

**Table 3. ESD Protection Characteristics**

Test Methodology	Class
Human Body Model (per JESD22-A114)	2 (Minimum)
Machine Model (per EIA/JESD22-A115)	A (Minimum)
Charge Device Model (per JESD22-C101)	IV (Minimum)

**Table 4. Electrical Characteristics** ( $T_A = 25^\circ\text{C}$  unless otherwise noted)

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

**Off Characteristics**

Zero Gate Voltage Drain Leakage Current ( $V_{DS} = 65\text{ Vdc}$ , $V_{GS} = 0\text{ Vdc}$ )	$I_{DSS}$	—	—	10	$\mu\text{Adc}$
Zero Gate Voltage Drain Leakage Current ( $V_{DS} = 28\text{ Vdc}$ , $V_{GS} = 0\text{ Vdc}$ )	$I_{DSS}$	—	—	1	$\mu\text{Adc}$
Gate-Source Leakage Current ( $V_{GS} = 5\text{ Vdc}$ , $V_{DS} = 0\text{ Vdc}$ )	$I_{GSS}$	—	—	1	$\mu\text{Adc}$

**On Characteristics**

Gate Threshold Voltage ( $V_{DS} = 10\text{ Vdc}$ , $I_D = 300\ \mu\text{Adc}$ )	$V_{GS(th)}$	1.2	2.0	2.7	Vdc
Gate Quiescent Voltage ( $V_{DD} = 28\text{ Vdc}$ , $I_D = 1400\text{ mA}$ , Measured in Functional Test)	$V_{GS(Q)}$	2.0	2.7	3.5	Vdc
Drain-Source On-Voltage ( $V_{GS} = 10\text{ Vdc}$ , $I_D = 3\text{ Adc}$ )	$V_{DS(on)}$	0.1	0.17	0.3	Vdc

**Functional Tests** <sup>(1)</sup> (In Freescale Test Fixture, 50 ohm system)  $V_{DD} = 28\text{ Vdc}$ ,  $I_{DQ} = 1400\text{ mA}$ ,  $P_{out} = 48\text{ W Avg.}$ ,  $f = 2140\text{ MHz}$ , Single-Carrier W-CDMA, IQ Magnitude Clipping, Input Signal PAR = 7.5 dB @ 0.01% Probability on CCDF. ACPR measured in 3.84 MHz Channel Bandwidth @  $\pm 5\text{ MHz}$  Offset.

Power Gain	$G_{ps}$	16.5	18.1	19.5	dB
Drain Efficiency	$\eta_D$	30.0	32.6	—	%
Output Peak-to-Average Ratio @ 0.01% Probability on CCDF	PAR	5.7	6.3	—	dB
Adjacent Channel Power Ratio	ACPR	—	-37.1	-35.0	dBc
Input Return Loss	IRL	—	-15	-7	dB

**Typical Broadband Performance** (In Freescale Test Fixture, 50 ohm system)  $V_{DD} = 28\text{ Vdc}$ ,  $I_{DQ} = 1400\text{ mA}$ ,  $P_{out} = 48\text{ W Avg.}$ , Single-Carrier W-CDMA, IQ Magnitude Clipping, Input Signal PAR = 7.5 dB @ 0.01% Probability on CCDF. ACPR measured in 3.84 MHz Channel Bandwidth @  $\pm 5\text{ MHz}$  Offset.

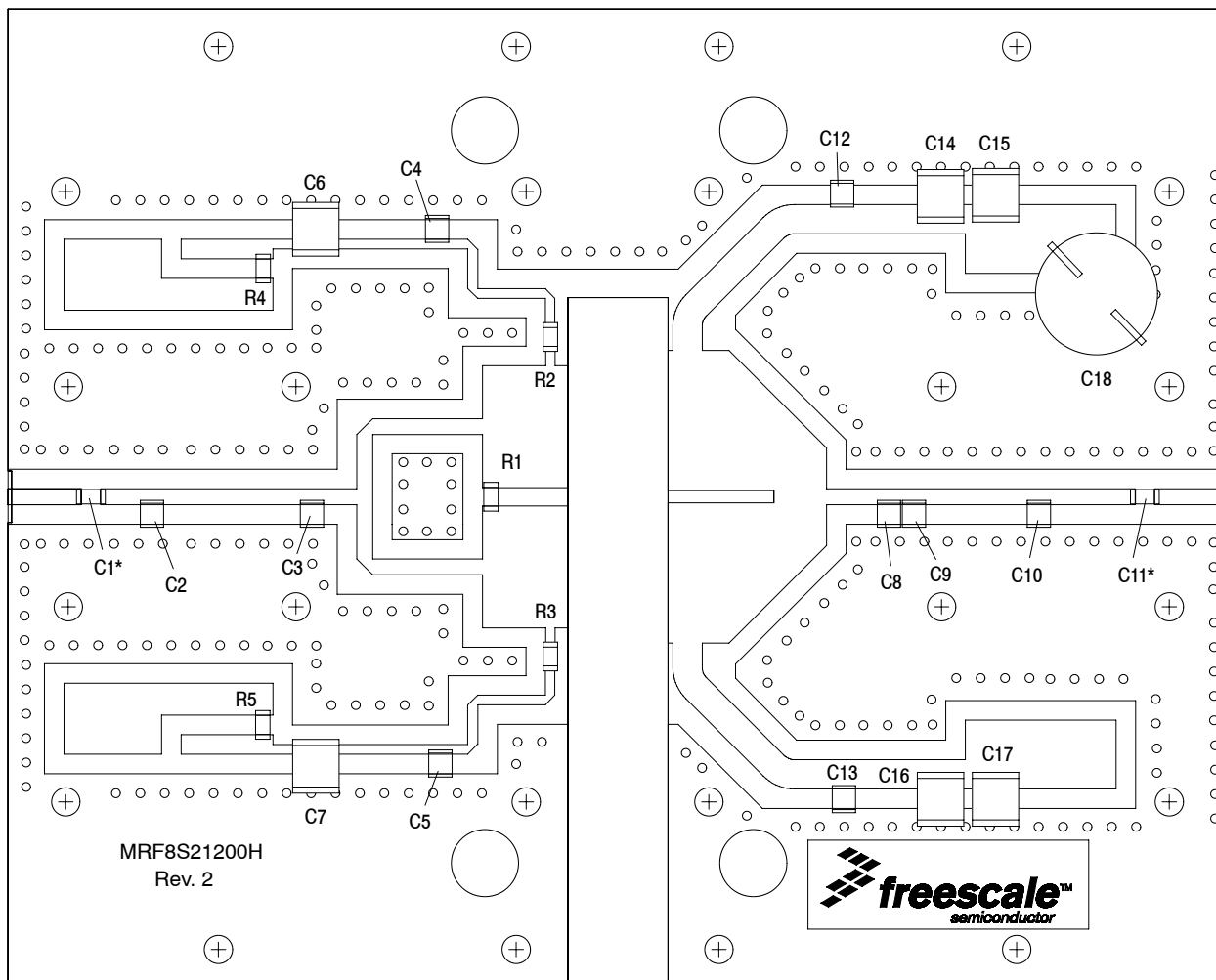
Frequency	$G_{ps}$ (dB)	$\eta_D$ (%)	Output PAR (dB)	ACPR (dBc)	IRL (dB)
2110 MHz	17.8	32.6	6.4	-37.7	-15
2140 MHz	18.1	32.6	6.3	-37.1	-15
2170 MHz	18.1	32.9	6.2	-36.2	-13

1. Part internally matched both on input and output.

(continued)

**Table 4. Electrical Characteristics** ( $T_A = 25^\circ\text{C}$  unless otherwise noted) (continued)

Characteristic	Symbol	Min	Typ	Max	Unit
<b>Typical Performances</b> (In Freescale Test Fixture, 50 ohm system) $V_{DD} = 28\text{ Vdc}$ , $I_{DQ} = 1400\text{ mA}$ , 2110–2170 MHz Bandwidth					
IMD Symmetry @ 140 W PEP, $P_{out}$ where IMD Third Order Intermodulation $\cong 30\text{ dBc}$ (Delta IMD Third Order Intermodulation between Upper and Lower Sidebands $> 2\text{ dB}$ )	$IMD_{sym}$	—	8	—	MHz
VBW Resonance Point (IMD Third Order Intermodulation Inflection Point)	$VBW_{res}$	—	35	—	MHz
Gain Flatness in 60 MHz Bandwidth @ $P_{out} = 48\text{ W Avg.}$	$G_F$	—	0.4	—	dB
Gain Variation over Temperature ( $-30^\circ\text{C}$ to $+85^\circ\text{C}$ )	$\Delta G$	—	0.02	—	dB/ $^\circ\text{C}$
Output Power Variation over Temperature ( $-30^\circ\text{C}$ to $+85^\circ\text{C}$ )	$\Delta P_{1dB}$	—	0.02	—	dB/ $^\circ\text{C}$



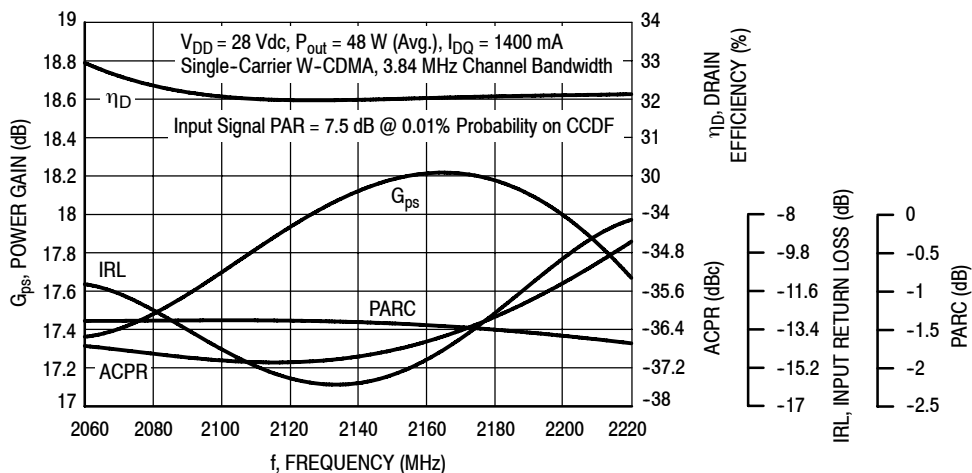
\*C1 and C11 are mounted vertically.

Figure 2. MRF8S21200HR6(HSR6) Test Circuit Component Layout

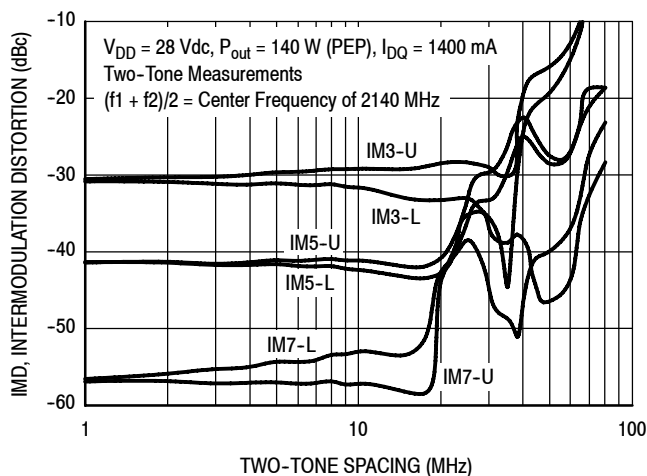
Table 5. MRF8S21200HR6(HSR6) Test Circuit Component Designations and Values

Part	Description	Part Number	Manufacturer
C1, C4, C5, C11, C12, C13	8.2 pF Chip Capacitors	ATC100B8R2CT500XT	ATC
C2	0.2 pF Chip Capacitor	ATC100B0R2BT500XT	ATC
C3	0.6 pF Chip Capacitor	ATC100B0R6BT500XT	ATC
C6, C7, C14, C15, C16, C17	10 $\mu$ F, 50 V Chip Capacitors	C5750X5R1H106MT	TDK
C8	0.5 pF Chip Capacitor	ATC100B0R5BT500XT	ATC
C9	0.8 pF Chip Capacitor	ATC100B0R8BT500XT	ATC
C10	0.3 pF Chip Capacitor	ATC100B0R3BT500XT	ATC
C18	470 $\mu$ F, 63 V Electrolytic Capacitor	MCGPR63V477M13X26-RH	Multicomp
R1	22 $\Omega$ , 1/4 W Chip Resistor	CRCW120622R0FKEA	Vishay
R2, R3	12 $\Omega$ , 1/4 W Chip Resistors	CRCW120612R0FKEA	Vishay
R4, R5	0 $\Omega$ , 3 A Chip Resistors	CRCW12060000Z0EA	Vishay
PCB	0.030", $\epsilon_r = 3.5$	RO4350B	Rogers

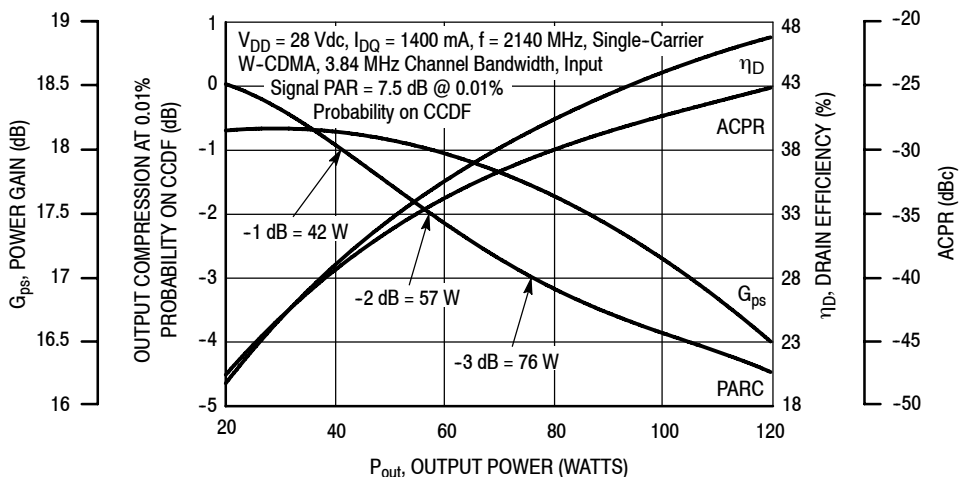
### TYPICAL CHARACTERISTICS



**Figure 3. Output Peak-to-Average Ratio Compression (PARC) Broadband Performance @  $P_{out} = 48$  Watts Avg.**

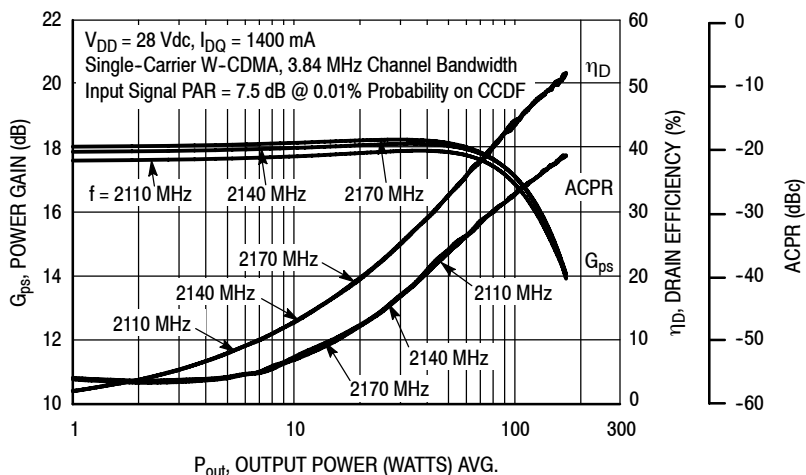


**Figure 4. Intermodulation Distortion Products versus Two-Tone Spacing**

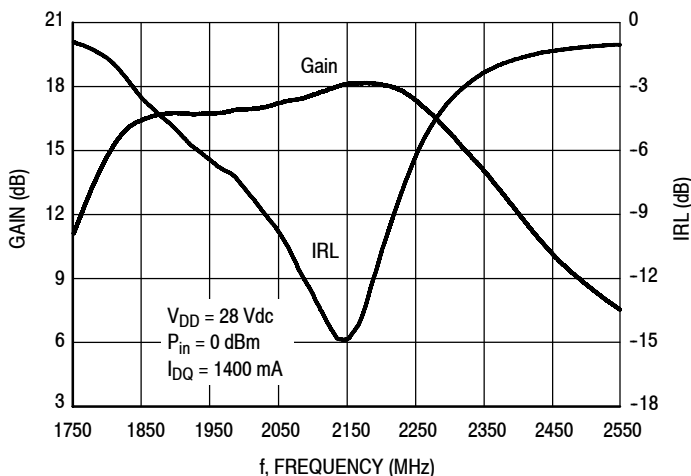


**Figure 5. Output Peak-to-Average Ratio Compression (PARC) versus Output Power**

## TYPICAL CHARACTERISTICS

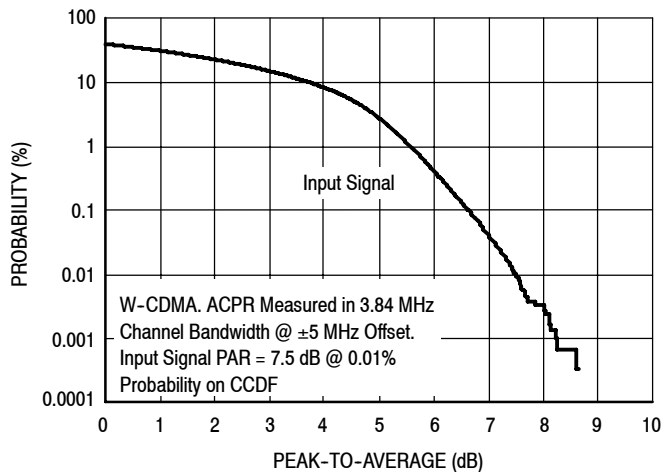


**Figure 6. Single-Carrier W-CDMA Power Gain, Drain Efficiency and ACPR versus Output Power**

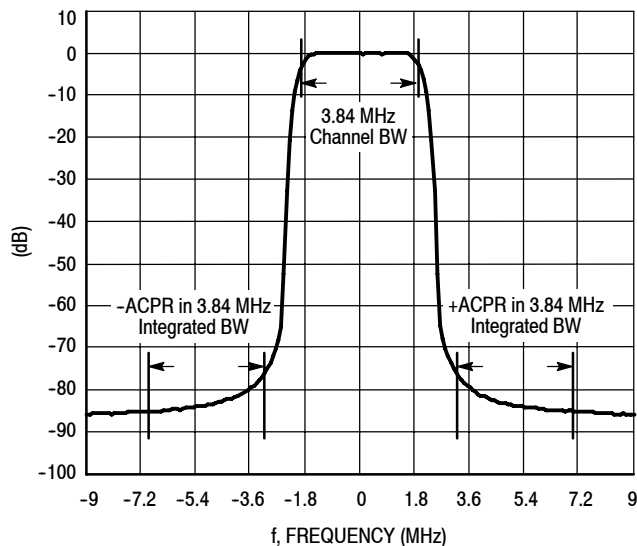


**Figure 7. Broadband Frequency Response**

## W-CDMA TEST SIGNAL



**Figure 8. CCDF W-CDMA IQ Magnitude Clipping, Single-Carrier Test Signal**



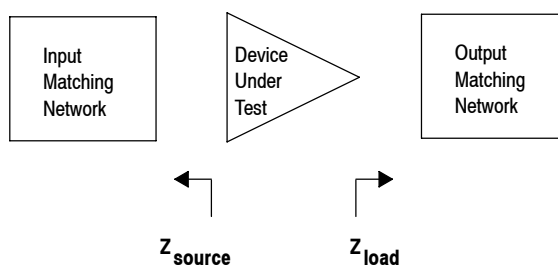
**Figure 9. Single-Carrier W-CDMA Spectrum**

$V_{DD} = 28 \text{ Vdc}$ ,  $I_{DQ} = 1400 \text{ mA}$ ,  $P_{out} = 48 \text{ W Avg.}$

f MHz	$Z_{source}$ $\Omega$	$Z_{load}$ $\Omega$
2060	3.64 - j4.51	1.42 - j2.27
2080	3.65 - j4.50	1.41 - j2.21
2100	3.64 - j4.53	1.40 - j2.15
2120	3.56 - j4.47	1.40 - j2.09
2140	3.58 - j4.44	1.39 - j2.03
2160	3.58 - j4.44	1.38 - j1.97
2180	3.57 - j4.44	1.38 - j1.91
2200	3.56 - j4.45	1.38 - j1.86
2220	3.54 - j4.64	1.37 - j1.80

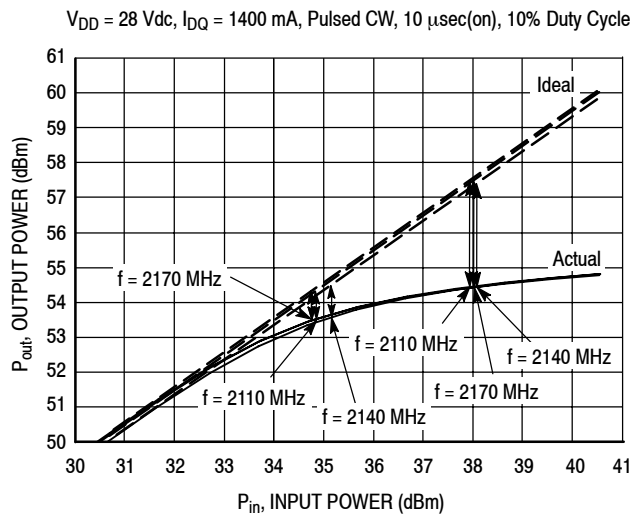
$Z_{source}$  = Test circuit impedance as measured from gate to ground.

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



**Figure 10. Series Equivalent Source and Load Impedance**

## ALTERNATIVE PEAK TUNE LOAD PULL CHARACTERISTICS



NOTE: Load Pull Test Fixture Tuned for Peak P1dB Output Power @ 28 V

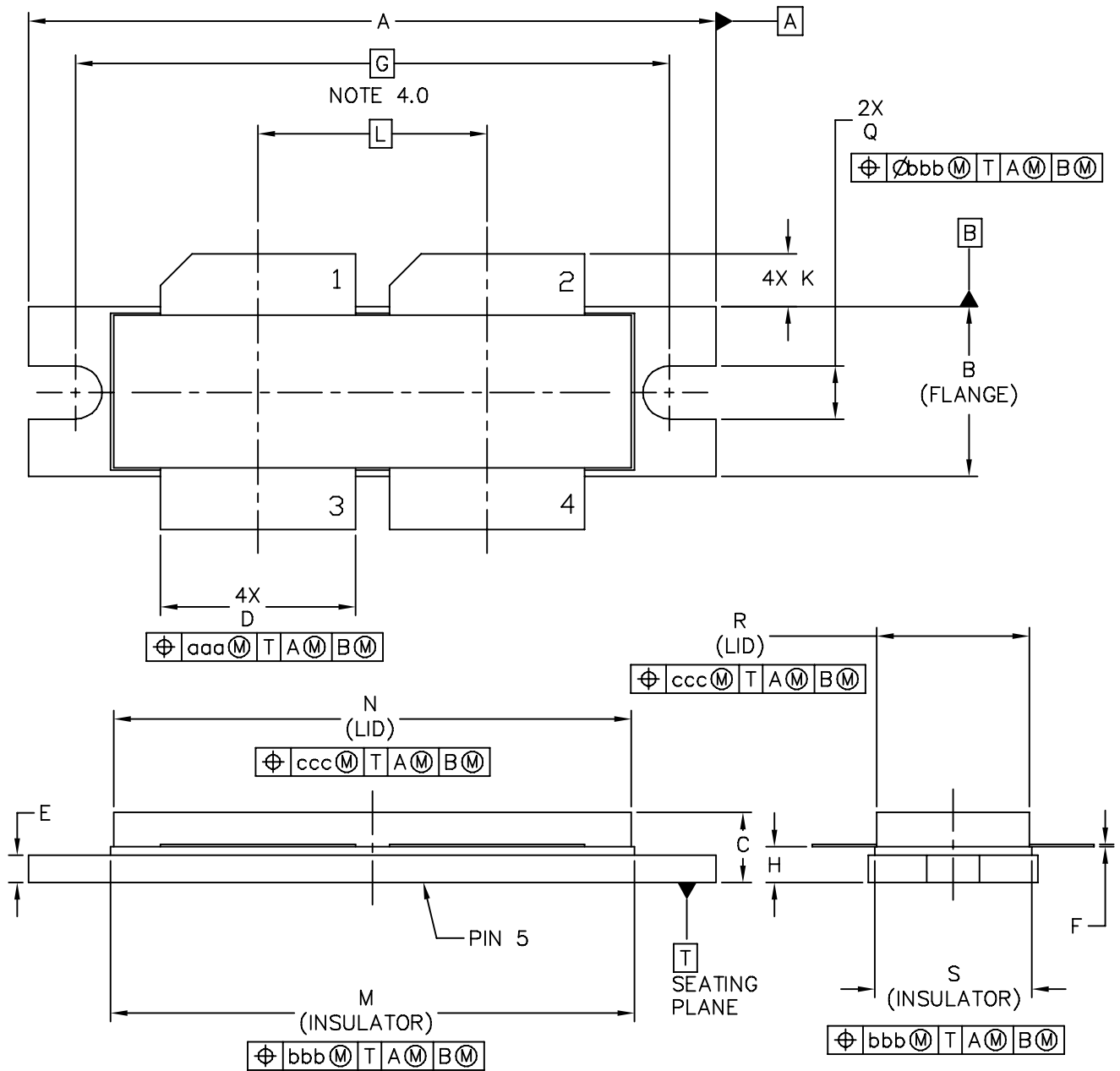
f (MHz)	P1dB		P3dB	
	Watts	dBm	Watts	dBm
2110	231	53.6	276	54.4
2140	230	53.6	279	54.5
2170	229	53.6	277	54.4

Test Impedances per Compression Level

f (MHz)		$Z_{source}$ $\Omega$	$Z_{load}$ $\Omega$
2110	P1dB	2.14 - j5.14	0.77 - j1.44
2140	P1dB	3.28 - j6.37	0.75 - j1.52
2170	P1dB	5.59 - j7.20	0.67 - j1.41

**Figure 11. Pulsed CW Output Power versus Input Power @ 28 V**

### PACKAGE DIMENSIONS



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	CASE NUMBER: 375D-05	31 MAR 2005	
	STANDARD: NON-JEDEC		

MRF8S21200HR6 MRF8S21200HSR6



NOTES:

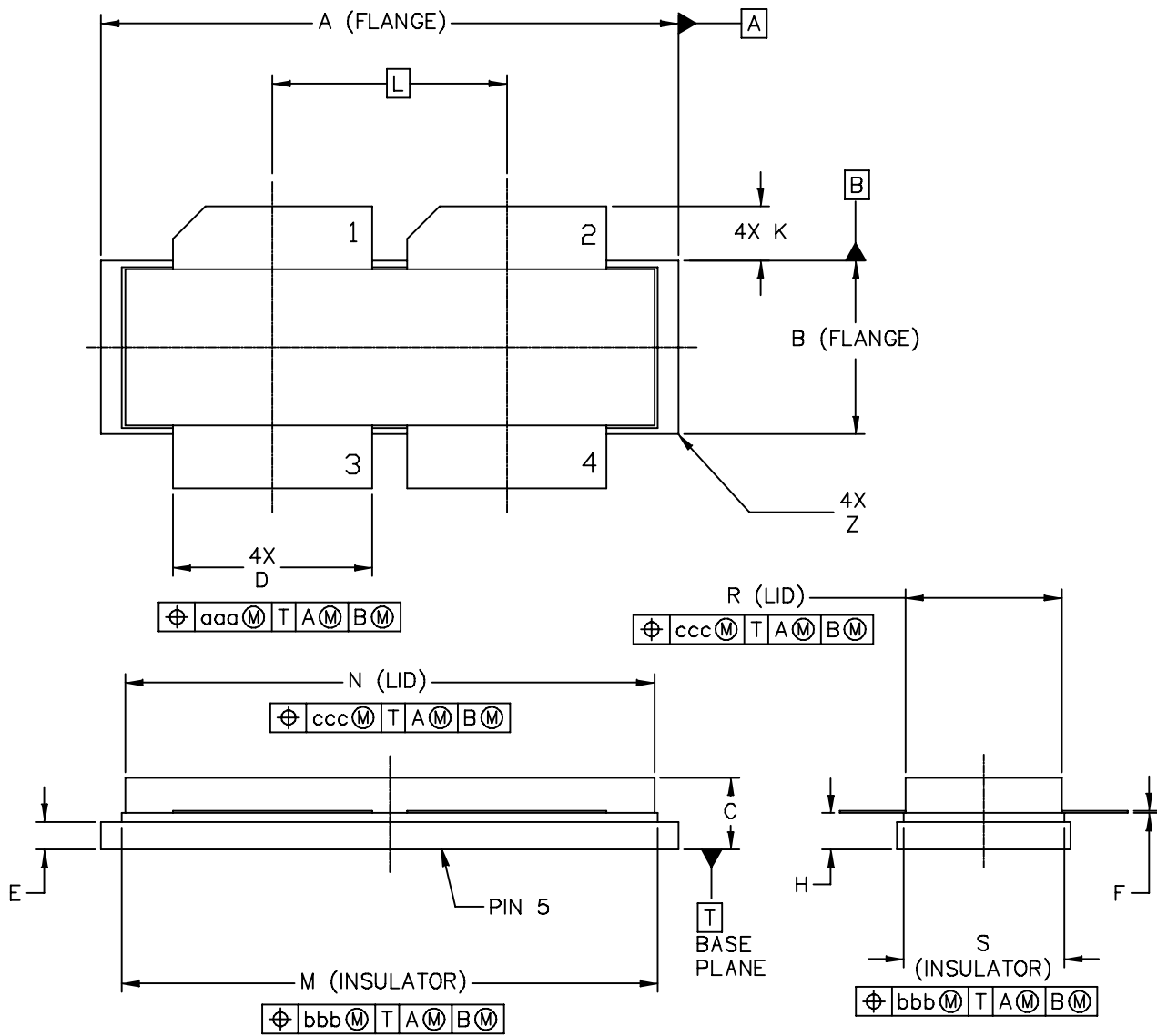
- 1.0 INTERPRET DIMENSIONS AND TOLERANCES PER ASME Y14.5M-1994.
- 2.0 CONTROLLING DIMENSION: INCH
- 3.0 DIMENSION H IS MEASURED .030 (0.762) AWAY FROM PACKAGE BODY.
- 4.0 RECOMMENDED BOLT CENTER DIMENSION OF 1.52 (38.61) BASED ON M3 SCREW.

STYLE 1:

- PIN 1 - DRAIN
- 2 - DRAIN
- 3 - GATE
- 4 - GATE
- 5 - SOURCE

DIM	INCH		MILLIMETER		DIM	INCH		MILLIMETER	
	MIN	MAX	MIN	MAX		MIN	MAX	MIN	MAX
A	1.615	1.625	41.02	41.28	N	1.218	1.242	30.94	31.55
B	.395	.405	10.03	10.29	Q	.120	.130	3.05	3.3
C	.150	.200	3.81	5.08	R	.355	.365	9.01	9.27
D	.455	.465	11.56	11.81	S	.365	.375	9.27	9.53
E	.062	.066	1.57	1.68					
F	.004	.007	0.1	0.18					
G	1.400 BSC		35.56 BSC		aaa	.013		0.33	
H	.082	.090	2.08	2.29	bbb	.010		0.25	
K	.117	.137	2.97	3.48	ccc	.020		0.51	
L	.540 BSC		13.72 BSC						
M	1.219	1.241	30.96	31.52					

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		STANDARD: NON-JEDEC			

NOTES:

1. INTERPRET DIMENSIONS AND TOLERANCES PER ASME Y14.5M-1994.
2. CONTROLLING DIMENSION: INCH
3. DIMENSION H IS MEASURED .030 AWAY FROM PACKAGE BODY

STYLE 1:

- PIN 1 - DRAIN
- 2 - DRAIN
- 3 - GATE
- 4 - GATE
- 5 - SOURCE

DIM	INCHES		MILLIMETERS		DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX		MIN	MAX	MIN	MAX
A	1.265	1.275	32.13	32.38	R	.355	.365	9.01	9.27
B	.395	.405	10.03	10.29	S	.365	.375	9.27	9.53
C	.150	.200	3.81	5.08	Z	---	.040	---	1.02
D	.455	.465	11.56	11.81					
E	.062	.066	1.57	1.68	aaa	.013		0.33	
F	.004	.007	0.1	0.18	bbb	.010		0.25	
H	.082	.090	2.08	2.29	ccc	.020		0.51	
K	.117	.137	2.97	3.48					
L	.540 BSC		13.72 BSC						
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					CASE NUMBER: 375E-04			05 AUG 2005	
					STANDARD: NON-JEDEC				

## PRODUCT DOCUMENTATION AND SOFTWARE

Refer to the following documents to aid your design process.

### Application Notes

- AN1955: Thermal Measurement Methodology of RF Power Amplifiers

### Engineering Bulletins

- EB212: Using Data Sheet Impedances for RF LDMOS Devices

### Software

- Electromigration MTTF Calculator
- RF High Power Model
- .s2p File

For Software, do a Part Number search at <http://www.freescale.com>, and select the “Part Number” link. Go to the Software & Tools tab on the part’s Product Summary page to download the respective tool.

## REVISION HISTORY

The following table summarizes revisions to this document.

Revision	Date	Description
0	Oct. 2009	• Initial Release of Data Sheet
1	Nov. 2009	• Removed Typical $P_{out}$ @ 1 dB Compression Point bullet from p. 1, and P1dB from the Typical Performance table, p. 3. P1dB was artificially low due to fixture tuning tradeoffs, i.e., fixture was tuned for back-off linearity versus optimum P1dB.
2	Oct. 2010	• Changed Human Body Model ESD rating from Class 1A to Class 2 to reflect recent ESD test results of the device, p. 2.

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