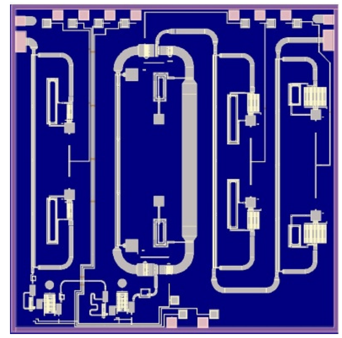
Applications

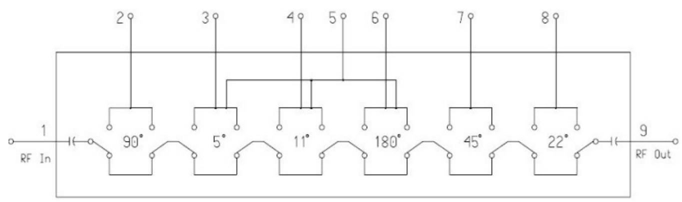
- Phased Array Antenna Systems
- Satellite Communication Systems
- Electronic Warfare



Product Features

- Frequency Range: 6 to 18 GHz
- 6-Bit Digital Phase Shifter
- 360° Coverage, LSB = 5.625°
- RMS Phase Error: 4°
- RMS Amplitude Error: 0.45 dB
- Insertion Loss: <10 dB
- Return Loss: >12 dB
- Input P1dB: >25 dBm
- Input IP3: >41 dBm
- Control Voltage: 0/+5 V
- Chip Dimensions: 3.15 x 3.15 x 0.10 mm

Functional Block Diagram



General Description

TriQuint's TGP2105 is a 6-bit, digital phase shifter fabricated on TriQuint's high performance 0.15µm GaAs pHEMT process. It operates over 6 to 18 GHz and provides 360° of phase coverage with a LSB of 5.625°. It also achieves a low RMS phase error of 4° with 8 dB of insertion loss over all states.

The TGP2105 uses positive switch logic, eliminating the need for a negative voltage rail. That, along with low insertion and a high degree of resolution makes the TGP2105 ideally suited for a variety of wideband phased array applications, including commercial and military radars, satellite-based communication systems and electronic warfare.

The device is lead-free and RoHS compliant.

Pad Configuration

Pad No.	Symbol
1	RF In
2	90° Bit
3	5° Bit
4	11° Bit
5	REF
6	180° Bit
7	45° Bit
8	22° Bit
9	RF Out

Ordering Information

Part	ECCN	Description
TGP2105	EAR99	6-Bit Digital Phase Shifter (+V_c)

Absolute Maximum Ratings

Parameter	Value
Control and Reference Voltage	6 V
Control Current	–15 to +5 mA
Power Dissipation	0.9 W
Input Power, CW, 50 Ω, 85°C	30 dBm
Channel Temperature	200°C
Mounting Temperature (30 Seconds)	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
Control Voltage (5^0, 11^0, 22^0, 45^0, 90^0, 180^0, REF)	0/+5 V

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

Electrical Specifications

Test conditions unless otherwise noted: 25°C. Control Voltage (REF, 5^0, 11^0, 22^0, 45^0, 90^0, 180^0) = 0/+5 V; See Bias Truth Table.

Parameter	Conditions	Min	Typ	Max	Units
Operational Frequency Range		6		18	GHz
Insertion Loss			6 - 10		dB
Input Return Loss			>12		dB
Output Return Loss			>12		dB
RMS Phase Error			4		deg
RFM Amplitude Error			0.45		dB
Input P1dB			>25		dBm
Input IP3	Tone spacing = 10 MHz Pin/Tone = 15 dBm		>41		dBm
Insertion Loss Temperature Coefficient			0.008		dB/°C

Bias Truth Table

Logic "0" = 0 V, Logic "1" = +5 V
Voltage for Logic "1" of V_{CTRL} (5^0, 11^0, 22^0, 45^0, 90^0, 180^0) must be the same with V_{REF}

Phase Shifter	5^0	11^0	22^0	45^0	90^0	180^0	REF
0° (Reference)	0	0	0	0	0	0	1
5°	1	0	0	0	0	0	1
11°	0	1	0	0	0	0	1
22°	0	0	1	0	0	0	1
45°	0	0	0	1	0	0	1
90°	0	0	0	0	1	0	1
180°	0	0	0	0	0	1	1
355°	1	1	1	1	1	1	1

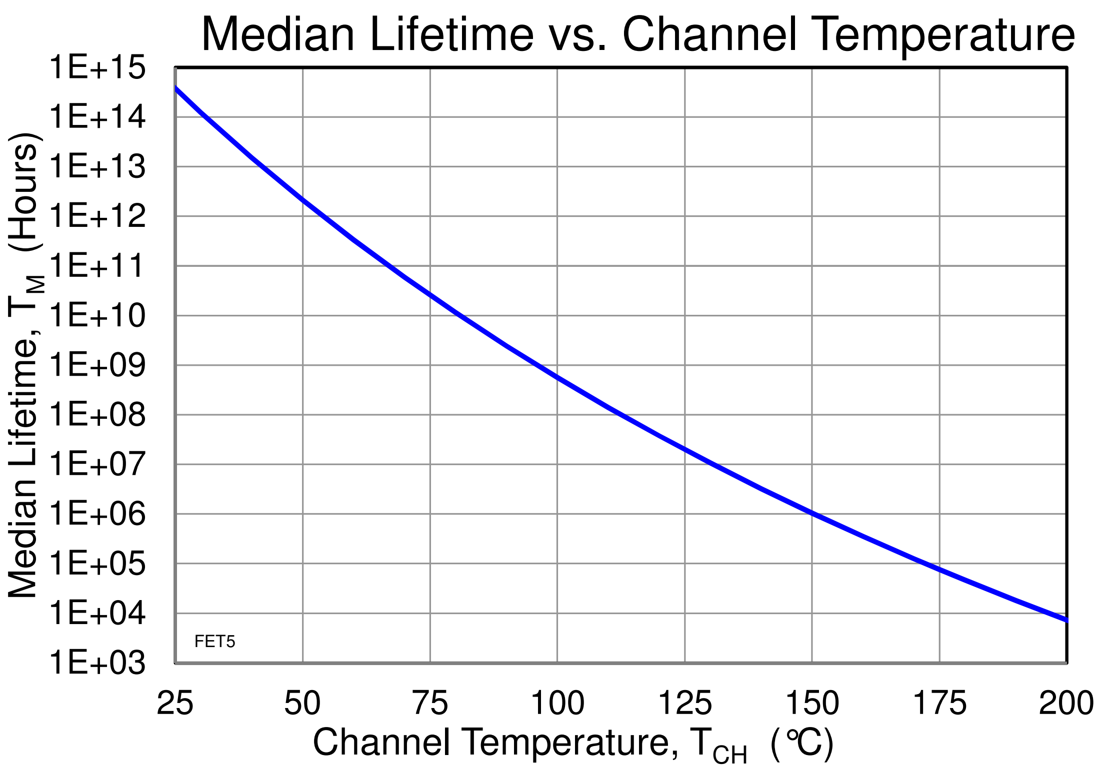
Thermal and Reliability Information

Parameter	Test Conditions	Value	Units
Thermal Resistance (θ_{JC}) (1)	P_{DISS} = 0.09 W, $T_{BASEPLATE}$ = 85°C	22	ºC/W
Channel Temperature (T_{CH})		87	°C
Median Lifetime (T_M)		3.8E+9	Hrs

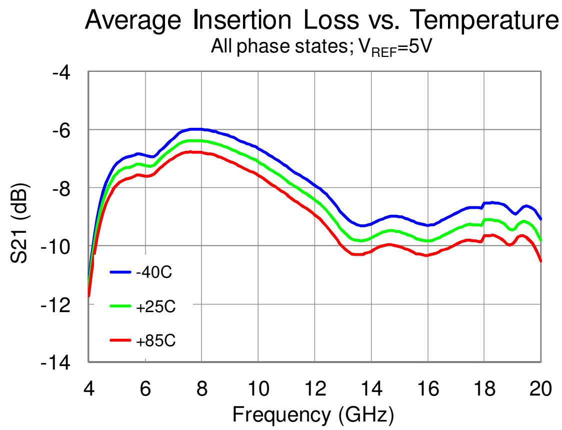
Notes:

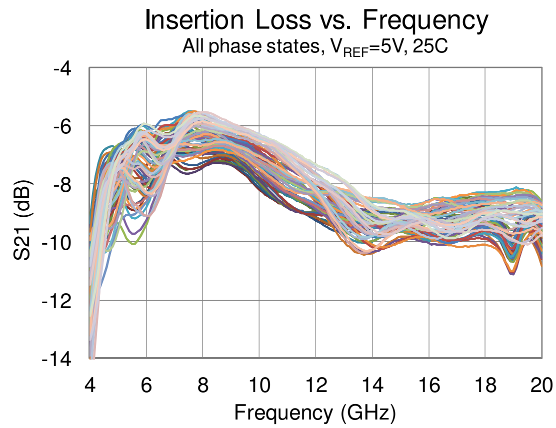
1. Thermal resistance measured to back of carrier plate. MMIC mounted on 40 mils thick CuMo carrier using 1.5 mil 80/20 AuSn.

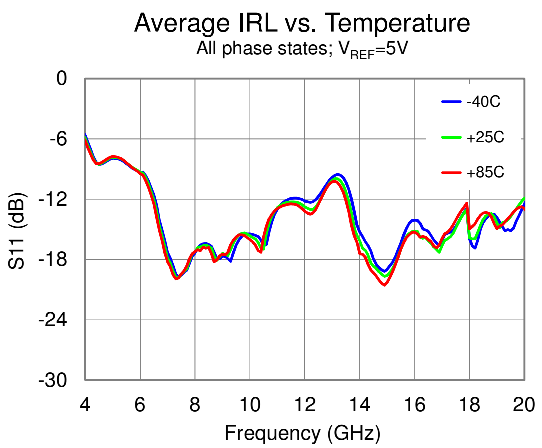
Median Lifetime

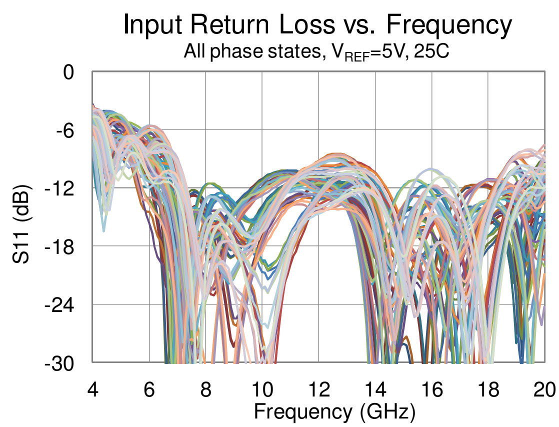


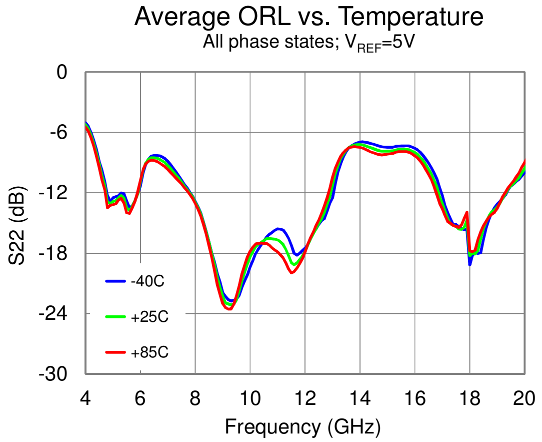
Typical Performance

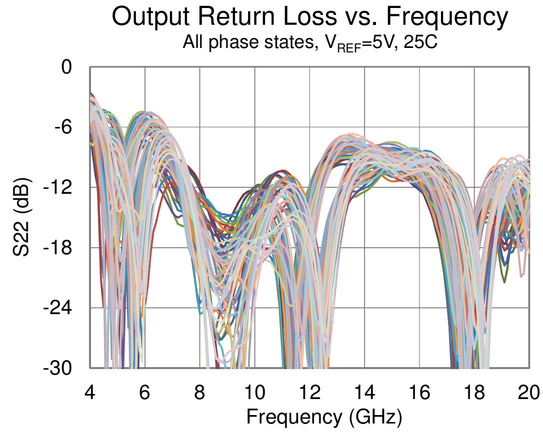




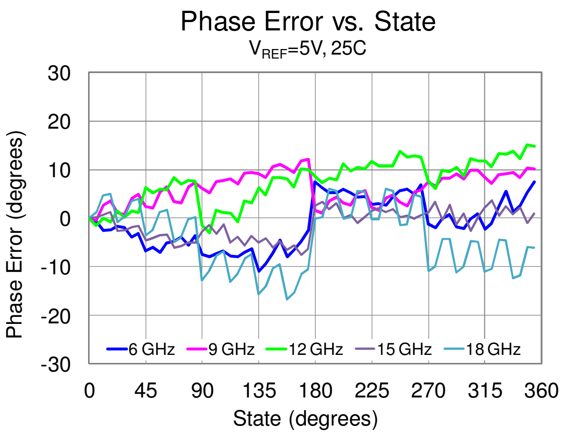


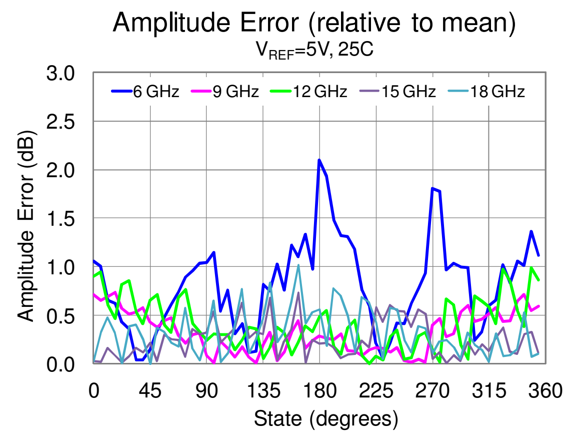


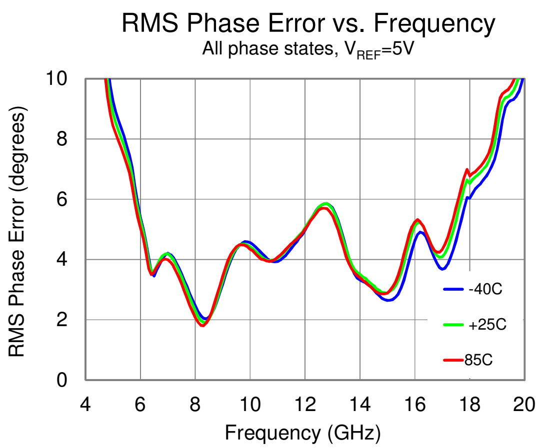


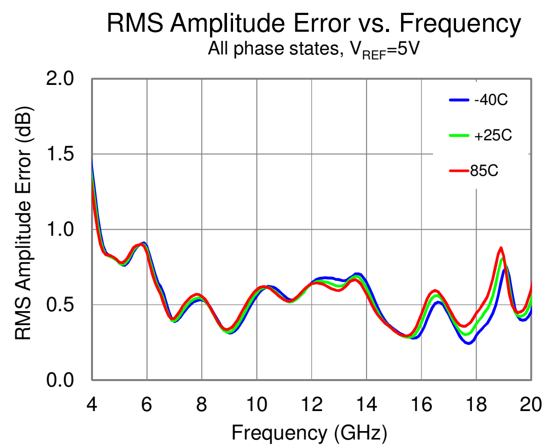


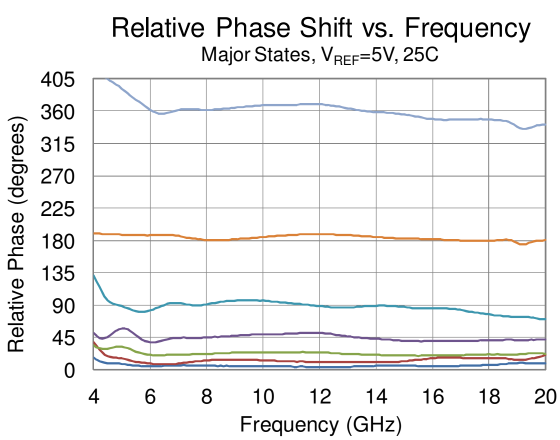
Typical Performance

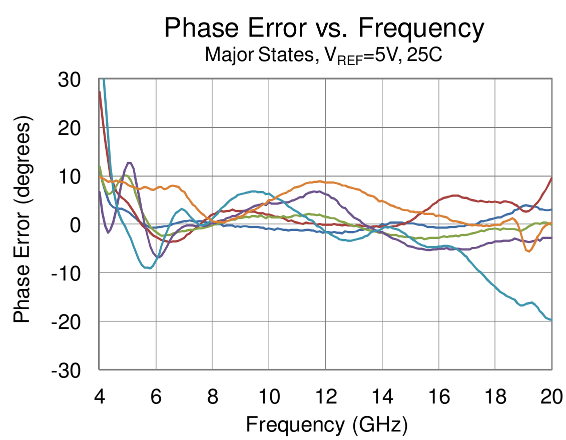




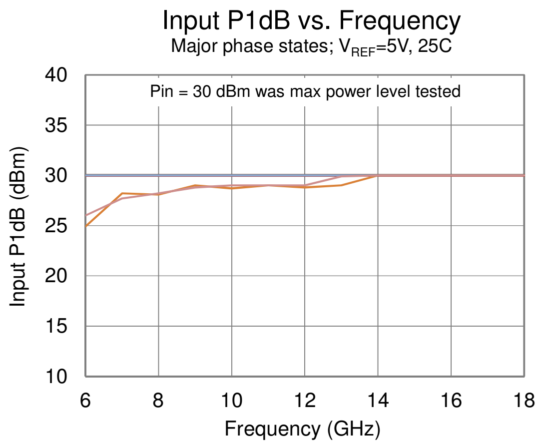


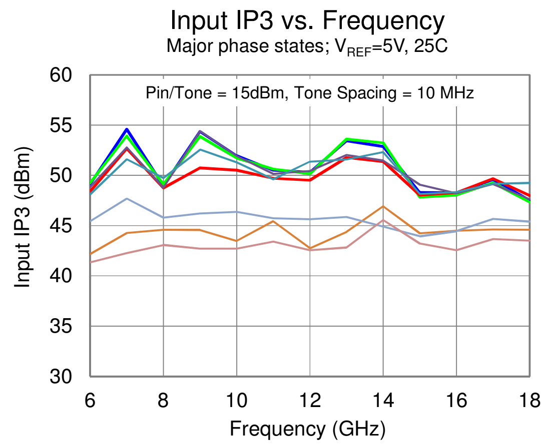


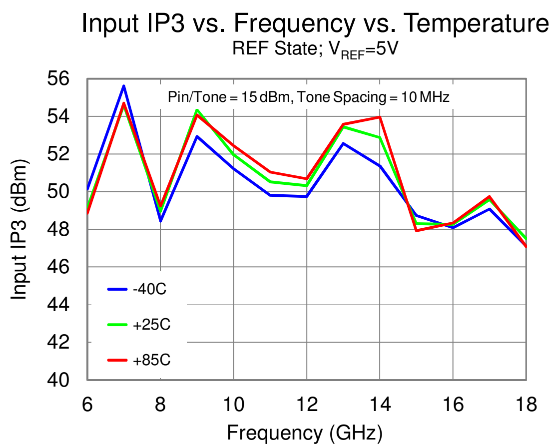




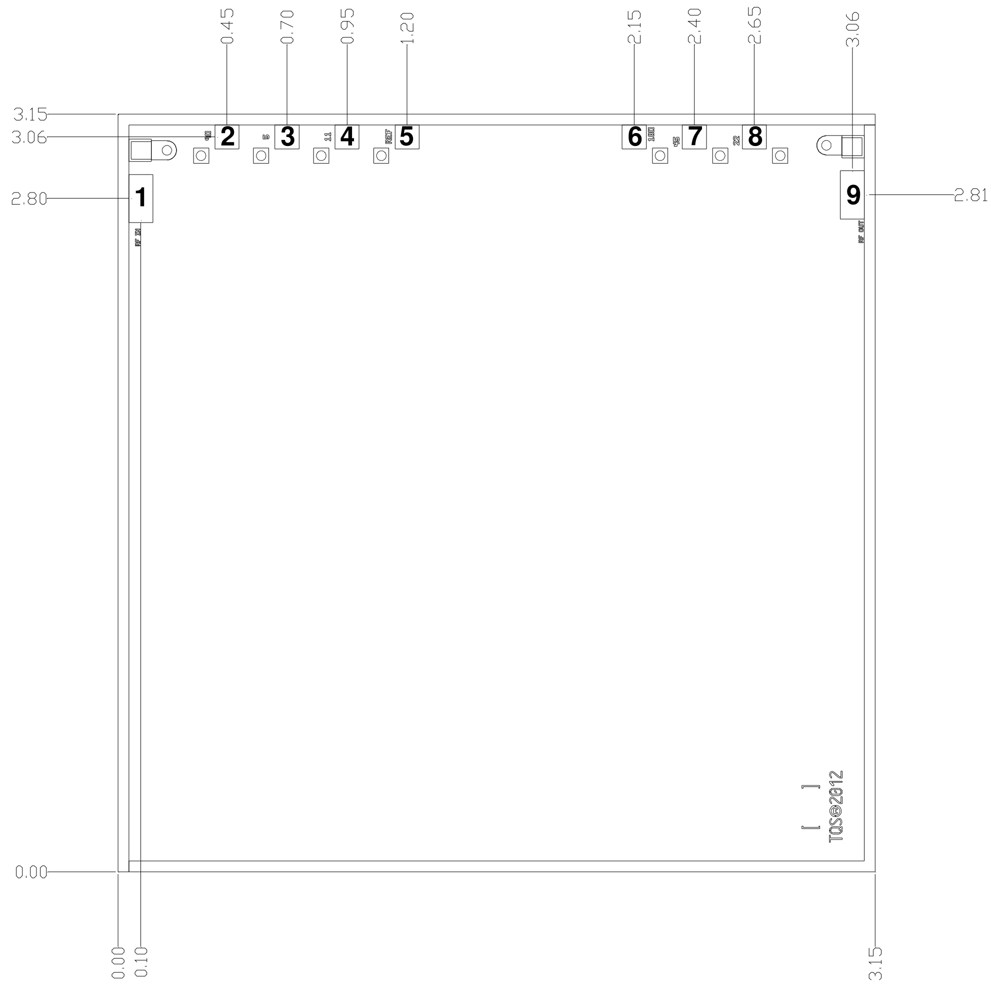
Typical Performance







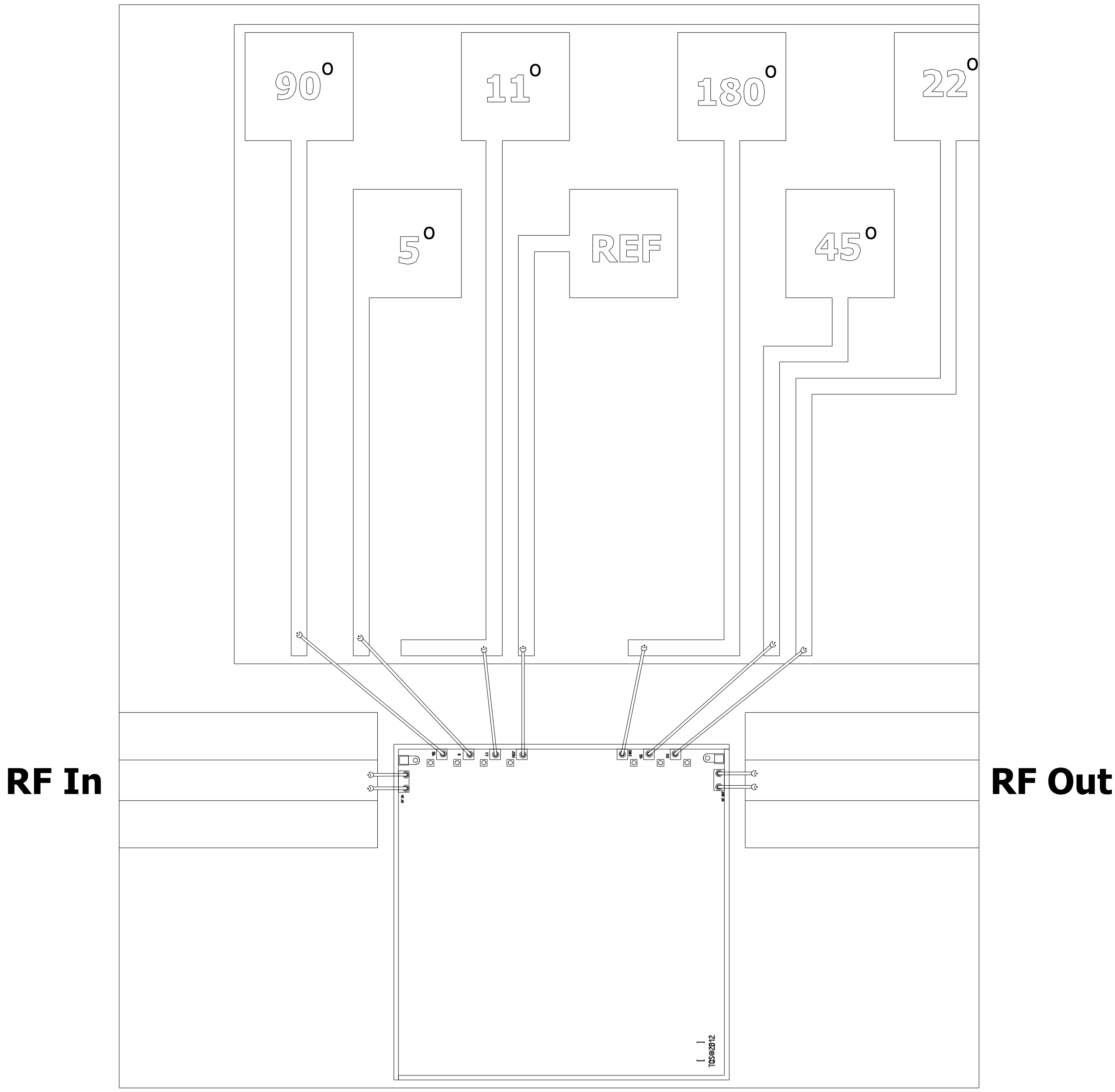
Mechanican Information and Bond Pad Description



Unit: millimeters
Thickness: 0.10
Die x, y size tolerance: ± 0.050
Chip edge to bond pad dimensions are shown to center of pad
Ground is backside of die

Bond Pad	Symbol	Description	Pad Size
1	RF In	Input; matched to 50 Ω; DC de-coupled	0.200 x 0.100
2	90	90° Bit	0.100 x 0.100
3	5	5° Bit	0.100 x 0.100
4	11	11° Bit	0.100 x 0.100
5	REF	Reference	0.100 x 0.100
6	180	180° Bit	0.100 x 0.100
7	45	45° Bit	0.100 x 0.100
8	22	22° Bit	0.100 x 0.100
9	RF Out	Output; matched to 50 Ω; DC de-coupled	0.200 x 0.100

Assembly Drawing



- The spacing between MMIC and TFN (at RF In or RF Out) is <5 mils typical.
- RF connections: Bond two 1 mil diameter, <20 mils length gold bond wires at RF In and RF Out for optimum RF performance.

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.
- Solder or Organic Adhesive attachment can be used for TGL2205.
- Curing should be done in a convection oven; proper exhaust is a safety concern.

Solder attachment reflow process assembly notes:

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

Organic adhesive attachment assembly notes:

- The organics such as epoxy or polyimide can be used.
- Epoxies cure at temperatures of 100 to 200°C.

Interconnect process assembly notes:

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

Product Compliance Information

ESD Sensitivity Ratings

Caution! ESD-Sensitive Device

ESD Rating: TBD
Value: TBD
Test: Human Body Model (HBM)
Standard: JEDEC Standard JESD22-A114

Solderability

This part is compliant with EU 2002/95/EC RoHS directive (Restrictions on the Use of Certain Hazardous Substances in Electrical and Electronic Equipment).

This product also has the following attributes:

- Lead Free
- Halogen Free (Chlorine, Bromine)
- Antimony Free
- TBBP-A ($C_{15}H_{12}Br_{4}0_{2}$) Free
- PFOS Free
- SVHC Free

ECCN

US Department of Commerce: EAR99

Contact Information

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

Web: www.triquint.com **Tel:** +1.972.994.8465
Email: info-sales@triquint.com **Fax:** +1.972.994.8504

For technical questions and application information: **Email:** info-products@triquint.com

Important Notice

The information contained herein is believed to be reliable. TriQuint makes no warranties regarding the information contained herein. TriQuint assumes no responsibility or liability whatsoever for any of the information contained herein. TriQuint assumes no responsibility or liability whatsoever for the use of the information contained herein. The information contained herein is provided "AS IS, WHERE IS" and with all faults, and the entire risk associated with such information is entirely with the user. All information contained herein is subject to change without notice. Customers should obtain and verify the latest relevant information before placing orders for TriQuint products. The information contained herein or any use of such information does not grant, explicitly or implicitly, to any party any patent rights, licenses, or any other intellectual property rights, whether with regard to such information itself or anything described by such information.

TriQuint products are not warranted or authorized for use as critical components in medical, life-saving, or life-sustaining applications, or other applications where a failure would reasonably be expected to cause severe personal injury or death.