Spatium™ QPR3238

32 -38 GHz GaN SSPA

Product Description

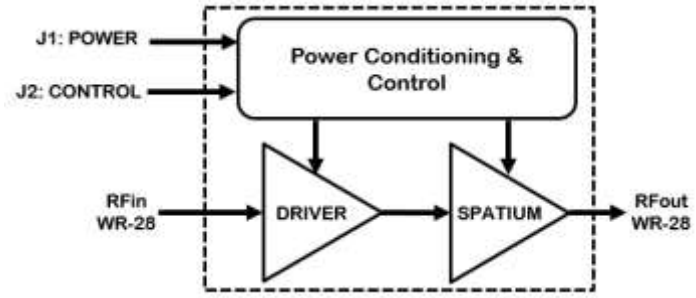
An excellent alternative to traveling wave tube amplifiers, Qorvo's Spatium™ QPR3238 is an integrated solid state, spatial-combining amplifier and driver amplifier with an operating range of 32–38 GHz while achieving 51.5 dBm (CW) of instantaneous saturated power. With its maximum performance in output power, gain, efficiency, and power flatness, this Spatium is the ideal building block for microwave high power transmitters for EW and radar applications.

The QPR3238 includes a DC enable function that can be used to pulse / modulate the RF output of the amplifier. In BLANK (Disable) mode, the amplifier's current draw is reduced to near 0A, resulting in a reduced noise and power dissipation.

Qorvo's patented and field-proven Spatium combining technology provides unprecedented Solid-State Power Amplifier (SSPA) performance in a rugged, compact size and weight which reduces total cost of ownership compared to alternative technologies. This product offering combines Qorvo's market leadership in GaN technology and wideband MMIC design along with our high-count combining techniques for a best in class solution to power amplification.

Output / Input

Functional Block Diagram



Product Features

- Frequency Range: 32 – 38 GHz
- Saturated Output Power: 52 dBm (P_{IN} = 0 dBm, Pulse)
- Saturated Output Power: 51.5 dBm (P_{IN} = 0 dBm, CW)
- Solid State MMIC Reliability
- Multi-Element Redundancy
- Instant On (no warm-up)
- Blank Mode
- Fast DC Pulsing

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

Applications

- TWTA Replacement

Ordering Information

Part No.	Description
QPR3238	32 – 38 GHz SSPA with Driver

Absolute Maximum Ratings

Parameter	Min Values	Max Values	Units
Supply Voltage (V_{DC}) *	18	24	V
Prime Power Consumption	-	1250	W
Enable Voltage	-	6.5	V
RF Input Power, Max. (VSWR = 1.5:1, T = 25 °C)	-	5	dBm
Load VSWR		3:1	-
Storage Temperature	-55	85	°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.

* Rating for thermal reliability

Recommended Operating Conditions

Parameter [1]	Min	Typ	Max	Units
Drain Voltage (V_{DC})		24	24	V
Quiescent Current		10		A
Operating Current		See data plots		A
Operating Temperature CW [2]	-40		43	°C
Operating Temperature, Pulse Mode, Duty Cycle ≤ 70% [2]	-40		71	°C
Pulse Width (+71 °C [2], Duty Cycle 70%)			1	uS
Pulse Width (+71 °C [2], Duty Cycle 60%)			50	uS
Pulse Width (+71 °C [2], Duty Cycle 50%)			500	uS
DC Pulse Width [3]	1			uS
DC Pulse Period [3]	2			uS

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

2 Refers to outside clamp surface temperature, 2 - sided cooling required.
3 Unit can be DC or RF pulsed, these limits are applicable to DC pulse only.

Specifications

Test conditions unless otherwise noted: V_{DC} = 24 V, I_{DQ} = 10 A, T_{CLAMP} = 25 °C

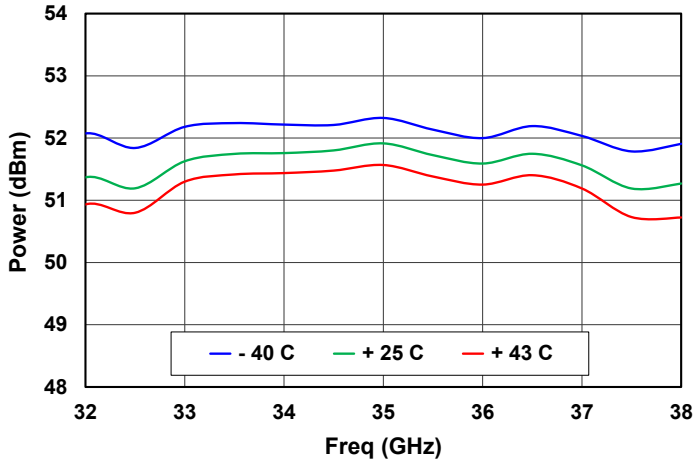
Parameter	Min	Typ	Max	Units
Frequency	32		38	GHz
Pulse Mode, Saturated Power (P_{IN} = 0 dBm) *		52		dBm
Pulse Mode, Power-Added Efficiency (P_{IN} = 0 dBm) *		15		%
Pulse Mode, Power Gain (P_{IN} = 0 dBm) *		52		dB
CW Mode, Saturated Power (P_{IN} = 0 dBm)		51.5		dBm
CW Mode, Power-Added Efficiency (P_{IN} = 0 dBm)		15		%
CW Mode, Power Gain (P_{IN} = 0 dBm)		51.5		dB
Small Signal Gain (Tested at -30 dBm)		70		dB
Input Return Loss (Tested at -30 dBm)		14		dB
Noise Power Density (Unit in Enable Mode)		-20		dBm / MHz
Switching Time ENABLE > 2.5 V to 90% RF (ON)		165	200	ns
Switching Time ENABLE < 2.5 V to 10% RF (OFF)		147	200	ns
Pulse Repetition Frequency			0.5	MHz
Input RF Interface **	WR-28 Waveguide Flange, Vertical			-
Output RF Interface **	WR-28 Waveguide Flange, Horizontal			-
Weight	13.4 (6.1)			lbs. (kg)
Dimensions (w/o handle), L x W x H	11.05 (280.67) x 5.50 (139.70) x 3.43 (87.12)			inches (mm)

* DC pulsing mode using SYS_ENABLE control.
** Waveguide interfaces are rotated 90 degrees with respect to one another, check outline drawing for details.

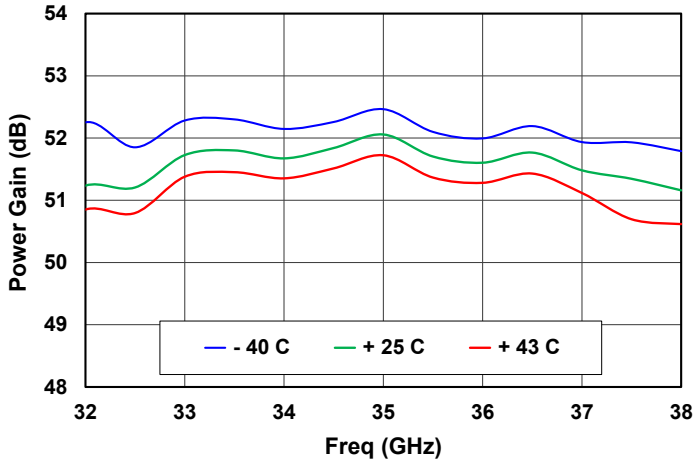
Typical Performance – Large Signal, CW Mode

Test conditions unless noted: V_{DC} = 24 V, I_{DQ} = 10 A, Pin = 0 dBm, CW, T_{CLAMP} = 25 °C

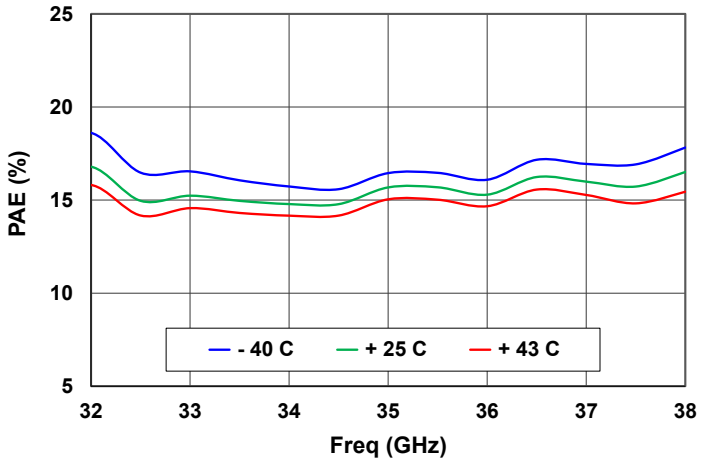
Power vs Temperature



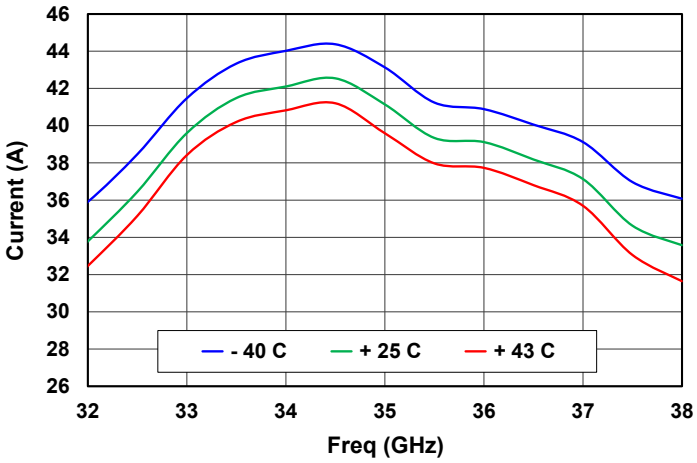
Power Gain vs Temperature



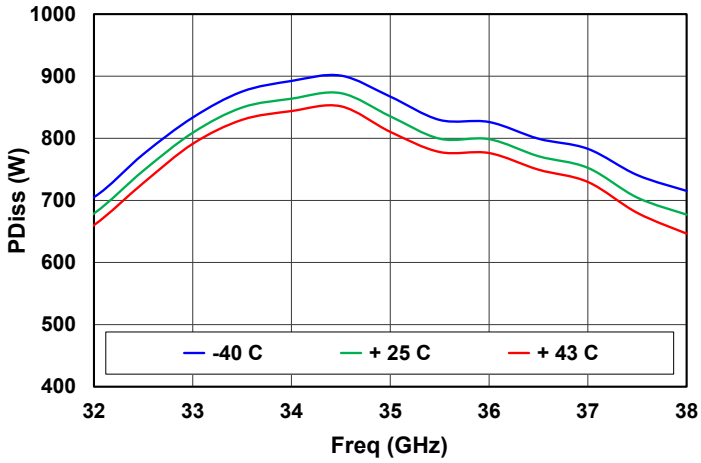
PAE vs Temperature



Current vs Temperature



PDiss vs Freq vs Temperature



Typical Performance – Large Signal, CW Mode

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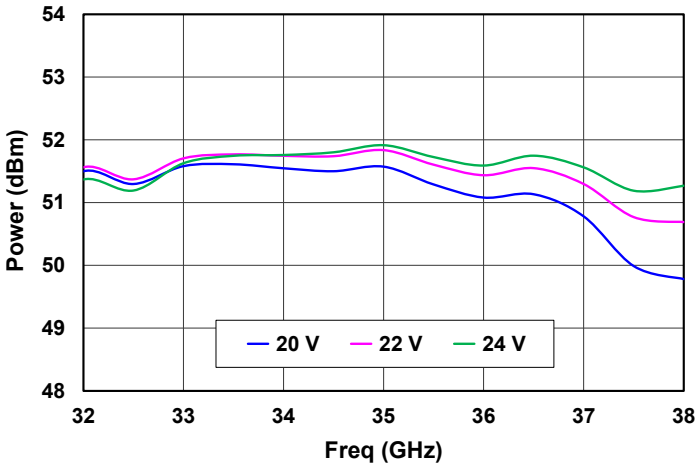
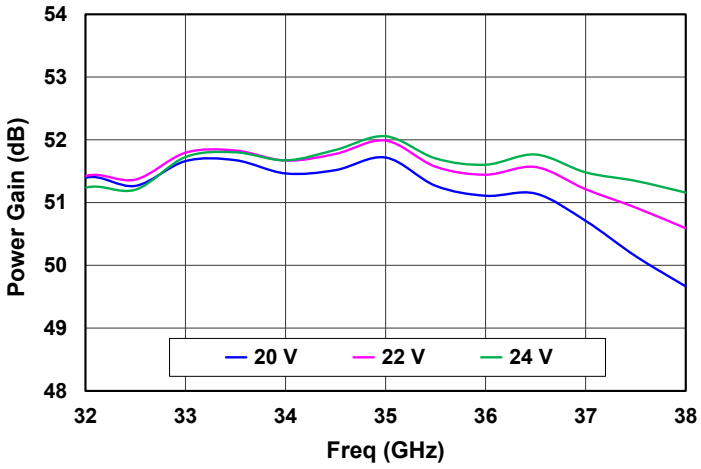
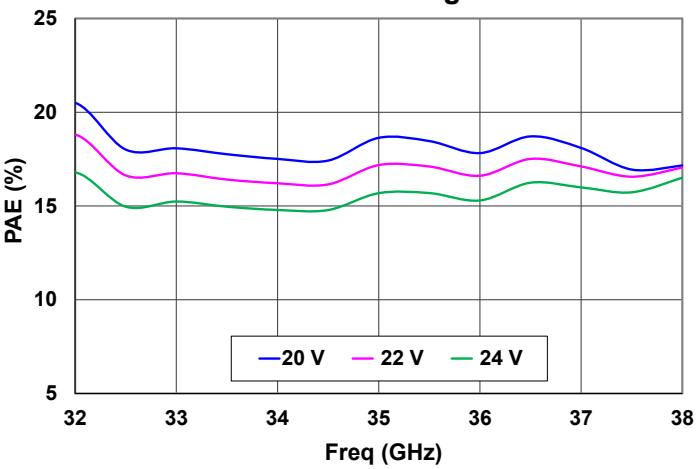
Power vs Voltage



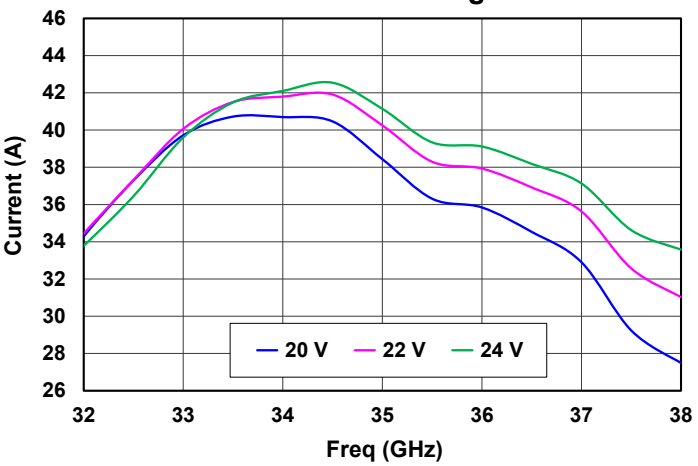
Power Gain vs Voltage



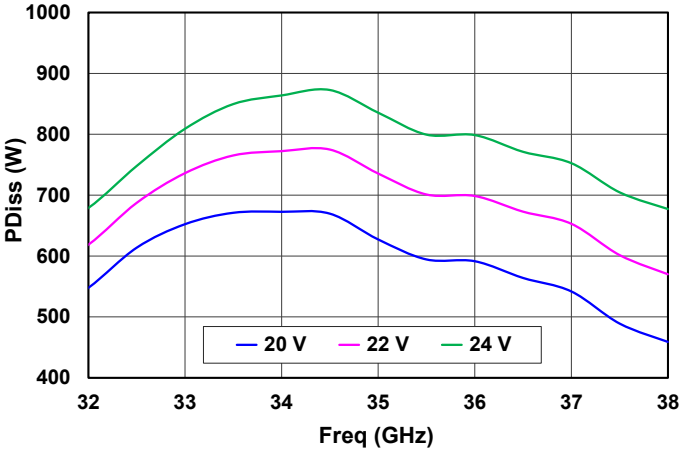
PAE vs Voltage



Current vs Voltage



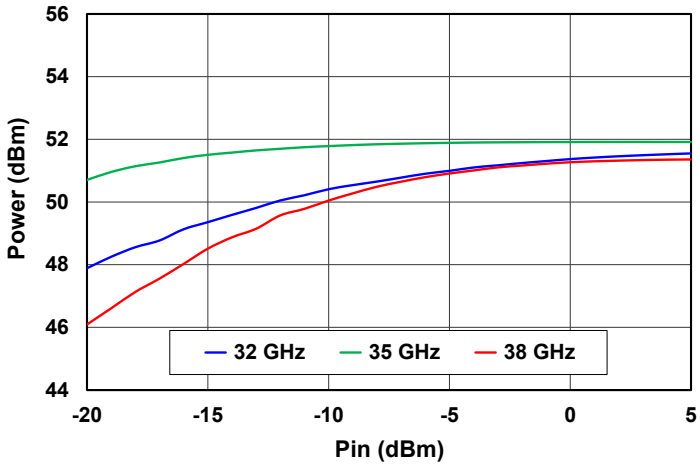
PDiss vs Freq vs Voltage



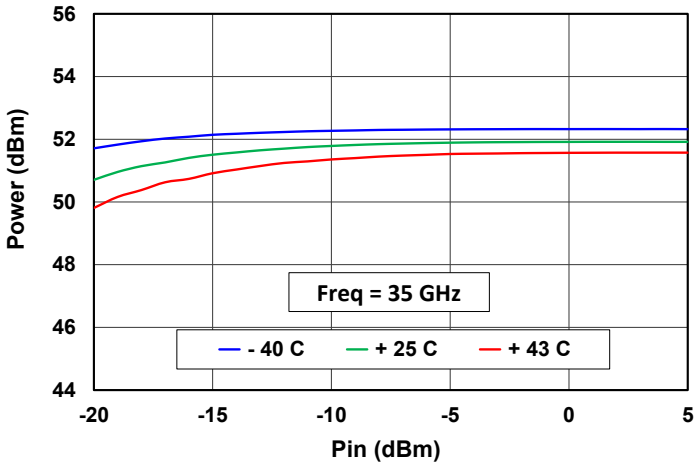
Typical Performance – Large Signal, CW Mode

Test conditions unless noted: V_{DC} = 24 V, I_{DQ} = 10 A, Pin = 0 dBm, CW, T_{CLAMP} = 25 °C

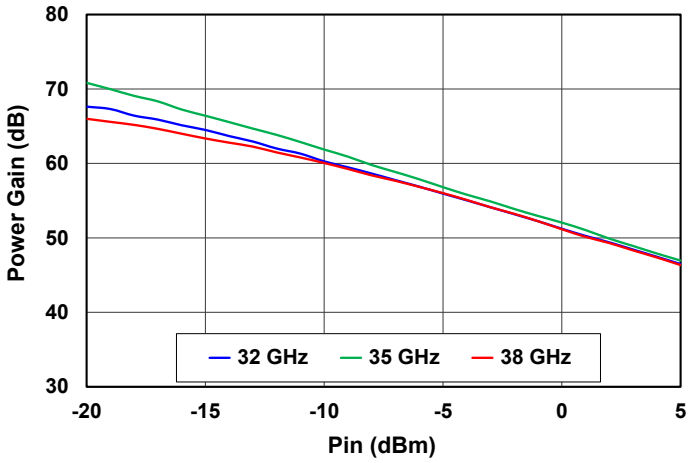
Power vs Pin vs Frequency



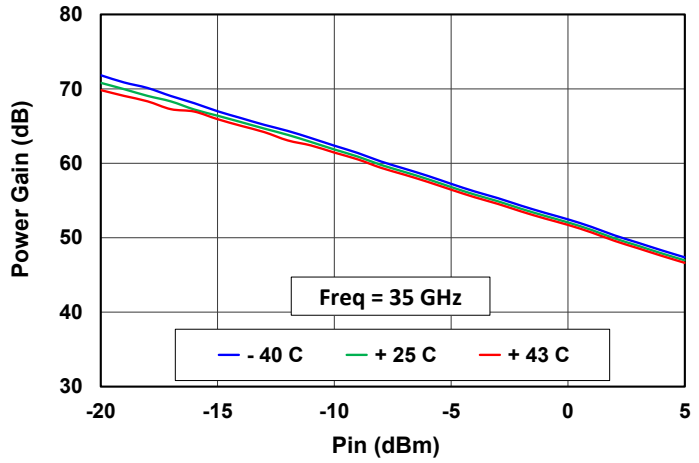
Power vs Pin vs Temp



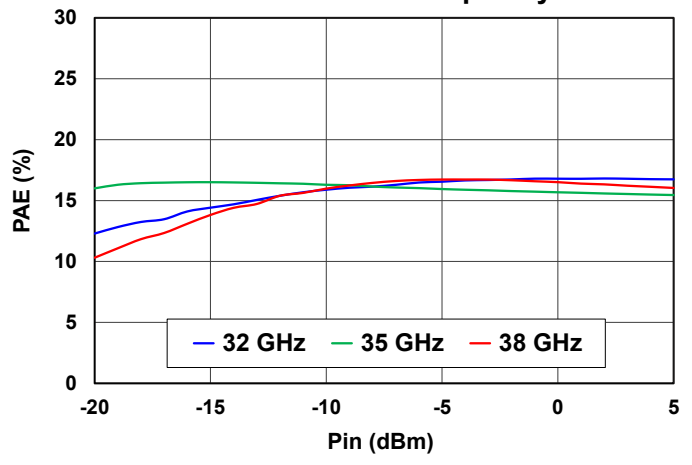
Power Gain vs Pin vs Frequency



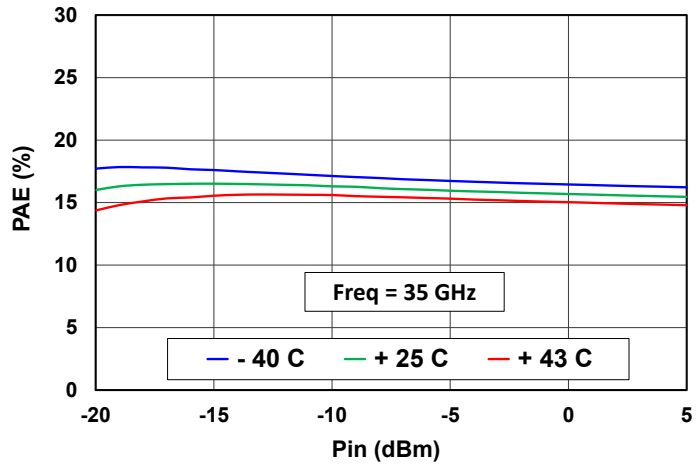
Power Gain vs Pin vs Temp



PAE vs Pin vs Frequency



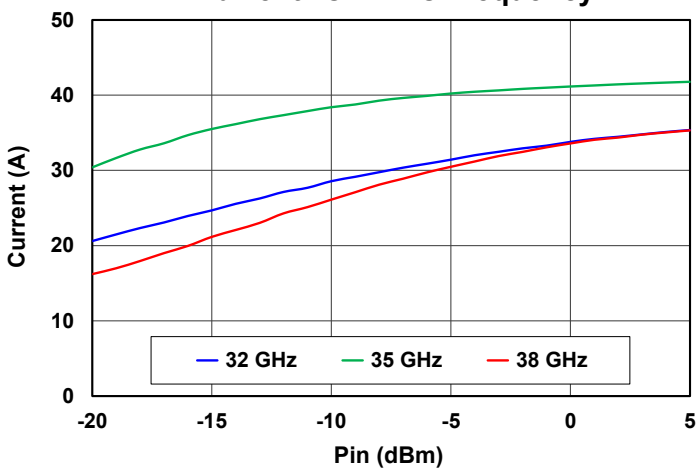
PAE vs Pin vs Temp



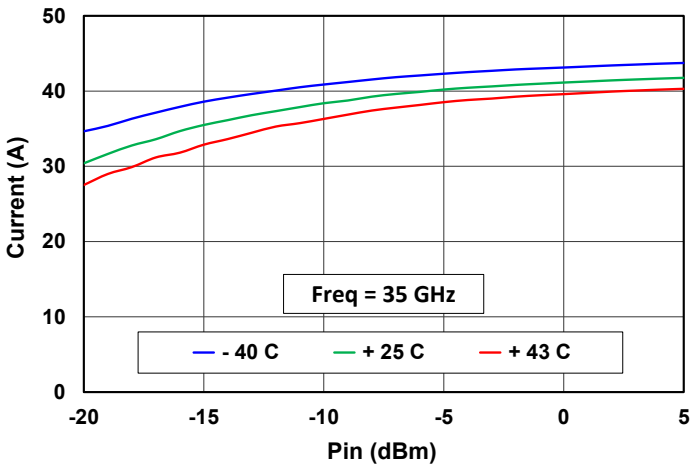
Typical Performance – Large Signal, CW Mode

Test conditions unless noted: V_{DC} = 24 V, I_{DQ} = 10 A, Pin = 0 dBm, CW, T_{CLAMP} = 25 °C

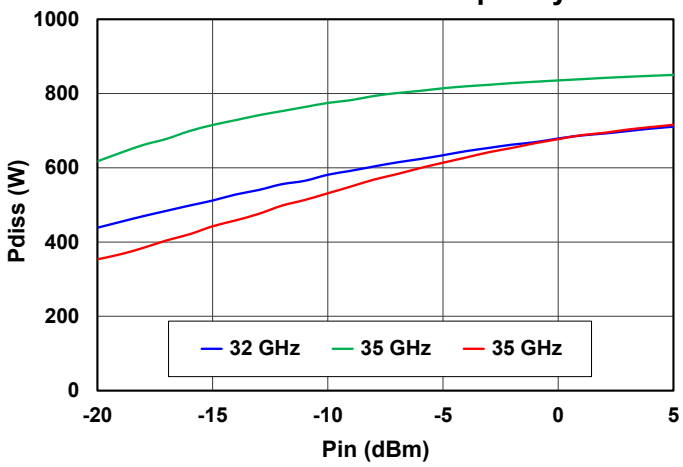
Current vs Pin vs Frequency



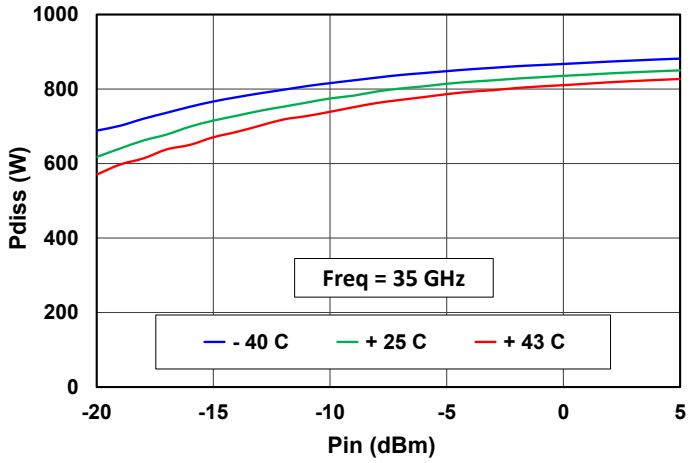
Current vs Pin vs Temp



PDiss vs Pin vs Frequency



Pdiss vs Pin vs Temp



Typical Performance – Large Signal, CW Mode

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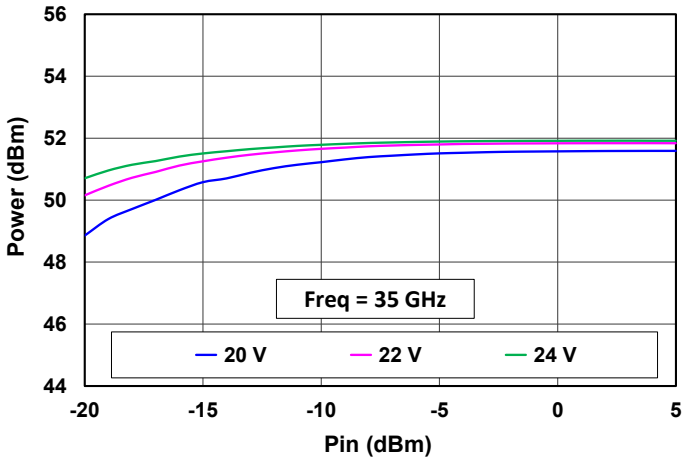
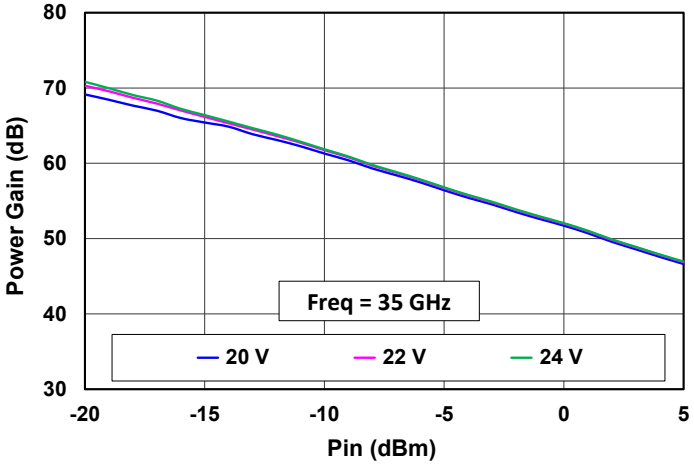
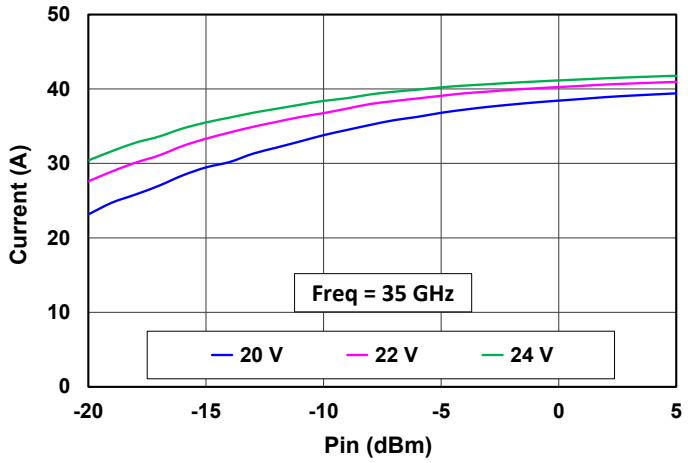
Power vs Pin vs Voltage



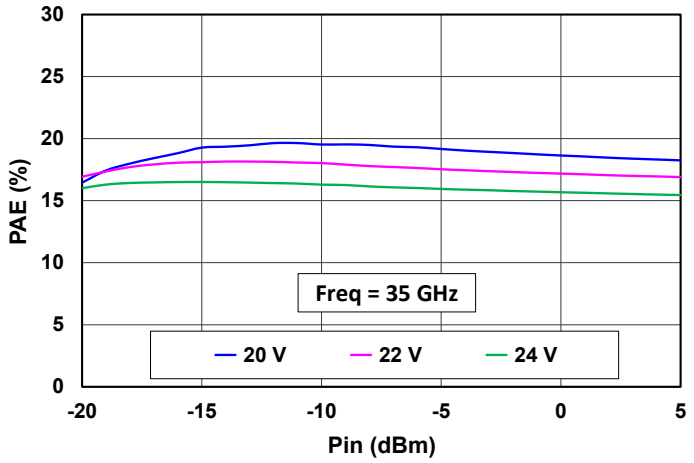
Power Gain vs Pin vs Voltage



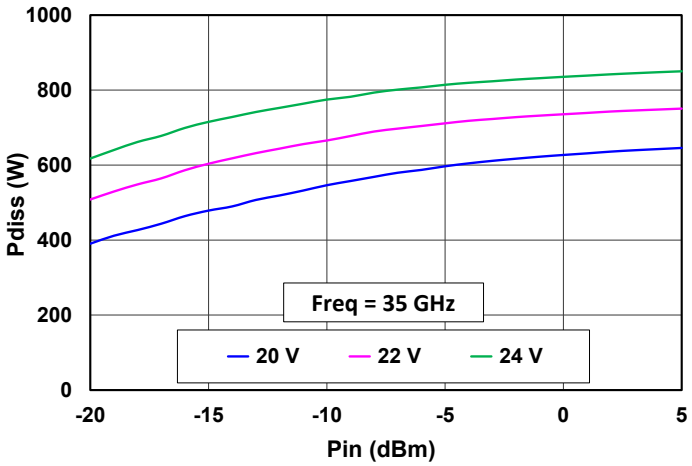
Current vs Pin vs Voltage



PAE vs Pin vs Voltage



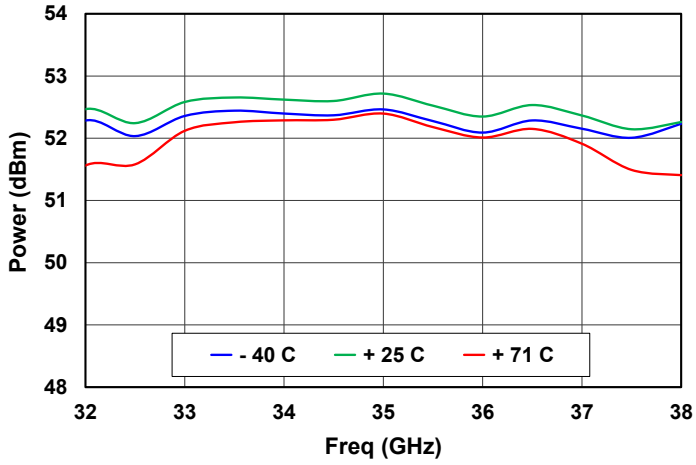
Pdiss vs Pin vs Voltage



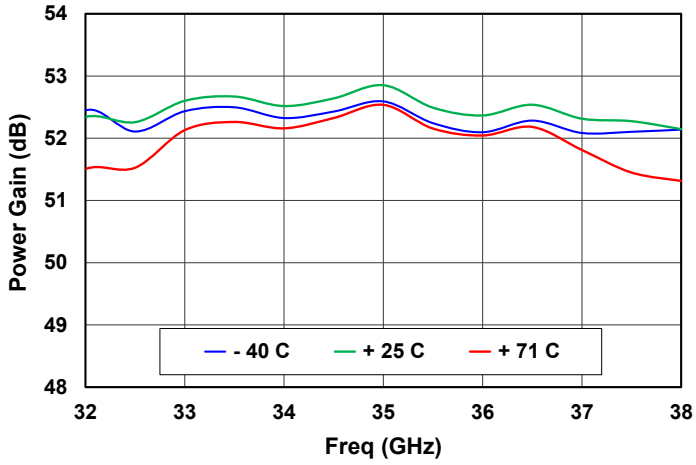
Typical Performance – Large Signal, Pulse Mode

Test conditions unless noted: V_{DC} = 24 V, I_{DQ} = 10 A, Pin = 0 dBm, T_{CLAMP} = 25 °C
Pulse Mode, DC Pulse, Duty Cycle = 50%, Pulse Width = 1 uS. Data shown in plots are peak values.

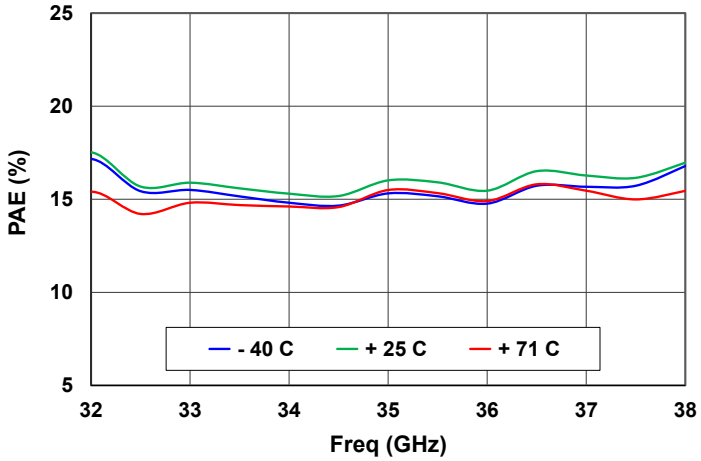
Power vs Temperature



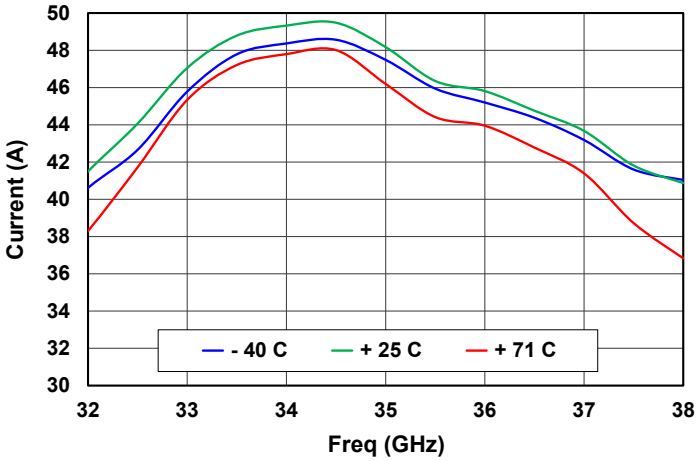
Power Gain vs Temperature



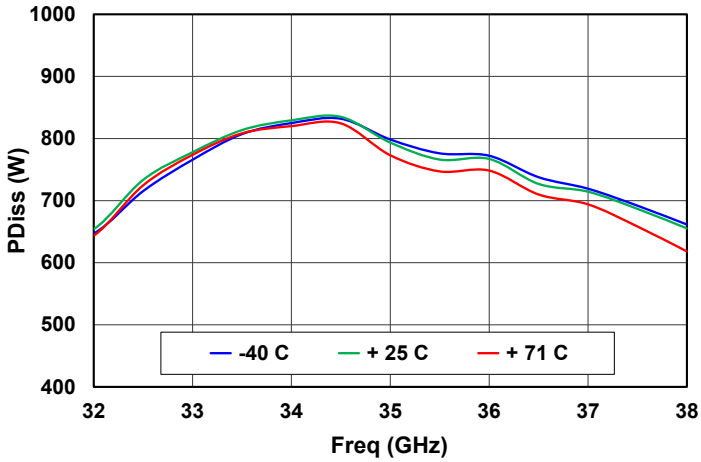
PAE vs Temperature



Current vs Temperature



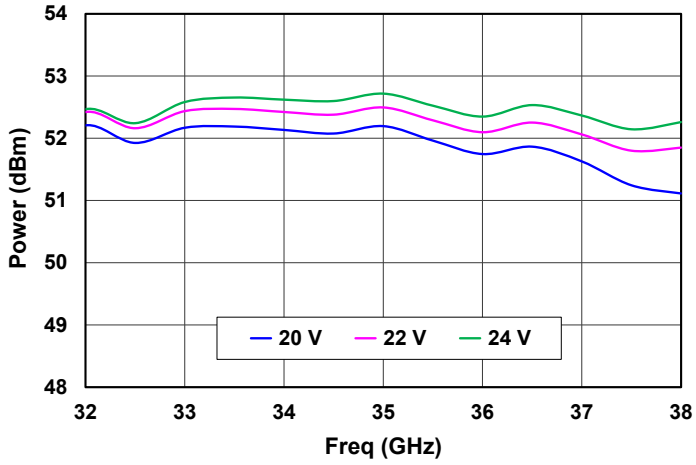
PDiss vs Freq vs Temperature



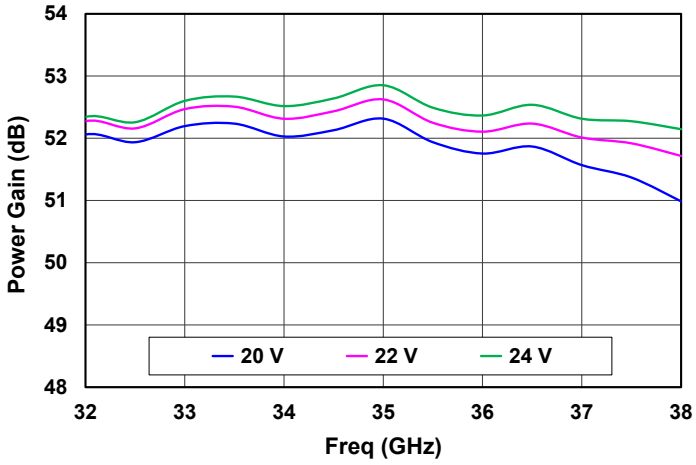
Typical Performance – Large Signal, Pulse Mode

Test conditions unless noted: V_{DC} = 24 V, I_{DQ} = 10 A, Pin = 0 dBm, T_{BASE} = 25 °C
Pulse Mode, DC Pulse, Duty Cycle = 50%, Pulse Width = 1 uS. Data shown in plots are peak values.

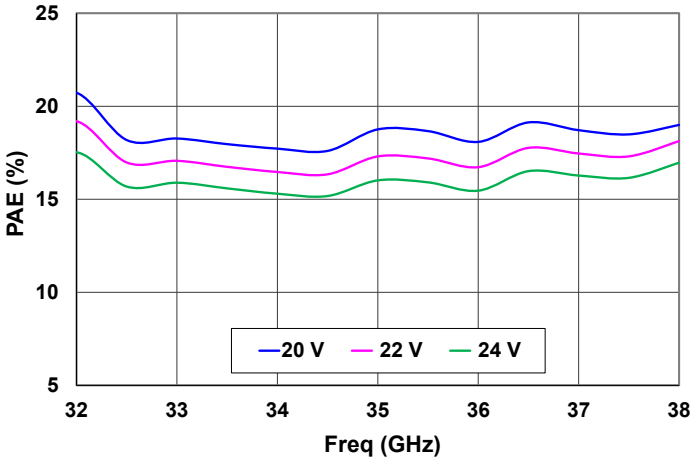
Power vs Voltage



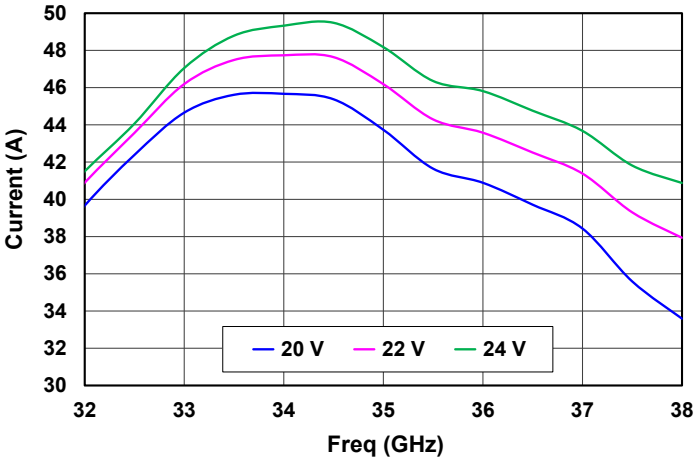
Power Gain vs Voltage



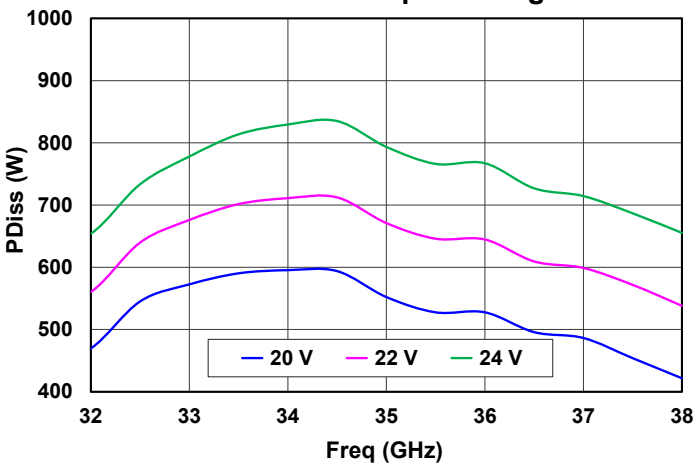
PAE vs Voltage



Current vs Voltage



PDiss vs Freq vs Voltage



Typical Performance – Large Signal, Pulse Mode

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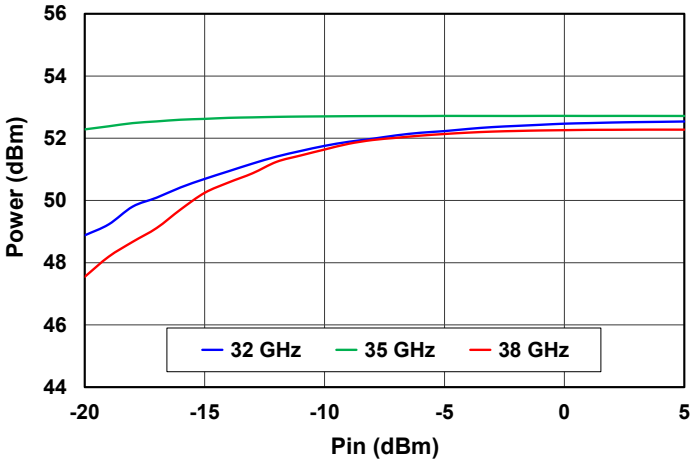
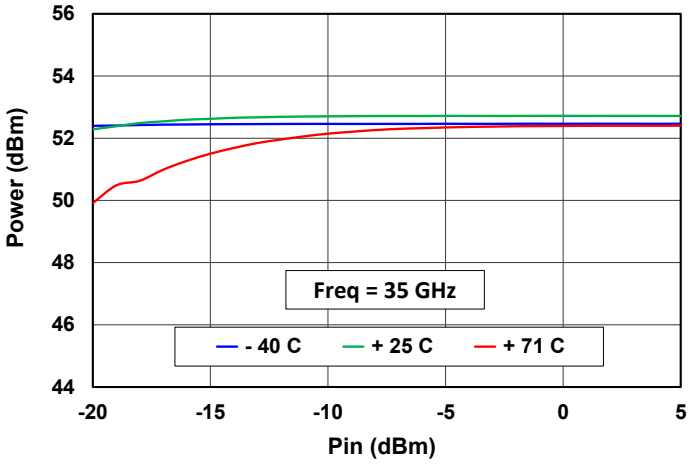
Pulse Mode, DC Pulsing, Duty Cycle = 50%, Pulse Width = 1 uS. Data shown in plots are peak values.

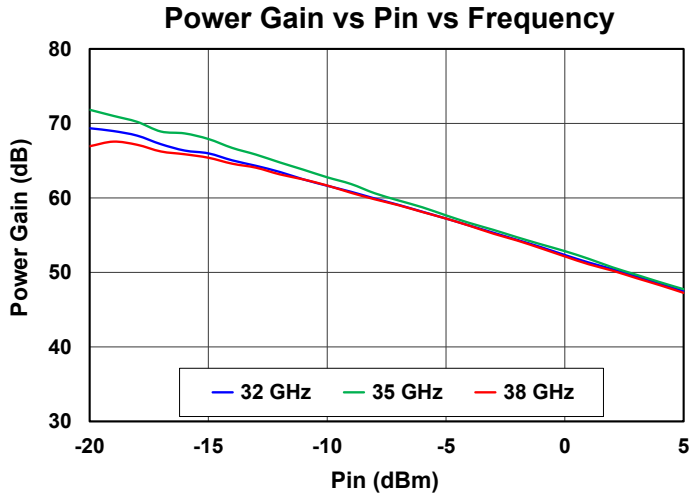
Power vs Pin vs Frequency



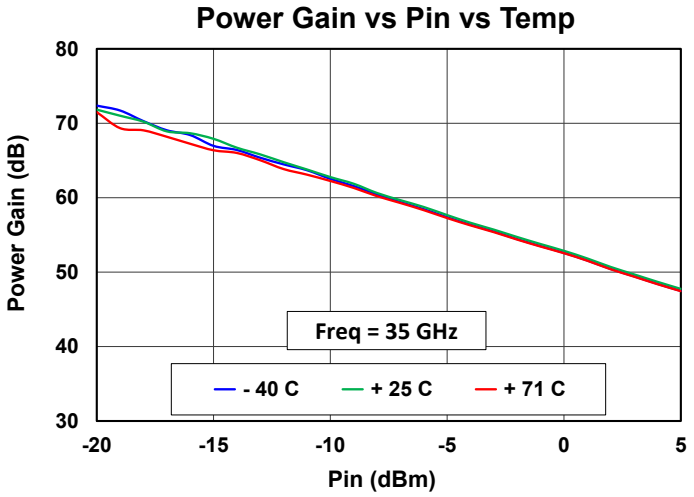
Power vs Pin vs Temp



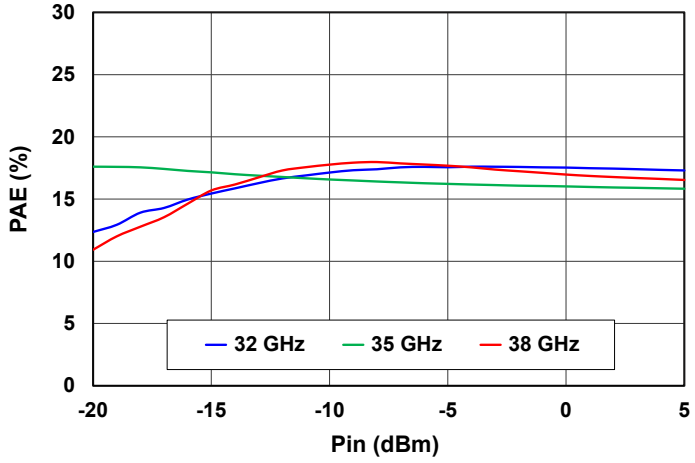
Power Gain vs Pin vs Frequency



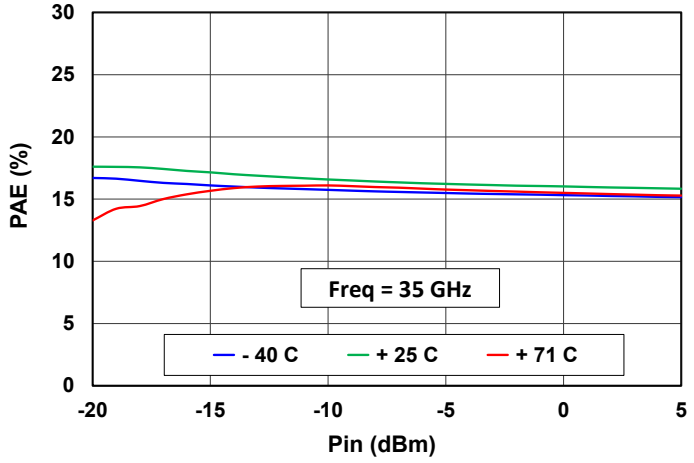
Power Gain vs Pin vs Temp



PAE vs Pin vs Frequency



PAE vs Pin vs Temp



Typical Performance – Large Signal, Pulse Mode

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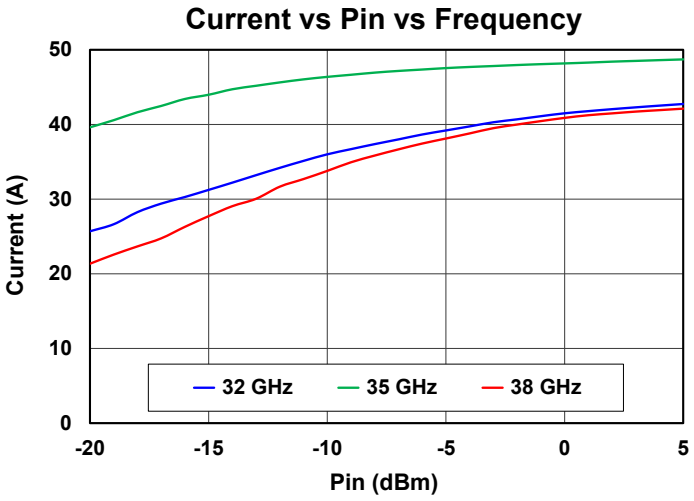
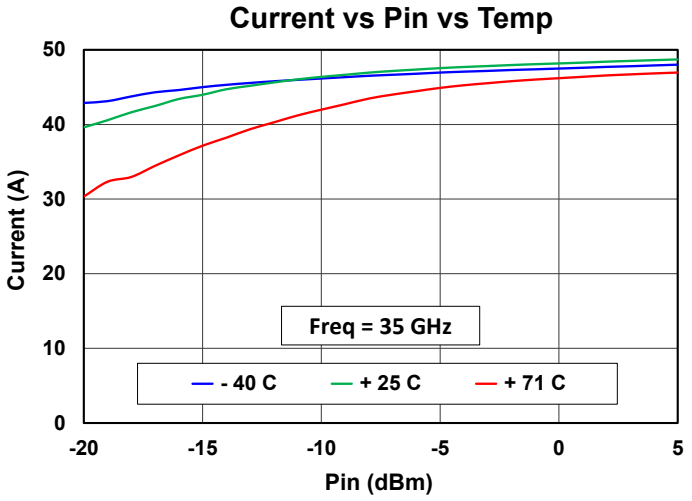
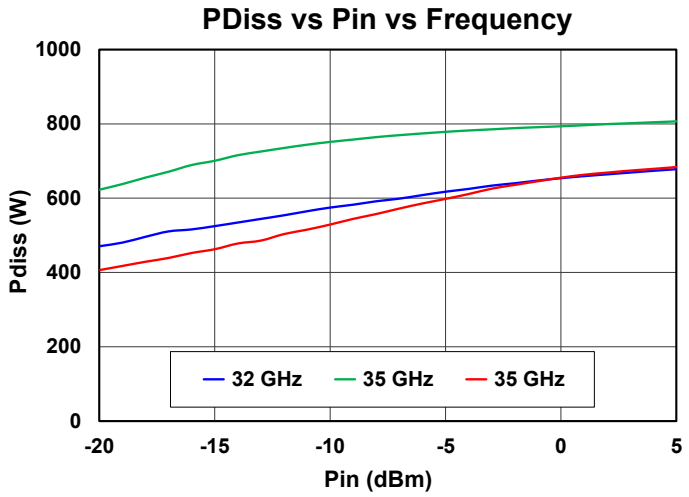
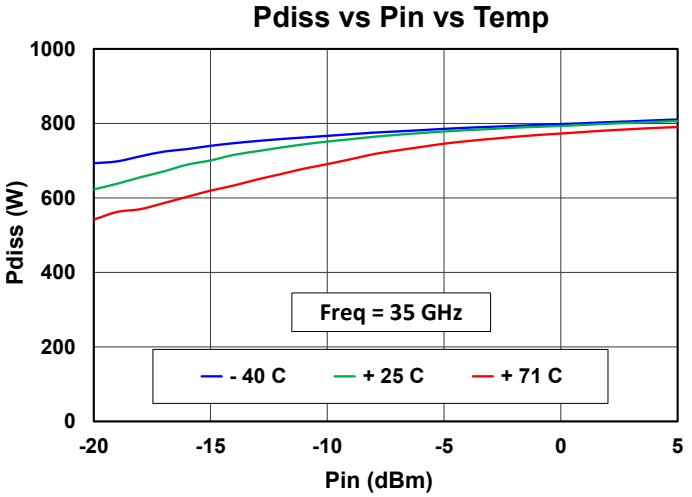
Pulse Mode, DC Pulsing, Duty Cycle = 50%, Pulse Width = 1 uS. Data shown in plots are peak values.





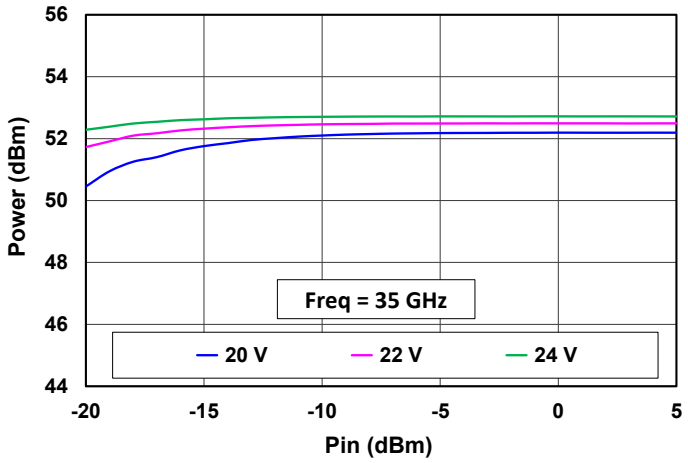




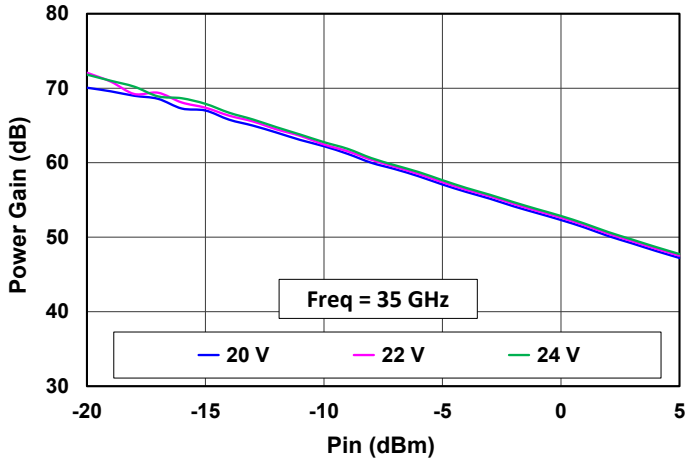
Typical Performance – Large Signal, Pulse Mode

Test conditions unless noted: V_{DC} = 24 V, I_{DQ} = 10 A, Pin = 0 dBm, T_{CLAMP} = 25 °C
Pulse Mode, DC Pulsing, Duty Cycle = 50%, Pulse Width = 1 uS. Data shown in plots are peak values.

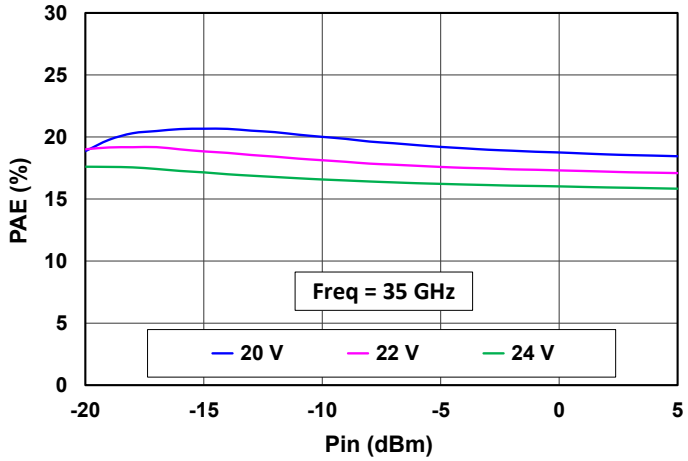
Power vs Pin vs Voltage



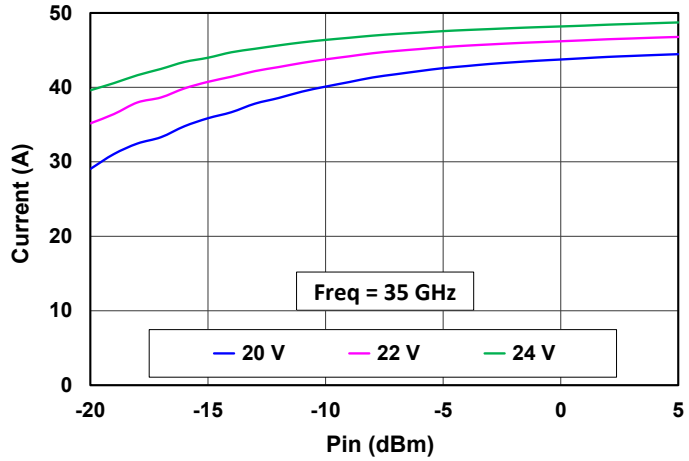
Power Gain vs Pin vs Voltage



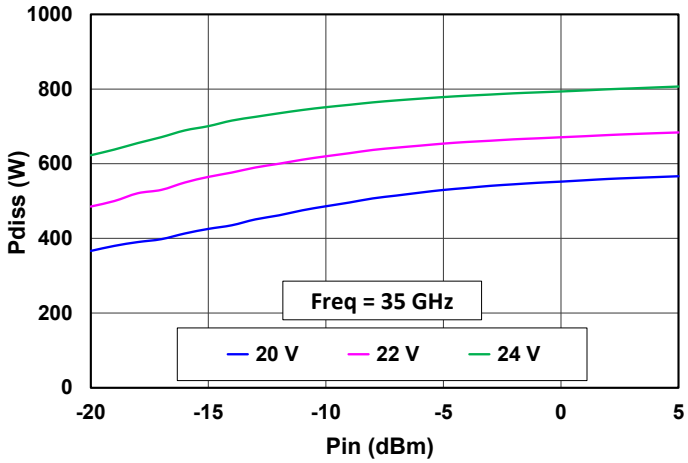
PAE vs Pin vs Voltage



Current vs Pin vs Voltage



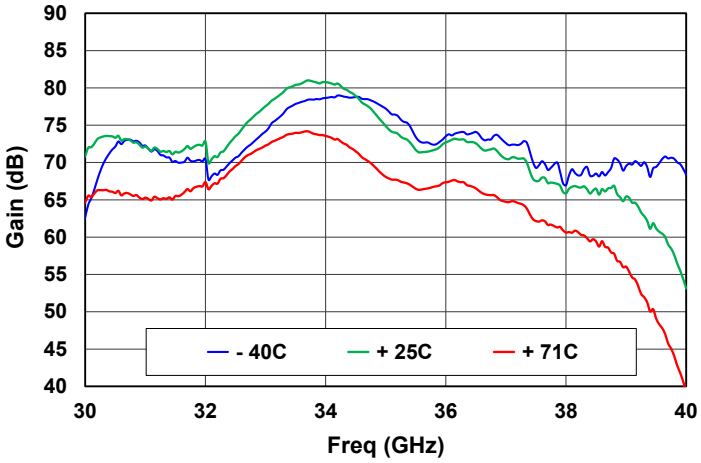
Pdiss vs Pin vs Voltage



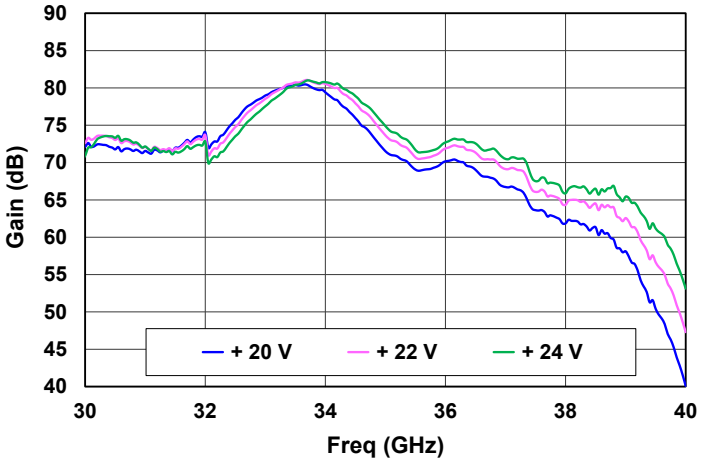
Typical Performance – Small Signal

Test conditions unless noted: V_{DC} = 24 V, I_{DQ} = 10 A, T_{CLAMP} = 25 °C

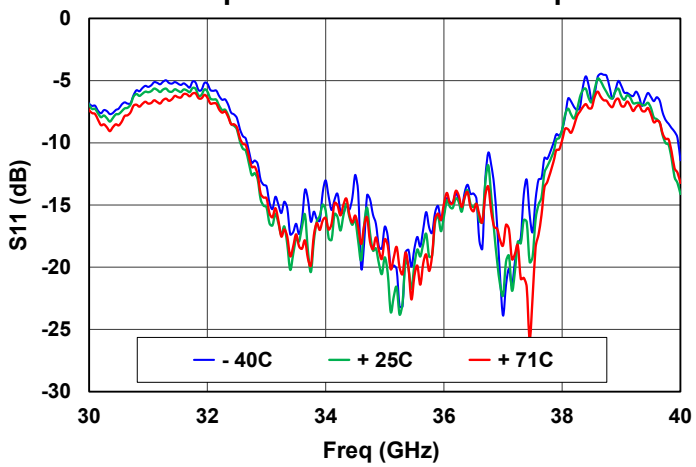
Small Signal Gain vs Temp



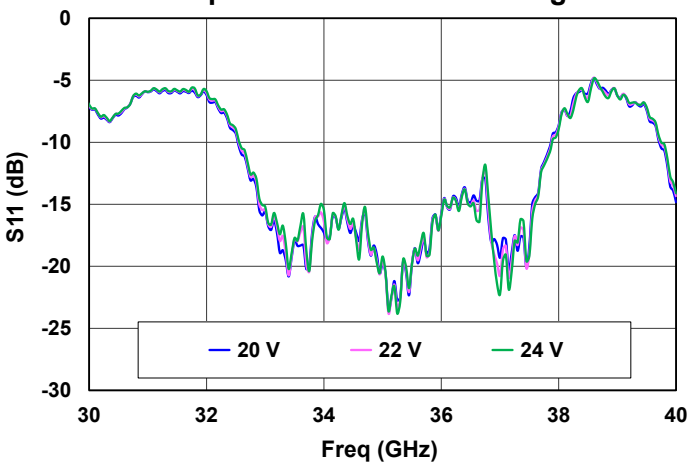
Small Signal Gain vs Voltage



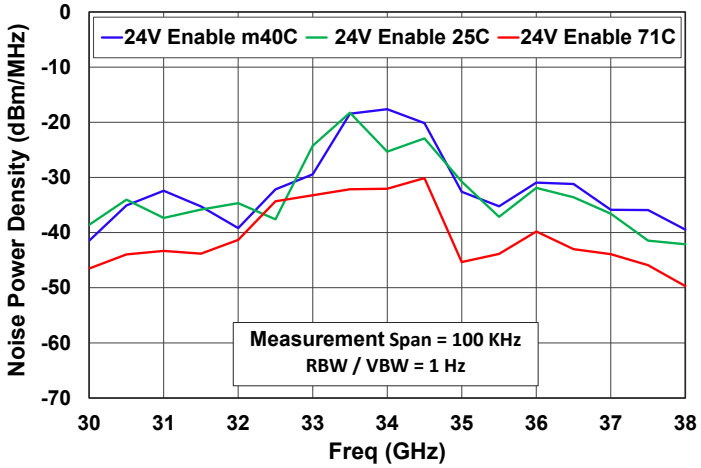
Input Return Loss vs Temp



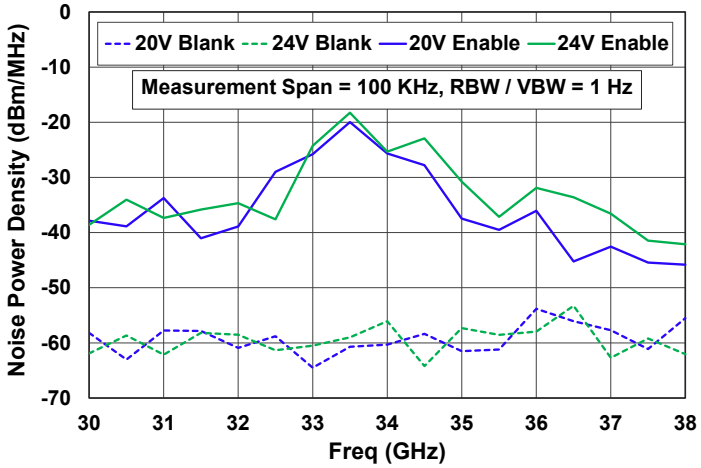
Inptu Return Loss vs Voltage



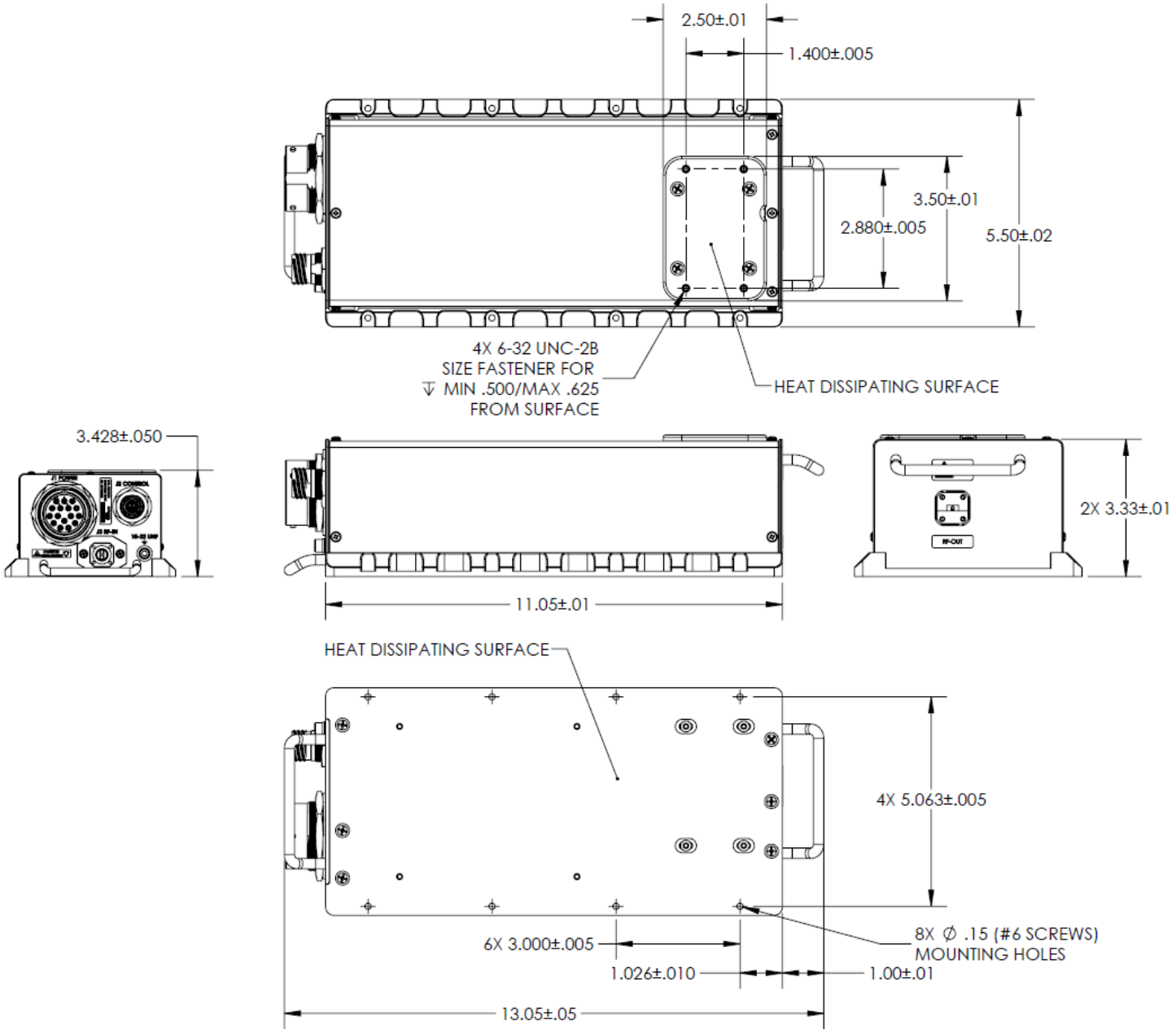
Noise Power Density vs Freq



Noise Power Density vs Freq

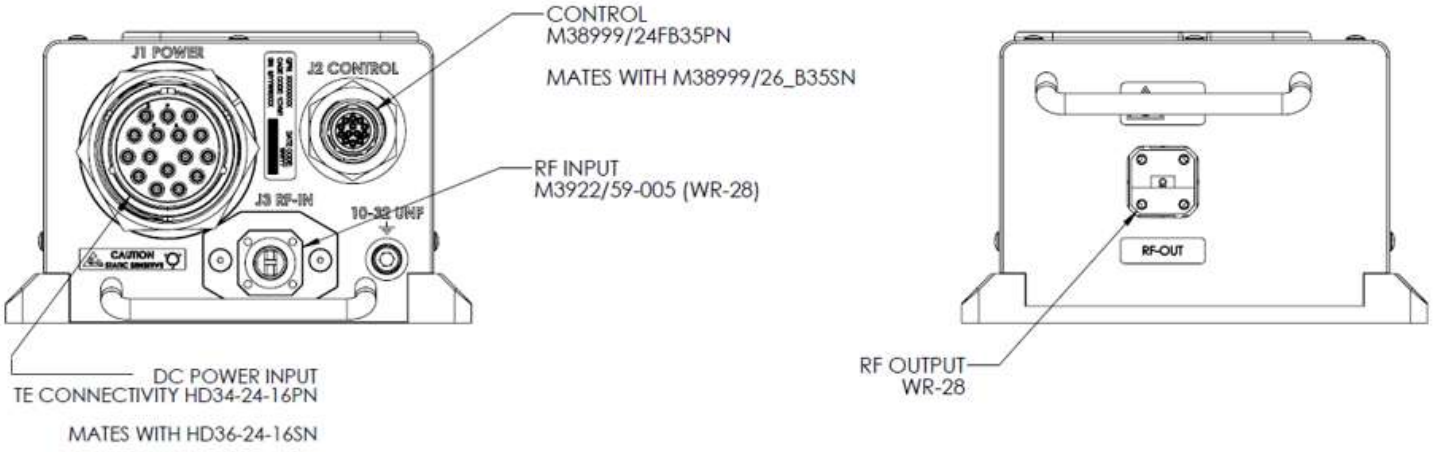


Mechanical Information



Dimensions are in INCHES
Detailed outline drawing available upon request

RF and Electrical Interface



RF Ports	Functions	Descriptions
RFIN	RF Input	RF Input, WR-28 waveguide, vertical orientation.
RFOUT	RF Output	RF Output, WR-28 waveguide, horizontal orientation.

J1 Pins	Functions	Descriptions
J1-A, J1-D, J1-E, J1-F, J1-G, J1-H, J1-R, J1-S	V_{DC}	Prime power supplies.
J1-B, J1-C, J1-J, J1-K, J1-L, J1-M, J1-N, J1-P	DC GROUND	Power supply ground returns.

J2 Pins	Functions	Descriptions
J2-1	RESET	Reset, TTL. Pull to 0V to reset system. Leave open or set to +5V when not in use.
J2-2, J2-6	GROUND	Signal GND.
J2-3	SYS ENABLE	System Enable / Disable, TTL. For normal operation, set to +5V. For blank mode (no RF), set to 0V, this will disable all MMIC drain supplies. If left open, the amplifier will power on with application of prime power supply.
J2-4, J2-5, J2-11, J2-12, J2-13	N/C	No internal connections.
J2-7	SPA FAULT	SPA Status, TTL, 0V indicates the SPA (high power amplifier stage) operating normal, +5V indicates the SPA not in normal condition.
J2-8	DRV FAULT	Driver Status, TTL, 0V indicates the unit driver operating normal, +5V indicates the unit driver not in normal condition.
J2-9	SPA TEMP	SPA temperature monitor using TI - LMT87. - 40 °C = +3.2V; 25 °C = +2.3V, 71 °C = +1.7V.
J2-10	DRV TEMP	Driver stage temperature monitor using TI - LMT87. - 40 °C = +3.2V; 25 °C = +2.3V, 71 °C = +1.7V.

Handling Precautions

Caution!
ESD-Sensitive Device

RF VOLTAGE HAZARD: Contact with RF fields at the output connector can cause burns or electric shock. High levels of RF/Microwave energy may be present when the unit is operating.

HIGH DC CURRENT HAZARD: High levels of DC current are present when the unit is operating.

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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