2:1 Mux/DeMux Gigabit Ethernet LAN Switch with Power-down Mode

Features

- 1:2 Gigabit LAN Switch
- Power-down support
- Low bit-to-bit skew: 200ps
- Very Low Crosstalk: –75dB @ 250MHz
- Status Indicator LEDs Switched with Ethernet pairs
- V_{DD} Operating Range: +3.0V to +3.6V
- Enhanced ESD Protection (on A, B, C, LED pins):
  – 8kV (contact)(1)
  – 1.0kV (machine model),
  11kV (human body model)
- >650 MHz bandwidth
- Packaging:
  – 56-contact TQFN (5 x 11mm, 0.5 pitch)
  – 42-contact TQFN (3.5 x 9mm, 0.5 pitch)
  – 42-contact TQFN (3.5 x 7mm, 0.4 pitch)

Description

The PI3L720 is a 8-Channel 2:1 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 B or C 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).

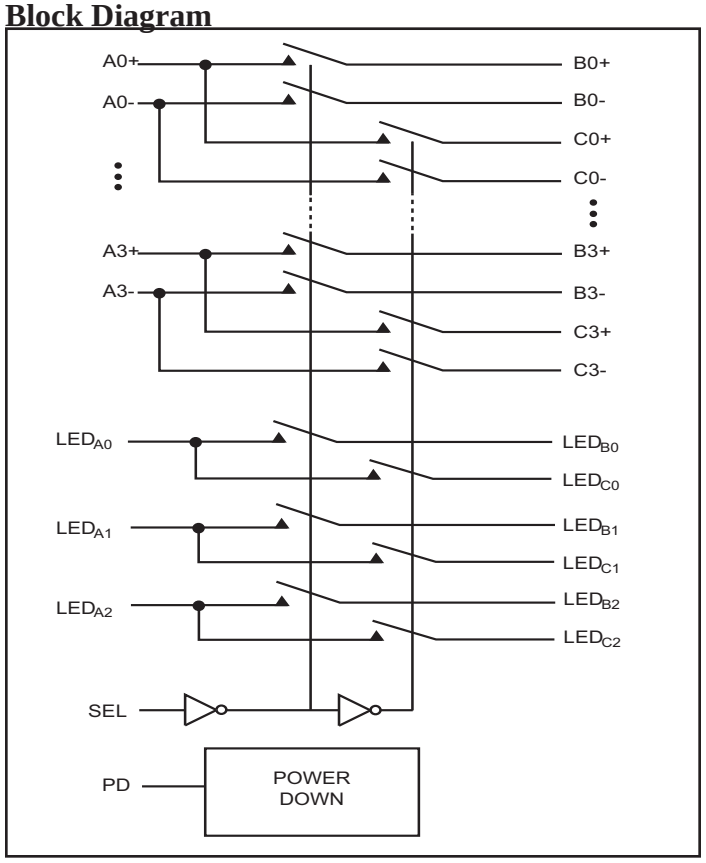
The PI3L720 provides a Power Down input (PD), which can put the device into standby mode (PD=1) while mobile, eliminating an external power switch.

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.

Applications

- Dual Physical Layer Device sharing to one interface connector, or one controller to dual connectors for docking
- Routes signals for 10/100/1000 Mbit Ethernet

Block Diagram

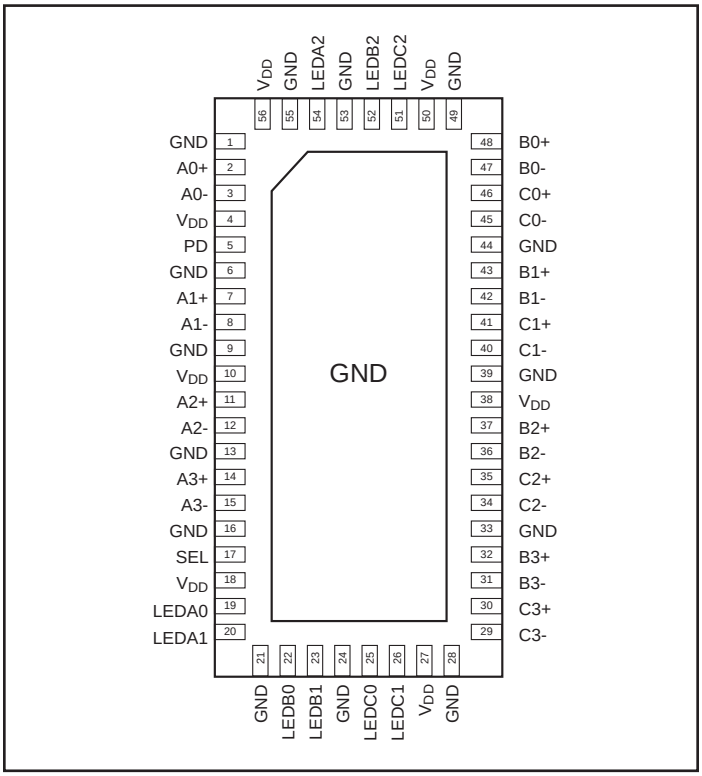


Truth Table

PD	SEL	Function
L	L	A_X to B_X; $LEDA_X$ to $LEDB_X$
L	H	A_X to C_X; LEA_X to $LEDC_X$
H	x	Hi-Z

Note:
1. IEC 6100-4-2

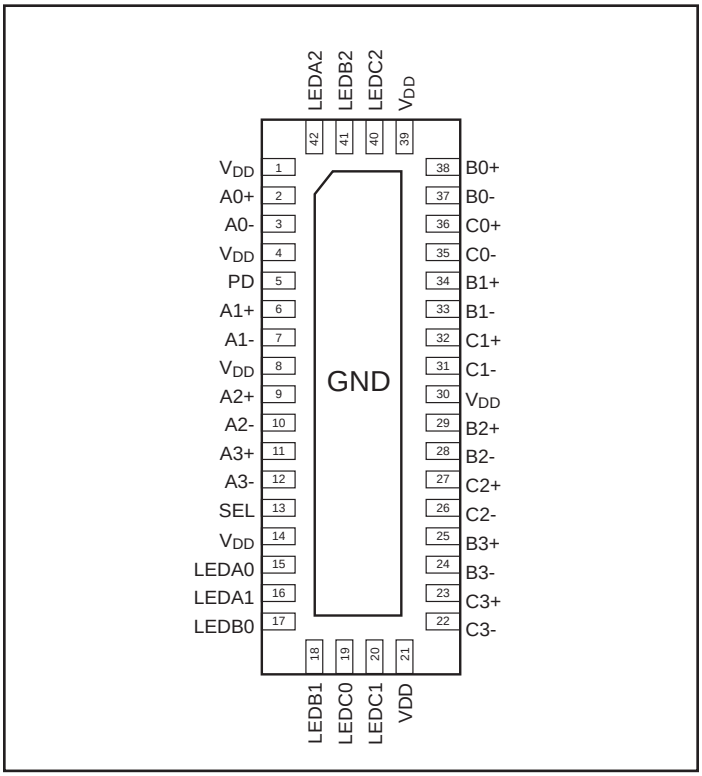
Pin Configuration (56-TQFN Top-Side View)



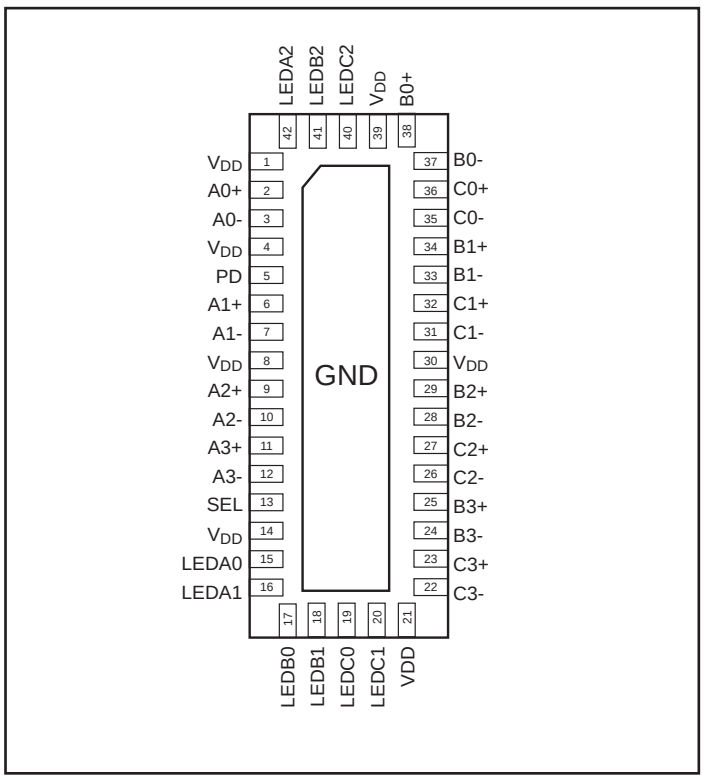
Pin Description

Pin Name	Description
A_X+, A_X-	Port A DeMux I/O
B_X+, B_X-	Port B Mux I/O
C_X+, C_X-	Port C LED Mux I/O
GND	Ground
LED_{ZX}	LED I/O
PD	Power Down. Active high, with internal pull-down resistor
SEL	Select
V_{DD}	Power

Pin Configuration (42-TQFN ZH, Top-Side View)



Pin Configuration (42-TQFN ZL, Top-Side View)



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 to +85°C, V_{DD} = 3.3V ±10%)

Paramenter	Description	Test Conditions[1]	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_{DD} = Max., I_{IN} = –18mA	–	–0.7	–1.2	
I_{IH}	Input HIGH Current	V_{DD} = Max., V_{IN} = V_{DD}	–	–	±2	µA
I_{IL}	Input LOW Current	V_{DD} = Max., V_{IN} = GND	–	–	±2	
R_{ON}	Switch On-Resistance[3]	V_{DD} = Min., 1.5V ≤ V_{IN} ≤ V_{DD} I_{IN} = –40mA	–	4.0	6.5	Ohm
$R_{FLAT(ON)}$	On-Resistance Flatness[3]	V_{DD} = Min., V_{IN} @ 1.5V and V_{DD} I_{IN} = –40mA	–	0.5	–	
ΔR_{ON}	On-Resistance match from center ports to any other port[3]	V_{DD} = Min., 1.5V ≤ V_{IN} ≤ V_{DD} I_{IN} = –40mA	–	0.4	1.0	

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

(T_A = –40°C to +85°C, V_{DD} = 3.3V ±10%)

Paramenter	Description	Test Conditions[1]	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_{DD} = Max., I_{IN} = –18mA	–	–0.7	–1.2	
I_{IH}	Input HIGH Current	V_{DD} = Max., V_{IN} = V_{DD}	–	–	±2	µA
I_{IL}	Input LOW Current	V_{DD} = Max., V_{IN} = GND	–	–	±2	
R_{ON}	Switch On-Resistance[3]	V_{DD} = Min., 1.25V ≤ V_{IN} ≤ V_{DD} I_{IN} = –10mA to –30mA	–	4.0	6.5	Ohm
$R_{FLAT(ON)}$	On-Resistance Flatness[3]	V_{DD} = Min., V_{IN} @ 1.25V and V_{DD} I_{IN} = –10mA to –30mA	–	0.5	–	
ΔR_{ON}	On-Resistance match from center ports to any other port[3]	V_{DD} = Min., 1.25V ≤ V_{IN} ≤ V_{DD} I_{IN} = –10mA to –30mA	–	0.4	1.0	

Capacitance (T_A = –40°C to +85°C, V_{DD} = 3.3V ±10%)

Parameters[4]	Description	Test Conditions[1]	Min.	Typ.	Max.	Units
C_{IN}	Input Capacitance	V_{IN} = 0V, f = 1MHz		2.0	3.0	pF
$C_{OFF(B1, B2)}$	Port B Capacitance, Switch OFF			3.0	6.0	
$C_{ON(A/B)}$	A/B Capacitance, Switch ON			8.0	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_{DD} = 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
$I_{DD\text{-}Standby}$[3]	Quiescent Power Supply Current	V_{DD} = Max., V_{IN} = GND or V_{DD}	—	0.3	0.5	mA
$I_{DD\text{-}Active}$[3]	Active Power Supply Current	V_{DD} = Max., V_{IN} = V_{DD} or GND		1.0	1.5	mA
$I_{DD\text{-}PD}$[3]	Power Down Current	PD = 1, V_{DD} = MAX, V_{IN} = V_{DD} or GND		0.15	0.25	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_{DD} = 3.3V, T_A = 25°C ambient and maximum loading..
3. Active power represents normal data communication. Standby power is when the device is enabled for operation but there is no LAN traffic (cable not connected). Power down current is the minimum power state used when not connected and mobile.
4. 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.

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

Parameter	Description	Test Conditions[1]	Min.	Typ.[2]	Max.	Units
X_{TALK}	Crosstalk[3]	R_L = 100-Ohm, f = 250MHz	—	–75	—	dB
O_{IRR}	OFF Isolation[3]		—	–35	—	
BW	Bandwidth –3dB[3]	R_L = 100-Ohm	—	650	—	MHz

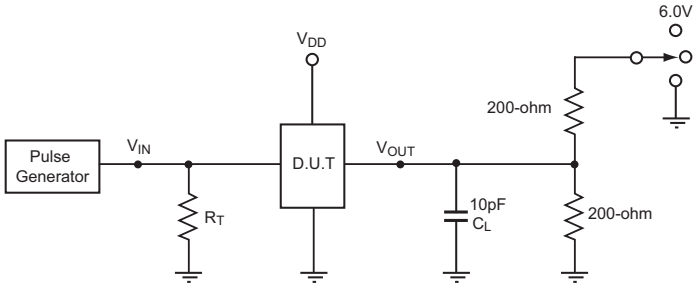
Notes:
1. For max. or min. conditions, use appropriate value specified under Electrical Characteristics for the applicable device type.
2. Typical values are at V_{DD} = 3.3V, T_A = 25°C ambient and maximum loading..
3. Guaranteed by design.
4. The bus switch contributes no propagational delay other 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.

Switching Characteristics (T_A = -40°C to +85°C, V_{DD} = 3.3V ± 10%)

Paramenter	Description	Min.	Typ.(2)	Max.	Units
t_{PD}	Propagation Delay(3,4)	–	0.25		ns
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	–	5.0	
$t_{SK(o)}$	Output Skew between center port to any other port(3)	–	0.1	0.2	
$t_{SK(p)}$	Skew between opposite transitions of the same output (t_{PHL} - t_{PLH}) (3)	–	0.1	0.2	
$t_{ON/OFF}$	Device enable / disable time from PD		100	200	

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_{DD} = 3.3V, T_A = 25°C ambient and maximum loading..
3. Guaranteed by design.
4. 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



Switch Positions

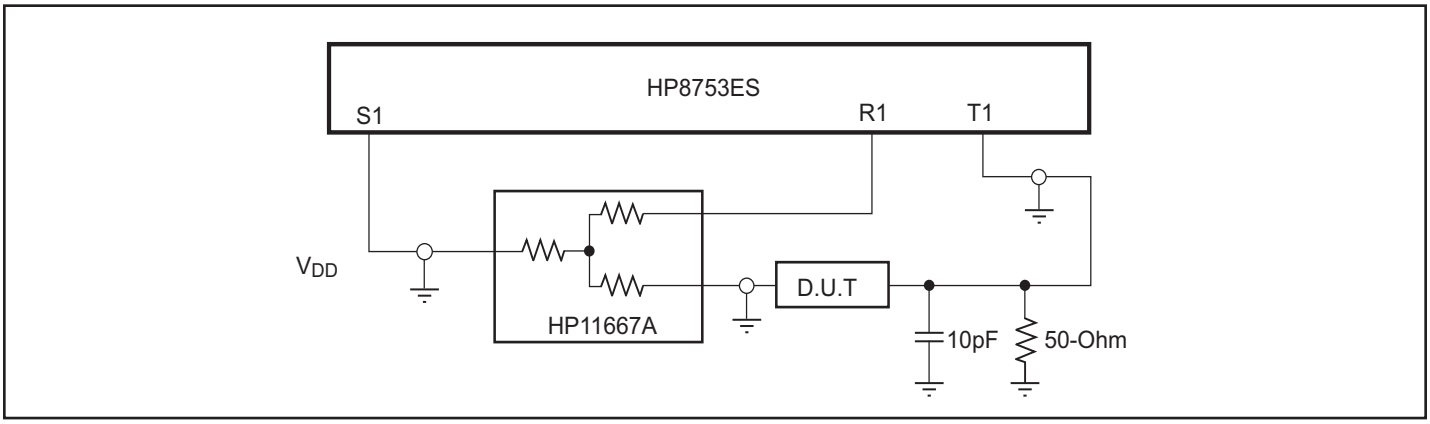
Test	Switch
t_{PLZ}, t_{PZL} (output on B-side)	6.0V
t_{PHZ}, t_{PZH} (output on B-side)	GND
Prop Delay	Open

Notes:

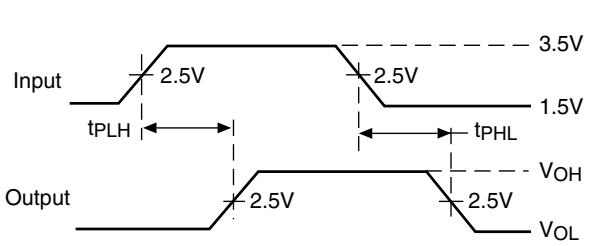
C_L = Load capacitance: includes jig and probe capacitance.

R_T = Termination resistance: should be equal to Z_{OUT} of the Pulse Generator

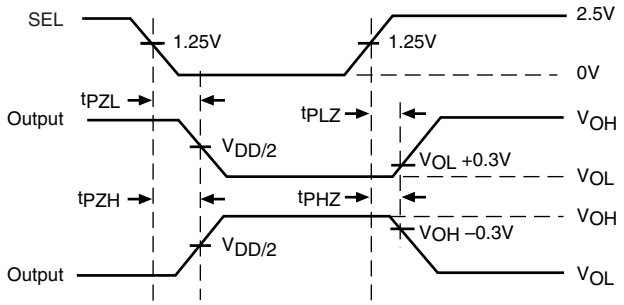
Test Circuit for Dynamic Electrical Characteristics



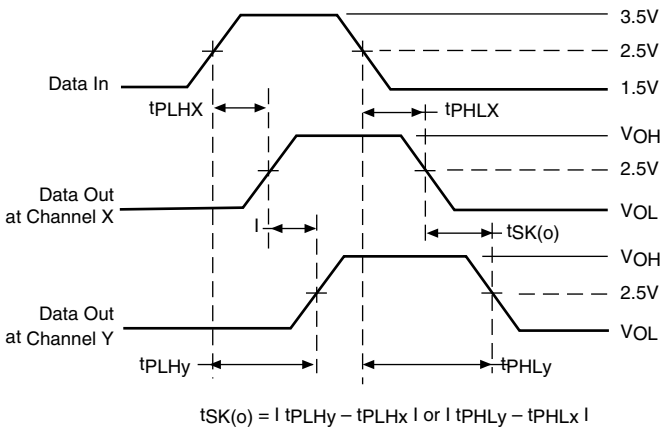
Switching Waveforms



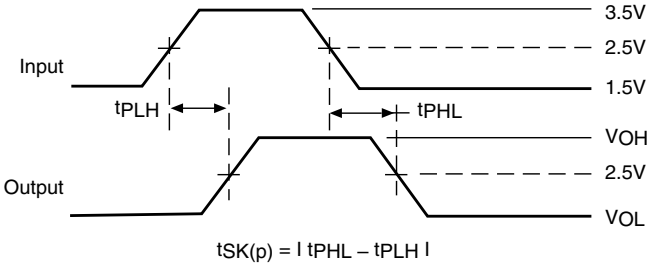
Voltage Waveforms Propagation Delay Times



Voltage Waveforms Enable and Disable Times



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



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

Notes:

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 ≤ MHz, Z_O = 50-Ohm, $t_R \leq 2.5$ns, $t_F \leq 2.5$ns.

Applications Information

Logic Inputs

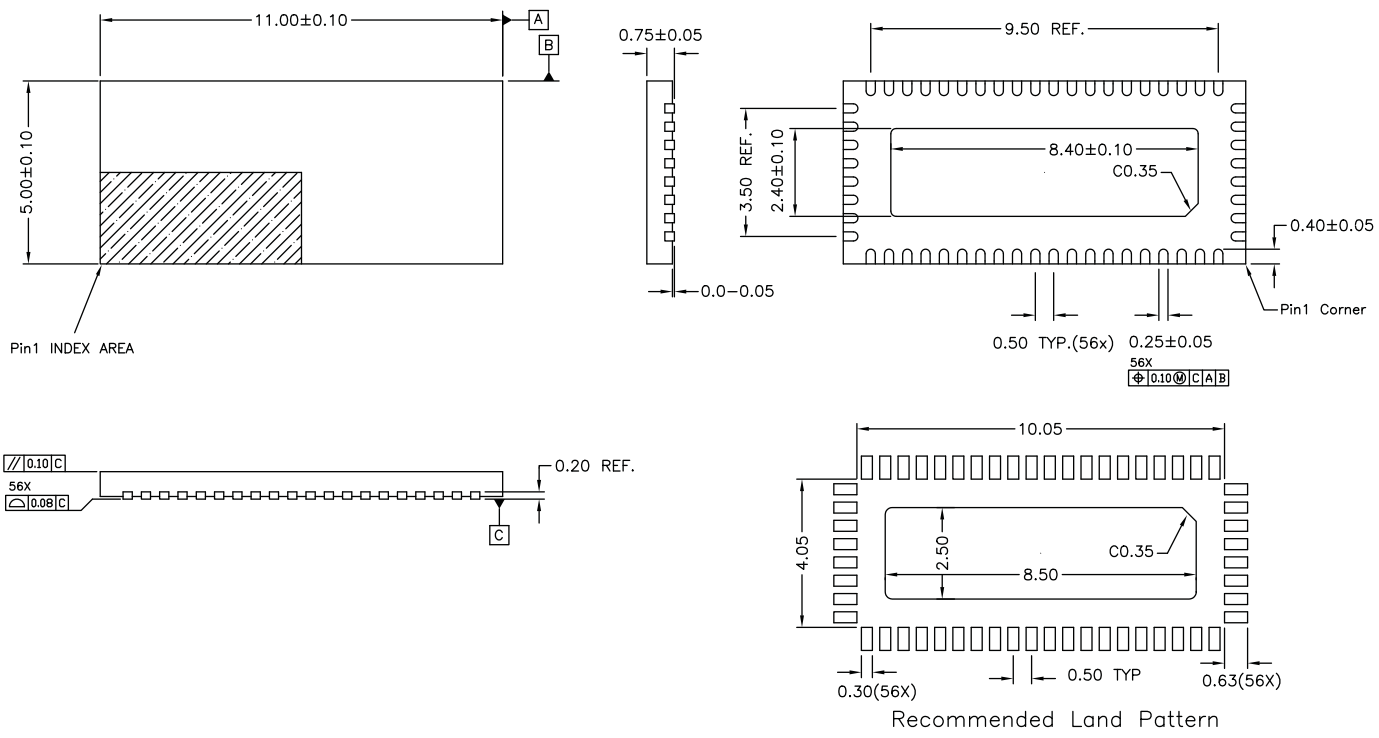
The logic control inputs can be driven up to +3.6V regardless of the supply voltage. For example, given a +3.3V supply, the output enables or select pins may be driven low to 0V and high to 3.6V. Driving IN Rail-to-Rail® minimizes power consumption.

Power-Supply Sequencing

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

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

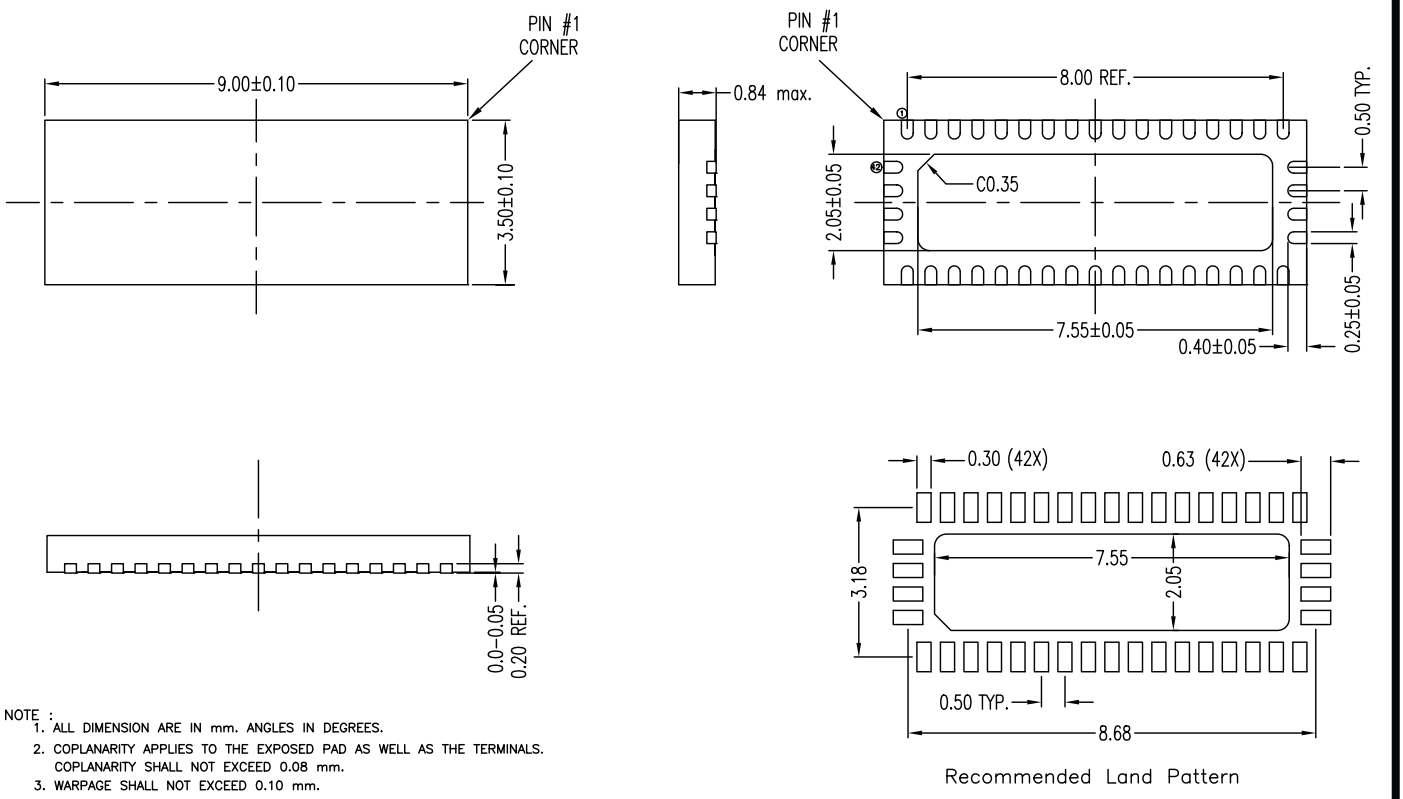
Packaging Mechanical: 56-Contact TQFN (ZF)



NOTE :
1. ALL DIMENSION ARE IN mm. ANGLES IN DEGREES.
2. BILATERAL COPLANARITY ZONE APPLIES TO THE EXPOSED HEAT SINK SLUG AS WELL AS THE TERMINALS.
3. REFER JEDEC MO–220 MODIFIED.
4. Thermal Via Diameter. Recommended 0.2~0.33mm
5. Thermal Via Pitch. Recommended 1.27mm

PERICOM Semiconductor Corporation	DATE: 05/15/08
DESCRIPTION: 56-contact, Thin Fine Pitch Quad Flat No-lead (TQFN)	
PACKAGE CODE: ZF56	
DOCUMENT CONTROL #: PD-2024	REVISION: C

Packaging Mechanical: 42-Contact TQFN (ZH)

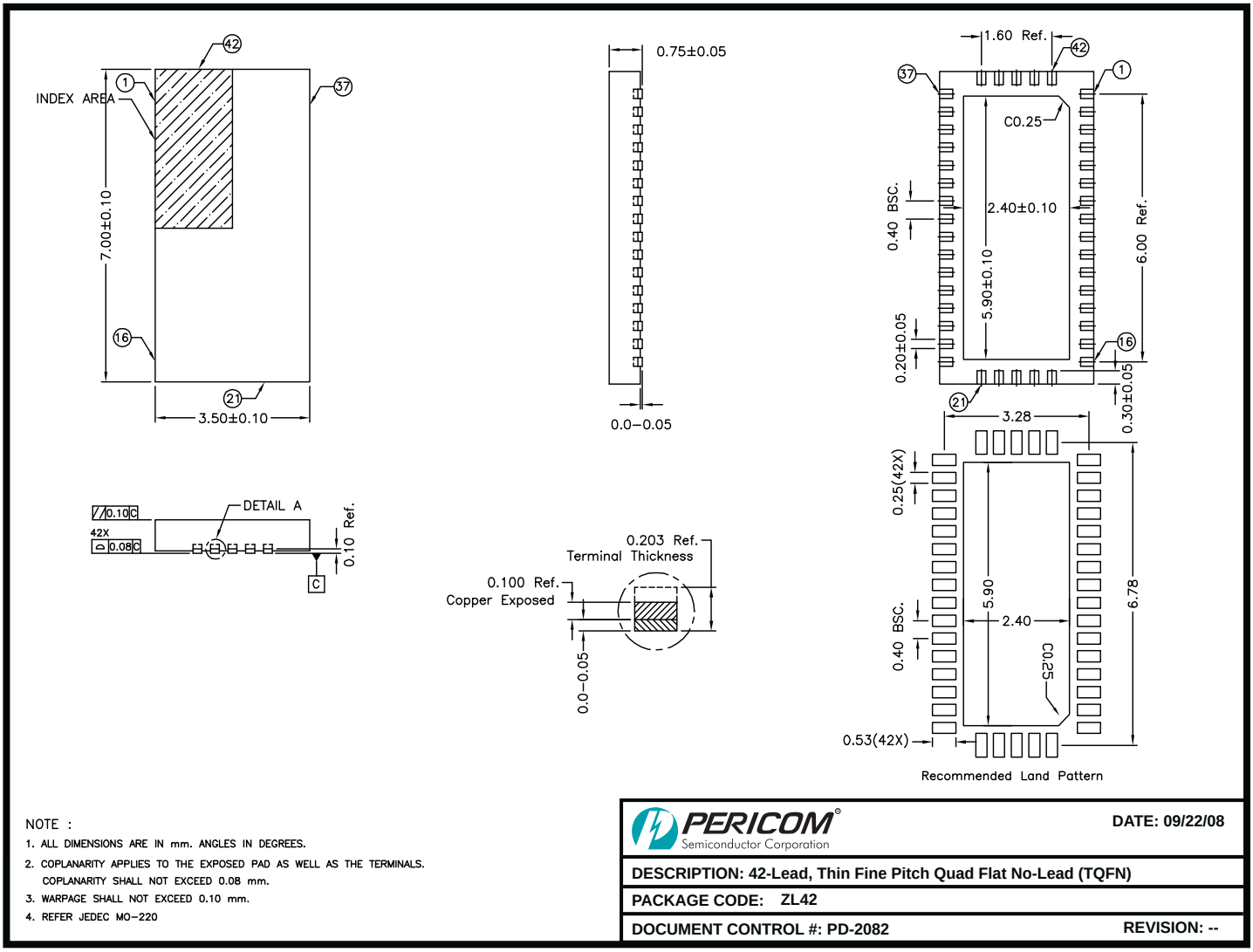


NOTE :
1. ALL DIMENSION ARE IN mm. ANGLES IN DEGREES.
2. COPLANARITY APPLIES TO THE EXPOSED PAD AS WELL AS THE TERMINALS. COPLANARITY SHALL NOT EXCEED 0.08 mm.
3. WARPAGE SHALL NOT EXCEED 0.10 mm.
4. REFER JEDEC MO-220 MODIFIED.
5. Thermal Via Diameter. Recommended 0.2~0.33mm
6. Thermal Via Pitch. Recommended 1.27mm

PERICOM Semiconductor Corporation	DATE: 03/03/08
DESCRIPTION: 42-contact Thin Fine Pitch Quad Flat No-Lead (TQFN)	
PACKAGE CODE: ZH (ZH42)	
DOCUMENT CONTROL #: PD-2035	REVISION: B

08-0098

Packaging Mechanical: 42-Contact TQFN (ZL)



08-0470

Ordering Information

Ordering Number	Package Code	Package Description
PI3L720ZFE	ZF	Pb-free & Green, 56-contact TQFN
PI3L720ZHE	ZH	Pb-free & Green, 42-contact TQFN (0.5mm pitch)
PI3L720ZLE	ZL	Pb-free & Green, 42-contact TQFN (0.4mm pitch)

Notes:

1. Thermal characteristics can be found on the company web site at www.pericom.com/packaging/
2. Add 'X' for Tape and Reel