

RF LDMOS Wideband Integrated Power Amplifiers

The MWIC930N wideband integrated circuit is designed for CDMA and GSM/GSM EDGE applications. It uses Freescale's newest High Voltage (26 to 28 Volts) LDMOS IC technology and integrates a multi-stage structure. Its wideband On-Chip integral matching circuitry makes it usable from 790 to 1000 MHz. The linearity performances cover all modulations for cellular applications: GSM, GSM EDGE, TDMA, N-CDMA and W-CDMA.

Final Application

- Typical Performance @ P1dB: $V_{DD} = 26$ Volts, $I_{DQ1} = 90$ mA, $I_{DQ2} = 240$ mA, $P_{out} = 30$ Watts P1dB, Full Frequency Band (921-960 MHz)
 Power Gain — 30 dB
 Power Added Efficiency — 45%

Driver Application

- Typical Single-Carrier N-CDMA Performance: $V_{DD} = 27$ Volts, $I_{DQ1} = 90$ mA, $I_{DQ2} = 240$ mA, $P_{out} = 5$ Watts Avg., Full Frequency Band (865-894 MHz), IS -95 (Pilot, Sync, Paging, Traffic Codes 8 Through 13), Channel Bandwidth = 1.2288 MHz. PAR = 9.8 dB @ 0.01% Probability on CCDF.
 Power Gain — 31 dB
 Power Added Efficiency — 21%
 ACPR @ 750 kHz Offset — -52 dBc in 30 kHz Bandwidth
- Capable of Handling 5:1 VSWR, @ 26 Vdc, 921 MHz, 30 Watts CW Output Power

Features

- Characterized with Series Equivalent Large-Signal Impedance Parameters
- On-Chip Matching (50 Ohm Input, DC Blocked, >4 Ohm Output)
- Integrated Quiescent Current Temperature Compensation with Enable/Disable Function
- On-Chip Current Mirror g_m Reference FET for Self Biasing Application (1)
- Integrated ESD Protection
- 200°C Capable Plastic Package
- N Suffix Indicates Lead-Free Terminations. RoHS Compliant.
- In Tape and Reel. R1 Suffix = 500 Units per 44 mm, 13 inch Reel.

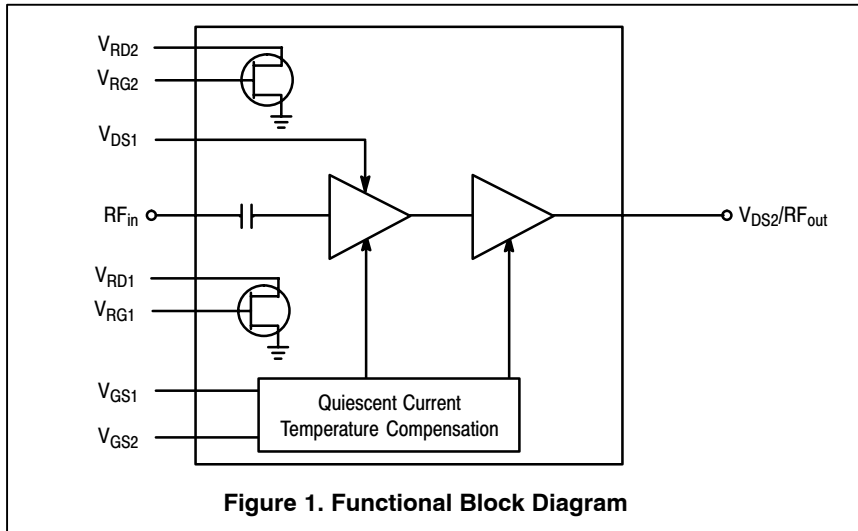
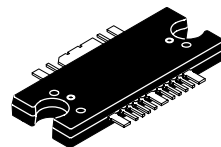


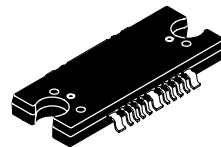
Figure 1. Functional Block Diagram

MWIC930NR1
MWIC930GNR1

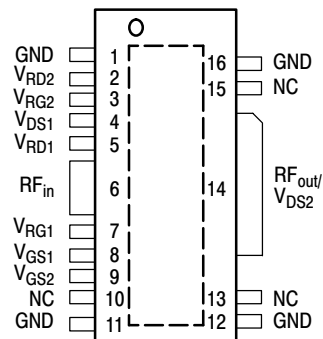
746-960 MHz, 30 W, 26-28 V
SINGLE N-CDMA, GSM/GSM EDGE
RF LDMOS WIDEBAND INTEGRATED
POWER AMPLIFIERS



CASE 1329-09
TO-272 WB-16
PLASTIC
MWIC930NR1



CASE 1329A-03
TO-272 WB-16 GULL
PLASTIC
MWIC930GNR1



(Top View)

Note: Exposed backside flag is source terminal for transistors.

Figure 2. Pin Connections

1. Refer to AN1987/D, Quiescent Current Control for the RF Integrated Circuit Device Family. Go to <http://www.freescale.com/rf>. Select Documentation/Application Notes - AN1987.

Table 1. Maximum Ratings

Rating	Symbol	Value	Unit
Drain-Source Voltage	V_{DSS}	-0.5, +65	Vdc
Gate-Source Voltage	V_{GS}	-0.5, +15	Vdc
Storage Temperature Range	T_{stg}	-65 to +175	°C
Operating Junction Temperature	T_J	200	°C

Table 2. Thermal Characteristics

Characteristic	Symbol	Value (1,2)	Unit
Thermal Resistance, Junction to Case	$R_{\theta JC}$		°C/W
GSM Application ($P_{out} = 30$ W CW)	Stage 1, 26 Vdc, $I_{DQ} = 90$ mA Stage 2, 26 Vdc, $I_{DQ} = 240$ mA	5.9 1.4	
GSM EDGE Application ($P_{out} = 15$ W CW)	Stage 1, 27 Vdc, $I_{DQ} = 90$ mA Stage 2, 27 Vdc, $I_{DQ} = 240$ mA	6.5 1.7	
CDMA Application ($P_{out} = 5$ W CW)	Stage 1, 27 Vdc, $I_{DQ} = 90$ mA Stage 2, 27 Vdc, $I_{DQ} = 240$ mA	6.5 1.8	

Table 3. ESD Protection Characteristics

Test Conditions	Class
Human Body Model	1 (Minimum)
Machine Model	M3 (Minimum)
Charge Device Model	C2 (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 ($T_C = 25^\circ\text{C}$, unless otherwise noted)

Characteristic	Symbol	Min	Typ	Max	Unit
----------------	--------	-----	-----	-----	------

Functional Tests (In Freescale Test Fixture, 50 ohm system) $V_{DD} = 27$ Vdc, $I_{DQ1} = 90$ mA, $I_{DQ2} = 240$ mA, $P_{out} = 5$ W Avg. N-CDMA, $f = 880$ MHz, Single-Carrier N-CDMA, 1.2288 MHz Channel Bandwidth Carrier. ACPR measured in 30 kHz Bandwidth @ ± 750 MHz Offset. PAR = 9.8 dB @ 0.01% Probability on CCDF

Power Gain	G_{ps}	28	31	—	dB
Power Added Efficiency	PAE	18	21	—	%
Input Return Loss ($f = 880$ MHz)	IRL	—	-12	-9	dB
Adjacent Channel Power Ratio	ACPR	—	-52	-48	dBc

Typical Performances (In Freescale Test Fixture) $V_{DD} = 26$ Vdc, $I_{DQ1} = 90$ mA, $I_{DQ2} = 240$ mA, 840 MHz < Frequency < 920 MHz

Quiescent Current Accuracy over Temperature (2) Stage 1 with 33.2 k Ω Gate Feed Resistors (-30 to 115°C) Stage 2 with 47.5 k Ω Gate Feed Resistors (-30 to 115°C)	ΔI_{1QT} ΔI_{2QT}	—	± 2.5 ± 2.5	—	%
Gain Flatness in 80 MHz Bandwidth @ $P_{out} = 5$ W CW	G_F	—	0.3	—	dB
Deviation from Linear Phase in 80 MHz Bandwidth @ $P_{out} = 5$ W CW	Φ	—	0.6	—	°
Delay @ $P_{out} = 5$ W CW Including Output Matching	Delay	—	3	—	ns
Part-to-Part Phase Variation @ $P_{out} = 5$ W CW	$\Delta\Phi$	—	± 15	—	°

1. Refer to AN1955/D, *Thermal Measurement Methodology of RF Power Amplifiers*. Go to <http://www.freescale.com/rf>.

Select Documentation/Application Notes - AN1955.

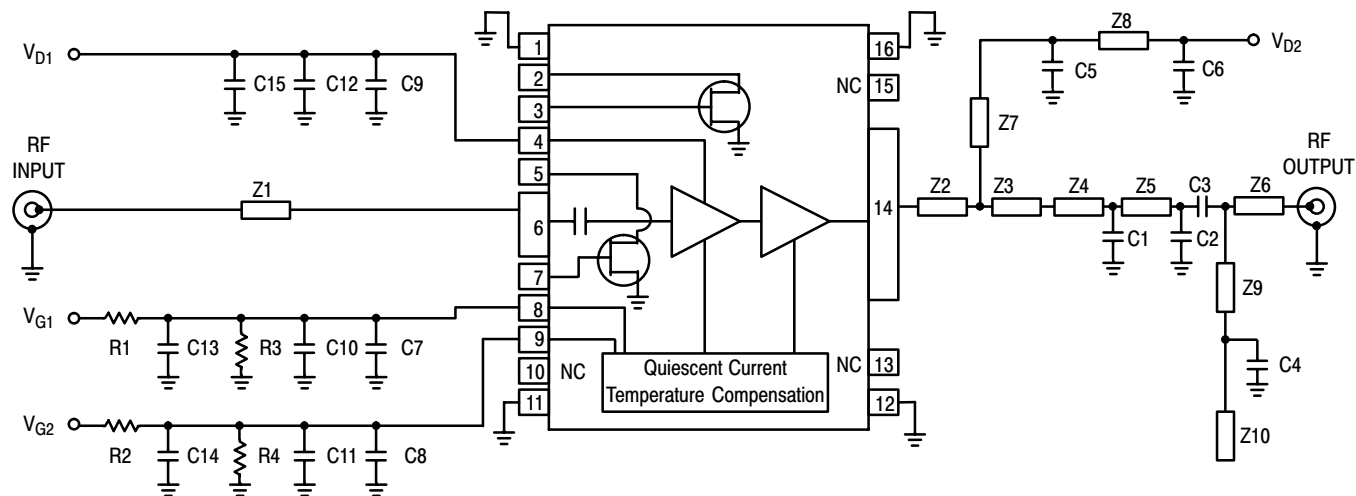
2. Refer to AN1977/D, *Quiescent Current Thermal Tracking Circuit in the RF Integrated Circuit Family*. Go to <http://www.freescale.com/rf>.

Select Documentation/Application Notes - AN1977.

(continued)

Table 5. Electrical Characteristics ($T_C = 25^\circ\text{C}$, unless otherwise noted) (continued)

Characteristic	Symbol	Min	Typ	Max	Unit
Typical GSM/GSM EDGE Performances (In Freescale GSM/GSM EDGE Test Fixture, 50 ohm system) $V_{DD} = 27\text{ Vdc}$, $I_{DQ1} = 90\text{ mA}$, $I_{DQ2} = 240\text{ mA}$, 921 MHz < Frequency < 960 MHz					
Output Power, 1dB Compression Point	P1dB	—	30	—	W
Power Gain @ $P_{out} = 30\text{ W CW}$	G_{ps}	—	30	—	dB
Power Added Efficiency @ $P_{out} = 30\text{ W CW}$	PAE	—	45	—	%
Input Return Loss @ $P_{out} = 30\text{ W CW}$	IRL	—	-12	—	dB
Intermodulation Distortion (15 W, 2-Tone, 100 kHz Tone Spacing)	IMD	—	-30	—	dBc
Intermodulation Distortion (1 W, 2-Tone, 100 kHz Tone Spacing)	IMD backoff	—	-45	—	dBc
Gain Flatness in 40 MHz Bandwidth @ $P_{out} = 30\text{ W CW}$	G_F	—	0.3	—	dB
Deviation from Linear Phase in 40 MHz Bandwidth @ $P_{out} = 30\text{ W CW}$	Φ	—	0.6	—	°



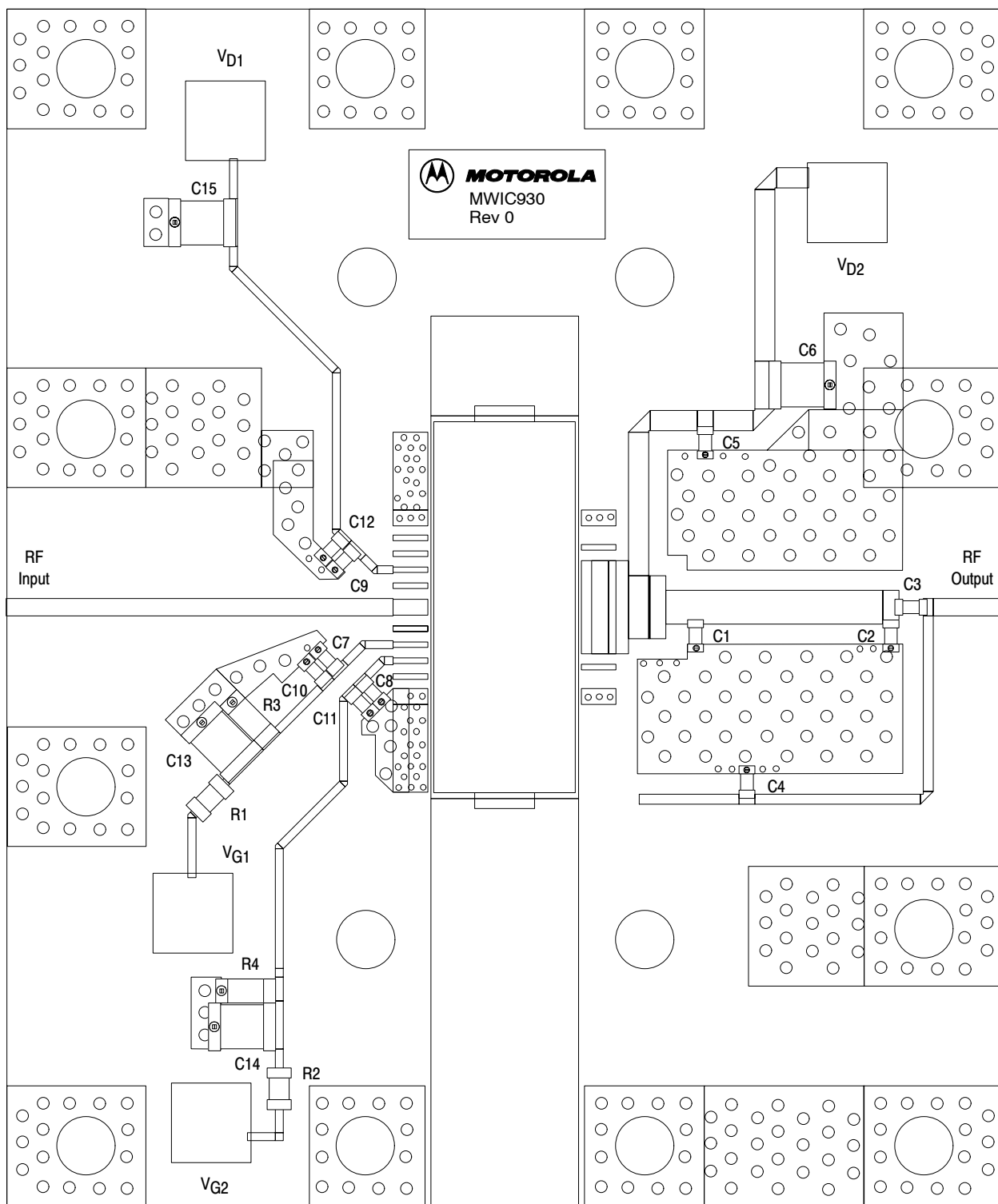
Z1	0.0438" x 0.970" 50 Ω Microstrip (not including lead pad)	Z6	0.0438" x 0.2009" Microstrip
Z2	0.234" x 0.1183" Microstrip (including lead pad)	Z7	0.5274" x 0.0504" Microstrip
Z3	0.1575" x 0.9379" Microstrip	Z8	0.0504" x 0.250" Microstrip
Z4	0.08425" x 0.0729" Microstrip	Z9	0.880" x 0.0254" Microstrip
Z5	0.08425" x 0.5111" Microstrip	Z10	0.0254" x 0.250" Microstrip
		PCB	Rogers 4350, 0.020", $\epsilon_r = 3.50$

Figure 3. MWIC930NR1(GNR1) Test Fixture Schematic

Table 6. MWIC930NR1(GNR1) Test Fixture Component Designations and Values

Part	Description	Part Number	Manufacturer
*C1	15 pF High Q Capacitor	ATC600S150JW	ATC
*C2	6.8 pF High Q Capacitor - GSM Fixture 8.2 pF High Q Capacitor - CDMA Fixture	ATC600S6R8CW ATC600S8R2CW	ATC
*C3	5.6 pF High Q Capacitor	ATC600S5R6CW	ATC
*C4, C5, C7, C8, C9	47 pF High Q Capacitors	ATC600S470JW	ATC
C6, C13, C14, C15	1 μF Chip Capacitors	GRM42-2X7R105K050AL	Murata
C10, C11, C12	10 nF Chip Capacitors	C0603C103J5R	Kemet
R1, R2	1 kΩ, 1/8 W Chip Resistors	RM73B2AT102J	KOA Speer
R3, R4	1 MΩ, 1/4 W Chip Resistors	RM73B2BT105J	KOA Speer

* For output matching and bypass purposes, it is strongly recommended to use these exact capacitors.



Freescale has begun the transition of marking Printed Circuit Boards (PCBs) with the Freescale Semiconductor signature/logo. PCBs may have either Motorola or Freescale markings during the transition period. These changes will have no impact on form, fit or function of the current product.

Figure 4. MWIC930NR1(GNR1) Test Circuit Component Layout

TYPICAL CHARACTERISTICS

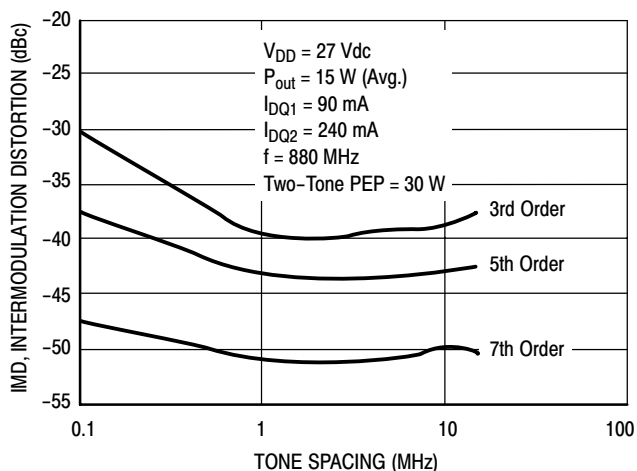


Figure 5. Intermodulation Distortion Products versus Output Power

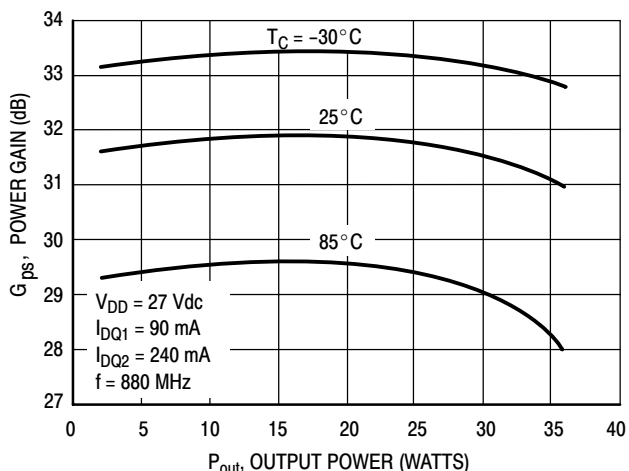


Figure 6. Power Gain versus Output Power

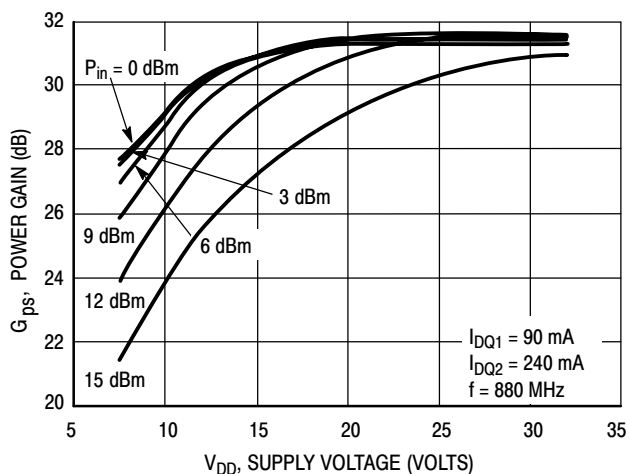


Figure 7. Power Gain versus Supply Voltage

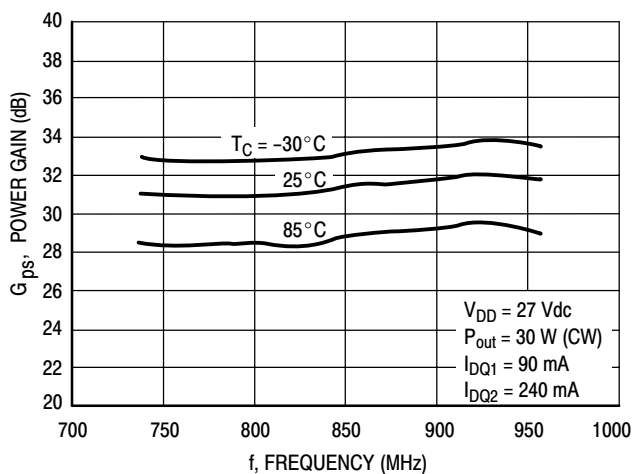


Figure 8. Power Gain versus Frequency

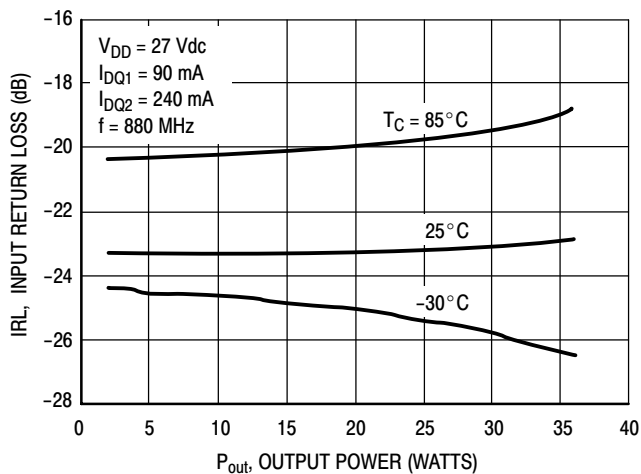


Figure 9. Input Return Loss versus Output Power

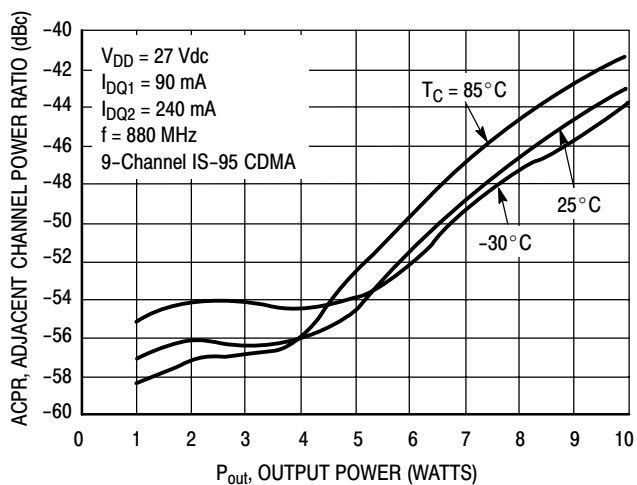


Figure 10. Adjacent Channel Power Ratio versus Output Power

TYPICAL CHARACTERISTICS

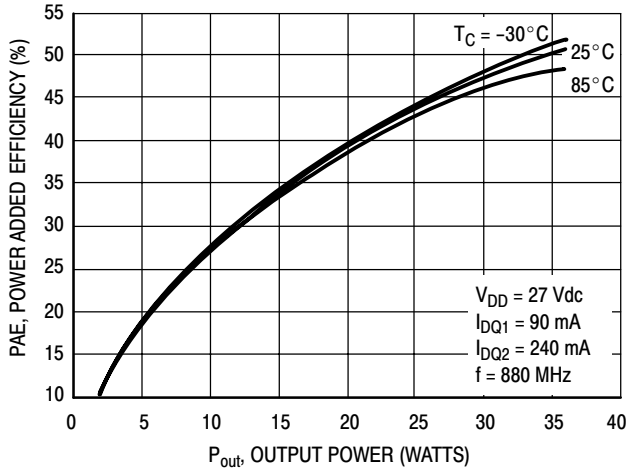


Figure 11. Power Added Efficiency versus Output Power

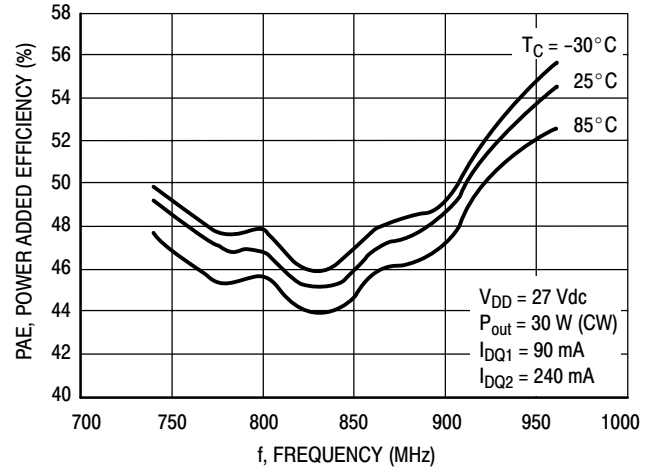
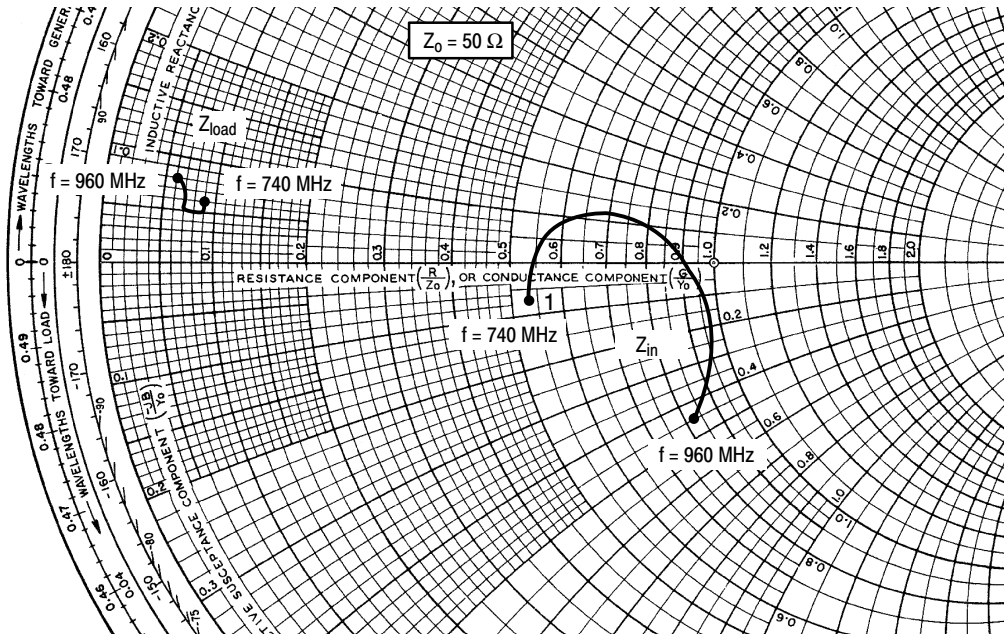


Figure 12. Power Added Efficiency versus Frequency



$V_{DD} = 27 \text{ Vdc}$, $I_{DQ1} = 90 \text{ mA}$, $I_{DQ2} = 240 \text{ mA}$, $P_{out} = 5 \text{ W Avg.}$

f MHz	Z_{in} Ω	Z_{load} Ω
740	$26.61 - j3.68$	$4.28 + j2.99$
760	$26.88 - j0.53$	$4.37 + j2.91$
780	$28.22 + j2.21$	$4.39 + j2.79$
800	$30.57 + j4.31$	$4.34 + j2.64$
820	$33.79 + j5.53$	$4.21 + j2.54$
840	$37.83 + j5.30$	$4.06 + j2.52$
860	$41.92 + j3.42$	$3.90 + j2.58$
880	$45.58 - j0.40$	$3.73 + j2.70$
900	$47.77 - j5.84$	$3.59 + j2.93$
920	$47.83 - j12.15$	$3.43 + j3.17$
940	$45.55 - j18.05$	$3.28 + j3.44$
960	$41.58 - j22.64$	$3.13 + j3.75$

Z_{in} = Device input impedance as measured from RF input to ground.

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

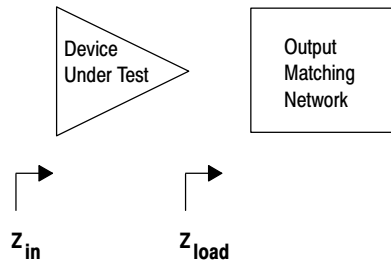
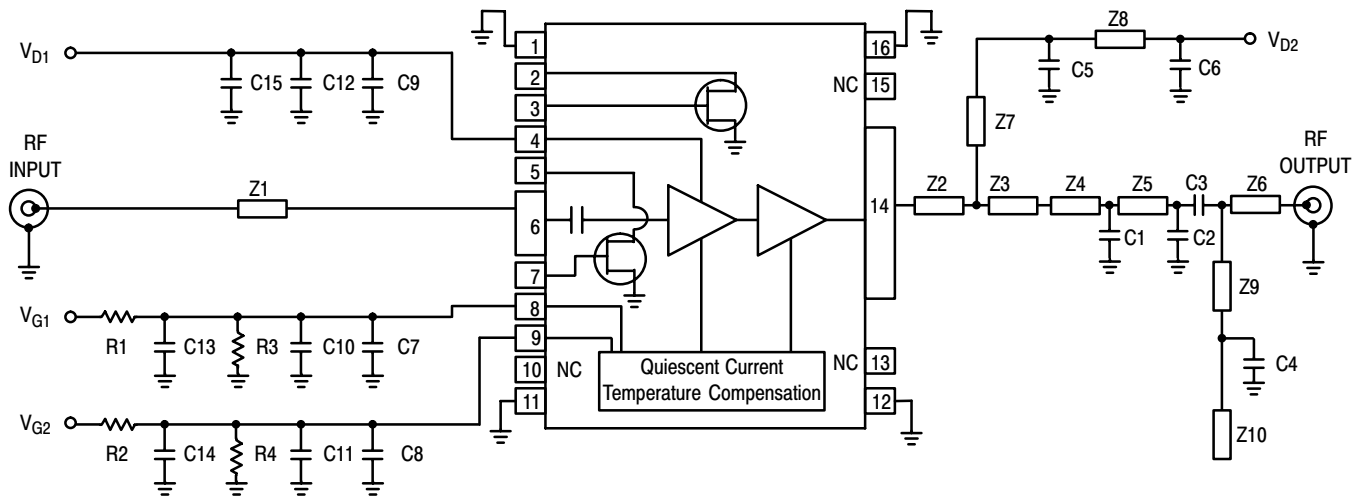


Figure 13. Series Equivalent Input and Load Impedance

DRIVER/PRE-DRIVER PERFORMANCE



Z1	0.0438" x 0.970" 50 Ω Microstrip (not including lead pad)	Z6	0.0438" x 0.2009" Microstrip
Z2	0.234" x 0.1183" Microstrip (including lead pad)	Z7	0.5274" x 0.0504" Microstrip
Z3	0.1575" x 0.9379" Microstrip	Z8	0.0504" x 0.250" Microstrip
Z4	0.08425" x 0.0729" Microstrip	Z9	0.880" x 0.0254" Microstrip
Z5	0.08425" x 0.5111" Microstrip	Z10	0.0254" x 0.250" Microstrip
		PCB	Rogers 4350, 0.020", $\epsilon_r = 3.50$

**Figure 14. MWIC930NR1(GNR1) Test Fixture Schematic —
Alternate Characterization for Driver/Pre-Driver Performance**

**Table 7. MWIC930NR1(GNR1) Test Fixture Component Designations and Values —
Alternate Characterization for Driver/Pre-Driver Performance**

Part	Description	Part Number	Manufacturer
*C1	12 pF High Q Capacitor	ATC600S120JW	ATC
*C2	8.2 pF High Q Capacitor - CDMA Fixture	ATC600S8R2CW	ATC
*C3	5.6 pF High Q Capacitor	ATC600S5R6CW	ATC
*C4, C5, C7, C8, C9	47 pF High Q Capacitors	ATC600S470JW	ATC
C6, C13, C14, C15	1 μF Chip Capacitors	GRM42-2X7R105K050AL	Murata
C10, C11, C12	10 nF Chip Capacitors	C0603C103J5R	Kemet
R1, R2	1 kΩ, 1/8 W Chip Resistors	RM73B2AT102J	KOA Speer
R3, R4	1 MΩ, 1/4 W Chip Resistors	RM73B2BT105J	KOA Speer

*For output matching and bypass purposes, it is strongly recommended to use these exact capacitors.

**TYPICAL CHARACTERISTICS
DRIVER/PRE-DRIVER PERFORMANCE**

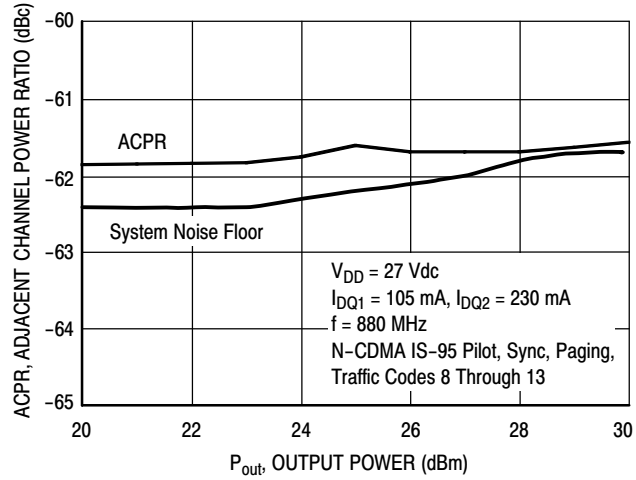
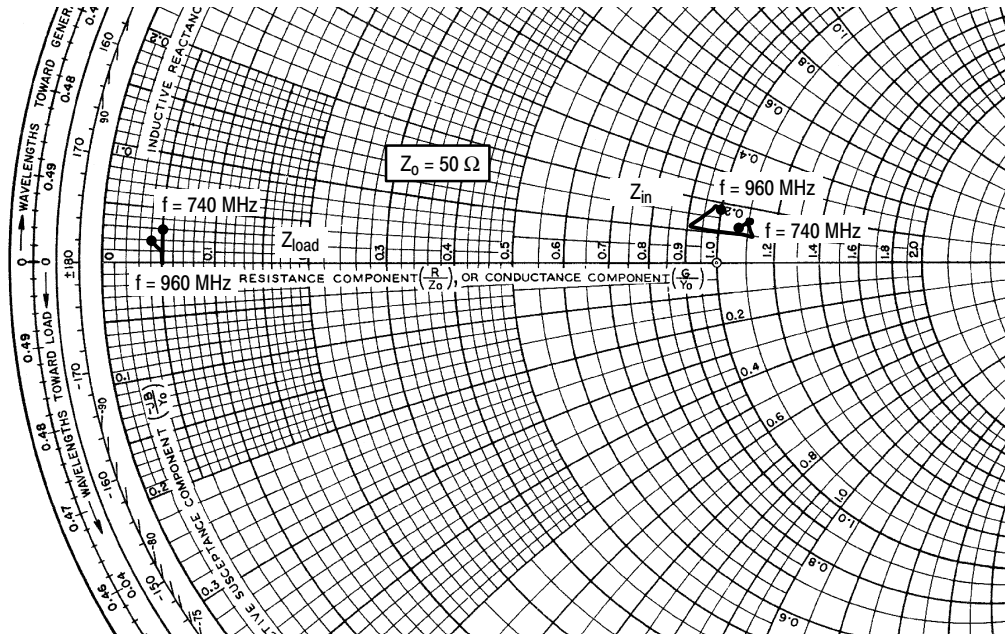


Figure 15. Single-Carrier N-CDMA ACPR versus Output Power



$V_{DD} = 27 \text{ Vdc}$, $I_{DQ1} = 105 \text{ mA}$, $I_{DQ2} = 230 \text{ mA}$, $P_{out} = 5 \text{ W Avg.}$

f MHz	Z_{in} Ω	Z_{load} Ω
740	$53.944 + j6.745$	$2.535 + j1.662$
760	$54.452 + j7.112$	$2.602 + j1.080$
780	$55.006 + j7.440$	$2.688 + j0.548$
800	$55.549 + j7.656$	$2.659 + j0.064$
820	$55.604 + j7.855$	$2.615 + j0.329$
840	$55.190 + j7.835$	$2.568 + j0.450$
860	$55.110 + j7.410$	$2.494 + j0.620$
880	$55.752 + j4.763$	$2.444 + j0.650$
900	$45.606 + j5.832$	$2.440 + j0.689$
920	$49.206 + j9.284$	$2.134 + j0.930$
940	$49.939 + j9.030$	$2.155 + j0.835$
960	$50.088 + j8.752$	$2.095 + j1.235$

Z_{in} = Device input impedance as measured from RF input to ground.

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

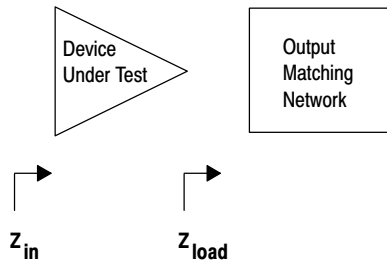
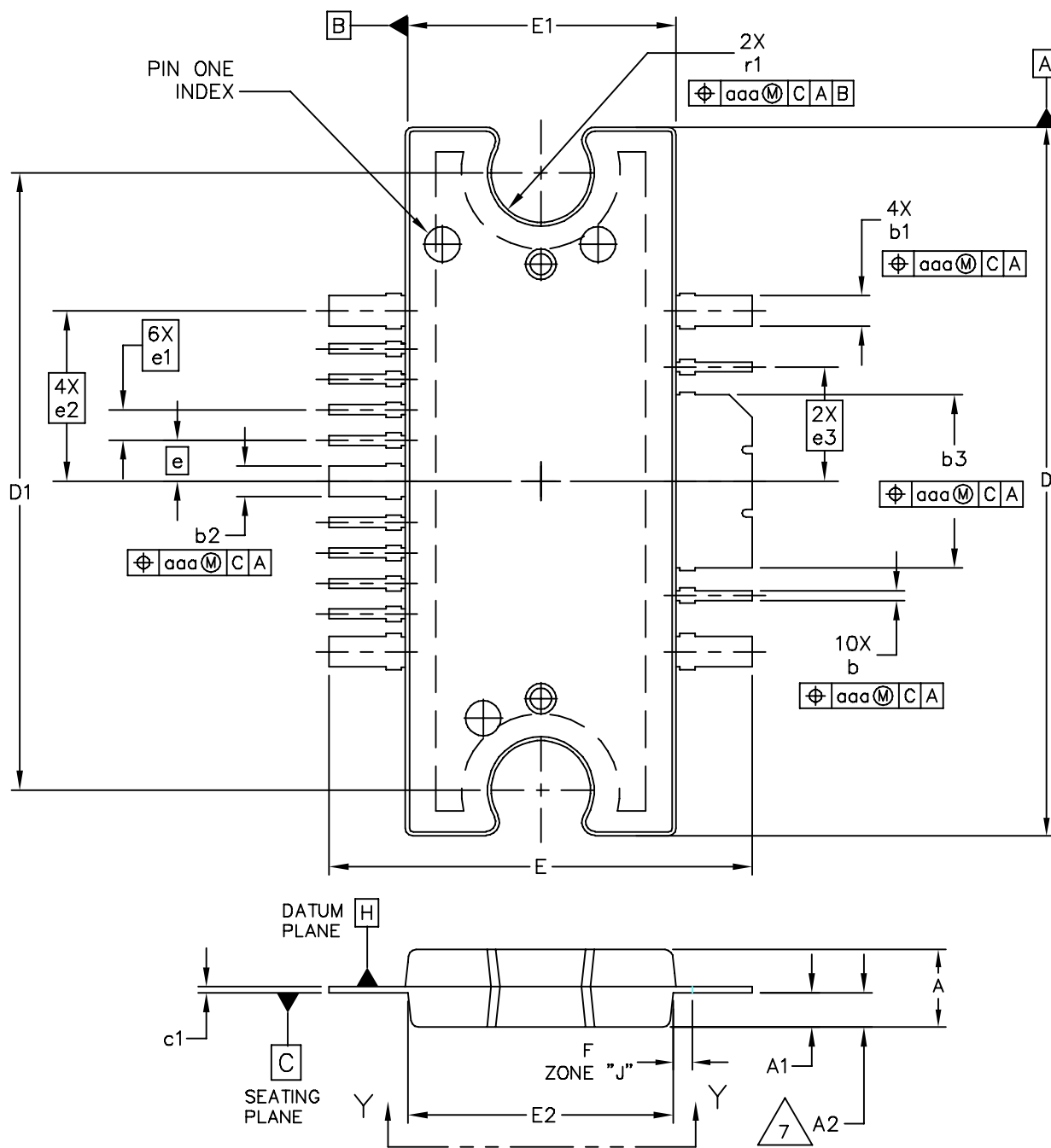


Figure 16. Series Equivalent Input and Load Impedance — Alternate Characterization for Driver/Pre-Driver Performance

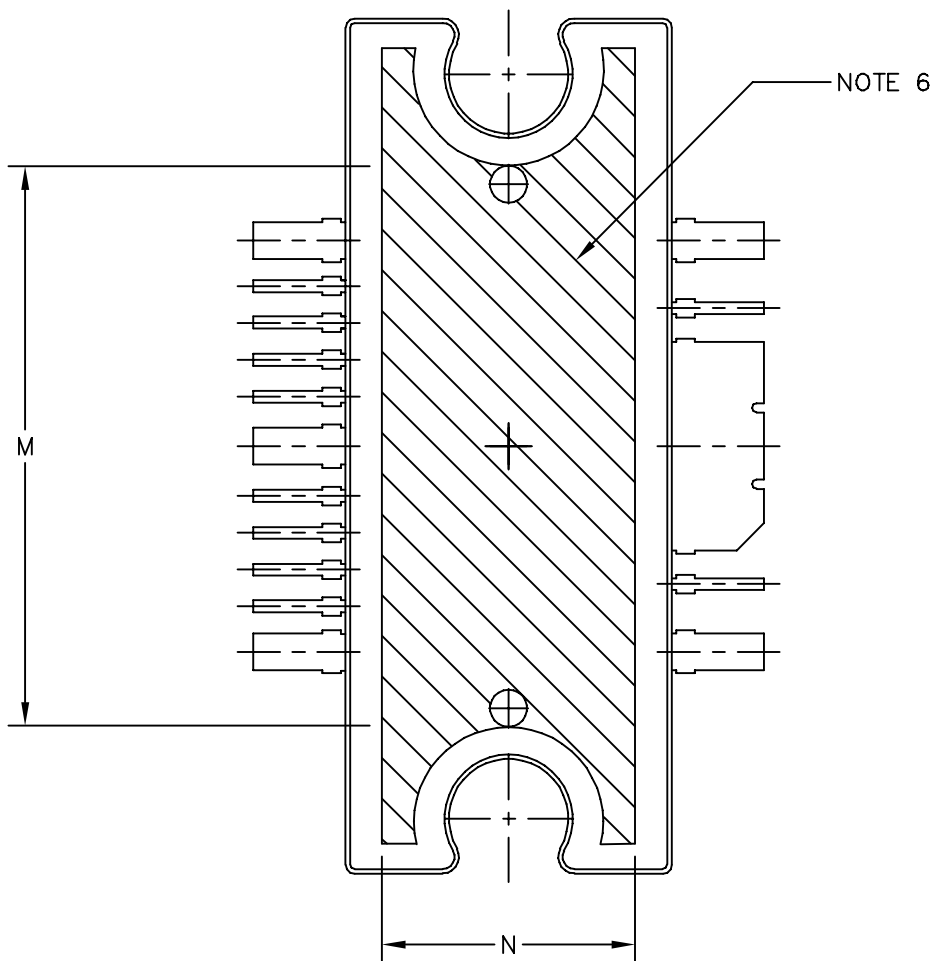
NOTES

NOTES

PACKAGE DIMENSIONS



© FREESCALE SEMICONDUCTOR, INC. ALL RIGHTS RESERVED.	MECHANICAL OUTLINE	PRINT VERSION NOT TO SCALE
TITLE: TO-272 WIDE BODY MULTI-LEAD	DOCUMENT NO: 98ARH99164A	REV: L
	CASE NUMBER: 1329-09	13 MAR 2006
	STANDARD: NON-JEDEC	



VIEW Y-Y

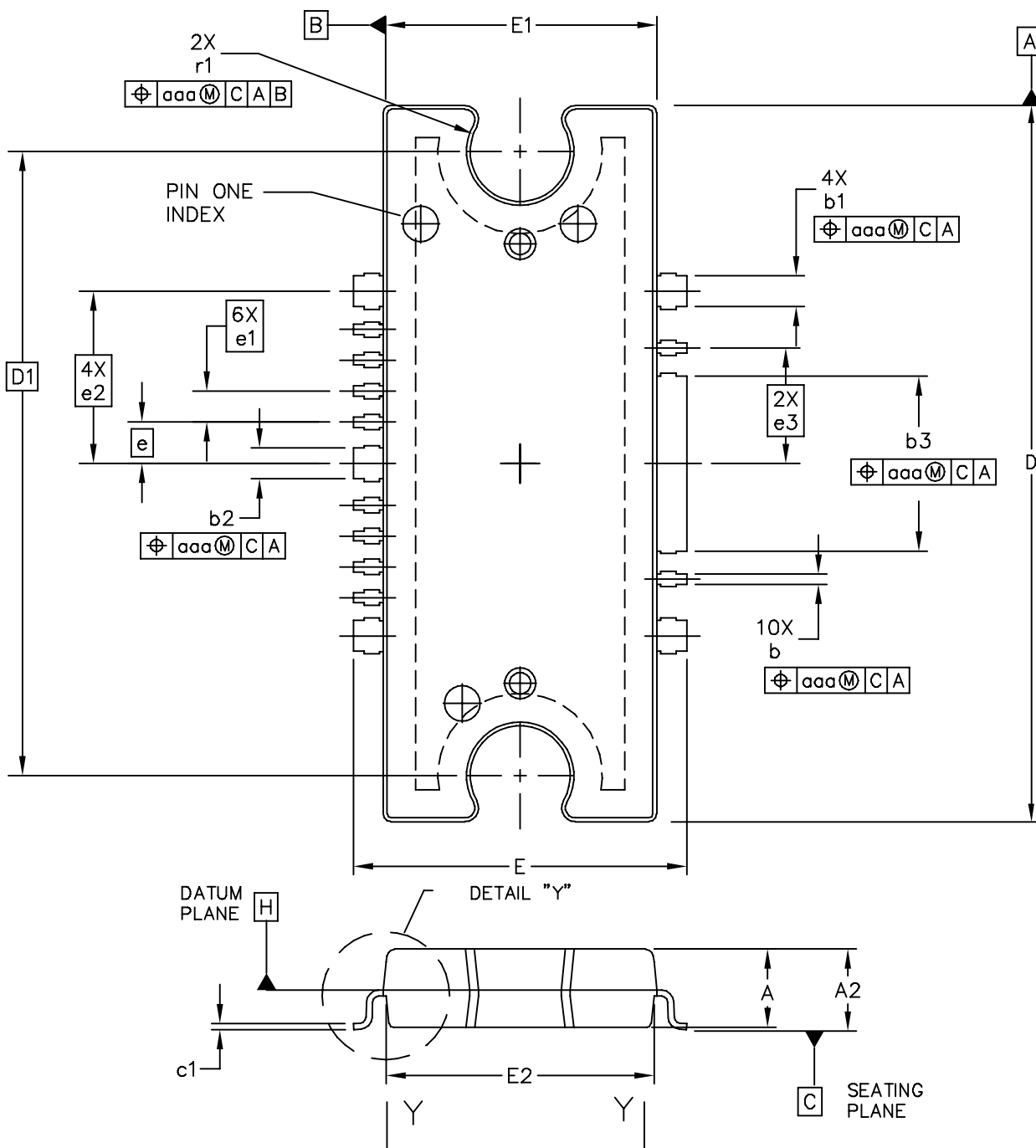
© FREESCALE SEMICONDUCTOR, INC. ALL RIGHTS RESERVED.	MECHANICAL OUTLINE	PRINT VERSION NOT TO SCALE	
TITLE: TO-272 WIDE BODY MULTI-LEAD	DOCUMENT NO: 98ARH99164A	REV: L	
	CASE NUMBER: 1329-09	13 MAR 2006	
	STANDARD: NON-JEDEC		

NOTES:

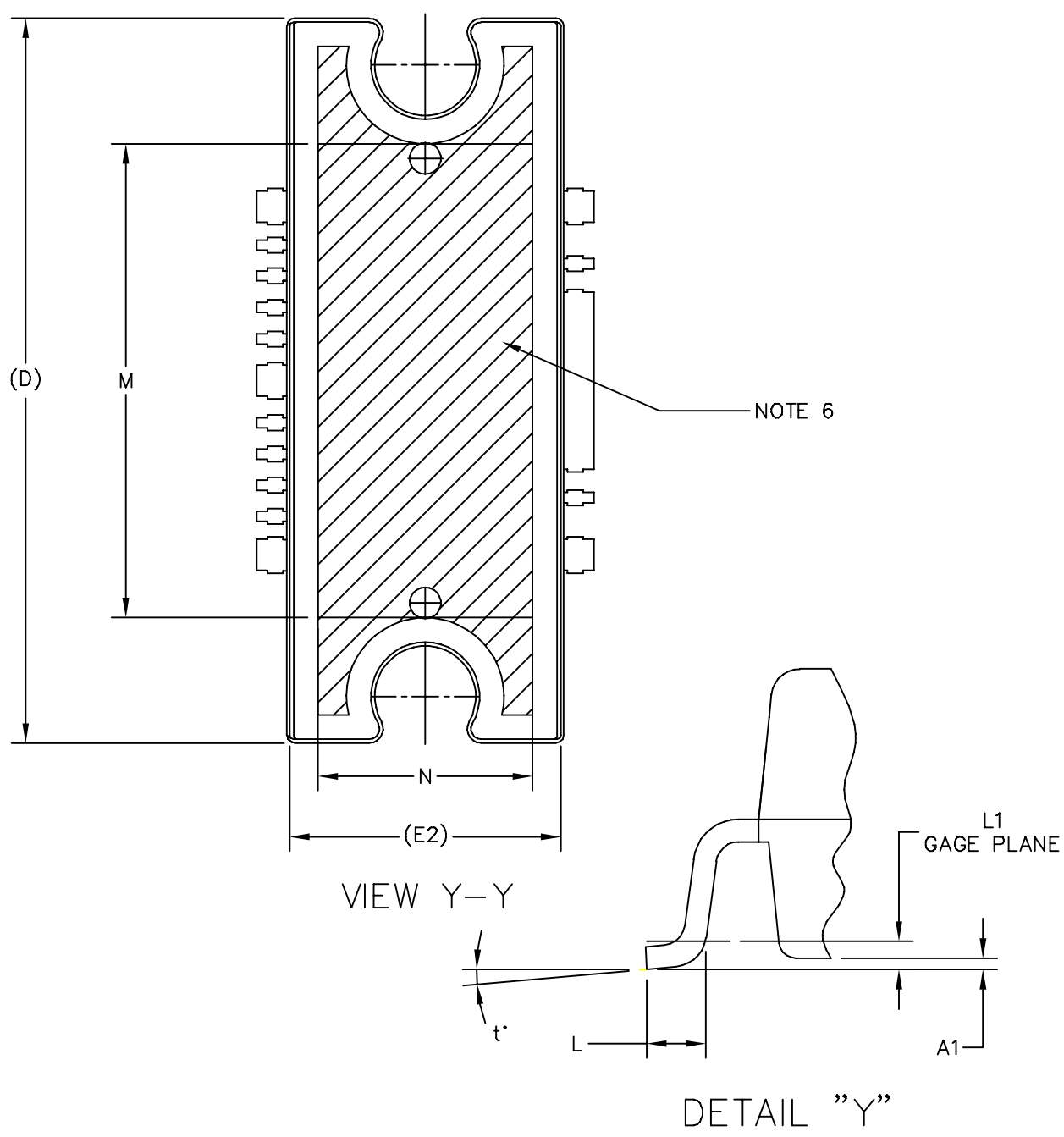
1. CONTROLLING DIMENSION: INCH
2. INTERPRET DIMENSIONS AND TOLERANCES PER ASME Y14.5M-1994.
3. DATUM PLANE -H- IS LOCATED AT THE TOP OF LEAD AND IS COINCIDENT WITH THE LEAD WHERE THE LEAD EXITS THE PLASTIC BODY AT THE TOP OF THE PARTING LINE.
4. DIMENSIONS "D" AND "E1" DO NOT INCLUDE MOLD PROTRUSION. ALLOWABLE PROTRUSION IS .006 (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 OF THE HEAT SLUG. HATCHED AREA SHOWN IS ON THE SAME PLANE.
7. DIM A2 APPLIES WITHIN ZONE "J" ONLY.

DIM	INCH		MILLIMETER		DIM	INCH		MILLIMETER	
	MIN	MAX	MIN	MAX		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	

© FREESCALE SEMICONDUCTOR, INC. ALL RIGHTS RESERVED.		MECHANICAL OUTLINE		PRINT VERSION NOT TO SCALE	
TITLE: TO-272 WIDE BODY MULTI-LEAD	DOCUMENT NO: 98ARH99164A		REV: L		
	CASE NUMBER: 1329-09		13 MAR 2006		
	STANDARD: NON-JEDEC				



© FREESCALE SEMICONDUCTOR, INC. ALL RIGHTS RESERVED.	MECHANICAL OUTLINE		PRINT VERSION NOT TO SCALE	
	TITLE: TO-272WB, 16 LEAD GULL WING PLASTIC		DOCUMENT NO: 98ASA10532D	REV: E
		CASE NUMBER: 1329A-03	3 APR 2006	
		STANDARD: NON-JEDEC		



© FREESCALE SEMICONDUCTOR, INC. ALL RIGHTS RESERVED.	MECHANICAL OUTLINE	PRINT VERSION NOT TO SCALE	
TITLE: TO-272WB, 16 LEAD GULL WING PLASTIC	DOCUMENT NO: 98ASA10532D	REV: E	
	CASE NUMBER: 1329A-03	3 APR 2006	
	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 (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 EXPOSED AREA OF THE HEAT SLUG. HATCHED AREA SHOWN IS ON THE SAME PLANE.

DIM	INCH		MILLIMETER		DIM	INCH		MILLIMETER	
	MIN	MAX	MIN	MAX		MIN	MAX	MIN	MAX
A	.100	.104	2.54	2.64	b	.011	.017	0.28	0.43
A1	.001	.004	0.02	0.10	b1	.037	.043	0.94	1.09
A2	.099	.110	2.51	2.79	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	.429	.437	10.9	11.1	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	
L	.018	.024	4.90	5.06	e3	.150 BSC		3.81 BSC	
L1	.01 BSC		.025 BSC		r1	.063	.068	1.6	1.73
M	.600	----	15.24	----	t	2'	8'	2'	8'
N	.270	----	6.86	----	aaa	.004		.10	

© FREESCALE SEMICONDUCTOR, INC. ALL RIGHTS RESERVED.		MECHANICAL OUTLINE		PRINT VERSION NOT TO SCALE	
TITLE: TO-272WB, 16 LEAD GULL WING PLASTIC			DOCUMENT NO: 98ASA10532D		REV: E
			CASE NUMBER: 1329A-03		3 APR 2006
			STANDARD: NON-JEDEC		

How to Reach Us:

Home Page:

www.freescale.com

E-mail:

support@freescale.com

USA/Europe or Locations Not Listed:

Freescale Semiconductor
Technical Information Center, CH370
1300 N. Alma School Road
Chandler, Arizona 85224
+1-800-521-6274 or +1-480-768-2130
support@freescale.com

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)
support@freescale.com

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

Asia/Pacific:

Freescale Semiconductor Hong Kong Ltd.
Technical Information Center
2 Dai King Street
Tai Po Industrial Estate
Tai Po, N.T., Hong Kong
+800 2666 8080
support.asia@freescale.com

For Literature Requests Only:

Freescale Semiconductor Literature Distribution Center
P.O. Box 5405
Denver, Colorado 80217
1-800-441-2447 or 303-675-2140
Fax: 303-675-2150
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. 2006. All rights reserved.

RoHS-compliant and/or Pb-free versions of Freescale products have the functionality and electrical characteristics of their non-RoHS-compliant and/or non-Pb-free counterparts. For further information, see <http://www.freescale.com> or contact your Freescale sales representative.

For information on Freescale's Environmental Products program, go to <http://www.freescale.com/epp>.