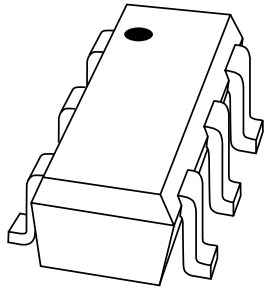


# DATA SHEET



## **BF1102; BF1102R** Dual N-channel dual gate MOS-FETs

Product specification  
Supersedes data of 1999 Jul 01

2000 Apr 11



## Dual N-channel dual gate MOS-FETs

## BF1102; BF1102R

## FEATURES

- Two low noise gain controlled amplifiers in a single package
- Specially designed for 5 V applications
- Superior cross-modulation performance during AGC
- High forward transfer admittance
- High forward transfer admittance to input capacitance ratio.

## APPLICATIONS

Gain controlled low noise amplifier for VHF and UHF applications such as television tuners and professional communications equipment.

## DESCRIPTION

The BF1102 and BF1102R are both two equal dual gate MOS-FETs which have a shared source pin and a shared gate 2 pin. Both devices have interconnected source and substrate; an internal bias circuit enables DC stabilization and a very good cross-modulation performance at 5 V supply voltage; integrated diodes between the gates and source protect against excessive input voltage surges. Both devices have a SOT363 micro-miniature plastic package.

## PINNING - SOT363

PIN	DESCRIPTION	
	BF1102	BF1102R
1	gate 1 (1)	gate 1 (1)
2	gate 2 (1 and 2)	source (1 and 2)
3	drain (1)	drain (1)
4	drain (2)	drain (2)
5	source (1 and 2)	gate 2 (1 and 2)
6	gate 1 (2)	gate 1 (2)

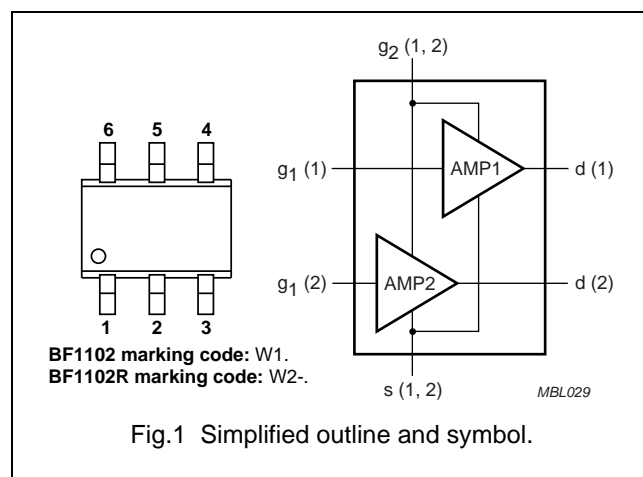


Fig.1 Simplified outline and symbol.

## QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Per MOS-FET unless otherwise specified						
$V_{DS}$	drain-source voltage		—	—	7	V
$I_D$	drain current (DC)		—	—	40	mA
$P_{tot}$	total power dissipation	$T_s \leq 102\text{ }^\circ\text{C}$ ; note 1	—	—	200	mW
$ y_{fs} $	forward transfer admittance	$I_D = 15\text{ mA}$	36	43	—	mS
$C_{ig1-s}$	input capacitance at gate 1	$I_D = 15\text{ mA}$	—	2.8	3.6	pF
$C_{rss}$	reverse transfer capacitance	$f = 1\text{ MHz}$	—	30	50	fF
F	noise figure	$f = 800\text{ MHz}$	—	2	2.8	dB
$X_{mod}$	cross-modulation	input level for $k = 1\%$ at 40 dB AGC	100	—	—	dB $\mu$ V
$T_j$	operating junction temperature		—	—	150	$^\circ\text{C}$

## Note

1.  $T_s$  is the temperature at the soldering point of the source lead.

## CAUTION

This product is supplied in anti-static packing to prevent damage caused by electrostatic discharge during transport and handling.

## Dual N-channel dual gate MOS-FETs

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## LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 60134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
<b>Per MOS-FET unless otherwise specified</b>					
$V_{DS}$	drain-source voltage		–	7	V
$I_D$	drain current (DC)		–	40	mA
$I_{G1}$	gate 1 current		–	$\pm 10$	mA
$I_{G2}$	gate 2 current		–	$\pm 10$	mA
$P_{tot}$	total power dissipation	$T_s \leq 102\text{ }^{\circ}\text{C}$	–	200	mW
$T_{stg}$	storage temperature		–65	+150	$^{\circ}\text{C}$
$T_j$	operating junction temperature		–	150	$^{\circ}\text{C}$

## THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	VALUE	UNIT
$R_{th\ j-s}$	thermal resistance from junction to soldering point	240	K/W

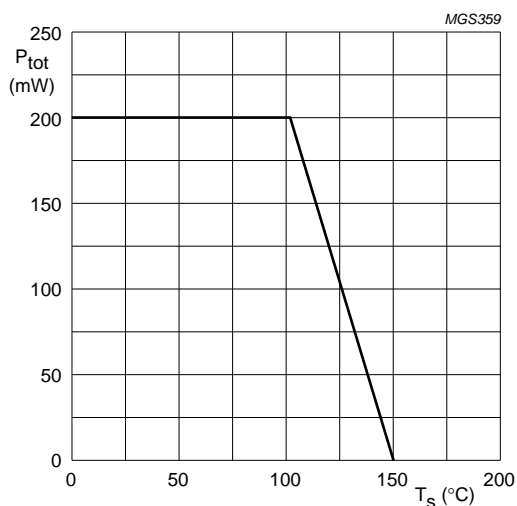


Fig.2 Power derating curve.

## Dual N-channel dual gate MOS-FETs

## BF1102; BF1102R

## STATIC CHARACTERISTICS

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
<b>Per MOS-FET unless otherwise specified</b>					
$V_{(BR)DSS}$	drain-source breakdown voltage	$V_{G1-S} = V_{G2-S} = 0$ ; $I_D = 10\text{ }\mu\text{A}$	7	–	V
$V_{(BR)G1-SS}$	gate 1-source breakdown voltage	$V_{GS} = V_{DS} = 0$ ; $I_{G1-S} = 10\text{ mA}$	6	15	V
$V_{(BR)G2-SS}$	gate 2-source breakdown voltage	$V_{GS} = V_{DS} = 0$ ; $I_{G2-S} = 5\text{ mA}$	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	$V_{DS} = 5\text{ V}$ ; $V_{G2-S} = 4\text{ V}$ ; $I_D = 100\text{ }\mu\text{A}$	0.3	1	V
$V_{G2-S(th)}$	gate 2-source threshold voltage	$V_{DS} = 5\text{ V}$ ; $V_{G1-S} = 4\text{ V}$ ; $I_D = 100\text{ }\mu\text{A}$	0.3	1.2	V
$I_{DSX}$	drain-source current	$V_{G2-S} = 4\text{ V}$ ; $V_{DS} = 5\text{ V}$ ; $R_G = 120\text{ k}\Omega$ ; note 1	12	20	mA
$I_{G1-S}$	gate 1 cut-off current	$V_{G1-S} = 5\text{ V}$ ; $V_{G2-S} = V_{DS} = 0$	–	50	nA
$I_{G2-S}$	gate 2 cut-off current	$V_{G2-S} = 5\text{ V}$ ; $V_{G1-S} = V_{DS} = 0$	–	20	nA

## Note

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

## DYNAMIC CHARACTERISTICS

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
<b>Per MOS-FET unless otherwise specified (note 1)</b>						
$ y_{fs} $	forward transfer admittance	$T_j = 25\text{ }^{\circ}\text{C}$	36	43	50	mS
$C_{ig1-ss}$	input capacitance at gate 1	$f = 1\text{ MHz}$	2	2.8	3.6	pF
$C_{ig2-ss}$	input capacitance at gate 2	$f = 1\text{ MHz}$ ; (note 2)	–	–	7	pF
$C_{oss}$	output capacitance	$f = 1\text{ MHz}$	–	1.6	2.5	pF
$C_{rss}$	reverse transfer capacitance	$f = 1\text{ MHz}$	–	30	50	fF
F	noise figure	$f = 800\text{ MHz}$ ; $Y_S = Y_{S\text{ opt}}$	–	2	2.8	dB
$X_{mod}$	cross-modulation	$f_w = 50\text{ MHz}$ ; $f_{unw} = 60\text{ MHz}$ ; (note 3) input level for $k = 1\%$ at 0 dB AGC input level for $k = 1\%$ at 40 dB AGC	85 100	– –	– –	dB $\mu$ V dB $\mu$ V

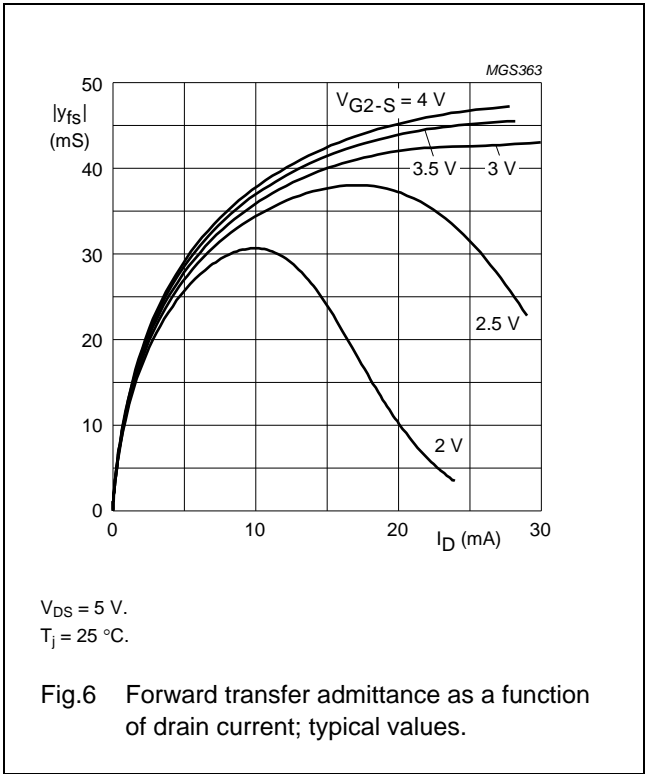
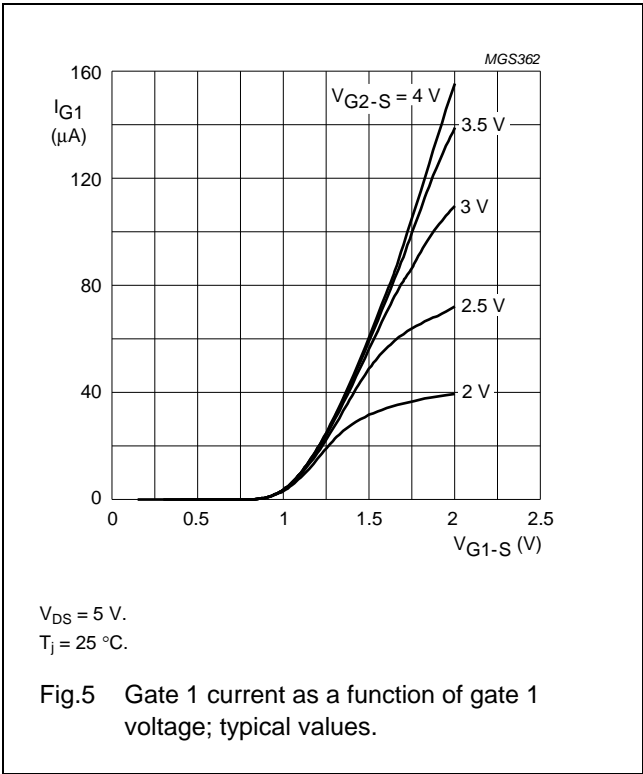
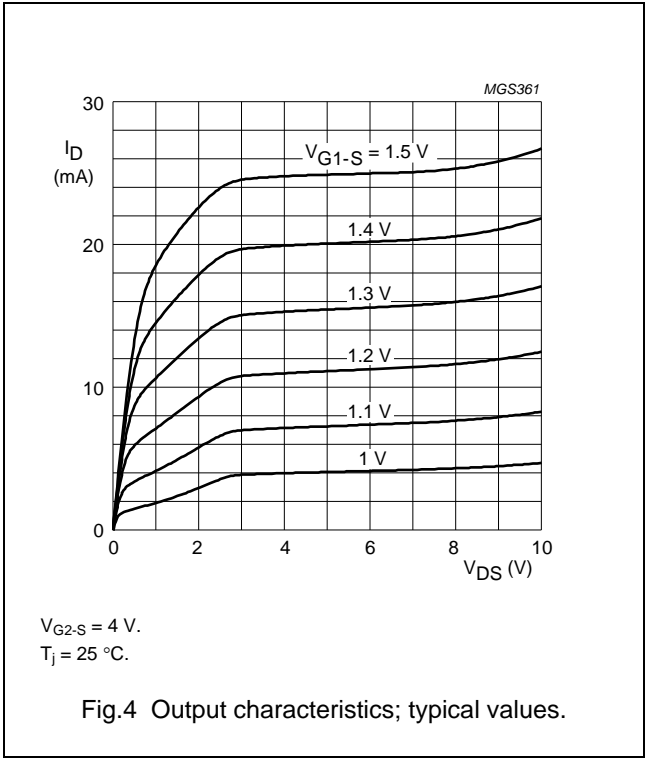
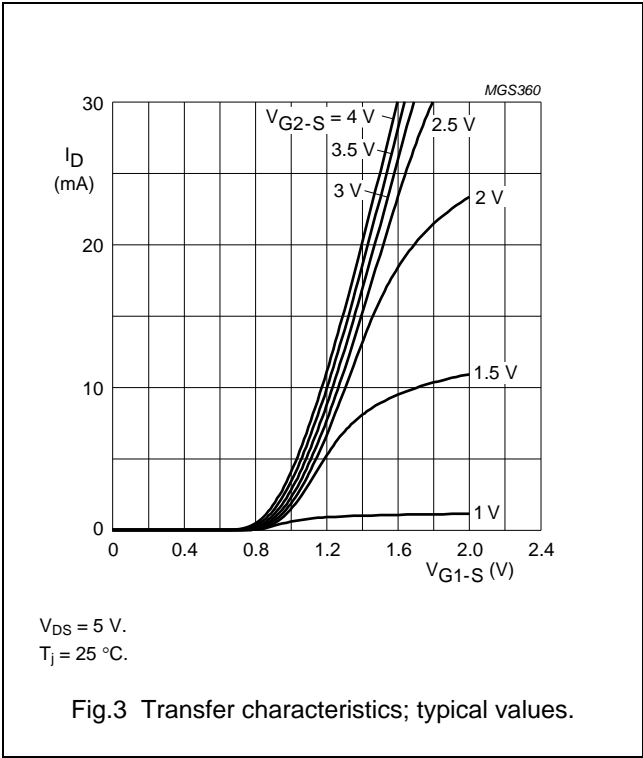
## Notes

1. Not used MOS-FET:  $V_{G1-S} = 0$ ;  $V_{DS} = 0$ .
2. Gate 2 capacitance of both MOS-FETs.
3. Measured in test circuit of Fig.20.

Dual N-channel dual gate MOS-FETs

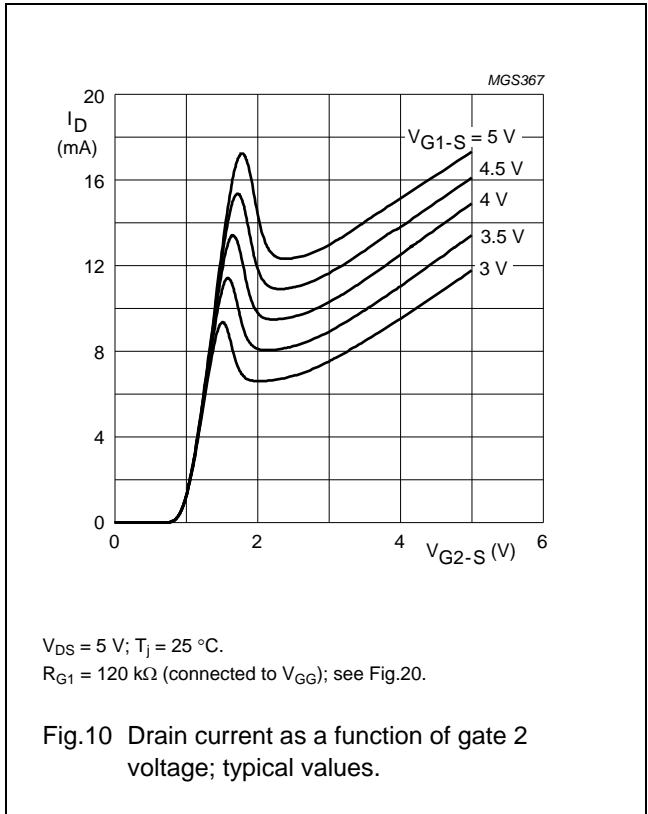
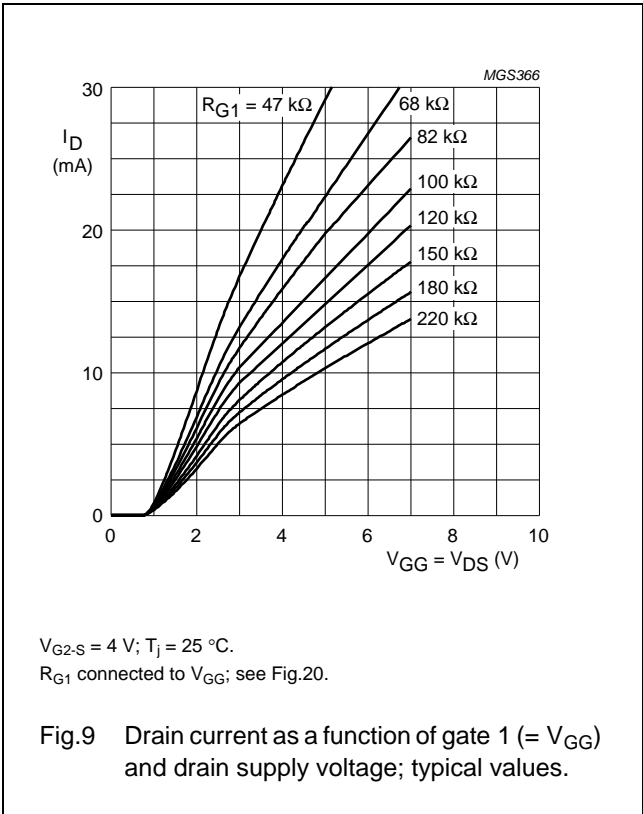
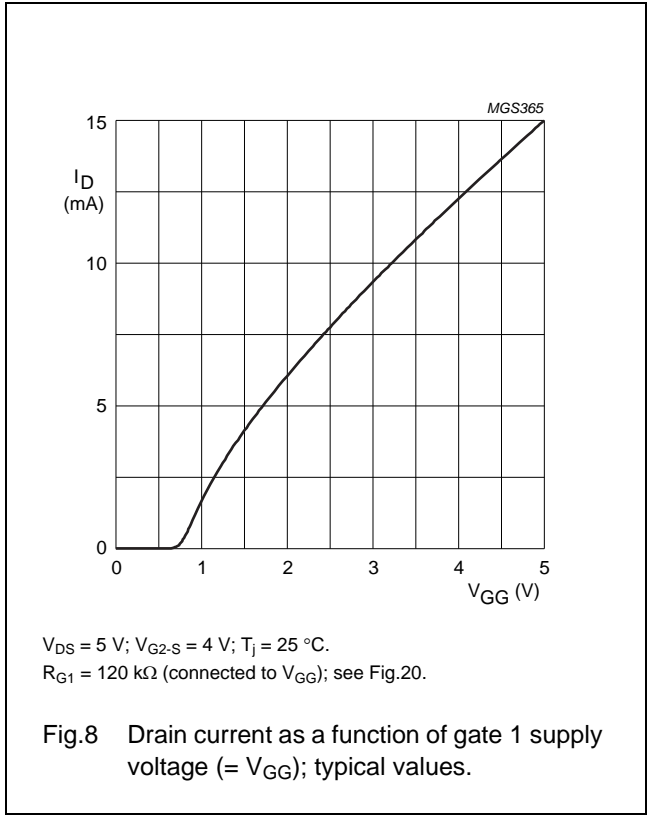
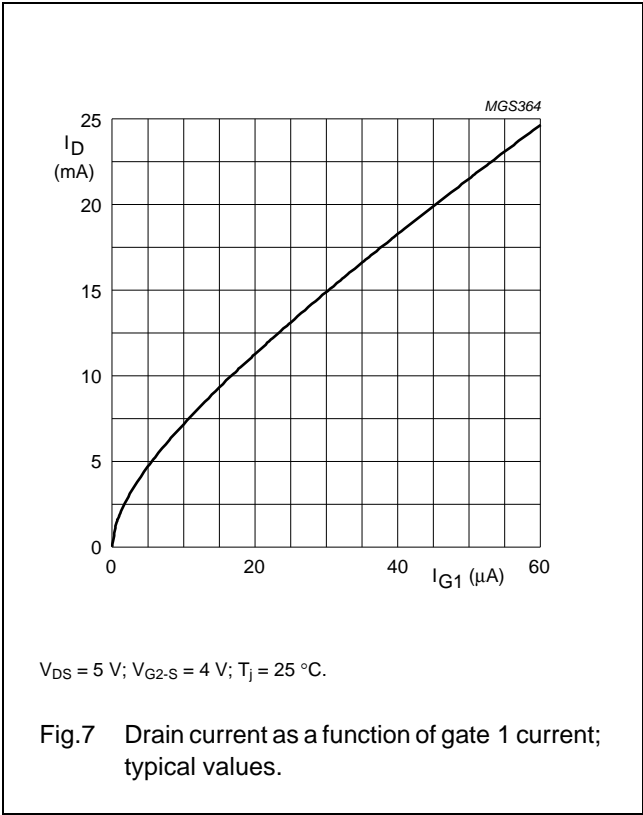
BF1102; BF1102R

ALL GRAPHS FOR ONE MOS-FET



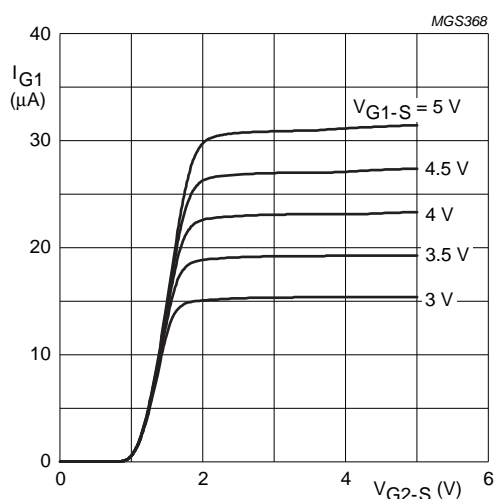
Dual N-channel dual gate MOS-FETs

BF1102; BF1102R



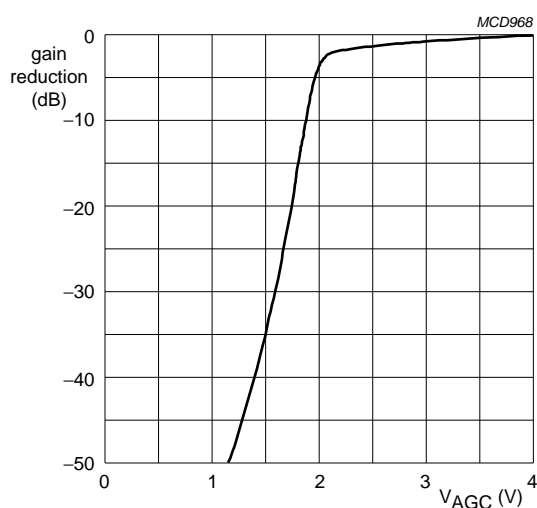
## Dual N-channel dual gate MOS-FETs

## BF1102; BF1102R



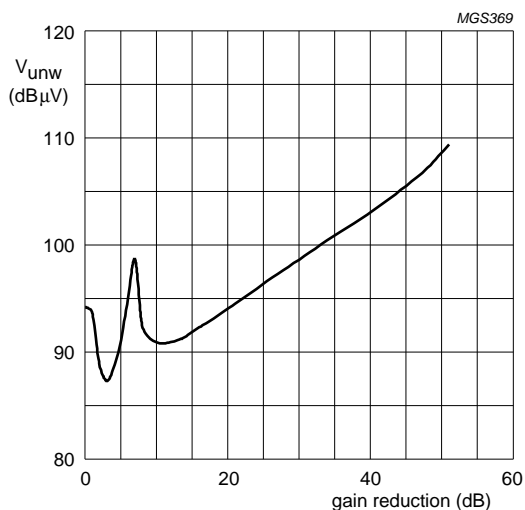
$V_{DS} = 5 \text{ V}$ ;  $T_J = 25 \text{ }^\circ\text{C}$ .  
 $R_{G1} = 120 \text{ k}\Omega$  (connected to  $V_{GG}$ ); see Fig.20.

Fig.11 Gate 1 current as a function of gate 2 voltage; typical values.



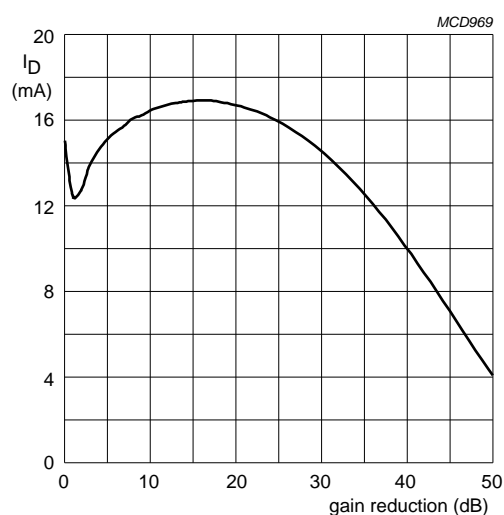
$V_{DS} = 5 \text{ V}$ ;  $V_{GG} = 5 \text{ V}$ ;  $f = 50 \text{ MHz}$ ;  $T_{amb} = 25 \text{ }^\circ\text{C}$ ;  
 $R_{G1} = 120 \text{ k}\Omega$  (connected to  $V_{GG}$ ); see Fig.20.

Fig.12 Typical gain reduction as a function of the AGC voltage; see Fig.20.



$V_{DS} = 5 \text{ V}$ ;  $V_{GG} = 5 \text{ V}$ ;  $f_w = 50 \text{ MHz}$ ;  $f_{unw} = 60 \text{ MHz}$ ;  $T_{amb} = 25 \text{ }^\circ\text{C}$ ;  
 $R_{G1} = 120 \text{ k}\Omega$  (connected to  $V_{GG}$ ); see Fig.20.

Fig.13 Unwanted voltage for 1% cross-modulation as a function of gain reduction; typical values.

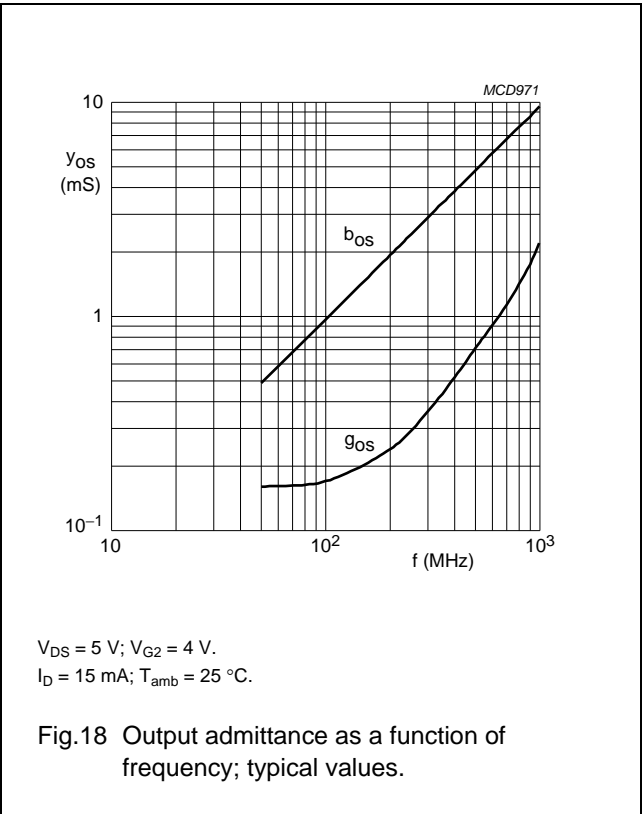
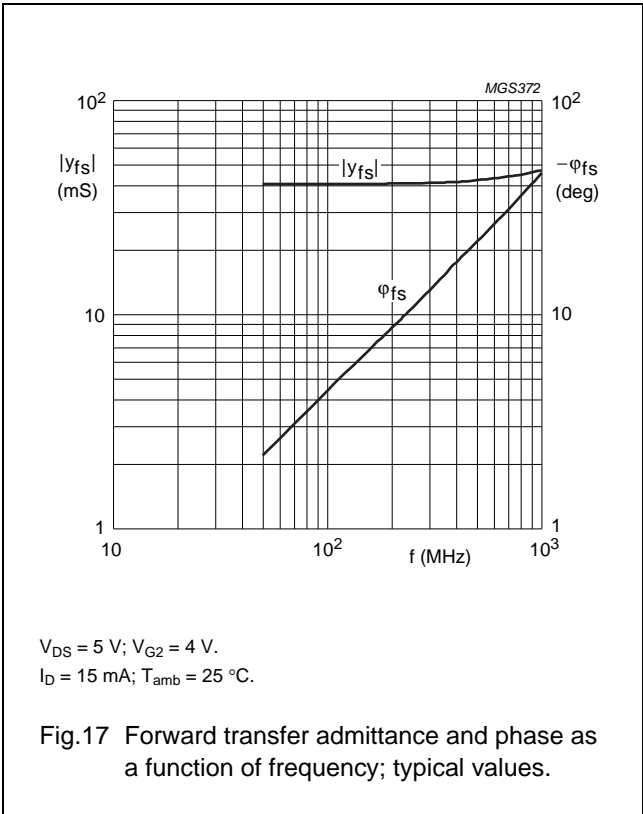
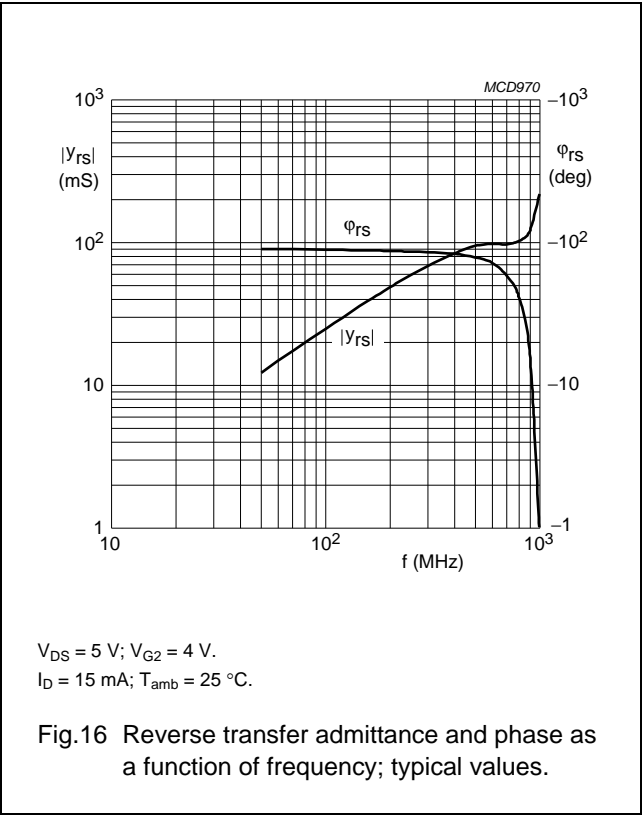
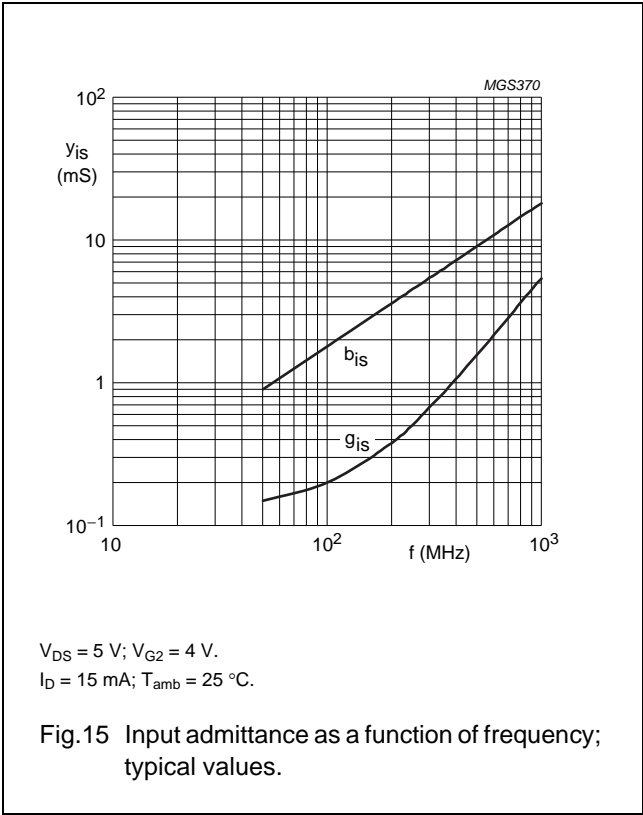


$V_{DS} = 5 \text{ V}$ ;  $V_{GG} = 5 \text{ V}$ ;  $f = 50 \text{ MHz}$ ;  $T_{amb} = 25 \text{ }^\circ\text{C}$ ;  
 $R_{G1} = 120 \text{ k}\Omega$  (connected to  $V_{GG}$ ); see Fig.20.

Fig.14 Drain current as a function of gain reduction; typical values.

Dual N-channel dual gate MOS-FETs

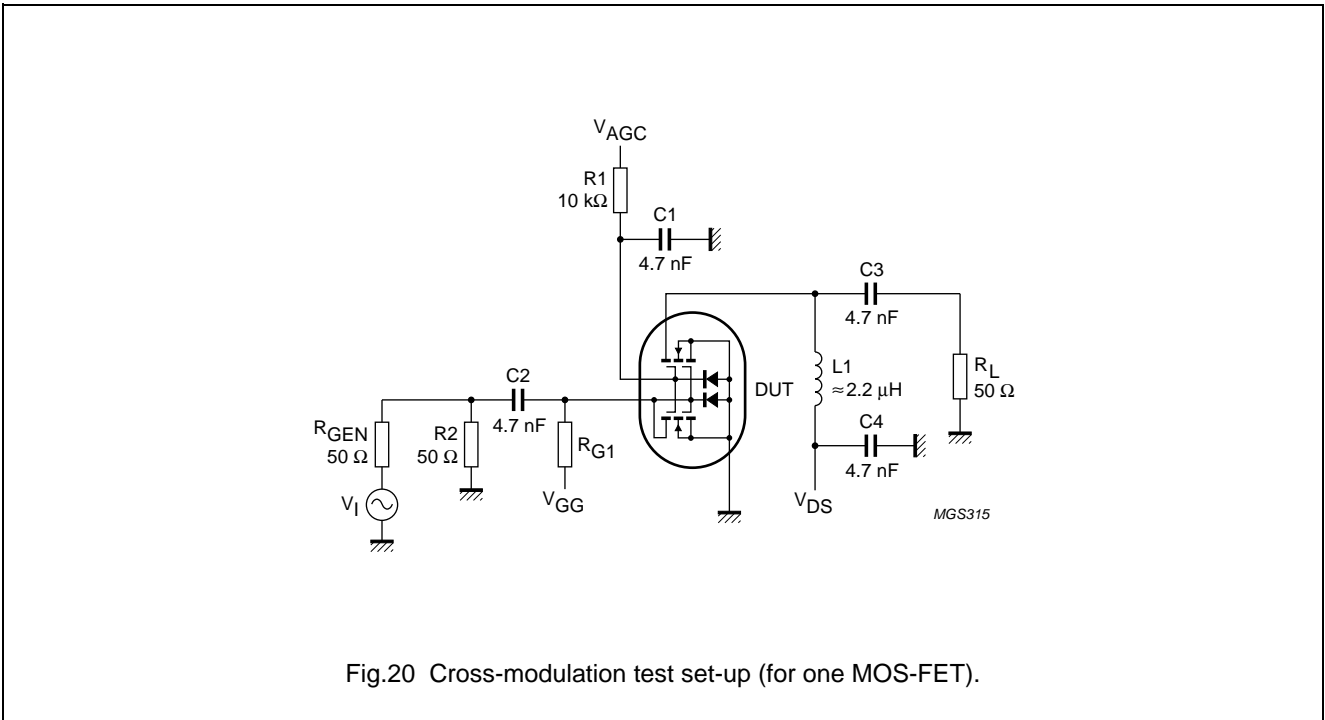
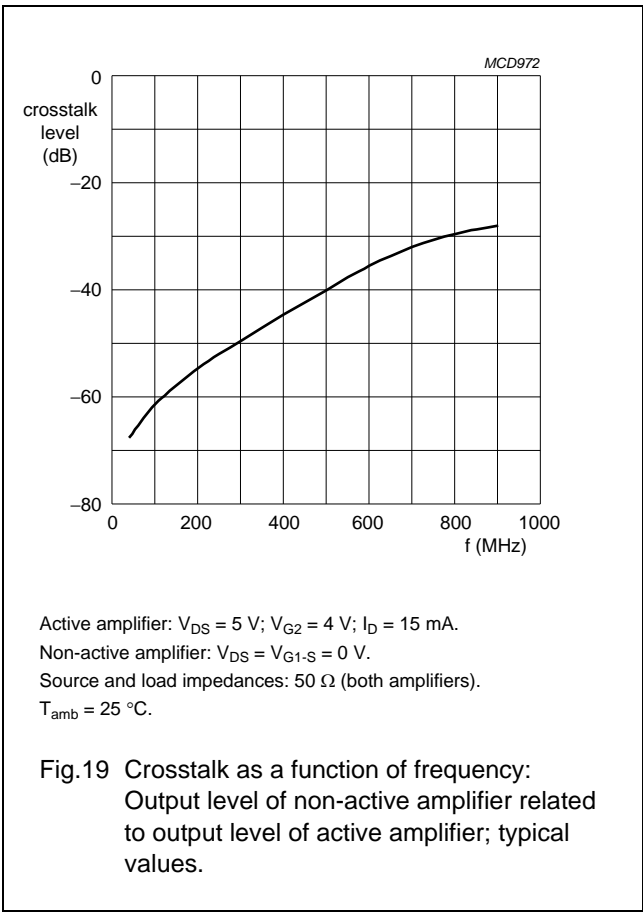
BF1102; BF1102R





Dual N-channel dual gate MOS-FETs

BF1102; BF1102R



## Dual N-channel dual gate MOS-FETs

## BF1102; BF1102R

**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	0.987	-5.6	4.069	173.5	0.001	95.4	0.986	-3.0
100	0.981	-11.1	4.042	167.0	0.002	81.3	0.983	-6.0
200	0.961	-21.9	3.926	154.4	0.005	75.8	0.976	-12.0
300	0.933	-32.1	3.778	142.4	0.006	69.6	0.960	-17.7
400	0.899	-42.0	3.593	130.6	0.007	65.6	0.945	-23.2
500	0.867	-51.1	3.412	119.6	0.007	64.4	0.928	-29.1
600	0.834	-59.9	3.216	109.2	0.007	67.5	0.914	-34.1
700	0.805	-67.9	3.010	99.0	0.006	78.7	0.901	-39.8
800	0.779	-75.7	2.804	89.2	0.007	92.7	0.886	-45.1
900	0.758	-82.1	2.656	80.3	0.007	120.7	0.889	-49.7
1000	0.740	-89.0	2.509	69.9	0.009	125.5	0.890	-55.7

**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> (Ω)
		(ratio)	(deg)	
800	2	0.621	61.61	25.85

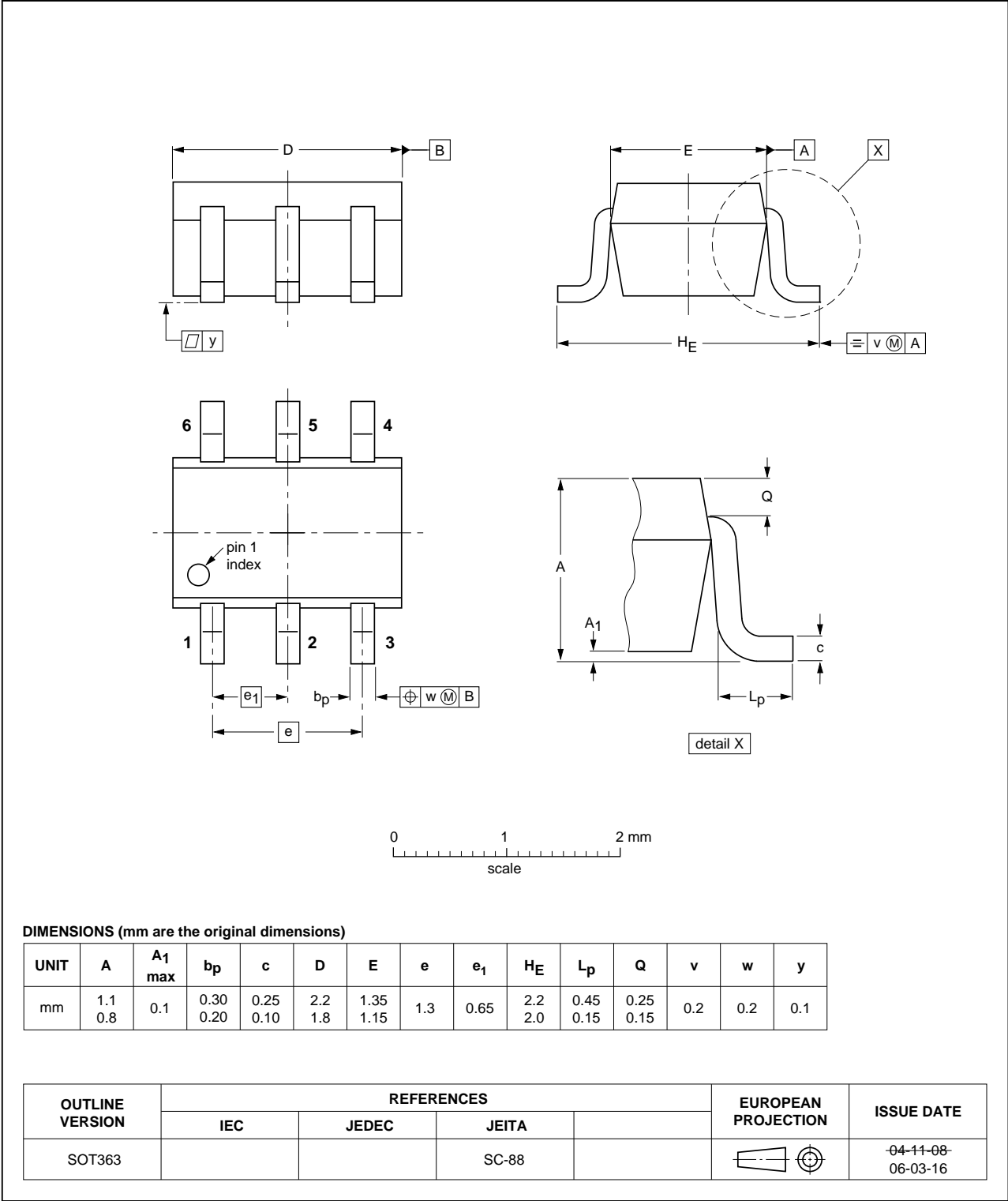
Dual N-channel dual gate MOS-FETs

BF1102; BF1102R

PACKAGE OUTLINE

Plastic surface-mounted package; 6 leads

SOT363



## Dual N-channel dual gate MOS-FETs

BF1102; BF1102R

## 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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Dual N-channel dual gate MOS-FETsBF1102; BF1102R

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## **Contact information**

For additional information please visit: <http://www.nxp.com>

For sales offices addresses send e-mail to: [salesaddresses@nxp.com](mailto:salesaddresses@nxp.com)

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