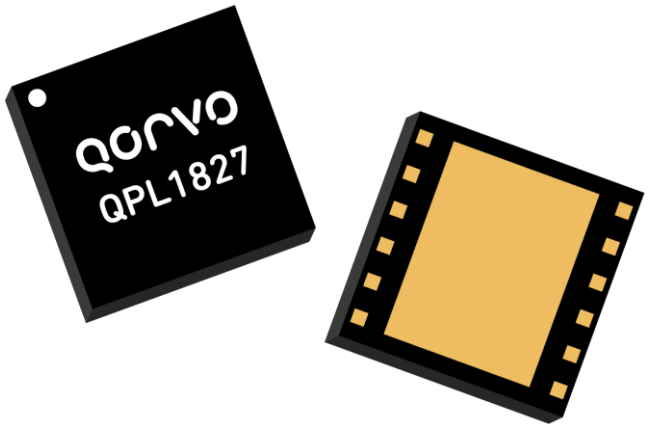
QPL1827

75 Ω 30 dB CATV Amplifier (50 – 1800MHz)

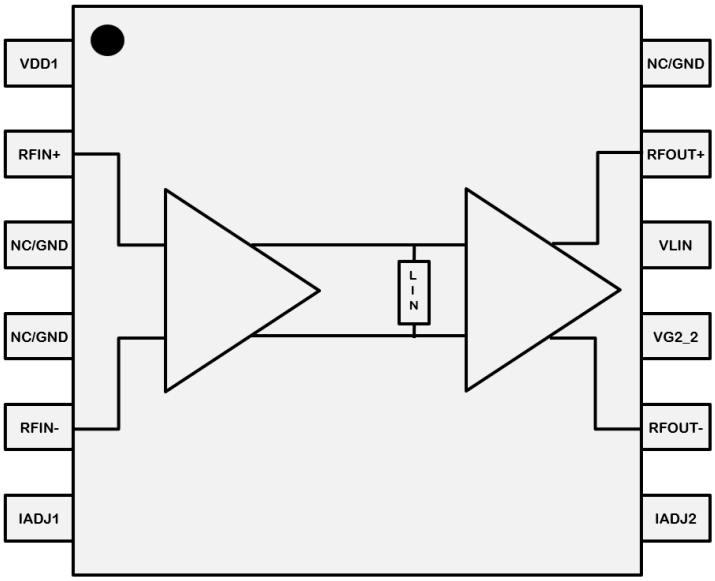
Product Overview

The QPL1827 is an ultra-linear, GaAs pHEMT, differential RF amplifier. The device features a 2-stage cascode design which provides 30dB of gain along with very low distortion from 50MHz to 1.8GHz. This ultra-linear IC is designed to support Broadband CATV DOCSIS 4.0 applications, such as Nodes, Amplifiers, and Remote PHY Devices, as well as Fiber to The Home (FTTH), Home Gateways, and Cable Modems. The device is powered by a dual supply that operates the first stage at 5V, and the second stage from 5V to 8V. The current can be set from 100mA to 165mA on the first stage, and 260mA to 350mA on the second stage. When the second stage is driven with 8V and 350mA the output is 67.5dBmV TCP with a CCN of 51dB. The QPL1827 is packaged in a 12-pin 5x5 mm^2 Laminate Module.



5 x 5 12–pin Laminate MCM Package

Functional Block Diagram



Key Features

- 50MHz to 1800MHz Operation
- 5V and 8V Operation
- Gain: 30dB Typical @ 1800MHz
- TCP: 63dBmV @ 5V
- TCP: 67.5dBmV @ 8V
- Noise Figure: 2.5/4.1dB @ 50/1800MHz
- Adjustable Bias Using External Resistors
- RoHS Compliant

Applications

- DOCSIS 4.0 Amplifiers
- DOCSIS 4.0 Optical Nodes
- DOCSIS 4.0 Remote PHY Devices
- FTTH GPON and GEPON
- DOCSIS 4.0 Cable Modem and Home Gateways

Ordering Information

Part Number	Description
QPL1827EVB-01	5V/5V Downstream Evaluation Board
QPL1827EVB-03	5V/8V Downstream Evaluation Board

Part Number	Description
QPL1827SB	Sample bag with 5 pieces
QPL1827SR	7” Reel with 100 pieces
QPL1827TR13	13” Reel with 2500 pieces

Contents

Absolute Maximum Ratings

Parameter	Rating
Supply Voltage (V_{DD})	+10 V
Supply Current (I_{DD})	200mA/450 mA (1st Stage/2nd Stage)
Maximum Input Level	+65 dBmV
Operating Temperature Range (Operating Device Heat Slug Temperature)	-40 to +100 °C
Storage Temperature Range	−65 to +150 °C
Maximum Junction Temperature	+150 °C

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.

Electrical Specifications

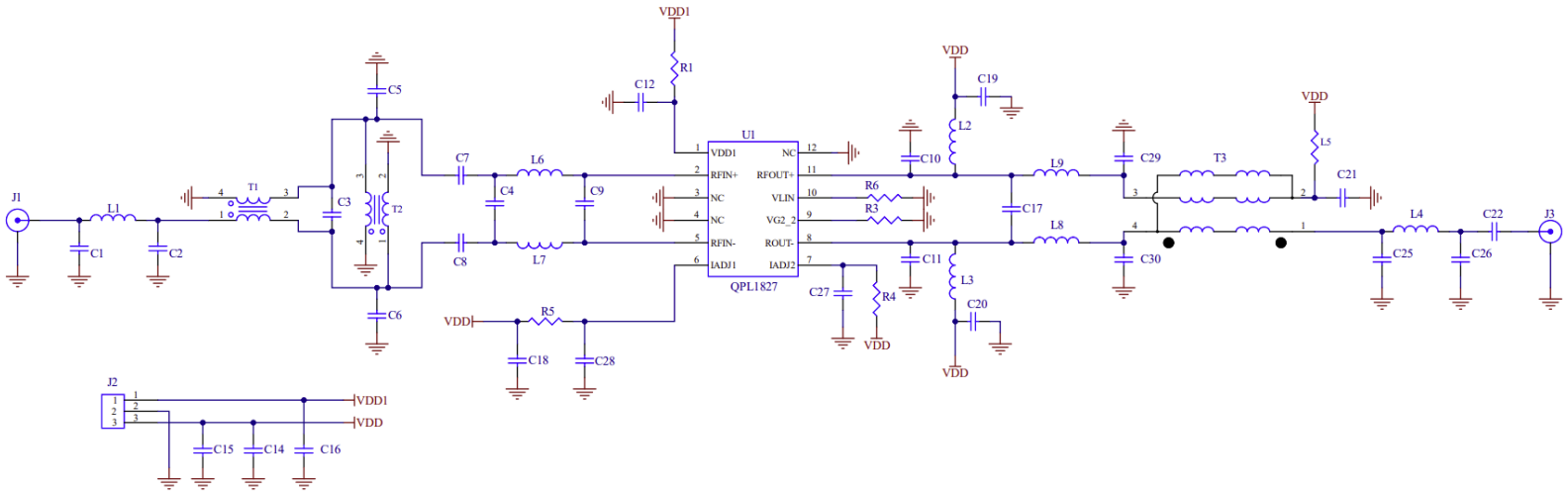
Parameter	Test Condition	Min	Typ	Max	Unit
Supply Voltage (VDD1)	1st Stage		5		V
Supply Current (IDD1)	2nd Stage at 5V		100		mA
Supply Current (IDD1)	2nd Stage at 8V		165		mA
Supply Voltage (VDD)	2nd Stage		5/8		V
Supply Current (IDD)	2nd Stage		260/350		mA
Frequency Range		50		1800	MHz
Gain at 100MHz			28		dB
Gain at 1800MHz			30		dB
Gain Slope	100 – 1800MHz		2.0		dB
Gain Flatness	100 – 1800MHz (See note 2)		±0.25		dB
Reverse Isolation	100 – 1800MHz		-40		dB
Input Return Loss	100 – 1800MHz		-20		dB
Output Return Loss	100 – 1800MHz		-20		dB
CCN	+63dBmV @ 5V Total Composite Output power +67.5dBmV @ 8V Total Composite Output power 261MHz to 1791MHz, 255 Ch, SC-QAM, 10dB tilt, 6dB Offset at 1026MHz		51 51		dB
Noise Figure	50MHz		2.5		dB
	1800MHz		4.1		dB
OIP2L	+12 dBm / tone output, Δf=53MHz, Full Band		90/90		dBm
OIP2U	+12 dBm / tone output, Δf=53MHz, Full Band		85/85		dBm
OIP3	+12 dBm / tone output, Δf=6MHz, Full Band		41/45		dBm
OP1dB	50-1800MHz		24.5/28		dBm
Thermal Resistance	Θ_{JC} (Junction to Device Heat Slug)		8.7		˚C/W

Notes:

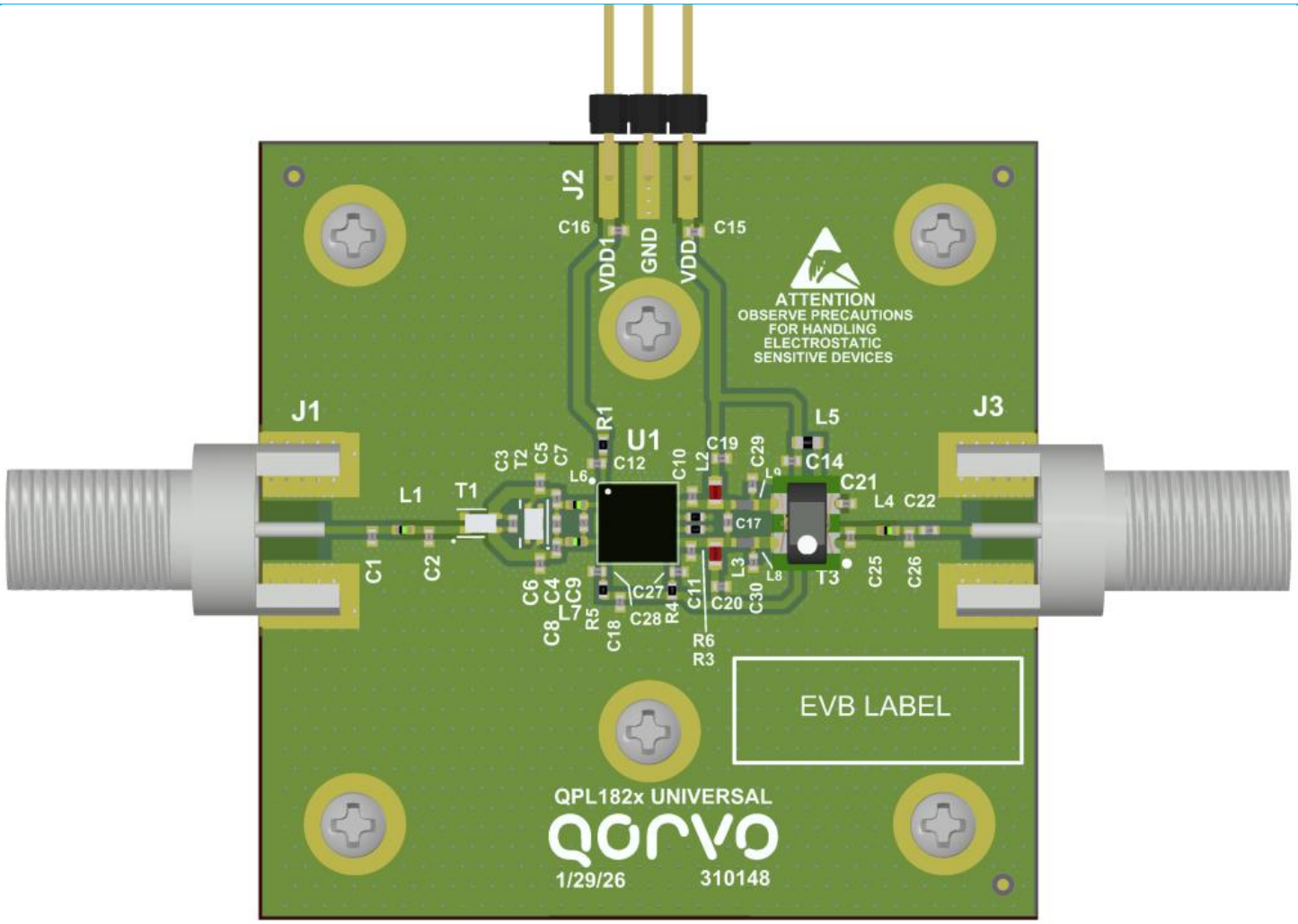
(1) Typical performance at these conditions: Temp = +25 °C, V_{DD} = +8 V, 75 Ω system, Full band unless otherwise noted.

(2) Flatness is defined as sum of positive and negative deviation from a least squares fit straight line.

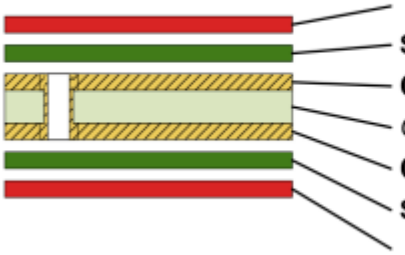
Evaluation Board Schematic 50MHz – 1800MHz



Evaluation Board Assembly Drawing



LAYER STACK LEGEND



Material	Layer	Thickness	Dielectric Material	Type
	Top Overlay			Legend
Surface Material	Top Solder	0.0004in	SM-001	Solder Mask
Copper	Top Layer	0.0014in		Signal
Core		*0.0590in*	*408HR*	*Dielectric*
Copper	Bottom Layer	0.0014in		Signal
Surface Material	Bottom Solder	0.0004in	SM-001	Solder Mask
	Bottom Overlay			Legend

Total thickness: 0.0626in

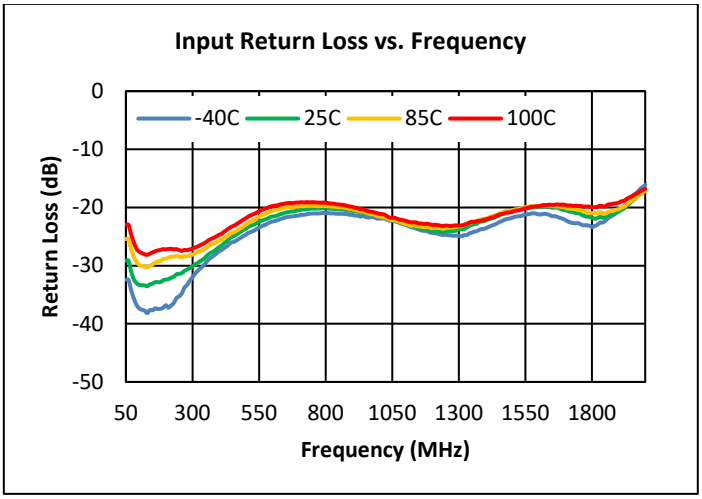
Evaluation Board Bill of Materials for 5V/5V and 100mA/260mA

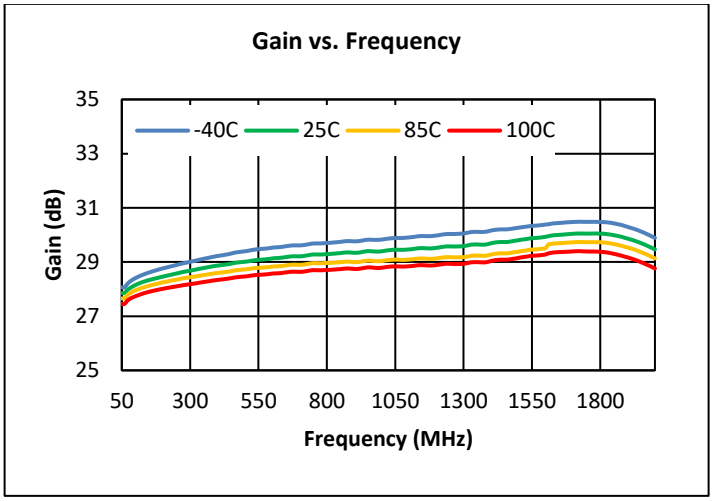
Ref. Designator	Part Value	Manufacturer	Manufacturer Part #
PCB	310148	Qorvo	QPL1825-4000 Rev. B
U1	1800MHz, Ultra-Linear Amp	Qorvo	QPL1827
C1, C10, C11	CAP, 0.2pF, +/-0.1pF, 50V, HI-Q, 0402	Murata	GJM1555C1HR20BB01D
C2, C4	CAP, 0.1pF, +/-0.1pF, 50V, HI-Q, 0402	Murata	GJM1555C1HR10BB01D
C3	CAP, 0.8pF, +/-0.1pF, 50V, HI-Q, 0402	Murata	GJM1555C1HR80BB01D
C7, C8	CAP, 470pF, 10%, 50V, X7R, 0402	Murata	GRM155R71H471KA01D
C12, C14, C15, C16, C18, C19, C20, C21	CAP, 10,000pF, 10%, 50V, X7R, 0402	Murata	GCM155R71H103KA55D
C22	CAP, 150pF, 5%, 50V, C0G, 0402	Murata	GRM1555C1H151JA01D
C29, C30	CAP, 1pF, +/-0.25pF, 50V, HI-Q, 0402	Murata	GJM1555C1H1R0CB01D
L1, L8, L9	IND, 1.4nH, ±0.2nH, W/W, HI-Q, 0402	Murata	LQW15AN1N4C10D
L4, R1, R4, R6	RES, 0 OHM, JUMPER, 1/10W, 0402	Panasonic	ERJ-2GE0R00X
R5	RES, 1.5K OHM, 5%, 1/10W, 0402	Panasonic	ERJ-2GEJ152X
L6, L7	IND, 1.3nH, ±0.1nH, W/W, HI-Q, 0402	Murata	LQW15AN1N3B80D
L2, L3	FER, BEAD, 1500 OHM, 500mA, 0603	Murata	BLM18HE152SN1D
T1, T2	1:1 Balun	Murata	DXW21BN7511SL07
T3	1:1 Balun	MiniRF	MRFXF0090
J1, J3	CONN, F	Millimeter Wave	MW-846-C-DD-75
J2	CONN, 3-PIN, 0.100"	Samtec	TSW-103-07-G-S
C5,C6,C9,C17,C25,C26,C27, C28, L5,R3	Not Populated Item	-	-
Heatsink	Heatsink 50mm x 50mm	Alpha Novatek	S08EFV05-A

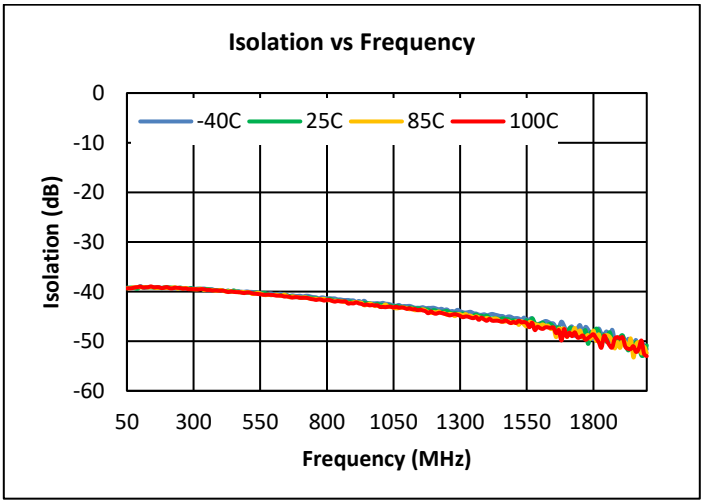
BOM Changes for 5V/8V and 165mA/350mA Operation

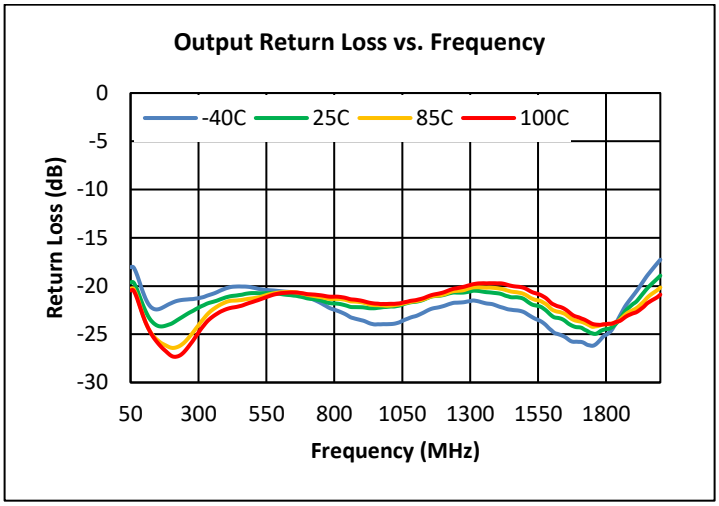
Ref. Designator	Part Value	Manufacturer	Manufacturer Part #
R4	RES, 240 OHM, 5%, 1/10W, 0402	Panasonic	ERJ-2GEJ241X

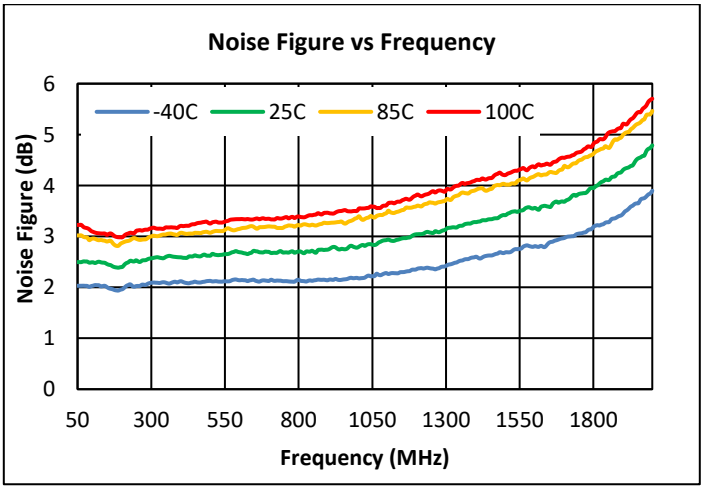
Performance Data, 5V/5V and 100mA/260mA



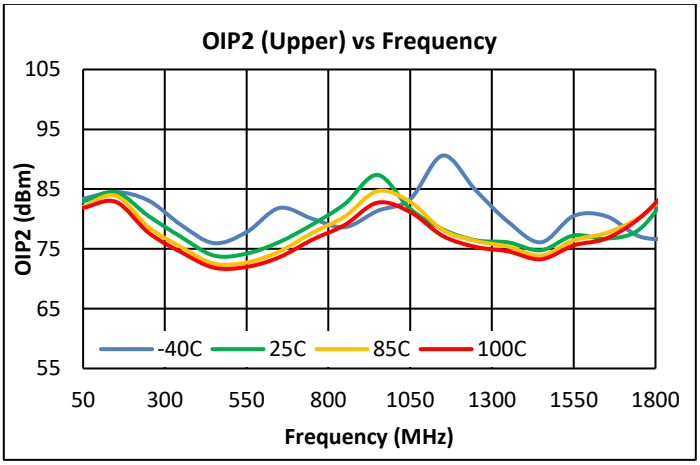


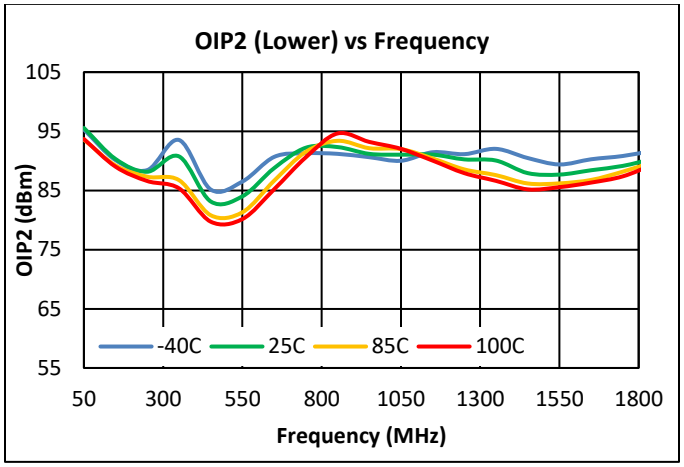


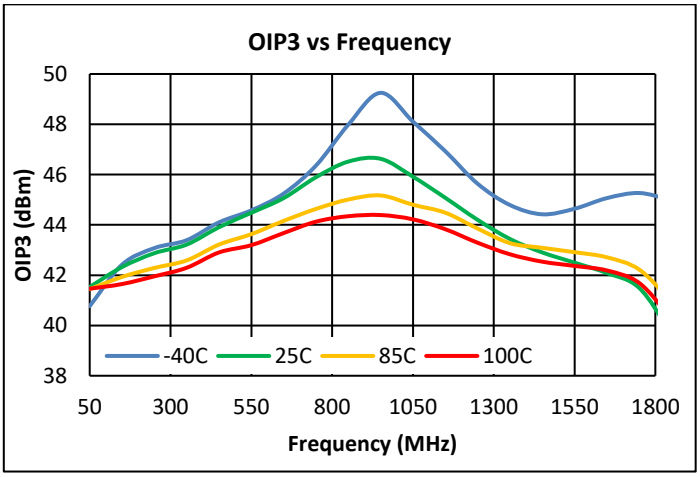


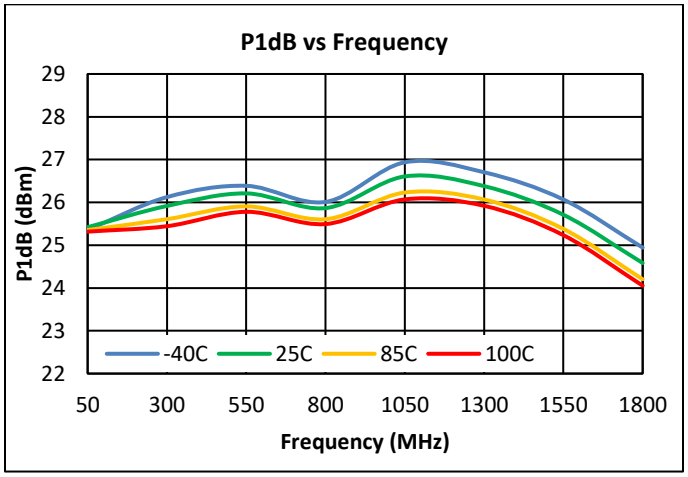


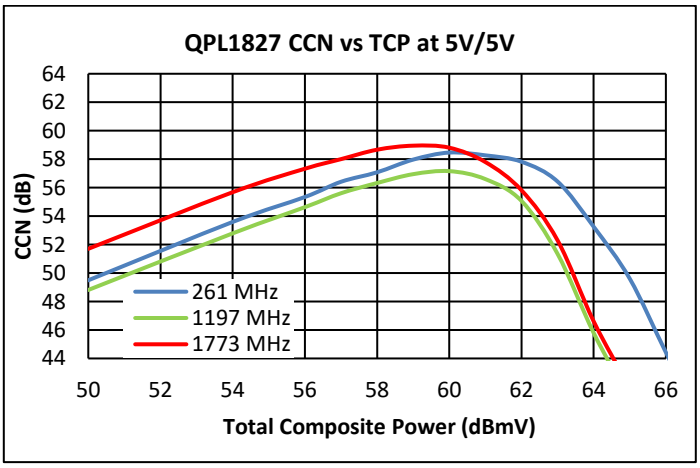
Performance Data, 5V/5V and 100mA/260mA (Cont'd)







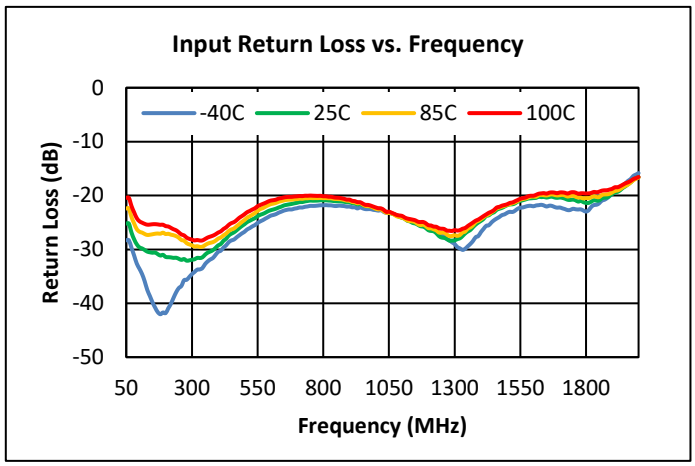


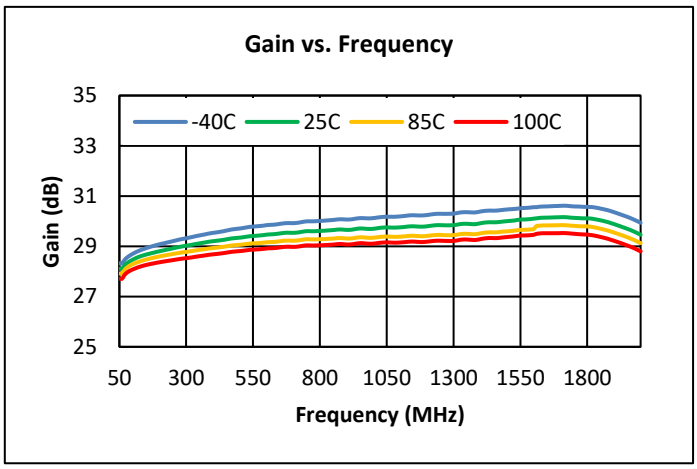


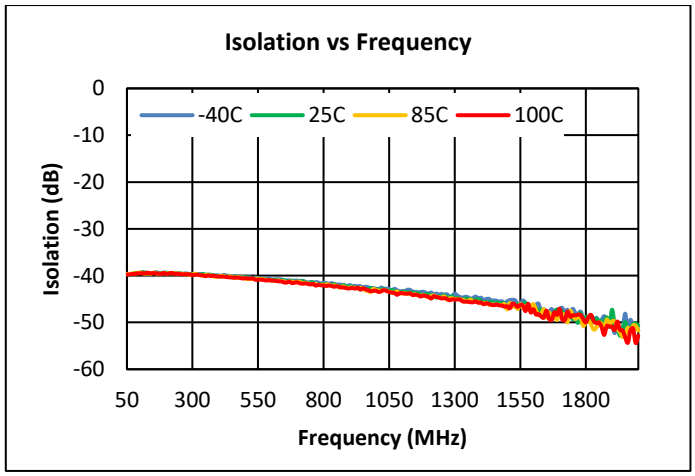
Notes:

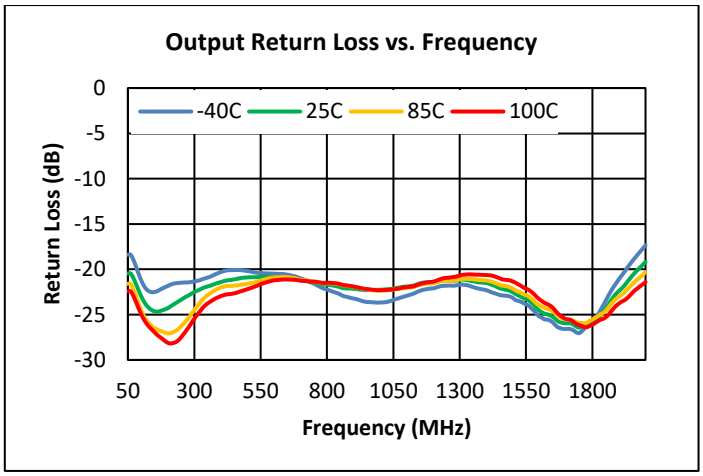
(1) 5V/5V OIP2: +12dBm/tone output @ Δf = 53MHz
(2) 5V/5V OIP3: +12dBm/tone output @ Δf = 6MHz
(3) CCN Test Conditions: 261-1791MHz, 10dB Tilt, 6dB offset at 1026MHz

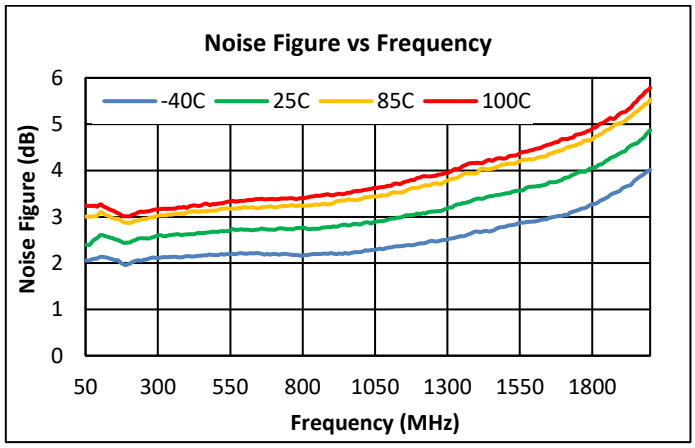
Performance Data, 5V/8V and 165mA/350mA



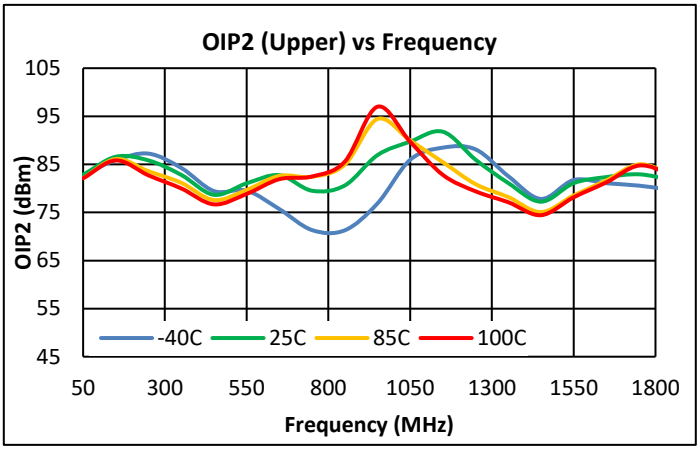


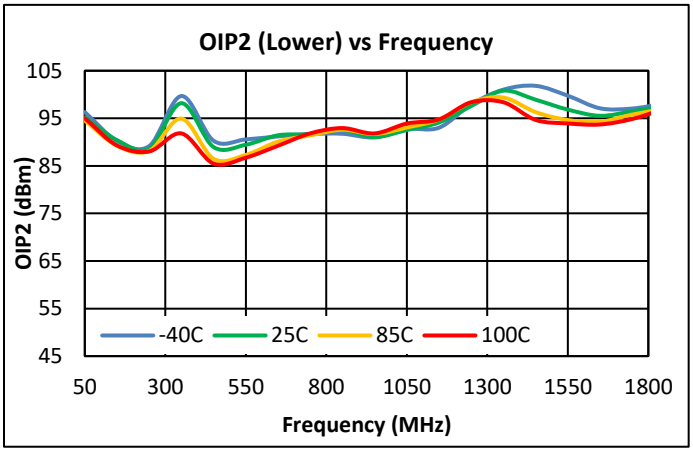


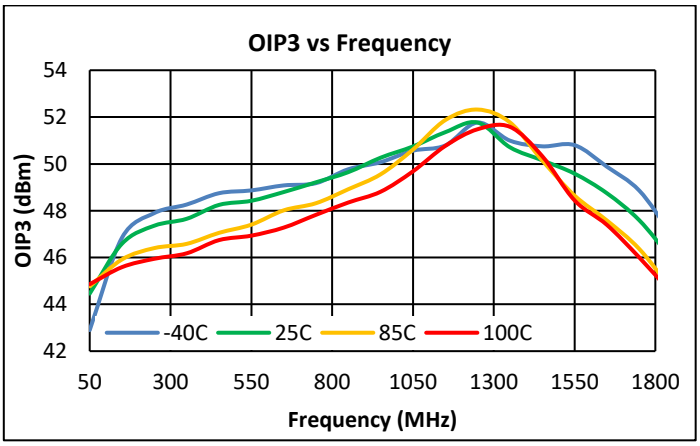


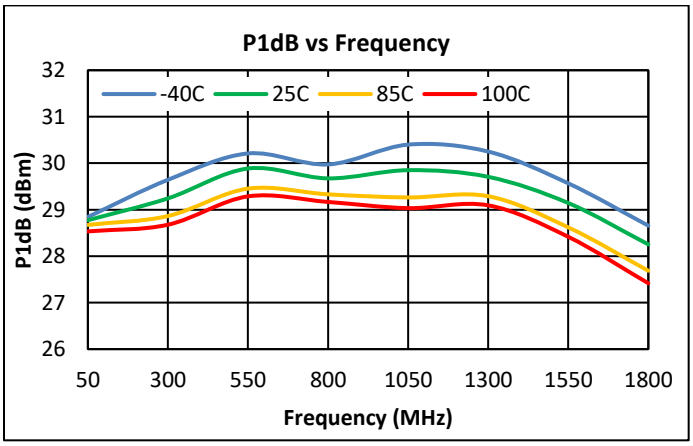


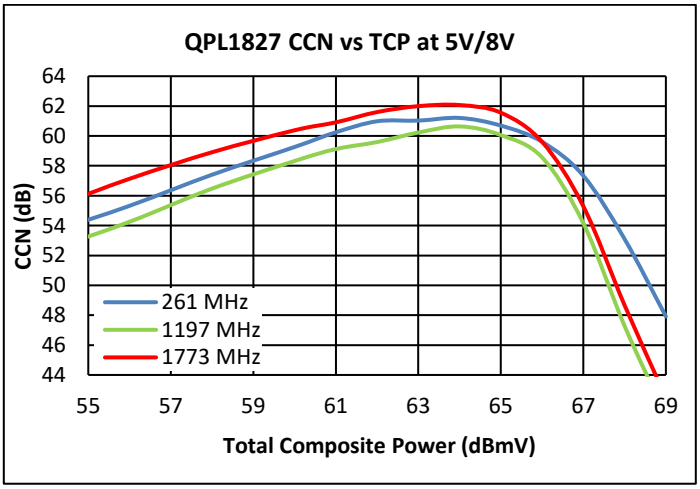
Performance Data, 5V/8V and 165mA/350mA (cont'd)







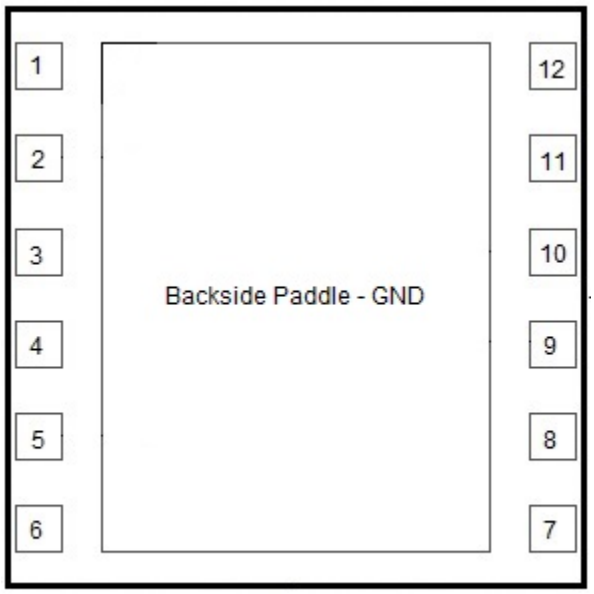




Notes:

(1) 5V/8V OIP2: +12dBm/tone output @ Δf = 53MHz
(2) 5V/8V OIP3: +12dBm/tone output @ Δf = 6MHz
(3) CCN Test Conditions: 261-1791MHz, 10dB Tilt, 6dB offset at 1026MHz

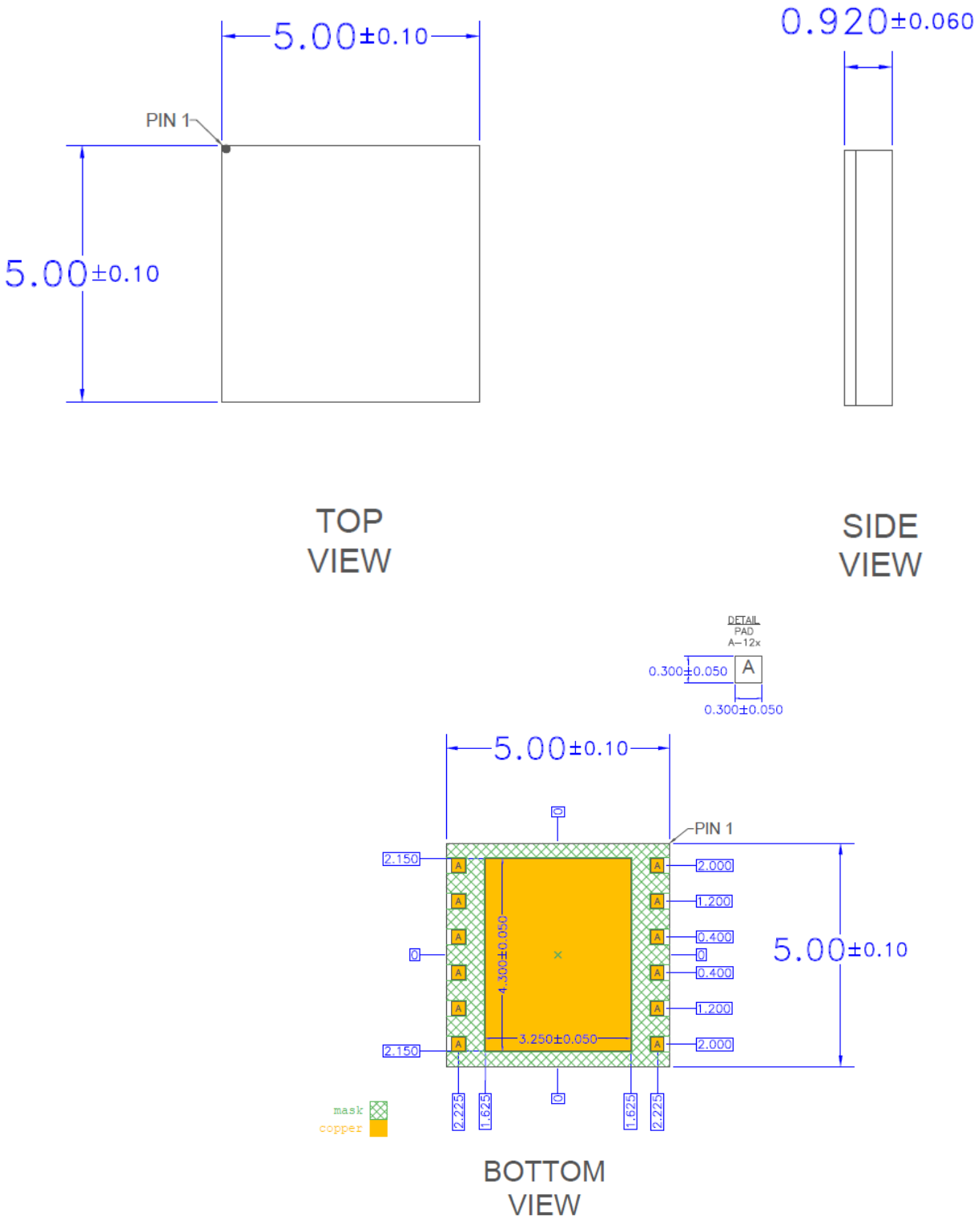
Pin Configuration and Description



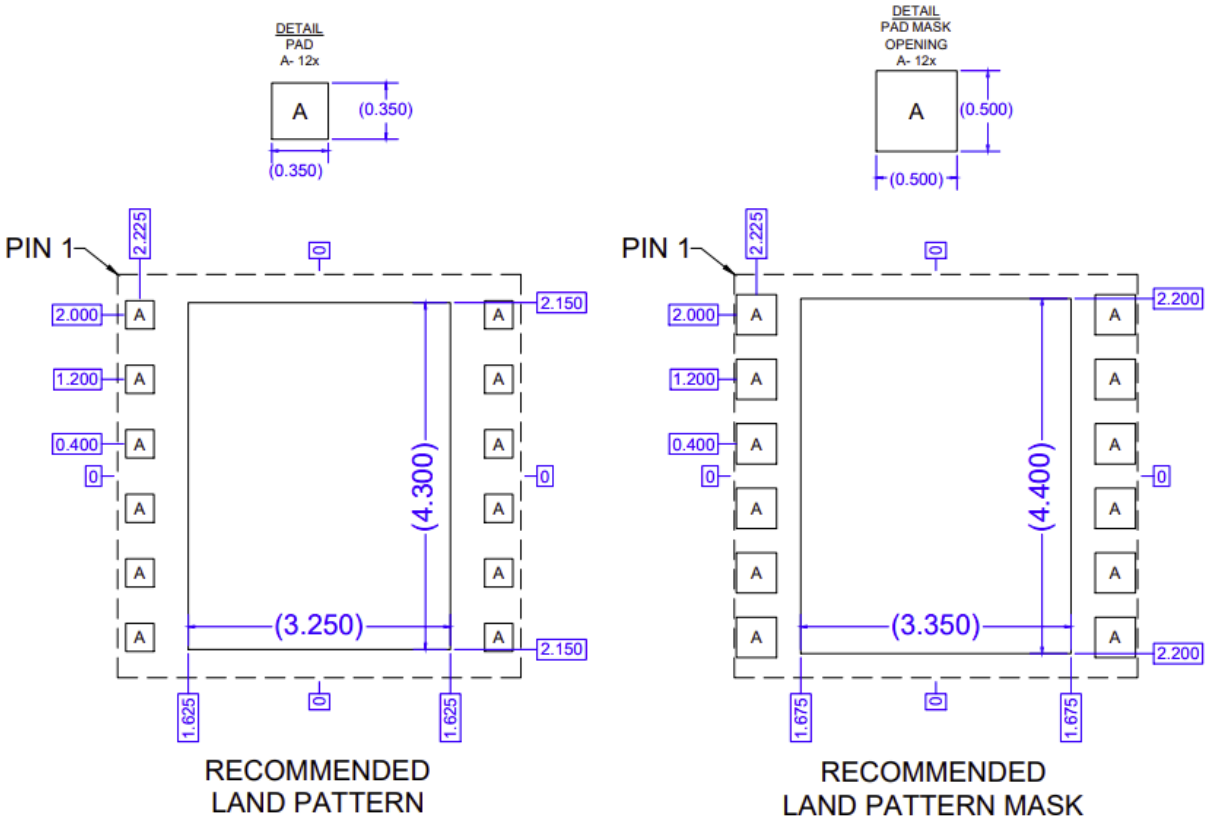
5 x 5 12-pin Laminate MCM

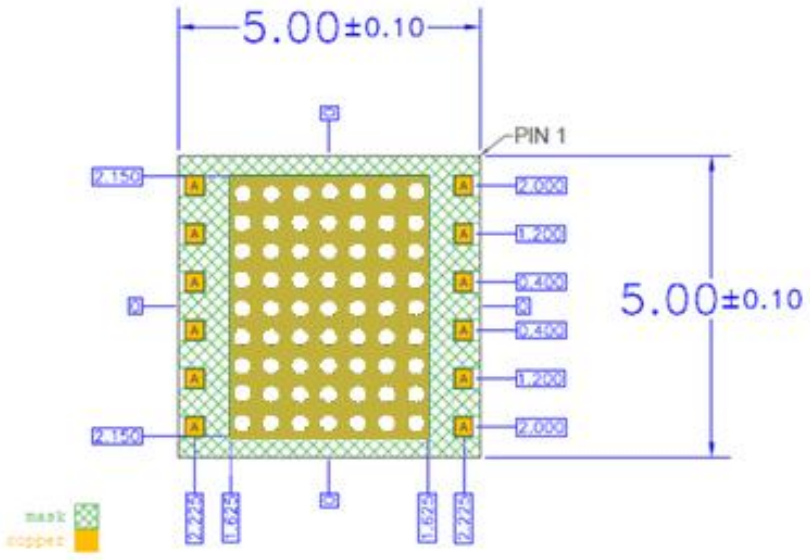
Pin Number	Label	Description
1	VDD1	VDD (1st stage)
2	RFIN+	RF input +
3	NC	Recommend connecting to EVB GND
4	NC	Recommend connecting to EVB GND
5	RFIN-	RF Input -
6	IADJ1	1st stage current set
7	IADJ2	2nd stage current set
8	RFOUT-	RF output - and VDD (2nd stage) through RF choke
9	VG2_2	2nd stage gate bias adj
10	VLIN	Linearizer current set
11	RFOUT+	RF output + and VDD (2nd stage) through RF choke
12	NC	Recommend connecting to EVB GND
Paddle	GND	DC/RF/Thermal/GND (Maximize vias in this area)

Package Outline



Landing Pattern





Recommended Via Pattern (63 Vias at 10mil Diameter)

Package Marking

Tape and Reel

Qorvo Part Number	Reel Diameter Inch (mm)	Hub Diameter Inch (mm)	Width (mm)	Pocket Pitch (mm)	Feed	Units Per Reel
QPL1827TR13	13 (330)	4 (102)	12	8	Single	2500

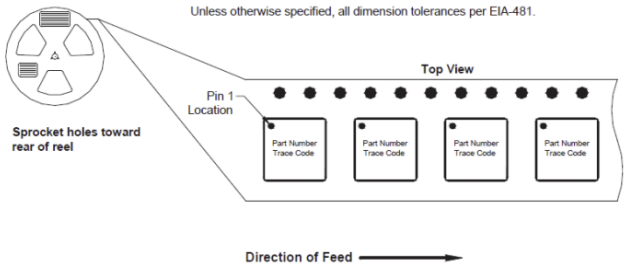


Figure 1: 5.000 mm x 5.000 mm (Carrier Tape Drawing with Part Orientation)

Handling Precautions

Parameter	Rating	Standard
ESD – Human Body Model (HBM)	Class 1B (500V to <1000V)	ANSI / ESDA / JEDEC JS-001
ESD – Charged Device Model (CDM)	Class C3 (≥ 1000V)	ANSI / ESDA / JEDEC JS-002
MSL – Moisture Sensitivity Level	MSL3	IPC / JEDEC J-STD-020

Caution!
ESD-Sensitive Device

Solderability

Compatible with both lead-free (260 °C max. reflow temp.) and tin / lead (245 °C max. reflow temp.) soldering processes. Solder profiles available upon request.

Contact plating: ENEPIG

RoHS Compliance

This part is compliant with 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:

- PFOS 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:

Tel: 1-844-890-8163

Web: www.qorvo.com

Email: customer.support@qorvo.com

Revision History

Revision	Description
A	Target Datasheet

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