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.

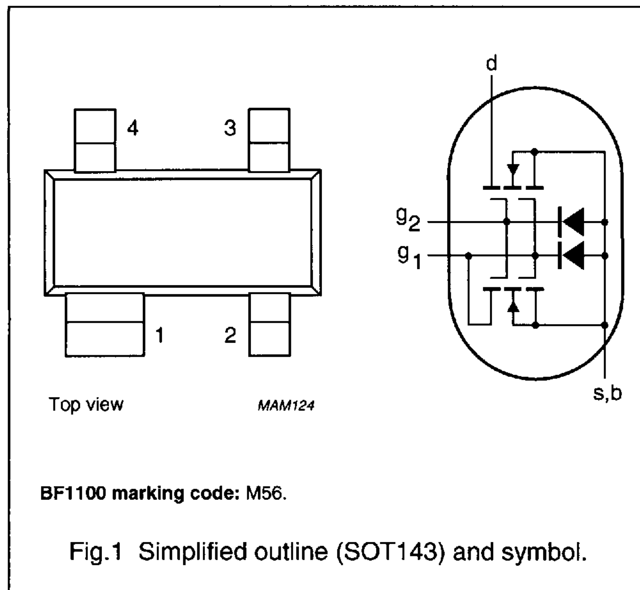
DESCRIPTION

Enhancement type field-effect transistor in a plastic microminiature SOT143 or SOT143R 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.

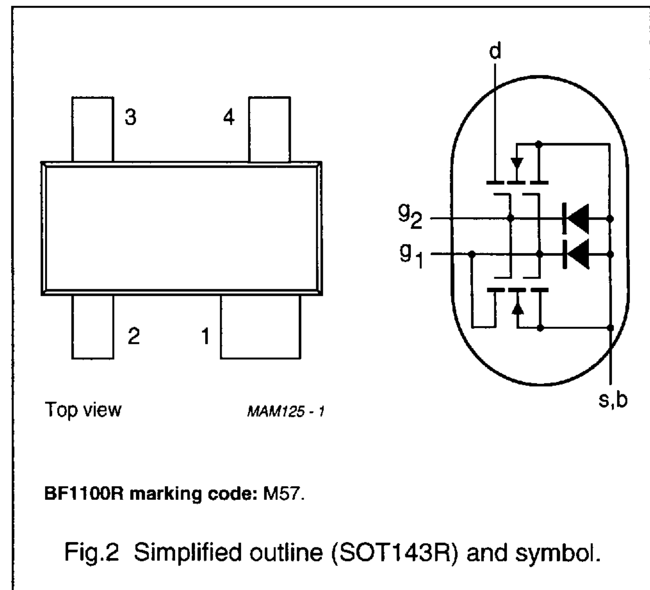
PINNING

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



BF1100 marking code: M56.

Fig.1 Simplified outline (SOT143) and symbol.



BF1100R marking code: M57.

Fig.2 Simplified outline (SOT143R) 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		–	–	200	mW
T_j	operating junction temperature		–	–	150	°C
$\lvert y_{fs} \rvert$	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

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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		–	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.3			
	BF1100	up to T_{amb} = 50 °C; note 1	–	200	mW
	BF1100R	up to T_{amb} = 40 °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.

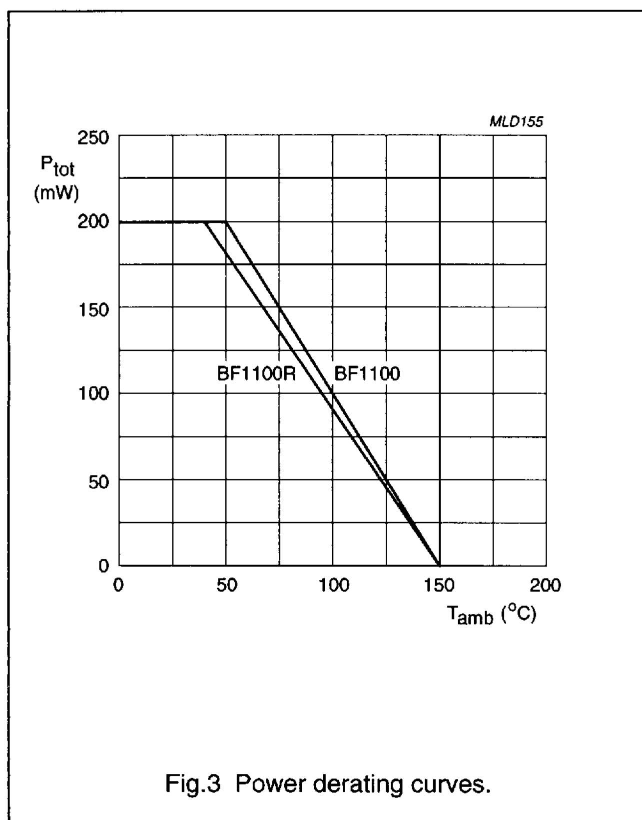

Fig.3 Power derating curves.

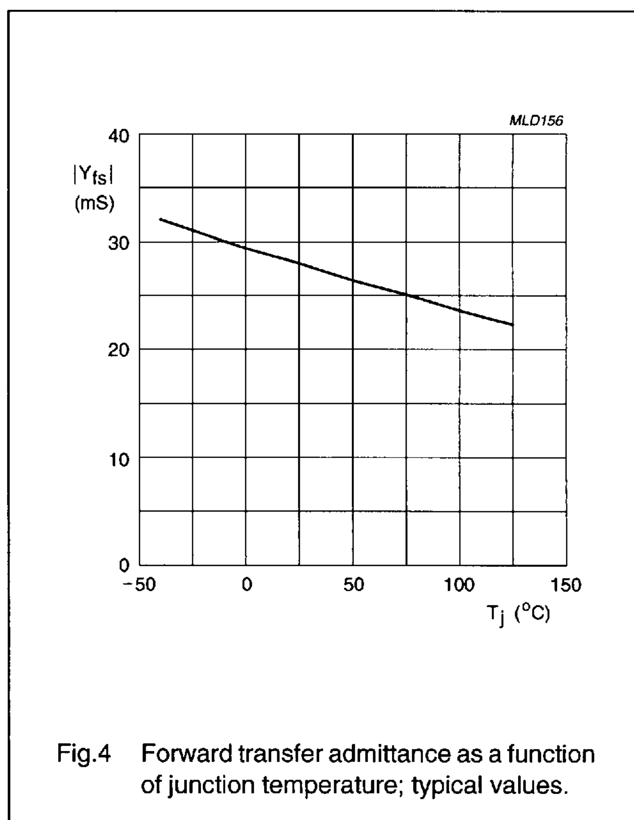

Fig.4 Forward transfer admittance as a function of junction temperature; typical values.

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THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1		
	BF1100		500	K/W
	BF1100R		550	K/W
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	note 2		
	BF1100	$T_s = 92\ °C$	290	K/W
	BF1100R	$T_s = 78\ °C$	360	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; $I_D = 20\ \mu A$	0.3	1	V
		$V_{G2\text{-}S} = 4$ V; $V_{DS} = 12$ V; $I_D = 20\ \mu A$	0.3	1	V
$V_{G2\text{-}S(th)}$	gate 2-source threshold voltage	$V_{G1\text{-}S} = 4$ V; $V_{DS} = 9$ V; $I_D = 20\ \mu A$	0.3	1.2	V
		$V_{G1\text{-}S} = 4$ V; $V_{DS} = 12$ V; $I_D = 20\ \mu A$	0.3	1.2	V
I_{DSX}	drain-source current	$V_{G2\text{-}S} = 4$ V; $V_{DS} = 9$ V; $R_{G1} = 180\ k\Omega$; note 1	8	13	mA
		$V_{G2\text{-}S} = 4$ V; $V_{DS} = 12$ V; $R_{G1} = 250\ k\Omega$; 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.27.
2. R_{G1} connects gate 1 to $V_{GG} = 12$ V; see Fig.27.

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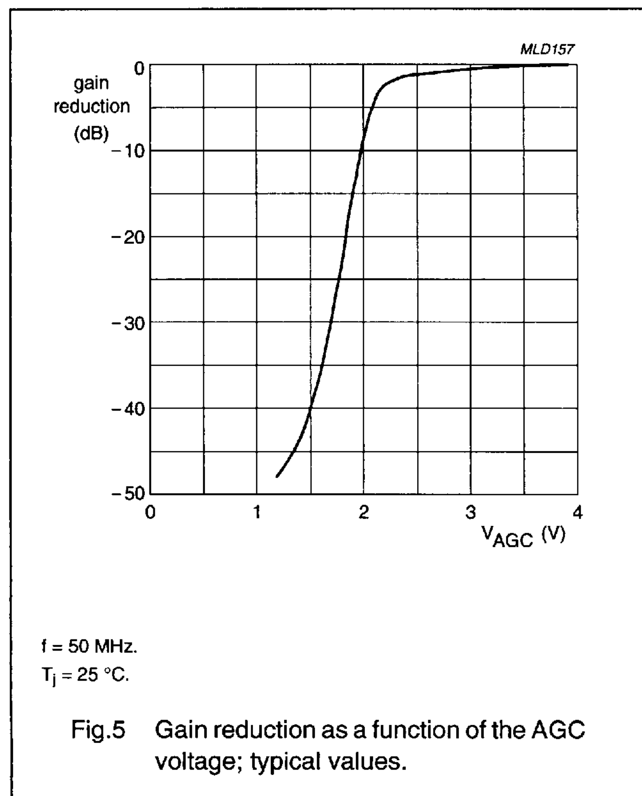
DYNAMIC CHARACTERISTICS

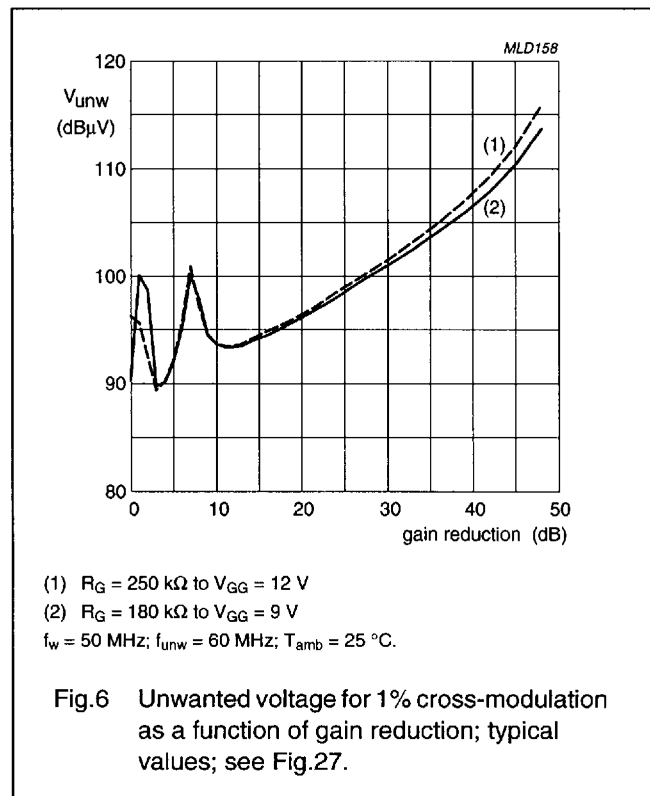
Common source; T_{amb} = 25 °C; $V_{G2\text{-}S}$ = 4 V; I_D = 10 mA; unless otherwise specified.

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
$C_{ig1\text{-}s}$	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
$C_{ig2\text{-}s}$	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.5 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.6 Unwanted voltage for 1% cross-modulation as a function of gain reduction; typical values; see Fig.27.

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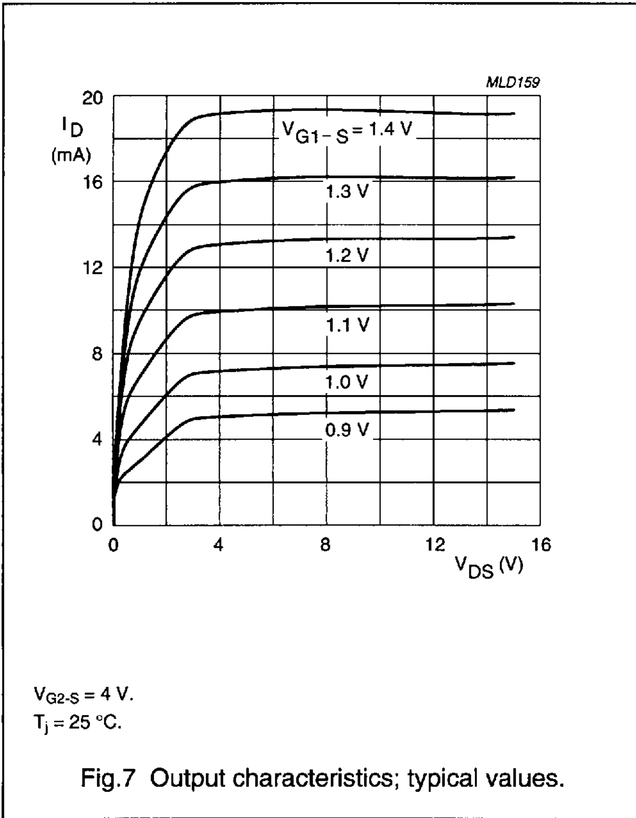
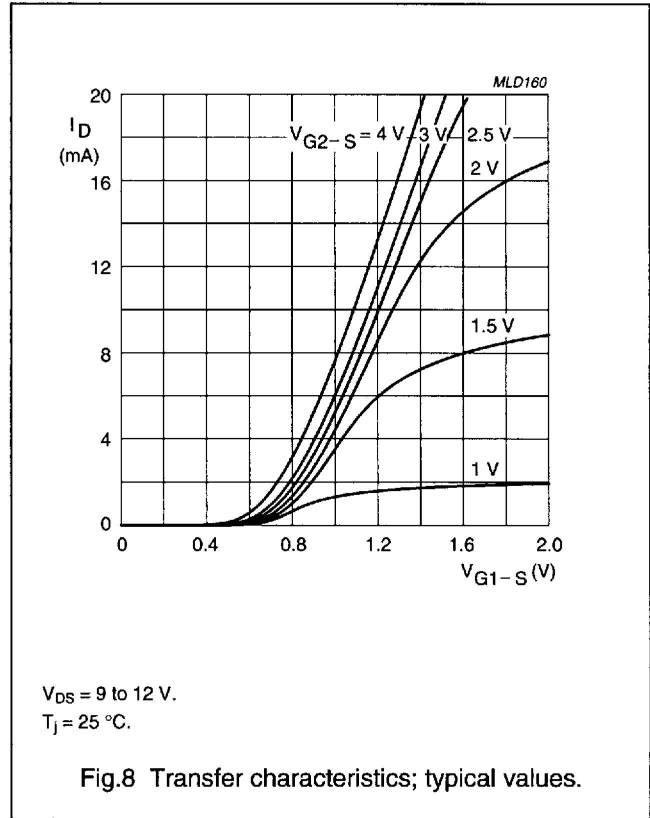


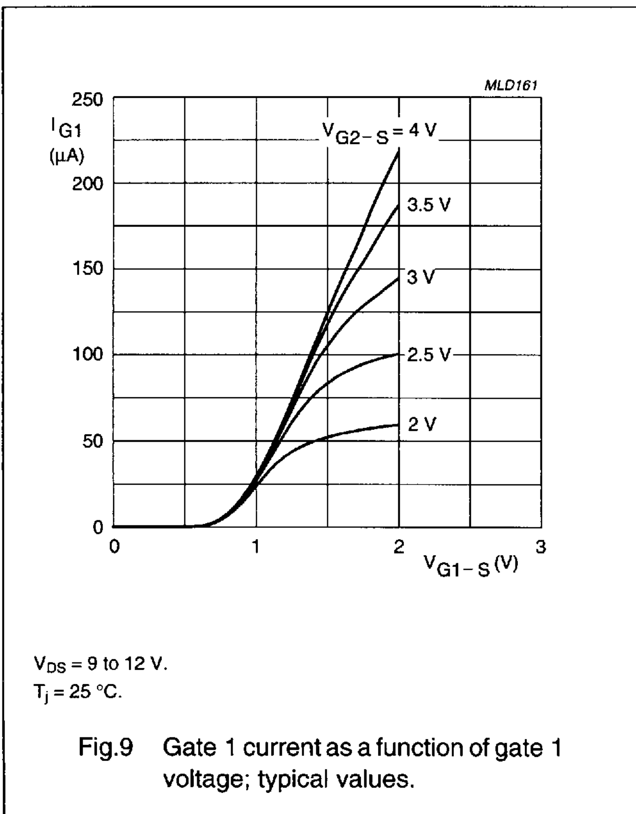
V_{G2-S} = 4 V.
T_j = 25 °C.

Fig.7 Output characteristics; typical values.



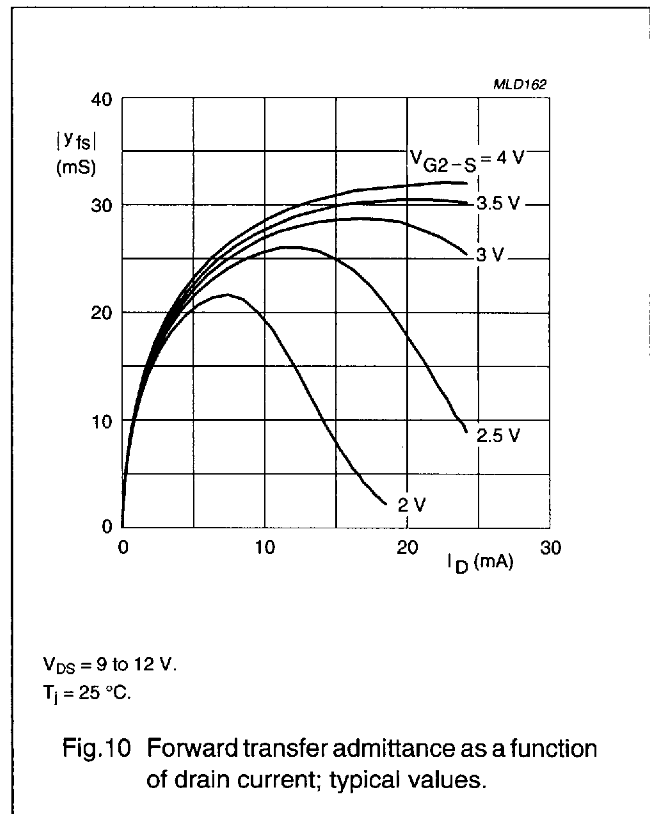
V_{DS} = 9 to 12 V.
T_j = 25 °C.

Fig.8 Transfer characteristics; typical values.



V_{DS} = 9 to 12 V.
T_j = 25 °C.

Fig.9 Gate 1 current as a function of gate 1 voltage; typical values.



V_{DS} = 9 to 12 V.
T_j = 25 °C.

Fig.10 Forward transfer admittance as a function of drain current; typical values.

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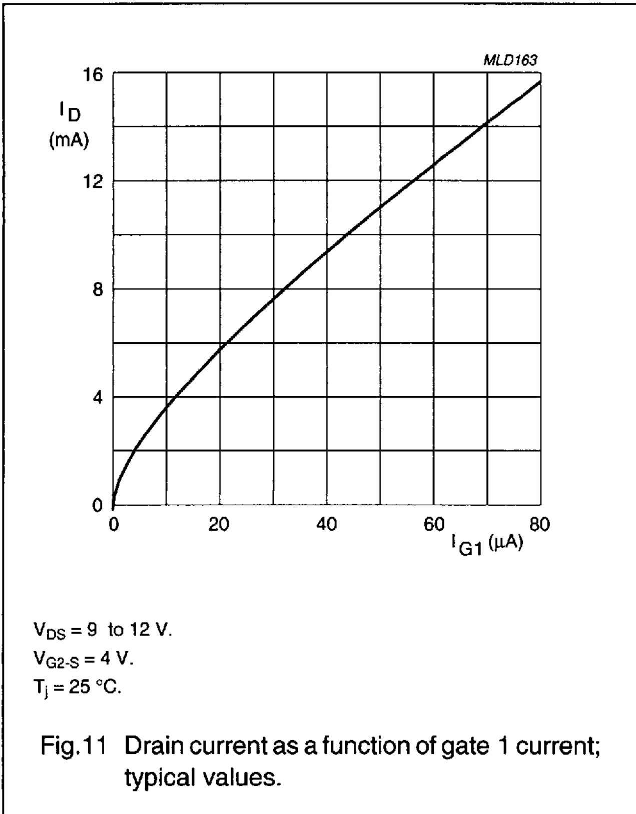
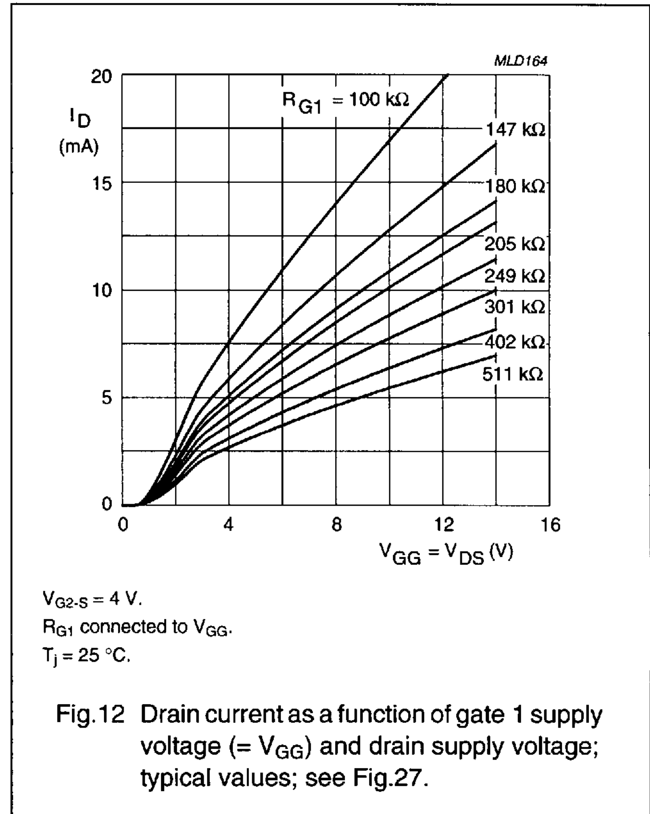


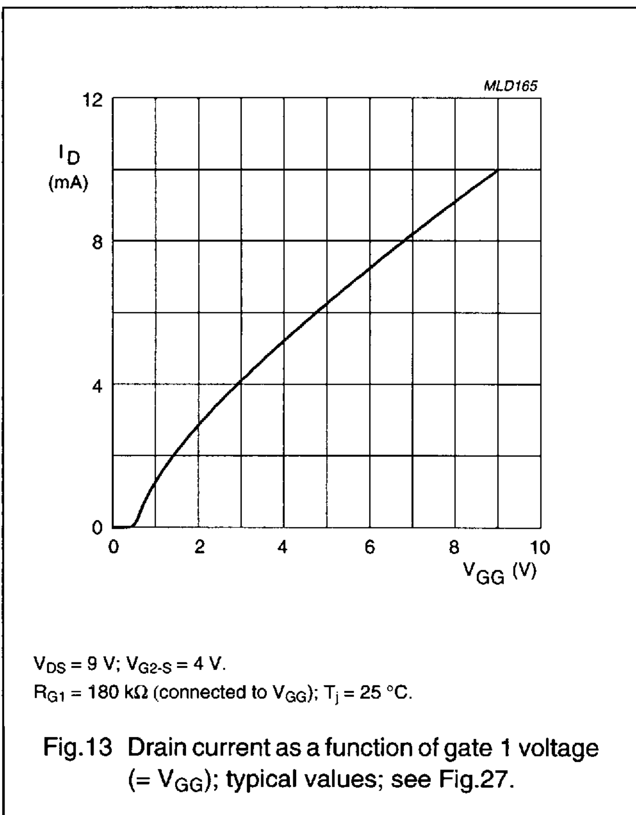
V_{DS} = 9 to 12 V.
$V_{G2\text{-}S}$ = 4 V.
T_j = 25 °C.

Fig.11 Drain current as a function of gate 1 current; typical values.



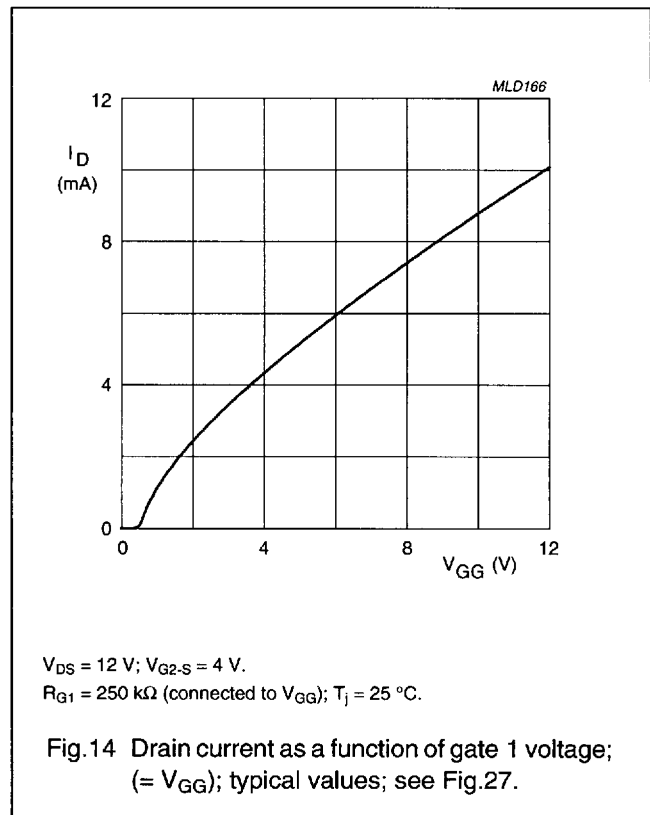
$V_{G2\text{-}S}$ = 4 V.
R_{G1} connected to V_{GG}.
T_j = 25 °C.

Fig.12 Drain current as a function of gate 1 supply voltage (= V_{GG}) and drain supply voltage; typical values; see Fig.27.



V_{DS} = 9 V; $V_{G2\text{-}S}$ = 4 V.
R_{G1} = 180 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.27.



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

Fig.14 Drain current as a function of gate 1 voltage; (= V_{GG}); typical values; see Fig.27.

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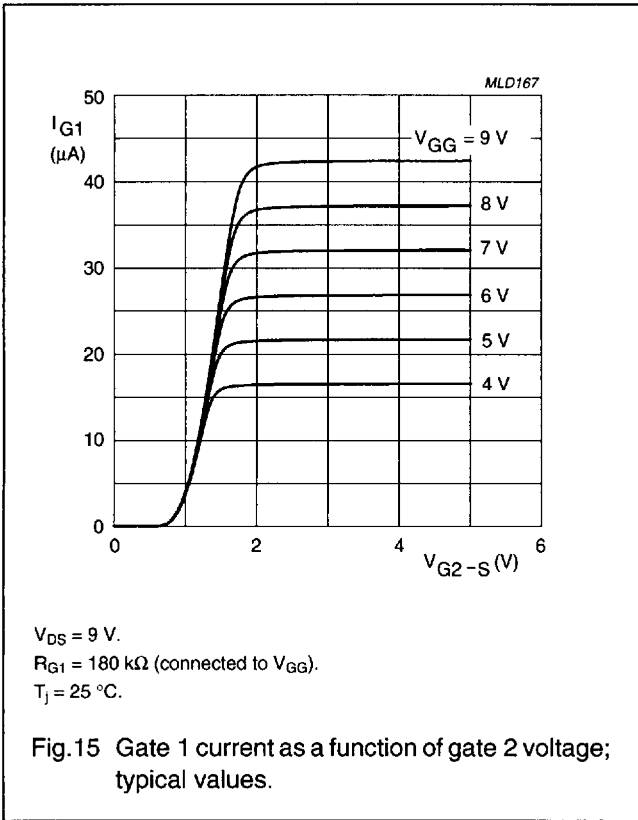
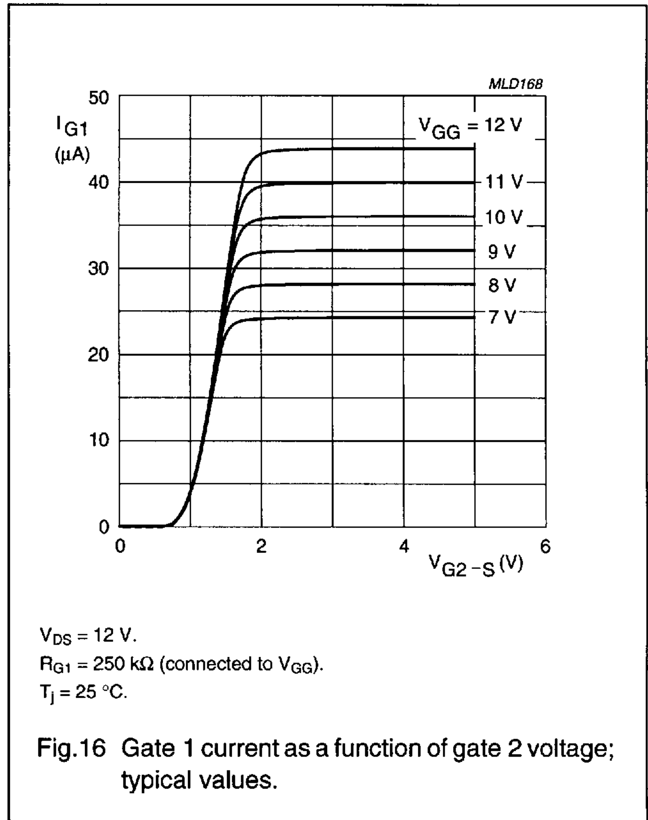


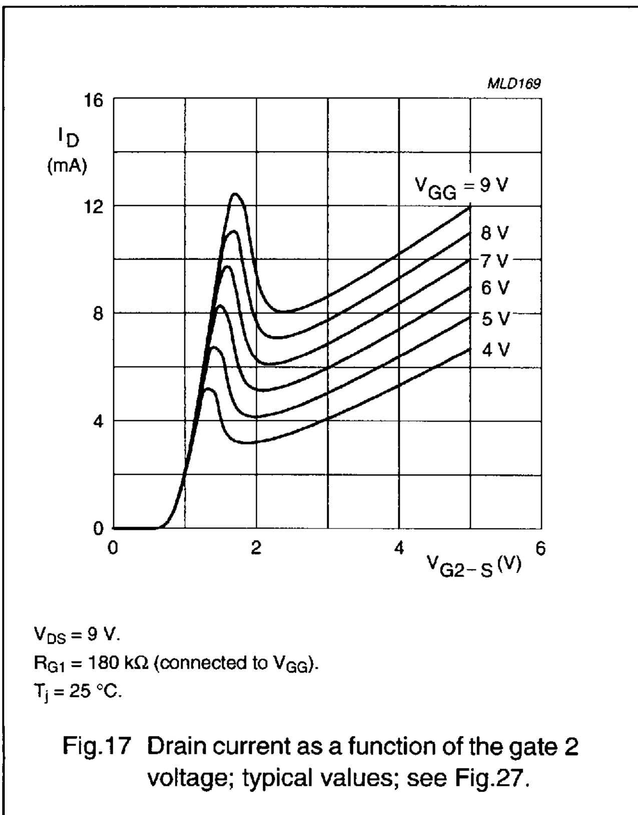
V_{DS} = 9 V.
R_{G1} = 180 kΩ (connected to V_{GG}).
T_j = 25 °C.

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



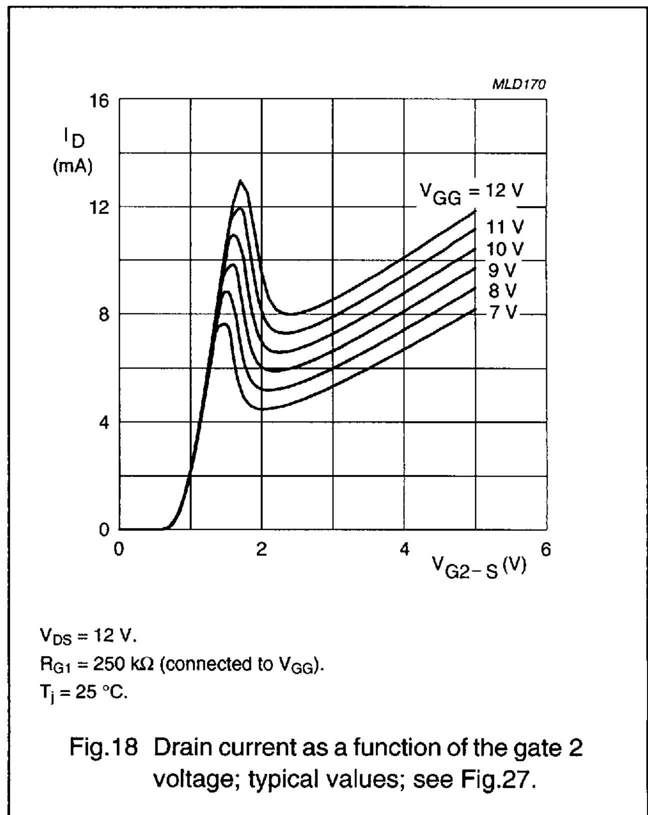
V_{DS} = 12 V.
R_{G1} = 250 kΩ (connected to V_{GG}).
T_j = 25 °C.

Fig.16 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.17 Drain current as a function of the gate 2 voltage; typical values; see Fig.27.



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

Fig.18 Drain current as a function of the gate 2 voltage; typical values; see Fig.27.

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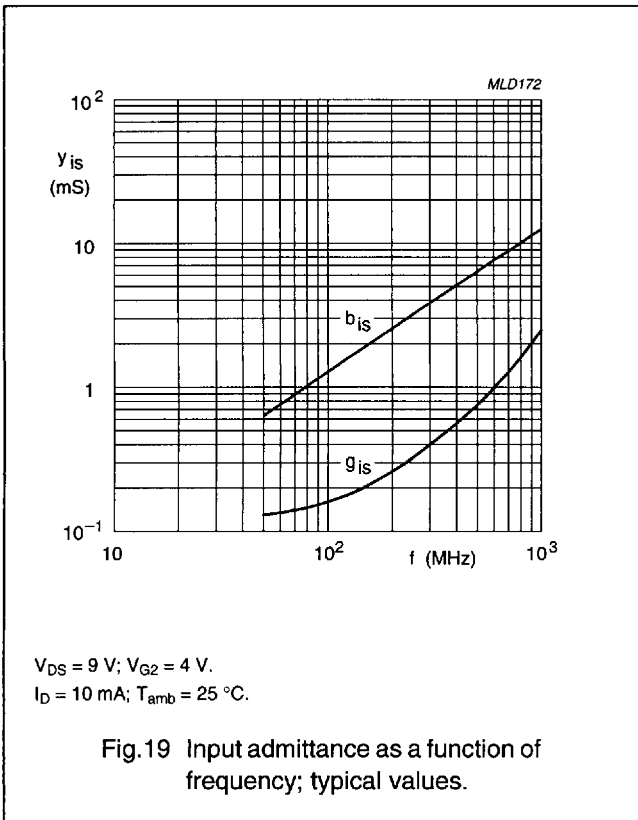
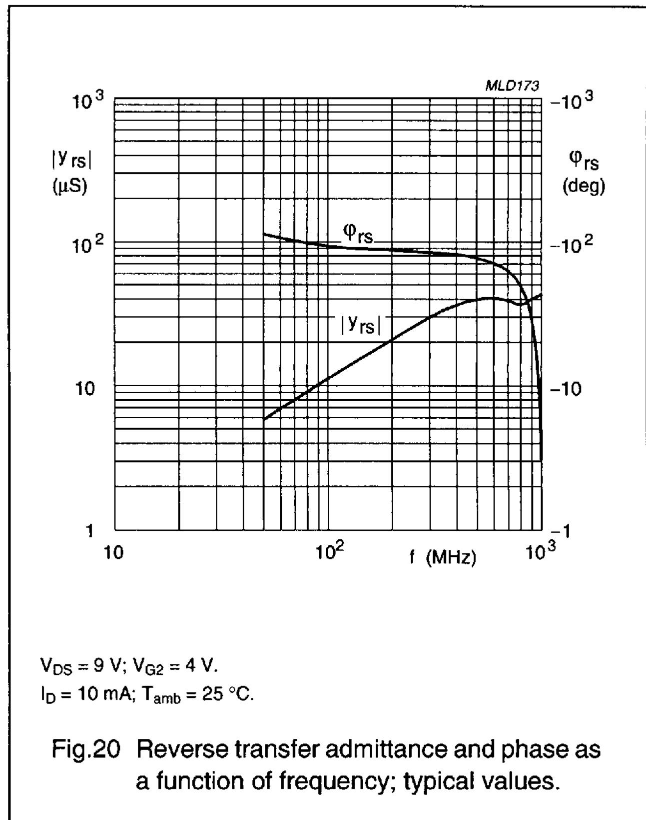


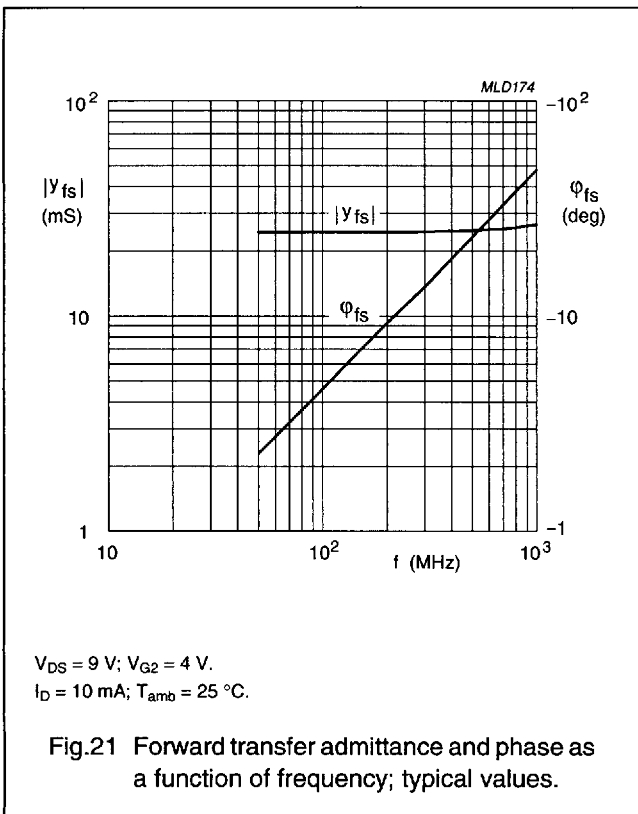
V_{DS} = 9 V; V_{G2} = 4 V.
I_D = 10 mA; T_{amb} = 25 °C.

Fig.19 Input admittance as a function of frequency; typical values.



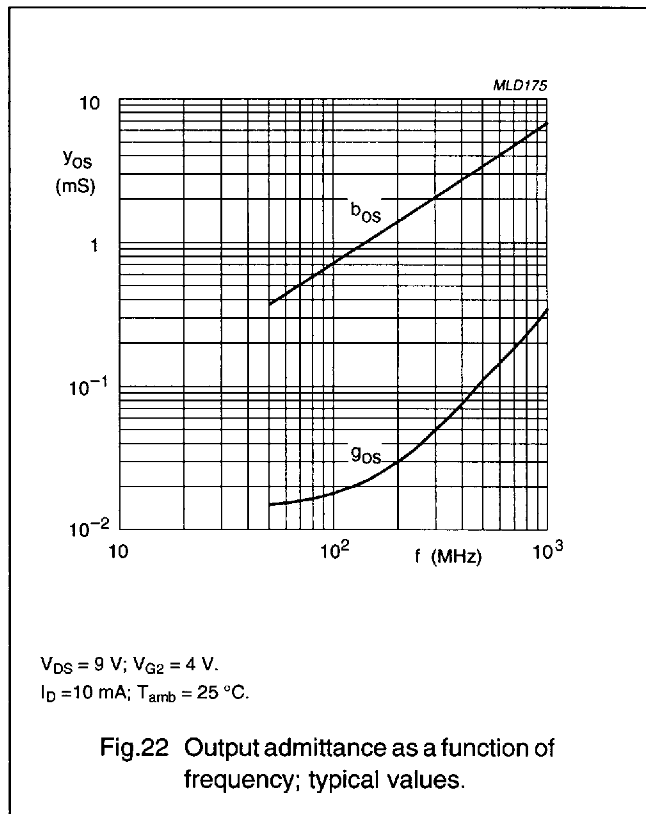
V_{DS} = 9 V; V_{G2} = 4 V.
I_D = 10 mA; T_{amb} = 25 °C.

Fig.20 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.21 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.22 Output admittance as a function of frequency; typical values.

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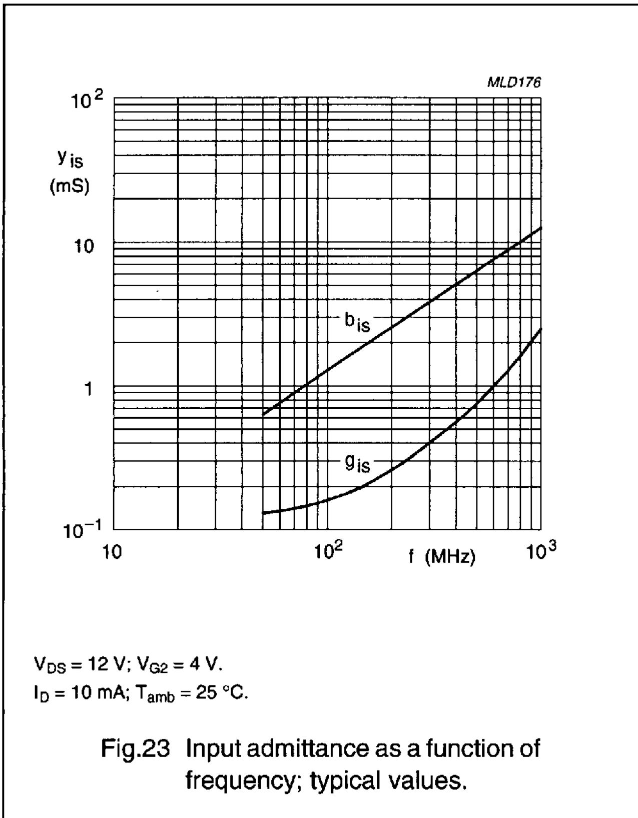
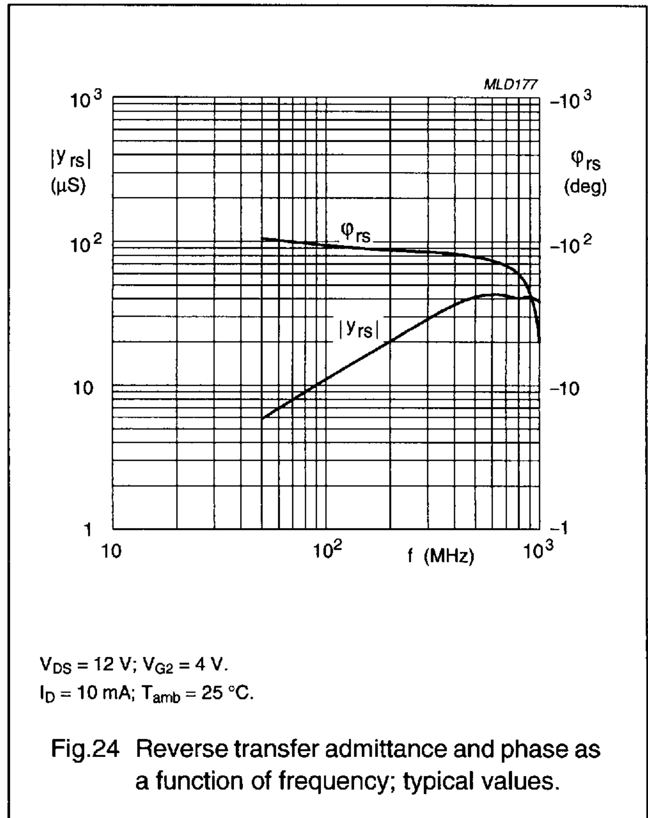


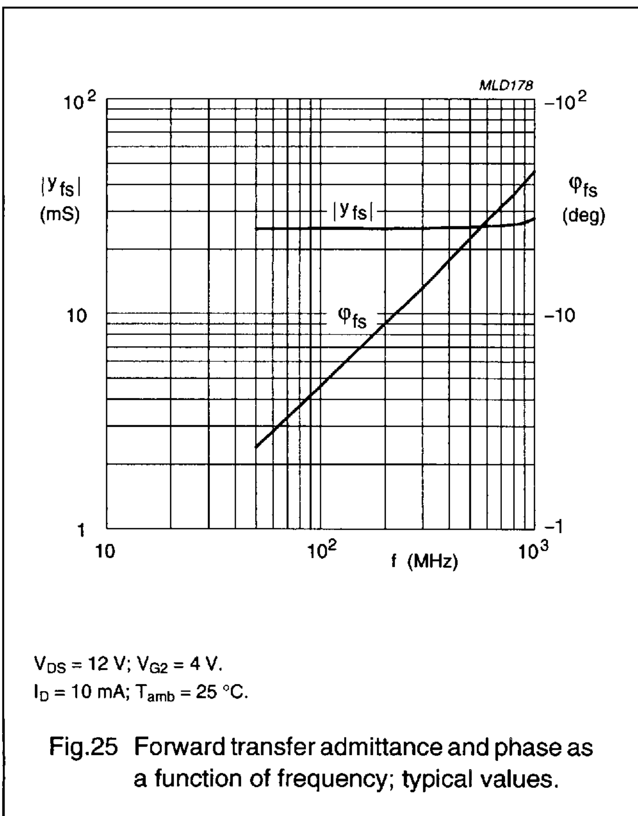
V_{DS} = 12 V; V_{G2} = 4 V.
I_D = 10 mA; T_{amb} = 25 °C.

Fig.23 Input admittance as a function of frequency; typical values.



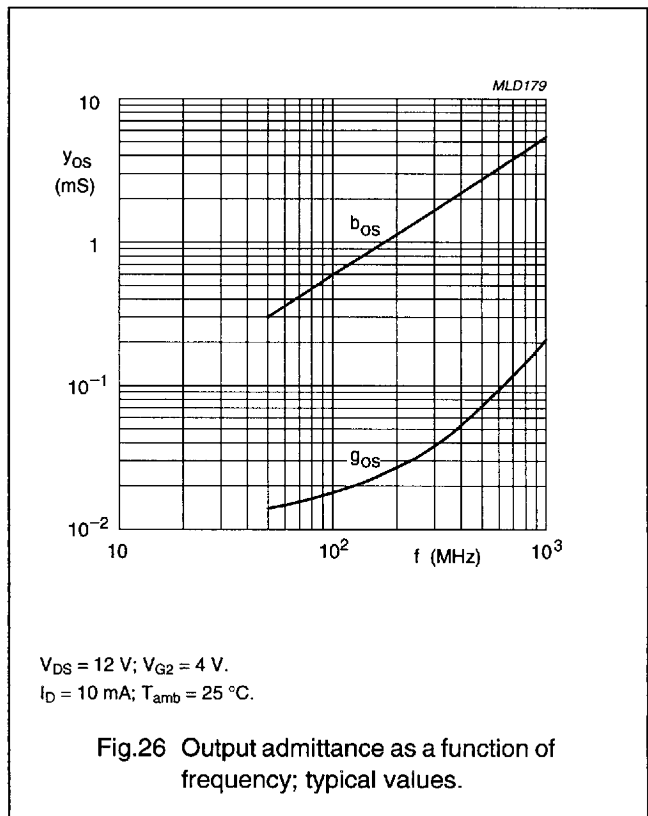
V_{DS} = 12 V; V_{G2} = 4 V.
I_D = 10 mA; T_{amb} = 25 °C.

Fig.24 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.25 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.26 Output admittance as a function of frequency; typical values.

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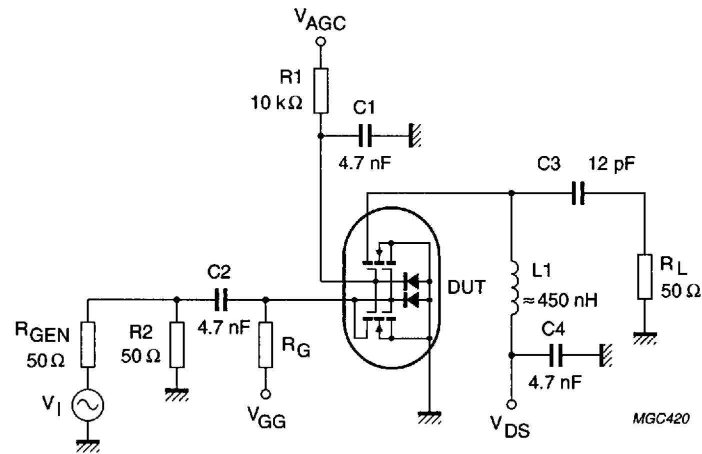

For $V_{GG} = V_{DS} = 9$ V, $R_G = 180$ kΩ.
For $V_{GG} = V_{DS} = 12$ V, $R_G = 250$ kΩ.

Fig.27 Cross-modulation test set-up.

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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	0.986	−3.6	2.528	174.4	0.001	63.7	1.000	−2.0
100	0.983	−7.4	2.531	169.8	0.001	80.7	1.000	−4.2
200	0.974	−14.7	2.490	159.5	0.002	81.0	0.996	−8.1
300	0.960	−21.8	2.446	149.8	0.002	80.3	0.994	−11.9
400	0.953	−28.7	2.412	139.8	0.003	76.3	0.992	−15.7
500	0.933	−35.4	2.341	130.1	0.003	76.5	0.987	−19.4
600	0.915	−42.0	2.283	120.4	0.004	79.0	0.984	−23.0
700	0.895	−47.9	2.205	111.6	0.003	81.5	0.981	−26.7
800	0.880	−53.5	2.146	102.9	0.003	90.8	0.978	−30.3
900	0.864	−59.6	2.087	93.4	0.003	106.6	0.974	−33.9
1000	0.839	−65.0	1.998	84.4	0.003	135.4	0.971	−37.6

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	0.986	−3.7	2.478	174.7	0.001	72.2	1.000	−1.6
100	0.984	−7.4	2.480	170.3	0.001	80.9	1.000	−3.5
200	0.974	−14.6	2.440	160.6	0.002	82.7	0.997	−6.6
300	0.960	−21.8	2.400	151.4	0.002	79.9	0.996	−9.7
400	0.953	−28.7	2.371	141.9	0.003	77.7	0.994	−12.8
500	0.933	−35.3	2.306	132.7	0.003	77.1	0.991	−15.8
600	0.915	−41.9	2.255	123.6	0.004	77.1	0.989	−18.7
700	0.894	−47.8	2.183	115.3	0.004	79.3	0.986	−21.7
800	0.879	−53.5	2.131	107.2	0.003	83.9	0.984	−24.6
900	0.863	−59.5	2.080	98.2	0.003	95.1	0.982	−27.5
1000	0.838	−65.0	1.999	89.7	0.003	115.8	0.980	−30.4

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

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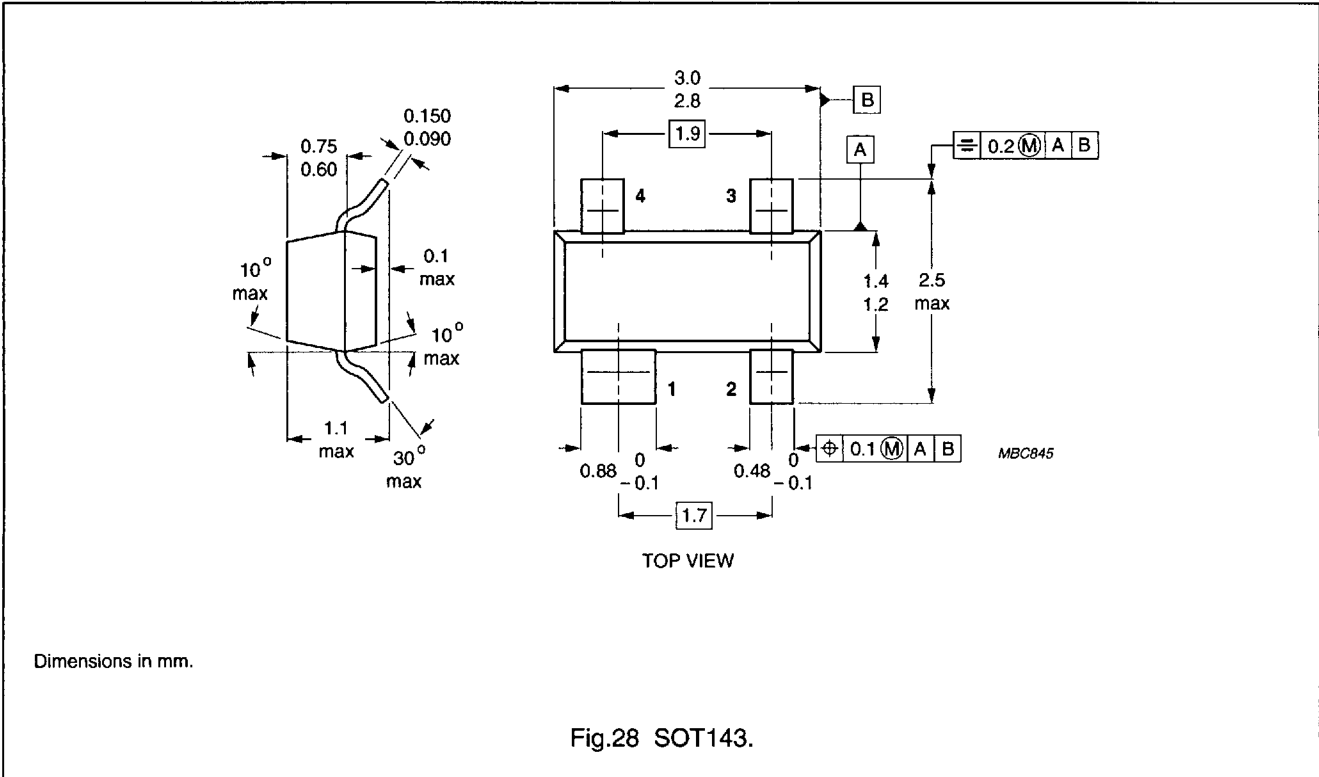
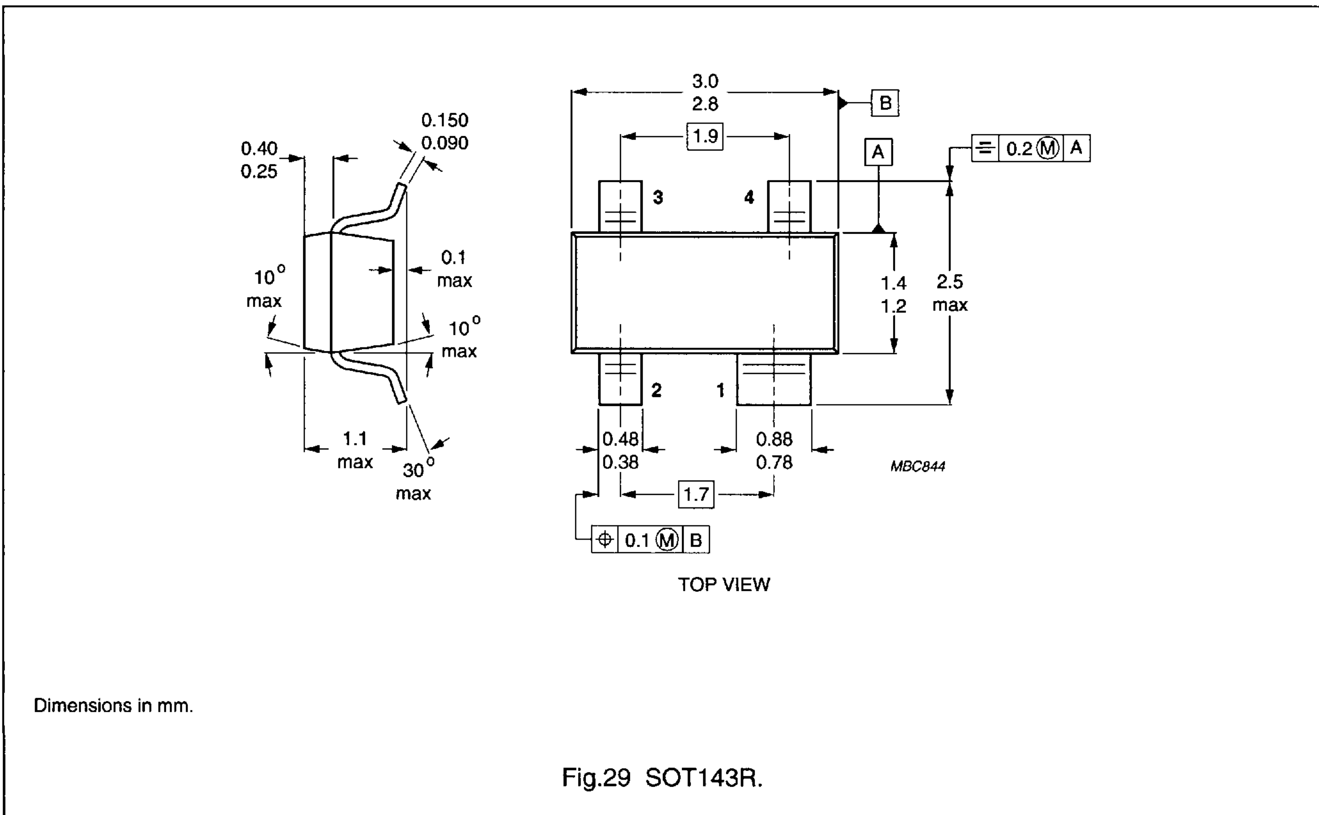
PACKAGE OUTLINES



Dimensions in mm.

Fig.28 SOT143.



Dimensions in mm.

Fig.29 SOT143R.

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