

BF909; BF909R

N-channel dual gate MOS-FETs

Rev. 02 — 19 November 2007

Product data sheet

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NXP Semiconductors

N-channel dual gate MOS-FETs

BF909; BF909R

FEATURES

- Specially designed for use at 5 V supply voltage
- High forward transfer admittance
- 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 SOT143 or SOT143R 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 ₂	gate 2
4	g ₁	gate 1

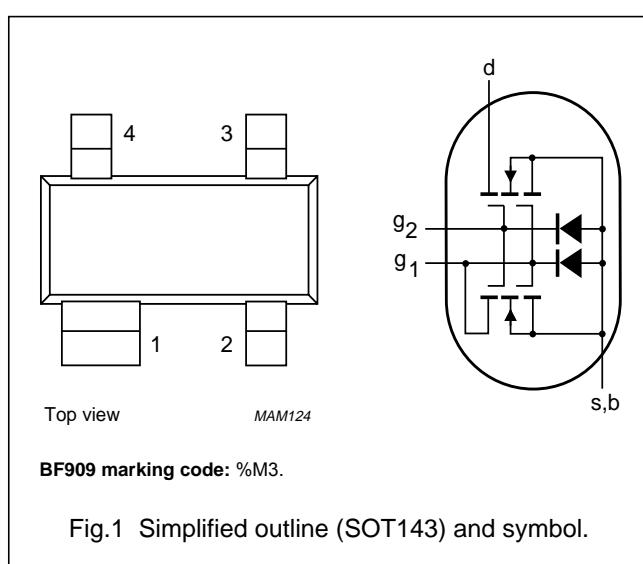


Fig.1 Simplified outline (SOT143) and symbol.

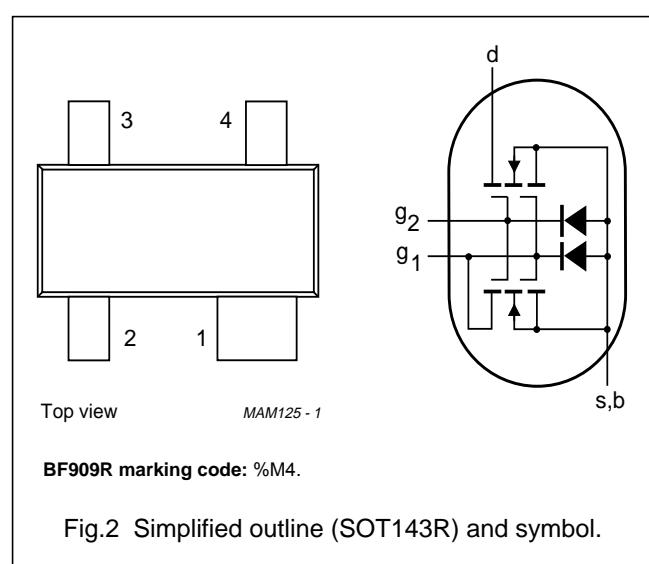


Fig.2 Simplified outline (SOT143R) and symbol.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V _{DS}	drain-source voltage		–	–	7	V
I _D	drain current		–	–	40	mA
P _{tot}	total power dissipation		–	–	200	mW
T _j	operating junction temperature		–	–	150	°C
y _{fs}	forward transfer admittance		36	43	50	mS
C _{ig1-s}	input capacitance at gate 1		–	3.6	4.3	pF
C _{rs}	reverse transfer capacitance	f = 1 MHz	–	35	50	fF
F	noise figure	f = 800 MHz	–	2	2.8	dB

N-channel dual gate MOS-FETs

BF909; BF909R

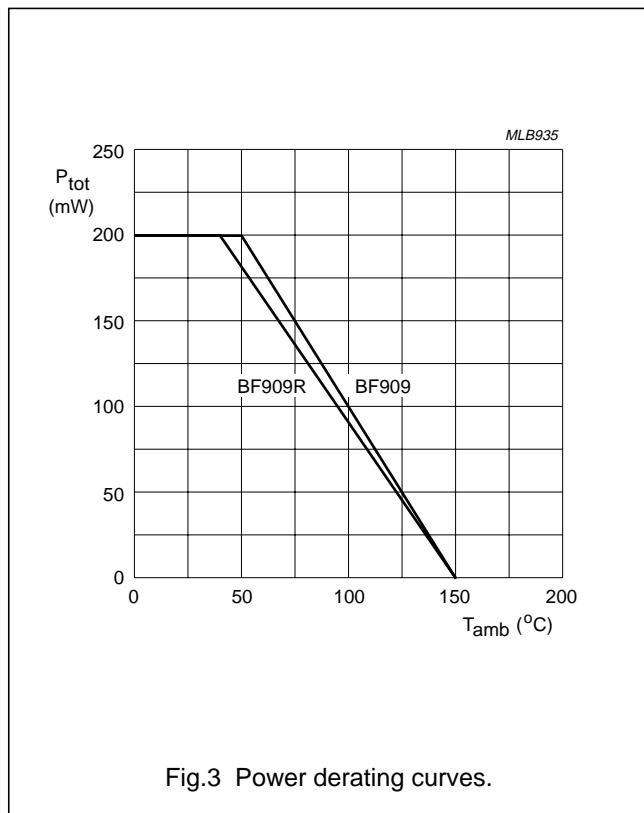
LIMITING VALUES

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		–	± 10	mA
I_{G2}	gate 2 current		–	± 10	mA
P_{tot}	total power dissipation BF909 BF909R	see Fig.3 up to $T_{amb} = 50$ °C; note 1 up to $T_{amb} = 40$ °C; note 1	– –	200 200	mW mW
T_{stg}	storage temperature		–65	+150	°C
T_j	operating junction temperature		–	150	°C

Note

1. Device mounted on a printed-circuit board.



N-channel dual gate MOS-FETs

BF909; BF909R

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j-a}$	thermal resistance from junction to ambient BF909 BF909R	note 1	500	K/W
			550	K/W
$R_{th\ j-s}$	thermal resistance from junction to soldering point BF909 BF909R	note 2 $T_s = 92\text{ }^\circ\text{C}$ $T_s = 78\text{ }^\circ\text{C}$	290	K/W
			360	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

 $T_j = 25\text{ }^\circ\text{C}$; 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	$V_{G1-S} = 5\text{ V}$; $V_{G2-S} = V_{DS} = 0$	–	50	nA
I_{G2-SS}	gate 2 cut-off current	$V_{G2-S} = 5\text{ V}$; $V_{G1-S} = V_{DS} = 0$	–	50	nA

Note

1. R_{G1} connects gate 1 to $V_{GG} = 5\text{ V}$; see Fig.18.

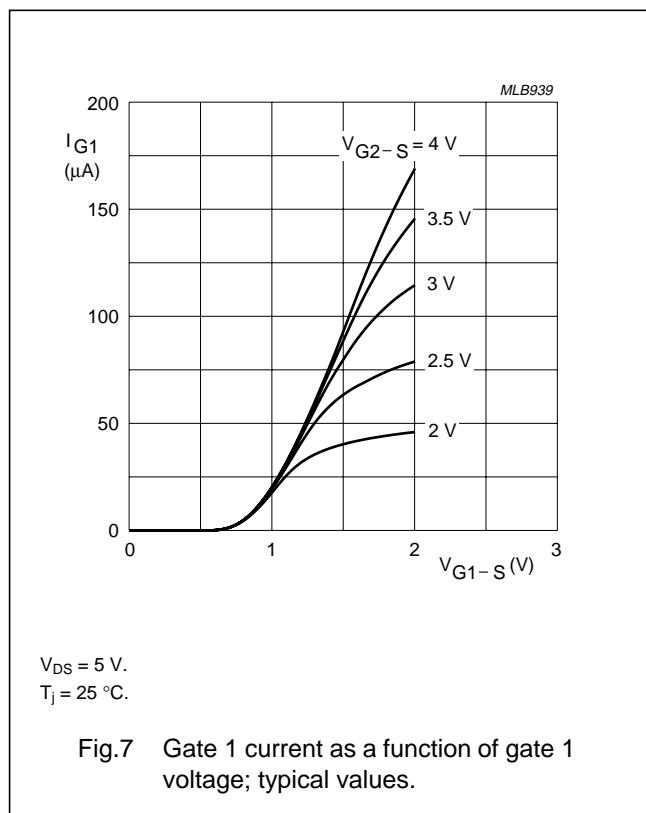
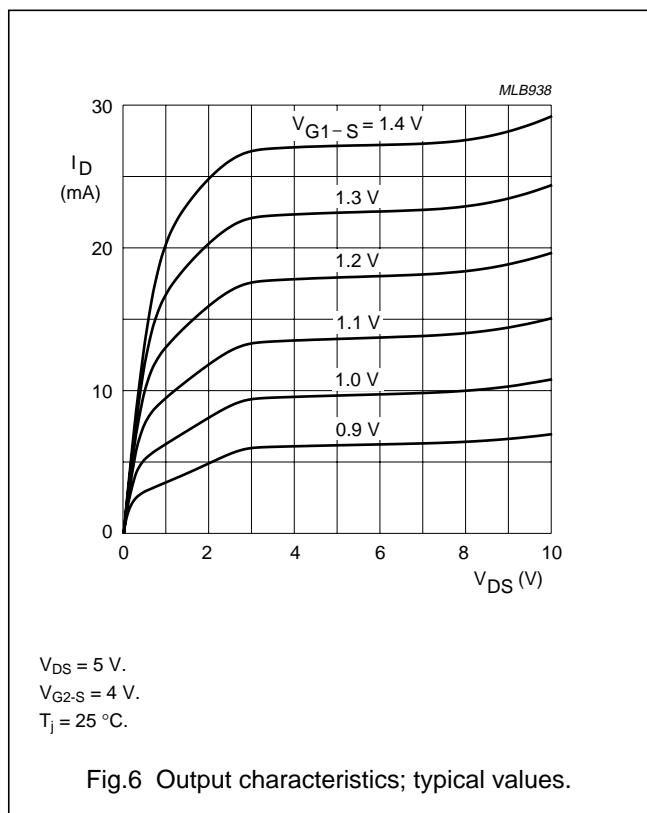
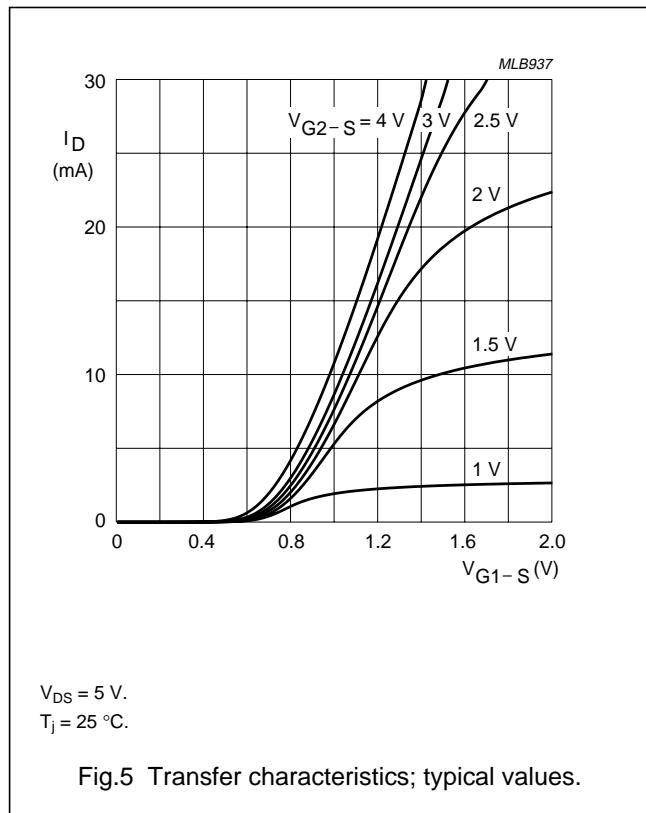
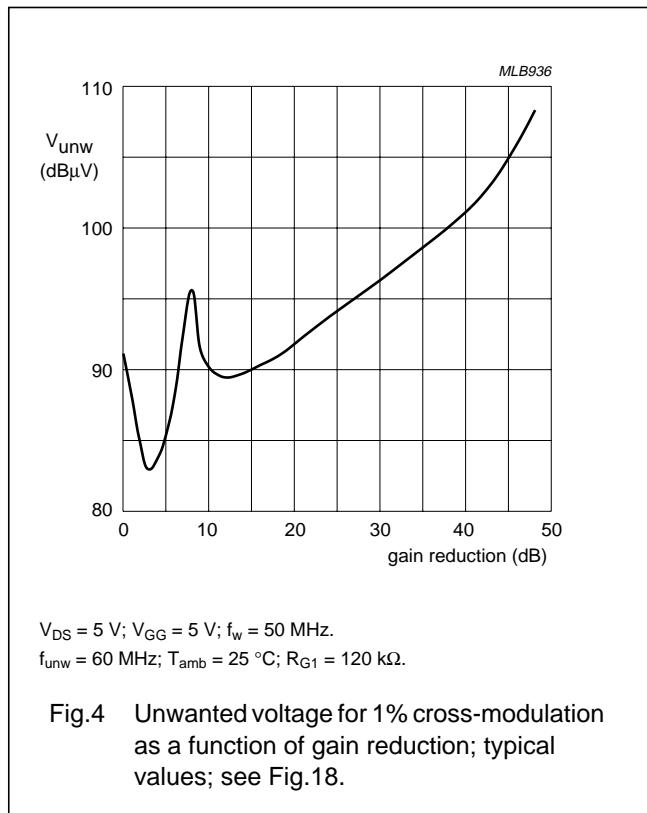
DYNAMIC CHARACTERISTICS

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$ y_{fs} $	forward transfer admittance	pulsed; $T_j = 25\text{ }^\circ\text{C}$	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	$f = 1\text{ MHz}$	–	35	50	fF
F	noise figure	$f = 800\text{ MHz}$; $G_S = G_{Sopt}$; $B_S = B_{Sopt}$	–	2	2.8	dB

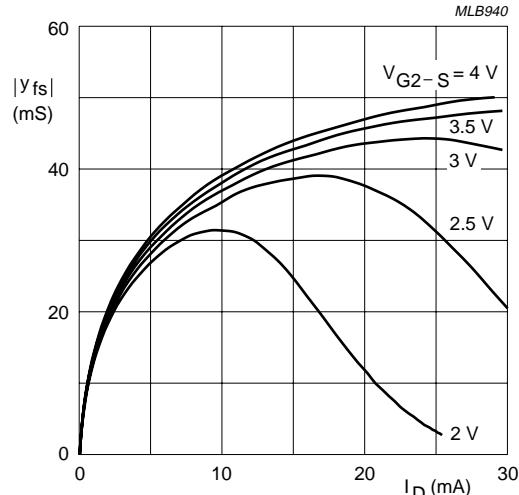
N-channel dual gate MOS-FETs

BF909; BF909R



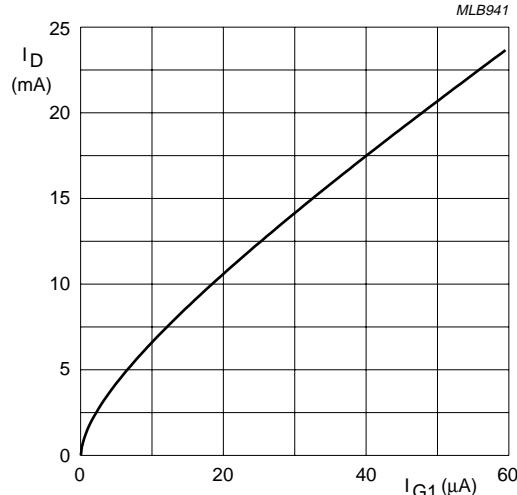
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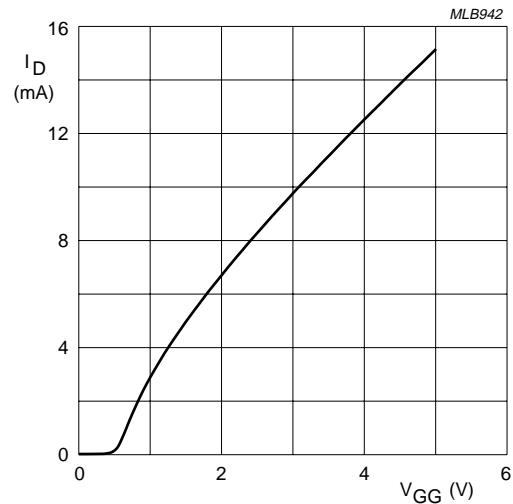
$V_{DS} = 5$ V.
 $T_j = 25$ °C.

Fig.8 Forward transfer admittance as a function of drain current; typical values.



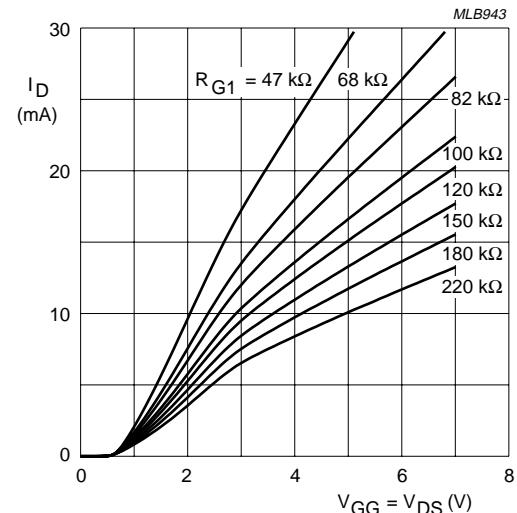
$V_{DS} = 5$ V; $V_{G2-S} = 4$ V.
 $T_j = 25$ °C.

Fig.9 Drain current as a function of gate 1 current; typical values.



$V_{DS} = 5$ V; $V_{G2-S} = 4$ V.
 $R_{G1} = 120$ kΩ (connected to V_{GG}); $T_j = 25$ °C.

Fig.10 Drain current as a function of gate 1 supply voltage (= V_{GG}); typical values; see Fig.18.

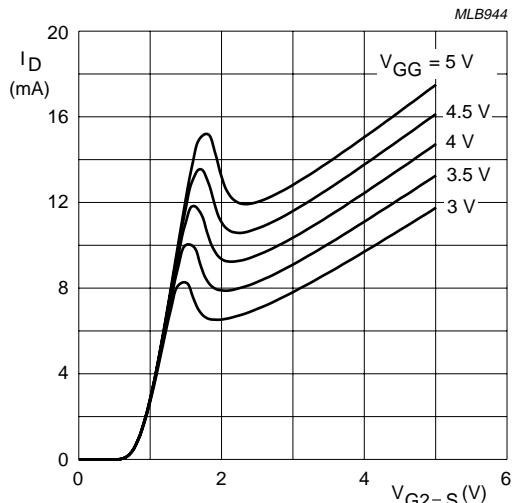


$V_{G2-S} = 4$ V.
 R_{G1} connected to V_{GG} ; $T_j = 25$ °C.

Fig.11 Drain current as a function of gate 1 (= V_{GG}) and drain supply voltage; typical values; see Fig.18.

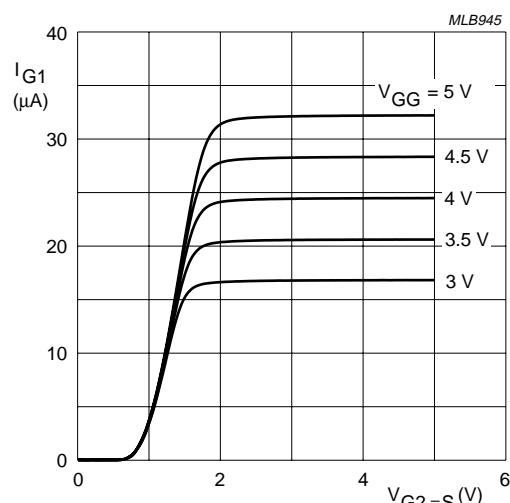
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BF909; BF909R



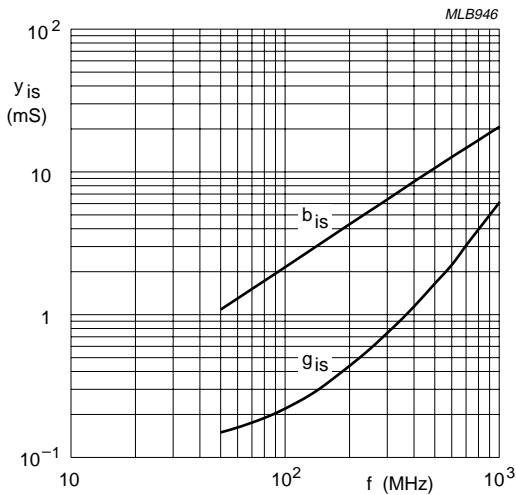
$V_{DS} = 5$ V; $T_j = 25$ °C.
 $R_{G1} = 120$ kΩ (connected to V_{GG}).

Fig.12 Drain current as a function of gate 2 voltage; typical values; see Fig.18.



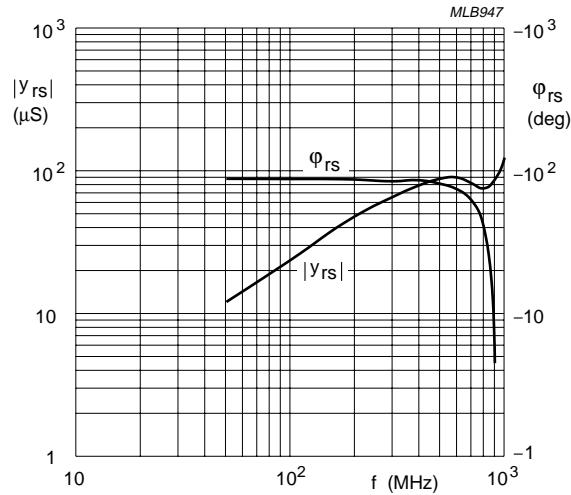
$V_{DS} = 5$ V; $T_j = 25$ °C.
 $R_{G1} = 120$ kΩ (connected to V_{GG}).

Fig.13 Gate 1 current as a function of gate 2 voltage; typical values; see Fig.18.



$V_{DS} = 5$ V; $V_{G2} = 4$ V.
 $I_D = 15$ mA; $T_{amb} = 25$ °C.

Fig.14 Input admittance as a function of frequency; typical values.

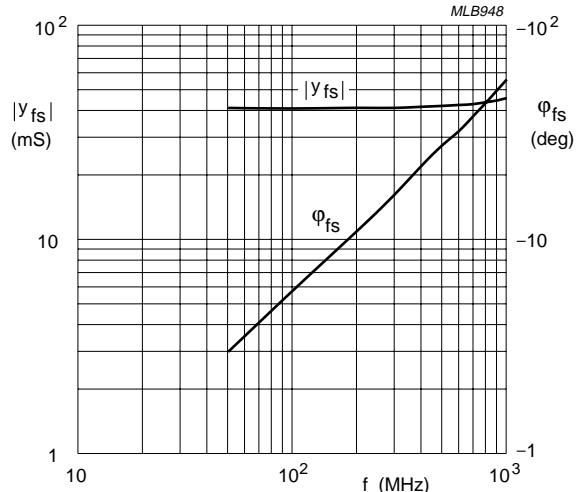


$V_{DS} = 5$ V; $V_{G2} = 4$ V.
 $I_D = 15$ mA; $T_{amb} = 25$ °C.

Fig.15 Reverse transfer admittance and phase as a function of frequency; typical values.

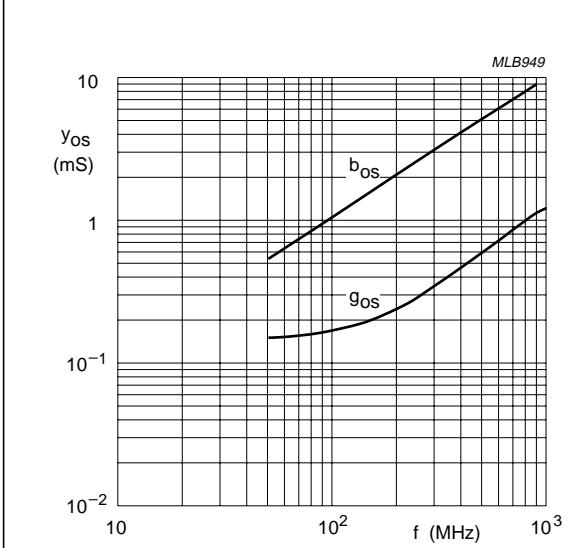
N-channel dual gate MOS-FETs

BF909; BF909R



$V_{DS} = 5$ V; $V_{G2} = 4$ V.
 $I_D = 15$ mA; $T_{amb} = 25$ °C.

Fig.16 Forward transfer admittance and phase as a function of frequency; typical values.



$V_{DS} = 5$ V; $V_{G2} = 4$ V.
 $I_D = 15$ mA; $T_{amb} = 25$ °C.

Fig.17 Output admittance as a function of frequency; typical values.

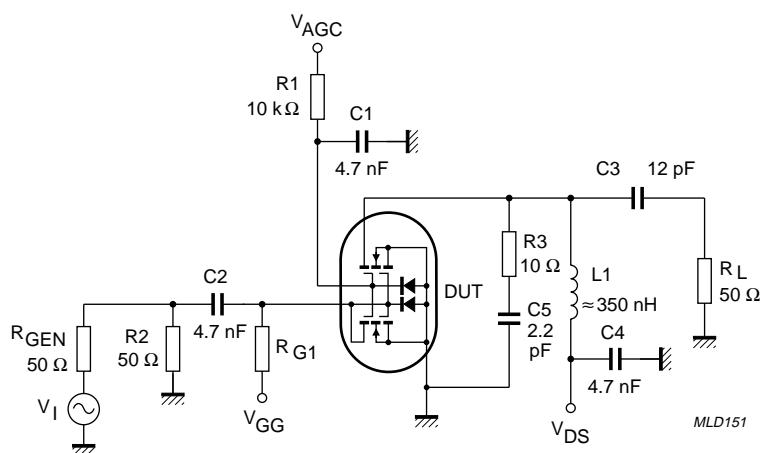


Fig.18 Cross-modulation test set-up.

N-channel dual gate MOS-FETs

BF909; BF909R

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

f (MHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	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

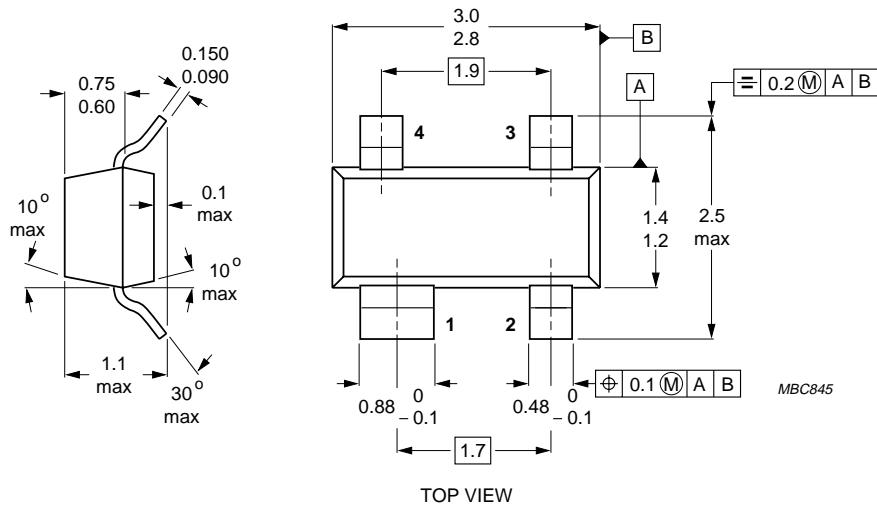
Table 2 Noise data: $T_{amb} = 25^{\circ}C$; $V_{DS} = 5 V$; $V_{G2-S} = 4 V$; $I_D = 15 \text{ mA}$

f (MHz)	F _{min} (dB)	Γ _{opt}		r _n
		(ratio)	(deg)	
800	2.00	0.603	67.71	0.581

N-channel dual gate MOS-FETs

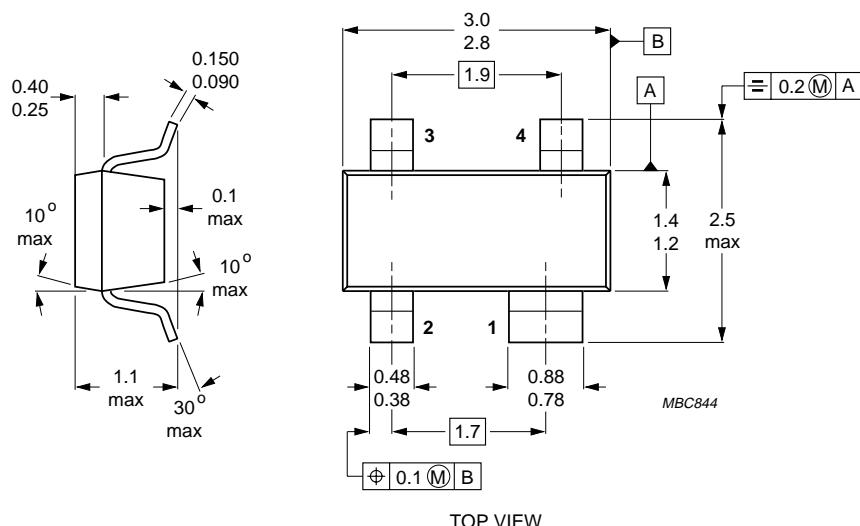
BF909; BF909R

PACKAGE OUTLINES



Dimensions in mm.

Fig.19 SOT143.



Dimensions in mm.

Fig.20 SOT143R.

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Document status ^{[1][2]}	Product status ^[3]	Definition
Objective [short] data sheet	Development	This document contains data from the objective specification for product development.
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[2] The term 'short data sheet' is explained in section "Definitions".

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Revision history

Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
BF909_N_2	20071119	Product data sheet	-	BF909_1
Modifications:		• Fig.1 and 2 on page 2; Figure note changed		
BF909_1	19950425	Product specification	-	-

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