Preliminary

QPA2575

32 – 38 GHz 3 Watt Power Amplifier

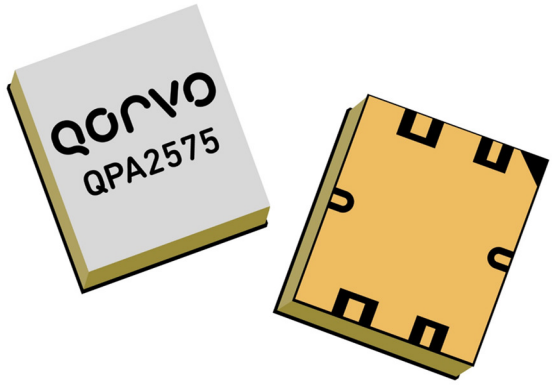
Product Overview

Qorvo's QPA2575 is a Ka-band power amplifier fabricated on Qorvo's QPHT15 0.15 um power pHEMT process. The QPA2575 operates from 32 to 38 GHz, providing 3 W of saturated power with 16 % power-added efficiency, and 19 dB small signal gain.

To simplify system integration, the QPA2575 is fully matched to 50 ohms with integrated DC blocking caps on both I/O ports. It is ideally suited to support both commercial and defense related opportunities.

The QPA2575 is 100% DC and RF tested on-wafer to ensure compliance to performance specifications.

Lead-free and RoHS compliant

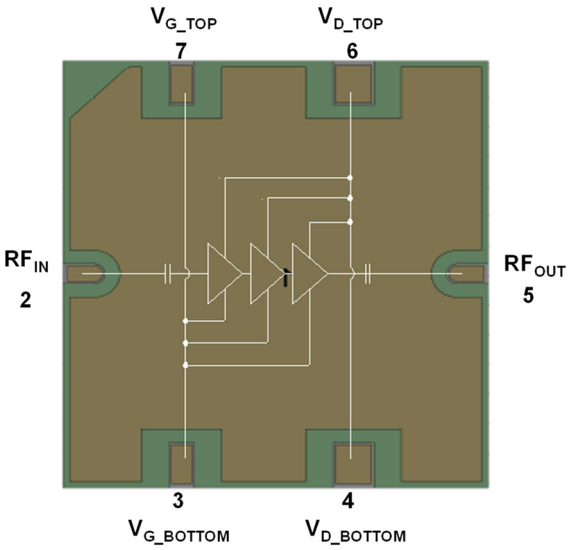


Key Features

- Frequency Range: 32 – 38 GHz
- P_{SAT} (P_{IN}=23 dBm): 35 dBm
- PAE (P_{IN}=23 dBm): 16 %
- Small Signal Gain: 19 dB
- Return Loss: 12 dB
- Bias: Pulsed V_D = 6 V, I_{DQ} = 2.1 A
- Package Dimensions: 7.0 x 8.0 x 1.465 mm

Performance is typical across frequency. Please reference electrical specification table and data plots for more details.

Functional Block Diagram



Applications

- Radar
- Satellite Communications

Ordering Information

Part No.	Description
QPA2575	32 - 38 GHz 3 Watt Power Amplifier
QPA2575TR7	250 pieces on a 7” reel
QPA2575EVB	Evaluation Board for QPA2575

Absolute Maximum Ratings

Parameter	Value / Range
Drain Voltage (V_D)	6.5 V
Gate Voltage Range (V_G)	–5 to 0 V
Drain Current (I_D)	3.6 A
Gate Current (I_G)	-14 to 29 mA
Power Dissipation (P_{DISS}), T_{BASE} = 85°C	Pulsed, 22 W
	CW, 16 W
Input Power (P_{IN}), 50 Ω, V_D = 6 V, I_{DQ} = 2.1 A, T_{BASE} = 85°C	26 dBm
Input Power (P_{IN}), 3:1 VSWR, V_D = 6 V, I_{DQ} = 2.1 A, T_{BASE} = 85°C	26 dBm
Channel Temperature, T_{CH}	200 °C
Mounting Temperature (30 seconds max)	260 °C
Storage Temperature	–55 to 150 °C

Operation of this device outside the parameter ranges given above may cause permanent damage. These are stress ratings only, and functional operation of the device at these conditions is not implied.

Recommended Operating Conditions

Parameter	Min	Typ	Max	Units
Input Power (P_{IN})*	19		23	dBm
Drain Voltage (V_D); pulsed		6 **		V
Drain Current, Quiescent (I_{DQ})		2.1		A
Drain Current, RF (I_{D_Drive})	See charts page 4, 8			A
Gate Voltage Typ. Range (V_G)	–0.35 to -0.85			V
Gate Current, RF (I_{G_Drive})	See charts page 4, 8			mA
Operating Temp. Range, T_{BASE}	–40	+25	+85	°C

Electrical specifications are measured at specified test conditions. Specifications are not guaranteed over all recommended operating conditions.

* Non-operating range: 8 – 18 dBm

** Not recommended for CW due to thermal

Electrical Specifications

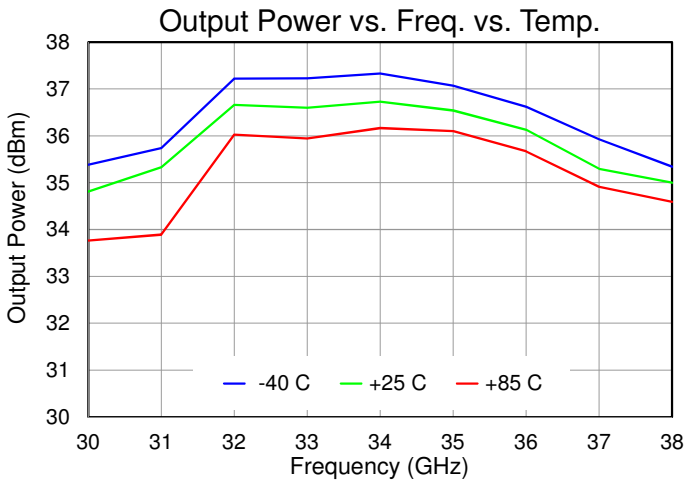
Parameter	Conditions (1) (2)	Min	Typ	Max	Units
Operational Frequency Range		32		38	GHz
Output Power at Saturation, P_{SAT}	P_{IN} = +23 dBm, Frequency = 32 - 36 GHz		36		dBm
	P_{IN} = +23 dBm, Frequency = 37 - 38 GHz		35		
Power Added Efficiency, PAE	P_{IN} = +23 dBm, Frequency = 32 - 36 GHz		22		%
	P_{IN} = +23 dBm, Frequency = 37 - 38 GHz		16		
Small Signal Gain, S21			> 19		dB
Input Return Loss, IRL			12		dB
Output Return Loss, ORL			12		dB
P_{SAT} Temperature Coefficient	T_{DIFF} = –40°C to +85°C; P_{IN} = +23 dBm		–0.009		dBm/°C
S21 Temperature Coefficient	T_{DIFF} = –40°C to +85°C		–0.04		dB/°C

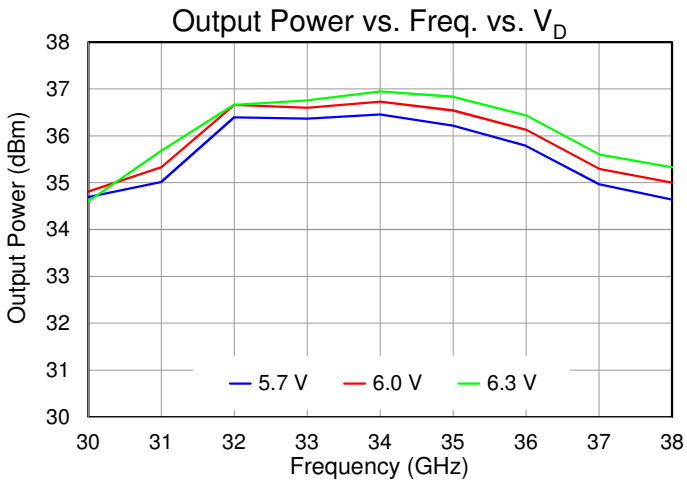
Notes:

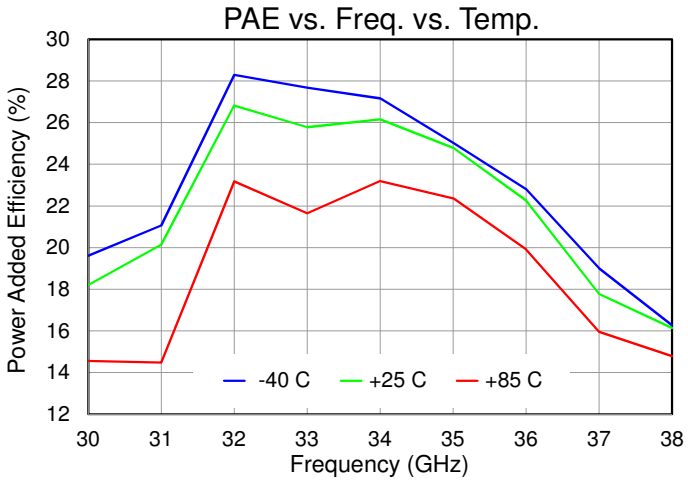
1. Test conditions unless otherwise noted: Pulsed VD = 6 V, IDQ = 2.1 A, adjusting VG (typical -0.6V +/-), Pulse Width = 50 uS, Duty Cycle = 35%, CW RF, TBASE = +25 °C, Z0 = 50 Ω
2. T_{BASE} is back side of package

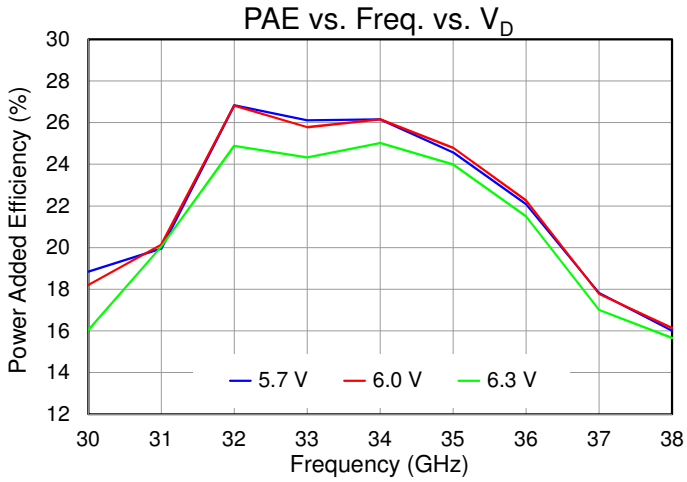
Performance Plots – Large Signal

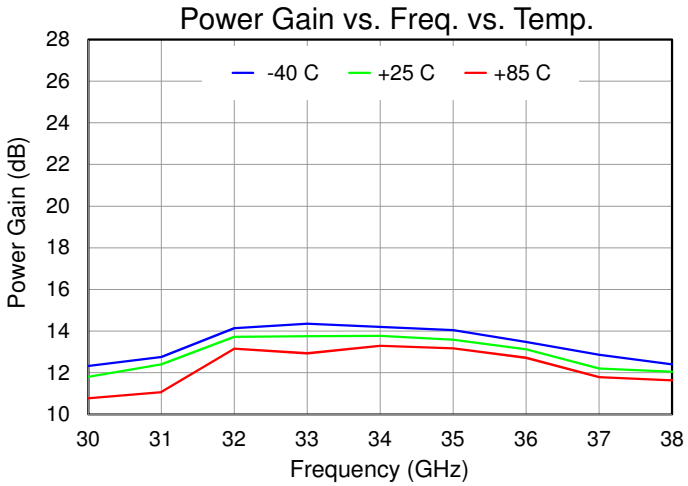
Test conditions unless otherwise noted: Pulsed V_D = 6 V, I_{DQ} = 2.1 A, CW P_{IN} = 23 dBm, PW = 50 uS, DC = 35%, T_{BASE} = +25 °C

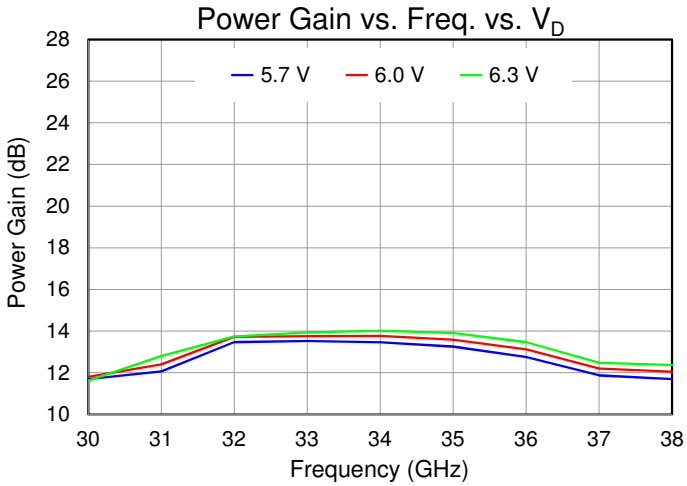












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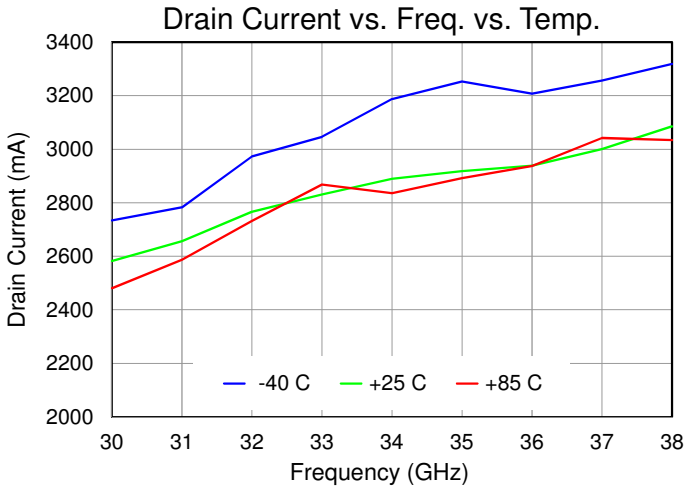

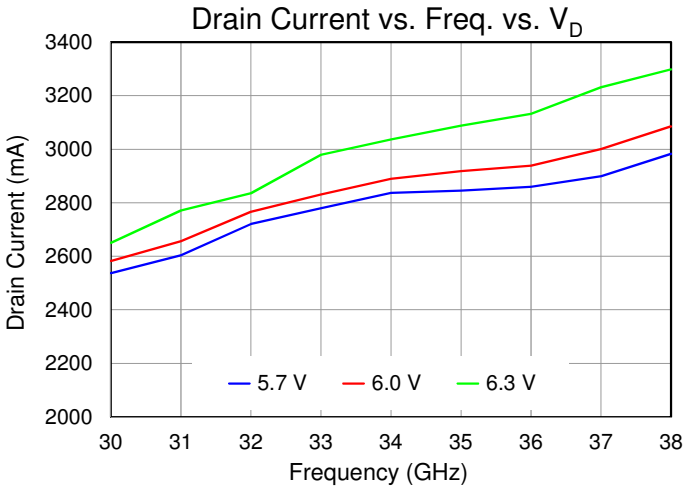

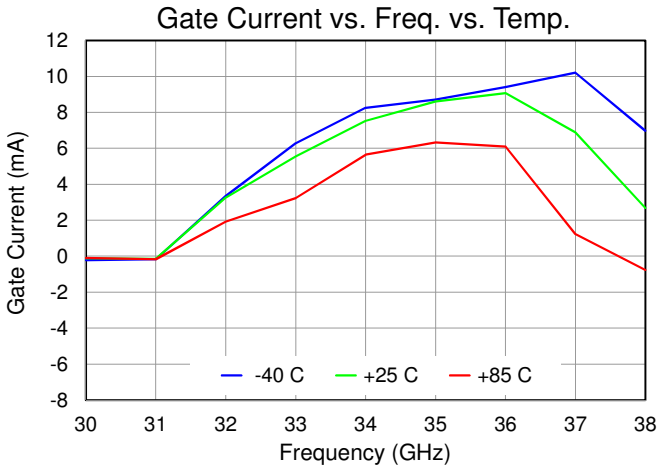

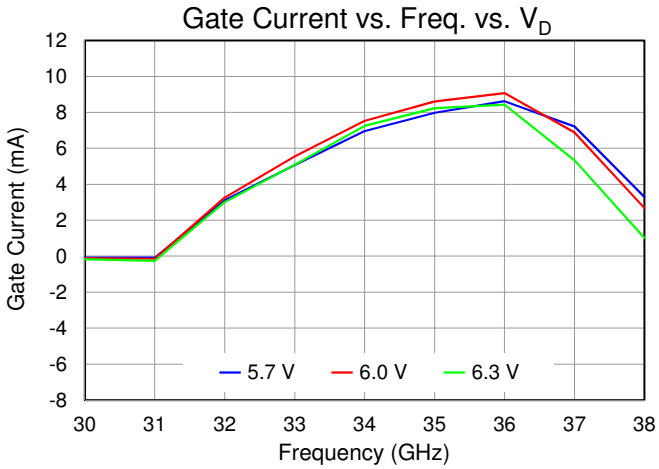

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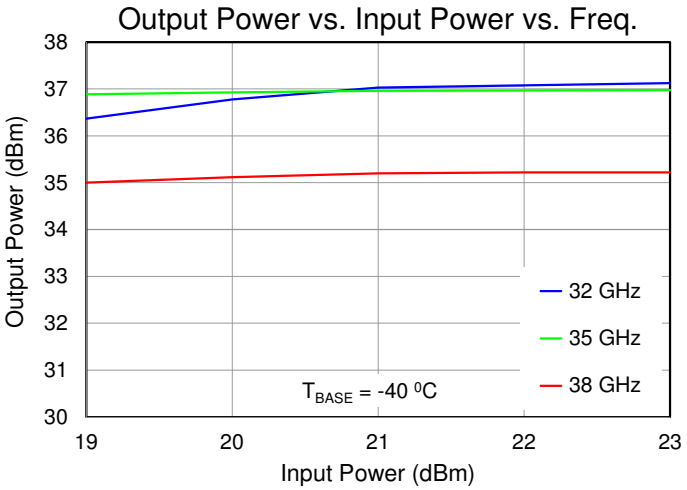

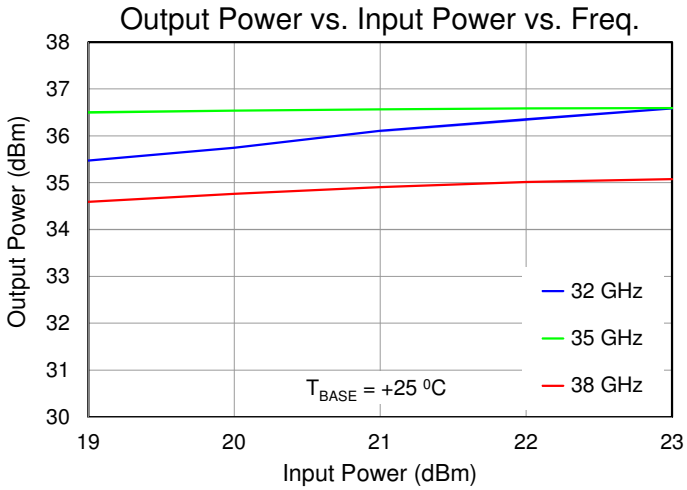

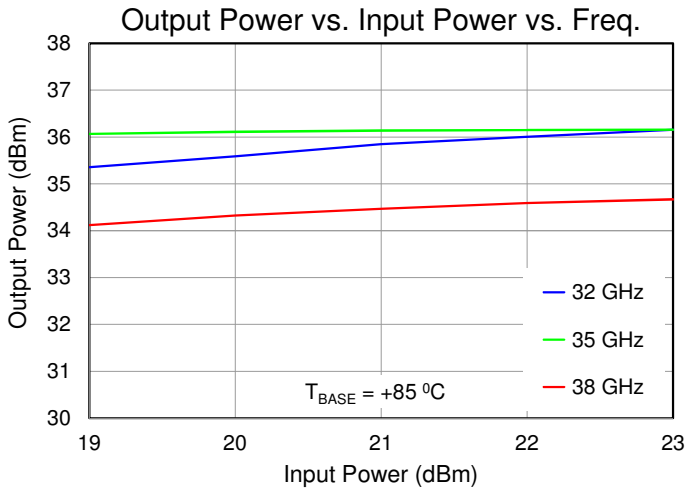

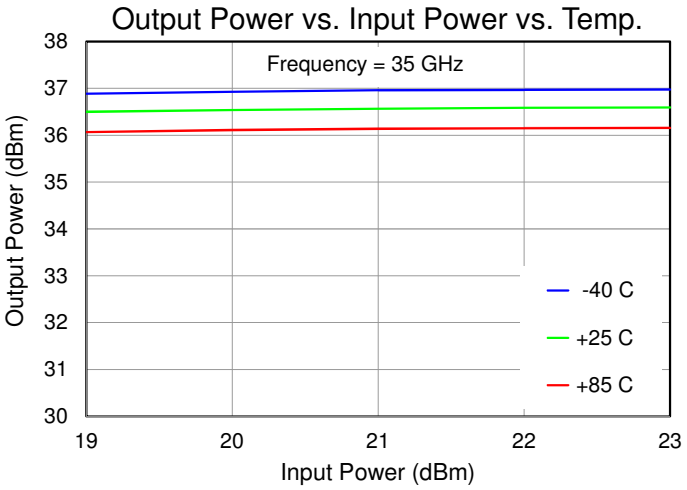

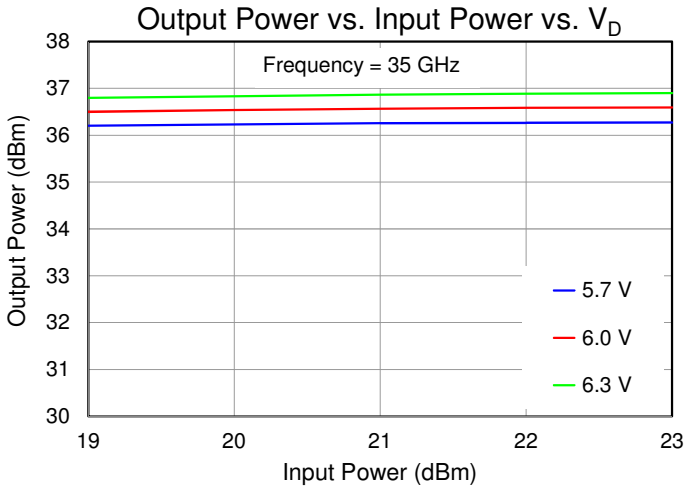

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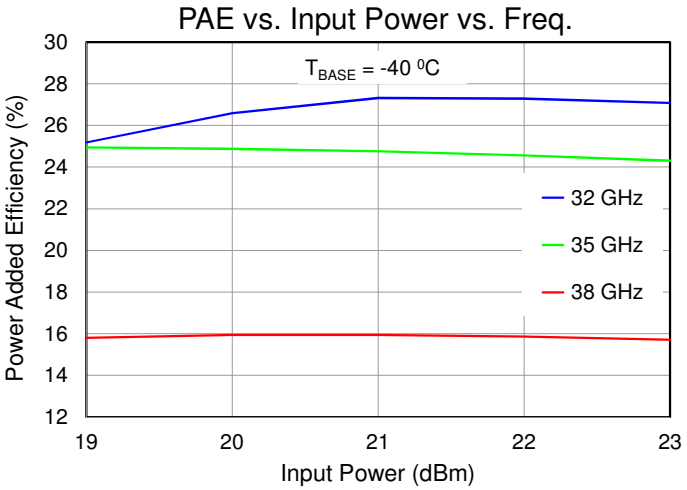

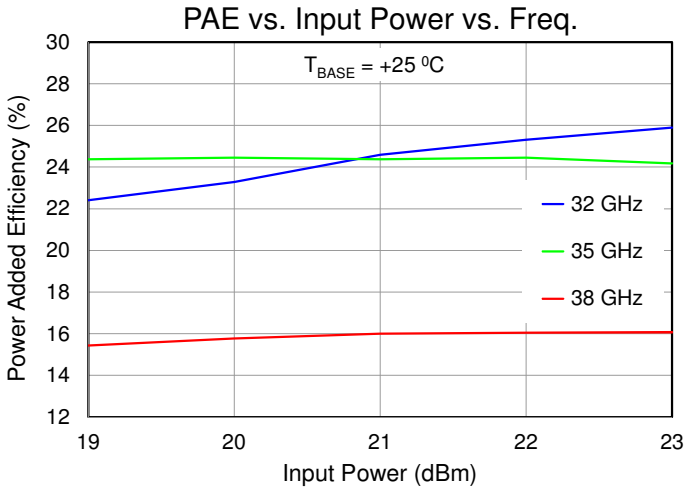

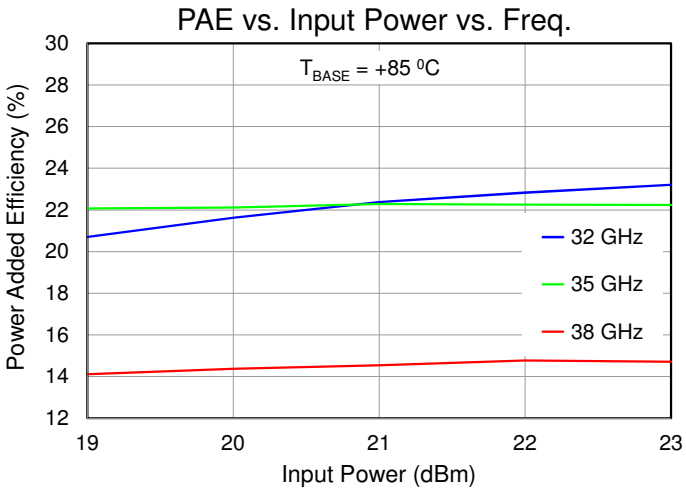

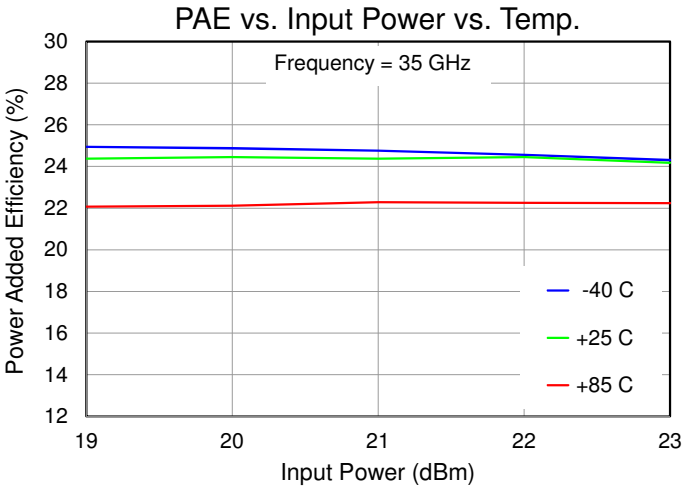

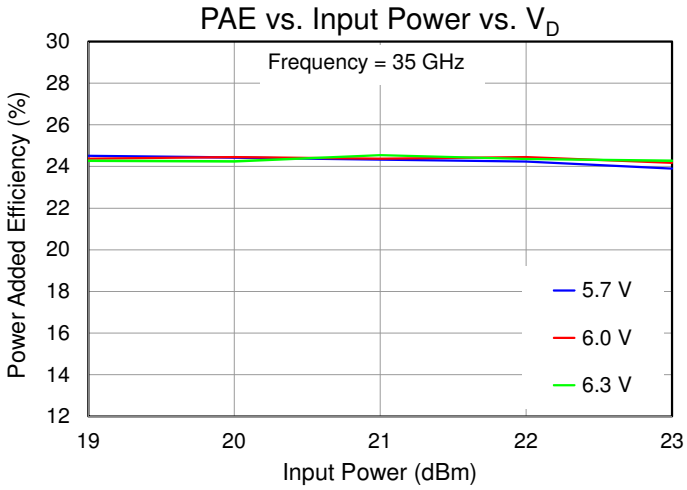

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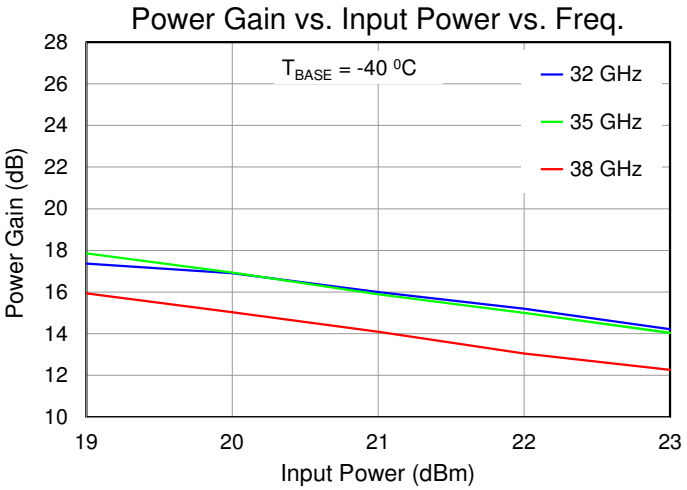
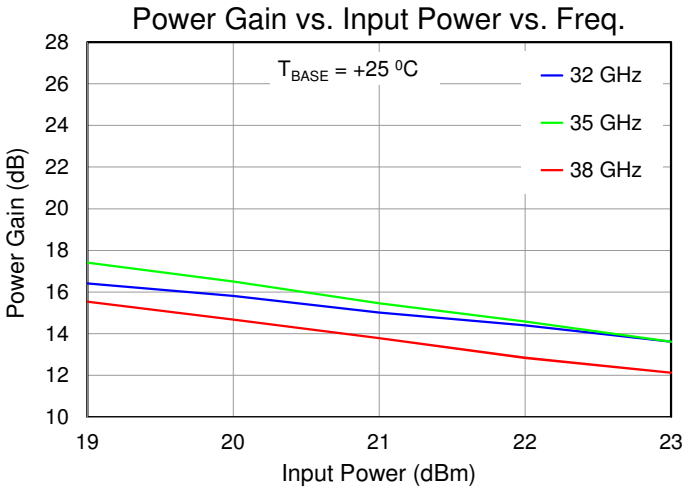
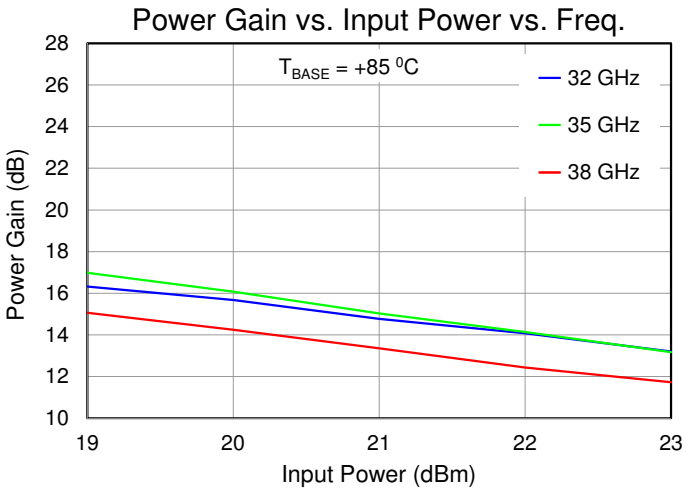
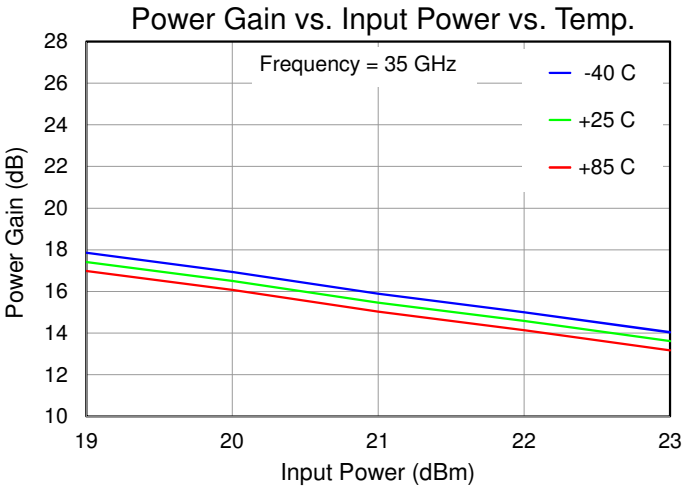
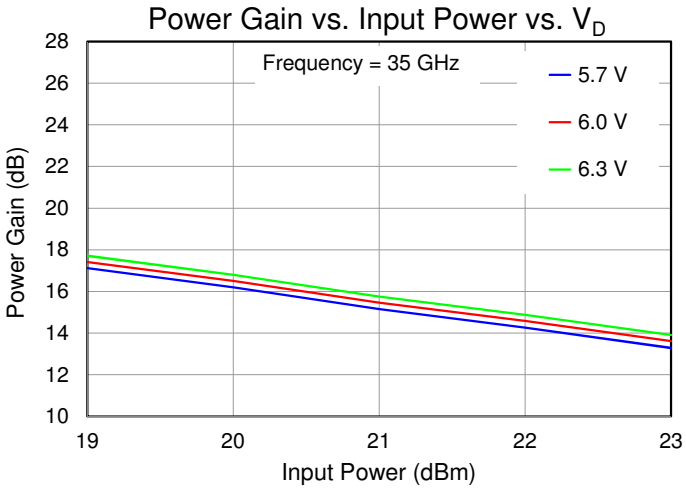




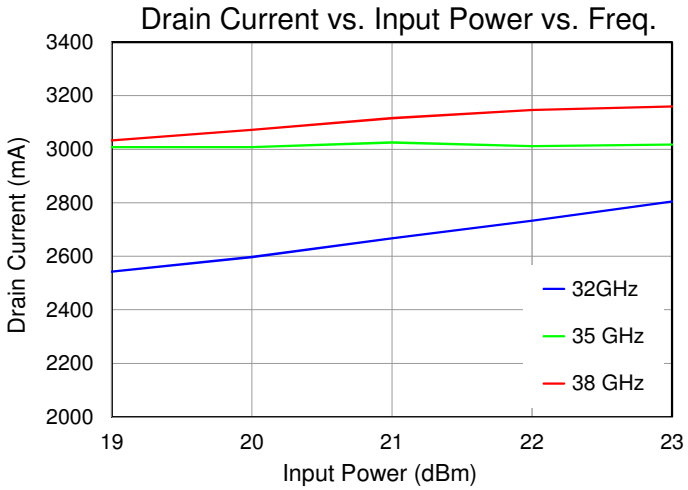


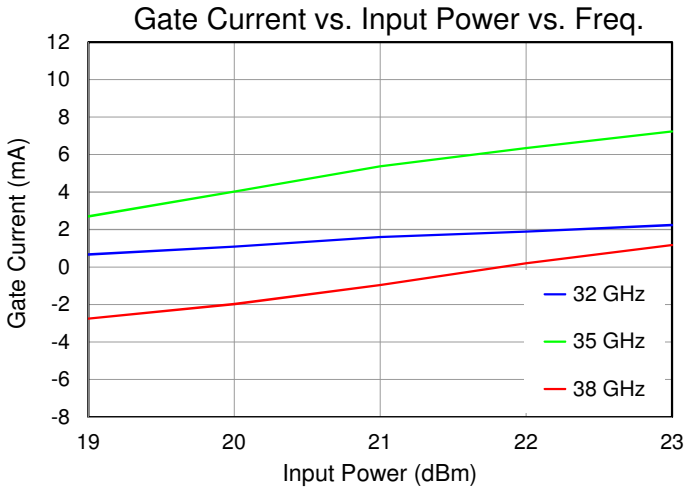


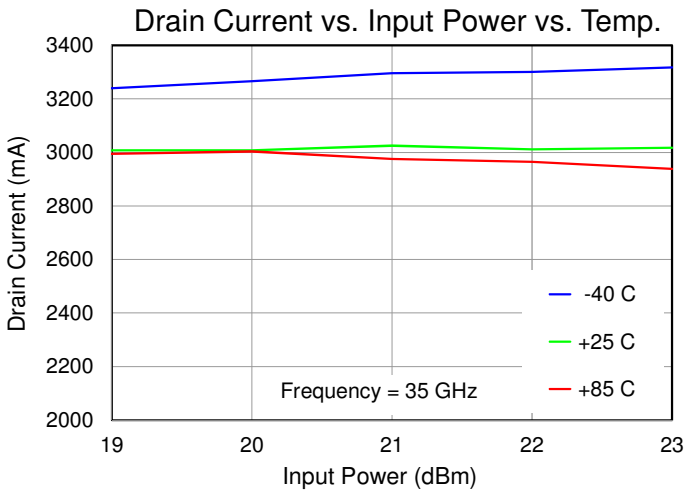


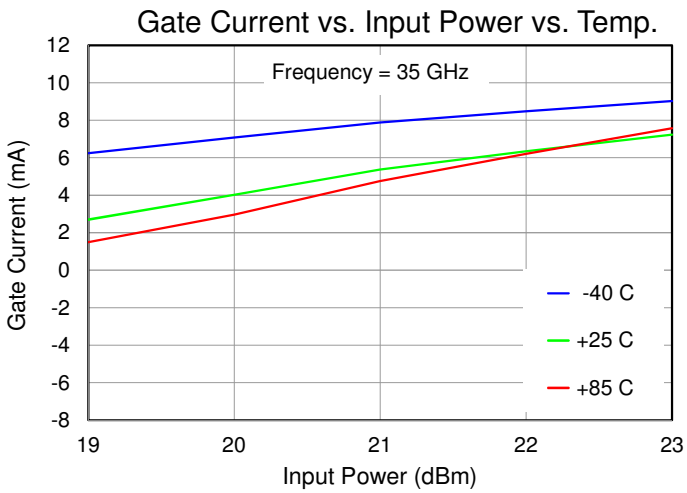
Performance Plots – Large Signal

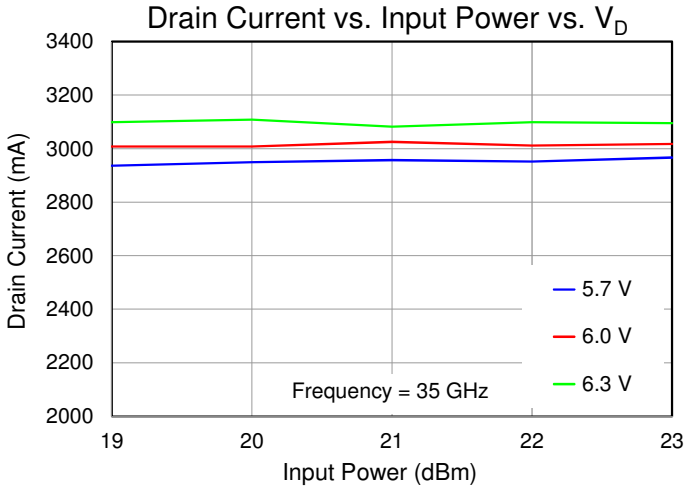
Test conditions unless otherwise noted: Pulsed V_D = 6 V, I_{DQ} = 2.1 A, CW P_{IN} = 23 dBm, PW = 50 uS, DC = 35%, T_{BASE} = +25 °C

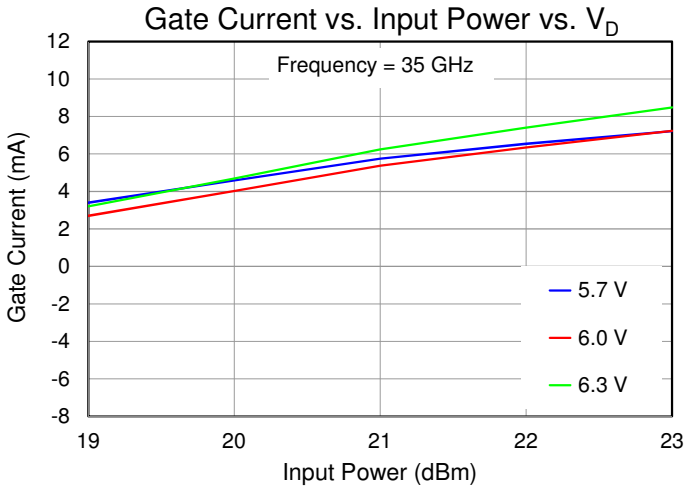








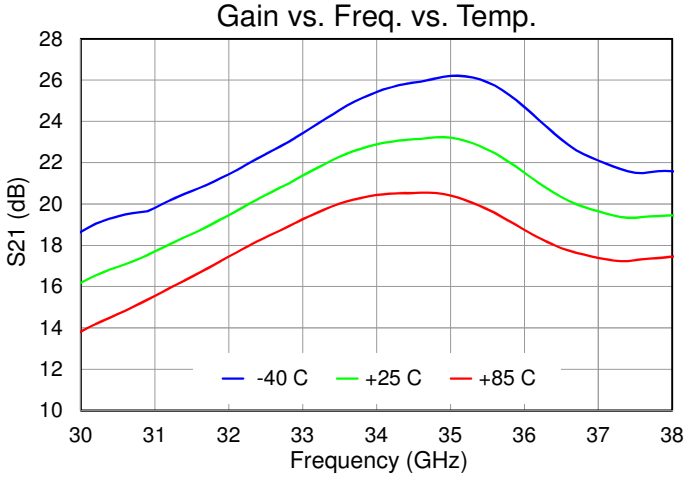




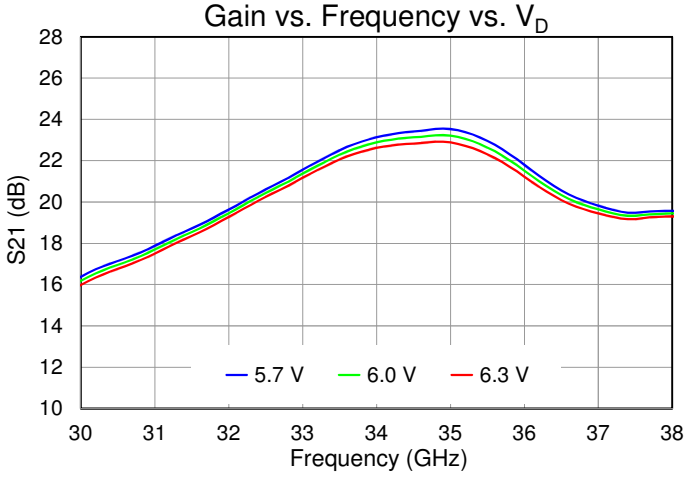
Performance Plots – Small Signal

Test conditions unless otherwise noted: CW, V_D = 6 V, I_{DQ} = 2.1 A, P_{IN} = -20 dBm, T_{BASE} = +25 °C

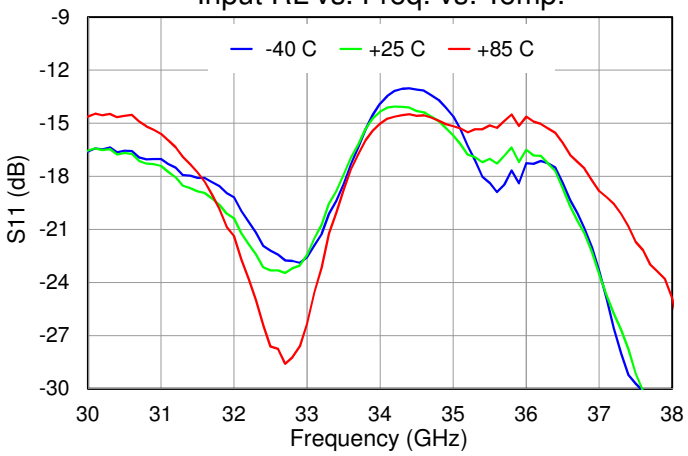
Gain vs. Freq. vs. Temp.



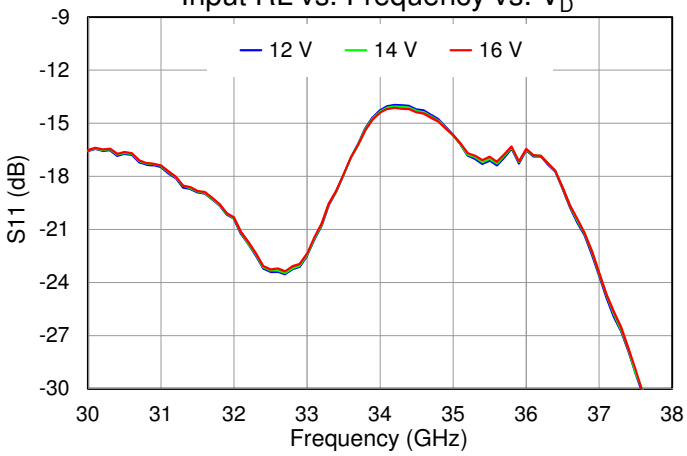
Gain vs. Frequency vs. V_D



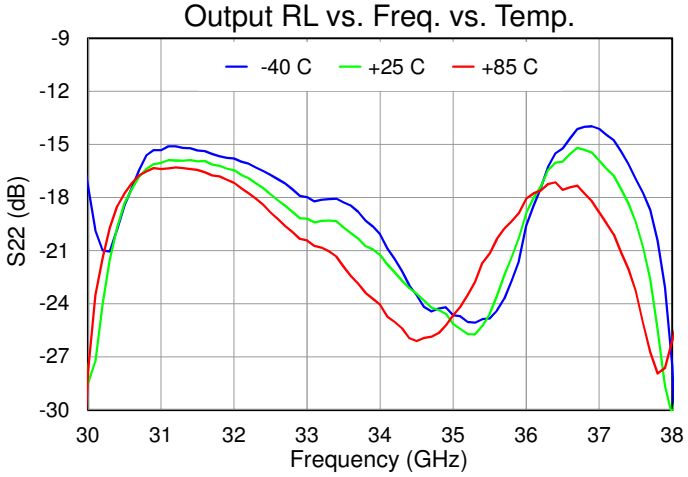
Input RL vs. Freq. vs. Temp.



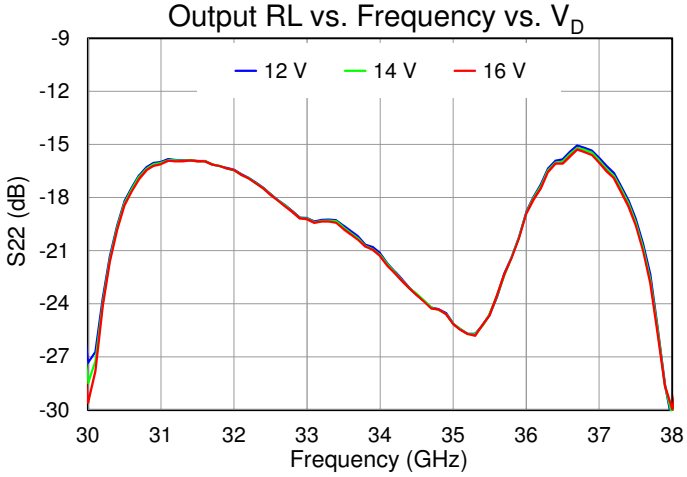
Input RL vs. Frequency vs. V_D



Output RL vs. Freq. vs. Temp.



Output RL vs. Frequency vs. V_D

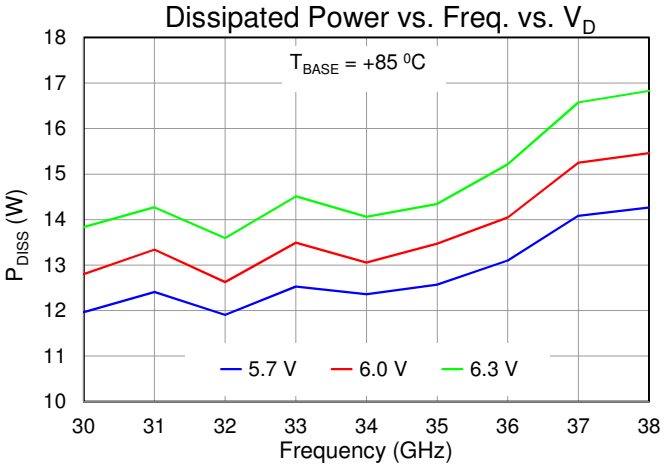


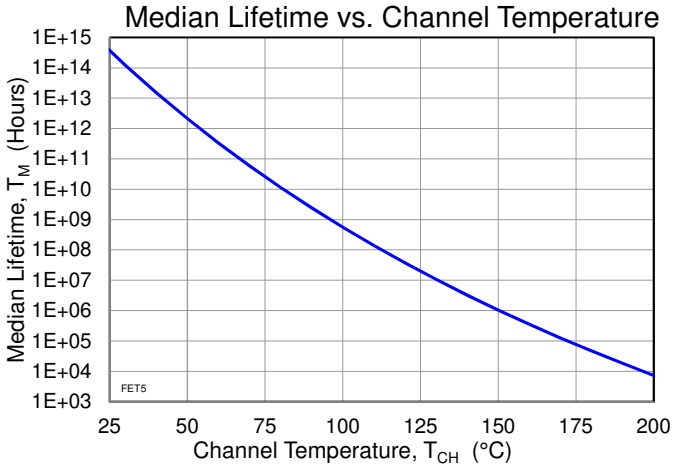
Thermal and Reliability Information

Parameter	Test Conditions	Value	Units
Thermal Resistance (θ_{JC}) (1)	T_{BASE} = 85 °C, V_D = 6 V, I_{DQ} = 2.1 A, No RF (quiescent DC operation) P_{DISS} = 12.6 W	5.92	ºC/W
Channel Temperature, T_{CH} (Under RF) (2)		160	°C
Thermal Resistance (θ_{JC}) (1)	T_{BASE} = 85 °C, Pulsed V_D = 6 V, I_{DQ} = 2.1 A, Freq = 38 GHz, I_{D_Drive} = 3.035 A, PW = 50 uS, DC = 35%, P_{IN} = 23 dBm, P_{OUT} = 34.6 dBm, P_{DISS} = 15.5 W	5.97	ºC/W
Channel Temperature, T_{CH} (Under RF) (2)		178	°C

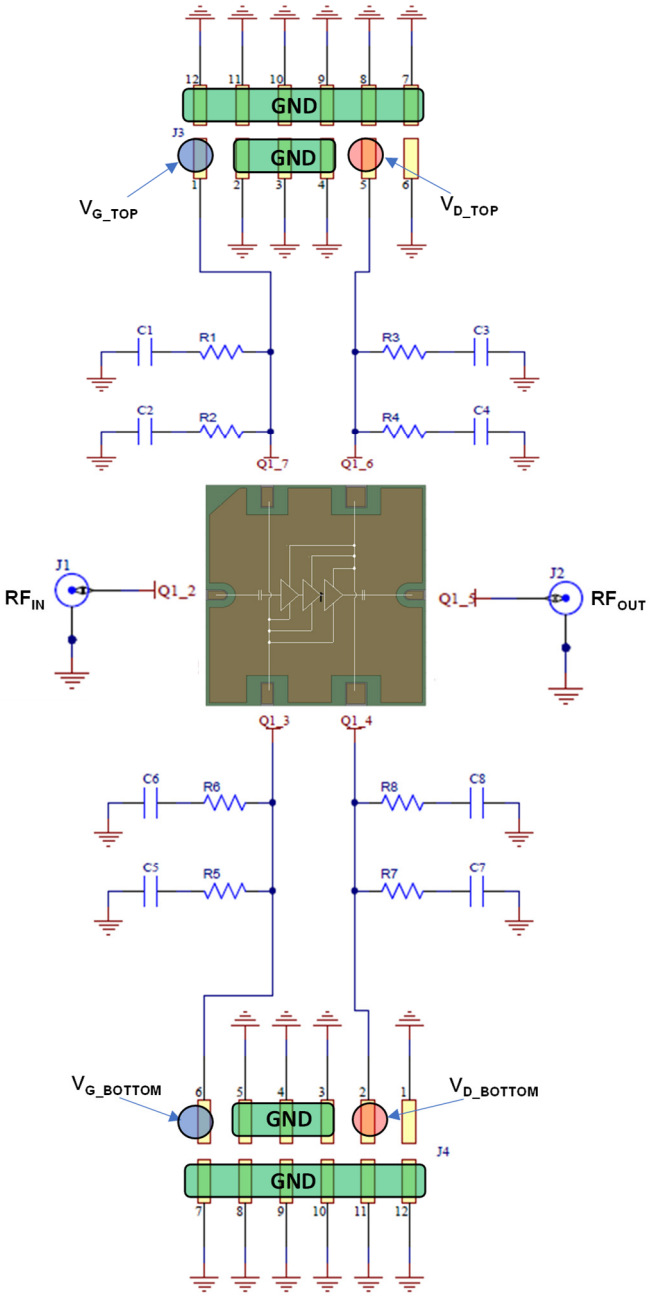
Notes:
1. Thermal resistance determined to the back of package (T_{BASE} = 85 °C)

Test conditions, unless otherwise noted:
Pulsed V_D = 6 V, I_{DQ} = 2.1 A, PW = 50 uS, DC = 35%, CW P_{IN} = 23 dBm, T_{BASE} = 85 °C





Applications Circuit (Pulsed V_D)



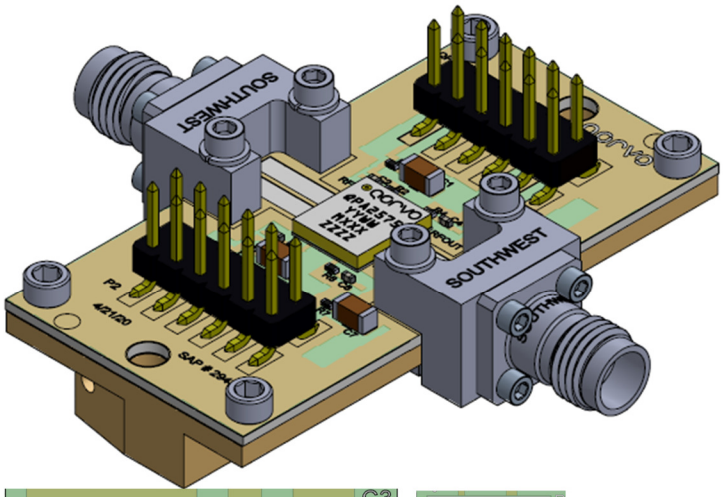
Bias-Up Procedure

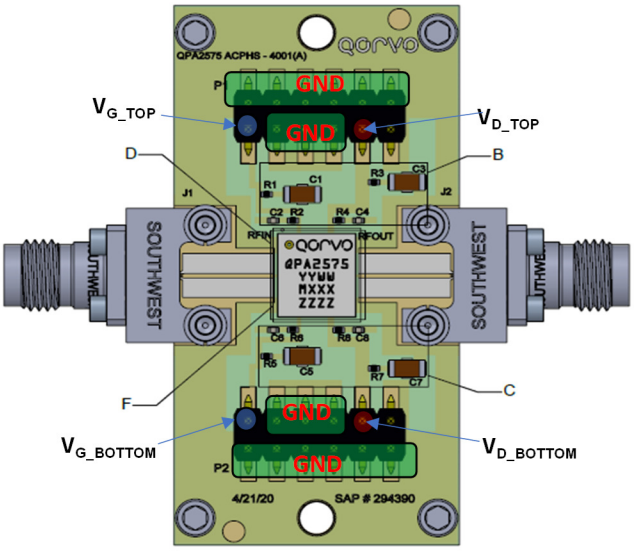
1. Set I_D limit to 3.6 A, I_G limit to 20 mA
2. Set V_G to –1.5 V
4. Set V_D +6 V
5. Adjust V_G more positive until I_{DQ} = 2.1 A
6. Apply RF signal

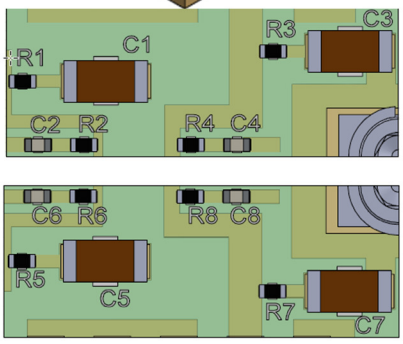
Bias-Down Procedure

1. Turn off RF signal
2. Reduce V_G to –1.5 V. Ensure I_{DQ} ~ 0mA
3. Set V_D to 0 V
4. Turn off V_D supply
5. Turn off V_G supply

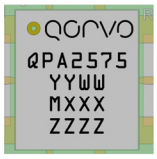
Application Evaluation Board

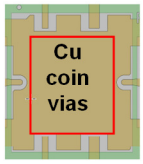




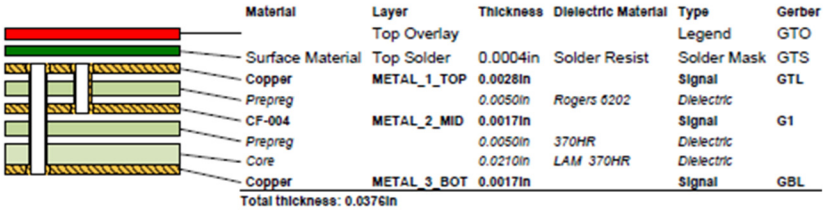


View B and C





View D and F

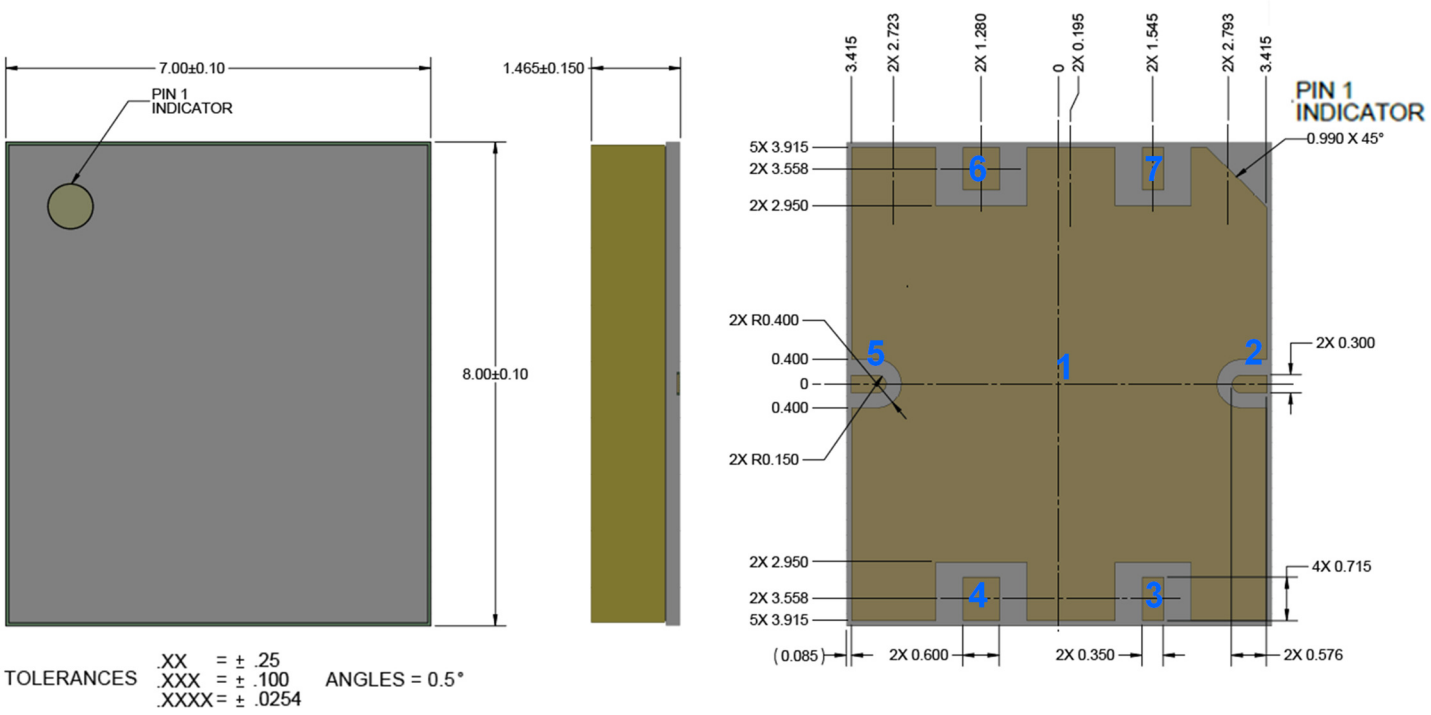


PCB Layers

Bill of Materials

Reference Des.	Value	Description	Manuf.	Part Number
C1, C3, C5, C7	10 uF	CAP, 10uF, ±20%, 50V, X5R, 1206	Various	
C2, C4, C6, C8	0.01 uF	CAP, 0.01uF, ±10%, 50V, X7R, 0402	Various	
R1, R2, R4 – R6, R8	5.1 Ω	RES, 5.1 Ohm, 5%, 50V, 0402	Various	
R3, R7	0 Ω	RES, 0 Ohm, JMPR, 0402	Various	
H1, H2	-	Header, connector, 2x6, 0.100”, SMD		
J1, J2	-	Connector, Female, End Launch, 2.4mm	Southwest Microwave	
J3, J4	-	Connector, Header, 2x6, 0.100”, SMD		
S1 – S4		Screw, cap, socket head, 2-56x1/8”		
PCB	-	Core FR4 0.027”thick, copper metal with immersion silver final plating. Total PCB thickness is 0.0376”	Rogers Corp.	Custom
Carrier	-	T-Carrier, Copper C110, 0.990 x 2.000 x 0.275”		Custom
Preform Solder	-	Preform, Solder, 0.984 x 1.994, 0.003”		
Solder	-	Paste, solder, Sn62Pb37, type 3		

Mechanical Information



Notes: unless otherwise specified;

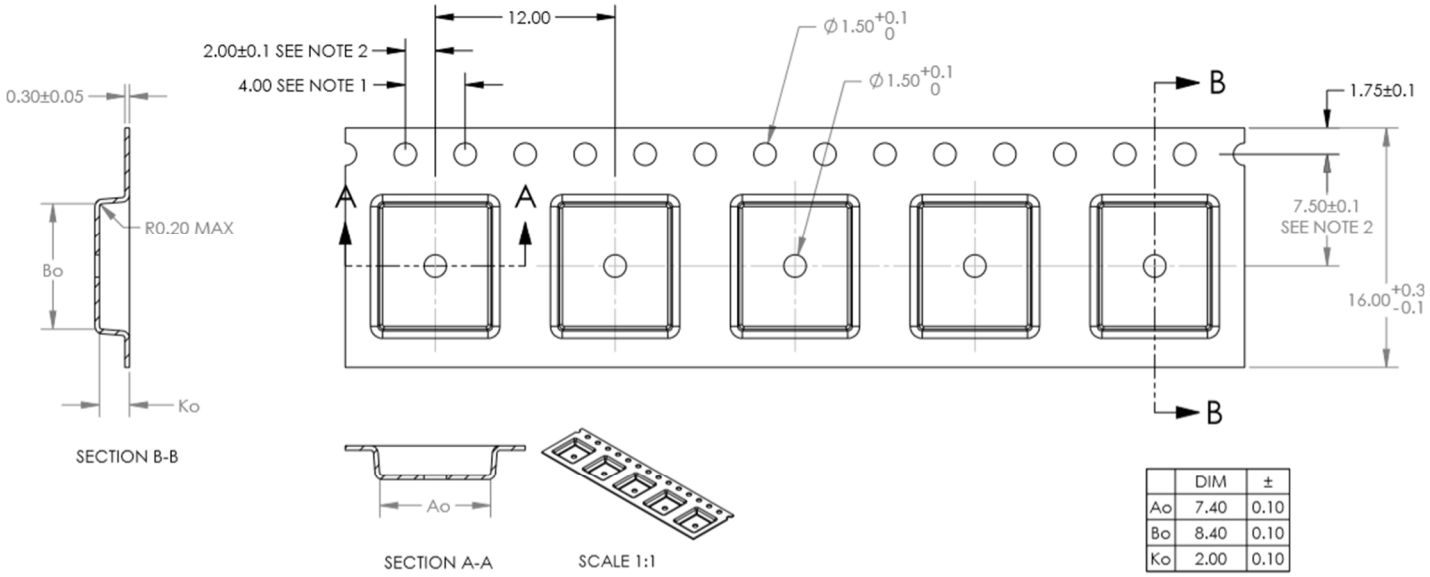
1. Dimensions: millimeters (mm)
2. Package is air cavity, leads are gold (Au) plated of 0.10um min., base is laminate; Part is epoxy sealed
3. Marking: YY is calendar year; WW is assembly week; MXXX is batch ID

Pin Description

Pin Number	Symbol	Description
1	Center Pad	Ground connection
2	RF_{IN}	RF input. 50 Ohms. DC blocked.
3	V_G	Gate voltage, bottom. Bypass network required; refer to page 11
4	V_D	Drain voltage, bottom. Bypass network required; refer to page 11
5	RF_{OUT}	RF output. 50 Ohms. DC blocked.
6	V_D	Drain voltage, top. Bypass network required; refer to page 11
7	V_G	Gate voltage, top. Bypass network required; refer to page 11

Tape and reel Information

Standard T/R size = 250 pieces on a 7” reel
Dimensions: millimeters (mm)
Tolerances unless otherwise noted: .X = ± .2; .XX = ± .10



	DIM	±
Ao	7.40	0.10
Bo	8.40	0.10
Ko	2.00	0.10

ALL DIMS IN MILLIMETERS
PER ASME Y14.5M
TOLERANCES UNLESS - SPECIFIED
1 PL ± 0.2 2 PL ± 0.10

NOTES:
1. 10 SPROCKET HOLE PITCH CUMULATIVE TOLERANCE ±0.2
2. POCKET POSITION RELATIVE TO SPROCKET HOLE MEASURED AS TRUE POSITION OF POCKET, NOT POCKET HOLE.
3. Ao AND Bo ARE MEASURED ON A PLANE AT A DISTANCE "R" ABOVE THE BOTTOM OF THE POCKET.

Solderability

Compatible with lead-free soldering processes with 260°C peak reflow temperature.

This package is air-cavity and non-hermetic, and therefore cannot be subjected to aqueous washing. The use of no-clean solder to avoid washing after soldering is highly recommended.

Contact plating: Ni-Au

Solder rework not recommended

Recommended Soldering Temperature Profile