

## RF Reference Design Library

# Gallium Arsenide PHEMT

### RF Power Field Effect Transistors

#### Device Characteristics (From Device Data Sheet)

Designed for WLL/MMDS/BWA or UMTS driver applications with frequencies from 1.8 to 3.6 GHz. Devices are unmatched and are suitable for use in Class AB linear base station applications.

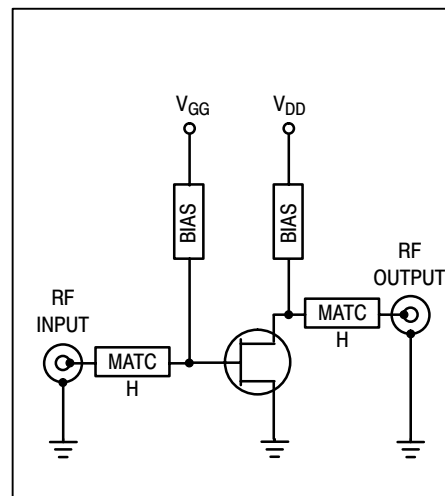
- Typical W-CDMA Performance: -42 dBc ACPR, 3.55 GHz, 12 Volts,  $I_{DQ} = 55$  mA, 5 MHz Offset/3.84 MHz BW, 64 DPCH (8.5 dB P/A @ 0.01% Probability)  
     Output Power — 300 mWatt  
     Power Gain — 11.5 dB  
     Efficiency — 25%
- 3 Watts P1dB @ 3.55 GHz
- Excellent Phase Linearity and Group Delay Characteristics
- High Gain, High Efficiency and High Linearity
- N Suffix Indicates Lead-Free Terminations

#### Reference Design Characteristics

- Typical Single-Channel W-CDMA Performance: -45 dBc ACPR, 2.45 GHz, 12 Volts,  $I_{DQ} = 55$  mA, 5 MHz Offset/3.84 MHz BW, 64 DPCH (8.5 dB P/A @ 0.01% Probability)  
     Output Power — 350 mWatt  
     Power Gain — 12.5 dB  
     Efficiency — 26%

**MRFG35003NT1**  
**MRFG35003MT1**  
**BWA**

**BWA**  
**2.4-2.5 GHz**



### MRFG35003NT1(MT1) BWA 2.4-2.5 GHz REFERENCE DESIGN

**Designed by: Monte Miller and Rick Hooper**

This reference design is designed to demonstrate the typical RF performance characteristics of the MRFG35003NT1(MT1) when applied for the 2.4-2.5 GHz W-CDMA frequency band. The reference design is tuned for the best tradeoff between good W-CDMA linearity and good power capability and efficiency.

#### REFERENCE DESIGN LIBRARY TERMS AND CONDITIONS

Freescale is pleased to make this reference design available for your use in development and testing of your own product or products, without charge. The reference design contains easy-to-copy, fully functional amplifier designs. Where possible, it consists of "no tune" distributed element matching circuits designed to be as small as possible, includes temperature compensated bias circuitry, and is designed to be used as "building blocks" for our customers.

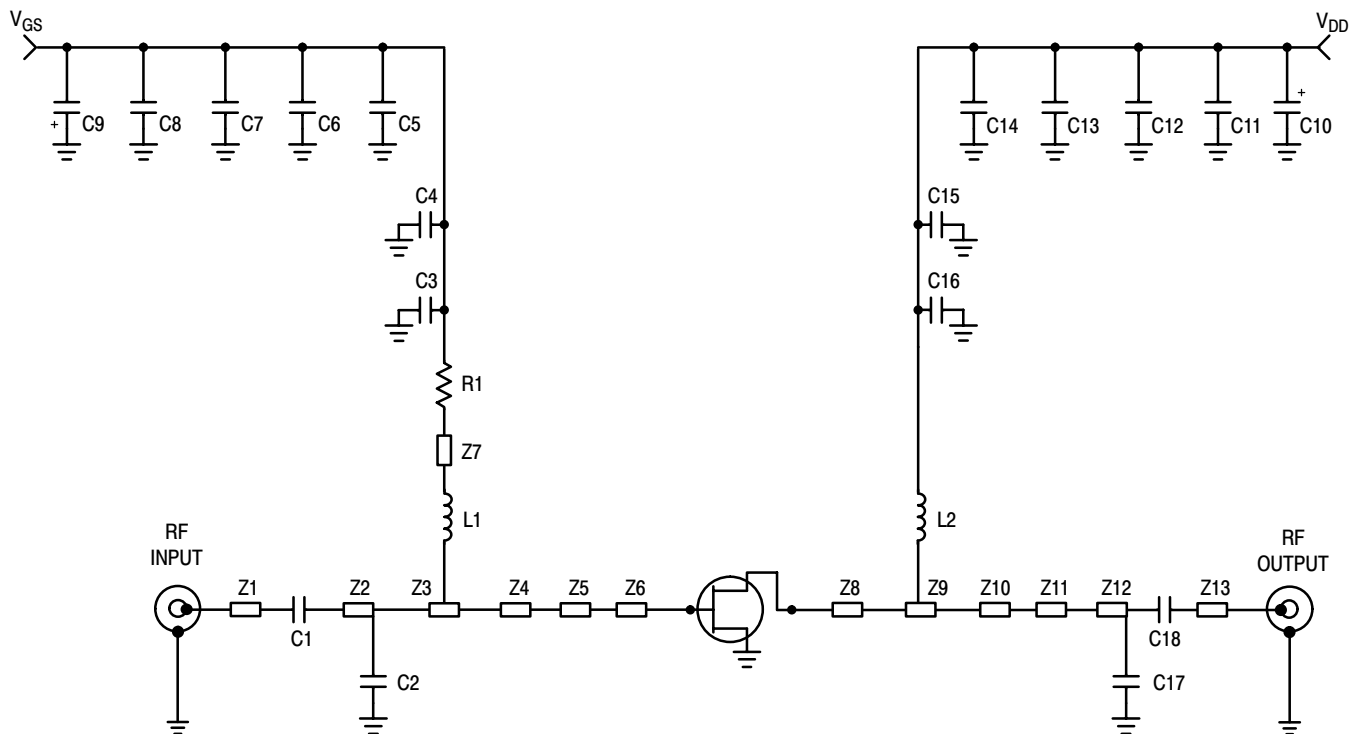
#### HEATSINKING

When operating this fixture please provide adequate heat-sinking for the device. Excessive heating of the device will prevent repeating of the included measurements.

#### NONLINEAR SIMULATION

To aid the design process and help reduce time to market for our customers, Freescale provides device models for several commercially available harmonic balance simulators. Our model Library is available for all major computer platforms supported by these simulators. For details on the RF model library and supported harmonic balance simulators, go to the following url:

<http://www.freescale.com/rf/models>

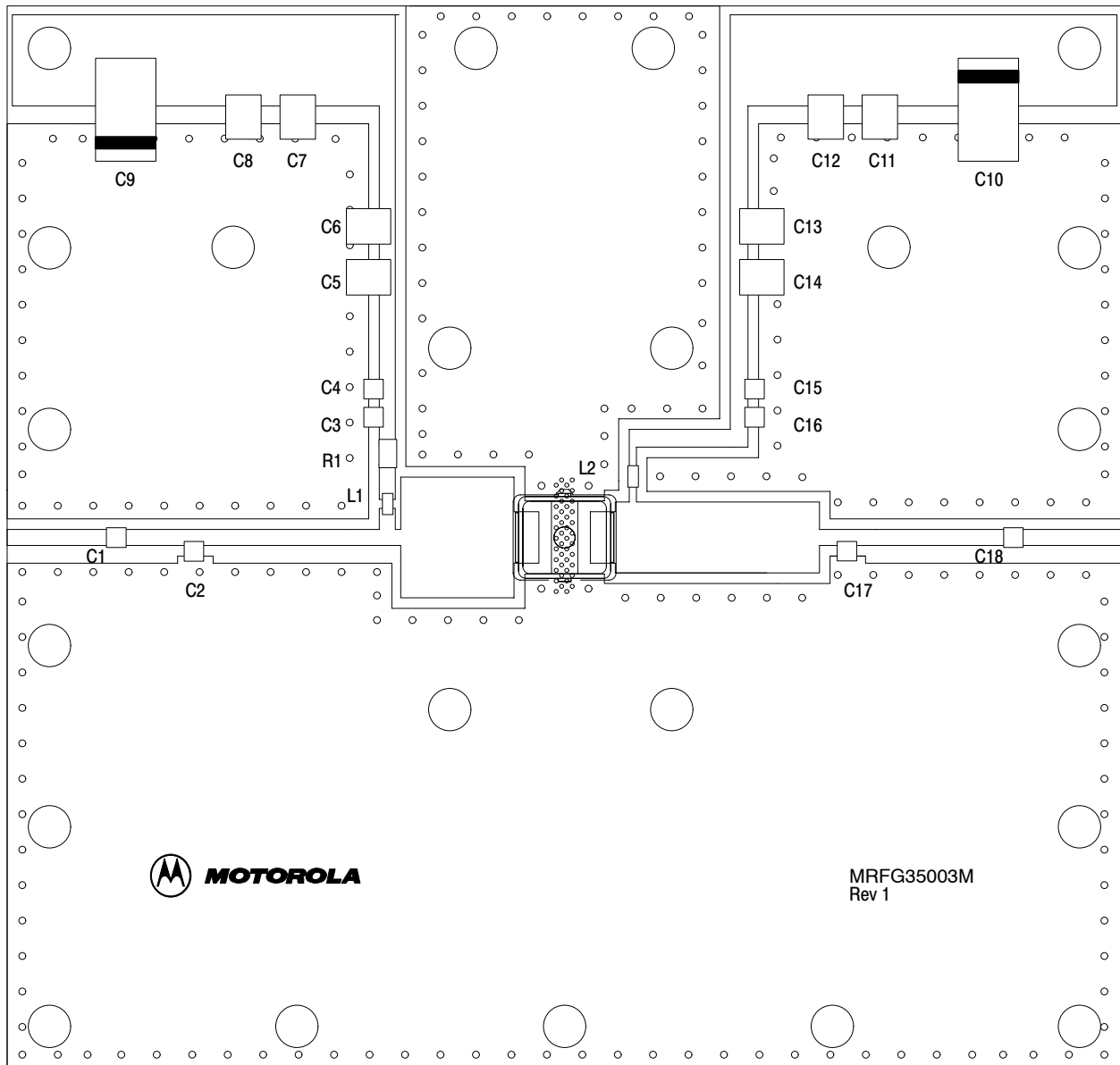


|         |                            |     |  |
|---------|----------------------------|-----|--|
| Z1, Z13 | 0.044" x 0.295" Microstrip | Z7  | 0.045" x 0.100" Microstrip               |
| Z2      | 0.044" x 0.730" Microstrip | Z9  | 0.200" x 0.040" Microstrip               |
| Z3      | 0.105" x 0.045" Microstrip | Z10 | 0.260" x 0.020" Microstrip               |
| Z4      | 0.044" x 0.015" Microstrip | Z11 | 0.200" x 0.516" Microstrip               |
| Z5      | 0.340" x 0.320" Microstrip | Z12 | 0.044" x 0.534" Microstrip               |
| Z6, Z8  | 0.146" x 0.070" Microstrip | PCB | Rogers 4350, 0.020", $\epsilon_r = 3.50$ |

**Figure 1. MRFG35003NT1(MT1) BWA Reference Design Schematic**

**Table 1. MRFG35003NT1(MT1) BWA Reference Design Component Designations and Values**

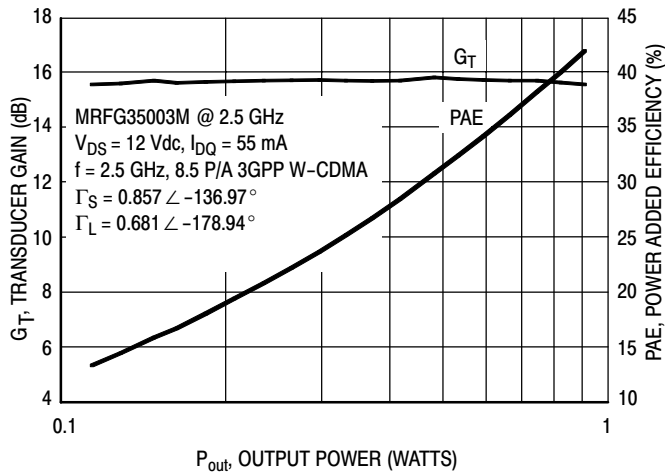
| Part    | Description                          | Value, P/N or DWG | Manufacturer |
|---------|--------------------------------------|-------------------|--------------|
| C1      | 3.9 pF Chip Capacitor                | 08051J3R9BBT      | AVX          |
| C2      | 0.9 pF Chip Capacitor                | 08051J0R9BBT      | AVX          |
| C3, C16 | 10 pF Chip Capacitors                | 100A100JP150X     | ATC          |
| C4, C15 | 100 pF Chip Capacitors               | 100A101JP150X     | ATC          |
| C5, C14 | 100 pF Chip Capacitors               | 100B101JP500X     | ATC          |
| C6, C13 | 1000 pF Chip Capacitors              | 100B102JP500X     | ATC          |
| C7, C12 | 0.1 $\mu$ F Chip Capacitors          | CDR33BX104AKWS    | Kemet        |
| C8, C11 | 39K pF Chip Capacitors               | 200B393KP500X     | ATC          |
| C9, C10 | 22 $\mu$ F Tantalum Capacitors       | T491X226K035AS    | Newark       |
| C17     | 1.0 pF Chip Capacitor                | 08051J1R0BBT      | AVX          |
| C18     | 15.0 pF Chip Capacitor               | 08051J15R0GBT     | AVX          |
| L1      | 4.7 nH Chip Inductor                 | LL2102-F4N7K      | TOKO         |
| L2      | 8.2 nH Chip Inductor                 | LL1608-FHN2K      | TOKO         |
| R1      | 75 $\Omega$ , 1/4 W 1% Chip Resistor | D55342M07B75JOR   | Newark       |



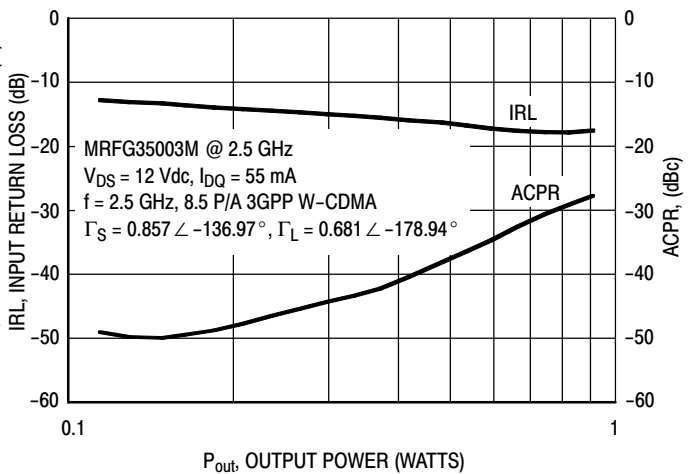
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**Figure 2. MRFG35003NT1(MT1) BWA Reference Design Component Layout**

## CHARACTERISTICS

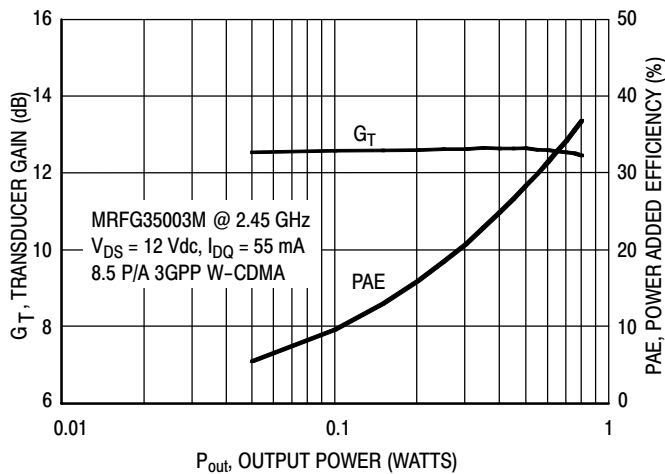


**Figure 3. Transducer Gain and Power Added Efficiency versus Output Power**

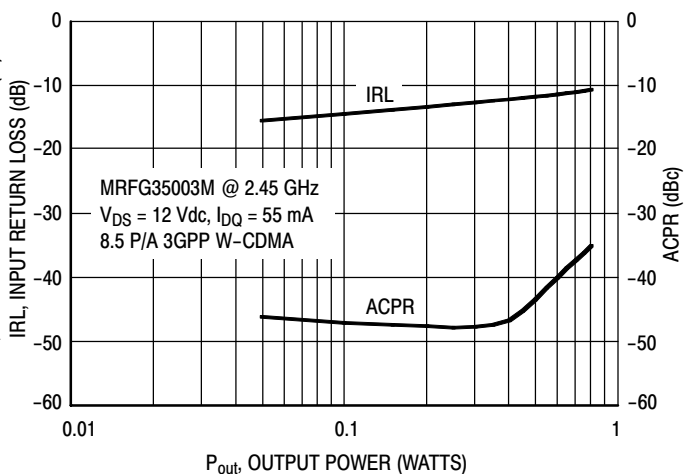


**Figure 4. W-CDMA ACPR and Input Return Loss versus Output Power**

**NOTE:** Data in Figures 3 and 4 is generated from load pull, not from the test circuit shown.



**Figure 5. Transducer Gain and Power Added Efficiency versus Output Power**



**Figure 6. W-CDMA ACPR and Input Return Loss versus Output Power**

**NOTE:** Data in Figures 5 and 6 is generated from the test circuit shown.

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