Spatium™ QPB3238N

32 – 38 GHz Ka-Band GaN Amplifier

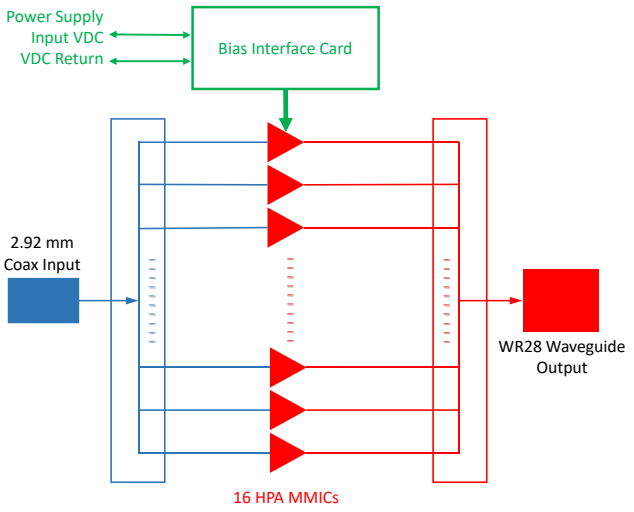
Product Description

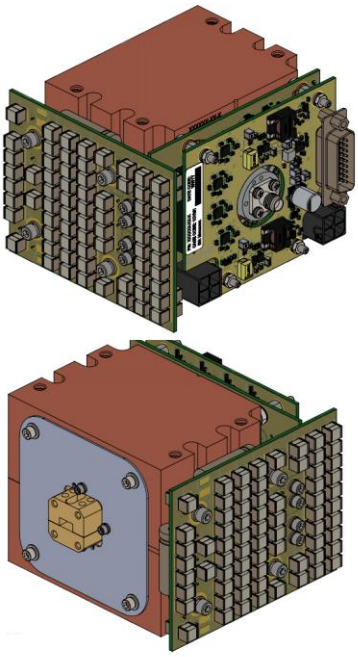
An excellent alternative to traveling wave tube amplifiers, Qorvo's Spatium™ QPB3238N is a solid state, spatial-combining amplifier with an operating range of 32–38 GHz. With its maximum performance in output power, gain, power added efficiency, and power flatness, this Spatium is the ideal building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

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)
- 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	Value / Unit
Prime Power for Spatium SSPA (V_{DC})	26.0 V
Drain Current (I_{D_DRIVE})	49.3 A
Load VSWR	3:1
Input Power (CW, VSWR 1.5:1, 25 °C)	43 dBm
Storage Temperature	–55 to +85 °C
Operating Temperature* (CW)	–40 to +43 °C
Max. Pulse Width (+71 °C*, Duty Cycle 70%)	1 us
Max. Pulse Width (+71 °C*, Duty Cycle 60%)	50 us
Max. Pulse Width (+71 °C*, Duty Cycle 50%)	500 us

* Refers to outside clamp max/min surface temperature. 2-sided cooling required (see page 15).

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	Value / Unit
Drain Voltage (V_D) (operation above 24 V is not recommended)	24 V
Quiescent Drain Current (I_{DQ})	7.2 A
Operating Drain Current (I_D)	39.3 A
Minimum Pulse Width	1.0 us
Minimum Pulse Period	2.0 us

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

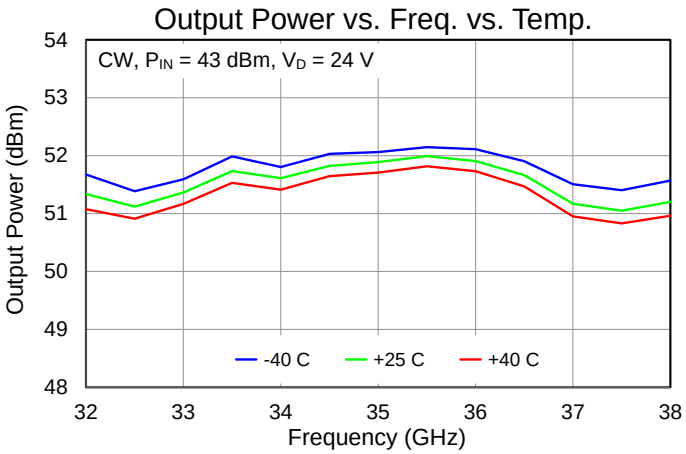
Electrical Specifications

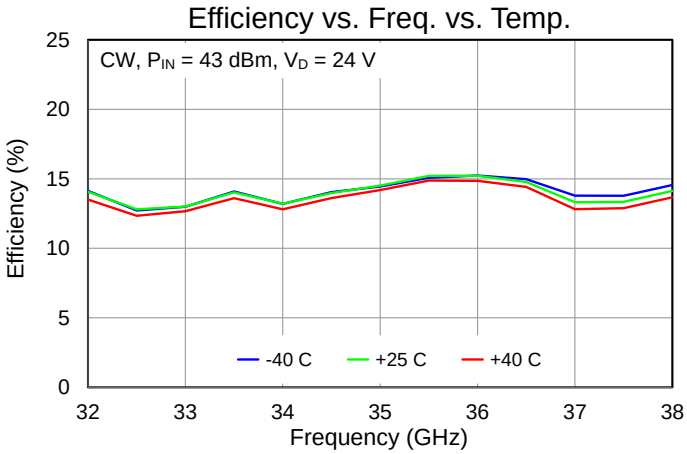
Parameter	Min	Typ	Max	Units
Frequency	32		38	GHz
Output Power (CW, P_{IN} = 43 dBm)		51.5		dBm
Power Gain (CW, P_{IN} = 43 dBm)		8.5		dB
Gain Flatness vs Freq. (CW, P_{IN} = 43 dBm)		± 0.4		dB
Efficiency (CW, P_{IN} = 43 dBm)		14.0		%
Switching Time (PW=500 ns, F=35 GHz, P_{IN}=43 dBm)				
ENABLE > 2.5 V to 90% RF (ON)		189	200	ns
ENABLE < 2.5 V to 10% RF (OFF)		169	200	ns
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

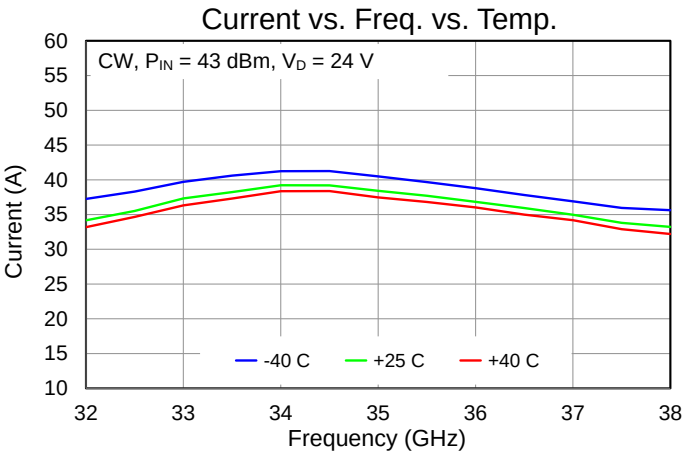
Test conditions unless otherwise noted: V_{DC} = 24 V, I_{DQ} = 7.2 A, CW, T = 25 °C

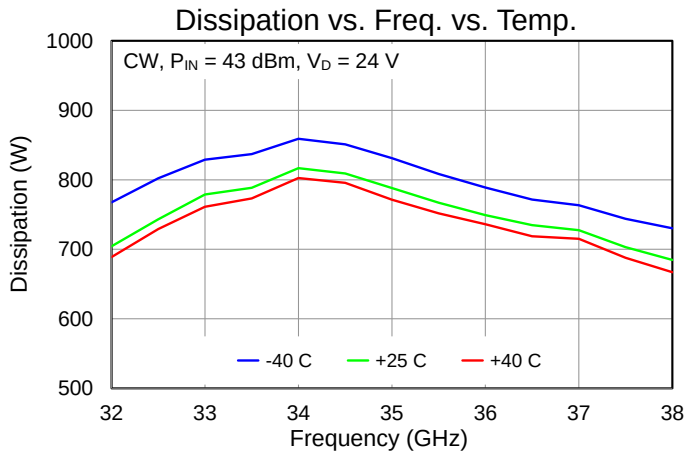
ypical Performance – Large Signal (CW)

Conditions unless otherwise specified: V_D = 24 V, I_{DQ} = 7.2 A, P_{IN} = 43 dBm



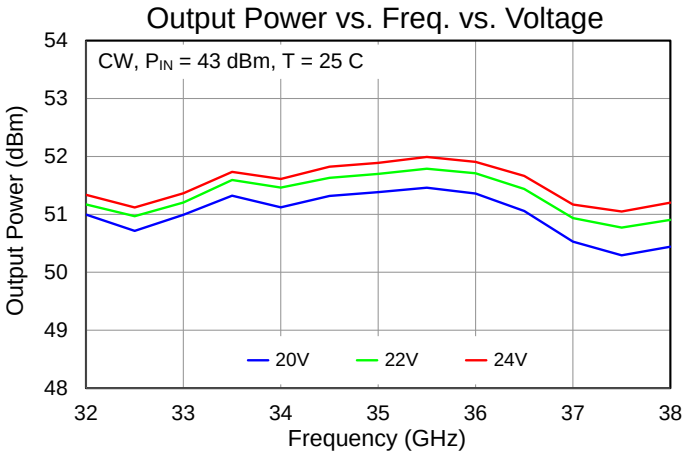


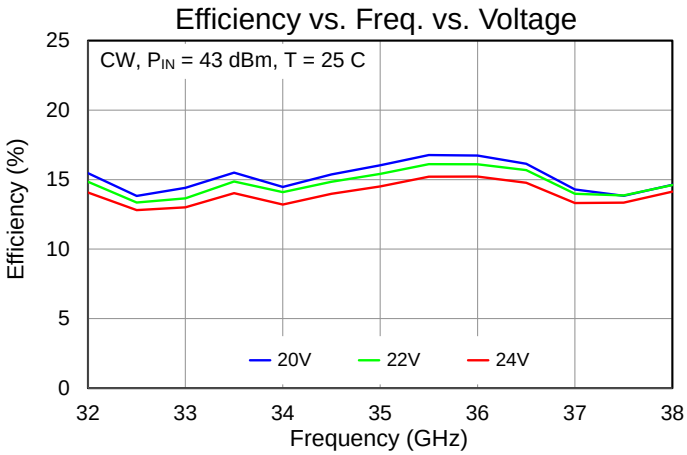


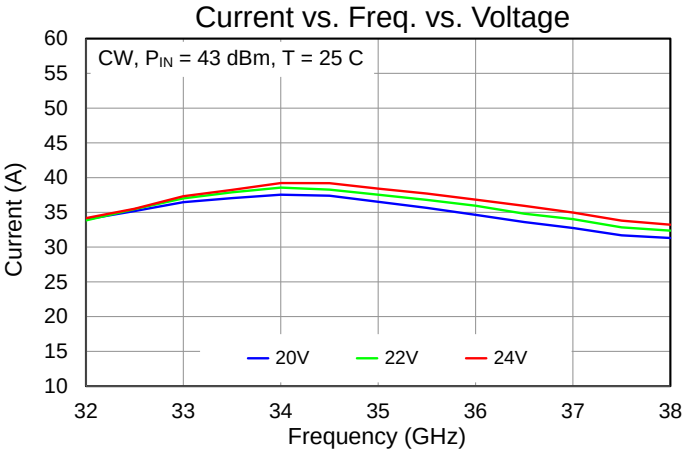


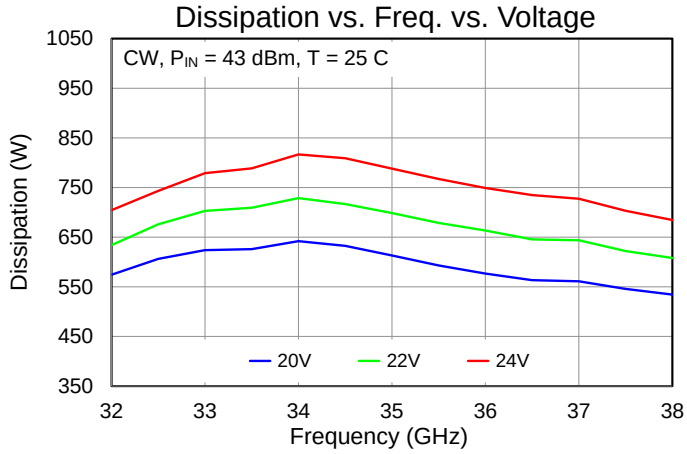
Typical Performance – Large Signal (CW)

Conditions unless otherwise specified: V_D = 24 V, I_{DQ} = 7.2 A, T = 25 °C, P_{IN} = 43 dBm





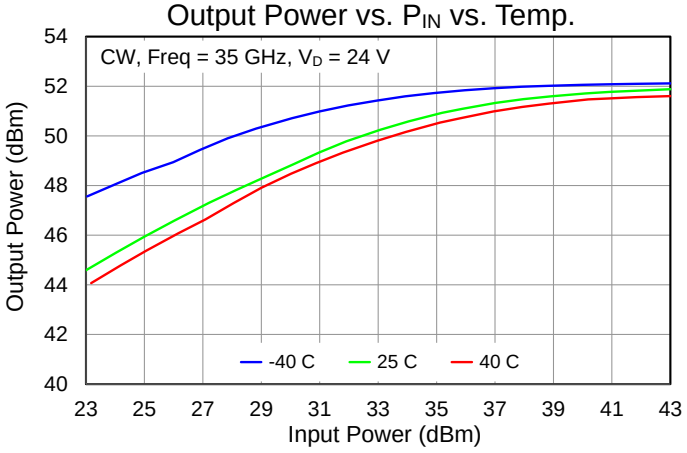




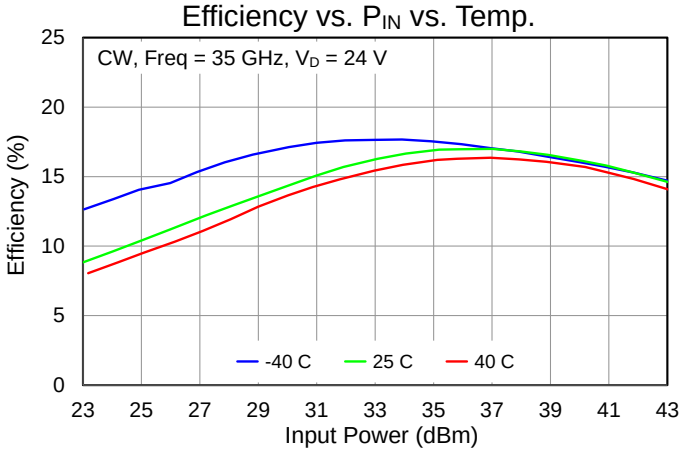
Typical Performance – Large Signal Drive Up (CW)

Conditions unless otherwise specified: V_D = 24 V, I_{DQ} = 7.2 A, CW

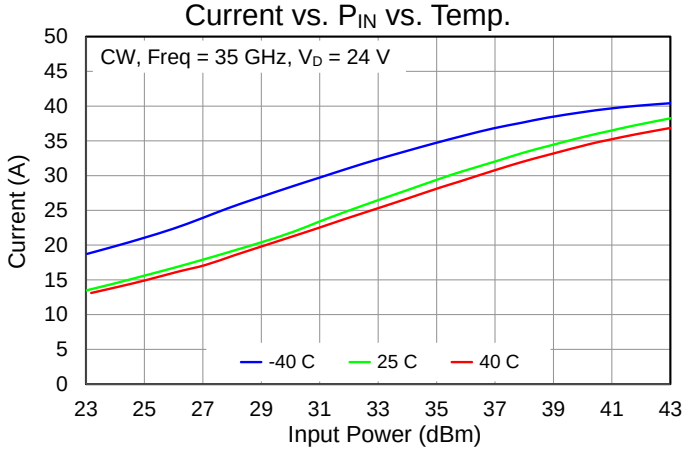
Output Power vs. P_{IN} vs. Temp.



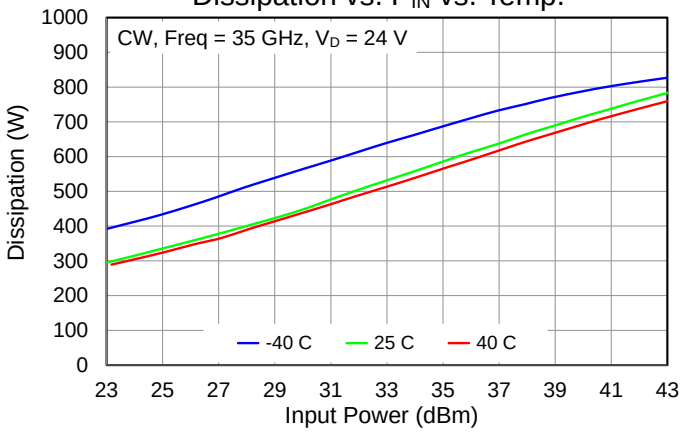
Efficiency vs. P_{IN} vs. Temp.



Current vs. P_{IN} vs. Temp.

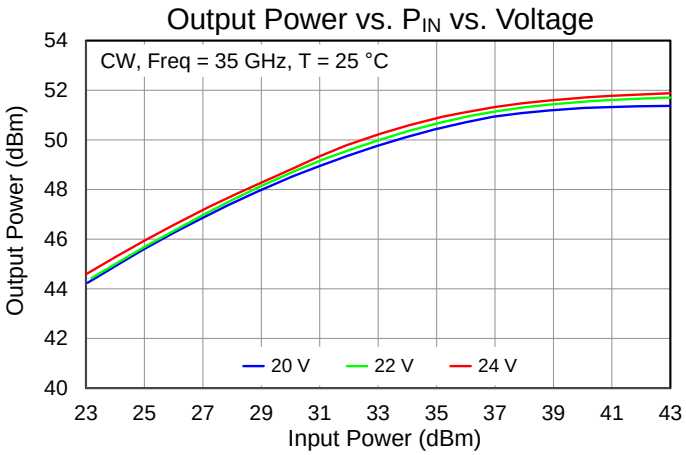


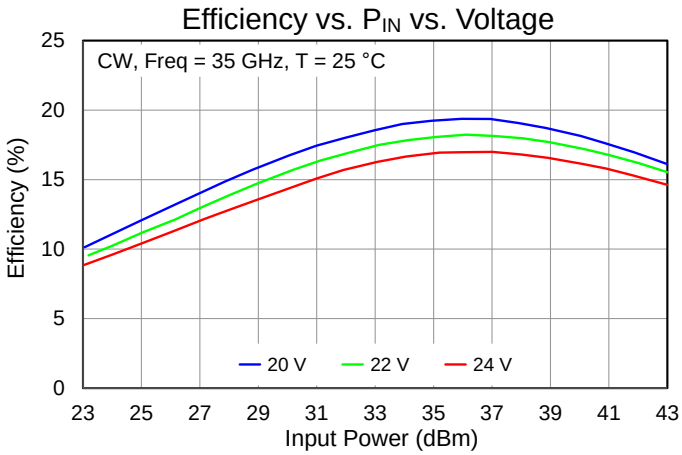
Dissipation vs. P_{IN} vs. Temp.

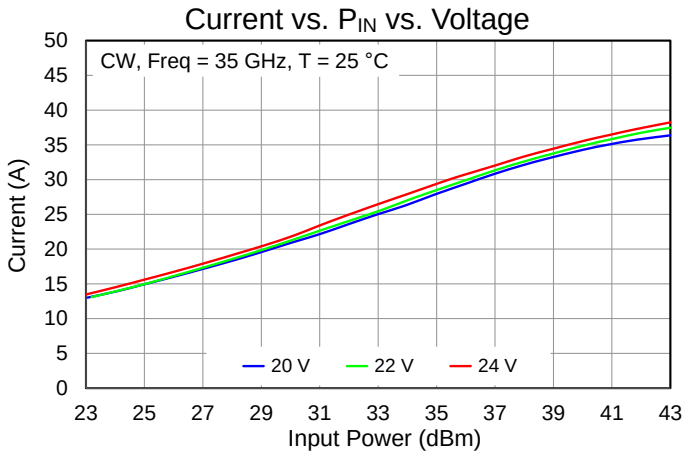


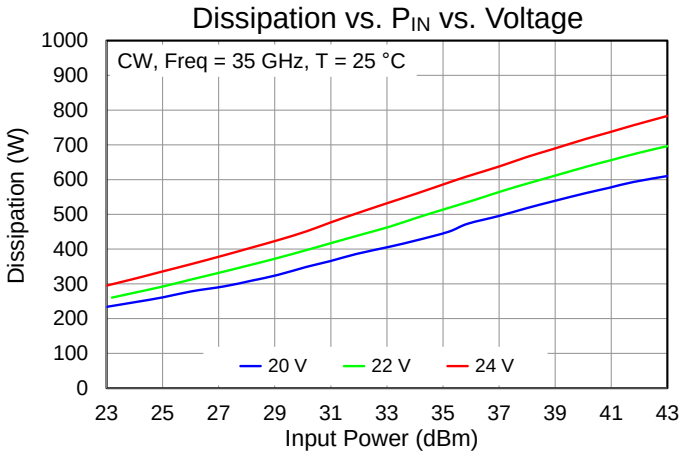
Typical Performance – Large Signal Drive Up (CW)

Conditions unless otherwise specified: V_D = 24 V, I_{DQ} = 7.2 A, CW



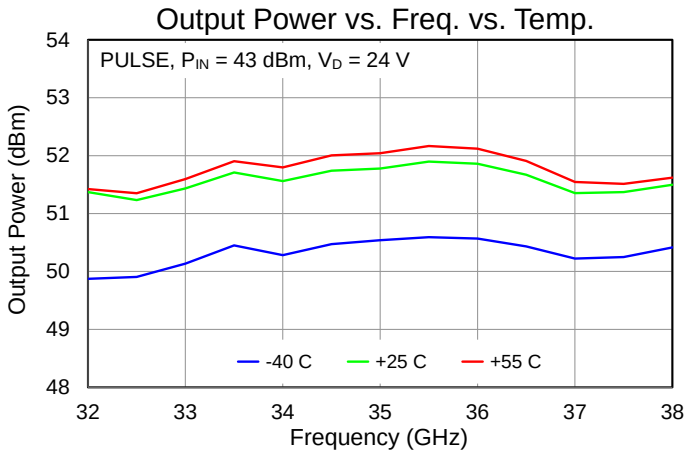


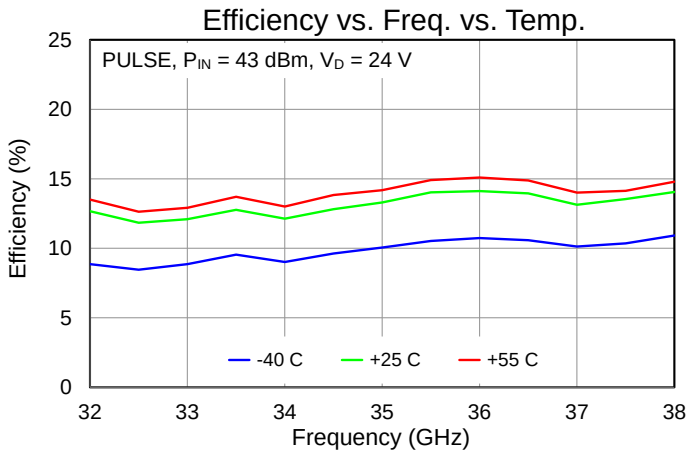


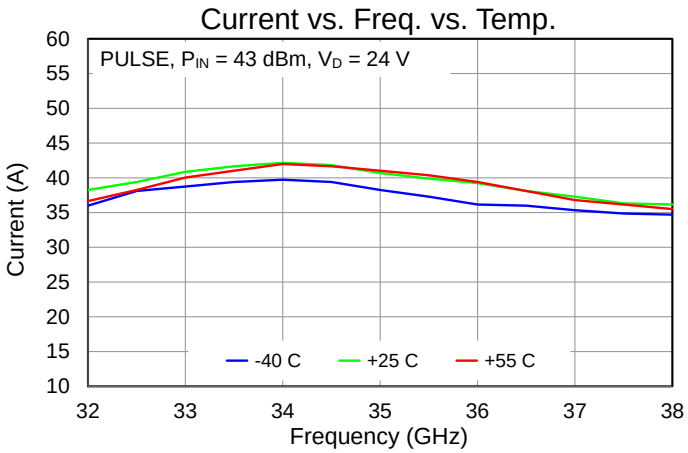


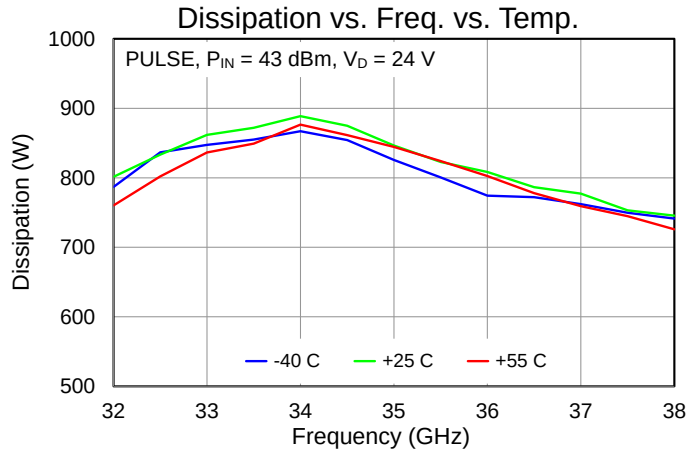
Typical Performance – Large Signal (Pulsed)

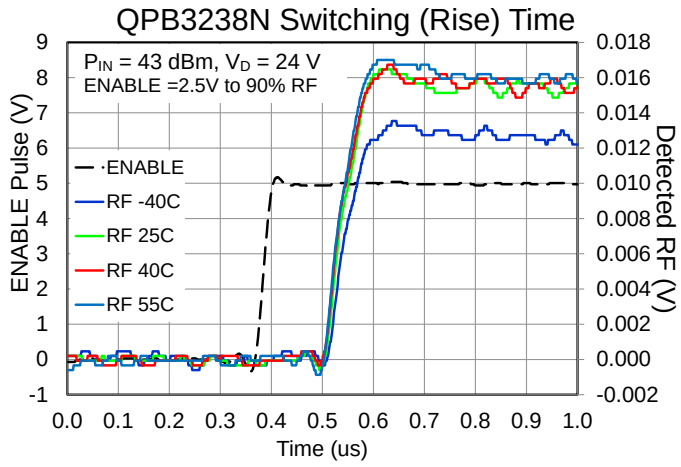
Conditions unless otherwise specified: V_D = 24 V, I_{DQ} = 7.2 A, P_{IN} = 43 dBm, PW = 9 us, DC = 12%

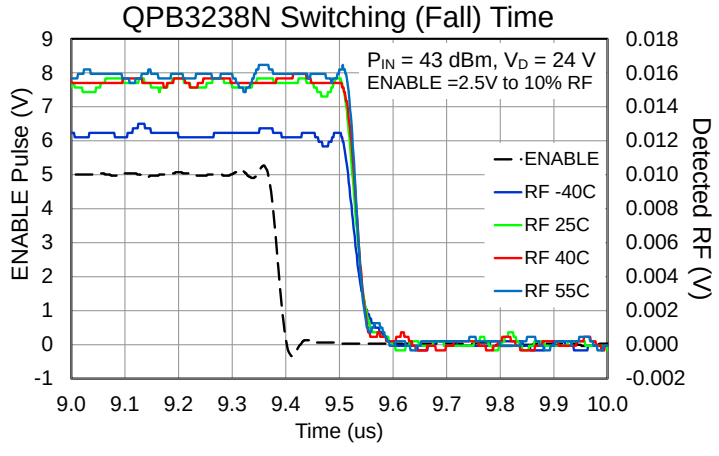






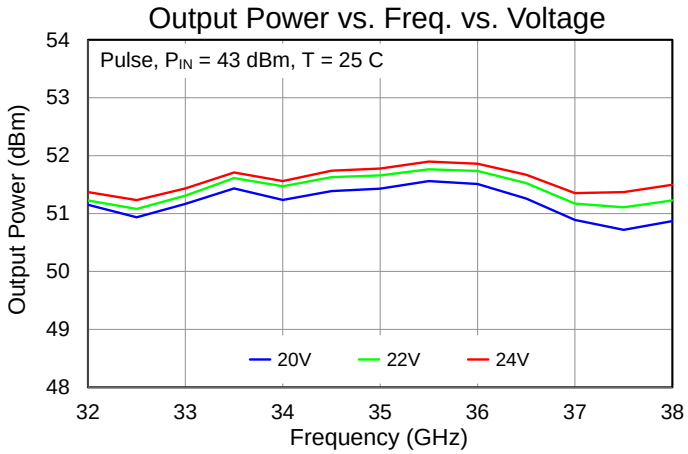


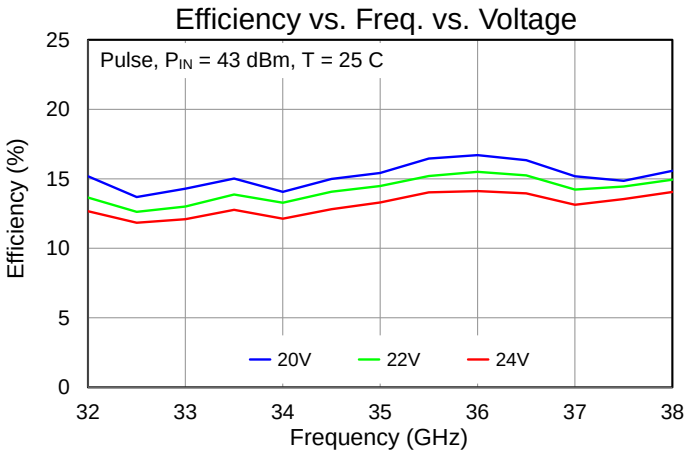


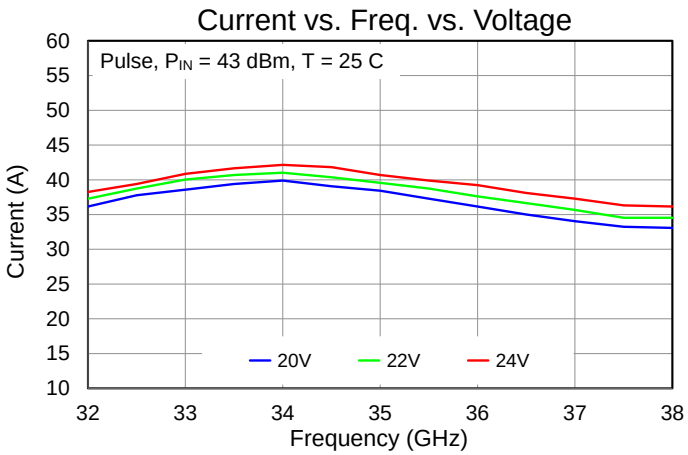


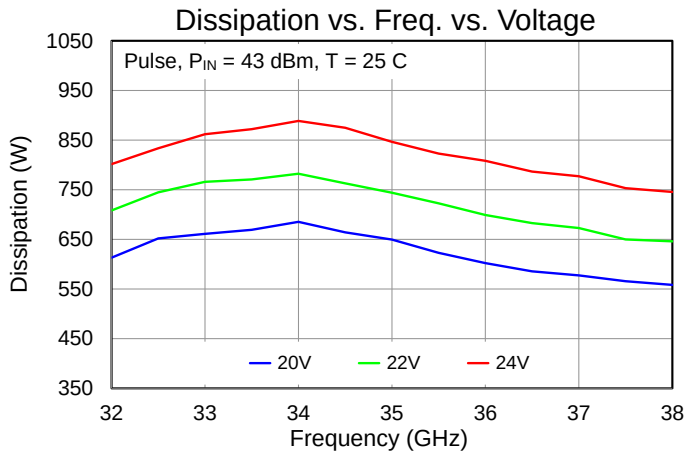
Typical Performance – Large Signal (Pulsed)

Conditions unless otherwise specified: V_D = 24 V, I_{DQ} = 7.2 A, T = 25 °C, P_{IN} = 43 dBm, PW = 9 us, DC = 12%





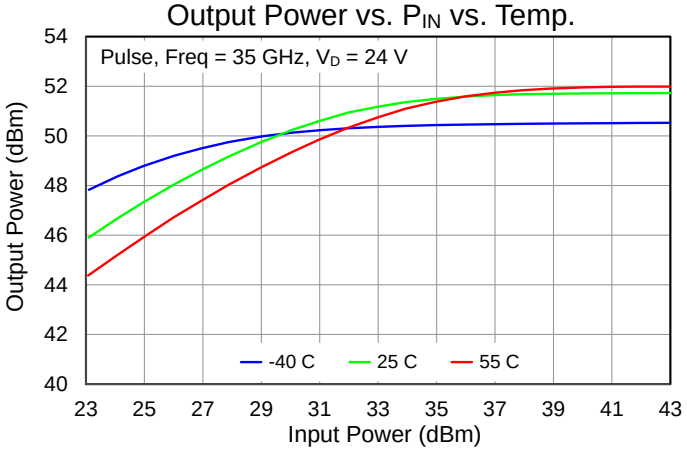




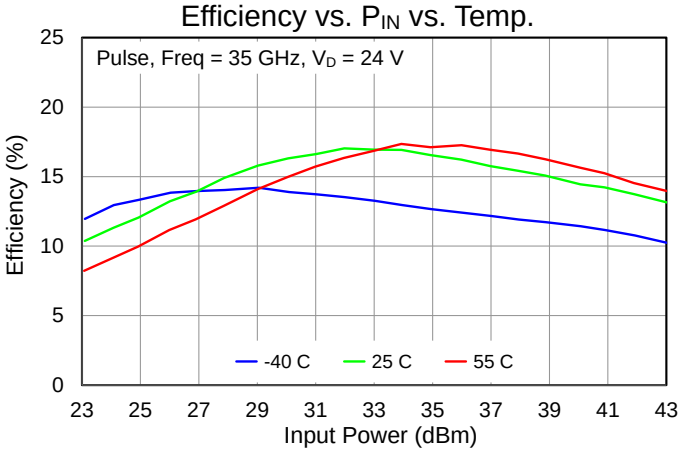
Typical Performance – Large Signal Drive Up (Pulsed)

Conditions unless otherwise specified: V_D = 24 V, I_{DQ} = 7.2 A, T = 25 °C, P_{IN} = 43 dBm, PW = 9 us, DC = 12%

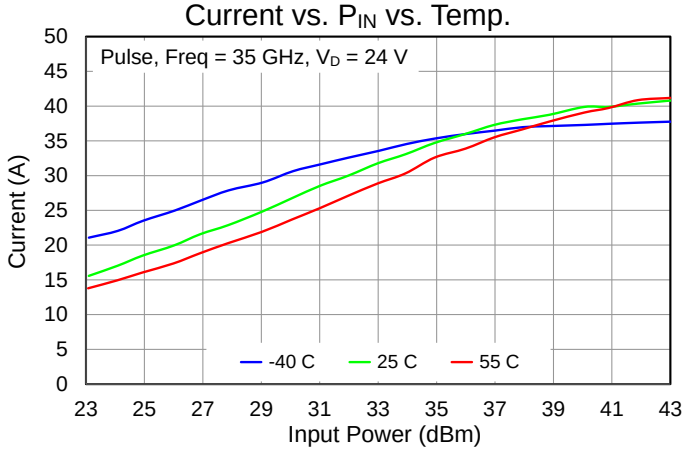
Output Power vs. P_{IN} vs. Temp.



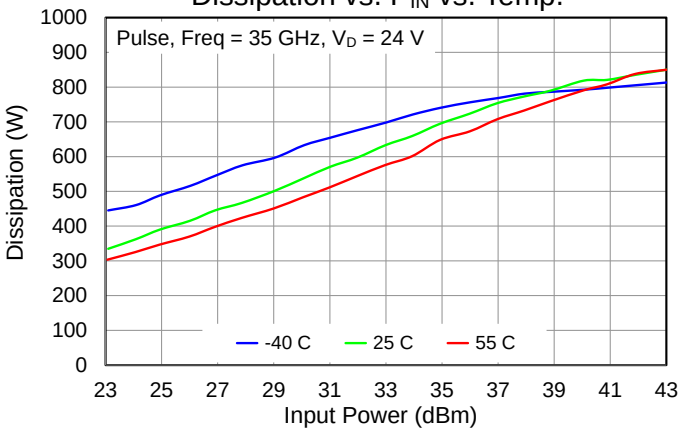
Efficiency vs. P_{IN} vs. Temp.



Current vs. P_{IN} vs. Temp.

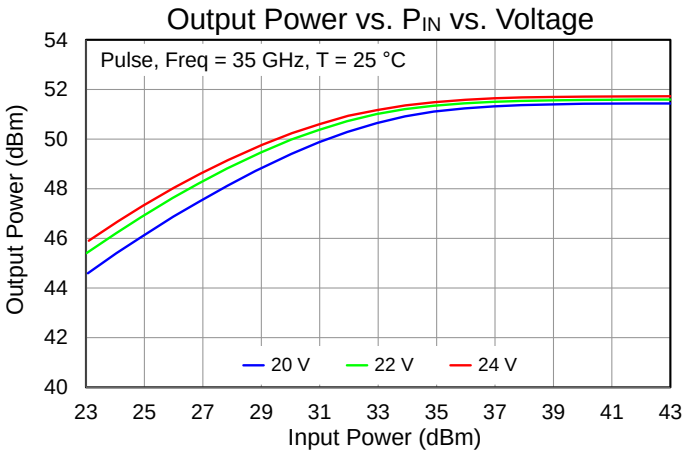


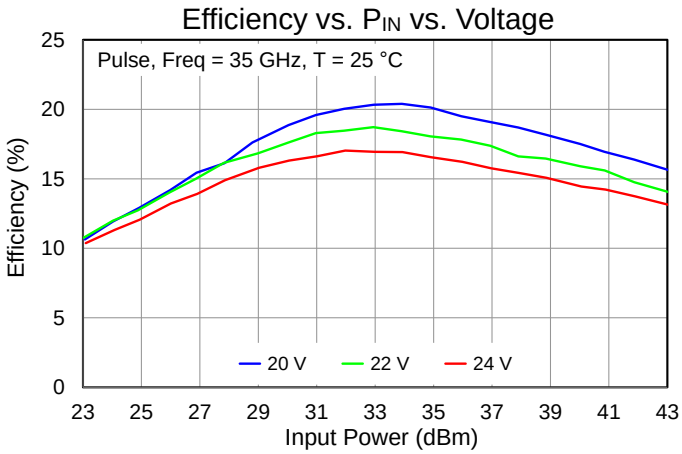
Dissipation vs. P_{IN} vs. Temp.

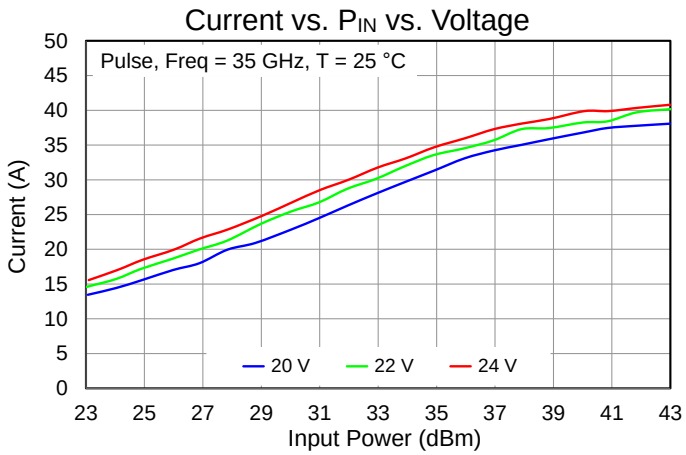


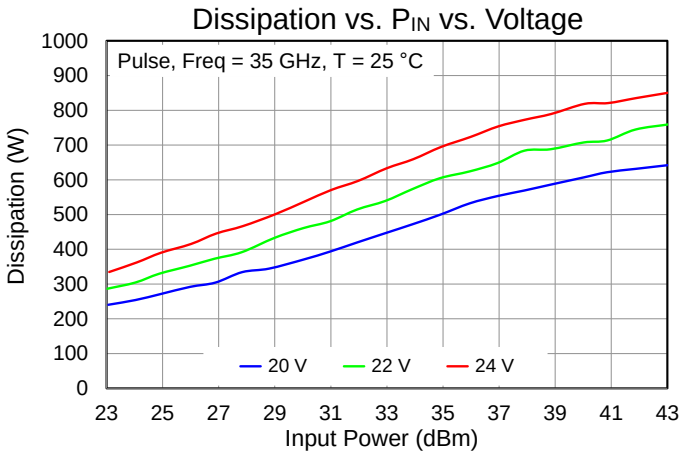
Typical Performance – Large Signal Drive Up (Pulsed)

Conditions unless otherwise specified: V_D = 24 V, I_{DQ} = 7.2 A, T = 25 °C, P_{IN} = 43 dBm, PW = 9 us, DC = 12%



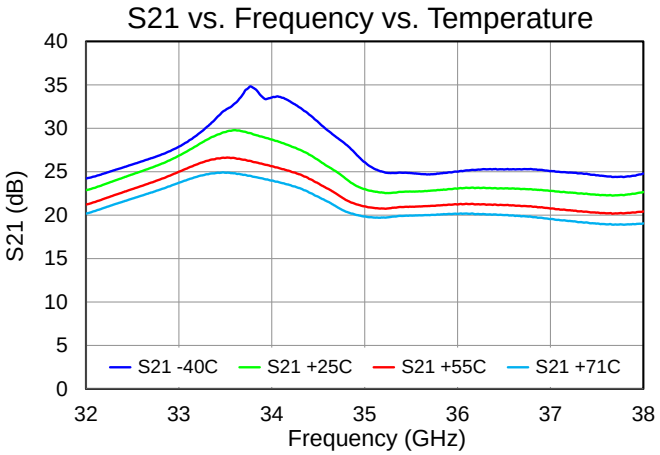


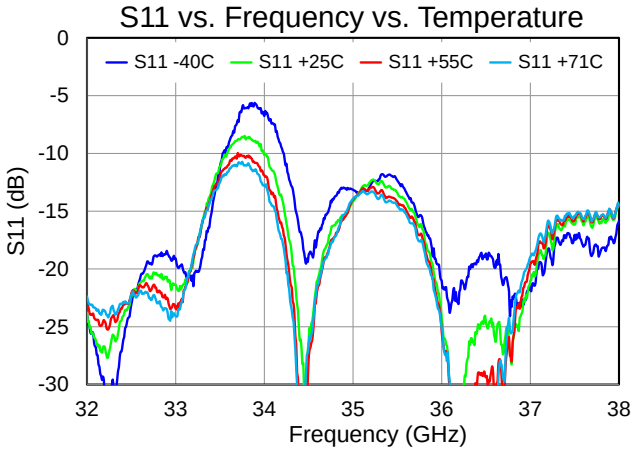


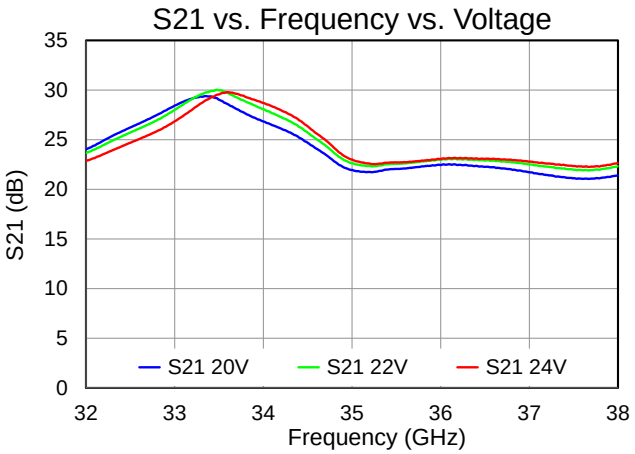


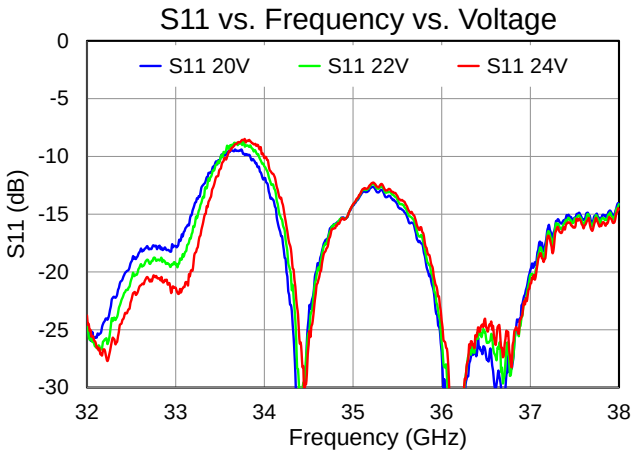
Typical Performance – Small Signal

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

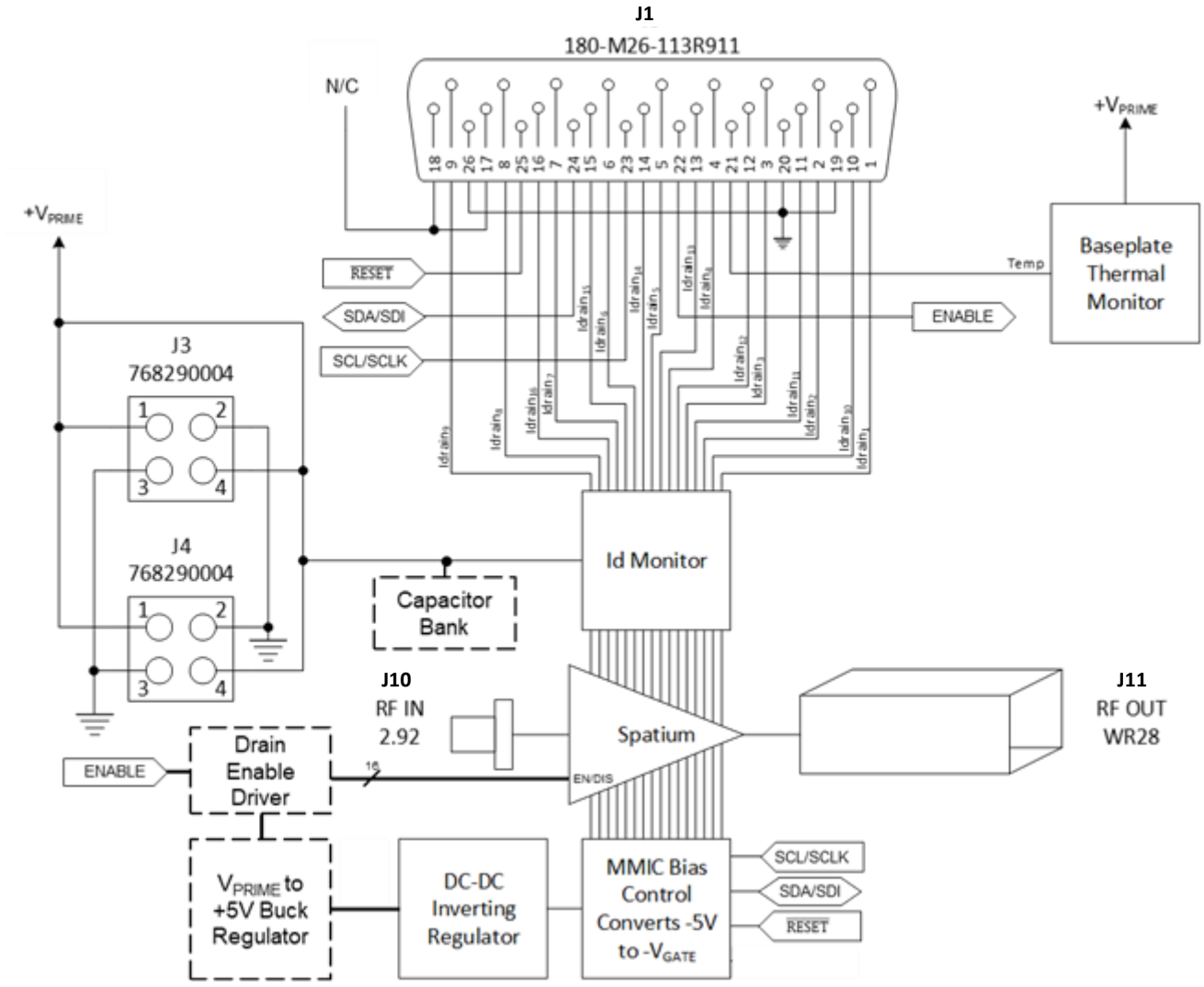






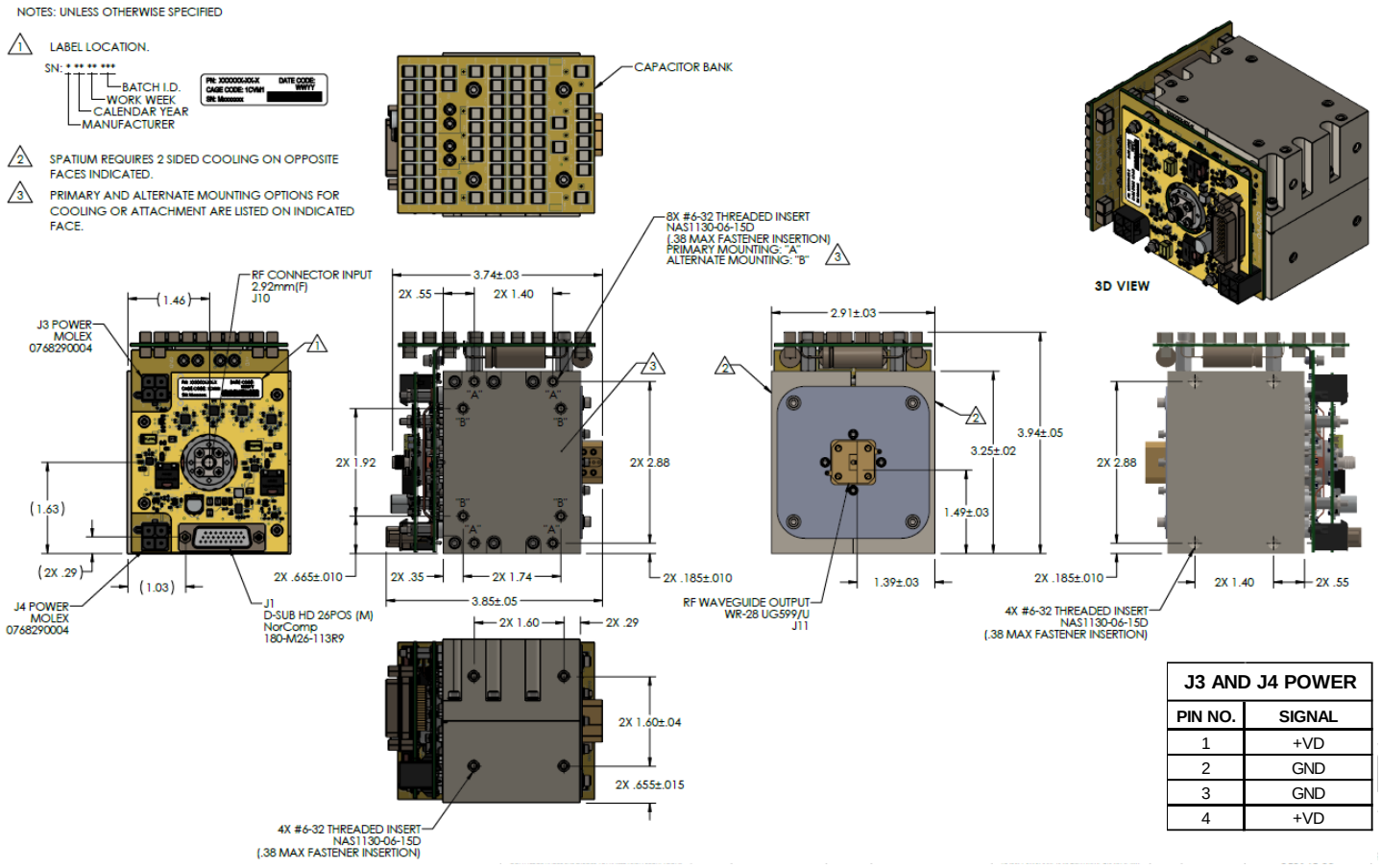


Block Diagram and Description



Pin No.	Label	Description
RF In	J10	2.92mm (F) Coaxial RF Input.
RF Out	J11	WR28 UG599/U Waveguide High Power RF Output
Auxiliary	J1	D-SUB HD 26POS (M), NorComp, 180-M26-113R9
Power	J3, J4	MOLEX, 07682900

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



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

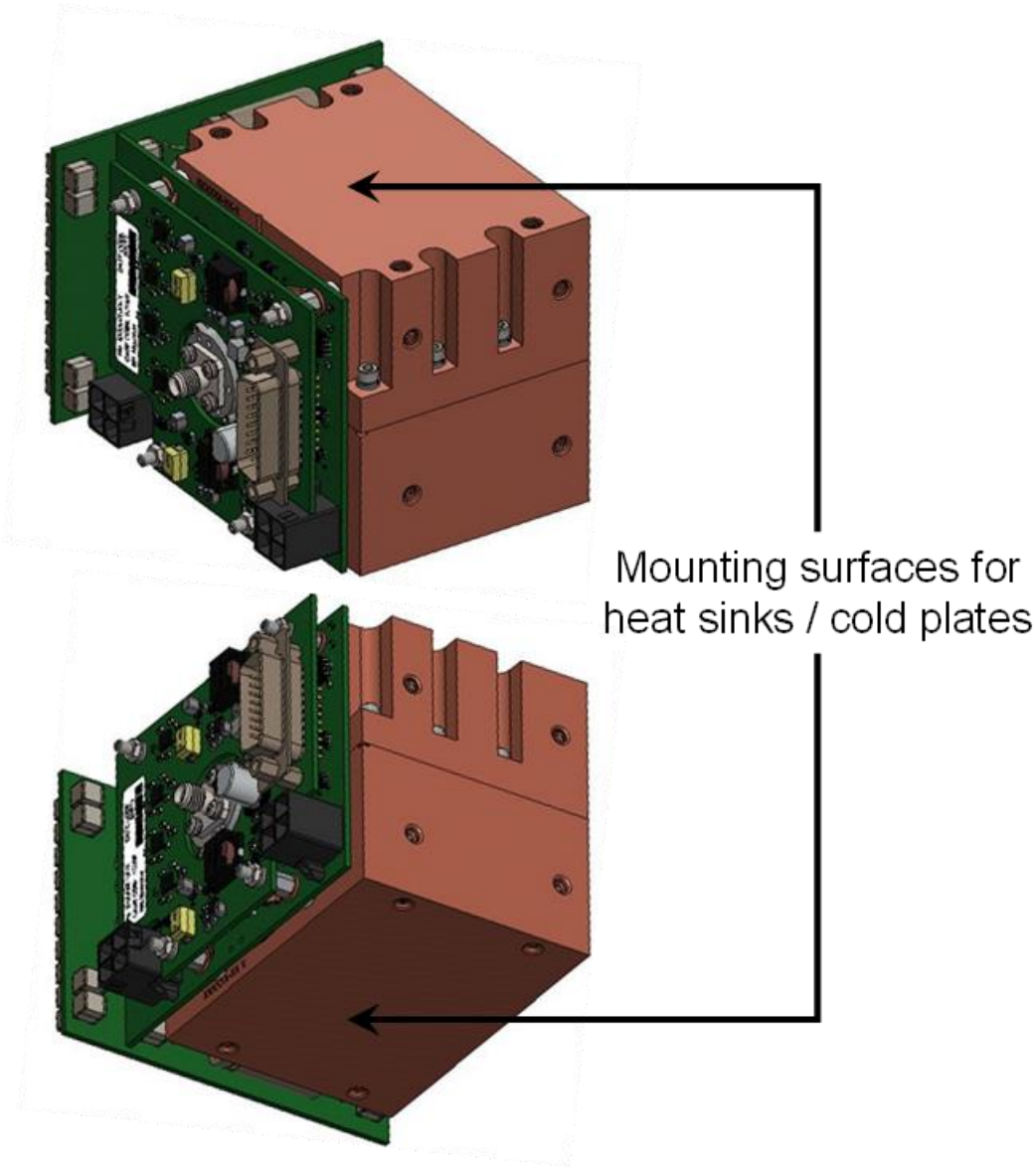
Dimensions are in INCHES

Mechanical Information – Bias Card Connector Pins

J1 CONNECTOR PIN FUNCTION AND DEFINITION		
PIN NO.	**FUNCTION**	**DESCRIPTION**
J1-1	DRAIN 1	Voltage output on this pin follows 0.5V/A times the current flowing through channel 1 of the Spatium
J1-2	DRAIN 2	Voltage output on this pin follows 0.5V/A times the current flowing through channel 2 of the Spatium
J1-3	DRAIN 3	Voltage output on this pin follows 0.5V/A times the current flowing through channel 3 of the Spatium
J1-4	DRAIN 4	Voltage output on this pin follows 0.5V/A times the current flowing through channel 4 of the Spatium
J1-5	DRAIN 5	Voltage output on this pin follows 0.5V/A times the current flowing through channel 5 of the Spatium
J1-6	DRAIN 6	Voltage output on this pin follows 0.5V/A times the current flowing through channel 6 of the Spatium
J1-7	DRAIN 7	Voltage output on this pin follows 0.5V/A times the current flowing through channel 7 of the Spatium
J1-8	DRAIN 8	Voltage output on this pin follows 0.5V/A times the current flowing through channel 8 of the Spatium
J1-9	DRAIN 9	Voltage output on this pin follows 0.5V/A times the current flowing through channel 9 of the Spatium
J1-10	DRAIN 10	Voltage output on this pin follows 0.5V/A times the current flowing through channel 10 of the Spatium
J1-11	DRAIN 11	Voltage output on this pin follows 0.5V/A times the current flowing through channel 11 of the Spatium
J1-12	DRAIN 12	Voltage output on this pin follows 0.5V/A times the current flowing through channel 12 of the Spatium
J1-13	DRAIN 13	Voltage output on this pin follows 0.5V/A times the current flowing through channel 13 of the Spatium
J1-14	DRAIN 14	Voltage output on this pin follows 0.5V/A times the current flowing through channel 14 of the Spatium
J1-15	DRAIN 15	Voltage output on this pin follows 0.5V/A times the current flowing through channel 15 of the Spatium
J1-16	DRAIN 16	Voltage output on this pin follows 0.5V/A times the current flowing through channel 16 of the Spatium
J1-17	5V0	5V internally generated reference voltage
J1-18	5V0	5V internally generated reference voltage
J1-19	GND	Connect to logic ground
J1-20	GND	Connect to logic ground
J1-21	VTEMP	Connects to Texas Instruments LMT87 temperature sensor output
J1-22	ENABLE	5V logic command bit to turn on/off the drain voltage leading to each channel of the Spatium. 0V puts the unit into a low-power state while 5V will allow normal operation. In the absence of an external logic signal (open), the amplifier will power on with the application of the supply voltage.
J1-23	SCL	I2C bus used to program amplifier for operation. Please contact Qorvo applications engineering for further information.
J1-24	SDA	I2C bus used to program amplifier for operation. Please contact Qorvo applications engineering for further information.
J1-25	RESET	I2C bus used to program amplifier for operation. Please contact Qorvo applications engineering for further information.
J1-26	GND	Connect to logic ground.
J1-1 through J1-16 can be used for diagnostics / status of MMIC; otherwise, leave open.		
J1-17 and J1-18 can be used to supply up to 100 mA of current if required. Otherwise, leave open. Do not apply a voltage to these pins.		
J1-21 can be used to monitor the reference temperature of the Spatium. For the relationship between the sensor output voltage and temperature, please see the LMT87 datasheet.		

https://www.ti.com/lit/ds/symlink/lmt87.pdf/

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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