DISCRETE SEMICONDUCTORS

DATA SHEET

BLV21
VHF power transistor

Product specification

August 1986

Philips
Semiconductors

VHF power transistor BLV21

DESCRIPTION

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

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

QUICK REFERENCE DATA

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

MODE OF OPERATION	V_{CE} V	f MHz	P_L W	G_p dB	η %	$\overline{z_I}$ Ω	$\overline{Y_L}$ mS
c.w.	28	175	15	> 10	> 65	1,4 + j1,85	33 – j27,5

PIN CONFIGURATION

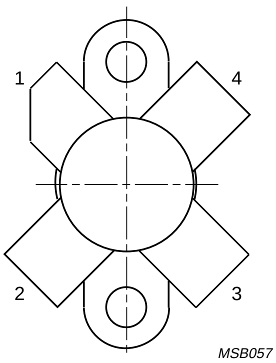


Fig.1 Simplified outline, SOT123.

PINNING

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

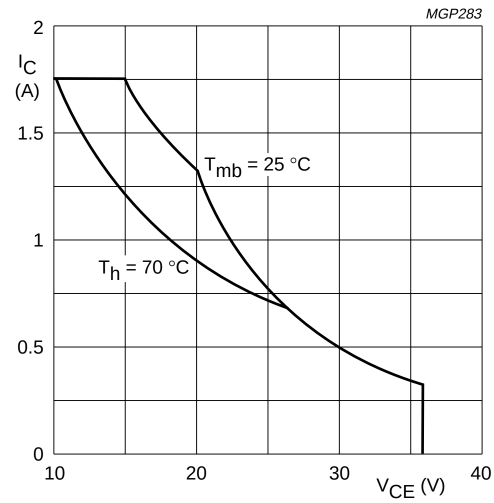


Fig.2 D.C. SOAR.

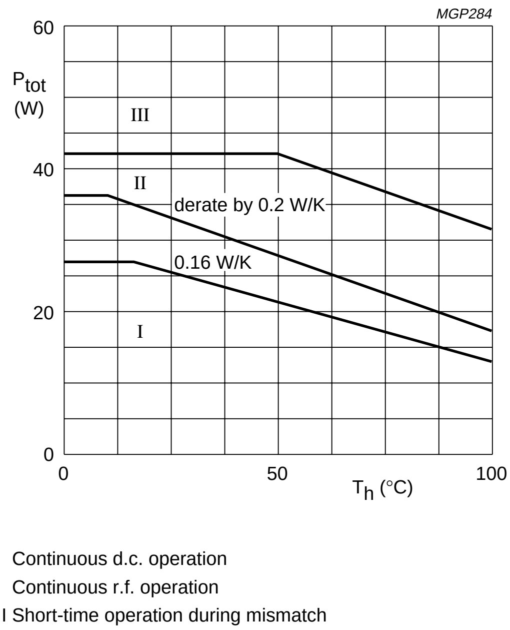


Fig.3 R.F. power dissipation; V_{CE} ≤ 28 V; f > 1 MHz.

THERMAL RESISTANCE

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

From junction to mounting base (d.c. dissipation)	$R_{th\ j\text{-}mb(dc)}$	=	6,55	K/W
From junction to mounting base (r.f. dissipation)	$R_{th\ j\text{-}mb(rf)}$	=	4,95	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 = 5 mA	$V_{(BR)\,CES}$	>	65	V
Collector-emitter breakdown voltage				
open base; I_C = 25 mA	$V_{(BR)\,CEO}$	>	36	V
Emitter-base breakdown voltage				
open collector; I_E = 2 mA	$V_{(BR)EBO}$	>	4	V
Collector cut-off current				
V_{BE} = 0; V_{CE} = 36 V	I_{CES}	<	2	mA
Second breakdown energy; L = 25 mH; f = 50 Hz				
open base	E_{SBO}	>	2,5	mJ
R_{BE} = 10 Ω	E_{SBR}	>	2,5	mJ
D.C. current gain[(1)]		typ.	50	
I_C = 0,7 A; V_{CE} = 5 V	h_{FE}		10 to 100	
Collector-emitter saturation voltage[(1)]				
I_C = 2 A; I_B = 0,4 A	V_{CEsat}	typ.	0,65	V
Transition frequency at f = 100 MHz[(1)]				
$-I_E$ = 0,7 A; V_{CB} = 28 V	f_T	typ.	650	MHz
$-I_E$ = 2 A; V_{CB} = 28 V	f_T	typ.	625	MHz
Collector capacitance at f = 1 MHz				
$I_E = I_e$ = 0; V_{CB} = 28 V	C_c	typ.	18	pF
Feedback capacitance at f = 1 MHz				
I_C = 100 mA; V_{CE} = 28 V	C_{re}	typ.	12,8	pF
Collector-flange capacitance	C_{cf}	typ.	2	pF

Note

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

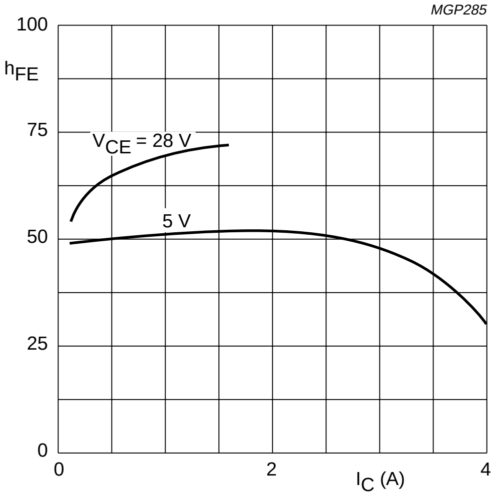


Fig.4 Typical values; T_j = 25 °C.

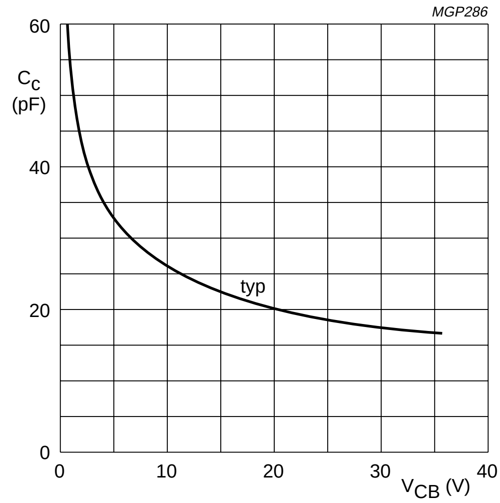


Fig.5 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

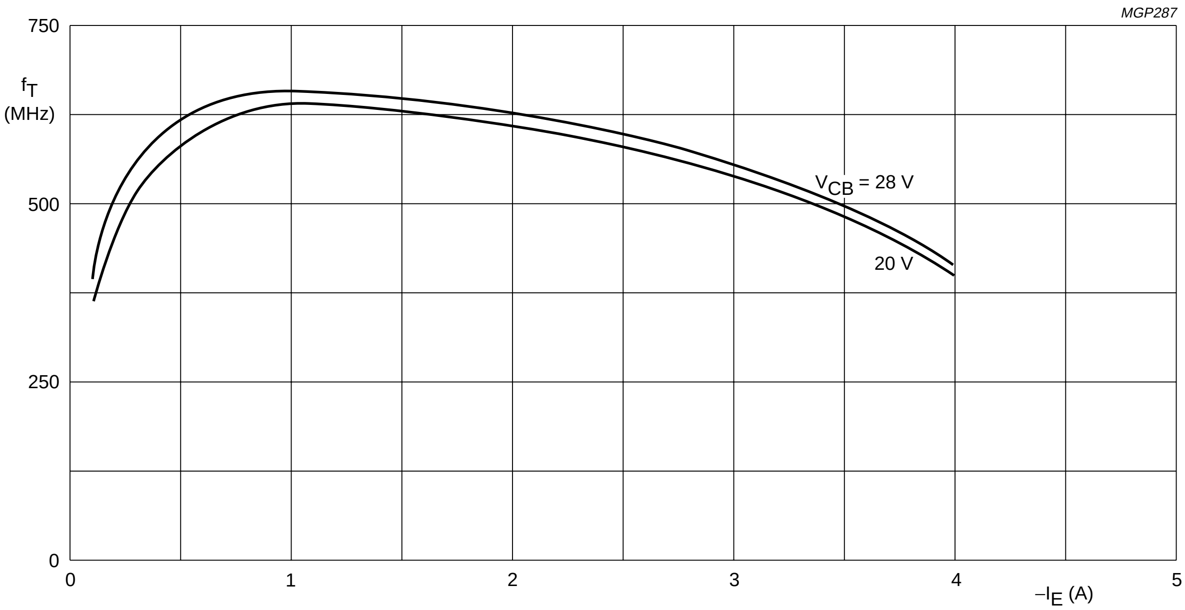


Fig.6 Typical values; f = 100 MHz; T_j = 25 °C.

APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit) T_h = 25 °C

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

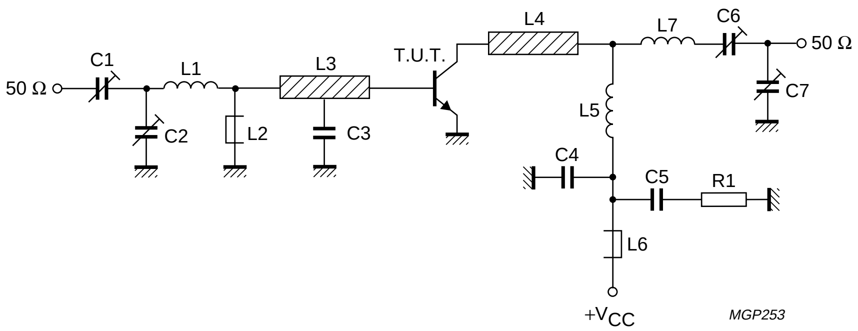


Fig.7 Test circuit; c.w. class-B.

List of components:

C1 = C7 = 2,5 to 20 pF film dielectric trimmer (cat. no. 2222 809 07004)

C2 = C6 = 5 to 60 pF film dielectric trimmer (cat. no. 2222 809 07011)

C3 = 27 pF ceramic capacitor (500 V)

C4 = 120 pF ceramic capacitor (500 V)

C5 = 100 nF polyester capacitor

L1 = 1 turn Cu wire (1,6 mm); int. dia. 8,4 mm; leads 2 × 5 mm

L2 = 7 turns closely wound enamelled Cu wire (0,5 mm); int. dia. 3 mm; leads 2 × 5 mm

L3 = L8 = Ferroxcube wide band h.f. choke, grade 3B (cat. no. 4312 020 36640)

L4 = L5 = strip (12 mm × 6 mm); tap for C3 at 5 mm from transistor

L6 = 3 turns closely wound enamelled Cu wire (1,0 mm); int. dia. 9,0 mm; leads 2 × 5 mm

L7 = 3 turns closely wound enamelled Cu wire (1,0 mm); int. dia. 8,2 mm; leads 2 × 5 mm

L4 and L5 are strips on a double Cu-clad printed-circuit board with epoxy fibre-glass dielectric, thickness 1/16".

R1 = R2 = 10 Ω carbon resistor

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

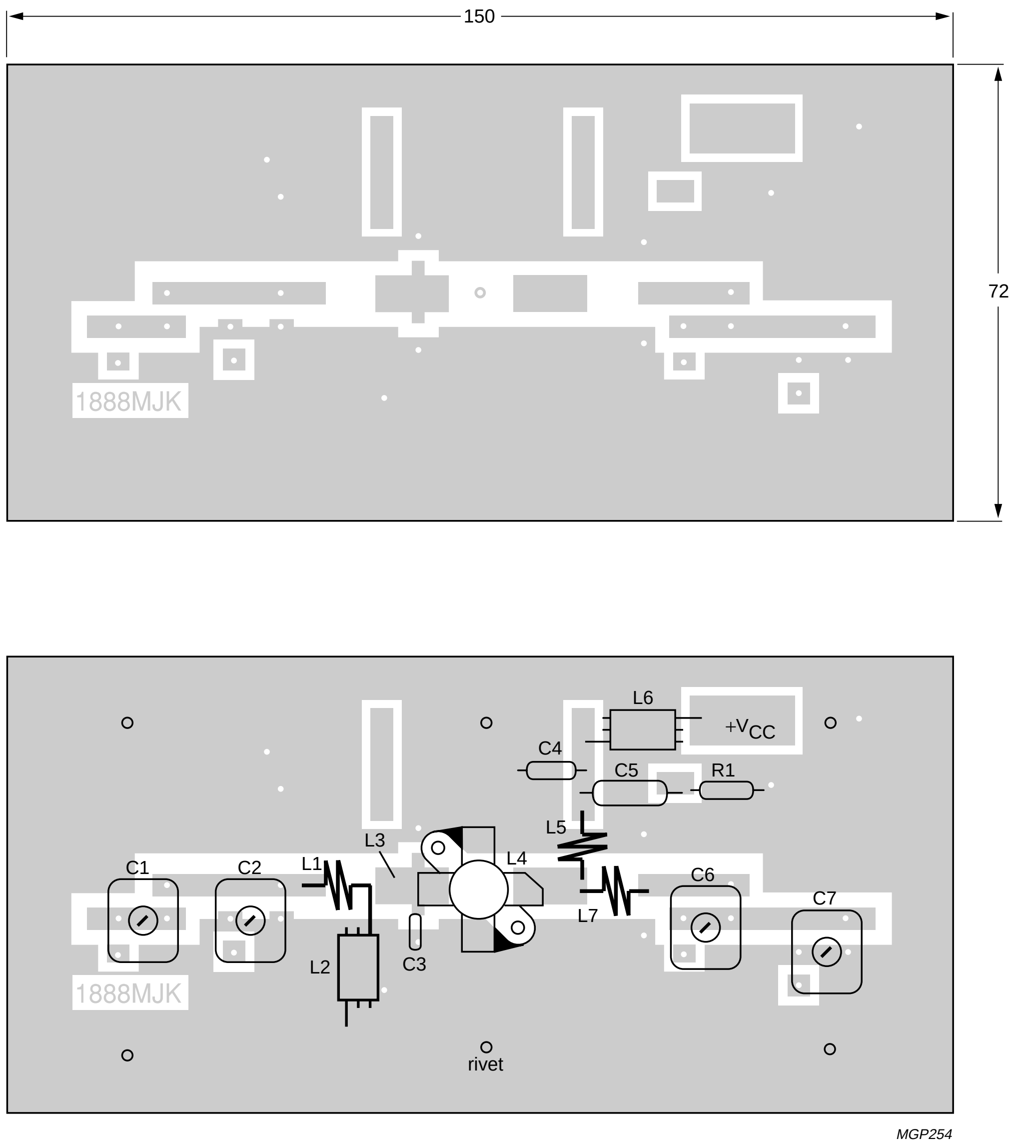


Fig.8 Component layout and printed-circuit board for 175 MHz test circuit.

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

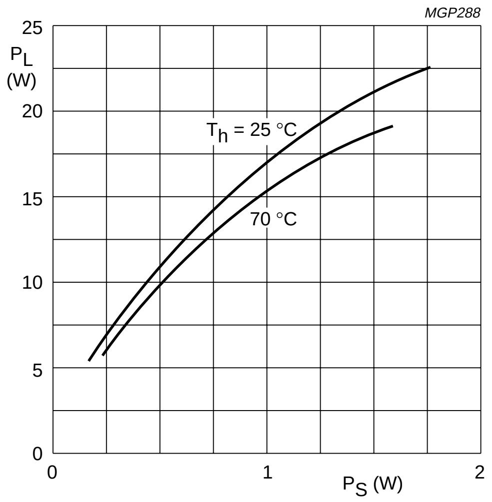


Fig.9 Typical values; V_{CE} = 28 V; f = 175 MHz.

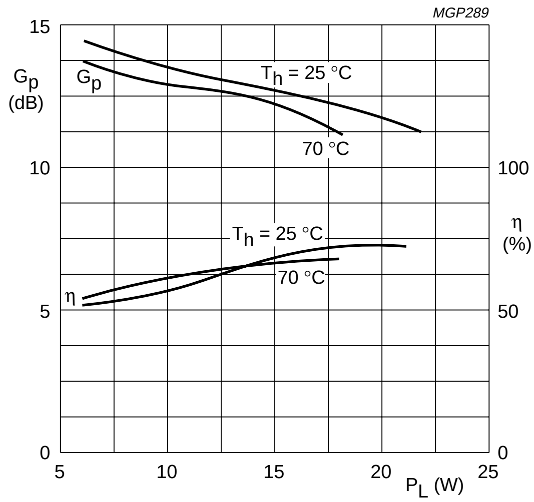
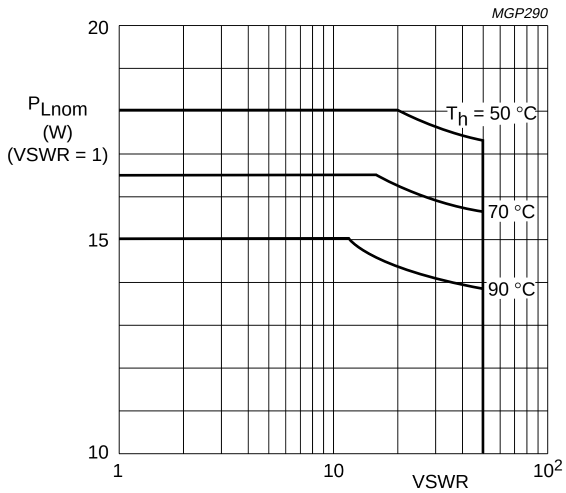
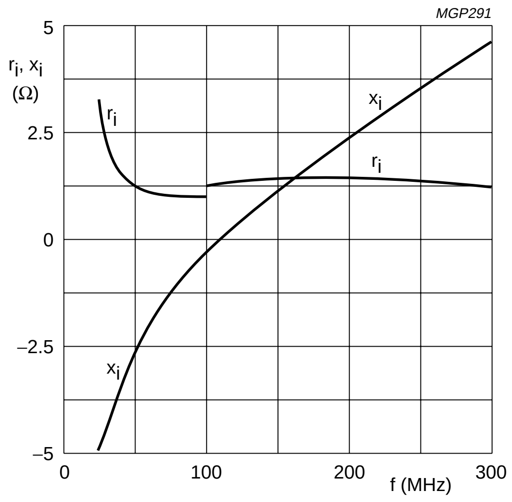


Fig.10 Typical values; V_{CE} = 28 V; f = 175 MHz.



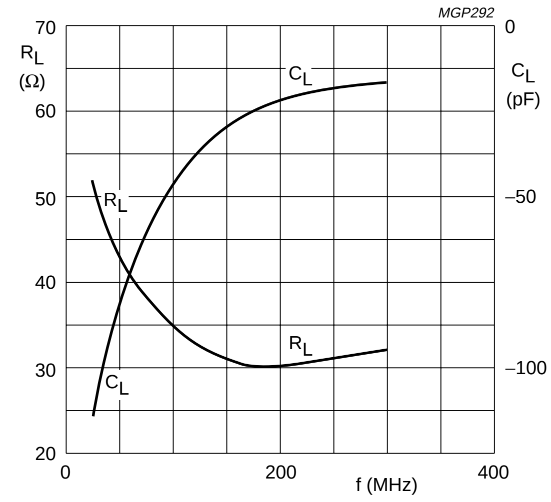
The graph shows the permissible output power under nominal conditions (VSWR = 1) as a function of the expected VSWR during short-time mismatch conditions with heatsink temperatures as parameter.

Fig.11 R.F. SOAR; c.w. class-B operation; f = 175 MHz; V_{CE} = 28 V; $R_{th\ mb-h}$ = 0,3 K/W



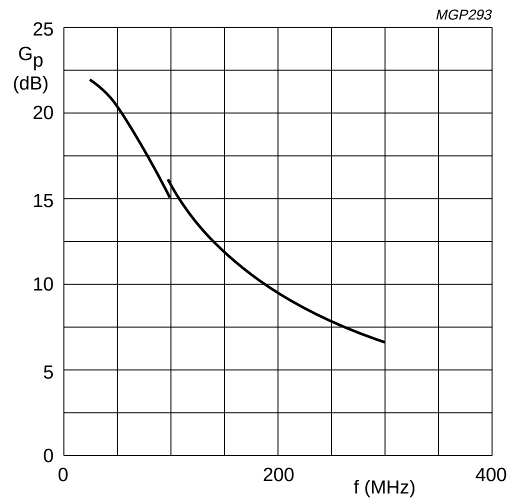
Typical values; V_{CE} = 28 V;
P_L = 15 W; T_h = 25 °C

Fig.12 Input impedance (series components).



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

Fig.13 Load impedance (parallel components).



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

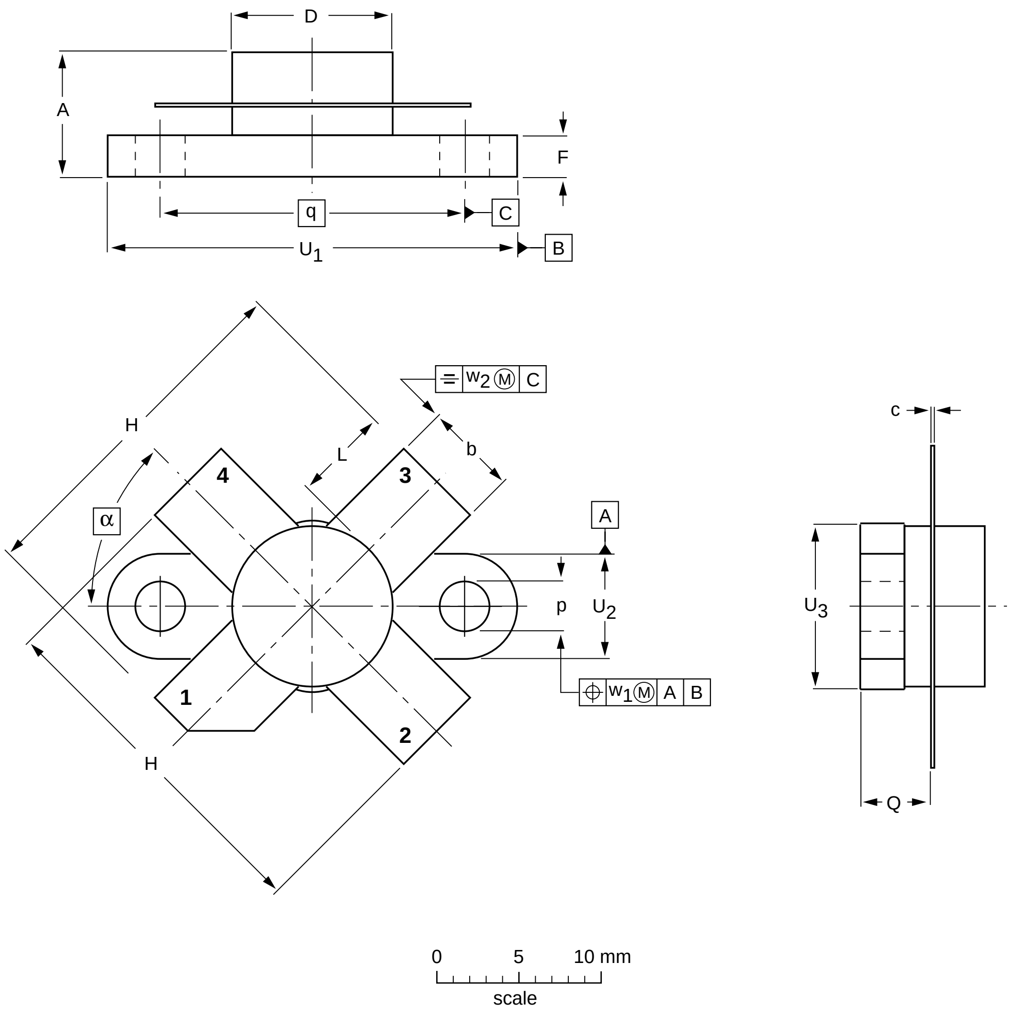
Fig.14

OPERATING NOTE

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

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.	

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