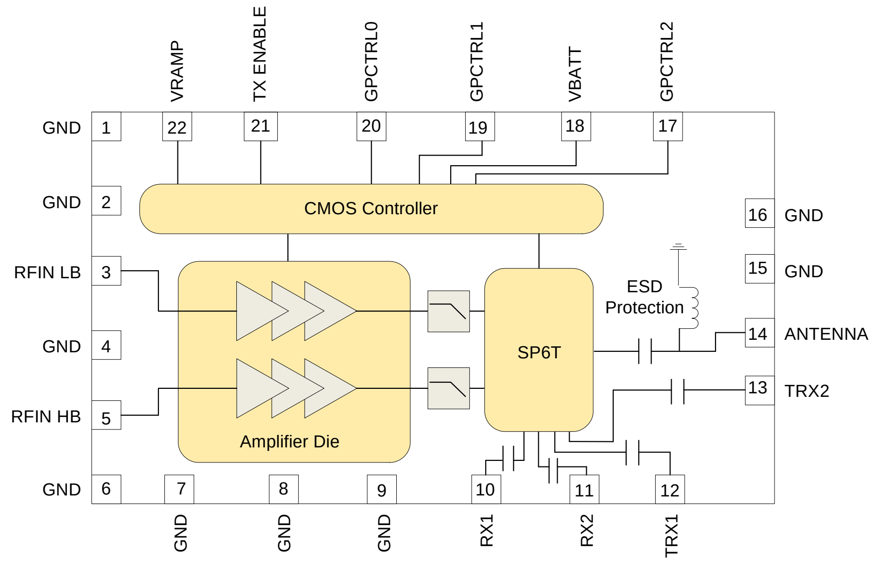
rfmd.com

RF3232

QUAD-BAND GSM/GPRS TRANSMIT MODULE WITH TWO UMTS PORTS

Package: Module 6.63mm x 5.24mm x 1.00mm



Functional Block Diagram

Features

- High Efficiency at Rated P_{OUT}
  V_{BATT} = 3.5V
  GSM850/EGSM900 = 41%
  DCS1800/PCS1900 = 33%
- Integrated Power Flattening Circuit
- Integrated V_{BATT} Tracking Circuit
- 8kV Robust ESD Protection at Antenna Port
- No External Routing
- Low Rx Insertion Loss
- Two High Linearity Tx/Rx UMTS Ports
- 0dBm to 6dBm Drive Level, >50dB of Dynamic Range

Applications

- For Single and Dual band 3G Applications
- GSM850/EGSM900/ DCS1800/PCS1900 Products
- 3.1V Multimode Mobile Applications
- GPRS Class 12 Compliant
- Portable Battery-Powered Equipment

Product Description

The RF3232 is a quad band (GSM850/EGSM900/DCS1800/PCS1900) GSM/GPRS Class 12 compliant transmit module with two symmetrical receive ports and two high linearity UMTS ports for single and dual-band multi-mode applications. This transmit module builds upon RFMD's leading power amplifier with PowerStar® integrated power control technology, pHEMT switch technology, and integrated transmit filtering for best-in-class harmonic performance. The results are high performance, reduced solution size, and ease of implementation. The device is designed for use as the final portion of the transmitter section in a GSM850/EGSM900/ DCS1800/PCS1900 and UMTS handset and eliminates the need for a PA-to-antenna switch module matching network. The device provides 50Ω matched input and output ports requiring no external matching components.

The RF3232 features RFMD's latest integrated power-flattening circuit, which significantly reduces current and power variation into load mismatch. Additionally, a V_{BATT} tracking feature is incorporated to maintain switching performance as supply voltage decreases. The RF3232 also integrates an ESD filter to provide excellent ESD protection at the antenna port.

Ordering Information

RF3232	Quad-Band GSM850/EGSM900/DCS1800/PCS1900 Transmit Module
RF3232SB	Transmit Module 5-Piece Sample Pack
RF3232PCBA-41X	Fully Assembled Evaluation Board

Optimum Technology Matching® Applied

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

7628 Thorndike Road, Greensboro, NC 27409-9421 · For sales or technical support, contact RFMD at (+1) 336-678-5570 or customerservice@rfmd.com.

Absolute Maximum Ratings

Parameter	Rating	Unit
Supply Voltage	-0.3 to +6.0	V
Power Control Voltage (V_{RAMP})	-0.3 to +3.0	V
Input RF Power	+10	dBm
Max Duty Cycle	50	%
Output Load VSWR	20:1	
Operating Temperature	-30 to +85	°C
Storage Temperature	-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.

RFMD Green: RoHS compliant per EU Directive 2002/95/EC, halogen free per IEC 61249-2-21, < 1000ppm each of antimony trioxide in polymeric materials and red phosphorus as a flame retardant, and <2% antimony in solder.

Parameter	Specification			Unit	Condition
	Min.	Typ.	Max.		
Recommended Operating Conditions					
ESD					
ESD Rx Pins			1000	V	HBM, JESD22-A114
			500	V	CDM, JESD22-C101C
ESD Antenna Pin			8	kV	IEC 61000-4-2
ESD All Other Pins			1000	V	HBM, JESD22-A114
			500	V	CDM, JESD22-C101C
Overall Power Control V_{RAMP}					
$V_{RAMP, MAX}$			1.8	V	Max. P_{OUT}
$V_{RAMP, MIN}$		0.25		V	Min. P_{OUT}
V_{RAMP} Input Capacitance			10	pF	DC to 200kHz
V_{RAMP} Input Current			10	µA	$V_{RAMP} = V_{RAMP, MAX}$
Power Control Range		50		dB	V_{RAMP} = 0.25V to $V_{RAMP, MAX}$
Overall Power Supply					
Power Supply Voltage	3.1	3.5	4.8	V	Operating Limits
Power Supply Current			10	µA	P_{IN} < -30dBm, TX Enable = Low, V_{RAMP} = 0.25V, Temp = -20°C to +85°C, V_{BATT} = 4.8V.
Overall Control Signals					
GpCtrl0, GpCtrl1, GpCtrl2 “Low”	0	0	0.5	V	
GpCtrl0, GpCtrl1, GpCtrl2 “High”	1.25	2.0	3.0	V	
GpCtrl0, GpCtrl1, GpCtrl2 “High Current”			10	µA	
TX Enable “Low”	0	0	0.5	V	
TX Enable “High”	1.25	2.0	3.0	V	
TX Enable “High Current”			10	µA	
RF Impedance					
RF Port Input and Output Impedance		50		Ω	

Parameter	Specification			Unit	Condition
	Min.	Typ.	Max.		
GSM850 Band					Nominal test conditions unless otherwise stated. All unused ports are terminated. V_{BATT} = 3.5V, P_{IN} = 3dBm, Temp = +25°C, V_{RAMP} = $V_{RAMP, MAX}$, Duty Cycle = 25%, Pulse Width = 1154μS, All unused ports = 50Ω Refer to logic table for mode of operation.
Operating Frequency Range	824		849	MHz	
Input Power	0	3	6	dBm	Full P_{OUT} guaranteed at minimum drive level.
Input VSWR		2.5:1	3:1		Over P_{OUT} range (5dBm to 33dBm)
Maximum Output Power	33	33.7		dBm	
	31			dBm	V_{BATT} = 3.1V to 4.8V, P_{IN} = 0dBm to 6dBm, Temp = -20°C to +85°C
Minimum Power Into 3:1 VSWR	30			dBm	Minimum power delivered to the load over 360° phase sweep.
PAE (Max P_{OUT})	36	44		%	Max P_{OUT}
PAE (Rated P_{OUT})	36	42		%	Set V_{RAMP} = $V_{RAMP\ RATED}$ for P_{OUT} = 33dBm
Peak Supply Current (Max P_{OUT})		1500	2000	mA	Max P_{OUT}
Peak Supply Current (Rated P_{OUT})		1350	1600	mA	Set V_{RAMP} = $V_{RAMP\ RATED}$ for P_{OUT} = 33dBm
2F0 Harmonic		-40	-33	dBm	
3F0 Harmonic		-40	-33	dBm	
All other harmonics up to 12.75GHz		-40	-33	dBm	
Forward Isolation 1		-57	-41	dBm	TX Enable = Low, P_{IN} = 6dBm, V_{RAMP} = 0.25V.
Forward Isolation 2		-27	-17	dBm	TX Enable = High, P_{IN} = 6dBm, V_{RAMP} = 0.25V.
Output Noise Power					Set V_{RAMP} = $V_{RAMP\ RATED}$ for P_{OUT} = 33dBm, RBW = 100kHz
869MHz to 894MHz		-85	-83		
1930MHz to 1990MHz		-117	-77		
Output Load VSWR Stability (Spurious Emissions)			-36	dBm	VSWR = 10:1, all phase angles (Set V_{RAMP} = $V_{RAMP\ RATED}$ for P_{OUT} = 33dBm into 50Ω load; load switched to VSWR = 10:1). V_{BATT} = 3.1V to 4.8V, P_{IN} = 0dBm to 6dBm, Temp = -20°C to +85°C, RBW = 3MHz, no oscillations
Output Load VSWR Ruggedness	No damage or permanent degradation to device				VSWR = 20:1, all phase angles (Set V_{RAMP} = $V_{RAMP\ RATED}$ for P_{OUT} = 33dBm into 50Ω load; load switched to VSWR = 20:1). V_{BATT} = 3.1V to 4.8V, P_{IN} = 0dBm to 6dBm, Temp = -30°C to +85°C

Parameter	Specification			Unit	Condition
	Min.	Typ.	Max.		
EGSM900 Band					Nominal test conditions unless otherwise stated. All unused ports are terminated. V_{BATT} = 3.5V, P_{IN} = 3dBm, Temp = +25°C, V_{RAMP} = $V_{RAMP, MAX}$, Duty Cycle = 25%, Pulse Width = 1154µS, All unused ports = 50Ω Refer to logic table for mode of operation.
Operating Frequency Range	880		915	MHz	
Input Power	0	3	6	dBm	Full P_{OUT} guaranteed at minimum drive level.
Input VSWR		2.5:1	3:1		Over P_{OUT} range (5dBm to 33dBm).
Maximum Output Power	33	33.7		dBm	
	31			dBm	V_{BATT} = 3.1V to 4.8V, P_{IN} = 0dBm to 6dBm, Temp = -20°C to +85°C
Minimum Power Into 3:1 VSWR	30			dBm	Minimum power delivered to the load over 360° phase sweep.
PAE (Max P_{OUT})	36	42		%	Max P_{OUT}
PAE (Rated P_{OUT})	35	39		%	Set V_{RAMP} = $V_{RAMP\ RATED}$ for P_{OUT} = 33dBm
Peak Supply Current (Max P_{OUT})		1650	2000	mA	Max P_{OUT}
Peak Supply Current (Rated P_{OUT})		1460	1650	mA	Set V_{RAMP} = $V_{RAMP\ RATED}$ for P_{OUT} = 33dBm
2F0 Harmonic		-40	-33	dBm	
3F0 Harmonic		-40	-33	dBm	
All other harmonics up to 12.75GHz		-40	-33	dBm	
Forward Isolation 1		-57	-41	dBm	TX Enable = Low, P_{IN} = 6dBm, V_{RAMP} = 0.25V.
Forward Isolation 2		-27	-17	dBm	TX Enable = High, P_{IN} = 6dBm, V_{RAMP} = 0.25V.
Output Noise Power					Set V_{RAMP} = $V_{RAMP\ RATED}$ for P_{OUT} = 33dBm, RBW = 100kHz
925MHz to 935MHz		-81	-77		
935MHz to 960MHz		-85	-83		
1805MHz to 1880MHz		-117	-77		
Output Load VSWR Stability (Spurious Emissions)			-36	dBm	VSWR = 10:1, all phase angles (Set V_{RAMP} = $V_{RAMP\ RATED}$ for P_{OUT} = 33dBm into 50Ω load; load switched to VSWR = 10:1). V_{BATT} = 3.1V to 4.8V, P_{IN} = 0dBm to 6dBm, Temp = -20°C to +85°C, RBW = 3MHz, no oscillations
Output Load VSWR Ruggedness	No damage or permanent degradation to device				VSWR = 20:1, all phase angles (Set V_{RAMP} = $V_{RAMP\ RATED}$ for P_{OUT} ≡ 33dBm into 50Ω load; load switched to VSWR = 20:1). V_{BATT} = 3.1V to 4.8V, P_{IN} = 0dBm to 6dBm, Temp = -30°C to +85°C

7628 Thorndike Road, Greensboro, NC 27409-9421 · For sales or technical support, contact RFMD at (+1) 336-678-5570 or customerservice@rfmd.com.

Parameter	Specification			Unit	Condition
	Min.	Typ.	Max.		
DCS1800 Band					Nominal test conditions unless otherwise stated. All unused ports are terminated. V_{BATT} = 3.5V, P_{IN} = 3dBm, Temp = +25°C, V_{RAMP} = $V_{RAMP, MAX}$, Duty Cycle = 25%, Pulse Width = 1154μS, All unused ports = 50Ω Refer to logic table for mode of operation.
Operating Frequency Range	1710		1785	MHz	
Input Power	0	3	6	dBm	Full P_{OUT} guaranteed at minimum drive level.
Input VSWR		2.5:1	3:1		Over P_{OUT} range (0dBm to 30dBm).
Maximum Output Power	30.0	30.9		dBm	
	28.0			dBm	V_{BATT} = 3.1V to 4.8V, P_{IN} = 0dBm to 6dBm, Temp = -20°C to +85°C
Minimum Power Into 3:1 VSWR	27.0			dBm	Minimum power delivered to the load over 360° phase sweep.
PAE (Max P_{OUT})	30	35		%	Max P_{OUT}
PAE (Rated P_{OUT})	30	34		%	Set V_{RAMP} = $V_{RAMP\ RATED}$ for P_{OUT} = 30dBm
Peak Supply Current (Max P_{OUT})		1000	1500	mA	Max P_{OUT}
Peak Supply Current (Rated P_{OUT})		820	1000	mA	Set V_{RAMP} = $V_{RAMP\ RATED}$ for P_{OUT} = 30dBm
2F0 Harmonic		-40	-33	dBm	
3F0 Harmonic		-40	-33	dBm	
All other harmonics up to 12.75GHz		-40	-33	dBm	
Forward Isolation 1		-73	-53	dBm	TX Enable = Low, P_{IN} = 6dBm, V_{RAMP} = 0.25V.
Forward Isolation 2		-30	-15	dBm	TX Enable = High, P_{IN} = 6dBm, V_{RAMP} = 0.25V.
Output Noise Power					Set V_{RAMP} = $V_{RAMP\ RATED}$ for P_{OUT} = 30dBm, RBW = 100kHz
925MHz to 935MHz		-100	-81		
935MHz to 960MHz		-100	-85		
1805MHz to 1880MHz		-90	-77		
Output Load VSWR Stability (Spurious Emissions)			-36	dBm	VSWR = 10:1, all phase angles (Set V_{RAMP} = $V_{RAMP\ RATED}$ for P_{OUT} = 30dBm into 50Ω load; load switched to VSWR = 10:1). V_{BATT} = 3.1V to 4.8V, P_{IN} = 0dBm to 6dBm, Temp = -20°C to +85°C, RBW = 3MHz, no oscillations
Output Load VSWR Ruggedness	No damage or permanent degradation to device				VSWR = 20:1, all phase angles (Set V_{RAMP} = $V_{RAMP\ RATED}$ for P_{OUT} = 30dBm into 50Ω load; load switched to VSWR = 20:1). V_{BATT} = 3.1V to 4.8V, P_{IN} = 0dBm to 6dBm, Temp = -30°C to +85°C

RFMD
rfmd.com

Parameter	Specification			Unit	Condition
	Min.	Typ.	Max.		
PCS1900 Band					Nominal test conditions unless otherwise stated. All unused ports are terminated. V_{BATT} = 3.5V, P_{IN} = 3dBm, Temp = +25°C, V_{RAMP} = $V_{RAMP, MAX}$, Duty Cycle = 25%, Pulse Width = 1154µS, All unused ports = 50Ω Refer to logic table for mode of operation.
Operating Frequency Range	1850		1910	MHz	
Input Power	0	3	6	dBm	Full P_{OUT} guaranteed at minimum drive level.
Input VSWR		2.5:1	3:1		Over P_{OUT} range (5dBm to 33dBm).
Maximum Output Power	30.0	31.3		dBm	
	28.0			dBm	V_{BATT} = 3.1V to 4.8V, P_{IN} = 0dBm to 6dBm, Temp = -20°C to +85°C
Minimum Power Into 3:1 VSWR	27.0			dBm	Minimum power delievered to the load over 360° phase sweep.
PAE (Max P_{OUT})	30	34		%	Max P_{OUT}
PAE (Rated P_{OUT})	30	33		%	Set V_{RAMP} = $V_{RAMP\ RATED}$ for P_{OUT} = 30dBm
Peak Supply Current (Max P_{OUT})		1150	1500	mA	Max P_{OUT}
Peak Supply Current (Rated P_{OUT})		875	1000	mA	Set V_{RAMP} = $V_{RAMP\ RATED}$ for P_{OUT} = 30dBm
2F0 Harmonic		-40	-33	dBm	
3F0 Harmonic		-40	-33	dBm	
All other harmonics up to 12.75GHz		-40	-33	dBm	
Non-Harmonic Spurious up to 12.75GHz			-36	dBm	Over P_{OUT} range (5dBm to 33dBm)
Forward Isolation 1		-73	-53	dBm	TX Enable = Low, P_{IN} = 6dBm, V_{RAMP} = 0.25V.
Forward Isolation 2		-30	-15	dBm	TX Enable = High, P_{IN} = 6dBm, V_{RAMP} = 0.25V.
Output Noise Power					Set V_{RAMP} = $V_{RAMP\ RATED}$ for P_{OUT} = 30dBm, RBW = 100kHz
869MHz to 894MHz		-100	-85		
1930MHz to 1990MHz		-90	-77		
Output Load VSWR Stability (Spurious Emissions)			-36	dBm	VSWR = 10:1, all phase angles (Set V_{RAMP} = $V_{RAMP\ RATED}$ for P_{OUT} = 30dBm into 50Ω load; load switched to VSWR = 10:1). V_{BATT} = 3.1V to 4.8V, P_{IN} = 0dBm to 6dBm, Temp = -20°C to +85°C, RBW = 3MHz, no oscillations
Output Load VSWR Ruggedness	No damage or permanent degradation to device				VSWR = 20:1, all phase angles (Set V_{RAMP} = $V_{RAMP\ RATED}$ for P_{OUT} = 30dBm into 50Ω load; load switched to VSWR = 20:1). V_{BATT} = 3.1V to 4.8V, P_{IN} = 0dBm to 6dBm, Temp = -30°C to +85°C

7628 Thorndike Road, Greensboro, NC 27409-9421 · For sales or technical support, contact RFMD at (+1) 336-678-5570 or customerservice@rfmd.com.

Parameter	Specification			Unit	Condition
	Min.	Typ.	Max.		
Rx Section					Nominal test conditions unless otherwise stated. V_{BATT} = 3.5V, Temp = +25°C, Duty Cycle = 25% Pulse Width = 1154us, V_{RAMP} = $V_{RAMP,\ MIN}$ All unused ports = 50Ω. Refer to logic table for mode of operation.
Insertion Loss GSM850/EGSM900 ANT-RX1		0.9	1.35	dB	Freq = 869MHz to 960MHz. See Note 1.
In-Band Ripple GSM850/EGSM900 ANT-RX1			0.2	dB	Freq = 869MHz to 960MHz.
Input VSWR GSM850/EGSM900 ANT-RX1		1.3:1	1.5:1		
Insertion Loss DCS1800/PCS1900 ANT-RX2		1.1	1.6	dB	Freq = 1805MHz to 1990MHz. See Note 1.
In-Band Ripple DCS1800/PCS1900 ANT-RX2			0.2	dB	Freq = 1805MHz to 1990MHz.
Input VSWR DCS1800/PCS1900 ANT-RX2		1.3:1	1.5:1		
Insertion Loss ANT-TRX1		0.7	1.1	dB	Freq = 824MHz to 960MHz. See Note 1.
In-Band Ripple ANT-TRX1			0.2	dB	Freq = 824MHz to 960MHz.
Input VSWR ANT-TRX1		1.2:1	1.5:1		
TRX1 Isolation to all Rx/TRx Ports	20	28		dB	
TRX1 IMD2		-121	-105	dBm	Tx = 836.5MHz at 20dBm; Blocker = 45MHz, 1718MHz at -15dBm; Rx = 881.5MHz
TRX1 IMD3		-120	-103	dBm	Tx = 836.5MHz at 20dBm; Blocker = 791.5MHz, 1718MHz at -15dBm; Rx = 881.5MHz
Insertion Loss ANT-TRX2		1.0	1.5	dB	Freq = 1710MHz to 2170MHz. See Note 1.
In-Band Ripple ANT-TRX2			0.2	dB	Freq = 1710MHz to 2170MHz.
Input VSWR ANT-TRX2		1.6:1	2:1		
TRX2 Isolation to all Rx/TRx Ports	20	23		dB	
TRX2 IMD2		-114	-105	dBm	Tx = 1950MHz at 20dBm; Blocker = 190MHz, 4090MHz at -15dBm; Rx = 2140MHz
TRX2 IMD3		-113	-103	dBm	Tx = 1950MHz at 20dBm; Blocker = 1760MHz, 4090MHz at -15dBm; Rx = 2140MHz

Parameter	Specification			Unit	Condition
	Min.	Typ.	Max.		
Tx Section					
Tx Leakage to RX1 Port GSM850/EGSM900		2	4	dBm	GSM850/EGSM900 Tx mode: Freq = 824MHz to 915MHz, $V_{RAMP} = V_{RAMP\ RATED}$ for P_{OUT} = 33dBm at Antenna port. See note 2.
Tx Leakage to RX2 Port DCS1800/PCS1900		2.5	4	dBm	DCS1800/PCS1900 Tx mode: Freq = 1710MHz to 1910MHz, $V_{RAMP} = V_{RAMP\ RATED}$ for P_{OUT} = 30dBm at Antenna port. See note 2.
Tx Leakage to TRX1 Port		3	4	dBm	GSM850/EGSM900 Tx mode: Freq = 824MHz to 915MHz, $V_{RAMP} = V_{RAMP\ RATED}$ for P_{OUT} = 33dBm at Antenna port. See note 2.
Tx Leakage to TRX2 Port		-5	4	dBm	DCS1800/PCS1900 Tx mode: Freq = 1710MHz to 1910MHz, $V_{RAMP} = V_{RAMP\ RATED}$ for P_{OUT} = 33dBm at Antenna port. See note 2.

Note 1: The insertion loss values listed are guaranteed at the DUT port reference plane (i.e. excludes resistive trace losses). The insertion loss values listed are values that would be measured with an ideal match at the Rx port (see Application Schematic).

Note 2: Isolation specification set to ensure at least the following isolation at rated P_{OUT}: Calculation example using typical values: Isolation = P_{OUT} at Antenna - P_{OUT} at Rx Port. Isolation LB = 33 - 3 = 30dB, Isolation HB = 30 - 3 = 27dB.

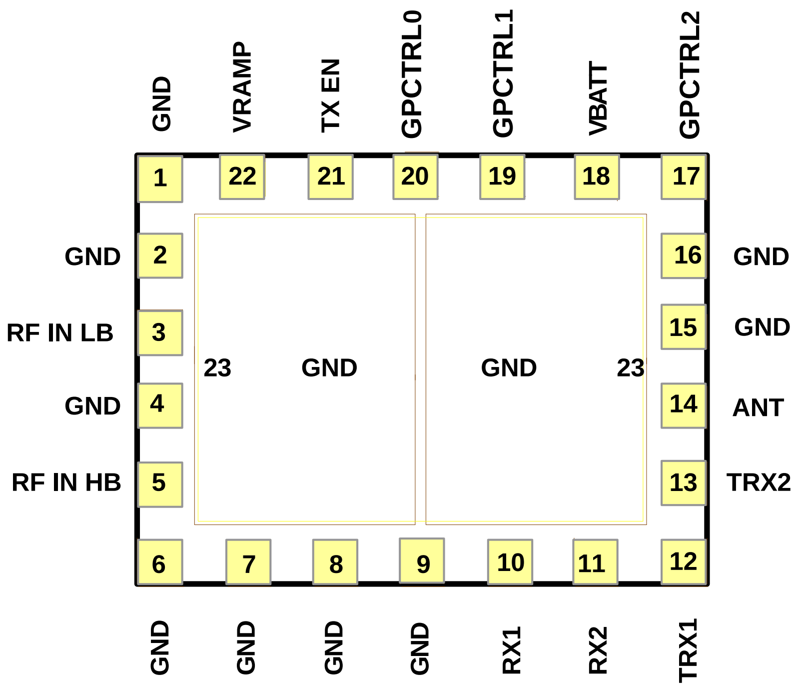
Module Control and Antenna Switch Logic

TX ENABLE	GPCTRL2	GPCTRL1	GPCTRL0	Tx Module Mode
0	0	0	0	Standby
0	1	0	0	RX1
0	0	1	0	RX2
0	0	1	1	TRX1
0	0	0	1	TRX2
1	0	1	0	Low Band GMSK
1	0	1	1	High Band GMSK

7628 Thorndike Road, Greensboro, NC 27409-9421 · For sales or technical support, contact RFMD at (+1) 336-678-5570 or customerservice@rfmd.com.

Pin	Function	Description
1	GND	Pin connected to module Ground.
2	GND	Pin connected to module Ground.
3	RF IN LB	RF input to the GSM850/EGSM900 bands. This is a 50Ω input.
4	GND	Pin connected to module Ground.
5	RF IN HB	RF input to the DCS1800/PCS1900 bands. This is a 50Ω input.
6	GND	Pin connected to module Ground.
7	GND	Pin connected to module Ground.
8	GND	Pin connected to module Ground.
9	GND	Pin connected to module Ground. Control pin that, together with GpCtrl1, selects mode of operation.
10	RX1	RX1 of antenna switch. This is a 50Ω output. RX1 is interchangeable with RX2.
11	RX2	RX2 of antenna switch. This is a 50Ω output. RX2 is interchangeable with RX1.
12	TRX1	TRX1 UMTS port of antenna switch. This is a 50Ω input/output.
13	TRX2	TRX2 UMTS port of antenna switch. This is a 50Ω input/output.
14	Antenna	Antenna port.
15	GND	Pin connected to module Ground.
16	GND	Pin connected to module Ground.
17	GPCTRL2	Control pin that together with GpCtrl0 and GpCtrl1 selects the band of operation.
18	VBATT	Power supply for the module. This should be connected to the battery terminal using as wide a trace as possible.
19	GPCTRL1	Control pin that together with GpCtrl0 and GpCtrl2 selects the band of operation.
20	GPCTRL0	Control pin that together with GpCtrl1 and GpCtrl2 selects the band of operation.
21	TX ENABLE	This signal enables the PA module for operation with a logic high. The switch is put in Tx mode determined by GpCtrl0, GpCtrl1, and GpCtrl2.
22	VRAMP	V_{RAMP} ramping signal from DAC. A simple RC filter is integrated into the RF3232 module. V_{RAMP} may or may not require additional filtering depending on the baseband selected.
23	GND	Pin connected to module Ground.

Pin Out
(Top View)



7628 Thorndike Road, Greensboro, NC 27409-9421 · For sales or technical support, contact RFMD at (+1) 336-678-5570 or customerservice@rfmd.com.

Theory of Operation

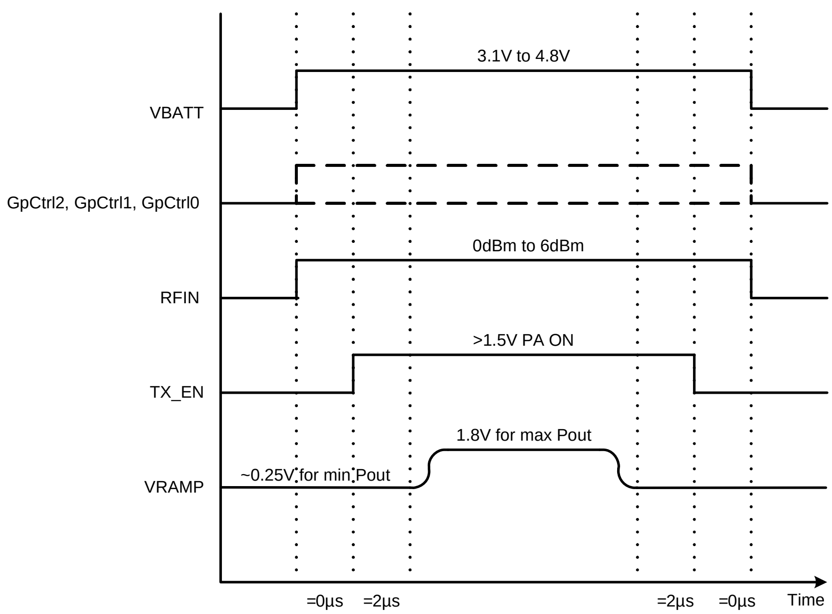
Product Description

The RF3232 is a quad-band, transmit module (TXM) with fully-integrated power control functionality, harmonic filtering, band selectivity, and Tx/Rx switching. The TXM is self-contained, having 50Ω I/O terminals, two high-linearity UMTS ports, and two symmetrical Rx ports allowing multi-band operation. The power control function eliminates all power control circuitry, including directional couplers, diode detectors, and power control ASICs, etc. The power control capability provides 50dB of continuous control range and 70dB of total control range, using a DAC-compatible, analog voltage input. The Tx Enable feature provides for PA activation (Tx mode) or Rx mode/standby. Internal switching provides a low-loss, low-distortion path from the antenna port to the Tx path (or Rx port), while maintaining proper isolation. Integrated filtering provides ETSI-compliant harmonic suppression at the antenna port even under high mismatch conditions, which is important as modern antennas often present a load that significantly deviates from nominal impedance.

Overview

The RF3232 simplifies the phone design by eliminating the need for the complicated control loop, harmonic filters, and Tx/Rx switch along with their associated matching components. The power control loop can be driven directly from the DAC output in the baseband circuit. The module has two Rx ports for GSM850/EGSM900 and DCS1800/PCS1900 bands of operation and two UMTS ports for multi-mode operation. The two Rx ports are symmetrical, they can be used either as GSM850/EGSM900 or DCS1800/PCS1900. To control the mode of operation, there are four logic control signals: Tx Enable, GpCtrl0, GpCtrl1 and GpCtrl2.

RF3232 Timing Diagram



GMSK Power On Sequence:

1. Apply VBATT
2. Apply GpCtrl2, GpCtrl1, GpCtrl0
3. Apply minimum VRAMP (~0.25V)
4. Apply TX_EN
5. Apply VRAMP for desired output power

RFIN can be applied at any time. For good transient response it must be applied before power ramp begins.

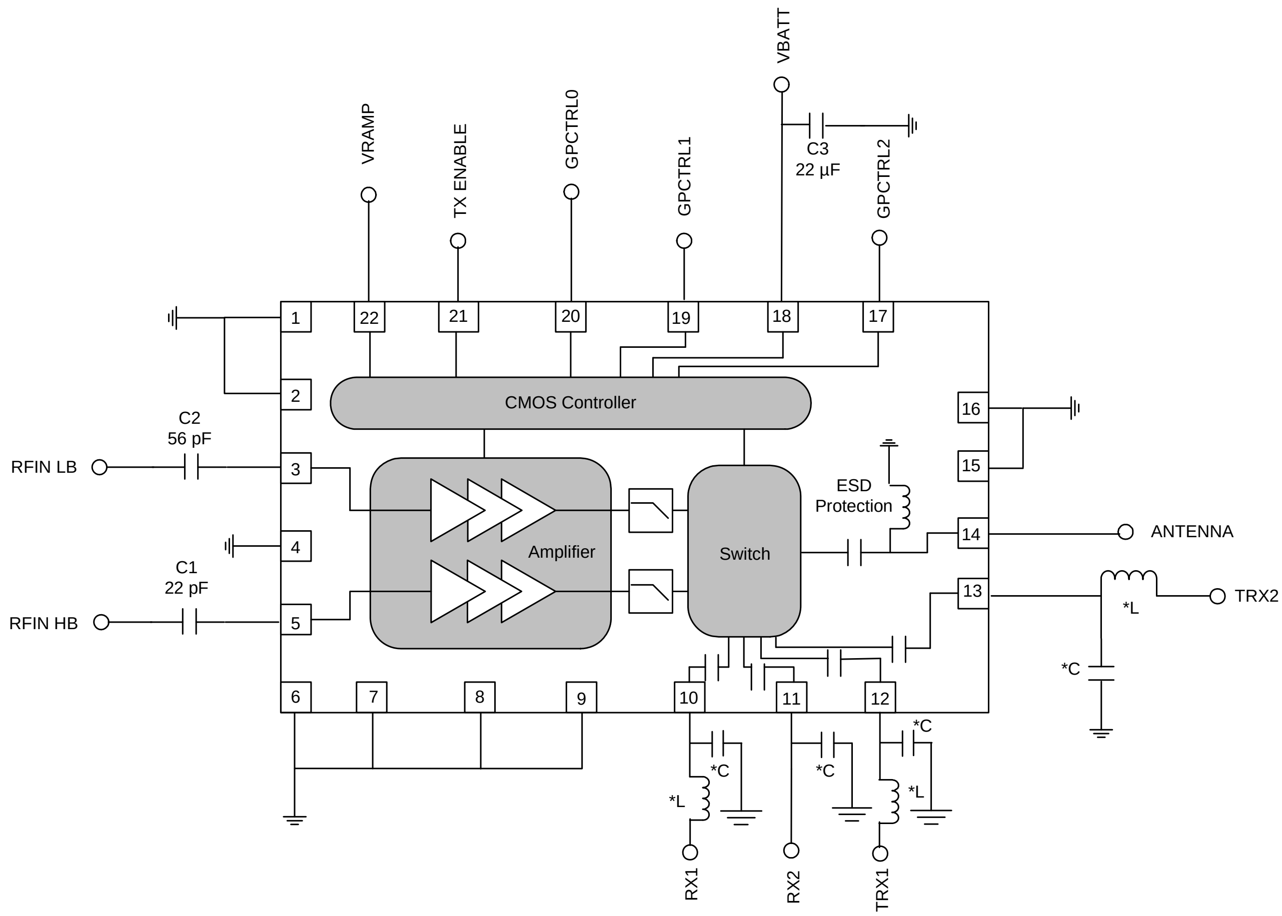
The Power Down Sequence is the reverse order of the Power On Sequence.

The RF3232 has an integrated power flattening circuit that reduces the amount of current variation when a mismatch is presented to the output of the PA. When a mismatch is presented to the output of the PA, its output impedance is varied and could present a load that will increase output power. As the output power increases, so does current consumption. The current consumption can become very high if not monitored and limited. The power flattening circuit is integrated onto the CMOS controller and requires no input from the user. Into a mismatch, the current varies as the phase changes. The power flattening circuit monitors current through an internal sense resistor. As the current changes, the loop is adjusted in order to maintain current. The result is flatter power and reduced current into mismatch.

The RF3232 also incorporates a V_{BATT} tracking feature that eliminates the need for the transceiver/baseband to regulate the ramping signal as the supply voltage decreases. The internal circuit monitors the supply voltage and adjusts the ramping signal such that the switching spectrum is minimally impacted.

RFMD
rfmd.com

Application Schematic



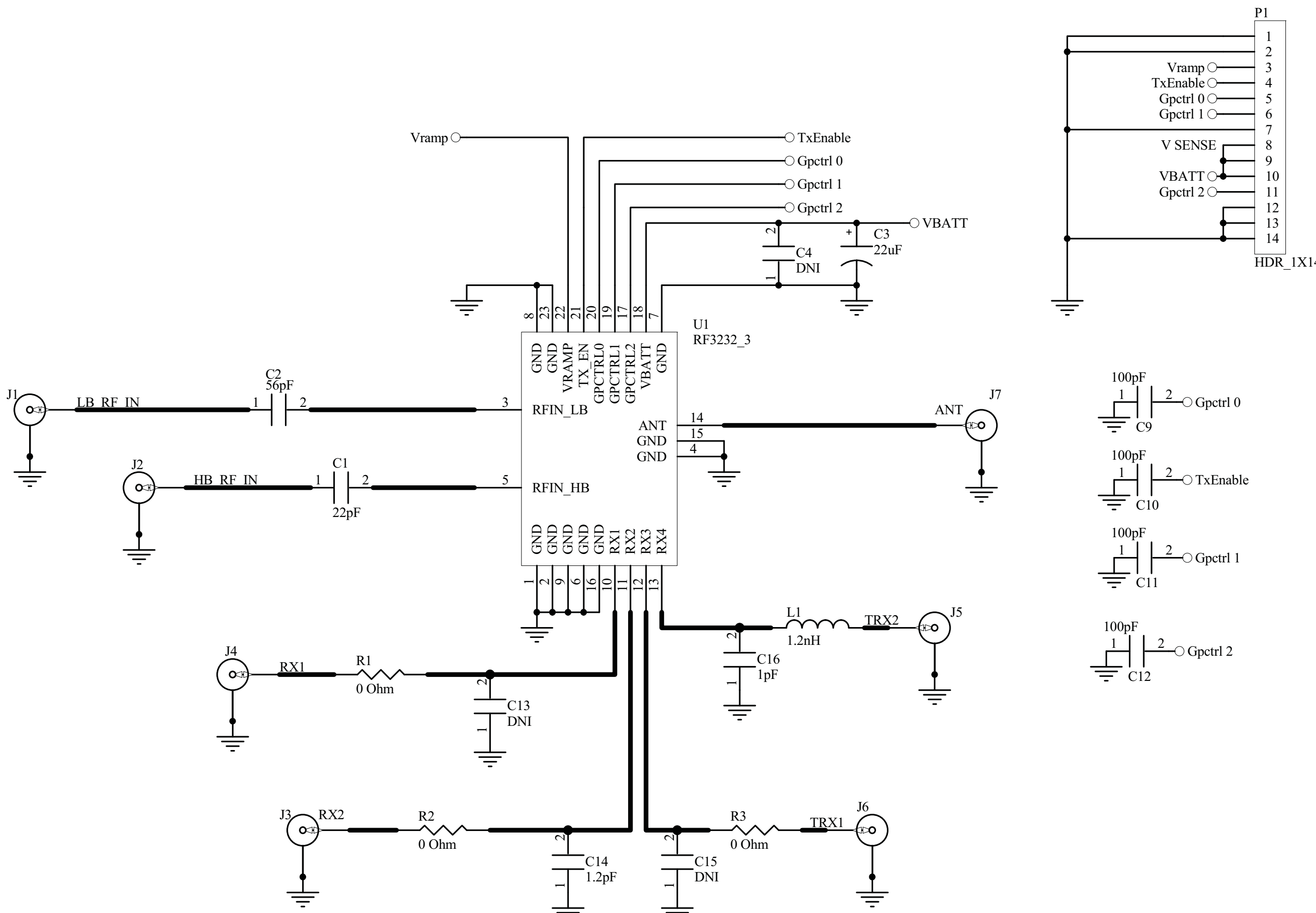
Notes:

- All input, output, and antenna traces are 50Ω microstrip.
- VBATT capacitor value may change depending on application.
- If placing an attenuation network on the input to the power amplifier, ensure that it is positioned on the transceiver side of the capacitor C1 (or C2) to prevent adversely affecting the base biasing of the power amplifier.
- Both Rx ports and TRx ports are symmetrical for LB and HB operation.
- Rx ports usually connect to SAW filters. *C and *L are used to match the Rx ports to a 50Ω filter for better Rx performance.
- No external matching on Rx/TRx ports are needed for best low-band Rx performance
- For best high band Rx performance, RX1, RX2, TRX1 and TRX2 needs external matching.
- The values shown in the table below may not be ideal for each application, therefore, some experimentation may be warranted to find the correct values.
- The recommended ordering of the Rx ports for transceiver layout compatibility and isolation requirements is as follows: RX1=850/900MHz, RX2=1800/1900MHz, TRX1=850/900MHz, and TRX2=1800/1900/2100MHz. If the different order is preferred, recommended matching components for high-band operation should be placed to respective ports

	External Matching Components for best Low Band Rx Performance	External Matching Components for best High Band Rx Performance
RX1 Port	None	Shunt 1.2pF and Series 2nH
RX2 Port	None	Shunt 1.2pF
TRX1 Port	None	Shunt 1pF and Series 1.2nH
TRX2 Port	None	Shunt 1pF and Series 1.2nH

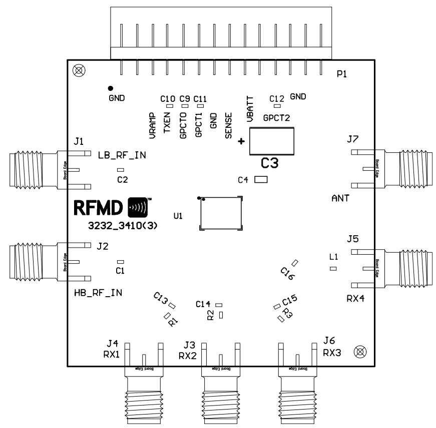
7628 Thorndike Road, Greensboro, NC 27409-9421 · For sales or technical support, contact RFMD at (+1) 336-678-5570 or customerservice@rfmd.com.

Evaluation Board Schematic



Notes: C9, C10, C11, and C12 are optional decoupling capacitors which may not be needed in the application. RX1, RX2, TRX1, and TRX2 usually connect to SAW filters. C13, C14, C15, and C16 are used to match the Rx pins to a 50Ω filter.

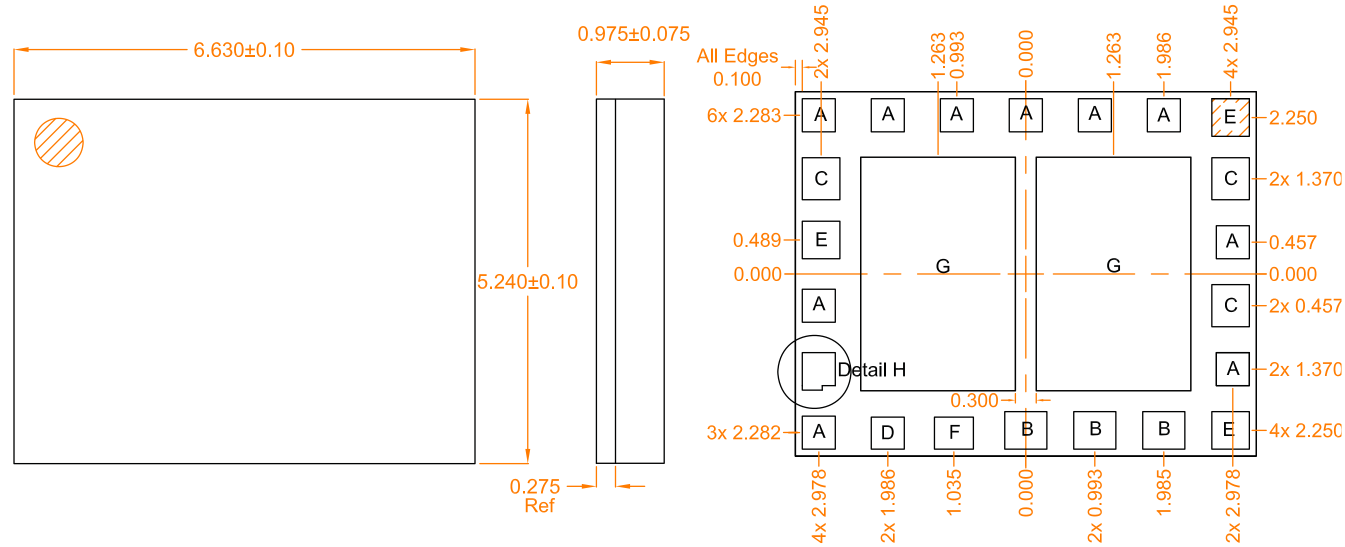
Evaluation Board Layout
Board Size 2.0” x 2.0”

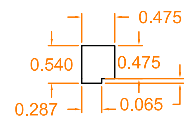


Note: All inputs, outputs, and antenna traces are 50Ω microstrips.

7628 Thorndike Road, Greensboro, NC 27409-9421 · For sales or technical support, contact RFMD at (+1) 336-678-5570 or customerservice@rfmd.com.

Package Drawing





Detail H

A = 0.475 x 0.475(mm)
B = 0.605 x 0.540 (mm)
C = 0.540 x 0.605 (mm)
D = 0.475 x 0.460 (mm)
E = 0.540 x 0.540(mm)
F = 0.560 x 0.460 (mm)
G = 2.225 x 3.360 (mm)

Notes:
1. Shaded area represents Pin 1 location

7628 Thorndike Road, Greensboro, NC 27409-9421 · For sales or technical support, contact RFMD at (+1) 336-678-5570 or customerservice@rfmd.com.

RFMD
rfmd.com

PCB Design Requirements

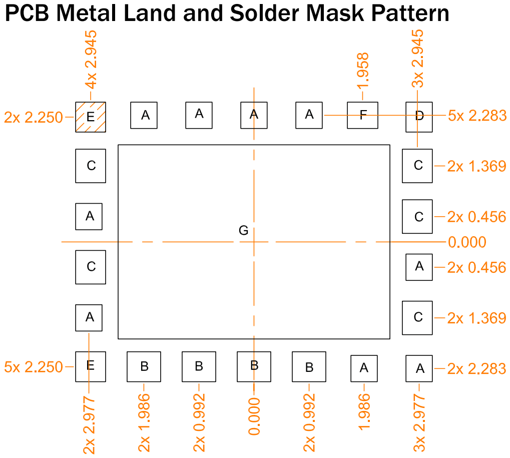
PCB Surface Finish

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

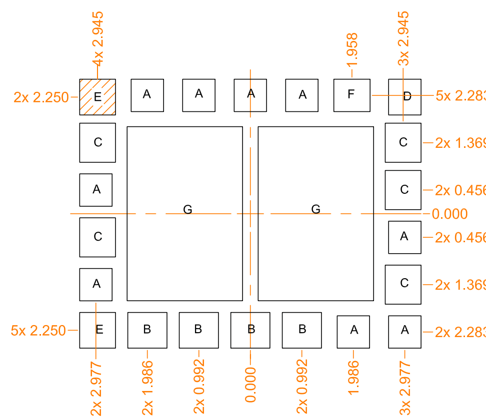
PCB land patterns for RFMD components are based on IPC-7351 standards and RFMD empirical data. The pad pattern shown has been developed and tested for optimized assembly at RFMD. The PCB land pattern has been developed to accommodate lead and package tolerances. Since surface mount processes vary from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

PCB Metal Land and Solder Mask Pattern



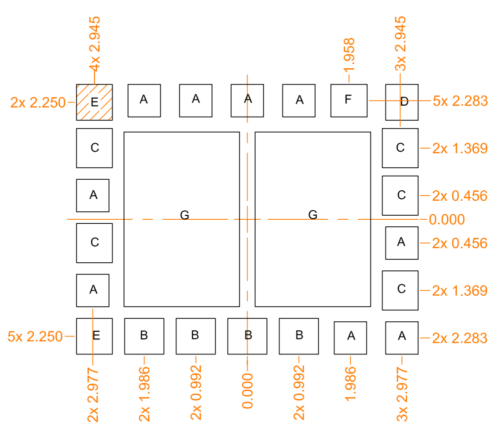
A = 0.475 x 0.475 mm
B = 0.605 x 0.540 mm
C = 0.540 x 0.605 mm
D = 0.475 x 0.540 mm
E = 0.540 x 0.540 mm
F = 0.550 x 0.475 mm
G = 4.900 x 3.500 mm

PCB METAL LAND PATTERN



A = 0.625 x 0.625
B = 0.755 x 0.690
C = 0.690 x 0.755
D = 0.625 x 0.690
E = 0.690 x 0.690
F = 0.700 x 0.625
G = 2.225 x 3.360

PCB SOLDER MASK PATTERN



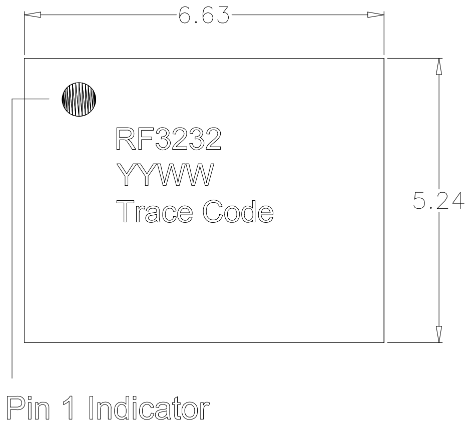
A = 0.625 x 0.625 mm
B = 0.755 x 0.690 mm
C = 0.690 x 0.755 mm
D = 0.625 x 0.690 mm
E = 0.690 x 0.690 mm
F = 0.700 x 0.625 mm
G = 2.225 x 3.360 mm

PCB SOLDER MASK PATTERN

Notes:
1. Shaded area represents Pin 1 location

7628 Thorndike Road, Greensboro, NC 27409-9421 · For sales or technical support, contact RFMD at (+1) 336-678-5570 or customerservice@rfmd.com.

Branding Diagram



Fill in the YYWW Notation with the Date Code
YY = Year
WW = Week

7628 Thorndike Road, Greensboro, NC 27409-9421 · For sales or technical support, contact RFMD at (+1) 336-678-5570 or customerservice@rfmd.com.

Tape and Reel

Carrier tape basic dimensions are based on EIA 481. 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 330mm (13 inches) in diameter or 178mm (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.

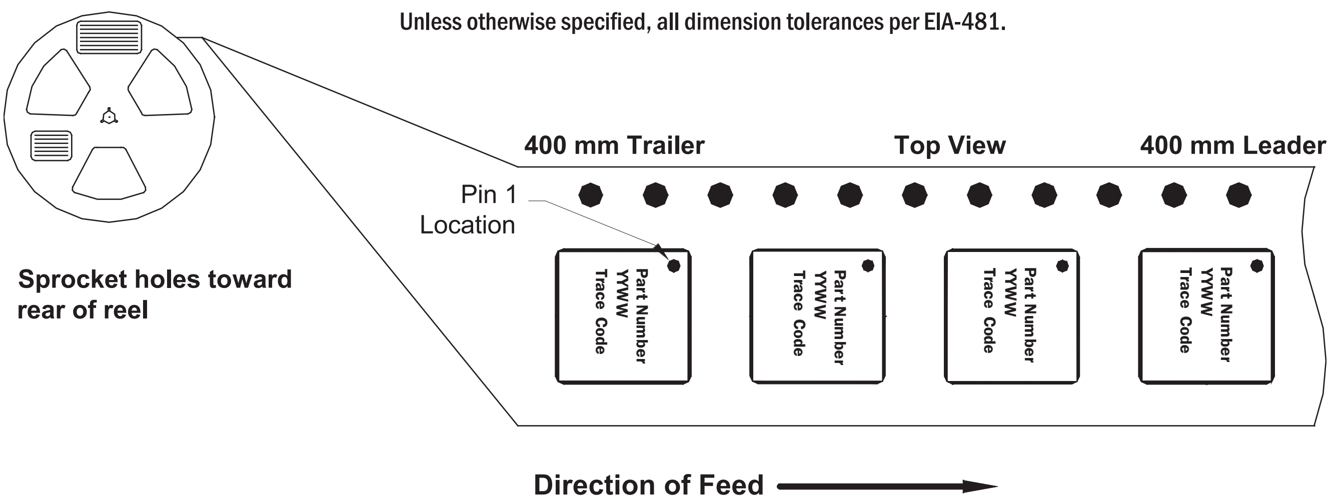
Prior to shipping, moisture sensitive parts (MSL level 2a-5a) are baked and placed into the pockets of the carrier tape. A cover tape is sealed over the top of the entire length of the carrier tape. The reel is sealed in a moisture barrier ESD bag with the appropriate units of desiccant and a humidity indicator card, 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, of Joint Industry Standard IPC/JEDEC J-STD-033.

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

Tape and Reel

RFMD Part Number	Reel Diameter Inch (mm)	Hub Diameter Inch (mm)	Width (mm)	Pocket Pitch (mm)	Feed	Units per Reel
RF3232TR13	13 (330)	4 (102)	12	8	Single	2500
RF3232TR7	7 (178)	2.4 (61)	12	8	Single	750

Unless otherwise specified, all dimension tolerances per EIA-481.



(Carrier Tape Drawing with Part Orientation)

RoHS* Banned Material Content

RoHS Compliant:	Yes
Package total weight in grams (g):	0.121
Compliance Date Code:	-
Bill of Materials Revision:	-
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

7628 Thorndike Road, Greensboro, NC 27409-9421 · For sales or technical support, contact RFMD at (+1) 336-678-5570 or customerservice@rfmd.com.