N-channel dual-gate MOS-FET | BF909AWR

FEATURES

- Specially designed for use at 5 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

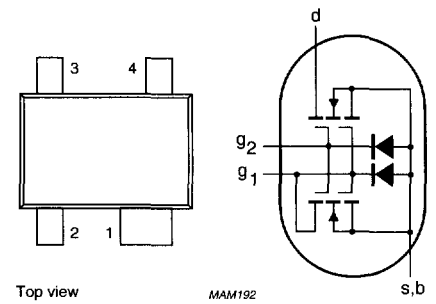
- VHF and UHF applications with 3 to 7 V supply voltage such as television tuners and professional communication equipment.

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.

PINNING

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



Marking code: MG.

Fig.1 Simplified outline (SOT343R) and symbol.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{DS}	drain-source voltage		–	–	7	V
I_D	drain current		–	–	40	mA
P_{tot}	total power dissipation		–	–	280	mW
T_j	operating junction temperature		–	–	150	°C
$\lvert y_{fs} \rvert$	forward transfer admittance		36	43	50	mS
$C_{ig1\text{-}s}$	input capacitance at gate 1		–	3.6	4.3	pF
C_{rs}	reverse transfer capacitance	f = 1 MHz	–	30	50	fF
F	noise figure	f = 800 MHz	–	2	2.8	dB

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 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{DS}	drain-source voltage		–	7	V
I_D	drain current		–	40	mA
I_{G1}	gate 1 current		–	±10	mA
I_{G2}	gate 2 current		–	±10	mA
P_{tot}	total power dissipation	up to T_{amb} = 50 °C; see Fig.2; note 1	–	280	mW
T_{stg}	storage temperature range		–65	+150	°C
T_j	operating junction temperature		–	+150	°C

Note

1. Device mounted on a printed-circuit board.

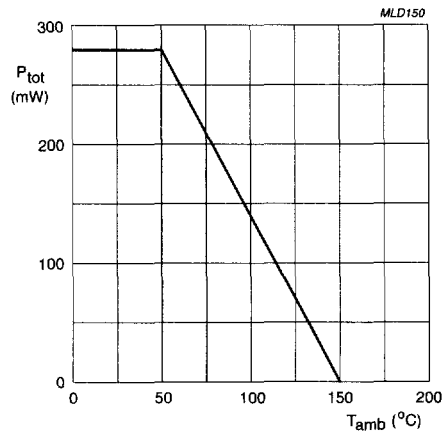


Fig.2 Power derating curve.

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	note 2	210	K/W

Notes

1. Device mounted on a printed-circuit board.
2. 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	$V_{G2\text{-}S} = V_{DS} = 0$; $I_{G1\text{-}S}$ = 10 mA	6	15	V
$V_{(BR)G2\text{-}SS}$	gate 2-source breakdown voltage	$V_{G1\text{-}S} = V_{DS} = 0$; $I_{G2\text{-}S}$ = 10 mA	6	15	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} = 5 V; I_D = 20 µA	0.3	1	V
$V_{G2\text{-}S(th)}$	gate 2-source threshold voltage	$V_{G1\text{-}S} = V_{DS}$ = 5 V; I_D = 20 µA	0.3	1.2	V
I_{DSX}	drain-source current	$V_{G2\text{-}S}$ = 4 V; V_{DS} = 5 V; R_{G1} = 120 kΩ; note 1	12	20	mA
$I_{G1\text{-}SS}$	gate 1 cut-off current	$V_{G2\text{-}S} = V_{DS} = 0$; $V_{G1\text{-}S}$ = 5 V	–	50	nA
$I_{G2\text{-}SS}$	gate 2 cut-off current	$V_{G1\text{-}S} = V_{DS} = 0$; $V_{G2\text{-}S}$ = 5 V	–	50	nA

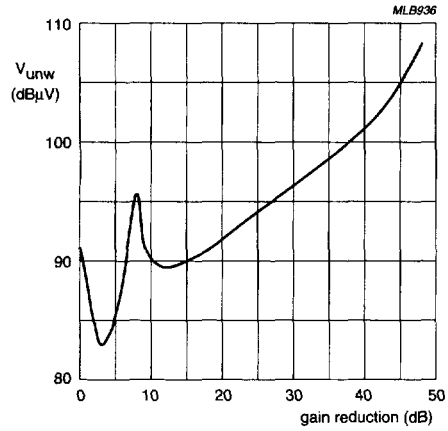
Note

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

DYNAMIC CHARACTERISTICS

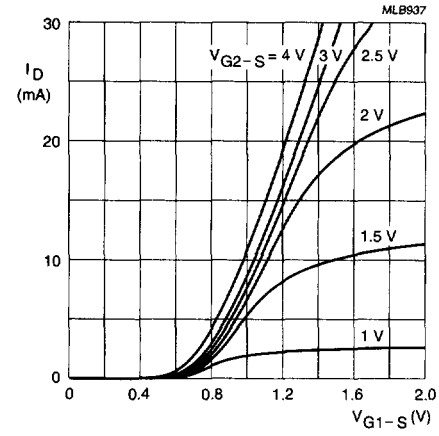
Common source; T_{amb} = 25 °C; V_{DS} = 5 V; $V_{G2\text{-}S}$ = 4 V; I_D = 15 mA; unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$\lvert y_{fs} \rvert$	forward transfer admittance	pulsed; T_j = 25 °C	36	43	50	mS
$C_{ig1\text{-}s}$	input capacitance at gate 1	f = 1 MHz	–	3.6	4.3	pF
$C_{ig2\text{-}s}$	input capacitance at gate 2	f = 1 MHz	–	2.3	3	pF
C_{os}	drain-source capacitance	f = 1 MHz	–	2.4	3	pF
C_{rs}	reverse transfer capacitance	f = 1 MHz	–	30	50	fF
F	noise figure	f = 800 MHz; $G_S = G_{Sopt}$; $B_S = B_{Sopt}$	–	2	2.8	dB



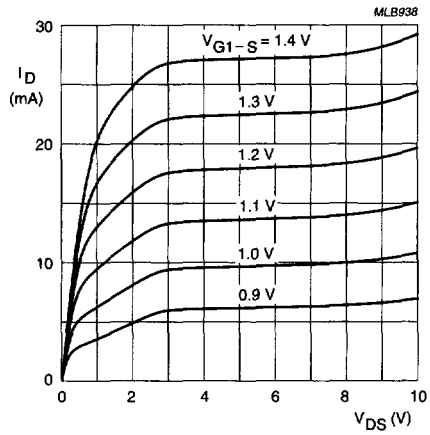
V_{DS} = 5 V; V_{GG} = 5 V; f_w = 50 MHz.
f_{unw} = 60 MHz; T_{amb} = 25 °C; R_{G1} = 120 kΩ.

Fig.3 Unwanted voltage for 1% cross-modulation as a function of gain reduction; typical values; see Fig.17.



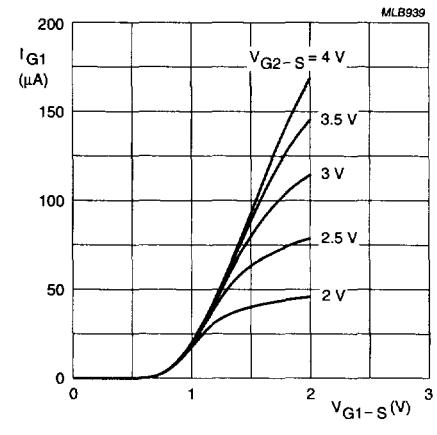
V_{DS} = 5 V; T_j = 25 °C.

Fig.4 Transfer characteristics; typical values.



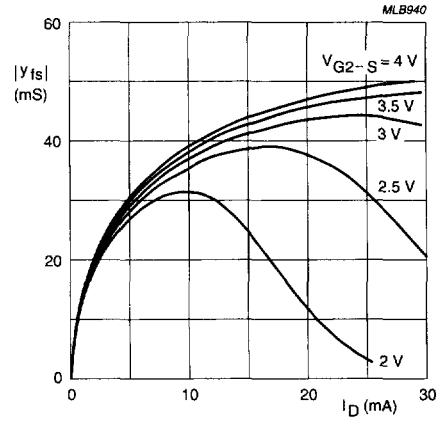
V_{G2-S} = 4 V; T_j = 25 °C.

Fig.5 Output characteristics; typical values.



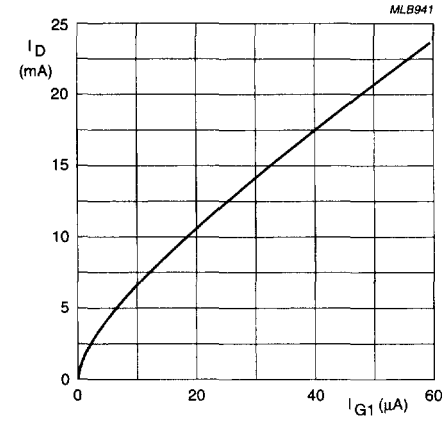
V_{DS} = 5 V; T_j = 25 °C.

Fig.6 Gate 1 current as a function of gate 1 voltage; typical values.



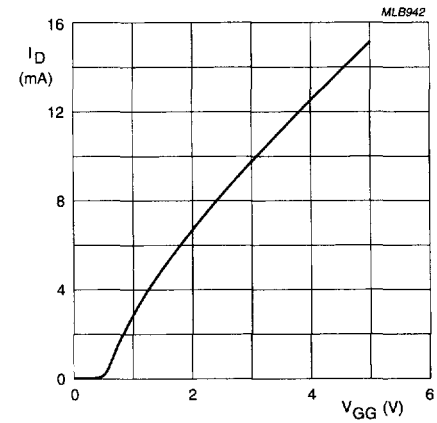
V_{DS} = 5 V; T_j = 25 °C.

Fig.7 Forward transfer admittance as a function of drain current; typical values.



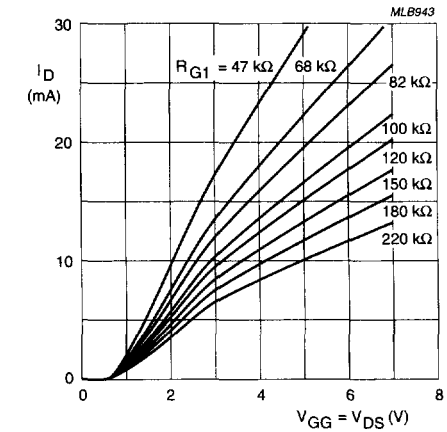
V_{DS} = 5 V; $V_{G2\text{-}S}$ = 4 V; T_j = 25 °C.

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



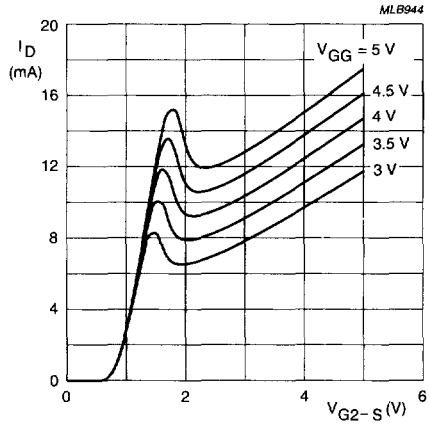
V_{DS} = 5 V; $V_{G2\text{-}S}$ = 4 V.
R_{G1} = 120 kΩ (connected to V_{GG}); T_j = 25 °C.

Fig.9 Drain current as a function of gate 1 supply voltage (= V_{GG}); typical values; see Fig.17.



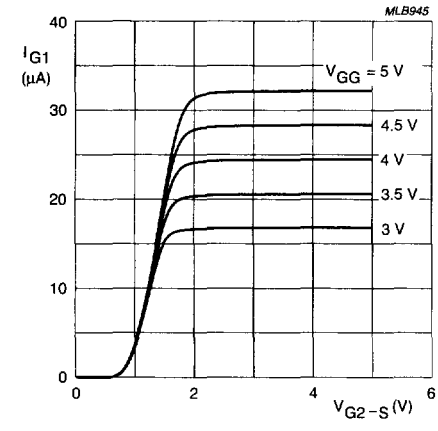
$V_{G2\text{-}S}$ = 4 V; R_{G1} connected to V_{GG}; T_j = 25 °C.

Fig.10 Drain current as a function of gate 1 (= V_{GG}) and drain supply voltage; typical values; see Fig.17.



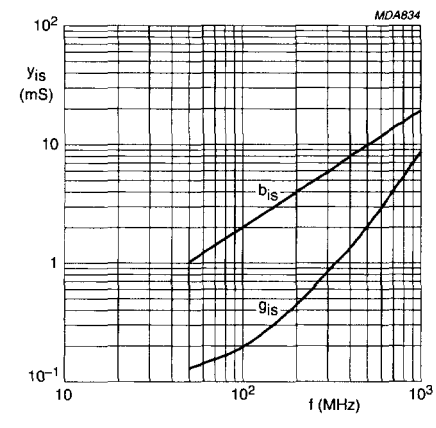
V_{DS} = 5 V; T_j = 25 °C; R_{G1} = 120 kΩ (connected to V_{GG}).

Fig.11 Drain current as a function of gate 2 voltage; typical values; see Fig.17.



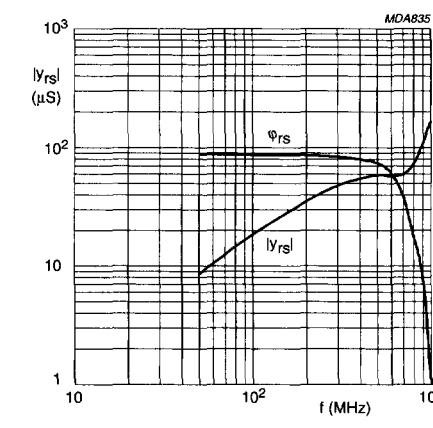
V_{DS} = 5 V; T_j = 25 °C; R_{G1} = 120 kΩ (connected to V_{GG}).

Fig.12 Gate 1 current as a function of gate 2 voltage; typical values; see Fig.17.



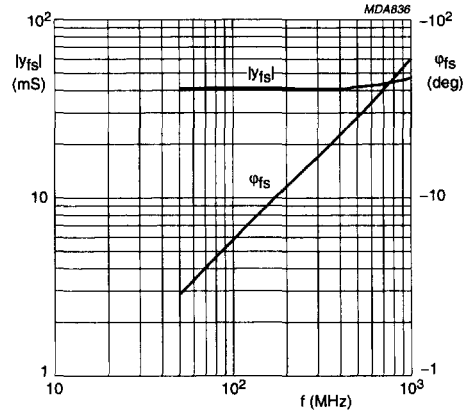
V_{DS} = 5 V; V_{G2} = 4 V; I_D = 15 mA; T_{amb} = 25 °C.

Fig.13 Input admittance as a function of frequency; typical values.



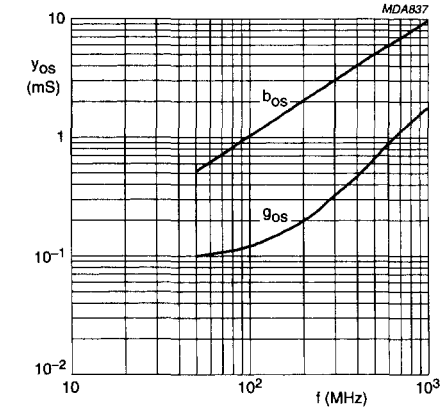
V_{DS} = 5 V; V_{G2} = 4 V; I_D = 15 mA; T_{amb} = 25 °C.

Fig.14 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.15 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.16 Output admittance as a function of frequency; typical values.

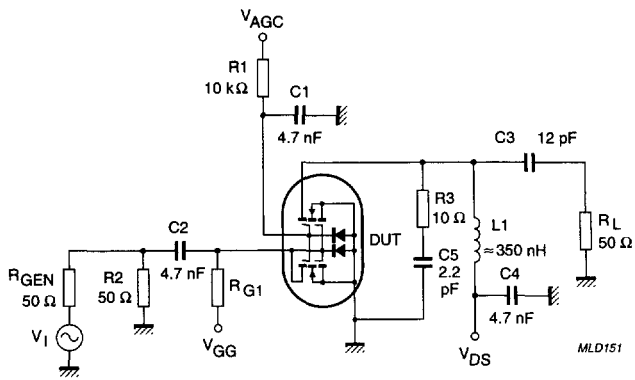


Fig.17 Cross-modulation test set-up.

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	−6.0	4.070	172.7	0.001	86.9	0.989	−3.1
100	0.980	−11.8	4.041	165.4	0.002	82.9	0.987	−6.1
200	0.956	−23.0	3.897	151.3	0.003	73.4	0.978	−12.1
300	0.911	−33.3	3.654	136.9	0.004	70.6	0.962	−17.7
400	0.888	−44.2	3.531	125.4	0.005	67.4	0.951	−23.3
500	0.845	−53.5	3.265	113.4	0.005	66.6	0.934	−28.6
600	0.803	−62.3	3.055	102.3	0.005	75.0	0.917	−33.6
700	0.758	−70.9	2.836	91.3	0.004	93.1	0.902	−38.5
800	0.719	−78.8	2.653	80.9	0.004	115.2	0.889	−43.5
900	0.683	−86.4	2.456	70.9	0.006	132.7	0.878	−48.3
1000	0.653	−93.9	2.299	61.4	0.008	141.0	0.870	−53.3

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
		(ratio)	(deg)	
800	2.00	0.603	67.71	0.581