QPB7425

75 Ω 25 dB CATV Amplifier (47 – 1218 MHz)

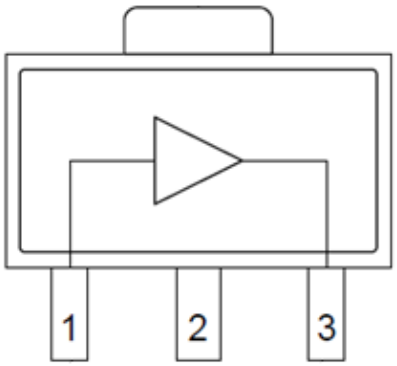
Product Overview

The QPB7425 is a GaAs pHEMT single ended RF amplifier IC featuring 25 dB of flat gain and low noise. This IC is designed to support Fiber to The Home (FTTH) applications from 47 to 1218 MHz using a single 8 V supply. Operation down to 3 V is possible for applications with reduced linearity requirements. QPB7425 offers extremely 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, or 8 V supply
- Gain; 25 dB Typical
- Noise Figure; 0.9 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 Nodes
- FDx Return Path
- Satellite Low Noise Amplifier
- Cable Modem and Set Top Box
- 50ohm LNA

Ordering Information

Part Number	Description
QPB7425SQ	Sample bag with 25 pieces
QPB7425SR	7" Reel with 100 pieces
QPB7425TR13	13" Reel with 2500 pieces
QPB7425PCK	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 – 3V

Parameter	Condition [1]	Min	Typ	Max	Unit
Supply Voltage (V_{DD})			3		V
Supply Current (I_{DD})			40		mA
Frequency Range		47		1218	MHz
Gain			24		dB
Gain Slope			0.5		dB
Reverse Isolation			26		dB
Input Return Loss			17		dB
Output Return Loss			16		dB
Noise Figure			1.2		dB
CSO	21 dBmV / ch output, 80 NTSC + 108 QAM, flat		51		dBc
CTB	21 dBmV / ch output, 80 NTSC + 108 QAM, flat		73		dBc
CCN	21 dBmV / ch output, 80 NTSC + 108 QAM, flat		50		dB
OIP2L	7 dBm / tone output		36		dBm
OIP2H	7 dBm / tone output		37		dBm
OIP3	7 dBm / tone output		27		dBm
OP1dB			15.4		dBm
Thermal Resistance	Θ_{JC}		35		˚C/W

Notes:

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

Electrical Specifications – 5V

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			25		dB
Gain Slope			0.5		dB
Reverse Isolation			26.4		dB
Input Return Loss			20		dB
Output Return Loss			17		dB
Noise Figure			1.1		dB
CSO	21 dBmV / ch output, 80 NTSC + 108 QAM, flat		59		dBc
CTB	21 dBmV / ch output, 80 NTSC + 108 QAM, flat		75		dBc
CCN	21 dBmV / ch output, 80 NTSC + 108 QAM, flat		52		dB
OIP2L	7 dBm / tone output		44		dBm
OIP2H	7 dBm / tone output		41		dBm
OIP3	7 dBm / tone output		37		dBm
OP1dB			20.6		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

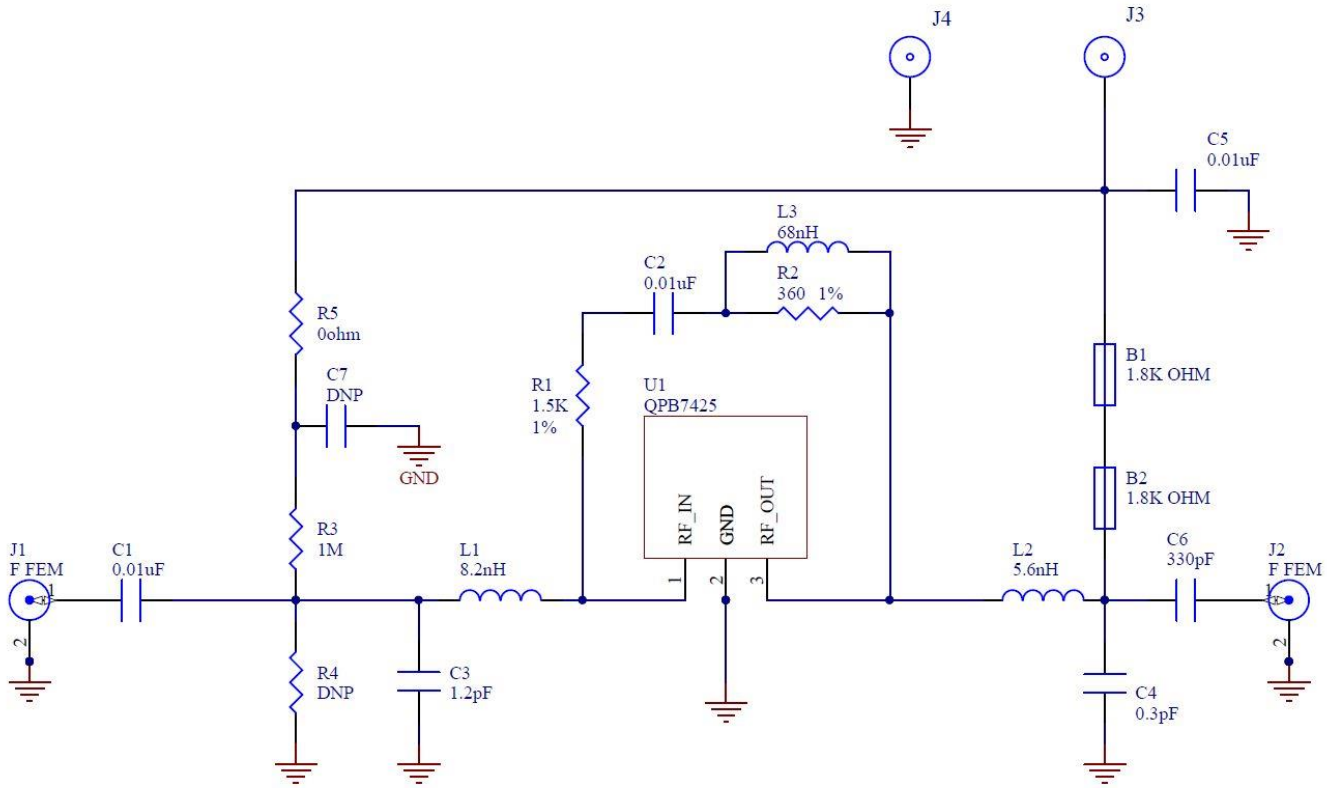
Electrical Specifications – 8V

Parameter	Condition [1]	Min	Typ	Max	Unit
Supply Voltage (V_{DD})			8		V
Supply Current (I_{DD})			105		mA
Frequency Range		47		1218	MHz
Gain			25		dB
Gain Slope			-0.5		dB
Reverse Isolation			27		dB
Input Return Loss			19		dB
Output Return Loss			16		dB
Noise Figure			1.1		dB
CSO	29 dBmV / ch output, 80 NTSC + 108 QAM, flat		57		dBc
CTB	29 dBmV / ch output, 80 NTSC + 108 QAM, flat		80		dBc
CCN	29 dBmV / ch output, 80 NTSC + 108 QAM, flat		56		dB
OIP2L	7 dBm / tone output		50		dBm
OIP2H	7 dBm / tone output		45		dBm
OIP3	7 dBm / tone output		39		dBm
OP1dB			24.7		dBm
Thermal Resistance	Θ_{JC}		35		°C/W

Notes:

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

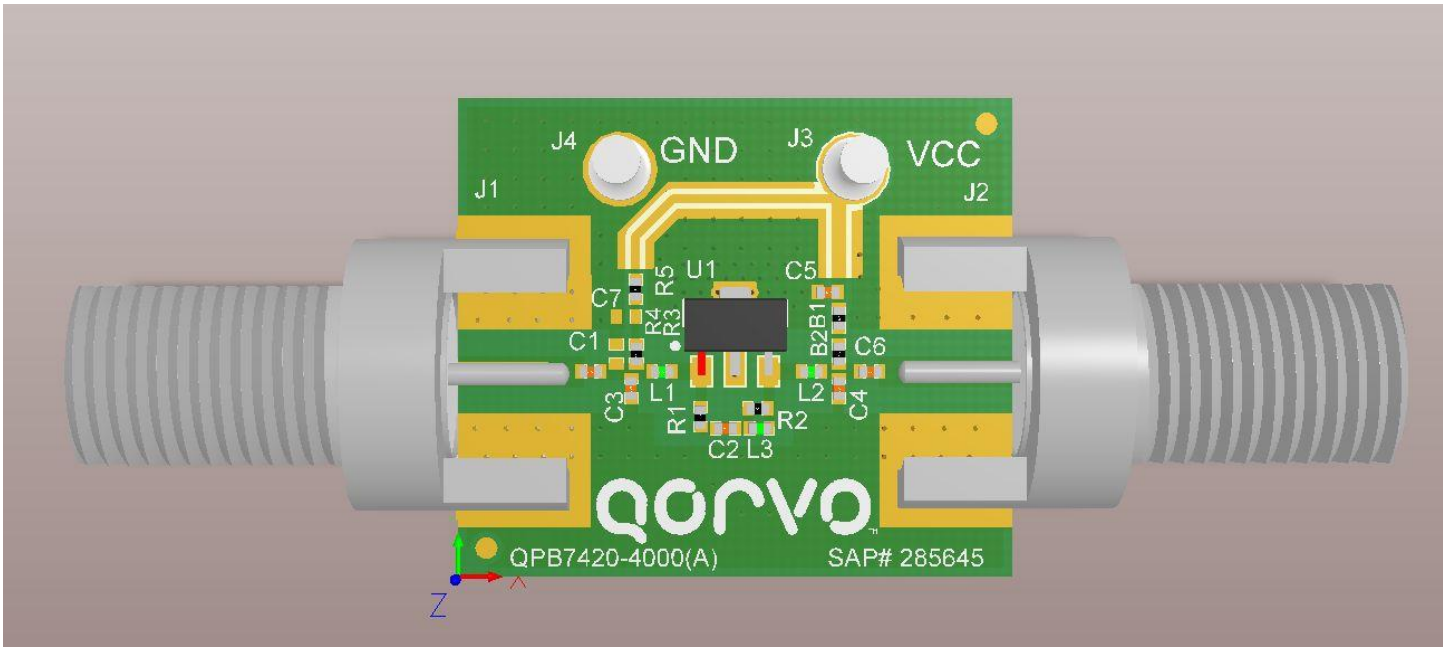
Evaluation Board Schematic (47 – 1218 MHz)



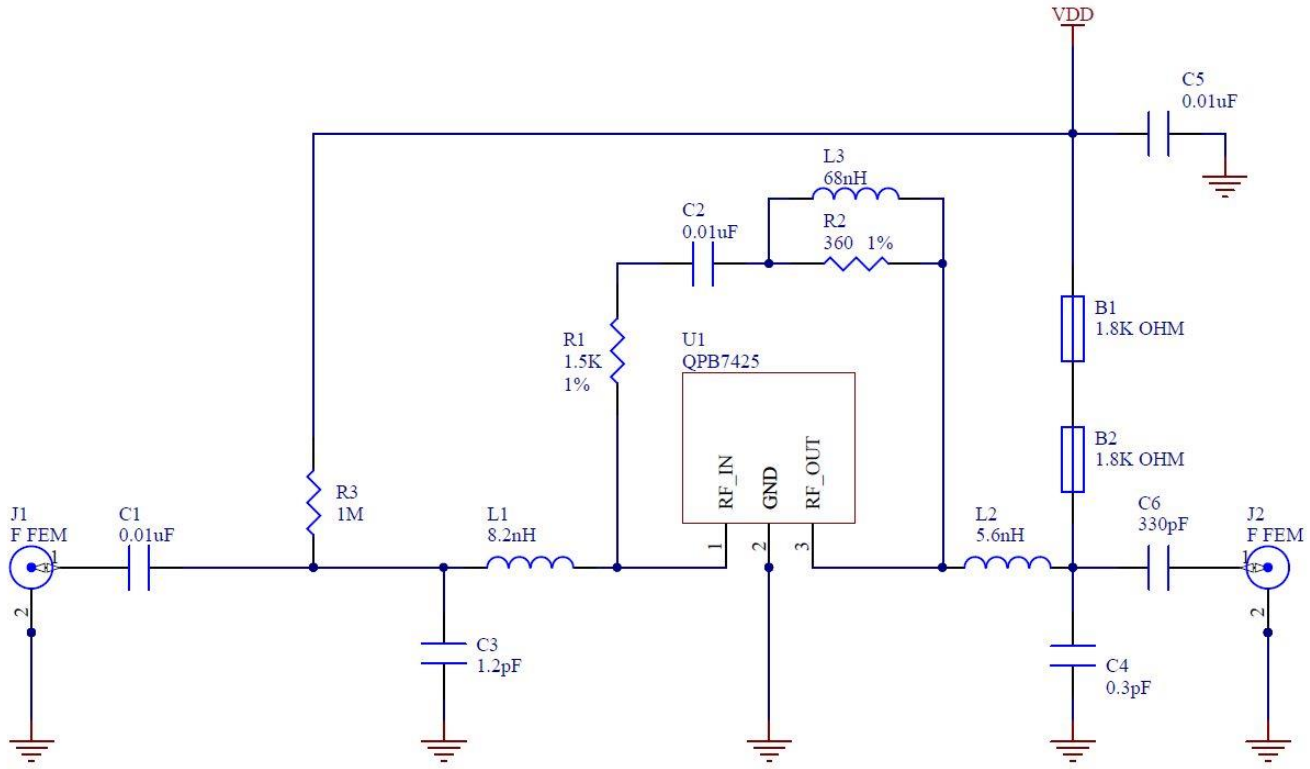
Evaluation Board Bill of Materials

Designator	Description	Manufacturer	Part Number
PCB	QPB7420-4000	DDI	QPB7420-4000(A)
U1	25dB FTTH Amplifier	Qorvo	QPB7425SB
B1, B2	FER, BEAD, 1.8K, 200mA, 0402	TDK	MMZ1005A182ET000
C1, C2, C5	CAP, 10000pF, 10%, 50V, X7R, 0402	Murata Electronics	GRM155R71H103KA88D
C3	CAP, 1.2pF, +/-0.1pF, 50V, C0G, 0402	Murata Electronics	GRM1555C1H1R2BA01D
C4	CAP, 0.3pF, +/-0.05pF, 50V, C0G, 0402	Murata Electronics	GRM1555C1HR30WA01D
C6	CAP, 330pF, 5%, 50V, C0G, 0402	Murata Electronics	GRM1555C1H331JA01D
R1	RES, 1.5 K Ω, 1%, 1/16W, 0402	Panasonic Industrial	ERJ-2RKF1501X
R2	RES, 360 Ω, 1%, 1/10W, 0402	Kamaya, Inc	RMC1/16SK3600FTH
R3	RES, 1M, 5%, 1/16W, 0402	Kamaya, Inc	RMC1/16S-105JTH
R5	RES, 0 Ω, 5%, 1/10W, 0402	Kamaya, Inc	RMC1/16SJPTH
L1	IND, 8.2nH, 2%, 550mA, M/L, 0402	Murata Electronics	LQG15HS8N2G02D
L2	IND, 5.6nH, ±0.1nH, 650mA, M/L, 0402	Murata Electronics	LQG15HS5N6B02D
L3	IND, 68nH, 2%, 250mA, M/L, 0402	Murata Electronics	LQG15HS68NG02D
J1, J2	CONN, F FEM EDGE MOUNT, 75 Ω, 0.068"	Millimeter Wave	MW-846-C-DD-75
J3, J4	TERM. SOLDER TURRET. .062 PCB	Mill-Max Mfg	2533-0-00-44-00-00-07-0
R4, C7	Not Populated	N/A	N/A

Evaluation Board Assembly Drawing



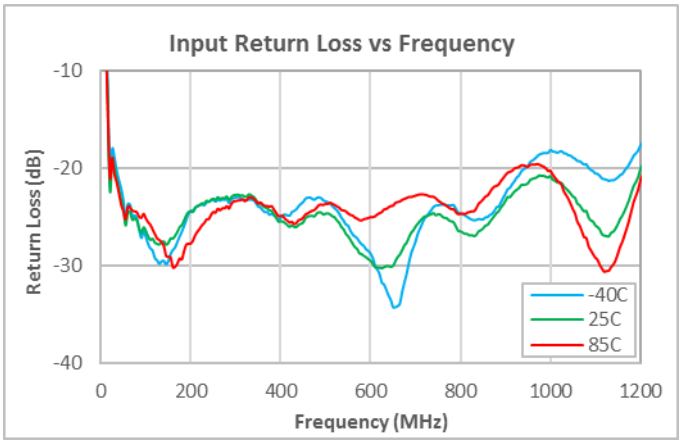
Typical Application Schematic (47 – 1218 MHz)

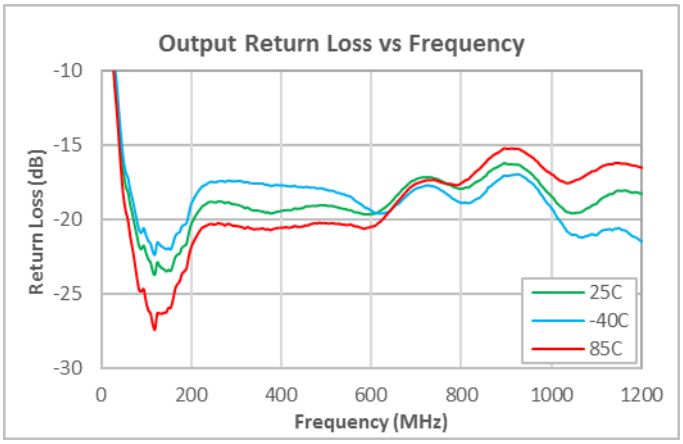


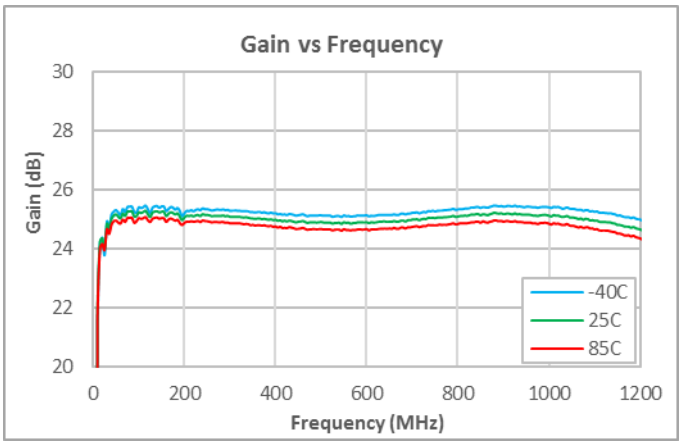
Notes:

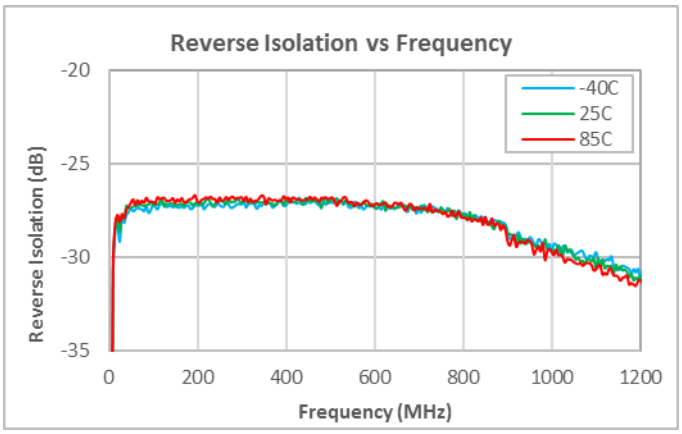
1. C3/L1 tunes input return loss.
2. L2/C4 tunes output return loss with some contribution from C6.
3. R1/L3 sets the level of feedback while B1, B2 provides the bias path with RF isolation from the RF output path.
4. R2 helps control high end tilt/peaking.
5. R3 can be removed for improvement to noise figure and return loss with slight degradation to linearity.

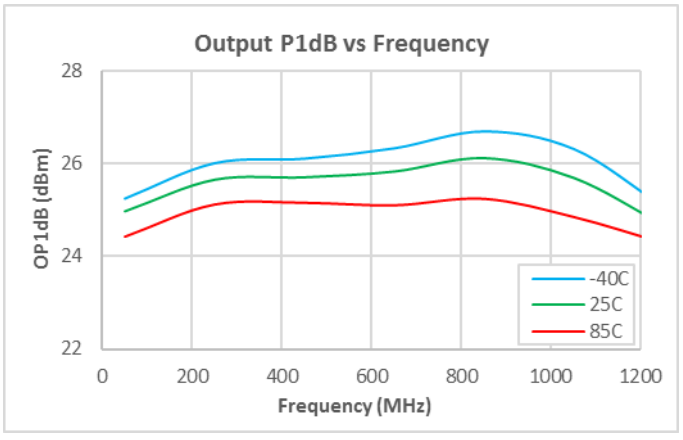
Performance Data – 8V

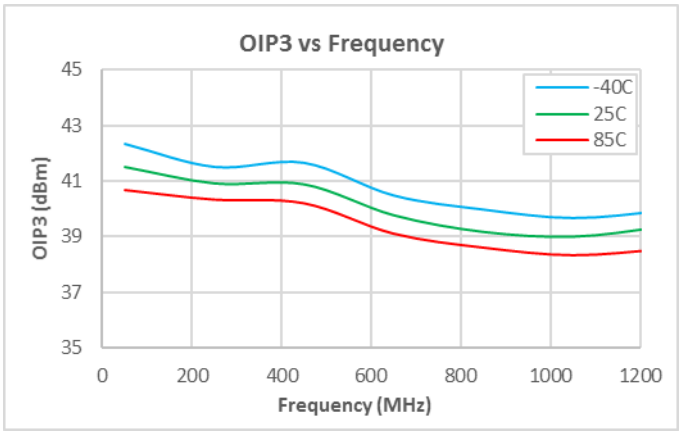








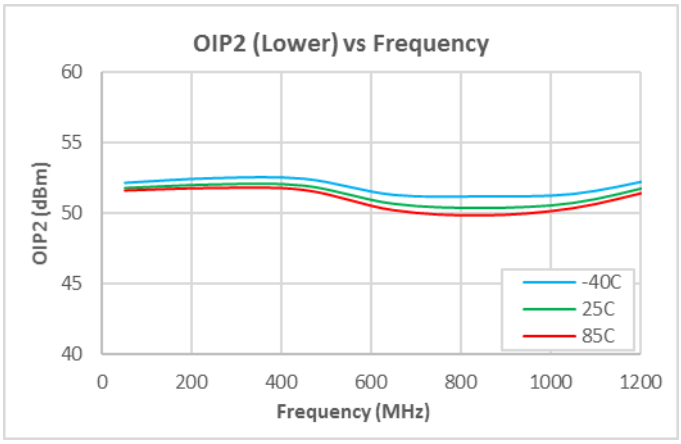


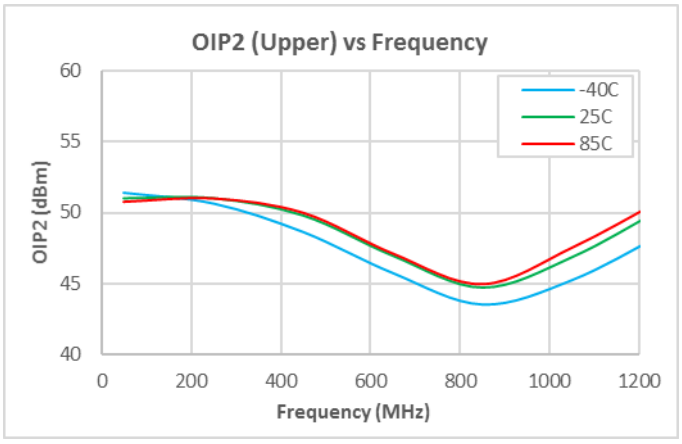


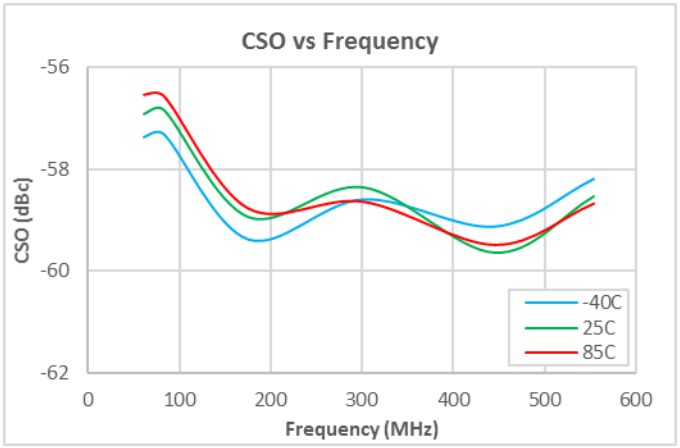
Notes:

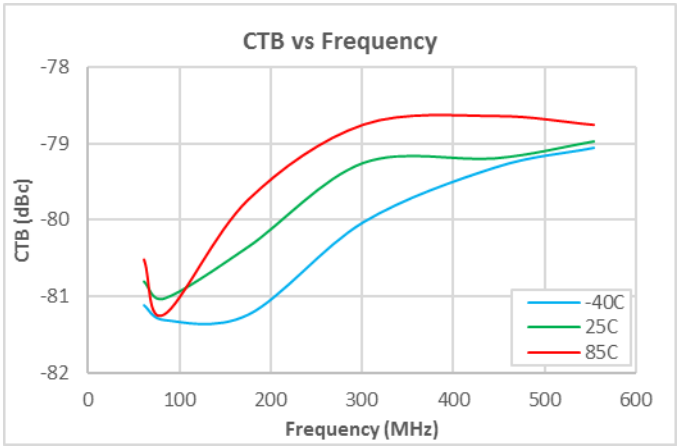
(1) OIP3: 7 dBm / tone output

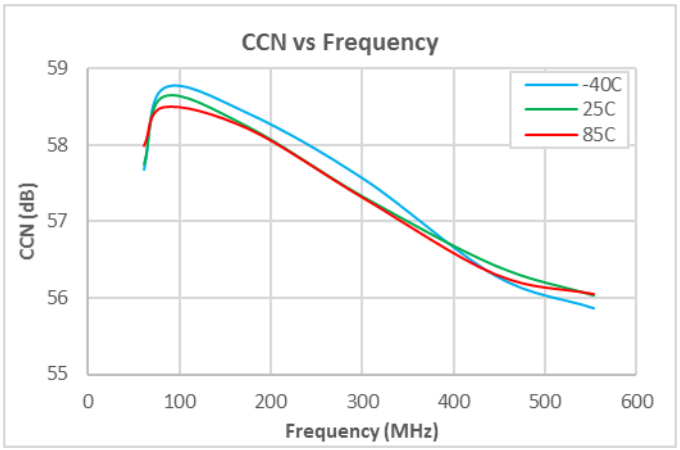
Performance Data – 8V

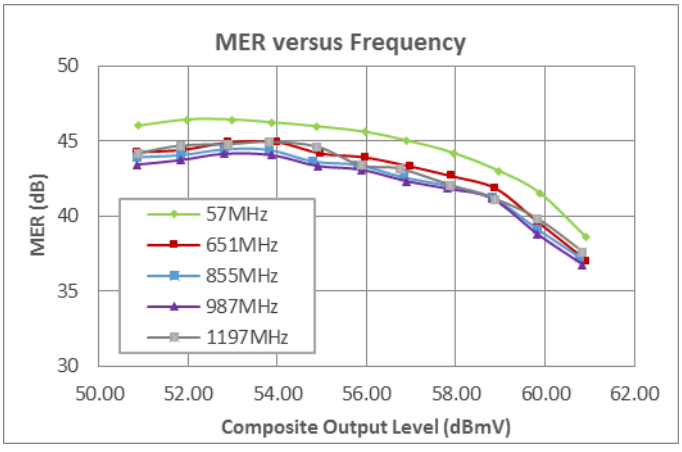








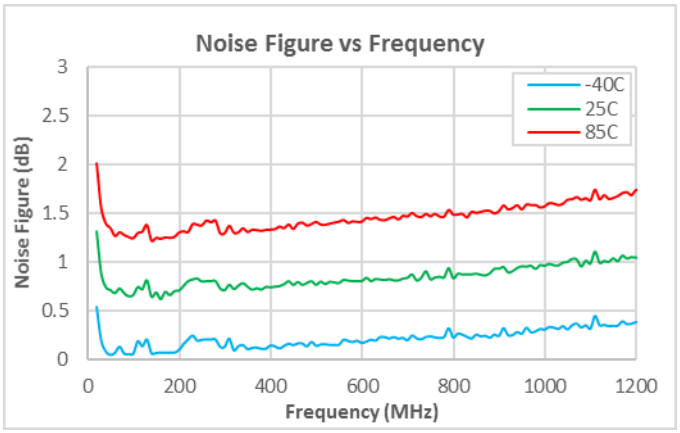


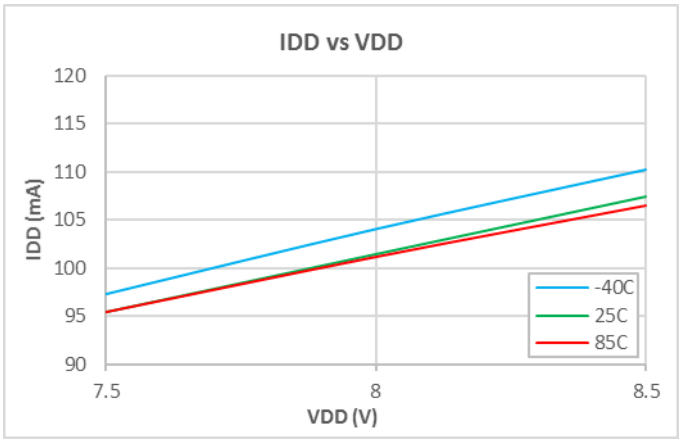


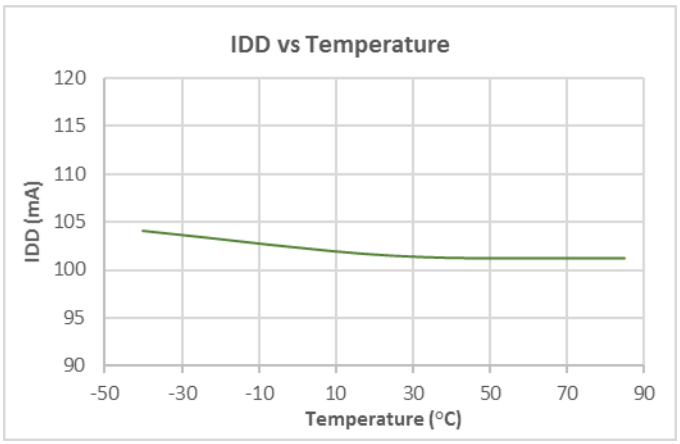
Notes:

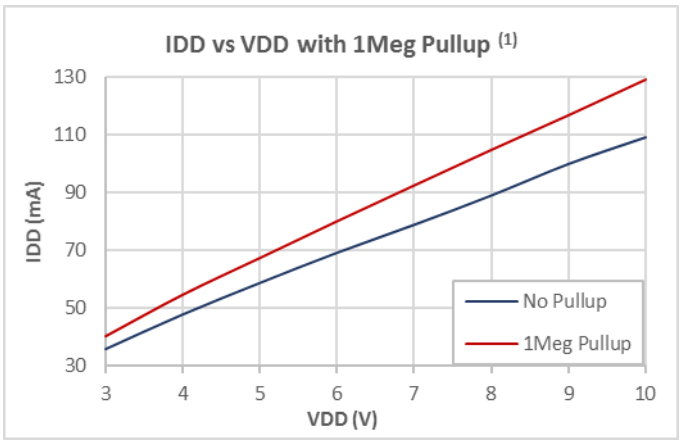
(1) OIP2: 7 dBm / tone output
(2) CSO/CTB, CCN: 29 dBmV / ch output, 80 NTSC + 108 QAM, flat
(3) MER: 190 QAM256 Channels, 57-1215MHz, ITU-T J.83, Annex B

Performance Data – 8V





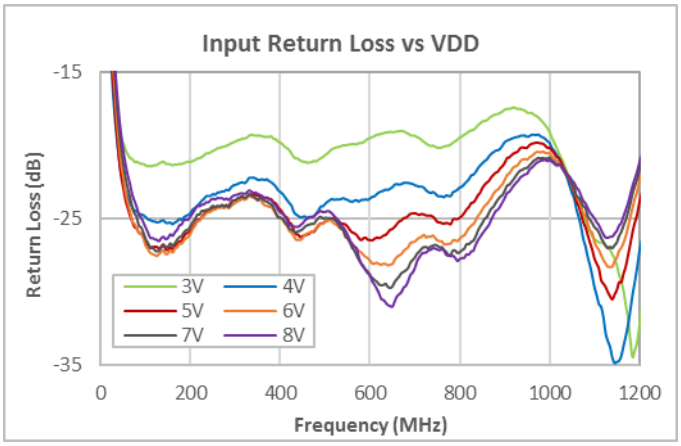


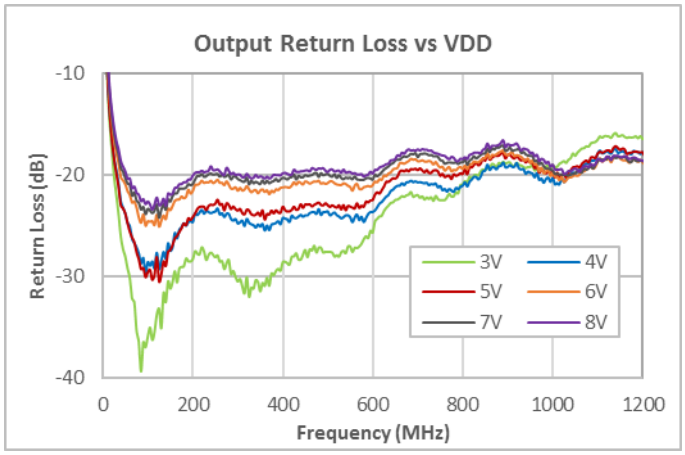


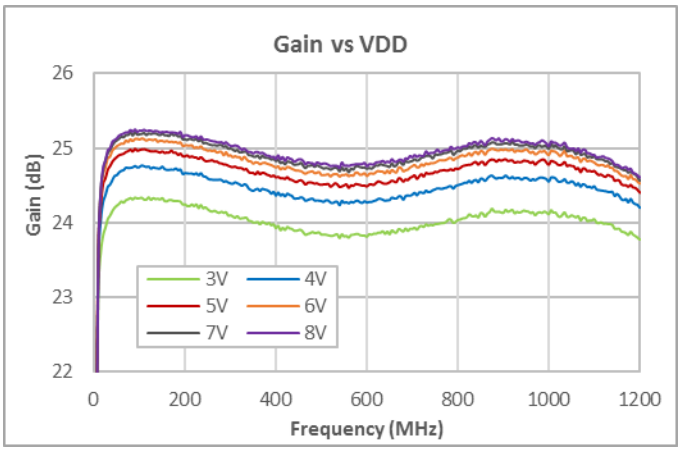
Notes:

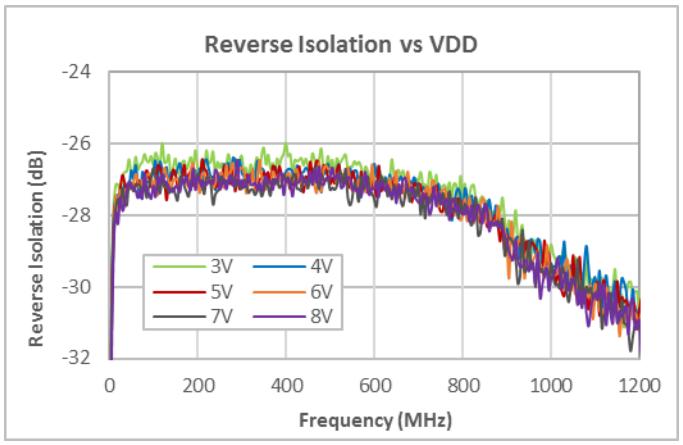
(1) 1Meg Pullup installed in R3, 0 Ω installed in R5. Refer to Evaluation Board Schematic on Pg 5.

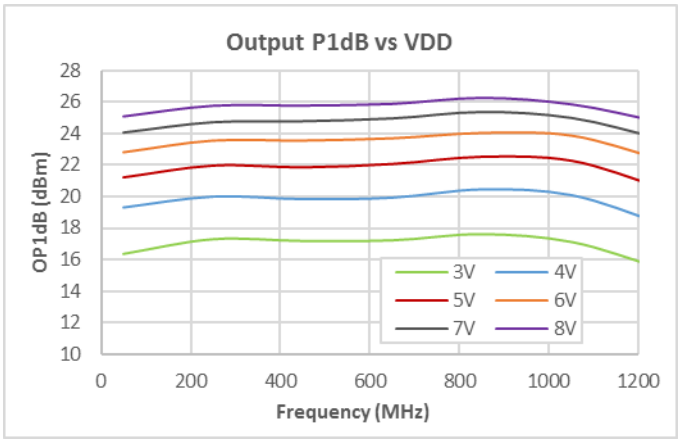
Performance Data vs Supply Voltage

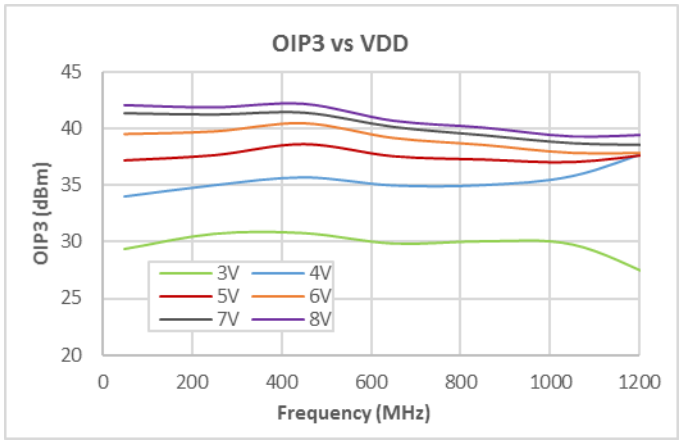








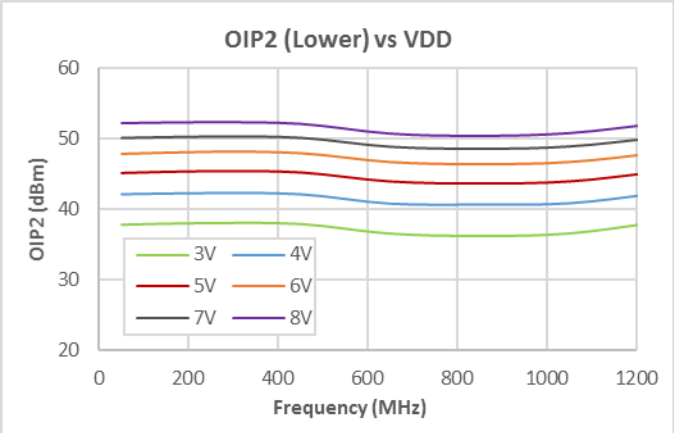


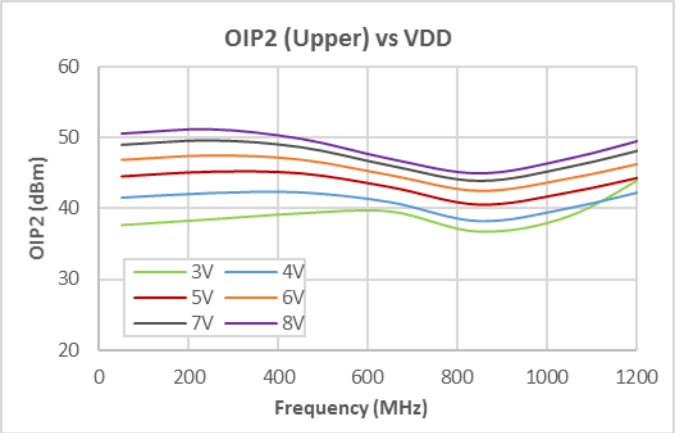


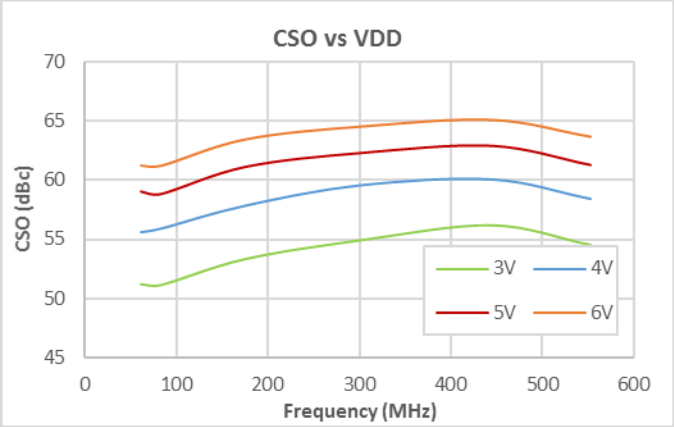
Notes:

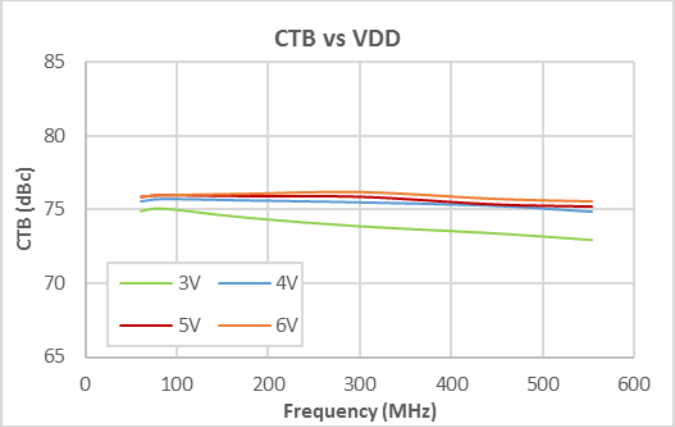
(1) OIP3: 7 dBm / tone output

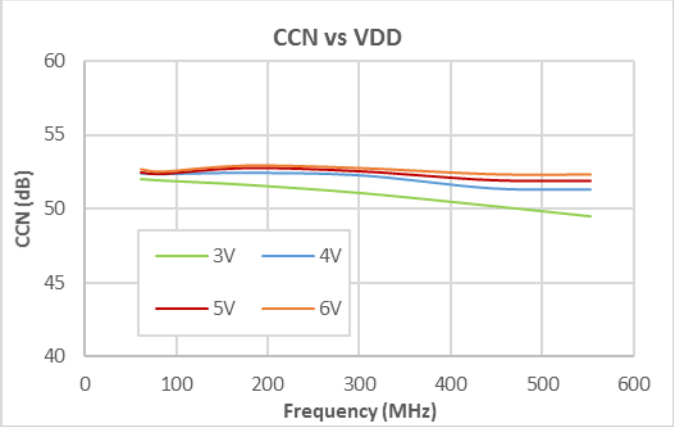
Performance Data vs Supply Voltage

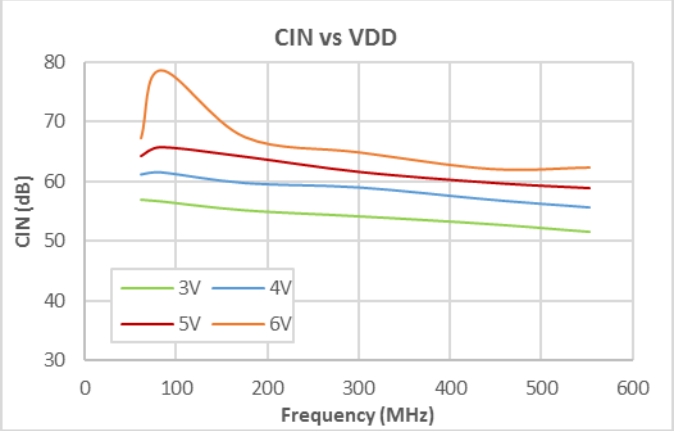






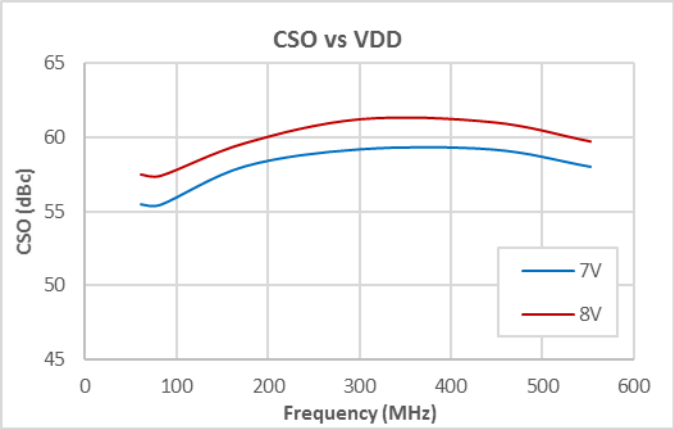


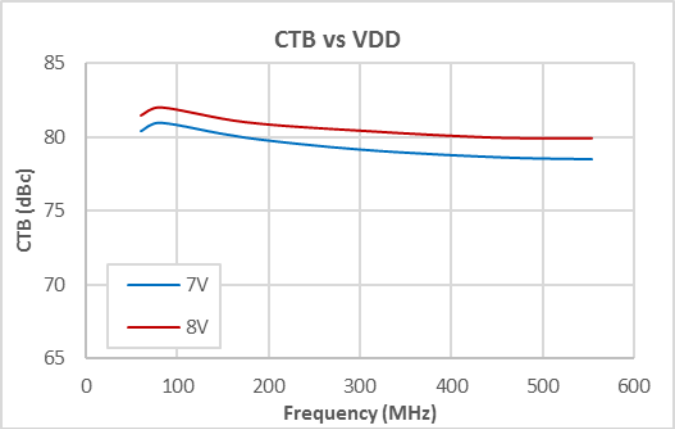


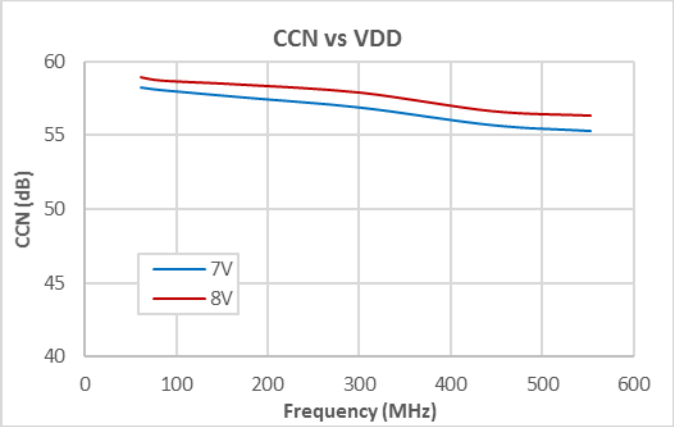


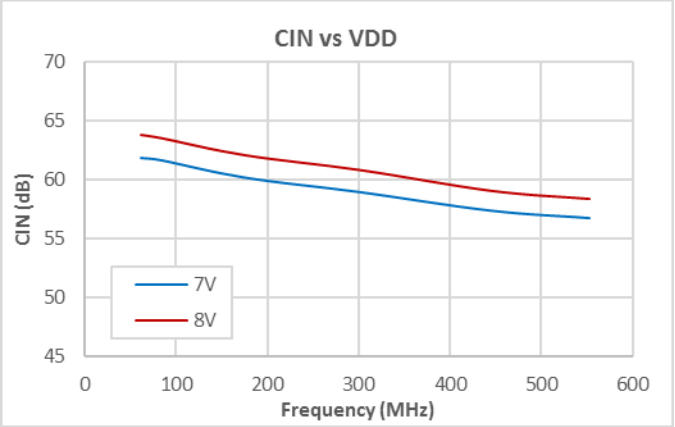
Notes:
(1) OIP2: 7 dBm / tone output
(2) CSO/CTB, CCN: 21 dBmV / ch output, 80 NTSC + 108 QAM, flat

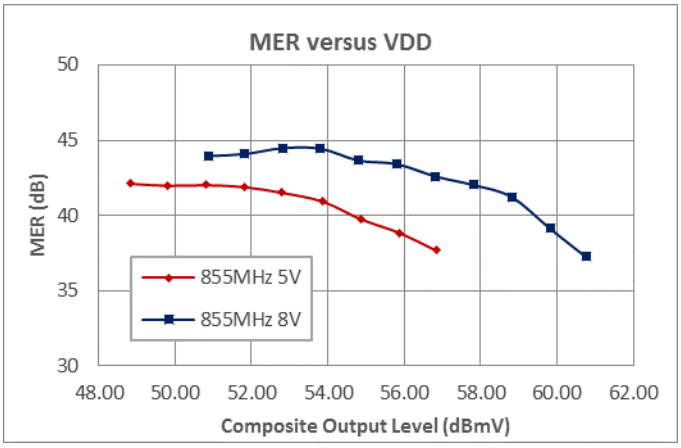
Performance Data vs Supply Voltage

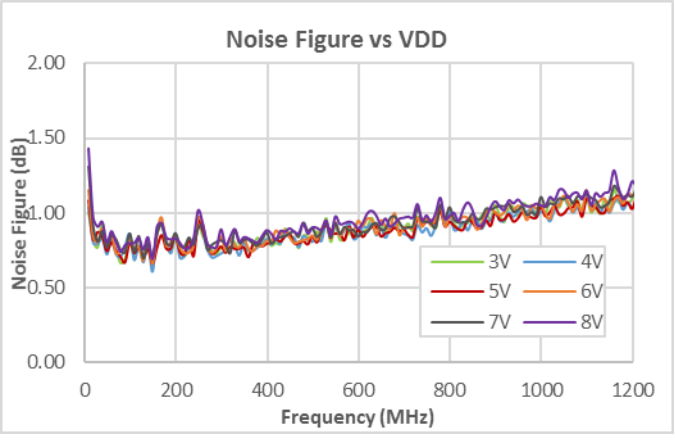












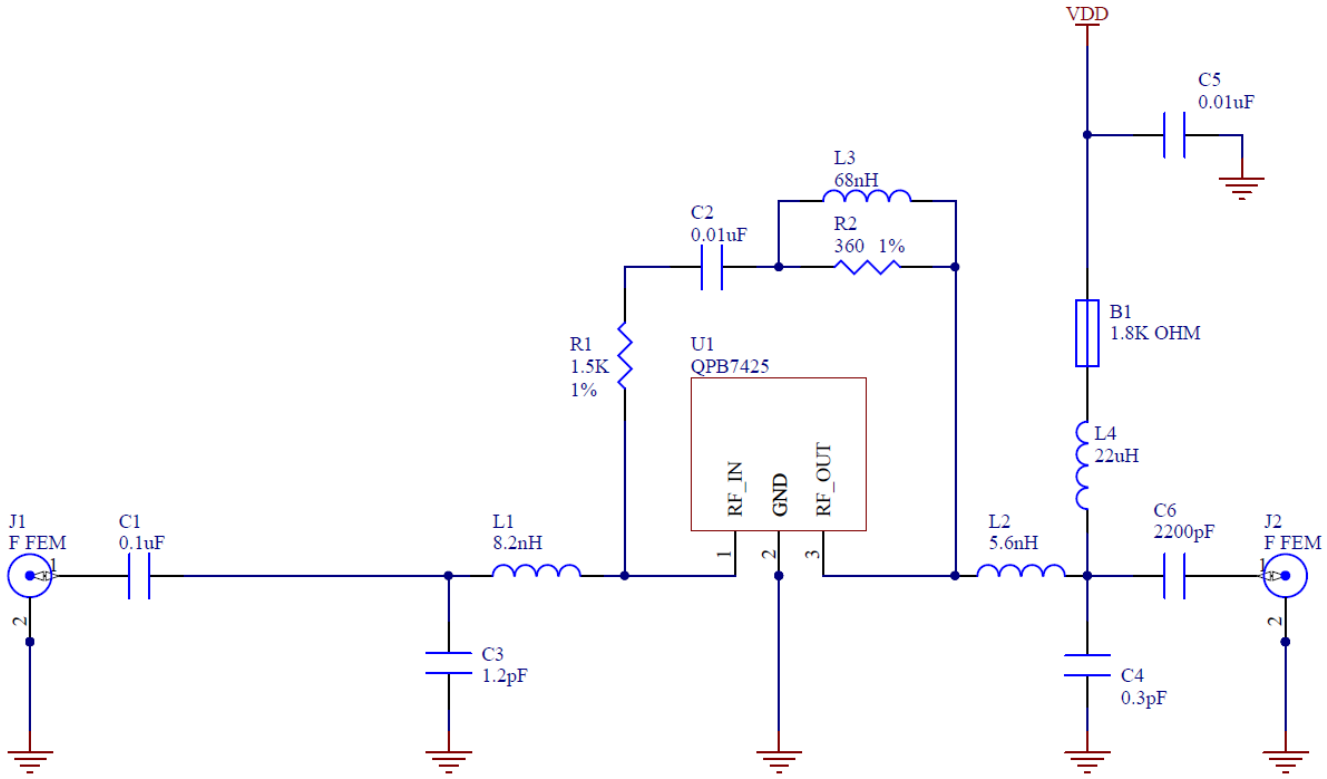
Notes:

(1) CSO/CTB, CCN: 29 dBmV / ch output, 80 NTSC + 108 QAM, flat

(2) MER: 190 QAM256 Channels, 57-1215MHz, ITU-T J.83, Annex B

Additional Applications

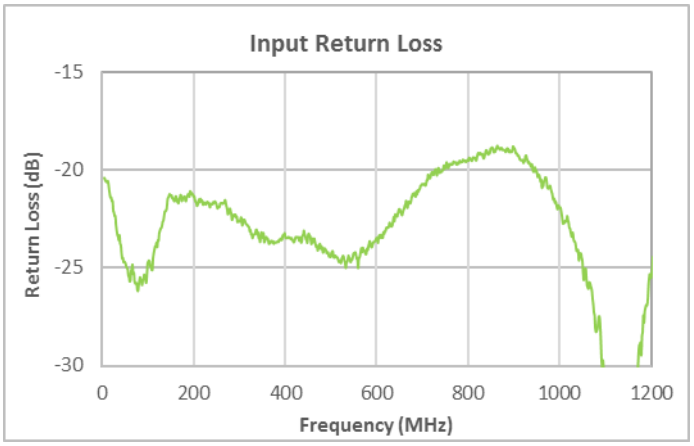
FDx Return Path Schematic (5 – 700MHz)

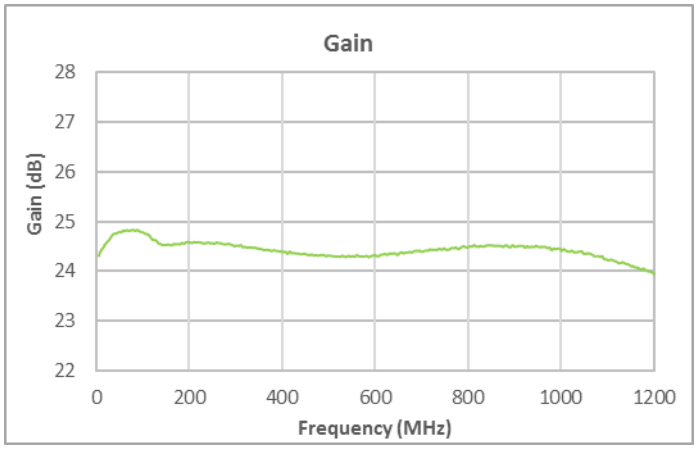


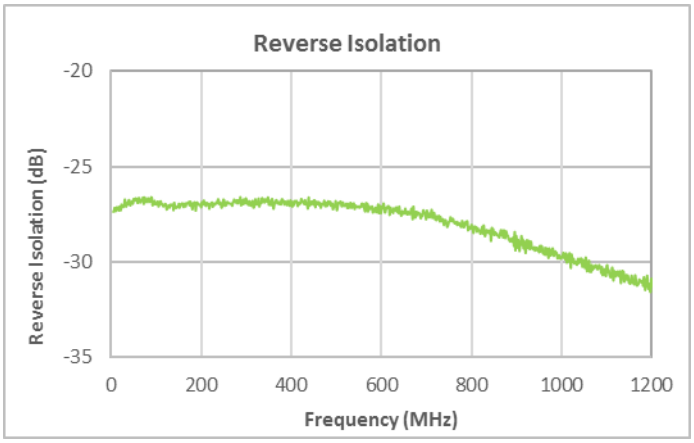
Notes:

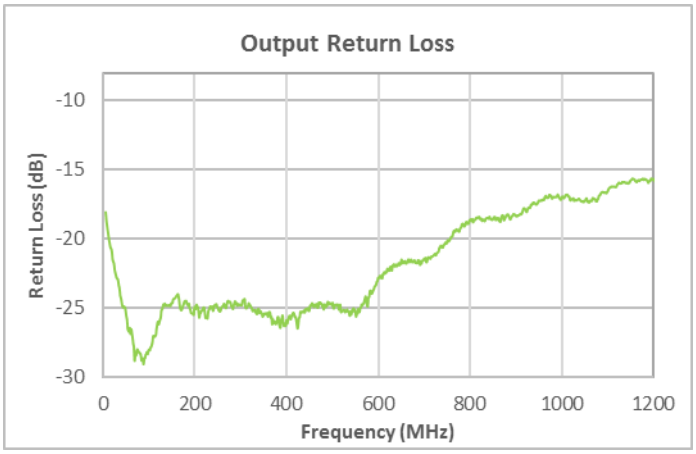
1. C3/L1 tunes input return loss.
2. L2/C4 tunes output return loss with some contribution from C6.
3. R1/L3 sets the level of feedback while B1, L4 provides the bias path with RF isolation from the RF output path.
4. R2 helps control high end tilt/peaking.

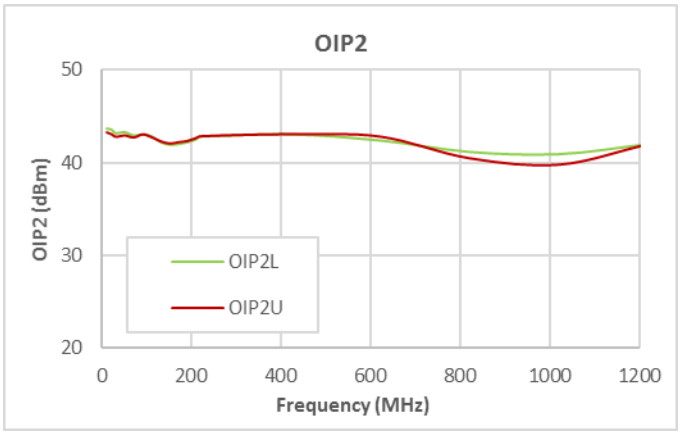
Performance Data (5-700MHz)

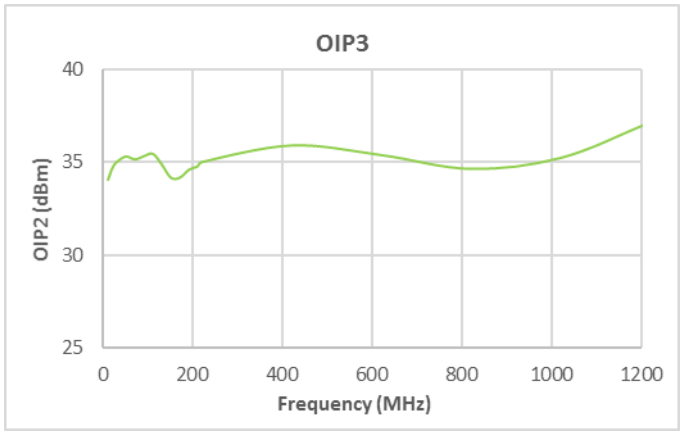










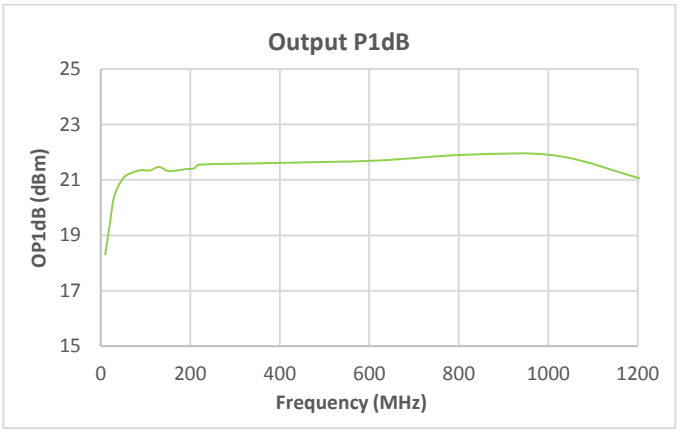


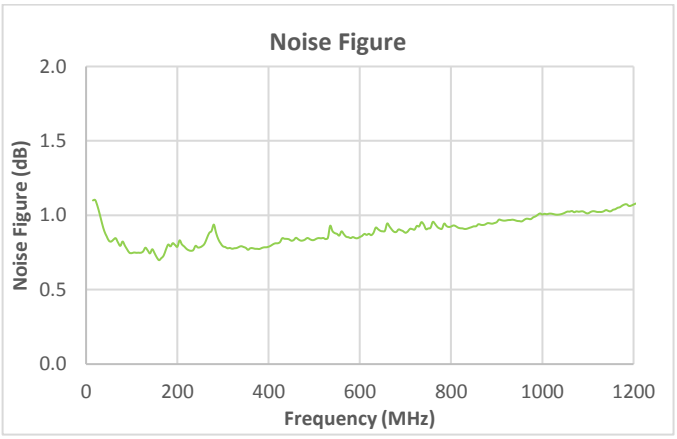
Notes:

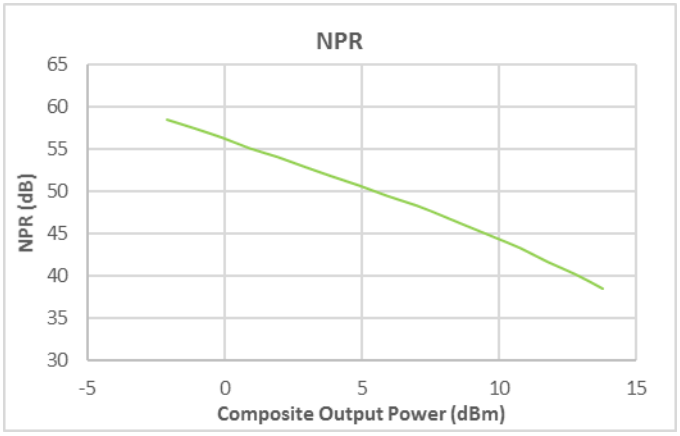
(1) 25C, 75ohm test system.

(2) OIP2, OIP3 tested with 5dBm per output tone

Performance Data (5-700MHz)





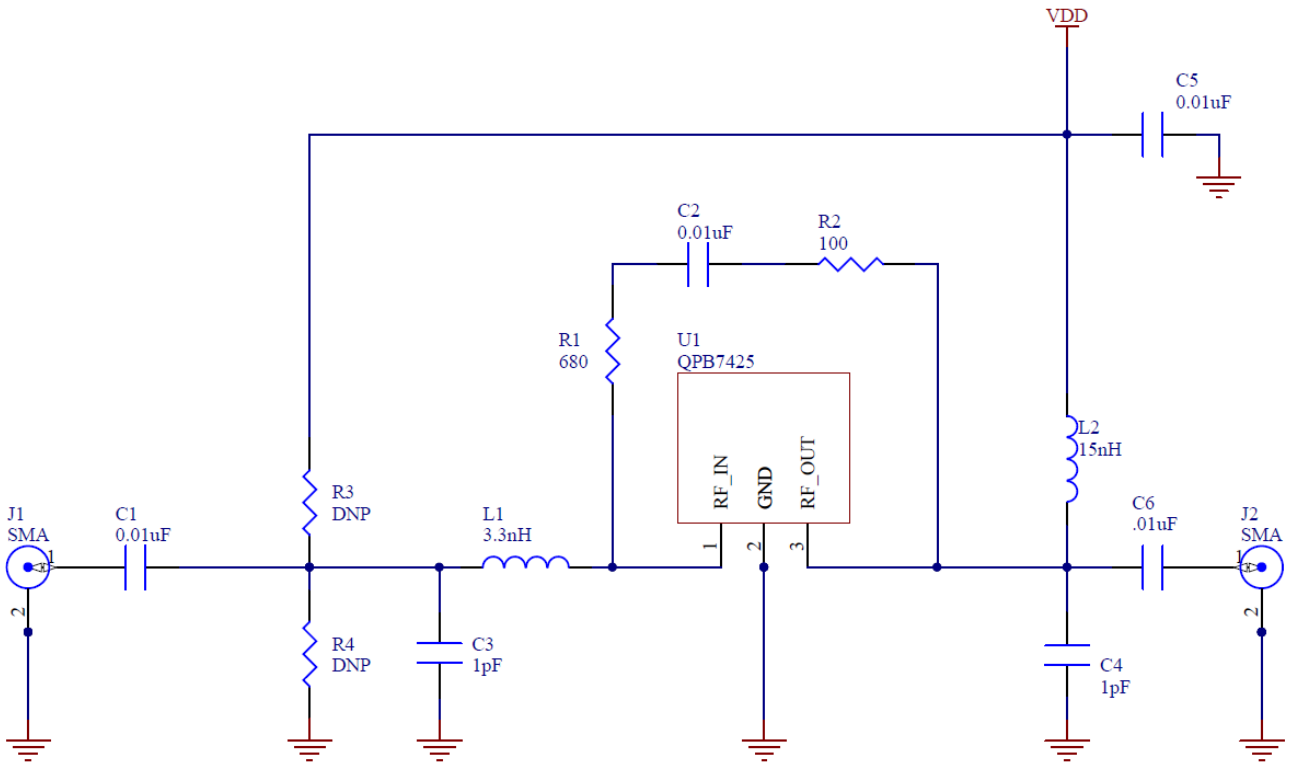


Notes:

(1) 25C, 75ohm test system.

(2) NPR waveform 5-85MHz; 13 6MHz QAM channels, middle channel inactive.

50ohm LNA Schematic (1.0 - 1.6GHz)



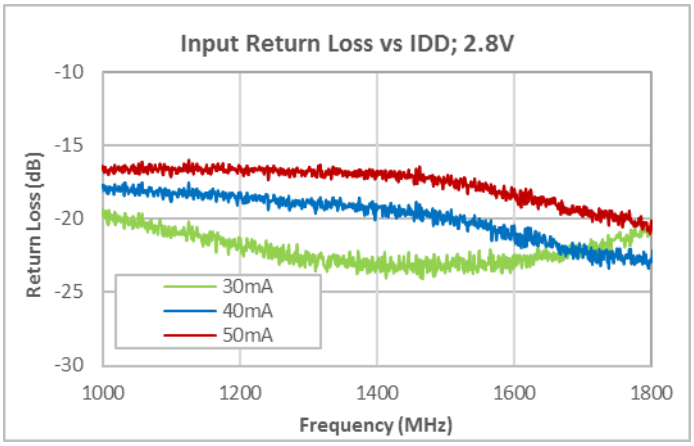
Notes:

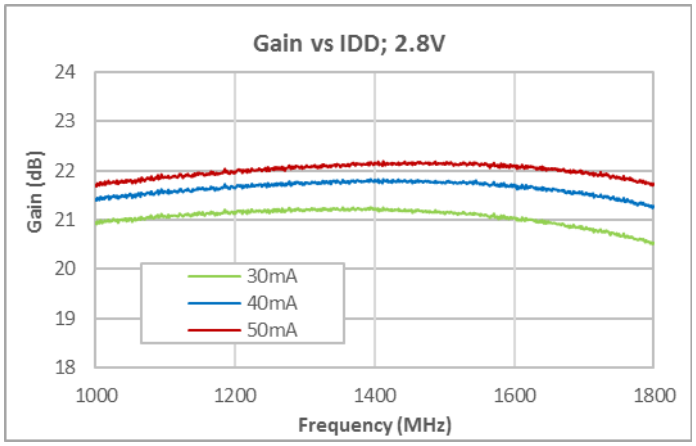
1. C3/L1 tunes input return loss.
2. L2/C4 tunes output return loss with some contribution from C6.
3. R1/L3 sets the level of feedback while B1, B2 provides the bias path with RF isolation from the RF output path.
4. R2 helps control high end tilt/peaking.
5. R3 or R4 can be added to adjust IDD if needed (refer to Table 1 below).
6. Nominal current without pullup/pulldown is 31mA for 2.8V, 57mA for 5V.

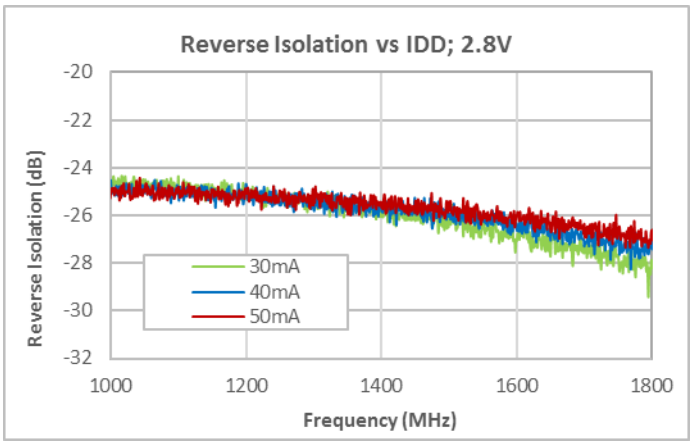
Table 1: R3/R4 vs IDD

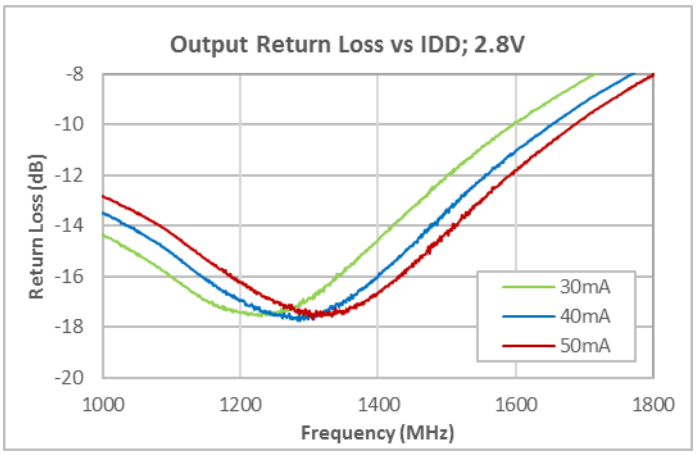
	IDD						
VDD	30mA	40mA	50mA	65mA	80mA	95mA	110mA
2.8V	∞	R3 = 475K	R3 = 221K	x	x	x	x
5V	x	x	R4 = 205K	R3 = 887K	R3 = 365K	R3 = 237K	R3 = 169K

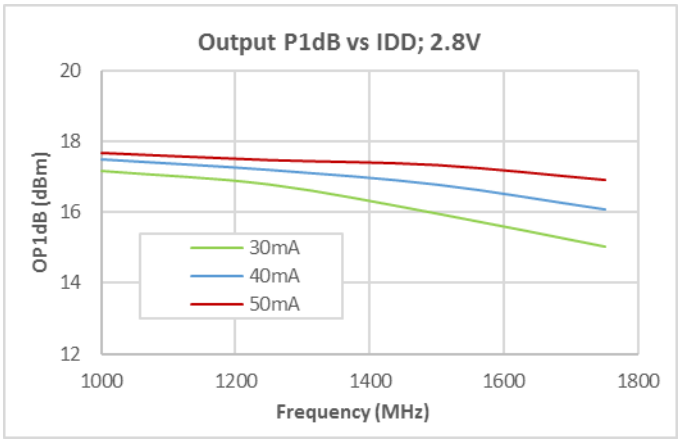
Performance Data (1.0 – 1.6GHz, 50ohms)

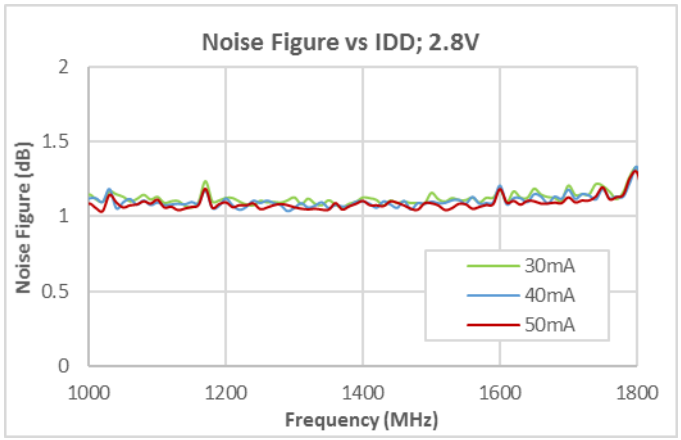








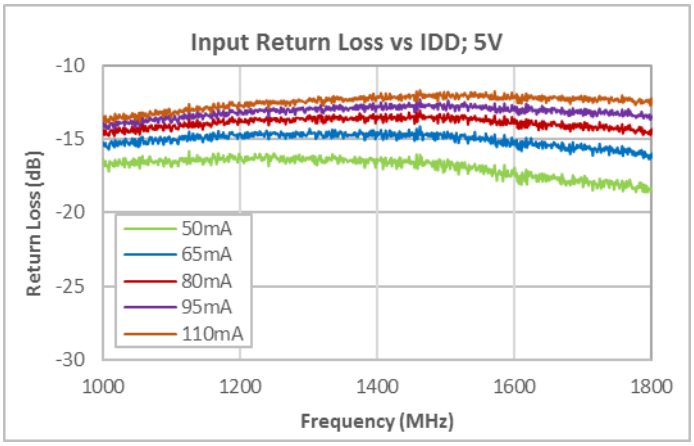


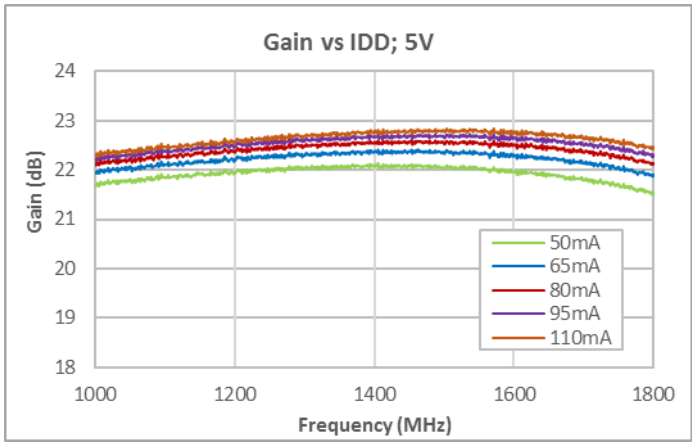


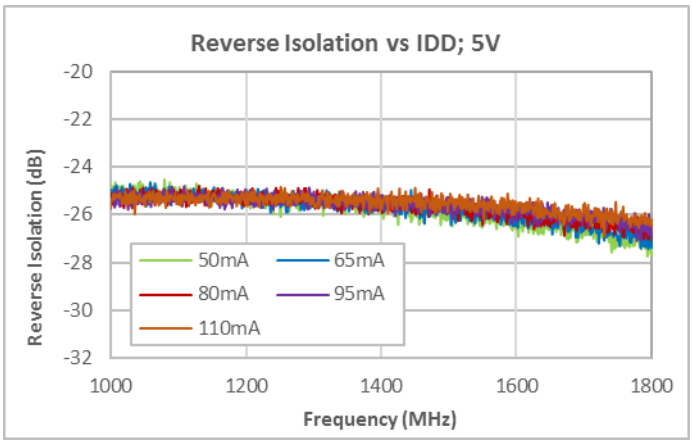
Notes:

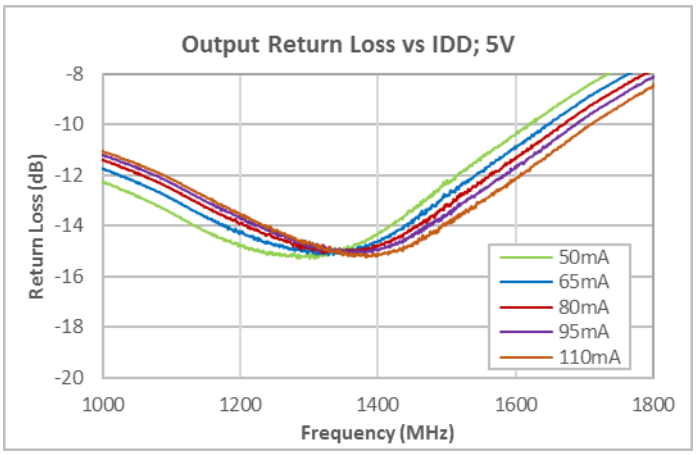
(1) 25C, 50ohm test system.

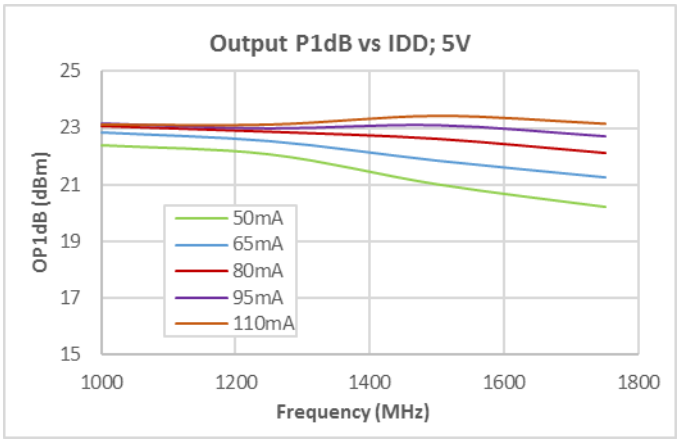
Performance Data (1.0 – 1.6GHz, 50ohms)

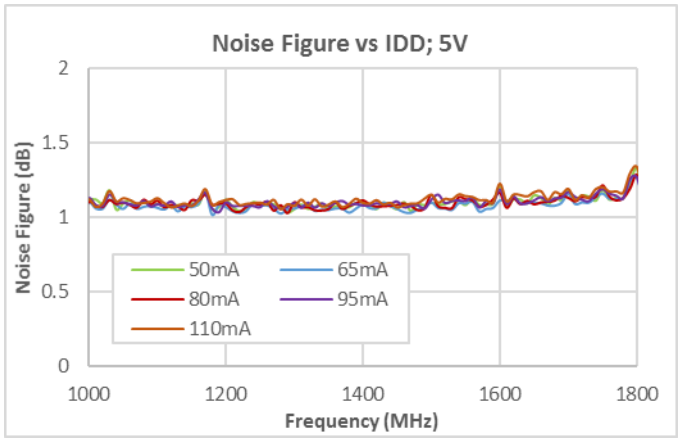








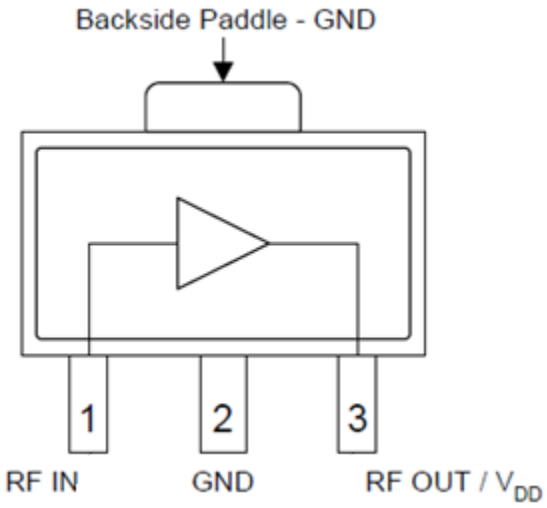




Notes:

(1) 25C, 50ohm test system.

Pin Configuration and Description



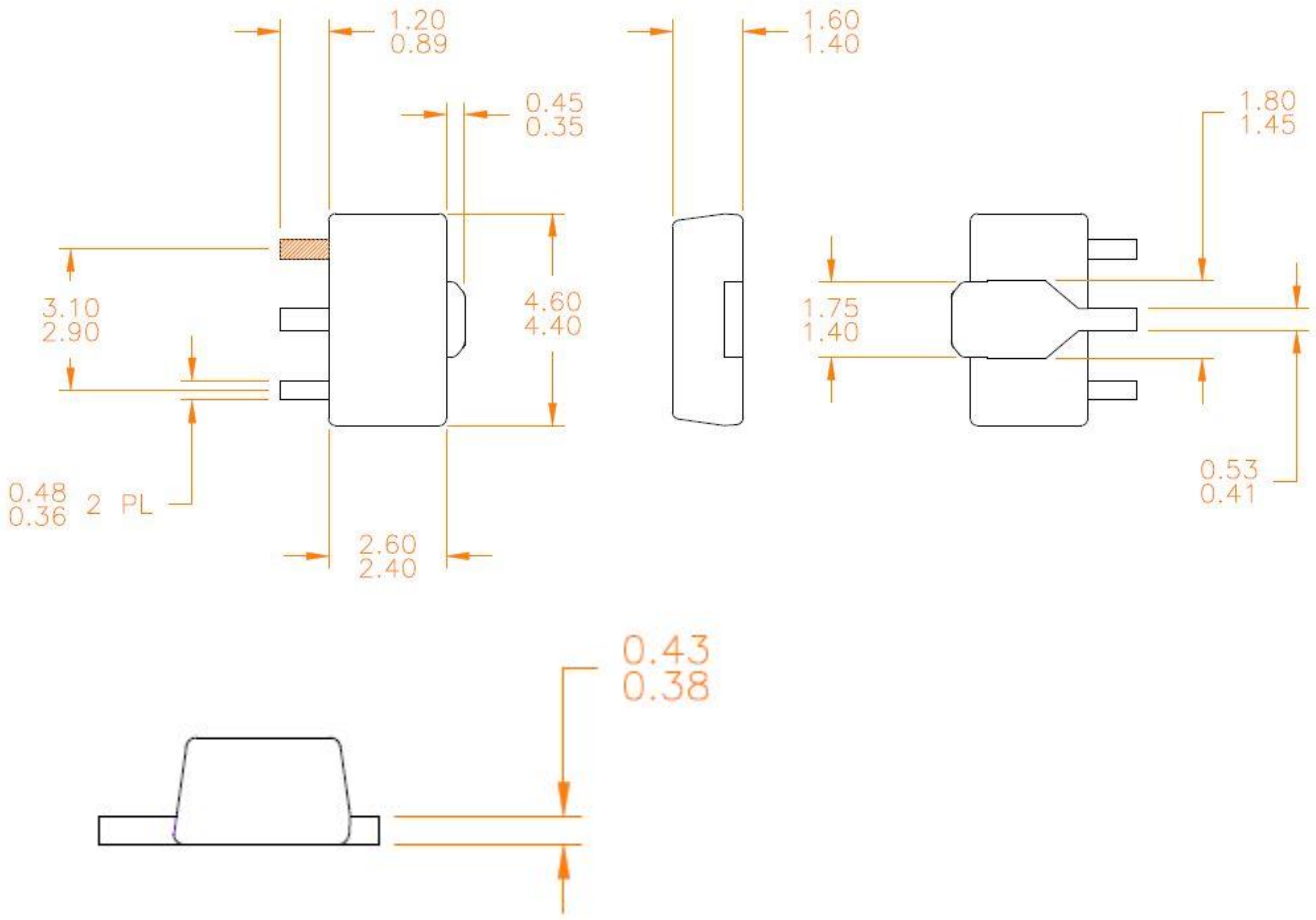
Top View

Pin No.	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:

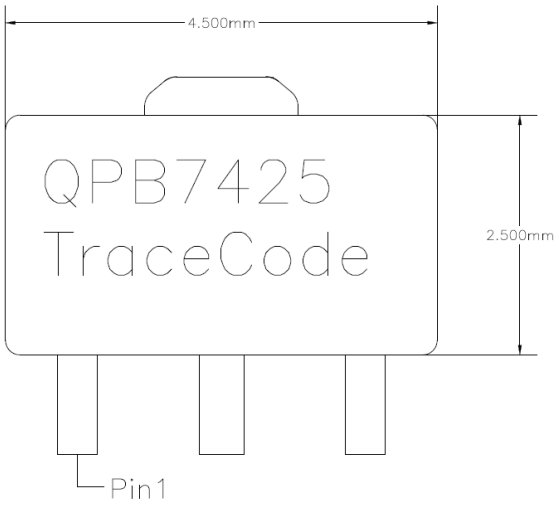
1. SHADED LEAD IS PIN 1.



Notes:

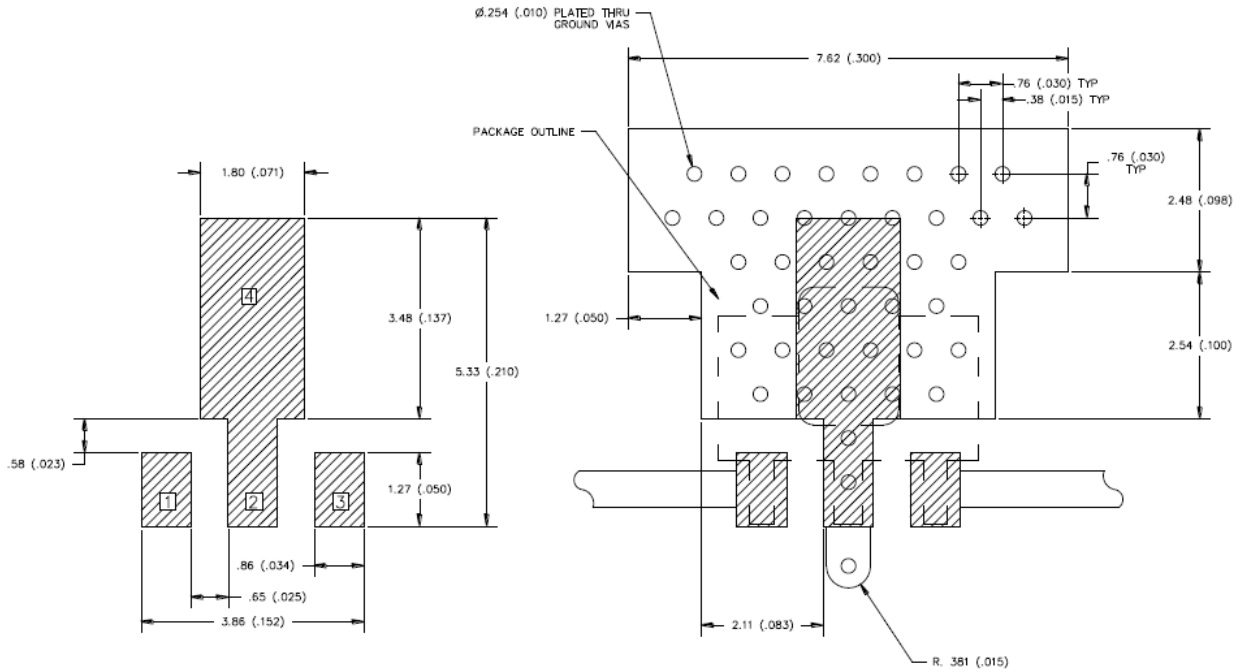
1. Dimensions in millimeters

Package Marking



Line 1 – Part Number
Line 2 – Short Trace Code (Upto 4 Characters)
Trace Code to be assigned by Sub Con

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.

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
- 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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