

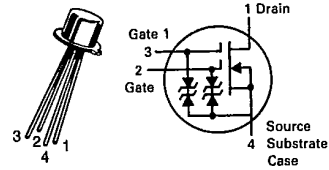
6367254 MOTOROLA SC (XSTRS/R F)

96D 82667 D

T-31-25

**MFE140**

CASE 20-03, STYLE 9  
TO-72 (TO-206AF)



**DUAL-GATE  
MOSFET  
FM AMPLIFIER**

N-CHANNEL — DEPLETION

**MAXIMUM RATINGS**

Rating	Symbol	Value	Unit
Drain-Source Voltage	V <sub>DS</sub>	25	Vdc
Gate-Source Voltage	V <sub>GS</sub>	±7.0	Vdc
Drain Current	I <sub>D</sub>	30	mAdc
Gate Current	I <sub>G</sub>	10	mAdc
Total Device Dissipation @ T <sub>A</sub> = 25°C Derate above 25°C	P <sub>D</sub>	300	mW
Operating and Storage Channel Temperature Range	T <sub>channel</sub> , T <sub>stg</sub>	-65 to +175	°C

**ELECTRICAL CHARACTERISTICS (T<sub>A</sub> = 25°C unless otherwise noted.)**

Characteristic	Symbol	Min	Typ	Max	Unit
<b>OFF CHARACTERISTICS</b>					
Drain-Source Breakdown Voltage (I <sub>D</sub> = 10 μAdc, V <sub>S</sub> = 0, V <sub>G1</sub> = -4.0 Vdc, V <sub>G2</sub> = +4.0 Vdc)	V <sub>(BR)DSX</sub>	25	—	—	Vdc
Gate 1-Source Breakdown Voltage (I <sub>G1</sub> = ±10 μAdc, V <sub>G2S</sub> = 0)	V <sub>(BR)G1SO</sub>	±7.0	—	±20	Vdc
Gate 2-Source Breakdown Voltage (I <sub>G2</sub> = ±10 μAdc, V <sub>G2S</sub> = 0)	V <sub>(BR)G2SO</sub>	±7.0	—	±20	Vdc
Gate 1 Leakage Current (V <sub>G1S</sub> = ±6.0 Vdc, V <sub>G2S</sub> = 0, V <sub>DS</sub> = 0)	I <sub>G1SS</sub>	—	—	20	nAdc
Gate 2 Leakage Current (V <sub>G2S</sub> = ±6.0 Vdc, V <sub>G1S</sub> = 0, V <sub>DS</sub> = 0)	I <sub>G2SS</sub>	—	—	20	nAdc
Gate 1 to Source Cutoff Voltage (V <sub>DS</sub> = 15 Vdc, V <sub>G2S</sub> = 4.0 Vdc, I <sub>D</sub> = 200 μAdc)	V <sub>G1S(off)</sub>	—	—	-4.0	Vdc
Gate 2 to Source Cutoff Voltage (V <sub>DS</sub> = 15 Vdc, V <sub>G1S</sub> = 0, I <sub>D</sub> = 200 μAdc)	V <sub>G2S(off)</sub>	—	—	-4.0	Vdc
<b>ON CHARACTERISTICS</b>					
Zero-Gate-Voltage Drain Current (V <sub>DS</sub> = 15 Vdc, V <sub>G2S</sub> = 0, V <sub>G1S</sub> = 4.0 Vdc)	I <sub>DSS</sub>	3.0	10	30	mAdc
<b>SMALL-SIGNAL CHARACTERISTICS</b>					
Forward Transfer Admittance (Gate 1 connected to Drain) (V <sub>DS</sub> = 15 Vdc, V <sub>G2S</sub> = 4.0 Vdc, I <sub>D</sub> = 10 mAdc, f = 1.0 kHz)	y <sub>fs</sub>	10	—	20	mmhos
Input Capacitance (V <sub>DS</sub> = 15 Vdc, V <sub>G2S</sub> = 4.0 Vdc, I <sub>D</sub> = I <sub>DSS</sub> , f = 1.0 MHz)	C <sub>iss</sub>	—	4.5	7.0	pF
Reverse Transfer Capacitance (V <sub>DS</sub> = 15 Vdc, V <sub>G2S</sub> = 4.0 Vdc, I <sub>D</sub> = I <sub>DSS</sub> , f = 1.0 MHz)	C <sub>rss</sub>	—	0.023	0.05	pF
Output Capacitance (V <sub>DS</sub> = 15 Vdc, V <sub>G2S</sub> = 4.0 Vdc, I <sub>D</sub> = I <sub>DSS</sub> , f = 1.0 MHz)	C <sub>oss</sub>	—	2.5	4.0	pF
<b>FUNCTIONAL CHARACTERISTICS</b>					
Noise Figure (Figure 8) (See Test Circuit in Figure 11)	NF	—	2.5	3.5	dB
Common Source Power Gain (Figure 7) (See Test Circuit in Figure 11)	G <sub>ps</sub>	20	23	—	dB
Level of Unwanted Signal for 1.0% Cross Modulation (Figure 10) (See Test Circuit in Figure 11)	—	—	45	—	mV

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**ELECTRICAL CHARACTERISTICS** (continued) ( $T_A = 25^\circ\text{C}$  unless otherwise noted.)

Characteristic	Symbol	Min	Typ	Max	Unit
Common-Source Conversion Power Gain (Gate 1 or Gate 2 Injection, Figure 12) (See Test Circuit in Figure 13) (Signal Frequency = 100 MHz, Local Oscillator Frequency = 110.7 MHz)	$G_c$	15	18.5	—	dB
1/2 I.F. Rejection (See Test Circuit in Figure 13)	$1/2  f_{REJ} $	—	50	—	dB

**COMMON-SOURCE ADMITTANCE PARAMETERS**

( $V_{DS} = 15\text{ Vdc}$ ,  $V_{G2S} = 4.0\text{ Vdc}$ ,  $I_D = 6.0\text{ mAdc}$ )

FIGURE 1 – INPUT ADMITTANCE

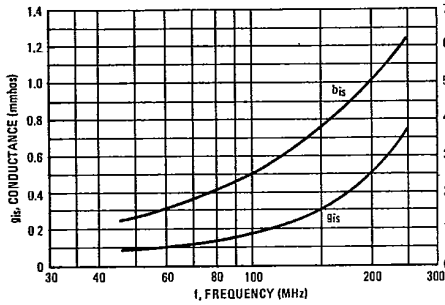


FIGURE 2 – REVERSE TRANSFER ADMITTANCE

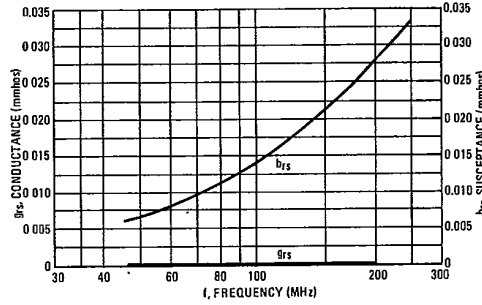


FIGURE 3 – FORWARD TRANSFER ADMITTANCE

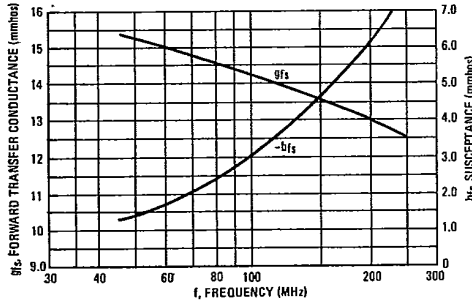
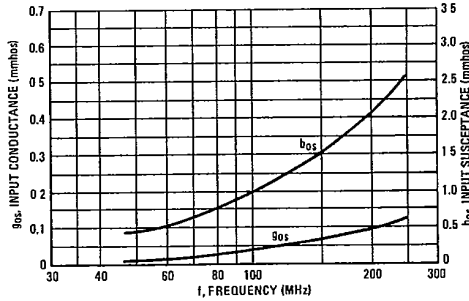


FIGURE 4 – OUTPUT ADMITTANCE



**FORWARD TRANSFER ADMITTANCE**

( $V_{DS} = 15\text{ Vdc}$ ,  $f = 1.0\text{ kHz}$ )

FIGURE 5 – GATE 1

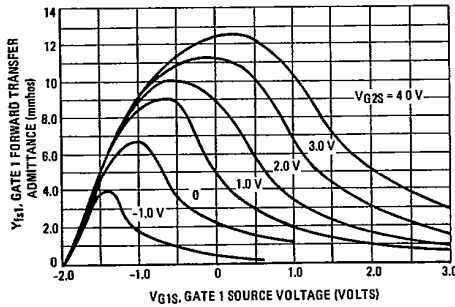
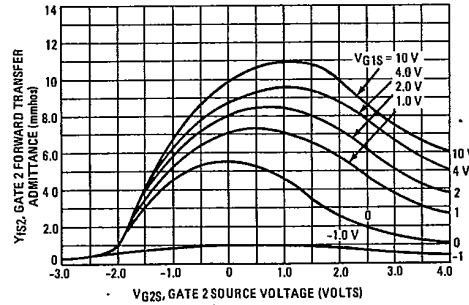


FIGURE 6 – GATE 2



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FIGURE 7 - POWER GAIN

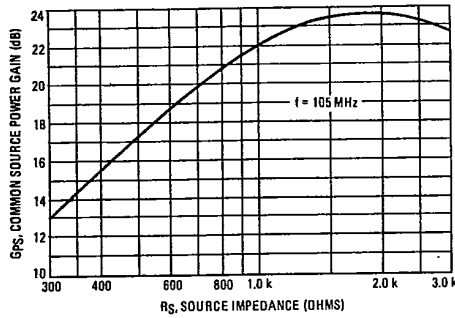


FIGURE 8 - NOISE FIGURE

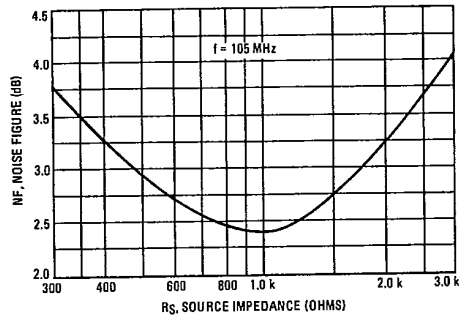


FIGURE 9 - GAIN REDUCTION

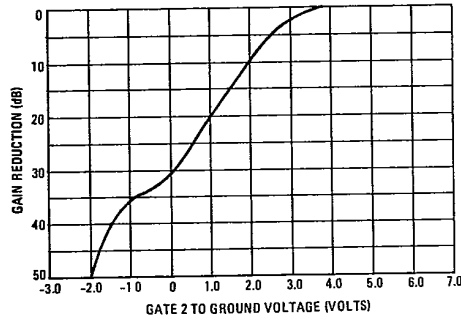


FIGURE 10 - CROSS MODULATION

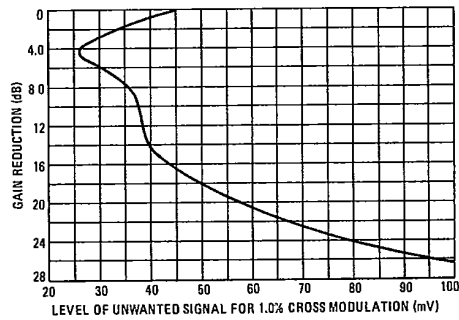
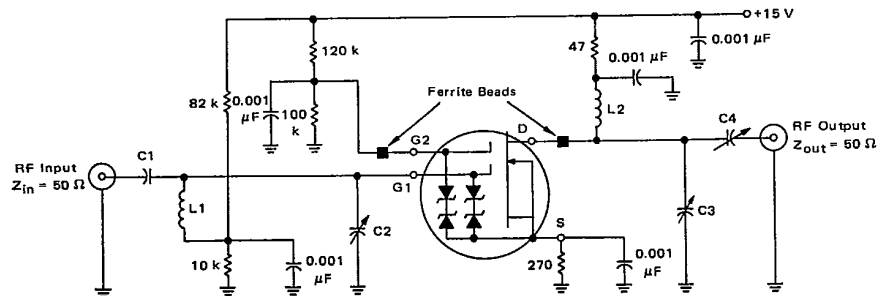


FIGURE 11 - 105 MHz POWER GAIN AND NOISE FIGURE TEST CIRCUIT



The following component values are for a stern stability factor = 2.0.  
 L1, L2 126 nH PAUL SMITH CO. SK-138-1  
 4-1/2 Turns (yellow)  
 C1 Nominal 7.0 pF Adjusted for source impedance of approximately 1000 Ω, JOHANSON JMC2951

C2 Nominal 4.0 pF ARCO 402  
 C3 Nominal 13.73 pF ARCO 403  
 C4 Nominal 4.36 pF JOHANSON JMC2951  
 All Decoupling Capacitors are Ceramic Discs.

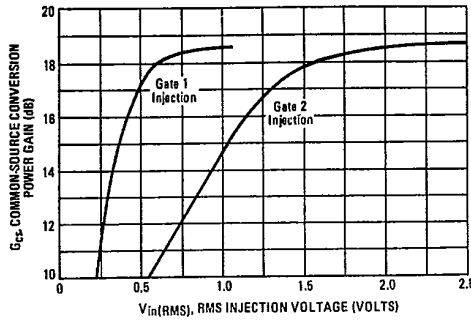
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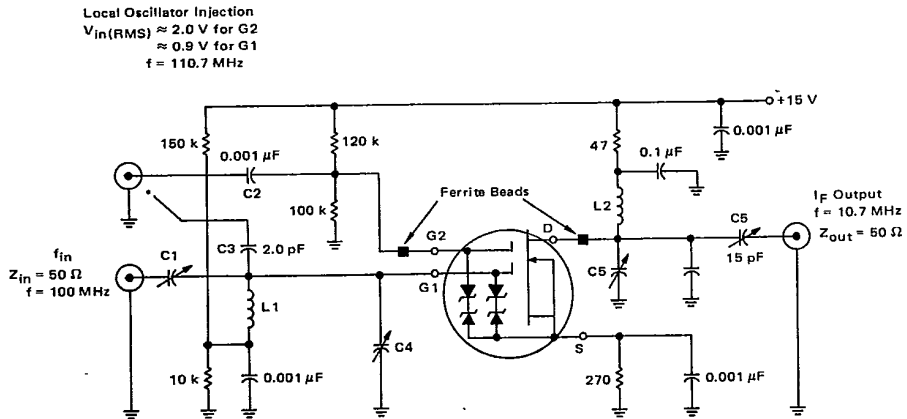
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FIGURE 12 - CONVERSION GAIN



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FIGURE 13 - CONVERSION GAIN TEST CIRCUIT



- L1 126 nH PAUL SMITH CO. SK-138-1  
4-1/2 Turns (yellow)
- L2 2.73  $\mu$ H High Unloaded Q
- C1 JOHANSON JMC2951
- C4,C5,C6 ARCO 402

\*For G1 injection, C2 is changed to bypass G2 to ground and C3 is added to connect G1 to the injection input.

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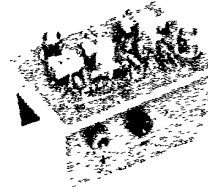
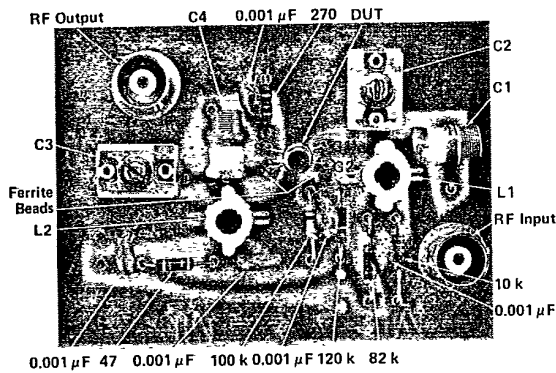
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PRINTED CIRCUIT BOARD LAYOUT INFORMATION

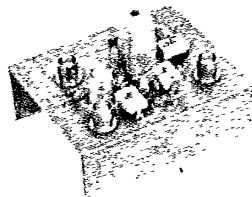
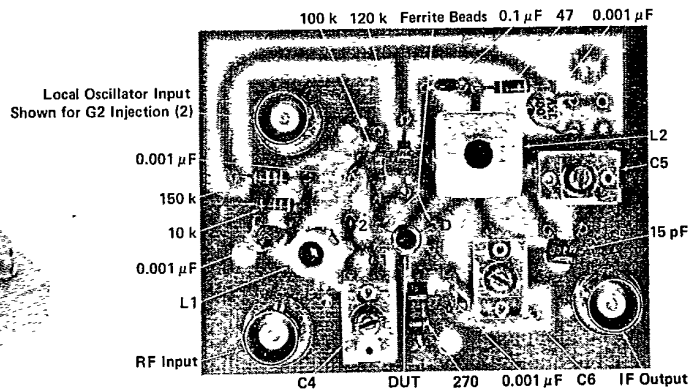
FIGURE 14 - TEST FIXTURES

105 MHz POWER GAIN AND NOISE  
FIGURE TEST CIRCUIT



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100 MHz to 10.7 MHz CONVERSION  
GAIN TEST CIRCUIT



Notes:

1. C1 is on the bottom side of the board.
2. For G1 Injection, C2 is changed to bypass G2 to ground and C3 is added to connect G1 to the Injection input. See Figure 13.