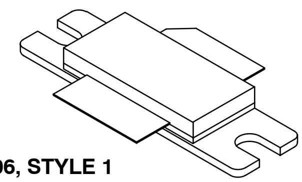
The RF MOSFET Line
RF Power Field Effect Transistors
N-Channel Enhancement-Mode Lateral MOSFETs

MRF5S19100HR3
MRF5S19100HSR3

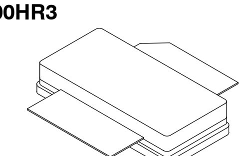
Designed for PCN and PCS base station applications with frequencies up to 1.9 to 2.0 GHz. Suitable for TDMA, CDMA and multicarrier amplifier applications.

- Typical 2-Carrier N-CDMA Performance: V_{DD} = 28 Volts, I_{DQ} = 1000 mA, P_{out} = 22 Watts Avg., Full Frequency Band. IS-95 (Pilot, Sync, Paging, Traffic Codes 8 Through 13) Channel Bandwidth = 1.2288 MHz. Peak/Avg. = 9.8 dB @ 0.01% Probability on CCDF.
  Power Gain — 13.9 dB
  Drain Efficiency — 25.5%
  IM3 @ 2.5 MHz Offset — -36.5 dBc @ 1.2288 MHz Channel Bandwidth
  ACPR @ 885 kHz Offset — -50.7 dBc @ 30 kHz Channel Bandwidth
- Capable of Handling 10:1 VSWR, @ 28 Vdc, 1960 MHz, 100 Watts CW Output Power
- Characterized with Series Equivalent Large-Signal Impedance Parameters
- Internally Matched, Controlled Q, for Ease of Use
- Qualified Up to a Maximum of 32 V_{DD} Operation
- Integrated ESD Protection
- Lower Thermal Resistance Package
- Low Gold Plating Thickness on Leads, 40μ″ Nominal.
- In Tape and Reel. R3 Suffix = 250 Units per 56 mm, 13 Inch Reel.

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



CASE 465-06, STYLE 1
NI-780
MRF5S19100HR3



CASE 465A-06, STYLE 1
NI-780S
MRF5S19100HSR3

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	269 1.54	W W/°C
Storage Temperature Range	T_{stg}	- 65 to +150	°C
Operating Junction Temperature	T_J	200	°C

THERMAL CHARACTERISTICS

Characteristic	Symbol	Value (1)	Unit
Thermal Resistance, Junction to Case Case Temperature 75°C, 100 W CW Case Temperature 70°C, 22 W CW	$R_{\theta JC}$	 0.64 0.65	°C/W

(1) 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	2 (Minimum)
Machine Model	M3 (Minimum)
Charge Device Model	C7 (Minimum)

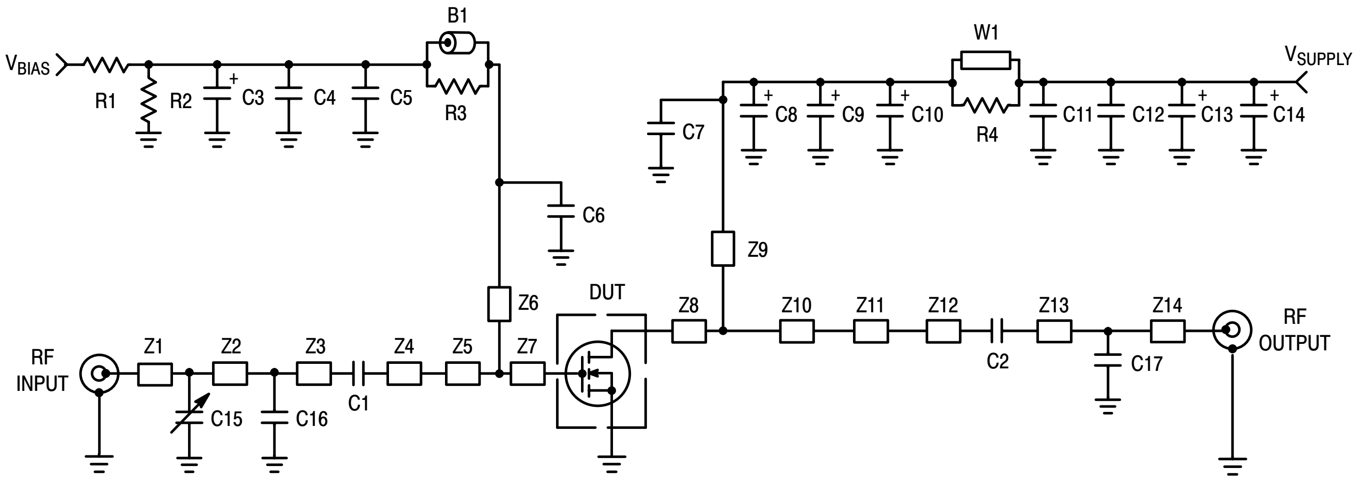
ELECTRICAL CHARACTERISTICS (T_C = 25°C unless otherwise noted)

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 (DC)					
Gate Threshold Voltage (V_{DS} = 10 Vdc, I_D = 240 µAdc)	$V_{GS(th)}$	—	2.7	—	Vdc
Gate Quiescent Voltage (V_{DS} = 28 Vdc, I_D = 1000 mAdc)	$V_{GS(Q)}$	—	3.7	—	Vdc
Drain-Source On-Voltage (V_{GS} = 10 Vdc, I_D = 2.4 Adc)	$V_{DS(on)}$	—	0.26	—	Vdc
Forward Transconductance (V_{DS} = 10 Vdc, I_D = 2.4 Adc)	g_{fs}	—	6.3	—	S
DYNAMIC CHARACTERISTICS					
Reverse Transfer Capacitance (1) (V_{DS} = 28 Vdc, V_{GS} = 0, f = 1.0 MHz)	C_{rss}	—	2.2	—	pF

FUNCTIONAL TESTS (In Motorola Test Fixture, 50 ohm system) V_{DD} = 28 Vdc, I_{DQ} = 1000 mA, P_{out} = 22 W Avg., f1 = 1930 MHz, f2 = 1932.5 MHz and f1 = 1987.5 MHz, f2 =1990 MHz, 2-Carrier N-CDMA, 1.2288 MHz Channel Bandwidth Carriers. ACPR measured in 30 kHz Bandwidth @ ±885 kHz Offset. IM3 measured in 1.2288 MHz Channel Bandwidth @ ±2.5 MHz Offset. Peak/Avg. = 9.8 dB @ 0.01% Probability on CCDF.

Characteristic	Symbol	Min	Typ	Max	Unit
Power Gain	G_{ps}	12.5	13.9	—	dB
Drain Efficiency	η_D	24	25.5	—	%
Intermodulation Distortion	IM3	—	-36.5	-35	dBc
Adjacent Channel Power Ratio	ACPR	—	-50.7	-48	dBc
Input Return Loss	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″, ε_r = 2.55

Figure 1. MRF5S19100HR3(HSR3) Test Circuit Schematic

Table 1. MRF5S19100HR3(HSR3) Test Circuit Component Designations and Values

Part	Description	Part Number	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 µF, 50 V Tantalum Capacitor	T494C105(1)050AS	Kemet
C4, C12	0.1 µF 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 µF, 35 V Tantalum Capacitor	T494D106(1)035AS	Kemet
C9, C10, C13, C14	22 µF, 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 kΩ Chip Resistor	D5534M07B1K00R	Newark
R2	560 kΩ Chip Resistor	CR1206 564JT	Newark
R3, R4	12 Ω Chip Resistors	RM73B2B120JT	Garrett Electronics
W1	1 turn 14 gauge wire		

* Need for part will vary from fixture to fixture.

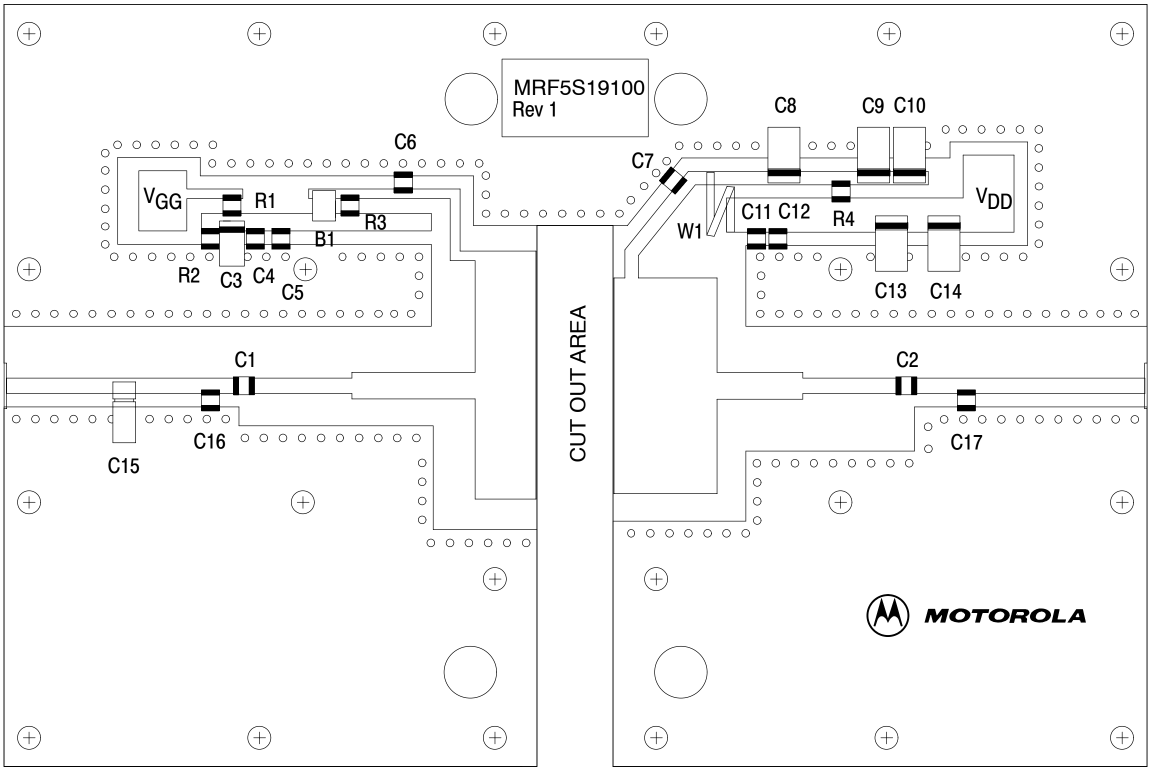


Figure 2. MRF5S19100HR3(HSR3) Test Circuit Component Layout

TYPICAL CHARACTERISTICS

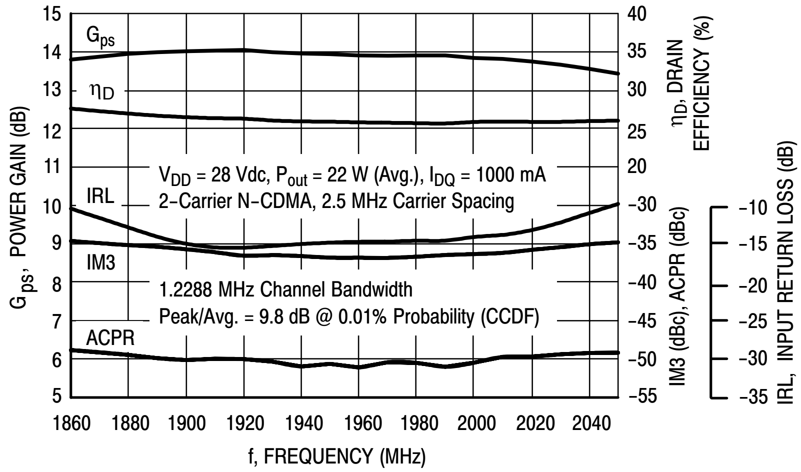


Figure 3. 2-Carrier N-CDMA Broadband Performance

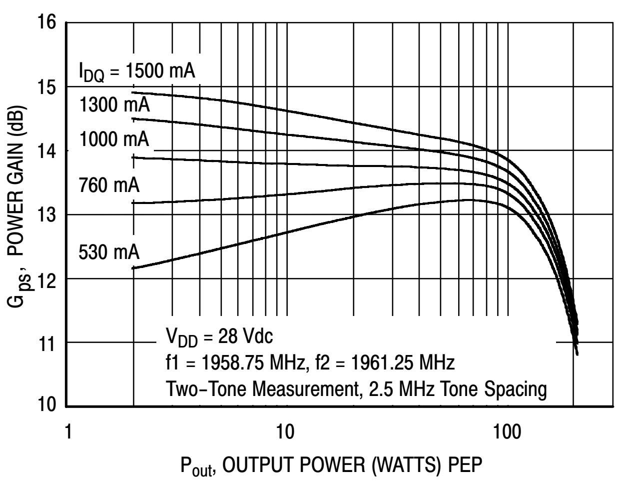


Figure 4. Two-Tone Power Gain versus Output Power

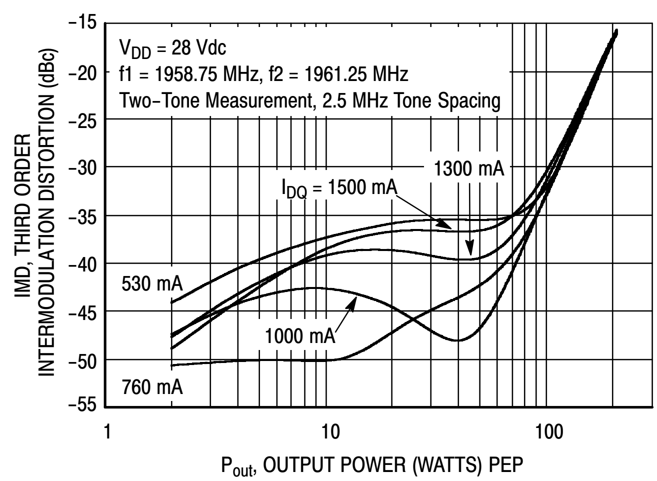


Figure 5. Third Order Intermodulation Distortion versus Output Power

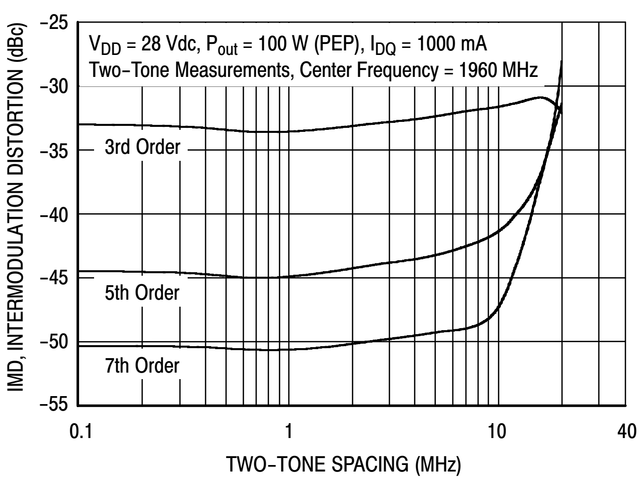


Figure 6. Intermodulation Distortion Products versus Tone Spacing

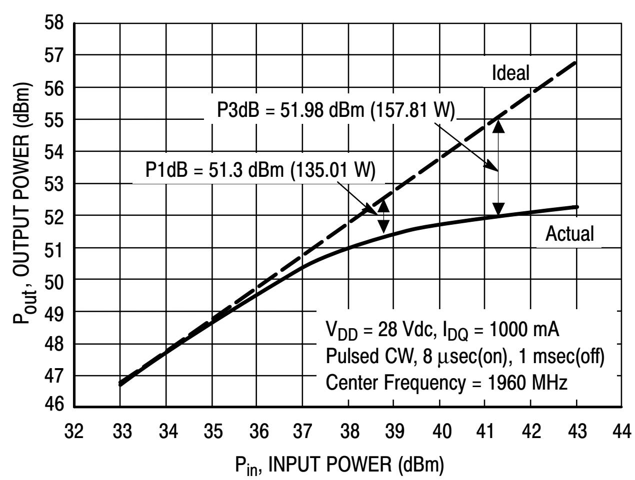


Figure 7. Pulse CW Output Power versus Input Power

TYPICAL CHARACTERISTICS

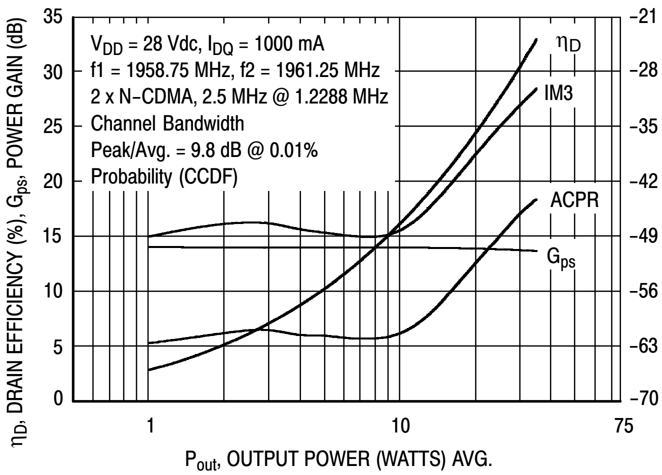
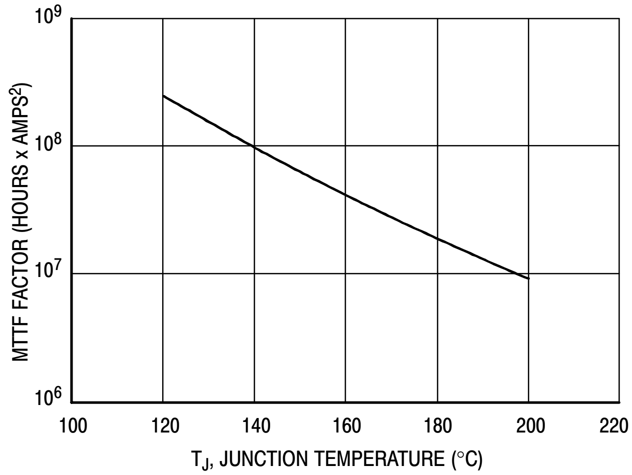


Figure 8. 2-Carrier N-CDMA ACPR, IM3, Power Gain and Drain Efficiency versus Output Power



This above graph displays calculated MTTF 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 MTTF factor by I_D^2 for MTTF in a particular application.

Figure 10. MTTF Factor versus Junction Temperature

TYPICAL CHARACTERISTICS N-CDMA TEST SIGNAL

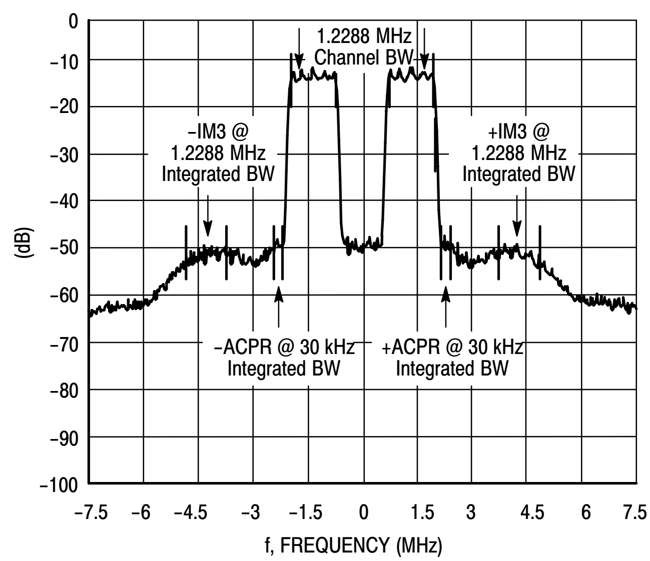
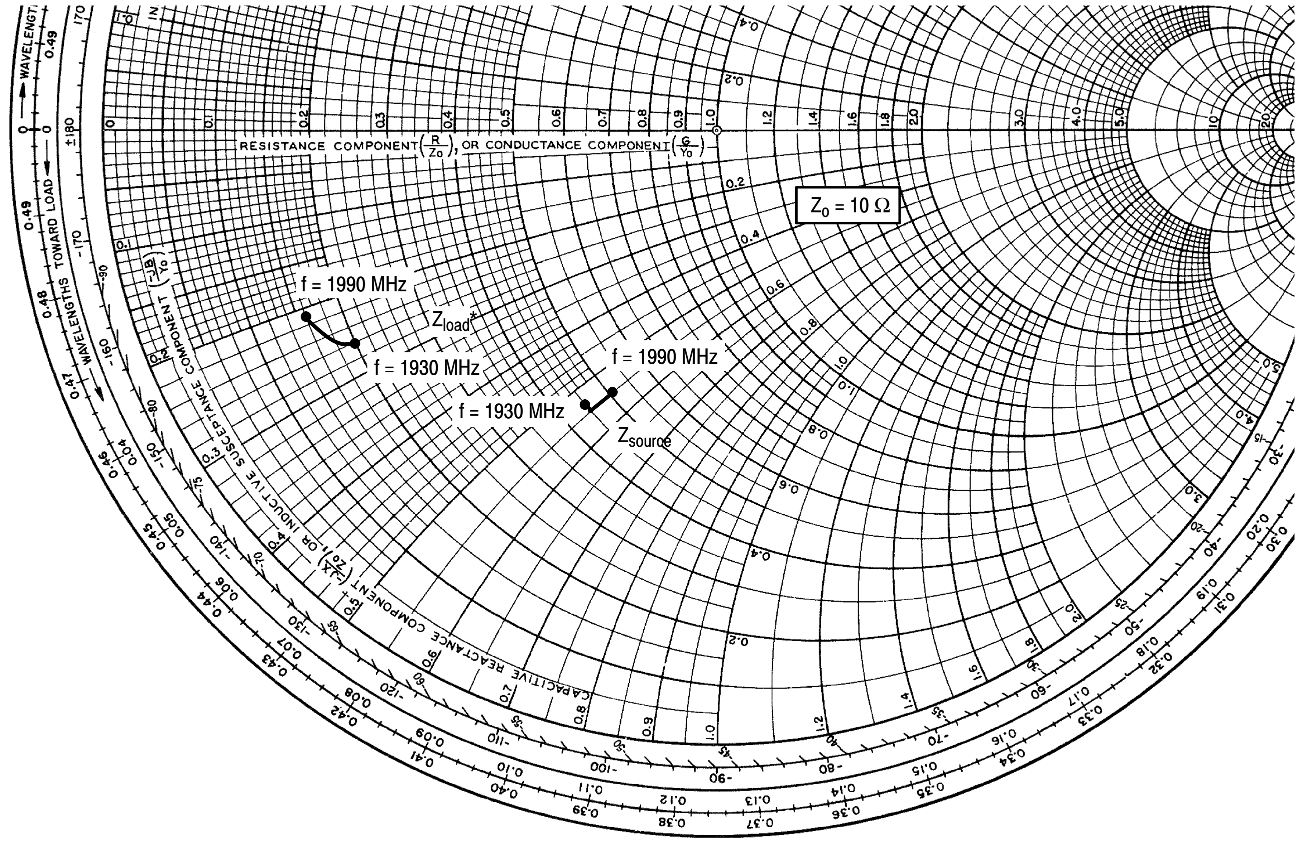


Figure 9. 2-Carrier N-CDMA Spectrum



V_{DD} = 28 Vdc, I_{DQ} = 1000 mA, P_{out} = 22 W Avg.

f MHz	Z_{source} Ω	Z_{load} Ω
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.

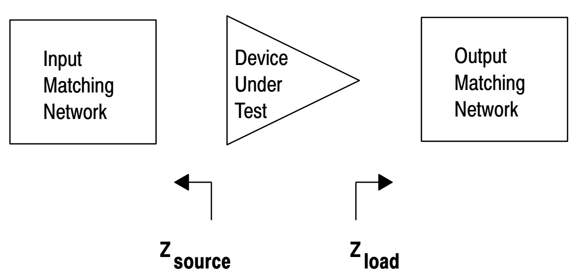


Figure 11. Series Equivalent Input and Output Impedance

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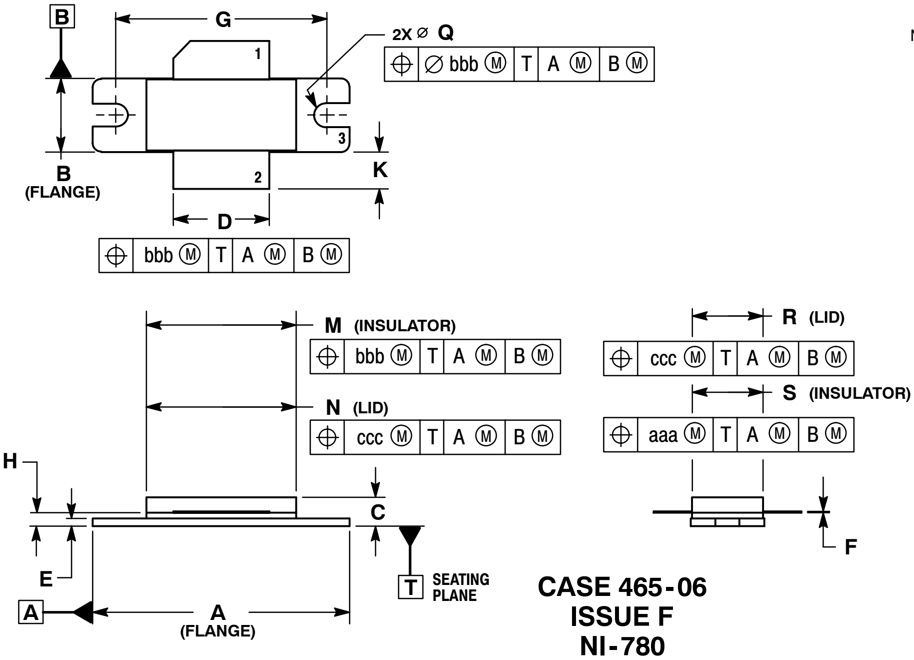
PACKAGE DIMENSIONS

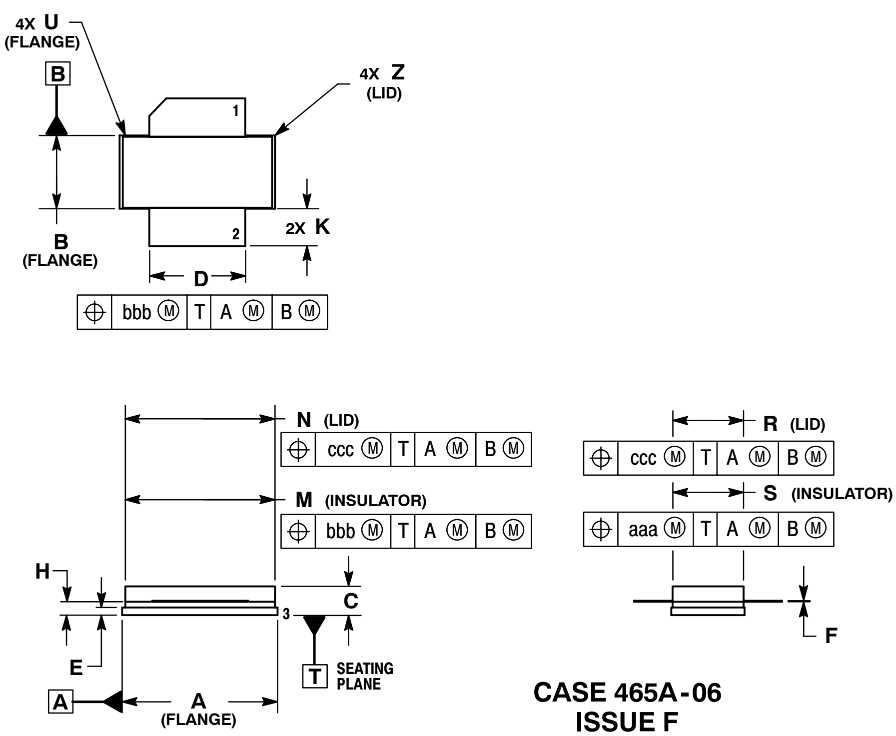


NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M−1994.
2. CONTROLLING DIMENSION: INCH.
3. DELETED
4. DIMENSION H IS MEASURED 0.030 (0.762) AWAY FROM PACKAGE BODY.

	INCHES		MILLIMETERS	
DIM	MIN	MAX	MIN	MAX
A	1.335	1.345	33.91	34.16
B	0.380	0.390	9.65	9.91
C	0.125	0.170	3.18	4.32
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	0.774	0.786	19.66	19.96
N	0.772	0.788	19.60	20.00
Q	∅.118	∅.138	∅3.00	∅3.51
R	0.365	0.375	9.27	9.53
S	0.365	0.375	9.27	9.52
aaa	0.005 REF		0.127 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 465-06
ISSUE F
NI-780
MRF5S19100HR3



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3. DELETED
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	INCHES		MILLIMETERS	
DIM	MIN	MAX	MIN	MAX
A	0.805	0.815	20.45	20.70
B	0.380	0.390	9.65	9.91
C	0.125	0.170	3.18	4.32
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	0.774	0.786	19.61	20.02
N	0.772	0.788	19.61	20.02
R	0.365	0.375	9.27	9.53
S	0.365	0.375	9.27	9.52
U	---	0.040	---	1.02
Z	---	0.030	---	0.76
aaa	0.005 REF		0.127 REF	
bbb	0.010 REF		0.254 REF	
ccc	0.015 REF		0.381 REF	

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

CASE 465A-06
ISSUE F
NI-780S
MRF5S19100HSR3

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