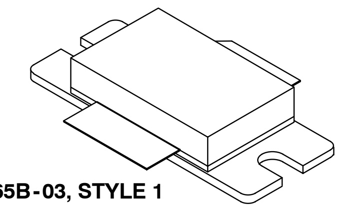
The RF Sub-Micron MOSFET Line
RF Power Field Effect Transistors
N-Channel Enhancement-Mode Lateral MOSFETs

MRF5S19150R3
MRF5S19150SR3

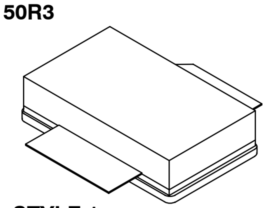
Designed for PCN and PCS base station applications at frequencies from 1.9 to 2.0 GHz. Suitable for TDMA, CDMA and multicarrier amplifier applications.

- Typical 2-Carrier N-CDMA Performance for V_{DD} = 28 Volts, P_{out} = 32 Watts, I_{DQ} = 1400 mA, f1 = 1958.75 MHz, f2 = 1961.25 MHz IS-95 CDMA (Pilot, Sync, Paging, Traffic Codes 8 Through 13) 1.2288 MHz Channel Bandwidth Carrier. Adjacent Channels Measured over a 30 kHz Bandwidth at f1 -885 kHz and f2 +885 kHz. Distortion Products Measured over 1.2288 MHz Bandwidth at f1 -2.5 MHz and f2 +2.5 MHz. Peak/Avg. = 9.8 dB @ 0.01% Probability on CCDF.
  - Output Power — 32 Watts Avg.
  - Power Gain — 14 dB
  - Efficiency — 26%
  - ACPR — -50 dB
  - IM3 — -36.5 dBc
- Internally Matched, Controlled Q, for Ease of Use
- High Gain, High Efficiency and High Linearity
- Integrated ESD Protection
- Designed for Maximum Gain and Insertion Phase Flatness
- Capable of Handling 5:1 VSWR, @ 28 Vdc, f1 = 1960 MHz, 100 Watts CW Output Power
- Excellent Thermal Stability
- Qualified Up to a Maximum of 32 V Operation
- In Tape and Reel. R3 Suffix = 250 Units per 56 mm, 13 inch Reel.

1990 MHz, 32 W, 28 V
LATERAL N-CHANNEL
RF POWER MOSFETs



CASE 465B-03, STYLE 1
NI-880
MRF5S19150R3



CASE 465C-02, STYLE 1
NI-880S
MRF5S19150SR3

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	357 2	Watts W/°C
Storage Temperature Range	T_{stg}	- 65 to +150	°C
Operating Junction Temperature	T_J	200	°C
CW Operation	CW	100	Watts

THERMAL CHARACTERISTICS

Characteristic	Symbol	Value (1,2)	Unit
Thermal Resistance, Junction to Case Case Temperature 80°C, 100 W CW Case Temperature 80°C, 32 W CW	$R_{\theta JC}$	 0.49 0.53	°C/W

(1) MTTF calculator available at http://www.motorola.com/semiconductors/rf. Select Tools/Software/Application Software/Calculators to access the MTTF calculators by product.
(2) Refer to AN1955/D, *Thermal Measurement Methodology of RF Power Amplifiers.* Go to http://www.motorola.com/semiconductors/rf. Select Documentation/Application Notes - AN1955.

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

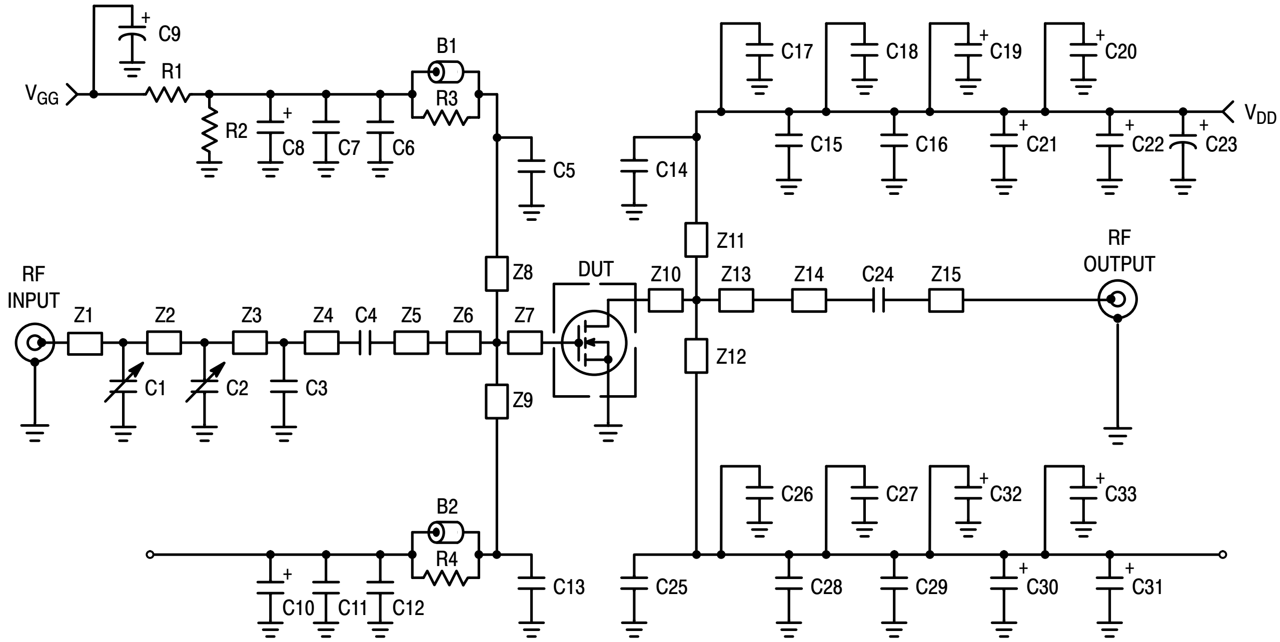
ESD PROTECTION CHARACTERISTICS

Test Conditions	Class
Human Body Model	1 (Minimum)
Machine Model	M3 (Minimum)
Charge Device Model	C7 (Minimum)

ELECTRICAL CHARACTERISTICS (T_C = 25°C unless otherwise noted)

Characteristic	Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTICS					
Zero Gate Voltage Drain Leakage Current (V_{DS} = 65 Vdc, V_{GS} = 0 Vdc)	I_{DSS}	—	—	10	μAdc
Zero Gate Voltage Drain Leakage Current (V_{DS} = 28 Vdc, V_{GS} = 0 Vdc)	I_{DSS}	—	—	1	μAdc
Gate-Source Leakage Current (V_{GS} = 5 Vdc, V_{DS} = 0 Vdc)	I_{GSS}	—	—	1	μAdc
ON CHARACTERISTICS					
Gate Threshold Voltage (V_{DS} = 10 Vdc, I_D = 360 μAdc)	$V_{GS(th)}$	2.5	2.8	3.5	Vdc
Gate Quiescent Voltage (V_{DS} = 28 Vdc, I_D = 1400 mAdc)	$V_{GS(Q)}$	—	3.8	—	Vdc
Drain-Source On-Voltage (V_{GS} = 10 Vdc, I_D = 3.6 Adc)	$V_{DS(on)}$	—	0.24	—	Vdc
Forward Transconductance (V_{DS} = 10 Vdc, I_D = 3.6 Adc)	g_{fs}	—	9	—	S
DYNAMIC CHARACTERISTICS					
Reverse Transfer Capacitance (1) (V_{DS} = 28 Vdc, V_{GS} = 0, f = 1 MHz)	C_{rss}	—	3.1	—	pF
FUNCTIONAL TESTS (In Motorola Test Fixture, 50 ohm system) 2-Carrier N-CDMA, 1.2288 MHz Channel Bandwidth Carriers. Peak/Avg = 9.8 dB @ 0.01% Probability on CCDF.					
Common-Source Amplifier Power Gain (V_{DD} = 28 Vdc, P_{out} = 32 W Avg, I_{DQ} = 1400 mA, f1 = 1930 MHz, f2 = 1932.5 MHz and f1 = 1987.5 MHz, f2 = 1990 MHz)	G_{ps}	13	14	—	dB
Drain Efficiency (V_{DD} = 28 Vdc, P_{out} = 32 W Avg, I_{DQ} = 1400 mA, f1 = 1930 MHz, f2 = 1932.5 MHz and f1 = 1987.5 MHz, f2 = 1990 MHz)	η	24	26	—	%
Third Order Intermodulation Distortion (V_{DD} = 28 Vdc, P_{out} = 32 W Avg, I_{DQ} = 1400 mA, f1 = 1930 MHz, f2 = 1932.5 MHz and f1 = 1987.5 MHz, f2 = 1990 MHz; IM3 measured over 1.2288 MHz Bandwidth at f1 -2.5 MHz and f2 +2.5 MHz referenced to carrier channel power.)	IM3	—	-36.5	-35	dBc
Adjacent Channel Power Ratio (V_{DD} = 28 Vdc, P_{out} = 32 W Avg, I_{DQ} = 1400 mA, f1 = 1930 MHz, f2 = 1932.5 MHz and f1 = 1987.5 MHz, f2 = 1990 MHz; ACPR measured over 30 kHz Bandwidth at f1 -885 MHz and f2 +885 MHz)	ACPR	—	-50	-48	dBc
Input Return Loss (V_{DD} = 28 Vdc, P_{out} = 32 W Avg, I_{DQ} = 1400 mA, f1 = 1930 MHz, f2 = 1932.5 MHz and f1 = 1987.5 MHz, f2 = 1990 MHz)	IRL	—	-17	-9	dB

(1) Part is internally matched both on input and output.



Z1	1.023″ x 0.082″ Microstrip	Z9	1.280″ x 0.046″ Microstrip
Z2	0.398″ x 0.082″ Microstrip	Z10	0.090″ x 1.055″ Microstrip
Z3	0.203″ x 0.082″ Microstrip	Z11	1.125″ x 0.068″ Microstrip
Z4	0.074″ x 0.082″ Microstrip	Z12	1.125″ x 0.068″ Microstrip
Z5	0.630″ x 0.084″ Microstrip	Z13	0.505″ x 1.055″ Microstrip
Z6	0.557″ x 1.030″ x 0.237″ Microstrip Taper	Z14	0.898″ x 0.105″ Microstrip
Z7	0.103″ x 1.030″ Microstrip	Z15	1.133″ x 0.082″ Microstrip
Z8	1.280″ x 0.046″ Microstrip	PCB	Arlon GX0300-55-22, 0.03″, ε_r = 2.55

Figure 1. MRF5S19150 Test Circuit Schematic

Table 1. MRF5S19150 Test Circuit Component Designations and Values

Part	Description
B1, B2	Short RF Beads
C1, C2	0.6 – 4.5 Variable Capacitors, Gigatrim
C3	0.8 pF Chip Capacitor, B Case
C4, C5, C13, C14, C24, C25	9.1 pF Chip Capacitors, B Case
C8, C10	1.0 μF, 50 V SMT Tantalum Capacitors
C6, C12, C16, C17, C18, C27, C28, C29	0.1 μF Chip Capacitors, B Case
C7, C11, C15, C26	1000 pF Chip Capacitors, B Case
C9	100 μF, 50 V Electrolytic Capacitor
C23	470 μF, 63 V Electrolytic Capacitor
C19, C20, C21, C22, C30, C31, C32, C33	22 μF, 35 V Tantalum Capacitors
R1	1 kΩ Chip Resistor
R2	560 kΩ Chip Resistor
R3, R4	12 Ω Chip Resistors

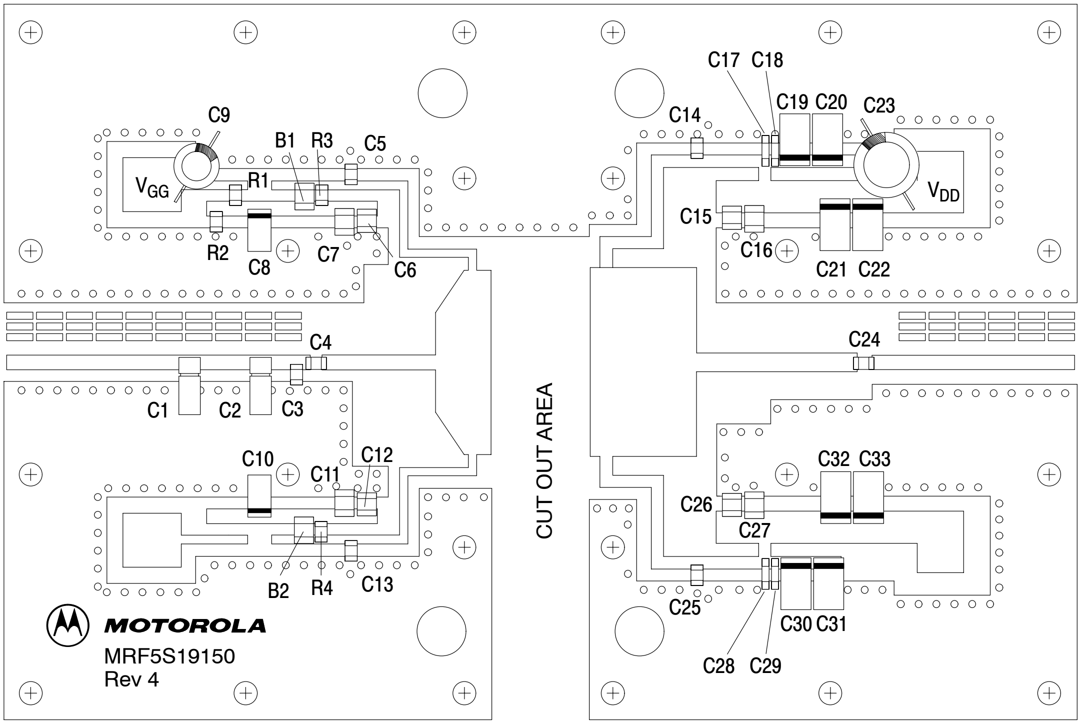


Figure 2. MRF5S19150 Test Circuit Component Layout

TYPICAL CHARACTERISTICS

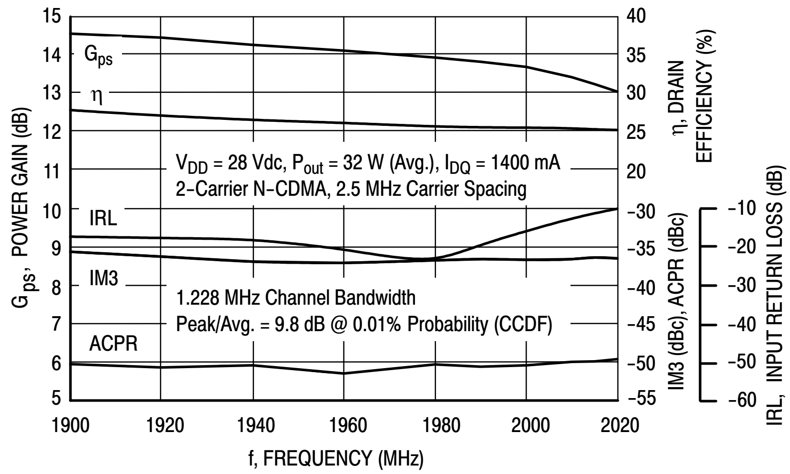


Figure 3. 2-Carrier N-CDMA Broadband Performance

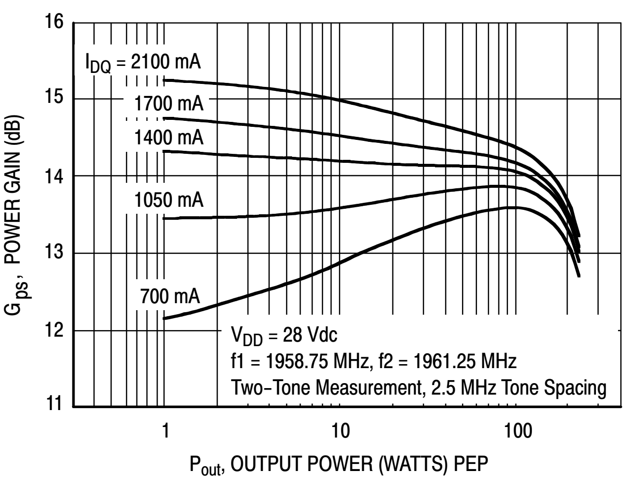


Figure 4. Two-Tone Power Gain versus Output Power

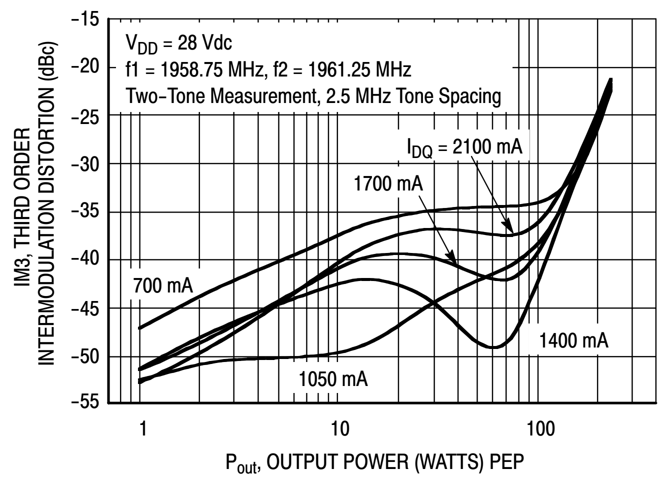


Figure 5. Third Order Intermodulation versus Output Power

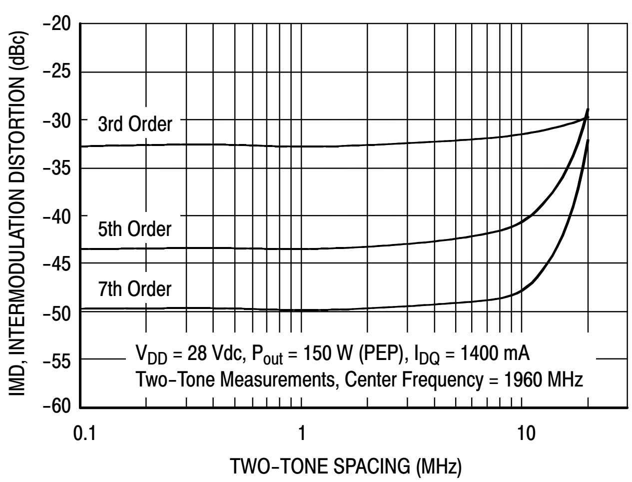


Figure 6. Intermodulation Distortion Products versus Tone Spacing

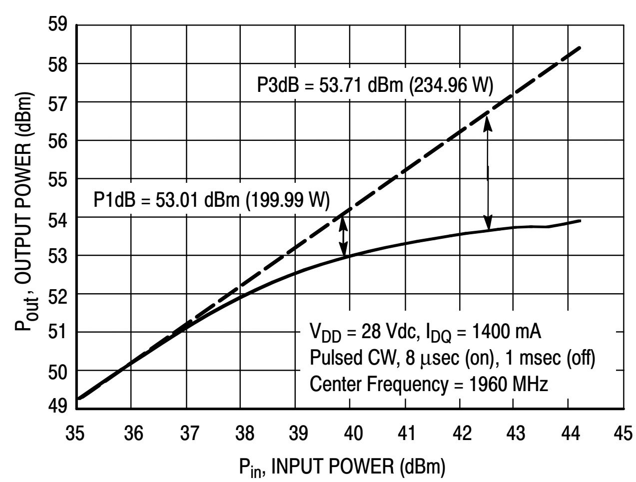


Figure 7. Pulse CW Output Power versus Input Power

TYPICAL CHARACTERISTICS

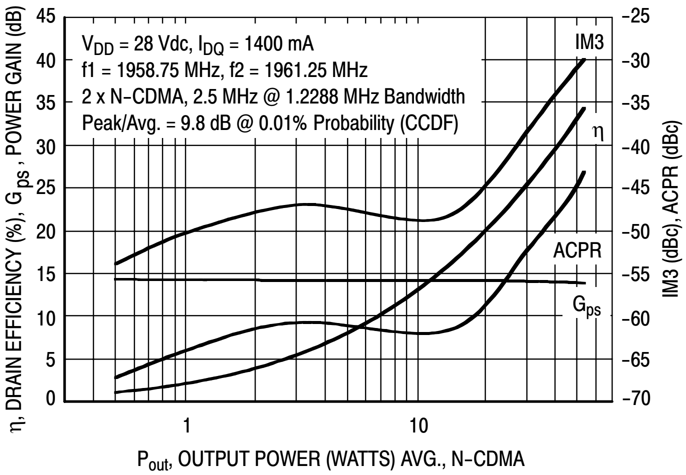


Figure 8. 2-Carrier N-CDMA ACPR, IM3, Power Gain, Drain Efficiency versus Output Power

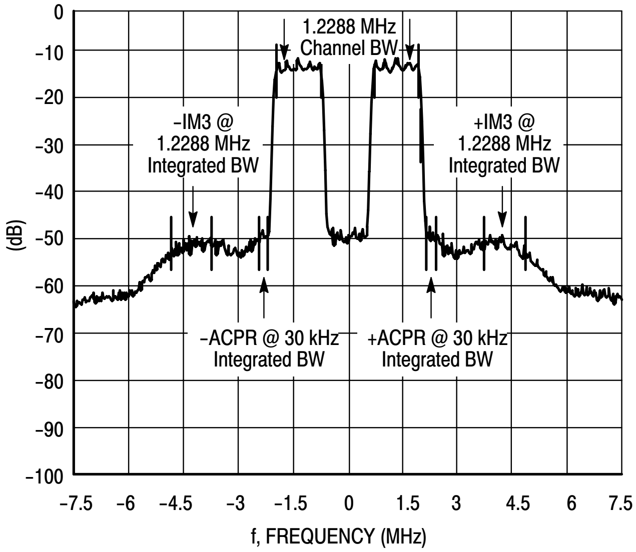
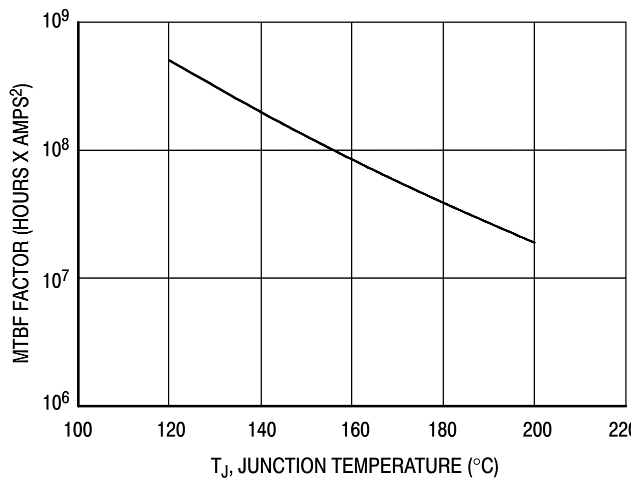
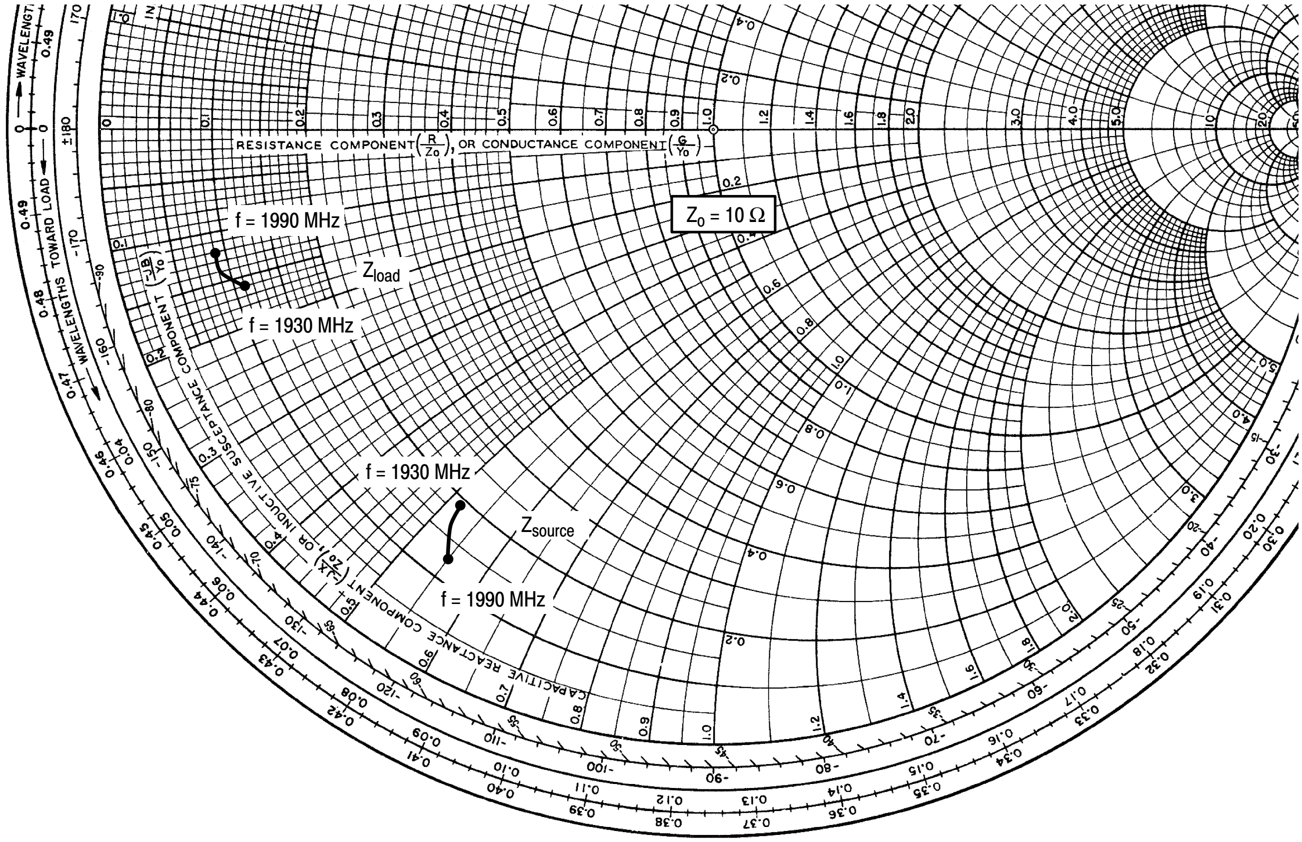


Figure 9. 2-Carrier N-CDMA Spectrum



This above graph displays calculated MTBF in hours x ampere^2 drain current. Life tests at elevated temperatures have correlated to better than ±10% of the theoretical prediction for metal failure. Divide MTBF factor by I_D^2 for MTBF in a particular application.

Figure 10. MTBF Factor versus Junction Temperature



V_{DD} = 28 V, I_{DQ} = 1400 mA, P_{out} = 32 W Avg.

f MHz	Z_{source} Ω	Z_{load} Ω
1930	1.89 - j5.24	1.06 - j1.58
1960	1.64 - j5.29	0.88 - j1.37
1990	1.3 - j5.49	0.90 - j1.21

Z_{source} = Test circuit impedance as measured from gate to ground.

Z_{load} = Test circuit impedance as measured from drain to ground.

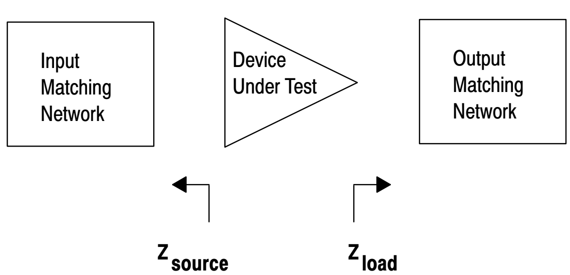


Figure 11. Series Equivalent Input and Output Impedance

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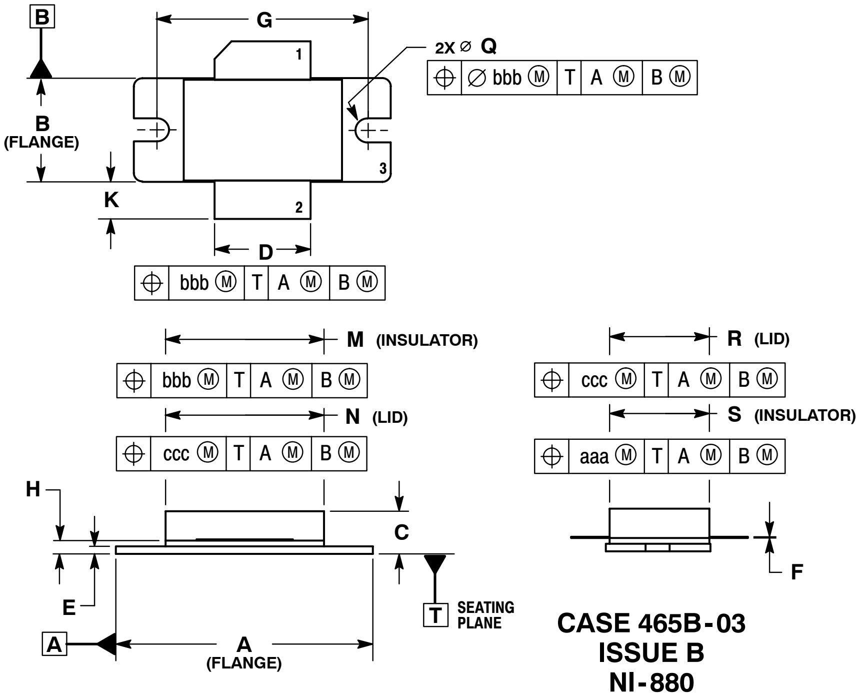
PACKAGE DIMENSIONS

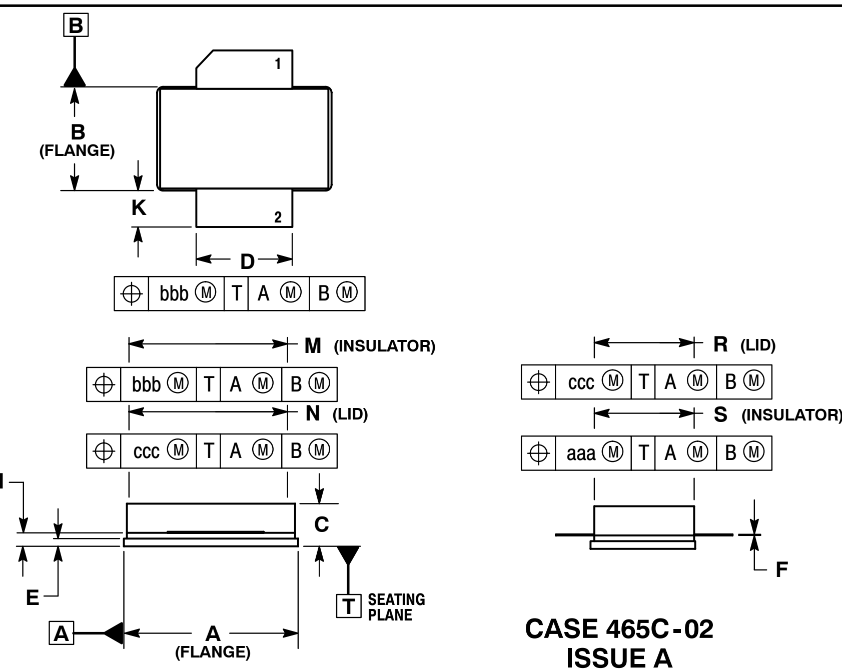


CASE 465B-03
ISSUE B
NI-880
MRF5S19150R3

NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M-1994.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSION H IS MEASURED 0.030 (0.762) AWAY FROM PACKAGE BODY.
4. DELETED

	INCHES		MILLIMETERS	
DIM	MIN	MAX	MIN	MAX
A	1.335	1.345	33.91	34.16
B	0.535	0.545	13.6	13.8
C	0.147	0.200	3.73	5.08
D	0.495	0.505	12.57	12.83
E	0.035	0.045	0.89	1.14
F	0.003	0.006	0.08	0.15
G	1.100 BSC		27.94 BSC	
H	0.057	0.067	1.45	1.70
K	0.170	0.210	4.32	5.33
M	0.872	0.888	22.15	22.55
N	0.871	0.889	19.30	22.60
Q	∅.118	∅.138	∅3.00	∅3.51
R	0.515	0.525	13.10	13.30
S	0.515	0.525	13.10	13.30
aaa	0.007 REF		0.178 REF	
bbb	0.010 REF		0.254 REF	
ccc	0.015 REF		0.381 REF	

STYLE 1:
PIN 1. DRAIN
2. GATE
3. SOURCE



CASE 465C-02
ISSUE A
NI-880S
MRF5S19150SR3

NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M-1994.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSION H IS MEASURED 0.030 (0.762) AWAY FROM PACKAGE BODY.

	INCHES		MILLIMETERS	
DIM	MIN	MAX	MIN	MAX
A	0.905	0.915	22.99	23.24
B	0.535	0.545	13.60	13.80
C	0.147	0.200	3.73	5.08
D	0.495	0.505	12.57	12.83
E	0.035	0.045	0.89	1.14
F	0.003	0.006	0.08	0.15
H	0.057	0.067	1.45	1.70
K	0.170	0.210	4.32	5.33
M	0.872	0.888	22.15	22.55
N	0.871	0.889	19.30	22.60
R	0.515	0.525	13.10	13.30
S	0.515	0.525	13.10	13.30
aaa	0.007 REF		0.178 REF	
bbb	0.010 REF		0.254 REF	
ccc	0.015 REF		0.381 REF	

STYLE 1:
PIN 1. DRAIN
2. GATE
3. SOURCE

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