Spatium™ QPB3238N

32 – 38 GHz Ka-Band GaN Amplifier

Product Description

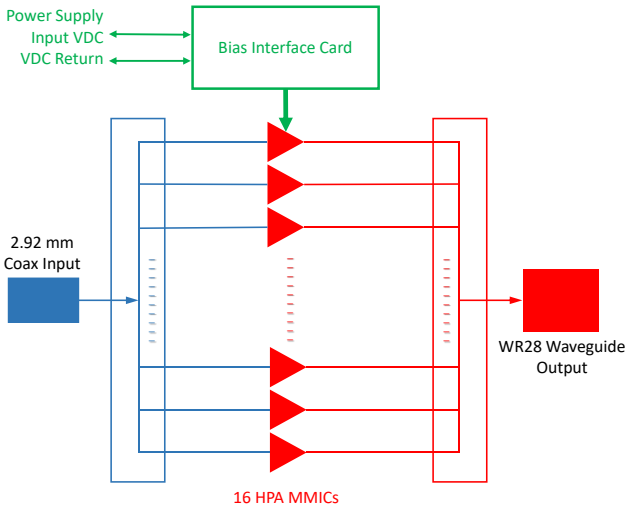
An excellent alternative to traveling wave tube amplifiers, Qorvo's Spatium™ QPB3238N is a solid state, spatial-combining amplifier with an operating range of 32–38 GHz. With its maximum performance in output power, gain, power added efficiency, and power flatness, this Spatium is the ideal building block for Satcom BUC's and other millimeter-wave subsystems with wide - ranging applications.

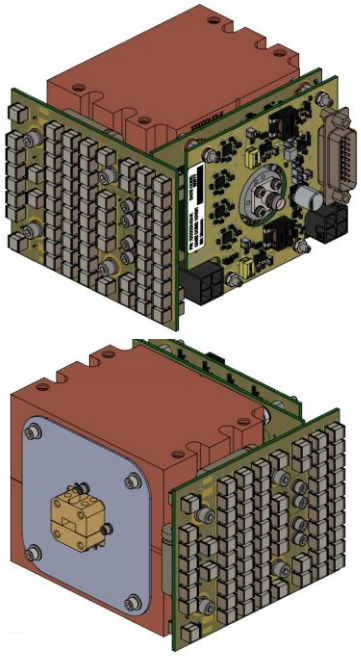
Qorvo's patented and field-proven Spatium combining technology provides unprecedented Solid-State Power Amplifier (SSPA) performance in a rugged, compact size and weight which reduces total cost of ownership compared to alternative technologies. This product offering combines Qorvo's market leadership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

The QPB3238N 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 1.5 MHz PRF for superior power savings and noise performance.

The QPB3238N 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.

Functional Block Diagram





Input (T) and Output (B)

Product Features

- Frequency Range: 32 – 38 GHz
- Saturated Output Power: 51.5 dBm (P_{IN} = 43 dBm)
- Large Signal Gain: 8.5 dB (P_{IN} = 43 dBm)
- Solid State MMIC Reliability
- Multi-Element Redundancy
- Instant On (no warm-up)
- Blank Mode
- Fast DC pulsing
- 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
QPB3238N	32 – 38 GHz Spatium™ Amplifier

Absolute Maximum Ratings

Parameter [1]	Min Value	Max Value	Units
Prime Power Supply (V_D) [2]	-	26	V
Power Supply Current	-	49.3	A
Load VSWR	-	3:1	-
Input Power (CW, VSWR 1.5:1, 25 °C)	-	43	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_D)		24		V
Quiescent Current (Small Signal Operation)		7.2		A
Operating Current (Under RF Drive)		See data plots		A
CW Mode Operating Temperature [1]	-40		43	°C
Pulse Mode Operating Temperature [1, 3] Pulse Width Max 1 uS, (Duty Cycle 70%)	-40		71	°C
Pulse Mode Operating Temperature [1, 3] Pulse Width Max 50 uS, (Duty Cycle 60%)	-40		71	°C
Pulse Mode Operating Temperature [1, 3] Pulse Width Max 500 uS, (Duty Cycle 50%)	-40		71	°C
DC Pulse Width [2]	1		See note 3	uS
DC Pulse Period [2]	2			uS

1. Refers to outside clamp surface temperature, 2- sided cooling required.
2. Unit can be DC or RF pulsed, these limits are applicable to DC pulsing only.
3. The maximum pulse width and duty cycle are limited by thermal reliability.

Electrical Specifications

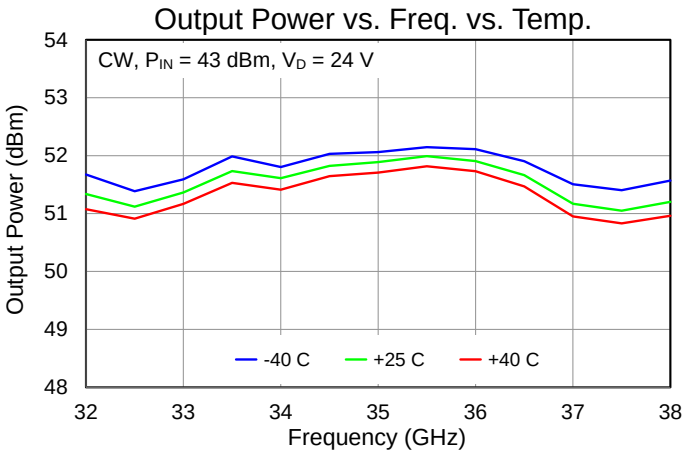
Conditions unless otherwise specified: V_D = 24 V, P_{IN} = 43 dBm, T_{CLAMP} = 25 °C

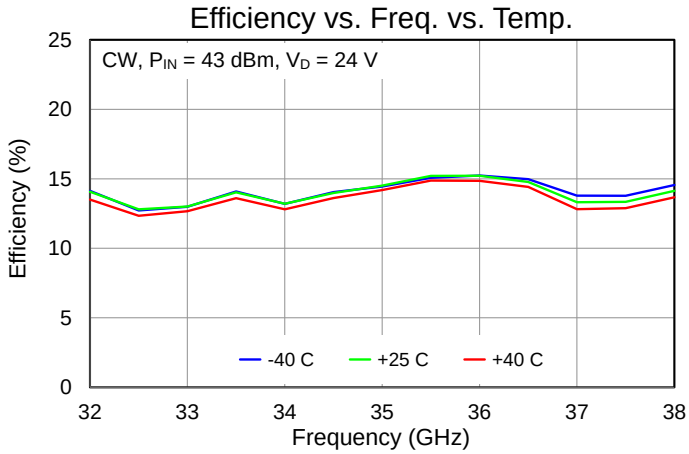
Parameter [1]	Min	Typ	Max	Units
Frequency	32		38	GHz
CW Mode Output Power (P_{IN} = 43 dBm)		51.5		dBm
CW Mode Power Gain (P_{IN} = 43 dBm)		8.5		dB
CW Mode Gain Flatness vs Freq. (P_{IN} = 43 dBm)		± 0.4		dB
CW Mode PAE (P_{IN} = 43 dBm)		14.0		%
Pulse Mode Output Power (P_{IN} = 43 dBm) [2]		51.5		dBm
Pulse Mode Power Gain (P_{IN} = 43 dBm) [2]		8.5		dB
Pulse Mode Gain Flatness vs Freq. (P_{IN} = 43 dBm) [2]		± 0.4		dB
Pulse Mode PAE (P_{IN} = 43 dBm) [2]		13		%
Switch Time (RF Pulsing)			30	ns
Switch Time Enable to 90% RF ON (DC Pulsing)		189	200	ns
Switch Time Disable 10% RF OFF (DC Pulsing)		169	200	ns
Small Signal Gain		24		dB
Input Return Loss (CW)		15		dB
DC Power (CW, P_{IN} = 43 dBm, average)		876		W
Input RF Interface	2.92 mm (F) Coaxial Connector			
Output RF Interface	WR-28 Waveguide			
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 3.85		inches
		100 x 74 x 98		millimeters

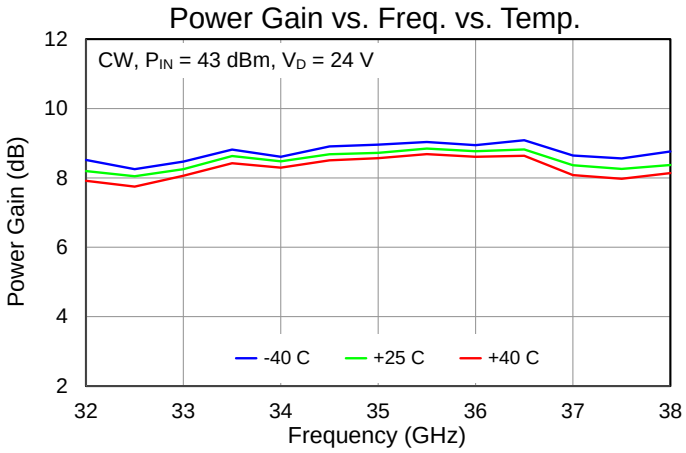
1. Electrical specifications are measured at specified or recommended test conditions. Specifications are not guaranteed over all recommended operating conditions.
2. DC pulsing, Pulse Width = 75 uS, DC = 12%.

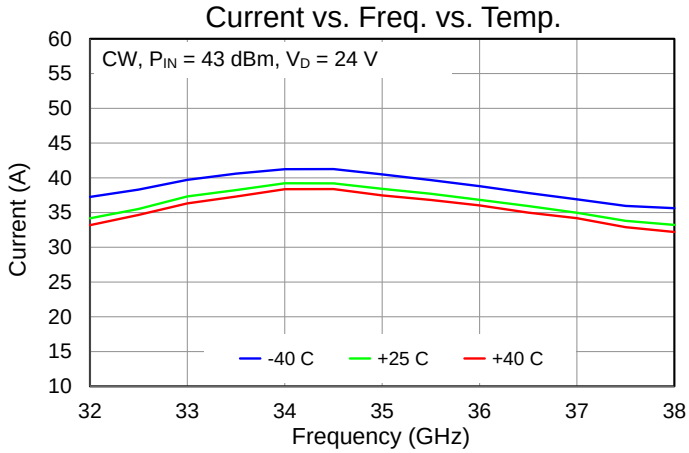
Typical Performance – Large Signal (CW)

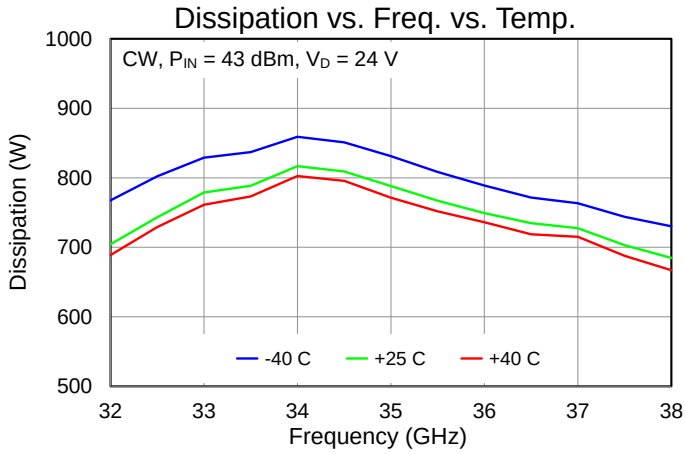
Conditions unless otherwise specified: V_D = 24 V, P_{IN} = 43 dBm, T_{CLAMP} = 25 °C





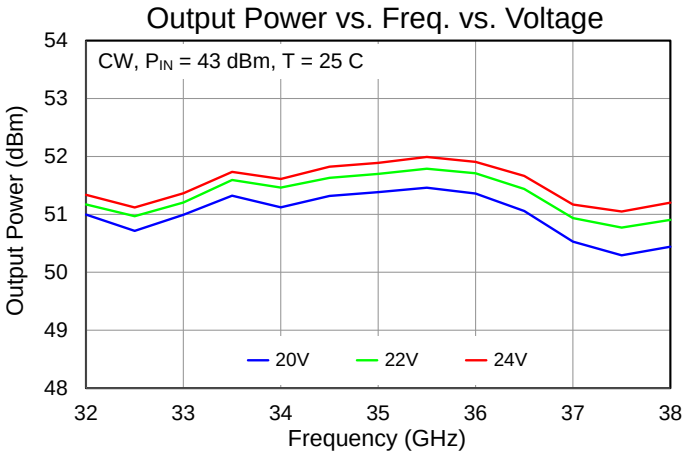


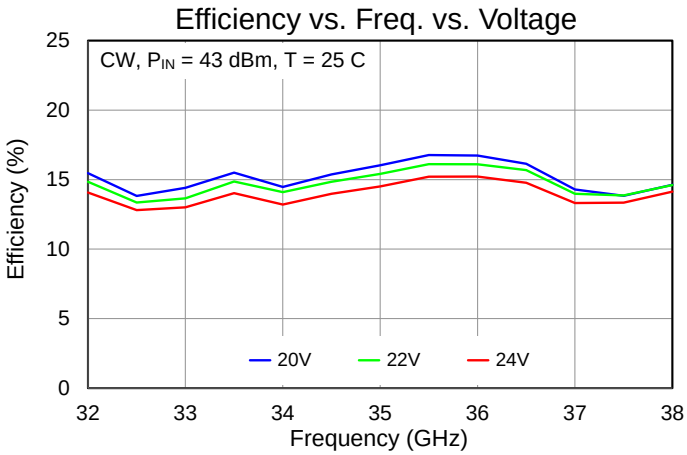


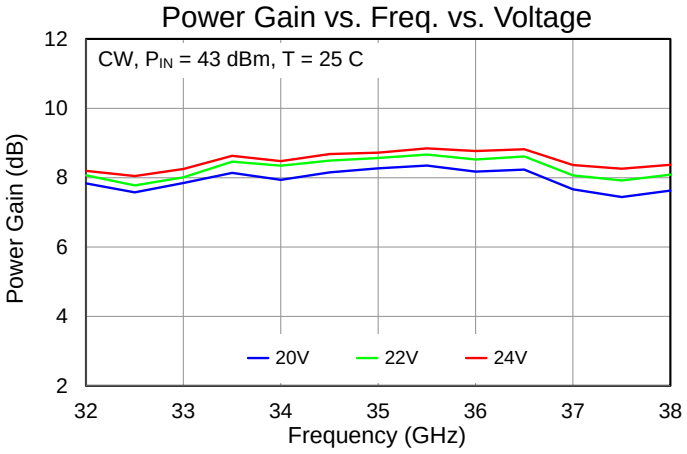


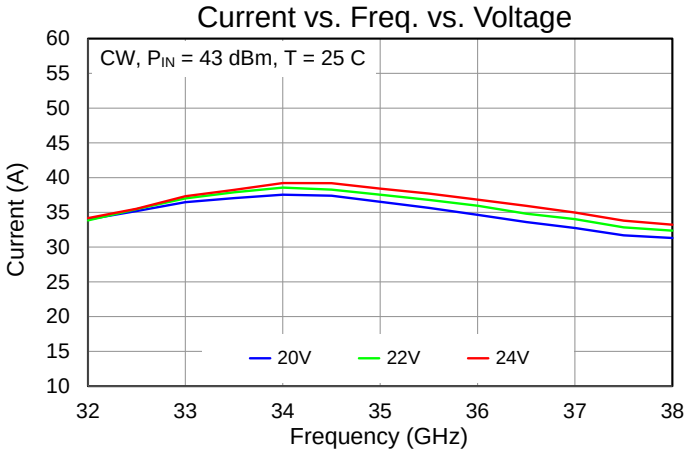
Typical Performance – Large Signal (CW)

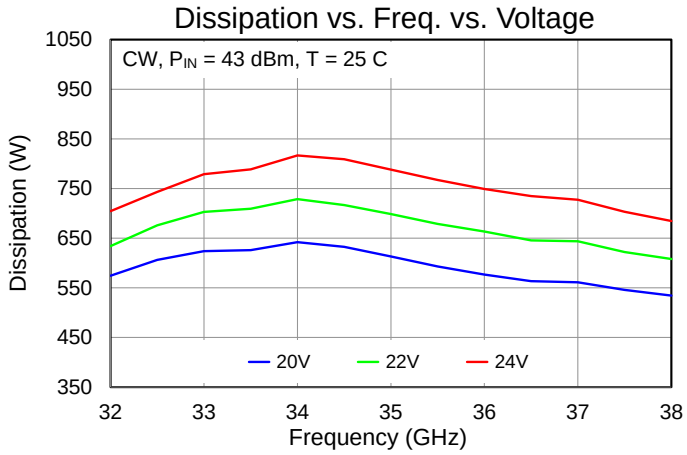
Conditions unless otherwise specified: V_D = 24 V, P_{IN} = 43 dBm, T_{CLAMP} = 25 °C







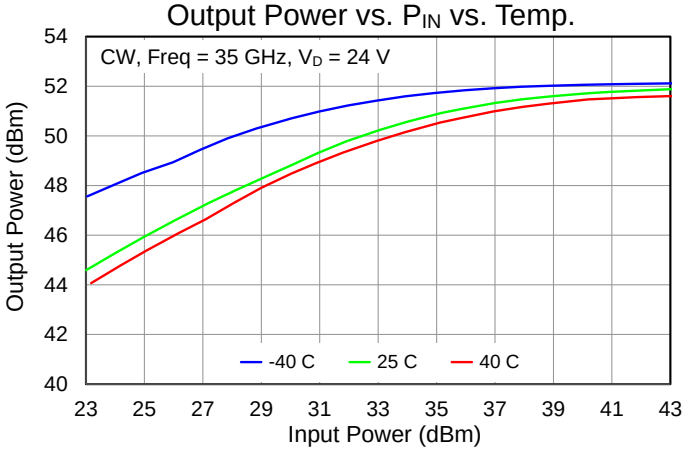




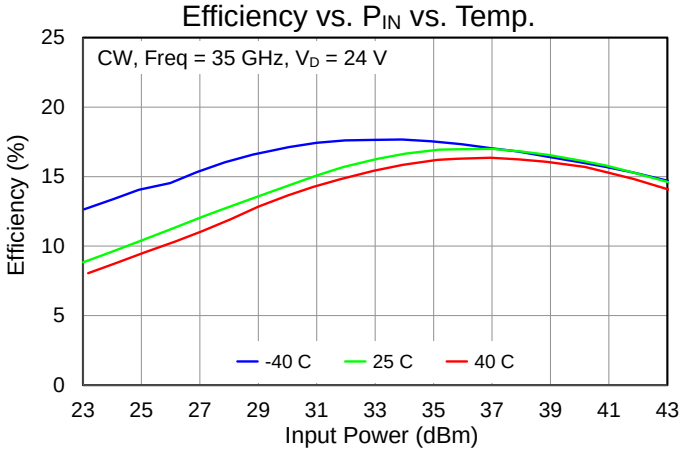
Typical Performance – Large Signal Drive Up (CW)

Conditions unless otherwise specified: V_D = 24 V, T_{CLAMP} = 25 °C

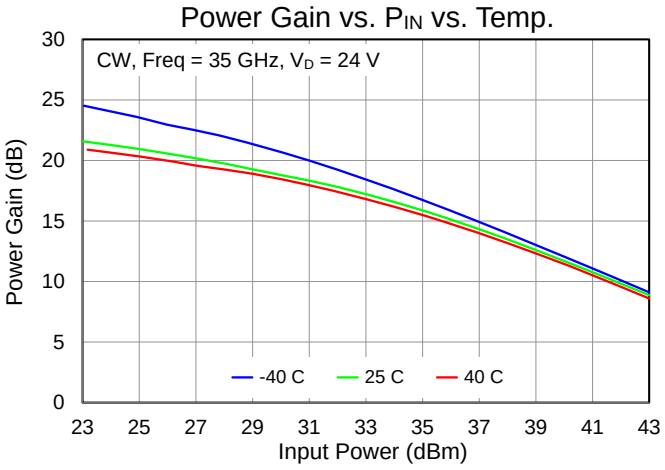
Output Power vs. P_{IN} vs. Temp.



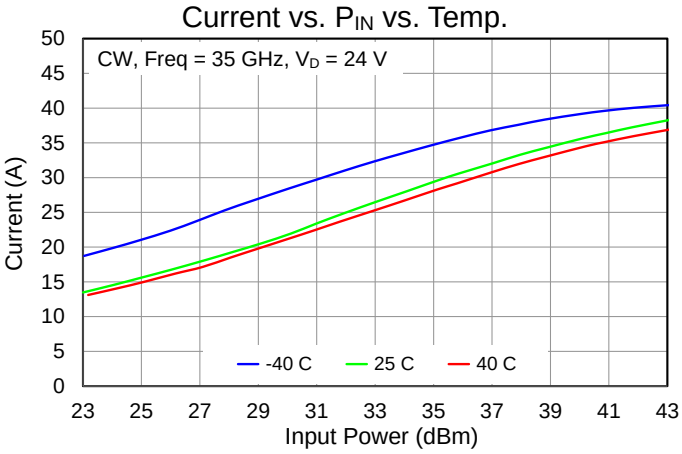
Efficiency vs. P_{IN} vs. Temp.



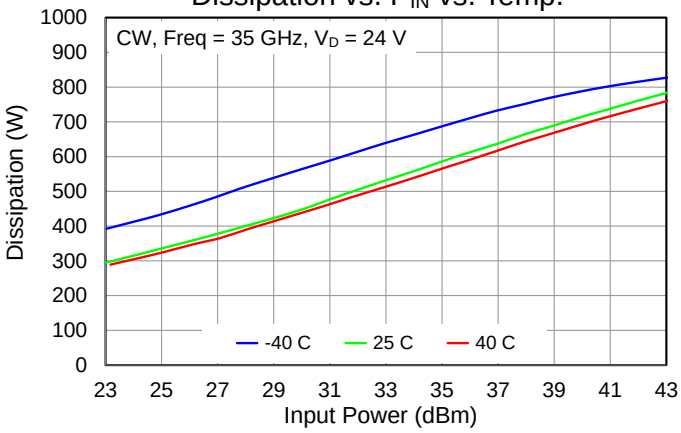
Power Gain vs. P_{IN} vs. Temp.



Current vs. P_{IN} vs. Temp.



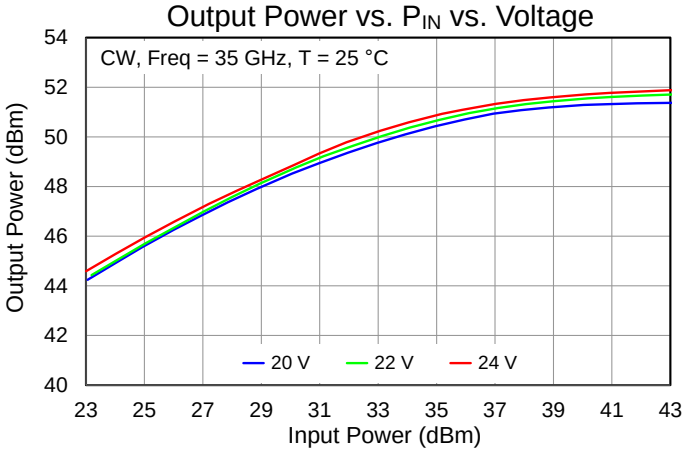
Dissipation vs. P_{IN} vs. Temp.



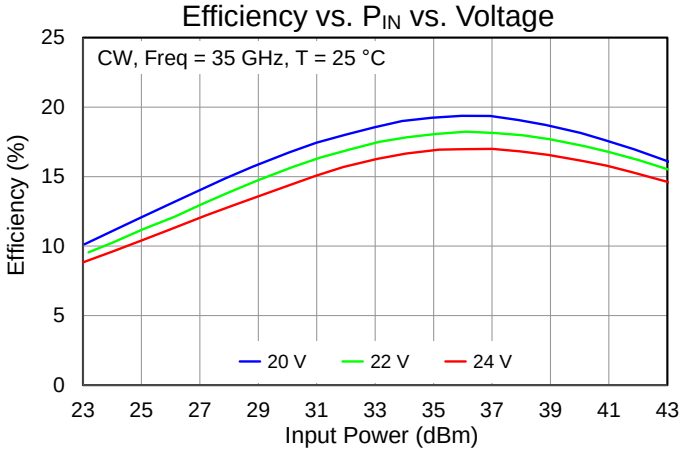
Typical Performance – Large Signal Drive Up (CW)

Conditions unless otherwise specified: V_D = 24 V, T_{CLAMP} = 25 °C

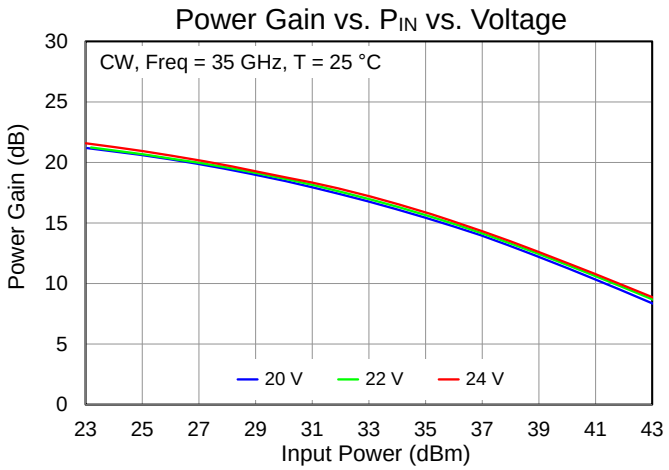
Output Power vs. P_{IN} vs. Voltage



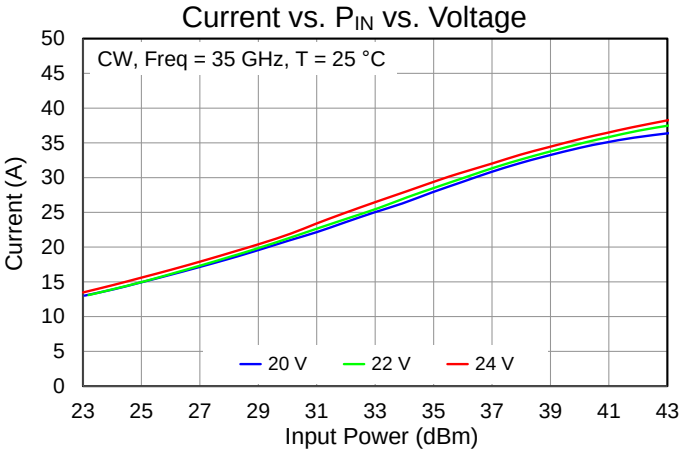
Efficiency vs. P_{IN} vs. Voltage



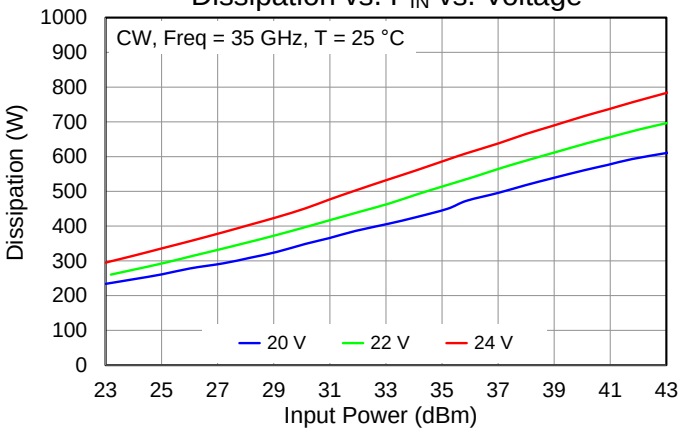
Power Gain vs. P_{IN} vs. Voltage



Current vs. P_{IN} vs. Voltage

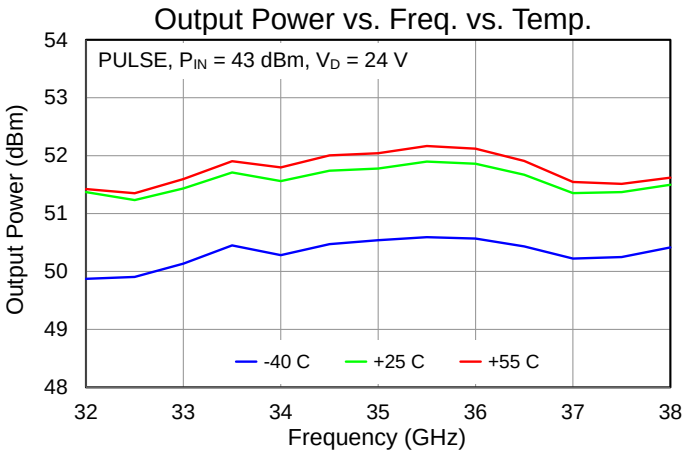


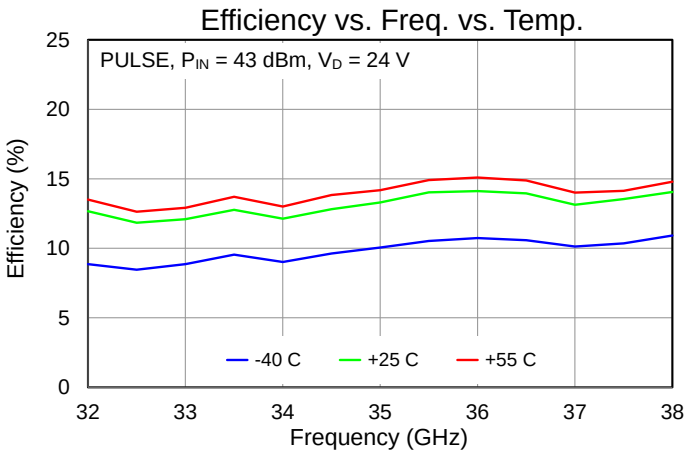
Dissipation vs. P_{IN} vs. Voltage

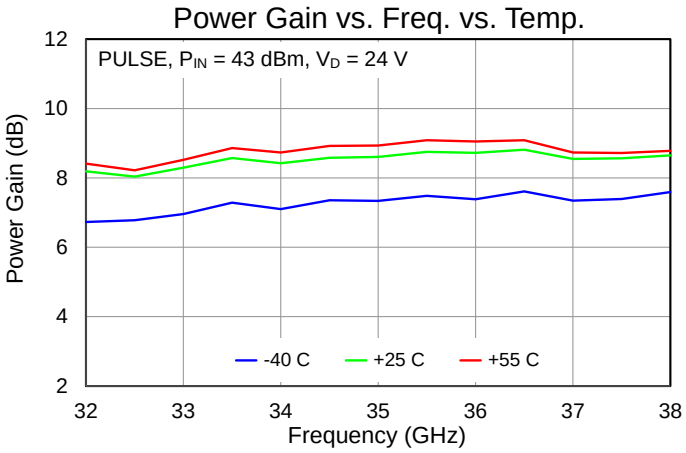


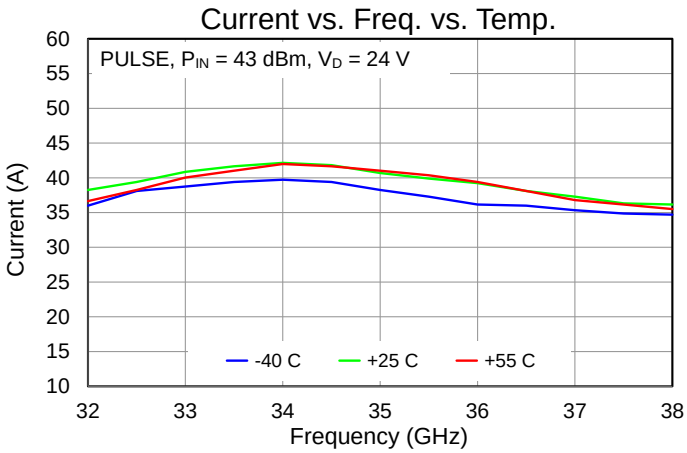
Typical Performance – Large Signal (Pulsed)

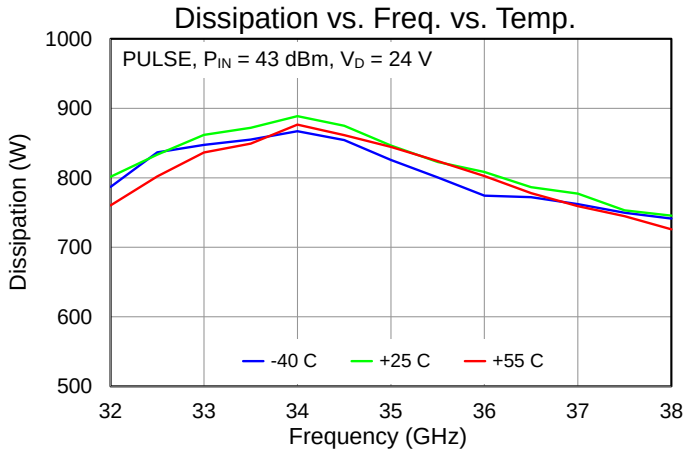
Conditions unless otherwise specified: V_D = 24 V, P_{IN} = 43 dBm, PW = 9 us, DC = 12%, T_{CLAMP} = 25 °C





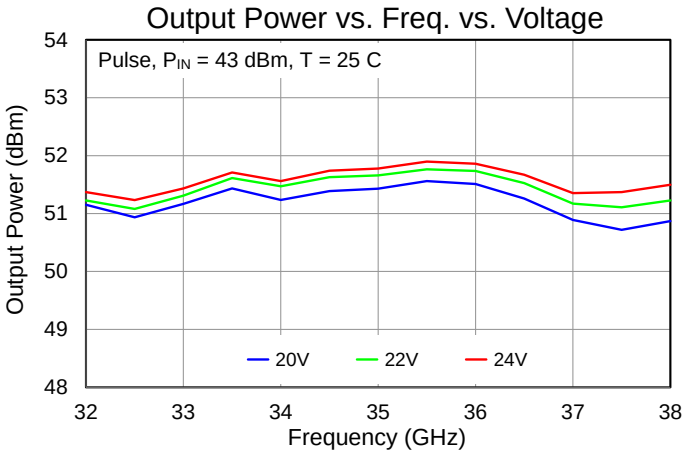


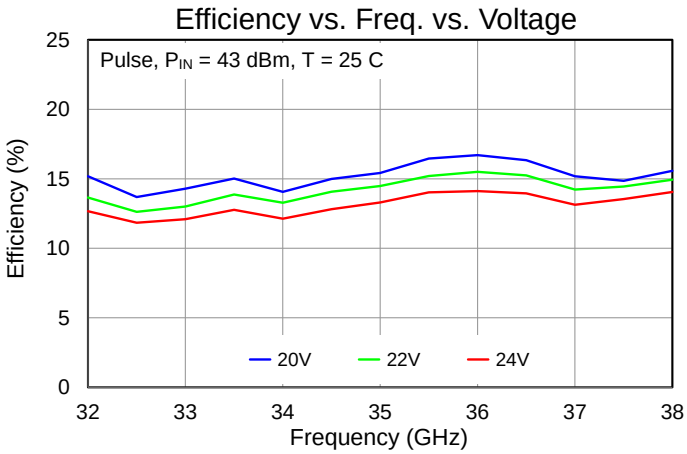


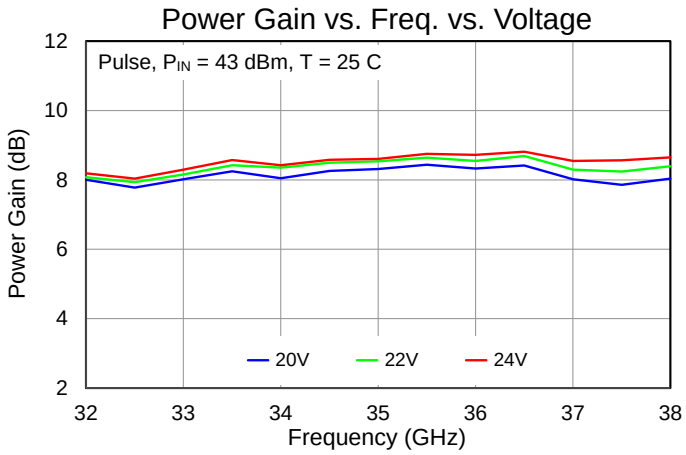


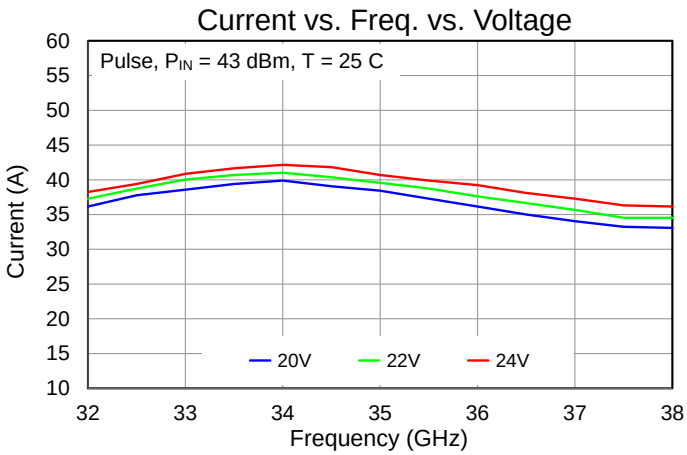
Typical Performance – Large Signal (Pulsed)

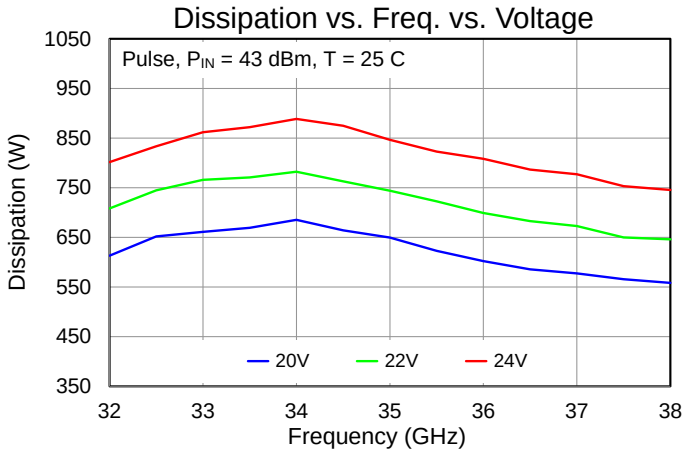
Conditions unless otherwise specified: V_D = 24 V, P_{IN} = 43 dBm, PW = 9 us, DC = 12%, T_{CLAMP} = 25 °C







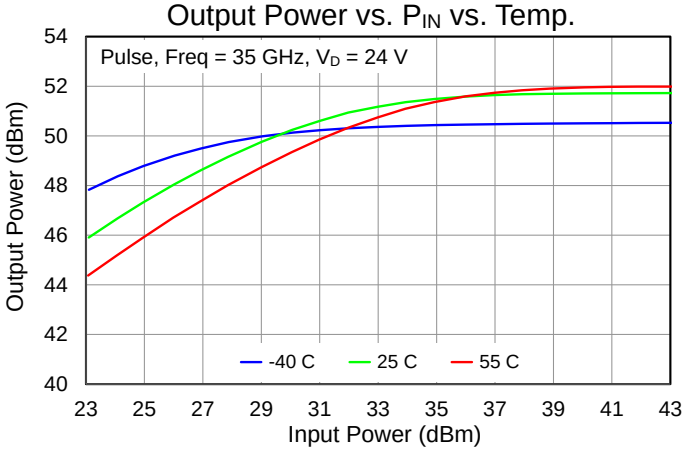




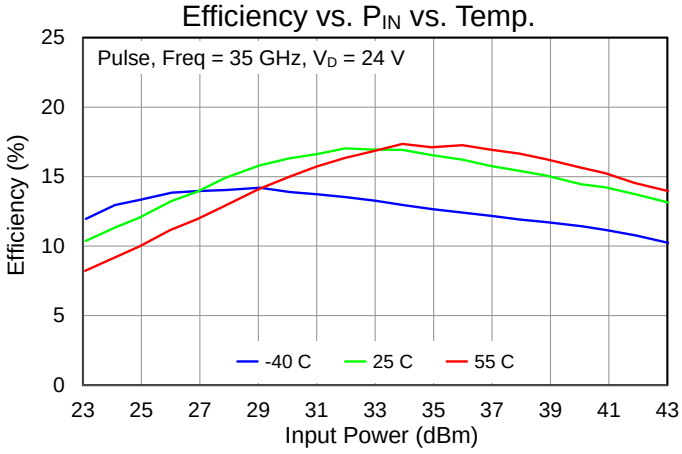
Typical Performance – Large Signal Drive Up (Pulsed)

Conditions unless otherwise specified: V_D = 24 V, P_{IN} = 43 dBm, PW = 9 us, DC = 12%, T_{CLAMP} = 25 °C

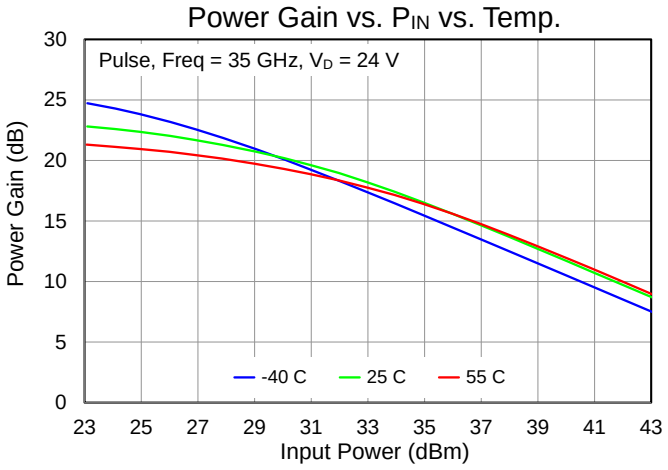
Output Power vs. P_{IN} vs. Temp.



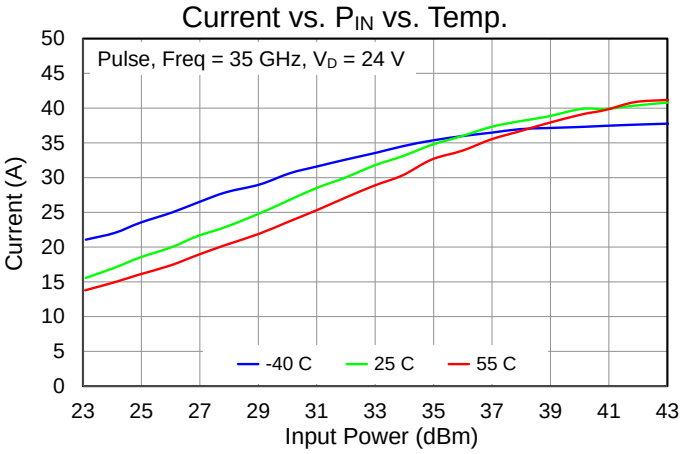
Efficiency vs. P_{IN} vs. Temp.



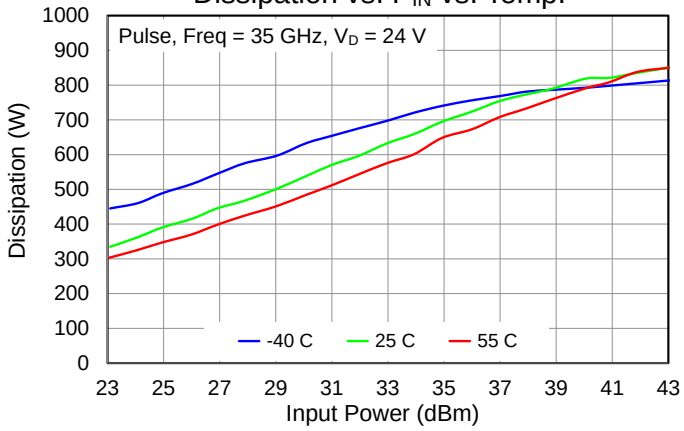
Power Gain vs. P_{IN} vs. Temp.



Current vs. P_{IN} vs. Temp.



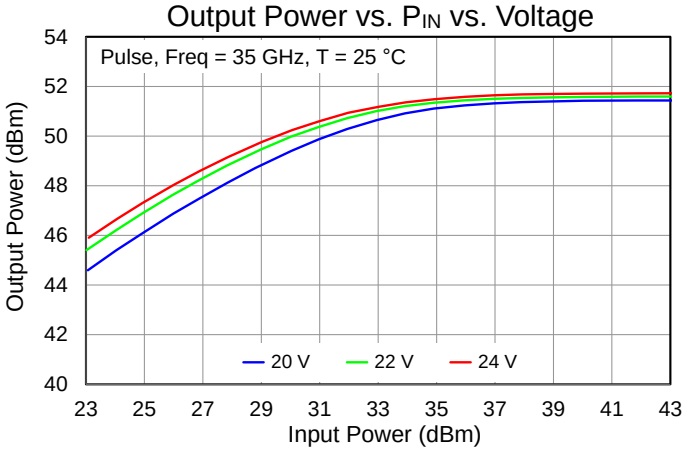
Dissipation vs. P_{IN} vs. Temp.



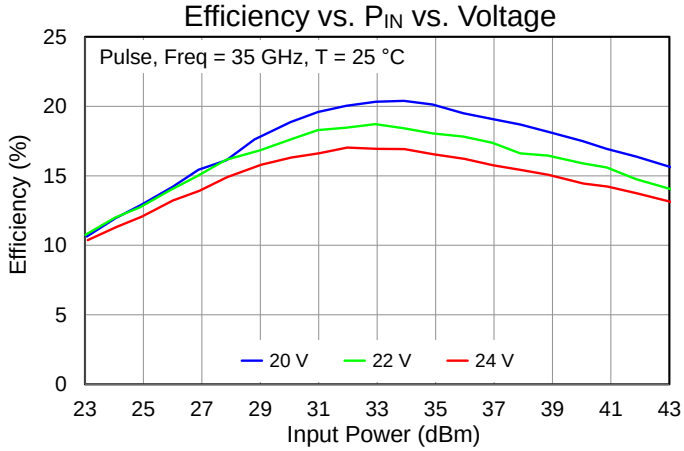
Typical Performance – Large Signal Drive Up (Pulsed)

Conditions unless otherwise specified: V_D = 24 V, P_{IN} = 43 dBm, PW = 9 us, DC = 12%, T_{CLAMP} = 25 °C

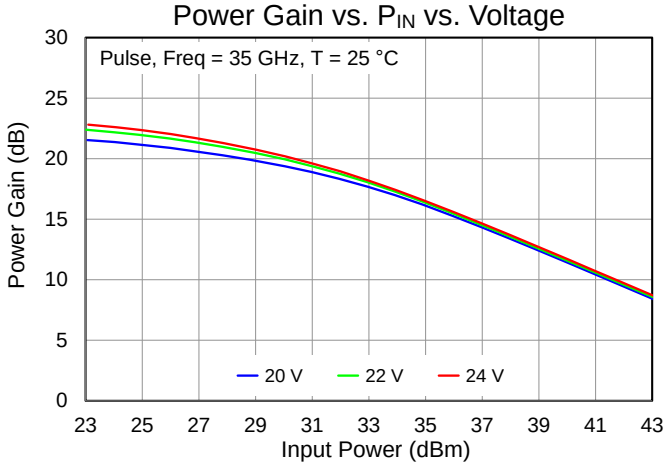
Output Power vs. P_{IN} vs. Voltage



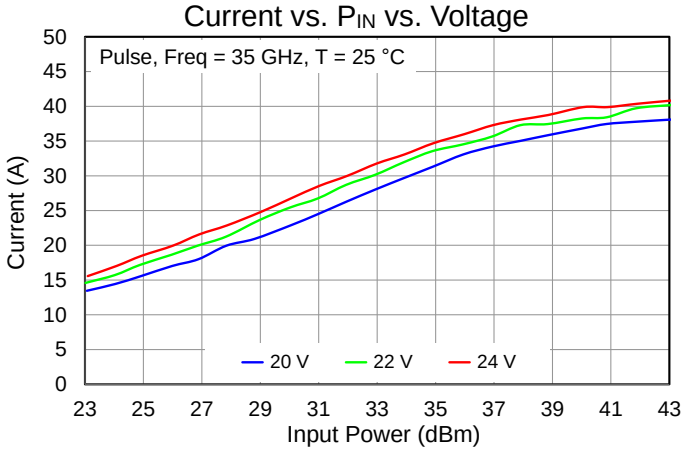
Efficiency vs. P_{IN} vs. Voltage



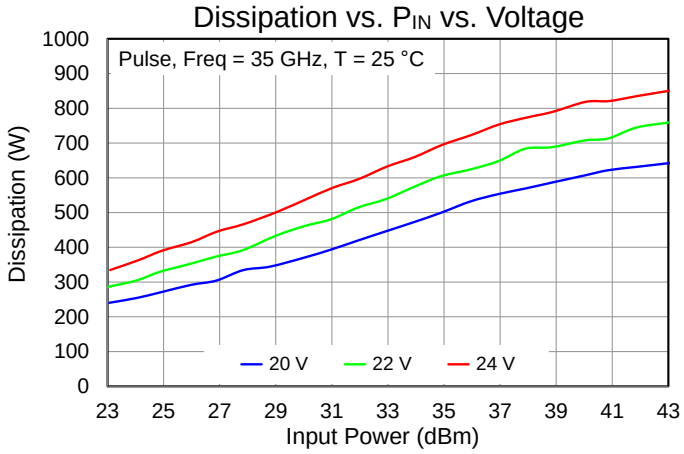
Power Gain vs. P_{IN} vs. Voltage



Current vs. P_{IN} vs. Voltage

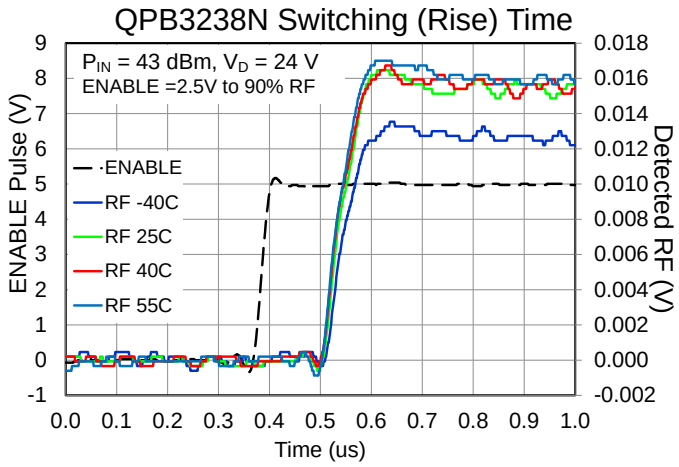


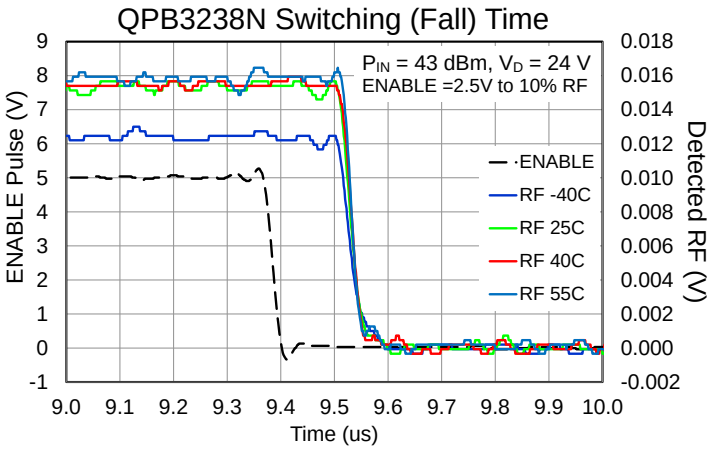
Dissipation vs. P_{IN} vs. Voltage



Typical Performance – Signal Switching (Pulsed)

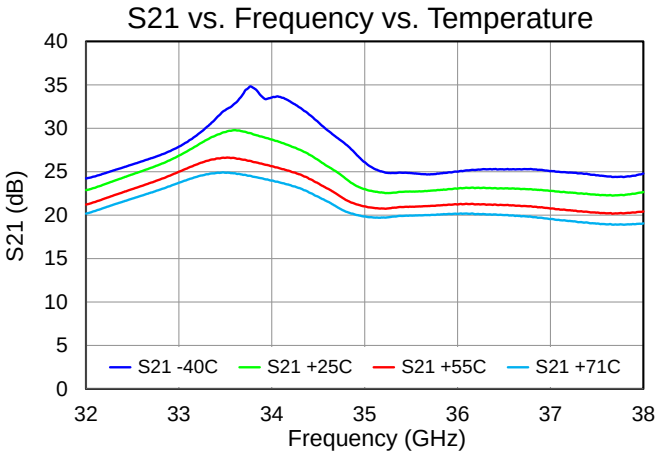
Conditions unless otherwise specified: V_D = 24 V, P_{IN} = 43 dBm, PW = 9 us, DC = 12%, T_{CLAMP} = 25 °C

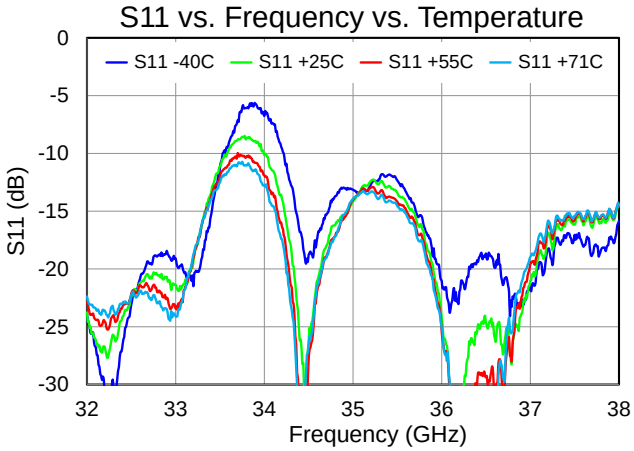


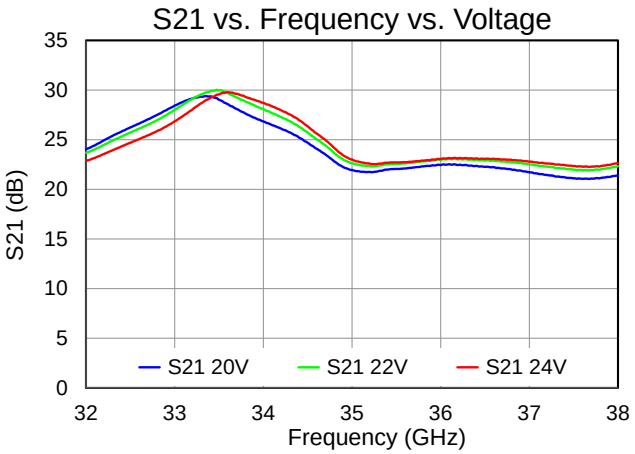


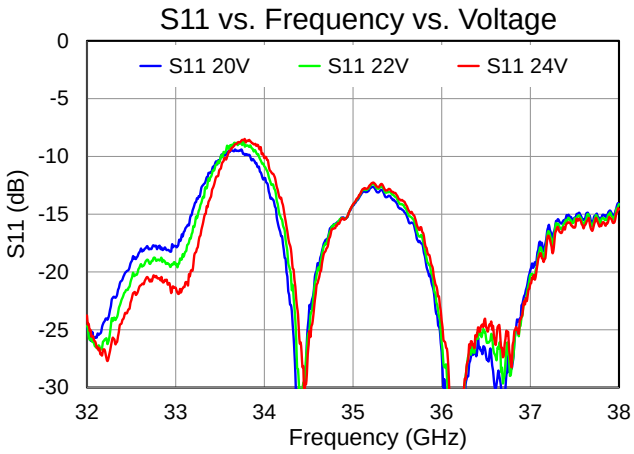
Typical Performance – Small Signal

Conditions unless otherwise specified: V_D = 24 V, I_{DQ} = 7.2 A, T_{CLAMP} = 25 °C

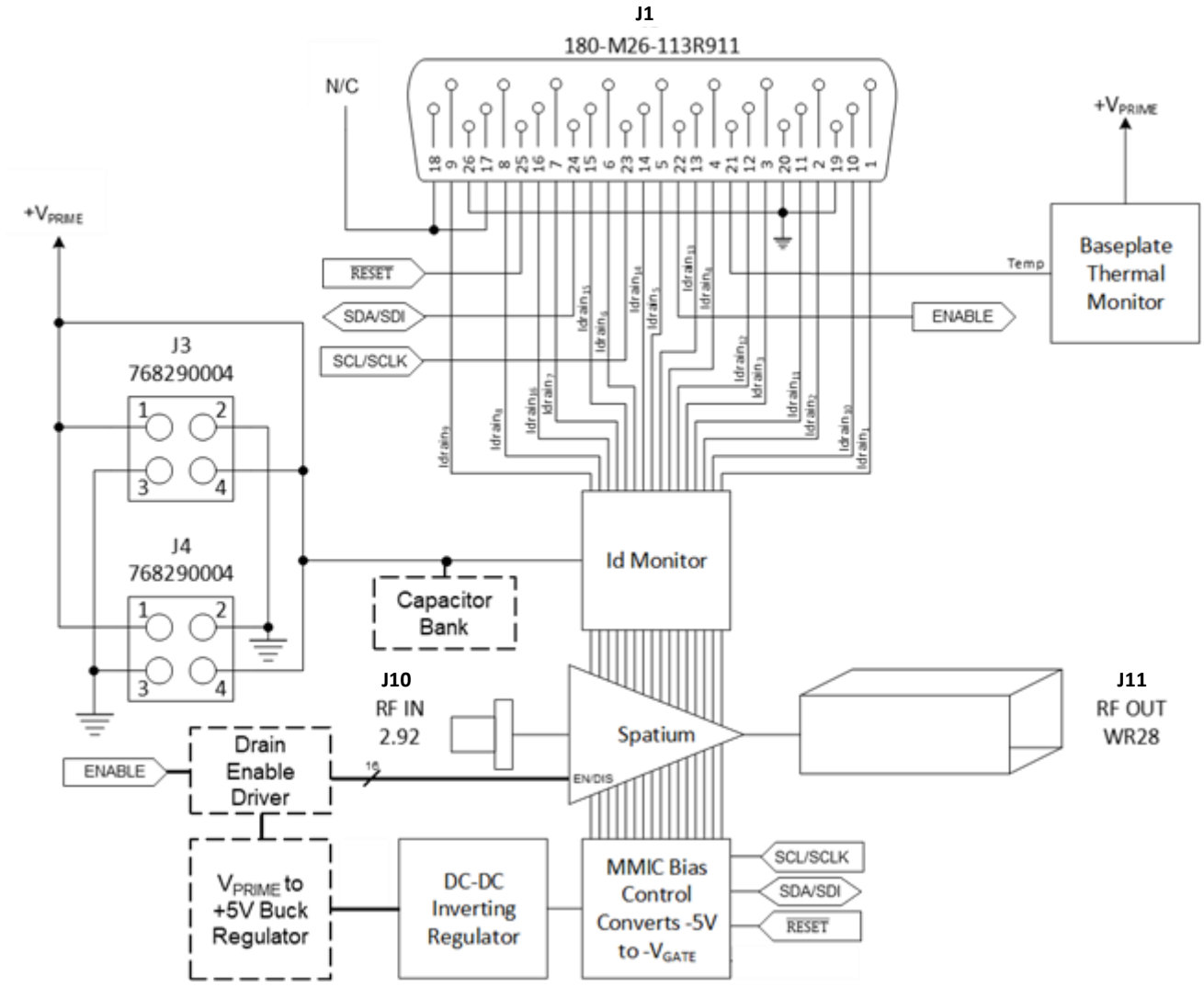








Block Diagram and Description



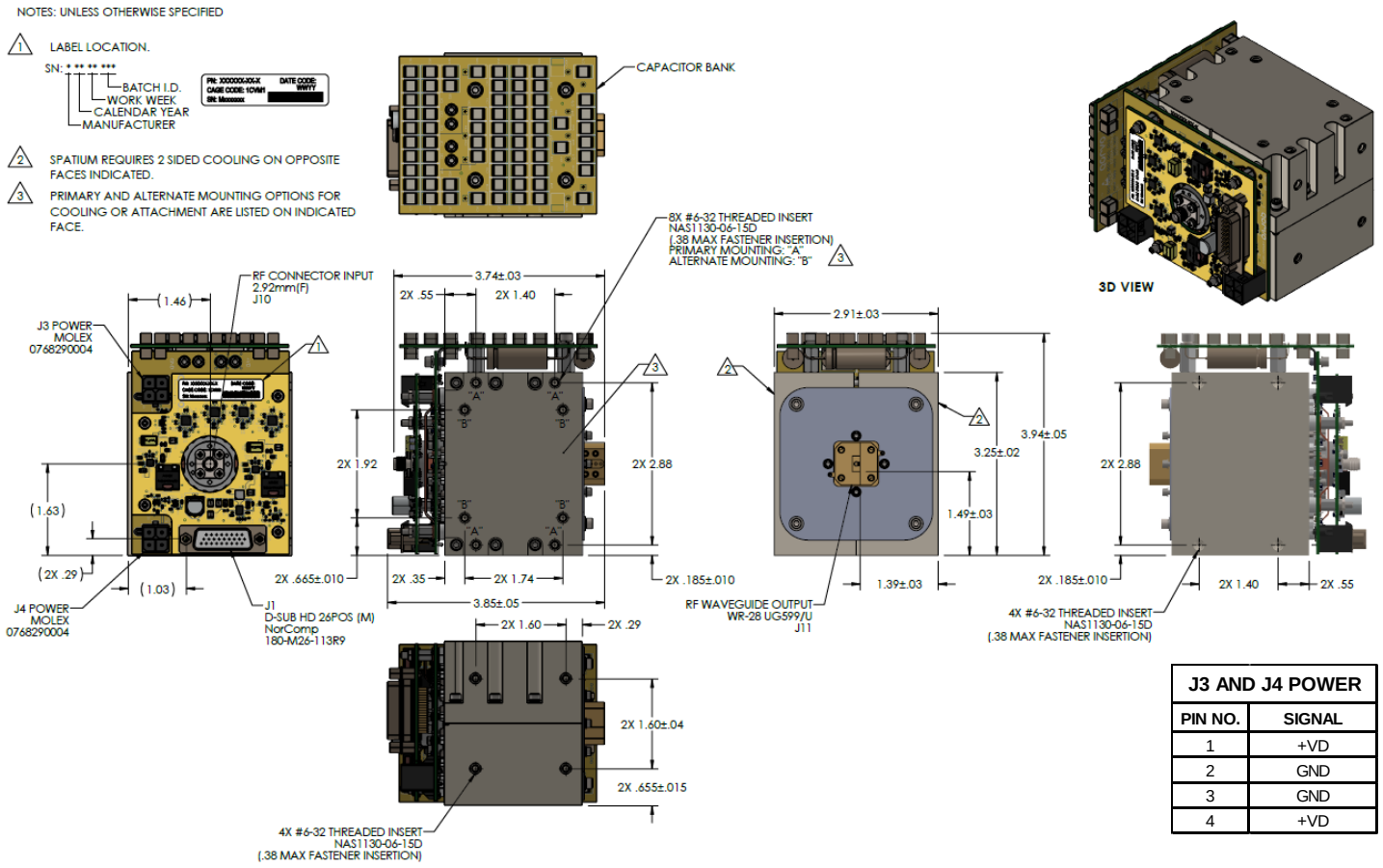
Pin No.	Label	Description
RF In	J10	2.92mm (F) Coaxial RF Input, DC Grounded.
RF Out	J11	WR28 UG599/U Waveguide High Power RF Output
Auxiliary	J1	D-SUB HD 26POS (M), NORCOMP, 180-M26-113R9. Mates with 180-026-273L000
Power	J3, J4	MOLEX, 768290004, Mates with Molex 1716920104

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 diagnostics / status of amplifier, 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. [1]
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 factory use only).
24	SDA	I2C bus used to program amplifier (For factory use only).
25	RESET	I2C bus used to program amplifier (For factory use only).
26	GND	Logic / signal ground.

1 Connects to Texas Instruments LMT87 temperature sensor output. For relation between output voltage and temperature, please see the LMT87 datasheet.

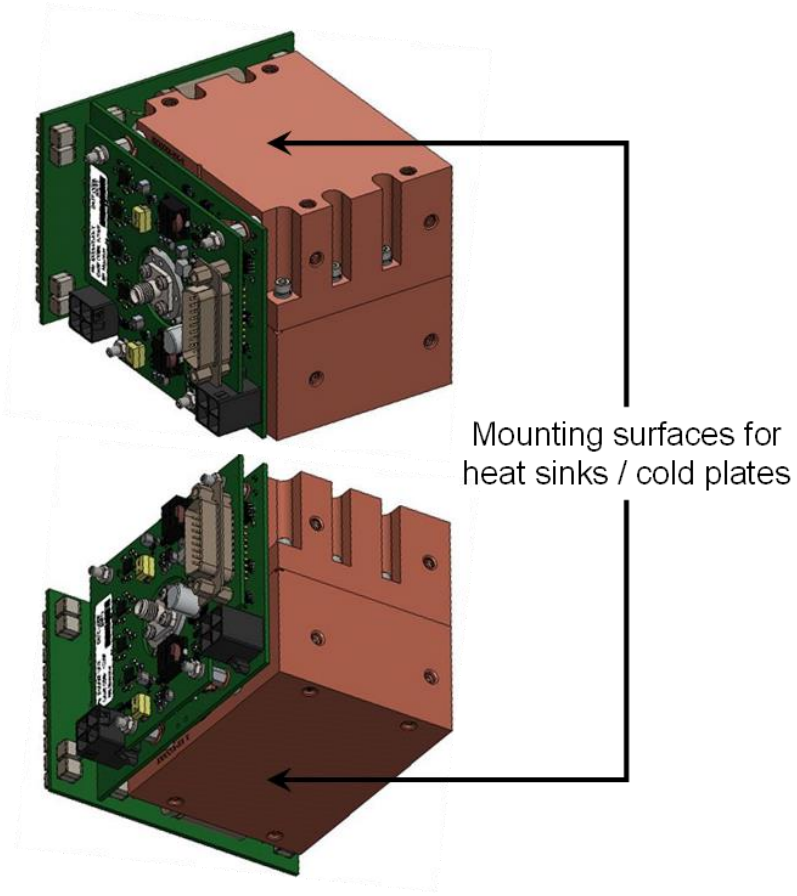
Mechanical Information – Outline Drawing (Spatium™ Unit with Bias Card)



J3 AND J4 POWER	
PIN NO.	SIGNAL
1	+VD
2	GND
3	GND
4	+VD

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

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