Qotana

Wideband GaAs & GaN MMIC

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P/N:QTDD101D

6-18GHz 7-Bit True Time Delay

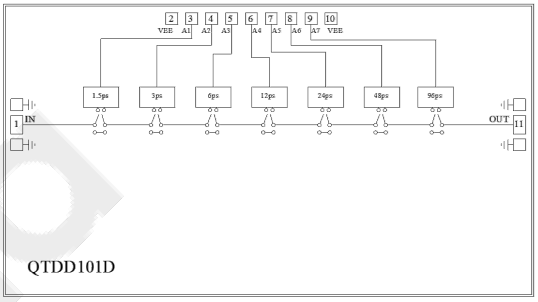
Ver.2.0.0

GaAs MMIC 7-Bit True Time Delay

Features

- Wide Adjustable Time Delay Range
- High Accuracy with Excellent Consistency
- Superior Immunity to Interference with High Stability

Functional Block Diagram



Description

The QTDD101D is a 7-bit GaAs MMIC digitally controlled true time delay (TTD) IC, operating over the frequency range of 6 to 18 GHz. It provides a maximum delay of 190.5 ps with 1.5 ps delay steps and a typical RMS delay accuracy of ±10 ps. The device features TTL-compatible control logic, operates from a single −5 V supply, and is designed for a standard 50 Ω matched impedance. An integrated passivation layer ensures long-term device reliability.

Electrical Specifications :TA = +25°C, VEE = -5V, VCTL = 0/+3V~ +5V

Parameters	Min	Typ	Max	Units
Frequency	6		18	GHz
Insertion Loss		11	13	dB
Time Delay Range		190.5		ps
Minimum Time Delay		1.5		ps
Time Delay Accuracy RMS		±10		ps
Time Delay Phase Accuracy		±30		°
Time Delay Amplitude Modulation		±1.0		dB
Input Return Loss		-17		dB
Output Return Loss		-17		dB
P1dB - Input 1dB Compression		24		dBm
Switching Speed		30		ns

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Absolute Maximum Ratings

Parameter	Rating
RF Input Power (RFIN)	+30dBm
Control Voltage	-0.5V to 8V
Channel Temperature	175°C
Operating Temperature	-55°C to +85°C
Storage Temperature	-65°C to +175°C
ESD Sensitivity (HBM)	Class 1A

ESD Caution

ELECTROSTATIC SENSITIVE DEVICE OBSERVE HANDLING PRECAUTIONS

Ordering Information

Part No.	Package	Description
QTDD101D	Die	6-18GHz 7-Bit True Time Delay

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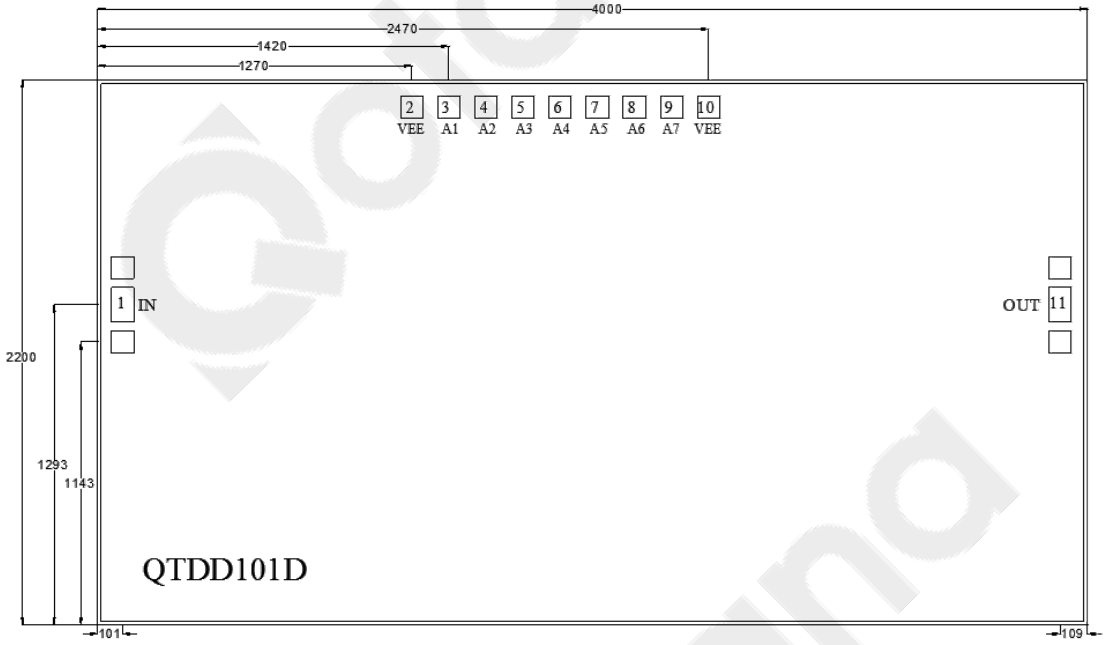
GaAs MMIC 7-Bit True Time Delay

Outline Drawing: All Dimensions in μm



Notes:

- 1. Die is 100 microns thick
- 2. VEE/A1~A7 bond pads are 90 x 90 microns
- 3. RF bond pads are 90 x 140 microns

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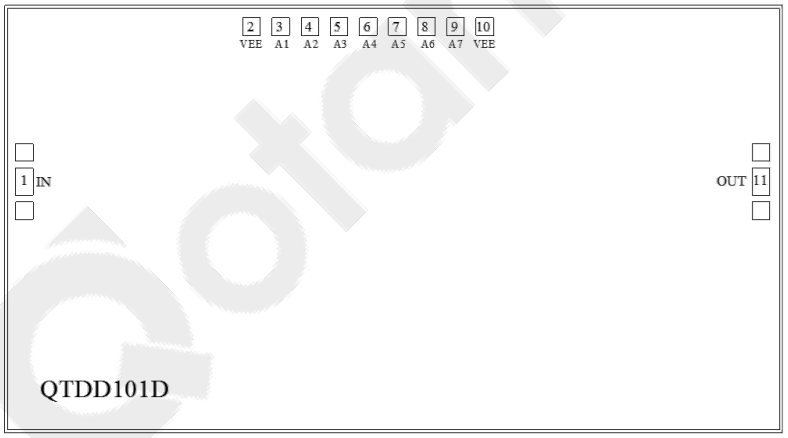
Pad Description

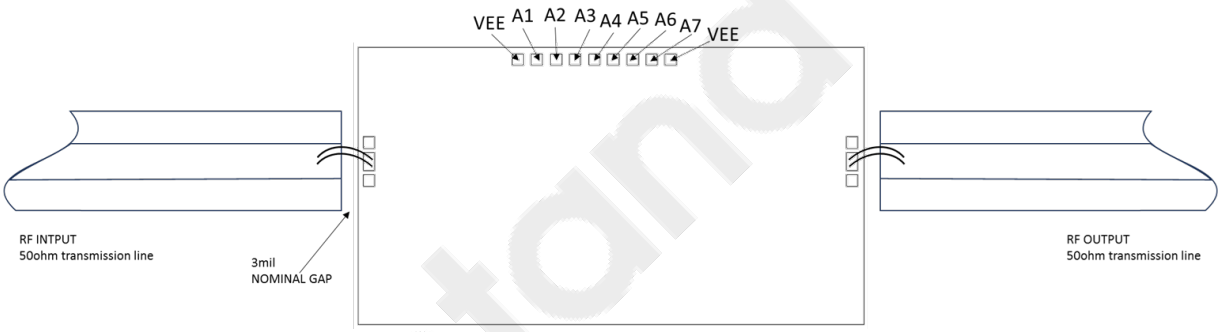


Notes:

- 1. No connection required for unlabeled pads
- 2. Backside and bond pad metal: Gold

Pad	Function	Description
1	IN	RF signal input terminal
3,4,5,6, 7,8,9	A1,A2,A3,A4, A5,A6,A7	Control pad, see truth table and control voltage table.
2,10	VEE	Digital circuit power port, connect to -5V power supply voltage
11	OUT	RF signal output terminal
Backside	Ground	Connect to RF / DC ground

Assembly Drawing



Bias Voltages

VEE	-6V

Control Voltages

State	Bias Condition
Low(0)	0 to 0.8V
High(1)	2 to 5V

Truth Table

Control Voltage Input							State(ps)
A1	A2	A3	A4	A5	A6	A7	
0	0	0	0	0	0	0	0(Reference)
1	0	0	0	0	0	0	1.5
0	1	0	0	0	0	0	3
0	0	1	0	0	0	0	6
0	0	0	1	0	0	0	12
0	0	0	0	1	0	0	24
0	0	0	0	0	1	0	48
0	0	0	0	0	0	1	96
1	1	1	1	1	1	1	190.5

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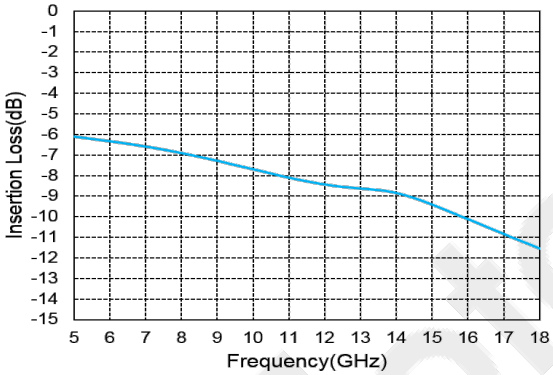
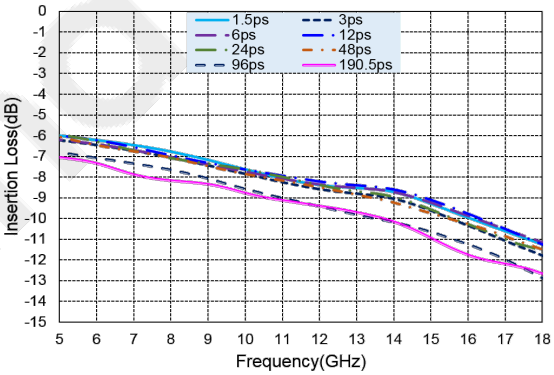
Typical Performance Plots

T_A = +25°C

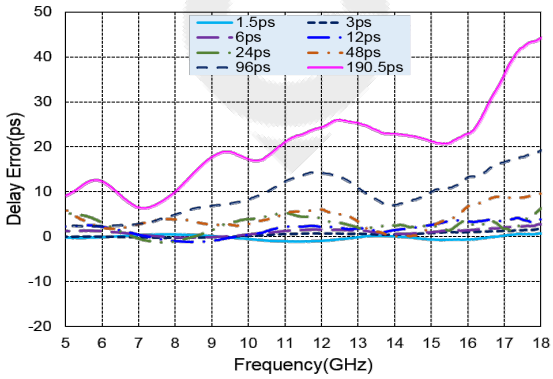
Insertion Loss



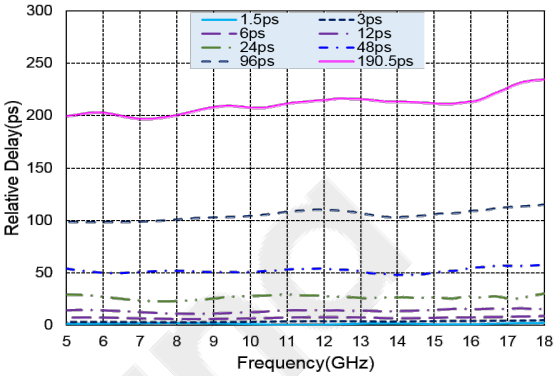
Insertion Loss



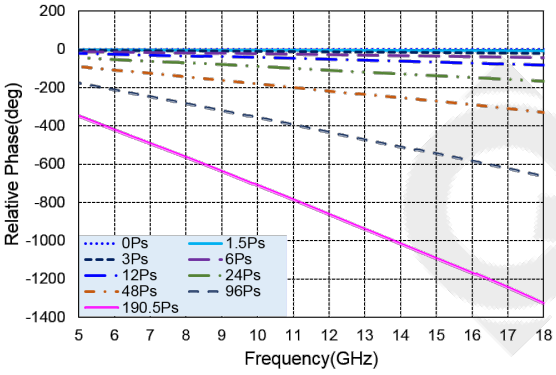
Delay Error



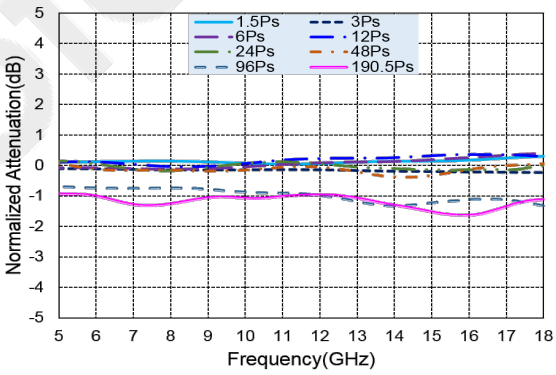
Relative Delay



Relative Phase



Normalized Attenuation



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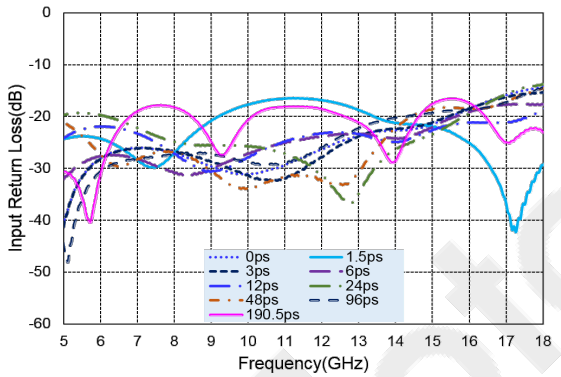
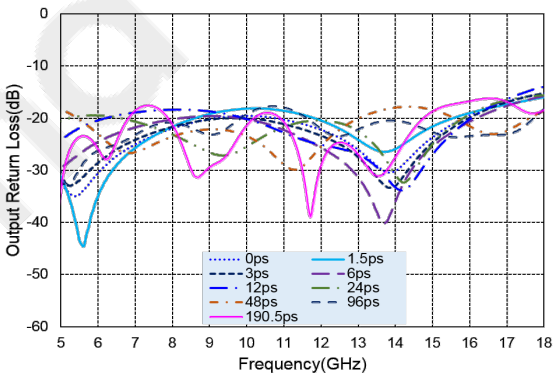
Typical Performance Plots

T_A = +25°C

Input RL



Output RL



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Assembly Instructions

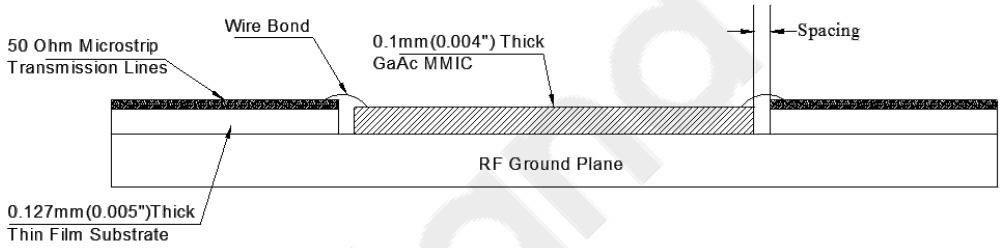

Figure1

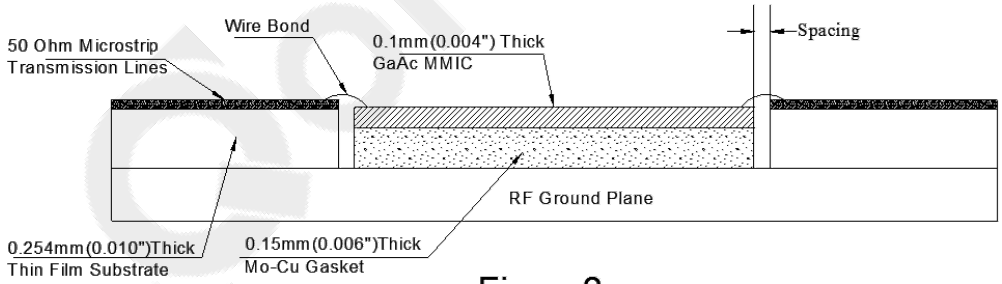

Figure2

- The small signal die can be bonded with conductive adhesive.
- It is recommended to use AuSn alloy for the power amplifier die, and weld it on a molybdenum copper substrate in the nitrogen or nitrogen-hydrogen atmosphere using the eutectic welding process. The time at temperatures above 320°C should not exceed 20 seconds.
- Thermosonic wedge bonding is an excellent interconnection technology.
- In general, the 25μm gold wire will be used to connect the die and microstrip lines. But if the pad size is less than 80μm, the 18μm gold wire is the best choice.
- During the process of assembling, the spacing should be between 0.06mm and 0.15mm when the frequency of the die is below 40GHz, but if the frequency is over 40GHz, the commend spacing is between 0.03mm and 0.06mm.
- You have to make sure that the surface of the die and microstrip line are almost keep in the same horizontal.

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