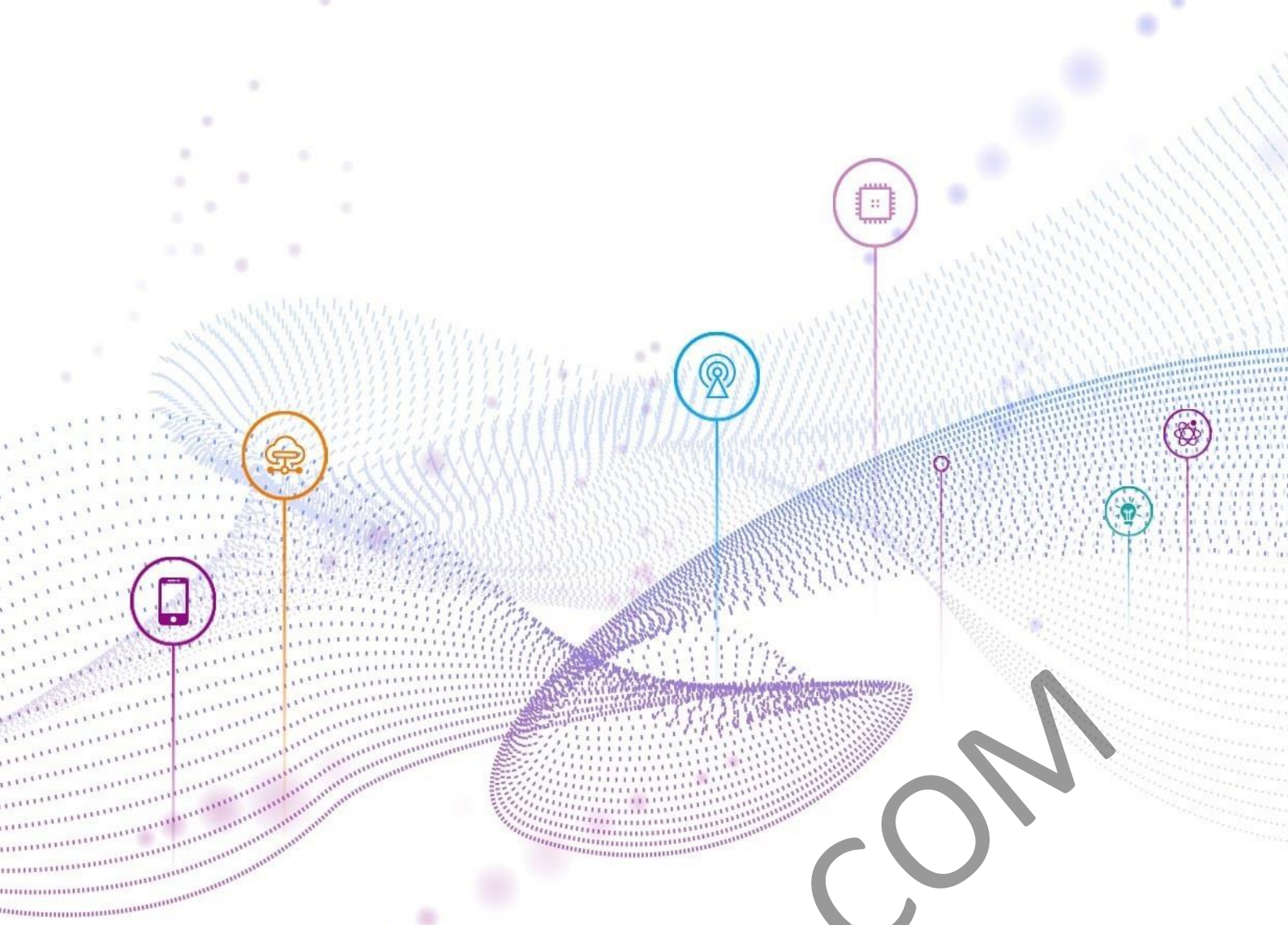


RTM7916-51 Datasheet

Issue V2.6

Date 2021-03-11

UNISOC (Shanghai) Technologies Co., Ltd.

1 General Description

The RTM7916-51 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.

In GMSK modes, the PA controller provides envelope amplitude control as a function of V_{RAMP} and reduces sensitivity to input drive, temperature, power supply, and process variations. Proper timing of MIPI commands and V_{RAMP} input ensures high isolation between the antenna and Tx-VCO while the VCO is being tuned prior to the transmit burst.

In EDGE and TD-SCDMA/TDD-LTE linear modes, V_{RAMP} voltage and MIPI-based bias settings optimize PA linearity and efficiency.

1.1 Features

- Small, low profile package
  - 5.5mm × 5.3mm × 0.84mm
  - 38-pad LGA package
- 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
  - 37% GSM850/ GSM900
  - 34% DCS1800/ PCS1900
- Wide GSMK input power range: -1dBm to 6dBm
- Input/Output matched internally to 50Ω
- Power control circuitry built-in for improved TRP variation

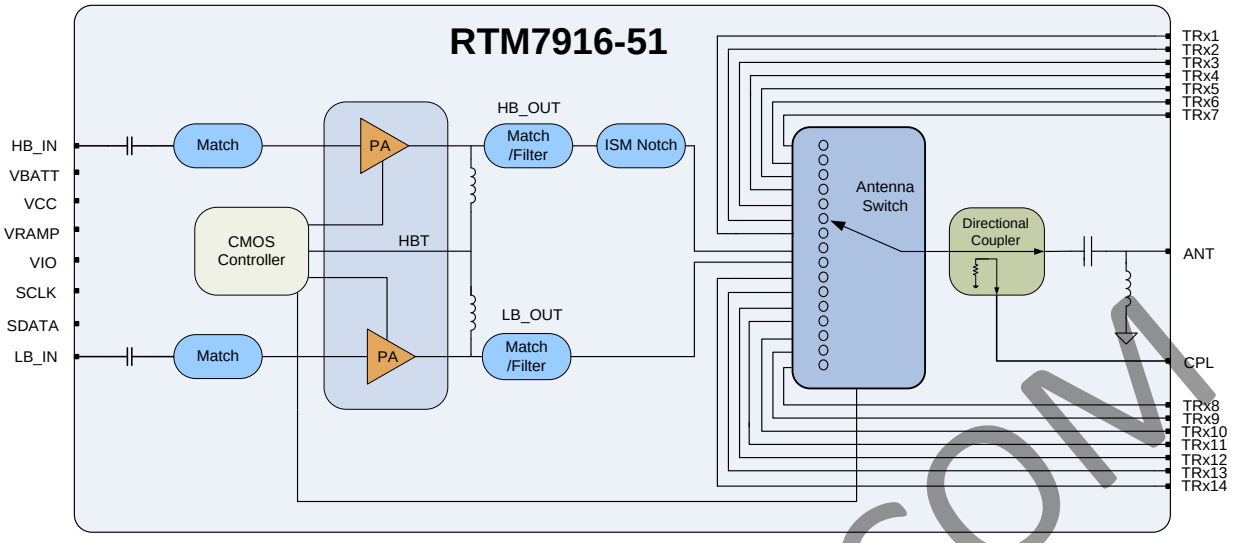
1.2 Applications

- 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

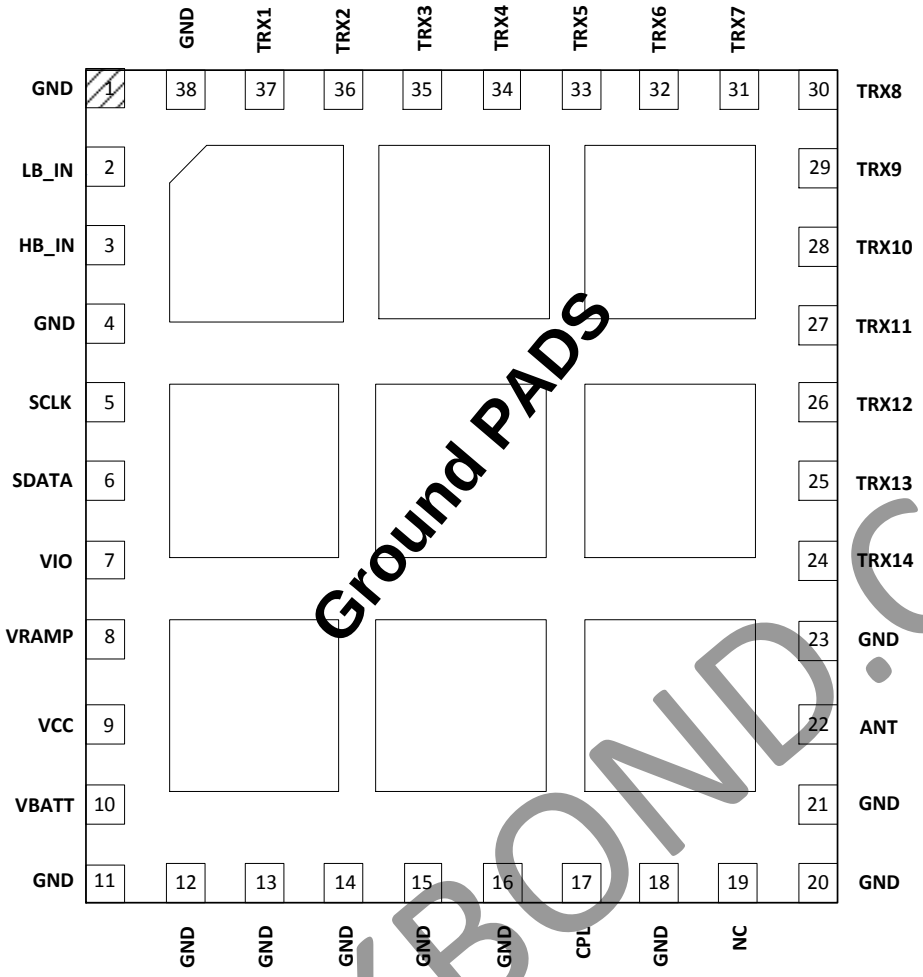
2 Functional Block Diagram

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
2	LB_IN	RF input to LB PA
3	HB_IN	RF input to HB PA
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
Others	GND	Ground
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		V_{BATT}	-	-	6	V
GMSK Burst Duty Cycle		D_B	-	-	50	%
Voltage Standing Wave Ratio		VSWR	-	-	20:1	V
Power Control Voltage		V_{RAMP}	-0.3	-	3	V
MIPI Supply Voltage		V_{IO}	-	-	2	V
MIPI Data and Clock Voltage		V_{MIPI}	-	-	2	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}	-20	25	+85	℃
	TD-SCDMA/TDD-LTE		-20	25	+85	

Table 6-2 Interface Impedances

Parameter	Conditions	Min.	Typ.	Max.	Units
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	V
MIPI Supply Voltage	V_{IO}	1.65	1.85	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	uA
TRx Mode Current	Any TRx Mode	250	600	750	μA

Table 6-3 V_{RAMP} Description

Mode	V_{RAMP} Voltage	Description
GMSK	0.2V to 2.0V	V_{RAMP} based power control
EDGE	1.2V to 2.0V	Linear HPM High current for high linearity
TD-SCDMA/TD-LTE	0.7V to 1.0V	Linear MPM Lower current consumption under the same MIPI bias setting with HPM.
TD-SCDMA/TD-LTE	0V to 0.5V	Linear LPM Lowest current consumption Gain is 3dB lower than MPM under the same MIPI bias setting.

7 MIPI RFFE Information

Table 7-1 MIPI RFFE Information

Bit Position	Description	Default Value	Notes		
Register 0, Address 0x00 (Mode Control)					
7	(Reserved)	0	(Reserved. Set to 0)		
6	(Reserved)	0	(Reserved. Set to 0)		
5	Gain Control	0	0 = nominal Gain, 1 = lower Gains (HB only)		
4:0	Mode Control	00000	0x00 = Standby	0x0B = LB EDGE/Linear Tx	
			0x01 = TRx5	0x0C = isolation	
			0x02 = TRx4	0x0D = TRx8	
			0x03 = TRx3	0x0E = HB GMSK Tx	
			0x04 = TRx9	0x0F = HB EDGE/Linear Tx	
			0x05 = TRx6	0x10 = TRx1	
			0x06 = isolation	0x11 = TRx13	
			0x07 = isolation	0x14 = TRx11	
			0x08 = TRx10	0x18 = TRx2	
			0x09 = TRx7	0x19 = TRx14	
			0x0A = LB GMSK Tx	0x1C = TRx12	
			Other = Reserved (Do Not Use)		
Register 1, Address 0x01 (Bias Control)					
7:4	PA stage 3 bias	1000	0000 = 250 µA		
			0001 = 500 µA	0110 = 1750 µA	1011 = 3000 µA
			0010 = 750 µA	0111 = 2000 µA	1100 = 3250 µA
			0011 = 1000 µA	1000 = 2250 µA	1101 = 3500 µA
			0100 = 1250 µA	1001 = 2500 µA	1110 = 3750 µA
			0101 = 1500 µA	1010 = 2750 µA	1111 = 4000 µA

Bit Position	Description	Default Value	Notes		
3:0	PA stage 1-2 bias	1000	0000 =250 µA		
			0001 = 500 µA	0110 = 1750 µA	1011 = 3000 µA
			0010 = 750 µA	0111 = 2000 µA	1100 = 3250 µA
			0011 = 1000 µA	1000 = 2250 µA	1101 = 3500 µA
			0100 = 1250 µA	1001 = 2500 µA	1110 = 3750 µA
			0101 = 1500 µA	1010 = 2750 µA	1111 = 4000 µA
Register 2, Address 0x02 (Reserved)					
7:0	(Reserved)	0x00	(Reserved)		
Register 3, Address 0x03 (Reserved)					
7:0	(Reserved)	0x00	(Reserved)		
Register 4, Address 0x04 (Reserved)					
7:0	(Reserved)	0x00	(Reserved)		
Register 5, Address 0x05 (Reserved)					
7:0	(Reserved)	0x00	(Reserved)		
Register 6, Address 0x06 (Reserved)					
7:0	(Reserved)	0x00	(Reserved)		
Register 26, Address 0x1A (RFFE Status)					
7:0	(Reserved)	0x00	(Reserved)		
Register 27, Address 0x1B (GROUP_ID)					
7:4	(Reserved)	0000	(Reserved)		
3:0	Group SID	0000	Group slave ID		
Register 28, Address 0x1C (GROUP_ID)					
7:6	PWR_MODE	00	00 = Normal Operation (ACTIVE)		
			01 = Default Settings (STARTUP)		
			10 = Low Power (LOW POWER)		
			11 = Reserved		
5	Trigger Mask2	1	Trigger Enable: 0, Trigger Disable: 1		
4	Trigger Mask 1	1	Trigger Enable: 0, Trigger Disable: 1		

Bit Position	Description	Default Value	Notes
3	Trigger Mask 0	1	Trigger Enable: 0, Trigger Disable: 1
2	Trigger Register 2	0	Not supported
1	Trigger Register 1	0	(Reserved)
0	Trigger Register 0	0	1 = Latch Register 0,1 contents
Register 29, Address 0x1D (PROD_ID)			
7:0	Product ID	0x96	Product ID
Register 30, Address 0x1E (MAN_ID)			
7:0	Manufacturer ID	0x9A	Manufacturer ID [7:0]
Register 31, Address 0x1F (USID)			
7:6	(Reserved)	00	(Reserved)
5:4	Manufacturer ID (MSB)	10	Manufacturer ID [9:8]
3:0	User ID	1110	USID = 1110

8 Electrical Specifications

Table 8-1 Electrical Specifications (GSM850/900 GMSK Mode)

GSM850/900 GMSK Mode						
Parameter	**Symbol**	**Conditions**	**Min.**	**Typ.**	**Max.**	**Unit**
Frequency Range	f_o	GSM850	824	-	849	MHz
		GSM900	880	-	915	
Power Added Efficiency	PAE	NTC, $P_{OUT} = P_{RATED}$, Duty cycle = 1:8	33	37	40	%
Harmonics	$2f_0$ to $3f_0$	BW = 3MHz, V_{RAMP} = Cal-V_{RAMP} 5dBm ≤ Cal-P_{OUT} ≤ P_{RATED}	-60	-	-38	dBm
	$4f_0$ to $12f_0$ Except for G900 $4f_0$		-60	-	-36	dBm
	G900 $4f_0$		-60	-	-35	dBm
	$2f_0$ to $4f_0$ VSWR=5:1		-60	-	-32	dBm
Output Power	P_{OUT_GMSK}	NTC, P_{IN} = -1dBm, V_{RAMP} = 1.85V	33.5	34	35.5	dBm
		ETC, V_{CC}=3.5V	32	33.2	-	dBm
Input VSWR	Γ_{IN}	$P_{OUT} \leq P_{RATED}$	1.5:1	-	2.5:1	-
Isolation	$ISO_{\_PDSD}$	P_{IN} ≤6dBm, V_{RAMP} ≤ 0.1V Forward Isolation Mode	-70	-	-50	dBm
	$ISO_{\_PESE}$	P_{IN} ≤6dBm, V_{RAMP} ≤ 0.1V LB_GMSK_TX Mode	-40	-	-15	
Stability	S	5dBm ≤ P_{OUT} ≤ P_{RATED} 0dBm ≤ P_{IN} ≤ 6dBm Load VSWR = 10:1, all phase angles	-	-	-36	dBm
Switching Spectrum	-	±400KHz	-	-	-27	dBm
Load Mismatch	-	5dBm ≤ P_{OUT} ≤ 33dBm 0dBm ≤ P_{IN} ≤ 6dBm Load VSWR = 20:1, all phase angles	No module damage or permanent degradation			
Noise Power	-	f_Rx = 869MHz to 894MHz	-84	-	-82	dBm

GSM850/900 GMSK Mode						
Parameter	**Symbol**	**Conditions**	**Min.**	**Typ.**	**Max.**	**Unit**
		NTC, P_{OUT} = P_{RATED}, RBW = 100KHz				
		f_Rx = 935MHz to 960MHz NTC, P_{OUT} = P_{RATED}, RBW = 100KHz	-84	-	-81	
		f_Rx = 925MHz to 935MHz NTC, P_{OUT} = P_{RATED}, RBW = 100KHz	-84	-	-79	
		f_Rx = 1805MHz to 1880MHz NTC, P_{OUT} = P_{RATED}, RBW = 100KHz	-90	-	-77	

NOTE

Unless otherwise specified, P_{RATED} = 33dBm.

Table 8-2 Electrical Specifications (GSM850/900 EDGE Mode)

GSM850/900 EDGE Mode						
Parameter	**Symbol**	**Conditions**	**Min.**	**Typ.**	**Max.**	**Unit**
Frequency Range	f_o	GSM850	824	-	849	MHz
		GSM900	880	-	915	
Power Added Efficiency	PAE	NTC, P_{OUT} = P_{RATED}, Duty cycle = 1:8	13	16	18	%
Harmonics	$2f_0$ to $15f_0$	BW = 3MHz 5dBm ≤ P_{OUT} ≤ P_{RATED}	-50	-	-40	dBm
Output Power	P_{OUT_EDGE}	NTC, ACPR / EVM /ORFS in specification	27.5	-	28.5	dBm
	P_{OUT_EDGE}	ETC, Pout	26	27.5	-	dBm
Input VSWR	Γ_{IN}	P_{OUT} ≤ P_{RATED}	-	-	3:1	-
Gain	$G_{\_NOM}$	NTC, P_{OUT} = P_{RATED}	30	32	34	dB
		Over temperature, P_{OUT} = P_{RATED}	27	-	36	dB
Gain@LPM	$G_{\_824}$	NTC	24	-	31	dB
ACPR	$ACPR_{\_200}$	P_{out} = P_{RATED} Bandwidth = 30KHz	-38	-	-33	dBc
	$ACPR_{\_400}$		-65	-	-57	
	$ACPR_{\_600}$		-75	-	-67	

GSM850/900 EDGE Mode						
Parameter	**Symbol**	**Conditions**	**Min.**	**Typ.**	**Max.**	**Unit**
EVM	$EVM_{\_RMS}$	$P_{out} = P_{RATED}$	-	-	4	%
Stability (Spurious)	S	$5dBm \le P_{OUT} \le P_{RATED}$ $0dBm \le P_{IN} \le 6dBm$ Load VSWR = 12:1, all phase angles	-50	-	-36	dBm
Load Mismatch	-	$5dBm \le P_{OUT} \le P_{RATED}$ Load VSWR = 20:1, all phase angles	No module damage or permanent degradation			
Noise Power	-	f_Rx = 869MHz to 894MHz NTC, $P_{OUT} = P_{RATED}$, RBW = 100KHz	-84	-	-80	dBm
		f_Rx = 935MHz to 960MHz NTC, $P_{OUT} = P_{RATED}$, RBW = 100KHz	-84	-	-81	
		f_Rx = 925MHz to 935MHz NTC, $P_{OUT} = P_{RATED}$, RBW = 100KHz	-84	-	-81	
		f_Rx = 1805MHz to 1880MHz NTC, $P_{OUT} = P_{RATED}$, RBW = 100KHz	-90	-	-86	

NOTE

Unless otherwise specified, P_{RATED} = 27.5dBm.

Table 8-3 Electrical Specifications (GSM1800/1900 GMSK Mode)

GSM1800/1900 GMSK Mode						
Parameter	**Symbol**	**Conditions**	**Min.**	**Typ.**	**Max.**	**Unit**
Frequency Range	f_o	DCS1800	1710	-	1785	MHz
		PCS1900	1850	-	1910	
Power Added Efficiency	PAE	NTC, $P_{OUT} = P_{RATED}$, Duty cycle = 1:8	28	34	38	%
Harmonics	$2f_0$ DCS	BW = 3MHz $0dBm \le Cal\text{-}P_{OUT} \le 31dBm$ $V_{RAMP} = Cal\text{-}V_{RAMP}$	-60	-	-38	dBm
	$3f_0, 4f_0$ DCS		-60	-	-35	dBm
	$2f_0$		-60	-	-38	dBm

GSM1800/1900 GMSK Mode						
Parameter	**Symbol**	**Conditions**	**Min.**	**Typ.**	**Max.**	**Unit**
	PCS					
	$3f_0$, $4f_0$ PCS		-60	-	-36	dBm
	$5f_0$ to $7f_0$ DCS, PCS		-60	-	-36	dBm
	$2f_0$ to $4f_0$ VSWR=5:1		-60	-	-32	dBm
Output Power	P_{OUT_GMSK}	NTC, P_{IN} = -1dBm, V_{RAMP} = 1.85V	31.0	31.6	32	dBm
		ETC, V_{CC}=3.5V	29.5	30.5	-	dBm
Input VSWR	Γ_{IN}	$P_{OUT} \leq P_{RATED}$		-	2.5:1	-
Isolation	$ISO_{\_PDSD}$	$P_{IN} \leq$ 6dBm, $V_{RAMP} \leq$ 0.1V Forward Isolation Mode	-	-	-53	dBm
	$ISO_{\_PESE}$	$P_{IN} \leq$ 6dBm, $V_{RAMP} \leq$ 0.1V HB_GMSK_TX Mode	-	-	-15	
Stability	S	0dBm $\leq P_{OUT} \leq P_{RATED}$ 0dBm $\leq P_{IN} \leq$ 6dBm Load VSWR =8:1, all phase angles	-	-	-36	dBm
Switching Spectrum	-	±400KHz	-	-	-27	dBm
Load Mismatch	-	5dBm $\leq P_{OUT} \leq P_{RATED}$ 0dBm $\leq P_{IN} \leq$ 6dBm Load VSWR = 20:1, all phase angles	No module damage or permanent degradation			
Noise Power	-	f_Rx = 1805MHz to 1880MHz NTC, $P_{OUT} = P_{RATED}$, RBW = 100KHz	-88	-	-77	dBm
		f_Rx = 925MHz to 960MHz NTC, $P_{OUT} = P_{RATED}$, RBW = 100KHz	-90	-	-73	
		f_Rx = 1930MHz to 1990MHz, NTC, $P_{OUT} = P_{RATED}$, RBW = 100KHz	-88	-	-77	
		f_Rx = 869MHz to 894MHz NTC, $P_{OUT} = P_{RATED}$, RBW = 100KHz	-90	-	-83	

NOTE

Unless otherwise specified, P_{RATED} = 31dBm.

Table 8-4 Electrical Specifications (GSM1800/1900 EDGE Mode)

GSM1800/1900 EDGE Mode						
Parameter	**Symbol**	**Conditions**	**Min.**	**Typ.**	**Max.**	**Unit**
Frequency Range	f_o	DCS1800	1710	-	1785	MHz
		PCS1900	1850	-	1910	
Power Added Efficiency	PAE	NTC, $P_{OUT} = P_{RATED}$, Duty cycle = 1:8	11	-	18	%
Harmonics	$2f_0$ to $7f_0$	BW = 3MHz 0dBm ≤ P_{OUT} ≤ P_{RATED}	-50	-	-40	dBm
Output Power	P_{OUT_EDGE}	NTC ACPR / EVM /ORFS in specification	26.5	-	-	dBm
	P_{OUT_EDGE}	ETC, P_{OUT}	25	26.5	-	dBm
Input VSWR	Γ_{IN}	$P_{OUT} \leq P_{RATED}$	-	-	2.5:1	-
Gain@HPM	$G_{\_NOM\_1800}$	NTC, $P_{OUT} = P_{RATED}$	30	32	35	dB
		Over temperature, $P_{OUT} = P_{RATED}$	28		37	dB
Gain@LPM	$G_{\_1800}$	NTC	19	22	26	dB
ACPR	$ACPR_{\_200}$	$P_{OUT} = P_{RATED}$ Bandwidth = 30KHz		-	-30	dBc
	$ACPR_{\_400}$			-	-57	
	$ACPR_{\_600}$			-	-63	
EVM	$EVM_{\_RMS}$	$P_{OUT} = P_{RATED}$	-	-	4	%
Stability	S	0dBm ≤ P_{OUT} ≤ P_{RATED} Load VSWR = 12:1, all phase angles	-	-	-36	dBm
Load Mismatch	-	5dBm ≤ P_{OUT} ≤ P_{RATED} Load VSWR = 20:1, all phase angles	No module damage or permanent degradation			
Noise Power	-	f_Rx = 1805MHz to 1880MHz NTC, $P_{OUT} = P_{RATED}$, RBW = 100KHz		-	-77	dBm
		f_Rx = 925MHz to 960MHz NTC, $P_{OUT} = P_{RATED}$, RBW = 100KHz		-	-77	
		f_Rx = 1930MHz to 1990MHz NTC, $P_{OUT} = P_{RATED}$, RBW = 100KHz	-	-	-80	
		f_Rx = 869MHz to 894MHz NTC, $P_{OUT} = P_{RATED}$, RBW = 100KHz	-	-	-83	

NOTE

Unless otherwise specified, P_{RATED} = 26.5dBm.

Table 8-5 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	-	24.5	-	dBm
Gain	G_{HPM_NOM}	$P_{OUT} = P_{OUT\_TD\_NOM}$	-	31	-	dB
Power Added Efficiency	PAE_{HPM}	$P_{OUT} = P_{OUT\_TD\_NOM}$	-	21	-	%
ACLR	ACLR_1.6MHz	$P_{OUT\_TD\_NOM}$	-	-	-35	dBc
	ACLR_3.2MHz	$P_{OUT\_TD\_NOM}$	-	-	-50	
EVM	EVM_{RMS}	$P_{OUT\_TD\_NOM}$	-	-	4	%
Harmonics Suppression	$2f_0$ to $6f_0$	$P_{OUT} \leq P_{OUT\_TD\_NOM}$, RBM = 1MHz	-	-	-36	dBm
Tx Noise in Rx Bands	-	Rx = 1805MHz to 1850MHz, $P_{OUT} = P_{OUT\_TD\_NOM}$, NTC, RBW = 100KHz	-	-	-81	dBm
Input VSWR	Γ_{IN}	-	-	-	2.5:1	VSWR
Stability (Spurious)	S	VSWR = 12:1, all phase angles, RBW = 1MHz	-	-	-36	dBm
Ruggedness – no damage	Ru	All phase angels, time = 10s	20:1	-	-	VSWR

Table 8-6 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	-	24.5	-	dBm
Gain	G_{HPM_NOM}	$P_{OUT} = P_{OUT\_TD\_NOM}$	28	30	32	dB
Power Added Efficiency	PAE_{HPM}	$P_{OUT} = P_{OUT\_TD\_NOM}$	10	12	20	%
ACLR	ACLR_1.6MHz	$P_{OUT\_TD\_NOM}$	-	-	-35	dBc
	ACLR_3.2MHz	$P_{OUT\_TD\_NOM}$	-	-	-50	
EVM	EVM_{RMS}	$P_{OUT\_TD\_NOM}$	-	-	4	%
Harmonics Suppression	$2f_0$ to $6f_0$	$P_{OUT} \leq P_{OUT\_TD\_NOM}$, RBM = 1MHz	-	-	-36	dBm
Tx Noise in Rx Bands	-	Rx = 1805MHz to 1850MHz, $P_{OUT} = P_{OUT\_TD\_NOM}$, NTC,	-	-	-81	dBm

TD-SCDMA Band 34 (2010-2025 MHz)						
Parameter	**Symbol**	**Conditions**	**Min.**	**Typ.**	**Max.**	**Unit**
		RBW = 100KHz				
Input VSWR	Γ_{IN}	-	-	-	2.5:1	VSWR
Stability	S	VSWR = 12:1, all phase angles RBW = 1MHz	-	-	-36	dBm
Ruggedness – no damage	Ru	All phase angles, time = 10s	20:1	-	-	VSWR

Table 8-7 Electrical Specifications (TDD-LTE Band 34/39)

TDD-LTE Band 34/39 (1880-1920 MHz, 2010-2025 MHz)						
Parameter	**Symbol**	**Conditions**	**Min.**	**Typ.**	**Max.**	**Unit**
Output Power	$P_{OUT\_TD\_NOM}$	NTC	-	23.5	--	dBm
Gain	G_{HPM_NOM}	$P_{OUT} = P_{OUT\_TDLTE\_NOM}$	-	30	-	dB
Power Added Efficiency	PAE_{HPM}	$P_{OUT} = P_{OUT\_TDLTE\_NOM}$	-	18	-	%
ACLR	$EUTRA_{\_ACLR1}$	$P_{OUT} = P_{OUT\_TDLTE\_NOM}$	-	-	-33	dBc
	$UTRA_{\_ACLR1}$	$P_{OUT} = P_{OUT\_TDLTE\_NOM}$	-	-	-36	
	$UTRA_{\_ACLR2}$	$P_{OUT} = P_{OUT\_TDLTE\_NOM}$	-	-	-39	
EVM	$EVM_{\_RMS}$	$P_{OUT\_TDLTE\_NOM}$	-	-	4	%
Harmonics Suppression	f_{02}	$P_{OUT} \leq P_{OUT\_TDLTE\_NOM}$, RBM = 1MHz	-	-	-36	dBm
	f_{03}				-46	
Input VSWR	Γ_{IN}	-	-	-	2.5:1	VSWR
Stability	S	VSWR = 12:1, all phase angles, RBW = 1MHz	-	-	-36	dBm
Ruggedness – no damage	Ru	All phase angles, time = 10s	20:1	-	-	VSWR

Table 8-8 Electrical Specifications (Ports TRx1 to TRx14)

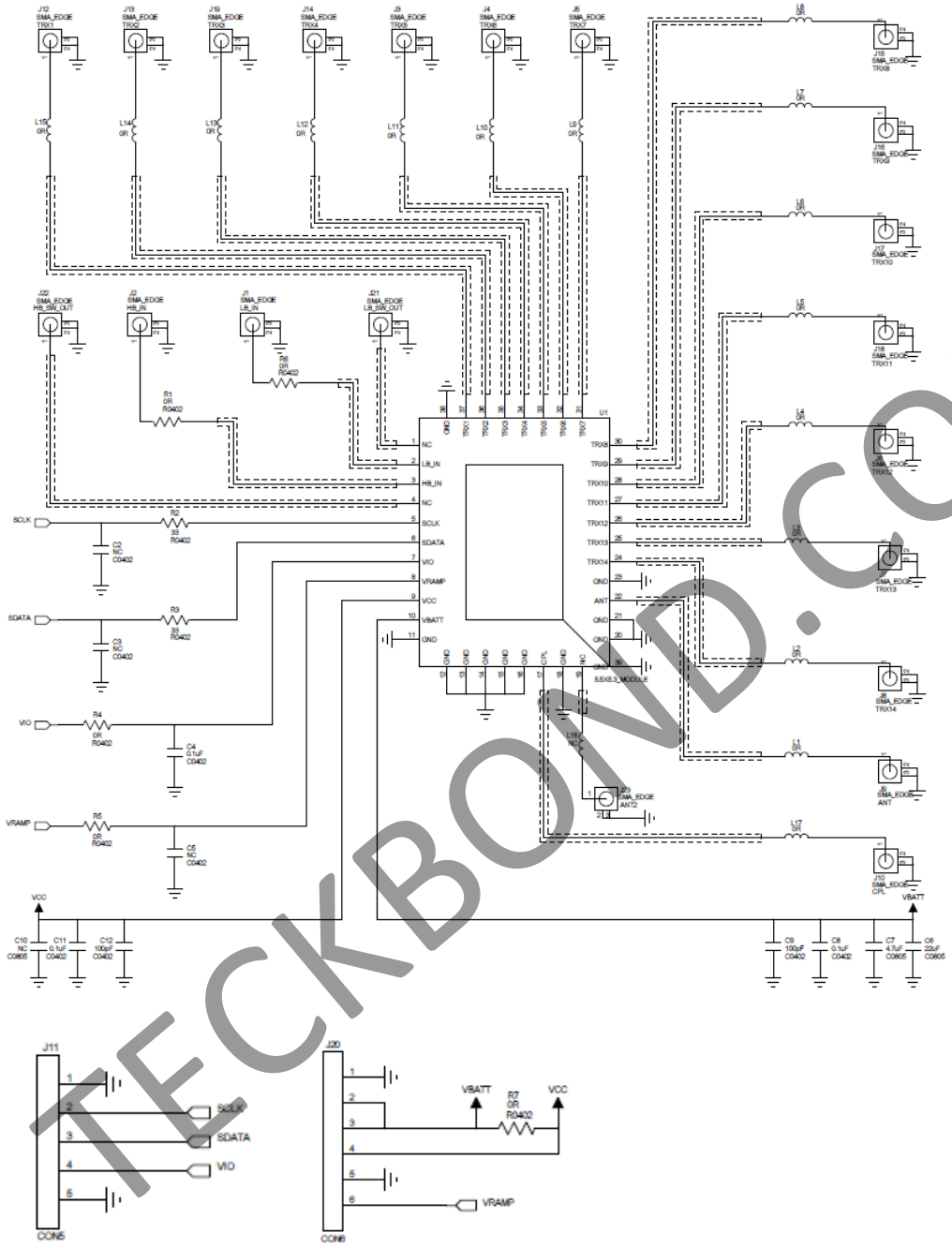
Ports TRx1 to TRx14						
Parameter	**Symbol**	**Conditions**	**Min.**	**Typ.**	**Max.**	**Unit**
Frequency Range	$f_{\_TRx}$	-	699	-	2690	MHz

Ports TRx1 to TRx14						
Parameter	**Symbol**	**Conditions**	**Min.**	**Typ.**	**Max.**	**Unit**
Insertion Loss NTC	$Rx_{\_IL\_LB}$	699MHz to 960MHz	-	0.75	1.0	dB
	$Rx_{\_IL\_MB}$	1710MHz to 2170MHz	-	1.4	1.75	
	$Rx_{\_IL\_HB}$	2300MHz to 2690MHz	-	1.5	2.1	
Insertion Loss ETC	$Rx_{\_IL\_LB}$	699MHz to 960MHz	-	0.75	1.3	dB
	$Rx_{\_IL\_MB}$	1710MHz to 2170MHz	-	1.4	2.1	
	$Rx_{\_IL\_HB}$	2300MHz to 2690MHz	-	1.5	2.4	
Isolation	$ISO_{\_ADJ\_TRx\_LB}$	699MHz to 960MHz	17	26	35	dB
	$ISO_{\_ADJ\_TRx\_MB}$	1710MHz to 2170MHz	16	23	30	
	$ISO_{\_ADJ\_TRx\_HB}$	2300MHz to 2690MHz	13	20	25	
	$ISO_{\_NADJ\_TRx\_LB}$	699MHz to 960MHz	22	35	36	
	$ISO_{\_NADJ\_TRx\_MB}$	1710MHz to 2170MHz	17	30	31	
	$ISO_{\_NADJ\_TRx\_HB}$	2300MHz to 2690MHz	13	25	27	
TRx Harmonics	$TRx_{\_2f0}$, $TRx_{\_3f0}$	50Ω, $P_{\_IN\_TRx}$ = 27dBm, NTC	-60	-	-55	dBm
TRx Ports IIP2	IMD2	Tx Power=20dBm Block Power =-15dBm	-	-105	-100	dBm
	IMD3		-	-106	-100	dBm
Leakage from Tx to TRx Ports	$P_{\_TxTRx}$	-	-10	-	5	dBm
Coupling Factor in TRx Mode	$CPL_{\_TRx\_LB}$	699MHz to 960MHz, NTC	-31	-27	-26	dB
	$CPL_{\_TRx\_MB}$	1710MHz to 2170MHz, NTC	-26	-21	-20	
	$CPL_{\_TRx\_HB}$	2300MHz to 2690MHz, NTC	-25	-20	-18	
Coupling Factor Variation over Output VSWR	$CPL_{\_SWR\_TRx\_LB}$	699MHz to 960MHz, VSWR 2.5:1 at ANT port	-0.5	-	0.5	dB
	$CPL_{\_SWR\_TRx\_MB}$	1710MHz to 2170MHz, VSWR 2.5:1 at ANT port	-1.0	-	1.0	
	$CPL_{\_SWR\_TRx\_HB}$	2300MHz to 2690MHz, VSWR 2.5:1 at ANT port	-1.0	-	1.0	
Coupling Factor Variation over Temperature	$CPL_{\_TV\_TRx\_LB}$	699MHz to 960MHz	-0.5	-	0.5	dB
	$CPL_{\_TV\_TRx\_MB}$	1710MHz to 1990MHz	1.0	-	1.0	
	$CPL_{\_TV\_TRx\_HB}$	2010MHz to 2690MHz	1.0	-	1.0	
TRx Port VSWR	-	NTC	-	-	2	VSWR
	-	ETC	-	-	2.5	VSWR
Turn-on Time	T_{ON_VBATT}	From 50% V_{BATT} and VIO to	5	-	20	μs

Ports TRx1 to TRx14						
Parameter	**Symbol**	**Conditions**	**Min.**	**Typ.**	**Max.**	**Unit**
		0.5 dB RF settling				
TRx-to-TRx Switch 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

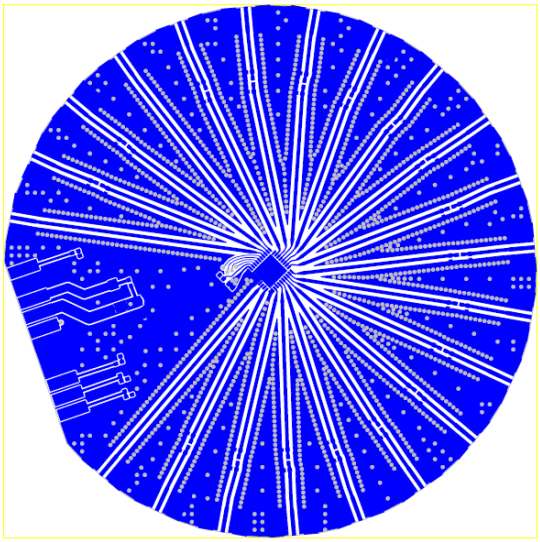


Figure 10-2 Bottom Layer

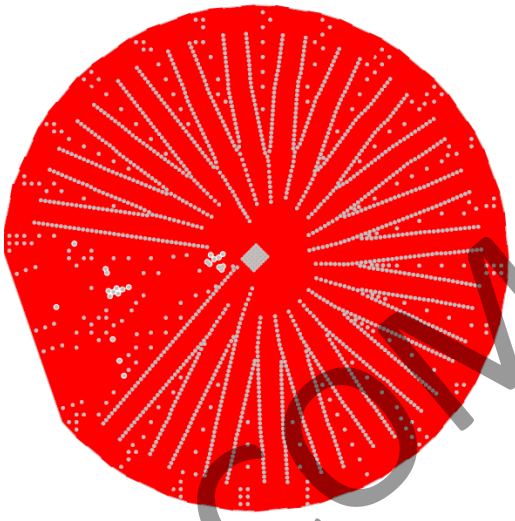
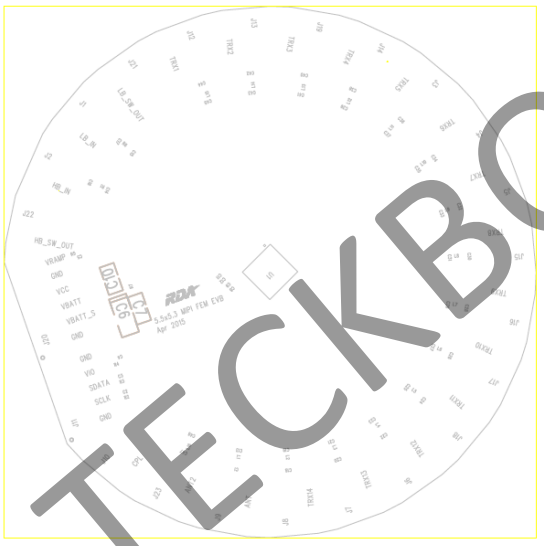


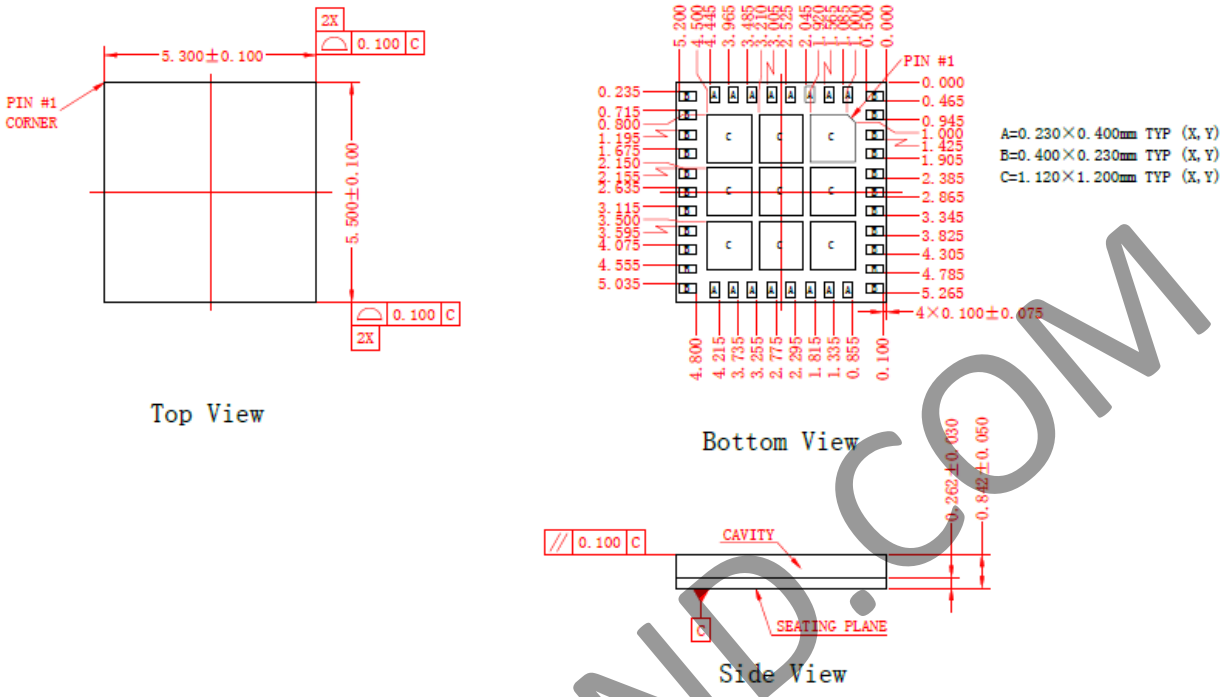
Figure 10-3 Top Silkscreen



11 Package Dimensions

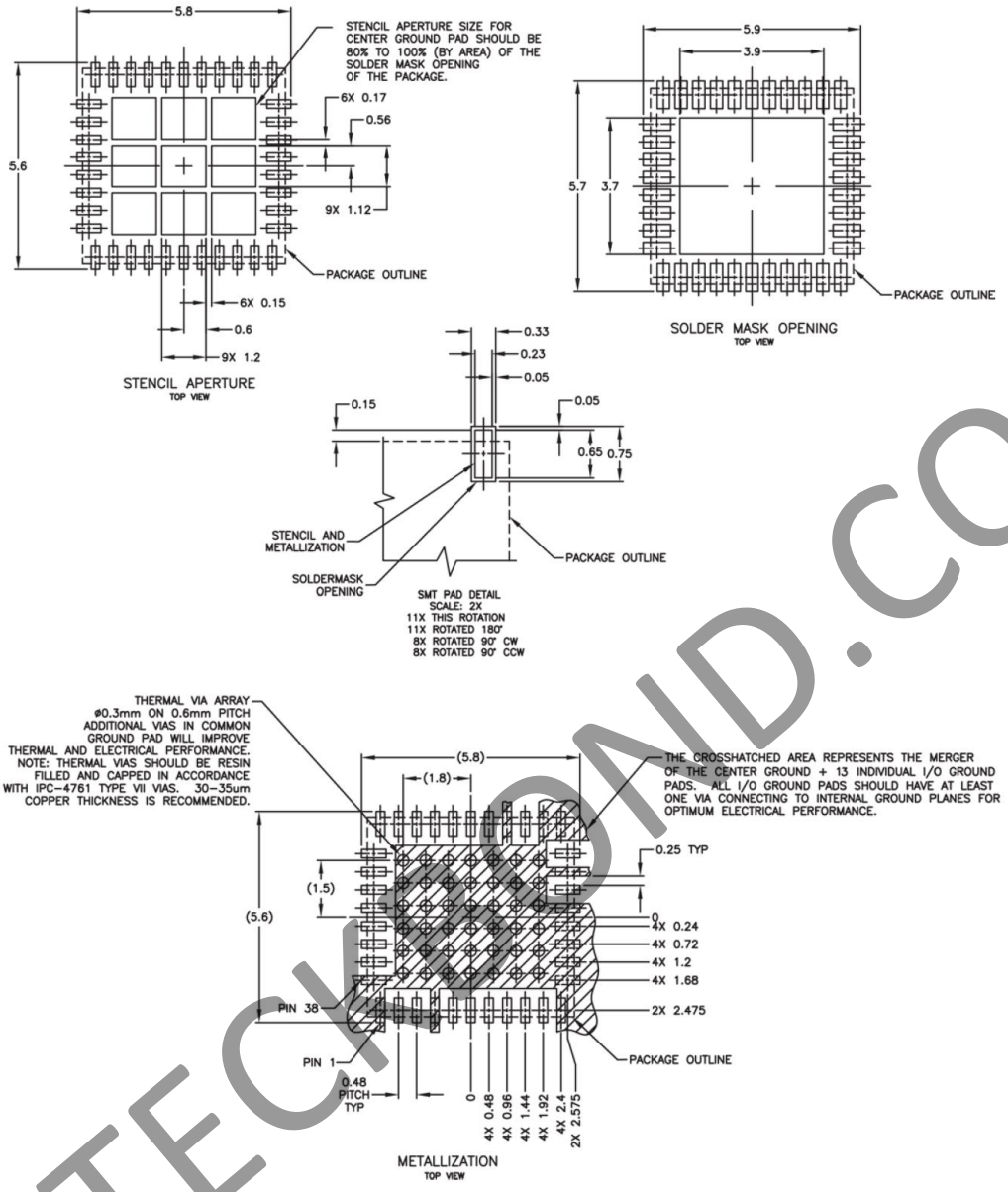
Figure 11-1 Package Dimensions

Unit: mm



12 Suggested PCB Design

Figure 12-1 Suggested PCB Design



13 Recommended Reflow Profile

The RTM7916-51 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

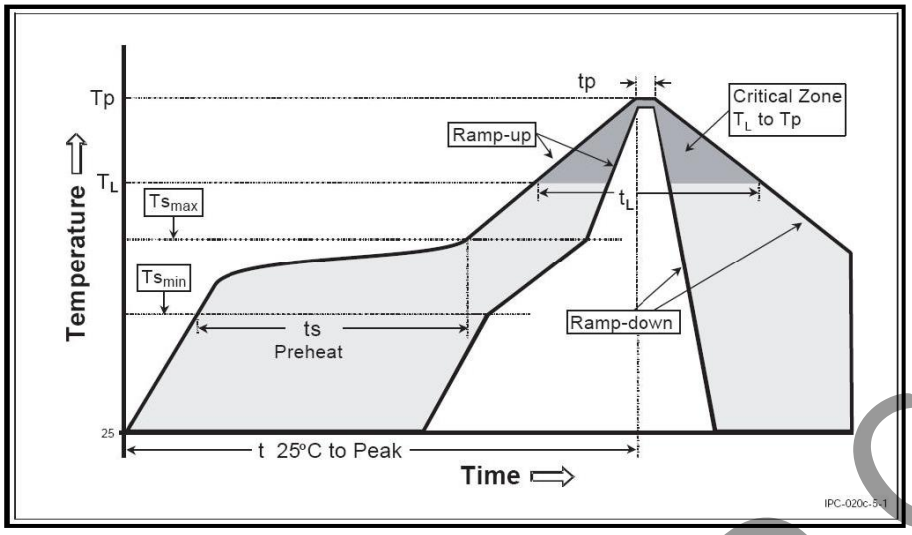


Table 13-1 Classification Reflow Profiles

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 Temperature (tp)	10-30seconds	20-40seconds

Profile Feature	Sn-Pb Eutectic Assembly	Pb-Free Assembly
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