DATA SHEET

BF1100WR
Dual-gate MOS-FET

Product specification
File under Discrete Semiconductors, SC07

1995 Apr 25

Philips Semiconductors

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FEATURES

- Specially designed for use at 9 to 12 V supply voltage
- Short channel transistor with high forward transfer admittance to input capacitance ratio
- Low noise gain controlled amplifier up to 1 GHz
- Superior cross-modulation performance during AGC.

APPLICATIONS

- VHF and UHF applications such as television tuners and professional communications equipment.

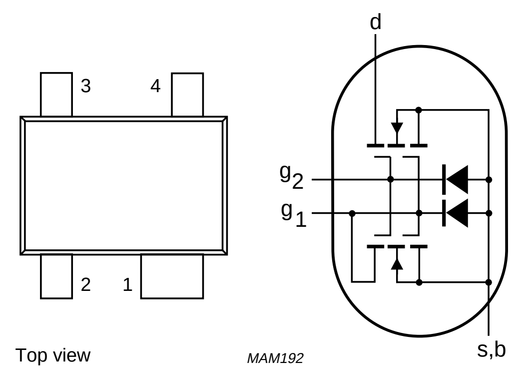
DESCRIPTION

Enhancement type field-effect transistor in a plastic microminiature SOT343R package. The transistor consists of an amplifier MOS-FET with source and substrate interconnected and an internal bias circuit to ensure good cross-modulation performance during AGC.

CAUTION
The device is supplied in an antistatic package. The gate-source input must be protected against static discharge during transport or handling.

PINNING

PIN	SYMBOL	DESCRIPTION
1	s, b	source
2	d	drain
3	g_2	gate 2
4	g_1	gate 1



Marking code: MF.

Fig.1 Simplified outline (SOT343R) and symbol.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{DS}	drain-source voltage		–	–	14	V
I_D	drain current		–	–	30	mA
P_{tot}	total power dissipation		–	–	280	mW
T_j	operating junction temperature		–	–	150	°C
$\|y_{fs}\|$	forward transfer admittance		24	28	33	mS
C_{ig1-s}	input capacitance at gate 1		–	2.2	2.6	pF
C_{rs}	reverse transfer capacitance	f = 1 MHz	–	25	35	fF
F	noise figure	f = 800 MHz	–	2	–	dB

LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{DS}	drain-source voltage		–	14	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	see Fig.2; up to T_{amb} = 50 °C; note 1	–	280	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	operating junction temperature		–	+150	°C

Note

1. Device mounted on a printed-circuit board.

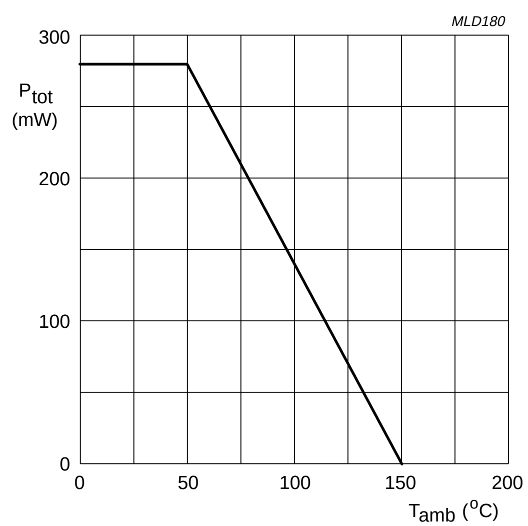


Fig.2 Power derating curve.

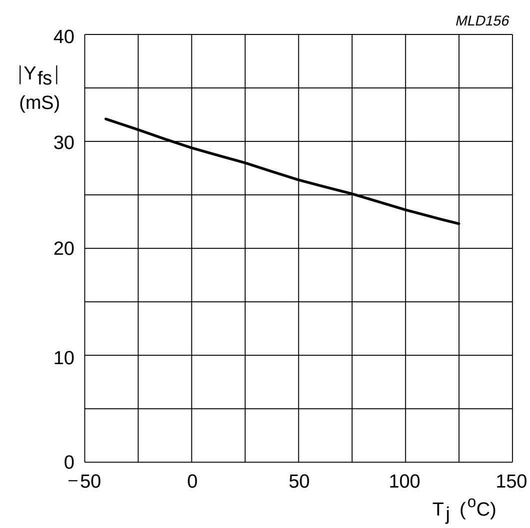


Fig.3 Forward transfer admittance as a function of junction temperature; typical values.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	350	K/W
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	T_s = 91 °C; note 2	210	K/W

Notes

1. Device mounted on a printed-circuit board.
2. T_s is the temperature at the soldering point of the source lead.

STATIC CHARACTERISTICS

T_j = 25 °C; unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
$V_{(BR)G1\text{-}SS}$	gate 1-source breakdown voltage	$V_{G2\text{-}S} = V_{DS} = 0$; $I_{G1\text{-}S}$ = 1 mA	13.2	20	V
$V_{(BR)G2\text{-}SS}$	gate 2-source breakdown voltage	$V_{G1\text{-}S} = V_{DS} = 0$; $I_{G2\text{-}S}$ = 1 mA	13.2	20	V
$V_{(F)S\text{-}G1}$	forward source-gate 1 voltage	$V_{G2\text{-}S} = V_{DS} = 0$; $I_{S\text{-}G1}$ = 10 mA	0.5	1.5	V
$V_{(F)S\text{-}G2}$	forward source-gate 2 voltage	$V_{G1\text{-}S} = V_{DS} = 0$; $I_{S\text{-}G2}$ = 10 mA	0.5	1.5	V
$V_{G1\text{-}S(th)}$	gate 1-source threshold voltage	$V_{G2\text{-}S}$ = 4 V; V_{DS} = 9 V; I_D = 20 μA	0.3	1	V
		$V_{G2\text{-}S}$ = 4 V; V_{DS} = 12 V; I_D = 20 μA	0.3	1	V
$V_{G2\text{-}S(th)}$	gate 2-source threshold voltage	$V_{G1\text{-}S}$ = 4 V; V_{DS} = 9 V; I_D = 20 μA	0.3	1.2	V
		$V_{G1\text{-}S}$ = 4 V; V_{DS} = 12 V; I_D = 20 μA	0.3	1.2	V
I_{DSX}	drain-source current	$V_{G2\text{-}S}$ = 4 V; V_{DS} = 9 V; R_{G1} = 180 kΩ; note 1	8	13	mA
		$V_{G2\text{-}S}$ = 4 V; V_{DS} = 12 V; R_{G1} = 250 kΩ; note 2	8	13	mA
$I_{G1\text{-}SS}$	gate 1 cut-off current	$V_{G2\text{-}S} = V_{DS} = 0$; $V_{G1\text{-}S}$ = 12 V	–	50	nA
$I_{G2\text{-}SS}$	gate 2 cut-off current	$V_{G1\text{-}S} = V_{DS} = 0$; $V_{G2\text{-}S}$ = 12 V	–	50	nA

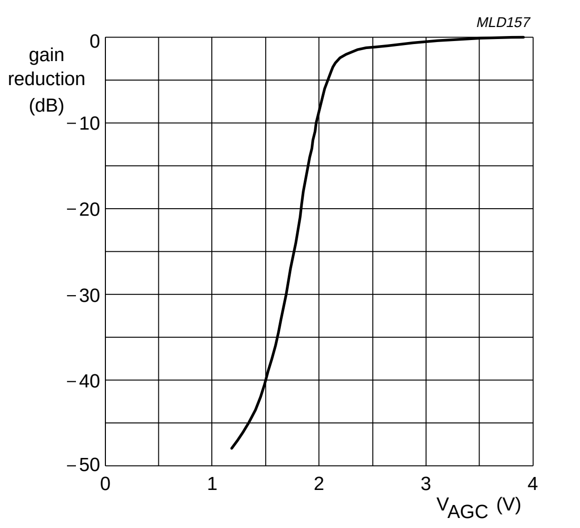
Notes

1. R_{G1} connects gate 1 to V_{GG} = 9 V; see Fig.26.
2. R_{G1} connects gate 1 to V_{GG} = 12 V; see Fig.26.

DYNAMIC CHARACTERISTICS

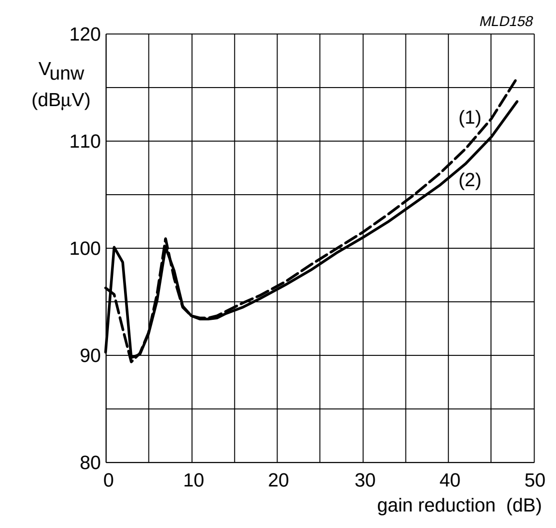
Common source; T_{amb} = 25 °C; V_{G2-S} = 4 V; I_D = 10 mA; unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$\|y_{fs}\|$	forward transfer admittance	pulsed; T_j = 25 °C				
		V_{DS} = 9 V	24	28	33	mS
		V_{DS} = 12 V	24	28	33	mS
C_{ig1-s}	input capacitance at gate 1	f = 1 MHz				
		V_{DS} = 9 V	–	2.2	2.6	pF
		V_{DS} = 12 V	–	2.2	2.6	pF
C_{ig2-s}	input capacitance at gate 2	f = 1 MHz				
		V_{DS} = 9 V	–	1.6	–	pF
		V_{DS} = 12 V	–	1.4	–	pF
C_{os}	drain-source capacitance	f = 1 MHz				
		V_{DS} = 9 V	–	1.4	1.8	pF
		V_{DS} = 12 V	–	1.1	1.5	pF
C_{rs}	reverse transfer capacitance	f = 1 MHz				
		V_{DS} = 9 V	–	25	35	fF
		V_{DS} = 12 V	–	25	35	fF
F	noise figure	f = 800 MHz; $G_S = G_{Sopt}$; $B_S = B_{Sopt}$				
		V_{DS} = 9 V	–	2	2.8	dB
		V_{DS} = 12 V	–	2	2.8	dB



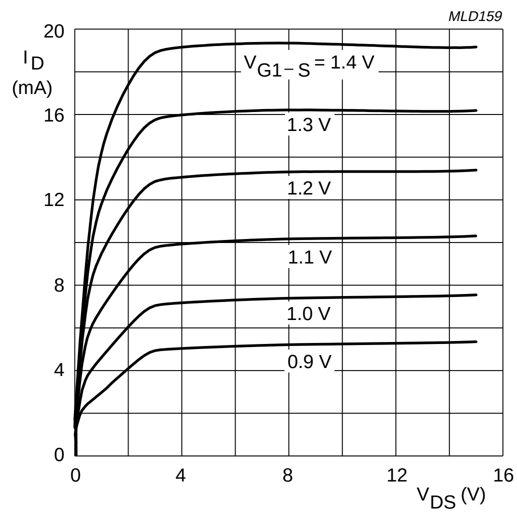
f = 50 MHz.
T_j = 25 °C.

Fig.4 Gain reduction as a function of the AGC voltage; typical values.



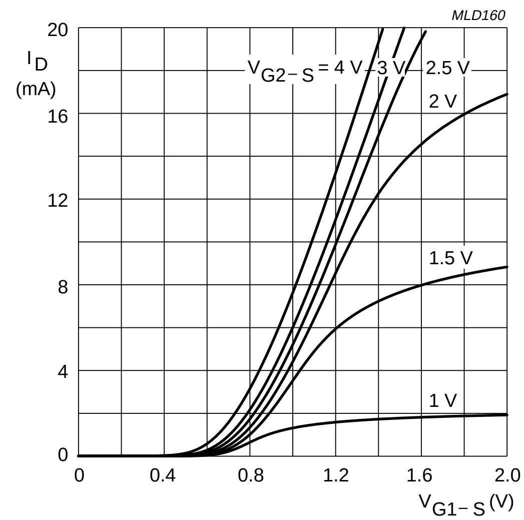
(1) R_G = 250 kΩ to V_{GG} = 12 V.
(2) R_G = 180 kΩ to V_{GG} = 9 V.
f_w = 50 MHz; f_{unw} = 60 MHz; T_{amb} = 25 °C.

Fig.5 Unwanted voltage for 1% cross-modulation as a function of gain reduction; typical values; see Fig.26.



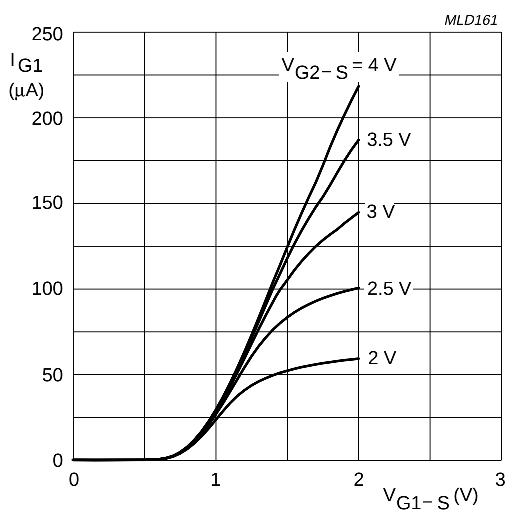
V_{G2-S} = 4 V.
T_j = 25 °C.

Fig.6 Output characteristics; typical values.



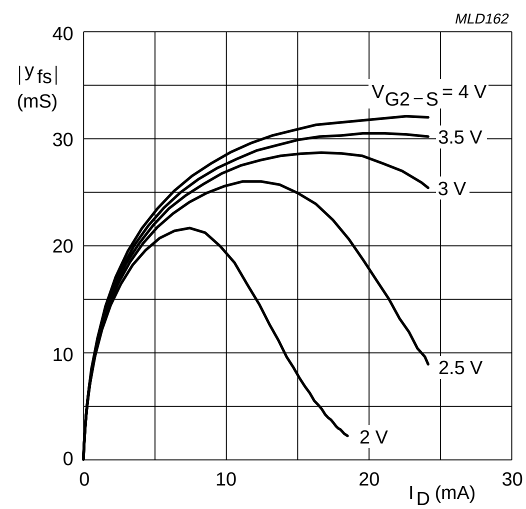
V_{DS} = 9 to 12 V.
T_j = 25 °C.

Fig.7 Transfer characteristics; typical values.



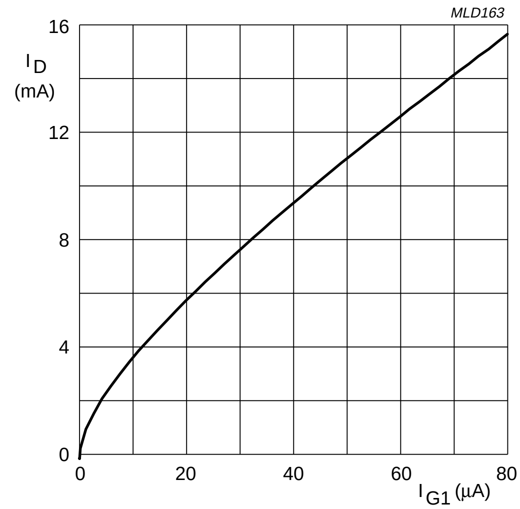
V_{DS} = 9 to 12 V.
T_j = 25 °C.

Fig.8 Gate 1 current as a function of gate 1 voltage; typical values.



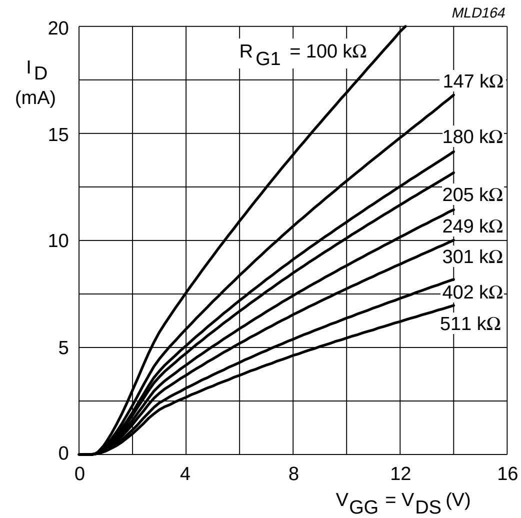
V_{DS} = 9 to 12 V.
T_j = 25 °C.

Fig.9 Forward transfer admittance as a function of drain current; typical values.



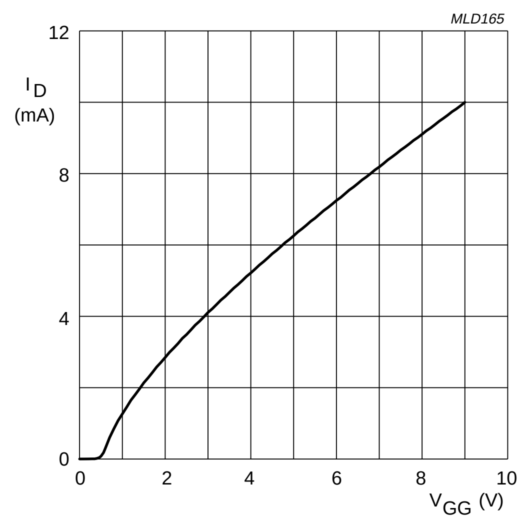
V_{DS} = 9 to 12 V.
$V_{G2\text{-}S}$ = 4 V.
T_j = 25 °C.

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



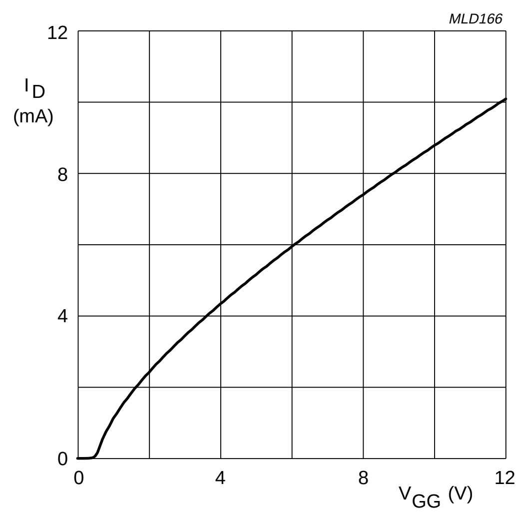
$V_{G2\text{-}S}$ = 4 V.
R_{G1} connected to V_{GG}.
T_j = 25 °C.

Fig.11 Drain current as a function of gate 1 supply voltage (= V_{GG}) and drain supply voltage; typical values; see Fig.26.



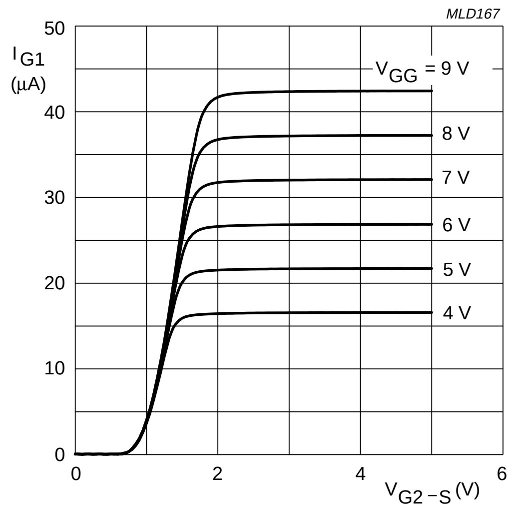
V_{DS} = 9 V; $V_{G2\text{-}S}$ = 4 V.
R_{G1} = 180 kΩ (connected to V_{GG}); T_j = 25 °C.

Fig.12 Drain current as a function of gate 1 voltage (= V_{GG}); typical values; see Fig.26.



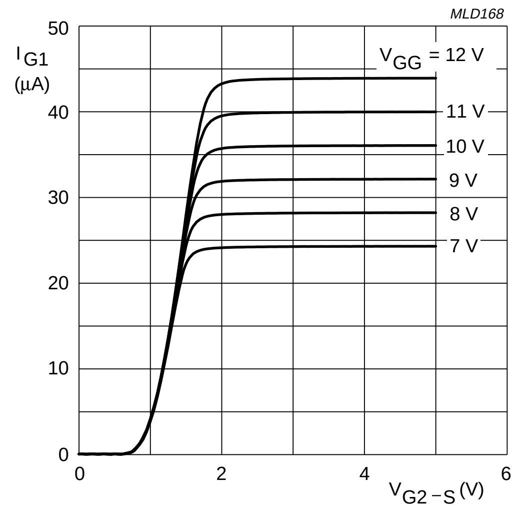
V_{DS} = 12 V; $V_{G2\text{-}S}$ = 4 V.
R_{G1} = 250 kΩ (connected to V_{GG}); T_j = 25 °C.

Fig.13 Drain current as a function of gate 1 voltage (= V_{GG}); typical values; see Fig.26.



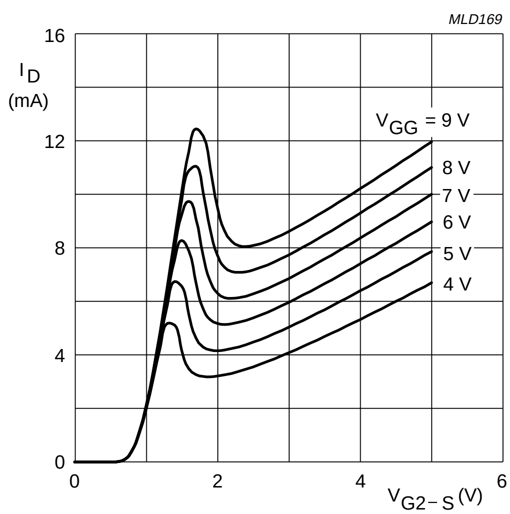
V_{DS} = 9 V.
R_{G1} = 180 kΩ (connected to V_{GG}); T_j = 25 °C.

Fig.14 Gate 1 current as a function of gate 2 voltage; typical values.



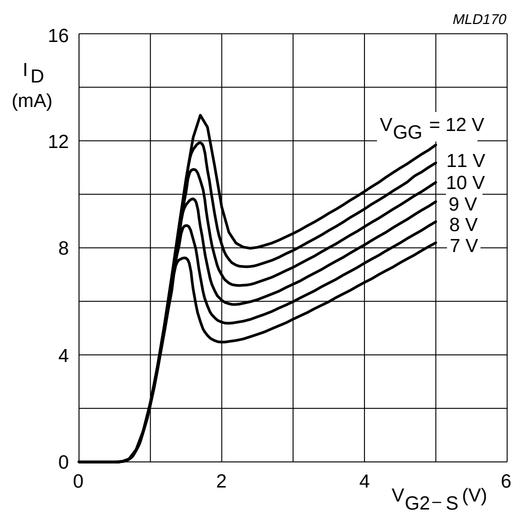
V_{DS} = 12 V.
R_{G1} = 250 kΩ (connected to V_{GG}); T_j = 25 °C.

Fig.15 Gate 1 current as a function of gate 2 voltage; typical values.



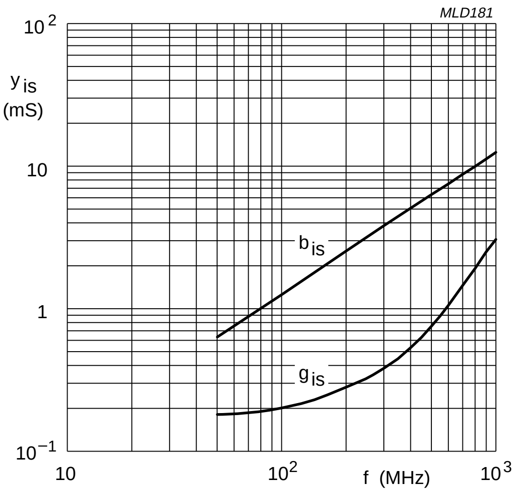
V_{DS} = 9 V.
R_{G1} = 180 kΩ (connected to V_{GG}); T_j = 25 °C.

Fig.16 Drain current as a function of the gate 2 voltage; typical values; see Fig.26.



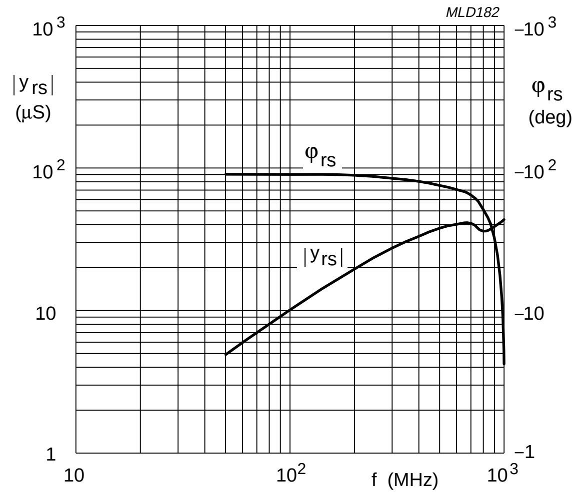
V_{DS} = 12 V.
R_{G1} = 250 kΩ (connected to V_{GG}); T_j = 25 °C.

Fig.17 Drain current as a function of the gate 2 voltage; typical values; see Fig.26.



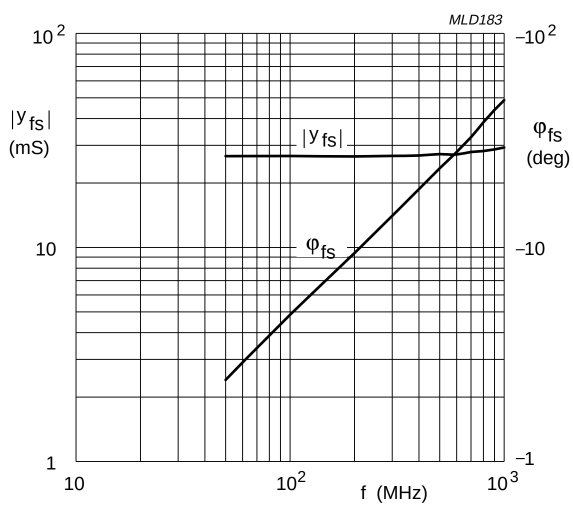
V_{DS} = 9 V; V_{G2} = 4 V.
I_D = 10 mA; T_{amb} = 25 °C.

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



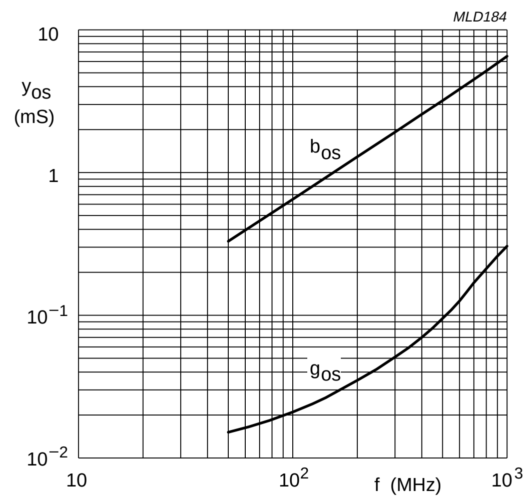
V_{DS} = 9 V; V_{G2} = 4 V.
I_D = 10 mA; T_{amb} = 25 °C.

Fig.19 Reverse transfer admittance and phase as a function of frequency; typical values.



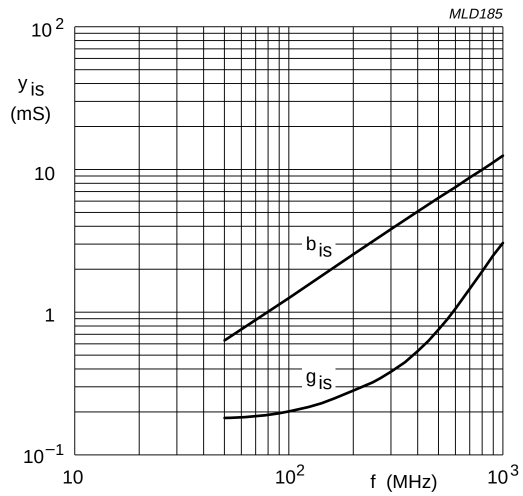
V_{DS} = 9 V; V_{G2} = 4 V.
I_D = 10 mA; T_{amb} = 25 °C.

Fig.20 Forward transfer admittance and phase as a function of frequency; typical values.



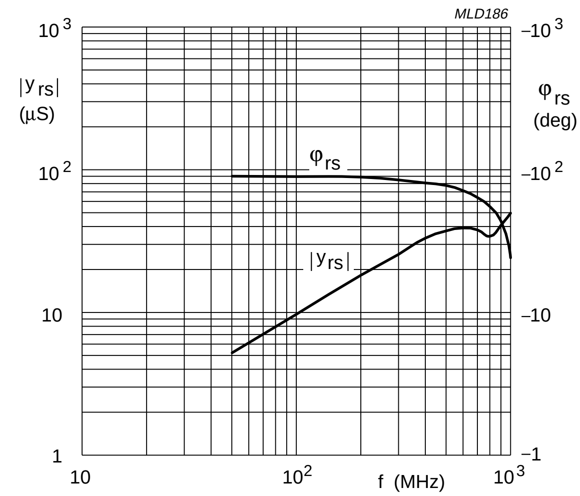
V_{DS} = 9 V; V_{G2} = 4 V.
I_D = 10 mA; T_{amb} = 25 °C.

Fig.21 Output admittance as a function of frequency; typical values.



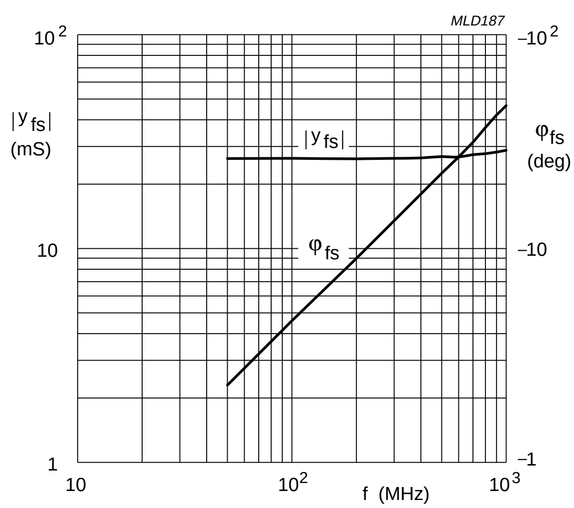
V_{DS} = 12 V; V_{G2} = 4 V.
I_D = 10 mA; T_{amb} = 25 °C.

Fig.22 Input admittance as a function of frequency; typical values.



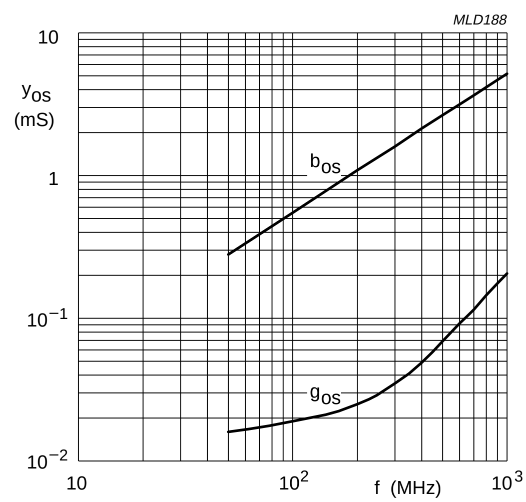
V_{DS} = 12 V; V_{G2} = 4 V.
I_D = 10 mA; T_{amb} = 25 °C.

Fig.23 Reverse transfer admittance and phase as a function of frequency; typical values.



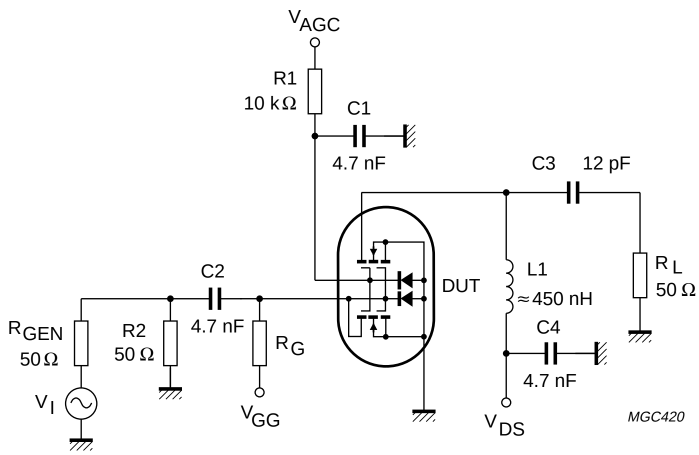
V_{DS} = 12 V; V_{G2} = 4 V.
I_D = 10 mA; T_{amb} = 25 °C.

Fig.24 Forward transfer admittance and phase as a function of frequency; typical values.



V_{DS} = 12 V; V_{G2} = 4 V.
I_D = 10 mA; T_{amb} = 25 °C.

Fig.25 Output admittance as a function of frequency; typical values.



For $V_{GG} = V_{DS} = 9$ V, $R_G = 180$ kΩ.
For $V_{GG} = V_{DS} = 12$ V, $R_G = 250$ kΩ.

Fig.26 Cross-modulation test circuit.

Table 1 Scattering parameters: V_{DS} = 9 V; V_{G2-S} = 4 V; I_D = 10 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	0.985	–3.9	2.618	175.1	0.001	137.9	1.000	–1.9
100	0.981	–7.3	2.602	170.5	0.001	80.4	0.999	–4.0
200	0.975	–14.4	2.577	160.7	0.002	74.0	0.995	–7.6
300	0.965	–21.6	2.555	151.6	0.002	79.3	0.994	–11.3
400	0.947	–28.3	2.513	141.8	0.003	80.5	0.992	–15.0
500	0.927	–34.9	2.449	133.4	0.003	82.8	0.988	–18.5
600	0.913	–41.7	2.339	124.6	0.003	78.9	0.984	–22.0
700	0.890	–47.9	2.361	115.4	0.003	80.6	0.982	–25.3
800	0.869	–54.0	2.302	106.4	0.003	93.9	0.979	–28.8
900	0.845	–59.7	2.228	97.6	0.003	104.8	0.976	–32.1
1000	0.823	–65.4	2.167	89.6	0.003	129.3	0.974	–35.5

Table 2 Noise data: V_{DS} = 9 V; V_{G2-S} = 4 V; I_D = 10 mA

f (MHz)	F_{min} (dB)	Γ_{opt}		r_n
		(ratio)	(deg)	
800	2.00	0.67	43.9	0.89

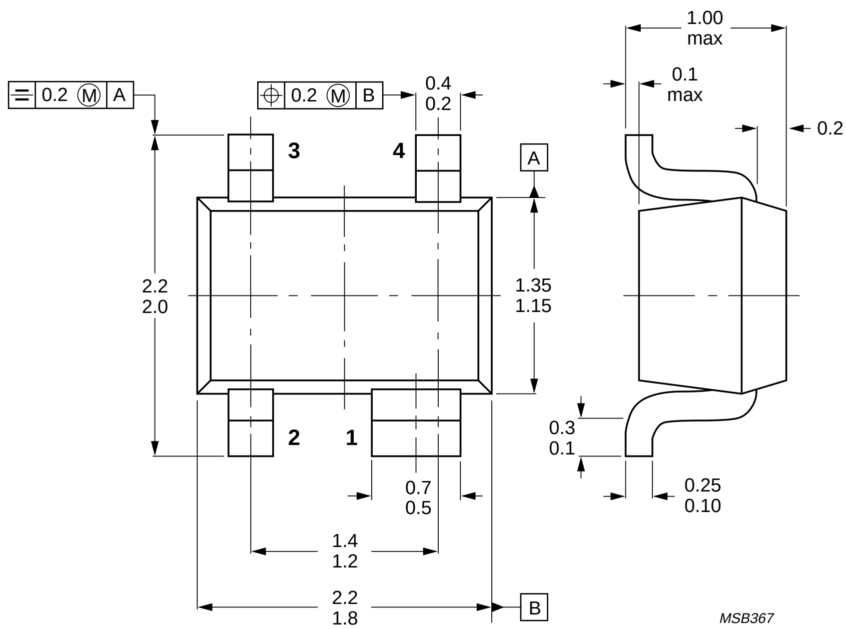
Table 3 Scattering parameters: V_{DS} = 12 V; V_{G2-S} = 4 V; I_D = 10 mA

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	0.985	–3.7	2.576	175.3	0.000	125.0	1.000	–1.6
100	0.980	–7.4	2.563	170.9	0.001	111.2	1.000	–3.3
200	0.973	–14.6	2.541	161.6	0.002	83.0	0.997	–6.4
300	0.962	–21.5	2.519	152.9	0.002	85.2	0.996	–9.3
400	0.946	–28.5	2.479	143.5	0.003	79.4	0.995	–12.4
500	0.929	–35.0	2.419	135.5	0.003	78.2	0.991	–15.3
600	0.912	–41.6	2.373	127.2	0.003	80.0	0.989	–18.1
700	0.895	–47.8	2.336	118.7	0.003	83.4	0.987	–20.9
800	0.868	–53.8	2.284	110.0	0.003	91.3	0.985	–23.7
900	0.845	–59.8	2.213	101.6	0.003	95.9	0.983	–26.5
1000	0.823	–65.7	2.160	94.1	0.003	112.2	0.981	–29.3

Table 4 Noise data: V_{DS} = 12 V; V_{G2-S} = 4 V; I_D = 10 mA

f (MHz)	F_{min} (dB)	Γ_{opt}		r_n
		(ratio)	(deg)	
800	2.00	0.66	43.3	0.97

PACKAGE OUTLINE



Dimensions in mm.

Fig.27 SOT343R.

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

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Argentina: see South America

Australia: 34 Waterloo Road, NORTH RYDE, NSW 2113, Tel. +61 2 9805 4455, Fax. +61 2 9805 4466

Austria: Computerstr. 6, A-1101 WIEN, P.O. Box 213, Tel. +43 1 60 101, Fax. +43 1 60 101 1210

Belarus: Hotel Minsk Business Center, Bld. 3, r. 1211, Volodarski Str. 6, 220050 MINSK, Tel. +375 172 200 733, Fax. +375 172 200 773

Belgium: see The Netherlands

Brazil: see South America

Bulgaria: Philips Bulgaria Ltd., Energoproject, 15th floor, 51 James Bourchier Blvd., 1407 SOFIA, Tel. +359 2 689 211, Fax. +359 2 689 102

Canada: PHILIPS SEMICONDUCTORS/COMPONENTS, Tel. +1 800 234 7381, Fax. +1 708 296 8556

China/Hong Kong: 501 Hong Kong Industrial Technology Centre, 72 Tat Chee Avenue, Kowloon Tong, HONG KONG, Tel. +852 2319 7888, Fax. +852 2319 7700

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Denmark: Prags Boulevard 80, PB 1919, DK-2300 COPENHAGEN S, Tel. +45 32 88 2636, Fax. +45 31 57 1949

Finland: Sinikalliontie 3, FIN-02630 ESPOO, Tel. +358 615 800, Fax. +358 615 80920

France: 4 Rue du Port-aux-Vins, BP317, 92156 SURESNES Cedex, Tel. +33 1 40 99 6161, Fax. +33 1 40 99 6427

Germany: Hammerbrookstraße 69, D-20097 HAMBURG, Tel. +49 40 23 52 60, Fax. +49 40 23 536 300

Greece: No. 15, 25th March Street, GR 17778 TAVROS, Tel. +30 1 4894 339/911, Fax. +30 1 4814 240

Hungary: see Austria

India: Philips INDIA Ltd, Shivsagar Estate, A Block, Dr. Annie Besant Rd. Worli, MUMBAI 400 018, Tel. +91 22 4938 541, Fax. +91 22 4938 722

Indonesia: see Singapore

Ireland: Newstead, Clonskeagh, DUBLIN 14, Tel. +353 1 7640 000, Fax. +353 1 7640 200

Israel: RAPAC Electronics, 7 Kehilat Saloniki St, TEL AVIV 61180, Tel. +972 3 645 0444, Fax. +972 3 648 1007

Italy: PHILIPS SEMICONDUCTORS, Piazza IV Novembre 3, 20124 MILANO, Tel. +39 2 6752 2531, Fax. +39 2 6752 2557

Japan: Philips Bldg 13-37, Kohnan 2-chome, Minato-ku, TOKYO 108, Tel. +81 3 3740 5130, Fax. +81 3 3740 5077

Korea: Philips House, 260-199 Itaewon-dong, Yongsan-ku, SEOUL, Tel. +82 2 709 1412, Fax. +82 2 709 1415

Malaysia: No. 76 Jalan Universiti, 46200 PETALING JAYA, SELANGOR, Tel. +60 3 750 5214, Fax. +60 3 757 4880

Mexico: 5900 Gateway East, Suite 200, EL PASO, TEXAS 79905, Tel. +1 800 234 7381, Fax. +1 708 296 8556

Middle East: see Italy

Netherlands: Postbus 90050, 5600 PB EINDHOVEN, Bldg. VB, Tel. +31 40 27 83749, Fax. +31 40 27 88399

New Zealand: 2 Wagener Place, C.P.O. Box 1041, AUCKLAND, Tel. +64 9 849 4160, Fax. +64 9 849 7811

Norway: Box 1, Manglerud 0612, OSLO, Tel. +47 22 74 8000, Fax. +47 22 74 8341

Philippines: Philips Semiconductors Philippines Inc., 106 Valero St. Salcedo Village, P.O. Box 2108 MCC, MAKATI, Metro MANILA, Tel. +63 2 816 6380, Fax. +63 2 817 3474

Poland: Ul. Lukiska 10, PL 04-123 WARSZAWA, Tel. +48 22 612 2831, Fax. +48 22 612 2327

Portugal: see Spain

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Russia: Philips Russia, Ul. Usatcheva 35A, 119048 MOSCOW, Tel. +7 095 926 5361, Fax. +7 095 564 8323

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Slovakia: see Austria

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South Africa: S.A. PHILIPS Pty Ltd., 195-215 Main Road Martindale, 2092 JOHANNESBURG, P.O. Box 7430 Johannesburg 2000, Tel. +27 11 470 5911, Fax. +27 11 470 5494

South America: Rua do Rocio 220, 5th floor, Suite 51, 04552-903 São Paulo, SÃO PAULO - SP, Brazil, Tel. +55 11 821 2333, Fax. +55 11 829 1849

Spain: Balmes 22, 08007 BARCELONA, Tel. +34 3 301 6312, Fax. +34 3 301 4107

Sweden: Kottbygatan 7, Akalla, S-16485 STOCKHOLM, Tel. +46 8 632 2000, Fax. +46 8 632 2745

Switzerland: Allmendstrasse 140, CH-8027 ZÜRICH, Tel. +41 1 488 2686, Fax. +41 1 481 7730

Taiwan: PHILIPS TAIWAN Ltd., 23-30F, 66, Chung Hsiao West Road, Sec. 1, P.O. Box 22978, TAIPEI 100, Tel. +886 2 382 4443, Fax. +886 2 382 4444

Thailand: PHILIPS ELECTRONICS (THAILAND) Ltd., 209/2 Sanpavuth-Bangna Road Prakanong, BANGKOK 10260, Tel. +66 2 745 4090, Fax. +66 2 398 0793

Turkey: Talatpasa Cad. No. 5, 80640 GÜLTEPE/ISTANBUL, Tel. +90 212 279 2770, Fax. +90 212 282 6707

Ukraine: PHILIPS UKRAINE, 2A Akademika Koroleva str., Office 165, 252148 KIEV, Tel. +380 44 476 0297/1642, Fax. +380 44 476 6991

United Kingdom: Philips Semiconductors Ltd., 276 Bath Road, Hayes, MIDDLESEX UB3 5BX, Tel. +44 181 730 5000, Fax. +44 181 754 8421

United States: 811 East Arques Avenue, SUNNYVALE, CA 94088-3409, Tel. +1 800 234 7381, Fax. +1 708 296 8556

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