TGS2355

0.5 – 6.0 GHz 100 Watt GaN Switch

Product Description

Qorvo's TGS2355 is a Single-Pole, Double-Throw (SPDT) reflective switch fabricated on Qorvo's QGaN25 0.25um GaN on SiC production process.

Operating from 0.5 to 6 GHz, the TGS2355 provides up to 100 W input power handling with < 1 dB insertion over most of the operating band and greater than 40 dB isolation.

The TGS2355 is available in a small 2.14 x 2.50 mm die size and requires very little control current allowing for easy system integration without impacting system power budgets.

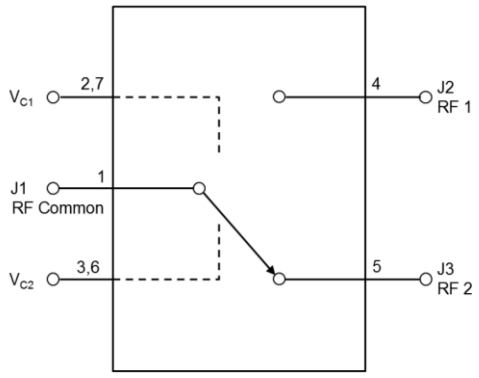
The TGS2355 is ideally suited for high power switching applications across both defense and commercial applications.

Product Features

- Frequency Range: 0.5 - 6 GHz
- Insertion Loss: < 1.3 dB
- Power Handling: 50 dBm (Pulsed)
- Isolation: 40 dB typical
- Control Voltages: 0 V/-40 V (from either side of the MMIC)
- Switching Speed: < 50 nS
- Reflective Switch
- Die Dimensions: 2.14 mm x 2.50 mm x 0.10 mm

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

Block Diagram



Applications

- Commercial and Military Radar
- Communications
- Electronic Warfare
- Test Instruments
- General Purpose
- High Power Switching

Ordering Information

Part No.	Description
TGS2355	0.5-6 GHz 100 Watt GaN Switch

Absolute Maximum Ratings

Parameter	Value
Control Voltage (V_C)	-50 V
Control Current (I_C)	-3.5 / +3.5 mA
Power Dissipation	36.8 W
RF Input Power (pulsed, 10% Duty Cycle, 20 µs pulse width)	51 dBm
Mounting Temperature (30 sec)	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	Min	Typ	Max	Units
Frequency	0.5		6	GHz
Input Power Handling (Pulsed)		50		dBm
Control Voltage		-40		V
Temperature 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 (1)	Min	Typ	Max	Units
Operational Frequency Range		0.5		6	GHz
$P_{0.1dB}$	Pulsed Input Power		50		dBm
Control Current (I_C)			1.0		mA
Insertion Loss	On-State		1.0		dB
Input Return Loss – Common Port Return Loss	On-State		15		dB
Output Return Loss – Switched Port Return Loss	On-State		15		dB
Isolation	Off-State		40		dB
Output Return Loss – Isolated Port Return Loss	Off-State		2.5		dB
Switching Speed (10-90%, 90-10%, VC=-20V)			50		ns
Control Voltage			-40	-48	V
Insertion Loss Temperature Coefficient			0.003		dB/ °C

Notes:
1. Test conditions unless otherwise noted: Temp= +25°C. Z_0 = 50 Ω, Vc = −40 V

Thermal and Reliability Information

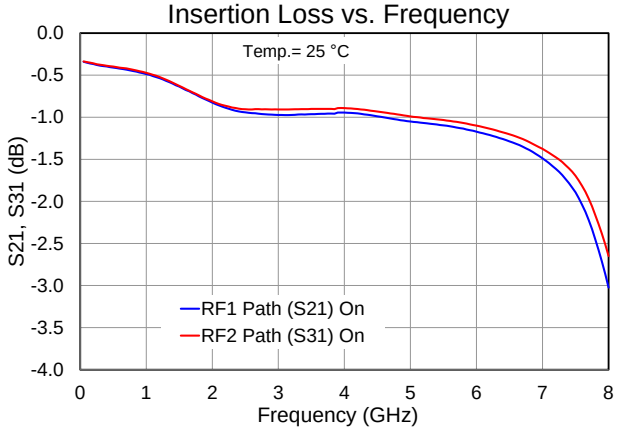
Parameter	Test Conditions	Value	Units
Thermal Resistance (θ_{JC}) (1,2)	T_{BASE} = 85 °C, V_{C1} = 0 V, V_{C2} = -40 V, P_{IN} = 100 W,	1.3	°C/W
Channel Temperature (T_{CH}) (1,2)	P_{DISS} = 29.3 W, Pulsed Power: PW = 20 µs, DC = 10 %	123	°C

1. MMIC soldered to 20 mil thick Cu-Mo carrier plate using AuSn solder. Thermal resistance is determined from the channel to the back of the die (fixed 85 °C temp.).
2. Refer to the following document: GaN Device Channel Temperature, Thermal Resistance, and Reliability Estimates

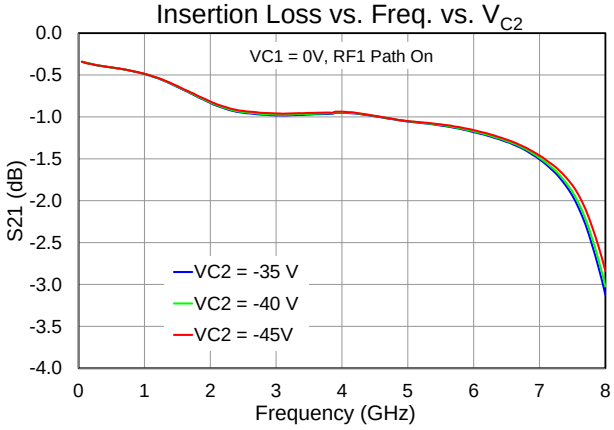
Performance Plots – Small Signal

Test conditions unless otherwise noted: V_{C1} = 0 V, V_{C2} = -40 V, CW Input, Temp= +25 °C.

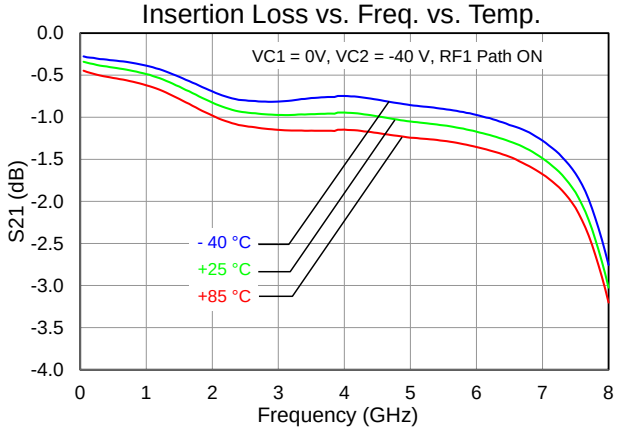
Insertion Loss vs. Frequency



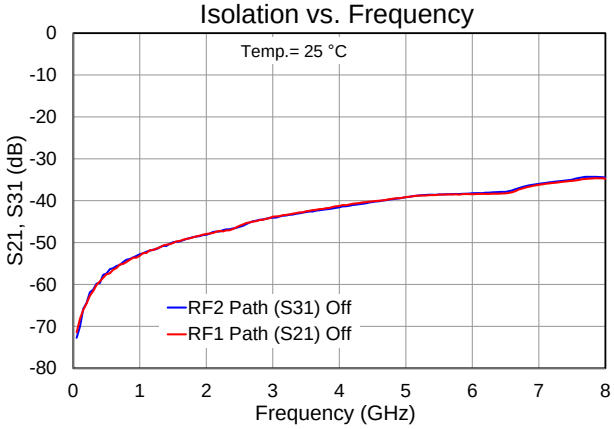
Insertion Loss vs. Freq. vs. V_{C2}



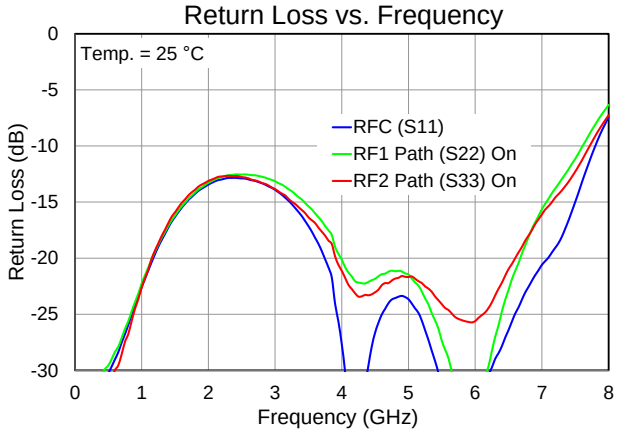
Insertion Loss vs. Freq. vs. Temp.



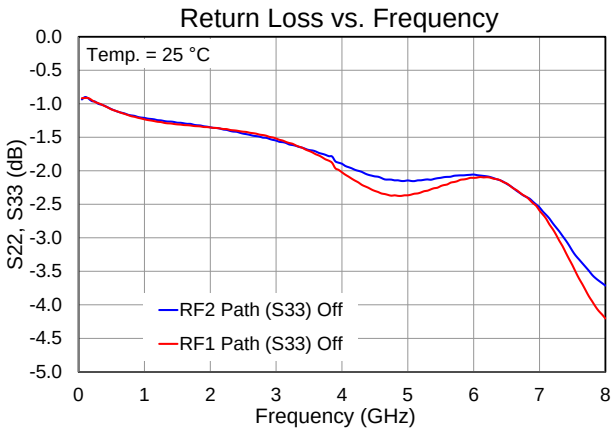
Isolation vs. Frequency



Return Loss vs. Frequency

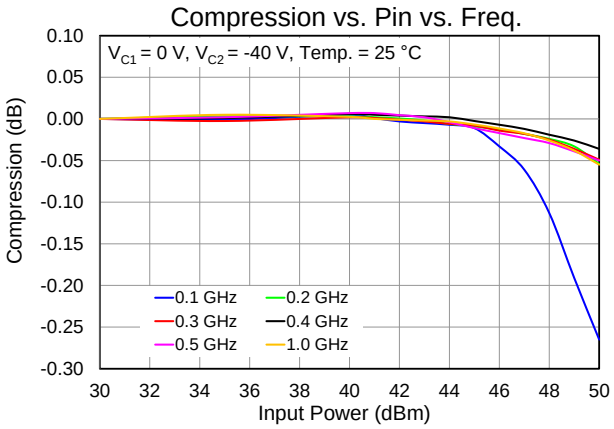


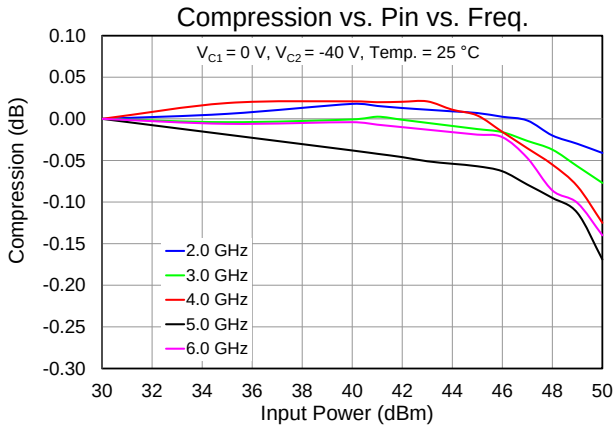
Return Loss vs. Frequency

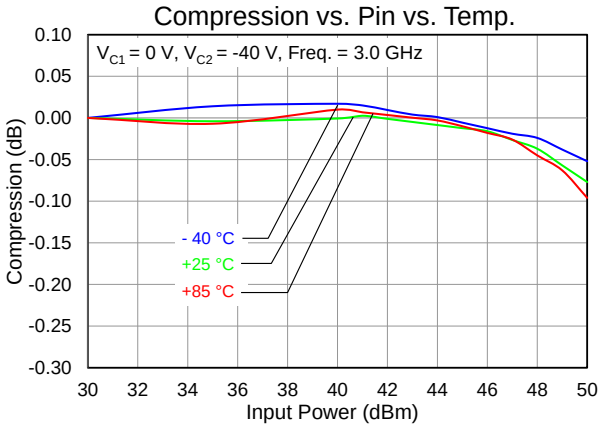


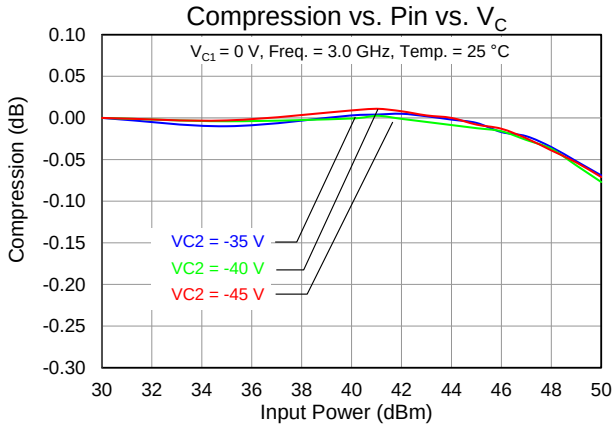
Performance Plots – Large Signal

Test conditions unless otherwise noted: V_{C1} = 0 V, V_{C2} = -40 V, Pulsed RF Input - PW=20 µsec, Duty Cycle=10%, Temp= +25 °C.

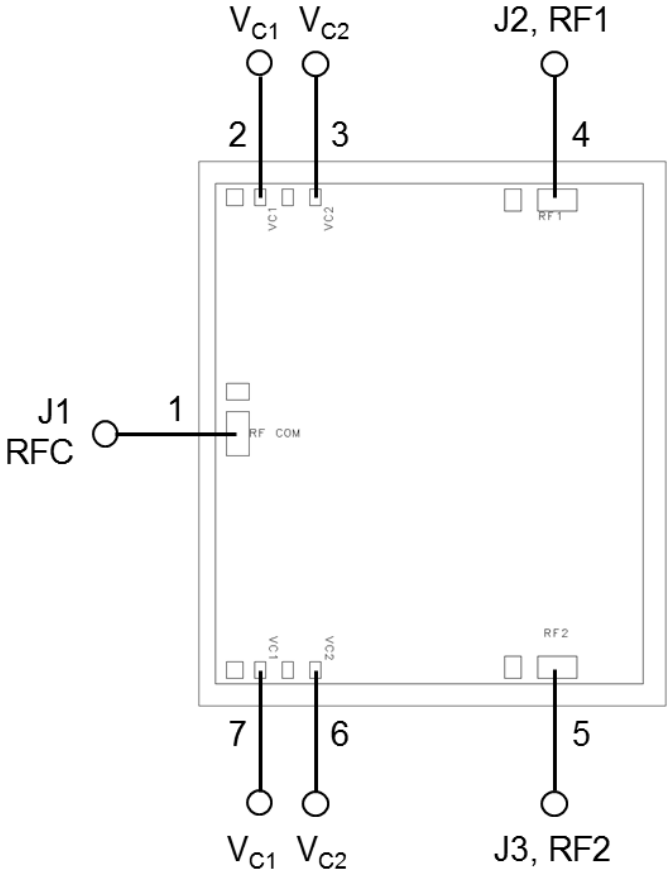








Applications Circuit



Notes:

DC blocking capacitors are required on all RF ports.

VC1 can be biased from either bond pad 2 or 7, and the non-biased bond pad can be left open.
VC2 can be biased from either bond pad 3 or 6, and the non-biased bond pad can be left open.

This switch can be configured as a Single Pole, Single Throw (SPST) by terminating one unused RF switched port with a 50 Ohm load.

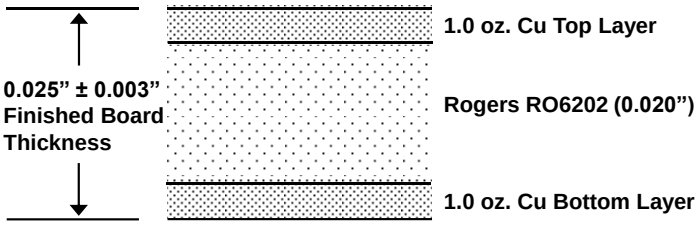
Function Table

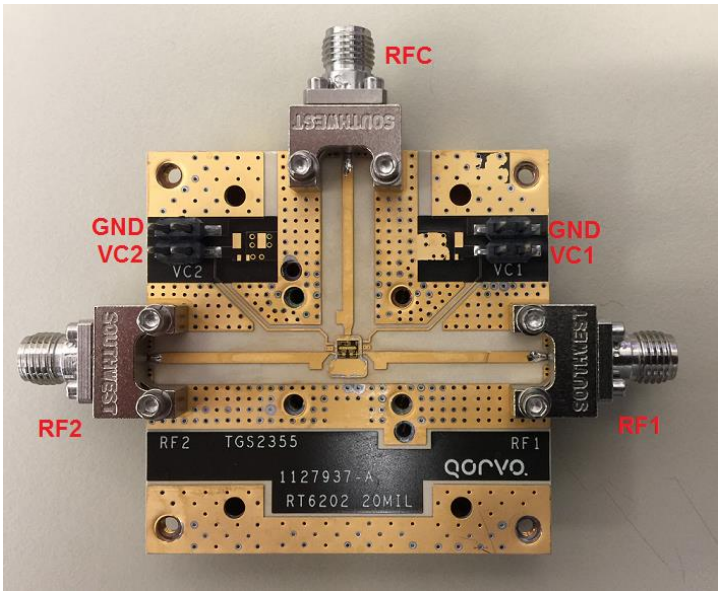
RF Path	State	V_{C1}	V_{C2}
RFC to RF1	On-State (Insertion Loss)	0 V	-40 V
	Off-State (Isolation)	-40 V	0 V
RFC to RF2	On-State (Insertion Loss)	-40 V	0 V
	Off-State (Isolation)	0 V	-40 V

Evaluation Board (EVB) Layout Assembly Using Coined PCB

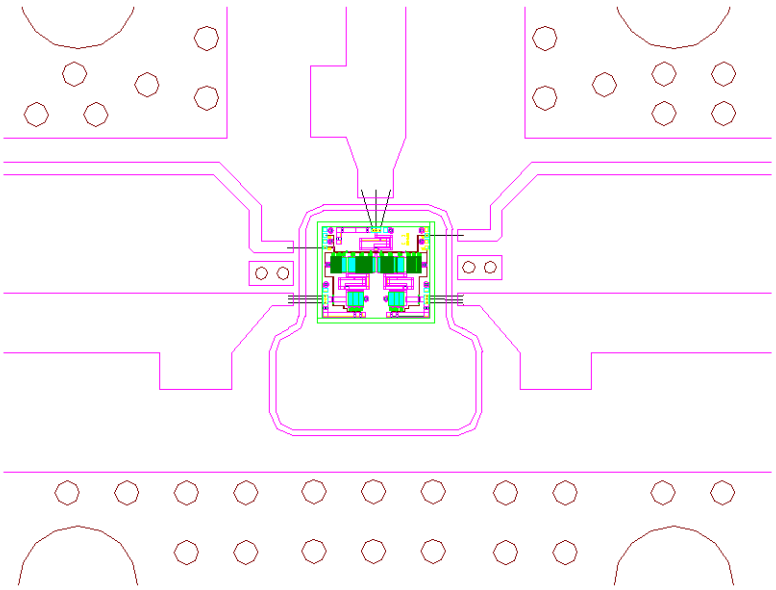
PC Board Layout

PCB Material Stack-up

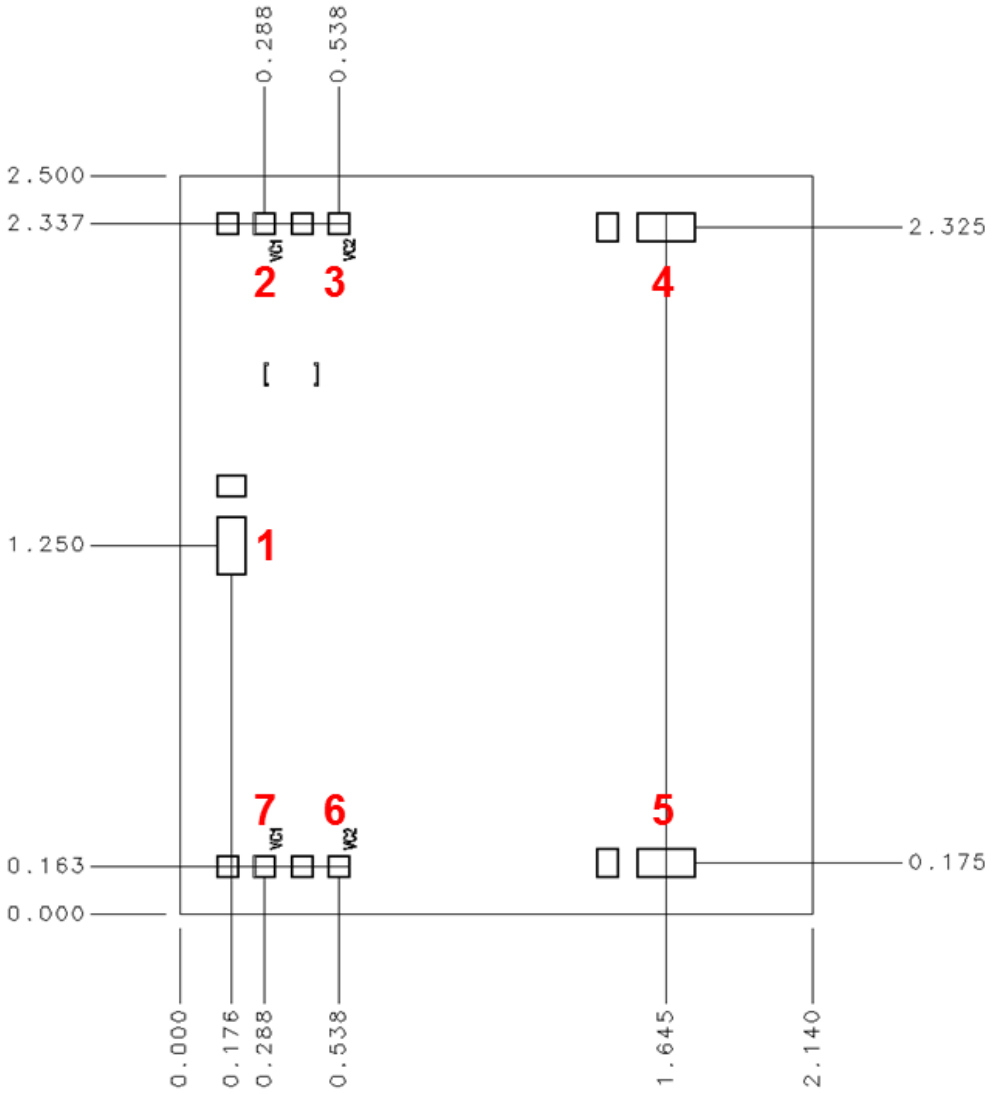




MMIC EVB Mounting Detail



Mechanical Drawing 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

Pin No.	Symbol	Description	Pad Size (mm)
1	RFC	RF common port; matched to 50 Ω; DC coupled	0.100 x 0.200
2, 7	VC1	Control voltage 1	0.075 x 0.075
3, 6	VC2	Control voltage 2	0.075 x 0.075
4	RF1	RF switched port 1; matched to 50 Ω; DC coupled	0.200 x 0.100
5	RF2	RF switched port 2; matched to 50 Ω; DC coupled	0.200 x 0.100

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.