



# RF LDMOS Wideband Integrated Power Amplifiers

The MW7IC2040N wideband integrated circuit is designed with on-chip matching that makes it usable from 1805 to 1990 MHz. This multi-stage structure is rated for 24 to 32 Volt operation and covers all typical cellular base station modulation formats.

- Typical Single-Carrier W-CDMA Performance:  $V_{DD} = 28$  Volts,  $I_{DQ1} = 130$  mA,  $I_{DQ2} = 330$  mA,  $P_{out} = 4$  Watts Avg.,  $f = 1932.5$ , Channel Bandwidth = 3.84 MHz, Input Signal PAR = 7.5 dB @ 0.01% Probability on CCDF.  
 Power Gain — 32 dB  
 Power Added Efficiency — 17.5%  
 ACPR @ 5 MHz Offset — -50 dBc in 3.84 MHz Bandwidth
- Capable of Handling 5:1 VSWR, @ 32 Vdc, 1960 MHz, 50 Watts CW Output Power (3 dB Input Overdrive from Rated  $P_{out}$ )
- Stable into a 3:1 VSWR. All Spurs Below -60 dBc @ 100 mW to 40 Watts CW  $P_{out}$ .
- Typical  $P_{out}$  @ 1 dB Compression Point  $\approx 30$  Watts CW

## GSM EDGE Application

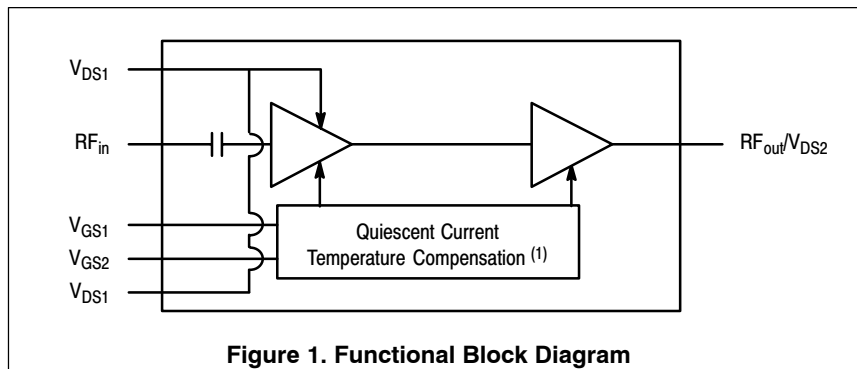
- Typical GSM EDGE Performance:  $V_{DD} = 28$  Volts,  $I_{DQ1} = 90$  mA,  $I_{DQ2} = 430$  mA,  $P_{out} = 16$  Watts Avg., 1805-1880 MHz  
 Power Gain — 33 dB  
 Power Added Efficiency — 35%  
 Spectral Regrowth @ 400 kHz Offset = -62 dBc  
 Spectral Regrowth @ 600 kHz Offset = -77 dBc  
 EVM — 1.5% rms

## GSM Application

- Typical GSM Performance:  $V_{DD} = 28$  Volts,  $I_{DQ1} = 90$  mA,  $I_{DQ2} = 430$  mA,  $P_{out} = 40$  Watts CW, 1805-1880 MHz and 1930-1990 MHz  
 Power Gain — 31 dB  
 Power Added Efficiency — 50%

## Features

- Characterized with Series Equivalent Large-Signal Impedance Parameters and Common Source S-Parameters
- On-Chip Matching (50 Ohm Input, DC Blocked, >3 Ohm Output)
- Integrated Quiescent Current Temperature Compensation with Enable/Disable Function (1)
- Integrated ESD Protection
- 225°C Capable Plastic Package
- RoHS Compliant
- In Tape and Reel. R1 Suffix = 500 Units per 44 mm, 13 inch Reel.

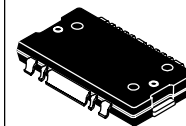
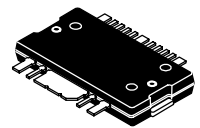


1. Refer to AN1977, Quiescent Current Thermal Tracking Circuit in the RF Integrated Circuit Family and to AN1987, Quiescent Current Control for the RF Integrated Circuit Device Family. Go to <http://www.freescale.com/rf>. Select Documentation/Application Notes - AN1977 or AN1987.

**MW7IC2040NR1**  
**MW7IC2040GNR1**  
**MW7IC2040NBR1**

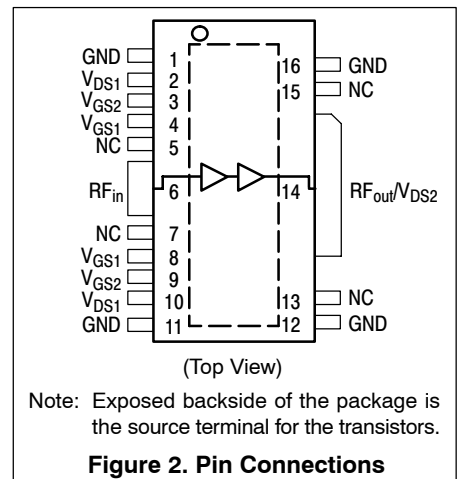
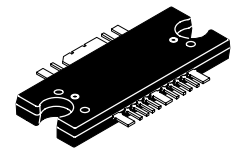
**1930-1990 MHz, 1805-1880 MHz,  
 4 W AVG., 28 V**  
**SINGLE W-CDMA, GSM EDGE, GSM**  
**RF LDMOS WIDEBAND**  
**INTEGRATED POWER AMPLIFIERS**

**CASE 1886-01**  
**TO-270 WB-16**  
**PLASTIC**  
**MW7IC2040NR1**



**CASE 1887-01**  
**TO-270 WB-16 GULL**  
**PLASTIC**  
**MW7IC2040GNR1**

**CASE 1329-09**  
**TO-272 WB-16**  
**PLASTIC**  
**MW7IC2040NBR1**



**Table 1. Maximum Ratings**

| Rating                               | Symbol    | Value       | Unit |
|--------------------------------------|-----------|-------------|------|
| Drain-Source Voltage                 | $V_{DSS}$ | -0.5, +65   | Vdc  |
| Gate-Source Voltage                  | $V_{GS}$  | -0.5, +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   |
| Input Power                          | $P_{in}$  | 25          | dBm  |

**Table 2. Thermal Characteristics**

| Characteristic  | Symbol   | Value (2,3) | Unit |
|---|--|-------------|------|
| Thermal Resistance, Junction to Case                          | $R_{\theta JC}$  |             | °C/W |
| W-CDMA<br>( $P_{out} = 4$ W Avg., Case Temperature = 73°C)    | Stage 1, 28 Vdc, $I_{DQ1} = 130$ mA<br>Stage 2, 28 Vdc, $I_{DQ2} = 330$ mA | 4.0<br>1.5  |      |
| GSM EDGE<br>( $P_{out} = 16$ W Avg., Case Temperature = 76°C) | Stage 1, 28 Vdc, $I_{DQ1} = 130$ mA<br>Stage 2, 28 Vdc, $I_{DQ2} = 330$ mA | 4.1<br>1.4  |      |
| GSM<br>( $P_{out} = 40$ W Avg., Case Temperature = 79°C)      | Stage 1, 28 Vdc, $I_{DQ1} = 130$ mA<br>Stage 2, 28 Vdc, $I_{DQ2} = 330$ mA | 3.9<br>1.3  |      |

**Table 3. ESD Protection Characteristics**

| Test Methodology                      | Class         |
|---------------------------------------|---------------|
| Human Body Model (per JESD22-A114)    | 1B (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   |

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

| Characteristic  | Symbol       | Min | Typ  | Max | Unit             |
|---|--------------|-----|------|-----|------------------|
| <b>Stage 1 — Off Characteristics</b>  |              |     |      |     |                  |
| Zero Gate Voltage Drain Leakage Current<br>( $V_{DS} = 65$ Vdc, $V_{GS} = 0$ Vdc)                         | $I_{DSS}$    | —   | —    | 10  | $\mu\text{A}$ dc |
| Zero Gate Voltage Drain Leakage Current<br>( $V_{DS} = 28$ Vdc, $V_{GS} = 0$ Vdc)                         | $I_{DSS}$    | —   | —    | 1   | $\mu\text{A}$ dc |
| Gate-Source Leakage Current<br>( $V_{GS} = 1.5$ Vdc, $V_{DS} = 0$ Vdc)                                    | $I_{GSS}$    | —   | —    | 1   | $\mu\text{A}$ dc |
| <b>Stage 1 — On Characteristics</b>   |              |     |      |     |                  |
| Gate Threshold Voltage<br>( $V_{DS} = 10$ Vdc, $I_D = 25$ $\mu\text{A}$ dc)                               | $V_{GS(th)}$ | 1.2 | 2    | 2.7 | Vdc              |
| Gate Quiescent Voltage<br>( $V_{DS} = 28$ Vdc, $I_{DQ1} = 130$ mAdc)                                      | $V_{GS(Q)}$  | —   | 2.7  | —   | Vdc              |
| Fixture Gate Quiescent Voltage<br>( $V_{DD} = 28$ Vdc, $I_{DQ1} = 130$ mAdc, Measured in Functional Test) | $V_{GG(Q)}$  | 13  | 14.5 | 16  | Vdc              |

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.

(continued)

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

| Characteristic  | Symbol           | Min  | Typ     | Max  | Unit            |
|---|------------------|------|---------|------|-----------------|
| <b>Stage 2 — Off Characteristics</b>  |                  |      |         |      |                 |
| 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    | $\mu\text{Adc}$ |
| <b>Stage 2 — On Characteristics</b>   |                  |      |         |      |                 |
| Gate Threshold Voltage<br>( $V_{DS} = 10\text{ Vdc}$ , $I_D = 140\ \mu\text{Adc}$ )   | $V_{GS(th)}$     | 1.2  | 2       | 2.7  | Vdc             |
| Gate Quiescent Voltage<br>( $V_{DS} = 28\text{ Vdc}$ , $I_{DQ2} = 330\text{ mAdc}$ )  | $V_{GS(Q)}$      | —    | 2.8     | —    | Vdc             |
| Fixture Gate Quiescent Voltage<br>( $V_{DD} = 28\text{ Vdc}$ , $I_{DQ2} = 330\text{ mAdc}$ , Measured in Functional Test)   | $V_{GG(Q)}$      | 7    | 8       | 9    | Vdc             |
| Drain-Source On-Voltage<br>( $V_{GS} = 10\text{ Vdc}$ , $I_D = 1\text{ Adc}$ )  | $V_{DS(on)}$     | 0.2  | 0.39    | 1.2  | Vdc             |
| <b>Stage 2 — Dynamic Characteristics <sup>(1)</sup></b>   |                  |      |         |      |                 |
| Output Capacitance<br>( $V_{DS} = 28\text{ Vdc} \pm 30\text{ mV(rms)ac}$ @ 1 MHz, $V_{GS} = 0\text{ Vdc}$ )   | $C_{oss}$        | —    | 246     | —    | pF              |
| <b>Functional Tests <sup>(3)</sup></b> (In Freescale Test Fixture, 50 ohm system) $V_{DD} = 28\text{ Vdc}$ , $I_{DQ1} = 130\text{ mA}$ , $I_{DQ2} = 330\text{ mA}$ , $P_{out} = 4\text{ W Avg.}$ , $f = 1932.5\text{ MHz}$ , Single-Carrier W-CDMA, 3GPP Test Model 1, 64 DPCH, 45.2% 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. |                  |      |         |      |                 |
| Power Gain  | $G_{ps}$         | 29.5 | 32      | 34.5 | dB              |
| Power Added Efficiency  | PAE              | 16   | 17.5    | —    | %               |
| Adjacent Channel Power Ratio  | ACPR             | —    | -50     | -46  | dBc             |
| Input Return Loss   | IRL              | —    | -15     | -8   | dB              |
| <b>Typical Performances</b> (In Freescale Test Fixture, 50 ohm system) $V_{DD} = 28\text{ Vdc}$ , $I_{DQ1} = 130\text{ mA}$ , $I_{DQ2} = 330\text{ mA}$ , 1930-1990 MHz   |                  |      |         |      |                 |
| $P_{out}$ @ 1 dB Compression Point, CW  | $P_{1dB}$        | —    | 30      | —    | W               |
| IMD Symmetry @ 22 W PEP, $P_{out}$ where IMD Third Order Intermodulation $\cong 30\text{ dBc}$ (Delta IMD Third Order Intermodulation between Upper and Lower Sidebands > 2 dB)   | $IMD_{sym}$      | —    | 60      | —    | MHz             |
| VBW Resonance Point<br>(IMD Third Order Intermodulation Inflection Point)   | $VBW_{res}$      | —    | 65      | —    | MHz             |
| Quiescent Current Accuracy over Temperature <sup>(2)</sup><br>with 5.6 k $\Omega$ Gate Feed Resistors (-30 to 85°C)   | $\Delta I_{QT}$  | —    | $\pm 3$ | —    | %               |
| Gain Flatness in 60 MHz Bandwidth @ $P_{out} = 4\text{ W Avg.}$   | $G_F$            | —    | 1.2     | —    | dB              |
| Average Deviation from Linear Phase in 60 MHz Bandwidth<br>@ $P_{out} = 30\text{ W CW}$   | $\Phi$           | —    | 0.5     | —    | °               |
| Average Group Delay @ $P_{out} = 30\text{ W CW}$ , $f = 1960\text{ MHz}$  | Delay            | —    | 2.5     | —    | ns              |
| Part-to-Part Insertion Phase Variation @ $P_{out} = 30\text{ W CW}$ ,<br>$f = 1960\text{ MHz}$ , Six Sigma Window   | $\Delta\Phi$     | —    | 33      | —    | °               |
| Gain Variation over Temperature<br>(-30°C to +85°C)   | $\Delta G$       | —    | 0.029   | —    | dB/°C           |
| Output Power Variation over Temperature<br>(-30°C to +85°C)   | $\Delta P_{1dB}$ | —    | 0.003   | —    | dBm/°C          |

1. Part internally matched both on input and output.

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.

3. Measurement made with device in straight lead configuration before any lead forming operation is applied.

(continued)

MW7IC2040NR1 MW7IC2040GNR1 MW7IC2040NBR1

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

| Characteristic  | Symbol   | Min | Typ  | Max | Unit |
|---|----------|-----|------|-----|------|
| <b>Typical W-CDMA Performance — 1800 MHz</b> (In Freescale W-CDMA 1805-1880 MHz Test Fixture, 50 ohm system) $V_{DD} = 28\text{ Vdc}$ , $I_{DQ1} = 130\text{ mA}$ , $I_{DQ2} = 330\text{ mA}$ , $P_{out} = 4\text{ W Avg.}$ , 1805-1880 MHz, Single-Carrier W-CDMA, 3GPP Test Model 1, 64 DPCH, 45.2% 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. |          |     |      |     |      |
| Power Gain  | $G_{ps}$ | —   | 33.5 | —   | dB   |
| Power Added Efficiency  | PAE      | —   | 16.5 | —   | %    |
| Adjacent Channel Power Ratio  | ACPR     | —   | -50  | —   | dBc  |
| Input Return Loss   | IRL      | —   | -6   | —   | dB   |

**Typical GSM EDGE Performance — 1800 MHz** (In Freescale GSM EDGE 1805-1880 MHz Test Fixture, 50 ohm system)  $V_{DD} = 28\text{ Vdc}$ ,  $P_{out} = 16\text{ W Avg.}$ ,  $I_{DQ1} = 90\text{ mA}$ ,  $I_{DQ2} = 430\text{ mA}$ , 1805-1880 MHz EDGE Modulation

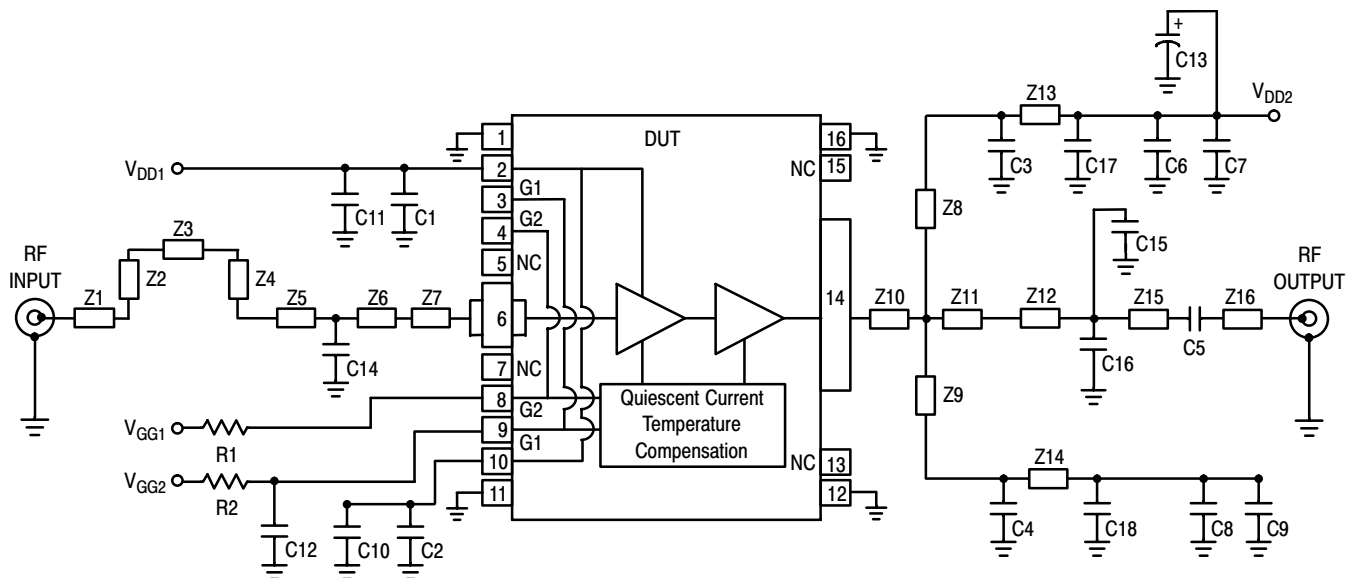
|                                     |          |   |     |   |       |
|-------------------------------------|----------|---|-----|---|-------|
| Power Gain                          | $G_{ps}$ | — | 33  | — | dB    |
| Power Added Efficiency              | PAE      | — | 35  | — | %     |
| Error Vector Magnitude              | EVM      | — | 1.5 | — | % rms |
| Spectral Regrowth at 400 kHz Offset | SR1      | — | -62 | — | dBc   |
| Spectral Regrowth at 600 kHz Offset | SR2      | — | -77 | — | dBc   |

**Typical GSM EDGE Performance — 1900 MHz** (In Freescale GSM EDGE 1930-1990 MHz Test Fixture, 50 ohm system)  $V_{DD} = 28\text{ Vdc}$ ,  $P_{out} = 16\text{ W Avg.}$ ,  $I_{DQ1} = 90\text{ mA}$ ,  $I_{DQ2} = 430\text{ mA}$ , 1930-1990 MHz EDGE Modulation

|                                     |          |   |     |   |       |
|-------------------------------------|----------|---|-----|---|-------|
| Power Gain                          | $G_{ps}$ | — | 30  | — | dB    |
| Power Added Efficiency              | PAE      | — | 33  | — | %     |
| Error Vector Magnitude              | EVM      | — | 1.5 | — | % rms |
| Spectral Regrowth at 400 kHz Offset | SR1      | — | -62 | — | dBc   |
| Spectral Regrowth at 600 kHz Offset | SR2      | — | -80 | — | dBc   |

**Typical CW Performance** (In Freescale GSM EDGE 1930-1990 MHz Test Fixture, 50 ohm system)  $V_{DD} = 28\text{ Vdc}$ ,  $I_{DQ1} = 90\text{ mA}$ ,  $I_{DQ2} = 430\text{ mA}$ ,  $P_{out} = 40\text{ W CW}$ , 1805-1880 MHz and 1930-1990 MHz

|                                    |          |   |     |   |    |
|------------------------------------|----------|---|-----|---|----|
| Power Gain                         | $G_{ps}$ | — | 31  | — | dB |
| Power Added Efficiency             | PAE      | — | 50  | — | %  |
| Input Return Loss                  | IRL      | — | -15 | — | dB |
| $P_{out}$ @ 1 dB Compression Point | P1dB     | — | 45  | — | W  |



|        |                              |          |   |
|--------|------------------------------|----------|---|
| Z1     | 0.0826" x 0.5043" Microstrip | Z10      | 0.3419" x 0.1725" Microstrip              |
| Z2     | 0.0826" x 0.3639" Microstrip | Z11      | 0.3419" x 0.4671" Microstrip              |
| Z3     | 0.0826" x 0.4258" Microstrip | Z12      | 0.0830" x 0.4220" Microstrip              |
| Z4     | 0.0826" x 0.3639" Microstrip | Z13, Z14 | 0.0830" x 0.2855" Microstrip              |
| Z5     | 0.0826" x 0.3060" Microstrip | Z15      | 0.0830" x 0.9030" Microstrip              |
| Z6     | 0.0826" x 0.9290" Microstrip | Z16      | 0.0830" x 0.2499" Microstrip              |
| Z7     | 0.0600" x 0.1273" Microstrip | PCB      | Rogers RO4350, 0.030", $\epsilon_r = 3.5$ |
| Z8, Z9 | 0.0800" x 1.3684" Microstrip |          |   |

Figure 3. MW7IC2040NR1(GNR1)(NBR1) Test Circuit Schematic — 1930-1990 MHz

Table 6. MW7IC2040NR1(GNR1)(NBR1) Test Circuit Component Designations and Values — 1930-1990 MHz

| Part                     | Description                                      | Part Number            | Manufacturer |
|--------------------------|--|------------------------|--------------|
| C1, C2, C3, C4, C5       | 6.8 pF Chip Capacitors                           | ATC100B6R8CT500XT      | ATC          |
| C6, C7, C8, C9, C10, C11 | 10 $\mu$ F, 50 V Chip Capacitors                 | GRM55DR61H106KA88L     | Murata       |
| C12                      | 2.2 $\mu$ F, 16 V Chip Capacitor                 | C1206C225K4RAC         | Kemet        |
| C13                      | 470 $\mu$ F, 63 V Electrolytic Capacitor, Radial | MCGPR63V477M13X26 - RH | Multicomp    |
| C14, C16                 | 0.8 pF Chip Capacitors                           | ATC100B0R8BT500XT      | ATC          |
| C15                      | 1 pF Chip Capacitor                              | ATC100B1R0BT500XT      | ATC          |
| C17, C18                 | 1 $\mu$ F, 50 V Chip Capacitors                  | GRM21BR71H105KA12L     | Murata       |
| R1, R2                   | 5.6 K $\Omega$ , 1/4 W Chip Resistors            | CRCW12065601FKEA       | Vishay       |

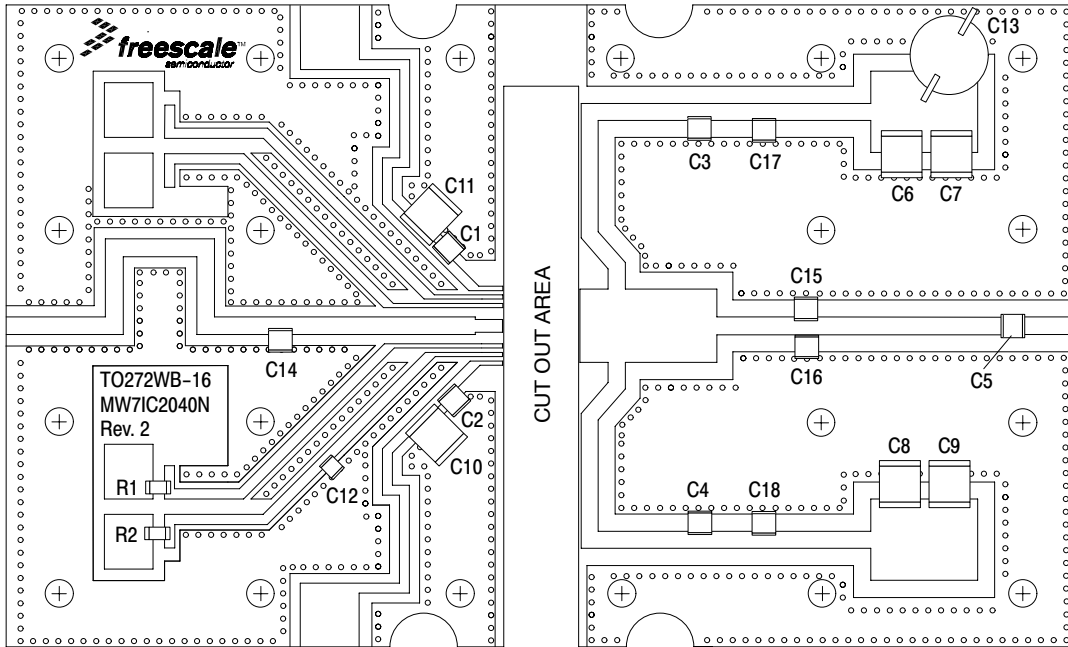
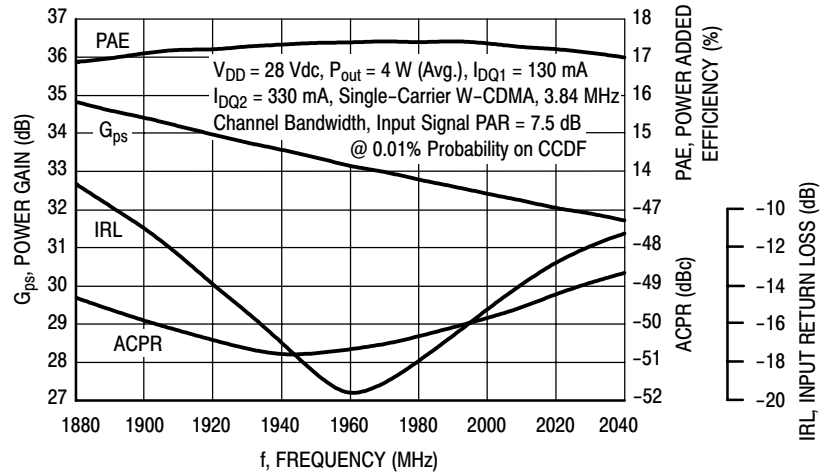
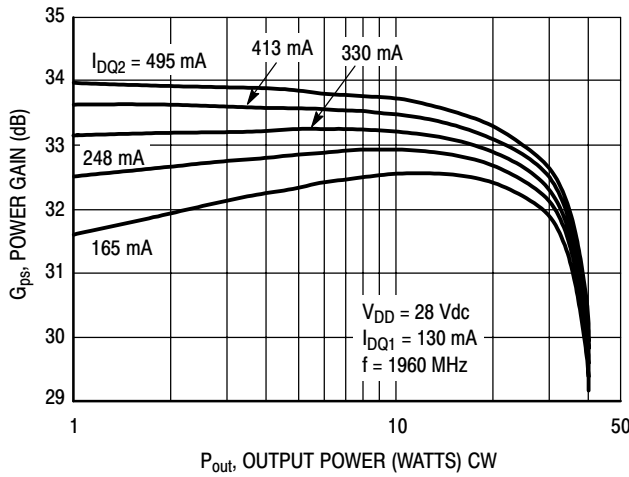


Figure 4. MW7IC2040NR1(GNR1)(NBR1) Test Circuit Component Layout — 1930-1990 MHz

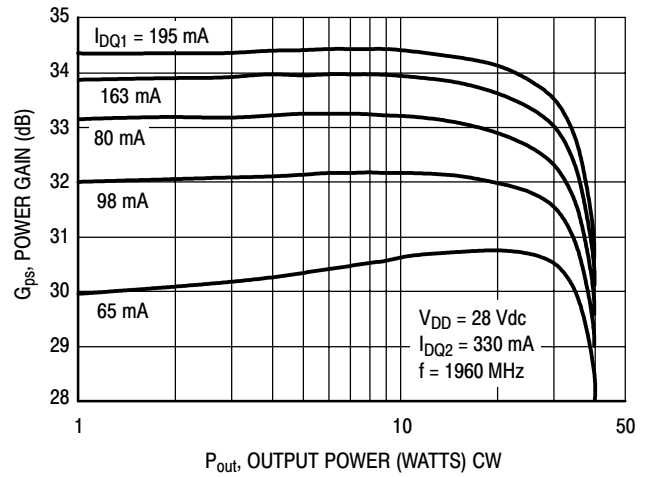
## TYPICAL CHARACTERISTICS



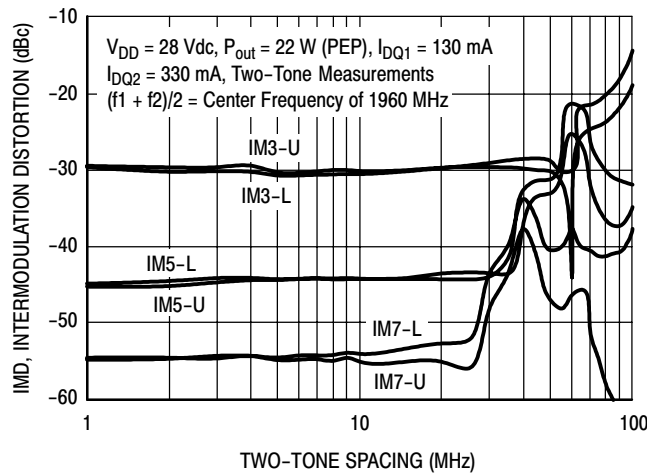
**Figure 5. Single Carrier W-CDMA Broadband Performance**  
@  $P_{out} = 4$  Watts Avg.



**Figure 6. Power Gain versus Output Power**  
@  $I_{DQ1} = 130$  mA

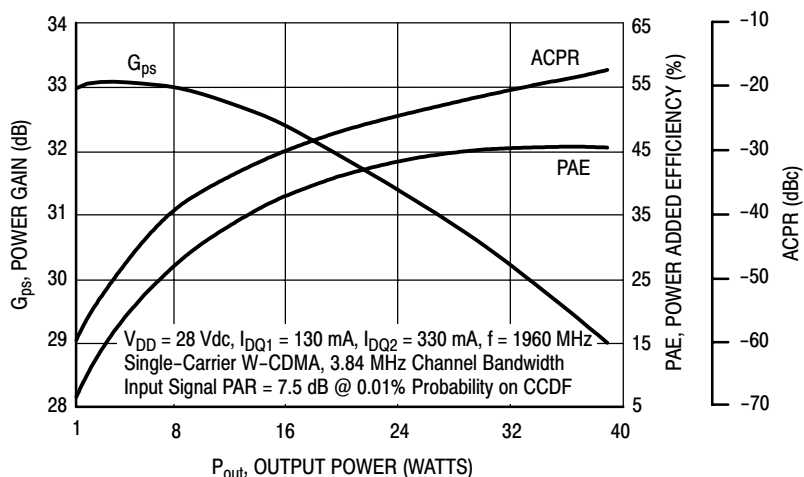


**Figure 7. Power Gain versus Output Power**  
@  $I_{DQ2} = 330$  mA

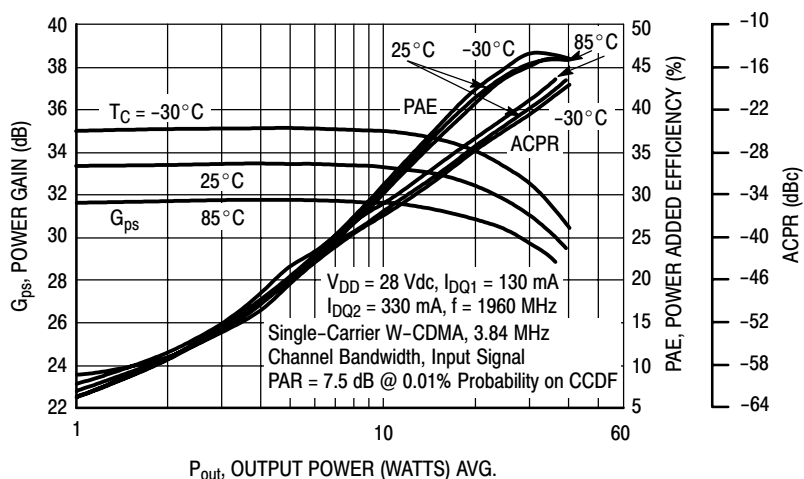


**Figure 8. Intermodulation Distortion Products**  
versus Two-Tone Spacing

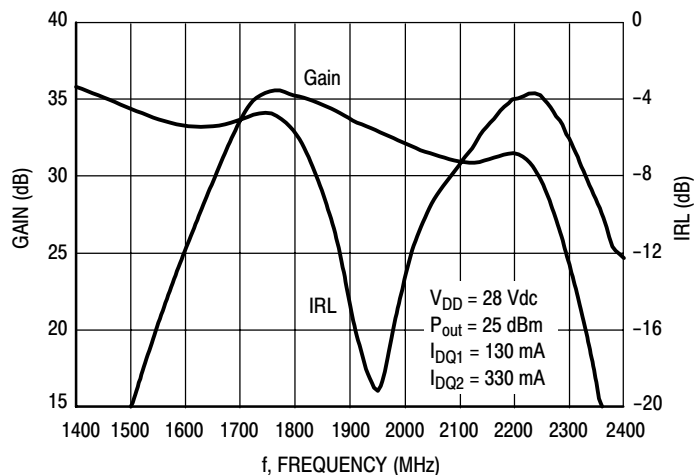
### TYPICAL CHARACTERISTICS



**Figure 9. Power Gain, ACPR and Power Added Efficiency versus Output Power**



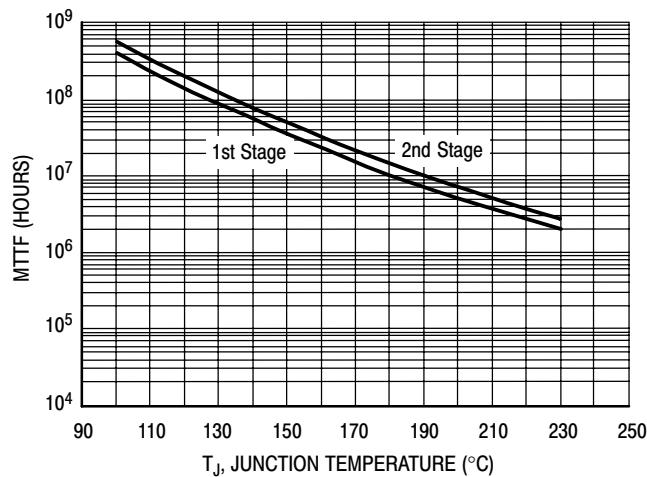
**Figure 10. Single-Carrier W-CDMA Power Gain, Power Added Efficiency and ACPR versus Output Power**



**Figure 11. Broadband Frequency Response**



## TYPICAL CHARACTERISTICS

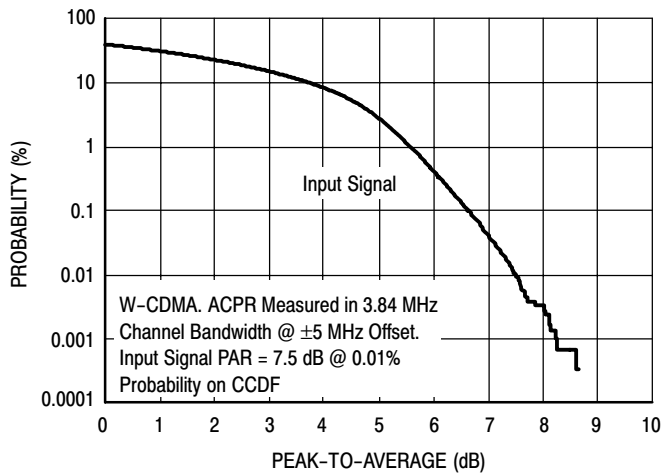


This above graph displays calculated MTTF in hours when the device is operated at  $V_{DD} = 28$  Vdc,  $P_{out} = 4$  W Avg., and PAE = 17.5%.

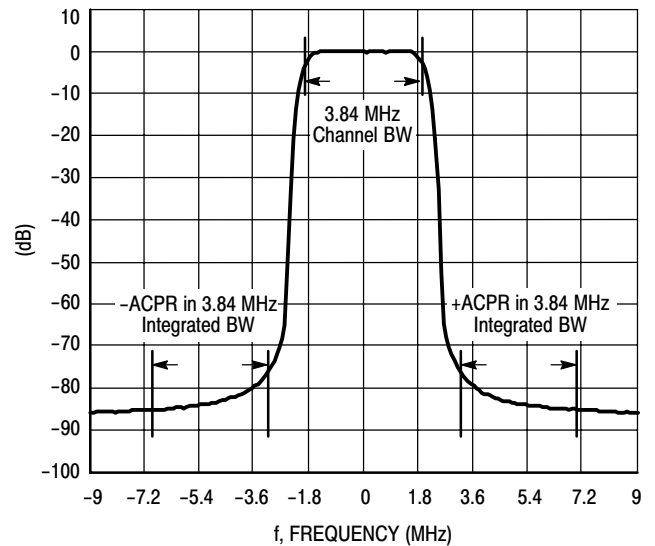
MTTF calculator available at <http://www.freescale.com/rf>. Select Software & Tools/Development Tools/Calculators to access MTTF calculators by product.

**Figure 12. MTTF versus Junction Temperature**

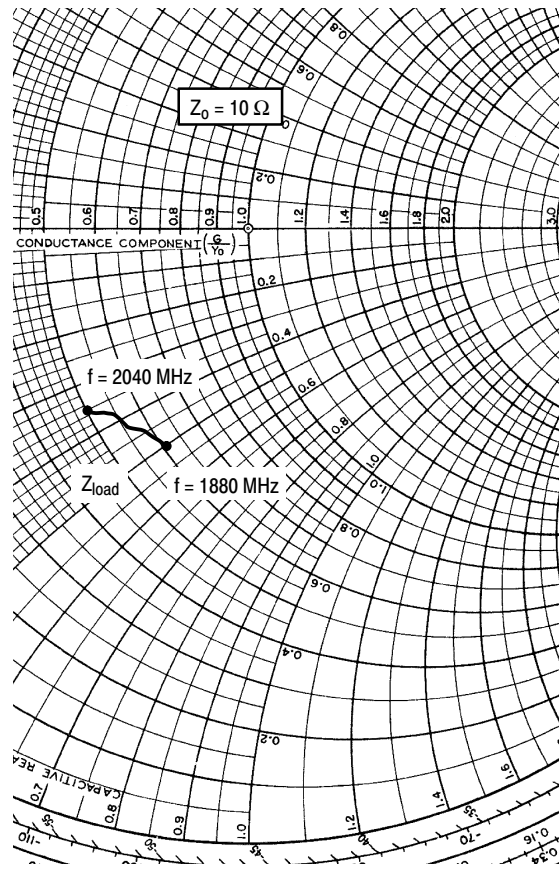
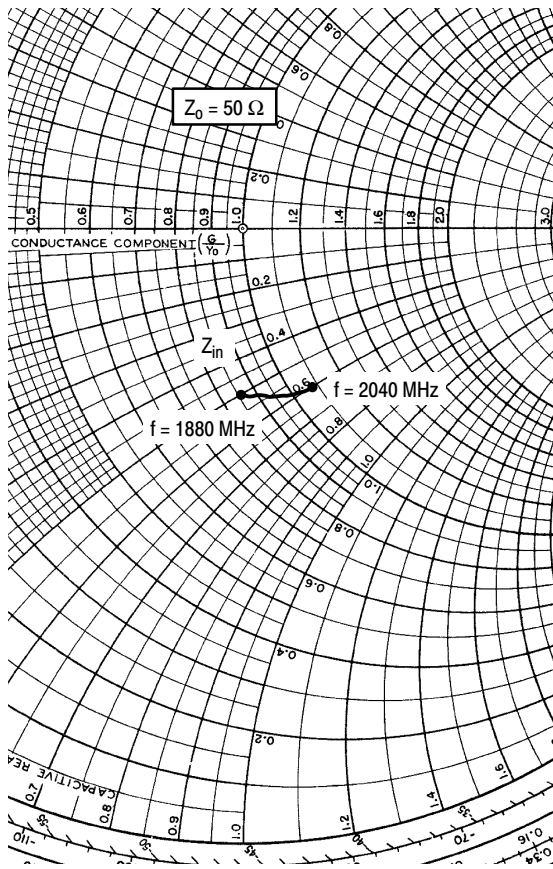
## W-CDMA TEST SIGNAL



**Figure 13. CCDF W-CDMA 3GPP, Test Model 1, 64 DPCH, 45.2% Clipping, Single-Carrier Test Signal**



**Figure 14. Single-Carrier W-CDMA Spectrum**



$V_{DD} = 28 \text{ Vdc}$ ,  $I_{DQ1} = 130 \text{ mA}$ ,  $I_{DQ2} = 330 \text{ mA}$ ,  $P_{out} = 4 \text{ W Avg.}$

| f<br>MHz | $Z_{in}$<br>$\Omega$ | $Z_{load}$<br>$\Omega$ |
|----------|----------------------|------------------------|
| 1880     | 42.97 - j25.07       | 6.10 - j5.01           |
| 1900     | 44.01 - j25.91       | 5.92 - j4.71           |
| 1920     | 45.14 - j26.72       | 5.76 - j4.44           |
| 1940     | 46.38 - j27.48       | 5.62 - j4.21           |
| 1960     | 47.71 - j28.19       | 5.51 - j4.01           |
| 1980     | 49.16 - j28.83       | 5.40 - j3.83           |
| 2000     | 50.71 - j29.40       | 5.27 - j3.71           |
| 2020     | 52.36 - j29.87       | 5.13 - j3.60           |
| 2040     | 54.12 - j30.23       | 4.99 - j3.52           |

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

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

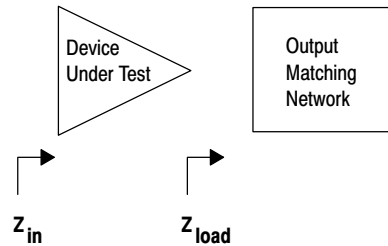
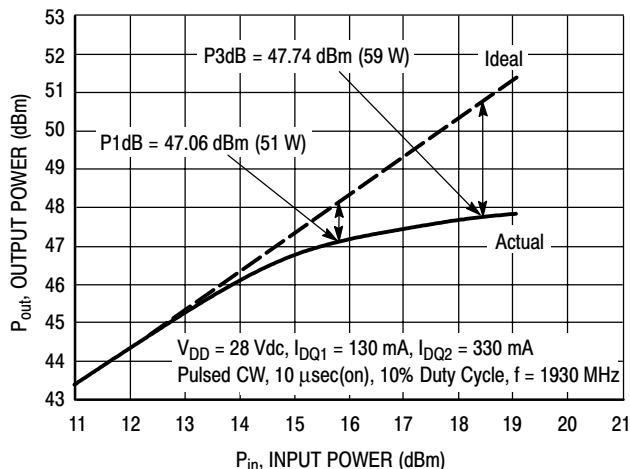


Figure 15. Series Equivalent Input and Load Impedance

## ALTERNATIVE PEAK TUNE LOAD PULL CHARACTERISTICS

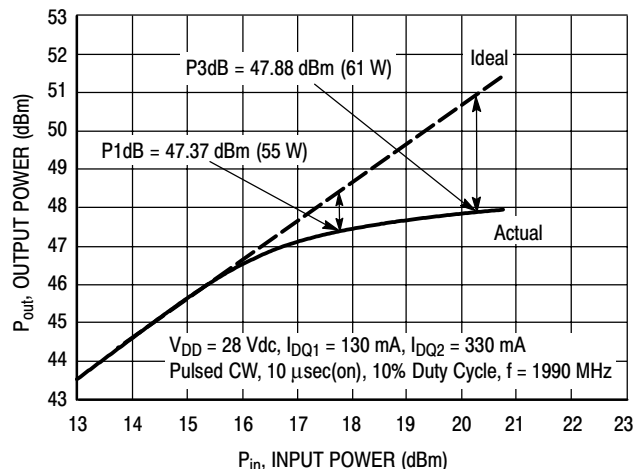


NOTE: Load Pull Test Fixture Tuned for Peak P1dB Output Power @ 28 V

Test Impedances per Compression Level

|      | $Z_{source}$<br>$\Omega$ | $Z_{load}$<br>$\Omega$ |
|------|--------------------------|------------------------|
| P1dB | 49.30 + j8.40            | 3.60 - j4.50           |

**Figure 16. Pulsed CW Output Power versus Input Power @ 28 V @ 1930 MHz**



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

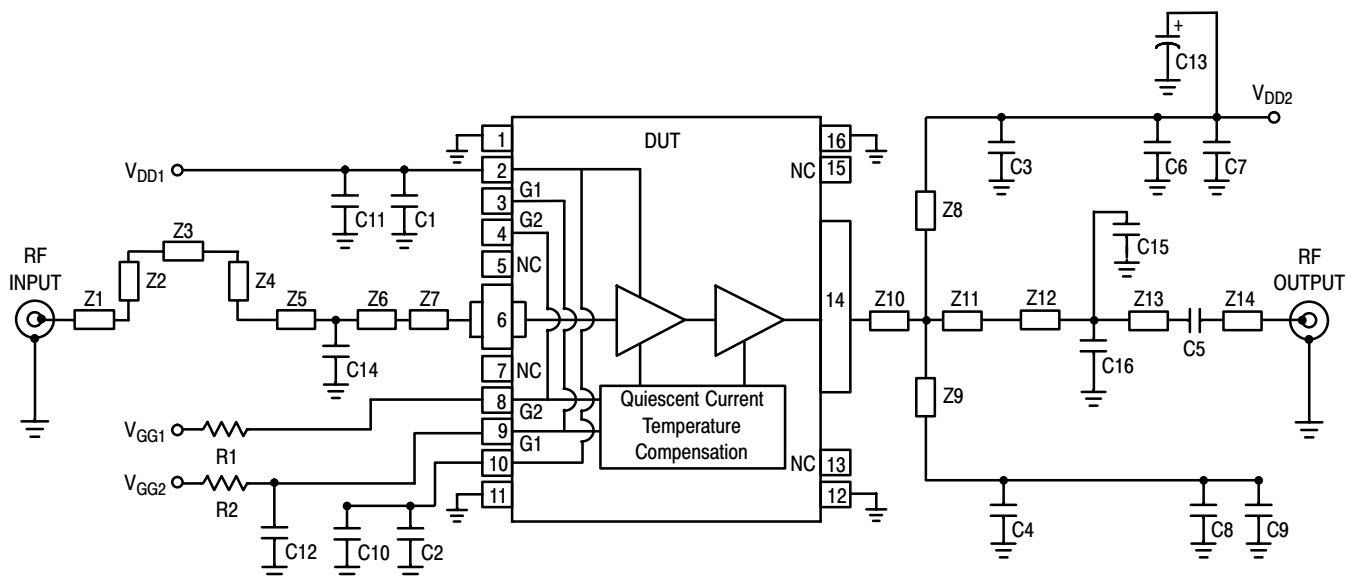
Test Impedances per Compression Level

|      | $Z_{source}$<br>$\Omega$ | $Z_{load}$<br>$\Omega$ |
|------|--------------------------|------------------------|
| P1dB | 50.0 - j4.90             | 3.40 - j5.10           |

**Figure 17. Pulsed CW Output Power versus Input Power @ 28 V @ 1990 MHz**

**Table 7. Common Source S-Parameters** ( $V_{DD} = 28\text{ V}$ ,  $I_{DQ1} = 90\text{ mA}$ ,  $I_{DQ2} = 430\text{ mA}$ ,  $T_C = 25^\circ\text{C}$ , 50 Ohm System)

| f<br>MHz | S <sub>11</sub> |        | S <sub>21</sub> |        | S <sub>12</sub> |        | S <sub>22</sub> |        |
|----------|-----------------|--------|-----------------|--------|-----------------|--------|-----------------|--------|
|          | S <sub>11</sub> | ∠ φ    | S <sub>21</sub> | ∠ φ    | S <sub>12</sub> | ∠ φ    | S <sub>22</sub> | ∠ φ    |
| 1500     | 0.595           | -118.5 | 2.110           | -151.3 | 0.00174         | -71.2  | 0.888           | -160.3 |
| 1550     | 0.545           | -147.4 | 3.851           | 178.9  | 0.00192         | -86.7  | 0.876           | 170.4  |
| 1600     | 0.482           | -176.5 | 7.415           | 144.7  | 0.00294         | -114.0 | 0.867           | 137.1  |
| 1650     | 0.398           | 156.7  | 15.620          | 103.6  | 0.00445         | -149.9 | 0.872           | 94.6   |
| 1700     | 0.332           | 146.1  | 37.544          | 45.5   | 0.00746         | 177.5  | 0.884           | 29.4   |
| 1750     | 0.542           | 116.5  | 62.685          | -48.6  | 0.00940         | 110.9  | 0.650           | -93.8  |
| 1800     | 0.488           | 59.6   | 50.513          | -124.5 | 0.00642         | 67.4   | 0.454           | 157.6  |
| 1850     | 0.373           | 8.7    | 42.562          | -178.8 | 0.00497         | 40.5   | 0.419           | 105.4  |
| 1900     | 0.294           | -46.7  | 38.690          | 132.3  | 0.00438         | 19.1   | 0.416           | 75.9   |
| 1950     | 0.269           | -107.0 | 36.138          | 85.3   | 0.00416         | -7.3   | 0.443           | 54.0   |
| 2000     | 0.297           | -161.3 | 33.838          | 39.7   | 0.00382         | -28.5  | 0.497           | 31.7   |
| 2050     | 0.342           | 154.0  | 32.122          | -4.7   | 0.00350         | -50.7  | 0.553           | 8.0    |
| 2100     | 0.389           | 114.8  | 30.682          | -48.5  | 0.00342         | -69.9  | 0.602           | -16.3  |
| 2150     | 0.420           | 78.2   | 29.594          | -92.4  | 0.00354         | -84.6  | 0.640           | -41.0  |
| 2200     | 0.424           | 41.2   | 28.734          | -137.7 | 0.00396         | -101.3 | 0.666           | -65.4  |
| 2250     | 0.388           | 2.9    | 27.277          | 175.2  | 0.00425         | -125.1 | 0.689           | -89.2  |
| 2300     | 0.302           | -37.2  | 24.568          | 126.4  | 0.00483         | -153.1 | 0.720           | -113.5 |
| 2350     | 0.188           | -78.8  | 20.404          | 78.5   | 0.00470         | 174.4  | 0.753           | -138.7 |
| 2400     | 0.066           | -123.6 | 16.281          | 33.8   | 0.00415         | 148.7  | 0.778           | -163.6 |
| 2450     | 0.034           | 55.1   | 12.661          | -8.6   | 0.00388         | 124.4  | 0.806           | 171.0  |
| 2500     | 0.104           | 12.1   | 9.738           | -48.2  | 0.00368         | 106.5  | 0.826           | 145.2  |
| 2550     | 0.154           | -17.7  | 7.577           | -85.7  | 0.00328         | 77.5   | 0.842           | 119.7  |
| 2600     | 0.191           | -44.6  | 5.905           | -121.7 | 0.00281         | 57.2   | 0.851           | 94.4   |
| 2700     | 0.250           | -94.4  | 3.679           | 169.8  | 0.00245         | 37.8   | 0.856           | 45.7   |
| 2750     | 0.278           | -118.4 | 2.921           | 136.7  | 0.00271         | 19.5   | 0.854           | 22.1   |
| 2800     | 0.309           | -142.0 | 2.330           | 104.5  | 0.00373         | 2.2    | 0.854           | -0.5   |
| 2850     | 0.343           | -165.3 | 1.874           | 72.7   | 0.00250         | -19.6  | 0.849           | -23.5  |
| 2900     | 0.382           | 171.0  | 1.518           | 41.5   | 0.00286         | -40.7  | 0.851           | -46.0  |
| 2950     | 0.420           | 147.7  | 1.226           | 10.6   | 0.00313         | -71.3  | 0.850           | -68.4  |
| 3000     | 0.459           | 124.6  | 0.985           | -19.8  | 0.00262         | -98.0  | 0.851           | -91.1  |
| 3050     | 0.498           | 102.9  | 0.782           | -49.0  | 0.00101         | -108.5 | 0.847           | -113.4 |
| 3100     | 0.542           | 79.6   | 0.641           | -76.9  | 0.00279         | -84.9  | 0.850           | -136.3 |
| 3150     | 0.577           | 56.4   | 0.531           | -105.1 | 0.00504         | -110.7 | 0.856           | -159.8 |
| 3200     | 0.603           | 33.6   | 0.439           | -133.3 | 0.00526         | -152.0 | 0.857           | 176.4  |
| 3250     | 0.628           | 11.0   | 0.363           | -161.1 | 0.00587         | -176.6 | 0.858           | 152.0  |
| 3300     | 0.654           | -11.9  | 0.303           | 171.0  | 0.00659         | 160.1  | 0.857           | 126.8  |
| 3350     | 0.661           | -35.4  | 0.250           | 143.7  | 0.00909         | 129.6  | 0.853           | 101.4  |
| 3400     | 0.678           | -57.0  | 0.208           | 115.4  | 0.00691         | 98.1   | 0.845           | 74.5   |
| 3450     | 0.692           | -80.2  | 0.157           | 88.5   | 0.00718         | 80.9   | 0.745           | 42.1   |
| 3500     | 0.704           | -103.7 | 0.158           | 71.5   | 0.01000         | 46.8   | 0.760           | 43.7   |



|    |                              |        |   |
|----|------------------------------|--------|---|
| Z1 | 0.0826" x 0.5043" Microstrip | Z8, Z9 | 0.0800" x 1.1139" Microstrip              |
| Z2 | 0.0826" x 0.3639" Microstrip | Z10    | 0.3419" x 0.1725" Microstrip              |
| Z3 | 0.0826" x 0.4258" Microstrip | Z11    | 0.3419" x 0.4671" Microstrip              |
| Z4 | 0.0826" x 0.3639" Microstrip | Z12    | 0.0830" x 0.4220" Microstrip              |
| Z5 | 0.0826" x 0.3459" Microstrip | Z13    | 0.0830" x 0.9030" Microstrip              |
| Z6 | 0.0826" x 0.9115" Microstrip | Z14    | 0.0830" x 0.2499" Microstrip              |
| Z7 | 0.0600" x 0.1273" Microstrip | PCB    | Rogers RO4350, 0.030", $\epsilon_r = 3.5$ |

Figure 18. MW7IC2040NR1(GNR1)(NBR1) Test Circuit Schematic — 1805-1880 MHz

Table 8. MW7IC2040NR1(GNR1)(NBR1) Test Circuit Component Designations and Values — 1805-1880 MHz

| Part                     | Description                                      | Part Number          | Manufacturer |
|--------------------------|--|----------------------|--------------|
| C1, C2, C3, C4, C5       | 6.8 pF Chip Capacitors                           | ATC100B6R8CT500XT    | ATC          |
| C6, C7, C8, C9, C10, C11 | 10 $\mu$ F, 50 V Chip Capacitors                 | GRM55DR61H106KA88L   | Murata       |
| C12                      | 2.2 $\mu$ F, 16 V Chip Capacitor                 | C1206C225K4RAC       | Kemet        |
| C13                      | 470 $\mu$ F, 63 V Electrolytic Capacitor, Radial | MCGPR63V477M13X26-RH | Multicomp    |
| C14, C15, C16            | 1 pF Chip Capacitors                             | ATC100B1R0BT500XT    | ATC          |
| R1, R2                   | 5.6 K $\Omega$ , 1/4 W Chip Resistors            | CRCW12065601FKEA     | Vishay       |

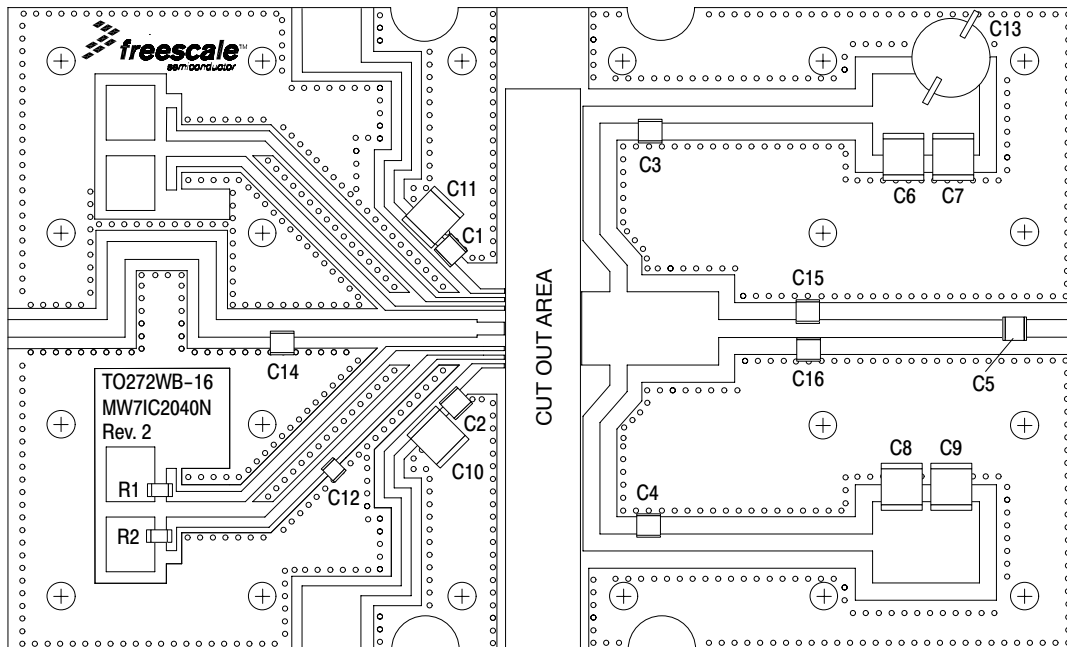
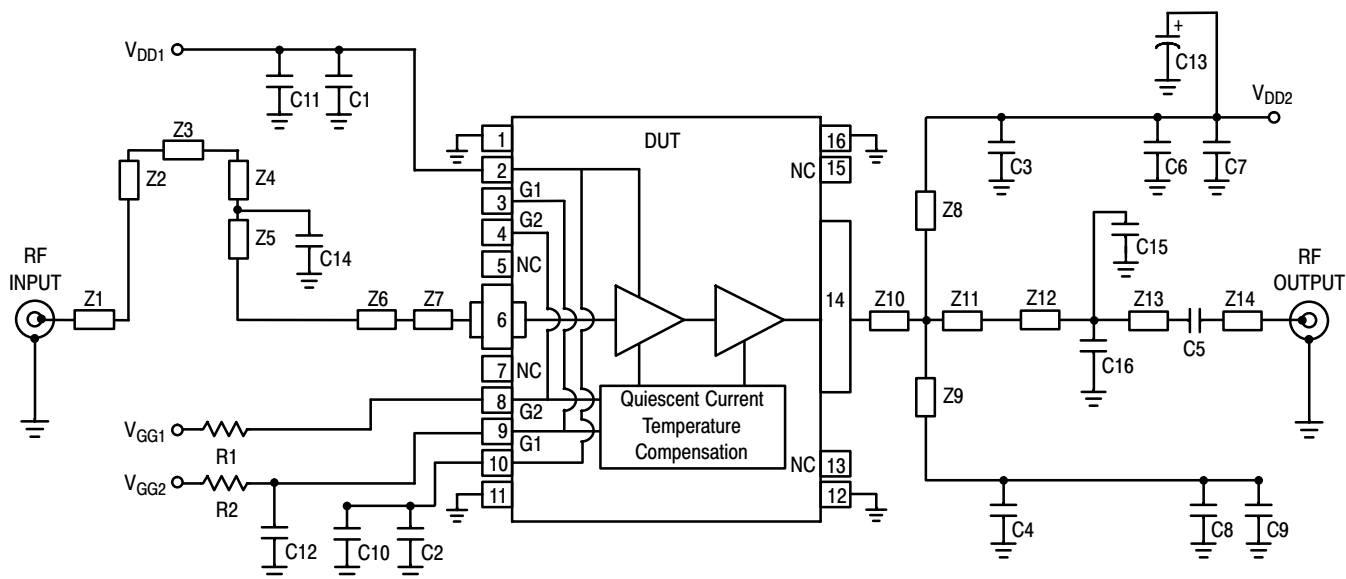


Figure 19. MW71C2040NR1(GNR1)(NBR1) Test Circuit Component Layout — 1805-1880 MHz

## GSM EDGE — 1805-1880 MHz



|    |                              |        |   |
|----|------------------------------|--------|---|
| Z1 | 0.0826" x 0.5043" Microstrip | Z8, Z9 | 0.0800" x 1.3354" Microstrip              |
| Z2 | 0.0826" x 0.3639" Microstrip | Z10    | 0.3419" x 0.1725" Microstrip              |
| Z3 | 0.0826" x 0.4258" Microstrip | Z11    | 0.3419" x 0.4671" Microstrip              |
| Z4 | 0.0826" x 0.2315" Microstrip | Z12    | 0.0830" x 0.3575" Microstrip              |
| Z5 | 0.0826" x 0.1324" Microstrip | Z13    | 0.0830" x 0.9675" Microstrip              |
| Z6 | 0.0826" x 1.2574" Microstrip | Z14    | 0.0830" x 0.2499" Microstrip              |
| Z7 | 0.0600" x 0.1273" Microstrip | PCB    | Rogers RO4350, 0.030", $\epsilon_r = 3.5$ |

**Figure 20. MW7IC2040NR1(GNR1)(NBR1) Test Circuit Schematic — 1805-1880 MHz**

**Table 9. MW7IC2040NR1(GNR1)(NBR1) Test Circuit Component Designations and Values — 1805-1880 MHz**

| Part                     | Description                                      | Part Number            | Manufacturer |
|--------------------------|--|------------------------|--------------|
| C1, C2, C3, C4, C5       | 6.8 pF Chip Capacitors                           | ATC100B6R8CT500XT      | ATC          |
| C6, C7, C8, C9, C10, C11 | 10 $\mu$ F, 50 V Chip Capacitors                 | GRM55DR61H106KA88L     | Murata       |
| C12                      | 2.2 $\mu$ F, 16 V Chip Capacitor                 | C1206C225K4RAC         | Kemet        |
| C13                      | 470 $\mu$ F, 63 V Electrolytic Capacitor, Radial | MCGPR63V477M13X26 - RH | Multicomp    |
| C14                      | 0.8 pF Chip Capacitor                            | ATC100B0R8BT500XT      | ATC          |
| C15                      | 1 pF Chip Capacitor                              | ATC100B1R0BT500XT      | ATC          |
| C16                      | 1.2 pF Chip Capacitor                            | ATC100B1R2BT500XT      | ATC          |
| R1, R2                   | 5.6 K $\Omega$ , 1/4 W Chip Resistors            | CRCW12065601FKEA       | Vishay       |

GSM EDGE — 1805-1880 MHz

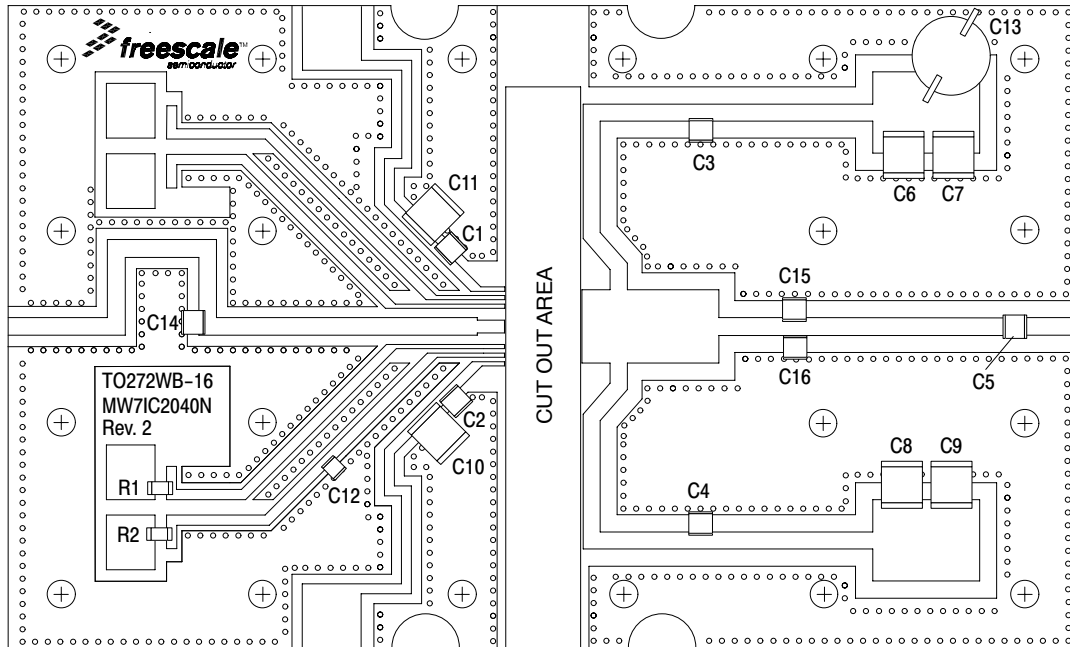
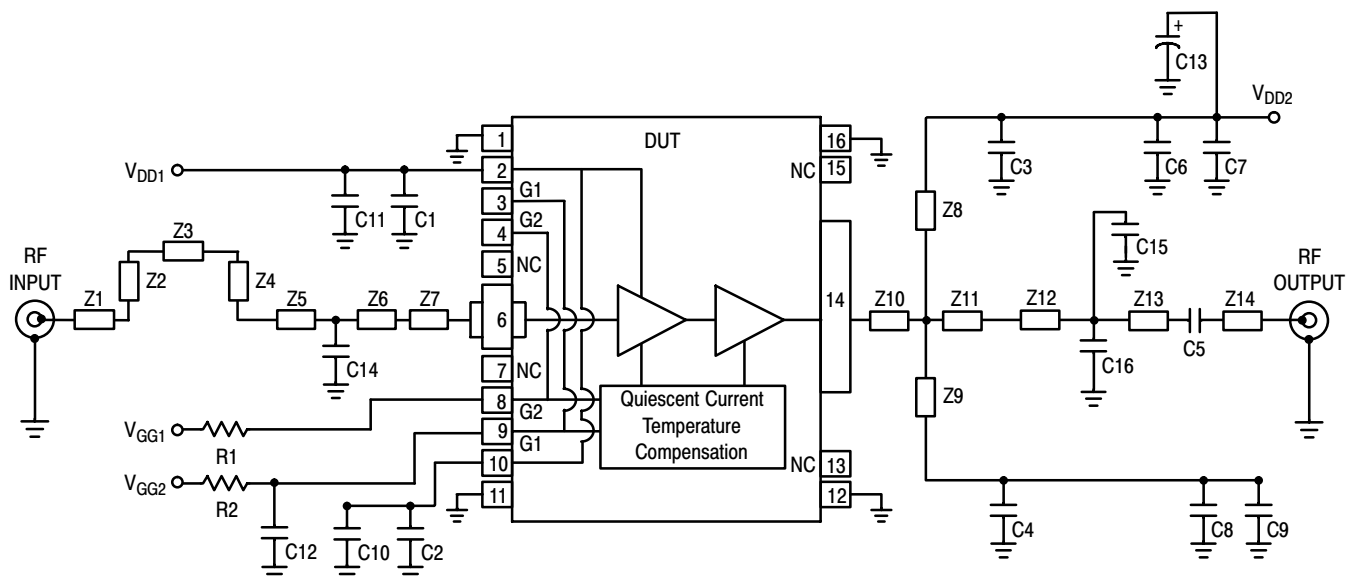


Figure 21. MW7IC2040NR1(GNR1)(NBR1) Test Circuit Component Layout — 1805-1880 MHz



## GSM EDGE — 1930-1990 MHz



|    |                              |        |   |
|----|------------------------------|--------|---|
| Z1 | 0.0826" x 0.5043" Microstrip | Z8, Z9 | 0.0800" x 1.6274" Microstrip              |
| Z2 | 0.0826" x 0.3639" Microstrip | Z10    | 0.3419" x 0.1725" Microstrip              |
| Z3 | 0.0826" x 0.4258" Microstrip | Z11    | 0.3419" x 0.4671" Microstrip              |
| Z4 | 0.0826" x 0.3639" Microstrip | Z12    | 0.0830" x 0.4685" Microstrip              |
| Z5 | 0.0826" x 0.6544" Microstrip | Z13    | 0.0830" x 0.8565" Microstrip              |
| Z6 | 0.0826" x 0.6030" Microstrip | Z14    | 0.0830" x 0.2499" Microstrip              |
| Z7 | 0.0600" x 0.1273" Microstrip | PCB    | Rogers RO4350, 0.030", $\epsilon_r = 3.5$ |

**Figure 22. MW7IC2040NR1(GNR1)(NBR1) Test Circuit Schematic — 1930-1990 MHz**

**Table 10. MW7IC2040NR1(GNR1)(NBR1) Test Circuit Component Designations and Values — 1930-1990 MHz**

| Part                     | Description                                      | Part Number            | Manufacturer |
|--------------------------|--|------------------------|--------------|
| C1, C2, C3, C4, C5       | 6.8 pF Chip Capacitors                           | ATC100B6R8CT500XT      | ATC          |
| C6, C7, C8, C9, C10, C11 | 10 $\mu$ F, 50 V Chip Capacitors                 | GRM55DR61H106KA88L     | Murata       |
| C12                      | 2.2 $\mu$ F, 16 V Chip Capacitor                 | C1206C225K4RAC         | Kemet        |
| C13                      | 470 $\mu$ F, 63 V Electrolytic Capacitor, Radial | MCGPR63V477M13X26 - RH | Multicomp    |
| C14                      | 0.5 pF Chip Capacitor                            | ATC100B0R5BT500XT      | ATC          |
| C15, C16                 | 0.8 pF Chip Capacitors                           | ATC100B0R8BT500XT      | ATC          |
| R1, R2                   | 5.6 K $\Omega$ , 1/4 W Chip Resistors            | CRCW12065601FKEA       | Vishay       |

GSM EDGE — 1930-1990 MHz

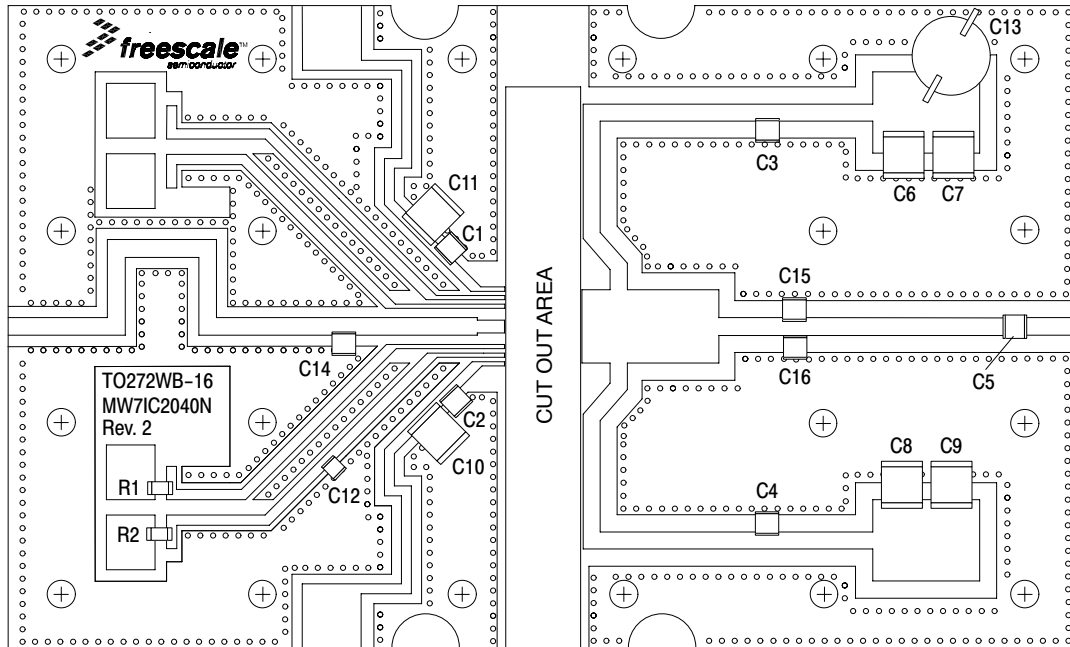
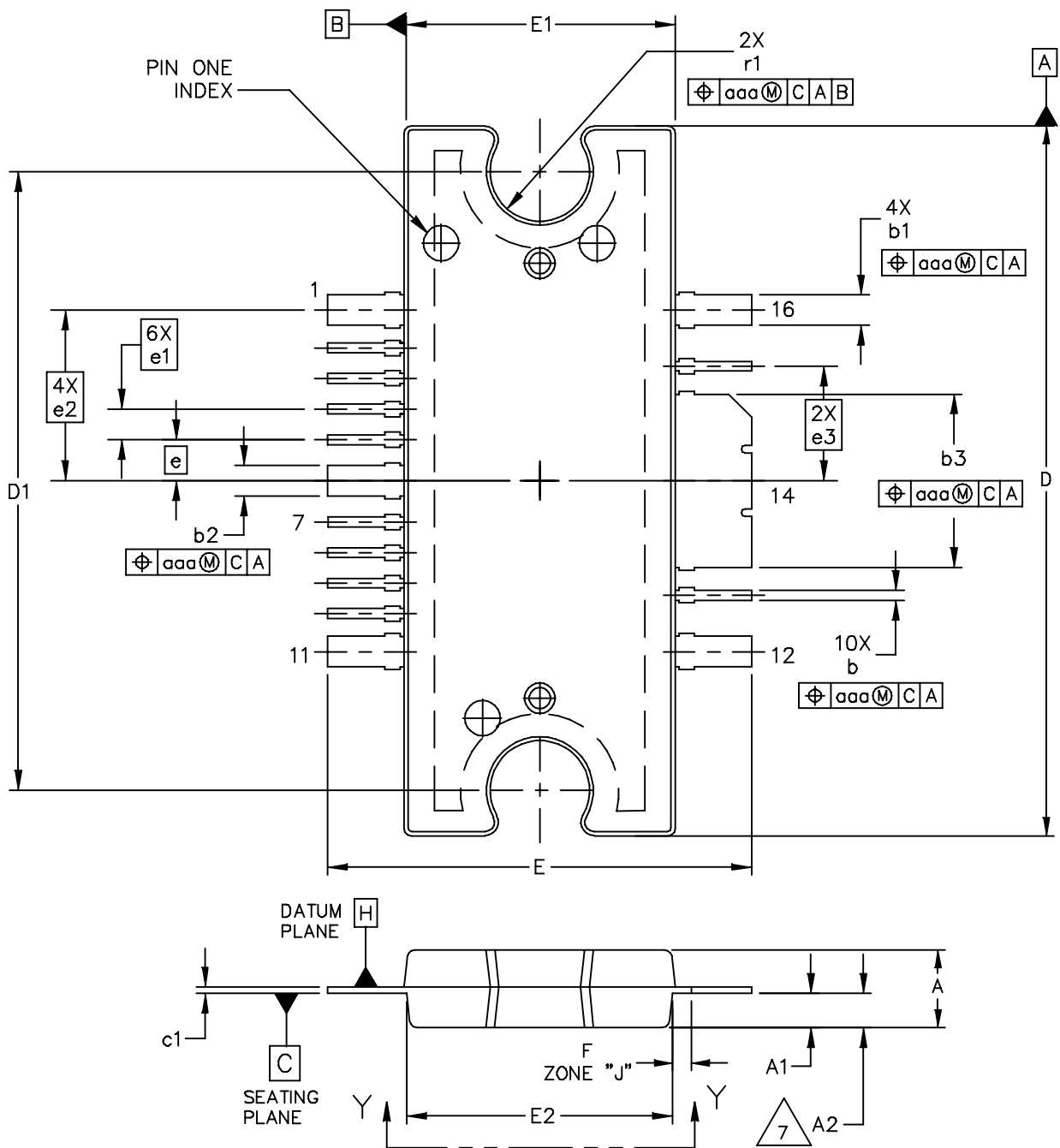


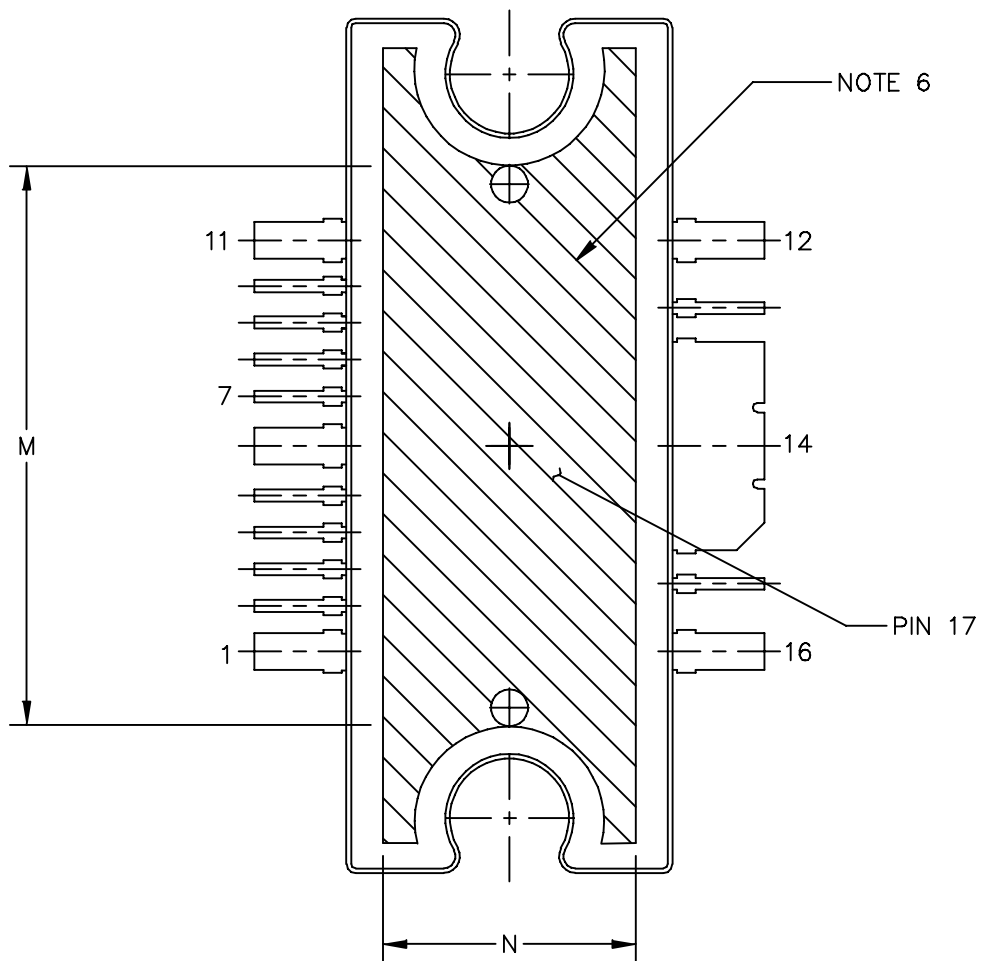
Figure 23. MW71C2040NR1(GNR1)(NBR1) Test Circuit Component Layout — 1930-1990 MHz

### PACKAGE DIMENSIONS



|   |                          |                            |
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| TITLE:<br>TO-272 WIDE BODY<br>MULTI-LEAD                | DOCUMENT NO: 98ARH99164A | REV: M                     |
|   | CASE NUMBER: 1329-09     | 23 AUG 2007                |
|   | STANDARD: NON-JEDEC      |                            |

MW7IC2040NR1 MW7IC2040GNR1 MW7IC2040NBR1



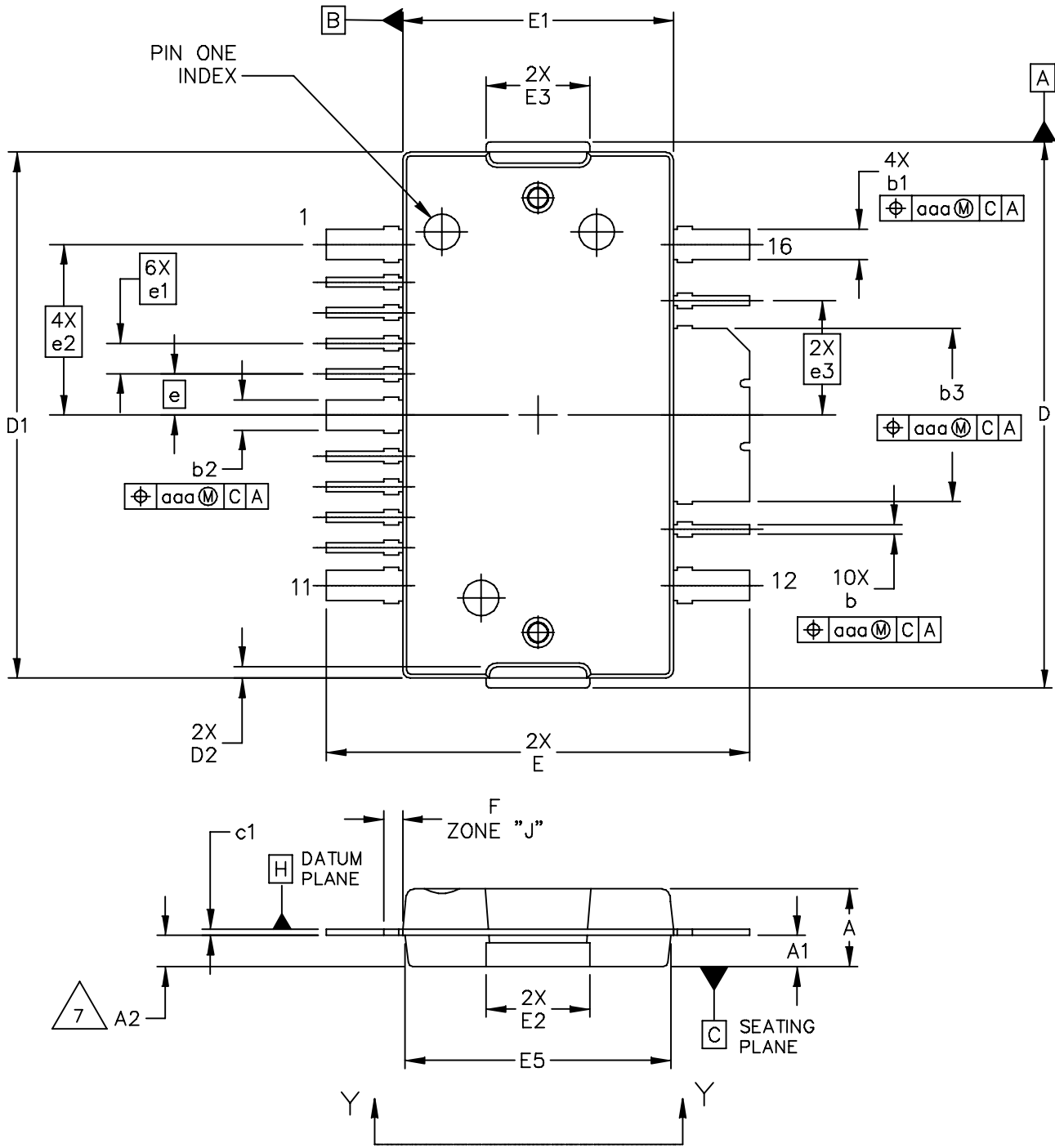
VIEW Y-Y

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| TITLE:<br>TO-272 WIDE BODY<br>MULTI-LEAD                | DOCUMENT NO: 98ARH99164A | REV: M                     |  |
|   | CASE NUMBER: 1329-09     | 23 AUG 2007                |  |
|   | STANDARD: NON-JEDEC      |                            |  |

NOTES:

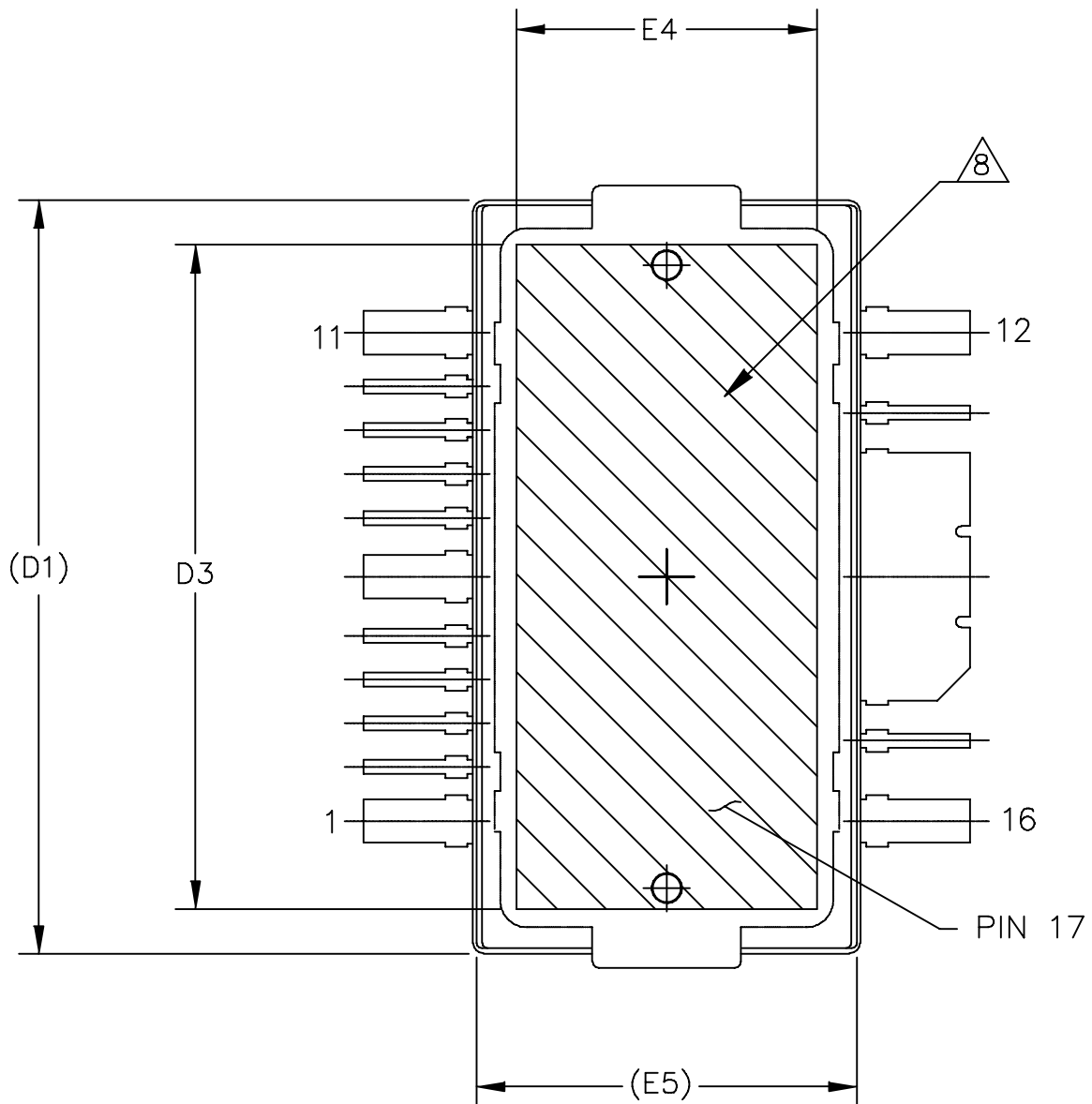
1. CONTROLLING DIMENSION: INCH
2. INTERPRET DIMENSIONS AND TOLERANCES PER ASME Y14.5M-1994.
3. DATUM PLANE -H- IS LOCATED AT THE TOP OF LEAD AND IS COINCIDENT WITH THE LEAD WHERE THE LEAD EXITS THE PLASTIC BODY AT THE TOP OF THE PARTING LINE.
4. DIMENSIONS "D" AND "E1" DO NOT INCLUDE MOLD PROTRUSION. 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", "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         |      |
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| TITLE:<br>TO-272 WIDE BODY<br>MULTI-LEAD                |          |      |                    |       | DOCUMENT NO: 98ARH99164A |                            |      | REV: M      |      |
|   |          |      |                    |       | CASE NUMBER: 1329-09     |                            |      | 23 AUG 2007 |      |
|   |          |      |                    |       | STANDARD: NON-JEDEC      |                            |      |             |      |



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| TITLE:<br>TO-270 WIDE BODY<br>16 LEAD                   | DOCUMENT NO: 98ASA10754D |                    | REV: A                     |
|   | CASE NUMBER: 1886-01     |                    | 31 AUG 2007                |
|   | STANDARD: NON-JEDEC      |                    |                            |

MW7IC2040NR1 MW7IC2040GNR1 MW7IC2040NBR1



VIEW Y-Y

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| TITLE:<br>TO-270 WIDE BODY<br>16 LEAD                   | DOCUMENT NO: 98ASA10754D | REV: A                     |  |
|   | CASE NUMBER: 1886-01     | 31 AUG 2007                |  |
|   | STANDARD: NON-JEDEC      |                            |  |

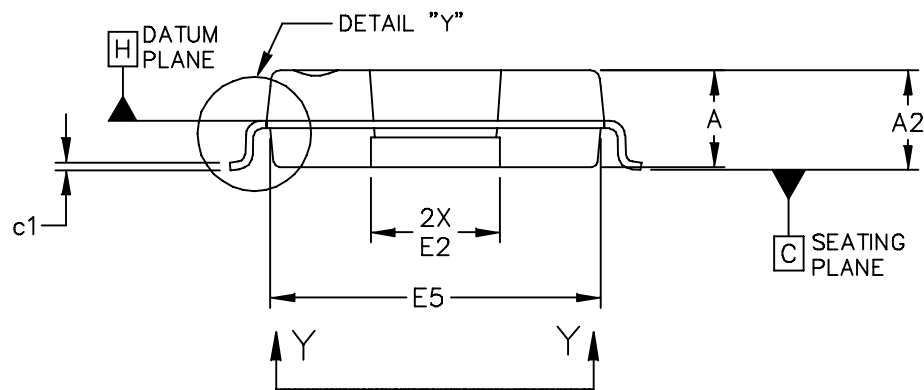
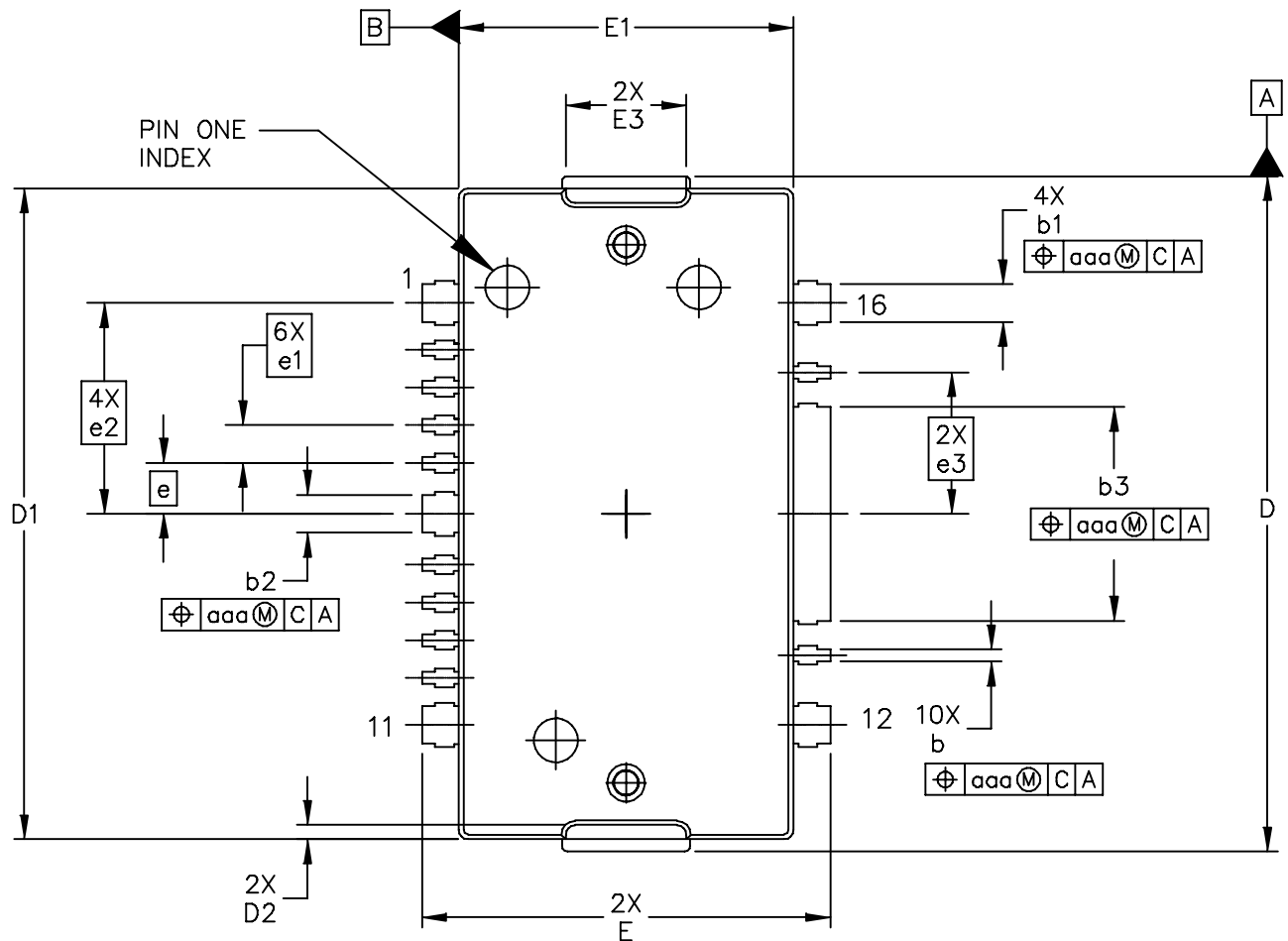
MW7IC2040NR1 MW7IC2040GNR1 MW7IC2040NBR1

NOTES:

1. CONTROLLING DIMENSION: INCH
2. INTERPRET DIMENSIONS AND TOLERANCES PER ASME Y14.5M-1994.
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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. DATUM -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. HATCHED AREA SHOWN IS ON THE SAME PLANE.

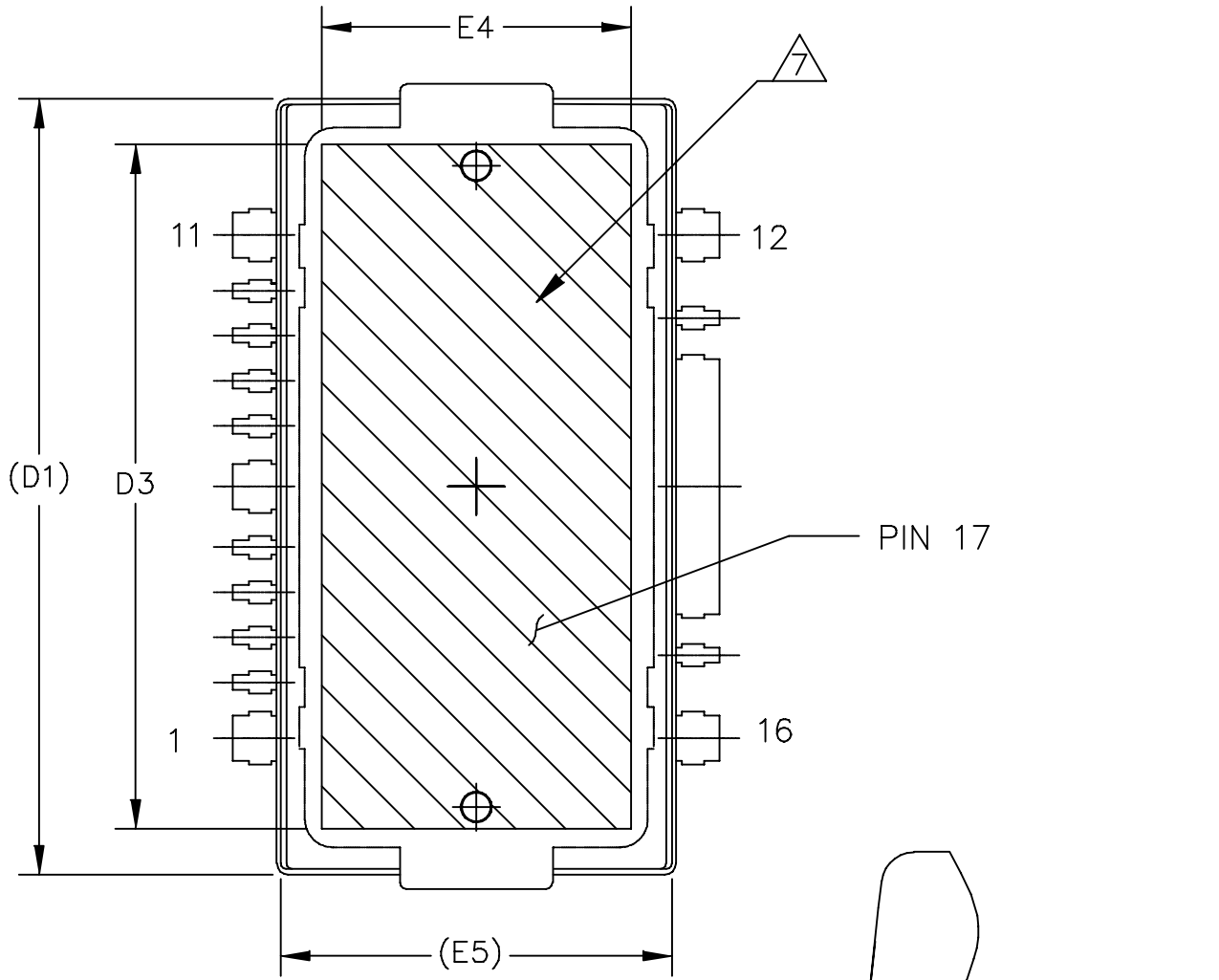
| DIM   | INCH |      | MILLIMETER         |       | DIM                      | INCH                       |      | MILLIMETER  |      |
|---|------|------|--------------------|-------|--------------------------|----------------------------|------|-------------|------|
|   | MIN  | MAX  | MIN                | MAX   |                          | MIN                        | MAX  | MIN         | MAX  |
| A   | .100 | .104 | 2.54               | 2.64  | F                        | .025 BSC                   |      | 0.64 BSC    |      |
| A1  | .039 | .043 | 0.99               | 1.09  | b                        | .011                       | .017 | 0.28        | 0.43 |
| A2  | .040 | .042 | 1.02               | 1.07  | b1                       | .037                       | .043 | 0.94        | 1.09 |
| D   | .712 | .720 | 18.08              | 18.29 | b2                       | .037                       | .043 | 0.94        | 1.09 |
| D1  | .688 | .692 | 17.48              | 17.58 | b3                       | .225                       | .231 | 5.72        | 5.87 |
| D2  | .011 | .019 | 0.28               | 0.48  | c1                       | .007                       | .011 | .18         | .28  |
| D3  | .600 | ---  | 15.24              | ---   | e                        | .054 BSC                   |      | 1.37 BSC    |      |
| E   | .551 | .559 | 14                 | 14.2  | e1                       | .040 BSC                   |      | 1.02 BSC    |      |
| E1  | .353 | .357 | 8.97               | 9.07  | e2                       | .224 BSC                   |      | 5.69 BSC    |      |
| E2  | .132 | .140 | 3.35               | 3.56  | e3                       | .150 BSC                   |      | 3.81 BSC    |      |
| E3  | .124 | .132 | 3.15               | 3.35  | aaa                      | .004                       |      | .10         |      |
| E4  | .270 | ---  | 6.86               | ---   |                          |                            |      |             |      |
| E5  | .346 | .350 | 8.79               | 8.89  |                          |                            |      |             |      |
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| TITLE:<br>TO-270 WIDE BODY<br>16 LEAD                   |      |      |                    |       | DOCUMENT NO: 98ASA10754D |                            |      | REV: A      |      |
|   |      |      |                    |       | CASE NUMBER: 1886-01     |                            |      | 31 AUG 2007 |      |
|   |      |      |                    |       | STANDARD: NON-JEDEC      |                            |      |             |      |



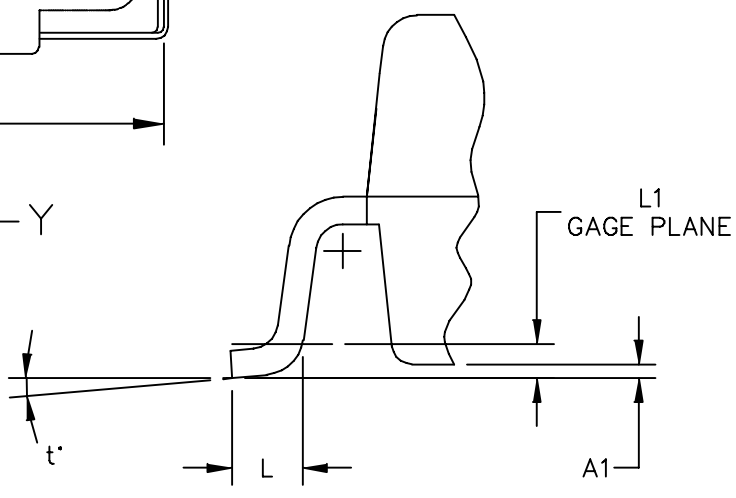


|   |                          |                    |             |                            |  |
|---|--------------------------|--------------------|-------------|----------------------------|--|
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| TITLE: TO-270 WIDE BODY<br>16 LEAD,<br>GULL WING        | DOCUMENT NO: 98ASA10755D |                    | REV: A      |                            |  |
|   | CASE NUMBER: 1887-01     |                    | 31 AUG 2007 |                            |  |
|   | STANDARD: NON-JEDEC      |                    |             |                            |  |

MW7IC2040NR1 MW7IC2040GNR1 MW7IC2040NBR1



VIEW Y-Y



DETAIL "Y"

|   |                          |                    |                            |
|---|--------------------------|--------------------|----------------------------|
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| TITLE: TO-270 WIDE BODY<br>16 LEAD,<br>GULL WING        | DOCUMENT NO: 98ASA10755D |                    | REV: A                     |
|   | CASE NUMBER: 1887-01     |                    | 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 (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. DATUM -A- AND -B- TO BE DETERMINED AT DATUM PLANE -H-.
7. 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  | L                        | .018                       | .024 | 0.46        | 0.61 |
| A1  | .001 | .004 | 0.02               | 0.10  | L1                       | .010 BSC                   |      | 0.25 BSC    |      |
| A2  | .099 | .110 | 2.51               | 2.79  | b                        | .011                       | .017 | 0.28        | 0.43 |
| D   | .712 | .720 | 18.08              | 18.29 | b1                       | .037                       | .043 | 0.94        | 1.09 |
| D1  | .688 | .692 | 17.48              | 17.58 | b2                       | .037                       | .043 | 0.94        | 1.09 |
| D2  | .011 | .019 | 0.28               | 0.48  | b3                       | .225                       | .231 | 5.72        | 5.87 |
| D3  | .600 | ---  | 15.24              | ---   | c1                       | .007                       | .011 | 0.18        | 0.28 |
| 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  | .132 | .140 | 3.35               | 3.56  | e2                       | .224 BSC                   |      | 5.69 BSC    |      |
| E3  | .124 | .132 | 3.15               | 3.35  | e3                       | .150 BSC                   |      | 3.81 BSC    |      |
| E4  | .270 | ---  | 6.86               | ---   | t                        | 2'                         | 8'   | 2'          | 8'   |
| E5  | .346 | .350 | 8.79               | 8.89  | aaa                      | .004                       |      | 0.10        |      |
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| TITLE: TO-270 WIDE BODY<br>16 LEAD,<br>GULL WING        |      |      |                    |       | DOCUMENT NO: 98ASA10755D |                            |      | REV: A      |      |
|   |      |      |                    |       | CASE NUMBER: 1887-01     |                            |      | 31 AUG 2007 |      |
|   |      |      |                    |       | STANDARD: NON-JEDEC      |                            |      |             |      |

## PRODUCT DOCUMENTATION, TOOLS AND SOFTWARE

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
- AN1987: Quiescent Current Control for the RF Integrated Circuit Device Family
- AN3263: Bolt Down Mounting Method for High Power RF Transistors and RFICs in Over-Molded Plastic Packages
- AN3789: Clamping of 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 and Tools, 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. 2009 | <ul style="list-style-type: none"><li>• Initial Release of Data Sheet</li></ul>  |
| 1        | Nov. 2009 | <ul style="list-style-type: none"><li>• Updated Human Body Model ESD from Class 1C to 1B to reflect Human Body Model actual test data, p. 2</li><li>• Fig. 13, CCDF W-CDMA 3GPP, Test Model 1, 64 DPCH, 45.2% Clipping, Single-Carrier Test Signal and Fig. 14, Single-Carrier W-CDMA Spectrum updated to show the undistorted input test signal, p. 9</li><li>• Added AN3789, Clamping of High Power RF Transistors and RFICs in Over-Molded Plastic Packages to Product Documentation, Application Notes, p. 28</li><li>• Added Electromigration MTTF Calculator and RF High Power Model availability to Product Software, p. 28</li></ul> |

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Freescale Semiconductor Japan Ltd.  
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ARCO Tower 15F  
1-8-1, Shimo-Meguro, Meguro-ku,  
Tokyo 153-0064  
Japan  
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[support.japan@freescale.com](mailto:support.japan@freescale.com)

### **Asia/Pacific:**

Freescale Semiconductor China Ltd.  
Exchange Building 23F  
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