DATA SHEET

BLW97
HF power transistor

Product specification

August 1986

Philips
Semiconductors

PHILIPS

HF power transistor BLW97

DESCRIPTION

N-P-N silicon planar epitaxial transistor designed for use in class-A, AB and B operated high-power industrial and military transmitting equipment in the h.f. band.

The transistor offers excellent performance as a linear amplifier in s.s.b. applications. It is resistance stabilized and is made to withstand severe load-mismatch conditions. All leads are isolated from the flange.

The transistors are supplied in matched h_{FE} groups.

QUICK REFERENCE DATA

R.F. performance up to T_h = 25 °C

MODE OF OPERATION	V_{CE} V	$I_{C(ZS)}$ A	f MHz	P_L W	G_p dB	η_{dt} %	d_3 dB	d_5 dB
s.s.b. (class-AB)	28	0,1	1,6 – 28	175 (PEP)	> 11,5	> 40	< –30	< –30

PIN CONFIGURATION

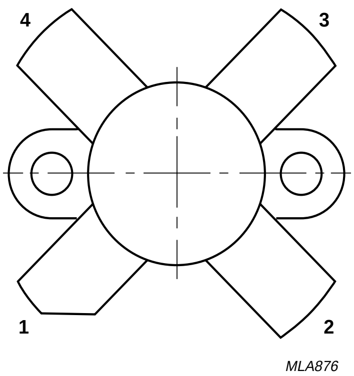


Fig.1 Simplified outline. SOT121B.

PINNING - SOT121B.

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 (peak value)				
$V_{BE} = 0$	V_{CESM}	max.	65	V
open base	V_{CEO}	max.	33	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4	V
Collector current				
average	$I_{C(AV)}$	max.	15	A
peak value; f > 1 MHz	I_{CM}	max.	50	A
Total d.c. power dissipation at $T_h = 25°C$	$P_{tot(d.c.)}$	max.	190	W
R.F. power dissipation				
f > 1 MHz; $T_h = 25°C$	$P_{tot(rf)}$	max.	230	W
Storage temperature	T_{stg}		–65 to + 150	°C
Operating junction temperature	T_j	max.	200	°C

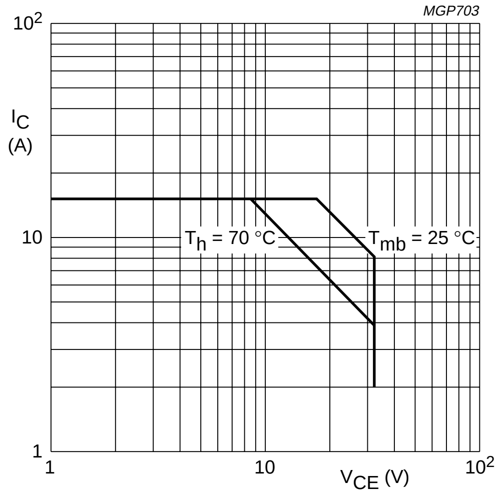
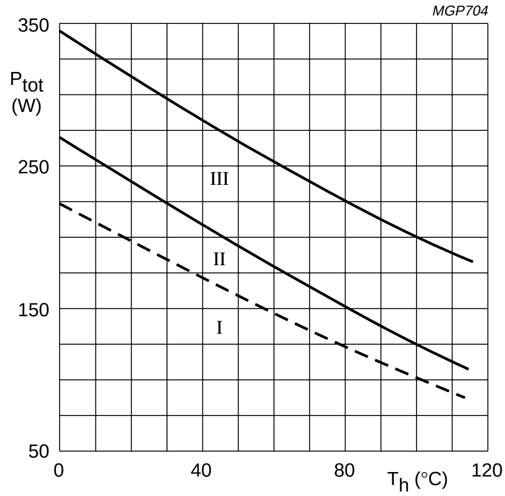


Fig.2 D.C. SOAR.



I Continuous d.c. operation
II Continuous r.f. operation (f > 1 Mhz).
III Short-time operation during mismatch; (f > 1 MHz).

Fig.3 Power/temperature derating curves.

THERMAL RESISTANCE

(dissipation = 120 W; T_h = 25 °C i.e. T_{mb} = 49 °C)

From junction to mounting base				
(d.c. dissipation)	$R_{th\ j\text{-}mb(dc)}$	=	0,63	K/W
From junction to mounting base				
(r.f. dissipation)	$R_{th\ j\text{-}mb(rf)}$	=	0,48	K/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,20	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector-emitter breakdown voltage					
V_{BE} = 0; I_C = 50 mA	$V_{(BR)CES}$	>		65	V
I_C = 100 mA; open base	$V_{(BR)CEO}$	>		33	V
Emitter-base breakdown voltage					
I_E = 20 mA; open collector	$V_{(BR)EBO}$	>		4	V
Collector cut-off current					
V_{CE} = 33 V; V_{BE} = 0	I_{CES}	<		20	mA
Second breakdown energy; L = 25 mH; f = 50 Hz					
open base	E_{SBO}	>		20	mJ
R_{BE} = 10 Ω	E_{SBR}	>		20	mJ
D.C. current gain[1]		typ.		30	
I_C = 10 A; V_{CE} = 5 V	h_{FE}	15	to	50	
D.C. current gain ratio of matched devices[1]					
I_C = 10 A; V_{CE} = 5 V	h_{FE1}/h_{FE2}	<		1,2	
Collector-emitter saturation voltage[1]					
I_C = 25 A; I_B = 5 A	V_{CEsat}	typ.		2,4	V
Transition frequency at f = 100 MHz[2]					
$-I_E$ = 10 A; V_{CB} = 28 V	f_T	typ.		230	MHz
$-I_E$ = 20 A; V_{CB} = 28 V	f_T	typ.		235	MHz
Collector capacitance at f = 1 MHz					
$I_E = i_e$ = 0; V_{CB} = 28 V	C_c	typ.		380	pF
Feedback capacitance at f = 1 MHz					
I_C = 0; V_{CE} = 28 V	C_{re}	typ.		235	pF
Collector-flange capacitance	C_{cf}	typ.		4,5	pF

Notes

1. Measured under pulse conditions: t_p = 500 µs.
2. Measured under pulse conditions: t_p = 300 µs; δ = 0,02.

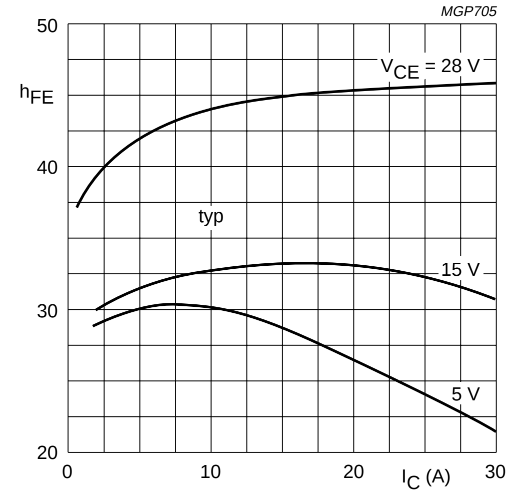


Fig.4 T_j = 25 °C.

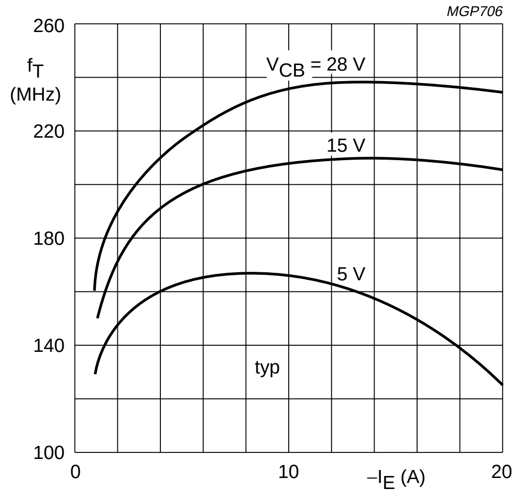


Fig.5 T_j = 25 °C; f = 100 MHz; t_p = 300 µs.

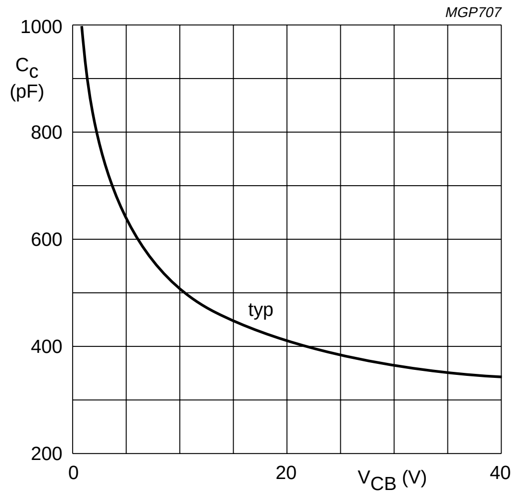


Fig.6 $I_E = i_e = 0$; f = 1 MHz; T_j = 25 °C.

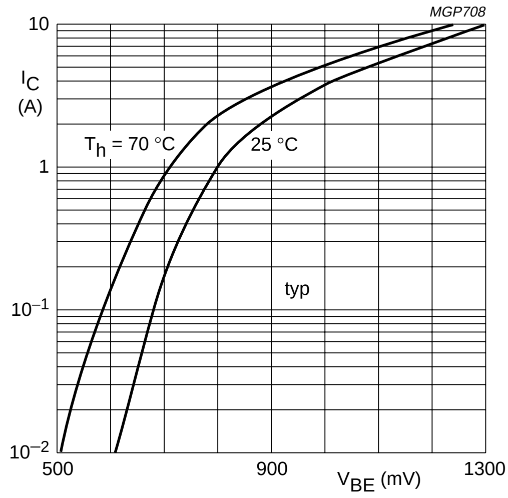


Fig.7 V_{CE} = 28 V.

APPLICATION INFORMATION

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

V_{CE} = 28 V; T_h = 25 °C; f_1 = 28,000 MHz; f_2 = 28,001 MHz.

OUTPUT POWER W	G_p dB	η_{dt} %	I_C A	d_3 (1) dB	d_5 (1) dB	$I_{C(ZS)}$ A
175 (PEP)	> 11,5 typ. 13,0	> 40 typ. 50	< 7,8 typ. 6,3	< –30 typ. –34	< –30 typ. –38	0,1

Note

1. The stated intermodulation distortion levels 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.

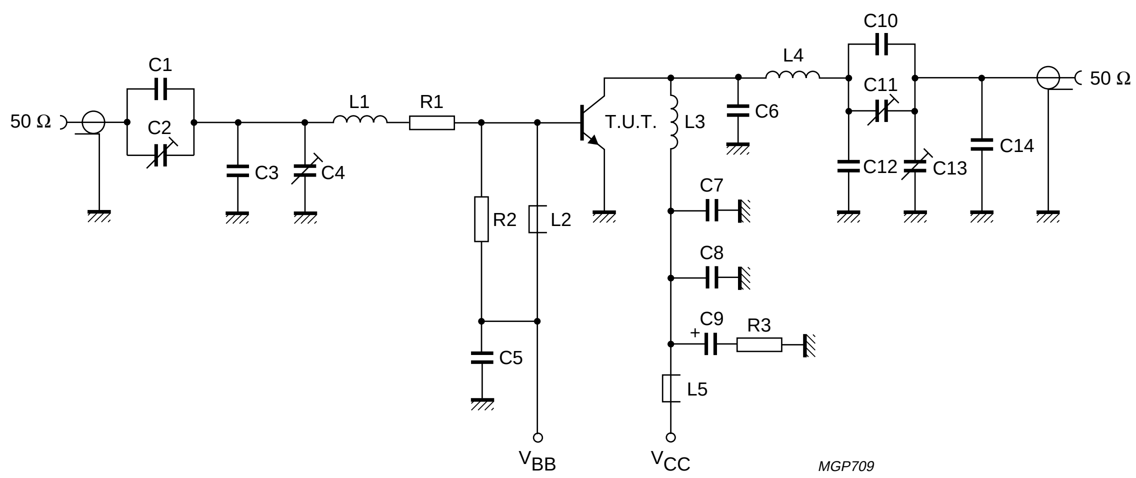


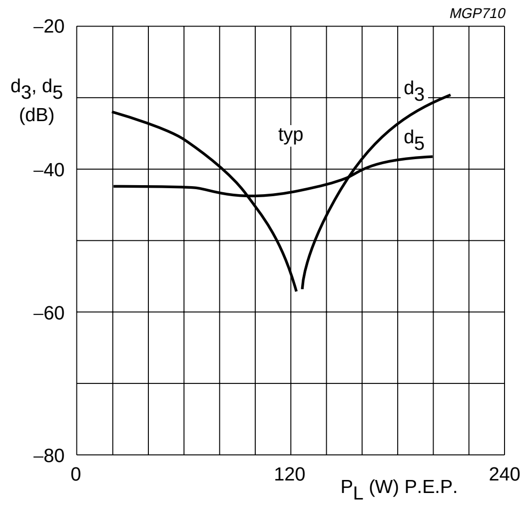
Fig.8 Class-AB (s.s.b.) test circuit.

List of components:

C1	=	47 pF (500 V) multilayer ceramic chip capacitor[1]
C2	=	100 pF film dielectric trimmer
C3	=	2 × 130 pF (300 V) multilayer ceramic chip capacitors in parallel[1]
C4	=	280 pF film dielectric trimmer
C5	=	10 nF (50 V) multilayer ceramic chip capacitor 2222 856 13103
C6	=	2 × 180 pF (300 V) multilayer ceramic chip capacitors in parallel[1]
C7	=	100 nF (50 V) multilayer ceramic chip capacitor 2222 856 48104
C8	=	10 nF (50 V) multilayer ceramic chip capacitor 2222 856 13103
C9	=	2,2 µF - 63 V solid aluminium electrolytic capacitor
C10	=	5 × 82 pF (500 V) multilayer ceramic chip capacitors in parallel[1]
C11	=	250 pF air dielectric trimmer
C12	=	5 × 33 pF ceramic feed-through capacitors mounted in parallel on a brass plate
C13	=	100 pF air dielectric trimmer
C14	=	3 × 91 pF (500 V) multilayer ceramic chip capacitors in parallel[1]
R1	=	0,7 Ω - 7 W (7 × 4,7 Ω - 1 W carbon resistors in parallel)
R2	=	27 Ω - 0,25 W carbon resistor
R3	=	4,7 Ω - 0,25 W carbon resistor
L1	=	73 nH; 4 turns Cu wire (1,5 mm); int. dia. 7 mm; length 9,4 mm; leads 2 × 5 mm
L2	=	Ferroxcube wide-band h.f. choke grade 3B (cat. no. 4312 020 36640); 6 leads in parallel
L3	=	70,4 nH; 4 turns Cu wire (2 mm); int. dia. 7 mm; length 14,8 mm; leads 2 × 5 mm
L4	=	83,5 nH; 4 turns Cu wire (2 mm); int. dia. 8 mm; length 15 mm; leads 2 × 5 mm
L5	=	Ferroxcube wide-band h.f. choke grade 3 B (cat. no. 4312 020 36640) with 6 leads in parallel

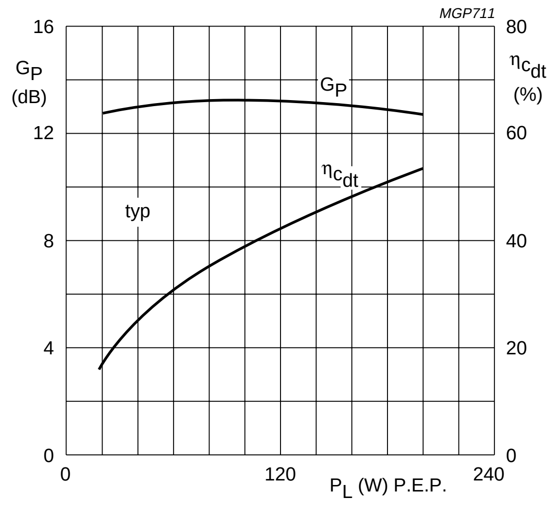
Note

1. American Technical Ceramics capacitor or capacitor of same quality.



V_{CE} = 28 V; $I_{C(ZS)}$ = 0,1 A; f_1 = 28,000 MHz;
f_2 = 28,001 MHz; T_h = 25 °C.

Fig.9 Intermodulation distortion (see note on preceding page).



V_{CE} = 28 V; $I_{C(ZS)}$ = 0,1 A; f_1 = 28,000 MHz;
f_2 = 28,001 MHz; T_h = 25 °C.

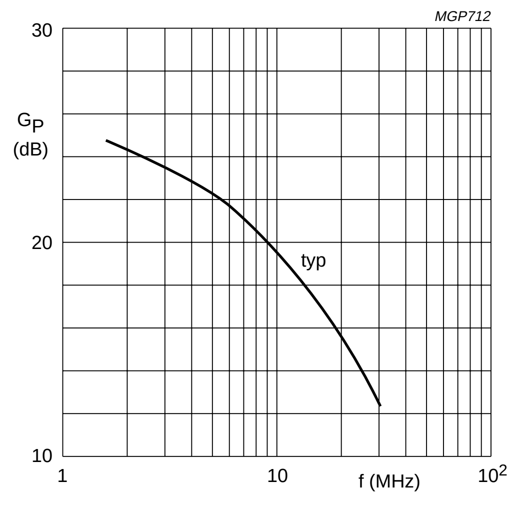
Fig.10 Power gain and double-tone efficiency.

RUGGEDNESS

The BLW97 is capable of withstanding full load mismatch (VSWR = 50 through all phases) up to 150 W (P.E.P.) or a load mismatch (VSWR = 5 through all phases) up to 175 W (P.E.P.) under the following conditions:

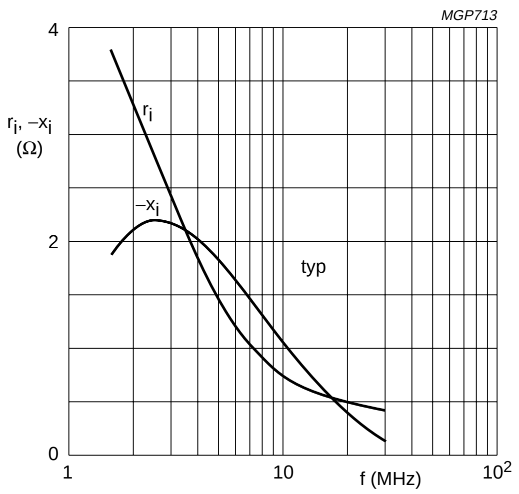
V_{CE} = 28 V; f = 28 MHz; T_h = 25 °C; $R_{th\ mb\text{-}h}$ = 0,2 K/W.

Figures 11 and 12 t typical curves which are valid for one transistor of a push-pull amplifier in s.s.b. class-AB operation.



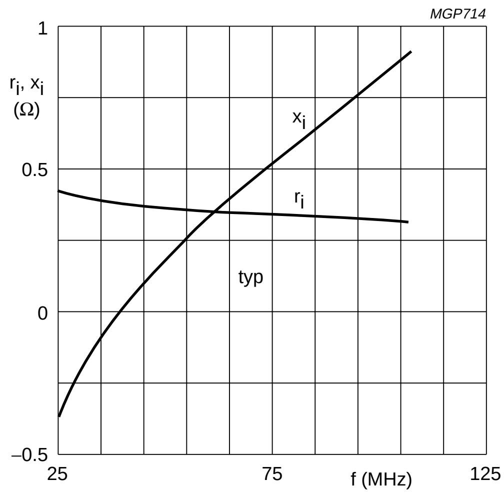
V_{CE} = 28 V; $I_{C(ZS)}$ = 0,1 A;
P_L = 175 W(PEP); T_h = 25 °C;
Z_L = 1,55 Ω

Fig.11 Power gain.



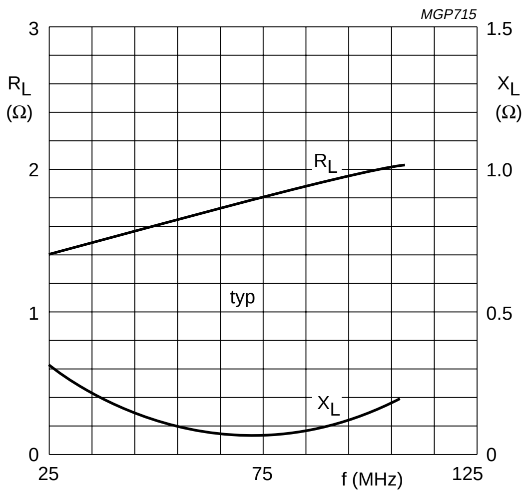
V_{CE} = 28 V; $I_{C(ZS)}$ = 0,1 A;
P_L = 175 W(PEP); T_h = 25 °C;
Z_L = 1,55 Ω

Fig.12 Input impedance (series components).



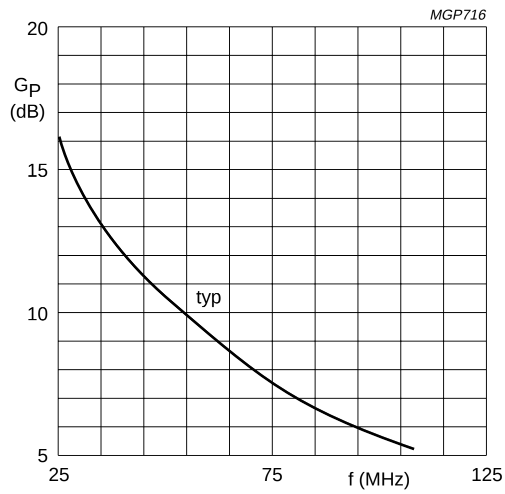
V_{CE} = 28 V; P_L = 175 W; T_h = 25 °C;
class-B operation.

Fig.13 Input impedance (series components).



V_{CE} = 28 V; P_L = 175 W; T_h = 25 °C;
class-B operation.

Fig.14 Load impedance (series components).

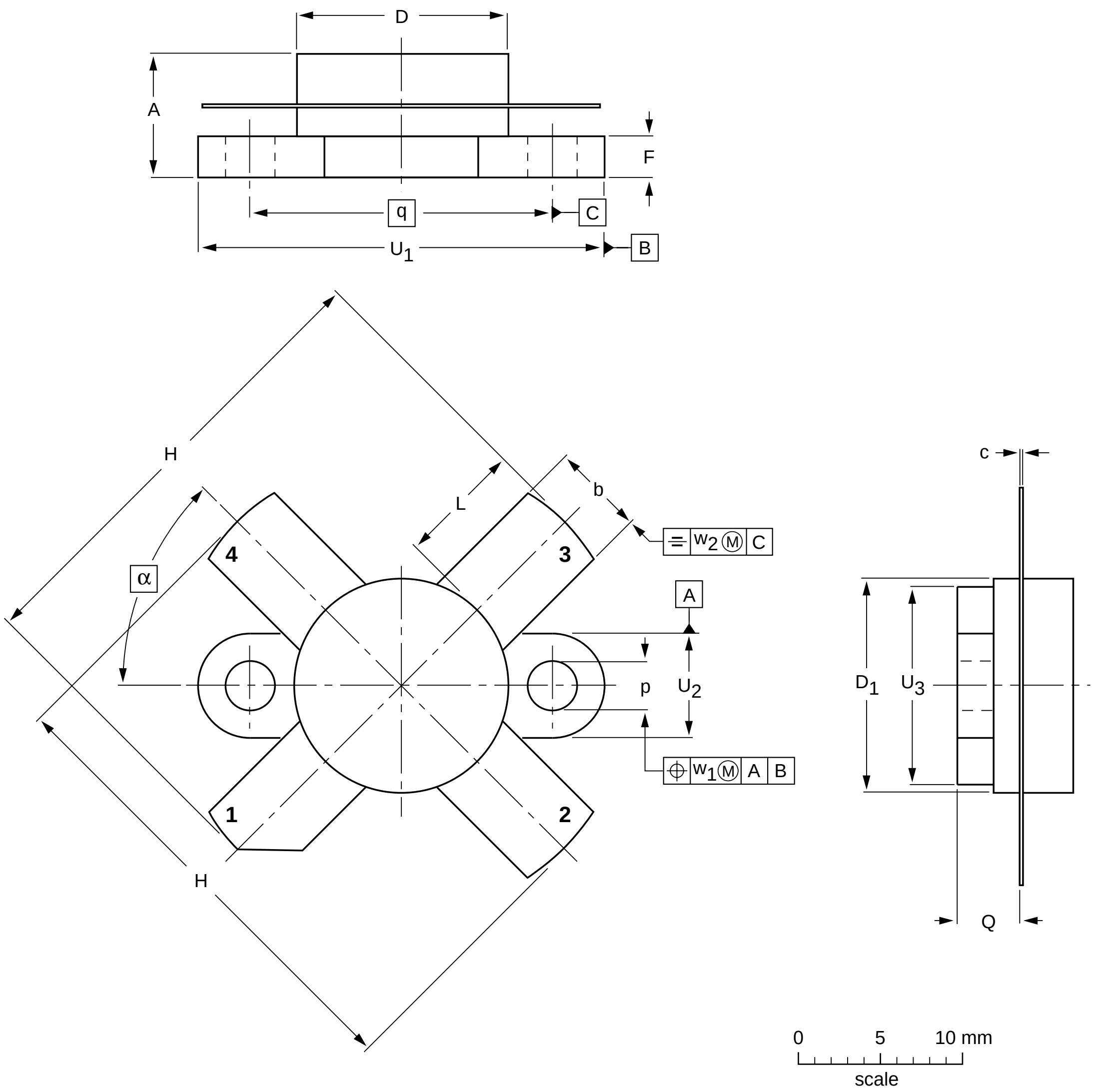


V_{CE} = 28 V; P_L = 175 W; T_h = 25 °C;
class-B operation.

Fig.15 Power gain.

PACKAGE OUTLINE

Flanged ceramic package; 2 mounting holes; 4 leads **SOT121B**



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	7.27 6.17	5.82 5.56	0.16 0.10	12.86 12.59	12.83 12.57	2.67 2.41	28.45 25.52	7.93 6.32	3.30 3.05	4.45 3.91	18.42	24.90 24.63	6.48 6.22	12.32 12.06	0.51	1.02	45°
inches	0.286 0.243	0.229 0.219	0.006 0.004	0.506 0.496	0.505 0.495	0.105 0.095	1.120 1.005	0.312 0.249	0.130 0.120	0.175 0.154	0.725	0.98 0.97	0.255 0.245	0.485 0.475	0.02	0.04	

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT121B						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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