

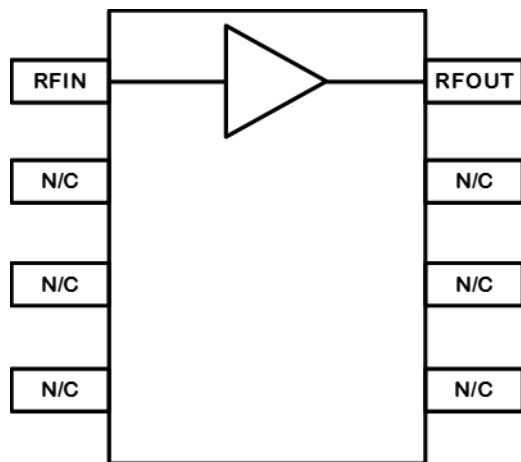
Product Overview

The QPB3321 is an HBT single ended RF amplifier IC operating as return path amplifier capable of supporting DOCSIS 3.1 applications. This IC is designed to provide a low noise, high gain option for 5-210MHz interface using an 8V power supply to provide lower overall power dissipation. 5V operation is possible in applications with reduced linearity and gain requirements. The QPB3321 is packaged in a convenient SOIC8 package and features an externally adjustable bias control.



Package: SOIC-8 with Exposed Pad

Functional Block Diagram



Top View

Key Features

- 5MHz to 210MHz Operation
- 8V and 5V Operation
- Gain; 17.5dB Typical
- Noise Figure 3.4dB Typical
- Adjustable Bias Using External Resistors
- SOIC-8 Exposed Pad

Applications

- Head End CMTS Equipment
- Post Amp for Return Path Optical Receivers
- DOCSIS 3.1 Optical Nodes
- Residential Amplifiers and Splitters

Ordering Information

Part No.	Description
QPB3321SQ	Sample bag with 25 pieces
QPB3321SR	7" Reel with 100 pieces
QPB3321TR13	13" Reel with 2500 pieces
QPB3321PCK	5 – 210 MHz PCBA with 5 pc sample bag

Absolute Maximum Ratings

Parameter	Rating
Supply Voltage (V_{DD})	+10V
Supply Current (I_{DD})	275mA
Maximum CW Input Power for $V_{DD}=8V$	+13dBm
Operating Temperature Range	-40 to +85 °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 – 8V

Parameter	Condition ⁽¹⁾	Min	Typ	Max	Unit
Supply Voltage (V_{DD})			8		V
Supply Current (I_{DD})			170		mA
Frequency Range		5		210	MHz
Gain			17.4		dB
Gain Flatness			±0.2		dB
Gain Tilt	Gain(210MHz) - Gain(5MHz)		-0.1		dB
Input Return Loss			19		dB
Output Return Loss	5MHz		21		dB
Reverse Isolation	Full bandwidth		21		dB
Noise Figure	Includes balun loss		3.4		dB
DTO	f1=13MHz, f2=19MHz 58dBmV per tone		78		-dBc
DSO	f1=13MHz, f2=19MHz 58dBmV per tone		59		-dBc
ACLR	Pout = 61dBmV, 5-195MHz OFDM w/ 9.6MHz exclusion band.		62.6		dB
OIP2	9dBm/tone, F1 = 113MHz, F2 = 119MHz		68		dBm
OIP3	9dBm/tone, F1 = 113MHz, F2 = 119MHz		48		dBm
Output P1dB	Full Band		24		dBm
Thermal Resistance	Θ_{JC}		28		°C/W

Notes:

1. Typical performance at these conditions: Temp = +25°C, V_{DD} = +8V, 75Ω system

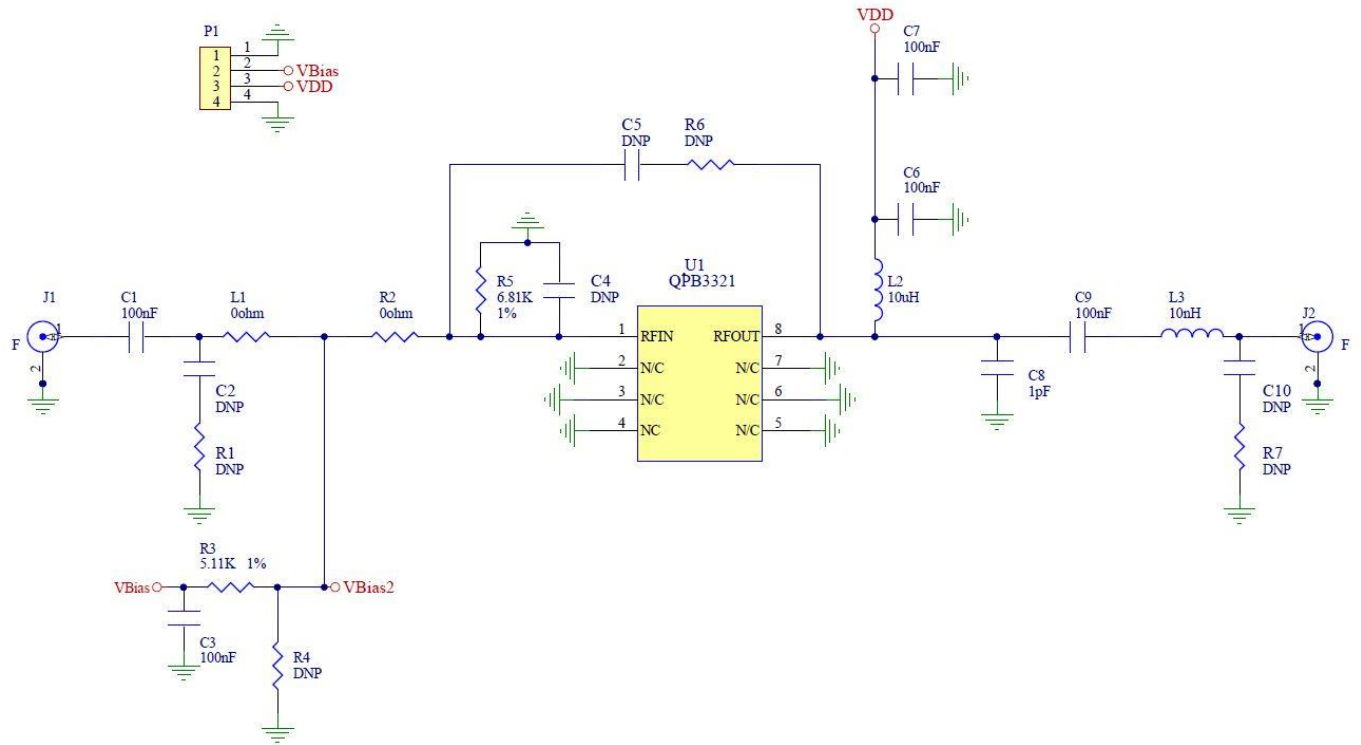
Electrical Specifications – 5V

Parameter	Condition ⁽¹⁾	Min	Typ	Max	Unit
Supply Voltage (V _{DD})			5		V
Supply Current (I _{DD})			100		mA
Frequency Range		5		210	MHz
Gain			15.8		dB
Gain Flatness			±0.2		dB
Gain Tilt	Gain(210MHz) - Gain(5MHz)		-0.2		dB
Input Return Loss			26		dB
Output Return Loss			21		dB
Reverse Isolation	Full bandwidth		22		dB
Noise Figure	Full bandwidth		4.8		dB
DTO	f1=13MHz, f2=19MHz 55dBmV per tone		74		-dBc
DSO	f1=13MHz, f2=19MHz 55dBmV per tone		54		-dBc
ACLR	Pout = 53dBmV, 5-195MHz OFDM w/ 9.6MHz exclusion band.		61		dB
OIP2	6dBm/tone, F1 = 113MHz, F2 = 119MHz		51		dBm
OIP3	6dBm/tone, F1 = 113MHz, F2 = 119MHz		38		dBm
Output P1dB	Full Band		19.3		dBm

Notes:

1. Typical performance at these conditions: Temp = +25°C, V_{DD} = +5V, 75Ω system

Evaluation Board Schematic 5-210MHz





QPB3321

17.5 dB Return Path Amplifier 5 – 210 MHz

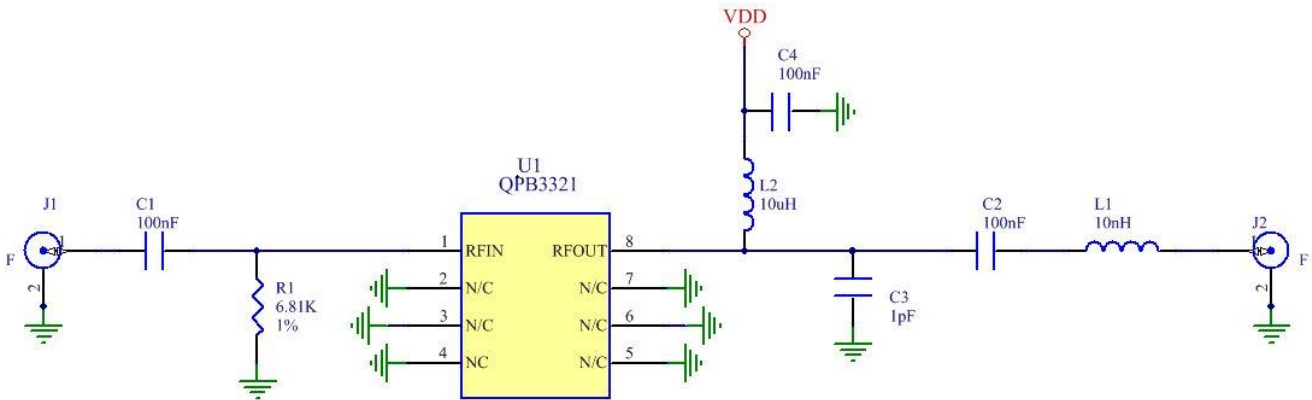
Evaluation Board Bill of Materials

Designator	Description	Manufacturer	Part Number
PCB	QPB3311-4000	DDI	QPB3311-4000(A)
C1, C3, C6, C7, C9	CAP, 0.1uF, 10%, 16V, X7R, 0402	Murata Electronics	GRM155R71C104KA88D
C8	CAP, 1.0pF, ±0.1pF, 50V, NPO, 0402	Murata Electronics	GRM1555C1H1R0BZ01D
J1, J2	CONN, F FEM EDGE MOUNT, 75 OHMS	Millimeter Wave Technologies, LLC	MW-846-C-DD-75
L1, R2	JMPR, 0 OHM, 0402	Panasonic	ERJ-2GE0R00
L2	IND, 10uH, 10%, 500mA, W/W, 1210	Murata	82103C
L3	IND, 10nH, 5%, M/L, 0402	Murata Electronics	LQG15HN10NJ02D
P1	CONN, HDR, ST, FRCTN LOCK, 4-PIN	Molex	22-23-2041
R3	RES, 5.11K, 1%, 1/16W, 0402	Cal-Chip Electronics	RM04F5111CT
R5	RES, 6.81K, 1%, 1/16W, 0402	Panasonic	ERJ-2RKF6811X
U1	17.5dB High-Linearity MMIC	Qorvo	QPB3321
C2, C4, C5, C10, R1, R4, R6, R7	DNP	N/A	N/A
HS1	Heat Sink 1.5 x 2	Shenzhen Minxingda Automation Equip	211086
S1, S2, S3, S4	Screw, 2-56x3/16:, Socket Head	McMaster-Carr Supply Co.	92196A076

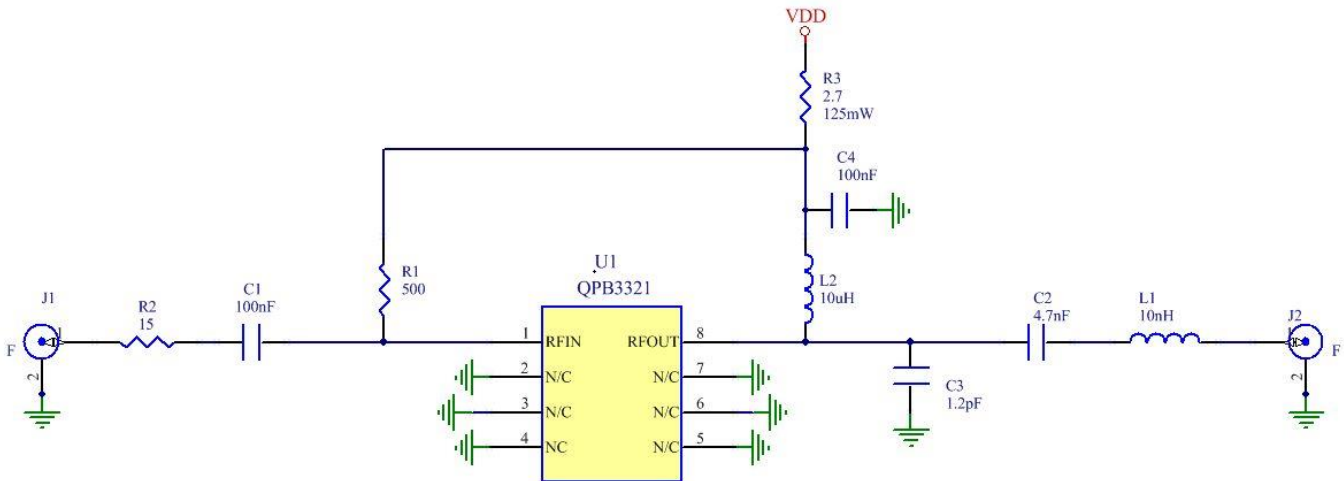
Evaluation Board Assembly Drawing



Typical Application Schematic, 8V



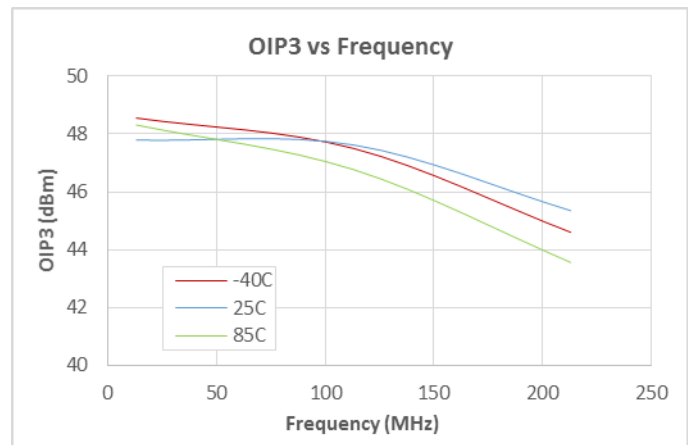
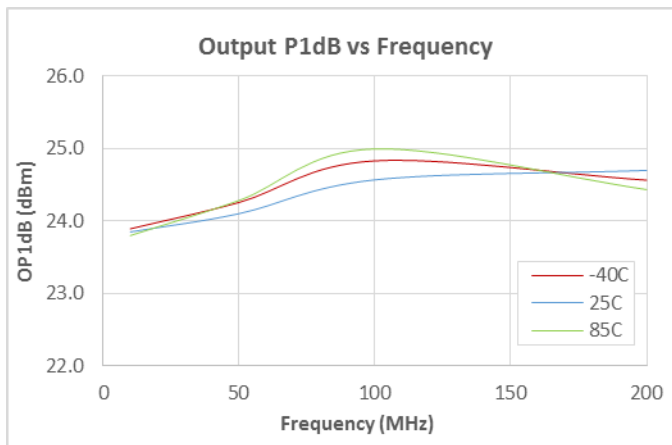
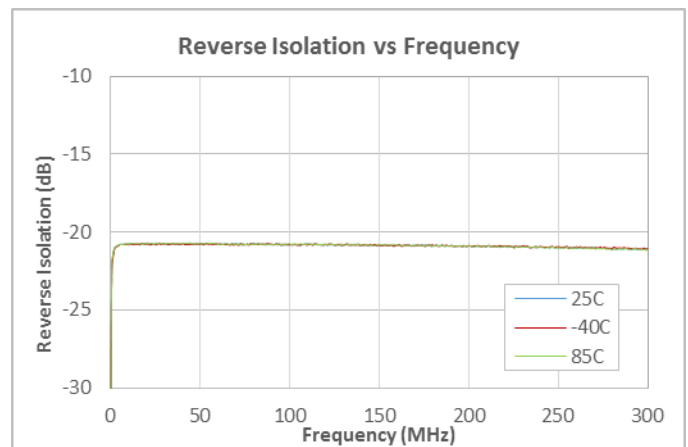
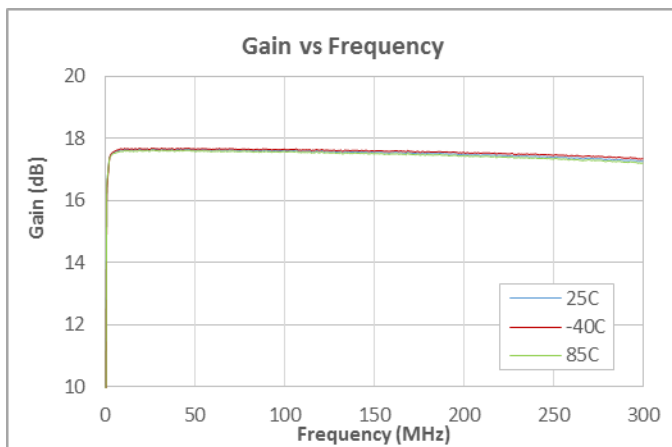
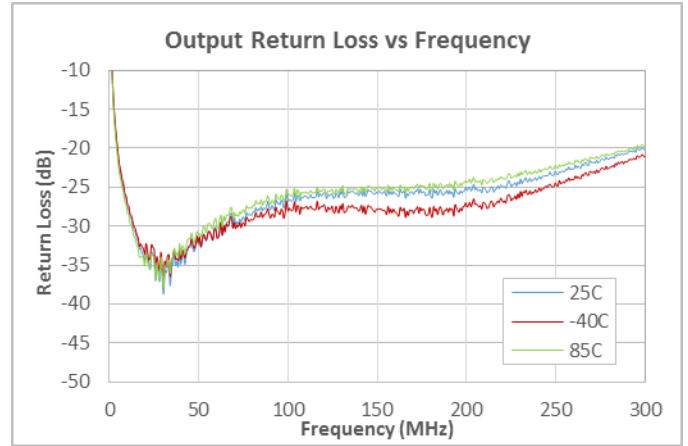
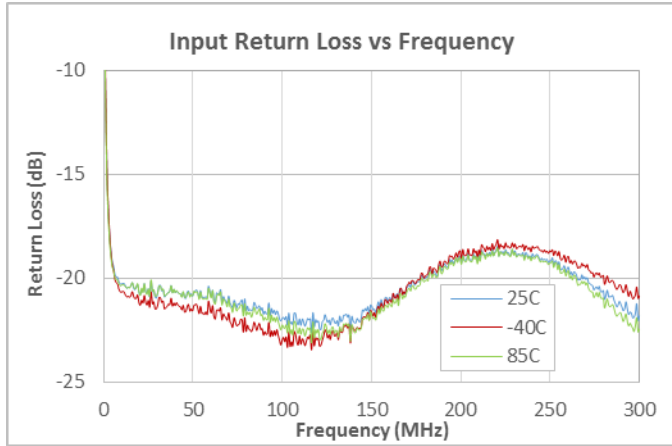
Typical Application Schematic, 5V



Notes:

1. R2 can be reduced to tradeoff reduced noise figure for degraded input return loss.
2. R1 increases bias current to recommended 100mA operating point to improve bias stability versus temperature.

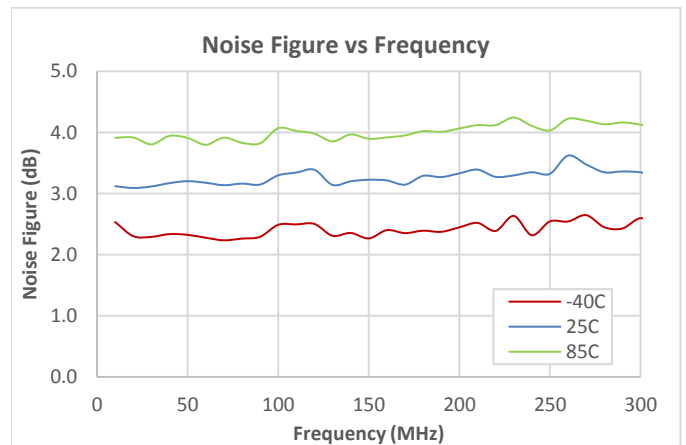
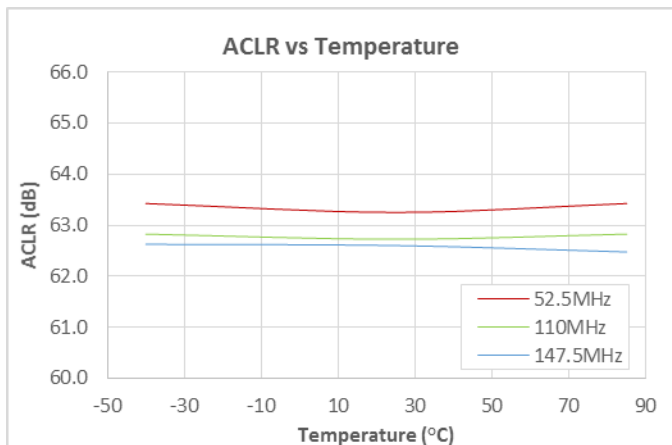
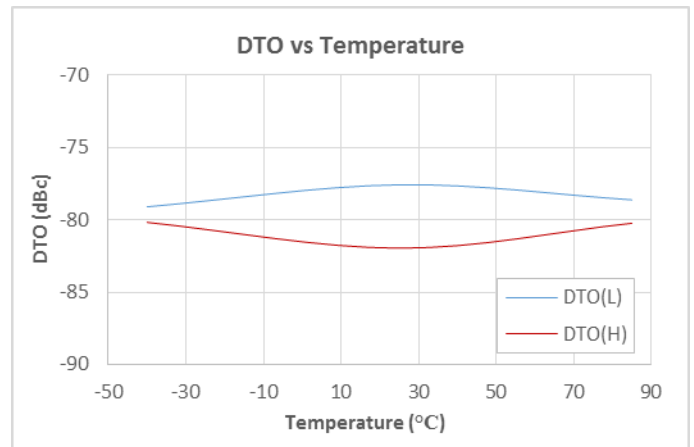
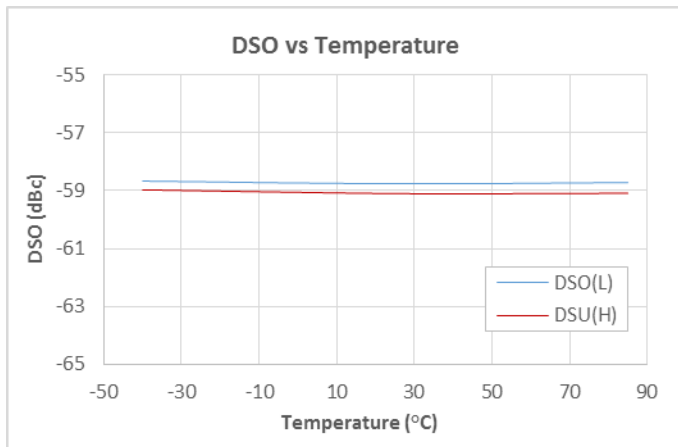
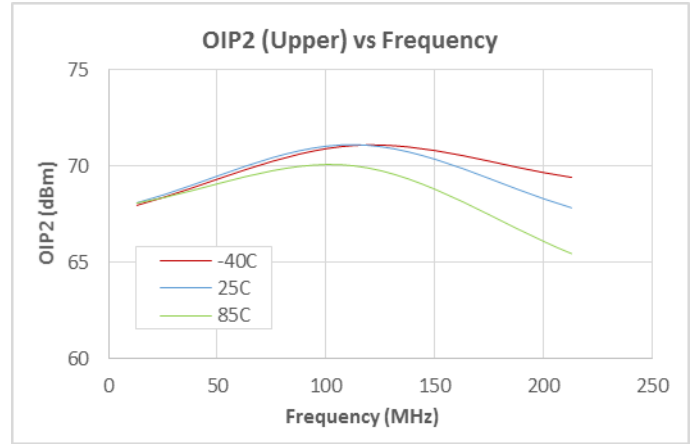
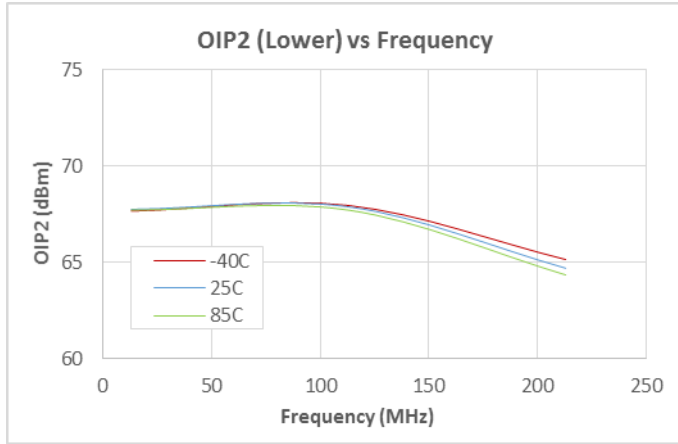
Performance Data – 8V



Notes:

- (1) OIP3: 9dBm/tone, F1 = 113MHz, F2 = 119MHz

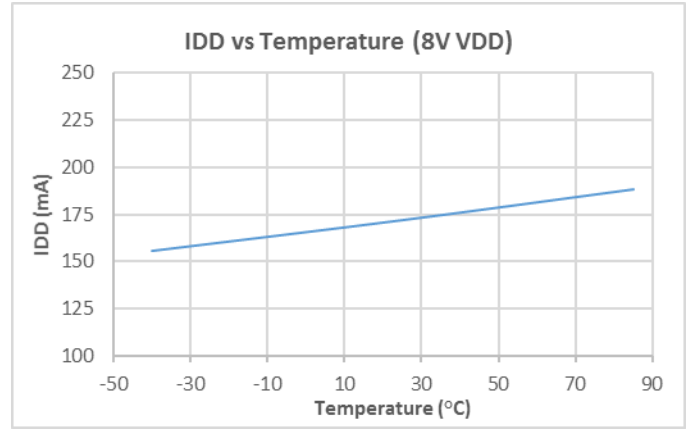
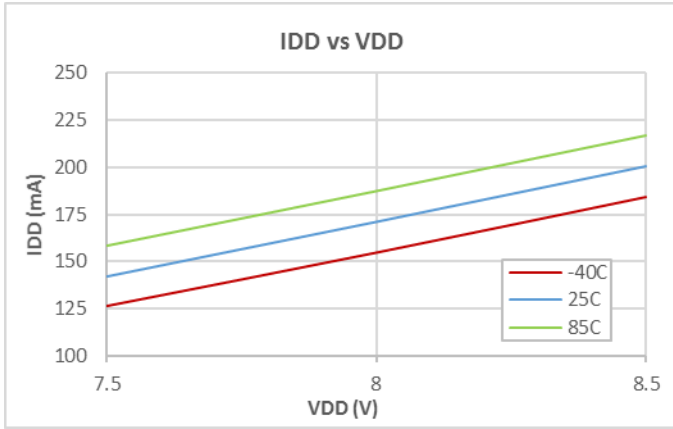
Performance Data – 8V



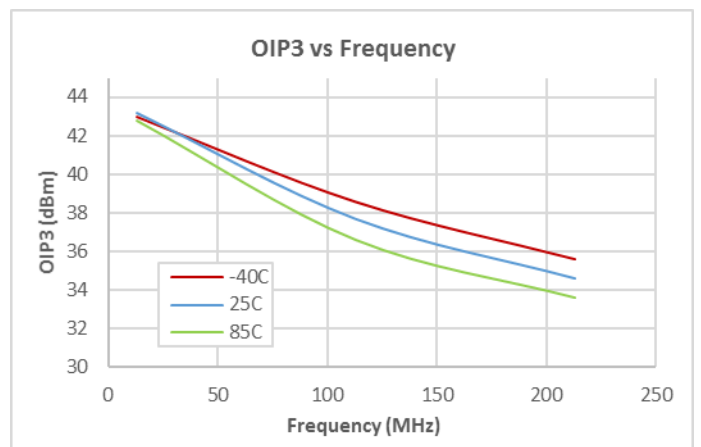
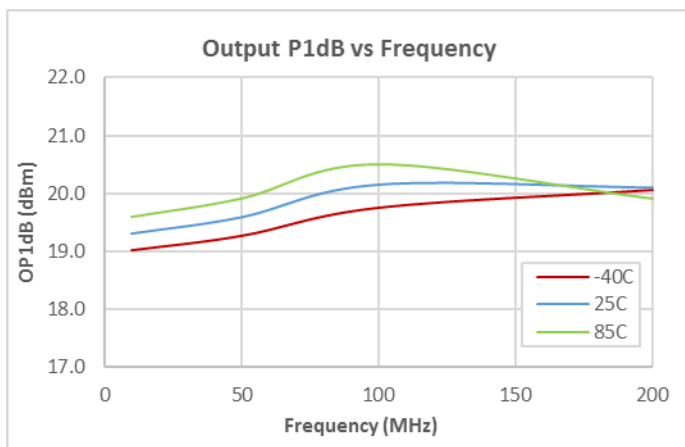
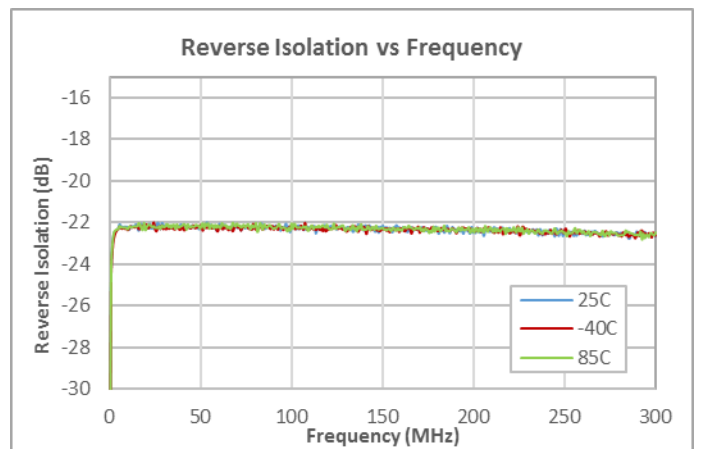
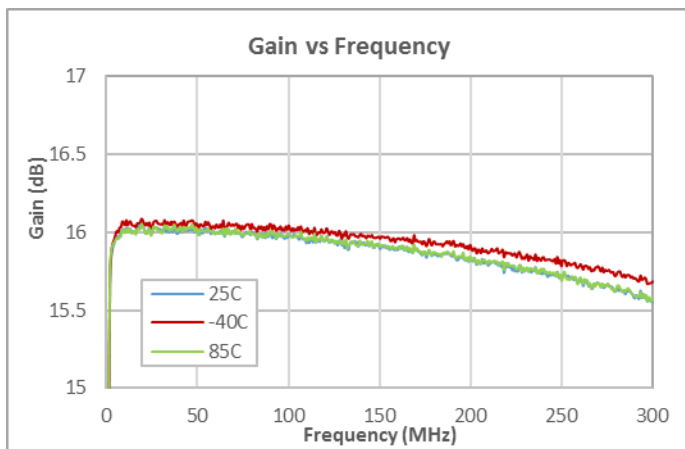
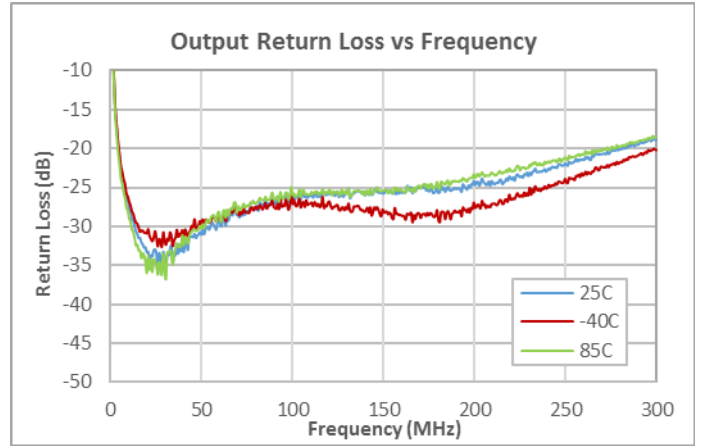
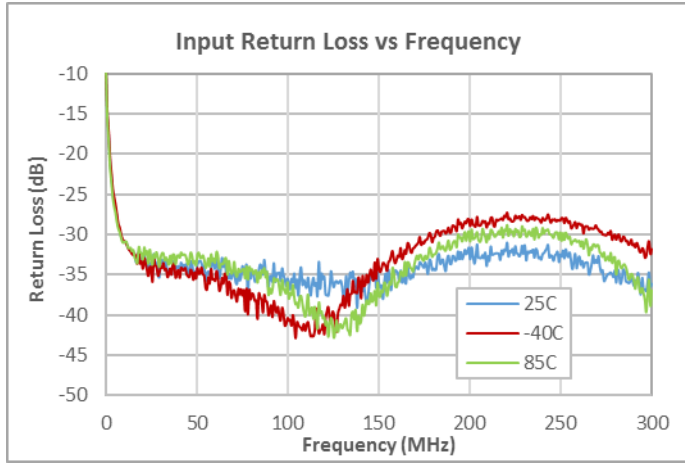
Notes:

- (2) OIP2: 9dBm/tone, F1 = 113MHz, F2 = 119MHz
- (3) DSO/DTO: f1=13MHz, f2=19MHz 58dBmV per tone
- (4) ACLR: Pout = 61dBmV, 5-195MHz OFDM w/ 9.6MHz exclusion band.

Performance Data – 8V

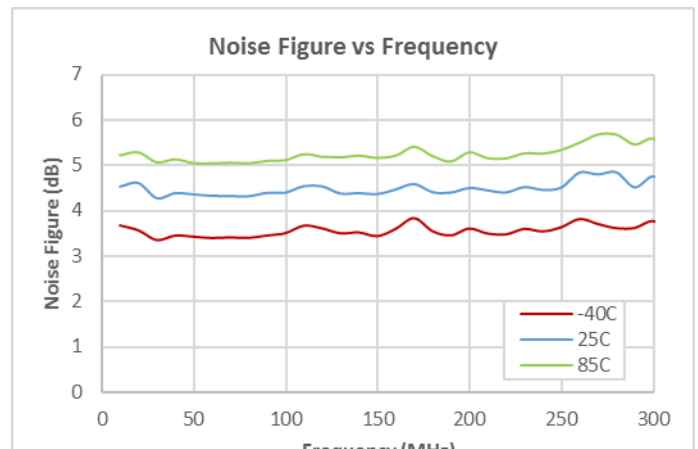
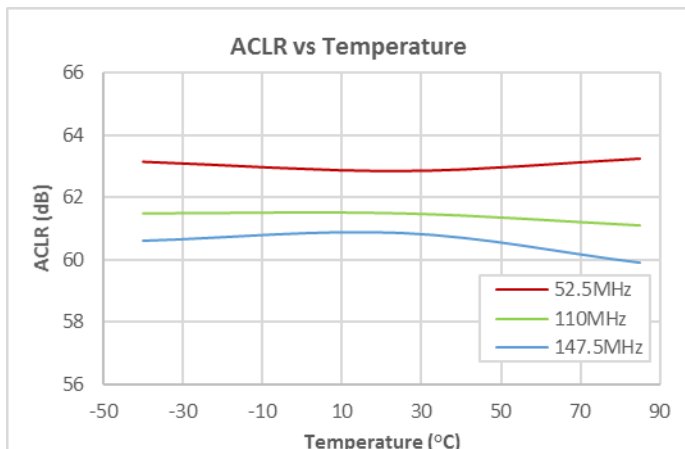
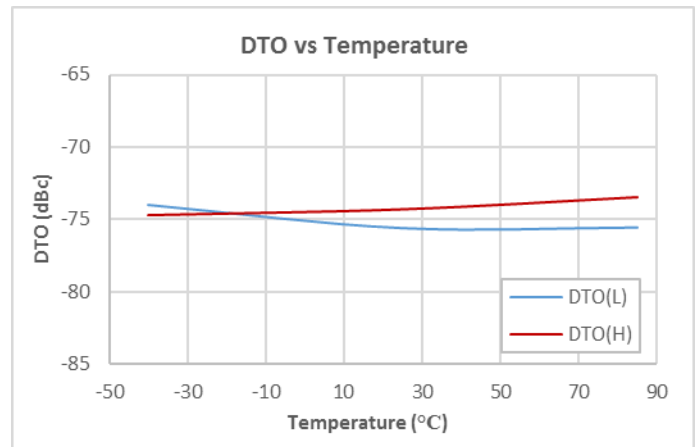
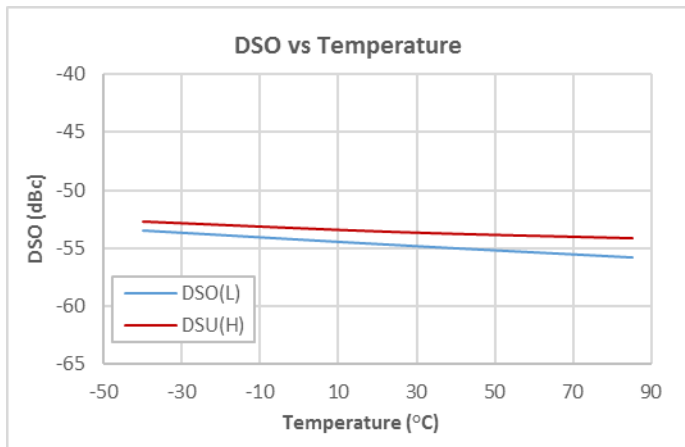
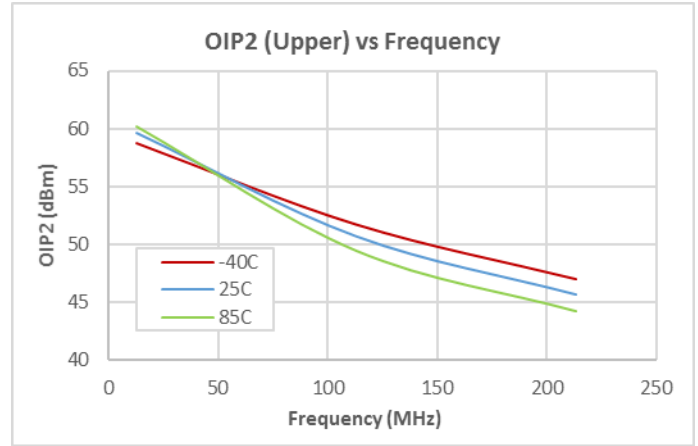
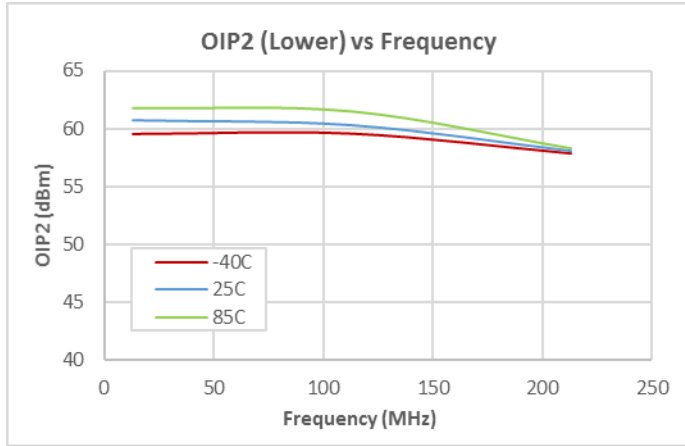


Performance Data – 5V



Notes:
 (1) OIP3: 6dBm/tone, F1 = 113MHz, F2 = 119MHz

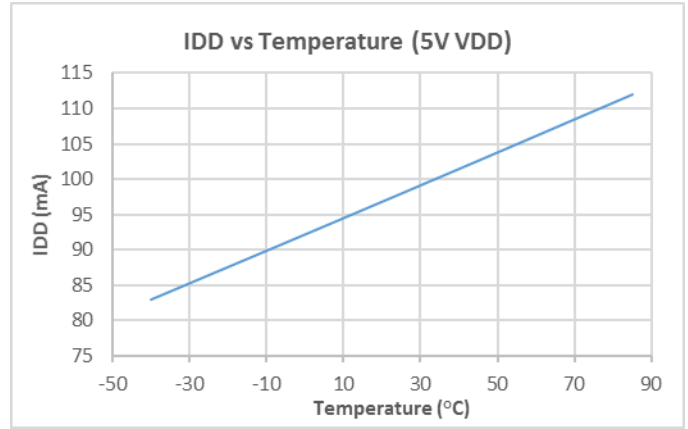
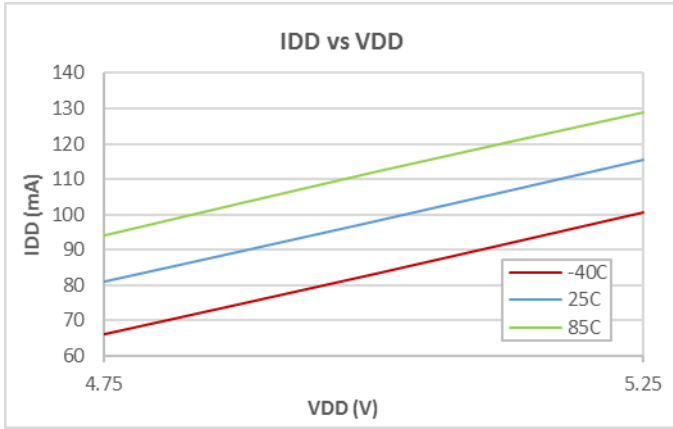
Performance Data – 5V



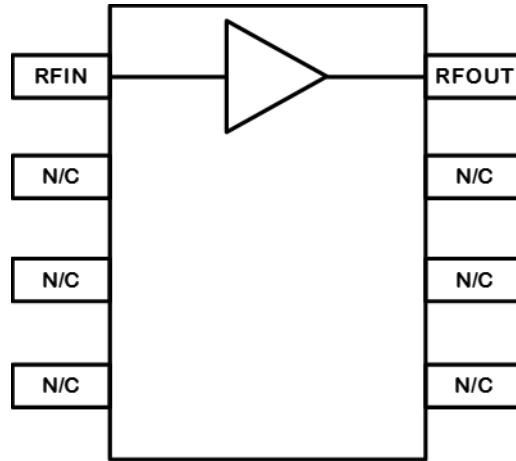
Notes:

- (1) OIP2: 6dBm/tone, F1 = 113MHz, F2 = 119MHz
- (2) DSO/DTO: f1=13MHz, f2=19MHz 55dBmV per tone
- (3) ACLR: Pout = 53dBmV, 5-195MHz OFDM w/ 9.6MHz exclusion band.

Performance Data – 5V



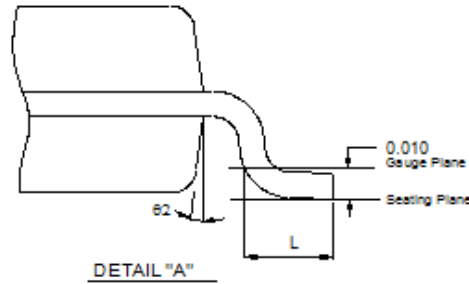
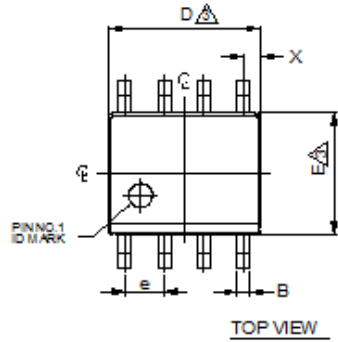
Pad Configuration and Description



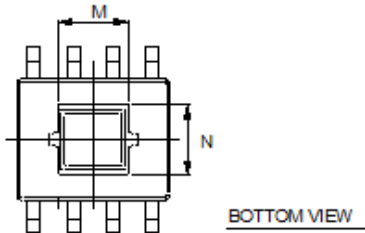
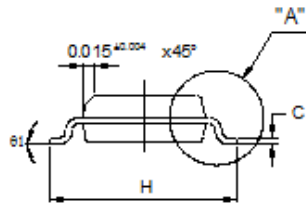
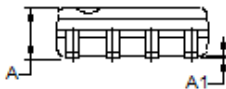
Top View

Pad No.	Label	Description
1	RFIN	RF Input, 75Ω
2	N/C	Internally Not Connected
3	N/C	Internally Not Connected
4	N/C	Internally Not Connected
5	N/C	Internally Not Connected
6	N/C	Internally Not Connected
7	N/C	Internally Not Connected
8	RFOUT	RF Output, 75Ω
Backside Paddle	GND	Ground. Use recommended via pattern to minimize inductance and thermal resistance. See PCB Mounting Pattern for suggested footprint.

Package Outline



SYMBOL	8 SOIC	
	MIN	MAX
A	0.054	0.068
A1	0.001	0.004
B	0.014	0.019
D	0.189	0.196
E	0.150	0.157
H	0.229	0.244
M	0.087	0.097
N	0.082	0.092
e	0.050 BSC	
C	0.0075	0.0098
L	0.020	0.040
X	0.0215 REF	
61	0°	8°
62	7° BSC	



EXPOSED PADDLE

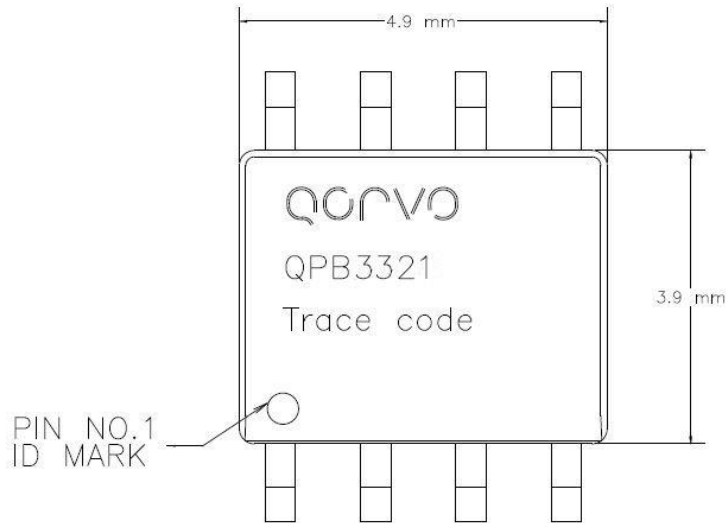
NOTE:

1. TOP PACKAGE SURFACE TO BE Ni, Pd, Au PLATING
2. BOTTOM PACKAGE SURFACE TO BE Ni, Pd, Au PLATING
3. DIMENSIONS ARE EXCLUSIVE MOLD FLASH AND GATE BURR.
4. FOOT LENGTH MEASURING IS BASED ON THE GAUGE PLANE METHOD.

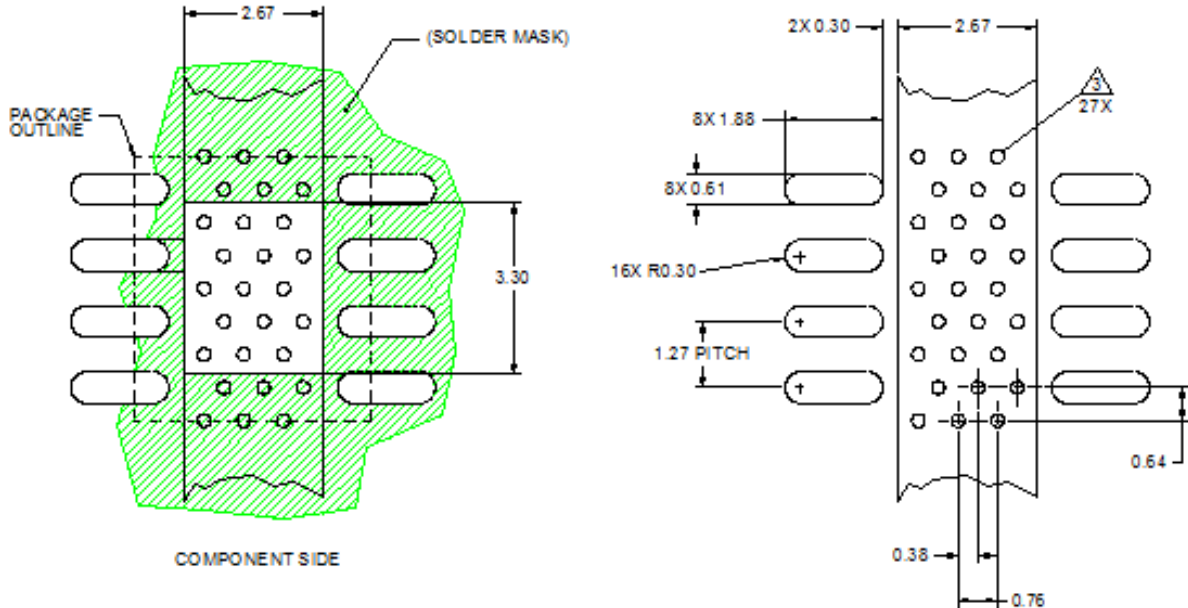
Notes:

1. Dimensions in millimeters

Package Marking



Recommended Mounting Pattern



Notes:

1. All dimensions are in millimeters. Angles are in degrees.
2. Use 1oz. copper minimum for top and bottom layers
3. Vias are required under the backside paddle for proper RF/DC grounding and thermal dissipation. We recommend a 0.35mm (#80/0.135") diameter bit for drilling via holes and a final plated through diameter of 0.25mm (0.010").
4. Ensure good backside paddle solder attach for reliable operation and best electrical performance.

Handling Precautions

Parameter	Rating	Standard
ESD – Human Body Model (HBM)	1B	ESDA / JEDEC JS-001-2012
ESD – Charged Device Model (CDM)	C3	JEDEC JESD22-C101F
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: NiPdAu

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.

This product also has the following attributes:

- Lead Free
- Halogen Free (Chlorine, Bromine)
- Antimony Free
- TBBP-A (C₁₅H₁₂Br₄O₂) Free
- PFOS 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

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