TPS002

50 GHz Prescaler – Clock Divider

Features

- Divide by 2 (TPS002-2) and Divide by 4 (TPS002-4) Prescaler
- Up to 50 GHz Operation
- Differential or Single Ended Input
- 50Ω Single Ended Impedance
- Differential Output
- Single Power Supply: +3.3V
- 4mm x 4mm QFN package
- Power Dissipation from 285 to 450 mW
- Output Amplitude 650mVpp Differential
- Minimum Input Amplitude 100mV

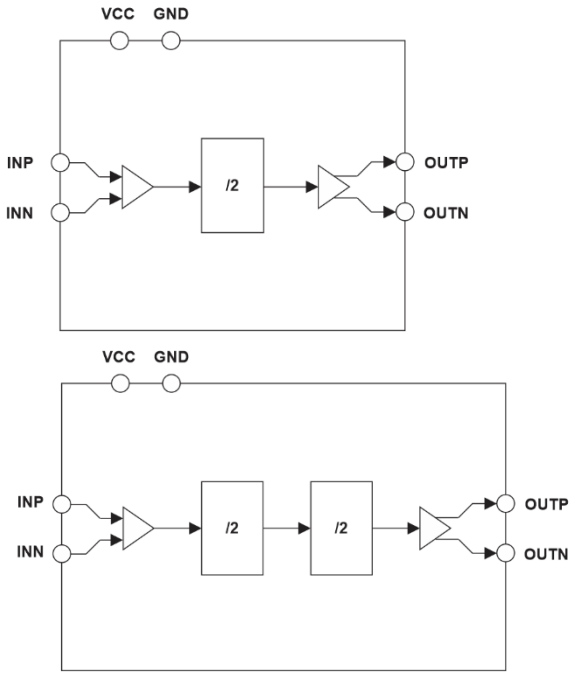

Figure 1 - Functional Block Diagram (TPS002-2 on Top, TPS002-4 on the Bottom).

Product Description

The differential-to-differential prescaler is a fixed divider block with a wide operating range. There are two versions of the prescaler. TPS002-2 has one divide by two prescaler; TPS002-4 has one divide by four prescaler. Both versions can operate up to 50 GHz.

Ordering information

PART NUMBER	DESCRIPTION
TPS002-2-QN	50 GHz Divide by 2 Prescaler
TPS002-4-QN	50 GHz Divide by 4 Prescaler
EVTPS002-X	Evaluation Board

CAUTION
DEVICE SUSCEPTIBLE TO DAMAGE BY ELECTROSTATIC DISCHARGE (ESD)

Absolute Maximum Ratings

Supply Voltages

VCC to GND……..…….…..... 3.5V

Input Voltages

INP, INN to VCC (when DC coupled) ……+/- 1V

Temperature

Junction Temperature ……..... +150°C
Lead, Soldering (10 Seconds) …….. +220°C
Storage …… -40 to 125°C

DC Electrical Specification

Test Conditions (see notes for specific conditions): Room Temperature; VCC = 3.3V; Input: 10GHz, 0.5Vpp Differential; Differential Outputs Terminated Into 50 Ω to 0V; Inputs and Outputs AC coupled.

	PARAMETER	SYMBOL	CONDITIONS, NOTE	MIN	TYP	MAX	UNITS
1.0	**INPUT (INP, INN)**						
1.1	Input Impedance	R_{IN}	Each Lead to VCC		50		Ω
2.0	**OUTPUT (OUTP, OUTN)**						
2.1	Output Impedance	R_{OUT}	Each Lead to VCC		50		Ω
3.0	**POWER SUPPLY REQUIREMENTS**						
3.1	Positive Supply Current	ICC	TPS002-2		90		mA
3.2	Positive Supply Current	ICC	TPS002-4		142		mA
3.3	Power Dissipation	P	TPS002-2		297		mW
3.4	Power Dissipation	P	TPS002-4		468		mW

AC Electrical Specification

Test Conditions (see notes for specific conditions): TPS002-2; Room Temperature; VCC = 3.3V; Input: 10GHz, 0.5Vpp Differential; Differential Outputs Terminated Into 50 Ω to 0V; Inputs and Outputs AC coupled.

	PARAMETER	SYMBOL	CONDITIONS, NOTE	MIN	TYP	MAX	UNITS
4.0	**DYNAMIC PERFORMANCE**						
4.1	Output Amplitude	V_{OUT}	Differential		650		mV
4.2	Phase Noise	Ph1	OUT=12.5GHz at 10Khz offset		-113		dBc/Hz
4.3	Phase Noise	Ph2	OUT=12.5GHz at 100Khz offset		-114		dBc/Hz
4.4	Phase Noise	Ph3	OUT=12.5GHz at 300Khz offset		-123		dBc/Hz
5.0	**TIMING**						
5.1	Output Rise Time	$T_{OUT,R}$	20% to 80%		7		ps
5.2	Output Falling Time	$T_{OUT,F}$	80% to 20%		8		ps
5.3	Propagation Delay	T_{DLY}	50% in to 50% out				ps

Operating Conditions

	PARAMETER	SYMBOL	CONDITIONS, NOTE	MIN	TYP	MAX	UNITS
6.0	**INPUT (INP, INN)**						
6.1	Input Amplitude	V_{IN}	Differential	100		1000	mVpp
6.2	Input Frequency	F_{IN}				50	GHz
7.0	**ANALOG OUTPUT (OUTP, OUTN)**						
7.1	Ext. Termination Resistor [1]	R_{TERM}	Required From Outputs To GND		50		Ω
8.0	**POWER SUPPLY REQUIREMENTS**						
8.1	Positive Supply Voltage	VCC		3.1	3.3	3.5	V
9.0	**OPERATING TEMPERATURE**						
9.1	Case Temperature [2]	Tc		-40		85	°C

Note: 1 - If the output is DC connected the termination resistor should be connected to VCC.
2 - The part is designed to maintain high performance operation within a case temperature range of -40 ~ 85°C and we recommend not to exceed the Absolute Maximum Temperature shown on page 2. For the best performance, operation within the specified temperature range with proper heat dissipation is recommended. The metal pad where the part is soldered should be connected to the ground plane with thermal vias for better heat dissipation. A heatsink can be attached to the bottom of the PCB, on a metal pad connected to the metal pad where the part is soldered.

TPS002-X Pin Description and Pin Out (20 I/O QFN Package)

P/I/O	PIN	NUM.	NAME	FUNCTION
P	1,3,5,8,11,13,15, bottom pad	8	GND	Ground
P	17,19	2	VCC	Positive Power Supply
I	2	1	INP	Input
I	4	1	INN	
O	14	1	OUTP	Output
O	12	1	OUTN	
-	6,7,9,10,16,18,20	7	NC	Reserved

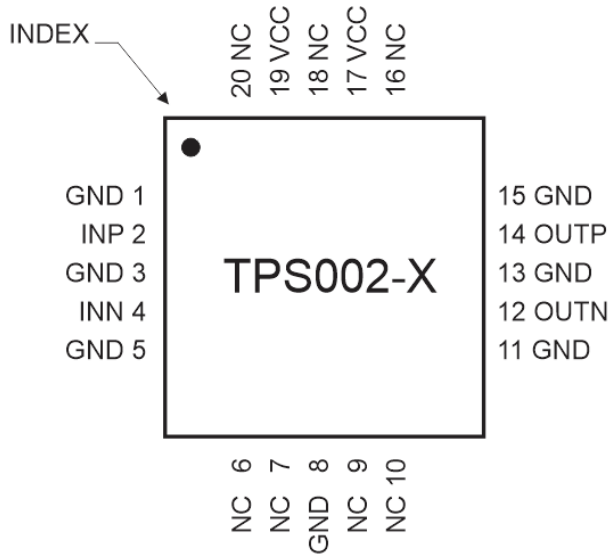

Figure 2 – TPS002-X pinout (top view) 20 I/O QFN package.

Typical Operating Circuit

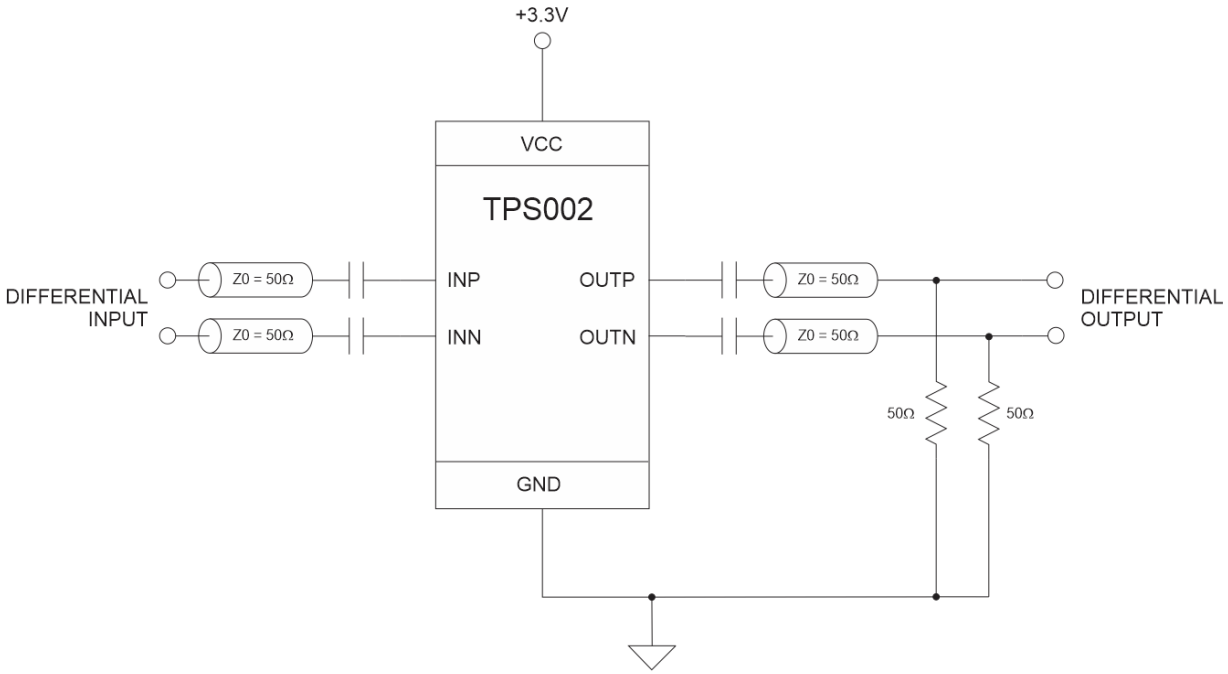

Figure 3 - Typical operating circuit.

Equivalent Circuit

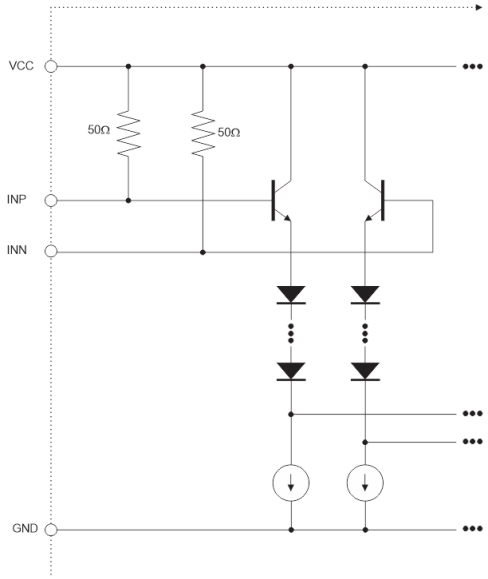

Figure 4 - Input circuit.

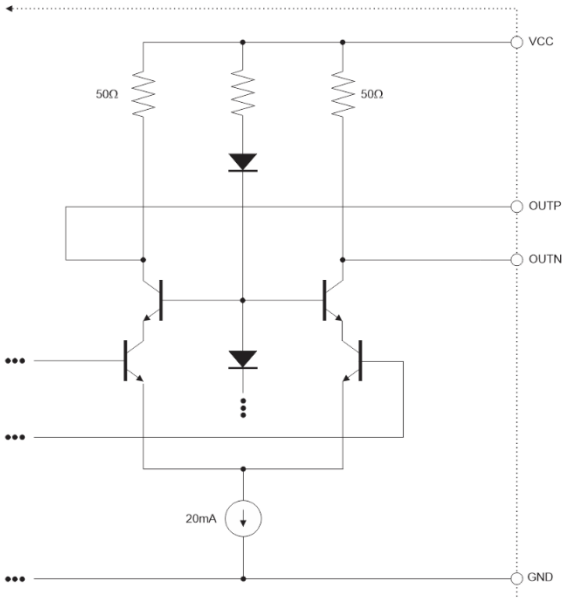

Figure 5 - Output circuit.

Typical Performance

Test Conditions: Room Temperature; VCC = 3.3V; Input 0.5Vpp Differential; Differential Outputs Terminated Into 50 Ω to GND; Inputs and Outputs AC Coupled.

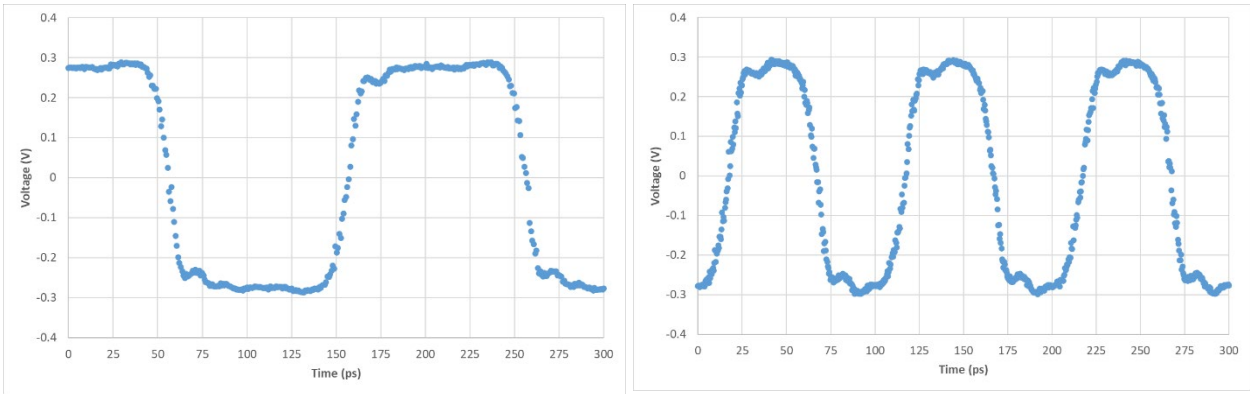

Figure 6 – TPS002-2 differential output with 10GHz and 20GHz input.

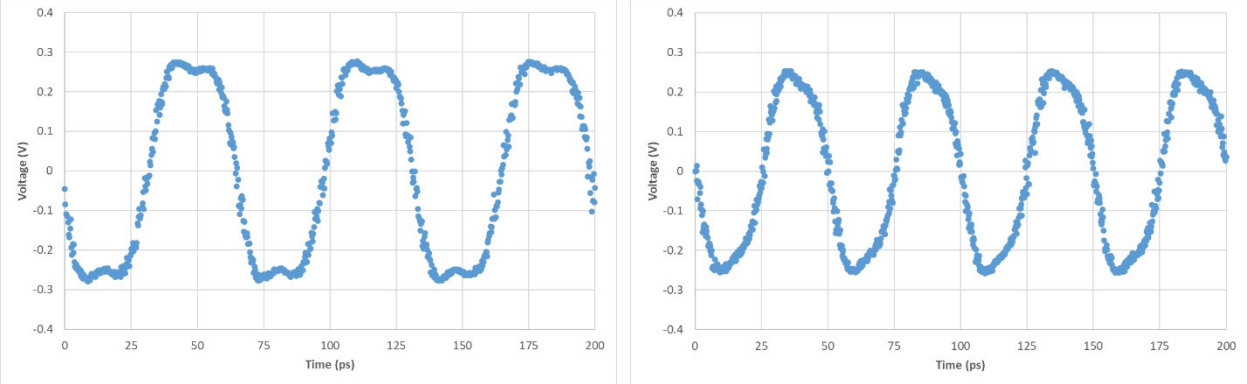

Figure 7 – TPS002-2 differential output with 30GHz and 40GHz input (15GHz and 20GHz output).

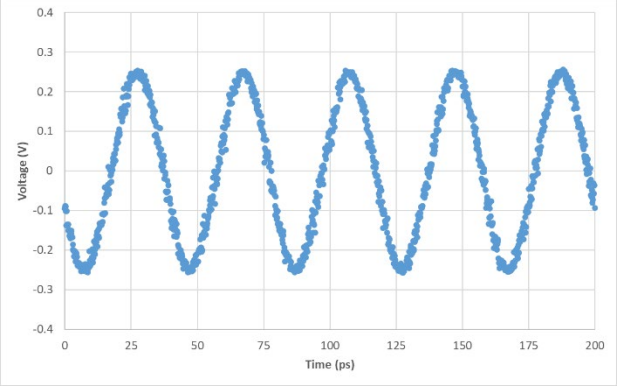

Figure 8 – TPS002-2 differential output with 50GHz input (25GHz output).

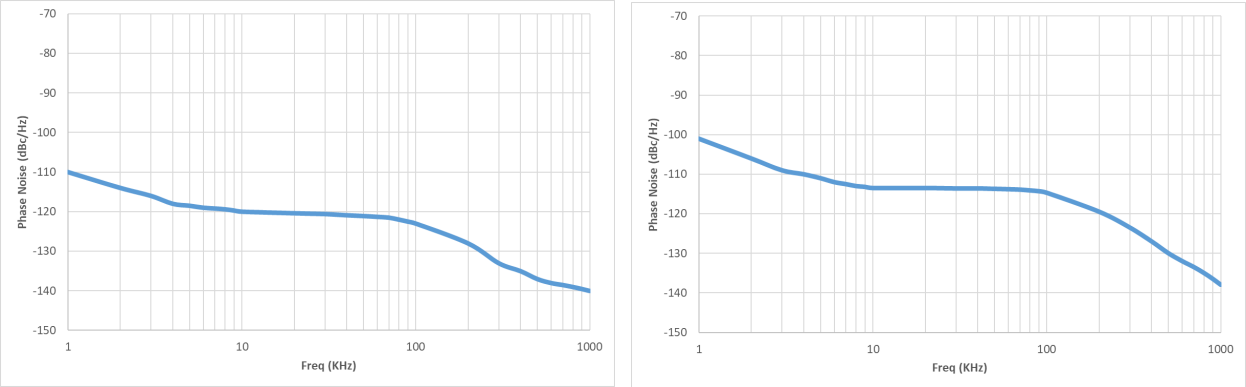

Figure 9 – TPS002-2 phase noise with 10GHz and 25GHz input (5GHz and 12.5GHz output).

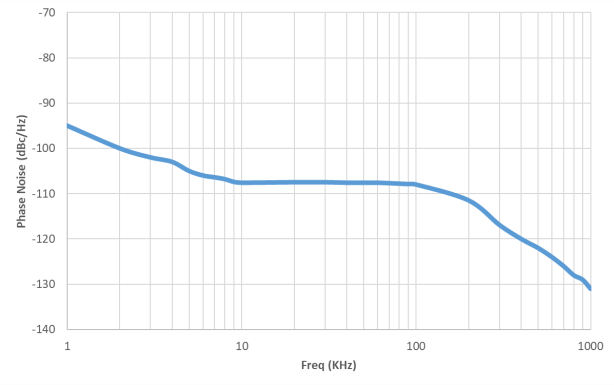

Figure 10 – TPS002-2 phase noise with 50GHz input (25GHz output).

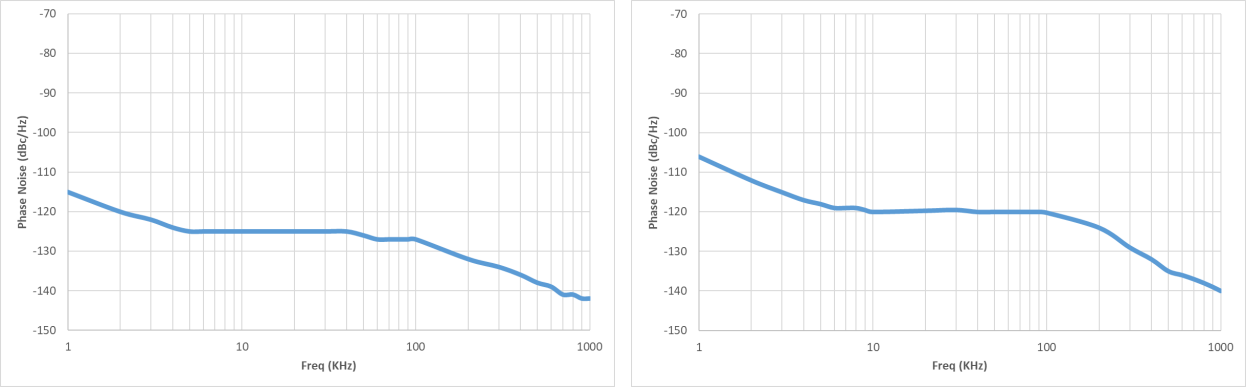

Figure 11 – TPS002-4 phase noise with 10GHz and 25GHz input (2.5GHz and 6.25GHz output).

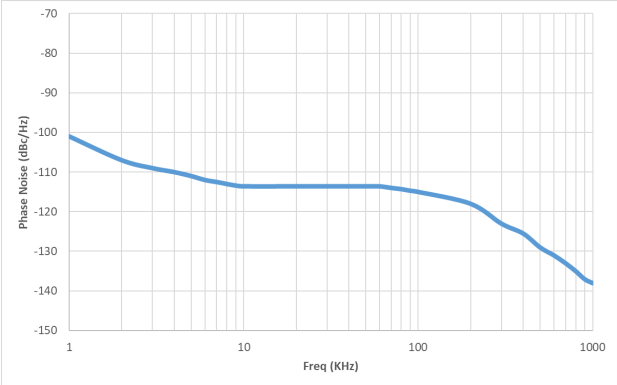

Figure 12 – TPS002-4 phase noise with 50GHz input (12.5GHz output).

Package Information -QN

The package is an organic laminate 20 IO QFN. The bottom pad should be connected to the board electrical GND plane. Multiple vias are recommended for better thermal dissipation.

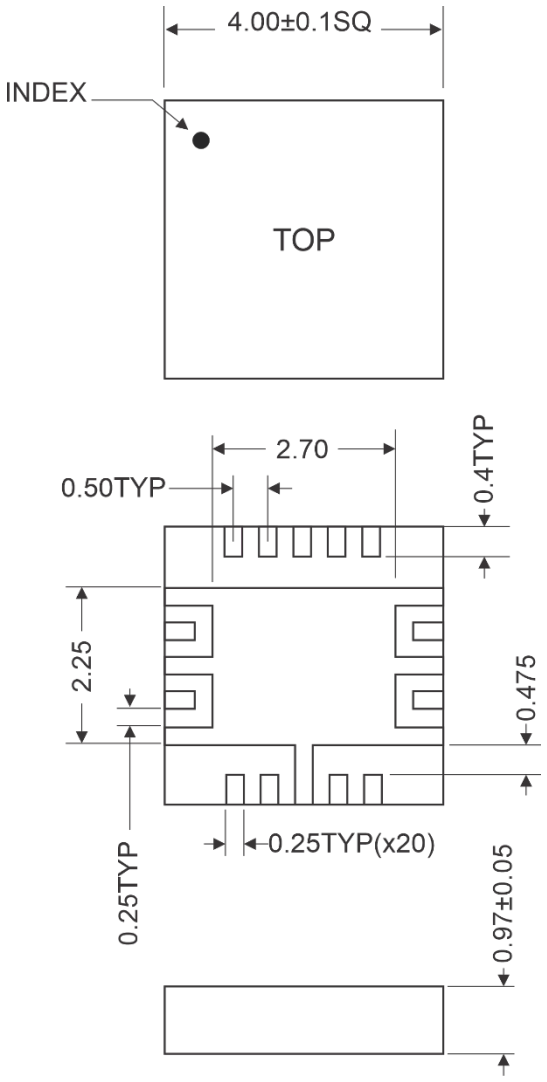

Figure 13 – TPS002-X-QN package outline, dimensions in mm.