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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.

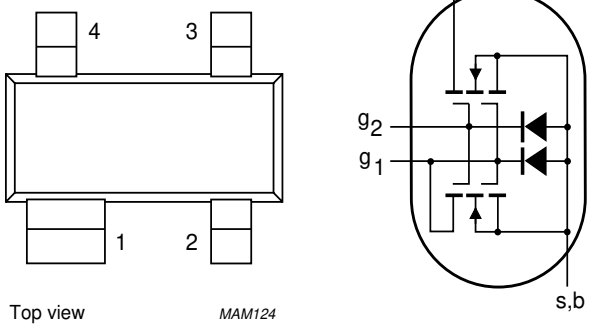
DESCRIPTION

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.

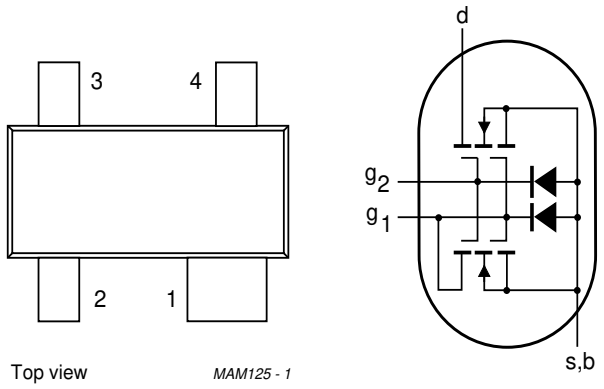
PINNING

PIN	SYMBOL	DESCRIPTION
1	s, b	source
2	d	drain
3	g_2	gate 2
4	g_1	gate 1



BF909 marking code: %M3.

Fig.1 Simplified outline (SOT143) and symbol.



BF909R marking code: %M4.

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
$\lvert y_{fs} \rvert$	forward transfer admittance		36	43	50	mS
$C_{ig1\text{-}s}$	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

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	see Fig.3			
	BF909	up to T_{amb} = 50 °C; note 1	–	200	mW
	BF909R	up to T_{amb} = 40 °C; note 1	–	200	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	operating junction temperature		–	150	°C

Note

1. Device mounted on a printed-circuit board.

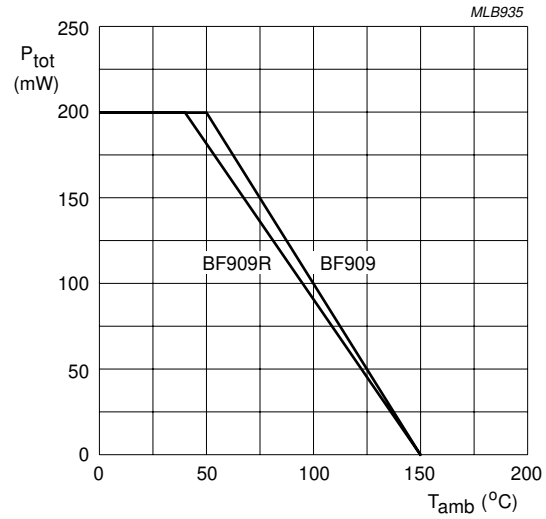


Fig.3 Power derating curves.

THERMAL CHARACTERISTICS

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

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

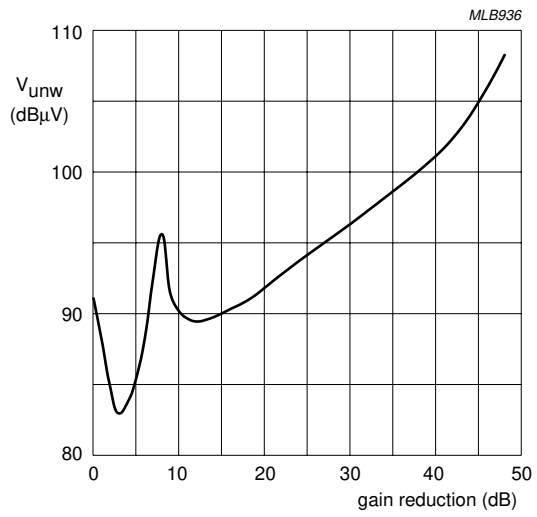
Note

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

DYNAMIC CHARACTERISTICS

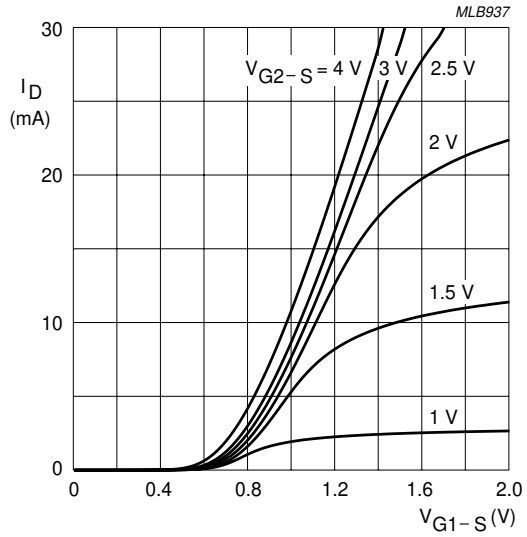
Common source; T_{amb} = 25 °C; V_{DS} = 5 V; $V_{G2\text{-}S}$ = 4 V; I_D = 15 mA; unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$\lvert y_{fs} \rvert$	forward transfer admittance	pulsed; T_j = 25 °C	36	43	50	mS
$C_{ig1\text{-}s}$	input capacitance at gate 1	f = 1 MHz	–	3.6	4.3	pF
$C_{ig2\text{-}s}$	input capacitance at gate 2	f = 1 MHz	–	2.3	3	pF
C_{os}	drain-source capacitance	f = 1 MHz	–	2.3	3	pF
C_{rs}	reverse transfer capacitance	f = 1 MHz	–	35	50	fF
F	noise figure	f = 800 MHz; G_S = G_{Sopt}; B_S = B_{Sopt}	–	2	2.8	dB



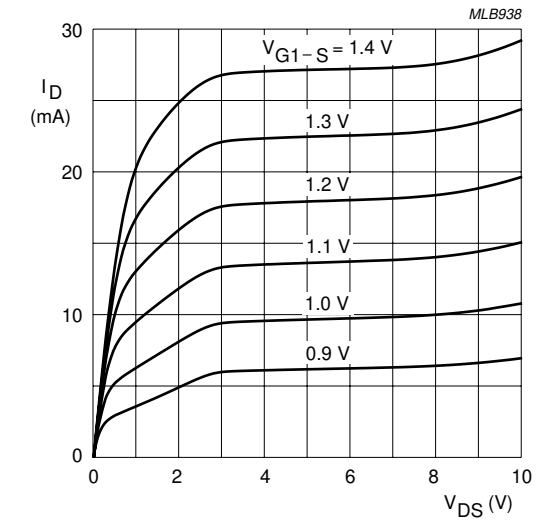
V_{DS} = 5 V; V_{GG} = 5 V; f_w = 50 MHz.
f_{unw} = 60 MHz; T_{amb} = 25 °C; R_{G1} = 120 kΩ.

Fig.4 Unwanted voltage for 1% cross-modulation as a function of gain reduction; typical values; see Fig.18.



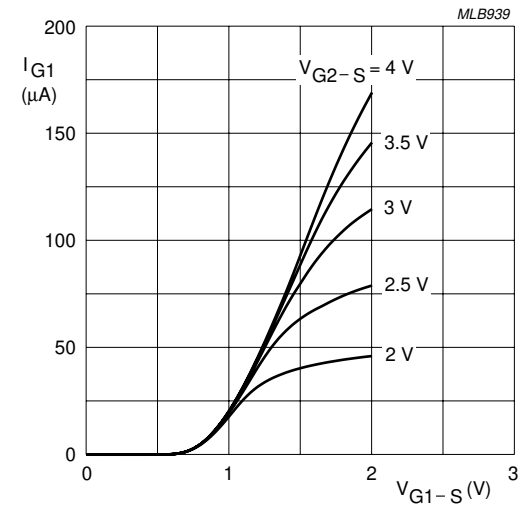
V_{DS} = 5 V.
T_j = 25 °C.

Fig.5 Transfer characteristics; typical values.



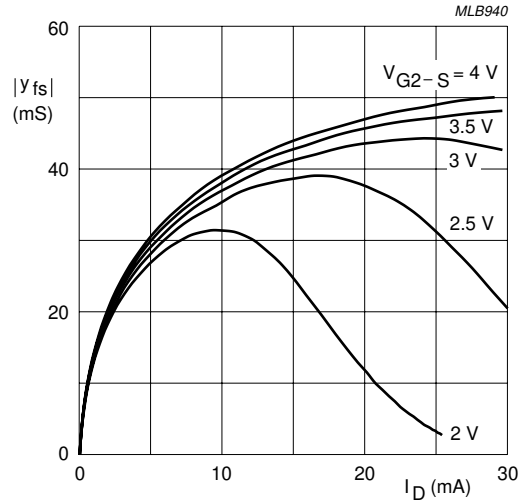
V_{DS} = 5 V.
V_{G2-S} = 4 V.
T_j = 25 °C.

Fig.6 Output characteristics; typical values.



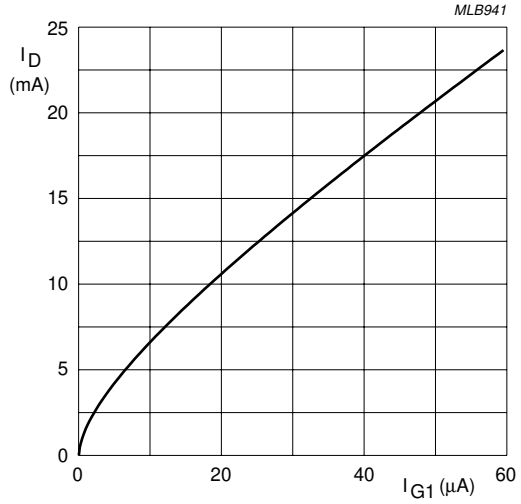
V_{DS} = 5 V.
T_j = 25 °C.

Fig.7 Gate 1 current as a function of gate 1 voltage; typical values.



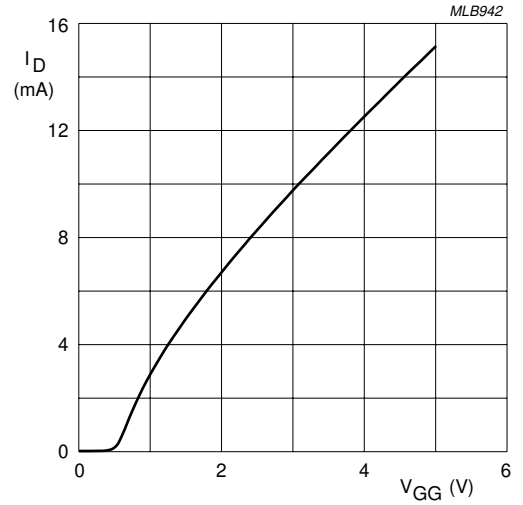
V_{DS} = 5 V.
T_j = 25 °C.

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



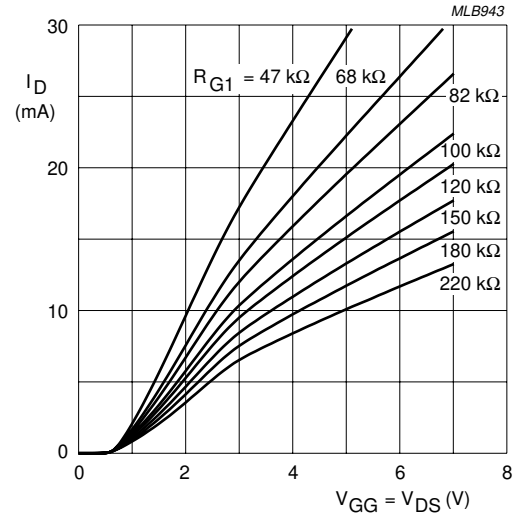
V_{DS} = 5 V; $V_{G2\text{-}S}$ = 4 V.
T_j = 25 °C.

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



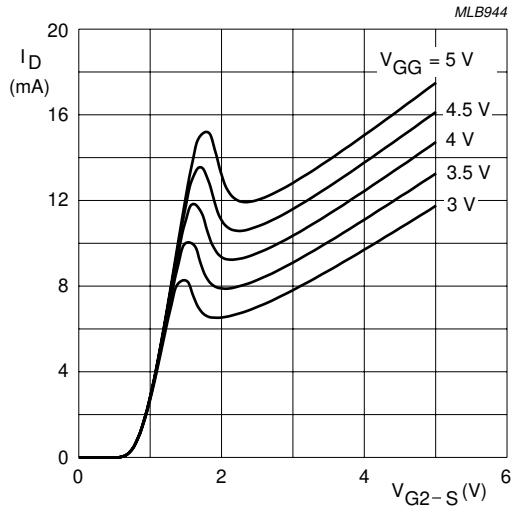
V_{DS} = 5 V; $V_{G2\text{-}S}$ = 4 V.
R_{G1} = 120 kΩ (connected to V_{GG}); T_j = 25 °C.

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



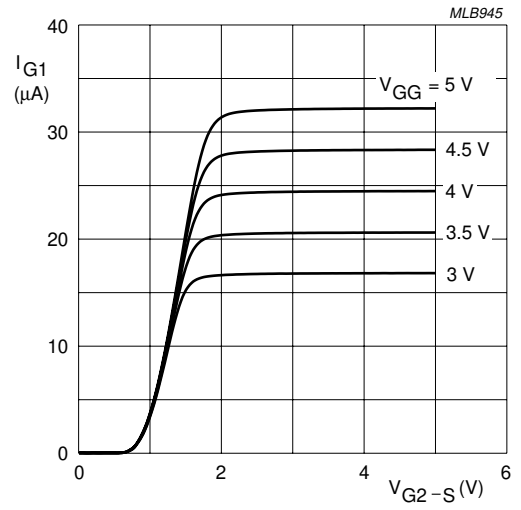
$V_{G2\text{-}S}$ = 4 V.
R_{G1} connected to V_{GG}; T_j = 25 °C.

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



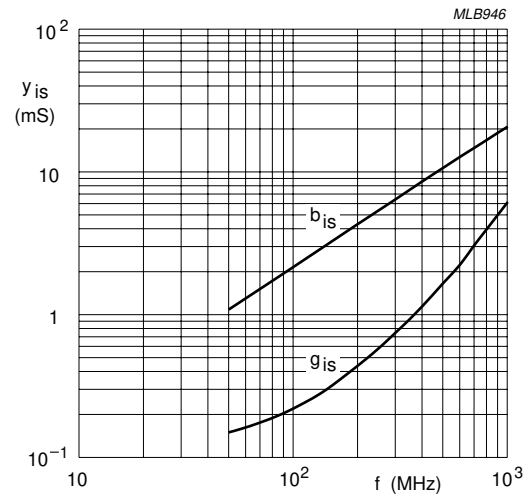
V_{DS} = 5 V; T_j = 25 °C.
R_{G1} = 120 kΩ (connected to V_{GG}).

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



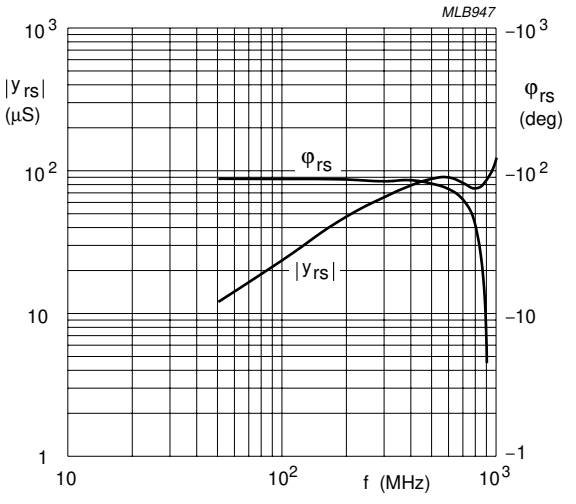
V_{DS} = 5 V; T_j = 25 °C.
R_{G1} = 120 kΩ (connected to V_{GG}).

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



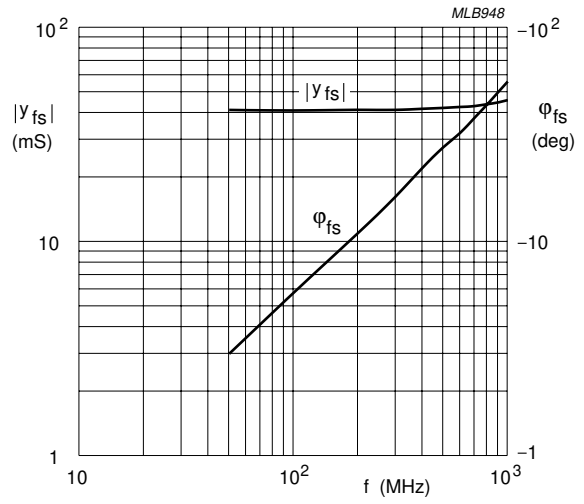
V_{DS} = 5 V; V_{G2} = 4 V.
I_D = 15 mA; T_{amb} = 25 °C.

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



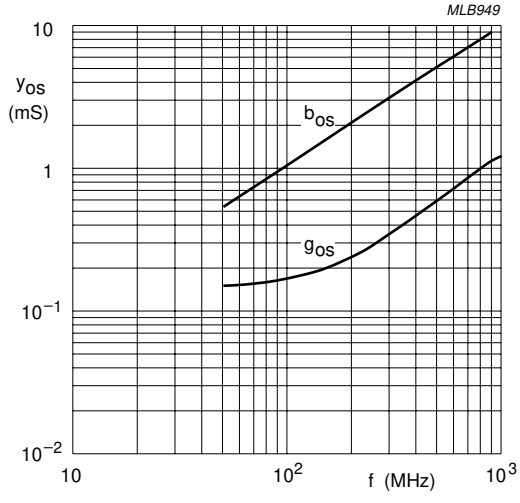
V_{DS} = 5 V; V_{G2} = 4 V.
I_D = 15 mA; T_{amb} = 25 °C.

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



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.

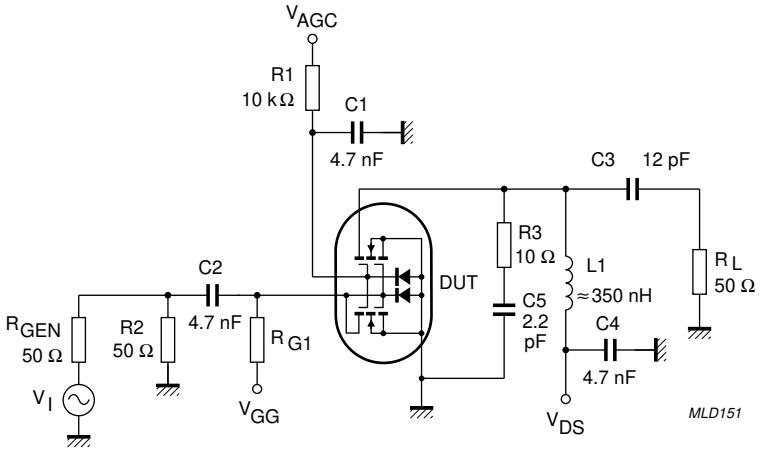


Fig.18 Cross-modulation test set-up.

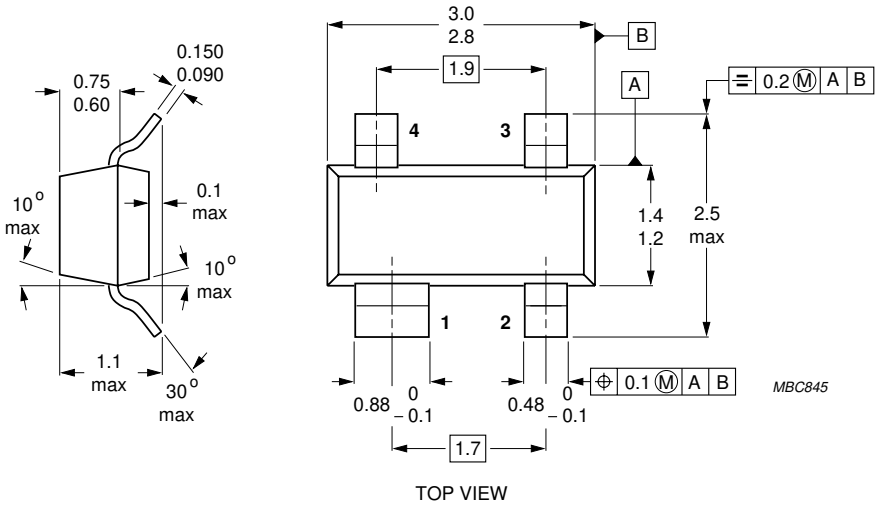
Table 1 Scattering parameters: T_{amb} = 25 °C; V_{DS} = 5 V; $V_{G2\text{-}S}$ = 4 V; I_D = 15 mA

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 °C; V_{DS} = 5 V; $V_{G2\text{-}S}$ = 4 V; I_D = 15 mA

f (MHz)	F_{min} (dB)	Γ_{opt}		r_n
		(ratio)	(deg)	
800	2.00	0.603	67.71	0.581

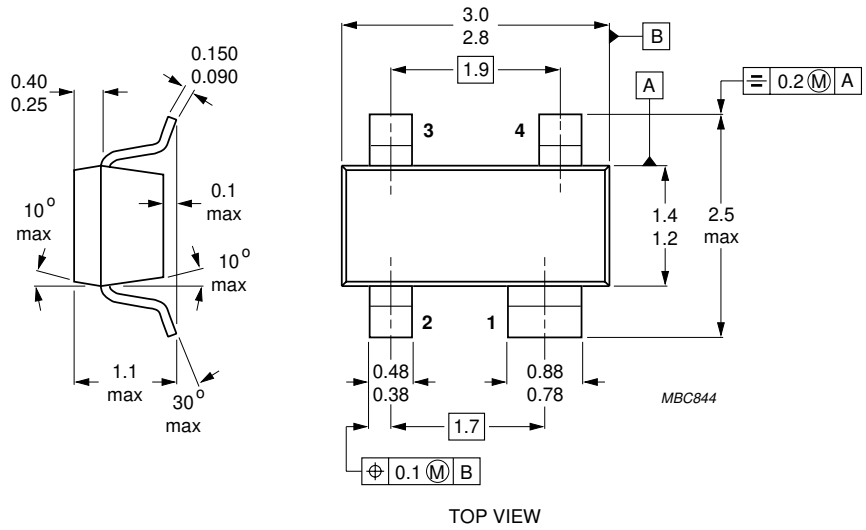
PACKAGE OUTLINES



TOP VIEW

Dimensions in mm.

Fig.19 SOT143.



TOP VIEW

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.
Preliminary [short] data sheet	Qualification	This document contains data from the preliminary specification.
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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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Date of release: 19 November 2007
Document identifier: BF909_N_2