Features

- Enhanced Performance Transmit Module
- No External Routing
- Enhanced Efficiency at Rated P_{OUT}
  V_{BATT}=3.6V
  GSM850/EGSM900 42%
  DCS1800/PCS1900 36%
- Low RX Insertion Loss
- Symmetrical RX Ports
- 0dBm to 6dBm Drive Level, >50dB of Dynamic Range
- Excellent ESD Protection at Antenna Port: 8kV
- Integrated Power Flattening Circuit
- V_{BATT} Tracking Circuit

Applications

- 3.2V Dual-Band GSM/GPRS Handsets
- GSM850/DCS1900 or EGSM900/DCS1800 Products
- GPRS Class 12 Compliant
- Portable Battery-Powered Equipment
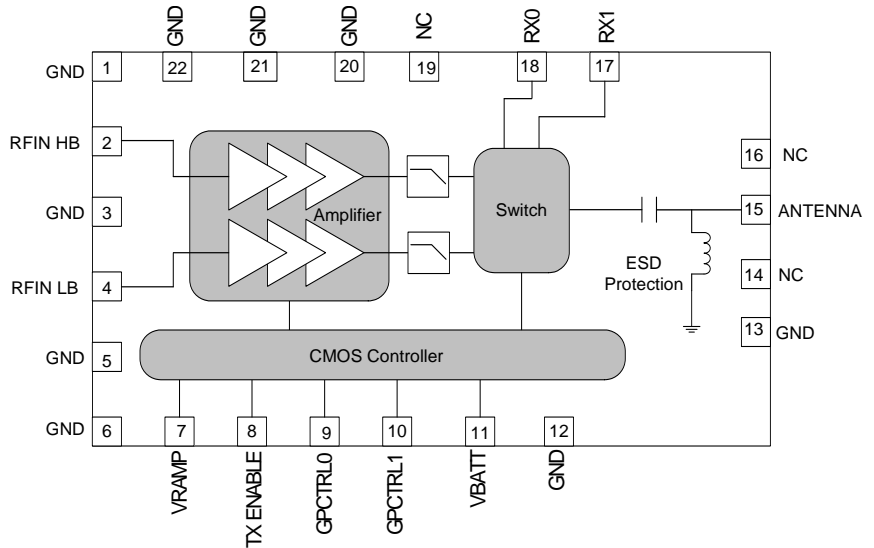
Functional Block Diagram

Product Description

The RF7173 is a dual band (GSM850/PCS1900 or EGSM900/DCS1800) GSM/GPRS Class 12 compliant transmit module with two symmetrical receive ports that has been specifically tuned for better efficiency. 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/PCS1900 or EGSM900/DCS1800 handset and eliminates the need for a PA-to-antenna switch module matching network.

The RF7173 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 RF7173 also integrates an ESD filter to provide excellent ESD protection at the antenna port. The RF7173 is designed to provide maximum efficiency at rated P_{OUT}.

RF7173	Dual-Band GSM850/PCS1900 or EGSM900/DCS1800 Transmit Module
RF7173SB	Transmit Module 5-Piece Sample Pack
RF7173PCBA-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 in Operating Mode	-0.3 to +6.0	V
Supply Voltage in Standby Mode	-0.3 to +6.0	V
Supply Voltage in Idle Mode	-0.3 to +6.0	V
Power Control Voltage (V_{RAMP})	-0.3 to +1.8	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.

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.		
ESD					
ESD RF Ports			1000	V	HBM, JESD22-A114
			500	V	CDM, JEDEC JESD22-C101
ESD Antenna Port			8	KV	IEC 61000-4-2
ESD Any Other Port			1000	V	HBM, JESD22-A114
			500	V	CDM, JEDEC JESD22-C101
Overall Power Control V_{RAMP}					
Power Control "ON"			1.8	V	Max. P_{OUT}
Power Control "OFF"		0.25		V	Min. P_{OUT}
V_{RAMP} Input Capacitance		15	20	pF	DC to 200 kHz
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	3.2	3.6	4.2	V	Operating Limits
Power Supply Current		40	80	μA	$P_{IN} < -30$ dBm, TX Enable = Low, $V_{RAMP} = 0.25V$, Temp = -20 °C to +85 °C, $V_{BATT} = 4.2V$
Overall Control Signals					
GpCtrl0, GpCtrl1 "Low"	0	0	0.5	V	
GpCtrl0, GpCtrl1 "High"	1.25	2.0	VBATT	V	
GpCtrl0, GpCtrl1 "High Current"		1	2	uA	
TX Enable "Low"	0	0	0.5	V	
TX Enable "High"	1.25	2.0	VBATT	V	
TX Enable "High Current"		1	2	uA	
RF Port Input and Output Impedance		50		Ω	

TX ENABLE	GpCtrl1	GpCtrl0	TX Module Mode
0	0	0	Low Power Mode (Stand-by)
0	1	0	RX 0
0	1	1	RX 1
1	1	0	GSM900 TX Mode
1	1	1	DCS1800 TX Mode

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Parameter	Specification			Unit	Condition
	Min.	Typ.	Max.		
GSM850 Band					Nominal conditions unless otherwise stated. All unused ports are terminated. $V_{BATT}=3.6V$, $P_{IN}=3\,dBm$, Temp=+25°C, TX Enable=High, $V_{RAMP}=1.8V$ TX Mode: GpCtrl1=High, GpCtrl0=Low, Duty Cycle=25%, Pulse Width=1154 µs
Operating Frequency Range	824		849	MHz	
Input Power	0	3	6	dBm	Full P_{OUT} guaranteed at minimum drive level.
Input VSWR		1.9:1	3.0:1		Over P_{OUT} range (5 dBm to 32.7 dBm)
Maximum Output Power	32.7	33.7		dBm	Nominal conditions.
	31	33.6		dBm	$V_{BATT}=3.2V$ to 4.2V, $P_{IN}=0\,dBm$ to 6 dBm, Temp=-20°C to +85°C, Duty Cycle=50%, Pulse Width=2308 µs, $V_{RAMP}\leq1.8V$
Minimum Power into 3:1 VSWR	30	31.2		dBm	Nominal conditions.
Supply Current at Rated Power	1.18	1.27	1.39	A	Nominal Conditions: $V_{RAMP}=V_{RAMP\_RATED\ V}$ for $P_{OUT}=32.7\,dBm$
Efficiency	36	42		%	Set $V_{RAMP}=V_{RAMP}$ rated for $P_{OUT}=32.7\,dBm$
2nd Harmonic		-40*	-33	dBm	$V_{RAMP}=V_{RAMP}$ rated for $P_{OUT}=32.7\,dBm$. *Typical value measured from worst case harmonic frequency across the band.
3rd Harmonic		-40*	-33	dBm	$V_{RAMP}=V_{RAMP}$ rated for $P_{OUT}=32.7\,dBm$. *Typical value measured from worst case harmonic frequency across the band.
All other harmonics up to 12.75 GHz		-40	-33	dBm	$V_{RAMP}=V_{RAMP}$ rated for $P_{OUT}=32.7\,dBm$
Non-Harmonic Spurious up to 12.75 GHz			-36	dBm	$V_{RAMP}=V_{RAMP}$ rated for $P_{OUT}=32.7\,dBm$, also over all power levels (5 dBm to 32.7 dBm)
Forward Isolation 1		-61	-41	dBm	TX Enable=Low, $P_{IN}=6\,dBm$, $V_{RAMP}=0.25V$
Forward Isolation 2		-27	-15	dBm	TX Enable=High, $P_{IN}=6\,dBm$, $V_{RAMP}=0.25V$
Output Noise Power		-89	-82	dBm	869 MHz to 894 MHz, $V_{RAMP}=V_{RAMP\ RATED}$ for $P_{OUT}=32.7\,dBm$, RBW=100 kHz
		-118	-74	dBm	1930 MHz to 1990 MHz, $V_{RAMP}=V_{RAMP\ RATED}$ for $P_{OUT}=32.7\,dBm$, RBW=100 kHz
Output Load VSWR Stability (Spurious Emissions)			-36	dBm	VSWR=12:1; all phase angles (Set $V_{RAMP}=V_{RAMP}$ rated for $P_{OUT}\leq32.7\,dBm$ into 50Ω load; Temp=-30°C to +85°C, $V_{BATT}=3.2V$ to 4.2V, $P_{IN}=0\,dBm$ to 6 dBm; load switched to VSWR=12:1)
Output Load VSWR Ruggedness	No damage or permanent degradation to device				VSWR=20:1; all phase angles (Set $V_{RAMP}=V_{RAMP}$ rated for $P_{OUT}=32.7\,dBm$ into 50Ω load; Temp=-30°C to +85°C, $V_{BATT}=3.2V$ to 4.2V, $P_{IN}=0\,dBm$ to 6 dBm; load switched to VSWR=20:1)

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Parameter	Specification			Unit	Condition
	Min.	Typ.	Max.		
GSM900 Band					Nominal conditions unless otherwise stated. All unused ports are terminated. $V_{BATT}=3.6V$, $P_{IN}=3\,dBm$, Temp=+25°C, TX Enable=High, $V_{RAMP}=1.8V$ TX Mode: GpCtrl1=High, GpCtrl0=Low, Duty Cycle=25%, Pulse Width=1154μs
Operating Frequency Range	880		915	MHz	
Input Power	0	3	6	dBm	Full P_{OUT} guaranteed at minimum drive level.
Input VSWR		1.9:1	3.0:1		Over P_{OUT} range (5dBm to 32.7dBm)
Maximum Output Power	32.7	33.7		dBm	Duty Cycle=25%, Pulse Width=1154μs
	31	33.7		dBm	$V_{BATT}=3.2V$ to 4.2V, $P_{IN}=0dBm$ to 6dBm, Temp=-20°C to +85°C, Duty Cycle=50%, Pulse Width=2308μs, $V_{RAMP}\leq1.8V$
Minimum Power into 3:1 VSWR	30	31.2		dBm	Nominal conditions.
Supply Current at Rated Power	1.18	1.27	1.39	A	Nominal Conditions: $V_{RAMP}=V_{RAMP\_RATED\ V}$ for $P_{OUT}=32.7\,dBm$
Efficiency	36	42		%	Set $V_{RAMP}=V_{RAMP}$ rated for $P_{OUT}=32.7\,dBm$
2nd Harmonic		-40*	-33	dBm	$V_{RAMP}=V_{RAMP}$ rated for $P_{OUT}=32.7\,dBm$. *Typical value measured from worst case harmonic frequency across the band.
3rd Harmonic		-40*	-33	dBm	$V_{RAMP}=V_{RAMP}$ rated for $P_{OUT}=32.7\,dBm$. *Typical value measured from worst case harmonic frequency across the band.
All other harmonics up to 12.75GHz		-40	-33	dBm	$V_{RAMP}=V_{RAMP}$ rated for $P_{OUT}=32.7\,dBm$
Non-Harmonic Spurious up to 12.75GHz			-36	dBm	$V_{RAMP}=V_{RAMP}$ rated for $P_{OUT}=32.7\,dBm$, also over all power levels (5dBm to 32.7dBm)
Forward Isolation 1		-54	-41	dBm	TX Enable=Low, $P_{IN}=6dBm$, $V_{RAMP}=0.25V$
Forward Isolation 2		-28	-15	dBm	TX Enable=High, $P_{IN}=6dBm$, $V_{RAMP}=0.25V$
Output Noise Power					
925MHz to 935MHz		-87	-77	dBm	$V_{RAMP}=V_{RAMP}$ rated for $P_{OUT}=32.7\,dBm$, RBW=100kHz
935MHz to 960MHz		-87	-83	dBm	
1805MHz to 1880MHz		-118	-87	dBm	
Output Load VSWR Stability (Spurious Emissions)			-36	dBm	VSWR=12:1; all phase angles (Set $V_{RAMP}=V_{RAMP}$ rated for $P_{OUT}\leq32.7\,dBm$ into 50Ω load; Temp=-30°C to +85°C, $V_{BATT}=3.2V$ to 4.2V, $P_{IN}=0dBm$ to 6dBm; load switched to VSWR=12:1)
Output Load VSWR Ruggedness	No damage or permanent degradation to device				VSWR=20:1; all phase angles (Set $V_{RAMP}=V_{RAMP}$ rated for $P_{OUT}=32.7\,dBm$ into 50Ω load; Temp=-30°C to +85°C, $V_{BATT}=3.2V$ to 4.2V, $P_{IN}=0dBm$ to 6dBm; load switched to VSWR=20:1)

Parameter	Specification			Unit	Condition
	Min.	Typ.	Max.		
DCS1800 Band					Nominal conditions unless otherwise stated. All unused ports are terminated. V_{BATT}=3.6V, P_{IN}=3dBm, Temp=+25°C, TX Enable=High, V_{RAMP}=1.8V TX Mode: GpCtrl1=High, GpCtrl0=High, Duty Cycle=25%, Pulse Width=1154µs
Operating Frequency Range	1710		1785	MHz	
Input Power	0	3	6	dBm	Full P_{OUT} guaranteed at minimum drive level.
Input VSWR		1.2:1	2.5:1		Over P_{OUT} range (0dBm to 30dBm)
Maximum Output Power	30.0	32		dBm	Duty Cycle=25%, Pulse Width=1154µs
	28	32		dBm	V_{BATT}=3.2V to 4.2V, P_{IN}=0dBm to 6dBm, Temp=-20°C to +85°C, Duty Cycle=50%, Pulse Width=2308µs, $V_{RAMP} \leq$1.8V
Minimum Power into 3:1 VSWR	27	28.7		dBm	Nominal conditions.
Supply Current at Rated Power	0.72	0.79	0.89	A	Nominal Conditions: V_{RAMP}=$V_{RAMP\_RATED V}$ for P_{OUT}=30dBm
Efficiency	32	36		%	Set V_{RAMP}=V_{RAMP} rated for P_{OUT}=30dBm
2nd Harmonic		-39*	-33	dBm	V_{RAMP}=V_{RAMP} rated for P_{OUT}=30dBm. *Typical value measured from worst case harmonic frequency across the band.
3rd Harmonic		-46*	-33	dBm	V_{RAMP}=V_{RAMP} rated for P_{OUT}=30dBm. *Typical value measured from worst case harmonic frequency across the band.
4th and 5th Harmonics		-35*	-28	dBm	V_{RAMP}=V_{RAMP} rated for P_{OUT}=30dBm. *Typical value measured from worst case harmonic frequency across the band. See Application Schematic for suggested external LPF.
All other harmonics up to 12.75GHz		-36	-33	dBm	V_{RAMP}=V_{RAMP} rated for P_{OUT}=30dBm
Non-Harmonic Spurious up to 12.75GHz			-36	dBm	V_{RAMP}=V_{RAMP} rated for P_{OUT}=30dBm, also over all power levels (0dBm to 30dBm)
Forward Isolation 1		-61	-51	dBm	TX Enable=Low, P_{IN}=6dBm, V_{RAMP}=0.25V
Forward Isolation 2		-28	-15	dBm	TX Enable=High, P_{IN}=6dBm, V_{RAMP}=0.25V
Output Noise Power					
925MHz to 935MHz		-102	-77	dBm	V_{RAMP}=V_{RAMP} rated for P_{OUT}=30dBm, RBW=100kHz
935MHz to 960MHz		-102	-83	dBm	
1805MHz to 1880MHz		-93	-79	dBm	
Output Load VSWR Stability (Spurious Emissions)			-36	dBm	VSWR=12:1; all phase angles (Set V_{RAMP}=V_{RAMP} rated for $P_{OUT} \leq$30dBm into 50Ω load; Temp=-30°C to +85°C, V_{BATT}=3.2V to 4.2V, P_{IN}=0dBm to 6dBm; load switched to VSWR=12:1)
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; Temp=-30°C to +85°C, V_{BATT}=3.2V to 4.2V, P_{IN}=0dBm to 6dBm; load switched to VSWR=20:1)

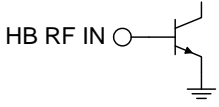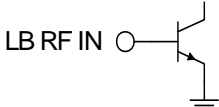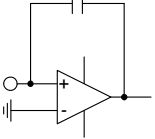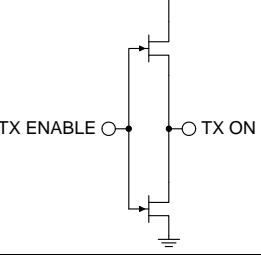DS100121

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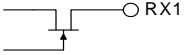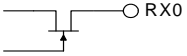
Parameter	Specification			Unit	Condition
	Min.	Typ.	Max.		
PCS1900 Band					Nominal conditions unless otherwise stated. All unused ports are terminated. V_{BATT}=3.6V, P_{IN}=3dBm, Temp=+25°C, TX Enable=High, V_{RAMP}=1.8V TX Mode: GpCtrl1=High, GpCtrl0=High, Duty Cycle=25%, Pulse Width=1154µs
Operating Frequency Range	1850		1910	MHz	
Input Power	0	3	6	dBm	Full P_{OUT} guaranteed at minimum drive level.
Input VSWR		1.3:1	2.5:1		Over P_{OUT} range (0dBm to 30dBm)
Maximum Output Power	30	31.8		dBm	Nominal conditions.
	28	31.7		dBm	V_{BATT}=3.2V to 4.2V, P_{IN}=0dBm to 6dBm, Temp=-20°C to +85°C, Duty Cycle=50%, Pulse Width=2308µs, V_{RAMP}≤1.8V
Minimum Power into 3:1 VSWR	27	28.6		dBm	Nominal conditions.
Supply Current at Rated Power	0.68	0.75	0.89	A	Nominal Conditions: V_{RAMP}=V_{RAMP_RATED} V for P_{OUT}=30dBm
Efficiency	32	36		%	Set V_{RAMP}=V_{RAMP} rated for P_{OUT}=30dBm
2nd Harmonic		-40*	-33	dBm	V_{RAMP}=V_{RAMP} rated for P_{OUT}=30dBm. *Typical value measured from worst case harmonic frequency across the band.
3rd Harmonic		-40*	-33	dBm	V_{RAMP}=V_{RAMP} rated for P_{OUT}=30dBm. *Typical value measured from worst case harmonic frequency across the band.
4th and 5th Harmonics		-33*	-28	dBm	V_{RAMP}=V_{RAMP} rated for P_{OUT}=30dBm. *Typical value measured from worst case harmonic frequency across the band. See Application Schematic for suggested external LPF.
All other harmonics up to 12.75GHz		-45	-33	dBm	V_{RAMP}=V_{RAMP} rated for P_{OUT}=30dBm
Non-Harmonic Spurious up to 12.75GHz			-36	dBm	V_{RAMP}=V_{RAMP} rated for P_{OUT}=30dBm, also over all power levels (0dBm to 30dBm)
Forward Isolation 1		-64	-51	dBm	TX Enable=Low, P_{IN}=6dBm, V_{RAMP}=0.25V
Forward Isolation 2		-28	-15	dBm	TX Enable=High, P_{IN}=6dBm, V_{RAMP}=0.25V
Output Noise Power		-100	-82	dBm	869MHz to 894MHz, V_{RAMP}=$V_{RAMP\ RATED}$ for P_{OUT}=30dBm, RBW=100kHz
		-91	-74	dBm	1930MHz to 1990MHz, V_{RAMP}=$V_{RAMP\ RATED}$ for P_{OUT}=30dBm, RBW=100kHz
Output Load VSWR Stability (Spurious Emissions)			-36	dBm	VSWR=12:1; all phase angles (Set V_{RAMP}=V_{RAMP} rated for P_{OUT}≤30dBm into 50Ω load; Temp=-30°C to +85°C, V_{BATT}=3.2V to 4.2V, P_{IN}=0dBm to 6dBm; load switched to VSWR=12:1)
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; Temp=-30°C to +85°C, V_{BATT}=3.2V to 4.2V, P_{IN}=0dBm to 6dBm; load switched to VSWR=20:1)

Parameter	Specification			Unit	Condition
	Min.	Typ.	Max.		
RX Section					Nominal conditions unless otherwise stated. V_{BATT}=3.6V, P_{IN}=3dBm, Temp=+25°C, TX Enable=Low, V_{RAMP}=1.8V. RX0 mode: GpCtrl1=High, GpCtrl0=Low. RX1 mode: GpCtrl1=High, GpCtrl0=High, RX LB Freq=869MHz to 894MHz or 925MHz to 960MHz, RX HB Freq=1805MHz to 1880MHz or 1930MHz to 1990MHz
Insertion Loss GSM850/EGSM900 ANT-RX0/ RX1		1.1	1.3	dB	RX LB Freq. See Note 1.
In-Band Ripple GSM850/EGSM900 ANT-RX0/RX1		0.05	0.1	dB	RX LB Freq.
Input VSWR GSM850/EGSM900 ANT-RX0/RX1		1.5:1	1.8:1		RX LB Freq.
Insertion Loss DCS1800/PCS1900 ANT-RX0/RX1		1.1	1.6	dB	RX HB Freq. See Note 1.
In-Band Ripple DCS1800/PCS1900 ANT-RX0/RX1		0.1	0.2	dB	RX HB Freq.
Input VSWR DCS1800/PCS1900 ANT-RX0/RX1		1.5:1	1.8:1		RX HB Freq.
TX Section					
Switch Leakage P_{OUT} at RX Port GSM850/EGSM900 ANT-RX0/RX1		-1	8	dBm	GSM850 TX mode: Freq=824MHz to 849MHz or EGSM900 TX mode: Freq=880MHz to 915MHz. GpCtrl1=High, GpCtrl0=Low, V_{RAMP}=V_{RAMP} rated for P_{OUT}=32.7dBm at antenna port. See Note 2.
Switch Leakage P_{OUT} at RX Port DCS1800/PCS1900 ANT-RX0/RX1		3	6	dBm	DCS1800 TX mode: Freq=1710MHz to 1785MHz or PCS1900TX mode: Freq=1850MHz to 1910MHz. GpCtrl1=High, GpCtrl0=High, V_{RAMP}=V_{RAMP} rated for P_{OUT}=30dBm at antenna port. See Note 2.

Note 1: The insertion loss values listed are measured into 50Ω without matching. Improved performance can be obtained by properly matching the antenna/receiver ports.
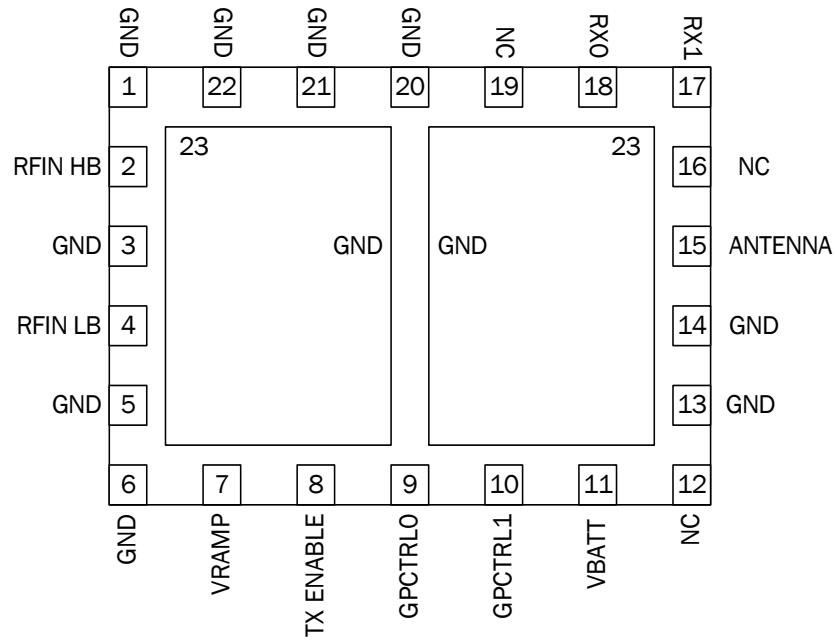Note 2: Isolation specification set to ensure at least the following isolation at rated power:
Calculation Example using typical values: P_{OUT} at Antenna-P_{OUT} at RX Port. Isolation LB=32.7-(-1)=33.7dB, HB=30-3=27dB.

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Pin	Function	Description	Interface Schematic
1	GND		
2	RFIN HB	RF input to the DCS1800/PCS1900 band. This is a 50Ω input.	HB RF IN
3	GND		
4	RFIN LB	RF input to the GSM850/EGSM900 band. This is a 50Ω input.	LB RF IN
5	GND		
6	GND		
7	VRAMP	V_{RAMP} ramping signal from DAC. A simple RC filter is integrated into the RF7173 module. V_{RAMP} may or may not require additional filtering depending on the baseband selected.	
8	TX ENABLE	This signal enables the PA module for operation with a logic high. The switch is put in TX mode determined by GpCtrl0 and GpCtrl1.	TX ENABLE TX ON
9	GPCTRL0	Control pin that together with GpCtrl1 selects band of operation.	
10	GPCTRL1	Control pin that together with GpCtrl0 selects band of operation.	
11	VBATT	Power supply for the module. This should be connected to the battery terminal using as wide a trace as possible.	
12	NC		
13	GND		
14	GND		
15	ANTENNA	Antenna port.	
16	NC		
17	RX1	RX1 port of antenna switch. This is a 50Ω output. RX1 is interchangeable with RX0.	RX1
18	RX0	RX0 port of antenna switch. This is a 50Ω output. RX0 is interchangeable with RX1.	RX0
19	NC		
20	GND		
21	GND		
22	GND		
23	GND		

Pin Out
(Top View)

GND	GND	GND	GND	NC	RX0	RX1
1	22	21	20	19	18	17

RFIN HB | 2 ... 23 ... GND ... GND ... 23 | 16 | NC

GND | 3 | 15 | ANTENNA

RFIN LB | 4 | 14 | GND

GND | 5 | 13 | GND

6	7	8	9	10	11	12
GND	VRAMP	TX ENABLE	GPCTRL0	GPCTRL1	VBATT	NC

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Theory of Operation

Product Description

The RF7173 is a dual-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 and two symmetrical RX ports allowing dual-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.

Overview

The RF7173 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. The 2 RX ports are symmetrical, they can be used either as GSM850/EGSM900 or DCS1800/PCS1900. To control the mode of operation, there are three logic control signals: TX Enable, GpCtrl0, and GpCtrl1. RF7173 offers high efficiency at the rated P_{OUT} as backed-off efficiency is improved in this TXM.

Power Ramping and Timing

The RF7173 should be powered on according to the power-on sequence below. It is designed to prevent operation of the amplifier under conditions that could cause damage to the device or erratic operation.

There are some setup times associated with the control signals of the RF7173. The most important of these is the settling time between TXEN going high and when VRAMP can begin to increase. This time is often referred to as the "pedestal" and is required so that the internal power control loop and bias circuitry can settle after being turned on. The RF7173 requires at least two μs or two quarter-bit times for proper settling of the power control loop.

The power-down sequence is in opposite order of the power-on sequence. As described in the figure below, V_{BATT} is applied first to provide bias to the silicon control chip. Then the RF drive is applied. Finally, when TXEN is high, The V_{RAMP} signal is held at a constant 0.25V, and two μs later, V_{RAMP} begins to ramp up. The shape of V_{RAMP} is important for maintaining the switching transients. The basic shape of the ramping function should be raised cosine to achieve best transient performance.

GMSK Power On/Off Sequence
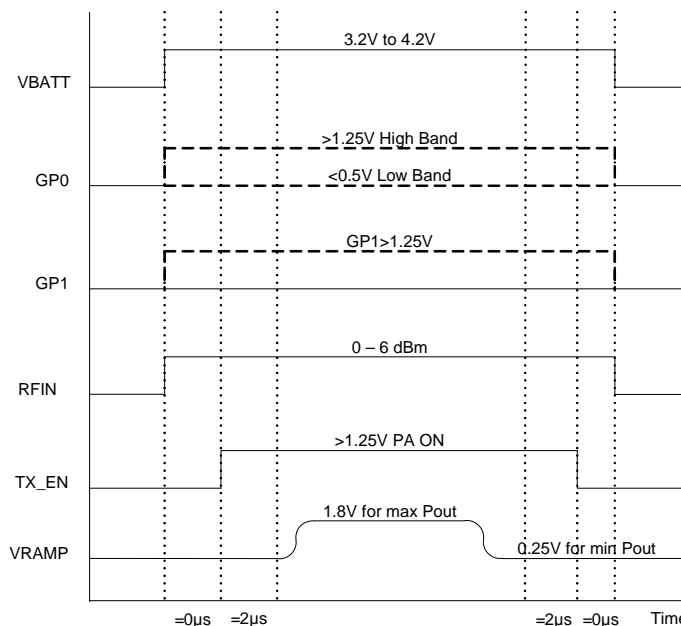
Power On Sequence:
1. Apply VBATT
2. Apply GP0/GP1
3. Apply RFIN
4. Apply TX_EN
5. Ramp VRAMP for desired output power

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.

Power Flattening and V_{BATT} Tracking

The RF7173 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 RF7173 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.

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Application Schematic
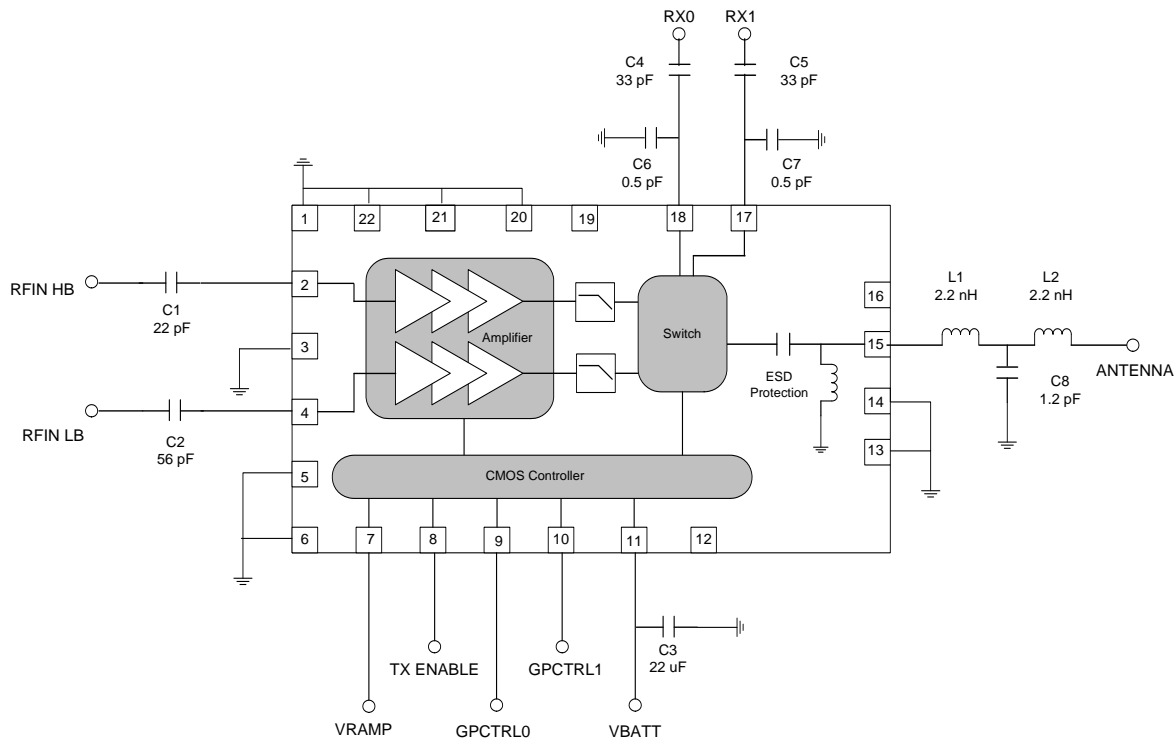
*All inputs, outputs, and antenna traces are 50Ω microstrip.

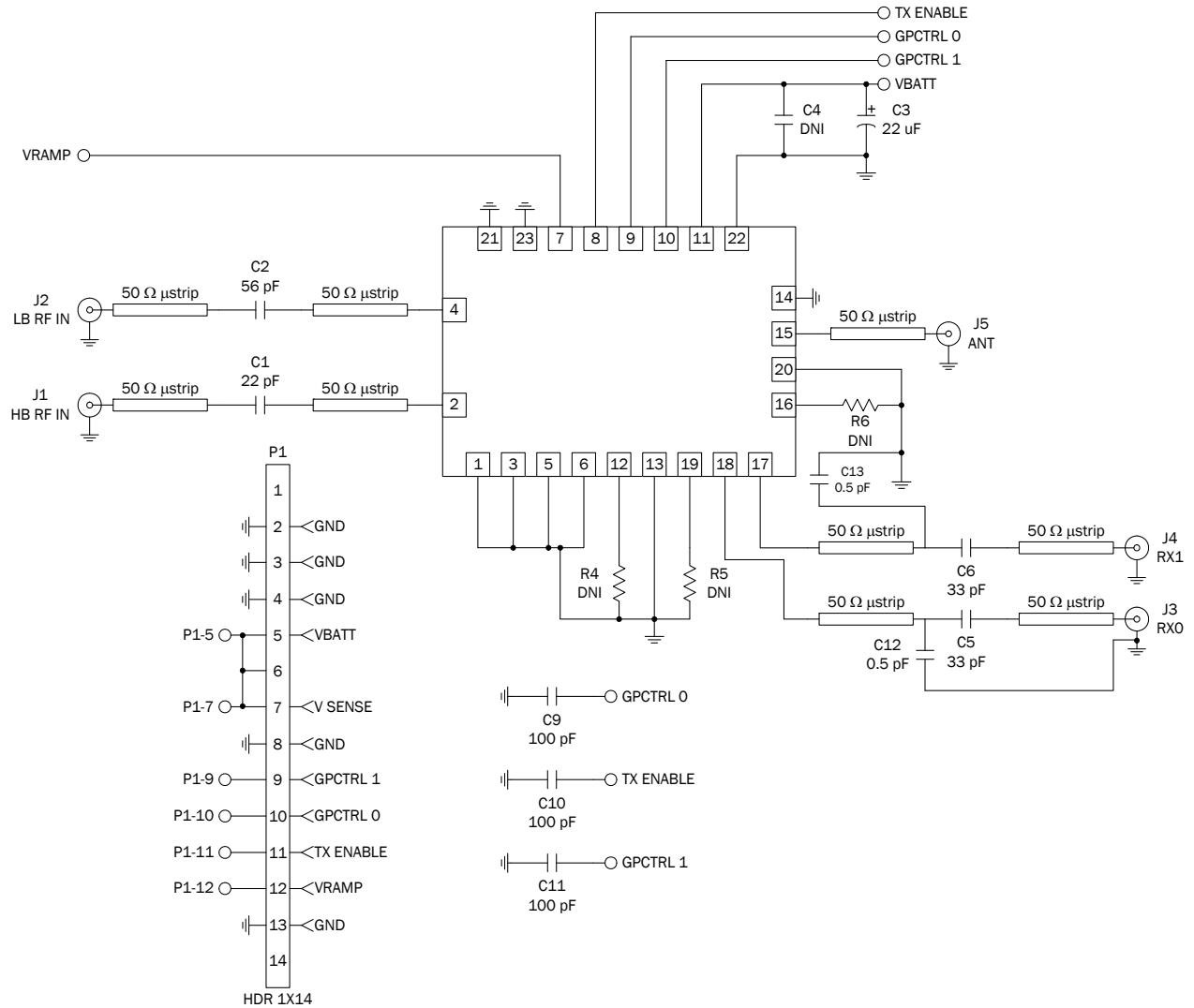**VBATT capacitor value may change depending on application.

***RX0 and RX1 usually connect to SAW filters; C4 and C5 are used to block DC voltage present on the RX ports. C6 and C7 are used to match the RX port to a 50Ω filter.
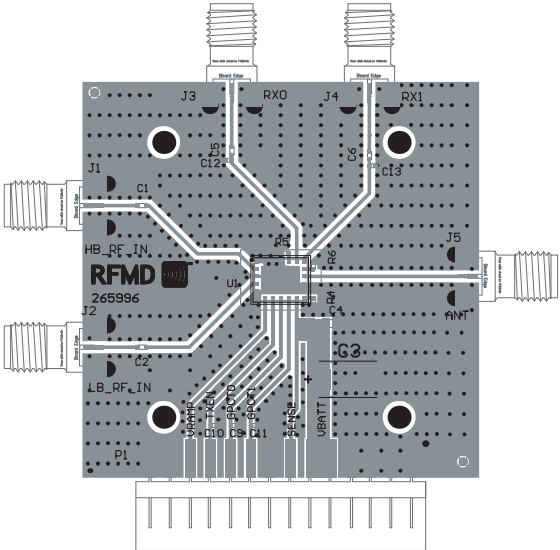
****If placing an attenuation network on the input to the power amplifier, ensure that it is positioned on the transceiver side of capacitor C1 (or C2) to prevent adversely affecting the base bias of the power amplifier.

*****L1, L2, and C8 are suggested external LPF to suppress higher order harmonics. Actual component values will depend on the application.

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Evaluation Board Schematic

TX ENABLE
GPCTRL 0
GPCTRL 1
VBATT

C4 DNI   C3 22 uF

VRAMP

21 23 7 8 9 10 11 22

C2 56 pF
J2 LB RF IN   50 Ω μstrip   50 Ω μstrip   4

14
15   50 Ω μstrip   J5 ANT
20
16   R6 DNI

C1 22 pF
J1 HB RF IN   50 Ω μstrip   50 Ω μstrip   2

C13 0.5 pF

P1

1 3 5 6 12 13 19 18 17

50 Ω μstrip   C6 33 pF   50 Ω μstrip   J4 RX1

1
2 GND
3 GND
4 GND
P1-5 5 VBATT
6
P1-7 7 V SENSE
8 GND
P1-9 9 GPCTRL 1
P1-10 10 GPCTRL 0
P1-11 11 TX ENABLE
P1-12 12 VRAMP
13 GND
14
HDR 1X14

R4 DNI   R5 DNI

50 Ω μstrip   50 Ω μstrip   J3 RX0
C12 0.5 pF   C5 33 pF

C9 100 pF   GPCTRL 0

C10 100 pF   TX ENABLE

C11 100 pF   GPCTRL 1

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Evaluation Board Layout
Board Size 2.0" x 2.0"

Package Drawing

A = 0.475 (mm) Sq Typ
B = 0.605 x 0.540 (mm) Typ
C = 0.540 x 0.605 (mm) Typ
D = 0.475 x 0.540 (mm)
E = 0.540 (mm) Sq Typ
F = 0.540 x 0.475 (mm)
G = 2.225 x 3.360 (mm) Typ
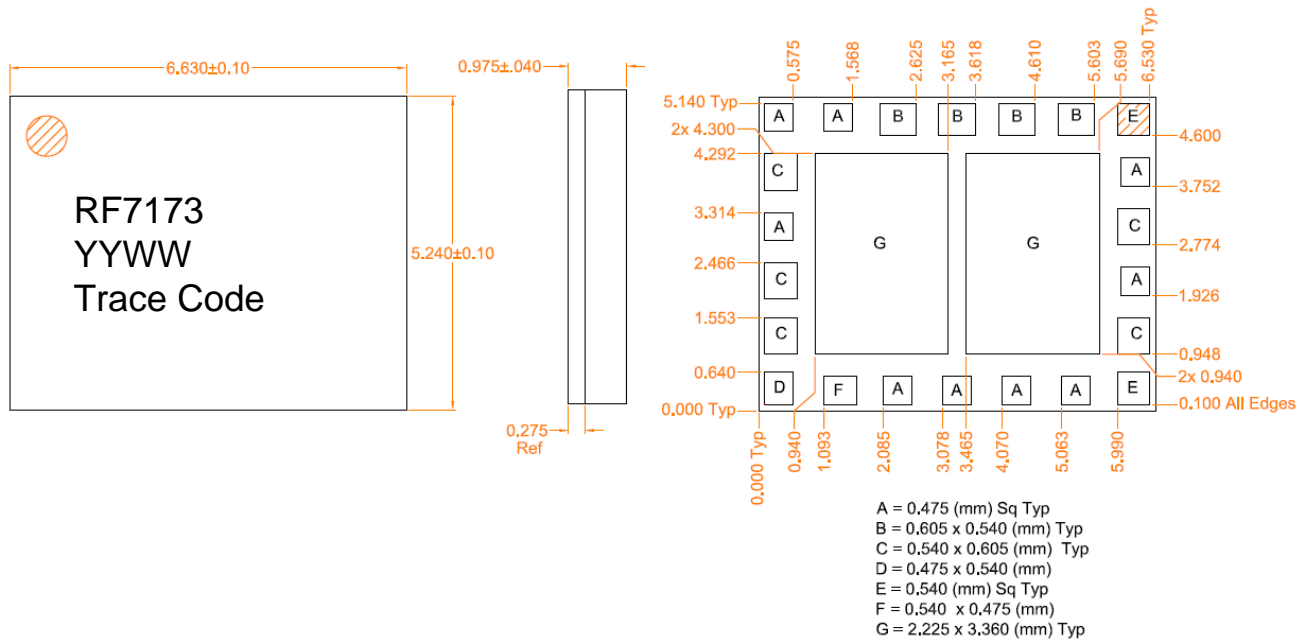
Notes:

YY indicates year, WW indicates work week, and Trace Code is a sequential number assigned at device assembly.

Shaded areas represent Pin 1 location.

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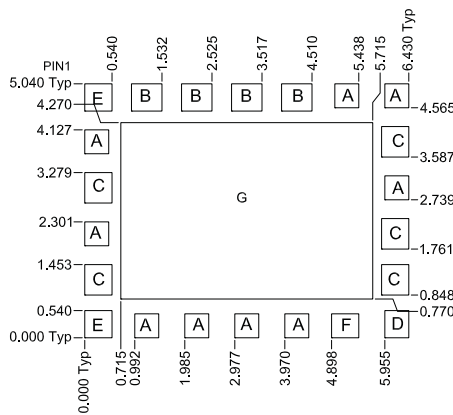
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PCB Design Requirements

PCB Surface Finish

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

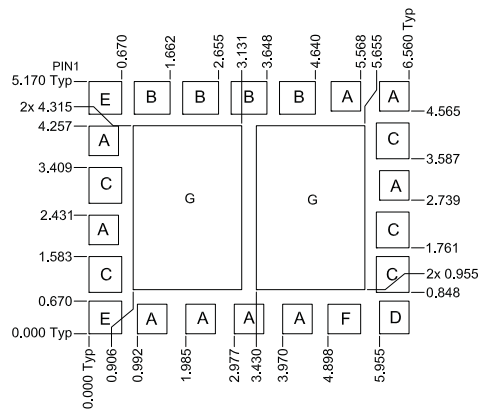**PCB Land Pattern Recommendation**

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.
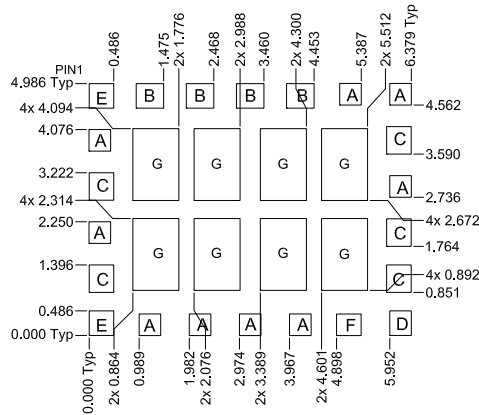
PCB Metal Land and Solder Mask Pattern

A = 0.475 mm Sq Typ
B = 0.605 x 0.540 mm Typ
C = 0.540 x 0.605 mm Typ
D = 0.475 x 0.540 mm
E = 0.540 mm Sq Typ
F = 0.540 x 0.475 mm
G = 5.000 x 3.500 mm

PCB METAL LAND PATTERN

A = 0.605 mm Sq Typ
B = 0.735 x 0.670 mm Typ
C = 0.670 x 0.735 mm Typ
D = 0.605 x 0.670 mm
E = 0.670 mm Sq Typ
F = 0.670 x 0.605 mm
G = 2.225 x 3.360 mm Typ

PCB SOLDER MASK PATTERN

A = 0.428 mm Sq Typ
B = 0.544 x 0.486 mm Typ
C = 0.486 x 0.544 mm Typ
D = 0.428 x 0.486 mm
E = 0.486 mm Sq Typ
F = 0.486 x 0.428 mm
G = 0.911 x 1.422 mm Typ

PCB STENCIL PATTERN

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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 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 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
RF7173TR13	13 (330)	4 (102)	12	8	Single	2500
RF7173TR7	7 (178)	2.4 (61)	12	8	Single	750

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

Sprocket holes toward rear of reel

400 mm Trailer   Top View   400 mm Leader

Pin 1 Location

Part Number YYWW Trace Code

Direction of Feed →
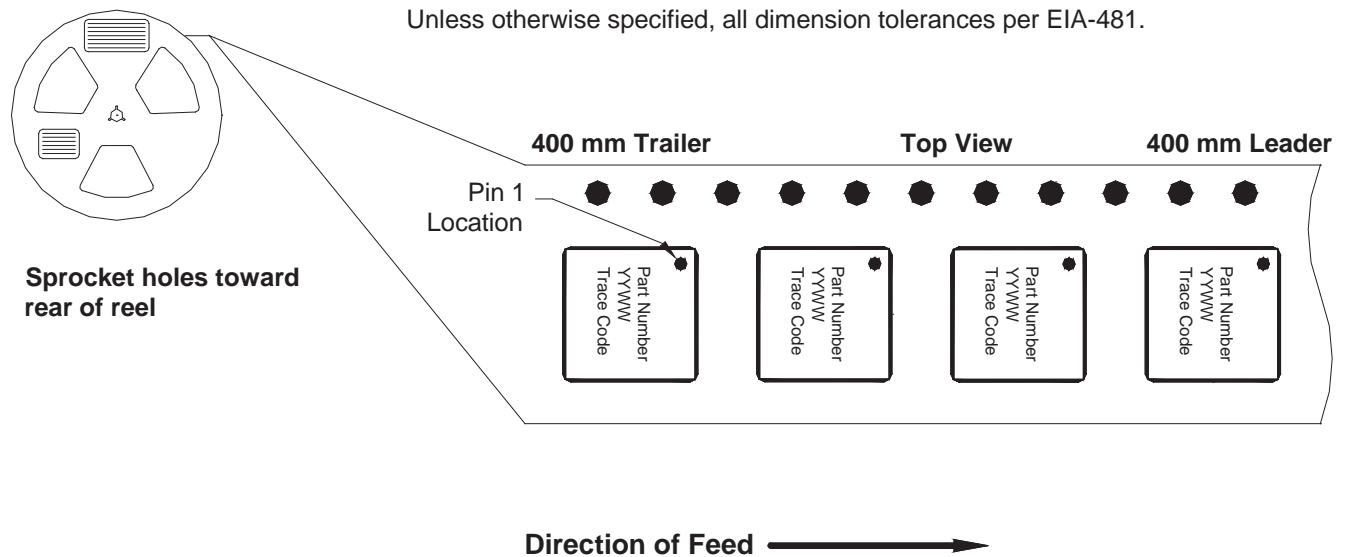
Figure 1. 5.24 mm x 6.63 mm (Carrier Tape Drawing with Part Orientation)

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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

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