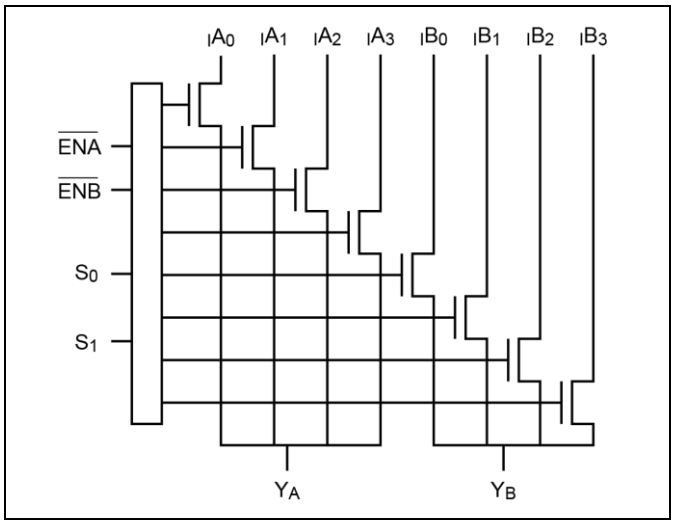
Low Voltage, High Bandwidth, 2-Channel, 4:1 Mux/DeMux, *NanoSwitch*™ with Single Enable

Description

The DIODES PI3CH3253 is a 2-channel, 4:1 Multiplexer/ Demultiplexer with 3-state outputs. The switch introduces no additional ground bounce noise or propagation delay.

The PI3CH3253 device is very useful in switching signals that have high bandwidth (500 MHz).

Block Diagram



Truth Table

$\overline{ENA}$	$\overline{ENB}$	S_1	S_0	Yn	Function
H	H	X	X	Hi-Z	Disable
L	L	L	L	$Y_A = {}_IA_0$; $Y_B = {}_IB_0$	$S_{0-1} = 0$
L	L	L	H	$Y_A = {}_IA_1$; $Y_B = {}_IB_1$	$S_{0-1} = 1$
L	L	H	L	$Y_A = {}_IA_2$; $Y_B = {}_IB_2$	$S_{0-1} = 2$
L	L	H	H	$Y_A = {}_IA_3$; $Y_B = {}_IB_3$	$S_{0-1} = 3$

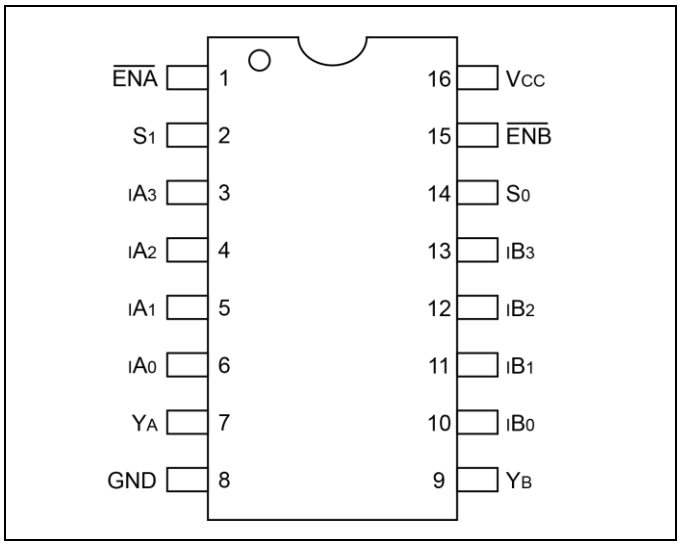
Note:
H = High Voltage Level; L = Low Voltage Level

Features

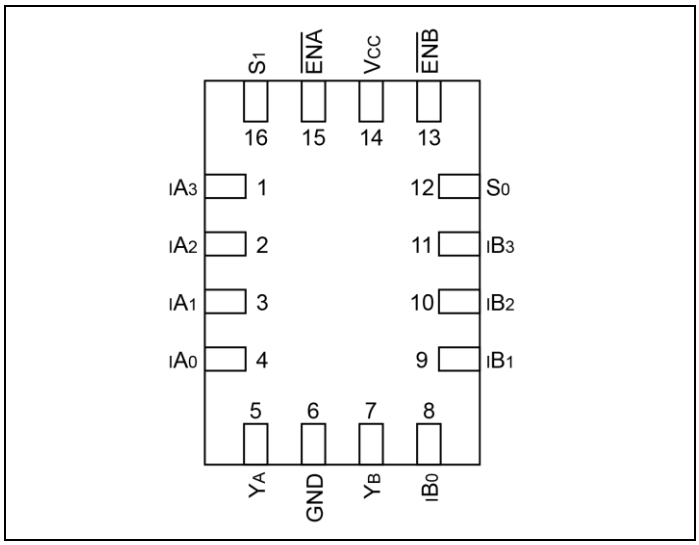
- Near-Zero Propagation Delay
- 4Ω Switches Connect Inputs to Outputs
- High Signal Passing Bandwidth (500MHz)
- Beyond Rail-to-Rail Switching
- 0 to 5V Switching with 3.3V Power Supply
- 0 to 3.3V Switching with 2.5V Power Supply
- 0 to 2.5V Switching with 1.8V Power Supply
- 5V I/O Tolerant with Supply in OFF and ON State
- 1.8V, 2.5V and 3.3V Supply Voltage Operation
- Hot Insertion Capable
- Industrial Operating Temperature: -40°C to +85°C
- 8kV ESD Protection (Human Body Model)
- Latch-up Performance: >200mA per JESD17
- Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)
- Halogen and Antimony Free. "Green" Device (Note 3)
- For automotive applications requiring specific change control (i.e. parts qualified to AEC-Q100/101/104/200, PPAP capable, and manufactured in IATF 16949 certified facilities), please contact us or your local Diodes representative.
  https://www.diodes.com/quality/product-definitions
- Packaging (Pb-free & Green available):
  - 16-pin, 173-mil Wide Plastic, TSSOP (L)
  - 16-pin, 150-mil Wide Plastic, QSOP (Q)
  - 16-pin, 1.8x2.6mm, UQFN (ZTA)

Notes:
1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS), 2011/65/EU (RoHS 2) & 2015/863/EU (RoHS 3) compliant.
2. See https://www.diodes.com/quality/lead-free/ for more information about Diodes Incorporated's definitions of Halogen- and Antimony-free, "Green" and Lead-free.
3. Halogen- and Antimony-free "Green" products are defined as those which contain <900ppm bromine, <900ppm chlorine (<1500ppm total Br + Cl) and <1000ppm antimony compounds.

Pin Configuration



TSSOP/QSOP Package



UQFN Package

Pin Description

TSSOP/QSOP Pin#	UQFN Pin#	Pin Name	Description
1	15	$\overline{ENA}$	Output Enable Channel A (Active-Low)
14, 2	12, 16	S_0, S_1	Select Input
6, 5, 4, 3	4, 3, 2, 1	${}_IA_0$, ${}_IA_1$, ${}_IA_2$, ${}_IA_3$	Data Input / Output (A Port)
7, 9	5, 7	Y_A, Y_B	Data Input / Output
8	6	GND	Ground
10, 11, 12, 13	8, 9, 10, 11	${}_IB_0$, ${}_IB_1$, ${}_IB_2$, ${}_IB_3$	Data Input / Output (B Port)
15	13	$\overline{ENB}$	Output Enable Channel B (Active-Low)
16	14	V_{CC}	Power

Maximum Ratings

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	64mA
Power Dissipation	0.35W
ESD (All Pins)	8KV (HBM) and 1KV (CDM)

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 operating range, T_A = -40 ~ +85°C, V_{CC}=3.3V±10%, unless otherwise noted)

Symbol	Description	Test Conditions(1)	Min	Typ(2)	Max	Unit
V_{IH}	Control Input HIGH Voltage	Guaranteed Logic HIGH Level	2.0			V
V_{IL}	Control Input LOW Voltage	Guaranteed Logic LOW Level	-0.5		0.8	V
V_{IK}	Clamp Diode Voltage	V_{CC} = Max., I_{IN} = -18mA		-1.3	-1.8	V
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	µA
I_{OZH}	High-Impedance Current(3)	0 ≤ Y, In ≤ V_{CC}			±1	µA
I_{OFF}	Power-Off Leakage Current	V_{CC} = 0V, V_{IN} = 0V to 5.5V			1	µA
R_{ON}	Switch On-Resistance(4)	V_{CC} = 3V, V_{IN} = 0.0V I_{ON} = 30mA		3.5	8	Ω
		V_{CC} = 3V, V_{IN} = 2.4V I_{ON} = -15mA		4	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, TA = 25°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.

2.5V supply (Over operating range, T_A = -40 ~ +85°C, V_{CC}=2.5V±10%, unless otherwise noted)

Symbol	Description	Test Conditions(1)	Min	Typ(2)	Max	Unit
V_{IH}	Control Input HIGH Voltage	Guaranteed Logic HIGH Level	1.7		V_{CC}+0.3	V
V_{IL}	Control Input LOW Voltage	Guaranteed Logic LOW Level	-0.3		0.7	V
V_{IK}	Clamp Diode Voltage	V_{CC} = Max., I_{IN} = -18mA		-1.3	-1.8	V
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	µA
I_{OZH}	High-Impedance Current(3)	0 ≤ Y, In ≤ V_{CC}			±1	µA
I_{OFF}	Power-Off Leakage Current	V_{CC} = 0V, V_{IN} = 0V to 5.5V			1	µA
R_{ON}	Switch On-Resistance(4)	V_{CC} = 2.3V, V_{IN} = 0.0V I_{ON} = 30mA		4	8	Ω
		V_{CC} = 2.3V, V_{IN} = 1.7V I_{ON} = -15mA		4	9	

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, TA = 25°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.

1.8V supply (Over operating range, T_A = -40 ~ +85ºC, V_{CC}=1.8V±10%, unless otherwise noted)

Symbol	Description	Test Conditions[1]	Min	Typ[2]	Max	Unit
V_{IH}	Control Input HIGH Voltage	Guaranteed Logic HIGH Level	1.2		V_{CC}+0.3	V
V_{IL}	Control Input LOW Voltage	Guaranteed Logic LOW Level	-0.3		0.6	V
V_{IK}	Clamp Diode Voltage	V_{CC} = Max., I_{IN} = -18mA		-1.3	-1.8	V
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	µA
I_{OZH}	High-Impedance Current[3]	0 ≤ Y, In ≤ V_{CC}			±1	µA
I_{OFF}	Power-Off Leakage Current	V_{CC} = 0V, V_{IN} = 0V to 5.5V			1	µA
R_{ON}	Switch On-Resistance[4]	V_{CC} = 1.65V, V_{IN} = 0.0V I_{ON} = 30mA		6	10	Ω
		V_{CC} = 1.65V, V_{IN} = 1.05V I_{ON} = -15mA		10	15	

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} = 1.8V, TA = 25°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.

Capacitance

T_A = 25ºC, f=1MHz

Symbol[1]	Description	Test Conditions	Typ	Max.	Unit
C_{IN}	Input Capacitance	V_{IN} = 0V	2.5	3.5	pF
$C_{OFF(IN)}$	In Capacitance, Switch Off		3.5	4.5	
$C_{OFF(Y)}$	Y Capacitance, Switch Off		8	11	
C_{ON}	Y/In Capacitance, Switch On		13	17	

Note:
1. These parameters are determined by device characterization but are not production tested

Power Supply Characteristics

Symbol	Description	Test Conditions[1]	Min	Typ[2]	Max	Unit
I_{CC}	Quiescent Power Supply Current	V_{CC} = 3.6V, V_{IN} = GND or V_{CC}		0.6	1.5	mA

Note:
1. For Max. or Min. conditions, use appropriate value specified under Electrical Characteristics for the applicable device.
2. Typical values are at +25°C ambient

Dynamic Electrical Characteristics

Over Operating Range, T_A = -40 ~ +85ºC, V_{CC}=3.3V±10%

Symbol	Description	Test Conditions	Min	Typ	Max	Unit
X_{TALK}	Crosstalk	See test Diagram		-60		dB
O_{IRR}	Off-Isolation	See test Diagram		-60		
BW	-3dB Bandwidth	See test Diagram		500		MHz

Switch Characteristics

Over 3.3V Operating Range

Symbol	Description	Test Conditions(1)	Min	Typ	Max	Unit
t_{PLH}, t_{PHL}	Propagation Delay(2, 3) Y to In, In to Y	See test Diagram			0.3	ns
t_{PZH}, t_{PZL}	Enable Time S or $\overline{EN}$ to Y or In	See test Diagram	1.5		5.5	
t_{PHZ}, t_{PLZ}	Disable Time S or $\overline{EN}$ to Y or In	See test Diagram	1.5		6	

Note:
1. See test circuit and waveforms.
2. This parameter is guaranteed but not tested on Propagation Delays.
3. The switch contributes no propagation 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 propagation delay to the system. Propagation 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.

Over 2.5V Operating Range

Symbol	Description	Test Conditions(1)	Min	Typ	Max	Unit
t_{PLH}, t_{PHL}	Propagation Delay(2, 3) Y to In, In to Y	See test Diagram			0.3	ns
t_{PZH}, t_{PZL}	Enable Time S or $\overline{EN}$ to Y or In	See test Diagram	1.5		6.5	
t_{PHZ}, t_{PLZ}	Disable Time S or $\overline{EN}$ to Y or In	See test Diagram	1.5		6	

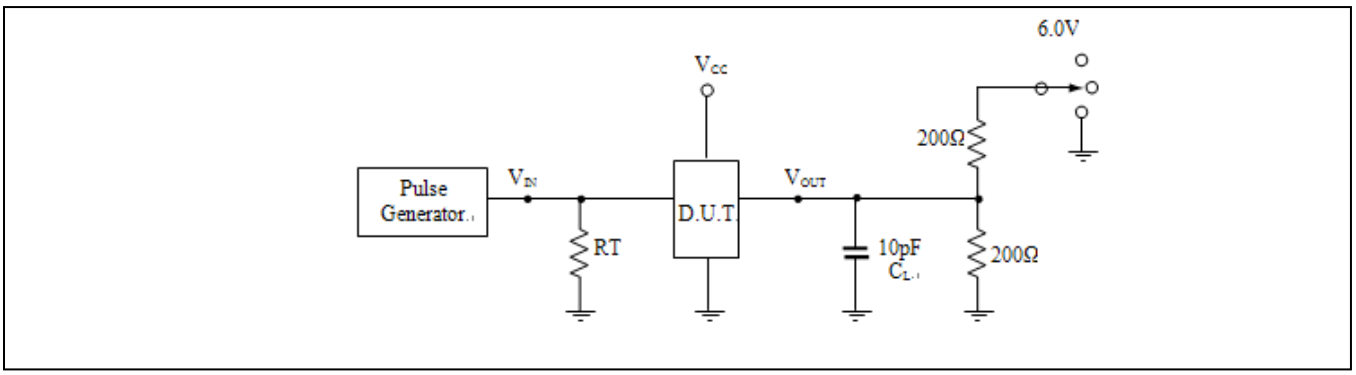
Note:
1. See test circuit and waveforms.
2. This parameter is guaranteed but not tested on Propagation Delays.
3. The switch contributes no propagation delay other than the RC delay of the On-Resistance of the switch and the load capacitance. The time constant for the switch alone is of the order of 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 propagation delay to the system. Propagation 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.

Over 1.8V Operating Range

Symbol	Description	Test Conditions(1)	Min	Typ	Max	Unit
t_{PLH}, t_{PHL}	Propagation Delay(2, 3) Y to In, In to Y	See test Diagram			0.3	ns
t_{PZH}, t_{PZL}	Enable Time S or $\overline{EN}$ to Y or In	See test Diagram	1.5		25.0	
t_{PHZ}, t_{PLZ}	Disable Time S or $\overline{EN}$ to Y or In	See test Diagram	1.5		12.0	

Note:
1. See test circuit and waveforms.
2. This parameter is guaranteed but not tested on Propagation Delays.
3. The switch contributes no propagation 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 propagation delay to the system. Propagation 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



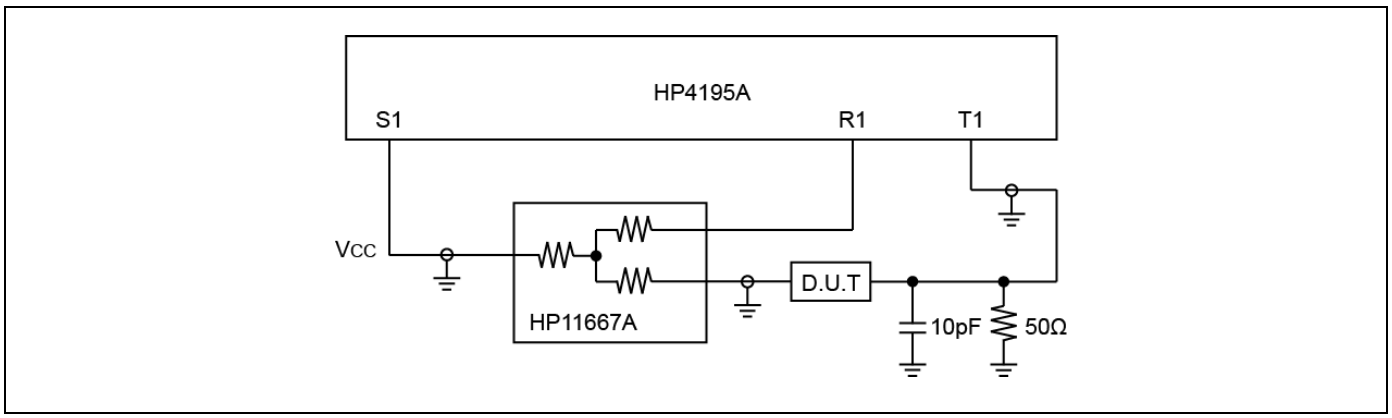
Notes:

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

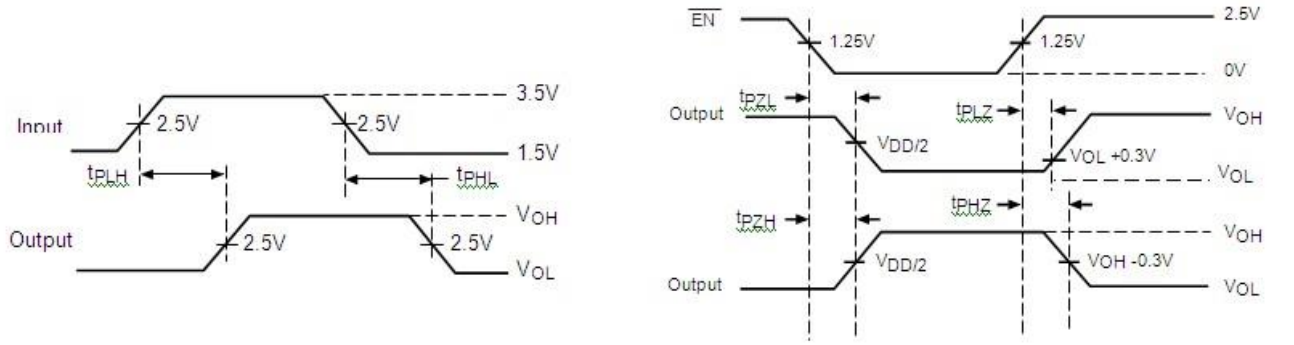
Switch Positions

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

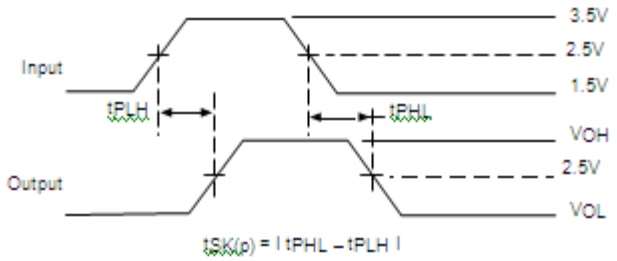
Test Circuit for Dynamic Electrical Characteristics



Switching Waveforms



Voltage Waveforms Enable and Disable Times



Pulse Skew - $t_{SK(p)}$

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, $\overline{EN}$ may be driven LOW to 0V and HIGH to 3.6V. Driving $\overline{EN}$ Rail-to-Rail® minimizes power consumption.

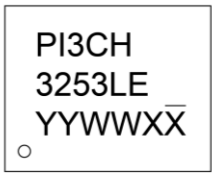
Hot Insertion

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 PI3CH3253 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.

Part Marking

L Package

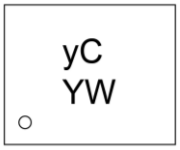


YY: Date Code (Year)
WW: Date Code (Workweek)
1st X: Assembly Site Code
2nd X: Wafer Fab Site Code
Bar above Fab Code means Cu wire

Q Package

Y: Date Code (Year)
W: Date Code (Workweek)
1st X: Assembly Site Code
2nd X: Wafer Fab Site Code
Bar above Fab Code means Cu wire

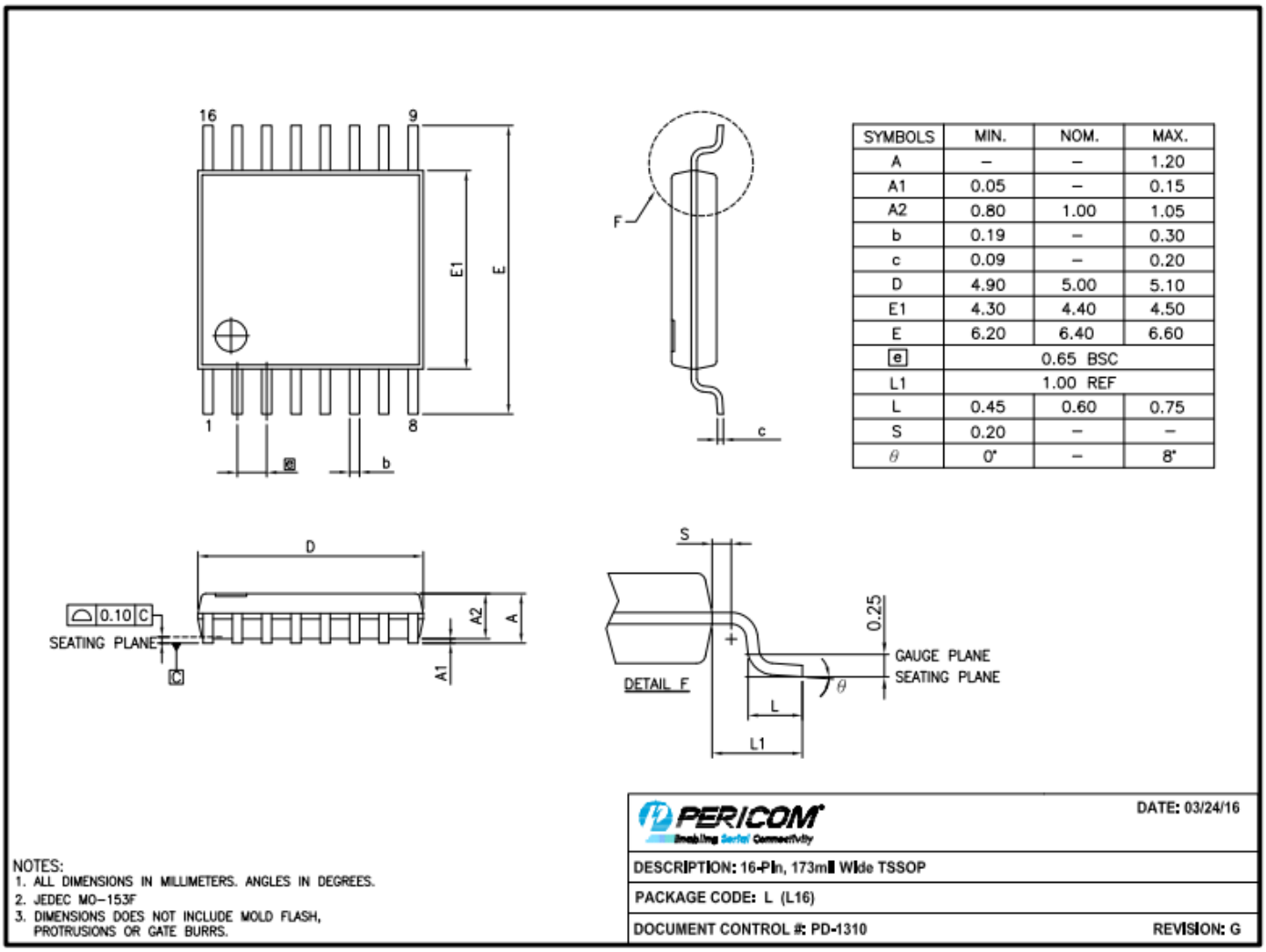
ZTA Package



Y: Date Code (Year)
W: Date Code (Workweek)

Packaging Mechanical

16-TSSOP (L)



SYMBOLS	MIN.	NOM.	MAX.
A	–	–	1.20
A1	0.05	–	0.15
A2	0.80	1.00	1.05
b	0.19	–	0.30
c	0.09	–	0.20
D	4.90	5.00	5.10
E1	4.30	4.40	4.50
E	6.20	6.40	6.60
e	0.65 BSC		
L1	1.00 REF		
L	0.45	0.60	0.75
S	0.20	–	–
θ	0°	–	8°

NOTES:
1. ALL DIMENSIONS IN MILLIMETERS. ANGLES IN DEGREES.
2. JEDEC MO-153F
3. DIMENSIONS DOES NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS.

PERICOM Enabling Serial Connectivity

DATE: 03/24/16

DESCRIPTION: 16-Pin, 173mil Wide TSSOP

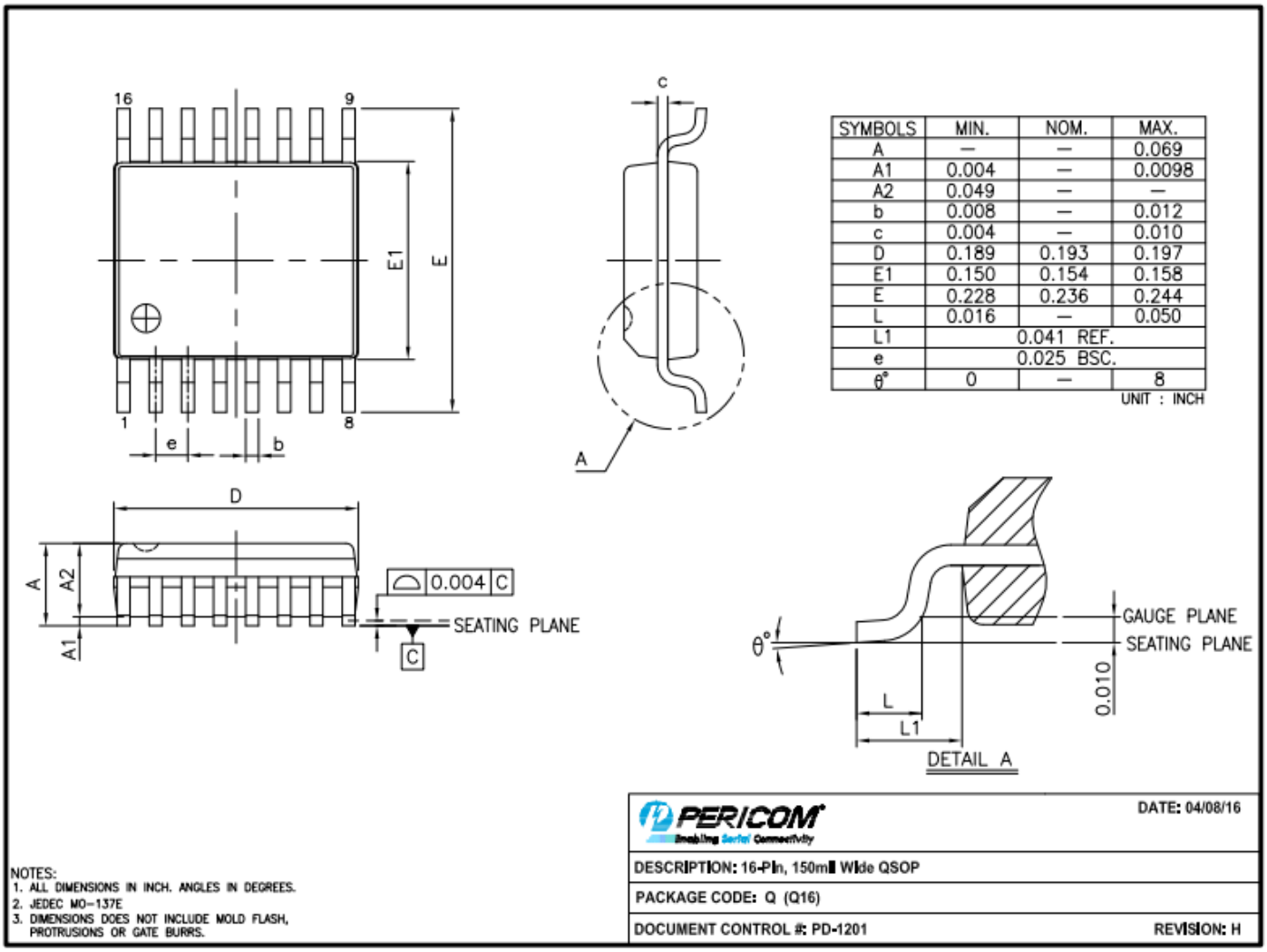
PACKAGE CODE: L (L16)

DOCUMENT CONTROL #: PD-1310

REVISION: G

16-0061

16- QSOP (Q)



SYMBOLS	MIN.	NOM.	MAX.
A	—	—	0.069
A1	0.004	—	0.0098
A2	0.049	—	—
b	0.008	—	0.012
c	0.004	—	0.010
D	0.189	0.193	0.197
E1	0.150	0.154	0.158
E	0.228	0.236	0.244
L	0.016	—	0.050
L1		0.041 REF.	
e		0.025 BSC.	
θ°	0	—	8

UNIT : INCH

NOTES:
1. ALL DIMENSIONS IN INCH. ANGLES IN DEGREES.
2. JEDEC MO-137E
3. DIMENSIONS DOES NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS.

16-0056

PERICOM Enabling Serial Connectivity

DATE: 04/08/16

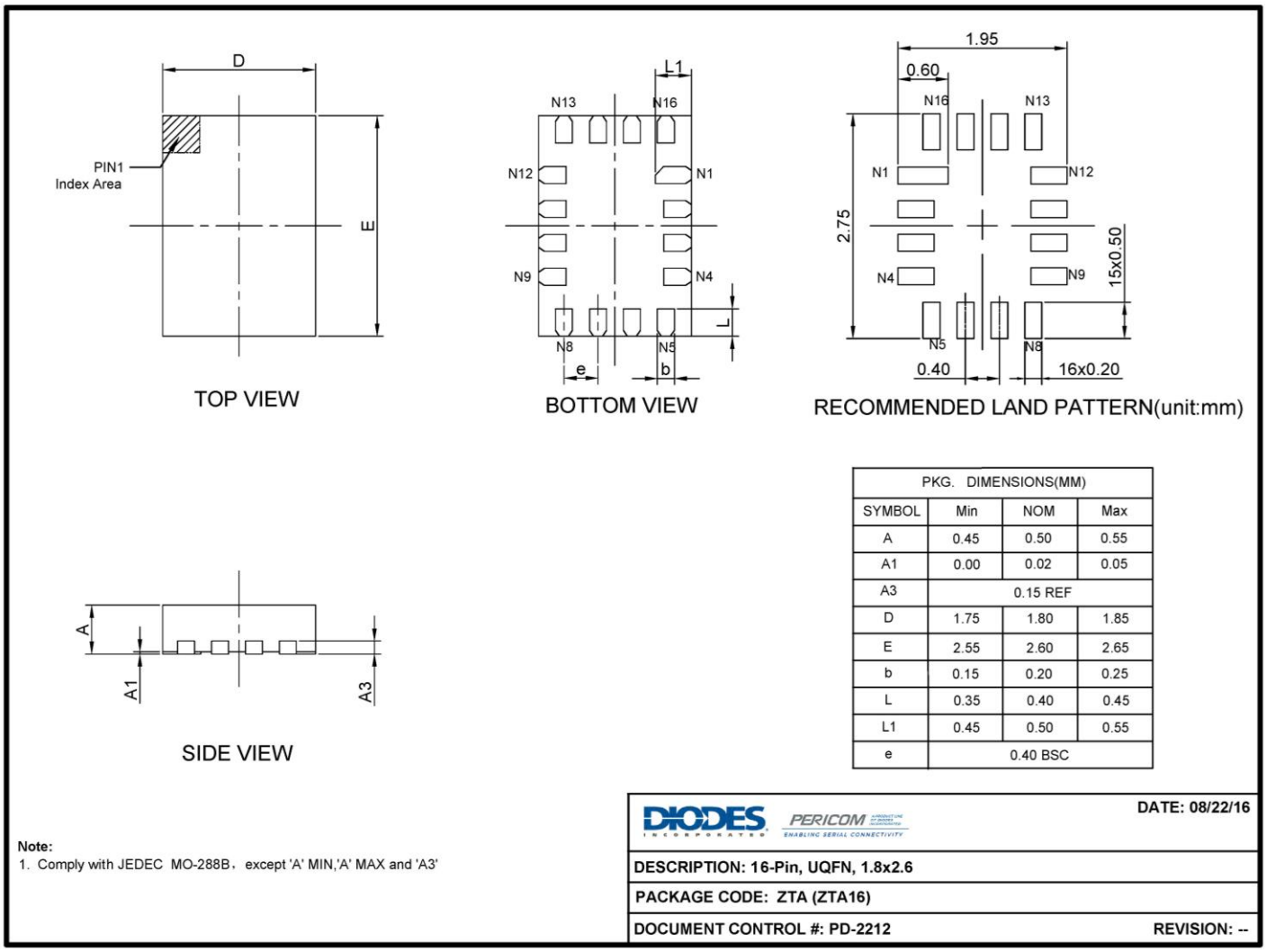
DESCRIPTION: 16-Pin, 150mil Wide QSOP

PACKAGE CODE: Q (Q16)

DOCUMENT CONTROL #: PD-1201

REVISION: H

16-UQFN (ZTA)



PKG. DIMENSIONS(MM)			
SYMBOL	Min	NOM	Max
A	0.45	0.50	0.55
A1	0.00	0.02	0.05
A3		0.15 REF	
D	1.75	1.80	1.85
E	2.55	2.60	2.65
b	0.15	0.20	0.25
L	0.35	0.40	0.45
L1	0.45	0.50	0.55
e		0.40 BSC	

Note:
1. Comply with JEDEC MO-288B，except 'A' MIN,'A' MAX and 'A3'

DATE: 08/22/16

DESCRIPTION: 16-Pin, UQFN, 1.8x2.6

PACKAGE CODE: ZTA (ZTA16)

DOCUMENT CONTROL #: PD-2212 REVISION: --

16-0164

For latest package info.
please check: http://www.diodes.com/design/support/packaging/pericom-packaging/packaging-mechanicals-and-thermal-characteristics/

Ordering Information

Part Number	Package Cede	Package Description
PI3CH3253LEX	L	16-Pin, 173mil wide (TSSOP)
PI3CH3253QEX	Q	16-Pin, 150mil-Wide (QSOP)
PI3CH3253ZTAEX	ZTA	16-Pin, 1.8x2.6mm (UQFN)

Notes:
1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS), 2011/65/EU (RoHS 2) & 2015/863/EU (RoHS 3) compliant.
2. See https://www.diodes.com/quality/lead-free/ for more information about Diodes Incorporated's definitions of Halogen- and Antimony-free, "Green" and Lead-free.
3. Halogen- and Antimony-free "Green" products are defined as those which contain <900ppm bromine, <900ppm chlorine (<1500ppm total Br + Cl) and <1000ppm antimony compounds.
4. E = Pb-free and Green
5. X suffix = Tape/Reel

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