

# VHF linear push-pull power MOS transistor

BLF348

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69E D

## 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, SOT262 A1 balanced flange envelope, with two ceramic caps. The mounting flange provides the common source connection for the transistors.

## PINNING – SOT262A1

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

## PIN CONFIGURATION

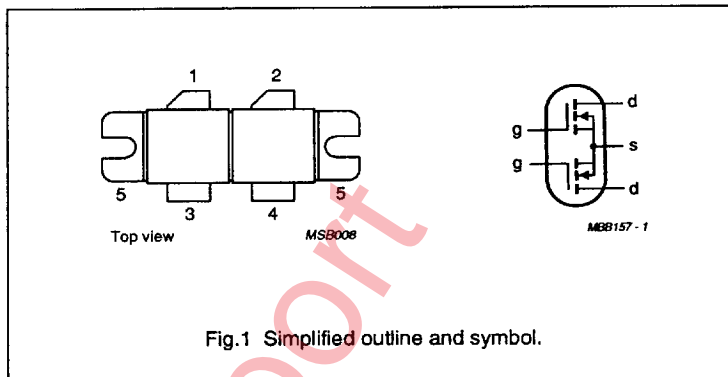


Fig.1 Simplified outline and symbol.

## CAUTION

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

## 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 in a push-pull common source test circuit.

MODE OF OPERATION	$f_{\text{vision}}$ (MHz)	$V_{\text{DS}}$ (V)	$I_{\text{D}}$ (A)	$T_{\text{h}}$ (°C)	$d_{\text{lm}}$ (dB) (note 1)	$P_{\text{o sync}}$ (W)	$G_{\text{p}}$ (dB)
class-A	224.25	28	2 x 4.6	70	-52	> 67	> 11
	224.25	28	2 x 4.6	25	-52	typ. 75	typ. 13

## Note

1. Three-tone test method (vision carrier -8 dB, sound carrier -7 dB, sideband signal -16 dB), zero dB corresponds to peak synchronization level.

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## LIMITING VALUES

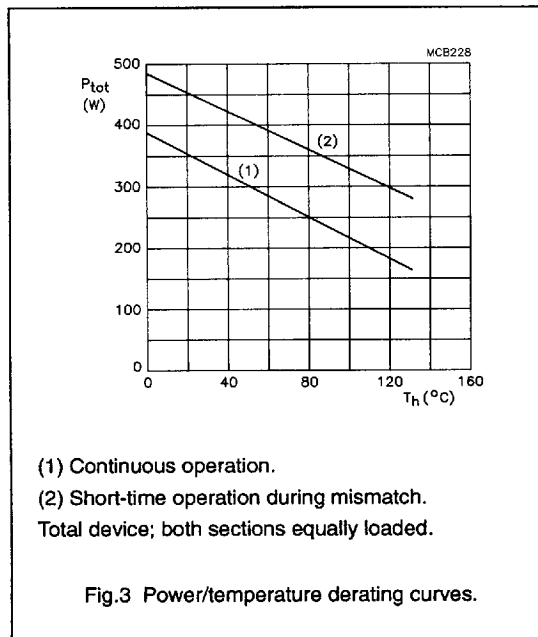
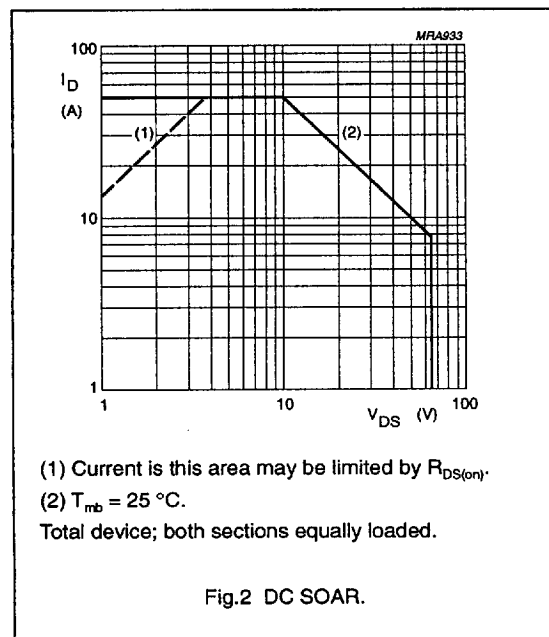
In accordance with the Absolute Maximum System (IEC 134).

Per transistor section unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
$V_{DSS}$	drain-source voltage		-	65	V
$\pm V_{GSS}$	gate-source voltage		-	20	V
$I_D$	DC drain current		-	25	A
$P_{tot}$	total power dissipation	up to $T_{mb} = 25^\circ\text{C}$ ; total device; both sections equally loaded	-	500	W
$T_{stg}$	storage temperature		-65	150	$^\circ\text{C}$
$T_j$	junction temperature		-	200	$^\circ\text{C}$

## THERMAL RESISTANCE

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



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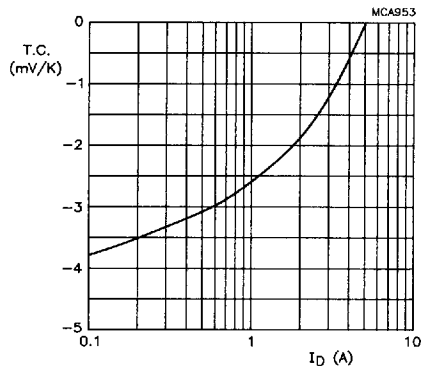
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## CHARACTERISTICS (per section)

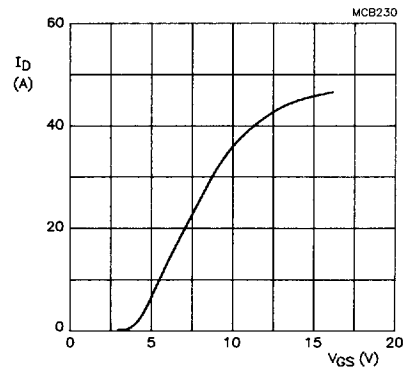
$T_j = 25\text{ }^\circ\text{C}$  unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{(BR)DSS}$	drain-source breakdown voltage	$V_{GS} = 0$ ; $I_D = 0.1\text{ A}$	65	—	—	V
$I_{DSS}$	drain-source leakage current	$V_{GS} = 0$ ; $V_{DS} = 28\text{ V}$	—	—	5	mA
$I_{GSS}$	gate-source leakage current	$\pm V_{GS} = 20\text{ V}$ ; $V_{DS} = 0$	—	—	1	$\mu\text{A}$
$V_{GS(th)}$	gate-source threshold voltage	$I_D = 0.1\text{ A}$ ; $V_{DS} = 10\text{ V}$	2	—	4.5	V
$\Delta V_{GS(th)}$	gate-source voltage difference of both transistor sections	$I_D = 0.1\text{ A}$ ; $V_{DS} = 10\text{ V}$	—	—	100	mV
$g_{fs}$	forward transconductance	$I_D = 8\text{ A}$ ; $V_{DS} = 10\text{ V}$	5	7.5	—	S
$g_{fs1}/g_{fs2}$	forward transconductance ratio of both transistor sections	$I_D = 8\text{ A}$ ; $V_{DS} = 10\text{ V}$	0.9	—	1.1	
$R_{DS(on)}$	drain-source on-state resistance	$I_D = 8\text{ A}$ ; $V_{GS} = 10\text{ V}$	—	0.1	0.15	$\Omega$
$I_{DSX}$	on-state drain current	$V_{GS} = 10\text{ V}$ ; $V_{DS} = 10\text{ V}$	—	37	—	A
$C_{is}$	input capacitance	$V_{GS} = 0$ ; $V_{DS} = 28\text{ V}$ ; $f = 1\text{ MHz}$	—	495	—	pF
$C_{os}$	output capacitance	$V_{GS} = 0$ ; $V_{DS} = 28\text{ V}$ ; $f = 1\text{ MHz}$	—	340	—	pF
$C_{fs}$	feedback capacitance	$V_{GS} = 0$ ; $V_{DS} = 28\text{ V}$ ; $f = 1\text{ MHz}$	—	40	—	pF



$V_{DS} = 10\text{ V}$ .

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



$V_{DS} = 10\text{ V}$ ;  $T_j = 25\text{ }^\circ\text{C}$ .

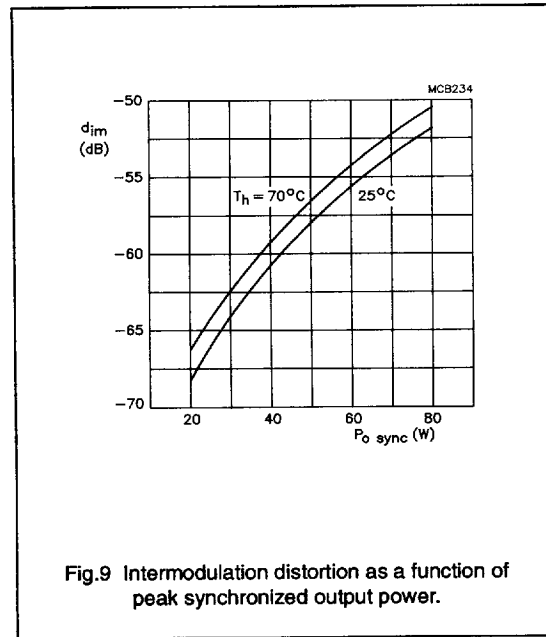
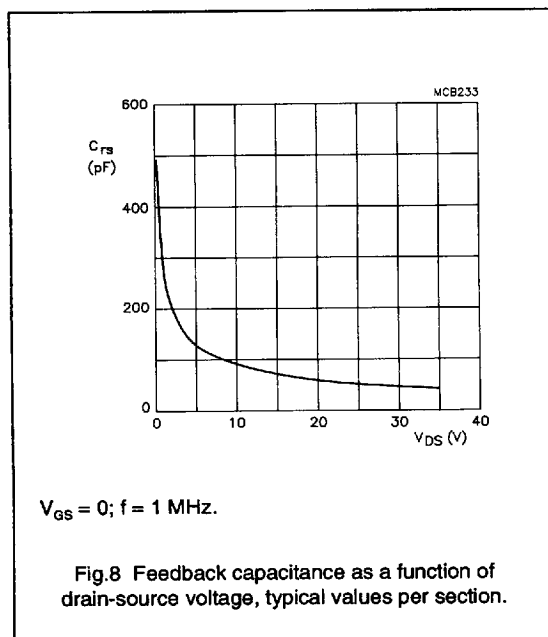
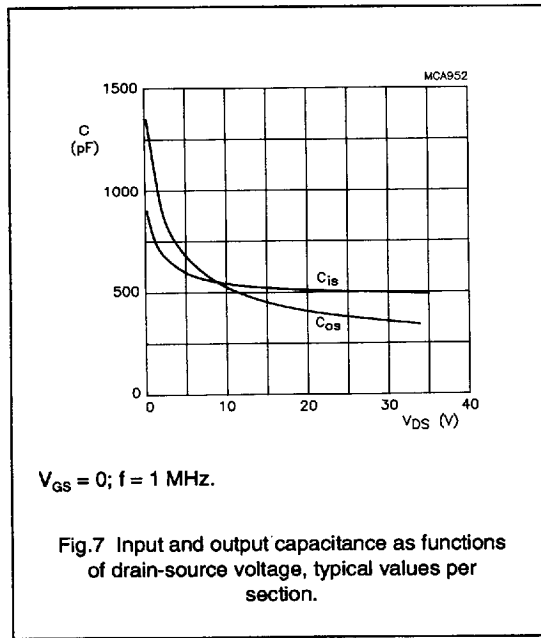
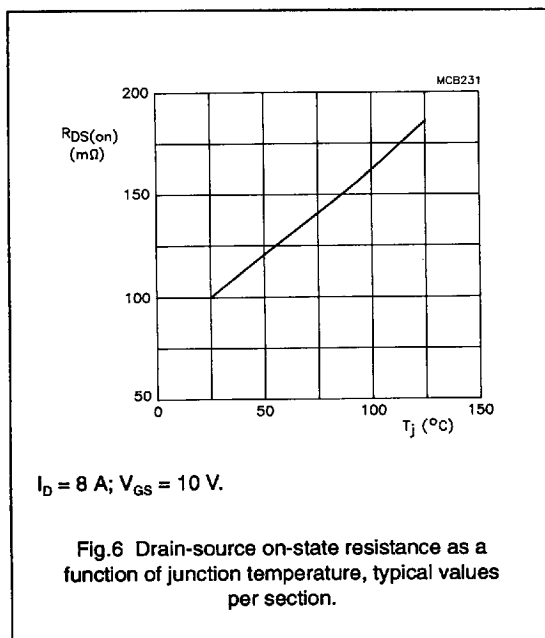
Fig.5 Drain current as a function of gate-source voltage, typical values per section.

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## APPLICATION INFORMATION FOR CLASS-A OPERATION

$T_h = 70\text{ }^\circ\text{C}$ ;  $R_{th, mb-h} = 0.15\text{ K/W}$  unless otherwise specified.

RF performance in a linear amplifier (common source circuit class-A circuit).

$R_{GS} = 82\text{ }\Omega$  per section; optimum load impedance per section =  $0.14 + j0.14\text{ }\Omega$ .

MODE OF OPERATION	$f_{\text{vision}}$ (MHz)	$V_{DS}$ (V)	$I_D$ (A)	$T_h$ ( $^\circ\text{C}$ )	$d_{im}$ (dB) (note 1)	$P_{o, sync}$ (W)	$G_p$ (dB)
class-A	224.25	28	2 x 4.6	70	-52	> 67 typ. 70	> 11 typ. 12.5
	224.25	28	2 x 4.6	25	-52	typ. 75	typ. 13
	224.25	28	2 x 4.6	70	-55	> 54 typ. 57	> 11 typ. 12.5
	224.25	28	2 x 4.6	25	-55	typ. 62	typ. 13

### Note

1. Three-tone test method (vision carrier -8 dB, sound carrier -7 dB, sideband signal -16 dB), zero dB corresponds to peak synchronization level.

### Ruggedness in class-A operation

The BLF348 is capable of withstanding a load mismatch corresponding to VSWR = 20 through all phases under the following conditions:

$V_{DS} = 28\text{ V}$ ;  $f = 224.25\text{ MHz}$  at rated output power.

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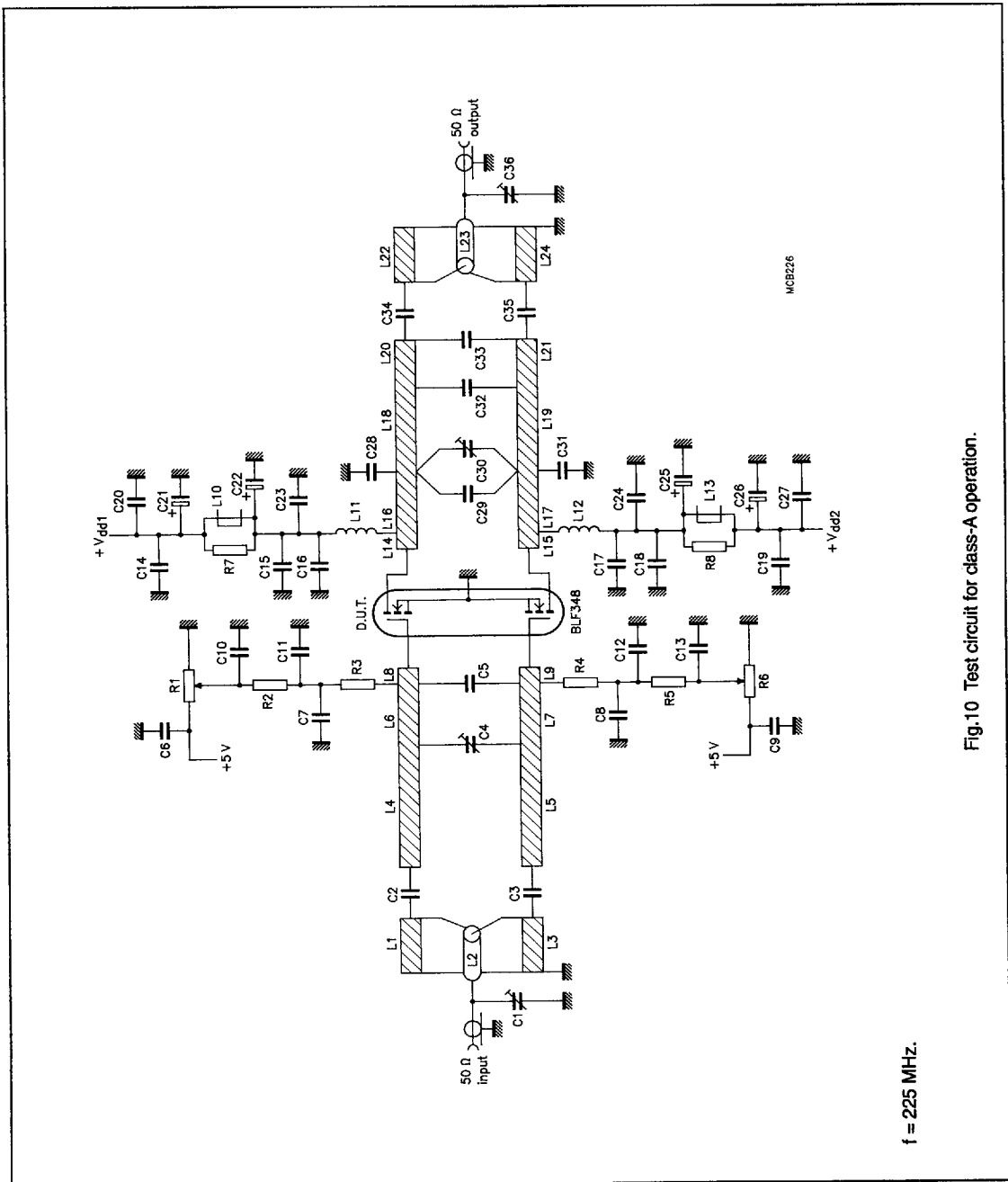


Fig.10 Test circuit for class-A operation.

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## List of components (class-A test circuit)

COMPONENT	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE NO.
C1	film dielectric trimmer	2 to 9 pF		2222 809 09006
C2, C3	multilayer ceramic chip capacitor (note 1)	2 x 10 pF in parallel + 22 pF		
C4, C30	film dielectric trimmer	5 to 60 pF		2222 809 08003
C5	multilayer ceramic chip capacitor (note 1)	82 pF, 500 V		
C6, C9, C10, C13, C14, C19	multilayer ceramic chip capacitor	100 nF, 50 V		2222 852 47104
C11, C12, C20, C27	multilayer ceramic chip capacitor (note 1)	1 nF, 500 V		
C7, C8, C16, C17	MKT film capacitor	1 $\mu$ F		2222 371 11105
C21, C26	electrolytic capacitor	10 $\mu$ F, 63 V		
C22, C25	electrolytic capacitor	220 $\mu$ F, 63 V		
C15, C18, C23, C24	multilayer ceramic chip capacitor (note 1)	510 pF, 500 V		
C28, C31	multilayer ceramic chip capacitor (note 1)	2 x 8.2 pF in parallel, 500 V		
C29	multilayer ceramic chip capacitor (note 1)	3 x 39 pF in parallel, 500 V		
C32	multilayer ceramic chip capacitor (note 1)	33 pF, 500 V		
C33	multilayer ceramic chip capacitor (note 1)	18 pF, 500 V		
C34, C35	multilayer ceramic chip capacitor (note 1)	10 pF + 18 pF + 62 pF (3 in parallel), 500 V		
C36	film dielectric trimmer	2 to 18 pF		2222 809 09003
L1, L3, L22, L24	stripline (note 2)	50 $\Omega$	4.8 x 80 mm	
L2, L23	semi-rigid cable (note 3)	50 $\Omega$	ext. conductor length 80 mm ext. dia 3.6 mm	
L4, L5	stripline (note 2)	43 $\Omega$	6 x 32 mm	
L6, L7	stripline (note 2)	43 $\Omega$	6 x 7 mm	
L8, L9	stripline (note 2)	43 $\Omega$	6 x 7 mm	
L10, L13	grade 3B Ferroxcube wideband HF choke	2 in parallel		4312 020 36642
L11, L12	$\frac{3}{4}$ turn enamelled 2 mm copper wire	40 nH	space 1 mm int. dia. 10 mm leads 2 x 7 mm	

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COMPONENT	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE NO.
L14, L15	stripline (notes 2 and 4)	43 $\Omega$	6 x 6 mm	
L16, L17	stripline (notes 2 and 4)	43 $\Omega$	6 x 9.5 mm	
L18, L19	stripline (notes 2 and 4)	43 $\Omega$	6 x 27.5 mm	
L20, L21	stripline (notes 2 and 4)	43 $\Omega$	6 x 13 mm	
R1, R6	10 turns Bourns potentiometer	50 k $\Omega$		
R2, R5	0.4 W metal film resistor	1 k $\Omega$		
R3, R4	0.4 W metal film resistor	82 $\Omega$		
R7, R8	1 W, $\pm 5\%$ metal film resistor	10 $\Omega$		

## Notes

1. American Technical Ceramics (ATC) capacitor, type 100B or other capacitor of the same quality.
2. The striplines L1, L3 - L9, L14 - L22 and L24 are on a double copper-clad printed circuit board with glass microfibre PTFE dielectric ( $\epsilon_r = 2.2$ ); thickness  $\frac{1}{16}$  inch; thickness of copper sheet 2 x 35  $\mu\text{m}$ .
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 on to striplines L14 - L21.

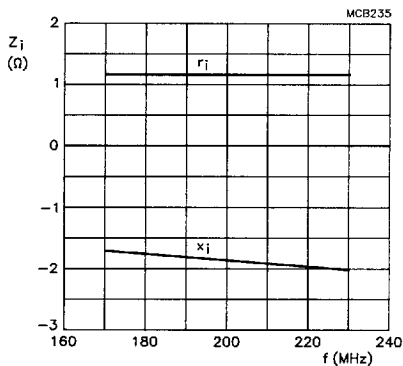


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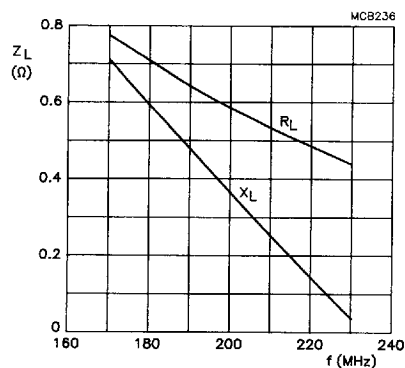
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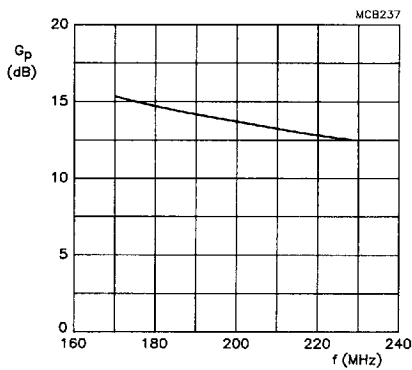
Class-A operation;  $V_{DS} = 28$  V;  $I_{DQ} = 2 \times 4.6$  A;  
 $R_{GS} = 82 \Omega$  (per section);  $T_h = 70$  °C.

Fig.11 Input impedance as a function of frequency (series components), typical values.



Class-A operation;  $V_{DS} = 28$  V;  $I_{DQ} = 2 \times 4.6$  A;  
 $R_{GS} = 82 \Omega$  (per section);  $T_h = 70$  °C.

Fig.12 Load impedance as a function of frequency (series components), typical values.



Class-A operation;  $V_{DS} = 28$  V;  $I_{DQ} = 2 \times 4.6$  A;  
 $R_{GS} = 82 \Omega$  (per section);  $T_h = 70$  °C.

Fig.13 Power gain as a function of frequency, typical values.