

N-Channel Dual-Gate MOSFET**Description**

The TMF3202Z is an enhancement type N-channel field-effect transistor. 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 SOT343 micro-miniature plastic package.

Features

- Gain controlled amplifier with AGC
- Integrated gate protection diodes
- High AGC-range, high gain, low noise figure

Applications

- Gain controlled input stage for UHF and VHF tuners
- Professional communications equipment

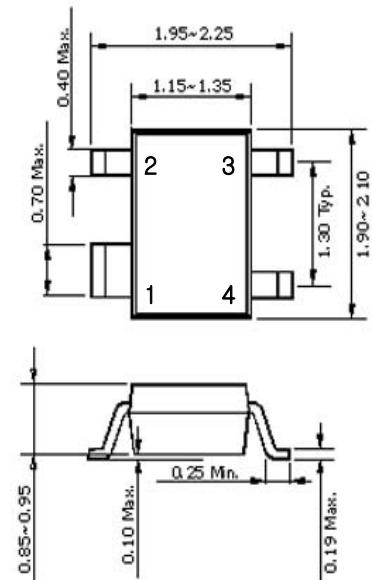
Absolute Maximum Ratings ($T_a = 25^\circ\text{C}$)

Parameter	Symbol	Ratings	Unit
Drain-Source Voltage	V_{DS}	10	V
Drain Current	I_D	30	mA
Gate 1 Current	I_{G1}	± 10	mA
Total Power Dissipation	P_{tot}	200	mW
Storage Temperature	T_{stg}	-65 ~ 150	$^\circ\text{C}$
Operating Junction Temperature	T_j	150	$^\circ\text{C}$

Caution : Electro Static Discharge sensitive device, observe handling precaution

SOT343

Unit in mm



1. SOURCE 3. GATE 2
2. DRAIN 4. GATE 1

DC Characteristics

($T_j = 25^\circ\text{C}$, unless otherwise specified)

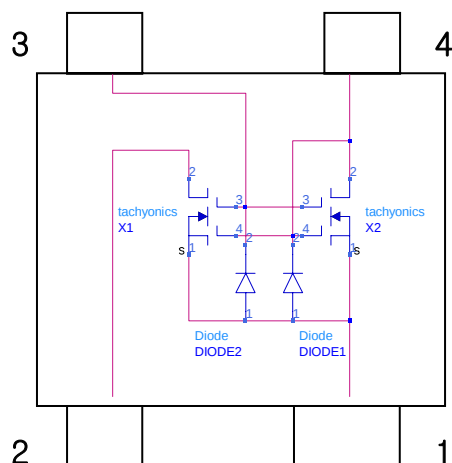
PARAMETER	SYMBOL	CONDITION	MIN.	MAX.	UNIT
Drain-source breakdown voltage	$V_{(BR)DSS}$	$V_{G1-S}=V_{G2-S}=0; I_D=10\mu\text{A}$	10	–	V
Gate1-source breakdown voltage	$V_{(BR)G1-SS}$	$V_{G2-S}=V_{DS}=0; I_{G1-S}=10\text{mA}$	6	10	V
Gate2-source breakdown voltage	$V_{(BR)G2-SS}$	$V_{G1-S}=V_{DS}=0; I_{G2-S}=10\text{mA}$	6	10	V
Forward source-gate1 voltage	$V_{(F)S-G1}$	$V_{G2-S}=V_{DS}=0; I_{S-G1}=10\text{mA}$	0.5	1.5	V
Forward source-gate2 voltage	$V_{(F)S-G2}$	$V_{G1-S}=V_{DS}=0; I_{S-G2}=10\text{mA}$	0.5	1.5	V
Gate1-source threshold voltage	$V_{G1-S(th)}$	$V_{DS}=5\text{V}; V_{G2-S}=4\text{V}; I_D=100\mu\text{A}$	0.3	1.0	V
Gate2-source threshold voltage	$V_{G2-S(th)}$	$V_{DS}=5\text{V}; V_{G1-S}=4\text{V}; I_D=100\mu\text{A}$	0.3	1.2	V
Drain-source current	I_{DSX}	$V_{G2-S}=4\text{V}; V_{DS}=5\text{V}; R_G=62\text{k}\Omega$	8	16	mA
Gate1 cut-off current	I_{G1-S}	$V_{G1-S}=5\text{V}; V_{G2-S}=V_{DS}=0$	–	10	nA
Gate2 cut-off current	I_{G2-S}	$V_{G2-S}=5\text{V}; V_{G1-S}=V_{DS}=0$	–	10	nA

AC Characteristics

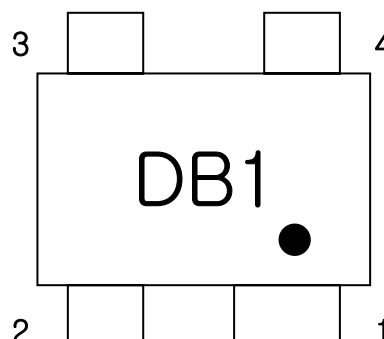
(Common source; $T_a = 25^\circ\text{C}$, $V_{G2-S} = 4\text{V}$, $V_{DS} = 5\text{V}$, $I_D = 12\text{mA}$;unless otherwise specified)

PARAMETER	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Forward transfer admittance	$ y_{FS} $	$T_j=25^\circ\text{C}$	25	30	40	mS
Input capacitance at gate1	C_{ig1-ss}	$f=1\text{MHz}$	–	1.7	2.2	pF
Input capacitance at gate2	C_{ig2-ss}	$f=1\text{MHz}$	–	3.3	–	pF
Output capacitance	C_{oss}	$f=1\text{MHz}$	–	0.9	–	pF
Reverse transfer capacitance	C_{rss}	$f=1\text{MHz}$	–	15	25	fF
Power gain	Gtr	$f=200\text{MHz}; Z_i = S_{11}^*, Z_o = S_{22}^*$	30	33	–	dB
		$f=400\text{MHz}; Z_i = S_{11}^*, Z_o = S_{22}^*$	27	30	–	dB
		$f=800\text{MHz}; Z_i = S_{11}^*, Z_o = S_{22}^*$	24	27	–	dB
Noise figure	NF	$f=400\text{MHz}; Z_i = S_{11 \text{ opt(NF)}}$	–	1.2	–	dB
		$f=800\text{MHz}; Z_i = S_{11 \text{ opt(NF)}}$	–	1.5	2.0	dB
Cross-modulation	X_{mod}	$k=1\%, f_w=50\text{MHz};$ $\text{funw}=60\text{MHz AGC} = 0\text{dB}$	90	–	–	dB μV
		$k=1\%, f_w=50\text{MHz};$ $\text{funw}=60\text{MHz AGC} = 10\text{dB}$	–	92	–	dB μV
		$k=1\%, f_w=50\text{MHz};$ $\text{funw}=60\text{MHz AGC} = 40\text{dB}$	100	105	–	dB μV

Equivalent circuit (Top view)



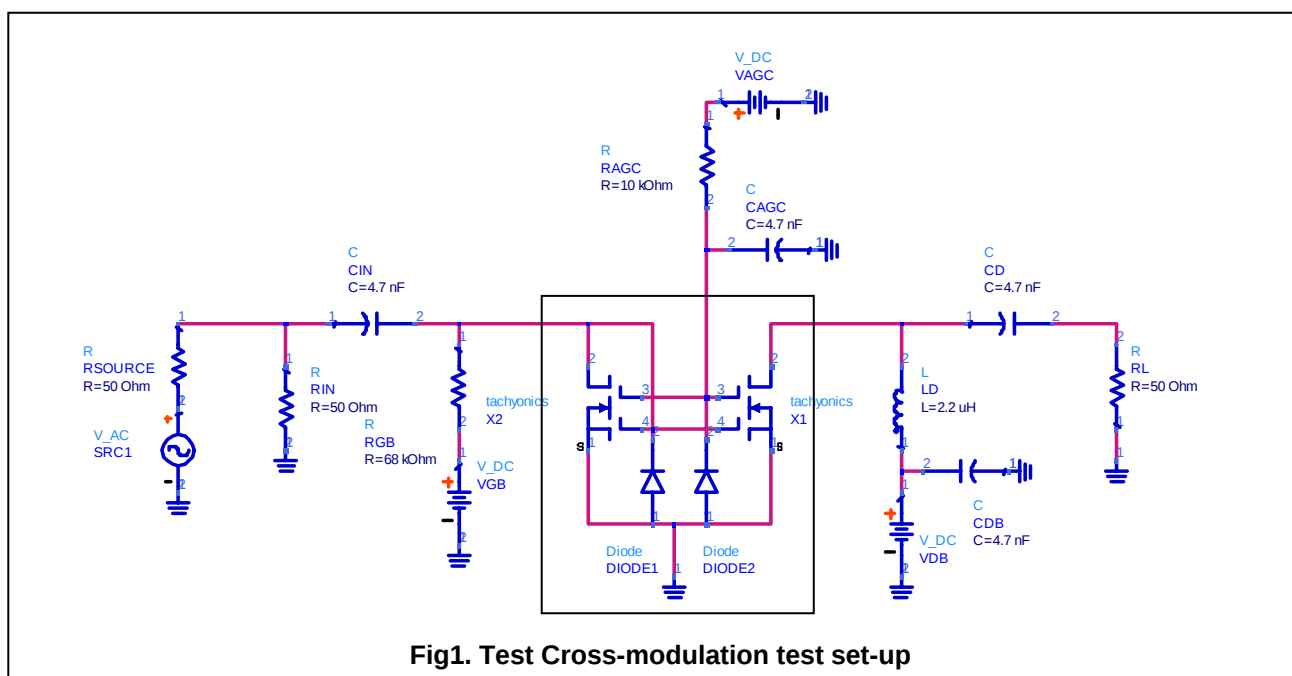
Making



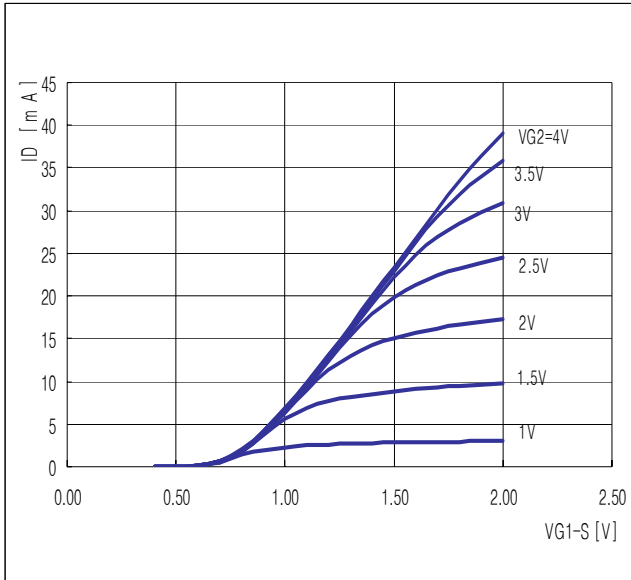
Pin Configuration

PIN	DESCRIPTION
1	SOURCE
2	DRAIN
3	GATE2
4	GATE1

Test circuit

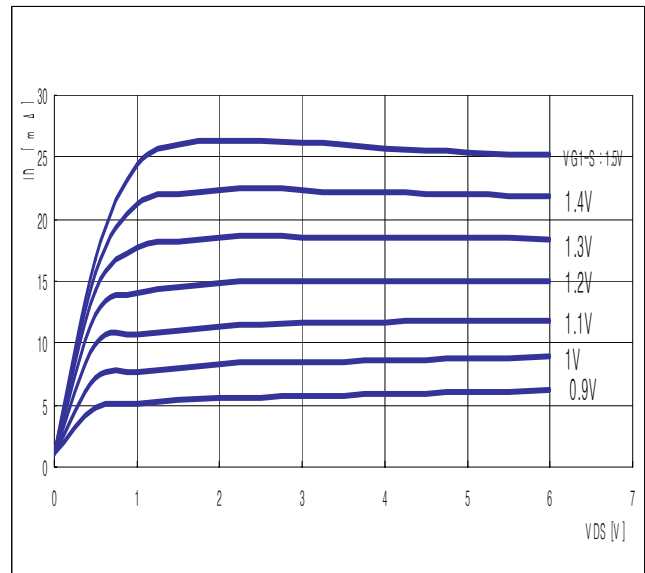


□ Graphs



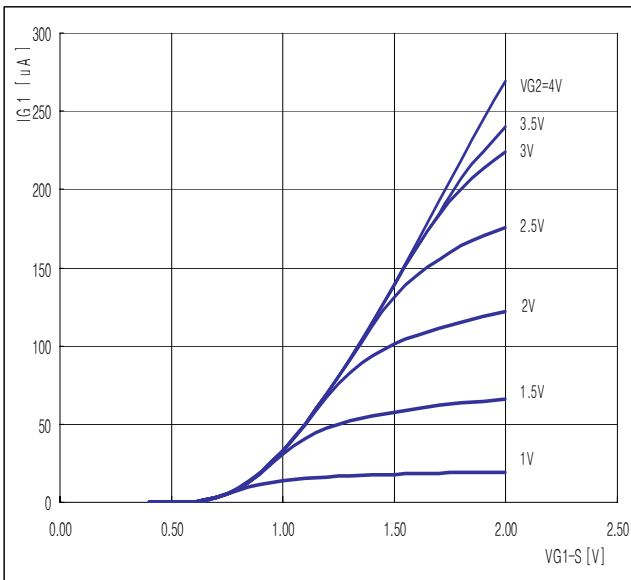
$V_{DS} = 5V$, $T_j = 25^\circ C$

Fig.2 Transfer characteristics



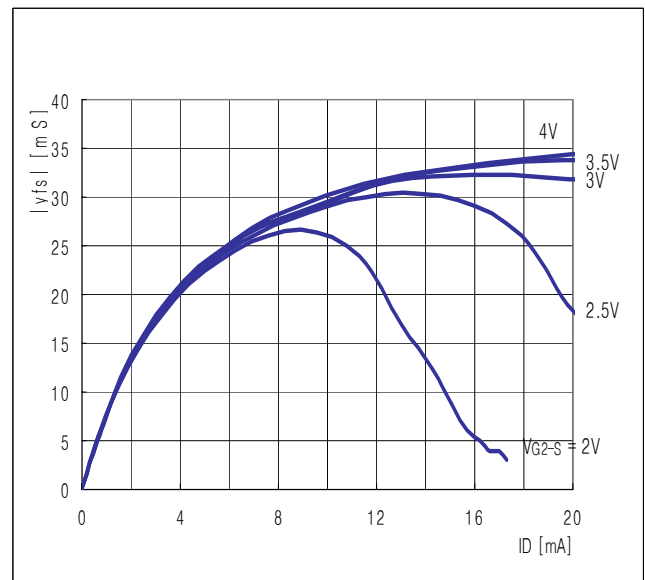
$V_{G2-S} = 4V$, $T_j = 25^\circ C$

Fig.3. Output characteristics



$V_{DS} = 5V$, $T_j = 25^\circ C$

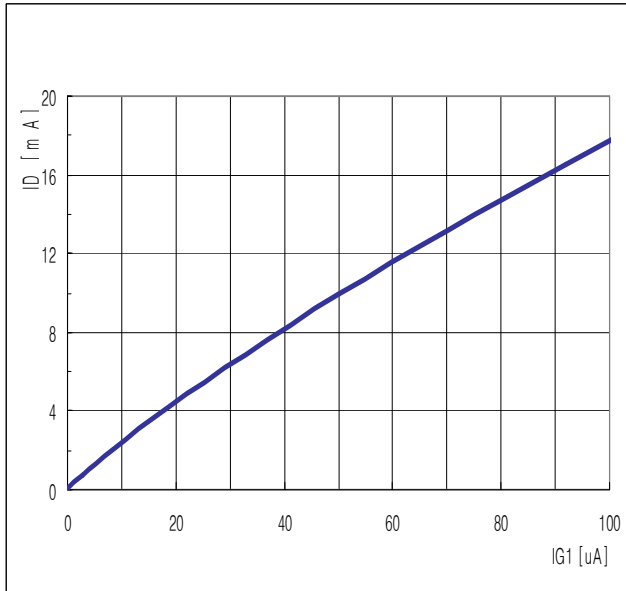
Fig.4 Gate1 Current as a function of gate1 Voltage



$V_{DS} = 5V$, $T_j = 25^\circ C$

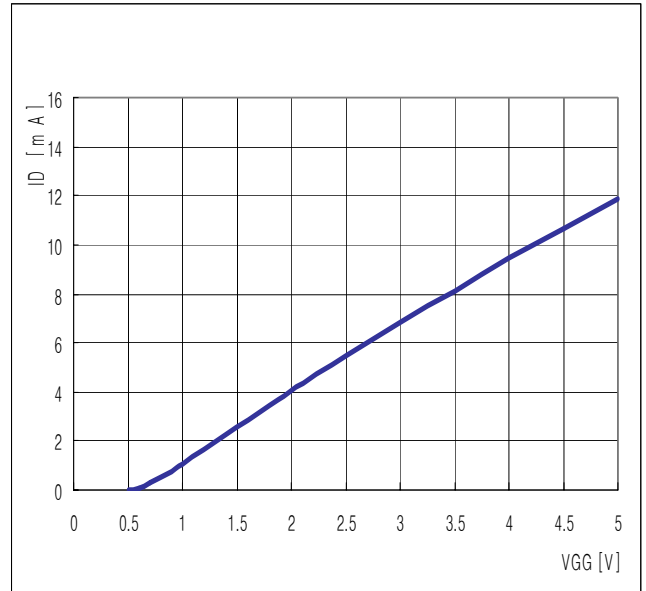
Fig.5. Forward transfer admittance as a function of drain current

Graphs



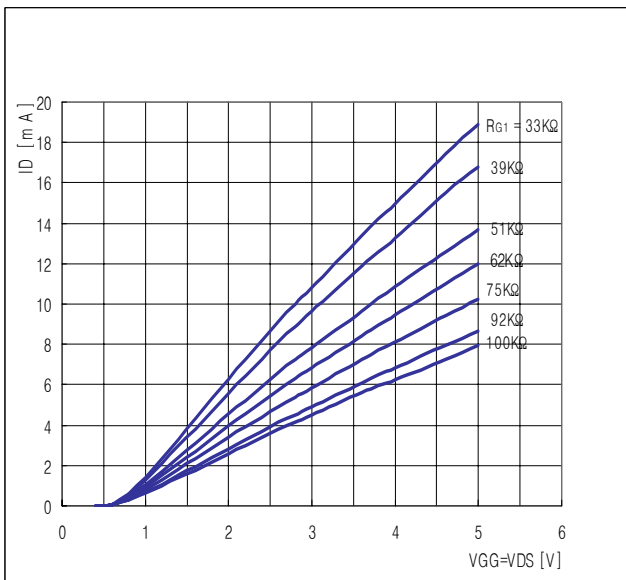
$V_{DS} = 5V$, $V_{G2-S} = 4V$, $T_j = 25^\circ C$

Fig6. Drain current as a function of gate1 current



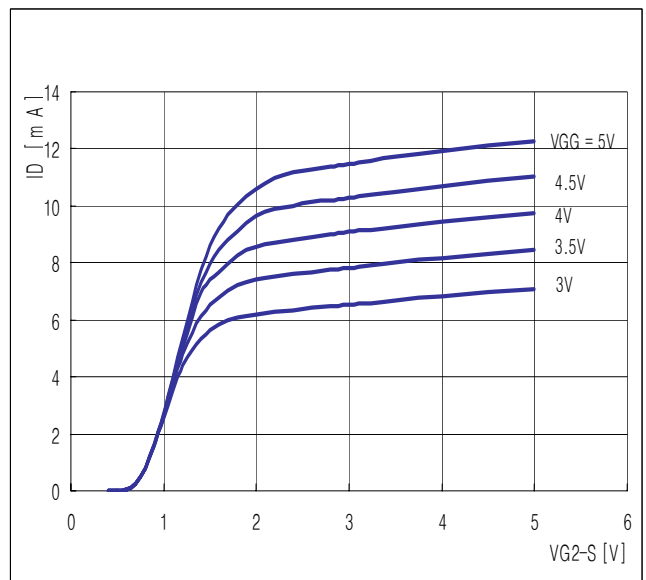
$V_{DS} = 5V$, $V_{G2-S} = 4V$, $R_{GB} = 62k\Omega$, $T_j = 25^\circ C$

Fig7. Drain current as a function of gate1 supply voltage



$V_{G2-S} = 4V$, $T_j = 25^\circ C$, $R_{GB} = (\text{Connected to VGG})$

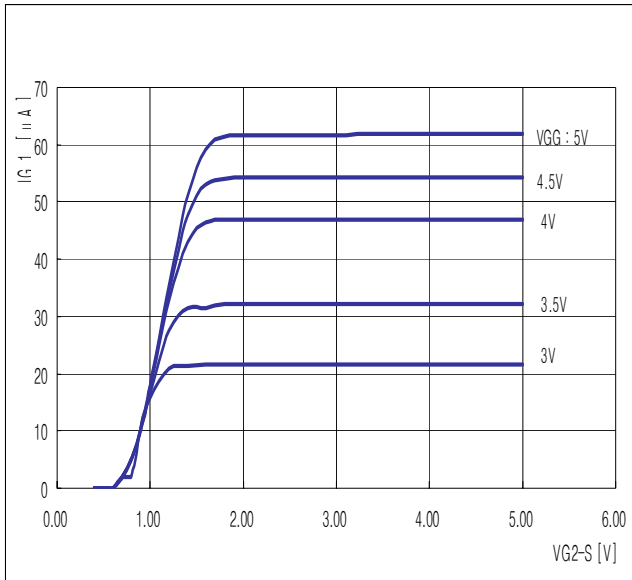
Fig8. Drain current as a function of gate1 and drain supply voltage ; see Fig1



$V_{DS} = 5V$, $T_j = 25^\circ C$, $R_{GB} = 62k\Omega$

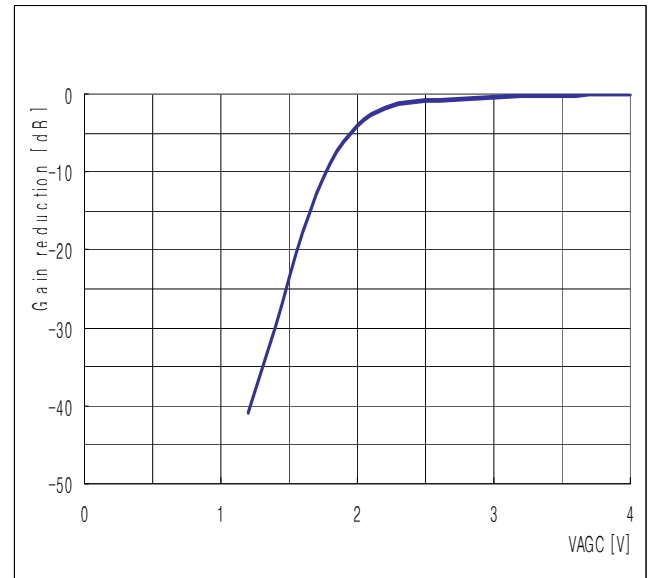
Fig9. Drain current as a function of gate2 voltage

□ Graphs



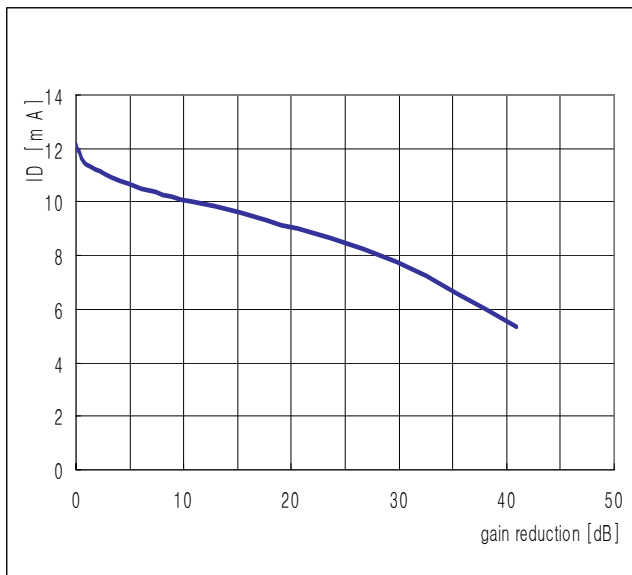
$V_{DS} = 5V$, $R_{GB} = 62k\Omega$, $T_j = 25^\circ C$; Connected to VGB

Fig10. Gate1 current as a function of gate2 voltage



$f=50MHz$, $Pin=-30dBm$, $V_{DS} = 5V$, $V_{GB} = 5V$, $R_{GB}=62k\Omega$, $T_j = 25^\circ C$

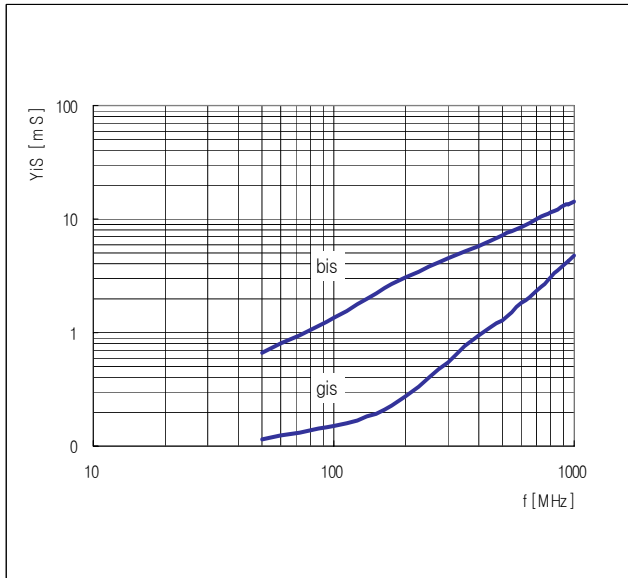
Fig11. Typical Gain reduction as a function of AGC Voltage ; see Fig1



$f=50MHz$, $Pin=-30dBm$, $V_{DS} = 5V$, $V_{GB} = 5V$, $R_{GB}=62k\Omega$

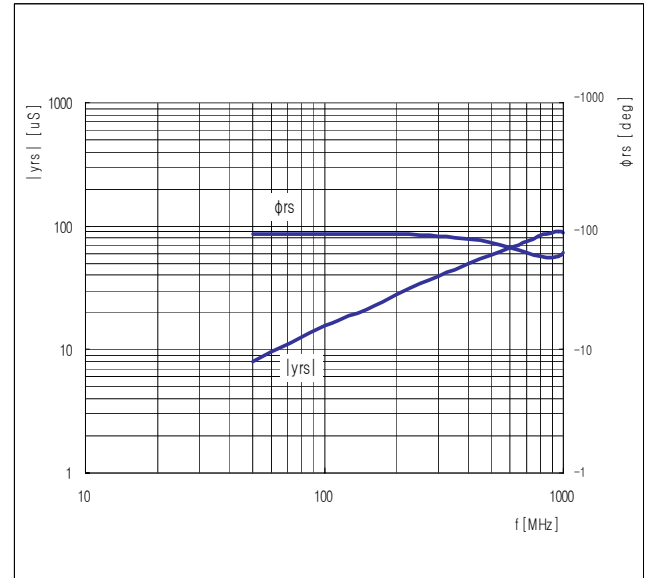
Fig12. Drain current as a function of gain reduction ; see Fig1

□ Graphs



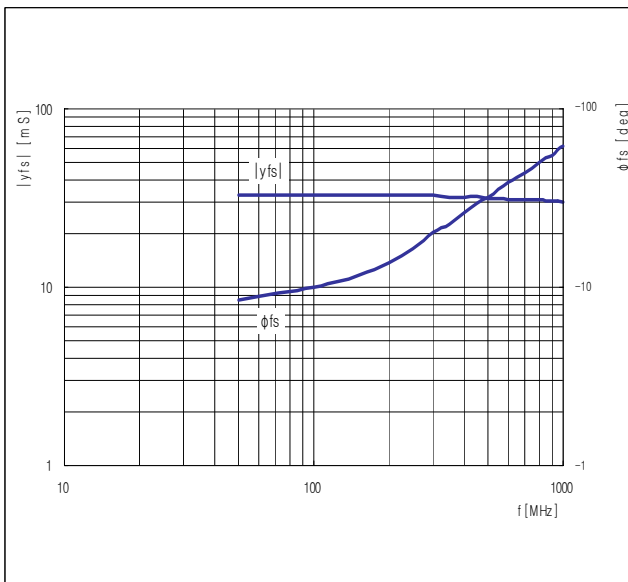
$V_{DS} = 5V, V_{G2-S} = 4V$

Fig13. Input admittance as a function of frequency



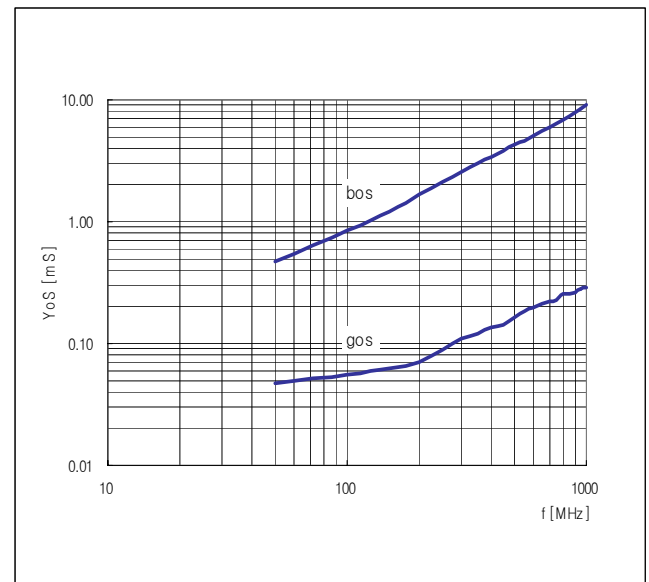
$V_{DS} = 5V, V_{G2-S} = 4V$

Fig14. Reverse transfer admittance and phase as a function of frequency



$V_{DS} = 5V, V_{G2-S} = 4V$

Fig15. Forward transfer admittance and phase as a function of frequency

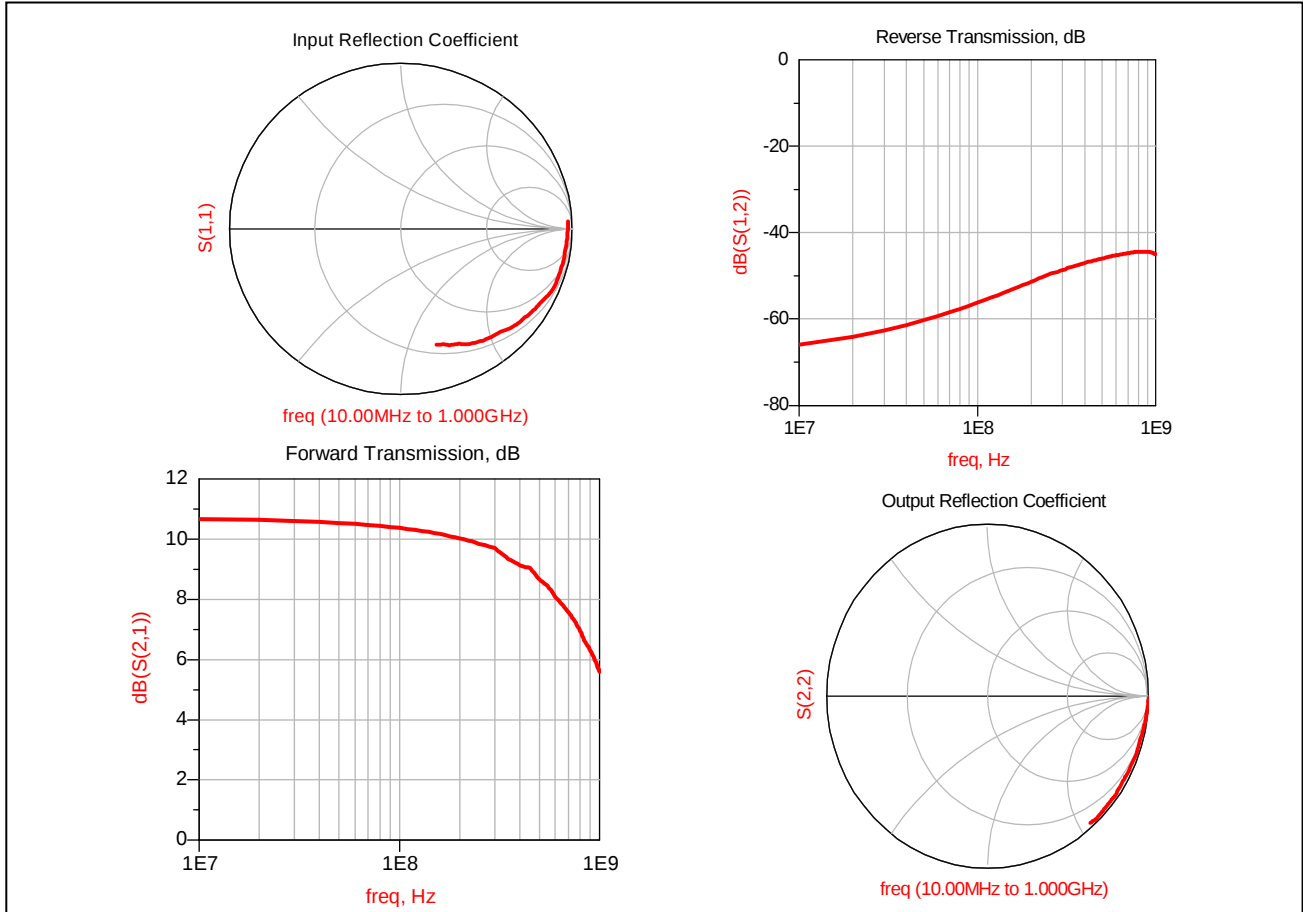


$V_{DS} = 5V, V_{G2-S} = 4V$

Fig16. Output admittance as a function of frequency

□ **Scattering parameters**

($V_{G2-S} = 4V$, $V_{DS} = 5V$, $I_D = 12mA$, $T_a = 25\text{ }^{\circ}C$)



$V_{DS}=5V$, $V_{G2-S}=4V$, $I_D=12mA$

f (MHz)	S11		S21		S12		S22	
	Magnitude (ratio)	Angle (deg)	Magnitude (ratio)	Angle (deg)	Magnitude (ratio)	Angle (deg)	Magnitude (ratio)	Angle (deg)
50	0.897	0.974	3.93	171.7	0.001	93.0	1.006	-1.86
100	0.915	-5.323	3.81	165.5	0.001	91.7	0.998	-4.89
200	0.952	-17.920	3.58	153.1	0.002	89	0.982	-10.97
300	0.938	-27.300	3.40	141.5	0.002	89.2	0.968	-16.13
400	0.912	-35.160	3.20	130.8	0.003	92.6	0.966	-20.8
500	0.836	-43.000	3.04	120.1	0.004	95.6	0.964	-26.01
600	0.863	-50.800	2.89	110.1	0.004	100.4	0.968	-30.59
700	0.830	-57.600	2.75	98.8	0.004	104.6	0.968	-35.8
800	0.800	-63.470	2.62	87.8	0.004	110.7	0.973	-40.87