DATA SHEET

BLW50F
HF/VHF power transistor

Product specification

August 1986

Philips
Semiconductors

PHILIPS

HF/VHF power transistor BLW50F

DESCRIPTION

N-P-N silicon planar epitaxial transistor primarily intended for use in class-A, AB and B operated, industrial and military transmitters in the h.f. and v.h.f. band. Resistance stabilization provides protection against device damage at severe load mismatch conditions. Matched h_{FE} groups are available on request.

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

QUICK REFERENCE DATA

R.F. performance

MODE OF OPERATION	V_{CE} V	f MHz	P_L W	G_p dB	η_{dt} %	I_C A	$I_{C(ZS)}$ mA	d_3 dB	T_h °C
s.s.b. (class-A)	45	1,6 - 28	0 - 16 (P.E.P.)	> 19,5	–	1,2	–	< –40	70
s.s.b. (class-AB)	50	1,6 - 28	10 - 65 (P.E.P.)	typ. 18	typ. 45(1)	1,45	50	typ. –30	25

Note

1. At 65W P.E.P.

PIN CONFIGURATION

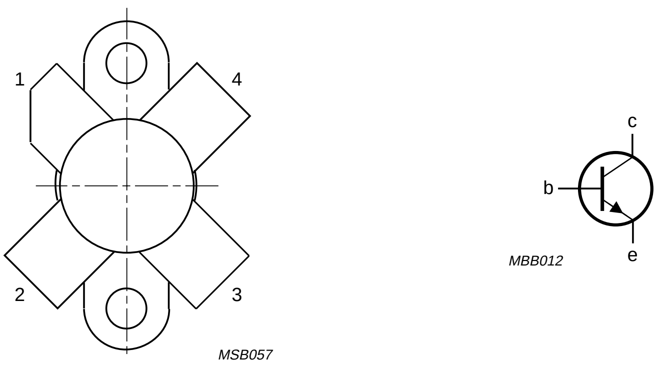


Fig.1 Simplified outline and symbol.

PINNING - SOT123

PIN	DESCRIPTION
1	collector
2	emitter
3	base
4	emitter

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.

RATINGS

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

Collector-emitter voltage (V_{BE} = 0)				
peak value	V_{CESM}	max.	110	V
Collector-emitter voltage (open base)	V_{CEO}	max.	55	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4	V
Collector current (average)	$I_{C(AV)}$	max.	2,5	A
Collector current (peak value); f > 1 MHz	I_{CM}	max.	7,5	A
D.C. and r.f. (f > 1 MHz) power dissipation; T_{mb} = 25 °C	P_{tot}; P_{rf}	max.	94	W
Storage temperature	T_{stg}		–65 to + 150	°C
Operating junction temperature	T_j	max.	200	°C

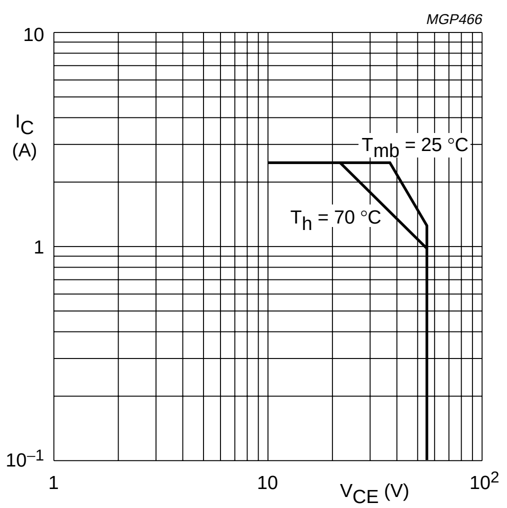
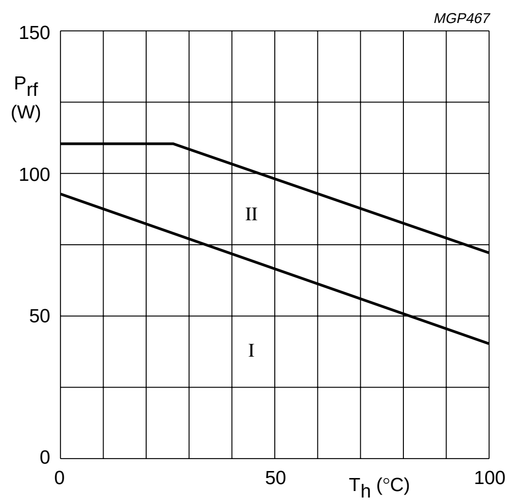


Fig.2 D.C. SOAR.



I Continuous d.c. and r.f. operation
II Short-time operation during mismatch

Fig.3 Power derating curves vs. temperature.

THERMAL RESISTANCE

(dissipation = 54 W; T_{mb} = 86 °C, i.e. T_h = 70 °C)

From junction to mounting base (d.c. and r.f. dissipation)	$R_{th\ j\text{-}mb}$	=	2,1	K/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,3	K/W

CHARACTERISTICS

T_j = 25 °C

Collector-emitter breakdown voltage				
V_{BE} = 0; I_C = 25 mA	$V_{(BR)\,CES}$	>	110	V
Collector-emitter breakdown voltage				
open base; I_C = 100 mA	$V_{(BR)\,CEO}$	>	55	V
Emitter-base breakdown voltage				
open collector; I_E = 10 mA	$V_{(BR)EBO}$	>	4	V
Collector cut-off current				
V_{BE} = 0; V_{CE} = 55 V	I_{CES}	<	10	mA
Second breakdown energy; L = 25 mH; f = 50 Hz				
open base	E_{SBO}	>	8	mJ
R_{BE} = 10 Ω	E_{SBR}	>	8	mJ
D.C. current gain(1)				
I_C = 1,2 A; V_{CE} = 5 V	h_{FE}	typ.	25	
			15 to 100	
D.C. current gain ratio of matched devices(1)				
I_C = 1,2 A; V_{CE} = 5 V	h_{FE1}/h_{FE2}	<	1,2	
Collector-emitter saturation voltage(1)				
I_C = 3,0 A; I_B = 0,6 A	V_{CEsat}	typ.	1,2	V
Transition frequency at f = 100 MHz(1)				
$-I_E$ = 1,2 A; V_{CB} = 45 V	f_T	typ.	490	MHz
$-I_E$ = 4,0 A; V_{CB} = 45 V	f_T	typ.	540	MHz
Collector capacitance at f = 1 MHz				
$I_E = I_e$ = 0; V_{CB} = 45 V	C_c	typ.	53	pF
Feedback capacitance at f = 1 MHz				
I_C = 50 mA; V_{CE} = 45 V	C_{re}	typ.	35	pF
Collector-flange capacitance	C_{cf}	typ.	2	pF

Note

1. Measured under pulse conditions: $t_p \leq 200$ µs; $\delta \leq 0{,}02$.

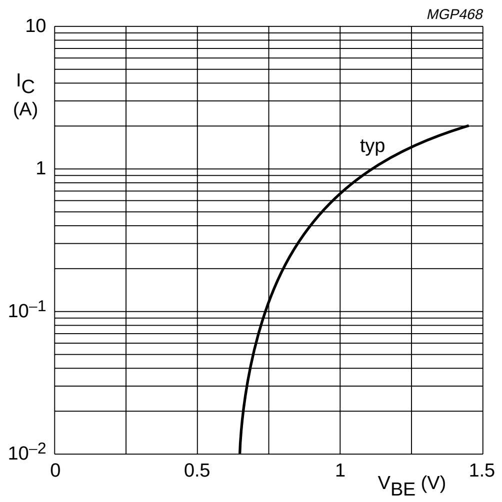


Fig.4 V_{CE} = 40 V; T_{mb} = 25 °C.

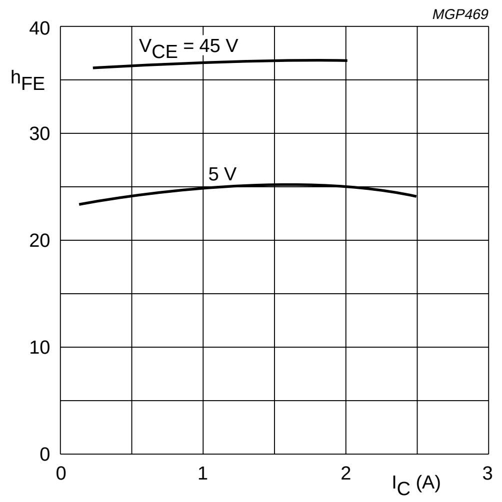


Fig.5 Typical values; T_j = 25 °C.

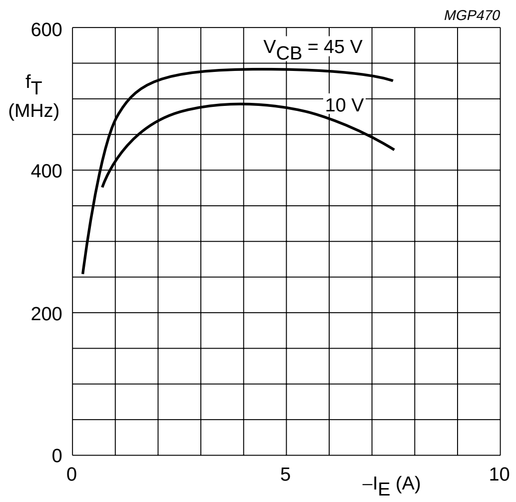


Fig.6 Typical values; f = 100 MHz; T_j = 25 °C.

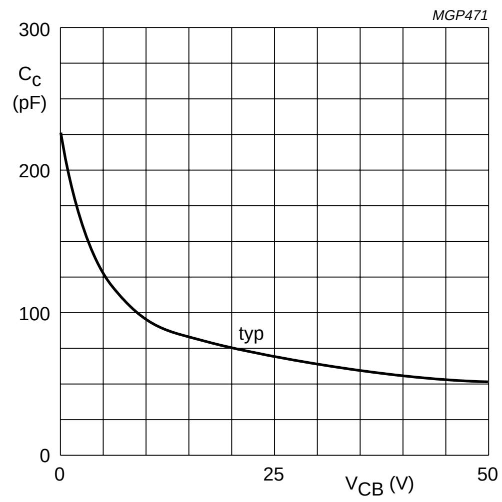


Fig.7 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

APPLICATION INFORMATION

R.F. performance in s.s.b. class-A operation (linear power amplifier)

V_{CE} = 45 V; f_1 = 28,000 MHz; f_2 = 28,001 MHz

OUTPUT POWER W	G_p dB	I_C A	d_3 (1) dB	d_5 (1) dB	T_h °C
> 16 (P.E.P.)	> 19,5	1,2	−40	< −40	70
typ. 17 (P.E.P.)	typ. 20,5	1,2	−40	< −40	70

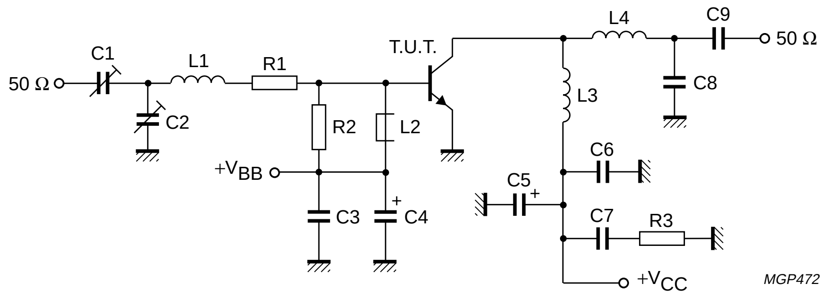


Fig.8 Test circuit; s.s.b. class-A.

List of components in Fig.8:

C1 = C2 = 10 to 780 pF film dielectric trimmer

C3 = 22 nF ceramic capacitor (63 V)

C4 = 4,7 µF/16 V electrolytic capacitor

C5 = 1 µF/75 V solid tantalum capacitor

C6 = C7 = 47 nF polyester capacitor (100 V)

C8 = 68 pF ceramic capacitor (500 V)

C9 = 3,9 nF ceramic capacitor

L1 = 3 turns closely wound enamelled Cu wire (1,0 mm); int. dia 9,0 mm; leads 2 × 5 mm

L2 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)

L3 = 1,05 µH; 15 turns enamelled Cu wire (1,0 mm); int. dia. 10 mm; length 17,4 mm; leads 2 × 5 mm

L4 = 162 nH; 6 turns enamelled Cu wire (1,0 mm); int. dia. 7,0 mm; length 11,6 mm; leads 2 × 5 mm

R1 = 1,6 Ω; parallel connection of 3 × 4,7 Ω carbon resistors (± 5%; 0,125 W)

R2 = 47 Ω carbon resistor (± 5%; 0,25 W)

R3 = 4,7 Ω carbon resistor (± 5%; 0,25 W)

Note

1. Stated intermodulation distortion figures are referred to the according level of either of the equal amplified tones. Relative to the according peak envelope powers these figures should be increased by 6 dB.

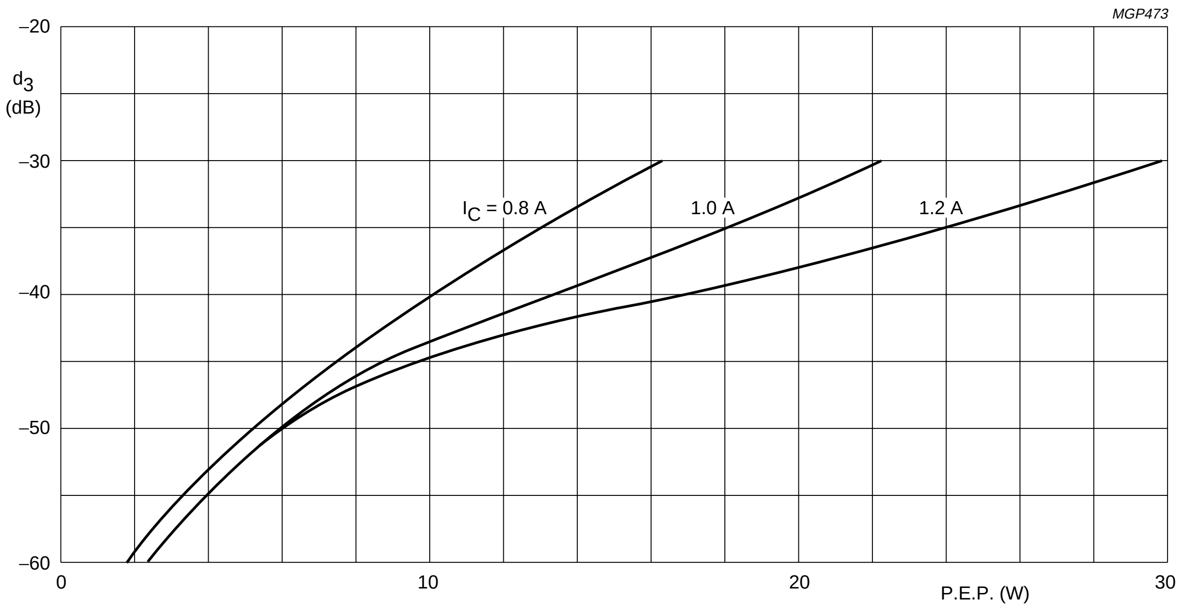


Fig.9 Intermodulation distortion (see note on previous page) as a function of output power. Typical values; V_{CE} = 45 V; f_1 = 28,000 MHz; f_2 = 28,001 MHz; T_h = 70 °C.

R.F. performance in s.s.b. class-AB operation (linear power amplifier)
V_{CE} = 50 V; f_1 = 28,000 MHz; f_2 = 28,001 MHz

OUTPUT POWER W	G_p dB	η_{dt}(%) AT 65 W P.E.P.	I_C (A) AT 65 W P.E.P.	d_3[1] dB	d_5[1] dB	$I_{C(ZS)}$ mA	T_h °C
10 to 65 (P.E.P.)	typ. 18	typ. 45	typ. 1,45	typ. –30	< –30	50	25

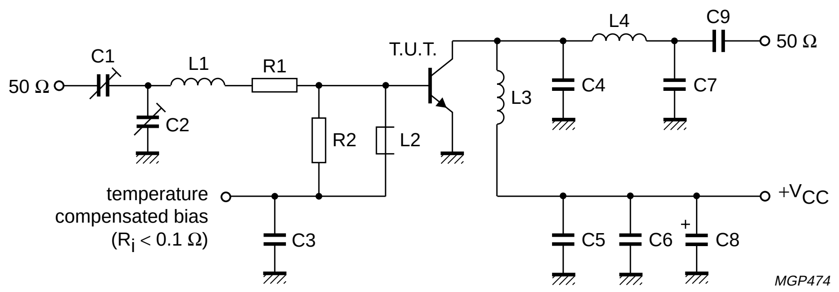


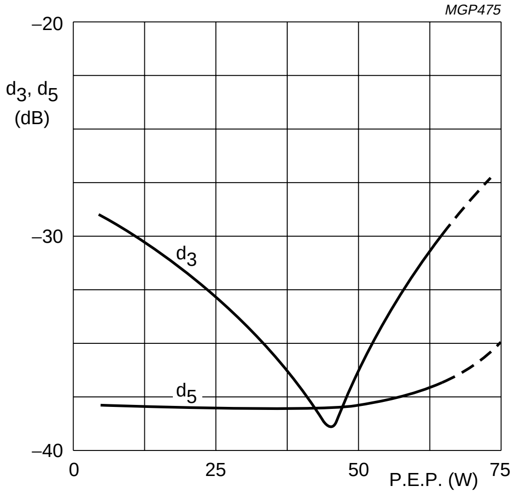
Fig.10 Test circuit; s.s.b. class-AB.

List of components:

C1 = C2 = 10 to 780 pF film dielectric trimmer
C3 = C5 = C6 = 220 nF polyester capacitor
C4 = 120 pF ceramic capacitor (500 V)
C7 = 150 pF ceramic capacitor (500 V)
C8 = 47µF/63 V electrolytic capacitor
C9 = 3,9 nF ceramic capacitor
L1 = 4 turns closely wound enamelled Cu wire (1,6 mm); int. dia 7,0 mm; leads 2 × 5 mm
L2 = Ferroxcube wide-band h.f. choke, grade 3B (cat.no. 4312 020 36640)
L3 = 9 turns enamelled Cu wire (1,0 mm); int. dia. 10 mm; length 14,5 mm; leads 2 × 5 mm
L4 = 6 turns enamelled Cu wire (1,0 mm); int. dia. 6,5 mm; length 11,0 mm; leads 2 × 5 mm
R1 = 2,4 Ω; parallel connection of 2 × 4,7 Ω carbon resistors
R2 = 39 Ω carbon resistor

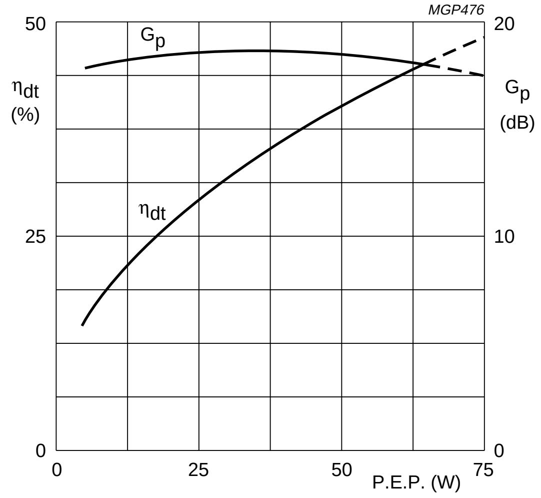
Note

1. Stated intermodulation distortion figures are referred to the according level of either of the equal amplified tones. Relative to the according peak envelope powers these figures should be increased by 6 dB.



V_{CE} = 50 V; $I_{C(ZS)}$ = 50 mA; f_1 = 28,000 MHz; f_2 = 28,001 MHz; T_h = 25 °C; typical values.

Fig.11 Intermodulation distortion as a function of output power[(1)].



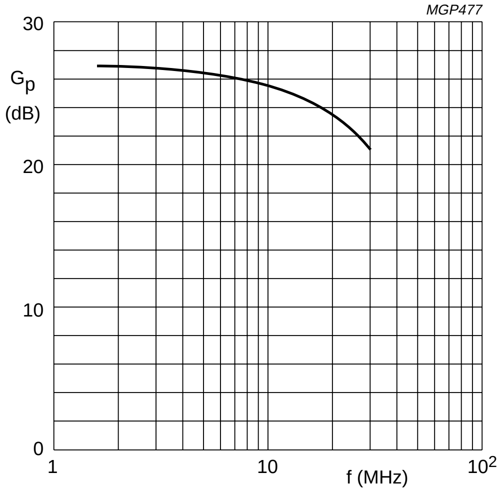
V_{CE} = 50 V; $I_{C(ZS)}$ = 50 mA; f_1 = 28,000 MHz; f_2 = 28,001 MHz; T_h = 25 °C; typical values.

Fig.12 Double-tone efficiency and power gain as a function of output power.

Ruggedness in s.s.b. operation

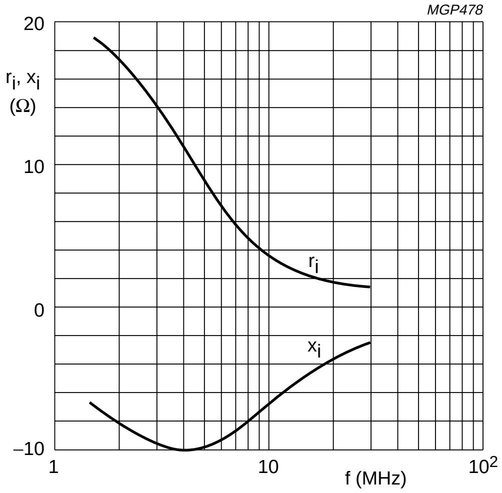
The BLW50F is capable of withstanding full load mismatch (VSWR = 50 through all phases) up to 45 W (P.E.P.) under the following conditions:

V_{CE} = 50 V; f_1 = 28,000 MHz; f_2 = 28,001 MHz; T_h = 70 °C; $R_{th\ mb\text{-}h}$ = 0,3 K/W.



V_{CE} = 50 V; $I_{C(ZS)}$ = 50 mA; P_L = 60 W;
T_h = 25 °C; Z_L = 16 Ω.

Fig.13 Power gain as a function of frequency.



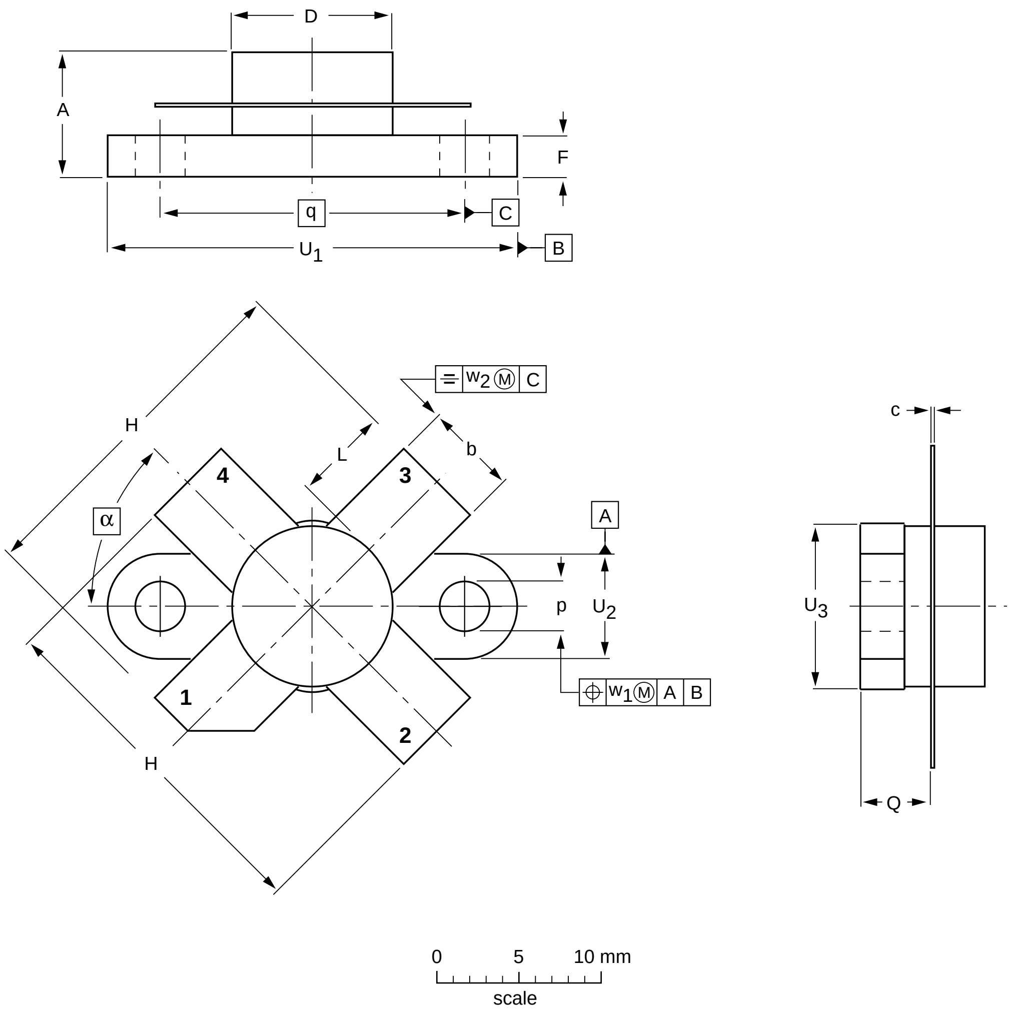
V_{CE} = 50 V; $I_{C(ZS)}$ = 50 mA; P_L = 60 W;
T_h = 25 °C; Z_L = 16 Ω.

Fig.14 Input impedance (series components) as a function of frequency.

Figs 13 and 14 are typical curves and hold for an unneutralized amplifier in s.s.b. class-AB operation.

PACKAGE OUTLINE

Flanged ceramic package; 2 mounting holes; 4 leads | **SOT123A**



DIMENSIONS (millimetre dimensions are derived from the original inch dimensions)

UNIT	A	b	c	D	D_1	F	H	L	p	Q	q	U_1	U_2	U_3	w_1	w_2	α
mm	7.47 6.37	5.82 5.56	0.18 0.10	9.73 9.47	9.63 9.42	2.72 2.31	20.71 19.93	5.61 5.16	3.33 3.04	4.63 4.11	18.42	25.15 24.38	6.61 6.09	9.78 9.39	0.51	1.02	45°
inches	0.294 0.251	0.229 0.219	0.007 0.004	0.383 0.373	0.397 0.371	0.107 0.091	0.815 0.785	0.221 0.203	0.131 0.120	0.182 0.162	0.725	0.99 0.96	0.26 0.24	0.385 0.370	0.02	0.04	

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT123A						97-06-28

DEFINITIONS

Data Sheet Status	
Objective specification	This data sheet contains target or goal specifications for product development.
Preliminary specification	This data sheet contains preliminary data; supplementary data may be published later.
Product specification	This data sheet contains final product specifications.
Limiting values	
Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 134). Stress above one or more of the limiting values may cause permanent damage to the device. These are stress ratings only and operation of the device at these or at any other conditions above those given in the Characteristics sections of the specification is not implied. Exposure to limiting values for extended periods may affect device reliability.	
Application information	
Where application information is given, it is advisory and does not form part of the specification.	

LIFE SUPPORT APPLICATIONS

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