RF3802

GaAs HBT PRE-DRIVER AMPLIFIER

RoHS Compliant & Pb-Free Product

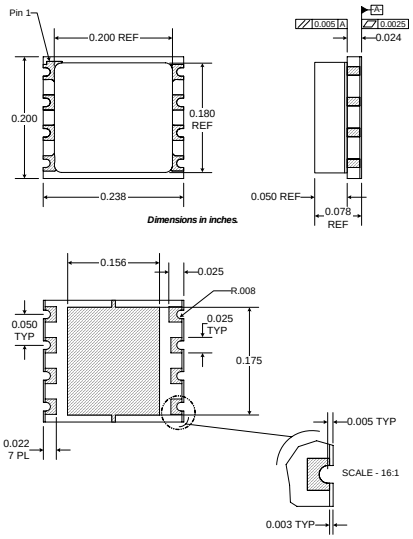
Typical Applications

- 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 AlN 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



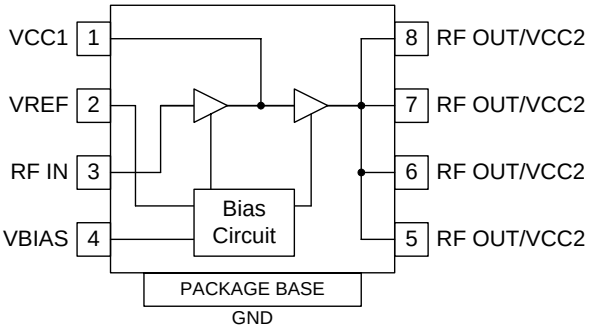
Package Style: AlN

Optimum Technology Matching® Applied

- ☐ Si BJT
- ☑ GaAs HBT
- ☐ GaAs MESFET
- ☐ Si Bi-CMOS
- ☐ SiGe HBT
- ☐ Si CMOS
- ☐ InGaP/HBT
- ☐ GaN HEMT
- ☐ SiGe Bi-CMOS

Features

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



Functional Block Diagram

Ordering Information

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

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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.

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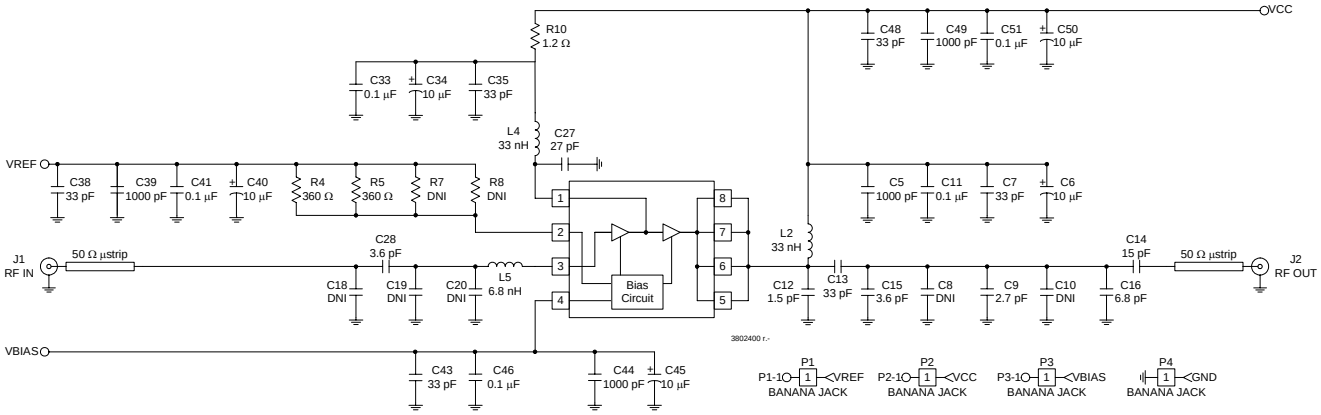
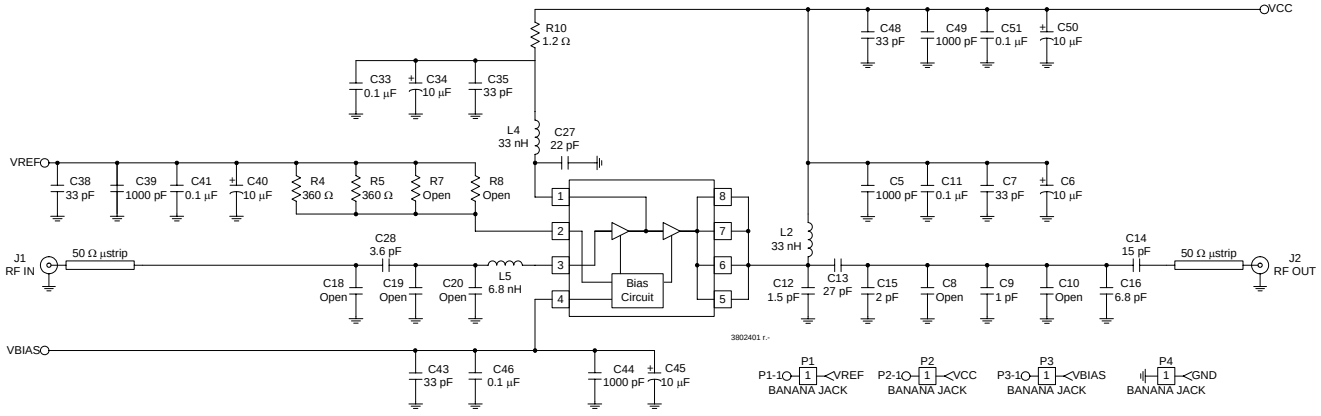
Parameter	Specification			Unit	Condition
	Min.	Typ.	Max.		
Overall					I_{REF}=22mA, V_{CC}=V_{BIAS}=V_{REF}=8V, Temp=+25°C
850MHz Band					
Frequency	869		894	MHz	
P1dB	36.0	36.5	37.0	dBm	
				dBm	
Total Efficiency	35.5	36.5	39.0	%	@ P1dB
Total Power Added Efficiency	34.5	35.5	38.0	%	@ P1dB
Large Signal 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}=22mA, V_{CC}=V_{BIAS}=V_{REF}=8V, Temp=+25°C
900MHz Band					
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}=22mA, V_{CC}=V_{BIAS}=V_{REF}=8V, Temp=+25°C
Power Supply					
Power Supply Voltage	7	8	9	V	
Supply Current	200	270	350	mA	I_{CCQ} for I_{REF}=22mA
Power Down Current			50	μA	V_{REF}=0V, V_{CC}=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_J.

Evaluation Board Schematic
GSM850 (869MHz to 894MHz)

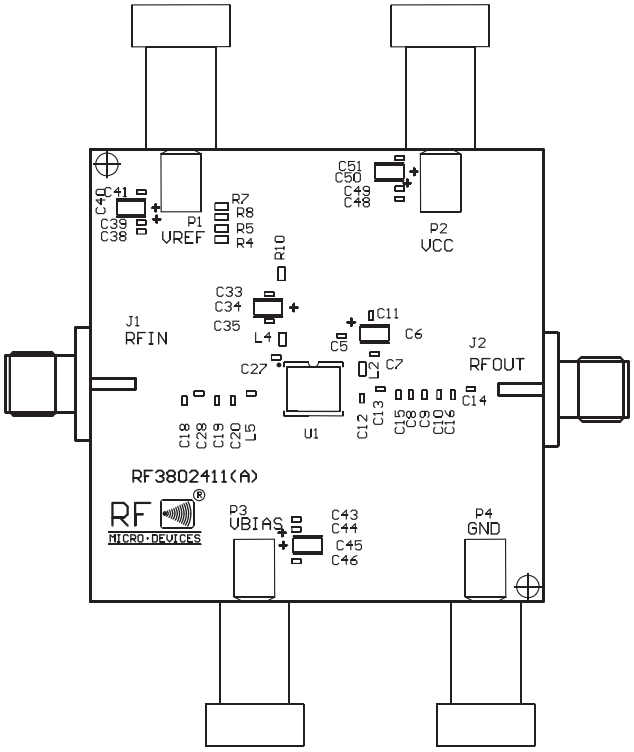


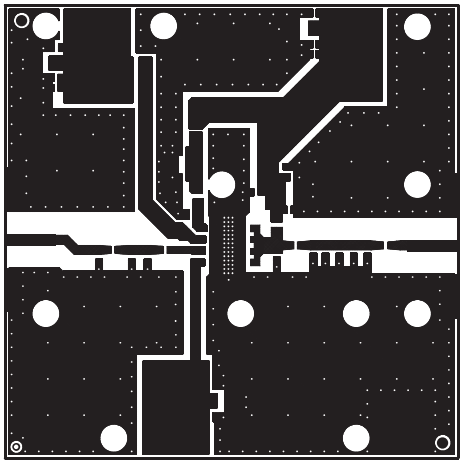
Evaluation Board Schematic
GSM900 (920MHz to 960MHz)

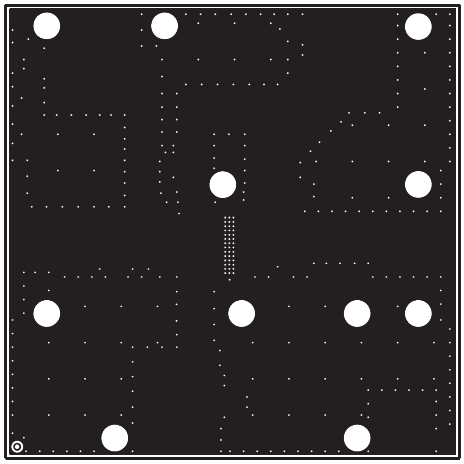


Evaluation Board Layout
Board Size 2.0” x 2.0”

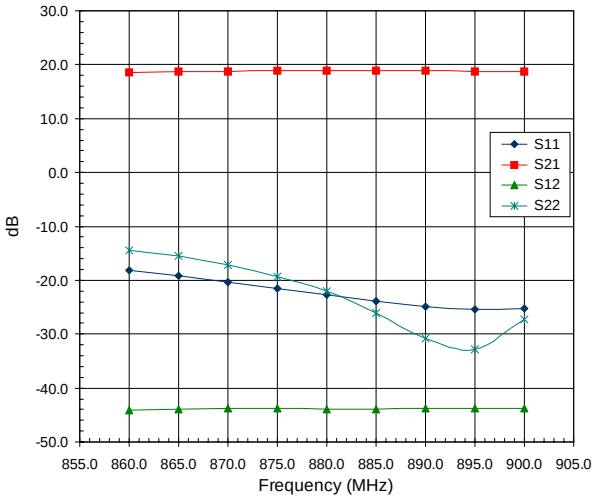
Board Thickness 0.020”, Board Material Rogers 4350



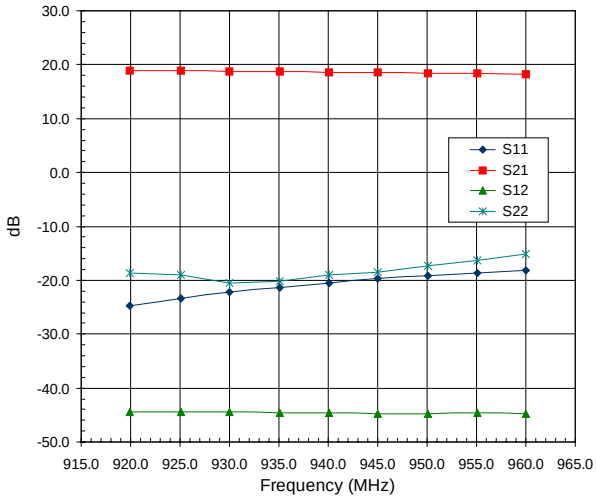




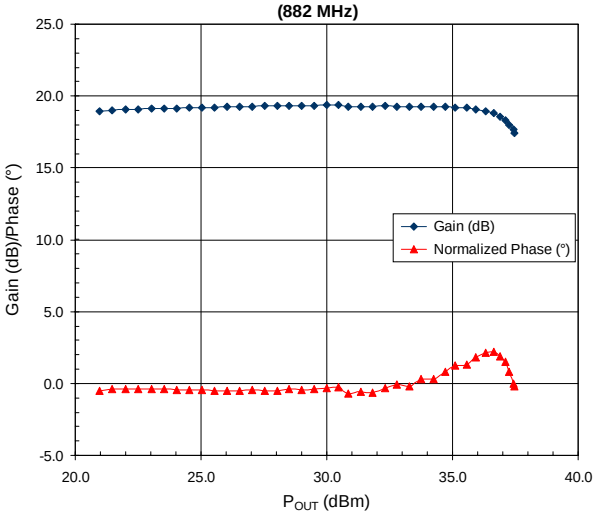
GSM850 Evaluation Board S-Parameters



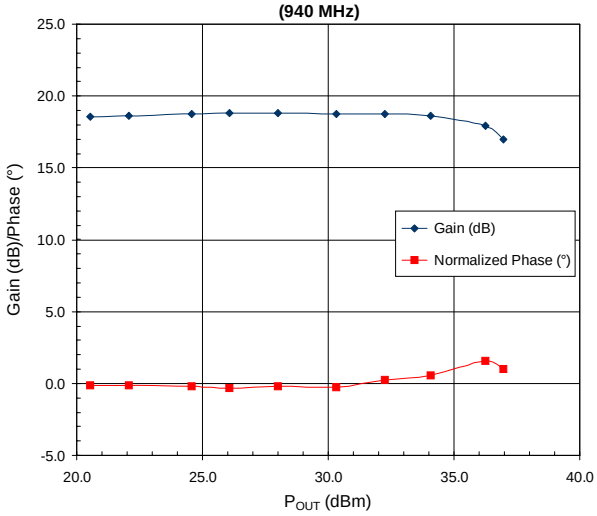
GSM900 Evaluation Board S-Parameters



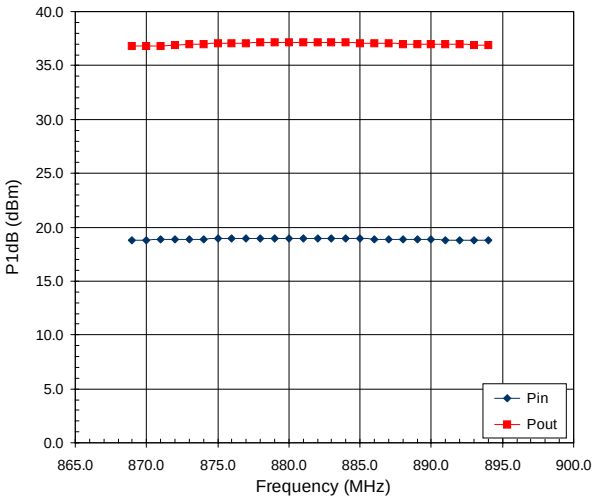
GSM850 Gain Phase versus P_{OUT} (882 MHz)



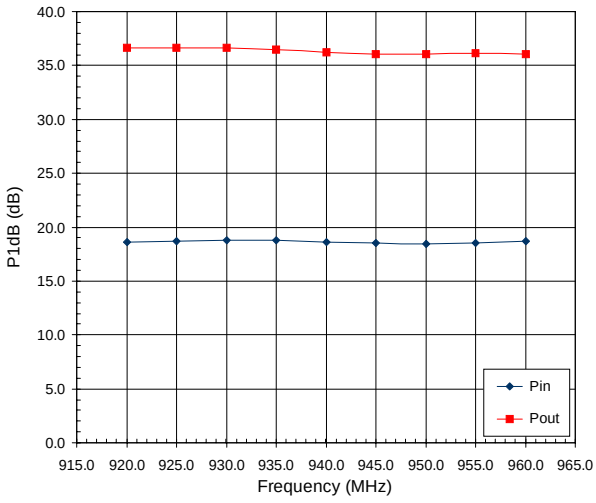
GSM900 Gain Phase versus P_{OUT} (940 MHz)



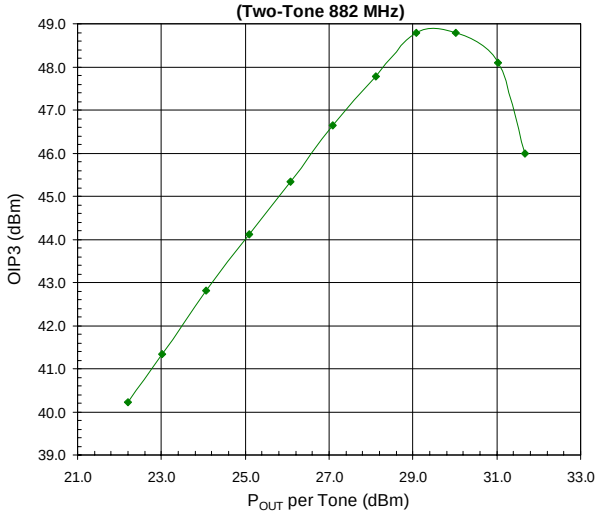
GSM850 P1dB versus Frequency



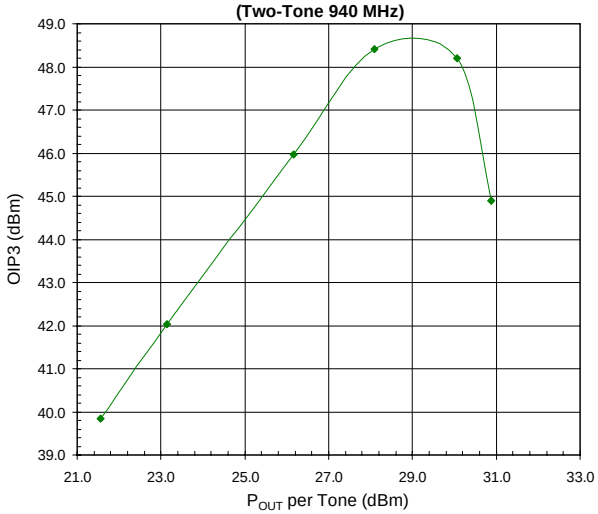
GSM900 P1dB versus Frequency



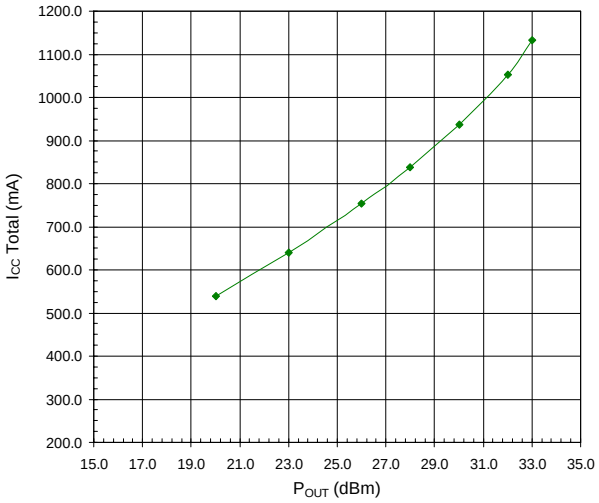
GSM850 OIP3 versus P_{OUT}
(Two-Tone 882 MHz)



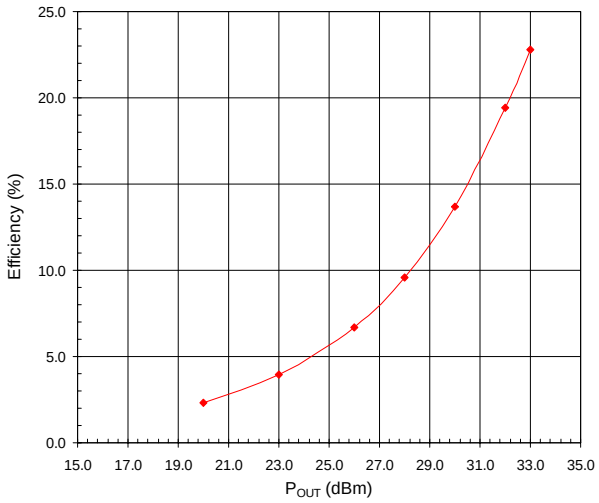
GSM900 OIP3 versus P_{OUT}
(Two-Tone 940 MHz)



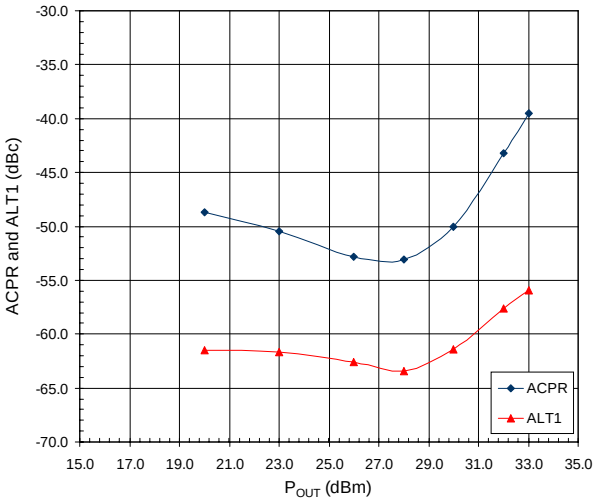
GSM850/CDMA2K Current versus P_{OUT}



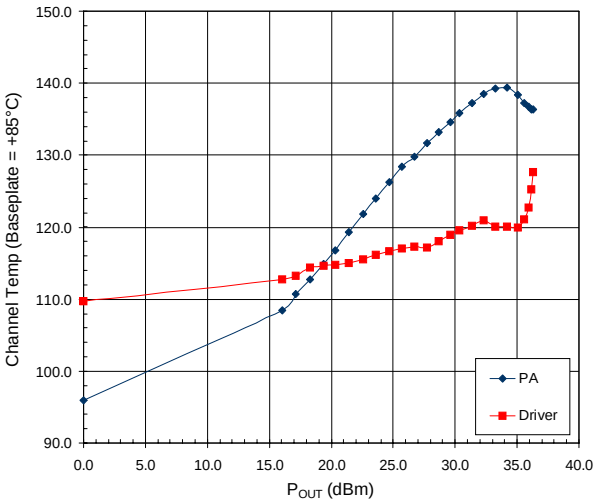
GSM850/CDMA2K Efficiency versus P_{OUT}



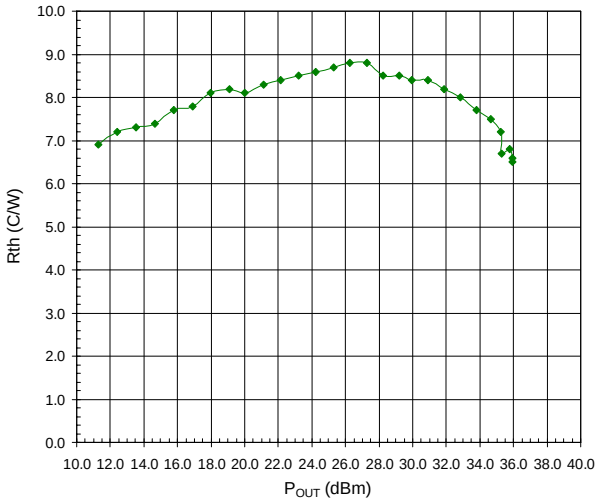
882 MHz CDMA2K 9-Channel SR1 ACPL and ALT1



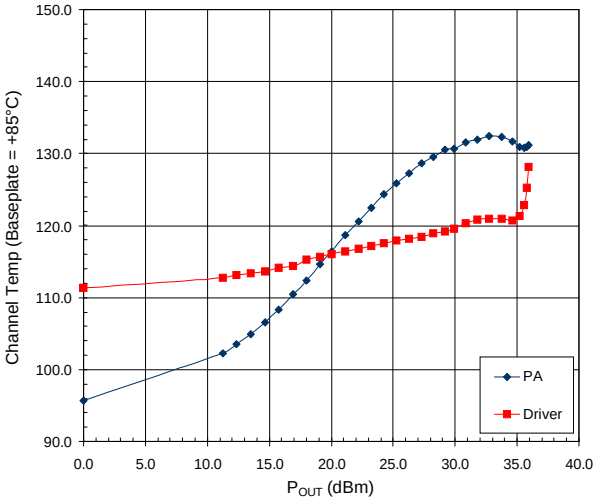
GSM850 Thermal Data



Thermal Resistance at 940 MHz



GSM900 Thermal Data



PCB Design Requirements

PCB Surface Finish

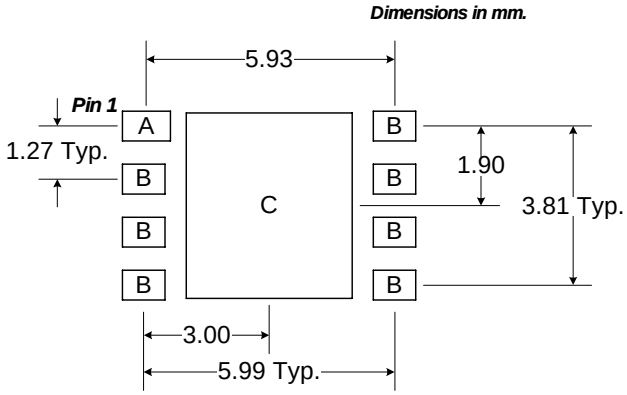
The PCB surface finish used for RFMD's qualification process is electroless nickel, immersion gold. Typical thickness is 3μinch to 8μinch gold over 180μinch nickel.

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

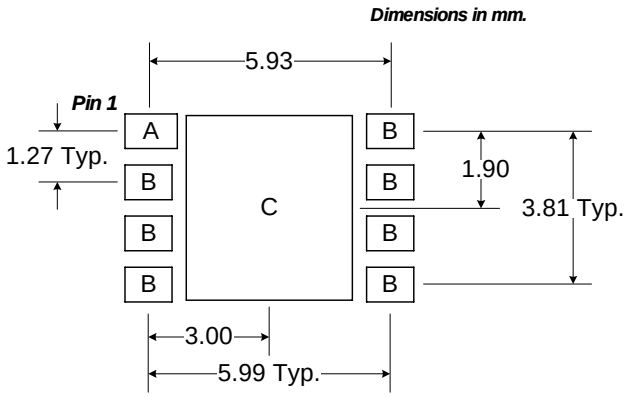
A = 1.14 x 0.71
B = 1.02 x 0.71 Typ.
C = 3.96 x 4.44



PCB Solder Mask Pattern

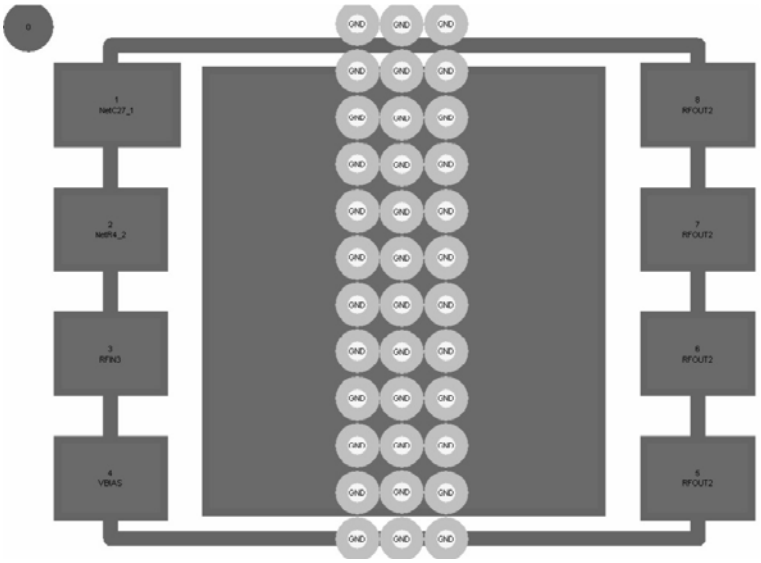
Liquid Photo-Imageable (LPI) solder mask is recommended. The solder mask footprint will match what is shown for the PCB metal land pattern with a 2mil to 3mil expansion to accommodate solder mask registration clearance around all pads. The center-grounding pad shall also have a solder mask clearance.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

A = 1.30 x 0.86
B = 1.17 x 0.86 Typ.
C = 4.11 x 4.60



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 boyd 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 (13inches) or 178mm (7inches). 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 rate 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