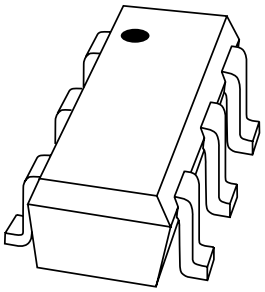
DATA SHEET



BF1204
Dual N-channel dual gate MOS-FET

Product specification
Supersedes data of 2000 Nov 13

2001 Apr 25

Philips Semiconductors

PHILIPS

Dual N-channel dual gate MOS-FET BF1204

FEATURES

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

APPLICATIONS

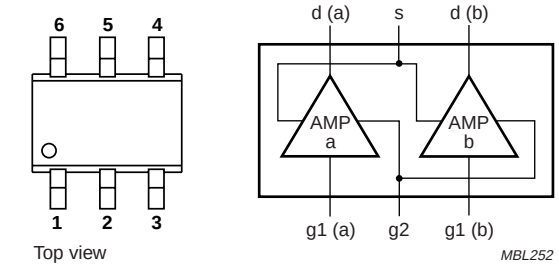
- Gain controlled low noise amplifiers for VHF and UHF applications with 3 to 9 V supply voltage, such as digital and analog television tuners and professional communications equipment.

DESCRIPTION

The BF1204 is a combination of two equal dual gate MOS-FET amplifiers with shared source and gate 2 leads. The source and substrate are interconnected. Internal bias circuits enable DC stabilization and a very good cross-modulation performance during AGC. Integrated diodes between the gates and source protect against excessive input voltage surges. The transistor has a SOT363 micro-miniature plastic package.

PINNING - SOT363

PIN	DESCRIPTION
1	gate 1 (a)
2	gate 2
3	gate 1 (b)
4	drain (b)
5	source
6	drain (a)



Marking code: L3-

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		–	–	10	V
I_D	drain current (DC)		–	–	30	mA
P_{tot}	total power dissipation	$T_s \leq 102$ °C; note 1	–	–	200	mW
$\lvert y_{fs} \rvert$	forward transfer admittance	I_D = 12 mA; f = 1 MHz	25	30	40	mS
C_{ig1-s}	input capacitance at gate 1	I_D = 12 mA; f = 1 MHz	–	1.7	2.2	pF
C_{rss}	reverse transfer capacitance	f = 1 MHz	–	15	–	fF
NF	noise figure	f = 800 MHz	–	1.1	1.8	dB
X_{mod}	cross-modulation	input level for k = 1% at 40 dB AGC	100	105	–	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		–	10	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	$T_s \leq 102$ °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

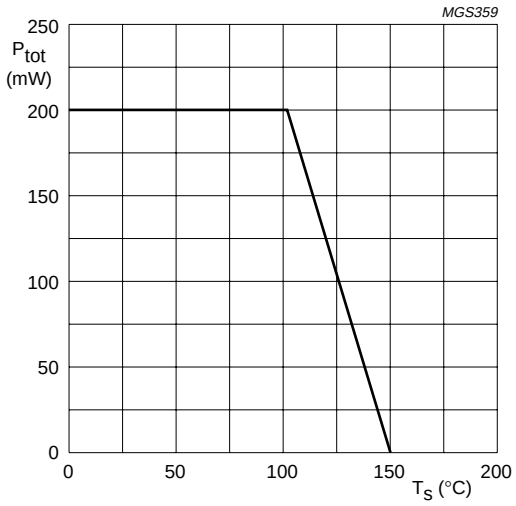


Fig.2 Power derating curve.

STATIC CHARACTERISTICS

T_j = 25 °C; per MOS-FET; 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 µA	10	–	V
$V_{(BR)G1-SS}$	gate-source breakdown voltage	$V_{GS} = V_{DS} = 0$; I_{G1-S} = 10 mA	6	10	V
$V_{(BR)G2-SS}$	gate-source breakdown voltage	$V_{GS} = V_{DS} = 0$; I_{G2-S} = 10 mA	6	10	V
$V_{(F)S-G1}$	forward source-gate voltage	$V_{G2-S} = V_{DS} = 0$; I_{S-G1} = 10 mA	0.5	1.5	V
$V_{(F)S-G2}$	forward source-gate voltage	$V_{G1-S} = V_{DS} = 0$; I_{S-G2} = 10 mA	0.5	1.5	V
$V_{G1-S(th)}$	gate-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-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	8	16	mA
I_{G1-S}	gate cut-off current	V_{G1-S} = 5 V; $V_{G2-S} = V_{DS} = 0$	–	50	nA
I_{G2-S}	gate cut-off current	V_{G2-S} = 4 V; $V_{G1-S} = V_{DS} = 0$	–	20	nA

Note

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

DYNAMIC CHARACTERISTICS

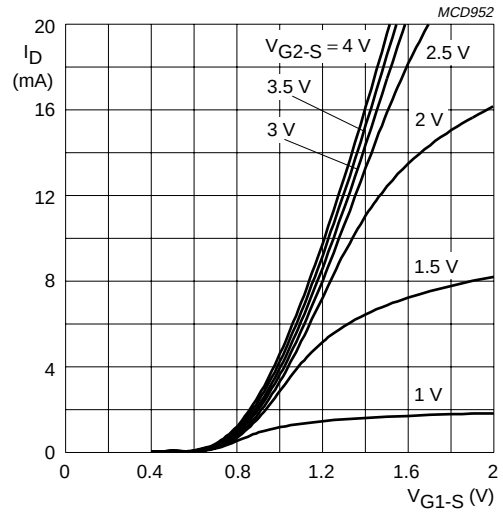
Common source; T_{amb} = 25 °C; V_{G2-S} = 4 V; V_{DS} = 5 V; I_D = 12 mA; per MOS-FET [1]; unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$\lvert y_{fs} \rvert$	forward transfer admittance	T_j = 25 °C	25	30	40	mS
C_{ig1-ss}	input capacitance at gate 1	f = 1 MHz	–	1.7	2.2	pF
C_{ig2-ss}	input capacitance at gate 2	f = 1 MHz	–	3.3	–	pF
C_{oss}	output capacitance	f = 1 MHz	–	0.85	–	pF
C_{rss}	reverse transfer capacitance	f = 1 MHz	–	15	–	fF
G_{tr}	power gain	f = 200 MHz; G_S = 2 mS; $B_S = B_{S(opt)}$; G_L = 0.5 mS; $B_L = B_{L(opt)}$; note 1	30	34	38	dB
		f = 400 MHz; G_S = 2 mS; $B_S = B_{S(opt)}$; G_L = 1 mS; $B_L = B_{L(opt)}$; note 1	26	30	34	dB
		f = 800 MHz; G_S = 3.3 mS; $B_S = B_{S(opt)}$; G_L = 1 mS; $B_L = B_{L(opt)}$; note 1	21	25	29	dB
NF	noise figure	f = 10.7 MHz; G_S = 20 mS; B_S = 0	–	9	11	dB
		f = 400 MHz; $Y_S = Y_{S(opt)}$	–	0.9	1.5	dB
		f = 800 MHz; $Y_S = Y_{S(opt)}$	–	1.1	1.8	dB
X_{mod}	cross-modulation	input level for k = 1% at 0 dB AGC; f_w = 50 MHz; f_{unw} = 60 MHz; note 2	90	–	–	dBµV
		input level for k = 1% at 10 dB AGC; f_w = 50 MHz; f_{unw} = 60 MHz; note 2	–	92	–	dBµV
		input level for k = 1% at 40 dB AGC; f_w = 50 MHz; f_{unw} = 60 MHz; note 2	100	105	–	dBµV

Notes

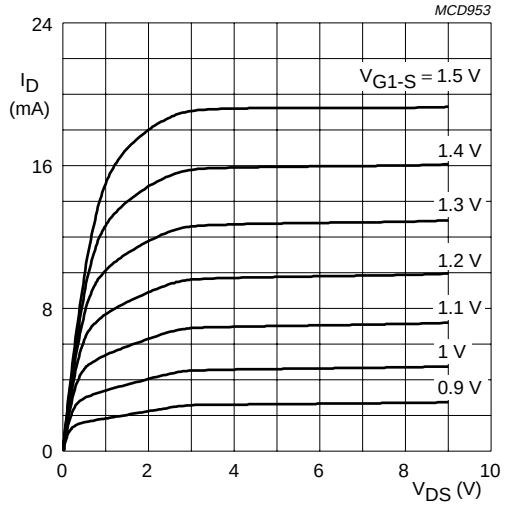
1. For the MOS-FET not in use: $V_{G1-S} = 0$; $V_{DS} = 0$.
2. Measured in Fig.19 test circuit.

ALL GRAPHS FOR ONE MOS-FET



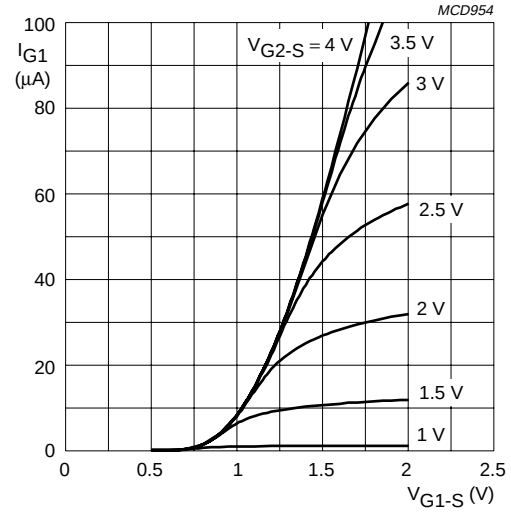
V_{DS} = 5 V.
T_j = 25 °C.

Fig.3 Transfer characteristics; typical values.



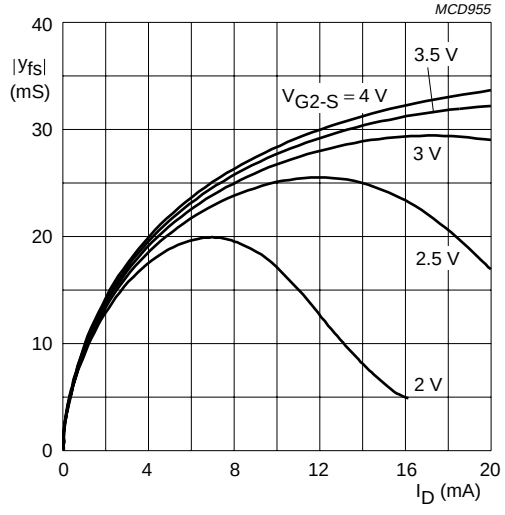
V_{G2-S} = 4 V.
T_j = 25 °C.

Fig.4 Output characteristics; typical values.



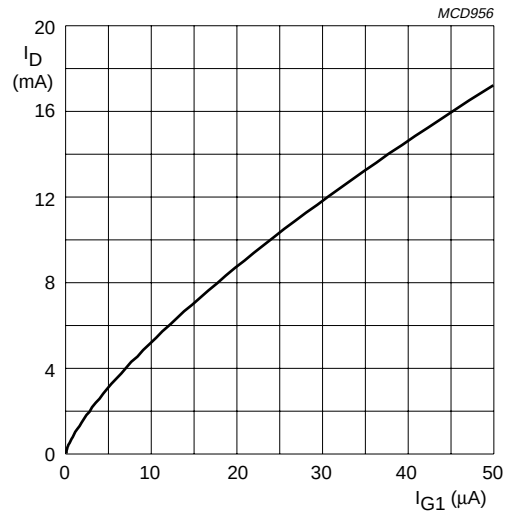
V_{DS} = 5 V.
T_j = 25 °C.

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



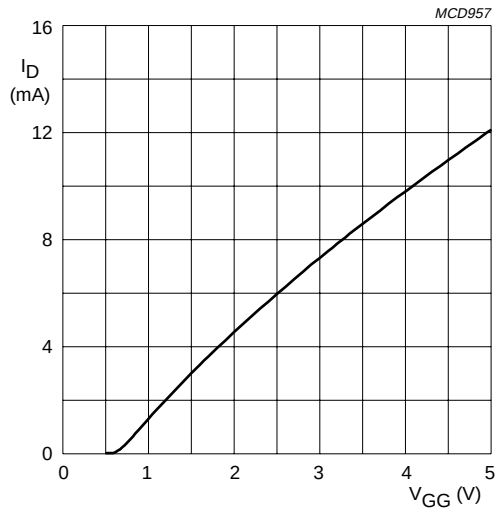
V_{DS} = 5 V.
T_j = 25 °C.

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



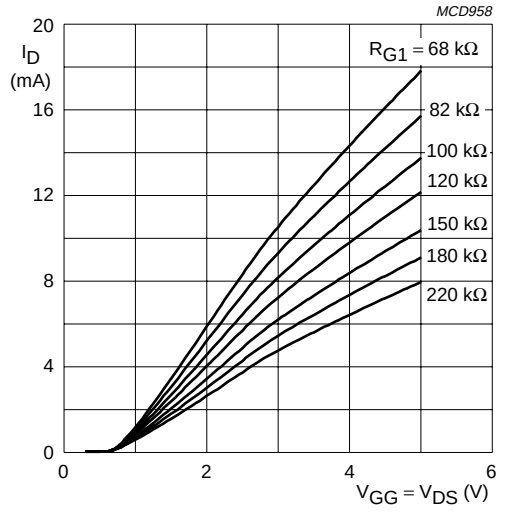
V_{DS} = 5 V; $V_{G2\text{-}S}$ = 4 V.
T_j = 25 °C.

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



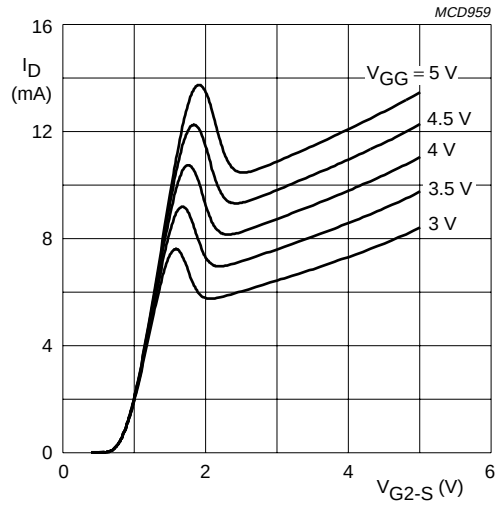
V_{DS} = 5 V; $V_{G2\text{-}S}$ = 4 V; T_j = 25 °C.
R_{G1} = 120 kΩ (connected to V_{GG}); see Fig.19.

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



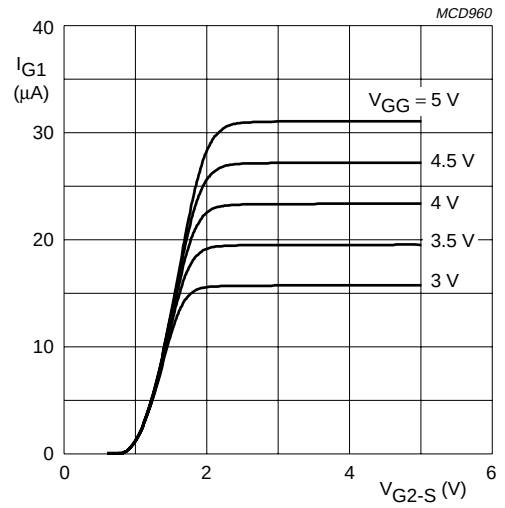
$V_{G2\text{-}S}$ = 4 V; T_j = 25 °C.
R_{G1} connected to V_{GG}; see Fig.19.

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



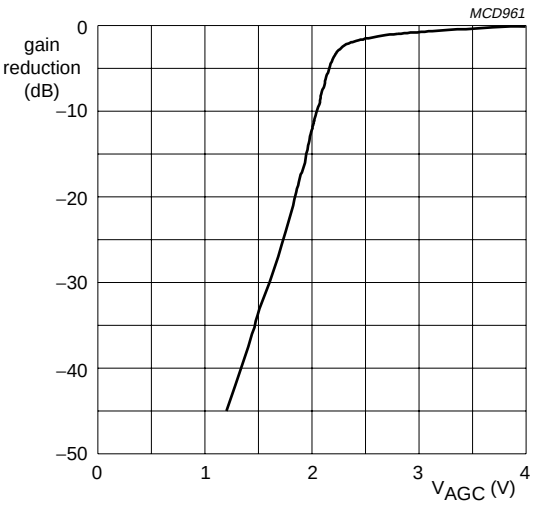
V_{DS} = 5 V; T_j = 25 °C.
R_{G1} = 120 kΩ (connected to V_{GG}); see Fig.19.

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



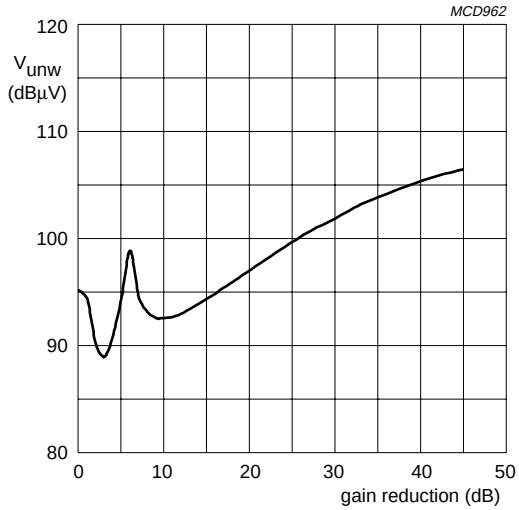
V_{DS} = 5 V; T_j = 25 °C.
R_{G1} = 120 kΩ (connected to V_{GG}); see Fig.19.

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



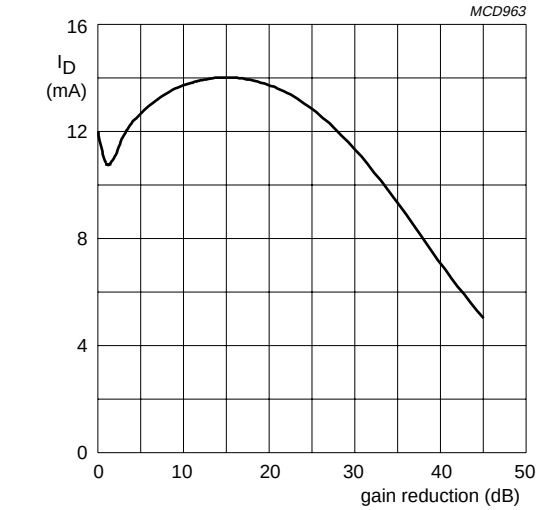
V_{DS} = 5 V; V_{GG} = 5 V; R_{G1} = 120 kΩ;
f = 50 MHz; T_{amb} = 25 °C.

Fig.12 Typical gain reduction as a function of AGC voltage; see Fig.19.



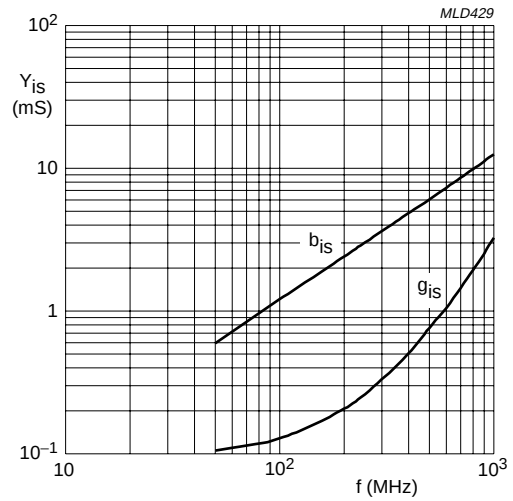
V_{DS} = 5 V; V_{GG} = 5 V; R_{G1} = 120 kΩ;
f= 50 MHz; f_{unw} = 60 MHz; T_{amb} = 25 °C.

Fig.13 Unwanted voltage for 1% cross-modulation as a function of gain reduction; typical values; see Fig.19.



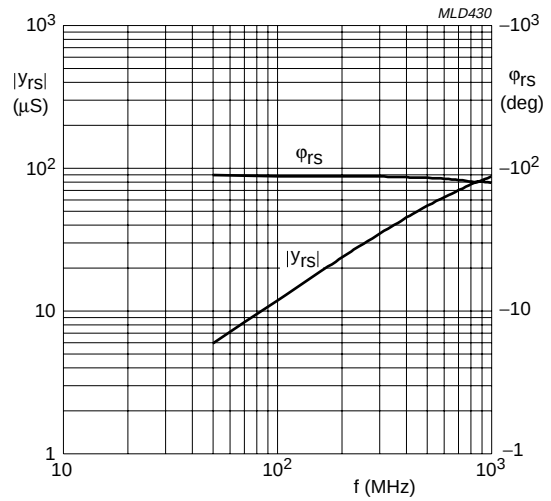
V_{DS} = 5 V; V_{GG} = 5 V; R_{G1} = 120 kΩ;
f = 50 MHz; T_{amb} = 25 °C.

Fig.14 Drain current as a function of gain reduction; typical values; see Fig.19.



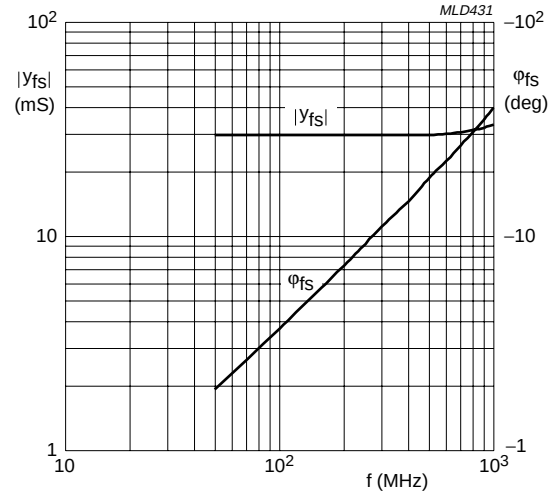
V_{DS} = 5 V; V_{G2} = 4 V.

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



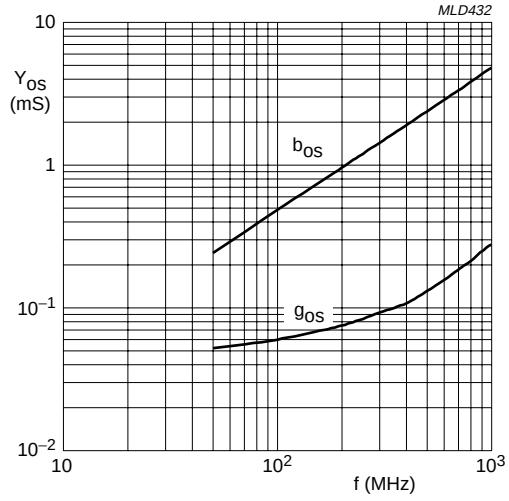
V_{DS} = 5 V; V_{G2} = 4 V.

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



V_{DS} = 5 V; V_{G2} = 4 V.

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



V_{DS} = 5 V; V_{G2} = 4 V.

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

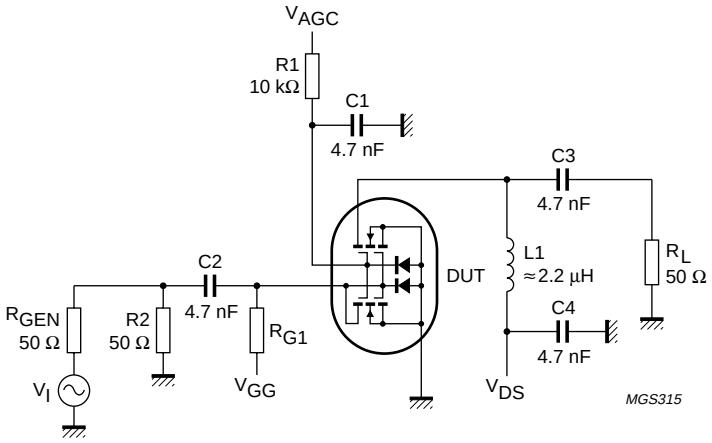


Fig.19 Cross-modulation test set-up (for one MOS-FET).

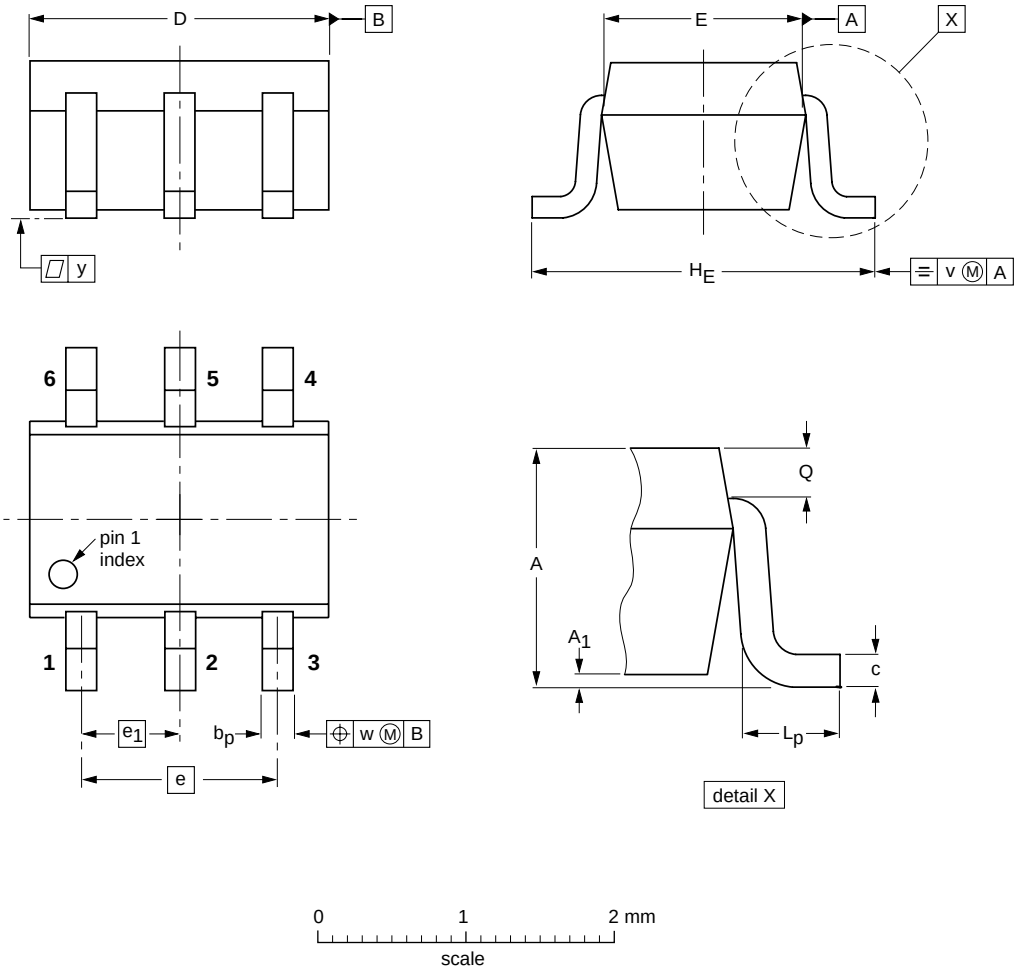
Scattering parameters

V_{DS} = 5 V; $V_{G2\text{-}S}$ = 4 V; I_D = 12 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	0.991	–3.29	2.95	175.78	0.00060	85.25	0.995	–1.44
100	0.987	–7.12	2.90	171.61	0.00119	84.74	0.994	–2.90
200	0.981	–14.21	2.86	163.45	0.00234	80.85	0.992	–5.70
300	0.969	–21.22	2.83	155.11	0.00339	75.77	0.989	–8.50
400	0.958	–28.14	2.79	147.37	0.00429	72.23	0.987	–11.25
500	0.939	–35.01	2.74	139.04	0.00508	68.24	0.983	–13.96
600	0.921	–41.75	2.68	131.35	0.00565	64.97	0.981	–16.67
700	0.898	–48.51	2.62	123.38	0.00611	61.90	0.976	–19.36
800	0.874	–54.96	2.55	115.74	0.00646	57.77	0.973	–22.04
900	0.847	–61.62	2.49	107.84	0.00662	55.04	0.969	–24.80
1000	0.817	–67.84	2.41	100.24	0.00670	52.16	0.966	–27.45

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[1]	PRODUCT STATUS[2]	DEFINITIONS
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.
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.
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. Changes will be communicated according to the Customer Product/Process Change Notification (CPCN) procedure SNW-SQ-650A.

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.

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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