

BLF145

HF power MOS transistor

Rev. 04 — 5 January 2007

Product data sheet

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NXP Semiconductors

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FEATURES

- High power gain
- Low noise figure
- Good thermal stability
- Withstands full load mismatch.

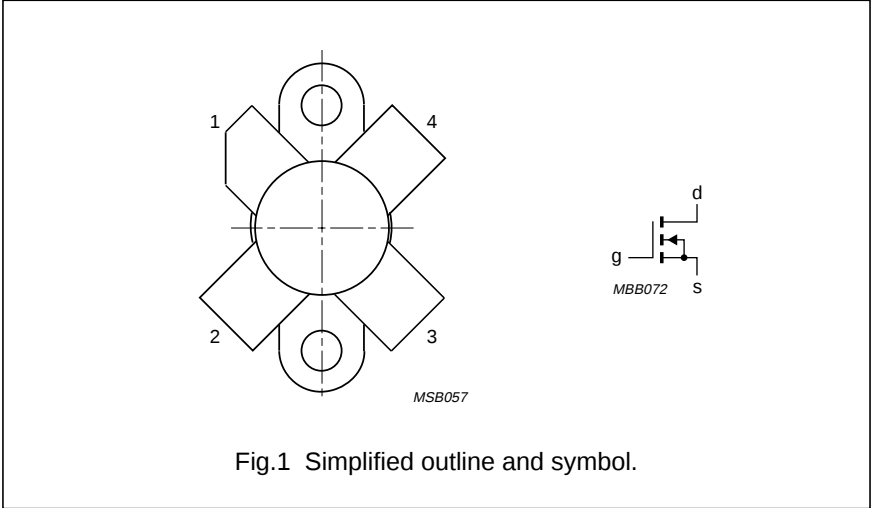
DESCRIPTION

Silicon N-channel enhancement mode vertical D-MOS transistor designed for SSB transmitter applications in the HF frequency range. The transistor is encapsulated in a 4-lead, SOT123A flange package, with a ceramic cap. All leads are isolated from the flange. Matched gate-source voltage (V_{GS}) groups are available on request.

PINNING - SOT123A

PIN	DESCRIPTION
1	drain
2	source
3	gate
4	source

PIN CONFIGURATION



CAUTION

This product is supplied in anti-static packing to prevent damage caused by electrostatic discharge during transport and handling. For further information, refer to Philips specs.: SNW-EQ-608, SNW-FQ-302A, and SNW-FQ-302B.

WARNING

Product and environmental safety - toxic materials

This product contains beryllium oxide. The product is entirely safe provided that the BeO disc is not damaged. All persons who handle, use or dispose of this product should be aware of its nature and of the necessary safety precautions. After use, dispose of as chemical or special waste according to the regulations applying at the location of the user. It must never be thrown out with the general or domestic waste.

QUICK REFERENCE DATA

RF performance at $T_h = 25\text{ }^{\circ}\text{C}$ in a common source test circuit.

MODE OF OPERATION	f (MHz)	V_{DS} (V)	I_D (A)	P_L (W)	G_p (dB)	η_D (%) ⁽¹⁾	d_3 (dB)
SSB, class-A	28	28	1.3	8 (PEP)	>24	–	<–40
SSB, class-AB	28	28	–	30 (PEP)	typ. 20	typ. 40	typ. –35

Note

1. 2-tone efficiency.

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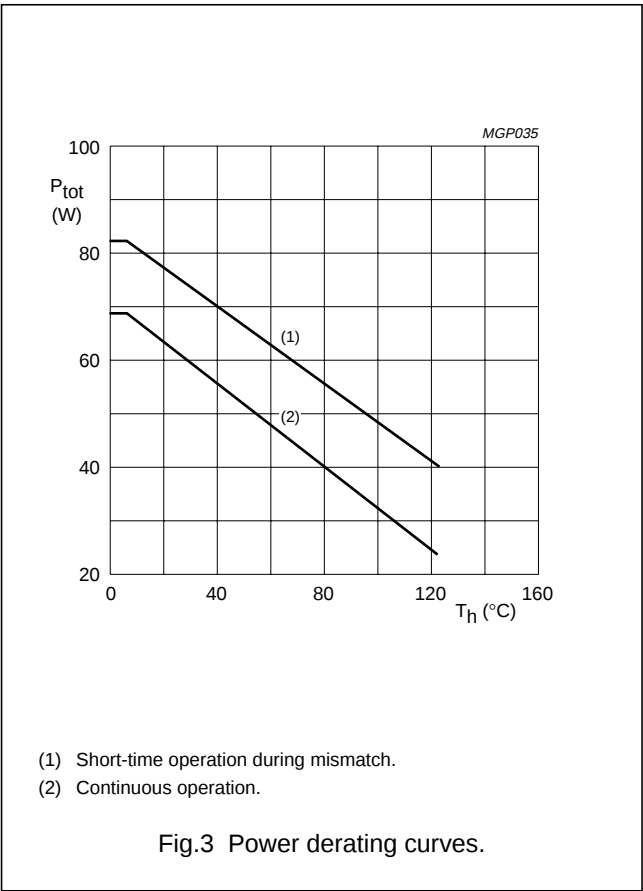
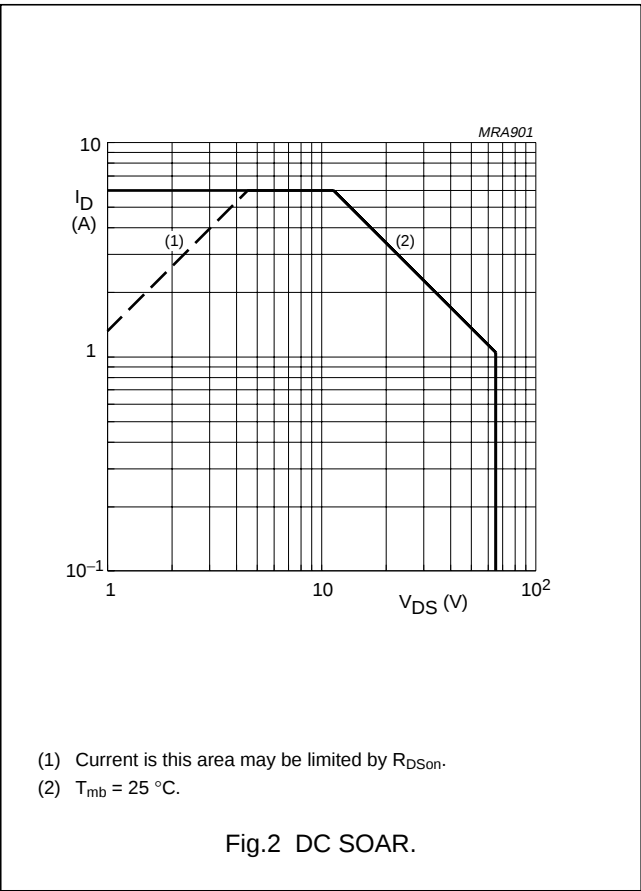
LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 60134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{DS}	drain-source voltage		–	65	V
V_{GS}	gate-source voltage		–	± 20	V
I_D	drain current (DC)		–	6	A
P_{tot}	total power dissipation	$T_{mb} \leq 25\text{ }^{\circ}\text{C}$	–	68	W
T_{stg}	storage temperature		–65	150	$^{\circ}\text{C}$
T_j	junction temperature		–	200	$^{\circ}\text{C}$

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	VALUE	UNIT
$R_{th\ j-mb}$	thermal resistance from junction to mounting base	2.6	K/W
$R_{th\ mb-h}$	thermal resistance from mounting base to heatsink	0.3	K/W



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CHARACTERISTICS

$T_j = 25\text{ }^{\circ}\text{C}$ unless otherwise specified.

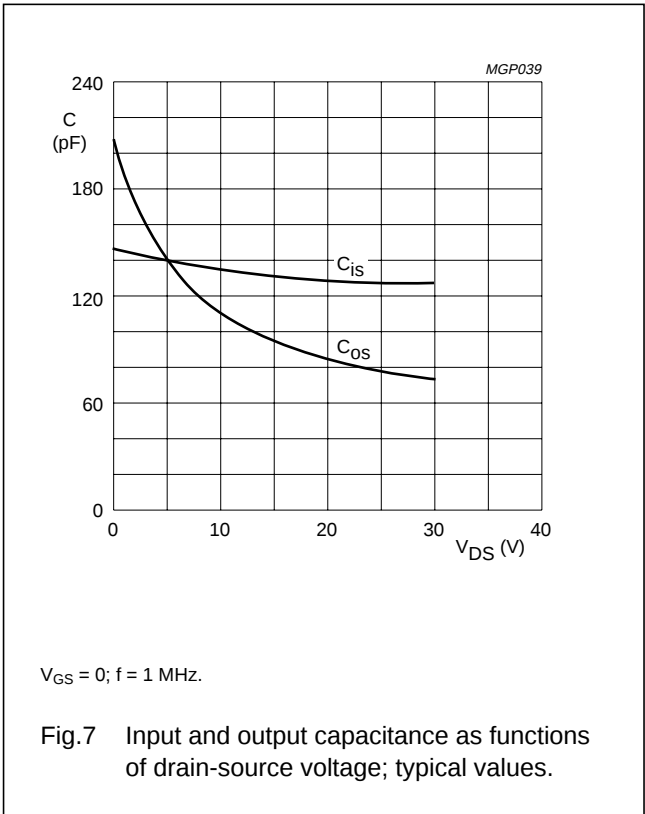
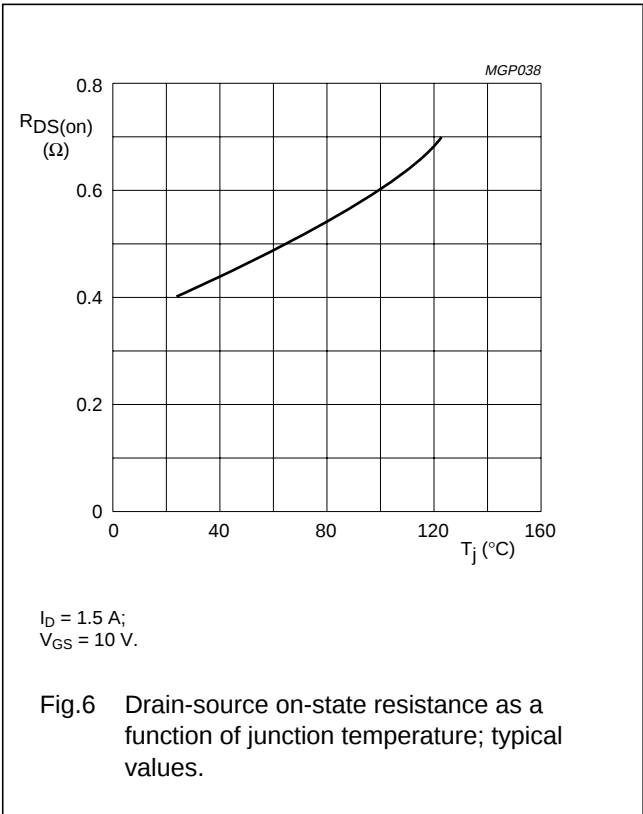
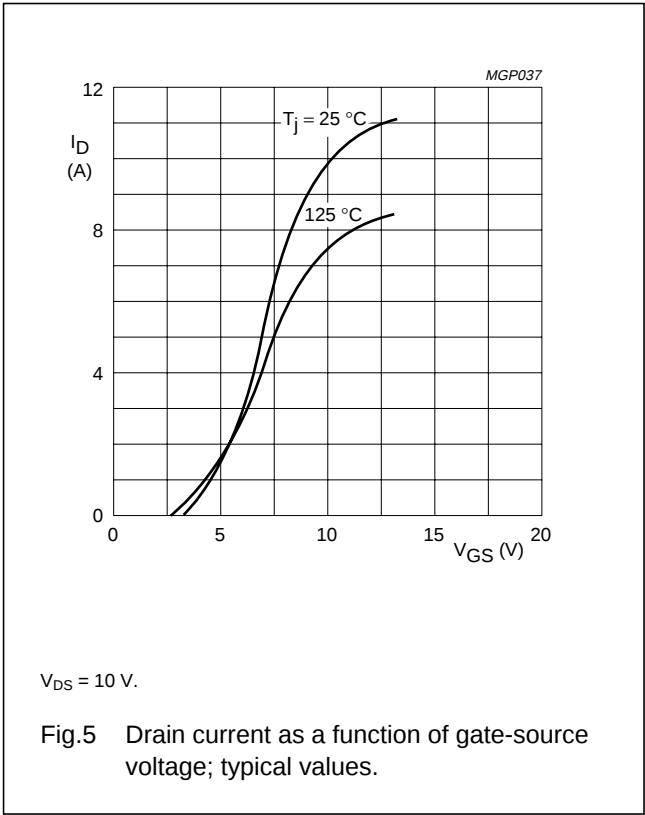
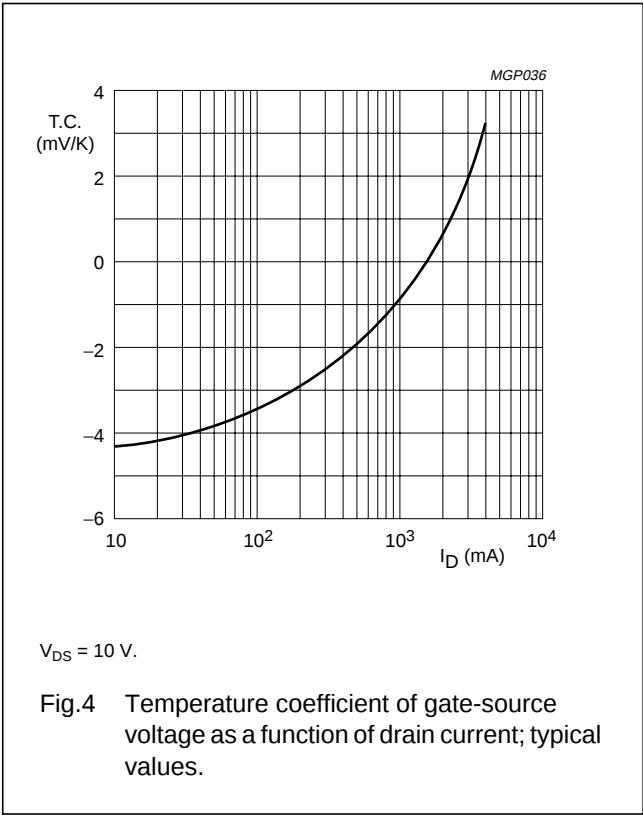
SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{(BR)DSS}$	drain-source breakdown voltage	$I_D = 10\text{ mA}$; $V_{GS} = 0$	65	–	–	V
I_{DSS}	drain-source leakage current	$V_{GS} = 0$; $V_{DS} = 28\text{ V}$	–	–	2	mA
I_{GSS}	gate-source leakage current	$V_{GS} = \pm 20\text{ V}$; $V_{DS} = 0$	–	–	1	μA
V_{GSth}	gate-source threshold voltage	$I_D = 10\text{ mA}$; $V_{DS} = 10\text{ V}$	2	–	4.5	V
ΔV_{GS}	gate-source voltage difference of matched devices	$I_D = 10\text{ mA}$; $V_{DS} = 10\text{ V}$	–	–	100	mV
g_{fs}	forward transconductance	$I_D = 1.5\text{ A}$; $V_{DS} = 10\text{ V}$	1.2	–	–	S
R_{DSon}	drain-source on-state resistance	$I_D = 1.5\text{ A}$; $V_{GS} = 10\text{ V}$	–	0.4	0.75	Ω
I_{DSX}	on-state drain current	$V_{GS} = 10\text{ V}$; $V_{DS} = 10\text{ V}$	–	10	–	A
C_{is}	input capacitance	$V_{GS} = 0$; $V_{DS} = 28\text{ V}$; $f = 1\text{ MHz}$	–	125	–	pF
C_{os}	output capacitance	$V_{GS} = 0$; $V_{DS} = 28\text{ V}$; $f = 1\text{ MHz}$	–	75	–	pF
C_{rs}	feedback capacitance	$V_{GS} = 0$; $V_{DS} = 28\text{ V}$; $f = 1\text{ MHz}$	–	7	–	pF

 V_{GS} group indicator

GROUP	LIMITS (V)		GROUP	LIMITS (V)	
	MIN.	MAX.		MIN.	MAX.
A	2.0	2.1	O	3.3	3.4
B	2.1	2.2	P	3.4	3.5
C	2.2	2.3	Q	3.5	3.6
D	2.3	2.4	R	3.6	3.7
E	2.4	2.5	S	3.7	3.8
F	2.5	2.6	T	3.8	3.9
G	2.6	2.7	U	3.9	4.0
H	2.7	2.8	V	4.0	4.1
J	2.8	2.9	W	4.1	4.2
K	2.9	3.0	X	4.2	4.3
L	3.0	3.1	Y	4.3	4.4
M	3.1	3.2	Z	4.4	4.5
N	3.2	3.3			

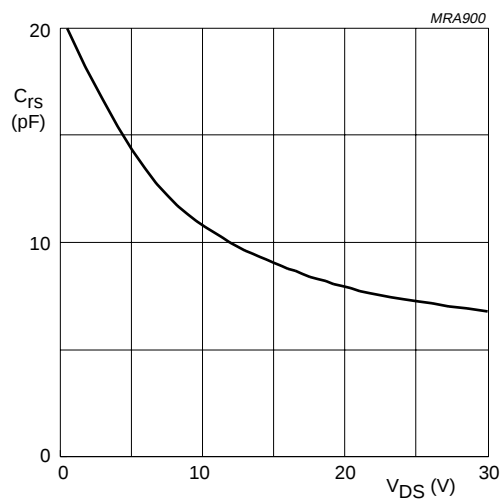
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$V_{GS} = 0$; $f = 1$ MHz.

Fig.8 Feedback capacitance as a function of drain-source voltage, typical values.

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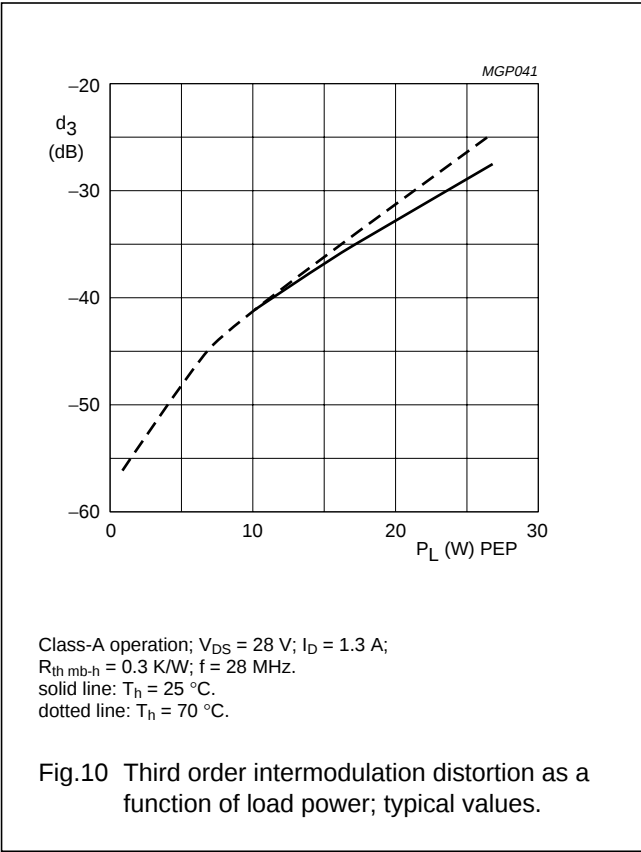
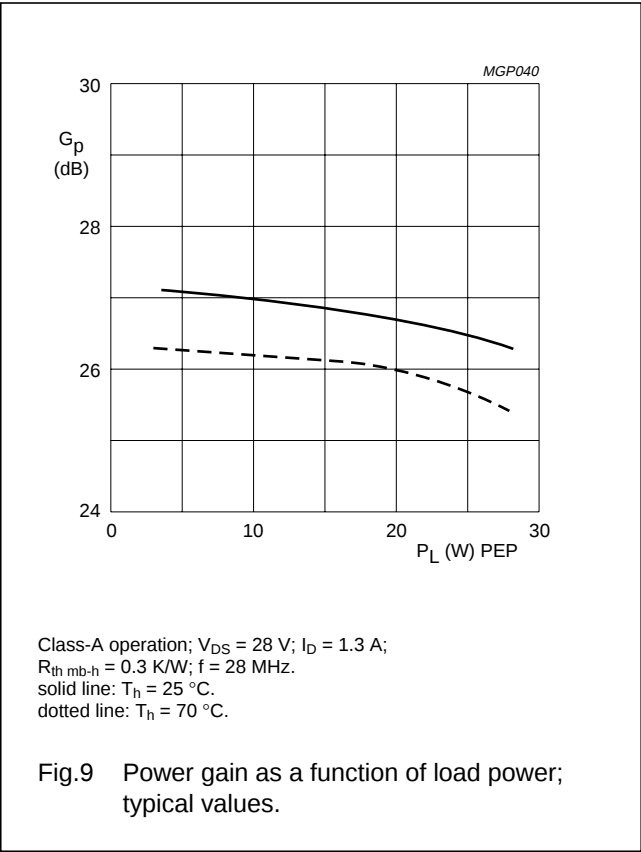
APPLICATION INFORMATION FOR CLASS-A OPERATION

$T_h = 25\text{ }^{\circ}\text{C}$; $R_{th\text{ mb-h}} = 0.3\text{ K/W}$; $R1 = 26\text{ }\Omega$; unless otherwise specified.
RF performance in SSB operation in a common source class-A circuit.

MODE OF OPERATION	f (MHz)	V _{DS} (V)	I _D (A)	P _L (W)	G _p (dB)	d ₃ (dB) ⁽¹⁾	d ₅ (dB) ⁽¹⁾	Z _L (Ω)
SSB, class-A	28	28	1.3	8 (PEP)	>24 typ. 27	>-40 typ. -43	<-40 typ. -70	18.4 + j5.2

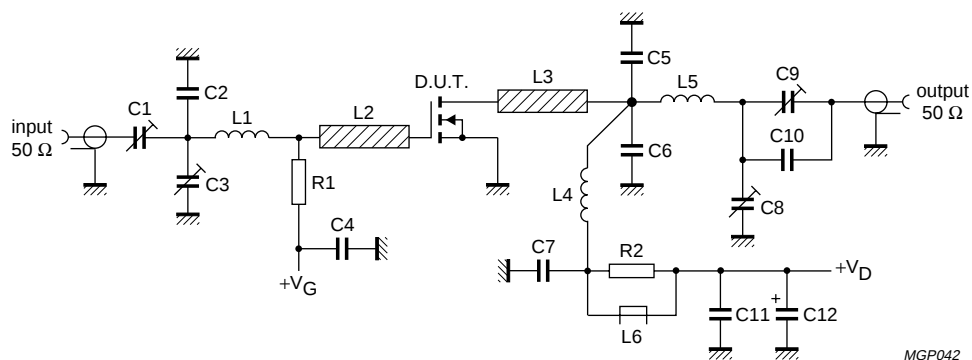
Note

- Maximum values at drive levels within the specified PEP values for either amplified tone. For the peak envelope power the values should be decreased by 6 dB.



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f = 28 MHz.

Fig.11 Test circuit for class-A operation.

List of components (see Fig.11)

COMPONENT	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE NO.
C1, C3, C8, C9	film dielectric trimmer	7 to 100 pF		2222 809 07015
C2, C10	multilayer ceramic chip capacitor; note 1	39 pF		
C4, C7	multilayer ceramic chip capacitor	100 nF		2222 852 47104
C5, C6	multilayer ceramic chip capacitor; note 1	27 pF		
C11	multilayer ceramic chip capacitor	3 × 100 nF		2222 852 47104
C12	electrolytic capacitor	2.2 μF, 63 V		2222 030 38228
L1	12 turns enamelled 0.5 mm copper wire	307 nH	length 8 mm; int. dia. 4 mm	
L2, L3	stripline; note 2	30 Ω	length 15 × 6 mm	
L4	14 turns enamelled 1 mm copper wire	1039 nH	length 14 mm; int. dia. 9 mm	
L5	9 turns enamelled 1 mm copper wire	305 nH	length 10 mm; int. dia. 6 mm	
L6	grade 3B Ferroxcube wideband HF choke			4312 020 36640
R1	0.25 W metal film resistor	26 Ω		
R2	0.25 W metal film resistor	10 Ω		

Notes

- American Technical Ceramics (ATC) capacitor, type 100B or other capacitor of the same quality.
- The striplines are on a double copper-clad printed circuit board, with epoxy dielectric ($\epsilon_r = 4.5$), thickness 1.6 mm.

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APPLICATION INFORMATION FOR CLASS-B OPERATION

$T_h = 25\text{ }^{\circ}\text{C}$; $R_{th\text{ mb-h}} = 0.3\text{ K/W}$; $R1 = 34\text{ }\Omega$; unless otherwise specified.
RF performance in SSB operation in a common source class-AB circuit.

MODE OF OPERATION	f (MHz)	V _{DS} (V)	I _{DQ} (A)	P _L (W)	G _p (dB)	η_D (%)	d ₃ (dB) ⁽¹⁾	d ₅ (dB) ⁽¹⁾	Z _L (Ω)
SSB, class-AB	28	28	0.25	30 (PEP)	typ. 20	typ. 40	typ. -35	typ. -40	8.9 + j1.0

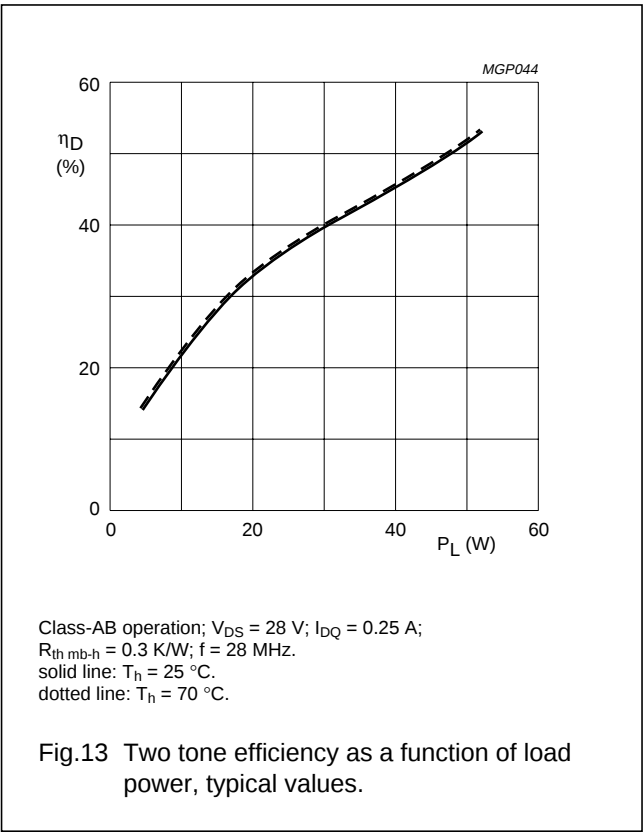
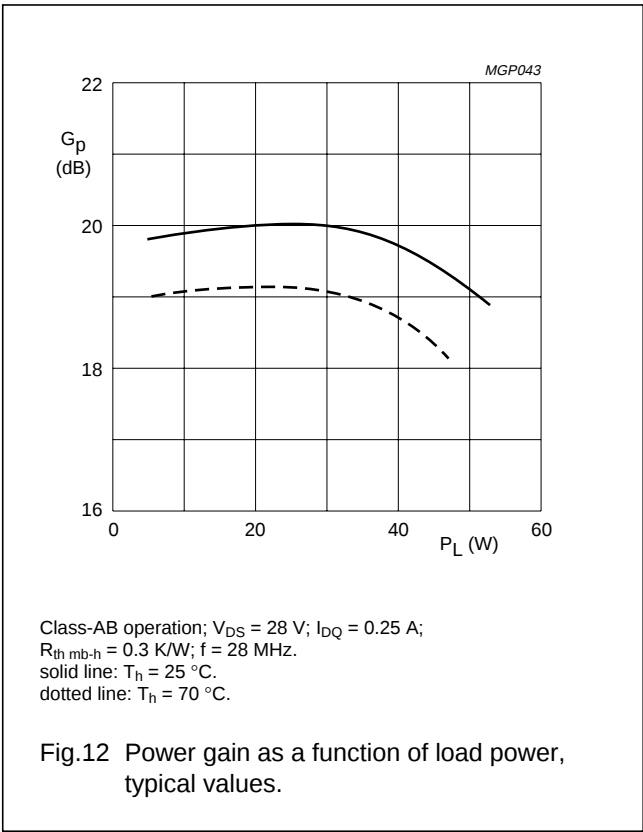
Note

1. Maximum values at drive levels within the specified PEP values for either amplified tone. For the peak envelope power the values should be decreased by 6 dB.

Ruggedness in class-AB operation

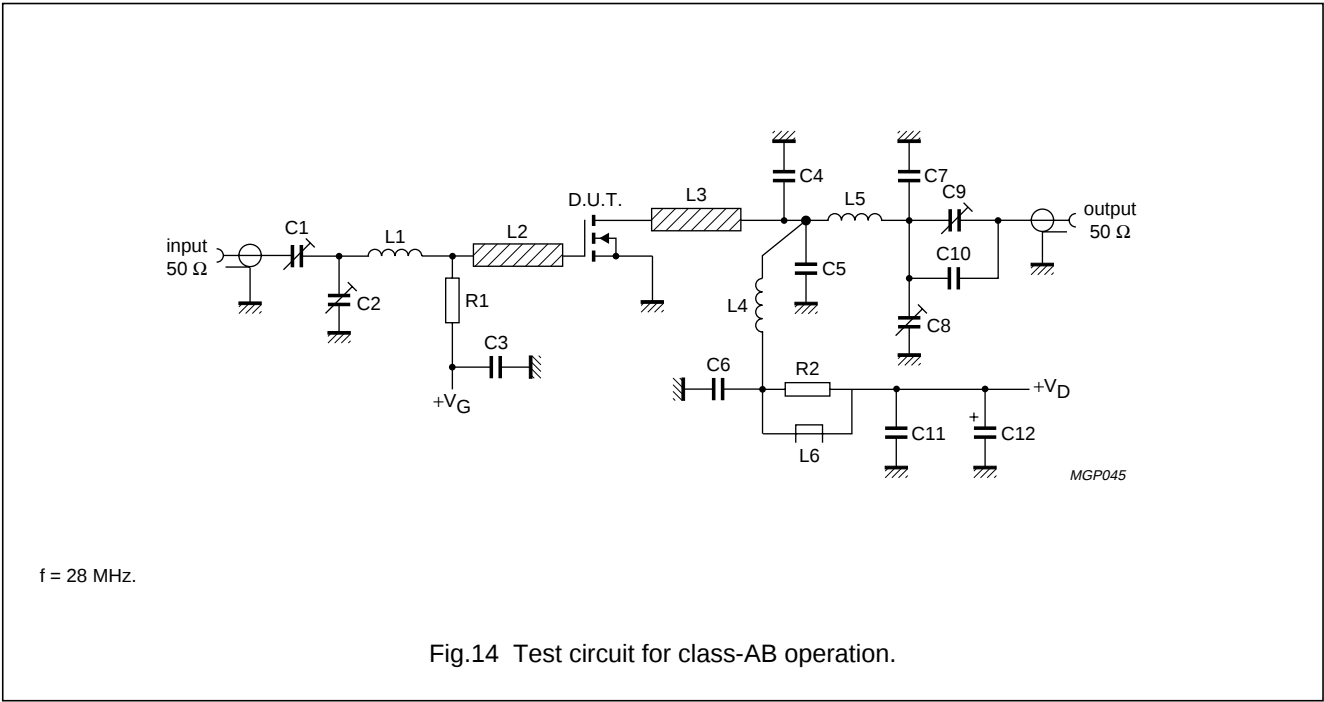
The BLF145 is capable of withstanding a load mismatch corresponding to VSWR = 50 through all phases at $P_L = 30\text{ W}$ single tone under the following conditions:

$V_{DS} = 28\text{ V}$; $f = 28\text{ MHz}$; $T_h = 25\text{ }^{\circ}\text{C}$; $R_{th\text{ mb-h}} = 0.3\text{ K/W}$ at rated load power.



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List of components (see Fig.14)

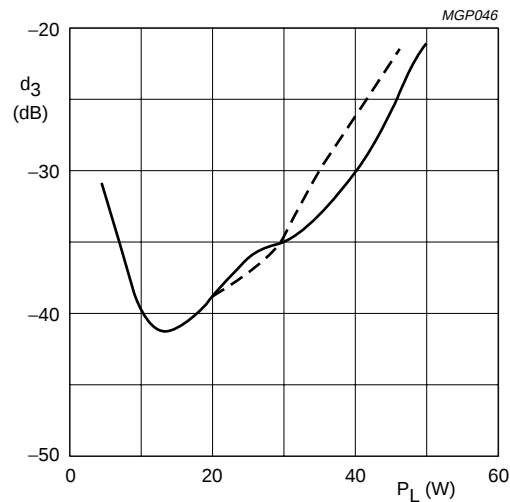
COMPONENT	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE NO.
C1, C2	film dielectric trimmer	5 to 60 pF		2222 809 07011
C3, C6	multilayer ceramic chip capacitor	100 nF		2222 852 47104
C4, C5	multilayer ceramic chip capacitor; note 1	27 pF		
C7, C10	multilayer ceramic chip capacitor; note 1	39 pF		
C8, C9	film dielectric trimmer	7 to 100 pF		2222 809 07015
C11	multilayer ceramic chip capacitor	3 × 100 nF		2222 852 47104
C12	electrolytic capacitor	2.2 μF, 63 V		2222 030 38228
L1	13 turns enamelled 0.5 mm copper wire	415 nH	length 10 mm; int. dia. 5 mm	
L2, L3	stripline; note 2	30 Ω	length 15 × 6 mm	
L4	10 turns enamelled 1 mm copper wire	390 nH	length 13 mm; int. dia. 7 mm	
L5	9 turns enamelled 1 mm copper wire	245 nH	length 10 mm; int. dia. 5 mm	
L6	grade 3B Ferroxcube wideband HF choke			4312 020 36640
R1	0.5 W metal film resistor	34 Ω		
R2	0.25 W metal film resistor	10 Ω		

Notes

1. American Technical Ceramics (ATC) capacitor, type 100B or other capacitor of the same quality.
2. The striplines are on a double copper-clad printed circuit board, with epoxy dielectric ($\epsilon_r = 4.5$), thickness 1.6 mm.

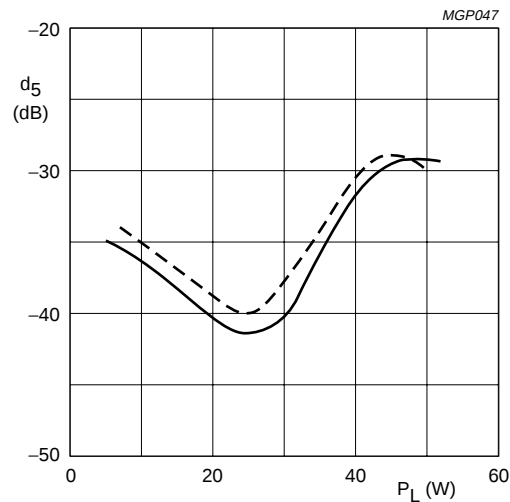
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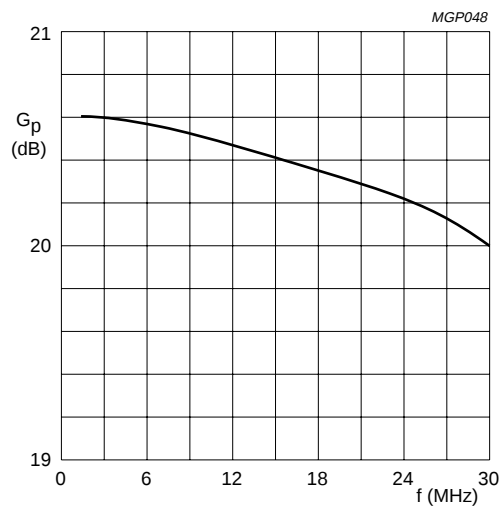
Class-AB operation; $V_{DS} = 28\text{ V}$; $I_{DQ} = 0.25\text{ A}$;
 $R_{th\text{ mb-h}} = 0.3\text{ K/W}$; $f = 28\text{ MHz}$.
solid line: $T_h = 25^\circ\text{C}$.
dotted line: $T_h = 70^\circ\text{C}$.

Fig.15 Third order intermodulation distortion as a function of load power, typical values.



Class-AB operation; $V_{DS} = 28\text{ V}$; $I_{DQ} = 0.25\text{ A}$;
 $R_{th\text{ mb-h}} = 0.3\text{ K/W}$; $f = 28\text{ MHz}$.
solid line: $T_h = 25^\circ\text{C}$.
dotted line: $T_h = 70^\circ\text{C}$.

Fig.16 Fifth order intermodulation distortion as a function of load power, typical values.



Class-AB operation; $V_{DS} = 28\text{ V}$; $I_{DQ} = 0.25\text{ A}$;
 $P_L = 30\text{ W}$; $T_h = 25^\circ\text{C}$; $R_{th\text{ mb-h}} = 0.3\text{ K/W}$;
 $R_1 = 34\ \Omega$; $Z_L = 8.9 + j1\ \Omega$.

Fig.17 Power gain as a function of frequency, typical values.

Table 1

Input impedance as a function of frequency
Class-AB operation; $V_{DS} = 28\text{ V}$; $I_{DQ} = 0.25\text{ A}$; $P_L = 30\text{ W}$;
 $T_h = 25^\circ\text{C}$; $R_{th\text{ mb-h}} = 0.3\text{ K/W}$; $R_1 = 34\ \Omega$;
 $Z_L = 8.9 + j1\ \Omega$.

f (MHz)	Z_i (Ω)
1.5	32.9 – j2.2
3.0	32.4 – j4.3
6.0	30.7 – j8.1
10	27.4 – j11.9
15	32.9 – j14.6
20	18.5 – j15.4
25	15.1 – j15.3
30	12.5 – j14.6

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BLF145 scattering parameters

 $V_{DS} = 28\text{ V}$; $I_D = 250\text{ mA}$; note 1

f (MHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	S ₁₁	∠ Φ	S ₂₁	∠ Φ	S ₁₂	∠ Φ	S ₂₂	∠ Φ
5	0.90	-70.90	62.40	138.40	0.02	49.80	0.83	-67.60
10	0.81	-108.90	42.47	117.90	0.03	30.70	0.72	-105.00
20	0.76	-140.20	23.90	100.40	0.03	16.40	0.66	-135.80
30	0.75	-151.90	16.27	92.20	0.03	10.50	0.65	-147.90
40	0.75	-157.90	12.18	86.50	0.03	8.00	0.64	-153.40
50	0.75	-161.40	9.70	82.00	0.03	6.60	0.65	-156.40
60	0.76	-163.70	8.01	78.10	0.03	5.80	0.66	-158.30
70	0.77	-165.30	6.78	74.50	0.03	5.60	0.67	-159.70
80	0.77	-166.60	5.85	71.30	0.03	6.20	0.68	-160.50
90	0.78	-167.50	5.14	68.30	0.02	7.30	0.69	-161.20
100	0.79	-168.40	4.56	65.30	0.02	8.80	0.71	-162.00
125	0.81	-170.40	3.48	58.20	0.02	15.50	0.74	-163.70
150	0.83	-172.00	2.74	52.50	0.02	27.00	0.77	-164.90
175	0.85	-173.60	2.23	47.70	0.02	41.30	0.80	-166.20
200	0.87	-175.20	1.86	43.00	0.02	54.50	0.82	-168.00
250	0.89	-178.40	1.32	35.30	0.03	72.80	0.86	-171.20
300	0.91	178.50	1.00	29.70	0.04	80.50	0.89	-174.20
350	0.93	175.50	0.77	25.50	0.05	83.90	0.91	-177.10
400	0.94	172.60	0.62	22.90	0.06	84.80	0.93	-179.90
450	0.94	169.90	0.50	20.90	0.07	85.30	0.94	177.60
500	0.95	167.20	0.43	20.30	0.08	84.20	0.94	175.10
600	0.95	161.90	0.32	21.60	0.10	82.40	0.95	170.60
700	0.95	156.80	0.26	25.40	0.12	79.90	0.96	166.40
800	0.94	151.90	0.23	31.50	0.14	78.20	0.96	162.30
900	0.94	147.20	0.22	38.60	0.16	74.10	0.94	158.60
1000	0.94	142.10	0.23	48.40	0.15	75.40	0.94	162.10

Note

1. For more extensive s-parameters see internet:
<http://www.semiconductors.philips.com/markets/communications/wirelesscommunication/broadcast>.

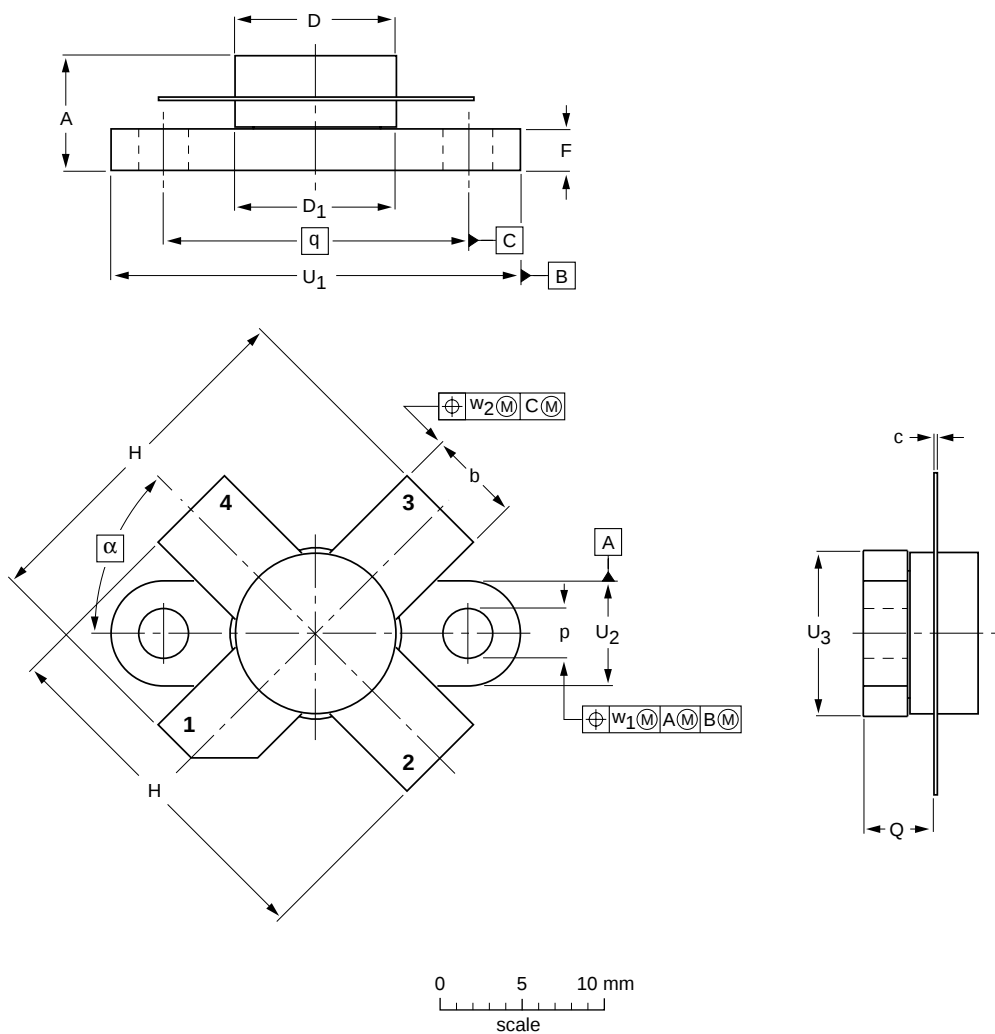
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PACKAGE OUTLINE

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 ₁	F	H	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	9.78 9.42	2.72 2.31	20.71 19.93	3.33 3.04	4.63 4.11	18.42	24.87 24.64	6.48 6.22	9.78 9.39	0.25	0.51	45°
inches	0.294 0.251	0.229 0.219	0.007 0.004	0.383 0.373	0.385 0.371	0.107 0.091	0.815 0.785	0.131 0.120	0.182 0.162	0.725	0.980 0.970	0.255 0.245	0.385 0.370	0.010	0.020	

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT123A						99-03-29

Legal information

Data sheet status

Document status ^{[1][2]}	Product status ^[3]	Definition
Objective [short] data sheet	Development	This document contains data from the objective specification for product development.
Preliminary [short] data sheet	Qualification	This document contains data from the preliminary specification.
Product [short] data sheet	Production	This document contains the product specification.

[1] Please consult the most recently issued document before initiating or completing a design.

[2] The term 'short data sheet' is explained in section "Definitions".

[3] The product status of device(s) described in this document may have changed since this document was published and may differ in case of multiple devices. The latest product status information is available on the Internet at URL <http://www.nxp.com>.

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Revision history

Revision history				
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BLF145_N_4	20070105	Product data sheet	-	BLF145_3
Modifications:	• corrections made to note 2 on page 8 • corrections made to note 2 on page 10			
BLF145_3 (9397 750 11581)	20031013	Product specification	-	BLF145_CNV_2
BLF145_CNV_2 (9397 750 xxxxx)	19971212	Product specification	-	-



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