

# RF LDMOS Wideband Integrated Power Amplifiers

The MD7IC18120N/GN wideband integrated circuit is designed with on-chip matching that makes it usable from 1805 to 1880 MHz. This multi-stage structure is rated for 26 to 32 Volt operation and covers all typical cellular base station modulation formats.

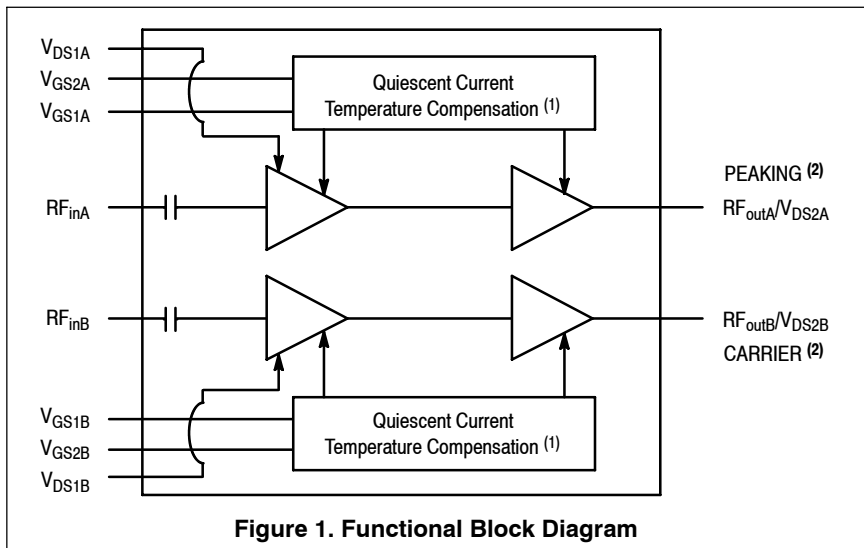
- Typical Doherty Single-Carrier W-CDMA Performance:  $V_{DD} = 28$  Volts,  $I_{DQ1A} = 70$  mA,  $I_{DQ1B} = 160$  mA,  $I_{DQ2B} = 500$  mA,  $V_{GS2A} = 1.7$  Vdc,  $P_{out} = 30$  Watts Avg., IQ Magnitude Clipping, Channel Bandwidth = 3.84 MHz, Input Signal PAR = 7.5 dB @ 0.01% Probability on CCDF.

| Frequency | $G_{ps}$ (dB) | PAE (%) | Output PAR (dB) |
|-----------|---------------|---------|-----------------|
| 1805 MHz  | 25.7          | 36.7    | 6.9             |
| 1840 MHz  | 25.7          | 36.3    | 6.9             |
| 1880 MHz  | 25.8          | 35.3    | 6.7             |

- Capable of Handling 10:1 VSWR, @ 32 Vdc, 1840 MHz, 140 Watts CW Output Power
- Stable into a 5:1 VSWR. All Spurs Below -60 dBc @ 100 Watts CW  $P_{out}$
- Typical  $P_{out}$  @ 1 dB Compression Point  $\approx$  120 Watts CW

## Features

- Production Tested in a Symmetrical Doherty Configuration
- 100% PAR Tested for Guaranteed Output Power Capability
- Characterized with Large-Signal Load-Pull Parameters and Common Source S-Parameters
- On-Chip Matching (50 Ohm Input, DC Blocked)
- Integrated Quiescent Current Temperature Compensation with Enable/Disable Function (1)
- Integrated ESD Protection
- Greater Negative Gate-Source Voltage Range for Improved Class C Operation
- 225°C Capable Plastic Package
- RoHS Compliant
- In Tape and Reel. R1 Suffix = 500 Units per 44 mm, 13 inch Reel.



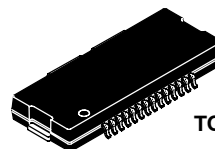
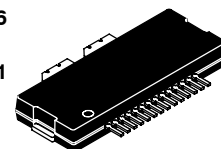
**Figure 1. Functional Block Diagram**

- Refer to AN1977, *Quiescent Current Thermal Tracking Circuit in the RF Integrated Circuit Family* and to AN1987, *Quiescent Current Control for the RF Integrated Circuit Device Family*. Go to <http://www.freescale.com/rf>. Select Documentation/Application Notes - AN1977 or AN1987.
- Peaking and Carrier orientation is determined by the test fixture design.

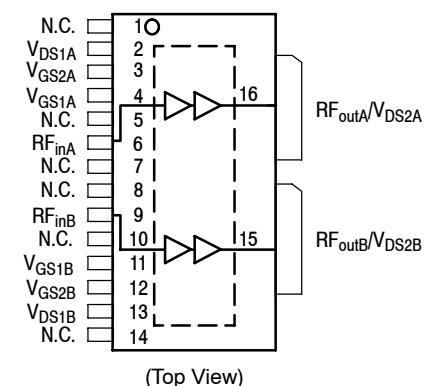
**MD7IC18120NR1**  
**MD7IC18120GNR1**

**1805-1880 MHz, 30 W AVG., 28 V**  
**SINGLE W-CDMA**  
**RF LDMOS WIDEBAND**  
**INTEGRATED POWER AMPLIFIERS**

**CASE 1866-02**  
**TO-270 WBL-16**  
**PLASTIC**  
**MD7IC18120NR1**



**CASE 1867-02**  
**TO-270 WBL-16 GULL**  
**PLASTIC**  
**MD7IC18120GNR1**



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

**Figure 2. Pin Connections**

**Table 1. Maximum Ratings**

| Rating                                                                     | Symbol    | Value       | Unit      |
|----------------------------------------------------------------------------|-----------|-------------|-----------|
| Drain-Source Voltage                                                       | $V_{DS}$  | -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 @ $T_C = 25^\circ\text{C}$<br>Derate above $25^\circ\text{C}$ | CW        | 175<br>1.5  | W<br>W/°C |
| Input Power                                                                | $P_{in}$  | 30          | dBm       |

**Table 2. Thermal Characteristics**

| Characteristic | Symbol | Value (2,3) | Unit |
|----------------|--------|-------------|------|
|----------------|--------|-------------|------|

**Final Doherty Application**

|                                                                                                                                                                                                                                                                                                                    |                 |                            |      |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|----------------------------|------|
| Thermal Resistance, Junction to Case<br>Case Temperature $78^\circ\text{C}$ , $P_{out} = 30\text{ W CW}$ , 1880 MHz<br>Stage 1A, 28 Vdc, $I_{DQ1A} = 70\text{ mA}$<br>Stage 1B, 28 Vdc, $I_{DQ1B} = 160\text{ mA}$<br>Stage 2A, 28 Vdc, $V_{G2A} = 1.7\text{ Vdc}$<br>Stage 2B, 28 Vdc, $I_{DQ2B} = 500\text{ mA}$ | $R_{\theta JC}$ | 4.5<br>4.5<br>0.88<br>0.88 | °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) | III (Minimum) |

**Table 4. Moisture Sensitivity Level**

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

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.

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

| Characteristic                                                                                    | Symbol    | Min | Typ | Max | Unit            |
|---------------------------------------------------------------------------------------------------|-----------|-----|-----|-----|-----------------|
| <b>Stage 1 — Off Characteristics</b> <sup>(1)</sup>                                               |           |     |     |     |                 |
| Zero Gate Voltage Drain Leakage Current<br>( $V_{DS} = 65\text{ Vdc}$ , $V_{GS} = 0\text{ Vdc}$ ) | $I_{DSS}$ | —   | —   | 10  | $\mu\text{Adc}$ |
| Zero Gate Voltage Drain Leakage Current<br>( $V_{DS} = 28\text{ Vdc}$ , $V_{GS} = 0\text{ Vdc}$ ) | $I_{DSS}$ | —   | —   | 1   | $\mu\text{Adc}$ |
| Gate-Source Leakage Current<br>( $V_{GS} = 1.5\text{ Vdc}$ , $V_{DS} = 0\text{ Vdc}$ )            | $I_{GSS}$ | —   | —   | 1   | $\mu\text{Adc}$ |

**Stage 1 — On Characteristics** <sup>(1)</sup>

|                                                                                                                 |                                                                        |            |            |            |     |
|-----------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------|------------|------------|------------|-----|
| Gate Threshold Voltage<br>( $V_{DS} = 10\text{ Vdc}$ , $I_D = 28\text{ }\mu\text{Adc}$ )                        | $V_{GS(th)}$                                                           | 1.2        | 2.0        | 2.7        | Vdc |
| Gate Quiescent Voltage<br>( $V_{DS} = 28\text{ Vdc}$ , $I_{DQ1A} = 70\text{ mA}$ , $I_{DQ1B} = 160\text{ mA}$ ) | $V_{GS(Q)}$                                                            | —          | 2.9        | —          | Vdc |
| Fixture Gate Quiescent Voltage<br>( $V_{DD} = 28\text{ Vdc}$ , Measured in Functional Test)                     | $I_{DQ1A} = 70\text{ mA}$<br>$I_{DQ1B} = 160\text{ mA}$<br>$V_{GG(Q)}$ | 4.0<br>7.1 | 5.0<br>8.1 | 6.0<br>9.1 | Vdc |

**Stage 2 — Off Characteristics** <sup>(1)</sup>

|                                                                                                   |           |   |   |    |                 |
|---------------------------------------------------------------------------------------------------|-----------|---|---|----|-----------------|
| Zero Gate Voltage Drain Leakage Current<br>( $V_{DS} = 65\text{ Vdc}$ , $V_{GS} = 0\text{ Vdc}$ ) | $I_{DSS}$ | — | — | 10 | $\mu\text{Adc}$ |
| Zero Gate Voltage Drain Leakage Current<br>( $V_{DS} = 28\text{ Vdc}$ , $V_{GS} = 0\text{ Vdc}$ ) | $I_{DSS}$ | — | — | 1  | $\mu\text{Adc}$ |
| Gate-Source Leakage Current<br>( $V_{GS} = 1.5\text{ Vdc}$ , $V_{DS} = 0\text{ Vdc}$ )            | $I_{GSS}$ | — | — | 1  | $\mu\text{Adc}$ |

**Stage 2 — On Characteristics** <sup>(1)</sup>

|                                                                                                                          |              |     |      |     |     |
|--------------------------------------------------------------------------------------------------------------------------|--------------|-----|------|-----|-----|
| Gate Threshold Voltage<br>( $V_{DS} = 10\text{ Vdc}$ , $I_D = 185\text{ }\mu\text{Adc}$ )                                | $V_{GS(th)}$ | 1.2 | 2.0  | 2.7 | Vdc |
| Gate Quiescent Voltage<br>( $V_{DS} = 28\text{ Vdc}$ , $I_{DQ2B} = 500\text{ mA}$ )                                      | $V_{GS(Q)}$  | —   | 2.6  | —   | Vdc |
| Fixture Gate Quiescent Voltage<br>( $V_{DD} = 28\text{ Vdc}$ , $I_{DQ2B} = 500\text{ mA}$ , Measured in Functional Test) | $V_{GG(Q)}$  | 5.3 | 6.3  | 7.3 | Vdc |
| Drain-Source On-Voltage<br>( $V_{GS} = 10\text{ Vdc}$ , $I_D = 1.8\text{ Adc}$ )                                         | $V_{DS(on)}$ | —   | 0.35 | —   | Vdc |

**Functional Tests** <sup>(2,3,4)</sup> (In Freescale Test Fixture, 50 ohm system)  $V_{DD} = 28\text{ Vdc}$ ,  $I_{DQ1A} = 70\text{ mA}$ ,  $I_{DQ1B} = 160\text{ mA}$ ,  $I_{DQ2B} = 500\text{ mA}$ ,  $V_{GS2A} = 1.7\text{ Vdc}$ ,  $P_{out} = 30\text{ W Avg.}$ ,  $f = 1880\text{ MHz}$ , Single-Carrier W-CDMA, IQ Magnitude Clipping, Input Signal PAR = 7.5 dB @ 0.01% Probability on CCDF.

|                                                          |          |      |      |      |    |
|----------------------------------------------------------|----------|------|------|------|----|
| Power Gain                                               | $G_{ps}$ | 24.0 | 25.8 | 28.0 | dB |
| Power Added Efficiency                                   | PAE      | 33.0 | 35.3 | —    | %  |
| Output Peak-to-Average Ratio @ 0.01% Probability on CCDF | PAR      | 6.0  | 6.7  | —    | dB |

1. Each side of device measured separately.
2. Part internally matched both on input and output.
3. Measurement made with device in a Symmetrical Doherty configuration.
4. Measurement made with device in straight lead configuration before any lead forming operation is applied.

(continued)

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

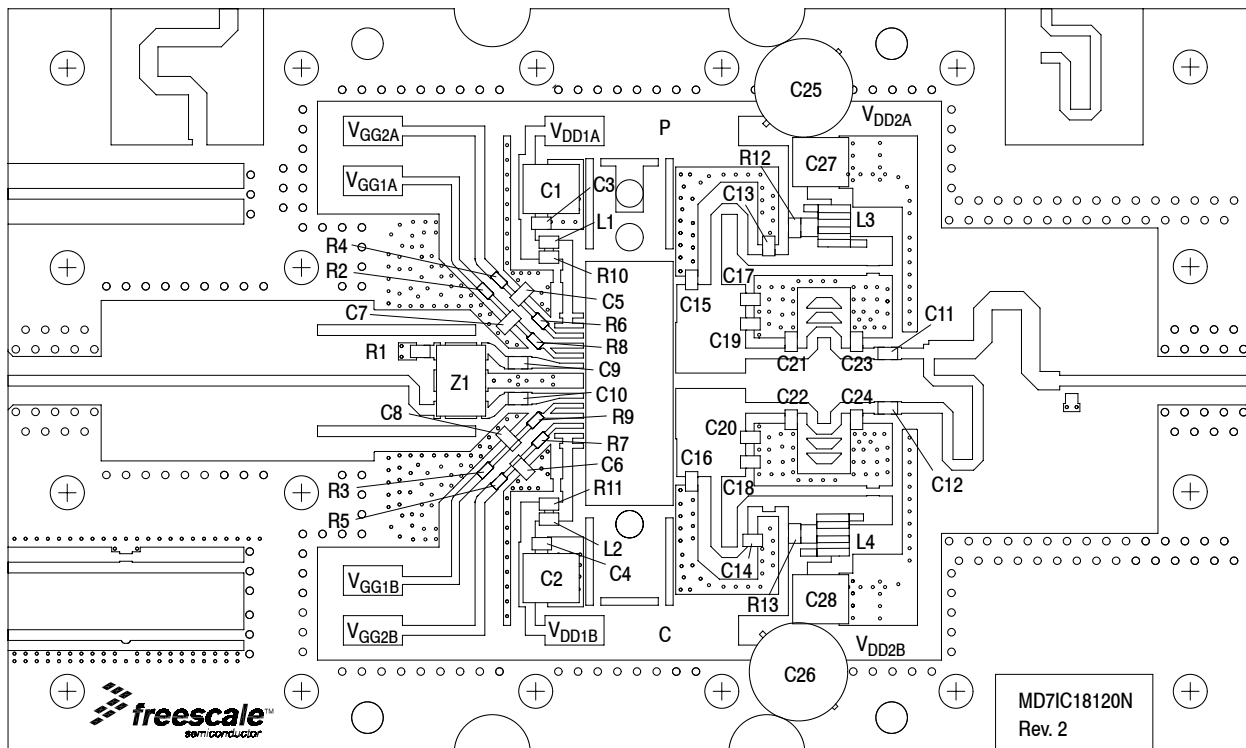
**Typical Broadband Performance** <sup>(1)</sup> (In Freescale Test Fixture, 50 ohm system)  $V_{DD} = 28\text{ Vdc}$ ,  $I_{DQ1A} = 70\text{ mA}$ ,  $I_{DQ1B} = 160\text{ mA}$ ,  $I_{DQ2B} = 500\text{ mA}$ ,  $V_{GS2A} = 1.7\text{ Vdc}$ ,  $P_{out} = 30\text{ W Avg.}$ , Single-Carrier W-CDMA, IQ Magnitude 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 | $G_{ps}$<br>(dB) | PAE<br>(%) | Output PAR<br>(dB) |
|-----------|------------------|------------|--------------------|
| 1805 MHz  | 25.7             | 36.7       | 6.9                |
| 1840 MHz  | 25.7             | 36.3       | 6.9                |
| 1880 MHz  | 25.8             | 35.3       | 6.7                |

**Typical Performances** <sup>(1)</sup> (In Freescale Doherty Test Fixture, 50 ohm system)  $V_{DD} = 28\text{ Vdc}$ ,  $I_{DQ1A} = 70\text{ mA}$ ,  $I_{DQ1B} = 160\text{ mA}$ ,  $I_{DQ2B} = 500\text{ mA}$ ,  $V_{GS2A} = 1.7\text{ Vdc}$ , 1805-1880 MHz Bandwidth

| Characteristic                                                                                                                                                                     | Symbol               | Min | Typ          | Max | Unit                  |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|-----|--------------|-----|-----------------------|
| $P_{out}$ @ 1 dB Compression Point, CW                                                                                                                                             | P1dB                 | —   | 120          | —   | W                     |
| IMD Symmetry @ 30 W PEP, $P_{out}$ where IMD Third Order Intermodulation $\cong 30\text{ dBc}$<br>(Delta IMD Third Order Intermodulation between Upper and Lower Sidebands > 2 dB) | IMD <sub>sym</sub>   | —   | 15           | —   | MHz                   |
| VBW Resonance Point<br>(IMD Third Order Intermodulation Inflection Point)                                                                                                          | VBW <sub>res</sub>   | —   | 35           | —   | MHz                   |
| Gain Flatness in 75 MHz Bandwidth @ $P_{out} = 30\text{ W Avg.}$                                                                                                                   | $G_F$                | —   | 0.3          | —   | dB                    |
| Quiescent Current Accuracy over Temperature<br>with 2 k $\Omega$ Gate Feed Resistors ( $-30$ to $85^\circ\text{C}$ ) <sup>(2)</sup>                                                | $\Delta I_{QT}$      | —   | 4.26<br>5.04 | —   | %                     |
| Gain Variation over Temperature<br>( $-30^\circ\text{C}$ to $+85^\circ\text{C}$ )                                                                                                  | $\Delta G$           | —   | 0.04         | —   | dB/ $^\circ\text{C}$  |
| Output Power Variation over Temperature<br>( $-30^\circ\text{C}$ to $+85^\circ\text{C}$ )                                                                                          | $\Delta P1\text{dB}$ | —   | 0.04         | —   | dBm/ $^\circ\text{C}$ |

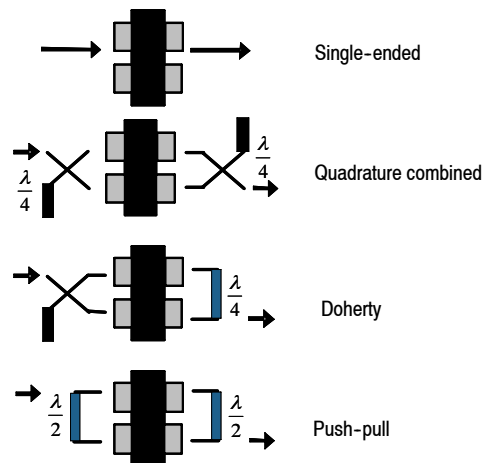
1. Measurement made with device in a Symmetrical Doherty configuration.
2. Refer to AN1977, *Quiescent Current Thermal Tracking Circuit in the RF Integrated Circuit Family* and to AN1987, *Quiescent Current Control for the RF Integrated Circuit Device Family*. Go to <http://www.freescale.com/rf>. Select Documentation/Application Notes – AN1977 or AN1987.



**Figure 3. MD7IC18120NR1(GNR1) Test Circuit Component Layout**

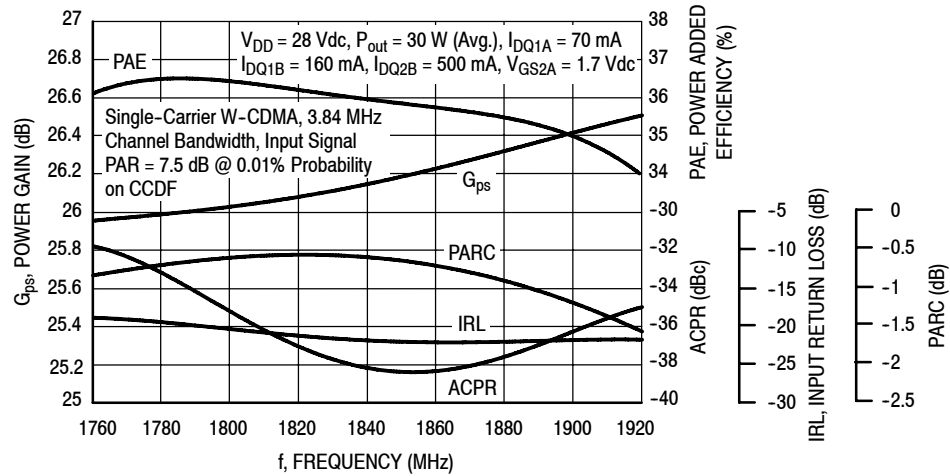
**Table 6. MD7IC18120NR1(GNR1) Test Circuit Component Designations and Values**

| Part                           | Description                                 | Part Number          | Manufacturer |
|--------------------------------|---------------------------------------------|----------------------|--------------|
| C1, C2, C27, C28               | 10 $\mu$ F, 50 V Chip Capacitors            | GRM55DR61H106KA88L   | Murata       |
| C3, C4, C5, C6, C7, C8         | 0.1 $\mu$ F Chip Capacitors                 | GRM21BR71H104KA01B   | Murata       |
| C9, C10, C11, C13, C14         | 10 pF Chip Capacitors                       | ATC600F100JT250XT    | ATC          |
| C12                            | 100 pF Chip Capacitor                       | ATC600F101JT250XT    | ATC          |
| C15, C16, C17, C18             | 2.2 pF Chip Capacitors                      | ATC600F2R2BT250XT    | ATC          |
| C19, C20                       | 1.5 pF Chip Capacitors                      | ATC600F1R5BT250XT    | ATC          |
| C21, C22, C23                  | 1.0 pF Chip Capacitors                      | ATC600F1R0BT250XT    | ATC          |
| C24                            | 0.5 pF Chip Capacitor                       | ATC600F0R5BT250XT    | ATC          |
| C25, C26                       | 330 $\mu$ F, 35 V Electrolytic Capacitors   | MCGPR35V337M10X16-RH | Panasonic    |
| L1, L2                         | 6.8 nH Chip Inductors                       | 0805CS-060XJLB       | CoilCraft    |
| L3, L4                         | 2.5 nH, 1 Turn Inductors                    | A01TKLC              | CoilCraft    |
| R1                             | 50 $\Omega$ , 1/8 W Chip Resistor           | SG732ATTDD51R0F      | KOA Speer    |
| R2, R3, R4, R5, R6, R7, R8, R9 | 1000 $\Omega$ , 1/10 W Chip Resistors       | SG731JTDD1001F       | KOA Speer    |
| R10, R11, R12, R13             | 10 $\Omega$ , 1/10 W Chip Resistors         | CRCW060310R0FKEA     | Vishay       |
| Z1                             | 1900 MHz Band 90°, 3 dB Chip Hybrid Coupler | GSC351-HYB1900       | SOSHIN       |
| PCB                            | 0.020", $\epsilon_r = 3.5$                  | RO4350B              | Rogers       |

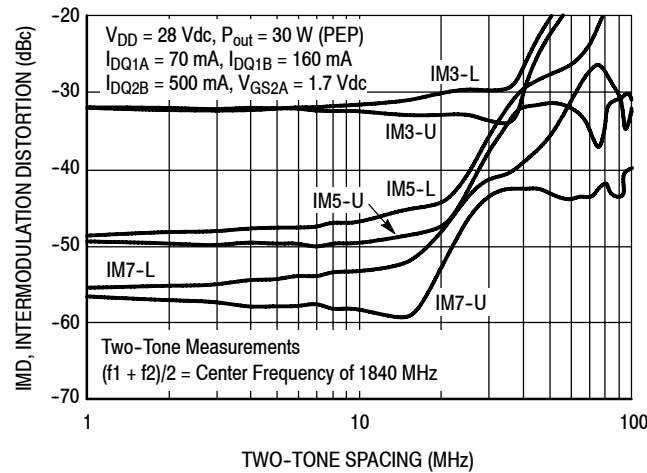


**Figure 4. Possible Circuit Topologies**

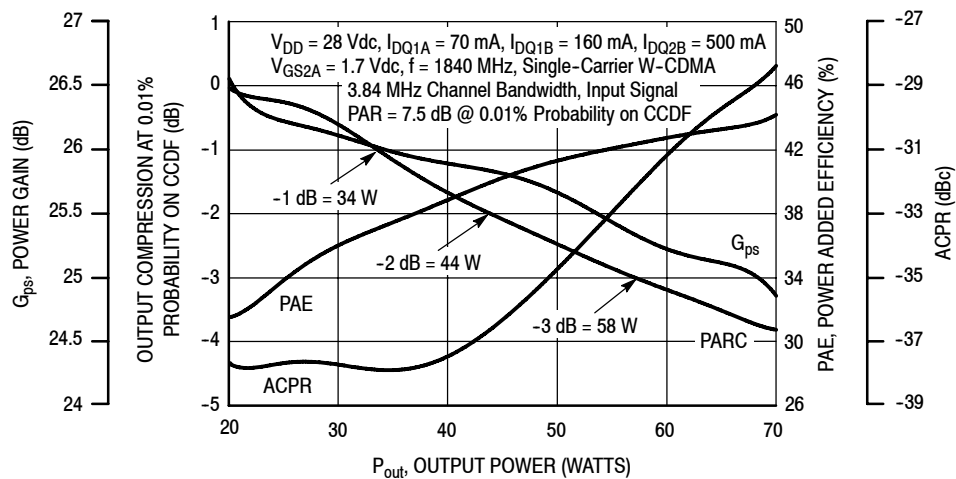
## TYPICAL CHARACTERISTICS



**Figure 5. Output Peak-to-Average Ratio Compression (PARC) Broadband Performance @  $P_{out} = 30$  Watts Avg.**

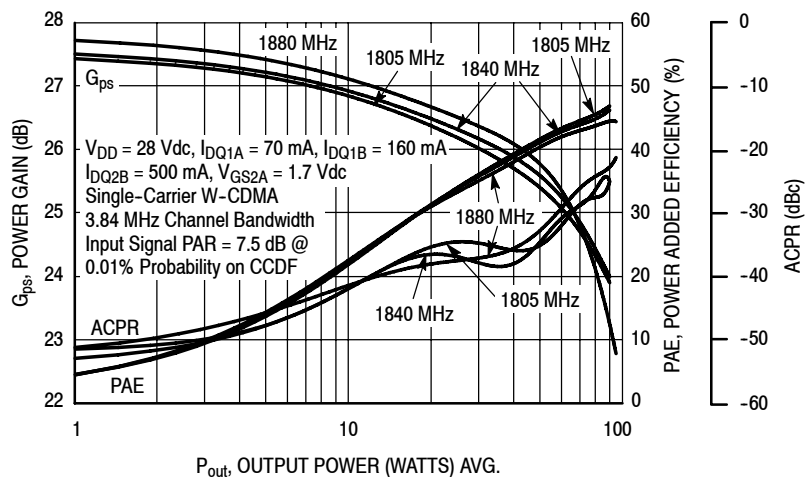


**Figure 6. Intermodulation Distortion Products versus Two-Tone Spacing**

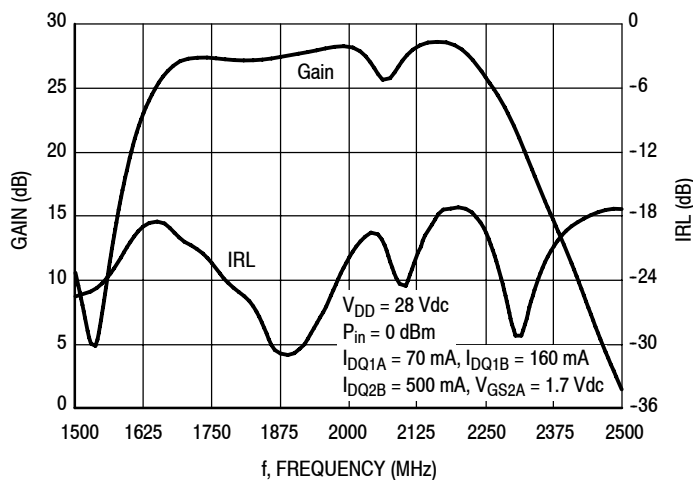


**Figure 7. Output Peak-to-Average Ratio Compression (PARC) versus Output Power**

## TYPICAL CHARACTERISTICS

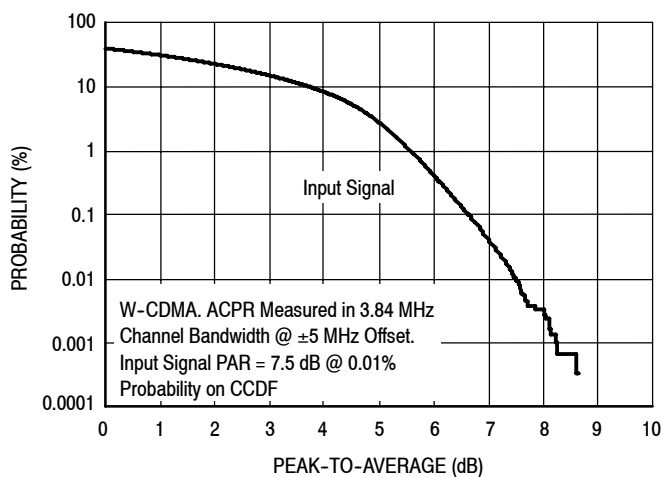


**Figure 8. Single-Carrier W-CDMA Power Gain, Power Added Efficiency and ACPR versus Output Power**

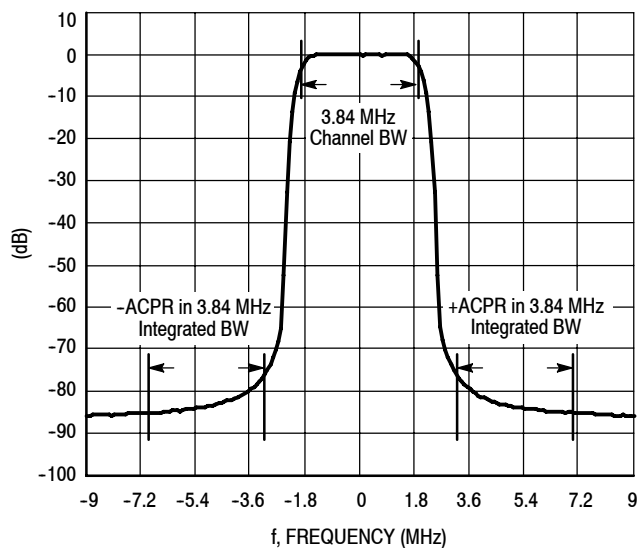


**Figure 9. Broadband Frequency Response**

## W-CDMA TEST SIGNAL



**Figure 10. CCDF W-CDMA IQ Magnitude Clipping, Single-Carrier Test Signal**



**Figure 11. Single-Carrier W-CDMA Spectrum**

$V_{DD} = 28 \text{ Vdc}$ ,  $I_{DQ1B} = 120 \text{ mA}$ ,  $I_{DQ2B} = 450 \text{ mA}$

| f<br>MHz | Max $P_{out}$ (1) |      | $Z_{in}$<br>$\Omega$ | $Z_{load}$<br>$\Omega$ |
|----------|-------------------|------|----------------------|------------------------|
|          | Watts             | dBm  |                      |                        |
| 1805     | 68                | 48.3 | $56.20 + j3.50$      | $2.79 - j5.39$         |
| 1840     | 69                | 48.4 | $60.80 - j6.10$      | $2.81 - j5.45$         |
| 1880     | 74                | 48.7 | $57.90 - j12.00$     | $2.41 - j5.63$         |

(1) Maximum output power measurement reflects pulsed 1 dB gain compression.

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

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

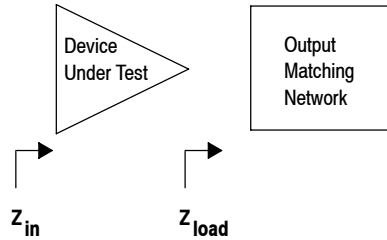


Figure 12. Maximum Output Power — Doherty Load Pull Optimization for Carrier Side

$V_{DD} = 28 \text{ Vdc}$ ,  $I_{DQ1B} = 120 \text{ mA}$ ,  $I_{DQ2B} = 450 \text{ mA}$

| f<br>MHz | Max Eff. (1)<br>% | $Z_{in}$<br>$\Omega$ | $Z_{load}$<br>$\Omega$ |
|----------|-------------------|----------------------|------------------------|
|          |                   |                      |                        |
| 1805     | 53.3              | $56.20 + j3.50$      | $4.10 - j4.49$         |
| 1840     | 53.4              | $60.80 - j6.10$      | $3.74 - j4.54$         |
| 1880     | 54.0              | $57.90 - j12.00$     | $3.65 - j4.55$         |

(1) Maximum efficiency measurement reflects pulsed 1 dB gain compression.

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

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

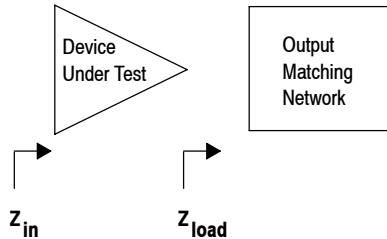
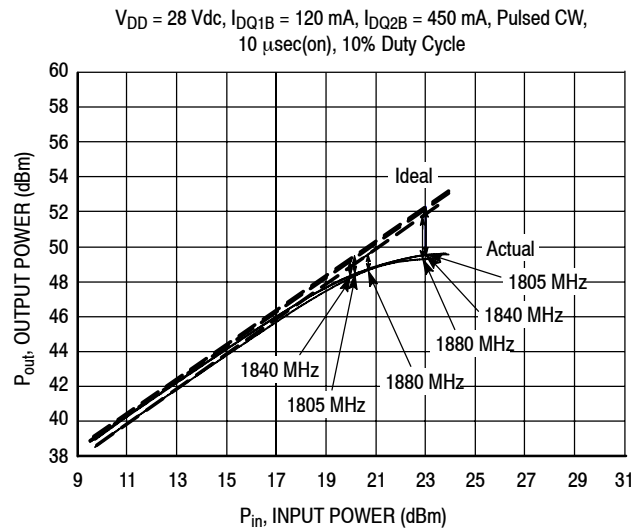


Figure 13. Maximum Efficiency — Doherty Load Pull Optimization for Carrier Side

## ALTERNATIVE PEAK TUNE LOAD PULL CHARACTERISTICS



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

| f<br>(MHz) | P1dB  |      | P3dB  |      |
|------------|-------|------|-------|------|
|            | Watts | dBm  | Watts | dBm  |
| 1805       | 70    | 48.5 | 89    | 49.5 |
| 1840       | 69    | 48.4 | 89    | 49.5 |
| 1880       | 74    | 48.7 | 85    | 49.3 |

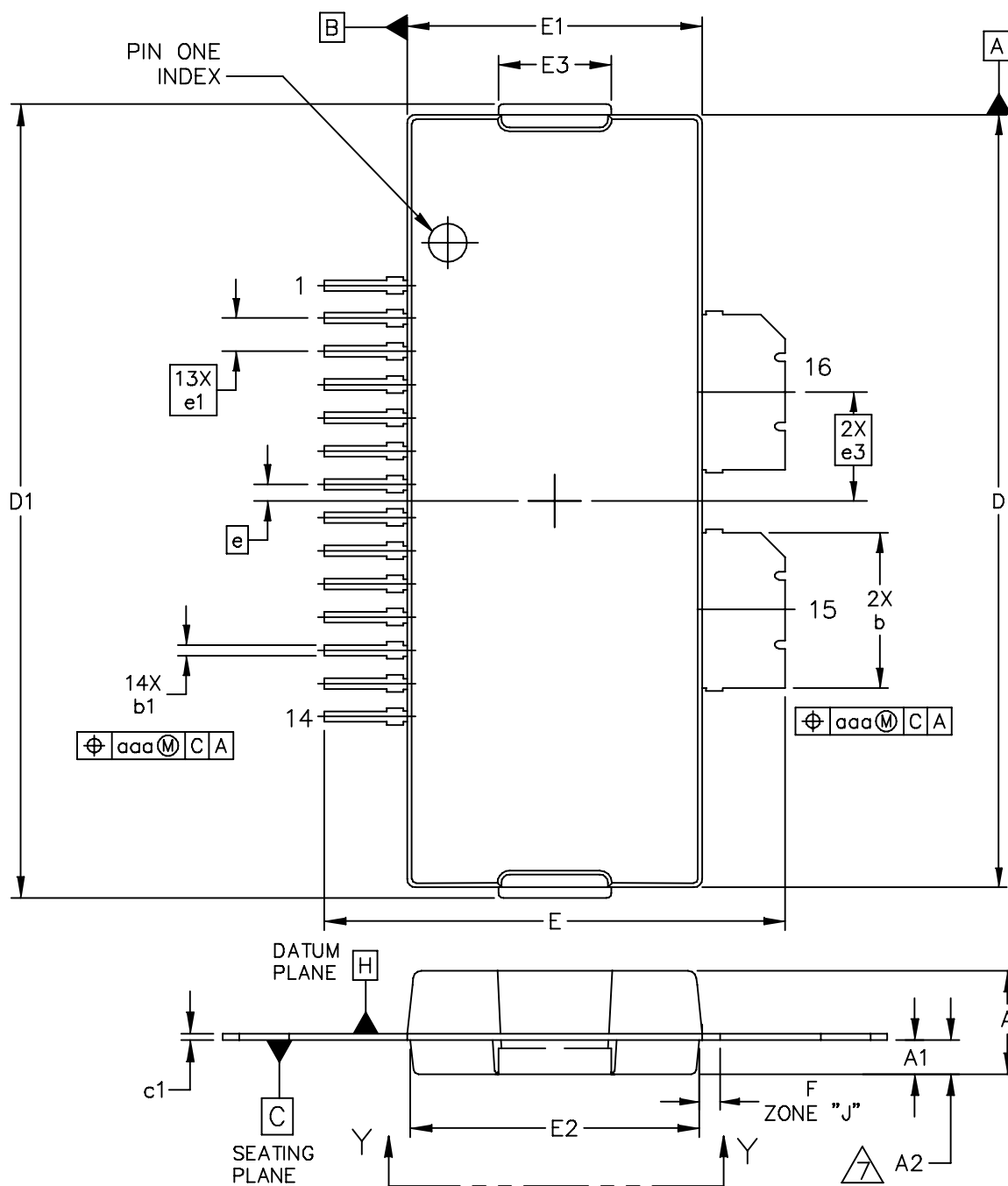
Test Impedances per Compression Level

| f<br>(MHz) |      | $Z_{source}$<br>$\Omega$ | $Z_{load}$<br>$\Omega$ |
|------------|------|--------------------------|------------------------|
| 1805       | P1dB | 56.20 - j3.50            | 2.80 - j5.40           |
| 1840       | P1dB | 60.80 + j6.10            | 2.80 - j5.40           |
| 1880       | P1dB | 57.90 + j12.00           | 2.40 - j5.60           |

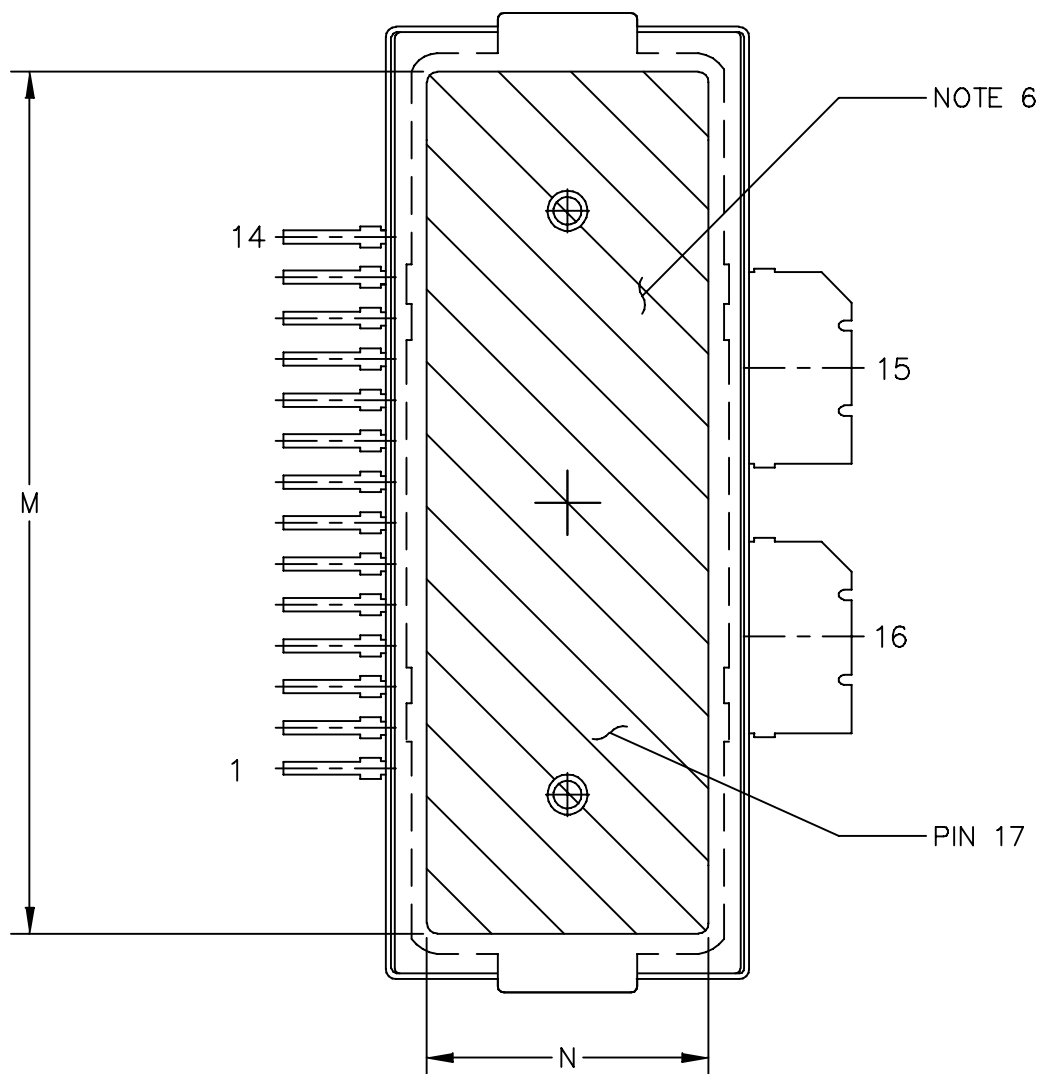
**Figure 14. Pulsed CW Output Power  
versus Input Power @ 28 V**

NOTE: Measurement made on the Class AB, carrier side of the device.

## PACKAGE DIMENSIONS



|                                                         |  |                          |  |                            |  |
|---------------------------------------------------------|--|--------------------------|--|----------------------------|--|
| © FREESCALE SEMICONDUCTOR, INC.<br>ALL RIGHTS RESERVED. |  | MECHANICAL OUTLINE       |  | PRINT VERSION NOT TO SCALE |  |
| TITLE:<br>TO-270 WIDE BODY LONG,<br>16 LEAD, PLASTIC    |  | DOCUMENT NO: 98ASA10739D |  | REV: A                     |  |
|                                                         |  | CASE NUMBER: 1866-02     |  | 02 AUG 2007                |  |
|                                                         |  | STANDARD: NON-JEDEC      |  |                            |  |



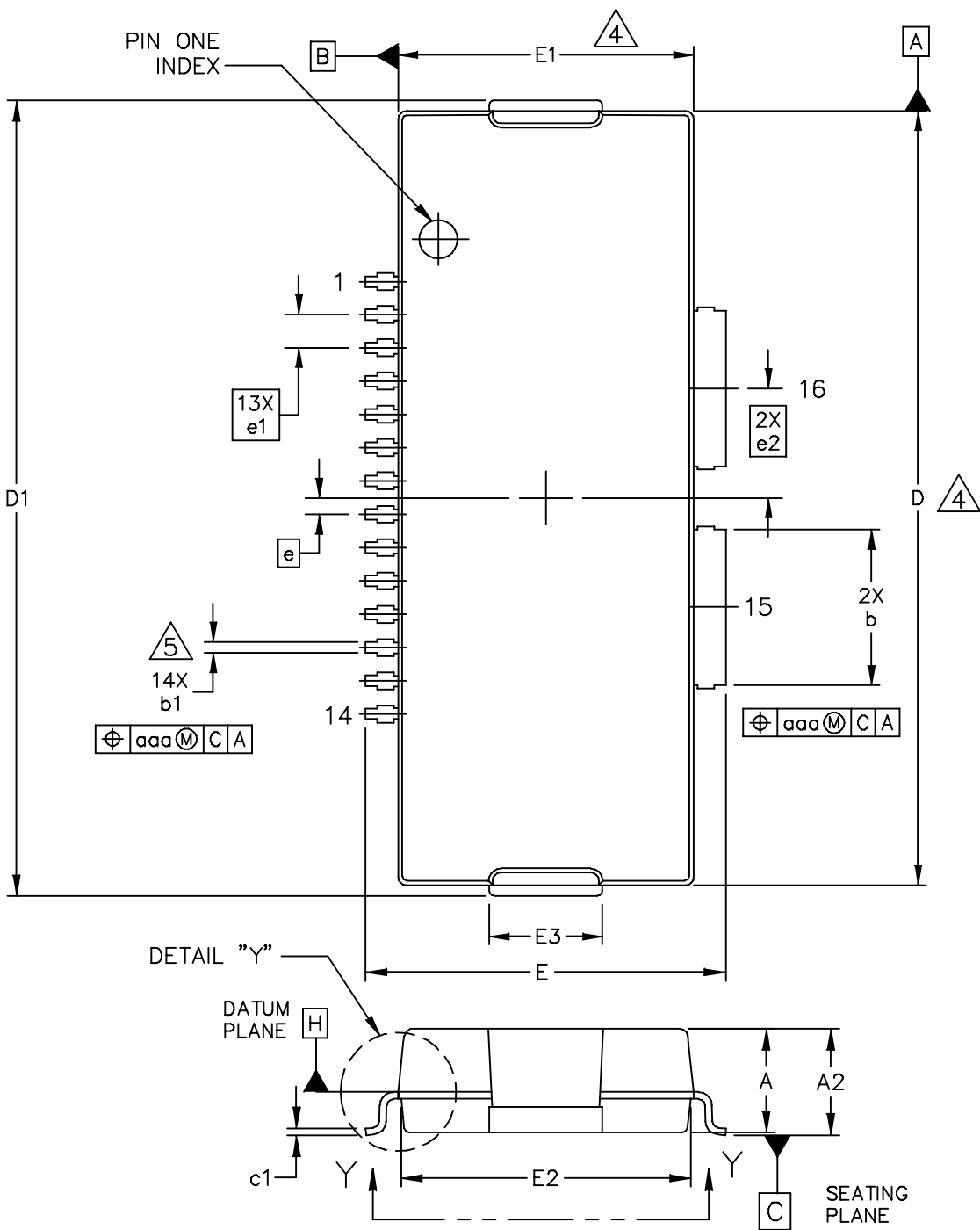
VIEW Y-Y

|                                                         |                    |                            |             |
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| TITLE:<br>TO-270 WIDE BODY LONG,<br>16 LEAD, PLASTIC    |                    | DOCUMENT NO: 98ASA10739D   | REV: A      |
|                                                         |                    | CASE NUMBER: 1866-02       | 02 AUG 2007 |
|                                                         |                    | STANDARD: NON-JEDEC        |             |

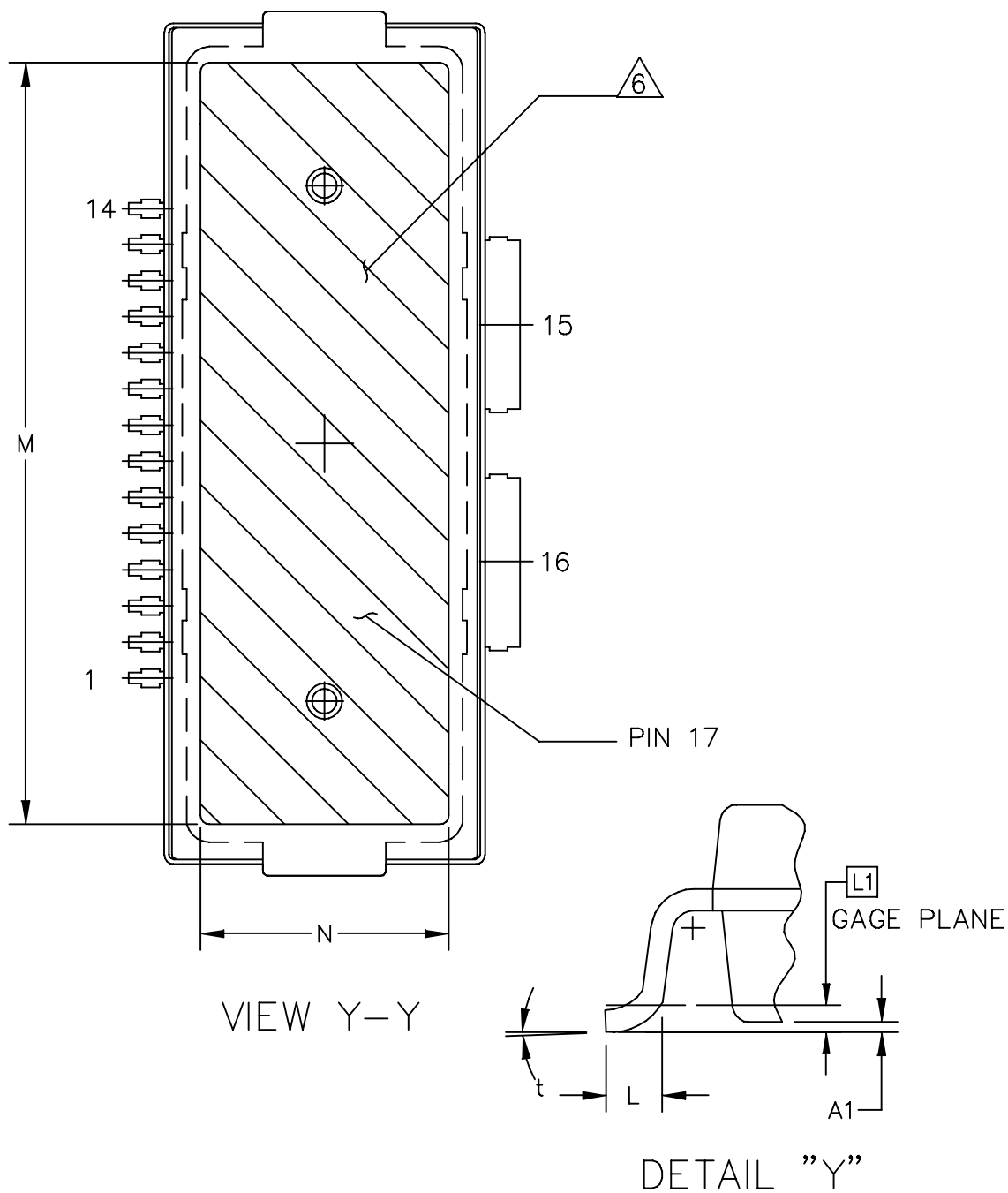
NOTES:

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 (0.15) PER SIDE. DIMENSIONS "D" AND "E1" DO INCLUDE MOLD MISMATCH AND ARE DETERMINED AT DATUM PLANE -H-.
5. DIMENSIONS "b" AND "b1" DO NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE .005 (0.13) TOTAL IN EXCESS OF THE "b" AND "b1" DIMENSIONS AT MAXIMUM MATERIAL CONDITION.
6. HATCHING REPRESENTS THE EXPOSED AREA OF THE HEAT SLUG.
7. DIM A2 APPLIES WITHIN ZONE "J" ONLY.

| DIM                                                     | INCH     |      | MILLIMETER         |       | DIM                      | INCH                       |      | MILLIMETER |             |
|---------------------------------------------------------|----------|------|--------------------|-------|--------------------------|----------------------------|------|------------|-------------|
|                                                         | MIN      | MAX  | MIN                | MAX   |                          | MIN                        | MAX  | MIN        | MAX         |
| A                                                       | .122     | .128 | 3.10               | 3.25  | M                        | .800                       | ---- | 20.32      | ----        |
| A1                                                      | .039     | .043 | 0.96               | 1.12  | N                        | .270                       | ---- | 6.86       | ----        |
| A2                                                      | .040     | .042 | 1.02               | 1.07  | b                        | .184                       | .190 | 4.67       | 4.83        |
| D                                                       | .928     | .932 | 23.57              | 23.67 | b1                       | .010                       | .016 | 0.25       | 0.41        |
| D1                                                      | .954     | .958 | 24.23              | 24.33 | c1                       | .007                       | .011 | 0.18       | 0.28        |
| E                                                       | .551     | .559 | 14.00              | 14.20 | e                        | .020 BSC                   |      | 0.51 BSC   |             |
| E1                                                      | .353     | .357 | 8.97               | 9.07  | e1                       | .040 BSC                   |      | 1.02 BSC   |             |
| E2                                                      | .346     | .350 | 8.79               | 8.89  | e3                       | .131 BSC                   |      | 3.33 BSC   |             |
| E3                                                      | .132     | .140 | 3.35               | 3.56  |                          |                            |      |            |             |
| F                                                       | .025 BSC |      | 0.64 BSC           |       | aaa                      | .004                       |      | 0.10       |             |
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| TITLE:<br>TO-270 WIDE BODY LONG,<br>16 LEAD, PLASTIC    |          |      |                    |       | DOCUMENT NO: 98ASA10739D |                            |      |            | REV: A      |
|                                                         |          |      |                    |       | CASE NUMBER: 1866-02     |                            |      |            | 02 AUG 2007 |
|                                                         |          |      |                    |       | STANDARD: NON-JEDEC      |                            |      |            |             |



|                                                                |                    |                            |             |
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| TITLE: TO-270<br>WIDE BODY LONG, 16 LEAD,<br>GULL WING PLASTIC |                    | DOCUMENT NO: 98ASA10740D   | REV: A      |
|                                                                |                    | CASE NUMBER: 1867-02       | 02 AUG 2007 |
|                                                                |                    | STANDARD: NON-JEDEC        |             |



|                                                                |  |                          |  |                            |  |
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| TITLE: TO-270<br>WIDE BODY LONG, 16 LEAD,<br>GULL WING PLASTIC |  | DOCUMENT NO: 98ASA10740D |  | REV: A                     |  |
|                                                                |  | CASE NUMBER: 1867-02     |  | 02 AUG 2007                |  |
|                                                                |  | STANDARD: NON-JEDEC      |  |                            |  |

# NOTES:

1. CONTROLLING DIMENSION: INCH
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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 DO NOT INCLUDE MOLD PROTRUSION. ALLOWABLE PROTRUSION IS .006 PER SIDE. DIMENSIONS DO INCLUDE MOLD MISMATCH AND ARE DETERMINED AT DATUM PLANE H.

5. DIMENSION DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE .005 TOTAL IN EXCESS OF THE DIMENSION AT MAXIMUM MATERIAL CONDITION.

6. HATCHING REPRESENTS THE EXPOSED AREA OF THE HEAT SLUG.

| INCH                                                              |         | MILLIMETER |          | INCH               |                          | MILLIMETER                 |             |
|-------------------------------------------------------------------|---------|------------|----------|--------------------|--------------------------|----------------------------|-------------|
| DIM                                                               | MIN     | MAX        | MIN      | MAX                | DIM                      | MIN                        | MAX         |
| A                                                                 | .122    | .128       | 3.10     | 3.25               | b                        | .184                       | .190        |
| A1                                                                | .001    | .004       | 0.02     | 0.10               | b1                       | .010                       | .016        |
| A2                                                                | .125    | .131       | 3.18     | 3.33               | c1                       | .007                       | .011        |
| D                                                                 | .928    | .932       | 23.57    | 23.67              | e                        | .020 BSC                   | 0.51 BSC    |
| D1                                                                | .954    | .958       | 24.23    | 24.33              | e1                       | .040 BSC                   | 1.02 BSC    |
| E                                                                 | .429    | .437       | 10.9     | 11.1               | e2                       | .131 BSC                   | 3.33 BSC    |
| E1                                                                | .353    | .357       | 8.97     | 9.07               | t                        | 2°                         | 8°          |
| E2                                                                | .346    | .350       | 8.79     | 8.89               | aaa                      | .004                       | 0.10        |
| E3                                                                | .132    | .140       | 3.35     | 3.56               |                          |                            |             |
| L                                                                 | .018    | .024       | 0.46     | 0.61               |                          |                            |             |
| L1                                                                | .01 BSC |            | 0.25 BSC |                    |                          |                            |             |
| M                                                                 | .800    | ----       | 20.32    | ----               |                          |                            |             |
| N                                                                 | .270    | ----       | 6.86     | ----               |                          |                            |             |
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| TITLE:<br>TO-270<br>WIDE BODY LONG, 16 LEAD,<br>GULL WING PLASTIC |         |            |          |                    | DOCUMENT NO: 98ASA10740D |                            | REV: A      |
|                                                                   |         |            |          |                    | CASE NUMBER: 1867-02     |                            | 02 AUG 2007 |
|                                                                   |         |            |          |                    | 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
- AN1977: Quiescent Current Thermal Tracking Circuit in the RF Integrated Circuit Family
- AN1987: Quiescent Current Control for the RF Integrated Circuit Device Family

### 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        | May 2010 | • Initial Release of Data Sheet |

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