

DATA SHEET

BF1109; BF1109R; BF1109WR N-channel dual-gate MOS-FETs

Product specification
Supersedes data of 1997 Sep 03
File under Discrete Semiconductors, SC07

1997 Dec 08

N-channel dual-gate MOS-FETs

BF1109; BF1109R; BF1109WR

FEATURES

- Short channel transistor with high forward transfer admittance to input capacitance ratio
- Low noise gain controlled amplifier up to 1 GHz
- Internal self-biasing circuit to ensure good cross-modulation performance during AGC and good DC stabilization.

APPLICATIONS

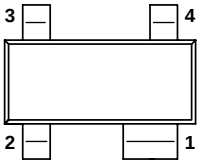
- VHF and UHF applications with 9 V supply voltage, such as television tuners and professional communications equipment.

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 BF1109, BF1109R and BF1109WR are encapsulated in the SOT143B, SOT143R and SOT343R plastic packages respectively.

PINNING

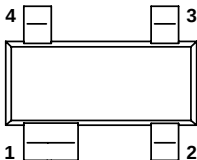
PIN	DESCRIPTION
1	source
2	drain
3	gate 2
4	gate 1



MSB035

BF1109R marking code: NBp.

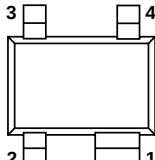
Fig.2 Simplified outline (SOT143R).



MSB014

BF1109 marking code: NFp.

Fig.1 Simplified outline (SOT143B).



MSB842

BF1109WR marking code: NB.

Fig.3 Simplified outline (SOT343R).

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{DS}	drain-source voltage		–	–	11	V
I_D	drain current (DC)		–	–	30	mA
P_{tot}	total power dissipation	$T_{amb} \leq 80\text{ }^{\circ}\text{C}$	–	–	200	mW
$ y_{fs} $	forward transfer admittance		–	30	–	mS
C_{ig1-ss}	input capacitance at gate 1		–	2.2	2.7	pF
C_{rss}	reverse transfer capacitance	$f = 1\text{ MHz}$	–	25	40	fF
F	noise figure	$f = 800\text{ MHz}$	–	1.5	2.5	dB
X_{mod}	cross-modulation	input level for $k = 1\%$ at 40 dB AGC	100	–	–	dB μ V
T_j	operating junction temperature		–	–	150	$^{\circ}\text{C}$

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.

N-channel dual-gate MOS-FETs

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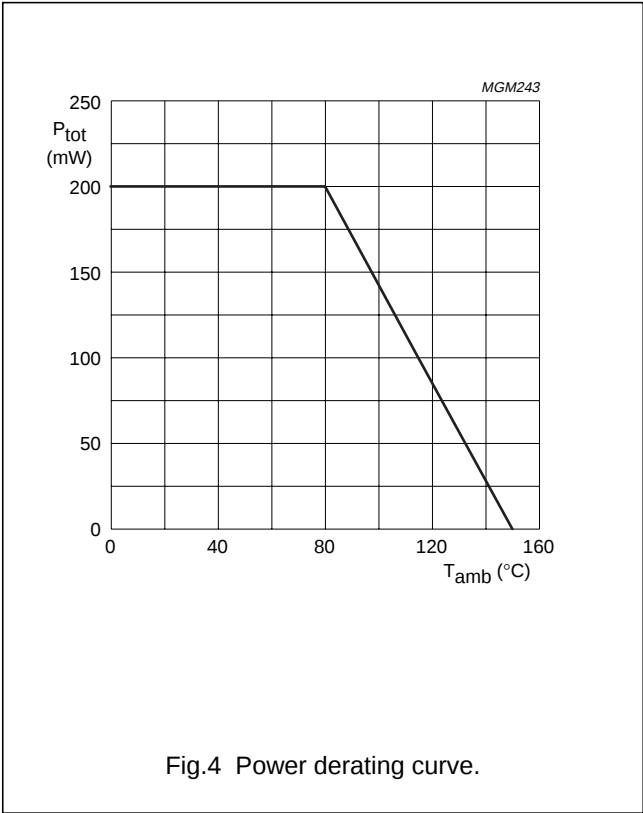
LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V _{DS}	drain-source voltage		–	11	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	T _{amb} ≤ 80 °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.



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THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j-a}$	thermal resistance from junction to ambient in free air	note 1	350	K/W
$R_{th\ j-s}$	thermal resistance from junction to soldering point		200	K/W

Note

1. Device mounted on a printed-circuit board.

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	$V_{G1-S} = V_{G2-S} = 0$; $I_D = 10\text{ }\mu\text{A}$	11	–	V
$V_{(BR)G1-SS}$	gate 1-source breakdown voltage	$V_{G2-S} = 0$; $I_{G1-S} = 10\text{ }\mu\text{A}$; $I_D = 0$	11	–	V
$V_{(BR)G2-SS}$	gate 2-source breakdown voltage	$V_{G1-S} = V_{DS} = 0$; $I_{G2-S} = 10\text{ }\mu\text{A}$	11	–	V
$V_{G2-S(th)}$	gate 2-source threshold voltage	$V_{G1-S} = 9\text{ V}$; $V_{DS} = 9\text{ V}$; $I_D = 20\text{ }\mu\text{A}$	0.3	1.2	V
I_{DSX}	self-biasing drain current	$V_{G2-S} = 4\text{ V}$; $V_{DS} = 9\text{ V}$	8	16	mA
I_{G1-SS}	gate 1 cut-off current	$V_{G1-S} = 9\text{ V}$; $V_{G2-S} = 0$; $I_D = 0$	–	20	nA
I_{G2-SS}	gate 2 cut-off current	$V_{G1-S} = V_{DS} = 0$; $V_{G2-S} = 9\text{ V}$	–	20	nA

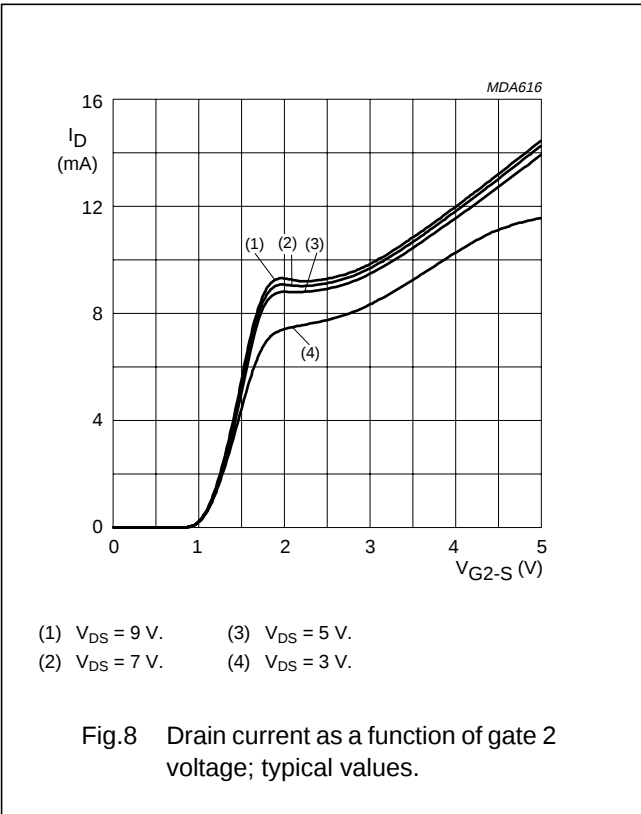
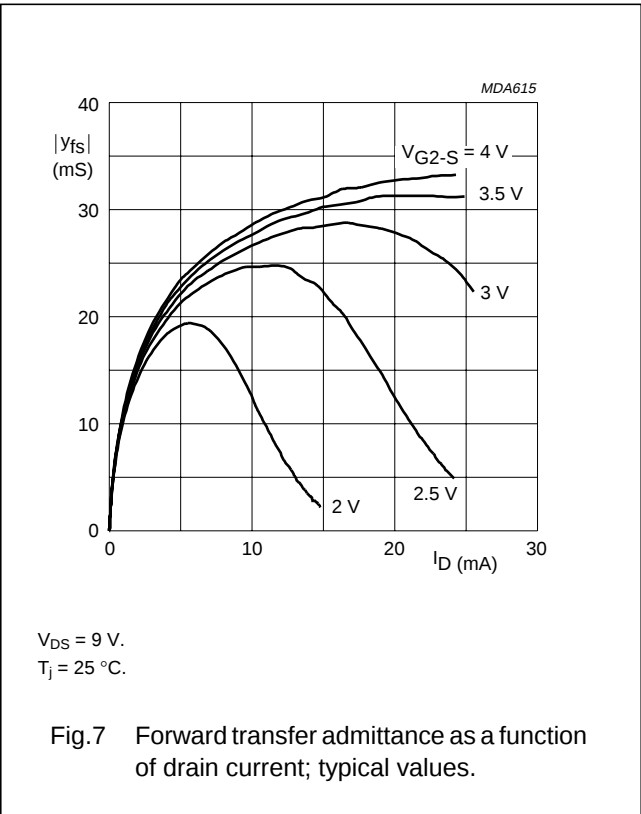
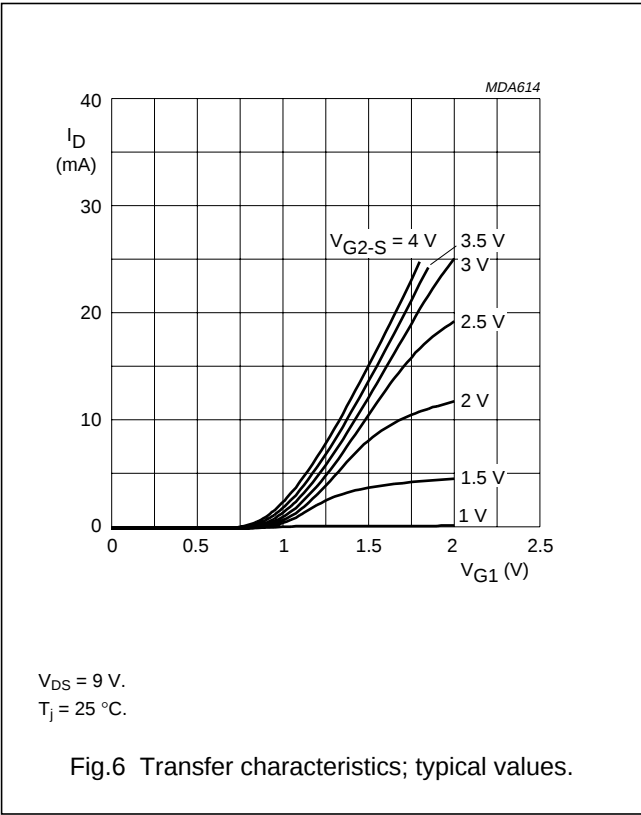
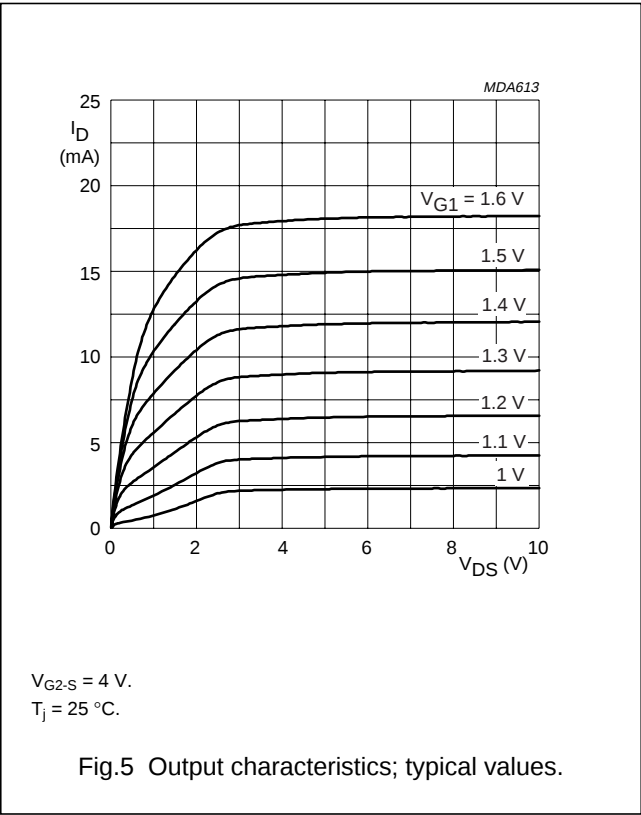
DYNAMIC CHARACTERISTICS

Common source; $T_{amb} = 25\text{ }^{\circ}\text{C}$; $V_{G2-S} = 4\text{ V}$; $V_{DS} = 9\text{ V}$; self-biasing current; unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$ y_{fs} $	forward transfer admittance	pulsed; $T_j = 25\text{ }^{\circ}\text{C}$	24	30	–	mS
C_{ig1-ss}	input capacitance at gate 1	$f = 1\text{ MHz}$	–	2.2	2.7	pF
C_{ig2-ss}	input capacitance at gate 2	$f = 1\text{ MHz}$	–	1.5	–	pF
C_{oss}	output capacitance	$f = 1\text{ MHz}$	–	1.3	–	pF
C_{rss}	reverse transfer capacitance	$f = 1\text{ MHz}$	–	25	40	fF
F	noise figure	$f = 800\text{ MHz}$; $Y_S = Y_{S\text{ opt}}$	–	1.5	2.5	dB
G_p	power gain	$G_S = 2\text{ mS}$; $B_S = B_{S\text{ opt}}$; $G_L = 0.5\text{ mS}$; $B_L = B_{L\text{ opt}}$; $f = 200\text{ MHz}$; see Fig.16	–	38	–	dB
		$G_S = 3.3\text{ mS}$; $B_S = B_{S\text{ opt}}$; $G_L = 1\text{ mS}$; $B_L = B_{L\text{ opt}}$; $f = 800\text{ MHz}$; see Fig.17	–	20	–	dB
X_{mod}	cross-modulation	input level for $k = 1\%$ at 0 dB AGC; $f_w = 50\text{ MHz}$; $f_{unw} = 60\text{ MHz}$; see Fig.18	85	–	–	dB μ V
		input level for $k = 1\%$ at 40 dB AGC; $f_w = 50\text{ MHz}$; $f_{unw} = 60\text{ MHz}$; see Fig.18	100	–	–	dB μ V

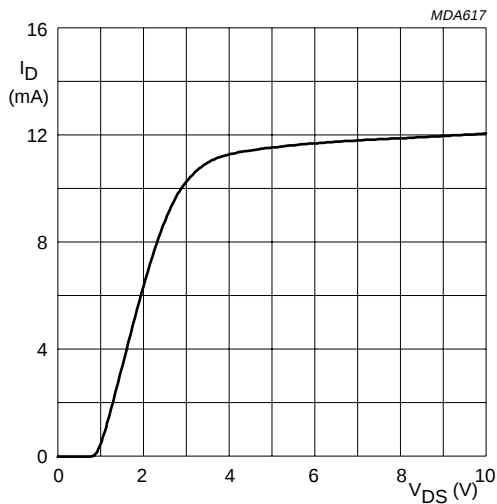
N-channel dual-gate MOS-FETs

BF1109; BF1109R; BF1109WR



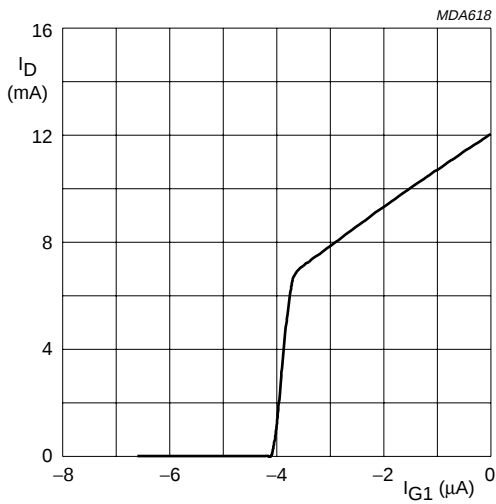
N-channel dual-gate MOS-FETs

BF1109; BF1109R; BF1109WR



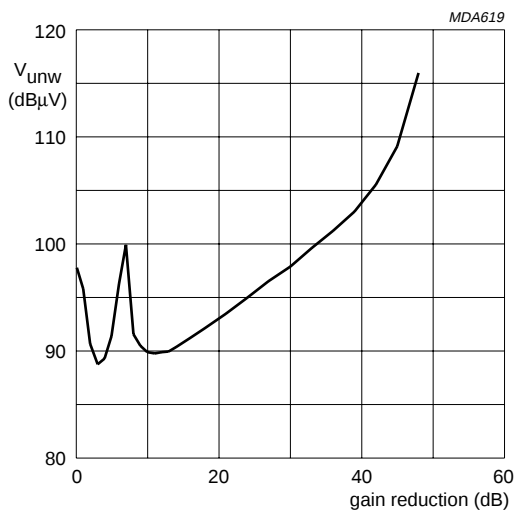
$V_{G2-S} = 4\text{ V}$.
 $T_J = 25\text{ }^{\circ}\text{C}$.

Fig.9 Drain current as a function of drain-source voltage; typical values.



$V_{DS} = 9\text{ V}$; $V_{G2-S} = 4\text{ V}$; $T_J = 25\text{ }^{\circ}\text{C}$.

Fig.10 Drain current as a function of gate 1 current; typical values.

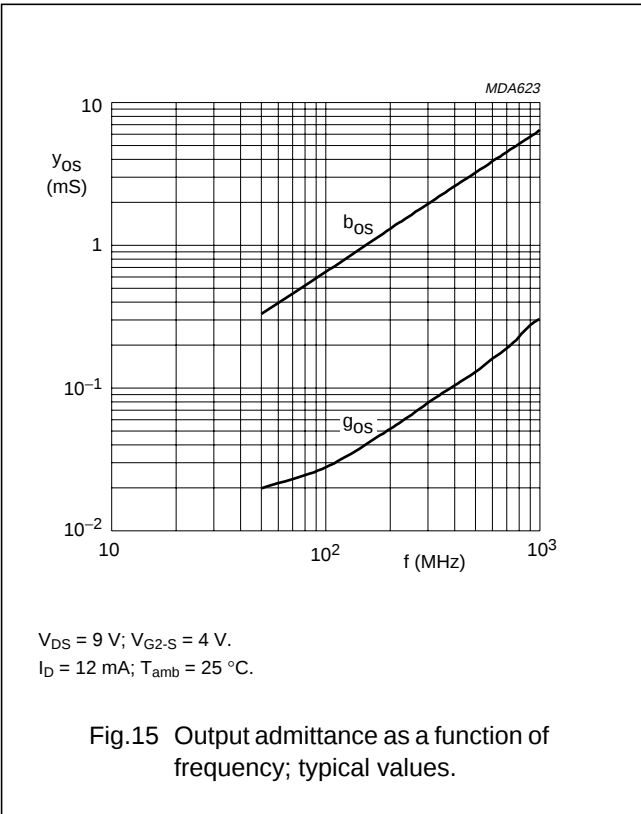
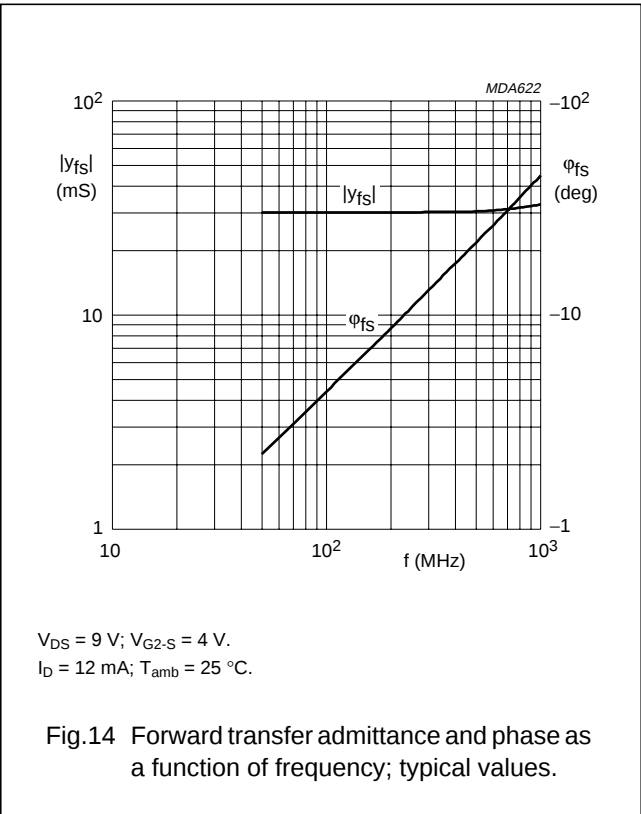
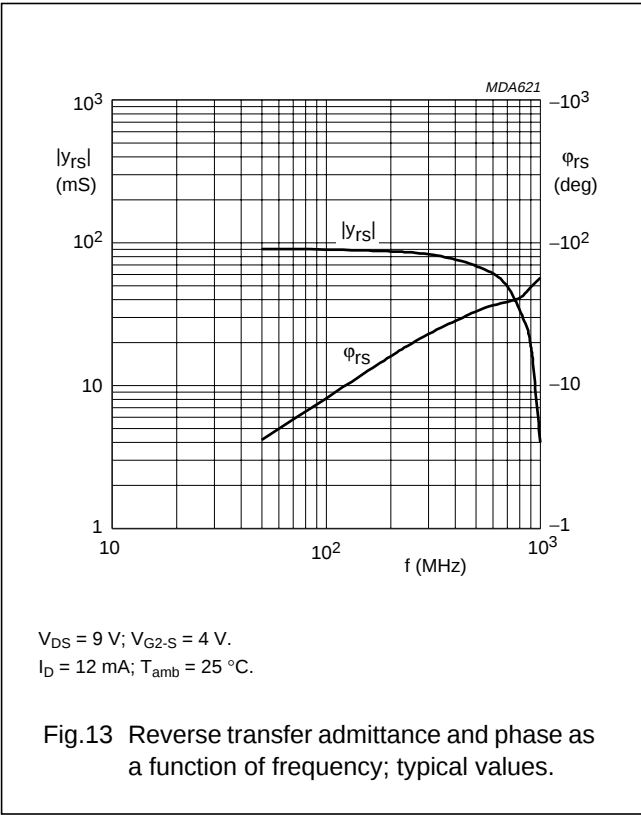
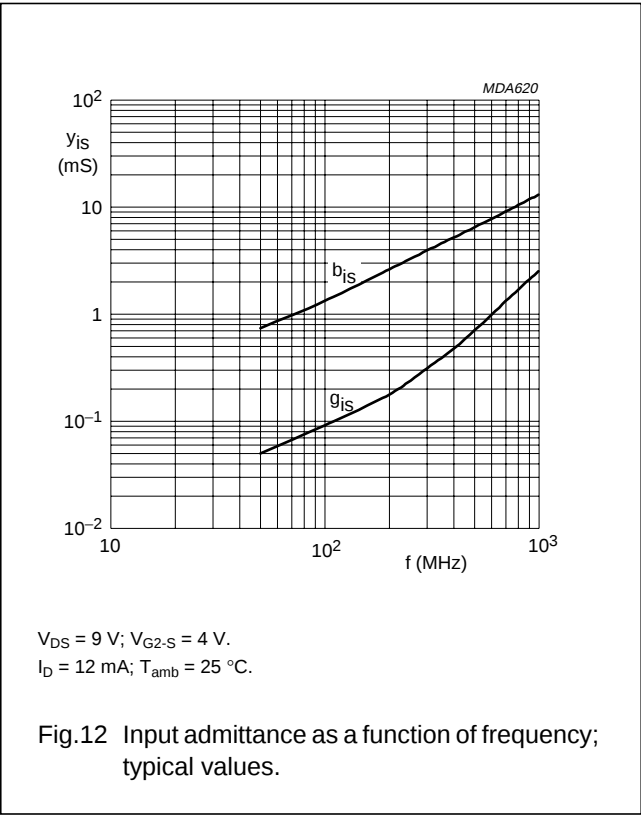


$V_{DS} = 9\text{ V}$; $V_{G2nom} = 4\text{ V}$; $I_{Dnom} = 12\text{ mA}$; $f_w = 50\text{ MHz}$;
 $f_{unw} = 60\text{ MHz}$; $T_{amb} = 25\text{ }^{\circ}\text{C}$.

Fig.11 Unwanted voltage for 1% cross-modulation as a function of gain reduction; typical values (see Fig.18).

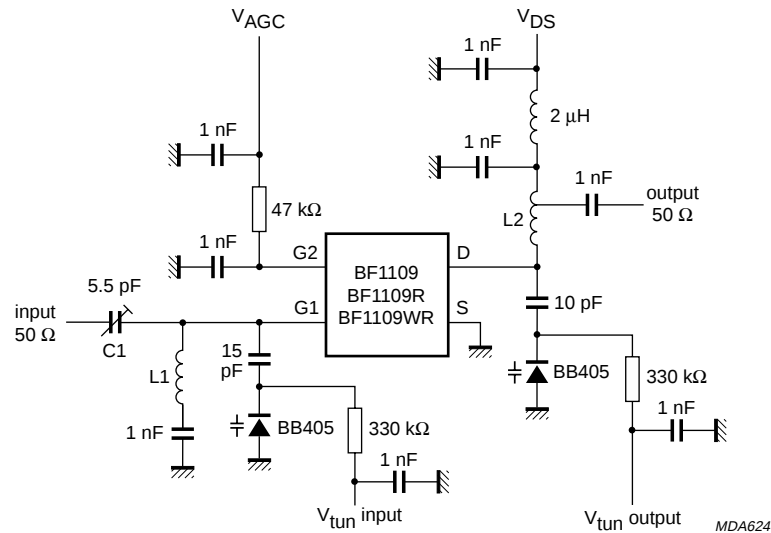
N-channel dual-gate MOS-FETs

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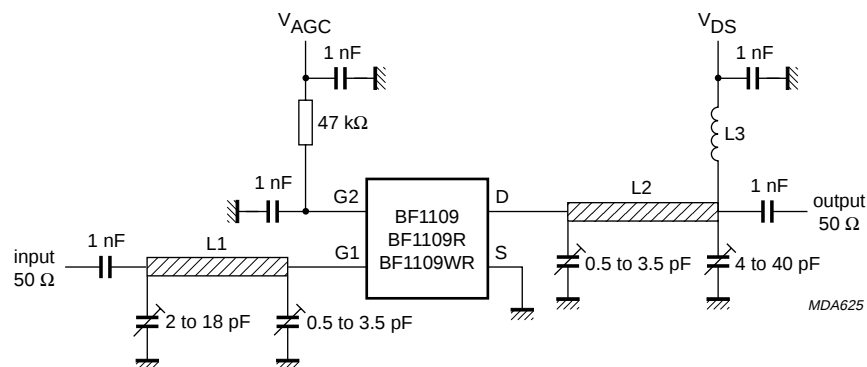
$V_{DS} = 9\text{ V}$, $G_S = 2\text{ mS}$, $G_L = 0.5\text{ mS}$, $f = 200\text{ MHz}$.

$L1 = 45\text{ nH}$, 4 turns, internal diameter = 4 mm, 0.8 mm copper wire.

$L2 = 160\text{ nH}$, 3 turns, internal diameter = 8 mm, 0.8 mm copper wire; tapped at approximately half a turn from the cold side, to set $G_L = 0.5\text{ mS}$.

$C1$ adjusted for $G_S = 2\text{ mS}$.

Fig.16 Gain test circuit.



$V_{DS} = 9\text{ V}$, $G_S = 3.3\text{ mS}$, $G_L = 1\text{ mS}$, $f = 800\text{ MHz}$.

$L1 = 2\text{ cm}$, silvered 0.8 mm copper wire 4 mm above ground plane.

$L2 = 2\text{ cm}$, silvered 0.8 mm copper wire 4 mm above ground plane.

$L3 = 11\text{ turns}$ 0.5 mm copper wire without spacing, internal diameter = 3 mm, $L = \text{approx. } 200\text{ nH}$.

Fig.17 Gain test circuit.

N-channel dual-gate MOS-FETs

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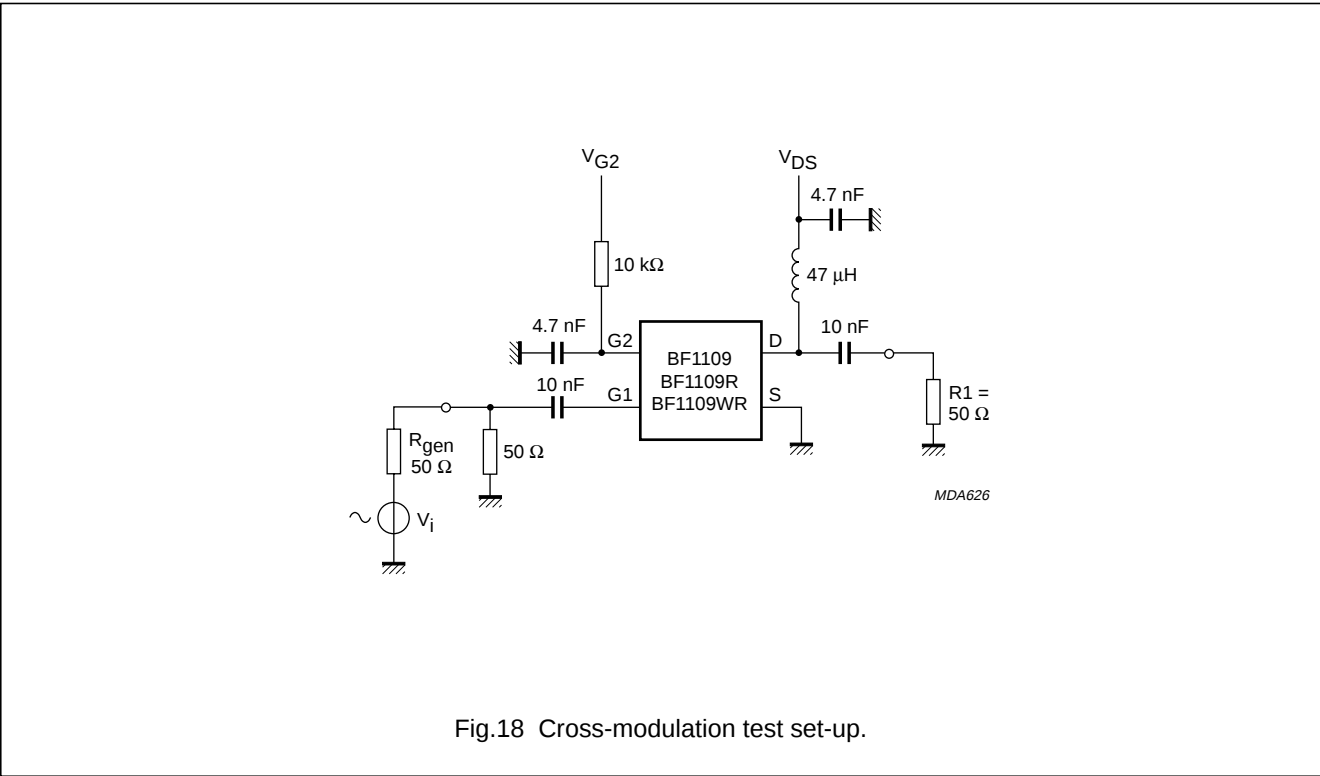


Fig.18 Cross-modulation test set-up.

Table 1 Scattering parameters: $V_{DS} = 9\text{ V}$; $V_{G2-S} = 4\text{ V}$; $I_D = 12\text{ mA}$

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	0.995	−3.71	3.013	175.0	0.000	88.2	0.998	−1.8
100	0.992	−7.29	3.002	170.2	0.001	83.7	0.997	−3.5
200	0.984	−14.3	2.967	160.7	0.002	86.2	0.995	−7.0
300	0.973	−21.2	2.922	151.3	0.002	83.2	0.992	−10.5
400	0.961	−27.9	2.869	142.0	0.003	84.1	0.990	−13.9
500	0.944	−34.4	2.793	132.9	0.003	85.7	0.987	−17.2
600	0.926	−40.8	2.730	124.1	0.003	88.4	0.985	−20.5
700	0.906	−46.9	2.660	115.3	0.003	94.6	0.983	−23.7
800	0.887	−52.9	2.605	106.5	0.004	107.2	0.981	−26.8
900	0.868	−58.8	2.527	97.8	0.004	114.9	0.977	−30.0
1000	0.852	−64.3	2.457	89.6	0.004	129.7	0.9377	−33.1

Table 2 Noise data: $V_{DS} = 9\text{ V}$; $V_{G2-S} = 4\text{ V}$; $I_D = 12\text{ mA}$

f (MHz)	F _{min} (dB)	Γ _{opt}		R _n (Ω)
		(ratio)	(deg)	
800	1.5	0.684	40.94	40.4

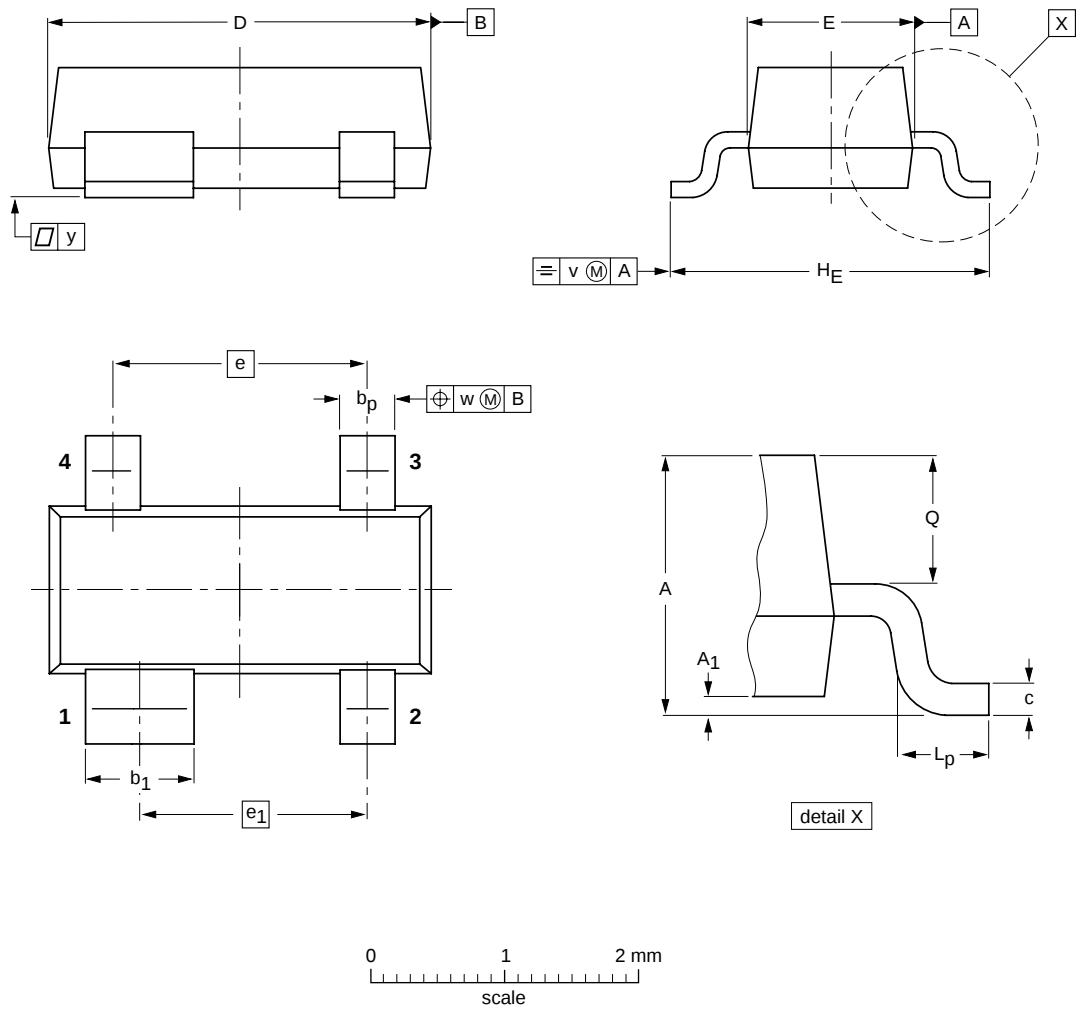
N-channel dual-gate MOS-FETs

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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

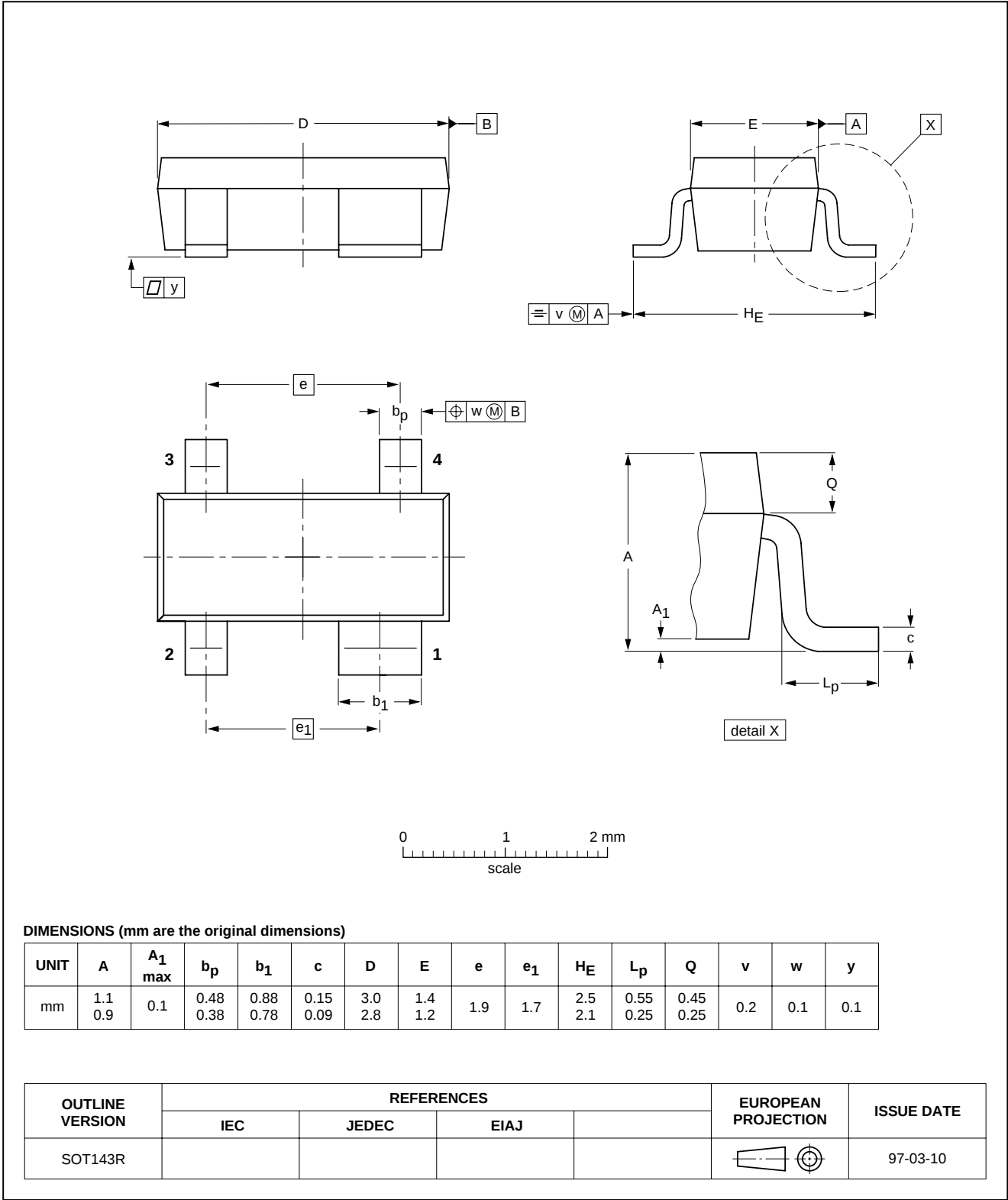
OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT143B						97-02-28

N-channel dual-gate MOS-FETs

BF1109; BF1109R; BF1109WR

Plastic surface mounted package; reverse pinning; 4 leads

SOT143R

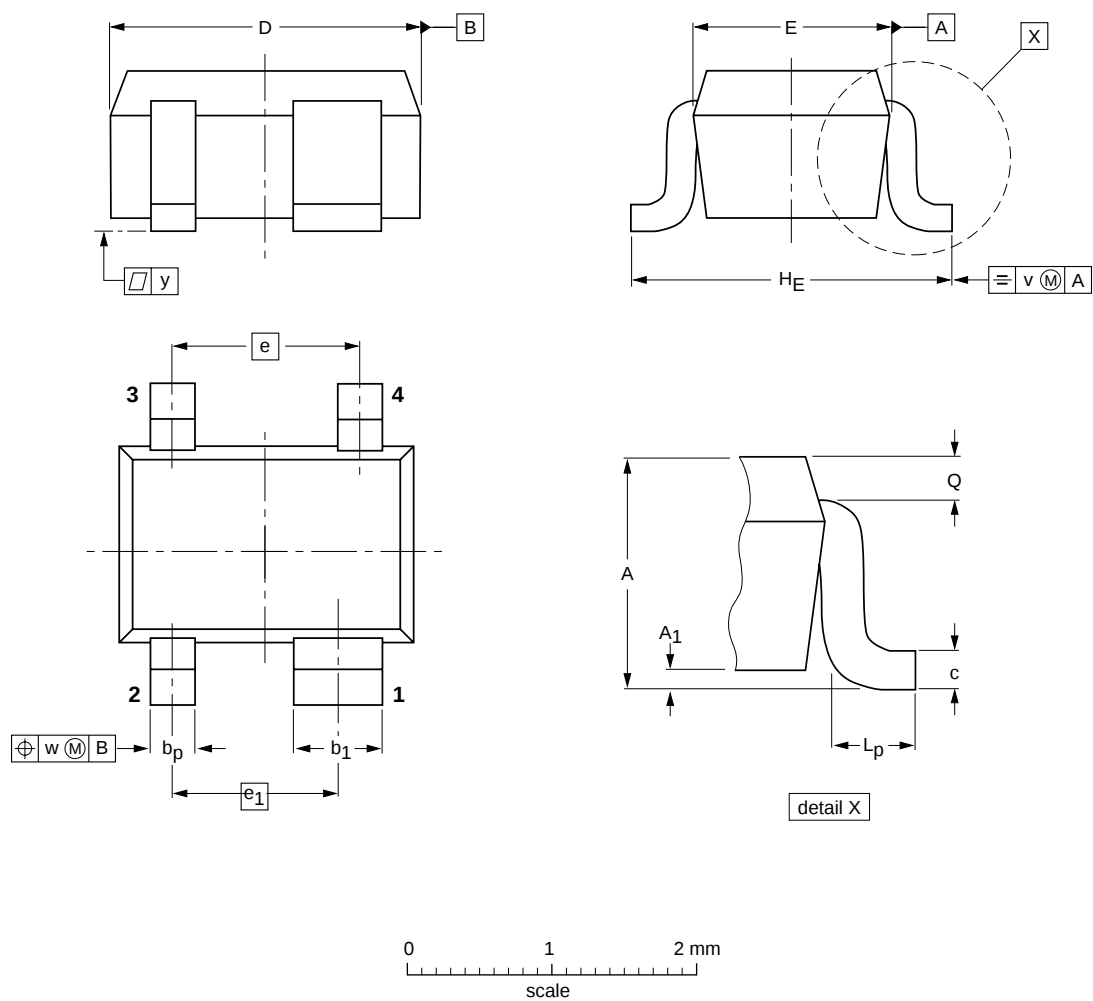


N-channel dual-gate MOS-FETs

BF1109; BF1109R; BF1109WR

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

BF1109; BF1109R; BF1109WR

DEFINITIONS

Data Sheet Status	
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.
Limiting values	
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.	
Application information	
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.

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NOTES

N-channel dual-gate MOS-FETs

BF1109; BF1109R; BF1109WR

NOTES

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v.2.0, 1997-12-08
Pages, 115kB[Download datasheet](#)[Download all documentation](#)**N-channel dual-gate MOS-FETs**[General description](#)[Features and benefits](#)[Applications](#)[Quick reference](#)[Parameters/similar products](#)[Block diagrams/pinning](#)[Pricing/ordering/availability](#)[Samples](#)[Products/packages](#)[Quality/reliability/chemical](#)[content](#)[Design support](#)[Print/email](#)[Disclaimers](#)

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General description[Hide](#)

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 BF1109, BF1109R and BF1109WR are encapsulated in the SOT143B, SOT143R and SOT343R plastic packages respectively.

[Back to top](#)**Features and benefits**[Hide](#)

Short channel transistor with high forward transfer admittance to input capacitance ratio

Low noise gain controlled amplifier up to 1 GHz

Internal self-biasing circuit to ensure good cross-modulation performance during AGC and good DC stabilization.

[Back to top](#)**Applications**[Hide](#)

VHF and UHF applications with 9 V supply voltage, such as television tuners and professional communications equipment.

[Back to top](#)**Parameters/similar products**[Hide](#)

Type number	Package	YFS MIN(mS)	I _D (mA)	Note	NOISE FIGURE MAX(dB)	REMARKS	V _{DS} (V)	□ V(P)GS MAX(V)	C _{IS} TYP(pF)	I _{DSS} MIN - MAX(mA)	COS TYP(pF)
BF1109	SOT143B (SOT4)	24	30	Fully internal bias	1.5@800MHz	VHF and UHF	11	1	2.2	8 to 16	1.3
BF1109R	SOT143R (SC-61B)	24	30	Fully internal bias	1.5@800MHz	VHF and UHF	11	1	2.2	8 to 16	1.3
BF1109WR	SOT343R (CMPAK-4)	24	30	Fully internal bias	1.5@800MHz	VHF and UHF	11	1	2.2	8 to 16	1.3

Similar products

BF1109_R_WR links to the similar products page containing an overview of products that are similar in function or related to the type number(s) as listed on this page. The similar products page includes products from the same catalog tree(s), relevant selection guides and products from the same functional category.

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Type number	Ordering code (12NC)	Orderable part number	Region	Distributor	In stock	Order quantity	Inventory date	Buy online	Samples
BF1109	9340 541 40215	BF1109,215	JAPAN	CHIP ONE STOP	no		08/27/2010	Buy online	Order samples
BF1109R	9340 502 90215	BF1109R,215	JAPAN	CHIP ONE STOP	no		08/27/2010	Buy online	Order samples
BF1109WR	9340 502 80115	BF1109WR,115	NA	MOUSER ELECTRONICS	3,000		11/12/2010	Buy online	Order samples
			NA	MOUSER ELECTRONICS	3,000		11/12/2010	Buy online	
			NA	AVNET ELECTRONICS MARKETING	250		11/12/2010	Buy online	
			JAPAN	CHIP ONE STOP	yes		08/27/2010	Buy online	

[Back to top](#)**Products/packages**[Hide](#)

Type number	Orderable part number	Ordering code (12NC)	Product status	Package	Packing	Marking	ECCN
BF1109	BF1109,215	9340 541 40215	Volume production	SOT143B (SOT4)	Tape reel smd	Standard Marking	
BF1109R	BF1109R,215	9340 502 90215	Volume production	SOT143R (SC-61B)	Tape reel smd	Standard Marking	
BF1109WR	BF1109WR,115	9340 502 80115	Volume production	SOT343R (CMPAK-4)	Tape reel smd	Standard Marking	

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Type number	Orderable part number	Chemical content	RoHS	Leadfree conversion date	RHF	IFR (FIT)	MTBF (hours)	MSL
BF1109	BF1109,215	BF1109	EU/CH RoHS COMPLIANT RoHS	week 47, 2002	D			NA
BF1109R	BF1109R,215	BF1109R	EU/CH RoHS COMPLIANT RoHS	week 47, 2002	D			NA
BF1109WR	BF1109WR,115	BF1109WR	EU/CH RoHS COMPLIANT RoHS	week 52, 2002	D			NA

Quality and reliability disclaimer

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Design support

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Selection guide

RF Manual 14th edition; Application and design manual for High Performance RF products (v.14.0, 2010-05-01)

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