

# N-channel dual-gate MOS-FET

# BF909AWR

### FEATURES

- Specially designed for use at 5 V supply voltage
- Short channel transistor with high forward transfer admittance to input capacitance ratio
- Low noise gain controlled amplifier up to 1 GHz
- Superior cross-modulation performance during AGC.

### APPLICATIONS

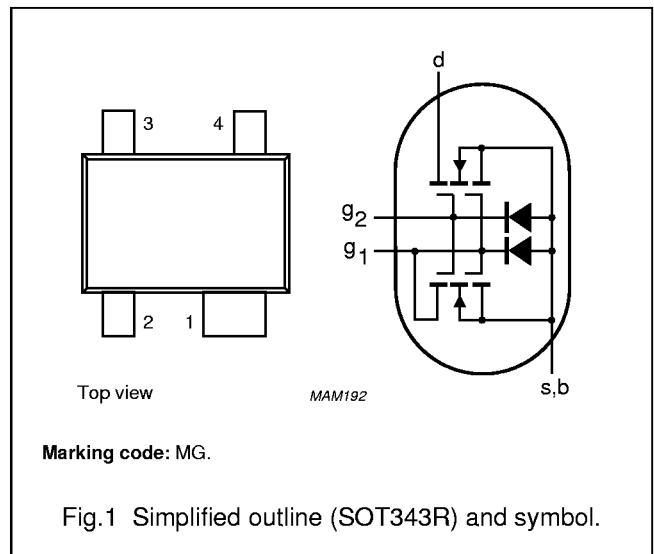
- VHF and UHF applications with 3 to 7 V supply voltage such as television tuners and professional communication equipment.

### DESCRIPTION

Enhancement type field-effect transistor in a plastic microminiature SOT343R package. The transistor consists of an amplifier MOS-FET with source and substrate interconnected and an internal bias circuit to ensure good cross-modulation performance during AGC.

### PINNING

PIN	SYMBOL	DESCRIPTION
1	s, b	source
2	d	drain
3	g <sub>2</sub>	gate 2
4	g <sub>1</sub>	gate 1



### QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V <sub>DS</sub>	drain-source voltage		–	–	7	V
I <sub>D</sub>	drain current		–	–	40	mA
P <sub>tot</sub>	total power dissipation		–	–	280	mW
T <sub>j</sub>	operating junction temperature		–	–	150	°C
y <sub>fs</sub>	forward transfer admittance		36	43	50	mS
C <sub>ig1-s</sub>	input capacitance at gate 1		–	3.6	4.3	pF
C <sub>rs</sub>	reverse transfer capacitance	f = 1 MHz	–	30	50	fF
F	noise figure	f = 800 MHz	–	2	2.8	dB

### 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.

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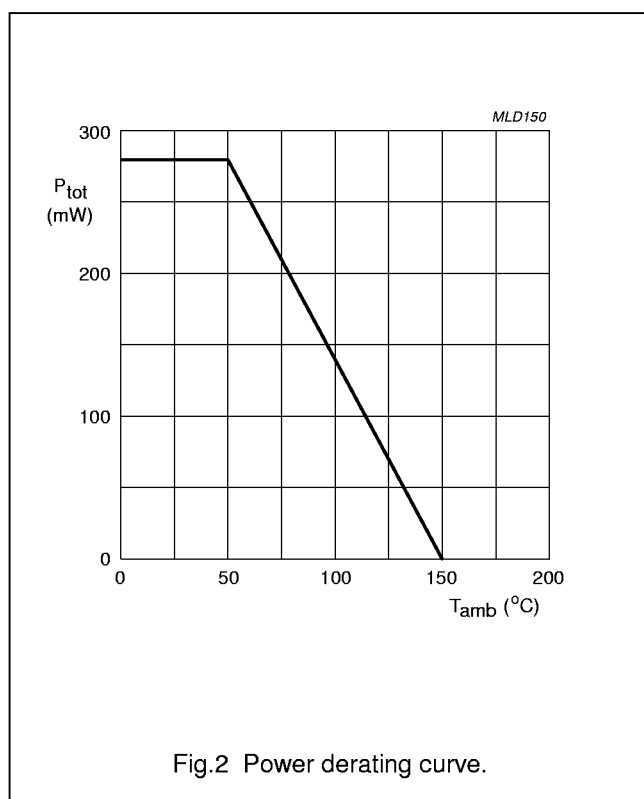
## LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
$V_{DS}$	drain-source voltage		–	7	V
$I_D$	drain current		–	40	mA
$I_{G1}$	gate 1 current		–	$\pm 10$	mA
$I_{G2}$	gate 2 current		–	$\pm 10$	mA
$P_{tot}$	total power dissipation	up to $T_{amb} = 50\text{ }^\circ\text{C}$ ; see Fig.2; note 1	–	280	mW
$T_{stg}$	storage temperature range		–65	+150	$^\circ\text{C}$
$T_j$	operating junction temperature		–	+150	$^\circ\text{C}$

### Note

1. Device mounted on a printed-circuit board.



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## THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j-a}$	thermal resistance from junction to ambient	note 1	350	K/W
$R_{th\ j-s}$	thermal resistance from junction to soldering point	note 2	210	K/W

## Notes

1. Device mounted on a printed-circuit board.
2. Soldering point of the source lead.

## STATIC CHARACTERISTICS

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
$V_{(BR)G1-SS}$	gate 1-source breakdown voltage	$V_{G2-S} = V_{DS} = 0$ ; $I_{G1-S} = 10\text{ mA}$	6	15	V
$V_{(BR)G2-SS}$	gate 2-source breakdown voltage	$V_{G1-S} = V_{DS} = 0$ ; $I_{G2-S} = 10\text{ mA}$	6	15	V
$V_{(F)S-G1}$	forward source-gate 1 voltage	$V_{G2-S} = V_{DS} = 0$ ; $I_{S-G1} = 10\text{ mA}$	0.5	1.5	V
$V_{(F)S-G2}$	forward source-gate 2 voltage	$V_{G1-S} = V_{DS} = 0$ ; $I_{S-G2} = 10\text{ mA}$	0.5	1.5	V
$V_{G1-S(th)}$	gate 1-source threshold voltage	$V_{G2-S} = 4\text{ V}$ ; $V_{DS} = 5\text{ V}$ ; $I_D = 20\text{ }\mu\text{A}$	0.3	1	V
$V_{G2-S(th)}$	gate 2-source threshold voltage	$V_{G1-S} = V_{DS} = 5\text{ V}$ ; $I_D = 20\text{ }\mu\text{A}$	0.3	1.2	V
$I_{DSX}$	drain-source current	$V_{G2-S} = 4\text{ V}$ ; $V_{DS} = 5\text{ V}$ ; $R_{G1} = 120\text{ k}\Omega$ ; note 1	12	20	mA
$I_{G1-SS}$	gate 1 cut-off current	$V_{G2-S} = V_{DS} = 0$ ; $V_{G1-S} = 5\text{ V}$	–	50	nA
$I_{G2-SS}$	gate 2 cut-off current	$V_{G1-S} = V_{DS} = 0$ ; $V_{G2-S} = 5\text{ V}$	–	50	nA

## Note

1.  $R_{G1}$  connects gate 1 to  $V_{GG} = 5\text{ V}$ .

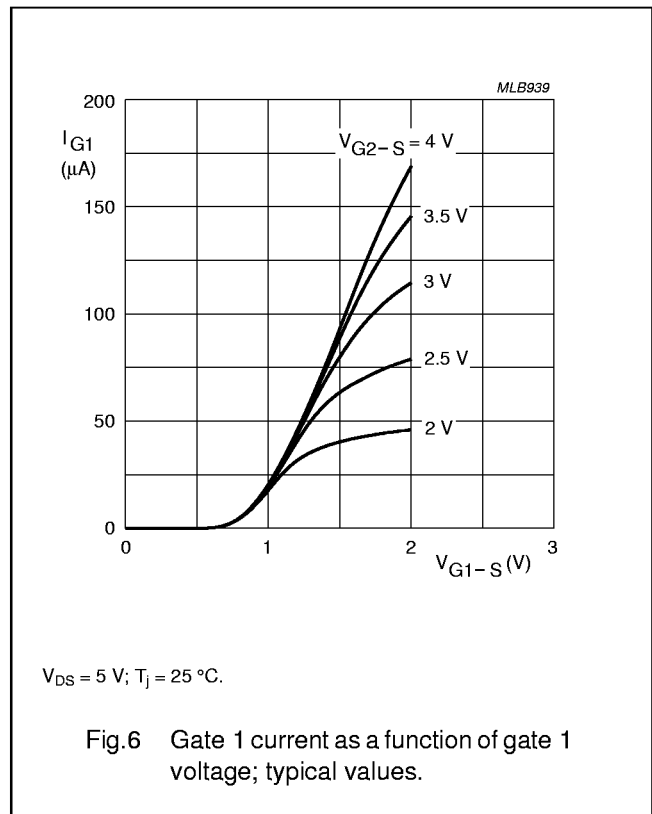
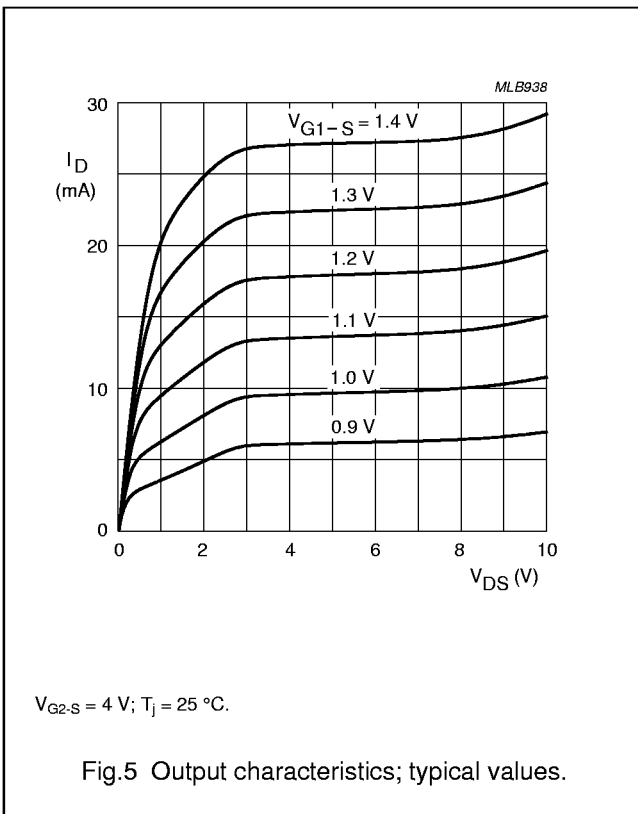
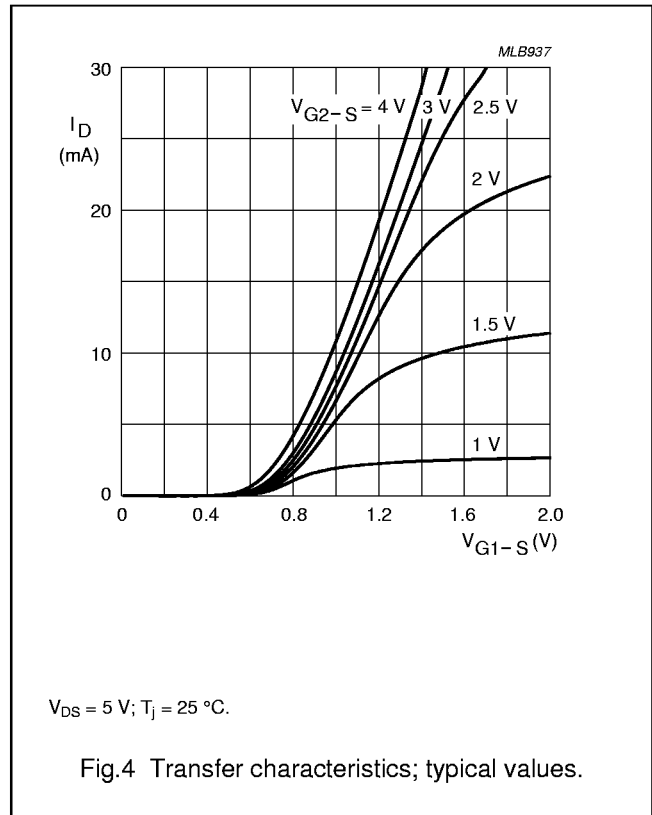
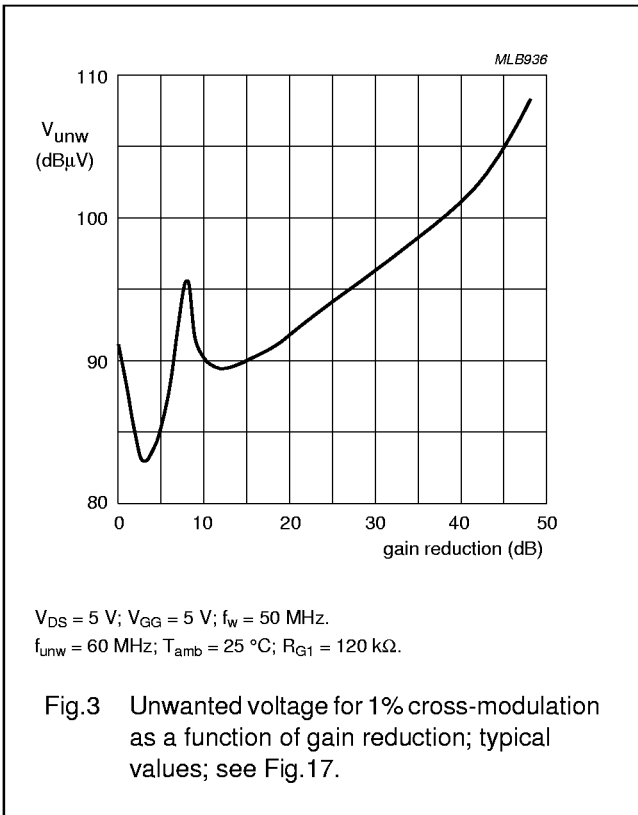
## DYNAMIC CHARACTERISTICS

Common source;  $T_{amb} = 25\text{ °C}$ ;  $V_{DS} = 5\text{ V}$ ;  $V_{G2-S} = 4\text{ V}$ ;  $I_D = 15\text{ mA}$ ; unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$ y_{fs} $	forward transfer admittance	pulsed; $T_j = 25\text{ °C}$	36	43	50	mS
$C_{ig1-s}$	input capacitance at gate 1	$f = 1\text{ MHz}$	–	3.6	4.3	pF
$C_{ig2-s}$	input capacitance at gate 2	$f = 1\text{ MHz}$	–	2.3	3	pF
$C_{os}$	drain-source capacitance	$f = 1\text{ MHz}$	–	2.4	3	pF
$C_{rs}$	reverse transfer capacitance	$f = 1\text{ MHz}$	–	30	50	fF
F	noise figure	$f = 800\text{ MHz}$ ; $G_S = G_{Sopt}$ ; $B_S = B_{Sopt}$	–	2	2.8	dB

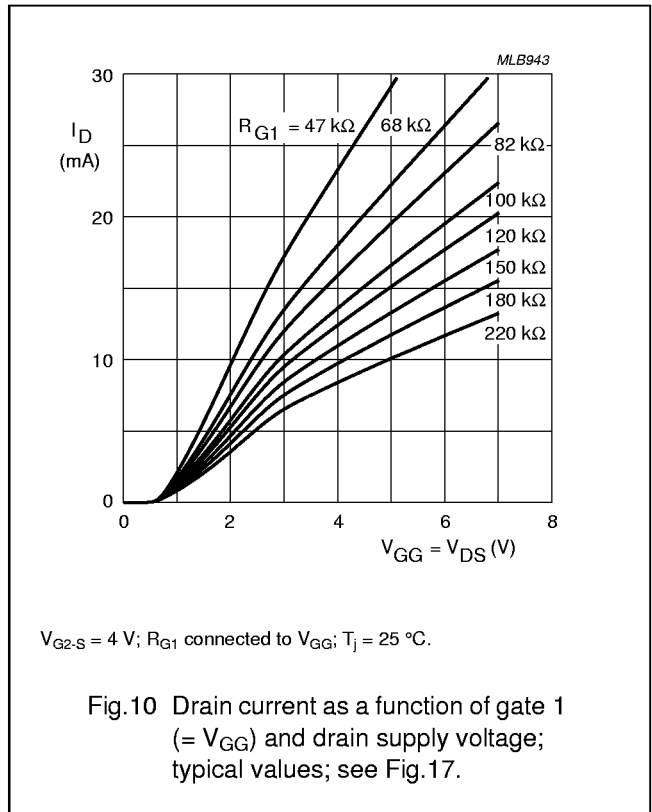
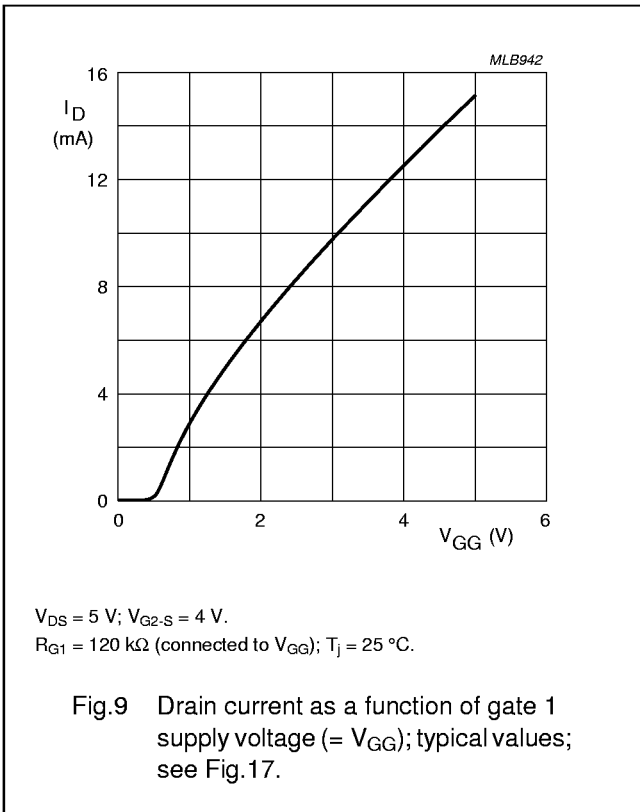
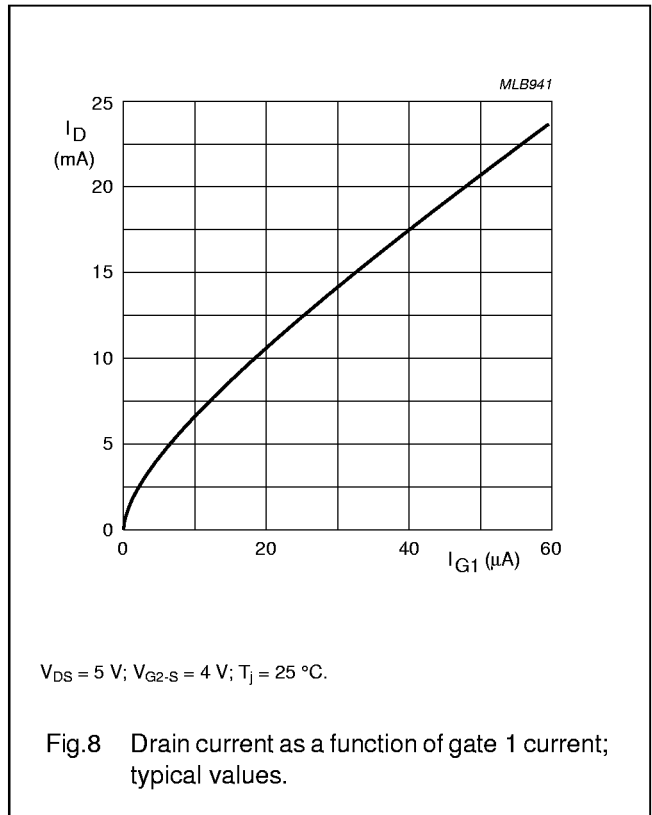
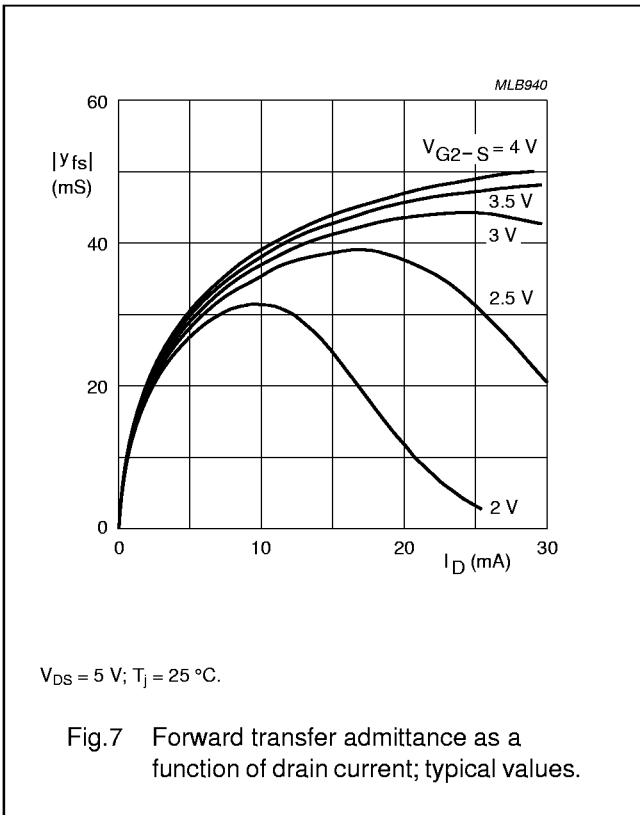
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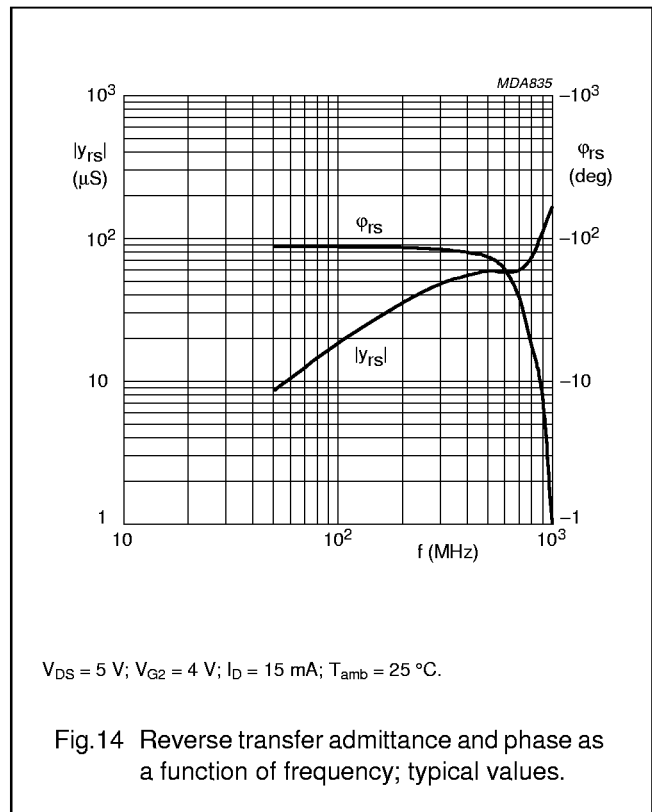
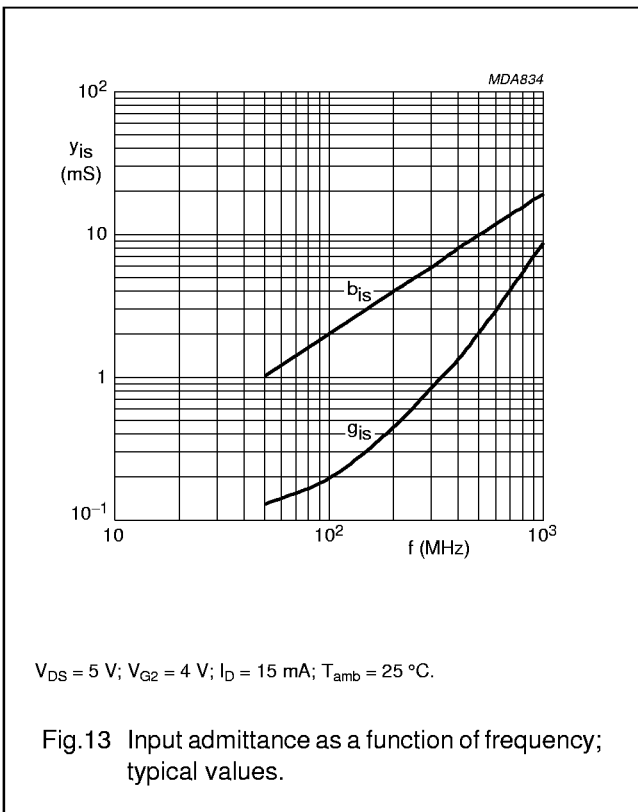
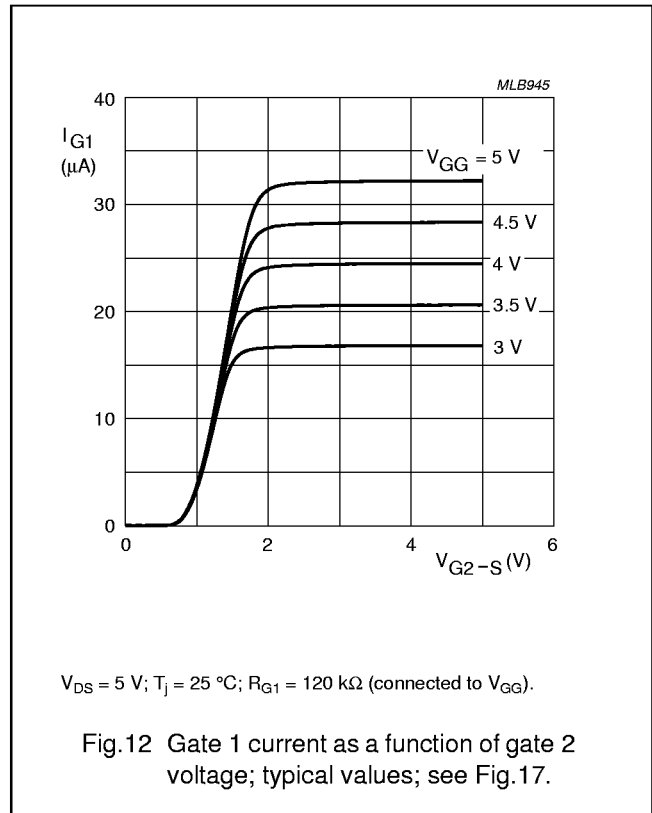
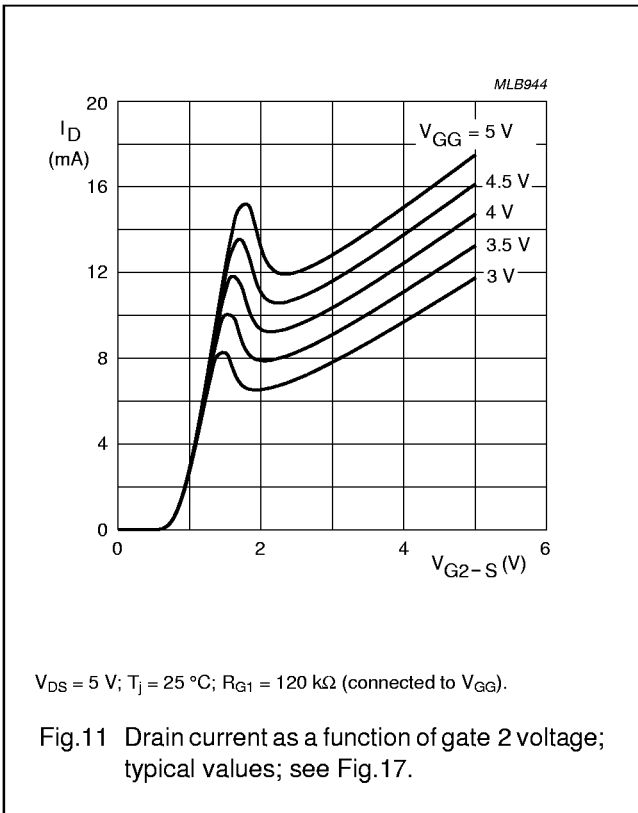
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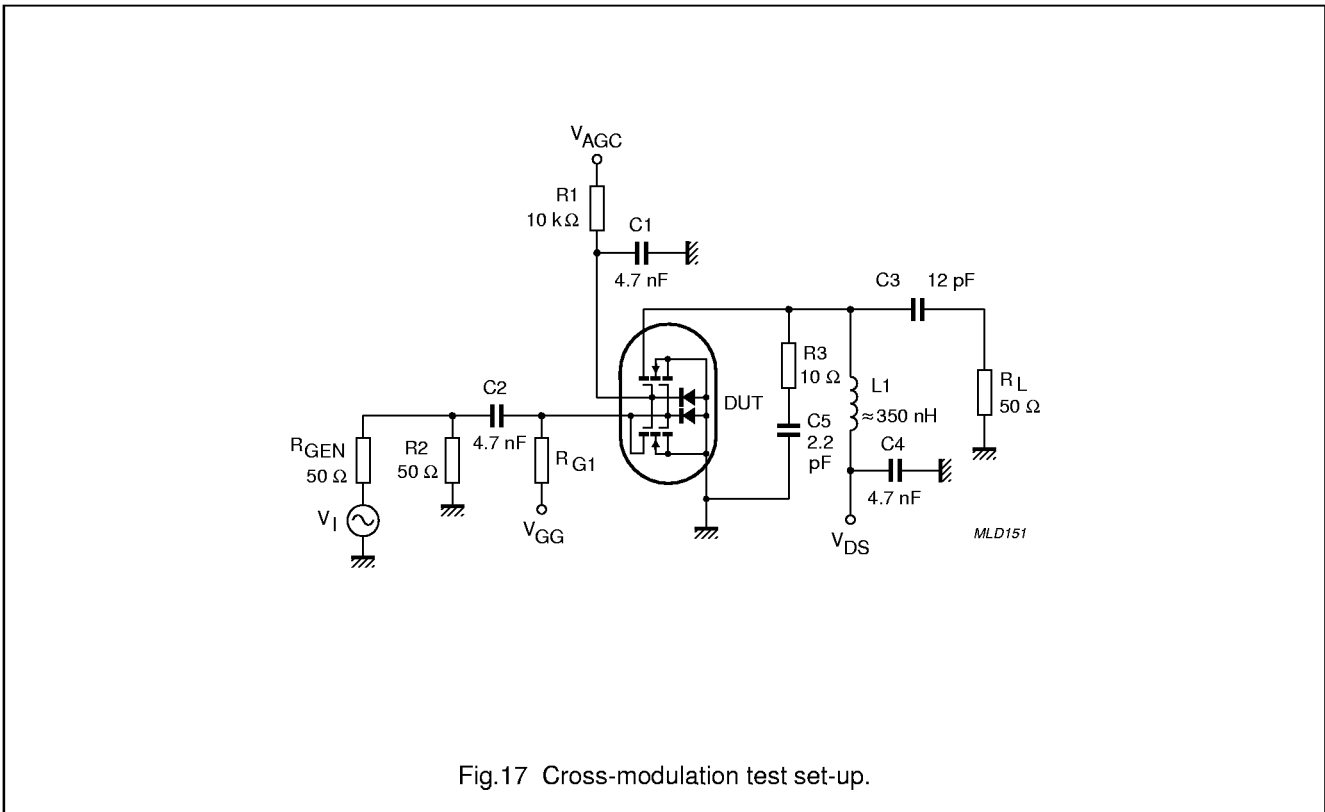
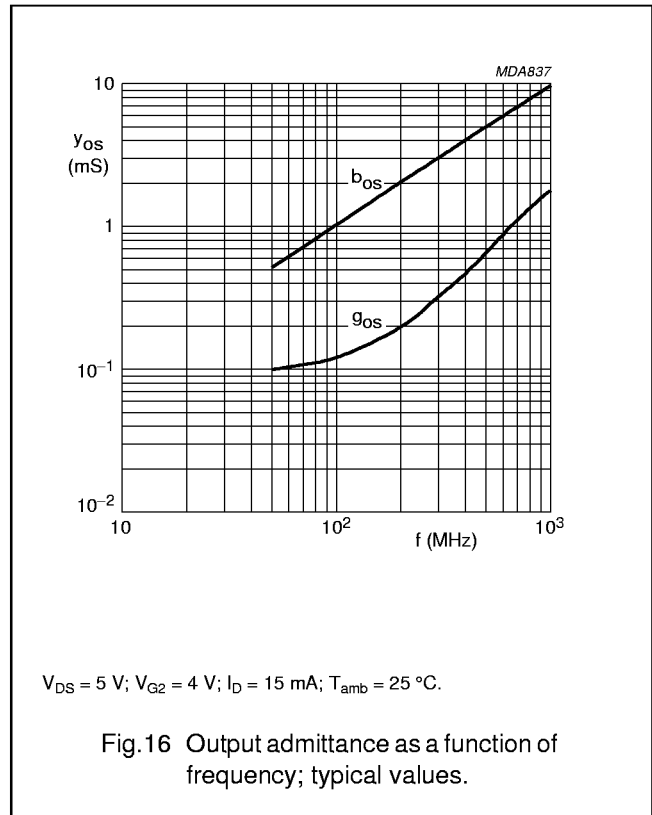
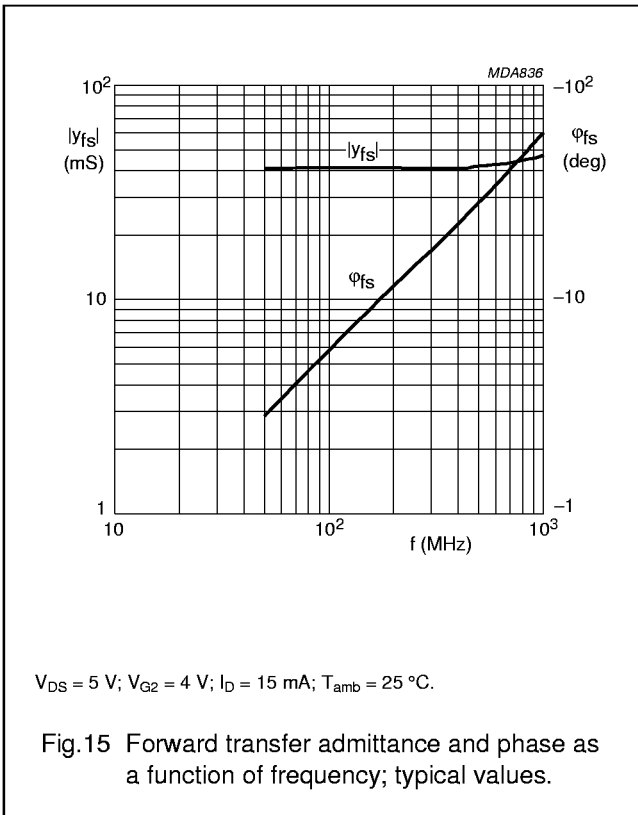
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**Table 1** Scattering parameters:  $V_{DS} = 5\text{ V}$ ;  $V_{G2-S} = 4\text{ V}$ ;  $I_D = 15\text{ mA}$ ;  $T_{amb} = 25\text{ }^\circ\text{C}$ 

f (MHz)	S <sub>11</sub>		S <sub>21</sub>		S <sub>12</sub>		S <sub>22</sub>	
	MAGNITUDE (ratio)	ANGLE (deg)	MAGNITUDE (ratio)	ANGLE (deg)	MAGNITUDE (ratio)	ANGLE (deg)	MAGNITUDE (ratio)	ANGLE (deg)
50	0.987	-6.0	4.070	172.7	0.001	86.9	0.989	-3.1
100	0.980	-11.8	4.041	165.4	0.002	82.9	0.987	-6.1
200	0.956	-23.0	3.897	151.3	0.003	73.4	0.978	-12.1
300	0.911	-33.3	3.654	136.9	0.004	70.6	0.962	-17.7
400	0.888	-44.2	3.531	125.4	0.005	67.4	0.951	-23.3
500	0.845	-53.5	3.265	113.4	0.005	66.6	0.934	-28.6
600	0.803	-62.3	3.055	102.3	0.005	75.0	0.917	-33.6
700	0.758	-70.9	2.836	91.3	0.004	93.1	0.902	-38.5
800	0.719	-78.8	2.653	80.9	0.004	115.2	0.889	-43.5
900	0.683	-86.4	2.456	70.9	0.006	132.7	0.878	-48.3
1000	0.653	-93.9	2.299	61.4	0.008	141.0	0.870	-53.3

**Table 2** Noise data:  $V_{DS} = 5\text{ V}$ ;  $V_{G2-S} = 4\text{ V}$ ;  $I_D = 15\text{ mA}$ ;  $T_{amb} = 25\text{ }^\circ\text{C}$ 

f (MHz)	F <sub>min</sub> (dB)	Γ <sub>opt</sub>		r <sub>n</sub>
		(ratio)	(deg)	
800	2.00	0.603	67.71	0.581



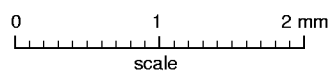
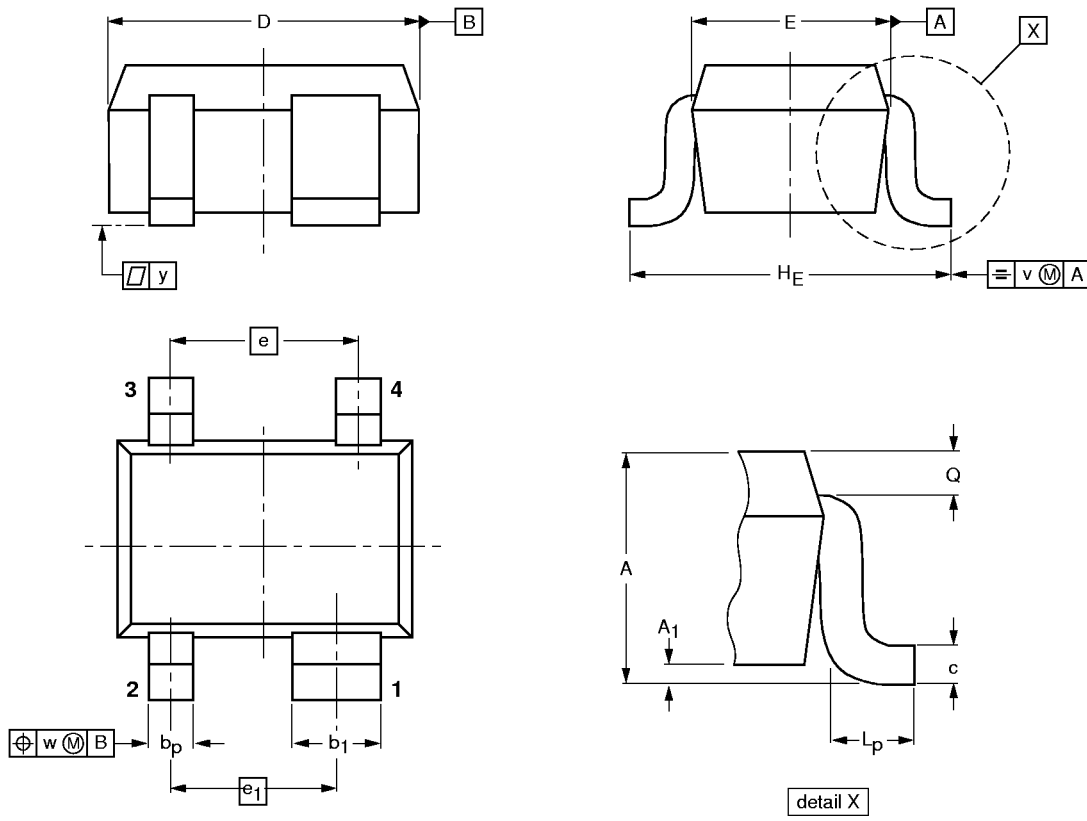
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PACKAGE OUTLINE

Plastic surface mounted package; reverse pinning; 4 leads

SOT343R



DIMENSIONS (mm are the original dimensions)

UNIT	A	A <sub>1</sub> max	b <sub>p</sub>	b <sub>1</sub>	c	D	E	e	e <sub>1</sub>	H <sub>E</sub>	L <sub>p</sub>	Q	v	w	y
mm	1.1 0.8	0.1	0.4 0.3	0.7 0.5	0.25 0.10	2.2 1.8	1.35 1.15	1.3	1.15	2.2 2.0	0.45 0.15	0.23 0.13	0.2	0.2	0.1

OUTLINE VERSION	REFERENCES			EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ		
SOT343R					97-05-21