Freescale Semiconductor
Technical Data

Document Number: MRF6P18190H
Rev. 0, 4/2005

RF Power Field Effect Transistor

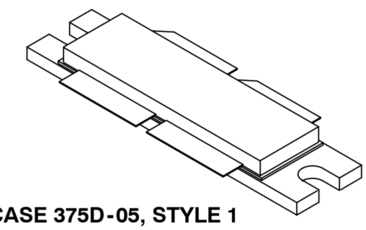
N-Channel Enhancement-Mode Lateral MOSFET

Designed for W-CDMA base station applications with frequencies from 1805 to 1880 MHz. Suitable for TDMA, CDMA and multicarrier amplifier applications. To be used in Class AB for PCN-PCS/cellular radio and WLL applications.

- Typical 2-carrier W-CDMA Performance: V_{DD} = 28 Volts, I_{DQ} = 2000 mA, P_{out} = 44 Watts Avg., Full Frequency Band, Channel Bandwidth = 3.84 MHz, PAR = 8.5 dB @ 0.01% Probability on CCDF.
  Power Gain — 15.9 dB
  Drain Efficiency — 27.5%
  IM3 @ 10 MHz Offset — -37 dBc @ 3.84 MHz Channel Bandwidth
  ACPR @ 5 MHz Offset — -41 dBc @ 3.84 MHz Channel Bandwidth
- Capable of Handling 10:1 VSWR, @ 28 Vdc, 1880 MHz, 190 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
- Designed for Lower Memory Effects and Wide Instantaneous Bandwidth Applications
- Low Gold Plating Thickness on Leads, 40μ″ Nominal.
- In Tape and Reel. R6 Suffix = 150 Units per 56 mm, 13 inch Reel.

MRF6P18190HR6

1805-1880 MHz, 44 W AVG., 28 V
2 x W-CDMA
LATERAL N-CHANNEL
RF POWER MOSFET



CASE 375D-05, STYLE 1
NI-1230

Table 1. Maximum Ratings

Rating	Symbol	Value	Unit
Drain-Source Voltage	V_{DSS}	-0.5, +68	Vdc
Gate-Source Voltage	V_{GS}	-0.5, +12	Vdc
Total Device Dissipation @ T_C = 25°C Derate above 25°C	P_D	648 3.7	W W/°C
Storage Temperature Range	T_{stg}	- 65 to +150	°C
Operating Junction Temperature	T_J	200	°C
CW Operation	CW	190	W

Table 2. Thermal Characteristics

Characteristic	Symbol	Value (1,2)	Unit
Thermal Resistance, Junction to Case Case Temperature 80°C, 190 W CW Case Temperature 76°C, 44 W CW	$R_{\theta JC}$	 0.27 0.30	°C/W

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

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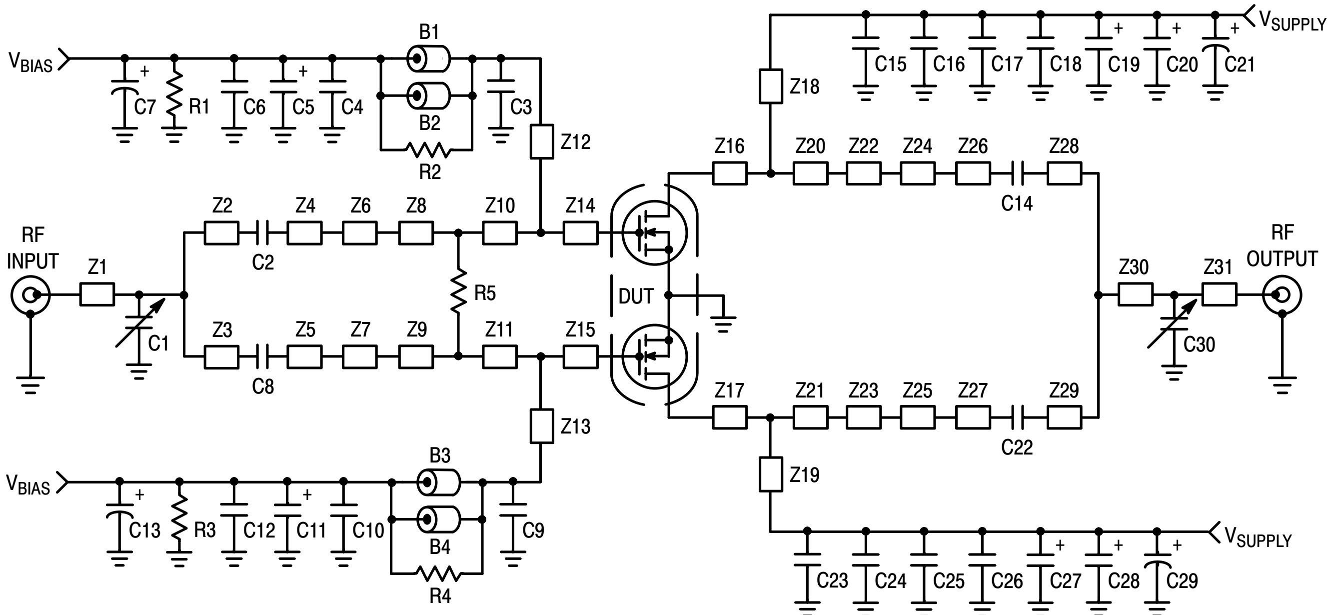
Table 3. ESD Protection Characteristics

Test Methodology	Class
Human Body Model (per JESD22-A114)	1C (Minimum)
Machine Model (per EIA/JESD22-A115)	A (Minimum)
Charge Device Model (per JESD22-C101)	III (Minimum)

Table 4. 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} = 68 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 = 250 μAdc)	$V_{GS(th)}$	1	2	3	Vdc
Gate Quiescent Voltage (V_{DS} = 28 Vdc, I_D = 1000 mAdc)	$V_{GS(Q)}$	2	2.8	4	Vdc
Drain-Source On-Voltage (V_{GS} = 10 Vdc, I_D = 2.2 Adc)	$V_{DS(on)}$	—	0.21	—	Vdc
Forward Transconductance (V_{DS} = 10 Vdc, I_D = 2 Adc)	g_{fs}	—	5.3	—	S
Dynamic Characteristics (1,2)					
Reverse Transfer Capacitance (V_{DS} = 28 Vdc ± 30 mV(rms)ac @ 1 MHz, V_{GS} = 0 Vdc)	C_{rss}	—	1.5	—	pF
Functional Tests (3) (In Freescale Test Fixture, 50 ohm system) V_{DD} = 28 Vdc, I_{DQ} = 2000 mA, P_{out} = 44 W Avg., f1 = 1807.5 MHz, f2 = 1817.5 MHz and f1 = 1867.5 MHz, f2 = 1877.5 MHz, 2-carrier W-CDMA, 3.84 MHz Channel Bandwidth Carriers. ACPR measured in 3.84 MHz Channel Bandwidth @ ±5 MHz Offset. IM3 measured in 3.84 MHz Bandwidth @ ±10 MHz Offset. PAR = 8.5 dB @ 0.01% Probability on CCDF.					
Power Gain	G_{ps}	14.5	15.9	17.5	dB
Drain Efficiency	η_D	25.5	27.5	—	%
Intermodulation Distortion	IM3	—	-37	-35	dBc
Adjacent Channel Power Ratio	ACPR	—	-41	-38	dBc
Input Return Loss	IRL	—	-12	-9	dB

1. Each side of device measured separately.
2. Part is internally matched both on input and output.
3. Measurements made with device in push-pull configuration.



Z1	0.700″ x 0.067″ Microstrip	Z18, Z19	0.477″ x 0.136″ Microstrip
Z2	1.140″ x 0.114″ Microstrip	Z20, Z21	0.289″ x 0.856″ Microstrip
Z3	2.112″ x 0.067″ Microstrip	Z22, Z23	0.215″ x 0.385″ Microstrip
Z4, Z5	0.174″ x 0.067″ Microstrip	Z24, Z25	0.118″ x 0.259″ Microstrip
Z6, Z7	0.382″ x 0.250″ Microstrip	Z26, Z27	0.108″ x 0.067″ Microstrip
Z8, Z9	0.036″ x 0.764″ Microstrip	Z28	2.163″ x 0.067″ Microstrip
Z10, Z11	0.178″ x 0.764″ Microstrip	Z29	1.397″ x 0.114″ Microstrip
Z12, Z13	0.689″ x 0.073″ Microstrip	Z30	0.492″ x 0.067″ Microstrip
Z14, Z15	0.111″ x 0.764″ Microstrip	Z31	0.207″ x 0.067″ Microstrip
Z16, Z17	0.124″ x 0.856″ Microstrip	PCB	Taconic RF-35, 0.030″, ε_r = 3.5

Figure 1. MRF6P18190H Test Circuit Schematic

Table 5. MRF6P18190H Test Circuit Component Designations and Values

Part	Description	Part Number	Manufacturer
B1, B2, B3, B4	Short RF Beads	2743019447	Fair-Rite
C1	0.6-4.5 pF Variable Capacitor	27271SL	Johanson Components
C2, C8, C14, C22	5.6 pF Chip Capacitors	100B5R6CP500X	ATC
C3, C9	7.5 pF Chip Capacitors	100B7R5CP500X	ATC
C4, C10, C18, C26	1K pF Chip Capacitors	100B102JP50X	ATC
C5, C11	1 μF, 50 V Tantalum Capacitors	T491C105K050AS	Kemet
C6, C12, C17, C25	0.1 μF Chip Capacitors	CDR33BX104AKWS	Kemet
C7, C13	100 μF, 50 V Electrolytic Capacitors, Radial	MCR50V107M8X11	Multicomp
C15, C23	6.8 pF Chip Capacitors	600B6R8BT250XT	ATC
C16, C24	0.56 μF Chip Capacitors (1825)	C1825C564J5RAC	Kemet
C19, C20, C27, C28	22 μF, 35 V Tantalum Capacitors	T491X226K035AS	Kemet
C21, C29	470 μF, 63 V Electrolytic Capacitors, Radial	MCR63V477M13X26	Multicomp
C30	0.4-2.5 pF Variable Capacitor	27283PC	Johanson Components
R1, R3	1 kΩ, 1/4 W Chip Resistors (1206)	CRCW12061001F100	Vishay
R2, R4	12 Ω, 1/4 W Chip Resistors (1206)	CRCW120612R0F100	Vishay
R5	560 Ω Resistor	D55342M07B560	Vishay

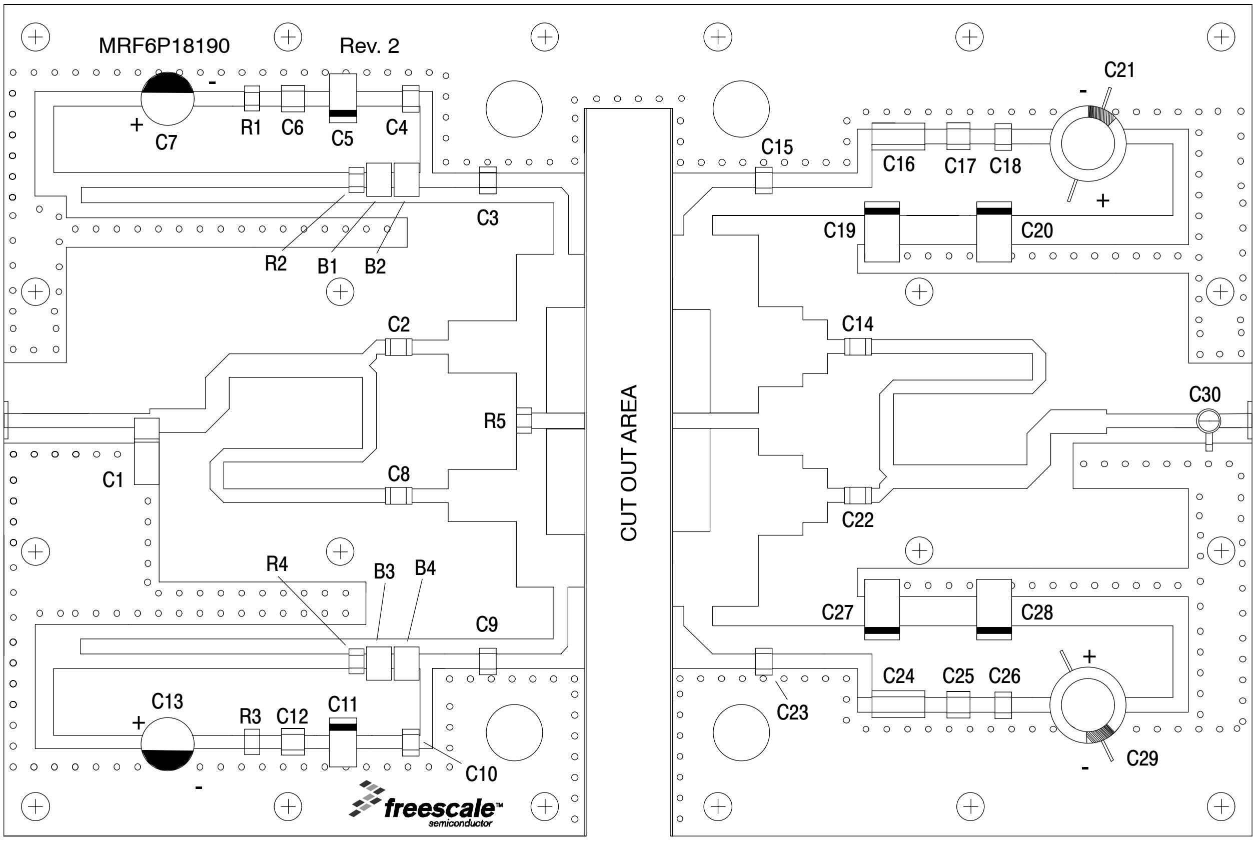


Figure 2. MRF6P18190H Test Circuit Component Layout

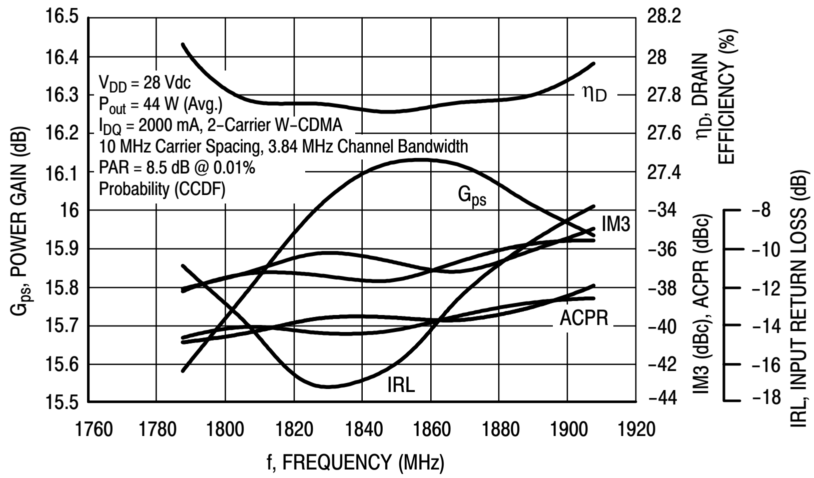


Figure 3. 2-Carrier W-CDMA Broadband Performance @ P_{out} = 44 Watts

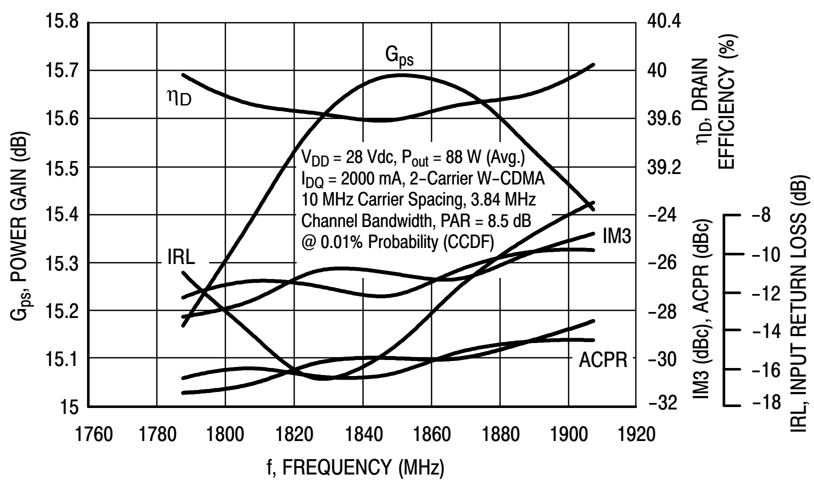


Figure 4. 2-Carrier W-CDMA Broadband Performance @ P_{out} = 88 Watts

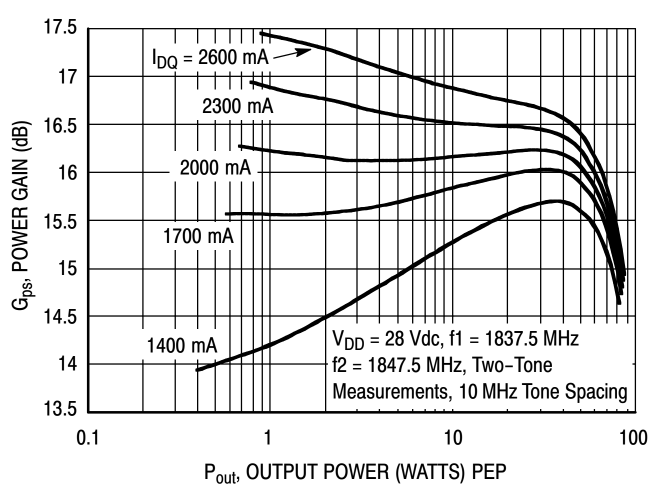


Figure 5. Two-Tone Power Gain versus Output Power

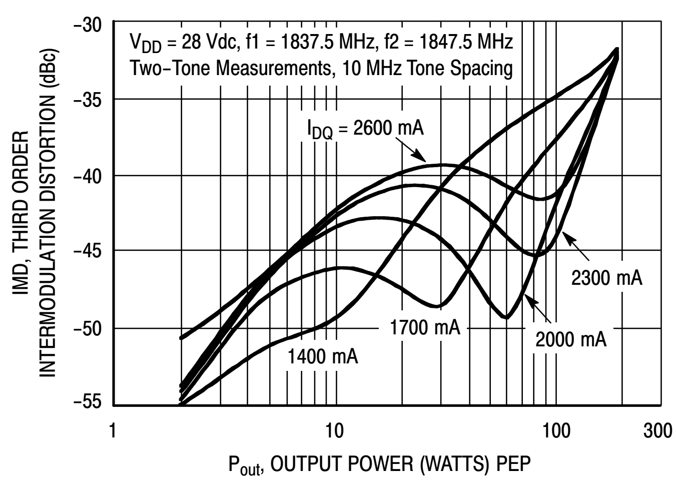


Figure 6. Third Order Intermodulation Distortion versus Output Power

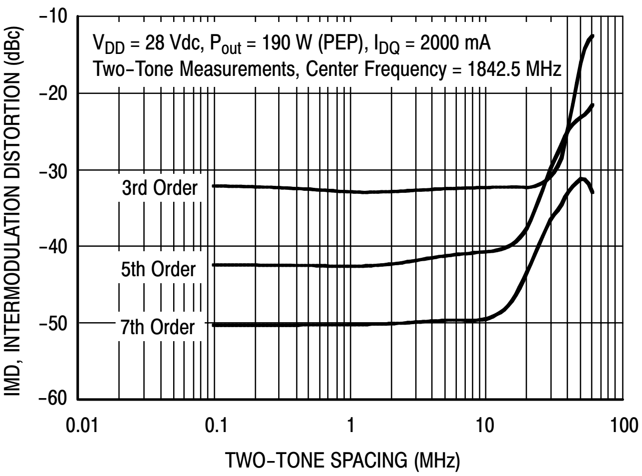


Figure 7. Intermodulation Distortion Products versus Tone Spacing

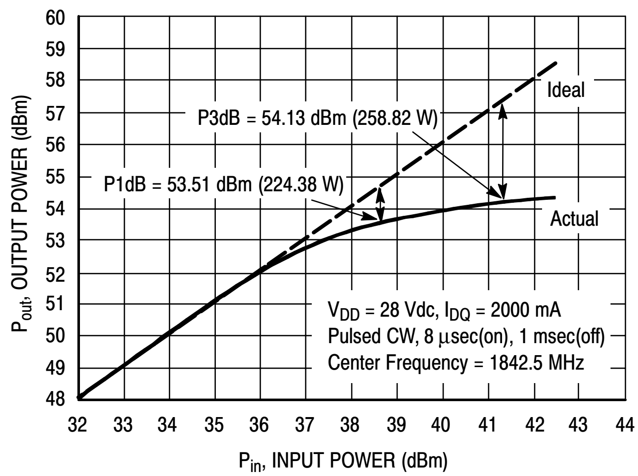


Figure 8. Pulse CW Output Power versus Input Power

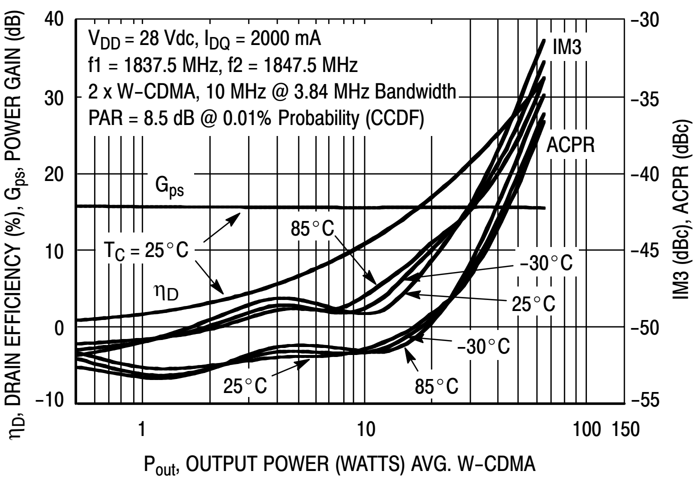


Figure 9. 2-Carrier W-CDMA ACPR, IM3, Power Gain and Drain Efficiency versus Output Power

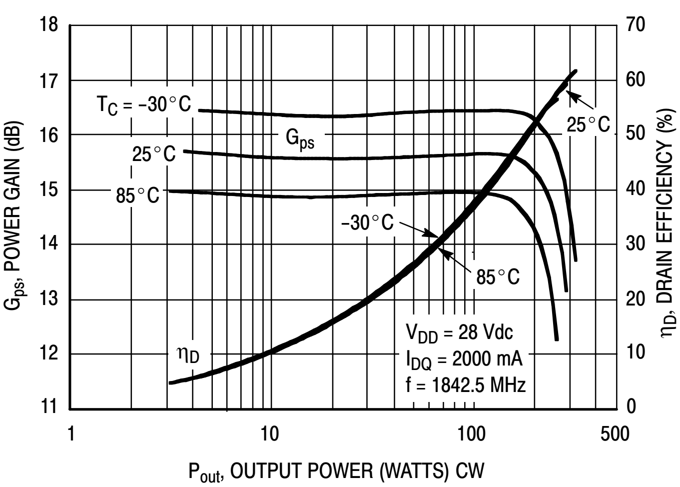


Figure 10. Power Gain and Drain Efficiency versus CW Output Power

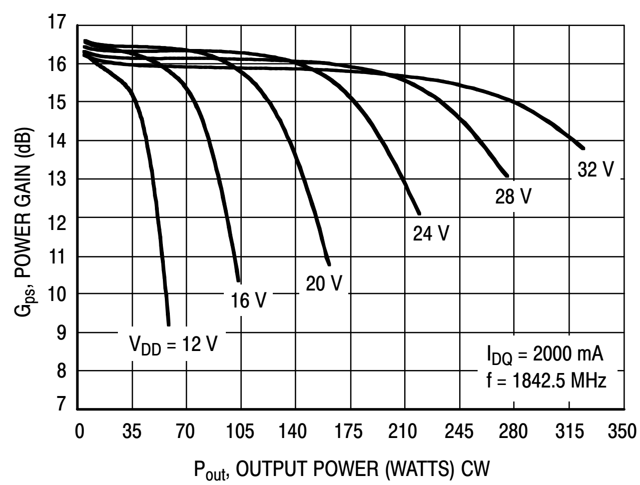
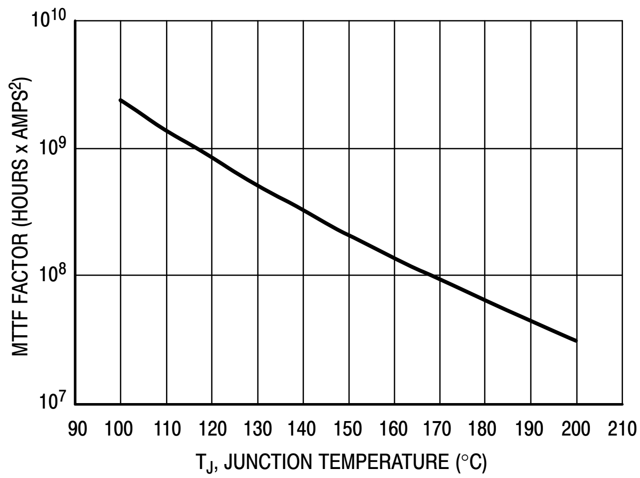


Figure 11. Power Gain versus Output Power

TYPICAL CHARACTERISTICS



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 12. MTTF Factor versus Junction Temperature

TYPICAL CHARACTERISTICS
W-CDMA TEST SIGNAL

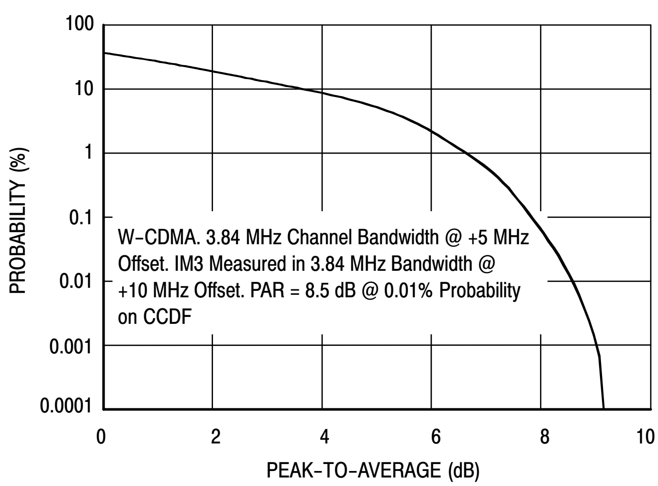


Figure 13. CCDF W-CDMA 3GPP, Test Model 1, 64 DPCH, 67% Clipping, Single-Carrier Test Signal

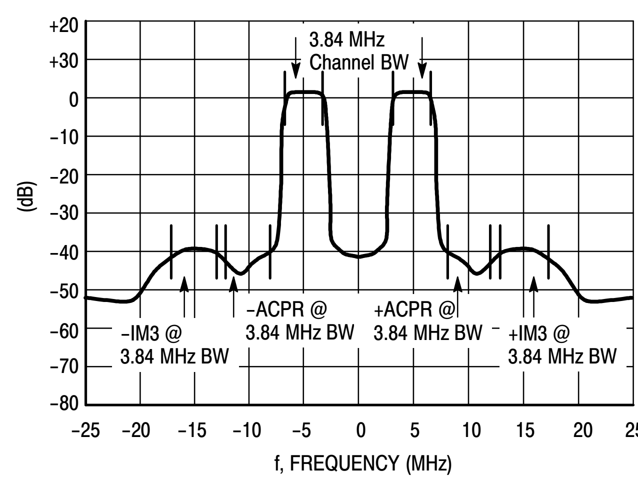
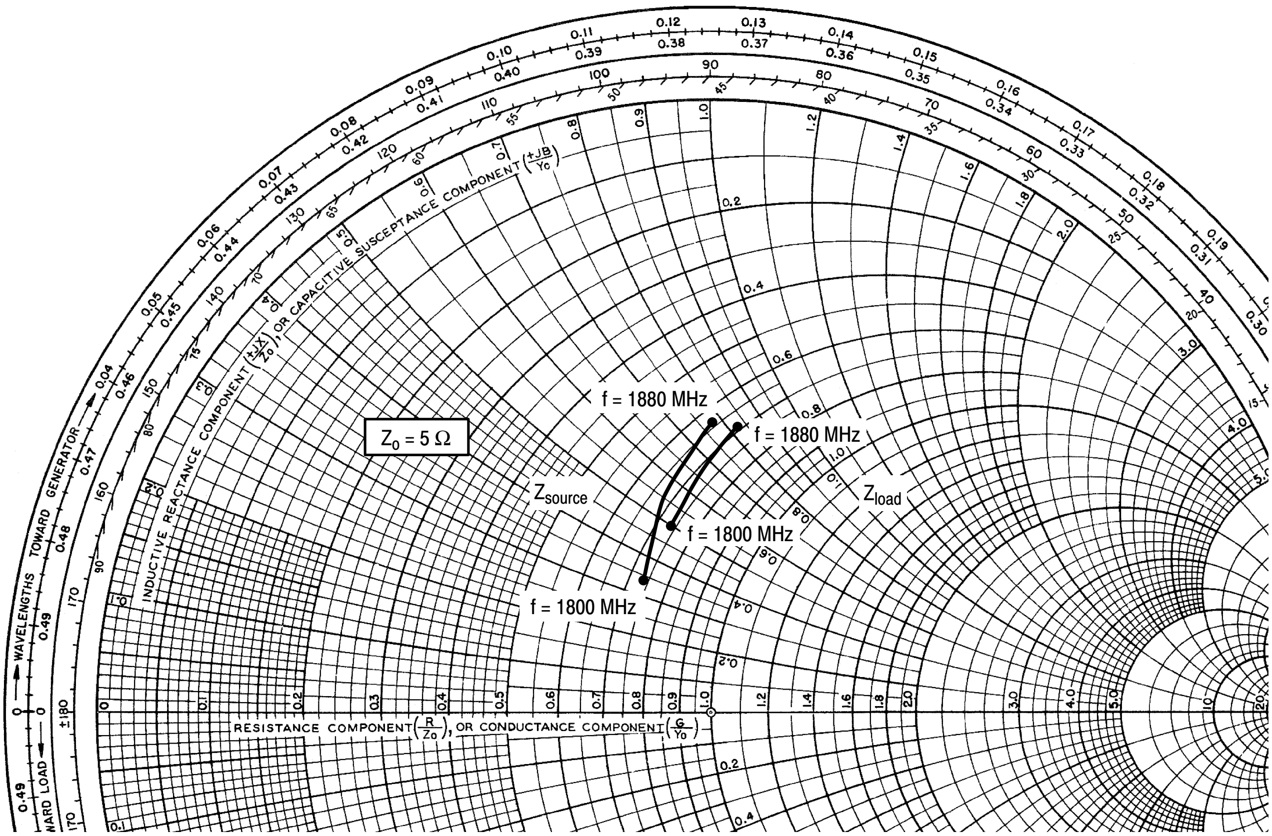


Figure 14. 2-Carrier W-CDMA Spectrum



V_{DD} = 28 Vdc, I_{DQ} = 2000 mA, P_{out} = 44 W Avg.

f MHz	Z_{source} Ω	Z_{load} Ω
1800	3.70 + j1.71	3.70 + j2.49
1840	3.40 + j2.75	3.55 + j3.29
1880	3.19 + j3.88	3.45 + j4.12

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

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

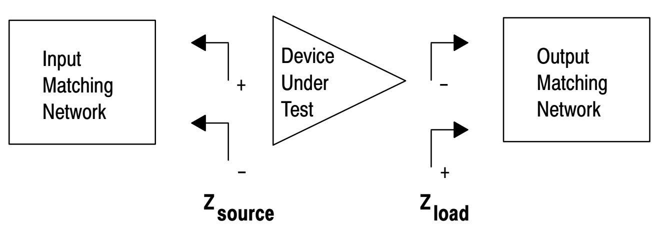
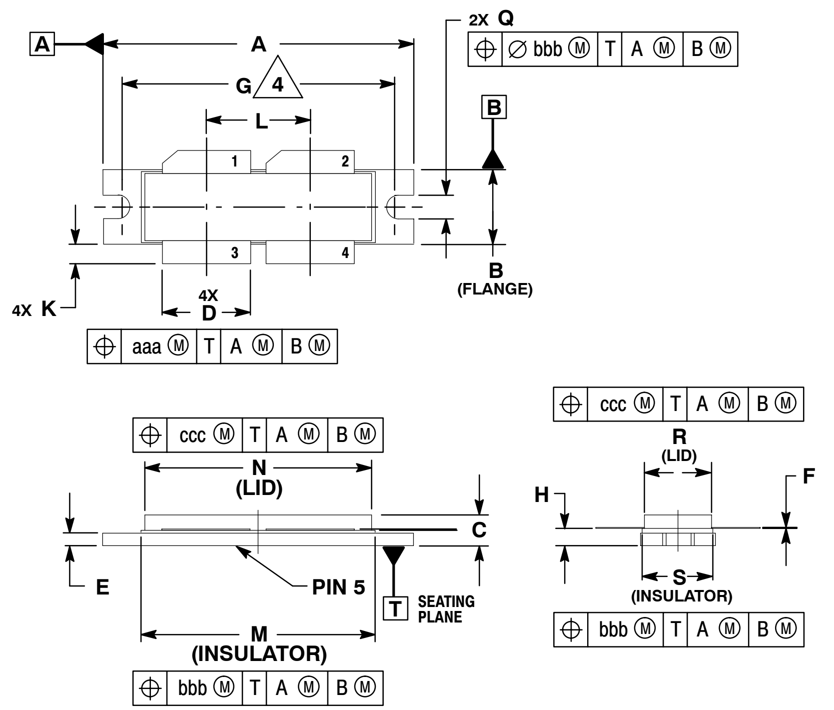


Figure 15. Series Equivalent Source and Load Impedance

NOTES

NOTES

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.

	INCHES		MILLIMETERS	
DIM	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	0.082	0.090	2.08	2.29
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-05
ISSUE D
NI-1230

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