



Spatium™ QPB0618N

6 – 18 GHz Wideband GaN Amplifier

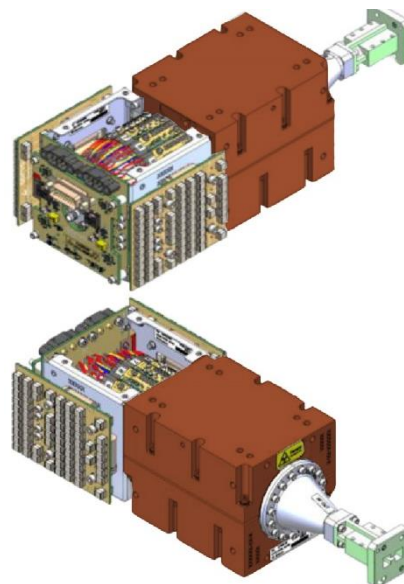
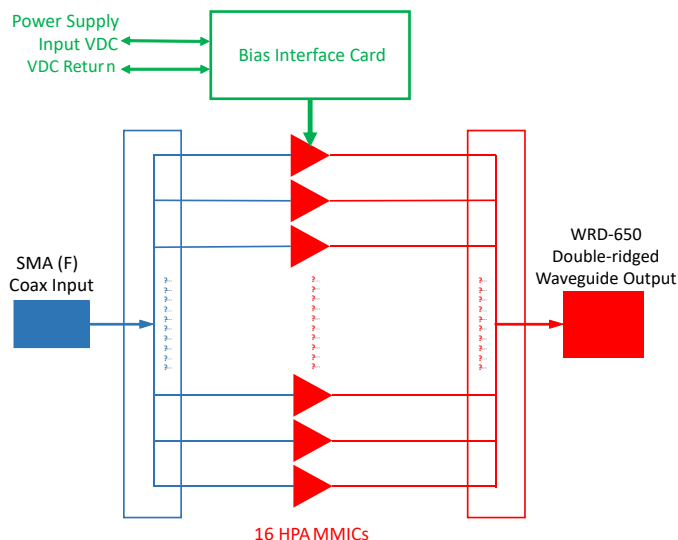
Product Description

An excellent alternative to traveling wave tube amplifiers, Qorvo's Spatium™ QPB0618N is a solid state, spatial combining amplifier with an operating range of 6–18 GHz. With its maximum performance in output power, gain, power added efficiency, and frequency range, this Spatium is the ideal building block for microwave 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 MMIC design along with our high-count combining techniques for a best in class solution to power amplification.

The QPB0618N 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



Input (T) and Output (B)

Product Features

- Frequency Range: 6 – 18 GHz
- Saturated Output Power: 53.9 dBm ($P_{IN} = 43$ dBm)
- Large Signal Gain: 10.9 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
QPB0618N	6 – 18 GHz Spatium™ Amplifier



Absolute Maximum Ratings

Parameter	Value / Unit
Prime Power (V_{DC})*	20V
Drain Current (I_{D_DRIVE})	85 A
RF Input Power	49
Operating Temperature*	–40 to +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	Value / Unit
Drain Voltage (V_D)	18 V
Quiescent Drain Current (I_{DQ})	54 A
Operating Drain Current (I_D)	70 A
Operating Temperature **	–40 to +71 °C

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

** Refers to outside clamp surface temperature

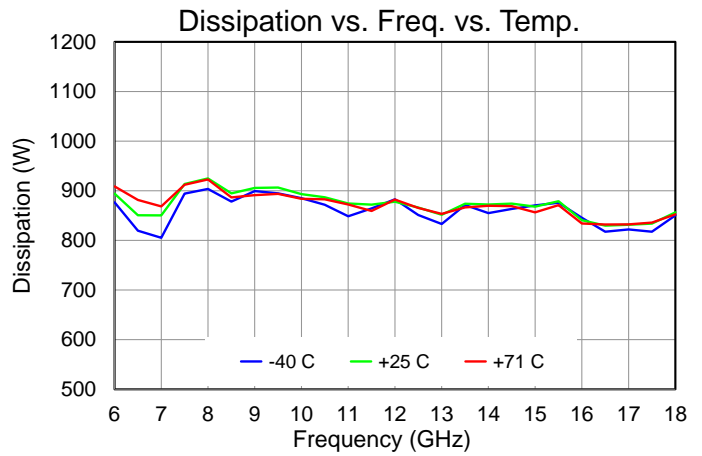
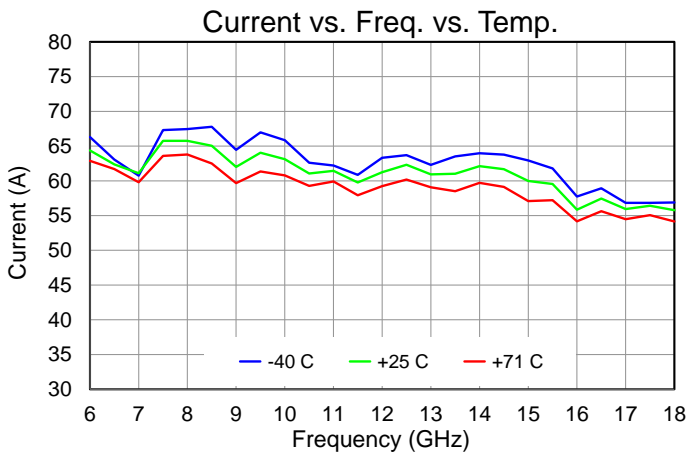
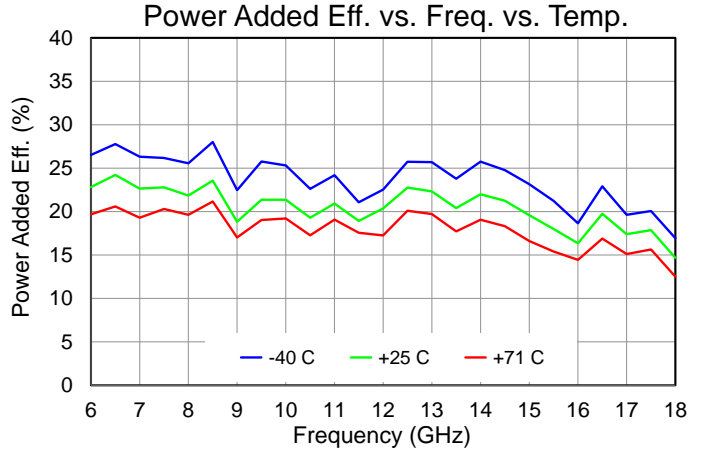
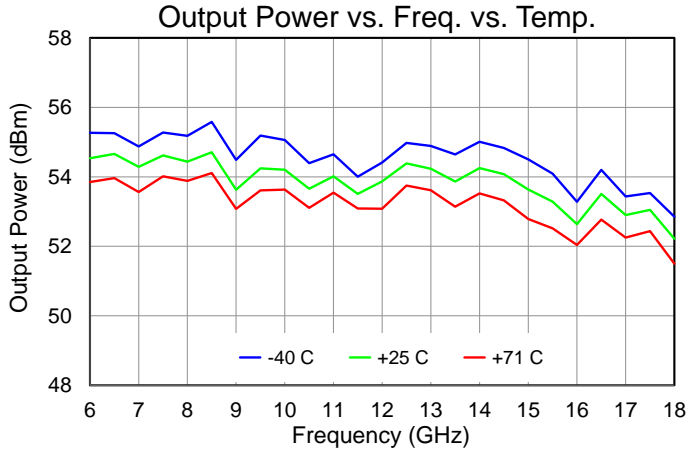
Electrical Specifications

Parameter	Min	Typ	Max	Units
Frequency	6		18	GHz
Saturated P_{OUT} , CW ($P_{IN} = 43$ dBm)		53.9		dBm
Power-Added Efficiency, CW ($P_{IN} = 43$ dBm)		20.5		%
Power Gain (CW, $P_{IN} = 43$ dBm)		10.9		dB
Small Signal Gain (S21)		17.3		dB
Input Return Loss		16		dB
Switching Time (PW=500 ns, F= 10 GHz, $P_{IN} = 43$ dBm)				
ENABLE to RF ON		142		ns
ENABLE to RF OFF		145		ns
Second Harmonic, CW (F_0 in band, $P_{IN} = 43$ dBm)		–27		dBc
Third Harmonic, CW (F_0 in band, $P_{IN} = 43$ dBm)		–14		dBc
Input RF Interface	SMA (F)			
Output RF Interface	WRD-650 Double-ridged Waveguide			
Weight: Amp + Bias Card	16.5 (7.48)			lbs. (kg)
Amp + Bias Card + One Capacitor Bank	17.0 (7.71)			lbs. (kg)
Amp + Bias Card + Two Capacitor Banks	17.5 (7.94)			lbs. (kg)
Dimensions: Amp + Bias Card (L) x (W) x (H)	12.45 x 3.4 x 3.4 (316.2 x 86.4 x 86.4)			inch (mm)
Amp + Bias Card + One Capacitor Bank	12.45 x 4.1 x 3.4 (316.2 x 104.1 x 86.4)			inch (mm)
Amp + Bias Card + Two Capacitor Banks	12.45 x 4.7 x 3.4 (316.2 x 119.4 x 86.4)			inch (mm)

Test conditions unless otherwise noted: $V_{DC} = 18$ V, $I_{DQ} = 54$ A, CW, T = 25 °C

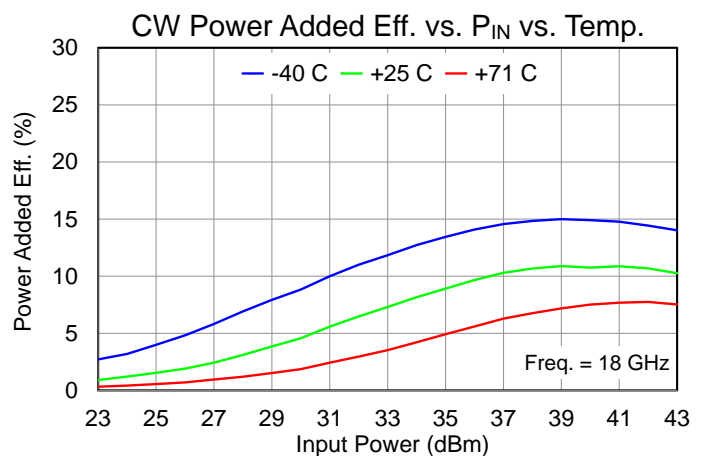
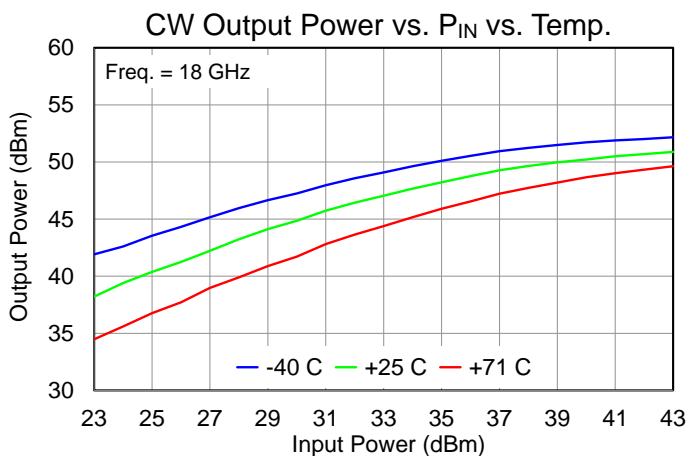
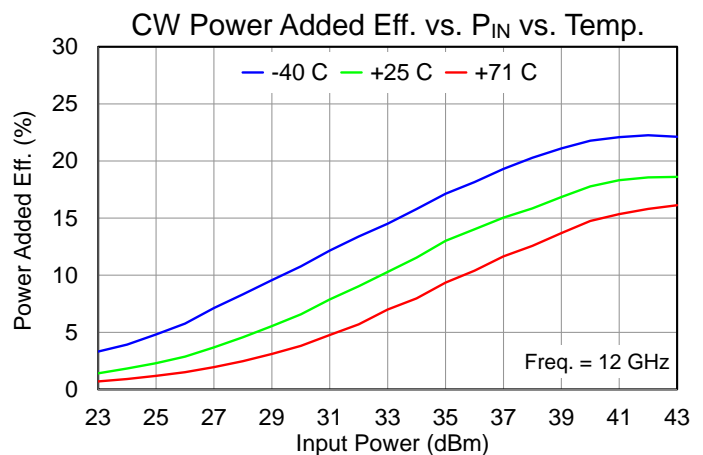
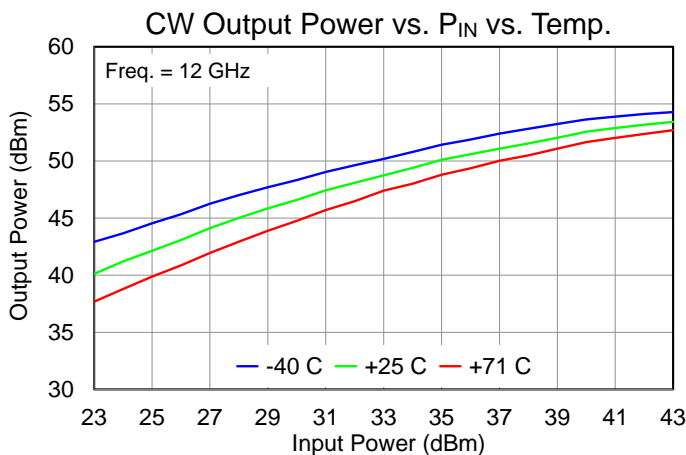
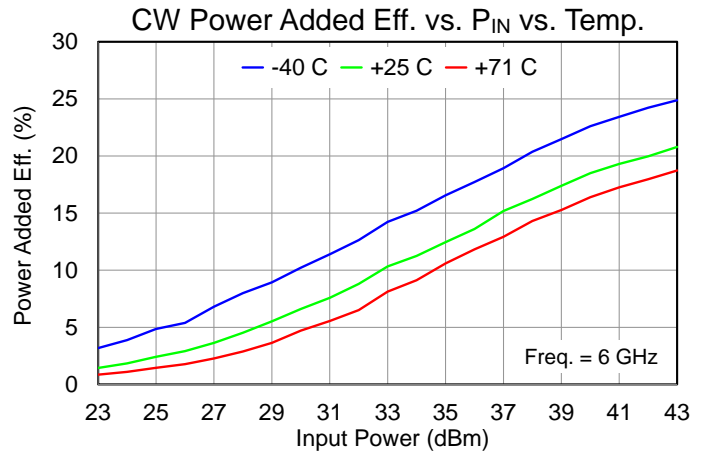
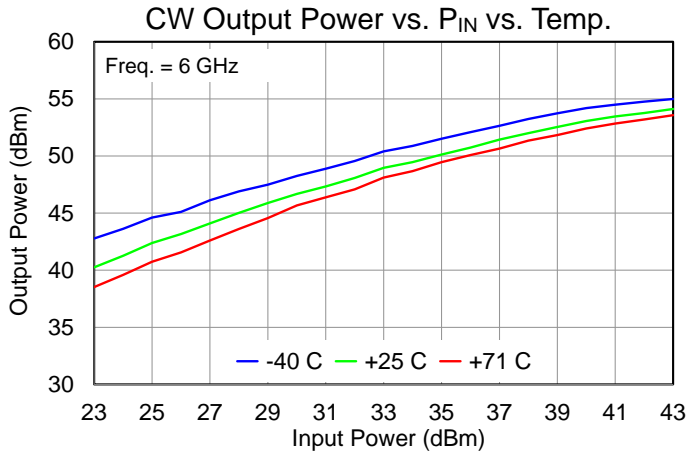
Typical Performance – Large Signal (CW)

Conditions unless otherwise specified: $V_D = 18\text{ V}$, $I_{DQ} = 54\text{ A}$, $P_{IN} = 43\text{ dBm}$



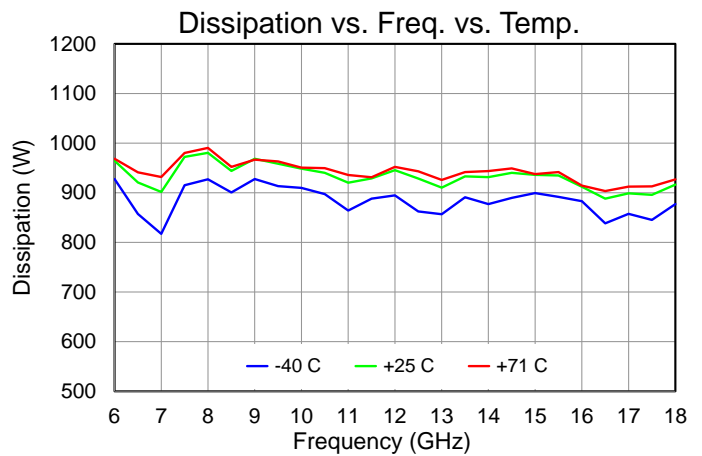
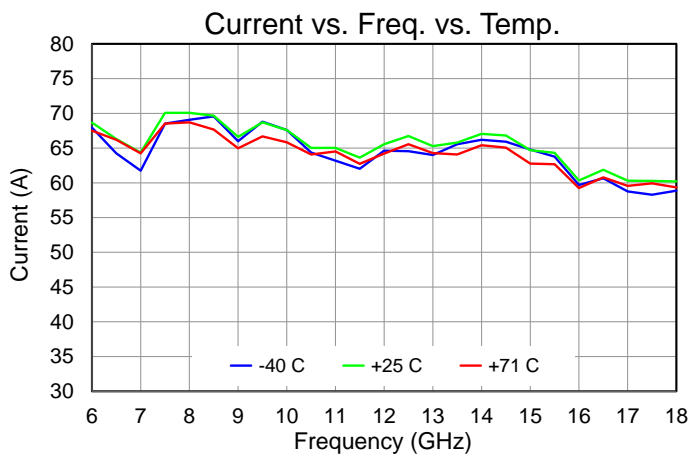
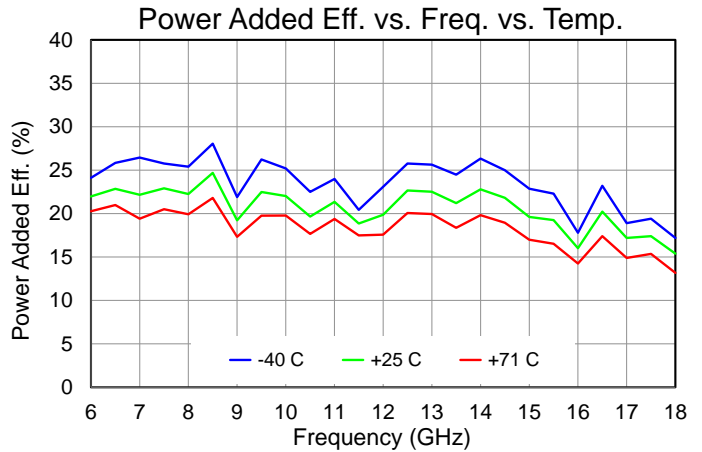
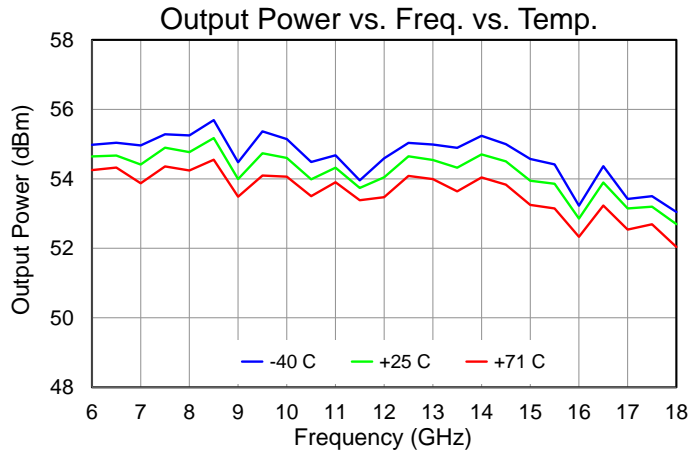
Typical Performance – Large Signal (CW)

Conditions unless otherwise specified: $V_D = 18\text{ V}$, $I_{DQ} = 54\text{ A}$



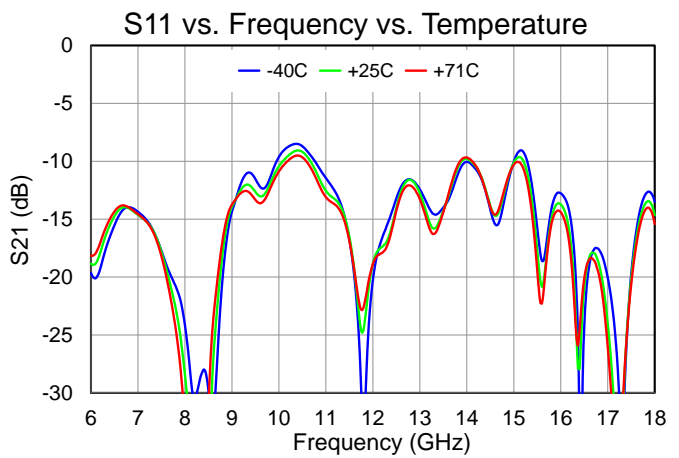
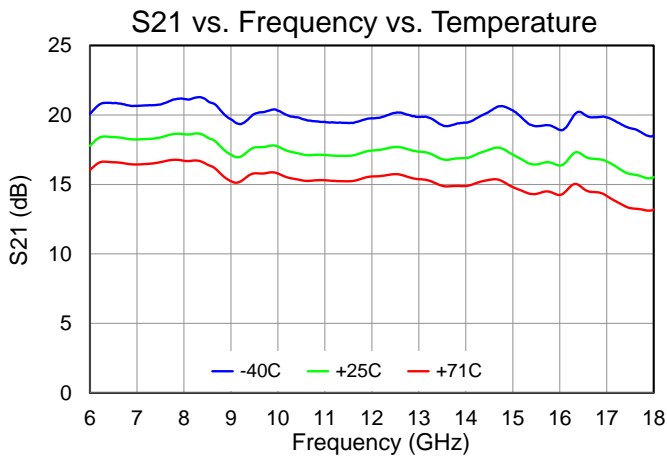
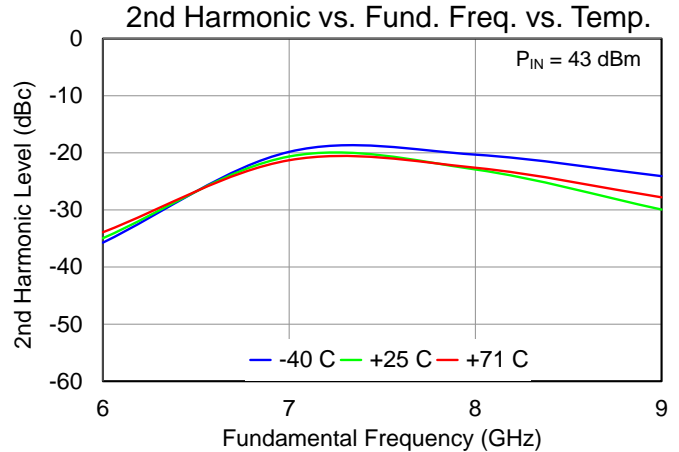
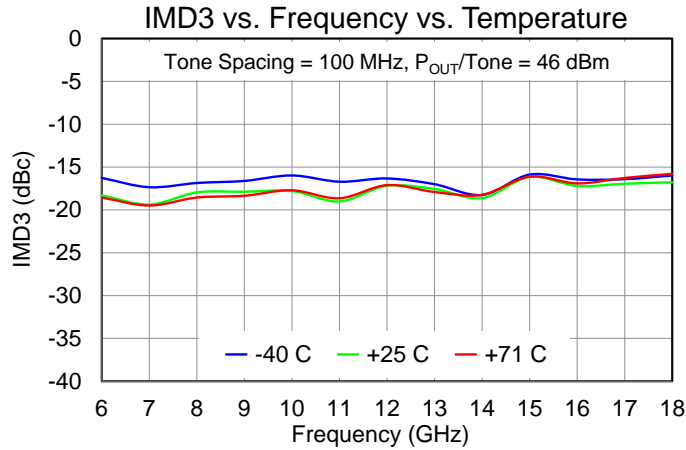
Typical Performance – Large Signal (Pulsed)

Conditions unless otherwise specified: $V_D = 18\text{ V}$, $I_{DQ} = 54\text{ A}$, $P_{IN} = 43\text{ dBm}$, $PW = 500\text{ ns}$, $DC = 50\%$



Typical Performance – Linearity, Harmonics, Small Signal

Conditions unless otherwise specified: $V_D = 18\text{ V}$, $I_{DQ} = 54\text{ A}$, $T = 25\text{ }^\circ\text{C}$, $P_{IN} = -10\text{ dBm}$, CW





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Reliability Information

Conditions unless otherwise specified: $V_D = 18\text{ V}$, $I_{DQ} = 54\text{ A}$, $P_{IN} = 43\text{ dBm}$

Mean Time Between Failure (@ Saturation Power, CW Mode)

CLAMP TEMP (C)	0	25	55	71
ENVIRONMENT	MBTF (x 1000 Hours)			
AUC	105	60	26	10
FG	466	258	101	39
GB	936	580	254	90

Failures Per Million Hours (@ Saturation Power, CW Mode)

CLAMP TEMP (C)	0	25	55	71
ENVIRONMENT	FPMH			
AUC	9.5	16.63	38.21	104.85
FG	2.15	3.88	9.93	25.58
GB	1.07	1.72	3.94	11.17

Calculations derived from MIL-HDBK-217F

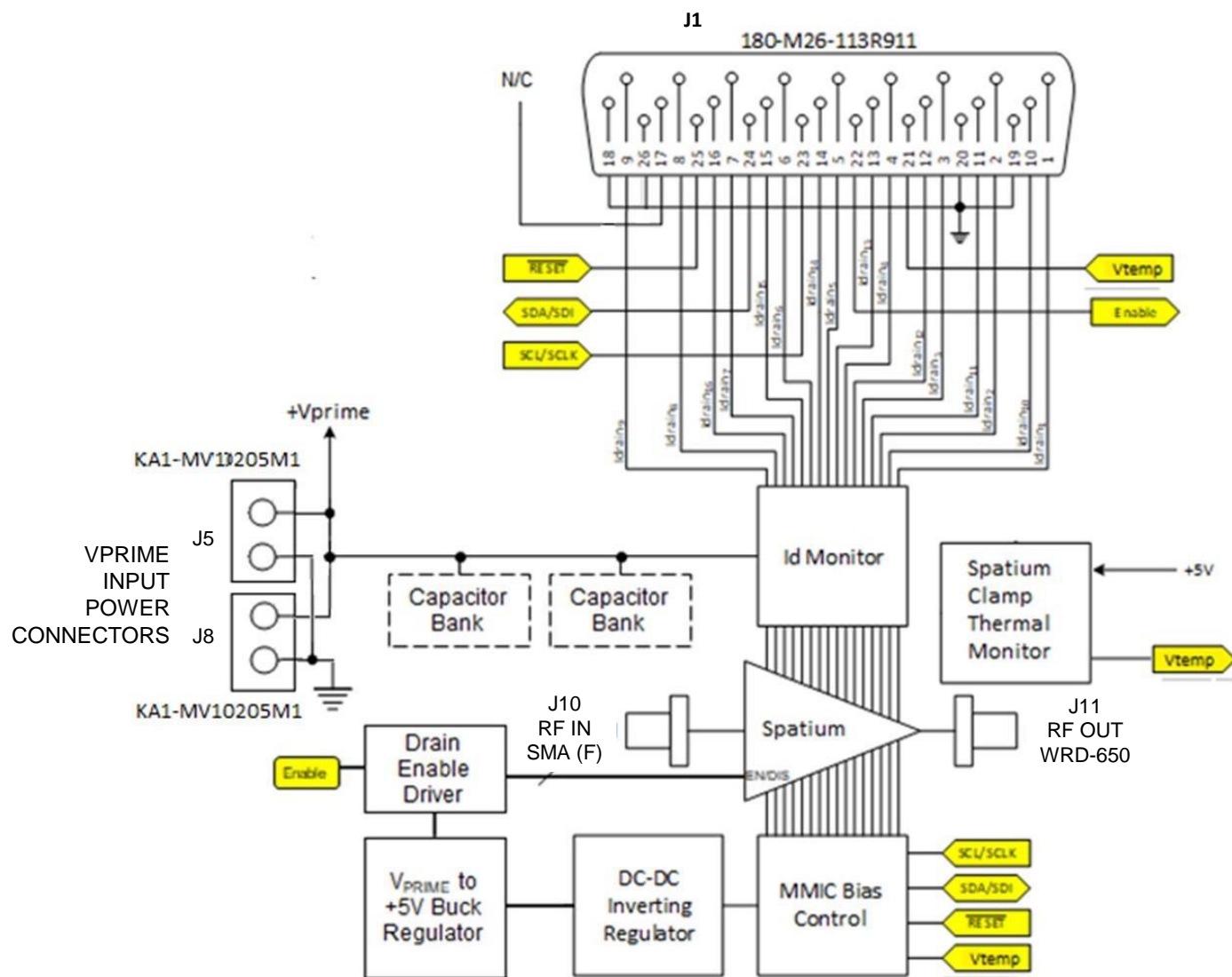
Operational environments are:

GB – Ground Benign

GF – Ground Fixed

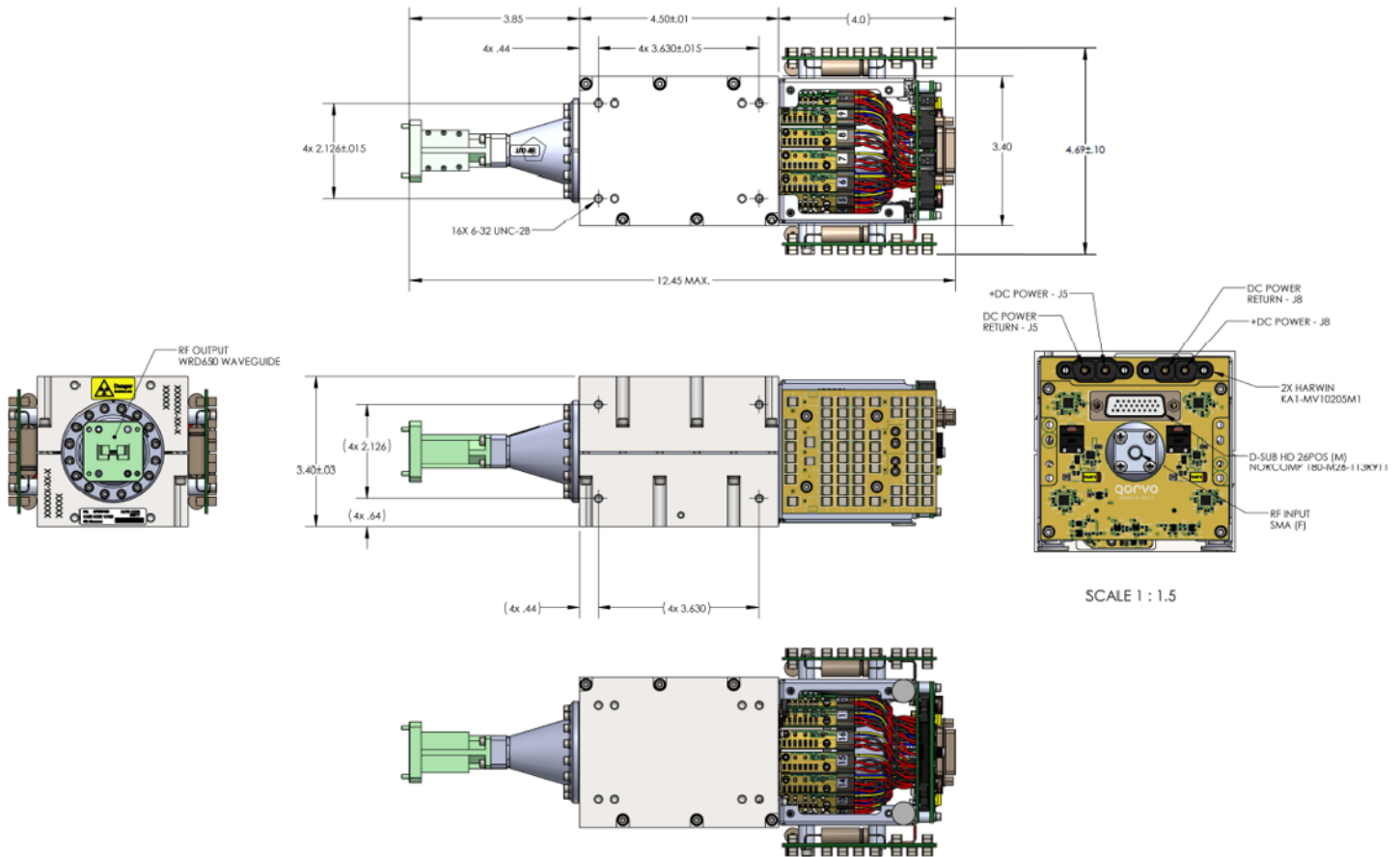
AUC – Airborne Uninhabited Cargo

Block Diagram and Description



Pin No.	Label	Description
RF In	J10	SMA (F)
RF Out	J11	WRD-650 Double-ridged Waveguide
Auxiliary	J1	D-SUB HD 26POS (M), NORCOMP 180-M26-113R911
Power	J5, J8	HARWIN, KA1-MV10205M1

Mechanical Information – Outline Drawing (Amp + Bias Card + 2 Cap. Banks)



Dimensions are in INCHES

Connector Pin Labels and Function Descriptions

Pin No.	Label	Description
1 - 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, should not be used as source
19, 20	GROUND	Logic / signal ground
21	VTEMP	Temperature monitoring, connects to Texas Instruments KMT87 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 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 operation at factory
24	SDA	I2C bus used to program amplifier for operation at factory
25	RESET	I2C bus used to program amplifier for operation at factory
26	GROUND	Logic / signal ground

Note: J1 connector pin assignments and function descriptions.



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

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Email: customer.support@qorvo.com

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