Spatium™ QPB0618J

2 – 18 GHz GaN Driver Amplifier

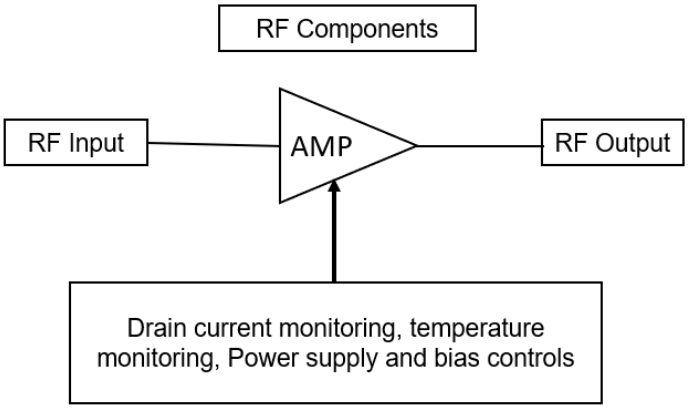
Product Description

The QPB0618J is a solid state driver amplifier based on GaN MMIC technology, with an operating range of 2 – 18 GHz with a saturated output power of 45 dBm (32 Watts). Its compact size and weight allow it to be used to drive a number of Spatium power amplifiers in microwave high power transmitters for EW and radar applications.

Planar multistage driver module for use with existing Spatium platforms operating in the 2 – 18 GHz frequency band. A variable attenuator in conjunction with a temperature sensor compensates for variation in gain over the operating temperature range. Gate bias and variable attenuator settings are digitally programmable using non-volatile I2C digital potentiometers. RF input and output are via SMA connectors. DC and control interface is provided via a Micro D-Sub connector.

The QPB0618J includes a DC enable function that can switch off the MMIC amplifiers to put the unit in low power consumption state. Users can use this mode for RF pulsing operation.

Functional Block Diagram



Product Features

- Frequency Range: 2 – 18 GHz
- Saturated Output Power: 45 dBm (P_{IN} = 3 dBm)
- Power Gain: 42 dB (P_{IN} = 3 dBm)
- Solid State MMIC Reliability
- Instant On (no warm-up)
- Blank Mode (Low Power Consumption)
- Fast DC Pulsing (DRAIN_EN)

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

Applications

- TWTA Replacement
- Electronic Warfare
- Radar
- Communications

Ordering Information

Part No.	Description
QPB0618J	2 – 18 GHz GaN Driver Amplifier

Absolute Maximum Ratings

Parameter [1]	Min Value	Max Value	Units
Prime Power Supply (V_{DC}) [2]	-	20	V
Load VSWR	-	3:1	N.A.
Input Power (CW, VSWR 1.5:1, T_{BASE} = 25 °C)	-	9	dBm
Storage Temperature	-54	75	°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 ($V_{DC,}$ also named V_SUPPLY)	16	18	20	V
Quiescent Current or Small Signal Operation		10.9		A
Operating Current		See data plots		A
CW Mode Operating Temperature [1]	-40		71	°C
DC Pulse Width [2]	0.5			us

1. Refers to base surface temperature.
2. Unit can be DC or RF pulsed, these limits are applicable to DC pulsing only, DC pulsing can be controlled by DRAIN_EN or GATE_EN.

Electrical Specifications

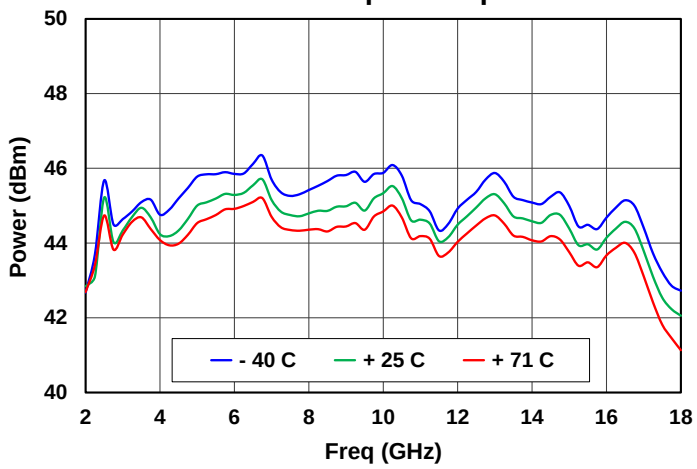
Parameter [1]	Min	Typ	Max	Units
Frequency	2		18	GHz
CW Mode Output Power (P_{IN} = 3 dBm)		45		dBm
CW Mode Power Gain (P_{IN} = 3 dBm)		42		dB
CW Mode PAE (P_{IN} = 3 dBm)		15		%
Pulse Mode Output Power (P_{IN} = 3 dBm) [2]		45.5		dBm
Pulse Mode Power Gain (P_{IN} = 3 dBm) [2]		42.5		dB
Pulse Mode PAE (P_{IN} = 3 dBm) [2]		15.5		%
Switch Time (RF Pulsing)			30	ns
Switch Time Enable to 90% RF ON (DC Pulsing)		131	200	ns
Switch Time Disable 10% RF OFF (DC Pulsing)		127	200	ns
Small Signal Gain		48		dB
Input Return Loss (CW)		10		dB
Input RF Interface	2.92 mm (F) SMA Coaxial Connector			
Output RF Interface	2.92 mm (F) SMA Coaxial Connector			
Weight		3.1 (1.406)		lbs. (kg)
Dimensions (L) x (W) x (H)		5.818 x 4.635 x 1.100		inches
		147.78 x 117.73 x 27.94		millimeters

1. Electrical specifications are measured at specified or recommended test conditions as shown in Recommended Operating Conditions Table. Specifications are not guaranteed over all recommended operating conditions.
2. DC pulsing controlled by DRAIN_EN. Pulse Width = 0.5 us, Duty Cycle = 50%.

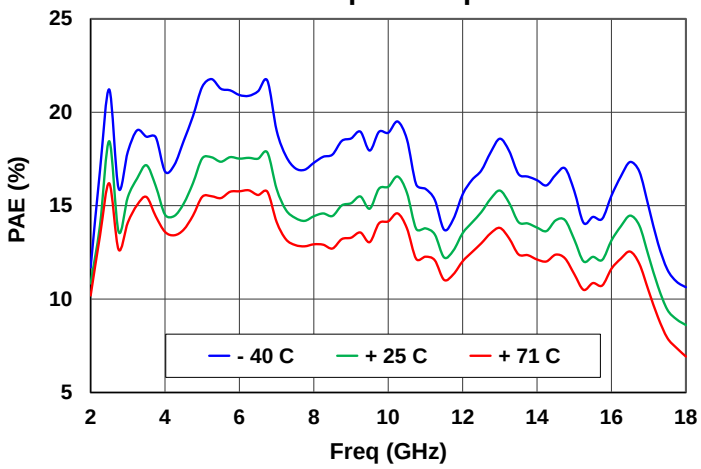
Typical Performance – CW Mode, Large Signal

Test conditions unless otherwise noted: V_{DC} = 18 V, Pin = 3 dBm, T_{BASE} = 25 °C

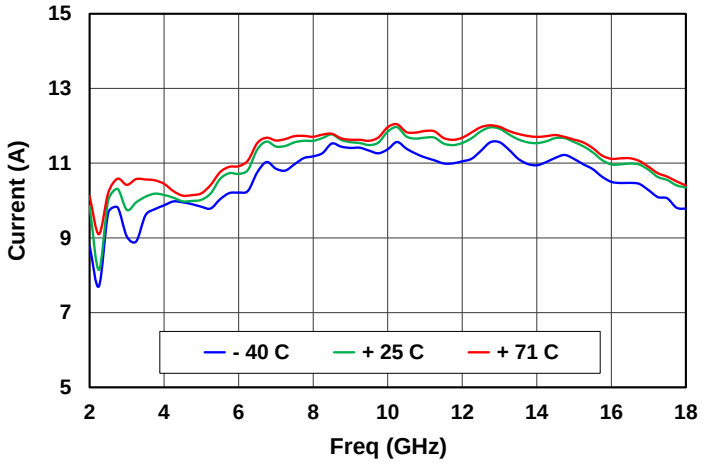
Power vs Freq vs Temperature



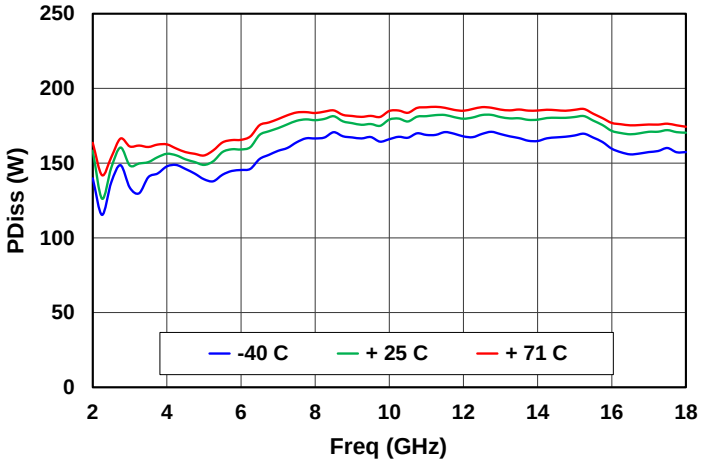
PAE vs Freq vs Temperature



Current vs Freq vs Temperature



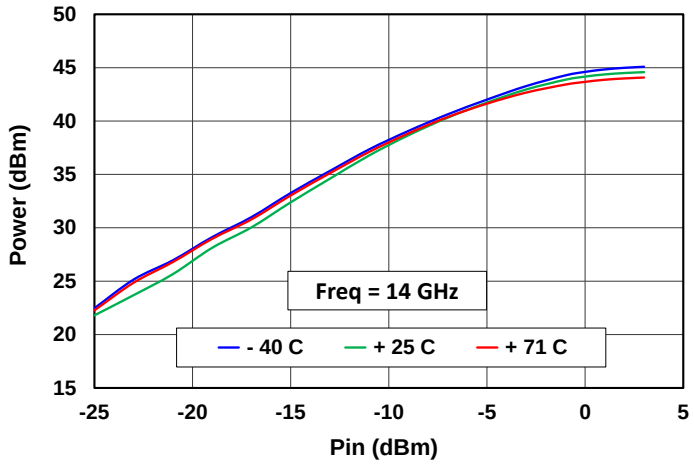
PDiss vs Freq vs Temperature



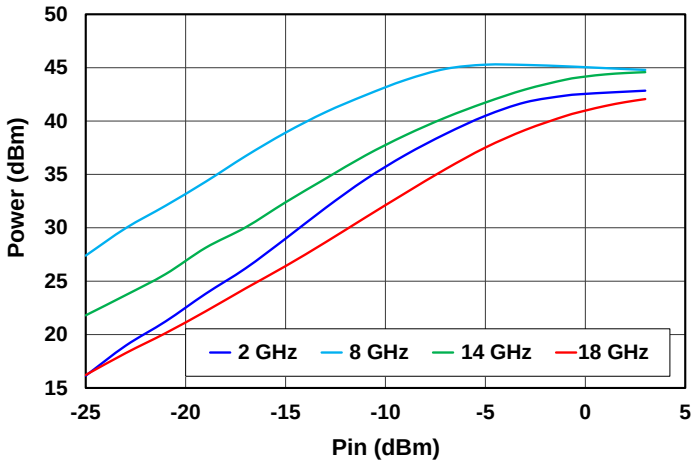
Typical Performance – CW Mode, Large Signal

Test conditions unless otherwise noted: V_{DC} = 18 V, T_{BASE} = 25 °C

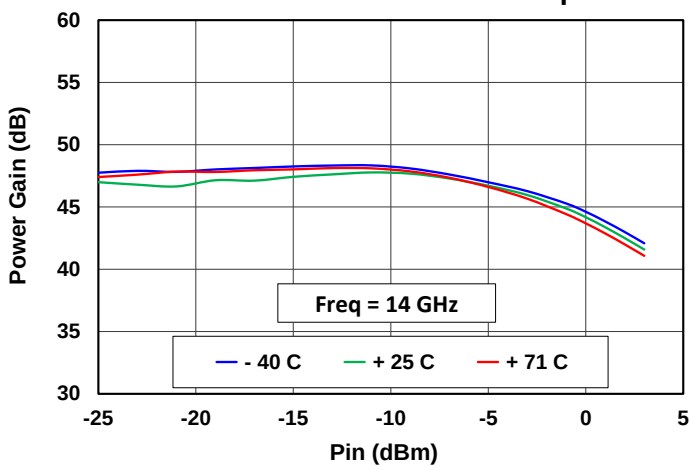
Power vs Pin vs Temp



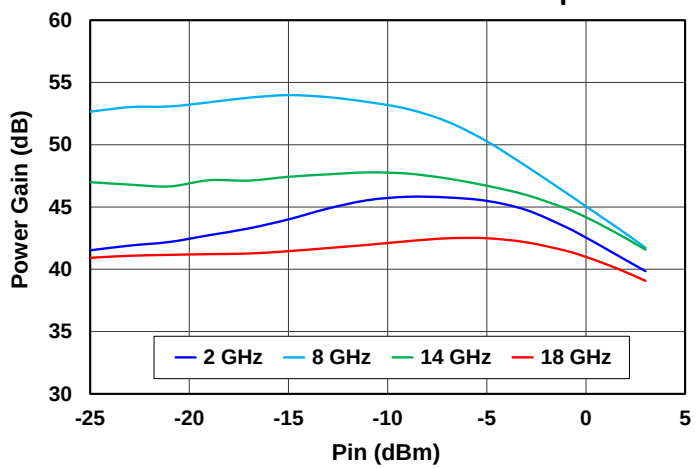
Power vs Pin vs Freq



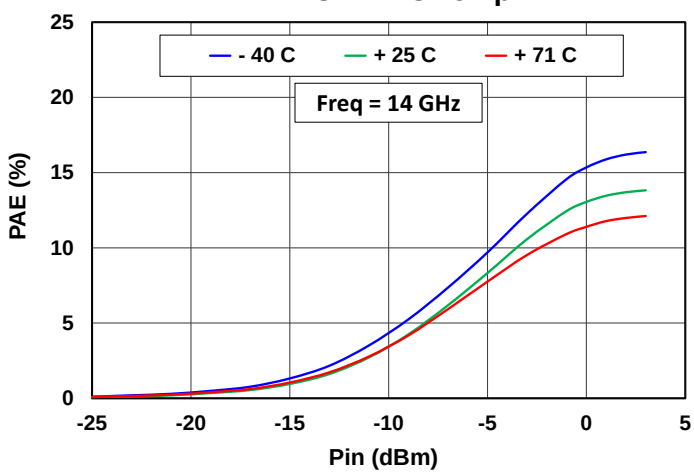
Power Gain vs Pin vs Temp



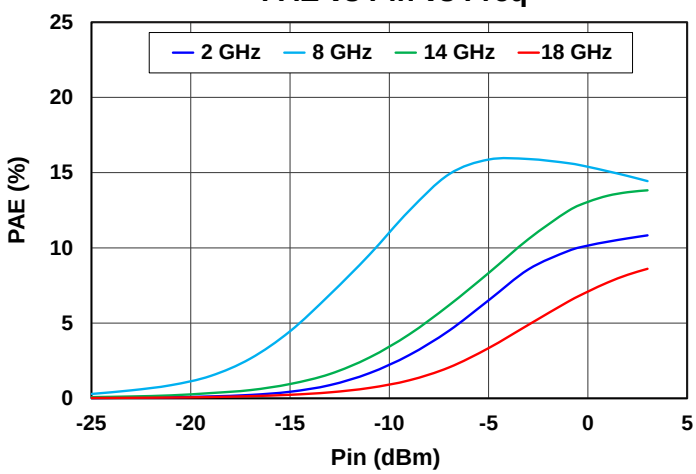
Power Gain vs Pin vs Freq



PAE vs Pin vs Temp



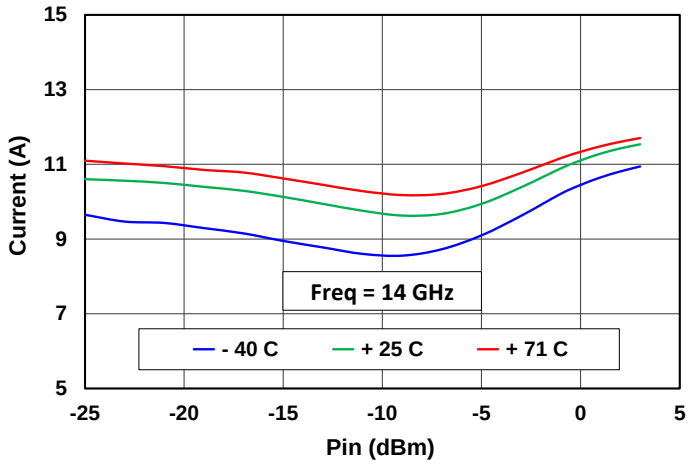
PAE vs Pin vs Freq



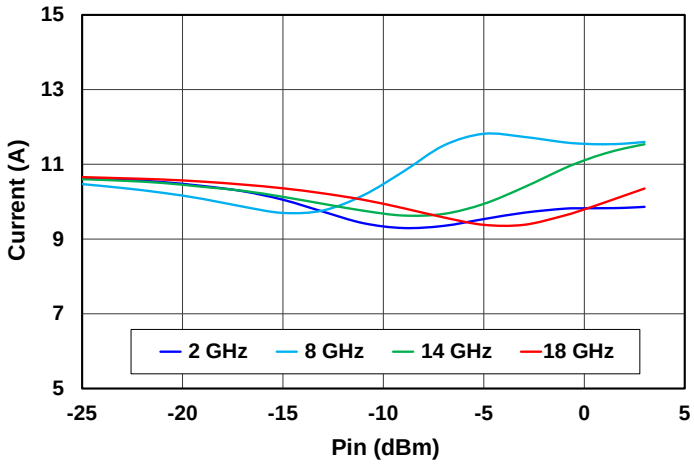
Typical Performance – CW Mode, Large Signal

Test conditions unless otherwise noted: V_{DC} = 18 V, T_{BASE} = 25 °C

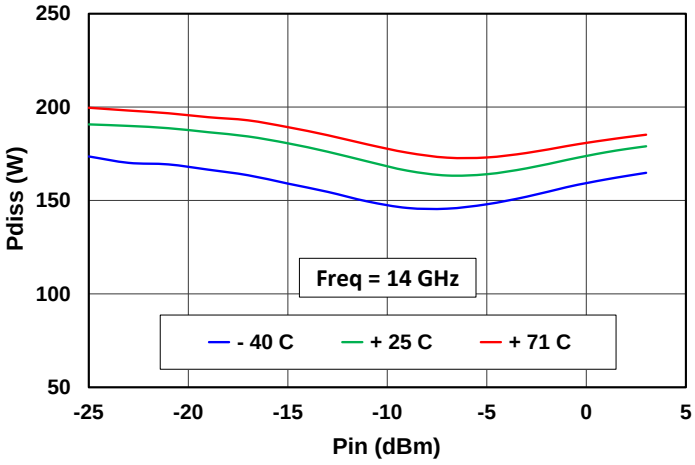
Current vs Pin vs Temp



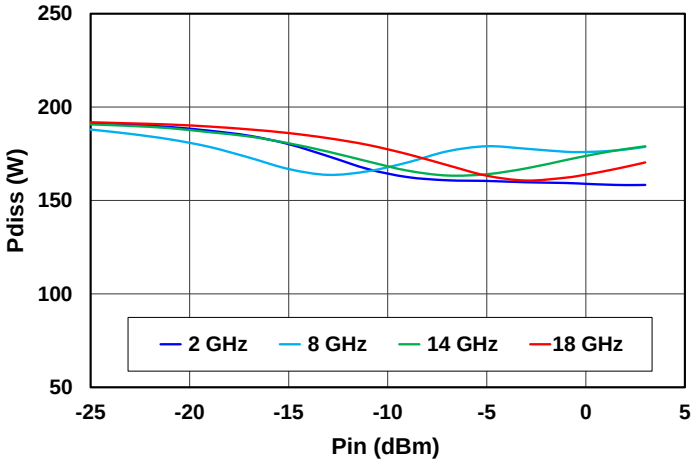
Current vs Pin vs Freq



Pdiss vs Pin vs Temp

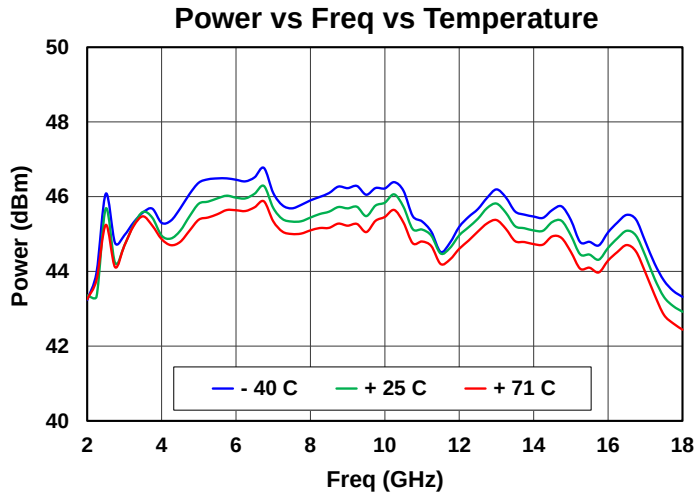


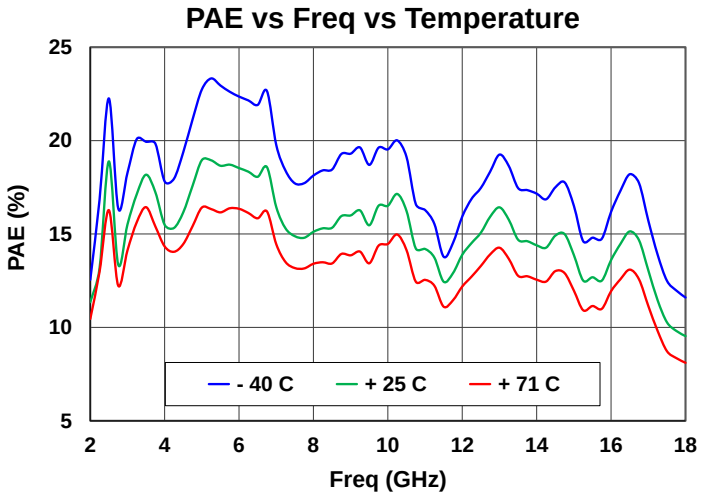
PDiss vs Pin vs Freq

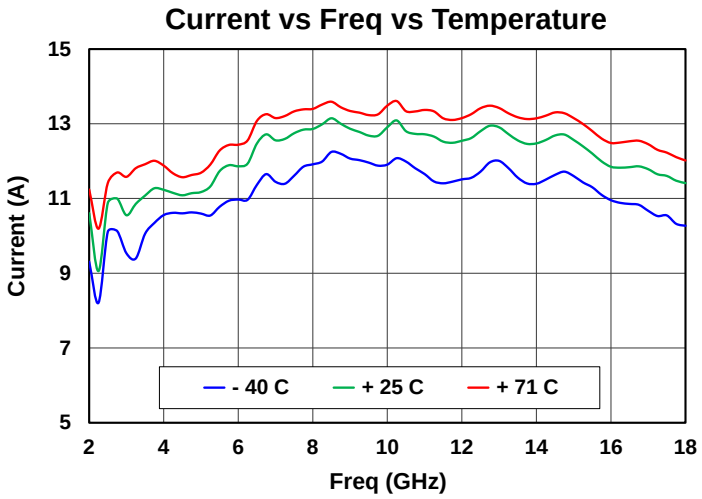


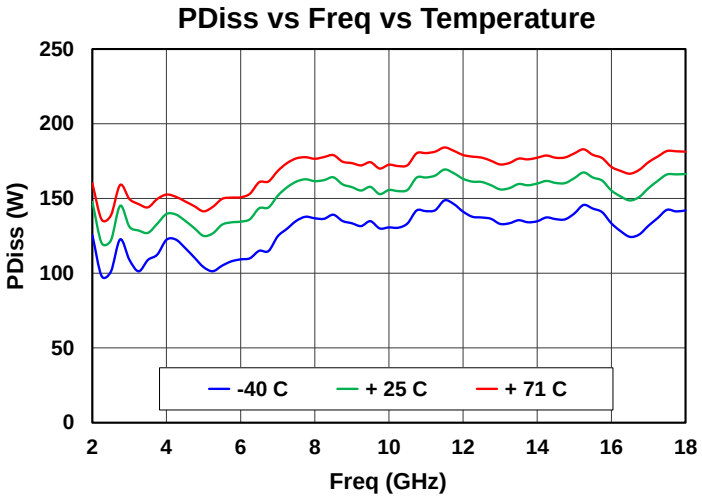
Typical Performance – Pulse Mode, Large Signal

Test conditions unless otherwise noted: V_{DC} = 18 V, Pin = 3 dBm, Pulse Width = 0.5 us, Duty Cycle = 50%,
Data shown in plots are peak values, T_{BASE} = 25 °C





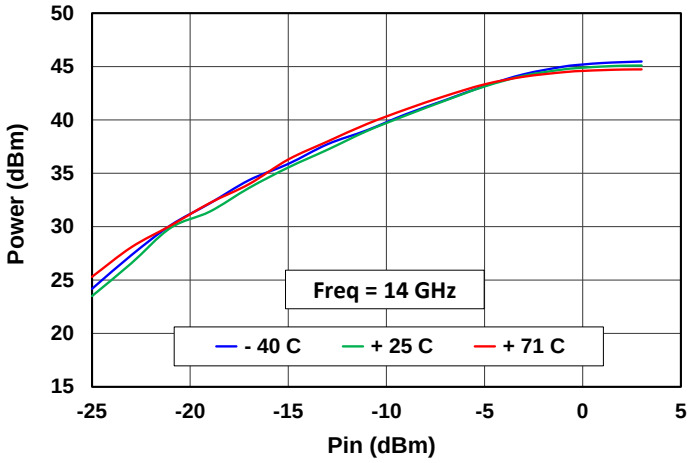




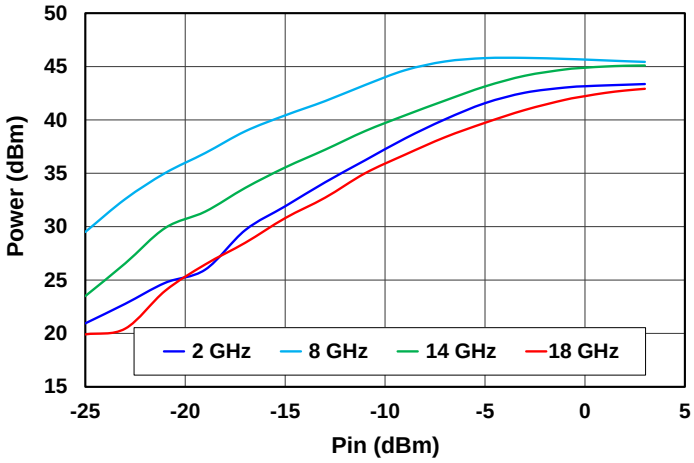
Typical Performance – Pulse Mode, Large Signal

Test conditions unless otherwise noted: V_{DC} = 18 V, Pulse Width = 0.5 us, Duty Cycle = 50%
Data shown in plots are peak values, T_{BASE} = 25 °C

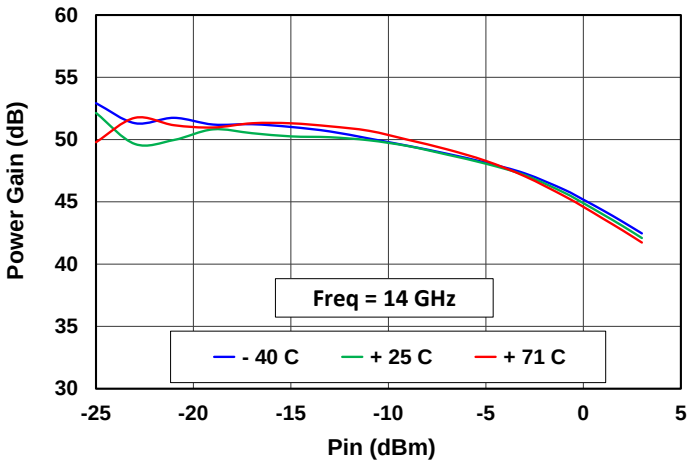
Power vs Pin vs Temp



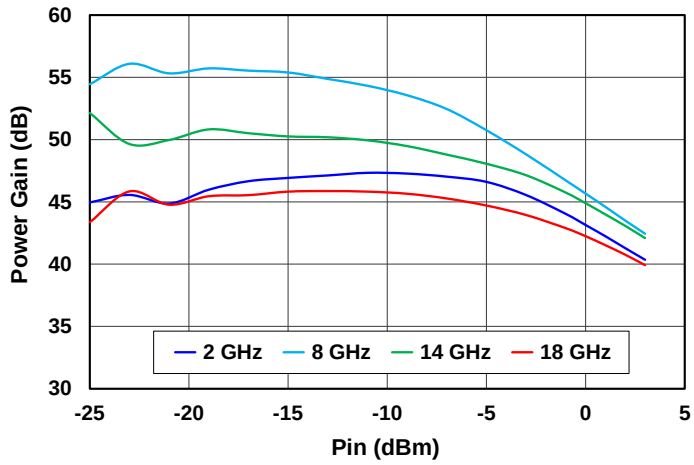
Power vs Pin vs Freq



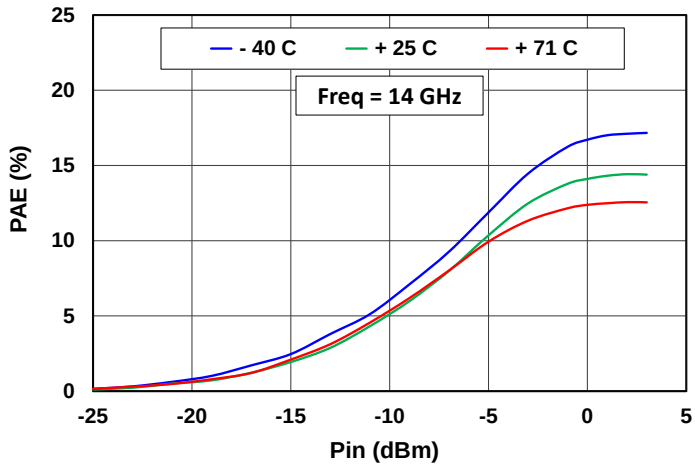
Power Gain vs Pin vs Temp



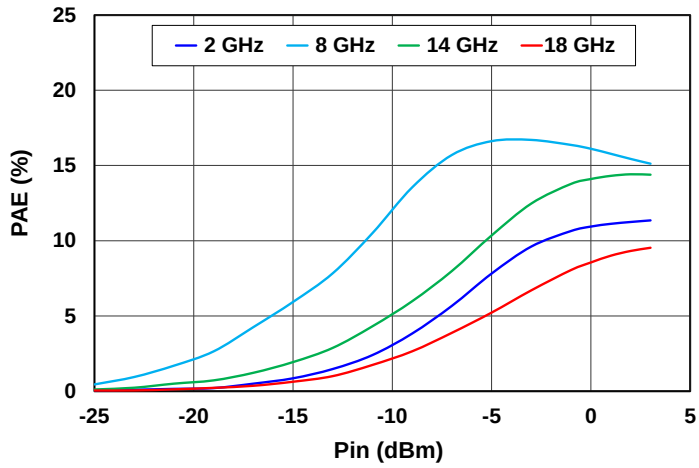
Power Gain vs Pin vs Freq



PAE vs Pin vs Temp



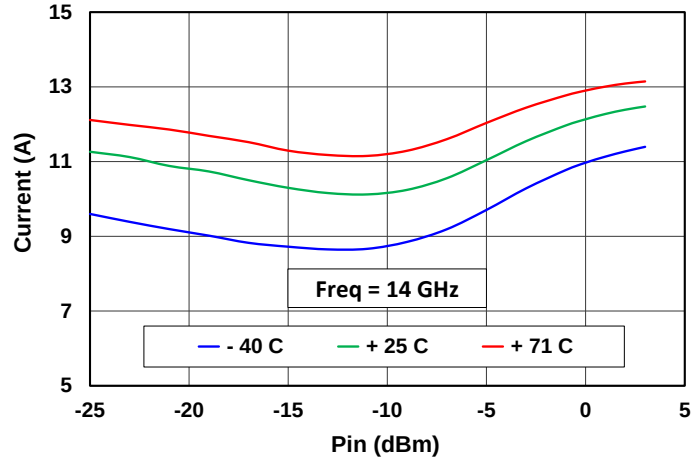
PAE vs Pin vs Freq



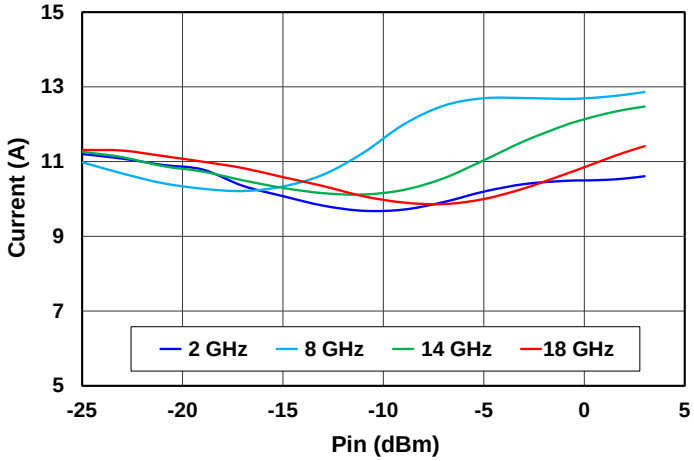
Typical Performance – Pulse Mode, Large Signal

Test conditions unless otherwise noted: V_{DC} = 18 V, Pulse Width = 0.5 us, Duty Cycle = 50%
Data shown in plots are peak values, T_{BASE} = 25 °C

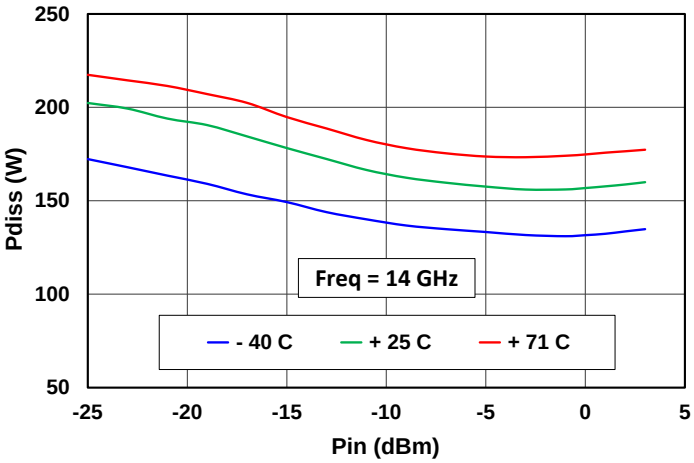
Current vs Pin vs Temp



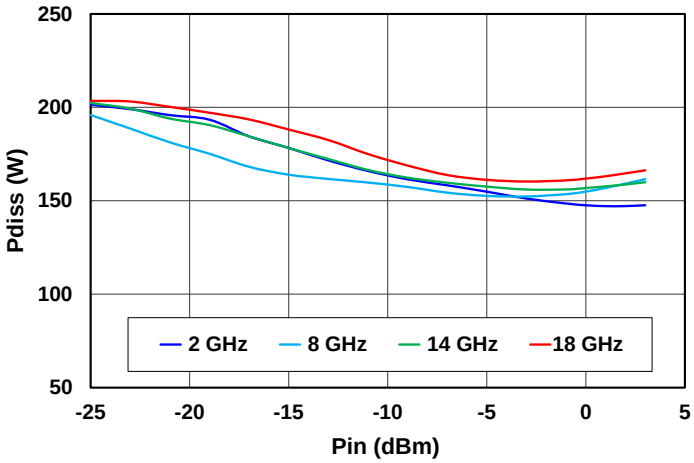
Current vs Pin vs Freq



Pdiss vs Pin vs Temp

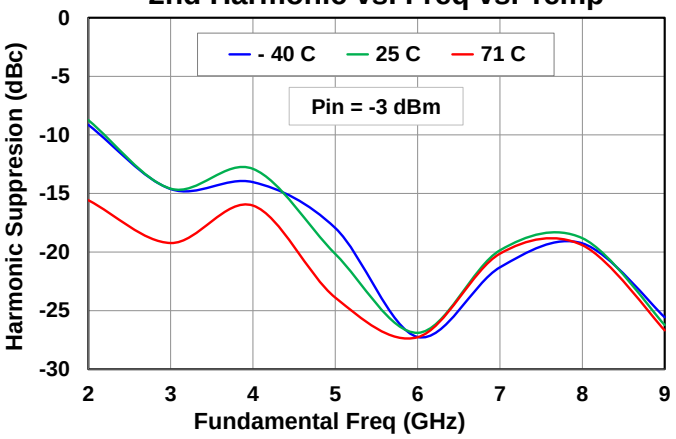


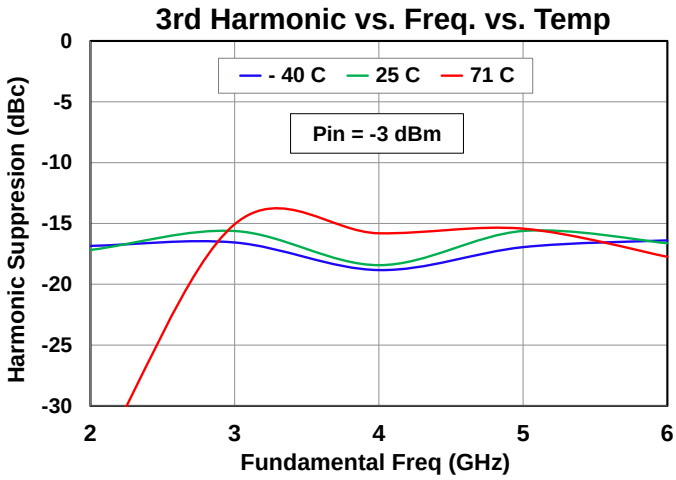
PDiss vs Pin vs Freq



Typical Performance – CW Mode, Harmonics

Test conditions unless otherwise noted: V_{DC} = 18 V, T_{BASE} = 25 °C

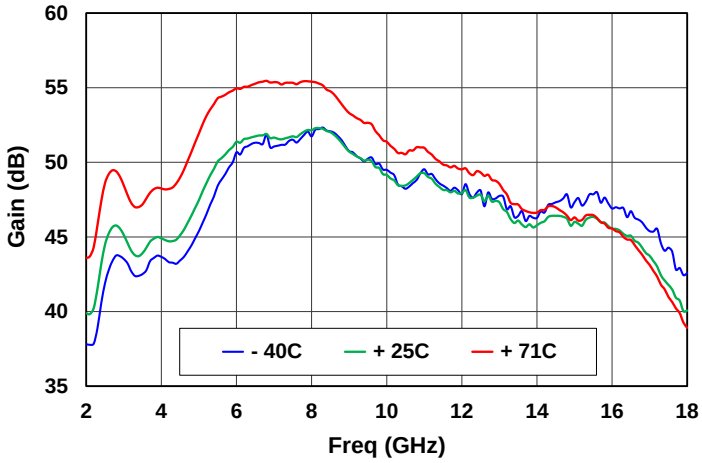




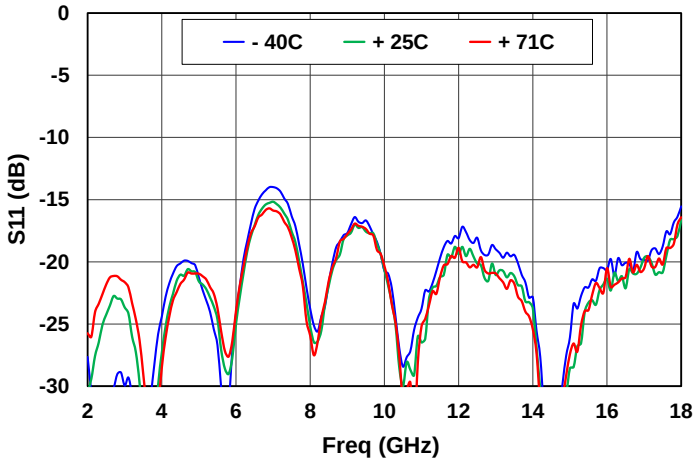
Typical Performance – Small Signal

Test conditions unless otherwise noted: V_{DC} = 18 V, T_{BASE} = 25 °C

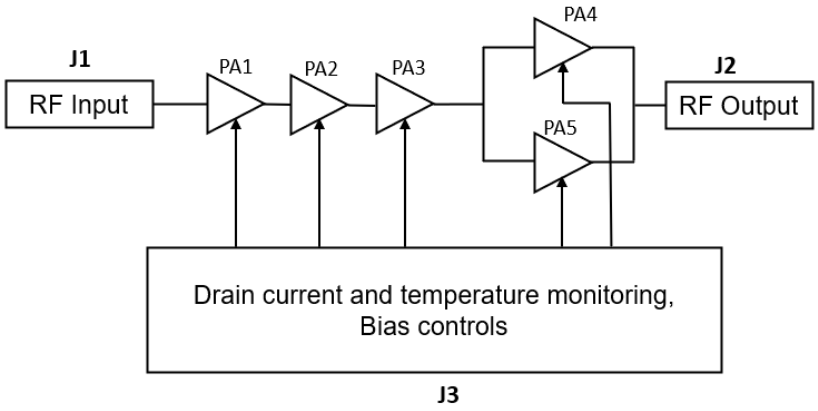
Small Signal Gain vs Temp



Input Return Loss vs Temp



Block Diagram



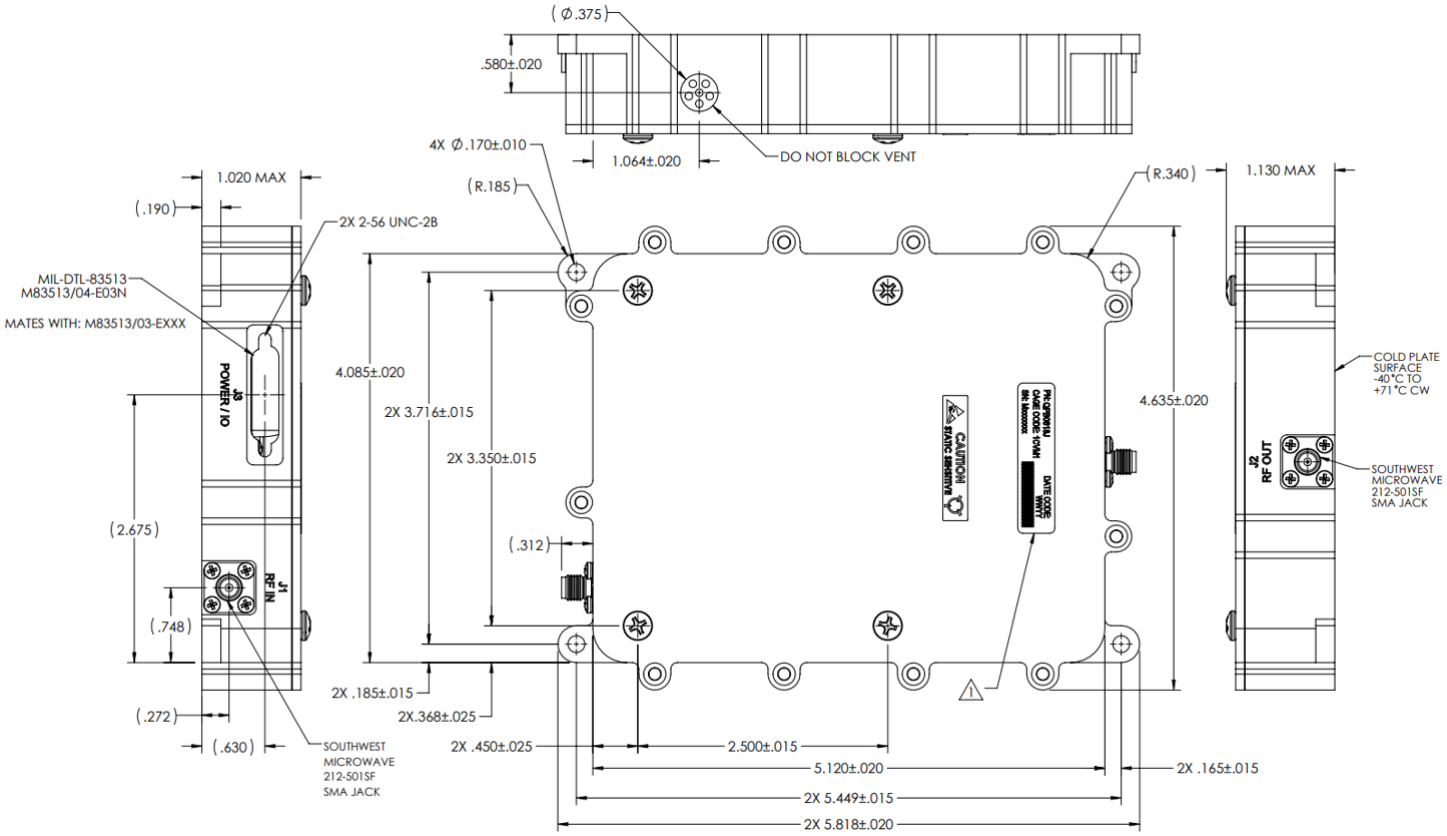
Pin No.	Label	Description
RF Input	J1	SMA (F) Coaxial RF input, DC coupled
RF Output	J2	SMA (F) Coaxial RF output, DC blocked
Power I/O	J3	MIL-DTL-83513, M83513/04-E03N D-Sub connector, Mates with M83513/03-Exxx

Connector Pin Labels and Function Descriptions (J3)

Pin No.	Label	Description
1	SDA	I2C bus used to program amplifier (For factory use only).
2	RESET	I2C bus used to program amplifier (For factory use only).
3	GND	Logic / power ground.
4	ID_PA5	Amplifier Bias Monitoring, voltage of this pin follows 0.5V/A times the current flowing through amplifier 5, 4, 3 and 2, Can be used for diagnostics / status of amplifier; otherwise leave open.
5	ID_PA4	
6	ID_PA3	
7	ID_PA2	
9	ID_PA1	
8, 10, 16	GND	Logic / power ground.
11 – 15	V_SUPPLY	Primary power supply voltage for amplifier.
17	SCL	I2C bus used to program amplifier (For factory use only).
18	GATE_EN [1]	5V CMOS logic command bit for setting the gain stages to low 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.
19 - 22	N/C	No internal connections.
23, 24	GND	Logic / power ground.
25	DRAIN_EN [2]	5V CMOS logic command bit to turn ON/OFF the drain voltage to each amplifier. 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.
26	VTEMP [3]	Temperature monitoring.
27	GND	Logic / power ground.
28	N/C	No internal connections.
29	V_SUPPLY	Primary power supply voltage for amplifier.
30, 31	GND	Logic / power ground.

1. Can be used for DC pulsing switch control, not recommended for fast DC pulsing.
2. Can be used for fast DC pulsing switch control.
3. Pin connected internally 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.

Mechanical Information – Amplifier Outline Drawing and Interface Connector



Dimensions are in INCHES

1. LABEL LOCATION:

SN: * ** ** ***
- BATCH I.D.
- WORK WEEK
- CALENDAR YEAR
- MANUFACTURER

PN: QPB0618J DATE CODE: WWYY
CAGE CODE: 1CVM1
SN: Mxxxxxxx

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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