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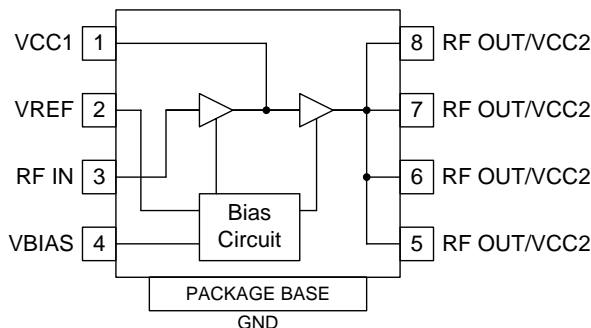


**Features**

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

**Applications**

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



Functional Block Diagram

**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 50Ω 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

**Ordering Information**

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

**Optimum Technology Matching® Applied**

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

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## 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.

Exceeding any one or a combination of the Absolute Maximum Rating conditions may cause permanent damage to the device. Extended application of Absolute Maximum Rating conditions to the device may reduce device reliability. Specified typical performance or functional operation of the device under Absolute Maximum Rating conditions is not implied.

RoHS status based on EU Directive 2002/95/EC (at time of this document revision).

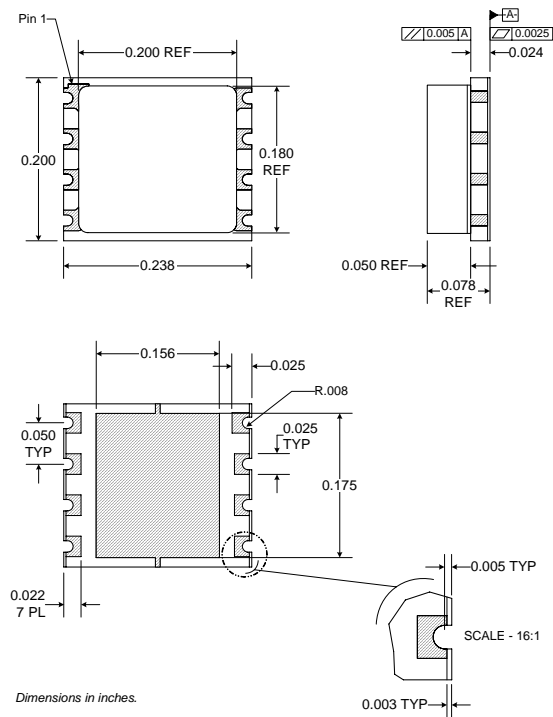
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Parameter	Specification			Unit	Condition
	Min.	Typ.	Max.		
<b>Overall</b>					$I_{REF} = 22 \text{ mA}$ , $V_{CC} = V_{BIAS} = V_{REF} = 8 \text{ V}$ , Temp = +25 °C
<b>850MHz Band</b>					
Frequency	869		894	MHz	
P1dB	36.0	36.5	37.0	dBm	
				dBm	
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	20 dBm < $P_{OUT}$ < 33 dBm
Second Harmonic			-40	dBc	
Third Harmonic			-40	dBc	
Input Return Loss	12	15		dB	
Output Return Loss	12	15		dB	
OIP3		41.0		dBm	23 dBm/tone
		46.0		dBm	26 dBm/tone
		48.0		dBm	28 dBm/tone
		49.0		dBm	30 dBm/tone
Noise		6.4		dB	$I_{REF} = 22 \text{ mA}$ , $V_{CC} = V_{BIAS} = V_{REF} = 8 \text{ V}$ , Temp = +25 °C

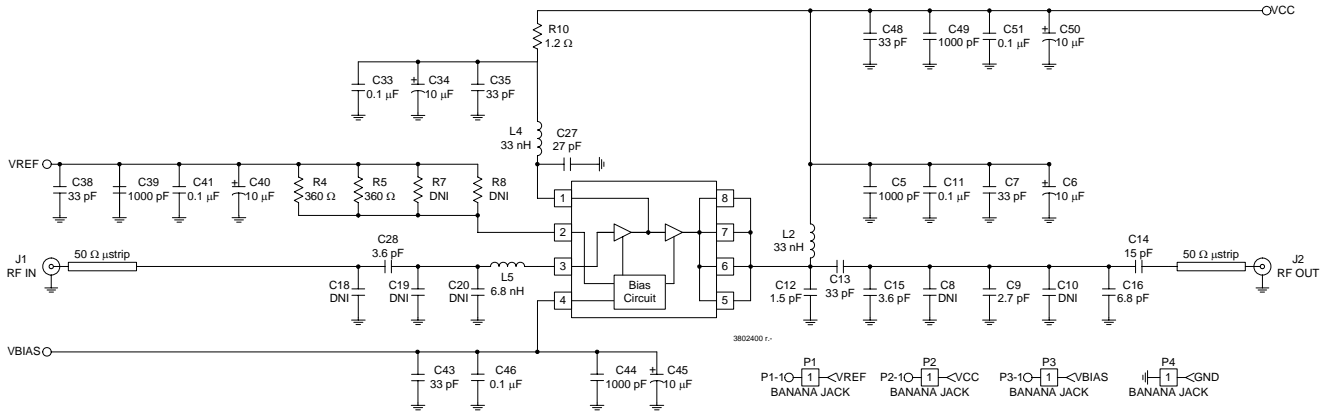
Parameter	Specification			Unit	Condition
	Min.	Typ.	Max.		
<b>900MHz Band</b>					
Frequency	920		960	MHz	
P1dB	35.5	36.5	37.0	dBm	
				dBm	
Total Efficiency	34.5	35.5	37.0	%	@ P1dB
Total Power Added Efficiency	33.5	34.5	36.5	%	@ P1dB
Large Signal Power Gain	17	18	20	dB	20 dBm < P <sub>OUT</sub> < 33 dBm
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	23 dBm/tone
		46.0		dBm	26 dBm/tone
		46.0		dBm	28 dBm/tone
	45.0	46.0	54.0	dBm	30 dBm/tone
Noise		6.4		dB	I <sub>REF</sub> =22 mA, V <sub>CC</sub> =V <sub>BIAS</sub> =V <sub>REF</sub> =8 V, Temp=+25 °C
<b>Power Supply</b>					
Power Supply Voltage	7	8	9	V	
Supply Current	200	270	350	mA	I <sub>CCQ</sub> for I <sub>REF</sub> =22 mA
Power Down Current			50	μA	V <sub>REF</sub> =0V, V <sub>CC</sub> =8V

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

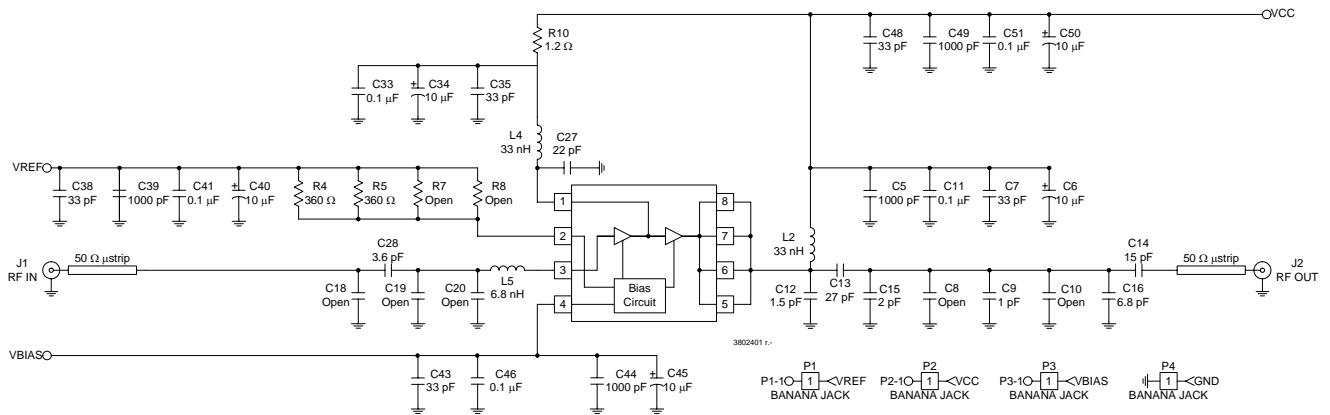
## Package Drawing



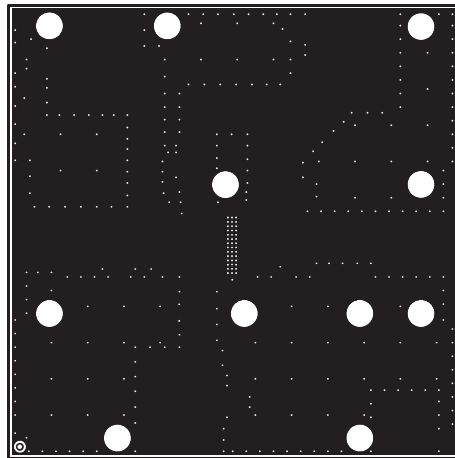
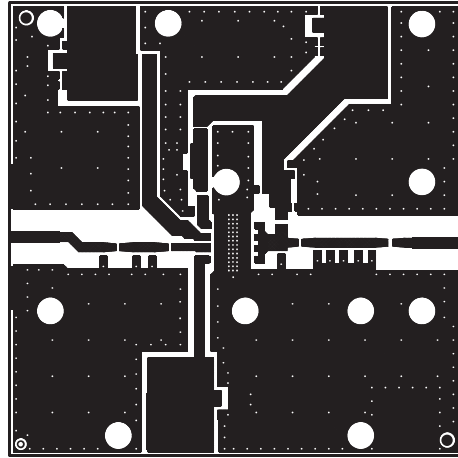
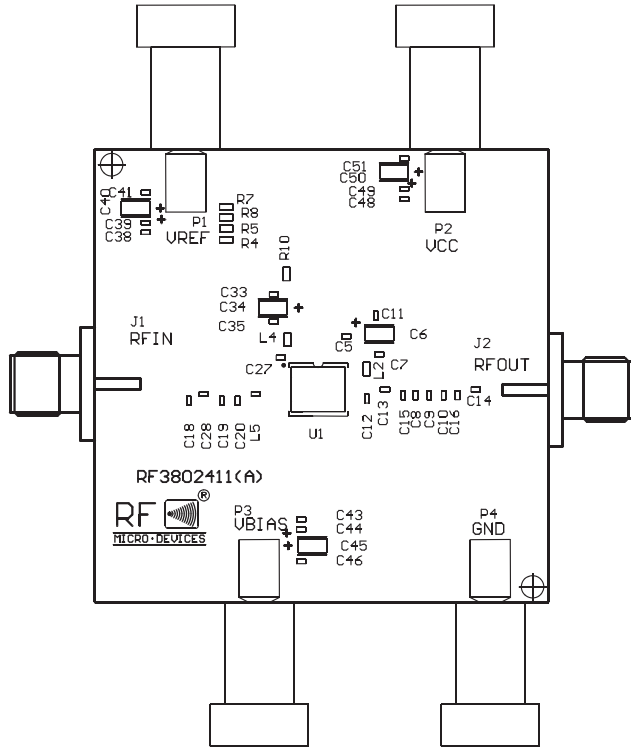
**Evaluation Board Schematic  
GSM850 (869 MHz to 894 MHz)**



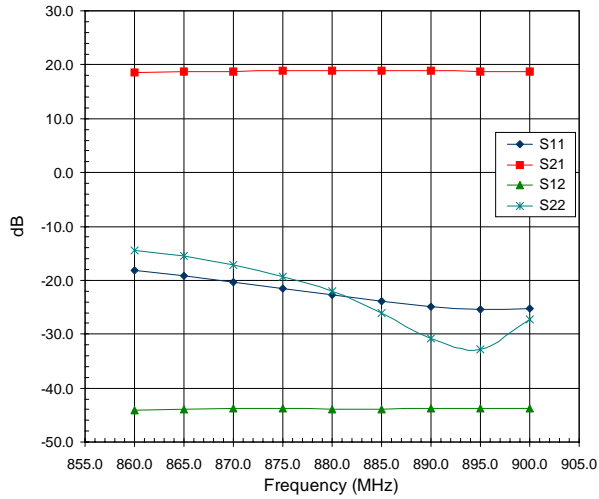
**Evaluation Board Schematic  
GSM900 (920 MHz to 960 MHz)**



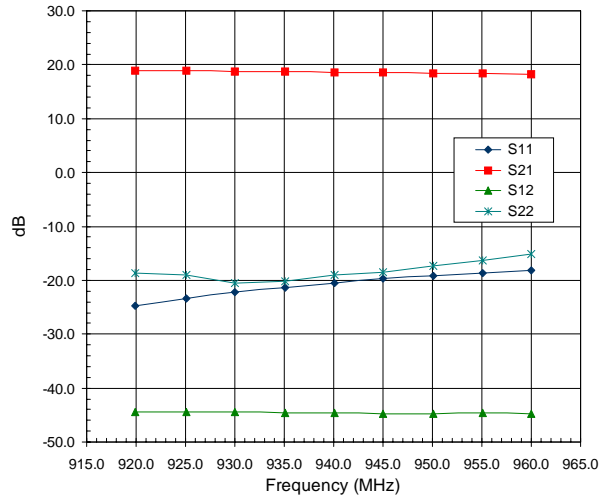
**Evaluation Board Layout**  
**Board Size 2.0" x 2.0"**  
**Board Thickness 0.020", Board Material Rogers 4350**



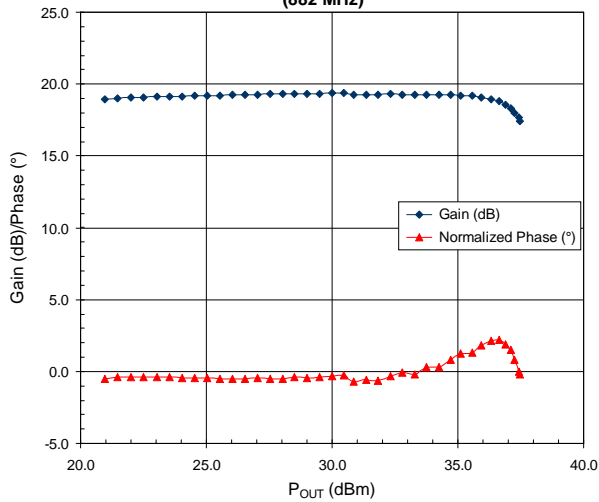
**GSM850 Evaluation Board S-Parameters**



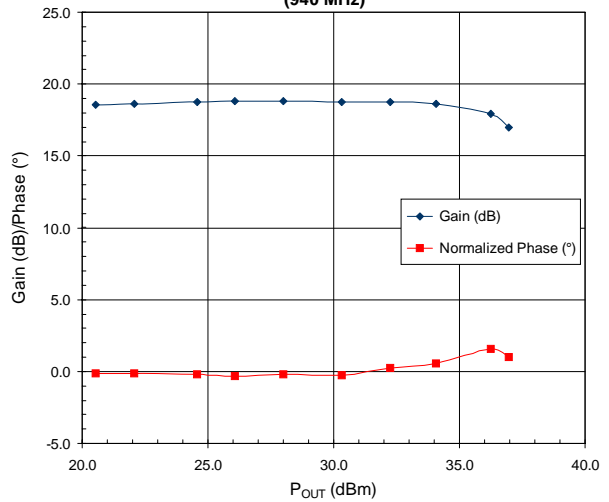
**GSM900 Evaluation Board S-Parameters**



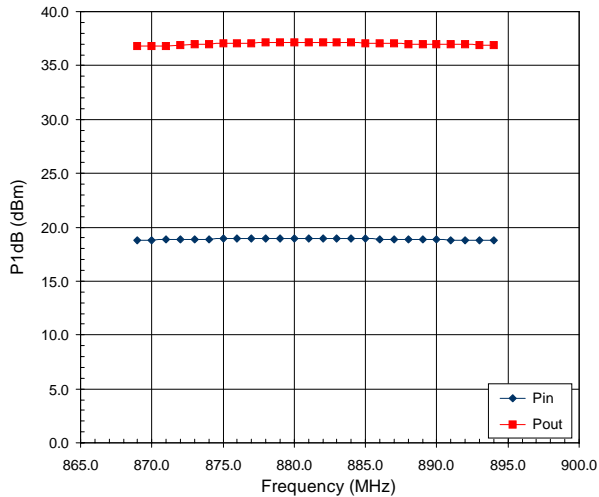
**GSM850 Gain Phase versus P<sub>OUT</sub> (882 MHz)**



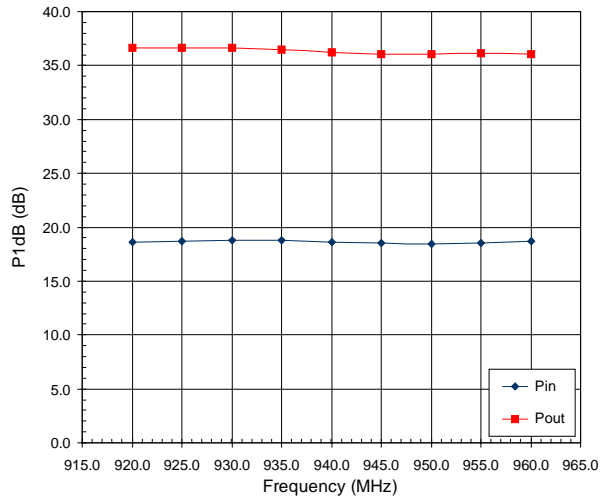
**GSM900 Gain Phase versus P<sub>OUT</sub> (940 MHz)**



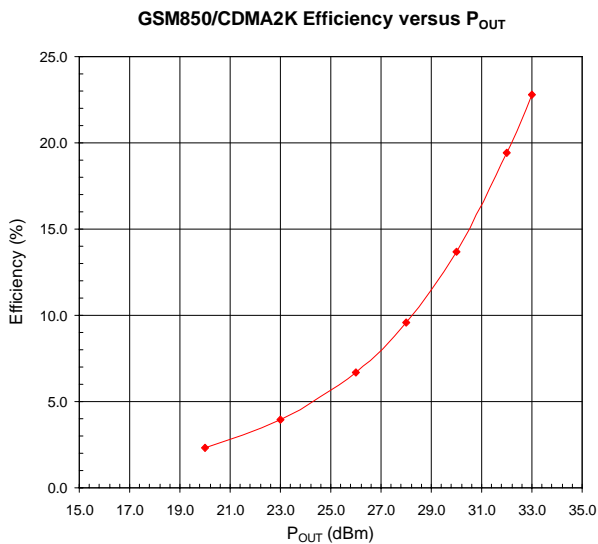
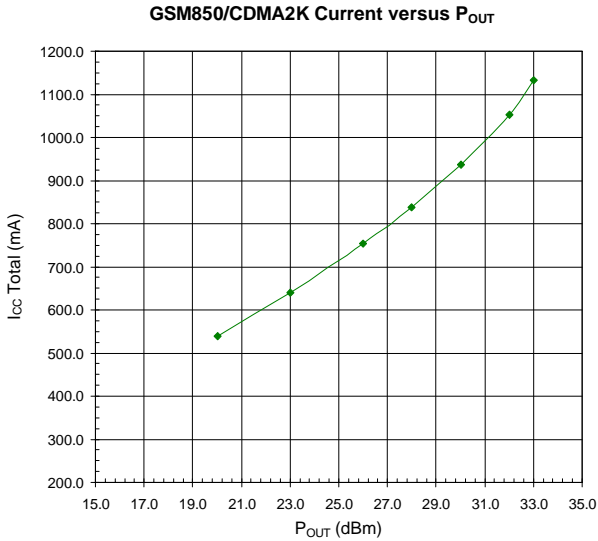
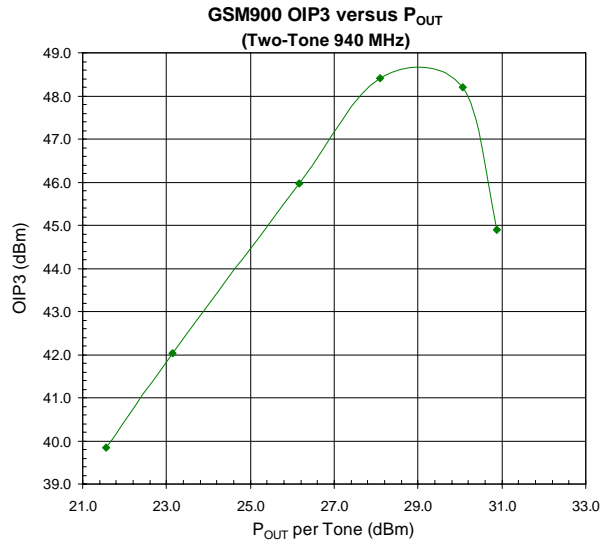
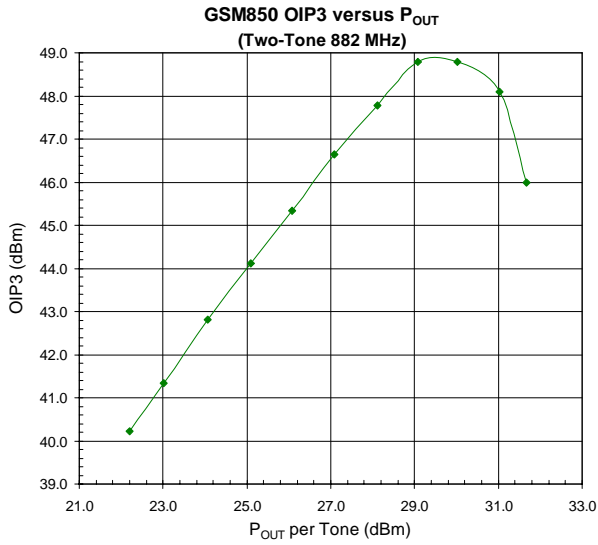
**GSM850 P1dB versus Frequency**



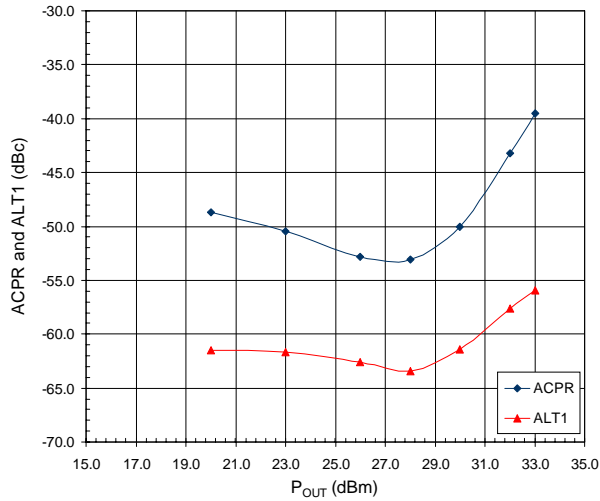
**GSM900 P1dB versus Frequency**



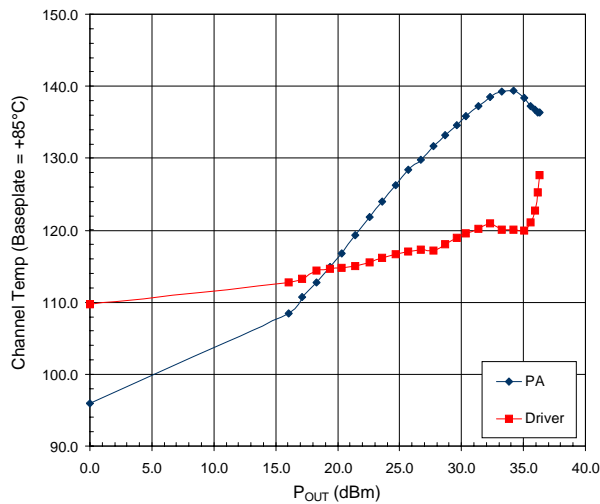




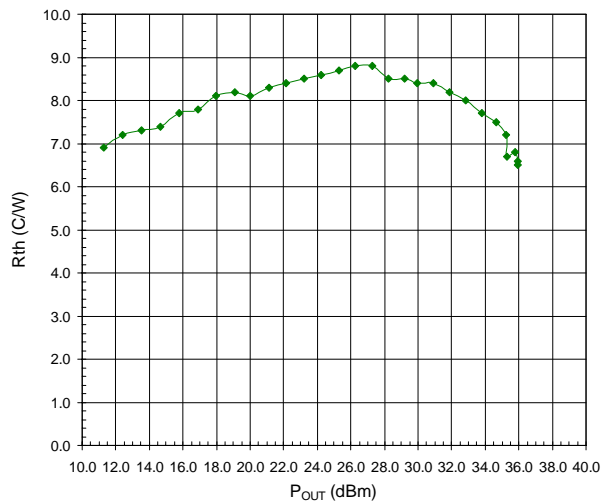
**882 MHz CDMA2K 9-Channel SR1 ACPL and ALT1**



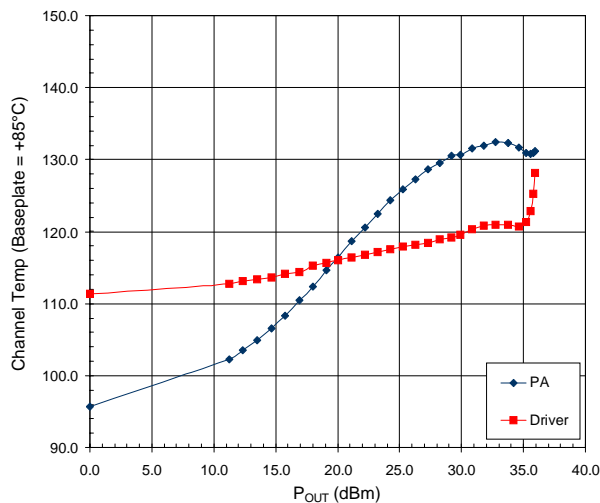
**GSM850 Thermal Data**



**Thermal Resistance at 940 MHz**



**GSM900 Thermal Data**



## PCB Design Requirements

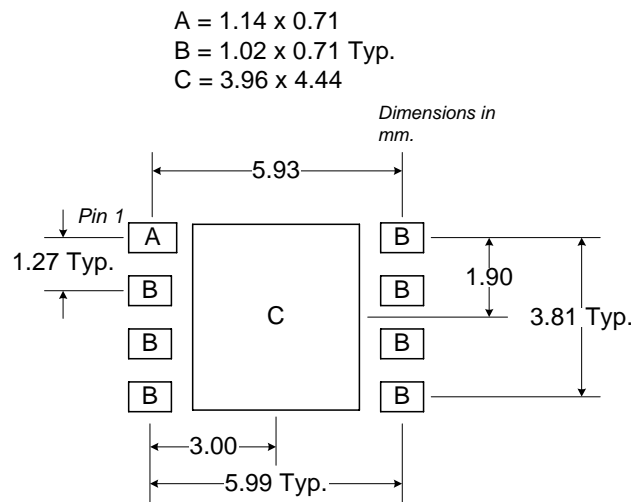
### PCB Surface Finish

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

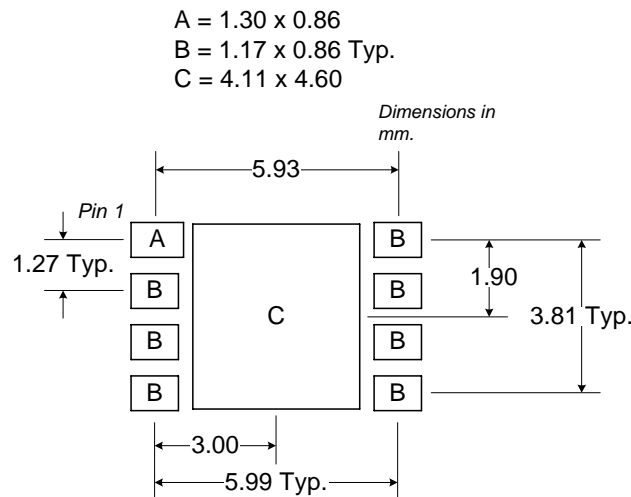
PCB land patterns for PFMD components are based on IPC-7351 standards and RFMD empirical data. The pad pattern shown has been developed and tested for optimized assembly at RFMD. The PCB land pattern has been developed to accommodate lead and package tolerances. Since surface mount processes vary from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

### PCB Metal Land Pattern



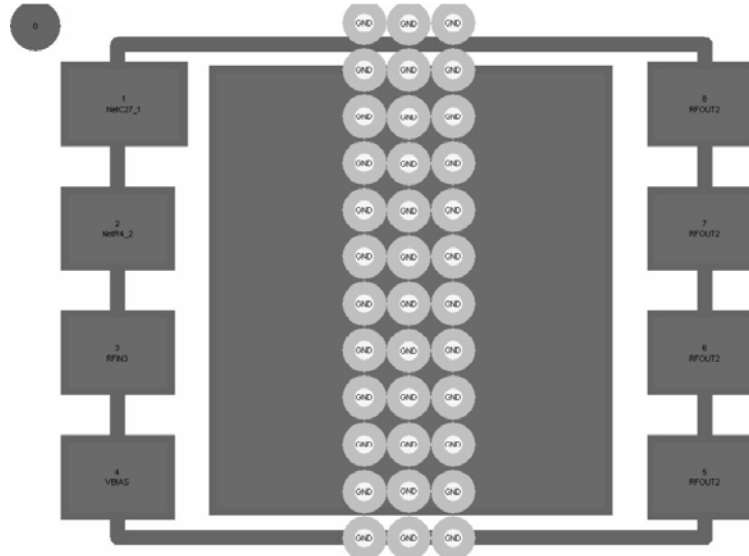
### PCB Solder Mask Pattern

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.



**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 8mils±2mils 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 board and the solder terminals from damaging stresses. The individual pocket design can vary from vendor to vendor, but wide 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.

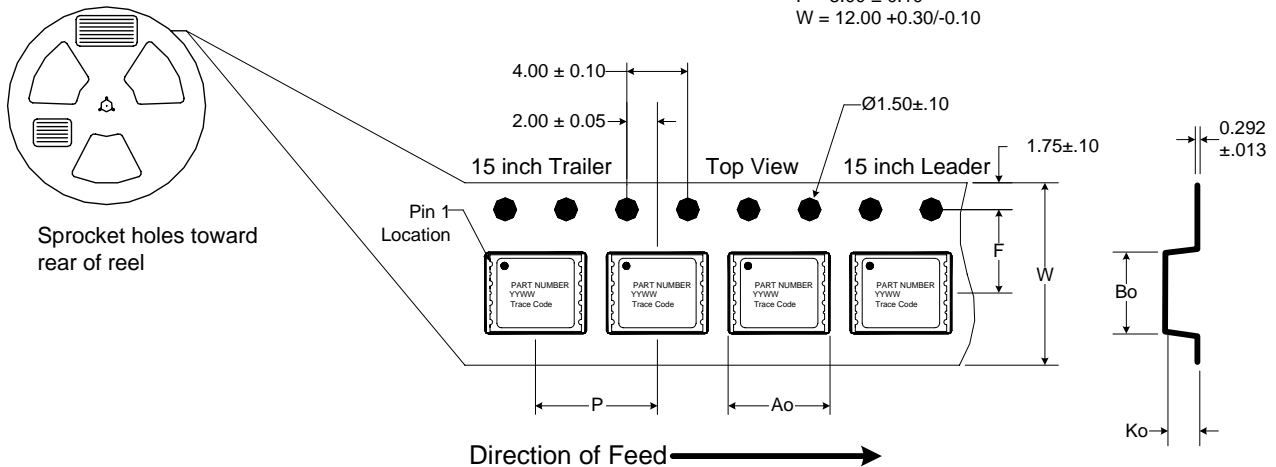
RFMD Part Number	Reel Diameter Inch (mm)	Hub Diameter Inch (mm)	Width (mm)	Pocket Pitch (mm)	Feed	Units per Reel
RF3802TR13	13 (330)	4 (102)	12	8	Single	2500
RF3802TR7	7 (178)	2.4 (61)	12	8	Single	750

### Carrier Tape Drawing with Part Orientation

Notes:

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

$A_o = 6.70 \pm 0.10$   
 $B_o = 5.40 \pm 0.10$   
 $F = 5.50 \pm 0.05$   
 $K_o = 2.10 \pm 0.10$   
 $P = 8.00 \pm 0.10$   
 $W = 12.00 +0.30/-0.10$



**RoHS\* Banned Material Content**

RoHS Compliant: yes  
 Package total weight in grams (g): 0.139  
 Compliance Date Code: N/A  
 Bill of Materials Revision: Rev B  
 Pb Free Category: e4

Bill of Materials	Parts Per Million (PPM)					
	Pb	Cd	Hg	Cr VI	PBB	PBDE
Die	0	0	0	0	0	0
Molding Compound	0	0	0	0	0	0
Lead Frame	0	0	0	0	0	0
Die Attach Epoxy	0	0	0	0	0	0
Wire	0	0	0	0	0	0
Solder Plating	0	0	0	0	0	0

This RoHS banned material content declaration was prepared solely on information, including analytical data, provided to RFMD by its suppliers, and applies to the Bill of Materials (BOM) revision noted above.

\* DIRECTIVE 2002/95/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 27 January 2003 on the restriction of the use of certain hazardous substances in electrical and electronic equipment

