< PRELIMINARY >

QM77040

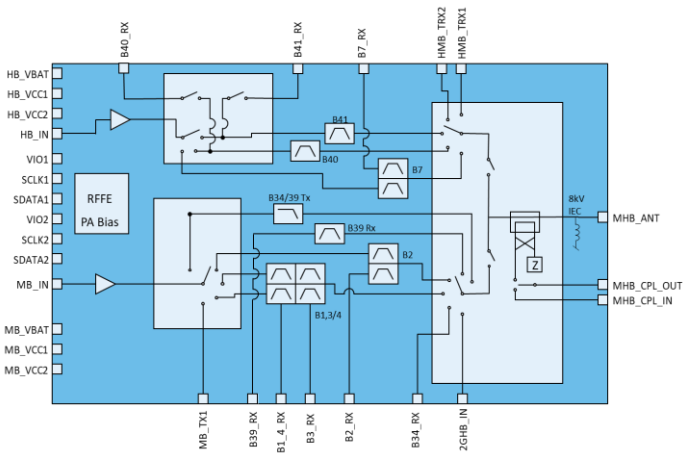
Linear Multi-Mode Mid and High Band S-PAD for 3G/4G/5G Applications

Product Overview

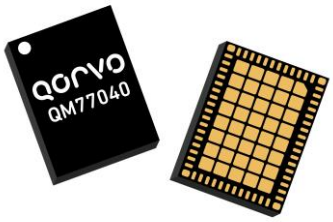
The Qorvo® QM77040 is a multi-mode, high efficiency linear Mid Band and High Band S-PAD (Switched PA plus Duplexer) module designed for use as the integrated RF front-end in multi-mode WCDMA/CDMA/TDS-CDMA/LTE/NR mobile cellular equipment. The high efficiency S-PAD contains two amplifier paths for 3G/4G/5G Mid and High Band frequencies followed by distribution switches, filters/duplexers/quadplexer and antenna switches for multi-band coverage of both transmit and receive functions. QM77040 band select and bias are programmed through two Mobile Industry Processor Interface (MIPI) buses. The QM77040 transmit-receive module supports Average Power Tracking (APT) for higher system efficiency at various power levels and modulations, as well as Envelope Tracking (ET) for current consumption optimization.

The QM77040 is packaged in a RoHS-compliant, compact 62-pin, 6.5 x 8.6 x 0.8 (max) mm surface-mount leadless package.

Functional Block Diagram



Functional Block Diagram



62 Pin 6.5x8.6 mm leadless SMT Package

Key Features

- Multi-Mode and Multi Band Capabilities; WCDMA/CDMA2000/ FDD-LTE/TDD-LTE/NR
- Integrated Band 1, 2, 3, 4, 7, 34, 39, 40 and 41(38) with Filters, Duplexers and Quadplexer for Transmit and Receive
- Additional Mid Bands Through External AUX Path
- Inter-band Downlink Carrier Aggregation (DL CA): B1+B3, B39+B41, B3+B7, B1+B3+B7 and B3+B41
- Designed and Optimized for Use with DC-DC Converter
- Support of Average Power Tracking (APT) and Envelope Tracking (ET) for High System Efficiency and Performance
- Support Power Class 2 (i.e. HPUE) for B41
- Support 5G NR for n41, n3 and n1
- MIPI RFFE 2.1 Applications

Applications

- 3G/4G/5G Multi-Mode Handsets
- WCDMA and LTE Datacards or Wearable Devices
- High Performance Communication Systems
- LTE Single Carrier Channel Bandwidths up to 20MHz and 5G NR Channel Bandwidths up to 100MHz
- LTE CA Bandwidths up to 60MHz, 16QAM and 64QAM

Ordering Information

Part Number	Description
QM77040SR	7” Reel with 100 pieces
QM77040TR13	13” Reel with 5000 pieces
QM77040DK	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 VCC	Standby Mode	+6.0 V
Supply Voltage VCC	Idle Mode	+6.0 V
Supply Voltage VCC	Operating Mode with 50 Ω load	+6.0 V
Supply Voltage, VBATT		-1.2V to +6.0 V
Digital control signals (VIO, SLCK, SDATA)		+2 V
RF Input Power	CW, 50 Ω load, T = 25˚C	+10 dBm
Output Load VSWR (Ruggedness: no damage or permanent perfromance degradation)	Ruggedness is guaranteed with closed loop condition, constant forward Pout = Max Prated (Pin ≤ +6dBm), QPSK 10MHz 12RB, Vcc = 3.1 to 4.8 V, Vbatt = 4.8V and over operating temperatures.	10 : 1
ESD	HBM	1000 V
ESD	CDM	500 V

Exceeding any one or a combination of the Absolute Maximum Rating conditions may cause permanent damage to the device. Extended application of the 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	1710		2690	MHz
Operating Ambient Temperature	-20	+25	+85	°C
Supply Voltage, VBATT	+3.0	3.8	+4.8	V
Supply Voltage, VCC1, VCC2	+0.5[1]	3.4	+4.8	V
Supply Volage, VIO	+1.65	+1.8	+1.95	V
VIO Rise Time			400	µs
RF Input Power			+6	dBm
SCLK, SDATA Logic Low	0	-	0.3*VIO	V
SCLK, SDATA Logic HIGH	0.7*VIO	-	VIO	V
SCLK, SDATA Input, Current			50	µA
SCLK Write Speed		38.4	52	MHz
SCLK Read Speed			26	MHZ
Total Leakage Current (ICC+IBAT)			20	µA

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

Notes:

1. VCC down to 0.5V may be used for backed-off power when using DC-DC converter to reduce low power current drain. Refer to Look-up Table (LUT) for recommended VCC settings for each output power level.

5G NR Test Waveforms

5G Waveform	Duplex Mode	Channel BW	SCS	Modulation	RB Allocation	RB Allocated	RB start	MPR
NR 1	FDD	20	15	OFDM QPSK	Inner Full	50	25	0
NR2	FDD	20	15	OFDM QPSK	Outer Full	100	0	1
NR 3	FDD	20	15	OFDM 256QAM	Outer Full	100	0	4.5
NR 4	FDD	30	15	OFDM QPSK	Inner Full	80	40	0
NR 5	FDD	30	15	OFDM QPSK	Outer Full	160	0	1
NR 6	FDD	30	15	OFDM 256QAM	Outer Full	160	0	4.5
NR 7	TDD	100	30	OFDM QPSK	Inner Full	135	67	0
NR 8	TDD	100	30	OFDM QPSK	Outer Full	270	0	1
NR 9	TDD	100	30	OFDM 256QAM	Outer Full	270	0	4.5

Electrical Specifications

Parameter	Conditions	Min.	Typ.	Max.	Units
4G FDD LTE Band 1 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	Band 1	1920		1980	MHz
Maxium Linear Output Power	ET Mode	26			dBm
Maxium Linear Output Power	HPM, VCC = 3.4V	25			dBm
	HPM, VCC = 3.1V, VBAT=3.4V, Temp = -20°C to +85°C	24			
	HPM, VCC = 3.4V, 20MHz 16QAM 100RB	23			
	HPM, VCC = 3.4V, 20MHz 64QAM 100 RB	22			
	HPM, VCC = 3.4V, 40MHz 16QAM 200RB	22			
Gain	HPM, VCC = 3.4V		28		dB
	HPM, VCC = 3.1V, VBAT=3.4V, Temp = -20°C to +85°C		27.7		
	LPM, VCC =1.15V, Pout=11.5dBm		21		
	LPM, VCC =0.6V, Pout=1.5dBm		15		
EUTRA – ACLR	HPM, VCC = 3.4V, Pout ≤ Pmax		-43	-33	dBc
UTRA - ACLR1	HPM, VCC = 3.4V, Pout ≤ Pmax		-43	-36	
UTRA - ACLR2	HPM, VCC = 3.4V, Pout ≤ Pmax		-62	-39	
EVM	All modulations		2	5	%
Gain transient time	Gain transient time between PA modes		-	10	µs
PAE	HPM, VCC = 3.4V, Pout = Pmax		14.5		%
Current Consumption	HPM, VCC = 3.4V, Pout = Pmax		640		mA
	LPM, VCC ≤ 0.6V, Pout = 1.5dBm		63		
Non CA RX Band Noise	2110 – 2170MHz, 20MHz QPSK 100RB		-187	-179	dBm/Hz
UL-CCA RX Band Noise	2110 – 2150MHz, 40MHz QPSK 100+30RB		-187	-179	
B3 RX Band Noise (1805 – 1880MHz)	Tx=1930MHz, 20MHz QPSK 25RB		-184	-174	
	Tx=1950MHz, 20MHz QPSK 25RB		-186	-179	
LB RX Band Noise	699 – 960MHz, 40MHz QPSK 200RB		-171	-165	
HB RX Band Noise	2300 – 2700MHz, 40MHz QPSK 200RB		-169	-165	
B7 RX Band Noise, DL CA	2620 – 2690MHz, 40MHz QPSK 200RB		-175	-170	
B42 RX Band Noise	3400 – 3600MHz, 40MHz QPSK 200RB		-164	-160	
ISM 5G Noise (except harmonics)	5150 – 5850MHz, 40MHz QPSK 200RB		-186	-175	
GPS Band Noise	1574 – 1577MHz, 40MHz QPSK 200RB		-167	-160	
Harmonics	2f0		-57		dBm
	3f0		-72		
Stability, spurious output level	Load VSWR = 6:1, all phase angles, Pfwd = Prated, maintain forward power (closed loop)		-	-36	dBm

PARAMETER	CONDITIONS		MIN.	TYP.	MAX.	UNITS
5G NR n1 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.					
Operational Frequency Range	NR Band n1		1920		1980	MHz
Maximum Linear Output Power	HPM, VCC = 3.4V	NR 1	25			dBm
Gain	HPM, VCC = 3.4V	NR 1		28.2		dB
	HPM, VCC = 3.1V, VBAT=3.4V, Temp = -20°C to +85°C	NR 1		27.7		
	LPM, VCC =1.15V, Pout=11.5dBm	NR 1		15		
PAE	HPM, VCC = 3.4V, Pout = Pmax	NR 1		15		%
Current Consumption	HPM, VCC = 3.4V, Pout = Pmax	NR 1		620		mA
NR ACLR	HPM, VCC = 3.4V, Pout ≤ Pmax - MPR	NR 2		-40	-33	dBc
UTRA - ACLR1	HPM, VCC = 3.4V, Pout ≤ Pmax - MPR	NR 2		-43	-36	
UTRA - ACLR2	HPM, VCC = 3.4V, Pout ≤ Pmax - MPR	NR 2		-47	-39	
EVM	HPM, VCC = 3.4V, Pout ≤ Pmax - MPR	NR 3		1.2		%

Parameter	Conditions	Min.	Typ.	Max.	Units
3G WCDMA Band 1 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	Band 1	1920		1980	MHz
Maximum Output Power	HPM, VCC = 3.4V	26			dBm
	HPM, VCC = 3.1V, VBAT = 3.4V, Temp = -20°C to +85°C	25			
Gain	HPM, VCC = 3.4V		28		dB
	HPM, VCC = 3.1V, VBAT=3.4V, Temp = -20°C to +85°C		27.7		
UMTS ACLR1 (±5MHz)	Pout ≤ Pmax		-44	-36	dBc
UMTS ACLR2 (±10MHz)	Pout ≤ Pmax		-57	-46	
EVM	All Condition		2	5	%
PAE	HPM, Pout = Pmax		17		%
Current Consumption	HPM, Pout = Pmax		690		mA
Phase discontinuity variation		-15	-	15	Degree
RX Band Noise	Pout ≤ Pmax		-186	-179	dBm/Hz
ISM 2.4G Noise	2400 to 2483 MHz		-180	-175	
ISM 5G Noise (except harmonics)	5150 to 5850 MHz		-183	-175	
GPS Band Noise	1574 to 1577 MHz		-180	-168	
Harmonics	2f0		-58		dBm
	3f0		-72		

Parameter	Conditions	Min.	Typ.	Max.	Units
Band 1_4 RX RX Electrical Specifications	Unless otherwise stated: All unused RF ports terminated in 50Ω, Input and Output = 50Ω, Temp = 25°C, VBAT = 3.8V				
Operational Frequency Range	Band 1 and Band 4	2110		2170	MHz
Insertion Loss	2112.5 to 2167.5MHz		2.6		dB
Additional Insertion Loss*, DL CA	Multi-close B1+B3+B7 3DL-CA		1.2		dB
RX Port VSWR			2.0		X:1
Attenuation	B3 TX, 1710 – 1785MHz	47	53		dB
	LB TX, 699 – 960MHz	40	58		
	HB TX, 2300 – 2690MHz	43	50		
	B42 TX, 3400 – 3600MHz	40	46		
	ISM 2.4G/5G	33	40		
TX to RX Isolation					
Self Isolation at RX Band	2110 – 2170MHz	53	65		dBc
Self Leakage TX power to RX port	1920 – 1980MHz, 5MHz QPSK 25RB		-37		dBm/5MHz
Cross Isolation at B3 RX Band	1805 – 1880MHz	52	62		dBc
Cross Leakage B3 TX to B1 RX	1710 – 1785MHz, 1.4MHz QPSK 6RB		-31		dBm/1.4MHz
Cross Isolation at B7 RX Band, B1+B3+B7 CA (B1 as PCC)	2620 – 2690MHz	50	66		dBc
Cross Leakage B1 TX to B7 RX, B1+B3+B7 CA (B1 as PCC)	1920 – 1980MHz, 20MHz QPSK 100RB		-29		dBm/20MHz
Duplexer Tx to ANT Isolation	LB RX band, 699 – 960MHz	45	69		dBc
	HB RX band, 2300 – 2700MHz	45	57		
	B42 RX, 3400 – 3600MHz	40	75		

* Insertion loss can be optimized with proper matching at RX ports.

Parameter	Conditions	Min.	Typ.	Max.	Units
4G FDD LTE Band 3/4 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	Band 3	1710		1785	MHz
	Band 4	1710		1755	
Maxium Linear Output Power	ET Mode	26			dBm
Maxium Linear Output Power	HPM, VCC = 3.4V	25			dBm
	HPM, VCC = 3.1V, VBAT=3.4V, Temp = -20°C to +85°C	24			
	HPM, VCC = 3.4V, 20MHz 16QAM 100RB	23			
	HPM, VCC = 3.4V, 20MHz 64QAM 100 RB	22			
	HPM, VCC = 3.4V, 40MHz 16QAM 200RB	22			
Gain	HPM, VCC = 3.4V		28.7		dB
	HPM, VCC = 3.1V, VBAT=3.4V, Temp = -20°C to +85°C		28.5		
	LPM, VCC =1.15V, Pout=11.5dBm		24		
	LPM, VCC =0.6V, Pout=1.5dBm		15		
EUTRA – ACLR	HPM, VCC = 3.4V, Pout ≤ Pmax		-39	-33	dBc
UTRA - ACLR1	HPM, VCC = 3.4V, Pout ≤ Pmax		-40	-36	
UTRA - ACLR2	HPM, VCC = 3.4V, Pout ≤ Pmax		-57	-39	
EVM	All modulations		2	5	%
Gain transient time	Gain transient time between PA modes		-	10	µs
PAE	HPM, VCC = 3.4V, Pout = Pmax		17		%
Current Consumption	HPM, VCC = 3.4V, Pout = Pmax		560		mA
	LPM, VCC ≤ 0.6V, Pout = 1.5dBm		60		
Non CA RX Band Noise	1805 – 1880MHz, 20MHz QPSK 50RB		-184	-179	dBm/Hz
B3 Intra-band NCCA RX Band Noise	Tx=1782.5MHz, 5MHz 25RB, Wgap=45MHz		-183	-178	
	Tx=1782.5MHz, 5MHz 12RB, Wgap=65MHz		-182	-175	
B1 RX Band Noise (2110 – 2170MHz)	Tx=1775MHz, 20MHz QPSK 50RB		-186	-179	
LB RX Band Noise	699 – 960MHz, 40MHz QPSK 200RB		-175	-170	
B7 Rx Band Noise, DL CA	2620 – 2690MHz, 40MHz QPSK 200RB		-186	-179	
B41 Rx Band Noise, DL CA	2496 – 2690MHz, 40MHz QPSK 200RB		-187	-179	
2.4G RX band noise	2402 – 2484MHz, 40MHz QPSK 200RB		-176	-170	
B42 RX Band Noise	3400 – 3600MHz, 40MHz QPSK 200RB		-156	-150	
ISM 5G Noise (except harmonics)	5150 – 5850MHz, 40MHz QPSK 200RB		-174	-168	
GPS Band Noise	1574 – 1577MHz, 40MHz QPSK 200RB		-170	-165	
Harmonics	2f0		-50		dBm
	3f0		-63		
Stability, spurious output level	Load VSWR = 6:1, all phase angles, Pfwd = Prated, maintain forward power (closed loop)		-	-36	dBm

Parameter	Conditions		Min.	Typ.	Max.	Units
5G NR n3 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					
Operational Frequency Range	NR Band n3		1710		1785	MHz
Maxium Linear Output Power	HPM, VCC = 3.4V	NR4	25			dBm
Gain	HPM, VCC = 3.4V	NR4		28.5		dB
	HPM, VCC = 3.1V, VBAT=3.4V, Temp = -20°C to +85°C	NR4		28.2		
	LPM, VCC =1.15V, Pout=11.5dBm	NR4		24		
PAE	HPM, VCC = 3.4V, Pout = Pmax	NR4		16.5		%
Current Consumption	HPM, VCC = 3.4V, Pout = Pmax	NR4		560		mA
NR - ACLR	HPM, VCC = 3.4V, Pout ≤ Pmax - MPR	NR5		-41	-33	dBc
UTRA - ACLR1	HPM, VCC = 3.4V, Pout ≤ Pmax - MPR	NR5		-45	-36	
UTRA - ACLR2	HPM, VCC = 3.4V, Pout ≤ Pmax - MPR	NR5		-49	-39	
EVM	HPM, VCC = 3.4V, Pout ≤ Pmax - MPR	NR6		1.2		%

Parameter	Conditions	Min.	Typ.	Max.	Units
Band 3 RX RX Electrical Specifications	Unless otherwise stated: All unused RF ports terminated in 50Ω, Input and Output = 50Ω, Temp = 25°C, VBAT = 3.8V				
Operational Frequency Range	Band 3	1805		1880	MHz
Insertion Loss, Non CA	1805.7 to 1879.3MHz		3.5		dB
Additional Insertion Loss, DL CA	Multi-close with B7 (including B1+B3+B7)		0.4		dB
	Multi-close with B41		0.6		
RX Port VSWR			2.5		X:1
Attenuation	B1 TX, 1920 – 1980MHz	43	54		dB
	LB TX, 699 – 960MHz	40	56		
	HB TX, 2300 – 2690MHz	36	45		
	B42 TX, 3400 – 3600MHz	40	55		
	ISM 2.4G/5G	30	37		
TX to RX Isolation					
Self Isolation at RX Band	1805 – 1880MHz	50	56		dBc
Self Leakage TX power to RX port	1710 – 1785MHz, 1.4MHz QPSK 6RB		-30		dBm/1.4MHz
Cross Isolation at B1 RX Band	2110 – 2170MHz	50	60		dBc
Cross Leakage B1 TX to B3 RX	1920 – 1980MHz, 5MHz QPSK 25RB		-33		dBm/5MHz
Cross Isolation at B7 RX Band, B1+B3+B7 CA (B3 as PCC)	2620 – 2690MHz	46	64		dBc
Cross Leakage B3 TX to B7 RX, B1+B3+B7 CA (B3 as PCC)	1710 – 1785MHz, 20MHz QPSK 100RB		-26		dBm/20MHz
Cross Isolation at B41 RX Band, B3+B41 CA (B3 as PCC)	2496 – 2690MHz	46	64		dBc
Cross Leakage B3 TX to B41 RX, B3+B41 CA (B3 as PCC)	1710 – 1785MHz, 20MHz QPSK 100RB		-20		dBm/20MHz
Duplexer Tx to ANT Isolation	LB RX band, 699 – 960MHz	45	67		dBc
	HB RX band, 2300 – 2700MHz	42	55		
	B42 RX, 3400 – 3600MHz	40	70		

Parameter	Conditions	Min.	Typ.	Max.	Units
4G FDD LTE Band 2 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	Band 2	1850		1910	MHz
Maxium Linear Output Power	ET Mode	26			dBm
Maxium Linear Output Power	HPM, VCC = 3.4V	25			dBm
	HPM, VCC = 3.1V, VBAT=3.4V, Temp = -20°C to +85°C	24			
	HPM, VCC = 3.4V, 20MHz 16QAM 100RB	23			
	HPM, VCC = 3.4V, 20MHz 64QAM 100 RB	22			
	HPM, VCC = 3.4V, 40MHz 16QAM 200RB	22			
Gain	HPM, VCC = 3.4V		28.5		dB
	HPM, VCC = 3.1V, VBAT=3.4V, Temp = -20°C to +85°C		28.3		
	LPM, VCC =1.15V, Pout=11.5dBm		22		
	LPM, VCC =0.6V, Pout=1.5dBm		15		
EUTRA – ACLR	HPM, VCC = 3.4V, Pout ≤ Pmax		-40	-33	dBc
UTRA - ACLR1	HPM, VCC = 3.4V, Pout ≤ Pmax		-41	-36	
UTRA - ACLR2	HPM, VCC = 3.4V, Pout ≤ Pmax		-60	-39	
EVM	All modulations		2	5	%
Gain transient time	Gain transient time between PA modes		-	10	µs
PAE	HPM, VCC = 3.4V, Pout = Pmax		17		%
Current Consumption	HPM, VCC = 3.4V, Pout = Pmax		550		mA
	LPM, VCC ≤ 0.6V, Pout = 1.5dBm		60		
Non CA RX Band Noise	1930 – 1990MHz, 20MHz QPSK 50RB		-185	-179	dBm/Hz
B2 Intra-band NCCA RX Band Noise	Tx=1902.5MHz,15MHz 36RB, Wgap=10MHz		-185	-179	
	Tx=1907.5MHz, 5MHz 12RB, Wgap=50MHz		-174	-170	
LB RX Band Noise	699 – 960MHz, 20MHz QPSK 100RB		-173	-165	
HB RX Band Noise	2300 – 2700MHz, 20MHz QPSK 100RB		-173	-165	
ISM 5G Noise (except harmonics)	5150 – 5850MHz, 20MHz QPSK 100RB		-181	-175	
GPS Band Noise	1574 – 1577MHz, 20MHz QPSK 100RB		-171	-165	
Harmonics	2f0		-45		dBm
	3f0		-58		
Stability, spurious output level	Load VSWR = 6:1, all phase angles, Pfwd = Prated, maintain forward power (closed loop)		-	-36	dBm

Parameter	Conditions	Min.	Typ.	Max.	Units
3G WCDMA Band 2 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	Band 2	1850		1910	MHz
Maximum Output Power	HPM, VCC = 3.4V	26			dBm
	HPM, VCC = 3.1V, VBAT = 3.4V, Temp = -20°C to +85°C	25			
Gain	HPM, VCC = 3.4V		28.8		dB
	HPM, VCC = 3.1V, VBAT=3.4V, Temp = -20°C to +85°C		28.5		
UMTS ACLR1 (±5MHz)	Pout ≤ Pmax		-43	-36	dBc
UMTS ACLR2 (±10MHz)	Pout ≤ Pmax		-60	-46	
EVM	All Condition		2.5	5	%
PAE	HPM, Pout = Pmax		19		%
Current Consumption	HPM, Pout = Pmax		615		mA
Phase discontinuity variation		-15	-	15	Degree
RX Band Noise	Pout ≤ Pmax		-184	-179	dBm/Hz
ISM 2.4G Noise	2400 to 2483 MHz		-176	-170	
ISM 5G Noise (except harmonics)	5150 to 5850 MHz		-187	-175	
GPS Band Noise	1574 to 1577 MHz		-177	-168	
Harmonics	2f0		-45		dBm
	3f0		-58		

Parameter	Conditions	Min.	Typ.	Max.	Units
3G CDMA2000 Band Class 1 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, 1xRTT C2k				
Operational Frequency Range	Band Class 1	1850		1910	MHz
Maximum Output Power	HPM, VCC = 3.4V	26			dBm
	HPM, VCC = 3.1V, VBAT = 3.4V, Temp = -20°C to +85°C	25			
Gain	HPM, VCC = 3.4V		29		dB
	HPM, VCC = 3.1V, VBAT=3.4V, Temp = -20°C to +85°C		28.5		
CDMA ACLR1 (±1.25MHz)	Pout ≤ Pmax		-53	-45	dBc
CDMA ACLR2 (±1.98MHz)	Pout ≤ Pmax		-59	-53	
EVM	All Condition		4.5		%
PAE	HPM, Pout = Pmax		19.5		%
Current Consumption	HPM, Pout = Pmax		600		mA
Phase discontinuity variation		-15	-	15	Degree
RX Band Noise	Pout ≤ Pmax		-184	-179	dBm/Hz
ISM 2.4G Noise	2400 to 2483 MHz		-175	-165	
ISM 5G Noise (except harmonics)	5150 to 5850 MHz		-183	-160	
GPS Band Noise	1574 to 1577 MHz		-176	-165	
Harmonics	2f0		-37		dBm
	3f0		-51		

Parameter	Conditions	Min.	Typ.	Max.	Units
Band 2 RX RX Electrical Specifications	Unless otherwise stated: All unused RF ports terminated in 50Ω, Input and Output = 50Ω, Temp = 25°C, VBAT = 3.8V				
Operational Frequency Range	Band 2 and Band 25	1930		1990	MHz
Insertion Loss	1930.7 to 1989.3MHz		2.7		dB
RX Port VSWR			2.0		X:1
Attenuation	LB TX, 699 – 960MHz	25	30		dB
	HB TX, 2300 – 2690MHz	30	39		
	ISM 2.4G/5G	33	41		
TX to RX Isolation					
Self Isolation at RX Band	1930 – 1990MHz	50	56		dBc
Self Leakage TX power to RX port	1850 – 1910MHz, 1.4MHz QPSK 6RB		-27		dBm/1.4MHz
Duplexer Tx to ANT Isolation	LB RX band, 699 – 960MHz	45	60		dBc
	HB RX band, 2300 – 2700MHz	40	49		
	B42 RX, 3400 – 3600MHz	40	75		

Parameter	Conditions	Min.	Typ.	Max.	Units
4G TDD LTE Band 39 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	Band 39	1880		1920	MHz
Maxium Linear Output Power	ET Mode	26			dBm
Maxium Linear Output Power	HPM, VCC = 3.4V	25			dBm
	HPM, VCC = 3.1V, VBAT=3.4V, Temp = -20°C to +85°C	24			
	HPM, VCC = 3.4V, 20MHz 16QAM 100RB	23			
	HPM, VCC = 3.4V, 20MHz 64QAM 100 RB	22			
	HPM, VCC = 3.4V, 35MHz 16QAM 175 RB	22			
Gain	HPM, VCC = 3.4V		30.3		dB
	HPM, VCC = 3.1V, VBAT=3.4V, Temp = -20°C to +85°C		29.4		
	LPM, VCC =1.15V, Pout=11.5dBm		22		
	LPM, VCC =0.6V, Pout=1.5dBm		15		
EUTRA - ACLR	HPM, VCC = 3.4V, Pout ≤ Pmax		-40	-33	dBc
UTRA - ACLR1	HPM, VCC = 3.4V, Pout ≤ Pmax		-41	-36	
UTRA - ACLR2	HPM, VCC = 3.4V, Pout ≤ Pmax		-49	-39	
EVM	All modulations		2	5	%
Gain transient time	Gain transient time between PA modes		-	10	µs
PAE	HPM, VCC = 3.4V, Pout = Pmax		22.5		%
Current Consumption	HPM, VCC = 3.4V, Pout = Pmax		415		mA
	LPM, VCC ≤ 0.6V, Pout = 1.5dBm		50		
HB RX Band Noise	2300 – 2700MHz, 35MHz QPSK 175RB		-142	-135	dBm/Hz
ISM 5G Noise (except harmonics)	5150 – 5850MHz, 20MHz QPSK 100RB		-176	-158	
GPS Band Noise	1574 – 1577MHz, 20MHz QPSK 100RB		-138	-130	
Harmonics	2f0		-70		dBm
	3f0		-48		
Stability, spurious output level	Load VSWR = 6:1, all phase angles, Pfwd = Prated, maintain forward power (closed loop)		-	-36	dBm

Parameter	Conditions	Min.	Typ.	Max.	Units
3G TDS-CDMA Band 39 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, TDS-CDMA modulation				
Operational Frequency Range	Band 39	1880		1920	MHz
Maximum Output Power	HPM, VCC = 3.4V	26			dBm
	HPM, VCC = 3.1V, VBAT = 3.4V, Temp = -20°C to +85°C	25			
Gain	HPM, VCC = 3.4V		30.5		dB
	HPM, VCC = 3.1V, VBAT=3.4V, Temp = -20°C to +85°C		30		
UMTS ACLR1 (±1.6MHz)	Pout ≤ Pmax		-43	-36	dBc
UMTS ACLR2 (±3.2MHz)	Pout ≤ Pmax		-61	-46	
EVM	All Condition		2	5	%
PAE	HPM, Pout = Pmax		23.5		%
Current Consumption	HPM, Pout = Pmax		500		mA
RX Band Noise	925 – 935MHz		-97	-81	dBm/100kHz
	935 – 960MHz		-97	-85	
	1805 – 1880MHz		-81	-75	
ISM 2.4G Noise	2400 to 2483 MHz		-145	-138	dBm/Hz
ISM 5G Noise (except harmonics)	5150 to 5850 MHz		-177	-156	
GPS Band Noise	1574 to 1577 MHz		-142	-130	
Harmonics	2f0		-69		dBm
	3f0		-48		

Parameter	Conditions	Min.	Typ.	Max.	Units
Band 39 RX RX Electrical Specifications	Unless otherwise stated: All unused RF ports terminated in 50Ω, Input and Output = 50Ω, Temp = 25°C, VBAT = 3.8V				
Operational Frequency Range	Band 39	1880		1920	MHz
Insertion Loss, Non CA	1882.5 to 1917.5MHz		2.3		dB
Additional Insertion Loss*, DL CA	Multi-close with B41		1.2		dB
RX Port VSWR			2.0		X:1
Attenuation	B41 TX, 2496 – 2690MHz	40	53		
	ISM 2.4G/5G	30	36		

* Insertion loss can be optimized with proper matching at RX ports.

Parameter	Conditions	Min.	Typ.	Max.	Units
4G TDD LTE Band 34 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	Band 34	2010		2025	MHz
Maxium Linear Output Power	ET Mode	26			dBm
Maxium Linear Output Power	HPM, VCC = 3.4V	25			dBm
	HPM, VCC = 3.1V, VBAT=3.4V, Temp = -20°C to +85°C	24			
	HPM, VCC = 3.4V, 15MHz 16QAM 75RB	23			
Gain	HPM, VCC = 3.4V		29		dB
	HPM, VCC = 3.1V, VBAT=3.4V, Temp = -20°C to +85°C		28.5		
	LPM, VCC =1.15V, Pout=11.5dBm		20		
	LPM, VCC =0.6V, Pout=1.5dBm		15		
EUTRA - ACLR	HPM, VCC = 3.4V, Pout ≤ Pmax		-41	-33	dBc
UTRA - ACLR1	HPM, VCC = 3.4V, Pout ≤ Pmax		-41	-36	
UTRA - ACLR2	HPM, VCC = 3.4V, Pout ≤ Pmax		-49	-39	
EVM	All modulations		2	5	%
Gain transient time	Gain transient time between PA modes		-	10	µs
PAE	HPM, VCC = 3.4V, Pout = Pmax		20.5		%
Current Consumption	HPM, VCC = 3.4V, Pout = Pmax		450		mA
	LPM, VCC ≤ 0.6V, Pout = 1.5dBm		58		
HB RX Band Noise	2300 – 2700MHz, 15MHz QPSK 75RB		-142	-135	dBm/Hz
ISM 5G Noise (except harmonics)	5150 – 5850MHz, 15MHz QPSK 75RB		-180	-158	
GPS Band Noise	1574 – 1577MHz, 15MHz QPSK 75RB		-137	-130	
Harmonics	2f0		-54		dBm
	3f0		-46		
Stability, spurious output level	Load VSWR = 6:1, all phase angles, Pfwd = Prated, maintain forward power (closed loop)		-	-36	dBm

Parameter	Conditions	Min.	Typ.	Max.	Units
3G TDS-CDMA Band 34 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, TDS-CDMA modulation				
Operational Frequency Range	Band 34	2010		2025	MHz
Maximum Output Power	HPM, VCC = 3.4V	26			dBm
	HPM, VCC = 3.1V, VBAT = 3.4V, Temp = -20°C to +85°C	25			
Gain	HPM, VCC = 3.4V		29.2		dB
	HPM, VCC = 3.1V, VBAT=3.4V, Temp = -20°C to +85°C		28.7		
UMTS ACLR1 (±1.6MHz)	Pout ≤ Pmax		-42	-36	dBc
UMTS ACLR2 (±3.2MHz)	Pout ≤ Pmax		-61	-46	
EVM	All Condition		2	5	%
PAE	HPM, Pout = Pmax		22.5		%
Current Consumption	HPM, Pout = Pmax		520		mA
RX Band Noise	925 – 935MHz		-95	-81	dBm/100kHz
	935 – 960MHz		-95	-85	
	1805 – 1880MHz		-81	-75	
ISM 2.4G Noise	2400 to 2483 MHz		-145	-135	dBm/Hz
ISM 5G Noise (except harmonics)	5150 to 5850 MHz		-178	-156	
GPS Band Noise	1574 to 1577 MHz		-140	-130	
Harmonics	2f0		-53		dBm
	3f0		-46		

Parameter	Conditions	Min.	Typ.	Max.	Units
Band 34 RX (no BPF) RX Electrical Specifications	Unless otherwise stated: All unused RF ports terminated in 50Ω, Input and Output = 50Ω, Temp = 25°C, VBAT = 3.8V				
Operational Frequency Range	Band 34	2010		2025	MHz
Insertion Loss	2012.5 to 2022.5MHz		1.0		dB
RX Port VSWR			2.0		X:1

Parameter	Conditions	Min.	Typ.	Max.	Units
4G FDD LTE Band 7 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	Band 7	2500		2570	MHz
Maxium Linear Output Power	ET Mode	26			dBm
Maxium Linear Output Power	HPM, VCC = 3.4V	25			dBm
	HPM, VCC = 3.1V, VBAT=3.4V, Temp = -20°C to +85°C	24			
	HPM, VCC = 3.4V, 20MHz 16QAM 100RB	23			
	HPM, VCC = 3.4V, 20MHz 64QAM 100 RB	22			
	HPM, VCC = 3.4V, 40MHz 16QAM 200RB	22			
Gain	HPM, VCC = 3.4V		29.2		dB
	HPM, VCC = 3.1V, VBAT=3.4V, Temp = -20°C to +85°C		28.9		
	LPM, VCC =1.15V, Pout=11.6dBm		24		
	LPM, VCC =0.6V, Pout=1.6dBm		20		
EUTRA - ACLR	HPM, VCC = 3.4V, Pout ≤ Pmax		-40	-33	dBc
UTRA - ACLR1	HPM, VCC = 3.4V, Pout ≤ Pmax		-41	-36	
UTRA - ACLR2	HPM, VCC = 3.4V, Pout ≤ Pmax		-62	-39	
EVM	All modulations		2	5	%
Gain transient time	Gain transient time between PA modes		-	10	µs
PAE	HPM, VCC = 3.4V, Pout = Pmax		15.5		%
Current Consumption	HPM, VCC = 3.4V, Pout = Pmax		600		mA
	LPM, VCC ≤ 0.6V, Pout = 1.6dBm		85		
Non CA RX Band Noise	2620 – 2690MHz, 20MHz QPSK 75RB		-185	-179	dBm/Hz
B7 intra-band NCCA RX Band Noise	Tx=2685MHz, 10MHz 50RB, Wgap=25MHz		-185	-179	
LB RX Band Noise	699 – 960MHz, 40MHz QPSK 200RB		-185	-175	
MB RX Band Noise	1452 – 2200MHz, 40MHz QPSK 200RB		-183	-175	
B3 RX Band Noise, DL CA	1805 – 1880MHz, 40MHz QPSK 200RB		-185	-179	
B1 RX Band Noise, DL CA	2110 – 2170MHz, 40MHz QPSK 200RB		-179	-175	
UL20M ISM Noise	2400 – 2472MHz, 20MHz QPSK 100RB		-160	-156	
ISM 5G Noise (except harmonics)	5150 – 5850MHz, 40MHz QPSK 200RB		-184	-160	
GPS Band Noise	1574 – 1577MHz, 40MHz QPSK 200RB		-184	-168	
Harmonics	2f0		-49		dBm
	3f0		-58		
Stability, spurious output level	Load VSWR = 6:1, all phase angles, Pfwd = Prated, maintain forward power (closed loop)		-	-36	dBm

Parameter	Conditions	Min.	Typ.	Max.	Units
Band 7 RX RX Electrical Specifications	Unless otherwise stated: All unused RF ports terminated in 50Ω, Input and Output = 50Ω, Temp = 25°C, VBAT = 3.8V				
Operational Frequency Range	Band 7	2620		2690	MHz
Insertion Loss, Non CA	2622.5 to 2687.5MHz		3.1		dB
Additional Insertion Loss, DL CA	Multi-close with B1+B3+B7		0.4		dB
RX Port VSWR			2.5		X:1
Attenuation	LB TX, 699 – 960MHz	36	45		dB
	MB TX, 1427 – 1980MHz	40	46		
	ISM 2.4G	40	55		
	ISM 5G	36	44		
TX to RX Isolation					
Self Isolation at RX Band	2620 – 2690MHz	50	56		dBc
Self Leakage TX power to RX port	2500 – 2570MHz, 5MHz QPSK 25RB		-32		dBm/5MHz
Cross Isolation at B3 RX Band, B1+B3+B7 CA (B7 as PCC)	1805 – 1880MHz	43	54		dBc
Cross Leakage B7 TX to B3 RX, B1+B3+B7 CA (B7 as PCC)	2500 – 2570MHz, 20MHz QPSK 100RB		-32		dBm/20MHz
Cross Isolation at B1 RX Band, B1+B3+B7 CA (B7 as PCC)	2110 – 2170MHz	36	42		dBc
Cross Leakage B7 TX to B1 RX, B1+B3+B7 CA (B7 as PCC)	2500 – 2570MHz, 20MHz QPSK 100RB		-38		dBm/20MHz
Duplexer Tx to ANT Isolation	LB RX band, 699 – 960MHz	36	45		dBc
	MB RX band, 1452 – 2200MHz	36	45		
	LAA RX, 5150 – 5850MHz	35	44		

Parameter	Conditions	Min.	Typ.	Max.	Units
4G TDD LTE Band 40 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	Band 40	2300		2400	MHz
Maxium Linear Output Power	ET Mode	26			dBm
Maxium Linear Output Power	HPM, VCC = 3.4V	25			dBm
	HPM, VCC = 3.1V, VBAT=3.4V, Temp = -20°C to +85°C	24			
	HPM, VCC = 3.4V, 20MHz 16QAM 100RB	23			
	HPM, VCC = 3.4V, 20MHz 64QAM 100RB	22			
	HPM, VCC = 3.4V, 40MHz 16QAM 200RB	22			
Gain	HPM, VCC = 3.4V		31		dB
	HPM, VCC = 3.1V, VBAT=3.4V, Temp = -20°C to +85°C		29.5		
	LPM, VCC =1.15V, Pout=11.6dBm		23		
	LPM, VCC =0.6V, Pout=1.6dBm		13.5		
EUTRA - ACLR	HPM, VCC = 3.4V, Pout ≤ Pmax		-41	-33	dBc
UTRA - ACLR1	HPM, VCC = 3.4V, Pout ≤ Pmax		-40	-36	
UTRA - ACLR2	HPM, VCC = 3.4V, Pout ≤ Pmax		-52	-39	
EVM	All modulations		2	5	%
Gain transient time	Gain transient time between PA modes		-	10	µs
PAE	HPM, VCC = 3.4V, Pout = Pmax		16.5		%
Current Consumption	HPM, VCC = 3.4V, Pout = Pmax		560		mA
	LPM, VCC ≤ 0.6V, Pout = 1.6dBm		63		
LB RX Band Noise	699 – 960MHz, 40MHz QPSK 200RB		-177	-170	dBm/Hz
MB RX Band Noise	1452 – 2200MHz, 40MHz QPSK 200RB		-167	-160	
UL20M ISM Noise (2423-2484MHz)	TX=2300 – 2370MHz, 20MHz QPSK 100RB		-158	-153	
ISM 5G Noise (except harmonics)	5150 – 5850MHz, 40MHz QPSK 200RB		-181	-160	
GPS Band Noise	1574 – 1577MHz, 40MHz QPSK 200RB		-178	-168	
Harmonics	2f0		-60		dBm
	3f0		-56		
Stability, spurious output level	Load VSWR = 6:1, all phase angles, Pfwd = Prated, maintain forward power (closed loop)		-	-36	dBm

Parameter	Conditions	Min.	Typ.	Max.	Units
Band 40 RX RX Electrical Specifications	Unless otherwise stated: All unused RF ports terminated in 50Ω, Input and Output = 50Ω, Temp = 25°C, VBAT = 3.8V				
Operational Frequency Range	Band 40	2300		2400	MHz
Insertion Loss, Non CA	2302.5 to 2397.5MHz		3.0		dB
RX Port VSWR			2.0		X:1
Attenuation	LB TX, 699 – 862MHz	25	33		dB
	B3 TX, 1710 – 1785MHz	35	40		
	ISM 2.4G, 2423 – 2484MHz	20	28		
	ISM 5G	25	35		
Filter TX-ANT Isolation	LB RX, 699 – 960MHz	40	73		dBc
	MB RX, 1452 – 1880MHz	30	48		

Parameter	Conditions	Min.	Typ.	Max.	Units
4G TDD LTE Band 41 (B38) 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	Band 41	2496		2690	MHz
Maxium Linear Output Power	ET Mode, Power Class 3	26			dBm
	ET Mode, Power Class 2	28			
Maxium Linear Output Power (Power Class 3)	HPM, VCC = 3.4V	25			dBm
	HPM, VCC = 3.1V, VBAT=3.4V, Temp = -20°C to +85°C	24			
	HPM, VCC = 3.4V, 20MHz 16QAM 100RB	23			
	HPM, VCC = 3.4V, 20MHz 64QAM 100RB	22			
	HPM, VCC = 3.4V, 40MHz 16QAM 200RB	22			
Maxium Linear Output Power (Power Class 2)	HPM, VCC = 4.2V	27			dBm
	HPM, VCC = 4.2V, VBAT=3.4V, Temp = -20°C to +85°C	26			
	HPM, VCC = 4.2V, 20MHz 16QAM 100RB	25			
	HPM, VCC = 4.2V, 20MHz 64QAM 100RB	24			
	HPM, VCC = 4.2V, 40MHz 16QAM 200RB	24			
Gain	HPM, VCC = 3.4V, Power Class 3		29.7		dB
	HPM, VCC = 3.1V, VBAT=3.4V, Temp = -20°C to +85°C, Power Class 3		29.4		
	HPM, VCC = 4.2V, Power Class 2		30.3		
	HPM, VCC = 4.2V, VBAT=3.4V, Temp = -20°C to +85°C, Power Class 2		29.6		
	LPM, VCC =1.15V, Pout=11.6dBm		24.5		
	LPM, VCC =0.6V, Pout=1.6dBm		20		
EUTRA - ACLR	HPM, VCC = 3.4V, Pout ≤ Pmax		-41	-33	dBc
UTRA - ACLR1	HPM, VCC = 3.4V, Pout ≤ Pmax		-40	-36	
UTRA - ACLR2	HPM, VCC = 3.4V, Pout ≤ Pmax		-51	-39	
EVM	All modulations		2	5	%
Gain transient time	Gain transient time between PA modes		-	10	µs
PAE (Power Class 3)	HPM, VCC = 3.4V, Pout = Pmax		15		%
Current Consumption (PC3)	HPM, VCC = 3.4V, Pout = Pmax		620		mA
	LPM, VCC ≤ 0.6V, Pout = 1.6dBm		65		
LB RX Band Noise	699 – 960MHz, 40MHz QPSK 200RB		-178	-173	dBm/Hz
B25 RX Band Noise (1930-1995MHz)	Pout ≤ Pmax with MPR 20MHz QPSK 100RB and 40MHz QPSK 200RB, both PC3 ad PC2		-174	-165	
B39 RX Band Noise, DL CA	1880 – 1920MHz, 40MHz QPSK 200RB		-182	-177	
B3 RX Band Noise, DL CA	1805 – 1880MHz, 40MHz QPSK 200RB		-183	-179	
B42 RX Band Noise	3400 – 3600MHz, 20MHz QPSK 100RB		-168	-163	
UL20M ISM Noise	2400 – 2462MHz, 20MHz QPSK 100RB		-158	-150	
ISM 5G Noise (except harmonics)	5150 – 5850MHz, 40MHz QPSK 200RB		-180	-160	
GPS Band Noise	1574 – 1577MHz, 40MHz QPSK 200RB		-176	-168	
Harmonics	2f0		-62		dBm

Parameter	Conditions	Min.	Typ.	Max.	Units
	3f0		-67		
Stability, spurious output level	Load VSWR = 6:1, all phase angles, Pfwd = Prated, maintain forward power (closed loop)		-	-36	dBm

Parameter	Conditions		Min.	Typ.	Max.	Units
5G NR n41 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					
Operational Frequency Range	NR Band n41		2496		2690	MHz
Maxium Linear Output Power	HPM, VCC = 3.4V, Power Class 3	NR7	25			dBm
Gain	HPM, VCC = 3.4V, Power Class 3	NR7		30.5		dB
	HPM, VCC = 3.1V, VBAT=3.4V, Temp = -20°C to +85°C, Power Class 3	NR7		30		
	LPM, VCC =1.15V, Pout=11.6dBm	NR7		24		
PAE (Power Class 3)	HPM, VCC = 3.4V, Pout = Pmax	NR7		14		%
Current Consumption (PC3)	HPM, VCC = 3.4V, Pout = Pmax	NR7		660		mA
NR - ACLR	HPM, VCC = 3.4V, Pout ≤ Pmax - MPR	NR8		-41	-33	dBc
EVM	HPM, VCC = 3.4V, Pout ≤ Pmax - MPR	NR9		1.4		%

Parameter	Conditions	Min.	Typ.	Max.	Units
Band 41/38 RX RX Electrical Specifications	Unless otherwise stated: All unused RF ports terminated in 50Ω, Input and Output = 50Ω, Temp = 25°C, VBAT = 3.8V				
Operational Frequency Range	Band 41 (including Band 38)	2496		2690	MHz
Insertion Loss, Non CA	2496 to 2690MHz		3.4		dB
Additional Insertion Loss*, DL CA	Multi-close with B39		0.5		dB
	Multi-close with B3		1.2		
RX Port VSWR			2.0		X:1
Attenuation	LB TX, 699 – 862MHz	23	29		dB
	B39 TX, 1880 – 1920MHz	27	33		
	B1 TX, 1920 – 1980MHz	27	33		
	B3 TX, 1710 – 1785MHz	30	37		
	At 2485MHz B38 OBB	0	5		
	ISM 2.4G, 2400 – 2467MHz	30	36		
	ISM 5G	40	50		
Filter TX-ANT Isolation	LB RX, 699 – 960MHz	40	70		dBc
	MB RX, 1452 – 2025MHz	30	40		
Cross Isolation at B3 RX Band, B3+B41 CA (B41 as PCC)	1805 – 1880MHz	43	50		dBc
Cross Leakage B41 TX to B3 RX, B3+B41 CA (B41 as PCC)	2496 – 2690MHz, 20MHz QPSK 100RB		-28		dBm/20MHz

* Insertion loss can be optimized with proper matching at RX ports.

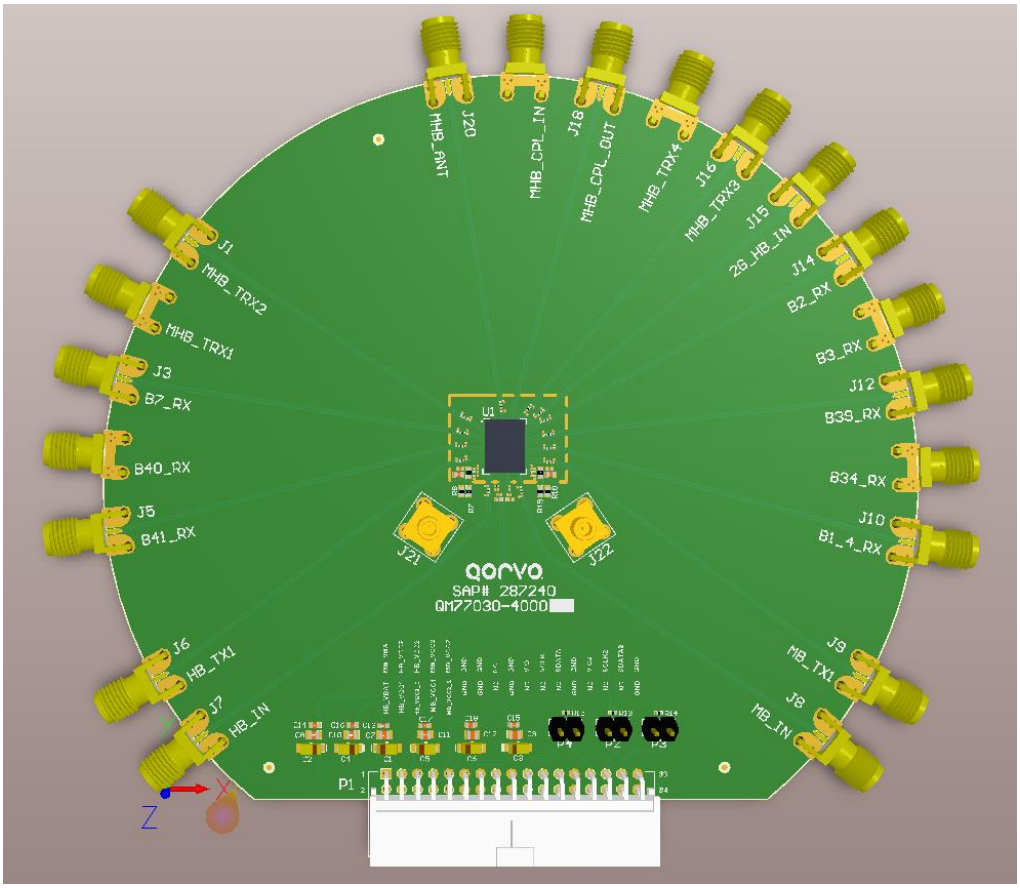
Parameter	Conditions	Min.	Typ.	Max.	Units
4G LTE MB PA_AUX_OUT TX Electrical Specifications	Unless otherwise stated: All unused RF ports terminated in 50Ω, Input and Output = 50Ω, Temp = 25°C, VBATT = 3.8V, APT Mode, QPSK, 10MHz, 12 Resource Blocks with MPR=0				
Operational Frequency Range	Mid Band	1710		2025	MHz
Maxium Linear Output Power	HPM, VCC = 3.4V	28.5			dBm
	HPM, VCC = 3.1V, VBAT=3.4V, Temp = -20°C to +85°C	27.5			
	HPM, VCC = 3.4V, 20MHz 16QAM 100RB	26.5			
	HPM, VCC = 3.4V, 20MHz 64QAM 100RB	25.5			
Gain	HPM, VCC = 3.4V		31		dB
	HPM, VCC = 3.1V, VBAT=3.4V, Temp = -20°C to +85°C		30.8		
	LPM, VCC =1.15V, Pout=15.5dBm		26		
	LPM, VCC =0.6V, Pout=5.5dBm		15		
EUTRA - ACLR	HPM, VCC = 3.4V, Pout ≤ Pmax		-40	-33	dBc
UTRA - ACLR1	HPM, VCC = 3.4V, Pout ≤ Pmax		-40	-36	
UTRA - ACLR2	HPM, VCC = 3.4V, Pout ≤ Pmax		-60	-39	
EVM	All modulations		2	5	%
Gain transient time	Gain transient time between PA modes		-	10	µs
PAE	HPM, VCC = 3.4V, Pout = Pmax		33.5		%
Current Consumption	HPM, VCC = 3.4V, Pout = Pmax		620		mA
	LPM, VCC ≤ 0.6V, Pout = 5.5dBm		90		
B25 RX Band Noise	1930 - 1995MHz, 20MHz QPSK 50RB		-131	-125	dBm/Hz
LB RX Band Noise	699 – 960MHz, 20MHz QPSK 100RB		-146	-138	
HB RX Band Noise	2300 – 2700MHz, 20MHz QPSK 100RB		-142	-135	
ISM 5G Noise (except harmonics)	5150 – 5850MHz, 20MHz QPSK 100RB		-158	-135	
GPS Band Noise	1574 – 1577MHz, 20MHz QPSK 100RB		-133	-125	
Harmonics	2f0		-12		dBm
	3f0		-18		
Stability, spurious output level	Load VSWR = 6:1, all phase angles, Pfwd = Prated, maintain forward power (closed loop)		-	-36	dBm

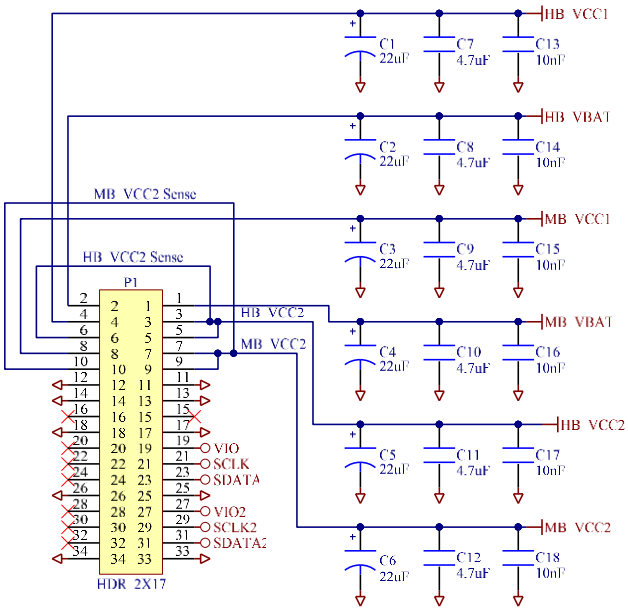
Parameter	Conditions	Min.	Typ.	Max.	Units
MHB TRX ASM_AUX port TRX Electrical Specifications	Unless otherwise stated: All unused RF ports terminated in 50Ω, Input and Output = 50Ω, Temp = 25°C, VBAT = 3.8V				
Frequency Range		1427		5850	MHz
Insertion Loss*	1427 – 1559MHz		0.8	1.5	dB
	1700 – 2200MHz		1.4	2.0	
	2300 – 2690MHz		1.6	2.4	
	3400 – 3800MHz		2.0	2.8	
	5150 – 5850MHz		2.2	3.2	
1.5GHz , Harmonics, 2f0 and 3f0	Pin=26dBm		-75	-60	dBm
MHB Harmonics, 2f0	Pin=26dBm		-77	-70	
MHB Harmonics, 3f0	Pin=26dBm		-76	-60	
3.5GHz armonics, 2f0 and 3f0	Pin=26dBm		-77	-60	
PCS/DCS Harmonics, 2f0 and 3f0	Pin=31dBm at 2G_HB_IN port		-66	-40	
B1/B4 Cross Isolation to 2G_HB	B1/B4 TRX at 2110 – 2170MHz.	25	40		dBc

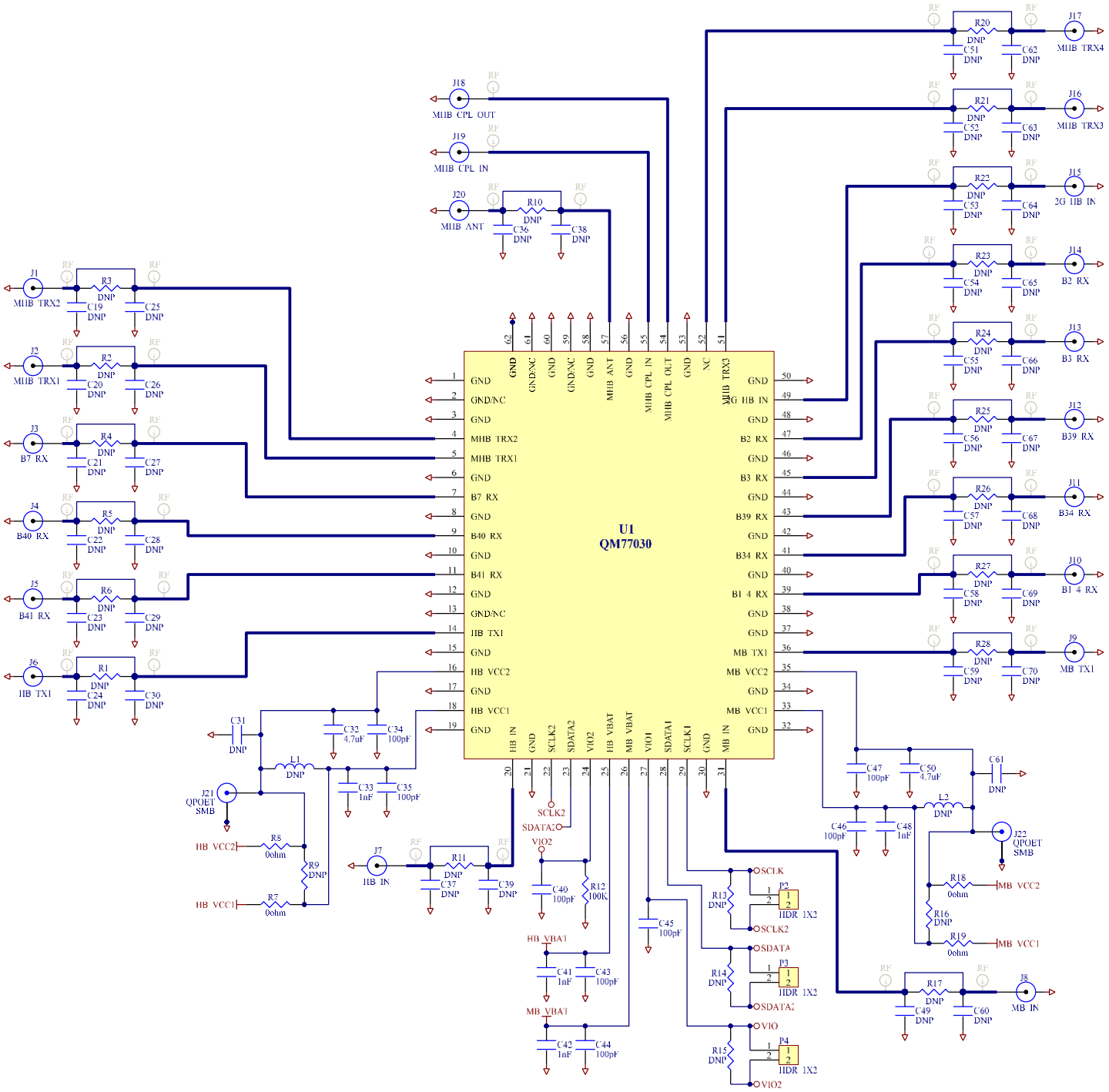
* Insertion loss can be optimized with proper matching at TRX ports.

Parameter	Conditions	Min.	Typ.	Max.	Units
MHB 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		1427		3800	MHz
Insertion Loss, CPL_IN to CPL_OUT	1427 – 2200MHz		1.5	2.4	dB
	2300 – 2690MHz		2.0	3.0	
	3400 – 3800MHz		2.8	3.5	
Coupling factor	Forward mode		20		dB
	Reverse mode		24		
Directivity	MB range (1.7-2.2GHz), Forward mode		15		dB
	MB range (1.7-2.2GHz), Reverse mode		19		
	HB range (2.3-2.7GHz), Forward mode		15		
	HB range (2.3-2.7GHz), Reverse mode		19		
	VHB range (3.4-3.8GHz), Forward mode		17		
	VHB range (3.4-3.8GHz), Reverse mode		17		

Evaluation Board Circuit Schematic and Layout







Notes:

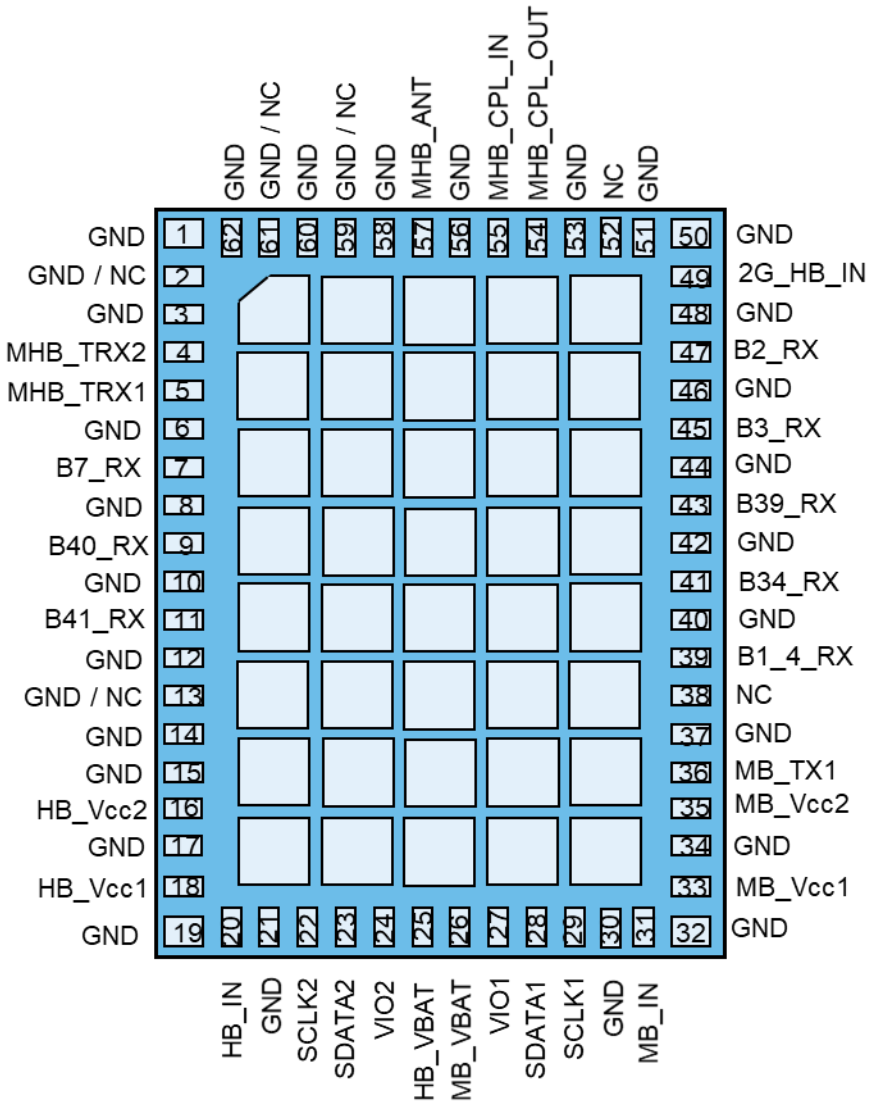
1. R12 100k resister on VIO2 is for evaluation purpose only and not required in applications.
2. QM77040 re-uses QM77030's EVB for testing and sampling.

Evaluation Board Bill of Material

Reference Designator	Description	Manufacturer	Part number
BOARD	PCB, QM77030 (re-use for QM77040)	TTM - San Jose	QM77030-4000(A)
U1	QM77040 Module	Qorvo	QM77040
C33,C48	CAP, 1000pF, 10%, 10V, X5R, 0201	Taiyo Yuden (SG)	RM LMK063 BJ102KP-F
C41,C42	CAP, 1000pF, 10%, 50V, X7R, 0402	Murata Electronics	GRM155R71H102KA01D
C34,C35,C40,C43,C44,C45,C46,C47	CAP, 100pF, 5%, 25V, C0G, 0201	Murata Electronics	GRM0335C1E101JA01D
C1,C2,C3,C4,C5,C6	CAP, 22uF, 10%, 10V, TANT-A	AVX Asia Limited	TAJA226K010RNJ
C7,C8,C9,C10,C11,C12	CAP, 4.7uF, 10%, 6.3V, X5R, 0805	Taiyo Yuden (SG)	CE JMK212 BJ475KD-T
C32,C50	CAP, 4.7uF, 20%, 6.3V, X5R, 0402	Murata Electronics	GRM155R60J475ME87D
C13,C14,C15,C16,C17,C18	CAP, 10000pF, 10%, 50V, X7R, 0603	Murata Electronics	GRM188R71H103KA01D
R12	RES, 100K, 5%, 1/20W, 0201	Kamaya, Inc	RMC1/20-104JPA15
R7, R8, R18, R19	RES, 0 OHM, 0603	KOA SHANGHAI ELEC TRADING CO	RK73Z1JTTD
J21,J22	CONN, SMB, ST PLUG REC, T/H	Aliner Industries, Inc.	21-003B0-T
J1,J2,J3,J4,J5,J6,J7,J8,J9,J10,J11,J12,J13,J14,J15,J16,J17,J18,J19,J20	CONN, SMA, END LNCH, MINI, FLT, 0.068"	MOLEX	73251-4432
P1	CONN, HDR, RT-ANG, 34-PIN, 0.100", T/H	MOLEX	90130-3134
P2,P3,P4	CONN, HDR, ST, 2-PIN, 0.100"	SAMTEC INC.	TSW-102-07-G-S

Note: “DNP” means “Do Not Populate” components and are not included on a standard EVB. Parts sourced separately.

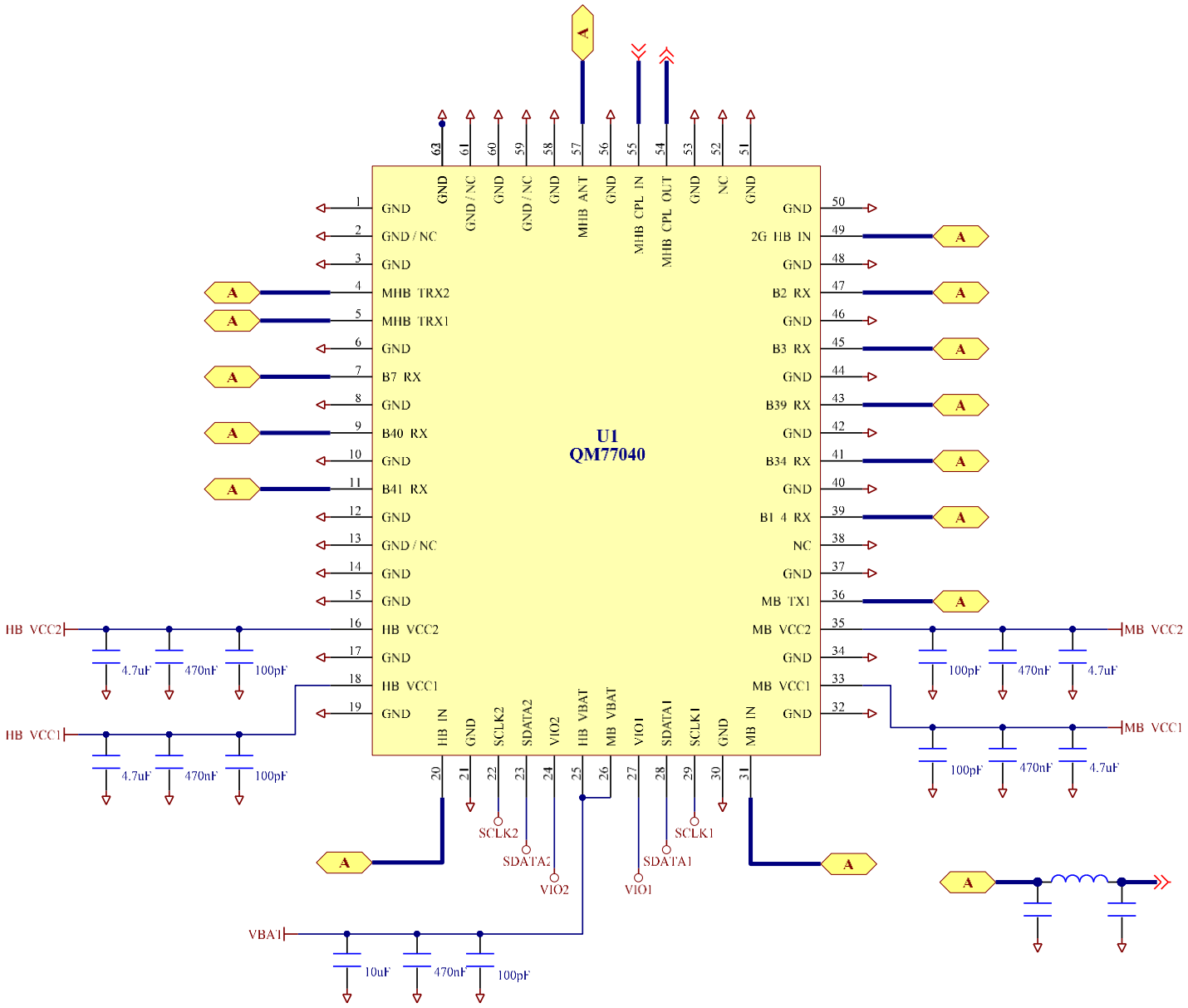
Pin Configuration and Description



Top View

Pin Number	Label	Description
2, 13, 59, 61	GND / NC	Should be grounded or left no connect.
4	MHB_TRX2	MHB ASM TRX port 2. Not DC blocked.
5	MHB_TRX1	MHB ASM TRX port 1. Not DC blocked.
7	B7_RX	B7 RX port through integrated duplexer. Not DC blocked
9	B40_RX	B40 RX port through integrated BPF. Not DC blocked
11	B41_RX	B41 RX port through integrated BPF. Not DC blocked
38, 52	NC	Not connected pins. Pin 38 and 52 grounded internally
14	GND	Ground connection
16	HB_VCC2	Supply voltage for HB PA Q2 collector
18	HB_VCC1	Supply voltage for HB PA Q1 collector
20	HB_IN	HB RF input port. Not DC blocked
22	SCLK2	Serial interface clock input signal for programming the RFFE2
23	SDATA2	Serial interface data I/O signal for programming the RFFE2
24	VIO2	Supply voltage for the MIPI serial interface RFFE2
25	HB_VBAT	Supply voltage for HB bias circuitry. Shall be connected together with MB_VBAT to same source
26	MB_VBAT	Supply voltage for MB bias circuitry. Shall be connected together with HB_VBAT to same source
27	VIO1	Supply voltage for the MIPI serial interface RFFE1
28	SDATA1	Serial interface data I/O signal for programming the RFFE1
29	SCLK1	Serial interface clock input signal for programming the RFFE1
31	MB_IN	MB RF input port. Not DC blocked
33	MB_VCC1	Supply voltage for MB PA Q1 collector
35	MB_VCC2	Supply voltage for MB PA Q2 collector
36	MB_TX1	MB PA AUX output port 1. Not DC blocked
39	B1_4_RX	B1 and B4 RX port through integrated quadplexer. Not DC blocked
41	B34_RX	B34 RX port through ASM (no BPF). Not DC blocked
43	B39_RX	B39 RX port through integrated BPF. Not DC blocked
45	B3_RX	B3 RX port through integrated quadplexer. Not DC blocked
47	B2_RX	B2 RX port through integrated duplexer. Not DC blocked
49	2G_HB_IN	Input port for routing 2G HB signal through the MB ASM to MB_ANT. Not DC blocked
51	GND	Ground connection
54	MHB_CPL_OUT	MHB coupler output port for the MHB ASM
55	MHB_CPL_IN	MHB coupler input port for the MHB ASM
57	MHB_ANT	Mid Band, High Band (MHB) antenna port from MHB ASM. Not DC blocked
See description	GND	These pins must be grounded; 1,3,6,8,10,12,15,17,19,21,30,32,34,37,40,42,44,46,48,50,53,56,58,60,62
Backside Pad	GND	Ground connection. The back side of the package should be connected to the ground plane through as short of a connection as possible. PCB vias under the device are required.

Application Circuit Schematic



Notes:

1. VCC2 and VCC1 can be connected to the same source, but should be connected as close to the source as possible with separate traces using a star routing configuration. Bypass capacitors should be placed as close to the DUT as possible.
2. HB_VBAT and MB_VBAT must be conncted to the same battery supply for proper function, and a star routing is also recommended.
3. Decoupling capacitor values for power supplies (VCC and VBAT) are suggested based on an EVB layout, and actual number and value of bypass capacitors needs to be evaluated per application.

System level ESD test passed 8kV on the QM77040 evaluation board per IEC 61000-4-2 requirements. However, additional protection circuits are recommended on the phone board to enhance the IEC ESD performance depending on the final UE requirements.

MIPI RFFE Information

Table 1 RFFE MIPI Control Logic Registers

Register Address	Data Bits	Register Name	QORVO Bit Field Name	Default [msb:lsb]	QORVO Description	Trigger Support	R/W/ RM
0x00	Reg00[7:0]	reserved_lb_1	Spare[7:0]	0b0000_0000	reserved	No	R/W
0x01	Reg01[7:0]	reserved_lb_2	Spare[7:0]	0b0000_0000	reserved	No	R/W
0x02	Reg02[7]	HB_PA_CTRL0	HB_PA_EN[7]	0b0	Enables HB PA Bias 0 = DISABLED 1 = ENABLED	T012	R/W
	Reg02[6]		Spare[6]	0b0	Spare (Unused) Bits	T012	R/W
	Reg02[5:2]		HB_PA_BAND[3:0]	0b0000	This register sets the PA configuration if HB_MSW is off (0). If HB_MSW is non-zero, it overrides the setting in this register. 0000 = OFF 0001 = reserved 0010 = B40 0011 = B41 0100 = B7 0101 = B40 -> B40_RX 0110 = B41 -> B41_RX 1001 = Hi Isolation Others are reserved	T012	R/W
	Reg02[1:0]		HB_PA_Mode[1:0]	0b00	PA Mode 0x = HPM 1x =LPM	T012	R/W
0x03	Reg03[7:5]	HB_PA_CRTL1	HB_PA_DAC1[2:0]	0b000	PA Biasing. IDAC1[2:0] = PA_BIAS[7:5] Stage 1 bias current	T012	R/W
	Reg03[4:0]		HB_PA_DAC2[4:0]	0b0_0000	PA Biasing. IDAC2[4:0] = PA_BIAS[4:0] Stage 2 bias current	T012	R/W
0x04	Reg04[7]	MB_PA_CTRL0	MB_PA_EN[7]	0b0	Enables MB PA 0 = DISABLED 1 = ENABLED	T012	R/W
	Reg04[6]		Spare[6]	0b0	Spare (Unused) Bits	T012	R/W
0x04	Reg04[5:2]		MB_PA_BAND[3:0]	0b0000	This register sets the PA configuration if MB_MSW is off (0). If MB_MSW is non-zero, it overrides the setting in this register. 0000 = OFF 0001 = B34/B39 0010 = reserved 0011 = B2 0100 = B3/4 0101 = B1 0110 = MB_AUX 1011 = Hi Isolation Others are reserved	T012	R/W
	Reg04[1:0]		MB_PA_MODE[1:0]	0b00	PA Mode 0x = HPM 1x = LPM	T012	R/W
0x05	Reg05[7:5]	MB_PA_CRTL1	MB_PA_DAC1[2:0]	0b000	PA Biasing. IDAC1[2:0] = PA_BIAS[7:5] Stage 1 biasing current	T012	R/W
	Reg05[4:0]		MB_PA_DAC2[4:0]	0b0_0000	PA Biasing. IDAC2[4:0] = PA_BIAS[4:0] Stage 2 biasing current	T012	R/W

Register Address	Data Bits	Register Name	QORVO Bit Field Name	Default [msb:lsb]	QORVO Description	Trigger Support	R/W/ RM
0x06	Reg06[7:0]	reserved_lb_3	Spare[7:0]	0b0000_0000	reserved	No	R/W
0x07	Reg07[7:0]	reserved_lb_4	Spare[7:0]	0b0000_0000	reserved	No	R/W
0x08	Reg08[7:3]	HB_ASM_CTRL	Spare[4:0]	0b0_0000	spare	T012	R/W
	Reg08[2:0]		HB_ASM_SEL[2:0]	0b000	000 = OFF 001 = B7 010 = B40 011 = B41 100 = MHB_TRX1 101 = MHB_TRX2 111 = HIGH ISO Others are reserved	T012	R/W
0x09	Reg09[7:4]	MB_ASM_CTRL	Spare[3:0]	4b0000	spare	T012	R/W
	Reg09[3:0]		MB_ASM_SEL[3:0]	0b0000	0000 = OFF 0001 = B34/B39 0010 = B39_RX 0011 = B2 0100 = B1/B3/B4 0101 = 2G_HB_IN 0110 = B34_RX 1111 = HIGH ISO Others are reserved	T012	R/W
0x0A	Reg10[7:0]	reserved_lb_5	Spare[7:0]	0b0000_0000	reserved	No	R/W
0x0B	Reg11[7:4]	CPLR_CTRL	Spare[3:0]	0b0000	spare	T012	R/W
	Reg11[3:2]		CPLR_DIR[1:0]	0b00	Coupler Direction 00 = disabled 01 = Forward 10 = Reverse 11 = CPLR_IN	T012	R/W
	Reg11[1:0]		CPLR_RANGE[1:0]	0b00	Coupler Range 00 = JB range (1.4-1.7) 01 = MB range (1.7-2.2) 10 = HB range (2.3-2.7) 11 = VHB range (3.4-3.8)	T012	R/W
0x0C	Reg12[7]	HB_MSW_CTRL0	Spare[7]	0b0	Spare (Unused) Bits	T012	R/W
	Reg12[6]		Spare[6]	0b0	Spare (Unused) Bits	T012	R/W
	Reg12[5:2]		HB_MSW_BAND[3:0]	0b0000	If this register is non-zero, it overrides the setting in the HB_PACTRL register. 0000 = OFF 0001 = reserved 0010 = B40 0011 = B41 0100 = B7 0101 = B40 -> B40_RX 0110 = B41 -> B41_RX 1001 = Hi Isolation Others are reserved	T012	R/W
	Reg12[1]		Spare[1]	0b0	spare (not Used)	T012	R/W
	Reg12[0]		Spare[0]	0b0	spare (not Used)	T012	R/W
0x0D	Reg13[7]	MB_MSW_CTRL0	Spare[7]	0b0	Spare (Unused) Bits	T012	R/W
	Reg13[6]		Spare[6]	0b0	Spare (Unused) Bits	T012	R/W

Register Address	Data Bits	Register Name	QORVO Bit Field Name	Default [msb:lsb]	QORVO Description	Trigger Support	R/W/ RM
	Reg13[5:2]		MB_MSW_BAND[3:0]	0b0000	If this register is non-zero, it overrides the setting in the MB_PACTRL register. 0000 = OFF 0001 = B34/B39 0010 = reserved 0011 = B2 0100 = B3/4 0101 = B1 0110 = MB_AUX 1011 = Hi Isolation Others are reserved	T012	R/W
	Reg13[1]		Spare[1]	0b0	spare (not Used)	T012	R/W
	Reg13[0]		Spare[0]	0b0	spare (not Used)	T012	R/W
0x1A	Reg26[7]	RFFE_STATUS	SW_RESET[7]	0b0	0: Normal operation 1: Software reset (reset of all configurable registers to default values, except for USID)	No	R/W
	Reg26[6]		CMD_FRAME_P_ERR[6]	0b0	Command sequence received with parity error – discard command.	No	R/W
	Reg26[5]		CMD_LEN_ERR[5]	0b0	Command length error	No	R/W
	Reg26[4]		ADDR_FRAME_P_ERR[4]	0b0	Address frame parity error = 1	No	R/W
	Reg26[3]		DATA_FRAME_P_ERR[3]	0b0	Data frame with parity error	No	R/W
	Reg26[2]		READ_UNUSED_REG[2]	0b0	Read command to an invalid address	No	R/W
	Reg26[1]		WRITE_UNUSED_REG[1]	0b0	Write command to an invalid address	No	R/W
	Reg26[0]		BID_GID_ERR[0]	0b0	Read command with a Broadcast_ID or GROUP_ID	No	R/W
0x1B	Reg27[7:4]	GROUP_ID	GSID0[3:0]	0b0000	Group slave ID 0	No	R/W
	Reg27[3:0]		GSID1[3:0]	0b0000	Group slave ID 1	No	R/W
0x1C	Reg28[7]	PM_TRIG	PA_PWR_MODE[7]	0b1	0: Normal operation (ACTIVE) 1: Low power (LOW POWER)	No	R/W
	Reg28[6]		PA_OPER_MODE[6]	0b0	0: Normal operation (ACTIVE) 1: Default settings (STARTUP)	No	R/W
	Reg28[5:3]		TriggerMask[2:0]	0b000	Setting these bits to '1' will cause the corresponding triggers to be masked (disabled), and RFFE writes to corresponding registers will change configuration immediately (no trigger command necessary). TriggerMask[2] = TriggerMask_2, TriggerMask[1] = TriggerMask_1,&TriggerMask[0] = TriggerMask_0 Note: Qorvo does not allow for changing the trigger mask and sending triggers within the same RFFE write.	No	R/W
	Reg28[2:0]		Trigger[2:0]	0b000	Setting these bits to '1' will cause the registers associated with that trigger to be loaded with the contents of its corresponding shadow register. Trigger[2] = Trigger_2, Trigger[1] = Trigger_1, and Trigger[0] = Trigger_0 Note: Qorvo does not allow for changing the trigger mask and sending triggers within the same RFFE write.	No	R/W
0x1D	Reg29[7:0]	PRODUCT_ID	PRODUCT_ID[7:0]	0b0100_0010	This part has two RFFE interfaces using the same register map. RFFE interface 1 has PID 0x42 (8b01000010) RFFE interface 2 has PID 0x43 (8b01000011)	No	R

Register Address	Data Bits	Register Name	QORVO Bit Field Name	Default [msb:lsb]	QORVO Description	Trigger Support	R/W/ RM
0x1E	Reg30[7:0]	MANUFACTURER_ID	MANUFACTURER_ID _LSB[7:0]	0b0011_0100	This is a read-only register. However, during the programming of the USID, a write command sequence is performed on this register, even though the write does not change its value. Note: This is the lower 8 least significant bits of the RFFE's MANUFACTURER_ID (i.e. MANUFACTURER_ID[7:0] = MANUFACTURER_ID_LSB[7:0]	No	R
0x1F	Reg31[7]	MAN_US_ID	Reserved[7]	0b0	This is a read-only bit that is reserved and yields a value of 0 at readback.	No	R
	Reg31[6]		Reserved[6]	0b0	This is a read-only bit that is reserved and yields a value of 0 at readback.	No	R
	Reg31[5:4]		MANUFACTURER_ID _MSB[1:0]	0b01	These bits are read-only. However, during the programming of the USID, a write command sequence is performed on this register even though the write does not change its value. Note: This is the up 2 most significant bits of the RFFE's MANUFACTURER_ID (i.e. MANUFACTURER_ID[9:8] = MANUFACTURER_ID_MSB[1:0]	No	R
	Reg31[3:0]		USID[3:0]	0b1111	Programmable USID. Performing a write to this register using the described programming sequences will program the USID in devices supporting this feature. These bits store the USID of the device. RFFE interface 1 has USID 0xF (4b1111) RFFE interface 2 has USID 0x8 (4b1000)	No	RM
0x20	Reg32[7:0]	EXT_PRODUCT_ID	EXT_PRODUCT_ID[7:0]	0b0000_0000	This is a read-only register. However, during the programming of the USID a write command sequence is performed on this register, even though the write does not change its value.	No	RM
0x21	Reg33[7:0]	REVISION_ID	REVISION_ID[7:0]	0b0000_0000	This is an RFFE2 register to contain information about the revision of this module. The intent here is to use this as a type of scratch register -- to contain various information or serialization.	No	R
0x22	Reg34[7:4]	GROUP_ID2	GSID0_2[3:0]	0b0000	Group slave ID 0 There is only 1 register for GSID0&GSID1, but this register can be accessed from either Reg27 or Reg34. This means that write to Reg34 will reflect in Reg27 also, and vice versa	No	R/W
	Reg34[3:0]		GSID1_2[3:0]	0b0000	Group slave ID 1 There is only 1 register for GSID0&GSID1, but this register can be accessed from either Reg27 or Reg34. This means that write to Reg34 will reflect in Reg27 also, and vice versa	No	R/W
0x23	Reg35[7]	RFFE_STATUS2	SW_RESET_2[7]	0b0	0: Normal operation 1: Software reset (reset of all configurable registers to default values, except for USID) There is only 1 register for RFFE_STATUS, but this register can be accessed from either Reg26 or Reg35/36. This means that write to Reg35/36 will reflect in Reg26 also, and vice versa	No	R/W
	Reg35[6]		Reserved[6]	0b0	Reserved	No	R/W
	Reg35[5]		Reserved[5]	0b0	Reserved	No	R/W
	Reg35[4]		Reserved[4]	0b0	Reserved	No	R/W
	Reg35[3]		Reserved[3]	0b0	Reserved	No	R/W
	Reg35[2]		Reserved[2]	0b0	Reserved	No	R/W
	Reg35[1]		Reserved[1]	0b0	Reserved	No	R/W

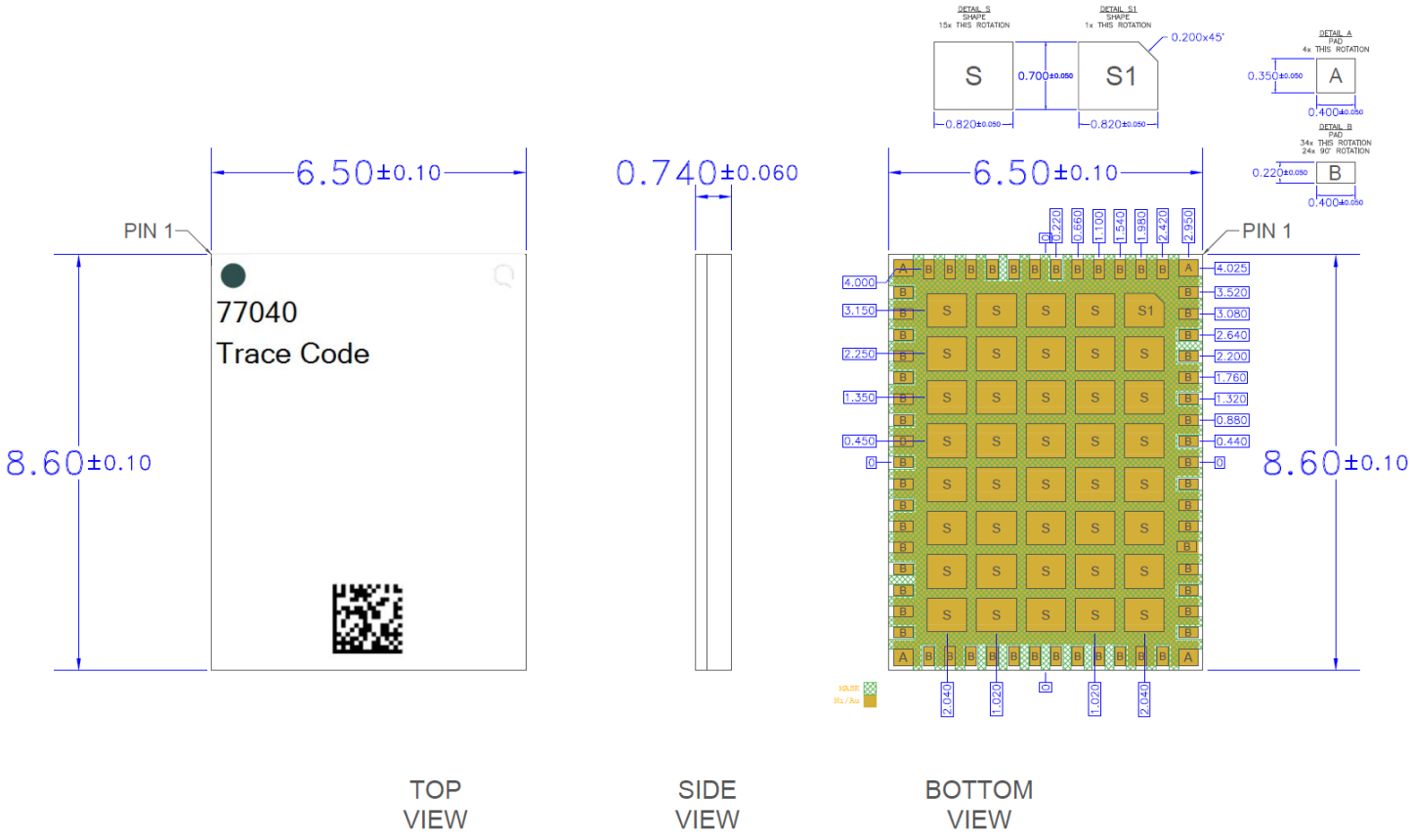
Register Address	Data Bits	Register Name	QORVO Bit Field Name	Default [msb:lsb]	QORVO Description	Trigger Support	R/W/RM
	Reg35[0]		Reserved[0]	0b0	Reserved	No	R/W
0x24	Reg36[7]	RFFE_STATUS3	Reserved[7]	0b0	Reserved	No	R/W
	Reg36[6]		CMD_FRAME_P_ERR_2[6]	0b0	Command sequence received with parity error – discard command.	No	R/W
	Reg36[5]		CMD_LEN_ERR_2[5]	0b0	Command length error	No	R/W
	Reg36[4]		ADDR_FRAME_P_ERR_2[4]	0b0	Address frame parity error = 1	No	R/W
	Reg36[3]		DATA_FRAME_P_ERR_2[3]	0b0	Data frame with parity error	No	R/W
	Reg36[2]		READ_UNUSED_REG_2[2]	0b0	Read command to an invalid address	No	R/W
	Reg36[1]		WRITE_UNUSED_REG_2[1]	0b0	Write command to an invalid address	No	R/W
	Reg36[0]		BID_GID_ERR_2[0]	0b0	Read command with a Broadcast_ID or GROUP_ID	No	R/W
0x2B	Reg43[7:4]	BUS_LOAD	Reserved[3:0]	0b0000	Reserved	No	R/W
	Reg43[3:0]		BUS_LOAD[3:0]	0b0100	SDATA Driver strength in Readback Mode 0x0: 10pf 0x1: 20pf 0x2: 30pf 0x3: 40pf 0x4: 50pf 0x5: 60pf 0x6: 80pf 0x7: 100pf 0x8: 120pf 0x9: 140pf 0xA: 160pf 0xB: 180pf 0xC: 200pf 0xD: 250pf 0xE-0xF: reserved	No	R/W
0x2C	Reg44[7:0]	TEST_PATTERN	Test_Pattern[7:0]	0b1101_0010	A read of this register returns the test pattern	No	R

Mechanical Information

Package Marking and Dimensions

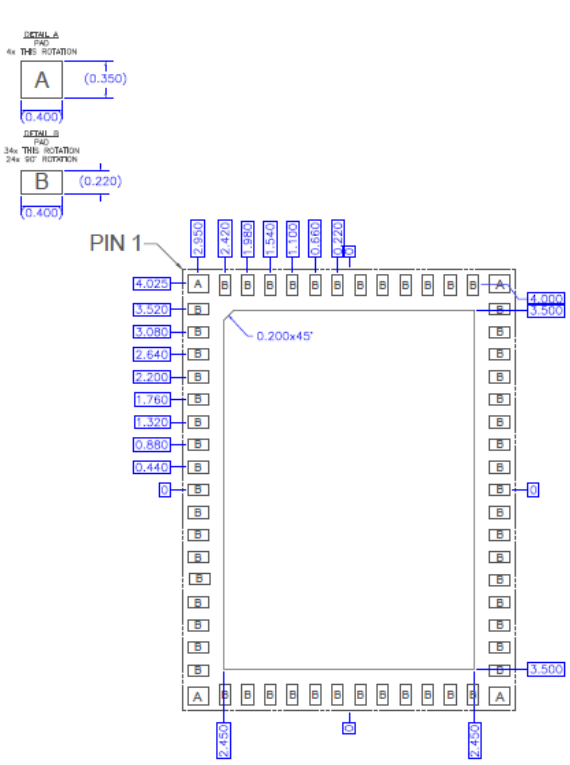
Marking: Part number – 77040

Trace code – XXXX

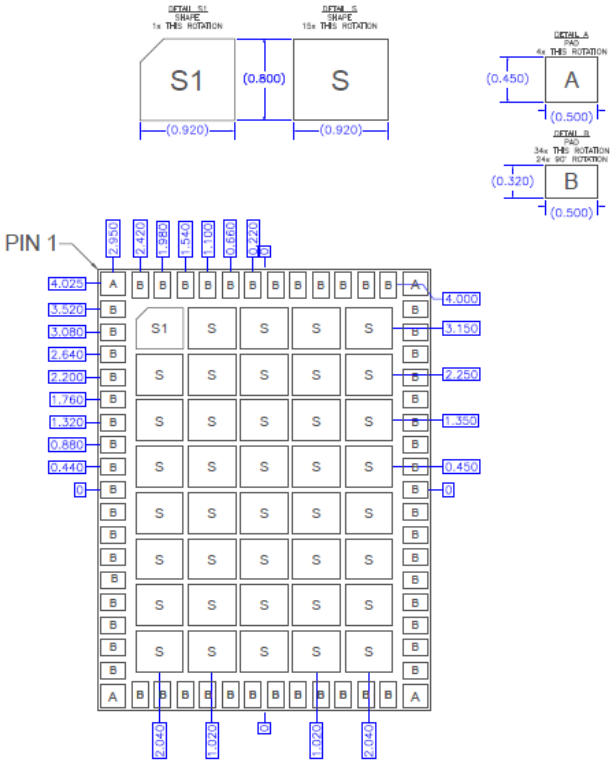


PCB Design Guidelines

PCB Metal Land and Solder Mask Pattern



RECOMMENDED
LAND PATTERN



RECOMMENDED
LAND PATTERN MASK

Notes:
1. All dimensions are in millimeters. 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	ESDA/JEDEC JS-001-2012
ESD – Charged Device Model (CDM)	Class C2a	JEDEC JESD22-C101F
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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REVISION HISTORY

REV.	DESCRIPTION OF CHANGE
DS20181105	Initial Preliminary Release
DS20190107	Added B3+B41 DL CA specifications and performances
DS20190226	Added n41 and n3 specifications, and updated all electrical property tables
DS20190503	Updated n41 and n3 specifications, added ET linear output power and noted no BPF on B34 Rx port
DS20190508	Updated MIPI RFFE 2.1 applications
DS20190730	Updated PCB design drawings with higher resolution, and added B41 Power Class 2 ET mode maximum linear output power
DS20190920	Updated all specification tables, and added n1 specifications