

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, 40 μ ” Nominal.
- In Tape and Reel. R6 Suffix = 150 Units per 56 mm, 13 inch Reel.



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

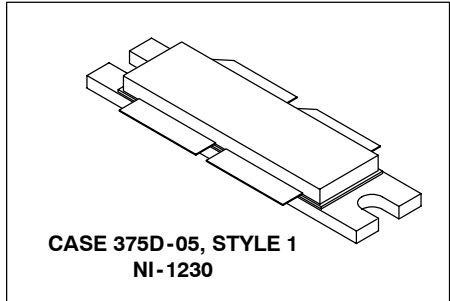


Table 1. Maximum Ratings

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 @ $T_C = 25^\circ\text{C}$ Derate above 25 $^\circ\text{C}$	P_D	648 3.7	W W/ $^\circ\text{C}$
Storage Temperature Range	T_{stg}	- 65 to +150	$^\circ\text{C}$
Operating Junction Temperature	T_J	200	$^\circ\text{C}$
CW Operation	CW	190	W

Table 2. Thermal Characteristics

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

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.

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 ($T_C = 25^\circ\text{C}$ unless otherwise noted)

Characteristic	Symbol	Min	Typ	Max	Unit
----------------	--------	-----	-----	-----	------

Off Characteristics

Zero Gate Voltage Drain Leakage Current ($V_{DS} = 68\text{ Vdc}$, $V_{GS} = 0\text{ Vdc}$)	I_{DSS}	—	—	10	μAdc
Zero Gate Voltage Drain Leakage Current ($V_{DS} = 28\text{ Vdc}$, $V_{GS} = 0\text{ Vdc}$)	I_{DSS}	—	—	1	μAdc
Gate-Source Leakage Current ($V_{GS} = 5\text{ Vdc}$, $V_{DS} = 0\text{ Vdc}$)	I_{GSS}	—	—	1	μAdc

On Characteristics

Gate Threshold Voltage ($V_{DS} = 10\text{ Vdc}$, $I_D = 250\ \mu\text{Adc}$)	$V_{GS(th)}$	1	2	3	Vdc
Gate Quiescent Voltage ($V_{DS} = 28\text{ Vdc}$, $I_D = 1000\ \text{mAdc}$)	$V_{GS(Q)}$	2	2.8	4	Vdc
Drain-Source On-Voltage ($V_{GS} = 10\text{ Vdc}$, $I_D = 2.2\ \text{Adc}$)	$V_{DS(on)}$	—	0.21	—	Vdc
Forward Transconductance ($V_{DS} = 10\text{ Vdc}$, $I_D = 2\ \text{Adc}$)	g_{fs}	—	5.3	—	S

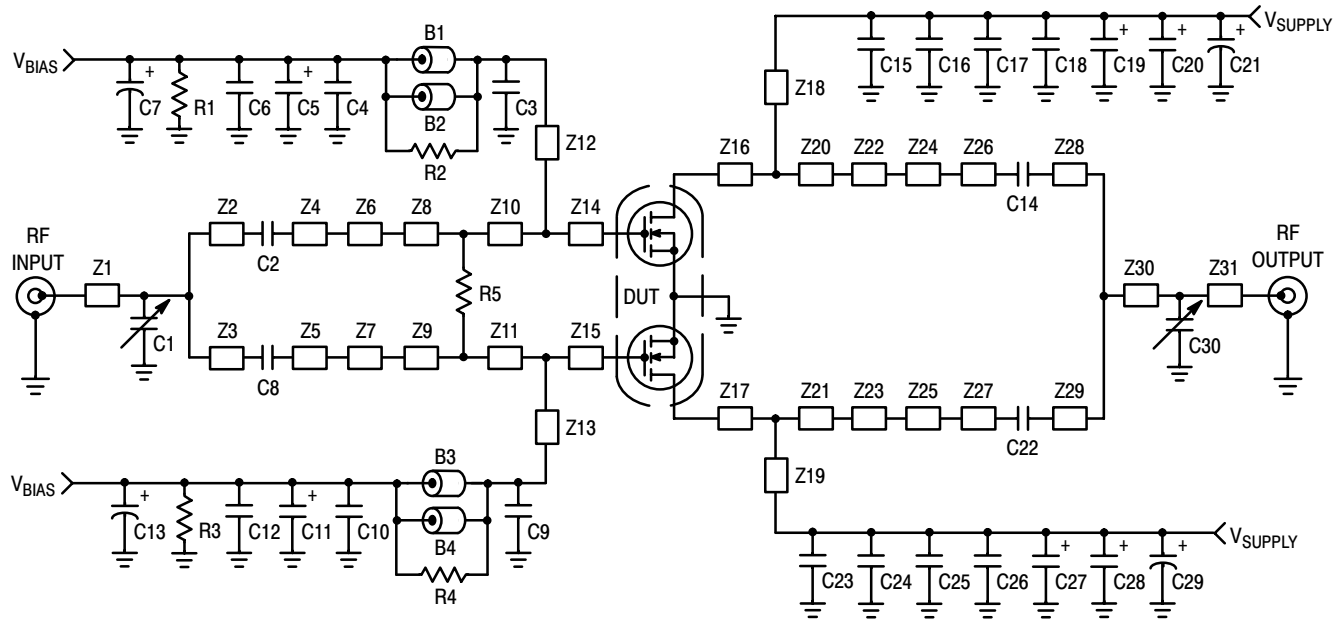
Dynamic Characteristics (1,2)

Reverse Transfer Capacitance ($V_{DS} = 28\text{ Vdc} \pm 30\ \text{mV(rms)ac}$ @ 1 MHz, $V_{GS} = 0\text{ Vdc}$)	C_{rss}	—	1.5	—	pF
--	-----------	---	-----	---	----

Functional Tests (3) (In Freescale Test Fixture, 50 ohm system) $V_{DD} = 28\text{ Vdc}$, $I_{DQ} = 2000\ \text{mA}$, $P_{out} = 44\ \text{W Avg.}$, $f_1 = 1807.5\ \text{MHz}$, $f_2 = 1817.5\ \text{MHz}$ and $f_1 = 1867.5\ \text{MHz}$, $f_2 = 1877.5\ \text{MHz}$, 2-carrier W-CDMA, 3.84 MHz Channel Bandwidth Carriers. ACPR measured in 3.84 MHz Channel Bandwidth @ $\pm 5\ \text{MHz}$ Offset. IM3 measured in 3.84 MHz Bandwidth @ $\pm 10\ \text{MHz}$ 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", $\epsilon_r = 3.5$

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 μ F, 50 V Tantalum Capacitors	T491C105K050AS	Kemet
C6, C12, C17, C25	0.1 μ F Chip Capacitors	CDR33BX104AKWS	Kemet
C7, C13	100 μ F, 50 V Electrolytic Capacitors, Radial	MCR50V107M8X11	Multicomp
C15, C23	6.8 pF Chip Capacitors	600B6R8BT250XT	ATC
C16, C24	0.56 μ F Chip Capacitors (1825)	C1825C564J5RAC	Kemet
C19, C20, C27, C28	22 μ F, 35 V Tantalum Capacitors	T491X226K035AS	Kemet
C21, C29	470 μ F, 63 V Electrolytic Capacitors, Radial	MCR63V477M13X26	Multicomp
C30	0.4-2.5 pF Variable Capacitor	27283PC	Johanson Components
R1, R3	1 k Ω , 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

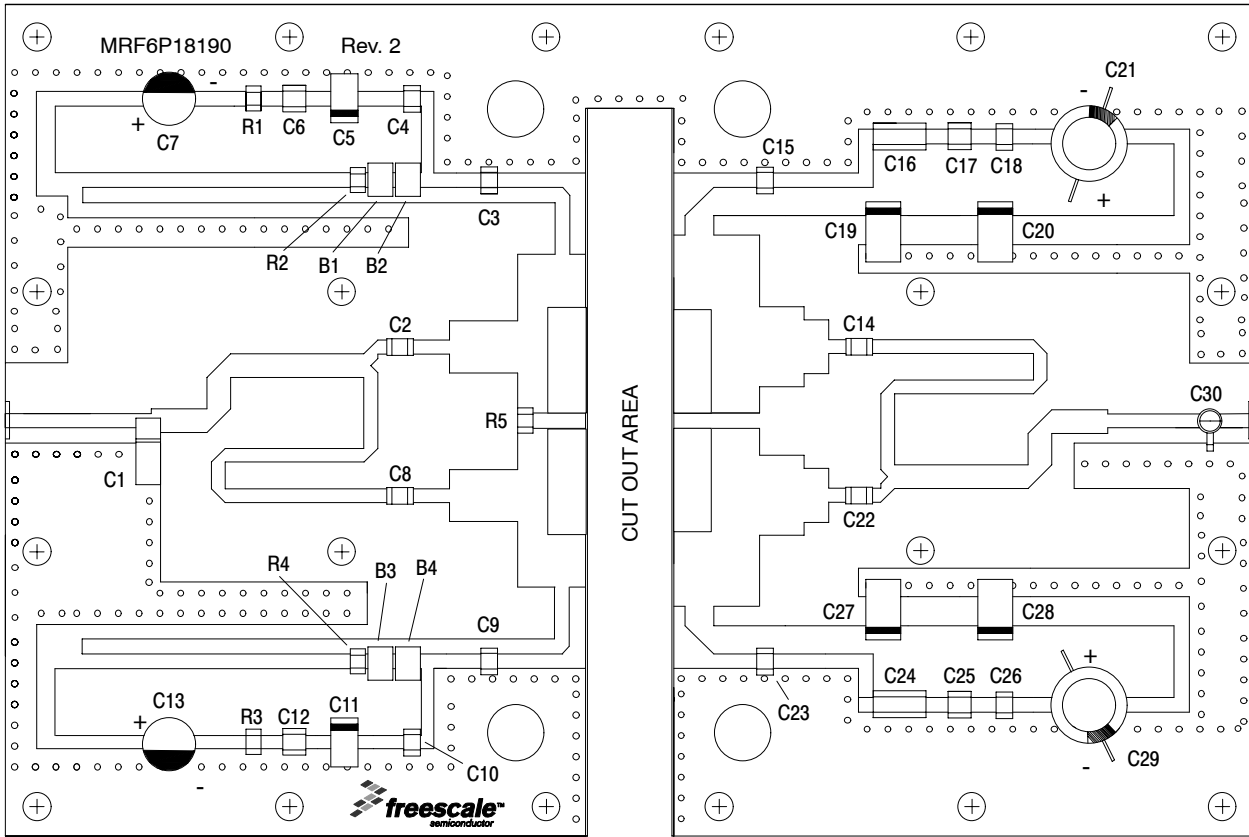


Figure 2. MRF6P18190H Test Circuit Component Layout

TYPICAL CHARACTERISTICS

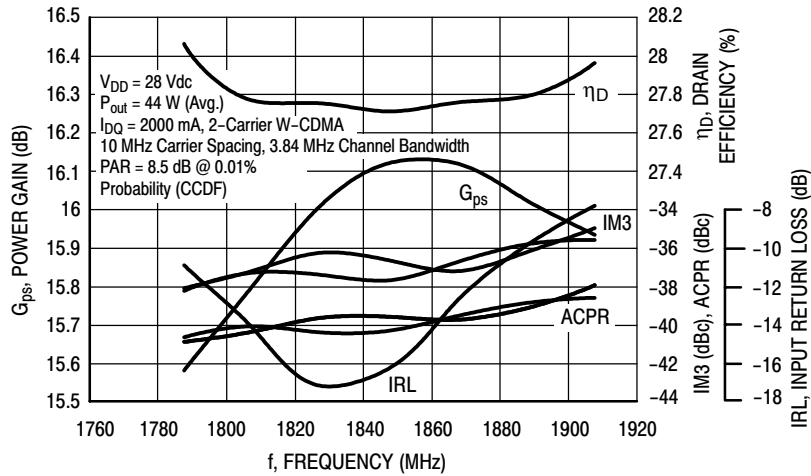


Figure 3. 2-Carrier W-CDMA Broadband Performance @ $P_{out} = 44$ Watts

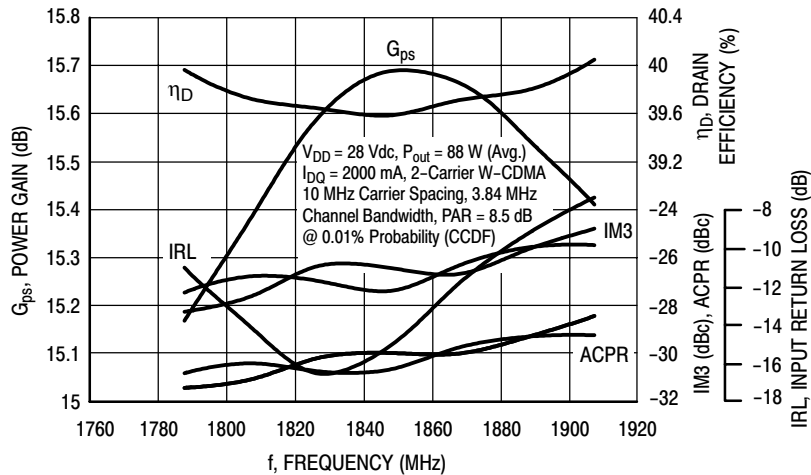


Figure 4. 2-Carrier W-CDMA Broadband Performance @ $P_{out} = 88$ Watts

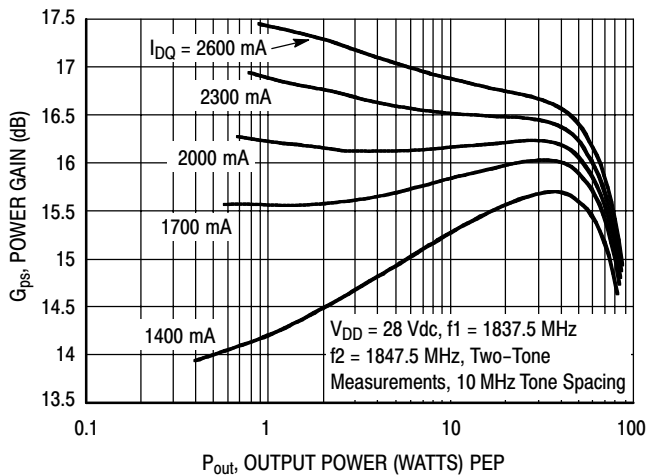


Figure 5. Two-Tone Power Gain versus Output Power

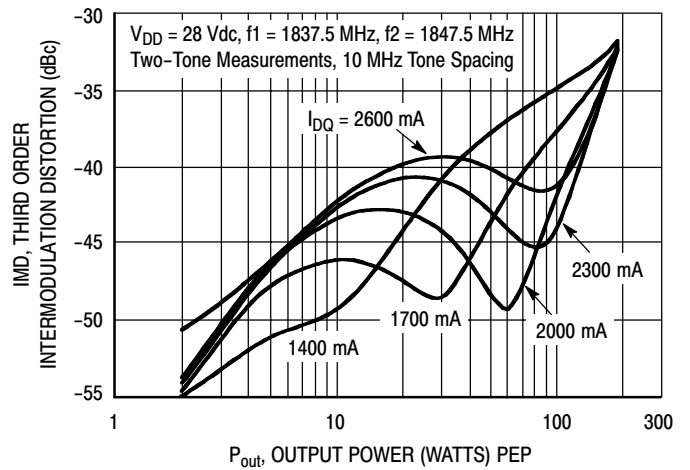


Figure 6. Third Order Intermodulation Distortion versus Output Power

TYPICAL CHARACTERISTICS

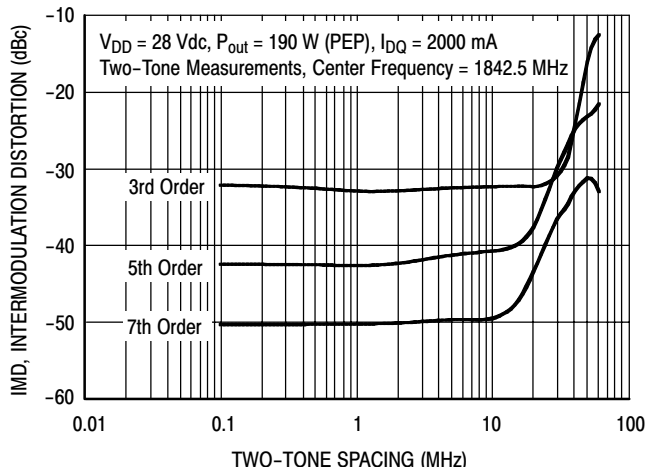


Figure 7. Intermodulation Distortion Products versus Tone Spacing

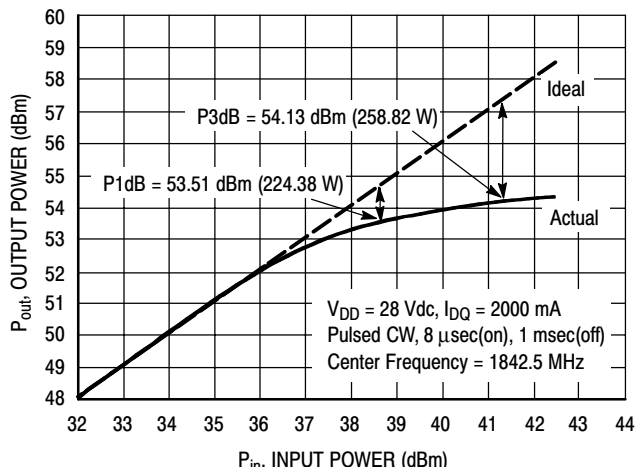


Figure 8. Pulse CW Output Power versus Input Power

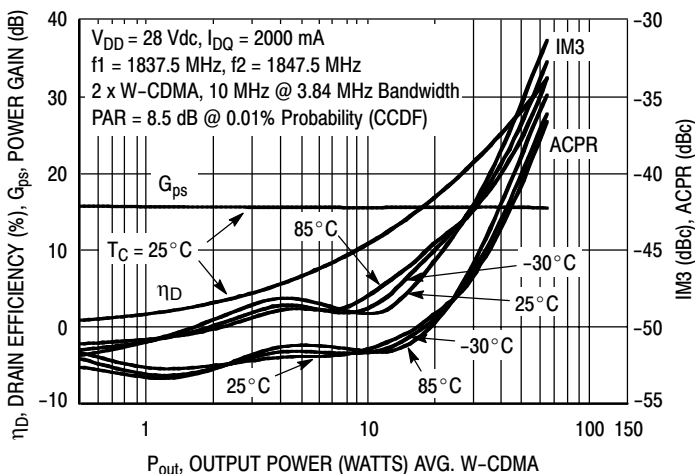


Figure 9. 2-Carrier W-CDMA ACPR, IM3, Power Gain and Drain Efficiency versus Output Power

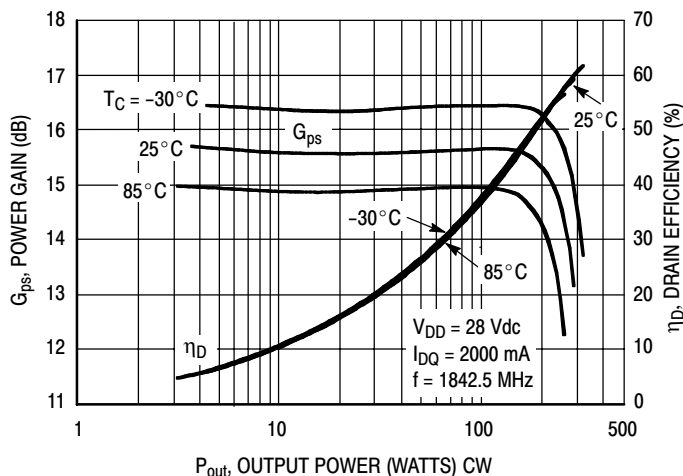


Figure 10. Power Gain and Drain Efficiency versus CW Output Power

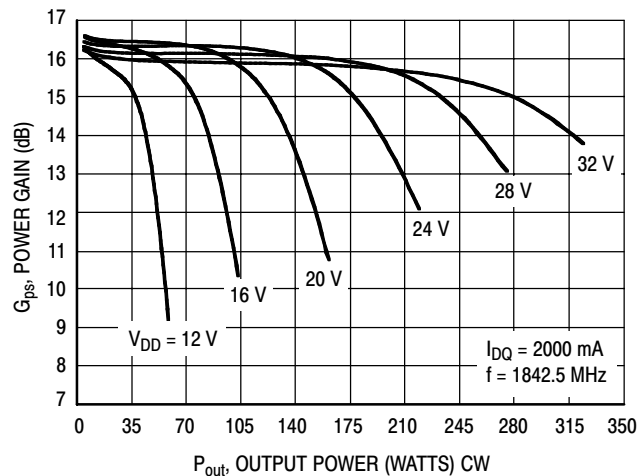
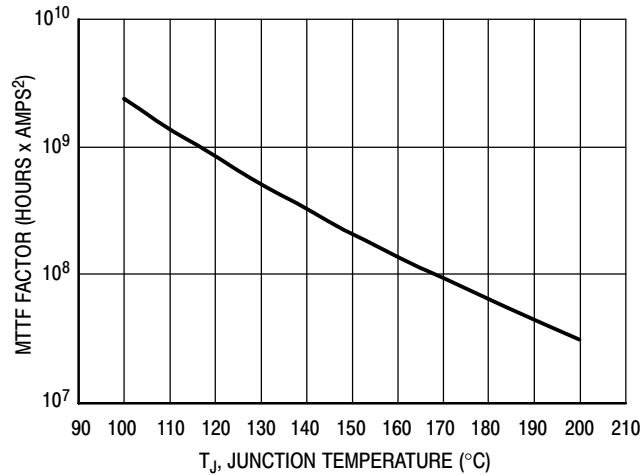


Figure 11. Power Gain versus Output Power

TYPICAL CHARACTERISTICS



This above graph displays calculated MTTF in hours x ampere² 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_D² for MTTF in a particular application.

Figure 12. MTTF Factor versus Junction Temperature

TYPICAL CHARACTERISTICS W-CDMA TEST SIGNAL

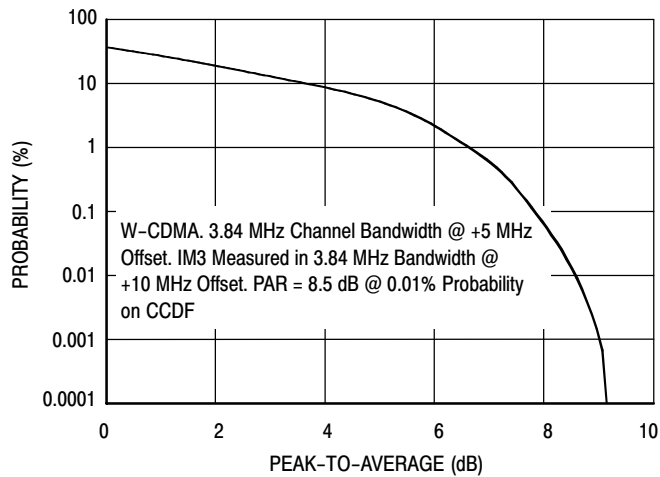


Figure 13. CCDF W-CDMA 3GPP, Test Model 1, 64 DPCH, 67% Clipping, Single-Carrier Test Signal

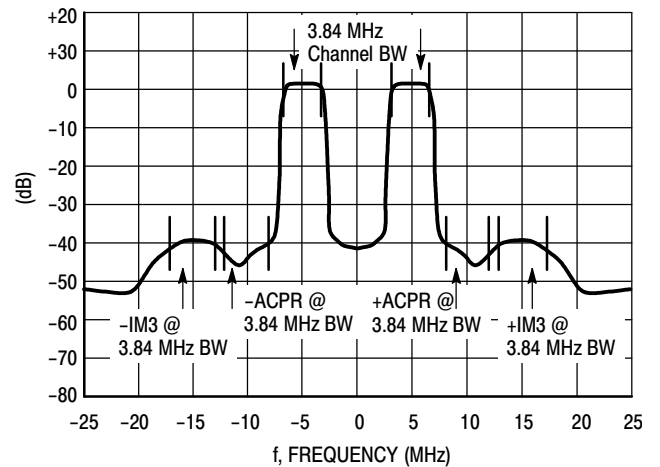
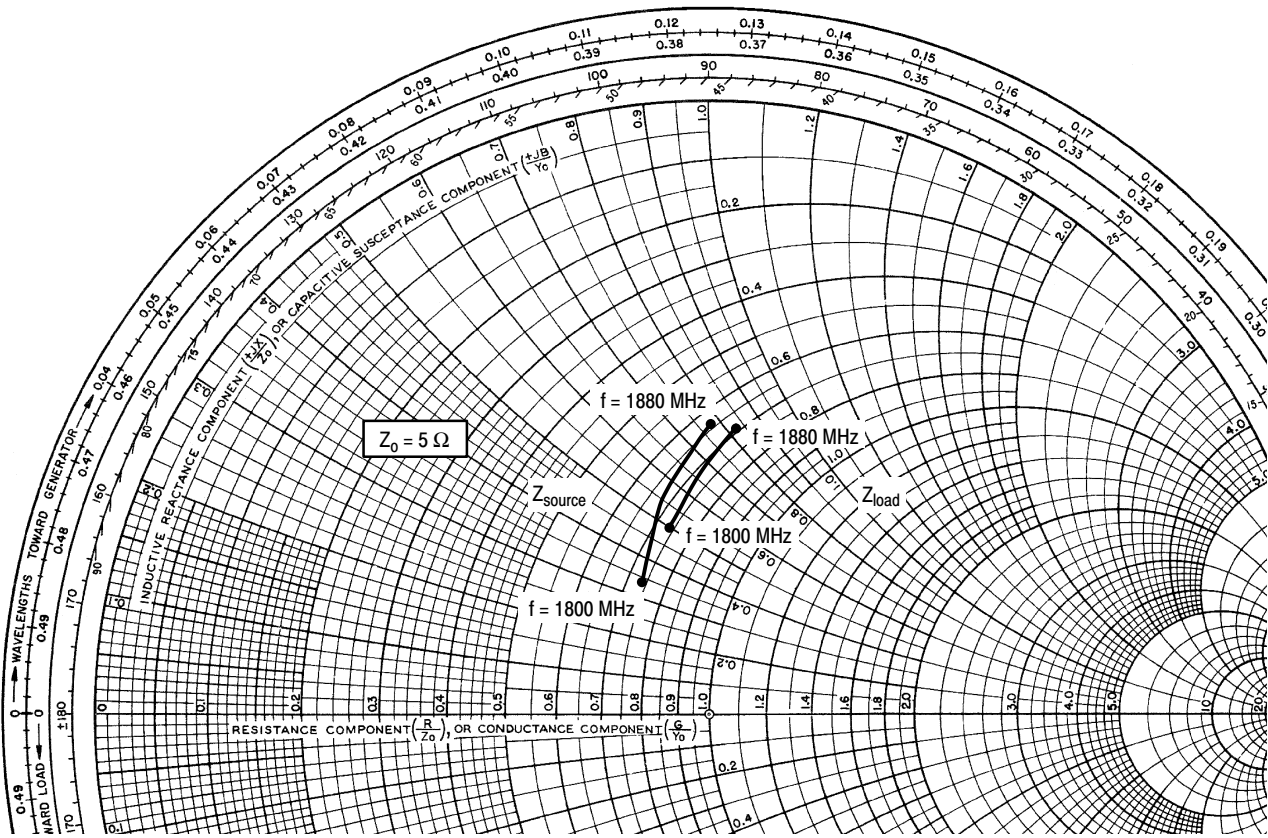


Figure 14. 2-Carrier W-CDMA Spectrum



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

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.

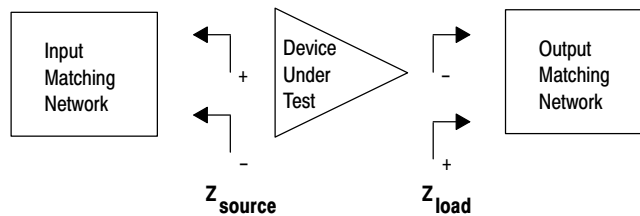
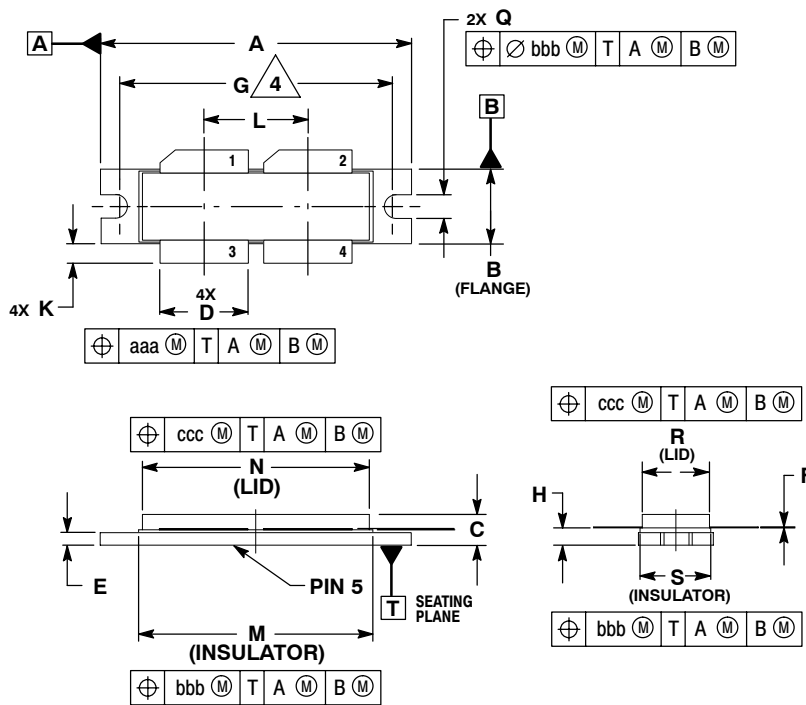


Figure 15. Series Equivalent Source and Load Impedance

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.

DIM	INCHES		MILLIMETERS	
	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**

How to Reach Us:

Home Page:
www.freescale.com

E-mail:
support@freescale.com

USA/Europe or Locations Not Listed:
Freescale Semiconductor
Technical Information Center, CH370
1300 N. Alma School Road
Chandler, Arizona 85224
+1-800-521-6274 or +1-480-768-2130
support@freescale.com

Europe, Middle East, and Africa:
Freescale Halbleiter Deutschland GmbH
Technical Information Center
Schatzbogen 7
81829 Muenchen, Germany
+44 1296 380 456 (English)
+46 8 52200080 (English)
+49 89 92103 559 (German)
+33 1 69 35 48 48 (French)
support@freescale.com

Japan:
Freescale Semiconductor Japan Ltd.
Headquarters
ARCO Tower 15F
1-8-1, Shimo-Meguro, Meguro-ku,
Tokyo 153-0064
Japan
0120 191014 or +81 3 5437 9125
support.japan@freescale.com

Asia/Pacific:
Freescale Semiconductor Hong Kong Ltd.
Technical Information Center
2 Dai King Street
Tai Po Industrial Estate
Tai Po, N.T., Hong Kong
+800 2666 8080
support.asia@freescale.com

For Literature Requests Only:
Freescale Semiconductor Literature Distribution Center
P.O. Box 5405
Denver, Colorado 80217
1-800-441-2447 or 303-675-2140
Fax: 303-675-2150
LDCForFreescaleSemiconductor@hibbertgroup.com

Information in this document is provided solely to enable system and software implementers to use Freescale Semiconductor products. There are no express or implied copyright licenses granted hereunder to design or fabricate any integrated circuits or integrated circuits based on the information in this document.

Freescale Semiconductor reserves the right to make changes without further notice to any products herein. Freescale Semiconductor makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does Freescale Semiconductor assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation consequential or incidental damages. "Typical" parameters that may be provided in Freescale Semiconductor data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals", must be validated for each customer application by customer's technical experts. Freescale Semiconductor does not convey any license under its patent rights nor the rights of others. Freescale Semiconductor products are not designed, intended, or authorized for use as components in systems intended for surgical implant into the body, or other applications intended to support or sustain life, or for any other application in which the failure of the Freescale Semiconductor product could create a situation where personal injury or death may occur. Should Buyer purchase or use Freescale Semiconductor products for any such unintended or unauthorized application, Buyer shall indemnify and hold Freescale Semiconductor and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that Freescale Semiconductor was negligent regarding the design or manufacture of the part.

Freescale™ and the Freescale logo are trademarks of Freescale Semiconductor, Inc. All other product or service names are the property of their respective owners.
© Freescale Semiconductor, Inc. 2005. All rights reserved.

