

True Time Delay, 5-Bit 6 - 18 GHz



CGY2393SUH/C1

Rev. V1

Features

- Insertion Loss: <7 dB
- IL Flatness: +/- 1.5 dB
- IL Variation Reference vs Full Delay: +/-1.2 dB
- Delay Range: 310 ps
- Delay Steps: 10 ps
- Delay RMS error: < 2 ps
- Input P1dB: >12 dBm
- Input Return Loss: < -19 dB
- Output Return Loss: < -13 dB
- 0 / 4V Control Lines
- Consumption: 440 mW @ 5 V
- Chip Size: 3500 x 4000 μm
- Tested, Inspected Known Good Die (KGD)
- Space and MIL-STD Available
- RoHS* Compliant

Applications

- Radar
- Telecommunication
- Instrumentation

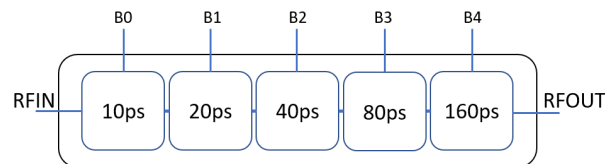
Description

The CGY2393SUH/C1 is a high performance GaAs MMIC 5-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. This device has a range of 310 ps with 10 to 160 ps steps. It uses an optimum switched line to obtain very low delay error and insertion loss variation.

The die is manufactured using the ED02AH 0.18 μm gate length pHEMT process. The MMIC uses gold bond 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
CGY2393SUH/C1	Die

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

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

Parameter	Test Conditions	Units	Min.	Typ.	Max.
Insertion Loss	—	dB	4.8	6.0	7.0
Time Delay Range	—	ps	300	310	320
Time Delay Minimum Step	—	ps	8	10	12
Input Reflection Coefficient	—	dB	—	-19.0	-17.0
Output Reflection Coefficient	—	dB	—	-14.5	-13.0
Insertion Loss Flatness	@ Ref	dB	0.8	1.5	2.0
Insertion Loss Variation	Ref vs. All States	dB	—	-1.2	—
P1dB	—	dBm	12.0	12.5	—

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
Supply Current Negative Positive	23 mA 150 mA
Input Power @ RF _{IN}	23 dBm
Junction Temperature	+150°C
Storage Temperature	-55°C to +150°C

- Exceeding any one or combination of these limits may cause permanent damage to this device.
- 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
Supply Current Negative Positive	13 mA 76 mA
Junction Temperature	+150°C
Storage Temperature	-55°C to +150°C

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.

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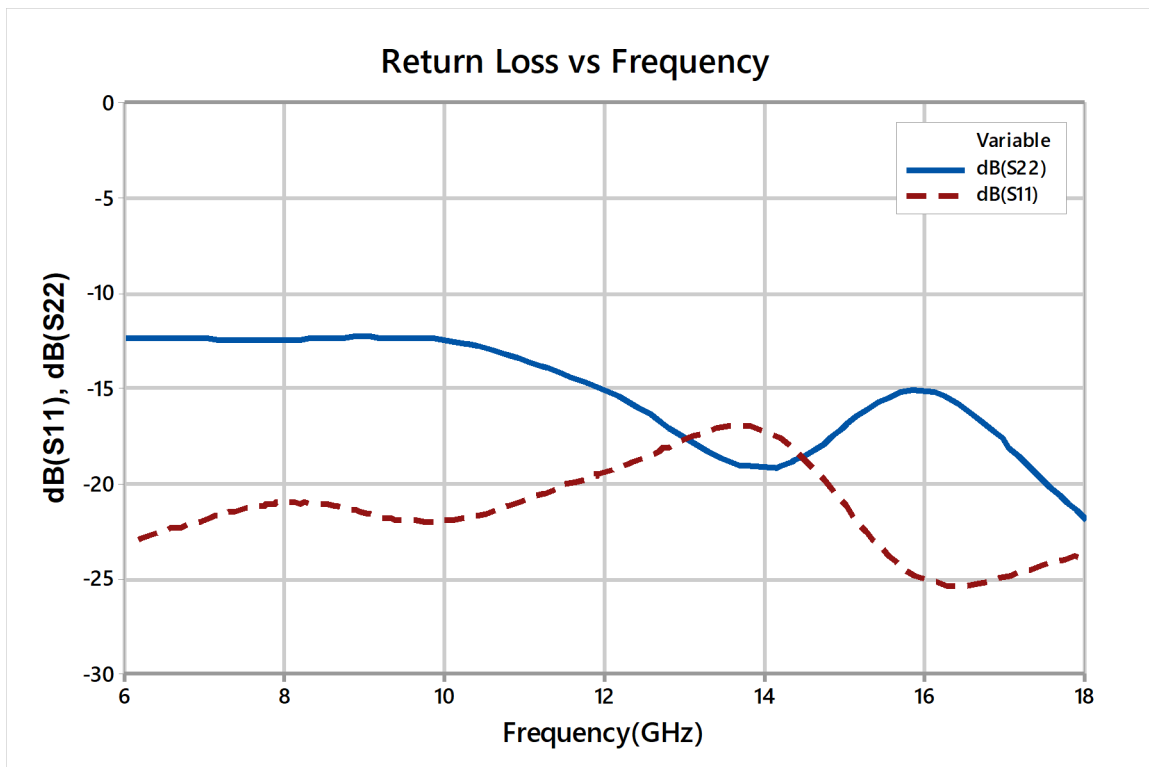
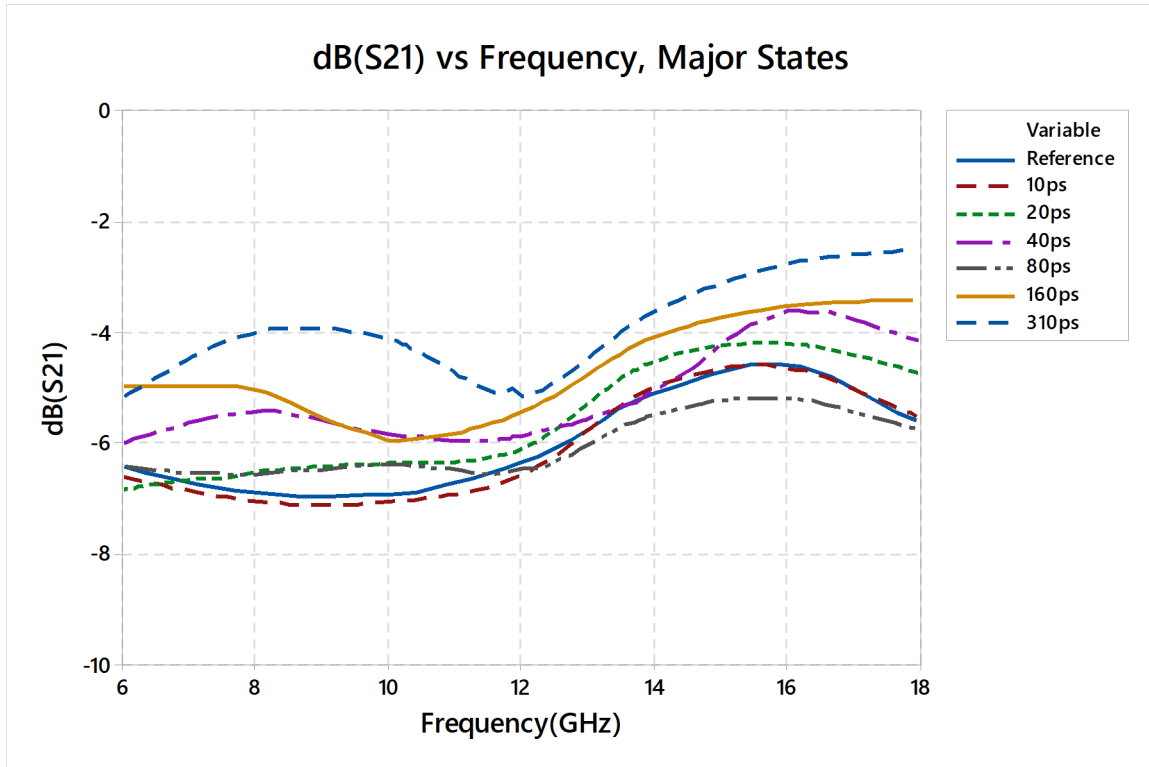
Logic Truth Table

	B0	B1	B2	B3	B4
Nominal Time Delay	10 ps	20 ps	40 ps	80 ps	160 ps
Pad	T1	T2	T3	T4	T5
Time Delay Activated	High	High	High	High	High
Reference State	Low	Low	Low	Low	Low

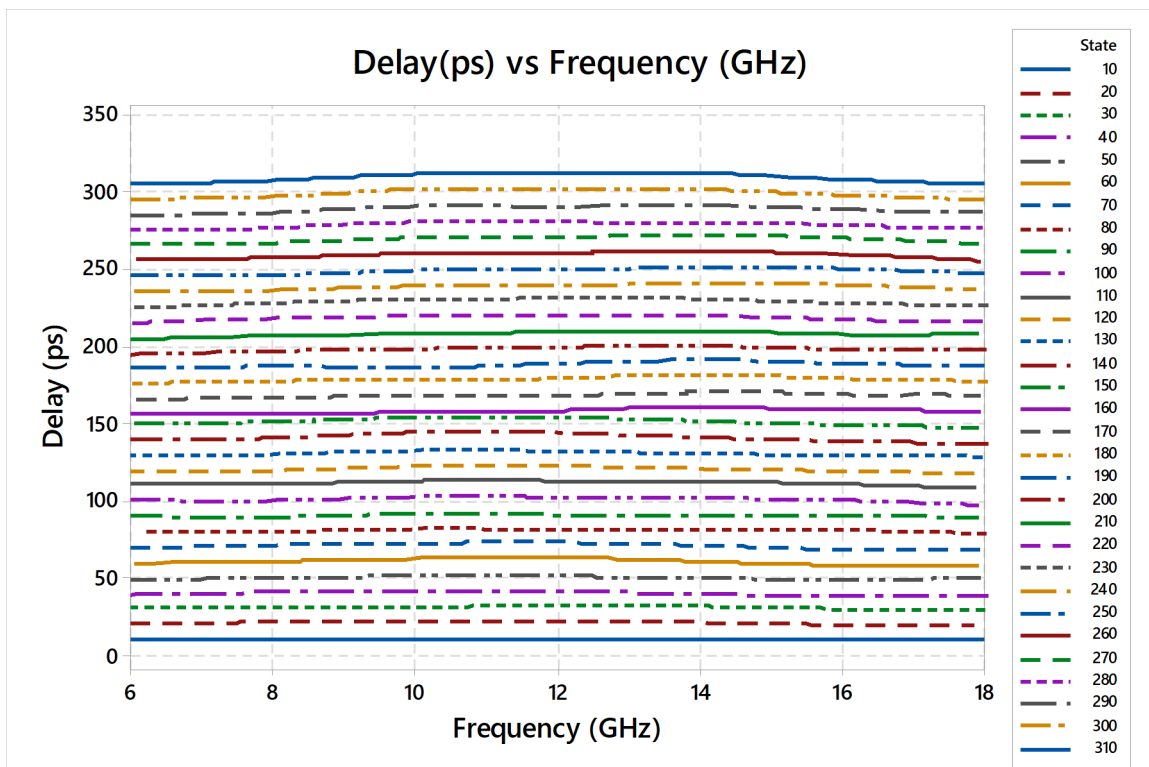
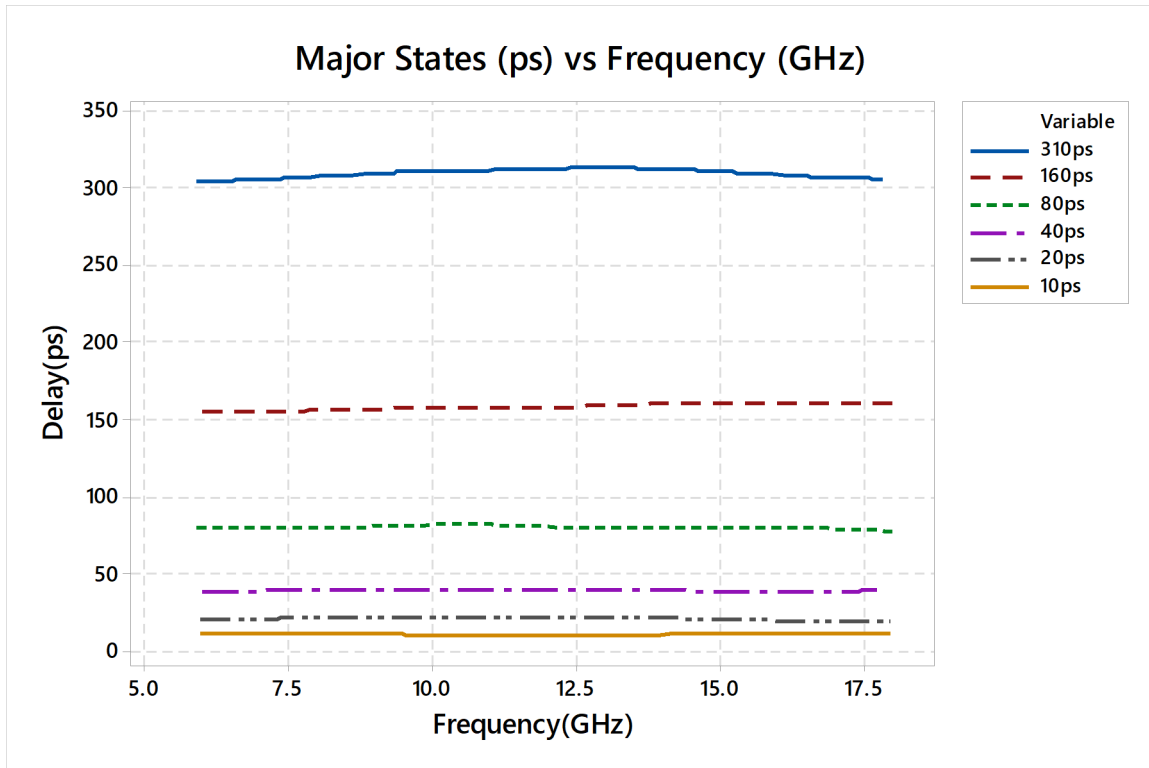
Control Voltage

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

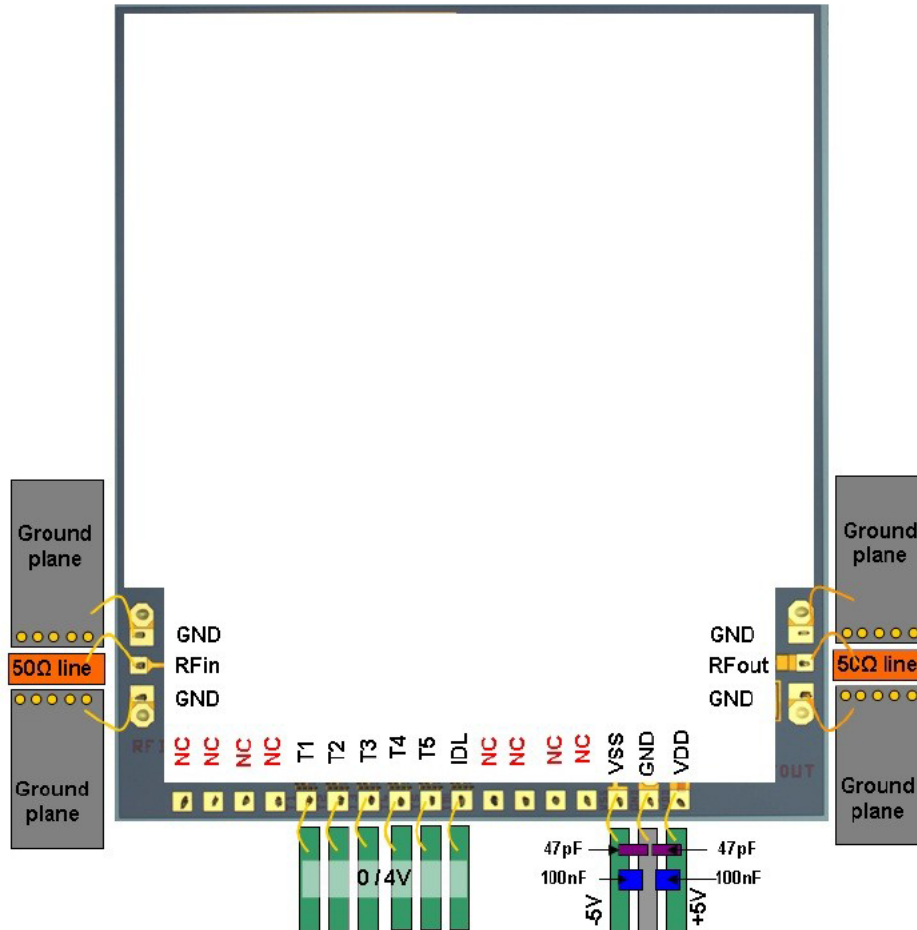
Typical Performance Curves: On Wafer Measurements



Typical Performance Curves: On Wafer Measurements



Bonding Diagram & Assembly Information



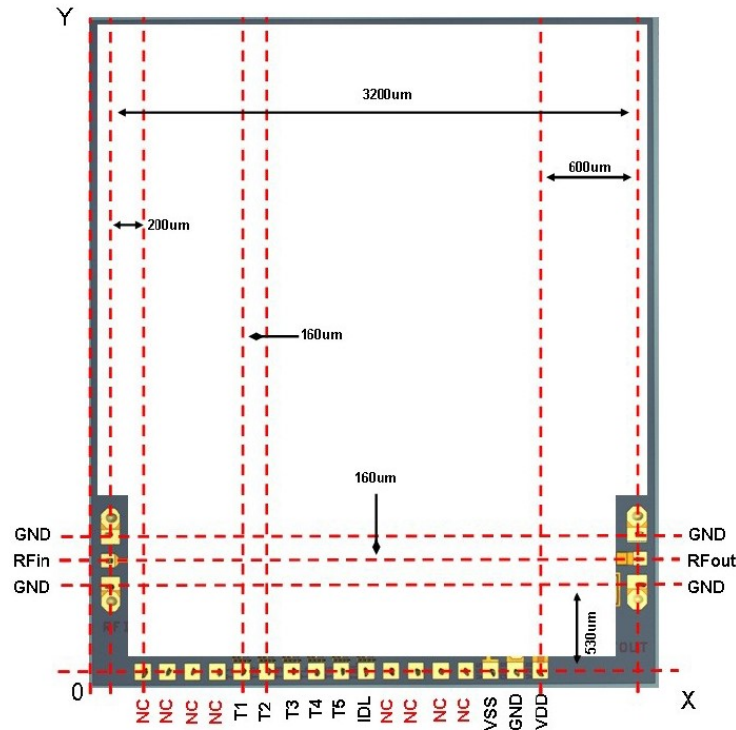
- The RF interfacing bond wires or ribbon should be kept as short as possible.
- The RF lines should be 300 μm wide or less to minimize discontinuities associated with the connection to the MMIC bond pads.
- The power supply (VSS or VSS2) must be decoupled to the ground with capacitors as close as possible to the chip.

Decoupling Parts List³

Parameter	Value
Chip SMD Capacitor 1	47 pF or 100 pF
Chip SMD Capacitor 1	100 nF

3. No decoupling on control pads.

Mechanical Information



Chip Size = 3500 x 4000 μm (3465 x 3965 $\mu\text{m} \pm 5 \mu\text{m}$ 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 Position⁴

Pad Name	Symbol	Coordinate		Description
		X	Y	
GND	GND	150	630	Ground
RFin	RF _{IN}	150	790	RF Input Port
GND	GND	150	950	Ground
GND	GND	3350	950	Ground
RFout	RF _{OUT}	3350	790	RF Output Port
GND	GND	3350	630	Ground
VDD	VDD	2910	100	Positive Supply Voltage
GND	GND	2750	100	Ground
VSS	VSS	2590	100	Negative Supply Voltage
IDL	IDL	1790	100	Amplifier Current Control
T5	B4	1630	100	160 ps Time Delay Control Input
T4	B3	1470	100	80 ps Time Delay Control Input
T3	B2	1310	100	40 ps Time Delay Control Input
T2	B1	1150	100	20 ps Time Delay Control Input
T1	B0	990	100	10 ps Time Delay Control Input

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

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