

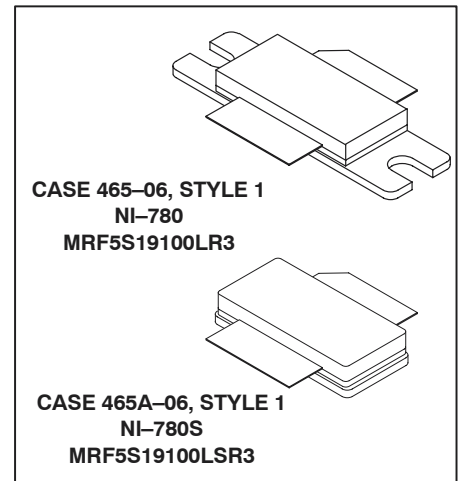
The RF MOSFET Line  
**RF Power Field Effect Transistors**  
N-Channel Enhancement-Mode Lateral MOSFETs

**MRF5S19100LR3**  
**MRF5S19100LSR3**

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

**1990 MHz, 22 W AVG, 2 x N-CDMA**  
**28 V LATERAL N-CHANNEL**  
**RF POWER MOSFETs**

- Typical 2-Carrier N-CDMA Performance for  $V_{DD} = 28$  Volts,  
 $I_{DQ} = 1000$  mA,  $f_1 = 1958.75$  MHz,  $f_2 = 1961.25$  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  $f_1 - 885$  kHz and  $f_2 + 885$  kHz. Distortion  
Products Measured over 1.2288 MHz Bandwidth at  $f_1 - 2.5$  MHz and  
 $f_2 + 2.5$  MHz. Peak/Avg. = 9.8 dB @ 0.01% Probability on CCDF.  
Output Power — 22 Watts Avg.  
Power Gain — 13.9 dB  
Efficiency — 25.5%  
ACPR — -50.7 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 10:1 VSWR, @ 28 Vdc, 1960 MHz, 100 Watts CW  
Output Power
- Excellent Thermal Stability
- Characterized with Series Equivalent Large-Signal Impedance Parameters
- Qualified Up to a Maximum of 32  $V_{DD}$  Operation
- In Tape and Reel. R3 Suffix = 250 Units per 56 mm, 13 Inch Reel.
- Low Gold Plating Thickness on Leads. L Suffix Indicates 40 $\mu$ m Nominal.



**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 $^\circ\text{C}$	$P_D$	236 1.35	Watts W/ $^\circ\text{C}$
Storage Temperature Range	$T_{stg}$	-65 to +150	$^\circ\text{C}$
Operating Junction Temperature	$T_J$	200	$^\circ\text{C}$

**THERMAL CHARACTERISTICS**

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Case Case Temperature 75 $^\circ\text{C}$ , 100 W CW Case Temperature 70 $^\circ\text{C}$ , 22 W CW	$R_{\theta JC}$	0.74 0.76	$^\circ\text{C}/\text{W}$

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

## ESD PROTECTION CHARACTERISTICS

Test Conditions	Class
Human Body Model	2 (Minimum)
Machine Model	M3 (Minimum)
Charge Device Model	C7 (Minimum)

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

Characteristic	Symbol	Min	Typ	Max	Unit
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### OFF CHARACTERISTICS

Zero Gate Voltage Drain Leakage Current (V <sub>DS</sub> = 65 Vdc, V <sub>GS</sub> = 0 Vdc)	I <sub>DSS</sub>	—	—	10	μA <sub>dc</sub>
Zero Gate Voltage Drain Leakage Current (V <sub>DS</sub> = 28 Vdc, V <sub>GS</sub> = 0 Vdc)	I <sub>DSS</sub>	—	—	1	μA <sub>dc</sub>
Gate–Source Leakage Current (V <sub>GS</sub> = 5 Vdc, V <sub>DS</sub> = 0 Vdc)	I <sub>GSS</sub>	—	—	1	μA <sub>dc</sub>

### ON CHARACTERISTICS (DC)

Gate Threshold Voltage (V <sub>DS</sub> = 10 Vdc, I <sub>D</sub> = 240 μA <sub>dc</sub> )	V <sub>GS(th)</sub>	—	2.7	—	Vdc
Gate Quiescent Voltage (V <sub>DS</sub> = 28 Vdc, I <sub>D</sub> = 1000 mA <sub>dc</sub> )	V <sub>GS(Q)</sub>	—	3.7	—	Vdc
Drain–Source On–Voltage (V <sub>GS</sub> = 10 Vdc, I <sub>D</sub> = 2.4 A <sub>dc</sub> )	V <sub>DS(on)</sub>	—	0.26	—	Vdc
Forward Transconductance (V <sub>DS</sub> = 10 Vdc, I <sub>D</sub> = 2.4 A <sub>dc</sub> )	g <sub>fs</sub>	—	6.3	—	S

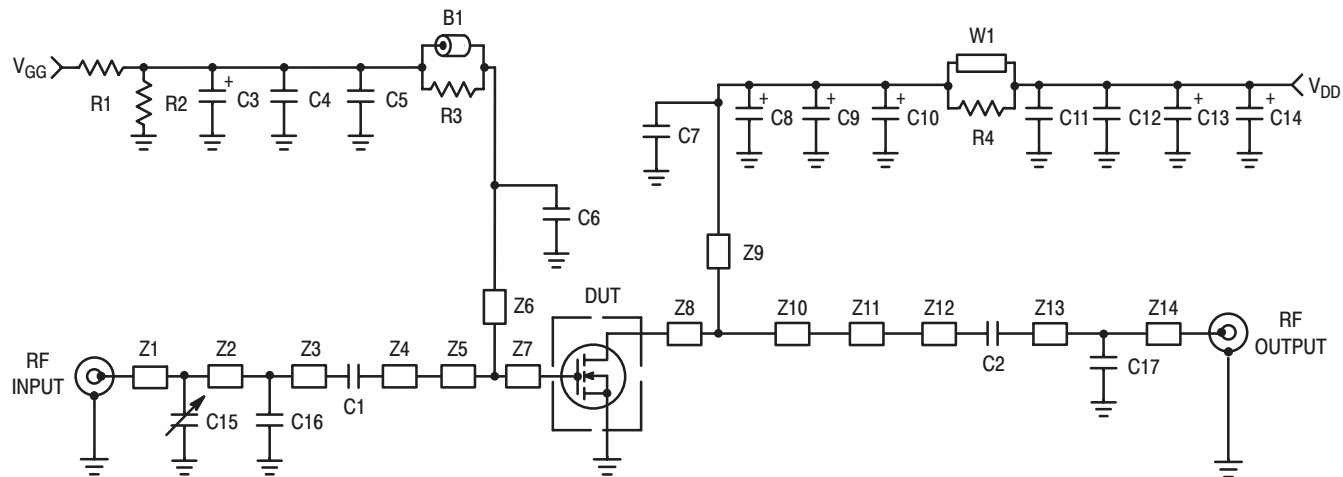
### DYNAMIC CHARACTERISTICS

Reverse Transfer Capacitance (1) (V <sub>DS</sub> = 28 Vdc, V <sub>GS</sub> = 0, f = 1.0 MHz)	C <sub>rss</sub>	—	2.2	—	pF
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**FUNCTIONAL TESTS** (In Motorola Test Fixture, 50 ohm system) 2–Carrier N–CDMA, 1.2288 MHz Channel Bandwidth Carriers. ACPR measured in 30 kHz Bandwidth and IM3 measured in 1.2288 MHz Bandwidth. Peak/Avg. Ratio = 9.8 dB @ 0.01% Probability on CCDF.

Power Gain (V <sub>DD</sub> = 28 Vdc, P <sub>out</sub> = 22 W Avg., I <sub>DQ</sub> = 1000 mA, f <sub>1</sub> = 1930 MHz, f <sub>2</sub> = 1932.5 MHz and f <sub>1</sub> = 1987.5 MHz, f <sub>2</sub> = 1990 MHz)	G <sub>ps</sub>	12.5	13.9	—	dB
Drain Efficiency (V <sub>DD</sub> = 28 Vdc, P <sub>out</sub> = 22 W Avg., I <sub>DQ</sub> = 1000 mA, f <sub>1</sub> = 1930 MHz, f <sub>2</sub> = 1932.5 MHz and f <sub>1</sub> = 1987.5 MHz, f <sub>2</sub> = 1990 MHz)	η	24	25.5	—	%
Third Order Intermodulation Distortion (V <sub>DD</sub> = 28 Vdc, P <sub>out</sub> = 22 W Avg., I <sub>DQ</sub> = 1000 mA, f <sub>1</sub> = 1930 MHz, f <sub>2</sub> = 1932.5 MHz and f <sub>1</sub> = 1987.5 MHz, f <sub>2</sub> = 1990 MHz); IM3 measured over 1.2288 MHz bandwidth @ f <sub>1</sub> –2.5 MHz and f <sub>2</sub> = +2.5 MHz)	IM3	—	–36.5	–35	dBc
Adjacent Channel Power Ratio (V <sub>DD</sub> = 28 Vdc, P <sub>out</sub> = 22 W Avg., I <sub>DQ</sub> = 1000 mA, f <sub>1</sub> = 1930 MHz, f <sub>2</sub> = 1932.5 MHz and f <sub>1</sub> = 1987.5 MHz, f <sub>2</sub> = 1990 MHz); ACPR measured over 30 kHz bandwidth @ f <sub>1</sub> –885 MHz and f <sub>2</sub> = +885 MHz)	ACPR	—	–50.7	–48	dBc
Input Return Loss (V <sub>DD</sub> = 28 Vdc, P <sub>out</sub> = 22 W Avg., I <sub>DQ</sub> = 1000 mA, f <sub>1</sub> = 1930 MHz, f <sub>2</sub> = 1932.5 MHz and f <sub>1</sub> = 1987.5 MHz, f <sub>2</sub> = 1990 MHz)	IRL	—	–13	–9	dB

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



Z1, Z3	0.140" x 0.080" Microstrip	Z9	0.590" x 0.071" Microstrip
Z2	0.450" x 0.080" Microstrip	Z10	0.450" x 1.133" Microstrip
Z4	0.525" x 0.080" Microstrip	Z11	0.450" x 0.141" Microstrip
Z5	0.636" x 0.141" Microstrip	Z12	0.490" x 0.080" Microstrip
Z6	0.650" x 0.050" Microstrip	Z13	0.085" x 0.080" Microstrip
Z7	0.320" x 1.299" Microstrip	Z14	1.124" x 0.080" Microstrip
Z8	0.091" x 1.133" Microstrip	PCB	Arlon GX-0300-55-22, 0.030", $\epsilon_r = 2.55$

**Figure 1. MRF5S19100LR3(LSR3) Test Circuit Schematic**

**Table 1. MRF5S19100LR3(LSR3) Test Circuit Component Designations and Values**

Part	Description	Value, P/N or DWG	Manufacturer
B1	Short RF Bead	95F786	Newark
C1	22 pF Chip Capacitor, B Case	100B220CP 500X	ATC
C2	10 pF Chip Capacitor, B Case	100B100CP 500X	ATC
C3	1 $\mu$ F, 50 V Tantalum Capacitor	T494C105(1)050AS	Kemet
C4, C12	0.1 $\mu$ F Chip Capacitors, B Case	CDR33BX104AKWS	Kemet
C5, C11	1K pF Chip Capacitors, B Case	100B102JP 500X	ATC
C6	2.7 pF Chip Capacitor, B Case	100B2R7BP 500X	ATC
C7	4.3 pF Chip Capacitor, B Case	100B4R3JP 500X	ATC
C8	10 $\mu$ F, 35 V Tantalum Capacitor	T494D106(1)035AS	Kemet
C9, C10, C13, C14	22 $\mu$ F, 35 V Tantalum Capacitors	T494X226(1)035AS	Kemet
C15	0.6 – 4.5 Gigatrim Variable Capacitor	44F3358	Newark
C16	2.2 pF Chip Capacitor, B Case	100B2R2BP 500X	ATC
C17*	0.3 pF Chip Capacitor, B Case	100B0R3BP 500X	ATC
R1	1 k $\Omega$ Chip Resistor	D5534M07B1K00R	Newark
R2	560 k $\Omega$ Chip Resistor	CR1206 564JT	Newark
R3, R4	12 $\Omega$ Chip Resistors	RM73B2B120JT	Garrett Electronics
W1	1 turn 14 gauge wire		

\* Need for part will vary from fixture to fixture.

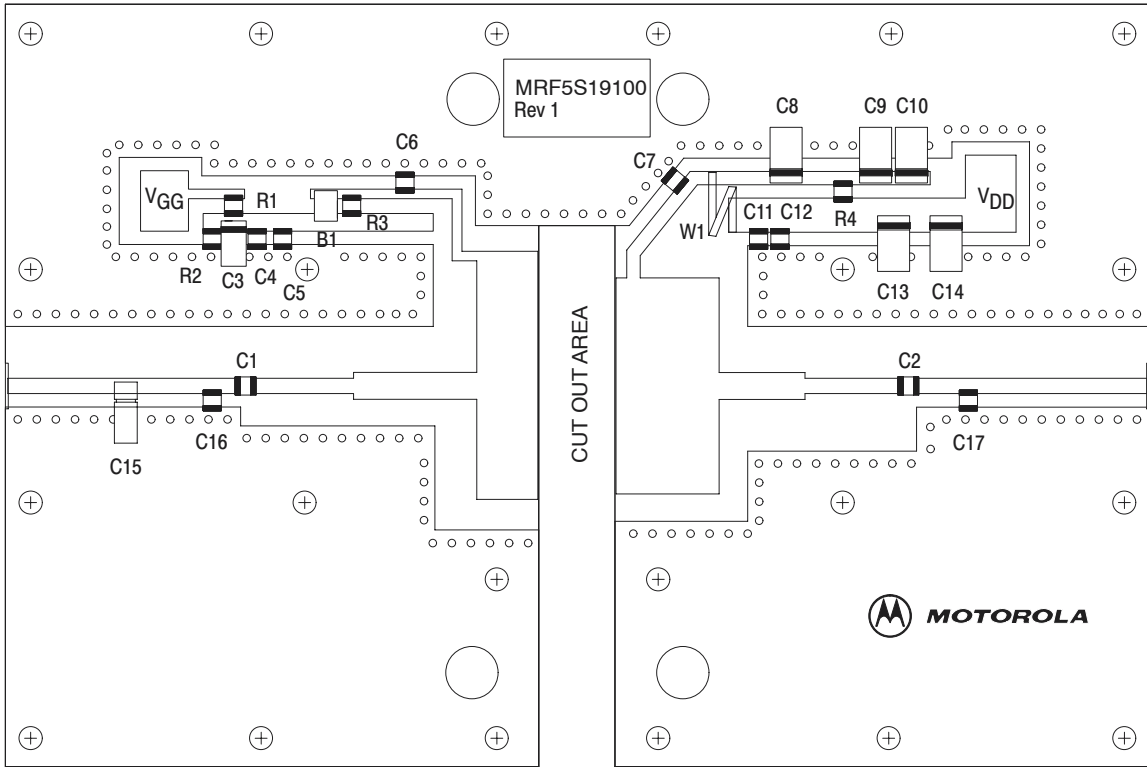
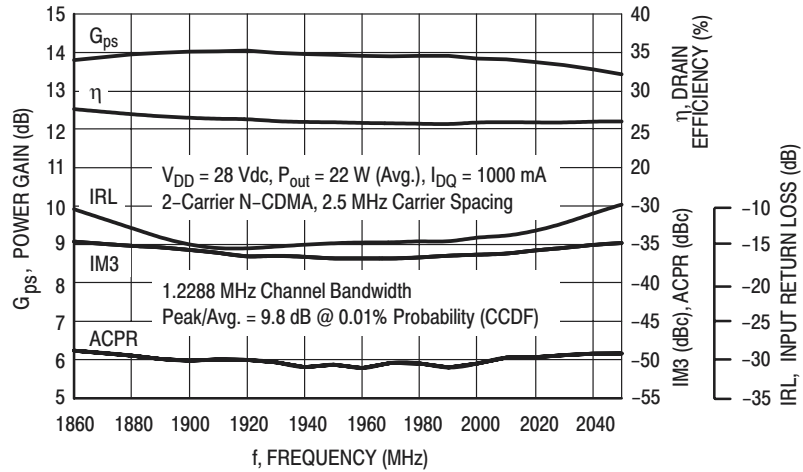
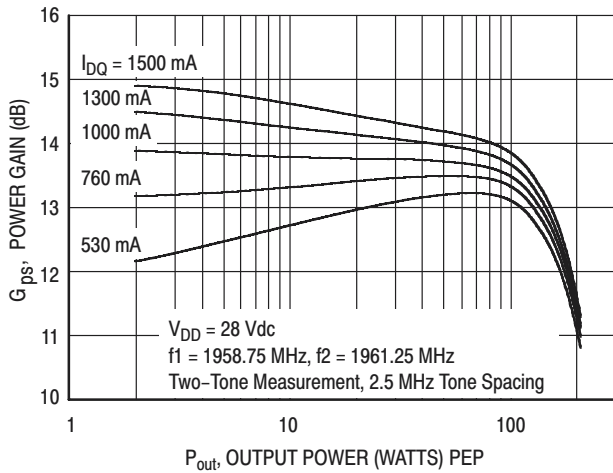


Figure 2. MRF5S19100LR3(LSR3) Test Circuit Component Layout

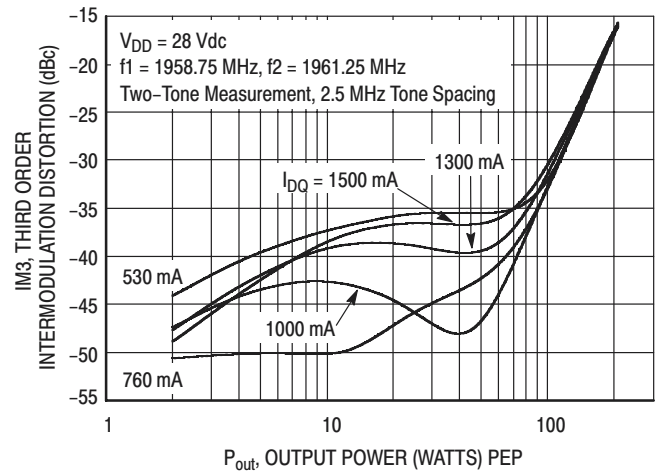
## TYPICAL CHARACTERISTICS



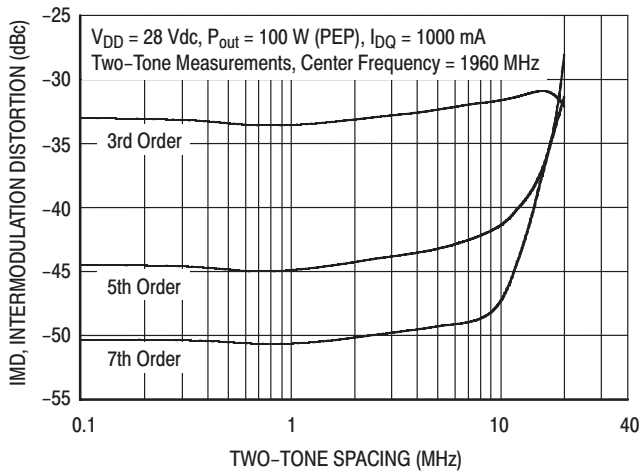
**Figure 3. 2-Carrier N-CDMA Broadband Performance**



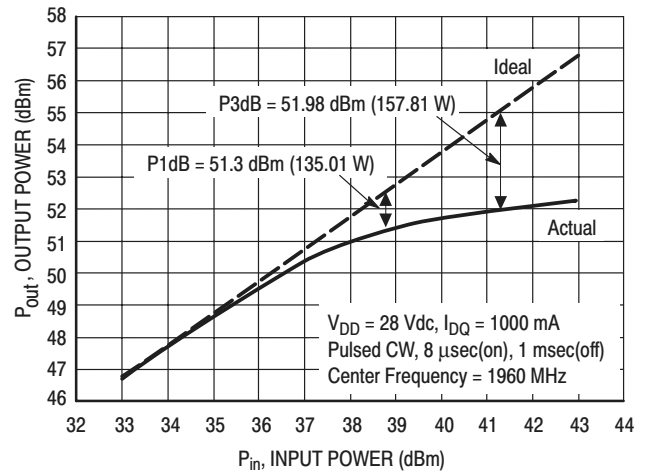
**Figure 4. Two-Tone Power Gain versus Output Power**



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



**Figure 6. Intermodulation Distortion Products versus Tone Spacing**



**Figure 7. Pulse CW Output Power versus Input Power**

## TYPICAL CHARACTERISTICS

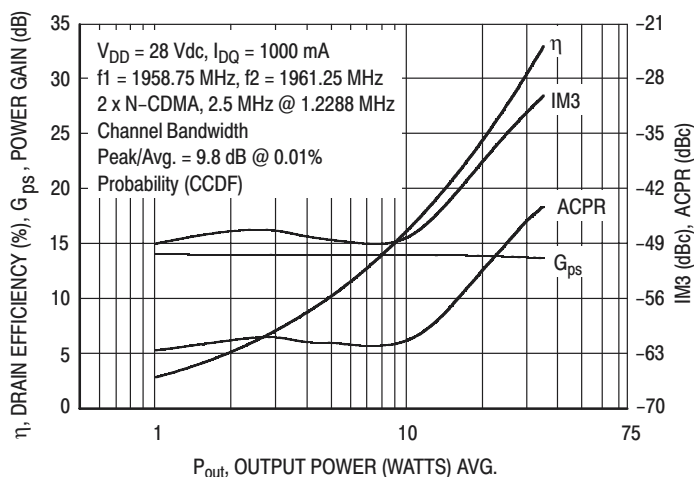


Figure 8. 2-Carrier N-CDMA ACPR, IM3, Power Gain and Drain Efficiency versus Output Power

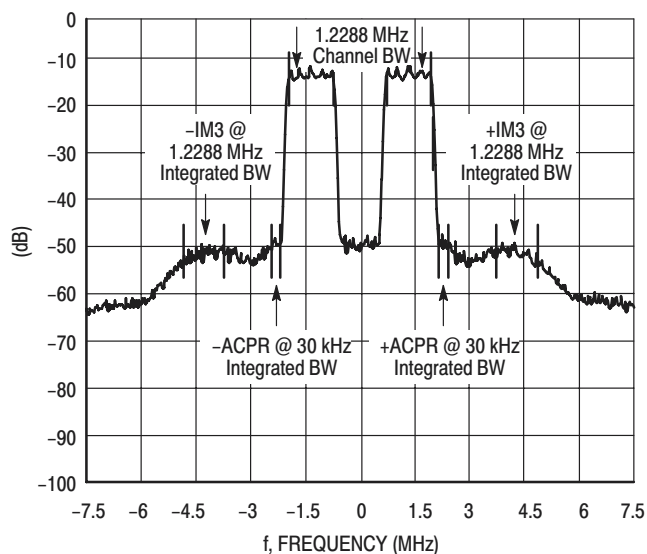
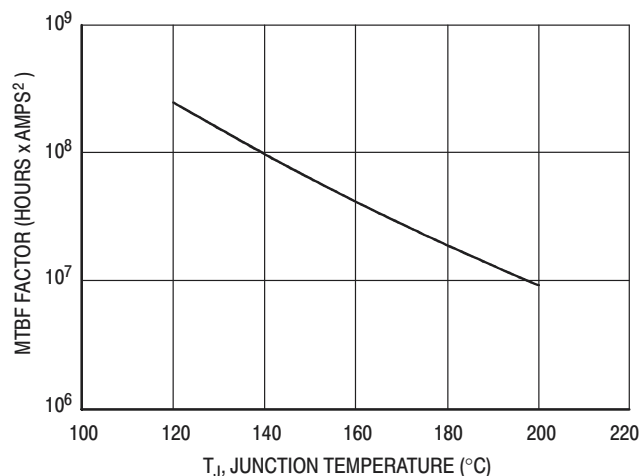
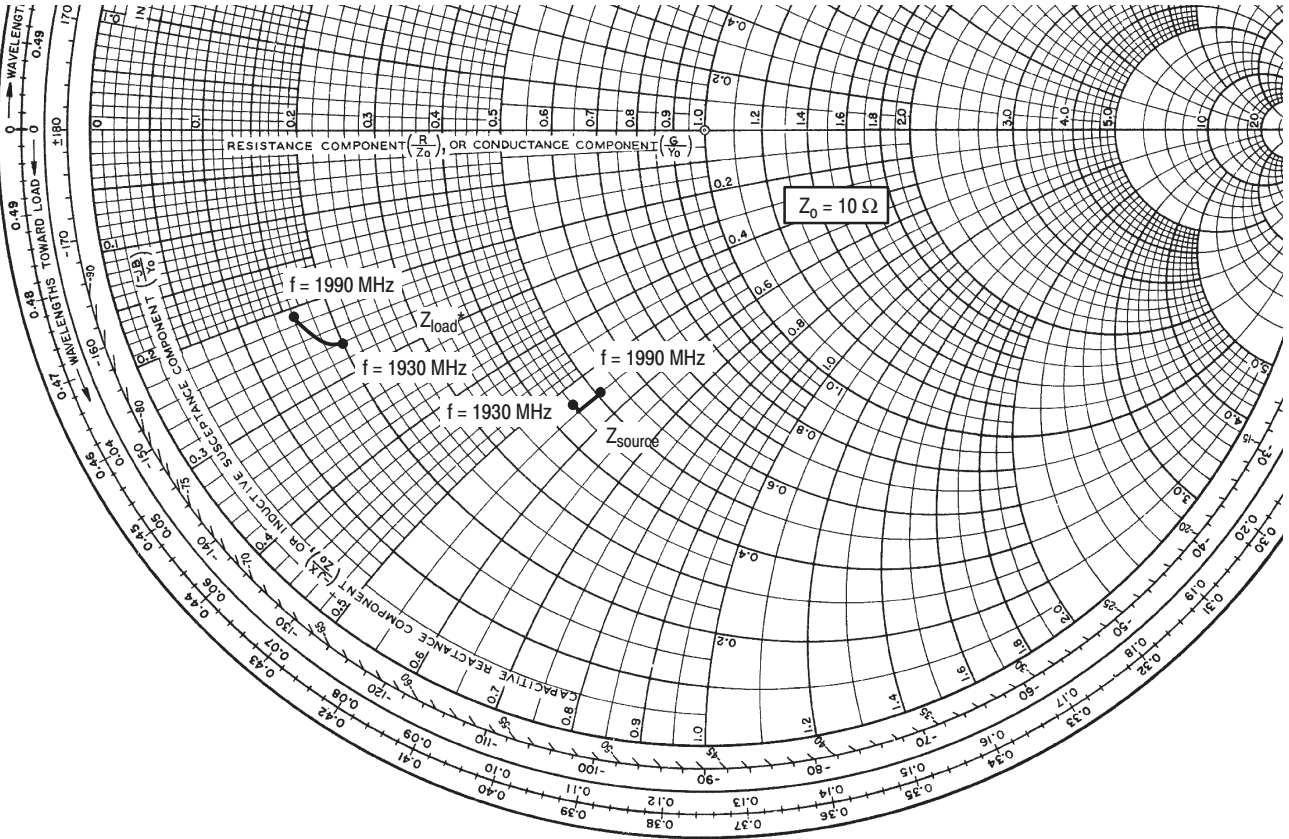


Figure 9. 2-Carrier N-CDMA Spectrum



This above graph displays calculated MTBF in hours x ampere<sup>2</sup> drain current. Life tests at elevated temperatures have correlated to better than  $\pm 10\%$  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



$V_{DD} = 28\text{ V}$ ,  $I_{DQ} = 1000\text{ mA}$ ,  $P_{out} = 22\text{ W Avg.}$

f MHz	$Z_{source}$ $\Omega$	$Z_{load}$ $\Omega$
1930	$4.45 - j5.32$	$1.98 - j2.58$
1960	$4.53 - j5.40$	$1.83 - j2.55$
1990	$5.12 - j5.45$	$1.60 - j2.15$

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

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

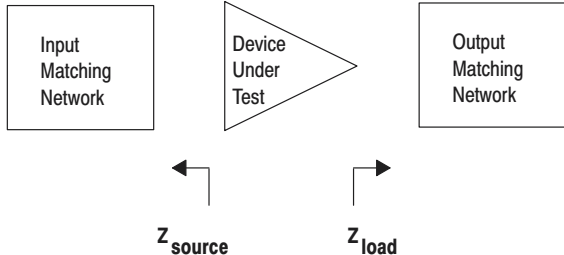


Figure 11. Series Equivalent Input and Output Impedance

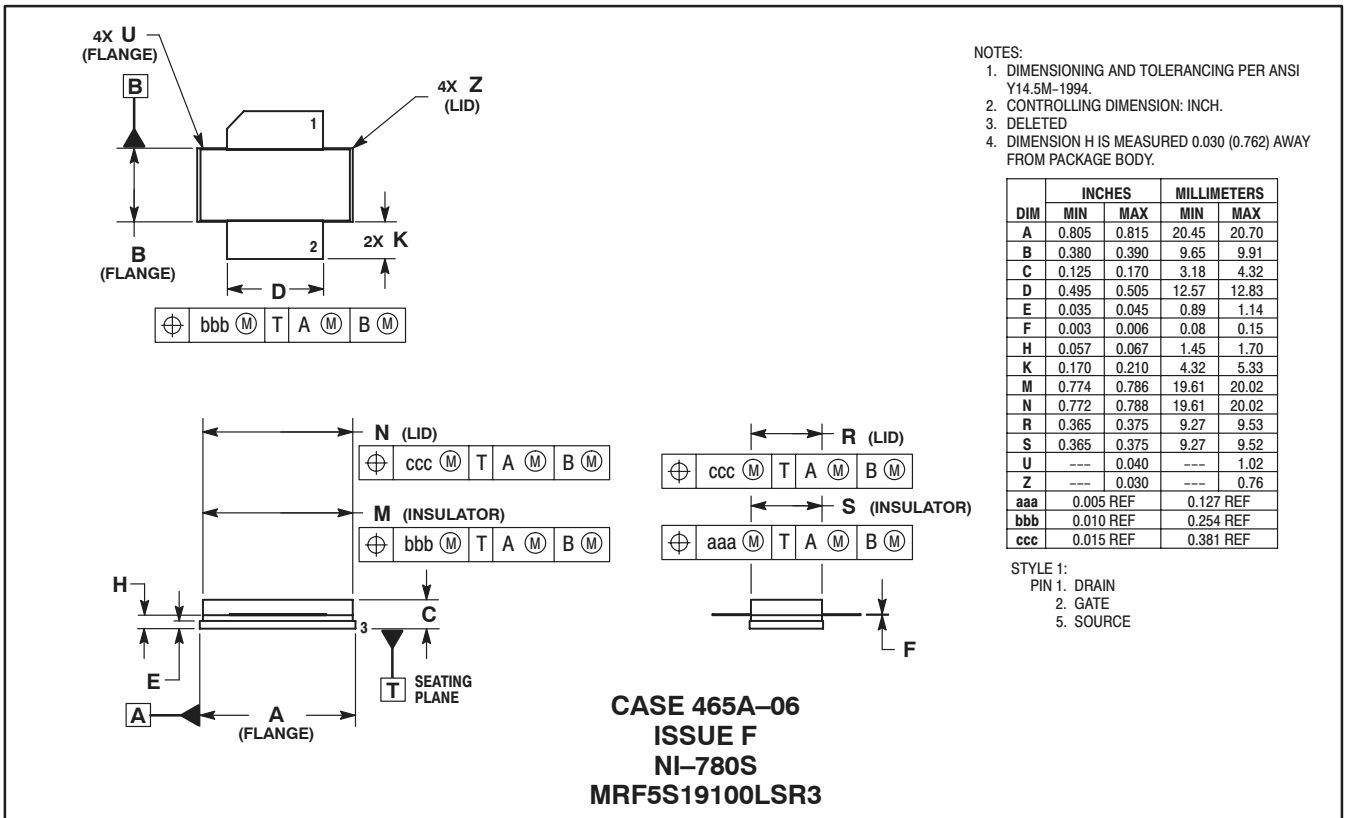
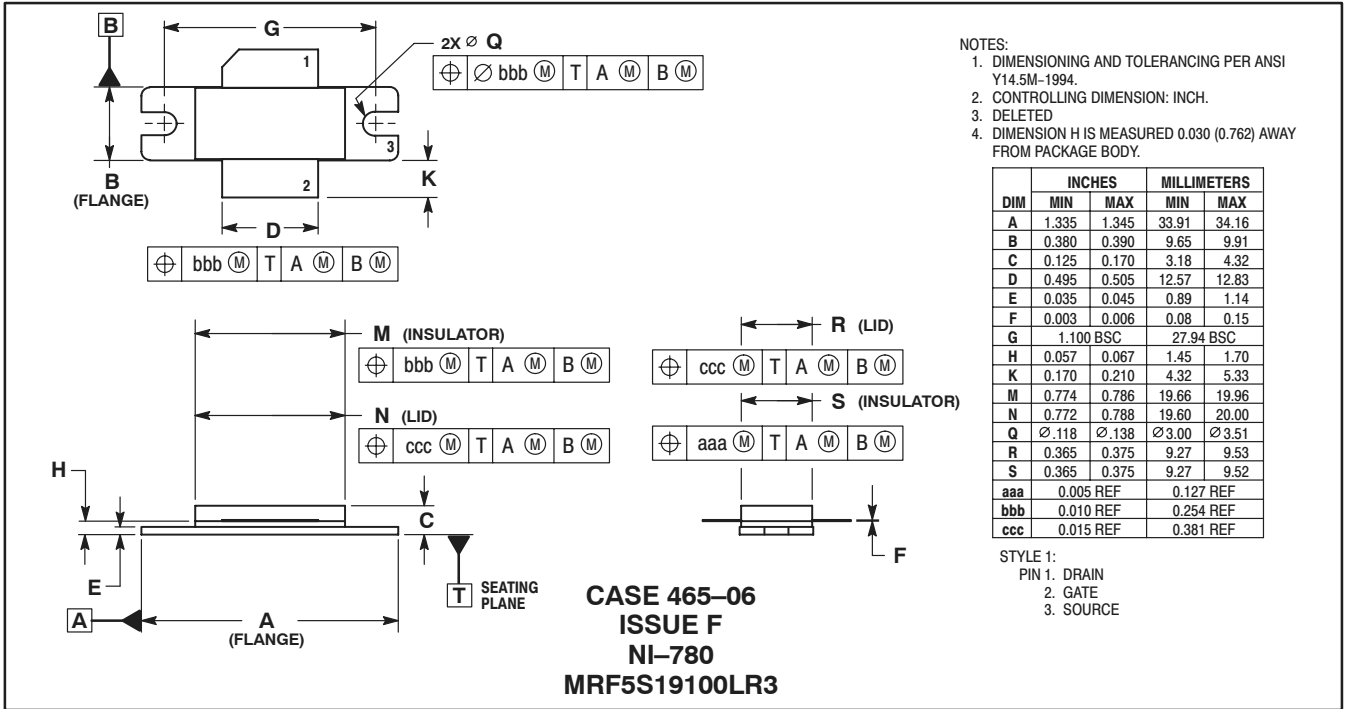
# NOTES



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## PACKAGE DIMENSIONS



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