True Time Delay, 1-Bit
6 - 18 GHz

CGY2394SUH/C1
Rev. V1

Features

- Insertion Loss: <6 dB
- IL Flatness: +/- 1.4 dB
- Delay Range: 320 ps
- Input P1dB: >9.5 dBm
- Input Return Loss: < -15 dB
- Output Return Loss: < -12 dB
- 0 / 4V Control Lines
- Chip Size: 5000 x 2000 µm
- Tested, Inspected Known Good Die (KGD)
- Space and MIL-STD Available
- RoHS* Compliant

Applications

- Radar
- Telecommunication
- Instrumentation

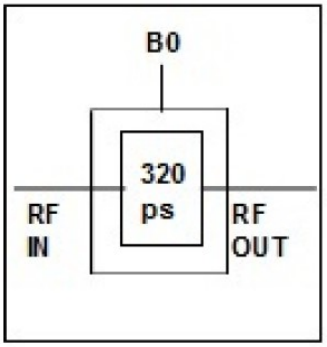
Description

The CGY2394SUH/C1 is a high performance GaAs MMIC 1-bit True Time Delay operating from 6 GHz up to 18 GHz.

The application of True Time Delay instead of phase shifter offers an enhanced broadband bandwidth with less beam squinting effects. It uses an optimum switched line to obtain very low delay error and insertion loss variation.

The die is manufactured using ED02AH a 0.18 µm gate length pHEMT process. The MMIC uses gold bonding pads, backside metallization and is fully protected with Silicon Nitride passivation to obtain the highest level of reliability. This technology has been evaluated for Space applications and is on the European Preferred Parts List of the European Space Agency.

Block Diagram



Ordering Information

Part Number	Package
CGY2394SUH/C1	Die

* Restrictions on Hazardous Substances, compliant to current RoHS EU directive.

Electrical Specifications: Measured On Wafer, Freq. = 12 GHz, T_A = +25°C

Parameter	Test Conditions	Units	Min.	Typ.	Max.
Insertion Loss	—	dB	—	5	8
Time Delay Range	—	ps	312	320	330
Time Delay Step	—	ps	8	10	12
Input Reflection Coefficient	—	dB	10	18	—
Output Reflection Coefficient	—	dB	10	14.5	—
Insertion Loss Variation	Ref vs. 320 ps	dB	—	±1.4	±2.0
P1dB	—	dBm	—	9.5	—

Absolute Maximum Ratings[1,2]

Parameter	Absolute Maximum
Time Delay Control Inputs	-0.1 V to 4.5 V
Supply Voltage Negative Positive	 -6 V to 0 V 0 V to +6 V
Input Power @ RF_{IN}	23 dBm
Junction Temperature	+150°C
Storage Temperature	-55°C to +150°C

1. Exceeding any one or combination of these limits may cause permanent damage to this device.
2. MACOM does not recommend sustained operation near these survivability limits.

Operating Conditions

Parameter	Condition
Time Delay Control Inputs	0 V to 4 V
Supply Voltage Negative Positive	 -5 V to 0 V 0 V to +5 V
Junction Temperature	+150°C
Operating Temperature	-40°C to +85°C

Logic Truth Table

	B0
Nominal Time Delay	320 ps
Pad	B0
Time Delay Activated	High
Reference State	Low

Control Voltage

State	Min.	Typ.	Max.	Unit
Low	-0.1	0	+0.1	V
High	+3.5	+4.0	+4.5	V

Handling Procedures

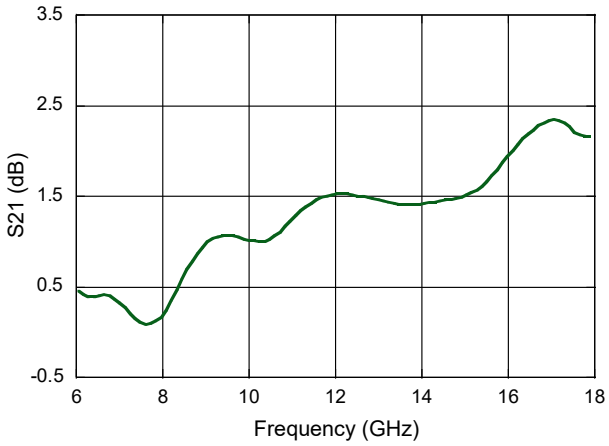
Please observe the following precautions to avoid damage:

Static Sensitivity

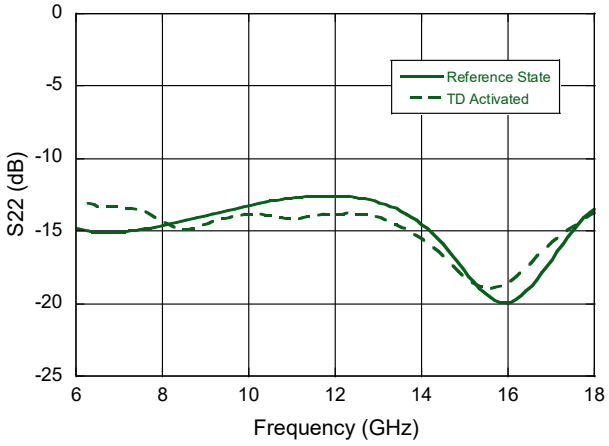
These electronic devices are sensitive to electrostatic discharge (ESD) and can be damaged by static electricity. Proper ESD control techniques should be used when handling these devices.

Typical Performance Curves: On Wafer Measurements

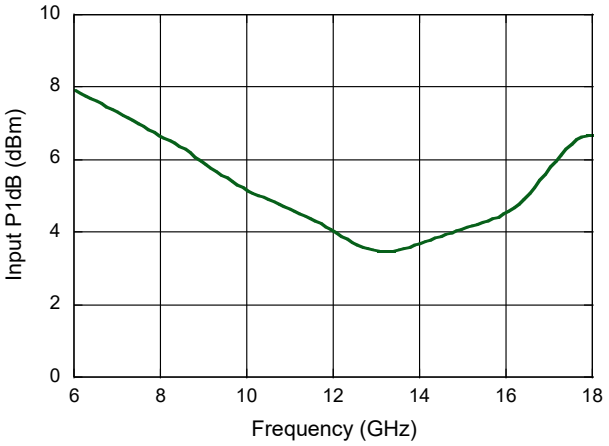
Gain Variation



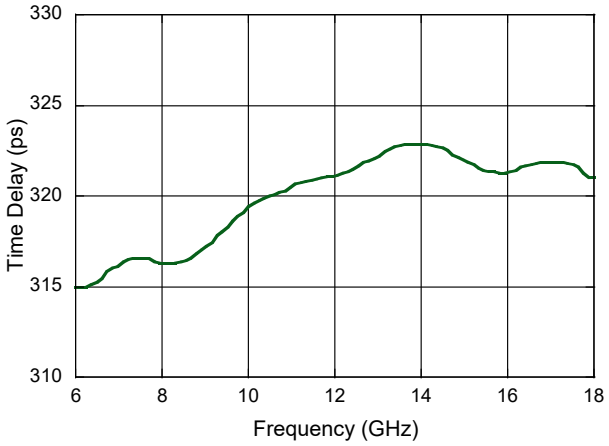
Output Return Loss



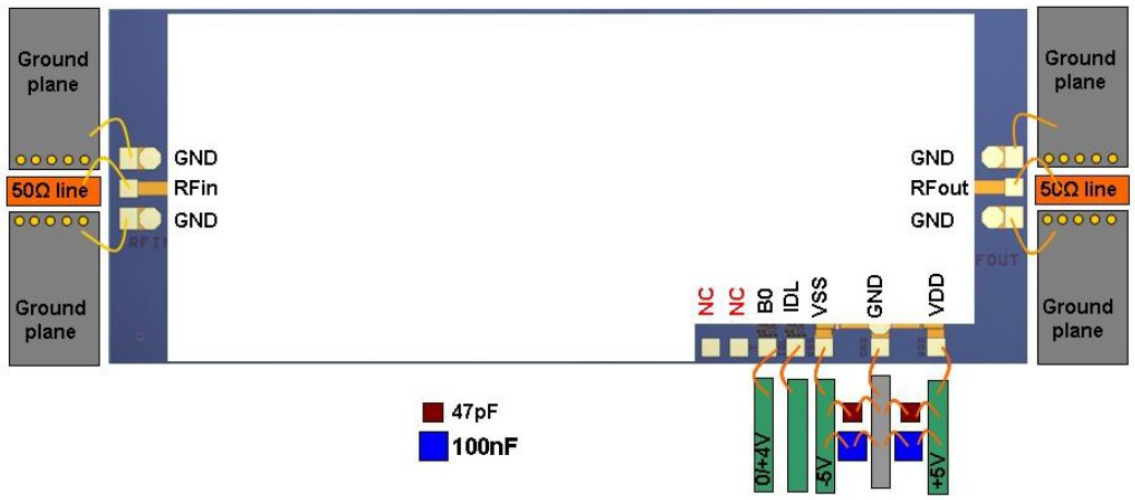
Input P1dB @ Reference State



Time Delay



Application Schematic



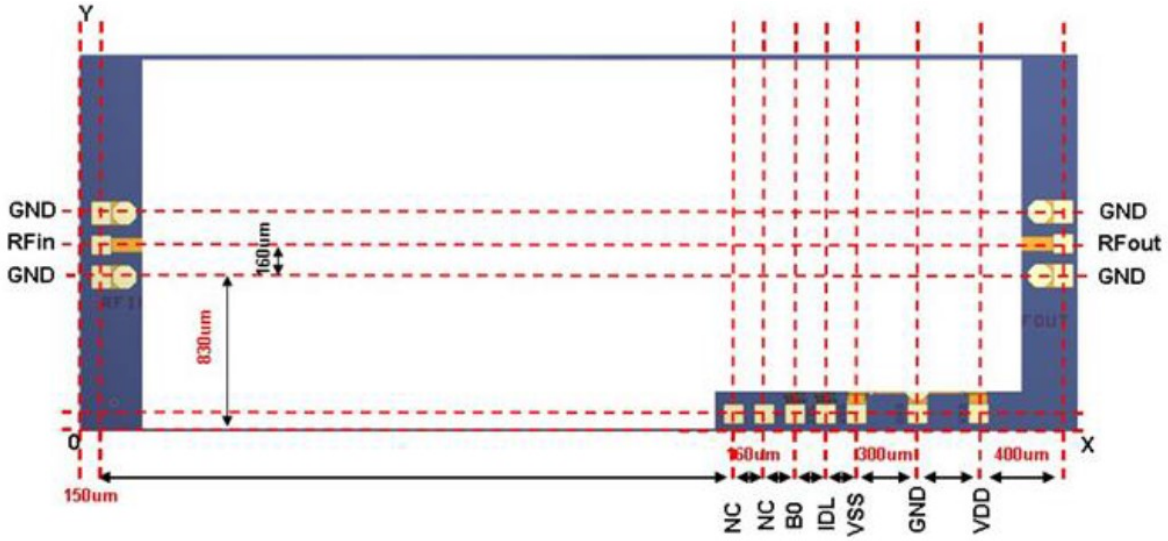
- The RF interfacing bond wires or ribbon should be kept as short as possible.
- The RF lines should be 300 µm wide or less to minimize discontinuities associated with the connection to the MMIC bond pads.

Decoupling Parts List[3]

Parameter	Value (V_{DD} & V_{SS})
Chip SMD Capacitor 1	47 pF or 100 pF
Chip SMD Capacitor 1	100 nF

3. No decoupling on digital control pads.

Mechanical Information



Chip Size = 5000 x 2000 µm (4965 x 1965 µm ± 5 µm after dicing)
DC Pads = 100 x 125 µm, top metal = Au
RF Pads = 110 x 150 µm, top metal = Au
Chip Thickness = 100 µm

Pad Position[4]

Pad Name	Symbol	Coordinate (µm)		Pad Size (µm^2)	Description
		X	Y		
GND	GND	150	830	16500	Ground
RF_{IN}	RF_{IN}	150	990	16500	RF Input Port
GND	GND	150	1150	16500	Ground
GND	GND	4850	1150	16500	Ground
RF_{OUT}	RF_{OUT}	4850	990	16500	RF Output Port
GND	GND	4850	830	16500	Ground
VDD	VDD	4450	100	12500	Positive Supply Voltage
GND	GND	4150	100	12500	Ground
VSS	VSS	2850	100	12500	Negative Supply Voltage
IDL	IDL	2690	100	12500	Amplifier Current Control
T	B0	2530	100	12500	Unit Time Delay Control Input

4. X = 0, Y = 0 at bottom left corner.