RTM7916-61 Datasheet

Issue V1.7

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1 General Description

The RTM7916-61 Transmit/Receive Front End Module (FEM) supports Class 12 GPRS, EDGE multi-slot operation, and TD-SCDMA/TDD-LTE linear transmission. Fourteen transmit/receive (TRx) ports and an integrated directional coupler enables broadband 3G/4G RF switch-through.

The module consists of a CMOS controller, a low-band PA block supporting GSM850/900 bands, a high-band PA block supporting DCS1800/PCS1900, TD-SCDMA bands 34/39, and TDD-LTE band 34/39, input/output matching network, Tx harmonic filtering, RF switching, and a directional coupler at the antenna output. The low-current PA controller includes the MIPI RFFE and decoder circuitry.

Selecting the linear GMSK operation disables VRAMP input so all PA biasing depends only on MIPI mode selection. The transmitted envelope is a linear function of RF input.

1.1 Features

- Small, low profile package
  - 5.5mm ×5.3mm ×0.84mm
  - 38-pad configuration
- Fully programmable MIPI RFFE control
- Fourteen low insertion loss/high linearity TRx switch ports
- Built-in IEC-compliant antenna ESD protection
- Integrated broadband directional coupler
- High efficiency
  - 38% GSM850
  - 37% GSM900
  - 32% DCS1800
  - 31% PCS1900
- Wide GSMK input power range: -1dBm to 6dBm
- Input/Output matched internally to 50Ω
- Power control circuitry built-in for improved TRP variation

1.2 Applications

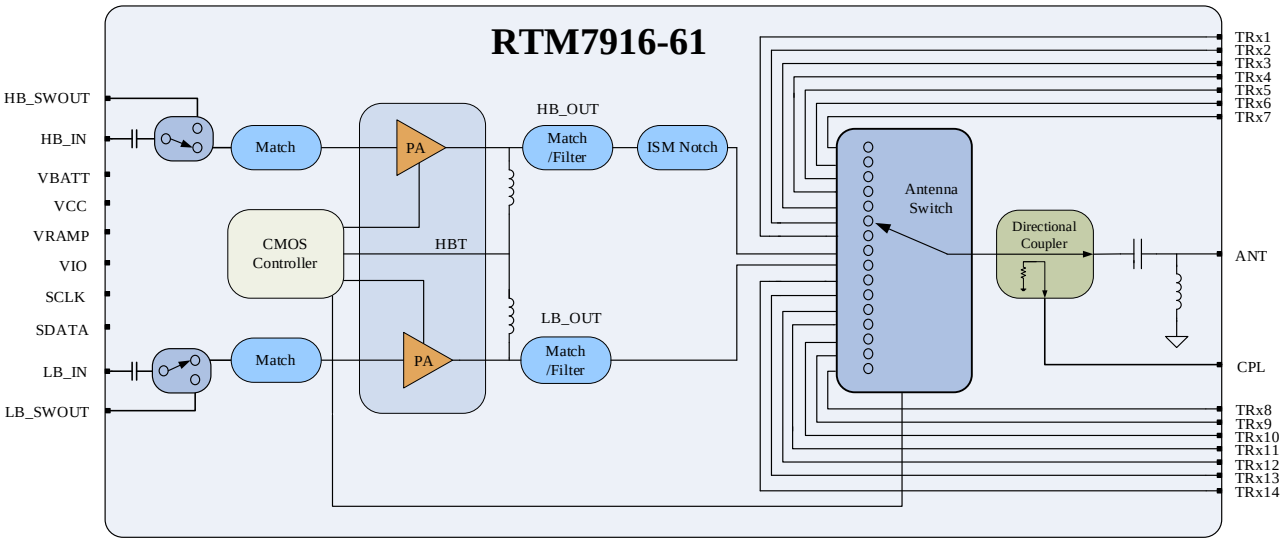
Cellular handsets encompassing Quad-Band GSM/EDGE, Dual-Band TD-SCDMA and TDD-LTE

- Class 4 GSM850/900
- Class 1 DCS1800/PCS1900
- Class 12 GPRS multi-slot operation
- Linear EDGE operation
- TD-SCDMA Bands 34/39

- TDD-LTE Band 34/39

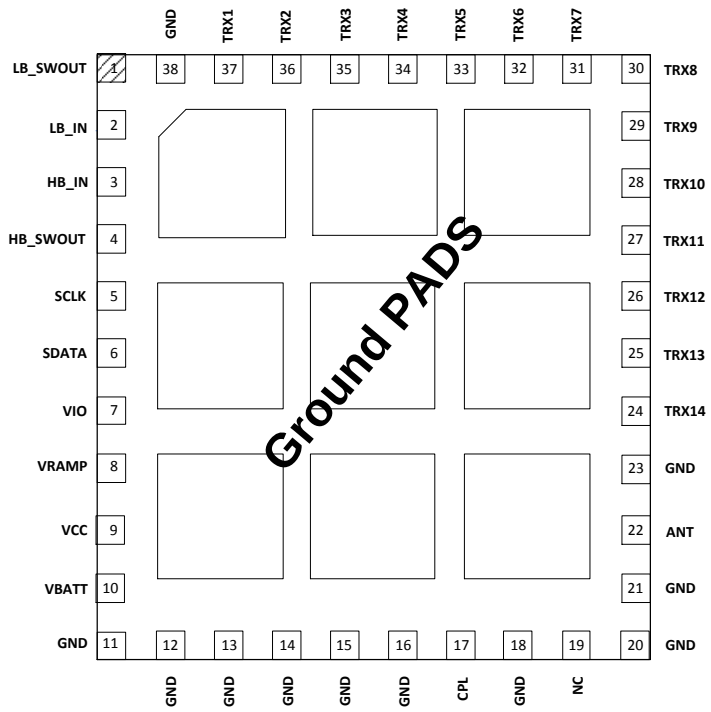
2 Functional Block Diagram

Figure 2-1 Functional Block Diagram



3 Pin Assignment

Figure 3-1 Pin Assignment



4 Pin Definition

Table 4-1 Pin Definition

Pin No.	Pin Name	Description
1	LB_SWOUT	Alternate RF output path for LB_IN
2	LB_IN	RF input to LB PA or LB_SWOUT
3	HB_IN	RF input to HB PA or HB_SWOUT
4	HB_SWOUT	Alternate RF output path for HB_IN
5	SCLK	MIPI clock
6	SDATA	MIPI serial data
7	VIO	MIPI supply voltage
8	VRAMP	Controls GMSK power; EDGE / TD-SCDMA, TDD-LTE bias
9	VCC	Supply voltage to output switch
10	VBATT	Supply voltage to PA
17	CPL	Directional coupler RF output
19	NC	No connection
22	ANT	RF output to antenna
24-37	TRx14-TRx1	Wideband TRx switch ports
Ground Pad Grid		Ground Pad Grid (device underside)

5 Absolute Maximum Ratings

Table 5-1 Absolute Maximum Ratings

Parameter		Symbol	Min.	Typ.	Max.	Unit
RF Input Power		P_{IN}	-	-	10	dBm
Supply Voltage (measured to GND ≤ 1μs)		V_{BATT}	-	-	6	V
DC Continuous During Burst		I_{BATT}	-	-	2.5	A
GMSK Burst Duty Cycle		D_B	-	-	50	%
Voltage Standing Wave Ratio		VSWR	-	-	20:1	V
Power Control Voltage		V_{RAMP}	-0.3	-	3.0	V
MIPI Supply Voltage		V_{IO}	-	-	2.0	V
MIPI Data and Clock Voltage		V_{MIPI}	-	-	2.0	V
Case Temperature	Operating	T_{CASE}	-30	-	+100	℃
	Storage	T_{STG}	-40	-	+150	℃
Moisture Sensitivity Level		MSL	-	-	3	-
Reflow Solder Temperature (J-STD-020B)		T_{SOLDER}	260	-	-	℃

6 Recommended Operating Conditions

Table 6-1 Recommended Operating Conditions

Parameter	Condition	Symbol	Min.	Typ.	Max.	Unit
Supply Voltage	GMSK	V_{BATT}	3.2	3.5	4.6	V
	EDGE/TD-SCDMA/TDD-LTE		3.2	3.6	4.6	V
	-	V_{CC}	3.2	-	4.6	V
GMSK Input Power	-	P_{IN}	-1	3	6	dBm
Operating Case Temperature	GMSK/EDGE 1-4 Slots (12.5%-50% duty cycle)	T_{CASE}	-40	+25	+85	℃
	TD-SCDMA/TDD-LTE		-40	+25	+85	

Table 6-2 Interface Impedances

Parameter	Conditions	Min.	Typ.	Max.	Unit
GMSK/EDGE Burst Duty Cycle	-	12.5	-	50	%
Supply Current	-	0	-	2.3	A
Resistance of V_{RAMP}	DC resistance to ground	5	-	-	MΩ
Capacitance of V_{RAMP}	Capacitance to ground	-	-	2	pF
Power Control Voltage	V_{RAMP}	0.2	-	2.0	V
MIPI Supply Voltage	V_{IO}	1.65	1.8	1.95	V
MIPI Signal Levels	V_{MIPI_LOW}	0	-	$0.2 \times V_{IO}$	V
	V_{MIPI_HIGH}	$0.8 \times V_{IO}$	-	V_{IO}	V
Standby Current(I_{CC} and I_{BATT})	Standby mode, NTC, V_{BATT}=4.8V, V_{CC}=4.8V, V_{IO} = 0V	-	-	20	μA
Standby Current(VIO)	Standby mode, NTC, V_{BATT}=3.5V, V_{CC}=3.5V, V_{IO} = 1.8V	-	-	15	μA
TRx Mode Current	Any TRx Mode	250	600	750	μA

Table 6-3 Linear GMSK/EDGE Power Modes - Recommended Maximum Operation Power

Band	Waveform	Power Mode	P_{RATED}	Unit
LB	GMSK	High Power Mode (HPM)	33.0	dBm
		Medium Power Mode (MPM)	29.0	dBm
		Low Power Mode (LPM)	23.0	dBm
		Ultra-Low Power Mode (ULPM)	15.0	dBm
	EDGE	Medium Power Mode (MPM)	27.5	dBm
		Low Power Mode (LPM)	21.5	dBm
		Ultra-Low Power Mode (ULPM)	15.5	dBm
HB	GMSK	High Power Mode (HPM)	30.5	dBm
		Medium Power Mode (MPM)	28.5	dBm
		Low Power Mode (LPM)	22.5	dBm
		Ultra-Low Power Mode (ULPM)	14.5	dBm
	EDGE	Medium Power Mode (MPM)	26.5	dBm
		Low Power Mode (LPM)	20.5	dBm
		Ultra-Low Power Mode (ULPM)	14.5	dBm

7 Operating Condition Truth Table

Table 7-1 MIPI RFFE Register Map(Linear GMSK Power Control Only)

Bit Position	Description	Trigger Support	R/W	Default Value	Notes		
Register 0, Address 0x00 (Mode Control)							
7	Register Map & Power Control Selector	Trigger0	R/W	0	Set to 0 to select this Linear GMSK Power Control register map		
6:3	PA Bias Mode Control			0000	0000 = LB GMSK/EDGE	0011 = Reserved	0110 = LB Switch OUT
					0001 = HB GMSK/EDGE	0100 = B34/39 TD-SCDMA	0110 = HB Switch OUT
					0010 = Reserved	0101 = B34/39 TDD-LTE	
2	PA Enable			0	0 = PA Tx Disabled, 1 = PA Tx Enabled		
1:0	Power Range Mode			00	00 = HPM	10 = LPM	
					01 = MPM	11 = ULPM	
Register 1, Address 0x01 (Reserved)							
7:0	Reserved	Trigger0	R/W	00000000	Reserved		
Register 2, Address 0x02 (Switch Control)							
7:5	(Reserved)	Trigger0	R/W	000	Reserved		
4:0	Switch Control			00000	0x00 = Standby	0x08 = TRx4	0x10 = TRx1
					0x01 = TRx10	0x09 = LB PA Tx	0x11 =TRx2
					0x02 = TRx9	0x0A = Forward Isolation	0x12=TRx11
					0x03 = Forward Isolation	0x0B = HB PA Tx	0x13 = TRx12

Bit Position	Description	Trigger Support	R/W	Default Value	Notes		
					0x04 = TRx5	0x0C = TRx3	0x14 = TRx13
					0x05 = TRx7	0x0D = LB PA Tx	0x15 = TRx14
					0x06 = TRx6	0x0E = Forward Isolation	Other = Reserved (Do Not Use)
					0x07 = TRx8	0x0F = HB PA Tx	
Register 3, Address 0x03 (Reserved)							
7:0	(Reserved)	Trigger0	R/W	00000000	(Reserved)		
Register 4, Address 0x04 (Reserved)							
7:0	(Reserved)	Trigger0	R/W	00000000	(Reserved)		
Register 5, Address 0x05 (Reserved)							
7:0	(Reserved)		R/W	00000000	(Reserved)		
Register 6, Address 0x06 (Reserved)							
7:0	(Reserved)		R/W	00000000	(Reserved)		

Table 7-2 MIPI RFFE Register Map(Common Registers)

Bit Position	Description	Trigger Support	R/W	Default Value	Notes		
Register 26, Address 0x1A (RFFE Status)							
7:0	Reserved	No	R/W	00000000	Reserved		
Register 27, Address 0x1B (GROUP_ID)							
7:4	Reserved	No	R/W		0000 = 250 µA	0110 = 1750 µA	1100 = 3250 µA
3:0	Group SID				0000 =250 µA	0110 = 1750 µA	1100 = 3250 µA
Register 28, Address 0x1C (PM_TRIG)							
7:6	PWR_MODE	No	R/W	00	00 = Normal Operation (ACTIVE) 01 = Default Settings (STARTUP) 10 = Low Power (LOW POWER) 11 = Reserved		
5	Trigger Mask 2			0	0 = Trigger Enable, 1 = Trigger Disable		
4	Trigger Mask 1			0	0 = Trigger Enable, 1 = Trigger Disable		

Bit Position	Description	Trigger Support	R/W	Default Value	Notes
3	Trigger Mask 0			0	Not supported
2	Trigger Register 2			0	Reserved
1	Trigger Register 1			0	1 = Latch Register 0, 1 contents
0	Trigger Register 0			0	
Register 29, Address 0x1D (PROD_ID)					
7:0	Product ID	No	R	0x96	Product ID
Register 30, Address 0x1E (MAN_ID)					
7:0	Manufacturer	No	R	0x9A	Manufacturer ID
Register 31, Address 0x1F (USID)					
7:6	Reserved	No	R/W	00	Reserved
5:4	Manufacturer ID (MSB)		R	10	Manufacturer ID (MSB)
3:0	User ID		R/W	1110	User ID

8 Electrical Specifications

Table 8-1 Electrical Characteristics - GMSK/EDGE Low Band(Linear GMSK)

GSM850/900 Linear GMSK/EDGE Mode							
Parameter	**Symbol**	**Power Mode**	**Conditions**	**Min.**	**Typ.**	**Max.**	**Unit**
Frequency Range	f_o	-	-	824		915	MHz
P_{SAT}	P_{SAT_GMSK}	GMSK HPM	PIN = 8 dBm	33.2	33.8	-	dBm
Power Added Efficiency, saturated	$PAE_{\_GMSK\_SAT}$	GMSK HPM	POUT = P_{RATED}, PIN = 8dBm	33	37	-	%
Power Added Efficiency, EDGE	$PAE_{\_EDGE}$	EDGE HPM	-	10	12	-	%
Gain	$GAIN_{\_GSMK}$	GMSK HPM	-	-	32	-	dB
		GMSK MPM	-	-	29	-	
		GMSK LPM	-	-	26	-	
		GMSK ULPM	-	-	22	-	
Output Noise Power (NTC)	-	ALL	Rx = 869 MHz to 894 MHz	-	-	-82	dBm/ 100 kHz
			Rx = 925 MHz to 935 MHz	-	-	-79	
			Rx = 935 MHz to 960 MHz	-	-	-79	
			Rx = 1805 MHz to 1880 MHz	-	-	-77	
			Rx = 1930 MHz to 1990 MHz	-	-	-77	
Harmonics	$2f_0$ to $13f_0$	GMSK ALL	$P_{OUT} \leq P_{RATED}$	--	-38	-33	dBm
Input VSWR	Γ_{IN}	ALL	$P_{OUT} \leq P_{RATED}$	-	-	2:1	-
Stability	S	ALL	VSWR ≤ 10:1	-	-	-36	dBm
Ruggedness	Ru	GMSK HPM	All Load Phase, 5dBm≤POUT	15:1	-	-	-

GSM850/900 Linear GMSK/EDGE Mode							
Parameter	**Symbol**	**Power Mode**	**Conditions**	**Min.**	**Typ.**	**Max.**	**Unit**
			≤33dBm				
Switching Transient	SWT	GMSK HPM	400kHz offset	-	-	-28	dBm/ 30kHz
		GSMK MPM		-	-	-28	
		GMSK LPM		-	-	-28	
		GMSK ULPM		-	-	-28	
EDGE ACPR (No Predistortion)	$ACPR_{200}$	EDGE MPM	200 kHz offset	-	-	-33	dBc/ 30 kHz
		EDGE LPM		-	-	-33	
		EDGE ULPM		-	-	-33	
	$ACPR_{400}$	EDGE MPM	400 kHz offset	-	-	-57	
		EDGE LPM		-	-	-57	
		EDGE ULPM		-	-	-57	
	$ACPR_{600}$	EDGE MPM	600 kHz offset	-	-	-67	
		EDGE LPM		-	-	-67	
		EDGE ULPM		-	-	-67	
EDGE EVM (No Predistortion)	EVM_{rms}	EDGE MPM		-	-	4	%
		EDGE LPM		-	-	4	
		EDGE ULPM		-	-	4	

Table 8-2 Electrical Characteristics - GMSK/EDGE High Band(Linear GMSK)

DCS1800/PCS1900 Linear GMSK/EDGE Mode							
Parameter	**Symbol**	**Power Mode**	**Conditions**	**Min.**	**Typ.**	**Max.**	**Unit**
Frequency Range	f_o	-	-	1710		1910	MHz
P_{SAT}	P_{SAT_GMSK}	GMSK HPM	P_{IN} = 6 dBm	30.5	31.5	-	dBm
P_{SAT} Degraded	PSAT_GMSK_ ETC	GMSK HPM	P_{IN} = 6 dBm	29.5	30.5	-	dBm
Power Added Efficiency, saturated	PAE_{GMSK_SAT}	GMSK HPH	$P_{OUT} = P_{RATED}$, P_{IN} = 6dBm	27	31	-	%
Power Added Efficiency, EDGE	PAE_{EDGE}	EDGE HPM	-	10	14.5	-	%

DCS1800/PCS1900 Linear GMSK/EDGE Mode							
Parameter	**Symbol**	**Power Mode**	**Conditions**	**Min.**	**Typ.**	**Max.**	**Unit**
Gain	$GAIN_{\_GSMK}$	GMSK HPM	-	-	31	-	dB
		GMSK MPM	-	-	28	-	
		GMSK LPM	-	-	26	-	
		GMSK ULPM	-	-	22	-	
Output Noise Power (NTC)	-	ALL	Rx = 869 MHz to 894 MHz	-	-	-77	dBm/ 100 kHz
			Rx = 925 MHz to 935 MHz	-	-	-73	
			Rx = 935 MHz to 960 MHz	-	-	-73	
			Rx = 1805 MHz to 1880 MHz	-	-	-77	
			Rx = 1930 MHz to 1990 MHz	-	-	-77	
Harmonics	$2f_0$ to $13f_0$	GMSK ALL	$P_{OUT} \leq P_{RATED}$	-	-	-33	dBm
Input VSWR	Γ_{IN}	ALL	$P_{OUT} \leq P_{RATED}$	-	-	2.5:1	
Stability	S	ALL	VSWR ≤ 8:1	-	-	-36	dBm
Ruggedness	Ru	HPM	VSWR 15:1, All Load Phase 0dBm≤POUT ≤30dBm	No module damage or permanent degradation			
Switching Transient	SWT	GMSK HPM	400kHz offset	-	-	-28	dBm/ 30kHz
		GSMK MPM		-	-	-28	
		GMSK LPM		-	-	-28	
		GMSK ULPM		-	-	-28	
EDGE ACPR (No Predistortion)	$ACPR_{\_200}$	EDGE MPM	200 kHz offset	-	-	-33	dBc/ 30 kHz
		EDGE LPM		-	-	-33	
		EDGE ULPM		-	-	-33	
	$ACPR_{\_400}$	EDGE MPM	400 kHz offset	-	-	-57	
		EDGE LPM		-	-	-57	

DCS1800/PCS1900 Linear GMSK/EDGE Mode							
Parameter	**Symbol**	**Power Mode**	**Conditions**	**Min.**	**Typ.**	**Max.**	**Unit**
		EDGE ULPM		-	-	-57	
	$ACPR_{\_600}$	EDGE MPM	600 kHz offset	-	-	-67	
		EDGE LPM		-	-	-67	
		EDGE ULPM		-	-	-67	
EDGE EVM (No Predistortion)	$EVM_{\_rms}$	EDGE MPM	-	-	-	4	%
		EDGE LPM		-	-	4	
		EDGE ULPM		-	-	4	

Table 8-3 Electrical Specifications (TD-SCDMA Band 39)

TD-SCDMA Band 39 (1880-1920 MHz)						
Parameter	**Symbol**	**Conditions**	**Min.**	**Typ.**	**Max.**	**Unit**
Output Power	$P_{OUT\_TD\_NOM}$	NTC		24		dBm
Gain	G_{HPM_NOM}	$P_{OUT} = P_{OUT\_TD\_NOM}$	29	31	33	dB
	G_{LPM}	P_{IN} = -35 dBm		22		dB
Power Added Efficiency	PAE_{HPM}	$P_{OUT} = P_{OUT\_TD\_NOM}$	20	22	24	%
ACLR	ACLR_1.6MHz	$P_{OUT\_TD\_NOM}$	-	-40	-35	dBc
	ACLR_3.2MHz	$P_{OUT\_TD\_NOM}$, $P_{OUT\_TD\_EX}$			-50	
EVM	EVM_{RMS}	$P_{OUT\_TD\_NOM}$	-	-	4	%
Harmonics Suppression	$2f_0$ to $6f_0$	$P_{OUT} \leq P_{OUT\_TD\_NOM}$ RBM = 1 MHz	-	-	-36	dBm
Tx Noise in Rx Bands	-	Rx = 1805 MHz to 1850 MHz, $P_{OUT} = P_{OUT\_TD\_NOM}$, RBW = 100kHz	-	-	-81	dBm
Input VSWR	Γ_{IN}	-	-	-	2.5:1	-
Stability	S	VSWR = 12:1 All phase, RBW = 1 MHz	-	-	-36	dBm
Ruggedness – no damage	Ru	All phase, time = 10s	20:1	-	-	VSWR

Table 8-4 Electrical Specifications (TD-SCDMA Band 34)

TD-SCDMA Band 34 (2010-2025 MHz)						
Parameter	**Symbol**	**Conditions**	**Min.**	**Typ.**	**Max.**	**Unit**
Output Power	$P_{OUT\_TD\_NOM}$	NTC	-	24	-	dBm
Gains	G_{HPM_NOM}	$P_{OUT} = P_{OUT\_TD\_NOM}$	29	31	-	dB
	G_{LPM}	P_{IN} = -35 dBm	-	22	-	dB
Power Added Efficiency	PAE_{HPM}	$P_{OUT} = P_{OUT\_TD\_NOM}$	13	15	17	%
ACLR	ACLP_1.6MHz	$P_{OUT\_TD\_NOM}$	-	-40	-36	dBc
	ACLP_3.2MHz	$P_{OUT\_TD\_NOM}$, $P_{OUT\_TD\_EX}$			-50	
EVM	$EVM_{\_RMS}$	$P_{OUT\_TD\_NOM}$	-	-	4	%
Harmonics Suppression	$2f_0$ to $6f_0$	$P_{OUT} \leq P_{OUT\_TD\_NOM}$, $P_{OUT\_TD\_EX}$ RBM = 1 MHz	-	-	-36	dBm
Input VSWR	Γ_{IN}	-	-	-	2.5:1	-
Stability	S	VSWR = 12:1 All phase, RBW = 1 MHz	-	-	-36	dBm
Ruggedness – no damage	Ru	All phase, time = 10s	20:1	-	-	VSWR

Table 8-5 Electrical Specifications (TDD-LTE Band 34/39)

TDD LTE Band 39 (1880-1920 MHz), Band 34 (2010-2025MHz)						
Parameter	**Symbol**	**Conditions**	**Min.**	**Typ.**	**Max.**	**Unit**
Output Power	$P_{OUT\_TD\_NOM}$	NTC	-	24	-	dBm
Gain	G_{HPM_NOM}	$P_{OUT} = P_{OUT\_TD\_NOM}$	29	31	33	dB
	G_{LPM}	P_{IN} = -35 dBm	-	22	-	dB
Power Added Efficiency	PAE_{HPM}	$P_{OUT} = P_{OUT\_TD\_NOM}$	13	15	17	%
ACLR	$EUTRA_{\_ACLR1}$	$P_{OUT} = P_{OUT\_TDLTED\_NOM}$	-	-38	-33	dBc
	$UTRA_{\_ACLR1}$	$P_{OUT} = P_{OUT\_TDLTED\_NOM}$	-	-	-36	
	$UTRA_{\_ACLR2}$	$P_{OUT} = P_{OUT\_TDLTED\_NOM}$	-	-	-39	
EVM	$EVM_{\_RMS}$	$P_{OUT\_TD\_NOM}$	-	-	4	%
Harmonics Suppression	f_{02}	$P_{OUT} \leq P_{OUT\_TD\_NOM}$, $P_{OUT\_TD\_EX}$ RBM = 1 MHz	-	-	-36	dBm
	f_{03}				-46	

TDD LTE Band 39 (1880-1920 MHz), Band 34 (2010-2025MHz)						
Parameter	**Symbol**	**Conditions**	**Min.**	**Typ.**	**Max.**	**Unit**
Input VSWR	Γ_{IN}	-	-	-	2.5:1	-
Stability	S	VSWR = 12:1 All phase, RBW = 1 MHz	-	-	-36	dBm
Ruggedness – no damage	Ru	All phase, time = 10s	20:1	-	-	VSWR

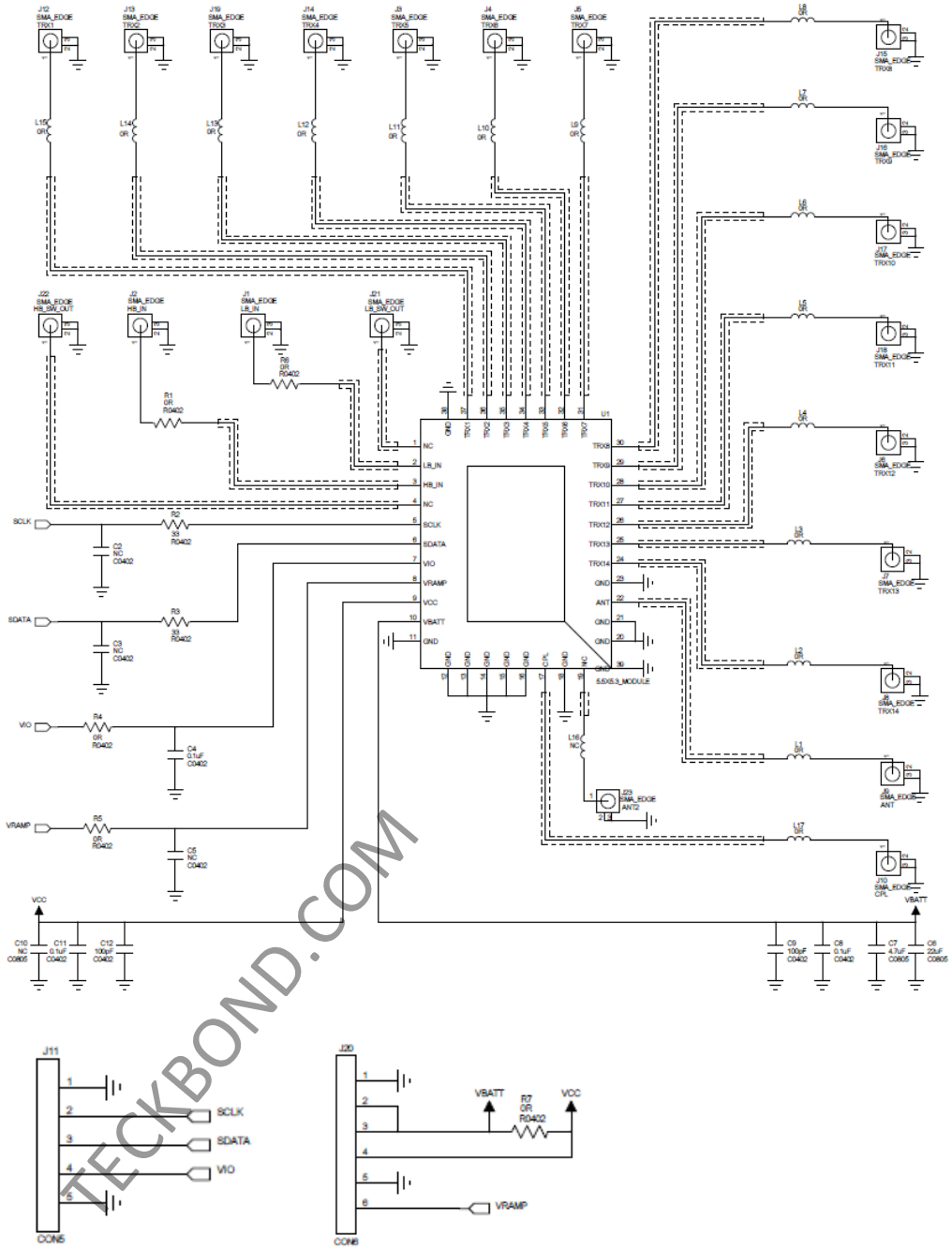
Table 8-6 Electrical Characteristics(TRx Ports)

Ports TRx1 to TRx14						
Parameter	**Symbol**	**Conditions**	**Min.**	**Typ.**	**Max.**	**Unit**
Frequency Range	$f_{\_TRx}$	-	699	-	2690	MHz
Insertion Loss	$TRx_{\_IL\_LB}$	699 MHz to 960 MHz	-	0.75	1.0	dB
	$TRx_{\_IL\_MB}$	1710 MHz to 1990 MHz	-	1.4	1.75	
	$TRx_{\_IL\_HB}$	2300 MHz to 2690 MHz	-	1.5	2.1	
Isolation	$ISO_{\_ADJ\_TRx\_LB}$	699 MHz to 960 MHz	17	26	35	dB
	$ISO_{\_ADJ\_TRx\_MB}$	1710 MHz to 1990 MHz	16	23	30	
	$ISO_{\_ADJ\_TRx\_HB}$	2010 MHz to 2690 MHz	13	20	25	
	$ISO_{\_NADJ\_TRx\_LB}$	699 MHz to 960 MHz	22	35	36	
	$ISO_{\_NADJ\_TRx\_MB}$	1710 MHz to 1990 MHz	17	30	31	
	$ISO_{\_NADJ\_TRx\_HB}$	2010 MHz to 2690 MHz	13	25	27	
TRx Harmonics	$TRx_{\_2f0}$, $TRx_{\_3f0}$	50Ω, $P_{\_IN\_TRx}$ = 27dBm NTC	-	-	-55	dBm
Leakage from Tx to TRx Ports	$P_{\_TxTRx}$	-	-10	-	5	dBm
Coupling Factor in TRx Mode	CPL_TRx_LB	699 MHz to 960 MHz, NTC	-31	-27	-26	dB
	CPL_TRx_MB	1710 MHz to 1990 MHz, NTC	-26	-21	-20	
	CPL_TRx_HB	2010 MHz to 2690 MHz, NTC	-25	-20	-18	
Coupling Factor Variation over Ouput VSWR	CPL_SWR_TRx_LB	699 MHz to 960 MHz, VSWR 2:5 at ANT port	-0.5	-	0.5	dB
	CPL_SWR_TRx_MB	1710 MHz to 1990 MHz, VSWR 2:5 at ANT port	-1	-	1	

Ports TRx1 to TRx14						
Parameter	**Symbol**	**Conditions**	**Min.**	**Typ.**	**Max.**	**Unit**
	CPL_SWR_TRx_HB	2010 MHz to 2690 MHz, VSWR 2:5 at ANT port	-1	-	1	
	CPL_TV_TRx_MB	1710 MHz to 1990 MHz	-1	-	1	
	CPL_TV_TRx_HB	2010 MHz to 2690 MHz	-1	-	1	
Turn-on Time	T_{ON_VBATT}	From 50% VBATT and VIO to 0.5dB RF Settling	5	-	20	μs
TRx to TRx Switching Speed	$T_{\_TRxTRx}$	From MIPI command to 0.5dB RF Settling	2	-	5	μs

9 Evaluation Board Schematic

Figure 9-1 Evaluation Board Schematic



10 Evaluation Board Layout

Figure 10-1 Top Layer

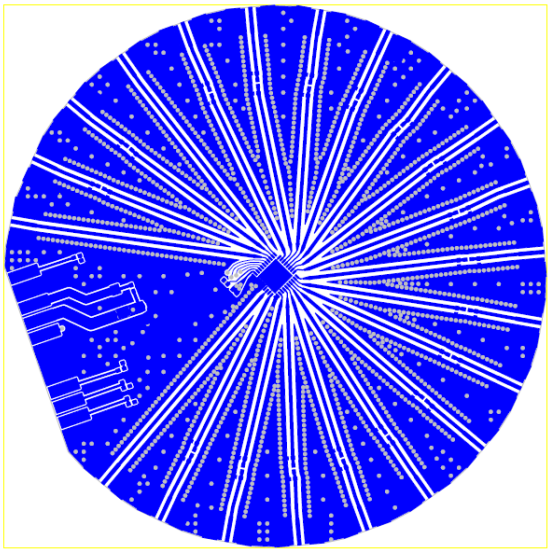


Figure 10-2 Bottom Layer

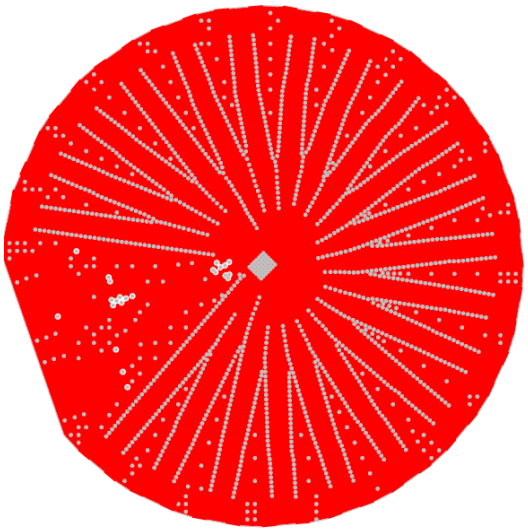
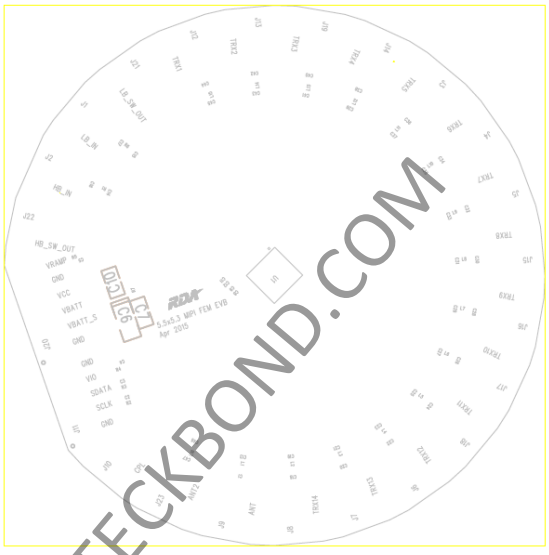


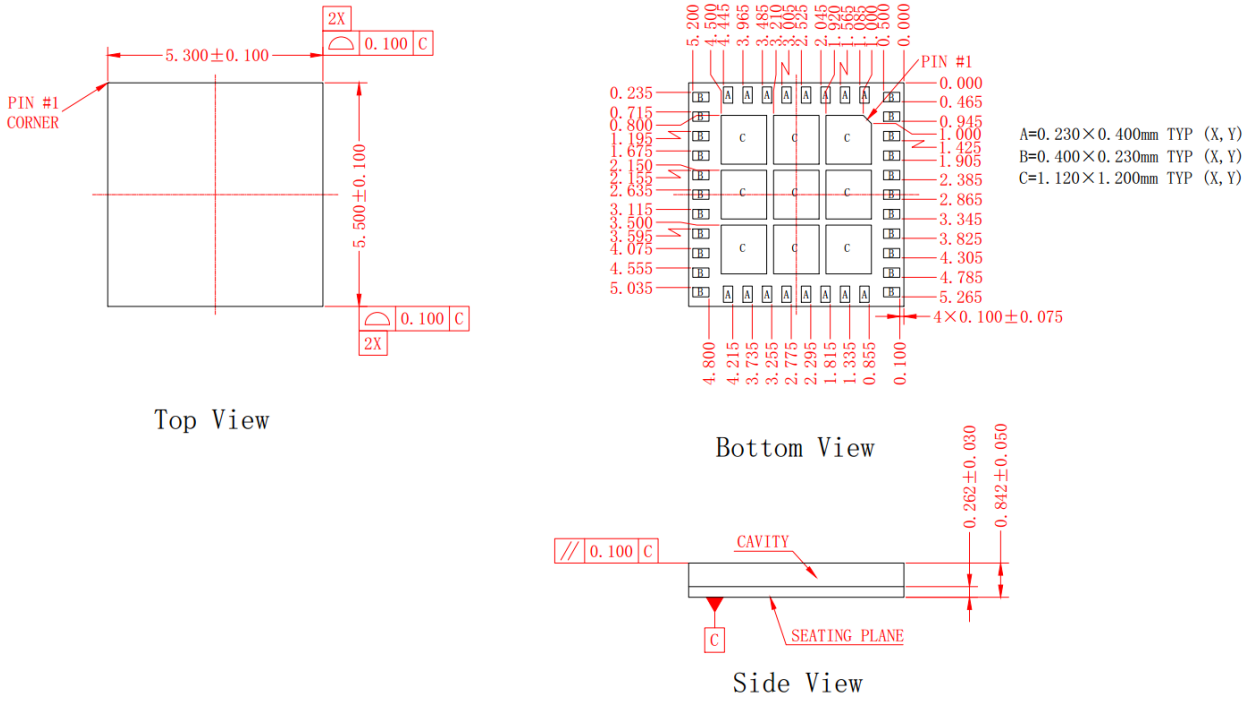
Figure 10-3 Top Silkscreen



11 Package Dimensions

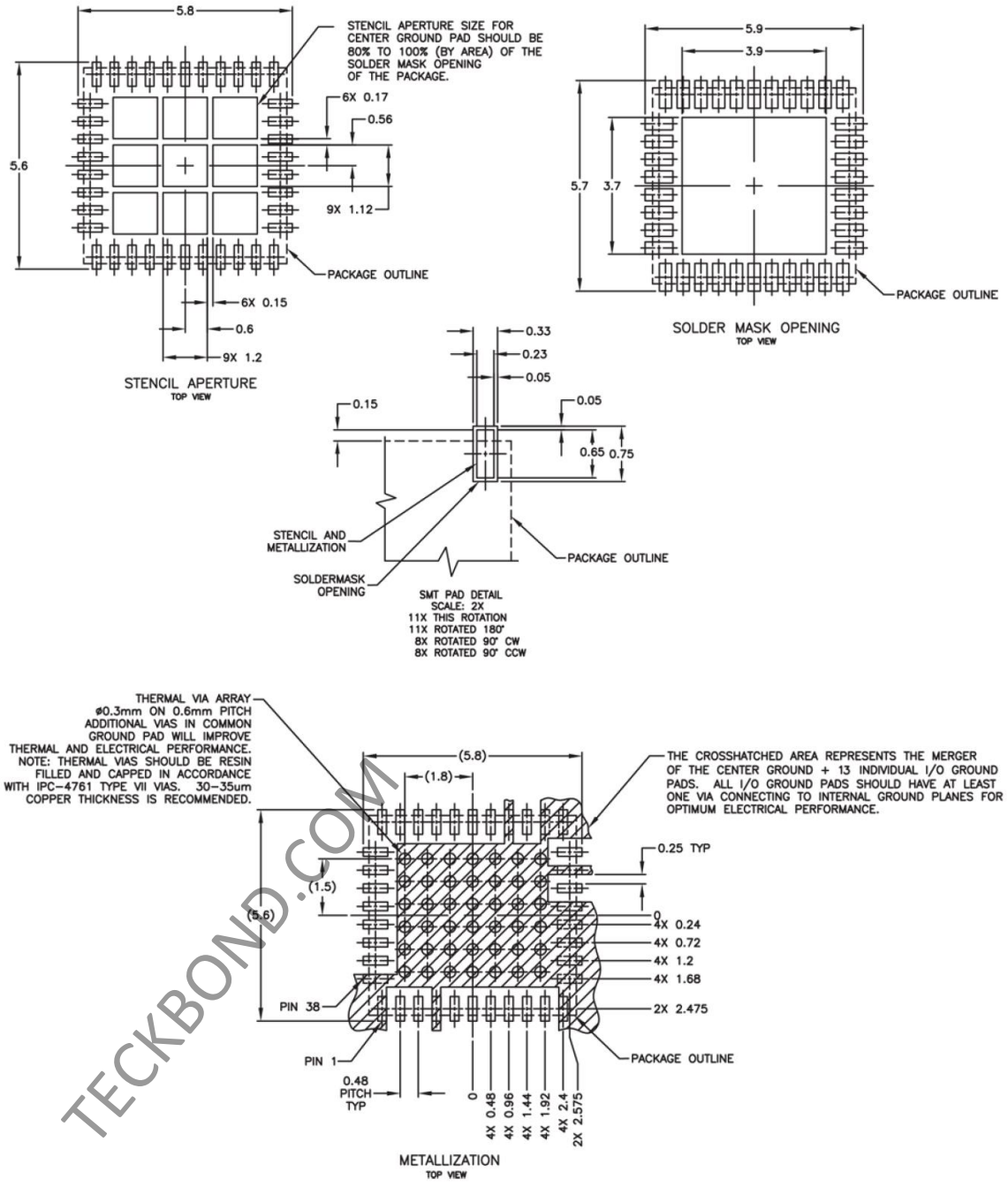
Figure 11-1 Package Dimensions

Unit: mm



12 Suggested PCB Design

Figure 12-1 Suggested PCB Design



13 Recommended Reflow Profile

The RTM7916-61 is rated to Moisture Sensitivity Level 3 (MSL3) at 260℃. It can be used for lead or lead-free soldering.

Figure 13-1 Classification Reflow Profile

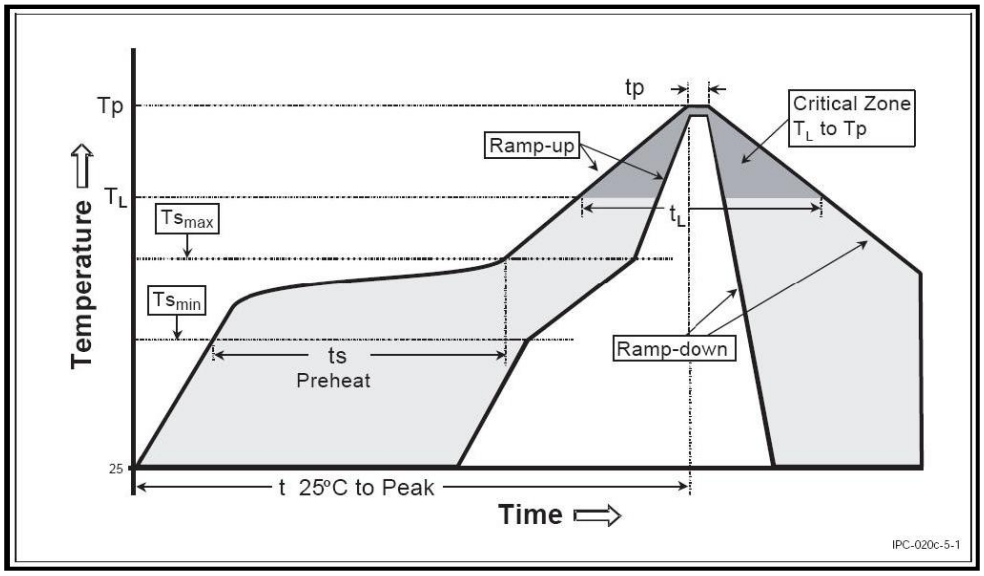


Table 13-1 Classification Reflow Profiles

Profile Feature	Sn-Pb Eutectic Assembly	Pb-Free Assembly
Average Ramp-Up Rate (Tsmax to Tp)	3℃/second max.	3℃/second max.
Preheat		
Temperature Min (Tsmin)	100℃	150℃
Temperature Max (Tsmax)	100℃	200℃
Time (tsmin to tsmax)	60-120seconds	60-180seconds
Time maintained above		
Temperature (TL)	183℃	217℃
Time (tL)	60-150seconds	60-150seconds
Peak / Classification Temperature(Tp)	See **Table 13-2**	See **Table 13-3**
Time within 5℃ of actual Peak	10-30seconds	20-40seconds

Profile Feature	Sn-Pb Eutectic Assembly	Pb-Free Assembly
Temperature (tp)		
Ramp-Down Rate	6℃/second max.	6℃/seconds max.
Time 25℃ to Peak Temperature	6 minutes max.	8 minutes max.

Table 13-2 Sn-Pb Eutectic Process – Package Peak Reflow Temperatures

Package Thickness	Volume mm^3 <350	Volume mm^3 ≥350
＜2.5mm	240+0/-5℃	225+0/-5℃
≥2.5mm	225+0/-5℃	225+0/-5℃

Table 13-3 Pb-free Process – Package Classification Reflow Temperatures

Package Thickness	Volume mm^3 ＜350	Volume mm^3 350-2000	Volume mm^3 ＞2000
＜1.6mm	260 + 0℃ *	260 + 0℃ *	260 + 0℃ *
1.6mm – 2.5mm	260 + 0℃ *	250 + 0℃ *	245 + 0℃ *
≥2.5mm	250 + 0℃ *	245 + 0℃ *	245 + 0℃ *

NOTE

*Tolerance: The device manufacturer/supplier shall assure process compatibility up to and including the stated classification temperature(this mean Peak reflow temperature + 0℃. For example 260+ 0℃) at the rated MSL Level.

NOTE

- All temperatures refer topside of the package. Measured on the package body surface.
- The profiling tolerance is + 0℃, - X℃ (based on machine variation capability)whatever is required to control the profile process but at no time will it exceed – 5℃. The producer assures process compatibility at the peak reflow profile temperatures defined in **Table 13-3**.
- Package volume excludes external terminals (balls, bumps, lands, leads) and/or non integral heat sinks.
- The maximum component temperature reached during reflow depends on package the thickness and volume. The use of convection reflow processes reduces the thermal gradients between packages. However, thermal gradients due to differences in thermal mass of SMD package may still exist.
- Components intended for use in a “lead-free” assembly process shall be evaluated using the “lead free” classification temperatures and profiles defined in **Table 13-1**, **Table 13-2**, **Table 13-3** whether or not lead free.

14 RoHS Compliant

The product does not contain lead, mercury, cadmium, hexavalent chromium, polybrominated biphenyls (PBB) or polybrominated diphenyl ethers (PBDE), and are therefore considered RoHS compliant.

15 ESD Precautions

ESD protection circuitry is contended in this device, but special handling precautions are required.

16 Tape Information

Figure 16-1 Tape Information