

# DATA SHEET

**BF909WR**

**N-channel dual-gate MOS-FET**

Product specification  
Supersedes data of 1997 Sep 05

2010 Sep 15



# N-channel dual-gate MOS-FET

# BF909WR

### 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 communications equipment.

### DESCRIPTION

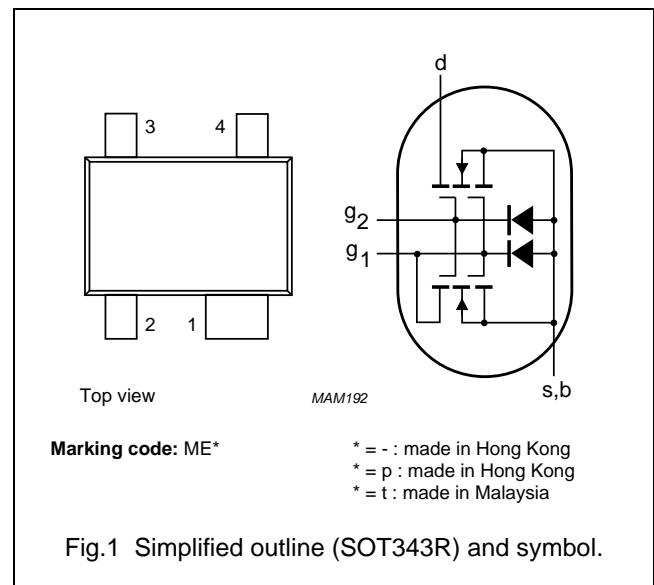
Enhancement type field-effect transistor in a plastic microminiature SOT343R package. The transistor consists of an amplifier MOS-FET with source and substrate interconnected and an internal bias circuit to ensure good cross-modulation performance during AGC.

### CAUTION

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

### 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

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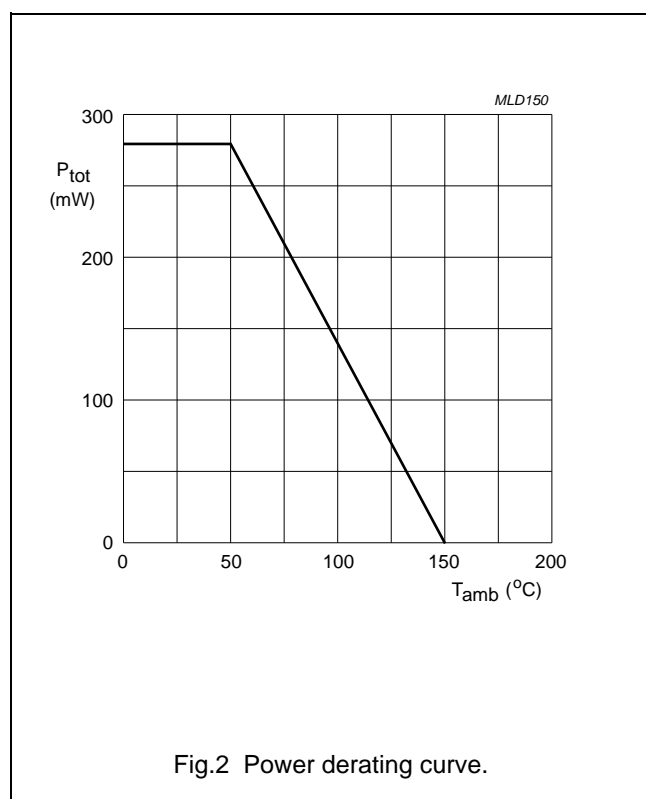
## LIMITING VALUES

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	$T_s = 91\text{ °C}$ ; note 2	210	K/W

## Notes

1. Device mounted on a printed-circuit board.
2.  $T_s$  is the temperature at the 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  $V_{GG} = 5\text{ V}$ .

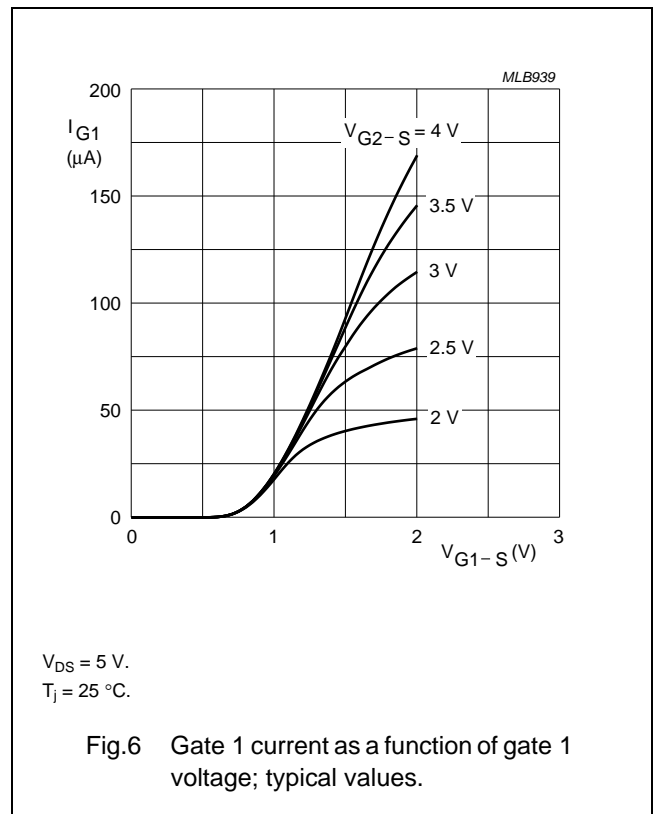
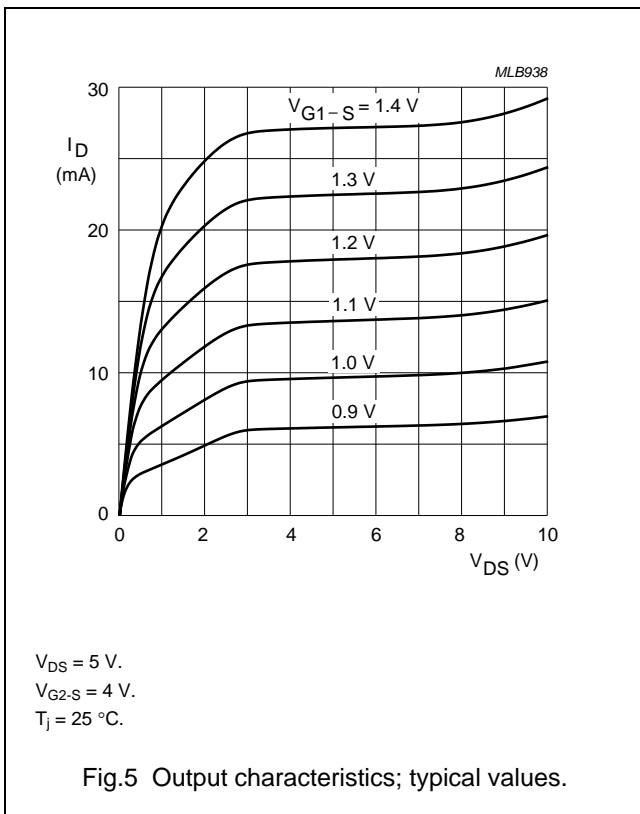
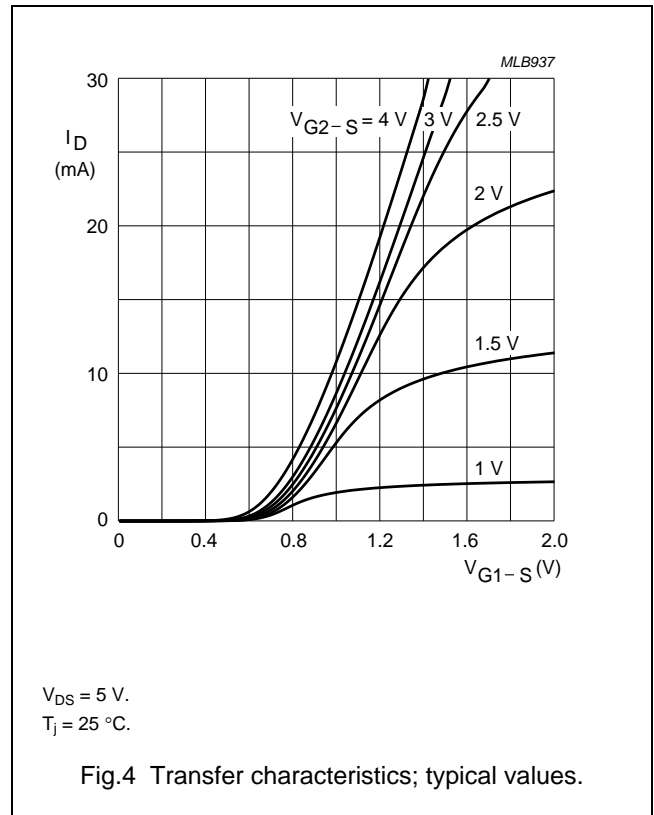
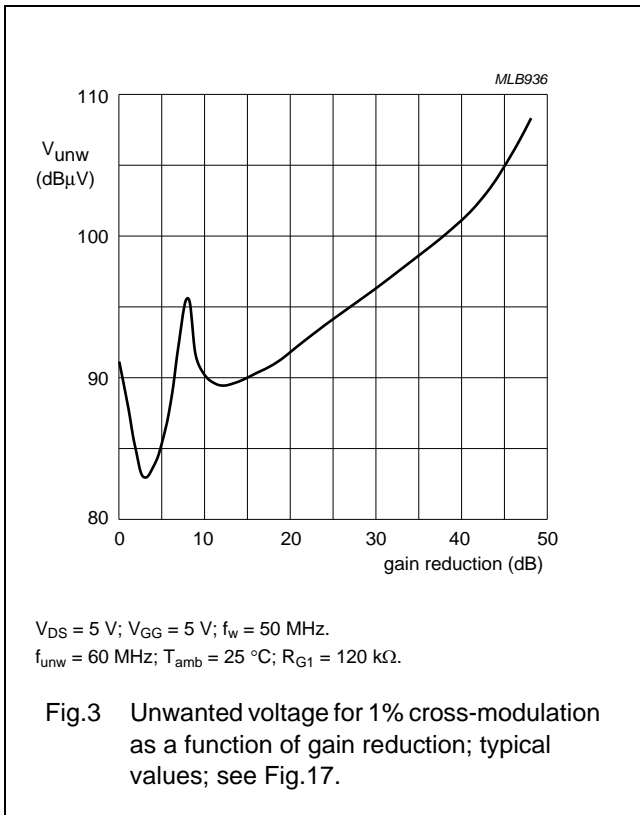
## DYNAMIC CHARACTERISTICS

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	$f = 1\text{ MHz}$	–	2.3	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

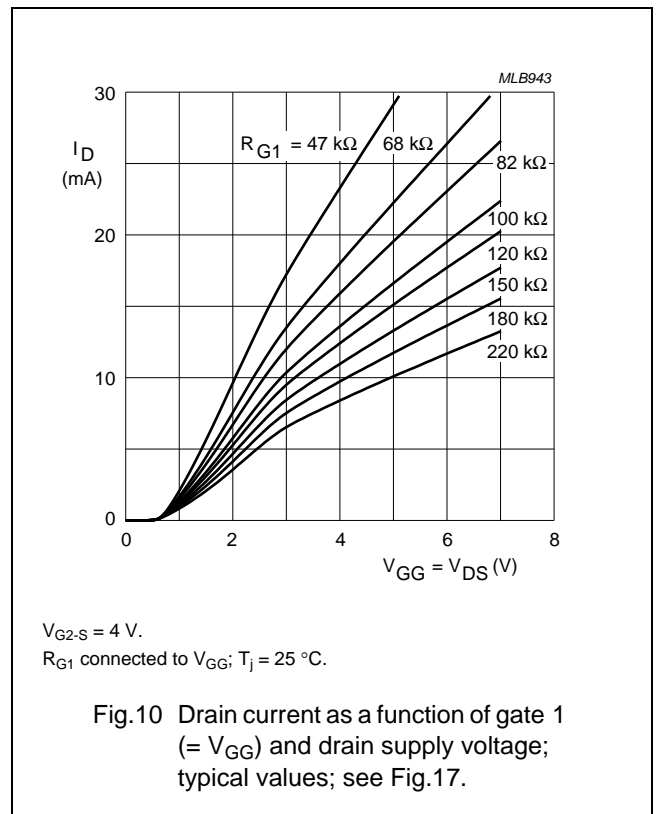
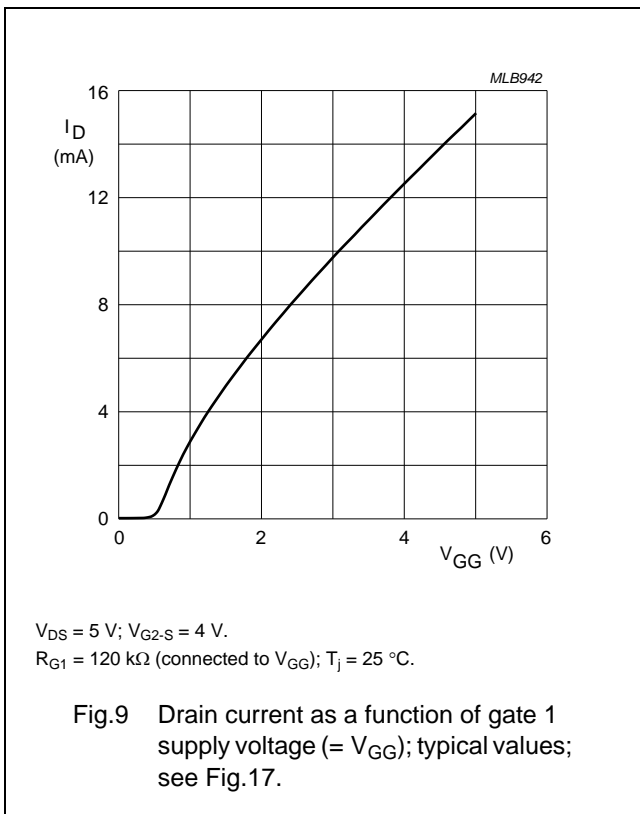
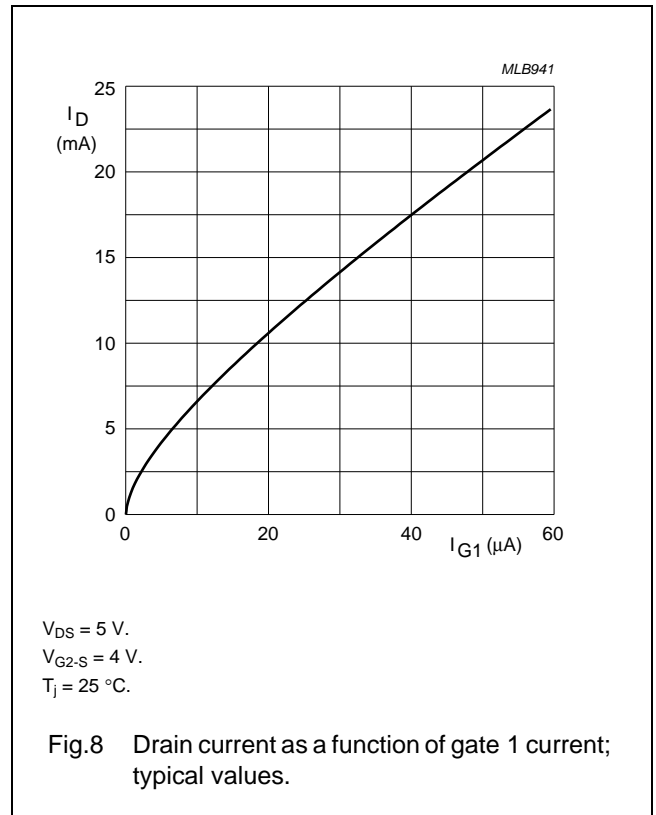
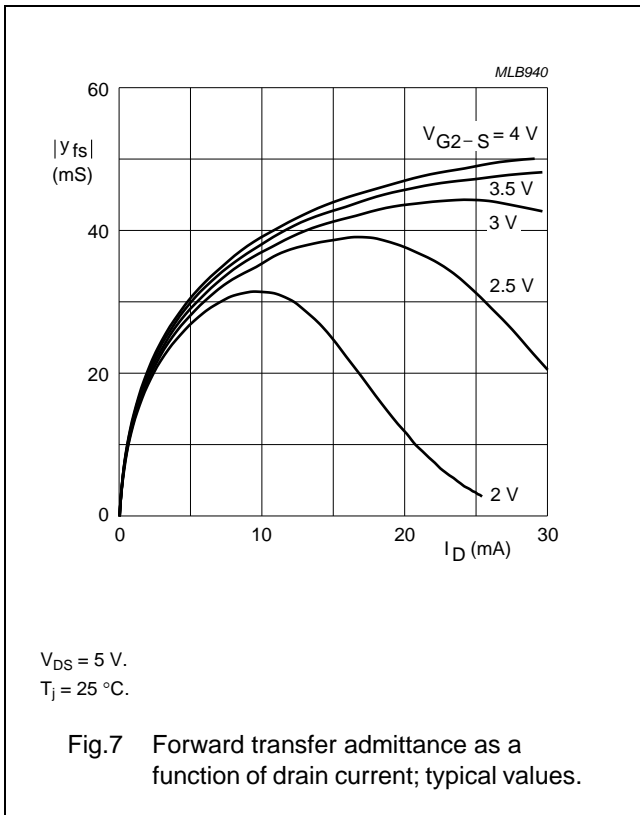
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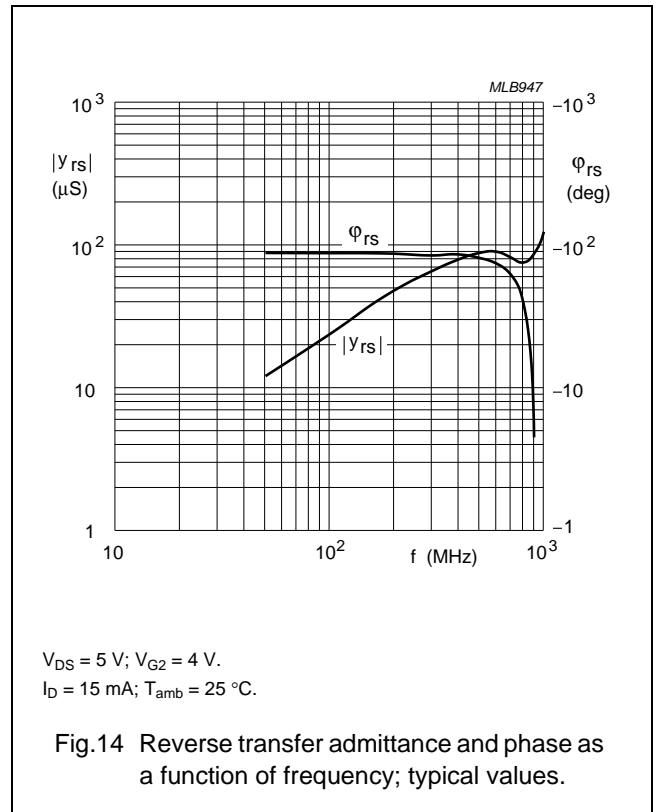
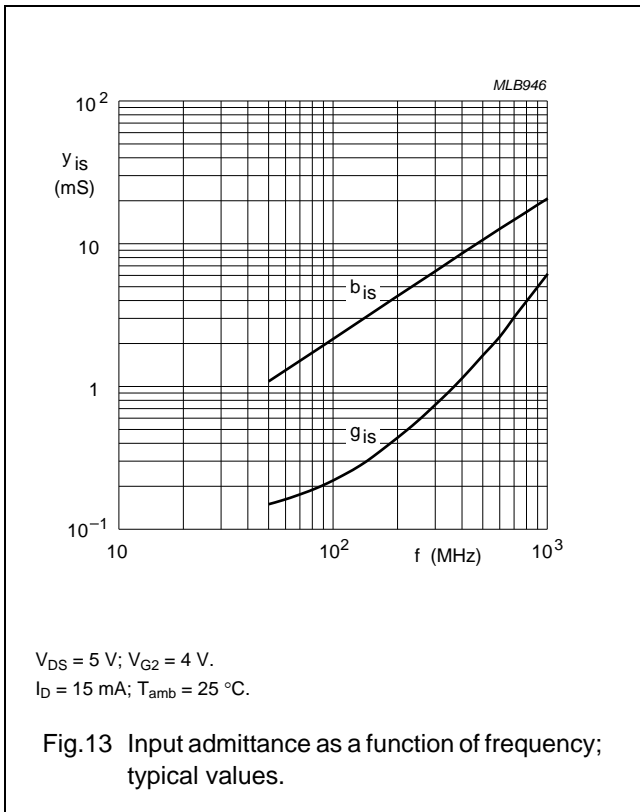
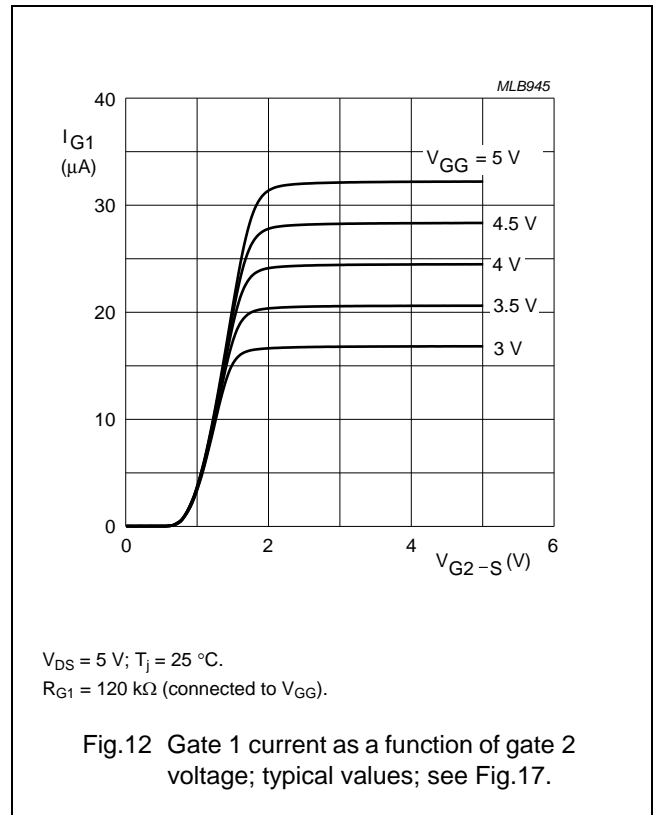
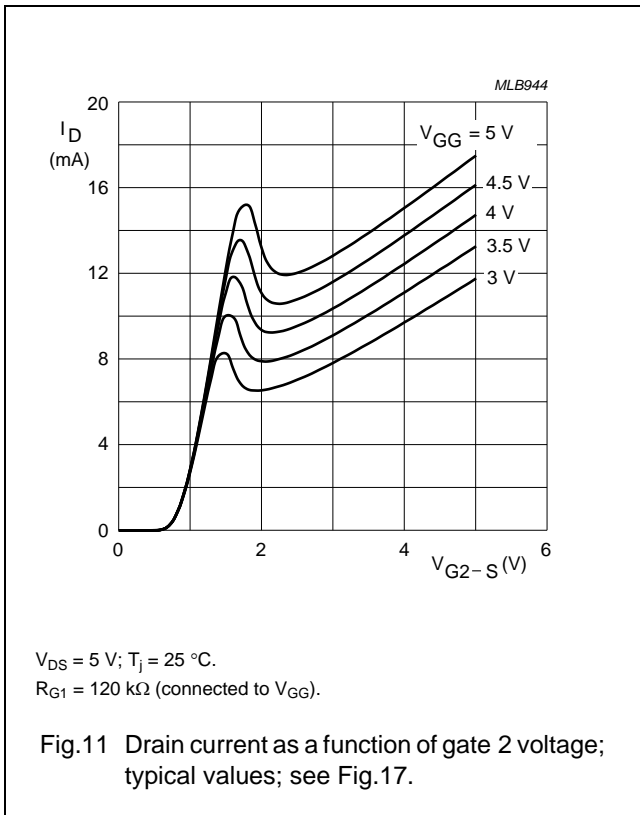
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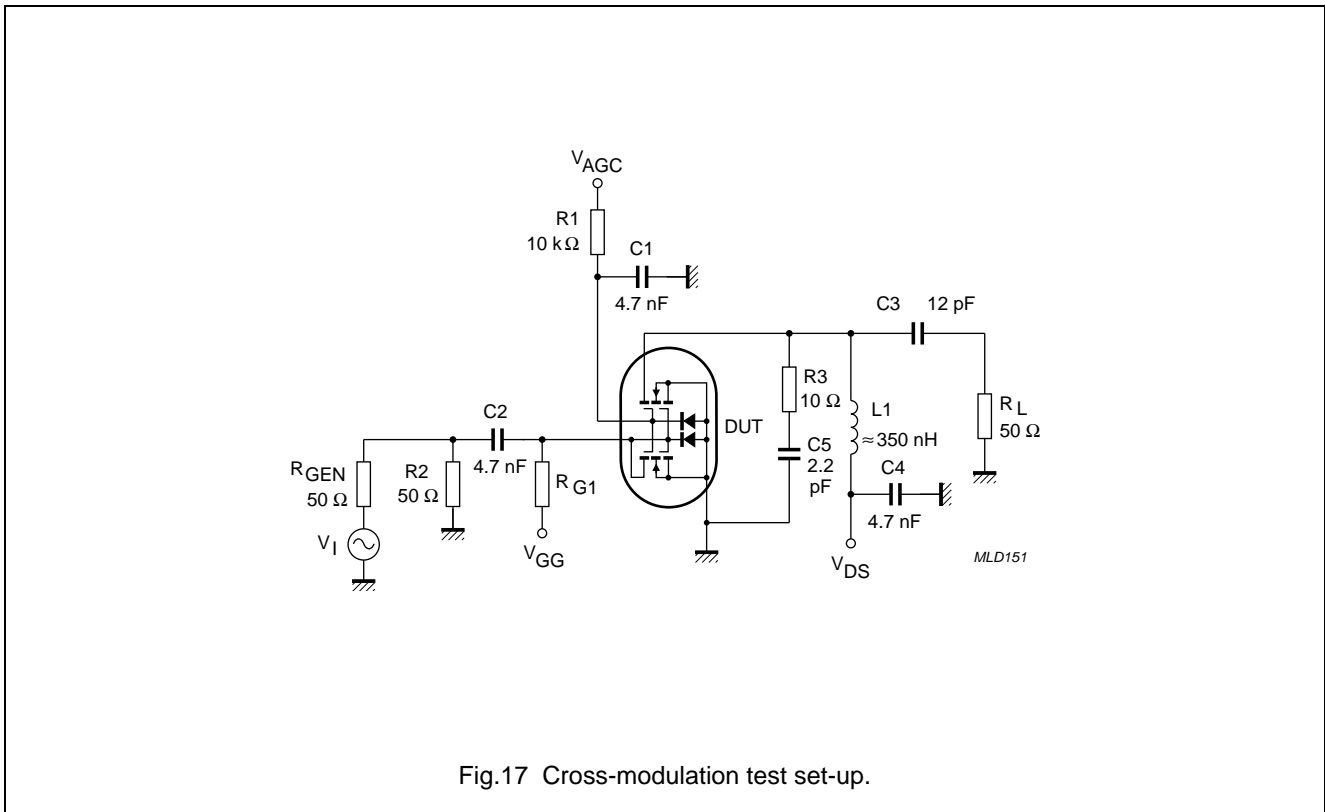
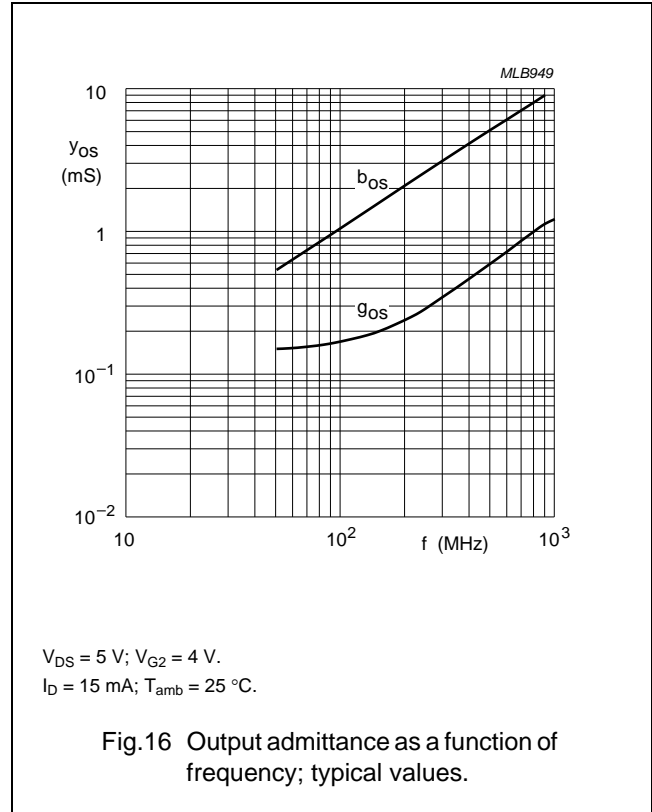
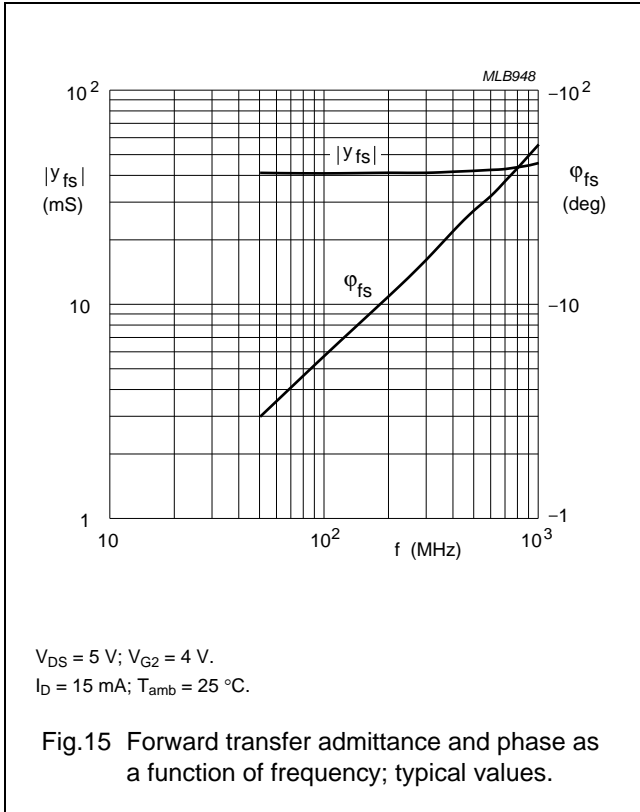
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**Table 1** Scattering parameters:  $V_{DS} = 5\text{ V}$ ;  $V_{G2-S} = 4\text{ V}$ ;  $I_D = 15\text{ mA}$ ;  $T_{amb} = 25\text{ °C}$ 

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	0.985	-6.4	4.064	172.3	0.001	86.9	0.985	-3.2
100	0.978	-12.6	3.997	164.9	0.002	82.7	0.982	-6.4
200	0.957	-25.0	3.886	150.8	0.005	74.3	0.973	-12.6
300	0.931	-36.5	3.682	137.3	0.006	68.9	0.960	-18.6
400	0.899	-47.6	3.484	123.8	0.007	59.6	0.947	-24.2
500	0.868	-57.4	3.260	111.7	0.007	57.9	0.936	-29.6
600	0.848	-66.6	3.053	101.0	0.006	58.5	0.927	-34.8
700	0.816	-74.6	2.829	90.3	0.005	65.5	0.919	-39.8
800	0.792	-82.2	2.652	79.9	0.005	83.3	0.913	-44.6
900	0.772	-89.3	2.470	69.5	0.005	114.9	0.910	-49.5
1000	0.754	-95.6	2.328	59.5	0.006	138.7	0.909	-54.6

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

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

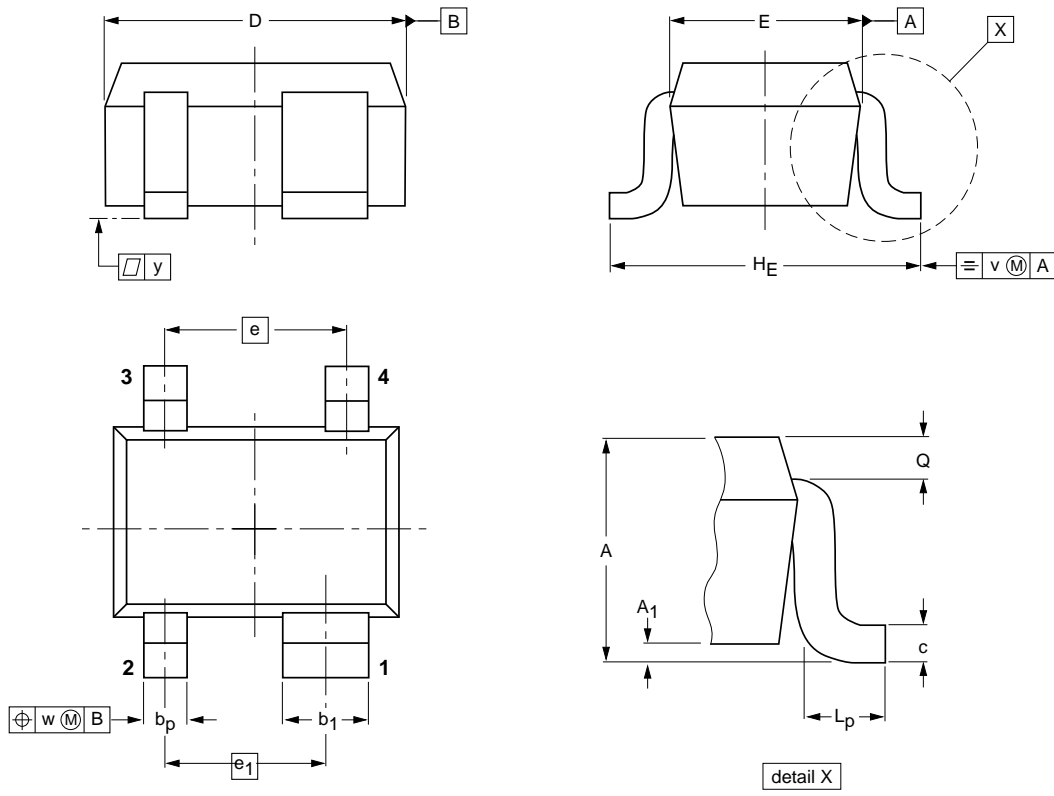
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PACKAGE OUTLINE

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 06-03-16

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## DATA SHEET STATUS

DOCUMENT STATUS <sup>(1)</sup>	PRODUCT STATUS <sup>(2)</sup>	DEFINITION
Objective data sheet	Development	This document contains data from the objective specification for product development.
Preliminary data sheet	Qualification	This document contains data from the preliminary specification.
Product data sheet	Production	This document contains the product specification.

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