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RF6276

3V 700MHz LTE LINEAR POWER AMPLIFIER

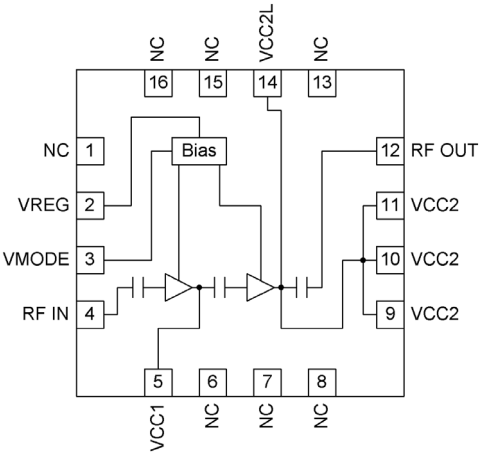
Package Style: QFN, 16-Pin, 3mmx3mm

Features

- Input/Output Internally Matched
- 15% Linear Efficiency at 17dBm, LPM
- LTE Compliant at 27dBm, HPM
- 34% Linear Efficiency at 27dBm
- -35dBc E-UTRA ACLR at 10MHz Offset
- 18mA Idle Current in LPM

Applications

- 3V LTE Band 13 Cellular Handset Frequency (777MHz to 787MHz)
- Multi-Mode Wireless Data Card



Functional Block Diagram

Product Description

The RF6276 is a linear high efficiency and output power amplifier designed for LTE cellular handsets. The device is manufactured on an advanced third generation GaAs HBT process and was designed for use as the final RF amplifier in 3V LTE handheld digital cellular equipment, spread-spectrum, and other applications in the 700MHz range. The RF6276 has digital control pin, which can reduce the current consumption up to 50% in low power mode and the output can be operated up to 17dBm in this mode. The RF6276 is assembled in a 16-pin, 3mmx3mm QFN package.

Ordering Information

RF6276	3V 700MHz LTE Linear Power Amplifier
RF6276PCBA-41X	Fully Assembled Evaluation Board

Optimum Technology Matching® Applied

☑ GaAs HBT	☐ SiGe BiCMOS	☐ GaAs pHEMT	☐ GaN HEMT
☐ GaAs MESFET	☐ Si BiCMOS	☐ Si CMOS	☐ RF MEMS
☐ InGaP HBT	☐ SiGe HBT	☐ Si BJT	☐ LDMOS

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Absolute Maximum Ratings

Parameter	Rating	Unit
Supply Voltage, V_{CC} (RF off)	7.0	V
Supply Voltage in standby mode	7.0	V
Supply Voltage in idle mode	6.0	V
Supply Voltage in operating mode	6.0	V
Supply Voltage, V_{CC} (RF on), P_{IN_MAX}=5dBm, P_{OUT}=28dBm, VSWR=5:1	4.3	V
Supply Voltage, V_{CCBIAS}	7.0	V
RF Input Power	6.0	dBm
RF Output Power	29.0	dBm
Output Load VSWR (Ruggedness)	10:1	
Control Voltage (V_{REG})	3.7	V
Mode Voltage (V_{MODE})	3.7	V
Operating Temperature	-30 to +85	°C
Operating Temperature (Ambient)	-30 to +110	°C
Storage Temperature (Ambient)	-55 to +150	°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 EUDirective2002/95/EC (at time of this document revision).

Parameter	Specification			Unit	Condition
	Min.	Typ.	Max.		
Band 13 High Power Mode Operation (Vmode Low)					Temp=+25°C, V_{CC}=3.4V, V_{REG}=2.85V, V_{MODE}=0V, LTE 16 QAM (10MHz), 50Ω Load.
Operating Frequency	777		787	MHz	
V_{CC}	3.1	3.4	4.2	V	
Linear Gain		29		dB	
Max Linear P_{OUT}	27			dBm	Maintain ACLR Specification
Linear Efficiency	30	34		%	Max Linear P_{OUT}
Maximum I_{CC}		430	490	mA	
E-UTRA ACLR		-35		dBc	±10MHz Offset, Measurement BW=9MHz
Noise Power in RX Band		-112		dBm/Hz	31MHz offset from the carrier, P_{OUT}=27dBm
2nd Harmonic			-10	dBm/1MHz	F=2f_0, RBW=1MHz
3rd to 16th Harmonic			-25	dBm/1MHz	F=N*f_0, RBW=1MHz, N=3, 4,....16
Stability			6:1		No Oscillations>-70dBc
Input VSWR		2:1			

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Parameter	Specification			Unit	Condition
	Min.	Typ.	Max.		
Band 13 Low Power Mode Operation (Vmode High)					Temp = +25°C, V_{CC} = 3.4V, V_{REG} = 2.85V, V_{MODE} = 2.85V, LTE 16 QAM (10MHz), 50Ω Load.
Operating Frequency Range	777		787	MHz	
V_{CC}	3.1	3.4	4.2	V	
Linear Gain		17		dB	
Max Linear P_{OUT}	17			dBm	Maintain ACLR Specification
Maximum I_{CC}		95		mA	
Linear Efficiency		15		%	Max Linear P_{OUT}
EVM			4	%	3GPP Spec is 12.5%
E-UTRA ACLR		-34		dBc	±10MHz Offset, Measurement BW = 9MHz
Stability			6:1		No Oscillations > -70dBc
Input VSWR		2.5:1			
High Power Mode Noise Power					T = 25°C Ambient, V_{CC} = 3.4V, V_{REG} = 2.85V, V_{MODE} = 0V, P_{OUT_MAX} = 27dBm, and LTE Modulation for all of the parameters (unless otherwise specified).
GPS		-150		dBm/Hz	P_{OUT} = P_{OUT_MAX}, Freq = 1570MHz to 1580MHz
GSM		-141		dBm/Hz	P_{OUT} = P_{OUT_MAX}, Freq = 869MHz to 960MHz
DCS		-160		dBm/Hz	P_{OUT} = P_{OUT_MAX}, Freq = 1805MHz to 1880MHz
W-CDMA		-160		dBm/Hz	P_{OUT} = P_{OUT_MAX}, Freq = 2110MHz to 2170MHz
Bluetooth™		-159		dBm/Hz	P_{OUT} = P_{OUT_MAX}, Freq = 2400MHz to 2480MHz
PHS		-160		dBm/Hz	P_{OUT} = P_{OUT_MAX}, Freq = 1893.5MHz to 1916.6MHz
PCS		-160		dBm/Hz	P_{OUT} = P_{OUT_MAX}, Freq = 1930MHz to 1990MHz
Power Supply					
Supply Voltage	3.1	3.4	4.2	V	P_{OUT} derated with VCC below 3.4V
High Gain Idle	40	75	110	mA	V_{MODE} = Low and V_{REG} = 2.85V
Low Gain Idle	7	18	25	mA	V_{MODE} = High and V_{REG} = 2.85V
V_{REG} Current		2.5	4	mA	V_{MODE} = High
V_{MODE} Current		550	600	uA	
DC Turn On/Off Time		1	6	uS	
RF Turn On/Off Time		1	40	uS	
Total Current (Power down)		0.2	2	uA	
V_{REG} Low Voltage	0		0.5	V	
V_{REG} High Voltage	2.75	2.85	2.95	V	

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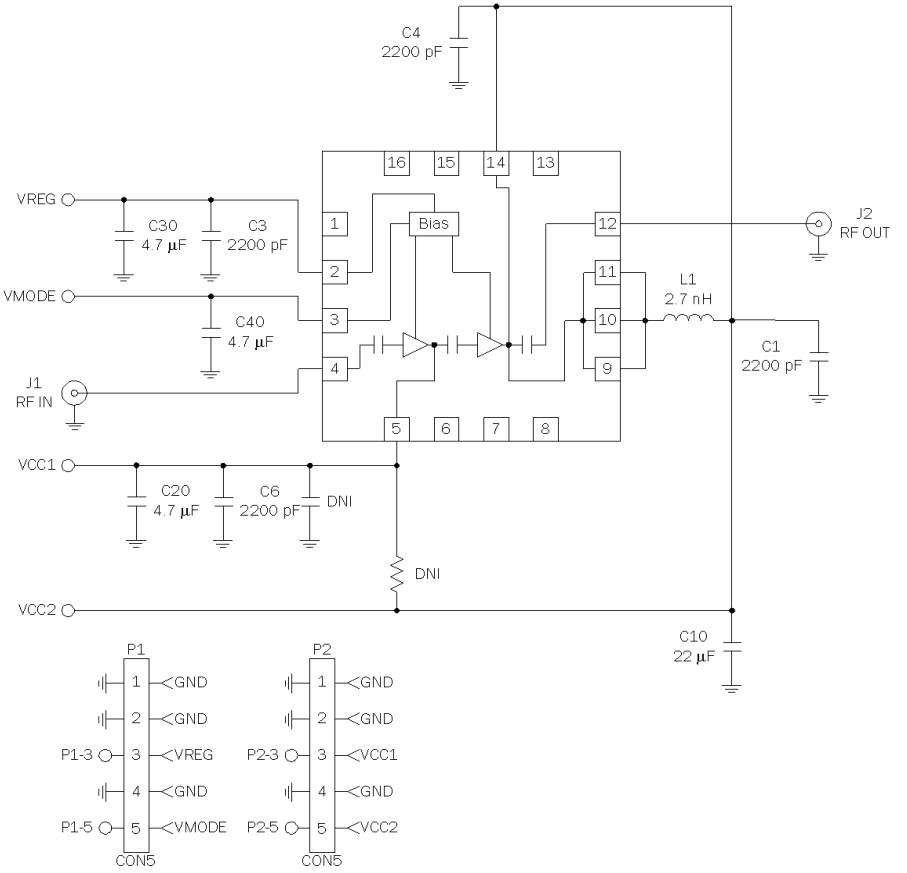
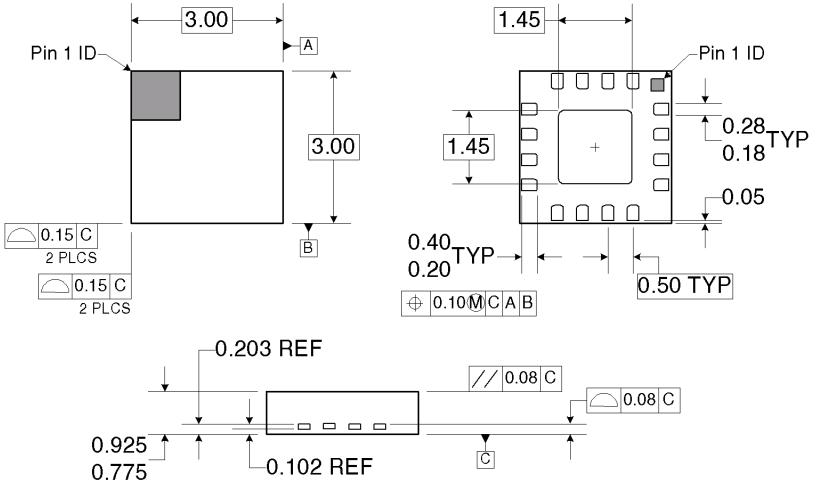
Evaluation Board Schematic - LTE



Pin	Function	Description
1	NC	No connection.
2	VREG	Regulated voltage supply for the amplifier bias circuit.
3	VMODE	For nominal operation (high power mode) V_{MODE} set to low. The device is in low power mode.V_{MODE}=High.
4	RF IN	RF input internally matched to 50Ω. This input is internally AC-coupled.
5	VCC1	First stage collector supply. Refer to the application schematic for external component.
6, 7, 8, 13, 15, 16	NC	No connection. Do not connect this pin to any external circuit.
9, 10, 11	VCC2	High power mode output stage collector supply. Refer to schematic for required external component.
12	RF OUT	RF output internally matched to 50Ω. This output is internally AC-coupled.
14	VCC2L	Low power mode output stage collector supply. Refer to schematic for required external component.
Pkg Base	GND	Ground connection. The backside of the package should be soldered to a top side ground pad which is connected to the ground plane with multiple vias. The pad should have a short thermal path to the ground plane.

Package Drawing



Shaded areas represent pin 1. *Dimensions in mm.*

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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

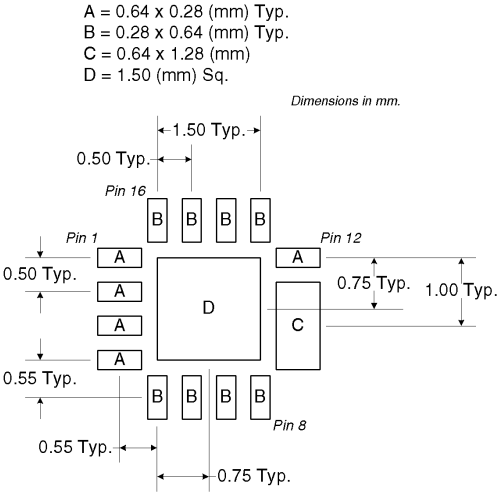

Figure 1. PCB Metal Land Pattern (Top View)

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 = 0.74 x 0.38 (mm) Typ.
B = 0.38 x 0.74 (mm) Typ.
C = 1.60 (mm) Sq.

Dimensions in mm.

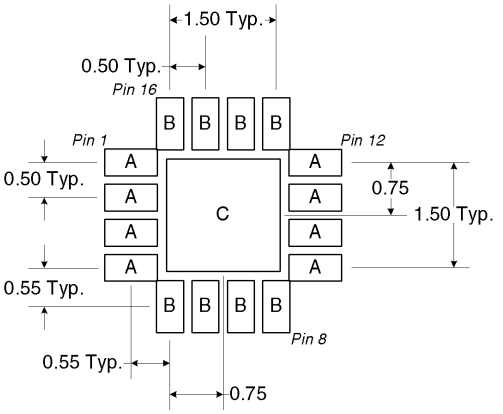

Figure 2. PCB Solder Mask Pattern (Top View)

Thermal Pad and Via Design

The PCB land pattern has been designed with a thermal pad that matches the die paddle size on the bottom of the device.

Thermal vias are required in the PCB layout to effectively conduct heat away from the package. The via pattern has been designed to address thermal, power dissipation and electrical requirements of the device as well as accommodating routing strategies.

The via pattern used for the RFMD qualification is based on thru-hole vias with 0.203mm to 0.330mm finished hole size on a 0.5mm to 1.2mm grid pattern with 0.025mm plating on via walls. If micro vias are used in a design, it is suggested that the quantity of vias be increased by a 4:1 ratio to achieve similar results.

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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.

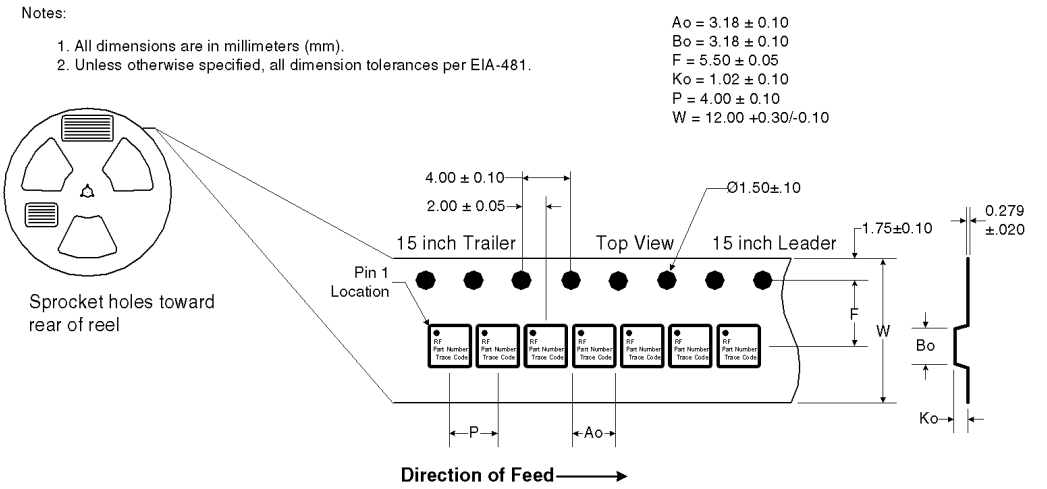
Carrier tape is wound or placed onto a shipping reel either 330 mm (13 inches) in diameter or 178 mm (7 inches) in diameter. The center hub design is large enough to ensure the radius formed by the carrier tape around it does not put unnecessary stress on the parts.

Prior to shipping, moisture sensitive parts (MSL level 2a-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/JEDEC J-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
RF6276TR7	7 (178)	2.4 (61)	12	4	Single	2500

QFN (Carrier Tape Drawing with Part Orientation)



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