Low Voltage 5Ω, 10-Channel 2-Port *NanoSwitch*™

Features:

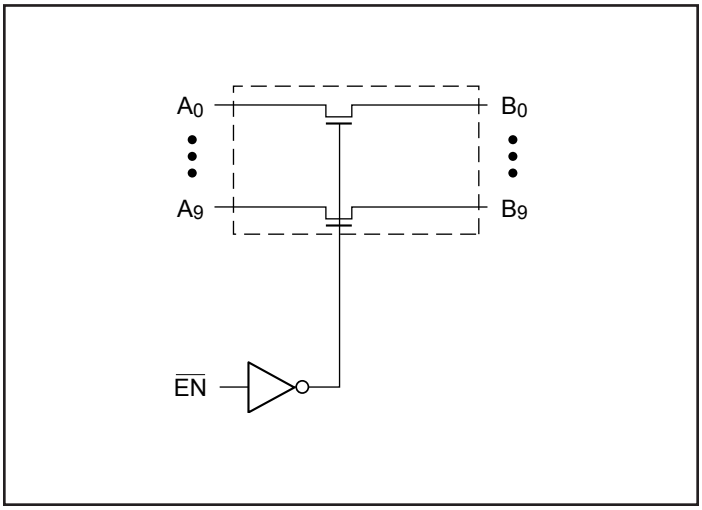
- Near-Zero propagation delay
- 5-ohm switches connect inputs to outputs
- High signal passing bandwidth (500 MHz)
- Beyond Rail-to-Rail switching
- 5V I/O tolerant with 3.3V supply
- 2.5V and 3.3V supply voltage operation
- Hot insertion capable
- Industrial operating temperature: –40ºC to +85ºC
- 2kV ESD Protection (human body model)
- Latch-up performance: >250mA per JESD17
- Packaging (Pb-free & Green available):
  – 24-pin 150 mil wide plastic QSOP (Q)
  – 24-pin 173 mil wide plastic TSSOP(L)

Description:

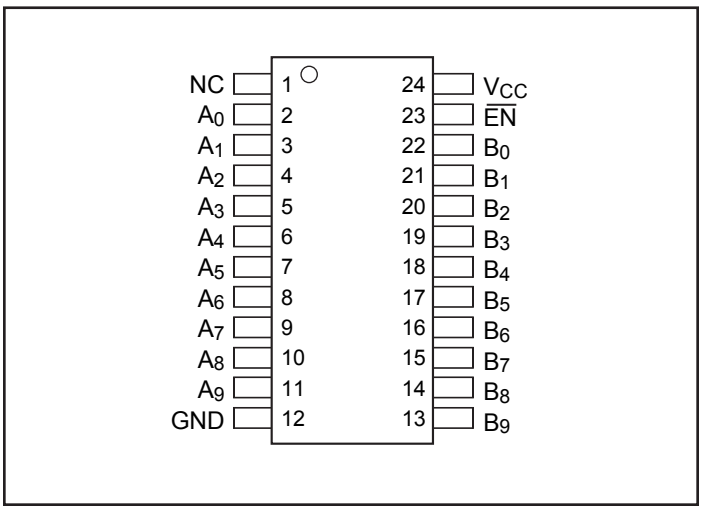
The PI3CH1010 is a 10-channel switch designed with a fast enable. The switch creates no additional propagation delay or additional ground bounce noise.

The PI3CH1010 device has an active LOW enable. It is very useful in switching signals that have high bandwidth (500 MHz).

Block Diagram



Pin Configuration



Truth Table(1)

Function	$\overline{EN}$	A0–9
Disconnect	H	Hi-Z
Connect	L	B0–9

Notes:
1. H = High Voltage Level, L = Low Voltage Level
   Hi-Z = High Impedance

Pin Description

Pin Name	Description
$\overline{EN}$	Enable Input (Active LOW)
$A_{0–9}$	A Ports
$B_{0–9}$	B Ports
GND	Ground
V_{CC}	Power

Maximum Ratings

(Above which the useful life may be impaired. For user guidelines, not tested.)

Storage Temperature	–65°C to +150°C
Ambient Temperature with Power Applied	–40°C to +85°C
Supply Voltage to Ground Potential	–0.5V to +4.6V
DC Input Voltage	–0.5V to +6.0V
DC Output Current	120 mA
Power Dissipation	0.5W

Note:
Stresses greater than those listed under MAXIMUM RATINGS may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect reliability.

DC Electrical Characteristics, 3.3V Supply (Over the Operating Range, T_A = –40°C to +85°C, V_{CC} = 3.3V ±10%)

Parameters	Description	Test Conditions[1]	Min.	Typ[2]	Max.	Units
V_{IH}	Input HIGH Voltage	Guaranteed Logic HIGH Level	2.0			V
V_{IL}	Input LOW Voltage	Guaranteed Logic LOW Level	–0.5		0.8	
V_{IK}	Clamp Diode Voltage	V_{CC} = Min., I_{IN} = –18 mA		–1.3	–1.8	
I_{IH}	Input HIGH Current	V_{CC} = Max., V_{IN} = V_{CC}			±1	µA
I_{IL}	Input LOW Current	V_{CC} = Max., V_{IN} = GND			±1	
I_{OZH}	High Impedance Output Current	0 ≤ A, B ≤ V_{CC}			±1	
R_{ON}	Switch On-Resistance[3]	V_{CC} = Min., V_{IN} = 0V, I_{ON} = 48 mA or –64mA		4	6	Ω
		V_{CC} = Min., V_{IN} = 3.6V, I_{ON} = –15 mA		5	8	

Notes:
1. For conditions shown as Max. or Min., use appropriate value specified under Electrical Characteristics for the applicable device type.
2. Typical values are at Vcc = 5.0V, T_A = 25°C ambient and maximum loading.
3. Measured by the voltage drop between A and B pin at indicated current through the switch. On-Resistance is determined by the lower of the voltages on the two (A,B) pins.

DC Electrical Characteristics, 2.5V Supply (Over Operating Range, T_A = –40°C to +85°C, V_{CC} = 2.5V ± 10%)

Parameters	Description	Test Conditions[1]	Min.	Typ.[2]	Max.	Units
V_{IH}	Input HIGH Voltage	Guaranteed Logic HIGH Level	1.8		V_{CC} + 0.3	V
V_{IL}	Inout LOW Voltage	Guaranteed Logic LOW Level	–0.3		0.8	
V_{IK}	Clamp Diode Voltage	V_{CC} = Max., I_{IN} = –6mA		–0.7	–1.8	
I_{IH}	Input HIGH Current	V_{CC} = Max., V_{IN} = V_{CC}			±1	µA
I_{IL}	Input LOW Current	V_{CC} = Max., V_{IN} = GND			±1	
I_{OZH}	High Impedance Current	0 ≤ A, B ≤ V_{CC}			±1	
R_{ON}	Switch On-Resistance[3]	V_{CC} = Min., V_{IN} = 0V, I_{ON} = –48mA		4	8	Ω
		V_{CC} = Min., V_{IN} = 2.25V, I_{ON} = –15mA		7	14	

Notes:
1. For conditions shown as Max. or Min., use appropriate value specified under Electrical Characteristics for the applicable device type.
2. Typical values are at Vcc = 5.0V, T_A = 25°C ambient and maximum loading.
3. Measured by the voltage drop between A and B pin at indicated current through the switch. On-Resistance is determined by the lower of the voltages on the two (A,B) pins.

Capacitance (T_A = 25°C, f = 1 MHz)

Parameters[1]	Description	Test Conditions	Typ.	Units
C_{IN}	Input Capacitance	V_{IN} = 0V	2.0	pF
C_{OFF}	A/B Capacitance, Switch Off	V_{IN} = 0V	3.5	
C_{ON}	A/B Capacitance, Switch On	V_{IN} = 0V	7.0	

Notes:
1. This parameter is determined by device characterization but is not production tested.

Power Supply Characteristics

Parameters	Description	Test Conditions[1]	Min.	Typ[2]	Max.	Units
I_{CC}	Quiescent Power Supply Current	V_{CC} = 3.6V, V_{IN} = GND or V_{CC}			0.8	mA

Notes:
1. For conditions shown as Max. or Min., use appropriate value specified under Electrical Characteristics for the applicable device.
2. Typical values are at V_{CC} = 3.3V, +25°C ambient.

Dynamic Electrical Characteristics Over the Operating Range (T_A = -40º to +85º, V_{CC} = 3.3V ± 10%)

Parameter	Description	Test Condition	Min.	Typ.	Max.	Units
X_{TALK}	Crosstalk	See Test Diagram		–60		dB
O_{IRR}	Off-Isolation	See Test Diagram		–60		
BW	–3dB Bandwidth	See Test Diagram	200	500		MHz

Switching Characteristics over 3.3V Operating Range

Parameters	Description	Test Conditions(1)	Min	Max	Units
t_{PLH} t_{PHL}	Propagation Delay(2,3) Ax to Bx, Bx to Ax	See Test Diagram		0.3	ns
t_{PZH} t_{PZL}	Enable Time $\overline{EN}$ to Ax or Bx	See Test Diagram	1.5	9.0	
t_{PHZ} t_{PLZ}	Disable Time $\overline{EN}$ to Ax or Bx		1.5	9.0	

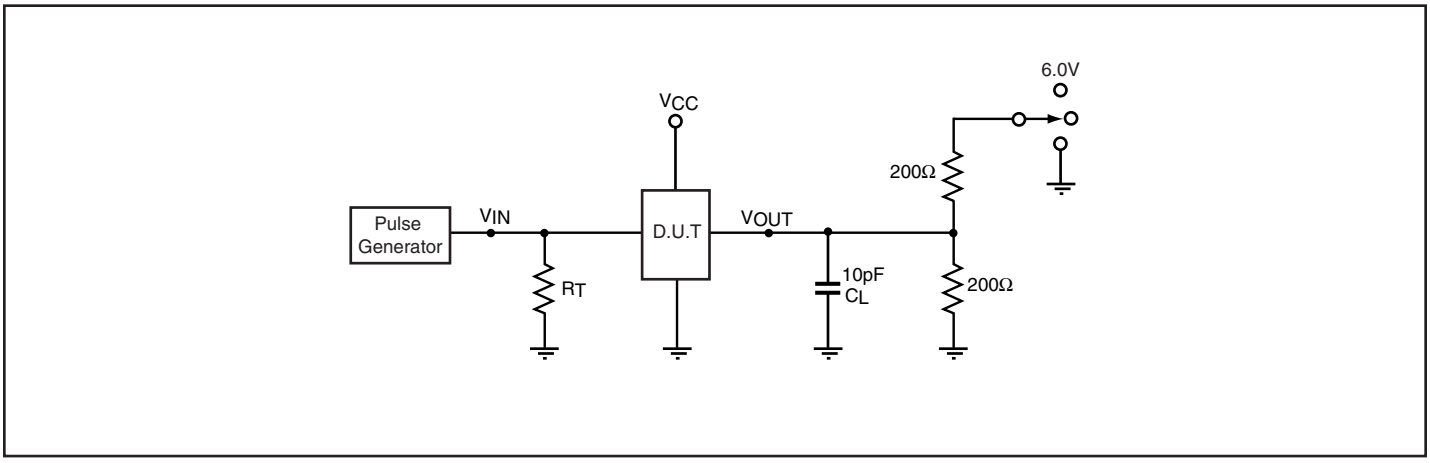
Notes:
1. See test circuit and waveforms.
2. This parameter is guaranteed but not tested on Propagation Delays.
3. The switch contributes no propagational delay other than the RC delay of the On-Resistance of the switch and the load capacitance. The time constant for the switch alone is of the order of 0.30ns for 10pF load. Since this time constant is much smaller than the rise/fall times of typical driving signals, it adds very little propagational delay to the system. Propagational delay of the switch when used in a system is determined by the driving circuit on the driving side of the switch and its interaction with the load on the driven side.

Switching Characteristics over 2.5V Operating Range

Parameters	Description	Conditions(1)	Com.		Units
			Min.	Max.	
t_{PLH} t_{PHL}	Propogation Delay(2,3) Ax to Bx, Bx to Ax	See Test Diagram		0.3	ns
t_{PZH} t_{PZL}	Enable Time $\overline{EN}$ to Ax or Bx	See Test Diagram	1.5	15.0	
t_{PHZ} t_{PLZ}	Disable Time $\overline{EN}$ to Ax or Bx		1.5	12.0	

Notes:
1. See test circuit and waveforms.
2. This parameter is guaranteed but not tested on Propagation Delays.
3. The switch contributes no propagational delay other than the RC delay of the On-Resistance of the switch and the load capacitance. The time constant for the switch alone is of the order of 0.30ns for 10pF load. Since this time constant is much smaller than the rise/fall times of typical driving signals, it adds very little propagational delay to the system. Propagational delay of the switch when used in a system is determined by the driving circuit on the driving side of the switch and its interaction with the load on the driven side.

Test Circuit for Electrical Characteristics



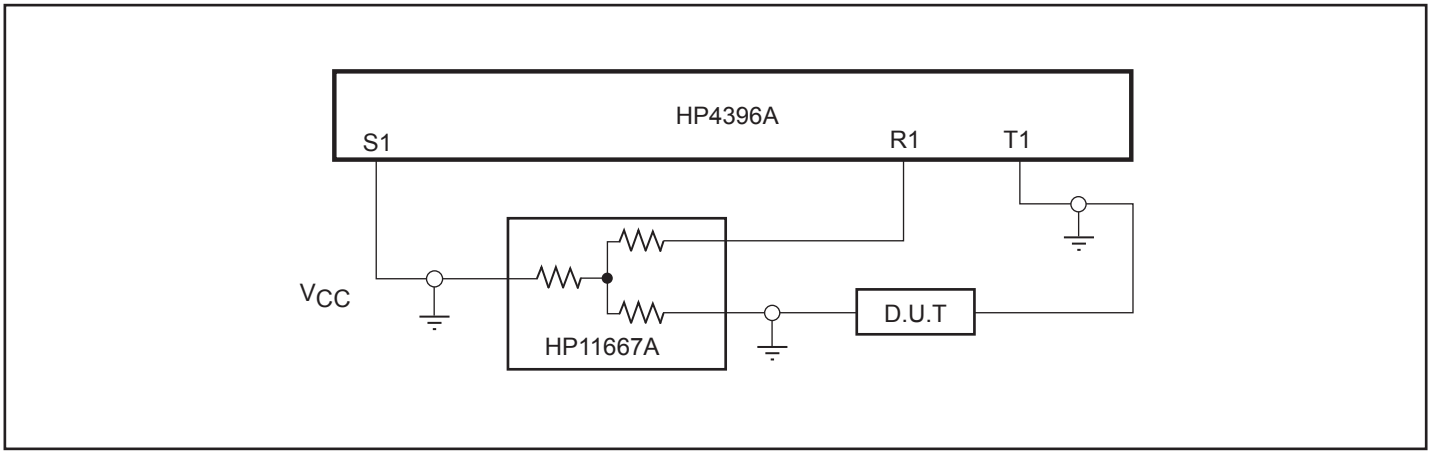
Notes:

- C_L = Load capacitance: includes jig and probe capacitance.
- R_T = Termination resistance: should be equal to Z_{OUT} of the Pulse Generator.
- All input impulses are supplied by generators having the following characteristics: PRR ≤ 10 MHz, Z_O = 50-ohm, $t_R \leq 2.5$ns, $t_F \leq 2.5$ns.
- The outputs are measured one at a time with one transition per measurement.

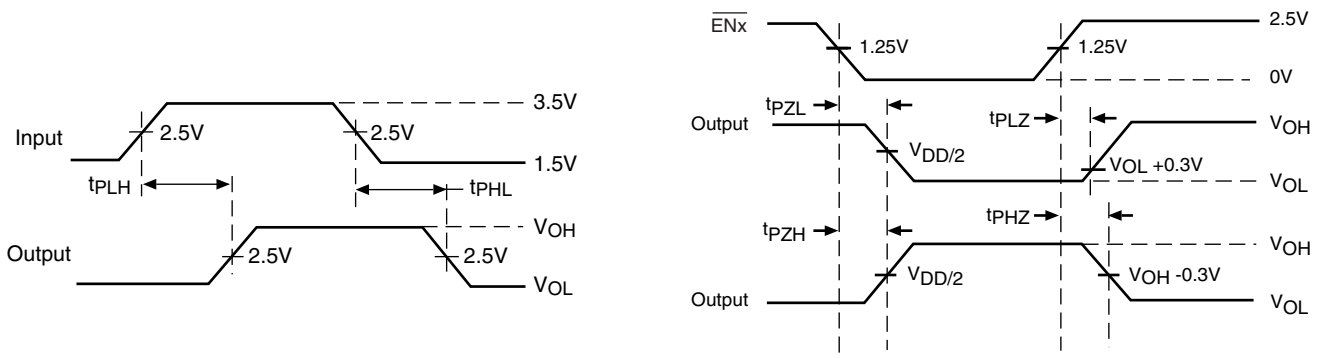
Switch Positions

Test	Switch
t_{PLZ}, t_{PZL}	6.0V
t_{PHZ}, t_{PZH}	GND
Prop Delay	Open

Test Circuit for Dynamic Electrical Characteristics

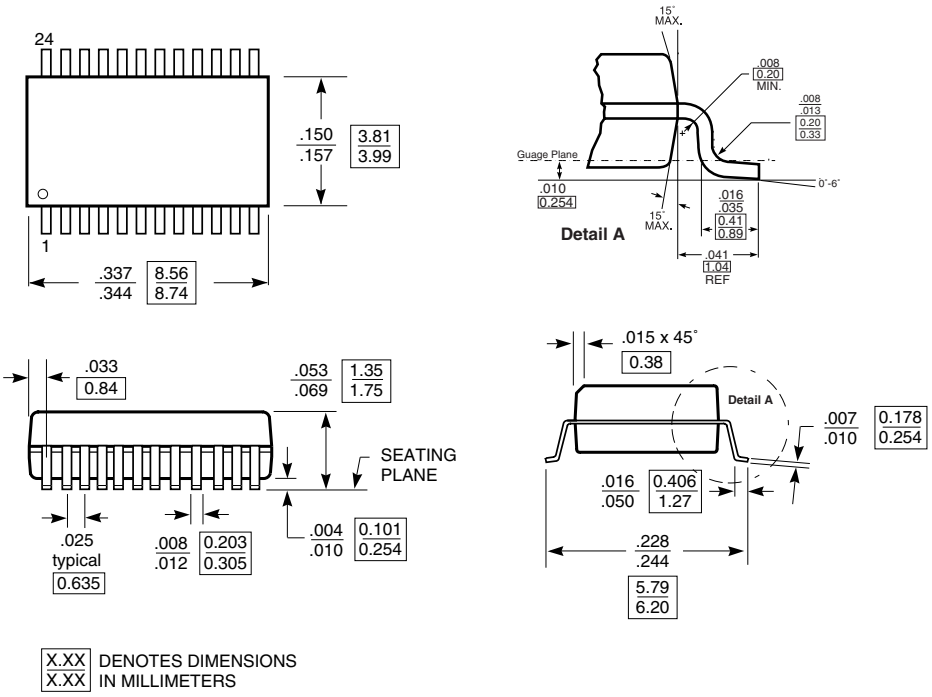


Switching Waveforms

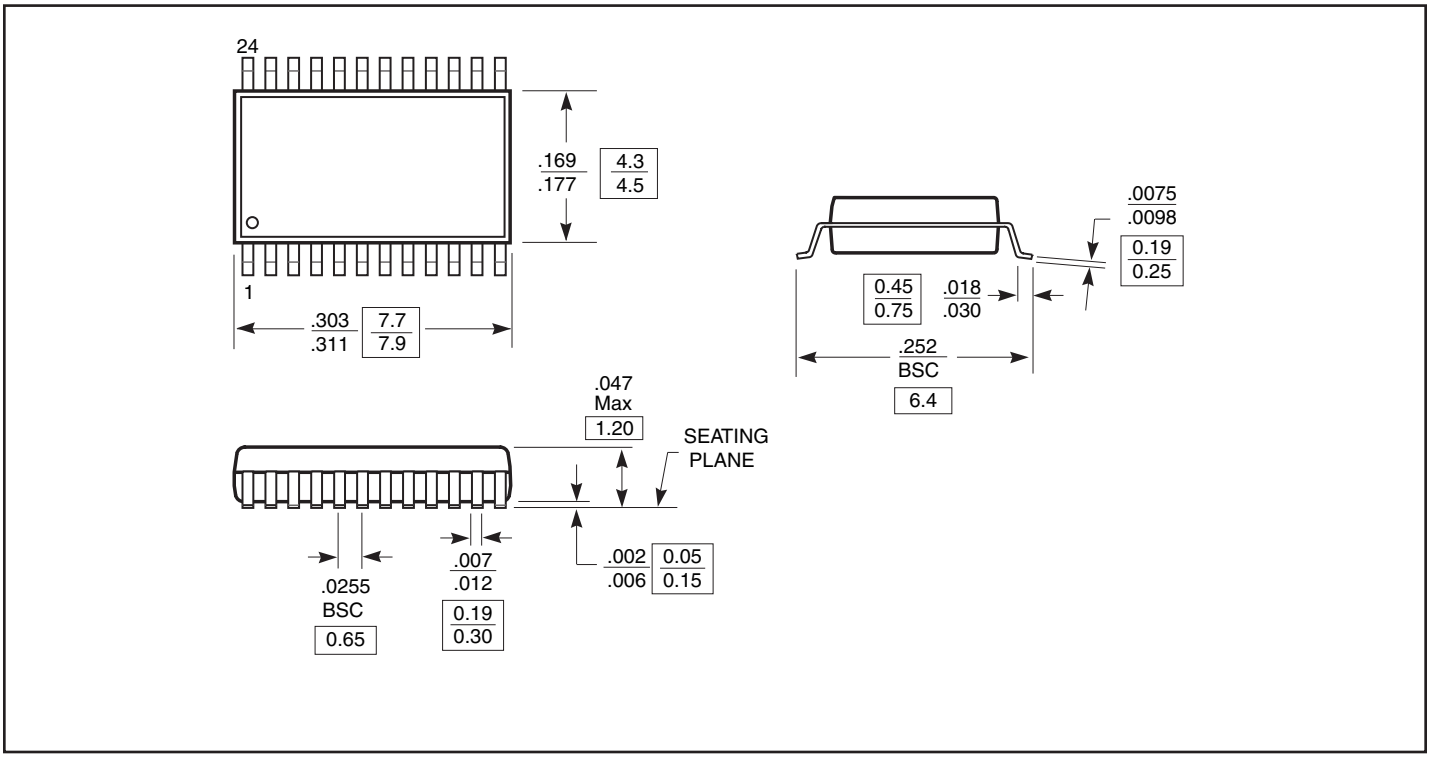


Voltage Waveforms Enable and Disable Times

Packaging Mechanical: 24-pin QSOP (Q)



Packaging Mechanical: 24-pin TSSOP (L)



Ordering Information

Ordering Code	Packaging Code	Package Description
PI3CH1010Q	Q	150-mil, 24-pin QSOP
PI3CH1010QE	Q	Pb-free & Green, 150-mil, 24-pin QSOP
PI3CH1010L	L	150-mil, 173-mil wide, 24-pin TSSOP
PI3CH1010LE	L	Pb-free & Green, 173-mil wide, 24-pin TSSOP

Notes:

- Thermal characteristics can be found on the company web site at www.pericom.com/packaging/
- E = Pb-free & Green
- Adding an X suffix = Tape/Reel