

DATA SHEET

BF1105; BF1105R; BF1105WR N-channel dual-gate MOS-FETs

Product specification
Supersedes data of 1997 Dec 01

1997 Dec 02



N-channel dual-gate MOS-FETs

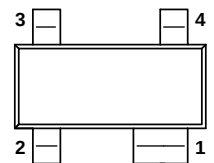
BF1105; BF1105R; BF1105WR

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.

PINNING

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



Top view MSB035

BF1105R marking code: NAp.

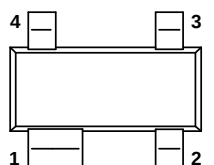
Fig.2 Simplified outline (SOT143R).

APPLICATIONS

- VHF and UHF applications with 5 V supply voltage, such as television tuners and professional communications equipment.

DESCRIPTION

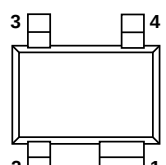
Enhancement type N-channel field-effect transistor with source and substrate interconnected. Integrated diodes between gates and source protect against excessive input voltage surges. The BF1105, BF1105R and BF1105WR are encapsulated in the SOT143B, SOT143R and SOT343R plastic packages respectively.



Top view MSB014

BF1105 marking code: NEp.

Fig.1 Simplified outline (SOT143B).



Top view MSB842

BF1105WR marking code: NA.

Fig.3 Simplified outline (SOT343R).

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{DS}	drain-source voltage		–	–	7	V
I_D	drain current		–	–	30	mA
P_{tot}	total power dissipation	$T_{amb} \leq 80^\circ\text{C}$	–	–	200	mW
$ y_{fs} $	forward transfer admittance		25	31	–	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	$f = 800\text{ MHz}$	–	1.7	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.

N-channel dual-gate MOS-FETs

BF1105; BF1105R; BF1105WR

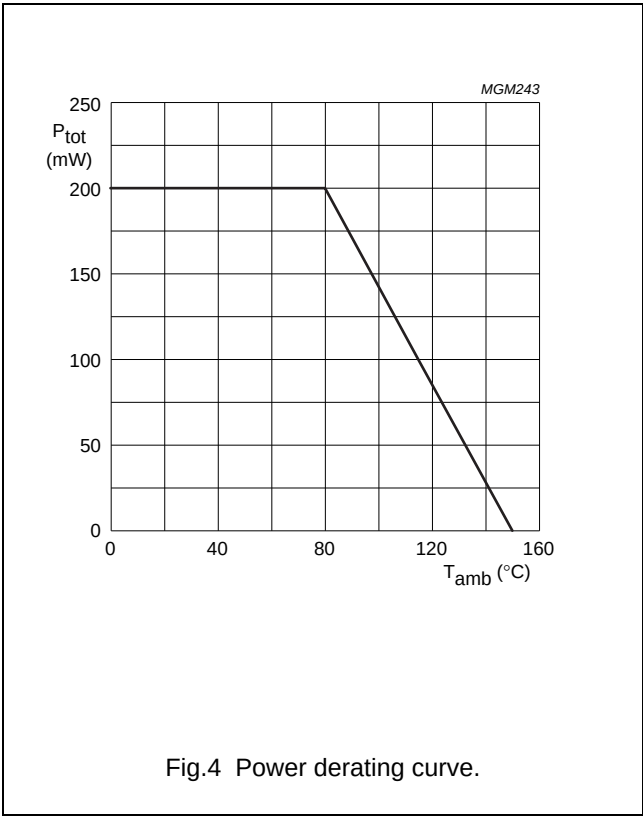
LIMITING VALUES

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		–	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; see Fig.4	–	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.



N-channel dual-gate MOS-FETs

BF1105; BF1105R; BF1105WR

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

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{(BR)DS}$	drain-source breakdown voltage	$V_{G1-S} = V_{G2-S} = 0$; $I_D = 10\ \mu\text{A}$	7	–	–	V
$V_{(BR)G1-SS}$	gate 1-source breakdown voltage	$V_{G2-S} = 0$; $I_D = 0$; $I_{G1-S} = 10\ \mu\text{A}$	7	–	–	V
$V_{(BR)G2-SS}$	gate 2-source breakdown voltage	$V_{G1-S} = V_{DS} = 0$; $I_{G2-S} = 10\ \mu\text{A}$	7	–	–	V
$V_{G2-S(th)}$	gate 2-source threshold voltage	$V_{G1-S} = 5\ \text{V}$; $V_{DS} = 5\ \text{V}$; $I_D = 20\ \mu\text{A}$	0.3	0.8	1.2	V
I_{DSX}	self-biasing drain current	$V_{G2-S} = 4\ \text{V}$; $V_{DS} = 5\ \text{V}$	8	–	16	mA
I_{G1-SS}	gate 1 cut-off current	$V_{G1-S} = 5\ \text{V}$; $V_{G2-S} = 0$; $I_D = 0$	–	–	50	nA
I_{G2-SS}	gate 2 cut-off current	$V_{G1-S} = V_{DS} = 0$; $V_{G2-S} = 4\ \text{V}$	–	–	20	nA

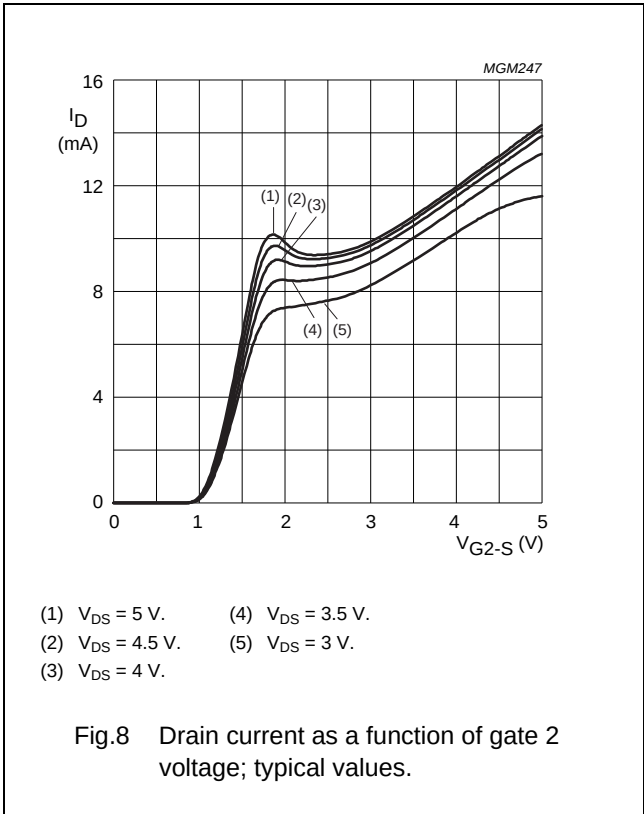
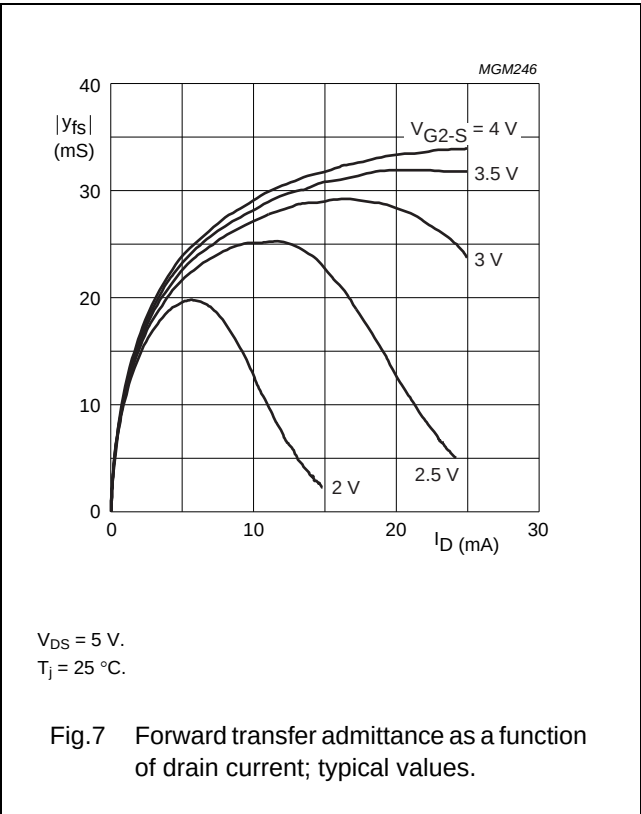
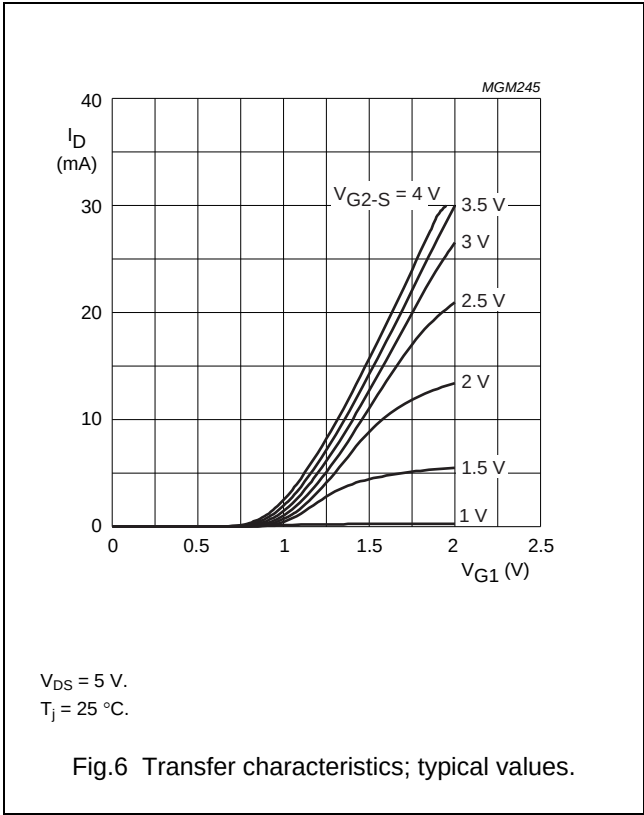
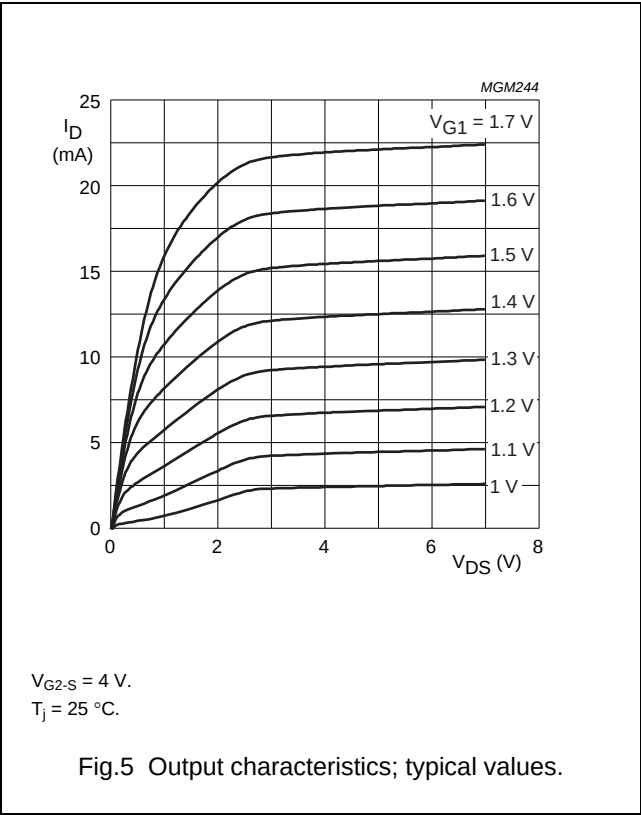
DYNAMIC CHARACTERISTICS

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$ y_{fs} $	forward transfer admittance	pulsed; $T_j = 25\ ^\circ\text{C}$	25	31	–	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	$f = 1\ \text{MHz}$	–	1.6	–	pF
C_{oss}	output capacitance	$f = 1\ \text{MHz}$	–	1.2	–	pF
C_{rss}	reverse transfer capacitance	$f = 1\ \text{MHz}$	–	25	40	fF
F	noise figure	$f = 800\ \text{MHz}$; $Y_S = Y_{S\ opt}$	–	1.7	2.5	dB
G_p	power gain	$G_S = 2\ \text{mS}$; $B_S = B_{S\ opt}$; $G_L = 0.5\ \text{mS}$; $B_L = B_{L\ opt}$; $f = 200\ \text{MHz}$; see Fig.16	–	38	–	dB
		$G_S = 3.3\ \text{mS}$; $B_S = B_{S\ opt}$; $G_L = 1\ \text{mS}$; $B_L = B_{L\ opt}$; $f = 800\ \text{MHz}$; 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 μV
		input level for $k = 1\%$ at 40 dB AGC; $f_w = 50\ \text{MHz}$; $f_{unw} = 60\ \text{MHz}$; see Fig.18	100	–	–	dB μV

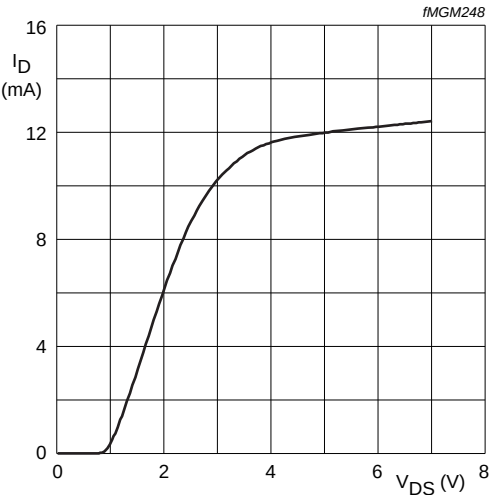
N-channel dual-gate MOS-FETs

BF1105; BF1105R; BF1105WR



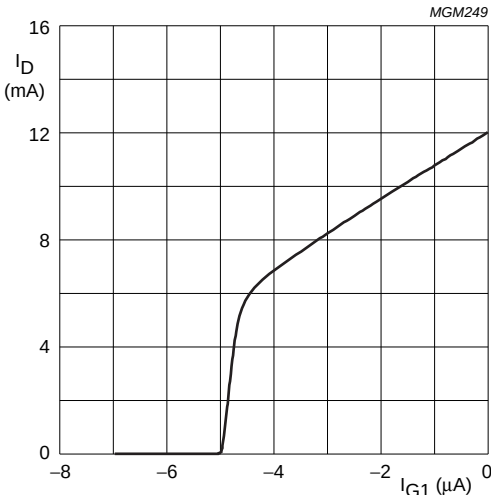
N-channel dual-gate MOS-FETs

BF1105; BF1105R; BF1105WR



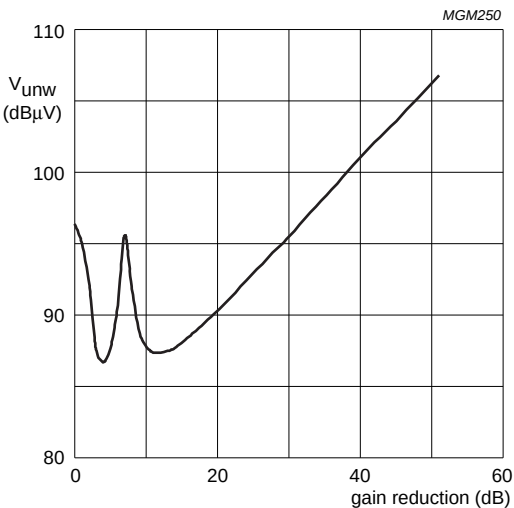
$V_{G2-S} = 4\text{ V}$.
 $T_J = 25\text{ }^{\circ}\text{C}$.

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



$V_{DS} = 5\text{ V}$; $V_{G2-S} = 4\text{ V}$; $T_J = 25\text{ }^{\circ}\text{C}$.

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

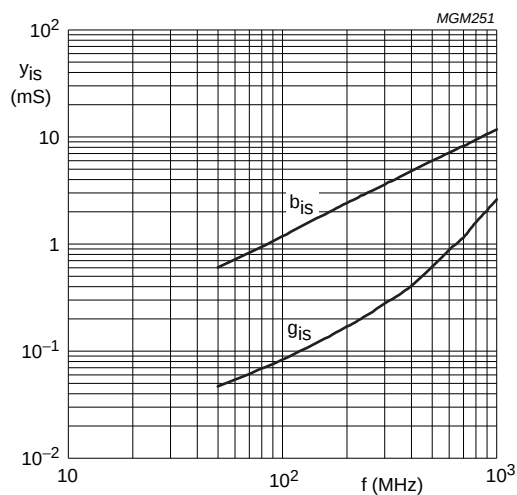


$V_{DS} = 5\text{ V}$; $V_{G2nom} = 4\text{ V}$; $I_{Dnom} = I_{self\text{ bias}}$; $f_w = 50\text{ MHz}$;
 $f_{unw} = 60\text{ MHz}$; $T_{amb} = 25\text{ }^{\circ}\text{C}$.

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

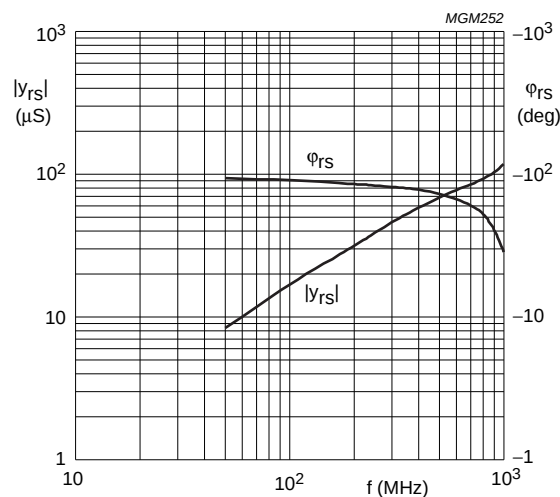
N-channel dual-gate MOS-FETs

BF1105; BF1105R; BF1105WR



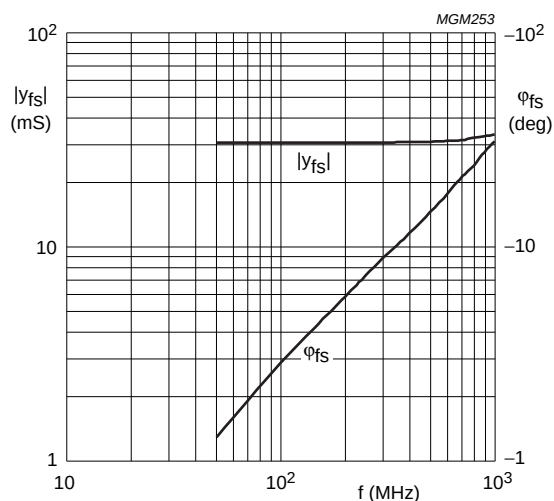
$V_{DS} = 5 \text{ V}$; $V_{G2-S} = 4 \text{ V}$.
 $I_D = 12 \text{ mA}$; $T_{amb} = 25 \text{ }^{\circ}\text{C}$.

Fig.12 Input admittance as a function of frequency; typical values.



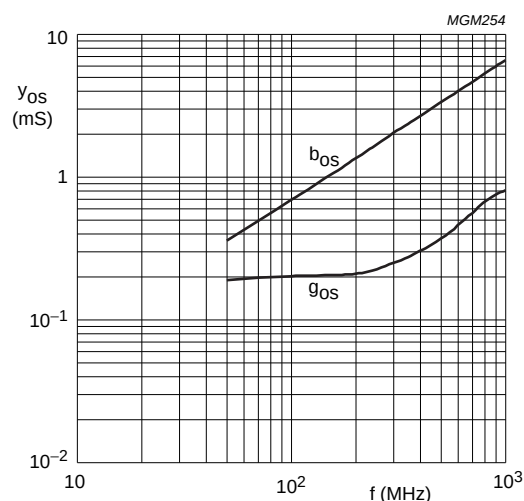
$V_{DS} = 5 \text{ V}$; $V_{G2-S} = 4 \text{ V}$.
 $I_D = 12 \text{ mA}$; $T_{amb} = 25 \text{ }^{\circ}\text{C}$.

Fig.13 Reverse transfer admittance and phase as a function of frequency; typical values.



$V_{DS} = 5 \text{ V}$; $V_{G2-S} = 4 \text{ V}$.
 $I_D = 12 \text{ mA}$; $T_{amb} = 25 \text{ }^{\circ}\text{C}$.

Fig.14 Forward transfer admittance and phase as a function of frequency; typical values.

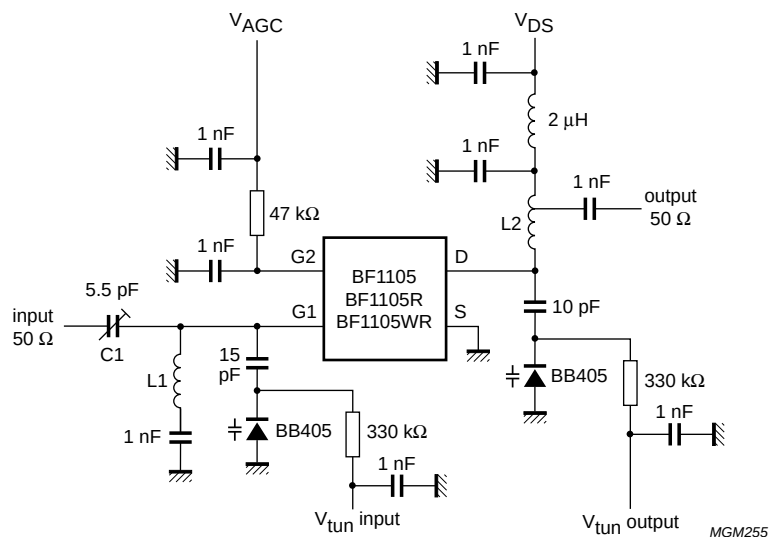


$V_{DS} = 5 \text{ V}$; $V_{G2-S} = 4 \text{ V}$.
 $I_D = 12 \text{ mA}$; $T_{amb} = 25 \text{ }^{\circ}\text{C}$.

Fig.15 Output admittance as a function of frequency; typical values.

N-channel dual-gate MOS-FETs

BF1105; BF1105R; BF1105WR



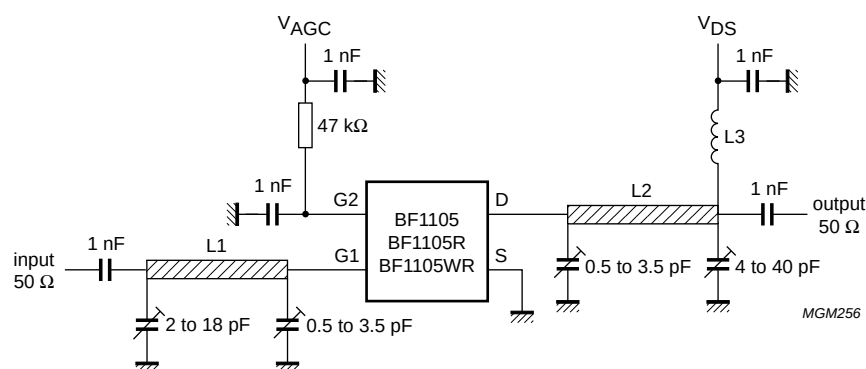
$V_{DS} = 5\text{ V}$, $G_S = 2\text{ mS}$, $G_L = 0.5\text{ mS}$, $f = 200\text{ MHz}$.

$L1 = 45\text{ nH}$, 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.



$V_{DS} = 5\text{ V}$, $G_S = 3.3\text{ mS}$, $G_L = 1\text{ mS}$, $f = 800\text{ MHz}$.

$L1 = 2\text{ cm}$, 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

BF1105; BF1105R; BF1105WR

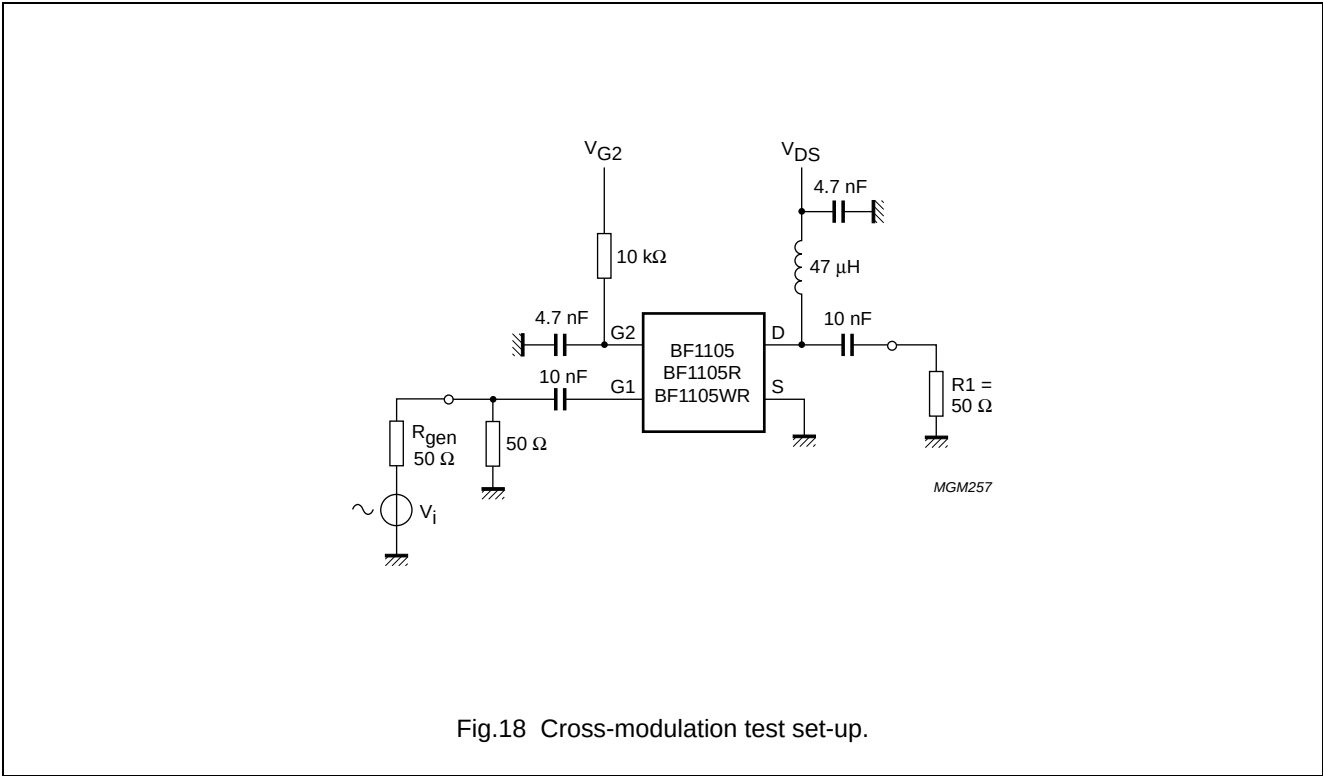


Table 1 Scattering parameters: $V_{DS} = 5\text{ V}$; $V_{G2-S} = 4\text{ V}$; $I_D = 12\text{ mA}$

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	0.994	−3.8	3.060	175.4	0.000	86.9	0.985	−2.1
100	0.991	−7.5	3.047	170.9	0.002	86.1	0.983	−4.2
200	0.982	−14.7	3.004	162.1	0.003	82.7	0.980	−8.3
300	0.968	−21.7	2.932	153.4	0.004	79.7	0.976	−12.1
400	0.956	−28.8	2.896	145.3	0.006	77.8	0.972	−16.2
500	0.937	−35.4	2.815	137.1	0.007	76.7	0.967	−20.0
600	0.918	−41.8	2.735	129.2	0.007	76.3	0.961	−23.7
700	0.897	−48.1	2.651	121.5	0.008	76.7	0.955	−27.3
800	0.878	−54.0	2.575	114.0	0.008	79.7	0.948	−30.9
900	0.858	−59.9	2.482	106.5	0.008	82.2	0.941	−34.4
1000	0.840	−65.5	2.396	99.5	0.008	88.0	0.935	−37.9

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

f (MHz)	F _{min} (dB)	Γ_{opt}		R _n (Ω)
		(ratio)	(deg)	
800	1.5	0.674	39.7	37.15

N-channel dual-gate MOS-FETs

BF1105; BF1105R; BF1105WR

PACKAGE OUTLINES

Plastic surface-mounted package; 4 leads

SOT143B

0 1 2 mm
scale

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	JEITA			
SOT143B						04-11-16 06-03-16

N-channel dual-gate MOS-FETs

BF1105; BF1105R; BF1105WR

Plastic surface-mounted package; reverse pinning; 4 leads

SOT143R

The technical drawing includes four views of the SOT143R package: a top view showing dimensions D, B, and y; a side view showing dimensions E, A, H_E, and a detail callout X; a bottom view showing dimensions e, b_p, w, B, 3, 4, 2, 1, b₁, and e₁; and a detail view of the lead showing dimensions A, Q, A₁, L_p, and c. A scale bar indicates 0 to 2 mm.

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

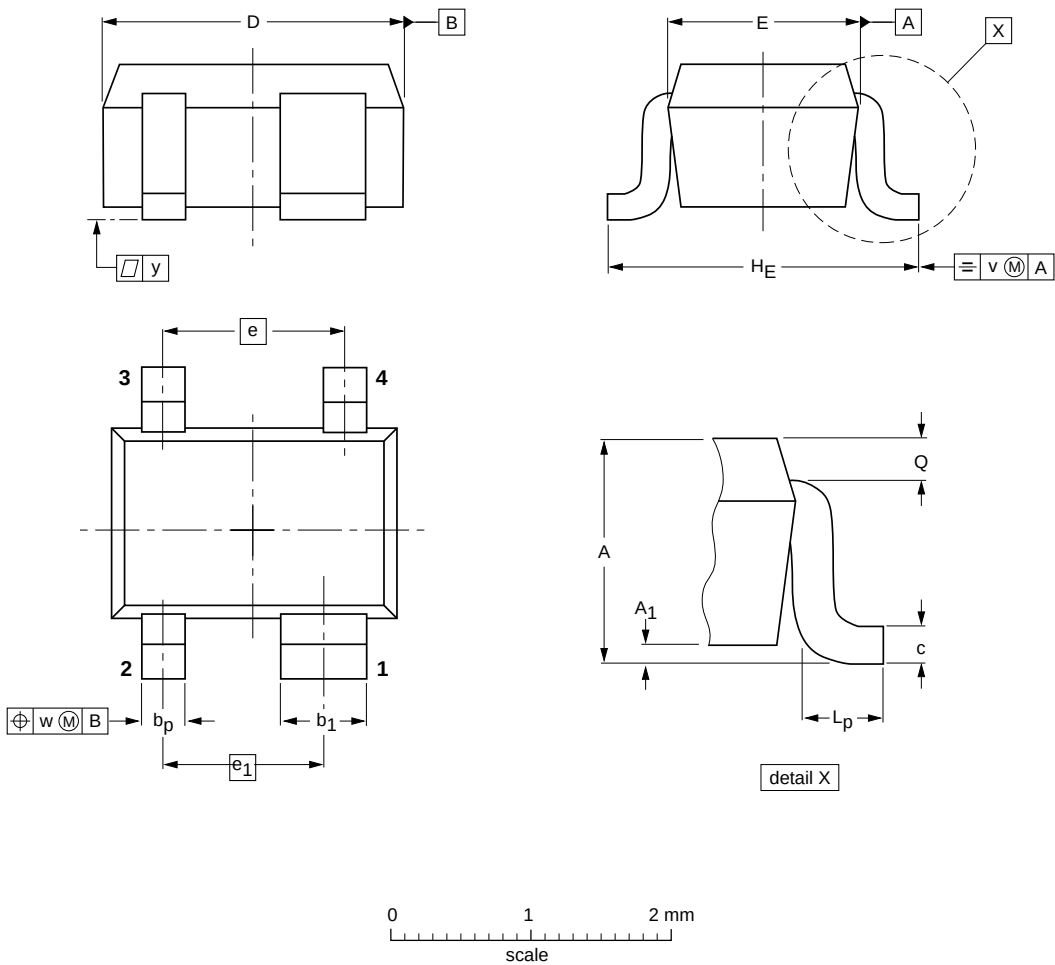
OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT143R			SC-61AA			04-11-16 06-03-16

N-channel dual-gate MOS-FETs

BF1105; BF1105R; BF1105WR

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 06-03-16

N-channel dual-gate MOS-FETs

BF1105; BF1105R; BF1105WR

DATA SHEET STATUS

DOCUMENT STATUS ⁽¹⁾	PRODUCT STATUS ⁽²⁾	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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1. Please consult the most recently issued document before initiating or completing a design.
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N-channel dual-gate MOS-FETs

BF1105; BF1105R; BF1105WR

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Contact information

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

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