

Low Voltage, High Bandwidth, 2-Channel, 4:1 Mux/DeMux, *NanoSwitch*[™] with Single Enable

Features

- Near-zero propagation delay
- 5-ohm switches connect inputs to outputs
- High signal passing bandwidth (300 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: -40°C to +85°C
- 2KV ESD Protection (human body model)
- Latch-up performance: >250mA per JESD17
- Packaging (Pb-free & Green available):
 - 16-pin 150-mil wide plastic QSOP (Q)
 - 16-pin 173-mil wide plastic TSSOP (L)
 - 20-contact TQFN (ZH)

Block Diagram



Description The PI3CH281

The PI3CH281 is a 2-channel, 4:1 Multiplexer/Demultiplexer with 3-state outputs. The switch introduces no additional ground bounce noise or propagation delay.

The PI3CH281 device is very useful in switching signals that have high bandwidth (300 MHz).

Pin Configuration⁽¹⁾



Note:

1. N.C, = No internal connection



Pin Description

Pin Name	Description
IAN, IBN	Data Inputs
S ₀₋₁	Select Inputs
ĒN	Enable
Y _A to Y _B	Data Outputs
GND	Ground
V _{CC}	Power

Truth Table⁽¹⁾

Enable	Sel	lect		
ĒN	S ₁	S ₀	Y	Function
Н	Х	Х	Hi-Z	Disable
L	L	L	I ₀	$S_{1-0} = 0$
L	L	Н	I ₁	$S_{1-0} = 1$
L	Н	L	I ₂	$S_{1-0} = 2$
L	Н	Н	I ₃	$S_{1-0} = 3$

Note:

1. H=High Voltage Level; L=Low Voltage Level

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	120mA
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, $T_A = -40^{\circ}C$ to $+85^{\circ}C$, $V_{CC} = 3.3V \pm 10\%$)
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Parameters ⁽⁴⁾	Description	Test Conditions ⁽¹⁾	Min.	Typ ⁽²⁾	Max.	Units
V _{IH}	Input HIGH Voltage	Guaranteed Logic HIGH Level	2.0			
V _{IL}	Input LOW Voltage	Guaranteed Logic LOW Level	-0.5		0.8	V
V _{IK}	Clamp Diode Voltage	$V_{CC} = Min., I_{IN} = -18 \text{ mA}$		-1.3	-1.8	
I _{IH}	Input HIGH Current	$V_{CC} = Max., V_{IN} = V_{CC}$			± 1	
I_{IL}	Input LOW Current	$V_{CC} = Max., V_{IN} = GND$			± 1	μΑ
I _{OZH}	High Impedance Output Current	$0 \le Y$, $In \le V_{CC}$			± 1	
		$V_{CC} = Min., V_{IN} = 0V,$		4	6	
R _{ON}	Switch On-Resistance ⁽³⁾	$I_{ON} = 48 \text{ mA or } -64 \text{mA}$		4	0	Ω
		$V_{CC} = Min., V_{IN} = 3.6V, I_{ON} = -15 \text{ mA}$		5	8	

Notes:

- 1. For Max. or Min. conditions, use appropriate value specified under Electrical Characteristics for the applicable device type.
- 2. Typical values are at $V_{CC} = 3.3V$, $T_A = 25^{\circ}C$ ambient and maximum loading.
- 3. Measured by the voltage drop between Y and In pin at indicated current through the switch. On-Resistance is determined by the lower of the voltages on the two (Y, In) pins.
- 4. This parameter is determined by device characterization but is not production tested.



Parameters ⁽⁴⁾	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 _{IL}	Inout LOW Voltage	Guaranteed Logic LOW Level	-0.3		0.8	V
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	
I _{IL}	Input LOW Current	$V_{CC} = Max., V_{IN} = GND$			±1	μΑ
I _{OZH}	High Impedance Current	$0 \le Y$, In $\le V_{CC}$			±1	
Dov	Switch On-Resistance ⁽³⁾	$V_{CC} = Min., V_{IN} = 0.0V,$ $I_{ON} = -48mA$		6	8	Ω
R _{ON}	Switch On-Resistance	$V_{CC} = Min., V_{IN} = 2.25V,$ $I_{ON} = -15mA$		7	14	52

DC Electrical Characteristics, 2.5V Supply (Over Operating Range, $T_A = -40^{\circ}C$ to $+85^{\circ}C$, $V_{CC} = 2.5V \pm 10\%$)

Notes:

1. For Max. or Min. conditions, use appropriate value specified under Electrical Characteristics for the applicable device type.

- 2. Typical values are at $V_{CC} = 2.5V$, $T_A = 25^{\circ}C$ ambient and maximum loading.
- 3. Measured by the voltage drop between Y and In pin at indicated current through the switch. On-Resistance is determined by the lower of the voltages on the two (Y, In) pins.
- 4. This parameter is determined by device characterization but is not production tested.

Capacitance ($T_A = 25^{\circ}C f = 1 \text{ MHz}$)

Parameters ⁽¹⁾	Description	Test Conditions	Тур.	Units
C _{IN}	Input Capacitance		3.0	
C _{OFF(IN)}	In Capacitance, Switch Off	$\mathbf{V}_{-} = 0\mathbf{V}$	3.5	тE
C _{OFF(Y)}	Y Capacitance, Switch Off	$V_{IN} = 0V$	12	pF
C _{ON}	Y/In Capacitance, Switch On		15.0	

Notes:

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

Power Supply Characteristics

Parameters	Description	Test Conditions ⁽¹⁾	Min.	Тур.	Max.	Units
I _{CC}	Quiescent Power Supply Current	$V_{CC} = 3.6 V$, $V_{IN} = GND$ or V_{CC}			0.8	mA

Notes:

1. For Max. or Min. conditions, use appropriate value specified under Electrical Characteristics for the applicable device.



Dynamic Electrical Characteristics Over the Operating Range ($T_A = -40^\circ$ to $+85^\circ$, $V_{CC} = 3.3V \pm 10\%$)

Parameter	Description	Test Condition	Min.	Тур.	Max.	Units
X _{TALK}	Crosstalk	See Test Diagram		-60		dB
O _{IRR}	Off-Isolation	See Test Diagram		-60		uБ
BW	-3dB Bandwidth	See Test Diagram	200	300		MHz

Switching Characteristics over 3.3V Operating Range

Danamatans	Parameters Description			Com.		Units
rarameters			Min.	Тур.	Max.	Units
t _{PLH} t _{PHL}	Propogation $Delay^{(2,3)}$ Y to In, In to Y	See Test Diagram			0.3	
t _{PZH} t _{PZL}	Enable Time S or \overline{EN} to Y or In	See Test Diegrom	1.5		9.0	ns
t _{PHZ} t _{PLZ}	Disable Time S or \overline{EN} to Y or In	See Test Diagram	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

Davamatava	Description	Conditions ⁽¹⁾	Co	m.	Units
Parameters	Description	Conditions	Min.	Max.	Units
t _{PLH} t _{PHL}	Propogation $Delay^{(2,3)}$ Y to In, In to Y	See Test Diagram		0.3	
t _{PZH} t _{PZL}	Enable Time S or \overline{EN} to Y or In	See Test Discrem	1.5	15.0	ns
t _{PHZ} t _{PLZ}	Disable Time S or \overline{EN} to Y or In	See Test Diagram	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
- Waveform 1 is for an output with internal conditions such that the output is low except when disabled by the output control.
- Waveform 2 is for an output with internal conditions such that the output is high except when disabled by the output control.
- All input impulses are supplied by generators having the following characteristics: $PRR \le 10$ MHz, $Z_O = 50$ -ohm, $t_R \le 2.5$ ns, $t_F \le 2.5$ ns.
- The outputs are measured one at a time with one transition per measurement.

Switch Positions

Test	Switch
tpLZ, tpZL	6.0V
t _{PHZ} , t _{PZH}	GND
Prop Delay	Open

Test Circuit for Dynamic Electrical Characteristics





Switching Waveforms





Applications Information

Logic Inputs

The logic control inputs can be driven up to 3.6V regardless of the supply voltage. For example, given a +3.3V supply, $\overline{\text{EN}}$ may be driven LOW to 0V and HIGH to 3.6V. Driving $\overline{\text{EN}}$ Rail-to-Rail[®] minimizes power consumption.

Power Supply-Sequencing

Proper power supply sequencing is recommended for all CMOS devices. Always apply V_{CC} before applying signals to the input/ output or control pins.

Hot Insertion

For Datacom and Telecom applications that have ten or more volts passing through the backplane, a high voltage from the power supply may be seen at the device input pins during hot insertion. The PI3CHxx devices have maximum limits of 6V and 120mA for 20ns. If the power is higher or applied for a longer time or repeatedly reaches the maximum limits, the devices can be damaged.

Rail-to-Rail is a registered trademark of Nippon Motorola, Ltd.

Packaging Mechanical: 16-pin QSOP (Q)





Packaging Mechanical: 16-pin TSSOP (L)



Packaging Mechanical: 20-contact TQFN (ZH)





Ordering Information

Ordering Code	Packaging Code	Package Description
PI3CH281Q	Q	150-mil, 16-pin QSOP
PI3CH281QE	Q	Pb-free & Green, 150-mil, 16-pin QSOP
PI3CH281L	L	173-mil, 16-pin TSSOP
PI3CH281LE	L	Pb-free & Green, 173-mil, 16-pin TSSOP
PI3CH281ZHE	ZH	Pb-free & Green, 16-contact TQFN

Notes:

• Thermal characteristics can be found on the company web site at www.pericom.com/packaging/

• E = Pb-free and Green

• Adding an X suffix = Tape /Reel

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