

### RoHS Compliant & Pb-Free Product

#### Typical Applications

- GaAs HBT Pre-Driver for Basestation Amplifiers
- Power Amplifier Stage for Commercial Wireless Infrastructure
- Class AB Operation for GSM/EDGE/CDMA Transmitter Applications

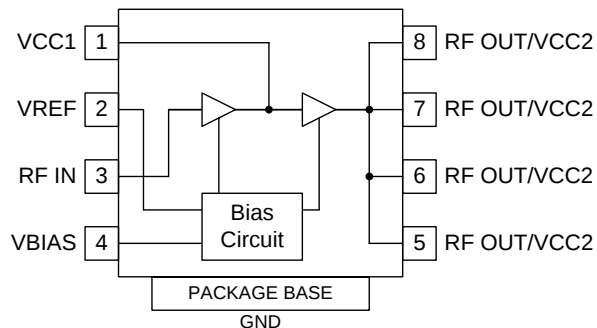
#### Product Description

The RF3802 is specifically designed for wireless infrastructure applications. Using a highly reliable GaAs HBT fabrication process, this high-performance dual-stage amplifier achieves high output power over a broad frequency range. The RF3802 amplifier also provides excellent efficiency and thermal stability through the use of a thermally-enhanced surface-mount AIN package. Ease of integration is accomplished through the incorporation of an optimized evaluation board design provided to achieve proper  $50\Omega$  operation. Various evaluation board configurations are available to address a broad range of wireless infrastructure applications:

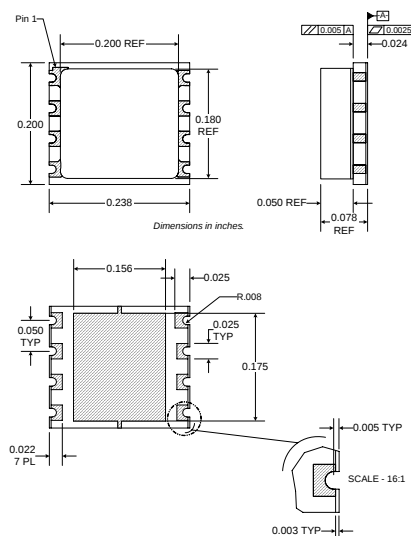
- AMPS/GSM850/EDGE850
- GSM900/EDGE900
- IS-95/CDMA2000/AMPS

#### Optimum Technology Matching® Applied

- |                                     |                                              |                                       |
|-------------------------------------|----------------------------------------------|---------------------------------------|
| <input type="checkbox"/> Si BJT     | <input checked="" type="checkbox"/> GaAs HBT | <input type="checkbox"/> GaAs MESFET  |
| <input type="checkbox"/> Si Bi-CMOS | <input type="checkbox"/> SiGe HBT            | <input type="checkbox"/> Si CMOS      |
| <input type="checkbox"/> InGaP/HBT  | <input type="checkbox"/> GaN HEMT            | <input type="checkbox"/> SiGe Bi-CMOS |



Functional Block Diagram



Package Style: AIN

#### Features

- 5W Output Power
- High Linearity
- 35% Power-Added Efficiency
- Thermally Enhanced AIN Packaging
- Broadband Platform Design Approach

#### Ordering Information

RF3802 GaAs HBT Pre-Driver Amplifier  
 RF3802PCBA-410 Fully Assembled Evaluation Board - GSM850  
 RF3802PCBA-411 Fully Assembled Evaluation Board - GSM900

RF Micro Devices, Inc.  
 7628 Thorndike Road  
 Greensboro, NC 27409, USA

Tel (336) 664 1233  
 Fax (336) 664 0454  
<http://www.rfmd.com>

# RF3802

## Absolute Maximum Ratings

| Parameter                           | Rating | Unit     |
|-------------------------------------|--------|----------|
| Supply Voltage ( $V_{CC}$ )         | 9      | $V_{PC}$ |
| Power Control Voltage ( $V_{REF}$ ) | 9      | V        |
| DC Supply Current                   | 2000   | mA       |
| Input RF Power                      | 23     | dBm      |
| Output Load VSWR                    | 5:1    |          |
| Operating Ambient Temperature       | +85    | °C       |
| Storage Temperature                 | +125   | °C       |



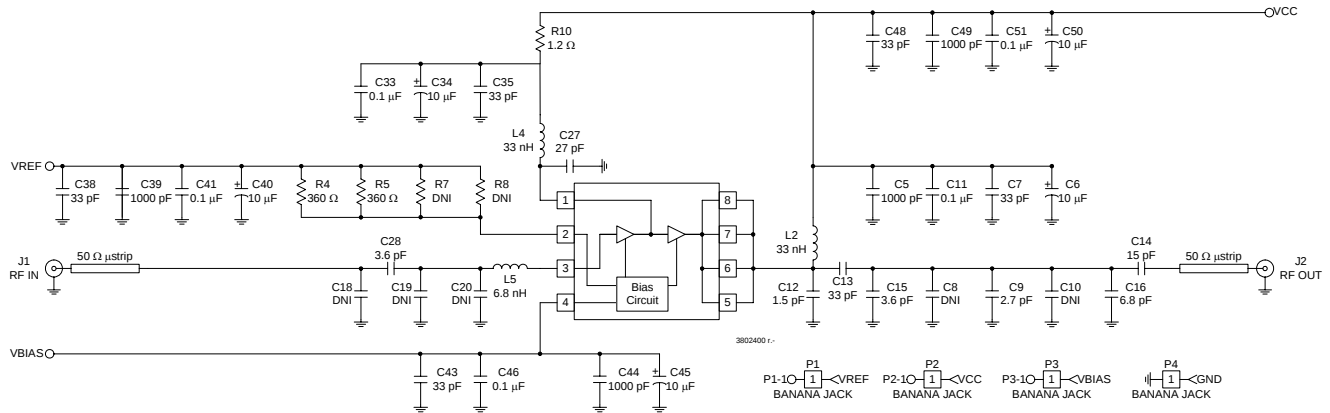
**Caution!** ESD sensitive device.

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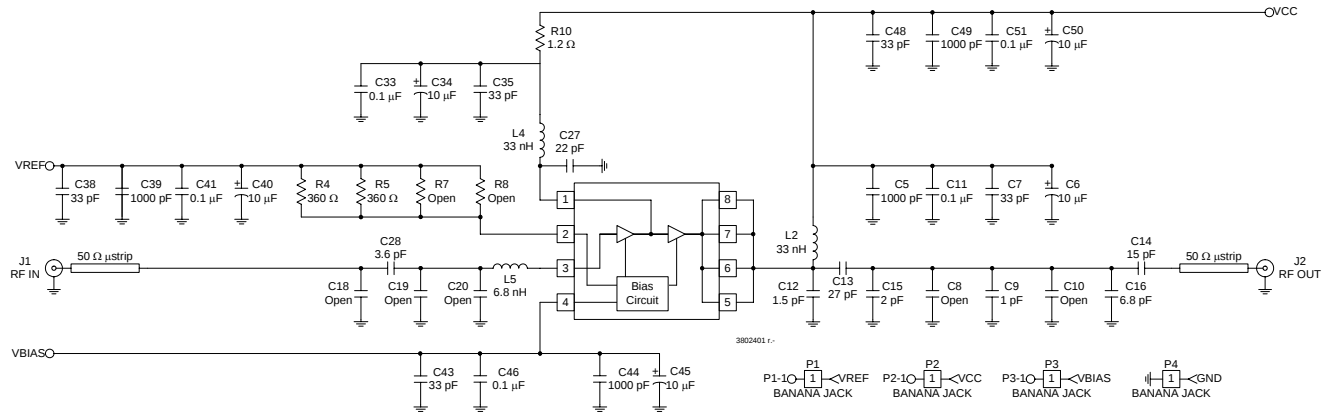
| Parameter                    | Specification |      |      | Unit | Condition                                                                   |
|------------------------------|---------------|------|------|------|-----------------------------------------------------------------------------|
|                              | Min.          | Typ. | Max. |      |                                                                             |
| <b>Overall</b>               |               |      |      |      | $I_{REF}=22\text{mA}$ , $V_{CC}=V_{BIAS}=V_{REF}=8\text{V}$ ,<br>Temp=+25°C |
| <b>850MHz Band</b>           |               |      |      |      |                                                                             |
| Frequency                    | 869           |      | 894  | MHz  |                                                                             |
| P1dB                         | 36.0          | 36.5 | 37.0 | dBm  |                                                                             |
|                              |               |      |      | dBm  |                                                                             |
| Total Efficiency             | 35.5          | 36.5 | 39.0 | %    | @ P1dB                                                                      |
| Total Power Added Efficiency | 34.5          | 35.5 | 38.0 | %    | @ P1dB                                                                      |
| Large Signal Power Gain      | 17.5          | 18.5 | 19.5 | dB   | 20dBm < $P_{OUT}$ < 33dBm                                                   |
| Second Harmonic              |               |      | -40  | dBc  |                                                                             |
| Third Harmonic               |               |      | -40  | dBc  |                                                                             |
| Input Return Loss            | 12            | 15   |      | dB   |                                                                             |
| Output Return Loss           | 12            | 15   |      | dB   |                                                                             |
| OIP3                         |               | 41.0 |      | dBm  | 23dBm/tone                                                                  |
|                              |               | 46.0 |      | dBm  | 26dBm/tone                                                                  |
|                              |               | 48.0 |      | dBm  | 28dBm/tone                                                                  |
|                              |               | 49.0 |      | dBm  | 30dBm/tone                                                                  |
| Noise                        |               | 6.4  |      | dB   | $I_{REF}=22\text{mA}$ , $V_{CC}=V_{BIAS}=V_{REF}=8\text{V}$ ,<br>Temp=+25°C |
| <b>900MHz Band</b>           |               |      |      |      |                                                                             |
| Frequency                    | 920           |      | 960  | MHz  |                                                                             |
| P1dB                         | 35.5          | 36.5 | 37.0 | dBm  |                                                                             |
|                              |               |      |      | dBm  |                                                                             |
| Total Efficiency             | 34.5          | 35.5 | 37.0 | %    | @ P1dB                                                                      |
| Total Power Added Efficiency | 33.5          | 34.5 | 36.5 | %    | @ P1dB                                                                      |
| Large Signal Power Gain      | 17            | 18   | 20   | dB   | 20dBm < $P_{OUT}$ < 33dBm                                                   |
| Second Harmonic              |               |      | -30  | dBc  | @ P1dB                                                                      |
| Third Harmonic               |               |      | -50  | dBc  | @ P1dB                                                                      |
| Input Return Loss            | 12            | 15   |      | dB   |                                                                             |
| Output Return Loss           | 12            | 15   |      | dB   |                                                                             |
| OIP3                         |               | 42.0 |      | dBm  | 23dBm/tone                                                                  |
|                              |               | 46.0 |      | dBm  | 26dBm/tone                                                                  |
|                              |               | 46.0 |      | dBm  | 28dBm/tone                                                                  |
|                              | 45.0          | 46.0 | 54.0 | dBm  | 30dBm/tone                                                                  |
| Noise                        |               | 6.4  |      | dB   | $I_{REF}=22\text{mA}$ , $V_{CC}=V_{BIAS}=V_{REF}=8\text{V}$ ,<br>Temp=+25°C |
| <b>Power Supply</b>          |               |      |      |      |                                                                             |
| Power Supply Voltage         | 7             | 8    | 9    | V    |                                                                             |
| Supply Current               | 200           | 270  | 350  | mA   | $I_{CCQ}$ for $I_{REF}=22\text{mA}$                                         |
| Power Down Current           |               |      | 50   | μA   | $V_{REF}=0\text{V}$ , $V_{CC}=8\text{V}$                                    |

| <b>Pin</b>          | <b>Function</b>    | <b>Description</b>                                                                                                            |
|---------------------|--------------------|-------------------------------------------------------------------------------------------------------------------------------|
| <b>1</b>            | <b>VCC1</b>        | For input stage.                                                                                                              |
| <b>2</b>            | <b>VREF</b>        | Control for active bias.                                                                                                      |
| <b>3</b>            | <b>RF IN</b>       | For input stage. Requires RF match and DC block.                                                                              |
| <b>4</b>            | <b>VBIAS</b>       | Supply for active bias.                                                                                                       |
| <b>5</b>            | <b>RF OUT/VCC2</b> | For output stage. Requires RF match, bias feed and DC block.                                                                  |
| <b>6</b>            | <b>RF OUT/VCC2</b> | See pin 5.                                                                                                                    |
| <b>7</b>            | <b>RF OUT/VCC2</b> | See pin 5.                                                                                                                    |
| <b>8</b>            | <b>RF OUT/VCC2</b> | See pin 5.                                                                                                                    |
| <b>Pkg<br/>Base</b> | <b>GND</b>         | Must be soldered to ground pad through as short a path as possible. This path also forms the thermal path for minimum $T_J$ . |

## Evaluation Board Schematic GSM850 (869MHz to 894MHz)



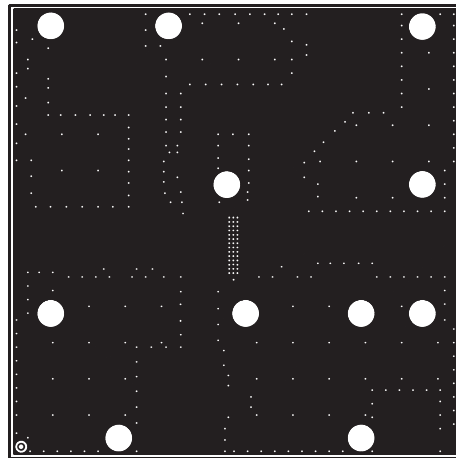
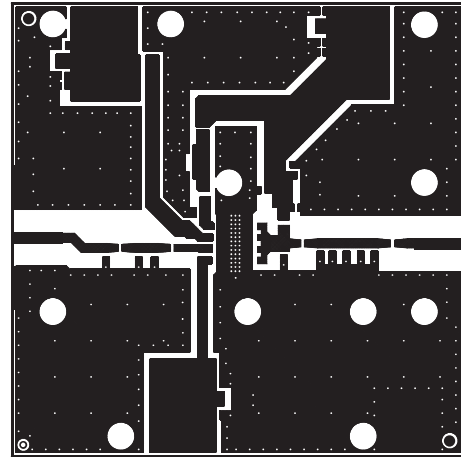
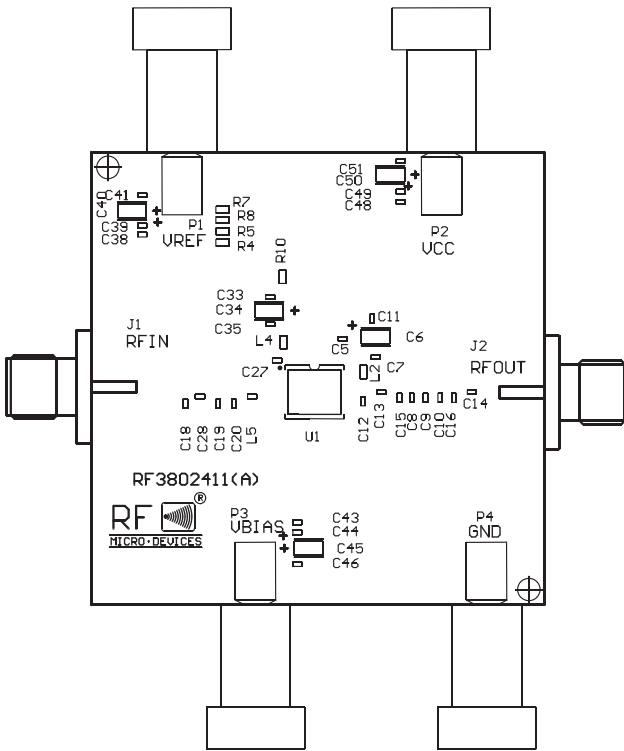
## Evaluation Board Schematic GSM900 (920MHz to 960MHz)



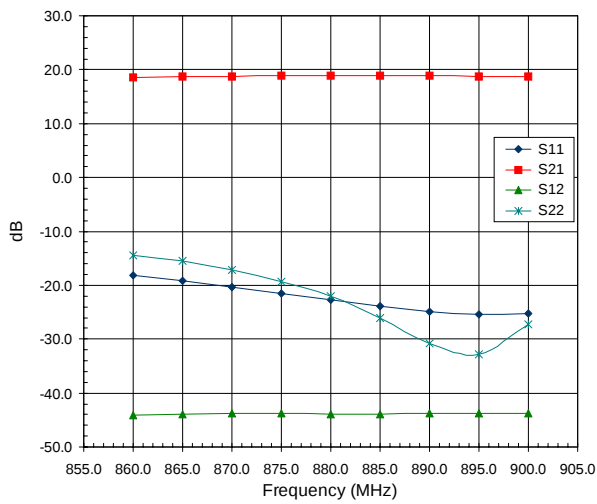
## Evaluation Board Layout

Board Size 2.0" x 2.0"

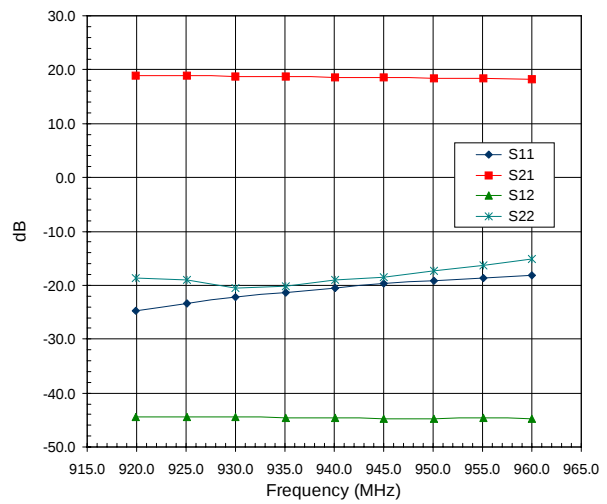
Board Thickness 0.020", Board Material Rogers 4350



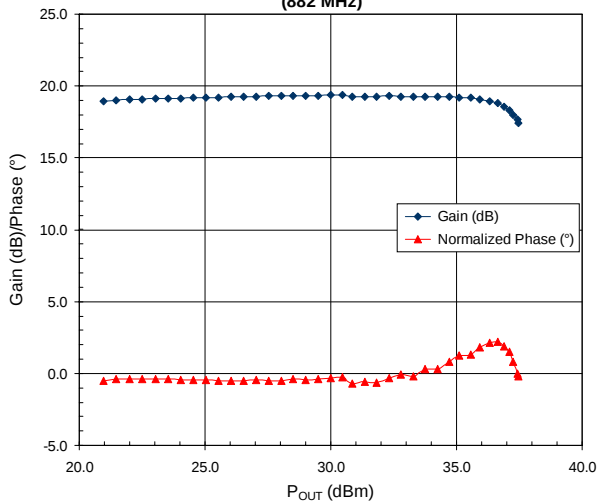
GSM850 Evaluation Board S-Parameters



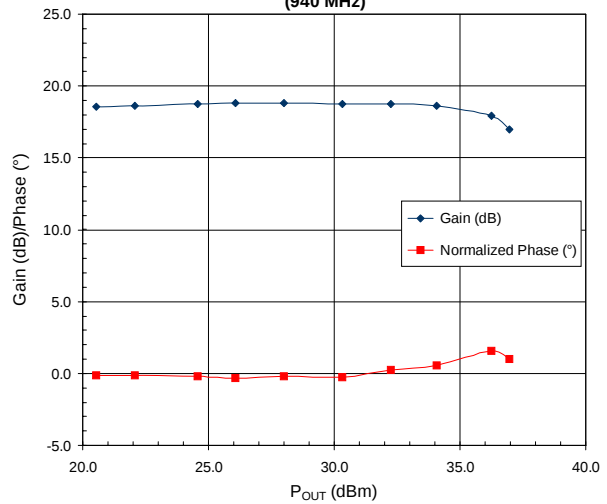
GSM900 Evaluation Board S-Parameters



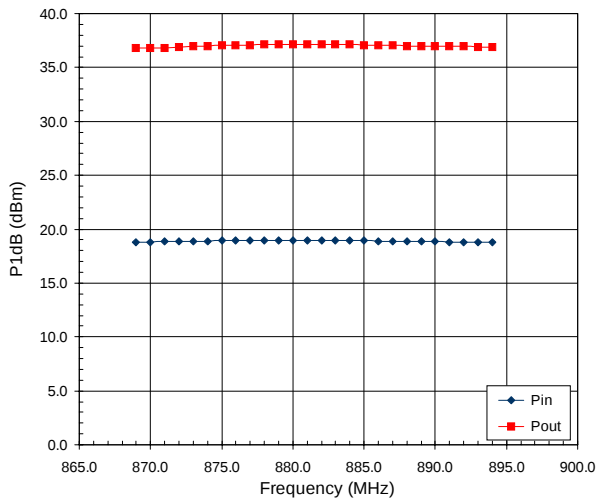
GSM850 Gain Phase versus  $P_{OUT}$   
(882 MHz)



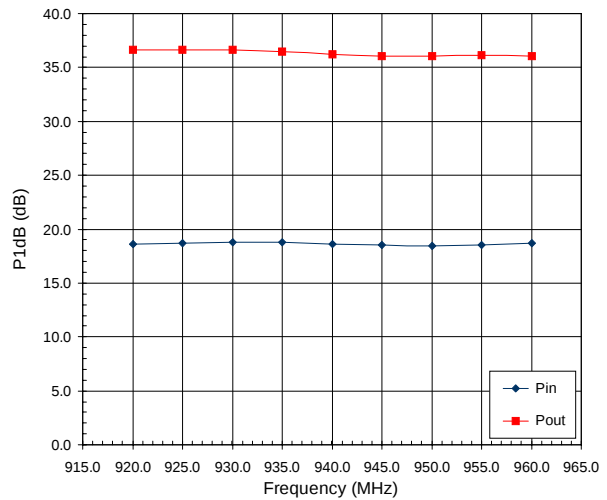
GSM900 Gain Phase versus  $P_{OUT}$   
(940 MHz)

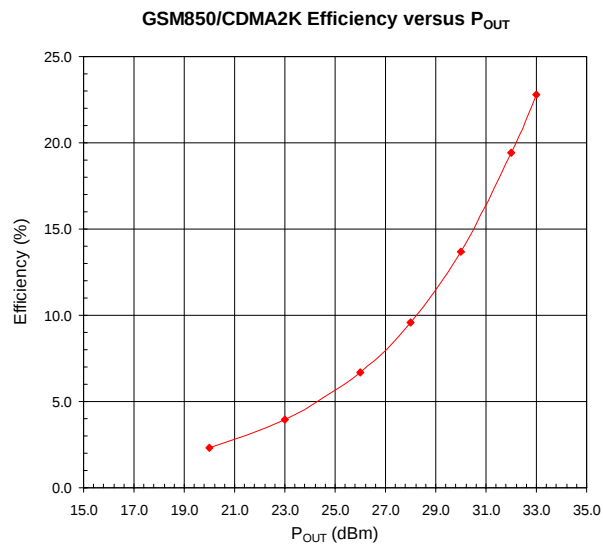
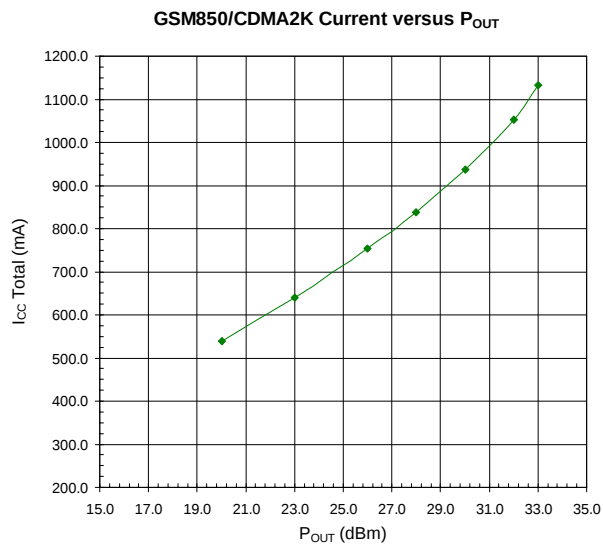
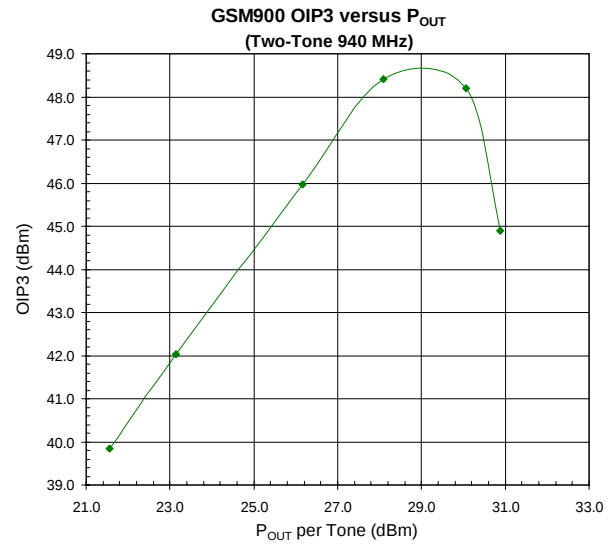
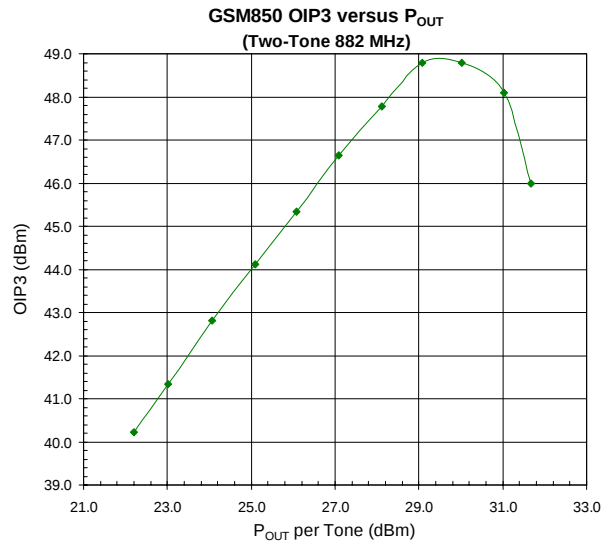


GSM850 P1dB versus Frequency



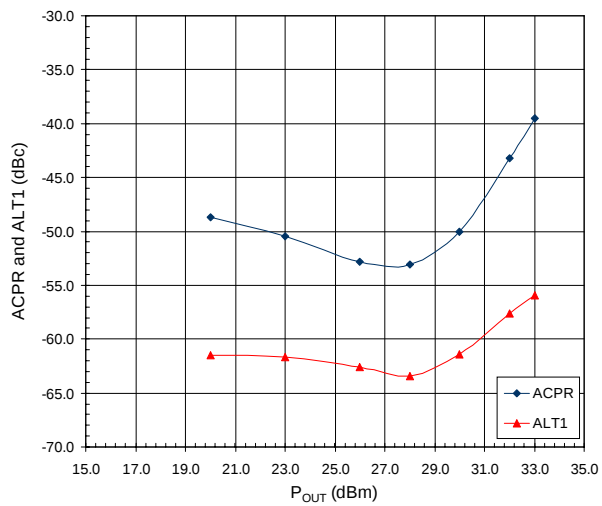
GSM900 P1dB versus Frequency



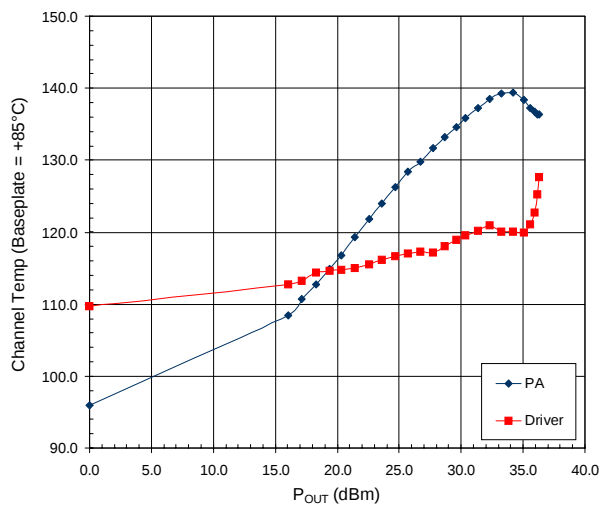


# RF3802

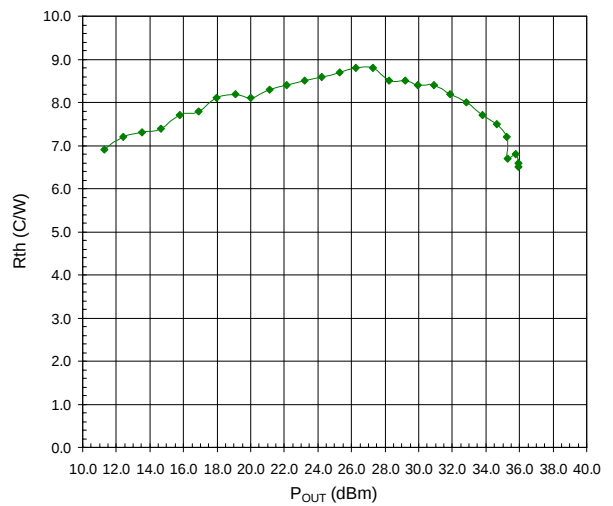
882 MHz CDMA2K 9-Channel SR1 ACPL and ALT1



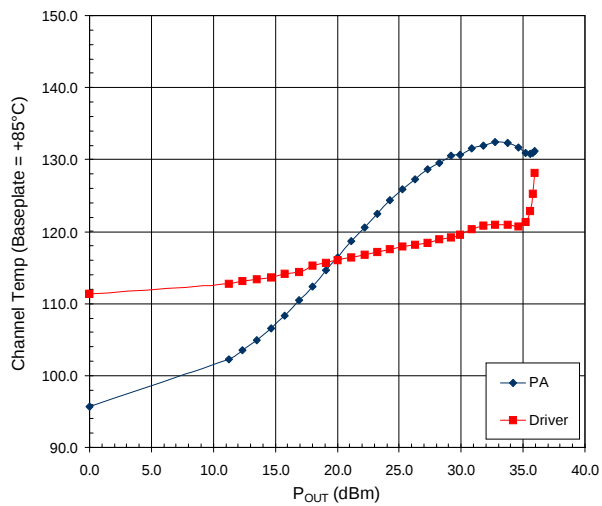
GSM850 Thermal Data



Thermal Resistance at 940 MHz



GSM900 Thermal Data



## PCB Design Requirements

### PCB Surface Finish

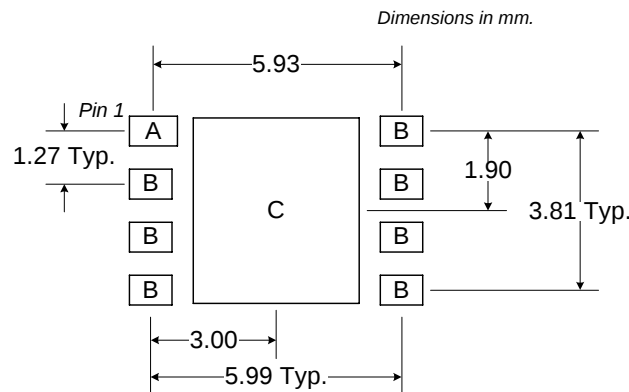
The PCB surface finish used for RFMD's qualification process is electroless nickel, immersion gold. Typical thickness is 3μinch to 8μinch gold over 180μinch nickel.

### PCB Land Pattern Recommendation

PCB land patterns for PFMD components are based on IPC-7351 standards and RFMD empirical data. The pad pattern shown has been developed and tested for optimized assembly at RFMD. The PCB land pattern has been developed to accommodate lead and package tolerances. Since surface mount processes vary from company to company, careful process development is recommended.

### PCB Metal Land Pattern

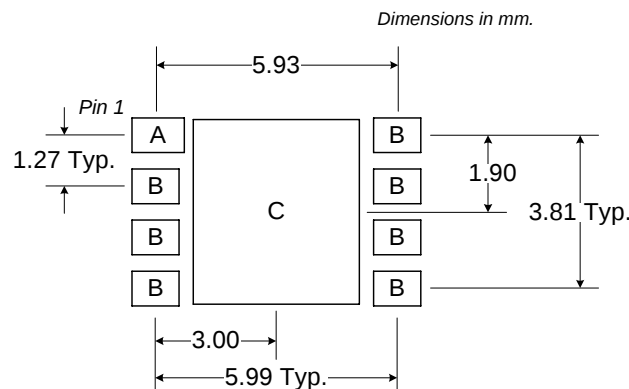
$$\begin{aligned} A &= 1.14 \times 0.71 \\ B &= 1.02 \times 0.71 \text{ Typ.} \\ C &= 3.96 \times 4.44 \end{aligned}$$



### PCB Solder Mask Pattern

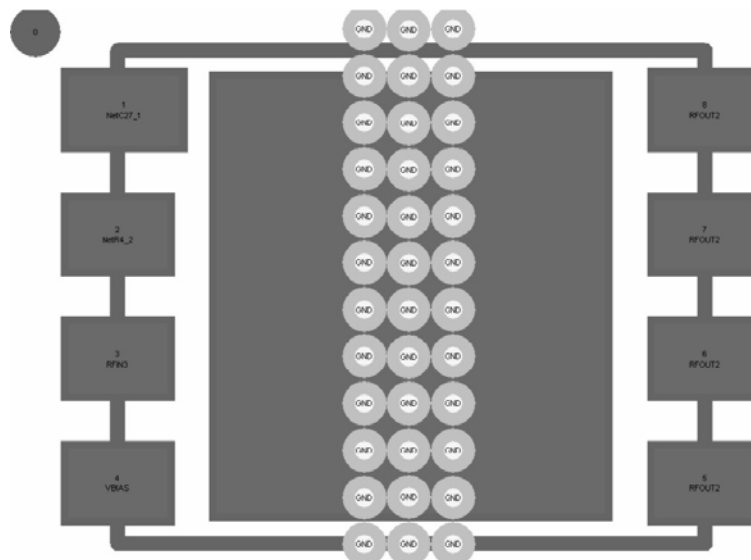
Liquid Photo-Imageable (LPI) solder mask is recommended. The solder mask footprint will match what is shown for the PCB metal land pattern with a 2mil to 3mil expansion to accommodate solder mask registration clearance around all pads. The center-grounding pad shall also have a solder mask clearance. Expansion of the pads to create solder mask clearance can be provided in the master data or requested from the PCB fabrication supplier.

$$\begin{aligned} A &= 1.30 \times 0.86 \\ B &= 1.17 \times 0.86 \text{ Typ.} \\ C &= 4.11 \times 4.60 \end{aligned}$$



## Thermal Pad and Via Design

The DUT must be connected to the PCB backside ground through a low inductance, low thermal resistance path. The required interface is achieved with the via pattern shown below for both low inductance as well as low thermal resistance. The footprint provided below worked well on the RFMD 20mil thick Rogers 4350 PCB and also standard FR4. The vias are 8mil vias that are partially plated through and are finished to  $8\text{mils} \pm 2\text{mils}$  with a minimum plating of 1.5mil. Failure to place these vias within the DUT mounting area on the PCB in this prescribed manner may result in electrical performance and/or reliability degradation.



## Tape and Reel Information

Carrier tape basic dimensions are based on EIA481. The pocket is designed to hold the part for shipping and loading onto SMT manufacturing equipment, while protecting the body and the solder terminals from damaging stresses. The individual pocket design can vary from vendor to vendor, but width and pitch will be consistent.

Carrier tape is wound or placed on a shipping reel with a diameter of either 330mm (13 inches) or 178mm (7 inches). The center hub design is large enough to ensure the radius formed by the carrier tape around it does not put unnecessary stress on the parts.

Prior to shipping, moisture sensitive parts (MSL level 2a to 5a) are baked and placed into the pockets of the carrier tape. A cover tape is sealed over the top of the entire length of the carrier tape. The reel is sealed in a moisture barrier, ESD bag, which is placed in a cardboard shipping box. It is important to note that unused moisture sensitive parts need to be resealed in the moisture barrier bag. If the reels exceed the exposure limit and need to be rebaked, most carrier tape and shipping reels are not rated as bakeable at 125°C. If baking is required, devices may be baked according to section 4, table 4-1, column 8 of Joint Industry Standard IPC/JEDECJ-STD-033A.

The following table provides useful information for carrier tape and reels used for shipping the devices described in this document.

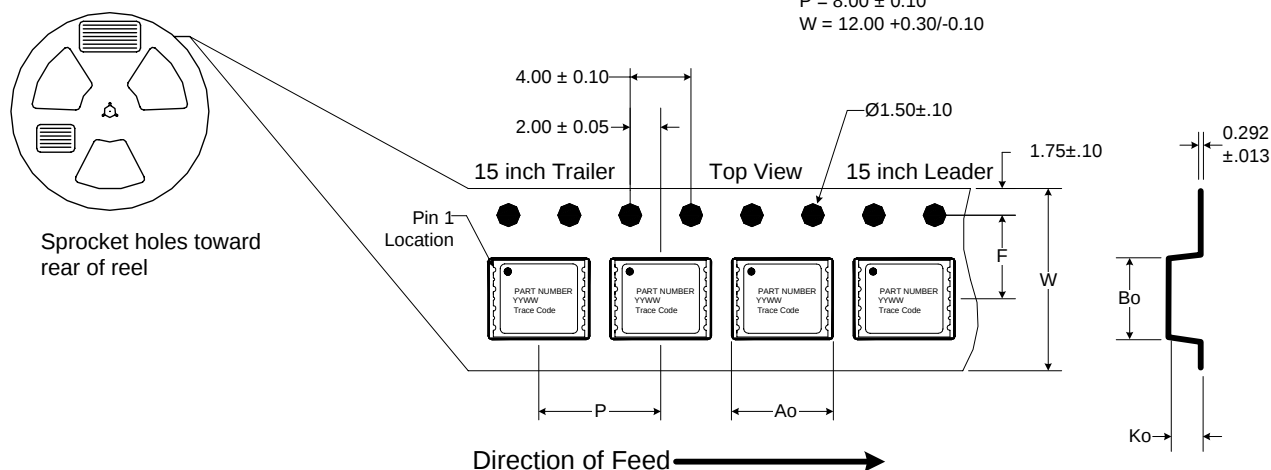
| RFMD Part Number | Reel Diameter<br>Inch (mm) | Hub Diameter<br>Inch (mm) | Width<br>(mm) | Pocket Pitch<br>(mm) | Feed   | Units per Reel |
|------------------|----------------------------|---------------------------|---------------|----------------------|--------|----------------|
| RF3802TR13       | 13 (330)                   | 4 (102)                   | 12            | 8                    | Single | 2500           |
| RF3802TR7        | 7 (178)                    | 2.4 (61)                  | 12            | 8                    | Single | 750            |

### Carrier Tape Drawing with Part Orientation

Notes:

1. All dimensions are in millimeters (mm).
2. Unless otherwise specified, all dimension tolerances per EIA-481.

$$\begin{aligned} A_o &= 6.70 \pm 0.10 \\ B_o &= 5.40 \pm 0.10 \\ F &= 5.50 \pm 0.05 \\ K_o &= 2.10 \pm 0.10 \\ P &= 8.00 \pm 0.10 \\ W &= 12.00 +0.30/-0.10 \end{aligned}$$



**RF3802**