

DATA SHEET

BF1212; BF1212R; BF1212WR N-channel dual-gate MOS-FETs

Product specification

2003 Nov 14

N-channel dual-gate MOS-FETs

BF1212; BF1212R; BF1212WR

FEATURES

- Short channel transistor with high forward transfer admittance to input capacitance ratio
- Low noise gain controlled amplifier
- Excellent low frequency noise performance
- Partly internal self-biasing circuit to ensure good cross-modulation performance during AGC and good DC stabilization.

APPLICATIONS

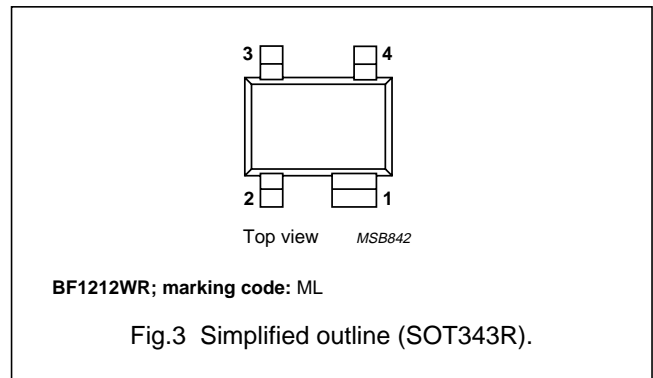
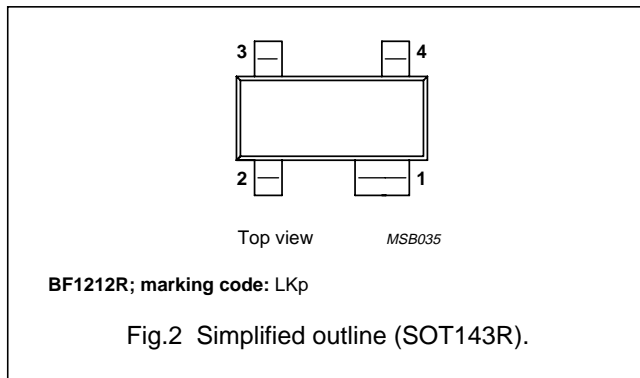
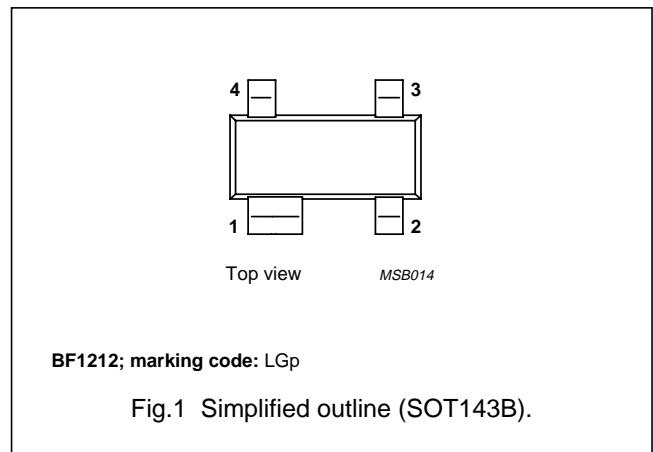
- Gain controlled low noise VHF and UHF amplifiers for 5 V digital and analog television tuner applications.

DESCRIPTION

Enhancement type N-channel field-effect transistor with source and substrate interconnected. Integrated diodes between gates and source protect against excessive input voltage surges. The BF1212, BF1212R and BF1212WR are encapsulated in the SOT143B, SOT143R and SOT343R plastic packages respectively.

PINNING

PIN	DESCRIPTION
1	source
2	drain
3	gate 2
4	gate 1



QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{DS}	drain-source voltage		–	–	6	V
I_D	drain current		–	–	30	mA
P_{tot}	total power dissipation		–	–	180	mW
$ y_{fs} $	forward transfer admittance		28	33	43	mS
C_{ig1-ss}	input capacitance at gate 1		–	1.7	2.2	pF
C_{rss}	reverse transfer capacitance	$f = 1 \text{ MHz}$	–	15	30	fF
F	noise figure	$f = 800 \text{ MHz}$	–	1.1	1.8	dB
X_{mod}	cross-modulation	input level for $k = 1 \%$ at 40 dB AGC	100	104	–	dB μ V
T_j	junction temperature		–	–	150	$^{\circ}\text{C}$

N-channel dual-gate MOS-FETs

BF1212; BF1212R; BF1212WR

CAUTION

This product is supplied in anti-static packing to prevent damage caused by electrostatic discharge during transport and handling. For further information, refer to Philips specs.: SNW-EQ-608, SNW-FQ-302A and SNW-FQ-302B.

ORDERING INFORMATION

TYPE NUMBER	PACKAGE		
	NAME	DESCRIPTION	VERSION
BF1212	–	plastic surface mounted package; 4 leads	SOT143B
BF1212R	–	plastic surface mounted package; reverse pinning; 4 leads	SOT143R
BF1212WR	–	plastic surface mounted package; reverse pinning; 4 leads	SOT343R

LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{DS}	drain-source voltage		–	6	V
I_D	drain current (DC)		–	30	mA
I_{G1}	gate 1 current		–	± 10	mA
I_{G2}	gate 2 current		–	± 10	mA
P_{tot}	total power dissipation				
	BF1212; BF1212R	$T_s \leq 116\text{ °C}$; note 1	–	180	mW
	BF1212WR	$T_s \leq 122\text{ °C}$; note 1	–	180	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C

Note

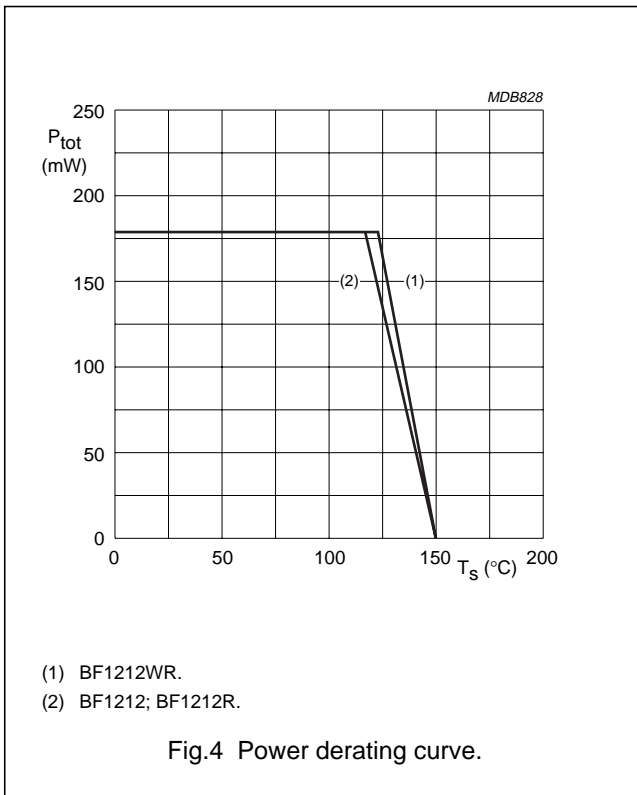
1. T_s is the temperature of the soldering point of the source lead.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	VALUE	UNIT
$R_{th\ j-s}$	thermal resistance from junction to soldering point		
	BF1212; BF1212R	185	K/W
	BF1212WR	155	K/W

N-channel dual-gate MOS-FETs

BF1212; BF1212R; BF1212WR



STATIC CHARACTERISTICS

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
$V_{(BR)DSS}$	drain-source breakdown voltage	$V_{G1-S} = V_{G2-S} = 0\text{ V}$; $I_D = 10\text{ }\mu\text{A}$	6	–	V
$V_{(BR)G1-SS}$	gate 1-source breakdown voltage	$V_{G2-S} = V_{DS} = 0\text{ V}$; $I_{G1-S} = 10\text{ mA}$	6	10	V
$V_{(BR)G2-SS}$	gate 2-source breakdown voltage	$V_{G1-S} = V_{DS} = 0\text{ V}$; $I_{G2-S} = 10\text{ mA}$	6	10	V
$V_{(F)S-G1}$	forward source-gate 1 voltage	$V_{G2-S} = V_{DS} = 0\text{ V}$; $I_{S-G1} = 10\text{ mA}$	0.5	1.5	V
$V_{(F)S-G2}$	forward source-gate 2 voltage	$V_{G1-S} = V_{DS} = 0\text{ V}$; $I_{S-G2} = 10\text{ mA}$	0.5	1.5	V
$V_{G1-S(th)}$	gate 1-source threshold voltage	$V_{G2-S} = 4\text{ V}$; $V_{DS} = 5\text{ V}$; $I_D = 100\text{ }\mu\text{A}$	0.3	1.0	V
$V_{G2-S(th)}$	gate 2-source threshold voltage	$V_{G1-S} = 5\text{ V}$; $V_{DS} = 5\text{ V}$; $I_D = 100\text{ }\mu\text{A}$	0.35	1.0	V
I_{DSX}	drain-source current	$V_{G2-S} = 4\text{ V}$; $V_{DS} = 5\text{ V}$; $R_{G1} = 150\text{ k}\Omega$; note 1	8	16	mA
I_{G1-S}	gate 1 cut-off current	$V_{G2-S} = V_{DS} = 0\text{ V}$; $V_{G1-S} = 5\text{ V}$	–	50	nA
I_{G2-S}	gate 2 cut-off current	$V_{G1-S} = V_{DS} = 0\text{ V}$; $V_{G2-S} = 4\text{ V}$	–	20	nA

Note

- R_{G1} connects G_1 to $V_{GG} = 5\text{ V}$.

N-channel dual-gate MOS-FETs

BF1212; BF1212R; BF1212WR

DYNAMIC CHARACTERISTICSCommon source; $T_{amb} = 25\text{ °C}$; $V_{G2-S} = 4\text{ V}$; $V_{DS} = 5\text{ V}$; $I_D = 12\text{ mA}$; unless otherwise specified.

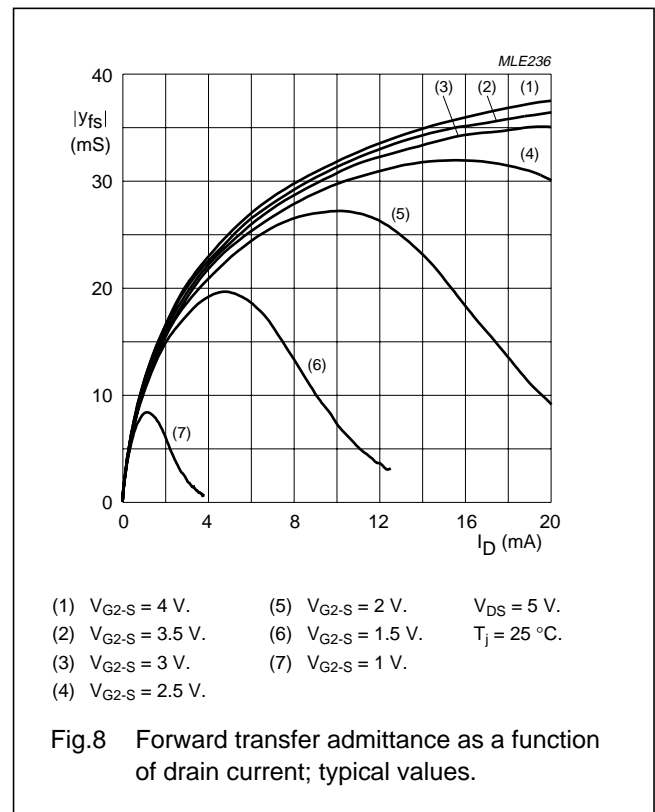
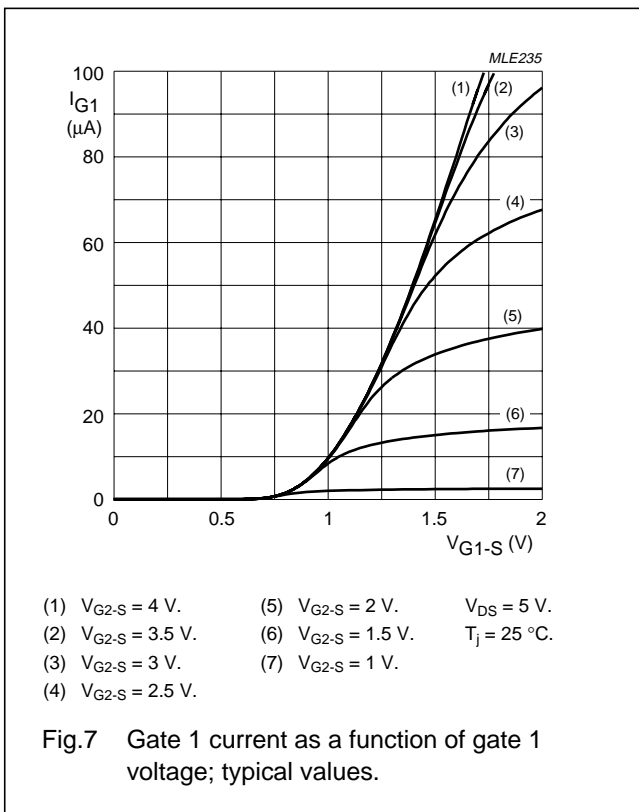
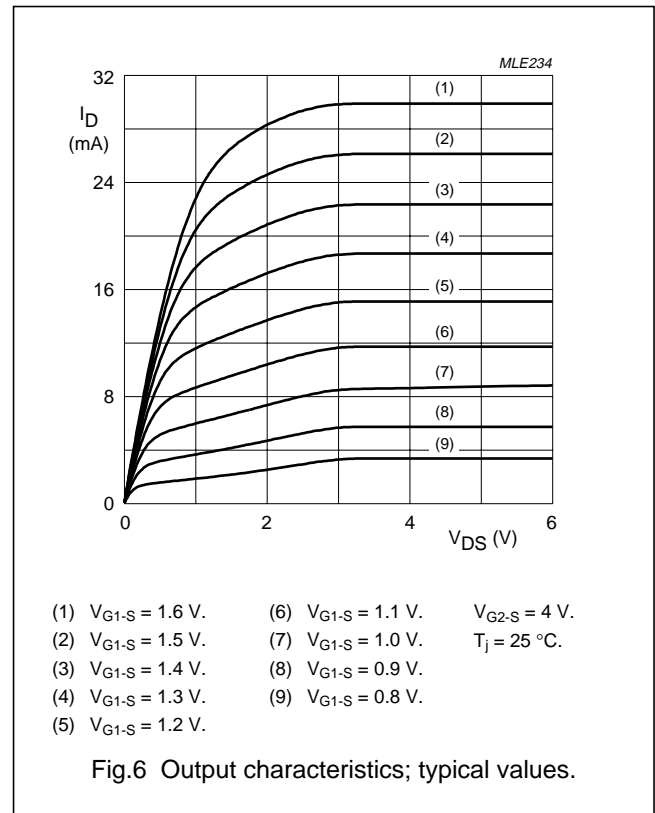
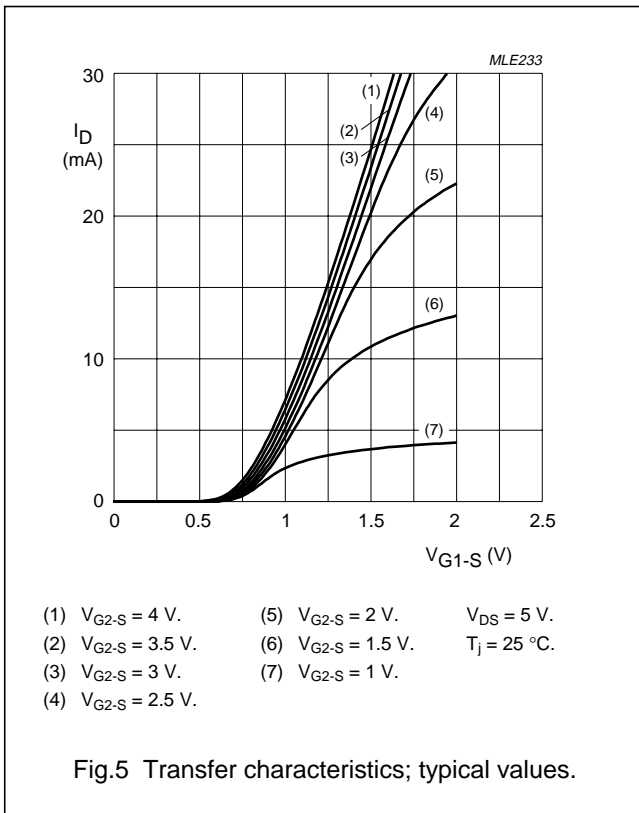
SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$ y_{fs} $	forward transfer admittance	pulsed; $T_j = 25\text{ °C}$	28	33	43	mS
C_{ig1-ss}	input capacitance at gate 1	$f = 1\text{ MHz}$	–	1.7	2.2	pF
C_{ig2-ss}	input capacitance at gate 2	$f = 1\text{ MHz}$	–	1.1	–	pF
C_{oss}	output capacitance	$f = 1\text{ MHz}$	–	0.9	–	pF
C_{rss}	reverse transfer capacitance	$f = 1\text{ MHz}$	–	15	30	fF
F	noise figure	$f = 11\text{ MHz}$; $G_S = 20\text{ mS}$; $B_S = 0$	–	4	–	dB
		$f = 400\text{ MHz}$; $Y_S = Y_{S(opt)}$	–	0.9	1.6	dB
		$f = 800\text{ MHz}$; $Y_S = Y_{S(opt)}$	–	1.1	1.8	dB
G_{tr}	power gain	$f = 200\text{ MHz}$; $G_S = 2\text{ mS}$; $B_S = B_{S(opt)}$; $G_L = 0.5\text{ mS}$; $B_L = B_{L(opt)}$	–	35	–	dB
		$f = 400\text{ MHz}$; $G_S = 2\text{ mS}$; $B_S = B_{S(opt)}$; $G_L = 1\text{ mS}$; $B_L = B_{L(opt)}$	–	30	–	dB
		$f = 800\text{ MHz}$; $G_S = 3.3\text{ mS}$; $B_S = B_{S(opt)}$; $G_L = 1\text{ mS}$; $B_L = B_{L(opt)}$	–	25	–	dB
X_{mod}	cross-modulation	input level for $k = 1\%$; $f_w = 50\text{ MHz}$; $f_{unw} = 60\text{ MHz}$; note 1				
		at 0 dB AGC	90	–	–	dB μ V
		at 10 dB AGC	–	89	–	dB μ V
	at 40 dB AGC	100	104	–	dB μ V	

Note

1. Measured in test circuit Fig.21.

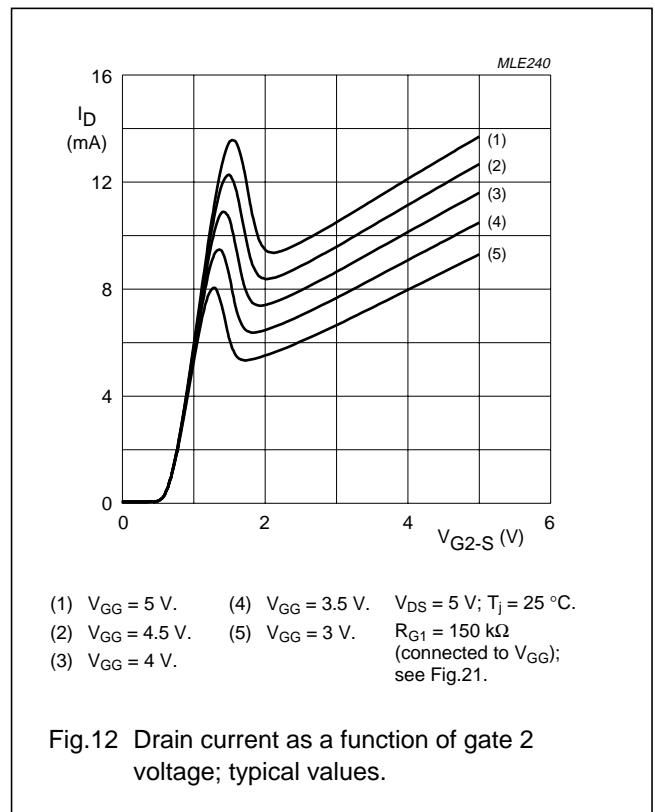
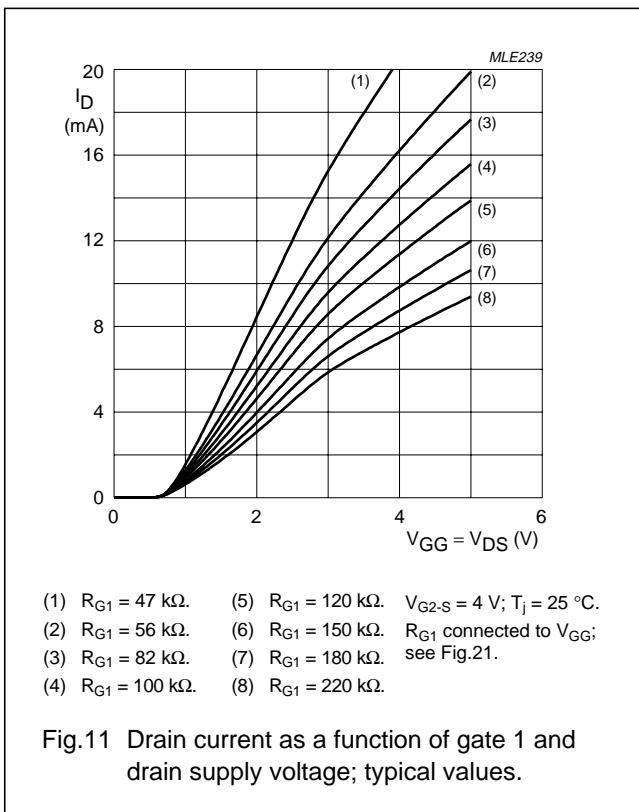
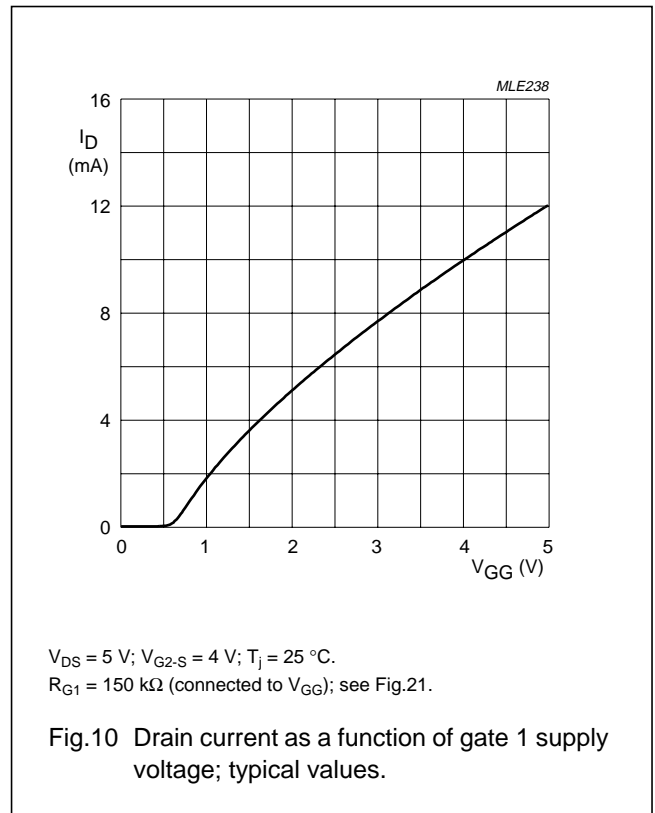
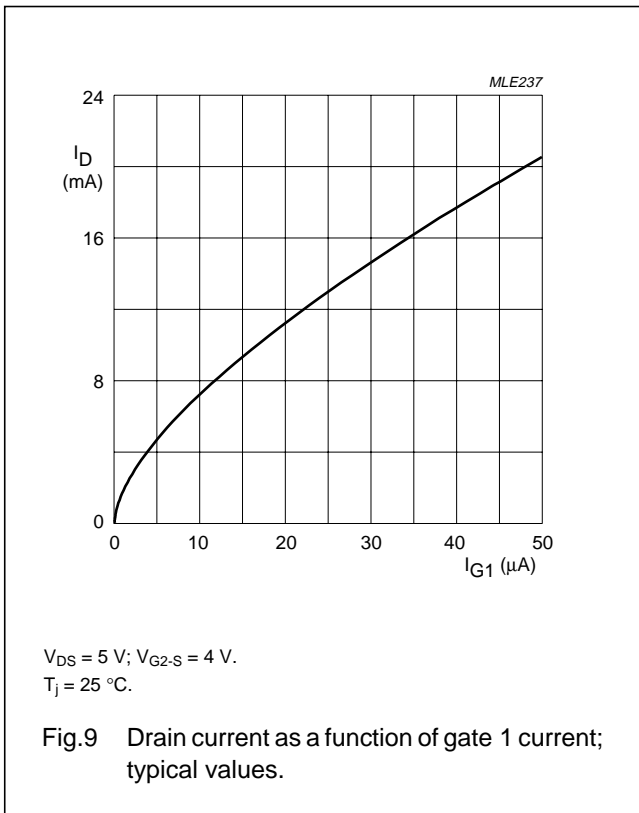
N-channel dual-gate MOS-FETs

BF1212; BF1212R; BF1212WR



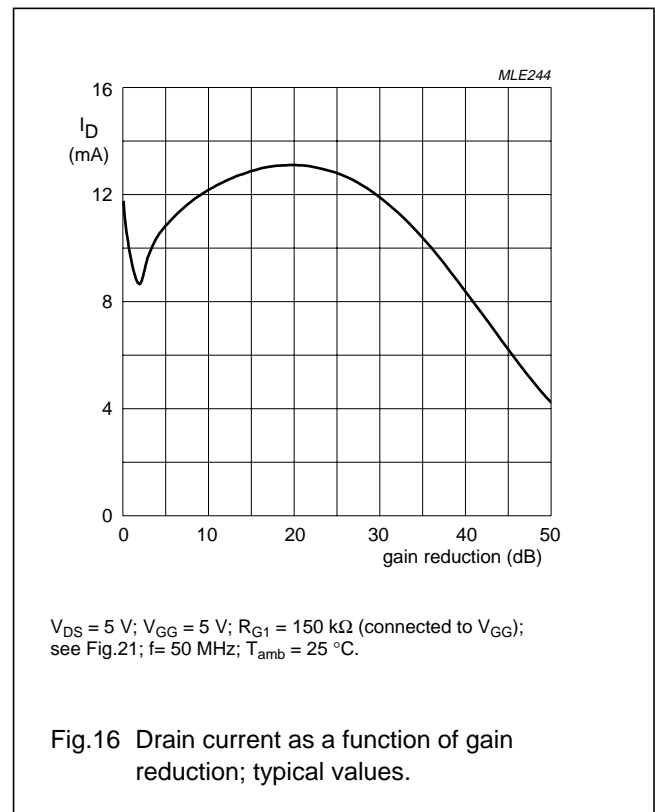
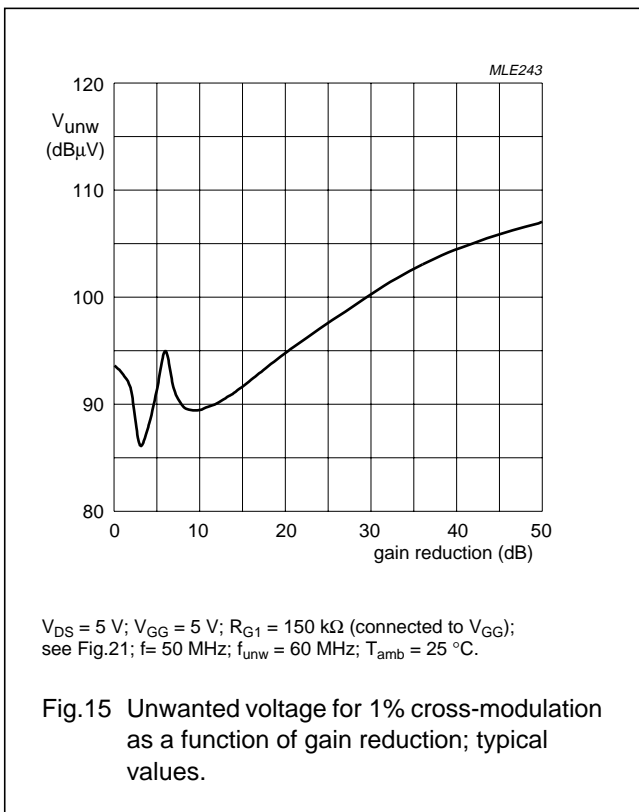
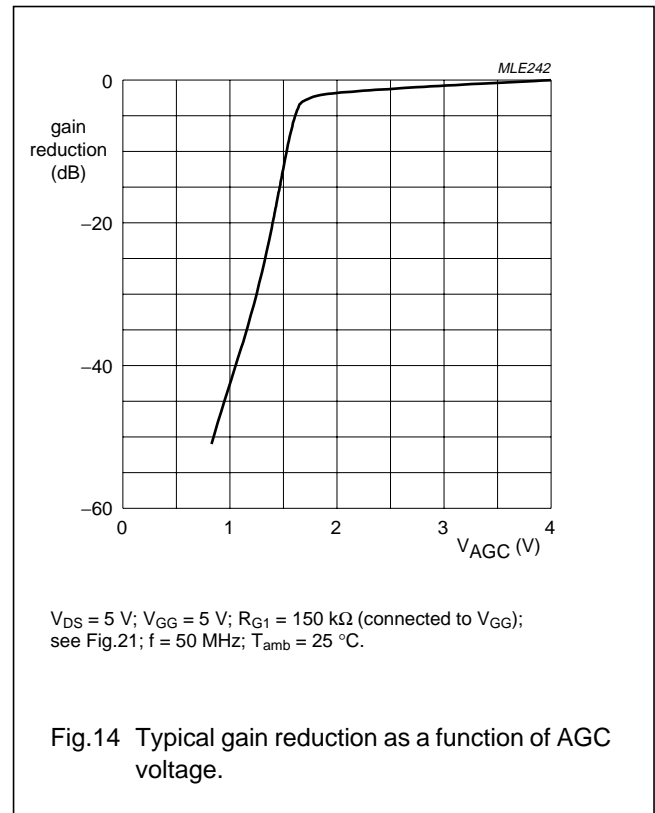
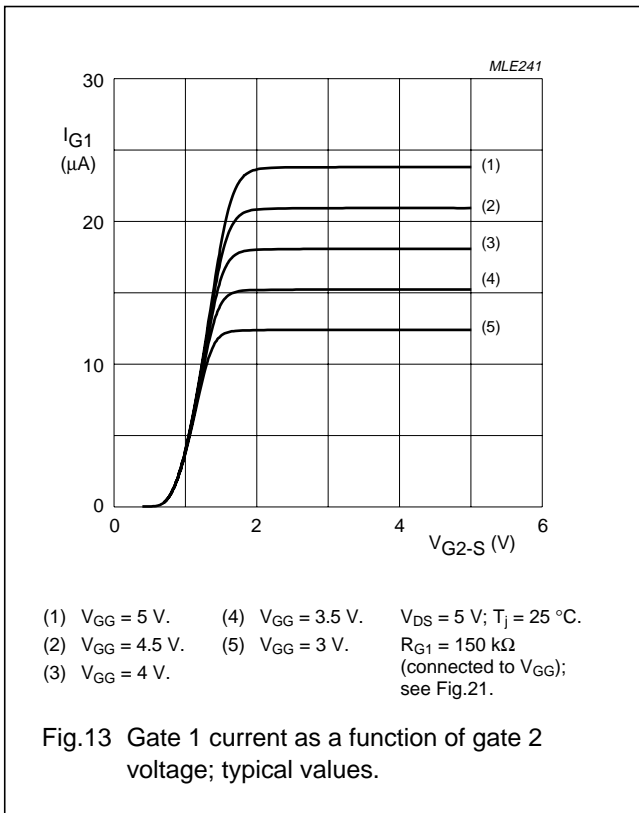
N-channel dual-gate MOS-FETs

BF1212; BF1212R; BF1212WR



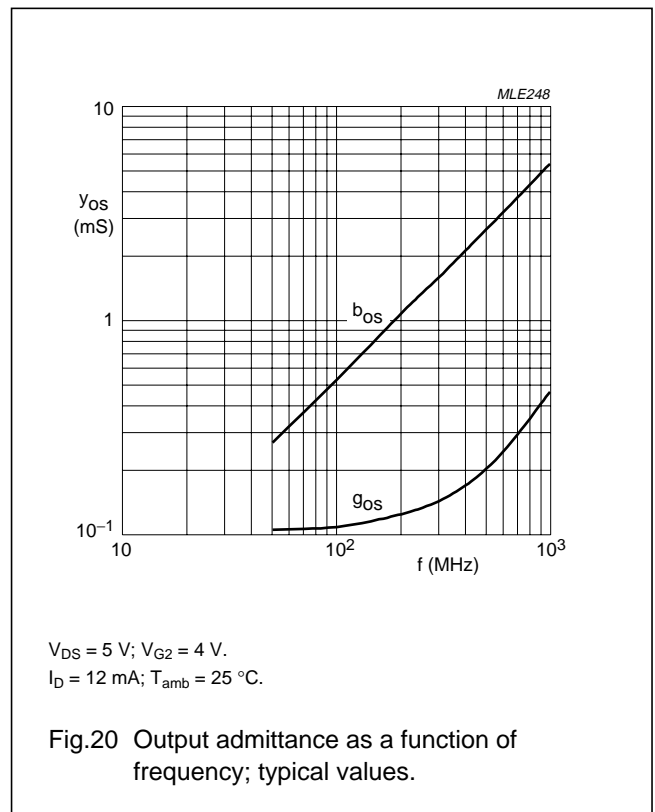
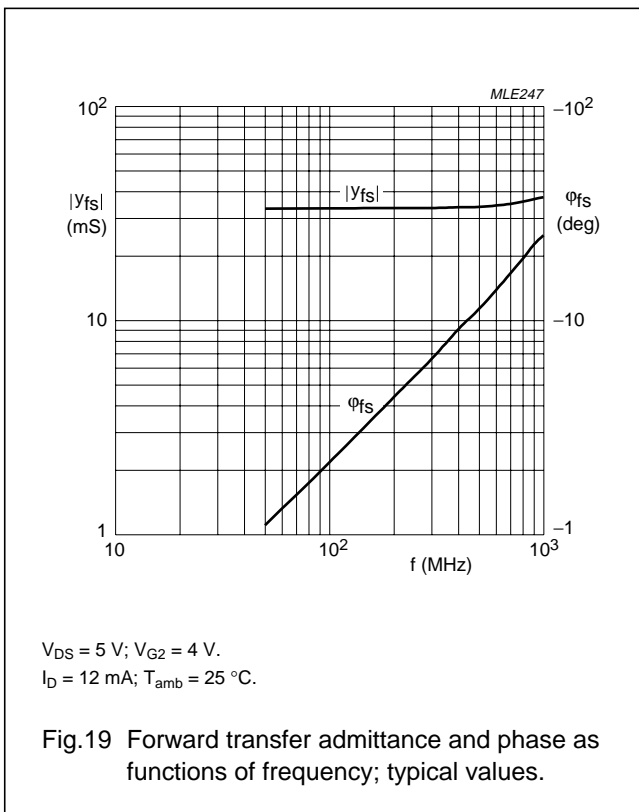
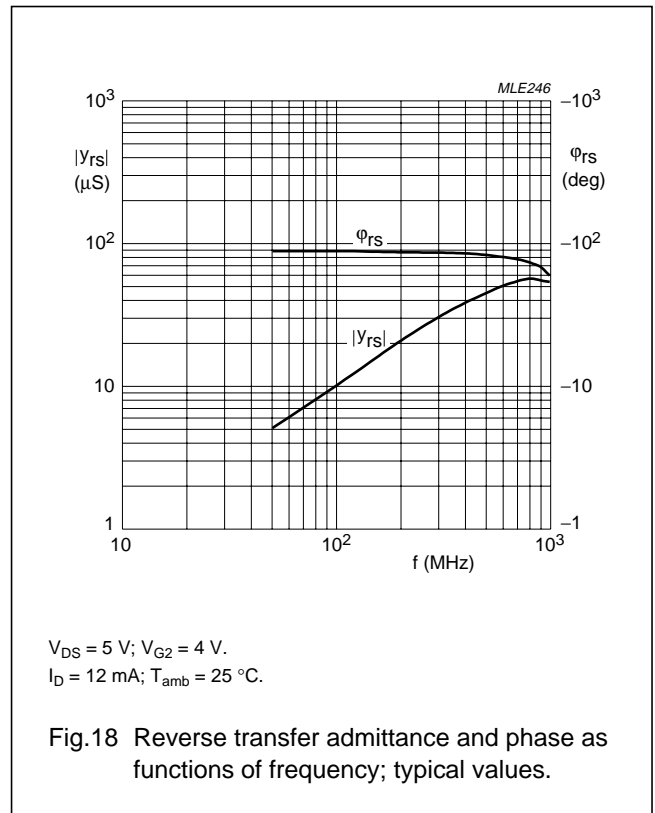
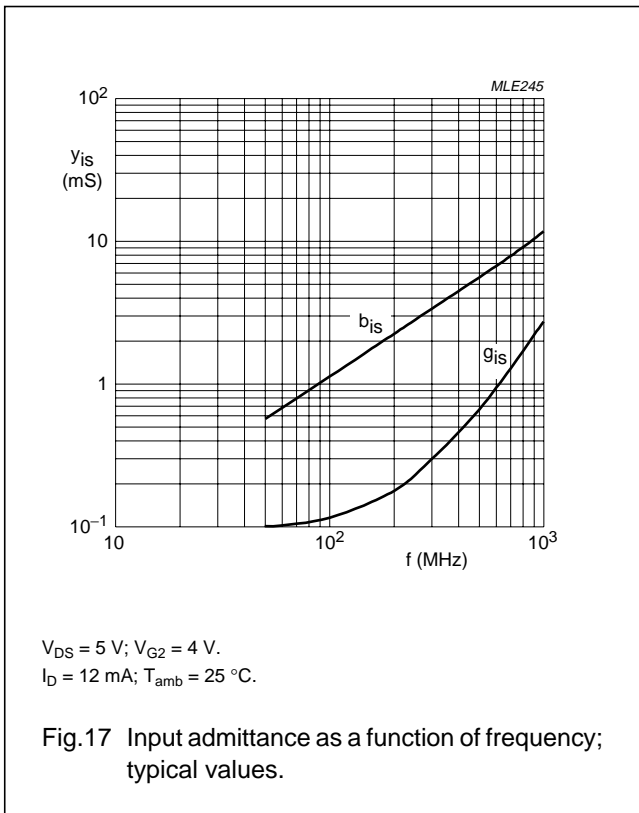
N-channel dual-gate MOS-FETs

BF1212; BF1212R; BF1212WR



N-channel dual-gate MOS-FETs

BF1212; BF1212R; BF1212WR



N-channel dual-gate MOS-FETs

BF1212; BF1212R; BF1212WR

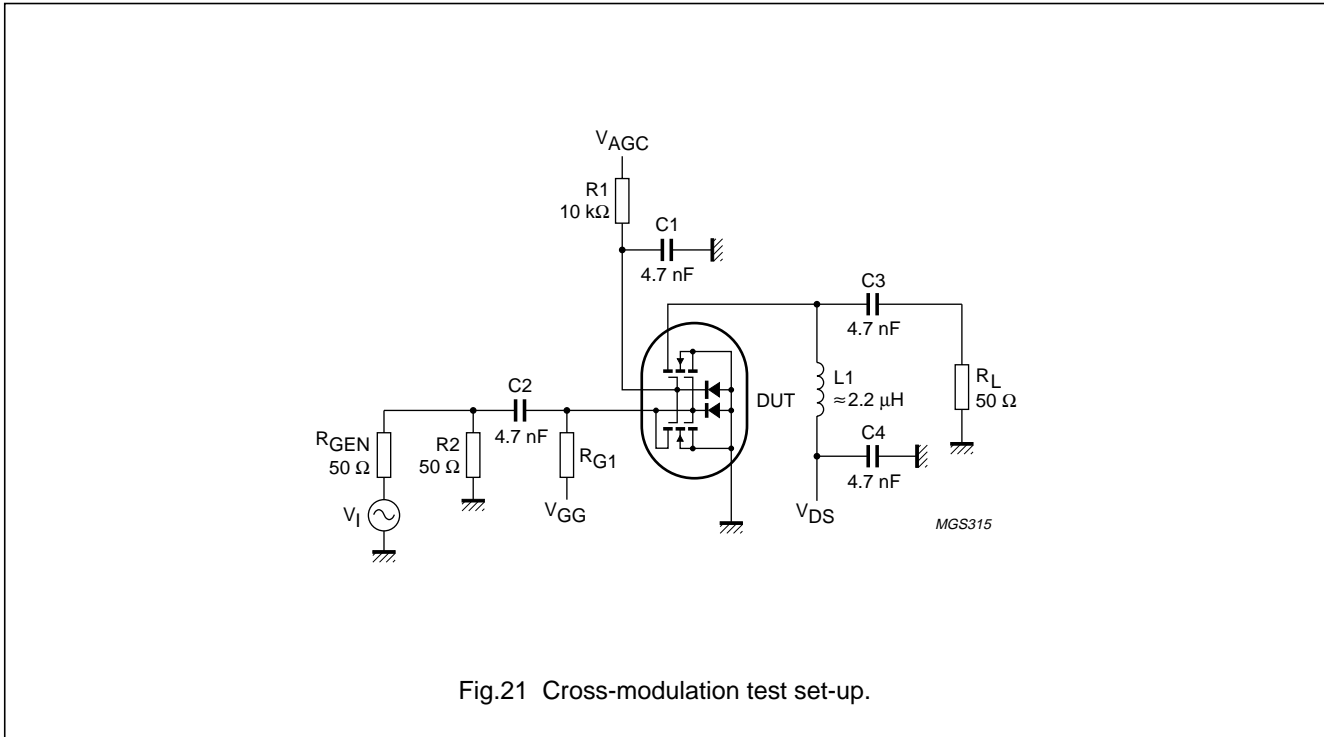


Fig.21 Cross-modulation test set-up.

Table 1 Scattering parameters: $V_{DS} = 5\text{ V}$; $V_{G2-S} = 4\text{ V}$; $I_D = 12\text{ mA}$; $T_{amb} = 25\text{ °C}$

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	0.990	-3.39	3.288	176.5	0.0005	86.9	0.990	-1.66
100	0.988	-6.76	3.280	173.0	0.0011	85.6	0.990	-3.30
200	0.983	-13.40	3.261	166.1	0.0021	81.2	0.991	-6.62
300	0.974	-19.86	3.218	159.0	0.0030	77.5	0.991	-9.92
400	0.969	-26.46	3.205	152.6	0.0039	74.6	0.994	-13.30
500	0.958	-32.73	3.141	145.9	0.0045	72.4	0.994	-16.56
600	0.947	-38.83	3.086	139.5	0.0049	70.9	0.993	-19.77
700	0.936	-44.75	3.017	133.1	0.0051	69.5	0.991	-22.78
800	0.924	-50.51	2.949	126.9	0.0051	69.9	0.981	-25.77
900	0.910	-56.18	2.870	120.5	0.0049	69.8	0.984	-28.72
1000	0.896	-61.64	2.785	114.7	0.0045	72.7	0.980	-31.77

Table 2 Noise data: $V_{DS} = 5\text{ V}$; $V_{G2-S} = 4\text{ V}$; $I_D = 12\text{ mA}$; $T_{amb} = 25\text{ °C}$

f (MHz)	F _{min} (dB)	Γ _{opt}		R _n (Ω)
		(ratio)	(deg)	
400	0.9	0.695	13.87	28.5
800	1.1	0.634	30.30	32.85

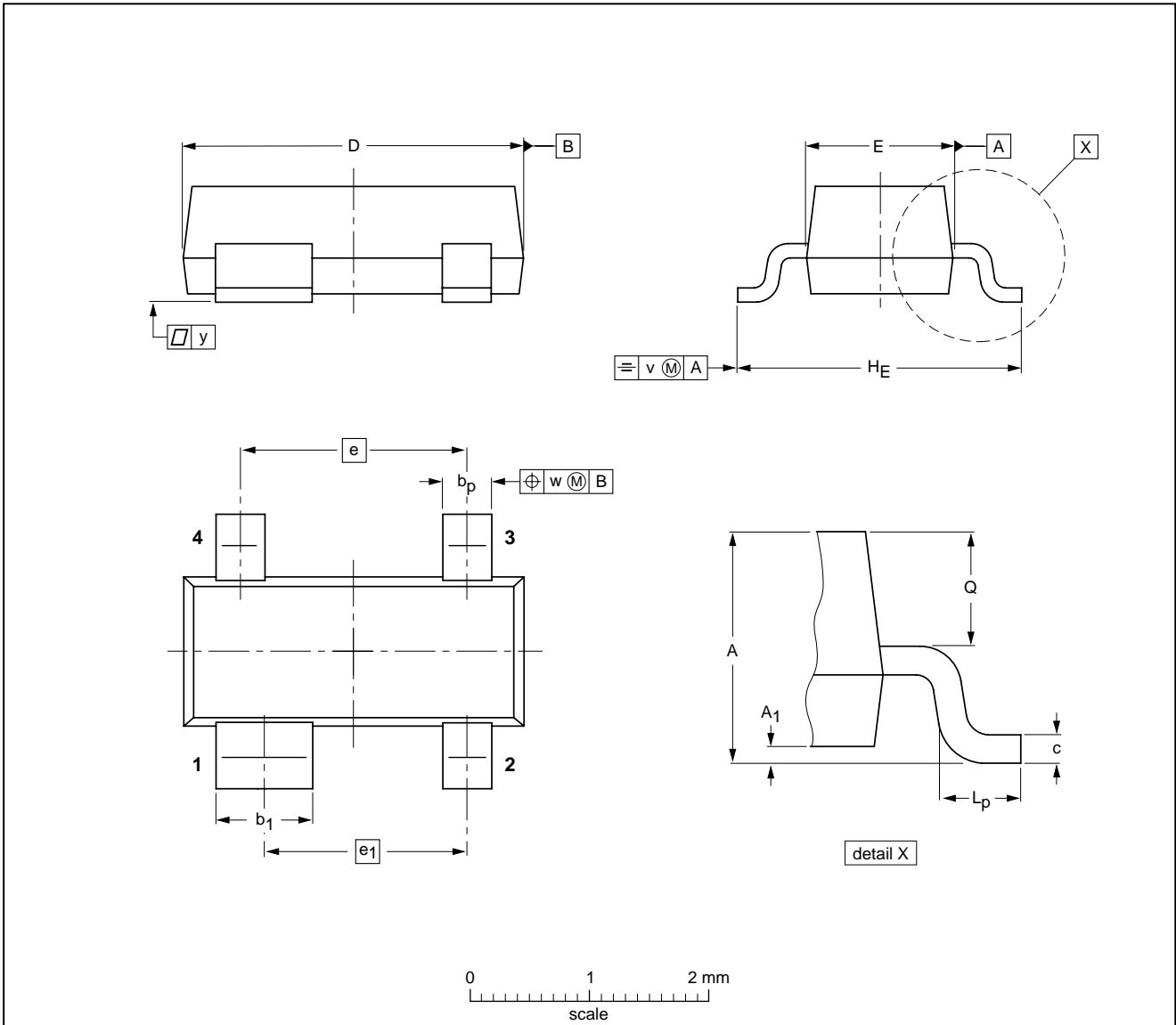
N-channel dual-gate MOS-FETs

BF1212; BF1212R; BF1212WR

PACKAGE OUTLINES

Plastic surface mounted package; 4 leads

SOT143B



DIMENSIONS (mm are the original dimensions)

UNIT	A	A ₁ max	b _p	b ₁	c	D	E	e	e ₁	H _E	L _p	Q	v	w	y
mm	1.1 0.9	0.1	0.48 0.38	0.88 0.78	0.15 0.09	3.0 2.8	1.4 1.2	1.9	1.7	2.5 2.1	0.45 0.15	0.55 0.45	0.2	0.1	0.1

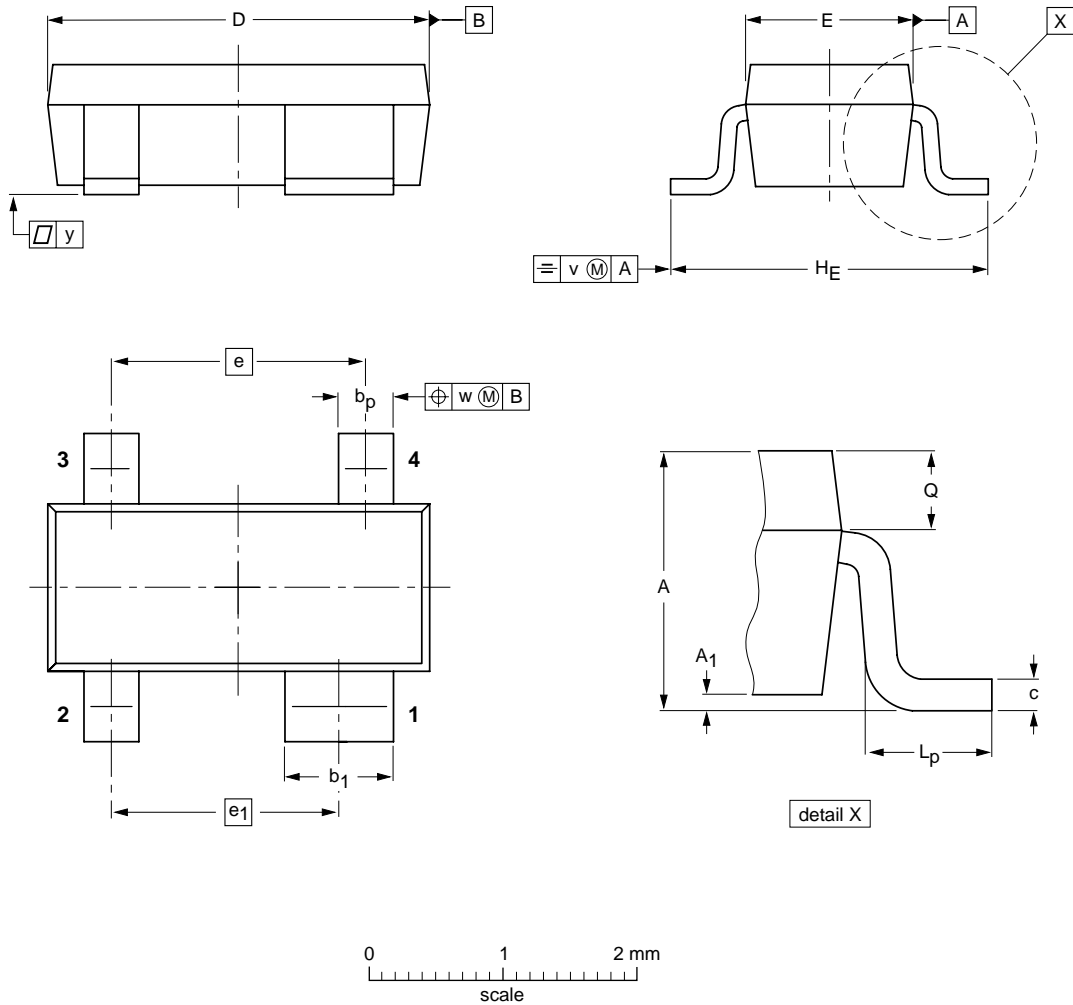
OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT143B						97-02-28

N-channel dual-gate MOS-FETs

BF1212; BF1212R; BF1212WR

Plastic surface mounted package; reverse pinning; 4 leads

SOT143R



DIMENSIONS (mm are the original dimensions)

UNIT	A	A ₁ max	b _p	b ₁	c	D	E	e	e ₁	H _E	L _p	Q	v	w	y
mm	1.1 0.9	0.1	0.48 0.38	0.88 0.78	0.15 0.09	3.0 2.8	1.4 1.2	1.9	1.7	2.5 2.1	0.55 0.25	0.45 0.25	0.2	0.1	0.1

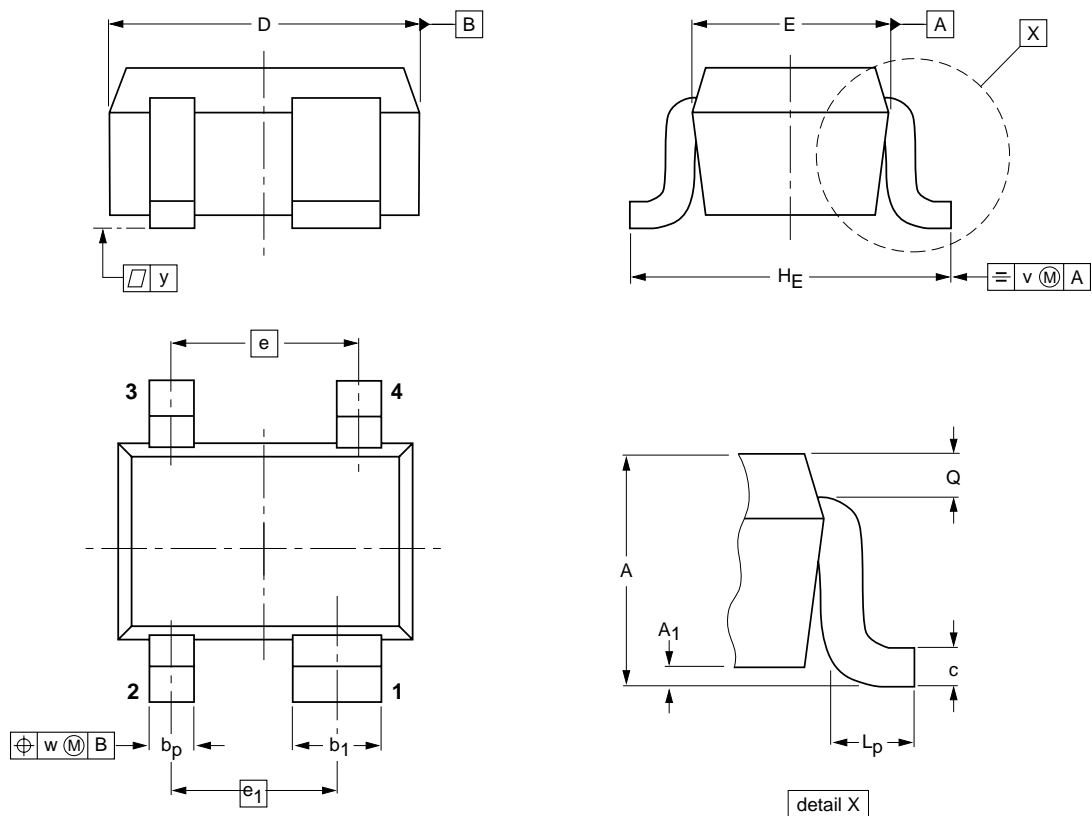
OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT143R			SC-61B			97-03-10 99-09-13

N-channel dual-gate MOS-FETs

BF1212; BF1212R; BF1212WR

Plastic surface mounted package; reverse pinning; 4 leads

SOT343R



DIMENSIONS (mm are the original dimensions)

UNIT	A	A ₁ max	b _p	b ₁	c	D	E	e	e ₁	H _E	L _p	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

N-channel dual-gate MOS-FETs

BF1212; BF1212R; BF1212WR

DATA SHEET STATUS

LEVEL	DATA SHEET STATUS ⁽¹⁾	PRODUCT STATUS ⁽²⁾⁽³⁾	DEFINITION
I	Objective data	Development	This data sheet contains data from the objective specification for product development. Philips Semiconductors reserves the right to change the specification in any manner without notice.
II	Preliminary data	Qualification	This data sheet contains data from the preliminary specification. Supplementary data will be published at a later date. Philips Semiconductors reserves the right to change the specification without notice, in order to improve the design and supply the best possible product.
III	Product data	Production	This data sheet contains data from the product specification. Philips Semiconductors reserves the right to make changes at any time in order to improve the design, manufacturing and supply. Relevant changes will be communicated via a Customer Product/Process Change Notification (CPCN).

Notes

1. Please consult the most recently issued data sheet before initiating or completing a design.
2. The product status of the device(s) described in this data sheet may have changed since this data sheet was published. The latest information is available on the Internet at URL <http://www.semiconductors.philips.com>.
3. For data sheets describing multiple type numbers, the highest-level product status determines the data sheet status.

DEFINITIONS

Short-form specification — The data in a short-form specification is extracted from a full data sheet with the same type number and title. For detailed information see the relevant data sheet or data handbook.

Limiting values definition — Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 60134). 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.

Application information — Applications that are described herein for any of these products are for illustrative purposes only. Philips Semiconductors make no representation or warranty that such applications will be suitable for the specified use without further testing or modification.

DISCLAIMERS

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 Semiconductors customers using or selling these products for use in such applications do so at their own risk and agree to fully indemnify Philips Semiconductors for any damages resulting from such application.

Right to make changes — Philips Semiconductors reserves the right to make changes in the products - including circuits, standard cells, and/or software - described or contained herein in order to improve design and/or performance. When the product is in full production (status 'Production'), relevant changes will be communicated via a Customer Product/Process Change Notification (CPCN). Philips Semiconductors assumes no responsibility or liability for the use of any of these products, conveys no licence or title under any patent, copyright, or mask work right to these products, and makes no representations or warranties that these products are free from patent, copyright, or mask work right infringement, unless otherwise specified.

Philips Semiconductors – a worldwide company

Contact information

For additional information please visit <http://www.semiconductors.philips.com>. Fax: +31 40 27 24825

For sales offices addresses send e-mail to: sales.addresses@www.semiconductors.philips.com.

© Koninklijke Philips Electronics N.V. 2003

SCA75

All rights are reserved. Reproduction in whole or in part is prohibited without the prior written consent of the copyright owner.

The information presented in this document does not form part of any quotation or contract, is believed to be accurate and reliable and may be changed without notice. No liability will be accepted by the publisher for any consequence of its use. Publication thereof does not convey nor imply any license under patent- or other industrial or intellectual property rights.

Printed in The Netherlands

R77/02/pp15

Date of release: 2003 Nov 14

Document order number: 9397 750 12308

Let's make things better.

**Philips
Semiconductors**



PHILIPS