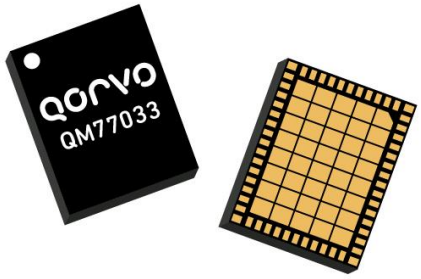
QM77033

Low Band Switched PA plus Duplexer



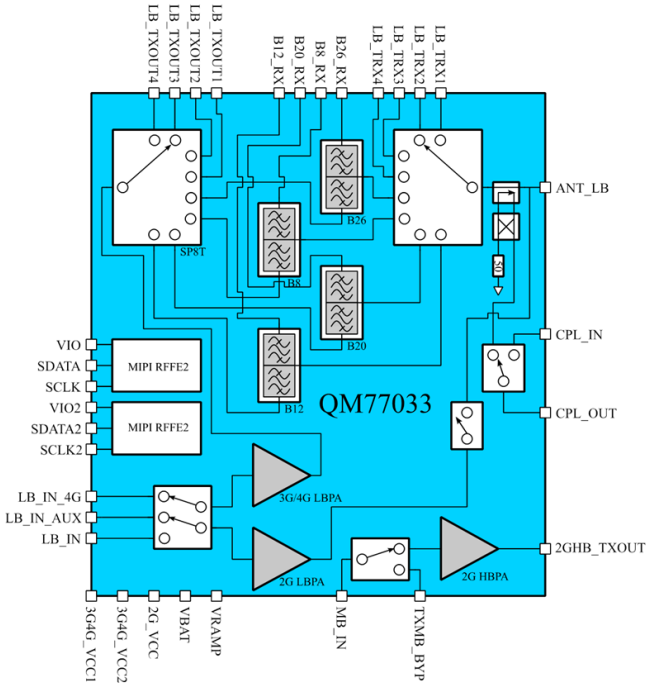
56 Pin 6.0x7.6 mm leadless SMT Package

Product Overview

The Qorvo® QM77033 is multi-mode, multi-band high efficiency linear Low Band S-PAD (Switched PA plus Duplexer) designed for use as the final amplification stage in multi-mode GSM / CDMA / EDGE / WCDMA / LTE mobile cellular equipment. The high efficiency LB S-PAD contains three amplifier paths for 3G/4G Low, 2G Low and 2G High Band frequencies followed by switch outputs for multi-band coverage. QM77033 band select and bias are programmed through Mobile Industry Processor Interface (MIPI) buses. This QM77033 supports Average Power Tracking (APT) for higher system efficiency at various power levels and modulations, as well as is Envelope Tracking (ET) capable for current consumption optimization.

The QM77033 is designed to be used with QM77031 Mid/High Band Module and is packaged in a RoHS-compliant, compact 56-pin, 6.0x7.6X0.8(max) mm surface-mount leadless package

Functional Block Diagram



Functional Block Diagram

Key Features

- Multi-Mode and Multi Band Capabilities; GSM/EDGE/CDMA2000/WCDMA/TDD-LTE
- Integrated Band 26(5), 8, 12 and 20 duplexers and GSM TX Harmonic Filters
- Quad-Band EDGE, GPRS class 12 compatible
- Additional Bands Through External Paths
- MIPI RFFE digital control interface
- 2G Pin and VRAMP Power Control
- Separate MIPI controllers for PA and ASM
- Uplink and Downlink Carrier Aggregation
- Designed and Optimized for use with DC-DC converter
- Power Modes and Bias Programmable with MIPI RFFE Interfaces

Applications

- 2G/3G/4G Multi-Mode handsets
- WCDMA and LTE datacards or wearable devices
- High performance Communication Systems
- LTE channel Bandwidths up to 20MHz

Ordering Information

Part Number	Description
QM77033SR	7” Reel with 100 pieces
QM77033TR13	13” Reel with 5,000 pieces
QM77033DK	Design Kit (includes Evaluation board)

Absolute Maximum Ratings

PARAMETER	CONDITIONS	RATING
Storage Temperature		−40 to +150 °C
Operating Temperature		−30 to +85 °C
Supply Voltage in Standby Mode		+6 V
Supply Voltage in Idle Mode		+6 V
Supply Voltage in Operating Mode		+6 V
Supply Voltage, VBATT		+6 V
Digital control signals (VIO, SLCK, SDATA)		+2 V
RF Input Power (3G/4G)	CW, 50 Ω, T = 25˚C	+10 dBm
Output Load VSWR (Ruggedness) ANT_LB (LB 2G/EDGE mode) *1	Open Loop*3	20:1
Output Load VSWR (Ruggedness) ANT_LB (3G/4G) *2	Closed Loop*3	20:1
Output Load VSWR (Ruggedness) 2G_HB_TXOUT (HB 2G/EDGE mode) *1	Open Loop*3	10:1
Output Load VSWR (Ruggedness) LB_TXOUT[1-4] *2	Closed Loop*3	10:1
ESD SAW Filter Pins (HBM)		500 V
ESD All (non-SAW Filter) Pins (HBM)		1000 V

*1 2G/EDGE is 50% duty-cycle up to rated power (set under 50-ohm condition)

*2 4G is 10M12RB modulation up to rated power (set under 50-ohm condition)

*3 Open-loop and Closed-Loop testing allows maximum RF input power to +6dBm

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.

Recommended Operating Conditions

Parameter	Min.	Typ.	Max.	Units
Operating Frequency Range	617		960	MHz
Operating Frequency Range (2G HB)	1710		1910	MHz
Operating Ambient Temperature	-20	+25	+85	°C
Supply Voltage, VBATT	+3.0		+4.8	V
Supply Voltage, 3G4G VCC1, VCC2	+0.5*1		+4.6	V
Supply Voltage, 2G VCC	+0.5*1		+4.6	V
Supply Voltage, VIO	+1.65	+1.8	+1.95	V
Vramp, GMSK (Pout=Max)			+1.65	V
Vramp, GMSK (Pout=Min)		+0.25		V
VIO Rise Time			450	µs
SCLK, SDATA Logic Low	0		0.3 * VIO	V
SCLK, SDATA Logic HIGH	0.7 * VIO	+1.8	VIO	V
SCLK, SDATA Input, Current			50	µA
Total Leakage Current (ICC+IBAT)			20	µA

*1 VCC down to 0.5V may be used for backed-off power when using DC-DC converter to reduce low power current drain.

Electrical specifications are measured at specified test conditions. Specifications are not guaranteed over all recommended operating conditions.

Electrical Specifications

Parameter	Conditions	Min.	Typ.	Max.	Units
2G GMSK Linear Mode GSM850/GSM900 TX Electrical Specifications	Unless otherwise stated: All unused RF ports terminated in 50Ω, Input and Output = 50Ω, Temp = 25°C, VCC = VBAT = 3.5V, GMSK Modulation, Duty Cycle = 25%, Period = 4.6ms.				
Operational Frequency Range	GSM850	824		849	MHz
	GSM900	880		915	
Input Power (Pin)				8	dBm
Maximum Output Power	HPM	34.5			dBm
	HPM, VBAT = 3.1V, Temp = -20 to +85°C	33			
	LPM		13		
PAE	Pin adjusted for Pout = 34.5dBm		40		%
Harmonics	2f0		-40	-33	dBm
	3f0		-40	-33	
Forward Isolation	VBAT = 3.1V, Temp = -20 to +85°C, PA OFF			-53	dBm
Noise Power, 736MHz to 757MHz	Pin adjusted for Pout=34.5dBm; RBW=100kHz			-83	dBm /100kHz
Noise Power, 757MHz to 763MHz				-77	
Noise Power, 869MHz to 894MHz				-83	
Noise Power, 925MHz to 935MHz				-73	
Noise Power, 935MHz to 960MHz				-83	
Noise Power, 1805MHz to 1880MHz				-77	
Noise Power, 1930MHz to 1990MHz				-77	
Noise Power, 2400MHz to 2500MHz				-156	dBm/Hz
Stability (Spurious), VSWR 6:1	VSWR=6:1; all phase angles; Pin adjusted for Prated into 50Ω load; VBAT=3.1 to 4.8V; Temp=-20 to +85°C; RBW=3MHz			-36	dBm
Ruggedness, VSWR 20:1	VSWR=20:1; all phase angles; Pin adjusted for Prated into 50Ω load; VBAT=3.1 to 4.8V; Temp=-20 to +85°C;	No damage			

Parameter	Conditions	Min.	Typ.	Max.	Units
2G GMSK Linear Mode DCS1800/PCS1900 TX Electrical Specifications	Unless otherwise stated: All unused RF ports terminated in 50Ω, Input and Output = 50Ω, Temp = 25°C, VCC = VBAT = 3.5V, GMSK Modulation, Duty Cycle = 25%, Period = 4.6ms.				
Operational Frequency Range	DCS1800	1710		1785	MHz
	PCS1900	1850		1910	
Input Power (Pin)				5	dBm
Maximum Output Power	HPM	32.8			dBm
	HPM, VBAT = 3.1V, Temp = -20 to +85°C	31.8			
	LPM		13		
PAE	Pin adjusted for Pout = 32.8dBm		40		%
Harmonics	2f0		-40	-33	dBm
	3f0		-40	-33	
Forward Isolation	VBAT = 3.1V, Temp = -20 to +85°C, PA OFF			-53	dBm
Noise Power, 736MHz to 757MHz	Pin adjusted for Pout = 32.8dBm; RBW = 100kHz			-83	dBm /100kHz
Noise Power, 757MHz to 763MHz				-77	
Noise Power, 869MHz to 894MHz				-83	
Noise Power, 925MHz to 935MHz				-73	
Noise Power, 935MHz to 960MHz				-83	
Noise Power, 1805MHz to 1880MHz				-77	
Noise Power, 1930MHz to 1990MHz				-77	
Noise Power, 2400MHz to 2500MHz				-145	dBm/Hz
Stability (Spurious), VSWR 5:1	VSWR=5:1; all phase angles; Pin adjusted for Prated into 50Ω load; VBAT=3.1 to 4.8V; Temp=-20 to +85°C; RBW=3MHz			-36	dBm
Ruggedness, VSWR 10:1	VSWR=10:1; all phase angles; Pin adjusted for Prated into 50Ω load; VBAT=3.1 to 4.8V; Temp=-20 to +85°C;	No damage			

Parameter	Conditions	Min.	Typ.	Max.	Units
2G GMSK Saturated Mode GSM850/GSM900 TX Electrical Specifications	Unless otherwise stated: All unused RF ports terminated in 50Ω, Input and Output = 50Ω, Temp = 25°C, VCC = VBAT = 3.5V, Pin = 3dBm, Duty Cycle = 25%, Period = 4.6ms.				
Operational Frequency Range	GSM850	824		849	MHz
	GSM900	880		915	
Input Power (Pin)		-1		5	dBm
Maximum Output Power		34.5			dBm
	VBAT = 3.1V, Temp = -20 to +85°C	33.5			
PAE	VRAMP adjusted for Pout = 34.5dBm		40		%
Harmonics	2f0		-40	-33	dBm
	3f0		-40	-33	
Forward Isolation	VBAT = 3.1V, Temp = -20 to +85°C, PA OFF			-53	dBm
Noise Power, 736MHz to 757MHz	VRAMP adjusted for Pout=34.5dBm; RBW=100kHz			-83	dBm /100kHz
Noise Power, 757MHz to 763MHz				-77	
Noise Power, 869MHz to 894MHz				-80	
Noise Power, 925MHz to 935MHz				-73	
Noise Power, 935MHz to 960MHz				-83	
Noise Power, 1805MHz to 1880MHz				-77	
Noise Power, 1930MHz to 1990MHz				-77	
Noise Power, 2400MHz to 2500MHz				-156	dBm/Hz
Stability (Spurious), VSWR 6:1	VSWR=6:1; all phase angles; VRAMP adjusted for Prated into 50Ω load; VBAT=3.1 to 4.8V; Pin=0 to 6dBm; Temp=-20 to +85°C; RBW=3MHz			-36	dBm
Ruggedness, VSWR 20:1	VSWR=20:1; all phase angles; VRAMP adjusted for Prated into 50Ω load; VBAT=3.1 to 4.8V; Pin=0 to 6dBm; Temp=-20 to +85°C;	No damage			

Parameter	Conditions	Min.	Typ.	Max.	Units
2G GMSK Saturated Mode DCS1800/PCS1900 TX Electrical Specifications	Unless otherwise stated: All unused RF ports terminated in 50Ω, Input and Output = 50Ω, Temp = 25°C, VCC = VBAT = 3.5V, Pin = 3dBm, Duty Cycle = 25%, Period = 4.6ms.				
Operational Frequency Range	DCS1800	1710		1785	MHz
	PCS1900	1850		1910	
Input Power (Pin)		-1		5	dBm
Maximum Output Power		32.8			dBm
	VBAT = 3.1V, Temp = -20 to +85°C	31.8			
PAE	VRAMP adjusted for Pout = 32.8dBm		40		%
Harmonics	2f0		-40	-33	dBm
	3f0		-40	-33	
Forward Isolation	VBAT = 3.1V, Temp = -20 to +85°C, PA OFF			-53	dBm
Noise Power, 736MHz to 757MHz	VRAMP adjusted for Pout = 32.8dBm; RBW = 100kHz			-83	dBm /100kHz
Noise Power, 757MHz to 763MHz				-77	
Noise Power, 869MHz to 894MHz				-83	
Noise Power, 925MHz to 935MHz				-73	
Noise Power, 935MHz to 960MHz				-83	
Noise Power, 1805MHz to 1880MHz				-77	
Noise Power, 1930MHz to 1990MHz				-77	
Noise Power, 2400MHz to 2500MHz				-145	dBm/Hz
Stability (Spurious), VSWR 5:1	VSWR=5:1; all phase angles; VRAMP adjusted for Prated into 50Ω load; VBAT=3.1 to 4.8V; Temp=-20 to +85°C; RBW=3MHz			-36	dBm
Ruggedness, VSWR 10:1	VSWR=10:1; all phase angles; VRAMP adjusted for Prated into 50Ω load; Temp=-20 to +85°C;	No damage			

Parameter	Conditions	Min.	Typ.	Max.	Units
2G EDGE GSM850/GSM900 TX Electrical Specifications	Unless otherwise stated: All unused RF ports terminated in 50Ω, Input and Output = 50Ω, Temp = 25°C, VCC = VBAT = 3.5V, Pout = 28.5dBm, Duty Cycle = 25%, Period = 4.6ms.				
Operational Frequency Range	GSM850	824		849	MHz
	GSM900	880		915	
Maximum Output Power		28.5			dBm
	VBAT = 3.1 to 4.5V; Temp = -20 to +85°C	27.5			
Gain		30	32	36	dB
	VBAT = 3.1V, Temp = -20 to +85°C	28		36	
Peak Supply Current			1000	1580	mA
PAE			20		%
Modulation Spectrum 400kHz offset	VBAT = 3.1V, Temp = -20 to +85°C		-62	-57	dBc /30kHz
EVM RMS	VBAT = 3.1V, Temp = -20 to +85°C		3	4.5	%
Noise Power 736MHz to 757MHz				-83	dBm /100kHz
Noise Power 757MHz to 763MHz				-77	
Noise Power 869MHz to 894MHz				-83	
Noise Power 925MHz to 935MHz				-73	
Noise Power 935MHz to 960MHz				-83	
Noise Power 1805MHz to 1880MHz				-77	
Noise Power 1930MHz to 1990MHz				-77	
Noise Power 2400MHz to 2500MHz				-156	dBm/Hz

Parameter	Conditions	Min.	Typ.	Max.	Units
2G EDGE DCS1800/PCS1900 TX Electrical Specifications	Unless otherwise stated: All unused RF ports terminated in 50Ω, Input and Output = 50Ω, Temp = 25°C, VCC = VBAT = 3.5V, Pout = 29.1dBm, Duty Cycle = 25%, Period = 4.6ms.				
Operational Frequency Range	DCS1800	1710		1785	MHz
	PCS1900	1850		1910	
Maximum Output Power		29.1			dBm
	VBAT = 3.1 to 4.5V; Temp = -20 to +85°C	28.1			
Gain		29	32.6	37	dB
	VBAT = 3.1V, Temp = -20 to +85°C	28		38	
Peak Supply Current			1000	1760	mA
PAE			20		%
Modulation Spectrum 400kHz offset	VBAT = 3.1V, Temp = -20 to +85°C		-62	-57	dBc /30kHz
EVM RMS	VBAT = 3.1V, Temp = -20 to +85°C		3	6	%
Noise Power 736MHz to 757MHz				-83	dBm /100kHz
Noise Power 757MHz to 763MHz				-77	
Noise Power 869MHz to 894MHz				-83	
Noise Power 925MHz to 935MHz				-73	
Noise Power 935MHz to 960MHz				-83	
Noise Power 1805MHz to 1880MHz				-77	
Noise Power 1930MHz to 1990MHz				-77	
Noise Power 2400MHz to 2500MHz				-156	dBm/Hz

Parameter	Conditions	Min.	Typ.	Max.	Units
3G WCDMA Band5/26 TX Electrical Specifications	Unless otherwise stated: All unused RF ports terminated in 50Ω, Input and Output = 50Ω, Temp = 25°C, VCC = 3.4V, VBAT = 3.8V, APT Mode, R99				
Operational Frequency Range	Band5/26	814		849	MHz
Maximum Output Power	HPM, VCC = 3.4V	25.5			dBm
	HPM, VCC = 3.1V, VBAT = 3.4V, Temp = -20°C to +85°C	24.5			
	LPM, VCC=1.2V		11		
Gain	HPM, VCC = 3.4V	23			dB
	HPM, VCC = 3.1V, VBAT=3.4V, Temp = -20°C to +85°C	22			
UMTS ACLR1 (±5MHz)	Pout ≤ Pmax		-42	-36	dBc
UMTS ACLR2 (±10MHz)	Pout ≤ Pmax		-54	-48	
EVM	All Condition			6.5	%
PAE	HPM, Pout = Pmax	18	23		%
Current Consumption	HPM, Pout = Pmax			565	mA
Phase discontinuity variation		-15		15	Degree
RX Band Noise	Pout ≤ Pmax		-188	-180	dBm/Hz
ISM 2.4G Noise	2400 to 2783MHz			-165	
ISM 5G Noise (except harmonics)	5150 to 5850MHz			-160	
GPS Band Noise	1574 to 1577MHz			-165	
Harmonics	2f0			-40	dBm
	3f0			-40	

Parameter	Conditions	Min.	Typ.	Max.	Units
3G WCDMA Band8 TX Electrical Specifications	Unless otherwise stated: All unused RF ports terminated in 50Ω, Input and Output = 50Ω, Temp = 25°C, VCC = 3.4V, VBAT = 3.8V, APT Mode, R99				
Operational Frequency Range	Band8	880		915	MHz
Maximum Output Power	HPM, VCC = 3.4V	25.5			dBm
	HPM, VCC = 3.1V, VBAT = 3.4V, Temp = -20°C to +85°C	24.5			
	LPM, VCC = 1.2V		11		
Gain	HPM, VCC = 3.4V	23			dB
	HPM, VCC = 3.1V, VBAT=3.4V, Temp = -20°C to +85°C	22			
UMTS ACLR1 (±5MHz)	Pout ≤ Pmax		-42	-36	dBc
UMTS ACLR2 (±10MHz)	Pout ≤ Pmax		-54	-48	
EVM	All Condition			5.5	%
PAE	HPM, Pout = Pmax	15	20		%
Current Consumption	HPM, Pout = Pmax			696	mA
Phase discontinuity variation		-15		15	Degree
RX Band Noise	Pout ≤ Pmax		-188	-183	dBm/Hz
ISM 2.4G Noise	2400 to 2783MHz			-165	
ISM 5G Noise (except harmonics)	5150 to 5850MHz			-160	
GPS Band Noise	1574 to 1577MHz			-165	
Harmonics	2f0			-40	dBm
	3f0			-40	

Parameter	Conditions	Min.	Typ.	Max.	Units
CDMA BC0, BC10 TX Electrical Specifications	Unless otherwise stated: All unused RF ports terminated in 50Ω, Input and Output = 50Ω, Temp = 25°C, VBAT = 3.8V, APT Mode, C2K 1xRTT Modulation				
Operational Frequency Range	BC0	815		849	MHz
	BC10	814		849	
Maximum Linear Output Power	HPM, VCC = 3.4V	24.5			dBm
	HPM, VCC = 3.1V, VBAT = 3.4V, Temp = -20°C to +85°C	23.5			
	LPM, VCC = 1.2V		11		
Gain	HPM, VCC = 3.4V	22			dB
	HPM, VCC = 3.1V, VBAT=3.4V, Temp = -20°C to +85°C	21			
CDMA ACLR1 (±0.885MHz)	Pout ≤ Pmax		-46		dBc
CDMA ACLR2 (±1.98MHz)	Pout ≤ Pmax		-58		
EVM	All Condition		2	5.5	%
Current consumption	HPM, Pout = Pmax			675	mA
RX Band Noise	Pout ≤ Pmax		-188	-180	dBm/Hz
GPS Band Noise	1574 to 1577MHz			-165	
Harmonics	2f0			-40	dBm
	3f0			-40	

Parameter	Conditions	Min.	Typ.	Max.	Units
4G FDD LTE Band5/26 TX Electrical Specifications	Unless otherwise stated: All unused RF ports terminated in 50Ω, Input and Output = 50Ω, Temp = 25°C, VCC = 3.4V, VBAT = 3.8V, APT Mode, QPSK, 10MHz, 12 Resource Blocks with MPR=0				
Operational Frequency Range	Band26	814		849	MHz
Maximum Linear Output Power	HPM, VCC = 3.4V	24.5			dBm
	HPM, VCC = 3.4V, VBAT=3.4V, Temp = -20°C to +85°C	23.5			
Gain	HPM, VCC = 3.4V	23			dB
	HPM, VCC = 3.4V, VBAT=3.4V, Temp = -20°C to +85°C	22			
	LPM, VCC =1V, Pout=11dBm	7			
EUTRA - ACLR	HPM, VCC = 3.4V, Pout ≤ Pmax		-38	-33	dBc
UTRA - ACLR1	HPM, VCC = 3.4V, Pout ≤ Pmax		-40	-36	
UTRA - ACLR2	HPM, VCC = 3.4V, Pout ≤ Pmax		-42	-39	
EVM	HPM, VCC = 3.4V, Pout ≤ Pmax		3	5	%
PAE	HPM, VCC = 3.4V, Pout = Pmax	16	20		%
Current Consumption	HPM, VCC = 3.4V, Pout = Pmax		420		mA
RX Band Noise	859 – 894MHz, 10MHz QPSK LTE 25RB		-183	-179	dBm/Hz
MB RX Noise (except harmonics)	1452 – 2200MHz, 10MHz QPSK LTE 50RB		-165	-150	
HB RX Noise (except harmonics)	2300 – 2700MHz, 10MHz QPSK LTE 50RB		-165	-150	
ISM 5G Noise (except harmonics)	5150 – 5850MHz, 10MHz QPSK LTE 50RB		-160	-150	
GPS Band Noise	1574 – 1577MHz, 10MHz QPSK LTE 50RB		-165	-150	
Harmonics	2f0		-75	-40	dBm
	3f0		-75	-55	
	3f0, leakage at 2GHB _TXOUT		-85	-50	

Parameter	Conditions	Min.	Typ.	Max.	Units
4G FDD LTE Band8 TX Electrical Specifications	Unless otherwise stated: All unused RF ports terminated in 50Ω, Input and Output = 50Ω, Temp = 25°C, VBATT = 3.8V, APT Mode, QPSK, 10MHz, 12 Resource Blocks with MPR=0				
Operational Frequency Range	Band8	880		915	MHz
Maximum Linear Output Power	HPM, VCC = 3.4V	24.5			dBm
	HPM, VCC = 3.4V, VBAT=3.4V, Temp = -20°C to +85°C	23.5			
Gain	HPM, VCC = 3.4V	22			dB
	HPM, VCC = 3.4V, VBAT=3.4V, Temp = -20°C to +85°C	21			
	LPM, VCC =1V, Pout=11dBm	7			
EUTRA - ACLR	HPM, VCC = 3.4V, Pout ≤ Pmax		-38	-33	dBc
UTRA - ACLR1	HPM, VCC = 3.4V, Pout ≤ Pmax		-40	-36	
UTRA - ACLR2	HPM, VCC = 3.4V, Pout ≤ Pmax		-42	-39	
EVM	HPM, VCC = 3.4V, Pout ≤ Pmax		3	5	%
PAE	HPM, VCC = 3.4V, Pout = Pmax	14	20		%
Current Consumption	HPM, VCC = 3.4V, Pout = Pmax		470		mA
RX Band Noise	925 – 960MHz, 10MHz QPSK LTE 25RB		-184	-178	dBm/Hz
MB RX Noise (except harmonics)	1452 – 2200MHz, 10MHz QPSK LTE 50RB		-165	-150	
HB RX Noise (except harmonics)	2300 – 2700MHz, 10MHz QPSK LTE 50RB		-165	-150	
B42 RX Noise	3400 – 3600MHz, 10MHz QPSK LTE 50RB		-160	-150	
ISM 5G Noise (except harmonics)	5150 – 5850MHz, 10MHz QPSK LTE 50RB		-160	-150	
GPS Band Noise	1574 – 1577MHz, 10MHz QPSK LTE 50RB		-165	-150	
Harmonics	2f0		-70	-50	dBm
	3f0		-75	-55	
	4f0		-75	-65	
	2f0, leakage at 2GHB _TXOUT		-75	-45	
	3f0, leakage at 2GHB _TXOUT		-85	-52	
	4f0, leakage at 2GHB _TXOUT		-85	-55	

Parameter	Conditions	Min.	Typ.	Max.	Units
4G FDD LTE Band12/17 TX Electrical Specifications	Unless otherwise stated: All unused RF ports terminated in 50Ω, Input and Output = 50Ω, Temp = 25°C, VBATT = 3.8V, APT Mode, QPSK, 10MHz, 12 Resource Blocks with MPR=0				
Operational Frequency Range	Band12	699		716	MHz
	Band17	704		716	
Maximum Linear Output Power	HPM, VCC = 3.4V	24.5			dBm
	HPM, VCC = 3.4V, VBAT=3.4V, Temp = -20°C to +85°C	23.5			
Gain	HPM, VCC = 3.4V	24			dB
	HPM, VCC = 3.4V, VBAT=3.4V, Temp = -20°C to +85°C	23			
	LPM, VCC =1V, Pout=11dBm	9			
EUTRA - ACLR	HPM, VCC = 3.4V, Pout ≤ Pmax		-38	-33	dBc
UTRA - ACLR1	HPM, VCC = 3.4V, Pout ≤ Pmax		-40	-36	
UTRA - ACLR2	HPM, VCC = 3.4V, Pout ≤ Pmax		-42	-39	
EVM	HPM, VCC = 3.4V, Pout ≤ Pmax		3	5	%
PAE	HPM, VCC = 3.4V, Pout = Pmax	16	20		%
Current Consumption	HPM, VCC = 3.4V, Pout = Pmax		440		mA
RX Band Noise	728 – 746MHz, 10MHz QPSK LTE 20RB		-184	-180	dBm/Hz
MB RX Noise (except harmonics)	1452 – 2200MHz, 10MHz QPSK LTE 50RB		-165	-150	
HB RX Noise (except harmonics)	2300 – 2700MHz, 10MHz QPSK LTE 50RB		-165	-150	
ISM 5G Noise (except harmonics)	5150 – 5850MHz, 10MHz QPSK LTE 50RB		-160	-147	
GPS Band Noise	1574 – 1577MHz, 10MHz QPSK LTE 50RB		-165	-150	
Harmonics	2f0		-45	-40	dBm
	3f0		-75	-55	
	3f0, leakage at 2GHB _TXOUT		-80	-60	

Parameter	Conditions	Min.	Typ.	Max.	Units
4G FDD LTE Band20 TX Electrical Specifications	Unless otherwise stated: All unused RF ports terminated in 50Ω, Input and Output = 50Ω, Temp = 25°C, VBATT = 3.8V, APT Mode, QPSK, 10MHz, 12 Resource Blocks with MPR=0				
Operational Frequency Range	Band20	832		862	MHz
Maximum Linear Output Power	HPM, VCC = 3.4V	24.5			dBm
	HPM, VCC = 3.4V, VBAT=3.4V, Temp = -20°C to +85°C	23.5			
Gain	HPM, VCC = 3.4V	23			dB
	HPM, VCC = 3.4V, VBAT=3.4V, Temp = -20°C to +85°C	22			
	LPM, VCC =1V, Pout=11dBm	8			
EUTRA - ACLR	HPM, VCC = 3.4V, Pout ≤ Pmax		-38	-33	dBc
UTRA - ACLR1	HPM, VCC = 3.4V, Pout ≤ Pmax		-40	-36	
UTRA - ACLR2	HPM, VCC = 3.4V, Pout ≤ Pmax		-42	-39	
EVM	HPM, VCC = 3.4V, Pout ≤ Pmax		3	5	%
PAE	HPM, VCC = 3.4V, Pout = Pmax	16	20		%
Current Consumption	HPM, VCC = 3.4V, Pout = Pmax		440		mA
RX Band Noise	791 – 821MHz, 5MHz QPSK LTE 25RB		-179	-181	dBm/Hz
MB RX Noise (except harmonics)	1452 – 2200MHz, 20MHz QPSK LTE 100RB		-165	-150	
HB RX Noise (except harmonics)	2300 – 2700MHz, 20MHz QPSK LTE 100RB		-165	-150	
ISM 5G Noise (except harmonics)	5150 – 5850MHz, 20MHz QPSK LTE 100RB		-160	-150	
GPS Band Noise	1574 – 1577MHz, 20MHz QPSK LTE 100RB		-165	-150	
Harmonics	2f0		-70	-40	dBm
	3f0		-75	-55	
	3f0, leakage at 2GHB _TXOUT		-80	-50	

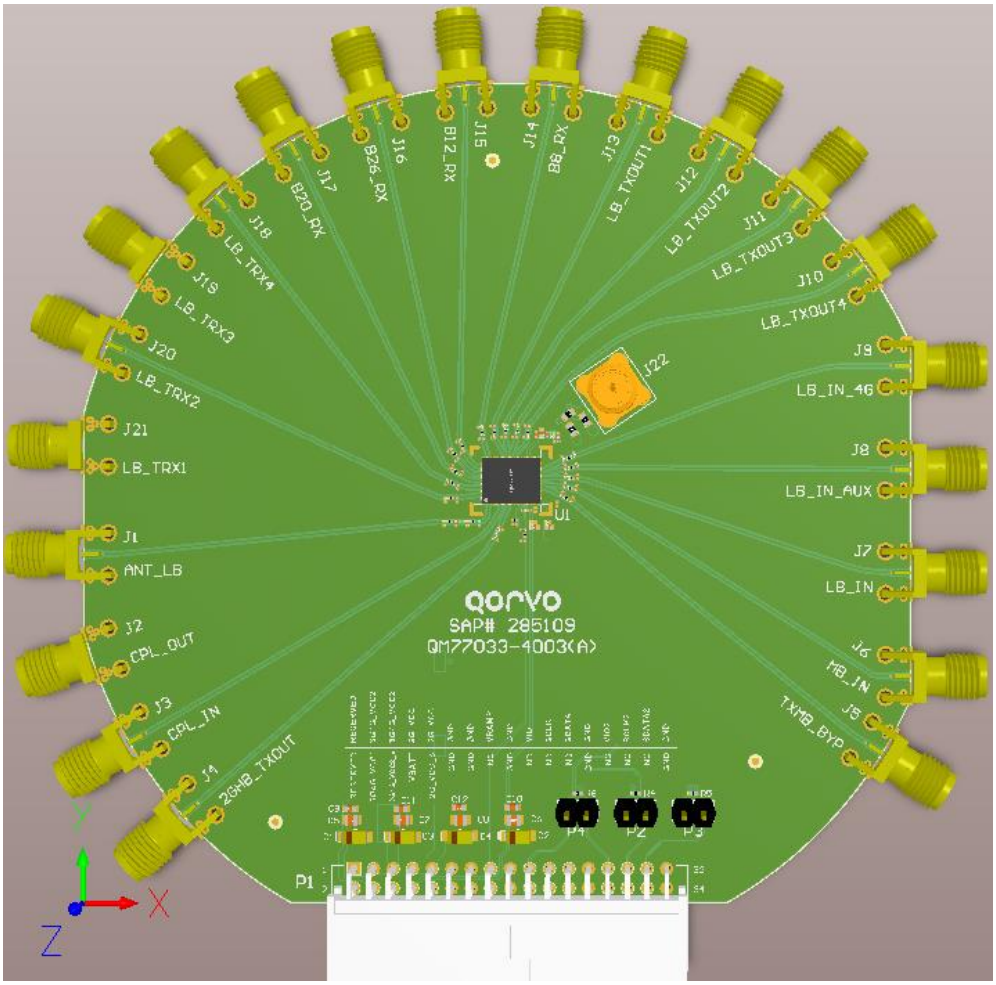
Parameter	Conditions	Min.	Typ.	Max.	Units
4G FDD LTE TXOUT TX Electrical Specifications	Unless otherwise stated: All unused RF ports terminated in 50Ω, Input and Output = 50Ω, Temp = 25°C, VBATT = 3.8V, APT Mode, QPSK, 10MHz, 12 Resource Blocks with MPR=0				
Operational Frequency Range	Band71	663		698	MHz
	Band12/17	699		716	
	Band13	777		787	
	Band20	832		862	
	Band28	703		748	
Maximum Linear Output Power	HPM, VCC = 3.4V	28			dBm
	HPM, VCC = 3.4V, VBAT=3.4V, Temp = -20°C to +85°C	27			
Gain	HPM, VCC = 3.4V	25			dB
	HPM, VCC = 3.4V, VBAT=3.4V, Temp = -20°C to +85°C	24			
	LPM, VCC =1.1V, Pout=14.5dBm	9			
EUTRA - ACLR	HPM, VCC = 3.4V, Pout ≤ Pmax		-38	-33	dBc
UTRA - ACLR1	HPM, VCC = 3.4V, Pout ≤ Pmax		-40	-36	
UTRA - ACLR2	HPM, VCC = 3.4V, Pout ≤ Pmax		-42	-39	
EVM	HPM, VCC = 3.4V, Pout ≤ Pmax		3	5	%
PAE	HPM, VCC = 3.4V, Pout = Pmax		40		%
Current Consumption	HPM, VCC = 3.4V, Pout = Pmax		560		mA
B13 RX Band Noise	746 - 756MHz, 10MHz QPSK LTE 20RB		-123	-130	dBm/Hz
B20 RX Band Noise	791 – 821MHz, 20MHz QPSK LTE 20RB		-133	-130	
B28 RX Band Noise	758 – 803MHz, 20MHz QPSK LTE 25RB		-133	-126	
MB RX Noise (except harmonics)	1452 – 2200MHz, 20MHz QPSK LTE 100RB		-167	-135	
HB RX Noise (except harmonics)	2300 – 2700MHz, 20MHz QPSK LTE 100RB		-162	-135	
ISM 2.4G Noise (except harmonics)	2400 – 2483.5MHz, 20MHz QPSK LTE 100RB		-140	-135	
ISM 5G Noise (except harmonics)	5150 – 5850MHz, 20MHz QPSK LTE 100RB		-140	-140	
GPS Band Noise	1574 – 1577MHz, 20MHz QPSK LTE 100RB		-137	-125	
Harmonics	2f0		-20	5	dBm
	3f0		-20	2	

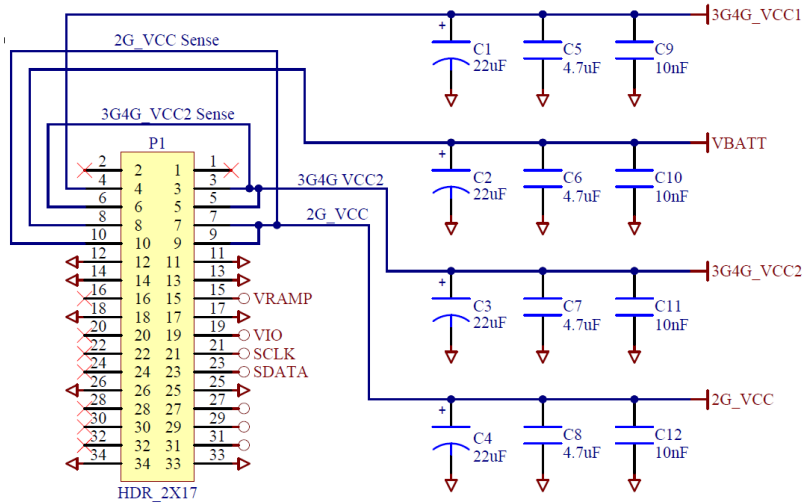
Parameter	Conditions	Min.	Typ.	Max.	Units
RX Electrical Specifications	Temp = 25°C, VBAT = 3.8V				
Band5/26 RX	Unless otherwise stated: All unused RF ports terminated in 50Ω, Input and Output = 50Ω				
Frequency Range		859		894	MHz
Insertion Loss	859.25 to 893.75MHz		3	3.8	dB
RX Port VSWR				2	X:1
ANT Port VSWR				2	
Attenuation	MB TX, 1427~1980MHz	40	60		dB
	HB TX, 2300~2690MHz	40	60		
	ISM 2.4G/5G	40			
	B42 TX, 3400~3600MHz	30			
Band8 RX	Unless otherwise stated: All unused RF ports terminated in 50Ω, Input and Output = 50Ω				
Frequency Range		925		960	MHz
Insertion Loss	925.25 to 959.75MHz		2.7	3.8	dB
RX Port VSWR				2	X:1
ANT Port VSWR				2	
Attenuation	MB TX, 1427~1980MHz	40			dB
	HB TX, 2300~2690MHz	40			
	ISM 2.4G/5G	40			
	B42 TX, 3400~3600MHz	30			
Band12/17 RX	Unless otherwise stated: All unused RF ports terminated in 50Ω, Input and Output = 50Ω				
Frequency Range		729		746	MHz
Insertion Loss	729.25 to 745.75MHz		2.2	3.3	dB
RX Port VSWR				2	X:1
ANT Port VSWR				2	
Attenuation	MB TX, 1427~1980MHz	40			dB
	HB TX, 2300~2690MHz	40			
	ISM 2.4G/5G	40			
Band20 RX	Unless otherwise stated: All unused RF ports terminated in 50Ω, Input and Output = 50Ω				
Frequency Range		791		821	MHz
Insertion Loss	793.5 to 818.5MHz		2.8	3.8	dB
RX Port VSWR				2	X:1
ANT Port VSWR				2	
Attenuation	MB TX, 1427~1980MHz	40	60		dB
	HB TX, 2300~2690MHz	40	60		
	3.5G TX, 3400 to 3600MHz	30			
	ISM 2.4G/5G	40	60		

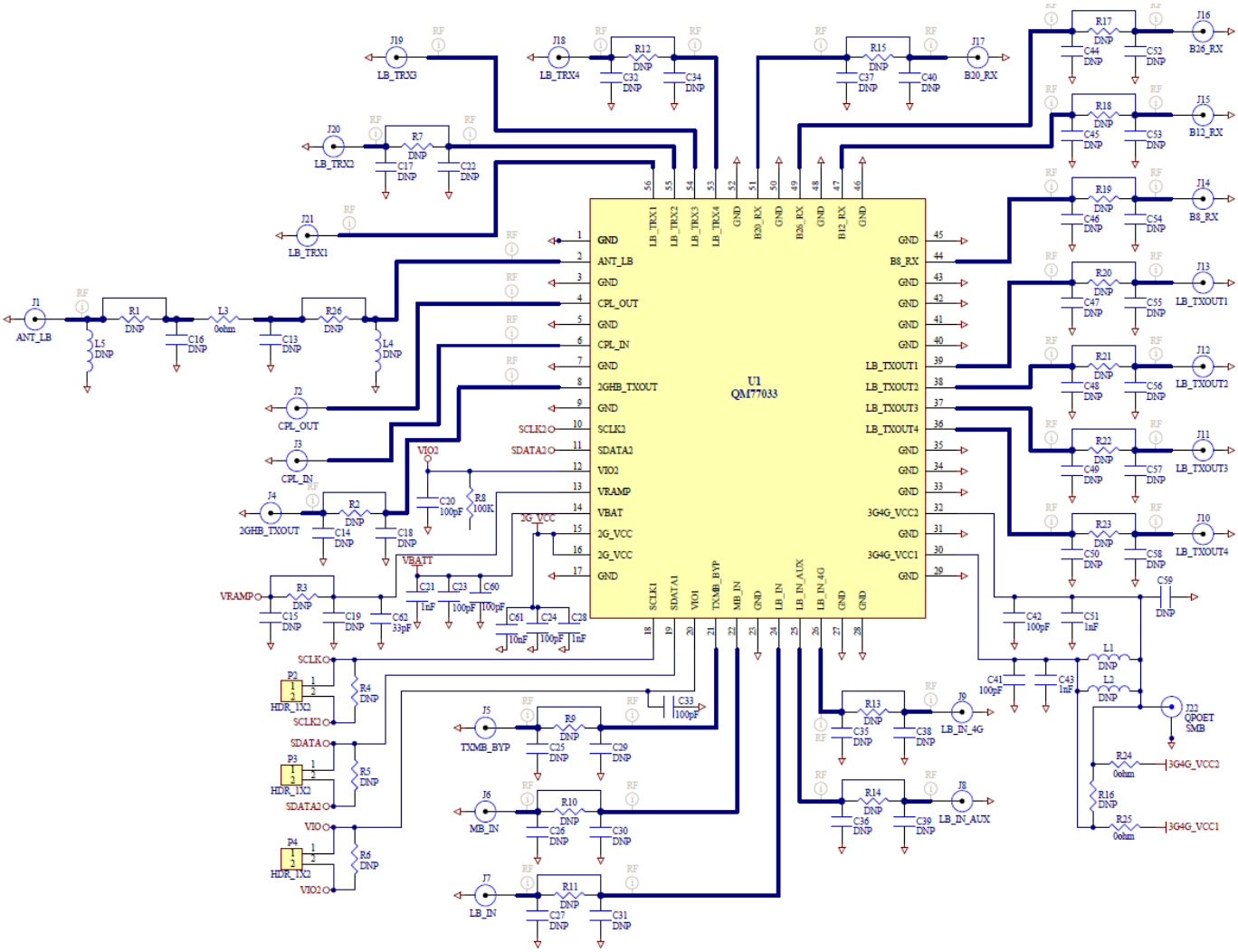
Parameter	Conditions	Min.	Typ.	Max.	Units
TRX Electrical Specifications	Unless otherwise stated: All unused RF ports terminated in 50Ω, Input and Output = 50Ω, Temp = 25°C, VBAT = 3.8V				
Frequency Range		617		960	MHz
Insertion Loss			0.8		dB
Harmonics 2f0				-60	dBm
B13 Harmonics, 2f0	GPS		-80	-75	
Harmonics, 3f0				-60	
B28 Harmonics, 3f0			-80	-75	
B12 Harmonics, 3f0			-80	-75	
B20 Harmonics, 3f0			-80	-75	

Parameter	Conditions	Min.	Typ.	Max.	Units
Bi-Directional Coupler Electrical Specifications	Unless otherwise stated: All unused RF ports terminated in 50Ω, Input and Output = 50Ω, Temp = 25°C, VBAT = 3.8V				
Frequency Range	Forward	663		915	MHz
	Reverse	824		915	
Coupling factor	Forward		20		dB
	Reverse		20		
Isolation	Forward		40		dB
	Reverse		40		
Directivity	Forward	18	20	50	dB
	Reverse	18	20	50	

Application Circuit Schematic

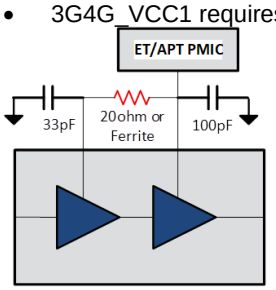






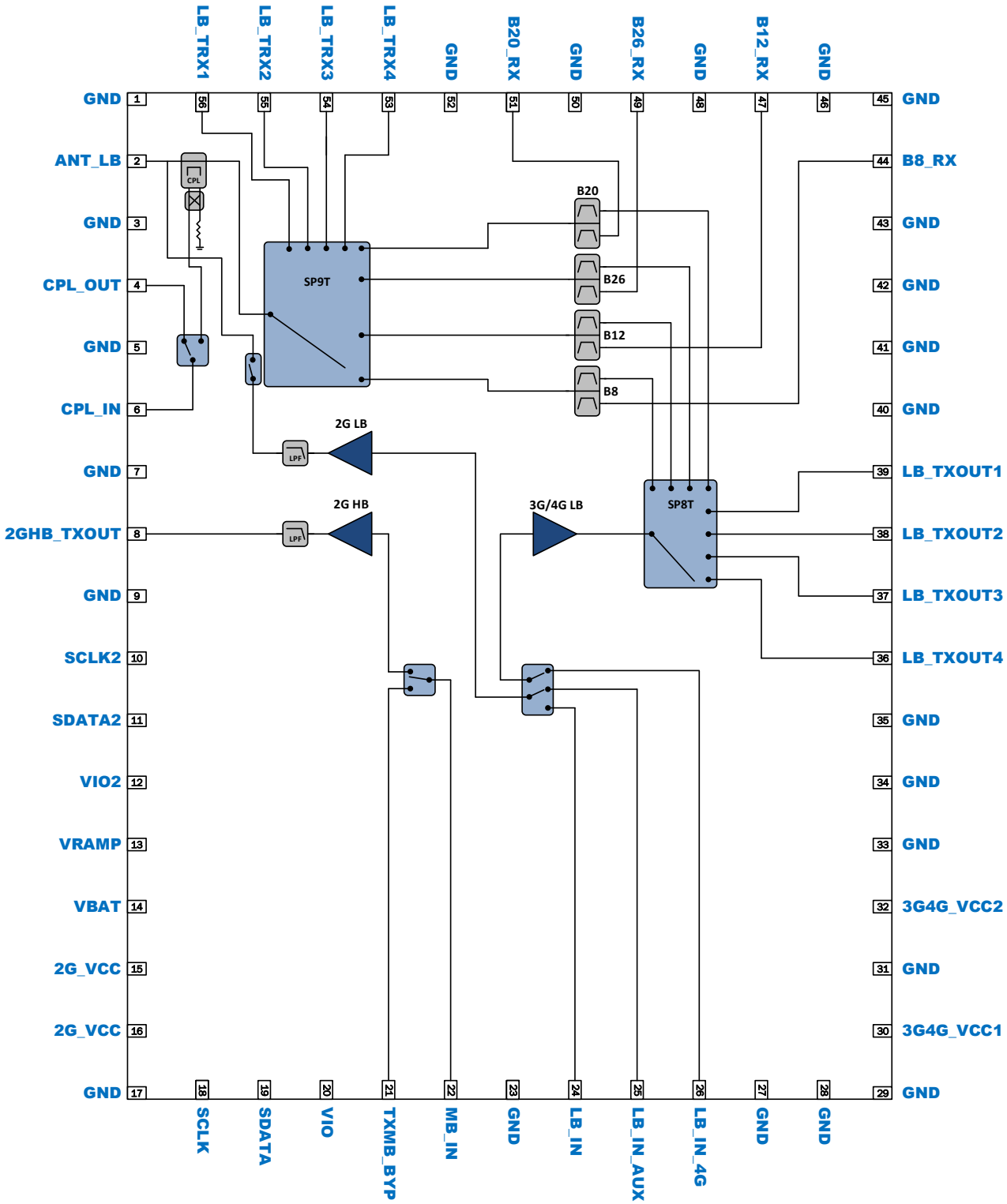
Notes;

1. ANT_LB and 2GHB_TXOUT need low-pass type pi matching network close to DUT for better performance.
2. VBAT requires decouplding caps 100pF and 1nF. Placed near the VBAT pin at least 100pF.
3. 2G_VCC requires decoupling caps 10nF, 100pF and 1nF Placed near the 2G_VCC pin at least 10nF.
4. 3G4G_VCC connection for ET / APT Mode with QM81010 PMIC:
   - 3G4G_VCC1 and 3G4G_VCC2 are tied together through the ferrite bead (preferred, or 20ohm resistor) as shown in the block diagram.
   - 3G4G_VCC1 requires decoupling cap 33pF and 3G4G_VCC2 requries decoupling cap 100pF. Placed near the VCC pins.



5. Connect to Ground unused pins, pin 10/11/12, 21 or 25, if don't use.
6. RC filter for Vramp needs to be optimized on customer board.
7. VIO2 pulldown resistor (location R8) needs to be confirmed ; NOT floating from VIO2 source, if using 1 RFFE / VIO1.

Pin Configuration and Description



Top View

Pin Number	Label	Description
2	ANT_LB	Low Band Antenna port from ASM.
4	CPL_OUT	Coupler output port for the ASM
6	CPL_IN	Coupler input port for the ASM
8	2GHB_TXOUT	RF output for the High-Band 2G PA.
10	SCLK2	SCLK MIPI digital input signal for programming the ASM (when VIO2=high)
11	SDATA2	SDATA MIPI digital input signal for programming the ASM (when VIO2=high)
12	VIO2	VIO MIPI voltage reference for programming the ASM (when VIO2=high)
13	VRAMP	Power control signal from DAC. A RC filter may not require additional filtering depending on the baseband selected.
14	VBAT	Supply voltage bias circuitry PA/Band-Switch
15, 16	2G_VCC	Supply voltage for the power amplifier circuitry of both 2G LB and HB PAs
18	SCLK	SCLK MIPI digital input signal for programming the PA and ASM (when VIO2=0V) SCLK MIPI digital input signal for programming the PA (when VIO2=high)
19	SDATA	SDATA MIPI digital input signal for programming the PA and ASM (when VIO2=0V) SDATA MIPI digital input signal for programming the PA (when VIO2=high)
20	VIO	VIO MIPI voltage reference for programming the PA and ASM (when VIO2=0V) VIO MIPI voltage reference for programming the PA (when VIO2=high)
21	TXMB_BYP	Bypass port for the Mid-Band 3G/4G.Not DC blocked
22	MB_IN	RF input for the High-Band 2G PA.. RF input for the Mid-Band 3G/4G Bypass.
24	LB_IN	RF input for the Low-Band 2G PA.
25	LB_IN_AUX	RF input for the Low-Band 2G/3G/4G PA.
26	LB_IN_4G	RF input for the Low-Band 3G/4G PA.
30	3G4G_VCC1	Supply voltage for the input amplifier stage of the 3G/4G LB PA
32	3G4G_VCC2	Supply voltage for the output amplifier stage of the 3G/4G LB PA
36	LB_TXOUT4	Low-Band 3G/4G PA/Band Mode Switch output.
37	LB_TXOUT3	Low-Band 3G/4G PA/Band Mode Switch output.
38	LB_TXOUT2	Low-Band 3G/4G PA/Band Mode Switch output.
39	LB_TXOUT1	Low-Band 3G/4G PA/Band Mode Switch output.
44	B8_RX	B8 duplexer RX port (single-ended). Also for use as GSM900 RX in 2G mode.
47	B12_RX	B12 duplexer RX port (single-ended).
49	B26_RX	B26 duplexer RX port (single-ended). Also for use as GSM850 RX in 2G mode.
51	B20_RX	B20 duplexer RX port (single-ended).
53	LB_TRX4	ASM LB TRX port. Not DC blocked. Intended for connection to ANT port of an external duplexer (FDD), or to an external BPF (TDD).
54	LB_TRX3	ASM LB TRX port. Not DC blocked. Intended for connection to ANT port of an external duplexer (FDD), or to an external BPF (TDD).
55	LB_TRX2	ASM LB TRX port. Not DC blocked. Intended for connection to ANT port of an external duplexer (FDD), or to an external BPF (TDD).
56	LB_TRX1	ASM LB TRX port. Not DC blocked. Intended for connection to ANT port of an external duplexer (FDD), or to an external BPF (TDD).
See description	GND	These pins must be grounded; 1,3,5,7,9,17,23,27,28,29,31,33,34,35,40,41,42,43,45,46,48,50,52
Backside Pad	GND	Ground connection. The back side of the package should be connected to the ground plan though as short of a connection as possible. PCB vias under the device are required.

MIPI RFFE Inofrmation

MIPI RFFE IDs

Parameter	ANT Switch (ASM) & Coupler	Power Amplifier & TX Distribution Switch
Default USID	0x8 (1000b)	0xF (1111b)
Product ID	0x45 (0100_0101b)	0x44 (0100_0100b)
Manufacturer ID	0x134	0x134

1. Antenna Switch / Coupler Section

Summary of User Defined Register (UDR) Space

Address	Reg #	Register name	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
0x000	Reg00	ANT_SW_CTRL	Spare					ANT_SW_CTRL0[3:0]		
0x001	Reg01	CPL_CTRL	CPL_DIR	RDAC[3:0]				CDAC[3:0]		

Register0x0000 – Antenna Switch Control

Bit(s)	Field Name	Description	Default	B/G	Trig.	R/W
7:4	SPARE	0000 = High Isolation	0000	N	T012	R/W
3:0	ANT_SW_CTRL0[3:0]	0000 = High Isolation	0000			
		0001 = 2GLB GSM/EDGE				
		0010 = B20				
		0011 = LB_TRX2				
		0100 = LB_TRX1				
		0101 = B26				
		0110 = B12				
		0111 = B8				
		1000 = Not used				
		1001 = LB_TRX4				
		1010 = LB_TRX3				
		1111 = Not used				

- Do NOT use ANT_SW_CTRL0=1111

Register0x0001 – Coupler Control

Bit(s)	Field Name	Description	Default	B/G	Trig.	R/W
7	CPL_DIR	0 = Normal switching, CPL_OUT = Forward Power	0	N	T012	R/W
		1 = Cross switching, CPL_OUT = Reverse Power				
6:3	RDAC[3:0]	Coupler isolation port 4-bit RDAC	1010			
2:0	CDAC[2:0]	000=0pF, 001=1pF, 010=2pF, 011=3pF, 100=4pF, 101=5pF, 110=6pF, 111=7pF	000			

- “CPL_IN is connected to CPL_OUT and internal coupler is disconnected” when RDAC[3:0],CDAC[2:0]=0000_111.

Register0x001C – PM Trigger

Bit(s)	Field Name	Description	Default	B/G	Trig.	R/W
7:6	Power_Mode[1:0]	00: ACTIVE - Normal Operation 01: STARTUP - Reset all registers to default settings 10: ACTIVE - Low Power - Antenna in isolation 11: STARTUP - Reset all registers to default settings	00	Y	N	R/W
5:3	TriggerMask[2:0]	Setting bit TriggerMask[N] disables Trigger[N] TriggerMask[N] updates before Trigger[N] is processed	111	N		
2:0	Trigger[2:0]	Setting bit Trigger[N] loads Trigger[N]'s associated registers	000	Y		W

Register0x001D – Product ID

Bit(s)	Field Name	Description	Default	B/G	Trig.	R/W
7:0	PROD_ID[7:0]	Lower eight bits of Product ID	0X45	N	N	R

Register0x001E – Manufacturer ID

Bit(s)	Field Name	Description	Default	B/G	Trig.	R/W
7:0	MFG_ID_LSB[7:0]	Lower eight bits of MIPI Manufacturer ID	0X34	N	N	R

Register0x001F – USID

Bit(s)	Field Name	Description	Default	B/G	Trig.	R/W
7:6	SPARE	Reserved	00	N	N	R
5:4	MFG_ID_MSB[9:8]	Upper two bits of MIPI Manufacturer ID	01			
3:0	USID[3:0]	Programmable Unique Slave ID	0x8			R/W

Register0x0020 – Extended Product ID

Bit(s)	Field Name	Description	Default	B/G	Trig.	R/W
7:0	PROD_ID[15:8]	Upper eight bits of Product ID	0X00	N	N	R

Register0x0022 – GSID

Bit(s)	Field Name	Description	Default	B/G	Trig.	R/W
7:4	GSID0[3:0]	Group Slave ID0	0x0	N	N	R/W
3:0	GSID1[3:0]	Group Slave ID1	0x0			

Register0x0023 – UDR Reset

Bit(s)	Field Name	Description	Default	B/G	Trig.	R/W
7	UDR_RST	Setting this bit initiates a software reset	0	Y	N	W
6:0	SPARE	Reserved	0000000	N		R

Register0x0024 – Error Status

Bit(s)	Field Name	Description	Default	B/G	Trig.	R/W
7	SPARE	Reserved for future use	0	N	N	R/W
6	CMD_FR_P_ERR	Command Frame received with a parity error	0			
5	CMD_LEN_ERR	Command Sequence received with an incorrect length	0			
4	ADDR_FR_P_ERR	Address Frame received with a parity error	0			
3	DATA_FR_P_ERR	Data Frame received with a parity error	0			
2	RD_INVLD_ADDR	Read Command Sequence received with an invalid address	0			
1	WR_INVLD_ADDR	Write Command Sequence received with an invalid address	0			
0	BID_GID_ERR	Read Command Sequence received with a BSID or GSID	0			

Register0x002B – BUS Load

Bit(s)	Field Name	Description	Default	B/G	Trig.	R/W
7:4	SPARE	Reserved	0x0	N	N	R/W
3:0	BUS_LD[3:0]	Reserved	0x0			

Register0x002C – Test Pattern

Bit(s)	Field Name	Description	Default	B/G	Trig.	R/W
7:0	TEST_PATT[7:0]	Test Pattern	0xD2	N	N	R

2. PA / TX Distribution Switch Section

Summary of User Defined Register (UDR) Space

Address	Reg #	Register name	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
0x000	Reg00	PA_TX_MODE	Spare	TX_MODE[3:0]				TX_EN	PA_MODE[1:0]	
0x001	Reg01	PA_TX_DIST_SW	TX_DIS_SW1[3:0]					TX_DIS_SW0[3:0]		
0x002	Reg02	PA_BIAS1	PA_BIAS1_MSB[7:4]					PA_BIAS1_LSB[3:0]		
0x003	Reg03	PA_BIAS2	Spare			PF_DISABLE		PA_BIAS2[3:0]		

Register0x0000 – PA TX Mode

Bit(s)	Field Name	Description	Default	B/G	Trig.	R/W
7	SPARE	Reserved	0	N	T012	R/W
6:3	TX_MODE[3:0]	0000 = 2G LB GSM (Vramp); RFIN = LB_IN	0000			
		0001 = 2G LB GSM/EDGE; RFIN = LB_IN				
		0010 = 2G LB GSM (Vramp); RFIN = LB_IN_AUX				
		0011 = 2G LB GSM/EDGE; RFIN = LB_IN_AUX				
		0100 = 4G LB + MB/HB Isolation ; RFIN = LB_IN_4G				
		0101 = 4G LB+ MB/HB Isolation; RFIN = LB_IN_AUX				
		0110 = 4G LB+ MB/HB Isolation; RFIN = LB_IN				
		0111 = Reserved				
		1000 = 2G HB GSM (Vramp); RFIN = MB_IN				
		1001 = 2G HB GSM/EDGE; RFIN = MB_IN				
		1010 = Reserved				
		1011 = Reserved				
		1100 = 4G LB + MB/HB Bypass; RFIN = LB_IN_4G				
		1101 = 4G LB + MB/HB Bypass; RFIN = LB_IN_AUX				
		1110 = 4G LB + MB/HB Bypass; RFIN = LB_IN				
		1111 = MB/HB Bypass + All LB PA Off				
2	TX_EN	1 = TX Enable	0			
		0 = TX Disable				
1:0	PA_MODE[1:0]	0x = High Gain Mode	00			
		1x = Low Gain Mode (-15dB)				

- “MH/HB isolation” when the path from MB_IN to TXMB_BYP is isolated.
- “MH/HB bypass” when the path from MB_IN to TXMB_BYP is connected.

Register0x0001 – TX Distribution Switch

Bit(s)	Field Name	Description	Default	B/G	Trig.	R/W
7:4	TX_DIST_SW1[3:0]	Reserved	0000	N	T012	R/W
3:0	TX_DIST_SW0[3:0]	0000 = High Isolation 0001 = Not used 0010 = B26 Internal Duplexer 0011 = B20 Internal Duplexer 0100 = B12 Internal Duplexer 0101 = LB_TXOUT2 0110 = LB_TXOUT3 0111 = LB_TXOUT4 1000 = Reserved 1001 = LB_TXOUT1 1010 = B8 Internal Duplexer 1011 = Reserved 1100 = Reserved 1101 = Reserved 1110 = Reserved 1111 = Not used	0000			

Register0x0002 – PA Bias1 (2G Mode, 3rd Stage)

Bit(s)	Field Name	Description	Default	B/G	Trig.	R/W
7:0	PA_BIAS1_MSB[7:4] PA_BIAS1_LSB[3:0]	00000000 0uA 00000001 60uA … 10000000 7.680mA …. 11111111 15.300mA	0000	N	T012	R/W

* Don't use (2G_EDGE==TRUE) && (Q2 ibias[7:0]==1111_1111)

Register0x0002 – PA Bias1 (3G/4G Mode)

Bit(s)	Field Name	Description	Default	B/G	Trig.	R/W
7:4	PA_BIAS1_MSB[7:4]	0000 0.8V 0001 0.9V … 1111 2.3V	0000	N	T012	R/W
3:0	PA_BIAS1_LSB[3:0]	0000 0.8V 0001 0.9V … 1111 2.3V	0000			

Register0x0003 – PA Bias2 (2G Mode, 1st & 2nd Stage)

Bit(s)	Field Name	Description	Default	B/G	Trig.	R/W
7:5	SPARE	Reserved	000	N	T012	R/W
4	Power_FLATNESS_DIS	Reserved (For Vramp only)	0			
7:4	SPARE	For 2G Linear mode only; 2G EDGE/Linear Mode: VCC3 LDO Voltage Regulator Output Clamp Voltage 0000 = 1.47V Vramp equivalent. 0001 = 1.46V Vramp equivalent. … 1111 = 1.23V Vramp equivalent.	0000			
3:0	PA_BIAS2[3:0]	0000 = 2.500V 0001 = 2.530V … 1111 = 2.950V	0000			

Register0x0003 – PA Bias2 (3G/4G Mode)

Bit(s)	Field Name	Description	Default	B/G	Trig.	R/W
7:4	SPARE	Reserved	0000	N	T012	R/W
3:0	PA_BIAS2[3:0]	Reserved	0000			

Register0x001C – PM Trigger

Bit(s)	Field Name	Description	Default	B/G	Trig.	R/W
7:6	Power_Mode[1:0]	00: ACTIVE - Normal Operation 01: STARTUP - Reset all registers to default settings 10: ACTIVE - Low Power - Antenna in isolation 11: STARTUP - Reset all registers to default settings	0	Y	N	R/W
5:3	TriggerMask[2:0]	Setting bit TriggerMask[N] disables Trigger[N] TriggerMask[N] updates before Trigger[N] is processed	111	N		
2:0	Trigger[2:0]	Setting bit Trigger[N] loads Trigger[N]'s associated registers	000	Y	N	W

Register0x001D – Product ID

Bit(s)	Field Name	Description	Default	B/G	Trig.	R/W
7:0	PROD_ID[7:0]	Lower eight bits of Product ID	0X44	N	N	R

Register0x001E – Manufacturer ID

Bit(s)	Field Name	Description	Default	B/G	Trig.	R/W
7:0	MFG_ID_LSB[7:0]	Lower eight bits of MIPI Manufacturer ID	0X34	N	N	R

Register0x001F – USID

Bit(s)	Field Name	Description	Default	B/G	Trig.	R/W
7:6	SPARE	Reserved	00	N	N	R
5:4	MFG_ID_MSB[9:8]	Upper two bits of MIPI Manufacturer ID	01			
3:0	USID[3:0]	Programmable Unique Slave ID	0xF			R/W

Register0x0020 – Extended Product ID

Bit(s)	Field Name	Description	Default	B/G	Trig.	R/W
7:0	PROD_ID[15:8]	Upper eight bits of Product ID	0X00	N	N	R

Register0x0022 – GSID

Bit(s)	Field Name	Description	Default	B/G	Trig.	R/W
7:4	GSID0[3:0]	Group Slave ID0	0x0	N	N	R/W
3:0	GSID1[3:0]	Group Slave ID1	0x0			

Register0x0023 – UDR Reset

Bit(s)	Field Name	Description	Default	B/G	Trig.	R/W
7	UDR_RST	Setting this bit initiates a software reset	0	Y	N	W
6:0	SPARE	Reserved	0000000	N		R

Register0x0024 – Error Status

Bit(s)	Field Name	Description	Default	B/G	Trig.	R/W
7	SPARE	Reserved for future use	0	N	N	R/W
6	CMD_FR_P_ERR	Command Frame received with a parity error	0			
5	CMD_LEN_ERR	Command Sequence received with an incorrect length	0			
4	ADDR_FR_P_ERR	Address Frame received with a parity error	0			
3	DATA_FR_P_ERR	Data Frame received with a parity error	0			
2	RD_INVLD_ADDR	Read Command Sequence received with an invalid address	0			
1	WR_INVLD_ADDR	Write Command Sequence received with an invalid address	0			
0	BID_GID_ERR	Read Command Sequence received with a BSID or GSID	0			

Register0x002B – BUS Load

Bit(s)	Field Name	Description	Default	B/G	Trig.	R/W
7:4	SPARE	Reserved	0x0	N	N	R/W
3:0	BUS_LD[3:0]	Approximate Bus Load 0x0: 5 pF 0x1: 7 pF 0x2: 10 pF 0x3: 15 pF 0x4: 20 pF (Not available) 0x5: 30 pF (Not available) 0x6: 40 pF (Not available) 0x7: 50 pF (Not available) 0x8 to 0xF : Spare	0x0			

Register0x002C – Test Pattern

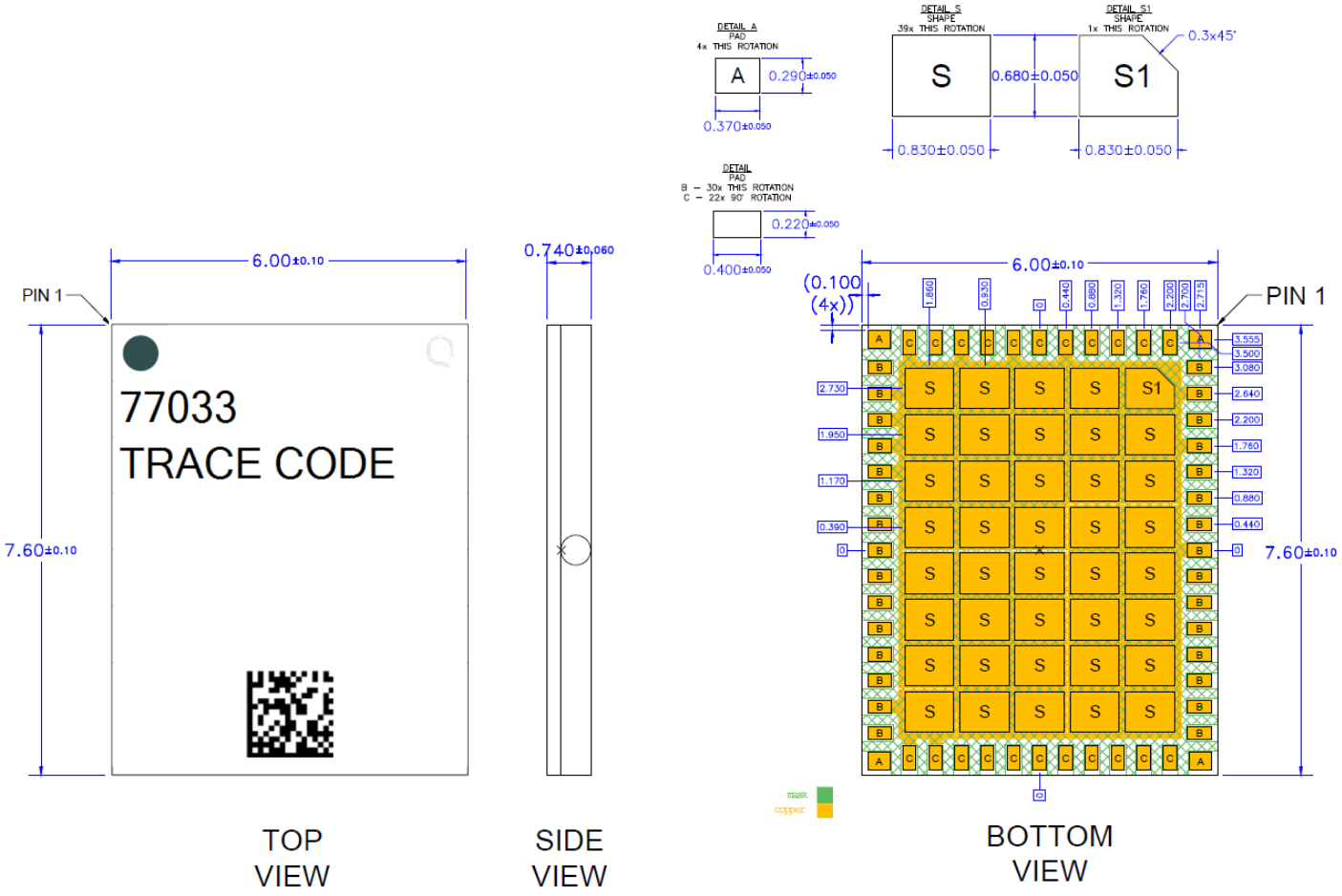
Bit(s)	Field Name	Description	Default	B/G	Trig.	R/W
7:0	TEST_PATT[7:0]	Test Pattern	0xD2	N	N	R

Mechanical Information

Package Marking and Dimensions

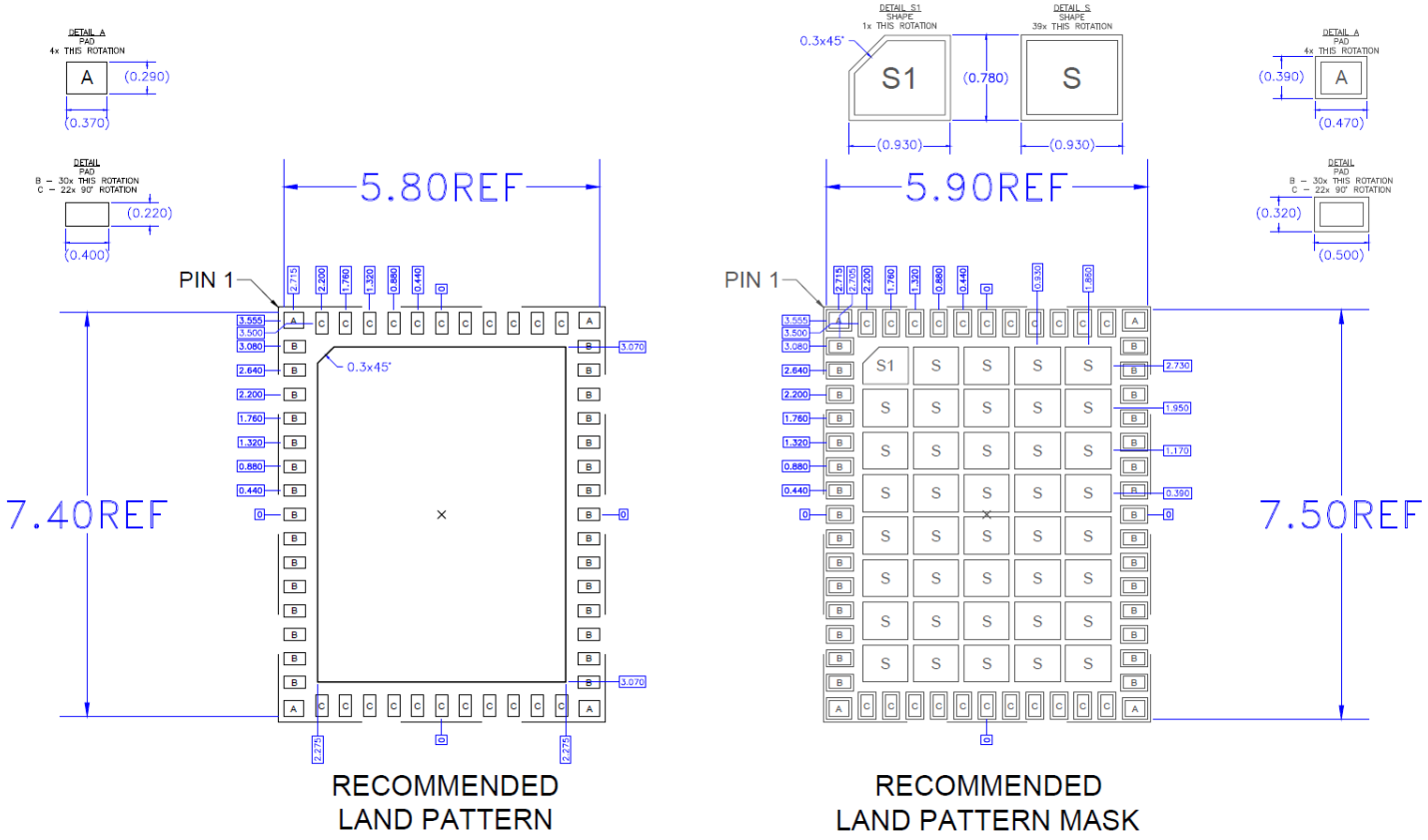
Marking: Part number – 77033

Trace code – XXXX



PCB Design Guidelines

PCB Metal Land and Solder Mask Pattern



Notes:
1. All dimensions are in millimiters. Angles are in degrees.
2. Dimension and tolerance formats conform to ASME Y14.4M-1994.
3. The terminal #1 identifier and terminal numbering conform to JESD 95-1 SPP-012.

Handling Precautions

Parameter	Rating	Standard
ESD – Human Body Model (HBM)	Class 1C – Non SAW Class 1B – SAW Pins	ANSI/ESDA/JEDEC JS-001
ESD – Charged Device Model (CDM)	Class C3	ANSI/ESDA/JEDEC JS-002
MSL – Moisture Sensitivity Level	Level 3	IPC/JEDEC J-STD-020

Caution!

ESD sensitive device

Solderability

Compatible with both lead-free (260 °C max. reflow temperature) and tin/lead (245 °C max. reflow temperature) soldering processes.

Package lead plating: Electrolytic plated Au over Ni

RoHS Compliance

This part is compliant with the 2011/65/EU RoHS directive (Restrictions on the Use of Certain Hazardous Substances in Electrical and Electronic Equipment), as amended by Directive 2015/863/EU.

This product also has the following attributes:

- Lead free
- Halogen Free (Chlorine, Bromine)
- Antimony Free
- TBBP-A ($C_{15}H_{12}Br_4O_2$) Free
- SVHC Free

Contact Information

For the latest specifications, additional product information, worldwide sales and distribution locations:

Web: www.qorvo.com

Tel: 1-844-890-8163

Email: customer.support@qorvo.com

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