

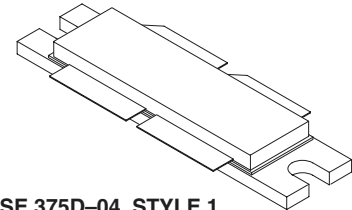
The RF Sub-Micron MOSFET Line  
**RF Power Field Effect Transistors**  
N-Channel Enhancement-Mode Lateral MOSFETs

Designed for CDMA base station applications with frequencies from 1930 to 1990 MHz. Suitable for FM, TDMA, CDMA and multicarrier amplifier applications. To be used in Class AB for PCN-PCS/cellular radio and WLL applications.

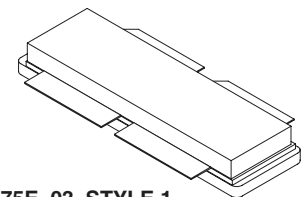
- CDMA Performance @ 1990 MHz, 26 Volts  
IS-97 CDMA Pilot, Sync, Paging, Traffic Codes 8 Thru 13  
885 kHz — -47 dBc @ 30 kHz BW  
1.25 MHz — -55 dBc @ 12.5 kHz BW  
2.25 MHz — -55 dBc @ 1 MHz BW  
Output Power — 15 Watts (Avg.)  
Power Gain — 11.7 dB  
Efficiency — 16%
- Internally Matched, Controlled Q, for Ease of Use
- High Gain, High Efficiency, High Linearity
- Integrated ESD Protection
- Designed for Maximum Gain and Insertion Phase Flatness
- Capable of Handling 10:1 VSWR, @ 26 Vdc, 1990 MHz, 120 Watts (CW) Output Power
- S-Parameter Characterization at High Bias Levels
- Excellent Thermal Stability
- Characterized with Series Equivalent Large-Signal Impedance Parameters

**MRF19120**  
**MRF19120S**

**1990 MHz, 120 W, 26 V**  
**LATERAL N-CHANNEL**  
**RF POWER MOSFETs**



**CASE 375D-04, STYLE 1**  
**NI-1230**  
**MRF19120**



**CASE 375E-03, STYLE 1**  
**NI-1230S**  
**MRF19120S**

**MAXIMUM RATINGS**

Rating	Symbol	Value	Unit
Drain-Source Voltage	$V_{DSS}$	65	Vdc
Gate-Source Voltage	$V_{GS}$	-0.5, +15	Vdc
Total Device Dissipation @ $T_C = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	$P_D$	389 2.22	Watts $\text{W}/^\circ\text{C}$
Storage Temperature Range	$T_{stg}$	-65 to +150	$^\circ\text{C}$
Operating Junction Temperature	$T_J$	200	$^\circ\text{C}$

**ESD PROTECTION CHARACTERISTICS**

Test Conditions	Class
Human Body Model	1 (Minimum)
Machine Model	M3 (Minimum)

**THERMAL CHARACTERISTICS**

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Case	$R_{\theta JC}$	0.45	$^\circ\text{C}/\text{W}$

NOTE – **CAUTION** – MOS devices are susceptible to damage from electrostatic charge. Reasonable precautions in handling and packaging MOS devices should be observed.

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

Characteristic	Symbol	Min	Typ	Max	Unit
<b>OFF CHARACTERISTICS (1)</b>					
Drain–Source Breakdown Voltage ( $V_{GS} = 0 \text{ Vdc}$ , $I_D = 10 \mu\text{A}$ )	$V_{(BR)DSS}$	65	—	—	Vdc
Gate–Source Leakage Current ( $V_{GS} = 5 \text{ Vdc}$ , $V_{DS} = 0 \text{ Vdc}$ )	$I_{GSS}$	—	—	1	$\mu\text{A}$
Zero Gate Voltage Drain Leakage Current ( $V_{DS} = 26 \text{ Vdc}$ , $V_{GS} = 0 \text{ Vdc}$ )	$I_{DSS}$	—	—	10	$\mu\text{A}$
<b>ON CHARACTERISTICS (1)</b>					
Forward Transconductance ( $V_{DS} = 10 \text{ Vdc}$ , $I_D = 2 \text{ A}$ )	$g_{fs}$	—	4.8	—	S
Gate Threshold Voltage ( $V_{DS} = 10 \text{ V}$ , $I_D = 200 \mu\text{A}$ )	$V_{GS(th)}$	2.5	3	3.8	Vdc
Gate Quiescent Voltage ( $V_{DS} = 26 \text{ V}$ , $I_D = 500 \text{ mA}$ )	$V_{GS(Q)}$	3	3.9	5	Vdc
Drain–Source On–Voltage ( $V_{GS} = 10 \text{ V}$ , $I_D = 2 \text{ A}$ )	$V_{DS(on)}$	—	0.38	0.5	Vdc
<b>DYNAMIC CHARACTERISTICS (1)</b>					
Reverse Transfer Capacitance ( $V_{DS} = 26 \text{ Vdc}$ , $V_{GS} = 0$ , $f = 1 \text{ MHz}$ )	$C_{rss}$	—	2.8	—	pF
<b>FUNCTIONAL TESTS (In Motorola Test Fixture, 50 ohm system) (2)</b>					
Common–Source Amplifier Power Gain ( $V_{DD} = 26 \text{ Vdc}$ , $P_{out} = 120 \text{ W PEP}$ , $I_{DQ} = 2 \times 500 \text{ mA}$ , $f_1 = 1990.0 \text{ MHz}$ , $f_2 = 1990.1 \text{ MHz}$ )	$G_{ps}$	10.7 10.5	11.7 11.7	— —	dB
Drain Efficiency ( $V_{DD} = 26 \text{ Vdc}$ , $P_{out} = 120 \text{ W PEP}$ , $I_{DQ} = 2 \times 500 \text{ mA}$ , $f_1 = 1990.0 \text{ MHz}$ , $f_2 = 1990.1 \text{ MHz}$ )	$\eta$	30	34	—	%
Intermodulation Distortion ( $V_{DD} = 26 \text{ Vdc}$ , $P_{out} = 120 \text{ W PEP}$ , $I_{DQ} = 2 \times 500 \text{ mA}$ , $f_1 = 1990.0 \text{ MHz}$ , $f_2 = 1990.1 \text{ MHz}$ )	IMD	— —	–31 –31	–28 –27	dB
Input Return Loss ( $V_{DD} = 26 \text{ Vdc}$ , $P_{out} = 120 \text{ W PEP}$ , $I_{DQ} = 2 \times 500 \text{ mA}$ , $f_1 = 1990.0 \text{ MHz}$ , $f_2 = 1990.1 \text{ MHz}$ )	IRL	—	–12	–9	dB
Common–Source Amplifier Power Gain ( $V_{DD} = 26 \text{ Vdc}$ , $P_{out} = 120 \text{ W PEP}$ , $I_{DQ} = 2 \times 500 \text{ mA}$ , $f_1 = 1930.0 \text{ MHz}$ , $f_2 = 1930.1 \text{ MHz}$ )	$G_{ps}$	—	11.7	—	dB
Drain Efficiency ( $V_{DD} = 26 \text{ Vdc}$ , $P_{out} = 120 \text{ W PEP}$ , $I_{DQ} = 2 \times 500 \text{ mA}$ , $f_1 = 1930.0 \text{ MHz}$ , $f_2 = 1930.1 \text{ MHz}$ )	$\eta$	—	34	—	%
Intermodulation Distortion ( $V_{DD} = 26 \text{ Vdc}$ , $P_{out} = 120 \text{ W PEP}$ , $I_{DQ} = 2 \times 500 \text{ mA}$ , $f_1 = 1930.0 \text{ MHz}$ , $f_2 = 1930.1 \text{ MHz}$ )	IMD	—	–31	—	dB
Input Return Loss ( $V_{DD} = 26 \text{ Vdc}$ , $P_{out} = 120 \text{ W PEP}$ , $I_{DQ} = 2 \times 500 \text{ mA}$ , $f_1 = 1930.0 \text{ MHz}$ , $f_2 = 1930.1 \text{ MHz}$ )	IRL	—	–14	—	dB
Power Output, 1 dB Compression Point ( $V_{DD} = 26 \text{ Vdc}$ , CW, $I_{DQ} = 2 \times 500 \text{ mA}$ , $f_1 = 1990.0 \text{ MHz}$ )	P1dB	—	120	—	Watts
Common–Source Amplifier Power Gain ( $V_{DD} = 26 \text{ Vdc}$ , $P_{out} = 120 \text{ W CW}$ , $I_{DQ} = 2 \times 500 \text{ mA}$ , $f_1 = 1990.0 \text{ MHz}$ )	$G_{ps}$	—	11	—	dB

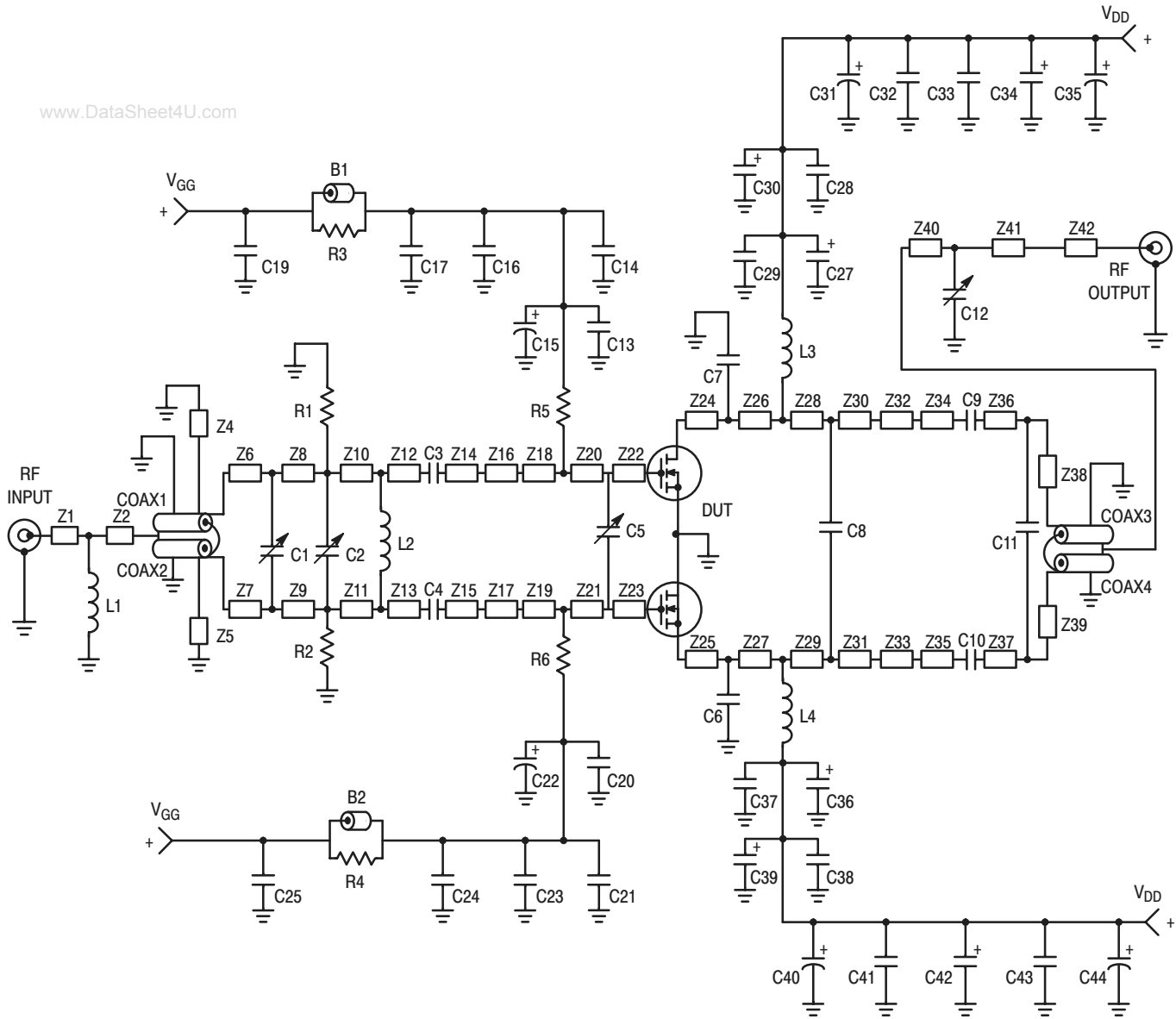
(1) Each side of device measured separately.

(2) Device measured in push–pull configuration.

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

Characteristic	Symbol	Min	Typ	Max	Unit
<b>FUNCTIONAL TESTS</b> (In Motorola Test Fixture, 50 ohm system) (2) (continued)					
Drain Efficiency ( $V_{DD} = 26\text{ Vdc}$ , $P_{out} = 120\text{ W CW}$ , $I_{DQ} = 2 \times 500\text{ mA}$ , $f_1 = 1990.0\text{ MHz}$ )	$\eta$	—	45	—	%
Output Mismatch Stress ( $V_{DD} = 26\text{ Vdc}$ , $P_{out} = 120\text{ W CW}$ , $I_{DQ} = 2 \times 500\text{ mA}$ , $f = 1990\text{ MHz}$ , $VSWR = 10:1$ , All Phase Angles at Frequency of Tests)	$\Psi$	No Degradation In Output Power Before and After Test			

(2) Device measured in push-pull configuration.



B1, B2	Ferrite Beads, Fair Rite	Z2	0.320" x 0.080" Microstrip
C1, C2	0.6 – 4.5 pF Variable Capacitors, Johanson Gigatrim	Z4, Z5	1.050" x 0.080" Microstrip
C3, C4, C9, C10	10 pF Chip Capacitors, B Case, ATC	Z6, Z7	0.120" x 0.080" Microstrip
C5, C12	0.4 – 2.5 pF Variable Capacitors, Johanson Gigatrim	Z8, Z9	0.140" x 0.080" Microstrip
C6, C7	2.0 pF Chip Capacitors, B Case, ATC	Z10, Z11	0.610" x 0.080" Microstrip
C8	1.1 pF Chip Capacitor, B Case, ATC	Z12, Z13	0.135" x 0.080" Microstrip
C11	0.1 pF Chip Capacitor, B Case, ATC	Z14, Z15	0.130" x 0.080" Microstrip
C13, C20, C29, C37	5.1 pF Chip Capacitors, B Case, ATC	Z16, Z17	0.300" x 0.350" Microstrip
C14, C21, C28, C38	91 pF Chip Capacitors, B Case, ATC	Z18, Z19	0.150" x 0.500" Microstrip
C15, C22, C31, C40	100 $\mu$ F, 50 V Electrolytic Capacitors, Sprague	Z20, Z21	0.075" x 0.500" Microstrip
C16, C23, C33, C43	0.039 $\mu$ F Chip Capacitors, B Case, ATC	Z22, Z23	0.330" x 0.500" Microstrip
C17, C24, C32, C41	1000 pF Chip Capacitors, B Case, ATC	Z24, Z25	0.100" x 0.550" Microstrip
C19, C25	0.020 $\mu$ F Chip Capacitors, B Case, ATC	Z26, Z27	0.175" x 0.550" Microstrip
C27, C34, C36, C42	22 $\mu$ F, 35 V Tantalum Surface Mount Chip Capacitors, Kemet	Z28, Z29	0.045" x 0.550" Microstrip
C30, C39	1.0 $\mu$ F, 35 V Tantalum Surface Mount Chip Capacitors, Kemet	Z30, Z31	0.190" x 0.325" Microstrip
C35, C44	470 $\mu$ F, 63 V Electrolytic Capacitors, Sprague	Z32, Z33	0.080" x 0.325" Microstrip
Coax1, Coax2	25 $\Omega$ , Semi Rigid Coax, 70 mil OD, 1.05" Long	Z34, Z35	0.515" x 0.080" Microstrip
Coax3, Coax4	50 $\Omega$ , Semi Rigid Coax, 85 mil OD, 1.05" Long	Z36, Z37	0.020" x 0.080" Microstrip
L1	5.0 nH, Minispring Inductor, Coilcraft	Z38, Z39	0.565" x 0.080" Microstrip
L2	8.0 nH, Minispring Inductor, Coilcraft	Z40	0.100" x 0.080" Microstrip
L3, L4	5.60 nH, Microspring Inductors, Coilcraft	Z41	0.470" x 0.080" Microstrip
R1, R2	1 k $\Omega$ , 1/2 W Fixed Metal Film Resistors, Dale	Z42	0.100" x 0.080" Microstrip
R3, R4	270 $\Omega$ , 1/8 W Fixed Film Chip Resistors, Dale	Board Material	0.03" Teflon <sup>®</sup> , $\epsilon_r = 2.55$ Copper Clad, 2 oz. Cu
R5, R6	1.0 k $\Omega$ , 1/8 W Fixed Film Chip Resistors, Dale	Connectors	N-Type Panel Mount, Stripline
Z1	0.150" x 0.080" Microstrip		

Figure 1. 1.93 – 1.99 GHz Broadband Test Circuit Schematic

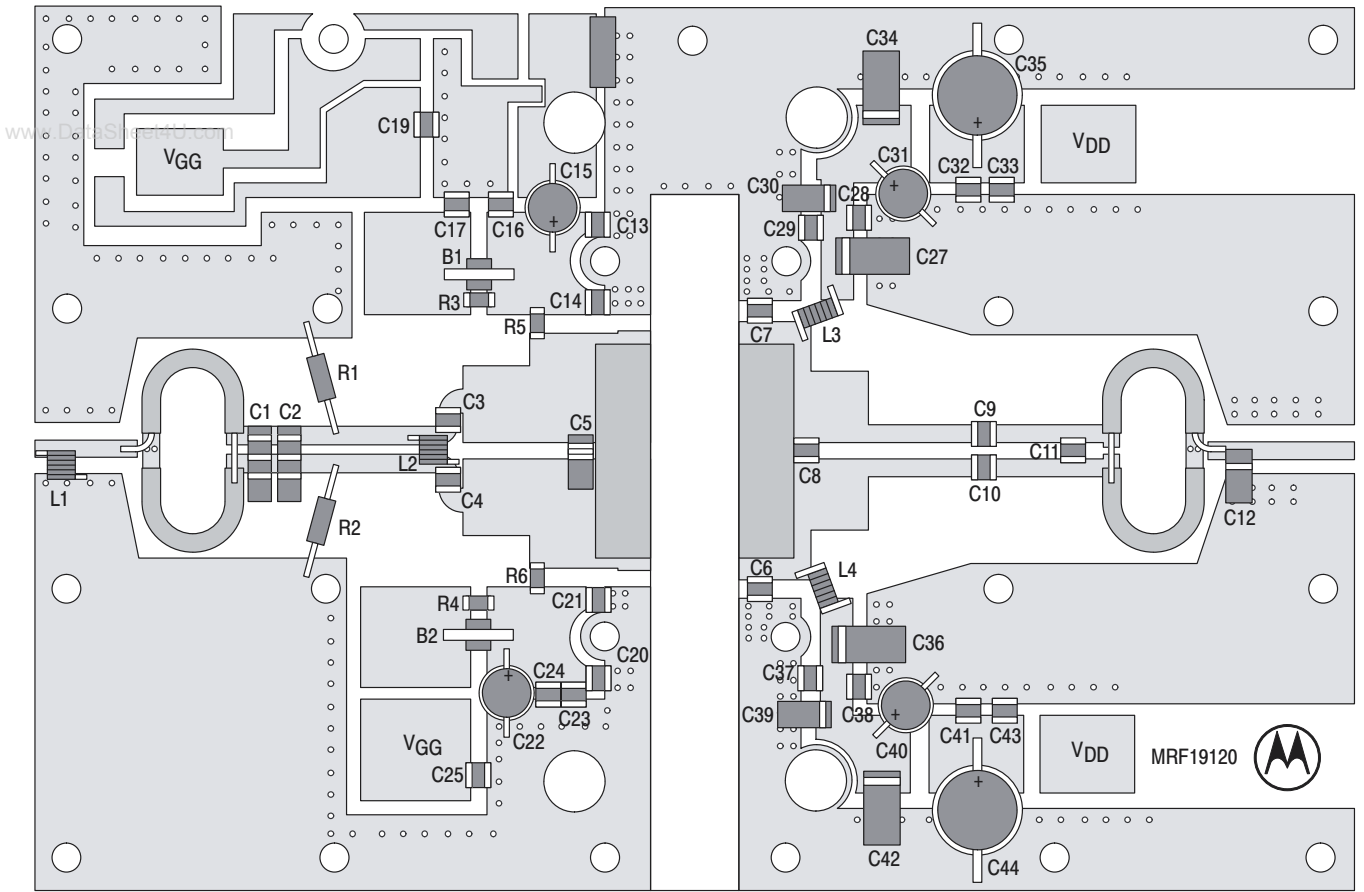
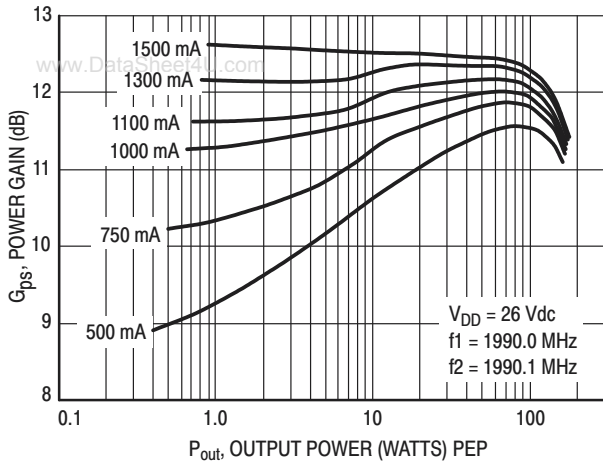
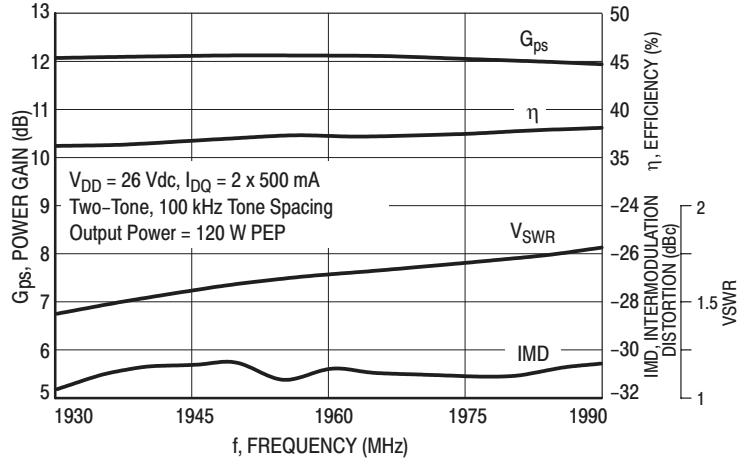


Figure 2. MRF19120 Test Circuit Component Layout

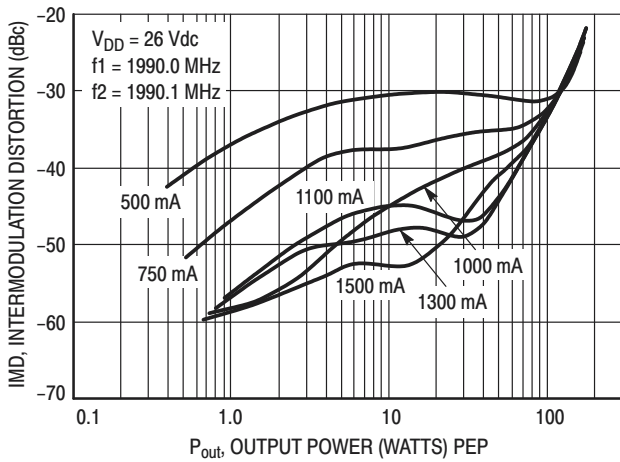
## TYPICAL CHARACTERISTICS



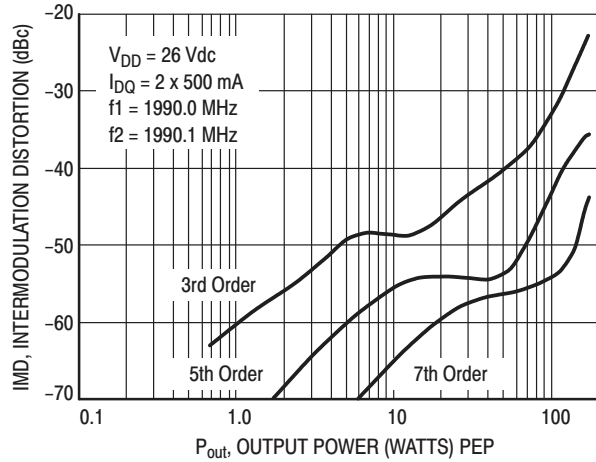
**Figure 3. Power Gain versus Output Power**



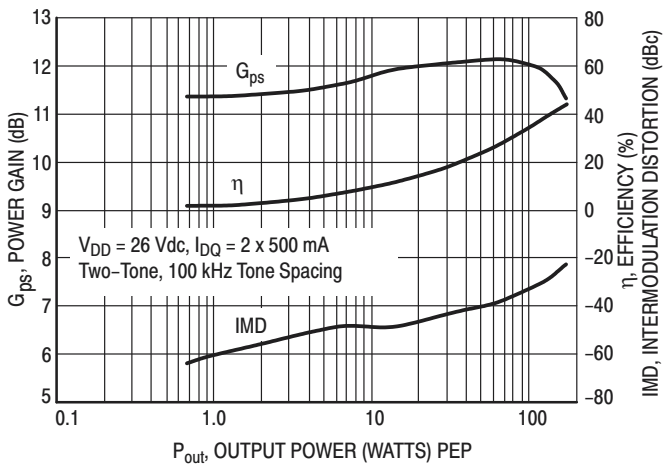
**Figure 4. Class AB Broadband Circuit Performance**



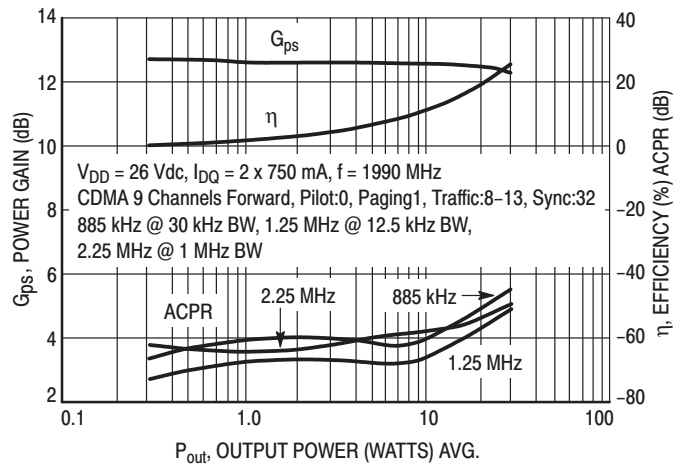
**Figure 5. Intermodulation Distortion versus Output Power**



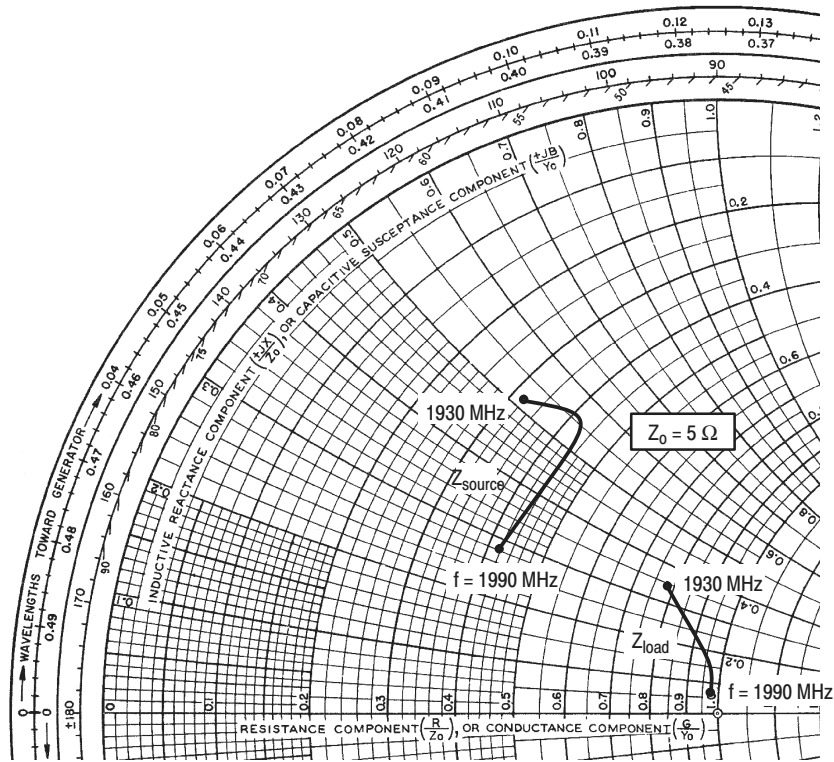
**Figure 6. Intermodulation Distortion Products versus Output Power**



**Figure 7. Power Gain, Efficiency, and IMD versus Output Power**



**Figure 8. Power Gain, Efficiency, and ACPR versus Output Power**



$V_{DD} = 26\text{ V}$ ,  $I_{DQ} = 2 \times 500\text{ mA}$ ,  $P_{out} = 120\text{ W PEP}$

f MHz	$Z_{source}$ $\Omega$	$Z_{load}$ $\Omega$
1930	$1.64 + j2.6$	$3.9 + j1.7$
1960	$2.10 + j2.8$	$4.8 + j0.8$
1990	$2.10 + j1.4$	$4.9 + j0.3$

$Z_{source}$  = Test circuit impedance as measured from gate to gate, balanced configuration.

$Z_{load}$  = Test circuit impedance as measured from drain to drain, balanced configuration.

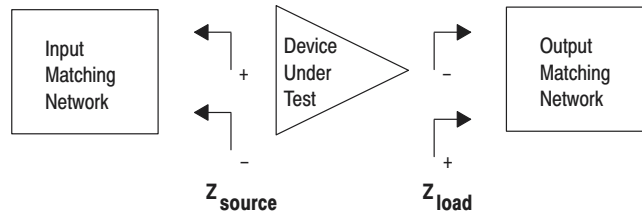


Figure 9. Series Equivalent Input and Output Impedance

# NOTES

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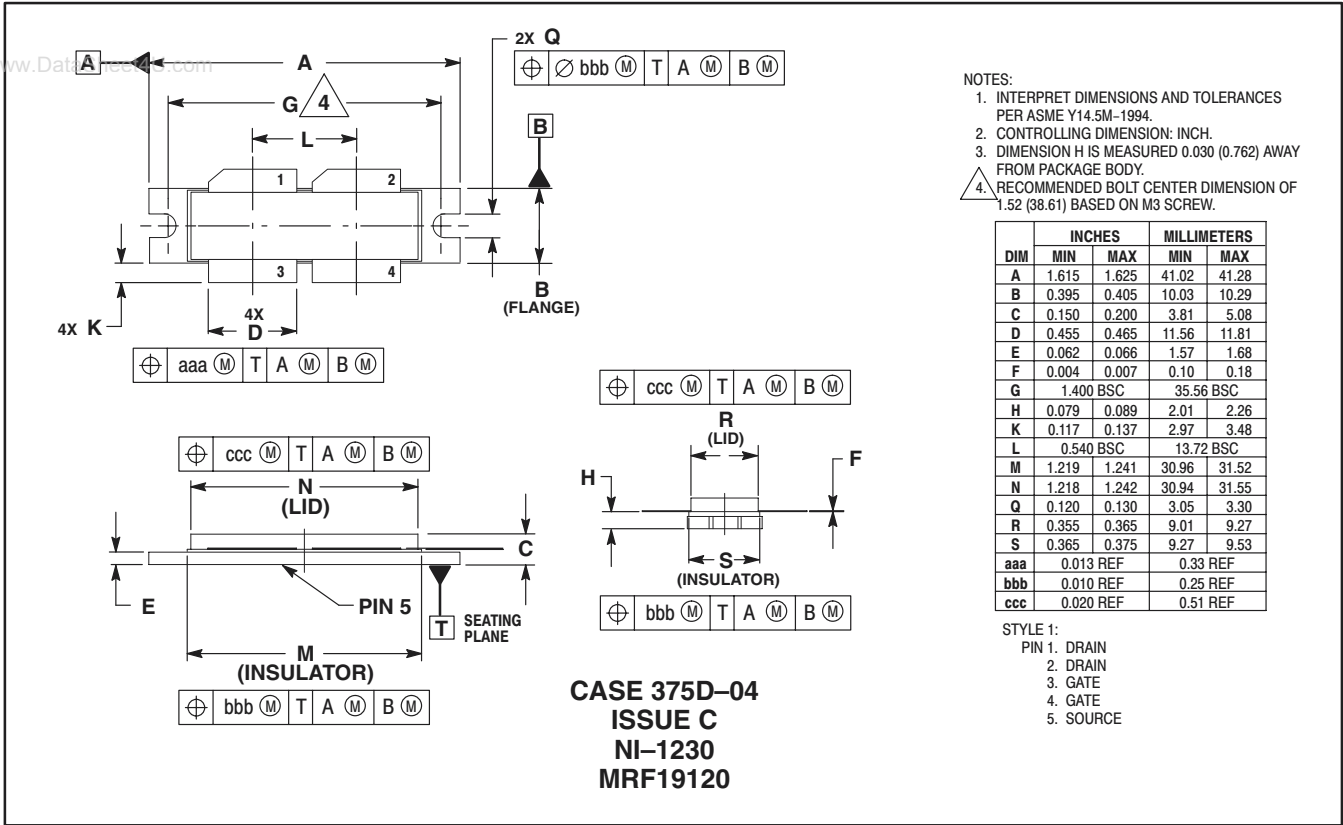
# NOTES

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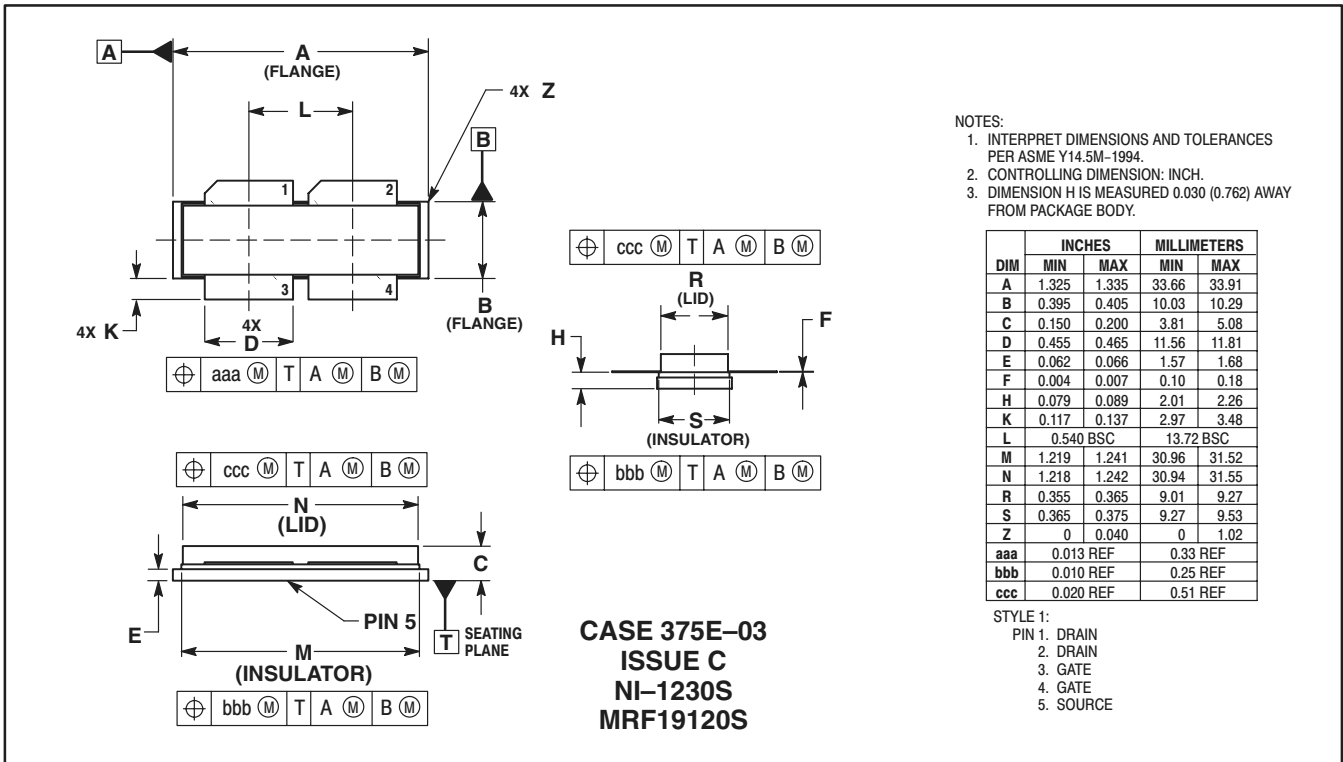
# PACKAGE DIMENSIONS



- NOTES:
1. INTERPRET DIMENSIONS AND TOLERANCES PER ASME Y14.5M-1994.
  2. CONTROLLING DIMENSION: INCH.
  3. DIMENSION H IS MEASURED 0.030 (0.762) AWAY FROM PACKAGE BODY.
  4. RECOMMENDED BOLT CENTER DIMENSION OF 1.52 (38.61) BASED ON M3 SCREW.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	1.615	1.625	41.02	41.28
B	0.395	0.405	10.03	10.29
C	0.150	0.200	3.81	5.08
D	0.455	0.465	11.56	11.81
E	0.062	0.066	1.57	1.68
F	0.004	0.007	0.10	0.18
G	1.400 BSC		35.56 BSC	
H	0.079	0.089	2.01	2.26
K	0.117	0.137	2.97	3.48
L	0.540 BSC		13.72 BSC	
M	1.219	1.241	30.96	31.52
N	1.218	1.242	30.94	31.55
Q	0.120	0.130	3.05	3.30
R	0.355	0.365	9.01	9.27
S	0.365	0.375	9.27	9.53
aaa	0.013 REF		0.33 REF	
bbb	0.010 REF		0.25 REF	
ccc	0.020 REF		0.51 REF	


- STYLE 1:  
 PIN 1. DRAIN  
 2. DRAIN  
 3. GATE  
 4. GATE  
 5. SOURCE



- NOTES:
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DIM	INCHES		MILLIMETERS	
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A	1.325	1.335	33.66	33.91
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M	1.219	1.241	30.96	31.52
N	1.218	1.242	30.94	31.55
R	0.355	0.365	9.01	9.27
S	0.365	0.375	9.27	9.53
Z	0	0.040	0	1.02
aaa	0.013 REF		0.33 REF	
bbb	0.010 REF		0.25 REF	
ccc	0.020 REF		0.51 REF	

- STYLE 1:  
 PIN 1. DRAIN  
 2. DRAIN  
 3. GATE  
 4. GATE  
 5. SOURCE

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