

# PRELIMINARY DATASHEET

## CGY2393SUH/C1 6-18GHz 5 bit True Time Delay

### 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. The CGY2393SUH/C1 has a range of 310ps with 10 to 160ps steps. It uses an optimum switched line to obtain very low delay error and insertion loss variation.

This product is part of Ommic's new 6 - 18 GHz chipset that is dedicated to Radar, Telecommunication and Instrumentation applications.

The die is manufactured using ED02AH OMMIC's 0.18  $\mu\text{m}$  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.

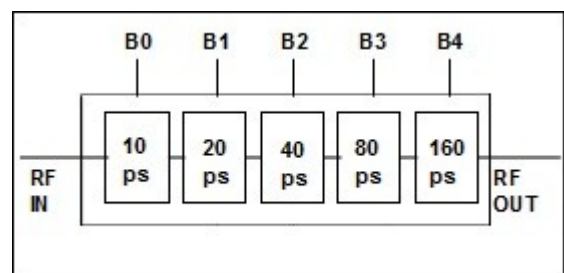
### APPLICATIONS

- ▶ Radar
- ▶ Telecommunication
- ▶ Instrumentation



### FEATURES

- ▶ Operating Range : 6 GHz to 18 GHz
- ▶ Insertion Loss < 7 dB
- ▶ IL Flatness = +/- 1.5 dB
- ▶ IL Variation ref vs full delay = +/-1.2dB
- ▶ Delay Range = 310 ps
- ▶ Delay steps = 10 ps
- ▶ Delay RMS error < 2ps
- ▶ Input P1dB > +12 dBm
- ▶  $S_{11}$  < -19 dB
- ▶  $S_{22}$  < -13 dB
- ▶ 0 / 4V Control Lines
- ▶ Consumption : 440mW @ 5V
- ▶ Chip size = 3500 x 4000  $\mu\text{m}$
- ▶ Tested, Inspected Known Good Die (KGD)
- ▶ Space and MIL-STD Available



CGY2393S 5-Bit 6-18 GHz TTD Block Diagram

## LIMITING VALUES

$T_{amb} = 25\text{ °C}$  unless otherwise noted

Symbol	Parameter	Conditions	MIN.	MAX.	UNIT
$B_N$	Time Delay control inputs		-0.1	+4.5	V
$V_{SS}$	Negative Voltage Supply		-6	0	V
$V_{DD}$	Positive Voltage Supply		0	+6	V
$P_{IN}$	Input power	$P_{RF}$ at RFIN		+23	dBm
$T_j$	Junction temperature			+150	°C
$T_{stg}$	Storage temperature		-55	+150	°C

## OPERATING CONDITIONS

$T_{amb} = 25\text{ °C}$  unless otherwise noted

Symbol	Parameter	Conditions	MIN.	MAX.	UNIT
$B_N$	Time Delay control inputs		0	+4	V
$V_{SS}$	Negative Voltage Supply		-5	0	V
$V_{DD}$	Positive Voltage Supply		0	+5	V
$I_{SS}$	Negative supply current			13	mA
$I_{DD}$	Positive supply current			76	mA
$T_{amb}$	Ambient temperature		-40	+85	°C

## THERMAL CHARACTERISTICS

Symbol	Parameter	Value	UNIT
$R_{th(j-a)}$	Thermal resistance from junction to ambient ( $T_a = 25\text{ °C}$ )	TBD	°C/W

## CHARACTERISTICS

T<sub>amb</sub> = 25 °C – RF Performance measured on wafer.

Symbol	Parameter	Conditions	MIN.	TYP.	MAX.	UNIT
BW	Bandwidth		6		18	GHz
<i>RF Performance at 12 GHz unless specified</i>						
IL	Insertion Loss		4,8	6	7	dB
TD <sub>r</sub>	Time Delay Range		300	310	320	ps
TD <sub>step</sub>	Time Delay minimum step		8	10	12	ps
S <sub>11</sub>	Input reflection coefficient			-19	-17	dB
S <sub>22</sub>	Output reflection coefficient			-14.5	-13	dB
IL <sub>flatness</sub>	Insertion Loss Flatness	@ Ref	+/- 0.8	+/- 1.5	+/- 2	dB
IL <sub>var</sub>	Insertion Loss Variation	Ref vs all states		- 1.2		dB
P <sub>1dB</sub>	Input 1dB compression point		12	12,5		dBm

## 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

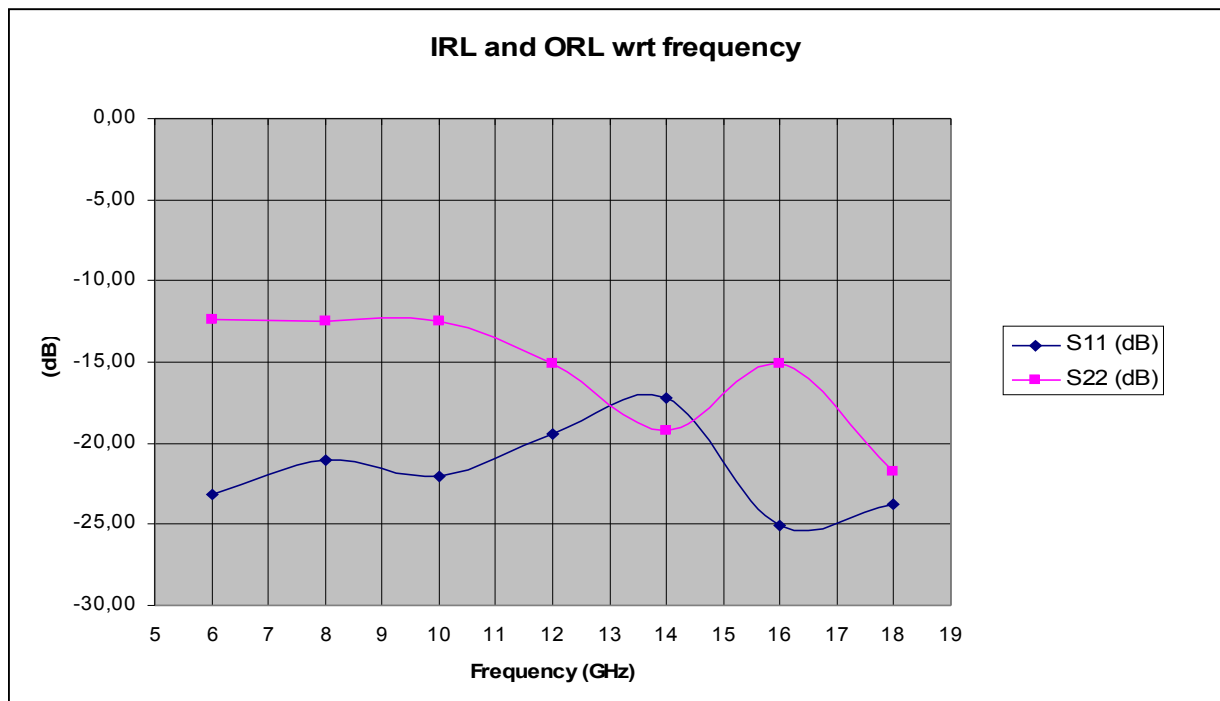
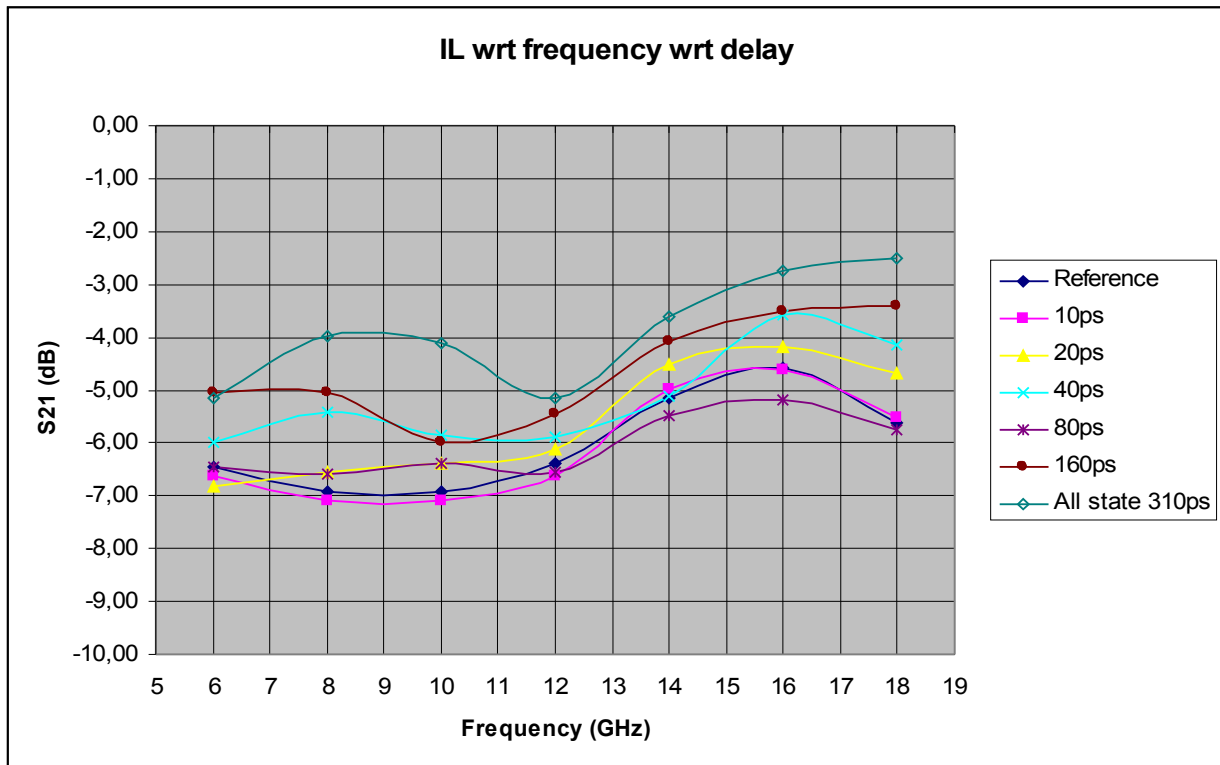
State	MIN.	TYP.	MAX.	UNIT
Low	-0.1	0	+0.1	V
High	+3.5	+4	+4.5	V



**Caution** : This device is a high performance RF component and can be damaged by inappropriate handling. Standard ESD precautions should be followed. OMMIC document "OM-CI-MV/ 001/ PG" contains more information on the precautions to take.

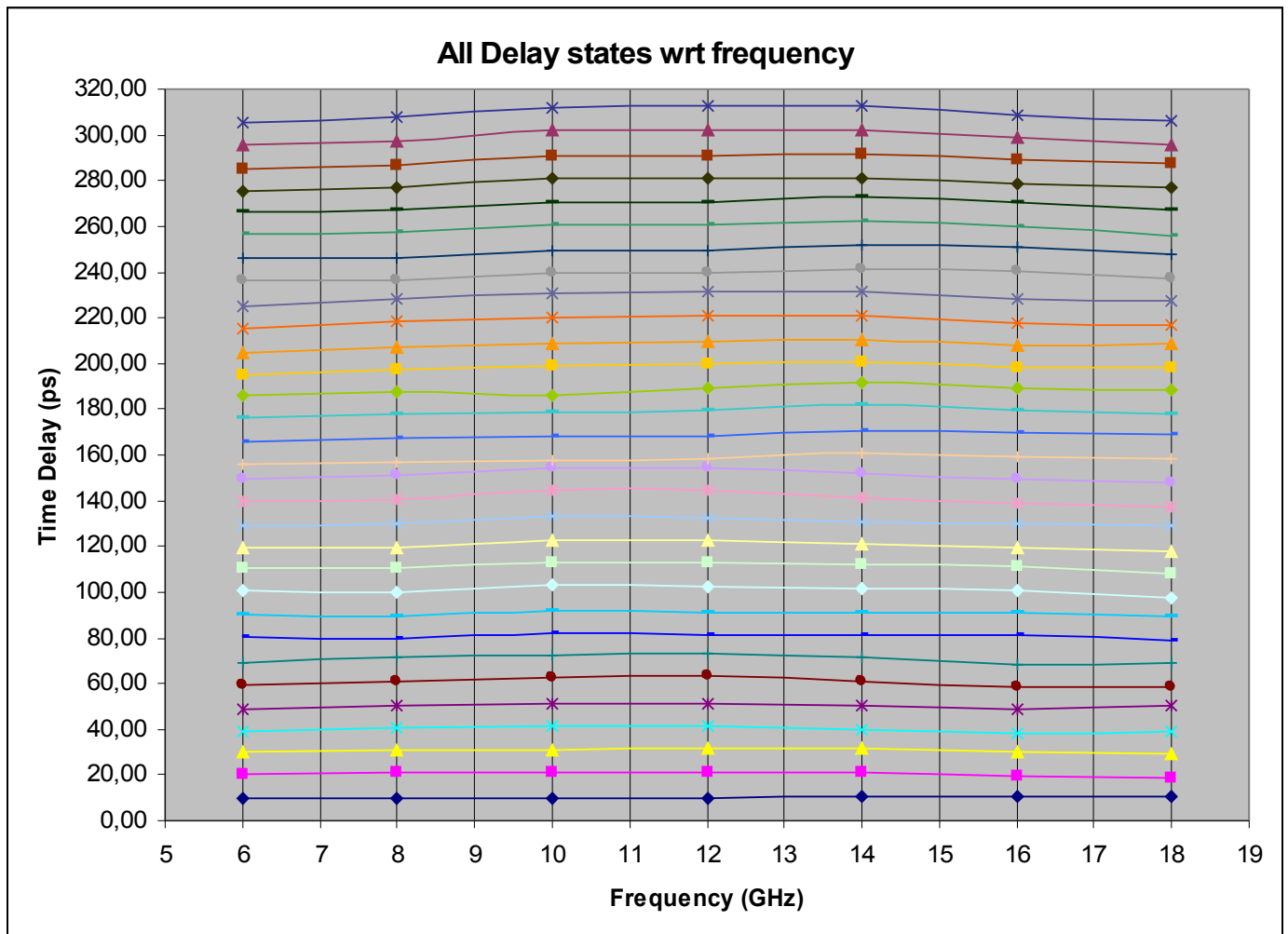
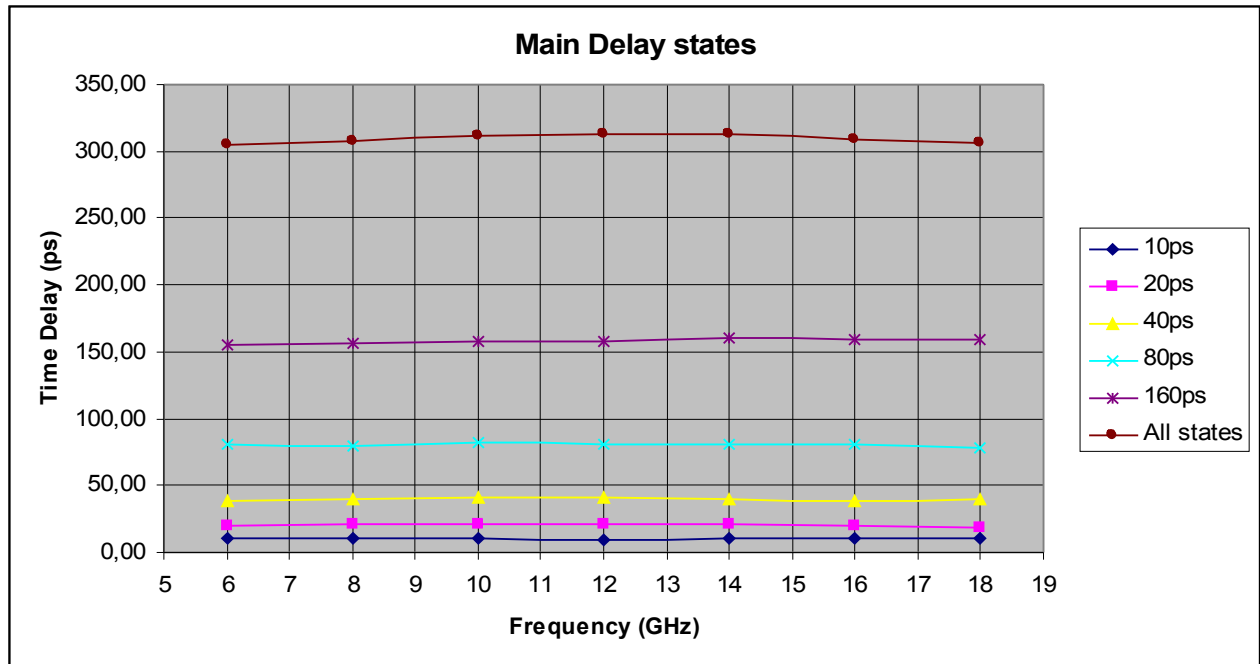
**ON WAFER MEASUREMENTS – S PARAMETERS**

Measured on wafer @ T = 25 °C



**ON WAFER MEASUREMENTS – TIME DELAY BEHAVIOUR**

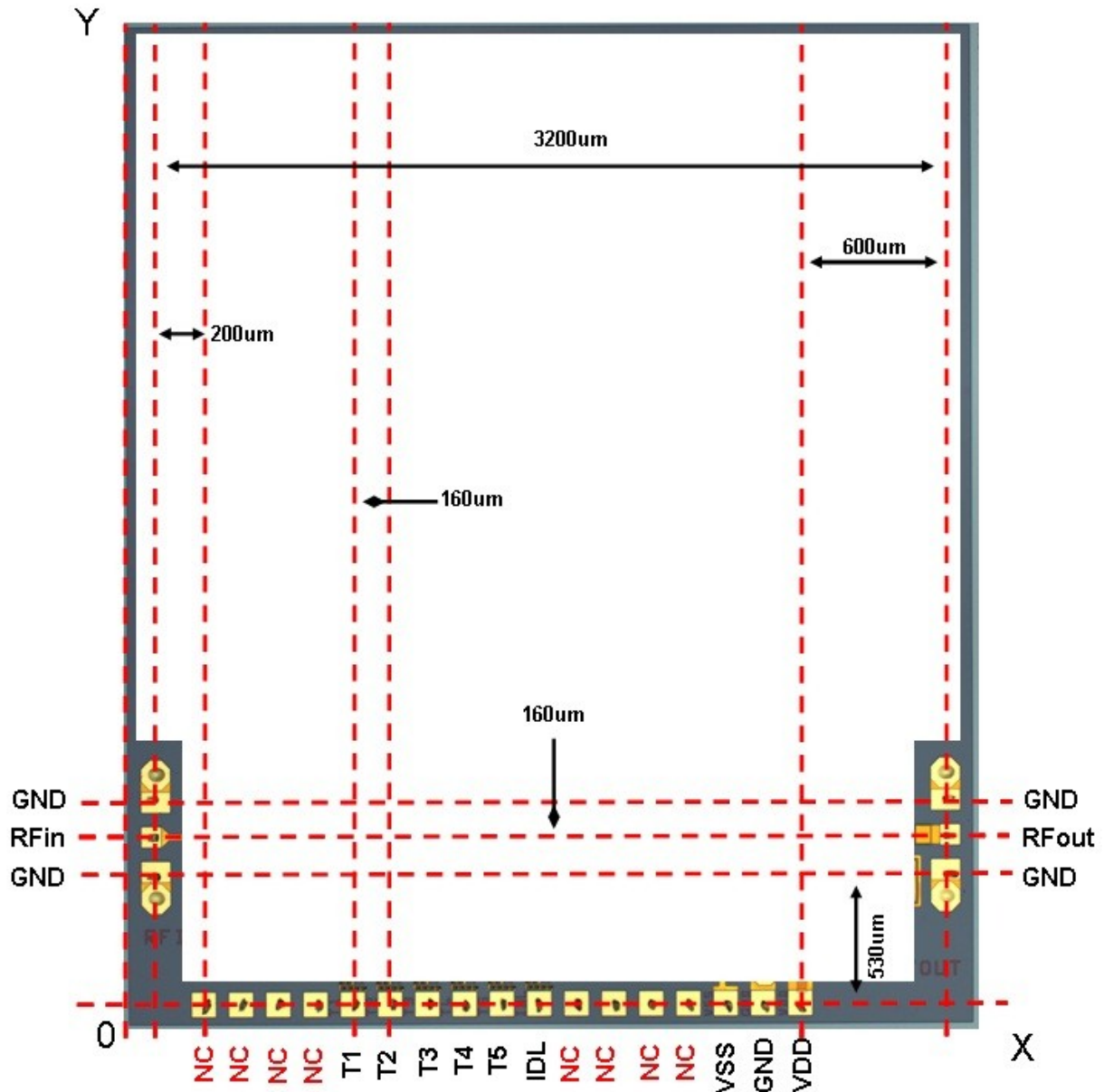
Measured on wafer @ T = 25 °C



**MECHANICAL INFORMATION**

Chip size = 3500 x 4000  $\mu\text{m}$  (3465 x 3965  $\mu\text{m} \pm 5 \mu\text{m}$  after dicing)

- DC Pads = 100 x 125  $\mu\text{m}$ , top metal = Au
- RF Pads = 110 x 150  $\mu\text{m}$ , top metal = Au
- Chip Thickness 100  $\mu\text{m}$



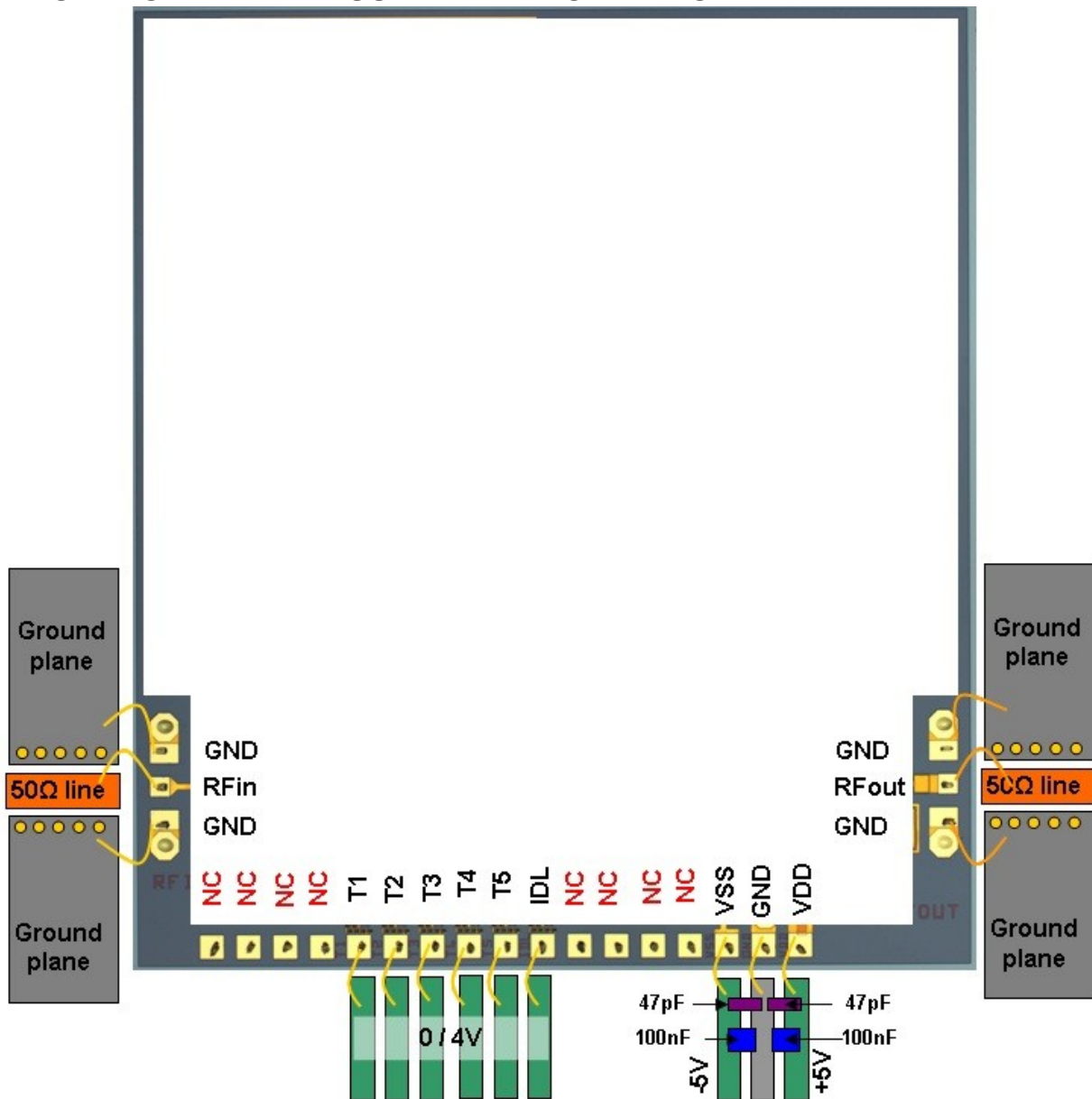
**PAD POSITION**

PAD NAME	SYMBOL	COORDINATES		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	160ps Time Delay Control input
T4	B3	1470	100	80ps Time Delay Control input
T3	B2	1310	100	40ps Time Delay Control input
T2	B1	1150	100	20ps Time Delay Control input
T1	B0	990	100	10ps Time Delay Control input

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



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**BONDING DIAGRAM AND ASSEMBLY INFORMATION**


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

**Decoupling BOM:**

	VDD	VSS
Chip SMD capacitor 1	47pF or 100pF	47pF or 100pF
Chip SMD capacitor 2	100nF	100nF


**NO DECOUPLING ON DIGITAL CONTROL PADS**



**DEFINITIONS**
**Limiting values definition**

Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 60134). Stress above one or more of the limiting values may cause permanent damage to the device. These are stress ratings only and operation of the device at these or at any other conditions above those given in the Characteristics sections of the specification is not implied. Exposure to limiting values for extended periods may affect device reliability.

**Application information**

Applications that are described herein for any of these products are for illustrative purposes only. OMMIC makes no representation or warranty that such applications will be suitable for the specified use without further testing or modification.

**DISCLAIMERS**
**Life support applications**

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**ORDERING INFORMATION**

Generic type	Package type	Version	Sort type	Description
CGY2393S	UH	C1	-	5 bit 6-18 GHz True Time Delay


**Document History : Version 1.0, Last Update 13/06/2013**