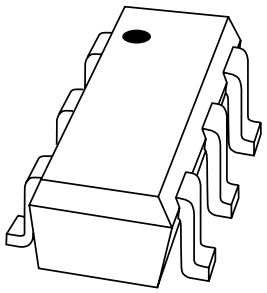
DATA SHEET



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

Product specification
Supersedes data of 1999 Jul 01

2000 Apr 11

Philips Semiconductors

PHILIPS

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

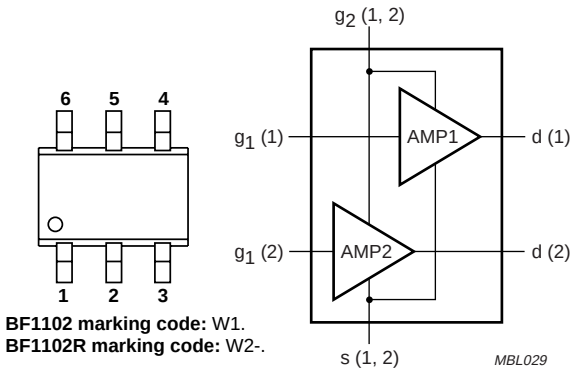
Gain controlled low noise amplifier for VHF and UHF applications such as television tuners and professional communications equipment.

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)



BF1102 marking code: W1.
BF1102R marking code: W2-.

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	$T_s \leq 102$ °C; note 1	–	–	200	mW
$\lvert y_{fs} \rvert$	forward transfer admittance	I_D = 15 mA	36	43	–	mS
$C_{ig1\text{-}s}$	input capacitance at gate 1	I_D = 15 mA	–	2.8	3.6	pF
C_{rss}	reverse transfer capacitance	f = 1 MHz	–	30	50	fF
F	noise figure	f = 800 MHz	–	2	2.8	dB
X_{mod}	cross-modulation	input level for k = 1% at 40 dB AGC	100	–	–	dBµV
T_j	operating junction temperature		–	–	150	°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. For further information, refer to Philips specs.: SNW-EQ-608, SNW-FQ-302A and SNW-FQ-302B.

LIMITING VALUES

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

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

THERMAL CHARACTERISTICS

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

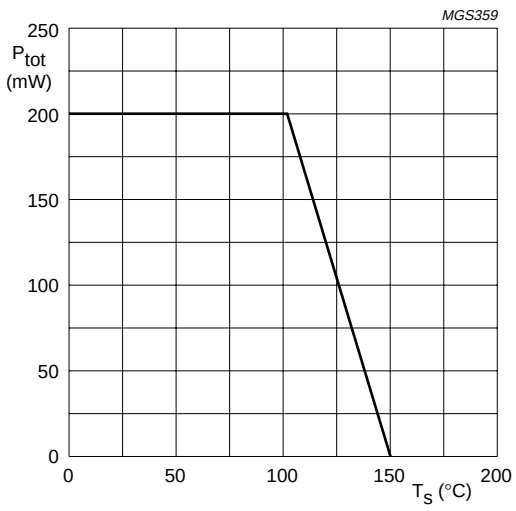


Fig.2 Power derating curve.

STATIC CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
Per MOS-FET unless otherwise specified					
$V_{(BR)DSS}$	drain-source breakdown voltage	$V_{G1-S} = V_{G2-S} = 0$; I_D = 10 μA	7	–	V
$V_{(BR)G1-SS}$	gate 1-source breakdown voltage	$V_{GS} = V_{DS} = 0$; I_{G1-S} = 10 mA	6	15	V
$V_{(BR)G2-SS}$	gate 2-source breakdown voltage	$V_{GS} = V_{DS} = 0$; I_{G2-S} = 5 mA	6	15	V
$V_{(F)S-G1}$	forward source-gate 1 voltage	$V_{G2-S} = V_{DS} = 0$; I_{S-G1} = 10 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 mA	0.5	1.5	V
$V_{G1-S(th)}$	gate 1-source threshold voltage	V_{DS} = 5 V; V_{G2-S} = 4 V; I_D = 100 μA	0.3	1	V
$V_{G2-S(th)}$	gate 2-source threshold voltage	V_{DS} = 5 V; V_{G1-S} = 4 V; I_D = 100 μA	0.3	1.2	V
I_{DSX}	drain-source current	V_{G2-S} = 4 V; V_{DS} = 5 V; R_G = 120 kΩ; note 1	12	20	mA
I_{G1-S}	gate 1 cut-off current	V_{G1-S} = 5 V; $V_{G2-S} = V_{DS} = 0$	–	50	nA
I_{G2-S}	gate 2 cut-off current	V_{G2-S} = 5 V; $V_{G1-S} = V_{DS} = 0$	–	20	nA

Note

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

DYNAMIC CHARACTERISTICS

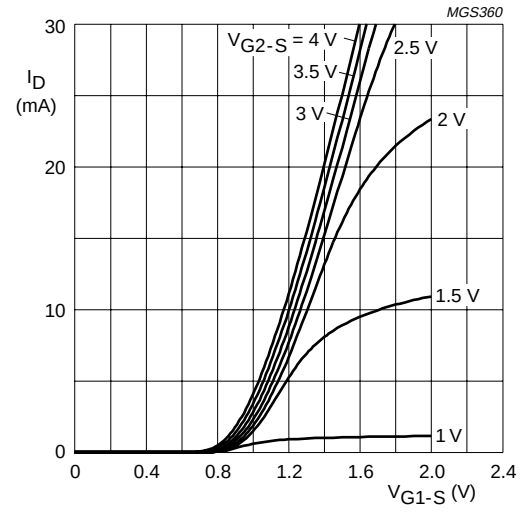
Common source; T_{amb} = 25 °C; V_{G2-S} = 4 V; V_{DS} = 5 V; I_D = 15 mA; unless otherwise specified.

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

Notes

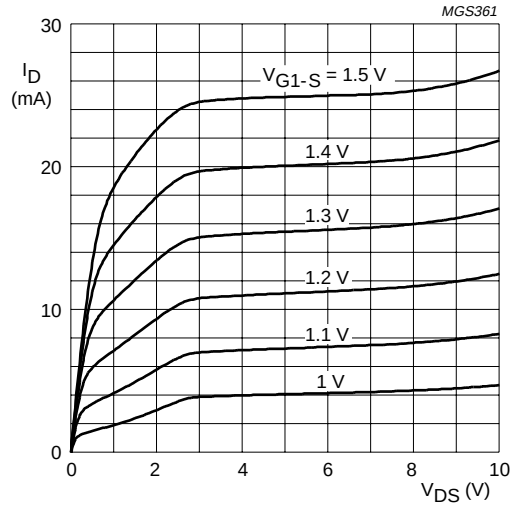
1. Not used MOS-FET: $V_{G1-S} = 0$; $V_{DS} = 0$.
2. Gate 2 capacitance of both MOS-FETs.
3. Measured in test circuit of Fig.20.

ALL GRAPHS FOR ONE MOS-FET



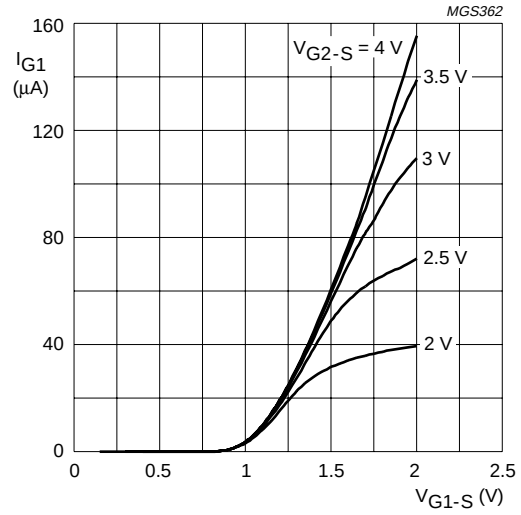
V_{DS} = 5 V.
T_j = 25 °C.

Fig.3 Transfer characteristics; typical values.



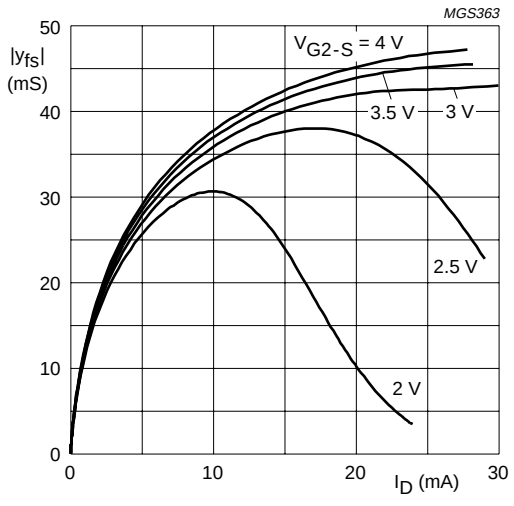
V_{G2-S} = 4 V.
T_j = 25 °C.

Fig.4 Output characteristics; typical values.



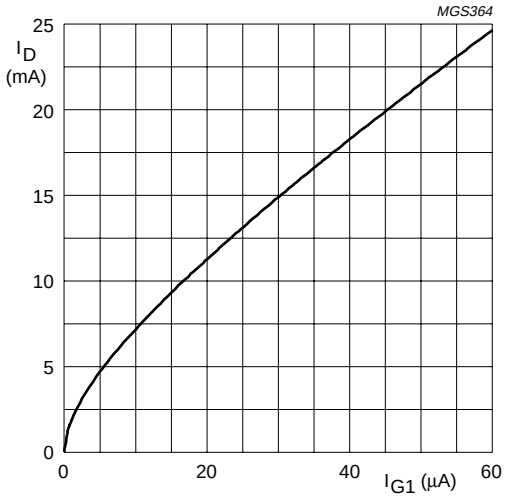
V_{DS} = 5 V.
T_j = 25 °C.

Fig.5 Gate 1 current as a function of gate 1 voltage; typical values.



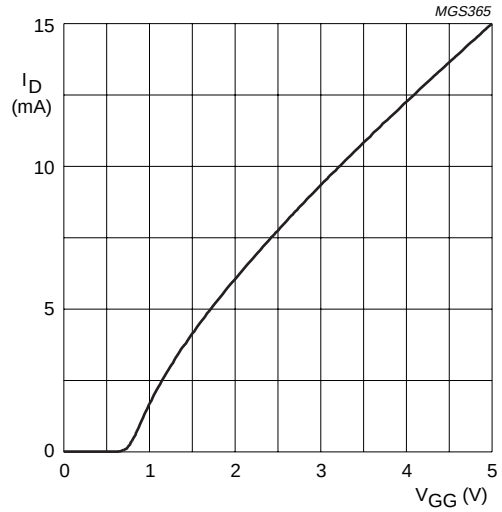
V_{DS} = 5 V.
T_j = 25 °C.

Fig.6 Forward transfer admittance as a function of drain current; typical values.



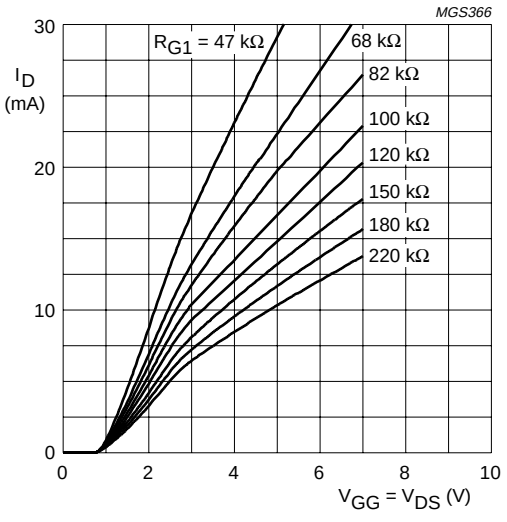
V_{DS} = 5 V; $V_{G2\text{-}S}$ = 4 V; T_j = 25 °C.

Fig.7 Drain current as a function of gate 1 current; typical values.



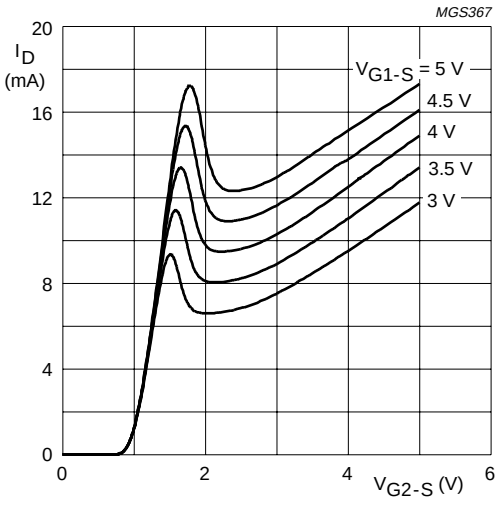
V_{DS} = 5 V; $V_{G2\text{-}S}$ = 4 V; T_j = 25 °C.
R_{G1} = 120 kΩ (connected to V_{GG}); see Fig.20.

Fig.8 Drain current as a function of gate 1 supply voltage (= V_{GG}); typical values.



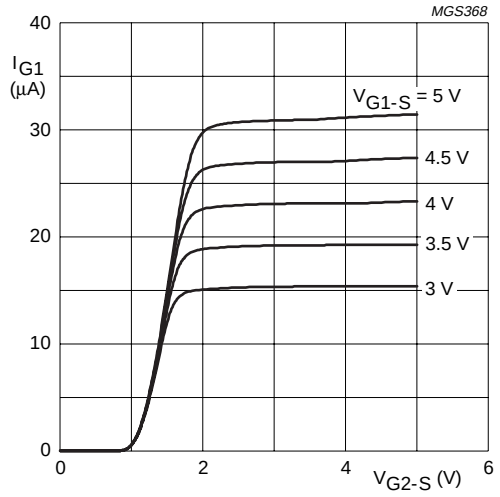
$V_{G2\text{-}S}$ = 4 V; T_j = 25 °C.
R_{G1} connected to V_{GG}; see Fig.20.

Fig.9 Drain current as a function of gate 1 (= V_{GG}) and drain supply voltage; typical values.



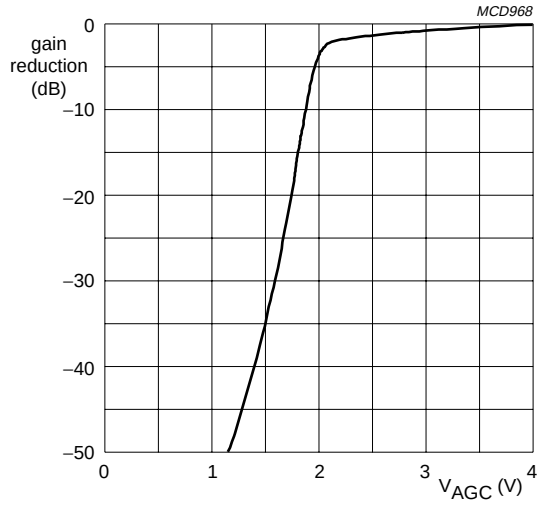
V_{DS} = 5 V; T_j = 25 °C.
R_{G1} = 120 kΩ (connected to V_{GG}); see Fig.20.

Fig.10 Drain current as a function of gate 2 voltage; typical values.



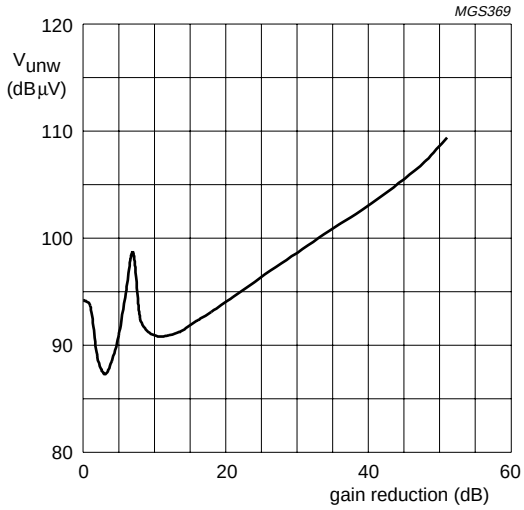
V_{DS} = 5 V; T_j = 25 °C.
R_{G1} = 120 kΩ (connected to V_{GG}); see Fig.20.

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



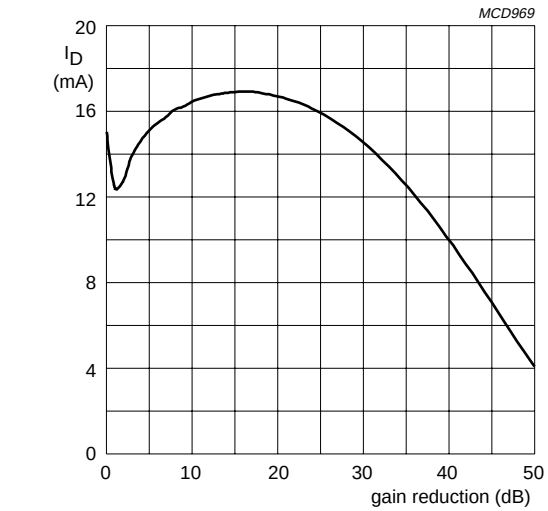
V_{DS} = 5 V; V_{GG} = 5 V; f = 50 MHz; T_{amb} = 25 °C;
R_{G1} = 120 kΩ (connected to V_{GG}); see Fig.20.

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



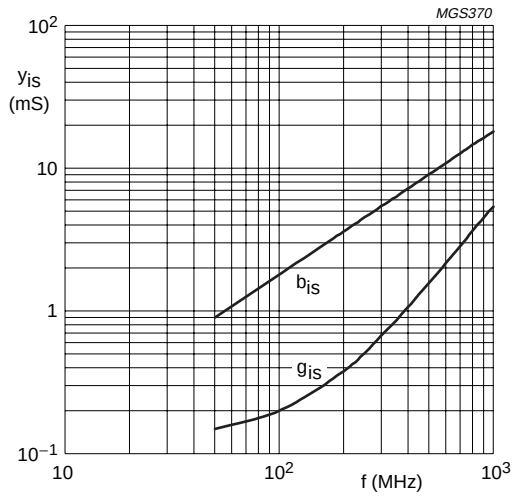
V_{DS} = 5 V; V_{GG} = 5 V; f_w = 50 MHz; f_{unw} = 60 MHz; T_{amb} = 25 °C;
R_{G1} = 120 kΩ (connected to V_{GG}); see Fig.20.

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



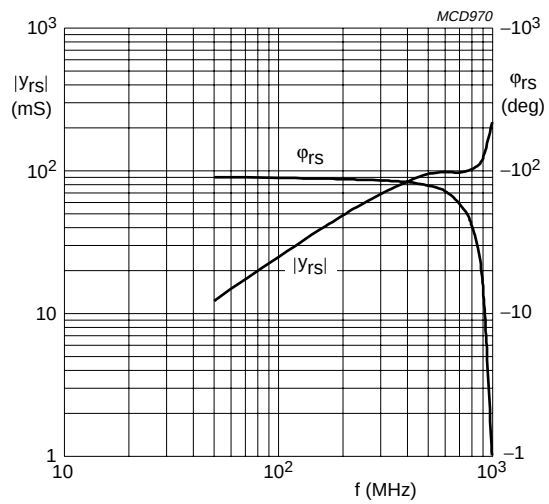
V_{DS} = 5 V; V_{GG} = 5 V; f = 50 MHz; T_{amb} = 25 °C;
R_{G1} = 120 kΩ (connected to V_{GG}); see Fig.20.

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



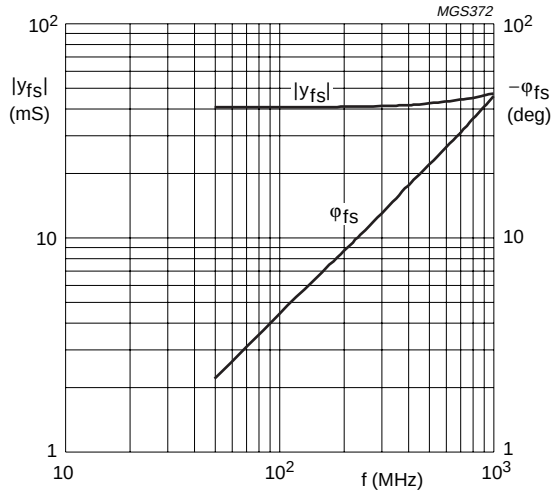
V_{DS} = 5 V; V_{G2} = 4 V.
I_D = 15 mA; T_{amb} = 25 °C.

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



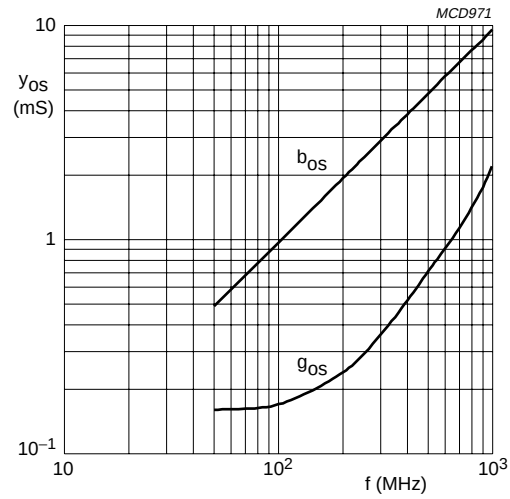
V_{DS} = 5 V; V_{G2} = 4 V.
I_D = 15 mA; T_{amb} = 25 °C.

Fig.16 Reverse transfer admittance and phase as a function of frequency; typical values.



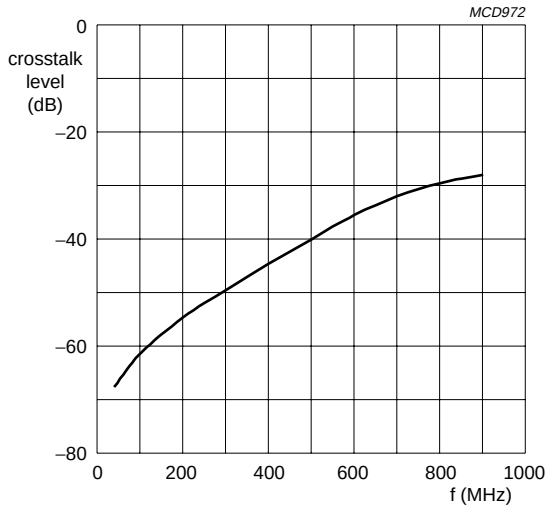
V_{DS} = 5 V; V_{G2} = 4 V.
I_D = 15 mA; T_{amb} = 25 °C.

Fig.17 Forward transfer admittance and phase as a function of frequency; typical values.



V_{DS} = 5 V; V_{G2} = 4 V.
I_D = 15 mA; T_{amb} = 25 °C.

Fig.18 Output admittance as a function of frequency; typical values.



Active amplifier: V_{DS} = 5 V; V_{G2} = 4 V; I_D = 15 mA.
Non-active amplifier: V_{DS} = V_{G1-S} = 0 V.
Source and load impedances: 50 Ω (both amplifiers).
T_{amb} = 25 °C.

Fig.19 Crosstalk as a function of frequency: Output level of non-active amplifier related to output level of active amplifier; typical values.

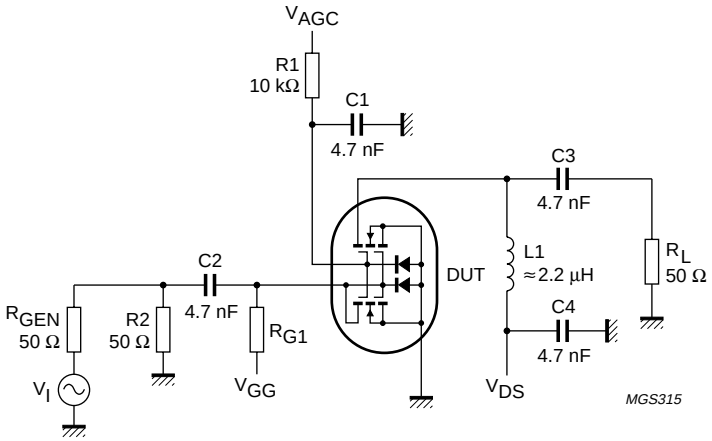


Fig.20 Cross-modulation test set-up (for one MOS-FET).

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

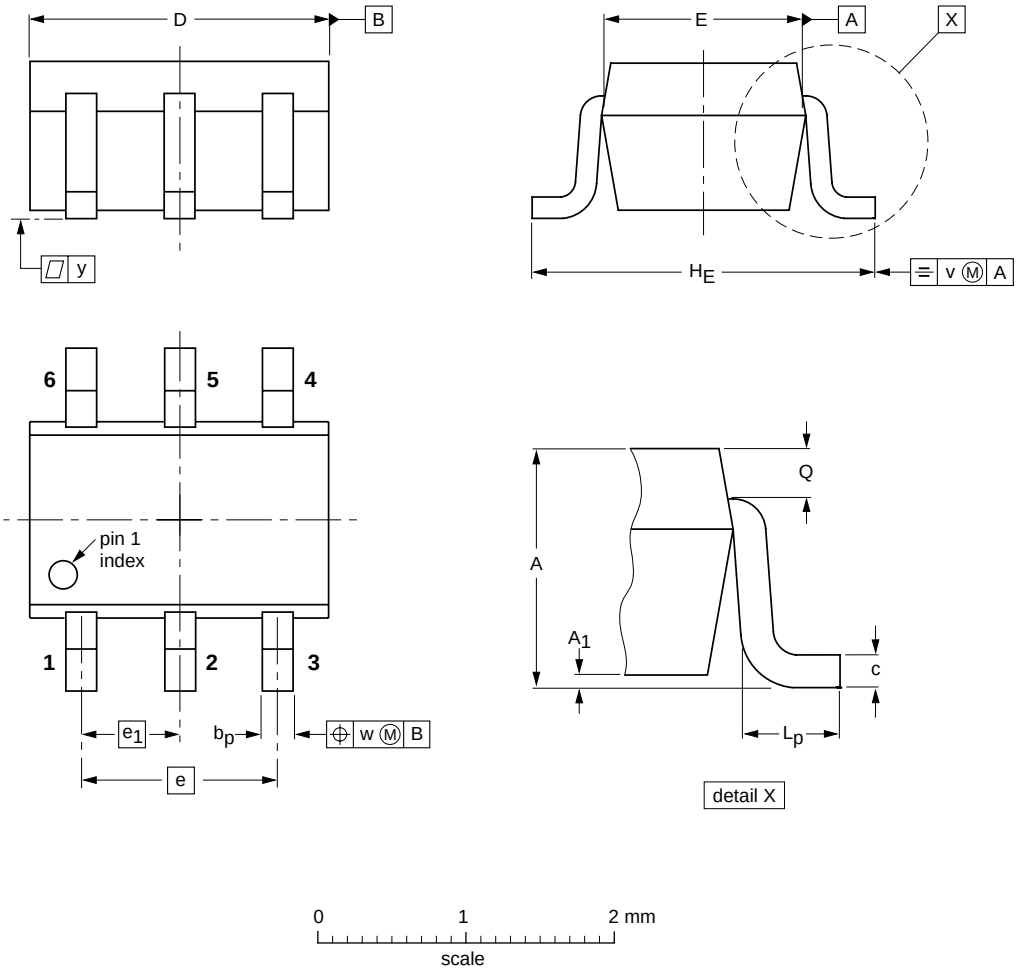
f (MHz)	s_{11}		s_{21}		s_{12}		s_{22}	
	MAGNITUDE (ratio)	ANGLE (deg)	MAGNITUDE (ratio)	ANGLE (deg)	MAGNITUDE (ratio)	ANGLE (deg)	MAGNITUDE (ratio)	ANGLE (deg)
50	0.987	–5.6	4.069	173.5	0.001	95.4	0.986	–3.0
100	0.981	–11.1	4.042	167.0	0.002	81.3	0.983	–6.0
200	0.961	–21.9	3.926	154.4	0.005	75.8	0.976	–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 V; $V_{G2\text{-}S}$ = 4 V; I_D = 15 mA; T_{amb} = 25 °C

f (MHz)	F_{min} (dB)	Γ_{opt}		R_n (Ω)
		(ratio)	(deg)	
800	2	0.621	61.61	25.85

PACKAGE OUTLINE

Plastic surface mounted package; 6 leads **SOT363**



DIMENSIONS (mm are the original dimensions)

UNIT	A	A_1 max	b_p	c	D	E	e	e_1	H_E	L_p	Q	v	w	y
mm	1.1 0.8	0.1	0.30 0.20	0.25 0.10	2.2 1.8	1.35 1.15	1.3	0.65	2.2 2.0	0.45 0.15	0.25 0.15	0.2	0.2	0.1

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT363			SC-88			97-02-28

DATA SHEET STATUS

DATA SHEET STATUS	PRODUCT STATUS	DEFINITIONS (1)
Objective specification	Development	This data sheet contains the design target or goal specifications for product development. Specification may change in any manner without notice.
Preliminary specification	Qualification	This data sheet contains preliminary data, and supplementary data will be published at a later date. Philips Semiconductors reserves the right to make changes at any time without notice in order to improve design and supply the best possible product.
Product specification	Production	This data sheet contains final specifications. Philips Semiconductors reserves the right to make changes at any time without notice in order to improve design and supply the best possible product.

Note

1. Please consult the most recently issued data sheet before initiating or completing a design.

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.

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NOTES

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