TGS4304

High Power Ka-Band Absorptive SPDT Switch

Product Description

Qorvo's TGS4304 is a GaAs absorptive Single Pole, Double Throw (SPDT) PIN monolithic switch designed to operate over the Ka-Band frequency range.

This switch maintains a low insertion loss with high power handling of 33 dBm or greater Input P_{1dB} at V_C = +10V.

These advantages, along with small size of the chip, make the TGS4304 ideal for use in communication and transmit/receive applications.

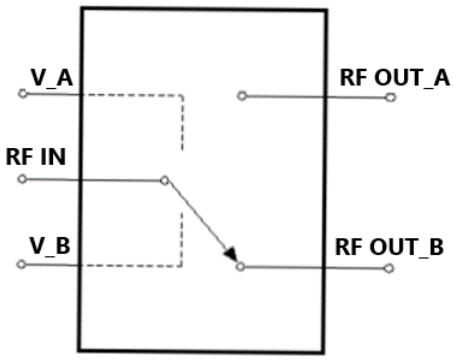
The TGS4304 is 100% DC & RF tested on-wafer to ensure performance compliance.

Product Features

- Frequency Range: 32 - 40 GHz
- Mid-band Insertion Loss: < 1.0 dB Typical
- Input P_{1dB}: >33 dBm @ V_C = +10V
- Switching Speed: < 4ns
- On-Chip Biasing Resistors
- DC Blocked at RF ports
- VPIN Technology
- Die Dimensions: 1.58 x 1.10 x 0.10 mm

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

Block Diagram



Applications

- Ka-Band Transmit / Receive
- Point-to-Point Radio
- Point-to-Multipoint Radio

Ordering Information

Part No.	Description
TGS4304	32 - 40 GHz High Power Switch

Absolute Maximum Ratings

Parameter	Value
Control Voltage	-5 to +25 V
Control Current	34 mA
RF Input Power (1), CW, 50 Ω, T = 25ºC	35 dBm
Mounting Temperature (30 sec)	320 °C
Storage Temperature	-65 to 150

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.

Notes: (1) Operation above 30dBm requires control voltage above +7.5V.

Recommended Operating Conditions

Parameter	Min	Typ.	Max	Units
Frequency	32		40	GHz
Control Voltage (V_A/V_B)		+5/-4		V
Control Current (I_A/I_B)		0/30		mA
Operating Temperature	-40	25	+85	°C

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

True Table

State	V_A	V_B
RF Out A	≥ +5 V @ ~0 mA	-4 V @ 30 mA
RF Out B	-4 V @ 30 mA	≥ +5 V @ ~0 mA

True Table

State	I_A	I_B
RF Out A	≥ +5 V @ ~0 mA	30 mA
RF Out B	30 mA	≥ +5 V @ ~0 mA

Operation at RF power levels >30 dBm requires increasing the positive voltage level to put a larger reverse bias on the diodes while the negative voltage level remains at -4 V with a current of approximately 30mA. If you are using -5V, use alternate assembly with off chip resistors.

Bond pads IA and IB bypass the on-chip series resistors to allow adjustment of the current to the diodes in their forward biased state.

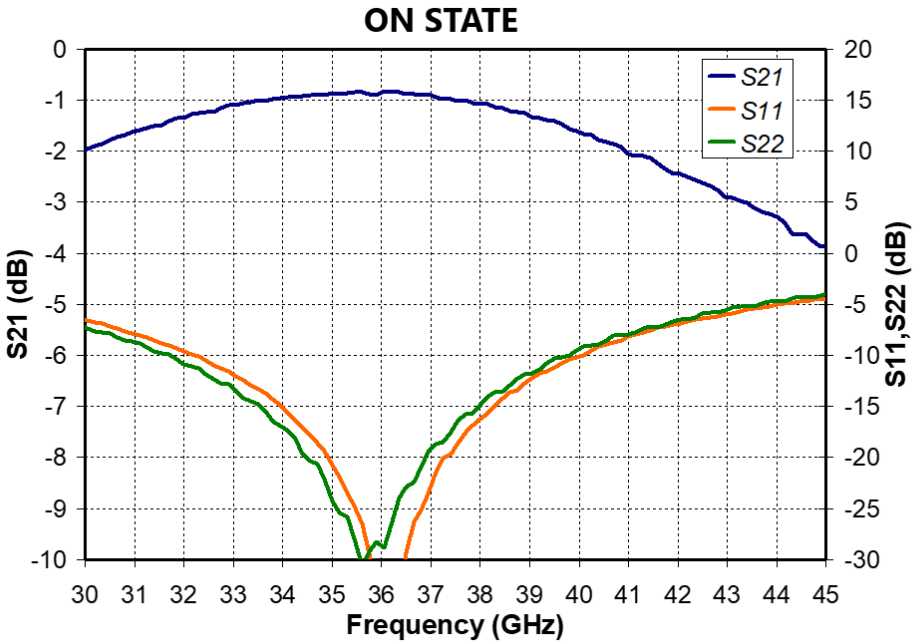
Electrical Specifications

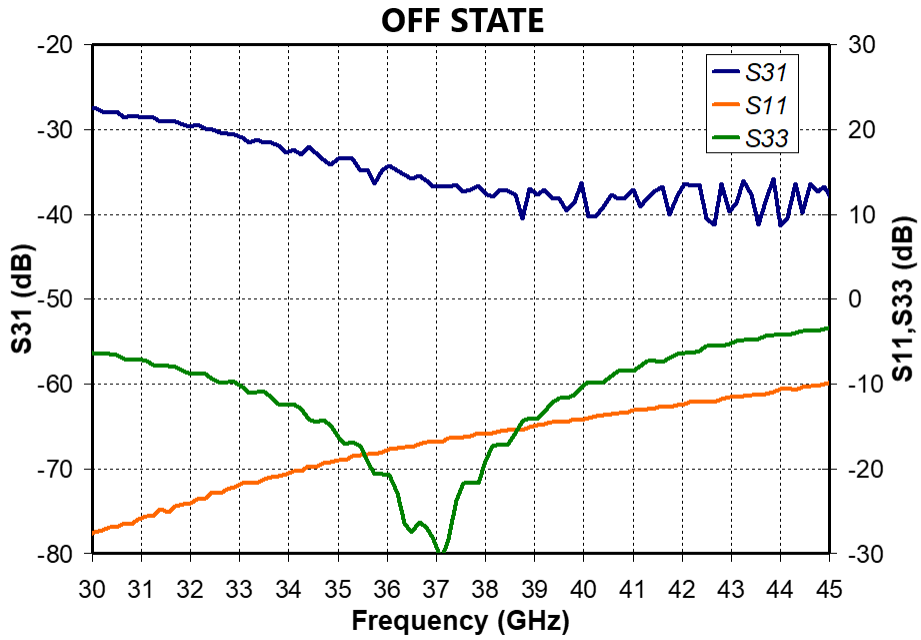
Test conditions unless otherwise noted: Temp= +25 °C, Bias Conditions: V_A = +5 V, I_A = 0 mA, V_B = -4 V, I_B = 30 mA

Parameter	Conditions	Min	Typical	Max	Units
Operational Frequency Range		32		40	GHz
Insertion Loss	Freq. = 32 to 34 GHz		1.3		dB
	Freq. = 34 to 37 GHz		0.9		
	Freq. = 37 to 40 GHz		1.3		
Return Loss – Common Port RL	Freq. = 32 to 40 GHz		10		dB
Output Power @ P_{1dB} (Freq. = 30 GHz)	V_C = +5 V		31		dBm
	V_C = +7.5 V		33		
	V_C = +10 V		34		
	V_C = +20 V		34.5		

Performance Plots – Small Signal

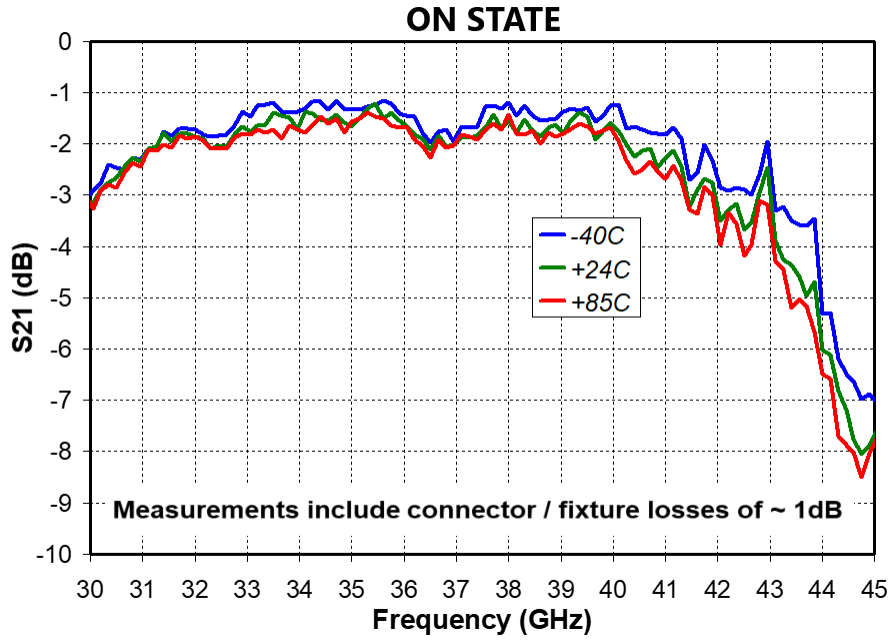
Test conditions unless otherwise noted: Temp= +25 °C, Bias Conditions: V_A = +5 V, I_A = 0 mA, V_B = -4 V, I_B = 30 mA

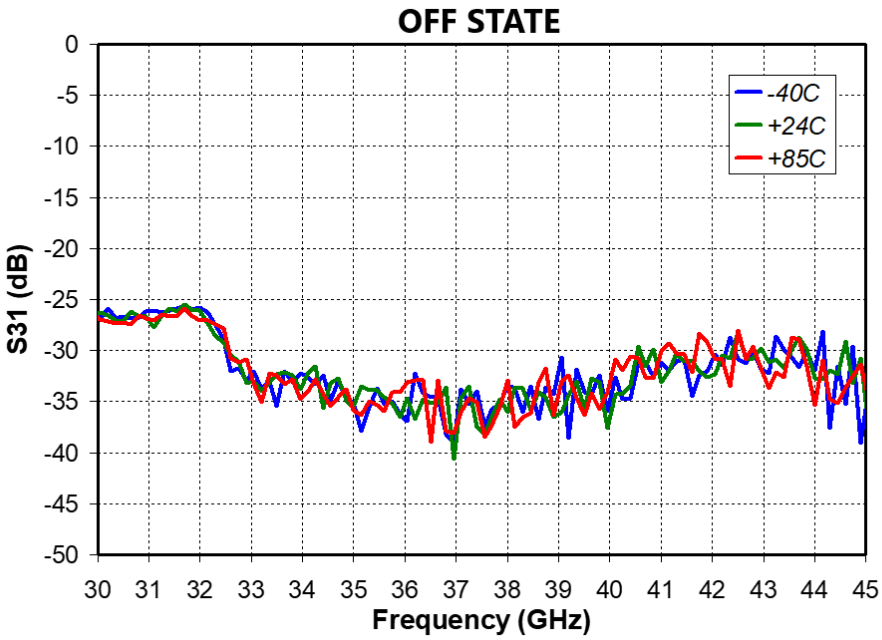




Performance Plots – Small Signal

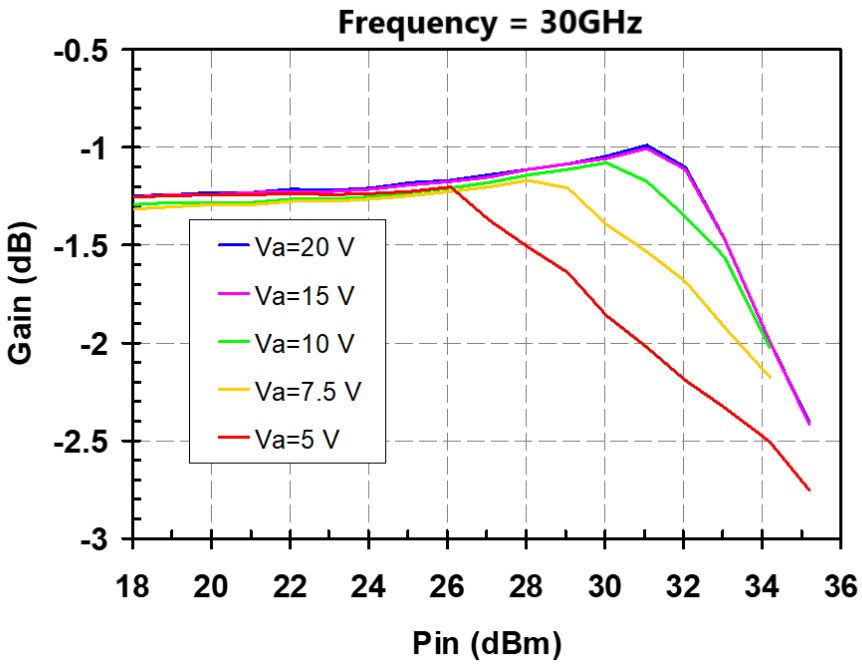
Test conditions unless otherwise noted: Bias Conditions: V_A = +5 V, I_A = 0 mA, V_B = -4 V, I_B = 30 mA





Performance Plots – Large Signal

Test conditions unless otherwise noted: Temp= +25 °C, Bias Conditions: V_A = +5 V, I_A = 0 mA, V_B = -4 V, I_B = 30 mA



Assembly Drawing & Bonding Diagram

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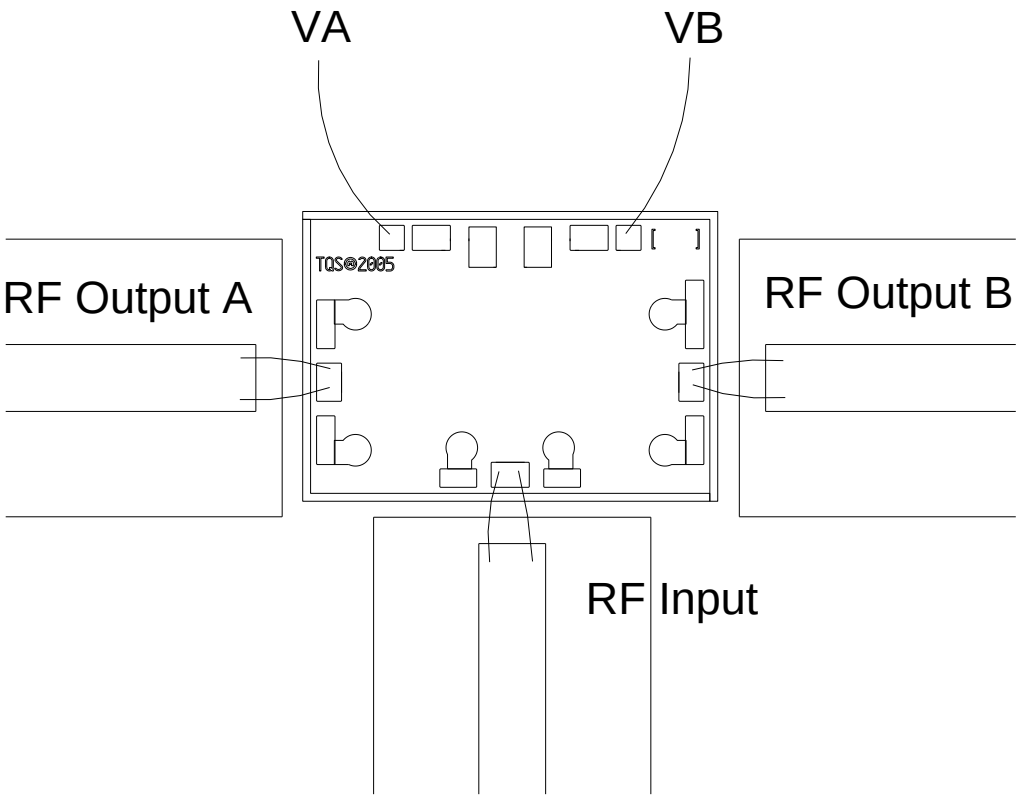

Alternate Assembly Drawing & Bonding Diagram

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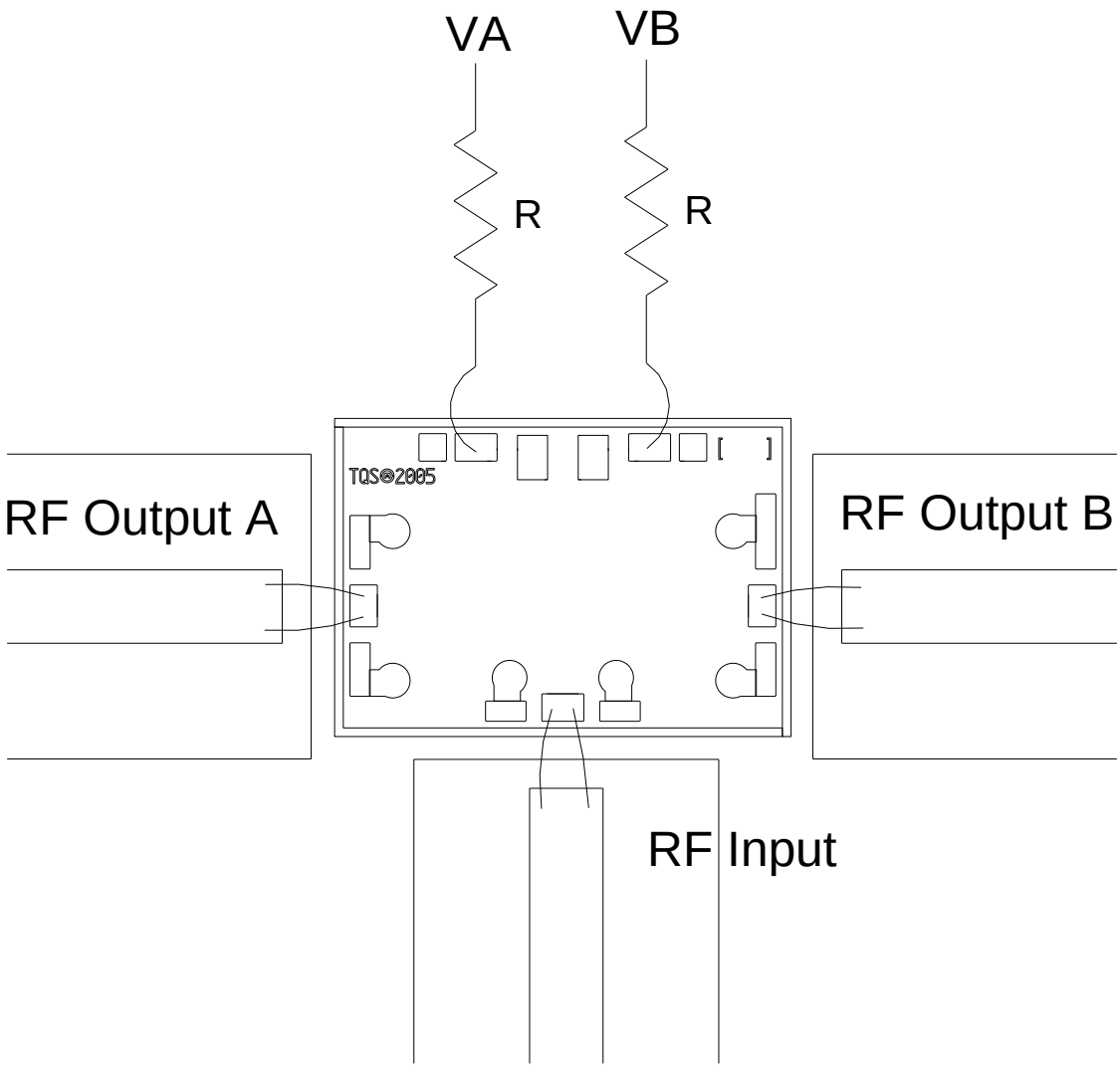
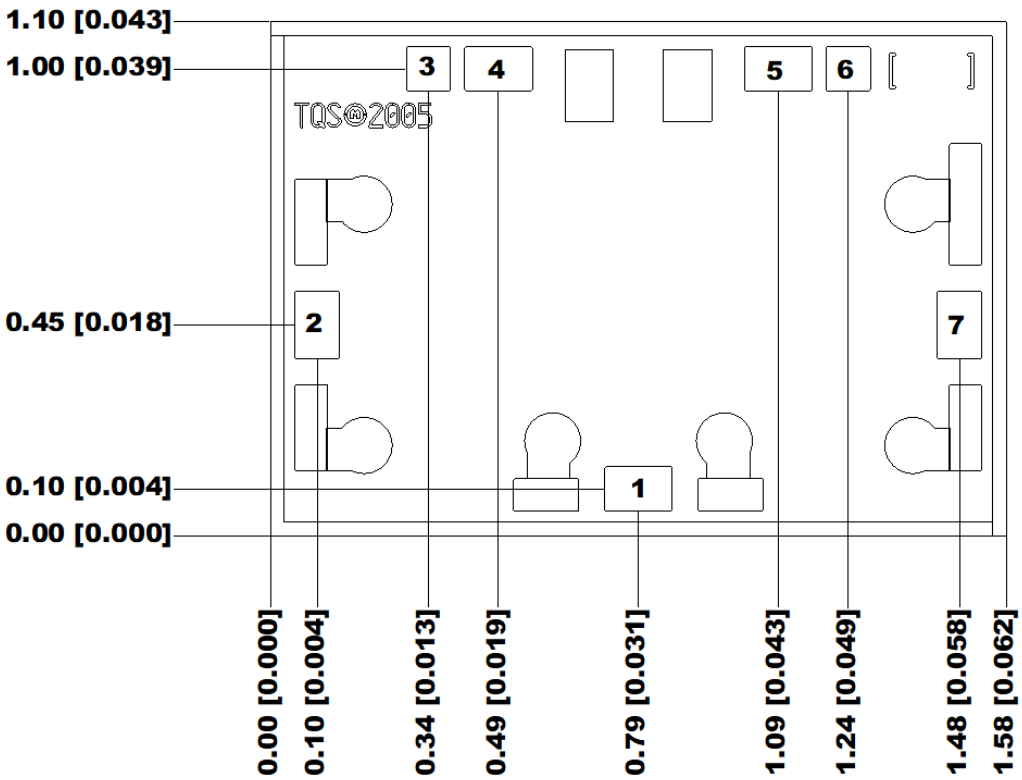


Notes: Refer to Bias Resistor Values Table for values of R vs. Control Voltage.

Bias Resistor Values

Maximum Negative Bias Voltage	R
-5 V	33 Ω
-7.5 V	117 Ω
-10 V	200 Ω
-15 V	367 Ω
-20 V	533 Ω

Mechanical Drawing and Bond Pad Description



Unit: millimeters (inches)
Thickness: 0.100 (0.004)
Die x, y size tolerance: +/- 0.050 (0.002)
Chip edge to bond pad dimensions is shown to center of pad
Ground is backside of MMIC

Pin No.	Symbol	Description	Pad Size (mm)
1	RF In	Input, RF common port	0.150 x 0.100
2	RF Out A	Out A, RF switched to port 1	0.100 x 0.150
3	VA	Control voltage A	0.100 x 0.100
4	IA	Control current A	0.150 x 0.100
5	IB	Control current B	0.150 x 0.100
6	VB	Control voltage B	0.100 x 0.100
7	RF Out B	Output B, RF switched port 2	0.100 x 0.150

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.
- Organic attachment (i.e., conductive epoxy) can be used in low-power applications.
- Curing should be done in a convection oven; proper exhaust is a safety concern.

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.

Handling Precautions

Parameter	Rating	Standard
ESD – Human Body Model (HBM)	Class 0A	ESDA / JEDEC JS-001-2012

Caution!
ESD-Sensitive Device

Solderability

Use only AuSn (80/20) solder and limit exposure to temperatures above 300 °C to 3-4 minutes, maximum.

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 ($C_{15}H_{12}Br_4O_2$) Free
- PFOS Free
- SVHC Free

Contact Information

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

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