

# DATA SHEET

## **BF909; BF909R** N-channel dual gate MOS-FETs

Product specification  
File under Discrete Semiconductors, SC07

1995 Apr 25

**Philips Semiconductors**



**PHILIPS**

# 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

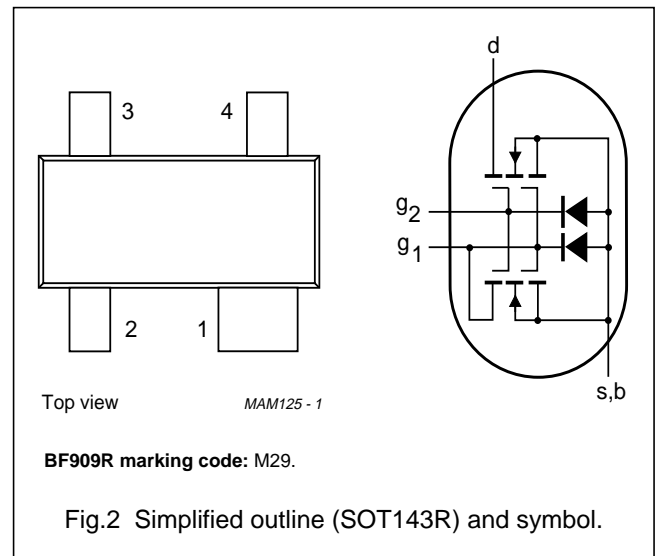
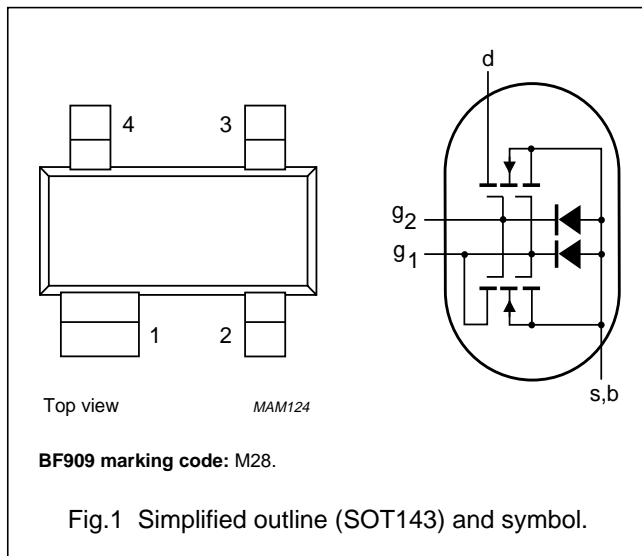
transistor consists of an amplifier MOS-FET with source and substrate interconnected and an internal bias circuit to ensure good cross-modulation performance during AGC.

### 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 <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		–	–	200	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	–	35	50	fF
F	noise figure	f = 800 MHz	–	2	2.8	dB

N-channel dual gate MOS-FETs

BF909; BF909R

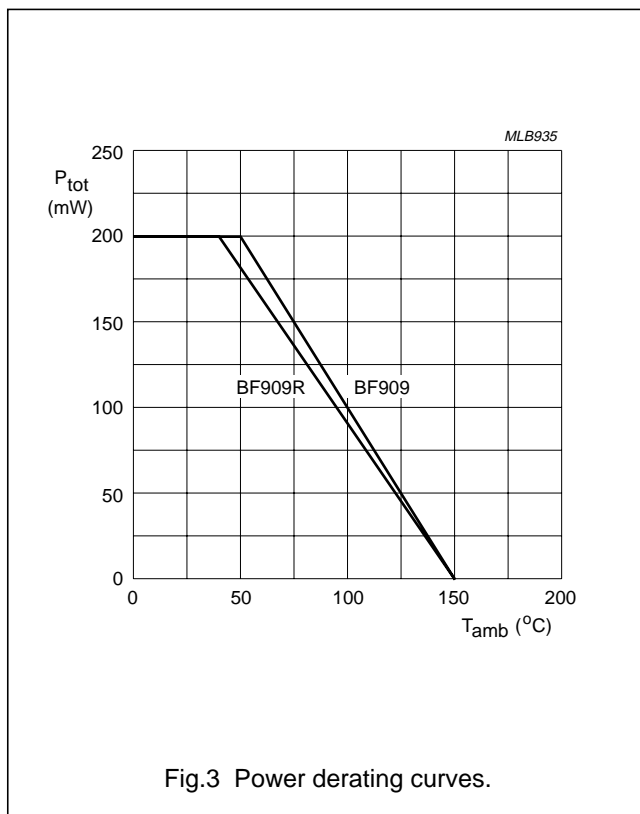
**LIMITING VALUES**

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 $T_{amb} = 50\text{ °C}$ ; note 1 up to $T_{amb} = 40\text{ °C}$ ; 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	note 1		
	BF909		500	K/W
	BF909R		550	K/W
$R_{th\ j-s}$	thermal resistance from junction to soldering point	note 2		
	BF909	$T_s = 92\text{ °C}$	290	K/W
	BF909R	$T_s = 78\text{ °C}$	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

$T_j = 25\text{ °C}$ ; 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.

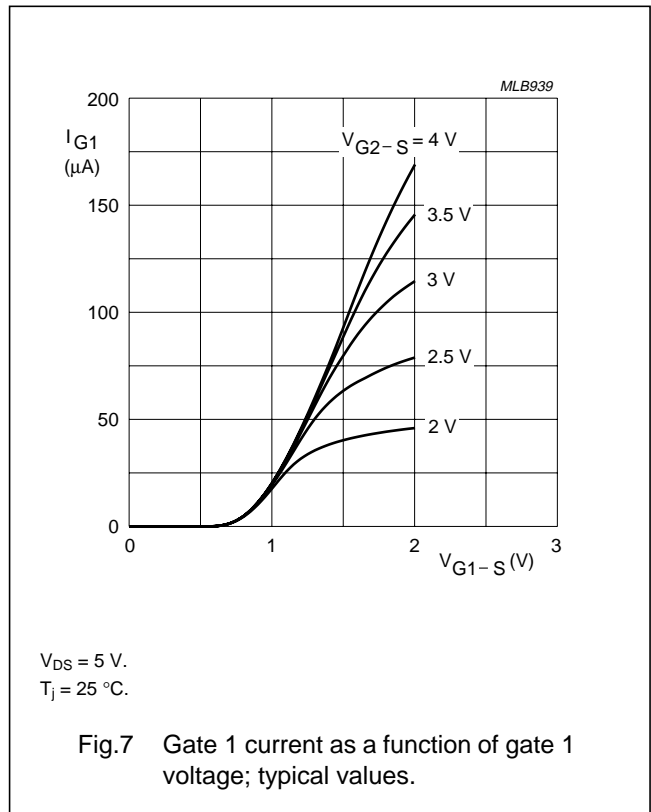
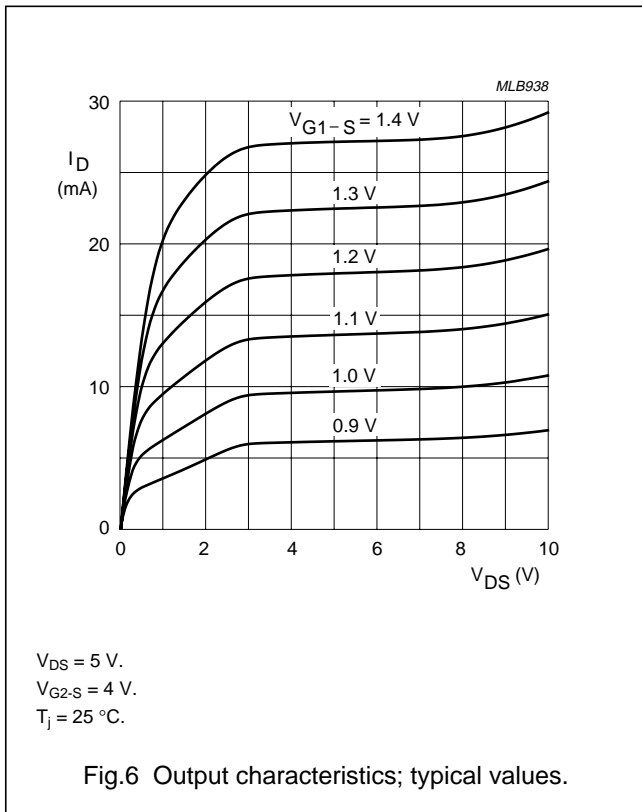
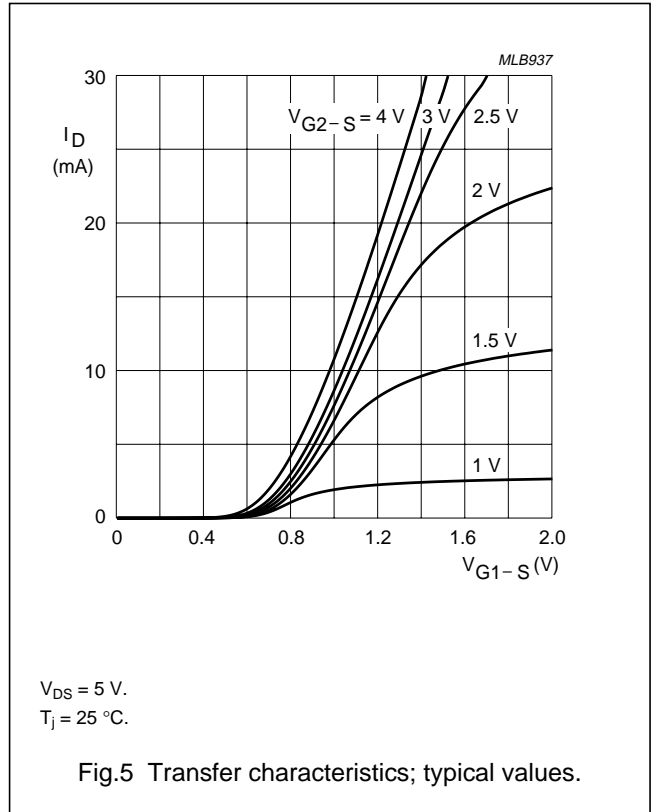
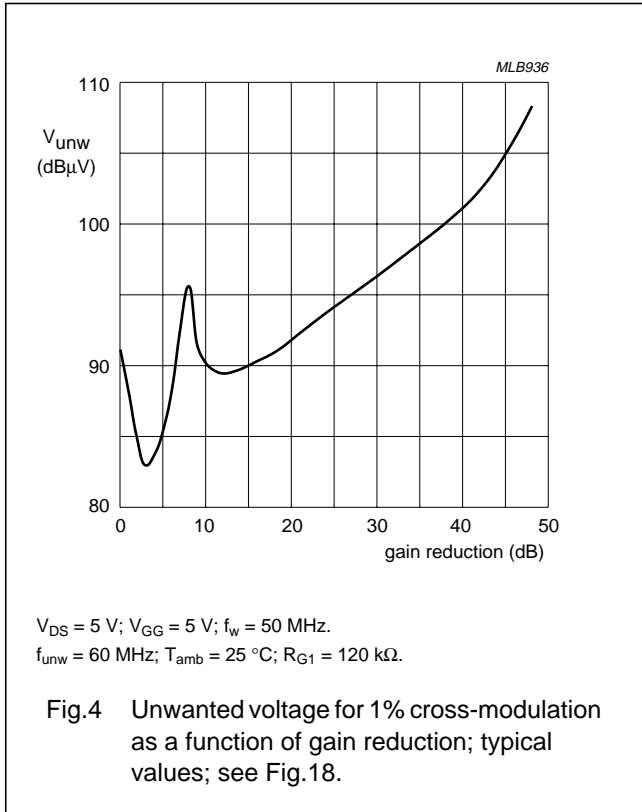
## DYNAMIC CHARACTERISTICS

Common source;  $T_{amb} = 25\text{ °C}$ ;  $V_{DS} = 5\text{ V}$ ;  $V_{G2-S} = 4\text{ V}$ ;  $I_D = 15\text{ mA}$ ; 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	$f = 1\text{ MHz}$	–	35	50	fF
F	noise figure	$f = 800\text{ MHz}$ ; $G_S = G_{Sopt}$ ; $B_S = B_{Sopt}$	–	2	2.8	dB

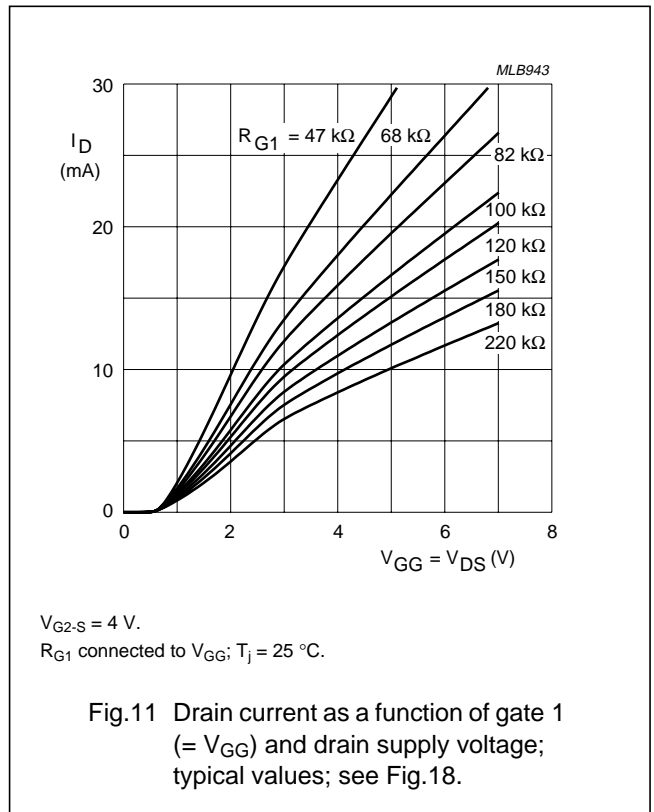
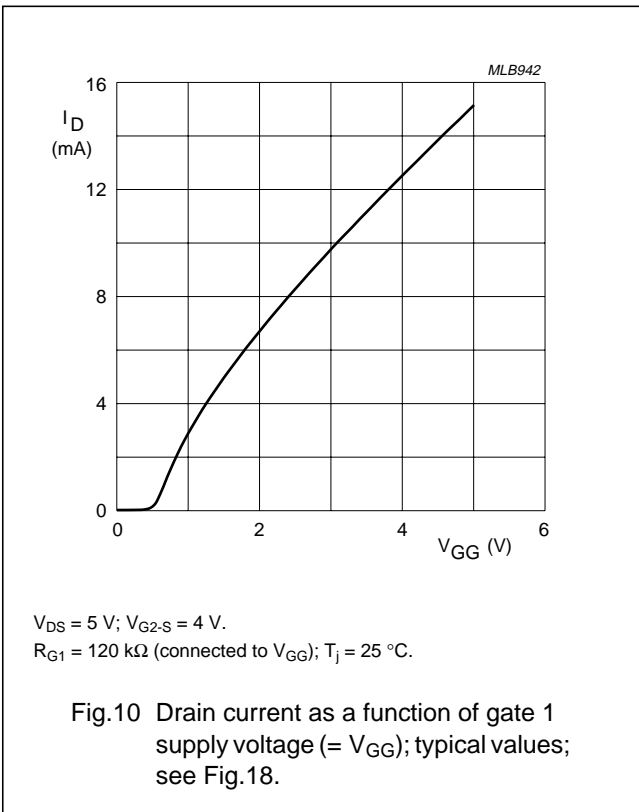
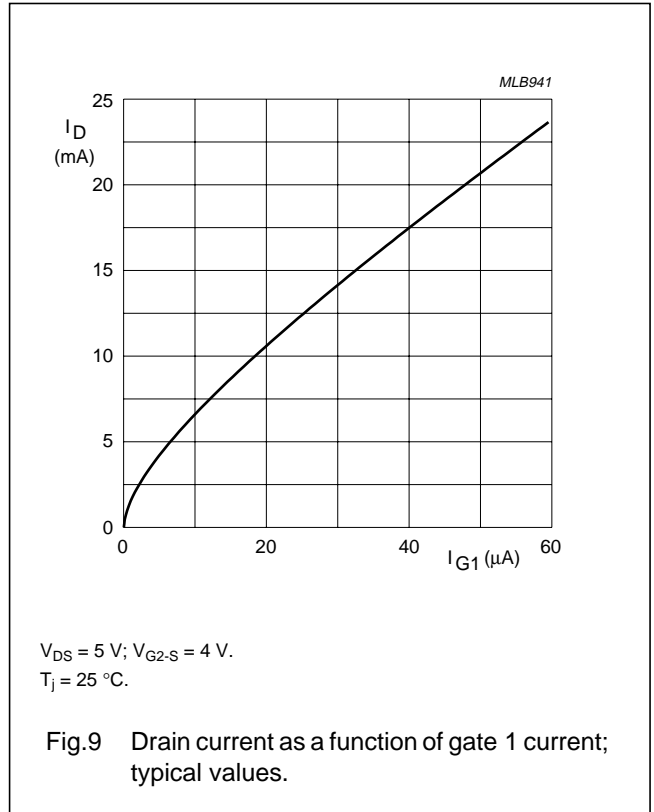
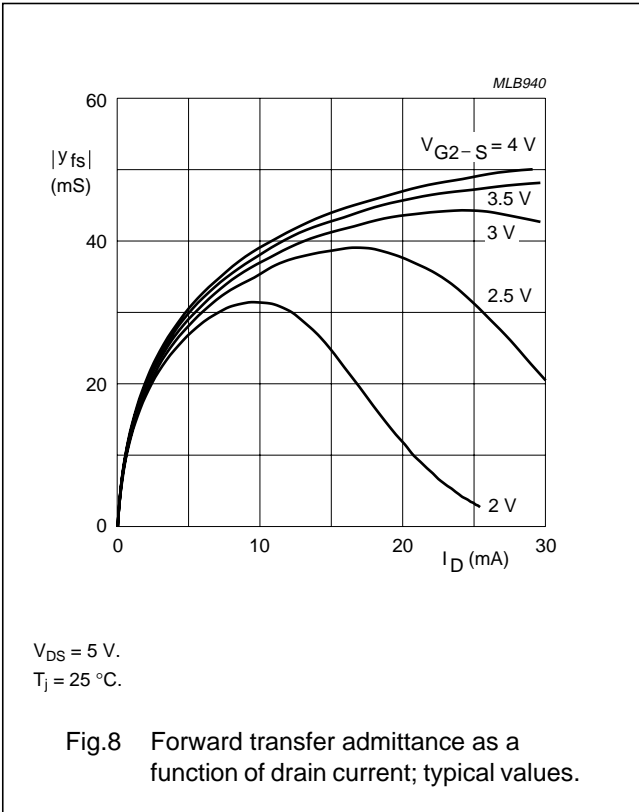
N-channel dual gate MOS-FETs

BF909; BF909R



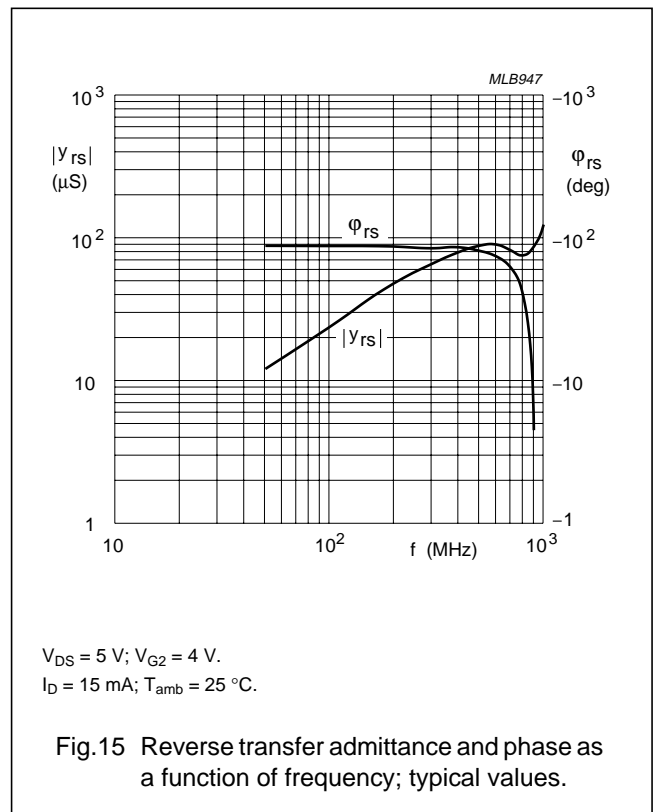
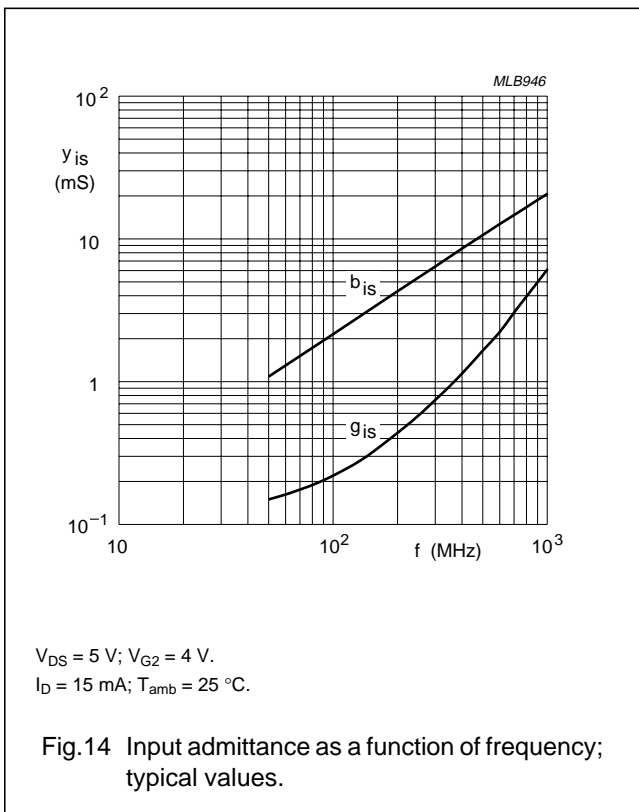
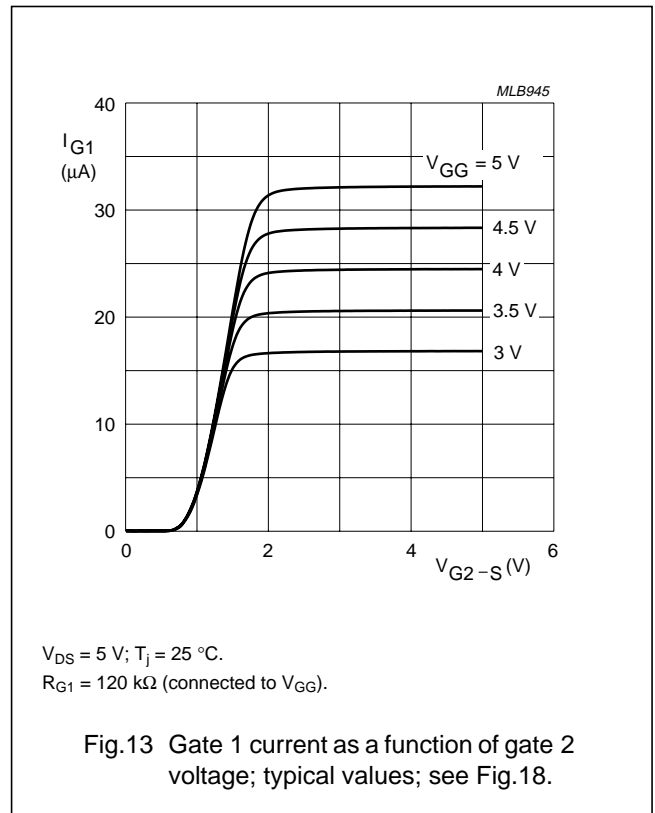
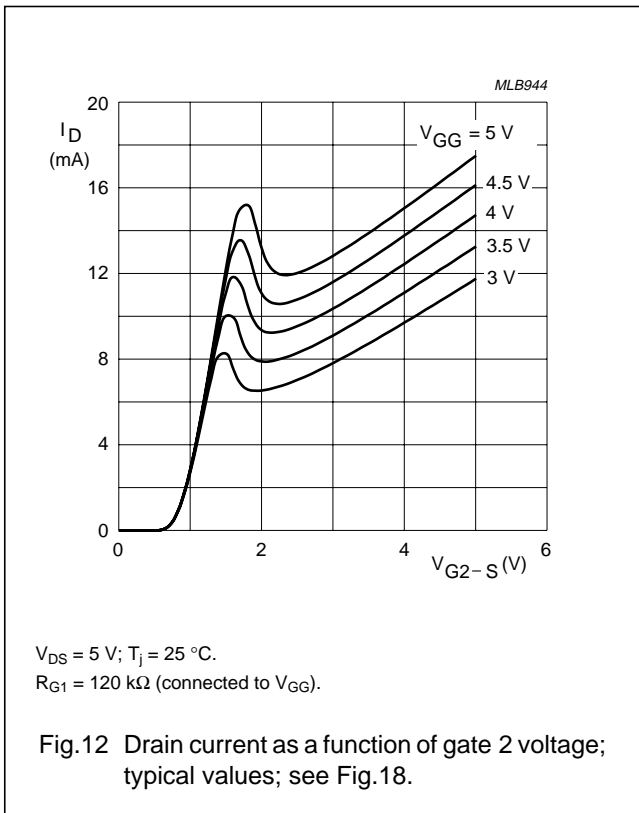
N-channel dual gate MOS-FETs

BF909; BF909R



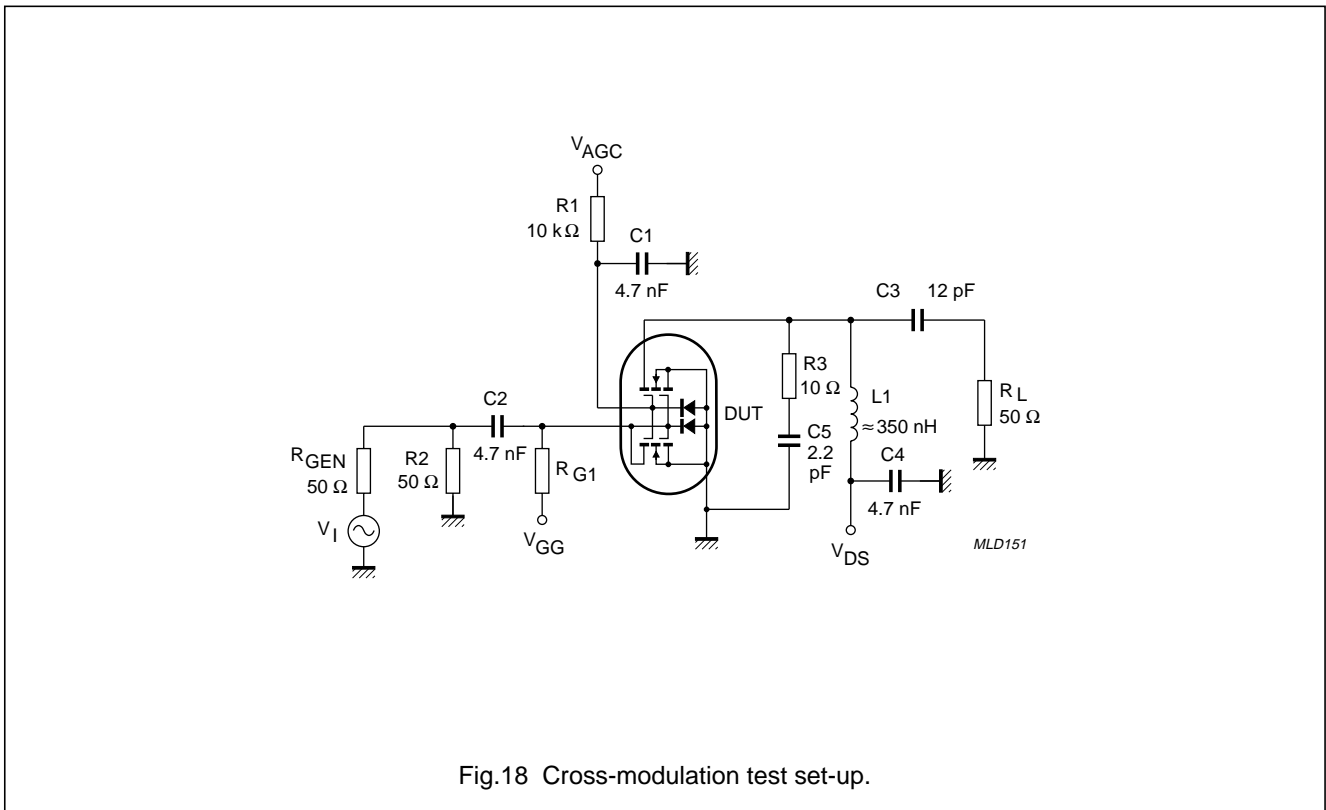
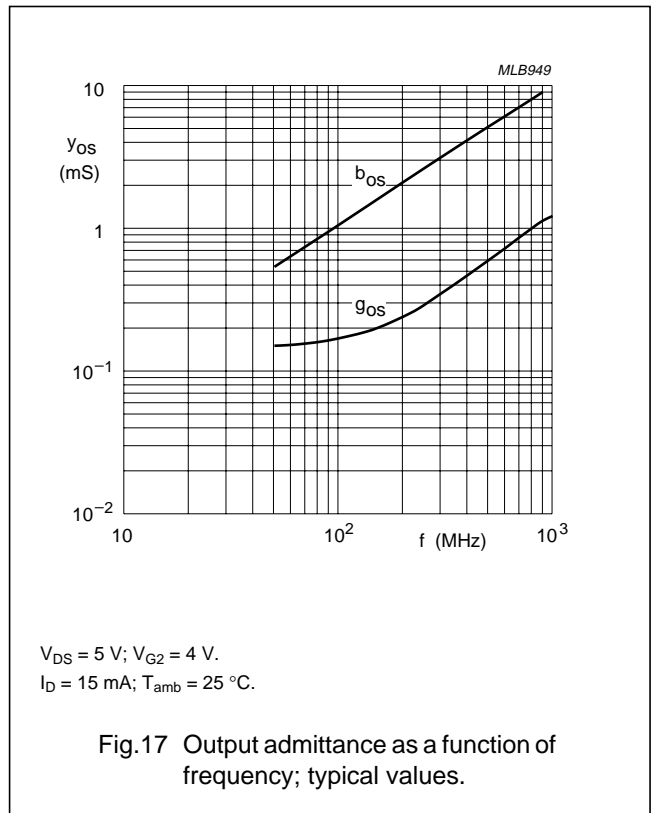
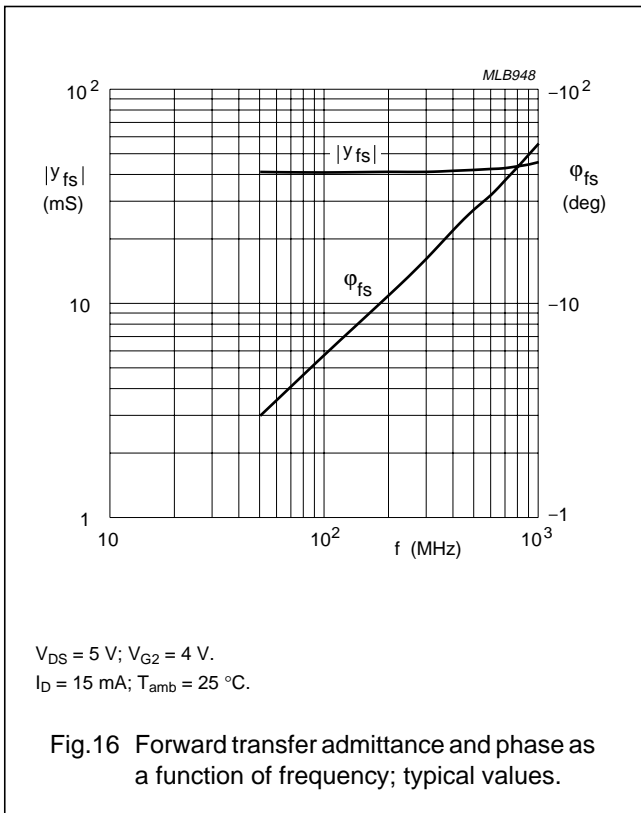
N-channel dual gate MOS-FETs

BF909; BF909R



N-channel dual gate MOS-FETs

BF909; BF909R





## N-channel dual gate MOS-FETs

## BF909; BF909R

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

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

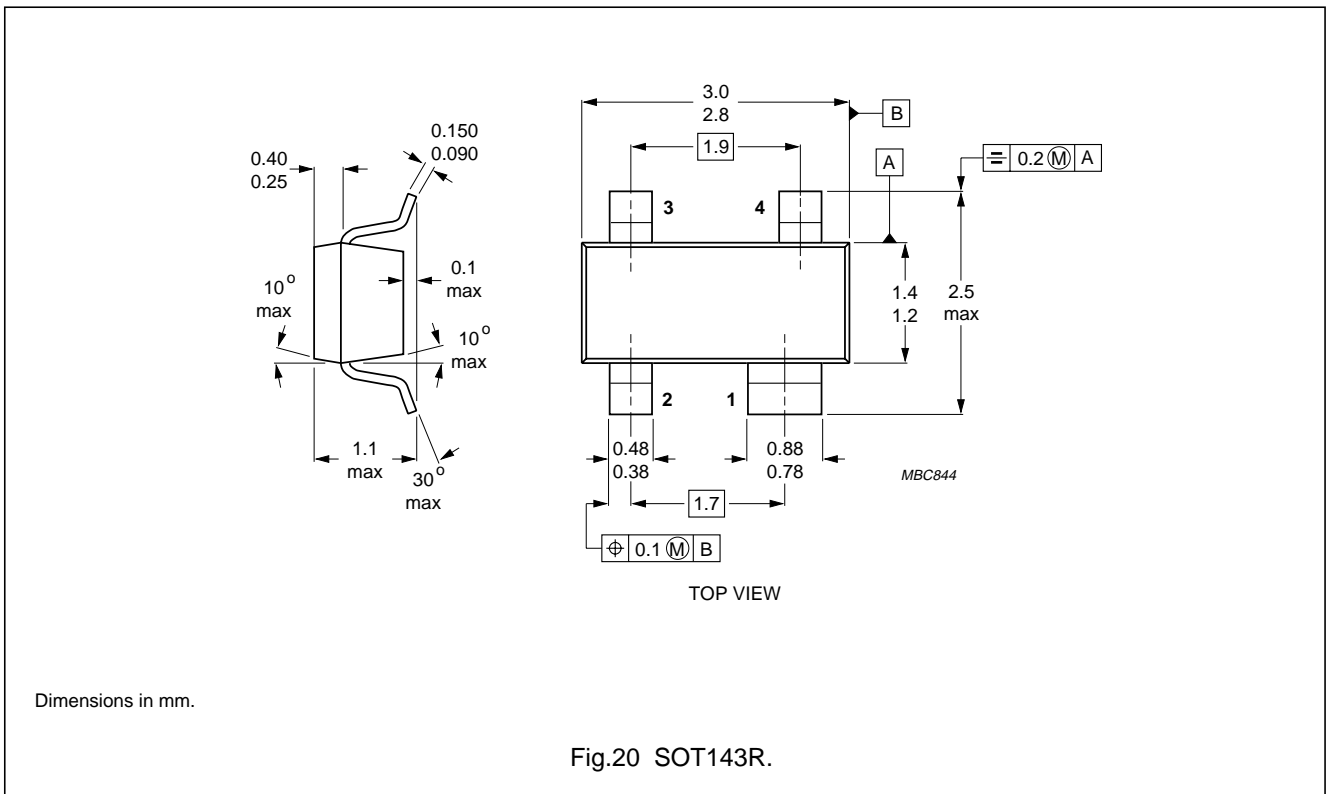
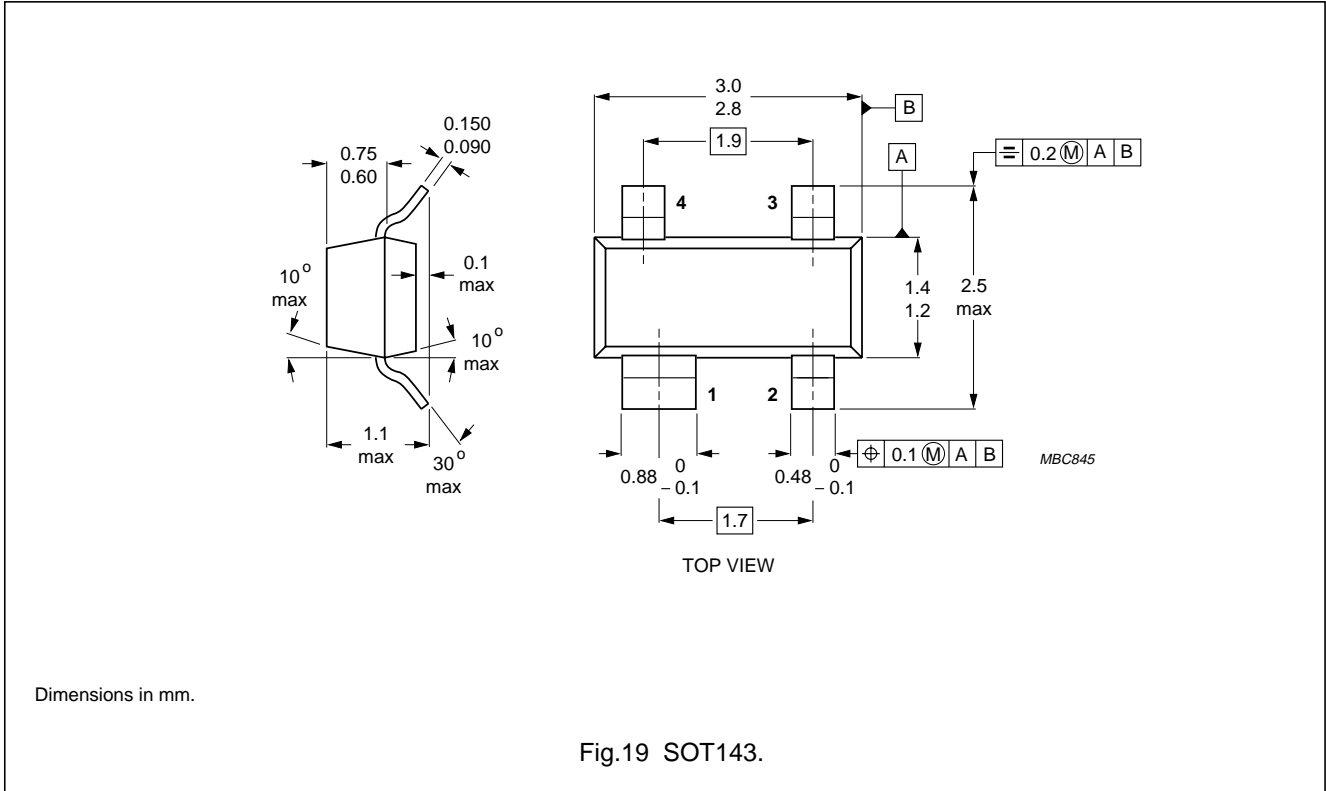
**Table 2** Noise data:  $T_{amb} = 25\text{ °C}$ ;  $V_{DS} = 5\text{ V}$ ;  $V_{G2-S} = 4\text{ V}$ ;  $I_D = 15\text{ mA}$ 

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

N-channel dual gate MOS-FETs

BF909; BF909R

PACKAGE OUTLINES



## N-channel dual gate MOS-FETs

BF909; BF909R

**DEFINITIONS**

<b>Data Sheet Status</b>	
Objective specification	This data sheet contains target or goal specifications for product development.
Preliminary specification	This data sheet contains preliminary data; supplementary data may be published later.
Product specification	This data sheet contains final product specifications.
<b>Limiting values</b>	
Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 134). Stress above one or more of the limiting values may cause permanent damage to the device. These are stress ratings only and operation of the device at these or at any other conditions above those given in the Characteristics sections of the specification is not implied. Exposure to limiting values for extended periods may affect device reliability.	
<b>Application information</b>	
Where application information is given, it is advisory and does not form part of the specification.	

**LIFE SUPPORT APPLICATIONS**

These products are not designed for use in life support appliances, devices, or systems where malfunction of these products can reasonably be expected to result in personal injury. Philips customers using or selling these products for use in such applications do so at their own risk and agree to fully indemnify Philips for any damages resulting from such improper use or sale.