

# DATA SHEET

## **BLW50F** HF/VHF power transistor

Product specification

August 1986

# 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

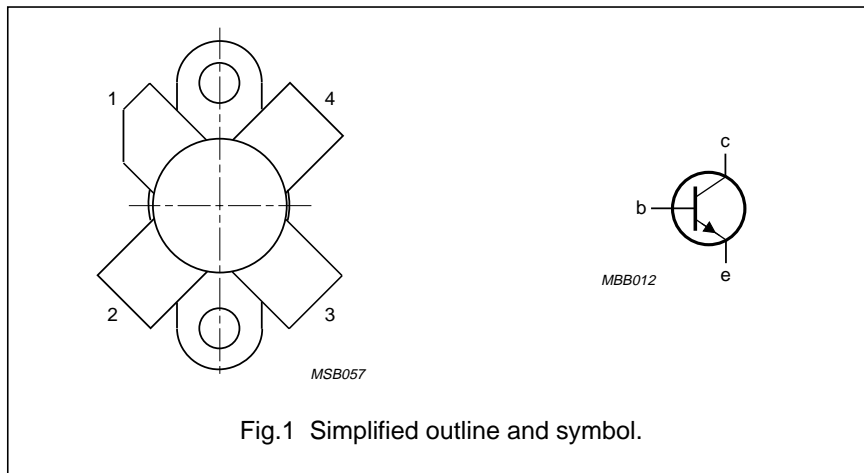
R.F. performance

MODE OF OPERATION	$V_{CE}$ V	f MHz	$P_L$ W	$G_p$ dB	$\eta_{dt}$ %	$I_C$ 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 <sup>(1)</sup>	1,45	50	typ. -30	25

### Note

- At 65W P.E.P.

### PIN CONFIGURATION



### 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.

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**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

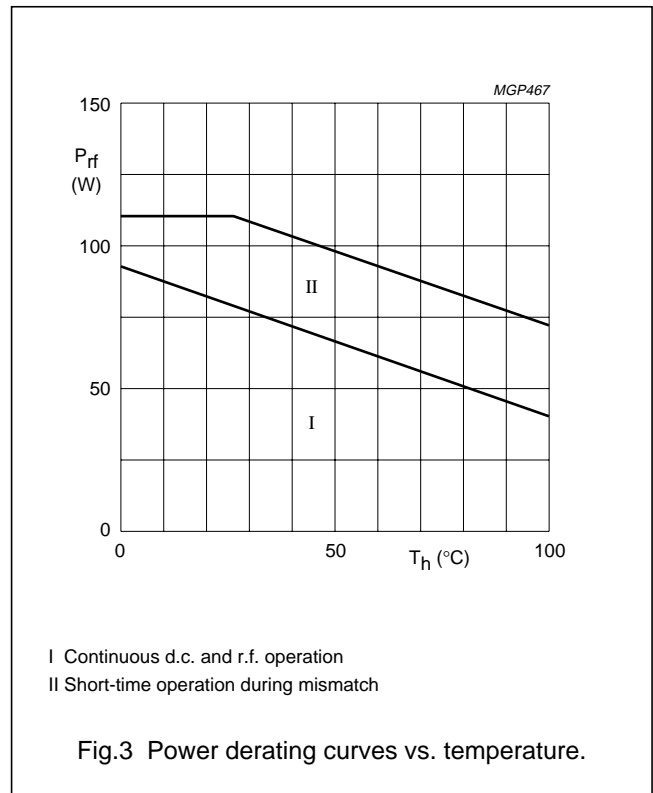
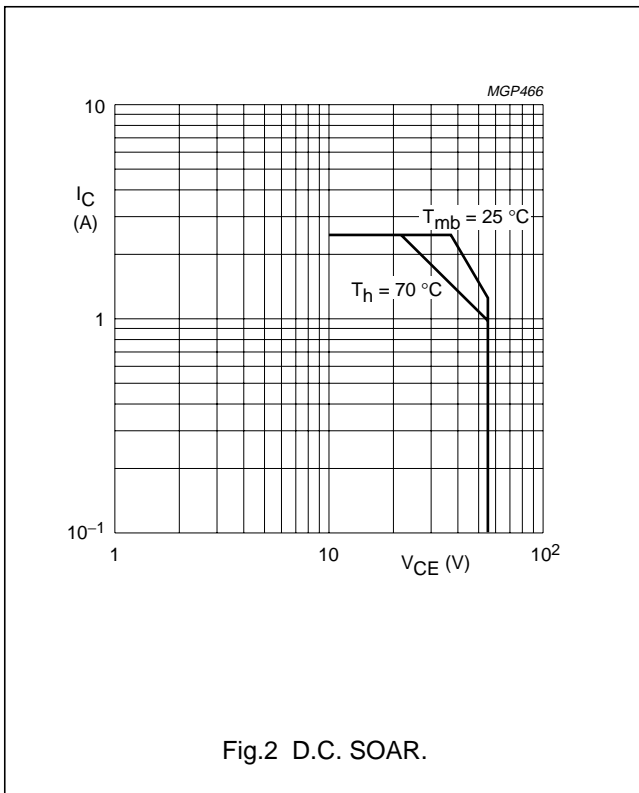
$P_{tot}; P_{rf}$  max. 94 W

Storage temperature

$T_{stg}$  -65 to + 150 °C

Operating junction temperature

$T_j$  max. 200 °C



**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)

$R_{th\ j-mb}$  = 2,1 K/W

From mounting base to heatsink

$R_{th\ mb-h}$  = 0,3 K/W

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**CHARACTERISTICS** $T_j = 25\text{ }^\circ\text{C}$ 

Collector-emitter breakdown voltage

 $V_{BE} = 0; I_C = 25\text{ mA}$  $V_{(BR)CES} > 110\text{ V}$ 

Collector-emitter breakdown voltage

open base;  $I_C = 100\text{ mA}$  $V_{(BR)CEO} > 55\text{ V}$ 

Emitter-base breakdown voltage

open collector;  $I_E = 10\text{ mA}$  $V_{(BR)EBO} > 4\text{ V}$ 

Collector cut-off current

 $V_{BE} = 0; V_{CE} = 55\text{ V}$  $I_{CES} < 10\text{ mA}$ Second breakdown energy;  $L = 25\text{ mH}; f = 50\text{ Hz}$ 

open base

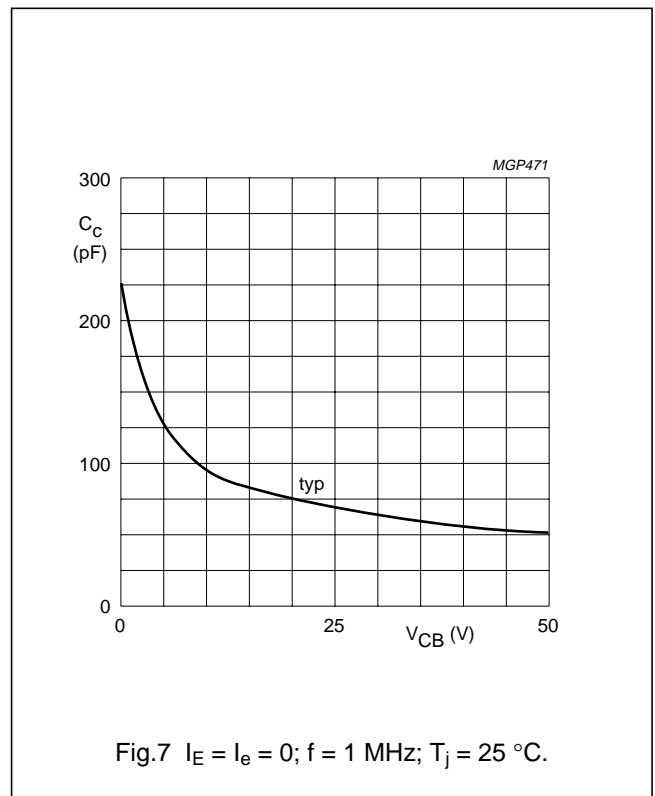
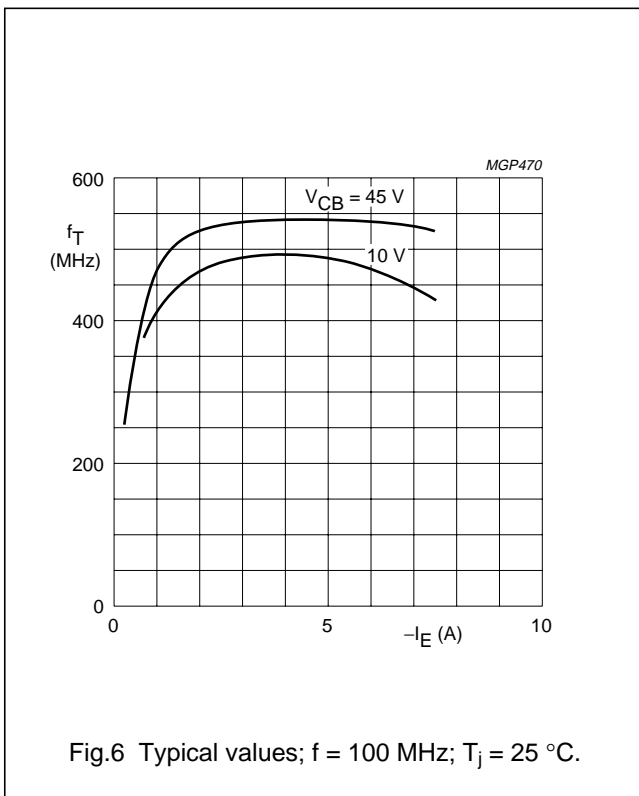
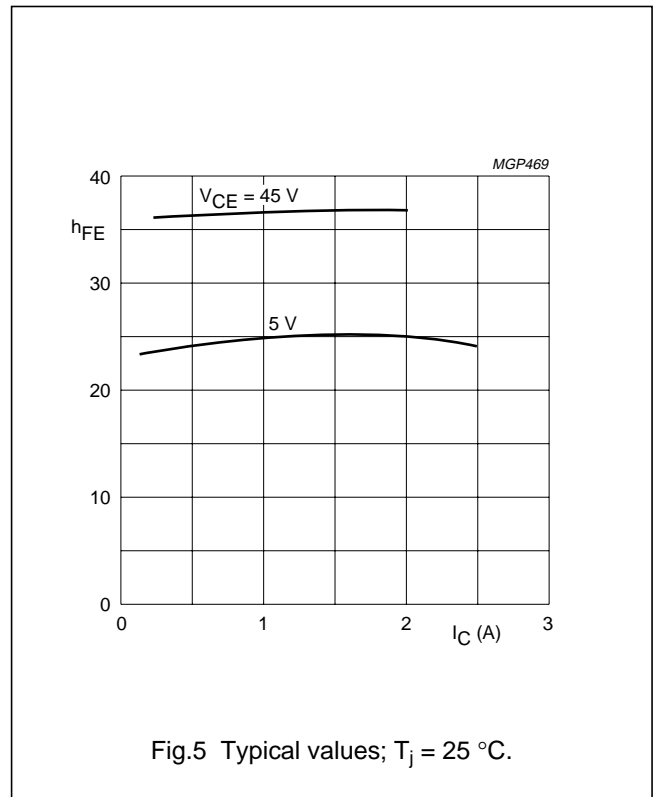
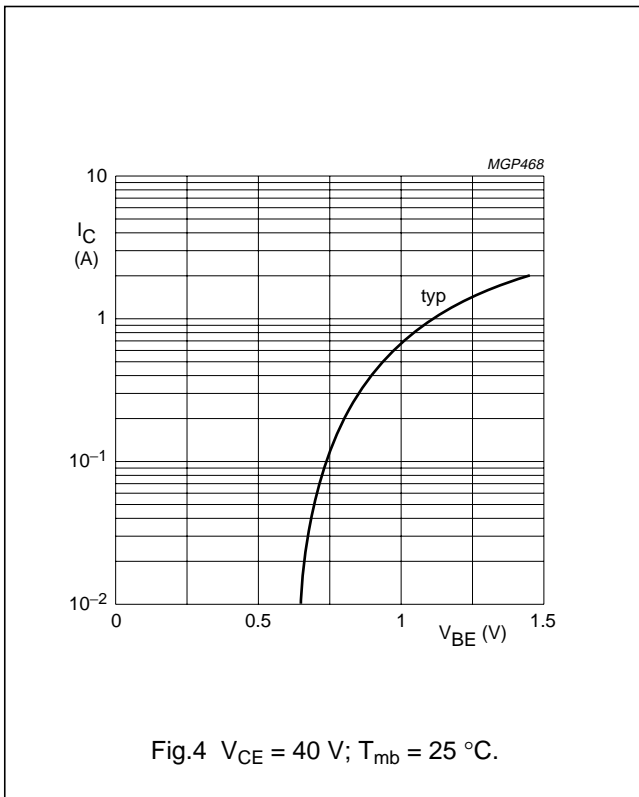
 $E_{SBO} > 8\text{ mJ}$  $R_{BE} = 10\ \Omega$  $E_{SBR} > 8\text{ mJ}$ D.C. current gain<sup>(1)</sup> $I_C = 1,2\text{ A}; V_{CE} = 5\text{ V}$  $h_{FE}$  typ. 25  
15 to 100D.C. current gain ratio of matched devices<sup>(1)</sup> $I_C = 1,2\text{ A}; V_{CE} = 5\text{ V}$  $h_{FE1}/h_{FE2} < 1,2$ Collector-emitter saturation voltage<sup>(1)</sup> $I_C = 3,0\text{ A}; I_B = 0,6\text{ A}$  $V_{CEsat}$  typ. 1,2 VTransition frequency at  $f = 100\text{ MHz}$ <sup>(1)</sup> $-I_E = 1,2\text{ A}; V_{CB} = 45\text{ V}$  $f_T$  typ. 490 MHz $-I_E = 4,0\text{ A}; V_{CB} = 45\text{ V}$  $f_T$  typ. 540 MHzCollector capacitance at  $f = 1\text{ MHz}$  $I_E = I_e = 0; V_{CB} = 45\text{ V}$  $C_c$  typ. 53 pFFeedback capacitance at  $f = 1\text{ MHz}$  $I_C = 50\text{ mA}; V_{CE} = 45\text{ V}$  $C_{re}$  typ. 35 pF

Collector-flange capacitance

 $C_{cf}$  typ. 2 pF**Note**1. Measured under pulse conditions:  $t_p \leq 200\ \mu\text{s}; \delta \leq 0,02$ .

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## APPLICATION INFORMATION

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

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

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

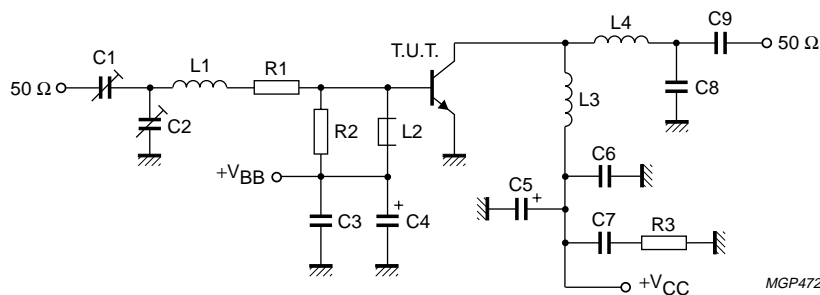


Fig.8 Test circuit; s.s.b. class-A.

## 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  $\mu\text{F}$ /16 V electrolytic capacitor
- C5 = 1  $\mu\text{F}$ /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  $2 \times 5 \text{ mm}$
- L2 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
- L3 = 1,05  $\mu\text{H}$ ; 15 turns enamelled Cu wire (1,0 mm); int. dia. 10 mm; length 17,4 mm; leads  $2 \times 5 \text{ mm}$
- L4 = 162 nH; 6 turns enamelled Cu wire (1,0 mm); int. dia. 7,0 mm; length 11,6 mm; leads  $2 \times 5 \text{ mm}$
- R1 = 1,6  $\Omega$ ; parallel connection of  $3 \times 4,7 \Omega$  carbon resistors ( $\pm 5\%$ ; 0,125 W)
- R2 = 47  $\Omega$  carbon resistor ( $\pm 5\%$ ; 0,25 W)
- R3 = 4,7  $\Omega$  carbon resistor ( $\pm 5\%$ ; 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.

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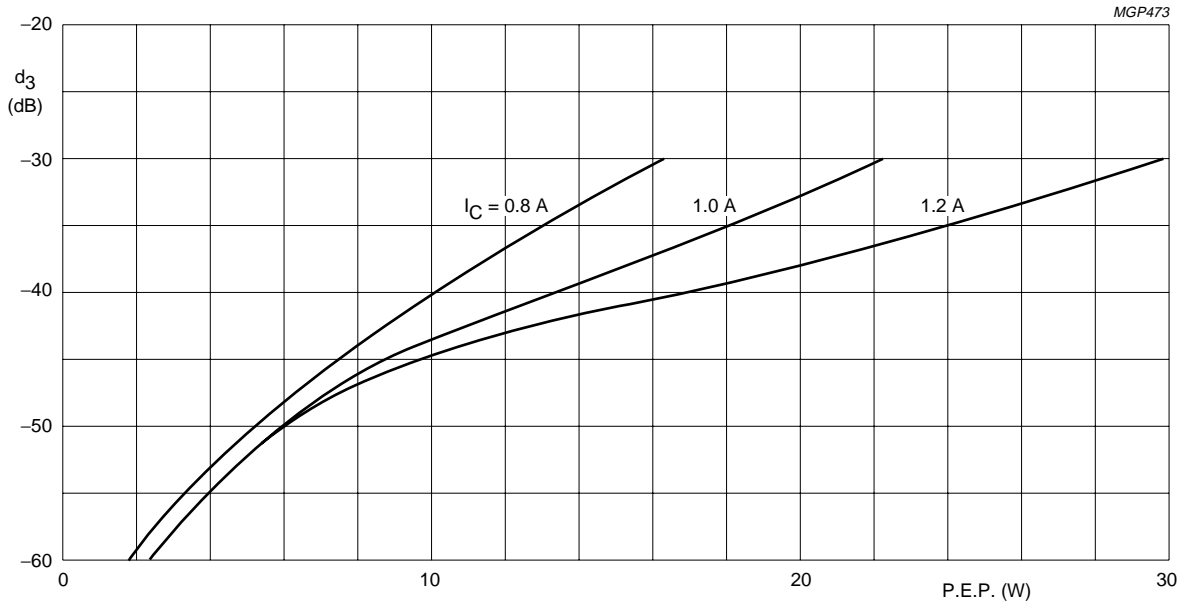


Fig.9 Intermodulation distortion (see note on previous page) as a function of output power. Typical values;  $V_{CE} = 45$  V;  $f_1 = 28,000$  MHz;  $f_2 = 28,001$  MHz;  $T_h = 70$  °C.

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

$V_{CE} = 50 \text{ V}$ ;  $f_1 = 28,000 \text{ MHz}$ ;  $f_2 = 28,001 \text{ MHz}$

OUTPUT POWER W	$G_p$ dB	$\eta_{dt}(\%)$ AT 65 W P.E.P.	$I_C$ (A) typ. 1,45	$d_3^{(1)}$ dB	$d_5^{(1)}$ dB	$I_{C(zs)}$ mA	$T_h$ $^{\circ}\text{C}$
10 to 65 (P.E.P.)	typ. 18	typ. 45	typ. 1,45	typ. -30	< -30	50	25

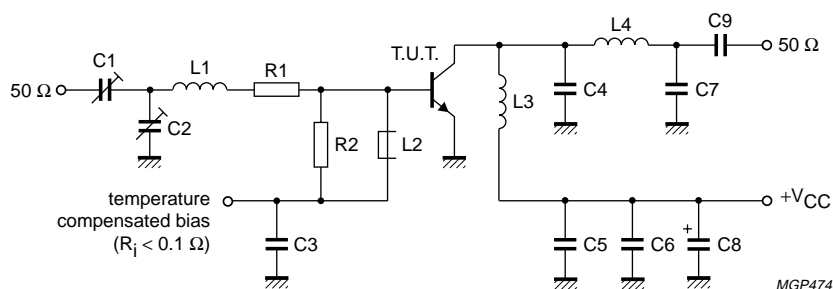


Fig.10 Test circuit; s.s.b. class-AB.

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 = 47 $\mu$ F/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  $\times$  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  $\times$  5 mm
- L4 = 6 turns enamelled Cu wire (1,0 mm); int. dia. 6,5 mm; length 11,0 mm; leads 2  $\times$  5 mm
- R1 = 2,4  $\Omega$ ; parallel connection of 2  $\times$  4,7  $\Omega$  carbon resistors
- R2 = 39  $\Omega$  carbon resistor

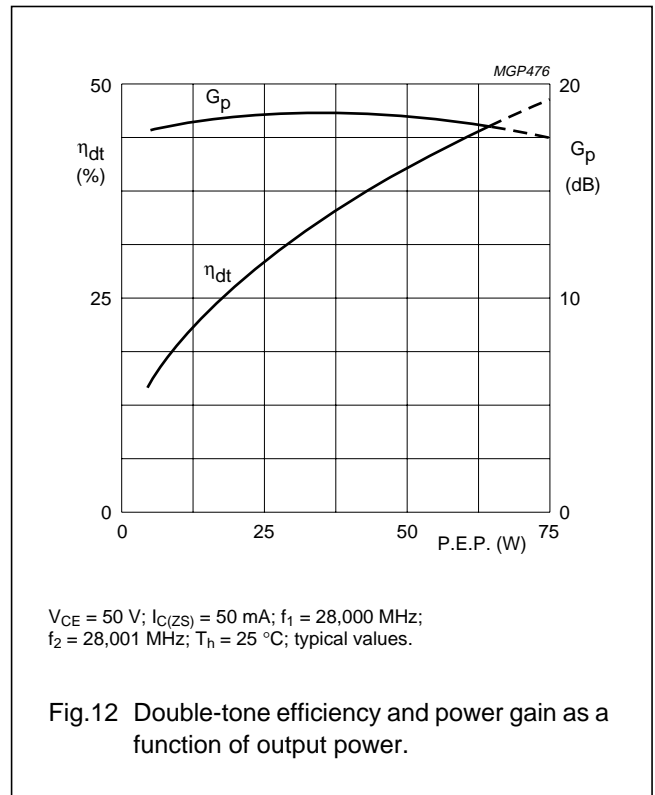
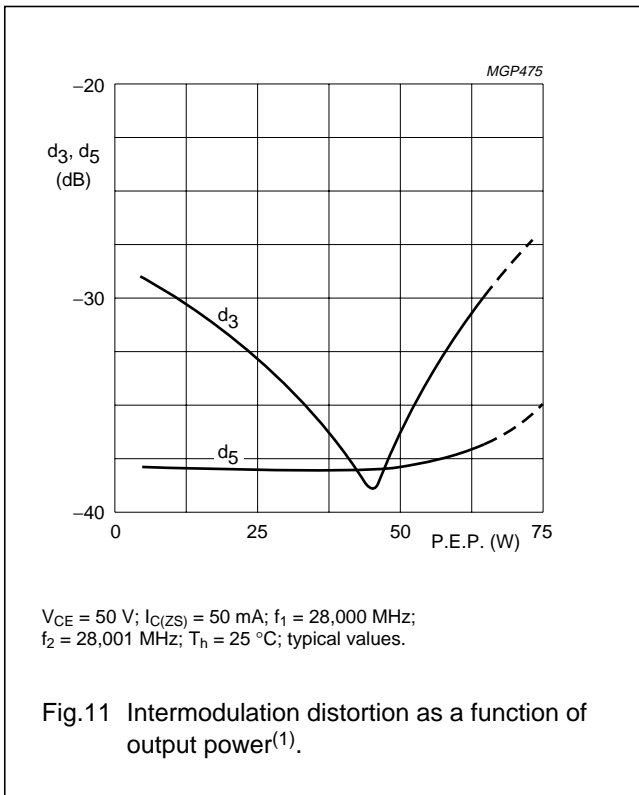
#### Note

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.



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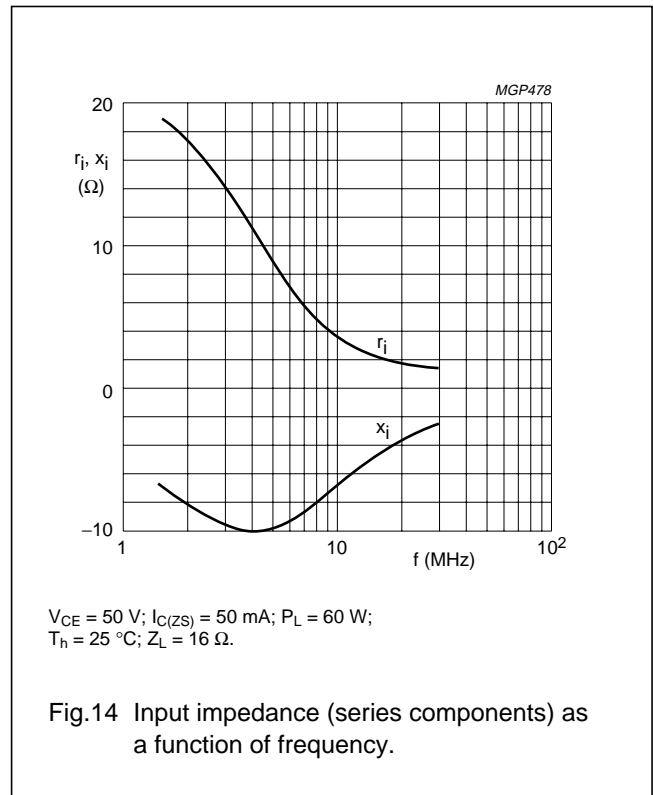
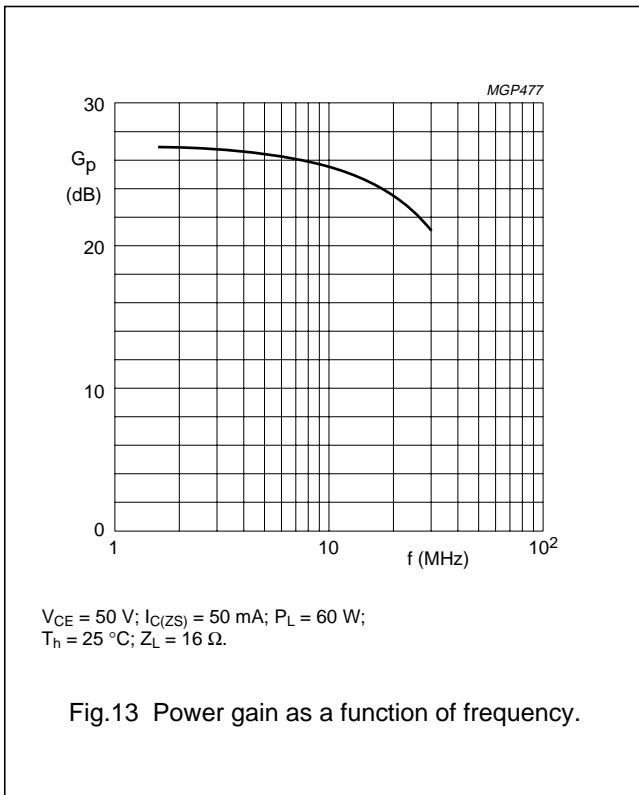
**Ruggedness in s.s.b. operation**

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:

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

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

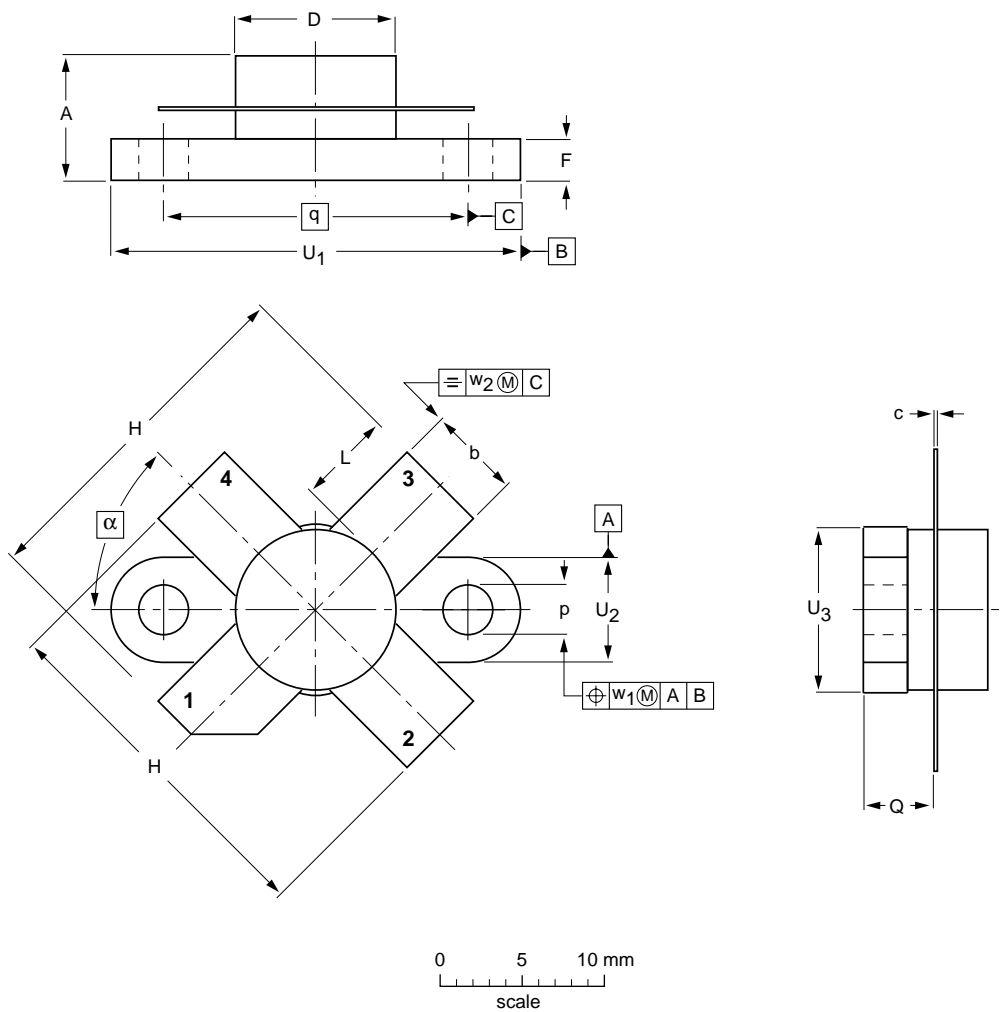
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PACKAGE OUTLINE

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 <sub>1</sub>	F	H	L	p	Q	q	U <sub>1</sub>	U <sub>2</sub>	U <sub>3</sub>	w <sub>1</sub>	w <sub>2</sub>	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

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**DEFINITIONS**

<b>Data Sheet Status</b>	
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.
<b>Limiting values</b>	
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.	
<b>Application information</b>	
Where application information is given, it is advisory and does not form part of the specification.	

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