

RF Power Field Effect Transistors

N-Channel Enhancement-Mode Lateral MOSFETs

Designed for W-CDMA and LTE base station applications with frequencies from 2620 to 2690 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, $I_{DQ} = 900$ mA, $P_{out} = 28$ 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)	η_D (%)	Output PAR (dB)	ACPR (dBc)
2620 MHz	15.5	31.5	6.3	-38.0
2655 MHz	15.5	31.1	6.3	-37.3
2690 MHz	15.6	31.1	6.2	-36.7

- Capable of Handling 10:1 VSWR, @ 32 Vdc, 2655 MHz, 135 Watts CW Output Power (3 dB Input Overdrive from Rated P_{out})
- Typical P_{out} @ 1 dB Compression Point $\approx$ 110 Watts CW

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 per 56 mm, 13 inch Reel.

MRF8S26120HR3
MRF8S26120HSR3

2620-2690 MHz, 28 W AVG., 28 V
W-CDMA, LTE
LATERAL N-CHANNEL
RF POWER MOSFETs

CASE 465-06, STYLE 1
NI-780
MRF8S26120HR3

CASE 465A-06, STYLE 1
NI-780S
MRF8S26120HSR3

Table 1. Maximum Ratings

Rating	Symbol	Value	Unit
Drain-Source Voltage	V_{DSS}	-0.5, +65	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 (1,2)	T_J	225	°C
CW Operation @ $T_C = 25^\circ\text{C}$ Derate above 25°C	CW	141 0.78	W W/°C

Table 2. Thermal Characteristics

Characteristic	Symbol	Value (2,3)	Unit
Thermal Resistance, Junction to Case Case Temperature 72°C , 28 W CW, 28 Vdc, $I_{DQ} = 900$ mA, 2690 MHz Case Temperature 85°C , 110 W CW(4), 28 Vdc, $I_{DQ} = 900$ mA, 2690 MHz	$R_{\theta JC}$	0.53 0.47	°C/W

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

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
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Off Characteristics

Zero Gate Voltage Drain Leakage Current ($V_{DS} = 65\text{ Vdc}$, $V_{GS} = 0\text{ Vdc}$)	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 ($V_{DS} = 10\text{ Vdc}$, $I_D = 172\text{ }\mu\text{Adc}$)	$V_{GS(th)}$	1.2	2.0	2.7	Vdc
Gate Quiescent Voltage ($V_{DD} = 28\text{ Vdc}$, $I_D = 900\text{ mAdc}$, Measured in Functional Test)	$V_{GS(Q)}$	1.5	2.6	3.0	Vdc
Drain-Source On-Voltage ($V_{GS} = 10\text{ Vdc}$, $I_D = 1.7\text{ Adc}$)	$V_{DS(on)}$	0.1	0.24	0.3	Vdc

Functional Tests ⁽¹⁾ (In Freescale Test Fixture, 50 ohm system) $V_{DD} = 28\text{ Vdc}$, $I_{DQ} = 900\text{ mA}$, $P_{out} = 28\text{ W Avg.}$, $f = 2690\text{ MHz}$, 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}	14.5	15.6	17.5	dB
Drain Efficiency	η_D	28.0	31.1	—	%
Output Peak-to-Average Ratio @ 0.01% Probability on CCDF	PAR	5.7	6.2	—	dB
Adjacent Channel Power Ratio	ACPR	—	-36.7	-34.5	dBc
Input Return Loss	IRL	—	-14	-9	dB

Typical Broadband Performance (In Freescale Test Fixture, 50 ohm system) $V_{DD} = 28\text{ Vdc}$, $I_{DQ} = 900\text{ mA}$, $P_{out} = 28\text{ W Avg.}$, 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)	η_D (%)	Output PAR (dB)	ACPR (dBc)	IRL (dB)
2620 MHz	15.5	31.5	6.3	-38.0	-13
2655 MHz	15.5	31.1	6.3	-37.3	-14
2690 MHz	15.6	31.1	6.2	-36.7	-14

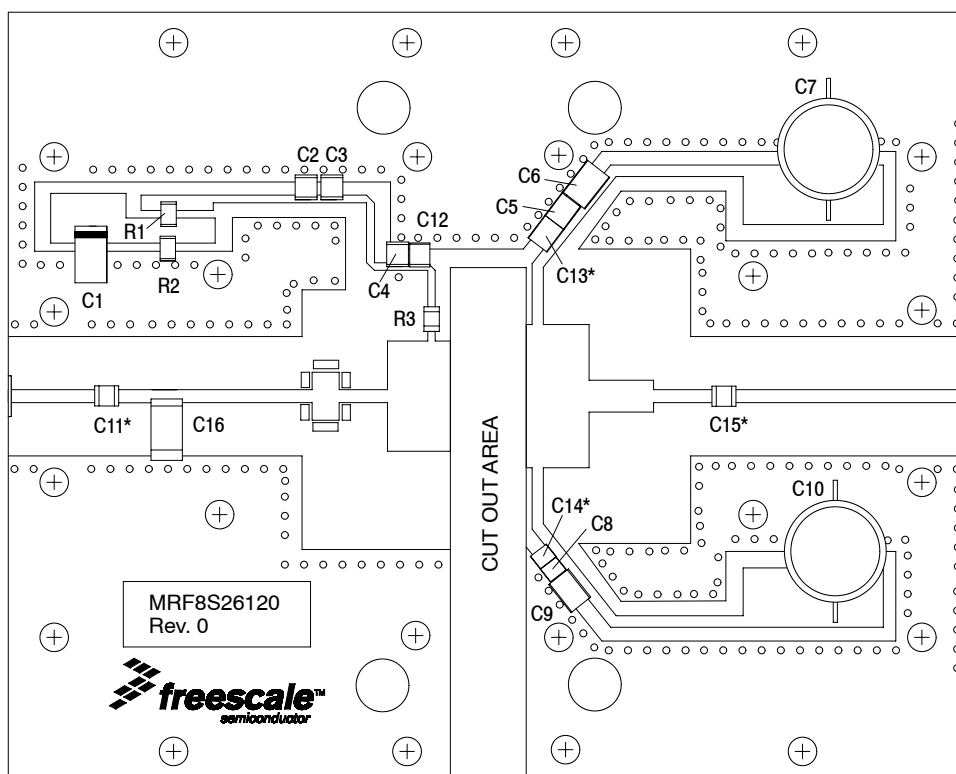
1. Part internally matched both on input and output.

(continued)

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

Characteristic	Symbol	Min	Typ	Max	Unit
Typical Performances (In Freescale Test Fixture, 50 ohm system) $V_{DD} = 28\text{ Vdc}$, $I_{DQ} = 900\text{ mA}$, 2620–2690 MHz Bandwidth					
P_{out} @ 1 dB Compression Point, CW	P_{1dB}	—	110	—	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 $> 2\text{ dB}$)	IMD_{sym}	—	18	—	MHz
VBW Resonance Point (IMD Third Order Intermodulation Inflection Point)	VBW_{res}	—	65	—	MHz
Gain Flatness in 70 MHz Bandwidth @ $P_{out} = 28\text{ W Avg.}$	G_F	—	0.1	—	dB
Gain Variation over Temperature (-30°C to $+85^\circ\text{C}$)	ΔG	—	0.015	—	dB/ $^\circ\text{C}$
Output Power Variation over Temperature (-30°C to $+85^\circ\text{C}$) (1)	ΔP_{1dB}	—	0.007	—	dB/ $^\circ\text{C}$

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



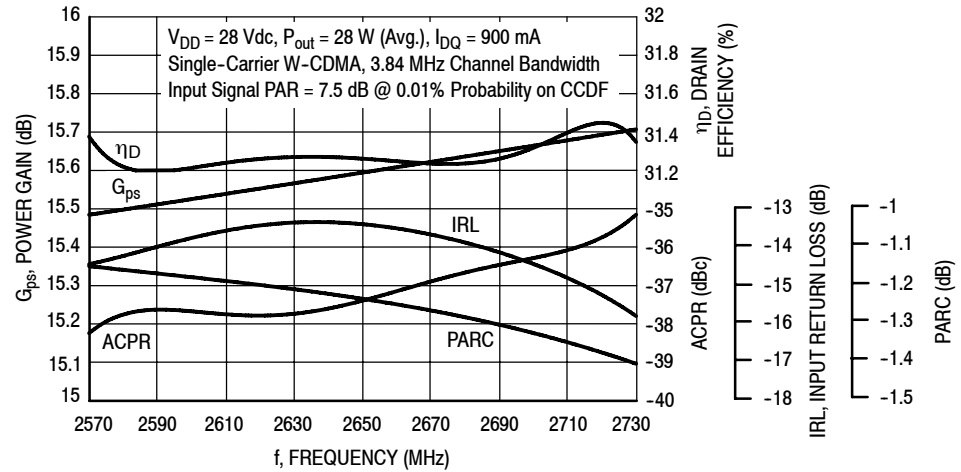
*C11, C13, C14, and C15 are mounted vertically.

Figure 1. MRF8S26120HR3(HSR3) Test Circuit Component Layout

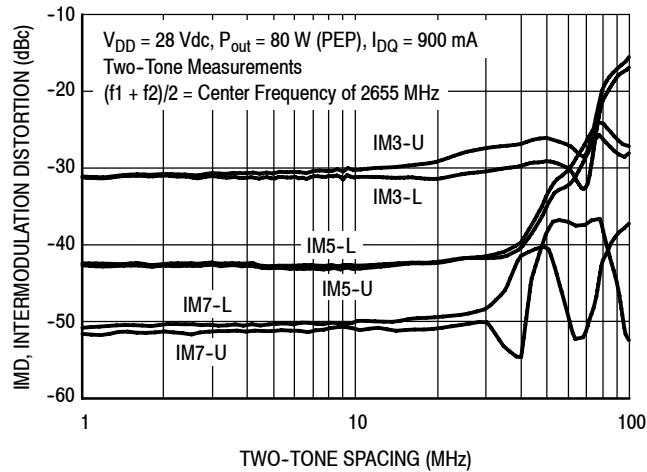
Table 5. MRF8S26120HR3(HSR3) Test Circuit Component Designations and Values

Part	Description	Part Number	Manufacturer
C1	22 μ F, 35 V Tantalum Capacitor	T494X226K035AT	Kemet
C2	330 nF, 100 V Chip Capacitor	C3225X7R2A334KT	TDK
C3	15 nF, 100 V Chip Capacitor	C3225C0G2A153JT	TDK
C4, C5, C8	2.2 μ F, 100 V Chip Capacitors	C3225X7R2A225KT	TDK
C6, C9	22 μ F, 50 V Chip Capacitors	C5750JF1H226ZT	TDK
C7, C10	470 μ F, 63 V Electrolytic Capacitors	MCGPR63V477M13X26-RH	Multicomp
C11, C12, C13, C14, C15	27 pF Chip Capacitors	ATC800B270JT500XT	ATC
C16	0.8 pF Chip Capacitor	ATC100B0R8BT500XT	ATC
R1	1 k Ω , 1/4 W Chip Resistor	CRCW12061K00FKEA	Vishay
R2	10 k Ω , 1/4 W Chip Resistor	CRCW120610K0FKEA	Vishay
R3	7.5 Ω , 1/4 W Chip Resistor	CRCW12067R50FNEA	Vishay
PCB	0.030", $\epsilon_r = 3.5$	RF-35	Taconic

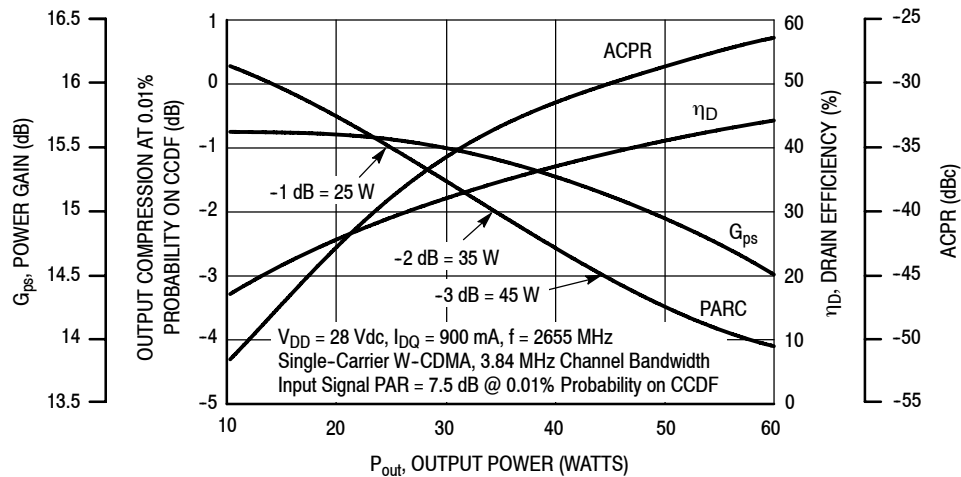
TYPICAL CHARACTERISTICS



**Figure 2. Output Peak-to-Average Ratio Compression (PARC)
Broadband Performance @ $P_{out} = 28$ 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

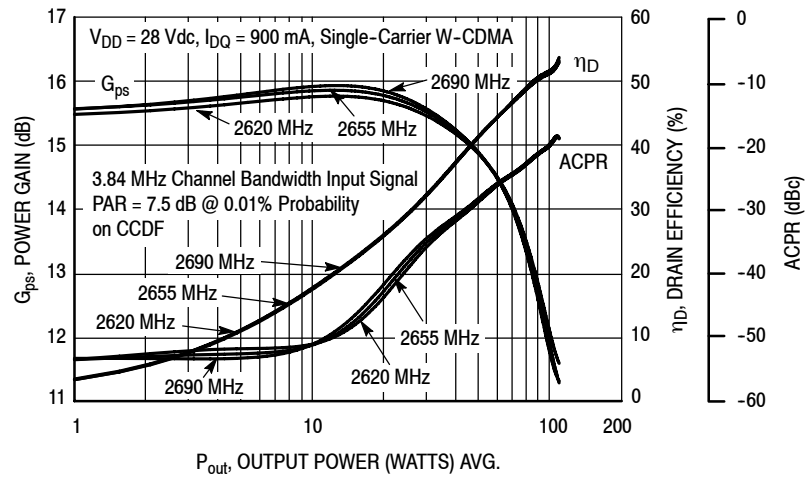


Figure 5. Single-Carrier W-CDMA Power Gain, Drain Efficiency and ACPR versus Output Power

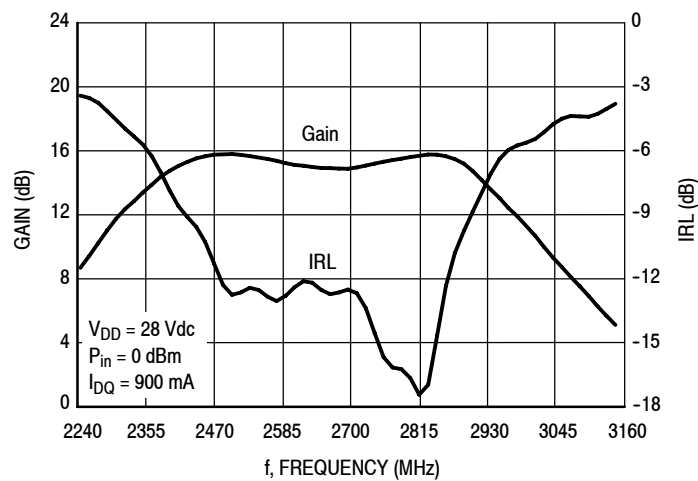


Figure 6. Broadband Frequency Response

W-CDMA TEST SIGNAL

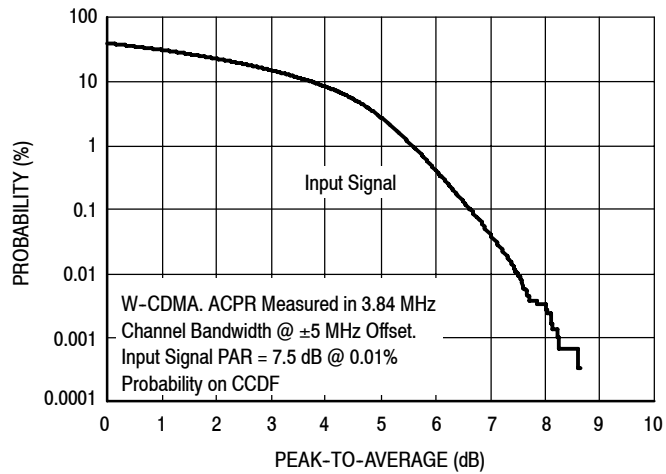


Figure 7. CCDF W-CDMA IQ Magnitude Clipping, Single-Carrier Test Signal

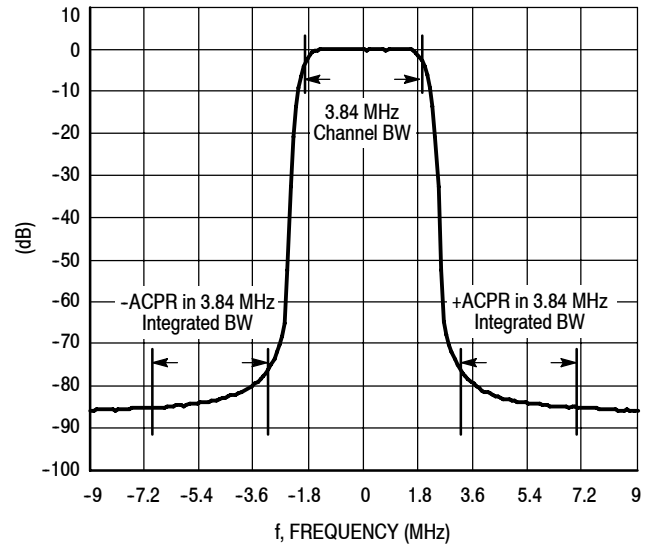


Figure 8. Single-Carrier W-CDMA Spectrum

$V_{DD} = 28 \text{ Vdc}$, $I_{DQ} = 900 \text{ mA}$, $P_{out} = 28 \text{ W Avg.}$

f MHz	Z_{source} Ω	Z_{load} Ω
2570	$5.21 - j5.62$	$3.17 - j4.27$
2590	$5.26 - j5.33$	$3.15 - j4.20$
2610	$5.31 - j5.02$	$3.12 - j4.12$
2630	$5.35 - j4.71$	$3.10 - j4.04$
2650	$5.39 - j4.39$	$3.07 - j3.96$
2670	$5.46 - j4.05$	$3.06 - j3.88$
2690	$5.53 - j3.77$	$3.06 - j3.82$
2710	$5.57 - j3.47$	$3.05 - j3.77$
2730	$5.59 - j3.15$	$3.05 - j3.73$

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

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

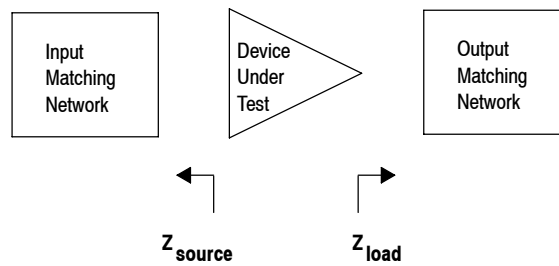
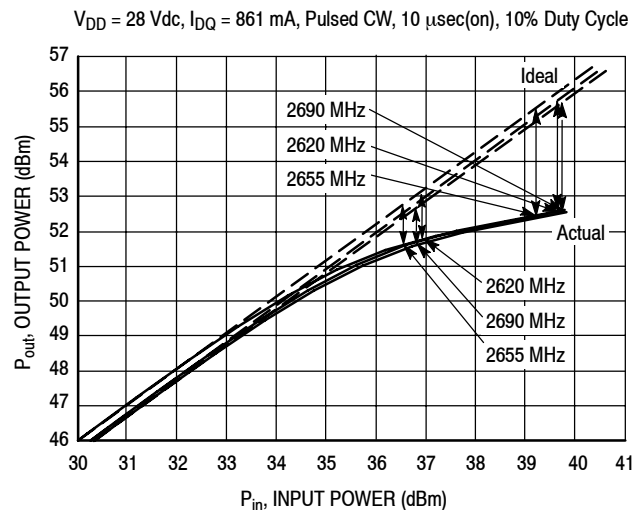


Figure 9. Series Equivalent Source and Load Impedance

ALTERNATIVE PEAK TUNE LOAD PULL CHARACTERISTICS



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

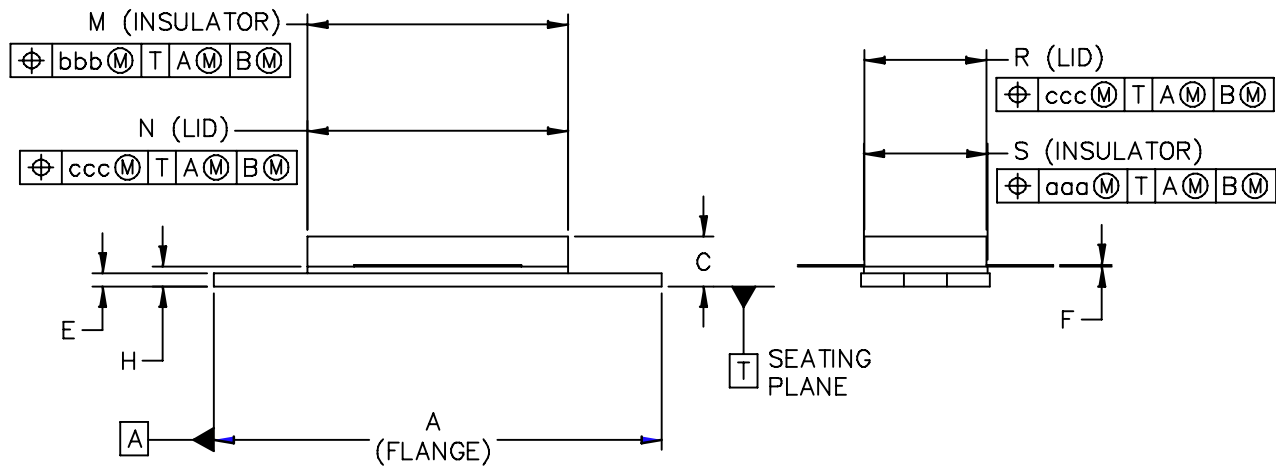
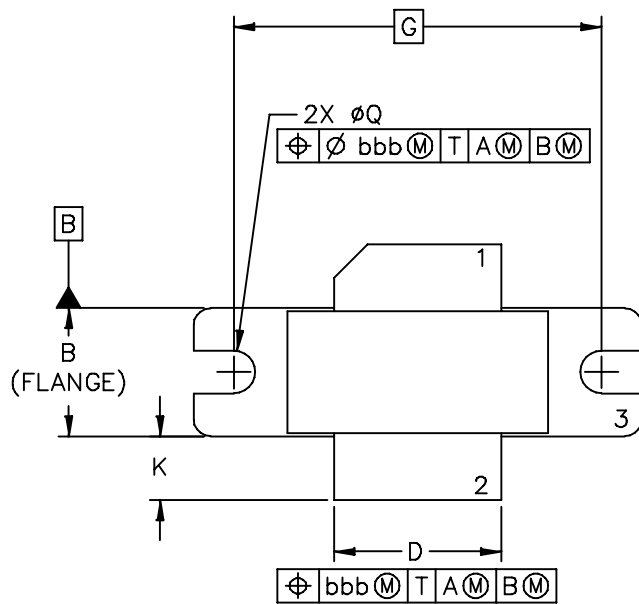
f (MHz)	P1dB		P3dB	
	Watts	dBm	Watts	dBm
2620	149	51.7	182	52.6
2655	144	51.6	177	52.5
2690	146	51.6	179	52.5

Test Impedances per Compression Level

f (MHz)		Z_{source} Ω	Z_{load} Ω
2620	P1dB	$5.83 - j7.00$	$1.44 - j2.87$
2655	P1dB	$7.87 - j6.87$	$1.72 - j3.15$
2690	P1dB	$9.46 - j5.13$	$1.52 - j3.20$

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

PACKAGE DIMENSIONS



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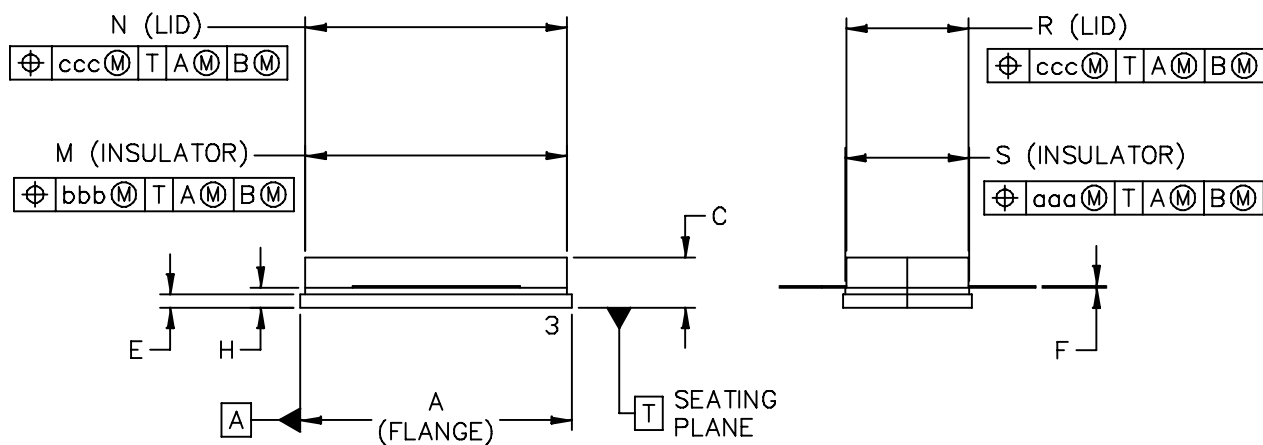
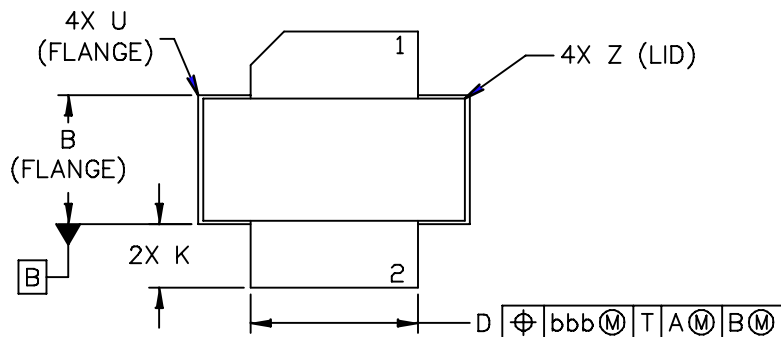
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2. CONTROLLING DIMENSION: INCH.
3. DELETED
4. DIMENSION H IS MEASURED .030 (.762) AWAY FROM PACKAGE BODY.

STYLE 1:

- PIN 1. DRAIN
2. GATE
3. SOURCE

DIM	INCH MIN MAX	MILLIMETER MIN MAX	DIM	INCH MIN MAX	MILLIMETER MIN MAX
A	1.335 – 1.345	33.91 – 34.16	R	.365 – .375	9.27 – 9.53
B	.380 – .390	9.65 – 9.91	S	.365 – .375	9.27 – 9.52
C	.125 – .170	3.18 – 4.32	aaa	– .005 –	– 0.127 –
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	.170 – .210	4.32 – 5.33	–	– – –	– – –
M	.774 – .786	19.66 – 19.96	–	– – –	– – –
N	.772 – .788	19.6 – 20	–	– – –	– – –
Q	Ø.118 – Ø.138	Ø3 – Ø3.51	–	– – –	– – –
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STYLE 1:

- PIN 1. DRAIN
2. GATE
3. SOURCE

INCH			MILLIMETER			INCH			MILLIMETER		
DIM	MIN	MAX	MIN	MAX		DIM	MIN	MAX	MIN	MAX	
A	.805	— .815	20.45	— 20.7		U	— — .040		— — 1.02		
B	.380	— .390	9.65	— 9.91		Z	— — .030		— — 0.76		
C	.125	— .170	3.18	— 4.32		aaa	— .005 —		— 0.127 —		
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		—	— — —		— — —		
H	.057	— .067	1.45	— 1.7		—	— — —		— — —		
K	.170	— .210	4.32	— 5.33		—	— — —		— — —		
M	.774	— .786	19.61	— 20.02		—	— — —		— — —		
N	.772	— .788	19.61	— 20.02		—	— — —		— — —		
R	.365	— .375	9.27	— 9.53		—	— — —		— — —		
S	.365	— .375	9.27	— 9.52		—	— — —		— — —		
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					CASE NUMBER: 465A—06				31 MAR 2005		
					STANDARD: NON—JEDEC						

PRODUCT DOCUMENTATION 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, 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	June 2010	• Initial Release of Data Sheet

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