

## 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.

## 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.*

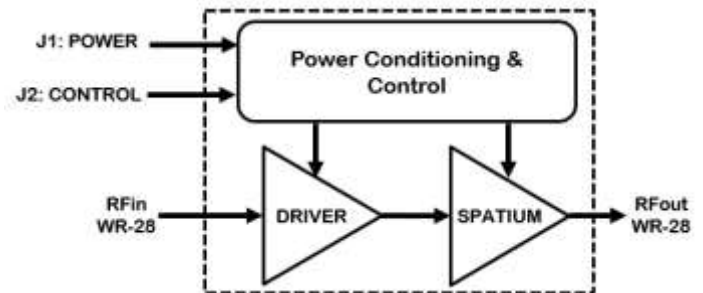
## Applications

- TWTA Replacement



Output / Input

## Functional Block Diagram



## Ordering Information

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

## Absolute Maximum Ratings

| Parameter                                      | Min Values | Max Values | Units |
|--|------------|------------|-------|
| Supply Voltage (V <sub>DC</sub> ) *            | 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 <sup>1</sup>   | Min            | Typ | Max | Units |
|--|----------------|-----|-----|-------|
| Drain Voltage (V <sub>DC</sub> )                                 |                | 24  | 24  | V     |
| Quiescent Current  |                | 10  |     | A     |
| Operating Current  | See data plots |     |     | A     |
| Operating Temperature CW <sup>2</sup>                            | -40            |     | 43  | °C    |
| Operating Temperature, Pulse Mode, Duty Cycle ≤ 70% <sup>2</sup> | -40            |     | 71  | °C    |
| Pulse Width (+71 °C <sup>2</sup> , Duty Cycle 70%)               |                |     | 1   | µS    |
| Pulse Width (+71 °C <sup>2</sup> , Duty Cycle 60%)               |                |     | 50  | µS    |
| Pulse Width (+71 °C <sup>2</sup> , Duty Cycle 50%)               |                |     | 500 | µS    |
| DC Pulse Width <sup>3</sup>                                      | 1              |     |     | µS    |
| DC Pulse Period <sup>3</sup>                                     | 2              |     |     | µS    |

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

<sup>2</sup> Refers to outside clamp surface temperature, 2 - sided cooling required.

<sup>3</sup> Unit can be DC or RF pulsed, these limits are applicable to DC pulse only.

## Specifications

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

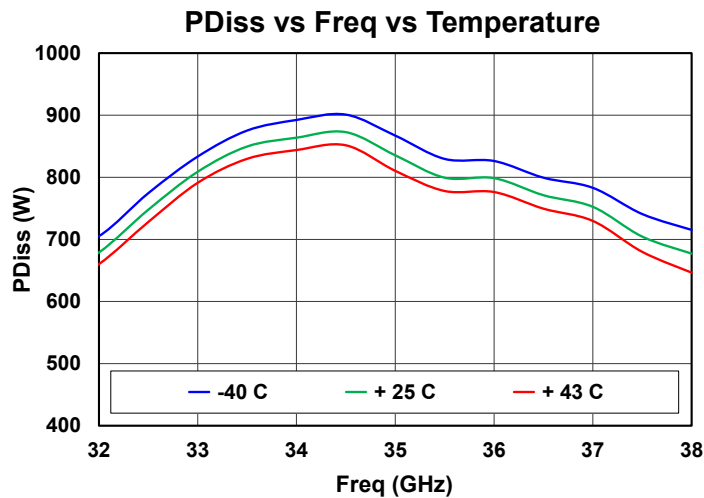
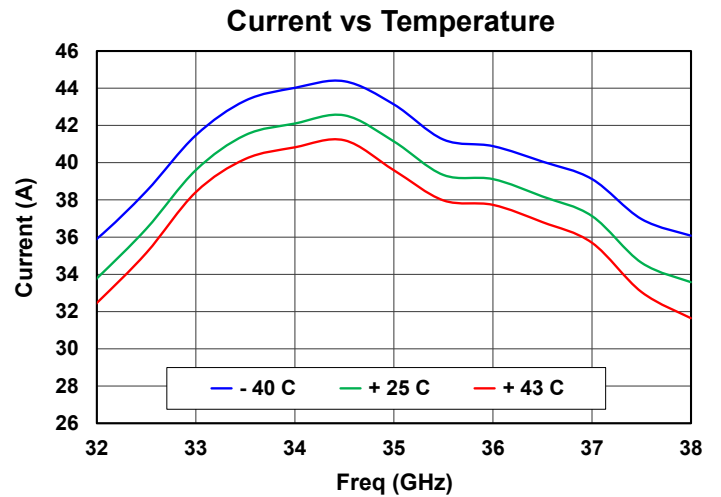
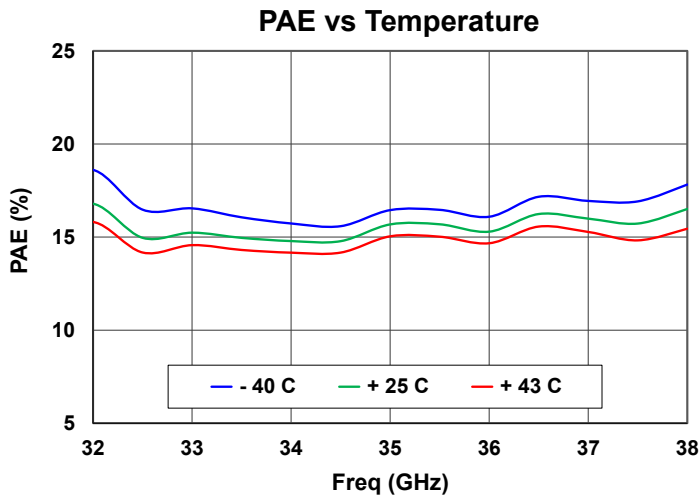
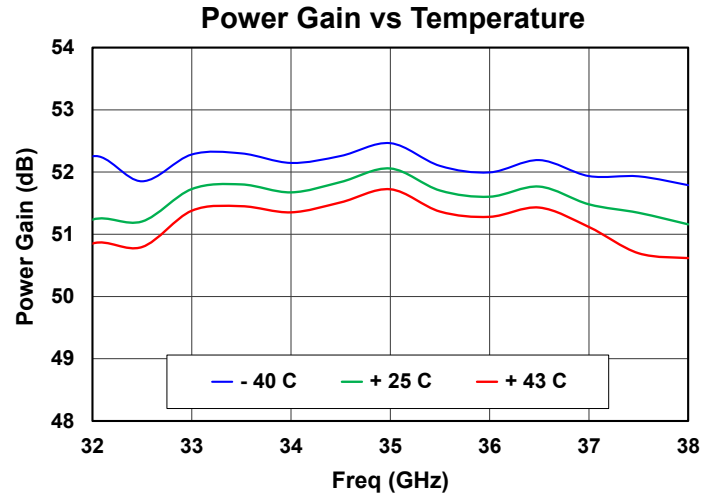
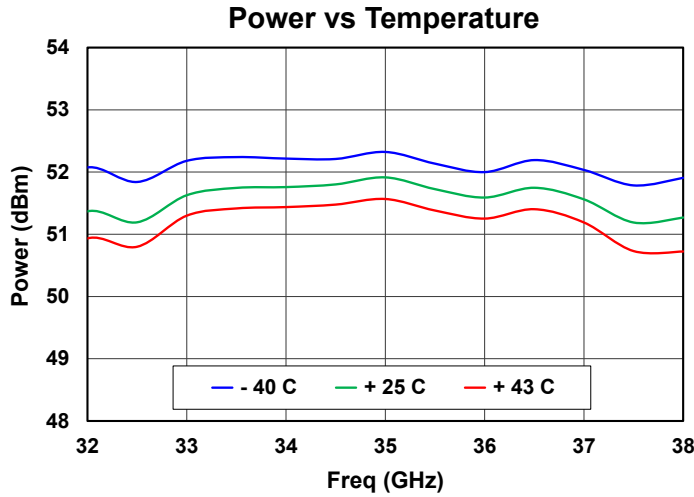
| Parameter  | Min   | Typ  | Max | Units       |
|--|---|------|-----|-------------|
| Frequency  | 32  |      | 38  | GHz         |
| Pulse Mode, Saturated Power ( $P_{IN} = 0\text{ dBm}$ ) *        |   | 52   |     | dBm         |
| Pulse Mode, Power-Added Efficiency ( $P_{IN} = 0\text{ dBm}$ ) * |   | 15   |     | %           |
| Pulse Mode, Power Gain ( $P_{IN} = 0\text{ dBm}$ ) *             |   | 52   |     | dB          |
| CW Mode, Saturated Power ( $P_{IN} = 0\text{ dBm}$ )             |   | 51.5 |     | dBm         |
| CW Mode, Power-Added Efficiency ( $P_{IN} = 0\text{ dBm}$ )      |   | 15   |     | %           |
| CW Mode, Power Gain ( $P_{IN} = 0\text{ dBm}$ )                  |   | 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.

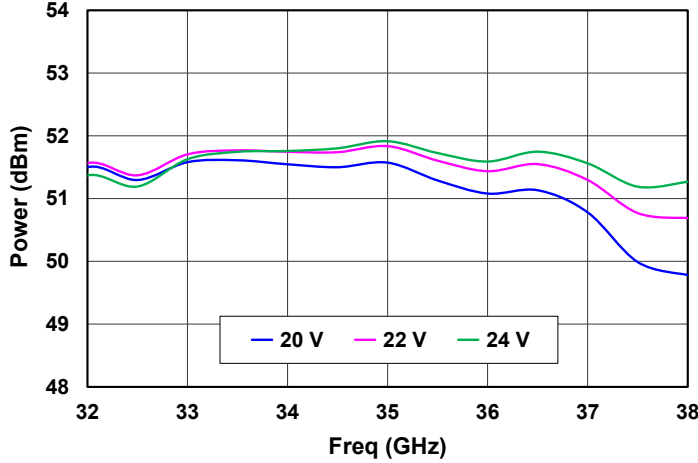
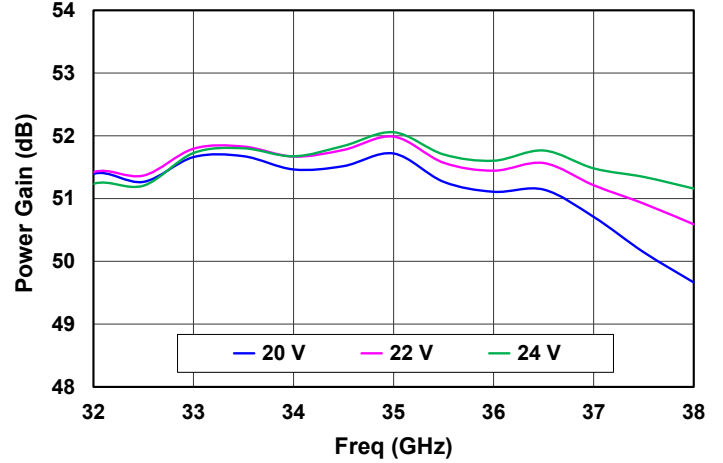
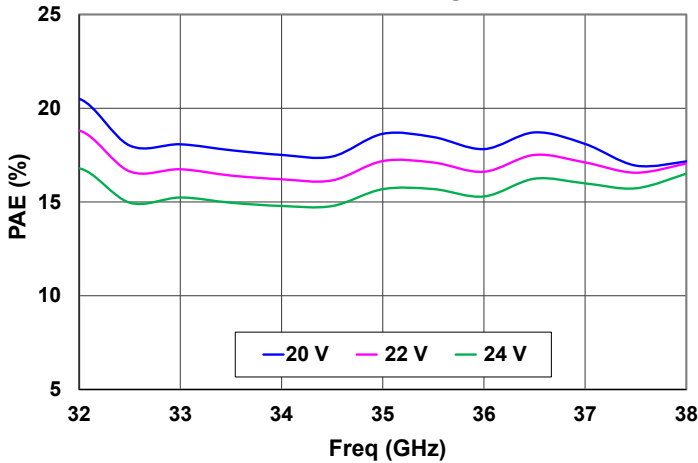
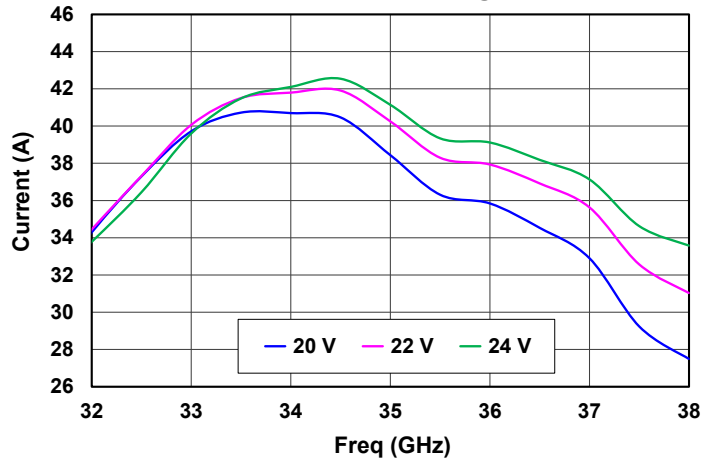
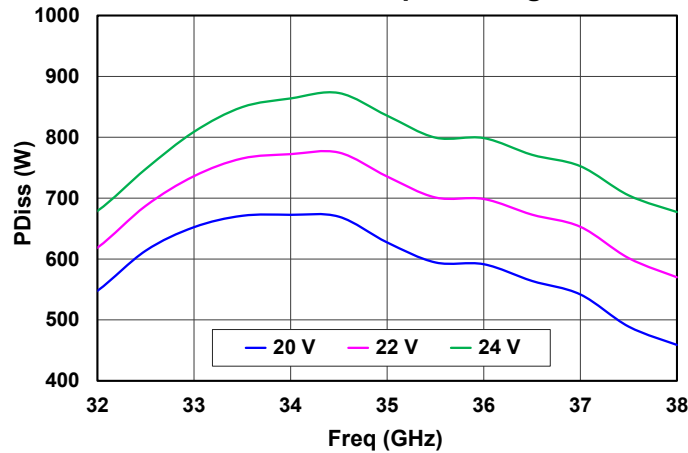
## Typical Performance – Large Signal, CW Mode

Test conditions unless noted:  $V_{DC} = 24\text{ V}$ ,  $I_{DQ} = 10\text{ A}$ ,  $P_{in} = 0\text{ dBm}$ , CW,  $T_{CLAMP} = 25\text{ }^{\circ}\text{C}$



## Typical Performance – Large Signal, CW Mode

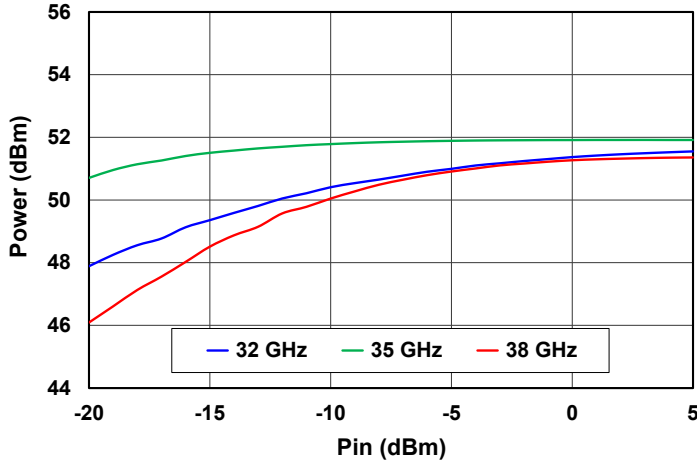
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**Power vs Voltage**

**Power Gain vs Voltage**

**PAE vs Voltage**

**Current vs Voltage**

**PDiss vs Freq vs Voltage**


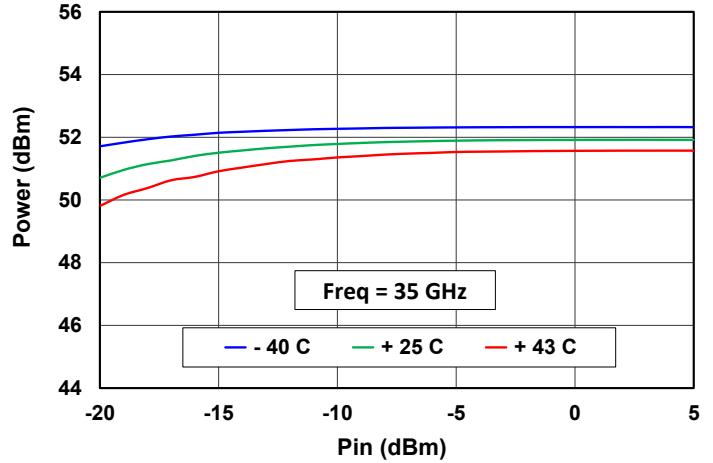
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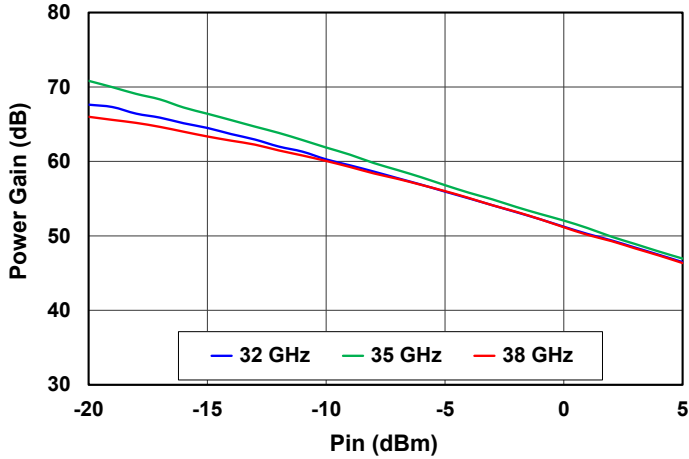
**Power vs Pin vs Frequency**



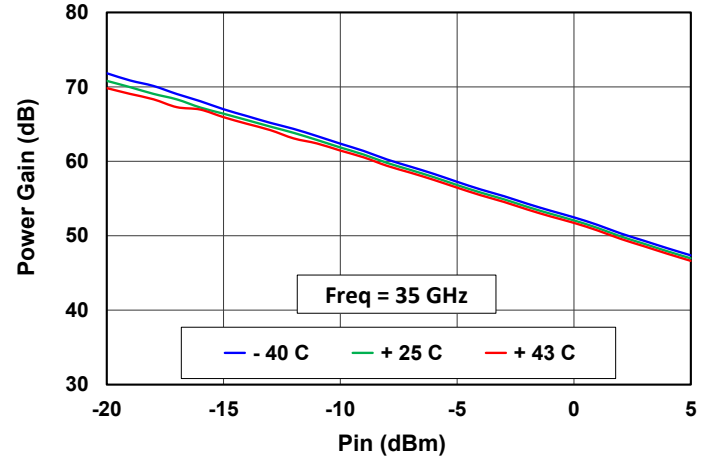
**Power vs Pin vs Temp**



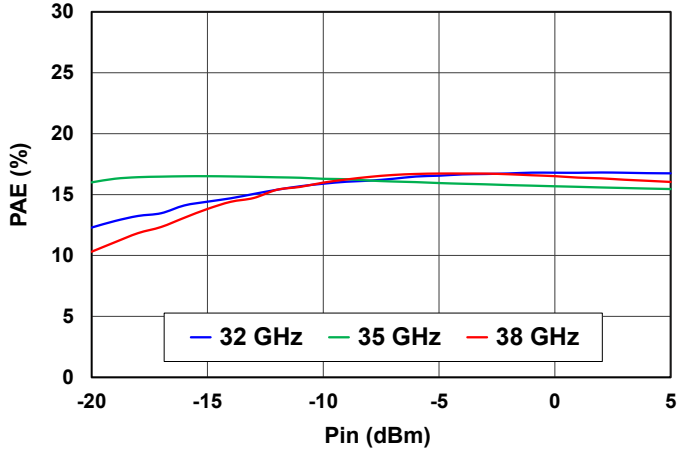
**Power Gain vs Pin vs Frequency**



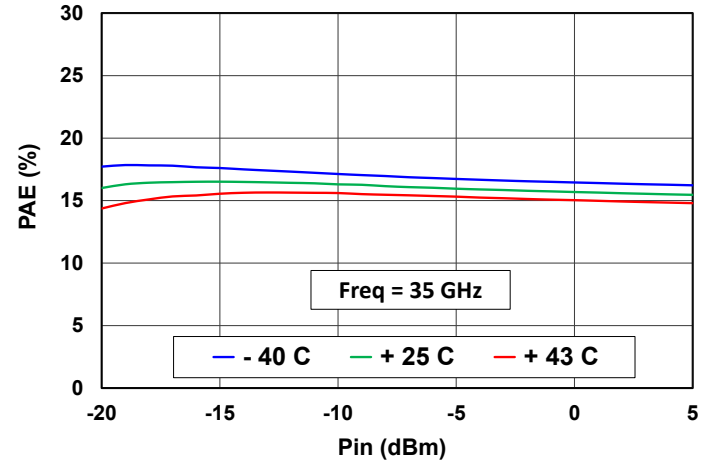
**Power Gain vs Pin vs Temp**



**PAE vs Pin vs Frequency**



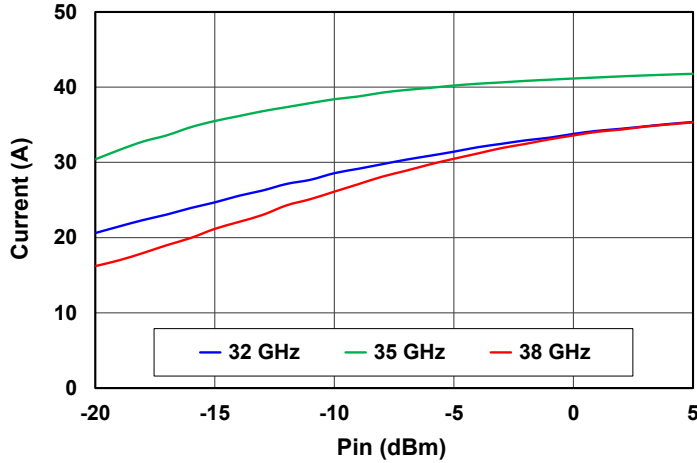
**PAE vs Pin vs Temp**



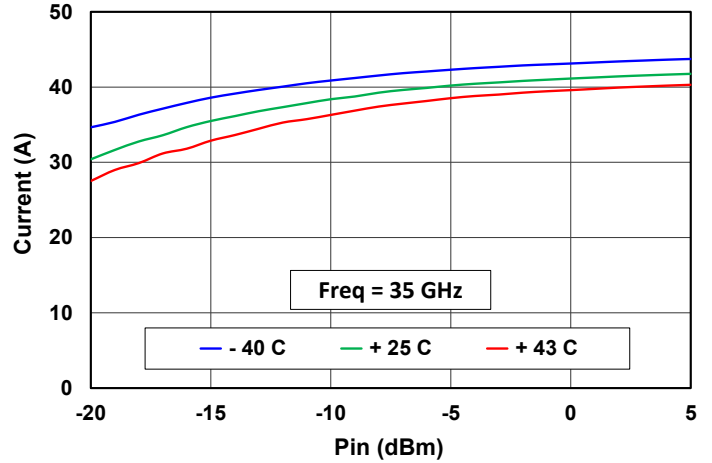
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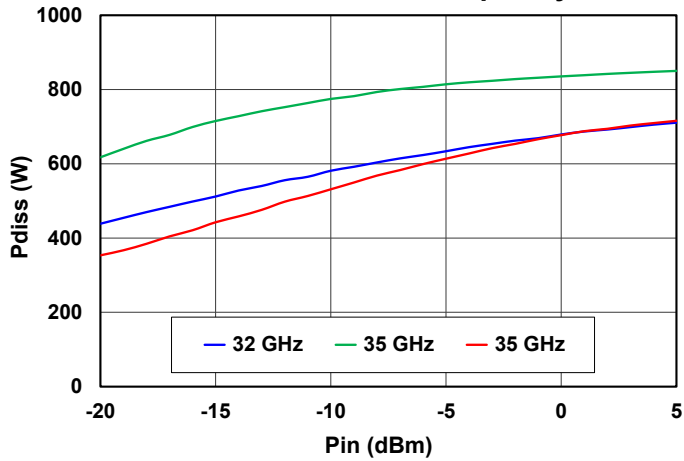
**Current vs Pin vs Frequency**



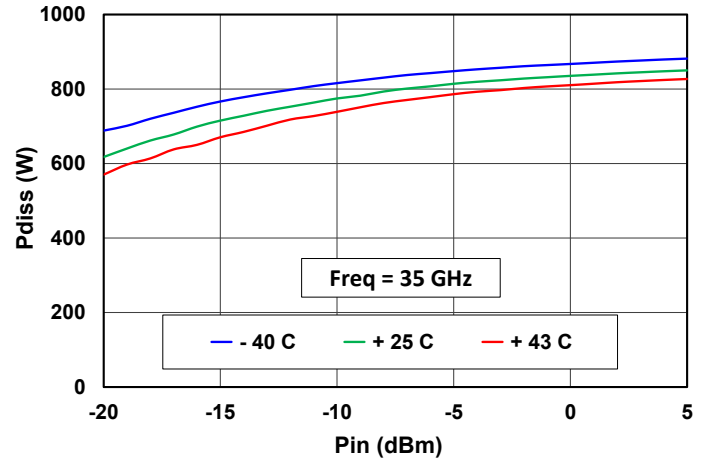
**Current vs Pin vs Temp**



**Pdiss vs Pin vs Frequency**

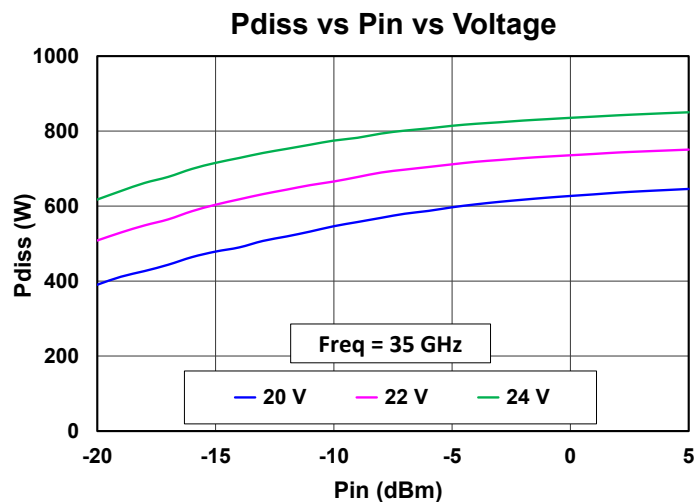
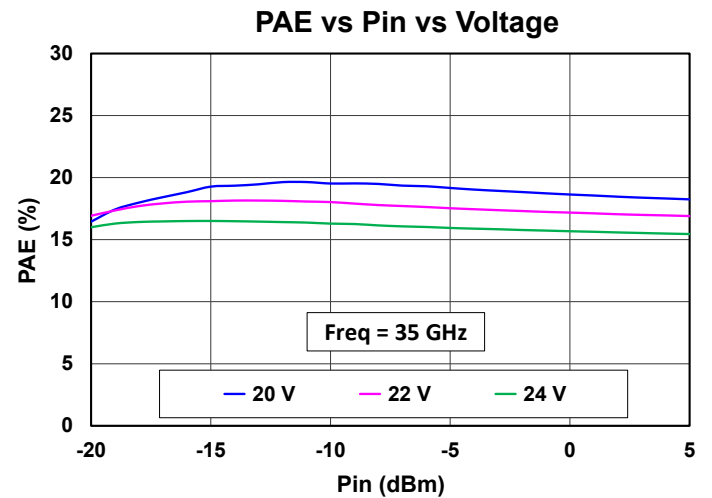
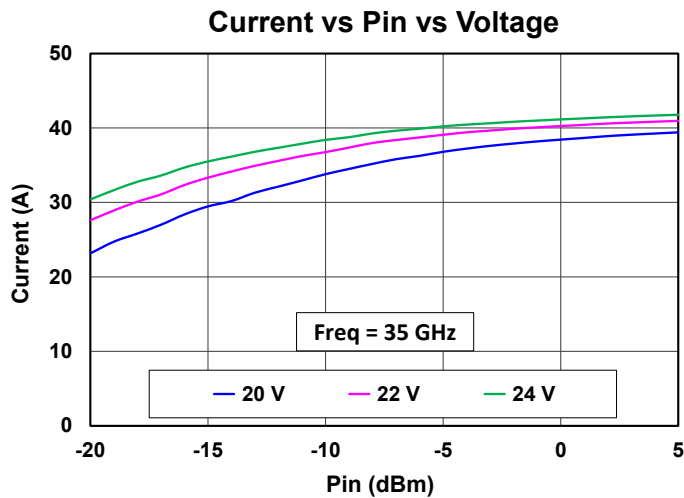
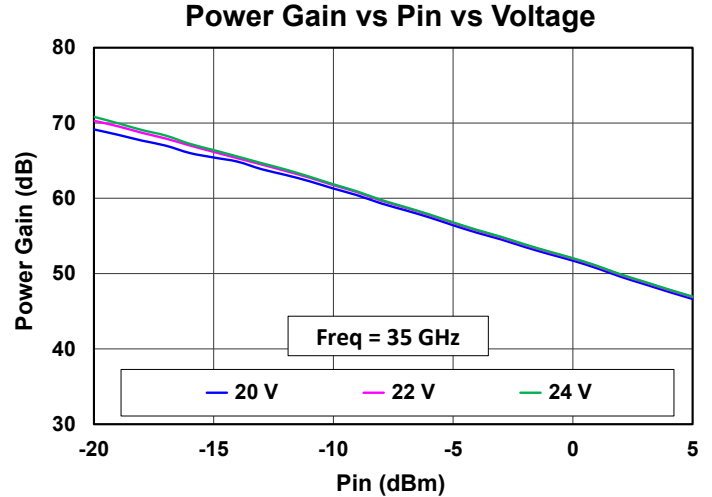
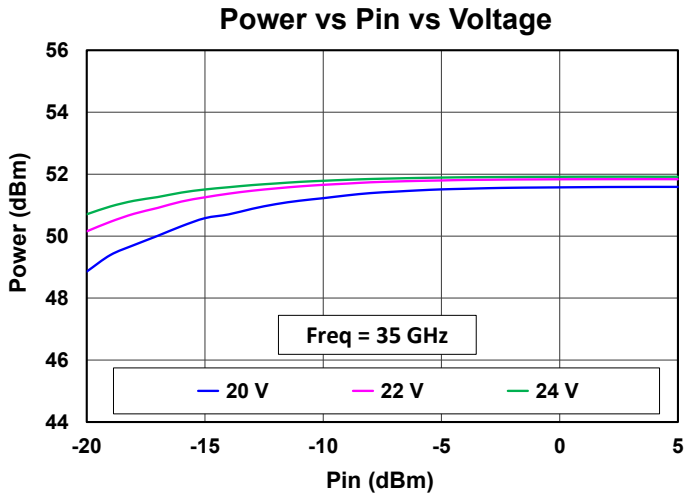


**Pdiss vs Pin vs Temp**



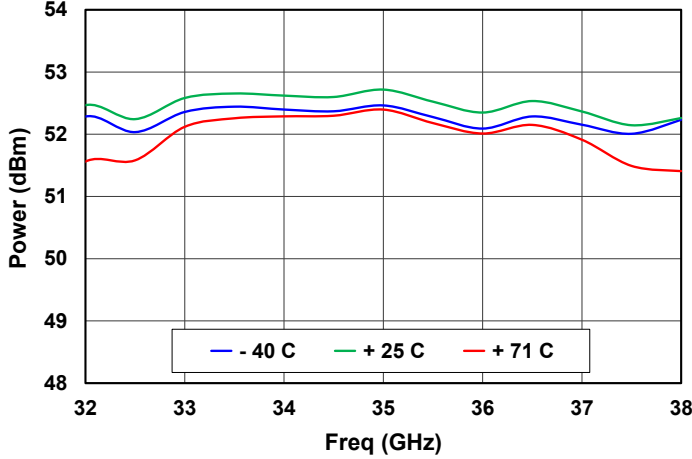
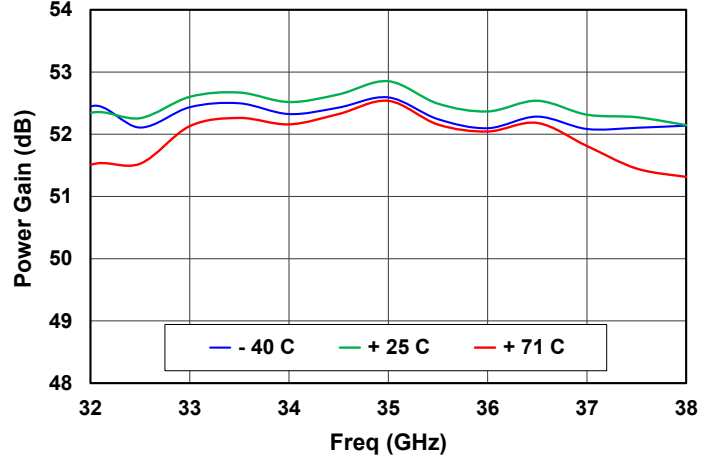
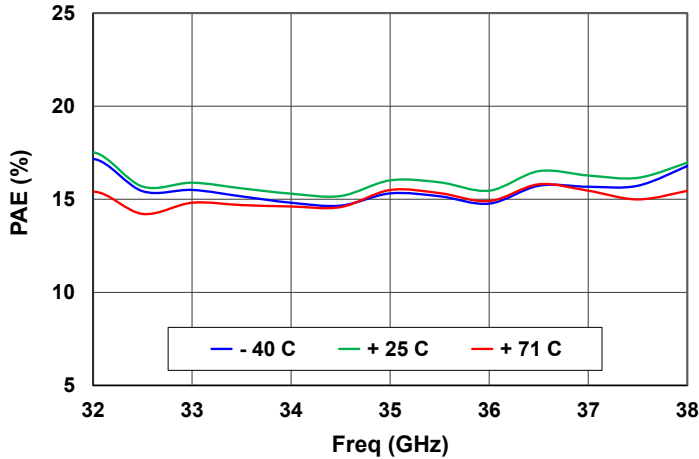
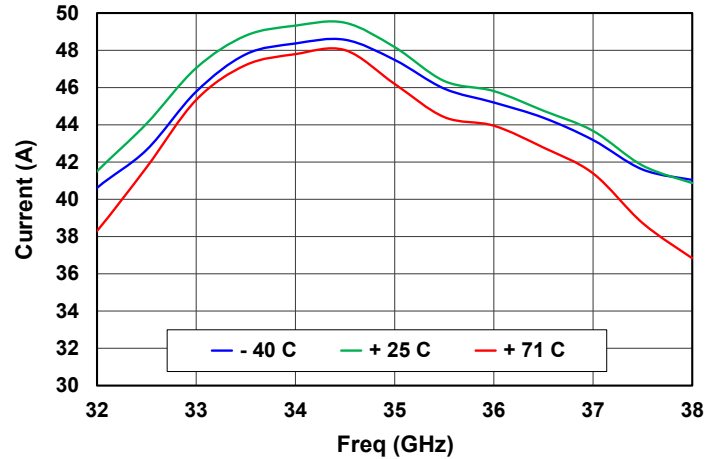
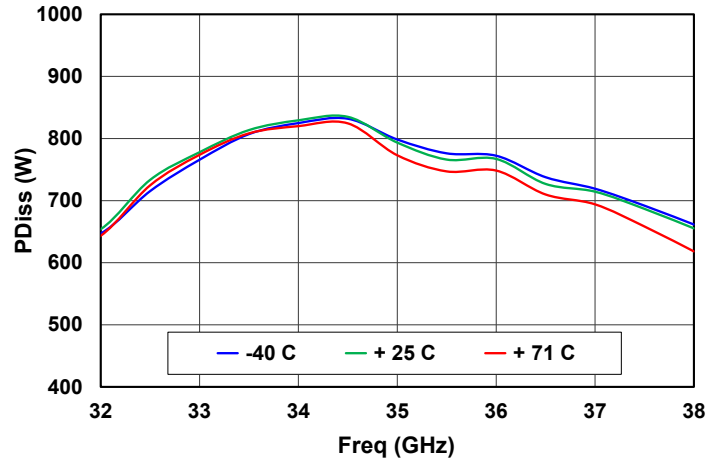
## Typical Performance – Large Signal, CW Mode

Test conditions unless noted:  $V_{DC} = 24\text{ V}$ ,  $I_{DQ} = 10\text{ A}$ ,  $P_{in} = 0\text{ dBm}$ , CW,  $T_{CLAMP} = 25\text{ }^{\circ}\text{C}$



## Typical Performance – Large Signal, Pulse Mode

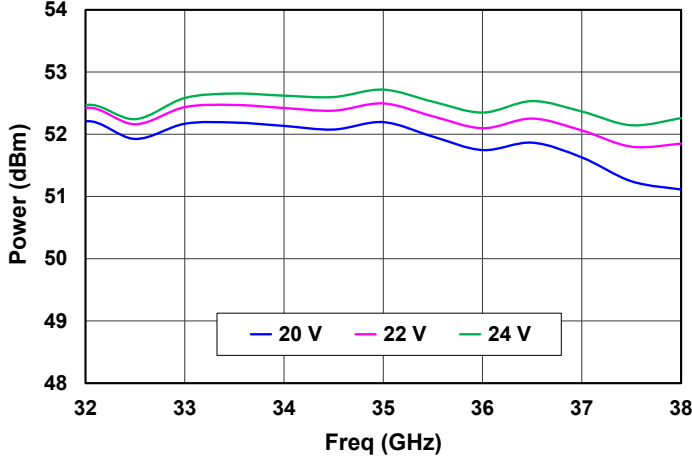
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 Pulse Mode, DC Pulse, Duty Cycle = 50%, Pulse Width = 1  $\mu\text{s}$ . Data shown in plots are peak values.

**Power vs Temperature**

**Power Gain vs Temperature**

**PAE vs Temperature**

**Current vs Temperature**

**PDiss vs Freq vs Temperature**


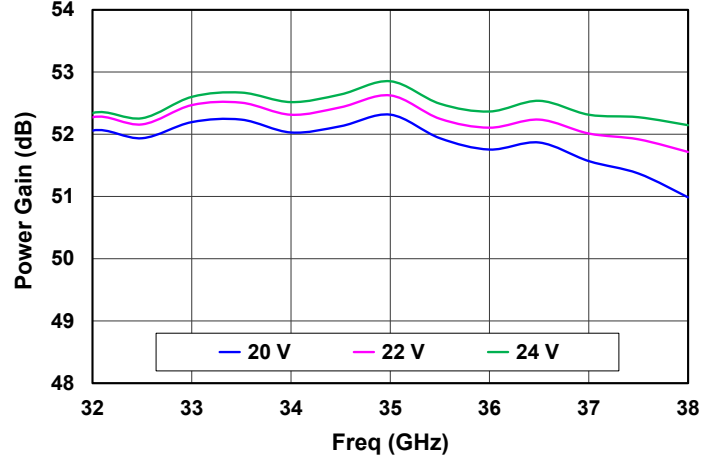
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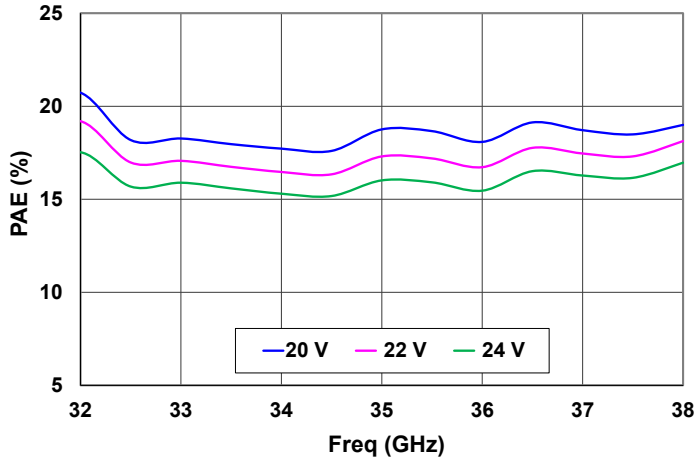
**Power vs Voltage**



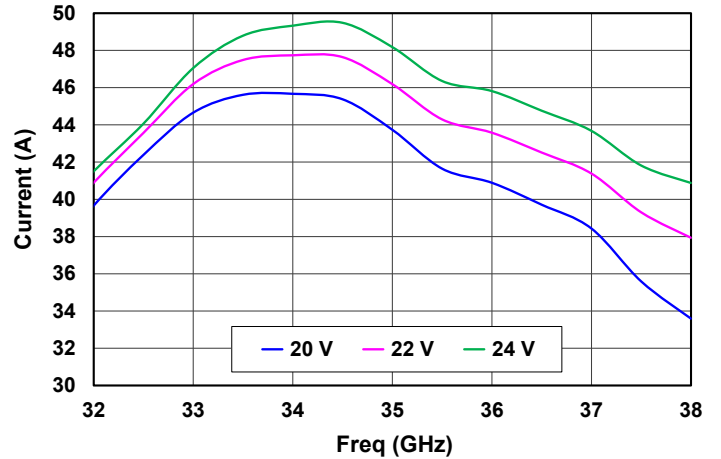
**Power Gain vs Voltage**



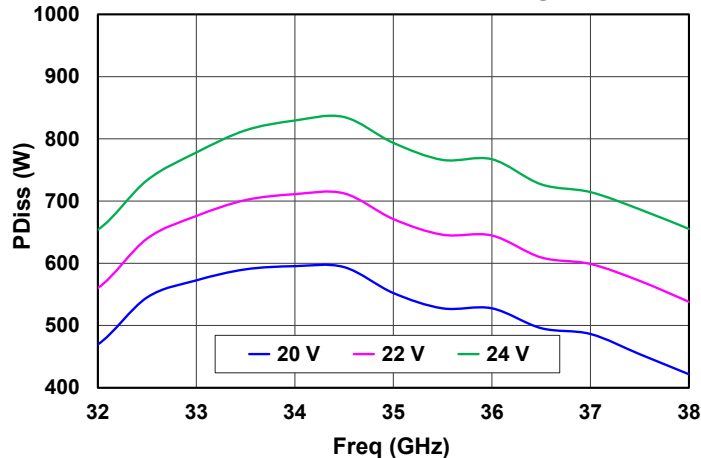
**PAE vs Voltage**



**Current vs Voltage**

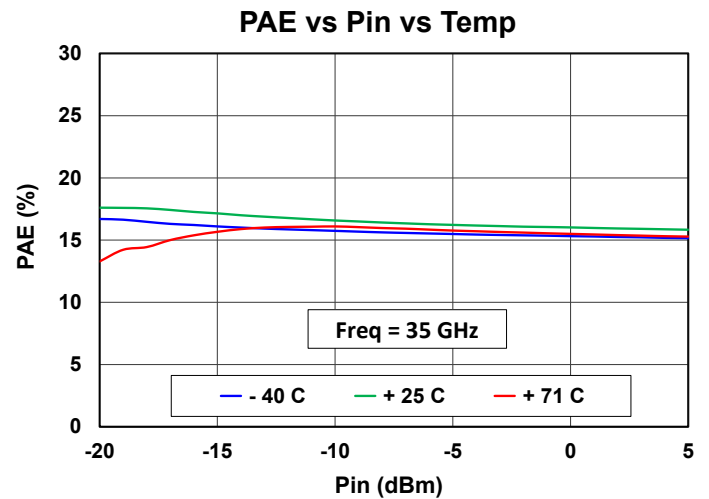
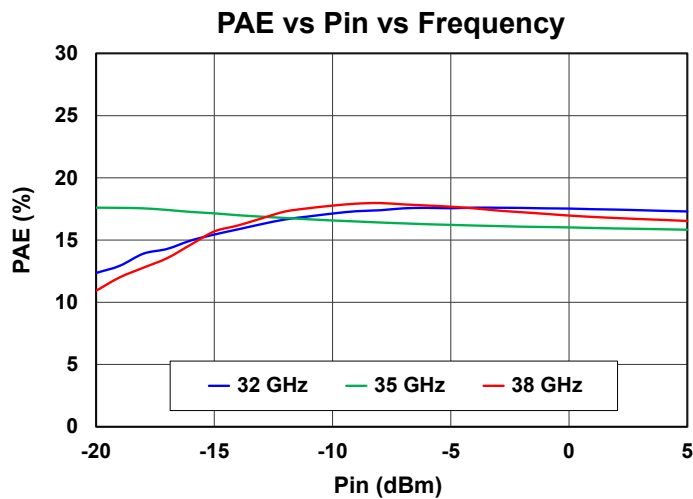
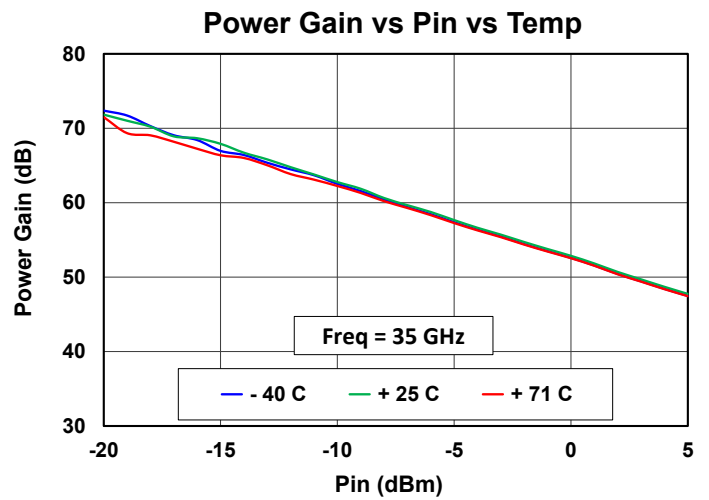
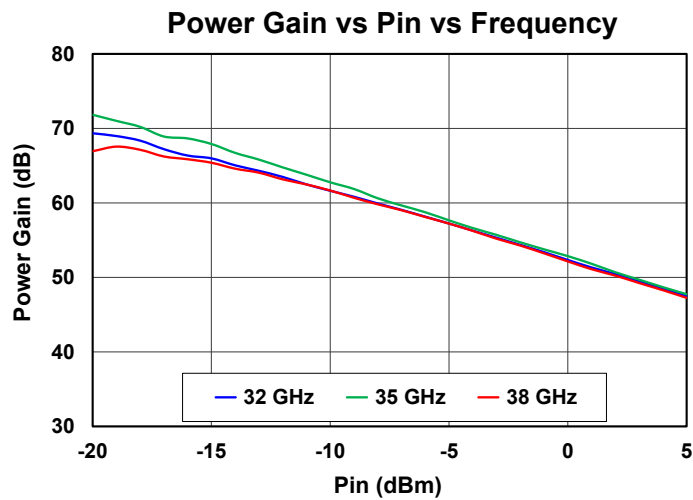
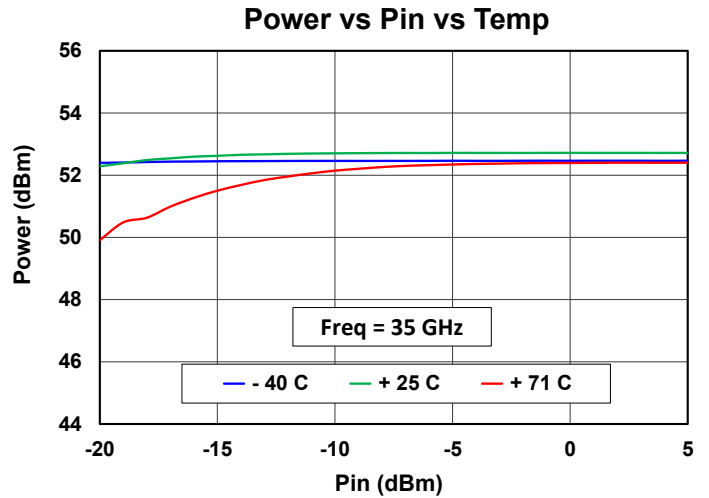
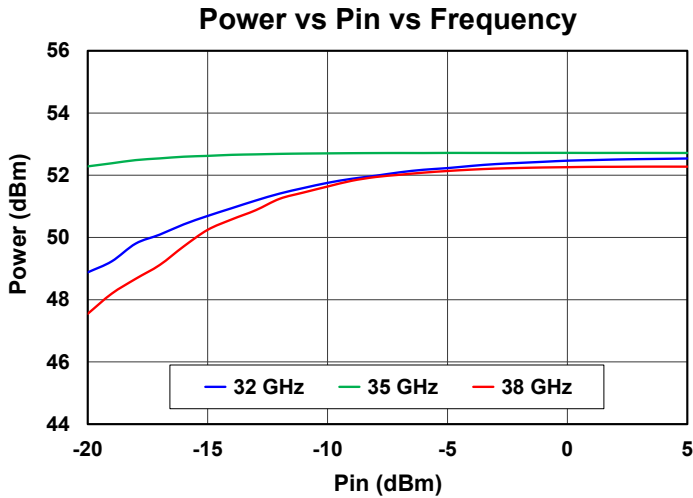


**PDiss vs Freq vs Voltage**



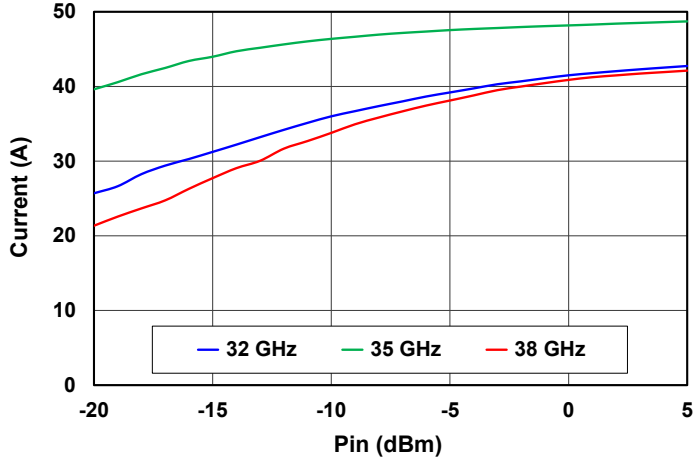
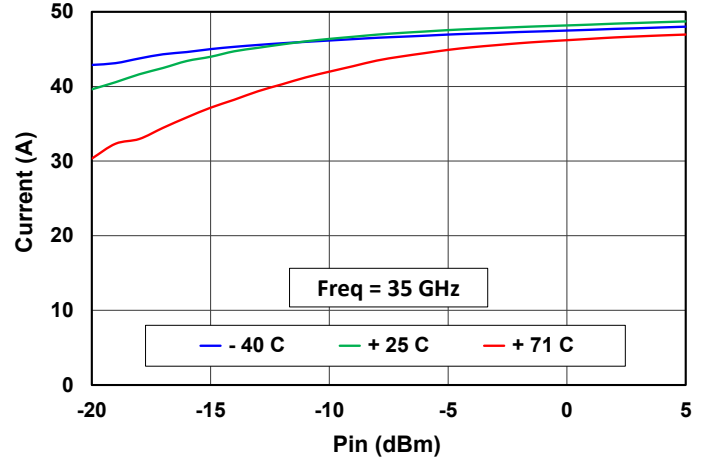
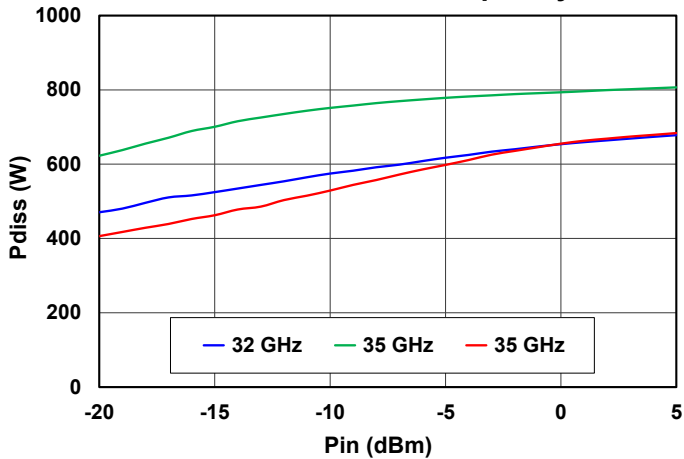
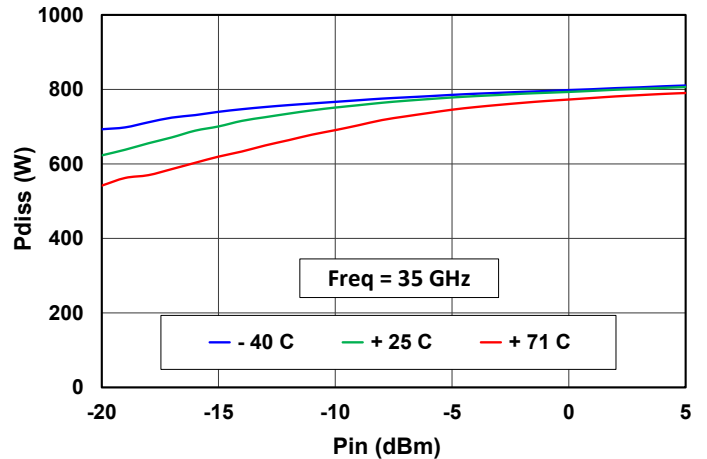
## Typical Performance – Large Signal, Pulse Mode

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



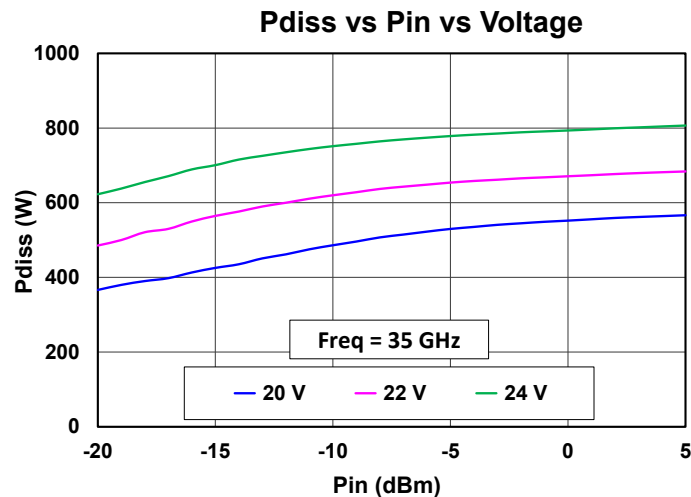
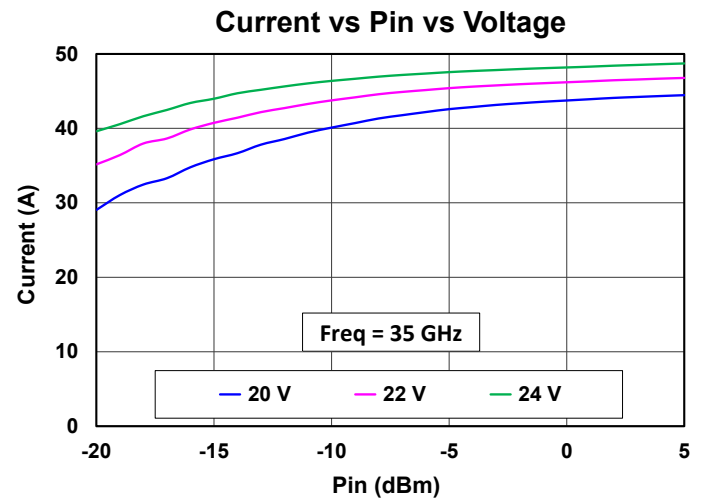
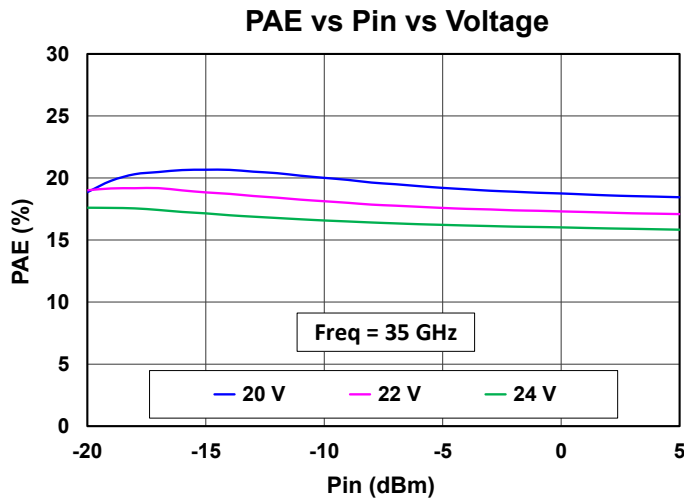
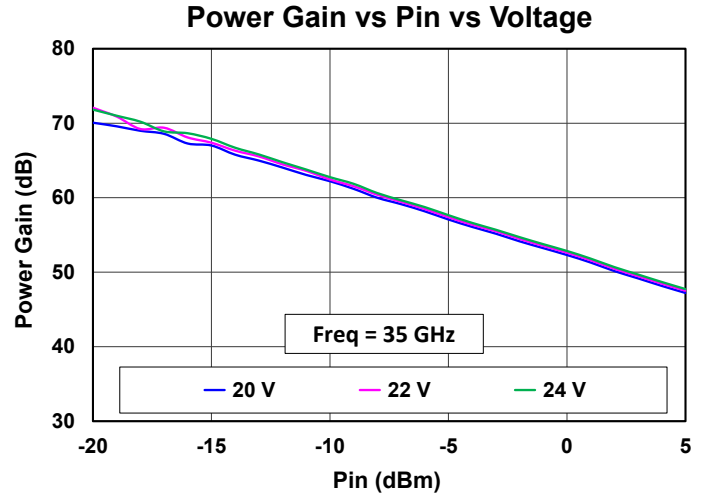
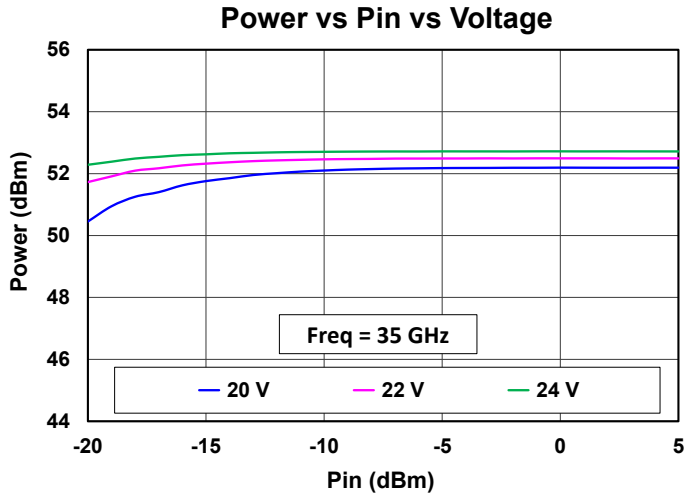
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**Current vs Pin vs Frequency**

**Current vs Pin vs Temp**

**Pdiss vs Pin vs Frequency**

**Pdiss vs Pin vs Temp**


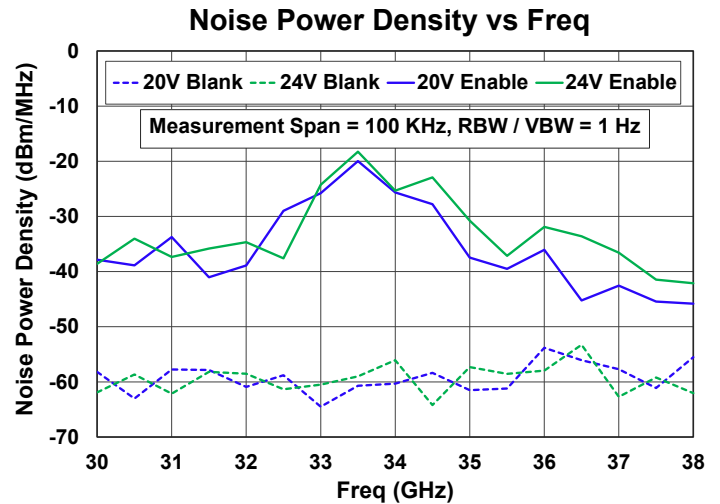
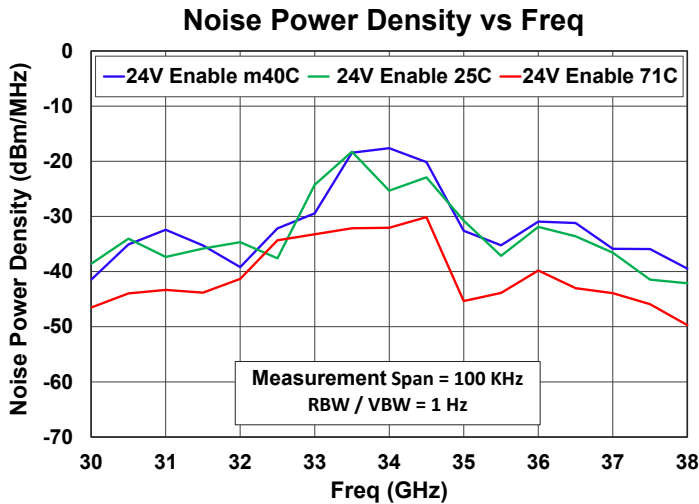
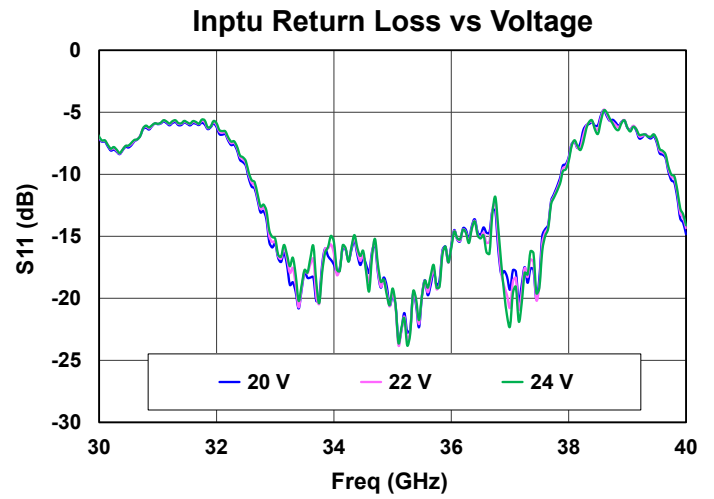
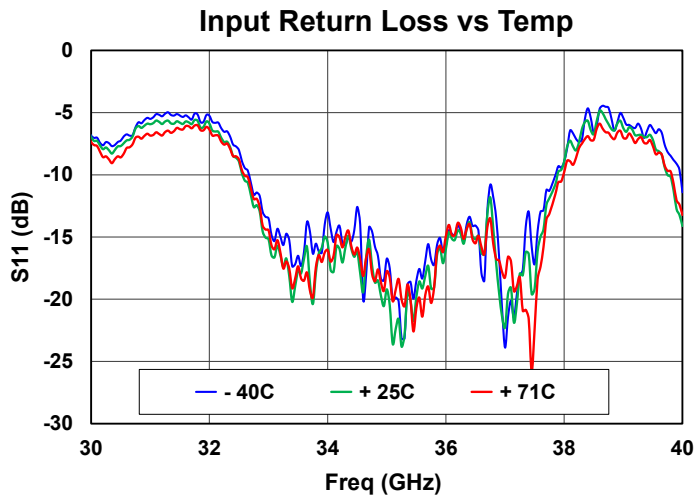
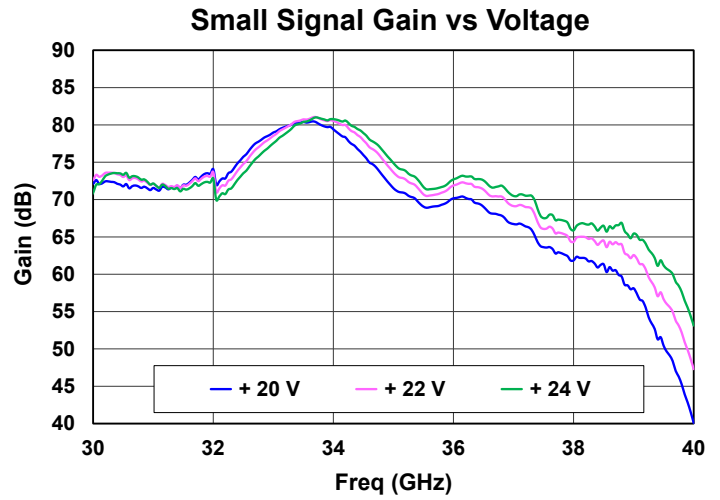
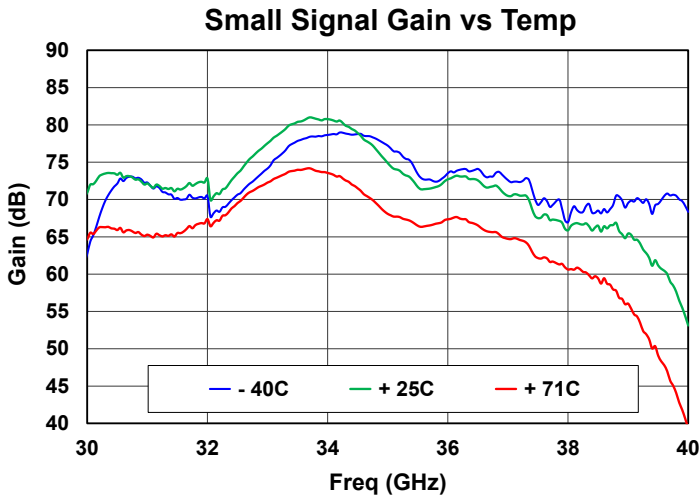
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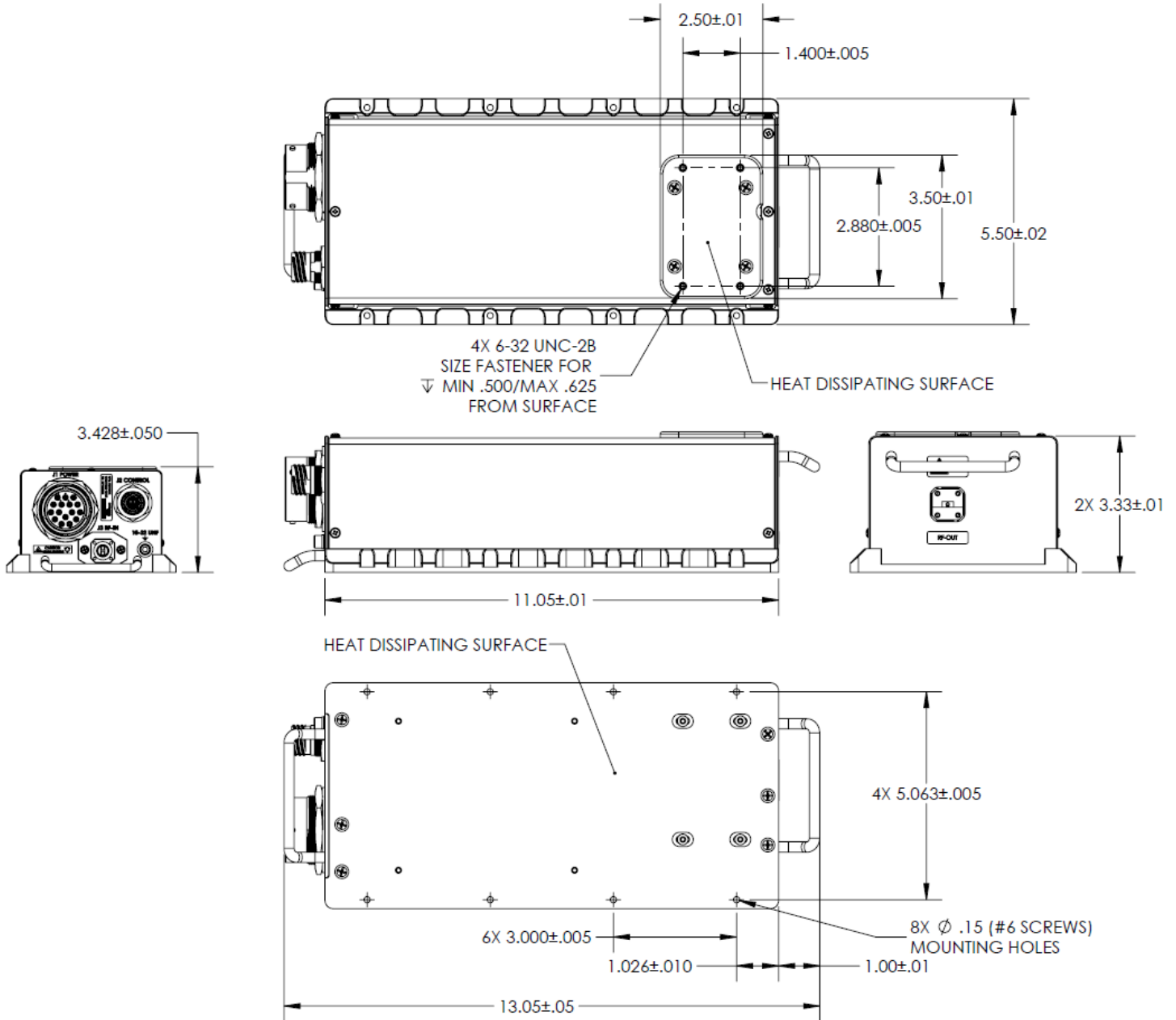


## Typical Performance – Small Signal

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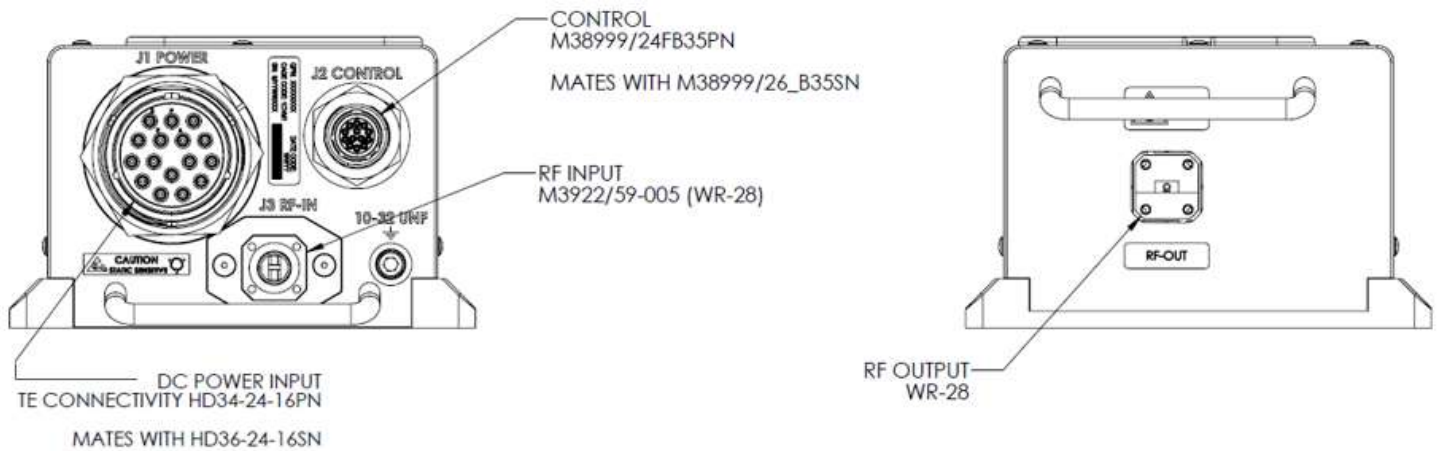


**Mechanical Information**



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 <sub>DC</sub> | 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

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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.

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

## Contact Information

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For the latest specifications, additional product information, worldwide sales and distribution locations:

Web: [www.qorvo.com](http://www.qorvo.com)

Tel: 1-844-890-8163

Email: [customer.support@qorvo.com](mailto:customer.support@qorvo.com)

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