

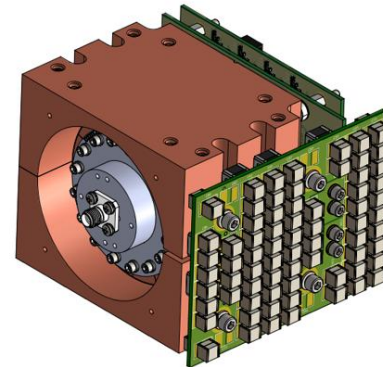
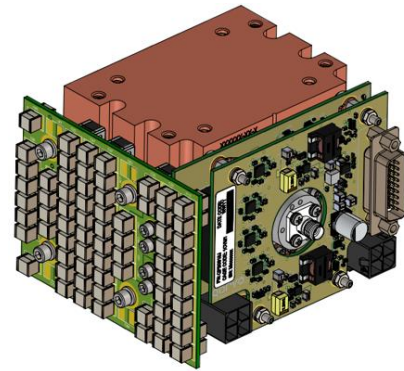
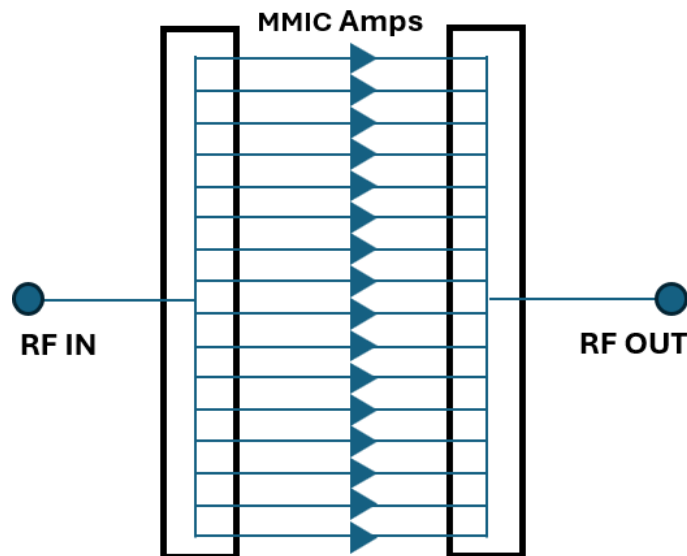
Product Description

An excellent alternative to traveling wave tube amplifiers, Qorvo’s Spatium™ QPB1840N is a solid state, spatial-combining amplifier with an operating range of 18–40 GHz. With its maximum performance in output power, gain, power added efficiency, and power flatness, this Spatium is the ideal building block for various millimeter-wave subsystems with wide-ranging applications.

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.

The QPB1840N is equipped with an integrated bias card, which allows for convenience of operation, reducing electrical losses in the bias networks, and weight reduction over using a separate bias card. It provides individualized bias settings for each amplifier blade in the Spatium SSPA as well as drain pulsing up to 1 MHz PRF for superior power savings and noise performance.

Functional Block Diagram



Product Features

- Frequency Range: 18 – 40 GHz
- Saturated Output Power: 44.0 dBm ($P_{IN} = 32$ dBm)
- Large Signal Gain: 12.0 dB ($P_{IN} = 32$ dBm)
- Solid State MMIC Reliability
- Multi-Element Redundancy
- Instant On (no warm-up)
- Integrated Bias Card

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

Applications

- TWTA Replacement

Ordering Information

Part No.	Description
QPB1840N	18 – 40 GHz Spatium™ Amplifier

Absolute Maximum Ratings

Parameter ¹	Min Value	Max Value	Units
Prime Power for Spatium SSPA (V _{DC}) ²	-	22	V
Power Supply Current (Under RF Drive)	-	20	A
Load VSWR	-	3:1	-
Input Power (CW, VSWR 1.5:1, 25 °C)	-	36	dBm
Storage Temperature	-55	85	°C

1. 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. Extended application of Absolute Maximum Rating conditions may reduce device reliability.
2. Rating for thermal reliability.

Recommended Operating Conditions

Parameter	Min	Typ	Max	Units
Drain Voltage (V _{DC})	18	18	20	V
Quiescent Current (Small Signal Operations)		7.4		A
Operating Current (Under RF Drive)		See data plots		A
Operating Temperature ¹	-40		71	°C
DC Pulse Width ²	0.5		See note 4	uS

1. Refers to outside clamp surface temperature, 2- sided cooling required.
2. Unit can be DC or RF pulsed, this limit is applicable to DC pulsing only.

Electrical Specifications

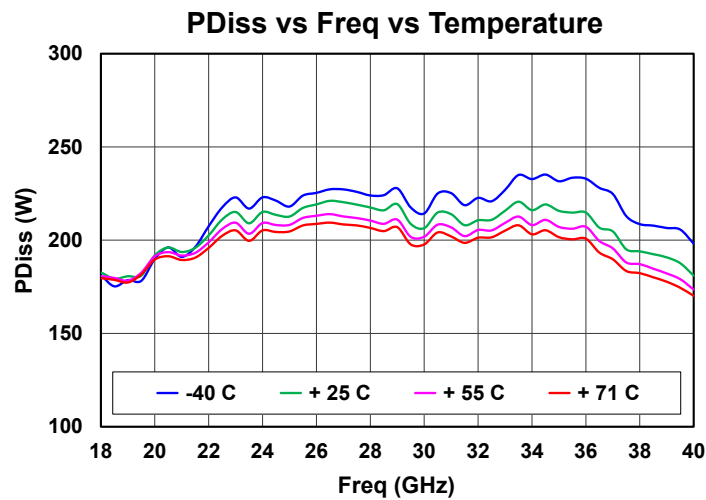
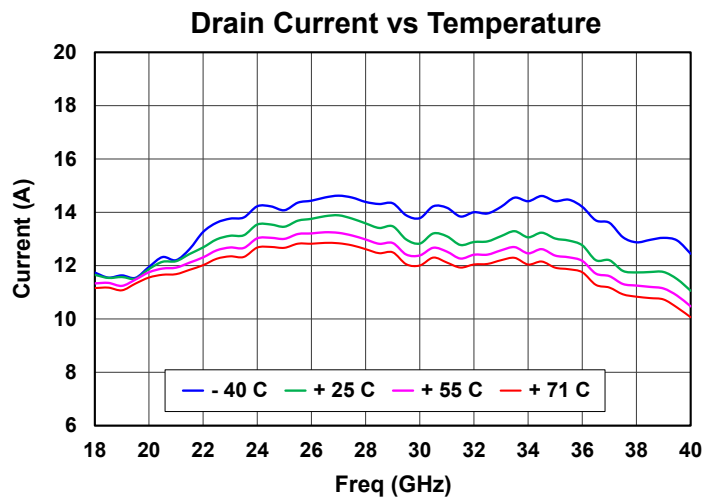
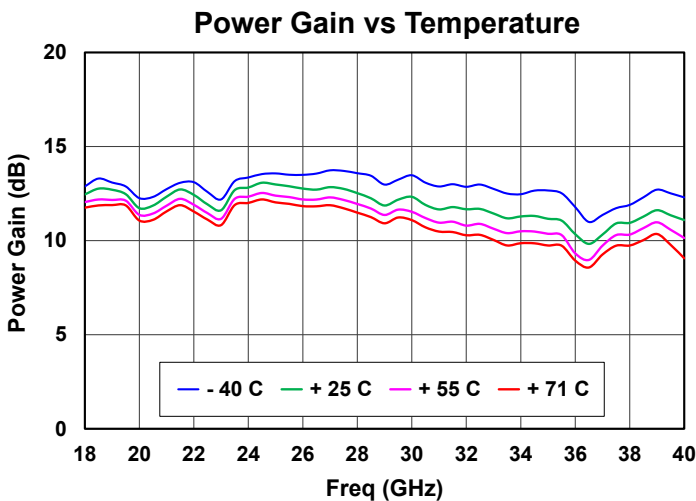
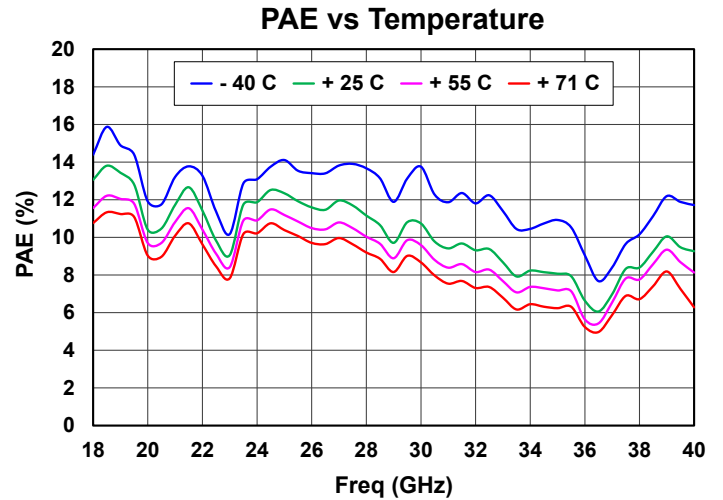
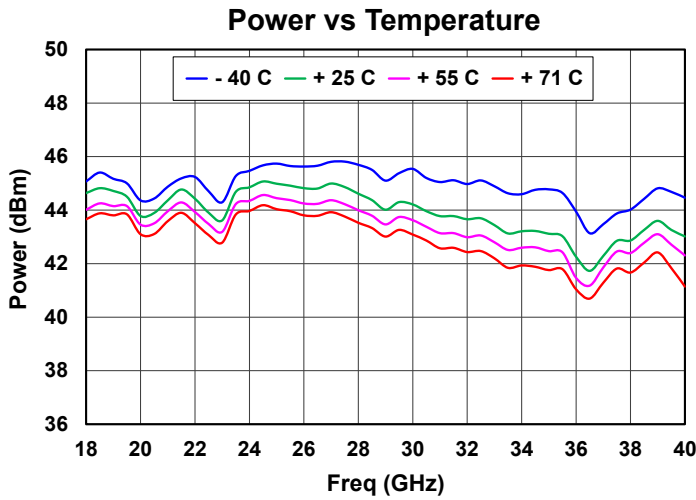
Test conditions unless otherwise noted: $V_{DC} = 18\text{ V}$, $T_{CLAMP} = 25\text{ °C}$

Parameter ¹	Min	Typ	Max	Units
Frequency	18		40	GHz
CW Output Power ($P_{IN} = 32\text{ dBm}$)		44.0		dBm
CW Power Gain ($P_{IN} = 32\text{ dBm}$)		12		dB
CW Gain Flatness vs Freq. ($P_{IN} = 32\text{ dBm}$)		+ / - 2.5		dB
CW PAE ($P_{IN} = 32\text{ dBm}$)		10		%
Pulse Mode Output Power ($P_{IN} = 32\text{ dBm}$) ²		44.2		dBm
Pulse Mode Power Gain ($P_{IN} = 32\text{ dBm}$) ²		12.2		dB
Pulse Mode Gain Flatness vs Freq. ($P_{IN} = 32\text{ dBm}$) ²		+ / - 2.5		dB
Pulse Mode PAE ($P_{IN} = 32\text{ dBm}$) ²		10		%
Switch Time (RF Pulsing)			30	ns
Switch Time Enable to 90% RF (ON, DC Pulsing)		105	200	ns
Switch Time Disable 10% RF (OFF, DC Pulsing)		137	200	ns
Small Signal Gain (S21)		20		dB
Input Return Loss (S11)		15		dB
Output Return Loss (S22)		15		dB
DC Power (CW, $P_{IN} = 32\text{ dBm}$, average)		270		W
Input RF Interface	2.92 mm (F) Coaxial Connector			
Output RF Interface	2.92 mm (F) Coaxial Connector			
Weight: Amplifier + Bias Card		6.1 (2.77)		lbs. (kg)
Dimensions: Amplifier + Bias Card (L) x (W) x (H)		3.94 x 2.91 x 4.04		inches
Dimensions: Amplifier + Bias Card (L) x (W) x (H)		100.0 x 73.9 x 102.6		millimeters

1. Electrical specifications are measured at specified test conditions. Specifications are not guaranteed over all recommended operating conditions.
2. Tested with DC pulsing, Pulse Width = 500 nS, Duty Cycle = 50%.

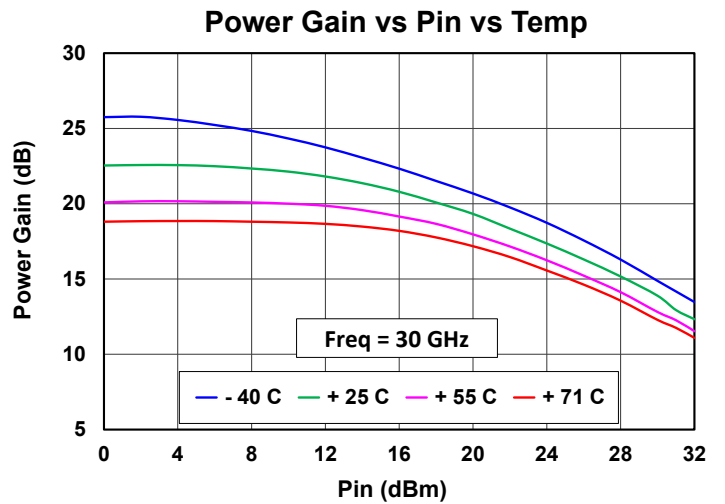
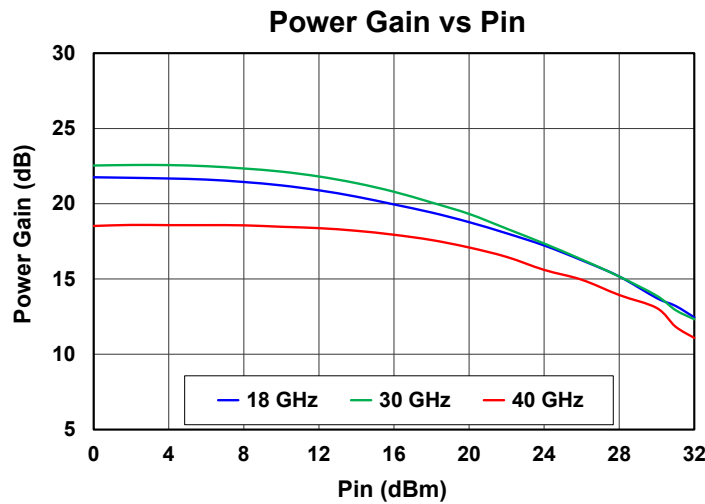
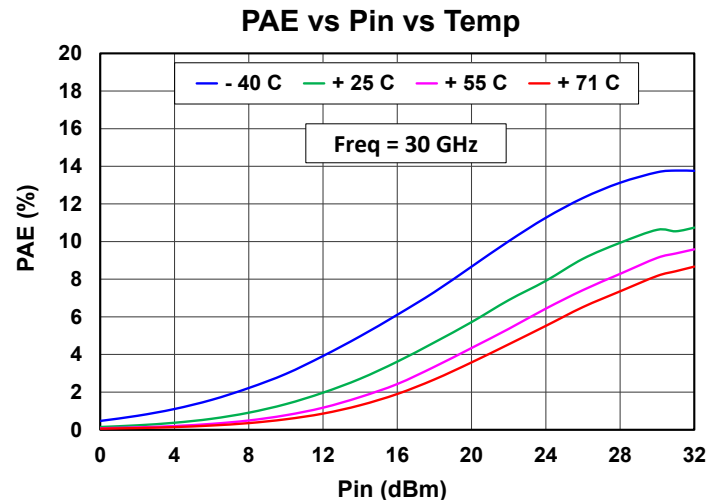
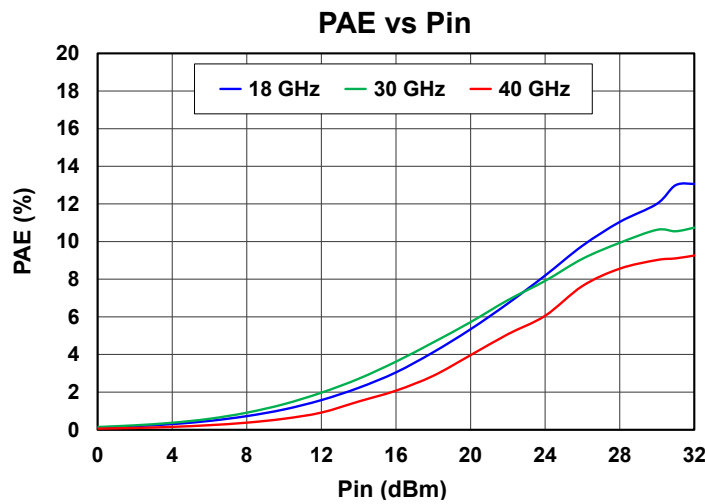
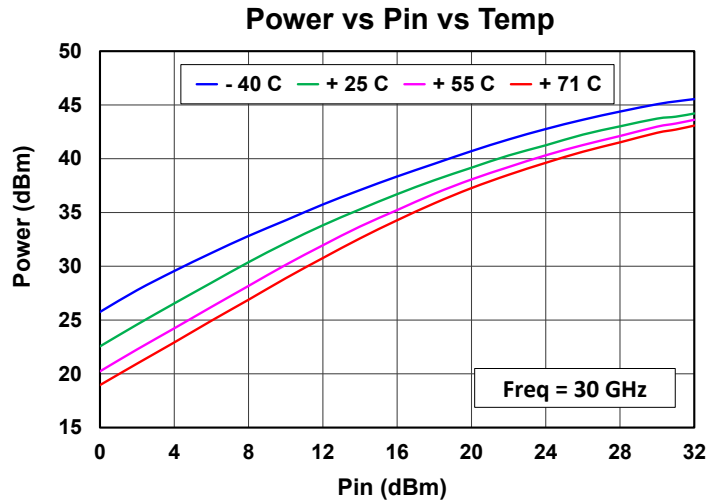
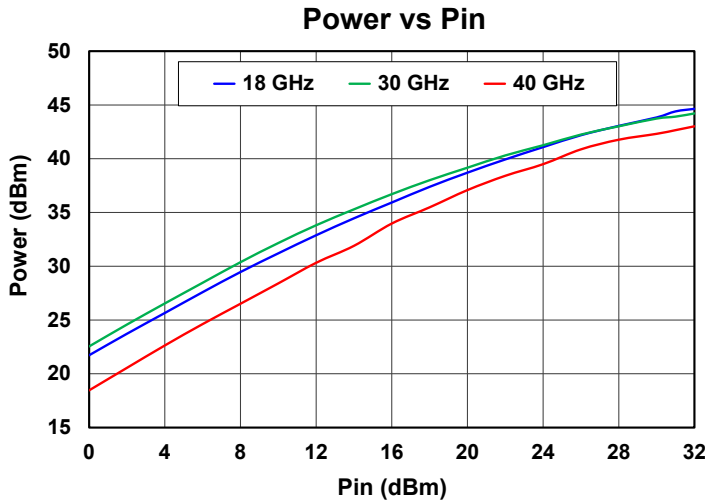
Large Signal Performance – CW

Conditions unless otherwise specified: $V_{DC} = 18\text{ V}$, $P_{IN} = 32\text{ dBm}$, $T_{CLAMP} = 25\text{ }^{\circ}\text{C}$



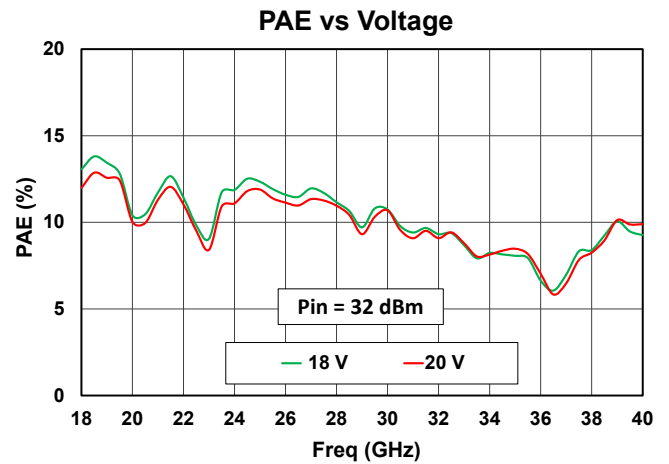
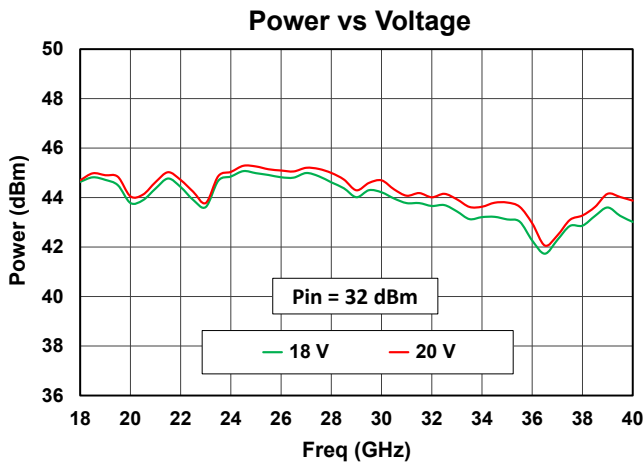
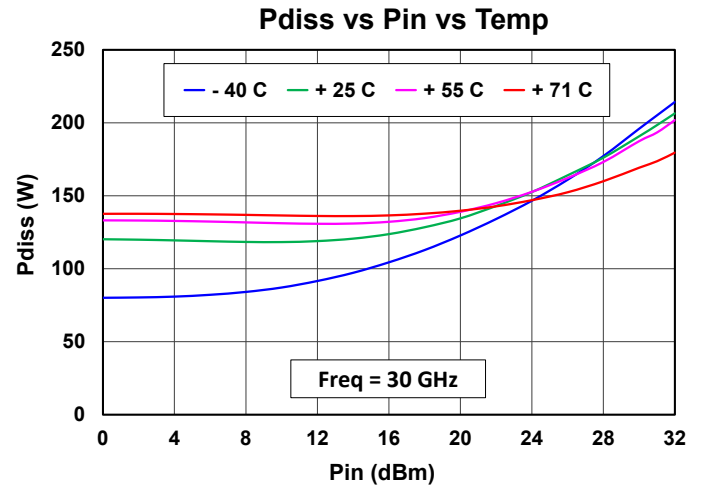
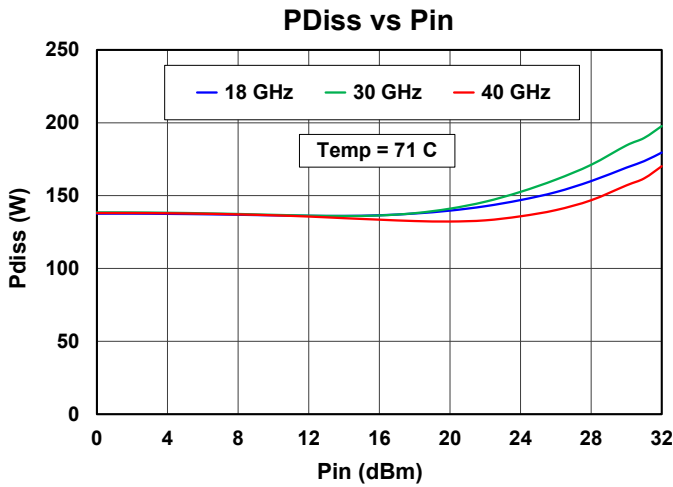
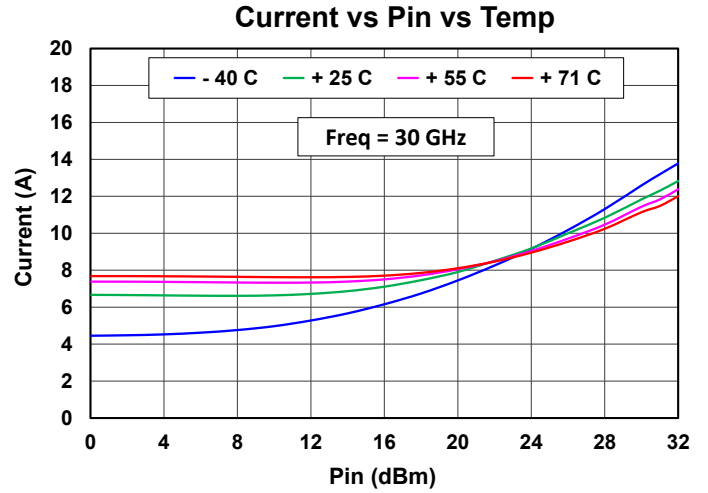
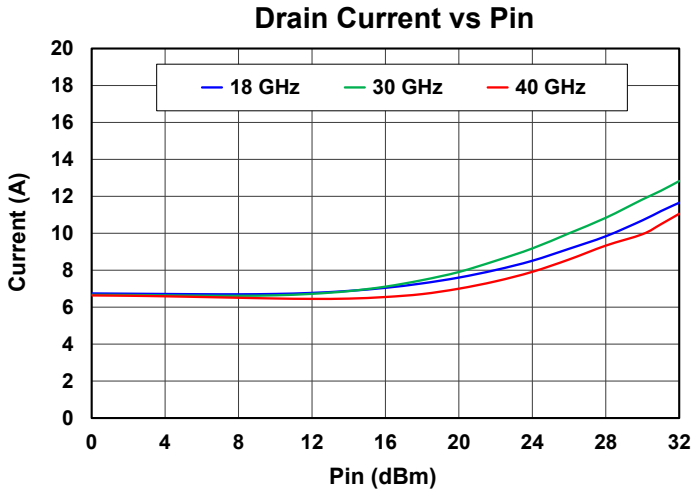
Large Signal Performance – CW

Conditions unless otherwise specified: $V_{DC} = 18V$, $T_{CLAMP} = 25^\circ C$



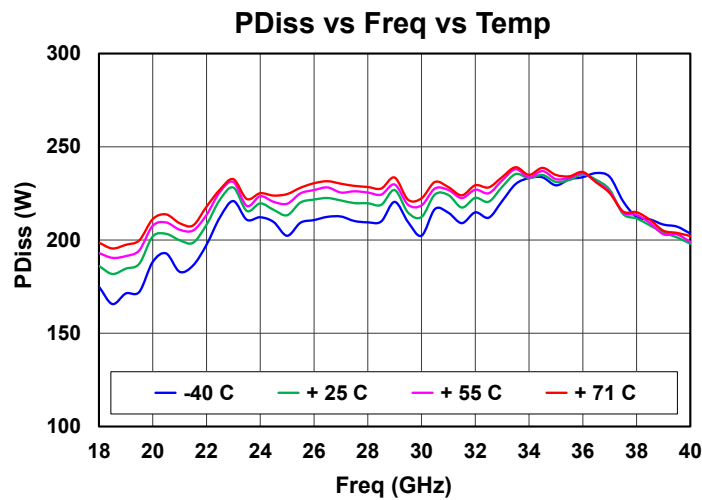
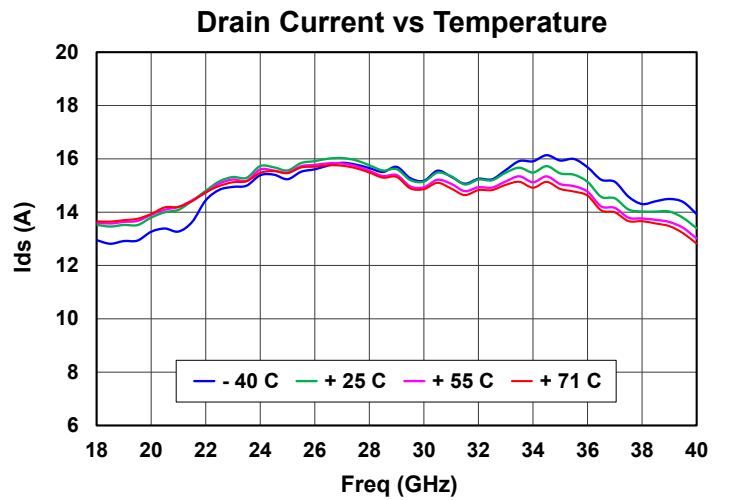
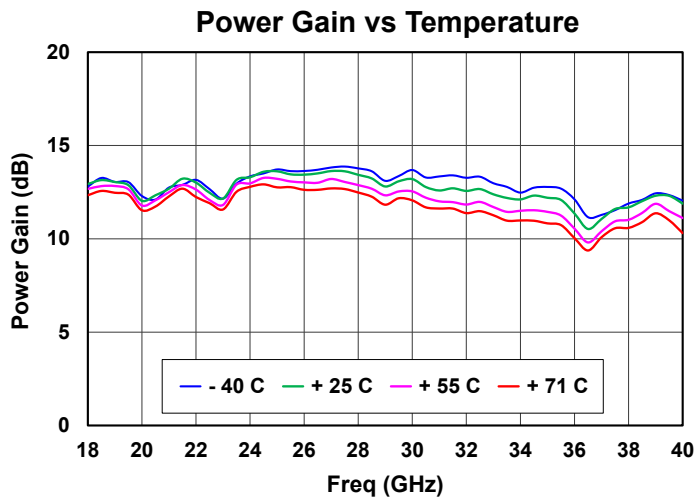
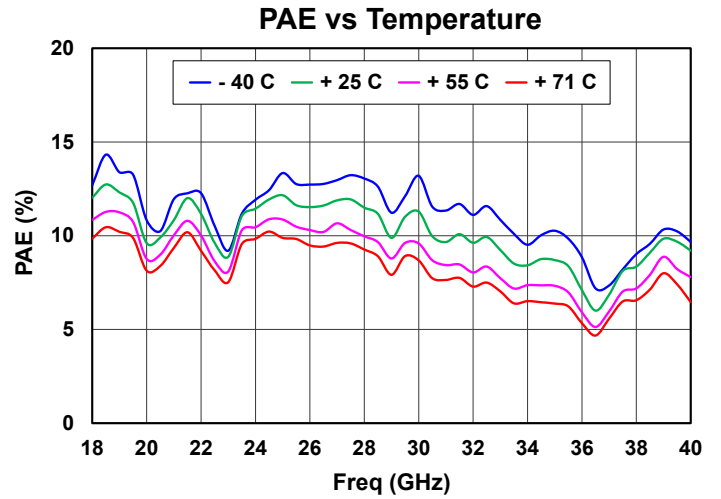
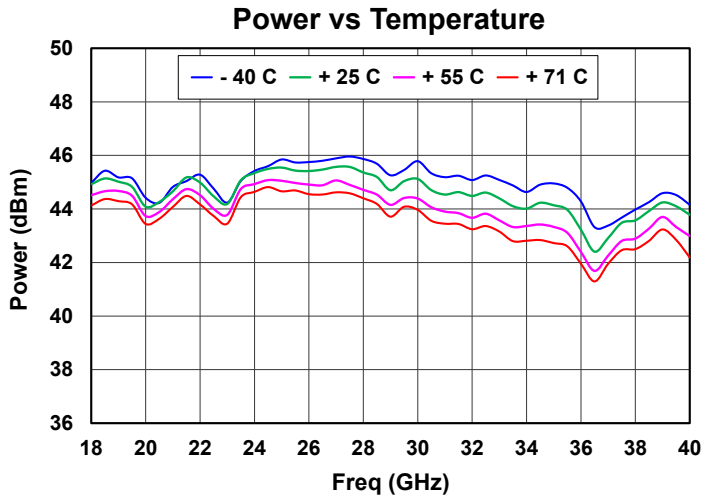
Large Signal Performance – CW

Conditions unless otherwise specified: $V_{DC} = 18\text{ V}$, $T_{CLAMP} = 25\text{ }^{\circ}\text{C}$



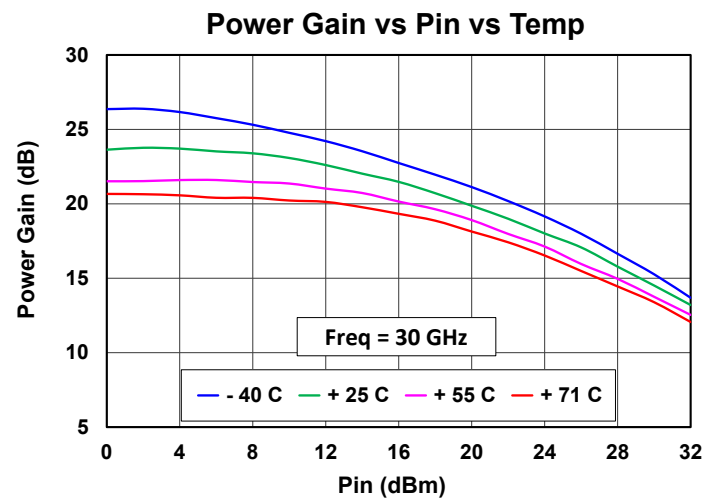
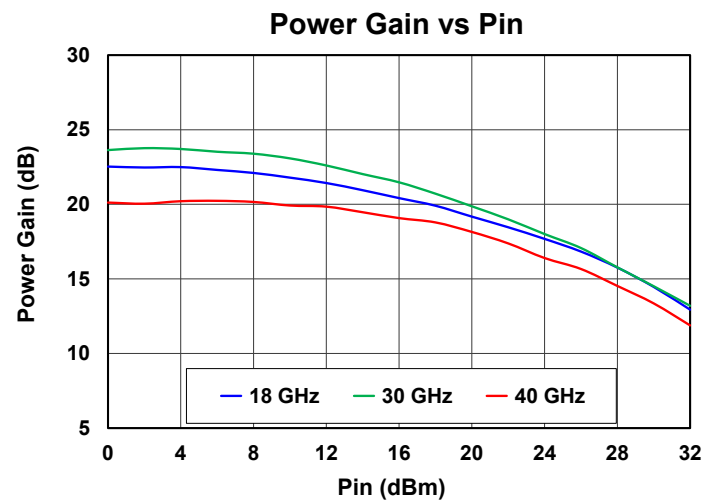
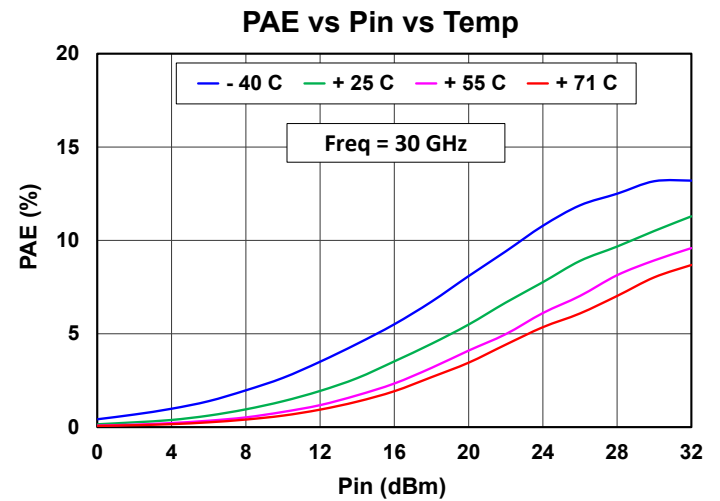
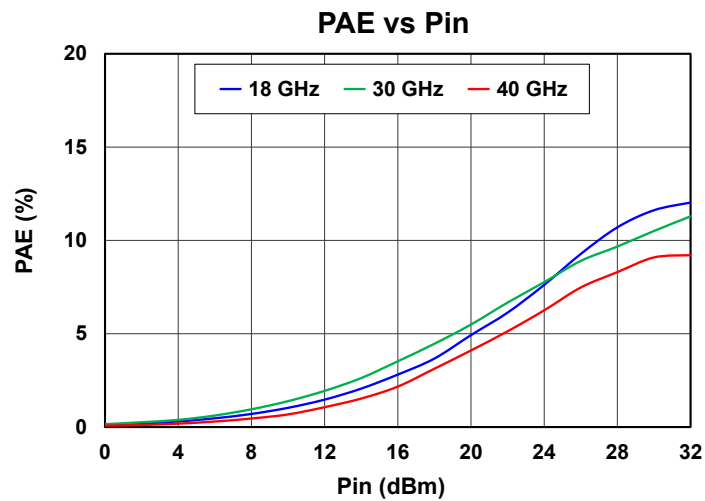
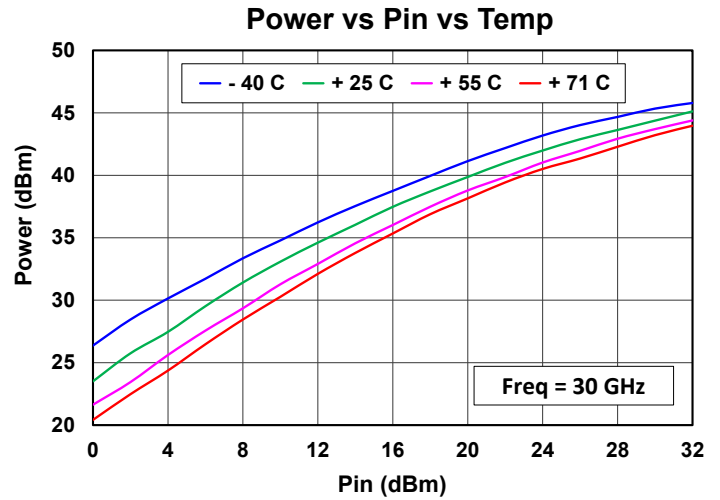
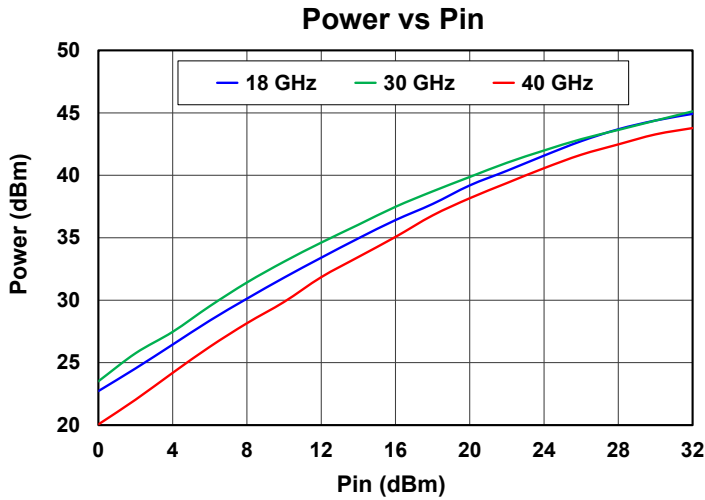
Large Signal Performance – Pulse

Conditions unless otherwise specified: $V_{DC} = 18\text{ V}$, $P_{IN} = 32\text{ dBm}$, Pulse Width = 500 ns, Duty Cycle = 50%, $T_{CLAMP} = 25\text{ }^{\circ}\text{C}$



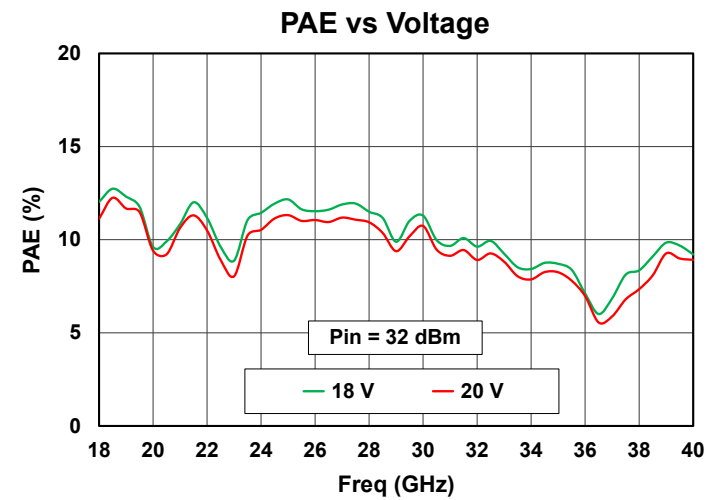
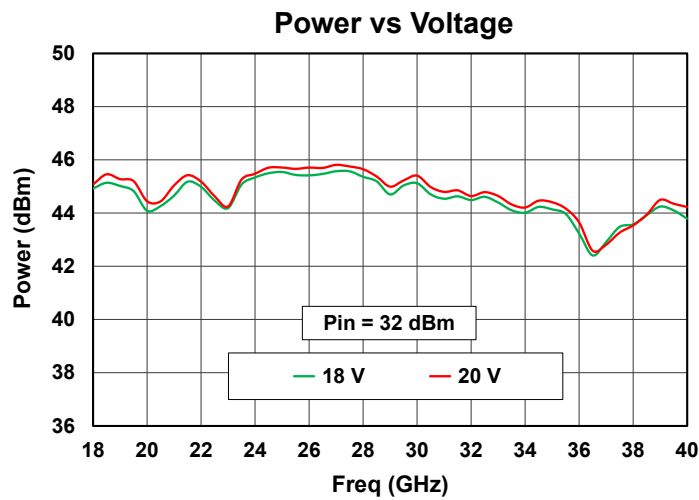
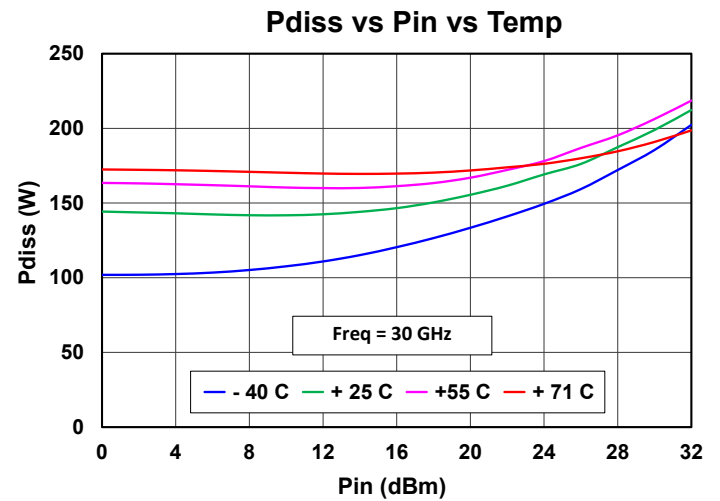
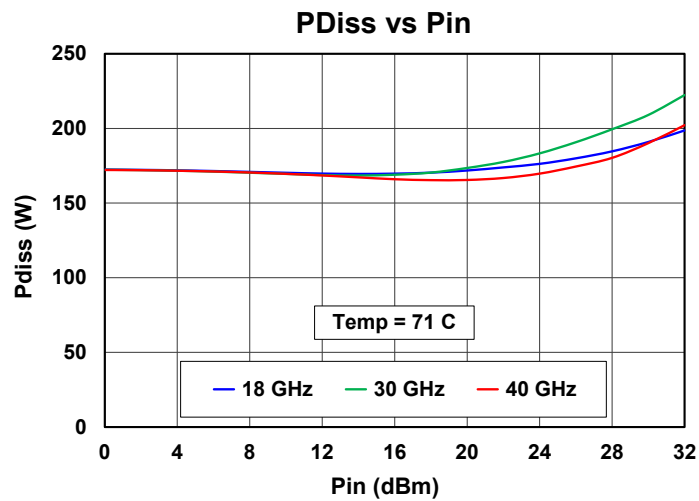
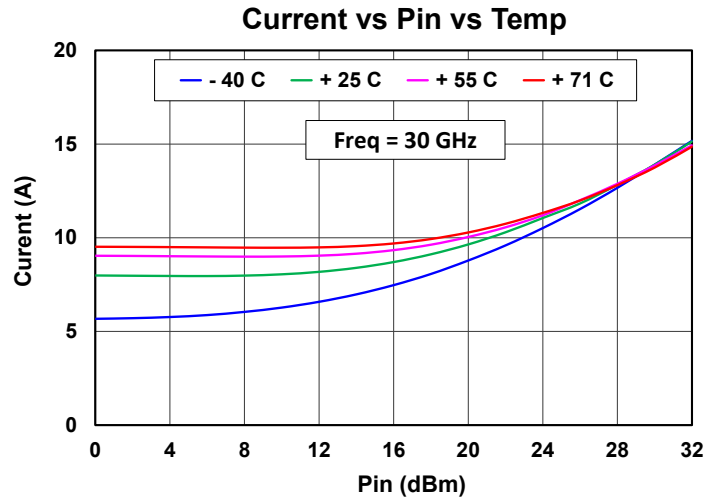
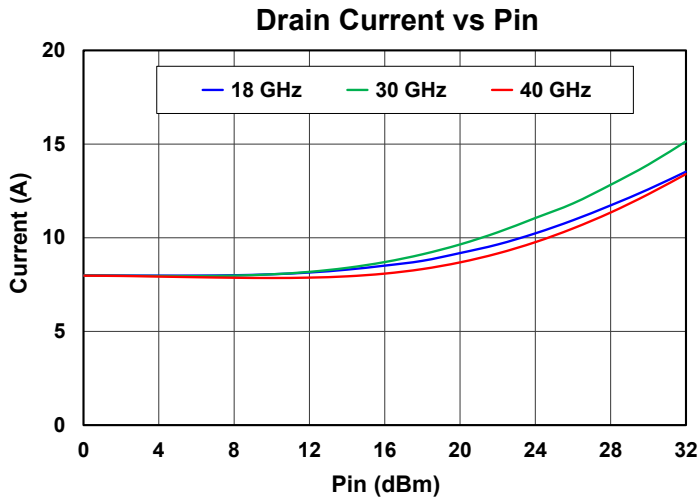
Large Signal Performance – Pulse

Conditions unless otherwise specified: $V_{DC} = 18\text{ V}$, Pulse Width = 500 nS, Duty Cycle = 50%, $T_{CLAMP} = 25\text{ }^{\circ}\text{C}$



Large Signal Performance – Pulse

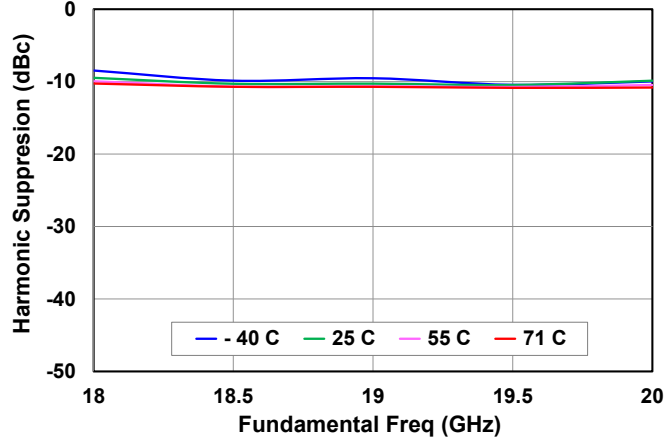
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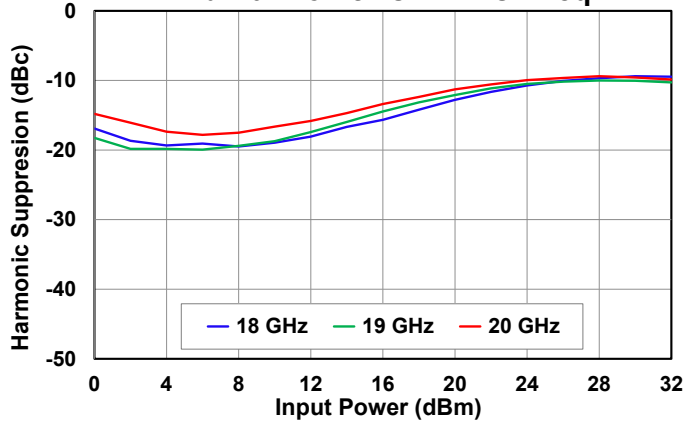
Typical Performance – HarmonicSuppressions (CW)

Conditions unless otherwise specified: $V_{DC} = 18\text{ V}$, $P_{IN} = 32\text{ dBm}$, $T_{CLAMP} = 25\text{ }^{\circ}\text{C}$

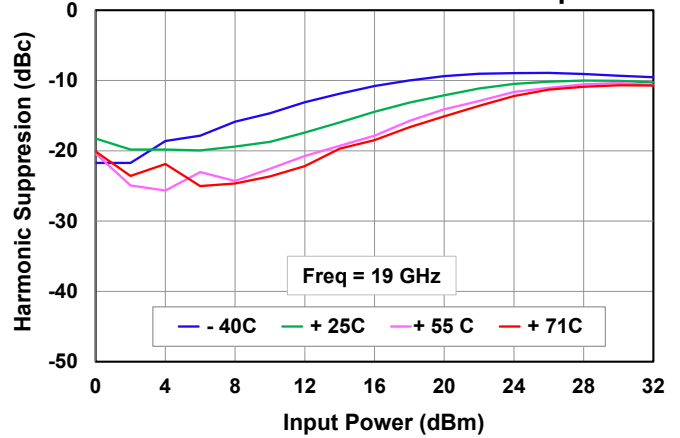
2nd Harmonic vs. Freq vs. Temp



2nd Harmonic vs. Pin vs. Freq

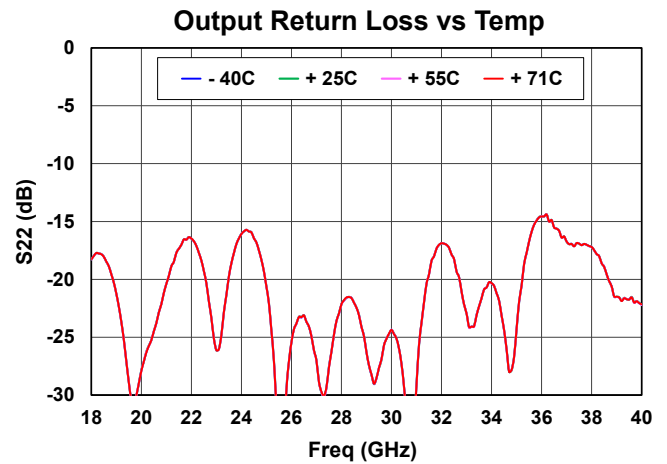
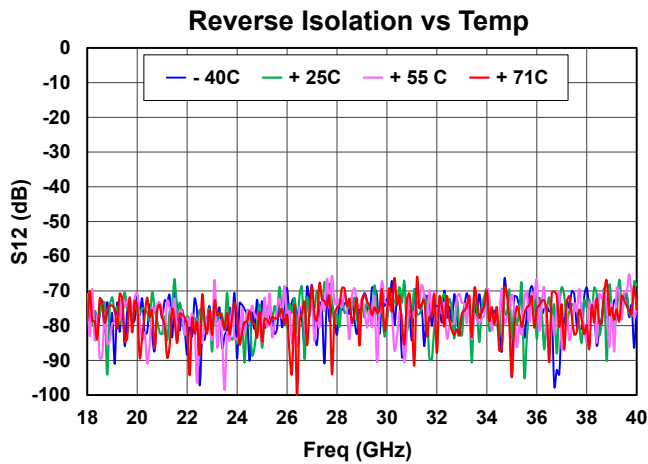
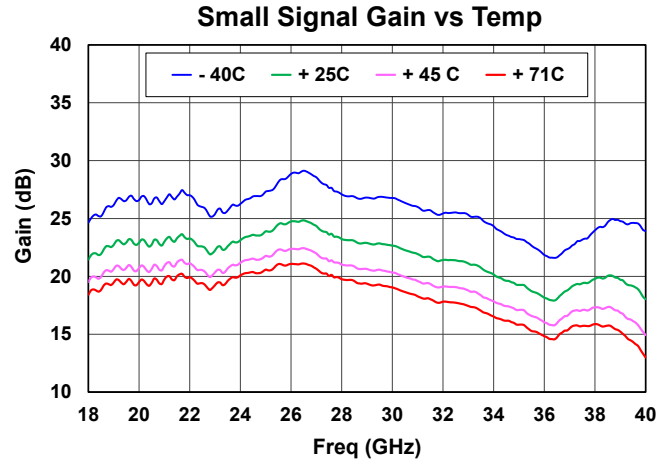
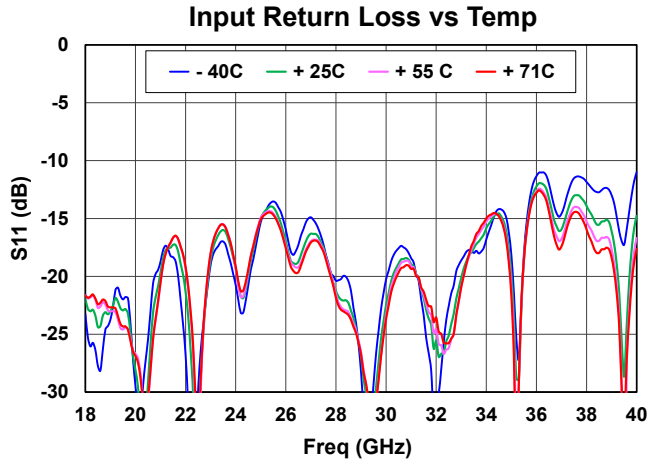


2nd Harmonic vs. Pin vs. Temp

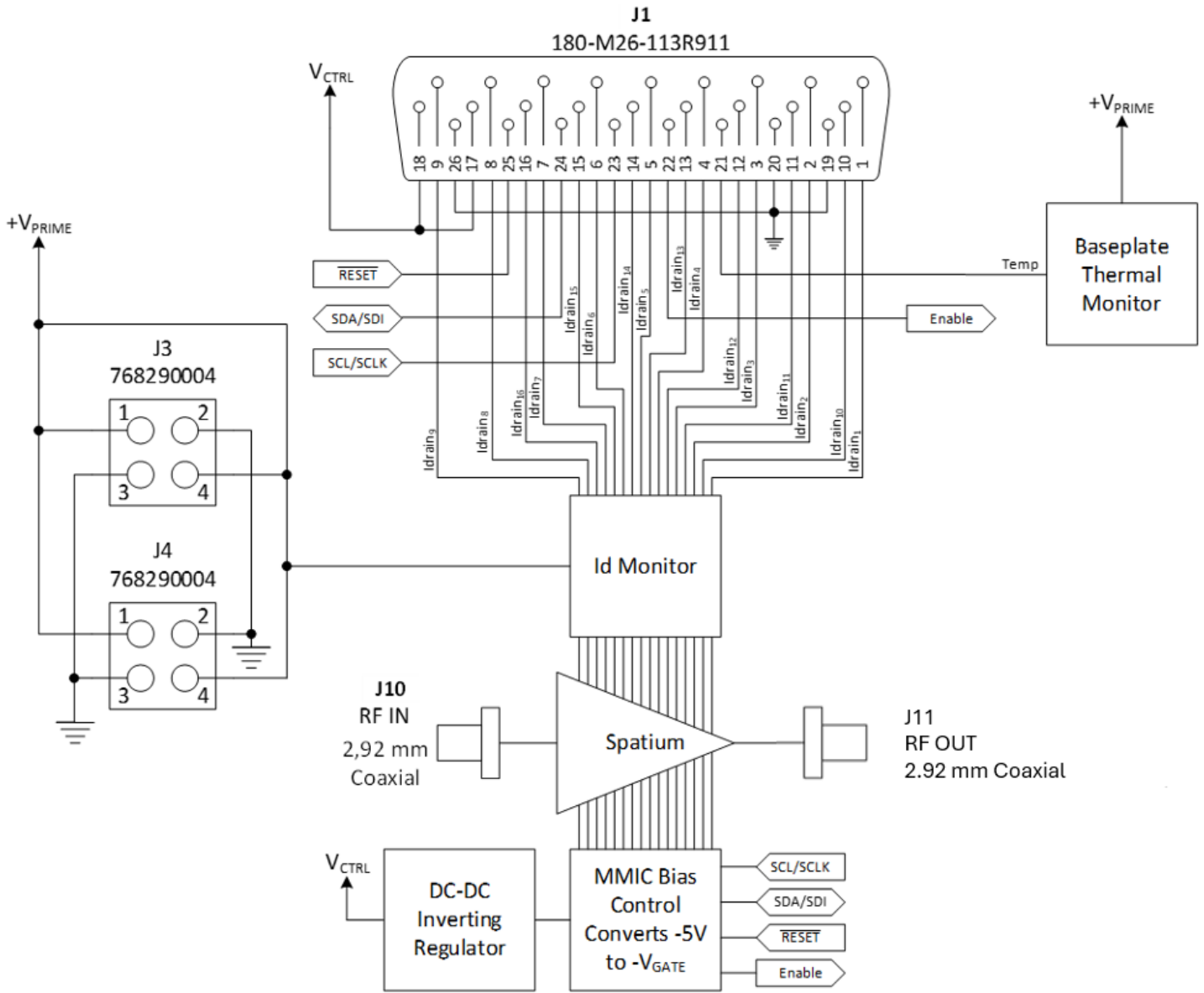


Typical Performance – Small Signal

Conditions unless otherwise specified: $V_{DC} = 18\text{ V}$, $T_{CLAMP} = 25\text{ }^{\circ}\text{C}$



Block Diagram and Description



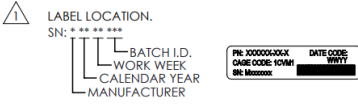
Pin No.	Label	Description
RF In	J10	2.92 mm (F) Coaxial Connector, DC Grounded
RF Out	J11	2.92 mm (F) Coaxial Connector, DC Grounded
Auxiliary	J1	D-SUB HD 26POS (M), NORCOMP, 180-M26-113R9, , mates with 180-026-273L000
Power	J3, J4	MOLEX, 0768290004, Power Supply, Mates with Molex 1716920104 / 1720630311

J1 Connector Pin Labels and Function Descriptions

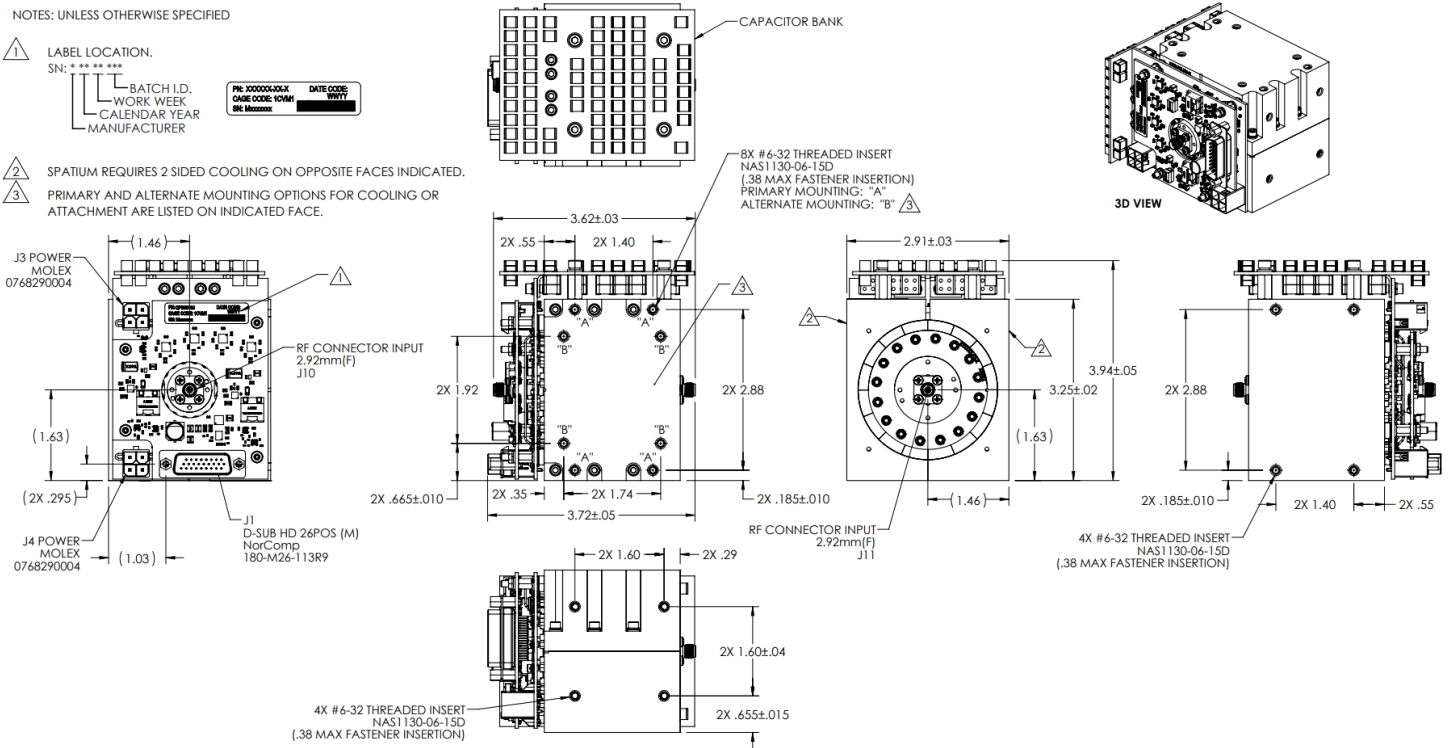
Pin No.	Label	Description
1 2 ... 16	ID_Drain 1 ID_Drain 2 ... ID_Drain 16	Amplifier Bias Monitoring, voltage of these pins follows 0.5V/A times the current flowing through amplifiers 1, 2 to 16, can be used for amplifier diagnostics, otherwise leave open.
17, 18	5V0	+5V internally generated reference voltage, can be used to supply 100mA of current if required, otherwise, leave open. Do not apply a voltage to these pins.
19, 20	GND	Logic / signal ground.
21	VTEMP	Temperature monitoring, connects to Texas Instruments LMT87 temperature sensor output. For relation between output voltage and temperature, please see the LMT87 datasheet. https://www.ti.com/lit/ds/symlink/lmt87.pdf .
22	ENABLE	5V CMOS logic command bit for setting the gain stages to lo power mode operation. 0V puts the unit into a low-power stage while 5V will allow normal operation, in the absence of an external logic signal (open), the amplifier will power on with the application of supply voltage.
23	SCL	I2C bus used to program amplifier (for factor use only).
24	SDA	I2C bus used to program amplifier (for factor use only).
25	RESET	I2C bus used to program amplifier (for factor use only).
26	GND	Logic / signal ground.

Mechanical Information – Outline Drawing (Spatium™ Unit with Bias Card)

NOTES: UNLESS OTHERWISE SPECIFIED

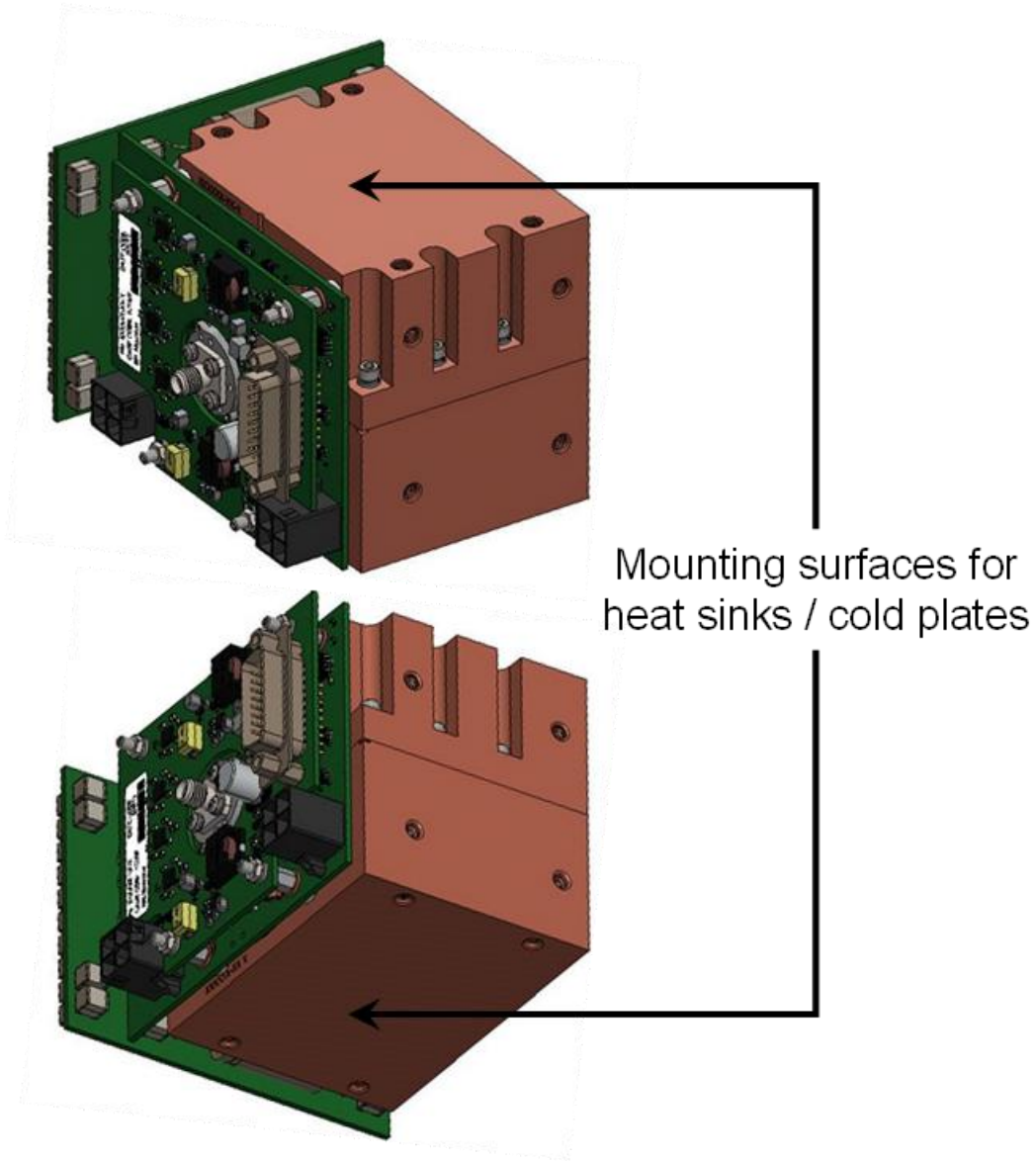


- 2 SPATIUM REQUIRES 2 SIDED COOLING ON OPPOSITE FACES INDICATED.
- 3 PRIMARY AND ALTERNATE MOUNTING OPTIONS FOR COOLING OR ATTACHMENT ARE LISTED ON INDICATED FACE.



Dimensions are in INCHES

Mechanical Information – Location Drawing for Heat Sinks / Cold Plates





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

Important Notice

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