BLF368

VHF push-pull power MOS transistor

Rev. 5 — 1 September 2015

AMPLEON

Product data sheet

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VHF push-pull power MOS transistor BLF368

FEATURES

- High power gain
- Easy power control
- Good thermal stability
- Gold metallization ensures excellent reliability.

DESCRIPTION

Dual push-pull silicon N-channel enhancement mode vertical D-MOS transistor, designed for broadcast transmitter applications in the VHF frequency range.

The transistor is encapsulated in a 4-lead SOT262A1 balanced flange package, with two ceramic caps. The mounting flange provides the common source connection for the transistors.

PIN CONFIGURATION

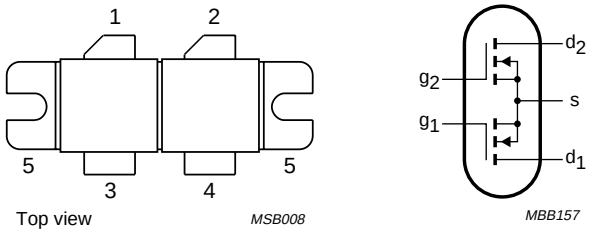


Fig.1 Simplified outline and symbol.

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.

PINNING - SOT262A1

PIN	DESCRIPTION
1	drain 1
2	drain 2
3	gate 1
4	gate 2
5	source

WARNING

Product and environmental safety - toxic materials

This product contains beryllium oxide. The product is entirely safe provided that the BeO discs are 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 push-pull common source test circuit.

MODE OF OPERATION	f (MHz)	V_{DS} (V)	P_L (W)	G_p (dB)	ΔG_p (dB) (note 1)	η_D (%)
CW, class-AB	225	32	300	>12 typ. 13.5	>1 typ. 0.4	>55 typ. 62

Note

1. Assuming a third order amplitude transfer characteristic, 1 dB gain compression corresponds with 30% synchronized input/25% synchronized output compression in television service (negative modulation, CCIR system).

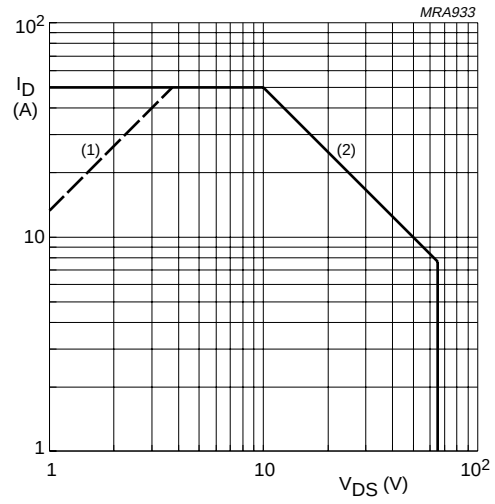
LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
Per transistor section unless otherwise specified					
V_{DS}	drain-source voltage		–	65	V
V_{GS}	gate-source voltage		–	±20	V
I_D	drain current (DC)		–	25	A
P_{tot}	total power dissipation	$T_{mb} \leq 25$ °C total device; both sections equally loaded	–	500	W
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	200	°C

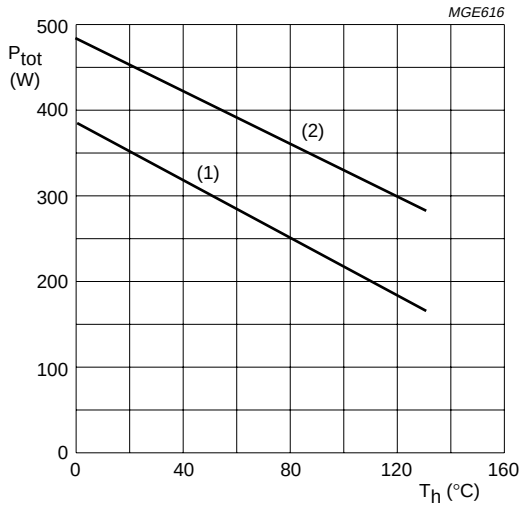
THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting base	total device; both sections equally loaded	0.35	K/W
$R_{th\ mb\text{-}h}$	thermal resistance from mounting base to heatsink	total device; both sections equally loaded	0.15	K/W



(1) Current in this area may be limited by R_{DSon}.
(2) T_{mb} = 25 °C.
Total device; both sections equally loaded.

Fig.2 DC SOAR.



(1) Continuous operation.
(2) Short-time operation during mismatch.
Total device; both sections equally loaded.

Fig.3 Power derating curves.

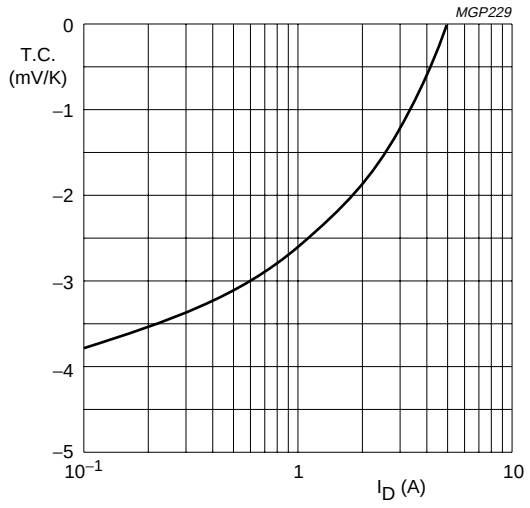
CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETERS	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Per transistor section						
$V_{(BR)DSS}$	drain-source breakdown voltage	V_{GS} = 0; I_D = 100 mA	65	–	–	V
I_{DSS}	drain-source leakage current	V_{GS} = 0; V_{DS} = 32 V	–	–	5	mA
I_{GSS}	gate-source leakage current	V_{GS} = ±20 V; V_{DS} = 0	–	–	1	µA
V_{GSth}	gate-source threshold voltage	I_D = 100 mA; V_{DS} = 10 V	2	–	4.5	V
ΔV_{GS}	gate-source voltage difference of both transistor sections	I_D = 100 mA; V_{DS} = 10 V	–	–	100	mV
g_{fs}	forward transconductance	I_D = 8 A; V_{DS} = 10 V	5	7.5	–	S
g_{fs1}/g_{fs2}	forward transconductance ratio of both transistor sections	I_D = 8 A; V_{DS} = 10 V	0.9	–	1.1	
R_{DSon}	drain-source on-state resistance	I_D = 8 A; V_{DS} = 10 V	–	0.1	0.15	Ω
I_{DSX}	on-state drain current	V_{GS} = 10 V; V_{DS} = 10 V	–	37	–	A
C_{is}	input capacitance	V_{GS} = 0; V_{DS} = 32 V; f = 1 MHz	–	495	–	pF
C_{os}	output capacitance	V_{GS} = 0; V_{DS} = 32 V; f = 1 MHz	–	340	–	pF
C_{rs}	feedback capacitance	V_{GS} = 0; V_{DS} = 32 V; f = 1 MHz	–	40	–	pF
$C_{d\text{-}f}$	drain-flange capacitance		–	5.4	–	pF

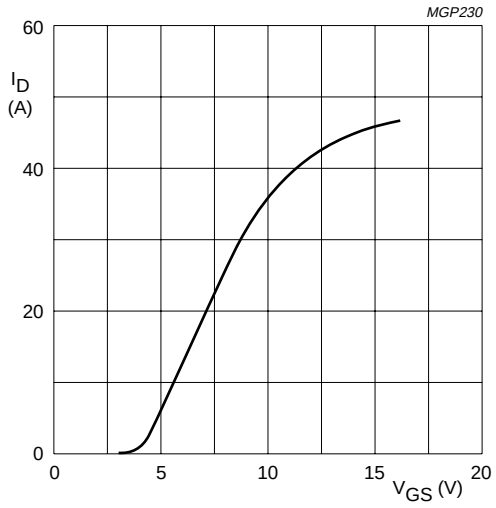
V_{GS} group indicator

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			



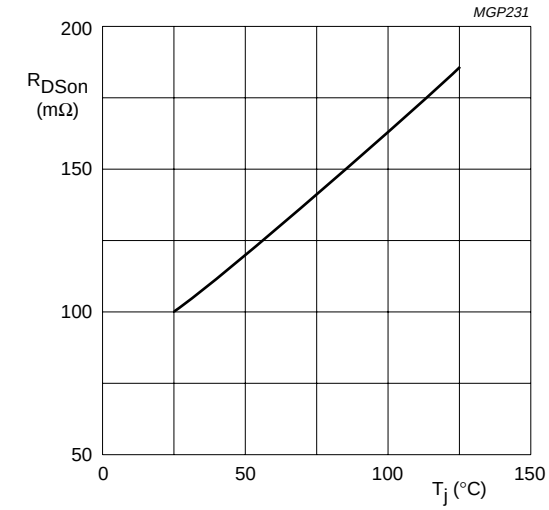
V_{DS} = 10 V.

Fig.4 Temperature coefficient of gate-source voltage as a function of drain current; typical values per section.



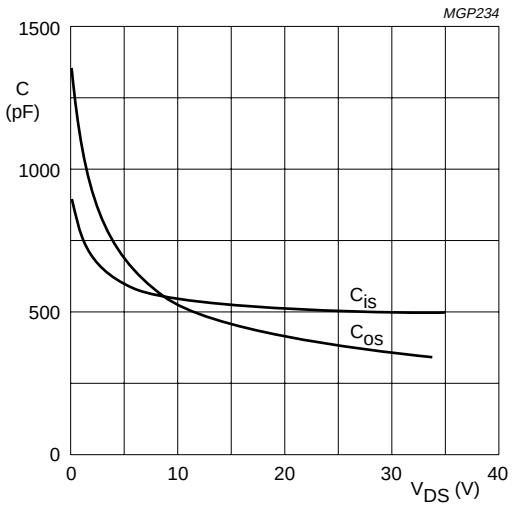
V_{DS} = 10 V; T_j = 25 °C.

Fig.5 Drain current as a function of gate-source voltage; typical values per section.



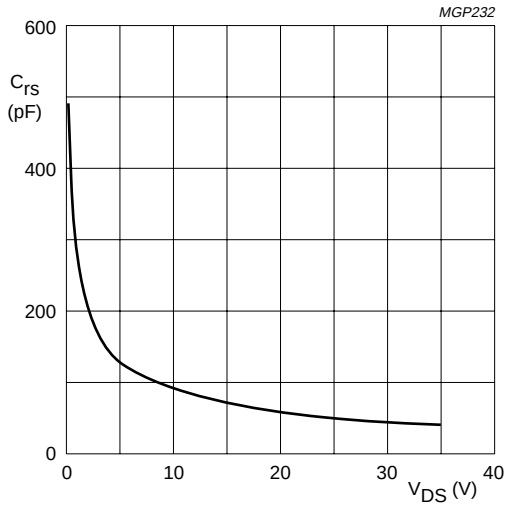
V_{GS} = 10 V; I_D = 8 A.

Fig.6 Drain-source on-state resistance as a function of junction temperature; typical values per section.



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

Fig.7 Input and output capacitance as functions of drain-source voltage; typical values per section.



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

Fig.8 Feedback capacitance as a function of drain-source voltage; typical values per section.

APPLICATION INFORMATION FOR CLASS-AB OPERATION

T_h = 25 °C; $R_{th\ mb\text{-}h}$ = 0.15 K/W unless otherwise specified. RF performance in CW operation in a common source class-AB circuit. R_{GS} = 536 Ω per section; optimum load impedance per section = 1.34 + j0.34 Ω; V_{DS} = 32 V.

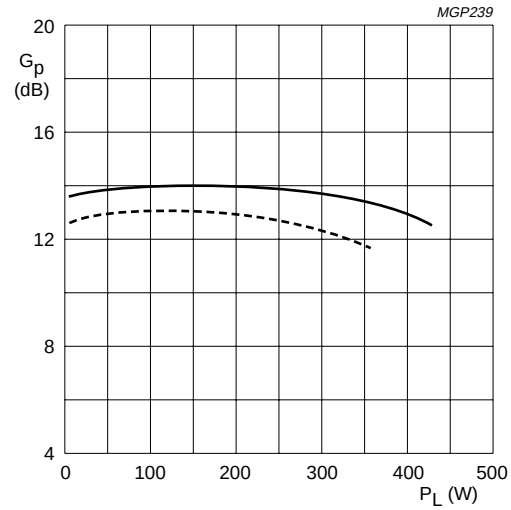
MODE OF OPERATION	f (MHz)	V_{DS} (V)	I_{DQ} (mA)	P_L (W)	G_p (dB)	ΔG_p[1] (dB)	η_D (%)
CW, class-AB	225	32	2 × 250	300	>12 typ. 13.5	>1 typ. 0.4	>55 typ. 62
	225	28	2 × 250	300	typ. 13	typ. 0.7	typ. 68
	225	35	2 × 250	300	typ. 14	typ. 0.2	typ. 60
	175	28	2 × 250	300	typ. 15	typ. 0.5	typ. 70

Note

1. Assuming a third order amplitude transfer characteristic, 1 dB compression corresponds with 30% synchronized input/25% synchronized output compression in television service (negative modulation, CCIR system).

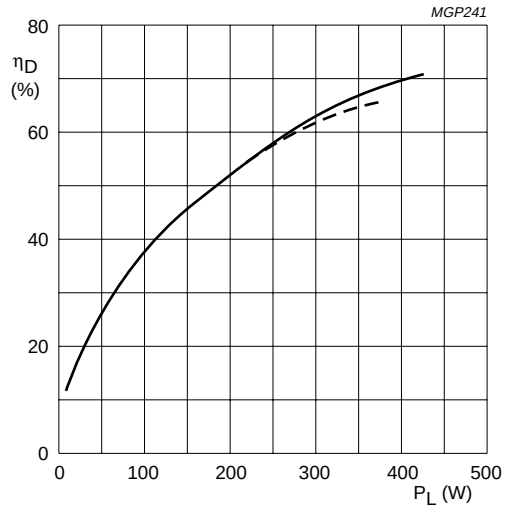
Ruggedness in class-AB operation

The BLF368 is capable of withstanding a load mismatch corresponding to VSWR = 10: 1 through all phases under the following conditions: V_{DS} = 32 V; f = 225 MHz at rated output power.



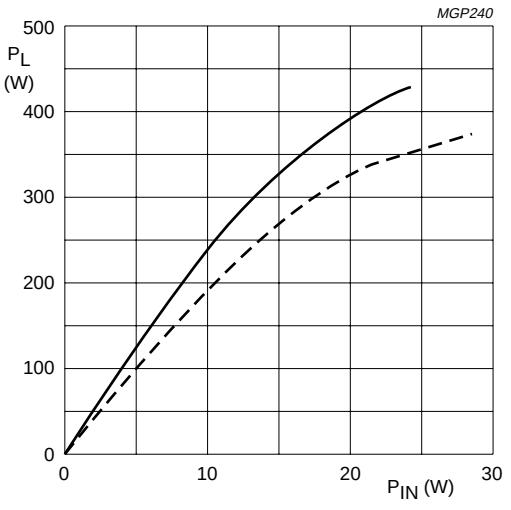
Class-AB operation; V_{DS} = 32 V; I_{DQ} = 2 × 250 mA;
Z_L = 1.34 + j0.34 Ω (per section); R_{GS} = 536 Ω (per section);
f = 225 MHz.
solid line: T_h = 25 °C. dotted line: T_h = 70 °C.

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



Class-AB operation; V_{DS} = 32 V; I_{DQ} = 2 × 250 mA;
Z_L = 1.34 + j0.34 Ω (per section); R_{GS} = 536 Ω (per section);
f = 225 MHz.
solid line: T_h = 25 °C. dotted line: T_h = 70 °C.

Fig.10 Efficiency as a function of load power; typical values per section.



Class-AB operation; V_{DS} = 32 V; I_{DQ} = 2 × 250 mA;
Z_L = 1.34 + j0.34 Ω (per section); R_{GS} = 536 Ω (per section);
f = 225 MHz.
solid line: T_h = 25 °C. dotted line: T_h = 70 °C.

Fig.11 Load power as a function of input power; typical values per section.

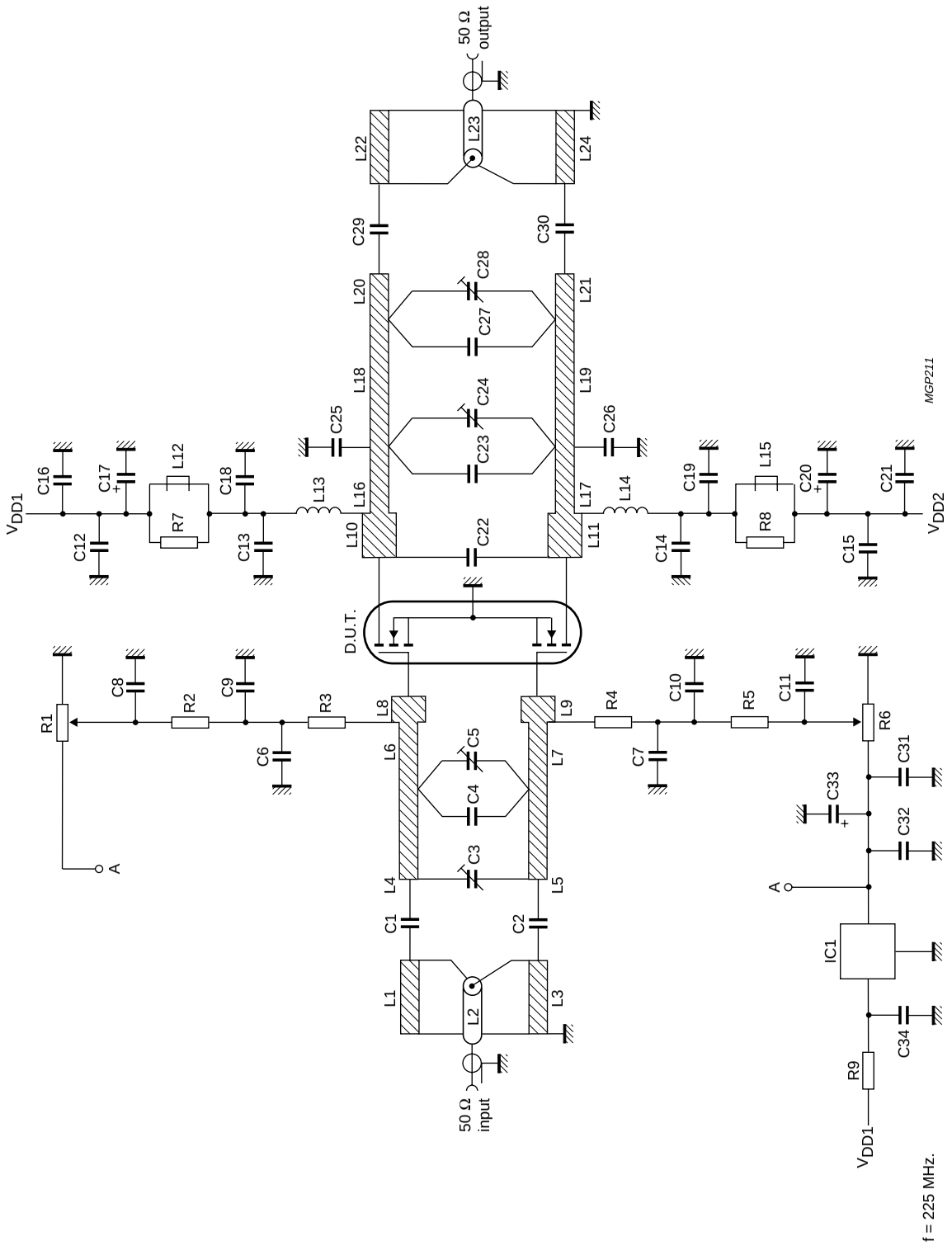


Fig.12 Test circuit for class-AB operation.

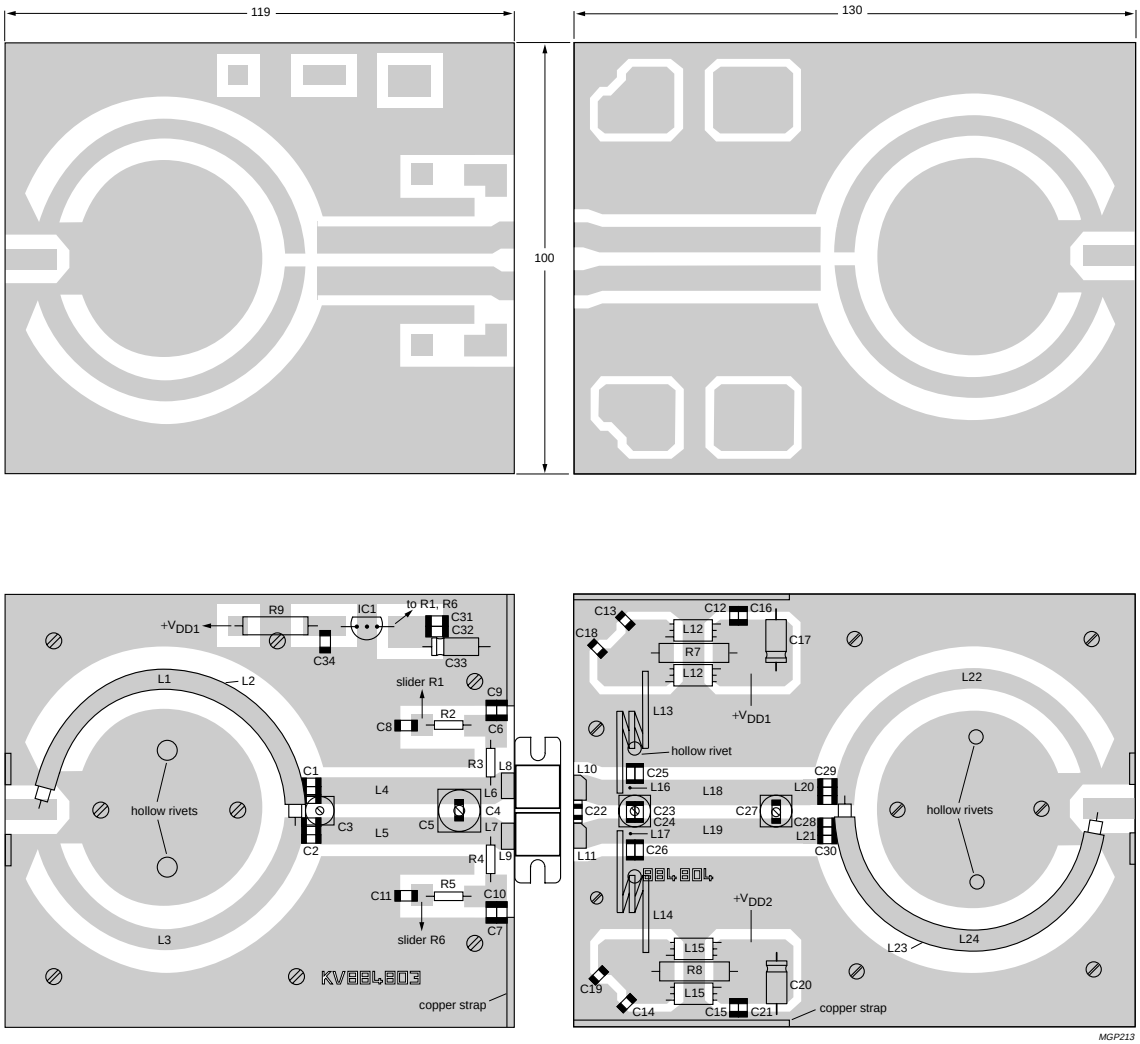
List of components class-AB test circuit (see Figs 12 and 13)

COMPONENT	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE NO.
C1, C2	multilayer ceramic chip capacitor; note 1	2 × 56 pF in parallel + 18 pF, 500 V		
C3	film dielectric trimmer	2 to 9 pF		2222 809 09005
C4	multilayer ceramic chip capacitor; note 1	47 pF, 500 V		
C5	film dielectric trimmer	5 to 60 pF		2222 809 08003
C6, C7, C9, C10, C12, C15, C31, C34	multilayer ceramic chip capacitor; note 1	1 nF, 500 V		2222 852 47104
C8, C11, C16, C21, C32	multilayer ceramic chip capacitor; note 1	100 nF, 50 V		
C17, C20, C33	electrolytic capacitor	10 μF, 63 V		
C22	multilayer ceramic chip capacitor; note 1	82 pF, 500 V		
C23	multilayer ceramic chip capacitor; note 1	10 pF + 30 pF in parallel, 500 V		
C24, C28	film dielectric trimmer	2 to 18 pF		2222 809 09006
C25, C26	multilayer ceramic chip capacitor; note 1	39 pF + 47 pF in parallel, 500 V		
C27	multilayer ceramic chip capacitor; note 1	18 pF, 500 V		
C29, C30	multilayer ceramic chip capacitor; note 1	3 × 100 pF in parallel, 500 V		
L1, L3, L22, L24	stripline; note 2	50 Ω	4.8 × 80 mm	
L2, L23	semi-rigid cable; note 3	50 Ω	ext. conductor length 80 mm ext. dia 3.6 mm	
L4, L5	stripline; note 2	43 Ω	6 × 32.5 mm	
L6, L7	stripline; note 2	43 Ω	6 × 10.5 mm	
L8, L9	stripline; note 2	43 Ω	6 × 3 mm	
L10, L11	stripline; note 2	43 Ω	6 × 10.5 mm	
L12, L15	grade 3B Ferroxcube wideband HF choke	2 in parallel		4312 020 36642
L13, L14	2 turns enamelled 1.6 mm copper wire	25 nH	space 2.5 mm int. dia. 5 mm leads 2 × 7 mm	
L16, L17	stripline; notes 2 and 4	43 Ω	6 × 3 mm	
L18, L19	stripline; notes 2 and 4	43 Ω	6 × 35 mm	
L20, L21	stripline; notes 2 and 4	43 Ω	6 × 9 mm	
R1, R6	10 turns potentiometer	50 kΩ		
R2, R5	metal film resistor	0.4 W, 1 kΩ		
R3, R4	metal film resistor	0.4 W, 536 Ω		

COMPONENT	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE NO.
R7, R8	metal film resistor	1 W, ±5%, 10 Ω		
R9	metal film resistor	1 W, 3.16 kΩ		
IC1	voltage regulator 78L05			

Notes

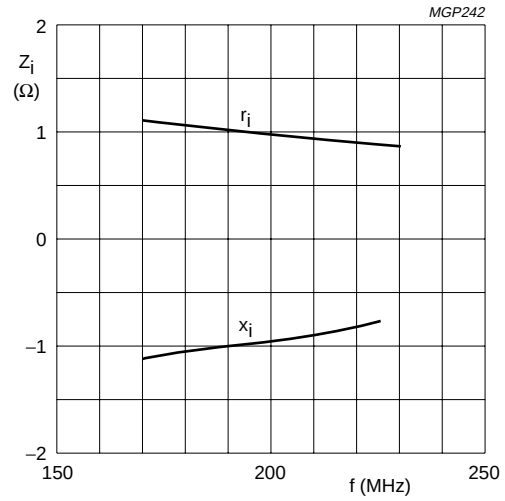
1. American Technical Ceramics (ATC) capacitor, type 100B or other capacitor of the same quality.
2. The striplines L1, L3 to L11, L16 to L22 and L24 are on a double copper-clad printed circuit board with glass microfibre PTFE dielectric (ε_r = 2.2); thickness $^1/_{16}$ inch; thickness of copper sheet 2 × 35 μm.
3. Semi-rigid cables L2 and L23 are soldered on to striplines L1 and L24.
4. A copper strap, thickness 0.8 mm, is soldered over the complete striplines L16 to L21 to avoid overheating by large RF currents.



The circuit and components are situated on one side of the PTFE fibre-glass board, the other side being fully metallized, to serve as a ground plane. Earth connections are made by means of copper straps and hollow rivets for a direct contact between upper and lower sheets.

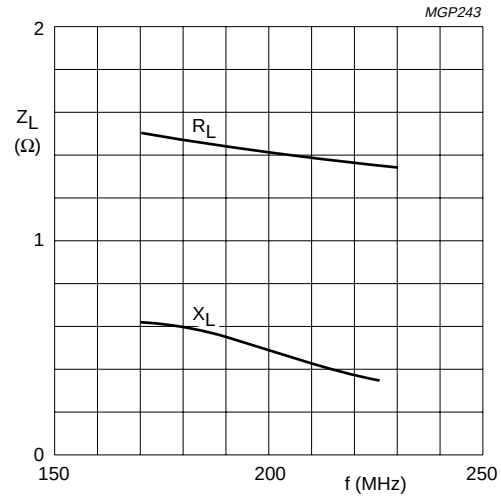
Dimensions in mm.

Fig.13 Component layout for 225 MHz class-AB test circuit.



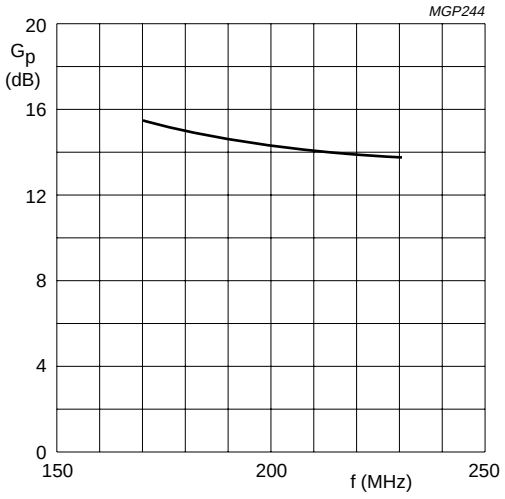
Class-AB operation; V_{DS} = 32 V; I_{DQ} = 2 × 250 mA; R_{GS} = 536 Ω (per section); P_L = 300 W.

Fig.14 Input impedance as a function of frequency (series components); typical values per section.



Class-AB operation; V_{DS} = 32 V; I_{DQ} = 2 × 250 mA; R_{GS} = 536 Ω (per section); P_L = 300 W.

Fig.15 Load impedance as a function of frequency (series components); typical values per section.



Class-AB operation; V_{DS} = 32 V; I_{DQ} = 2 × 250 mA; R_{GS} = 536 Ω (per section); P_L = 300 W.

Fig.16 Power gain as a function of frequency; typical values per section.

BLF368 scattering parameters

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

f (MHz)	s_{11}		s_{21}		s_{12}		s_{22}	
	$\|s_{11}\|$	$\angle\Phi$	$\|s_{21}\|$	$\angle\Phi$	$\|s_{12}\|$	$\angle\Phi$	$\|s_{22}\|$	$\angle\Phi$
5	0.86	–159.2	21.94	96.8	0.01	–0.8	0.90	169.1
10	0.86	–168.9	11.14	88.5	0.01	21.1	0.85	174.3
20	0.86	–173.4	5.45	79.2	0.01	18.7	0.83	178.2
30	0.86	–174.2	3.53	72.3	0.02	8.7	0.83	–179.8
40	0.87	–174.4	2.54	66.3	0.02	0.3	0.84	–178.0
50	0.88	–174.5	1.94	61.0	0.02	–6.7	0.85	–176.7
60	0.90	–174.7	1.54	56.1	0.01	–12.5	0.86	–175.9
70	0.91	–174.9	1.25	51.8	0.01	–17.4	0.88	–175.4
80	0.92	–175.2	1.04	47.9	0.01	–21.1	0.89	–175.1
90	0.93	–175.5	0.88	44.4	0.01	–24.1	0.90	–175.0
100	0.93	–175.9	0.75	41.0	0.01	–26.6	0.91	–175.1
125	0.95	–176.7	0.53	34.0	0.01	–29.8	0.93	–175.6
150	0.96	–177.6	0.38	29.3	0.01	–28.2	0.94	–175.7
175	0.97	–178.4	0.30	25.8	0.00	–21.2	0.96	–176.1
200	0.97	–179.1	0.23	22.6	0.00	–6.2	0.97	–176.8
250	0.98	179.5	0.16	18.7	0.00	45.7	0.98	–177.7
300	0.99	178.4	0.11	17.1	0.01	70.9	0.99	–178.6
350	0.99	177.3	0.08	16.6	0.01	76.9	0.99	–179.2
400	0.99	176.4	0.07	18.9	0.01	84.9	0.99	–179.9
450	0.99	175.3	0.05	21.7	0.01	87.8	0.99	179.5
500	0.99	174.4	0.05	27.2	0.01	88.4	1.00	178.9
600	0.99	172.6	0.04	37.8	0.02	89.3	1.00	177.8
700	1.00	170.8	0.03	50.9	0.02	90.0	1.00	176.8
800	1.00	169.0	0.03	62.1	0.03	91.1	1.00	175.8
900	1.00	167.1	0.04	71.3	0.03	91.6	1.00	174.9
1000	1.00	165.1	0.04	76.4	0.04	92.3	1.00	173.8

Note

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

BLF368 scattering parameters

V_{DS} = 32 V; I_D = 250 mA; note 1

f (MHz)	s_{11}		s_{21}		s_{12}		s_{22}	
	$\|s_{11}\|$	$\angle\Phi$	$\|s_{21}\|$	$\angle\Phi$	$\|s_{12}\|$	$\angle\Phi$	$\|s_{22}\|$	$\angle\Phi$
5	0.86	–157.9	23.11	97.5	0.01	–2.1	0.90	168.6
10	0.86	–168.3	11.76	88.9	0.01	20.9	0.84	174.0
20	0.86	–173.1	5.75	79.4	0.01	18.7	0.82	178.1
30	0.86	–174.0	3.73	72.5	0.02	8.8	0.83	–179.7
40	0.87	–174.3	2.68	66.5	0.02	0.5	0.83	–177.9
50	0.88	–174.5	2.05	61.2	0.02	-6.5	0.84	–176.5
60	0.90	–174.6	1.63	56.4	0.01	–12.3	0.86	–175.7
70	0.91	–174.8	1.33	52.1	0.01	–17.1	0.87	–175.2
80	0.92	–175.2	1.10	48.2	0.01	–20.9	0.88	–174.8
90	0.93	–175.5	0.93	44.7	0.01	–23.9	0.89	–174.7
100	0.93	–175.8	0.80	41.4	0.01	–26.3	0.91	–174.8
125	0.95	–176.6	0.56	34.3	0.01	–29.5	0.92	–175.3
150	0.96	–177.5	0.41	29.5	0.01	–27.8	0.94	–175.5
175	0.97	–178.4	0.31	26.0	0.00	–20.8	0.96	–175.9
200	0.97	–179.1	0.25	22.8	0.00	–5.6	0.97	–176.6
250	0.98	179.6	0.16	18.9	0.00	45.9	0.98	–177.5
300	0.99	178.4	0.12	17.0	0.01	71.1	0.98	–178.4
350	0.99	177.3	0.09	16.9	0.01	77.4	0.99	–179.1
400	0.99	176.4	0.07	18.6	0.01	84.9	0.99	–179.8
450	0.99	175.4	0.06	21.2	0.01	87.9	0.99	179.7
500	0.99	174.4	0.05	24.8	0.01	88.5	1.00	179.0
600	0.99	172.6	0.04	36.3	0.02	89.4	1.00	177.9
700	1.00	170.8	0.03	49.2	0.02	90.1	1.00	176.9
800	1.00	169.0	0.03	61.2	0.03	91.2	1.00	175.9
900	1.00	167.1	0.04	70.4	0.03	91.8	1.00	175.0
1000	1.00	165.1	0.04	75.8	0.04	92.5	1.00	173.9

Note

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

BLF368 scattering parameters

V_{DS} = 35 V; I_D = 250 mA; note 1

f (MHz)	s_{11}		s_{21}		s_{12}		s_{22}	
	$\|s_{11}\|$	$\angle\Phi$	$\|s_{21}\|$	$\angle\Phi$	$\|s_{12}\|$	$\angle\Phi$	$\|s_{22}\|$	$\angle\Phi$
5	0.86	–156.9	23.97	98.1	0.01	–3.2	0.90	168.3
10	0.86	–167.8	12.21	89.2	0.01	20.7	0.84	173.8
20	0.86	–172.9	5.98	79.6	0.01	18.7	0.82	178.1
30	0.86	–173.9	3.88	72.7	0.01	8.9	0.82	–179.7
40	0.87	–174.2	2.79	66.7	0.02	0.6	0.82	–177.8
50	0.89	–174.4	2.13	61.4	0.02	–6.4	0.84	–176.4
60	0.90	–174.6	1.70	56.5	0.01	–12.2	0.85	–175.5
70	0.91	–174.8	1.38	52.2	0.01	–16.9	0.87	–175.0
80	0.92	–175.2	1.15	48.4	0.01	–20.8	0.88	–174.7
90	0.93	–175.5	0.97	44.9	0.01	–23.7	0.89	–174.5
100	0.93	–175.8	0.83	41.5	0.01	–26.0	0.90	–174.6
125	0.95	–176.6	0.58	34.5	0.01	–29.2	0.92	–175.1
150	0.96	–177.5	0.43	29.6	0.01	–27.6	0.94	–175.3
175	0.97	–178.3	0.33	26.1	0.00	–20.4	0.96	–175.7
200	0.97	–179.0	0.26	22.9	0.00	–5.1	0.96	–176.4
250	0.98	179.6	0.17	19.0	0.00	46.5	0.98	–177.3
300	0.99	178.4	0.12	16.9	0.01	71.2	0.98	–178.3
350	0.99	177.3	0.09	16.5	0.01	77.5	0.99	–179.0
400	0.99	176.4	0.07	18.1	0.01	84.9	0.99	–179.7
450	0.99	175.4	0.06	20.5	0.01	87.9	0.99	179.7
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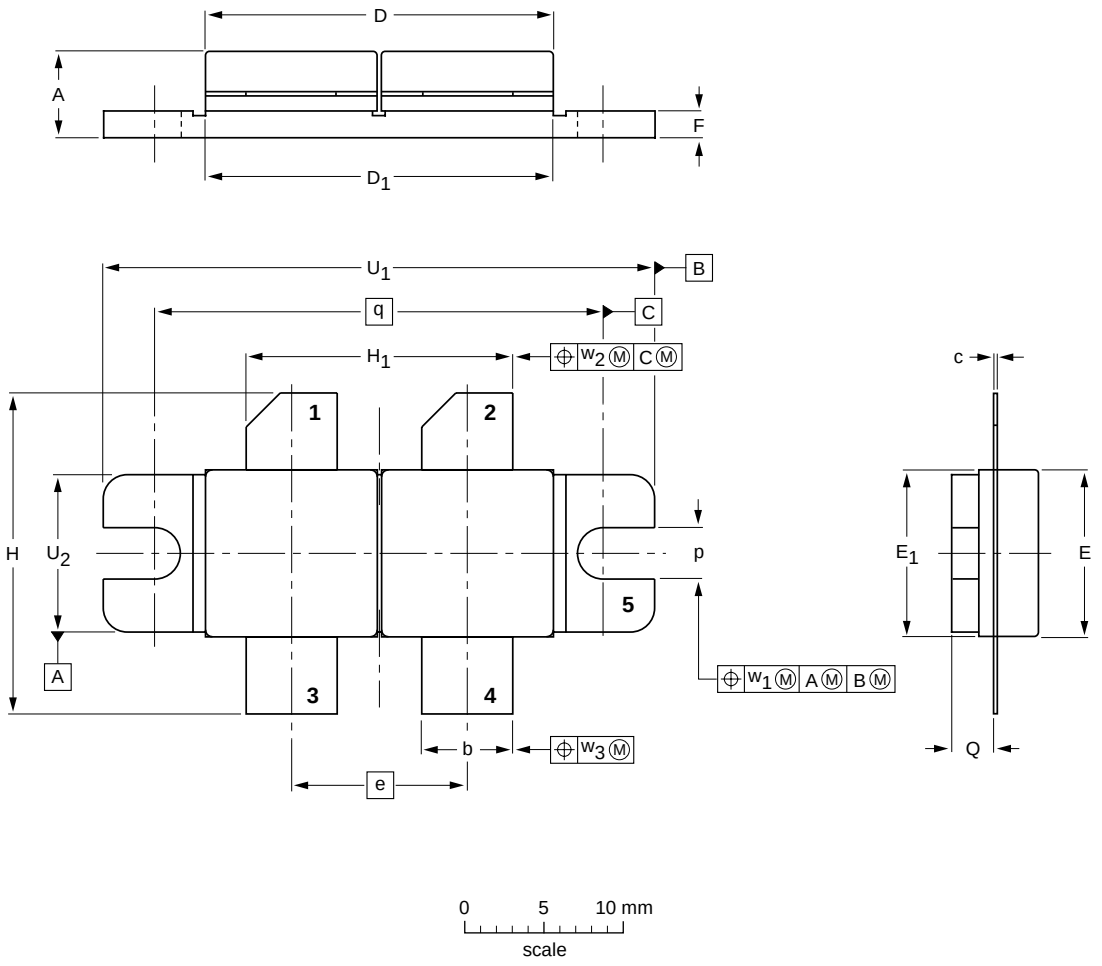
900	1.00	167.1	0.04	69.8	0.03	91.9	1.00	175.0
1000	1.00	165.1	0.04	75.8	0.04	92.6	1.00	173.9

Note

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

PACKAGE OUTLINE

Flanged double-ended ceramic package; 2 mounting holes; 4 leads **SOT262A1**



DIMENSIONS (millimetre dimensions are derived from the original inch dimensions)

UNIT	A	b	c	D	D_1	e	E	E_1	F	H	H_1	p	Q	q	U_1	U_2	w_1	w_2	w_3
mm	5.77 5.00	5.85 5.58	0.16 0.10	22.17 21.46	21.98 21.71	11.05	10.27 10.05	10.29 10.03	1.78 1.52	21.08 19.56	17.02 16.51	3.28 3.02	2.85 2.59	27.94	34.17 33.90	9.91 9.65	0.25	0.51	0.25
inches	0.227 0.197	0.230 0.220	0.006 0.004	0.873 0.845	0.865 0.855	0.435	0.404 0.396	0.405 0.396	0.070 0.060	0.830 0.770	0.670 0.650	0.129 0.119	0.112 0.102	1.100	1.345 1.335	0.390 0.380	0.010	0.020	0.010

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT262A1						99-03-29

DATA SHEET STATUS

LEVEL	DATA SHEET STATUS(1)	PRODUCT STATUS(2)(3)	DEFINITION
I	Objective data	Development	This data sheet contains data from the objective specification for product development. Philips Semiconductors reserves the right to change the specification in any manner without notice.
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Contact information

For additional information please visit **http://www.semiconductors.philips.com**. Fax: **+31 40 27 24825**
For sales offices addresses send e-mail to: **sales.addresses@www.semiconductors.philips.com**.

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