Freescale Semiconductor
Technical Data

Document Number: MW6IC2420N
Rev. 0, 3/2007

√RoHS

RF LDMOS Integrated Power Amplifier

MW6IC2420NBR1

**2450 MHz, 20 W, 28 V
CW
RF LDMOS INTEGRATED POWER AMPLIFIER**

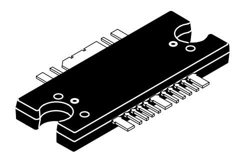
The MW6IC2420NB integrated circuit is designed with on-chip matching that makes it usable at 2450 MHz. This multi-stage structure is rated for 26 to 32 Volt operation and covers all typical industrial, scientific and medical modulation formats.

Driver Applications

- Typical CW Performance at 2450 MHz: V_{DD} = 28 Volts, I_{DQ1} = 210 mA, I_{DQ2} = 370 mA, P_{out} = 20 Watts
  Power Gain — 19.5 dB
  Power Added Efficiency — 27%
- Capable of Handling 3:1 VSWR, @ 28 Vdc, 2170 MHz, 20 Watts CW Output Power
- Stable into a 3:1 VSWR. All Spurs Below -60 dBc @ 100 mW to 10 W CW P_{out}.

Features

- Characterized with Series Equivalent Large-Signal Impedance Parameters and Common Source Scattering Parameters
- On-Chip Matching (50 Ohm Input, DC Blocked, >3 Ohm Output)
- Integrated Quiescent Current Temperature Compensation with Enable/Disable Function
- Integrated ESD Protection
- 200°C Capable Plastic Package
- RoHS Compliant
- In Tape and Reel. R1 Suffix = 500 Units per 44 mm, 13 inch Reel



**CASE 1329-09
TO-272 WB-16
PLASTIC**

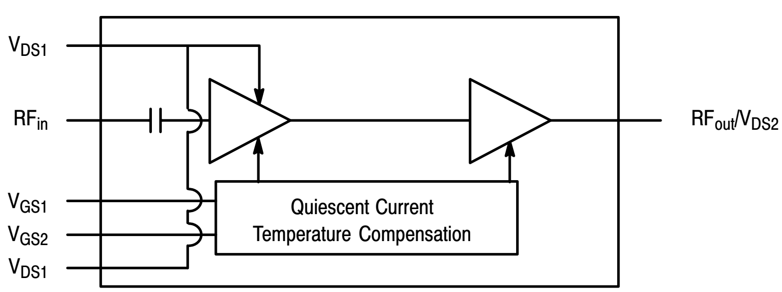
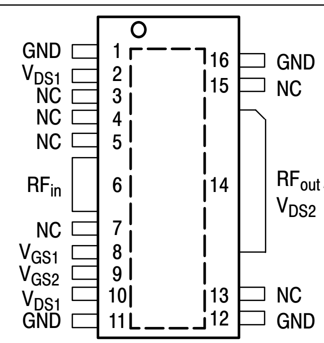


Figure 1. Functional Block Diagram



(Top View)

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

Figure 2. Pin Connections

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Table 1. Maximum Ratings

Rating	Symbol	Value	Unit
Drain-Source Voltage	V_{DSS}	-0.5, +68	Vdc
Gate-Source Voltage	V_{GS}	-0.5, +6	Vdc
Storage Temperature Range	T_{stg}	-65 to +200	°C
Operating Junction Temperature	T_J	200	°C
Input Power	P_{in}	23	dBm

Table 2. Thermal Characteristics

Characteristic		Symbol	Value (1)	Unit
Thermal Resistance, Junction to Case		$R_{\theta JC}$		°C/W
W-CDMA Application	Stage 1, 28 Vdc, I_{DQ} = 210 mA		1.8	
(P_{out} = 4.5 W Avg.)	Stage 2, 28 Vdc, I_{DQ} = 370 mA		1	

Table 3. ESD Protection Characteristics

Test Methodology	Class
Human Body Model (per JESD22-A114)	1A (Minimum)
Machine Model (per EIA/JESD22-A115)	A (Minimum)
Charge Device Model (per JESD22-C101)	III (Minimum)

Table 4. Moisture Sensitivity Level

Test Methodology	Rating	Package Peak Temperature	Unit
Per JESD 22-A113, IPC/JEDEC J-STD-020	3	260	°C

Table 5. Electrical Characteristics (T_C = 25°C unless otherwise noted)

Characteristic	Symbol	Min	Typ	Max	Unit
Functional Tests (In Freescale Wideband 2110-2170 MHz Test Fixture, 50 ohm system) V_{DD} = 28 Vdc, I_{DQ1} = 210 mA, I_{DQ2} = 370 mA, P_{out} = 4.5 W Avg., f1 = 2112.5 MHz, f2 = 2122.5 MHz and f1 = 2157.5 MHz, f2 = 2167.5 MHz, 2-Carrier W-CDMA, 3.84 MHz Channel Bandwidth Carriers. ACPR measured in 3.84 MHz Channel Bandwidth @ ±5 MHz Offset. IM3 measured in 3.84 MHz Channel Bandwidth @ ±10 MHz Offset. PAR = 8.5 dB @ 0.01% Probability on CCDF.					
Power Gain	G_{ps}	25.5	28	30	dB
Power Added Efficiency	PAE	13.7	15	—	%
Intermodulation Distortion	IM3	—	-43	-40	dBc
Adjacent Channel Power Ratio	ACPR	—	-46	-43	dBc
Input Return Loss	IRL	—	-15	-10	dB

1. Refer to AN1955, *Thermal Measurement Methodology of RF Power Amplifiers.* Go to http://www.freescale.com/rf. Select Documentation/Application Notes - AN1955.

(continued)

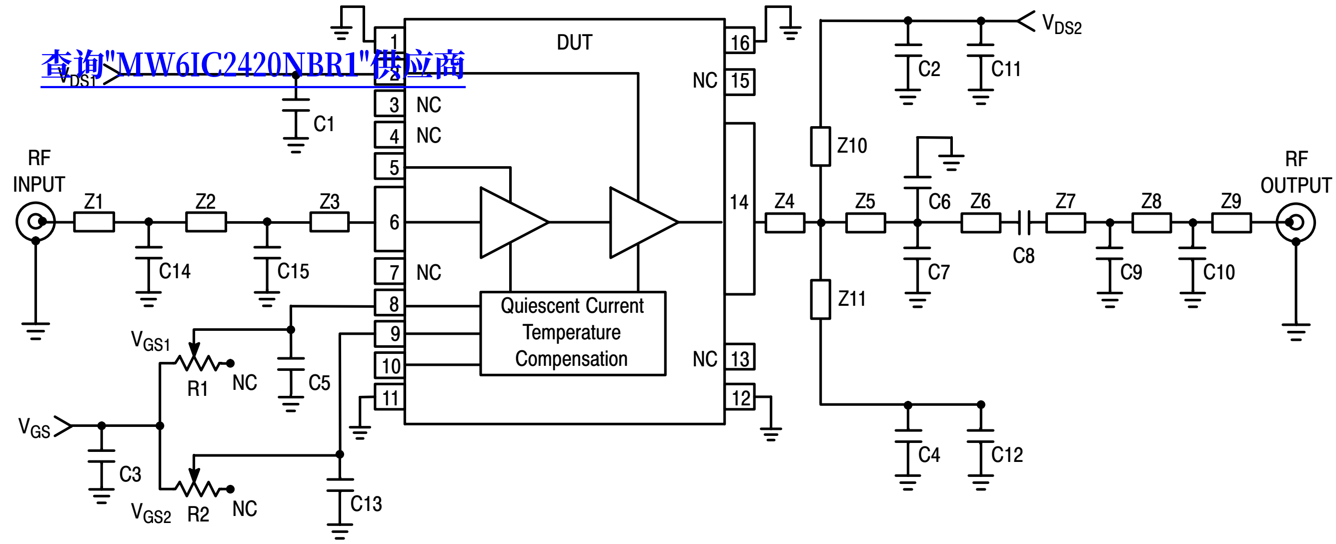
Table 5. Electrical Characteristics (T_C = 25°C unless otherwise noted) **(continued)**

Characteristic	Symbol	Min	Typ	Max	Unit
Typical Performances (In Freescale Test Fixture, 50 ohm system) V_{DD} = 28 Vdc, I_{DQ1} = 210 mA, I_{DQ2} = 370 mA, 2110-2170 MHz					
Video Bandwidth @ 20 W PEP P_{out} where IM3 = -30 dBc (Tone Spacing from 100 kHz to VBW) ΔIMD3 = IMD3 @ VBW frequency - IMD3 @ 100 kHz <1 dBc (both sidebands)	VBW	—	30	—	MHz
Quiescent Current Accuracy over Temperature with 18 kΩ Gate Feed Resistors (-10 to 85°C) (1)	ΔI_{QT}	—	±5	—	%
Gain Flatness in 30 MHz Bandwidth @ P_{out} = 1 W CW	G_F	—	0.2	—	dB
Average Deviation from Linear Phase in 30 MHz Bandwidth @ P_{out} = 1 W CW	Φ	—	2	—	°
Average Group Delay @ P_{out} = 1 W CW Including Output Matching	Delay	—	2.8	—	ns
Part-to-Part Insertion Phase Variation @ P_{out} = 1 W CW, Six Sigma Window	ΔΦ	—	18	—	°

Table 6. Electrical Characteristics (T_C = 25°C unless otherwise noted)

Characteristic	Symbol	Min	Typ	Max	Unit
Typical Performances (In Freescale Test Fixture, 50 ohm system) V_{DD} = 28 Vdc, I_{DQ1} = 110 mA, I_{DQ2} = 370 mA, 2110-2170 MHz					
Saturated Pulsed Output Power (8 μsec(on), 1 msec(off))	P_{sat}	—	60	—	W

1. Refer to AN1977, *Quiescent Current Thermal Tracking Circuit in the RF Integrated Circuit Family.* Go to http://www.freescale.com/rf. Select Documentation/Application Notes - AN1977.



Z1	0.510″ x 0.054″ Microstrip	Z6	0.189″ x 0.237″ Microstrip
Z2	0.300″ x 0.054″ Microstrip	Z7	0.127″ x 0.054″ Microstrip
Z3, Z8	0.410″ x 0.054″ Microstrip	Z9	0.182″ x 0.054″ Microstrip
Z4	0.138″ x 0.237″ Microstrip	Z10, Z11	1.073″ x 0.054″ Microstrip
Z5	0.086″ x 0.237″ Microstrip	PCB	Taconic RF35, 0.020″, ε_r = 3.5

Figure 3. MW6IC2420NBR1 Test Circuit Schematic — 2450 MHz

Table 7. MW6IC2420NBR1 Test Circuit Component Designations and Values

Part	Description	Part Number	Manufacturer
C1, C2, C3, C4	2.2 μF Chip Capacitors	C32225X5R1H225MT	TDK
C5, C13	100 nF Chip Capacitors	C1206C104K1KAC	Kemet
C6, C7	0.5 pF Chip Capacitors	08051J0R5BS	AVX
C8	6.8 pF Chip Capacitor	08051J6R8BS	AVX
C9	2.2 pF Chip Capacitor	08051J2R2BS	AVX
C10	1 pF Chip Capacitor	08051J1R0BS	AVX
C11, C12	5.6 pF Chip Capacitors	08051J5R6BS	AVX
C14	0.3 pF Chip Capacitor	ATC100B0R3BT500XT	ATC
C15	0.5 pF Chip Capacitor	ATC100B0R5BT500XT	ATC
R1, R2	5 kΩ Potentiometer CMS Cermet Multi-turn	3224W-1-502E	Bourns

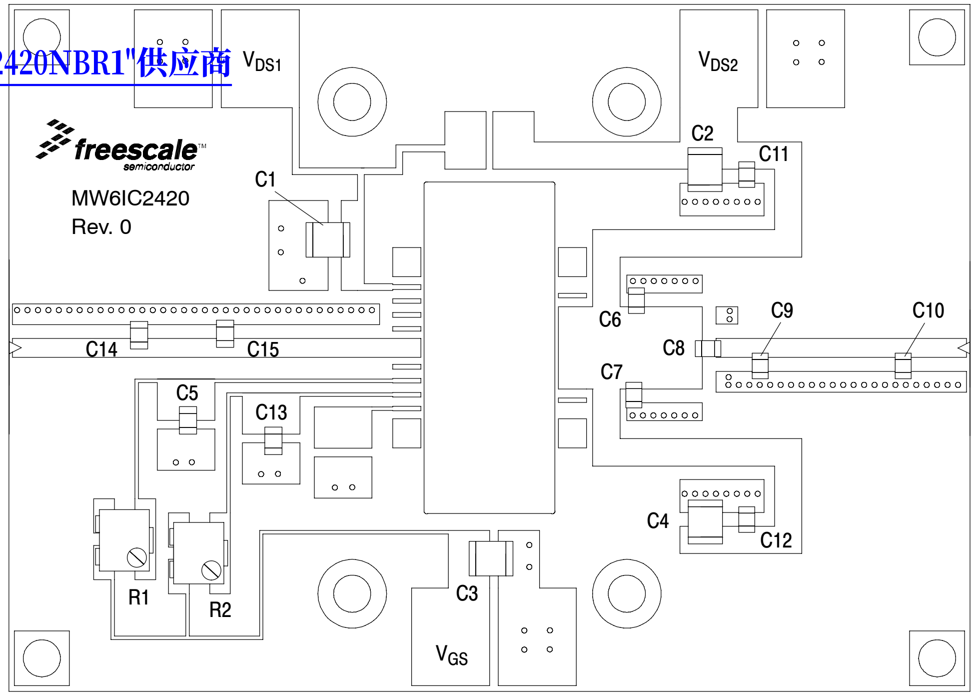


Figure 4. MW6IC2420NBR1 Test Circuit Component Layout — 2450 MHz

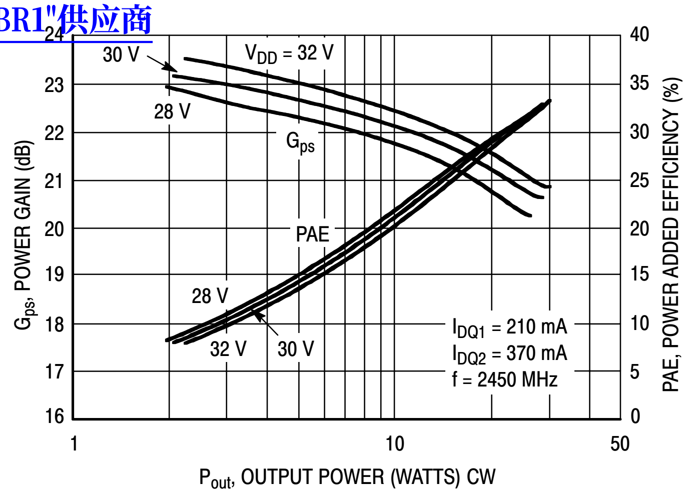


Figure 5. Power Gain and Power Added Efficiency versus CW Output Power as a Function of V_{DD}

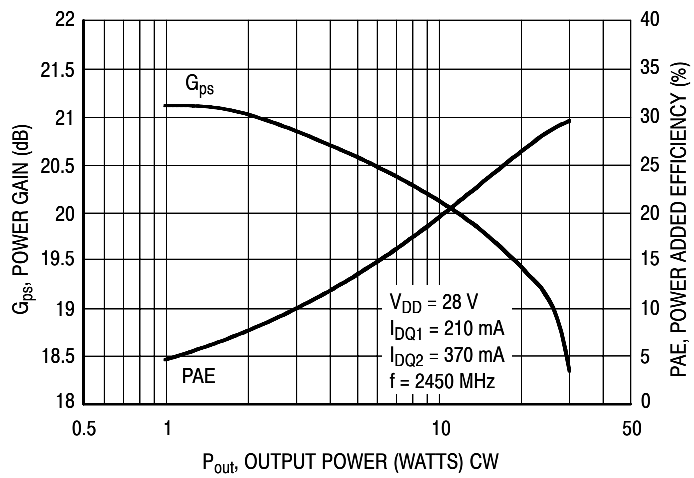


Figure 6. Power Gain and Power Added Efficiency versus CW Output Power

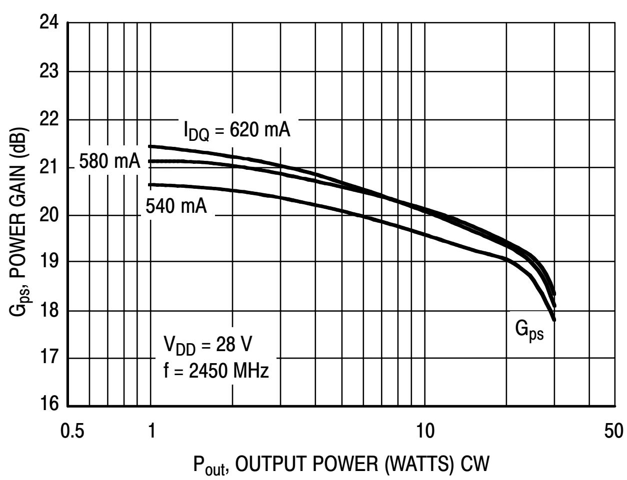
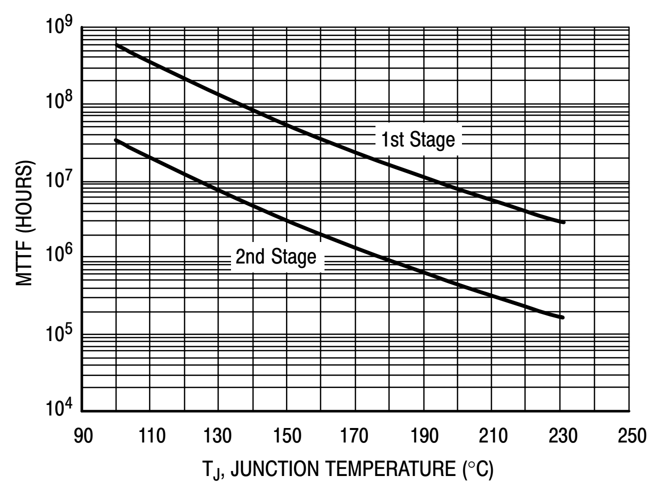


Figure 7. Power Gain and Power Added Efficiency versus CW Output Power as a Function of Total I_{DQ}

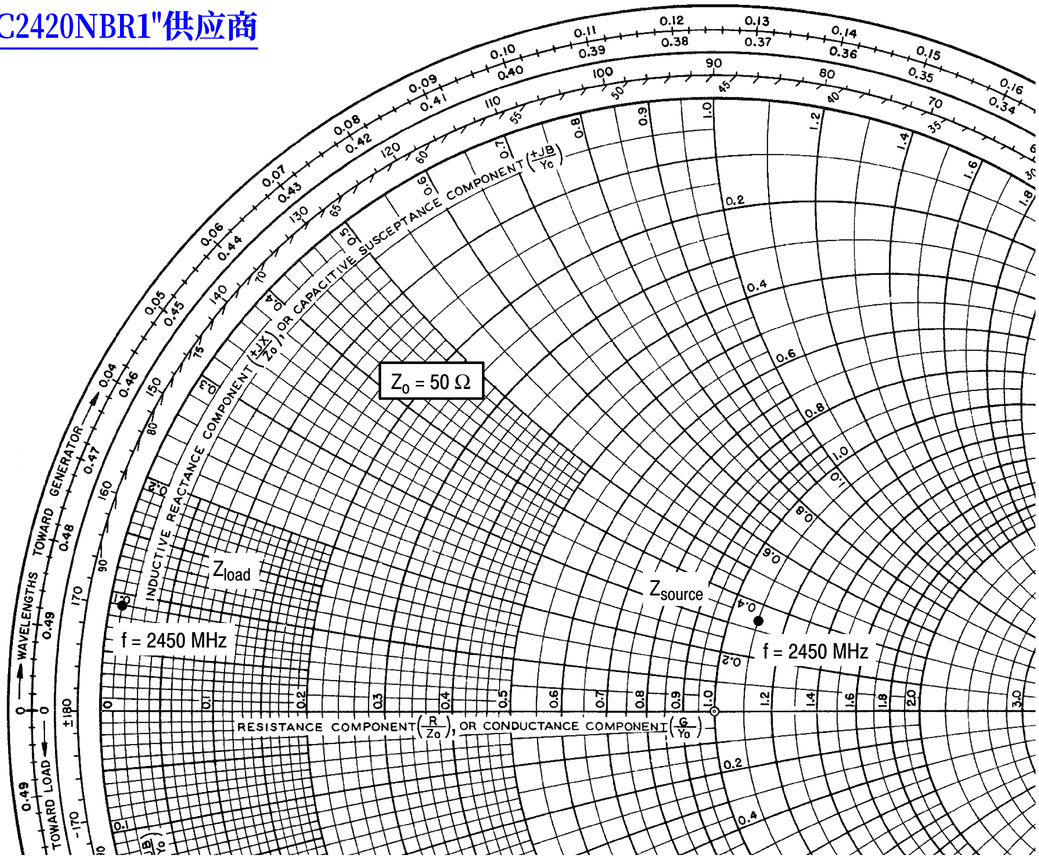


This above graph displays calculated MTTF in hours when the device is operated at V_{DD} = 28 Vdc, P_{out} = 20 W Avg., and PAE = 27%.

MTTF calculator available at http:/www.freescale.com/rf. Select Tools/Software/Application Software/Calculators to access the MTTF calculators by product.

Figure 8. MTTF versus Junction Temperature

查询"MW6IC2420NBR1"供应商



V_{DD} = 28 Vdc, I_{DQ1} = 210 mA, I_{DQ2} = 370 mA, P_{out} = 20 W CW

f MHz	Z_{source} Ω	Z_{load} Ω
2450	54.8 + j16.6	0.42 + j4.3

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

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

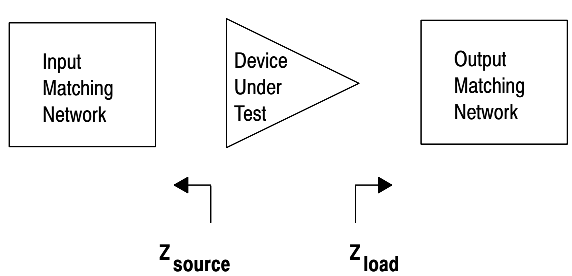
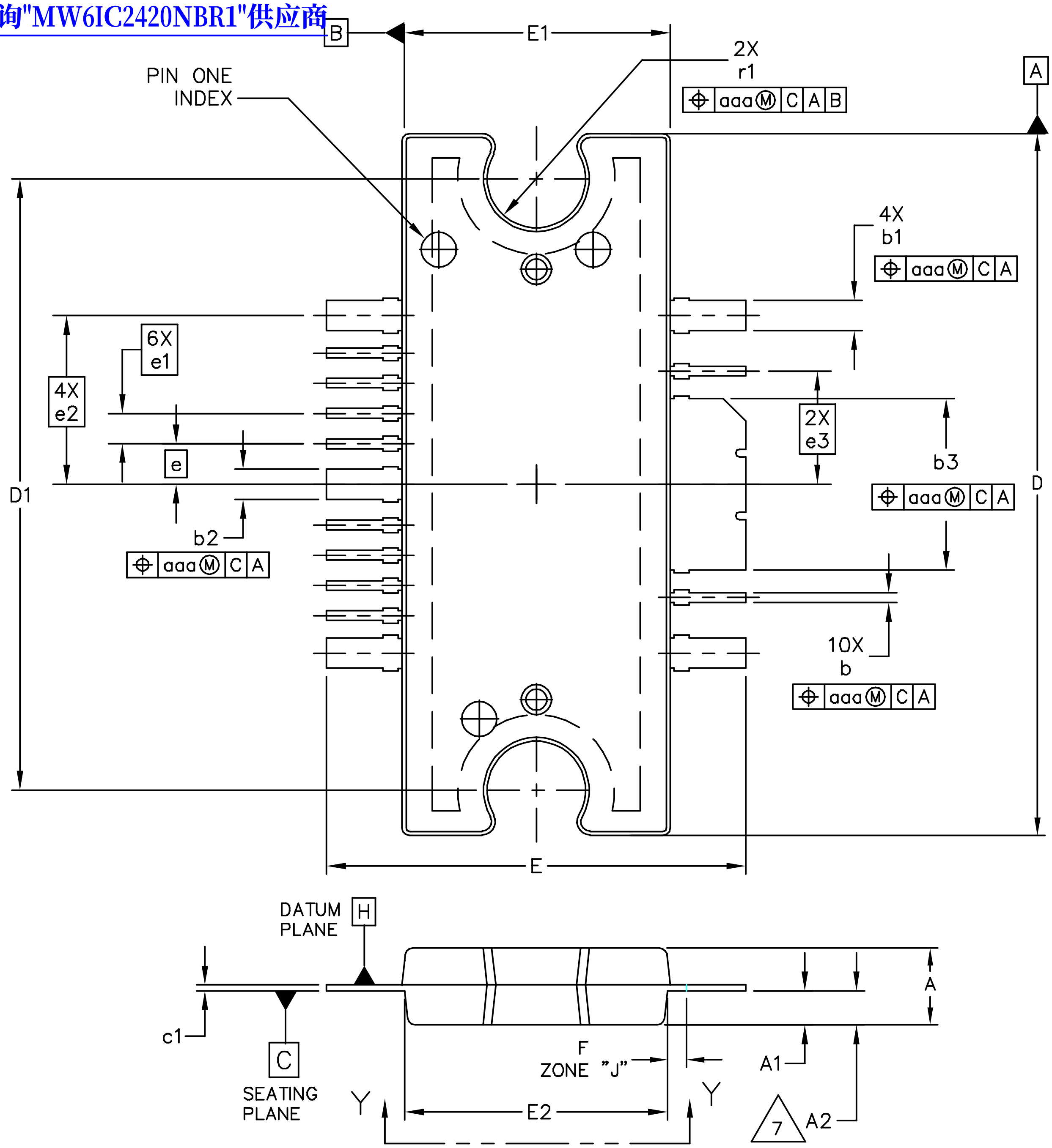


Figure 9. Series Equivalent Source and Load Impedance

PACKAGE DIMENSIONS



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	CASE NUMBER: 1329−09	13 MAR 2006
	STANDARD: NON−JEDEC	

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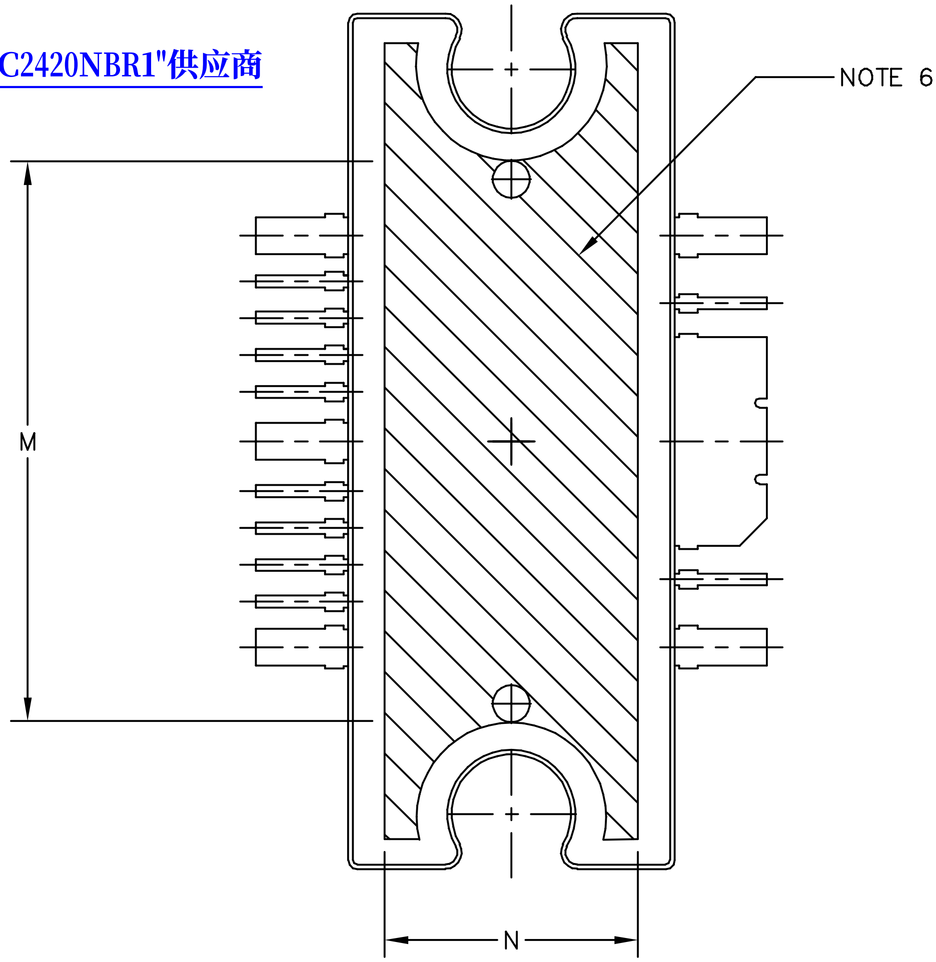

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NOTES:

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 (0.15) PER SIDE. DIMENSIONS "D" AND "E1" DO INCLUDE MOLD MISMATCH AND ARE DETERMINED AT DATUM PLANE −H−.

5. DIMENSIONS "b", "b1", "b2" AND "b3" DO NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE .005 (0.13) TOTAL IN EXCESS OF THE "b", "b1", "b2" AND "b3" DIMENSIONS AT MAXIMUM MATERIAL CONDITION.

6. HATCHING REPRESENTS THE EXPOSED AREA OFTHE HEAT SLUG. HATCHED AREA SHOWN IS ON THE SAME PLANE.

7. DIM A2 APPLIES WITHIN ZONE "J" ONLY.

	INCH		MILLIMETER			INCH		MILLIMETER	
DIM	MIN	MAX	MIN	MAX	DIM	MIN	MAX	MIN	MAX
A	.100	.104	2.54	2.64	b	.011	.017	0.28	0.43
A1	.038	.044	0.96	1.12	b1	.037	.043	0.94	1.09
A2	.040	.042	1.02	1.07	b2	.037	.043	0.94	1.09
D	.928	.932	23.57	23.67	b3	.225	.231	5.72	5.87
D1	.810 BSC		20.57 BSC		c1	.007	.011	.18	.28
E	.551	.559	14.00	14.20	e	.054 BSC		1.37 BSC	
E1	.353	.357	8.97	9.07	e1	.040 BSC		1.02 BSC	
E2	.346	.350	8.79	8.89	e2	.224 BSC		5.69 BSC	
F	.025 BSC		0.64 BSC		e3	.150 BSC		3.81 BSC	
M	.600	----	15.24	----	r1	.063	.068	1.6	1.73
N	.270	----	6.86	----					
					aaa	.004		.10	

MECHANICAL OUTLINE

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PRODUCT DOCUMENTATION

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
- AN1977: Quiescent Current Thermal Tracking Circuit in the RF Integrated Circuit Family
- 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

REVISION HISTORY

The following table summarizes revisions to this document.

Revision	Date	Description
0	Mar. 2007	• Initial Release of Data Sheet

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Freescale Semiconductor Japan Ltd.
Headquarters
ARCO Tower 15F
1-8-1, Shimo-Meguro, Meguro-ku,
Tokyo 153-0064
Japan
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support.japan@freescale.com

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