



QM48858

Dual-band Wi-Fi Integrated Front-End Module

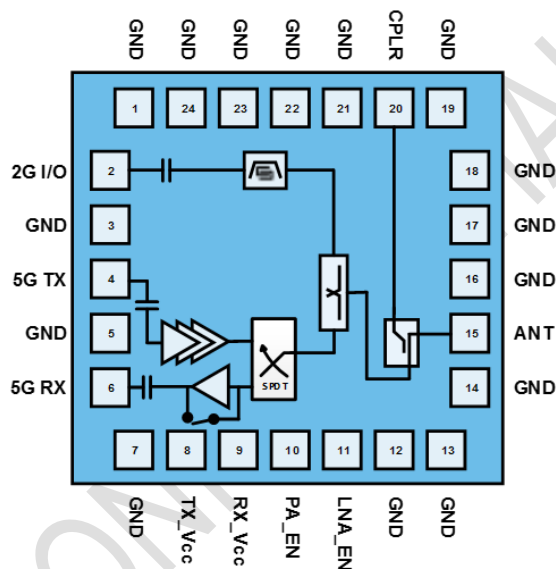
Product Description

The QM48858 is a WLAN dual-band, integrated front end module that consists of a dual-band diplexer + coupler, 2.4 GHz BAW Wi-Fi coexistence filter, and 5 GHz PA, LNA, and Switch. The dual band coupler at the antenna pin allows for monitoring of power in both 2.4 GHz and 5 GHz paths.

The QM48858 integrated front-end module in an ultra- small, 3.0mm x 3.0mm footprint package for 802.11ac applications. The architecture and interface are optimized for next generation WLAN integration into handset and tablet devices.

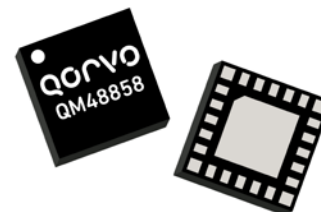
The front-end module features chipset-specific compatible control voltages to facilitate ease of use. With its low power dissipation, the front-end Module contributes to the extended battery life of next generation WLAN solutions.

Functional Block Diagram



Top View

24 Pin 3x3 mm leadless SMT Package



Feature Overview

- Fully Integrated, high performance 802.11ac front-end module including highly selective BAW filter achieving low insertion loss and high attenuation.
- Internally matched RF input/output to 50 ohms
- Temperature Compensated Bias Network
- Single direct battery voltage
- High Performance Power Amplifier
- LNA with Bypass Mode
- SPDT Antenna T/R Switch
- Integrated Power Coupler

Applications

- IEEE 802.11b/g/n/a/ac WLAN Applications
- Single-Placement RF Integrated Front-End Module
- Dual-band Wireless LAN Systems
- Portable Battery-Powered Equipment

Ordering Information

PART NUMBER	DESCRIPTION
QM48858SB	5 piece sample bag
QM48858SQ	25 piece sample bag
QM48858SR	7" Reel with 100 pieces
QM48858TR13-5K	13" Reel with 5000 pieces
QM48858PCB4B01	Evaluation Board

Absolute Maximum Ratings

PARAMETER	CONDITIONS	RATING
Storage Temperature		-40 to 150 °C
Case Temperature, Survival		-40 to 100 °C
Device Voltage, V_{CC}		+6.0 V
RF Maximum Input Power (Tx Mode/Rx Mode)	CW, 50Ω, $V_{CC} = 3.7$ V, $T = 25^{\circ}\text{C}$	+10 dBm
RF Maximum Input Power (Rx Bypass)	CW, 50Ω, $V_{CC} = 3.7$ V, $T = 25^{\circ}\text{C}$	+25 dBm
RF Maximum Input Power (Tx Mode)	10:1 VSWR, $V_{CC} = 4.8$ V, $T = 25^{\circ}\text{C}$	+2 dBm

Operation of this device outside the parameter ranges given above may cause permanent damage.

Recommended Operating Conditions

PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNITS
Operating Temperature		-40	25	85	°C
Operating Voltage V_{CC}	Vphone	3.0	3.7	4.8	V
RF Impedance	All RF ports (single-ended)	-	50	-	Ohms
Control Voltage (V-high)	PA_EN / LNA_EN	2.8	3.3	V_{CC}	V
Control Voltage (V-low)	PA_EN / LNA_EN	0	0.1	0.4	V
Control Current (I-high)	PA_EN / LNA_EN	-	-	200	uA
Control Current (I-low)	PA_EN / LNA_EN	-	-	1	uA
Sleep Mode Current	PA_EN / LNA_EN = LOW	-	5	-	uA
Bypass Current	PA_EN / LNA_EN = HIGH	-	300	-	uA

Electrical specifications are measured at nominal operating conditions unless otherwise noted.

Logic Truth Table

MODE	PA_EN	LNA_EN
802.11a/n/ac TX Mode	High	Low
802.11a/n/ac RX Gain	Low	High
802.11a/n/ac RX Bypass	High	High
802.11a/n/ac Sleep Mode	Low	Low

Electrical Specifications – 5.0 GHz Transmit

(V_{CC}=3.7V; Temp=25°C; unless noted otherwise)

PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNITS
Frequency Range		5150	-	5925	MHz
Extended Frequency Range		4900	-	5925	MHz
Small Signal Gain			27		dB
Gain Flatness	For any 80 MHz bandwidth (for 11ac signals) over freq. range	-	+/-0.25	-	dB
Gain Flatness	For entire frequency band	-	+/-1.25	-	dB
Margin Spectrum Emission Mask 11a, 6 Mbps	Pout = 20.0 dBm	-	3.0	-	dB
Margin Spectrum Emission Mask 11n, MCS0 HT20	Pout = 19.0 dBm	-	3.0	-	dB
DEVM 11a, 54 Mbps	Pout = 17.0 dBm	-	-32	-	dB
DEVM 11n, MCS7 HT20	Pout = 17.0 dBm	-	-34	-	dB
DEVM 11ac, MCS9 VHT40/80	Pout = 15.5 dBm	-	-39	-	dB
Current 11a, 6 Mbps	Pout = 20.0 dBm	-	300	-	mA
Current 11n, MCS0 HT20	Pout = 19.0 dBm	-	270	-	mA
Current 11a, 54 Mbps 11n, MCS7 HT20	Pout = 17.0 dBm	-	240	-	mA
Current 11ac, MCS9 VHT40/80	Pout = 15.5 dBm	-	220	-	mA
Quiescent Current	No RF Applied	-	160	-	mA
TX Harmonics (2f ₀)	FEM Pout = 20.0 dBm; 6 Mbps	-	-55	-	dBm/MHz
TX Harmonics (3f ₀)	FEM Pout = 20.0 dBm; 6 Mbps	-	-65	-	dBm/MHz

Dual-band Wi-Fi Integrated Front-End Module

PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNITS
OOB Gain	30 – 960 MHz	-	-50	-	dB
	1500 – 1600 MHz	-	-50	-	dB
	1800 – 1900 MHz	-	-55	-	dB
	1900 – 2100 MHz	-	-50	-	dB
	2300 – 2390 MHz	-	-38	-	dB
	2412 – 2485 MHz	-	-36	-	dB
	2490 – 2690 MHz	-	-52	-	dB
	3400 – 3600 MHz	-	-25	-	dB
	3667 – 3883 MHz	-	+2	-	dB
	6900 – 7093 MHz	-	20	-	dB
	7333 – 7750 MHz	-	12	-	dB
	10560 – 11650 MHz	-	-50	-	dB
	15540 – 17760 MHz	-	-20	-	dB
PA Switching Speed	TX Normal mode	-	200	-	nS
Return Loss – TX Port	TX Normal mode	-	15	-	dB
Return Loss – ANT Port	TX Normal mode	-	10	-	dB
PA Stability	Pout=20.0 dBm; VSWR 4:1 all phases; V _{CC} = 3.7 V	All non-harmonically related spurs < -41.25 dBm/MHz			

Operating condition is +25°C at +3.7V unless otherwise noted.

Dual-band Wi-Fi Integrated Front-End Module

Electrical Specifications – 5.0 GHz Receive

(Vcc=3.7V; Temp=25°C; unless noted otherwise)

PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNITS
Frequency Range		5150	-	5925	MHz
Extended Frequency Range		4900	-	5925	MHz
Gain – LNA mode	LNA Enabled	-	11	-	dB
Gain Flatness – LNA mode	For any 80 MHz bandwidth over the frequency range. LNA Enabled.	-	+/-1.5	-	dB
Noise Figure – LNA mode	LNA Enabled	-	4.3	-	dB
Current – LNA mode	LNA Enabled	-	10	-	mA
Input IP2 – LNA mode	LNA Enabled 2500 - 2700 MHz	-	55	-	dBm
Input IP3 – LNA mode	LNA Enabled	-	6	-	dBm
Input IP3 – LNA mode	LNA Enabled 1700 - 2000 MHz	-	15	-	dBm
OOB Gain	30 - 2170 MHz	-	-46	-	dB
	2400 - 2485 MHz	-	-55	-	
	3400 - 3600 MHz	-	-35	-	
LNA Switching Speed	LNA Enabled	-	200	-	nS
Return Loss – RX Port LNA mode	LNA Enabled	-	8	-	dB
Return Loss – ANT Port LNA mode	LNA Enabled	-	10	-	dB

Test condition is +25°C at +3.7V unless otherwise noted.

Electrical Specifications – 5.0 GHz Rx Bypass

(Vcc=3.7V; Temp=25°C; unless noted otherwise)

PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNITS
Frequency Range		5150	-	5925	MHz
Extended Frequency Range		4900	-	5925	MHz
Gain – Bypass mode	LNA Disabled	-	-5.0	-	dB
Gain Flatness – Bypass mode	For any 80 MHz bandwidth over the frequency range. LNA Disabled.	-	+/-0.75	-	dB
Input IP3 – Bypass mode	LNA Disabled	-	20	-	dBm
Return Loss – RX Port Bypass mode	LNA Disabled	-	8	-	dB
Return Loss – ANT Port Bypass mode	LNA Disabled	-	10	-	dB

Test condition is +25°C at +3.7V unless otherwise noted.

Electrical Specifications – 2.4 GHz Transmit and Receive

PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNITS
Frequency Range		2402.5		2481.5	MHz
Insertion Loss	ANT to 2G I/O	-	1.7	-	dB
Insertion Loss Flatness	For any 40 MHz bandwidth over the frequency range. LNA Enabled.	-	+/-0.75	-	dB
Return Loss	2G TX / RX Port	-	14	-	dB
Return Loss	ANT Port	-	13	-	dB
OOB Gain (ANT-2G I/O)	30 – 1200 MHz	-	-33	-	dB
	1200 – 1700 MHz	-	-33	-	dB
	1700 – 2170 MHz	-	-38	-	dB
	2320 – 2370 MHz	-	-45	-	dB
	2370 – 2390 MHz	-	-5	-	dB
	2500 – 2700 MHz	-	-50	-	dB
	3100 – 3300 MHz	-	-38	-	dB
	3400 – 3600 MHz	-	-37	-	dB
	4800 – 5900 MHz	-	-53	-	dB
2G I/O to ANT Isolation	4800 – 4963 MHz (in Bypass Mode)	-	-55	-	dB
2G I/O to ANT Isolation	4800 – 4963 MHz (in 5G TX Mode)	-	-28	-	dB

Test condition is +25°C at +3.7V unless otherwise noted.

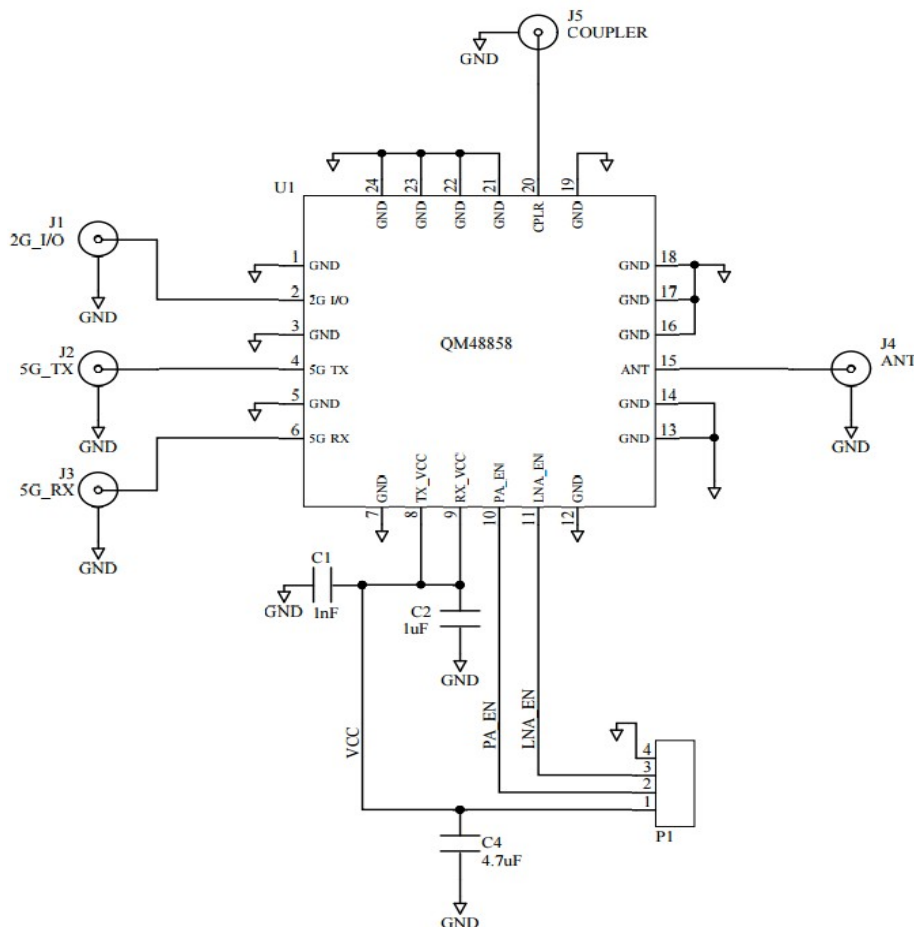
Electrical Specifications - Coupler

PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNITS
Coupling Factor	2400 – 2500 MHz	-	16.5	-	dB
Coupling Factor	4900 – 5850 MHz	-	13.5	-	dB

Test condition is +25°C at +3.7V unless otherwise noted.

Application Circuit Schematic and Layout

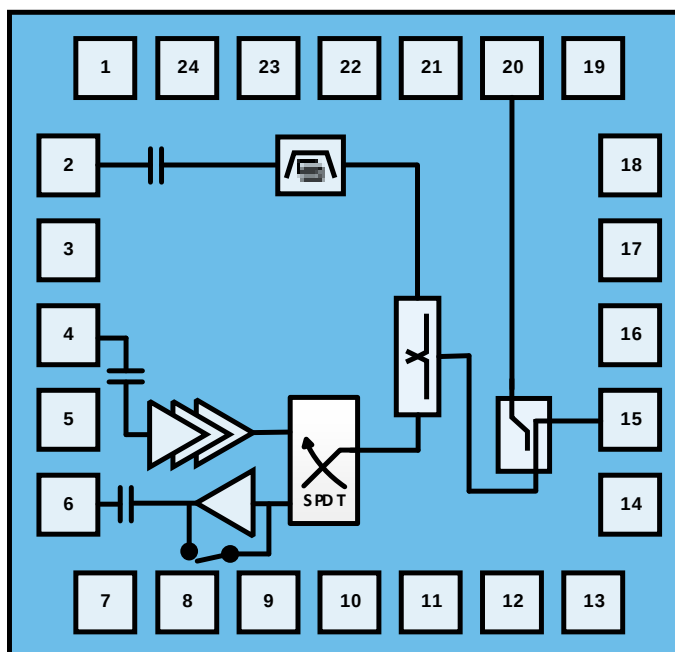
APPLICATION SCHEMATIC



Bill of Material

REF. DES.	VALUE	DESCRIPTION	MANUFACTURER	MFG PART NUMBER
C1	1 nF	Multilayer Ceramic 0201, 10%		
C2	1 uF	Multilayer Ceramic 0402, 10%		
C4	4.7 uF	Multilayer Ceramic 0603, 10%		

Pin Configuration and Description

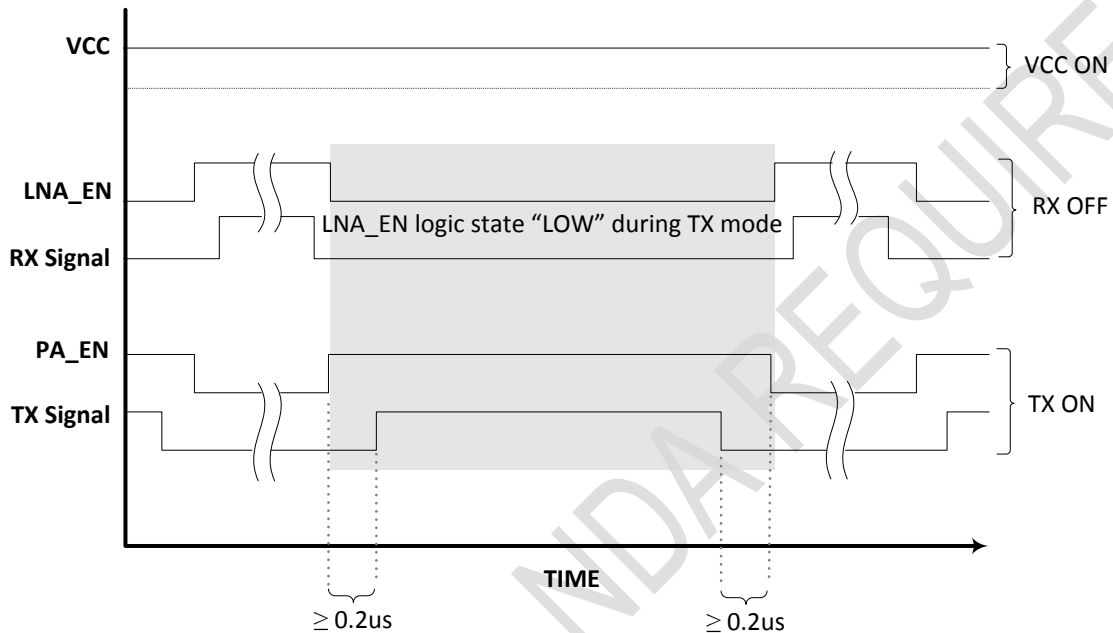


Top View

PIN NUMBER	LABEL	DESCRIPTION
2	2G I/O	2G input/output port
4	5G TX	RF input port for the 802.11a/n/ac PA. This port is matched to 50Ω and DC blocked internally.
6	5G RX	RF output port for the 802.11a/n/ac LNA. This port is matched to 50Ω and DC blocked internally.
8	TX Vcc	Supply voltage
9	RX Vcc	Supply voltage
10	PA_EN	Logic Control voltage 1. See truth table for proper voltage settings.
11	LNA_EN	Logic Control voltage 2. See truth table for proper voltage settings.
15	ANT	Combined 2G/5G Antenna port. This port is DC short.
20	CPLR	Dual band RF coupler port.
1,3,5,7,12-14,16-19 21-24	Ground	Ground connection. The backside of the package should be connected to the ground plane through a short path, i.e., PCB vias under the device are recommended.

Timing Diagram

QM48858 Transmit Mode RF/DC Power ON/OFF Sequence



Note:

Observe the timing sequence shown in the diagram above and described below. DC, RF, and ON/OFF Time signal levels per datasheet specifications.

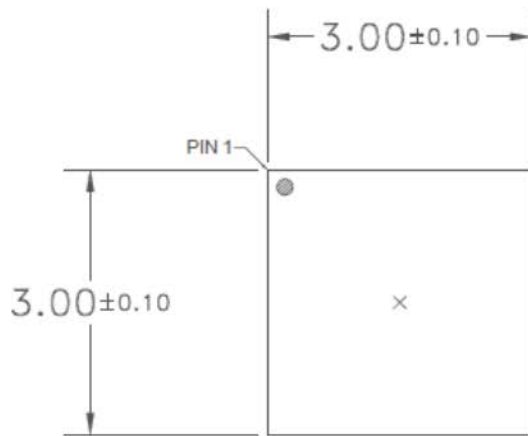
- Apply VCC prior to turning PA enable ON
- Turn PA enable ON prior to applying RF signal
- Turn RF signal OFF prior to turning PA enable OFF
- Turn PA enable OFF prior to turning VCC OFF
- TX/RX simultaneous transition is allowed

Mechanical Information

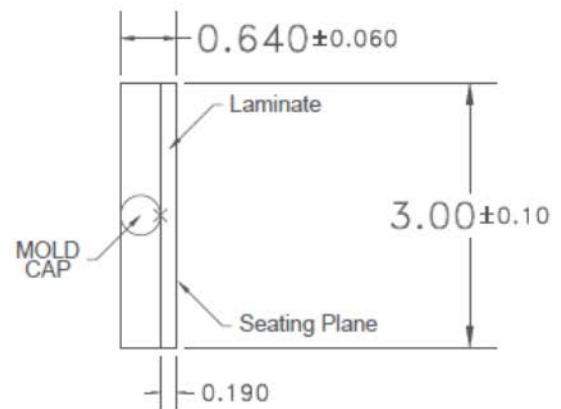
Package Marking and Dimensions

Marking: Part number – QM48858

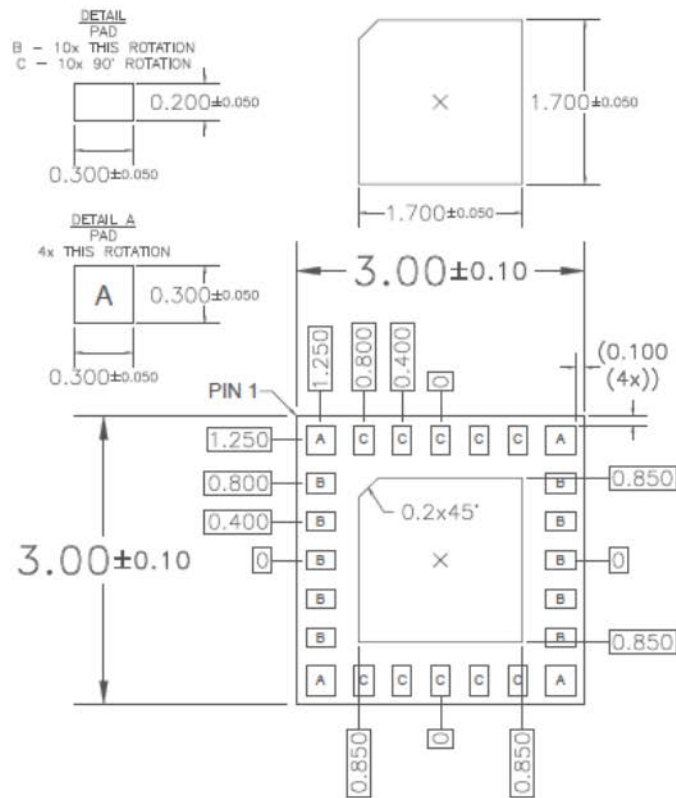
Trace code – XXXX



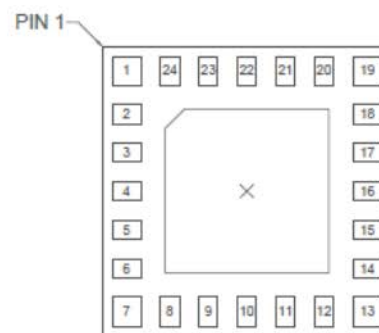
TOP VIEW



SIDE VIEW



TOP xRAY VIEW

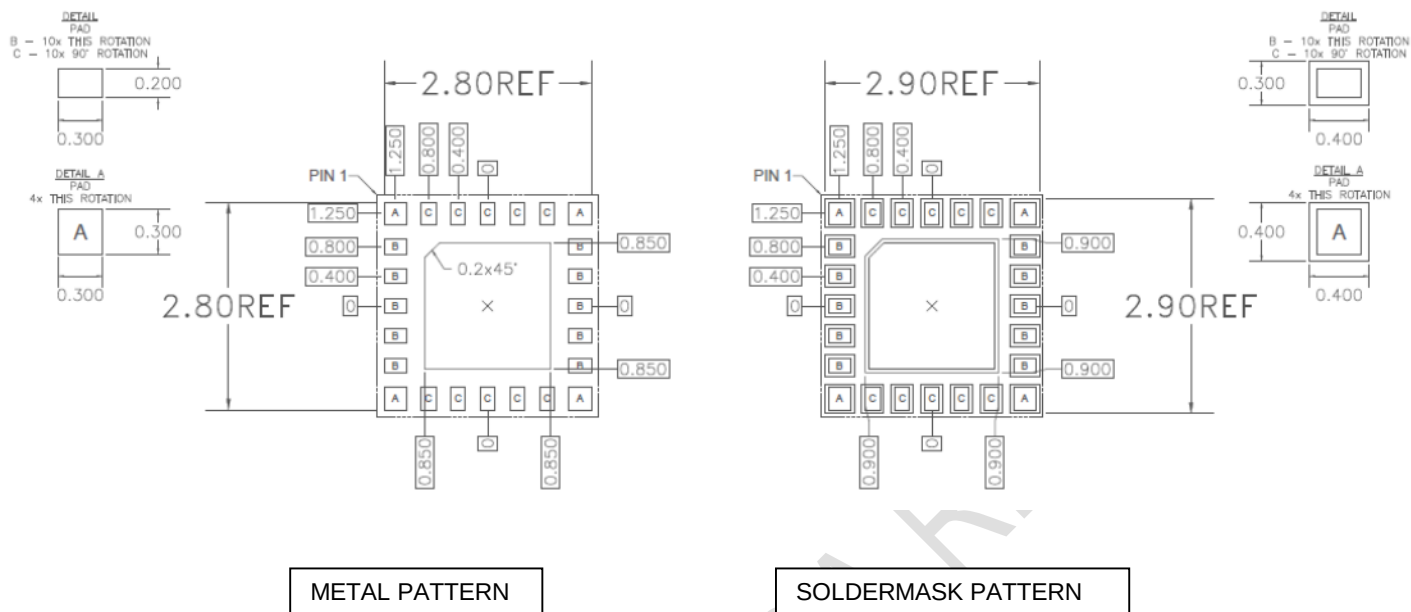


TOP xRAY PINS VIEW

Notes:

1. All dimensions are in microns. 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.

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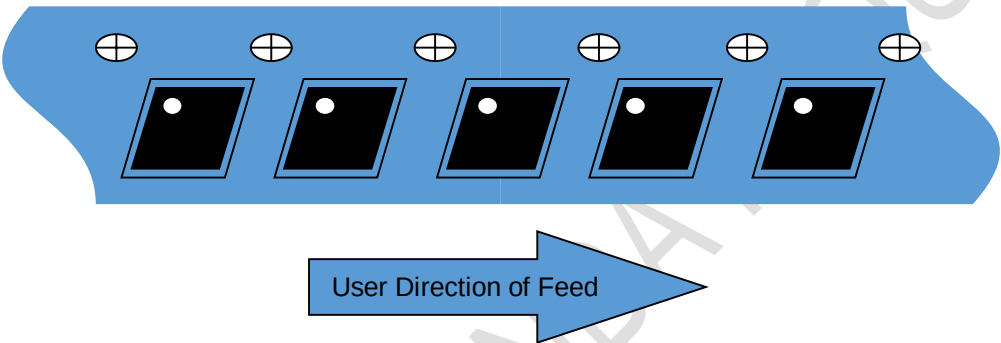


Notes:

1. All dimensions are in microns. Angles are in degrees.
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Tape and Reel Information

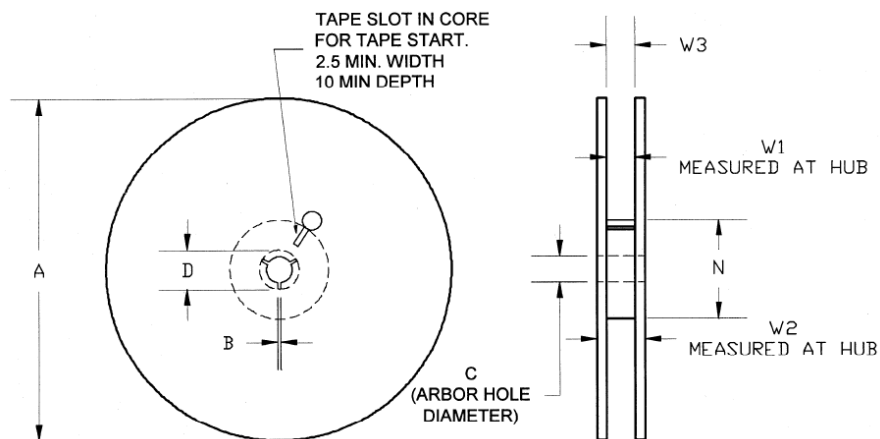
Tape and reel specifications for this part are also available on the Qorvo website.
Standard T/R size = 5000 pieces on a 13" reel.



Feature	Measure	Symbol	Size (in)	Size (mm)
Cavity	Length	A0	0.126	3.20
	Width	B0	0.126	3.20
	Depth	K0	0.039	1.00
	Pitch	P1	0.157	4.0
Centerline Distance	Cavity to Perforation - Length Direction	P2	0.079	2.0
	Cavity to Perforation - Width Direction	F	0.217	5.50
Cover Tape	Width	C	0.362	9.20
Carrier Tape	Width	W	0.472	12.0

Tape and Reel Information – Reel Dimensions

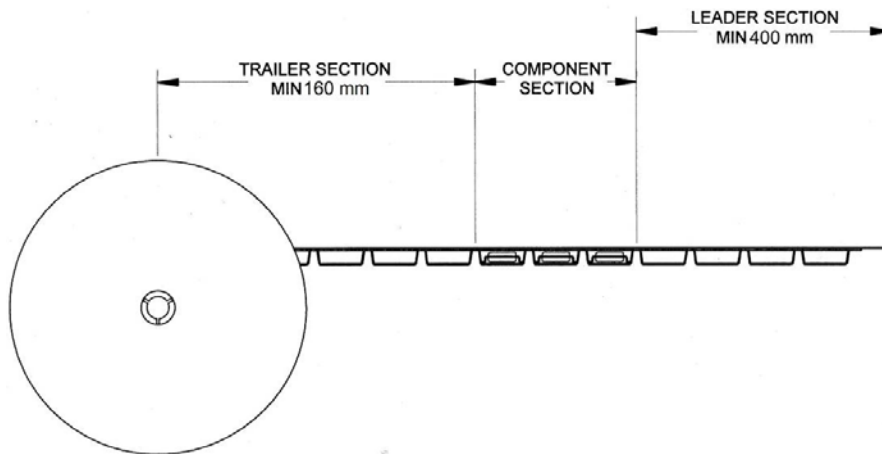
Packaging reels are used to prevent damage to devices during shipping and storage, loaded carrier tape is typically wound onto a plastic take-up reel. The reel size is 13" diameter. The reels are made from high-impact injection-molded polystyrene (HIPS), which offers mechanical and ESD protection to packaged devices.



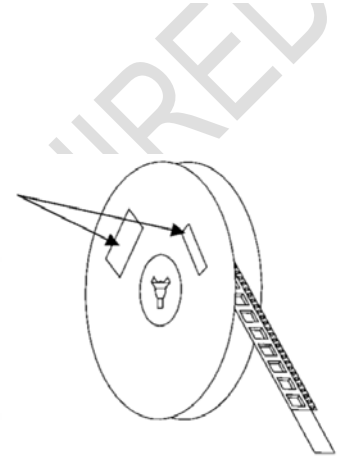
Feature	Measure	Symbol	Size (in)	Size (mm)
Flange	Diameter	A	12.992	330.0
	Thickness	W2	0.717	18.2
	Space Between Flange	W1	0.504	12.8
Hub	Outer Diameter	N	4.016	102.0
	Arbor Hole Diameter	C	0.512	13.0
	Key Slit Width	B	0.079	2.0
	Key Slit Diameter	D	0.795	20.2

Tape and Reel Information – Tape Length and Label Placement

Tape and reel specifications for this part are also available on the Qorvo website.
Standard T/R size = 5000 pieces on a 13" reel



Note 2



Notes:

1. Empty part cavities at the trailing and leading ends are sealed with cover tape. See EIA 481.
2. Labels are placed on the flange opposite the sprockets in the carrier tape.

Handling Precautions

PARAMETER	RATING	STANDARD
ESD – Human Body Model (HBM)	Class 1C – all except pin 2 Class 1B – pin 2	ESDA/JEDEC JS-001-2012
ESD – Charged Device Model (CDM)	Class C3	JEDEC JESD22-C101F, JS-002-2014
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 (C₁₅H₁₂Br₄O₂) Free
- SVHC Free

