

# Ethernet Coax Transceiver Interface

## Features

- Compliant with IEEE802.3 10BASE5 and 10BASE2
- Pin compatible with the popular 8392
- Internal squelch circuit to eliminate input noise
- Hybrid mode collision detect for extended distance
- Automatic AUI port isolation when coaxial connector is not present
- Low power BiCMOS design
- 16-Pin DIP or 28-Pin PLCC

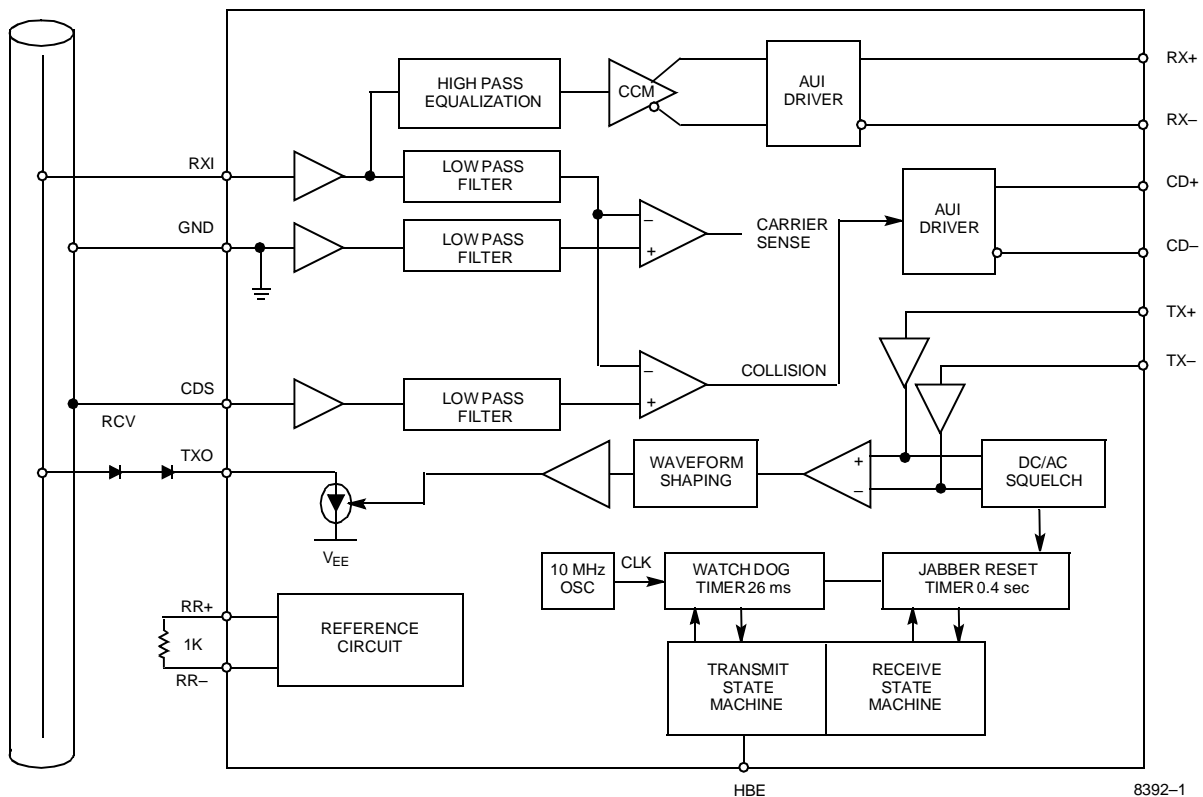
## Functional Description

The CY7B8392 is a low power coaxial transceiver for Ethernet 10BASE5 and 10BASE2 applications. The device contains all the circuits required to perform transmit, receive, collision detection, heartbeat generation, jabber timer and attachment unit interface (AUI) functions. In addition, the CY7B8392 features an advanced hybrid collision detection.

The transmitter output is connected directly to a double terminated 50Ω cable.

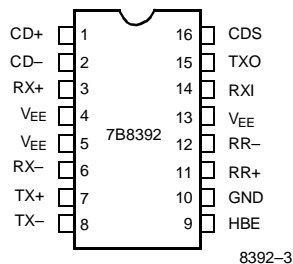
The CY7B8392 is fabricated with an advanced low power BiCMOS process. Typical standby current during idle is 25 mA.

## Logic Block Diagram

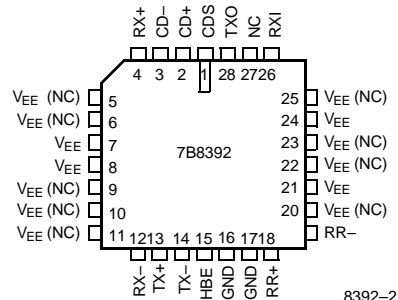


## Pin Configurations

### DIP Top View



### PLCC Top View



## Pin Description

Pin Number		Pin Name	Description
16-Pin DIP	28-Pin PLCC		
1 2	2 3	CD+ CD-	AUI Collision Output pins. Differential driver that transmit a 10-MHz signal during collision events, jabber and CD Heartbeat conditions. Also referred to as CI port.
3 6	4 12	RX+ RX-	AUI Receive Output pins. Differential driver that outputs the signal receive from the line. Also referred to as DI port.
7 8	13 14	TX+ TX-	AUI Transmit Input pins. Differential receiver that inputs the signal for transmission onto the cable.
9	15	HBE	Heartbeat Enable Pin. When this pin is grounded, the heartbeat is enabled. When the pin is connected to $V_{EE}$ , the heartbeat is disabled.
11 12	18 19	RR+ RR-	External Resistor. A 1K 1% resistor should be connected between these pins to establish proper internal operation current.
14	26	RXI	Receive Input. This pin is connected directly to the coaxial cable.
15	28	TXO	Transmitter Output. This pin is connected directly (10BASE2 thin wire) or through a diode to the coaxial cable.
16	1	CDS	Collision Detect Sense. Ground sense connection for the collision detect circuit. This pin should be connected separately to the shield to prevent ground drops from altering the receive mode collision detect threshold.
10	16,17	GND	Positive Power Supply Pin.
4,5,13	5-11, 20-25	$V_{EE}$	Negative Power Supply Pin.

## CY7B8392 Description

### Transmitter

The CY7B8392 transfers Manchester-encoded data from the AUI port of the DTE (TX+ and TX-) to the coaxial cable. The output waveform is wave shaped to meet IEEE 802.3 specifications. For Ethernet compatible applications (10BASE5), an external isolation diode should be added to further reduce the coax load capacitance.

The AUI squelch circuit prevents signals with less than 15 ns pulse width or smaller than 225 mV in amplitude from reaching the output driver. The squelch circuit also turns the transmitter off at the end of the packet if the amplitude remains less than 225 mV for more than 190 ns.

### Receiver

The CY7B8392 receiver transfers the serial data from the coaxial cable to the DTE via the balanced differential output (RX+ and RX-). The received signal is amplified and equalized by the on chip equalizer.

The device also contains an internal squelch function that discriminates noise from valid data. A 4-pole Bessel filter is used to extract the DC level of the received signal. If the DC level of the received signal is lower than an internally set squelch threshold, the CY7B8392 receive function will not be activated.

### Collision Detection

The collision detection circuit monitors the signal level on the coax cable. This signal voltage level is compared against the collision voltage threshold  $V_{CD}$ . When the measured signal level is more negative than  $V_{CD}$ , a collision condition is declared by the CY7B8392 by sending a 10-MHz signal over the CD+/CD- pair.

### Long Cable Application

The IEEE 802.3 standard is designed for 500 meters of Ethernet cable and 185 meters of thin coax cable (RG58A/U). To extend the cable segment to 1000 meters and 300 meters of Ethernet cable and thin coaxial cable respectively, transmit collision detection mode is required. The disadvantage of ordinary transmit collision detection mode is that it will detect collision only when the station is transmitting; it will not be able to detect collision of two far-end stations when it is not transmitting. Transmit mode collision detection is not allowed in repeater applications.

The CY7B8392 utilizes a hybrid combination of receive and transmit collision detection. When the device is not transmitting, the unit automatically sets the collision threshold voltage to the smaller (less negative) receive level. This allows collision detection of two far end stations while the unit is not transmitting. If the unit enters the transmit mode, the collision detection threshold is automatically changed to the larger (more negative) transmit collision detection threshold. This feature eliminates the need for an external voltage divider at the input of CDS when using the 1000 meters and 300 meters of Ethernet and thin coaxial cable length, respectively.

### Heartbeat Test Function

The Heartbeat Test Function is enabled when the HBE pin is tied to ground. When enabled, a 10-MHz collision signal is transmitted to the MAC over the CD+/CD- pair after the transmission of a packet for  $10 \pm 5BT^{[1]}$ . The Heartbeat function should be disabled by tying the HBE pin to  $V_{EE}$  for repeater applications.

#### Note:

1.  $BT$  = Bit Time = 100 ns.

### Jabber Function

The on-chip watchdog timer prevents the DTE from locking up a network by transmitting continuously. When the transmission exceeds the jabber time limit, the Jabber function disables the transmitter and sends a 10-MHz signal over the CD± pair. Once the transmitter is in the jabber state, it must remain in the idle state for 500 ms before it will exit the jabber state.

### AUI Function

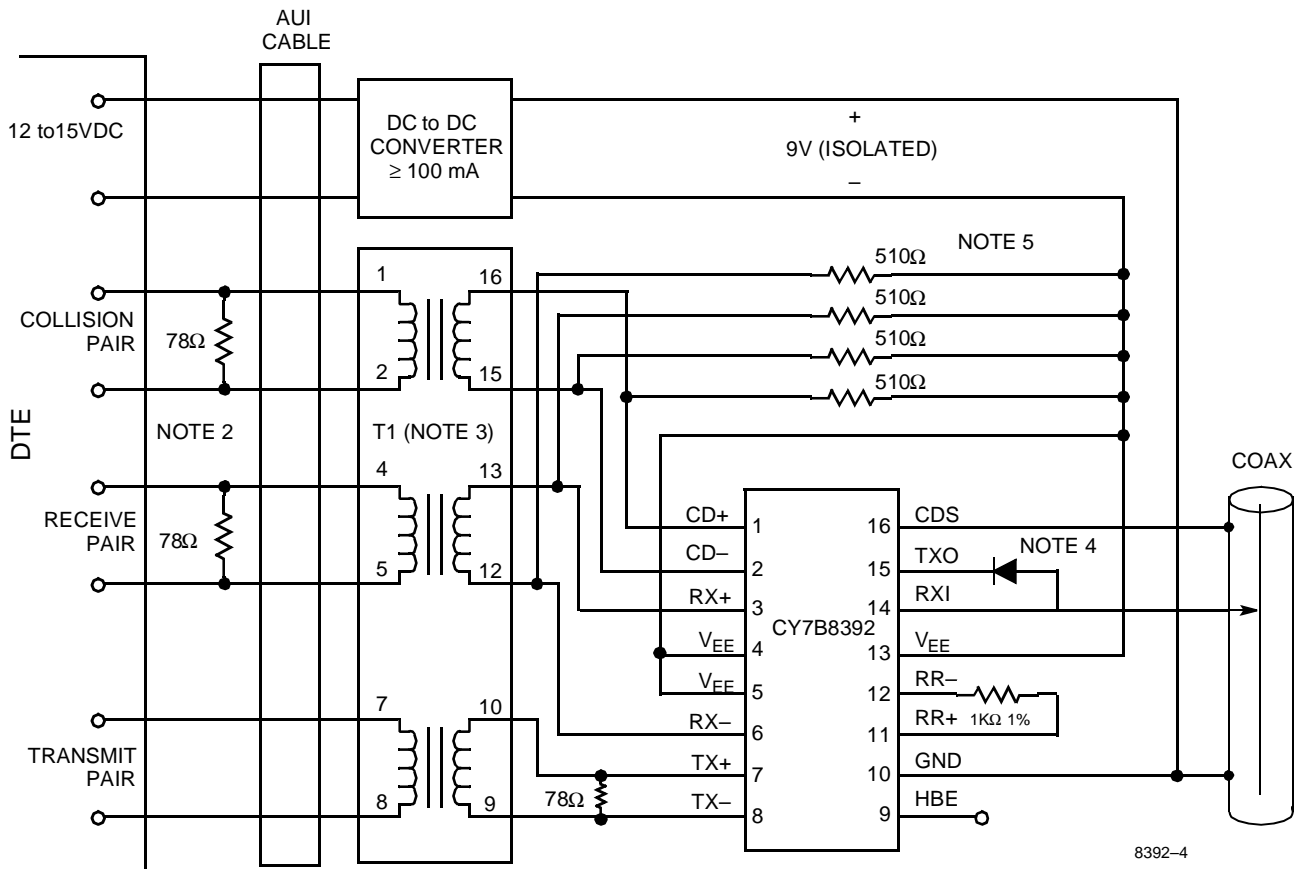
The CY7B8392 Auto AUI function will isolate the AUI CI port when coaxial cable is not present. The CY7B8392 monitors the average DC level at the RXI input and determines if a prop-

erly terminated coaxial segment is attached. While RXI is unterminated the AUI port will remain powered down. The AUI port will only be activated when RXI is connected to a terminated coaxial segment.

When the RXI input becomes unterminated (after power-up), a 10-MHz signal is transmitted over the CI circuit for 800 ms. After the transmission of the 10-MHz signal, the CI port is disabled.

This function allows multiple MAUs to be connected to a single AUI port without having to turn off the coaxial transceiver manually.

### Connection Diagram for Standard CY7B8392 Applications



### 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 .....	-0°C to +70°C
Supply Voltage .....	-12V
Input Voltage .....	GND+0.3V to V <sub>EE</sub> -0.3V
ESD Protection .....	2200V <sup>[6]</sup>

### Operating Range

Range	Ambient Temperature	V <sub>EE</sub>
Commercial	0°C to +70°C	-9V ± 5%

#### Notes:

2. 78Ω resistors not required if AUI cable not present.
3. T1 is a 1:1 pulse transformer, with an inductance of 30 to 100 μH.
4. IN916 or equivalent.
5. Resistors may be as small as 510Ω; larger values may be used to reduce power dissipation.
6. HBM measurement exception: HBE and RXI pins ESD protected to 1100V

**Electrical Characteristics** Over the Operating Range<sup>[7]</sup>

Parameter	Description	Min.	Typ.	Max.	Unit
V <sub>EE</sub>	Supply Voltage	-8.55	-9.0	-9.45	V
I <sub>EE1</sub>	(V <sub>EE</sub> to GND) Non-transmitting <sup>[8]</sup>		-25	-35	mA
I <sub>EE2</sub>	(V <sub>EE</sub> to GND) Transmitting		-70	-80	mA
I <sub>MAU</sub>	Input Bias Current (RXI and T <sub>XO</sub> pin)	-2		25	μA
I <sub>TDC</sub>	Transmitter Output DC Current	37	41	45	mA
I <sub>TAC</sub>	Transmitter AC Current	±28			mA
I <sub>CDS</sub>	Cable Sense Input Bias Current		1	3	μA
V <sub>IH</sub>	HBE input HIGH voltage	-4.2			V
V <sub>IL</sub>	HBE input LOW voltage			-4.8	V
I <sub>IH</sub>	HBE input HIGH current			300	μA
I <sub>IL</sub>	HBE input LOW current	-10			μA
V <sub>DIS</sub>	AUI Disable Voltage At RXI		-4.0		V
V <sub>CD</sub>	Collision Threshold (Receive Mode)	-1.45	-1.53	-1.62	V
V <sub>CS</sub>	Carrier Sense Threshold	-0.42		-0.60	V
R <sub>X, CD</sub>	Differential Output Voltage	±475		±1500	mV
VOB	Differential Output Voltage Imbalance - Idle			± 40	mV
V <sub>OC</sub>	Common Mode Voltage <sup>[9]</sup> (DI and CI ports)		-3.5		V
V <sub>TS</sub>	Transmitter Squelch Threshold <sup>[10]</sup>	-175	-225	-300	mV
R <sub>RXI</sub>	Shunt Resistance—Non-transmitting <sup>[11]</sup>	100			kΩ
R <sub>TXO</sub>	Shunt Resistance—Transmitting <sup>[11]</sup>	10			kΩ
R <sub>TX</sub>	Differential Impedance At TX±		30		kΩ

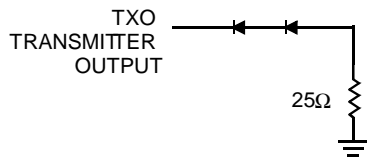
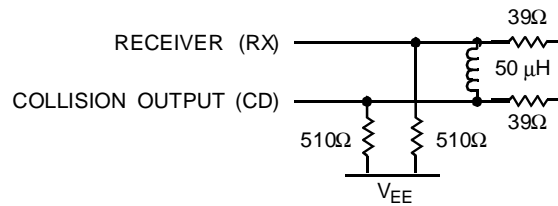
**Capacitance**

Parameter	Description	Test Conditions	Typ.	Unit
C <sub>X</sub>	Input Capacitance	Guaranteed by Design	1.5	pF

**Notes:**

7. Testing is done under test load as defined in AC Test Loads and Waveforms.
8. Not including current through external pulldown resistors.
9. During idle, V<sub>OC</sub> is reduced to minimize the power dissipation across the load resistors connected to RX± and CD±.
10. For a minimum pulse width of >40 ns.
11. To measure shunt resistance, the pin (RXI or TXO) is terminated to 0 volts and the current is measured, then the pin is forced to -2 volts and the current is measured. The resistance is found by:

$$R = \frac{DV}{DI} = \frac{2V}{I_{(0V)} - I_{(-2V)}}$$

**AC Test Loads and Waveforms**

**(a)**

**(b)**

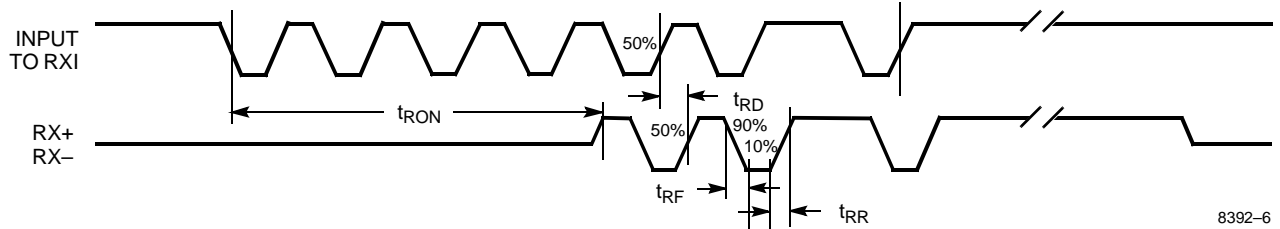
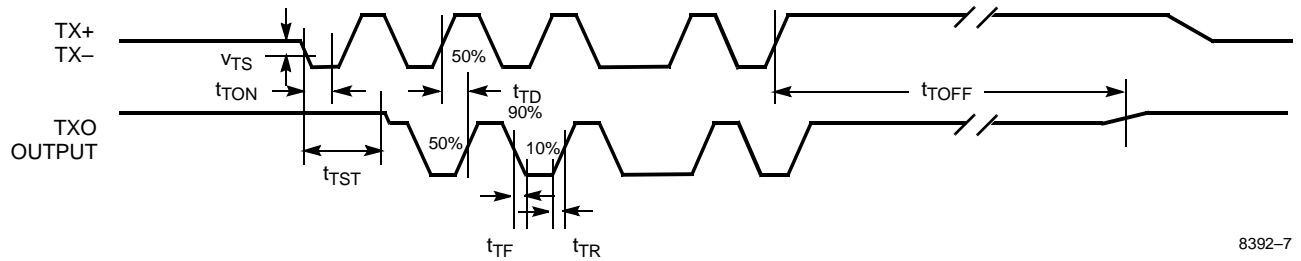
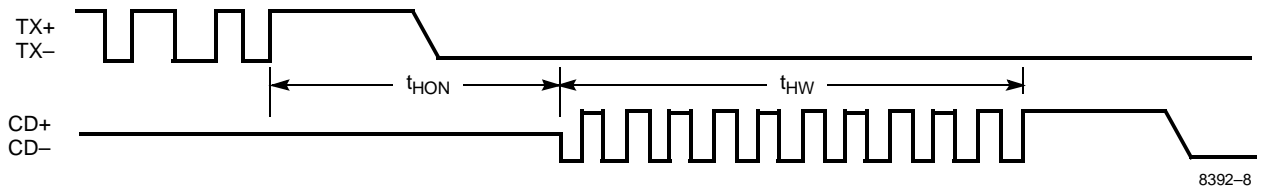
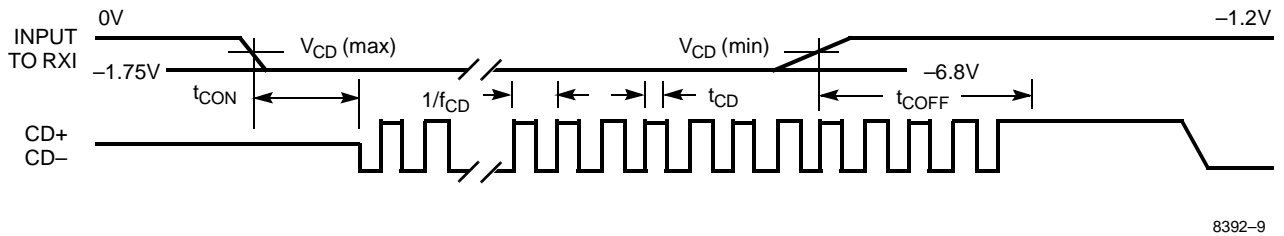
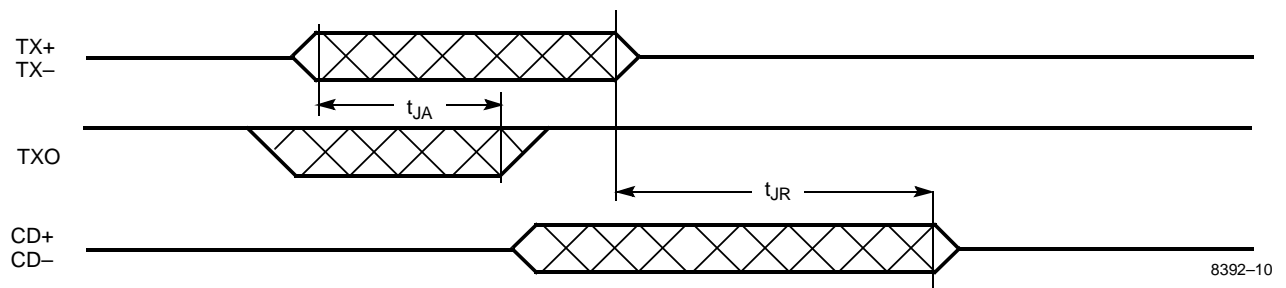
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**Switching Characteristics Over the Operating Range**

Parameter	Description	Min.	Typ.	Max.	Unit
t <sub>RON</sub>	Receiver Start-Up Delay		2.5	5	bits
t <sub>RONV</sub>	First Validly Timed Bit On RX±			t <sub>RON</sub> +1	bits
t <sub>RD</sub>	Receiver Propagation Delay		25	50	ns
t <sub>RR</sub>	Differential Output Rise Time (RX±, CD±)		4	7	ns
t <sub>RF</sub>	Differential Output Fall Time (RX±, CD±)		4	7	ns
t <sub>OS</sub>	Differential Output Settling Time (VOB = ± 40mV)		1		μs
t <sub>RJ</sub>	Receiver and Cable Total Jitter		±2		ns
t <sub>TST</sub>	Transmitter Start-Up Delay		1	2	bits
t <sub>TSTV</sub>	First Validly Timed Bit On TXO			t <sub>TST</sub> +1	bits
t <sub>TD</sub>	Transmitter Propagation Delay		25	50	ns
t <sub>TR</sub>	Transmitter Output Rise Time (TXO)	20	25	30	ns
t <sub>TF</sub>	Transmitter Fall Time (TXO)	20	25	30	ns
t <sub>TM</sub>	t <sub>TR</sub> and t <sub>TF</sub> Mismatch		±0.5	±3	ns
t <sub>TS</sub>	Transmit Skew (TXO)		±0.5	±2	ns
t <sub>TON</sub>	Transmit Turn-On Pulse Width at V <sub>TS</sub> (TX±) <sup>[12]</sup>	10	20	40	ns
t <sub>TOFF</sub>	Transmit Turn-Off Delay	130	200	300	ns
t <sub>CON</sub>	Collision Turn-On Delay		7	13	bits
t <sub>COFF</sub>	Collision Turn-Off Delay			20	bits
f <sub>CD</sub>	Collision Frequency	8.5	10	12.5	MHz
t <sub>CD</sub>	Collision Pulse Width	40	50	60	ns
t <sub>HON</sub>	CD Heartbeat Delay	0.6	1.1	1.6	μs
t <sub>HW</sub>	CD Heartbeat Duration	0.5	1.0	1.5	μs
t <sub>JA</sub>	Jabber Activation Delay	20	26	32	ms
t <sub>JR</sub>	Jabber Reset Time Out	300	420	550	ms

**Notes:**

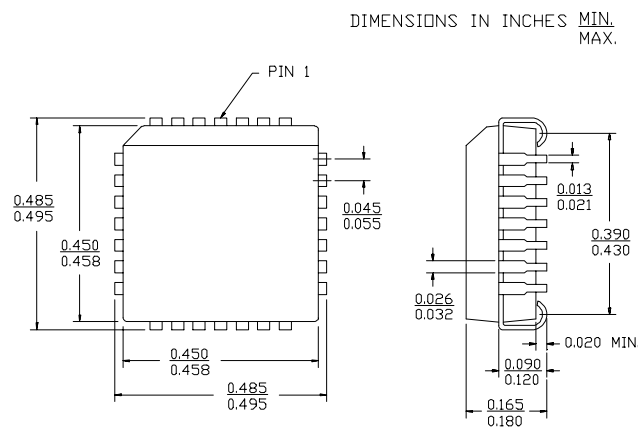
12. For a minimum pulse amplitude of &gt;300 mV.

**Switching Waveforms**
**ReceiverTiming**

**Transmit Timing**

**Heartbeat Timing**

**Collision Timing**

**Jabber Timing**


**Ordering Information**

Ordering Code	Package Name	Package Type	Operating Range
CY7B8392-JC	J64	28-Lead Plastic Leaded Chip Carrier	Commercial
CY7B8392-PC	P1	16-Lead (300-Mil) Molded DIP	

Document #: 38-00430-B

**Package Diagrams**
**28-Lead Plastic Leaded Chip Carrier J64**

**16-Lead (300-Mil) Molded DIP P1**
