HF/VHF power transistor

BLW83

DESCRIPTION

N-P-N silicon planar epitaxial transistor for use in transmitting amplifiers operating in the h.f. and v.h.f. bands, with a nominal supply voltage of 28 V. The transistor is specified for s.s.b. applications as linear amplifier in class-A and AB. The device is resistance stabilized and is guaranteed to withstand severe load mismatch conditions.

Matched h_{FE} groups are available on request.

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

QUICK REFERENCE DATA

R.F. performance

MODE OF OPERATION	V_{CE} V	f MHz	P_L W	G_p dB	η_{dt} %	I_C A	d_3 dB	T_h °C
s.s.b. (class-A)	**26**	**1,6 – 28**	**0 – 10 (P.E.P.)**	**> 20**	–	**1,35**	**< –40**	**70**
s.s.b. (class-AB)	28	1,6 – 28	3 – 30 (P.E.P.)	typ. 21	typ. 40	typ. 1,34	typ. –30	25

PIN CONFIGURATION

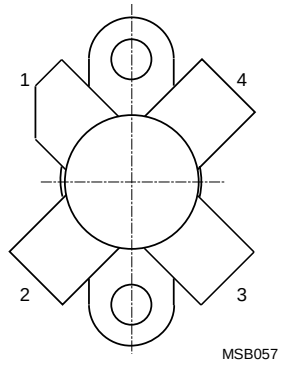

Fig.1 Simplified outlin

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)

From junction to mounting base (d.c. dissipation)	$R_{th\ j\text{-}mb(dc)}$	=	3,15 K/W
From junction to mounting base (r.f. dissipation)	$R_{th\ j\text{-}mb(rf)}$	=	2,35 K/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,3 K/W

Collector-emitter voltage (V_{BE} = 0)			
peak value	V_{CESM}	max.	65 V
Collector-emitter voltage (open base)	V_{CEO}	max.	36 V
Emitter-base voltage (open-collector)	V_{EBO}	max.	4 V
Collector current (average)	$I_{C(AV)}$	max.	3 A
Collector current (peak value); f > 1 MHz	I_{CM}	max.	9 A
R.F. power dissipation (f > 1 MHz); T_{mb} = 25 °C	P_{rf}	max.	76 W
Storage temperature	T_{stg}	−65 to + 150 °C	
Operating junction temperature	T_j	max.	200 °C

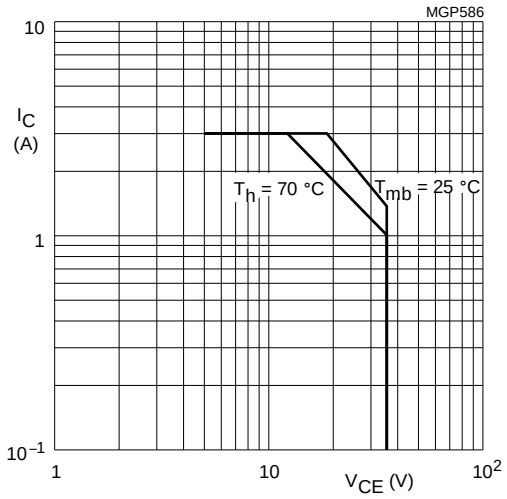

Fig.2 D.C. SOAR.

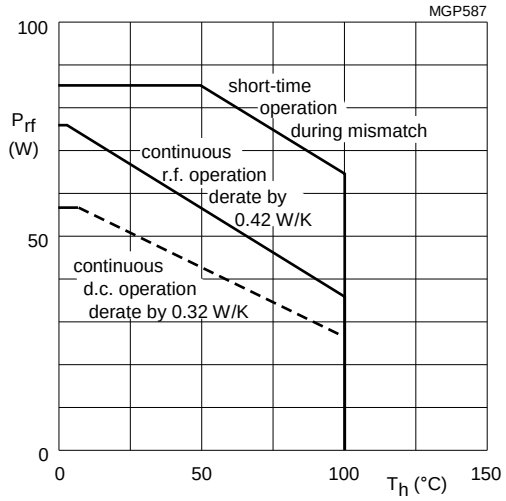

Fig.3 R.F. power dissipation; $V_{CE} \leq 28$ V; f ≥ 1 MHz.

THERMAL RESISTANCE

(dissipation = 35 W; T_{mb} = 80 °C, i.e. T_h = 70 °C)

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector-emitter breakdown voltage			
V_{BE} = 0; I_C = 10 mA	$V_{(BR)CES}$	>	65 V
Collector-emitter breakdown voltage			
open base; I_C = 50 mA	$V_{(BR)CEO}$	>	36 V
Emitter-base breakdown voltage			
open collector; I_E = 10 mA	$V_{(BR)EBO}$	>	4 V
Collector cut-off current			
V_{BE} = 0; V_{CE} = 36 V	I_{CES}	<	4 mA
Second breakdown energy; L = 25 mH; f = 50 Hz			
open base	E_{SBO}	>	8 mJ
R_{BE} = 10 Ω	E_{SBR}	>	8 mJ
D.C. current gain (1)		typ.	50
I_C = 1,25 A; V_{CE} = 5 V	h_{FE}	10 to 100	
D.C. current gain ratio of matched devices(1)			
I_C = 1,25 A; V_{CE} = 5 V	h_{FE1}/h_{FE2}	<	1,2
Collector-emitter saturation voltage(1)			
I_C = 3,75 A; I_B = 0,75 A	V_{CEsat}	typ.	1,5 V
Transition frequency at f = 100 MHz(1)			
$-I_E$ = 1,25 A; V_{CB} = 28 V	f_T	typ.	530 MHz
$-I_E$ = 3,75 A; V_{CB} = 28 V	f_T	typ.	530 MHz
Collector capacitance at f = 1 MHz			
$I_E = I_e$ = 0; V_{CB} = 28 V	C_c	typ.	50 pF
Feedback capacitance at f = 1 MHz			
I_C = 100 mA; V_{CE} = 28 V	C_{re}	typ.	31 pF
Collector-flange capacitance	C_{cf}	typ.	2 pF

Note

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

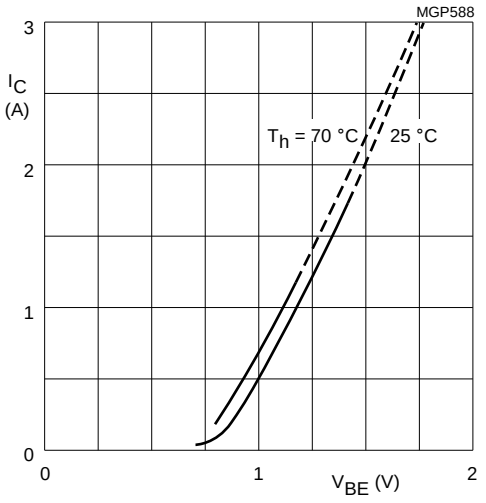

Fig.4 Typical values; V_{CE} = 28 V.

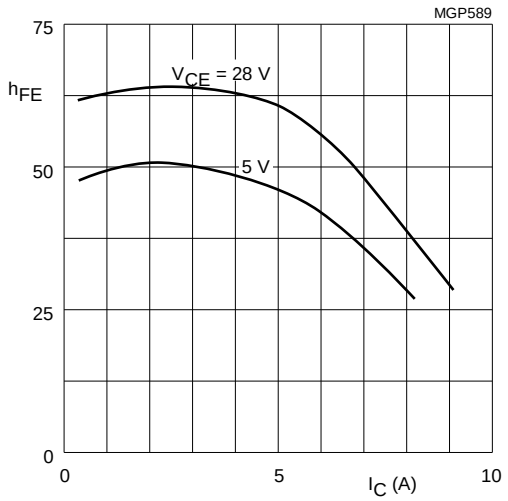

Fig.5 Typical values; T_j = 25 °C.

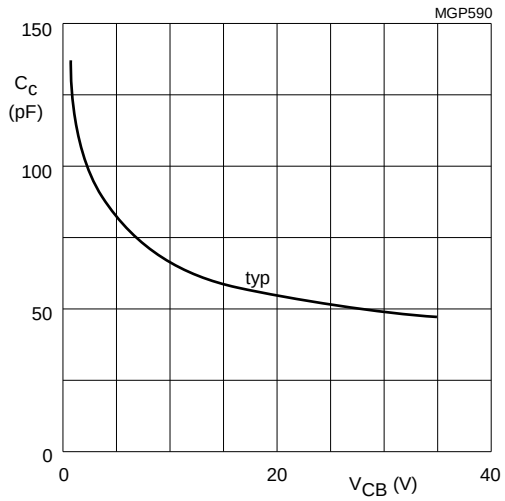

Fig.6 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

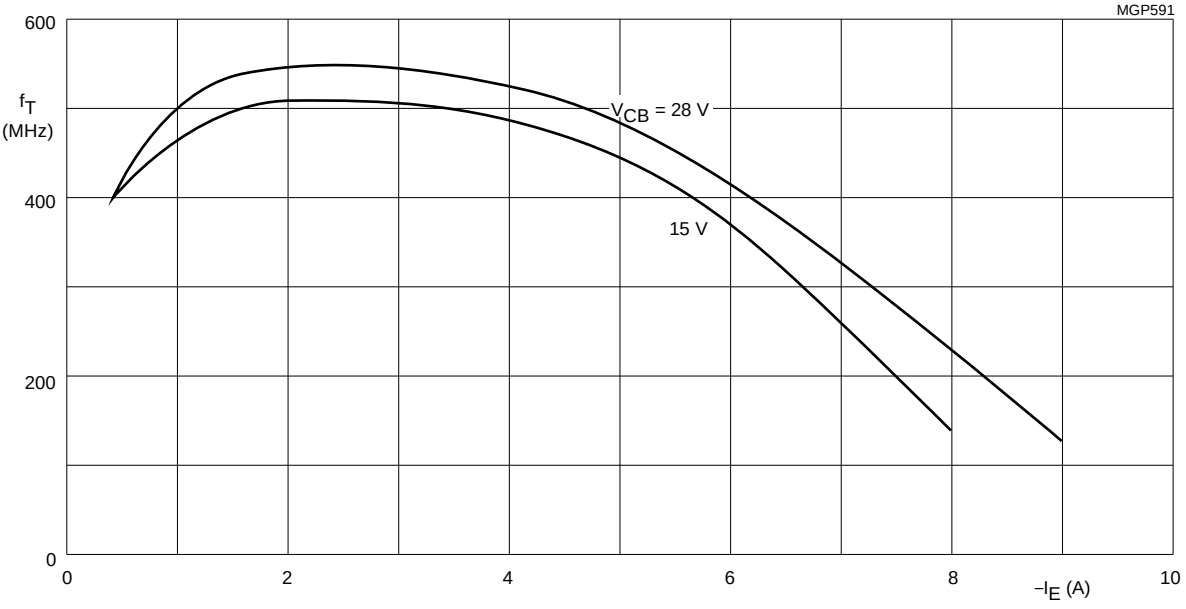

Fig.7 Typical values; f = 100 MHz; T_j = 25 °C.

APPLICATION INFORMATION

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

V_{CE} = 26 V; f_1 = 28,000 MHz; f_2 = 28,001 MHz

OUTPUT POWER W	G_p dB	I_C A	d_3 dB(1)	d_5 dB(1)	T_h °C
> 10 (P.E.P.)	> 20	1,35	−40	< −40	70
typ. 11 (P.E.P.)					
typ. 12 (P.E.P.)	typ. 24	1,35	−40	< −40	25

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.

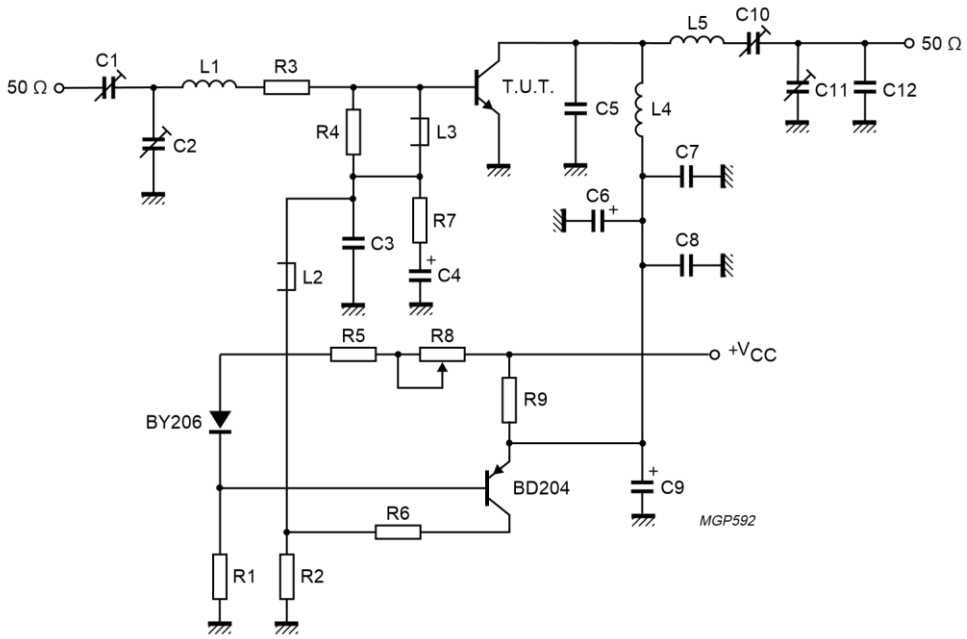

Fig.8 Test circuit; s.s.b. class-A.

List of components in Fig.8:

C1 = C2 = 10 to 780 pF film dielectric trimmer
C3 = 22 nF ceramic capacitor (63 V)

C4 = 47 µF/10 V electrolytic capacitor
C5 = 56 pF ceramic capacitor (500 V)
C6 = 47 µF/35 V electrolytic capacitor
C7 = C8 = 220 nF polyester capacitor
C9 = 10 µF/35 V electrolytic capacitor
C10 = C11 = 7 to 100 pF film dielectric trimmer
C12 = 82 pF ceramic capacitor (500 V)
L1 = 3 turns closely wound enamelled Cu wire (1,6 mm); int. dia. 9,0 mm; leads to 2 × 5 mm
L2 = L3 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L4 = 11 turns closely wound enamelled Cu wire (1,6 mm); int. dia. 11,0 mm
L5 = 14 turns closely wound enamelled Cu wire (1,6 mm); int. dia. 11,0 mm
R1 = 600 Ω; parallel connection of 2 × 1,2 kΩ carbon resistors (±5%; 0,5 W each)
R2 = 15 Ω carbon resistor (±5%; 0,25 W)
R3 = 1,2 Ω; parallel connection of 4 × 4,7 Ω carbon resistors (±5%; 0,125 W each)
R4 = 33 Ω carbon resistor (±5%; 0,25 W)
R5 = 18 Ω carbon resistor (±5%; 0,25 W)
R6 = 120 Ω wirewound resistor (±5%; 5,5 W)
R7 = 1 Ω carbon resistor (±5%; 0,125 W)
R8 = 47 Ω wirewound potentiometer (3 W)
R9 = 1,57 Ω;parallel connection of 3 × 4,7 Ω wirewound resistors (5%; 5,5 W each)

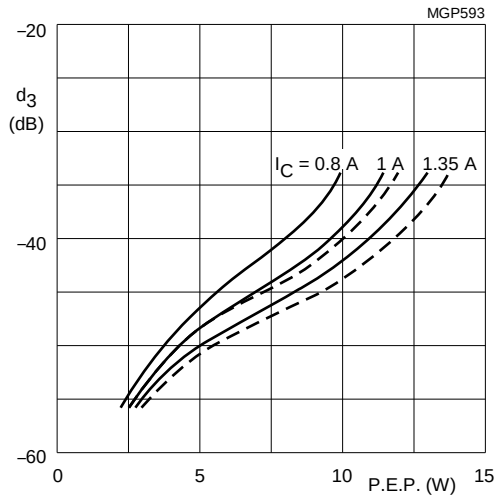

Fig.9 Intermodulation distortion as a function of output power.
Typical values; V_{CE} = 26 V; —— T_h = 70 °C; – – – T_h = 25 °C.

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

OUTPUT POWER	G_p	η_{dt} (%)	I_C (A)	d_3	d_5	$I_{C(ZS)}$	T_h

W	dB	at 30 W P.E.P.		dB(1)	dB(1)	mA	°C
3 to 30 (P.E.P.)	typ. 21	typ. 40	typ. 1,34	typ. −30	< −30	25	25
3 to 25 (P.E.P.)	typ. 21	–	–	typ. −30	< −30	25	70

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.

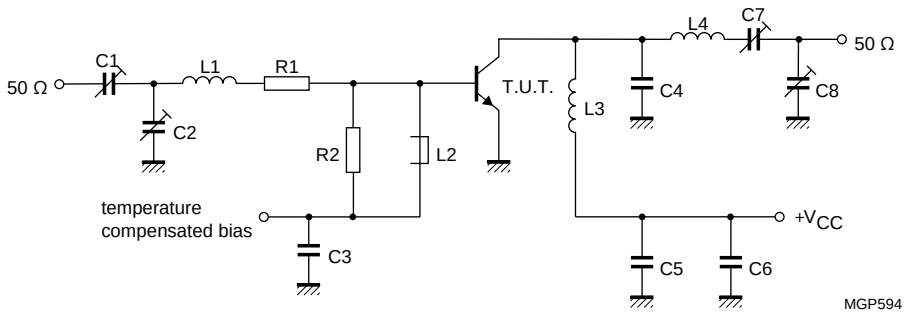

Fig.10 Test circuit; s.s.b. class-AB.

List of components:

C1 = C2 = 10 to 780 pF film dielectric trimmer
C3 = C5 = C6 = 220 nF polyester capacitor
C4 = 56 pF ceramic capacitor (500 V)
C7 = C8 = 15 to 575 pF film dielectric trimmer
L1 = 4 turns closely wound enamelled Cu wire (1,6 mm); int. dia. 7,0 mm; leads 2 × 5 mm
L2 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L3 = 4 turns enamelled Cu wire (1,6 mm); int. dia. 10 mm; length 9,4 mm; leads 2 × 5 mm
L4 = 7 turns enamelled Cu wire (1,6 mm); int. dia. 12 mm; length 17,2 mm; leads 2 × 5 mm
R1 = 1,2 Ω; parallel connection of 4 × 4,7 Ω carbon resistors
R2 = 39 Ω carbon resistor

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

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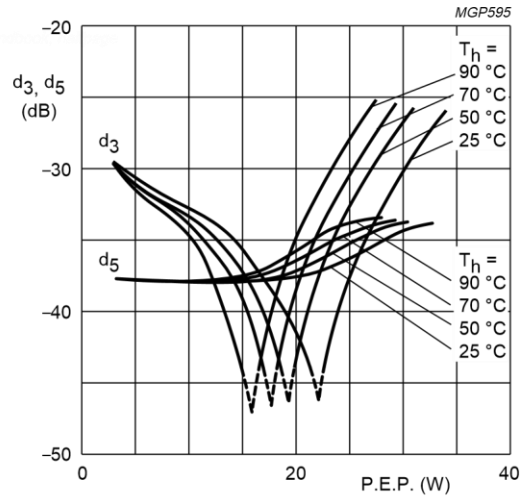
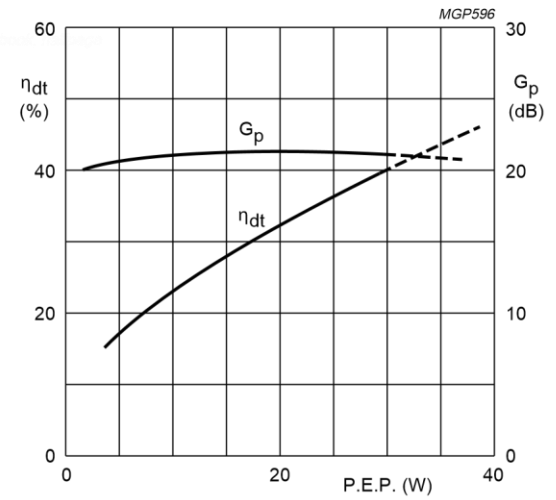
Ruggedness in s.s.b. operation

f_1 = 28,000 MHz; f_2 = 28,001 MHz; V_{CE} = 28 V; T_h = 70 °C and P_{Lnom} = 35 W (P.E.P.).



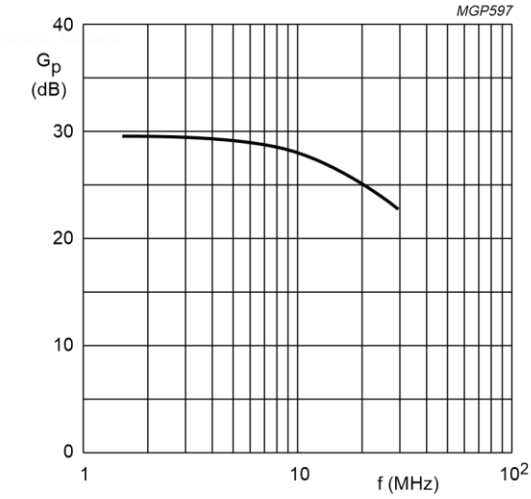
V_{CE} = 28 V; $I_{C(ZS)}$ = 25 mA; f_1 = 28,000 MHz; f_2 = 28,001 MHz; typical values

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



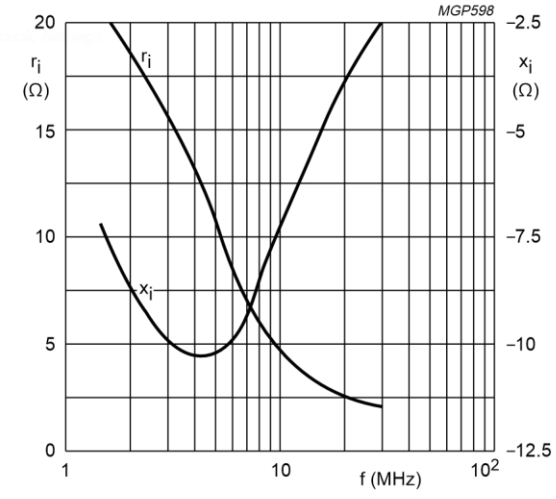
V_{CE} = 28 V; $I_{C(ZS)}$ = 25 mA; f_1 = 28,000 MHz; f_2 = 28,001 MHz; T_h = 25 °C; typical values

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



V_{CE} = 28 V; $I_{C(ZS)}$ = 25 mA; P_L = 30 W; T_h = 25 °C; Z_L = 9,5 Ω

Fig.13 Power gain as a function of frequency.



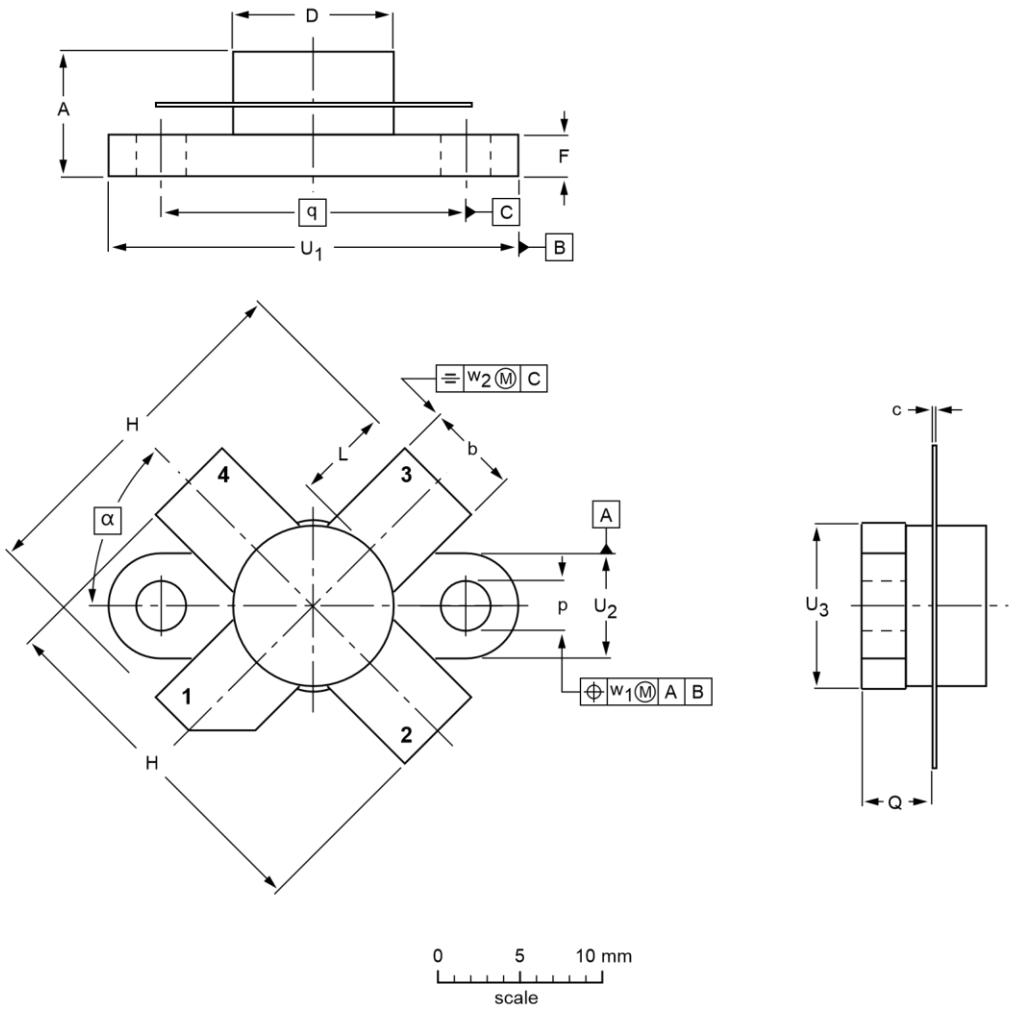
V_{CE} = 28 V; $I_{C(ZS)}$ = 25 mA; P_L = 30 W; T_h = 25 °C; Z_L = 9,5 Ω

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

The BLW83 is capable of withstanding a load mismatch (VSWR = 50) under the following conditions:

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

These products are not designed for use in life support appliances, devices, or systems where malfunction of these products can reasonably be expected to result in personal injury. Philips customers using or selling these products for use in such applications do so at their own risk and agree to fully indemnify Philips for any damages resulting from such improper use or sale.