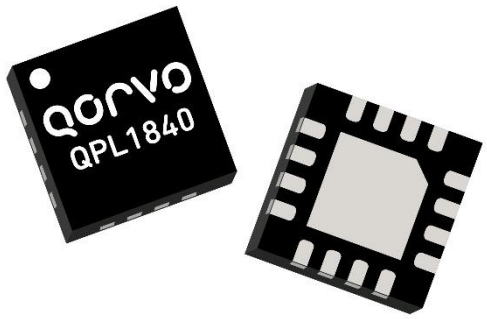
QPL1840

75 Ω 17 dB CATV Amplifier (5 – 1800MHz)

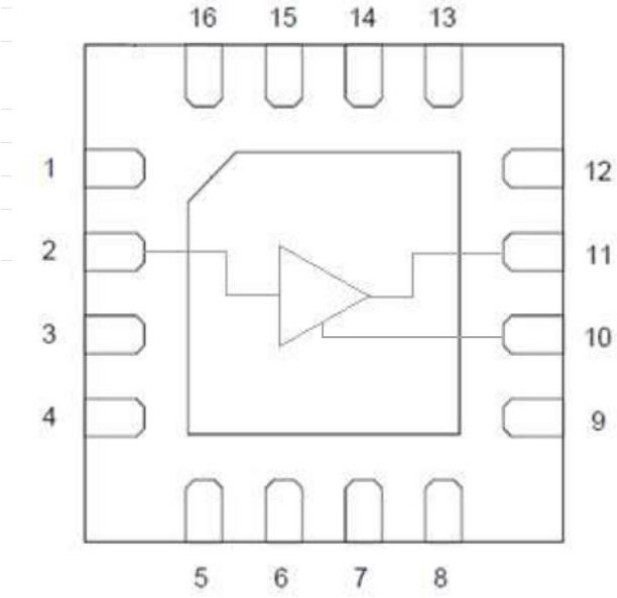
Product Overview

The QPL1840 is a GaAs pHEMT single ended MMIC RF amplifier IC featuring 17dB of gain and low noise from 5MHz to 1800MHz. This high linearity 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 single supply that can operate at 5V to 8V with current set from 125 mA to 135 mA. At 5V and 125 mA the QPL1840 provides an output of 54dBmV TCP with a CCN of 51dB. The QPL1840 is packaged in a 3 x 3 16–pin QFN.



3 x 3 16–pin QFN

Functional Block Diagram



3 x 3 16–pin QFN Package

Key Features

- 5 MHz to 1800 MHz Operation
- 5V & 8V Operation
- Gain: 17.5dB Typical
- TCP: 54dBmV @ 5V
- Noise Figure: 1.5dB @ 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	Part Number	Description
QPL1840EVB-01	5V Downstream Evaluation Board	QPL1840SB	Sample bag with 5 pieces
QPL1840EVB-02	5V Upstream Evaluation Board	QPL1840SR	7” Reel with 100 pieces
QPL1840EVB-03	8V Downstream Evaluation Board	QPL1840TR7	7” Reel with 2500 pieces
QPL1840EVB-04	8V Upstream Evaluation Board		

Table of Contents

Absolute Maximum Ratings

Parameter	Rating
Supply Voltage (V_{DD})	+10 V
Supply Current (I_{DD})	160 mA
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

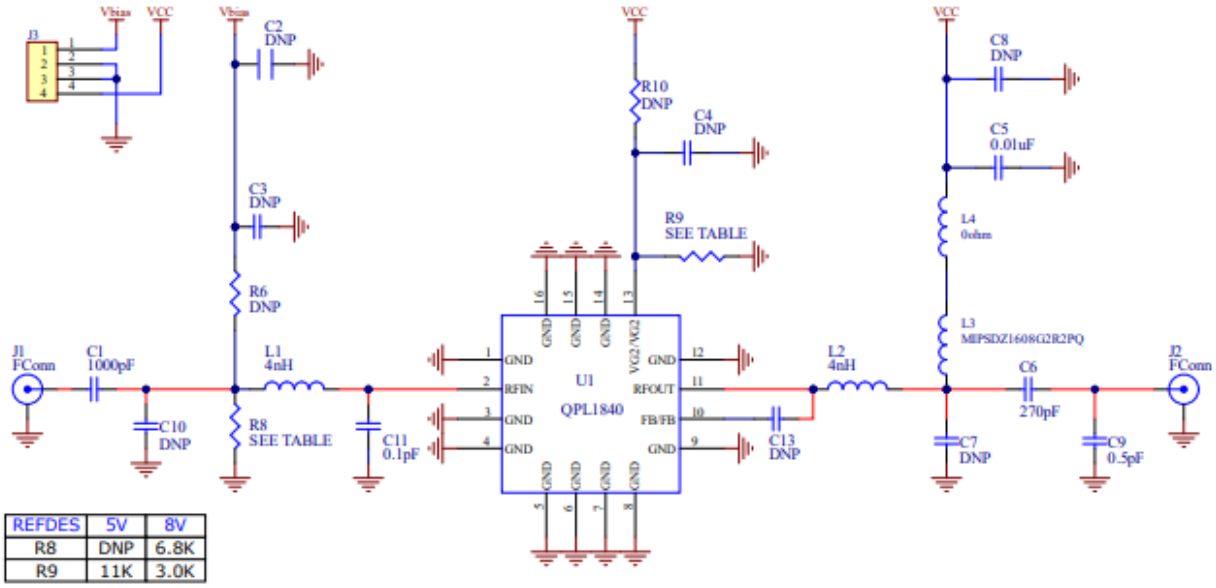
Exceeding any one or a combination of the Absolute Maximum Rating conditions may cause permanent damage to the device. Extended application of Absolute Maximum Rating conditions to the device may reduce device reliability.

Electrical Specifications (Downstream)

Parameter	Test Condition	Min	Typ	Max	Unit
Supply Voltage (VDD)			5/8		V
Supply Current (IDD)			125/135		mA
Frequency Range		50		1800	MHz
Gain			17.5		dB
Reverse Isolation			21		dB
Input Return Loss	50 – 1800MHz		-20		dB
Output Return Loss	50 – 1800MHz		-20		dB
CCN	+54dBmV @ 5V Total Composite Output power 258MHz to 1791MHz, 256 Ch, SC-QAM, 0dB tilt, 6dB Offset at 1023MHz		51		dB
Noise Figure	50 - 1800MHz		1.5		dB
OIP2L	+5 dBm / tone output, Δf=53MHz, Full Band		70/69		dBm
OIP2U	+5 dBm / tone output, Δf=53MHz, Full Band		55/55		dBm
OIP3	+5 dBm / tone output, Δf=6MHz, Full Band		33/32		dBm
OP1dB	50-1800MHz		20/23		dBm
Thermal Resistance	ΘJC (Junction to Device Heat Slug)		27.5		˚C/W

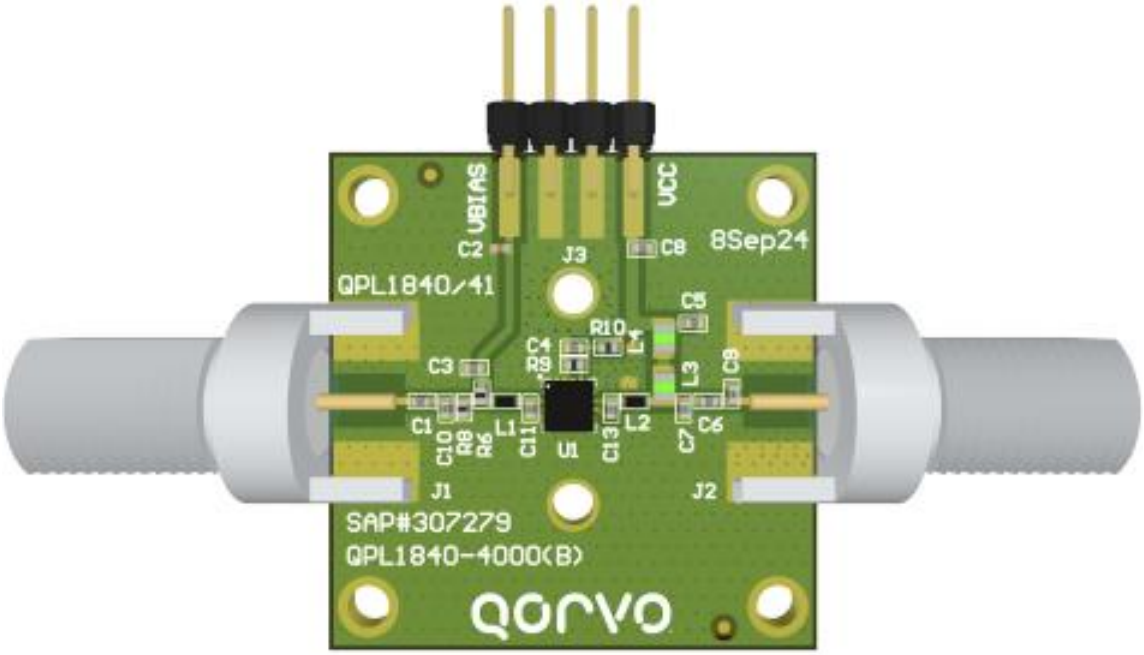
Note: Typical performance at these conditions: Temp = +25 °C, V_{DD} = +5 V, 75 Ω system, Full band unless otherwise noted

Evaluation Board Schematic 50 MHz – 1800 MHz (Downstream)



REFDES	5V	8V
R8	DNP	6.8K
R9	11K	3.0K

Evaluation Board Assembly Drawing (Downstream)



LAYER STACK LEGEND

Material	Layer	Thickness	Dielectric Material	Type
	Top Overlay			Legend
Surface Material	Top Solder	0.0010in	SM-001	Solder Mask
Metal	**Top Layer**	**0.0014in**	**1Oz**	**Signal**
Core		*0.0580in*	*FR408HR*	*Dielectric*
Metal	**Bottom Layer**	**0.0014in**	**1Oz**	**Signal**

Total thickness: 0.0618

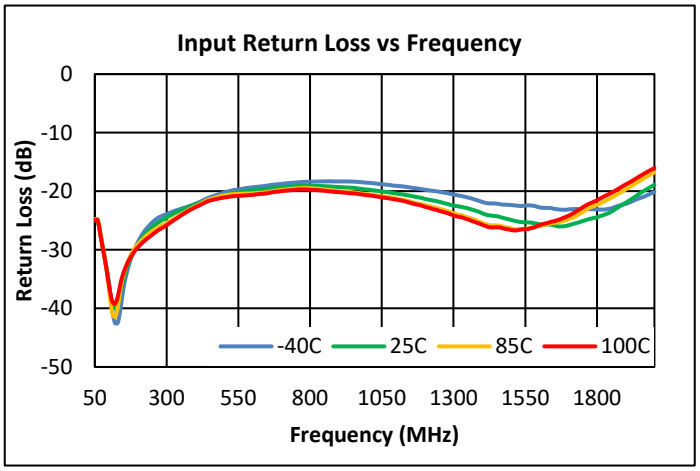
Evaluation Board Bill of Materials for Downstream 5V

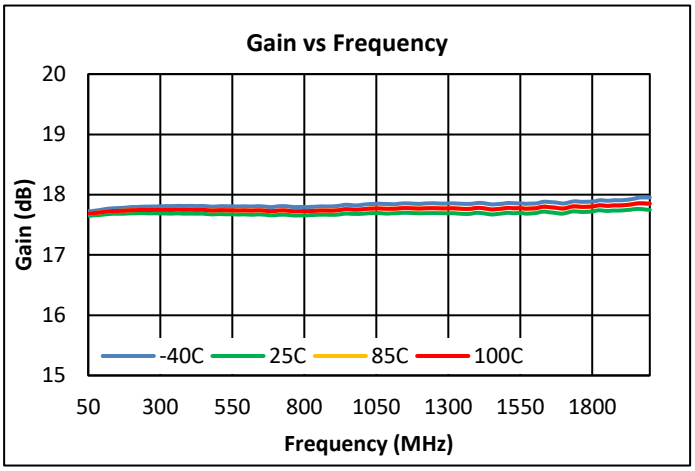
Ref Des	Description	Manufacturer	Part Number
PCB	PCB, QPL1840	Qorvo	QPL1840-4000(B)
U1	1.8GHz 5V, 17dB gain	Qorvo	QPL1840
C1	CAP, 1000pF, 5%, 50V, C0G, 0402	MURATA	GRM1555C1H102JA01D
C5	CAP, 0.01uF, 10%, 50V, X7R, 0402	MURATA	GCM155R71H103KA55D
C6	CAP, 270pF, 5%, 50V, C0G, 0402	MURATA	GCM1555C1H271JA16D
C9	CAP, 0.5pF, +/-0.25pF, 50V, HI-Q, 0402	MURATA	GJM1555C1HR50CB01D
C11	CAP, 0.1pF, +/-0.05pF, 50V, HI-Q, 0402	MURATA	GJM1555C1HR10WB01D
R9	RES, 11K OHM, 5%, 1/10W, 0402	Kamaya, Inc	RMC1/16S-113JTH
L4	RES, 0 OHM, JMPR, 1/3W, 0603	VISHAY AMERICAS	CRCW06030000Z0EAHP
L1, L2	IND, 4nH, ±0.1nH, W/W, HI-Q, 1950mA, 0402	MURATA	LQW15AN4N0B80D
L3	IND, 2.2uH, 20%, 0.36A, 0.7mm, W/W, 0603	TAIYO YUDEN	BRL1608T2R2M
J1, J2	CONN, F FEM EDGE MOUNT, 75R, 0.068"	Millimeter Wave	MW-846-C-DD-75
J3	CONN, HDR, ST, 4-PIN, 0.100"	SAMTEC INC.	TSW-104-08-S-S
C2,C3,C4,C7,C8, C10,C13,R6,R8,R10	NOT POPULATED ITEM		DUMMY PART

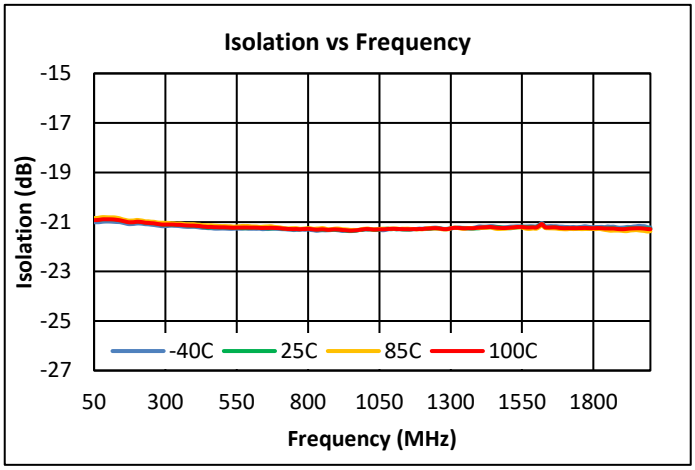
BOM Changes for Downstream 8V Operation

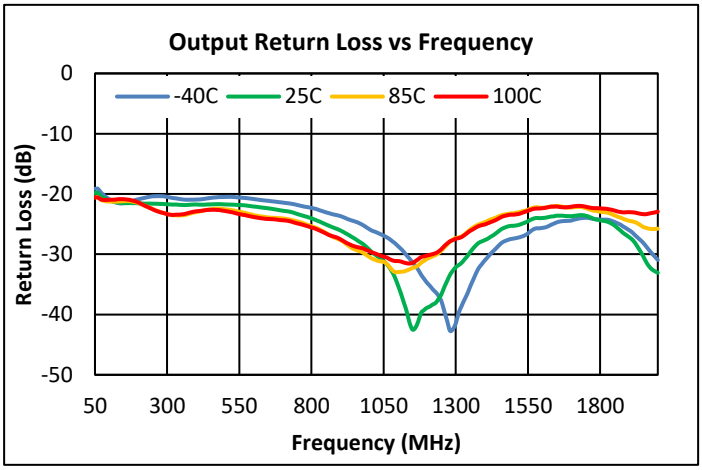
R8	6.8K OHM, 5%, 1/16W, 0402	KOA Speer Electronics, Inc	RK73B1ETTP682J
R9	RES, 3K OHM, 5%, 1/10W, 0402	Kamaya, Inc	RMC1/16S-302JTH

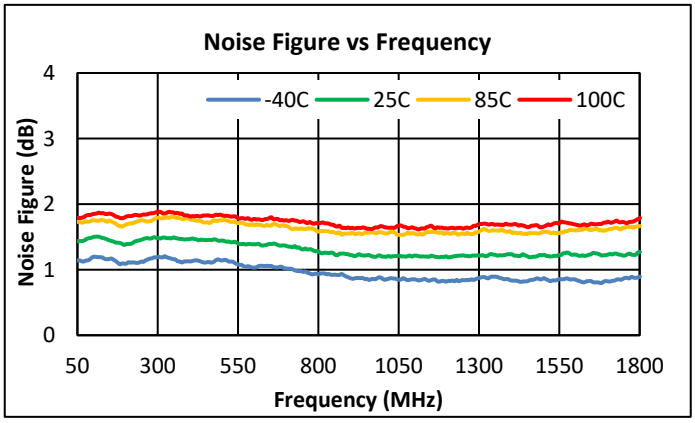
Performance Data, Downstream 5V



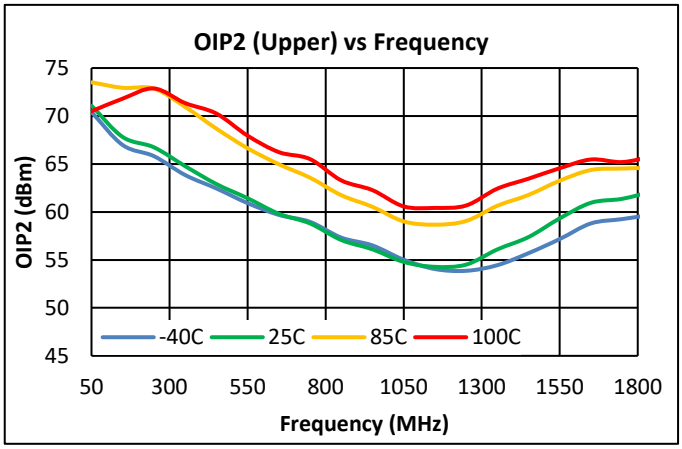


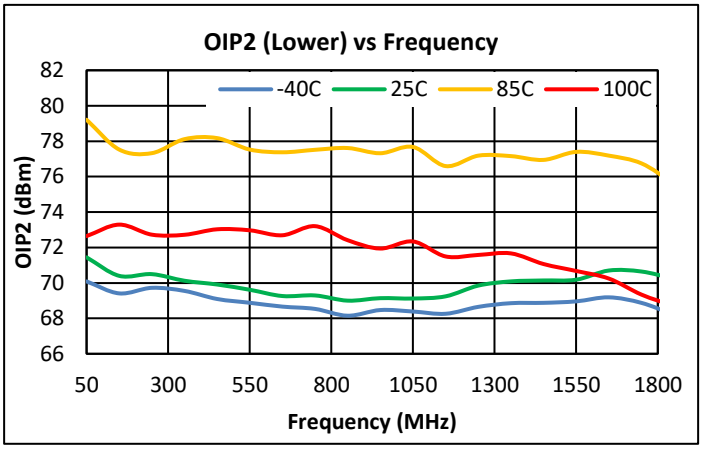


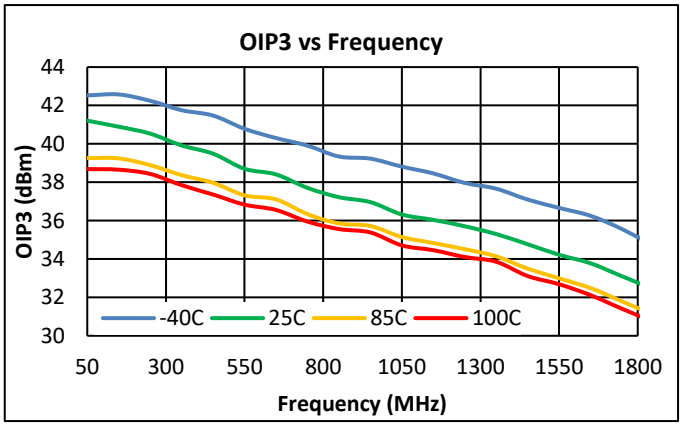


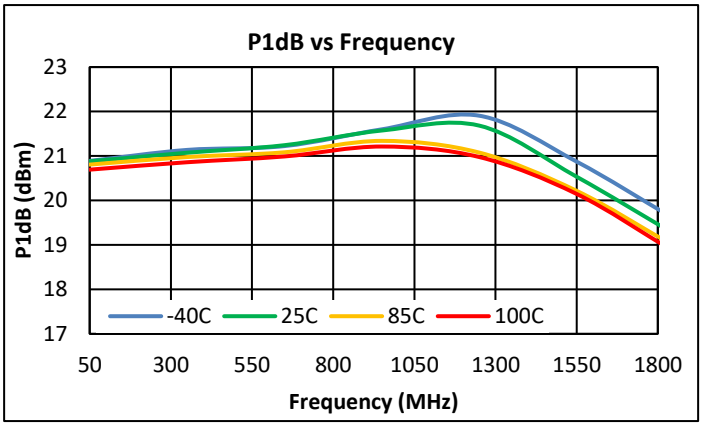


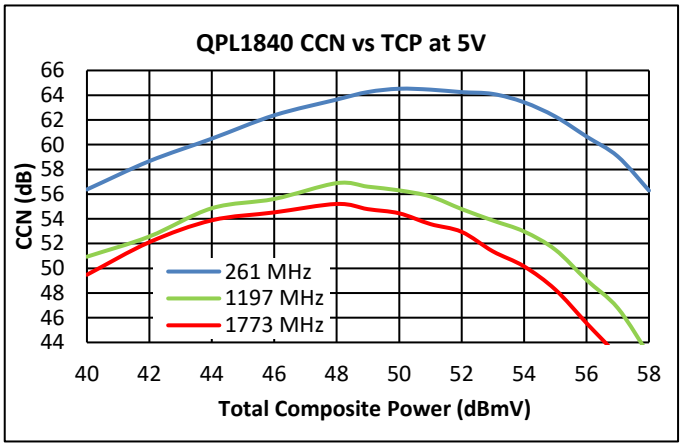
Performance Data, Downstream 5V (cont'd)







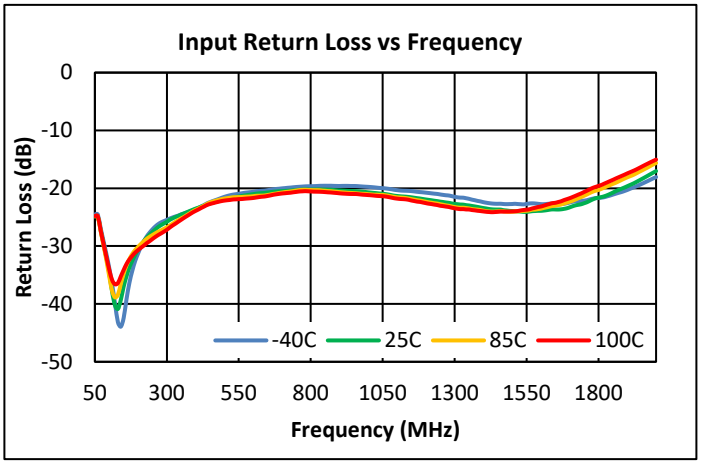


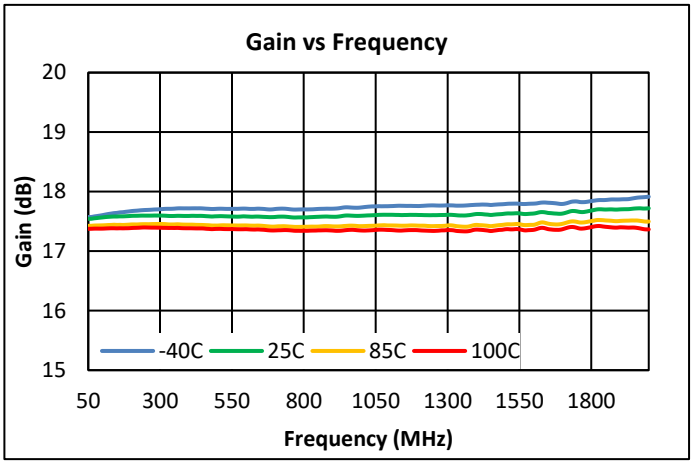


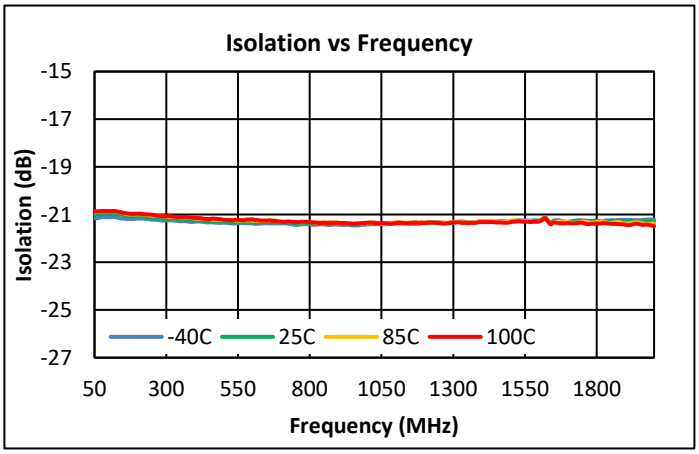
Notes:

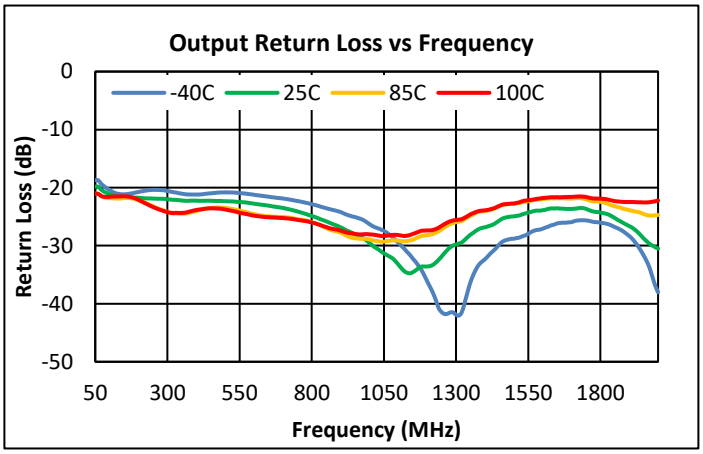
(1) 5V OIP2: +5Bm / tone output @ Δf = 53MHz
(2) 5V OIP3: +5dBm / tone output @ Δf = 6MHz
(3) CCN Test conditions: 0dB tilt, 6dB offset at 1023MHz, 258-1791MHz loading
(4) BER Test Conditions: 258 – 1791 MHz, 256 Ch SC-QAM, 0dB tilt, 6dB offset

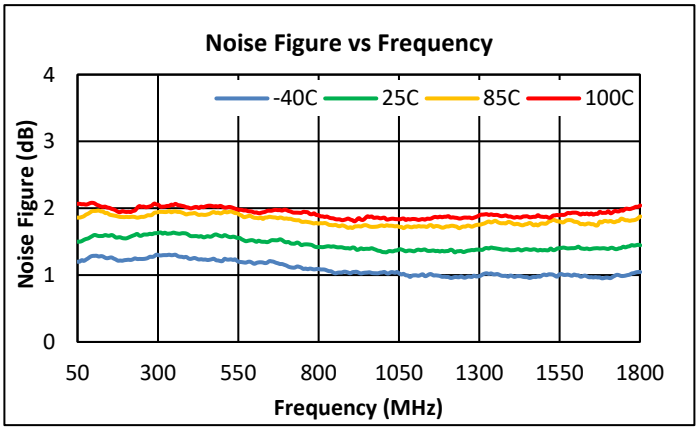
Performance Data, Downstream 8V



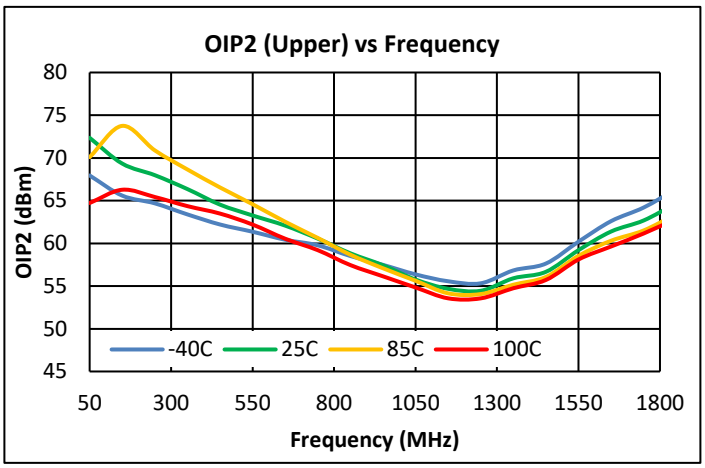


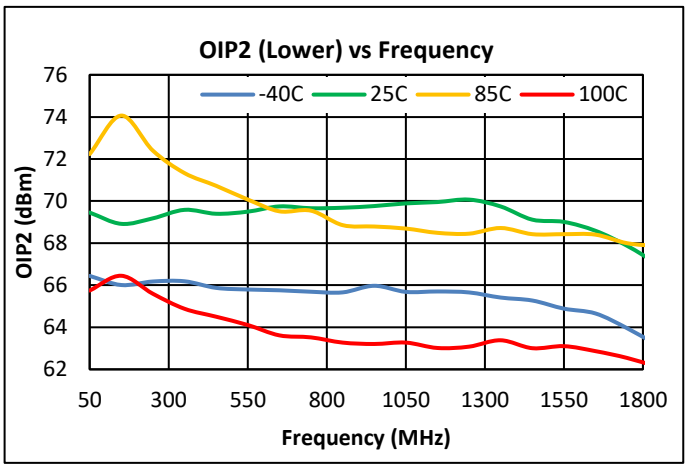


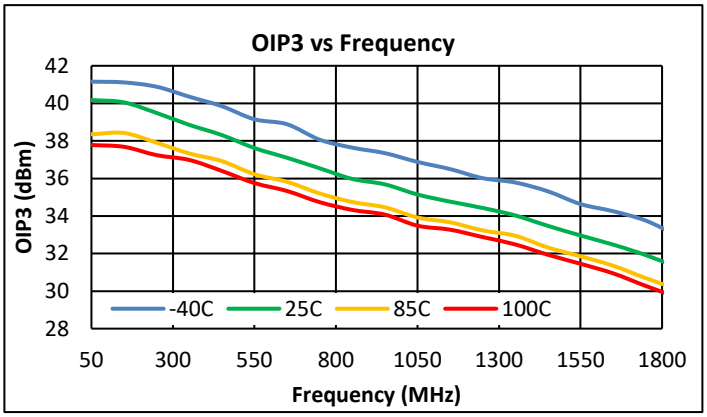


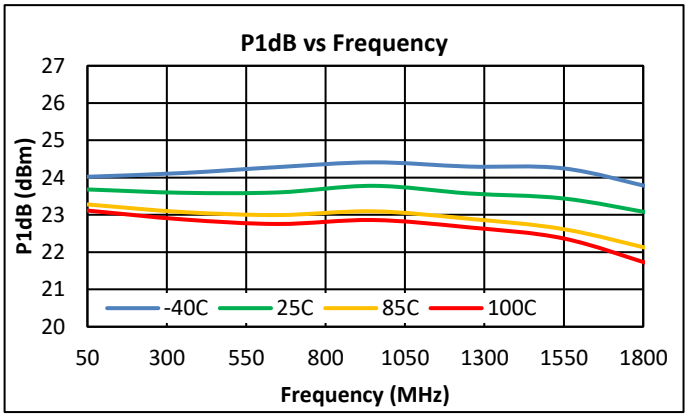


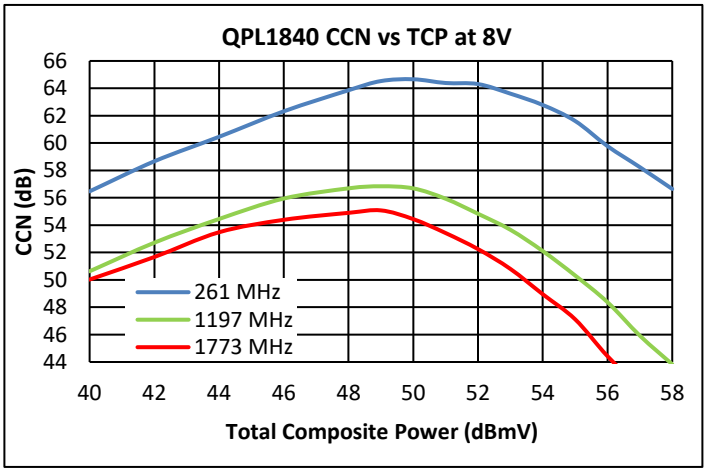
Performance Data, Downstream 8V (Cont'd)











Notes:

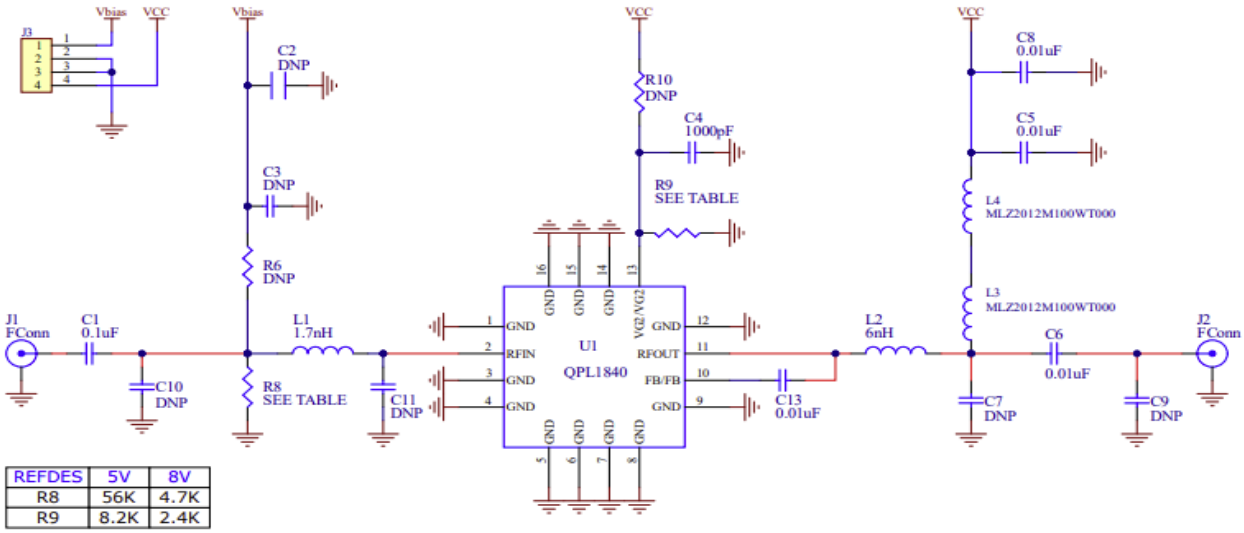
(1) 8V OIP2: +5dBm/tone output @ Δf = 53MHz
(2) 8V OIP3: +5dBm / tone output @ Δf = 6MHz
(3) CCN Test conditions: 0dB tilt, 6dB offset at 1023MHz, 258-1791MHz loading
(4) BER Test Conditions: 258 – 1791 MHz, 256 Ch SC-QAM, 0dB tilt, 6dB offset

Electrical Specifications (Upstream)

Parameter	Test Condition	Min	Typ	Max	Unit
Supply Voltage (VDD)			5/8		V
Supply Current (IDD)			115/115		mA
Frequency Range		5		850	MHz
Gain			17.5		dB
Reverse Isolation			21		dB
Input Return Loss	5 – 700MHz		-20		dB
Input Return Loss	700 – 850MHz		-19		
Output Return Loss	5 – 850MHz		-20		dB
MER	At +53dBmV @ 5V and +55dBmV @ 8V Total Composite Output power. 5MHz to 850MHz, 113 Ch, SC-QAM, 0dB tilt, 0dB Offset (Source corrected)		51		dB
Noise Figure	5 - 15MHz		2.0/2.3		dB
Noise Figure	15 - 850		1.6/1.7		dB
OIP2L	+5 dBm / tone output, Δf=53MHz, Full Band		65/62		dBm
OIP2U	+5 dBm / tone output, Δf=53MHz, Full Band		51/50		dBm
OIP3	+5 dBm / tone output, Δf=6MHz, Full Band		34.5/34		dBm
OP1dB	5-850MHz		20/22		dBm
Thermal Resistance	ΘJC (Junction to Device Heat Slug)		27.5		˚C/W

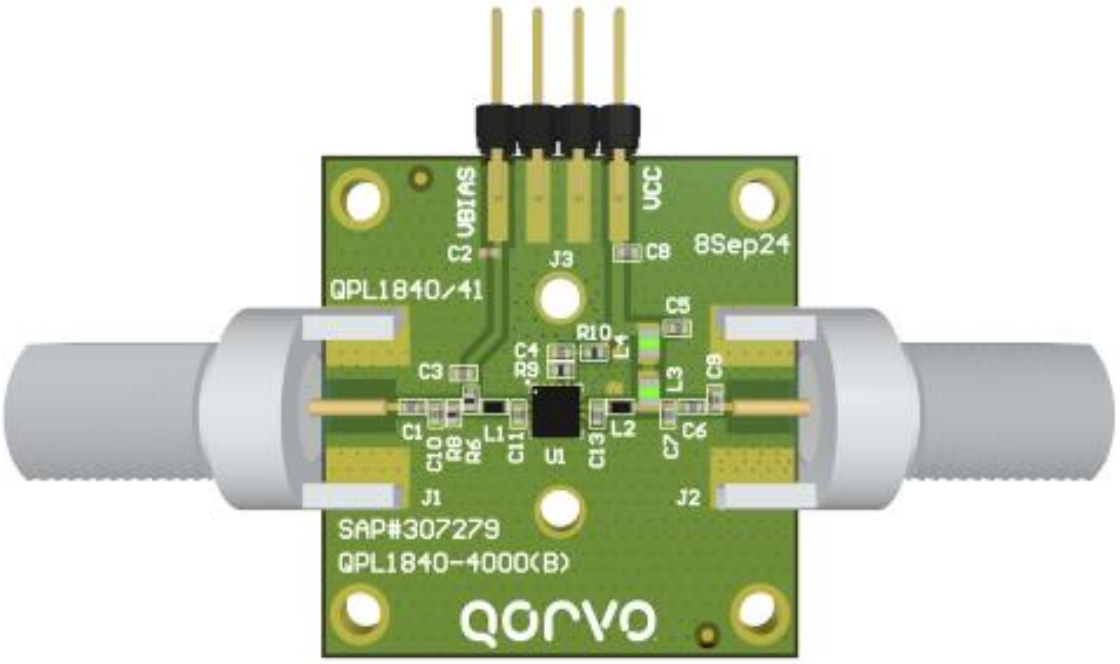
Note: Typical performance at these conditions: Temp = +25 °C, V_{DD} = +5 V, 75 Ω system, Full band unless otherwise noted

Evaluation Board Schematic 5 MHz – 850 MHz (Upstream)



REFDES	5V	8V
R8	56K	4.7K
R9	8.2K	2.4K

Evaluation Board Assembly Drawing (Upstream)



LAYER STACK LEGEND

Material	Layer	Thickness	Dielectric Material	Type
	Top Overlay			Legend
Surface Material	Top Solder	0.0010in	SM-001	Solder Mask
Metal	**Top Layer**	**0.0014in**	**1Oz**	**Signal**
Core		*0.0580in*	*FR408HR*	*Dielectric*
Metal	**Bottom Layer**	**0.0014in**	**1Oz**	**Signal**

Total thickness: 0.0618

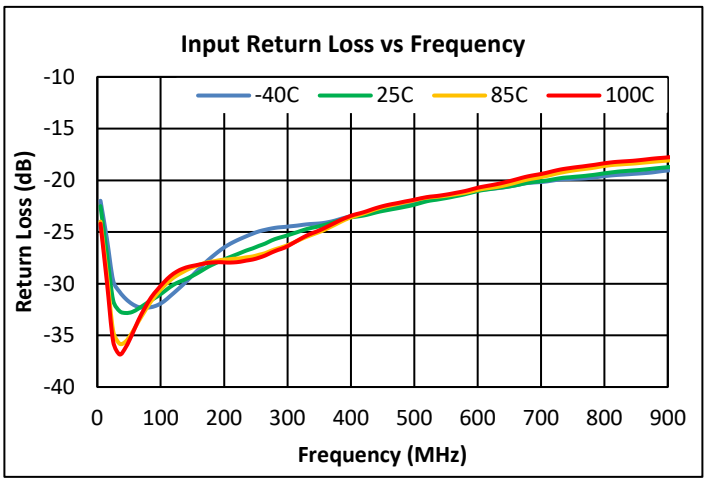
Evaluation Board Bill of Materials for Upstream 5V

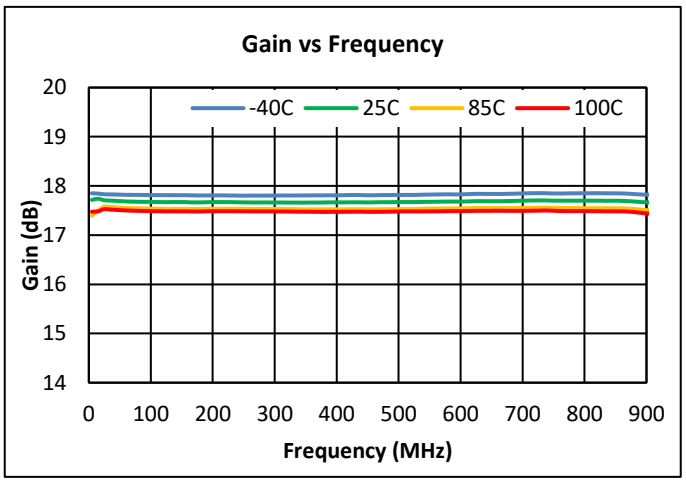
PCB	PCB, QPL1840	Qorvo	QPL1840-4000(B)
U1	1.8GHz 5V, 17dB gain	Qorvo	QPL1840
C1	CAP, 0.1uF, 10%, 50V, X5R, 0402	MURATA	04025D104KAT2A
C4	CAP, 1000pF, 10%, 50V, X7R, AEC200 0402	TDK	CGA2B2X7R1H102K050BA
C5,C6,C8,C13	CAP, 0.01uF, 10%, 50V, X7R, 0402	MURATA	GCM155R71H103KA55D
R8	RES, 56K OHM, 5%, 1/10W, 0402	Panasonic	ERJ-2GEJ563X
R9	RES, 8.2K OHM, 5%, 1/10W, 0402	Kamaya, Inc	RMC1/16S-822JTH
L1	IND, 1.7nH, ±0.2nH, W/W,HIQ,1150mA,0402	MURATA	LQW15AN1N7C80D
L2	IND, 6nH, ±0.1nH, W/W, HI-Q, 1600mA,0402	MURATA	LQW15AN6N0B80D
L3,L4	IND, 10uH, 20%, 350mA, M/L, 0805	TDK	MLZ2012M100WT000
J1,J2	CONN, F FEM EDGE MOUNT, 75R, 0.068"	Millimeter Wave	MW-846-C-DD-75
J3	CONN, HDR, ST, 4-PIN, 0.100"	SAMTEC INC.	TSW-104-08-S-S
C2,C3,C7,C9 C10,C11,R6,R10	NOT POPULATED ITEM		DUMMY PART

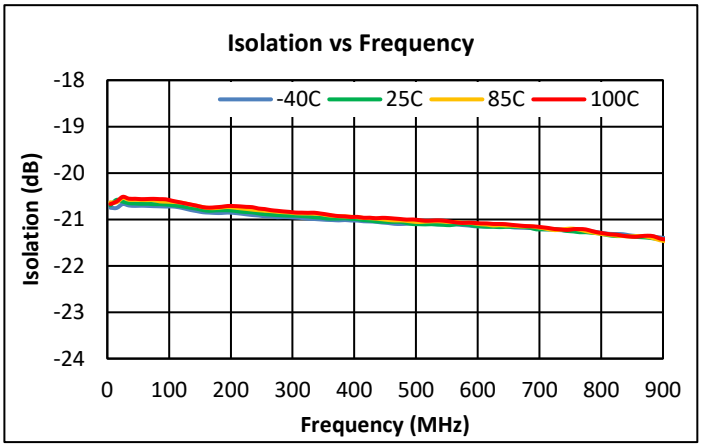
BOM Changes for Upstream 8V Operation

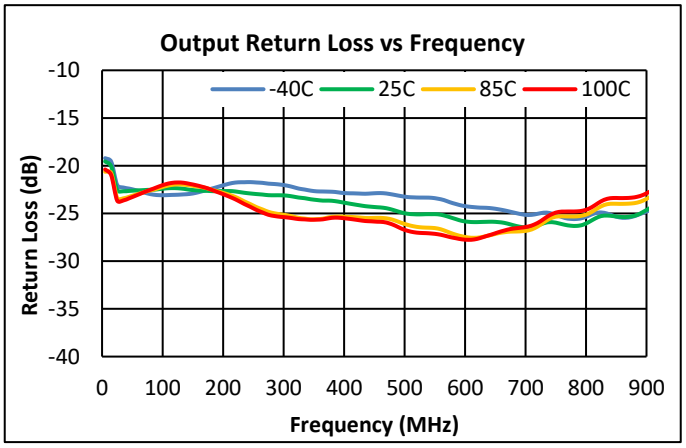
R8	RES, 4.7K OHM, 5%, 1/10W, 0402	Kamaya, Inc	RMC1/16S-472JTH
R9	RES, 2.4K OHM, 5%, 1/10W, 0402	Kamaya, Inc	RMC1/16S-242JTH

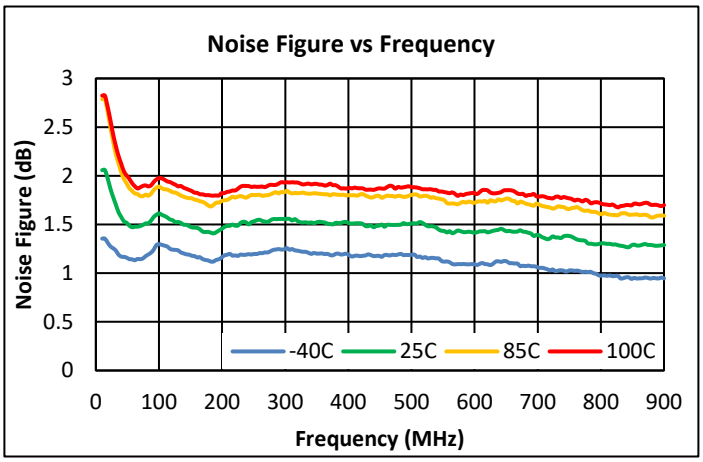
Performance Data, Upstream 5V

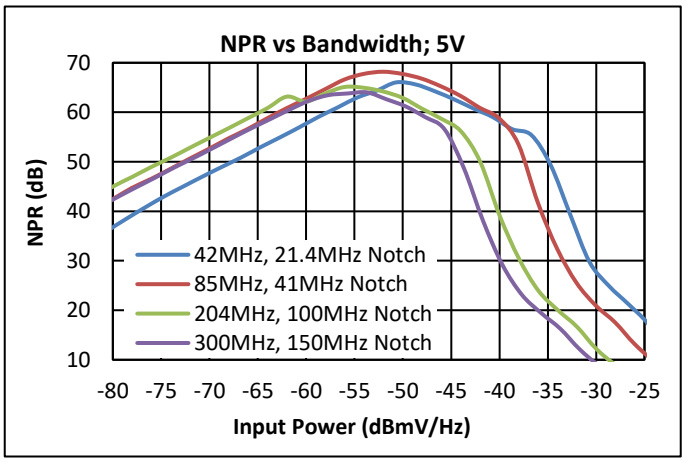




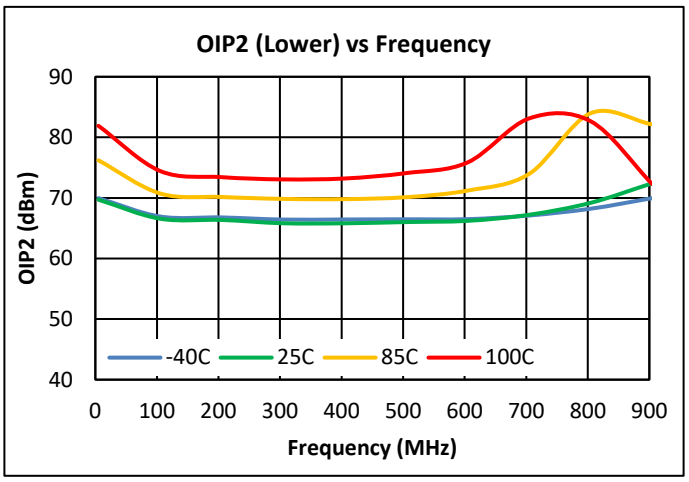


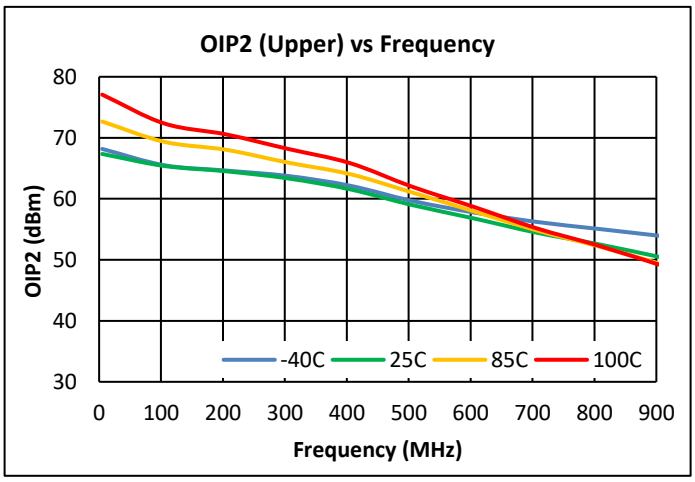


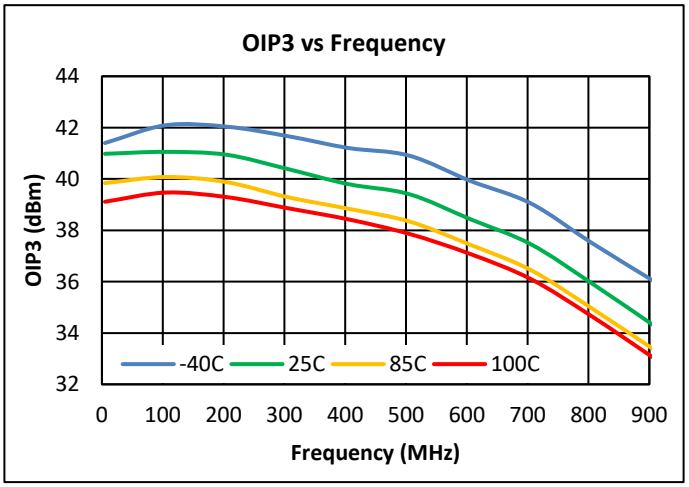


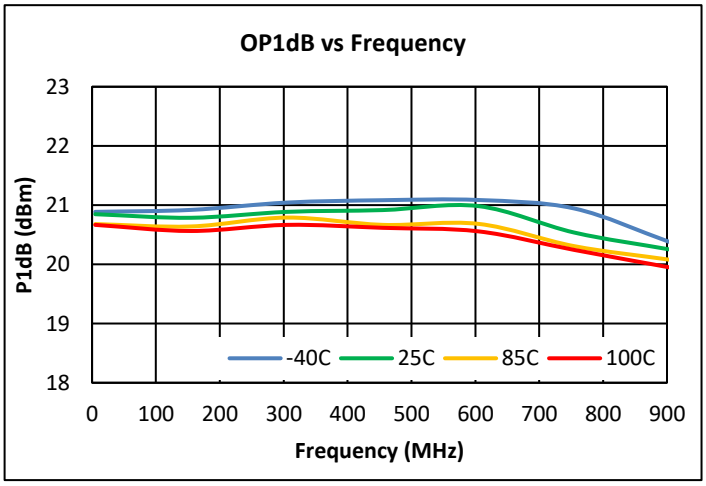


Performance Data, Upstream 5V (Cont'd)





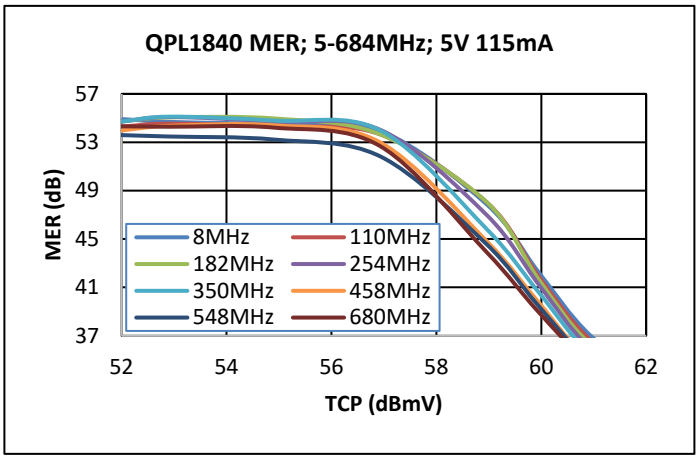


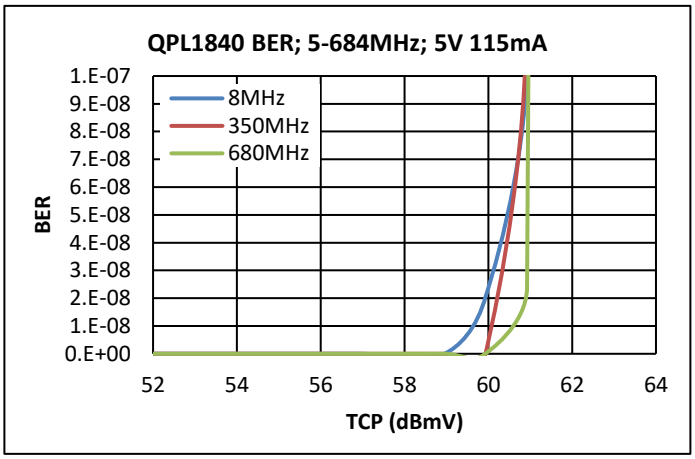


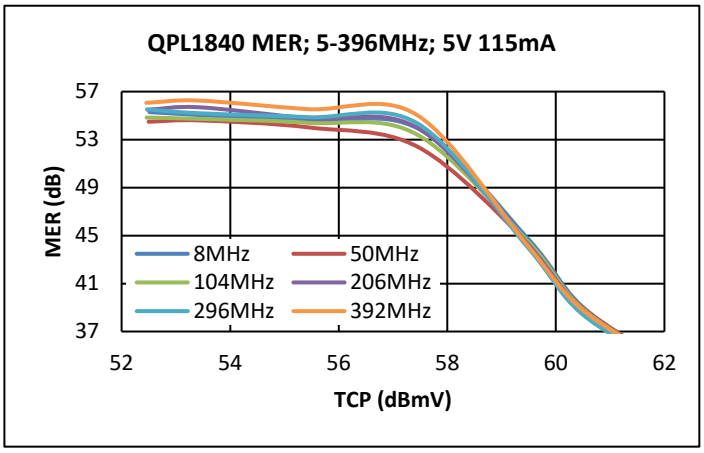
Notes:

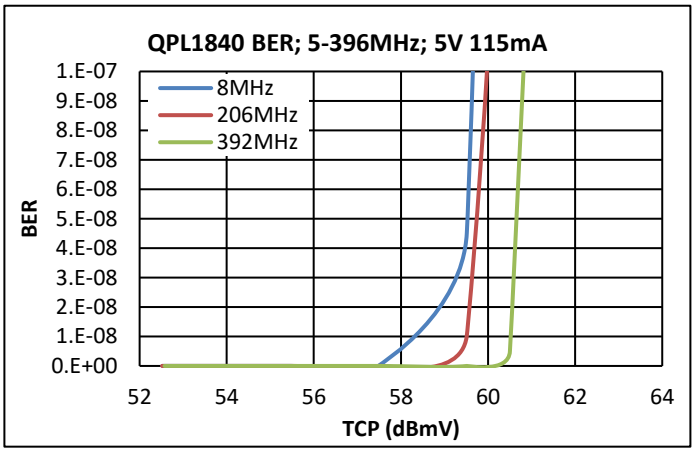
(1) 5V OIP2: +5dBm / tone output @ Δf = 6MHz
(2) 5V OIP3: +5dBm / tone output @ Δf = 6MHz

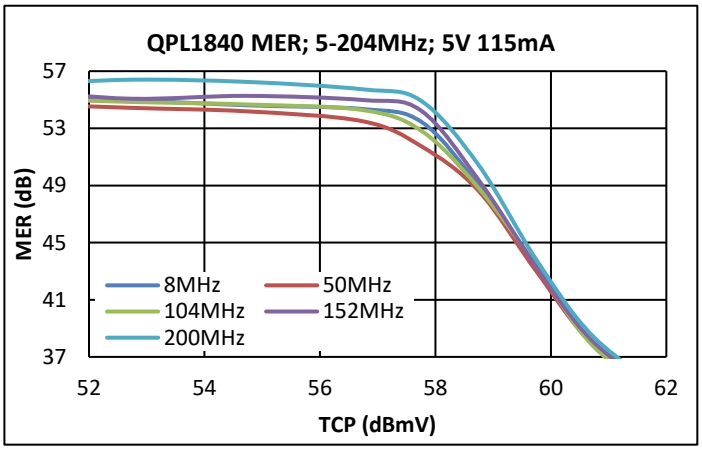
Performance Data, Upstream 5V

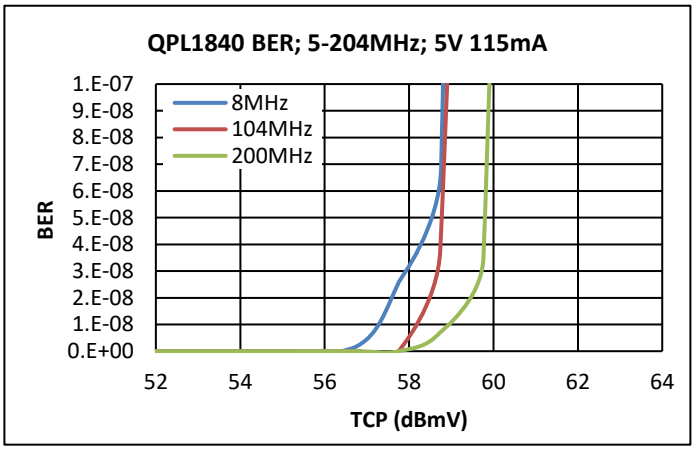








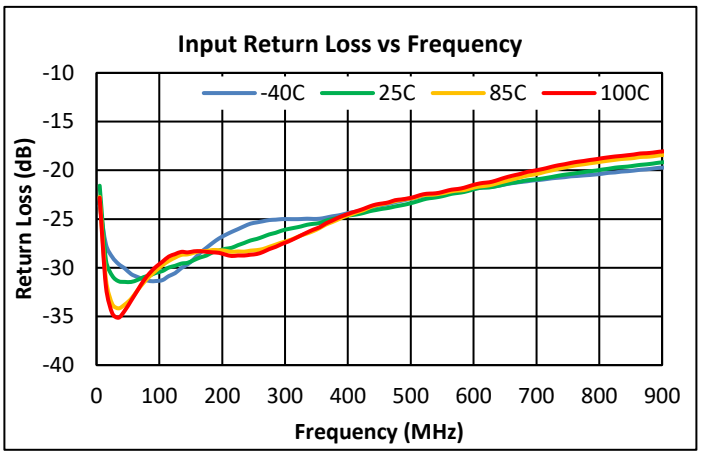


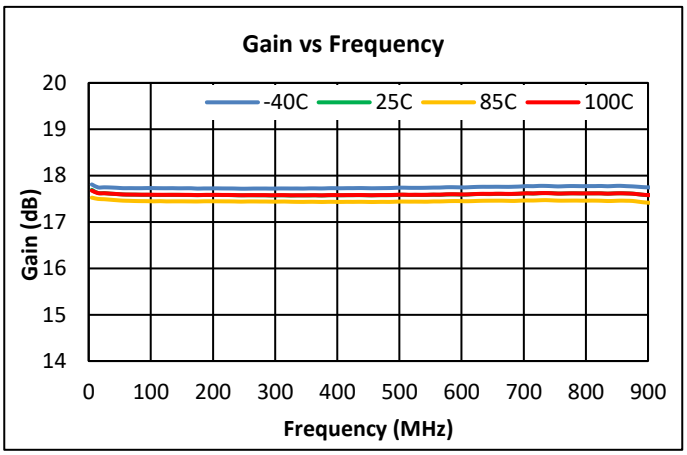


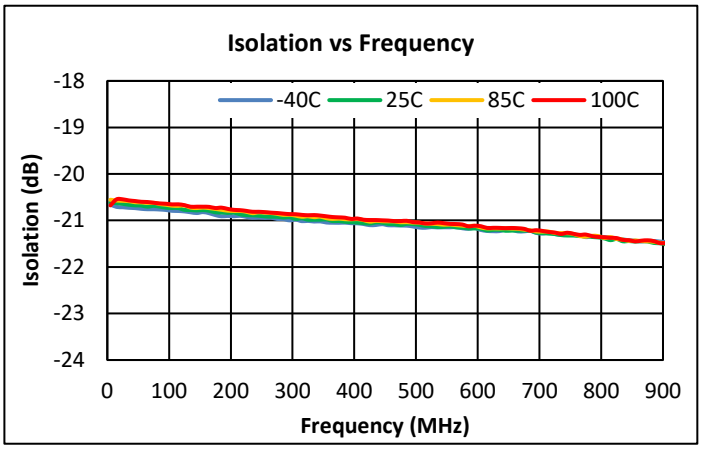
Notes:

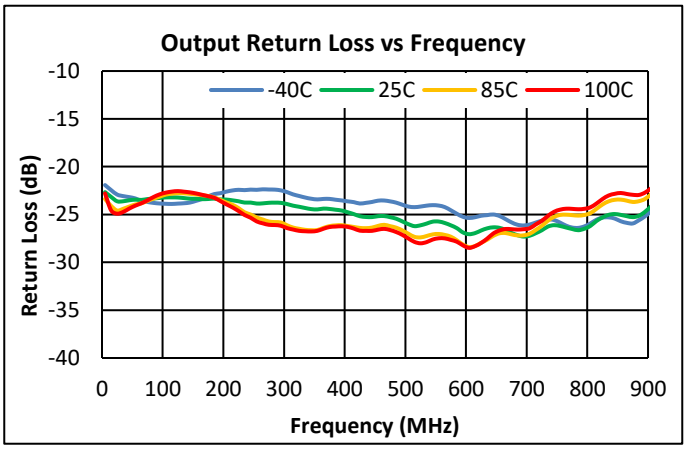
(1.) BER & MER Test Conditions: 5-684MHz, 113 Ch SC-QAM, 0dB Tilt
(2.) BER & MER Test Conditions: 5-396MHz, 65 Ch SC-QAM, 0dB Tilt
(3.) BER & MER Test Conditions: 5-204MHz, 33 Ch SC-QAM, 0dB Tilt
(4.) Source corrected

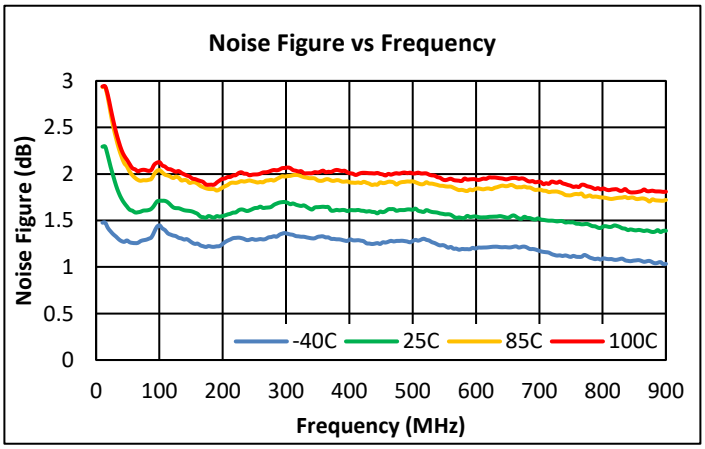
Performance Data, Upstream 8V

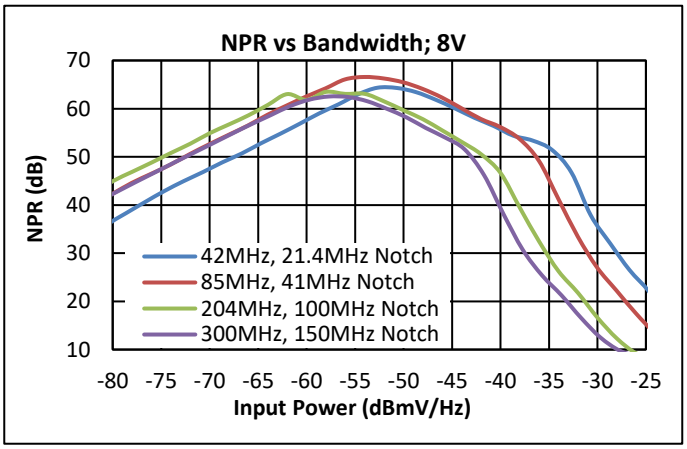




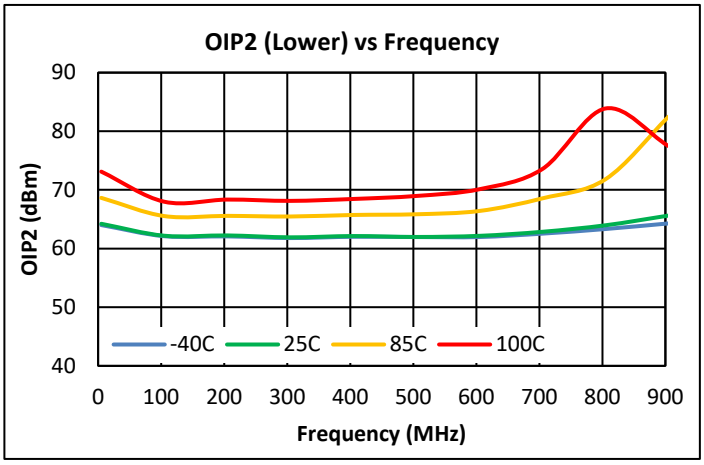


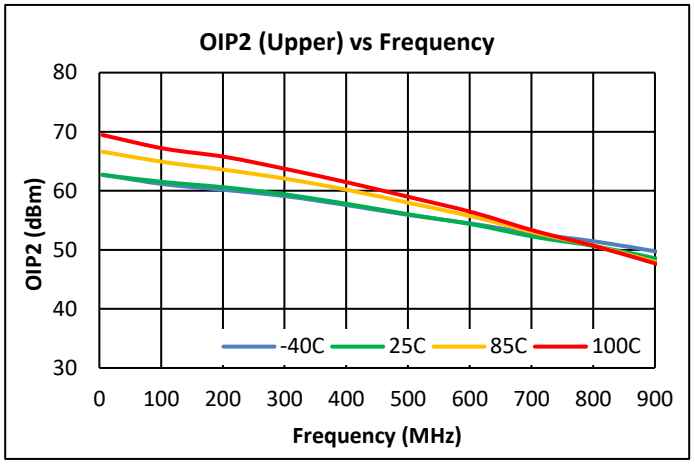


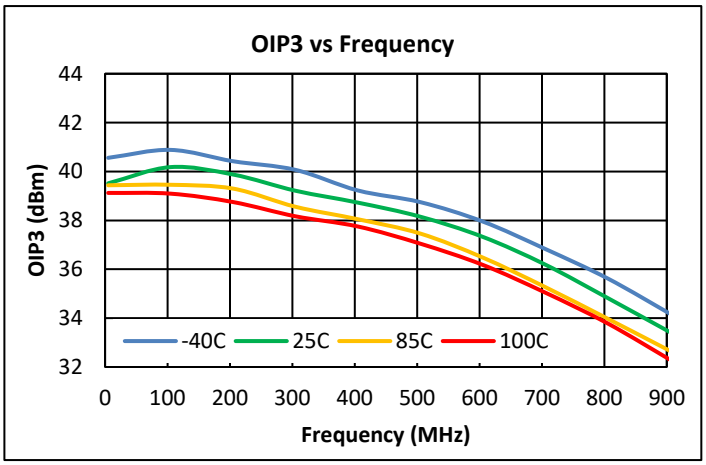


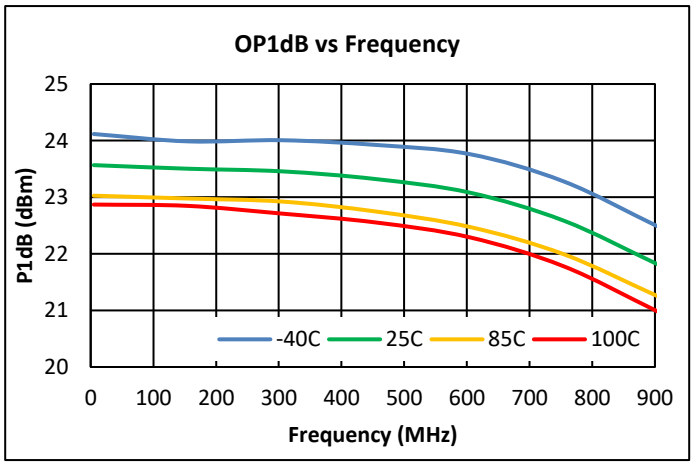


Performance Data, Upstream 8V (Cont'd)





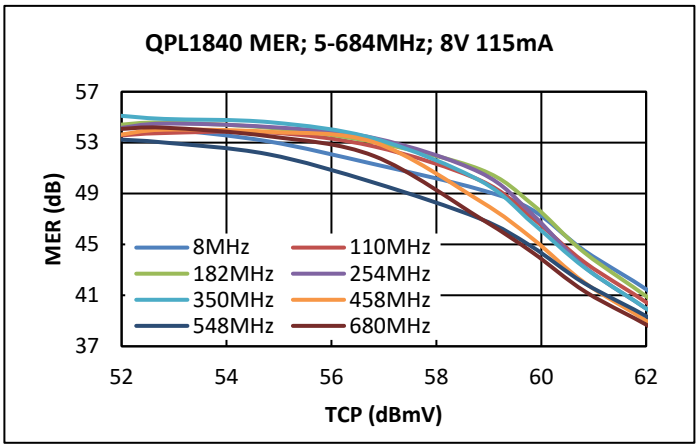


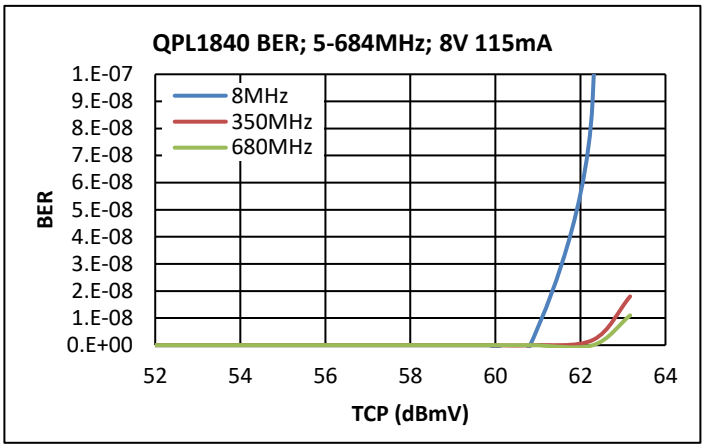


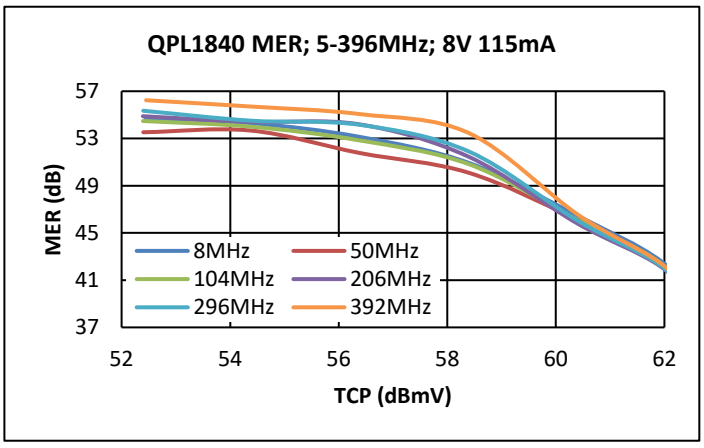
Notes:

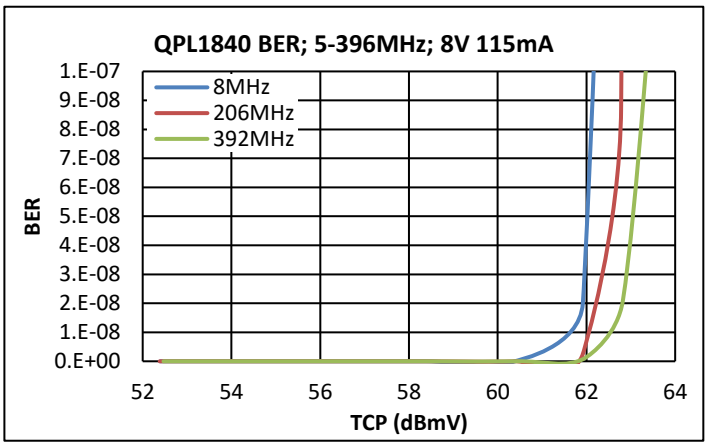
(1) 8V OIP2: +5dBm/tone output @ Δf = 6MHz
(2) 8V OIP3: +5dBm / tone output @ Δf = 6MHz

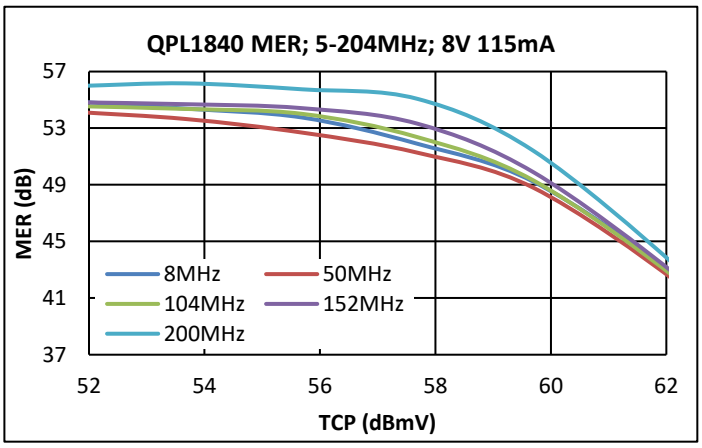
Performance Data, Upstream 8V

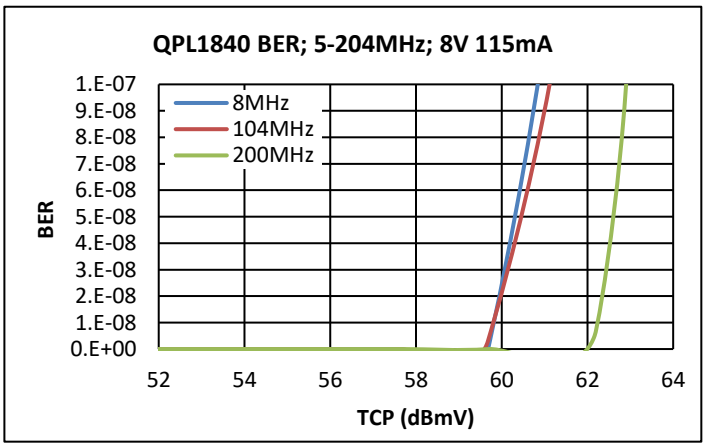








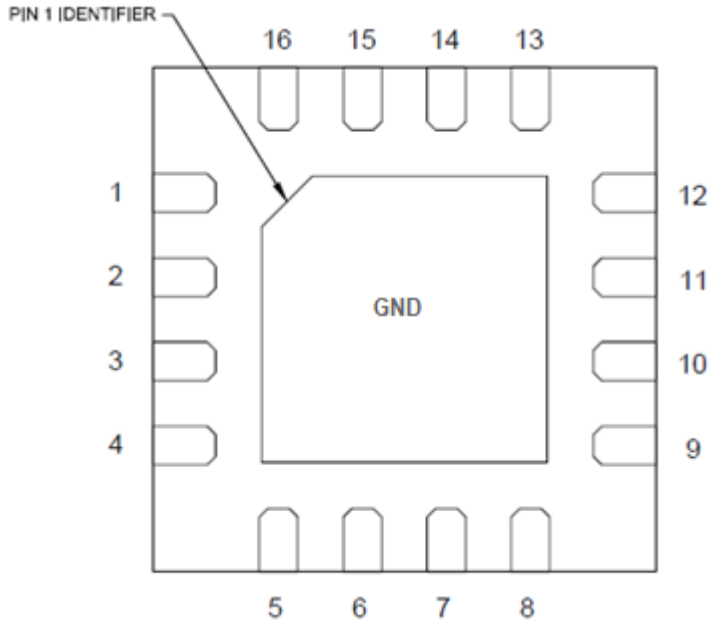




Notes:

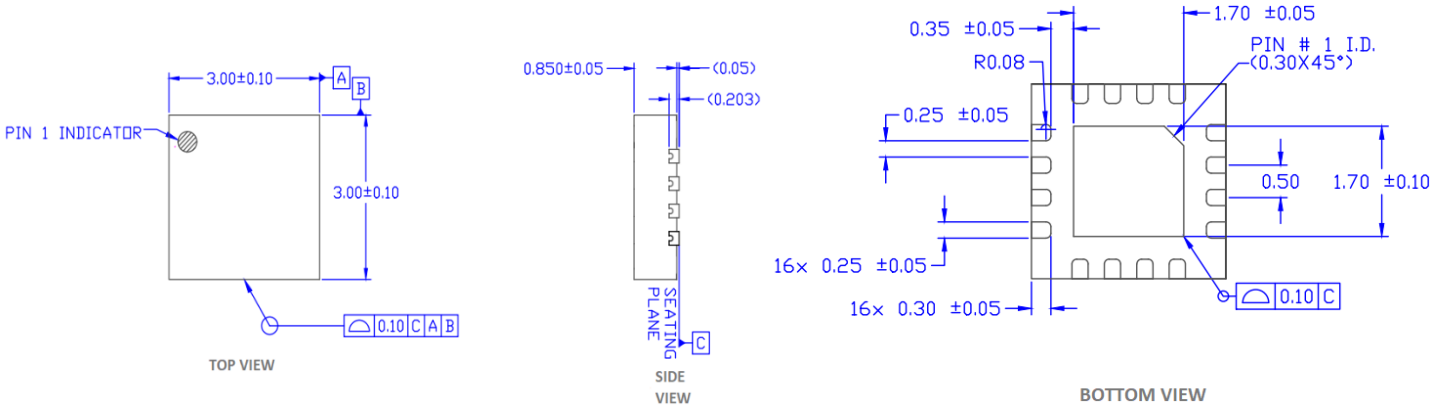
(1.) BER & MER Test Conditions: 5-684MHz, 113 Ch SC-QAM, 0dB Tilt
(2.) BER & MER Test Conditions: 5-396MHz, 65 Ch SC-QAM, 0dB Tilt
(3.) BER & MER Test Conditions: 5-204MHz, 33 Ch SC-QAM, 0dB Tilt
(4.) Source corrected

Pin Configuration and Description

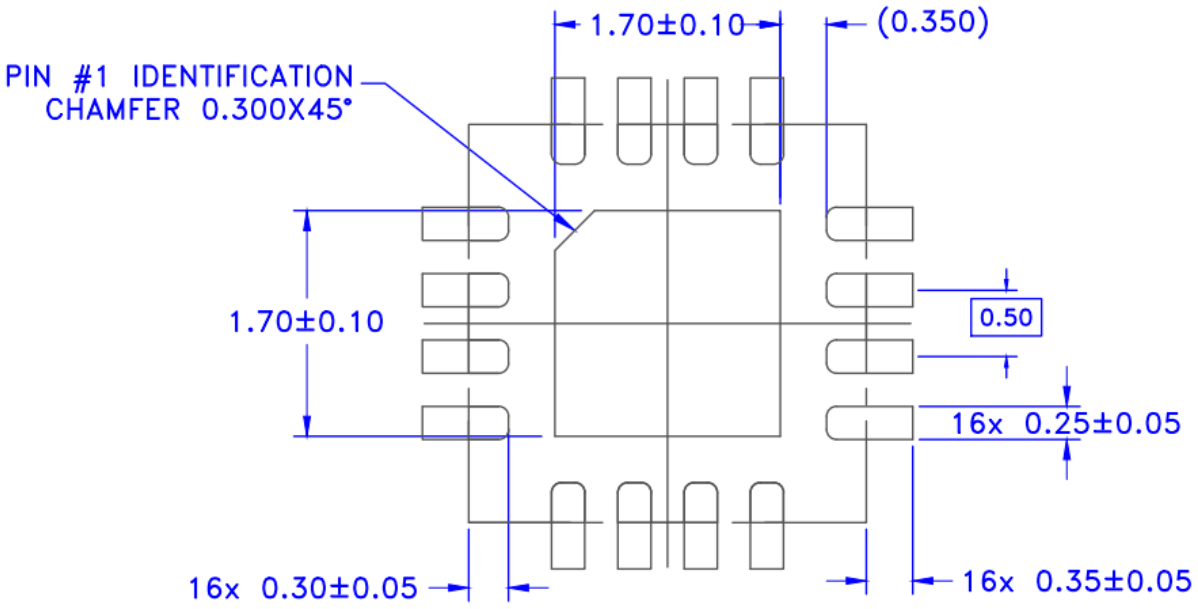


Pin Number	Label	Description
1,3,4,5,6,7,8,9,12, 14,15,16	NC	Not connected internally. It may be left floating or connected to ground (preferred).
2	RFin	RF input. External DC blocking capacitor required.
10	CFB	Feedback capacitor
11	RFout/VDD	RF output. External bias choke to VDD required. External DC blocking capacitor required.
13	VG2	VG2 bias adjust. Set by resistor (R9) to ground.
Paddle	GND	DC/RF/Thermal/GND. (Maximize vias in this area)

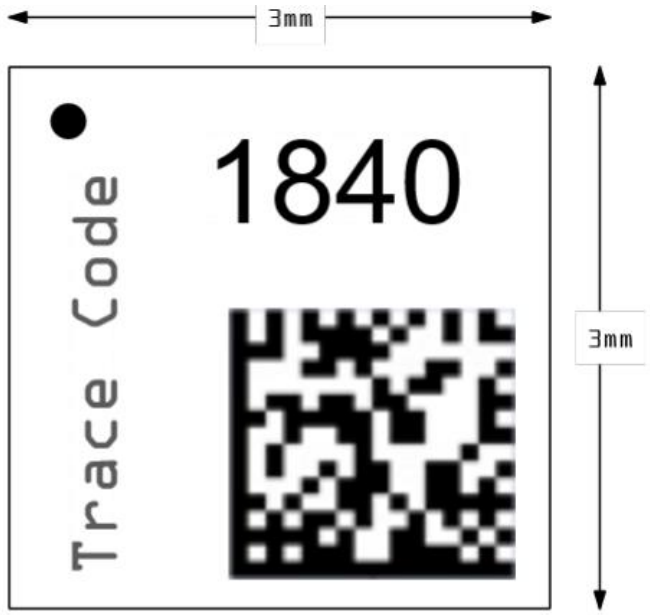
Package Outline



Recommended PCB Land Pattern



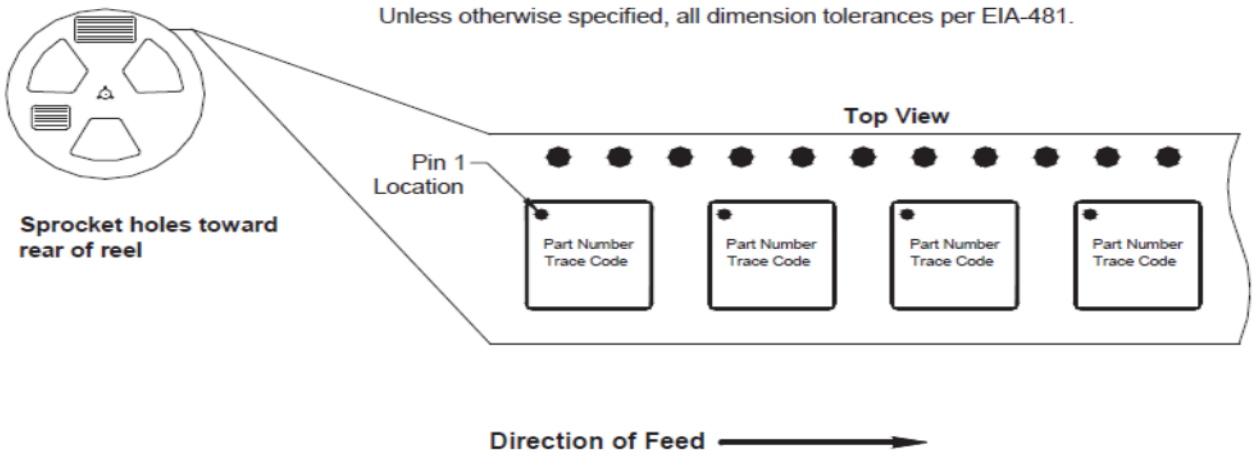
Package Marking



Tape and Reel

Table 1. Tape and Reel

Qorvo Part Number	Reel Diameter Inch (mm)	Hub Diameter Inch (mm)	Width (mm)	Pocket Pitch (mm)	Feed	Units Per Reel
QPL184018TR7	7 (178)	2.4 (61)	12	4	Single	2500



Handling Precautions

Parameter	Rating	Standard	 Caution! ESD Sensitive Device
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	MSL2	IPC / JEDEC J-STD-020	

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 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:
Web: www.qorvo.com

Tel: +1 844-890-8163

Email: customer.support@qorvo.com

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