TGA2623

10 – 11 GHz 35 W GaN Power Amplifier

Product Overview

Qorvo's TGA2623 is an x-band, high power MMIC amplifier fabricated on Qorvo's production 0.25um GaN on SiC process (QGaN25).

The TGA2623 operates from 10 – 11 GHz and provides a superior combination of power, gain and efficiency. Achieving 35W of saturated output power with 27.5dB of large signal gain and 47% power-added efficiency, the TGA2623 provides the level of performance demanded by today's system architectures.

Depending on the system requirements, the TGA2623 can support cost saving initiatives on existing systems while supporting next generation systems with increased performance.

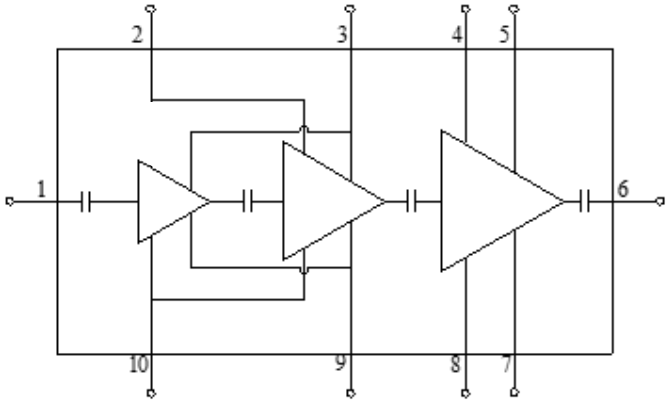
Lead-free and RoHS compliant.

Key Features

- Frequency Range: 10 – 11 GHz
- P_{SAT} (P_{IN}=18 dBm): 45.5 dBm
- P1dB: 41dBm @ Midband
- PAE (P_{IN}=18 dBm): > 47 %
- Power Gain (P_{IN}=18 dBm): 27.5 dB
- Small Signal Gain: 35 dB
- Bias: V_D = 28 V, I_{DQ} = 290 mA
- Pulsed V_D: PW = 100 us, DC = 10%
- Die Dimensions: 4.830 x 4.970 x 0.100 mm

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

Functional Block Diagram



Applications

- X-Band Radar

Ordering Information

Part No.	Description
TGA2623	10 – 11 GHz 7 Watt GaN Amplifier
TGA2623EVB01	Evaluation Board for TGA2623

Absolute Maximum Ratings

Parameter	Value / Range
Drain Voltage (V_D)	40 V
Gate Voltage Range (V_G)	−5 V to 0 V
Drain Current (I_{D12})	2300 mA
Drain Current (I_{D3})	4300 mA
Gate Current (I_G)	See plot pg. 9
Power Dissipation (P_{DISS}), 85 °C, CW	96 W
Input Power (P_{IN}), 50 Ω, V_D=28 V, 85 °C	24 dBm
Input Power (P_{IN}), 6:1 VSWR, V_D=28 V, 85 °C	20 dBm
Soldering Temperature (30 s, max.)	320 °C
Storage Temperature	−55 to +150 °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.

Recommended Operating Conditions

Parameter	Value / Range
Drain Voltage (V_D)	28 V
Drain Current (I_{DQ})	290 mA
Operating Temperature	−40 to +85 °C

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

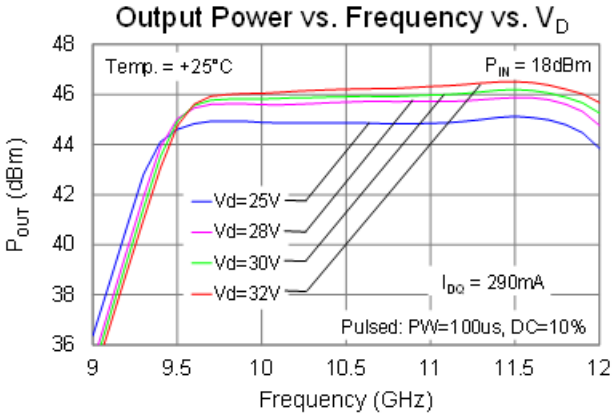
Electrical Specifications

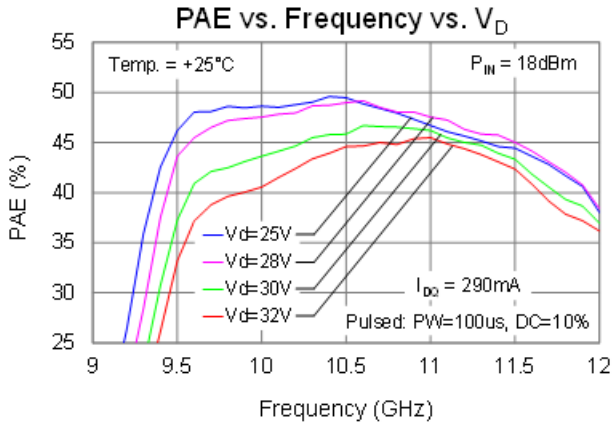
Parameter	Min	Typ	Max	Units
Operational Frequency	10		11	GHz
Small Signal Gain		35		dB
Input Return Loss		15		dB
Output Return Loss		10		dB
Power Gain (Pin = 18dBm)		27.5		dB
Output Power (Pin = 18dBm)		45.5		dBm
Power Added Efficiency (Pin = 18dBm)		47		%
Power @ 1dB Compression (P1dB, Midband)		41		dB
Small Signal Gain Temperature Coefficient		–0.075		dB/°C
Recommended Operating Voltage:	20	28	32	V

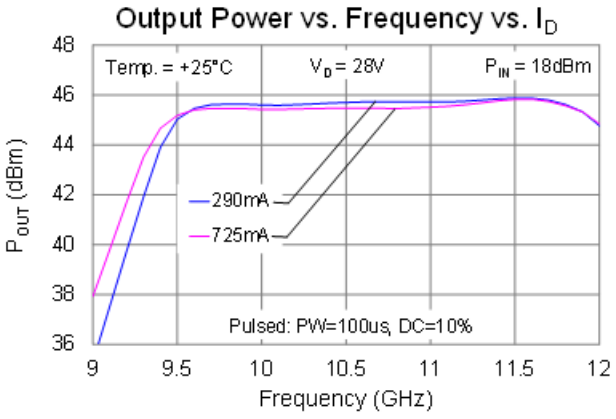
Test conditions unless otherwise noted: 25 °C, V_D = 28 V, I_{DQ} = 290 mA, Pulsed V_D: PW = 100 us, DC = 10%

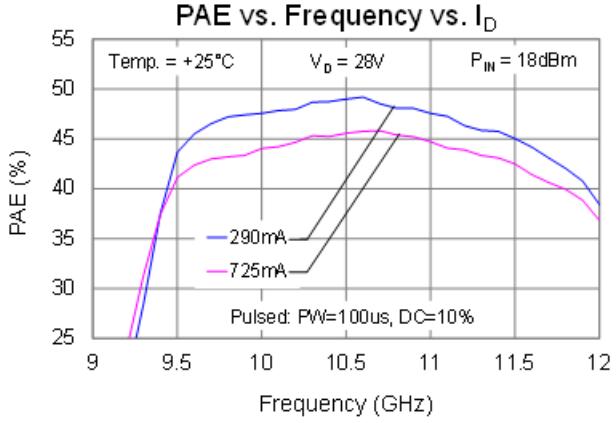
Performance Plots – Large Signal (Pulsed)

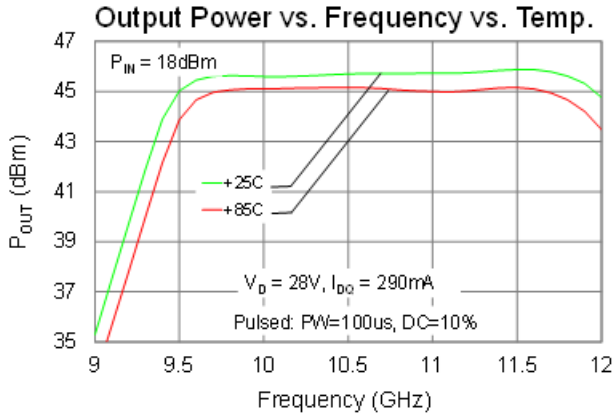
Test conditions unless otherwise noted: 25 °C, V_D = 28 V, I_{DQ} = 290 mA, Pulsed V_D: PW = 100 us, DC = 10%

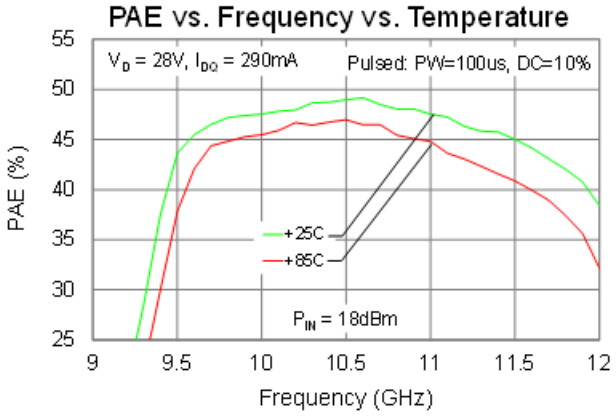






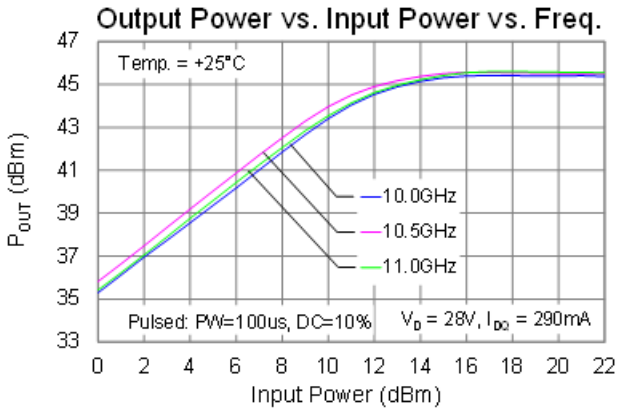


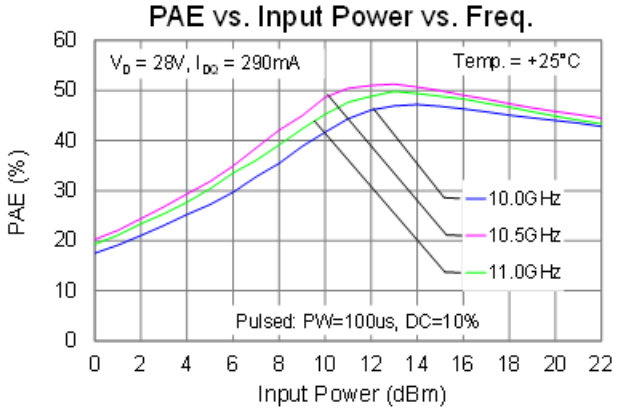


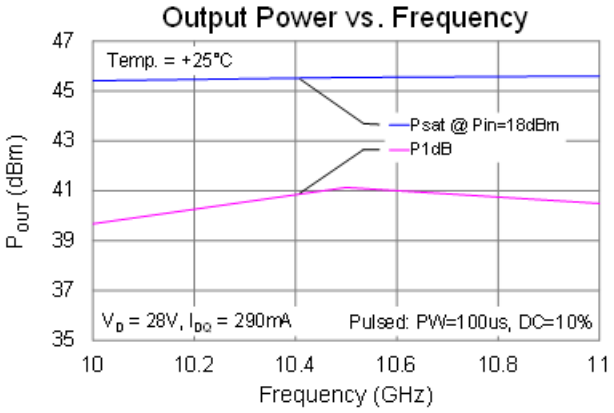


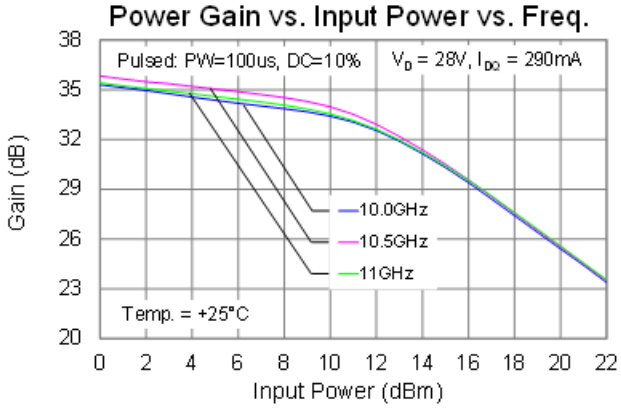
Performance Plots – Large Signal (Pulsed)

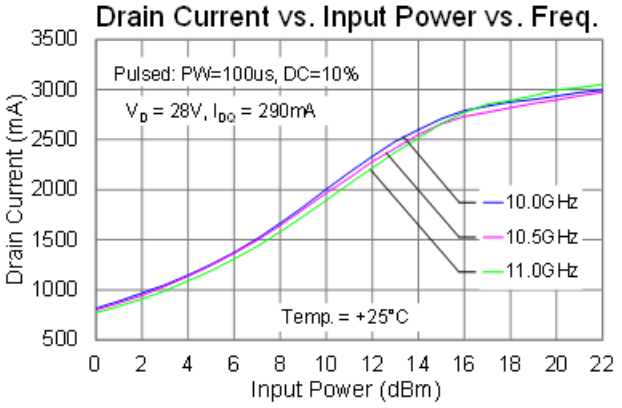
Test conditions unless otherwise noted: 25 °C, V_D = 28 V, I_{DQ} = 290 mA, Pulsed V_D: PW = 100 us, DC = 10%

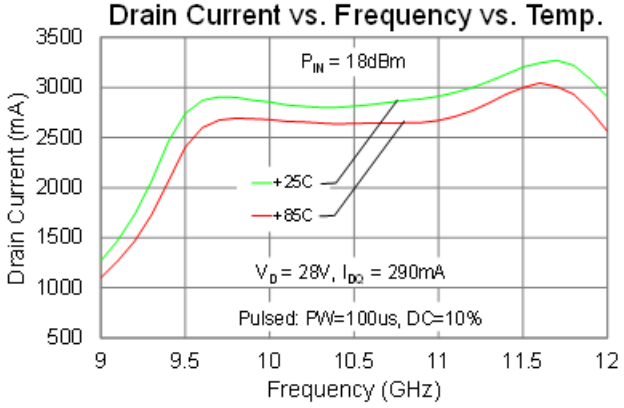






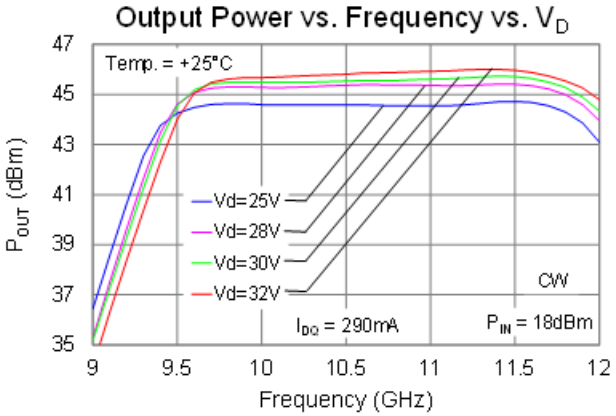


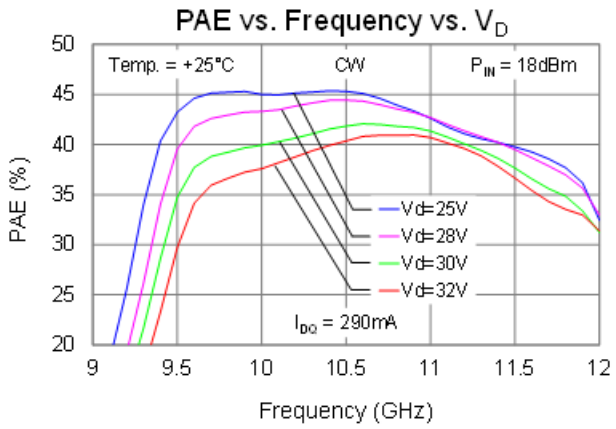


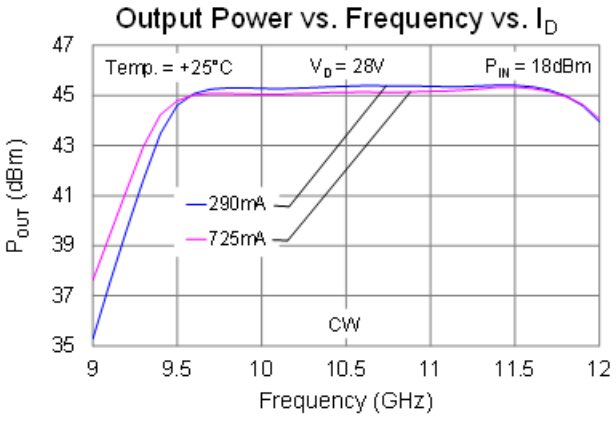


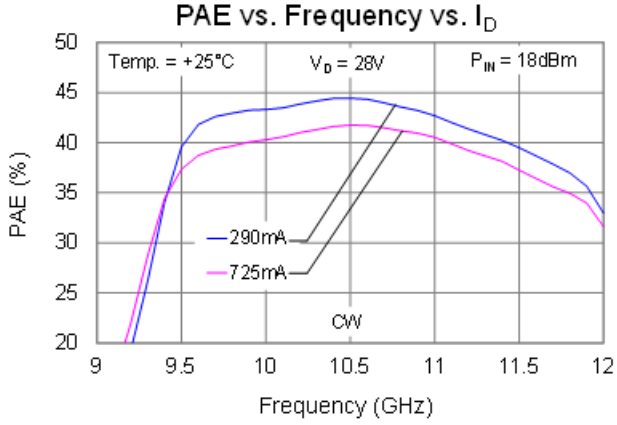
Performance Plots – Large Signal (CW)

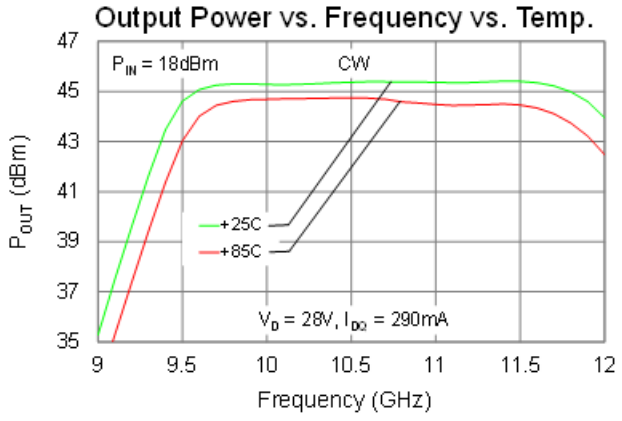
Test conditions unless otherwise noted: 25 °C, V_D = 28 V, I_{DQ} = 290 mA, CW

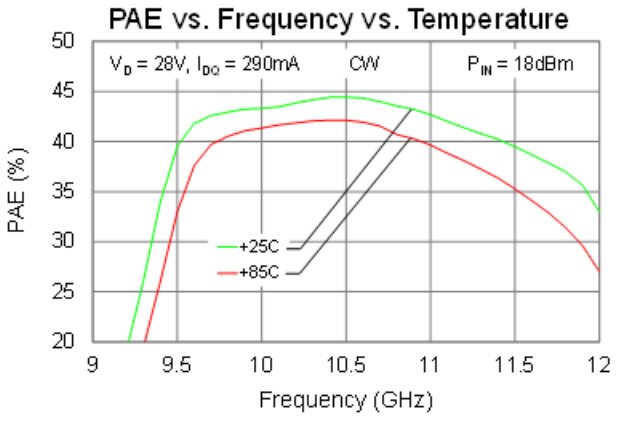






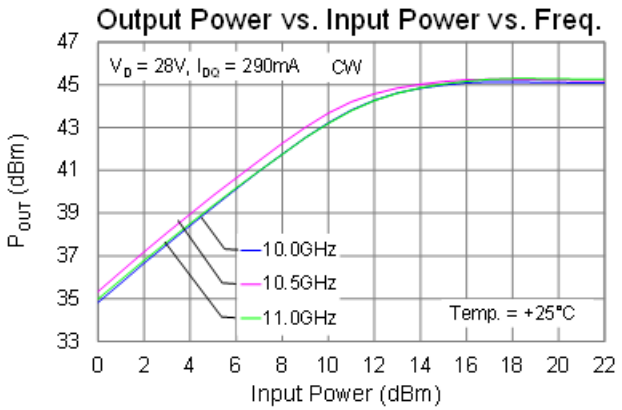


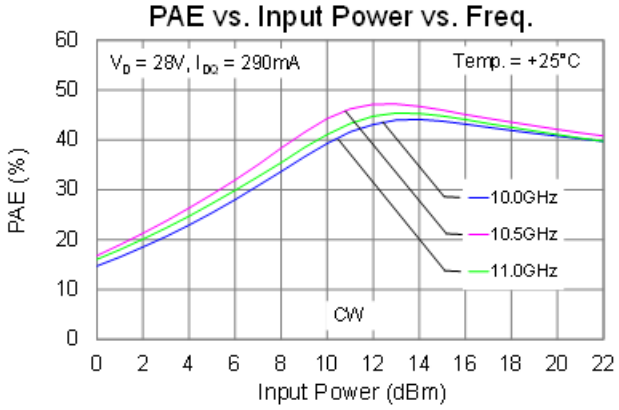


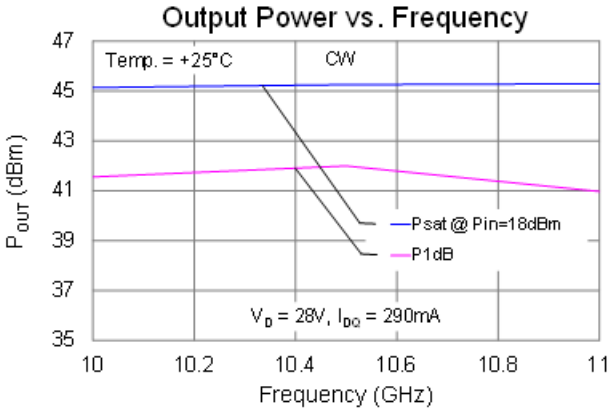


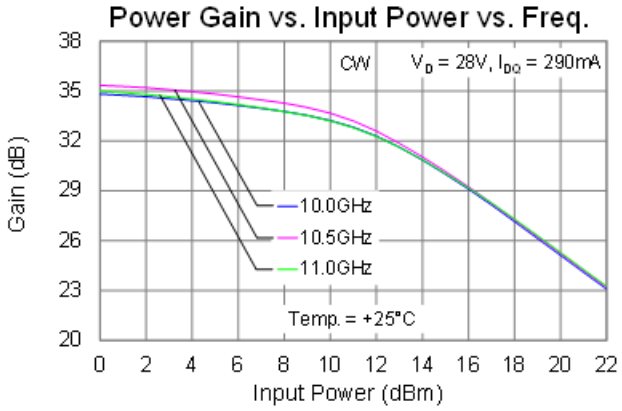
Performance Plots – Large Signal (CW)

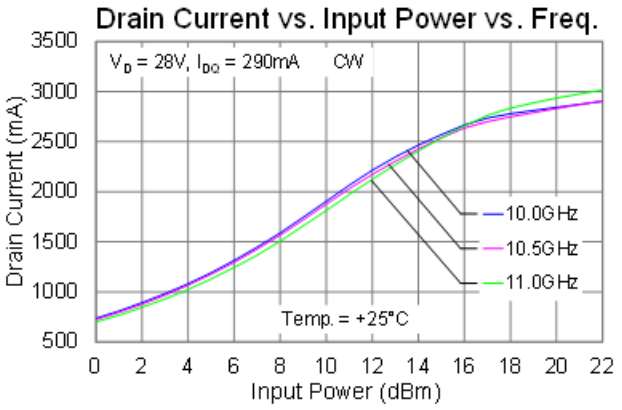
Test conditions unless otherwise noted: 25 °C, V_D = 28 V, I_{DQ} = 290 mA, CW

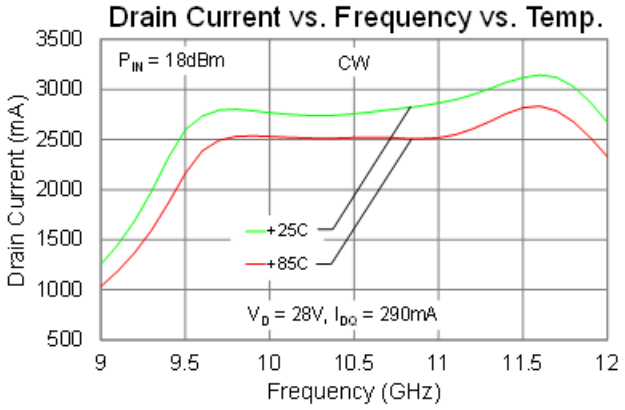






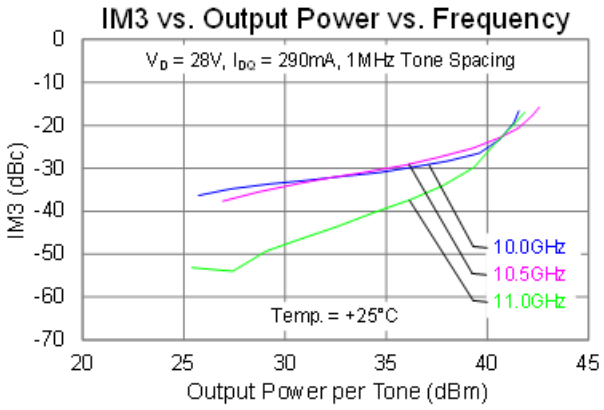


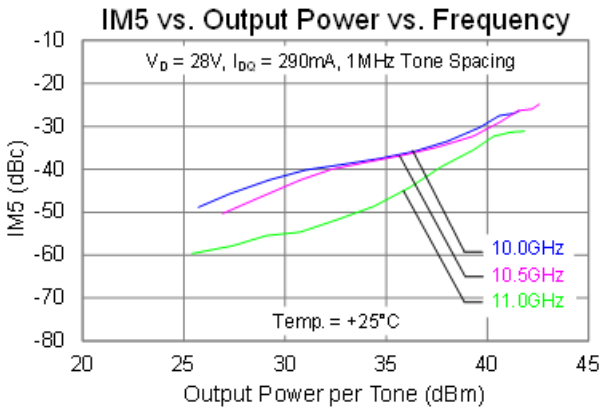


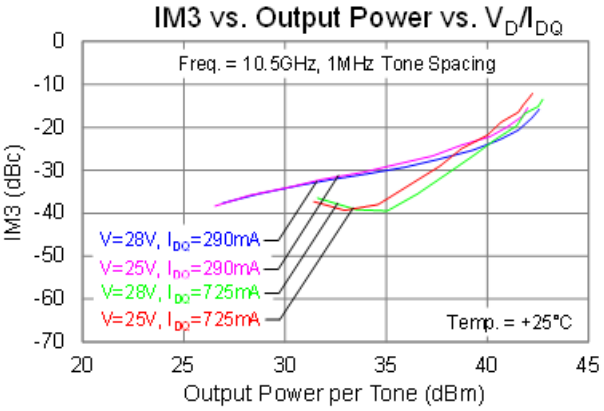


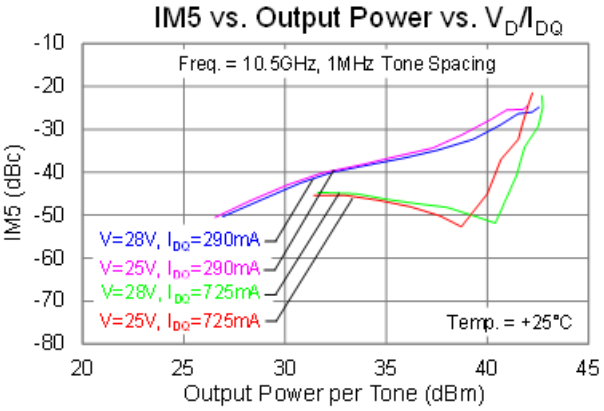
Performance Plots – Linearity

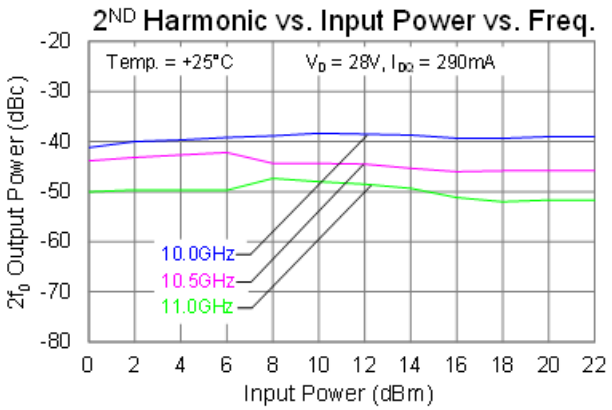
Test conditions unless otherwise noted: 25 °C, V_D = 28 V, I_{DQ} = 290 mA, CW

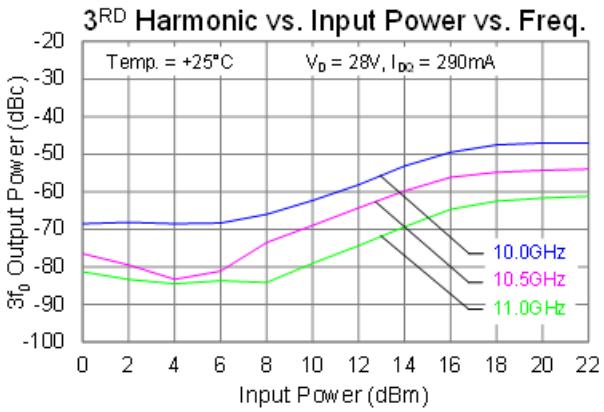






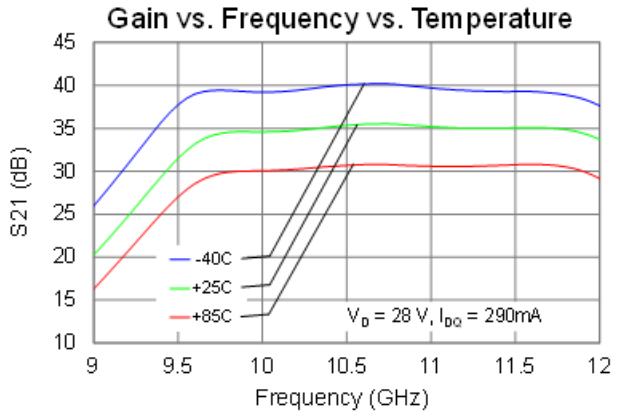


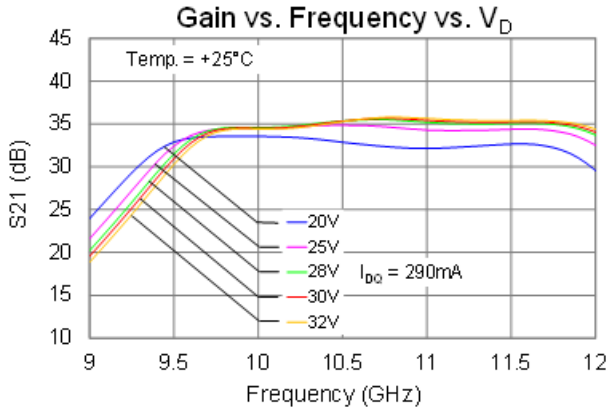


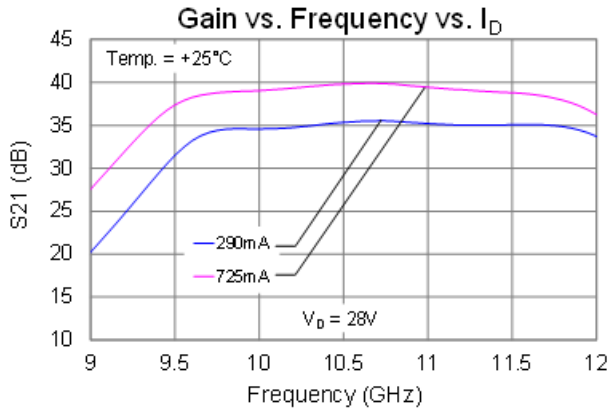


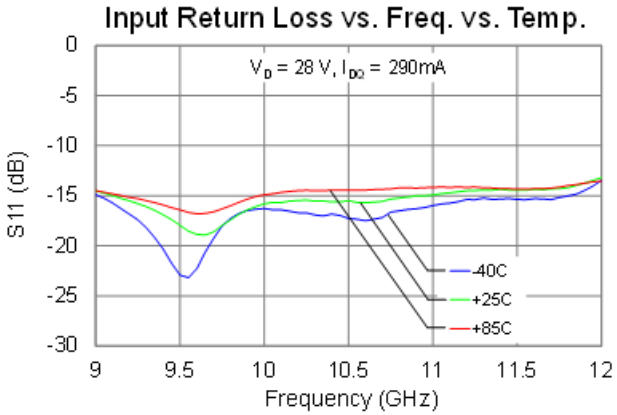
Performance Plots – Small Signal

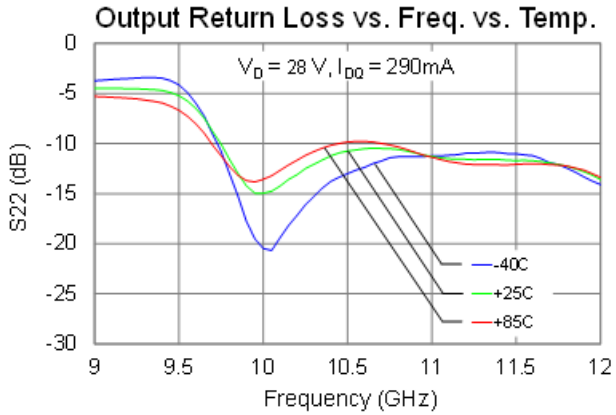
Test conditions unless otherwise noted: 25 °C, V_D = 28 V, I_{DQ} = 290 mA, CW











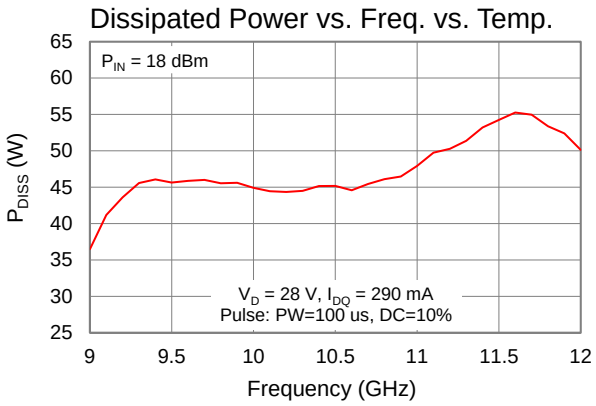
Thermal and Reliability Information

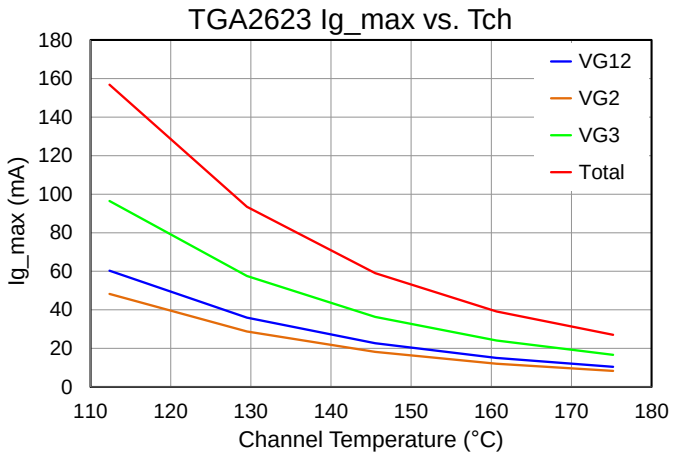
Parameter	Test Conditions	Value	Units
Thermal Resistance (θ_{JC}) (1)	T_{BASE} = 85 °C, Pulsed V_D: PW = 100 us, DC = 10% V_D = 28 V, I_{D_Drive} = 3.00 A, P_{IN} = 22 dBm, P_{OUT} = 45.3 dBm, P_{DISS} = 51 W	0.781	ºC/W
Channel Temperature, T_{CH} (Under RF) (2)		124.8	°C
Thermal Resistance (θ_{JC}) (1)	T_{BASE} = 85 °C, CW, V_D = 28 V, I_{D_Drive} = 2.94 A, P_{IN} = 22 dBm, P_{OUT} = 44.9 dBm, P_{DISS} = 52 W	1.305	ºC/W
Channel Temperature, T_{CH} (Under RF) (2)		152.9	°C

Notes:

1. Thermal resistance determined to the back of 40 mil CuMo carrier plate (T_{BASE} = 85 °C)
2. °IR scan equivalent channel temperature. Refer to the following document: GaN Device Channel Temperature, Thermal Resistance, and Reliability Estimates

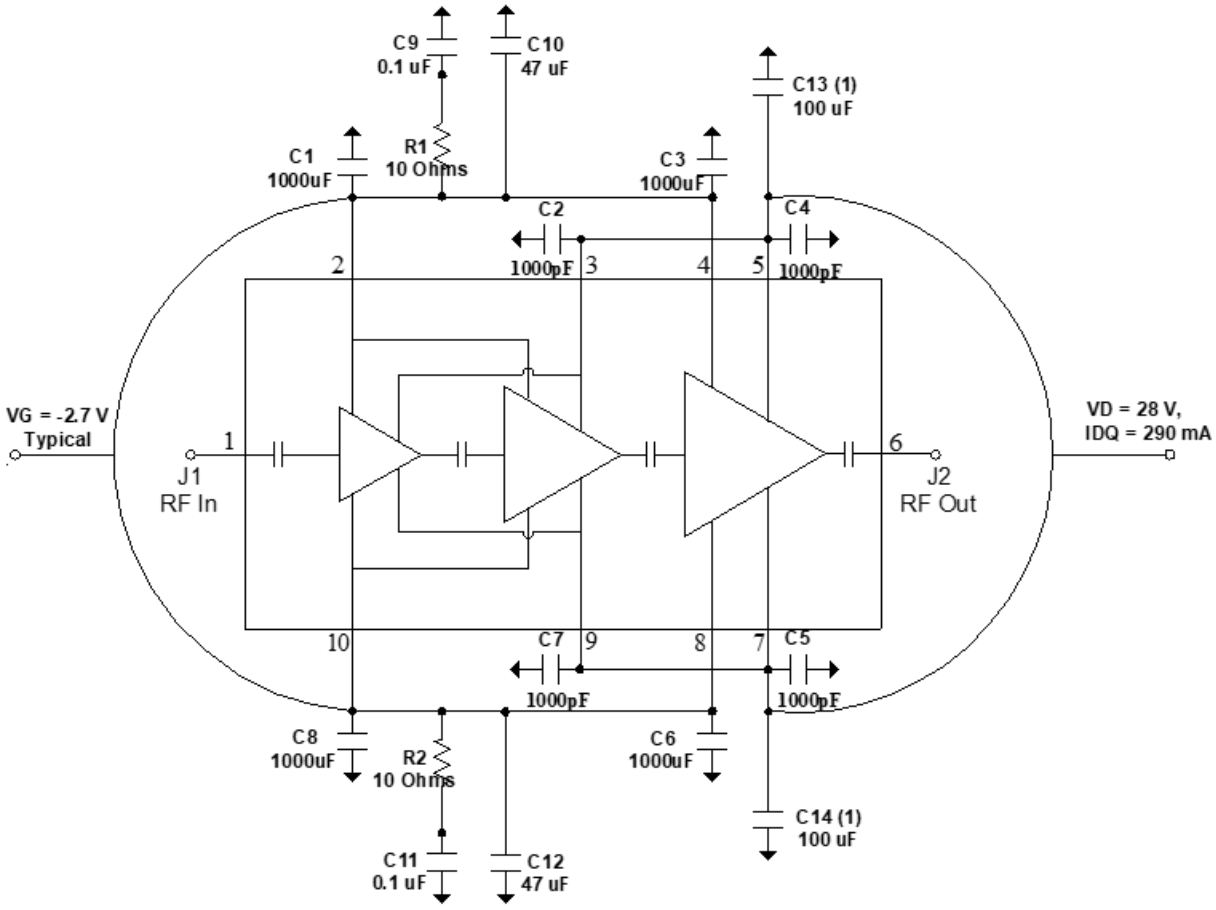
Dissipated Power and Maximum Gate Current





Test conditions unless otherwise noted: 25 °C, V_D = 28 V, I_{DQ} = 290 mA, Pulsed V_D: PW = 100 us, DC = 10%

Applications Information

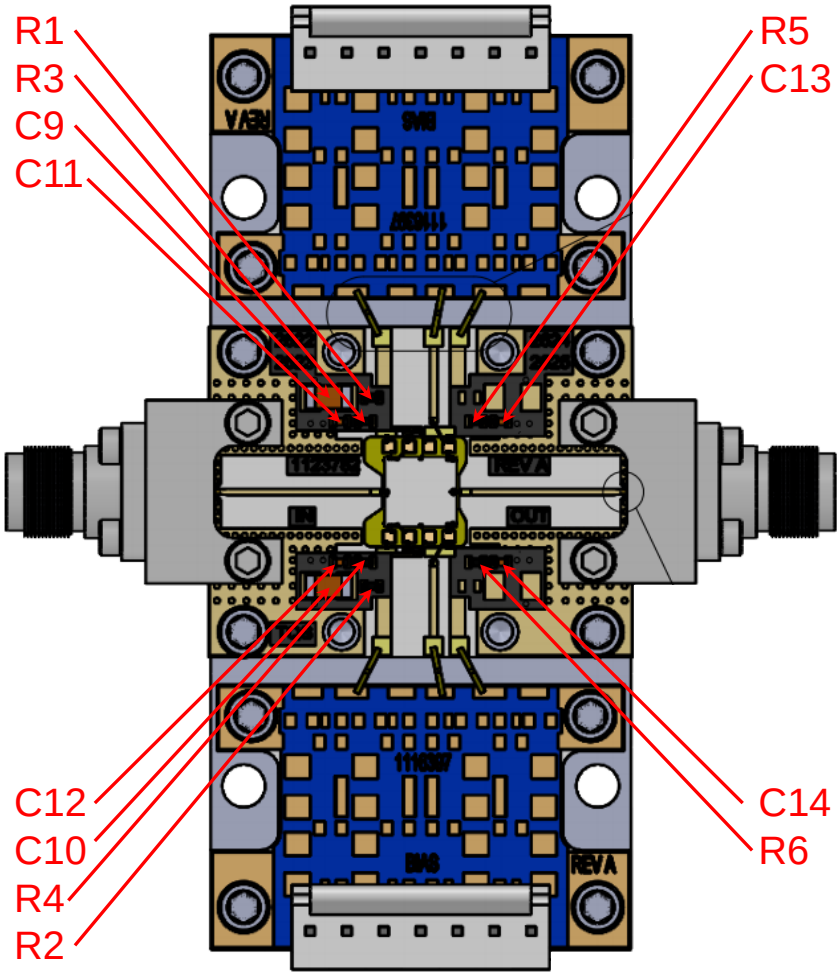


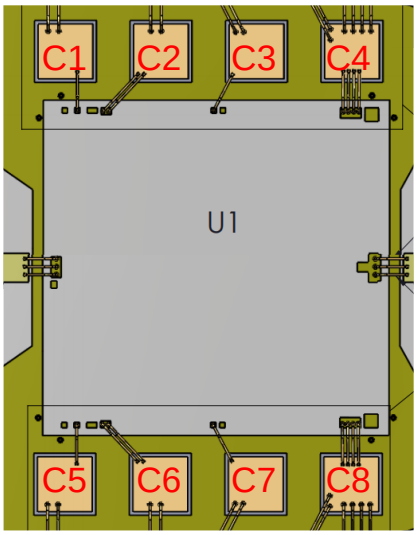
1. Remove caps for pulse operation. These caps are part of the cable harness for CW operation.

Bill of Materials

Reference Des.	Value	Description	Manuf.	Part Number
C1 – C8	1000pF	SLC, 50V	Various	
C9, C11	0.1uF	Cap, 0402, 50V, 10%, X7R	Various	
C10, C12	47uF	Cap, 1206, 50V, 10%, X7R	Various	
R1 – R2	10Ω	Res, 0402	Various	
R3 – R4	0Ω	Res, 0402	Various	

Evaluation Board (EVB) Layout Assembly





Die attach detail

RF PCB is made from Rogers 4003C dielectric, .008 inch thick, 0.5 oz. copper both sides.

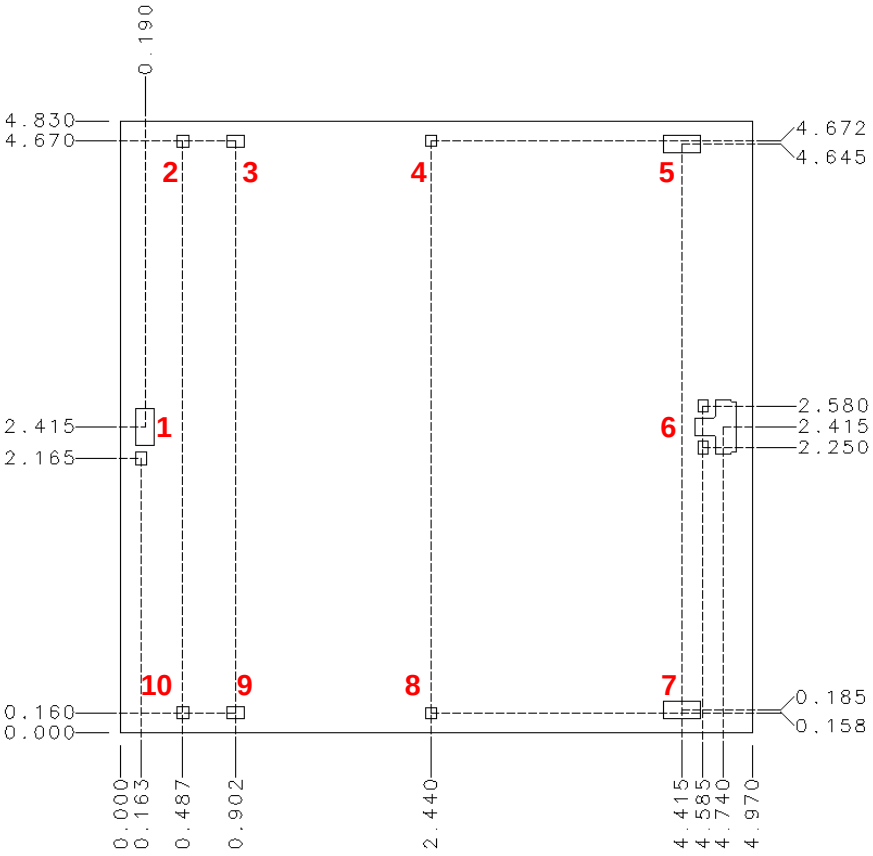
Bias-Up Procedure

1. Set I_D limit to 3.5A, I_G limit to 10mA
2. Set V_G to -5.0V
3. Set V_D +28V
4. Adjust V_G more positive until I_{DQ} = 290mA
5. Apply RF signal

Bias-Down Procedure

1. Turn off RF signal
2. Reduce V_G to −5.0 V. Ensure I_{DQ} ~ 0 mA
4. Set V_D to 0 V
5. Turn off V_D supply
6. Turn off V_G supply

Mechanical Information



Dimensions are in mm
Thickness: 0.100
Die x, y size tolerance: ± 0.008
Ground is backside of die

Bond Pad Description

Pad	Symbol	Size (um x um)	Description
1	RF IN	140 x 290	RF input. 50 Ohms. DC blocked
2	V_{G2}	90 x 90	Gate voltage stage 2. Bypass network required; refer to page 18.
3, 9	V_{D12}	140 x 90	Drain voltage stages 1 & 2. Bypass network required; refer to page 18.
4, 8	V_{G3}	85 x 85	Gate voltage stage 3. Bypass network required; refer to page 18.
5, 7	V_{D3}	290 x 140	Drain voltage stage 3. Bypass network required; refer to page 18.
6	RF OUT	120 x 430	RF output. 50 Ohms. DC blocked.
10	V_{G12}	90 x 90	Gate voltage stages 1 & 2. Bypass network required; refer to page 18.

Assembly Notes

Component placement and adhesive attachment assembly notes:

- Vacuum pencils and/or vacuum collets are the preferred method of pick up.
- Air bridges must be avoided during placement.
- The force impact is critical during auto placement.

Reflow process assembly notes:

- Use AuSn (80/20) solder and limit exposure to temperatures above 300 °C to 3 – 4 minutes, maximum.
- An alloy station or conveyor furnace with reducing atmosphere should be used.
- Do not use any kind of flux.
- Coefficient of thermal expansion matching is critical for long-term reliability.
- Devices must be stored in a dry nitrogen atmosphere.

Interconnect process assembly notes:

- Thermosonic ball bonding is the preferred interconnect technique.
- Force, time, and ultrasonic are critical parameters.
- Aluminum wire should not be used.
- Devices with small pad sizes should be bonded with 0.0007-inch wire.