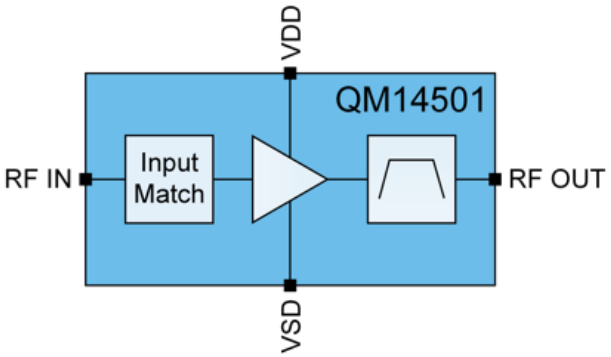
QM14501

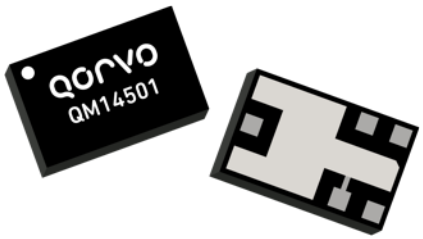
GPS, GLONASS, and BeiDou Low Noise Amplifier With Integrated Output SAW Filter

Product Overview

The QM14501 is a Low Noise Amplifier with an integrated SAW filter at the output. The low noise figure and high gain make the QM14501 ideal for GNSS receivers requiring high sensitivity. This module uses pHEMT process and integrates input matching and low loss, high rejection SAW filter at the output. This results in a simplified and high-performing receiver design. The QM14501 is packaged in a 3.3 mm x 2.1 mm x 1.0 mm package with low external component count required to achieve the best-in-class performance.

Functional Block Diagram





Package Style: module 3.3 mm x 2.1 mm x 1.0 mm

Key Features

- Low Noise Figure: 0.9 dB
- Gain: 13.5 dB
- High IIP3: +8 dBm
- Current Tunability Via Single Resistor
- Operating frequencies: 1.55 – 1.61 GHz
- Small package: 3.3 mm x 2.1 mm x 1.0 mm (nominal)

Applications

- Cellular and Non-Cellular GNSS receivers (GPS, GLONASS, and BeiDou platforms)

Ordering Information

Part Number	Description
QM14501SB	5 Piece Sample Bag
QM14501SR	100 Piece Reel
QM14501TR13-5K	5000 Piece 13” Reel
QM14501PCK401	Fully Assembled Evaluation Board

Absolute Maximum Ratings

Parameter	Rating	Unit
V_{DD}	3.6	V
Logic – SD	3.6	V
Supply Current I_{DD}	20	mA
RF Input Power	+15	dBm
Operating Temperature	-30 to +85	°C
Storage Temperature	-65 to +150	°C
ESD (HBM)	TBD	V

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.

Nominal Operating Parameters

Parameter	Specification			Unit	Condition
	Min.	Typ.	Max.		
General Performance					
V_{DD} Supply Voltage	1.5		3.3	V	
V_{DD} Supply Current, Gain Mode		8		mA	
V_{DD} Supply Current, Low Current Mode		4.5		mA	
V_{DD} Supply Current, Shutdown Mode		0.1		uA	
SD – Control Logic Voltage HIGH	1.0		V_{DD}	V	
SD – Control Logic Voltage LOW	0		0.4	V	
SD Control Logic Current		760		uA	

Electrical Specifications – GPS Band (1575.42 MHz ± 12 MHz)

Parameter	Specification			Unit	Condition
	Min.	Typ.	Max.		
					Nominal conditions unless otherwise stated (T = 25 °C, 50 Ω) V_{DD} = 2.8 V, VSD = 2.8 V, R2 = 3 kΩ
Gain Mode					
Operating Frequency Range	1563.42		1587.42	MHz	
V_{DD} Supply Current		8.8		mA	
Gain		13.7		dB	
Noise Figure		0.9		dB	
Input Return Loss		7		dB	
Output Return Loss		24		dB	
Reverse Isolation		23		dB	
Input 1dB Compression Point		-2		dBm	
Input Third Order Intercept Point		9		dBm	F1 – F2 = 1 MHz, PF1 & PF2 = -30 dBm
Cell Band Rejection (Relative to 1575 GHz at 827.5 Hz)		54		dBc	
PCS Band Rejection (Relative to 1575 GHz at 1885 MHz)		45		dBc	
Stability Factor k	1				20 MHz to 10 GHz
Low Current Mode					Nominal conditions unless otherwise stated (T = 25 °C, 50 Ω) V_{DD} = 2.8 V, VSD = 1.67 V, R2 = 3 kΩ
V_{DD} Supply Current		4.9		mA	
Gain		12.8		dB	
Noise Figure		1.0		dB	
Input Return Loss		6		dB	
Output Return Loss		25		dB	
Reverse Isolation		22		dB	
Input 1dB Compression Point		0		dBm	
Input Third Order Intercept Point		6		dBm	F1 – F2 = 1 MHz, PF1 & PF2 = -30 dBm
Cell Band Rejection (Relative to 1575 GHz at 827.5 Hz)		55		dBc	
PCS Band Rejection (Relative to 1575 GHz at 1885 MHz)		44		dBc	
Stability Factor k	1				20 MHz to 10 GHz
Low Voltages	V_{DD} = 2 V	V_{DD} = 1.5 V	V_{DD} = 1 V		Nominal conditions unless otherwise stated (T = 25 °C, 50 Ω) VSD = V_{DD}, R2 = 1.5 kΩ
V_{DD} Supply Current	10.5	7.3	4	mA	
Gain	14	13.5	11.5	dB	
Noise Figure	0.85	0.95	1.1	dB	
Input 1dB Compression Point	-2	-4	-6	dB	
Input Third Order Intercept Point	10	7.5	3	dB	

Electrical Specifications: GLONASS (1598 MHz – 1605 MHz)

Parameter	Specification			Unit	Condition
	Min.	Typ.	Max.		
					Nominal conditions unless otherwise stated (T = 25 °C, 50 Ω) V_{DD} = 2.8 V, VSD = 2.8 V, R2 = 3 kΩ
Gain Mode					
Operating Frequency Range	1598		1606	MHz	
V_{DD} Supply Current		8.8		mA	
Gain		13.1		dB	
Noise Figure		0.9		dB	
Input Return Loss		7		dB	
Output Return Loss		21		dB	
Reverse Isolation		24		dB	
Input 1dB Compression Point		-1		dBm	
Input Third Order Intercept Point		8		dBm	F1 – F2 = 1 MHz, PF1 & PF2 = -30 dBm
Cell Band Rejection (Relative to 1575 GHz at 827.5 Hz)		54		dBc	
PCS Band Rejection (Relative to 1575 GHz at 1885 MHz)		45		dBc	
Stability Factor k	1				20 MHz to 10 GHz
Low Current Mode					Nominal conditions unless otherwise stated (T = 25 °C, 50 Ω) V_{DD} = 2.8 V, VSD = 1.67 V, R2 = 3 kΩ
V_{DD} Supply Current		4.9		mA	
Gain		12.2		dB	
Noise Figure		1.0		dB	
Input Return Loss		6		dB	
Output Return Loss		18		dB	
Reverse Isolation		23		dB	
Input 1dB Compression Point		0		dBm	
Input Third Order Intercept Point		5		dBm	F1 – F2 = 1 MHz, PF1 & PF2 = -30 dBm
Cell Band Rejection (Relative to 1575 GHz at 827.5 Hz)		55		dBc	
PCS Band Rejection (Relative to 1575 GHz at 1885 MHz)		44		dBc	
Stability Factor k	1				20 MHz to 10 GHz
Low Voltages	V_{DD} = 2 V	V_{DD} = 1.5 V	V_{DD} = 1 V		Nominal conditions unless otherwise stated (T = 25 °C, 50 Ω) VSD = V_{DD}, R2 = 1.5 kΩ
V_{DD} Supply Current	10.5	7.3	4	mA	
Gain	13.5	13	1.1	dB	
Noise Figure	0.85	0.95	1.1	dB	
Input 1dB Compression Point	-2	-4	-6	dB	
Input Third Order Intercept Point	10	7.5	3	dB	

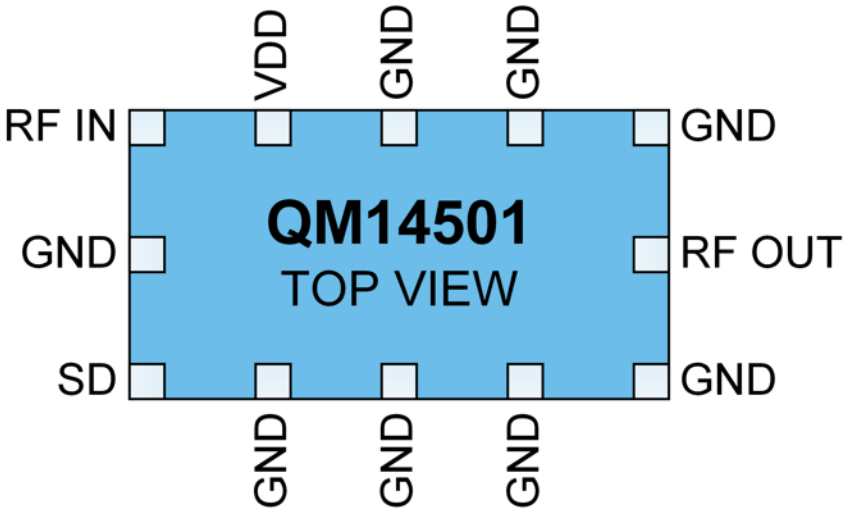
Electrical Specifications: BeiDou (1561.098 MHz)

Parameter	Specification			Unit	Condition
	Min.	Typ.	Max.		
					Nominal conditions unless otherwise stated (T = 25 °C, 50 Ω) V_{DD} = 2.8 V, VSD = 2.8 V, R2 = 3 kΩ
Gain Mode					
Operating Frequency Range	1559		1563	MHz	
V_{DD} Supply Current		8.8		mA	
Gain		13.1		dB	
Noise Figure		0.9		dB	
Input Return Loss		9		dB	
Output Return Loss		13		dB	
Reverse Isolation		24		dB	
Input 1dB Compression Point		-1		dBm	
Input Third Order Intercept Point		9		dBm	F1 – F2 = 1 MHz, PF1 & PF2 = -30 dBm
Cell Band Rejection (Relative to 1575 GHz at 827.5 Hz)		54		dBc	
PCS Band Rejection (Relative to 1575 GHz at 1885 MHz)		45		dBc	
Stability Factor k	1				20 MHz to 10 GHz
Low Current Mode					Nominal conditions unless otherwise stated (T = 25 °C, 50 Ω) V_{DD} = 2.8 V, VSD = 1.67 V, R2 = 3 kΩ
V_{DD} Supply Current		4.9		mA	
Gain		12.1		dB	
Noise Figure		1.1		dB	
Input Return Loss		8		dB	
Output Return Loss		12		dB	
Reverse Isolation		23		dB	
Input 1dB Compression Point		0		dBm	
Input Third Order Intercept Point		6		dBm	F1 – F2 = 1 MHz, PF1 & PF2 = -30 dBm
Cell Band Rejection (Relative to 1575 GHz at 827.5 Hz)		55		dBc	
PCS Band Rejection (Relative to 1575 GHz at 1885 MHz)		44		dBc	
Stability Factor k	1				20 MHz to 10 GHz
Low Voltages	V_{DD} = 2 V	V_{DD} = 1.5 V	V_{DD} = 1 V		Nominal conditions unless otherwise stated (T = 25 °C, 50 Ω) VSD = V_{DD}, R2 = 1.5 kΩ
V_{DD} Supply Current	10.5	7.3	4	mA	
Gain	13	12.5	10.5	dB	
Noise Figure	0.95	1	1.2	dB	
Input 1dB Compression Point	-2	-4	-6	dBm	
Input Third Order Intercept Point	10	7.5	3	dBm	

Pin – Out Description

Pin	Name	Description
1	RFIN	LNA input
2	GND	Ground
3	SD	Shutdown
4	GND	Ground
5	GND	Ground
6	GND	Ground
7	GND	Ground
8	RFOUT	Filter output
9	GND	Ground
10	GND	Ground
11	GND	Ground
12	V_{DD}	DC supply

Pin – Out Drawing



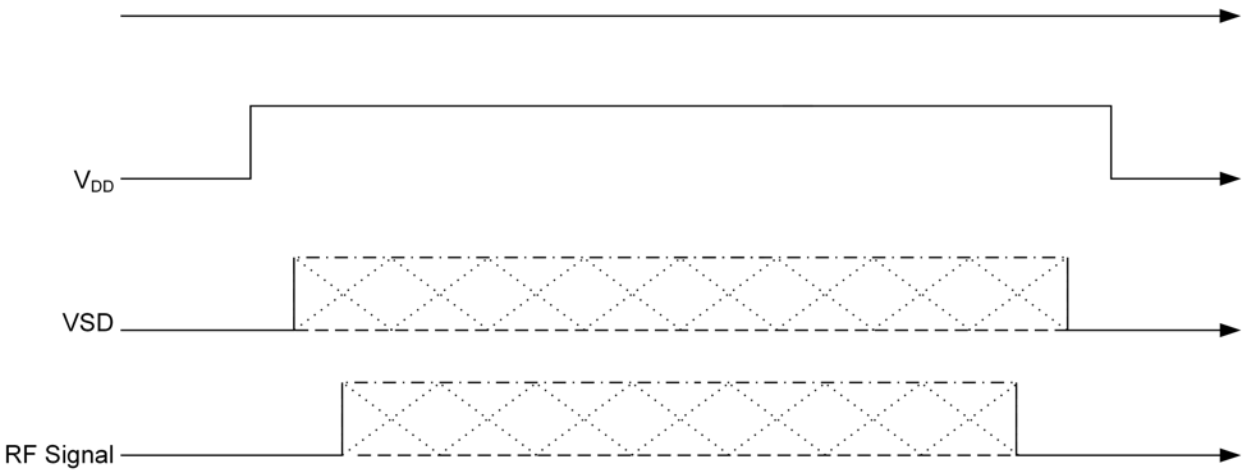
Timing Diagram

Power – Up/Down Sequence

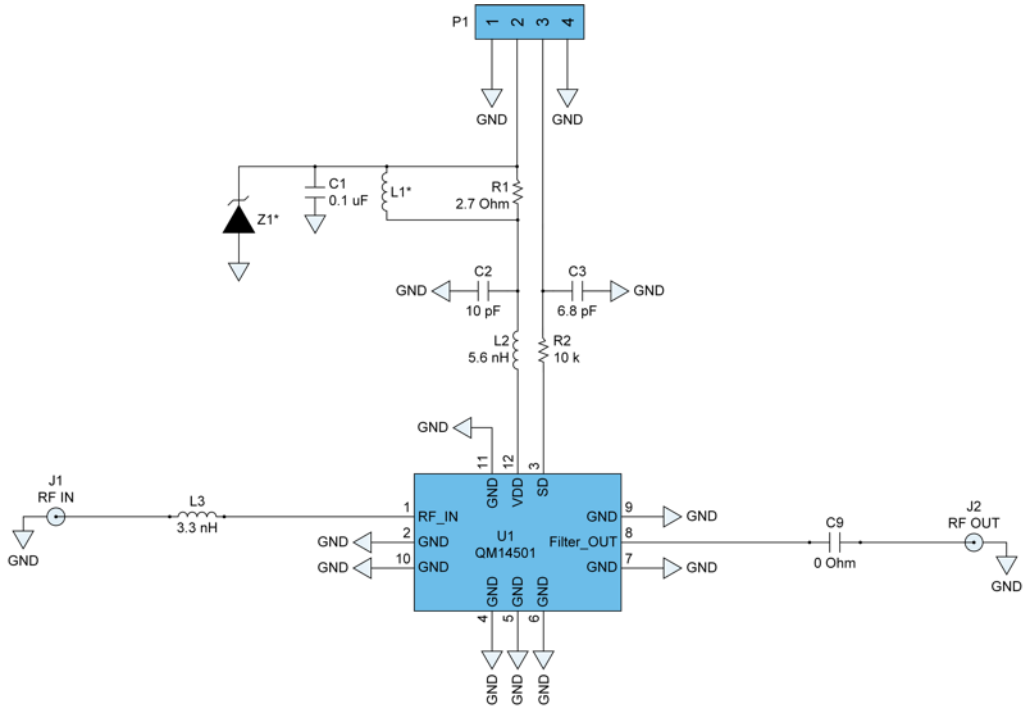
It is very important that the user adhere to the correct power – up/down sequence in order to avoid damaging the device. When V_{DD} is not applied to part, all the control lines must be set to 0 V (or ground).

ON Sequence: First turn ON V_{DD}, apply control signals (EN) and then RF signal.

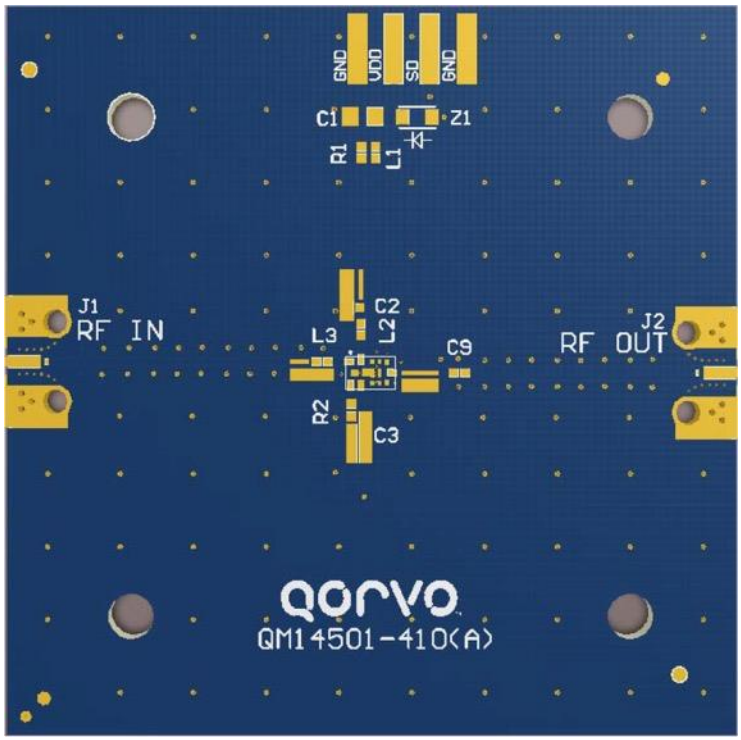
OFF Sequence: First turn OFF the RF signal then control signals (EN) and finally turn OFF the V_{DD}.



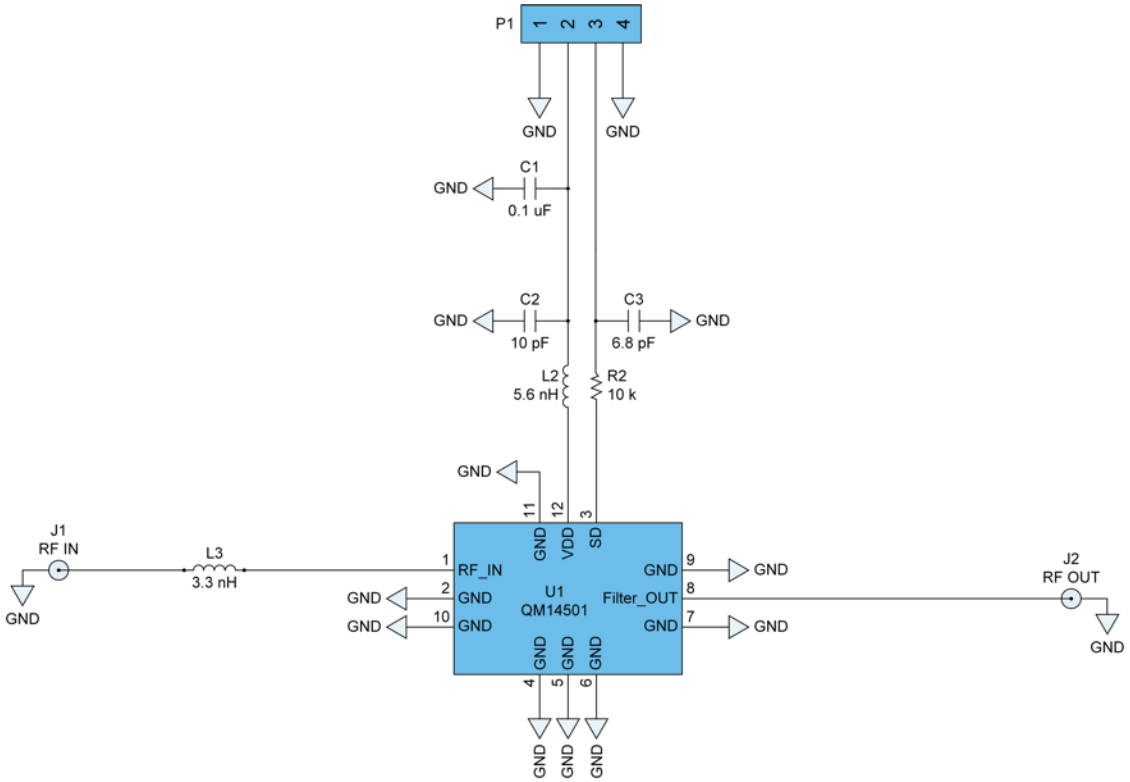
Evaluation Board Schematic



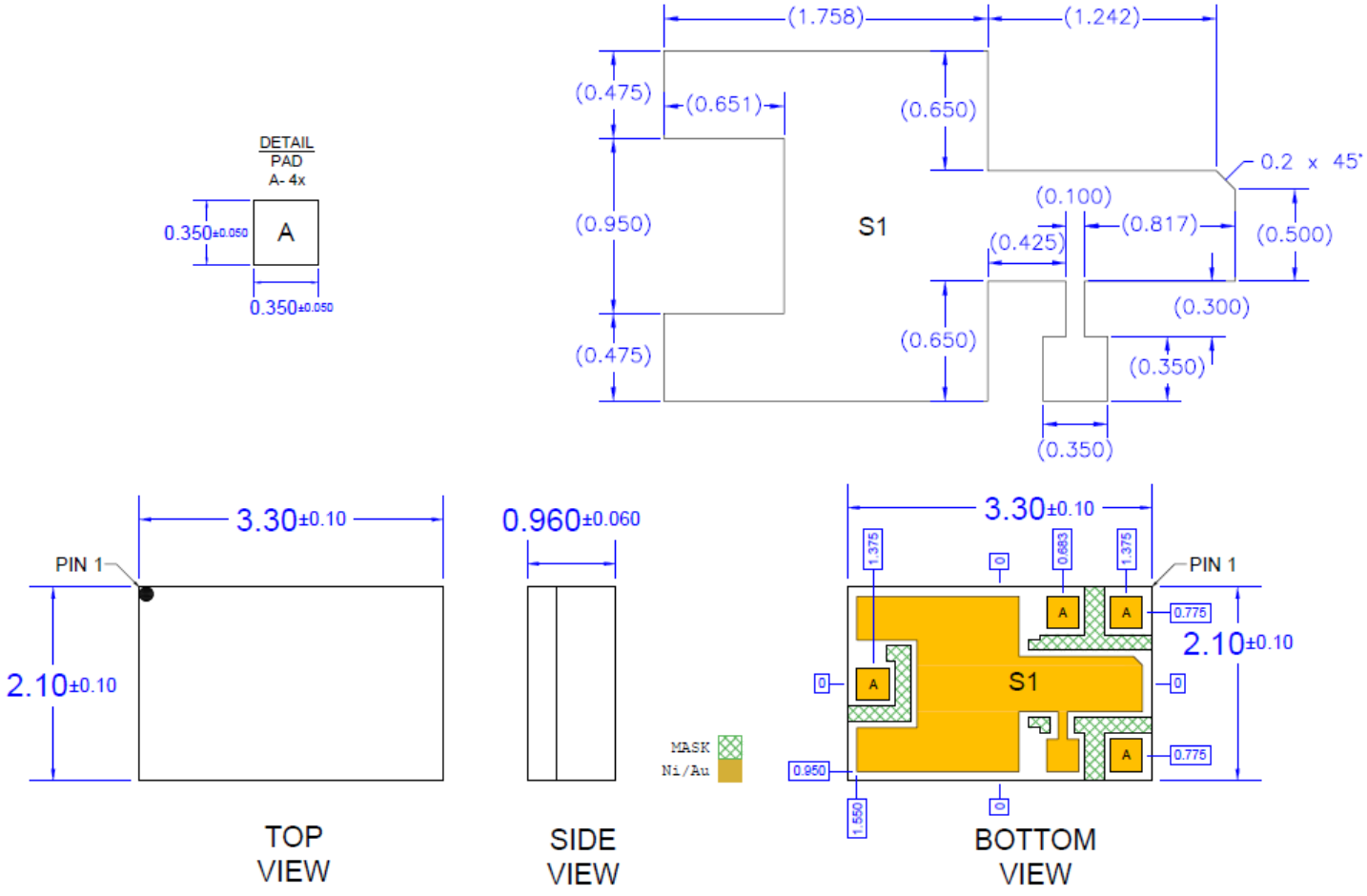
Evaluation Board Layout



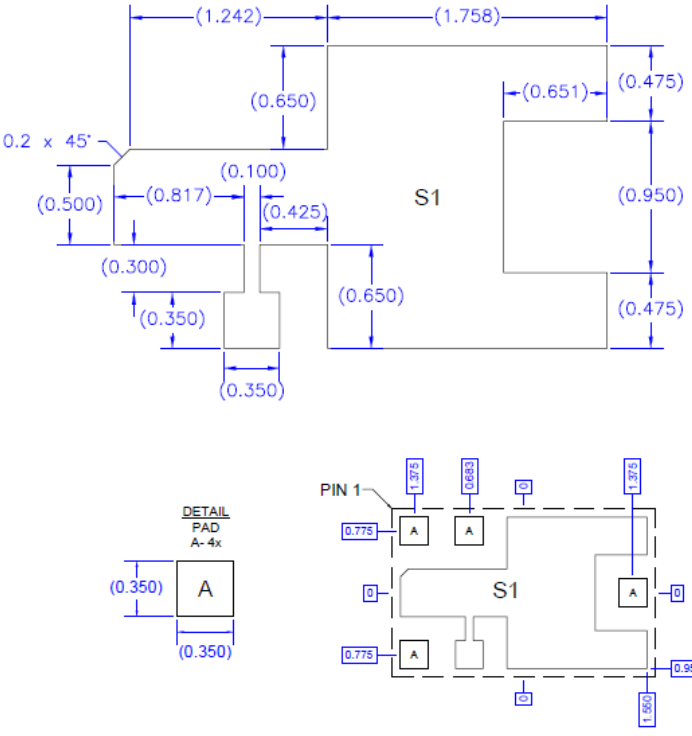
Applications Schematic



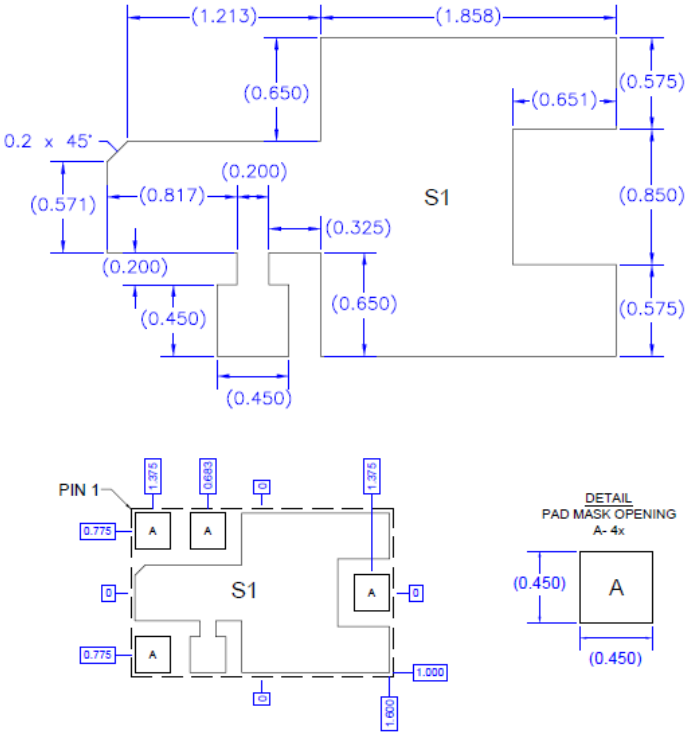
Package Outline



PCB Patterns



RECOMMENDED
LAND PATTERN



RECOMMENDED
LAND PATTERN MASK

Solderability

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

Package lead plating: 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

REVISION HISTORY

Revision	Description
DS20160310	Initial Release.
DS20160401	Updated ordering information.
DS20170510	Converted from RFMD to Qorvo template. Changed ordering information (pg. 1) – "QM14501PCK-410" changed to "QM14501PCK401".
D - 20180315	Added "Not For New Designs" information
E - 20180510	Removed "Not For New Designs" marks – part will be supported into the future
F - 20200219	Updated Package Outline and land pattern drawings

Contact Information

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