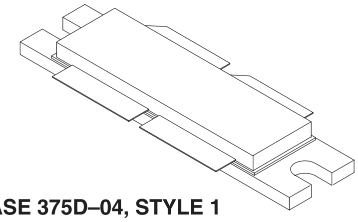
The RF Sub–Micron MOSFET Line
RF Power Field Effect Transistors
N–Channel Enhancement–Mode Lateral MOSFETs

MRF19120
MRF19120S

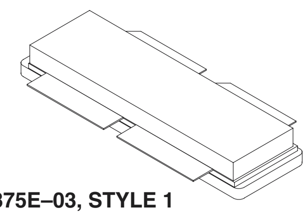
1990 MHz, 120 W, 26 V
LATERAL N–CHANNEL
RF POWER MOSFETs

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



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°C Derate above 25°C	P_D	389 2.22	Watts W/°C
Storage Temperature Range	T_{stg}	–65 to +150	°C
Operating Junction Temperature	T_J	200	°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	°C/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°C unless otherwise noted)

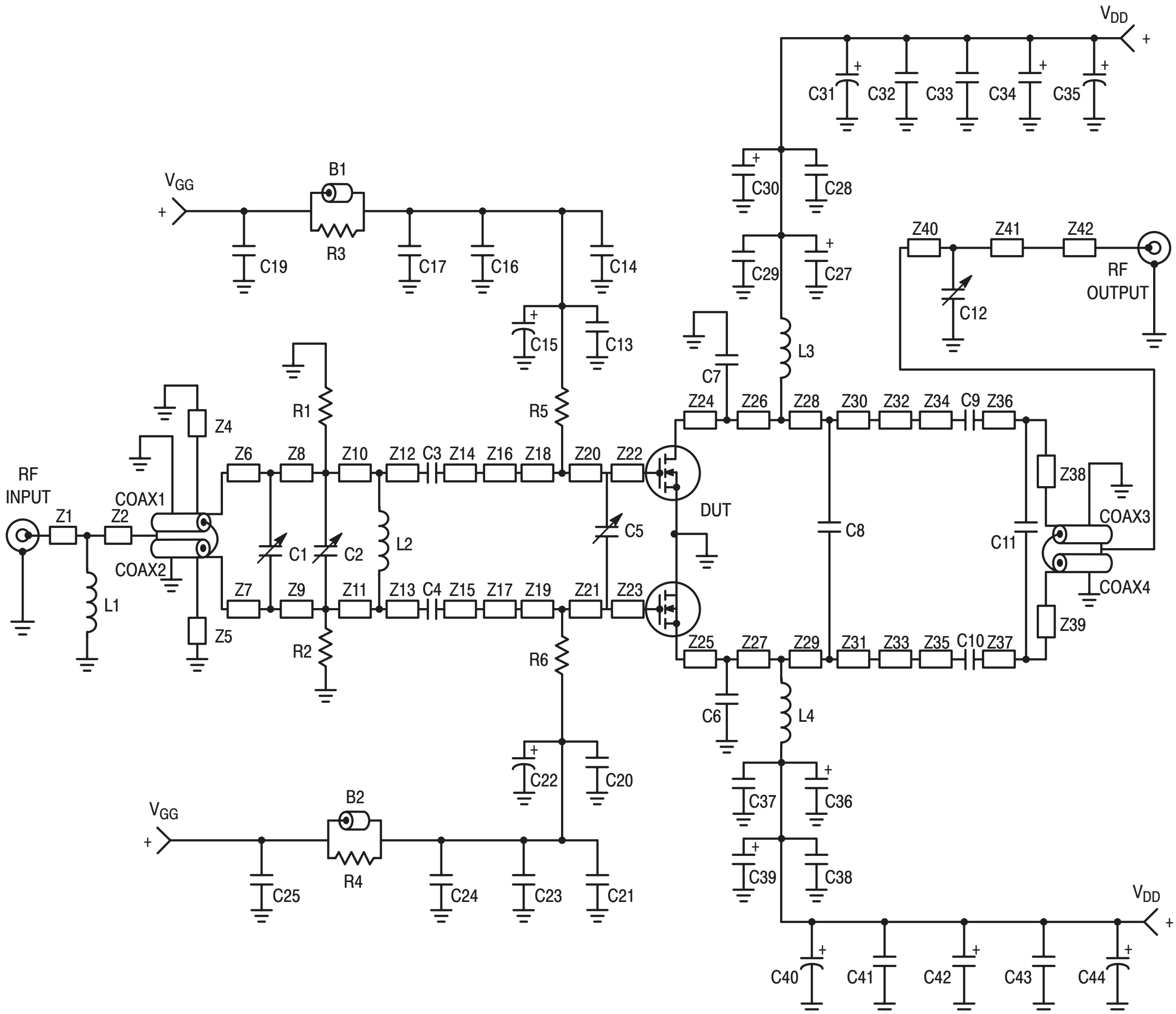
Characteristic	Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTICS (1)					
Drain–Source Breakdown Voltage (V_{GS} = 0 Vdc, I_D = 10 μAdc)	$V_{(BR)DSS}$	65	—	—	Vdc
Gate–Source Leakage Current (V_{GS} = 5 Vdc, V_{DS} = 0 Vdc)	I_{GSS}	—	—	1	μAdc
Zero Gate Voltage Drain Leakage Current (V_{DS} = 26 Vdc, V_{GS} = 0 Vdc)	I_{DSS}	—	—	10	μAdc
ON CHARACTERISTICS (1)					
Forward Transconductance (V_{DS} = 10 Vdc, I_D = 2 Adc)	g_{fs}	—	4.8	—	S
Gate Threshold Voltage (V_{DS} = 10 V, I_D = 200 μA)	$V_{GS(th)}$	2.5	3	3.8	Vdc
Gate Quiescent Voltage (V_{DS} = 26 V, I_D = 500 mA)	$V_{GS(Q)}$	3	3.9	5	Vdc
Drain–Source On–Voltage (V_{GS} = 10 V, I_D = 2 A)	$V_{DS(on)}$	—	0.38	0.5	Vdc
DYNAMIC CHARACTERISTICS (1)					
Reverse Transfer Capacitance (V_{DS} = 26 Vdc, V_{GS} = 0, f = 1 MHz)	C_{rss}	—	2.8	—	pF
FUNCTIONAL TESTS (In Motorola Test Fixture, 50 ohm system) (2)					
Common–Source Amplifier Power Gain (V_{DD} = 26 Vdc, P_{out} = 120 W PEP, I_{DQ} = 2 × 500 mA, f1 = 1990.0 MHz, f2 = 1990.1 MHz) MRF19120 MRF19120S	G_{ps}	10.7 10.5	11.7 11.7	— —	dB
Drain Efficiency (V_{DD} = 26 Vdc, P_{out} = 120 W PEP, I_{DQ} = 2 × 500 mA, f1 = 1990.0 MHz, f2 = 1990.1 MHz)	η	30	34	—	%
Intermodulation Distortion (V_{DD} = 26 Vdc, P_{out} = 120 W PEP, I_{DQ} = 2 × 500 mA, f1 = 1990.0 MHz, f2 = 1990.1 MHz) MRF19120 MRF19120S	IMD	— —	–31 –31	–28 –27	dB
Input Return Loss (V_{DD} = 26 Vdc, P_{out} = 120 W PEP, I_{DQ} = 2 × 500 mA, f1 = 1990.0 MHz, f2 = 1990.1 MHz)	IRL	—	–12	–9	dB
Common–Source Amplifier Power Gain (V_{DD} = 26 Vdc, P_{out} = 120 W PEP, I_{DQ} = 2 × 500 mA, f1 = 1930.0 MHz, f2 = 1930.1 MHz)	G_{ps}	—	11.7	—	dB
Drain Efficiency (V_{DD} = 26 Vdc, P_{out} = 120 W PEP, I_{DQ} = 2 × 500 mA, f1 = 1930.0 MHz, f2 = 1930.1 MHz)	η	—	34	—	%
Intermodulation Distortion (V_{DD} = 26 Vdc, P_{out} = 120 W PEP, I_{DQ} = 2 × 500 mA, f1 = 1930.0 MHz, f2 = 1930.1 MHz)	IMD	—	–31	—	dB
Input Return Loss (V_{DD} = 26 Vdc, P_{out} = 120 W PEP, I_{DQ} = 2 × 500 mA, f1 = 1930.0 MHz, f2 = 1930.1 MHz)	IRL	—	–14	—	dB
Power Output, 1 dB Compression Point (V_{DD} = 26 Vdc, CW, I_{DQ} = 2 × 500 mA, f1 = 1990.0 MHz)	P1dB	—	120	—	Watts
Common–Source Amplifier Power Gain (V_{DD} = 26 Vdc, P_{out} = 120 W CW, I_{DQ} = 2 × 500 mA, f1 = 1990.0 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°C unless otherwise noted)

Characteristic	Symbol	Min	Typ	Max	Unit
FUNCTIONAL TESTS (In Motorola Test Fixture, 50 ohm system) (2) (continued)					
Drain Efficiency (V_{DD} = 26 Vdc, P_{out} = 120 W CW, I_{DQ} = 2 × 500 mA, f1 = 1990.0 MHz)	η	—	45	—	%
Output Mismatch Stress (V_{DD} = 26 Vdc, P_{out} = 120 W CW, I_{DQ} = 2 × 500 mA, f = 1990 MHz, VSWR = 10:1, All Phase Angles at Frequency of Tests)	Ψ	No Degradation In Output Power Before and After Test			

(2) Device measured in push–pull configuration.



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

Figure 1. 1.93 – 1.99 GHz Broadband Test Circuit Schematic

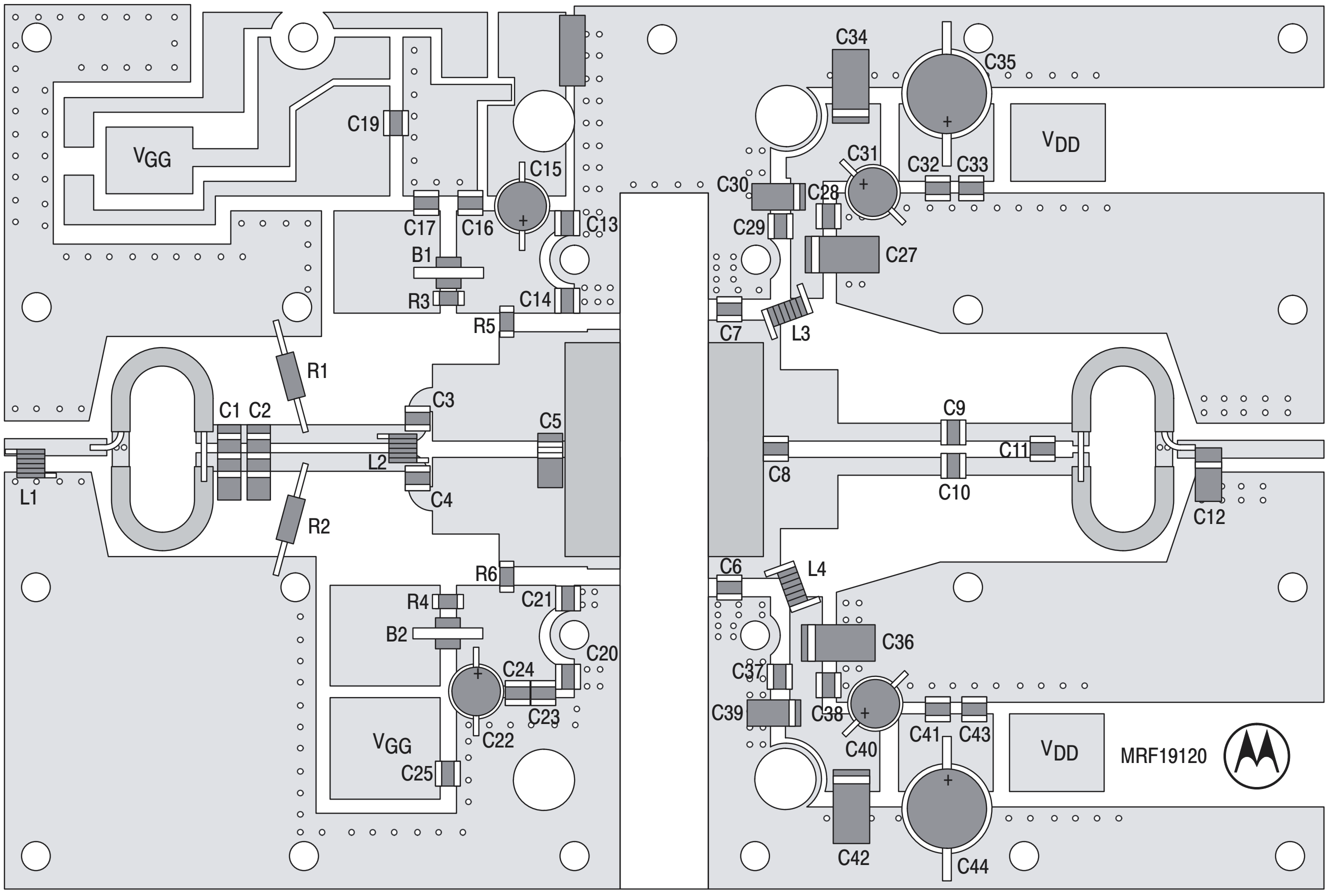


Figure 2. MRF19120 Test Circuit Component Layout

TYPICAL CHARACTERISTICS

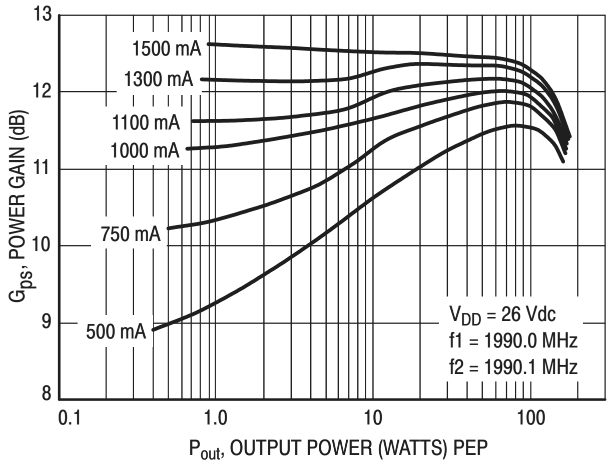


Figure 3. Power Gain versus Output Power

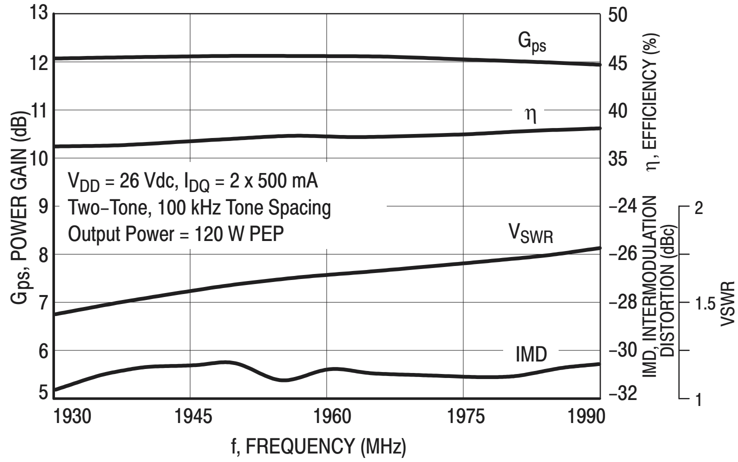


Figure 4. Class AB Broadband Circuit Performance

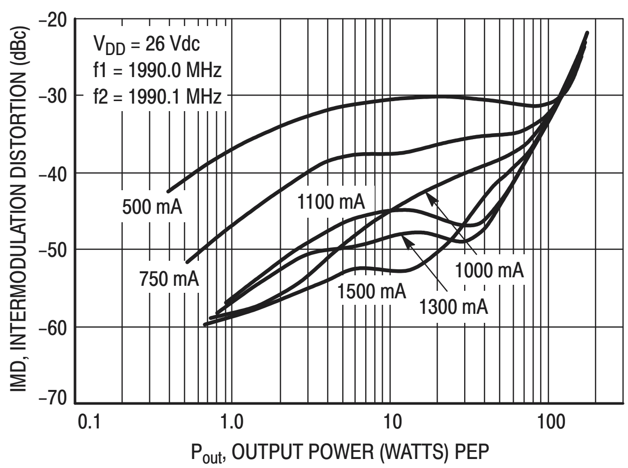


Figure 5. Intermodulation Distortion versus Output Power

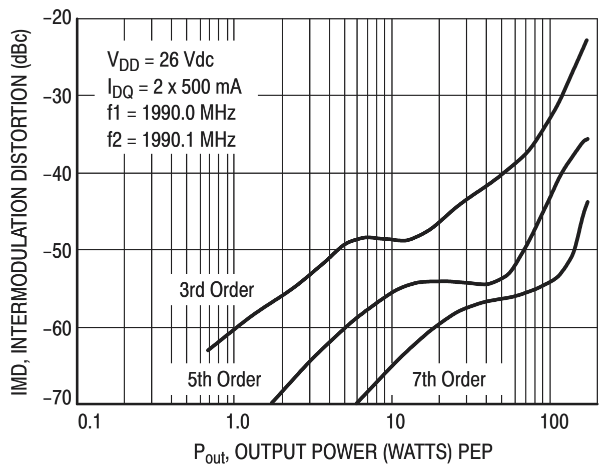


Figure 6. Intermodulation Distortion Products versus Output Power

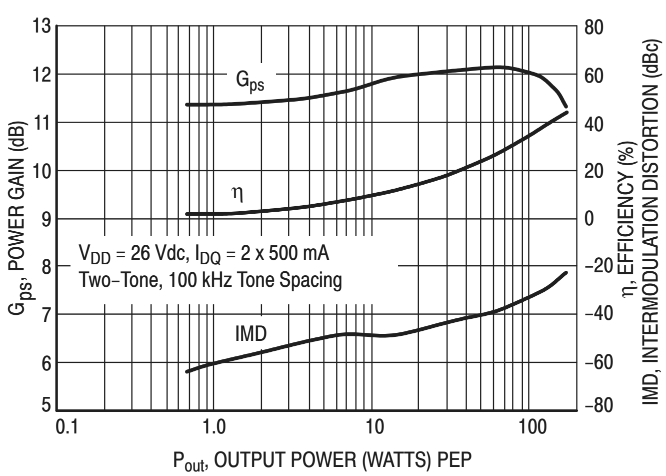


Figure 7. Power Gain, Efficiency, and IMD versus Output Power

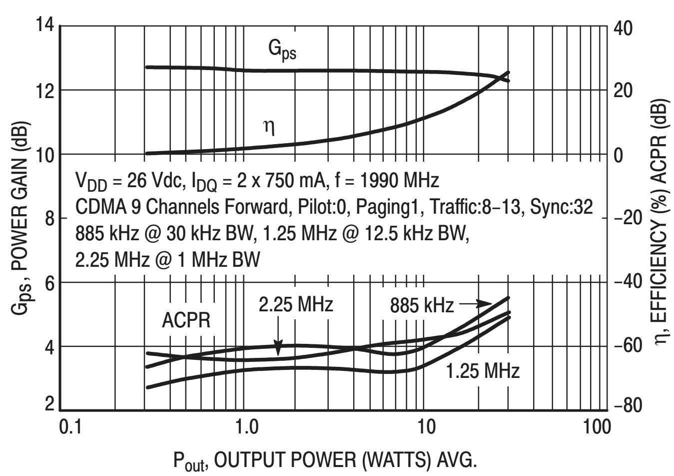
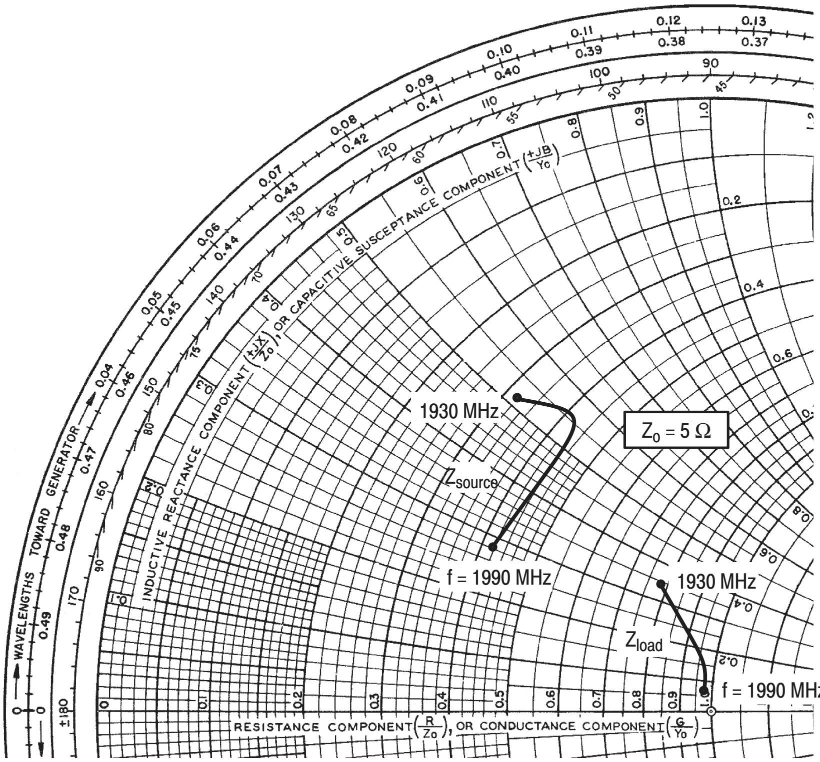


Figure 8. Power Gain, Efficiency, and ACPR versus Output Power



V_{DD} = 26 V, I_{DQ} = 2 × 500 mA, P_{out} = 120 W PEP

f MHz	Z_{source} Ω	Z_{load} Ω
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.

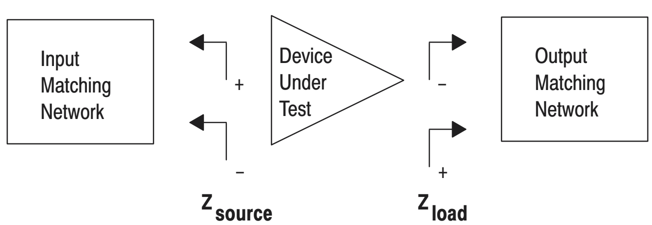


Figure 9. Series Equivalent Input and Output Impedance

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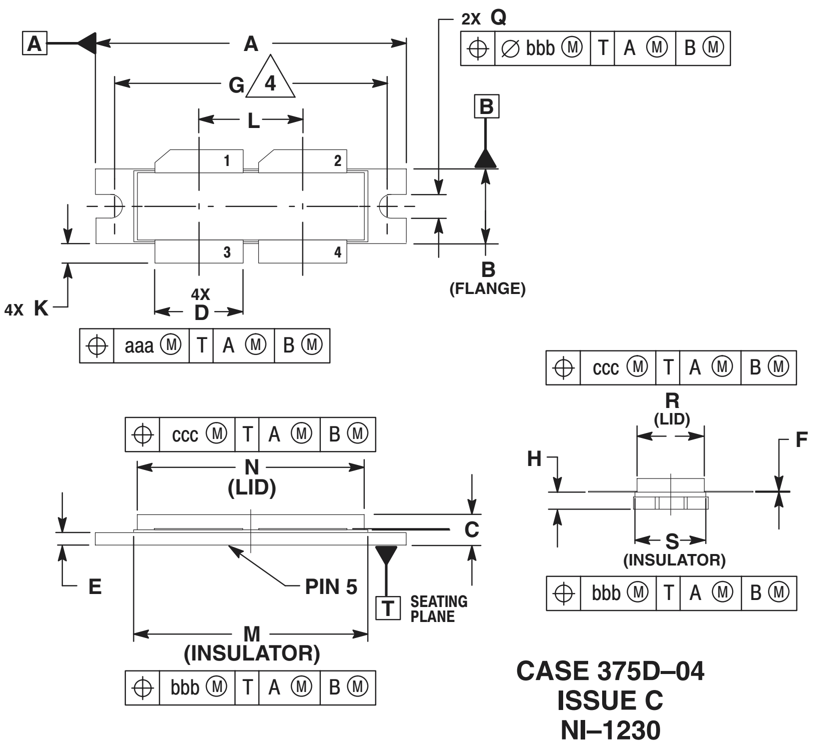
PACKAGE DIMENSIONS

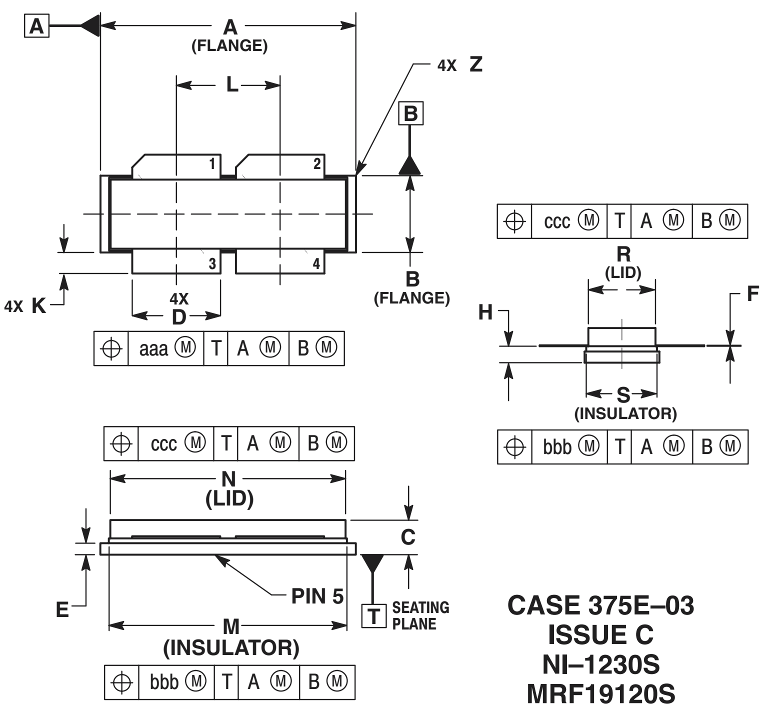


NOTES:
1. INTERPRET DIMENSIONS AND TOLERANCES PER ASME Y14.5M–1994.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSION H IS MEASURED 0.030 (0.762) AWAY FROM PACKAGE BODY.
4. RECOMMENDED BOLT CENTER DIMENSION OF 1.52 (38.61) BASED ON M3 SCREW.

DIM	INCHES MIN	INCHES MAX	MILLIMETERS MIN	MILLIMETERS 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

CASE 375D–04
ISSUE C
NI–1230
MRF19120



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DIM	INCHES MIN	INCHES MAX	MILLIMETERS MIN	MILLIMETERS MAX
A	1.325	1.335	33.66	33.91
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
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
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

CASE 375E–03
ISSUE C
NI–1230S
MRF19120S

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