



# RF Power Field Effect Transistors

## N-Channel Enhancement-Mode Lateral MOSFETs

Designed for CDMA base station applications with frequencies from 790 to 895 MHz. Can be used in Class AB and Class C for all typical cellular base station modulation formats.

- Typical Single-Carrier W-CDMA Performance:  $V_{DD} = 28$  Volts,  $I_{DQ} = 1500$  mA,  $P_{out} = 70$  Watts Avg., IQ Magnitude Clipping, Channel Bandwidth = 3.84 MHz, Input Signal PAR = 7.5 dB @ 0.01% Probability on CCDF.

Frequency	$G_{ps}$ (dB)	$\eta_D$ (%)	Output PAR (dB)	ACPR (dBc)
850 MHz	21.3	36.2	6.5	-37.0
875 MHz	21.4	37.4	6.3	-36.7
895 MHz	21.1	37.5	6.2	-36.9

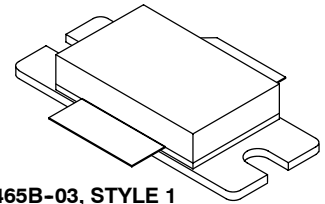
- Capable of Handling 7:1 VSWR, @ 32 Vdc, 875 MHz, 390 Watts CW <sup>(1)</sup> Output Power (3 dB Input Overdrive from Rated  $P_{out}$ ), Designed for Enhanced Ruggedness
- Typical  $P_{out}$  @ 1 dB Compression Point  $\approx$  260 Watts CW <sup>(1)</sup>

### Features

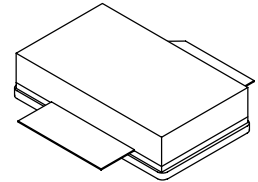
- 100% PAR Tested for Guaranteed Output Power Capability
- Characterized with Series Equivalent Large-Signal Impedance Parameters and Common Source S-Parameters
- Internally Matched for Ease of Use
- Integrated ESD Protection
- Greater Negative Gate-Source Voltage Range for Improved Class C Operation
- Designed for Digital Predistortion Error Correction Systems
- Optimized for Doherty Applications
- RoHS Compliant
- In Tape and Reel. R3 Suffix = 250 Units, 56 mm Tape Width, 13 inch Reel. For R5 Tape and Reel option, see p. 16.

**MRF8S8260HR3**  
**MRF8S8260HSR3**

**850-895 MHz, 70 W AVG. 28 V**  
**SINGLE W-CDMA**  
**LATERAL N-CHANNEL**  
**RF POWER MOSFETs**



**CASE 465B-03, STYLE 1**  
**NI-880**  
**MRF8S8260HR3**



**CASE 465C-02, STYLE 1**  
**NI-880S**  
**MRF8S8260HSR3**

**Table 1. Maximum Ratings**

Rating	Symbol	Value	Unit
Drain-Source Voltage	$V_{DSS}$	-0.5, +70	Vdc
Gate-Source Voltage	$V_{GS}$	-6.0, +10	Vdc
Operating Voltage	$V_{DD}$	32, +0	Vdc
Storage Temperature Range	$T_{stg}$	-65 to +150	°C
Case Operating Temperature	$T_C$	150	°C
Operating Junction Temperature <sup>(2,3)</sup>	$T_J$	225	°C
CW Operation @ $T_C = 25^\circ\text{C}$ Derate above 25°C	CW	201 0.94	W W/°C

**Table 2. Thermal Characteristics**

Characteristic	Symbol	Value <sup>(3,4)</sup>	Unit
Thermal Resistance, Junction to Case Case Temperature 83°C, 70 W CW, 28 Vdc, $I_{DQ} = 1500$ mA, 895 MHz Case Temperature 80°C, 260 W CW <sup>(1)</sup> , 28 Vdc, $I_{DQ} = 1500$ mA, 895 MHz	$R_{\theta JC}$	0.36 0.31	°C/W

1. Exceeds recommended operating conditions. See CW operation data in Maximum Ratings table.
2. Continuous use at maximum temperature will affect MTTF.
3. MTTF calculator available at <http://www.freescale.com/rf>. Select Software & Tools/Development Tools/Calculators to access MTTF calculators by product.
4. Refer to AN1955, *Thermal Measurement Methodology of RF Power Amplifiers*. Go to <http://www.freescale.com/rf>. Select Documentation/Application Notes - AN1955.

**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 ( $V_{DS} = 70\text{ Vdc}$ , $V_{GS} = 0\text{ Vdc}$ )	$I_{DSS}$	—	—	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 ( $V_{DS} = 10\text{ Vdc}$ , $I_D = 1380\ \mu\text{Adc}$ )	$V_{GS(th)}$	1.5	2.3	3.0	Vdc
Gate Quiescent Voltage ( $V_{DD} = 28\text{ Vdc}$ , $I_D = 1500\ \text{mAdc}$ , Measured in Functional Test)	$V_{GS(Q)}$	2.3	3.0	3.8	Vdc
Drain-Source On-Voltage ( $V_{GS} = 10\text{ Vdc}$ , $I_D = 3.0\ \text{Adc}$ )	$V_{DS(on)}$	0.1	0.24	0.3	Vdc

**Functional Tests** <sup>(1)</sup> (In Freescale Test Fixture, 50 ohm system)  $V_{DD} = 28\text{ Vdc}$ ,  $I_{DQ} = 1500\ \text{mA}$ ,  $P_{out} = 70\ \text{W Avg.}$ ,  $f = 895\ \text{MHz}$ , 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	$G_{ps}$	19.6	21.1	22.6	dB
Drain Efficiency	$\eta_D$	35.5	37.5	—	%
Output Peak-to-Average Ratio @ 0.01% Probability on CCDF	PAR	5.8	6.2	—	dB
Adjacent Channel Power Ratio	ACPR	—	-36.9	-35.0	dBc
Input Return Loss	IRL	—	-16	-12	dB

**Typical Broadband Performance** (In Freescale Test Fixture, 50 ohm system)  $V_{DD} = 28\text{ Vdc}$ ,  $I_{DQ} = 1500\ \text{mA}$ ,  $P_{out} = 70\ \text{W Avg.}$ , 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)
850 MHz	21.3	36.2	6.5	-37.0	-9
875 MHz	21.4	37.4	6.3	-36.7	-13
895 MHz	21.1	37.5	6.2	-36.9	-16

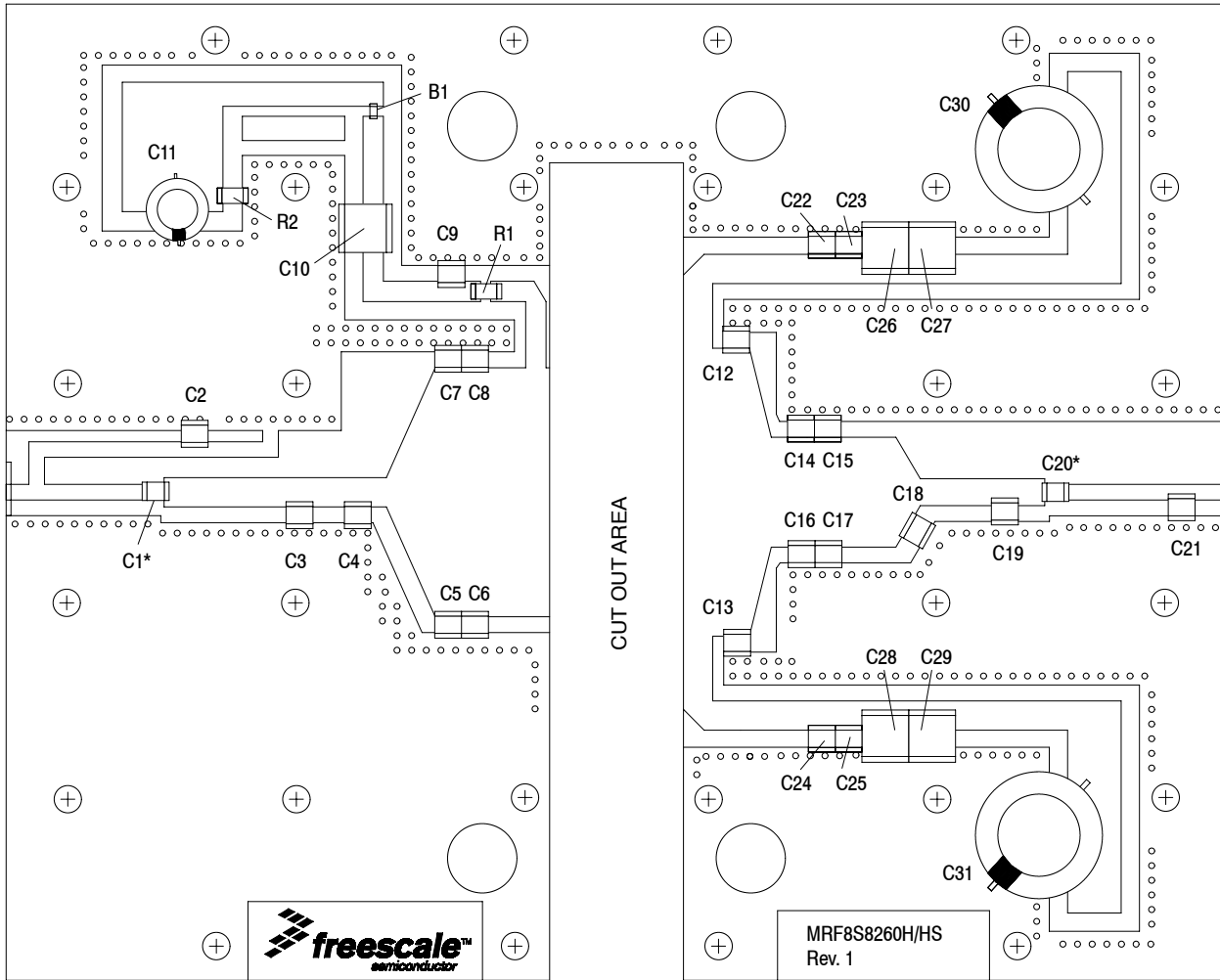
1. Part internally matched both on input and output.

(continued)

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

Characteristic	Symbol	Min	Typ	Max	Unit
<b>Typical Performance</b> (In Freescale Test Fixture, 50 ohm system) $V_{DD} = 28\text{ Vdc}$ , $I_{DQ} = 1500\text{ mA}$ , 850-895 MHz Bandwidth					
$P_{out}$ @ 1 dB Compression Point, CW	P1dB	—	260 (1)	—	W
IMD Symmetry @ 80 W PEP, $P_{out}$ where IMD Third Order Intermodulation $\cong 30\text{ dBc}$ (Delta IMD Third Order Intermodulation between Upper and Lower Sidebands > 2 dB)	IMD <sub>sym</sub>	—	9.7	—	MHz
VBW Resonance Point (IMD Third Order Intermodulation Inflection Point)	VBW <sub>res</sub>	—	60	—	MHz
Gain Flatness in 45 MHz Bandwidth @ $P_{out} = 70\text{ W Avg.}$	G <sub>F</sub>	—	0.3	—	dB
Gain Variation over Temperature ( $-30^\circ\text{C}$ to $+85^\circ\text{C}$ )	$\Delta G$	—	0.016	—	dB/ $^\circ\text{C}$
Output Power Variation over Temperature ( $-30^\circ\text{C}$ to $+85^\circ\text{C}$ ) (1)	$\Delta P_{1dB}$	—	0.002	—	dB/ $^\circ\text{C}$

1. Exceeds recommended operating conditions. See CW operation data in Maximum Ratings table.



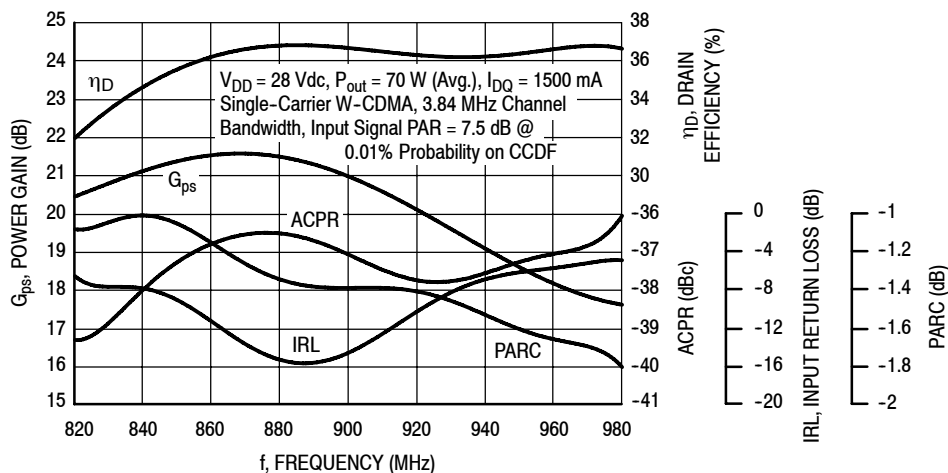
\*C1 and C20 are mounted vertically.

Figure 1. MRF8S8260HR3(HSR3) Test Circuit Component Layout

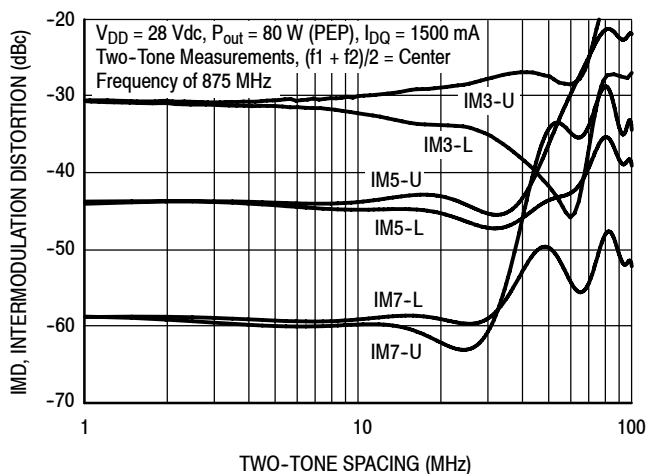
Table 5. MRF8S8260HR3(HSR3) Test Circuit Component Designations and Values

Part	Description	Part Number	Manufacturer
B1	RF Bead	BLM21PG300SN1D	Murata
C1	2.7 pF Chip Capacitor	ATC100B2R7BT500XT	ATC
C2	100 pF Chip Capacitor	ATC100B101JT500XT	ATC
C3	2.4 pF Chip Capacitor	ATC100B2R4JT500XT	ATC
C4	5.1 pF Chip Capacitor	ATC100B5R1CT500XT	ATC
C5 C7	3.3 pF Chip Capacitors	ATC100B3R3CT500XT	ATC
C6, C8	3.9 pF Chip Capacitors	ATC100B3R9CT500XT	ATC
C9, C20, C22, C23, C24, C25	43 pF Chip Capacitors	ATC100B430JT500XT	ATC
C10	4.7 $\mu$ F, 100 V Chip Capacitor	GRM55ER72A475KA01B	Murata
C11	22 $\mu$ F Electrolytic Capacitor	UUD1V220MCL1GS	Nichicon
C12, C13	8.2 pF Chip Capacitors	ATC100B8R2CT500XT	ATC
C14, C16	3.9 pF Chip Capacitors	ATC100B3R9CT500XT	ATC
C15, C17	3.0 pF Chip Capacitors	ATC100B3R0CT500XT	ATC
C18	0.7 pF Chip Capacitor	ATC100B0R7BT500XT	ATC
C19	4.3 pF Chip Capacitor	ATC100B4R3CT500XT	ATC
C21	0.1 pF Chip Capacitor	ATC100B0R1BT500XT	ATC
C26, C27, C28, C29	10 $\mu$ F, 50 V Chip Capacitors	GRM55DR61H106KA88L	Murata
C30, C31	470 $\mu$ F Electrolytic Capacitors	MCGPR63V477M13X26-RH	Multicomp
R1	2.0 $\Omega$ , 1/4 W Chip Resistor	P2.0VCT-ND	Panasonic
R2	1 K $\Omega$ , 1/4 W Chip Resistor	CRCW12061K00FKEA	Vishay
PCB	0.030", $\epsilon_r = 3.5$	TC350	Arlon

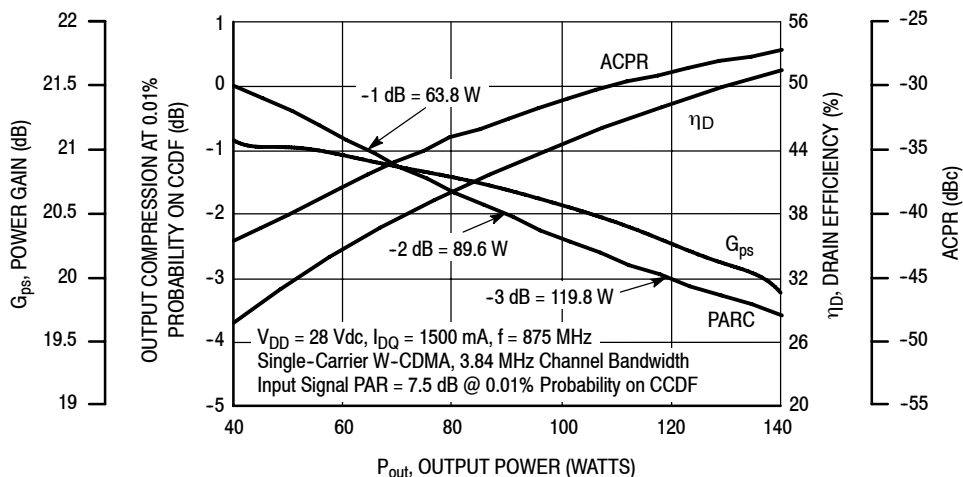
## TYPICAL CHARACTERISTICS



**Figure 2. Output Peak-to-Average Ratio Compression (PARC) Broadband Performance @  $P_{out} = 70$  Watts Avg.**

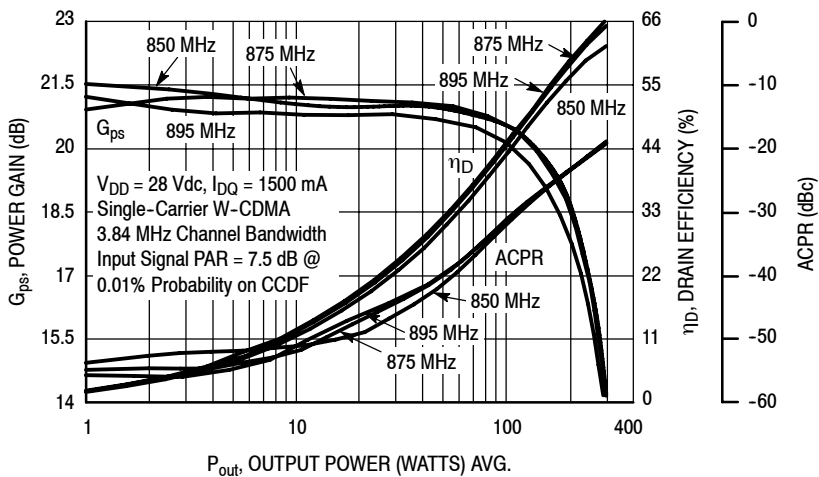


**Figure 3. Intermodulation Distortion Products versus Two-Tone Spacing**

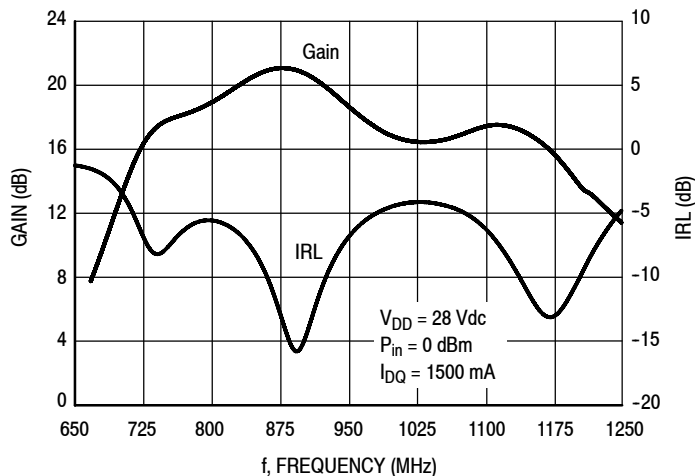


**Figure 4. Output Peak-to-Average Ratio Compression (PARC) versus Output Power**

### TYPICAL CHARACTERISTICS

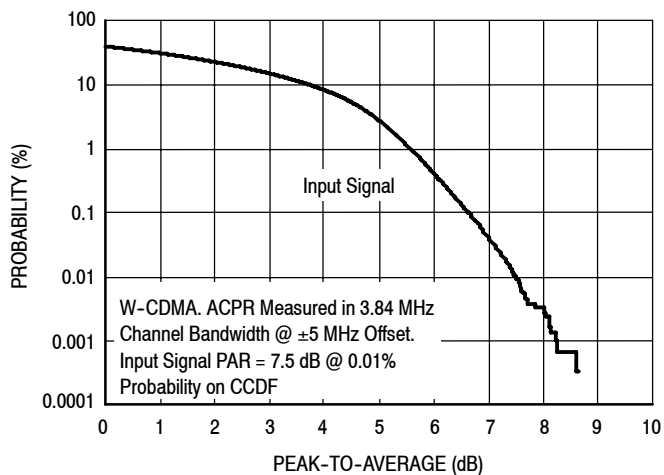


**Figure 5. Single-Carrier W-CDMA Power Gain, Drain Efficiency and ACPR versus Output Power**

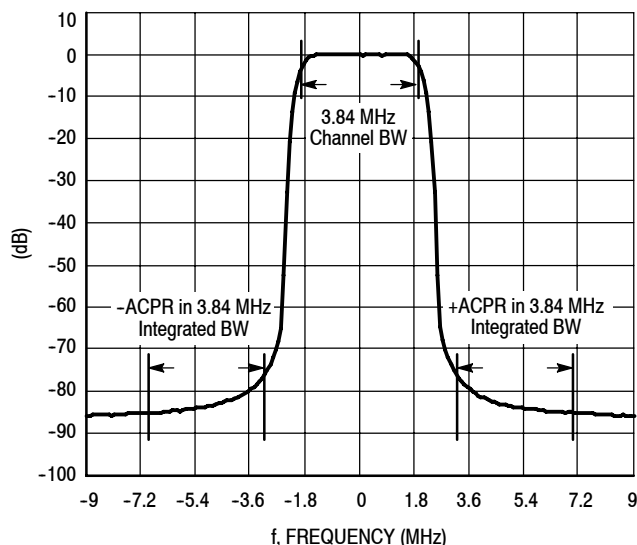


**Figure 6. Broadband Frequency Response**

### W-CDMA TEST SIGNAL



**Figure 7. CCDF W-CDMA IQ Magnitude Clipping, Single-Carrier Test Signal**



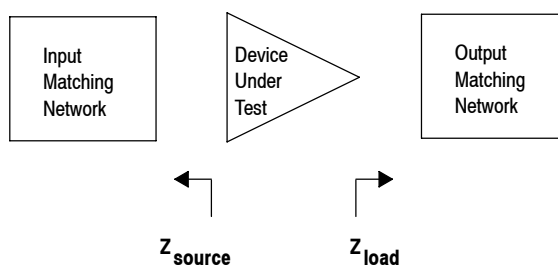
**Figure 8. Single-Carrier W-CDMA Spectrum**

$V_{DD} = 28 \text{ Vdc}$ ,  $I_{DQ} = 1500 \text{ mA}$ ,  $P_{out} = 70 \text{ W Avg.}$

f MHz	$Z_{source}$ $\Omega$	$Z_{load}$ $\Omega$
820	3.19 - j1.47	1.38 - j0.80
840	2.98 - j1.61	1.37 - j0.52
860	2.78 - j1.75	1.38 - j0.29
880	2.50 - j1.87	1.44 - j0.14
900	2.20 - j1.92	1.48 - j0.01
920	1.96 - j1.79	1.52 + j0.12
940	1.82 - j1.58	1.59 + j0.32
960	1.74 - j1.35	1.68 + j0.51
980	1.68 - j1.12	1.77 + j0.61

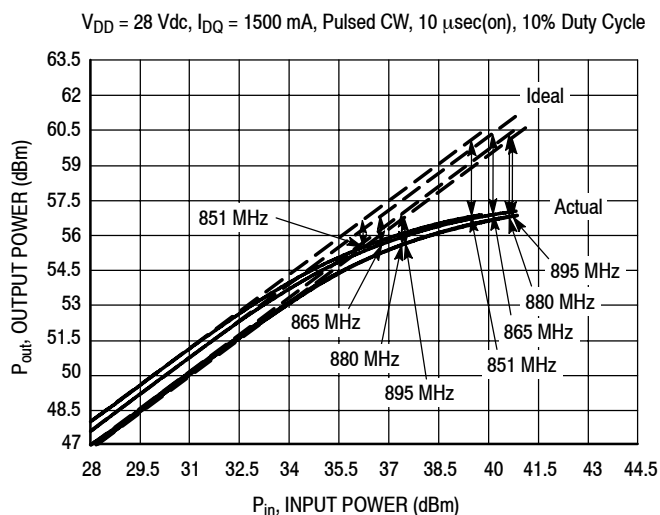
$Z_{source}$  = Test circuit impedance as measured from gate to ground.

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



**Figure 9. Series Equivalent Source and Load Impedance**

## ALTERNATIVE PEAK TUNE LOAD PULL CHARACTERISTICS



f (MHz)	P1dB		P3dB	
	Watts	dBm	Watts	dBm
851	359	55.5	482	56.8
865	366	55.6	485	56.9
880	362	55.6	477	56.8
895	365	55.6	478	56.8

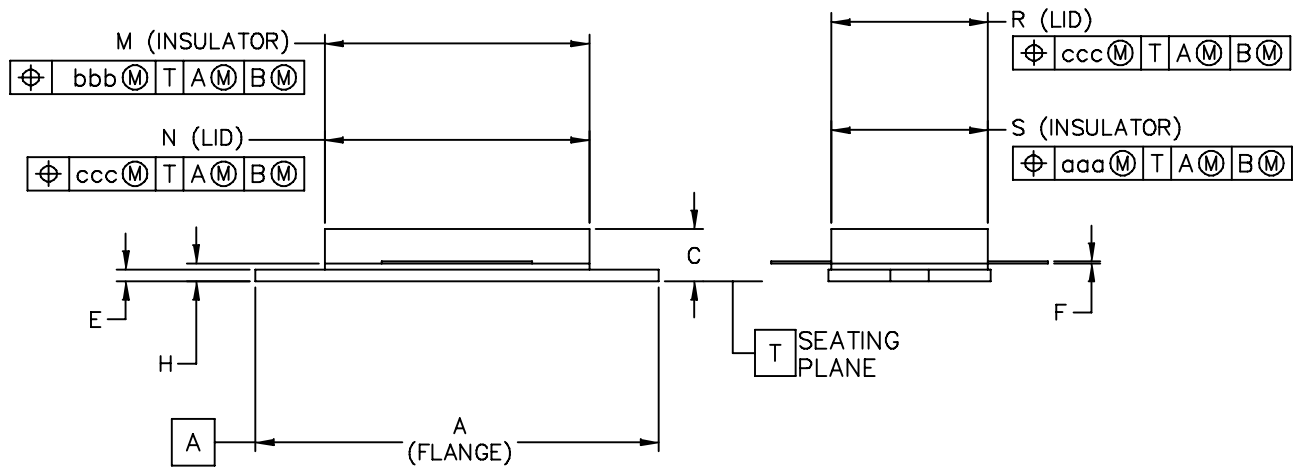
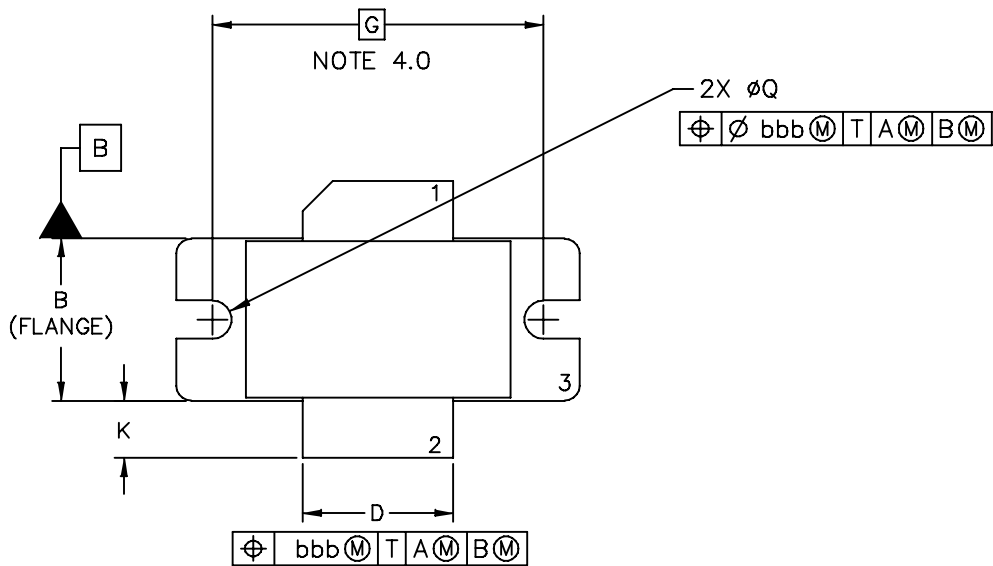
Test Impedances per Compression Level

f (MHz)		$Z_{\text{source}}$ $\Omega$	$Z_{\text{load}}$ $\Omega$
851	P1dB	1.46 - j2.70	3.02 + j0.04
865	P1dB	1.85 - j3.04	2.92 + j0.03
880	P1dB	2.20 - j3.31	2.85 + j0.70
895	P1dB	2.53 - j3.58	2.50 + j0.76

Figure 10. Pulsed CW Output Power versus Input Power @ 28 V



## PACKAGE DIMENSIONS



© FREESCALE SEMICONDUCTOR, INC. ALL RIGHTS RESERVED.	MECHANICAL OUTLINE	PRINT VERSION NOT TO SCALE
TITLE:  <div style="text-align: center; font-size: 1.2em;">NI-880</div>	DOCUMENT NO: 98ARB18493C CASE NUMBER: 465B-03 STANDARD: NON-JEDEC	REV: E 10 SEP 2007

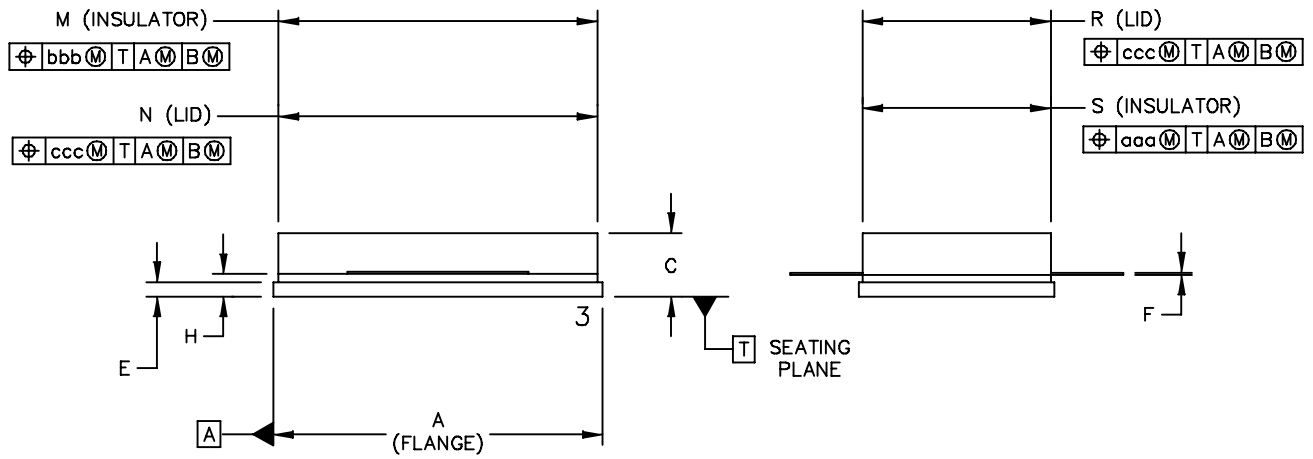
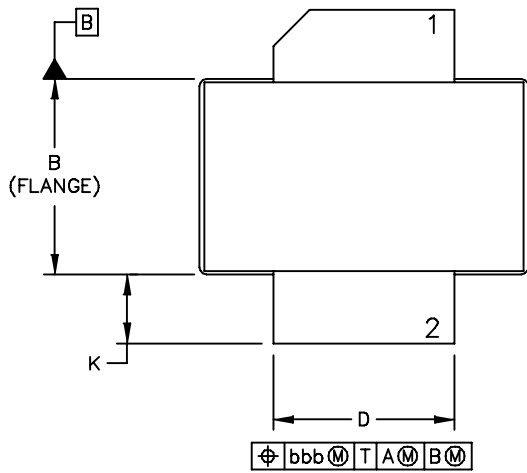
NOTES:

- 1.0 DIMENSIONING AND TOLERANCING PER ANSI 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 1.16 (29.57) BASED ON M3 SCREW.

STYLE 1:

- PIN 1. DRAIN
2. GATE
3. SOURCE

DIM	INCH		MILLIMETER		DIM	INCH		MILLIMETER	
	MIN	MAX	MIN	MAX		MIN	MAX	MIN	MAX
A	1.335	1.345	33.91	34.16	R	.515	– .525	13.1	– 13.3
B	.535	.545	13.6	13.8	S	.515	– .525	13.1	– 13.3
C	.147	.200	3.73	5.08	aaa	–	.007 –	–	0.178 –
D	.495	.505	12.57	12.83	bbb	–	.010 –	–	0.254 –
E	.035	.045	0.89	1.14	ccc	–	.015 –	–	0.381 –
F	.003	.006	0.08	0.15	–	–	–	–	–
G	1.100 BSC		27.94 BSC		–	–	–	–	–
H	.057	.067	1.45	1.7	–	–	–	–	–
K	.175	.205	4.44	5.21	–	–	–	–	–
M	.872	.888	22.15	22.55	–	–	–	–	–
N	.871	.889	19.3	22.6	–	–	–	–	–
Q	∅.118	∅.138	∅3	∅3.51	–	–	–	–	–
© FREESCALE SEMICONDUCTOR, INC. ALL RIGHTS RESERVED.			MECHANICAL OUTLINE			PRINT VERSION NOT TO SCALE			
TITLE:  NI-880					DOCUMENT NO: 98ARB18493C			REV: E	
					CASE NUMBER: 465B-03			10 SEP 2007	
					STANDARD: NON-JEDEC				



© FREESCALE SEMICONDUCTOR, INC. ALL RIGHTS RESERVED.	MECHANICAL OUTLINE	PRINT VERSION NOT TO SCALE	
TITLE:  NI-880S	DOCUMENT NO: 98ARB18660C	REV: D	
	CASE NUMBER: 465C-02	09 JUN 2005	
	STANDARD: NON-JEDEC		

NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M-1994.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSION H IS MEASURED .030 (0.762) AWAY FROM PACKAGE BODY.

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

DIM	INCH		MILLIMETER		DIM	INCH		MILLIMETER	
	MIN	MAX	MIN	MAX		MIN	MAX	MIN	MAX
A	.905	-.915	22.99	- 23.24	aaa	- .007	-	- 0.178	-
B	.535	-.545	13.6	- 13.8	bbb	- .010	-	- 0.254	-
C	.147	-.200	3.73	- 5.08	ccc	- .015	-	- 0.381	-
D	.495	-.505	12.57	- 12.83	-	-	-	-	-
E	.035	-.045	0.89	- 1.14	-	-	-	-	-
F	.003	-.006	0.08	- 0.15	-	-	-	-	-
H	.057	.067	1.45	1.7	-	-	-	-	-
K	.170	-.210	4.32	- 5.33	-	-	-	-	-
M	.872	-.888	22.15	- 22.55	-	-	-	-	-
N	.871	-.889	19.3	- 22.6	-	-	-	-	-
R	.515	-.525	13.1	- 13.3	-	-	-	-	-
S	.515	-.525	13.1	- 13.3	-	-	-	-	-

© FREESCALE SEMICONDUCTOR, INC. ALL RIGHTS RESERVED.		MECHANICAL OUTLINE		PRINT VERSION NOT TO SCALE	
TITLE:  NI-880S		DOCUMENT NO: 98ARB18660C		REV: D	
		CASE NUMBER: 465C-02		09 JUN 2005	
		STANDARD: NON-JEDEC			

## PRODUCT DOCUMENTATION, TOOLS AND SOFTWARE

Refer to the following documents, tools and software 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 and Tools, 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.

## R5 TAPE AND REEL OPTION

R5 Suffix = 50 Units, 56 mm Tape Width, 13 inch Reel.

The R5 tape and reel option for MRF8S8260H and MRF8S8260HS parts will be available for 2 years after release of MRF8S8260H and MRF8S8260HS. Freescale Semiconductor, Inc. reserves the right to limit the quantities that will be delivered in the R5 tape and reel option. At the end of the 2 year period customers who have purchased these devices in the R5 tape and reel option will be offered MRF8S8260H and MRF8S8260HS in the R3 tape and reel option.

## REVISION HISTORY

The following table summarizes revisions to this document.

Revision	Date	Description
0	Jan. 2011	<ul style="list-style-type: none"><li>• Initial Release of Data Sheet</li></ul>

## **How to Reach Us:**

### **Home Page:**

[www.freescale.com](http://www.freescale.com)

### **Web Support:**

<http://www.freescale.com/support>

### **USA/Europe or Locations Not Listed:**

Freescale Semiconductor, Inc.  
Technical Information Center, EL516  
2100 East Elliot Road  
Tempe, Arizona 85284  
1-800-521-6274 or +1-480-768-2130  
[www.freescale.com/support](http://www.freescale.com/support)

### **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)  
[www.freescale.com/support](http://www.freescale.com/support)

### **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](mailto:support.japan@freescale.com)

### **Asia/Pacific:**

Freescale Semiconductor China Ltd.  
Exchange Building 23F  
No. 118 Jianguo Road  
Chaoyang District  
Beijing 100022  
China  
+86 10 5879 8000  
[support.asia@freescale.com](mailto:support.asia@freescale.com)

### **For Literature Requests Only:**

Freescale Semiconductor Literature Distribution Center  
1-800-441-2447 or +1-303-675-2140  
Fax: +1-303-675-2150  
[LDCForFreescaleSemiconductor@hibbertgroup.com](mailto: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. 2011. All rights reserved.

