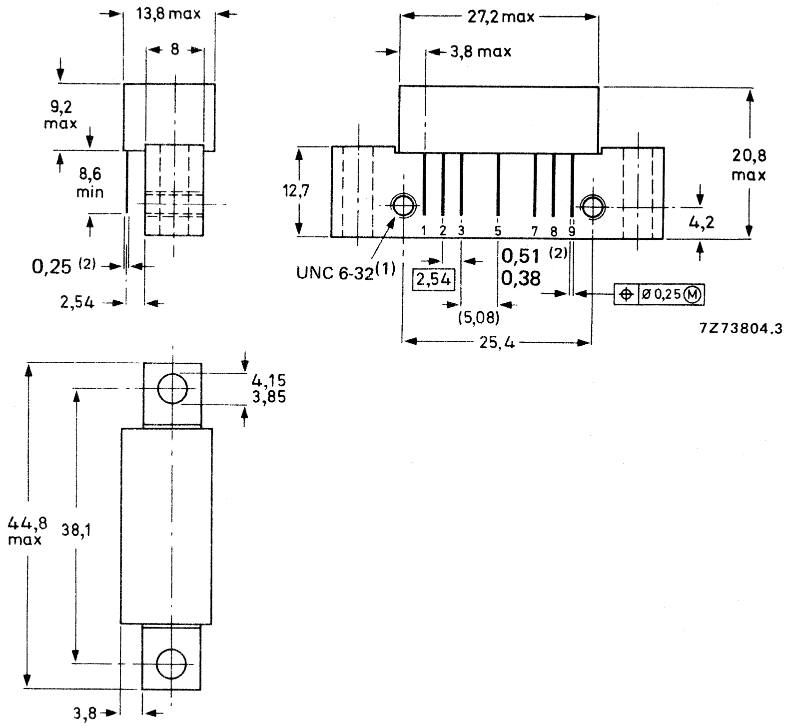
Sot-115 (see Fig. 1).

* The module normally operates at V_B = 24 V, but is able to withstand supply transients up to 30 V.

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-115.



(1) Screw 6-32UNC-2A available upon request (see "Accessories").
(2) Leads gold-plated.

Soldering recommendations

The maximum permissible temperature of the soldering iron is 260 °C for a contact time of maximum 3 s, when the soldered joints are 3 mm or more from the module.

RATINGS

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

R.F. input voltage	V_i	max.	65 dBmV
Storage temperature	T_{stg}	−40 to + 100	°C
Operating mounting base temperature	T_{mb}	−20 to + 90	°C*

CHARACTERISTICS at T_{mb} = 30 °C unless otherwise specified

Supply voltage V_B = + 24 V

Power gain at f = 10 MHz	G_p		22,0 ± 0,5 dB
Slope cable equivalent f = 5 MHz to 200 MHz	S_L		−0,2 to + 0,5 dB
Flatness of frequency response f = 5 MHz to 200 MHz	F_L	≤	± 0,2 dB
Return losses at input and output $Z_S = Z_L$ = 75 Ω; f = 5 MHz to 200 MHz	$S_{11\text{-}22}$	≥	20 dB
Output voltage at d_{im} = −60 dB (DIN 45004B, par. 6.3: 3-tone) $V_p = V_o$; f_p = 33,25 MHz $V_q = V_o$ −6 dB; f_q = 42,25 MHz $V_r = V_o$ −6 dB; f_r = 44,25 MHz Measured at $f_{(p+q-r)}$ = 33,25 MHz	V_o	≥	67 dBmV
Output voltage at d_{im} = −60 dB (DIN 45004B, par. 6.3: 3-tone) $V_p = V_o$; f_p = 187,25 MHz $V_q = V_o$ −6 dB; f_q = 194,25 MHz $V_r = V_o$ −6 dB; f_r = 196,25 MHz Measured at $f_{(p+q-r)}$ = 185,25 MHz	V_o	≥	64 dBmV
2nd-order distortion V_o = 50 dBmV; f_p = 90 MHz V_o = 50 dBmV; f_q = 100 MHz Measured at $f_{(p+q)}$ = 190 MHz	d_2	≤	−67 dB
Composite triple beat at 22 channels V_o = 50 dBmV; measured on channel 7	CTB	≤	−67 dB
Cross modulation at 22 channels V_o = 50 dBmV; measured in channel 2	X_{mod}	≤	−60 dB
Noise figure f = 200 MHz	F	≤	5,5 dB
Total d.c. current consumption	I_{tot}	typ. ≤	200 mA 230 mA

CATV AMPLIFIER MODULE

Hybrid amplifier module for use in CATV systems and operating at frequencies from 5 MHz to 200 MHz. This device is intended as a reverse amplifier for use in two-way systems.

QUICK REFERENCE DATA

Frequency range	f	5 to 200	MHz
Source impedance and load impedance	$Z_S = Z_L$	75	Ω
Power gain at f = 10 MHz	G_p	24,0 ± 0,5	dB
Slope cable equivalent f = 5 MHz to 200 MHz	S_L	−0,2 to + 0,5	dB
Flatness of frequency response f = 5 MHz to 200 MHz	F_L	⩽ +0,2	dB
Return losses at input and output f = 5 MHz to 200 MHz	S_{11-22}	⩾ 20	dB
Output voltage at d_{im} = −60 dB; measured at 33,25 MHz (DIN 45004B, par. 6,3: 3-tone)	V_o	⩾ 67	dBmV
2nd-order distortion V_o = 50 dBmV	d_2	⩽ −67	dB
Composite triple beat; 22 channels V_o = 50 dBmV	CTB	⩽ −67	dB
Cross modulation at 22 channels V_o = 50 dBmV	X_{mod}	⩽ −59	dB
Noise figure f = 200 MHz	F	⩽ 5,5	dB
D.C. supply voltage	$+V_B$	= 24	V*
Total d.c. current consumption V_B = + 24 V	I_{tot}	typ. 200	mA
Operating mounting base temperature	T_{mb}	−20 to + 90	°C

MECHANICAL DATA

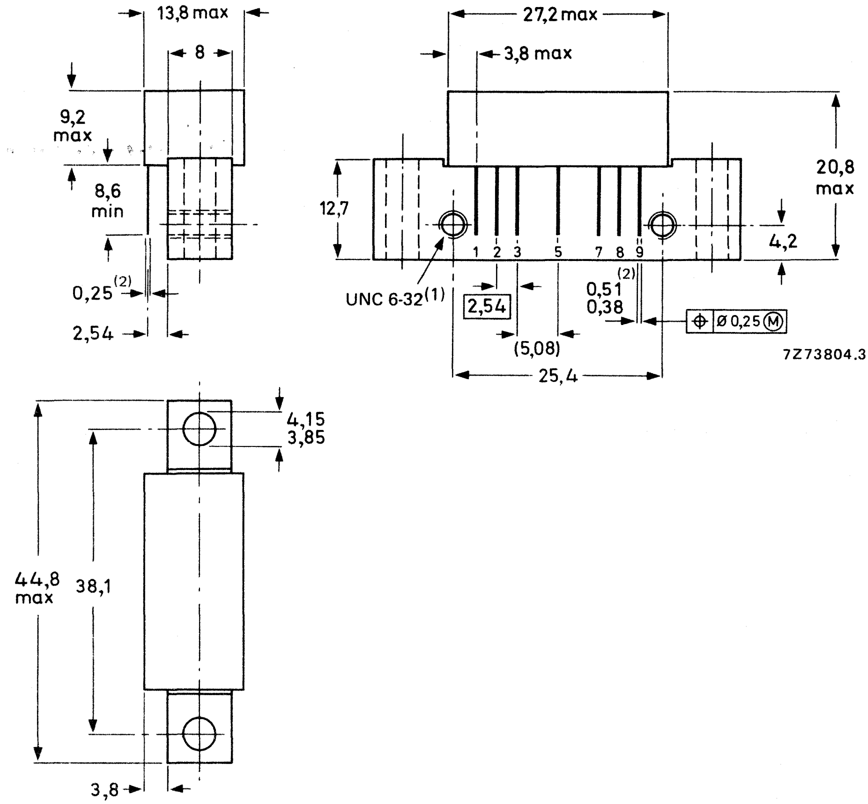
SOT-115 (see Fig. 1).

* The module normally operates at V_B = 24 V, but is able to withstand supply transients up to 30 V.

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-115.



(1) Screw 6-32UNC-2A available upon request (see "Accessories").
(2) Leads availavle in gold-plated and tin-plated execution.

Soldering recommendations

The maximum permissible temperature of the soldering iron is 260 °C for a contact time of maximum 3 s, when the soldered joints are 3 mm or more from the module.

RATINGS

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

R.F. input voltage	V_i	max.	63 dBmV
Storage temperature	T_{stg}	−40 to + 100	°C
Operating mounting base temperature	T_{mb}	−20 to + 90	°C

CHARACTERISTICS at T_{mb} = 30 °C unless otherwise specified

Supply voltage V_B = +24 V

Power gain at f = 10 MHz	G_p		24,0 ± 0,5 dB
Slope cable equivalent f = 5 MHz to 200 MHz	S_L		−0,2 to + 0,5 dB
Flatness of frequency response f = 5 MHz to 200 MHz	F_L	⩽	± 0,2 dB
Return losses at input and output $Z_S = Z_L$ = 75 Ω; f = 5 MHz to 200 MHz	$S_{11\text{-}22}$	⩾	20 dB
Output voltage at d_{im} = −60 dB (DIN 45004B, par. 6,3: 3-tone) $V_p = V_o$; f_p = 35,25 MHz $V_q = V_o$ −6 dB; f_q = 42,25 MHz $V_r = V_o$ −6 dB; f_r = 44,25 MHz Measured at $f_{(p+q-r)}$ = 33,25 MHz	V_o	⩾	67 dBmV
Output voltage at d_{im} = −60 dB (DIN 45004B, par. 6,3: 3-tone) $V_p = V_o$; f_p = 187,25 MHz $V_q = V_o$ −6 dB; f_q = 194,25 MHz $V_r = V_o$ −6 dB; f_r = 196,25 MHz Measured at $f_{(p+q-r)}$ = 185,25 MHz	V_o	⩾	64 dBmV
2nd order distortion V_o = 50 dBmV; f_p = 90 MHz V_o = 50 dBmV; f_q = 100 MHz Measured at $f_{(p+q)}$ = 190 MHz	d_2	⩽	−67 dB
Composite triple beat at 22 channels V_o = 50 dBmV; measured on channel 7	CTB	⩽	−67 dB
Cross modulation at 22 channels V_o = 50 dBmV; measured in channel 2	X_{mod}	⩽	−59 dB
Noise figure f = 200 MHz	F	⩽	5,5 dB
Total d.c. current consumption	I_{tot}	typ. ⩽	200 mA 230 mA

CATV AMPLIFIER MODULES

Hybrid amplifier modules for CATV systems operating at frequencies up to 450 MHz.

BGY70: 12,5 dB input amplifier module;
BGY71: 12,5 dB output amplifier module.

Features:

- excellent linearity;
- extremely low noise;
- optimal reliability ensured by TiPtAu metallized crystals, silicon nitride passivation and rugged construction.

QUICK REFERENCE DATA

			BGY70	BGY71	
Frequency range	f		40 to 450	40 to 450	MHz
Source impedance and load impedance	$Z_S = Z_L$	=	75	75	Ω
Power gain at f = 50 MHz	G_p		12,5 ± 0,4	12,5 ± 0,4	dB
Slope cable equivalent f = 40 MHz to 450 MHz			0,5 to 2	0,5 to 2	dB
Flatness of frequency response f = 40 MHz to 450 MHz		⩽	± 0,2	± 0,2	dB
Return losses at input and output f = 40 MHz to 450 MHz		⩾	18	18	dB
Output voltage at d_{im} = –60 dB (DIN 45004B, par. 6.3: 3-tone)	V_o	⩾	62,5	65	dBmV
2nd order distortion at channel R V_o = 50 dBmV on channel 2 and 13	d_2	⩽	–71	–73	dB
Composite triple beat 52 channels V_o = 46 dBmV		⩽	–55	–59	dB
Output capability X_{mod} = –57 dB; 52 channels flat	V_o	⩾	46,5	49,5	dBmV
Noise figure f = 40 MHz to 450 MHz	F	⩽	7,5	8,5	dB
D.C. supply voltage	$+V_B$	=	24	24	V*
Total d.c. current consumption at V_B = + 24 V	I_{tot}	typ.	160	200	mA
Operating mounting base temperature	T_{mb}		–20 to + 90	–20 to + 90	°C

MECHANICAL DATA

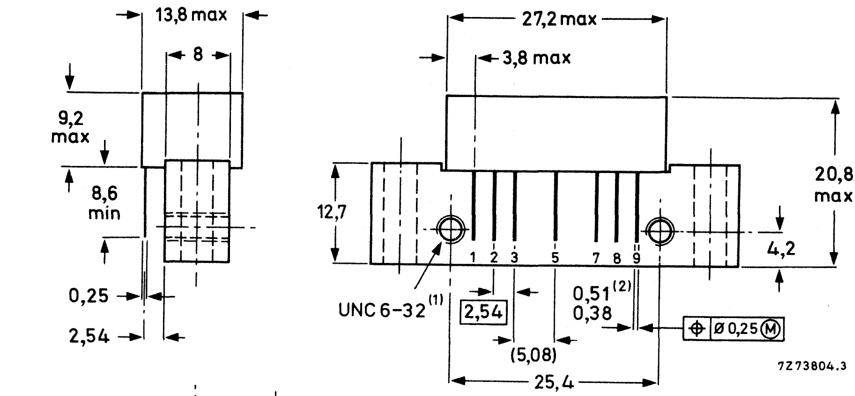
SOT-115 (see Fig. 1).

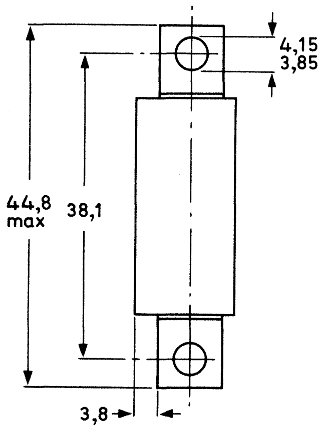
* The modules normally operate at V_B = 24 V, but are able to withstand supply transients up to 30 V.

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-115.





Terminal connections

1	= input
2, 3, 7, 8	= common
5	= + V_B
9	= output

(1) Screw 6-32UNC-2A available upon request (see "Accessories").
(2) Leads available in gold-plated and tin-plated execution.

Soldering recommendations

The maximum permissible temperature of the soldering iron is 260 °C for a contact time of maximum 3 s, when the soldered joints are 3 mm or more from the module.

RATINGS

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

R.F. input voltage	V_i	max.	67 dBmV
Storage temperature	T_{stg}	−40 to + 100	°C
Operating mounting base temperature	T_{mb}	−20 to + 90	°C

CHARACTERISTICS

Supply voltage V_B = + 24 V; T_{amb} = 25 °C

			BGY70	BGY71	
Power gain at f = 50 MHz	G_p		12,5 ± 0,4	12,5 ± 0,4	dB
Slope cable equivalent f = 40 MHz to 450 MHz			0,5 to 2	0,5 to 2	dB
Flatness of frequency response f = 40 MHz to 450 MHz		≤	± 0,2	± 0,2	dB
Return losses at input and output $Z_S = Z_L = 75\ \Omega$; f = 40 MHz to 450 MHz		≥	18	18	dB
Output voltage at d_{im} = −60 dB (DIN 45004B, 6.3: 3-tone) $V_p = V_o$; f_p = 387,25 MHz $V_q = V_o$−6 dB; f_q = 394,25 MHz $V_r = V_o$−6 dB; f_r = 396,25 MHz Measured at $f_{(p+q-r)}$ = 385,25 MHz	V_o	≥	61	63,5	dBmV
Output voltage at d_{im} = −60 dB (DIN 45004B, par. 6.3: 3-tone) $V_p = V_o$; f_p = 287,25 MHz $V_q = V_o$ −6 dB; f_q = 294,25 MHz $V_r = V_o$ −6 dB; f_r = 296,25 MHz Measured at $f_{(p+q-r)}$ = 285,25 MHz	V_o	≥	62,5	65	dBmV
2nd order distortion V_o = 50 dBmV; channel 2 V_o = 50 dBmV; channel 13 Measured at channel R	d_2	≤	−71	−73	dB
V_o = 50 dBmV; channel G V_o = 50 dBmV; channel N Measured at channel H 14	d_2	typ.	−68	−70	dB
Composite triple beat 52 channels V_o = 46 dBmV; channel H 14		≤	−55	−59	dB
Output capability on channel H 14 X_{mod} = −57 dB; 52 channels flat	V_o	≥	46,5	49,5	dBmV
Noise figure f = 40 MHz to 450 MHz	F	≤	7,5	8,5	dB
Total d.c. current consumption	I_{tot}	typ. ≤	160 180	200 220	mA mA

CATV AMPLIFIER MODULES

Hybrid amplifier modules for CATV systems operating at frequencies up to 450 MHz.

BGY74: 17 dB input amplifier module;
BGY75: 17 dB output amplifier module.

Features:

- excellent linearity;
- extremely low noise;
- optimal reliability ensured by TiPtAu metallized crystals, silicon nitride passivation and rugged construction.

QUICK REFERENCE DATA

			BGY74	BGY75	
Frequency range	f		40 to 450	40 to 450	MHz
Source impedance and load impedance	$Z_S = Z_L$	=	75	75	Ω
Power gain at f = 50 MHz	G_p		17,0 ± 0,4	17,0 ± 0,4	dB
Slope cable equivalent f = 40 MHz to 450 MHz			0,5 to 1,5	0,5 to 1,5	dB
Flatness of frequency response f = 40 MHz to 450 MHz		⩽	± 0,1	± 0,1	dB
Return losses at input and output f = 40 MHz to 450 MHz		⩾	18	18	dB
Output voltage at d_{im} = –60 dB (DIN 45004B, par. 6.3: 3-tone)	V_o	⩾	62,5	65	dBmV
2nd order distortion at channel R V_o = 50 dBmV on channel 2 and 13	d_2	⩽	–71	–73	dB
Composite triple beat 52 channels V_o = 46 dBmV		⩽	–56	–60	dB
Output capability X_{mod} = –57 dB; 52 channels flat	V_o	⩾	46,5	49,5	dBmV
Noise figure f = 40 MHz to 450 MHz	F	⩽	7	7,5	dB
D.C. supply voltage	$+V_B$	=	24	24	V*
Total d.c. current consumption at V_B = + 24 V	I_{tot}	typ.	180	200	mA ←
Operating mounting base temperature	T_{mb}		–20 to + 90	–20 to + 90	°C

MECHANICAL DATA

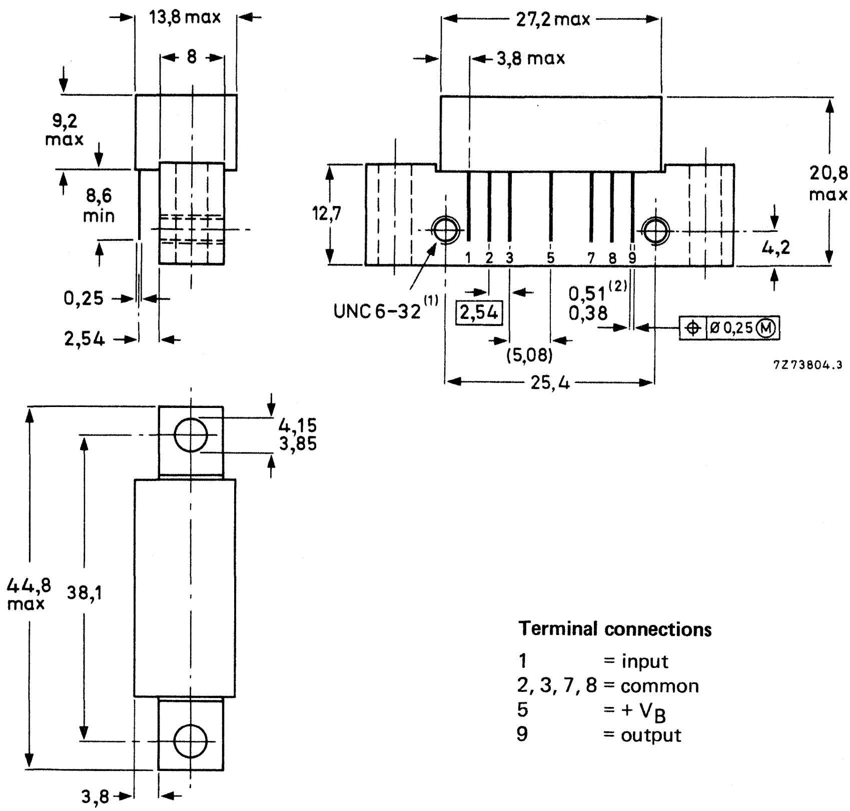
SOT-115 (see Fig. 1).

* The modules normally operate at V_B = 24 V, but are able to withstand supply transients up to 30 V.

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-115.



Terminal connections

1	= input
2, 3, 7, 8	= common
5	= + V_B
9	= output

(1) Screw 6-32UNC-2A available upon request (see "Accessories").
(2) Leads gold-plated.

Soldering recommendations

The maximum permissible temperature of the soldering iron is 260 °C for a contact time of maximum 3 s, when the soldered joints are 3 mm or more from the module.

RATINGS

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

R.F. input voltage	V_i	max.	65 dBmV
Storage temperature	T_{stg}	−40 to + 100	°C
Operating mounting base temperature	T_{mb}	−20 to + 90	°C

CHARACTERISTICS

Supply voltage V_B = + 24 V; T_{amb} = 25 °C

			BGY74	BGY75	
Power gain at f = 50 MHz	G_p		17,0 ± 0,4	17,0 ± 0,4	dB
Slope cable equivalent f = 40 MHz to 450 MHz			0,5 to 1,5	0,5 to 1,5	dB
Flatness of frequency response f = 40 MHz to 450 MHz		≤	± 0,1	± 0,1	dB
Return losses at input and output $Z_S = Z_L$ = 75 Ω; f = 40 MHz to 450 MHz		≤	18	18	dB
Output voltage at d_{im} = −60 dB (DIN 45004B, 6.3: 3-tone) $V_p = V_o$; f_p = 387,25 MHz $V_q = V_o$−6 dB; f_q = 394,25 MHz $V_r = V_o$−6 dB; f_r = 396,25 MHz Measured at $f_{(p+q-r)}$ = 385,25 MHz	V_o	≥	61	63,5	dBmV
Output voltage at d_{im} = −60 dB (DIN 45004B, par. 6.3: 3-tone) $V_p = V_o$; f_p = 287,25 MHz $V_q = V_o$ −6 dB; f_q = 294,25 MHz $V_r = V_o$ −6 dB; f_r = 296,25 MHz Measured at $f_{(p+q-r)}$ = 285,25 MHz	V_o	≥	62,5	65	dBmV
2nd order distortion V_o = 50 dBmV; channel 2 V_o = 50 dBmV; channel 13 Measured at channel R	d_2	≤	−71	−73	dB
V_o = 50 dBmV; channel G V_o = 50 dBmV; channel N Measured at channel H 14	d_2	typ.	−68	−70	dB
Composite triple beat 52 channels V_o = 46 dBmV; channel H 14		≤	−56	−60	dB
Output capability on channel H 14 X_{mod} = −57 dB; 52 channels flat	V_o	≥	46,5	49,5	dBmV
Noise figure f = 40 MHz to 450 MHz	F	≤	7	7,5	dB
Total d.c. current consumption	I_{tot}	typ.	180	200	mA
		≤	200	220	mA

CATV AMPLIFIER MODULE

Hybrid amplifier module for use as 34 dB line extender in CATV systems operating at frequencies up to 450 MHz.

Features:

- excellent linearity;
- extremely low noise;
- optimum reliability ensured by TiPtAu metallized crystals, silicon nitride glass barrier and rugged construction.

QUICK REFERENCE DATA

Frequency range	f	40	to	450	MHz
Source impedance and load impedance	$Z_S = Z_L$			75	Ω
Power gain at f = 50 MHz	G_p	34,0	±	1,0	dB
Slope cable equivalent f = 40 MHz to 450 MHz	S_L	0,5	to	2,5	dB
Flatness of frequency response f = 40 MHz to 450 MHz	F_L	⩽		± 0,3	dB
Return losses at input and output f = 40 MHz to 450 MHz	$S_{11\text{-}22}$	⩾		18	dB
Output voltage at d_{im} = −60 dB (DIN 45004, par. 6.3: 3-tone)	V_o	⩾		63,5	dBmV
2nd-order distortion at channel R V_o = 50 dBmV on channels 2 and 13	d_2	⩽		−70	dB
Composite triple beat; 52 channels V_o = 46 dBmV	CTB	⩽		−59	dB
Output capability Xmod = −57 dB; 52 channels flat	V_o	⩾		47	dBmV
Noise figure f = 40 MHz to 450 MHz	F	⩽		6	dB
D.C. supply voltage	$+V_B$	=		24	V*
Total d.c. current consumption V_B = +24 V	I_{tot}	typ.		320	mA
Operating mounting base temperature	T_{mb}	−20	to	+90	°C

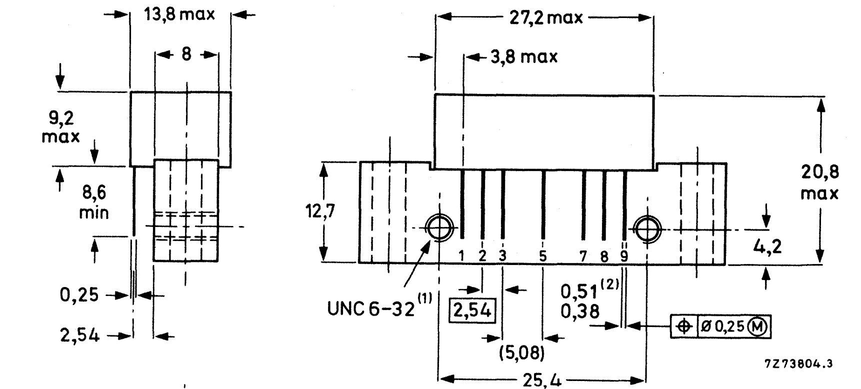
MECHANICAL DATA

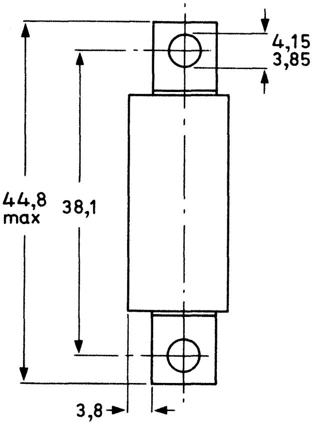
SOT-115 (see Fig. 1).

* The module normally operates at V_B = 24 V, but is able to withstand incidental supply transients up to 30 V.

MECHANICAL DATA Dimensions in mm

Fig. 1 SOT-115.





Terminal connections

1	= input
2, 3, 7, 8	= common
5	= $+V_B$
9	= output

(1) Screw 6-32UNC-2A available upon request (see "Accessories").
(2) Leads gold-plated.

Soldering recommendations

The maximum permissible temperature of the soldering iron is 260 °C for a contact time of maximum 3 s, when the soldered joints are 3 mm or more from the module.

RATINGS

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

R.F. input voltage	V_i	max.	55 dBmV
Storage temperature	T_{stg}	–40 to +100	°C
Operating mounting base temperature	T_{mb}	–20 to +90	°C

CHARACTERISTICS

Supply voltage $V_B = +24$ V; $T_{amb} = 25$ °C

Power gain at f = 50 MHz	G_p	34,0 ± 1,0	dB
Slope cable equivalent f = 40 MHz to 450 MHz	S_L	0,5 to 2,5	dB
Flatness of frequency response f = 40 MHz to 450 MHz	F_L	≤ ± 0,3	dB
Return losses at input and output $Z_S = Z_L = 75\ \Omega$; f = 40 MHz to 450 MHz	$S_{11\text{-}22}$	≥ 18	dB
Output voltage at $d_{im} = -60$ dB (DIN 45004B, par. 6.3: 3-tone) $V_p = V_o$; $f_p = 387{,}25$ MHz $V_q = V_o - 6$ dB; $f_q = 394{,}25$ MHz $V_r = V_o - 6$ dB; $f_r = 396{,}25$ MHz Measured at $f_{(p+q-r)} = 385{,}25$ MHz	V_o	≥ 62	dBmV
Output voltage at $d_{im} = -60$ dB (DIN 45004B, par. 6.3: 3-tone) $V_p = V_o$; $f_p = 287{,}25$ MHz $V_q = V_o - 6$ dB; $f_q = 294{,}25$ MHz $V_r = V_o - 6$ dB; $f_r = 296{,}25$ MHz Measured at $f_{(p+q-r)} = 285{,}25$ MHz	V_o	≥ 63,5	dBmV
2nd-order distortion $V_o = 50$ dBmV; channel 2 $V_o = 50$ dBmV; channel 13 Measured at channel R	d_2	≤ −70	dB
$V_o = 50$ dBmV; channel G $V_o = 50$ dBmV; channel N Measured at channel H14	d_2	typ. −67	dB
Composite triple beat 52 channels $V_o = 46$ dBmV; channel H14	CTB	≤ −59	dB
Output capability on channel H14 Xmod = −57 dB; 52 channels flat	V_o	≥ 47	dBmV
Noise figure f = 40 MHz to 450 MHz	F	≤ 6	dB
Total d.c. current consumption	I_{tot}	typ. 320 ≤ 340	mA mA

CATV AMPLIFIER MODULES

Hybrid amplifier modules for CATV systems operating at frequencies up to 450 MHz.

BGY84: 17,0 dB input amplifier module
BGY85: 17,0 dB output amplifier module

Features:

- excellent linearity;
- extremely low noise;
- optimal reliability ensured by TiPtAu metallized crystals, silicon nitride passivation and rugged construction.

QUICK REFERENCE DATA

		BGY84	BGY85	
Frequency range	f	40 to 450	40 to 450	MHz
Source impedance and load impedance	$Z_S = Z_L$	75	75	Ω
Power gain at f = 50 MHz	G_p	17,0 ± 0,5	17,0 ± 0,5	dB
Slope cable equivalent f = 40 MHz to 450 MHz	S_L	0,5 to 1,5	0,5 to 1,5	dB
Return losses at input and output f = 40 MHz f = 450 MHz	$S_{11\text{-}22}$	 ≥ 20 ≥ 18	 20 18	 dB dB
Output voltage at d_{im} = –60 dB (DIN 45004B, par. 6.3: 3-tone)	V_o	≥ 60	62,5	dBmV
2nd order distortion V_o = 46 dBmV	d_2	≤ –70	–70	dB
Composite triple beat 60 channels V_o = 46 dBmV	CTB	≤ –55	–58	dB
Cross modulation distortion V_o = 46 dBmV; 60 channels	X_{mod}	≤ –57	–60	dB
Noise figure f = 40 MHz to 450 MHz	F	≤ 6,5	7,0	dB
D.C. supply voltage	$+V_B$	24	24	V*
Total d.c. current consumption at V_B = + 24 V	I_{tot}	typ. 180	220	mA

MECHANICAL DATA

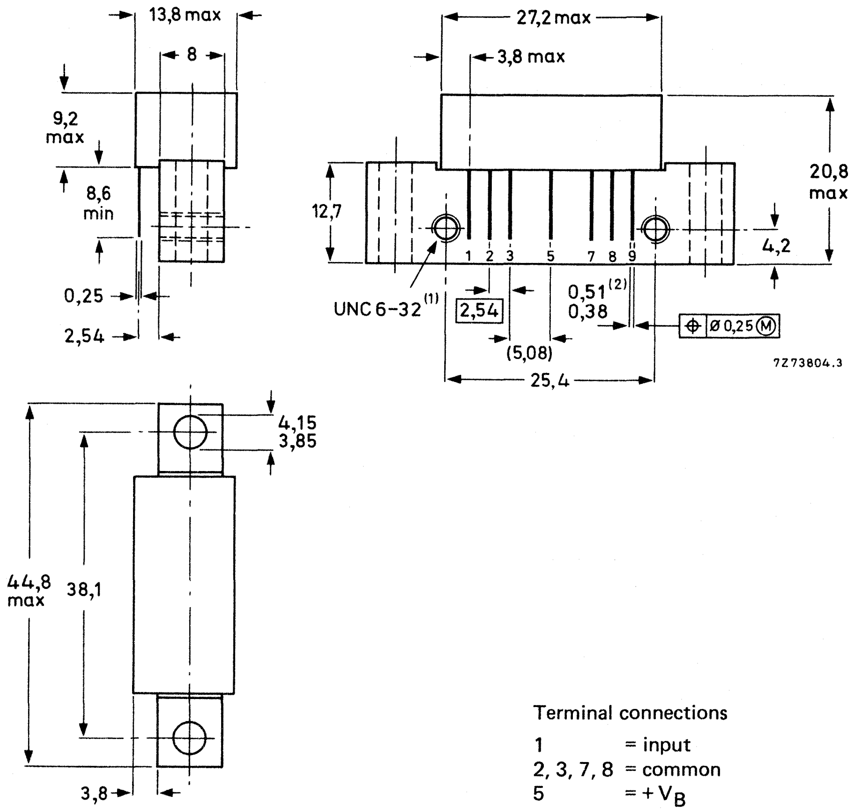
SOT-115 (see Fig. 1).

* The modules normally operate at V_B = 24 V, but are able to withstand supply transients up to 30 V.

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-115.



Terminal connections

1	= input
2, 3, 7, 8	= common
5	= $+V_B$
9	= output

(1) Screw 6-32UNC-2A available on request (see "Accessories").
(2) Gold plated leads.

Soldering recommendations

The maximum permissible temperature of the soldering iron is 260 °C for a contact time of maximum 3 s, when the soldered joints are 3 mm or more from the module.

RATINGS

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

R.F. input voltage	V_i	max.	65 dBmV
Storage temperature	T_{stg}		−40 to + 100 °C
Operating mounting base temperature	T_{mb}		−20 to + 100 °C

CHARACTERISTICS

Supply voltage V_B = + 24 V; T_{mb} = 30 °C

			BGY84	BGY85	
Power gain					
f = 50 MHz	G_p		17,0 ± 0,4	17,0 ± 0,4	dB
f = 450 MHz			17,3 to 18,8	17,3 to 18,8	dB
Slope cable equivalent					
f = 40 MHz to 450 MHz	S_L		+ 0,5 to + 1,5	+ 0,5 to 1,5	dB
Flatness of frequency response					
f = 40 MHz to 450 MHz	F_L	⩽	± 0,2	± 0,2	dB
Return losses at input and output					
$Z_S = Z_L = 75\ \Omega$					
f = 40 to 80 MHz		⩾	20	20	dB
f = 80 to 160 MHz	$S_{11\text{-}22}$	⩾	19	19	dB
f = 160 to 450 MHz		⩾	18	18	dB
Output voltage at d_{im} = −60 dB					
(DIN 45004B, 6.3: 3-tone)					
$V_p = V_o$; f_p = 440,25 MHz					
$V_q = V_o$ −6 dB; f_q = 447,25 MHz					
$V_r = V_o$ −6 dB; f_r = 449,25 MHz					
Measured at $f_{(p+q-r)}$ = 438,25 MHz	V_o	⩾	60	62,5	dBmV
2nd order distortion					
V_o = 46 dBmV; channel 2					
V_o = 46 dBmV; channel H5					
Measured at channel H14	d_2	⩽	−70	−70	dB
Composite triple beat 60 channels					
V_o = 46 dBmV; channel H22	CTB	⩽	−55	−58	dB
Cross modulation distortion					
V_o = 46 mVdB; 60 channels					
Measured at channel 2	X_{mod}	⩽	−57	−60	dB
Noise figure					
f = 40 MHz to 450 MHz	F	⩽	6,5	7,0	dB
Total d.c. current consumption	I_{tot}	typ.	180	220	mA
		⩽	200	240	mA

CATV AMPLIFIER MODULES

Hybrid amplifier modules for CATV systems operating at frequencies up to 450 MHz.

BGY84A: 18,5 dB input amplifier module
BGY85A: 18,5 dB output amplifier module

Features:

- excellent linearity;
- extremely low noise;
- optimal reliability ensured by TiPtAu metallized crystals, silicon nitride passivation and rugged construction.

QUICK REFERENCE DATA

			BGY84A	BGY85A	
Frequency range	f		40 to 450	40 to 450	MHz
Source impedance and load impedance	$Z_S = Z_L$		75	75	Ω
Power gain at f = 50 MHz	G_p		18,4 ± 0,4	18,4 ± 0,4	dB
Slope cable equivalent f = 40 MHz to 450 MHz	S_L		0,3 to 1,5	0,3 to 1,5	dB
Flatness of frequency response f = 40 MHz to 450 MHz	F_L	⩽	± 0,2	± 0,2	dB
Return losses at input and output f = 40 MHz	$S_{11\text{-}22}$	⩾	20	20	dB
f = 450 MHz		⩾	18	18	dB
Output voltage at d_{im} = −60 dB (DIN 45004B, par. 6.3: 3-tone)	V_o	⩾	60	62,5	dBmV
2nd order distortion V_o = 46 dBmV	d_2	⩽	−72	−72	dB
Composite triple beat 60 channels V_o = 46 dBmV	CTB	⩽	−55	−59	dB
Cross modulation distortion V_o = 46 dBmV; 60 channels	X_{mod}	⩽	−58	−61	dB
Noise figure f = 40 MHz to 450 MHz	F	⩽	6,5	7,0	dB
D.C. supply voltage	$+V_B$		24	24	V*
Total d.c. current consumption at V_B = + 24 V	I_{tot}	typ.	180	220	mA

MECHANICAL DATA

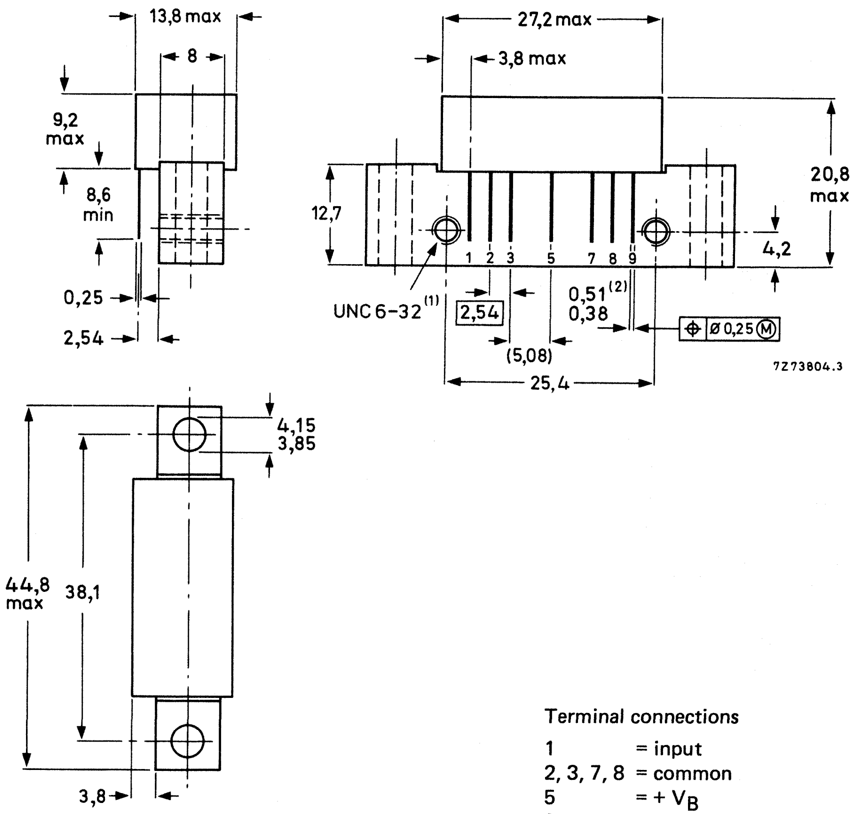
SOT-115 (see Fig. 1).

* The modules normally operate at V_B = 24 V, but are able to withstand supply transients up to 30 V.

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-115.



Terminal connections

1	= input
2, 3, 7, 8	= common
5	= + V_B
9	= output

(1) Screw 6-32UNC-2A available on request (see "Accessories").
(2) Leads gold-plated.

Soldering recommendations

The maximum permissible temperature of the soldering iron is 260 °C for a contact time of maximum 3 s, when the soldered joints are 3 mm or more from the module.

RATINGS

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

R.F. input voltage	V_i	max.	65 dBmV
Storage temperature	T_{stg}		−40 to + 100 °C
Operating mounting base temperature	T_{mb}		−20 to + 100 °C

CHARACTERISTICS

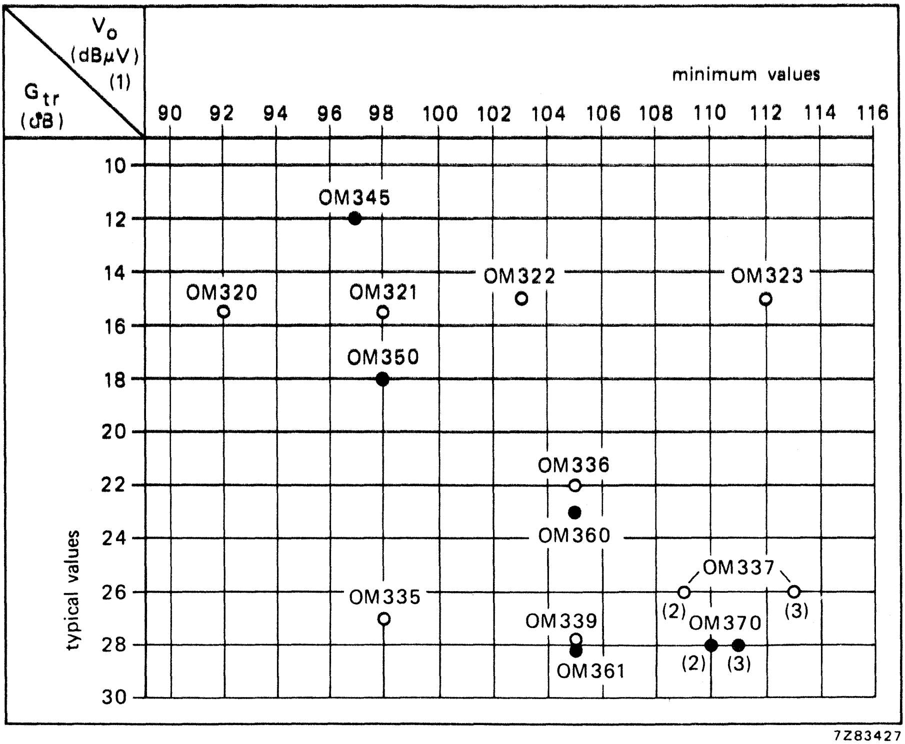
Supply voltage V_B = + 24 V; T_{mb} = 30 °C

			BGY84A	BGY85A
Power gain at f = 50 MHz	G_p		18,4 ± 0,4	18,4 ± 0,4 dB
Power gain at f = 450 MHz	G_p		18,7 to 20,2	18,7 to 20,2 dB
Slope cable equivalent f = 40 MHz to 450 MHz	S_L		+ 0,3 to 1,5	+ 0,3 to 1,5 dB
Flatness of frequency response f = 40 MHz to 450 MHz	F_L	≤	± 0,2	± 0,2 dB
Return losses at input and output $Z_S = Z_L$ = 75 Ω f = 40 to 80 MHz f = 80 to 160 MHz f = 160 to 450 MHz	$S_{11\text{-}22}$	 ≥ ≥ ≥	 20 19 18	 20 dB 19 dB 18 dB
Output voltage at d_{im} = −60 dB (DIN 45004B, 6.3: 3-tone) $V_p = V_o$; f_p = 440,25 MHz $V_q = V_o$ −6 dB; f_q = 447,25 MHz $V_r = V_o$ −6 dB; f_r = 449,25 MHz Measured at $f_{(p+q-r)}$ = 438,25 MHz	V_o	≥	60	62,5 dBmV
2nd order distortion V_o = 46 dBmV; channel 2 V_o = 46 dBmV; channel H5 Measured at channel H14	d_2	≤	−72	−72 dB
Composite triple beat 60 channels V_o = 46 dBmV; channel H22	CTB	≤	−55	−59 dB
Cross modulation distortion V_o = 46 dBmV; 60 channels Measured at channel 2	X_{mod}	≤	−58	−61 dB
Noise figure f = 40 MHz to 450 MHz	F	≤	6,5	7,0 dB
Total d.c. current consumption	I_{tot}	typ. ≤	180 200	220 mA 240 mA

DEVICE DATA

Hybrid ICs for wideband amplifiers

HYBRID ICs FOR WIDE-BAND AMPLIFIERS



(1) At −60 dB intermodulation distortion (DIN 45004, par. 6.3: 3-tone).
(2) UHF.
(3) VHF.

Fig. 1 Type/performance in matrix survey.

The matrix survey (Fig. 1) and the tables next page show both the 12 V and 24 V ranges.

Note that the modules are available in the combination of high gain- high output voltage.

12 V supply voltage

	type	stage	gain (dB)	$V_{o(rms)}$ (dBμV) −60 dB IMD (note 1) min. values	noise figure (dB)	max. VSWR typ. values (note 2) input	output	supply current (mA)	page
low	OM345	1	12	97	5,5	2,0	1,4	11,5	547
medium	OM350	2	18	98	6,0	1,5	1,9	18	553
medium	OM360	3	23	105	7,0	1,3	1,5	55	559
output	OM361	3	28	105	6,0	1,5	1,7	50	565
high output	OM370	3	28	111	7,0	2,3	1,9	105	571

24 V supply voltage

	type	stages	gain (dB)	$V_{o(rms)}$ (dBμV) −60 dB IMD (note 1) min. values	noise figure (dB)	max. VSWR typ. values (note 2) input	output	supply current (mA)	page
low output	OM320	2	15,5	92	5,5	2,2	2,5	33	501
	OM321	2	15,5	98	6,0	2,5	2,0	33	507
	OM335	3	27	98	5,5	1,9	3,2	35	525
medium output	OM322	2	15	103	7,0	1,7	1,7	60	513
	OM336	3	22	105	7,0	1,4	1,6	65	531
	OM339	3	28	105	6,0	1,5	1,5	66	543
high	OM323*	2	15	112	9,0	1,9	2,3	100	529
output	OM337*	3	26	113	9,8	2,3	1,8	115	535

* Also available in A-version for external coil and output capacitor.

Notes

1. Measured at −60 dB intermodulation distortion to DIN 45004, par. 6.3: 3-tone, f = 470 MHz.
2. The typical maximum VSWR occurring in the frequency range 40-860 MHz, for a sample connected to a 75 Ω line.

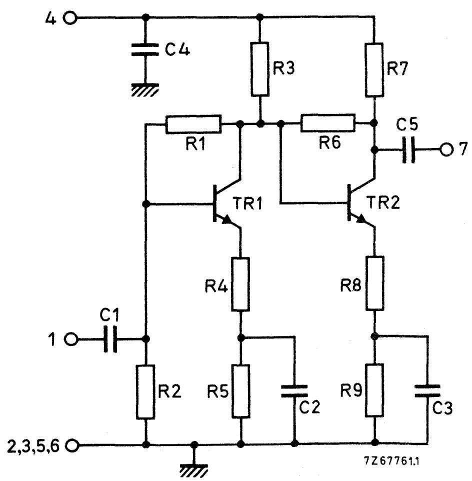
HYBRID VHF/UHF WIDE-BAND AMPLIFIER

Two-stage wide-band amplifier in the hybrid technique, designed for use in mast-head booster amplifiers, as pre-amplifier in MATV systems, and as general-purpose amplifier for v.h.f. and u.h.f. applications

QUICK REFERENCE DATA				
Frequency range	f		40 to 860	MHz
Source and load (characteristic) impedance	$R_S = R_\ell = Z_o$	=	75	Ω
Transducer gain	$G_{tr} = \lvert s_f \rvert^2$	typ.	15, 5	dB
Flatness of frequency response	$\pm\Delta \lvert s_f \rvert^2$	typ.	1	dB
Output voltage at −60 dB intermodulation distortion (DIN45004, 3-tone)	$V_{o(rms)}$	>	92	dBμV
Noise figure	F	typ.	5, 5	dB
D.C. supply voltage	V_B	=	24	V ± 10%
Operating ambient temperature	T_{amb}		−20 to +70	°C

ENCAPSULATION 7-pin, in-line, resin-coated body, see MECHANICAL DATA

CIRCUIT DIAGRAM



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

Operating ambient temperature	T_{amb}		−20 to +70	°C
Storage temperature	T_{stg}		−40 to +125	°C
D.C. supply voltage	V_B	max.	28	V
Peak voltages on pins 1 and 7	V_{1M}, V_{7M}	max.	28	V
	$-V_{1M}$, V_{7M}	max.	10	V
Peak incident powers on pins 1 and 7	P_{I1M}, P_{I7M}	max.	100	mW

CHARACTERISTICS

Measuring conditions

V.H.F.-U.H.F. test socket	catalogue no. 3504 110 01840 *			
Ambient temperature	T_{amb}	=	25	°C
D.C. supply voltage	V_B	=	24	V
Source impedance and load impedance	R_S, R_ℓ	=	75	Ω
Characteristic impedance of h.f. connections	Z_o	=	75	Ω
Frequency range	f		40 to 860	MHz

Performance

Supply current	I_B	typ.	23	mA
Transducer gain	$G_{tr} = \lvert s_f \rvert^2$		13 to 18	dB
		typ.	15,5	dB
Flatness of frequency response	$\pm\Delta \lvert s_f \rvert^2$	typ.	1	dB
Individual maximum v.s.w.r.				
input	$VSWR_{(i)}$	typ.	2,2	**
output	$VSWR_{(o)}$	typ.	2,5	**
Back attenuation				
f = 100 MHz	$\lvert s_r \rvert^2$	typ.	30	dB
f = 860 MHz	$\lvert s_r \rvert^2$	typ.	24	dB
Output voltage at −60 dB intermodulation distortion (DIN45004, par. 6.3: 3-tone)	$V_{o(rms)}$	>	92	dBμV
		typ.	94	dBμV
Noise figure	F	typ.	5,5	dB

s-parameters	$s_f = s_{21}$	$s_i = s_{11}$
	$s_r = s_{12}$	$s_o = s_{22}$

* This socket can be made available for customer reference purposes.
** Highest value, for a sample, occurring in the frequency range.

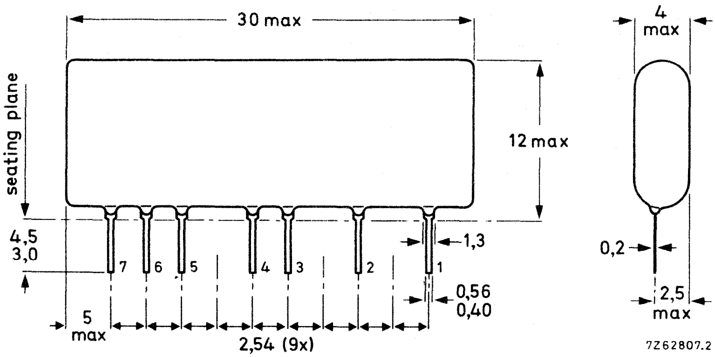
OPERATING CONDITIONS

Ambient temperature range	T_{amb}		−20 to +70	°C
D.C. supply voltage	V_B	=	24	V ±10%
Frequency range	f		40 to 860	MHz
Source impedance and load impedance	R_s, R_ℓ	=	75	Ω

MECHANICAL DATA Dimensions in mm

Encapsulation

The device is resin coated.



Terminal connections

1 = Input
2, 3, 5, 6 = Common
4 = Supply (+)
7 = Output

Soldering recommendations

Hand soldering

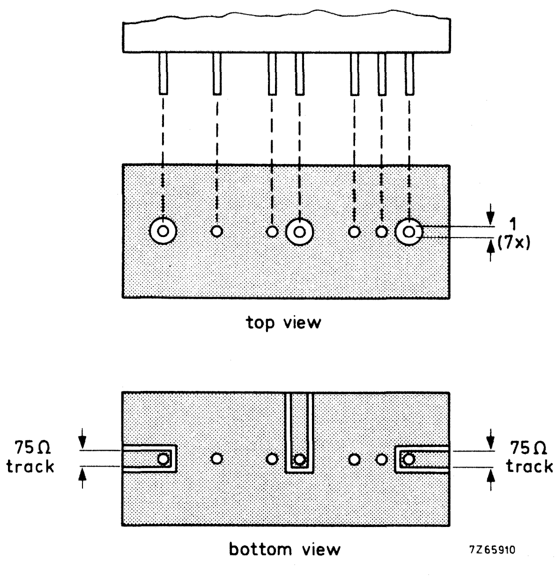
Maximum contact time for a soldering-iron temperature of 260 °C; up to seating plane: 5 s

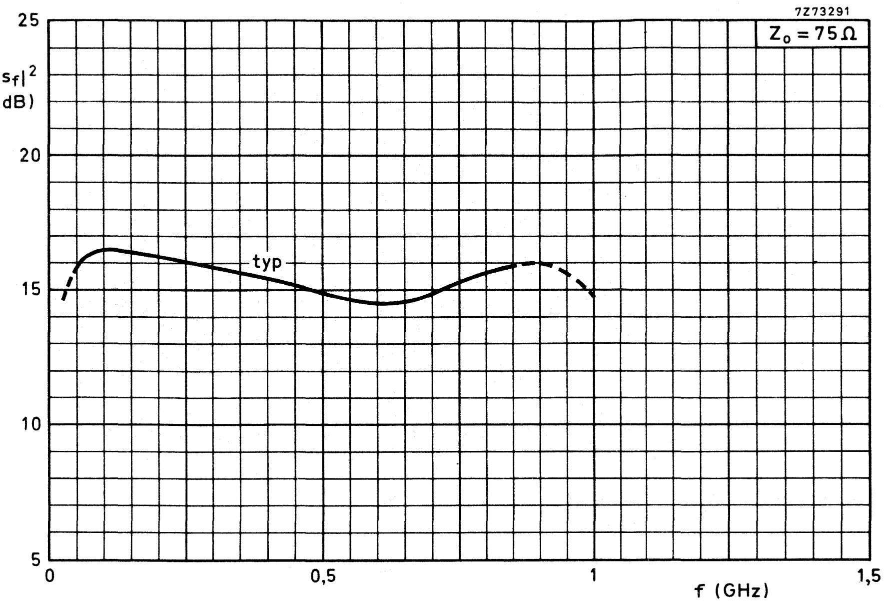
Dip or wave soldering

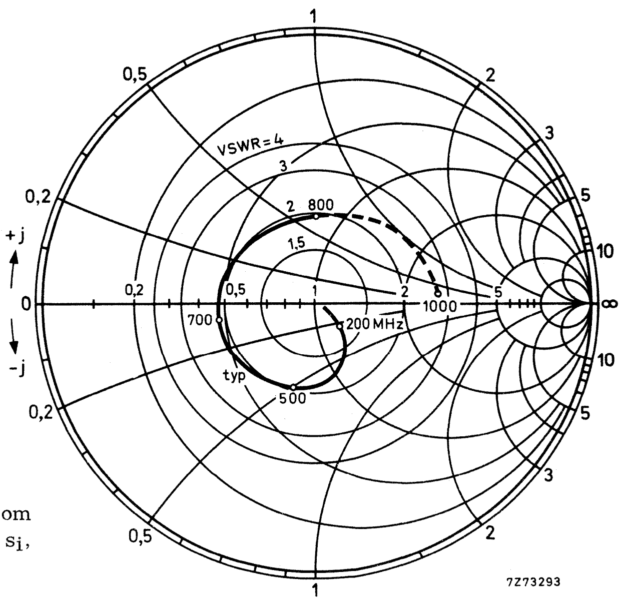
260 °C is the maximum permissible temperature of the solder; it must not be in contact with the joint for more than 5 seconds. The total contact time of successive solder waves must not exceed 5 seconds.
The device may be mounted against the printed-circuit board, but the temperature of the device must not exceed 125 °C. If the printed-circuit board has been pre-heated, forced cooling may be necessary immediately after soldering to keep the temperature below the allowable limit.

Mounting recommendations

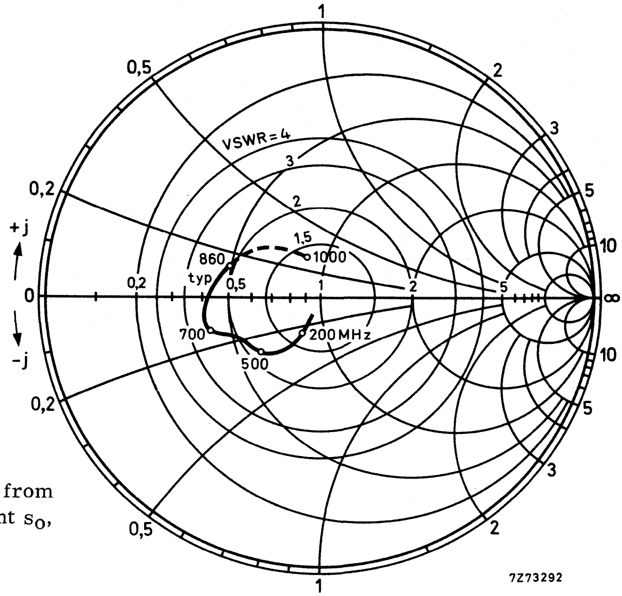
The module should preferably be mounted on double-sided printed-circuit board, see the example shown below.
Input and output should be connected to 75 Ω tracks.
The connections to the "common" pins should be as close to the seating plane as possible.







Input impedance derived from input reflection coefficient s_i, co-ordinates in ohm x 75.



Output impedance derived from output reflection coefficient s_o, co-ordinates in ohm x 75.

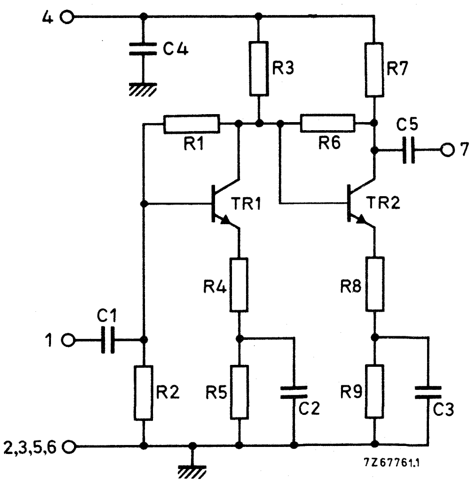
HYBRID VHF/UHF WIDE BAND AMPLIFIER

Two-stage wide-band amplifier in the hybrid technique, designed for use in mast-head booster-amplifiers, as pre-amplifier in MATV systems, and as general-purpose amplifier for v.h.f. and u.h.f. applications.

QUICK REFERENCE DATA				
Frequency range	f		40 to 860	MHz
Source and load (characteristic) impedance	$R_S = R_\ell = Z_o$	=	75	Ω
Transducer gain	$G_{tr} = \lvert s_f \rvert^2$	typ.	15,5	dB
Flatness of frequency response	$\pm\Delta \lvert s_f \rvert^2$	typ.	1	dB
Output voltage at −60 dB intermodulation distortion (DIN45004, 3-tone)	$V_{o(rms)}$	>	98	dBμV
Noise figure	F	typ.	6	dB
D.C. supply voltage	V_B	=	24	V ±10%
Operating ambient temperature	T_{amb}		−20 to +70	°C

ENCAPSULATION 7-pin, in-line, resin-coated body, see MECHANICAL DATA

CIRCUIT DIAGRAM



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

Operating ambient temperature	T_{amb}		−20 to +70	°C
Storage temperature	T_{stg}		−40 to +125	°C
D.C. supply voltage	V_B	max.	28	V
Peak voltages on pins 1 and 7	V_{1M}, V_{7M}	max.	28	V
	$-V_{1M}$, $-V_{7M}$	max.	10	V
Peak incident powers on pins 1 and 7	P_{I1M}, P_{I7M}	max.	100	mW

CHARACTERISTICS

Measuring conditions

V.H.F.-U.H.F. test socket	catalogue no. 3504 110 01840 *			
Ambient temperature	T_{amb}	=	25	°C
D.C. supply voltage	V_B	=	24	V
Source impedance and load impedance	R_s, R_ℓ	=	75	Ω
Characteristic impedance of h.f. connections	Z_o	=	75	Ω
Frequency range	f	=	40 to 860	MHz

Performance

Supply current	I_B	typ.	33	mA
Transducer gain	$G_{tr} = \|s_f\|^2$		13 to 18	dB
		typ.	15,5	dB
Flatness of frequency response	$\pm\Delta\|s_f\|^2$	typ.	1	dB
Individual maximum v.s.w.r.				
input	$VSWR_{(i)}$	typ.	2,5	**
output	$VSWR_{(o)}$	typ.	2,0	**
Back attenuation				
f = 100 MHz	$\|s_r\|^2$	typ.	30	dB
f = 860 MHz	$\|s_r\|^2$	typ.	26	dB
Output voltage at −60 dB intermodulation distortion (DIN45004, par. 6.3: 3-tone)	$V_{o(rms)}$	>	98	dBμV
		typ.	100	dBμV
Noise figure	F	typ.	6	dB

s-parameters:	$s_f = s_{21}$	$s_i = s_{11}$
	$s_r = s_{12}$	$s_o = s_{22}$

* This socket can be made available for customer reference purposes.
** Highest value, for a sample, occurring in the frequency range.

OPERATING CONDITIONS

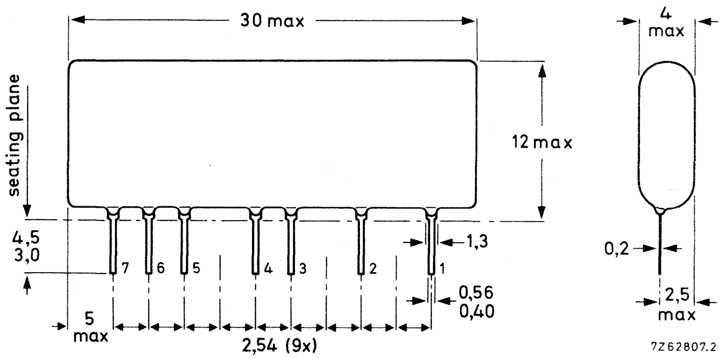
Ambient temperature range	T_{amb}		−20 to +70	°C
D.C. supply voltage	V_B	=	24	V ±10%
Frequency range	f		40 to 860	MHz
Source impedance and load impedance	R_s, R_ℓ	=	75	Ω

MECHANICAL DATA

Dimensions in mm

Encapsulation

The device is resin coated.



Terminal connections

1	= Input
2, 3, 5, 6	= Common
4	= Supply (+)
7	= Output

Soldering recommendations

Hand soldering

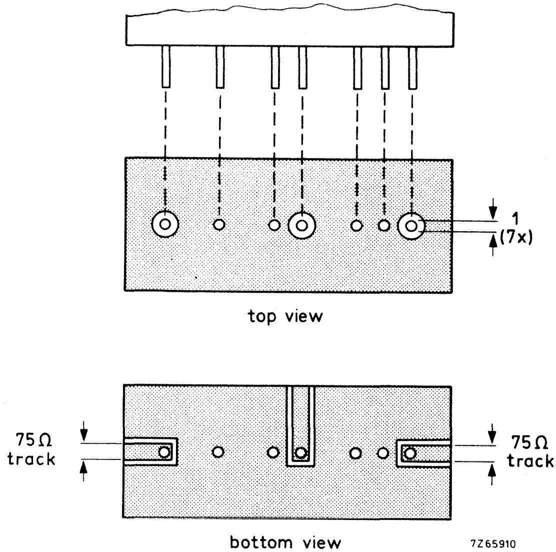
Maximum contact time for a soldering-iron temperature of 260 °C; up to seating plane: 5 s

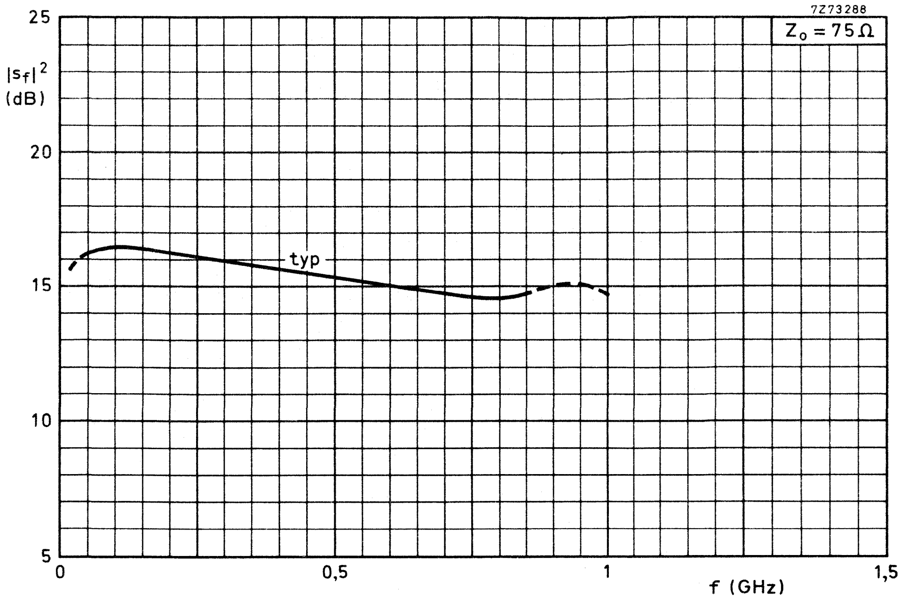
Dip or wave soldering

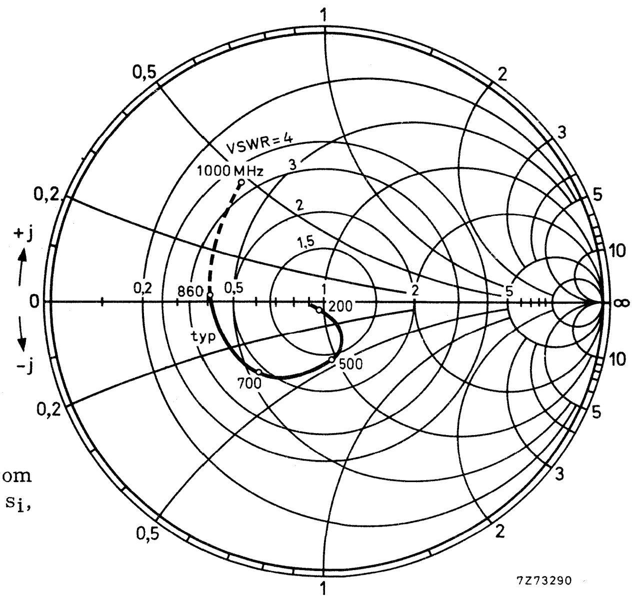
260 °C is the maximum permissible temperature of the solder; it must not be in contact with the joint for more than 5 seconds. The total contact time of successive solder waves must not exceed 5 seconds.
The device may be mounted against the printed-circuit board, but the temperature of the device must not exceed 125 °C. If the printed-circuit board has been pre-heated, forced cooling may be necessary immediately after soldering to keep the temperature below the allowable limit.

Mounting recommendations

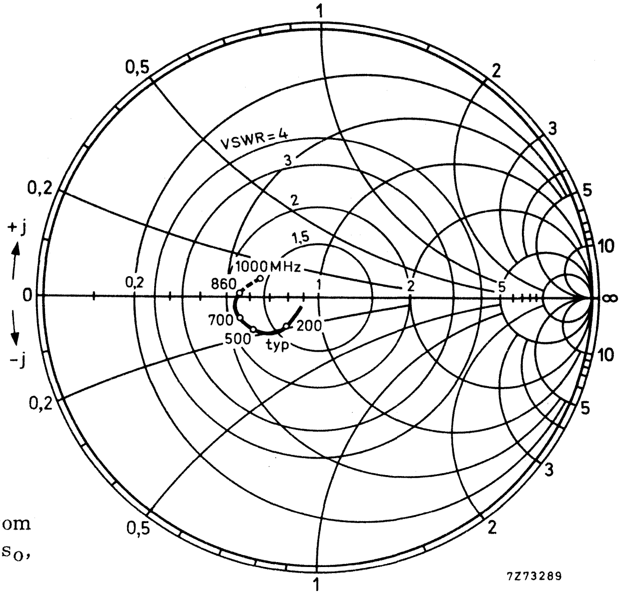
The module should preferably be mounted on double-sided printed-circuit board, see the example shown below.
Input and output should be connected to 75 Ω tracks.
The connections to the "common" pins should be as close to the seating plane as possible.







Input impedance derived from input reflection coefficient s_i, co-ordinates in ohm x 75.



Output impedance derived from output reflection coefficient s_o, co-ordinates in ohm x 75.

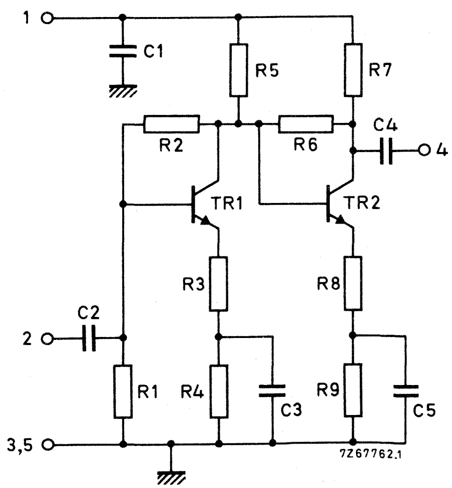
HYBRID VHF/UHF WIDE-BAND AMPLIFIER

Two-stage wide-band amplifier in the hybrid technique, designed for use as distribution amplifier in MATV and CATV systems and as general-purpose amplifier for v.h.f. and u.h.f. applications. Except for the encapsulation coating, the OM322 and OM175 have the same specification. OM322 will replace OM175.

QUICK REFERENCE DATA				
Frequency range	f		40 to 860	MHz
Source and load (characteristic) impedance	$R_S = R_\ell = Z_o$		75	Ω
Transducer gain	$G_{tr} = \|s_f\|^2$	typ.	15	dB
Flatness of frequency response	$\pm\Delta\|s_f\|^2$	typ.	0,3	dB
Output voltage at −60 dB intermodulation distortion (DIN45004, 3-tone)	$V_{o(rms)}$	>	103	dBμV
Noise figure	F	typ.	7	dB
D.C. supply voltage	V_B	=	24	V ±10%
Operating ambient temperature	T_{amb}		−20 to +70	°C

ENCAPSULATION 5-lead, resin coated body on metal base, see MECHANICAL DATA

CIRCUIT DIAGRAM



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

Operating ambient temperature	T_{amb}		−20 to +70	°C
Operating mounting-base temperature	T_{mb}	max.	100	°C
Storage temperature	T_{stg}		−40 to +125	°C
D.C. supply voltage	V_B	max.	28	V
Peak voltages on pins 2 and 4	V_{2M}, V_{4M}	max.	28	V
	$-V_{2M}$, $-V_{4M}$	max.	10	V
Peak incident powers on pins 2 and 4	P_{I2M}, P_{I4M}	max.	100	mW

CHARACTERISTICS

Measuring conditions

Ambient temperature	T_{amb}	=	25	°C
D.C. supply voltage	V_B	=	24	V
Source impedance and load impedance	R_s, R_ℓ	=	75	Ω
Characteristic impedance of h.f. connections	Z_o	=	75	Ω
Frequency range	f	=	40 to 860	MHz

Performance

Supply current	I_B	typ.	60	mA	
Transducer gain	$G_{tr} = \|s_f\|^2$		14 to 16	dB	
		typ.	15	dB	
Flatness of frequency response	$\pm\Delta\|s_f\|^2$	typ.	0,3	dB	
		<	0,5	dB	
Individual maximum v.s.w.r.					
input	$VSWR_{(i)}$	typ.	1,7		[1]
output	$VSWR_{(o)}$	typ.	1,7		[1]
Back attenuation					
f = 100 MHz	$\|s_r\|^2$	typ.	31	dB	
f = 860 MHz	$\|s_r\|^2$	typ.	25	dB	
Output voltage at −60 dB intermodulation distortion (DIN45004, par. 6.3: 3-tone)	$V_{o(rms)}$	>	103	dBμV	
		typ.	105	dBμV	
Noise figure	F	typ.	7	dB	

s-parameters:	$s_f = s_{21}$	$s_i = s_{11}$
	$s_r = s_{12}$	$s_o = s_{22}$

[1]) Highest value, for a sample, occurring in the frequency range.

OPERATING CONDITIONS

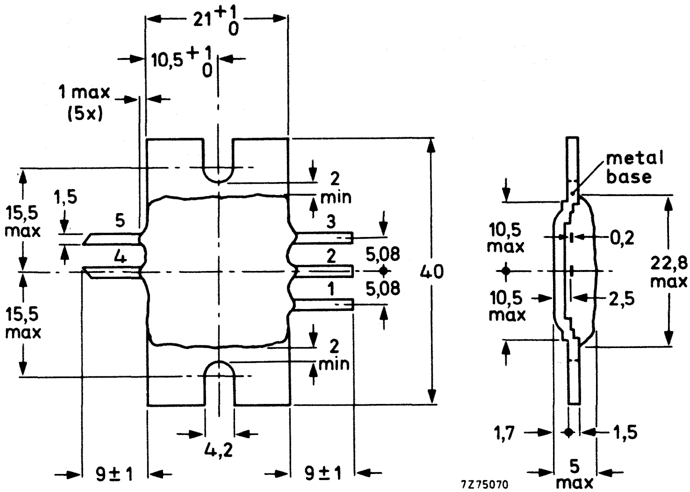
Ambient temperature range	T_{amb}	−20 to +70	°C
D.C. supply voltage	V_B	= 24	V ±10%
Frequency range	f	40 to 860	MHz
Source impedance and load impedance	R_S, R_ℓ	= 75	Ω

MECHANICAL DATA

Dimensions in mm

Encapsulation

The device is resin coated and mounted on a metal mounting base.



Terminal connections

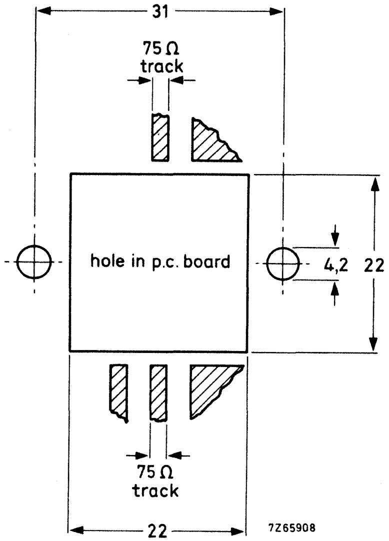
1	= Supply (+)
2	= Input
3 and 5	= Common (internally connected to metal base)
4	= Output

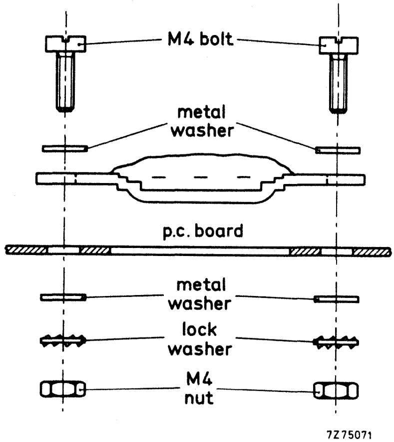
Soldering recommendations

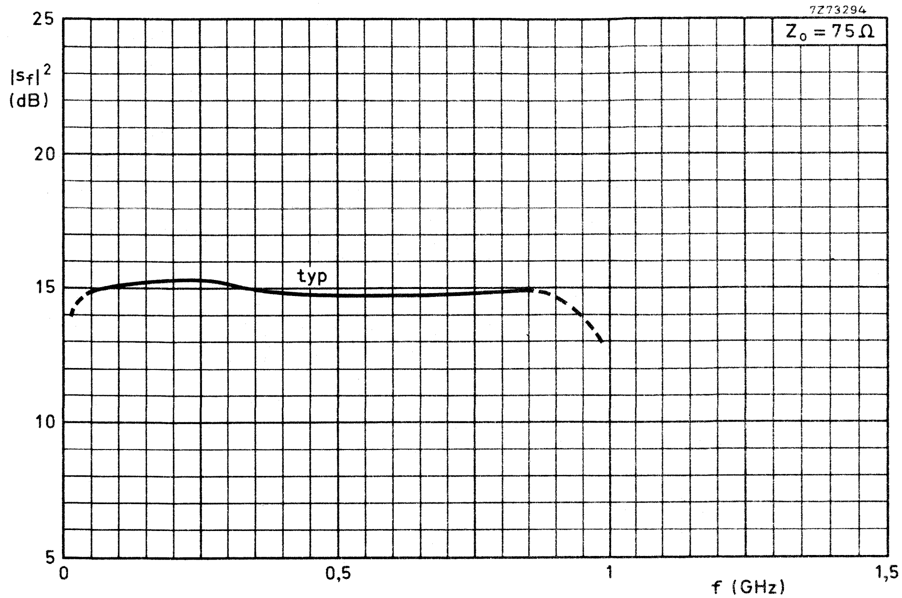
Maximum contact time for a soldering-iron temperature of 260 °C — 5 s

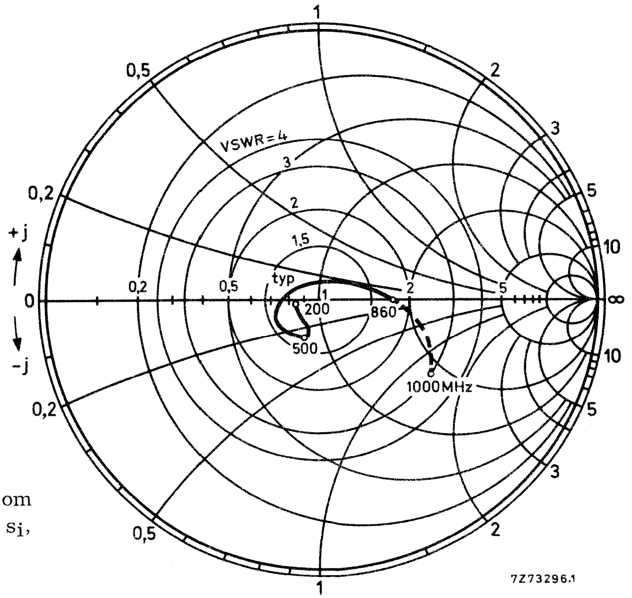
Mounting recommendations

The module should preferably be mounted on a double-sided printed-circuit board, see the examples shown below. Input and output should be connected to 75 Ω tracks.

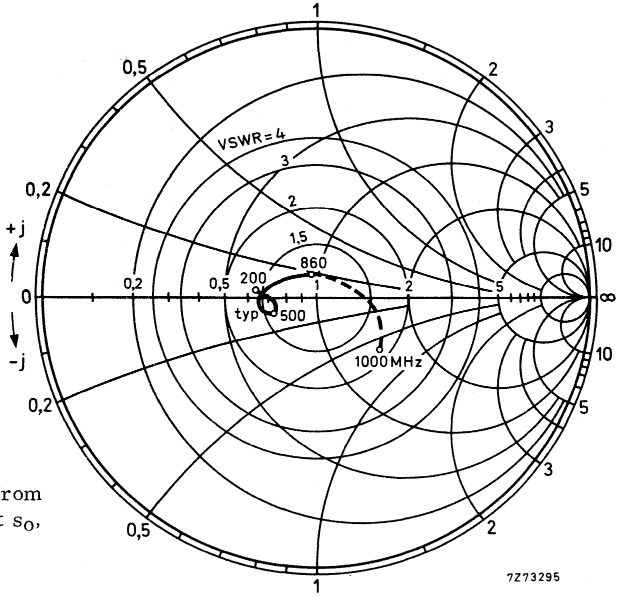








Input impedance derived from input reflection coefficient s_i, co-ordinates in ohm x 75



Output impedance derived from output reflection coefficient s_o, co-ordinates in ohm x 75

HYBRID V.H.F./U.H.F. WIDE-BAND AMPLIFIER

Two-stage wide-band amplifier in the hybrid technique, designed for use in MATV systems, and as general purpose amplifier for v.h.f. and u.h.f. applications requiring a high output level.
The OM323A needs an external collector-coil and blocking capacitor, whereas, the OM323 has these components built-in.

QUICK REFERENCE DATA

Frequency range	f		40 to 860	MHz
Source and load (characteristic) impedance	$R_s = R_\ell = Z_o$	=	75	Ω
Transducer gain	$G_{tr} = \lvert s_f \rvert^2$	typ	15	dB
Flatness of frequency response	$\pm\Delta \lvert s_f \rvert^2$	typ	0,5	dB
Output voltage at −60 dB intermodulation distortion (DIN45004, 3-tone); f = 470 MHz	$V_{o(rms)}$	typ	113	dBμV
Noise figure	F	typ	9	dB
D.C. supply voltage	V_B	=	24	V ± 10%
Operating mounting-base temperature	T_{mb}		−30 to +100	°C

ENCAPSULATION 9-pin, in-line, resin-coated body on a right-angled metal mounting tab, see MECHANICAL DATA

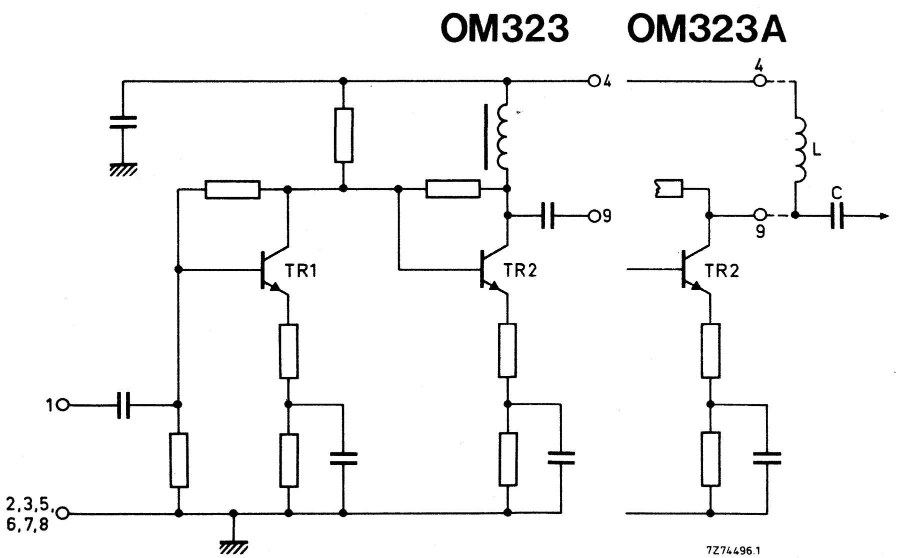


Fig. 1 Circuit diagram.

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

Operating mounting-base temperature	T_{mb}		−30 to +100	°C
Storage temperature	T_{stg}		−40 to +125	°C
D.C. supply voltage	V_B	max	28	V
Peak voltages on pin 1	V_{1M}	max	28	V
	$-V_{1M}$	max	24	V
Peak voltages on pin 9	V_{9M}	max	28	V
	$-V_{9M}$	max	4	V
Peak incident powers on pins 1 and 9	P_{I1M}, P_{I9M}	max	100	mW

CHARACTERISTICS

Measuring conditions

V.H.F.–U.H.F. test socket	catalogue no. 3504 110 01830 *			
Mounting base temperature	T_{mb}	=	25	°C
D.C. supply voltage	V_B	=	24	V
Source impedance and load impedance	R_s, R_ℓ	=	75	Ω
Characteristic impedance of h.f. connections	Z_o	=	75	Ω
Frequency range	f	=	40 to 860	MHz

Performance

Supply current	I_B		95 to 105	mA
		typ	100	mA
Transducer gain	$G_{tr} = \|s_f\|^2$		14 to 17	dB
		typ	15	dB
Flatness of frequency response	$\pm\Delta \|s_f\|^2$	typ	0,5	dB
Individual maximum v.s.w.r.				
input	$VSWR_{(i)}$	typ	1,9	**
output	$VSWR_{(o)}$	typ	2,3	**
Back attenuation				
f = 100 MHz	$\|s_r\|^2$	typ	29	dB
f = 650 MHz	$\|s_r\|^2$	typ	25,5	dB
f = 860 MHz	$\|s_r\|^2$	typ	24	dB

* This socket can be made available for customer reference purposes.
** Highest value, for a sample, occurring in the frequency range.

Output voltage			
at −60 dB intermodulation distortion			
(DIN45004, par. 6.3: 3-tone)		>	112 dBμV
f = 40–230 MHz	$V_{o(rms)}$	typ	114 dBμV
f = 470 MHz	$V_{o(rms)}$	typ	113 dBμV
f = 860 MHz	$V_{o(rms)}$	typ	112 dBμV
Noise figure			
channel 2	F	typ	8 dB
channel 65	F	typ	9 dB

s-parameters:	$s_f = s_{21}$	$s_i = s_{11}$
	$s_r = s_{12}$	$s_o = s_{22}$

OPERATING CONDITIONS

Mounting-base temperature range	T_{mb}		−30 to +100 °C
D.C. supply voltage	V_B	=	24 V ± 10%
Frequency range	f		40 to 860 MHz
Source impedance and load impedance	R_s, R_ℓ	=	75 Ω

THERMAL DATA

a. The maximum permissible temperature at the mounting base is 100 °C.

b. When the mounting tab is screwed to a double-sided printed-circuit board with dimensions 37 mm x 51 mm, its temperature will be 57 °C above the temperature of the surrounding free air.

c. When a heatsink is fixed to the mounting tab and the pins are soldered into a double-sided printed-circuit board with dimensions 37 mm x 51 mm, the tab will reach the temperatures stated in the following table.

Notes

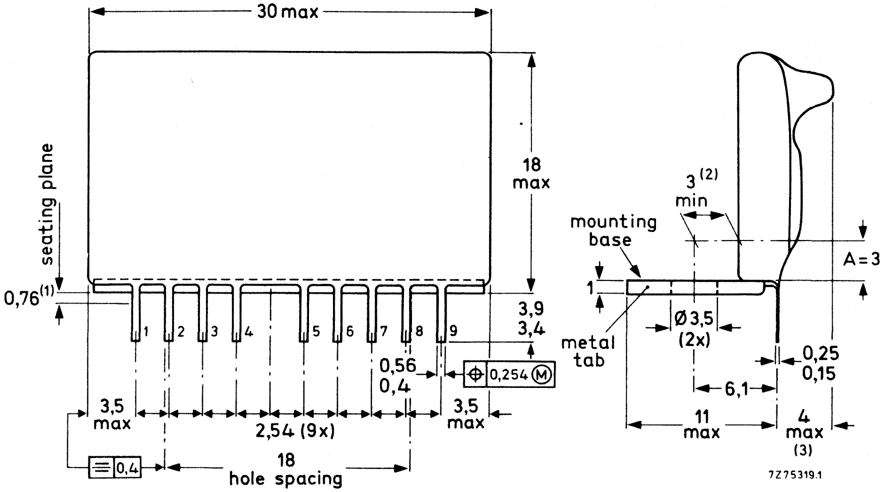
1. When the device is fixed only to a heatsink, not to a printed-circuit board, the values of the second column of the table should be increased by 2 °C and those of the third column decreased by 2 °C.
2. The user is free to realize proper cooling by using differently shaped sinks, or, preferably, by fixing the tab to any convenient part of the equipment (e.g. a wall of the metal cabinet).

heatsink data thickness 1 mm	$T_{mb} - T_{amb}$ °C	$T_{amb\ max}$ °C
Bright aluminium heatsink L-shaped bar, length 100 mm, height 165 mm	24	76
Blackened aluminium heatsink L-shaped bar; length 50 mm, height 70 mm	23	77

MECHANICAL DATA

Dimensions in mm

The amplifier is resin coated and has a metal mounting tab at a right angle to the encapsulation part.



(1) Tolerance applies within this zone.
(2) Distance applies within zone A.
(3) For the OM323A: 3 mm maximum.

Fig. 2 Encapsulation.

Terminal connections

1	= Input
2, 3, 5, 6, 7, 8	= Common, connected to mounting tab
4	= Supply (+)
9	= Output

Soldering recommendations

Hand soldering

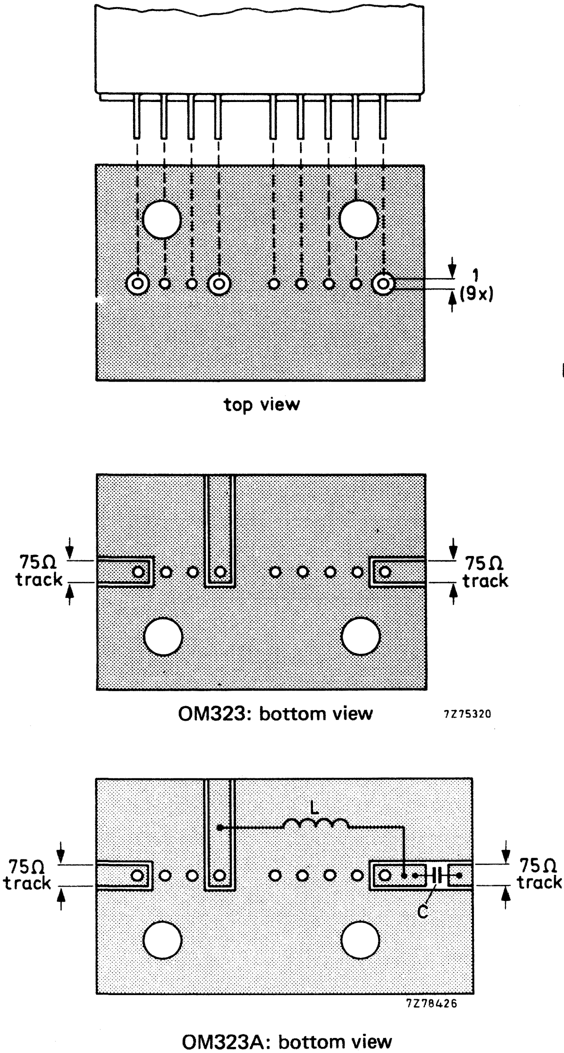
Maximum contact time for a soldering-iron temperature of 260 °C up to the seating plane is 5 s.

Dip or wave soldering

260 °C is the maximum permissible temperature of the solder; it must not be in contact with the joint for more than 5 seconds. The total contact time of successive solder waves must not exceed 5 seconds. The device may be mounted against the printed-circuit board, but the temperature of the device must not exceed 125 °C. If the printed-circuit board has been pre-heated, forced cooling may be necessary immediately after soldering to keep the temperature below the allowable limit.

Mounting recommendations

The module should preferably be mounted on a double-sided printed-circuit board, see the following example. An example is also given of heatsink mounting.
Input and output should be connected to 75 Ω tracks.
The connections to the common pins should be as close to the seating plane as possible.



L > 5 μH; e.g. catalogue no. 3122 108 20150 or 27 turns enamelled Cu wire (0,3 mm) wound on a ferrite core with a diameter of 1,6 mm.
C > 220 pF ceramic capacitor.

Fig. 3 Printed-circuit board holes and tracks for the OM323 and OM323A.

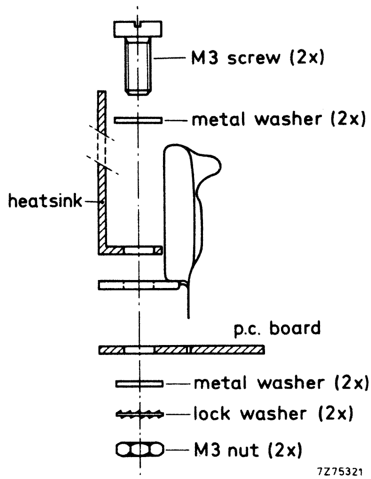


Fig. 4 Example of heatsink mounting.

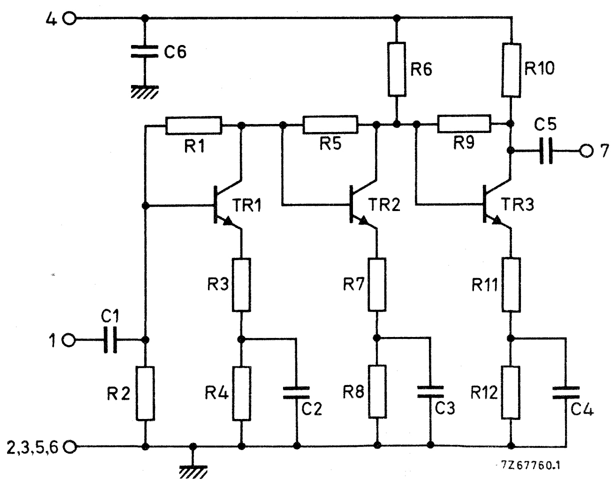
HYBRID VHF/UHF WIDE-BAND AMPLIFIER

Three-stage wide-band amplifier in the hybrid technique, designed for use in mast-head booster-amplifiers, as pre-amplifier in MATV systems, and as general-purpose amplifier for v.h.f. and u.h.f. applications.

QUICK REFERENCE DATA				
Frequency range	f		40 to 860	MHz
Source and load (characteristic) impedance	$R_S = R_\ell = Z_0$	=	75	Ω
Transducer gain	$G_{tr} = \|s_f\|^2$	typ.	27	dB
Flatness of frequency response	$\pm\Delta\ \|s_f\|^2$	typ.	1,6	dB
Output voltage at −60 dB intermodulation distortion (DIN45004, 3-tone)	$V_{o(rms)}$	>	98	dBμV
Noise figure	F	typ.	5,5	dB
D.C. supply voltage	V_B	=	24	V ±10%
Operating ambient temperature	T_{amb}		−20 to +70	°C

ENCAPSULATION 7-pin, in-line, resin-coated body, see MECHANICAL DATA

CIRCUIT DIAGRAM



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

Operating ambient temperature	T_{amb}		−20 to +70	°C
Storage temperature	T_{stg}		−40 to +125	°C
D.C. supply voltage	V_B	max.	28	V
Peak voltages on pins 1 and 7	V_{1M}, V_{7M}	max.	28	V
	$-V_{1M}$, $-V_{7M}$	max.	10	V
Peak incident powers on pins 1 and 7	P_{I1M}, P_{I7M}	max.	100	mW

CHARACTERISTICS

Measuring conditions

V.H.F.-U.H.F. test socket	catalogue no. 3504 110 01840 *			
Ambient temperature	T_{amb}	=	25	°C
D.C. supply voltage	V_B	=	24	V
Source impedance and load impedance	R_s, R_ℓ	=	75	Ω
Characteristic impedance of h.f. connections	Z_o	=	75	Ω
Frequency range	f	=	40 to 860	MHz

Performance

Supply current	I_B	typ.	35	mA
Transducer gain	$G_{tr} = \|s_f\|^2$		23 to 31	dB
		typ.	27	dB
Flatness of frequency response	$\pm\Delta\|s_f\|^2$	typ.	1,6	dB
Individual maximum v.s.w.r.				
input	$VSWR_{(i)}$	typ.	1,9	**
output	$VSWR_{(o)}$	typ.	3,2	**
Back attenuation				
f = 100 MHz	$\|s_r\|^2$	typ.	46	dB
f = 860 MHz	$\|s_r\|^2$	typ.	40	dB
Output voltage at −60 dB intermodulation distortion (DIN45004, par. 6.3: 3-tone)	$V_{o(rms)}$	>	98	dBμV
		typ.	101	dBμV
Noise figure	F	typ.	5,5	dB

s-parameters:		
	$s_f = s_{21}$	$s_i = s_{11}$
	$s_r = s_{12}$	$s_o = s_{22}$

* This socket can be made available for customer reference purposes.

** Highest value, for a sample, occurring in the frequency range.

OPERATING CONDITIONS

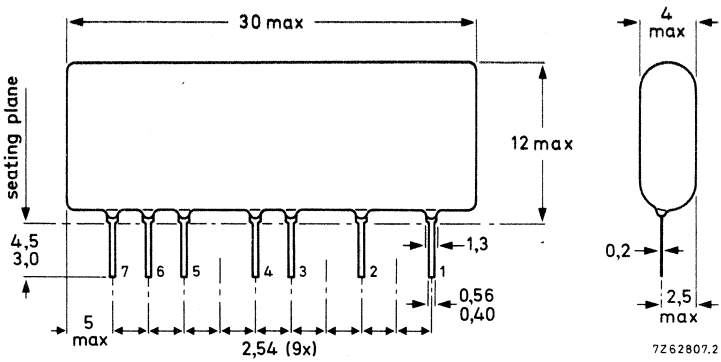
Ambient temperature range	T_{amb}		−20 to +70	°C
D.C. supply voltage	V_B	=	24	V ±10%
Frequency range	f		40 to 860	MHz
Source impedance and load impedance	R_s, R_ℓ	=	75	Ω

MECHANICAL DATA

Dimensions in mm

Encapsulation

The device is resin coated.



Terminal connections

1	= Input
2, 3, 5, 6	= Common
4	= Supply (+)
7	= Output

Soldering recommendations

Hand soldering

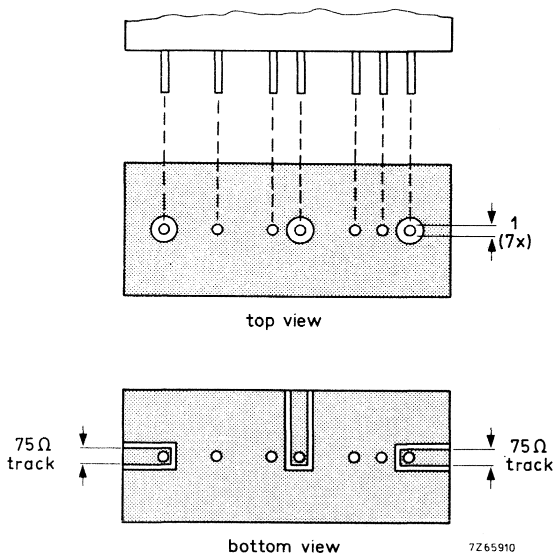
Maximum contact time for a soldering-iron temperature of 260 °C; up to seating plane: 5 s

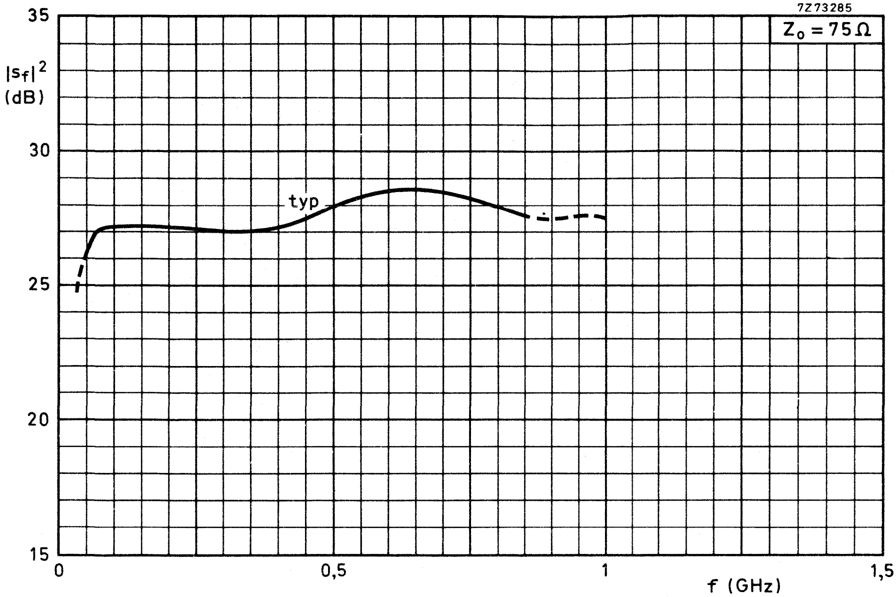
Dip or wave soldering

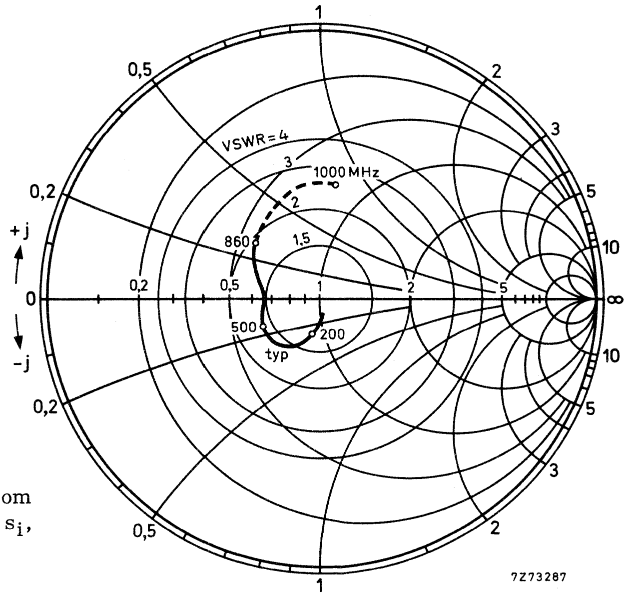
260 °C is the maximum permissible temperature of the solder; it must not be in contact with the joint for more than 5 seconds. The total contact time of successive solder waves must not exceed 5 seconds.
The device may be mounted against the printed-circuit board, but the temperature of the device must not exceed 125 °C. If the printed-circuit board has been pre-heated, forced cooling may be necessary immediately after soldering to keep the temperature below the allowable limit.

Mounting recommendations

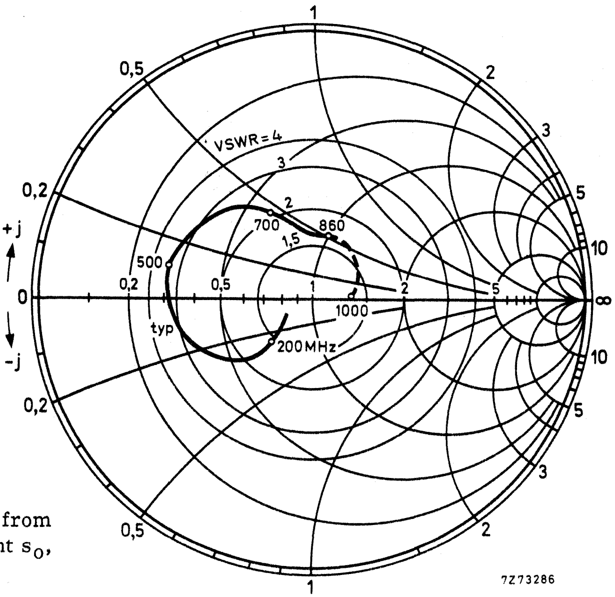
The module should preferably be mounted on double-sided printed-circuit board, see the example shown below.
Input and output should be connected to 75 Ω tracks.
The connections to the "common" pins should be as close to the seating plane as possible.







Input impedance derived from input reflection coefficient s_i, co-ordinates in ohm x 75.



Output impedance derived from output reflection coefficient s_o, co-ordinates in ohm x 75.

HYBRID VHF/UHF WIDE-BAND AMPLIFIER

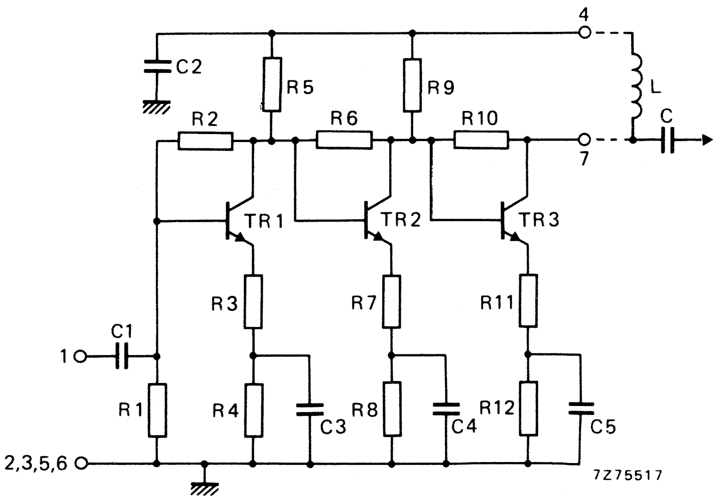
Three-stage wide-band amplifier in the hybrid technique, designed for use in mast-head booster-amplifiers, as preamplifier in MATV systems, and as general-purpose amplifier for v.h.f. and u.h.f. applications.

QUICK REFERENCE DATA

Frequency range	f		40 to 860	MHz
Source and load (characteristic) impedance	$R_s = R_\ell = Z_o$	=	75	Ω
Transducer gain	$G_{tr} = \|s_f\|^2$	typ.	22	dB
Flatness of frequency response	$\pm\Delta\|s_f\|^2$	typ.	1,0	dB
Output voltage at −60 dB intermodulation distortion (DIN 45004, 3-tone)	$V_{o(rms)}$	>	105	dBμV
Noise figure	F	typ.	7	dB
D.C. supply voltage	V_B	=	24	V ±10%
Operating ambient temperature	T_{amb}		−20 to +70	°C

ENCAPSULATION 7-pin, in-line, resin-coated body, see MECHANICAL DATA

CIRCUIT DIAGRAM



RATINGS

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

Operating ambient temperature	T_{amb}		–20 to +70	°C
Storage temperature	T_{stg}		–40 to +125	°C
D.C. supply voltage	V_B	max.	28	V
Peak voltages on pins 1 and 7	V_{1M}, V_{7M}	max.	28	V
	$-V_{1M}, -V_{7M}$	max.	10	V
Peak incident powers on pins 1 and 7	P_{I1M}, P_{I7M}	max.	100	mW

CHARACTERISTICS

Measuring conditions

V.H.F.-U.H.F. test socket	catalogue no. 3504 110 01840 *			
Ambient temperature	T_{amb}	=	25	°C
D.C. supply voltage	V_B	=	24	V
Source impedance and load impedance	R_s, R_ℓ	=	75	Ω
Characteristic impedance of h.f. connections	Z_o	=	75	Ω
Frequency range	f	=	40 to 860	MHz

Performance

Supply current	I_B	typ.	65	mA
Transducer gain	$G_{tr} = \|s_f\|^2$		20 to 24	dB
		typ.	22	dB
Flatness of frequency response	$\pm\Delta\|s_f\|^2$	typ.	1,0	dB
Individual maximum v.s.w.r.				
input	$VSWR_{(i)}$	typ.	1,4	**
output	$VSWR_{(o)}$	typ.	1,6	**
Back attenuation				
f = 100 MHz	$\|s_r\|^2$	typ.	42	dB
f = 860 MHz	$\|s_r\|^2$	typ.	40	dB
Output voltage at –60 dB intermodulation distortion (DIN 45004, par. 6.3: 3-tone)	$V_{o(rms)}$	>	105	dBμV
		typ.	107	dBμV
Noise figure	F	typ.	7	dB

s-parameters:		
	$s_f = s_{21}$	$s_i = s_{11}$
	$s_r = s_{12}$	$s_o = s_{22}$

* This socket can be made available for customer reference purposes.
** Highest value, for a sample, occurring in the frequency range.

OPERATING CONDITIONS

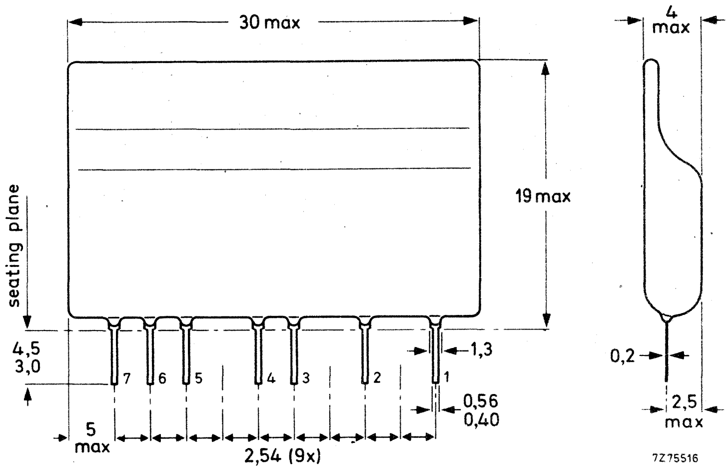
Ambient temperature range	T_{amb}	−20 to +70	°C
D.C. supply voltage	V_B	= 24	V ±10%
Frequency range	f	40 to 860	MHz
Source impedance and load impedance	R_s, R_ℓ	= 75	Ω

MECHANICAL DATA

Dimensions in mm

Encapsulation

The device is resin coated.



Terminal connections

1 = Input
2, 3, 5, 6 = Common
4 = Supply (+)
7 = Output.

Soldering recommendations

Hand soldering

Maximum contact time for a soldering-iron temperature of 260 °C up to the seating plane is 5 s.

Dip or wave soldering

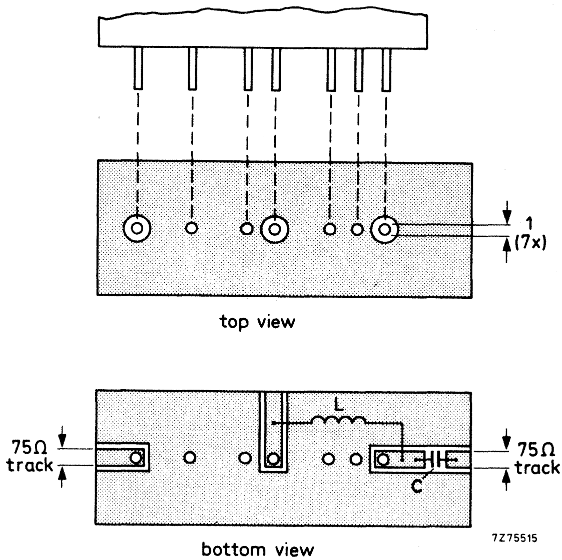
260 °C is the maximum permissible temperature of the solder; it must not be in contact with the joint for more than 5 seconds. The total contact time of successive solder waves must not exceed 5 seconds. The device may be mounted against the printed-circuit board, but the temperature of the device must not exceed 125 °C. If the printed-circuit board has been pre-heated, forced cooling may be necessary immediately after soldering to keep the temperature below the allowable limit.

Mounting recommendations

The module should preferably be mounted on double-sided printed-circuit board, see the example shown below.

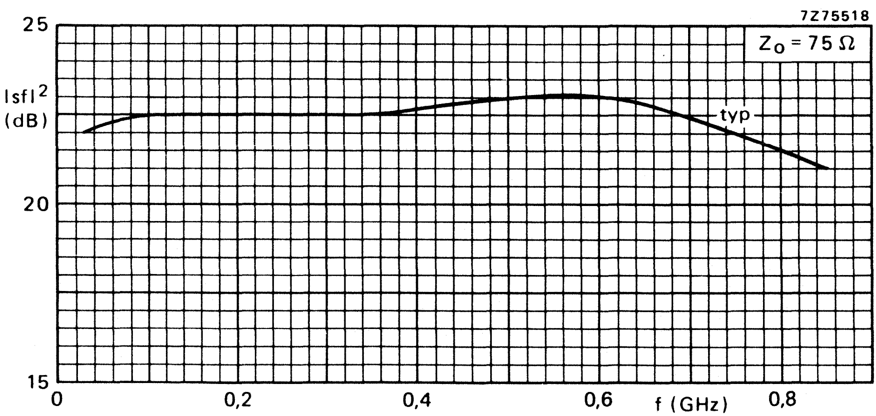
Input and output should be connected to 75 Ω tracks.

The connections to the 'common' pins should be as close to the seating plane as possible.



L > 5 μH; e.g. catalogue no. 3122 108 20150 or 27 turns enamelled Cu wire (0,3 mm) wound on a ferrite core with a diameter of 1,6 mm.

C > 220 pF ceramic capacitor.



HYBRID V.H.F./U.H.F. WIDE-BAND AMPLIFIER

Three-stage wide-band amplifier in the hybrid technique, designed for use in MATV systems, and as general purpose amplifier for v.h.f. and u.h.f. applications requiring a high output level.
The OM337A needs an external collector-coil and blocking capacitor, whereas, the OM337 has these components built-in.

QUICK REFERENCE DATA

Frequency range	f		40 to 860	MHz
Source and load (characteristic) impedance	$R_S = R_\ell = Z_o$	=	75	Ω
Transducer gain	$G_{tr} = \|s_f\|^2$	typ.	26	dB
Flatness of frequency response	$\pm\Delta \|s_f\|^2$	typ.	1	dB
Output voltage at −60 dB intermodulation distortion (DIN45004, 3-tone); f = 470 MHz	$V_{o(rms)}$	typ.	112	dBμV
Noise figure	F	typ.	9,8	dB
D.C. supply voltage	V_B	=	24	V ± 10%
Operating mounting-base temperature	T_{mb}		−30 to +100	°C

ENCAPSULATION 9-pin, in-line, resin-coated body on a right-angled metal mounting tab, see MECHANICAL DATA

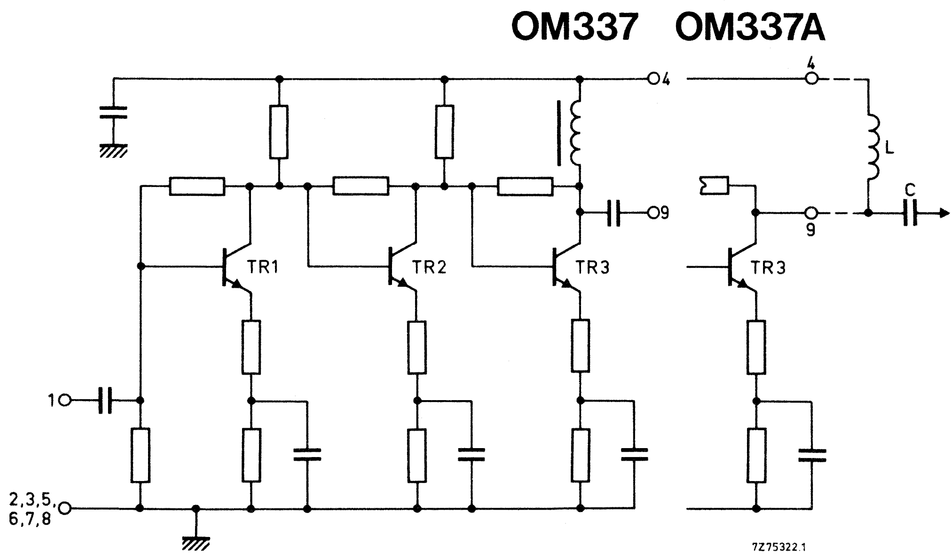


Fig. 1 Circuit diagram.

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

Operating mounting-base temperature	T_{mb}		−30 to +100	°C
Storage temperature	T_{stg}		−40 to +125	°C
D.C. supply voltage	V_B	max.	28	V
Peak voltages on pin 1	V_{1M}	max.	28	V
	$-V_{1M}$	max.	24	V
Peak voltages on pin 9	V_{9M}	max.	28	V
	$-V_{9M}$	max.	4	V
Peak incident powers on pins 1 and 9	P_{I1M}, P_{I9M}	max.	100	mW

CHARACTERISTICS

Measuring conditions

V.H.F.—U.H.F. test socket	catalogue no. 3504 110 01830*			
Mounting base temperature	T_{mb}	=	25	°C
D.C. supply voltage	V_B	=	24	V
Source impedance and load impedance	R_s, R_ℓ	=	75	Ω
Characteristic impedance of h.f. connections	Z_o	=	75	Ω
Frequency range	f	=	40 to 860	MHz

Performance

Supply current	I_B		110 to 120	mA	
		typ.	115	mA	
Transducer gain	$G_{tr} = \|s_f\|^2$		23 to 29	dB	
		typ.	26	dB	
Flatness of frequency response	$\pm\Delta \|s_f\|^2$	typ.	1	dB	
Individual maximum v.s.w.r.					
input	$VSWR_{(i)}$	typ.	2,3		**
output	$VSWR_{(o)}$	typ.	1,8		**
Back attenuation					
f = 100 MHz	$\|s_r\|^2$	typ.	44	dB	
f = 650 MHz	$\|s_r\|^2$	typ.	41	dB	
f = 860 MHz	$\|s_r\|^2$	typ.	43	dB	

* This socket can be made available for customer reference purposes.
** Highest value, for a sample, occurring in the frequency range.

Output voltage				
at −60 dB intermodulation distortion				
(DIN45004, par. 6.3: 3-tone)				
f = 40–230 MHz	$V_{o(rms)}$	>	113	dBμV
		typ.	114	dBμV
f = 470 MHz	$V_{o(rms)}$	typ.	112	dBμV
f = 860 MHz	$V_{o(rms)}$	typ.	110	dBμV
Noise figure				
channel 2	F	typ.	7	dB
channel 65	F	typ.	9,8	dB

s-parameters:	$s_f = s_{21}$	$s_i = s_{11}$
	$s_r = s_{12}$	$s_o = s_{22}$

OPERATING CONDITIONS

Mounting-base temperature range	T_{mb}		−30 to +100	°C
D.C. supply voltage	V_B	=	24	V ± 10%
Frequency range	f		40 to 860	MHz
Source impedance and load impedance	$R_s, R_ℓ$	=	75	Ω

THERMAL DATA

a. The maximum permissible temperature at the mounting base is 100 °C.

b. When the mounting tab is screwed to a double-sided printed-circuit board with dimensions 37 mm x 51 mm, its temperature will be 57 °C above the temperature of the surrounding free air.

c. When a heatsink is fixed to the mounting tab and the pins are soldered into a double-sided printed-circuit board with dimensions 37 mm x 51 mm, the tab will reach the temperatures stated in the following table.

Notes:

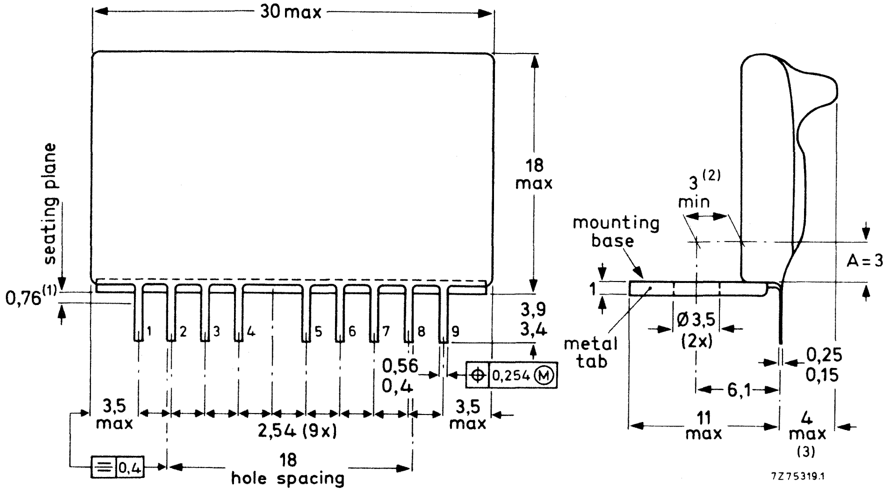
1. When the device is fixed only to a heatsink, not to a printed-circuit board, the values of the second column of the table should be increased by 2 °C and those of the third column decreased by 2 °C.
2. The user is free to realize proper cooling by using differently shaped sinks, or, preferably, by fixing the tab to any convenient part of the equipment (e.g. a wall of the metal cabinet).

heatsink data thickness 1 mm	$T_{mb} - T_{amb}$ °C	$T_{amb\ max}$ °C
Bright aluminium heatsink L-shaped bar; length 100 mm, height 65 mm	27,5	72,5
Blackened aluminium heatsink L-shaped bar; length 50 mm, height 70 mm	26,5	73,5

MECHANICAL DATA

Dimensions in mm

The amplifier is resin coated and has a metal mounting tab at a right angle to the encapsulated part.



(1) Tolerance applies within this zone.
(2) Distance applies within zone A.
(3) For the OM337A: 3 mm maximum.

Fig. 2 Encapsulation.

Terminal connections

1	= Input
2, 3, 5, 6, 7, 8	= Common, connected to mounting tab
4	= Supply (+)
9	= Output

Soldering recommendations

Hand soldering

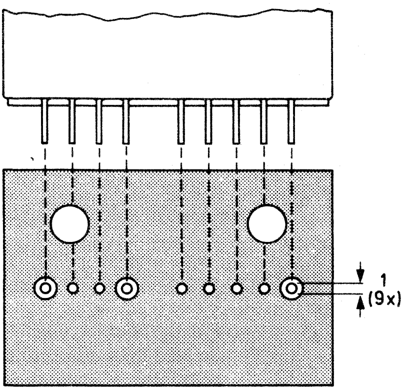
Maximum contact time for a soldering-iron temperature of 260 °C up to the seating plane is 5 s.

Dip or wave soldering

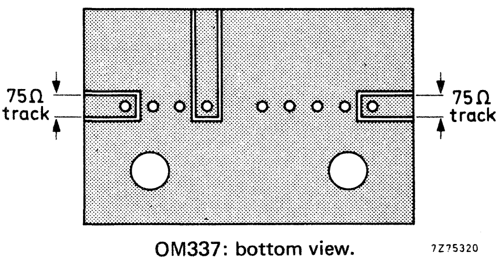
260 °C is the maximum permissible temperature of the solder; it must not be in contact with the joint for more than 5 seconds. The total contact time of successive solder waves must not exceed 5 seconds. The device may be mounted against the printed-circuit board, but the temperature of the device must not exceed 125 °C. If the printed-circuit board has been pre-heated, forced cooling may be necessary immediately after soldering to keep the temperature below the allowable limit.

Mounting recommendations

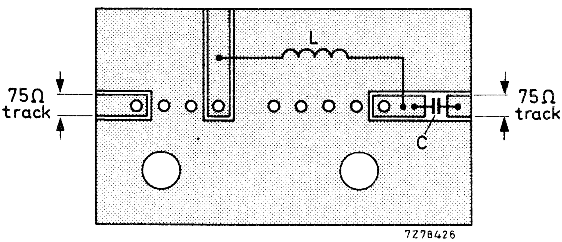
The module should preferably be mounted on a double-sided printed-circuit board, see the following example. An example is also given of heatsink mounting.
Input and output should be connected to 75 Ω tracks.
The connections to the common pins should be as close to the seating plane as possible.



top view



OM337: bottom view.



OM337A: bottom view.

Fig. 3 Printed-circuit board holes and tracks for the OM337 and OM337A.

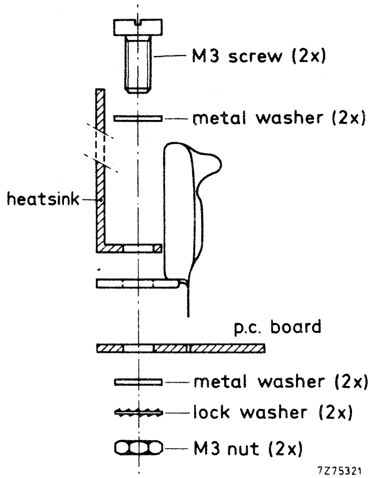


Fig. 4 Example of heatsink mounting.

L > 5 μH; e.g. catalogue no. 3122 108 20150 or 27 turns enamelled Cu wire (0,3 mm) wound on a ferrite core with a a diameter of 1,6 mm.
C > 220 pF ceramic capacitor.

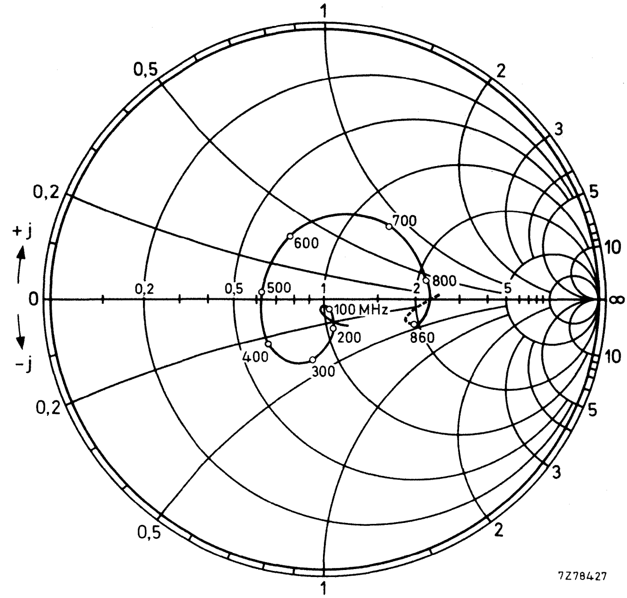


Fig. 5 Input impedance derived from input reflection coefficient s_i, co-ordinates in ohm x 75; typical values.

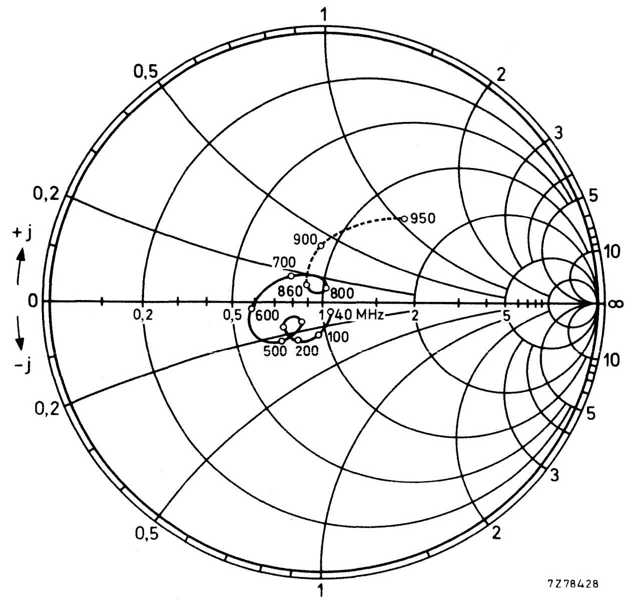


Fig. 6 Output impedance derived from output reflection coefficient s_o, co-ordinates in ohm x 75; typical values.

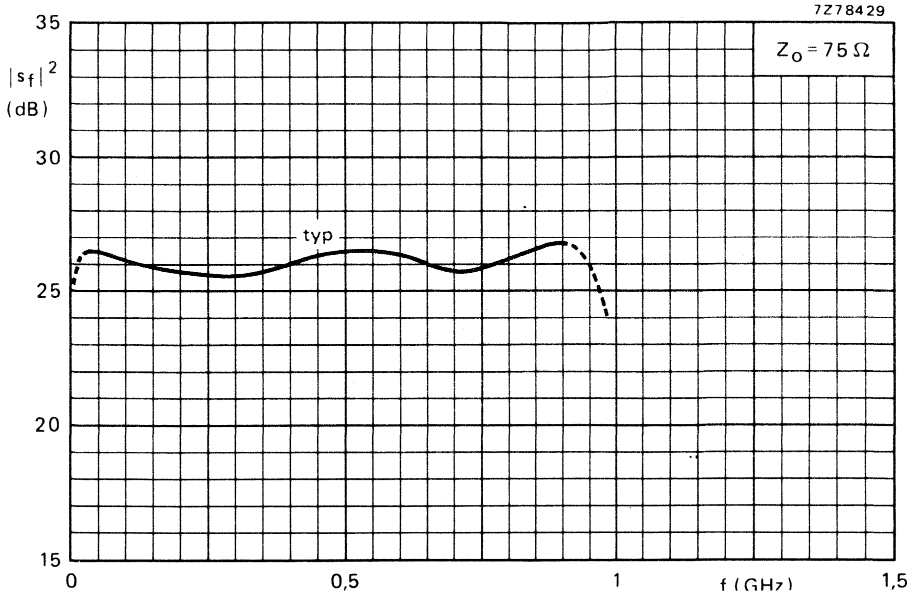


Fig. 7 Transducer gain as a function of frequency.

HYBRID INTEGRATED CIRCUIT VHF/UHF WIDE-BAND AMPLIFIER

Three-stage wide-band amplifier in the hybrid integrated circuit technique, designed for use in mast-head booster-amplifiers, as amplifier in MATV systems, and as general-purpose amplifier for v.h.f. and u.h.f. applications.

QUICK REFERENCE DATA

Frequency range	f		40 to 860	MHz
Source and load (characteristic) impedance	$R_s = R_\ell = Z_o$	=	75	Ω
Transducer gain	$G_{tr} = \|s_f\|^2$	typ.	28	dB
Flatness of frequency response	$\pm\Delta\|s_f\|^2$	typ.	1,5	dB
Output voltage at −60 dB intermodulation distortion (DIN 45004, 3-tone)	$V_{o(rms)}$	>	105	dBμV
Noise figure	F	typ.	6	dB
D.C. supply voltage	V_B	=	24	V ±10%
Operating ambient temperature	T_{amb}		−20 to +70	°C

ENCAPSULATION 7-pin, in-line, resin-coated body, see MECHANICAL DATA (Fig. 2)

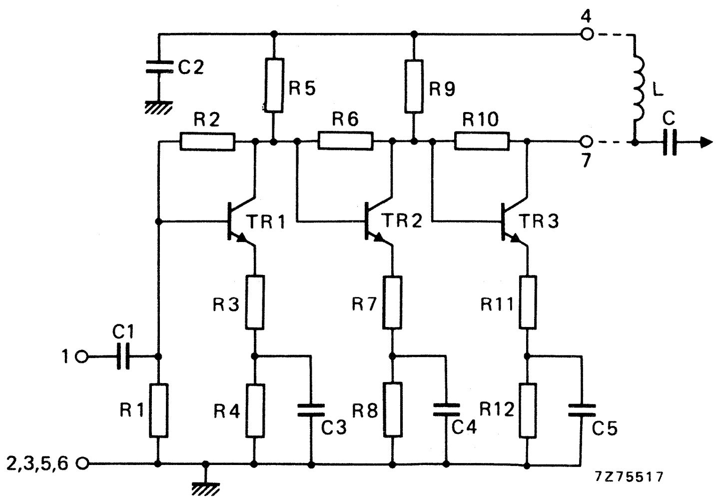


Fig. 1 Circuit diagram.

RATINGS

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

Operating ambient temperature	T_{amb}		−20 to +70	°C
Storage temperature	T_{stg}		−40 to +125	°C
D.C. supply voltage	V_B	max.	28	V
Peak voltages on pins 1 and 7	V_{1M}, V_{7M}	max.	28	V
	$-V_{1M}$, $-V_{7M}$	max.	10	V
Peak incident powers on pins 1 and 7	P_{I1M}, P_{I7M}	max.	100	mW

CHARACTERISTICS

Measuring conditions

V.H.F.-U.H.F. test socket	catalogue no. 3504 110 01840 *			
Ambient temperature	T_{amb}	=	25	°C
D.C. supply voltage	V_B	=	24	V
Source impedance and load impedance	R_s, R_ℓ	=	75	Ω
Characteristic impedance of h.f. connections	Z_o	=	75	Ω
Frequency range	f	=	40 to 860	MHz

Performance

Supply current	I_B	typ.	67	mA
Transducer gain	$G_{tr} = \|s_f\|^2$		25 to 30	dB
		typ.	28	dB
Flatness of frequency response	$\pm\Delta\|s_f\|^2$	typ.	1,5	dB
Individual maximum v.s.w.r.				
input	$VSWR_{(i)}$	typ.	1,5	**
output	$VSWR_{(o)}$	typ.	1,5	**
Back attenuation				
f = 100 MHz	$\|s_r\|^2$	typ.	46	dB
f = 860 MHz	$\|s_r\|^2$	typ.	31	dB
Output voltage at −60 dB intermodulation distortion (DIN 45004, par. 6.3: 3-tone)	$V_{o(rms)}$	>	105	dBμV
		typ.	107	dBμV
Noise figure	F	typ.	6	dB

s-parameters:	$s_f = s_{21}$	$s_i = s_{11}$
	$s_r = s_{12}$	$s_o = s_{22}$

* This socket can be made available for customer reference purposes.
** Highest value, for a sample, occurring in the frequency range.

OPERATING CONDITIONS

Ambient temperature range	T_{amb}	−20 to +70	°C
D.C. supply voltage	V_B	= 24	V ±10%
Frequency range	f	40 to 860	MHz
Source impedance and load impedance	R_S, R_ℓ	= 75	Ω

MECHANICAL DATA

Dimensions in mm

The device is resin coated.

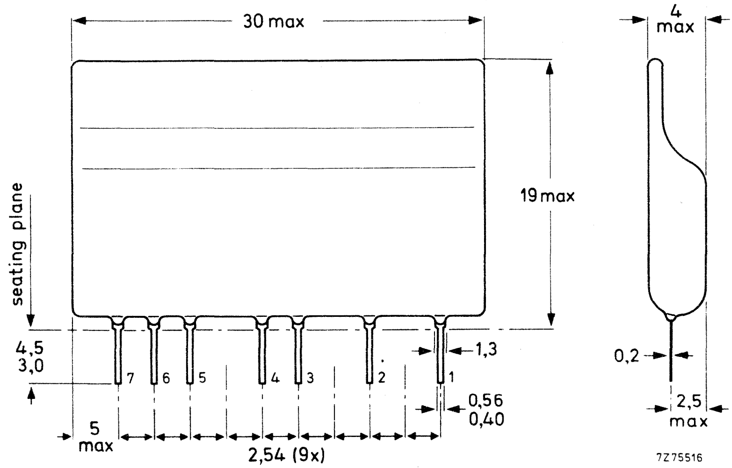


Fig. 2 Encapsulation.

Terminal connections

1 = input
2, 3, 5, 6 = common
4 = supply (+)
7 = output

Soldering recommendations

Hand soldering

Maximum contact time for a soldering-iron temperature of 260 °C up to the seating plane is 5 s.

Dip or wave soldering

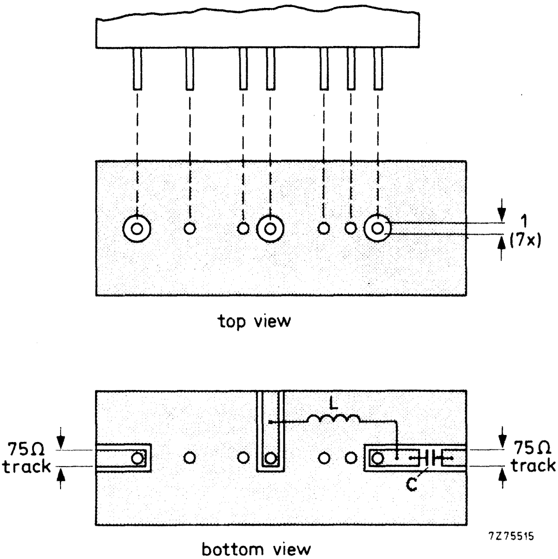
260 °C is the maximum permissible temperature of the solder; it must not be in contact with the joint for more than 5 seconds. The total contact time of successive solder waves must not exceed 5 seconds. The device may be mounted against the printed-circuit board, but the temperature of the device must not exceed 125 °C. If the printed-circuit board has been pre-heated, forced cooling may be necessary immediately after soldering to keep the temperature below the allowable limit.

Mounting recommendations

The module should preferably be mounted on double-sided printed-circuit board, see the example shown below.

Input and output should be connected to 75 Ω tracks.

The connections to the 'common' pins should be as close to the seating plane as possible.



L > 5 μH; e.g. catalogue no. 3122 108 20150 or 27 turns enamelled Cu wire (0,3 mm) wound on a ferrite core with a diameter of 1,6 mm.
C > 220 pF ceramic capacitor.

Fig. 3 Printed-circuit board holes and tracks.

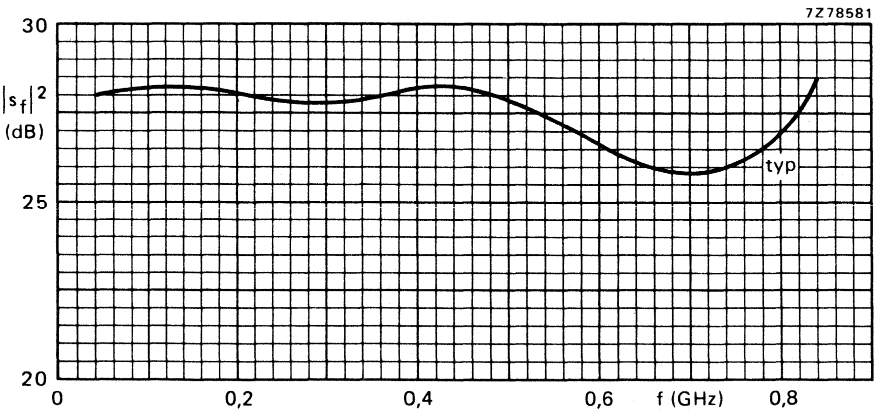


Fig. 4 Transducer gain as a function of frequency; Z_o = 75 Ω.

HYBRID INTEGRATED CIRCUIT VHF/UHF WIDE-BAND AMPLIFIER

One-stage wide-band amplifier in hybrid integrated circuit technique on a thin-film substrate, intended for aerial amplifiers in car radios, caravans or RATV and MATV applications.

QUICK REFERENCE DATA

D.C. supply voltage	V_B	=	12	V ± 10%
Frequency range	f		40 to 860	MHz
Source and load (characteristic) impedance	$R_s = R_\ell = Z_o$	=	75	Ω
Transducer gain	$G_{tr} = \|s_f\|^2$	typ.	12	dB
Flatness of frequency response	$\pm \Delta \|s_f\|^2$	typ.	1	dB
Output voltage at −60 dB intermodulation distortion (DIN 45004, 3-tone)	$V_{o(rms)}$	typ.	99	dBμV
Noise figure	F	typ.	5,5	dB
Operating ambient temperature	T_{amb}		−20 to + 70	°C

ENCAPSULATION 5-pin, in-line, resin-coated body, see MECHANICAL DATA (Fig. 2)

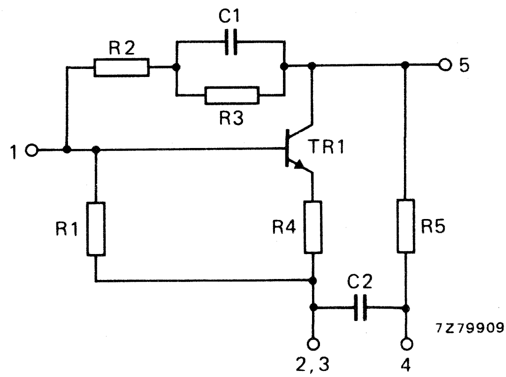


Fig. 1 Circuit diagram.

RATINGS

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

Operating ambient temperature	T_{amb}		−20 to +70	°C
Storage temperature	T_{stg}		−40 to +125	°C
D.C. supply voltage	V_B	max.	15	V
Peak incident powers on pins 1 and 5	P_{I1M}, P_{I5M}	max.	100	mW

CHARACTERISTICS

Measuring conditions

Ambient temperature	T_{amb}	=	25	°C
D.C. supply voltage	V_B	=	12	V
Source impedance and load impedance	R_s, R_ℓ	=	75	Ω
Characteristic impedance of h.f. connections	Z_o	=	75	Ω
Frequency range	f	=	40 to 860	MHz

Performance

Supply current	I_B	typ.	11,5	mA
Transducer gain	$G_{tr} = \lvert s_f \rvert^2$	typ.	12	dB
Flatness of frequency response	$\pm \Delta \lvert s_f \rvert^2$	typ.	1	dB
Individual maximum v.s.w.r.				
input	$VSWR_{(i)}$	typ.	2,0	*
output	$VSWR_{(o)}$	typ.	1,4	*
Back attenuation				
f = 100 MHz	$\lvert s_r \rvert^2$	typ.	22	dB
f = 860 MHz	$\lvert s_r \rvert^2$	typ.	19	dB
Output voltage at −60 dB intermodulation distortion (DIN 45004, par. 6.3: 3-tone)	$V_{o(rms)}$	typ.	99	dBμV
Noise figure	F	typ.	5,5	dB

s-parameters:	$s_f = s_{21}$	$s_i = s_{11}$
	$s_r = s_{12}$	$s_o = s_{22}$

* Highest value, for a sample, occuring in the frequency range.

OPERATING CONDITIONS

Ambient temperature range	T_{amb}		−20 to + 70	°C
D.C. supply voltage	V_B	=	12	V ±10%
Frequency range	f		40 to 860	MHz
Source impedance and load impedance	R_s, R_ℓ	=	75	Ω

MECHANICAL DATA

Dimensions in mm

The device is resin coated.

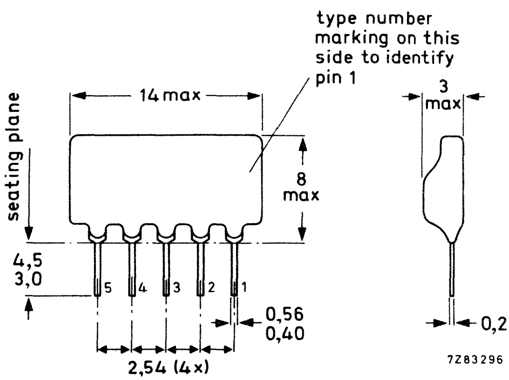


Fig. 2 Encapsulation.

Terminal connections

1 = input
2,3 = common
4 = supply (+)
5 = output

Soldering recommendations

Hand soldering

Maximum contact time for a soldering-iron temperature of 260 °C up to the seating plane is 5 s.

Dip or wave soldering

260 °C is the maximum permissible temperature of the solder; it must not be in contact with the joint for more than 5 seconds. The total contact time of successive solder waves must not exceed 5 seconds. The device may be mounted against the printed-circuit board, but the temperature of the device must not exceed 125 °C. If the printed-circuit board has been pre-heated, forced cooling may be necessary immediately after soldering to keep the temperature below the allowable limit.

Mounting recommendations

The module should preferably be mounted on double-sided printed-circuit board, see the example shown below.

Input and output should be connected to 75 Ω tracks.

The connections to the 'common' pins should be as close to the seating plane as possible.

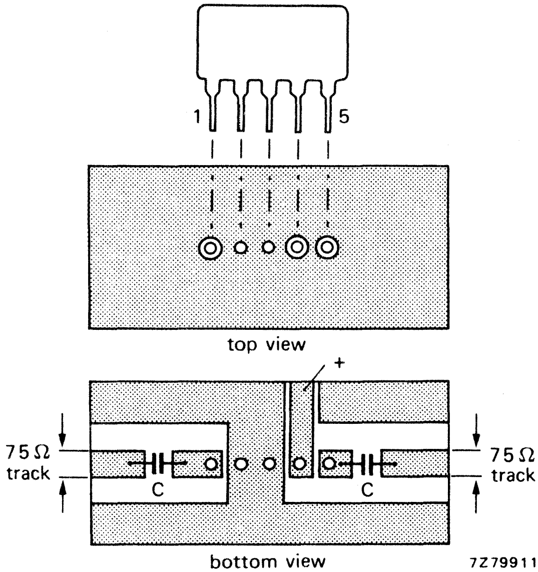


Fig. 3 Printed-circuit board holes and tracks.
C > 220 pF ceramic capacitor.

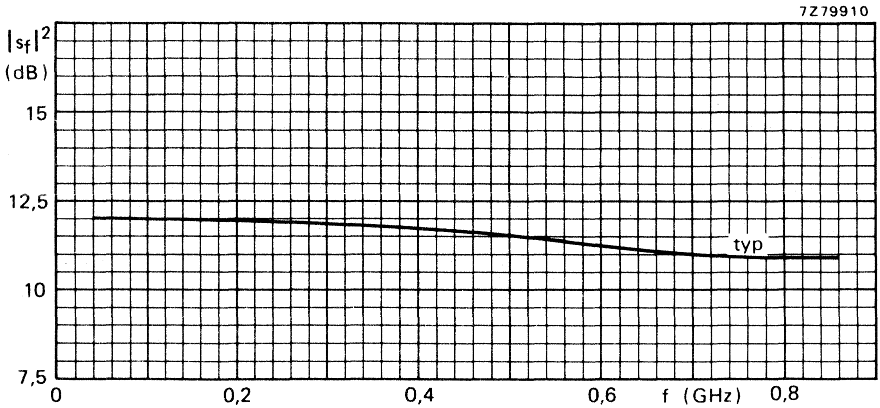


Fig. 4 Transducer gain as a function of frequency; Z_o = 75 Ω.

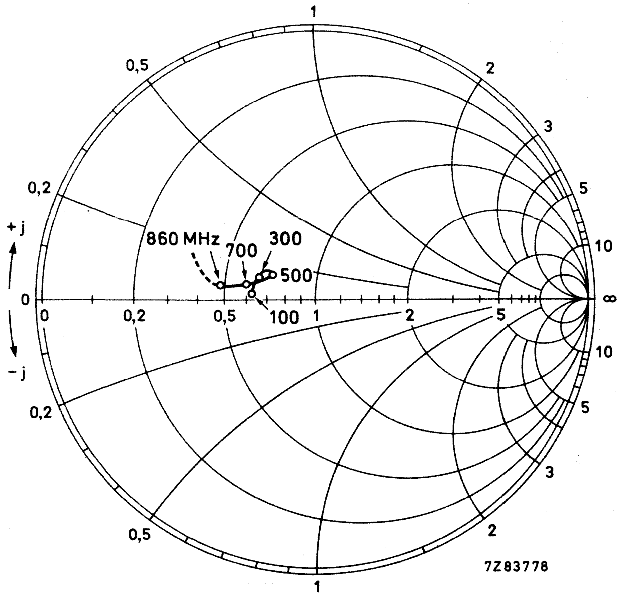


Fig. 5 Input impedance derived from input reflection coefficient s_i, co-ordinates in ohm x 75; typical values.

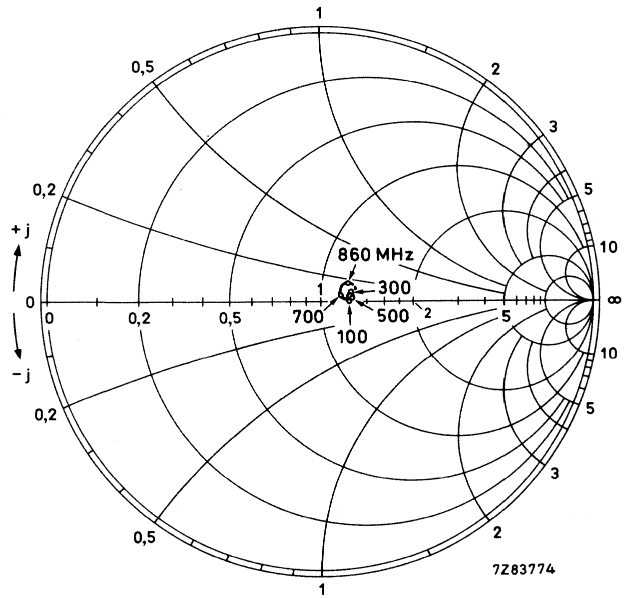


Fig. 6 Output impedance derived from output reflection coefficient s_o, co-ordinates in ohm x 75; typical values.

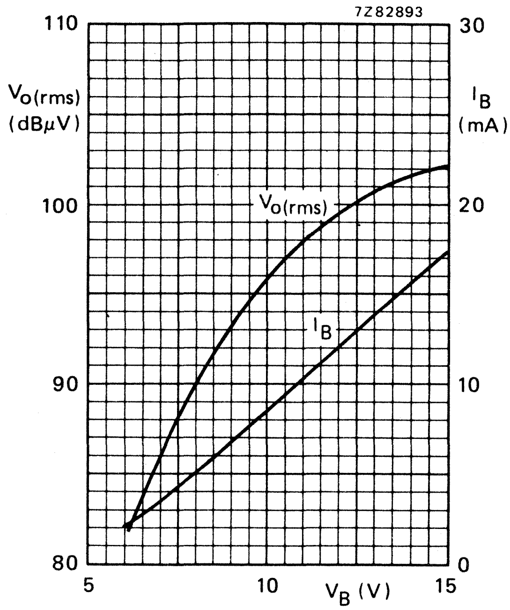


Fig. 7 Output voltage and supply current as a function of the supply voltage; typical values.

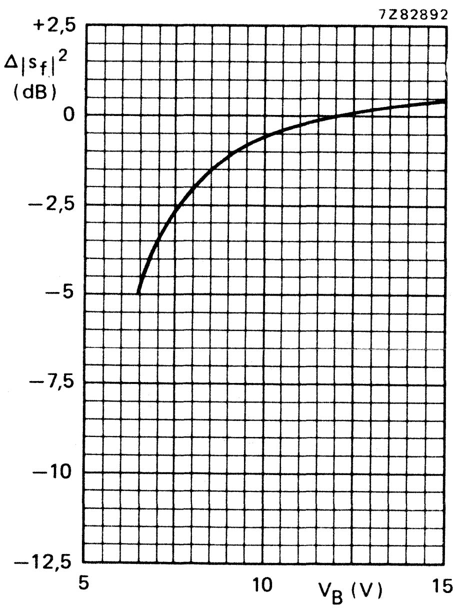


Fig. 8 Variation of transducer gain with supply voltage; reference 0 dB at 12 V; f = 100 to 860 MHz; typical values.

HYBRID INTEGRATED CIRCUIT VHF/UHF WIDE-BAND AMPLIFIER

Two-stage wide-band amplifier in hybrid integrated circuit technique on a thin-film substrate, intended for RATV and MATV applications.

QUICK REFERENCE DATA

D.C. supply voltage	V_B	=	12	V ± 10%
Frequency range	f		40 to 860	MHz
Source and load (characteristic) impedance	$R_s = R_\ell = Z_o$	=	75	Ω
Transducer gain	$G_{tr} = \lvert s_f \rvert^2$	typ.	18	dB
Flatness of frequency response	$\pm \Delta \lvert s_f \rvert^2$	typ.	1	dB
Output voltage at −60 dB intermodulation distortion (DIN 45004, 3-tone)	$V_{o(rms)}$	typ.	100	dBμV
Noise figure	F	typ.	6	dB
Operating ambient temperature	T_{amb}		−20 to +70	°C

ENCAPSULATION 5-pin, in-line, resin-coated body, see MECHANICAL DATA (Fig. 2)

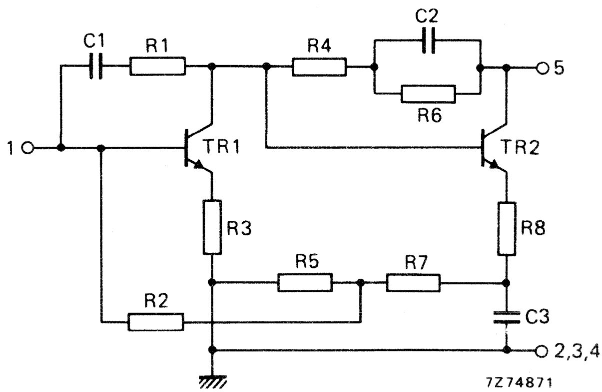


Fig. 1 Circuit diagram.

RATINGS

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

Operating ambient temperature	T_{amb}		−20 to + 70	°C
Storage temperature	T_{stg}		−40 to + 125	°C
D.C. supply voltage	V_B	max.	15	V
Peak incident powers on pins 1 and 5	P_{I1M}, P_{I5M}	max.	100	mW

CHARACTERISTICS

Measuring conditions

Ambient temperature	T_{amb}	=	25	°C
D.C. supply voltage	V_B	=	12	V
Source impedance and load impedance	R_s, R_ℓ	=	75	Ω
Characteristic impedance of h.f. connections	Z_o	=	75	Ω
Frequency range	f	=	40 to 860	MHz

Performance

Supply current	I_B	typ.	18	mA
Transducer gain	$G_{tr} = \lvert s_f \rvert^2$	typ.	18	dB
Flatness of frequency response	$\pm \Delta \lvert s_f \rvert^2$	typ.	1	dB
Individual maximum v.s.w.r.				
input	$VSWR_{(i)}$	typ.	1,5	*
output	$VSWR_{(o)}$	typ.	1,9	*
Back attenuation				
f = 100 MHz	$\lvert s_r \rvert^2$	typ.	29	dB
f = 860 MHz	$\lvert s_r \rvert^2$	typ.	25	dB
Output voltage at −60 dB intermodulation distortion (DIN 45004, par. 6.3: 3-tone)	$V_{o(rms)}$	typ.	100	dBμV
Noise figure	F	typ.	6	dB

s-parameters:	$s_f = s_{21}$	$s_i = s_{11}$
	$s_r = s_{12}$	$s_o = s_{22}$

* Highest value, for a sample, occuring in the frequency range.

OPERATING CONDITIONS

Ambient temperature range	T_{amb}	−20 to + 70 °C
D.C. supply voltage	V_B	= 12 V ± 10%
Frequency range	f	40 to 860 MHz
Source impedance and load impedance	R_s, R_ℓ	= 75 Ω

MECHANICAL DATA

Dimensions in mm

The device is resin coated.

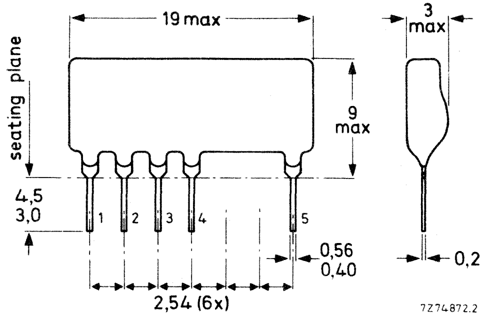


Fig. 2 Encapsulation.

Terminal connections

1 = input
2,3,4 = common
5 = output/supply(+)

Soldering recommendations

Hand soldering

Maximum contact time for a soldering-iron temperature of 260 °C up to the seating plane is 5 s.

Dip or wave soldering

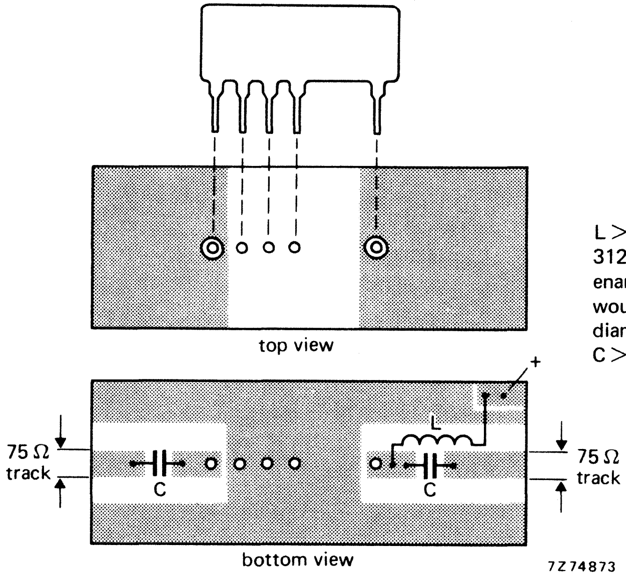
260 °C is the maximum permissible temperature of the solder; it must not be in contact with the joint for more than 5 seconds. The total contact time of successive solder waves must not exceed 5 seconds. The device may be mounted against the printed-circuit board, but the temperature of the device must not exceed 125 °C. If the printed-circuit board has been pre-heated, forced cooling may be necessary immediately after soldering to keep the temperature below the allowable limit.

Mounting recommendations

The module should preferably be mounted on double-sided printed-circuit board, see the example shown below.

Input and output should be connected to 75 Ω tracks.

The connections to the 'common' pins should be as close to the seating plane as possible.



L > 5 μH; e.g. catalogue no. 3122 108 20150 or 27 turns enamelled Cu wire (0,3 mm) wound on a ferrite core with a diameter of 1,6 mm.
C > 220 pF ceramic capacitor.

Fig. 3 Printed-circuit board holes and tracks.

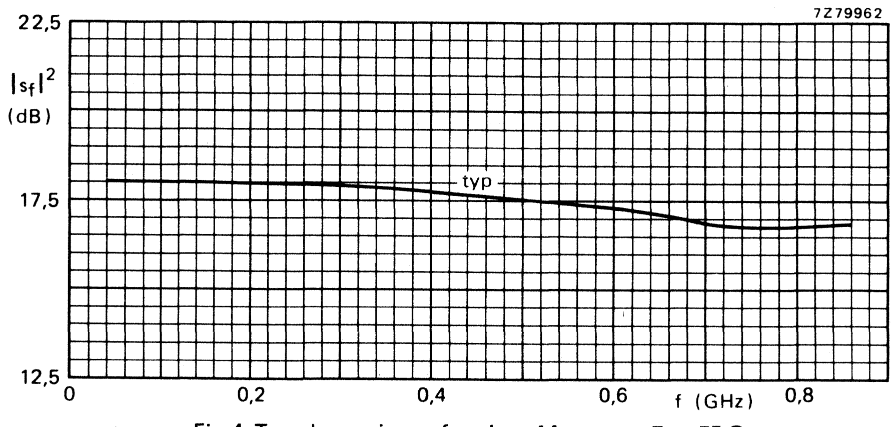


Fig. 4 Transducer gain as a function of frequency; Z_o = 75 Ω.

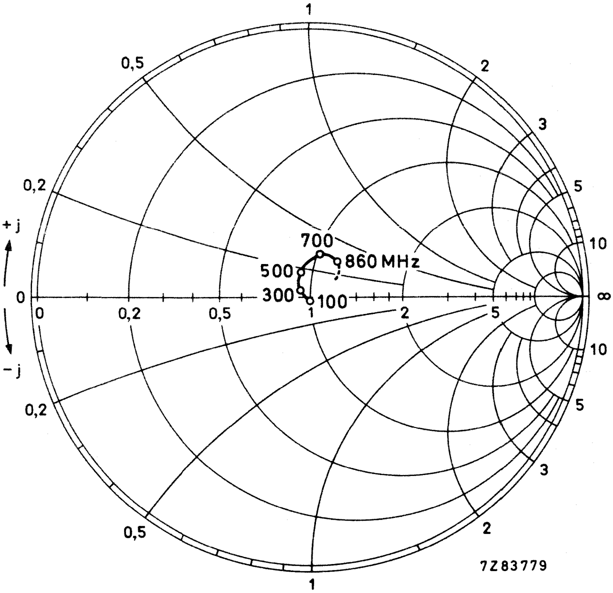


Fig. 5 Input impedance derived from input reflection coefficient s_i, co-ordinates in ohm x 75; typical values.

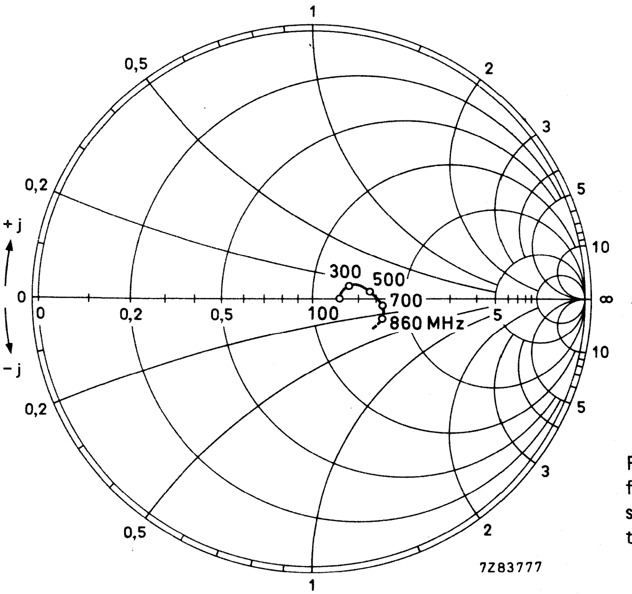


Fig. 6 Output impedance derived from output reflection coefficient s_o, co-ordinates in ohm x 75; typical values.

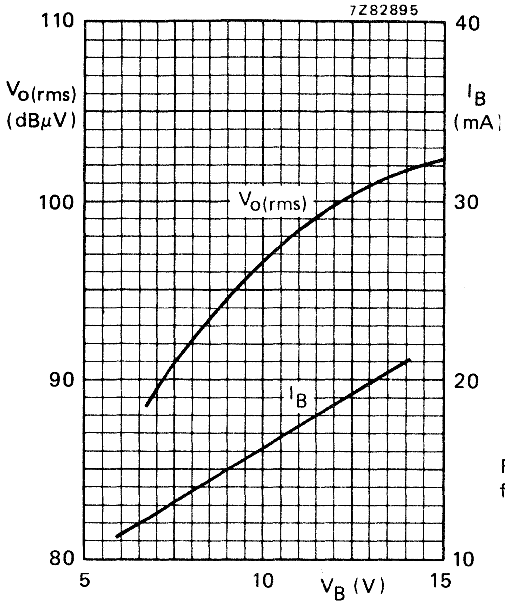


Fig. 7 Output voltage and supply current as a function of the supply voltage; typical values.

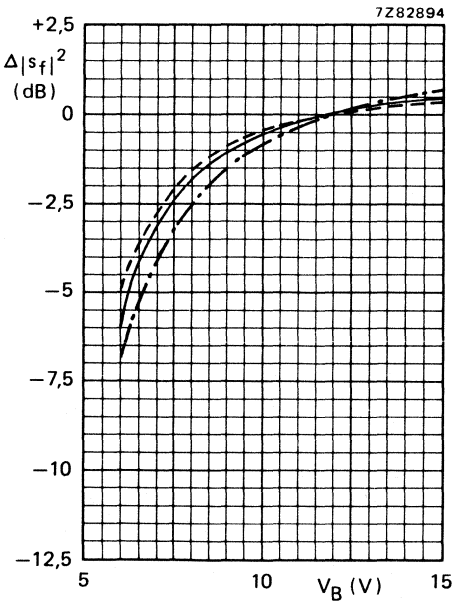


Fig. 8 Variation of transducer gain with supply voltage; reference 0 dB at 12 V:
——— f = 500 MHz;
– – – – f = 100 MHz;
—·—·— f = 860 MHz;
typical values.

HYBRID INTEGRATED CIRCUIT VHF/UHF WIDE-BAND AMPLIFIER

Three-stage wide-band amplifier in hybrid integrated circuit technique on a thin-film substrate, intended for use in mast-head booster-amplifiers, as preamplifier in MATV systems, and as general-purpose amplifier for v.h.f. and u.h.f. applications.

QUICK REFERENCE DATA

Frequency range	f		40 to 860	MHz
Source and load (characteristic) impedance	$R_s = R_\ell = Z_o$	=	75	Ω
Transducer gain	$G_{tr} = \|s_f\|^2$	typ.	23	dB
Flatness of frequency response	$\pm\Delta\|s_f\|^2$	typ.	0,5	dB
Output voltage at −60 dB intermodulation distortion (DIN 45004, 3-tone)	$V_{o(rms)}$	>	105	dBμV
Noise figure	F	typ.	7	dB
D.C. supply voltage	V_B	=	12	V ± 10%
Operating ambient temperature	T_{amb}		−20 to +70	°C

ENCAPSULATION 8-pin, in-line, resin-coated body, see MECHANICAL DATA (Fig. 2)

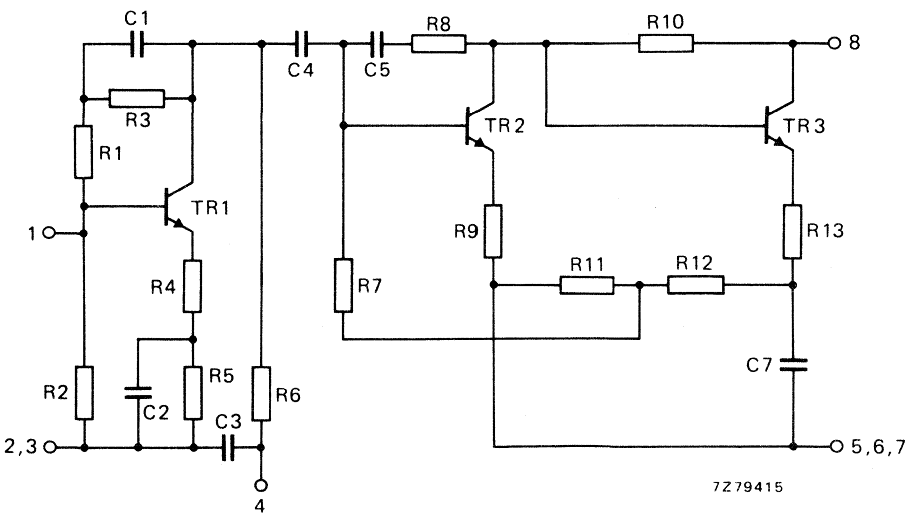


Fig. 1 Circuit diagram.

RATINGS

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

Operating ambient temperature	T_{amb}		−20 to +70	°C
Storage temperature	T_{stg}		−40 to +125	°C
D.C. supply voltage	V_B	max.	15	V
Peak incident powers on pins 1 and 7	P_{I1M}, P_{I7M}	max.	100	mW

CHARACTERISTICS

Measuring conditions

Ambient temperature	T_{amb}	=	25	°C
D.C. supply voltage	V_B	=	12	V
Source impedance and load impedance	R_s, R_ℓ	=	75	Ω
Characteristic impedance of h.f. connections	Z_o	=	75	Ω
Frequency range	f	=	40 to 860	MHz

Performance

Supply current	I_B	typ.	55	mA
Transducer gain	$G_{tr} = \|s_f\|^2$	typ.	23	dB
			21 to 25	dB
Flatness of frequency response	$\pm\Delta\|s_f\|^2$	typ.	0,5	dB
Individual maximum v.s.w.r.				
input	$VSWR_{(i)}$	typ.	1,3	*
output	$VSWR_{(o)}$	typ.	1,5	*
Back attenuation				
f = 100 MHz	$\|s_r\|^2$	typ.	42	dB
f = 860 MHz	$\|s_r\|^2$	typ.	33	dB
Output voltage at −60 dB intermodulation distortion (DIN 45004, par. 6.3: 3-tone)	$V_{o(rms)}$	>	105	dBμV
		typ.	107	dBμV
Noise figure	F	typ.	7	dB

s-parameters:	$s_f = s_{21}$	$s_i = s_{11}$
	$s_r = s_{12}$	$s_o = s_{22}$

* Highest value, for a sample, occurring in the frequency range.

OPERATING CONDITIONS

Ambient temperature range	T_{amb}	−20 to +70	°C
D.C. supply voltage	V_B	= 12	V ± 10%
Frequency range	f	40 to 860	MHz
Source impedance and load impedance	R_s, R_ℓ	= 75	Ω

MECHANICAL DATA

Dimensions in mm

The device is resin coated.

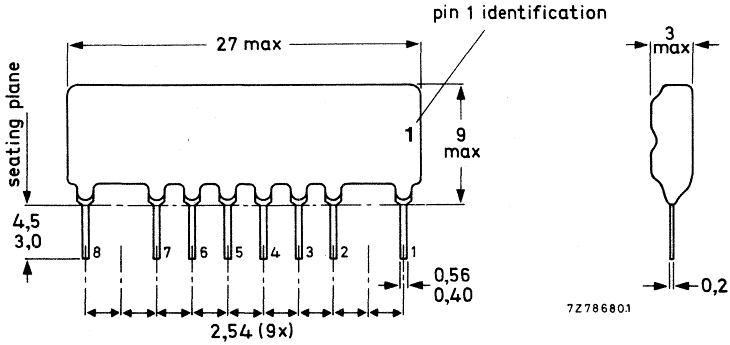


Fig. 2 Encapsulation.

Terminal connections

1 = input
2, 3, 5, 6, 7 = common
4 = supply (+)
8 = output/supply (+)

Soldering recommendations

Hand soldering

Maximum contact time for a soldering-iron temperature of 260 °C up to the seating plane is 5 s.

Dip or wave soldering

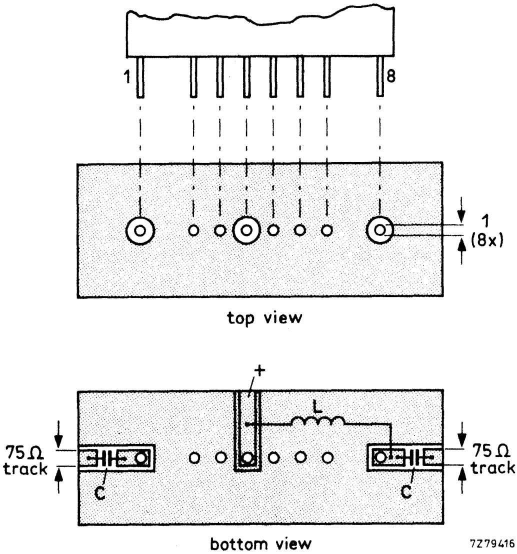
260 °C is the maximum permissible temperature of the solder; it must not be in contact with the joint for more than 5 seconds. The total contact time of successive solder waves must not exceed 5 seconds. The device may be mounted against the printed-circuit board, but the temperature of the device must not exceed 125 °C. If the printed-circuit board has been pre-heated, forced cooling may be necessary immediately after soldering to keep the temperature below the allowable limit.

Mounting recommendations

The module should preferably be mounted on double-sided printed-circuit board, see the example shown below.

Input and output should be connected to 75 Ω tracks.

The connections to the 'common' pins should be as close to the seating plane as possible.



L > 5 μH; e.g. catalogue no. 3122 108 20150 or 27 turns enamelled Cu wire (0,3 mm) wound on a ferrite core with a diameter of 1,6 mm.
C > 220 pF ceramic capacitor.

Fig. 3 Printed-circuit board holes and tracks.

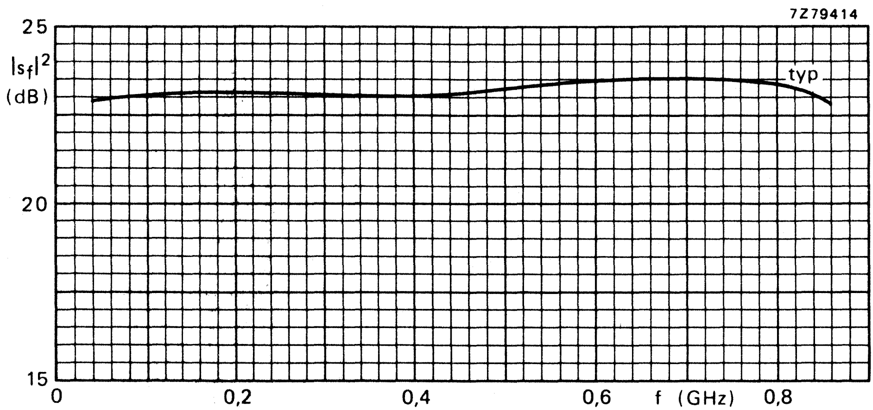


Fig. 4 Transducer gain as a function of frequency; Z_o = 75 Ω.

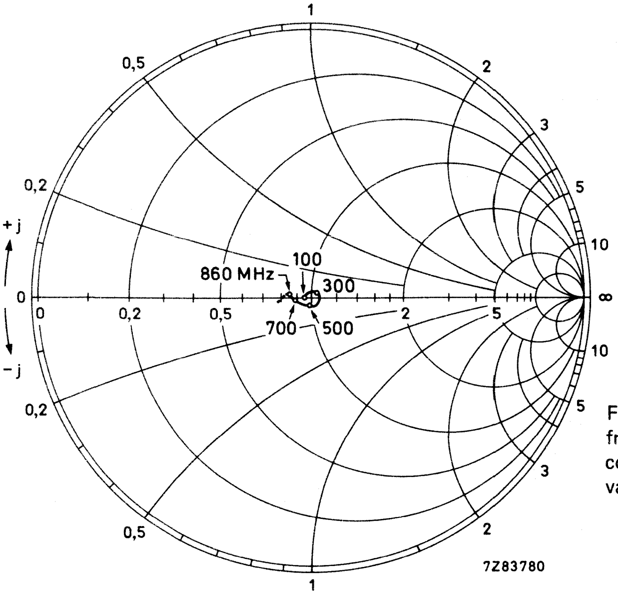


Fig. 5 Input impedance derived from input reflection coefficient s_i, co-ordinates in ohm x 75; typical values.

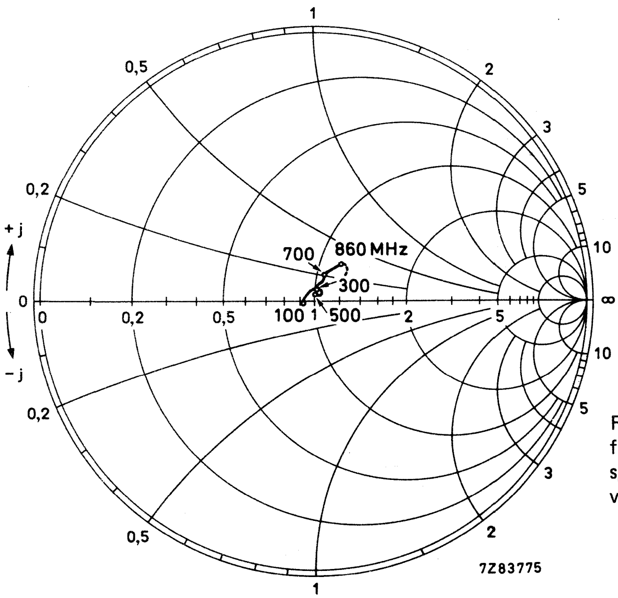


Fig. 6 Output impedance derived from output reflection coefficient s_o, co-ordinates in ohm x 75; typical values.

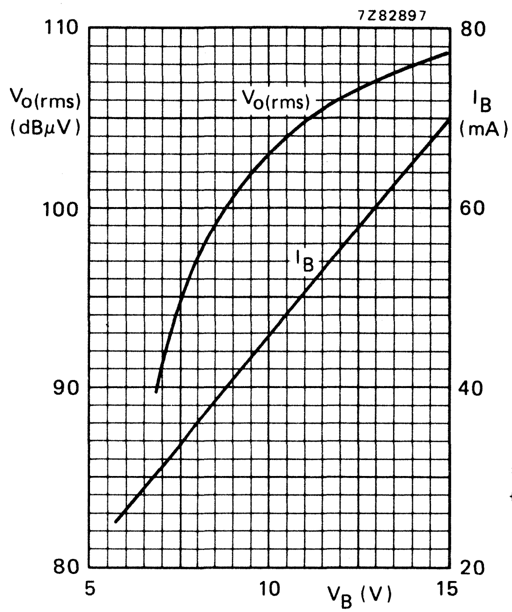


Fig. 7 Output voltage and supply current as a function of the supply voltage; typical values.

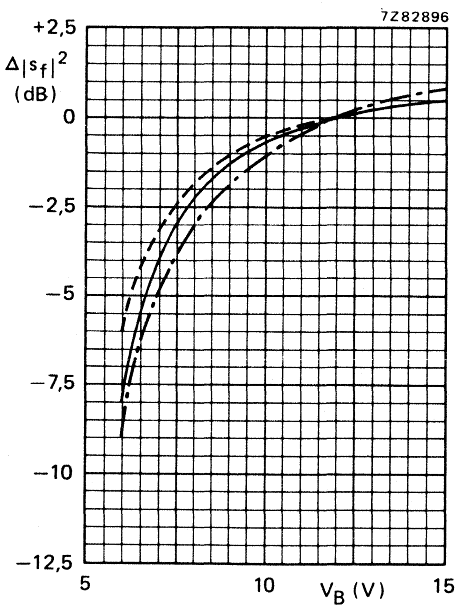


Fig. 8 Variation of transducer gain with supply voltage; reference 0 dB at 12 V;
——— f = 500 MHz;
– – – – f = 100 MHz;
—.—.— f = 860 MHz;
typical values.

HYBRID INTEGRATED CIRCUIT VHF/UHF WIDE-BAND AMPLIFIER

Three-stage wide-band amplifier in hybrid integrated circuit technique on a thin-film substrate, intended for use in mast-head booster-amplifiers, as an amplifier in MATV systems, and as general-purpose amplifier for v.h.f. and u.h.f. applications.

QUICK REFERENCE DATA

Frequency range	f		40 to 860	MHz
Source and load (characteristic) impedance	$R_s = R_\ell = Z_o$	=	75	Ω
Transducer gain	$G_{tr} = \lvert s_f \rvert^2$	typ.	28	dB
Flatness of frequency response	$\pm\Delta\lvert s_f \rvert^2$	typ.	1	dB
Output voltage at −60 dB intermodulation distortion (DIN 45004, 3-tone)	$V_{o(rms)}$	>	105	dBμV
Noise figure	F	typ.	6	dB
D.C. supply voltage	V_B	=	12	V ± 10%
Operating ambient temperature	T_{amb}		−20 to +70	°C

ENCAPSULATION 8-pin, in-line, resin-coated body, see MECHANICAL DATA (Fig. 2)

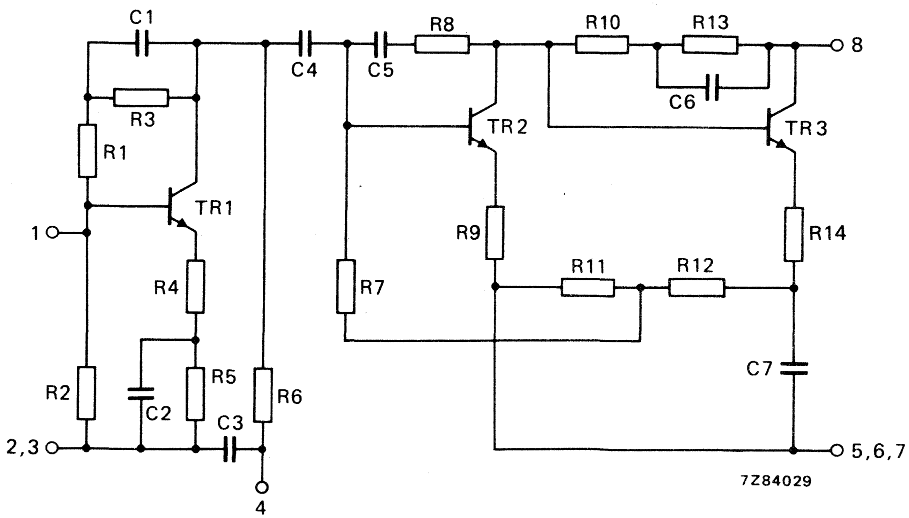


Fig. 1 Circuit diagram.

RATINGS

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

Operating ambient temperature	T_{amb}		−20 to +70	°C
Storage temperature	T_{stg}		−40 to +125	°C
D.C. supply voltage	V_B	max.	15	V
Peak incident powers on pins 1 and 8	P_{I1M}, P_{I8M}	max.	100	mW

CHARACTERISTICS

Measuring conditions

Ambient temperature	T_{amb}	=	25	°C
D.C. supply voltage	V_B	=	12	V
Source impedance and load impedance	R_s, R_ℓ	=	75	Ω
Characteristic impedance of h.f. connections	Z_o	=	75	Ω
Frequency range	f	=	40 to 860	MHz

Performance

Supply current	I_B	typ.	50	mA
Transducer gain	$G_{tr} = \|s_f\|^2$	typ.	28	dB
			26 to 31	dB
Flatness of frequency response	$\pm\Delta\|s_f\|^2$	typ.	1	dB
Individual maximum v.s.w.r.				
input	$VSWR_{(i)}$	typ.	1,5	*
output	$VSWR_{(o)}$	typ.	1,7	*
Back attenuation				
f = 100 MHz	$\|s_r\|^2$	typ.	45	dB
f = 860 MHz	$\|s_r\|^2$	typ.	35	dB
Output voltage at −60 dB intermodulation distortion (DIN 45004, par. 6,3; 3-tone)	$V_{o(rms)}$	>	105	dBμV
		typ.	107	dBμV
Noise figure	F	typ.	6	dB

s-parameters:	$s_f = s_{21}$	$s_i = s_{11}$
	$s_r = s_{12}$	$s_o = s_{22}$

* Highest value, for a sample, occurring in the frequency range.

OPERATING CONDITIONS

Ambient temperature range	T_{amb}		−20 to +70	°C
D.C. supply voltage	V_B	=	12	V ± 10%
Frequency range	f		40 to 860	MHz
Source impedance and load impedance	R_s, R_ℓ	=	75	Ω

MECHANICAL DATA

Dimensions in mm

The device is resin coated.

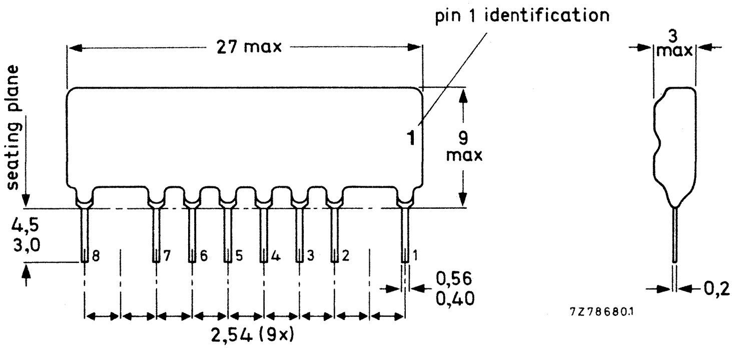


Fig. 2 Encapsulation.

Terminal connections

1	= input
2, 3, 5, 6, 7	= common
4	= supply (+)
8	= output/supply (+)

Soldering recommendations

Hand soldering

Maximum contact time for a soldering-iron temperature of 260 °C up to the seating plane is 5 s.

Dip or wave soldering

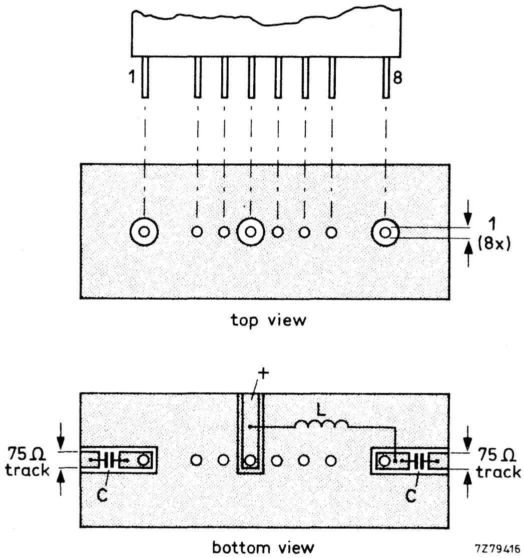
260 °C is the maximum permissible temperature of the solder; it must not be in contact with the joint for more than 5 seconds. The total contact time of successive solder waves must not exceed 5 seconds. The device may be mounted against the printed-circuit board, but the temperature of the device must not exceed 125 °C. If the printed-circuit board has been pre-heated, forced cooling may be necessary immediately after soldering to keep the temperature below the allowable limit.

Mounting recommendations

The module should preferably be mounted on double-sided printed-circuit board, see the example shown below.

Input and output should be connected to 75 Ω tracks.

The connections to the 'common' pins should be as close to the seating plane as possible.



L > 5 μH; e.g. catalogue no. 3122 108 20150 or 27 turns enamelled Cu wire (0,3 mm) wound on a ferrite core (material 4B1; catalogue number 3122 104 91110) with a diameter of 1,6 mm.
C > 220 pF ceramic capacitor.

Fig. 3 Printed-circuit board holes and tracks.

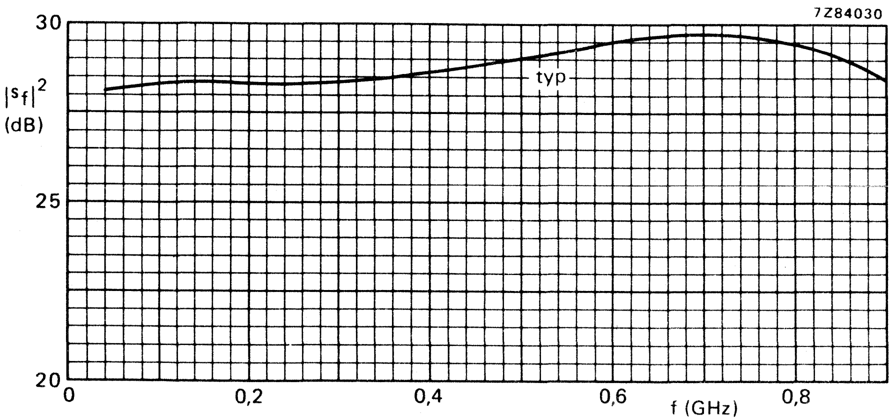


Fig. 4 Transducer gain as a function of frequency; $Z_o = 75\ \Omega$.

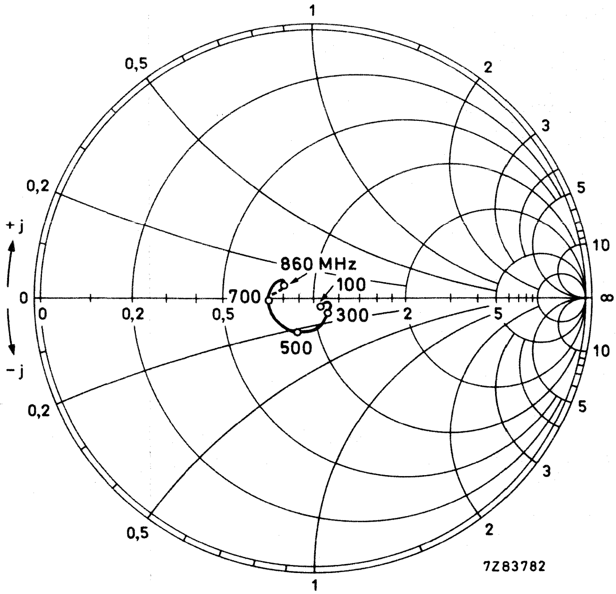


Fig. 5 Input impedance derived from input reflection coefficient s_i, co-ordinates in ohm x 75; typical values.

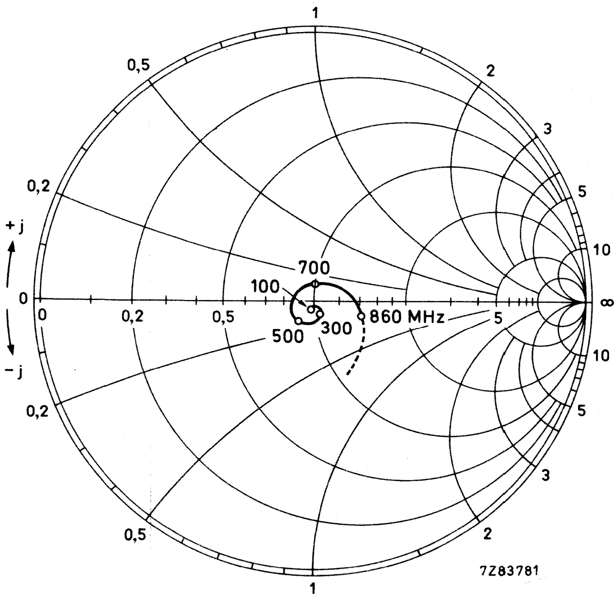


Fig. 6 Output impedance derived from output reflection coefficient s_o, co-ordinates in ohm x 75; typical values.

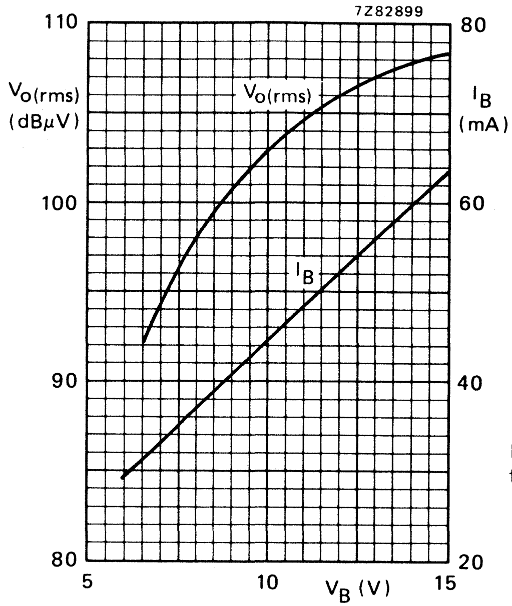


Fig. 7 Output voltage and supply current as a function of the supply voltage; typical values.

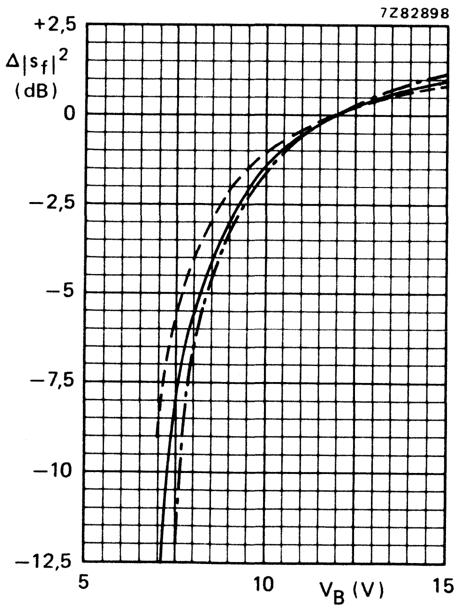


Fig. 8 Variation of transducer gain with supply voltage; reference 0 dB at 12 V;
——— f = 500 MHz;
– – – – f = 100 MHz;
—·—·—· f = 860 MHz;
typical values.

HYBRID INTEGRATED CIRCUIT VHF/UHF WIDE-BAND AMPLIFIER

Three-stage wide-band amplifier in hybrid integrated circuit technique on a thin-film substrate, intended for use in mast-head booster-amplifiers, as an amplifier in MATV and CATV systems, and as general-purpose amplifier for v.h.f. and u.h.f. applications.

QUICK REFERENCE DATA

Frequency range	f		40 to 860	MHz
Source and load (characteristic) impedance	$R_s = R_\ell = Z_o$	=	75	Ω
Transducer gain	$G_{tr} = \|s_f\|^2$	typ.	28	dB
Flatness of frequency response	$\pm\Delta\|s_f\|^2$	typ.	1	dB
Output voltage at −60 dB intermodulation distortion (DIN 45004, 3-tone)				
VHF	$V_{o(rms)}$	typ.	113	dBμV
UHF	$V_{o(rms)}$	typ.	112	dBμV
Noise figure	F	typ.	7	dB
D.C. supply voltage	V_B	=	12	V ± 10%
Operating ambient temperature	T_{amb}		−20 to +70	°C

ENCAPSULATION 9-pin, in-line, resin-coated body, see MECHANICAL DATA (Fig.2)

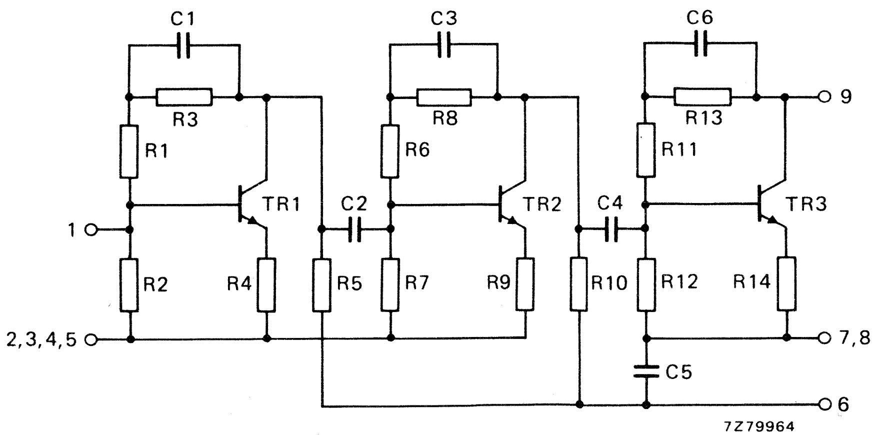


Fig. 1 Circuit diagram.

RATINGS

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

Operating ambient temperature	T_{amb}		−20 to +70	°C
Storage temperature	T_{stg}		−40 to +125	°C
D.C. supply voltage	V_B	max.	15	V
Peak incident powers on pins 1 and 8	P_{I1M}, P_{I8M}	max.	100	mW

CHARACTERISTICS

Measuring conditions

Ambient temperature	T_{amb}	=	25	°C
D.C. supply voltage	V_B	=	12	V
Source impedance and load impedance	R_s, R_ℓ	=	75	Ω
Characteristic impedance of h.f. connections	Z_o	=	75	Ω
Frequency range	f	=	40 to 860	MHz

Performance

Supply current	I_B	typ.	105	mA
Transducer gain	$G_{tr} = \|s_f\|^2$	typ.	28	dB
			26 to 31	dB
Flatness of frequency response	$\pm\Delta\|s_f\|^2$	typ.	1	dB
Individual maximum v.s.w.r.				
input	$VSWR_{(i)}$	typ.	2,3	*
output	$VSWR_{(o)}$	typ.	1,9	*
Back attenuation				
f = 100 MHz	$\|s_r\|^2$	typ.	45	dB
f = 860 MHz	$\|s_r\|^2$	typ.	35	dB
Output voltage at −60 dB intermodulation distortion (DIN 45004, par. 6,3; 3-tone)				
VHF	$V_{o(rms)}$	>	111	dBμV
		typ.	113	dBμV
UHF	$V_{o(rms)}$	>	110	dBμV
		typ.	112	dBμV
Noise figure	F	typ.	7	dB

s-parameters:	$s_f = s_{21}$	$s_i = s_{11}$
	$s_r = s_{12}$	$s_o = s_{22}$

* Highest value, for a sample, occurring in the frequency range.

OPERATING CONDITIONS

Ambient temperature range	T_{amb}		−20 to +70	°C
D.C. supply voltage	V_B	=	12	V ± 10%
Frequency range	f		40 to 860	MHz
Source impedance and load impedance	R_s, R_ℓ	=	75	Ω

MECHANICAL DATA

Dimensions in mm

The device is resin coated.

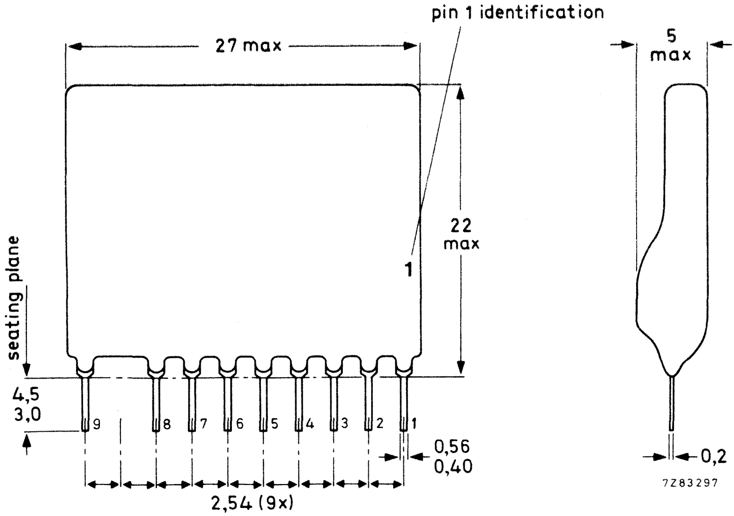


Fig. 2 Encapsulation.

Terminal connections

1	= input
2, 3, 4, 5 and 7, 8	= common
6	= supply (+)
9	= output/supply (+)

Soldering recommendations

Hand soldering

Maximum contact time for a soldering-iron temperature of 260 °C up to the seating plane is 5 s.

Dip or wave soldering

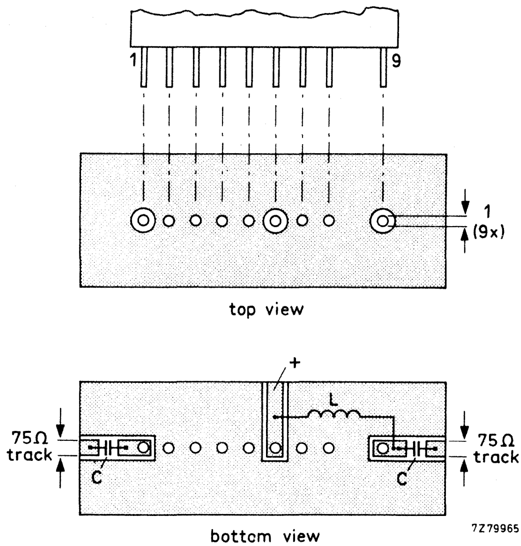
260 °C is the maximum permissible temperature of the solder; it must not be in contact with the joint for more than 5 seconds. The total contact time of successive solder waves must not exceed 5 seconds. The device may be mounted against the printed-circuit board, but the temperature of the device must not exceed 125 °C. If the printed-circuit board has been pre-heated, forced cooling may be necessary immediately after soldering to keep the temperature below the allowable limit.

Mounting recommendations

The module should preferably be mounted on double-sided printed-circuit board, see the example shown below.

Input and output should be connected to 75 Ω tracks.

The connections to the 'common' pins should be as close to the seating plane as possible.



L > 5 μH; e.g. catalogue no. 3122 108 20150 or 27 turns enamelled Cu wire (0,3 mm) wound on a ferrite core (material 4B1; catalogue no. 3122 104 91110) with a diameter of 1,6 mm.
C > 220 pF ceramic capacitor.

Fig. 3 Printed-circuit board holes and tracks.

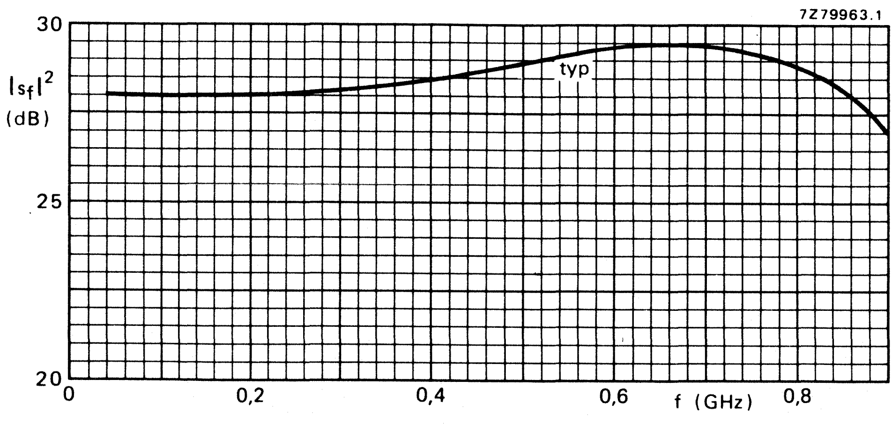


Fig. 4 Transducer gain as a function of frequency; Z_o = 75 Ω.

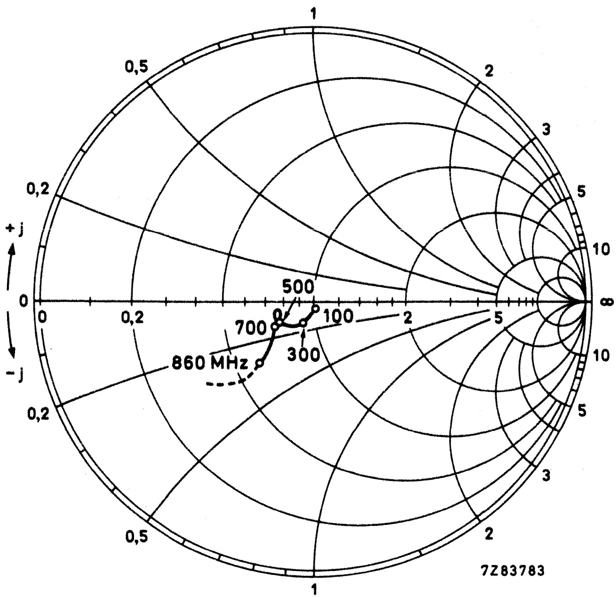


Fig. 5 Input impedance derived from input reflection coefficient s_i, co-ordinates in ohm x 75; typical values.

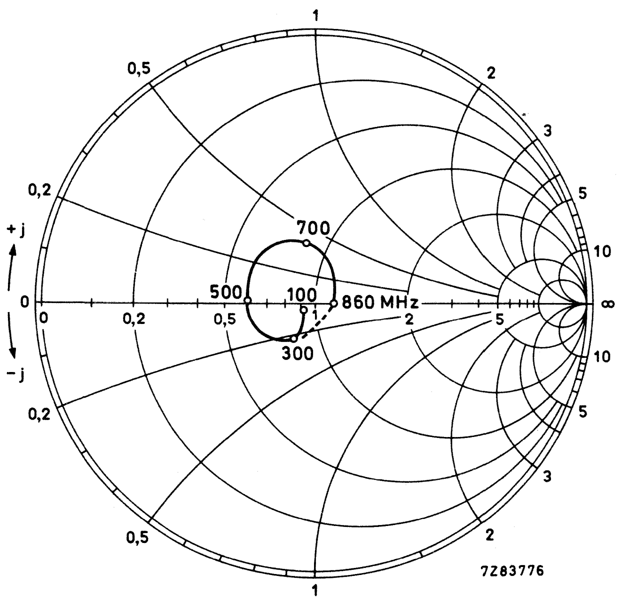


Fig. 6 Output impedance derived from output reflection coefficient s_o, co-ordinates in ohm x 75; typical values.

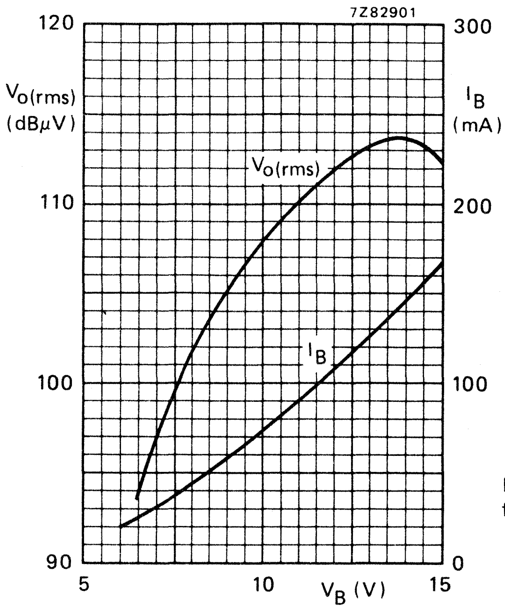


Fig. 7 Output voltage and supply current as a function of the supply voltage; typical values.

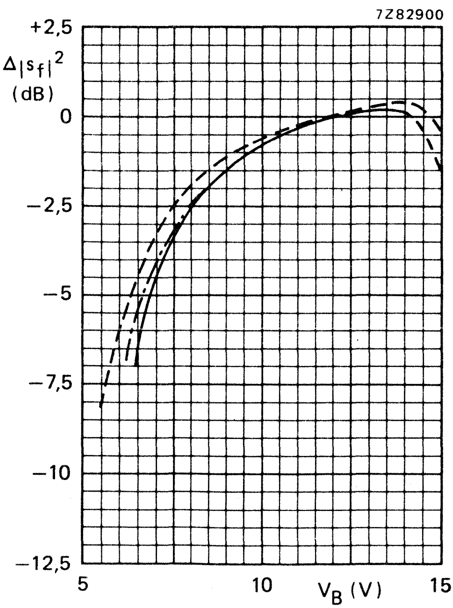
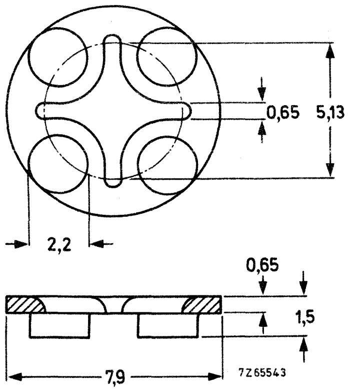


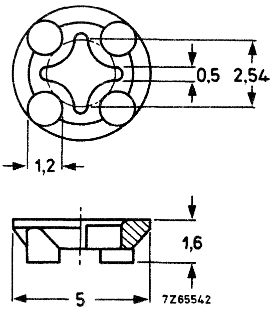
Fig. 8 Variation of transducer gain with supply voltage; reference 0 dB at 12 V;
——— f = 500 MHz;
– – – – f = 100 MHz;
—.—.—. f = 860 MHz;
typical values.

MECHANICAL DATA

Dimensions in mm



Distance disc 56245 for TO-5 or TO-39; insulating material.

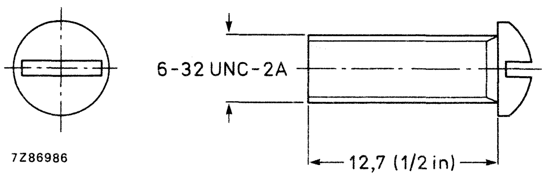


Distance disc 56246 for TO-18 or TO-72; insulating material.

Maximum permissible temperature: 100 °C.

ROUND HEAD SCREW 6-32 UNC-2A

Available, upon request, under type number 56396 or 12 NC code number 9390 298 10xx0.



INDEX OF TYPE NUMBERS

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

Mm = Microminiature semiconductors for hybrid circuits
SD = Small-signal diodes
Sp = Special diodes
T = Tuner diodes
Vrg = Voltage regulator diodes
Sm = Small-signal transistors

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

P = Low-frequency power transistors

P = Low-frequency power transistors

FET = Field-effect transistors
HVP = High-voltage power transistors
Mm = Microminiature semiconductors for hybrid circuits
P = Low-frequency power transistors
Sm = Small-signal transistors
WBT = Wideband hybrid IC transistors

* = series
FET = Field-effect transistors
Mm = Microminiature semiconductors for hybrid circuits
RFP = R.F. power transistors and modules
RT = Tripler
Sm = Small-signal transistors
ThM = Thyristor modules
WBM = Wideband hybrid IC modules
WBT = Wideband hybrid IC transistors

RFP = R.F. power transistors and modules
WBM = Wideband hybrid IC modules

* = series
FET = Field-effect transistors
Mm = Microminiature semiconductors for hybrid circuits
Sm = Small-signal transistors
PDT = Photodiodes or transistors
Th = Thyristors
Tri = Triacs

* = series
PM = Power MOS transistors
R = Rectifier diodes
SP = Low-frequency switching power transistors
Th = Thyristors
Tri = Triacs

* = series
Mm = Microminiature semiconductors for hybrid circuits
R = Rectifier diodes
TS = Transient suppressor diodes
Vrf = Voltage reference diodes
Vrg = Voltage regulator diodes

* = series
D = Displays
LED = Light-emitting diodes
P = Low-frequency power transistors
Ph = Photoconductive devices
PhC = Photocouplers
St = Rectifier stacks
WBM = Wideband hybrid IC modules
Vrg = Voltage regulator diodes

* = series
FET = Field-effect transistors
I = Infrared devices
P = Low-frequency power transistors
Ph = Photoconductive devices
R = Rectifier diodes
RFP = R.F. power transistors and modules
SD = Small-signal diodes
Sm = Small-signal transistors
St = Rectifier stacks
Vrf = Voltage reference diodes
WBT = Wideband hybrid IC transistors

A = Accessories
FET = Field-effect transistors
I = Infrared devices
Ph = Photoconductive devices
RFP = R.F. power transistors and modules
Sm = Small-signal transistors

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