# 3.3V, 5-Bit, 4-Port Bus Exchange *NanoSwitch*™

Product Features

- Near-zero propagation delay
- 5-ohm switches connect inputs to outputs
- Direct bus connection when switches are ON
- Ultra-low quiescent power (0.1μA typical)
  – Ideally suited for notebook applications
- Packages (Pb Free & Green Available)
  – 24-pin 173-mil wide plastic TSSOP (L)
 – 24-pin 150-mil wide plastic QSOP (Q)

Product Description

The PI3B3383 is a 5-bit, 4-port bus switch with exchange designed with a low ON-resistance allowing inputs to be connected directly to outputs. The bus switch creates no additional propagational delay or additional ground bounce noise. The switches are turned ON by the Bus Enable ($\overline{BE}$) input signal, and the Bus Exchange (BX) input signal offers nibble swapping of the AB and CD pairs of signals. This exchange configuration allows byte swapping of buses in systems. It can also be used as a quad 2-to-1 multiplexer and to create low delay barrel shifters, etc.

Logic Block Diagram
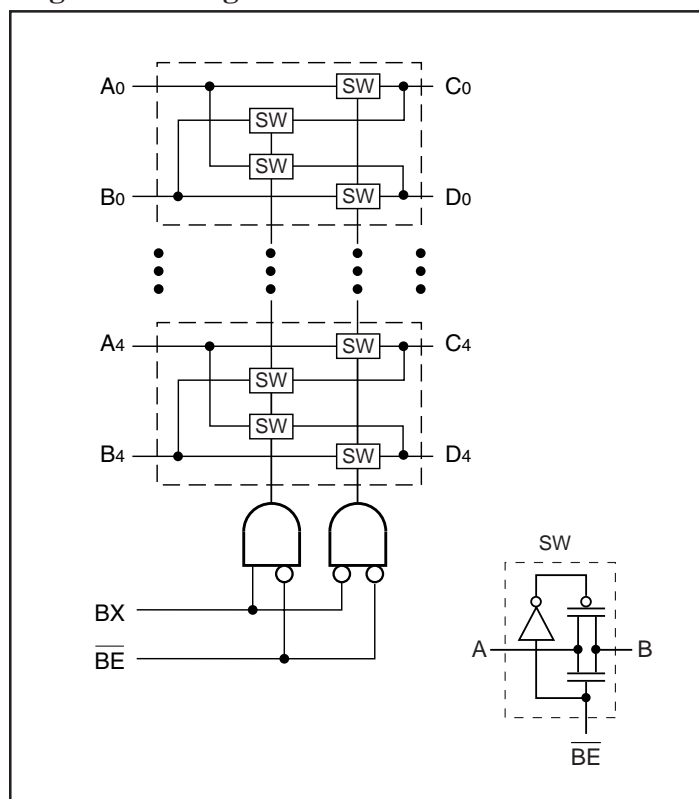
Product Pin Configuration
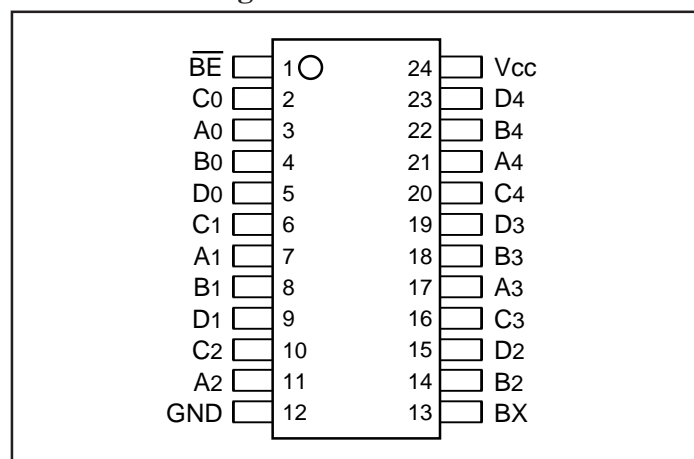
Product Pin Description

Pin Name	Description
$\overline{BE}$	Bus Enable Input (Active LOW)
BX	Bus Exchange Input
Ax	Bus A
Bx	Bus B
Cx	Bus C
Dx	Bus D
GND	Ground
V_{CC}	Power

Truth Table[1]

Function	$\overline{BE}$	BX	A0-A4	B0-B4
Disconnect	H	X	Hi-Z	Hi-Z
Connect	L	L	C0-C4	D0-D4
Exchange	L	H	D0-D4	C0-C4

Note:
1. H   = High Voltage Level
   X   = Don't Care
   L   = Low Voltage Level
   Hi-Z = High Impedance

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 +4.6V
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 (Over the Operating Range, $T_A = -40°C$ to $+85°C$, $V_{CC} = 3.3V \pm 10\%$)

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	
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	μA
I_{OZH}	High Impedance Output Current	0< AB, CD < V_{CC}			±1	
V_{IK}	Clamp Diode Voltage	$V_{CC} = M_{IN}$., $I_{IN} = -18mA$		–0.7	–1.2	V
R_{ON}	Switch On Resistance[3]	$V_{CC} = M_{IN}$., V_{IN} = 0.0V, I_{ON} = 48mA $V_{CC} = M_{IN}$., V_{IN} = 2.4V, I_{ON} = 15mA		5 10	7 15	Ω

Notes:
1. For Max. or Min. conditions, use appropriate value specified under Electrical Characteristics for the applicable device type.
2. Typical values are at $V_{CC} = 3.3V$, $T_A = 25°C$ ambient and maximum loading.
3. Measured by the voltage drop between AB and CD pin at indicated current through the switch. ON resistance is determined by the lower of the voltages on the two (A or B, C or D) pins.

Capacitance ($T_A = 25°C$, f = 1 MHz)

Parameters[1]	Description	Test Conditions	Typ.	Units
C_{IN}	Input Capacitance		3.0	
C_{OFF}	AB/CD Capacitance, Switch Off	V_{IN} = 0V	12.0	pF
C_{ON}	AB/CD Capacitance, Switch On		24.0	

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} = Max.	V_{IN} = GND or V_{CC}		0.1	10	μA
ΔI_{CC}	Supply Current per Input@ LVTTL HIGH	V_{CC} = Max.	V_{IN} = 3.0V[3]			750	

Notes:
1. For Max. or Min. conditions, use appropriate value specified under Electrical Characteristics for the applicable device.
2. Typical values are at V_{CC} = 3.0V, +25°C ambient.
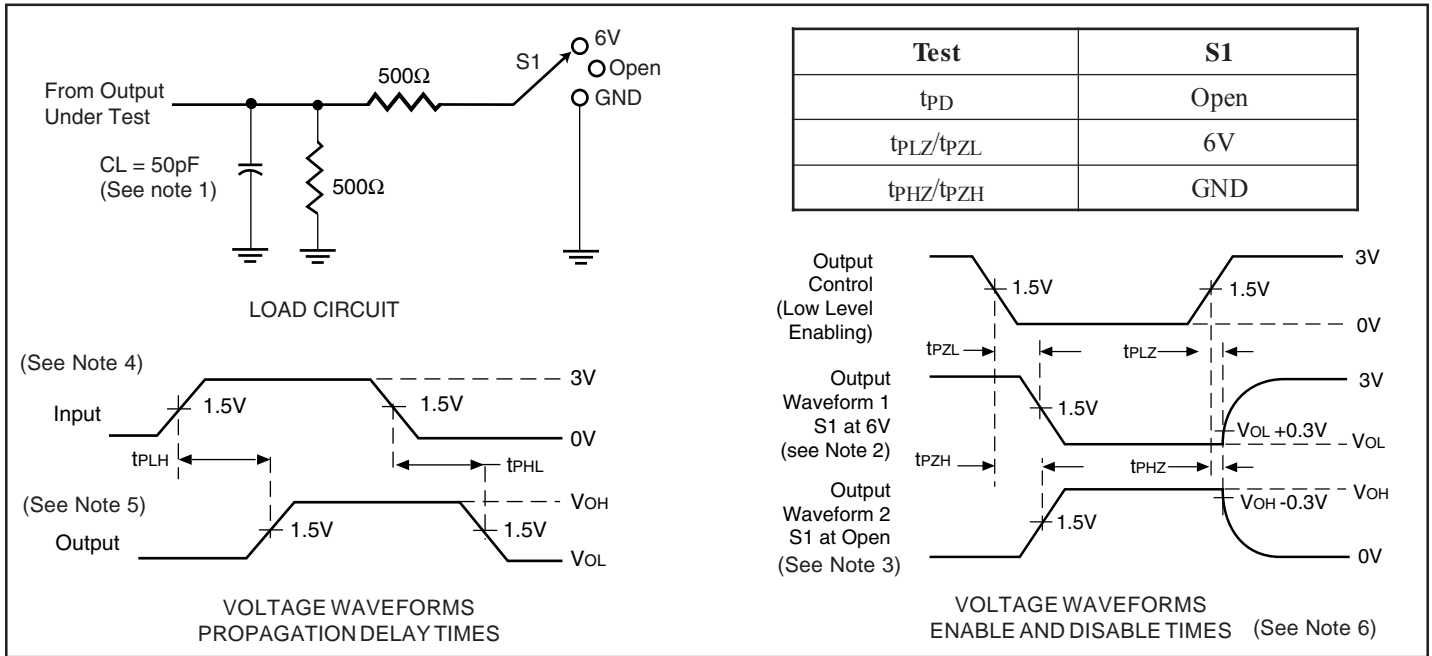3. Per LVTTL driven input (V_{IN} = 2.4V, control inputs only); A, B, C, and D pins do not contribute to I_{CC}.

PI3B3383 Switching Characteristics over Operating Range

Parameters	Description	Conditions[1]	Com			Units
			Min.	Typ.	Max.	
t_{PLH} t_{PHL}	Propagation Delay[2,3] Ax to Cx, Bx to Dx	Cl = 50pF Rl = 500Ω		0.25		ns
t_{PZH} t_{PZL}	Bus Enable Time $\overline{BE}$ to Cx or Dx		1		4.5	
t_{PHZ} t_{PLZ}	Bus Disable Time $\overline{BE}$ to Cx or Dx		1		4.5	
t_{BX}	Bus Exchange Time, BX to Cx or Dx		1		4.8	

Notes:
1. See test circuit and waveforms.
2. This parameter is guaranteed but not tested on Propagation Delays.
3. The bus 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 0.25ns for 50pF 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 bus 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.

Parameter Measurements

LOAD CIRCUIT

Test	S1
t_{PD}	Open
t_{PLZ}/t_{PZL}	6V
t_{PHZ}/t_{PZH}	GND

(See Note 4)

VOLTAGE WAVEFORMS
PROPAGATION DELAY TIMES

VOLTAGE WAVEFORMS
ENABLE AND DISABLE TIMES   (See Note 6)

Notes:

1. C_L includes probe and jig capacitance.
2. Waveform 1 is for an output with internal conditions such that the output is LOW except when disabled by the output control.
3. Waveform 2 is for an output with internal conditions such that the output is HIGH except when disabled by the output control.
4. All input pulses are supplied by generators having the following characteristics: PRR<10 MHz, $Z_O = 50\Omega$, $t_r \leq 2.5ns$, $t_f \leq 2.5ns$.
5. The outputs are measured one at a time with one transition per measurement.
6. t_{PLZ} and t_{PHZ} are the same as t_{dis}, t_{PZL} and t_{PZH} are the same as t_{en}, t_{PLH} and t_{PHL} are the same as t_{pd}.

Packaging Mechanical: 24-Pin TSSOP (L) Package

X.XX DENOTES DIMENSIONS
X.XX IN MILLIMETERS
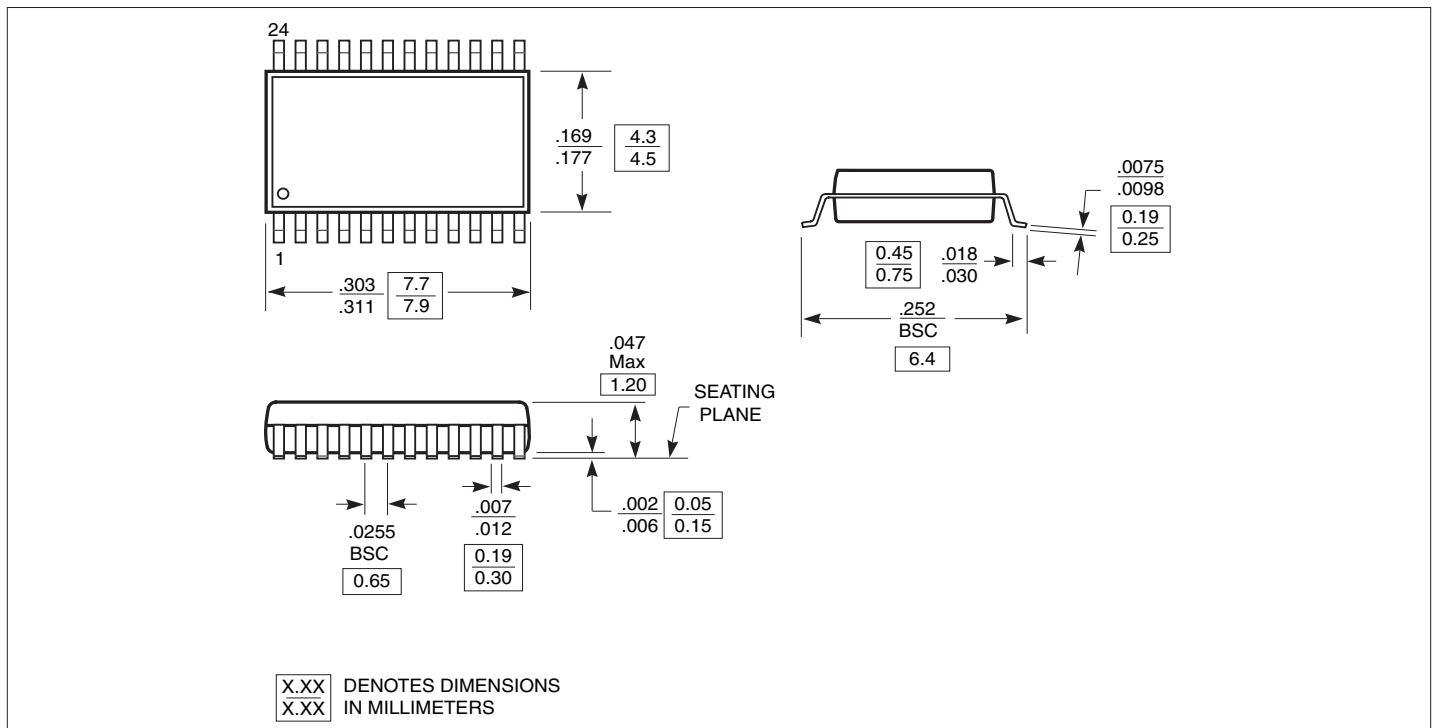
Packaging Mechanical: 24-Pin QSOP (Q) Package
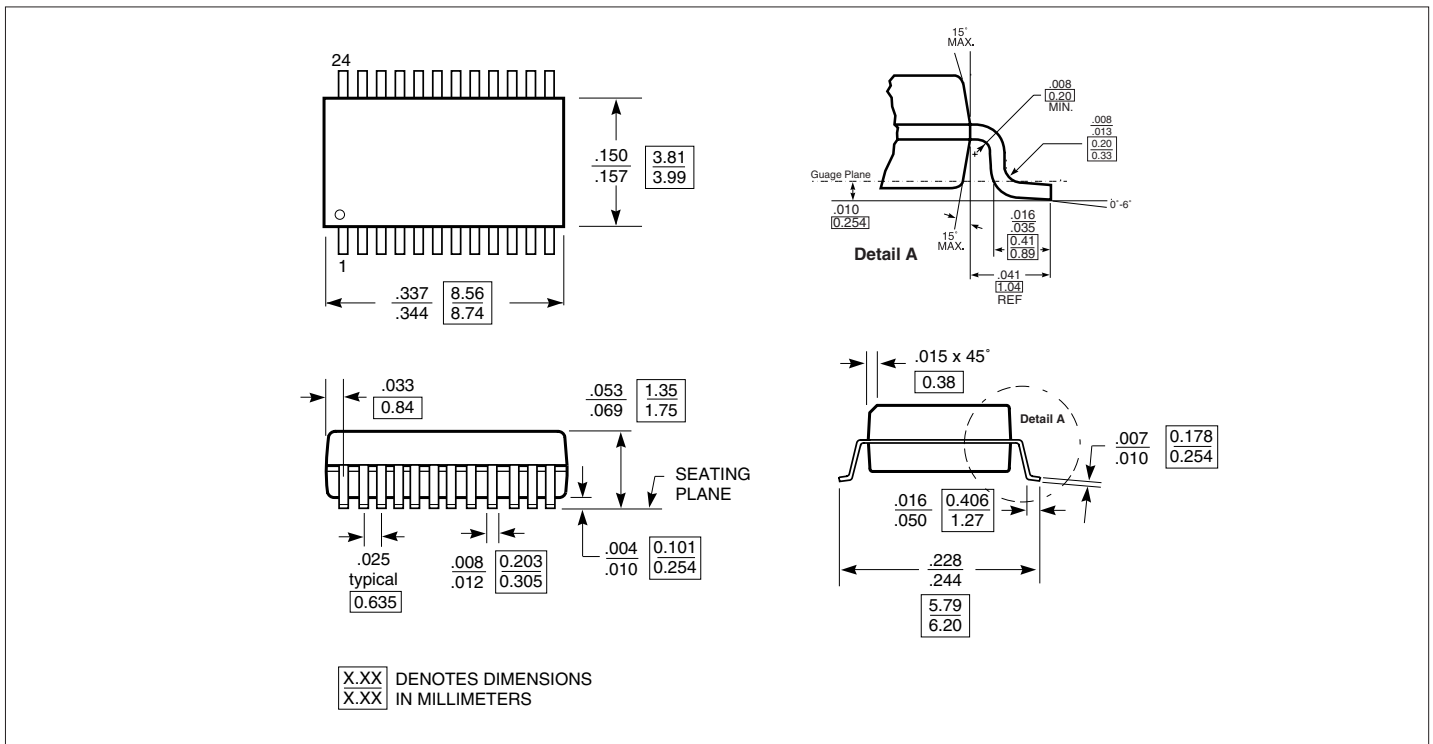
Applications Information

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, IN may be driven low to 0V and high to 3.6V. Driving IN Rail-to-Rail® minimizes power consumption.

Power-Supply Sequencing and Hot-Plug Information

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

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

Ordering Information

Part	Pin - Package	Temperature
PI3B3383L	24 TSSOP (L)	-40°C to +85°C
PI3B3383LE	24 TSSOP (L)	-40°C to +85°C
PI3B3383Q	24 QSOP (Q)	-40°C to +85°C
PI3B3383QE	24 QSOP (Q)	-40°C to +85°C

Notes:
- Thermal characteristics can be found on the company web site at www.pericom.com/packaging/
- Adding an X suffix = Tape/Reel