PERICOM®

PI3L500

3.3V, 8-Channel, 2:1 Mux/DeMux
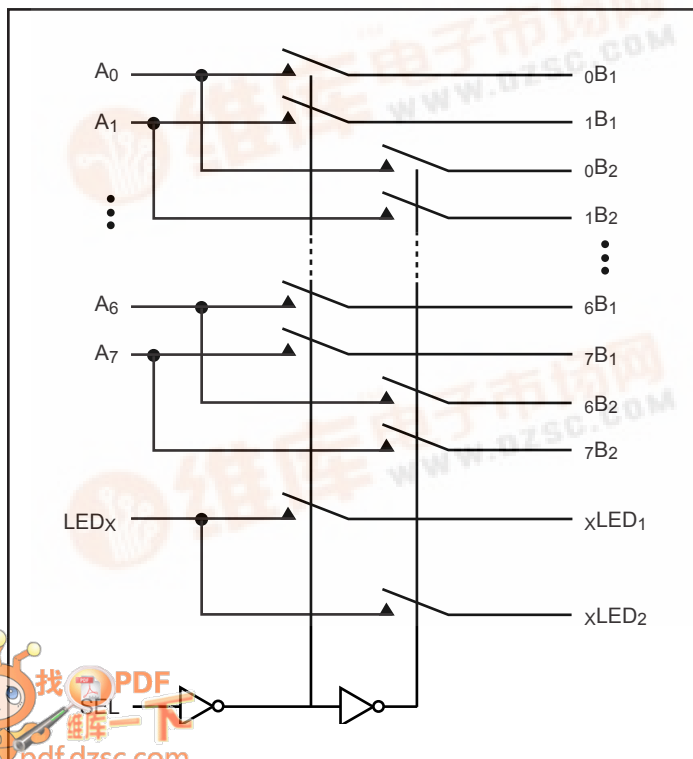## Gigabit Ethernet LAN Switch with Single Enable

Features

- R_{ON} is 4Ω typical
- Low bit-to-bit skew: 200ps
- Low Crosstalk: –22dB @ 250MHz
- Near-Zero propagation delay: 250ps
- Switching speed: 9ns
- Channel On capacitance: 10pF (typical)
- Live Insertion Capable
- Status Indicator LEDs Switched with Ethernet pairs
- V_{CC} Operating Range: +3.0V to +3.6V
- ESD>3000V . . . Human Body Model
- >350 MHz bandwidth (or data frequency)
- Packaging:
  · Pb-free and Green 56-contact TQFN (ZF)

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Applications

- Dual Physical Layer Device sharing to one interface connector
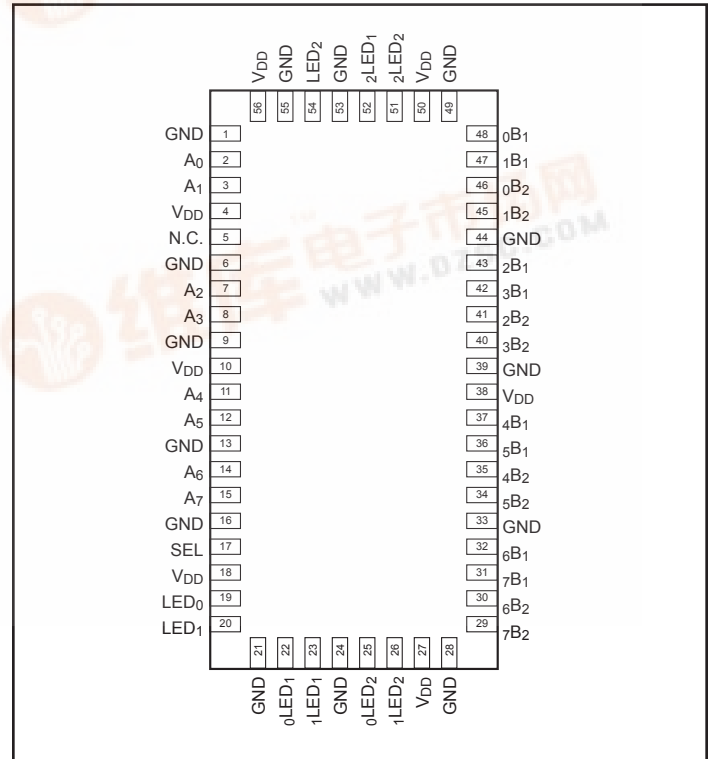- Routes signals for 10/100/1000 Mbit Ethernet

Description

Pericom Semiconductor's PI3L series of switch circuits are produced using the Company's advanced sub-micron CMOS technology, achieving industry leading performance.

The PI3L500 is a 16- to 8- Channel multiplexer/demultiplexer LAN Switch with Hi-Z outputs. Industry leading advantages include a propagation delay of less than 250ps, resulting from its low channel resistance and I/O capacitance. The device multiplexes differential outputs from a Gigabit Ethernet transceiver (PHY) device to one of two corresponding B1 or B2 outputs. The switch is bidirectional and offers little or no attenuation of the high-speed signals at the outputs. It is designed for low bit-to-bit skew, high channel-to-channel noise isolation and is compatible with various standards, such as 10/100/1000 Base-T (Ethernet).

Generally, this part can be used to replace mechanical relays in low-voltage LAN applications that interface a physical layer over CAT 5 or CAT 6 unshielded twisted pair cable through an isolation transformer.

Block Diagram

Pin Description

Pin Description

Pin Name	Description
A_X	Demux Inputs
$_XB_Y$	Mux Inputs
LED_Z	LED Demux Inputs
$_ZLED_Y$	LED Mux Inputs
GND	Ground
V_{CC}	Power
SEL	Select

Truth Table

SEL	Function
L	A_X to $_XB_1$; LED_Z to $_ZLED_1$
H	A_X to $_XB_2$; LED_Z to $_ZLED_2$

Maximum Ratings

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

Storage Temperature..	$-65°C$ to $+150°C$
Supply Voltage to Ground Potential	$-0.5V$ to $+4.0V$
DC Input Voltage...	$-0.5V$ to $+5.5V$
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 for 1000 Base-T Ethernet Switching over Operating Range

$(T_A = -40°C \text{ to } +85°C, V_{CC} = 3.3V \pm 10\%)$

Paramenter	Description	Test Conditions	Min.	Typ.[2]	Max.	Units
V_{IH}	Input HIGH Voltage	Guaranteed HIGH level (Control Pins)	2.0	–	–	V
V_{IL}	Input LOW Voltage	Guaranteed LOW level (Control Pins)	–0.5	–	0.8	
V_{IK}	Clamp Diode Voltage	V_{CC} = Max., I_{IN} = –18mA	–	–0.7	–1.2	
I_{IH}	Input HIGH Current	V_{CC} = Max., V_{IN} = V_{CC}	–	–	±5	μA
I_{IL}	Input LOW Current	V_{CC} = Max., V_{IN} = GND	–	–	±5	
R_{ON}	Switch On-Resistance[3]	V_{CC} = Min., 1.5V ≤ V_{IN} ≤ V_{CC} I_{IN} = –40mA	–	4.0	6.5	Ω
$R_{FLAT(ON)}$	On-Resistance Flatness[4]	V_{CC} = Min., V_{IN} @ 1.5V and V_{CC} I_{IN} = –40mA	–	0.5	–	
ΔR_{ON}	On-Resistance match from center ports to any other port[4]	V_{CC} = Min., 1.5V ≤ V_{IN} ≤ V_{CC} I_{IN} = –40mA	–	0.4	1.0	

DC Electrical Characteristics for 10/100 Base-T Ethernet Switching over Operating Range

$(T_A = -40°C \text{ to } +85°C, V_{CC} = 3.3V \pm 10\%)$

Paramenter	Description	Test Conditions	Min.	Typ.[2]	Max.	Units
V_{IH}	Input HIGH Voltage	Guaranteed HIGH level (Control Pins)	2.0	–	–	V
V_{IL}	Input LOW Voltage	Guaranteed LOW level (Control Pins)	–0.5	–	0.8	
V_{IK}	Clamp Diode Voltage	V_{CC} = Max., I_{IN} = –18mA	–	–0.7	–1.2	
I_{IH}	Input HIGH Current	V_{CC} = Max., V_{IN} = V_{CC}	–	–	±5	μA
I_{IL}	Input LOW Current	V_{CC} = Max., V_{IN} = GND	–	–	±5	
R_{ON}	Switch On-Resistance[3]	V_{CC} = Min., 1.25V ≤ V_{IN} ≤ V_{CC} I_{IN} = –10mA to –30mA	–	4.0	6.5	Ω
$R_{FLAT(ON)}$	On-Resistance Flatness[4]	V_{CC} = Min., V_{IN} @ 1.25V and V_{CC} I_{IN} = –10mA to –30mA	–	0.5	–	
ΔR_{ON}	On-Resistance match from center ports to any other port[4]	V_{CC} = Min., 1.25V ≤ V_{IN} ≤ V_{CC} I_{IN} = –10mA to –30mA	–	0.4	1.0	

Capacitance $(T_A = 25°C, f = 1MHz)$

Parameters[5]	Description	Test Conditions	Typ.	Max.	Units
C_{IN}	Input Capacitance		2.0	3.0	
$C_{OFF(B1, B2)}$	Port B Capacitance, Switch OFF	$V_{IN} = 0V$	4.0	6.0	pF
$C_{ON(A/B)}$	A/B Capacitance, Switch ON		10.0	11.0	

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 A and B pins at indicated current through the switch. ON resistance is determined by the lower of the voltages on the two (A & B) pins.
4. 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}	—	0.5	3.5	mA

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. Per TTL driven input (control inputs only); A and B pins do not contribute to I_{CC}.

Dynamic Electrical Characteristics Over the Operating Range $(T_A = –40°C$ to $+85°C,$ $V_{CC} = 3.3V \pm10\%$, GND = 0V)

Parameter	Description	Test Conditions	Min.	Typ.[2]	Max.	Units
X_{TALK}	Crosstalk	$R_L = 100\Omega$, f = 250MHz	—	–27	—	dB
O_{IRR}	OFF Isolation		—	–32	—	dB
BW	Bandwidth –3dB	$R_L = 100\Omega$	—	350	—	MHz

Switching Characteristics

Paramenter	Description	Min.	Typ.[2]	Max.	Units
t_{PD}	Propagation Delay[2,3]	–	0.25		
t_{PZH}, t_{PZL}	Line Enable Time - SEL to A_N, B_N	0.5	–	15.0	
t_{PHZ}, t_{PLZ}	Line Disable Time - SEL to A_N, B_N	0.5	–	9.0	ns
$t_{SK(o)}$	Output Skew between center port (A_4 to A_5) to any other port[2]	–	0.1	0.2	
$t_{SK(p)}$	Skew between opposite transitions of the same output (t_{PHL} - t_{PLH})[2]	–	0.1	0.2	

Notes:
1. For max. or min. conditions, use appropriate value specified under Electrical Characteristics for the applicable device type.
2. Guaranteed by design.
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 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 bus switch when used in a system is determined by the driving circuit on the driving side of the switch and its interactions with the load on the driven side.

Test Circuit for Electrical Characteristics[1]
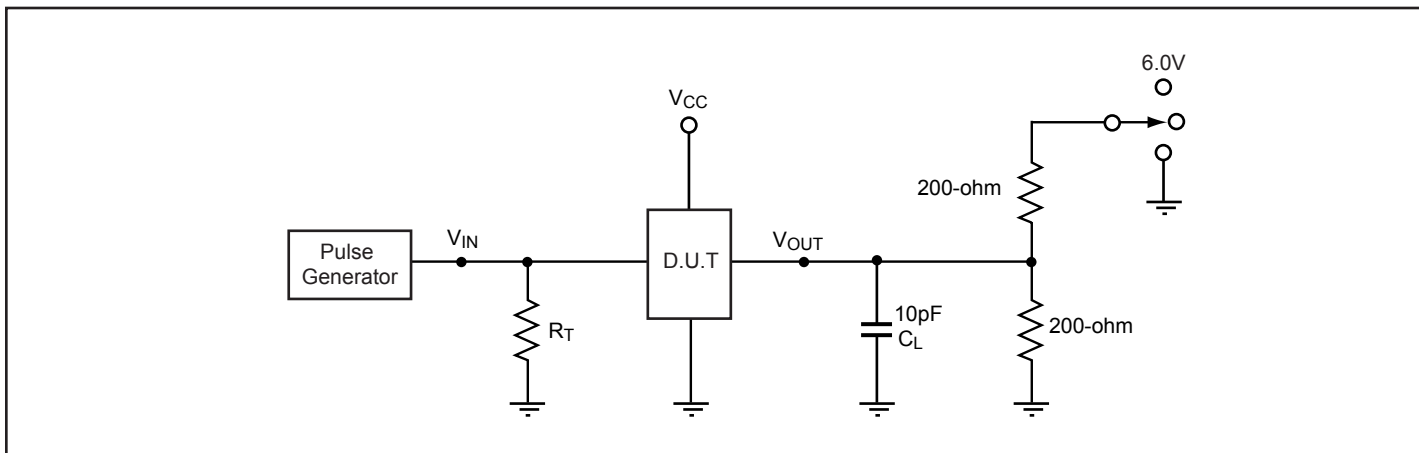
Notes:
1. C_L = Load capacitance: includes jig and probe capacitance.
2. R_T = Termination resistance: should be equal to Z_{OUT} of the Pulse Generator
3. Waveform 1 is for an output with internal conditions such that the output is low except when disabled by the output control.
    Waveform 2 is for an output with internal conditions such that the output is high except when disabled by the output control.
4. All input impulses are supplied by generators having the following characteristics: PRR ≤ MHz, Z_O = 50Ω, t_R ≤ 2.5ns, t_F ≤ 2.5ns.
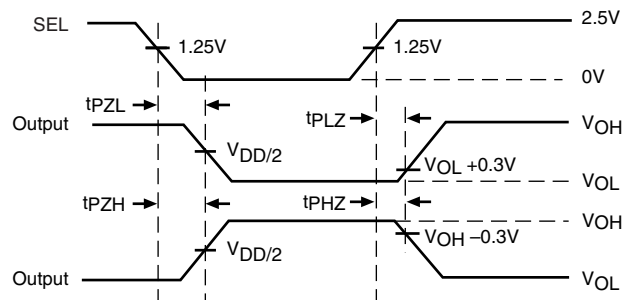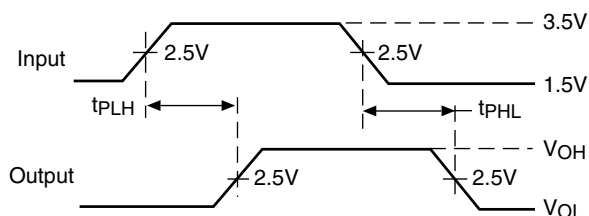5. The outputs are measured one at a time with one transition per measurement.

Switch Positions

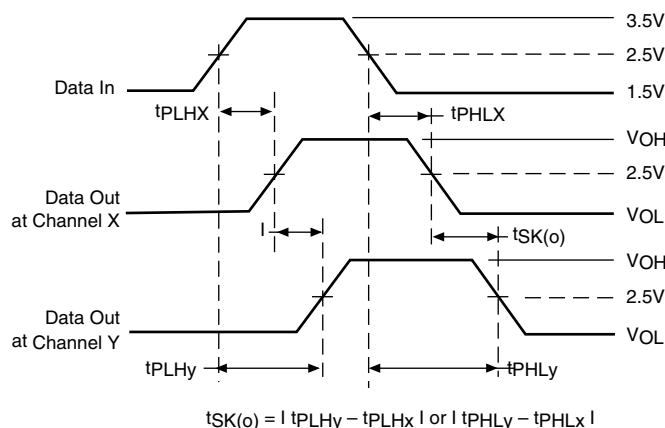| Test	Switch
t_{PLZ}, t_{PZL} (output on B-side)	6.0V
t_{PHZ}, t_{PZH} (output on B-side)	GND
Prop Delay	Open

Test Circuit for Dynamic Electrical Characteristics
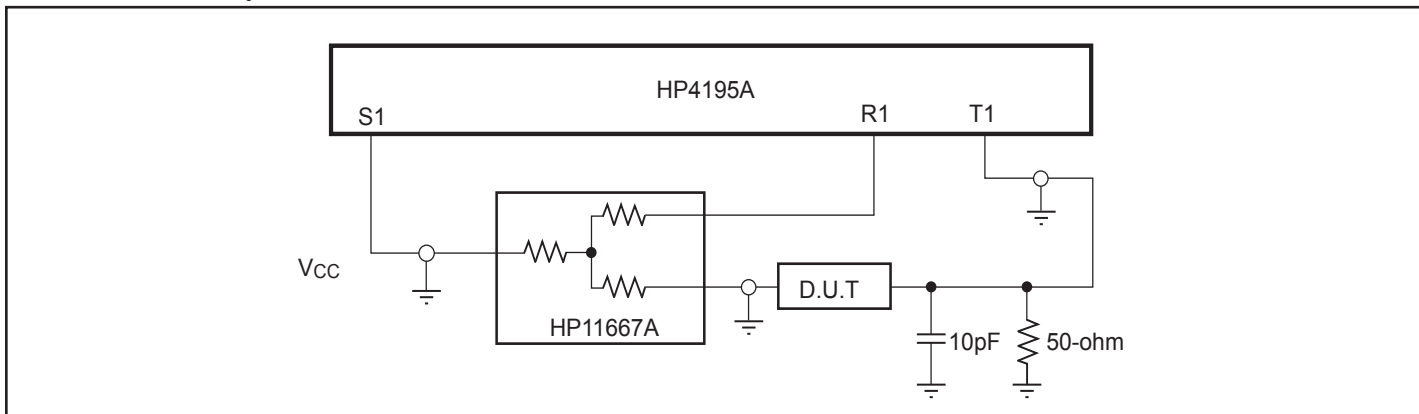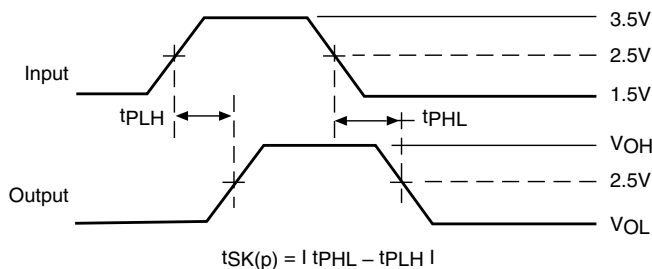
Switching Waveforms

Voltage Waveforms Propagation Delay Times

Voltage Waveforms Enable and Disable Times

$$t_{SK(o)} = |\, t_{PLHy} - t_{PLHx}\,|\ \text{or}\ |\, t_{PHLy} - t_{PHLx}\,|$$

Output Skew - $t_{SK(o)}$

$$t_{SK(p)} = |\, t_{PHL} - t_{PLH}\,|$$

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, the output enables or select pins may be driven low to 0V and high to 3.6V. Driving IN Rail-to-Rail® minimizes power consumption.
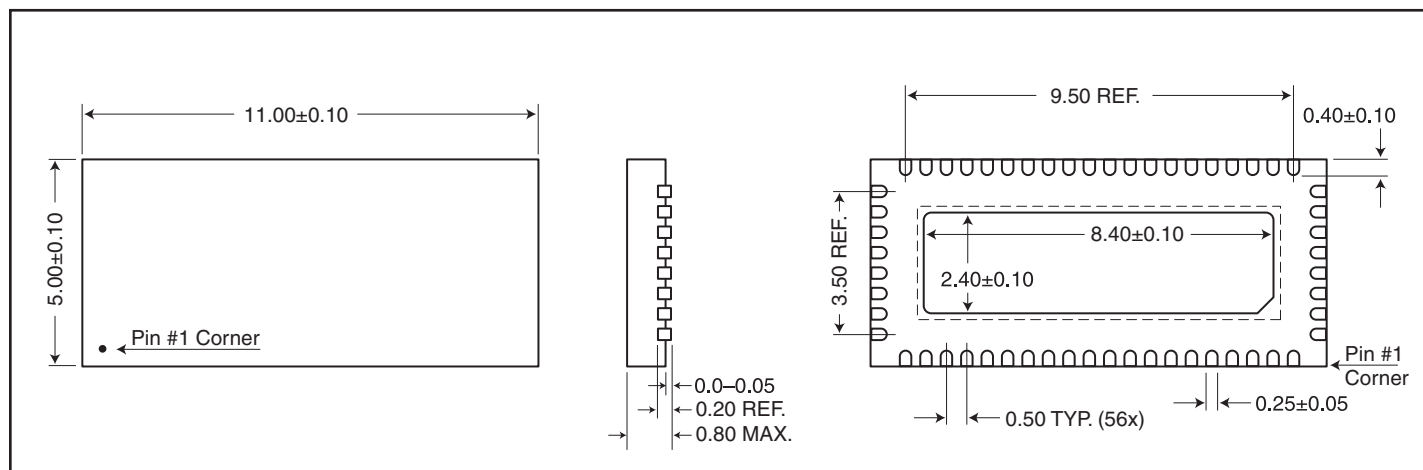
Power-Supply Sequencing

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

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

PERICOM®

Packaging Mechanical: 56-Contact TQFN (ZF)

Ordering Information

Ordering Number	Package Code	Package Description
PI3L500ZFEX	ZF	Pb-free & Green, 56-contact TQFN
PI3L500ZFX	ZF	56-contact TQFN

Notes:

1. Thermal characteristics can be found on the company web site at www.pericom.com/packaging/
2. Number of Transistors = TBD
3. X = Tape and Reel