BLF175 HF/VHF power MOS transistor Rev. 4 — 1 September 2015



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Thank you for your cooperation and understanding,

Ampleon

BLF175

FEATURES

- High power gain
- Low intermodulation distortion
- · Easy power control
- Good thermal stability
- Withstands full load mismatch
- Gold metallization ensures excellent reliability.

DESCRIPTION

Silicon N-channel enhancement mode vertical D-MOS transistor designed for large signal amplifier applications in the HF/VHF frequency range.

The transistor has a 4-lead, SOT123A flange package, with a ceramic cap. All leads are isolated from the flange.

A marking code, showing gate-source voltage (V_{GS}) information is provided for matched pair applications. Refer to the handbook 'General' section for further information.

PINNING - SOT123A

PIN	DESCRIPTION
1	drain
2	source
3	gate
4	source



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 °C in a common source test circuit.

MODE OF OPERATION	f (MH _Z)	V _{DS} (V)	I _{DQ} (mA)	P _L (W)	G _p (dB)	η _D (%)	d ₃ (dB)
class-A	28	50	800	8 (PEP)	>24	_	<-40
class-AB	28	50	150	30 (PEP)	typ. 24	typ. 40 ⁽¹⁾	typ. –35
CW, class-B	108	50	30	30	typ. 20	typ. 65	_

Note

1. 2-tone efficiency.

BLF175

LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V _{DS}	drain-source voltage		_	125	V
±V _{GS}	gate-source voltage		-	20	V
ID	DC drain current		-	4	A
P _{tot}	total power dissipation	$T_{mb} \le 25 \ ^{\circ}C$	-	68	W
T _{stg}	storage temperature		-65	+150	°C
Tj	junction temperature		-	200	°C

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
R _{th j-mb}	thermal resistance from junction to mounting base	$T_{mb} = 25 \ ^{\circ}C; P_{tot} = 68 \text{ W}$	2.6	K/W
R _{th mb-h}	thermal resistance from mounting base to heatsink	$T_{mb} = 25 \text{ °C}; P_{tot} = 68 \text{ W}$	0.3	K/W





BLF175

CHARACTERISTICS

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V _{(BR)DSS}	drain-source breakdown voltage	I _D = 100 mA; V _{GS} = 0	125	-	-	V
I _{DSS}	drain-source leakage current	$V_{GS} = 0; V_{DS} = 50 V$	_	-	100	μA
I _{GSS}	gate-source leakage current	$\pm V_{GS} = 20 \text{ V}; \text{ V}_{DS} = 0$	-	-	1	μA
V _{GSth}	gate-source threshold voltage	I _D = 10 mA; V _{DS} = 10 V	2	-	4.5	V
ΔV_{GS}	gate-source voltage difference of matched pairs	I _D = 10 mA; V _{DS} = 10 V	-	-	100	mV
g fs	forward transconductance	I _D = 1 A; V _{DS} = 10 V	1.1	1.6	-	S
R _{DSon}	drain-source on-state resistance	I _D = 1 A; V _{GS} = 10 V	-	0.75	1.5	Ω
I _{DSX}	on-state drain current	V _{GS} = 10 V; V _{DS} = 10 V	-	5.5	-	А
C _{is}	input capacitance	$V_{GS} = 0; V_{DS} = 50 V; f = 1 MHz$	_	130	-	pF
C _{os}	output capacitance	$V_{GS} = 0; V_{DS} = 50 V; f = 1 MHz$	-	36	-	pF
C _{rs}	feedback capacitance	V _{GS} = 0; V _{DS} = 50 V; f = 1 MHz	-	3.7	-	pF

V_{GS} group indication

GROUP		IITS /)	GROUP	LIMITS (V)		
	MIN.	MAX.		MIN.	MAX.	
А	2.0	2.1	0	3.3	3.4	
В	2.1	2.2	Р	3.4	3.5	
С	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	Т	3.8	3.9	
G	2.6	2.7	U	3.9	4.0	
Н	2.7	2.8	V	4.0	4.1	
J	2.8	2.9	W	4.1	4.2	
К	2.9	3.0	Х	4.2	4.3	
L	3.0	3.1	Y	4.3	4.4	
М	3.1	3.2	Z	4.4	4.5	
Ν	3.2	3.3				



BLF175



APPLICATION INFORMATION FOR CLASS-A OPERATION

 $\label{eq:thmosel} \begin{array}{l} T_h=25~^\circ C;~R_{th~mb-h}=0.3~\text{K/W};~\text{unless otherwise specified}.\\ \text{RF performance in SSB operation in a common source circuit.}\\ f_1=28.000~\text{MHz};~f_2=28.001~\text{MHz}. \end{array}$

P _L	f	V _{DS}	I _{DQ}	G _p	d ₃	d ₅	R _{GS}
(W)	(MHz)	(V)	(mA)	(dB)	(dB) ⁽¹⁾	(dB) ⁽¹⁾	(Ω)
0 to 8 (PEP)	28	50	800	> 24 typ. 28	>-40 typ44	< -40 typ64	24 24

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.

BLF175



 $R_{GS} = 24 \Omega$; $r_1 = 28.000 \text{ MHZ}$; r_2 solid line: $T_h = 25 \text{ °C}$.

dotted line: $T_h = 70 \circ C$.

Fig.9 Power gain as a function of load power; typical values.



Fig.11 Power gain as a function of frequency; typical values.



$$\begin{split} & \text{Class-A operation; V}_{\text{DS}} = 50 \text{ V; } \ \text{I}_{\text{DQ}} = 0.8 \text{ A;} \\ & \text{R}_{\text{GS}} = 24 \ \Omega; \ \text{f}_1 = 28.000 \text{ MHz; } \ \text{f}_2 = 28.001 \text{ MHz.} \\ & \text{solid line: T}_h = 25 \ ^{\circ}\text{C.} \\ & \text{dotted line: T}_h = 70 \ ^{\circ}\text{C.} \end{split}$$

Fig.10 Third order intermodulation distortion as a function of load power; typical values.



Fig.12 Third order intermodulation distortion as a function of frequency; typical values.



BLF175

COMPONENT	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE NO.
C1	multilayer ceramic chip capacitor (note 1)	39 pF		
C2	multilayer ceramic chip capacitor	3 × 10 nF		2222 852 47103
C3, C4, C6	multilayer ceramic chip capacitor	100 nF		2222 852 47104
C5	multilayer ceramic chip capacitor	10 nF		2222 852 47103
C7	multilayer ceramic chip capacitor	3 × 100 nF		2222 852 47104
C8	aluminium electrolytic capacitor	10 μF, 63 V		2222 030 28109
C9	multilayer ceramic chip capacitor (note 1)	24 pF		
L1	4 turns enamelled 0.6 mm copper wire	86 nH	length 3.3 mm; int. dia. 5 mm; leads 2×2 mm	
L2	36 turns enamelled 0.7 mm copper wire wound on a rod grade 4B1 Ferroxcube drain choke	20 μΗ	length 30 mm; int. dia. 5 mm	4330 030 30031
L3	grade 3B Ferroxcube wideband RF choke			4312 020 36640
L4	8 turns enamelled 1 mm copper wire	189 nH	length 9.5 mm; int. dia. 5 mm; leads 2×3 mm	
R1	0.4 W metal film resistor	24 Ω		
R2	0.4 W metal film resistor	1500 Ω		
R3	0.4 W metal film resistor	10 Ω		
Τ1	4 : 1 transformer; 18 turns twisted pair of 0.25 mm copper wire with 10 twists per cm, wound on a grade 4C6 toroidal core		dimensions $9 \times 6 \times 3$ mm	4322 020 97171

List of components (class-A test circuit)

Note

1. American Technical Ceramics (ATC) capacitor, type 100B or other capacitor of the same quality.



MGP077

 40 P_L (W) PEP 60

HF/VHF power MOS transistor

BLF175

APPLICATION INFORMATION FOR CLASS-AB OPERATION

 $T_h = 25 \text{ °C}; R_{th mb-h} = 0.3 \text{ K/W}; \text{ unless otherwise specified.}$ RF performance in SSB operation in a common source circuit. f₁ = 28.000 MHz; f₂ = 28.001 MHz.

P _L	f	V _{DS}	I _{DQ}	G _p	ղը	d ₃	d₅	R _{GS}
(W)	(MHz)	(V)	(mA)	(dB)	(%)	(dB) ⁽¹⁾	(dB) ⁽¹⁾	(Ω)
30 (PEP)	28	50	150	typ. 24	typ. 40 ⁽²⁾	typ. –35	typ. –40	22

Notes

- 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.
- 2. 2-tone efficiency.

Ruggedness in class-AB operation

The BLF175 is capable of withstanding a load mismatch corresponding to VSWR = 50 through all phases at PL = 30 W single tone under the following conditions:

V_{DS} = 50 V; f = 28 MHz.





BLF175

COMPONENT	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE NO.
C1, C10	multilayer ceramic chip capacitor (note 1)	62 pF		
C2, C4, C8, C11	film dielectric trimmer	5 to 60 pF		2222 809 07011
C3	multilayer ceramic chip capacitor (note 1)	51 pF		
C5, C6, C9	multilayer ceramic chip capacitor	100 nF		2222 852 47104
C7	multilayer ceramic chip capacitor (note 1)	10 pF		
C12	aluminium electrolytic capacitor	10 μF, 63 V		2222 030 28109
L1	9 turns enamelled 1 mm copper wire	280 nH	length 11 mm; int. dia. 6 mm; leads 2×4 mm	
L2, L3	stripline (note 2)	30 Ω	length 10 mm; width 6 mm	
L4	14 turns enamelled 1 mm copper wire	1650 nH	length 20 mm; int. dia. 12 mm; leads 2×2 mm	
L5	10 turns enamelled 1 mm copper wire	380 nH	length 13 mm; int. dia. 7 mm; leads 2×3 mm	
L6	grade 3B Ferroxcube wideband RF choke			4312 020 36640
R1	0.4 W metal film resistor	22 Ω		
R2	0.4 W metal film resistor	1 MΩ		
R3	0.4 W metal film resistor	10 Ω		

List of components (class-AB test circuit)

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 PTFE fibre-glass dielectric (ϵ_r = 4.5), thickness 1.6 mm.



BLF175







Class-AB operation; V_{DS} = 50 V; I_{DQ} = 0.15 A; P_L = 30 W (PEP); R_{GS} = 22 \Omega.

Fig.22 Load impedance as a function of frequency (series components); typical values.

APPLICATION INFORMATION FOR CLASS-B OPERATION

RF performance in SSB operation in a common source circuit.

MODE OF	f	V _{DS}	I _{DQ}	PL	G _p	η _D	R _{GS}
OPERATION	(MHz)	(V)	(mA)	(W)	(dB)	(%)	(Ω)
CW, class-B	108	50	30	30	typ. 20	typ. 65	10



BLF175

MGP087

200



BLF175

BLF175 scattering parameters

 V_{DS} = 50 V; I_{D} = 100 mA; note 1.

f (MHz)		s ₁₁	S	21	S	12	5	5 ₂₂
	s ₁₁	$\angle \Phi$	s ₂₁	$\angle \Phi$	s ₁₂	$\angle \Phi$	s ₂₂	$\angle \Phi$
5	0.86	-110.20	36.90	114.20	0.02	25.20	0.64	-84.90
10	0.83	-139.40	20.39	93.30	0.02	5.10	0.55	-112.00
20	0.85	-155.70	9.82	72.60	0.02	-13.40	0.60	-129.30
30	0.88	-161.50	5.96	59.30	0.02	-24.70	0.69	-138.00
40	0.90	-164.90	3.98	49.30	0.02	-31.70	0.76	-144.30
50	0.92	-167.10	2.83	41.90	0.01	-35.80	0.82	-149.30
60	0.94	-169.00	2.11	36.00	0.01	-36.80	0.86	-153.50
70	0.96	-170.70	1.63	31.20	0.01	-33.70	0.89	-157.00
80	0.96	-172.20	1.29	27.40	0.00	-23.00	0.91	-159.90
90	0.97	-173.40	1.04	24.20	0.00	3.30	0.92	-162.40
100	0.97	-174.30	0.86	21.70	0.00	42.50	0.94	-164.50
125	0.99	-176.50	0.57	16.40	0.01	81.60	0.95	-168.80
150	0.99	-178.10	0.40	13.40	0.01	88.70	0.97	-171.90
175	0.99	-179.80	0.30	11.60	0.02	90.70	0.98	-174.50
200	1.00	179.20	0.23	11.00	0.02	90.80	0.98	-176.70
250	1.00	177.00	0.15	11.70	0.03	90.50	0.99	179.80
300	1.00	175.10	0.11	16.70	0.03	89.60	0.99	176.90
350	0.99	173.30	0.08	24.10	0.04	88.30	0.99	174.30
400	1.00	171.80	0.07	33.10	0.05	88.00	0.99	171.90
450	0.99	170.10	0.07	42.70	0.05	87.80	0.99	169.60
500	0.99	168.50	0.07	51.90	0.06	86.50	0.99	167.40
600	0.99	165.40	0.07	64.20	0.07	84.90	0.99	163.10
700	0.99	162.30	0.09	70.60	0.09	83.10	0.98	158.90
800	0.99	158.90	0.10	73.80	0.10	82.20	0.98	154.80
900	0.99	155.30	0.12	74.90	0.12	80.70	0.97	150.60
1000	0.98	151.80	0.14	76.40	0.14	79.80	0.97	146.20

Note

1. For more extensive s-parameters see internet website:

http://www.semiconductors.philips.com.markets/communications/wirelesscommunicationms/broadcast

PACKAGE OUTLINE

Flanged ceramic package; 2 mounting holes; 4 leads



BLF175

SOT123A

BLF175

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Printed in The Netherlands

613524/03/pp**21**

Date of release: 2003 Jul 22

Document order number: 9397 750 11582

SCA75

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