Freescale Semiconductor
Technical Data

Document Number: MRF8S26120H
Rev. 0, 6/2010

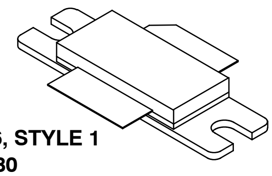
RoHS

RF Power Field Effect Transistors

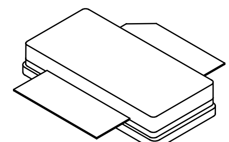
N-Channel Enhancement-Mode Lateral MOSFETs

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

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 ≃ 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.

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°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

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

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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°C unless otherwise noted)

Characteristic	Symbol	Min	Typ	Max	Unit
Off Characteristics					
Zero Gate Voltage Drain Leakage Current (V_{DS} = 65 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 = 172 μAdc)	$V_{GS(th)}$	1.2	2.0	2.7	Vdc
Gate Quiescent Voltage (V_{DD} = 28 Vdc, I_D = 900 mAdc, Measured in Functional Test)	$V_{GS(Q)}$	1.5	2.6	3.0	Vdc
Drain-Source On-Voltage (V_{GS} = 10 Vdc, I_D = 1.7 Adc)	$V_{DS(on)}$	0.1	0.24	0.3	Vdc

Functional Tests (1) (In Freescale Test Fixture, 50 ohm system) V_{DD} = 28 Vdc, I_{DQ} = 900 mA, P_{out} = 28 W Avg., f = 2690 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 @ ±5 MHz Offset.

Characteristic	Symbol	Min	Typ	Max	Unit
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 Vdc, I_{DQ} = 900 mA, P_{out} = 28 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 @ ±5 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

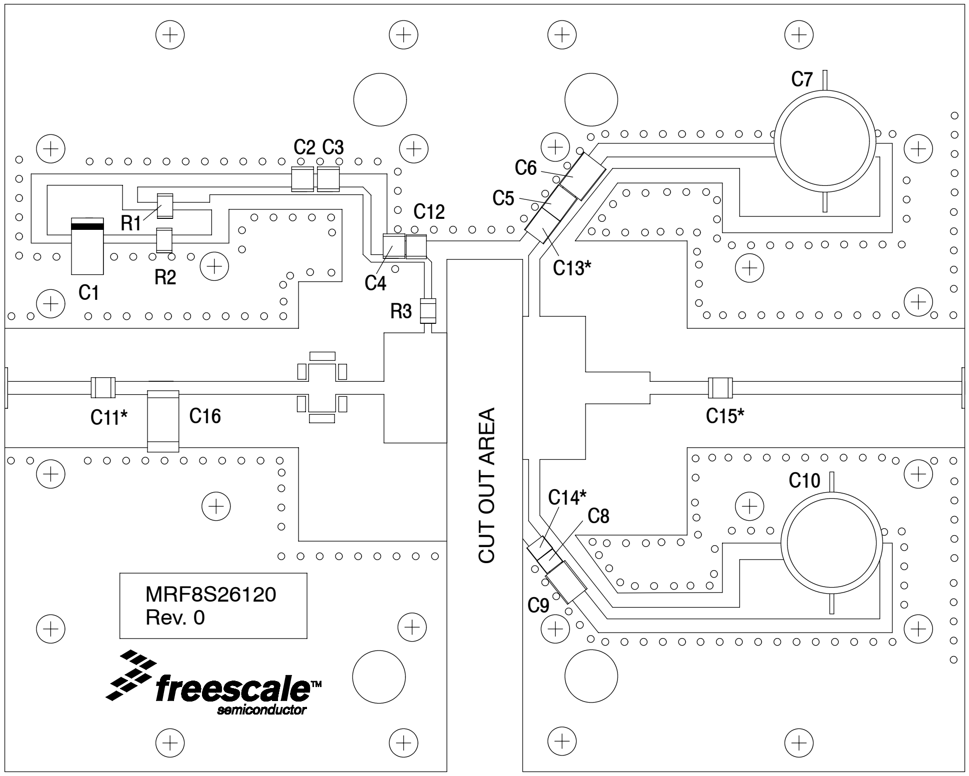
1. Part internally matched both on input and output.

(continued)

Table 4. Electrical Characteristics (T_A = 25°C unless otherwise noted) **(continued)**

Characteristic	Symbol	Min	Typ	Max	Unit
Typical Performances (In Freescale Test Fixture, 50 ohm system) V_{DD} = 28 Vdc, I_{DQ} = 900 mA, 2620-2690 MHz Bandwidth					
P_{out} @ 1 dB Compression Point, CW	P1dB	—	110	—	W
IMD Symmetry @ 80 W PEP, P_{out} where IMD Third Order Intermodulation ≅ 30 dBc (Delta IMD Third Order Intermodulation between Upper and Lower Sidebands > 2 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 W Avg.	G_F	—	0.1	—	dB
Gain Variation over Temperature (-30°C to +85°C)	ΔG	—	0.015	—	dB/°C
Output Power Variation over Temperature (-30°C to +85°C) [(1)]	ΔP1dB	—	0.007	—	dB/°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 μF, 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 μF, 100 V Chip Capacitors	C3225X7R2A225KT	TDK
C6, C9	22 μF, 50 V Chip Capacitors	C5750JF1H226ZT	TDK
C7, C10	470 μF, 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 kΩ, 1/4 W Chip Resistor	CRCW12061K00FKEA	Vishay
R2	10 kΩ, 1/4 W Chip Resistor	CRCW120610K0FKEA	Vishay
R3	7.5 Ω, 1/4 W Chip Resistor	CRCW12067R50FNEA	Vishay
PCB	0.030″, ε_r = 3.5	RF-35	Taconic

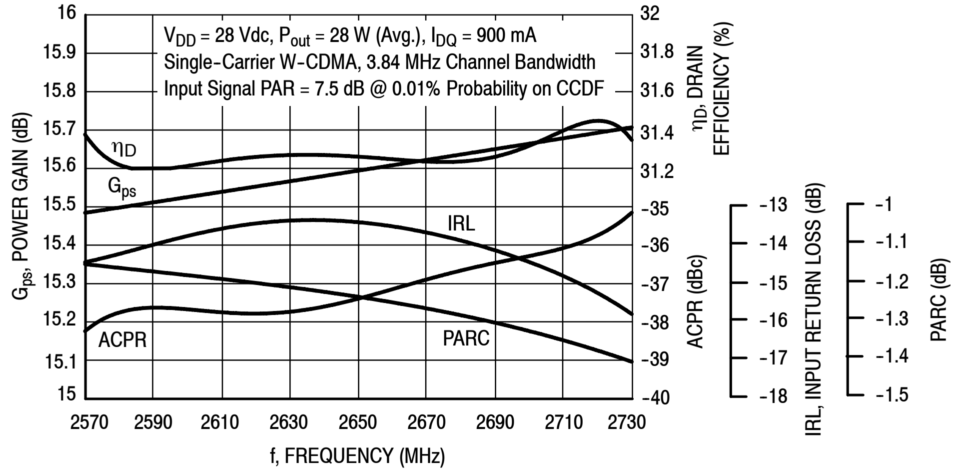


Figure 2. Output Peak-to-Average Ratio Compression (PARC) Broadband Performance @ P_{out} = 28 Watts Avg.

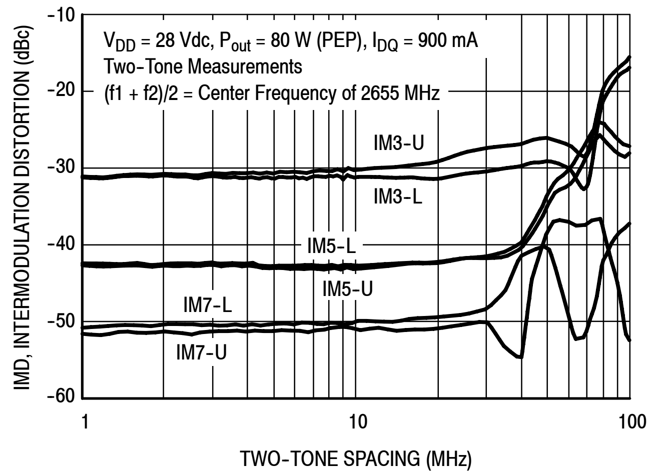


Figure 3. Intermodulation Distortion Products versus Two-Tone Spacing

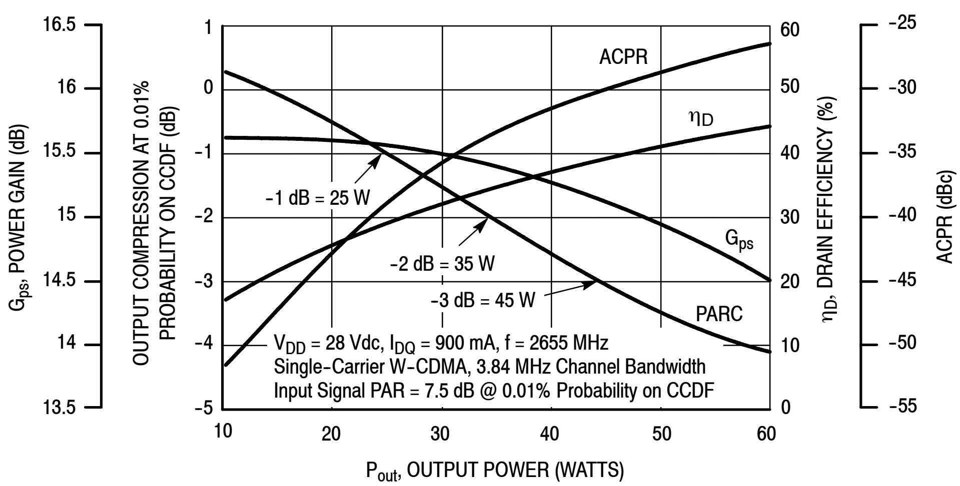


Figure 4. Output Peak-to-Average Ratio Compression (PARC) versus Output Power

TYPICAL CHARACTERISTICS

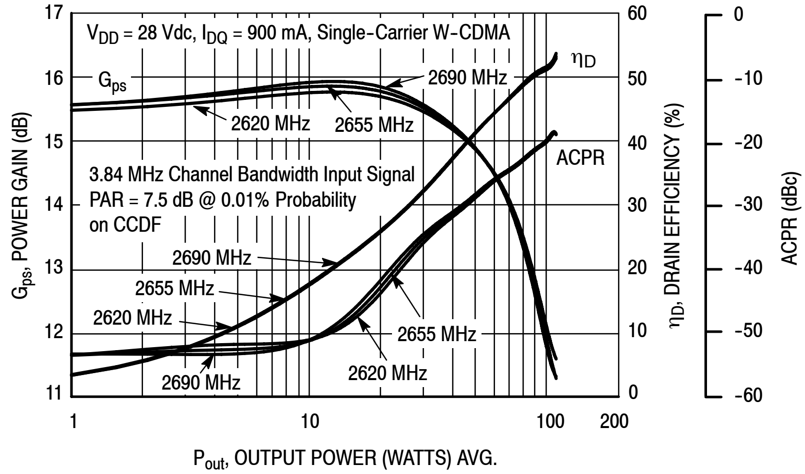


Figure 5. Single-Carrier W-CDMA Power Gain, Drain Efficiency and ACPR versus Output Power

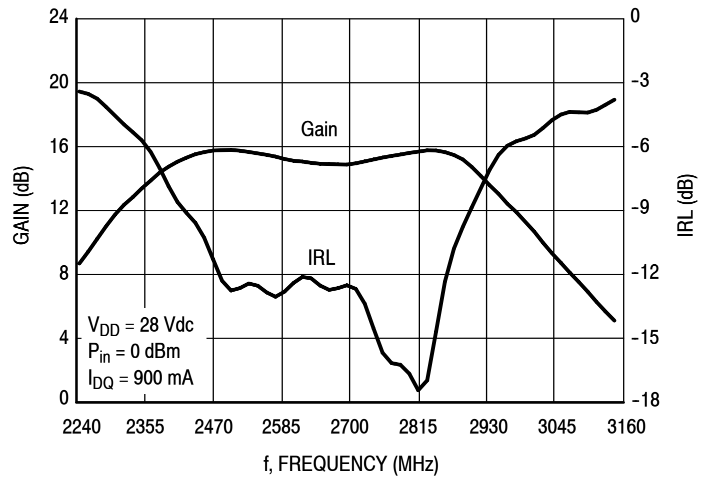


Figure 6. Broadband Frequency Response

W-CDMA TEST SIGNAL

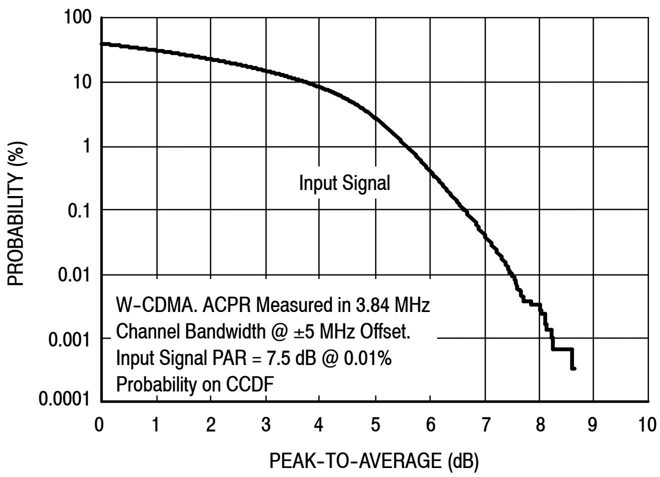


Figure 7. CCDF W-CDMA IQ Magnitude Clipping, Single-Carrier Test Signal

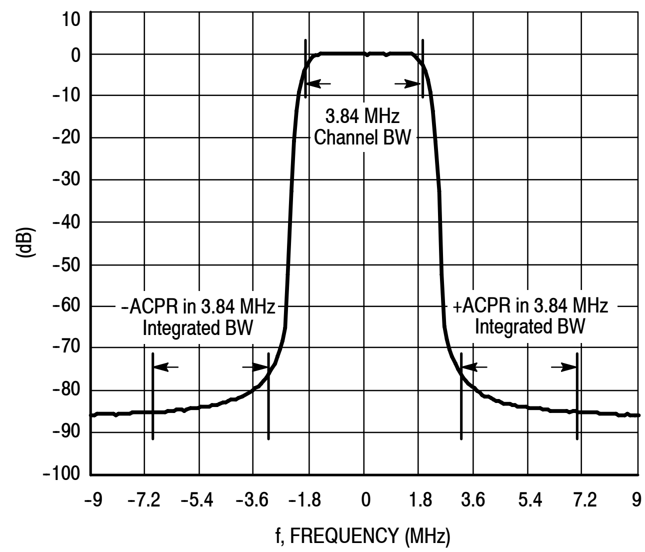


Figure 8. Single-Carrier W-CDMA Spectrum

V_{DD} = 28 Vdc, I_{DQ} = 900 mA, P_{out} = 28 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.

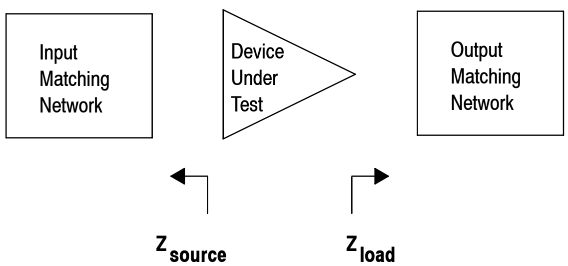
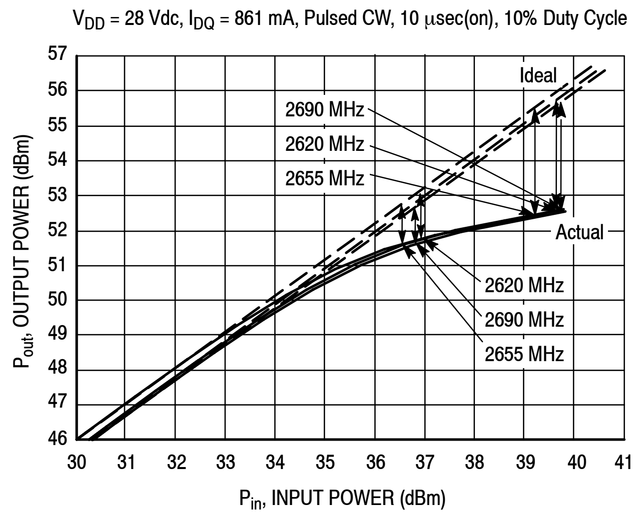


Figure 9. Series Equivalent Source and Load Impedance

ALTERNATIVE PEAK TUNE LOAD PULL CHARACTERISTICS



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

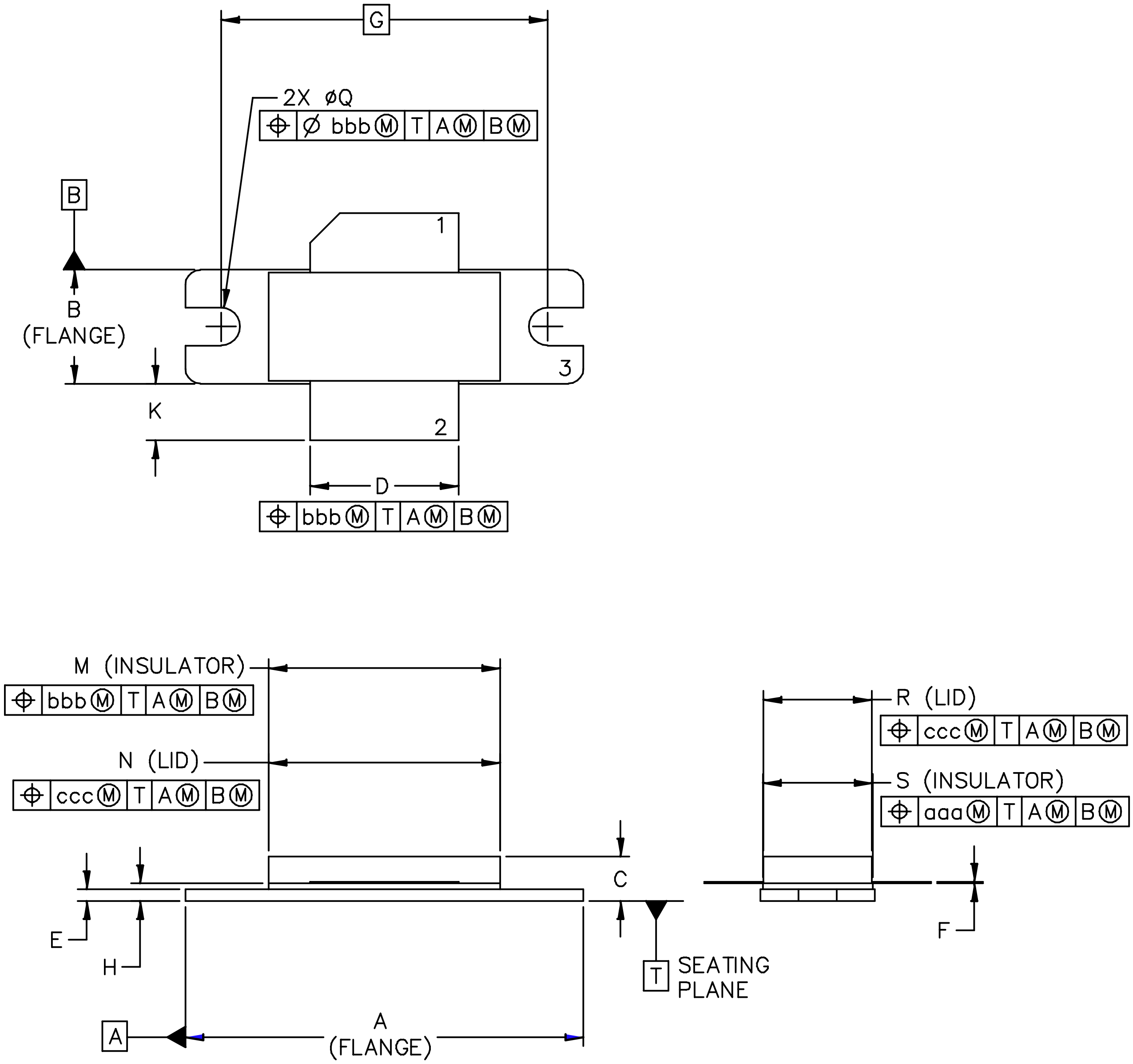
f (MHz)	P1dB		P3dB	
	Watts	dBm	Watts	dBm
2620	149	51.7	182	52.6
2655	144	51.6	177	52.5
2690	146	51.6	179	52.5

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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	CASE NUMBER: 465–06	31 MAR 2005
	STANDARD: NON–JEDEC	

NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M—1994.
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		INCH MAX	MILLIMETER MIN		MILLIMETER MAX	DIM	INCH MIN		INCH MAX	MILLIMETER MIN		MILLIMETER 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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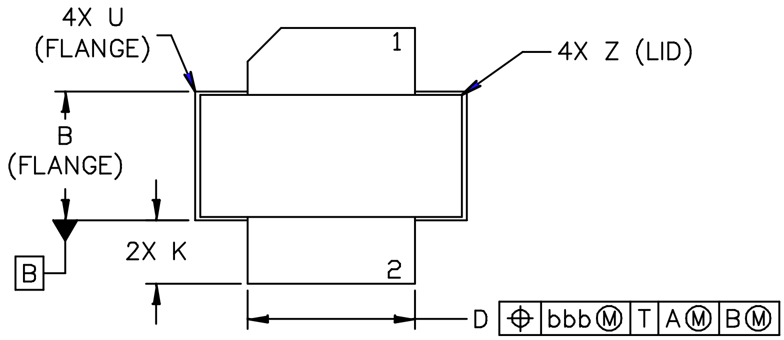

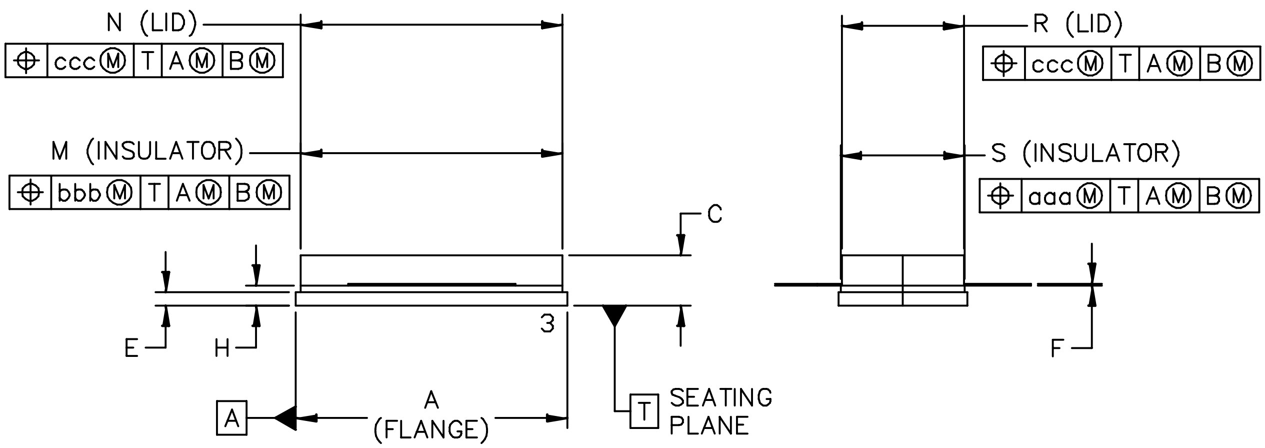

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3. DELETED

4. DIMENSION H IS MEASURED .030 (0.762) AWAY FROM PACKAGE BODY.

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

DIM	INCH MIN		INCH MAX	MILLIMETER MIN		MILLIMETER MAX	DIM	INCH MIN		INCH MAX	MILLIMETER MIN		MILLIMETER 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	–	–	–	–	–	–	–

MECHANICAL OUTLINE

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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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