

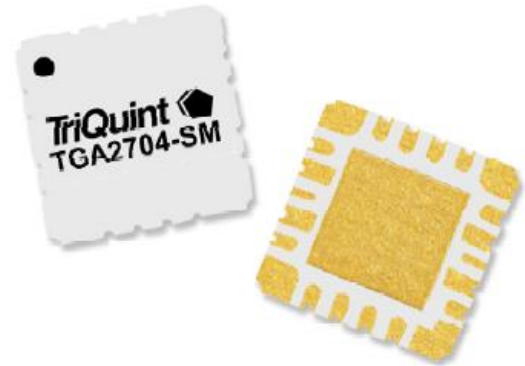
## Product Overview

Qorvo's TGA2704-SM is a high power amplifier package fabricated on Qorvo's production 0.25um pHEMT GaAs process. The TGA2704-SM operates from 9–11 GHz, provides 7 W of saturated output power with 21 dB of small signal gain and 40% power-added efficiency.

The TGA2704-SM features a ceramic QFN de-signed for surface mount to a printed circuit board.

Fully matched to 50 Ohms and with integrated DC blocking capacitors on both I/O ports, the TGA2704-SM is ideally suited to support both commercial and defense related applications.

Lead-free and RoHS compliant.



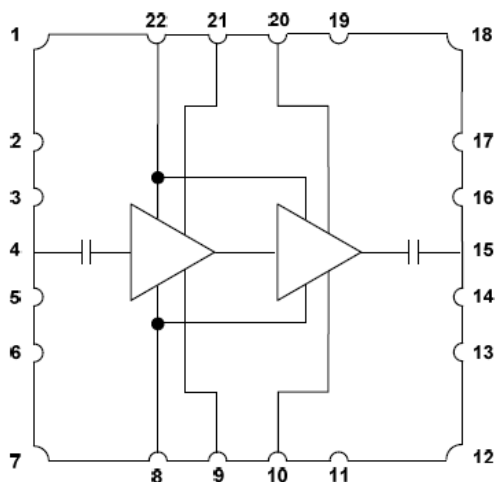
QFN 7 x 7 x 1.27 mm Air Cavity Laminate Package

## Key Features

- Frequency Range: 9 – 11 GHz
- $P_{SAT}$  ( $P_{IN}=22$  dBm): 38.5 dBm
- PAE ( $P_{IN}=22$  dBm): 40 %
- Small Signal Gain: 21 dB
- Bias:  $V_{D1} = 9$  V,  $I_{D1} = 1.05$  A,  $V_G = -0.7$ V typical
- Package Dimensions: 7.0 x 7.0 x 1.27 mm

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

## Functional Block Diagram



## Applications

- Point-to-Point Radio
- Satellite Communications
- Radar, Traffic Control
- Weather Monitoring
- Port Security

## Ordering Information

Part No.	Description
TGA2704-SM	9 – 11 GHz 7 W GaAs PA
TGA2704-SMEVB	Evaluation Board

## Absolute Maximum Ratings

Parameter	Rating
Drain Voltage ( $V_D$ )	10 V
Gate Voltage Range ( $V_G$ )	-1.2 to +0.5 V
Drain Current ( $I_D$ )	3.85 A
Gate Current ( $I_G$ )	-14 to +126 mA
RF Input Power, CW, 50 $\Omega$ , T=25 °C	23 dBm
Channel Temperature ( $T_{CH}$ )	200 °C
Storage Temperature	-55 to +150 °C
Mounting Temperature (30 seconds)	260 °C

Exceeding any one or a combination of the Absolute Maximum Rating conditions may cause permanent damage to the device. Extended application of Absolute Maximum Rating conditions to the device may reduce device reliability.

## Recommended Operating Conditions

Parameter	Min	Typ	Max	Units
Drain Voltage ( $V_D$ )		9		V
Drain Current, Quiescent ( $I_{DQ}$ )		1.05		A
Drain Current, RF ( $I_{D\_Drive}$ )	See chart page 4, 6			mA
Gate Voltage Typ. Range ( $V_G$ )	-0.3 to -0.9			V
Gate Current, RF ( $I_{G\_Drive}$ )		1.5		mA
Operating Temp. Range	-40	+25	+85	°C

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

## Electrical Specifications

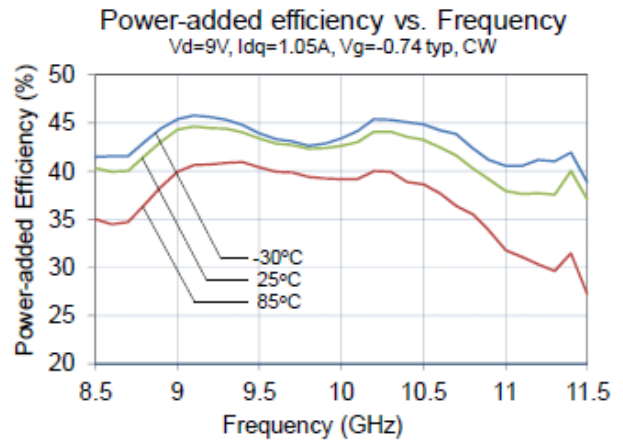
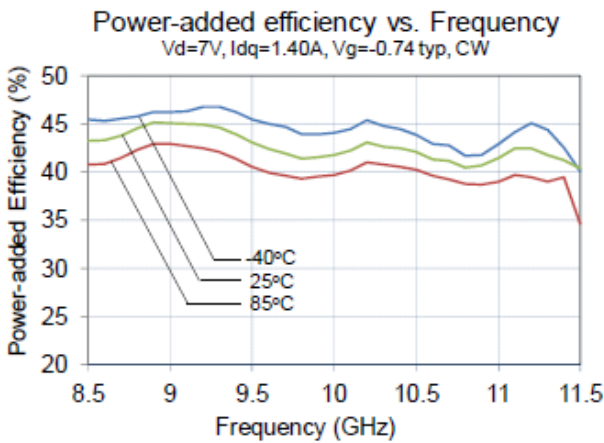
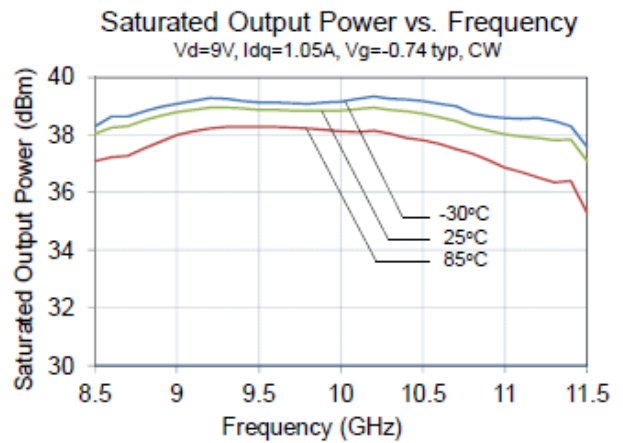
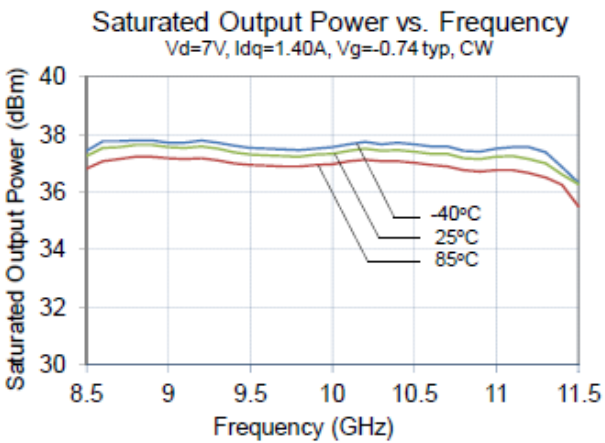
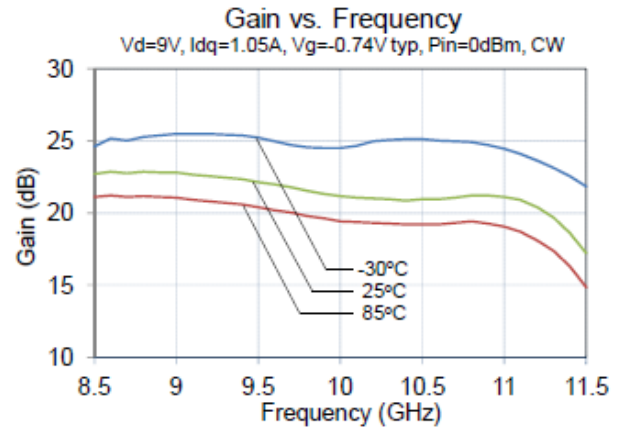
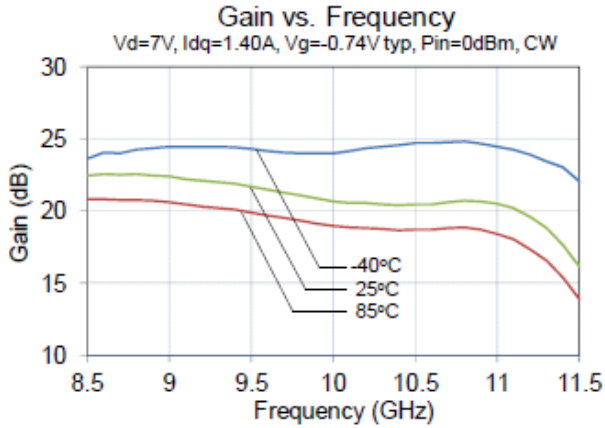
Parameter	Conditions <sup>(1)</sup> <sup>(2)</sup>	Min	Typ.	Max	Units
Operational Frequency Range	Unless Otherwise	9		11	GHz
Output Power at Saturation, $P_{SAT}$	$P_{IN} = +22$ dBm		38.5		dBm
Output Power at 1dB compression, $P_{1dB}$	$P_{IN} = +16$ to +17 dBm range		37.5		dBm
Power Added Efficiency, PAE	$P_{IN} = +22$ dBm		40		%
Small Signal Gain, $S_{21}$			21		dB
Input Return Loss, IRL			10		dB
Output Return Loss, ORL			13		dB
$P_{SAT}$ Temperature Coefficient	$T_{diff} = (85 - (-40))$ °C, $P_{in} = +22$ dBm		-0.011		dBm/°C

Notes:

1. Test conditions unless otherwise noted: CW,  $V_D = 9V$ ,  $I_D = 1.05$  A, adjusting  $V_G$  (typical -0.7V),  $T_{BASE} = +25$  °C,  $Z_0 = 50$   $\Omega$
2.  $T_{BASE}$  is back side of package

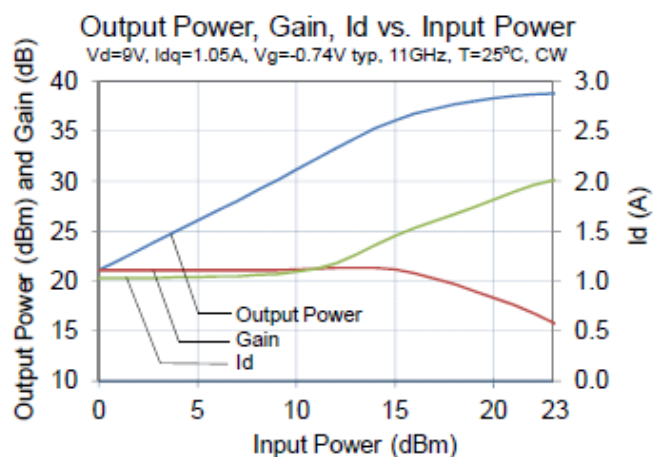
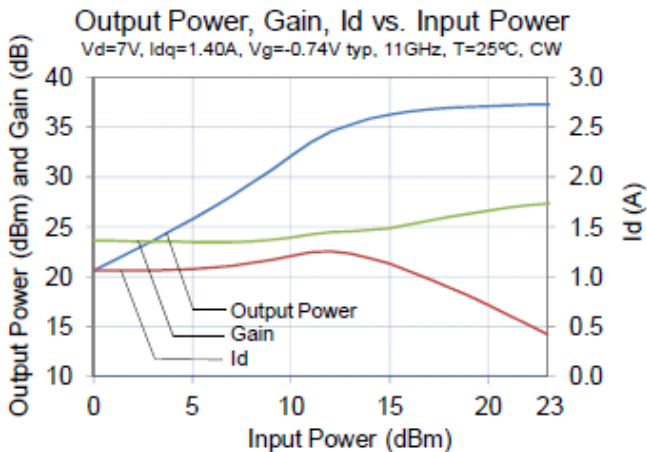
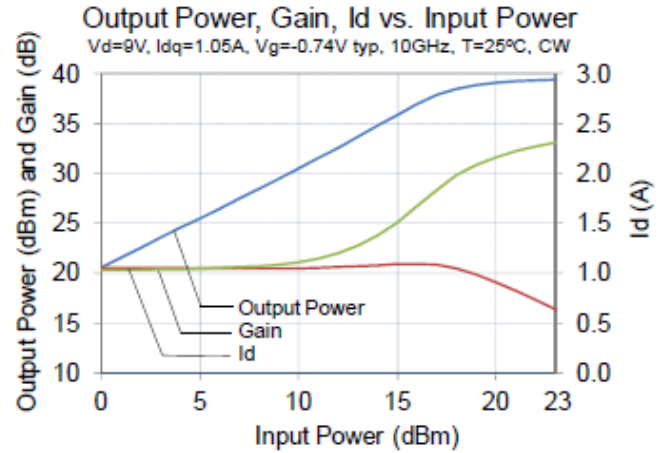
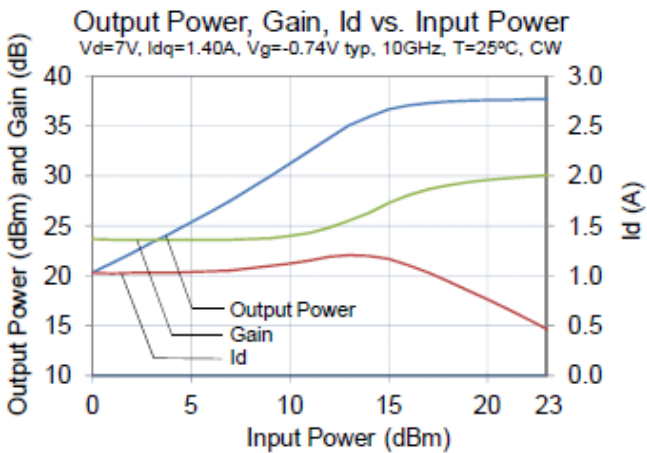
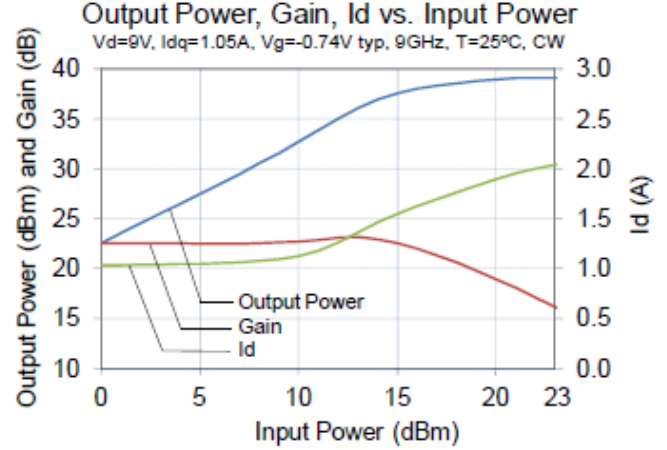
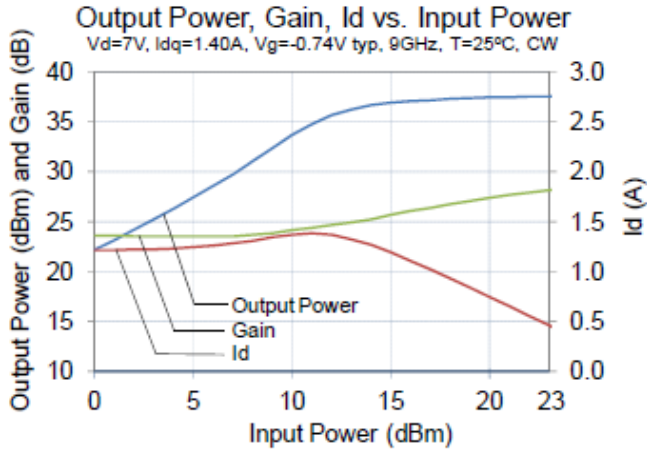
Performance Plots

Test conditions unless otherwise noted: CW,  $V_D/I_D = 7V/1.4A$  vs.  $9V/1.05A$ , adjusting  $V_G$  (typical  $-0.7V$ ),  $P_{IN} = +22dBm$ ,  $T_{BASE} = +25^\circ C$ ,  $Z_0 = 50 \Omega$



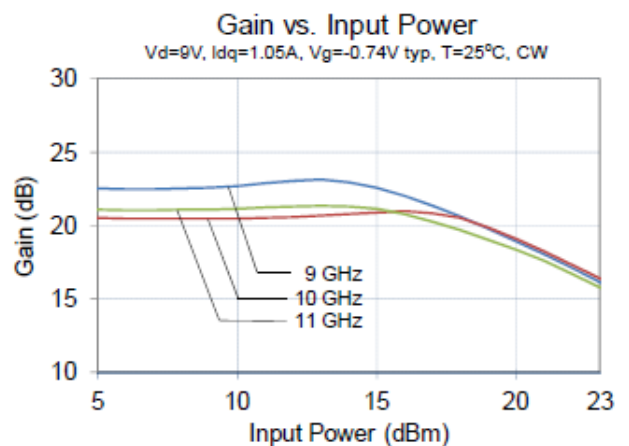
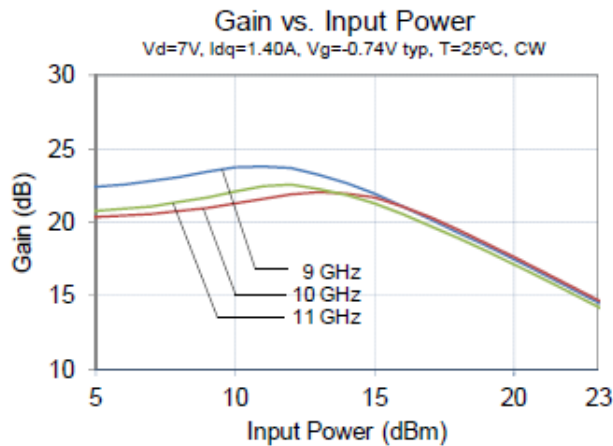
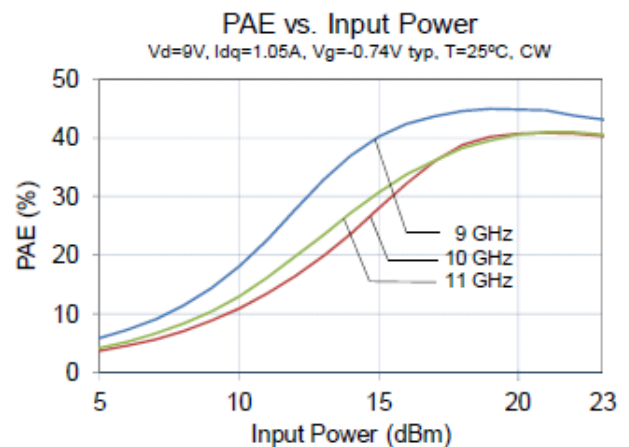
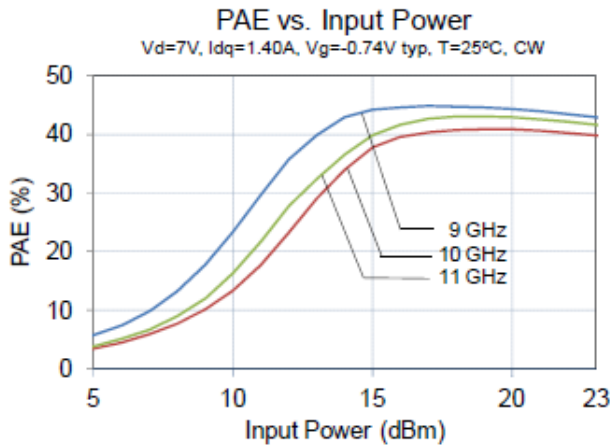
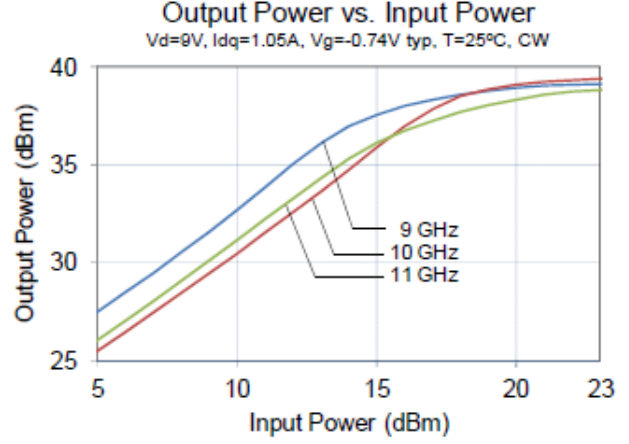
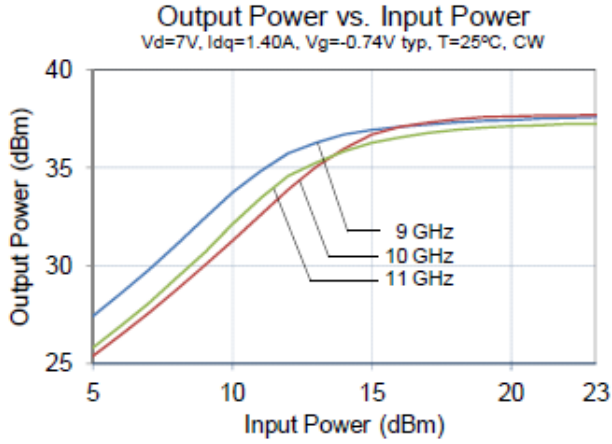
Performance Plots

Test conditions unless otherwise noted: CW,  $V_D/I_D = 7V/1.4A$  vs.  $9V/1.05A$ , adjusting  $V_G$  (typical  $-0.7V$ ),  $P_{IN} = +22dBm$ ,  $T_{BASE} = +25^\circ C$ ,  $Z_0 = 50 \Omega$



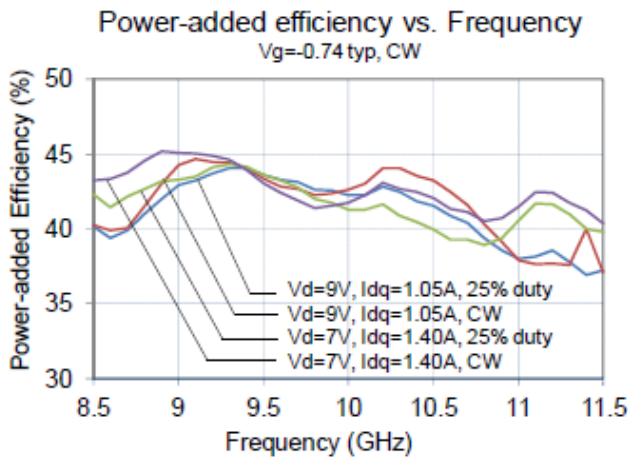
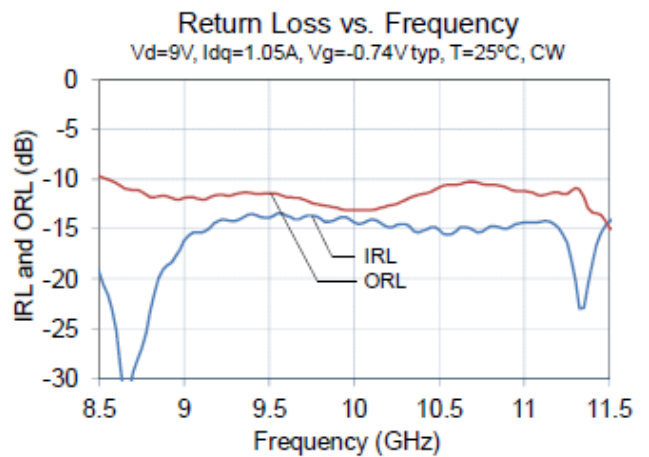
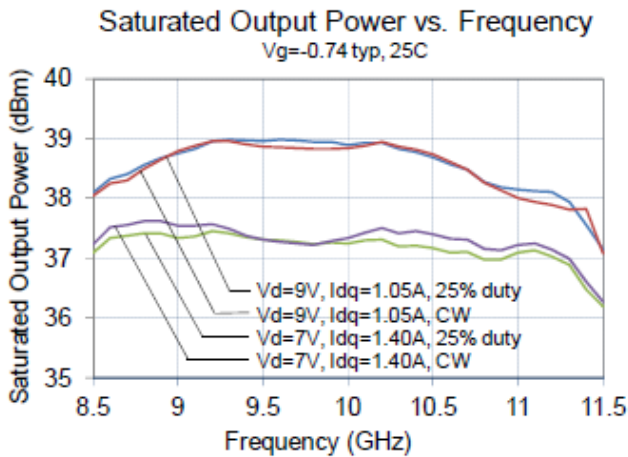
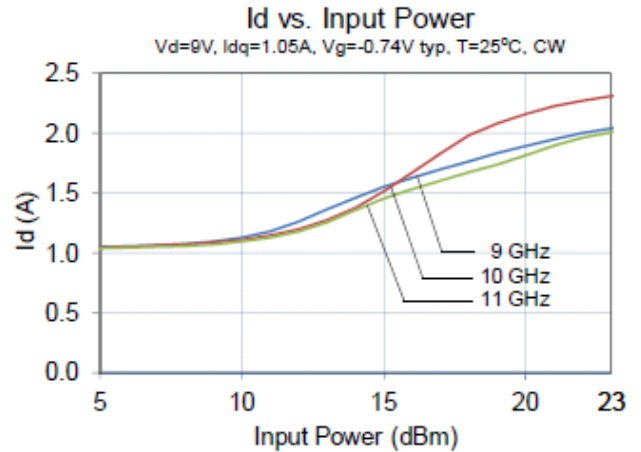
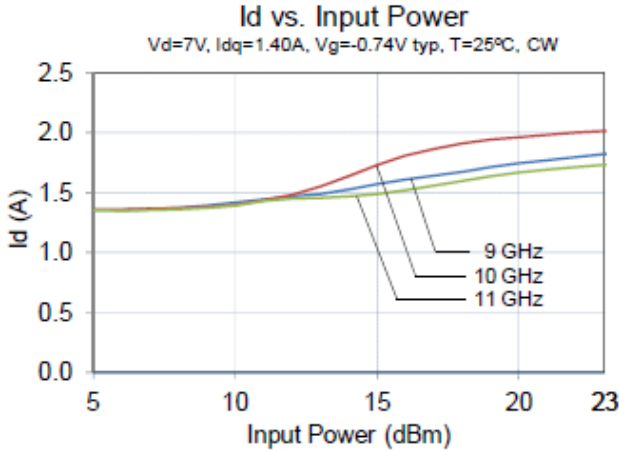
Performance Plots

Test conditions unless otherwise noted: CW,  $V_D/I_D = 7V/1.4A$  vs.  $9V/1.05A$ , adjusting  $V_G$  (typical  $-0.7V$ ),  $P_{IN} = +22dBm$ ,  $T_{BASE} = +25^\circ C$ ,  $Z_0 = 50 \Omega$



Performance Plots

Test conditions unless otherwise noted: CW,  $V_D/I_D = 7V/1.4A$  vs.  $9V/1.05A$ , adjusting  $V_G$  (typical  $-0.7V$ ),  $P_{IN} = +22dBm$ ,  $T_{BASE} = +25^\circ C$ ,  $Z_0 = 50 \Omega$



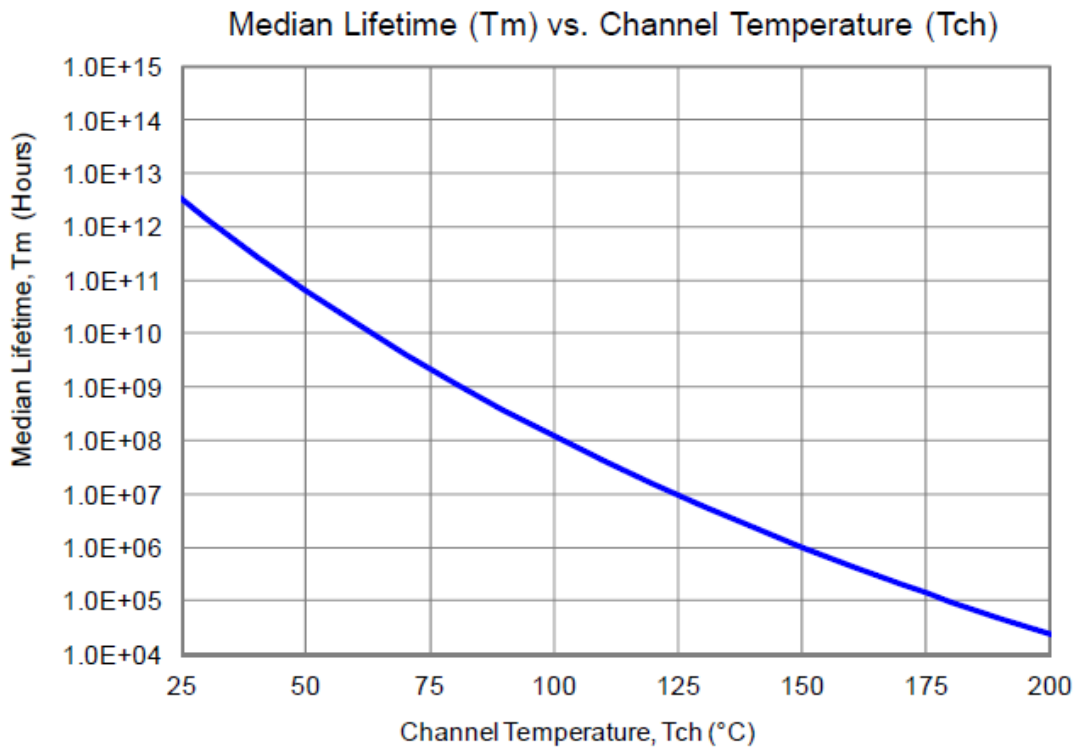


## Thermal and Reliability Information

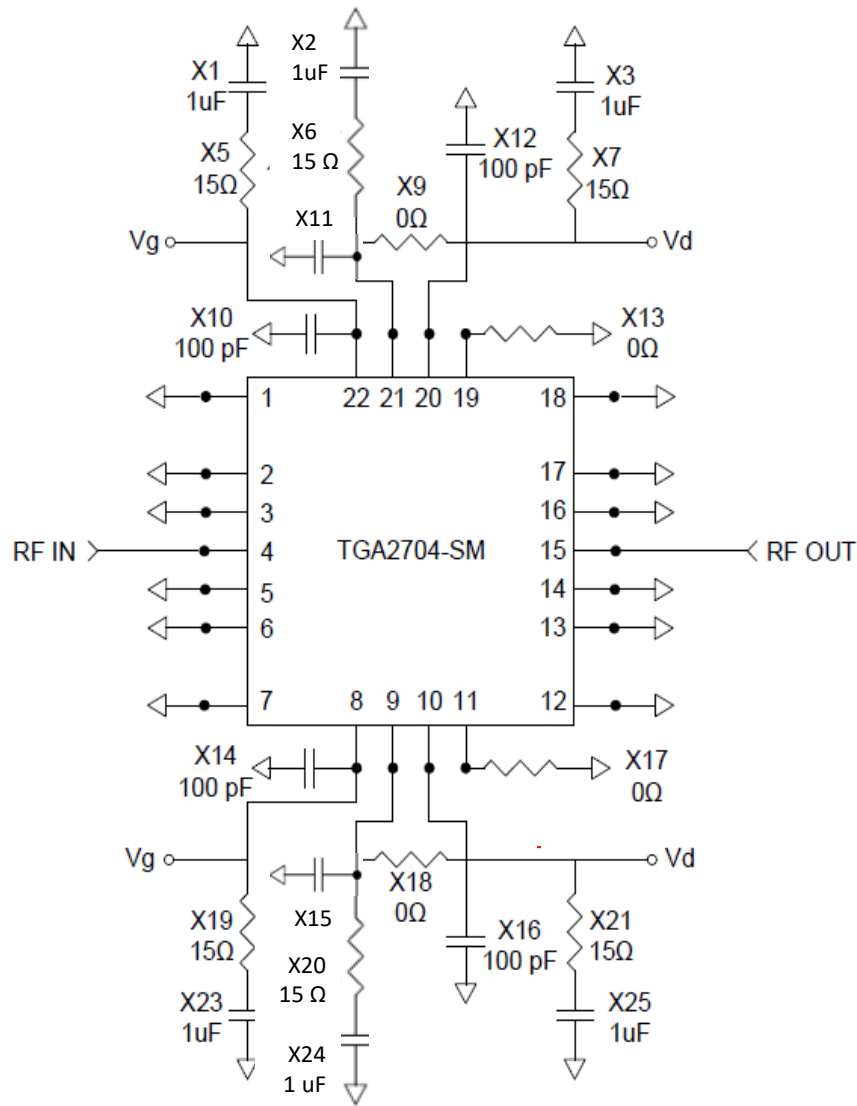
Parameter	Test Conditions <sup>1/</sup>	Value	Units
Thermal Resistance, $\theta_{JC}$	$T_{BASE} = 85\text{ }^{\circ}\text{C}$ , CW, $V_D = 7\text{ V}$ , $I_{DQ} = 1.4\text{ A}$ , no $P_{IN}$ , $P_{DISS} = 9.8\text{ W}$	7.8	$^{\circ}\text{C/W}$
Channel Temperature, $T_{CH}$		161	$^{\circ}\text{C}$
Median Lifetime, $T_M$		4.1E+5	Hrs
Thermal Resistance, $\theta_{JC}$	$T_{BASE} = 85\text{ }^{\circ}\text{C}$ , CW, $V_D = 7\text{ V}$ , $I_{DQ} = 1.4\text{ A}$ , $I_{D\_Drive} = 1.93\text{ A}$ , $P_{OUT} = 37.3\text{ dBm}$ , $P_{DISS} = 8.1\text{ W}$	6.4	$^{\circ}\text{C/W}$
Channel Temperature, $T_{CH}$		137	$^{\circ}\text{C}$
Median Lifetime, $T_M$		3.1E+6	Hrs
Thermal Resistance, $\theta_{JC}$	$T_{BASE} = 85\text{ }^{\circ}\text{C}$ , CW, $V_D = 9\text{ V}$ , $I_{DQ} = 1.05\text{ A}$ , no $P_{IN}$ , $P_{DISS} = 9.5\text{ W}$	7.5	$^{\circ}\text{C/W}$
Channel Temperature, $T_{CH}$		156	$^{\circ}\text{C}$
Median Lifetime, $T_M$		6.1E+5	Hrs
Thermal Resistance, $\theta_{JC}$	$T_{BASE} = 85\text{ }^{\circ}\text{C}$ , CW, $V_D = 9\text{ V}$ , $I_{DQ} = 1.05\text{ A}$ , $I_{D\_Drive} = 2.11\text{ A}$ , $P_{OUT} = 38.9\text{ dBm}$ , $P_{DISS} = 11.2\text{ W}$	6.3	$^{\circ}\text{C/W}$
Channel Temperature, $T_{CH}$		156	$^{\circ}\text{C}$
Median Lifetime, $T_M$		6.1E+5	Hrs

**Notes:**

- Thermal resistance determined to the back of package  $T_{BASE}$



**Recommended Application Circuit**



**Notes:**

1. Tied all V<sub>D</sub>'s together; tied all V<sub>G</sub>'s together

**Bias Up Procedure**

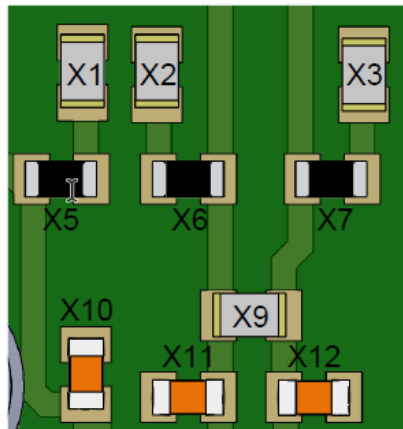
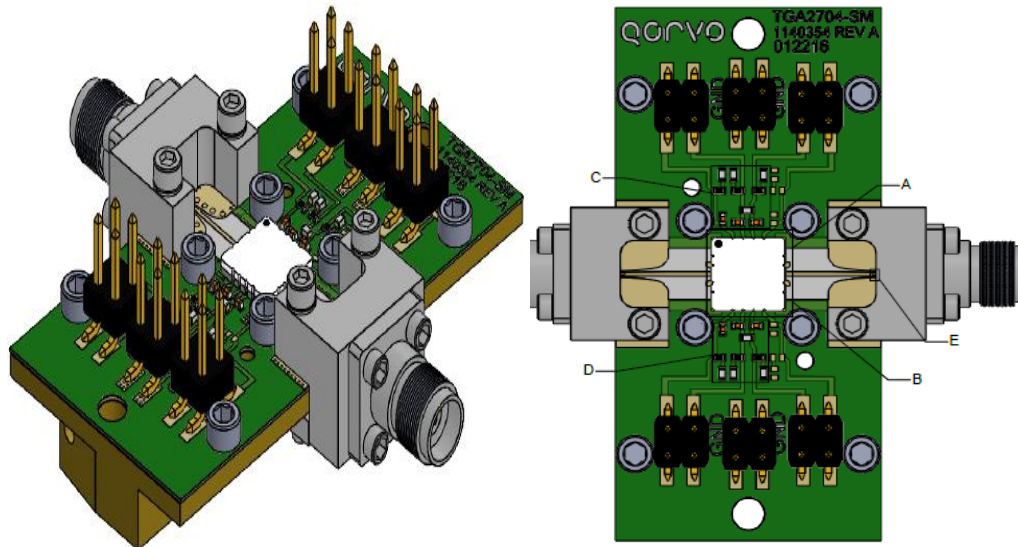
1. Set I<sub>D</sub> limit to 3.2 A, I<sub>G</sub> limit to 10 mA
2. Apply -1.1 V to V<sub>G</sub>
3. Apply +9 V to V<sub>D</sub>; ensure I<sub>DQ</sub> is approx. 0 mA
4. Adjust V<sub>G</sub> until I<sub>DQ</sub> = 1.05 A (V<sub>G</sub> ~ -2.7 V +/- Typ.)
5. Turn on RF supply

**Bias Down Procedure**

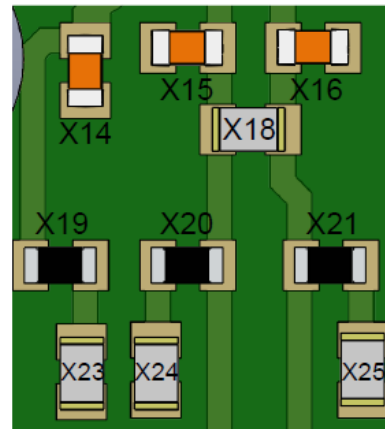
1. Turn off RF supply
2. Reduce V<sub>G</sub> to -1.1 V; ensure I<sub>DQ</sub> is approx. 0 mA
3. Set V<sub>D</sub> to 0 V
4. Turn off V<sub>D</sub> supply
5. Turn off V<sub>G</sub> supply



## Application Evaluation Board (EVB)



DETAIL C



DETAIL D

Notes:

1. Board Material is RO4003 0.008" thickness with ½ oz. copper cladding
2. Vias under the ground paddle are copper filled.

## Bill of Materials

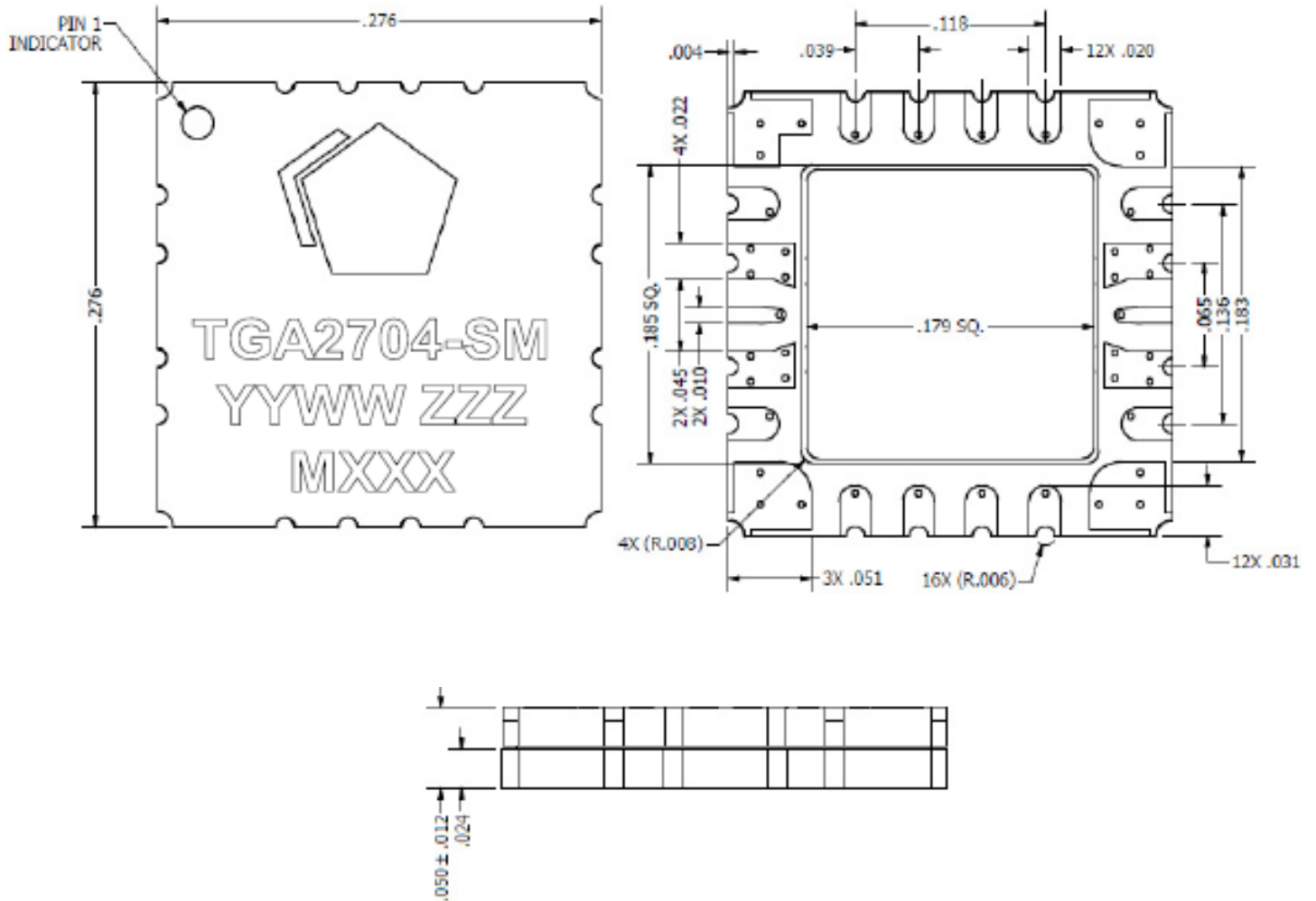
Reference Des.	Value	Description	Manuf.	Part Number
X1 – X3, X23 – X25	1 uF	CAP, 1uF, ±20%, 16V, X5R, 0402	Qorvo	
X10 – X12, X14 – X16	100 pF	CAP, 100pF, ±10%, 50V, X7R, 0402	Various	
X5 – X7, X19 – X21	15 Ω	RES, 15 ohm, 1/10W, ±5%, 0402	Various	
X9, X18	0 Ω	RES, 0 ohm, Jumper, 1/10W, ±1%, 0402	Various	

Pin Description



Pad No.	Label	Description
1 – 3, 5 – 7, 12 – 14, 16 – 18	GND	Ground. Must be grounded on PCB
11, 19	GND	Ground. Recommended to ground on PCB
4	RF <sub>IN</sub>	RF input, matched to 50Ω, DC blocked
8	V <sub>G</sub>	Gate voltage. External bypassing required; refer to page 8 for recommendation
9	V <sub>D1</sub>	Drain 1 voltage. External bypassing required; refer to page 8 for recommendation
10	V <sub>D2</sub>	Drain 2 voltage. External bypassing required; refer to page 8 for recommendation
15	RF <sub>OUT</sub>	RF output, matched to 50Ω, DC blocked
20	V <sub>D2</sub>	Drain 2 voltage. External bypassing required; refer to page 8 for recommendation
21	V <sub>D1</sub>	Drain 1 voltage. External bypassing required; refer to page 8 for recommendation
22	V <sub>G</sub>	Gate voltage. External bypassing required; refer to page 8 for recommendation
	GND	Backside paddle. Multiple conductive filled vias should be employed to minimize inductance and thermal resistance; see Mounting Configuration on page 12 for suggested footprint.

Mechanical Dimensions and Marking

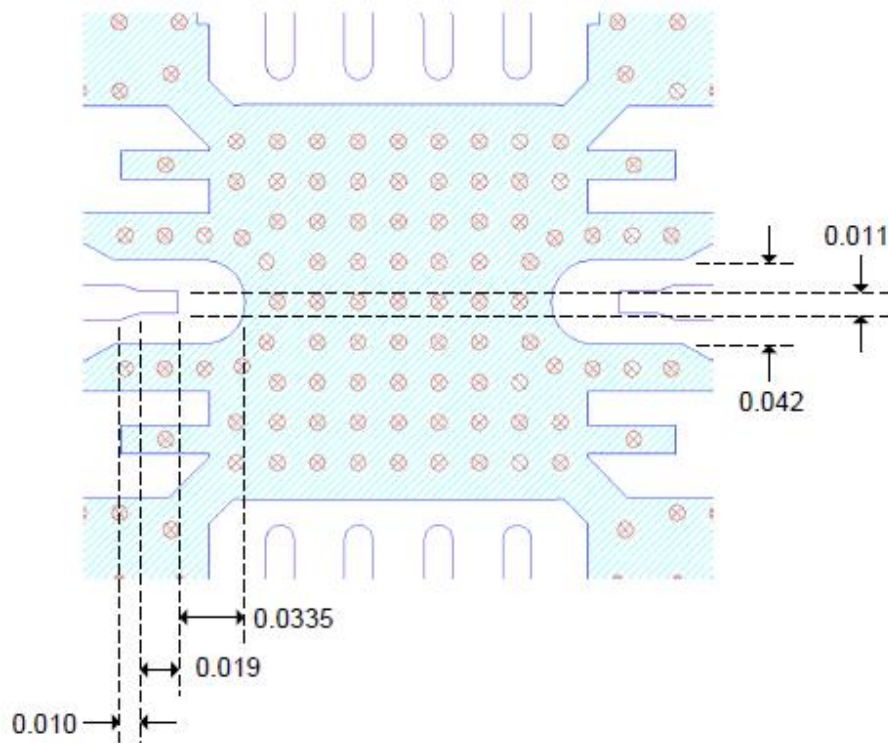


All dimensions in inches and are +/- 0.006 in unless otherwise noted.

Marking:

- YYWW assembly lot start year YY, week WW
- ZZZ part serial number
- MXXX batch ID

PCB Mounting Pattern



Notes:

1. All dimensions are in inches. Angles are in degrees.
2. Ground vias are critical for the proper performance of this device. Vias should use a 0.008 in diameter drill
3. For best thermal performance, vias under the ground paddle should be copper filled.
4. The pad pattern shown has been developed and tested for optimized assembly at Qorvo. The PCB land pattern has been developed to accommodate lead and package tolerances. Since surface mount processes vary from company to company, careful process development is recommended

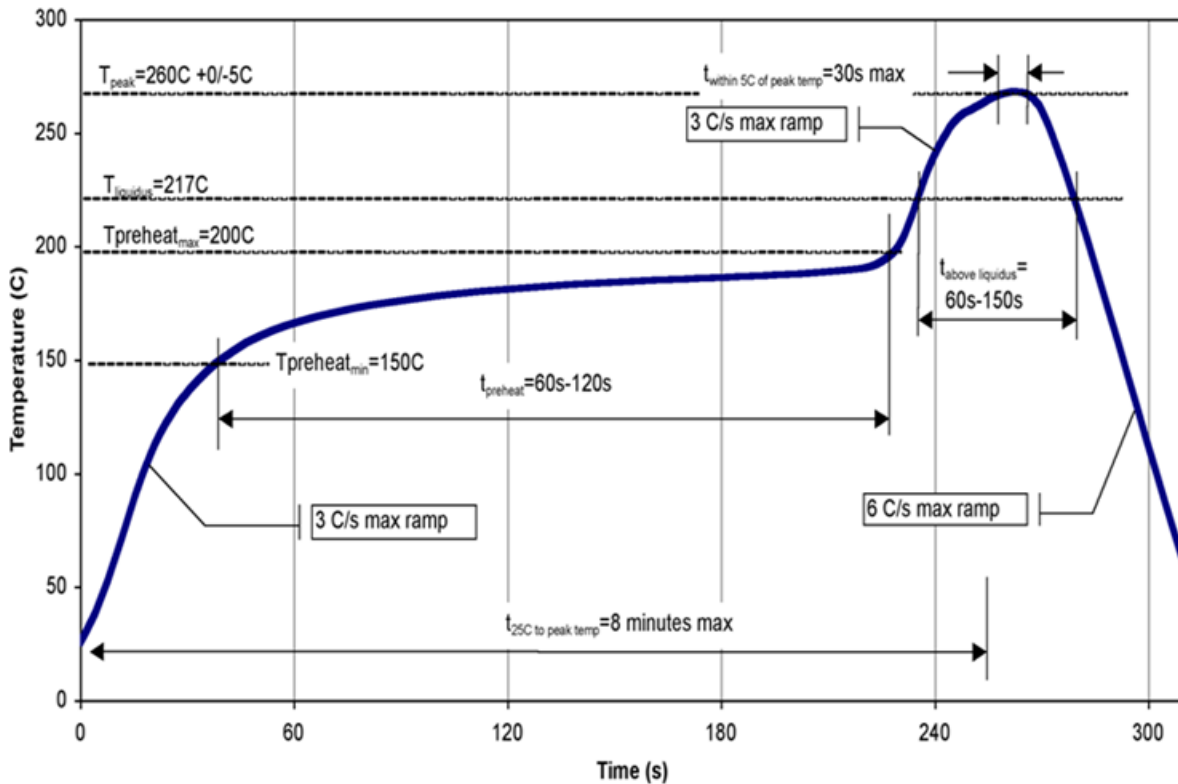
Assembly Notes

Compatible with lead-free soldering processes with 260°C peak reflow temperature.

This package is air-cavity and non-hermetic, and therefore cannot be subjected to aqueous washing. The use of no-clean solder to avoid washing after soldering is highly recommended.

Contact plating: Ni-Au

Solder rework not recommended



Recommended Soldering Temperature Profile

## Handling Precautions

Parameter	Rating	Standard
ESD – Human Body Model (HBM)	1A	ANSI/ESD/JEDEC JS-001
ESD – Charged Device Model (CDM)	C3	ANSI/ESD/JEDEC JS-002
MSL – Moisture Sensitivity Level	3	IPC/JEDEC J-STD-020



Caution!  
ESD-Sensitive Device

## RoHS Compliance

This product is compliant with the 2011/65/EU RoHS directive (Restrictions on the Use of Certain Hazardous Substances in Electrical and Electronic Equipment), as amended by Directive 2015/863/EU.

This product also has the following attributes:

- Lead Free
- Halogen Free (Chlorine, Bromine)
- Antimony Free
- TBBP-A (C<sub>15</sub>H<sub>12</sub>Br<sub>4</sub>O<sub>2</sub>) Free
- SVHC Free

## Contact Information

For the latest specifications, additional product information, worldwide sales and distribution locations:

**Tel:** 1-844-890-8163

**Web:** [www.qorvo.com](http://www.qorvo.com)

**Email:** [customer.support@qorvo.com](mailto:customer.support@qorvo.com)

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