

SCCS065C - August 1994 - Revised September 2001

## 16-Bit Registered Transceivers

### Features

- $I_{off}$  supports partial-power-down mode operation
- Edge-rate control circuitry for significantly improved noise characteristics
- Typical output skew < 250 ps
- ESD > 2000V
- TSSOP (19.6-mil pitch) and SSOP (25-mil pitch) packages
- Industrial temperature range of  $-40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$
- $V_{CC} = 5\text{V} \pm 10\%$

#### CY74FCT16952T Features:

- 64 mA sink current, 32 mA source current
- Typical  $V_{OLP}$  (ground bounce) < 1.0V at  $V_{CC} = 5\text{V}$ ,  $T_A = 25^{\circ}\text{C}$

#### CY74FCT162952T Features:

- Balanced 24 mA output drivers
- Reduced system switching noise
- Typical  $V_{OLP}$  (ground bounce) < 0.6V at  $V_{CC} = 5\text{V}$ ,  $T_A = 25^{\circ}\text{C}$

#### CY74FCT162H952T Features:

- Bus hold retains last active state
- Eliminates the need for external pull-up or pull-down resistors

### Functional Description

These 16-bit registered transceivers are high-speed, low-power devices. 16-bit operation is achieved by connecting the control lines of the two 8-bit registered transceivers together. For data flow from bus A-to-B,  $\overline{\text{CEAB}}$  must be LOW to allow data to be stored when  $\text{CLKAB}$  transitions from LOW-to-HIGH. The stored data will be present on the output when  $\overline{\text{OEAB}}$  is LOW. Control of data from B-to-A is similar and is controlled by using the  $\overline{\text{CEBA}}$ ,  $\text{CLKBA}$ , and  $\overline{\text{OEBA}}$  inputs.

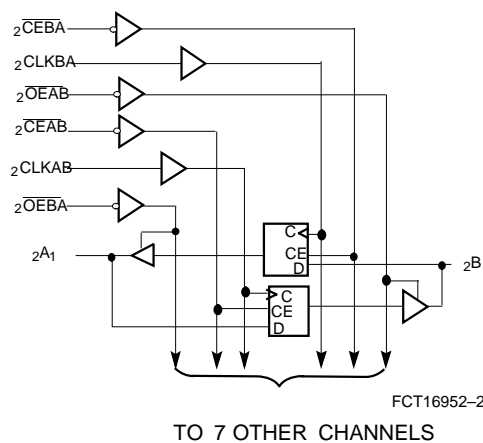
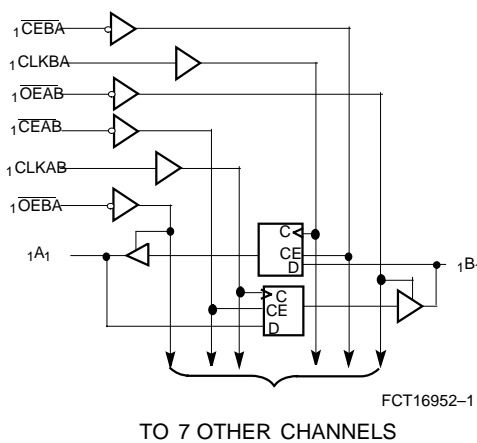
This device is fully specified for partial-power-down applications using  $I_{off}$ . The  $I_{off}$  circuitry disables the outputs, preventing damaging current backflow through the device when it is powered down.

The CY74FCT16952T is ideally suited for driving high-capacitance loads and low-impedance backplanes.

The CY74FCT162952T has 24-mA balanced output drivers with current-limiting resistors in the outputs. This reduces the need for external terminating resistors and provides for minimal undershoot and reduced ground bounce. The CY74FCT162952T is ideal for driving transmission lines.

The CY74FCT162H952T is a 24-mA balanced output part that has "bus hold" on the data inputs. The device retains the input's last state whenever the input goes to high impedance. This eliminates the need for pull-up/down resistors and prevents floating inputs.

### Logic Block Diagrams



### Pin Configuration SSOP/TSSOP Top View

|                 |    |    |                 |
|-----------------|----|----|-----------------|
| 1 OEAB          | 1  | 56 | 1 OEBA          |
| 1 CLKAB         | 2  | 55 | 1 CLKBA         |
| 1 CEAB          | 3  | 54 | 1 CEBA          |
| GND             | 4  | 53 | GND             |
| 1A <sub>1</sub> | 5  | 52 | 1B <sub>1</sub> |
| 1A <sub>2</sub> | 6  | 51 | 1B <sub>2</sub> |
| V <sub>CC</sub> | 7  | 50 | V <sub>CC</sub> |
| 1A <sub>3</sub> | 8  | 49 | 1B <sub>3</sub> |
| 1A <sub>4</sub> | 9  | 48 | 1B <sub>4</sub> |
| 1A <sub>5</sub> | 10 | 47 | 1B <sub>5</sub> |
| GND             | 11 | 46 | GND             |
| 1A <sub>6</sub> | 12 | 45 | 1B <sub>6</sub> |
| 1A <sub>7</sub> | 13 | 44 | 1B <sub>7</sub> |
| 1A <sub>8</sub> | 14 | 43 | 1B <sub>8</sub> |
| 2A <sub>1</sub> | 15 | 42 | 2B <sub>1</sub> |
| 2A <sub>2</sub> | 16 | 41 | 2B <sub>2</sub> |
| 2A <sub>3</sub> | 17 | 40 | 2B <sub>3</sub> |
| GND             | 18 | 39 | GND             |
| 2A <sub>4</sub> | 19 | 38 | 2B <sub>4</sub> |
| 2A <sub>5</sub> | 20 | 37 | 2B <sub>5</sub> |
| 2A <sub>6</sub> | 21 | 36 | 2B <sub>6</sub> |
| V <sub>CC</sub> | 22 | 35 | V <sub>CC</sub> |
| 2A <sub>7</sub> | 23 | 34 | 2B <sub>7</sub> |
| 2A <sub>8</sub> | 24 | 33 | 2B <sub>8</sub> |
| GND             | 25 | 32 | GND             |
| 2CEAB           | 26 | 31 | 2CEBA           |
| 2CLKAB          | 27 | 30 | 2CLKBA          |
| 2OEAB           | 28 | 29 | 2OEBA           |

FCT16952-3

**Pin Description**

| Name  | Description   |
|-------|---|
| OEAB  | A-to-B Output Enable Input (Active LOW)                         |
| OEBA  | B-to-A Output Enable Input (Active LOW)                         |
| CEAB  | A-to-B Clock Enable Input (Active LOW)                          |
| CEBA  | B-to-A Clock Enable Input (Active LOW)                          |
| CLKAB | A-to-B Clock Input  |
| CLKBA | B-to-A Clock Input  |
| A     | A-to-B Data Inputs or B-to-A Three-State Outputs <sup>[1]</sup> |
| B     | B-to-A Data Inputs or A-to-B Three-State Outputs <sup>[1]</sup> |

**Function Table<sup>[2, 3]</sup>**

For A-to-B (Symmetric with B-to-A)

| Inputs |       |      |   | Outputs          |
|--------|-------|------|---|------------------|
| CEAB   | CLKAB | OEAB | A | B                |
| H      | X     | L    | X | B <sup>[4]</sup> |
| X      | L     | L    | X | B <sup>[4]</sup> |
| L      | ┐     | L    | L | L                |
| L      | ┐     | L    | H | H                |
| X      | X     | H    | X | Z                |

**Notes:**

- On the CY74FCT162H952T these pins have bus hold.
- A-to-B data flow is shown; B-to-A data flow is similar but uses, CEBA, CLKBA, and OEBA.
- H = HIGH Voltage Level.  
L = LOW Voltage Level.  
X = Don't Care.  
┐ = LOW-to-HIGH Transition.  
Z = HIGH Impedance.
- Level of B before the indicated steady-state input conditions were established.
- Operation beyond the limits set forth may impair the useful life of the device. Unless otherwise noted, these limits are over the operating free-air temperature range.
- Unused inputs must always be connected to an appropriate logic voltage level, preferably either V<sub>CC</sub> or ground.

**Maximum Ratings<sup>[5, 6]</sup>**

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

|  |                                       |
|--|---------------------------------------|
| Storage Temperature .....                          | -55°C to +125°C                       |
| Ambient Temperature with Power Applied.....        | -55°C to +125°C                       |
| DC Input Voltage .....                             | -0.5V to +7.0V                        |
| DC Output Voltage.....                             | -0.5V to +7.0V                        |
| DC Output Current (Maximum Sink Current/Pin) ..... | -60 to +120 mA                        |
| Power Dissipation .....                            | 1.0W                                  |
| Static Discharge Voltage.....                      | >2001V (per MIL-STD-883, Method 3015) |

**Operating Range**

| Range      | Ambient Temperature | V <sub>CC</sub> |
|------------|---------------------|-----------------|
| Industrial | -40°C to +85°C      | 5V ± 10%        |

**Electrical Characteristics** Over the Operating Range

| Parameter                              | Description   | Test Conditions   | Min.   | Typ. <sup>[7]</sup> | Max. | Unit |
|--|---|---|--|---------------------|------|------|
| V <sub>IH</sub>                        | Input HIGH Voltage  |   | 2.0  |                     |      | V    |
| V <sub>IL</sub>                        | Input LOW Voltage   |   |  |                     | 0.8  | V    |
| V <sub>H</sub>                         | Input Hysteresis <sup>[8]</sup>                             |   |  | 100                 |      | mV   |
| V <sub>IK</sub>                        | Input Clamp Diode Voltage                                   | V <sub>CC</sub> =Min., I <sub>IN</sub> =-18 mA              |  | -0.7                | -1.2 | V    |
| I <sub>IH</sub>                        | Input HIGH Current  | Standard  | V <sub>CC</sub> =Max., V <sub>I</sub> =V <sub>CC</sub> |                     | ±1   | μA   |
|  |   | Bus Hold  |  |                     | ±100 |      |
| I <sub>IL</sub>                        | Input LOW Current   | Standard  | V <sub>CC</sub> =Max., V <sub>I</sub> =GND             |                     | ±1   | μA   |
|  |   | Bus Hold  |  |                     | ±100 | μA   |
| I <sub>BBH</sub><br>I <sub>BBL</sub>   | Bus Hold Sustain Current on Bus Hold Input <sup>[9]</sup>   | V <sub>CC</sub> =Min.                                       | V <sub>I</sub> =2.0V                                   | -50                 |      | μA   |
|  |   |   | V <sub>I</sub> =0.8V                                   | +50                 |      | μA   |
| I <sub>BHHO</sub><br>I <sub>BHLO</sub> | Bus Hold Overdrive Current on Bus Hold Input <sup>[9]</sup> | V <sub>CC</sub> =Max., V <sub>I</sub> =1.5V                 |  |                     | TBD  | mA   |
| I <sub>OZH</sub>                       | High Impedance Output Current (Three-State Output pins)     | V <sub>CC</sub> =Max., V <sub>OUT</sub> =2.7V               |  |                     | ±1   | μA   |
| I <sub>OZL</sub>                       | High Impedance Output Current (Three-State Output pins)     | V <sub>CC</sub> =Max., V <sub>OUT</sub> =0.5V               |  |                     | ±1   | μA   |
| I <sub>OS</sub>                        | Short Circuit Current <sup>[10]</sup>                       | V <sub>CC</sub> =Max., V <sub>OUT</sub> =GND                | -80  | -140                | -200 | mA   |
| I <sub>O</sub>                         | Output Drive Current <sup>[10]</sup>                        | V <sub>CC</sub> =Max., V <sub>OUT</sub> =2.5V               | -50  |                     | -180 | mA   |
| I <sub>OFF</sub>                       | Power-Off Disable   | V <sub>CC</sub> =0V, V <sub>OUT</sub> ≤4.5V <sup>[11]</sup> |  |                     | ±1   | μA   |

**Output Drive Characteristics for CY74FCT16952T**

| Parameter       | Description         | Test Conditions                                | Min. | Typ. <sup>[7]</sup> | Max. | Unit |
|-----------------|---------------------|--|------|---------------------|------|------|
| V <sub>OH</sub> | Output HIGH Voltage | V <sub>CC</sub> =Min., I <sub>OH</sub> =-3 mA  | 2.5  | 3.5                 |      | V    |
|                 |                     | V <sub>CC</sub> =Min., I <sub>OH</sub> =-15 mA | 2.4  | 3.5                 |      | V    |
|                 |                     | V <sub>CC</sub> =Min., I <sub>OH</sub> =-32 mA | 2.0  | 3.0                 |      | V    |
| V <sub>OL</sub> | Output LOW Voltage  | V <sub>CC</sub> =Min., I <sub>OL</sub> =64 mA  |      | 0.2                 | 0.55 | V    |

**Output Drive Characteristics for CY74FCT162952T, CY74FCT162H952T**

| Parameter        | Description                         | Test Conditions   | Min. | Typ. <sup>[7]</sup> | Max. | Unit |
|------------------|-------------------------------------|---|------|---------------------|------|------|
| I <sub>ODL</sub> | Output LOW Current <sup>[10]</sup>  | V <sub>CC</sub> =5V, V <sub>IN</sub> =V <sub>IH</sub> or V <sub>IL</sub> , V <sub>OUT</sub> =1.5V | 60   | 115                 | 150  | mA   |
| I <sub>ODH</sub> | Output HIGH Current <sup>[10]</sup> | V <sub>CC</sub> =5V, V <sub>IN</sub> =V <sub>IH</sub> or V <sub>IL</sub> , V <sub>OUT</sub> =1.5V | -60  | -115                | -150 | mA   |
| V <sub>OH</sub>  | Output HIGH Voltage                 | V <sub>CC</sub> =Min., I <sub>OH</sub> =-24 mA  | 2.4  | 3.3                 |      | V    |
| V <sub>OL</sub>  | Output LOW Voltage                  | V <sub>CC</sub> =Min., I <sub>OL</sub> =24 mA   |      | 0.3                 | 0.55 | V    |

**Capacitance<sup>[8]</sup>** (T<sub>A</sub> = +25°C, f = 1.0 MHz)

| Parameter        | Description        | Test Conditions       | Typ. <sup>[7]</sup> | Max. | Unit |
|------------------|--------------------|-----------------------|---------------------|------|------|
| C <sub>IN</sub>  | Input Capacitance  | V <sub>IN</sub> = 0V  | 4.5                 | 6.0  | pF   |
| C <sub>OUT</sub> | Output Capacitance | V <sub>OUT</sub> = 0V | 5.5                 | 8.0  | pF   |

**Note:**

7. Typical values are at V<sub>CC</sub>= 5.0V, T<sub>A</sub>= +25°C ambient.
8. This parameter is specified but not tested.
9. Pins with bus hold are described in the Pin Description.
10. Not more than one output should be shorted at a time. Duration of short should not exceed one second. The use of high-speed test apparatus and/or sample and hold techniques are preferable in order to minimize internal chip heating and more accurately reflect operational values. Otherwise prolonged shorting of a high output may raise the chip temperature well above normal and thereby cause invalid readings in other parametric tests. In any sequence of parameter tests, I<sub>OS</sub> tests should be performed last.
11. Tested at +25°C.

**Power Supply Characteristics**

| Parameter       | Description                                      | Test Conditions <sup>[12]</sup>  | Typ. <sup>[7]</sup>                       | Max. | Unit                 |    |
|-----------------|--|--|---|------|----------------------|----|
| $I_{CC}$        | Quiescent Power Supply Current                   | $V_{CC}=\text{Max.}$<br>$V_{IN}\leq 0.2V$<br>$V_{IN}\geq V_{CC}-0.2V$  | 5   | 500  | $\mu A$              |    |
| $\Delta I_{CC}$ | Quiescent Power Supply Current (TTL inputs HIGH) | $V_{CC}=\text{Max.}$<br>$V_{IN}=3.4V^{[13]}$   | 0.5                                       | 1.5  | mA                   |    |
| $I_{CCD}$       | Dynamic Power Supply Current <sup>[14]</sup>     | $V_{CC}=\text{Max.}$ , One Input Toggling,<br>50% Duty Cycle, Outputs Open,<br>OEAB or OEBA=GND  | 75  | 120  | $\mu A/\text{MHz}$   |    |
| $I_C$           | Total Power Supply Current <sup>[15]</sup>       | $V_{CC}=\text{Max.}$ , $F_1=5\text{ MHz}$ ,<br>$F_0=10\text{ MHz (CLKAB)}$<br>OEAB = CEAB = GND<br>OEBA = $V_{CC}$ 50% Duty Cycle,<br>Outputs Open, One Bit Toggling | $V_{IN}=V_{CC}$ or<br>$V_{IN}=\text{GND}$ | 0.8  | 1.7                  | mA |
|                 |  |  | $V_{IN}=3.4V$ or<br>$V_{IN}=\text{GND}$   | 1.3  | 3.2                  |    |
|                 |  | $V_{CC}=\text{Max.}$ , $f_0=10\text{ MHz (CLKAB)}$<br>$f_1=2.5\text{ MHz}$ ,<br>OEAB = CEAB = GND<br>OEBA = $V_{CC}$ 50% Duty Cycle,<br>Outputs Open,                | $V_{IN}=V_{CC}$ or<br>$V_{IN}=\text{GND}$ | 3.8  | 6.5 <sup>[16]</sup>  |    |
|                 |  | Sixteen Bit Toggling   | $V_{IN}=3.4V$ or<br>$V_{IN}=\text{GND}$   | 8.3  | 20.0 <sup>[16]</sup> |    |

**Notes:**

12. For conditions shown as Max. or Min., use appropriate value specified under Electrical Characteristics for the applicable device type.
13. Per TTL driven input ( $V_{IN}=3.4V$ ); all other inputs at  $V_{CC}$  or GND.
14. This parameter is not directly testable, but is derived for use in Total Power Supply calculations.
15.  $I_C = I_{\text{QUIESCENT}} + I_{\text{INPUTS}} + I_{\text{DYNAMIC}}$   
 $I_C = I_{CC} + \Delta I_{CC} D_H N_T + I_{CCD} (f_0/2 + f_1 N_1)$   
 $I_{CC}$  = Quiescent Current with CMOS input levels  
 $\Delta I_{CC}$  = Power Supply Current for a TTL HIGH input ( $V_{IN}=3.4V$ )  
 $D_H$  = Duty Cycle for TTL inputs HIGH  
 $N_T$  = Number of TTL inputs at  $D_H$   
 $I_{CCD}$  = Dynamic Current caused by an input transition pair (HLH or LHL)  
 $f_0$  = Clock frequency for registered devices, otherwise zero  
 $f_1$  = Input signal frequency  
 $N_1$  = Number of inputs changing at  $f_1$   
 All currents are in milliamps and all frequencies are in megahertz.
16. Values for these conditions are examples of the  $I_{CC}$  formula. These limits are specified but not tested.

**Switching Characteristics** Over the Operating Range<sup>[17]</sup>

| Parameter                            | Description   | CY74FCT16952AT<br>CY74FCT162952AT<br>CY74FCT162H952AT |      | CY74FCT162952BT |      | Unit | Fig. No. <sup>[18]</sup> |
|--------------------------------------|---|---|------|-----------------|------|------|--------------------------|
|                                      |   | Min.  | Max. | Min.            | Max. |      |                          |
| t <sub>PLH</sub><br>t <sub>PHL</sub> | Propagation Delay<br>CLKAB, CLKBA to B, A                 | 2.0   | 10.0 | 2.0             | 7.5  | ns   | 1, 5                     |
| t <sub>PZH</sub><br>t <sub>PZL</sub> | Output Enable Time<br>OEBA, OEAB to A, B                  | 1.5   | 10.5 | 1.5             | 8.0  | ns   | 1, 7, 8                  |
| t <sub>PHZ</sub><br>t <sub>PLZ</sub> | Output Disable Time<br>OEBA, OEAB to A, B                 | 1.5   | 10.0 | 1.5             | 7.5  | ns   | 1, 7, 8                  |
| t <sub>SU</sub>                      | Set-Up Time, HIGH or LOW<br>A, B to CLKAB, CLKBA          | 2.5   | —    | 2.5             | —    | ns   | 4                        |
| t <sub>H</sub>                       | Hold Time, HIGH or LOW<br>A, B to CLKAB, CLKBA            | 2.0   | —    | 1.5             | —    | ns   | 4                        |
| t <sub>SU</sub>                      | Set-Up Time, HIGH or LOW<br>CEAB, CEBA to CLKAB, CLKBA    | 3.0   | —    | 3.0             | —    | ns   | 4                        |
| t <sub>H</sub>                       | Hold Time, HIGH or LOW<br>CEAB, CEBA to CLKAB, CLKBA      | 2.0   | —    | 2.0             | —    | ns   | 4                        |
| t <sub>W</sub>                       | Pulse Width HIGH or LOW<br>CLKAB or CLKBA <sup>[19]</sup> | 3.0   | —    | 3.0             | —    | ns   | 5                        |
| t <sub>SK(O)</sub>                   | Output Skew <sup>[20]</sup>                               | —   | 0.5  | —               | 0.5  | ns   | —                        |

| Parameter                            | Description   | CY74FCT16952CT<br>CY74FCT162H952CT |      | Unit | Fig. No. <sup>[18]</sup> |
|--------------------------------------|---|------------------------------------|------|------|--------------------------|
|                                      |   | Min.                               | Max. |      |                          |
| t <sub>PLH</sub><br>t <sub>PHL</sub> | Propagation Delay<br>CLKAB, CLKBA to B, A                 | 2.0                                | 6.3  | ns   | 1, 5                     |
| t <sub>PZH</sub><br>t <sub>PZL</sub> | Output Enable Time<br>OEBA, OEAB to A, B                  | 1.5                                | 7.0  | ns   | 1, 7, 8                  |
| t <sub>PHZ</sub><br>t <sub>PLZ</sub> | Output Disable Time<br>OEBA, OEAB to A, B                 | 1.5                                | 6.5  | ns   | 1, 7, 8                  |
| t <sub>SU</sub>                      | Set-Up Time, HIGH or LOW<br>A, B to CLKAB, CLKBA          | 2.5                                | —    | ns   | 4                        |
| t <sub>H</sub>                       | Hold Time, HIGH or LOW<br>A, B to CLKAB, CLKBA            | 1.5                                | —    | ns   | 4                        |
| t <sub>SU</sub>                      | Set-Up Time, HIGH or LOW<br>CEAB, CEBA to CLKAB, CLKBA    | 3.0                                | —    | ns   | 4                        |
| t <sub>H</sub>                       | Hold Time, HIGH or LOW<br>CEAB, CEBA to CLKAB, CLKBA      | 2.0                                | —    | ns   | 4                        |
| t <sub>W</sub>                       | Pulse Width HIGH or LOW<br>CLKAB or CLKBA <sup>[19]</sup> | 3.0                                | —    | ns   | 5                        |
| t <sub>SK(O)</sub>                   | Output Skew <sup>[20]</sup>                               | —                                  | 0.5  | ns   | —                        |

**Notes:**

17. Minimum limits are specified but not tested on Propagation Delays.
18. See "Parameter Measurement Information" in the General Information section.
19. This parameter is specified but not tested.
20. Skew between any two outputs of the same package switching in the same direction. This parameter is ensured by design.

**Ordering Information CY74FCT16952**

| Speed (ns) | Ordering Code          | Package Name | Package Type            | Operating Range |
|------------|------------------------|--------------|-------------------------|-----------------|
| 6.3        | CY74FCT16952CTPACT     | Z56          | 56-Lead (240-Mil) TSSOP | Industrial      |
| 10.0       | CY74FCT16952ATPVC/PVCT | O56          | 56-Lead (300-Mil) SSOP  | Industrial      |

**Ordering Information CY74FCT162952**

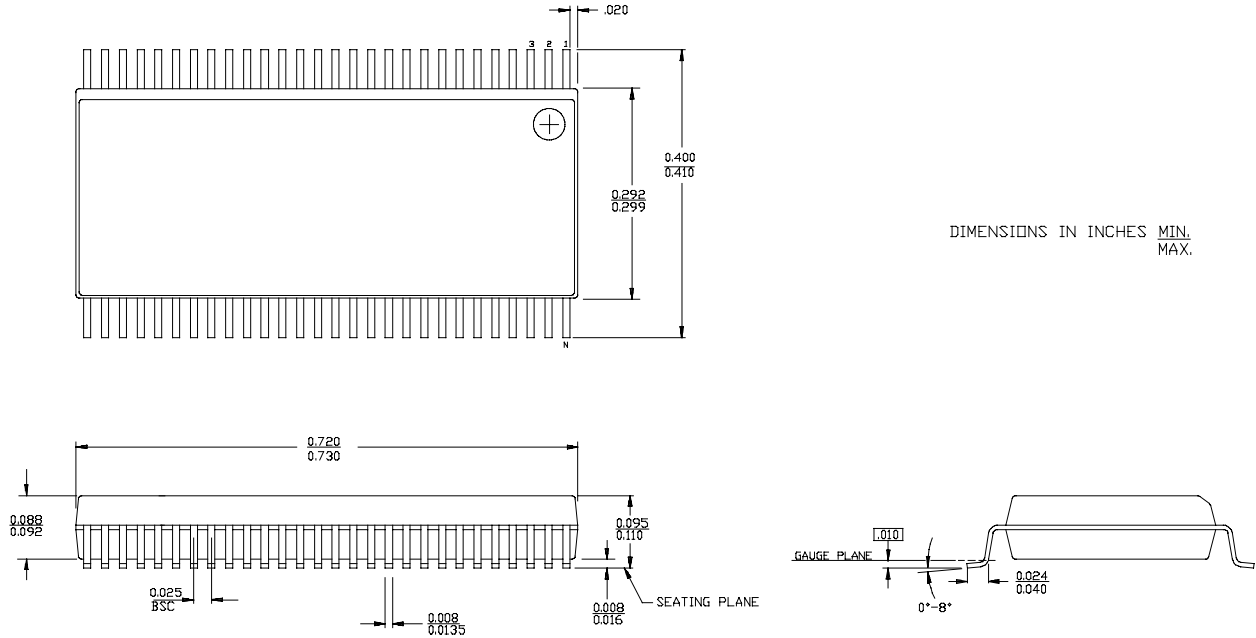
| Speed (ns) | Ordering Code      | Package Name | Package Type            | Operating Range |
|------------|--------------------|--------------|-------------------------|-----------------|
| 7.5        | CY74FCT162952BTPVC | O56          | 56-Lead (300-Mil) SSOP  | Industrial      |
|            | 74FCT162952BTPVCT  | O56          | 56-Lead (300-Mil) SSOP  |                 |
| 10.0       | 74FCT162952ATPACT  | Z56          | 56-Lead (240-Mil) TSSOP | Industrial      |

**Ordering Information CY74FCT162H952**

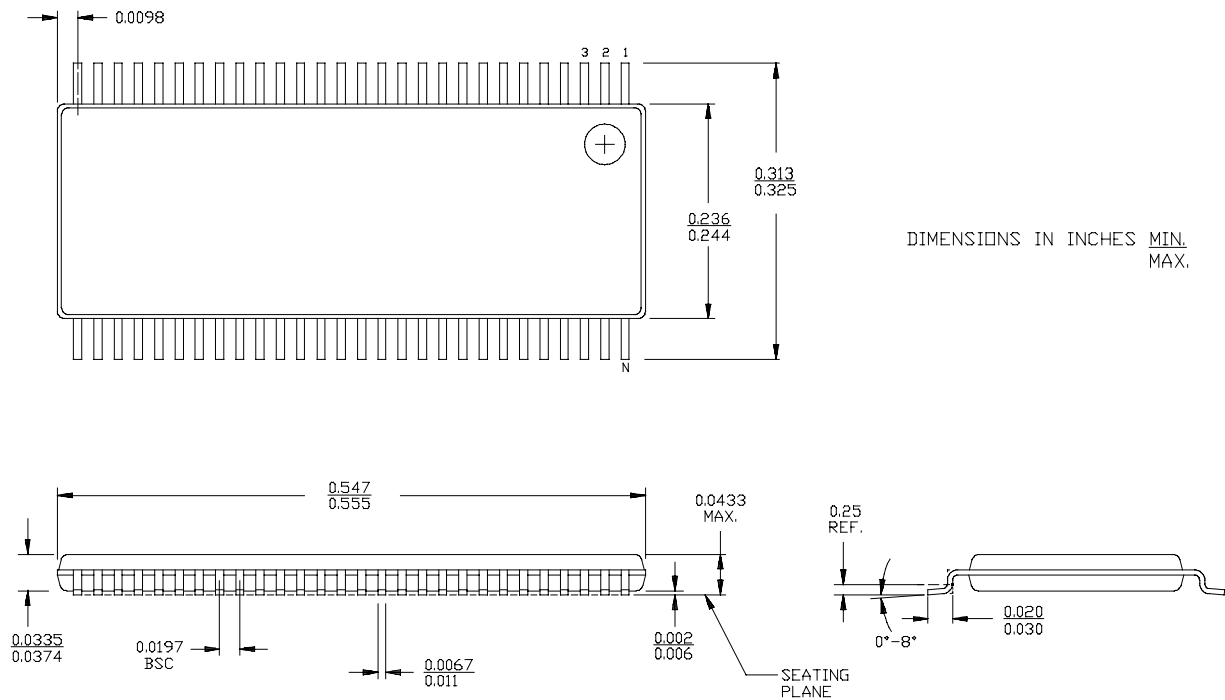
| Speed (ns) | Ordering Code          | Package Name | Package Type            | Operating Range |
|------------|------------------------|--------------|-------------------------|-----------------|
| 6.3        | 74FCT162H952CTPVC/PVCT | O56          | 56-Lead (300-Mil) SSOP  | Industrial      |
| 10.0       | 74FCT162H952ATPACT     | Z56          | 56-Lead (240-Mil) TSSOP | Industrial      |

**Package Diagrams**

**56-Lead Shrunk Small Outline Package O56**



**56-Lead Thin Shrunk Small Outline Package Z56**



**PACKAGING INFORMATION**

| Orderable Device   | Status <sup>(1)</sup> | Package Type | Package Drawing | Pins | Package Qty | Eco Plan <sup>(2)</sup> | Lead/Ball Finish | MSL Peak Temp <sup>(3)</sup> |
|--------------------|-----------------------|--------------|-----------------|------|-------------|-------------------------|------------------|------------------------------|
| 74FCT162952ATPACT  | ACTIVE                | TSSOP        | DGG             | 56   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| 74FCT162952BTPVCG4 | ACTIVE                | SSOP         | DL              | 56   | 20          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| 74FCT162952BTPVCT  | ACTIVE                | SSOP         | DL              | 56   | 1000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| 74FCT162952ETPACT  | OBSOLETE              | TSSOP        | DGG             | 56   |             | TBD                     | Call TI          | Call TI                      |
| 74FCT162952ETPVCT  | OBSOLETE              | SSOP         | DL              | 56   |             | TBD                     | Call TI          | Call TI                      |
| 74FCT162H952ATPACT | ACTIVE                | TSSOP        | DGG             | 56   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| 74FCT162H952CTPVC  | ACTIVE                | SSOP         | DL              | 56   | 20          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| 74FCT162H952CTPVCT | ACTIVE                | SSOP         | DL              | 56   | 1000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| 74FCT162H952ETPAC  | OBSOLETE              | TSSOP        | DGG             | 56   |             | TBD                     | Call TI          | Call TI                      |
| 74FCT162H952ETPACT | OBSOLETE              | TSSOP        | DGG             | 56   |             | TBD                     | Call TI          | Call TI                      |
| 74FCT16952ATPVCG4  | ACTIVE                | SSOP         | DL              | 56   | 20          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| 74FCT16952ATPVCTG4 | ACTIVE                | SSOP         | DL              | 56   | 1000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| 74FCT16952CTPACTE4 | ACTIVE                | TSSOP        | DGG             | 56   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| 74FCT16952CTPACTG4 | ACTIVE                | TSSOP        | DGG             | 56   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| CY74FCT162952BTPVC | ACTIVE                | SSOP         | DL              | 56   | 20          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| CY74FCT162952ETPAC | OBSOLETE              | TSSOP        | DGG             | 56   |             | TBD                     | Call TI          | Call TI                      |
| CY74FCT162952ETPVC | OBSOLETE              | SSOP         | DL              | 56   |             | TBD                     | Call TI          | Call TI                      |
| CY74FCT16952ATPVC  | ACTIVE                | SSOP         | DL              | 56   | 20          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| CY74FCT16952ATPVCT | ACTIVE                | SSOP         | DL              | 56   | 1000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| CY74FCT16952CTPACT | ACTIVE                | TSSOP        | DGG             | 56   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| CY74FCT16952ETPVC  | OBSOLETE              | SSOP         | DL              | 56   |             | TBD                     | Call TI          | Call TI                      |
| CY74FCT16952ETPVCT | OBSOLETE              | SSOP         | DL              | 56   |             | TBD                     | Call TI          | Call TI                      |
| FCT162952ATPACTE4  | ACTIVE                | TSSOP        | DGG             | 56   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| FCT162952ATPACTG4  | ACTIVE                | TSSOP        | DGG             | 56   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| FCT162952BTPVCTG4  | ACTIVE                | SSOP         | DL              | 56   | 1000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| FCT162H952ATPACTE4 | ACTIVE                | TSSOP        | DGG             | 56   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| FCT162H952ATPACTG4 | ACTIVE                | TSSOP        | DGG             | 56   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| FCT162H952CTPVCG4  | ACTIVE                | SSOP         | DL              | 56   | 20          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |



| Orderable Device   | Status <sup>(1)</sup> | Package Type | Package Drawing | Pins | Package Qty | Eco Plan <sup>(2)</sup> | Lead/Ball Finish | MSL Peak Temp <sup>(3)</sup> |
|--------------------|-----------------------|--------------|-----------------|------|-------------|-------------------------|------------------|------------------------------|
| FCT162H952CTPVCTG4 | ACTIVE                | SSOP         | DL              | 56   | 1000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |

<sup>(1)</sup> The marketing status values are defined as follows:

**ACTIVE:** Product device recommended for new designs.

**LIFEBUY:** TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

**NRND:** Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

**PREVIEW:** Device has been announced but is not in production. Samples may or may not be available.

**OBSOLETE:** TI has discontinued the production of the device.

<sup>(2)</sup> Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check <http://www.ti.com/productcontent> for the latest availability information and additional product content details.

**TBD:** The Pb-Free/Green conversion plan has not been defined.

**Pb-Free (RoHS):** TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.

**Pb-Free (RoHS Exempt):** This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.

**Green (RoHS & no Sb/Br):** TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

<sup>(3)</sup> MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

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**TAPE AND REEL INFORMATION**



**QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE**



\*All dimensions are nominal

| Device             | Package Type | Package Drawing | Pins | SPQ  | Reel Diameter (mm) | Reel Width W1 (mm) | A0 (mm) | B0 (mm) | K0 (mm) | P1 (mm) | W (mm) | Pin1 Quadrant |
|--------------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| 74FCT162952ATPACT  | TSSOP        | DGG             | 56   | 2000 | 330.0              | 24.4               | 8.6     | 15.6    | 1.8     | 12.0    | 24.0   | Q1            |
| 74FCT162952BTPVCT  | SSOP         | DL              | 56   | 1000 | 330.0              | 32.4               | 11.35   | 18.67   | 3.1     | 16.0    | 32.0   | Q1            |
| 74FCT162H952ATPACT | TSSOP        | DGG             | 56   | 2000 | 330.0              | 24.4               | 8.6     | 15.6    | 1.8     | 12.0    | 24.0   | Q1            |
| 74FCT162H952CTPVCT | SSOP         | DL              | 56   | 1000 | 330.0              | 32.4               | 11.35   | 18.67   | 3.1     | 16.0    | 32.0   | Q1            |
| CY74FCT16952ATPVCT | SSOP         | DL              | 56   | 1000 | 330.0              | 32.4               | 11.35   | 18.67   | 3.1     | 16.0    | 32.0   | Q1            |
| CY74FCT16952CTPACT | TSSOP        | DGG             | 56   | 2000 | 330.0              | 24.4               | 8.6     | 15.6    | 1.8     | 12.0    | 24.0   | Q1            |

**TAPE AND REEL BOX DIMENSIONS**



\*All dimensions are nominal

| Device             | Package Type | Package Drawing | Pins | SPQ  | Length (mm) | Width (mm) | Height (mm) |
|--------------------|--------------|-----------------|------|------|-------------|------------|-------------|
| 74FCT162952ATPACT  | TSSOP        | DGG             | 56   | 2000 | 346.0       | 346.0      | 41.0        |
| 74FCT162952BTPVCT  | SSOP         | DL              | 56   | 1000 | 346.0       | 346.0      | 49.0        |
| 74FCT162H952ATPACT | TSSOP        | DGG             | 56   | 2000 | 346.0       | 346.0      | 41.0        |
| 74FCT162H952CTPVCT | SSOP         | DL              | 56   | 1000 | 346.0       | 346.0      | 49.0        |
| CY74FCT16952ATPVCT | SSOP         | DL              | 56   | 1000 | 346.0       | 346.0      | 49.0        |
| CY74FCT16952CTPACT | TSSOP        | DGG             | 56   | 2000 | 346.0       | 346.0      | 41.0        |

DGG (R-PDSO-G\*\*)

PLASTIC SMALL-OUTLINE PACKAGE

48 PINS SHOWN



- NOTES: A. All linear dimensions are in millimeters.  
 B. This drawing is subject to change without notice.  
 C. Body dimensions do not include mold protrusion not to exceed 0,15.  
 D. Falls within JEDEC MO-153

DL (R-PDSO-G\*\*)

PLASTIC SMALL-OUTLINE PACKAGE

48 PINS SHOWN



- NOTES: A. All linear dimensions are in inches (millimeters).  
 B. This drawing is subject to change without notice.  
 C. Body dimensions do not include mold flash or protrusion not to exceed 0.006 (0,15).  
 D. Falls within JEDEC MO-118

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