

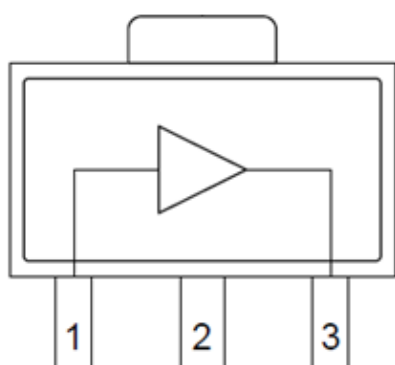
Product Overview

The QPB7420 is a GaAs pHEMT single ended RF amplifier IC featuring 20dB of flat gain and low noise. This IC is designed to support Fiber to The Home (FTTH) applications from 47 to 1218MHz using a single 5V supply, or it can be used from 3V to 8V depending on linearity requirements. QPB7420 offers low noise and distortion plus high gain in a SOT-89 package for convenient layout and design in set top and infrastructure projects for 75 Ω CATV and satellite applications.



3-pin SOT-89 Package

Functional Block Diagram



Top View

Key Features

- 47 MHz to 1218 MHz Operation
- 3 V, 5 V, and 8 V Operation
- Gain; 20 dB Typical
- Noise Figure; 1.1 dB Typical at 850 MHz
- Adjustable Bias Using External Resistors
- Convenient SOT-89 Package
- RoHS Compliant

Applications

- FTTH GPON and GEPON
- DOCSIS 3.1
- Head End CMTS Equipment
- Optical Node
- Satellite Low Noise Amplifier
- Cable Modem and Set Top Box
- Single Ended Gain Block

Ordering Information

Part Number	Description
QPB7420SQ	Sample bag with 25 pieces
QPB7420SR	7" Reel with 100 pieces
QPB7420TR13	13" Reel with 2500 pieces
QPB7420PCK-1	47 – 1218 MHz PCBA with 5 pc sample bag

Absolute Maximum Ratings

Parameter	Rating
Supply Voltage (V_{DD})	+10 V
Supply Current (I_{DD})	140 mA
Maximum Input Level	65 dBmV
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 – 3 V

Parameter	Condition ⁽¹⁾	Min	Typ	Max	Unit
Supply Voltage (V_{DD})			3		V
Supply Current (I_{DD})			35		mA
Frequency Range		47		1218	MHz
Gain			20		dB
Gain Slope			1.0		dB
Reverse Isolation			22		dB
Input Return Loss			21		dB
Output Return Loss			21		dB
Noise Figure			1.3		dB
CSO	20 dBmV / ch output, 80 NTSC + 108 QAM, flat		54		dBc
CTB	20 dBmV / ch output, 80 NTSC + 108 QAM, flat		75		dBc
CCN	20 dBmV / ch output, 80 NTSC + 108 QAM, flat		52		dB
OIP2L	7 dBm / tone output		38		dBm
OIP2H	7 dBm / tone output		37		dBm
OIP3	7 dBm / tone output		28		dBm
OP1dB			15.3		dBm
Thermal Resistance	Θ_{JC}		35		°C/W

Notes:

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

Electrical Specifications – 5 V

Parameter	Condition ⁽¹⁾	Min	Typ	Max	Unit
Supply Voltage (V_{DD})			5		V
Supply Current (I_{DD})			55		mA
Frequency Range		47		1218	MHz
Gain			20.4		dB
Gain Slope			1.1		dB
Reverse Isolation			23		dB
Input Return Loss			23		dB
Output Return Loss			20		dB
Noise Figure			1.2		dB
CSO	20 dBmV / ch output, 80 NTSC + 108 QAM, flat		60		dBc
CTB	20 dBmV / ch output, 80 NTSC + 108 QAM, flat		77		dBc
CCN	20 dBmV / ch output, 80 NTSC + 108 QAM, flat		55		dB
OIP2L	7 dBm / tone output		44		dBm
OIP2H	7 dBm / tone output		41		dBm
OIP3	7 dBm / tone output		35.5		dBm
OP1dB			20		dBm
Thermal Resistance	Θ_{JC}		35		$^{\circ}\text{C/W}$

Notes:

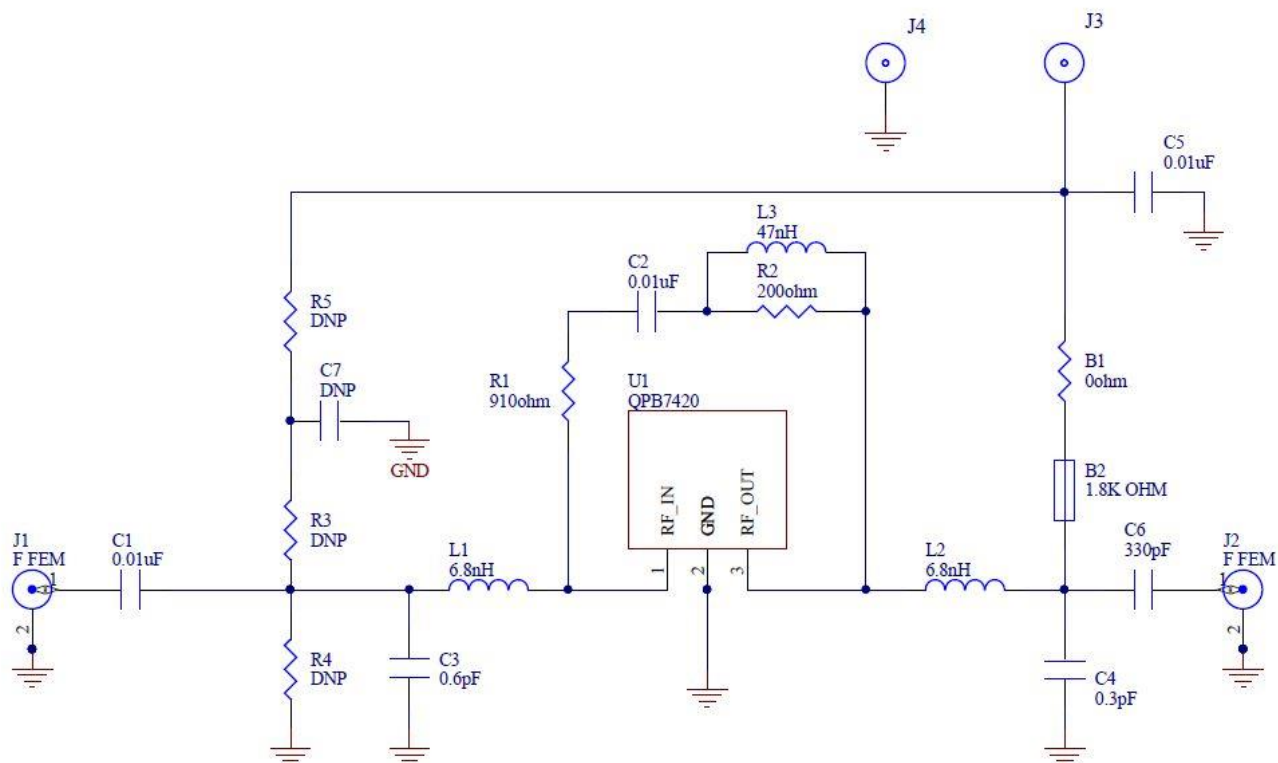
1. Typical performance at these conditions: Temp = +25 $^{\circ}\text{C}$, V_{DD} = +5 V, 75 Ω system, Full band unless otherwise noted

Electrical Specifications – 8 V

Parameter	Condition ⁽¹⁾	Min	Typ	Max	Unit
Supply Voltage (V_{DD})			8		V
Supply Current (I_{DD})			90		mA
Frequency Range		47		1218	MHz
Gain			20.6		dB
Gain Slope			1.1		dB
Reverse Isolation			23		dB
Input Return Loss			19		dB
Output Return Loss			17		dB
Noise Figure			1.3		dB
CSO	28 dBmV / ch output, 80 NTSC + 108 QAM, flat		60		dBc
CTB	28 dBmV / ch output, 80 NTSC + 108 QAM, flat		76		dBc
CCN	28 dBmV / ch output, 80 NTSC + 108 QAM, flat		59		dB
OIP2L	7 dBm / tone output		52		dBm
OIP2H	7 dBm / tone output		47		dBm
OIP3	7 dBm / tone output		40		dBm
OP1dB			24.2		dBm
Thermal Resistance	Θ_{JC}		35		$^{\circ}\text{C/W}$

Notes:

1. Typical performance at these conditions: Temp = +25 $^{\circ}\text{C}$, V_{DD} = +5 V, 75 Ω system, Full band unless otherwise noted

Evaluation Board Schematic 47 MHz – 1218 MHz




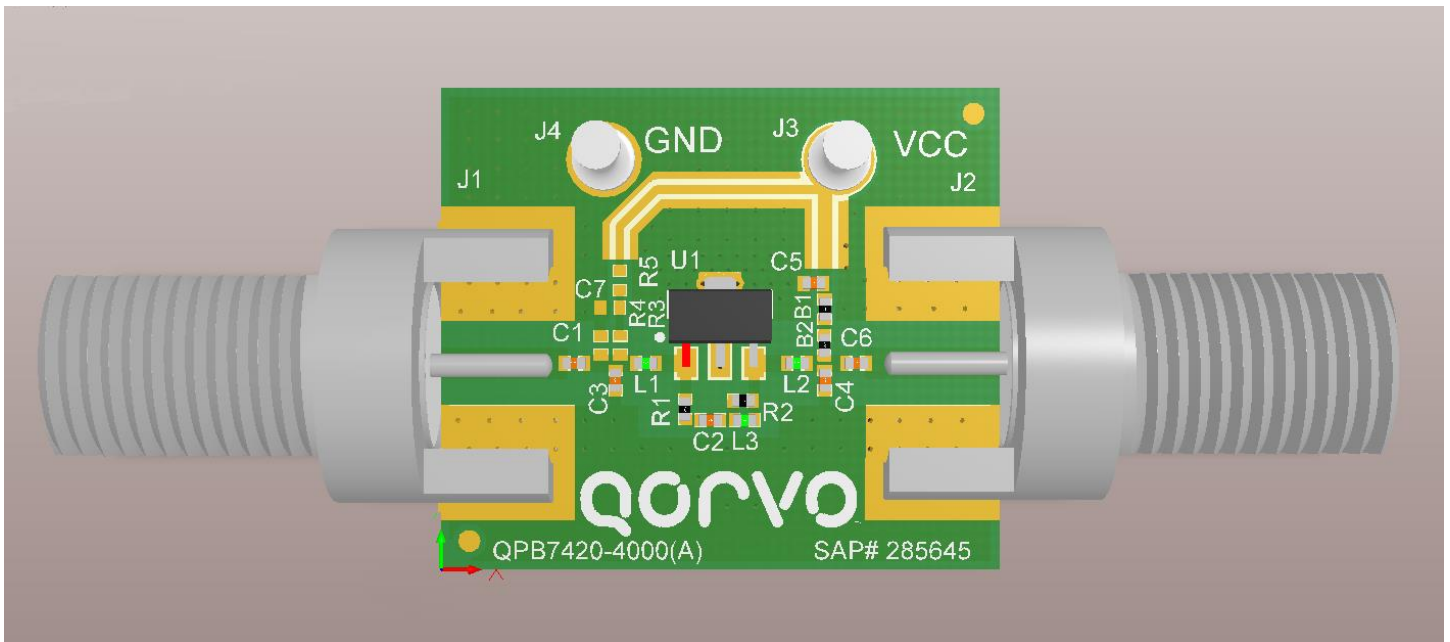
QPB7420

75 Ω 20 dB CATV Amplifier 47 – 1218 MHz

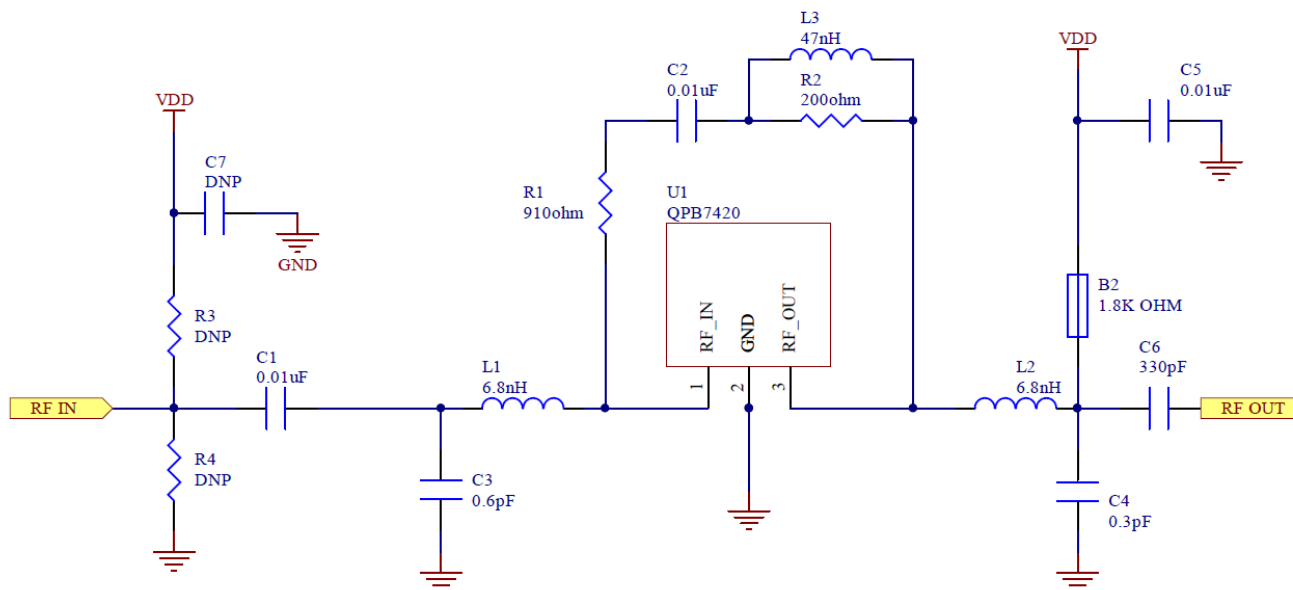
Evaluation Board Bill of Materials

Designator	Description	Manufacturer	Part Number
PCB	QPB7420-4000	DDI	QPB7420-4000(A)
U1	20dB FTTH Amplifier	Qorvo	QPB7420SB
B1	RES, 0 Ω , 5%, 1/10W, 0402	Kamaya, Inc	RMC1/16SJPTH
B2	FER, BEAD, 1.8K, 200mA, 0402	TDK	MMZ1005A182ET000
C1, C2, C5	CAP, 0.01 μ F, 10%, 50V, X7R, 0402	Murata Electronics	GRM155R71H103KA88D
C3	CAP, 0.6pF, +/-0.1pF, 50V, HI-Q, 0402	Murata Electronics	GJM1555C1HR60BB01D
C4	CAP, 0.3pF, +/-0.05pF, 50V, C0G, 0402	Murata Electronics	GRM1555C1HR30WA01D
C6	CAP, 330pF, 5%, 50V, C0G, 0402	Murata Electronics	GRM1555C1H331JA01D
J1, J2	CONN, F FEM EDGE MOUNT, 75 OHMS, 0.068"	Millimeter Wave Technologies, LLC	MW-846-C-DD-75
J3, J4	TERM. SOLDER TURRET, 0.062 PCB	Mill-Max Manufacturing	2533-0-00-44-00-00-07-0
L1, L2	IND, 6.8nH, 5%, M/L, 0402	Murata Electronics	LQG15HN6N8J02D
L3	IND, 47nH, 5%, M/L, 0402	Murata Electronics	LQG15HN47NJ02D
R1	RES, 910 Ω , 5%, 1/16W, 0402	Panasonic Industrial	ERJ-2GEJ911X
R2	RES, 200 Ω , 5%, 1/16W, 0402	Kamaya, Inc	RMC1/16S-201JTH
R3, R4, R5, C7	Not Populated		

Evaluation Board Assembly Drawing



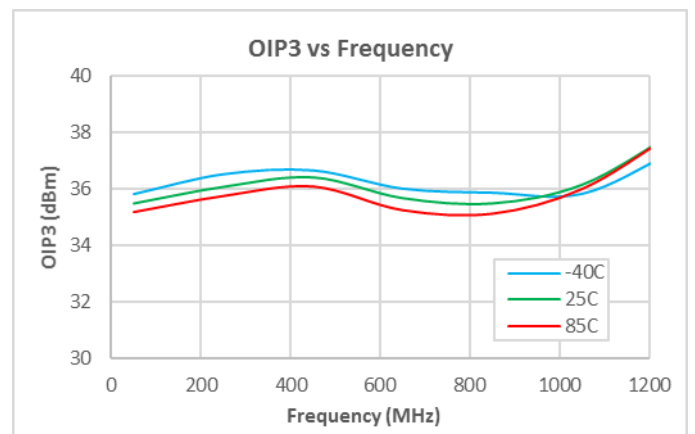
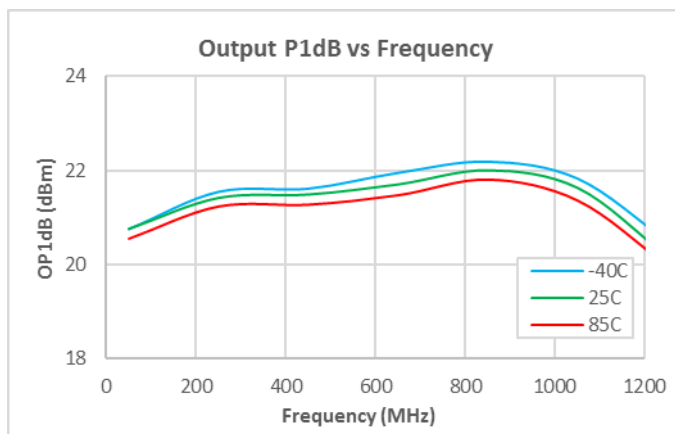
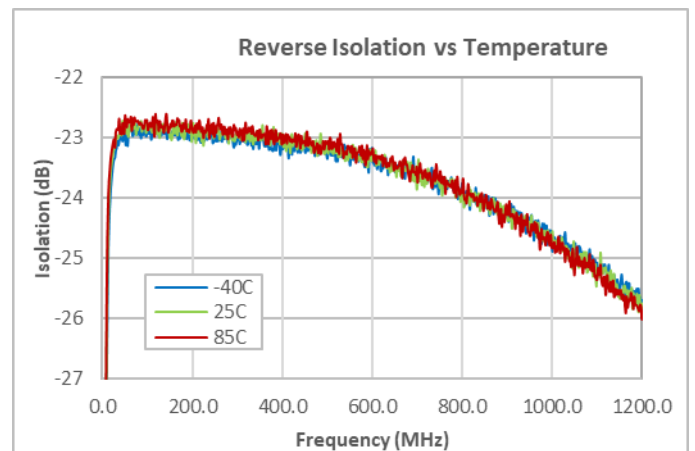
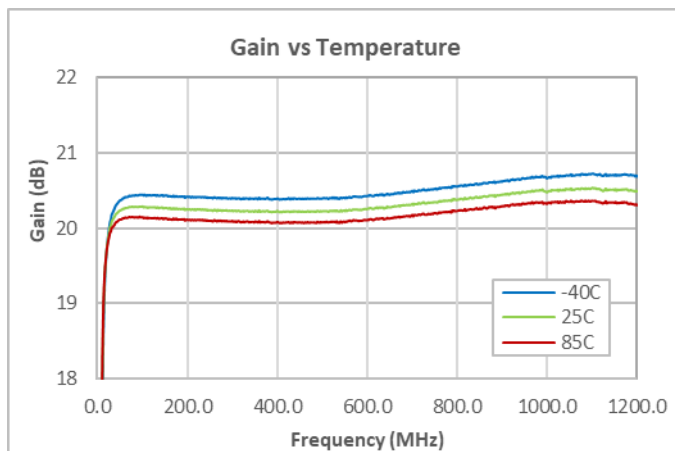
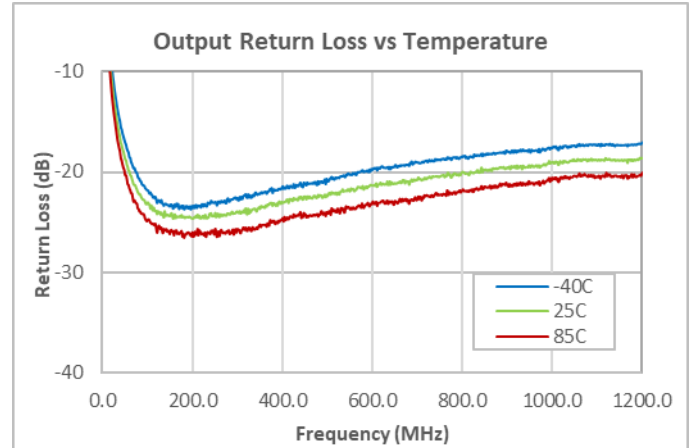
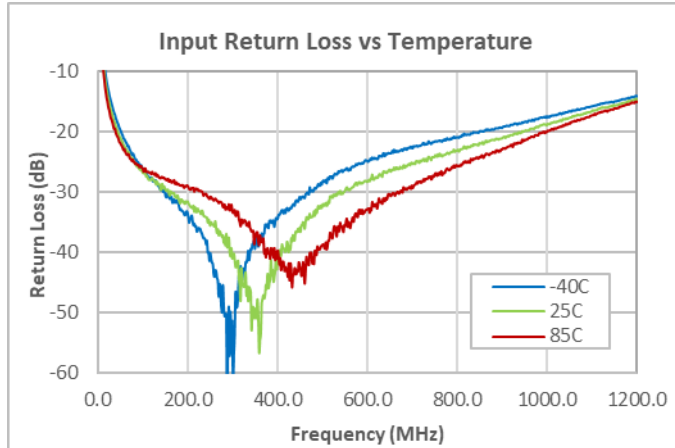
Typical Application Schematic, 47 MHz – 1218 MHz



Notes:

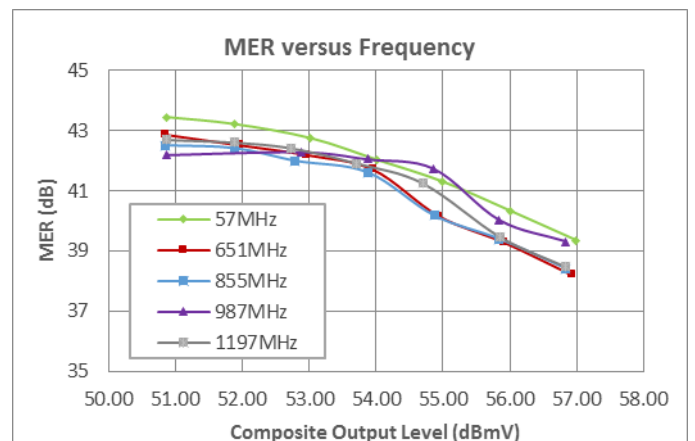
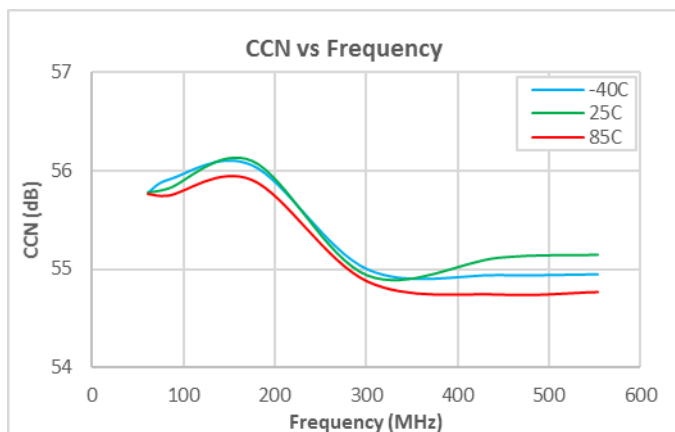
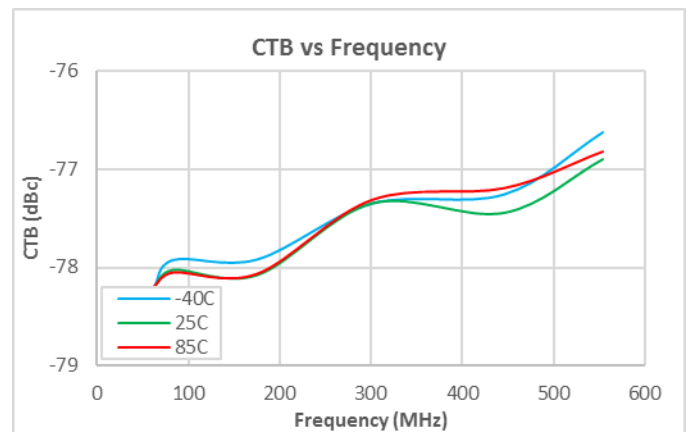
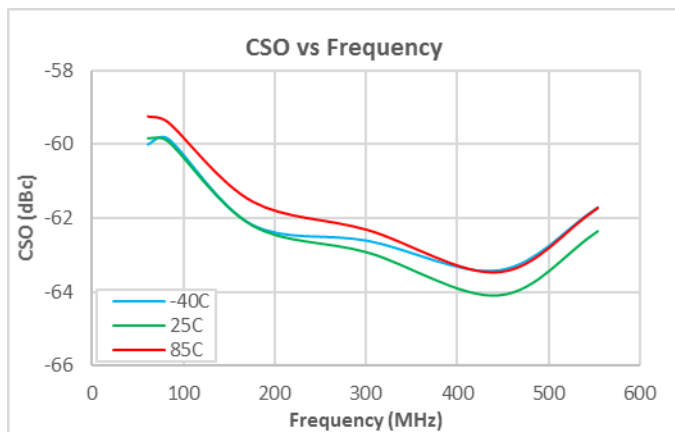
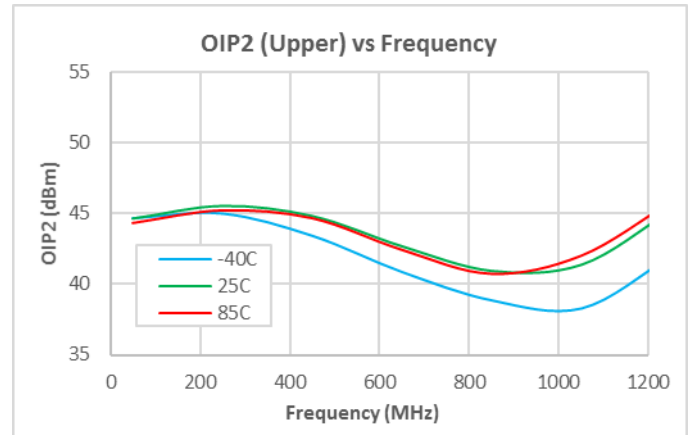
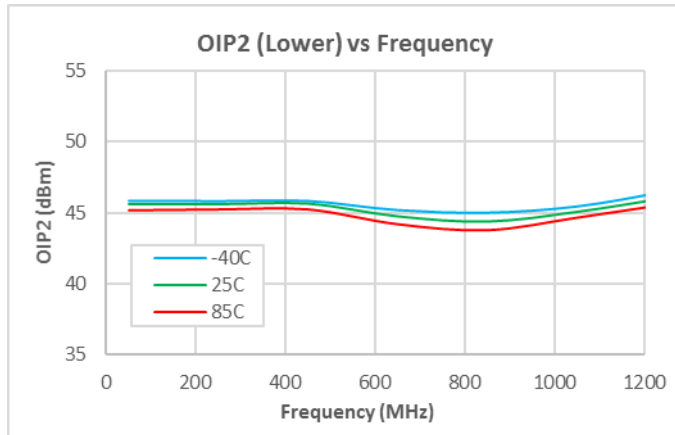
1. C3/L1 tunes input return loss.
2. L2/C4 tunes output return loss with some contribution from C6.
3. The feedback network is composed of R1 and R2, with C3 being a DC block and L3 providing high end peaking. The ratio of R1 to R2 controls flatness and tilt while the total feedback resistance affects device gain.
4. B2 provides the bias path with RF isolation from the RF output path.
5. R3 and R4 are options that may be added from the input to VDD or to ground to increase linearity or shed power, trading off degraded noise figure and return loss. Refer to Additional Application Data section below for further information.

Performance Data – 5 V



Notes:
(1) OIP3: 7 dBm/tone output

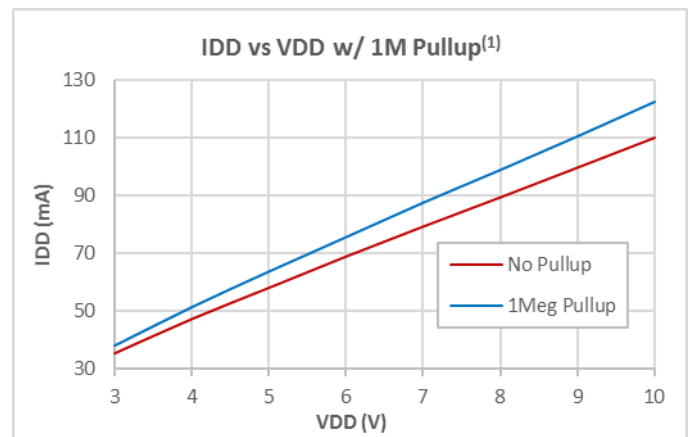
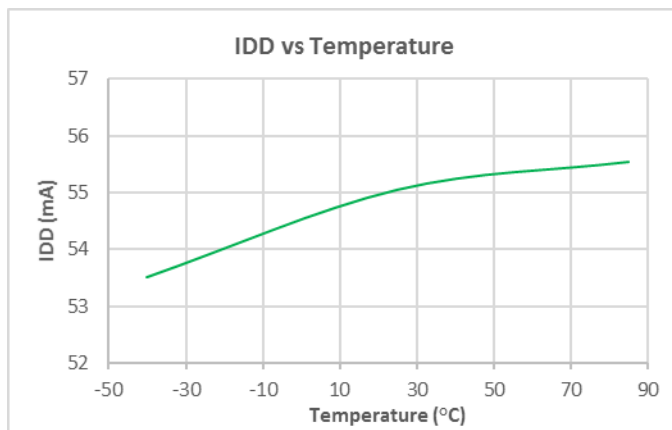
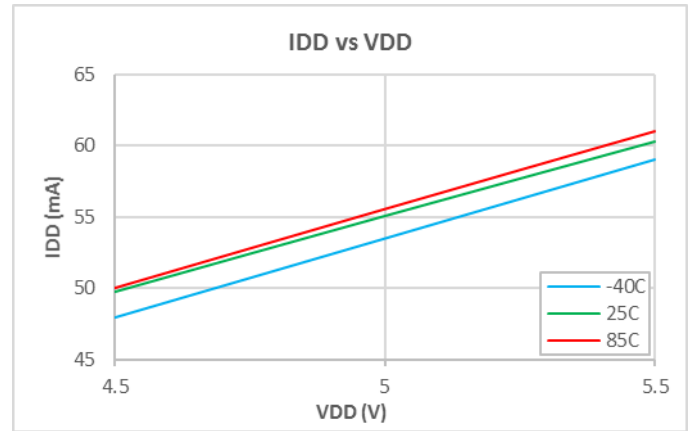
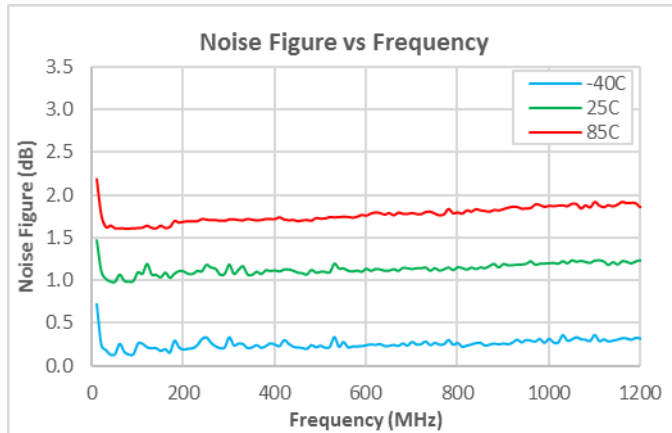
Performance Data – 5 V



Notes:

- (1) OIP2: 7 dBm/ tone output
- (2) CSO/CTB, CCN: 20 dBmV/ ch output, 80 NTSC + 108 QAM, flat
- (3) MER: 190 QAM256 Channels, 57-1215MHz, ITU-T J.83, Annex B

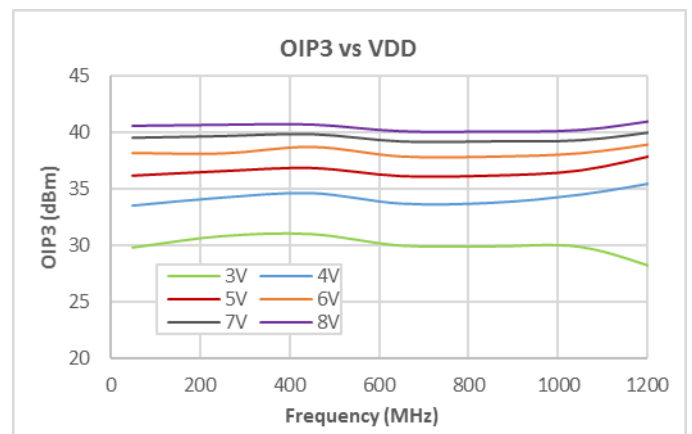
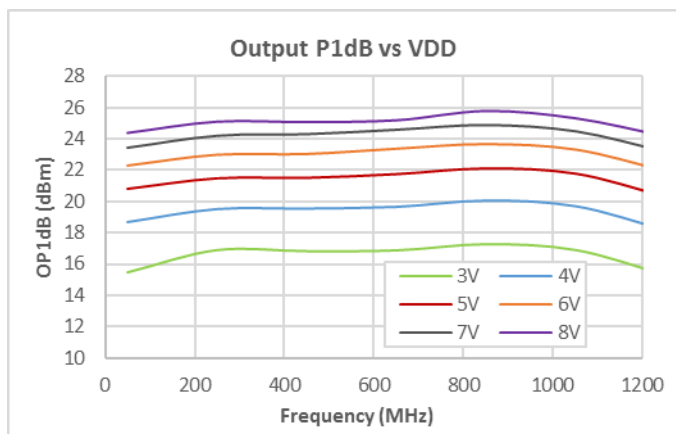
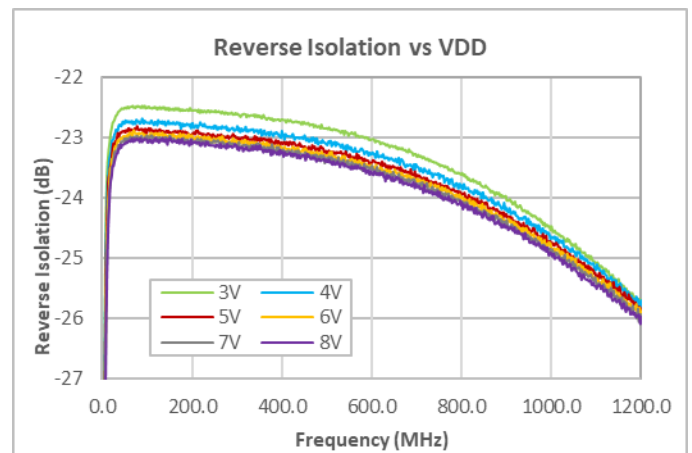
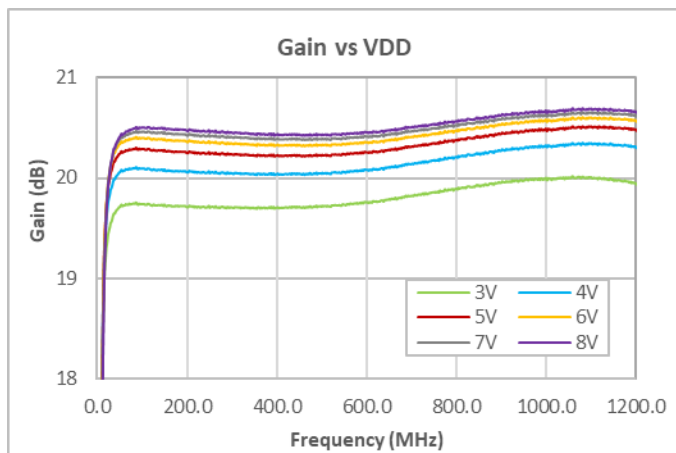
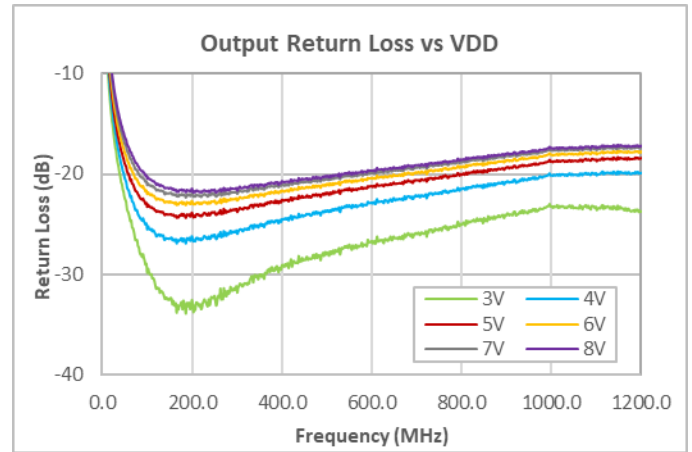
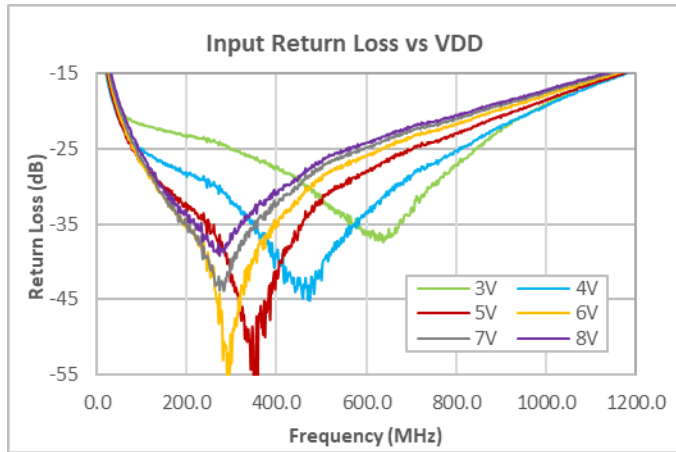
Performance Data – 5 V



Notes:

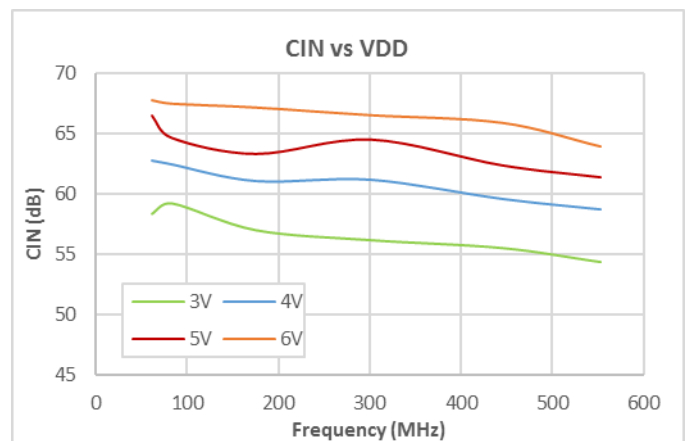
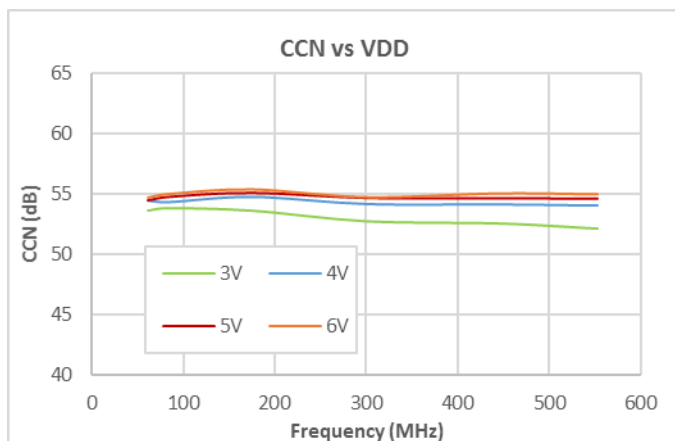
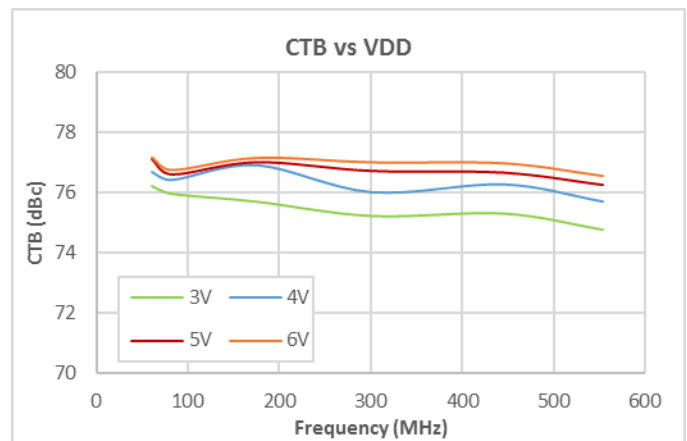
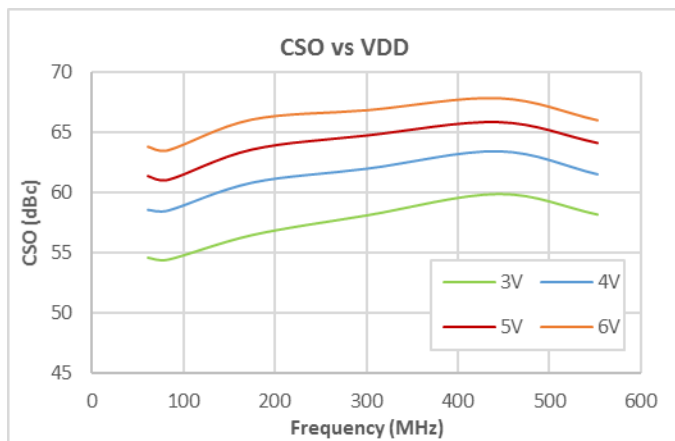
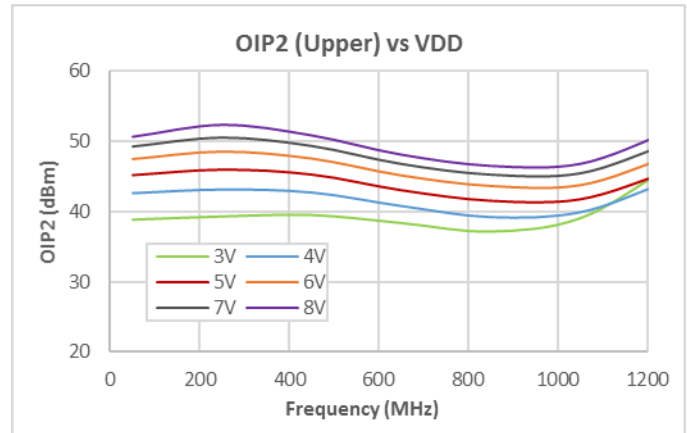
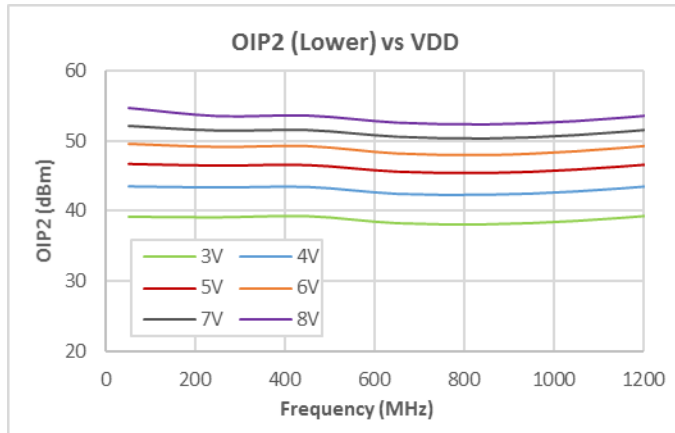
- (1) 1 M Ω Pullup installed in R3, 0 Ω installed in R5. Refer to Evaluation Board Schematic on Pg 5.

Performance Data vs Supply Voltage



Notes:
(1) OIP3: 7 dBm/tone output

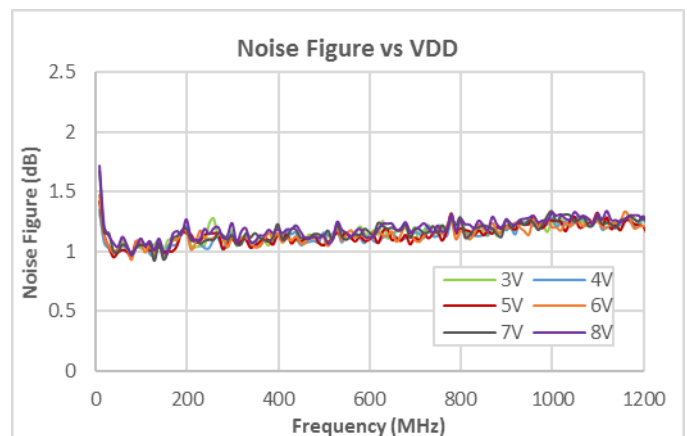
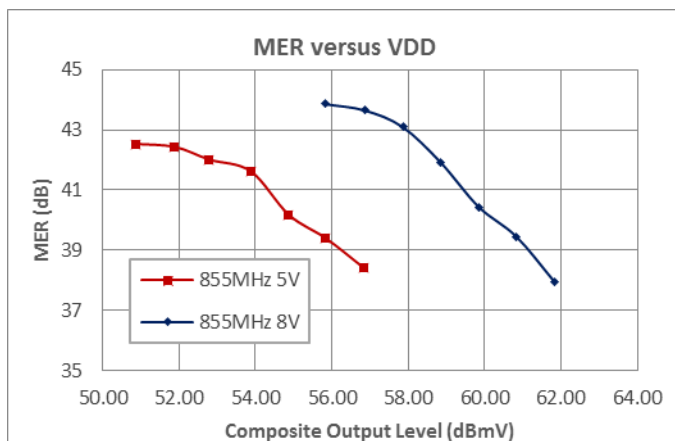
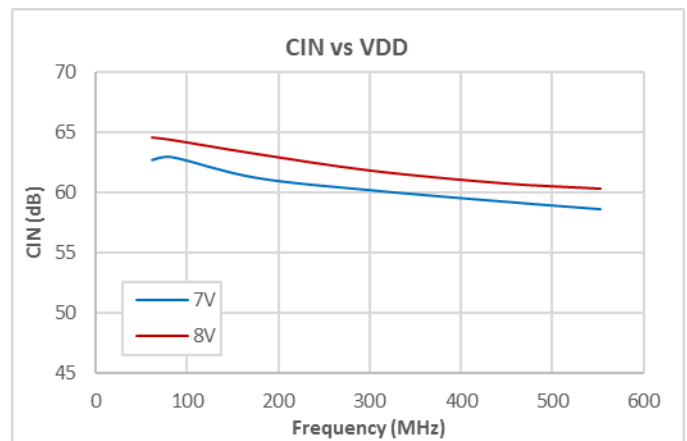
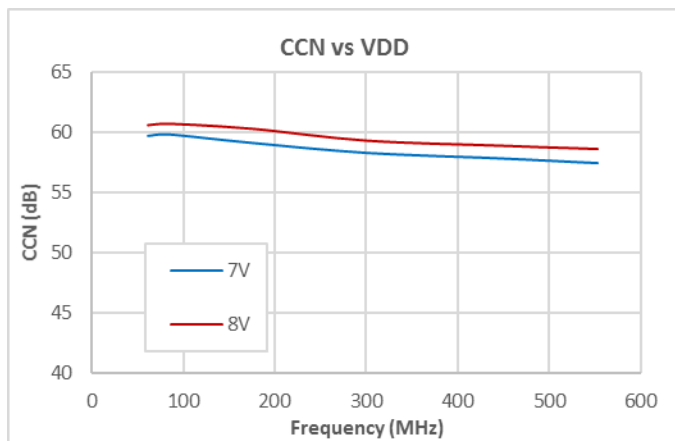
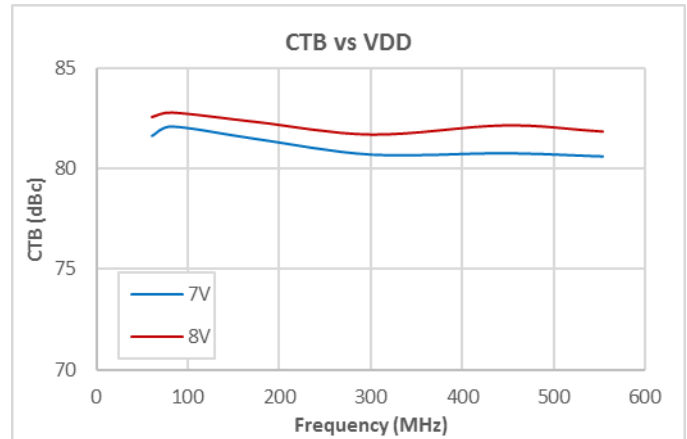
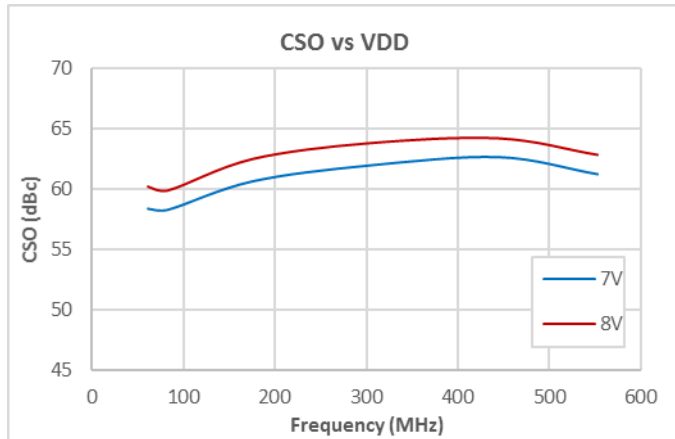
Performance Data vs Supply Voltage



Notes:

- (1) OIP2: 7 dBm / tone output
- (2) CSO/CTB, CCN: 20 dBmV / ch output, 80 NTSC + 108 QAM, flat

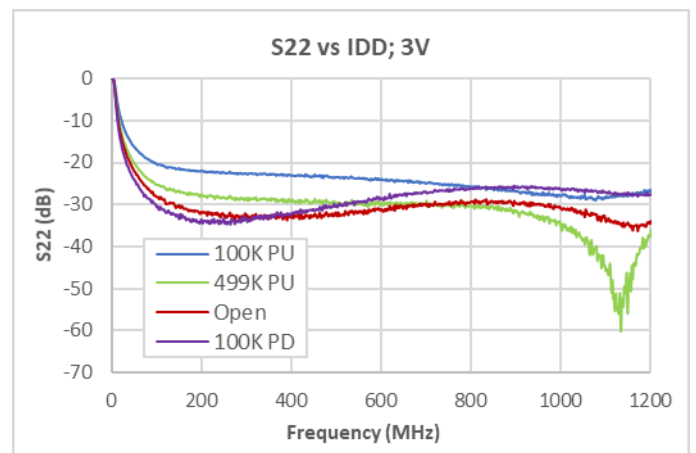
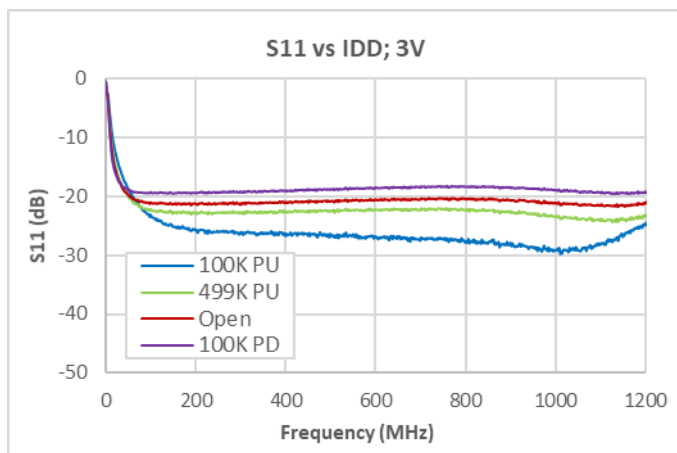
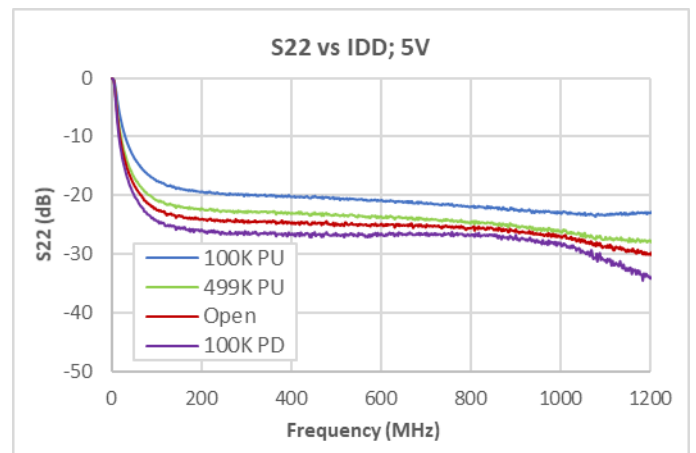
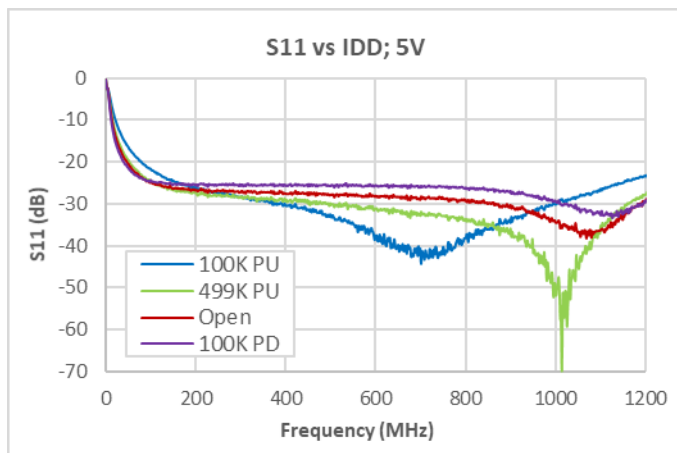
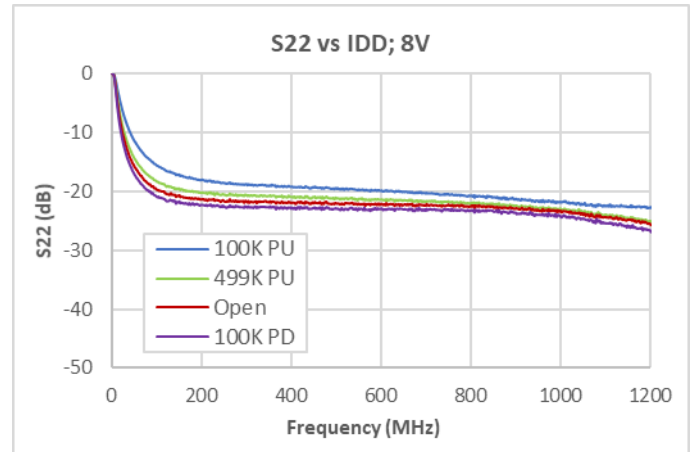
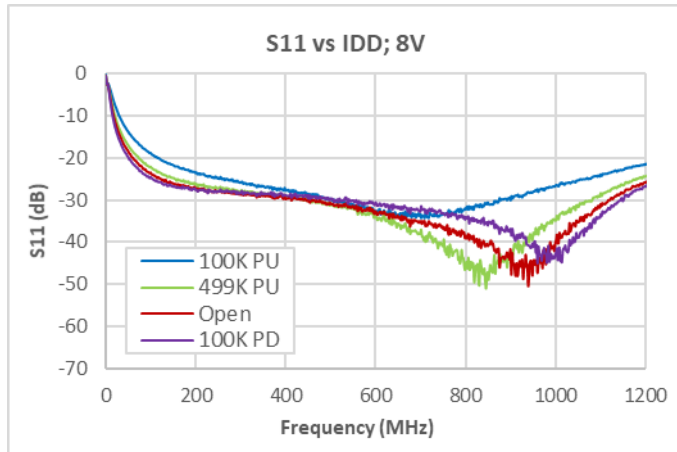
Performance Data vs Supply Voltage



Notes:

- (1) CSO/CTB, CCN: 28 dBmV/ch output, 80 NTSC + 108 QAM, flat
- (2) MER: 190 QAM256 Channels, 57-1215MHz, ITU-T J.83, Annex B

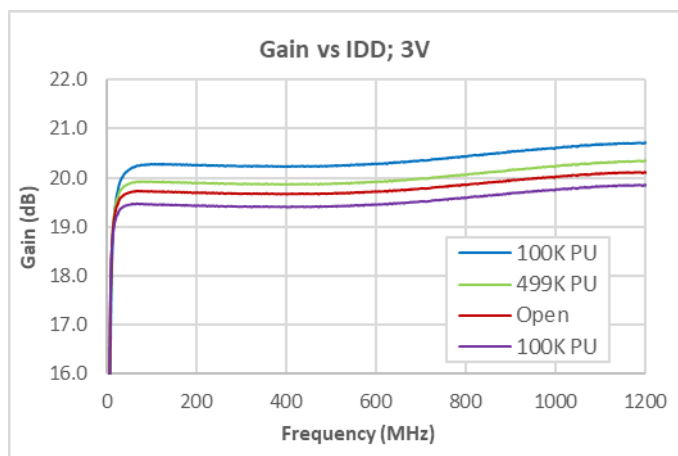
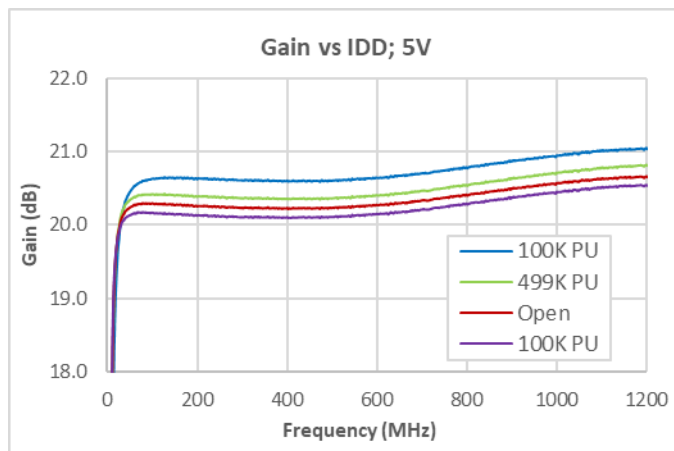
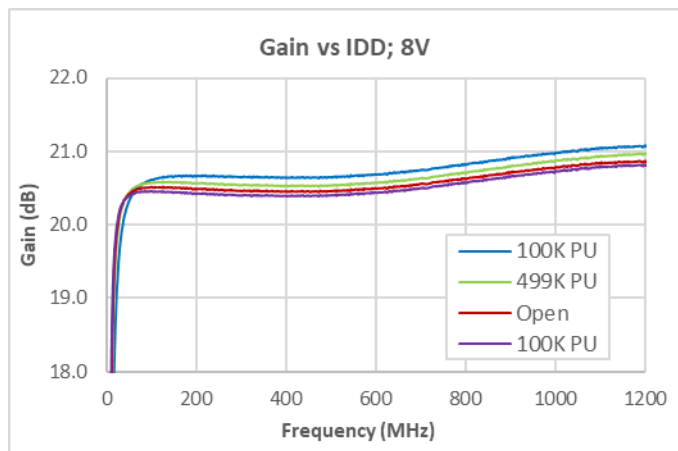
Additional Application Data; Pullup Resistor Options



Notes:

- (1) VDD as noted. 75ohm system.

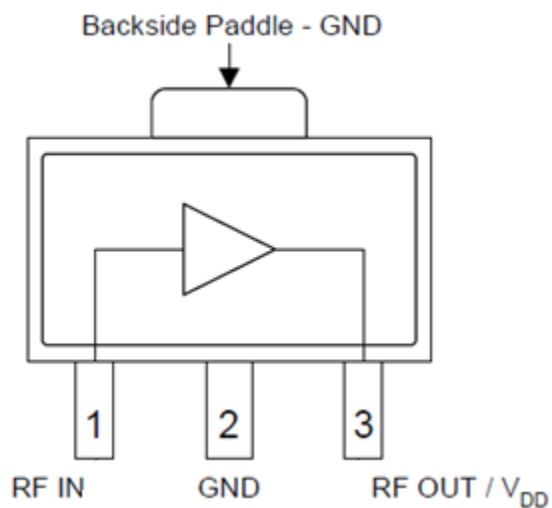
Additional Application Data; Pullup Resistor Options



Notes:

- (1) VDD as noted. 75ohm system.

Pin Configuration and Description



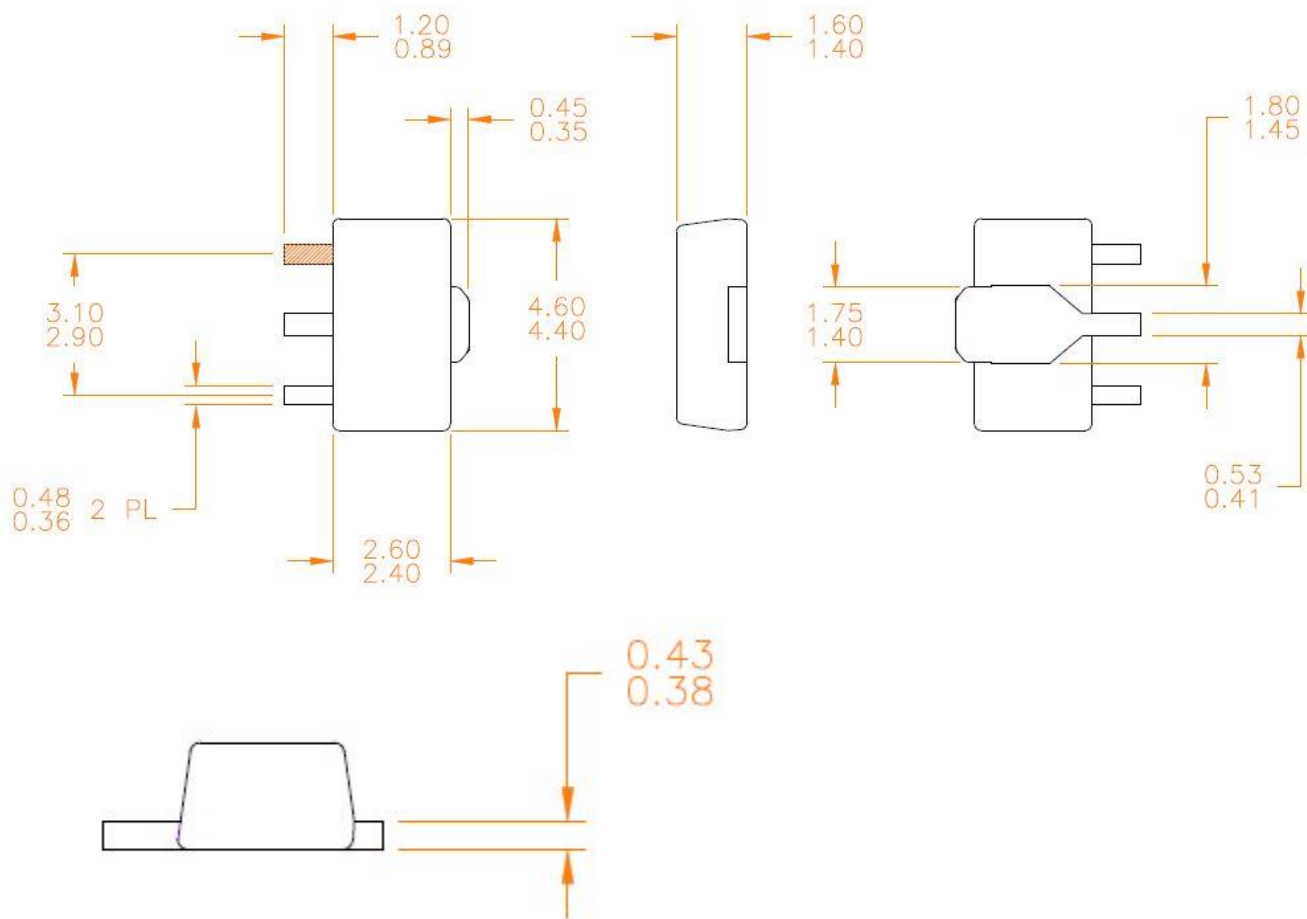
Top View

Pin Number	Label	Description
1	RF IN	RF Input, DC blocking capacitor required
2	GND	Internally Not Connected
3	RF OUT / VDD	RF Output – VDD bias choke required
Backside Paddle	GND	Ground. Use recommended via pattern to minimize inductance and thermal resistance. See PCB Mounting Pattern for suggested footprint.

Package Outline

NOTES:

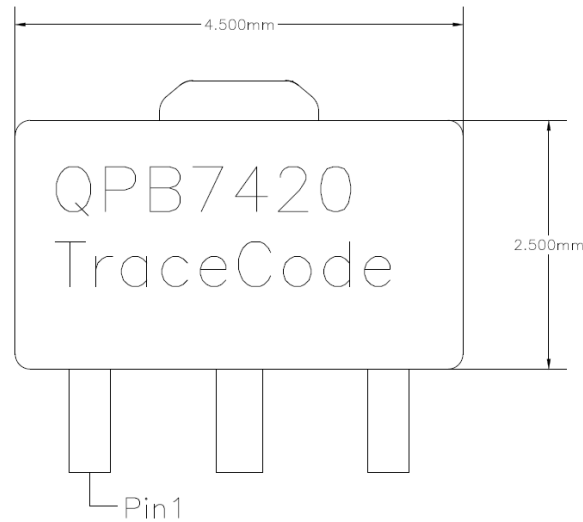
1. SHADED LEAD IS PIN 1.



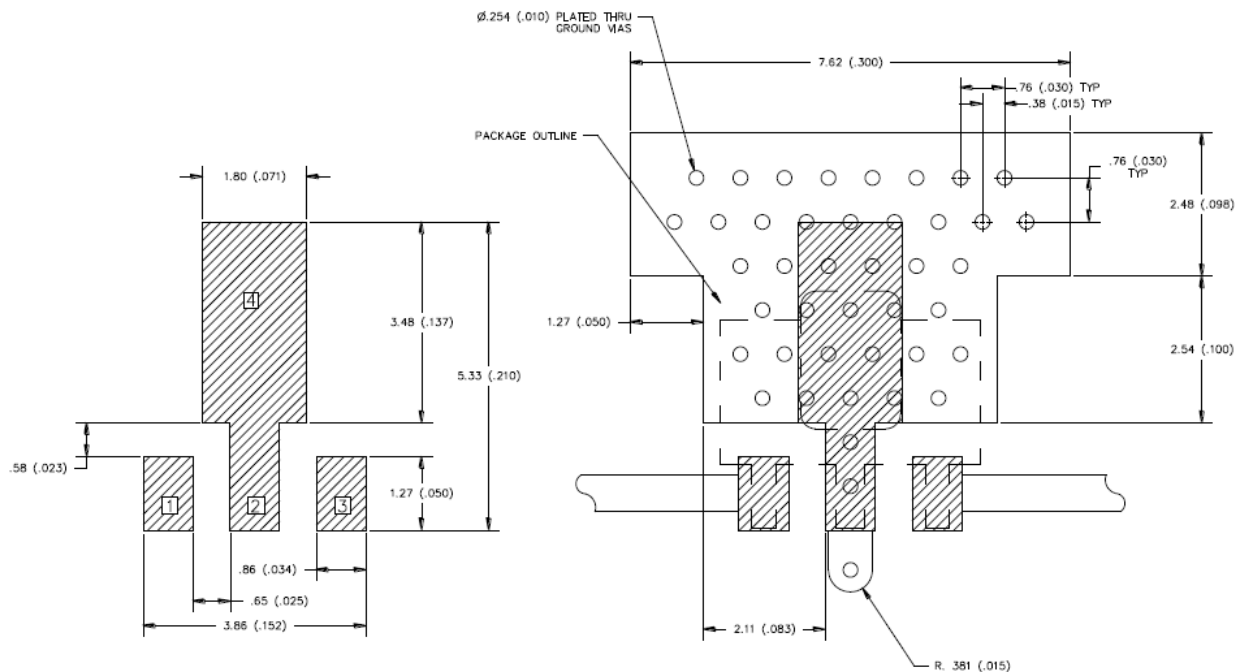
Notes:

1. Dimensions in millimeters

Package Marking



Recommended Mounting Pattern



Notes:

1. Ground/thermal vias are critical for the proper performance of this device. Vias should use a .35 mm (#80/.0135') diameter drill and have a final, plated thru diameter of 0.25 mm (0.010").
2. Add as much copper as possible to inner and outer layers near the part to ensure optimal thermal performance.
3. RF trace width depends upon the PC board material and construction.
4. All dimensions are in millimeters (inches). Angles are in degrees.

Handling Precautions

Parameter	Rating	Standard
ESD – Human Body Model (HBM)	1B (500V)	ESDA / JEDEC JS-001-2012
ESD – Charged Device Model (CDM)	C1 (1000V)	JEDEC JESD22-C101F
MSL – Moisture Sensitivity Level	MSL1	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: Matte Sn

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:

- 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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