RF5184

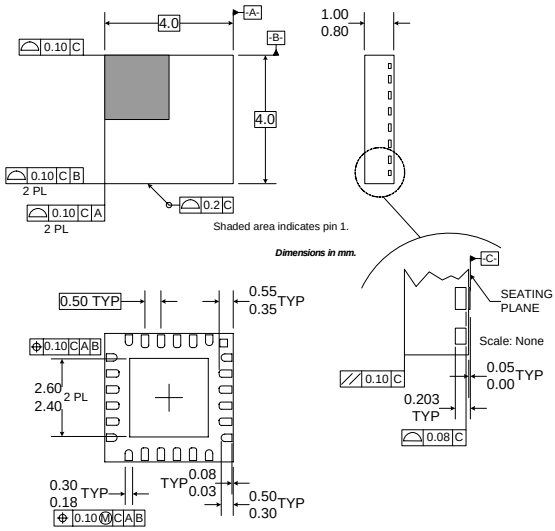
DUAL-BAND 800MHz/1900MHz
W-CDMA POWER AMPLIFIER MODULE

Typical Applications

- 3V W-CDMA Cellular Handset (Band 5)
- 3V W-CDMA US-PCS Handset (Band 2)

Product Description

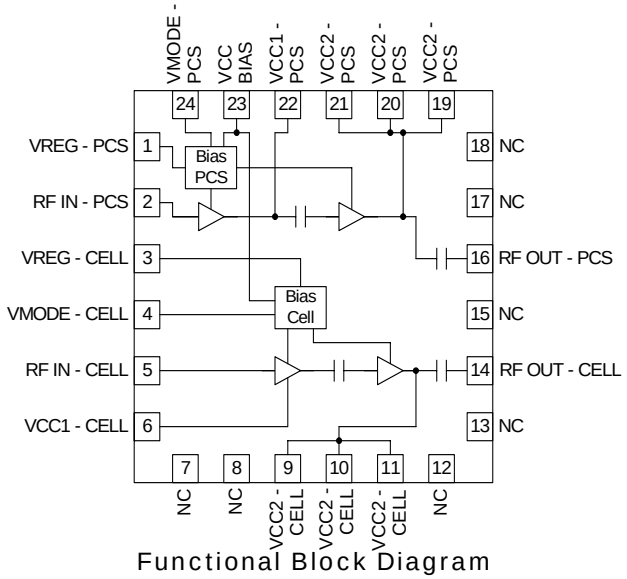
The RF5184 is a high-power, high-efficiency linear amplifier module specifically designed for 3V handheld systems. The device is manufactured on an advanced third generation GaAs HBT process, and was designed for use as the final RF amplifier in W-CDMA handheld digital cellular equipment, spread-spectrum systems, and other applications in the 824MHz to 849MHz band (Band 5) and 1850MHz to 1910MHz band (Band 2). The RF5184 has a digital control line for low power applications to lower quiescent current. The RF5184 is assembled in a 24-pin, 4mmx4mm, QFN package.



Package Style: QFN, 24-Pin, 4x4

Optimum Technology Matching® Applied

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



Functional Block Diagram

Features

- Input/Output Internally Matched@50Ω
- 43% Peak Linear Efficiency for Cell Band
- -41dBc ACLR @ 5MHz for Cell Band
- -40dBc ACLR@5MHz for PCS Band
- 44% Peak Linear Efficiency for PCS Band
- HSDPA Capable

Ordering Information

RF5184	Dual-Band 800MHz/1900MHz W-CDMA Power Amplifier Module
RF5184PCBA-410	Fully Assembled Evaluation Board

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Absolute Maximum Ratings

Parameter	Rating	Unit
Supply Voltage (RF off)	+8.0	V
Supply Voltage ($P_{OUT} \leq 31$dBm)	+5.2	V
Control Voltage (V_{REG})	+3.9	V
Input RF Power	+10	dBm
Mode Voltage (V_{MODE})	+3.9	V
Operating Temperature	-30 to +110	°C
Storage Temperature	-40 to +150	°C

Caution! ESD sensitive device.

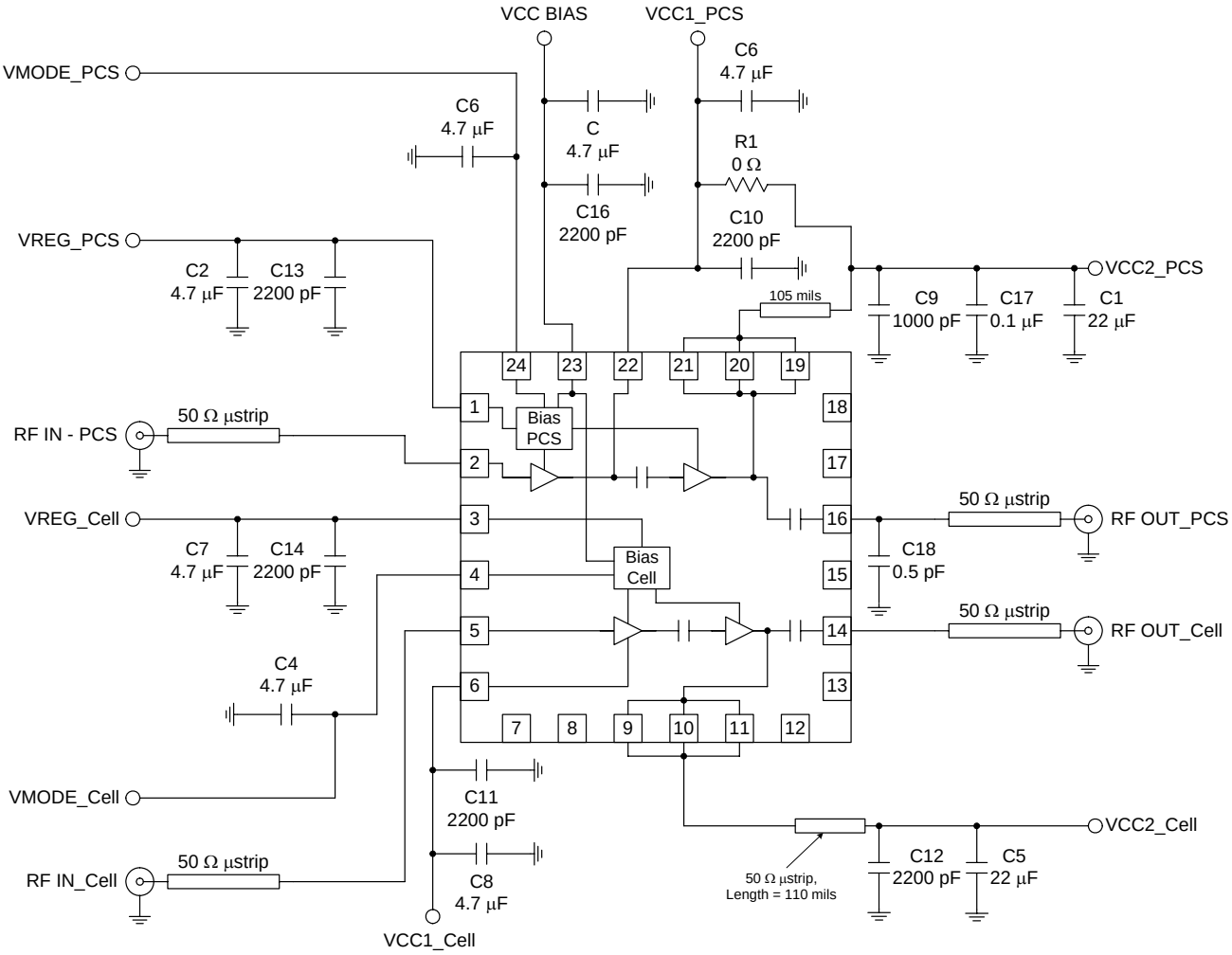
Parameter	Specification			Unit	Condition
	Min.	Typ.	Max.		
High Power Mode - W-CDMA Cell Band (V_{MODE} Low)					T=25°C Ambient, V_{CC}=3.4V, V_{REG}=2.8V, V_{MODE}=0V, and P_{OUT}=28dBm for all parameters (unless otherwise specified).
Operating Frequency Range	824		849	MHz	
Linear Gain	26.0	28.5	31.0	dB	
Maximum Linear Output	28			dBm	
Linear Efficiency	39	43		%	
Maximum I_{CC}		432	476	mA	
ACLR @ 5MHz	-37	-41		dBc	
ACLR @ 10MHz	-48	-54		dBc	
Input VSWR		2:1			
Stability In-Band			6:1		No oscillation>-70dBc
Stability Out-of-Band			10:1		No damage
Noise Power		-133		dBm/Hz	At 45MHz offset.
Mid Power Mode - W-CDMA Cell Band (V_{MODE} High)					T=25°C Ambient, V_{CC}=3.4V, V_{REG}=2.8V, V_{MODE}=2.8V, and P_{OUT}=16dBm for all parameters (unless otherwise specified).
Operating Frequency Range	824		849	MHz	
Linear Gain	25	27	30	dB	
Maximum Linear Output	16			dBm	
Maximum I_{CC}		125	150	mA	
ACLR @5MHz	-37	-41		dBc	
ACLR @10MHz	-48	-59		dBc	
Input VSWR		2:1			
Output VSWR Stability			6:1 10:1		No oscillation>-70dBc No damage
Low Power Mode - W-CDMA Cell Band (V_{MODE} High)					T=25°C Ambient, V_{CC}=0.75V, V_{REG}=2.8V, V_{MODE}=2.8V, and P_{OUT}=8dBm for all parameters (unless otherwise specified).
Operating Frequency Range	824		849	MHz	
Linear Gain		22		dB	
Efficiency		11.5		%	
ACLR @ 5MHz		-42		dBc	
ACLR @ 10MHz		-55		dBc	

Parameter	Specification			Unit	Condition
	Min.	Typ.	Max.		
High Power Mode - W-CDMA PCS Band (V_{MODE} Low)					T=25°C Ambient, V_{CC}=3.4V, V_{REG}=2.8V, V_{MODE}=0V, and P_{OUT}=28dBm for all parameters (unless otherwise specified).
Operating Frequency Range	1850		1910	MHz	
Linear Gain	26.5	29.0	31.5	dB	
Maximum Linear Output	28			dBm	
Linear Efficiency	39	44		%	
Maximum I_{CC}		422	476	mA	
ACLR @ 5MHz	-36	-40		dBc	
ACLR @ 10MHz	-47	-51		dBc	
Input VSWR		2:1			
Output VSWR Stability			6:1		No oscillation>-70dBc
			10:1		No damage
Noise Power		-137		dBm/Hz	At 80MHz offset.
Mid Power Mode - W-CDMA PCS Band (V_{MODE} High)					T=25°C Ambient, V_{CC}=3.4V, V_{REG}=2.8V, V_{MODE}=2.8V, and P_{OUT}=16dBm for all parameters (unless otherwise specified).
Operating Frequency Range	1850		1910	MHz	
Linear Gain	25.5	28.0	30.5	dB	
Maximum Linear Output	16			dBm	
ACLR @ 5MHz	-36	-42		dBc	
ACLR @ 10MHz	-47	-58		dBc	
Maximum I_{CC}		125	150	mA	
Input VSWR		2:1			
Output VSWR Stability			6:1		No oscillation>-70dBc
			10:1		No damage
Low Gain Mode - W-CDMA PCS Band (V_{MODE} High)					T=25°C Ambient, V_{CC}=0.75V, V_{REG}=2.8V, V_{MODE}=2.8V, and P_{OUT}=8dBm for all parameters (unless otherwise specified).
Operating Frequency Range	1850		1910	MHz	
Linear Gain		22		dB	
ACLR @ 5MHz		-43		dBc	
ACLR @ 10MHz		-58		dBc	
Efficiency		11.5		%	

Parameter	Specification			Unit	Condition
	Min.	Typ.	Max.		
Power Supply					
Supply Voltage	3.2	3.4	4.2	V	
High Power Idle Current - Cell	45	60	80	mA	
Mid Power Idle Current - Cell	35	45	70	mA	
Low Power Idle Current - Cell		42		mA	V_{CC}=0.75V
V_{REG} Current - Cell		2.5	4.0	mA	
High Power Idle Current - PCS	45	70	95	mA	
Mid Power Idle Current - PCS	40	60	85	mA	
Low Power Idle Current - PCS		57		mA	V_{CC}=0.75V
V_{REG} Current - PCS		2	4	mA	
V_{MODE} Current		125	350	uA	
RF Turn On/Off Time		1.2	6	uS	
DC Turn On/Off Time		2	40	uS	
Total Current (Power Down)		0.2	2.0	uA	
V_{REG} Low Voltage (Power Down)	0		0.5	V	
V_{REG} High Voltage (Recommended)	2.75	2.8	2.95	V	
V_{REG} High Voltage (Operational)	2.7		3.0	V	
V_{MODE} Voltage	0		0.5	V	High Gain Mode
V_{MODE} Voltage	2.0		3.0	V	Low Gain Mode

Pin	Function	Description	Interface Schematic
1	VREG_PCS	Regulated voltage supply for PCS band amplifier bias circuit. In power down mode, both V_{REG_PCS} and V_{MODE_PCS} need to be LOW (<0.5V).	
2	RFIN_PCS	PCS band RF input internally matched to 50Ω. This input is internally AC-coupled.	
3	VREG_Cell	Regulated voltage supply for Cell band amplifier bias circuit. In power down mode, both V_{REG_Cell} and V_{MODE_Cell} need to be LOW (<0.5V).	
4	VMODE_ Cell	Cell band mode control pin. For nominal operation (High Power mode), V_{MODE_Cell} is set LOW. When set HIGH, devices are biased lower to improve efficiency.	
5	RFIN_Cell	Cell band RF input internally matched to 50Ω. This input is internally AC-coupled.	
6	VCC1_Cell	Cell band first stage collector supply. A 2200uF and a 4.7μF decoupling capacitors are required.	
7	NC	No connection. Do not connect this pin to any external circuit.	
8	NC	No connection. Do not connect this pin to any external circuit.	
9	VCC2_Cell	Cell band output stage collector supply. Please see the schematic for required external components.	
10	VCC2_Cell	Same as Pin 9.	
11	VCC2_Cell	Same as Pin 9.	
12	NC	No connection. Do not connect this pin to any external circuit.	
13	NC	No connection. Do not connect this pin to any external circuit.	
14	RFOUT_Cell	Cell band RF output. Internally AC-coupled.	
15	NC	No connection. Do not connect this pin to any external circuit.	
16	RFOUT_ PCS	PCS band RF output. Internally AC-coupled.	
17	NC	No connection. Do not connect this pin to any external circuit.	
18	NC	No connection. Do not connect this pin to any external circuit.	
19	VCC2_PCS	PCS band output stage collector supply. Please see the schematic for required external components.	
20	VCC2_PCS	Same as Pin 19.	
21	VCC2_PCS	Same as Pin 19.	
22	VCC1_PCS	PCS band first stage collector supply. A 4.7μF decoupling capacitor is required.	
23	VCC BIAS	Bias circuit supply voltage.	
24	VMODE_ PCS	PCS band mode control pin. For nominal operation (High Power mode), VMODE_PCS is set Low. When set HIGH, devices are biased lower to improve efficiency.	
Pkg Base	GND	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.	

Evaluation Board Schematic - W-CDMA



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 are based on IPC-SM-782 standards when possible. The pad pattern shown has been developed and tested for optimized assembly at RFMD; however, it may require some modifications to address company specific assembly processes. The PCB land pattern has been developed to accommodate lead and package tolerances.

PCB Metal Land Pattern

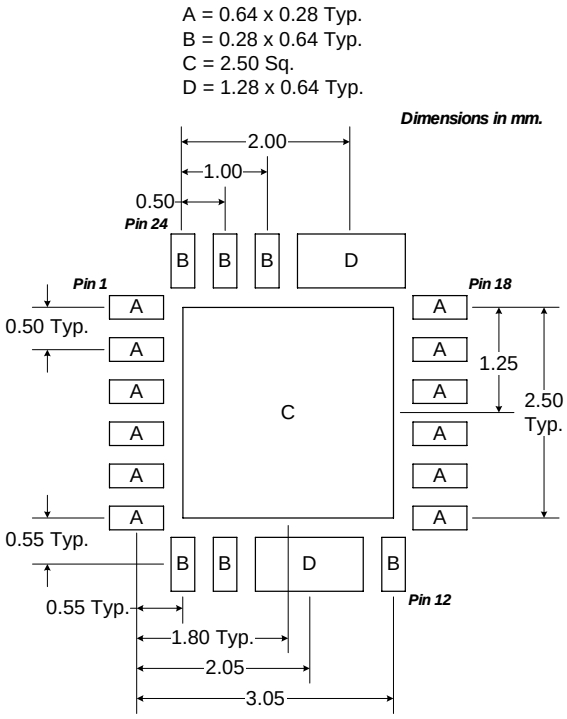


Figure 1. PCB Metal Land Pattern (Top View)

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.

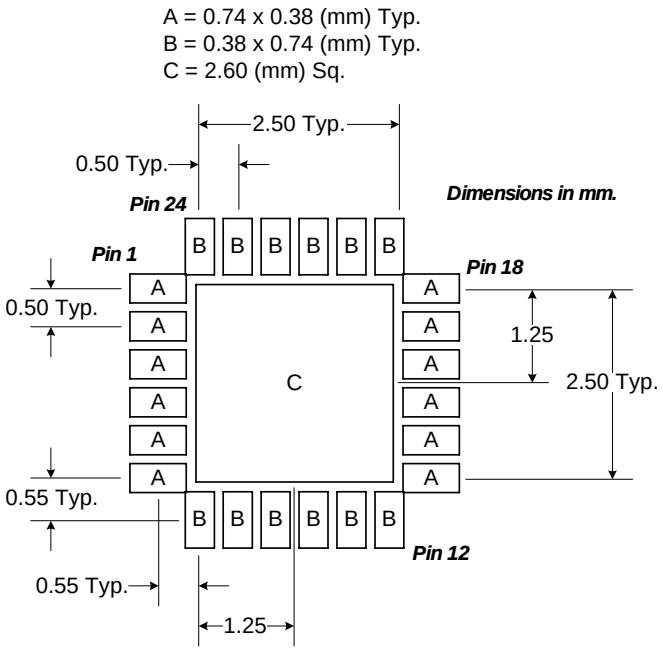


Figure 2. PCB Solder Mask (Top View)