

# RF Power Field-Effect Transistors

## N-Channel Enhancement-Mode Lateral MOSFETs

Designed primarily for CW large-signal output and driver applications with frequencies up to 450 MHz. Devices are unmatched and are suitable for use in industrial, medical and scientific applications.

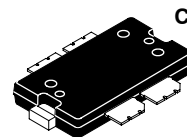
- Typical CW Performance at 220 MHz:  $V_{DD} = 50$  Volts,  $I_{DQ} = 450$  mA,  $P_{out} = 150$  Watts  
 Power Gain — 25 dB  
 Drain Efficiency — 68.3%
- Capable of Handling 10:1 VSWR, @ 50 Vdc, 220 MHz, 150 Watts CW Output Power

### Features

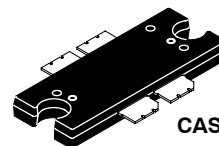
- Characterized with Series Equivalent Large-Signal Impedance Parameters
- Qualified Up to a Maximum of 50  $V_{DD}$  Operation
- Integrated ESD Protection
- 225°C Capable Plastic Package
- RoHS Compliant
- In Tape and Reel. R1 Suffix = 500 Units per 44 mm, 13 inch Reel.

**MRF6V2150NR1**  
**MRF6V2150NBR1**

**10-450 MHz, 150 W, 50 V**  
**LATERAL N-CHANNEL**  
**SINGLE-ENDED**  
**BROADBAND**  
**RF POWER MOSFETs**



**CASE 1486-03, STYLE 1**  
**TO-270 WB-4**  
**PLASTIC**  
**MRF6V2150NR1**



**CASE 1484-04, STYLE 1**  
**TO-272 WB-4**  
**PLASTIC**  
**MRF6V2150NBR1**

**PARTS ARE SINGLE-ENDED**

**Table 1. Maximum Ratings**

Rating	Symbol	Value	Unit
Drain-Source Voltage	$V_{DSS}$	-0.5, +110	Vdc
Gate-Source Voltage	$V_{GS}$	-0.5, +12	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

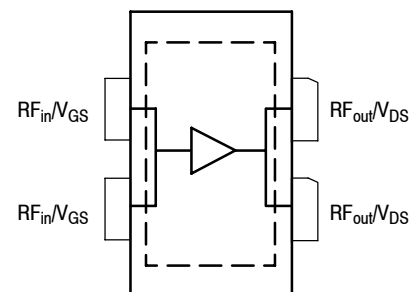
**Table 2. Thermal Characteristics**

Characteristic	Symbol	Value (2,3)	Unit
Thermal Resistance, Junction to Case Case Temperature 80°C, 150 W CW	$R_{\theta JC}$	0.24	°C/W

**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)

1. Continuous use at maximum temperature will affect MTF.
2. MTF calculator available at <http://www.freescale.com/rf>. Select Software & Tools/Development Tools/Calculators to access MTF 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.



(Top View)

Note: Exposed backside of the package is the source terminal for the transistor.

**Figure 1. Pin Connections**

**Table 4. Moisture Sensitivity Level**

Test Methodology	Rating	Package Peak Temperature	Unit
Per JESD22-A113, IPC/JEDEC J-STD-020	3	260	°C

**Table 5. 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 ( $V_{DS} = 100\text{ Vdc}$ , $V_{GS} = 0\text{ Vdc}$ )	$I_{DSS}$	—	—	2.5	mA
Zero Gate Voltage Drain Leakage Current ( $V_{DS} = 50\text{ Vdc}$ , $V_{GS} = 0\text{ Vdc}$ )	$I_{DSS}$	—	—	50	$\mu\text{Adc}$
Drain-Source Breakdown Voltage ( $I_D = 75\text{ mA}$ , $V_{GS} = 0\text{ Vdc}$ )	$V_{(BR)DSS}$	110	—	—	Vdc
Gate-Source Leakage Current ( $V_{GS} = 5\text{ Vdc}$ , $V_{DS} = 0\text{ Vdc}$ )	$I_{GSS}$	—	—	10	$\mu\text{Adc}$

**On Characteristics**

Gate Threshold Voltage ( $V_{DS} = 10\text{ Vdc}$ , $I_D = 400\ \mu\text{Adc}$ )	$V_{GS(th)}$	1	1.62	3	Vdc
Gate Quiescent Voltage ( $V_{DD} = 50\text{ Vdc}$ , $I_D = 450\text{ mAdc}$ , Measured in Functional Test)	$V_{GS(Q)}$	1.5	2.6	3.5	Vdc
Drain-Source On-Voltage ( $V_{GS} = 10\text{ Vdc}$ , $I_D = 1\text{ Adc}$ )	$V_{DS(on)}$	—	0.26	—	Vdc

**Dynamic Characteristics**

Reverse Transfer Capacitance ( $V_{DS} = 50\text{ Vdc} \pm 30\text{ mV(rms)ac}$ @ 1 MHz, $V_{GS} = 0\text{ Vdc}$ )	$C_{rss}$	—	1.6	—	pF
Output Capacitance ( $V_{DS} = 50\text{ Vdc} \pm 30\text{ mV(rms)ac}$ @ 1 MHz, $V_{GS} = 0\text{ Vdc}$ )	$C_{oss}$	—	93	—	pF
Input Capacitance ( $V_{DS} = 50\text{ Vdc}$ , $V_{GS} = 0\text{ Vdc} \pm 30\text{ mV(rms)ac}$ @ 1 MHz)	$C_{iss}$	—	163	—	pF

**Functional Tests** (In Freescale Test Fixture, 50 ohm system)  $V_{DD} = 50\text{ Vdc}$ ,  $I_{DQ} = 450\text{ mA}$ ,  $P_{out} = 150\text{ W}$ ,  $f = 220\text{ MHz}$ , CW

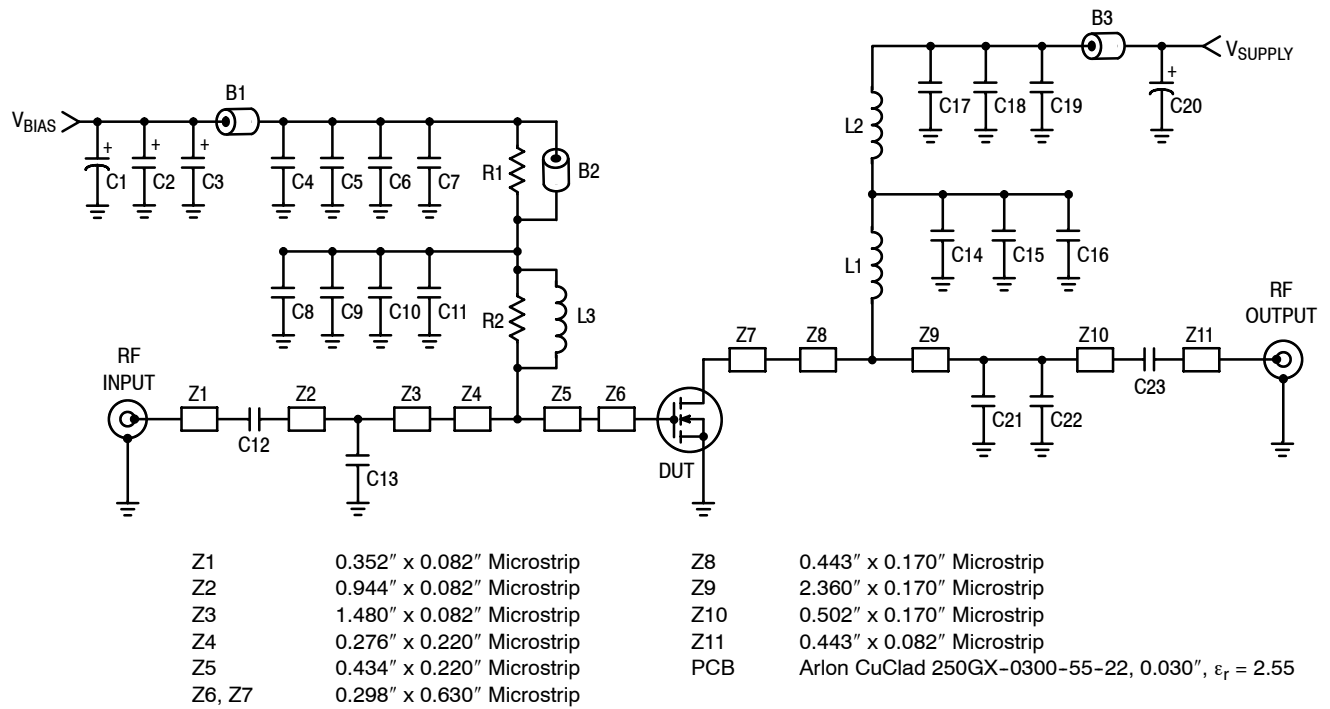
Power Gain	$G_{ps}$	23.5	25	26.5	dB
Drain Efficiency	$\eta_D$	66	68.3	—	%
Input Return Loss	IRL	—	-17	-9	dB

**Typical Performances** (In Freescale 27 MHz and 450 MHz Test Fixtures, 50 ohm system)  $V_{DD} = 50\text{ Vdc}$ ,  $I_{DQ} = 450\text{ mA}$ ,  $P_{out} = 150\text{ W}$  CW

Power Gain	$f = 27\text{ MHz}$	$G_{ps}$	—	32.3	—	dB
	$f = 450\text{ MHz}$		—	22.9	—	
Drain Efficiency	$f = 27\text{ MHz}$	$\eta_D$	—	78.7	—	%
	$f = 450\text{ MHz}$		—	57.6	—	
Input Return Loss	$f = 27\text{ MHz}$	IRL	—	-10.6	—	dB
	$f = 450\text{ MHz}$		—	-17.6	—	



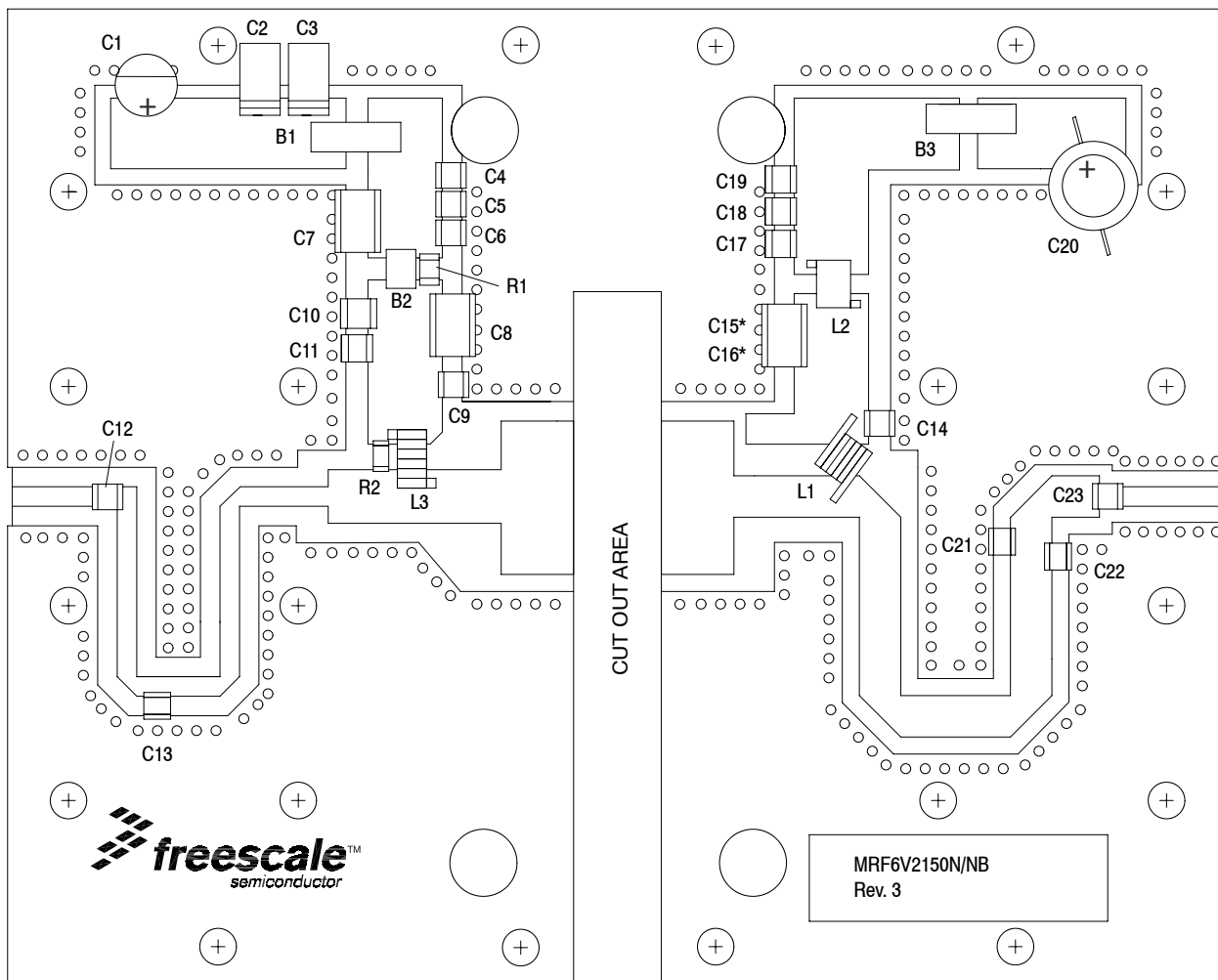
ATTENTION: The MRF6V2150N and MRF6V2150NB are high power devices and special considerations must be followed in board design and mounting. Incorrect mounting can lead to internal temperatures which exceed the maximum allowable operating junction temperature. Refer to Freescale Application Note AN3263 (for bolt down mounting) or AN1907 (for solder reflow mounting) **PRIOR TO STARTING SYSTEM DESIGN** to ensure proper mounting of these devices.



**Figure 2. MRF6V2150NR1(NBR1) Test Circuit Schematic — 220 MHz**

**Table 6. MRF6V2150NR1(NBR1) Test Circuit Component Designations and Values — 220 MHz**

Part	Description	Part Number	Manufacturer
B1, B2	95 $\Omega$ , 100 MHz Long Ferrite Beads, Surface Mount	2743021447	Fair-Rite
B3	47 $\Omega$ , 100 MHz Short Ferrite Bead, Surface Mount	2743019447	Fair-Rite
C1	47 $\mu$ F, 50 V Electrolytic Capacitor	476KXM063M	Illinois Capacitor
C2	22 $\mu$ F, 35 V Tantalum Chip Capacitor	T494X226K035AT	Kemet
C3	10 $\mu$ F, 35 V Tantalum Chip Capacitor	T491D106K035AT	Kemet
C4, C17	39 K pF Chip Capacitors	ATC200B393KT50XT	ATC
C5, C18	22 K pF Chip Capacitors	ATC200B203KT50XT	ATC
C6, C11, C19	0.1 $\mu$ F, 50 V Chip Capacitors	CDR33BX104AKYS	Kemet
C7, C8, C15, C16	2.2 $\mu$ F, 50 V Chip Capacitors	C1825C225J5RAC	Kemet
C9, C12, C14, C23	1000 pF Chip Capacitors	ATC100B102JT50XT	ATC
C10	220 nF Chip Capacitor	C1812C224K5RAC	Kemet
C13	75 pF Chip Capacitor	ATC100B750JT500XT	ATC
C20	470 $\mu$ F, 63 V Electrolytic Capacitor	ESME630ELL471MK25S	United Chemi-Con
C21	30 pF Chip Capacitor	ATC100B300JT500XT	ATC
C22	33 pF Chip Capacitor	ATC100B330JT500XT	ATC
L1	4 Turn #18 AWG, 0.18" ID	None	None
L2	82 nH Inductor	1812SMS-82NJL	Coilcraft
L3	17.5 nH Inductor	B06TJL	Coilcraft
R1	270 $\Omega$ , 1/4 W Chip Resistor	CRCW12062700FKEA	Vishay
R2	27 $\Omega$ , 1/4 W Chip Resistor	CRCW12064R75FKEA	Vishay



\* Stacked

Figure 3. MRF6V2150NR1(NBR1) Test Circuit Component Layout — 220 MHz

## TYPICAL CHARACTERISTICS

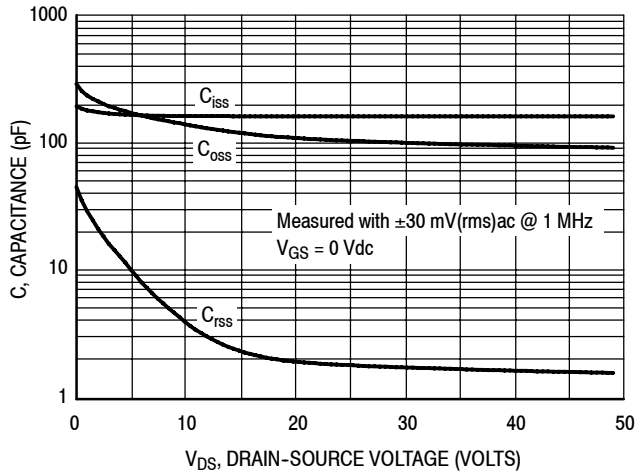


Figure 4. Capacitance versus Drain-Source Voltage

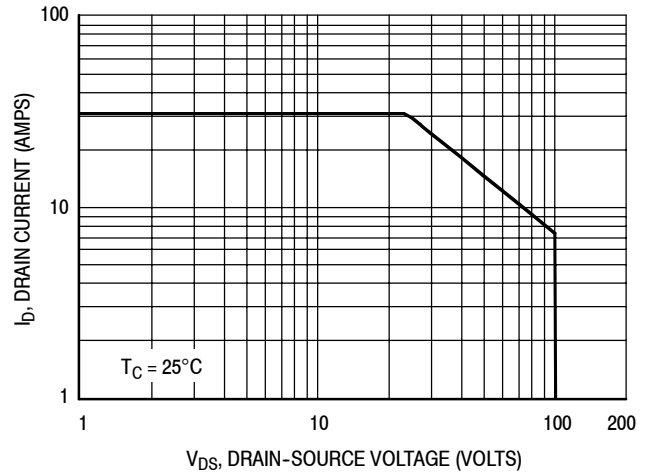


Figure 5. DC Safe Operating Area

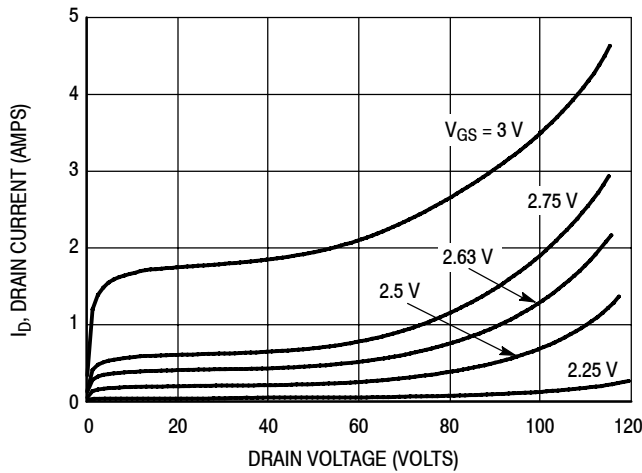


Figure 6. DC Drain Current versus Drain Voltage

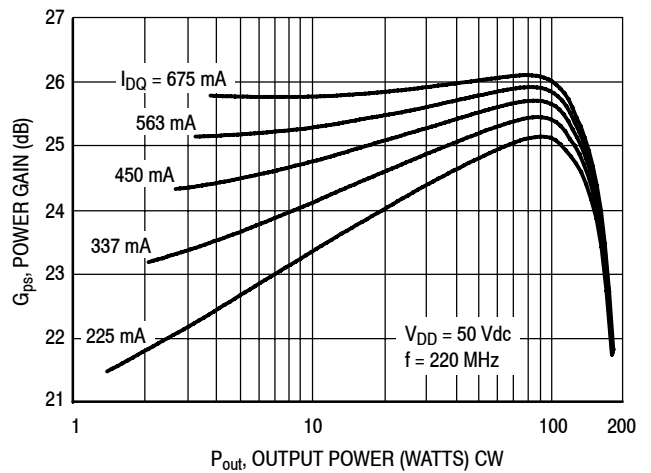


Figure 7. CW Power Gain versus Output Power

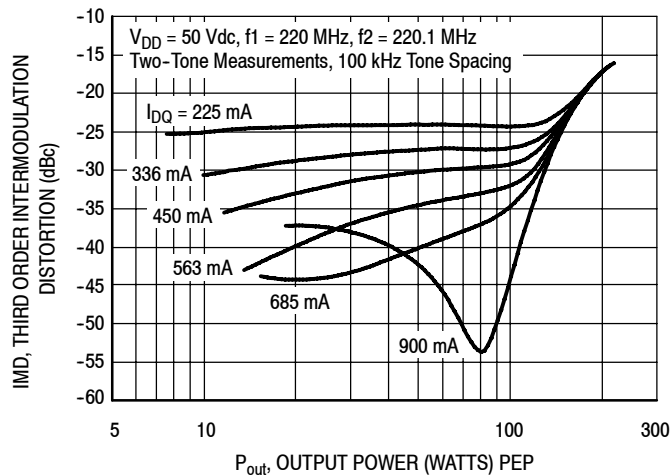


Figure 8. Third Order Intermodulation Distortion versus Output Power

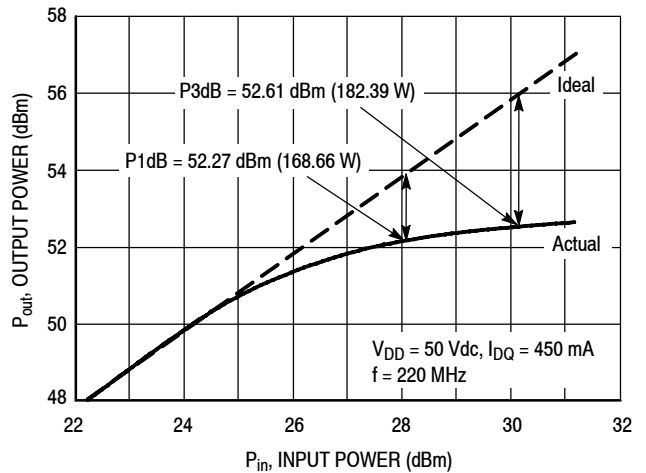
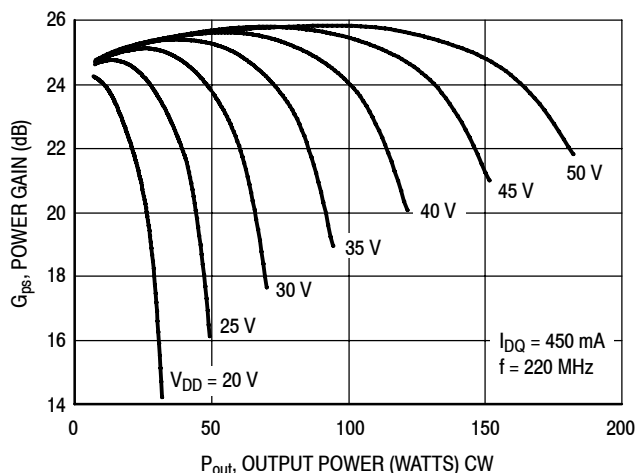
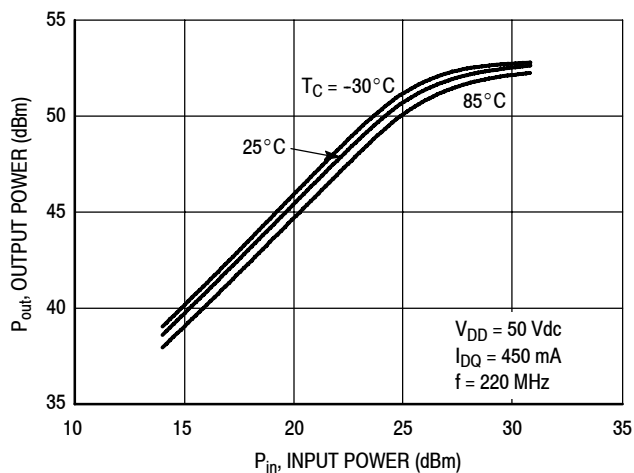


Figure 9. CW Output Power versus Input Power

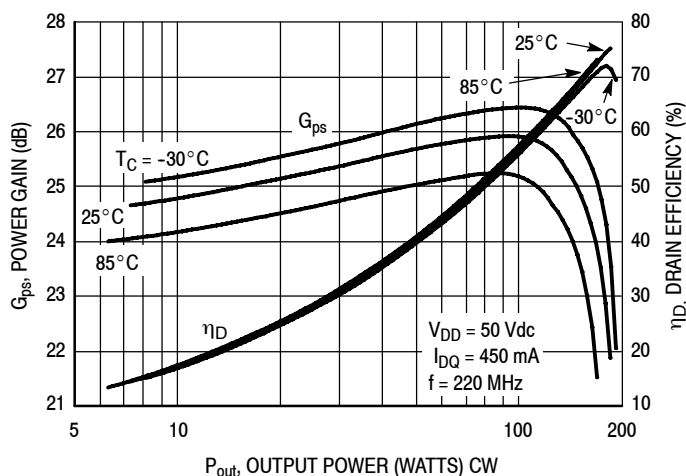
### TYPICAL CHARACTERISTICS



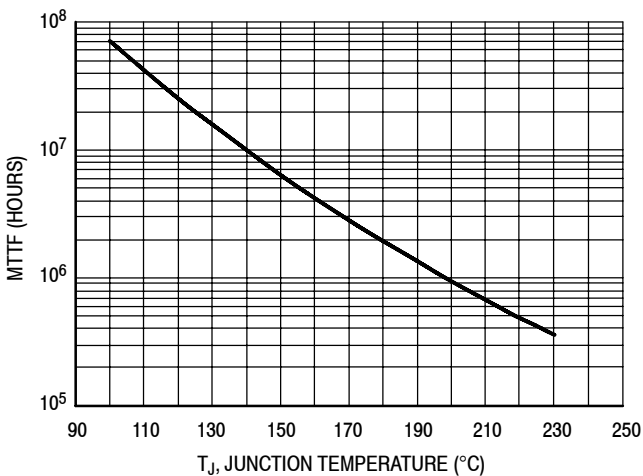
**Figure 10. Power Gain versus Output Power**



**Figure 11. Power Output versus Power Input**



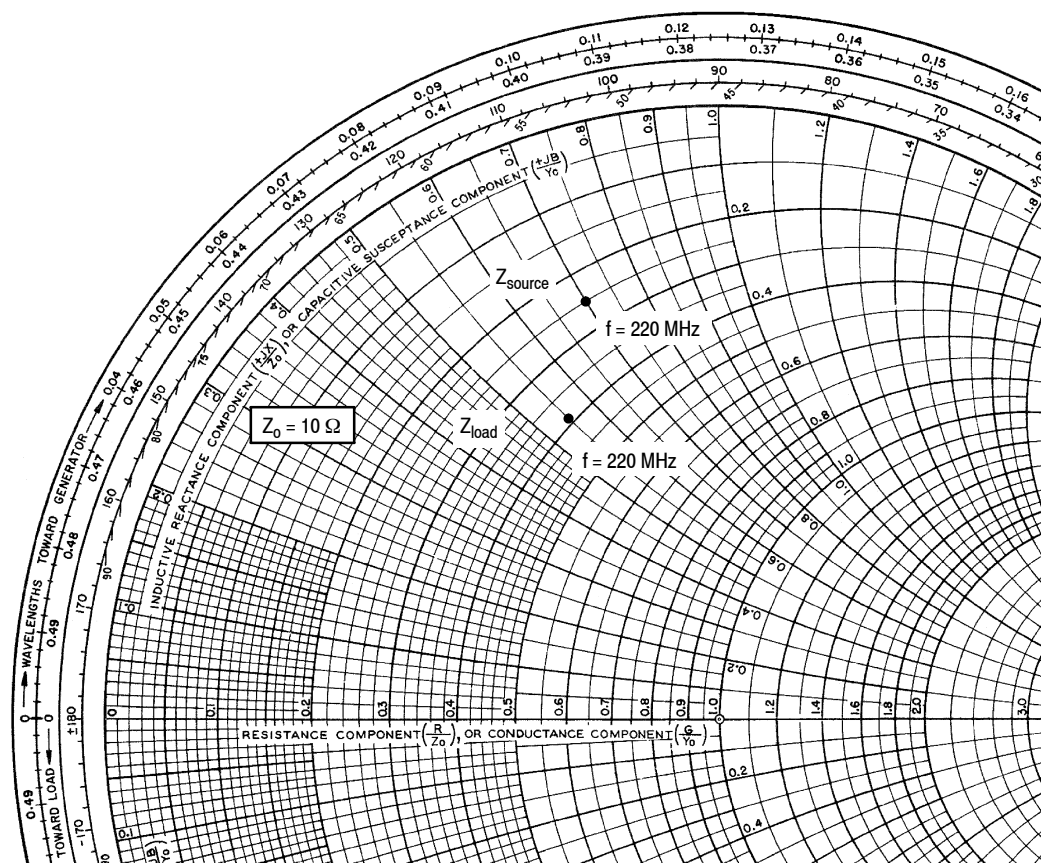
**Figure 12. Power Gain and Drain Efficiency versus CW Output Power**



This above graph displays calculated MTTF in hours when the device is operated at  $V_{DD} = 50$  Vdc,  $P_{out} = 150$  W CW, and  $\eta_D = 68.3\%$ .

MTTF calculator available at <http://www.freescale.com/rf>. Select Software & Tools/Development Tools/Calculators to access MTTF calculators by product.

**Figure 13. MTTF versus Junction Temperature**



$V_{DD} = 50 \text{ Vdc}$ ,  $I_{DQ} = 450 \text{ mA}$ ,  $P_{out} = 150 \text{ W CW}$

f MHz	$Z_{source}$ $\Omega$	$Z_{load}$ $\Omega$
220	$2.45 + j6.95$	$3.90 + j5.50$

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

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

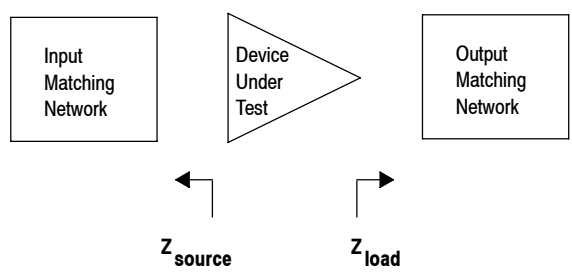


Figure 14. Series Equivalent Source and Load Impedance — 220 MHz

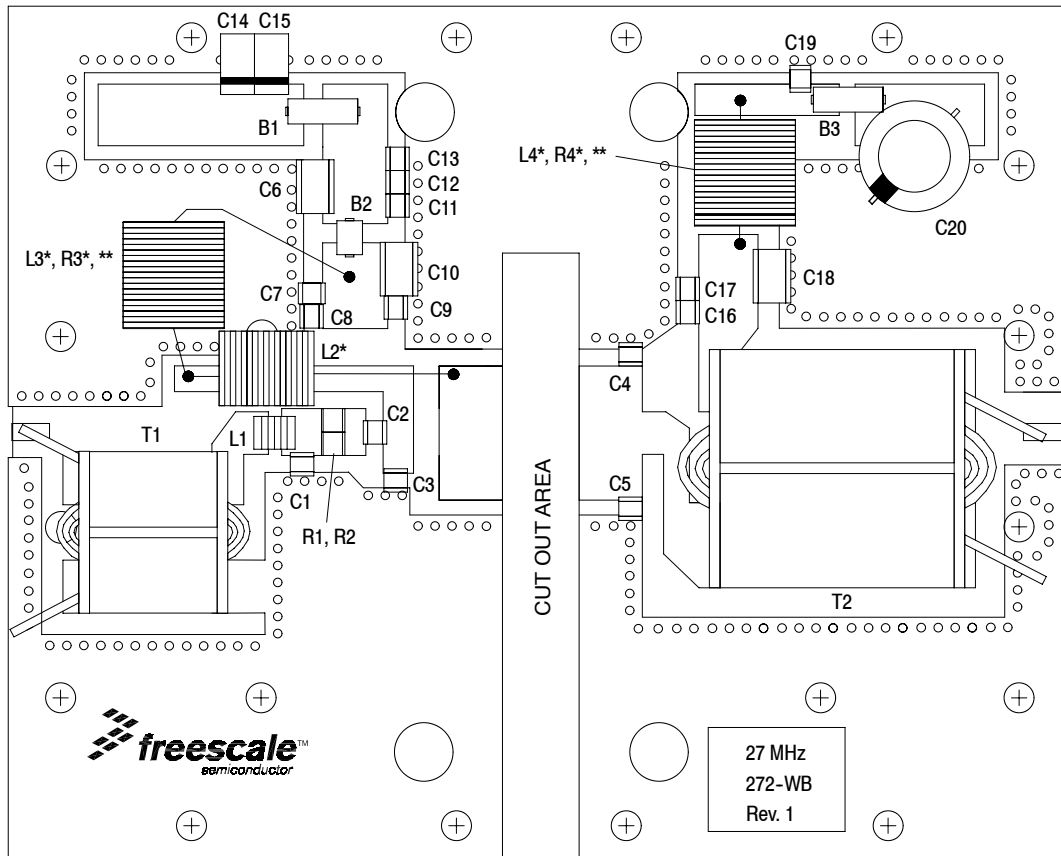


Figure 15. MRF6V2150NR1(NBR1) Test Circuit Component Layout — 27 MHz

Table 7. MRF6V2150NR1(NBR1) Test Circuit Component Designations and Values — 27 MHz

Part	Description	Part Number	Manufacturer
B1, B3	95 $\Omega$ , 100 MHz Long Ferrite Beads	2743021447	Fair-Rite
B2	47 $\Omega$ , 100 MHz Short Ferrite Bead	2743019447	Fair-Rite
C1, C4, C5, C16	100 pF Chip Capacitors	ATC100B101JT500XT	ATC
C2	620 pF Chip Capacitor	ATC100B621JT200XT	ATC
C3	1000 pF Chip Capacitor	ATC100B102JT50XT	ATC
C6	2.2 $\mu$ F, 50 V Chip Capacitor	C1825C225J5RAC-TU	Kemet
C7	0.1 $\mu$ F Chip Capacitor	CDR33BX104AKYS	Kemet
C8	0.22 $\mu$ F, 50 V Chip Capacitor	C1812C224K5RAC-TU	Kemet
C9, C12	22K pF Chip Capacitors	ATC200B223KT50XT	ATC
C10, C18	0.01 $\mu$ F, 100 V Chip Capacitors	C1825C103K1GAC-TU	Kemet
C11, C19	0.1 pF Chip Capacitors	ATC100B0R1BT500XT	ATC
C13, C17	39K pF Chip Capacitors	ATC200B393KT50XT	ATC
C14	22 $\mu$ F, 35 V Tantalum Capacitor	T491X226K035AT	Kemet
C15	10 $\mu$ F, 35 V Tantalum Capacitor	T491D106K035AT	Kemet
C20	470 $\mu$ F, 63 V Electrolytic Capacitor	MCGPR63V477M13X26-RH	Multicomp
L1	47 nH Inductor	1812SMS-47NJ	Coilcraft
L2*	9 Turn, #16 AWG, Inductor, Hand Wound, 0.250" ID	Copper Wire	
L3*	10 Turn, #16 AWG, Inductor, Hand Wound, 0.375" ID	Copper Wire	
L4*	9 Turn, #16 AWG, Inductor, Hand Wound, 0.375" ID	Copper Wire	
R1, R2	3.3 $\Omega$ , 1/2 W Chip Resistors	RK73B2ETTD3R3J	KOA
R3*, **	1 K $\Omega$ , 1/4 W Resistor	MCCFR0W4J0102A50	Multicomp
R4*, **	510 $\Omega$ , 1/2 W Resistor	MCRC1/2G511JT-RH	Multicomp
T1	RF600 Transformer 16:1 Impedance Ratio	RF600LF-16	Comm Concepts
T2	RF1000 Transformer 9:1 Impedance Ratio	RF1000LF-9	Comm Concepts

\* Leaded components mounted over traces.

\*\* Resistor is mounted at center of inductor coil.

MRF6V2150NR1 MRF6V2150NBR1



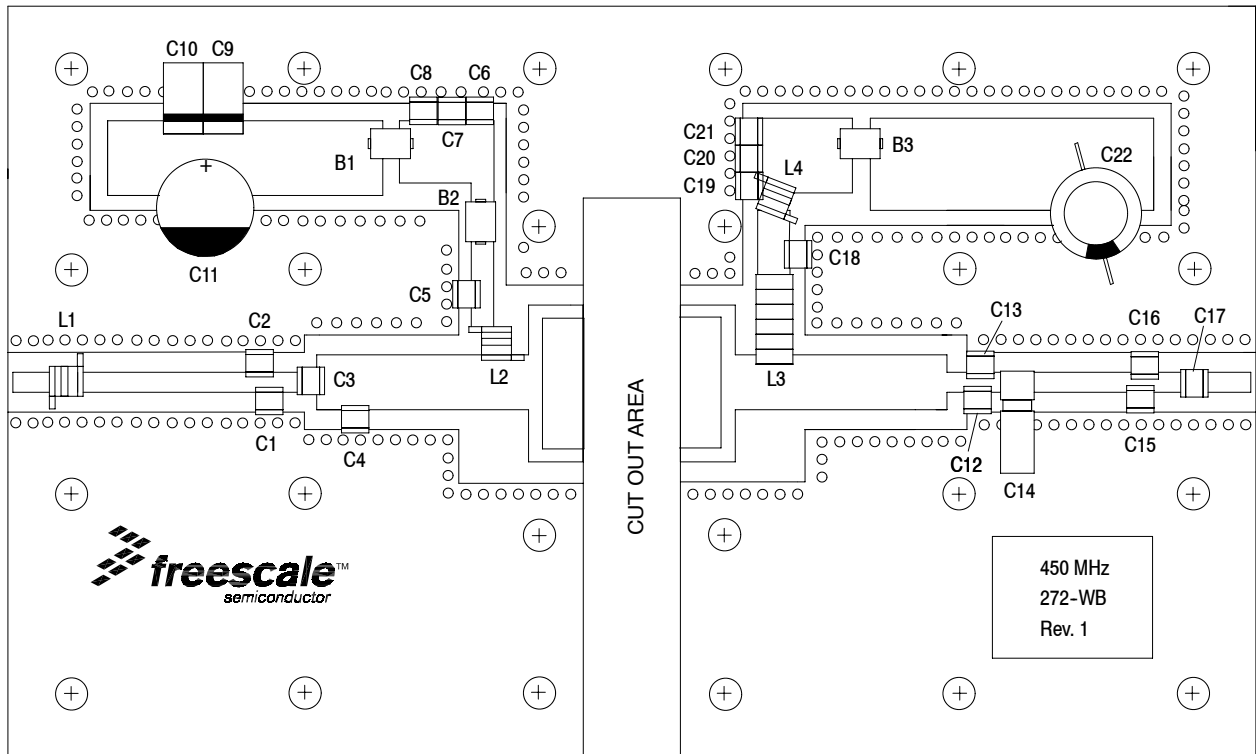
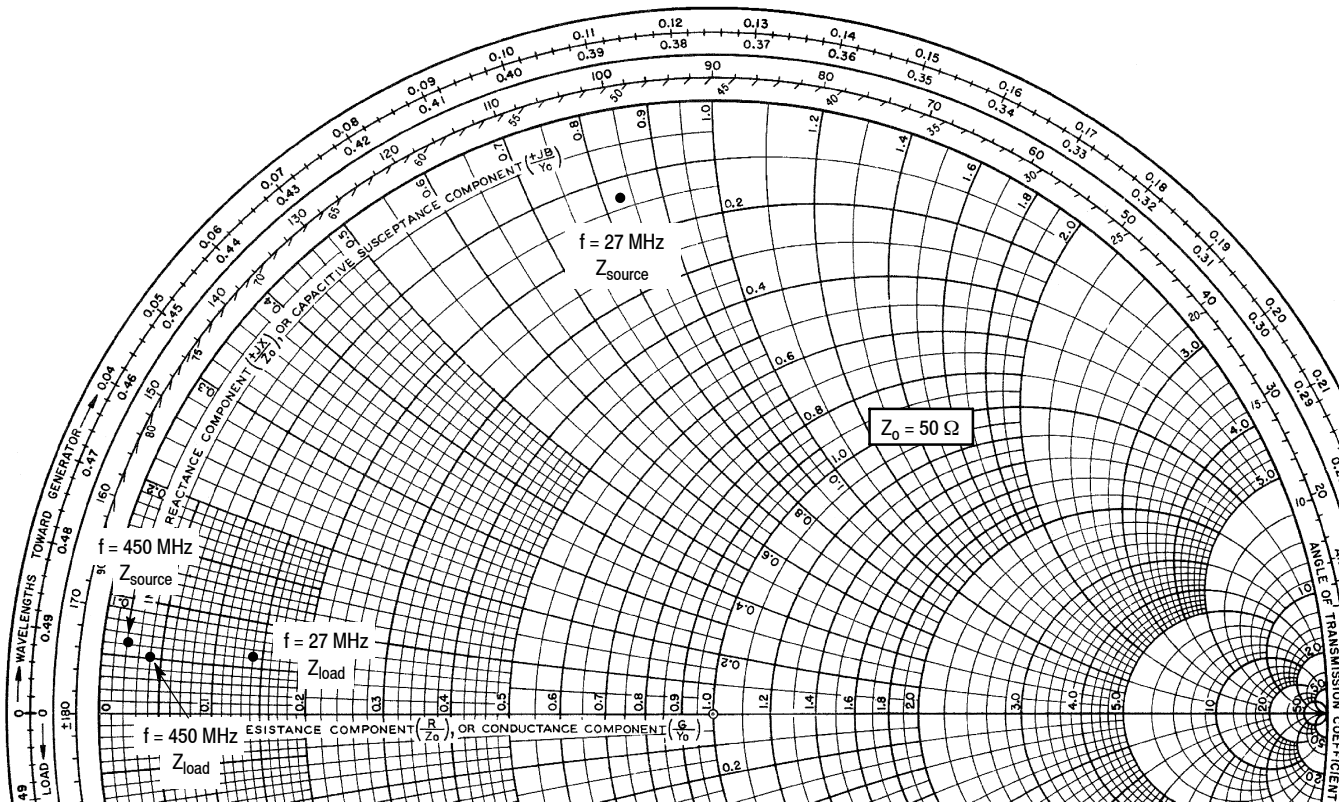


Figure 16. MRF6V2150NR1(NBR1) Test Circuit Component Layout — 450 MHz

Table 8. MRF6V2150NR1(NBR1) Test Circuit Component Designations and Values — 450 MHz

Part	Description	Part Number	Manufacturer
B1, B2, B3	47 Ω, 100 MHz Short Ferrite Beads	2743019447	Fair-Rite
C1	6.8 pF Chip Capacitor	ATC100B6R8CT500XT	ATC
C2	15 pF Chip Capacitor	ATC100B150JT500XT	ATC
C3, C5, C17, C18	240 pF Chip Capacitors	ATC100B241JT200XT	ATC
C4	36 pF Chip Capacitor	ATC100B360JT500XT	ATC
C6, C21	0.1 μF, 50 V Chip Capacitors	CDR33BX104AKYS	Kemet
C7, C20	10K pF Chip Capacitors	ATC200B103KT50XT	ATC
C8, C19	22K pF Chip Capacitors	ATC200B223KT50XT	ATC
C9	10 μF, 35 V Tantalum Capacitor	T491D106K035AS	Kemet
C10	22 μF, 35 V Tantalum Capacitor	T491X226K035AS	Kemet
C11	47 μF, 50 V Electrolytic Capacitor	476KXM050M	Illinois Capacitor
C12	18 pF Chip Capacitor	ATC100B180JT500XT	ATC
C13	10 pF Chip Capacitor	ATC100B100JT500XT	ATC
C14	0.6 - 4.5 pF Variable Capacitor	27271SL	Johanson
C15	3 pF Chip Capacitor	ATC100B3R0CT500XT	ATC
C16	0.5 pF Chip Capacitor	ATC100B0R5BT500XT	ATC
C22	470 μF, 63 V Electrolytic Capacitor	MCGPR63V477M13X26-RH	Multicomp
L1, L2	5 nH Mini Spring Air Core Inductors	A02TKLC	Coilcraft
L3	17.5 nH Mini Spring Air Core Inductor	B06TJLC	Coilcraft
L4	82 nH Midi Spring Air Core Inductor	1812SMS-82NJLC	Coilcraft
PCB	Arlon CuClad 250GX-0300-55-22, 0.030", $\epsilon_r = 2.55$	DS2054	DS



$V_{DD} = 50 \text{ Vdc}$ ,  $I_{DQ} = 450 \text{ mA}$ ,  $P_{out} = 150 \text{ W CW}$

f MHz	$Z_{source}$ $\Omega$	$Z_{load}$ $\Omega$
27	$6.57 + j41.4$	$7.16 + j3.02$
450	$0.80 + j3.20$	$2.20 + j2.30$

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

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

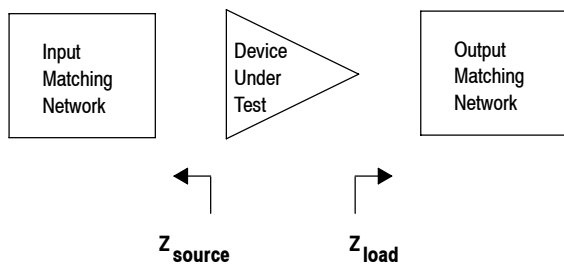
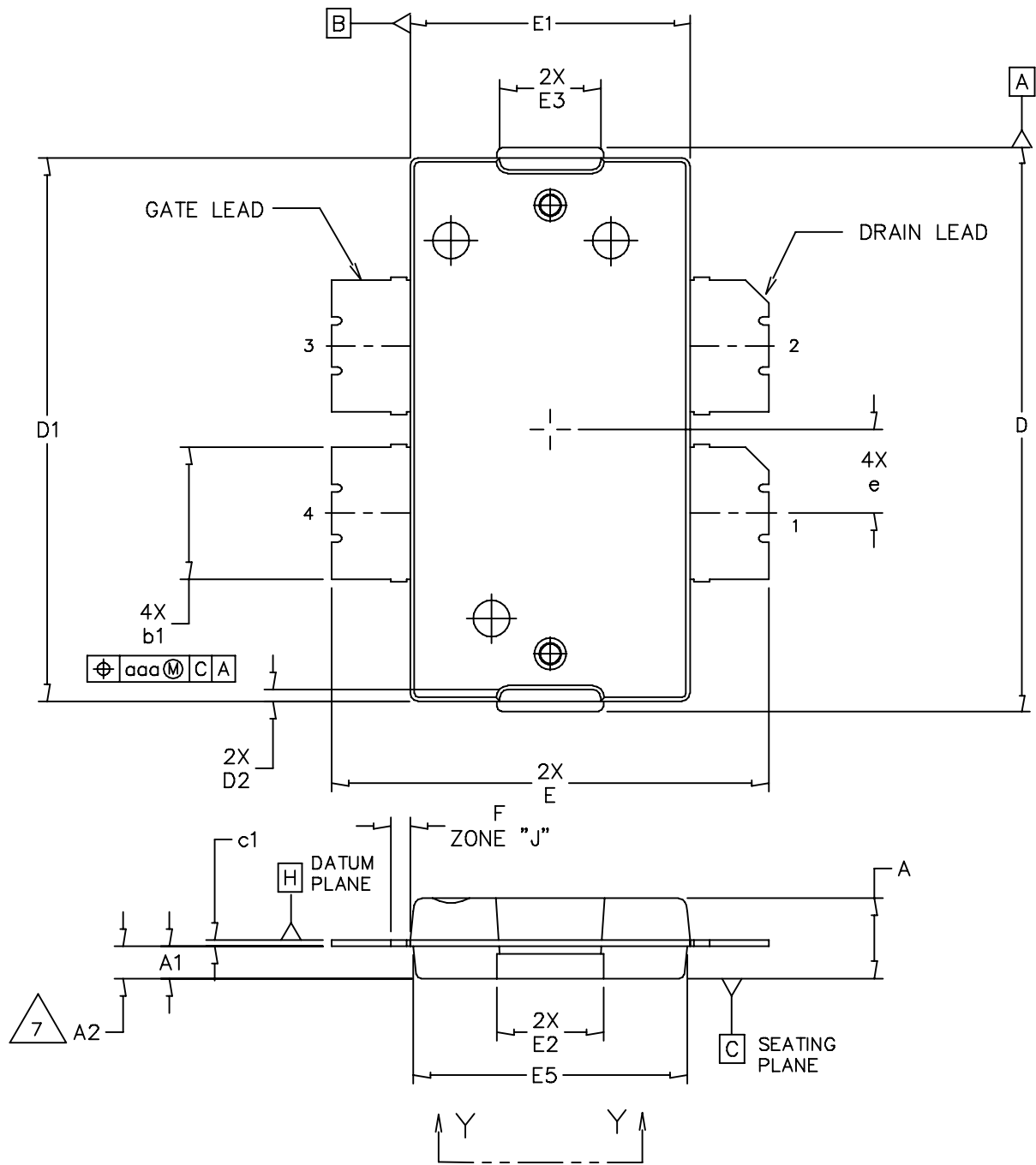
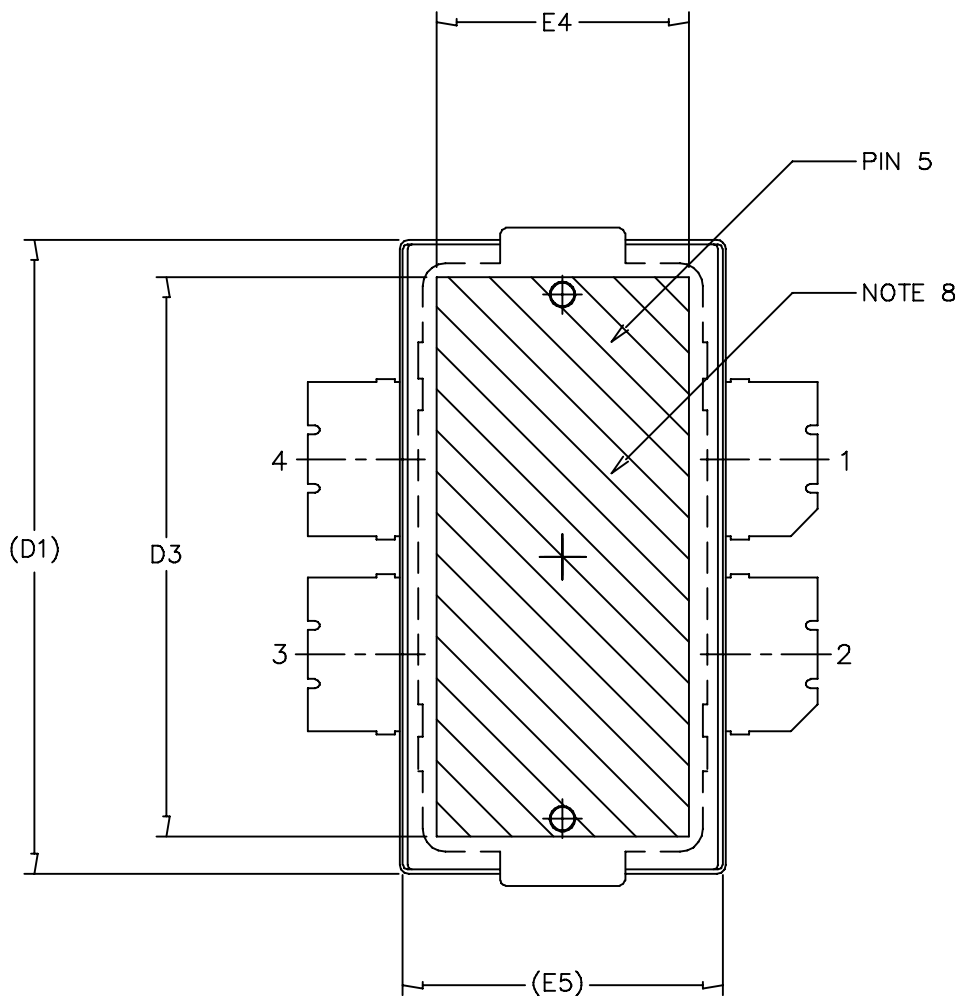


Figure 17. Series Equivalent Source and Load Impedance — 27, 450 MHz

### PACKAGE DIMENSIONS



© FREESCALE SEMICONDUCTOR, INC. ALL RIGHTS RESERVED.		MECHANICAL OUTLINE		PRINT VERSION NOT TO SCALE	
TITLE: TO-270 4 LEAD, WIDE BODY			DOCUMENT NO: 98ASA10577D		REV: D
			CASE NUMBER: 1486-03		13 AUG 2007
			STANDARD: NON-JEDEC		



© FREESCALE SEMICONDUCTOR, INC. ALL RIGHTS RESERVED.	MECHANICAL OUTLINE	PRINT VERSION NOT TO SCALE	
TITLE: TO-270 4 LEAD, WIDE BODY		DOCUMENT NO: 98ASA10577D	REV: D
		CASE NUMBER: 1486-03	13 AUG 2007
		STANDARD: NON-JEDEC	

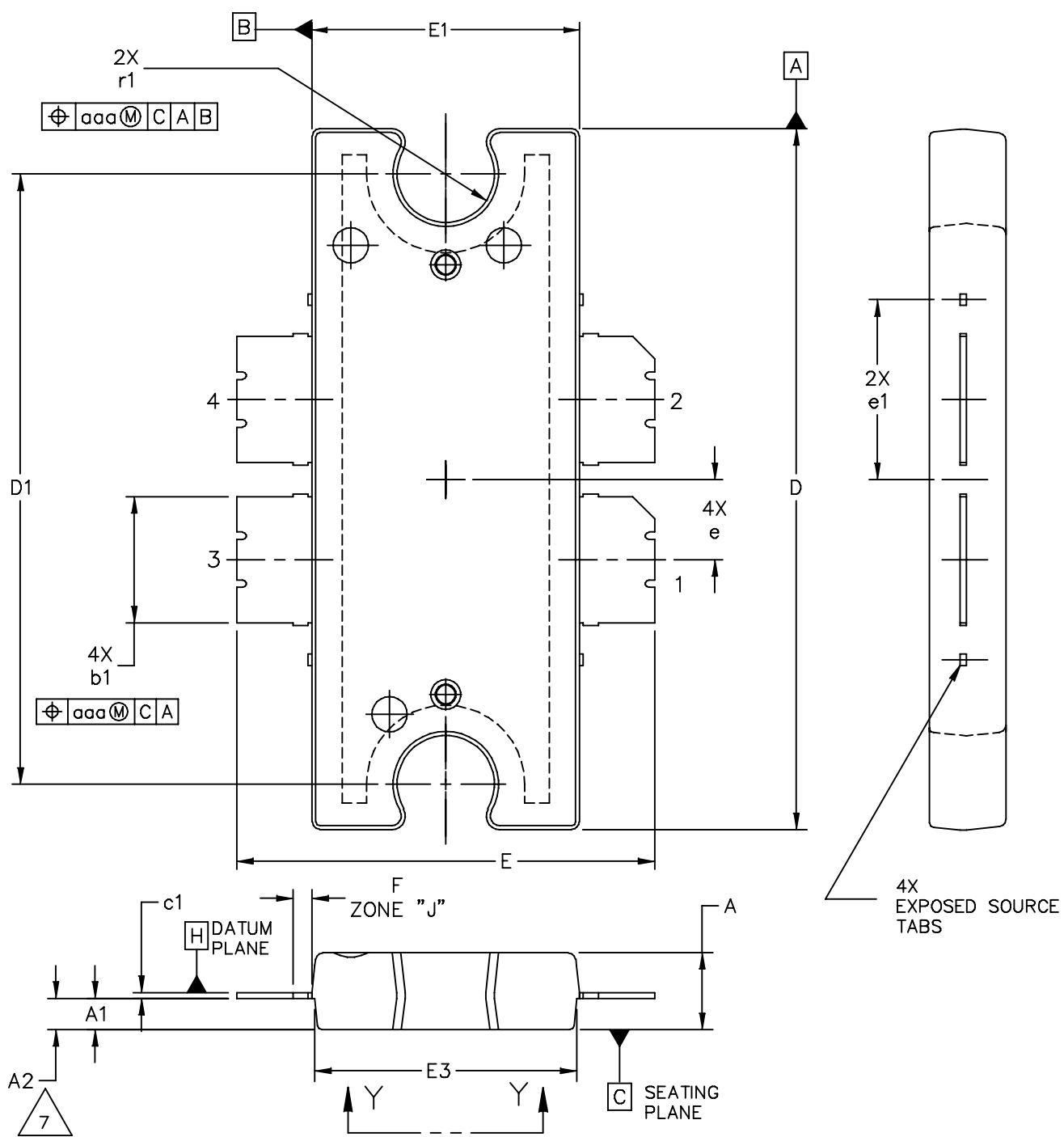
NOTES:

1. CONTROLLING DIMENSION: INCH
2. INTERPRET DIMENSIONS AND TOLERANCES PER ASME Y14.5M-1994.
3. DATUM PLANE -H- IS LOCATED AT THE TOP OF LEAD AND IS COINCIDENT WITH THE LEAD WHERE THE LEAD EXITS THE PLASTIC BODY AT THE TOP OF THE PARTING LINE.
4. DIMENSIONS "D" AND "E1" DO NOT INCLUDE MOLD PROTRUSION. ALLOWABLE PROTRUSION IS .006 PER SIDE. DIMENSIONS "D" AND "E1" DO INCLUDE MOLD MISMATCH AND ARE DETERMINED AT DATUM PLANE -H-.
5. DIMENSIONS "b1" DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE .005 TOTAL IN EXCESS OF THE "b1" DIMENSION AT MAXIMUM MATERIAL CONDITION.
6. DATUMS -A- AND -B- TO BE DETERMINED AT DATUM PLANE -H-.
7. DIMENSION A2 APPLIES WITHIN ZONE "J" ONLY.
8. HATCHING REPRESENTS THE EXPOSED AREA OF THE HEAT SLUG.

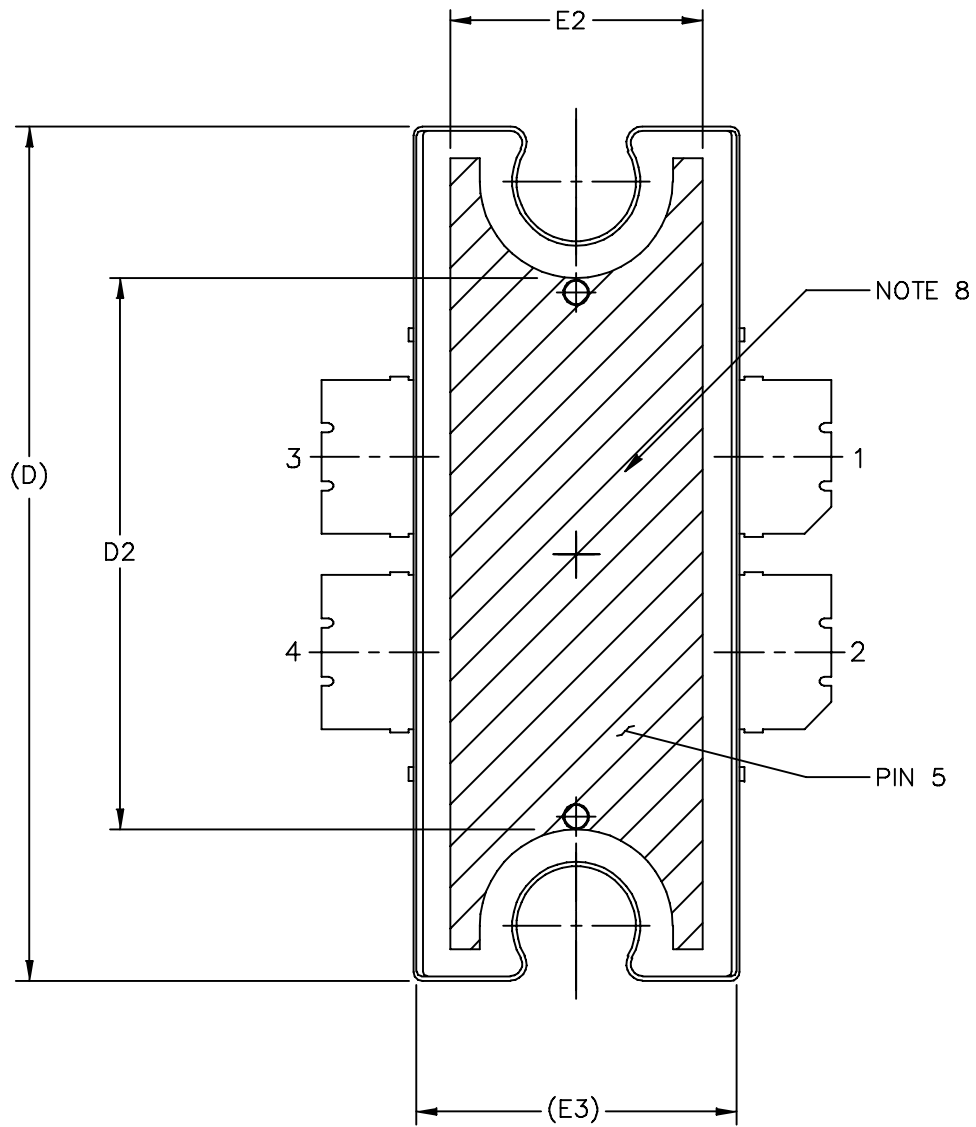
STYLE 1:

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

DIM	INCH		MILLIMETER		DIM	INCH		MILLIMETER	
	MIN	MAX	MIN	MAX		MIN	MAX	MIN	MAX
A	.100	.104	2.54	2.64	F	.025 BSC		0.64 BSC	
A1	.039	.043	0.99	1.09	b1	.164	.170	4.17	4.32
A2	.040	.042	1.02	1.07	c1	.007	.011	.18	.28
D	.712	.720	18.08	18.29	e	.106 BSC		2.69 BSC	
D1	.688	.692	17.48	17.58	aaa	.004		.10	
D2	.011	.019	0.28	0.48					
D3	.600	---	15.24	---					
E	.551	.559	14	14.2					
E1	.353	.357	8.97	9.07					
E2	.132	.140	3.35	3.56					
E3	.124	.132	3.15	3.35					
E4	.270	---	6.86	---					
E5	.346	.350	8.79	8.89					
© FREESCALE SEMICONDUCTOR, INC. ALL RIGHTS RESERVED.			MECHANICAL OUTLINE			PRINT VERSION NOT TO SCALE			
TITLE:  TO-270 4 LEAD WIDE BODY					DOCUMENT NO: 98ASA10577D			REV: D	
					CASE NUMBER: 1486-03			13 AUG 2007	
					STANDARD: NON-JEDEC				



© FREESCALE SEMICONDUCTOR, INC. ALL RIGHTS RESERVED.		MECHANICAL OUTLINE	PRINT VERSION NOT TO SCALE
TITLE: TO-272 4 LEAD, WIDE BODY		DOCUMENT NO: 98ASA10575D	REV: E
		CASE NUMBER: 1484-04	31 AUG 2007
		STANDARD: NON-JEDEC	



© FREESCALE SEMICONDUCTOR, INC. ALL RIGHTS RESERVED.	MECHANICAL OUTLINE	PRINT VERSION NOT TO SCALE	
TITLE: TO-272 4 LEAD, WIDE BODY	DOCUMENT NO: 98ASA10575D	REV: E	
	CASE NUMBER: 1484-04	31 AUG 2007	
	STANDARD: NON-JEDEC		

NOTES:

1. CONTROLLING DIMENSION: INCH
2. INTERPRET DIMENSIONS AND TOLERANCES PER ASME Y14.5M-1994.
3. DATUM PLANE H IS LOCATED AT THE TOP OF LEAD AND IS COINCIDENT WITH THE LEAD WHERE THE LEAD EXITS THE PLASTIC BODY AT THE TOP OF THE PARTING LINE.
4. DIMENSIONS "D" AND "E1" DO NOT INCLUDE MOLD PROTRUSION. ALLOWABLE PROTRUSION IS .006 PER SIDE. DIMENSIONS "D" AND "E1" DO INCLUDE MOLD MISMATCH AND ARE DETERMINED AT DATUM PLANE H.
5. DIMENSIONS "b1" DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE .005 TOTAL IN EXCESS OF THE "b1" DIMENSION AT MAXIMUM MATERIAL CONDITION.
6. DATUM A AND B TO BE DETERMINED AT DATUM PLANE H.
7. DIMENSION A2 APPLIES WITHIN ZONE "J" ONLY.
8. HATCHING REPRESENTS EXPOSED AREA OF THE HEAT SLUG. HATCHED AREA SHOWN IS ON THE SAME PLANE.

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

DIM	INCH		MILLIMETER		DIM	INCH		MILLIMETER	
	MIN	MAX	MIN	MAX		MIN	MAX	MIN	MAX
A	.100	.104	2.54	2.64	b1	.164	.170	4.17	4.32
A1	.039	.043	0.99	1.09	c1	.007	.011	.18	.28
A2	.040	.042	1.02	1.07	r1	.063	.068	1.60	1.73
D	.928	.932	23.57	23.67	e	.106 BSC		2.69 BSC	
D1	.810 BSC		20.57 BSC		e1	.239 INFO ONLY		6.07 INFO ONLY	
D2	.600	---	15.24	---	aaa	.004		.10	
E	.551	.559	14	14.2					
E1	.353	.357	8.97	9.07					
E2	.270	---	6.86	---					
E3	.346	.350	8.79	8.89					
F	.025 BSC		0.64 BSC						

© FREESCALE SEMICONDUCTOR, INC. ALL RIGHTS RESERVED.		MECHANICAL OUTLINE	PRINT VERSION NOT TO SCALE
TITLE:  TO-272 4 LEAD WIDE BODY	DOCUMENT NO: 98ASA10575D		REV: E
	CASE NUMBER: 1484-04		31 AUG 2007
	STANDARD: NON-JEDEC		



Refer to the following documents to aid your design process.

**Application Notes**

- AN1907: Solder Reflow Attach Method for High Power RF Devices in Plastic Packages
- AN1955: Thermal Measurement Methodology of RF Power Amplifiers
- AN3263: Bolt Down Mounting Method for High Power RF Transistors and RFICs in Over-Molded Plastic Packages

**Engineering Bulletins**

- EB212: Using Data Sheet Impedances for RF LDMOS Devices

**Software**

- Electromigration MTTF Calculator
- RF High Power Model

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	Feb. 2007	<ul style="list-style-type: none"> <li>• Initial Release of Data Sheet</li> </ul>
1	May 2007	<ul style="list-style-type: none"> <li>• Corrected Test Circuit Component part numbers in Table 6, Component Designations and Values for C4, C17, C5, C18, C9, C12, C14, C23, C13, C21, and C22, p. 3</li> </ul>
2	Apr. 2008	<ul style="list-style-type: none"> <li>• Added Case Operating Temperature limit to the Maximum Ratings table and set limit to 150°C, p. 1</li> <li>• Corrected C<sub>iss</sub> test condition to indicate AC stimulus on the V<sub>GS</sub> connection versus the V<sub>DS</sub> connection, Dynamic Characteristics table, p. 2</li> <li>• Updated PCB information to show more specific material details, Fig. 2, Test Circuit Schematic, p. 3</li> <li>• Updated Part Numbers in Table 6, Component Designations and Values, to latest RoHS compliant part numbers, p. 3</li> <li>• Replaced Case Outline 1486-03, Issue C, with 1486-03, Issue D, p. 8-10. Added pin numbers 1 through 4 on Sheet 1.</li> <li>• Replaced Case Outline 1484-04, Issue D, with 1484-04, Issue E, p. 11-13. Added pin numbers 1 through 4 on Sheet 1, replacing Gate and Drain notations with Pin 1 and Pin 2 designations.</li> </ul>
3	Dec. 2008	<ul style="list-style-type: none"> <li>• Added Typical Performances table for 27 MHz, 450 MHz applications, p. 2</li> <li>• Added Figs. 15 and 16, Test Circuit Component Layout - 27 MHz and 450 MHz, and Tables 7 and 8, Test Circuit Component Designations and Values - 27 MHz and 450 MHz, p. 8, 9</li> <li>• Added Fig. 17, Series Equivalent Source and Load Impedance for 27 MHz, 450 MHz, p. 10</li> </ul>
4	Apr. 2010	<ul style="list-style-type: none"> <li>• Operating Junction Temperature increased from 200°C to 225°C in Maximum Ratings table, related “Continuous use at maximum temperature will affect MTTF” footnote added and changed 200°C to 225°C in Capable Plastic Package bullet, p. 1</li> <li>• Added Electromigration MTTF Calculator and RF High Power Model availability to Product Software, p. 17</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. 2007-2008, 2010. All rights reserved.

Компания «Океан Электроники» предлагает заключение долгосрочных отношений при поставках импортных электронных компонентов на взаимовыгодных условиях!

Наши преимущества:

- Поставка оригинальных импортных электронных компонентов напрямую с производств Америки, Европы и Азии, а так же с крупнейших складов мира;
- Широкая линейка поставок активных и пассивных импортных электронных компонентов (более 30 млн. наименований);
- Поставка сложных, дефицитных, либо снятых с производства позиций;
- Оперативные сроки поставки под заказ (от 5 рабочих дней);
- Экспресс доставка в любую точку России;
- Помощь Конструкторского Отдела и консультации квалифицированных инженеров;
- Техническая поддержка проекта, помощь в подборе аналогов, поставка прототипов;
- Поставка электронных компонентов под контролем ВП;
- Система менеджмента качества сертифицирована по Международному стандарту ISO 9001;
- При необходимости вся продукция военного и аэрокосмического назначения проходит испытания и сертификацию в лаборатории (по согласованию с заказчиком);
- Поставка специализированных компонентов военного и аэрокосмического уровня качества (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Actel, Aeroflex, Peregrine, VPT, Syfer, Eurofarad, Texas Instruments, MS Kennedy, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits, General Dynamics и др.);

Компания «Океан Электроники» является официальным дистрибьютором и эксклюзивным представителем в России одного из крупнейших производителей разъемов военного и аэрокосмического назначения «JONHON», а так же официальным дистрибьютором и эксклюзивным представителем в России производителя высокотехнологичных и надежных решений для передачи СВЧ сигналов «FORSTAR».



## JONHON

«JONHON» (основан в 1970 г.)

Разъемы специального, военного и аэрокосмического назначения:

(Применяются в военной, авиационной, аэрокосмической, морской, железнодорожной, горно- и нефтедобывающей отраслях промышленности)

«FORSTAR» (основан в 1998 г.)

ВЧ соединители, коаксиальные кабели,  
кабельные сборки и микроволновые компоненты:

(Применяются в телекоммуникациях гражданского и специального назначения, в средствах связи, РЛС, а так же военной, авиационной и аэрокосмической отраслях промышленности).



Телефон: 8 (812) 309-75-97 (многоканальный)

Факс: 8 (812) 320-03-32

Электронная почта: [ocean@oceanchips.ru](mailto:ocean@oceanchips.ru)

Web: <http://oceanchips.ru/>

Адрес: 198099, г. Санкт-Петербург, ул. Калинина, д. 2, корп. 4, лит. А