DATA SHEET

BLF378
VHF push-pull power MOS transistor

Product specification
Supersedes data of October 1992
File under Discrete Semiconductors, SC08a

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Philips Semiconductors

PHILIPS

VHF push-pull power MOS transistor — BLF378

FEATURES

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

APPLICATIONS

- Broadcast transmitter applications in the VHF frequency range.

DESCRIPTION

Dual push-pull silicon N-channel enhancement mode vertical D-MOS transistor encapsulated in a 4-lead, SOT262A1 balanced flange package with two ceramic caps. The mounting flange provides the common source connection for the transistors.

CAUTION
The device is supplied in an antistatic package. The gate-source input must be protected against static discharge during transport or handling.

PINNING - SOT262A1

PIN	SYMBOL	DESCRIPTION
1	d_1	drain 1
2	d_2	drain 2
3	g_1	gate 1
4	g_2	gate 2
5	s	source

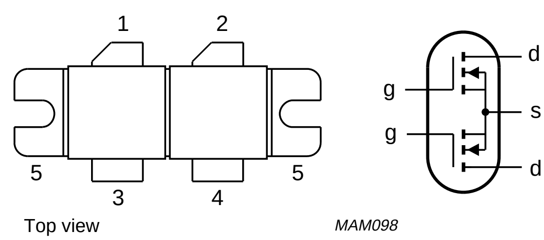


Fig.1 Simplified outline and symbol.

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)(1)	η_D (%)
CW, class-AB	225	50	250	>14; typ. 16	<1; typ. 0.6	>50; typ. 55

Note

1. Assuming a 3rd order amplitude transfer characteristic, 1 dB gain compression corresponds with 30% synchronized input / 25% synchronized output compression in television service (negative modulation, CCIR system).

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.

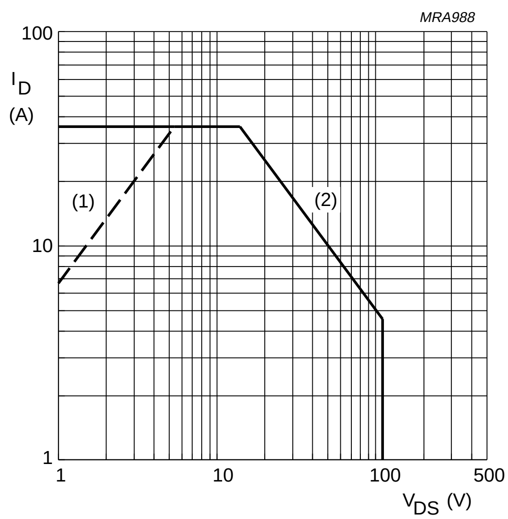
LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
Per transistor section					
V_{DSS}	drain-source voltage		–	110	V
V_{GSS}	gate-source voltage		–	±20	V
I_D	DC drain current		–	18	A
P_{tot}	total power dissipation	up to T_{mb} = 25 °C total device; both sections equally loaded	–	500	W
T_{stg}	storage temperature		–65	150	°C
T_j	junction temperature		–	200	°C

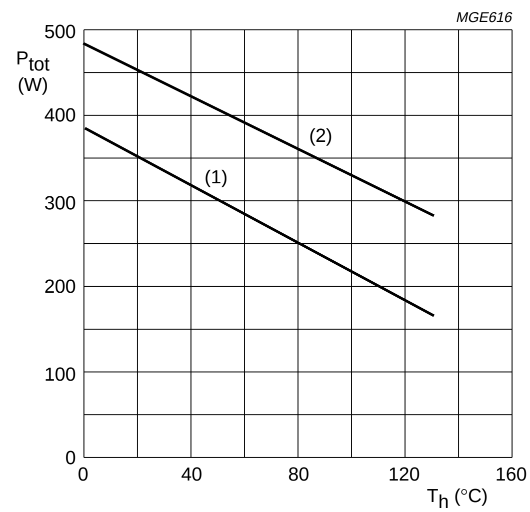
THERMAL CHARACTERISTICS

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



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

Fig.2 DC SOAR.



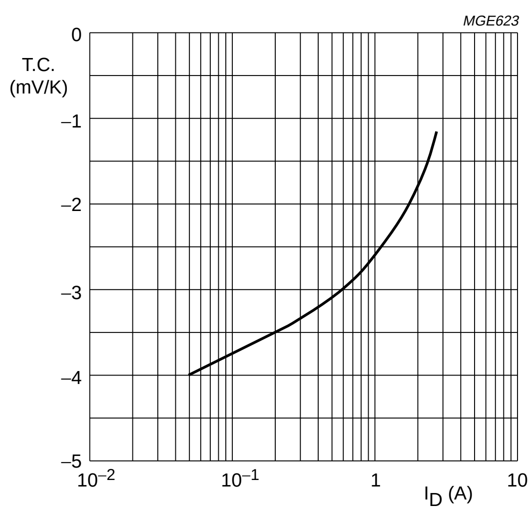
Total device; both sections equally loaded.
(1) Continuous operation.
(2) Short-time operation during mismatch.

Fig.3 Power derating curves.

CHARACTERISTICS

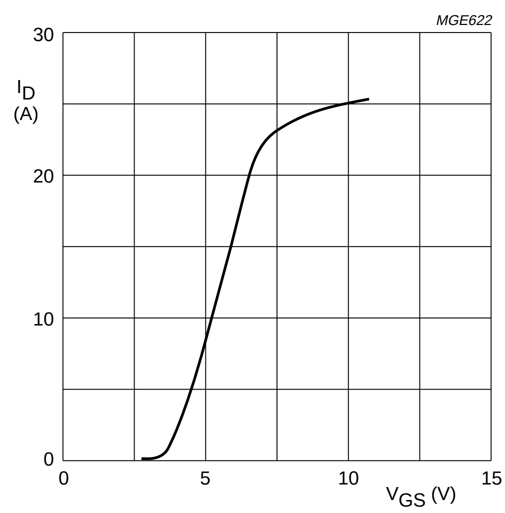
T_j = 25 °C; unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Per transistor section						
$V_{(BR)DSS}$	drain-source breakdown voltage	V_{GS} = 0; I_D = 50 mA	110	–	–	V
I_{DSS}	drain-source leakage current	V_{GS} = 0; V_{DS} = 50 V	–	–	2.5	mA
I_{GSS}	gate-source leakage current	V_{GS} = ±20 V; V_{DS} = 0	–	–	1	μA
V_{GSth}	gate-source threshold voltage	I_D = 50 mA; V_{DS} = 10 V	2.0	–	4.5	V
ΔV_{GS}	gate-source voltage difference of both transistor sections	I_D = 50 mA; V_{DS} = 10 V	–	–	100	mV
g_{fs}	forward transconductance	I_D = 5 A; V_{DS} = 10 V	4.5	6.2	–	S
g_{fs1}/g_{fs2}	forward transconductance ratio of both transistor sections	I_D = 5 A; V_{DS} = 10 V	0.9	–	1.1	
R_{DSon}	drain-source on-state resistance	I_D = 5 A; V_{GS} = 10 V	–	0.2	0.3	Ω
I_{DSX}	on-state drain current	V_{GS} = 10 V; V_{DS} = 10 V	–	25	–	A
C_{is}	input capacitance	V_{GS} = 0; V_{DS} = 50 V; f = 1 MHz	–	480	–	pF
C_{os}	output capacitance	V_{GS} = 0; V_{DS} = 50 V; f = 1 MHz	–	190	–	pF
C_{rs}	feedback capacitance	V_{GS} = 0; V_{DS} = 50 V; f = 1 MHz	–	14	–	pF
C_{d-f}	drain-flange capacitance		–	5.4	–	pF



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.

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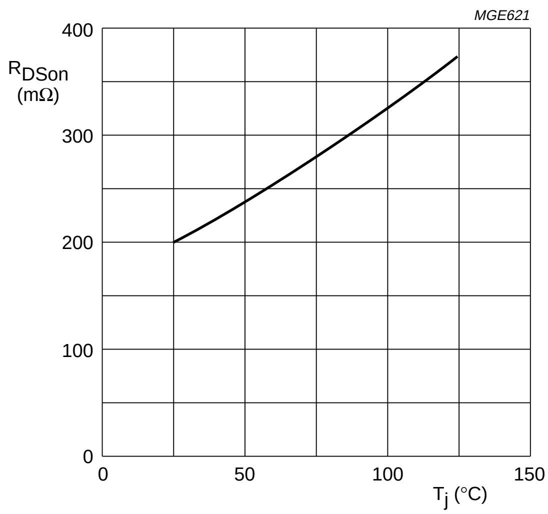
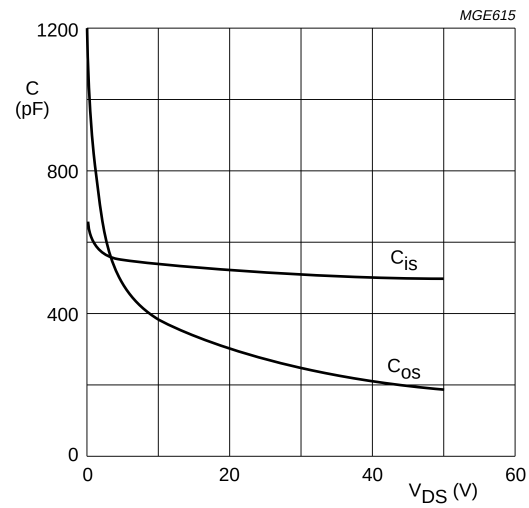


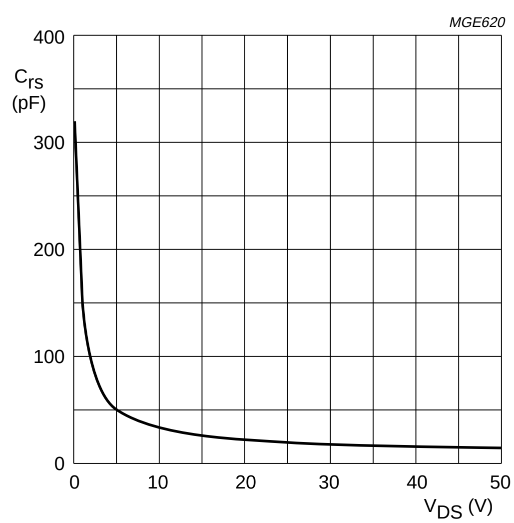
I_D = 5 A; V_{GS} = 10 V.

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

Class-AB operation

RF performance in CW operation in a common source class-AB circuit. T_h = 25 °C; $R_{th\ mb-h}$ = 0.15 K/W; unless otherwise specified. R_{GS} = 2.8 Ω per section; optimum load impedance per section = 0.74 + j2 Ω (V_{DS} = 50 V).

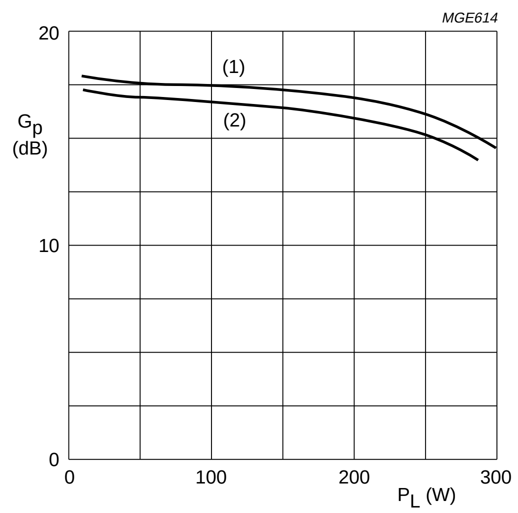
MODE OF OPERATION	f (MHz)	V_{DS} (V)	I_{DQ} (A)	P_L (W)	G_p (dB)	ΔG_p (dB) (1)	η_D (%)
CW, class-AB	225	50	2 × 0.5	250	>14 typ. 16	<1 typ. 0.6	>50 typ. 55
	225	45	2 × 0.5	250	typ. 15	typ. 1	typ. 60

Note

1. Assuming a 3rd order amplitude transfer characteristic, 1 dB gain compression corresponds with 30% synchronized input / 25% synchronized output compression in television service (negative modulation, CCIR system).

Ruggedness in class-AB operation

The BLF378 is capable of withstanding a load mismatch corresponding to VSWR = 7 : 1 through all phases under the conditions: V_{DS} = 50 V; f = 225 MHz at rated output power.

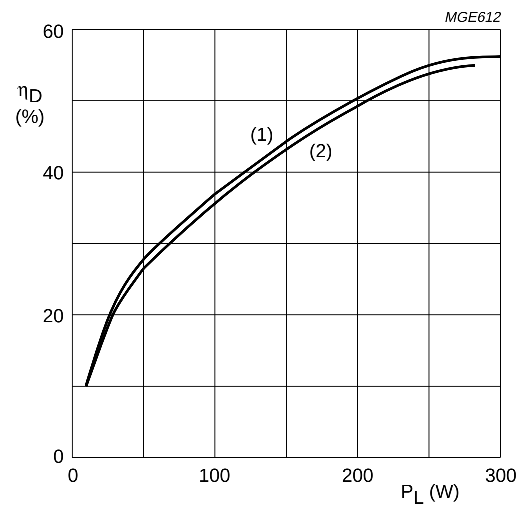


Class-AB operation; V_{DS} = 50 V; I_{DQ} = 2 × 0.5 A; f = 225 MHz;
Z_L = 0.74 + j2 Ω (per section); R_{GS} = 2.8 Ω (per section).

(1) T_h = 25 °C.

(2) T_h = 70 °C.

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

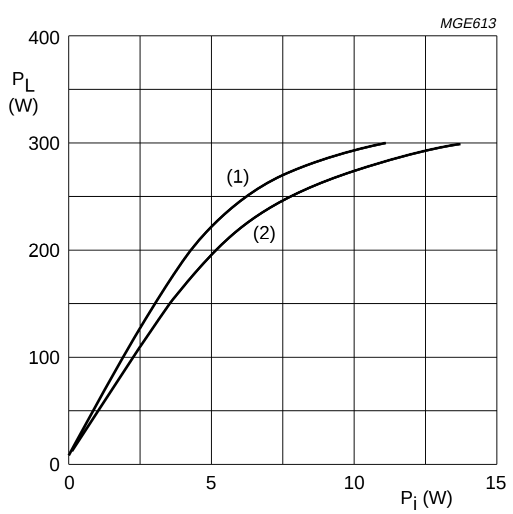


Class-AB operation; V_{DS} = 50 V; I_{DQ} = 2 × 0.5 A; f = 225 MHz;
Z_L = 0.74 + j2 Ω (per section); R_{GS} = 2.8 Ω (per section).

(1) T_h = 25 °C.

(2) T_h = 70 °C.

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



Class-AB operation; V_{DS} = 50 V; I_{DQ} = 2 × 0.5 A; f = 225 MHz;
Z_L = 0.74 + j2 Ω (per section); R_{GS} = 2.8 Ω (per section).

(1) T_h = 25 °C.

(2) T_h = 70 °C.

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

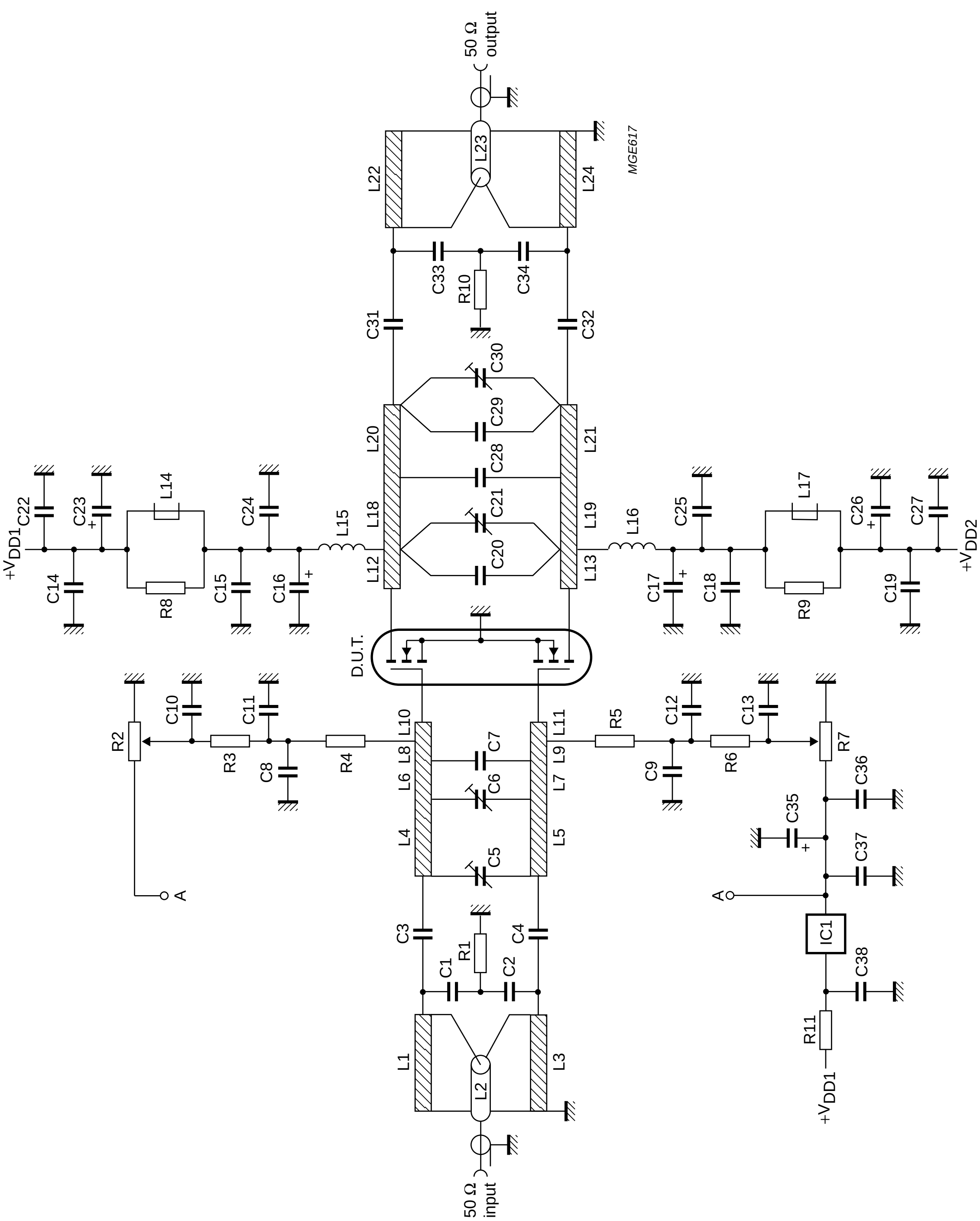


Fig.12 Test circuit for class-AB operation at f = 225 MHz.

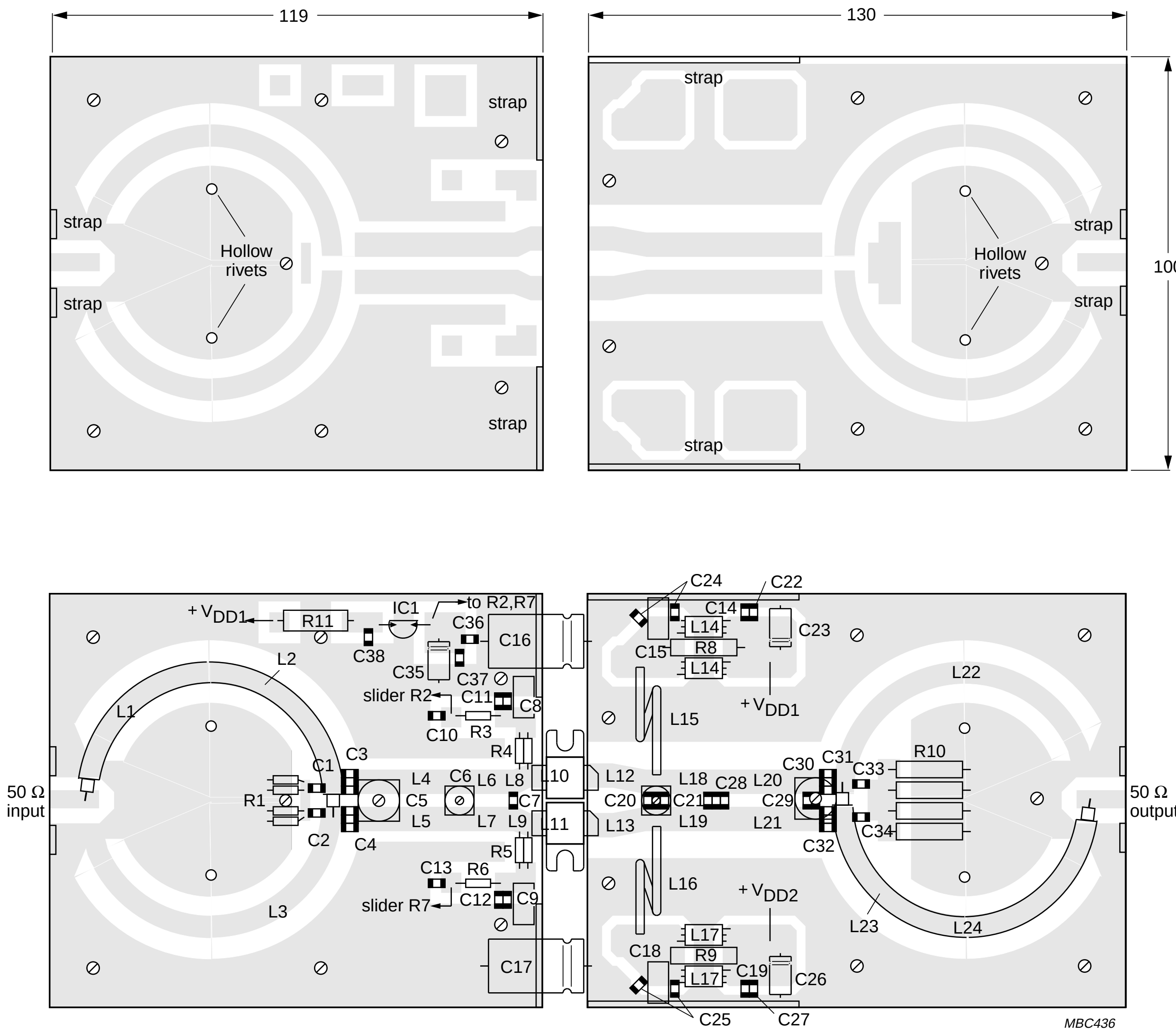
List of components (see Figs 12 and 13)**.**

COMPONENT	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE NO.
C1, C2	multilayer ceramic chip capacitor; note 1	27 pF, 500 V		
C3, C4, C31, C32	multilayer ceramic chip capacitor; note 1	3 × 18 pF in parallel, 500 V		
C5	film dielectric trimmer	4 to 40 pF		2222 809 08002
C6, C30	film dielectric trimmer	2 to 18 pF		2222 809 09006
C7	multilayer ceramic chip capacitor; note 1	100 pF, 500 V		
C8, C9, C15, C18	MKT film capacitor	1 μF, 63 V		2222 371 11105
C10, C13, C14, C19, C36	multilayer ceramic chip capacitor	100 nF, 50 V		2222 852 47104
C11, C12	multilayer ceramic chip capacitor; note 1	2 × 1 nF in parallel, 500 V		
C16, C17	electrolytic capacitor	220 μF, 63 V		
C20	multilayer ceramic chip capacitor; note 1	3 × 33 pF in parallel, 500 V		
C21	film dielectric trimmer	2 to 9 pF		2222 809 09005
C22, C27, C37, C38	multilayer ceramic chip capacitor; note 1	1 nF, 500 V		
C23, C26, C35	electrolytic capacitor	10 μF, 63 V		
C24, C25	multilayer ceramic chip capacitor; note 1	2 × 470 pF in parallel, 500 V		
C28	multilayer ceramic chip capacitor; note 1	2 × 10 pF in parallel + 18 pF, 500 V		
C29	multilayer ceramic chip capacitor; note 1	2 × 5.6 pF in parallel, 500 V		
C33, C34	multilayer ceramic chip capacitor; note 1	5.6 pF, 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 × 24 mm	
L6, L7	stripline; note 2	43 Ω	6 × 14.5 mm	
L8, L9	stripline; note 2	43 Ω	6 × 4.4 mm	
L10, L11	stripline; note 2	43 Ω	6 × 3.2 mm	
L12, L13	stripline; note 2	43 Ω	6 × 15 mm	
L14, L17	grade 3B Ferroxcube wideband HF choke	2 in parallel		4312 020 36642
L15, L16	1¾ turns enamelled 2 mm copper wire	40 nH	space 1 mm int. dia. 10 mm leads 2 × 7 mm	

COMPONENT	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE NO.
L18, L19	stripline; note 2	43 Ω	6 × 13 mm	
L20, L21	stripline; note 2	43 Ω	6 × 29.5 mm	
R1	0.4 W metal film resistor	10 Ω		
R2, R7	10 turns potentiometer	50 kΩ		
R3, R6	0.4 W metal film resistor	1 kΩ		
R4, R5	0.4 W metal film resistor	2 × 5.62 Ω in parallel		
R8, R9	1 W, ±5% metal film resistor	10 Ω		
R10	1 W metal film resistor	4 × 10 Ω in parallel		
R11	1 W metal film resistor	5.11 kΩ		
IC1	voltage regulator 78L05			

Notes

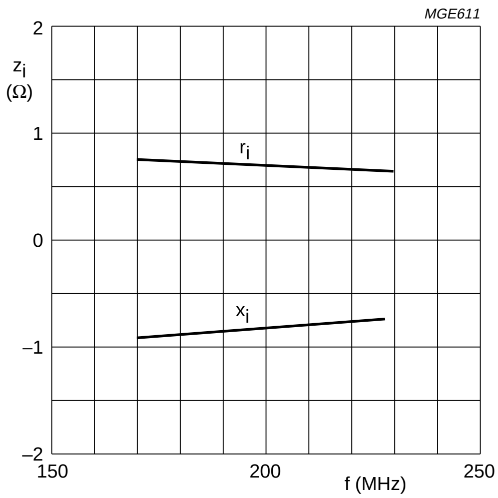
1. American Technical Ceramics (ATC) capacitor, type 100B or other capacitor of the same quality.
2. The striplines L1, L3 to L13, L18 to L22 and L24 are on a double copper-clad printed-circuit board with glass microfibre PTFE dielectric (ε_r = 2.2); thickness $^1/_{16}$ inch; thickness of copper sheet 2 × 35 μm.
3. Semi-rigid cables L2 and L23 are soldered on to striplines L1 and L24.



Dimensions in mm.

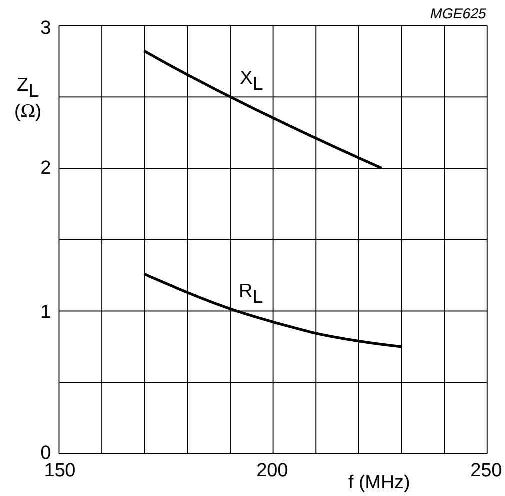
The circuit and components are situated on one side of the PTFE fibre-glass board, the other side being fully metallized to serve as an earth.
Earth connections are made by means of copper straps for a direct contact between upper and lower sheets.

Fig.13 Printed-circuit board and component layout for 225 MHz class-AB test circuit.



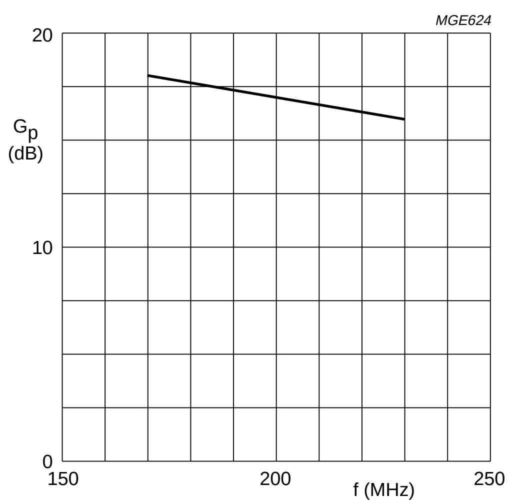
Class-AB operation; V_{DS} = 50 V; I_{DQ} = 2 × 0.5 A;
R_{GS} = 2.8 Ω (per section); P_L = 250 W.

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



Class-AB operation; V_{DS} = 50 V; I_{DQ} = 2 × 0.5 A;
R_{GS} = 2.8 Ω (per section); P_L = 250 W.

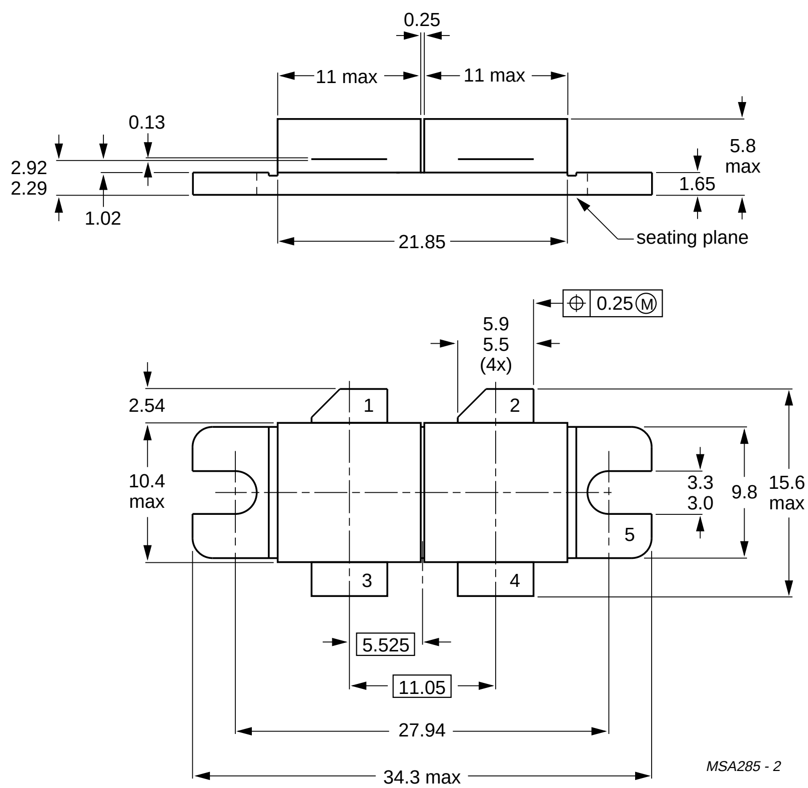
Fig.15 Load impedance as a function of frequency (series components), typical values per section.



Class-AB operation; V_{DS} = 50 V; I_{DQ} = 2 × 0.5 A;
R_{GS} = 2.8 Ω (per section); P_L = 250 W.

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

PACKAGE OUTLINE



Dimensions in mm.

Fig.17 SOT262A1.

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

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