



SCCS060B - August 1994 - Revised September 2001

# CY74FCT16646T CY74FCT162646T

## 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  $+85^{\circ}\text{C}$
- $V_{CC} = 5\text{V} \pm 10\%$

#### CY74FCT16646T Features:

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

#### CY74FCT162646T Features:

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

### Functional Description

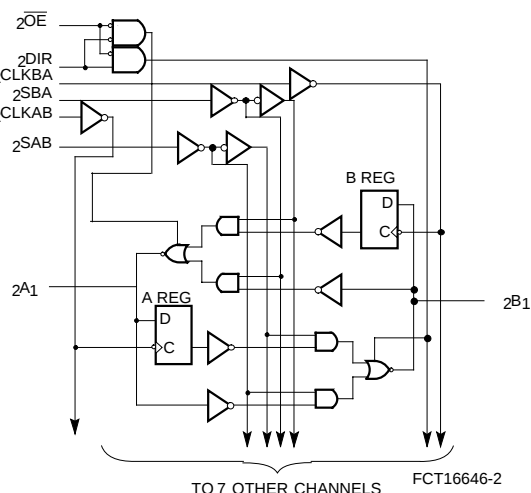
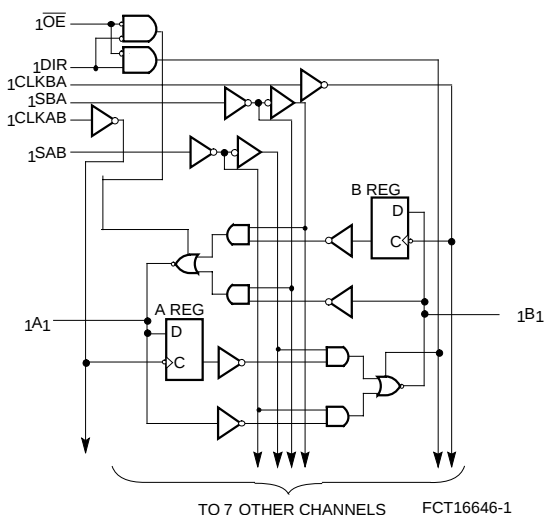
The CY74FCT16646T and CY74FCT162646T 16-bit transceivers are three-state, D-type registers, and control circuitry arranged for multiplexed transmission of data directly from the input bus or from the internal registers. Data on the A or B bus will be clocked into the registers as the appropriate clock pin goes to a HIGH logic level. Output Enable (OE) and direction pins (DIR) are provided to control the transceiver function. In the transceiver mode, data present at the high impedance port may be stored in either the A or B register, or in both. The select controls can multiplex stored and real-time (transparent mode) data. The direction control determines which bus will receive data when the Output Enable (OE) is Active LOW. In the isolation mode (Output Enable (OE) HIGH), A data may be stored in the B register and/or B data may be stored in the A register.

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.

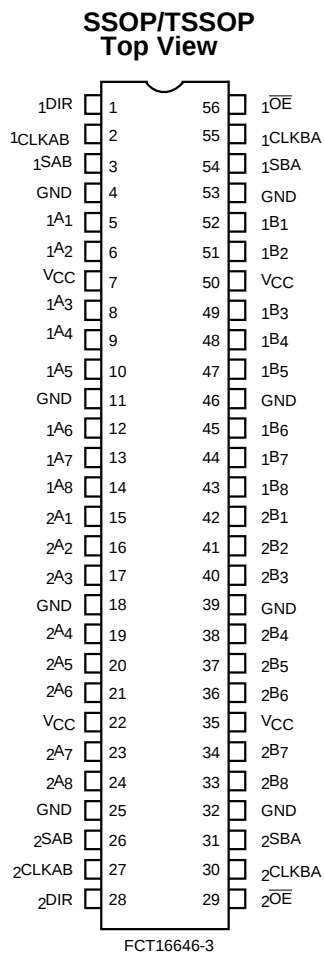
The CY74FCT16646T is ideally suited for driving high-capacitance loads and low-impedance backplanes.

The CY74FCT162646T 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 CY74FCT162646T is ideal for driving transmission lines.

### Logic Block Diagrams



## Pin Configuration

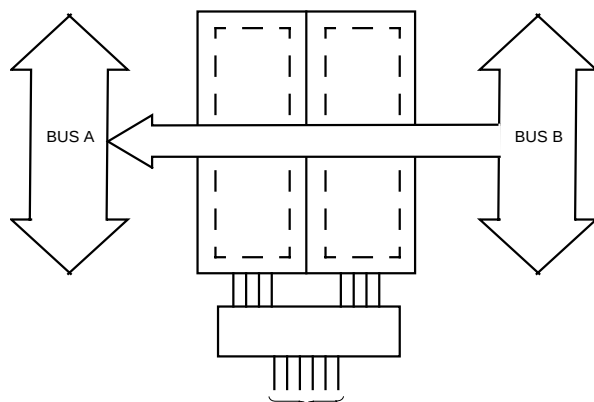


## Pin Description

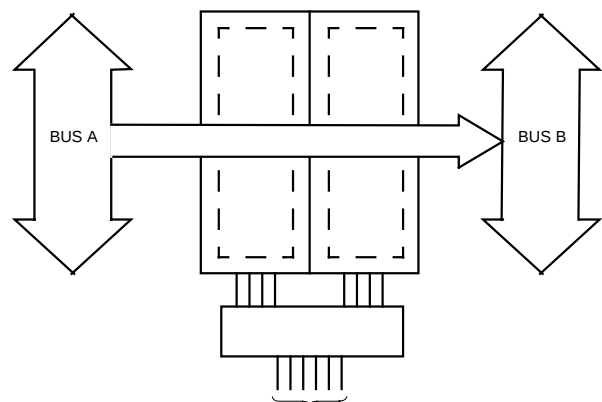
| Pin Names    | Description                                       |
|--------------|---------------------------------------------------|
| A            | Data Register A Inputs<br>Data Register B Outputs |
| B            | Data Register B Inputs<br>Data Register A Outputs |
| CLKAB, CLKBA | Clock Pulse Inputs                                |
| SAB, SBA     | Output Data Source Select Inputs                  |
| DIR          | Direction                                         |
| OE           | Output Enable (Active LOW)                        |

**Function Table<sup>[1]</sup>**

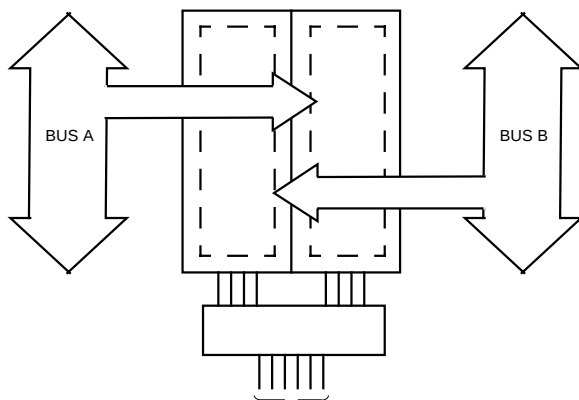
| Inputs |        |             |             |        |        | Data I/O <sup>[2]</sup> |        | Function                                            |
|--------|--------|-------------|-------------|--------|--------|-------------------------|--------|-----------------------------------------------------|
| OE     | DIR    | CLKAB       | CLKBA       | SAB    | SBA    | A                       | B      |                                                     |
| H<br>H | X<br>X | H or L<br>┐ | H or L<br>┐ | X<br>X | X<br>X | Input                   | Input  | Isolation<br>Store A and B Data                     |
| L<br>L | L<br>L | X<br>X      | X<br>H or L | X<br>X | L<br>H | Output                  | Input  | Real Time B Data to A Bus<br>Stored B Data to A Bus |
| L<br>L | H<br>H | X<br>H or L | X<br>X      | L<br>H | X<br>X | Input                   | Output | Real Time A Data to Bus<br>Stored A Data to B Bus   |



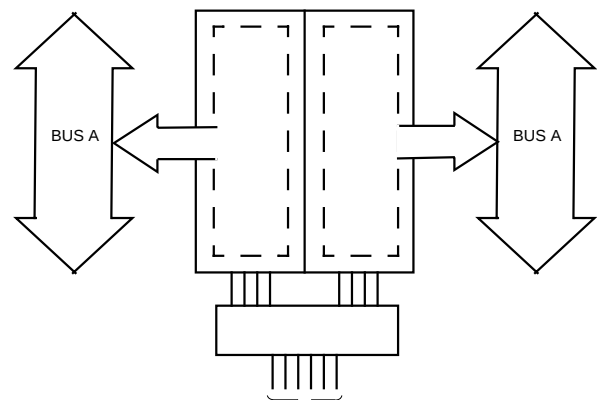
DIR L    OE L    CLKAB X    CLKBA X    SAB X    SBA L  
**Real-Time Transfer  
Bus B to Bus A**



DIR H    OE L    CLKAB X    CLKBA X    SAB L    SBA X  
**Real-Time Transfer  
Bus A to Bus B**



DIR H  
L  
X    OE L  
L  
H    CLKAB  
┐  
X  
┐  
CLKBA  
┐  
X  
┐  
SAB X  
X  
X    SBA X  
X  
X  
**Storage from  
A and/or B**



DIR<sup>[3]</sup> L    OE L    CLKAB X  
H or L    CLKBA H or L  
X    SAB X  
H    SBA H  
X  
**Transfer Stored Data  
to A and/or B**

**Notes:**

- H = HIGH Voltage Level. L = LOW Voltage Level. X = Don't Care ┐ = LOW-to-HIGH Transition
- The data output functions may be enabled or disabled by various signals at the OE or DIR inputs. Data input functions are always enabled, i.e., data at the bus pins will be stored on every LOW-to-HIGH transition on the clock inputs.
- Cannot transfer data to A-bus and B-bus simultaneously.

### Maximum Ratings<sup>[4]</sup>

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

|                                                 |       |                 |
|-------------------------------------------------|-------|-----------------|
| Storage Temperature .....                       | Com'l | –55°C to +125°C |
| Ambient Temperature with<br>Power Applied ..... | Com'l | –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>[5]</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>[6]</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                                         | V <sub>CC</sub> =Max., V <sub>I</sub> =V <sub>CC</sub>     |      |                     | ±1   | μA   |
| I <sub>IL</sub>  | Input LOW Current                                          | V <sub>CC</sub> =Max., V <sub>I</sub> =GND                 |      |                     | ±1   | μA   |
| I <sub>OZH</sub> | High Impedance Output Current<br>(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<br>(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>[7]</sup>                       | V <sub>CC</sub> =Max., V <sub>OUT</sub> =GND               | –80  | –140                | –200 | mA   |
| I <sub>O</sub>   | Output Drive Current <sup>[7]</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>[9]</sup> |      |                     | ±1   | μA   |

### Output Drive Characteristics for CY74FCT16646T

| Parameter       | Description         | Test Conditions                                | Min. | Typ. <sup>[5]</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 CY74FCT162646T

| Parameter        | Description                        | Test Conditions                                                                                   | Min. | Typ. <sup>[5]</sup> | Max. | Unit |
|------------------|------------------------------------|---------------------------------------------------------------------------------------------------|------|---------------------|------|------|
| I <sub>ODL</sub> | Output LOW Current <sup>[7]</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>[7]</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    |

#### Notes:

- 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.
- Typical values are at V<sub>CC</sub>= 5.0V, T<sub>A</sub>= +25° C ambient.
- This parameter is specified but not tested.
- 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 parametrics tests. In any sequence of parameter tests, I<sub>OS</sub> tests should be performed last.
- This parameter is measured at characterization but not tested.
- Tested at +25° C.

**Capacitance** ( $T_A = +25^\circ\text{C}$ ,  $f = 1.0\text{ MHz}$ )

| Symbol    | Description <sup>[8]</sup> | Conditions     | Typ. | Max. | Unit |
|-----------|----------------------------|----------------|------|------|------|
| $C_{IN}$  | Input Capacitance          | $V_{IN} = 0V$  | 4.5  | 6.0  | pF   |
| $C_{OUT}$ | Output Capacitance         | $V_{OUT} = 0V$ | 5.5  | 8.0  | pF   |

**Power Supply Characteristics**

| Parameter       | Description                                       | Test Conditions <sup>[10]</sup>                                                                                                                                              |                                                   | Min. | Typ. <sup>[5]</sup> | Max.                 | Unit                     |
|-----------------|---------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------|------|---------------------|----------------------|--------------------------|
| $I_{CC}$        | Quiescent Power Supply Current                    | $V_{CC} = \text{Max.}$                                                                                                                                                       | $V_{IN} \leq 0.2V$<br>$V_{IN} \geq V_{CC} - 0.2V$ | —    | 5                   | 500                  | $\mu\text{A}$            |
| $\Delta I_{CC}$ | Quiescent Power Supply Current<br>TTL Inputs HIGH | $V_{CC} = \text{Max.}$<br>$V_{IN} = 3.4V^{[11]}$                                                                                                                             |                                                   | —    | 0.5                 | 1.5                  | mA                       |
| $I_{CCD}$       | Dynamic Power Supply<br>Current <sup>[12]</sup>   | $V_{CC} = \text{Max.}$<br>Outputs Open<br>DIR=OE=GND<br>One-Bit Toggling<br>50% Duty Cycle                                                                                   | $V_{IN} = V_{CC}$ or<br>$V_{IN} = \text{GND}$     | —    | 75                  | 120                  | $\mu\text{A}/\text{MHz}$ |
| $I_C$           | Total Power Supply Current <sup>[13]</sup>        | $V_{CC} = \text{Max.}$<br>Outputs Open<br>$f_0 = 10\text{ MHz}$ (CLKBA)<br>50% Duty Cycle<br>DIR=OE=GND<br>One-Bit Toggling<br>$f_1 = 5\text{ MHz}$<br>50% Duty Cycle        | $V_{IN} = V_{CC}$ 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                  |                          |
|                 |                                                   | $V_{CC} = \text{Max.}$<br>Outputs Open<br>$f_0 = 10\text{ MHz}$ (CLKBA)<br>50% Duty Cycle<br>DIR=OE=GND<br>Sixteen-Bits Toggling<br>$f_1 = 2.5\text{ MHz}$<br>50% Duty Cycle | $V_{IN} = V_{CC}$ or<br>$V_{IN} = \text{GND}$     | —    | 3.8                 | 6.5 <sup>[14]</sup>  |                          |
|                 |                                                   |                                                                                                                                                                              | $V_{IN} = 3.4V$ or<br>$V_{IN} = \text{GND}$       | —    | 8.3                 | 20.0 <sup>[14]</sup> |                          |

**Notes:**

10. For conditions shown as Max. or Min., use appropriate value specified under Electrical Characteristics for the applicable device type.

11. Per TTL driven input ( $V_{IN} = 3.4V$ ); all other inputs at  $V_{CC}$  or GND.

12. This parameter is not directly testable, but is derived for use in Total Power Supply calculations.

13.  $I_C = I_{QUIESCENT} + I_{INPUTS} + I_{DYNAMIC}$   
 $I_C = I_{CC} + \Delta I_{CC} D_H N_T + I_{CCD}(f_0/2 + f_1 N_1)$   
 $I_{CC}$  = 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.

14. 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>[15]</sup>

| Parameter                            | Description                             | CY74FCT16646T |      | CY74FCT16646AT<br>CY74FCT162646AT |      | Unit | Fig. No. <sup>[16]</sup> |
|--------------------------------------|-----------------------------------------|---------------|------|-----------------------------------|------|------|--------------------------|
|                                      |                                         | Min.          | Max. | Min.                              | Max. |      |                          |
| t <sub>PLH</sub><br>t <sub>PHL</sub> | Propagation Delay<br>Bus to Bus         | 1.5           | 9.0  | 1.5                               | 6.3  | ns   | 1, 2                     |
| t <sub>PZH</sub><br>t <sub>PZL</sub> | Output Enable Time<br>DIR or OE to Bus  | 1.5           | 14.0 | 1.5                               | 9.8  | ns   | 1, 7, 8                  |
| t <sub>PHZ</sub><br>t <sub>PLZ</sub> | Output Disable Time<br>DIR or OE to Bus | 1.5           | 9.0  | 1.5                               | 6.3  | ns   | 1, 7, 8                  |
| t <sub>PLH</sub><br>t <sub>PHL</sub> | Propagation Delay<br>Clock to Bus       | 1.5           | 9.0  | 1.5                               | 6.3  | ns   | 1, 5                     |
| t <sub>PLH</sub><br>t <sub>PHL</sub> | Propagation Delay<br>SBA or SAB to Bus  | 1.5           | 11.0 | 1.5                               | 7.7  | ns   | 1,5                      |
| t <sub>SU</sub>                      | Set-Up Time HIGH or<br>LOW Bus to Clock | 2.0           | —    | 2.0                               | —    | ns   | 4                        |
| t <sub>H</sub>                       | Hold Time HIGH or<br>LOW Bus to Clock   | 1.5           | —    | 1.5                               | —    | ns   | 4                        |
| t <sub>W</sub>                       | Clock Pulse Width<br>HIGH or LOW        | 5.0           | —    | 5.0                               | —    | ns   | 6                        |
| t <sub>SK(O)</sub>                   | Output Skew <sup>[17]</sup>             | —             | 0.5  | —                                 | 0.5  | ns   | —                        |

| Parameter                            | Description                             | CY74FCT16646CT<br>CY74FCT162646CT |      | Unit | Fig. No. <sup>[16]</sup> |
|--------------------------------------|-----------------------------------------|-----------------------------------|------|------|--------------------------|
|                                      |                                         | Min.                              | Max. |      |                          |
| t <sub>PLH</sub><br>t <sub>PHL</sub> | Propagation Delay<br>Bus to Bus         | 1.5                               | 5.4  | ns   | 1, 2                     |
| t <sub>PZH</sub><br>t <sub>PZL</sub> | Output Enable Time<br>DIR or OE to Bus  | 1.5                               | 7.8  | ns   | 1, 7, 8                  |
| t <sub>PHZ</sub><br>t <sub>PLZ</sub> | Output Disable Time<br>DIR or OE to Bus | 1.5                               | 6.3  | ns   | 1, 7, 8                  |
| t <sub>PLH</sub><br>t <sub>PHL</sub> | Propagation Delay<br>Clock to Bus       | 1.5                               | 5.7  | ns   | 1, 5                     |
| t <sub>PLH</sub><br>t <sub>PHL</sub> | Propagation Delay<br>SBA or SAB to Bus  | 1.5                               | 6.2  | ns   | 1,5                      |
| t <sub>SU</sub>                      | Set-Up Time HIGH or<br>LOW Bus to Clock | 2.0                               | —    | ns   | 4                        |
| t <sub>H</sub>                       | Hold Time HIGH or<br>LOW Bus to Clock   | 1.5                               | —    | ns   | 4                        |
| t <sub>W</sub>                       | Clock Pulse Width<br>HIGH or LOW        | 5.0                               | —    | ns   | 6                        |
| t <sub>SK(O)</sub>                   | Output Skew <sup>[17]</sup>             | —                                 | 0.5  | ns   | —                        |

**Notes:**

15. Minimum limits are specified but not tested on Propagation Delays.

16. See "Parameter Measurement Information" in the General Information section.

17. Skew any two outputs of the same package switching in the same direction. This parameter is ensured by design.

**Ordering Information CY74FCT16646**

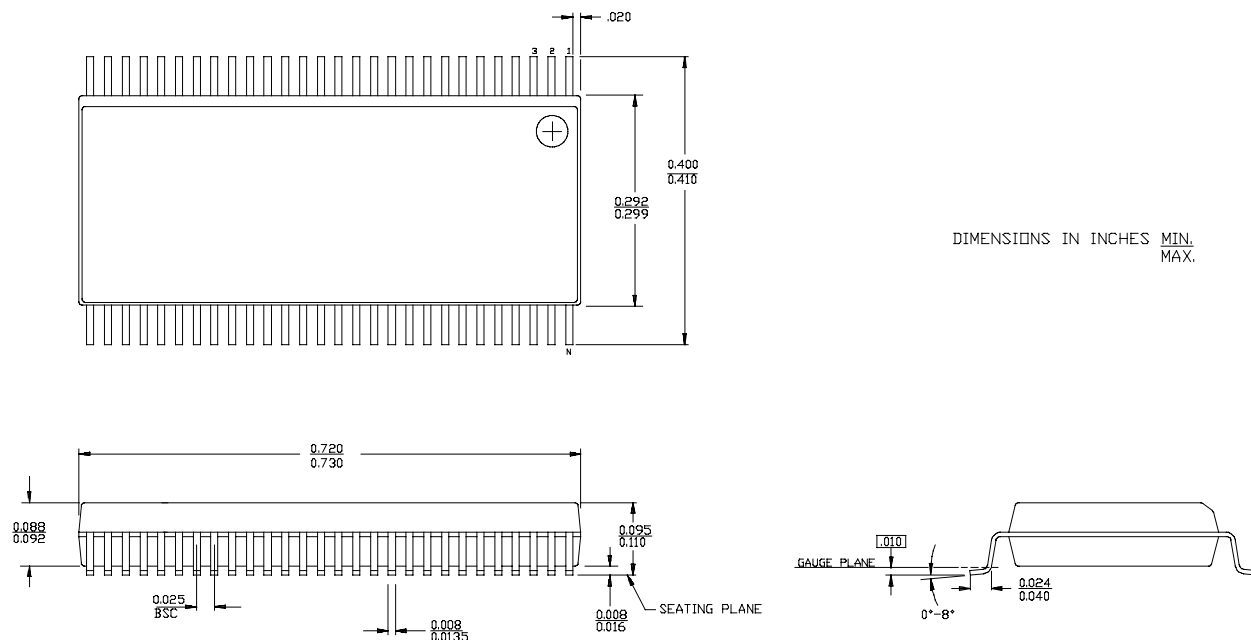
| Speed (ns) | Ordering Code          | Package Name | Package Type           | Operating Range |
|------------|------------------------|--------------|------------------------|-----------------|
| 5.4        | CY74FCT16646CTPVC/PVCT | O56          | 56-Lead (300-Mil) SSOP | Industrial      |
| 6.3        | CY74FCT16646ATPVC/PVCT | O56          | 56-Lead (300-Mil) SSOP | Industrial      |
| 9.0        | CY74FCT16646TPVC/PVCT  | O56          | 56-Lead (300-Mil) SSOP | Industrial      |

**Ordering Information CY74FCT162646**

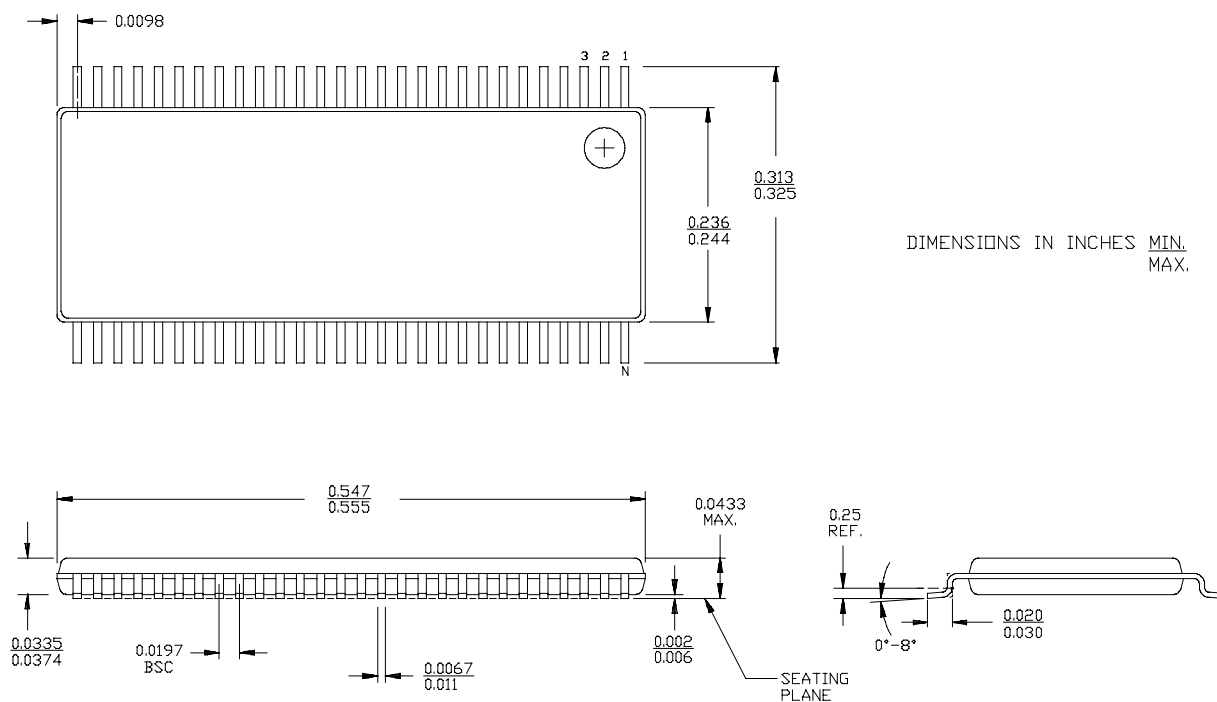
| Speed (ns) | Ordering Code      | Package Name | Package Type            | Operating Range |
|------------|--------------------|--------------|-------------------------|-----------------|
| 5.4        | 74FCT162646CTPACT  | Z56          | 56-Lead (240-Mil) TSSOP | Industrial      |
|            | CY74FCT162646CTPVC | O56          | 56-Lead (300-Mil) SSOP  |                 |
|            | 74FCT162646CTPVCT  | O56          | 56-Lead (300-Mil) SSOP  |                 |
| 6.3        | 74FCT162646ATPACT  | Z56          | 56-Lead (240-Mil) TSSOP | Industrial      |
|            | CY74FCT162646ATPVC | O56          | 56-Lead (300-Mil) SSOP  |                 |
|            | 74FCT162646ATPVCT  | O56          | 56-Lead (300-Mil) SSOP  |                 |

**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> |
|--------------------|-----------------------|--------------|-----------------|------|-------------|-------------------------|------------------|------------------------------|
| 74FCT162646ATPACT  | ACTIVE                | TSSOP        | DGG             | 56   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| 74FCT162646ATPVCG4 | ACTIVE                | SSOP         | DL              | 56   | 20          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| 74FCT162646ATPVCT  | ACTIVE                | SSOP         | DL              | 56   | 1000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| 74FCT162646CTPACT  | ACTIVE                | TSSOP        | DGG             | 56   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| 74FCT162646CTPVCG4 | ACTIVE                | SSOP         | DL              | 56   | 20          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| 74FCT162646CTPVCT  | ACTIVE                | SSOP         | DL              | 56   | 1000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| 74FCT16646ATPVCG4  | ACTIVE                | SSOP         | DL              | 56   | 20          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| 74FCT16646ATPVCTG4 | ACTIVE                | SSOP         | DL              | 56   | 1000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| 74FCT16646CTPVCG4  | ACTIVE                | SSOP         | DL              | 56   | 20          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| 74FCT16646CTPVCTG4 | ACTIVE                | SSOP         | DL              | 56   | 1000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| 74FCT16646TPVCTG4  | ACTIVE                | SSOP         | DL              | 56   | 1000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| CY74FCT162646ATPVC | ACTIVE                | SSOP         | DL              | 56   | 20          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| CY74FCT162646CTPVC | ACTIVE                | SSOP         | DL              | 56   | 20          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| CY74FCT16646ATPVC  | ACTIVE                | SSOP         | DL              | 56   | 20          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| CY74FCT16646ATPVCT | ACTIVE                | SSOP         | DL              | 56   | 1000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| CY74FCT16646CTPVC  | ACTIVE                | SSOP         | DL              | 56   | 20          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| CY74FCT16646CTPVCT | ACTIVE                | SSOP         | DL              | 56   | 1000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| CY74FCT16646ETPVC  | OBSOLETE              | SSOP         | DL              | 56   |             | TBD                     | Call TI          | Call TI                      |
| CY74FCT16646ETPVCT | OBSOLETE              | SSOP         | DL              | 56   |             | TBD                     | Call TI          | Call TI                      |
| CY74FCT16646TPVCT  | ACTIVE                | SSOP         | DL              | 56   | 1000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| FCT162646ATPACTE4  | ACTIVE                | TSSOP        | DGG             | 56   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| FCT162646ATPACTG4  | ACTIVE                | TSSOP        | DGG             | 56   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| FCT162646ATPVCTG4  | ACTIVE                | SSOP         | DL              | 56   | 1000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| FCT162646CTPACTE4  | ACTIVE                | TSSOP        | DGG             | 56   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| FCT162646CTPACTG4  | ACTIVE                | TSSOP        | DGG             | 56   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| FCT162646CTPVCTG4  | ACTIVE                | SSOP         | DL              | 56   | 1000        | 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> |
|------------------|-----------------------|--------------|-----------------|------|-------------|-------------------------|------------------|------------------------------|
| no Sb/Br)        |                       |              |                 |      |             |                         |                  |                              |

<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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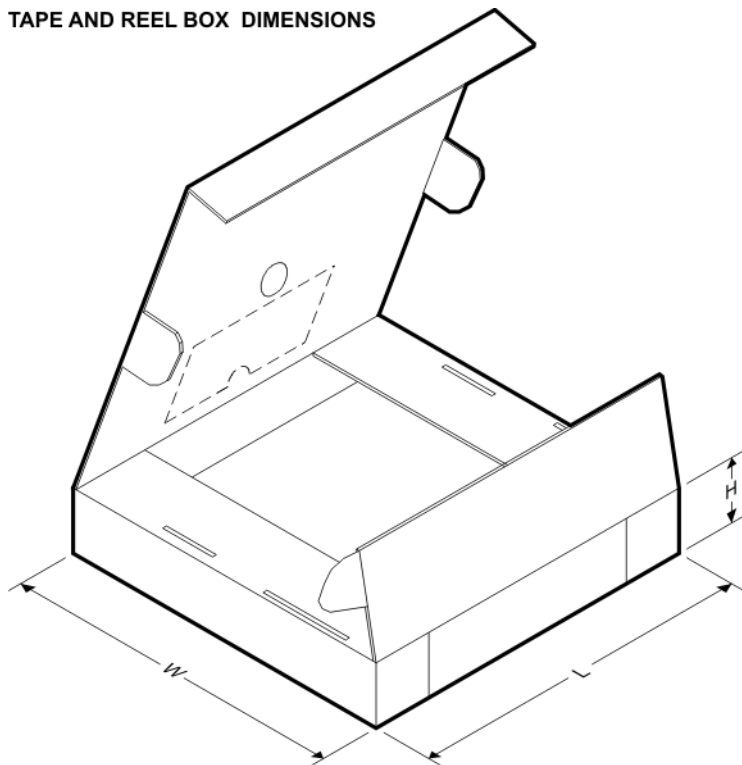
**TAPE AND REEL INFORMATION**



\*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 |
|--------------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| 74FCT162646ATPACT  | TSSOP        | DGG             | 56   | 2000 | 330.0              | 24.4               | 8.6     | 15.6    | 1.8     | 12.0    | 24.0   | Q1            |
| 74FCT162646ATPVCT  | SSOP         | DL              | 56   | 1000 | 330.0              | 32.4               | 11.35   | 18.67   | 3.1     | 16.0    | 32.0   | Q1            |
| 74FCT162646CTPACT  | TSSOP        | DGG             | 56   | 2000 | 330.0              | 24.4               | 8.6     | 15.6    | 1.8     | 12.0    | 24.0   | Q1            |
| 74FCT162646CTPVCT  | SSOP         | DL              | 56   | 1000 | 330.0              | 32.4               | 11.35   | 18.67   | 3.1     | 16.0    | 32.0   | Q1            |
| CY74FCT16646ATPVCT | SSOP         | DL              | 56   | 1000 | 330.0              | 32.4               | 11.35   | 18.67   | 3.1     | 16.0    | 32.0   | Q1            |
| CY74FCT16646CTPVCT | SSOP         | DL              | 56   | 1000 | 330.0              | 32.4               | 11.35   | 18.67   | 3.1     | 16.0    | 32.0   | Q1            |
| CY74FCT16646TPVCT  | SSOP         | DL              | 56   | 1000 | 330.0              | 32.4               | 11.35   | 18.67   | 3.1     | 16.0    | 32.0   | Q1            |

**TAPE AND REEL BOX DIMENSIONS**



\*All dimensions are nominal

| Device             | Package Type | Package Drawing | Pins | SPQ  | Length (mm) | Width (mm) | Height (mm) |
|--------------------|--------------|-----------------|------|------|-------------|------------|-------------|
| 74FCT162646ATPACT  | TSSOP        | DGG             | 56   | 2000 | 346.0       | 346.0      | 41.0        |
| 74FCT162646ATPVCT  | SSOP         | DL              | 56   | 1000 | 346.0       | 346.0      | 49.0        |
| 74FCT162646CTPACT  | TSSOP        | DGG             | 56   | 2000 | 346.0       | 346.0      | 41.0        |
| 74FCT162646CTPVCT  | SSOP         | DL              | 56   | 1000 | 346.0       | 346.0      | 49.0        |
| CY74FCT16646ATPVCT | SSOP         | DL              | 56   | 1000 | 346.0       | 346.0      | 49.0        |
| CY74FCT16646CTPVCT | SSOP         | DL              | 56   | 1000 | 346.0       | 346.0      | 49.0        |
| CY74FCT16646TPVCT  | SSOP         | DL              | 56   | 1000 | 346.0       | 346.0      | 49.0        |

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

## PLASTIC SMALL-OUTLINE PACKAGE

48 PINS SHOWN

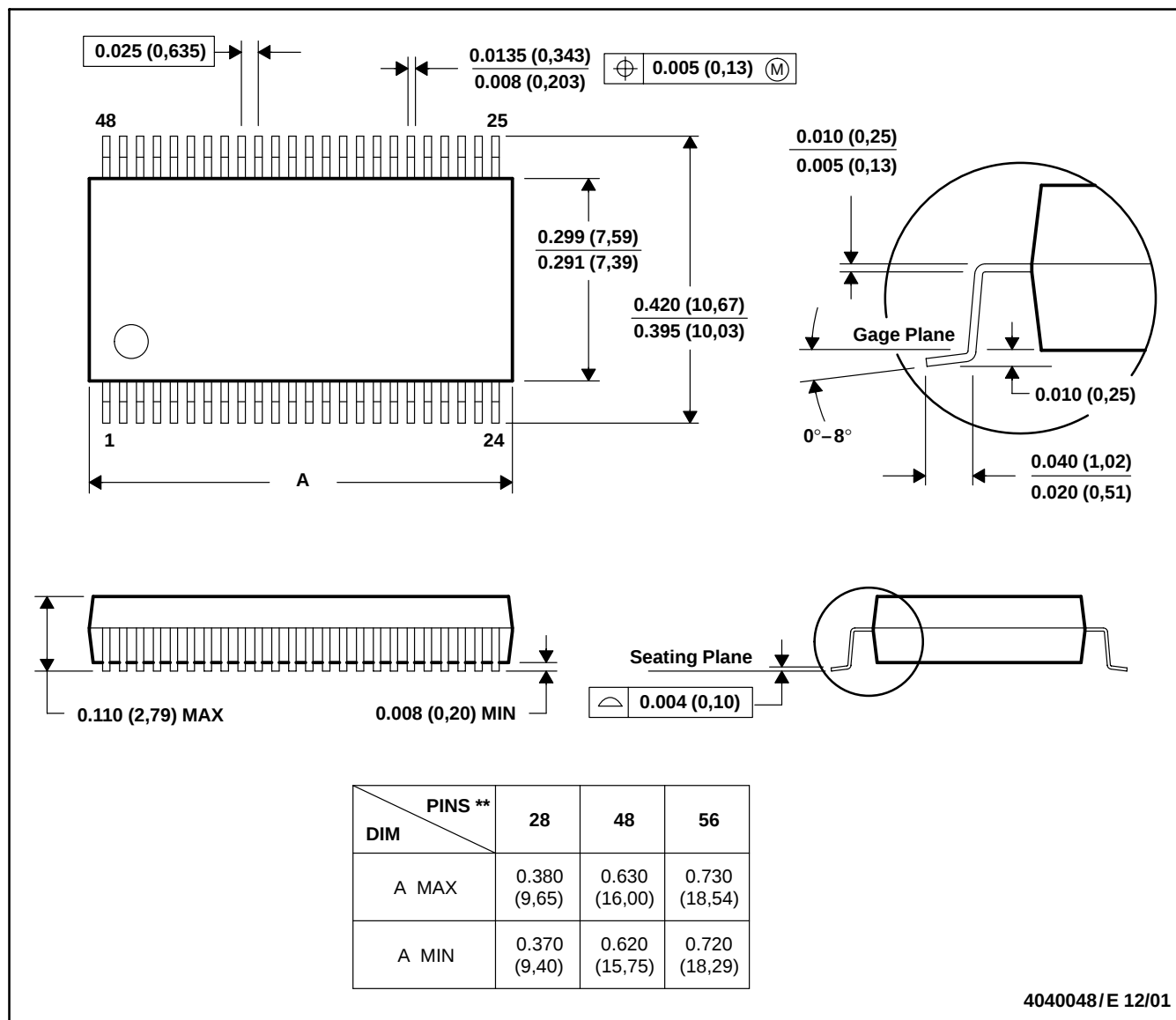


- NOTES: A. All linear dimensions are in millimeters.  
 B. This drawing is subject to change without notice.  
 C. Body dimensions do not include mold protrusion not to exceed 0,15.  
 D. Falls within JEDEC MO-153

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

**PACKAGING INFORMATION**

| Orderable Device   | Status<br>(1) | Package Type | Package<br>Drawing | Pins | Package<br>Qty | Eco Plan<br>(2)            | Lead/Ball Finish<br>(6) | MSL Peak Temp<br>(3) | Op Temp (°C) | Device Marking<br>(4/5) | Samples                 |
|--------------------|---------------|--------------|--------------------|------|----------------|----------------------------|-------------------------|----------------------|--------------|-------------------------|-------------------------|
| 74FCT162646ATPACT  | ACTIVE        | TSSOP        | DGG                | 56   | 2000           | Green (RoHS<br>& no Sb/Br) | CU NIPDAU               | Level-1-260C-UNLIM   | -40 to 85    | FCT162646A              | <a href="#">Samples</a> |
| 74FCT162646ATPVCG4 | ACTIVE        | SSOP         | DL                 | 56   | 20             | Green (RoHS<br>& no Sb/Br) | CU NIPDAU               | Level-1-260C-UNLIM   | -40 to 85    | FCT162646A              | <a href="#">Samples</a> |
| 74FCT162646ATPVCT  | ACTIVE        | SSOP         | DL                 | 56   | 1000           | Green (RoHS<br>& no Sb/Br) | CU NIPDAU               | Level-1-260C-UNLIM   | -40 to 85    | FCT162646A              | <a href="#">Samples</a> |
| 74FCT162646CTPACT  | ACTIVE        | TSSOP        | DGG                | 56   | 2000           | Green (RoHS<br>& no Sb/Br) | CU NIPDAU               | Level-1-260C-UNLIM   | -40 to 85    | FCT162646C              | <a href="#">Samples</a> |
| 74FCT162646CTPVCG4 | ACTIVE        | SSOP         | DL                 | 56   | 20             | Green (RoHS<br>& no Sb/Br) | CU NIPDAU               | Level-1-260C-UNLIM   | -40 to 85    | FCT162646C              | <a href="#">Samples</a> |
| 74FCT162646CTPVCT  | ACTIVE        | SSOP         | DL                 | 56   | 1000           | Green (RoHS<br>& no Sb/Br) | CU NIPDAU               | Level-1-260C-UNLIM   | -40 to 85    | FCT162646C              | <a href="#">Samples</a> |
| 74FCT16646ATPVCG4  | ACTIVE        | SSOP         | DL                 | 56   | 20             | Green (RoHS<br>& no Sb/Br) | CU NIPDAU               | Level-1-260C-UNLIM   | -40 to 85    | FCT16646A               | <a href="#">Samples</a> |
| 74FCT16646TPVCTG4  | OBSOLETE      | SSOP         | DL                 | 56   |                | TBD                        | Call TI                 | Call TI              | -40 to 85    |                         |                         |
| CY74FCT162646ATPVC | ACTIVE        | SSOP         | DL                 | 56   | 20             | Green (RoHS<br>& no Sb/Br) | CU NIPDAU               | Level-1-260C-UNLIM   | -40 to 85    | FCT162646A              | <a href="#">Samples</a> |
| CY74FCT162646CTPVC | ACTIVE        | SSOP         | DL                 | 56   | 20             | Green (RoHS<br>& no Sb/Br) | CU NIPDAU               | Level-1-260C-UNLIM   | -40 to 85    | FCT162646C              | <a href="#">Samples</a> |
| CY74FCT16646ATPVC  | ACTIVE        | SSOP         | DL                 | 56   | 20             | Green (RoHS<br>& no Sb/Br) | CU NIPDAU               | Level-1-260C-UNLIM   | -40 to 85    | FCT16646A               | <a href="#">Samples</a> |
| CY74FCT16646ATPVCT | ACTIVE        | SSOP         | DL                 | 56   | 1000           | Green (RoHS<br>& no Sb/Br) | CU NIPDAU               | Level-1-260C-UNLIM   | -40 to 85    | FCT16646A               | <a href="#">Samples</a> |
| CY74FCT16646CTPVC  | ACTIVE        | SSOP         | DL                 | 56   | 20             | Green (RoHS<br>& no Sb/Br) | CU NIPDAU               | Level-1-260C-UNLIM   | -40 to 85    | FCT16646C               | <a href="#">Samples</a> |
| CY74FCT16646CTPVCT | ACTIVE        | SSOP         | DL                 | 56   | 1000           | Green (RoHS<br>& no Sb/Br) | CU NIPDAU               | Level-1-260C-UNLIM   | -40 to 85    | FCT16646C               | <a href="#">Samples</a> |
| CY74FCT16646ETPVC  | OBSOLETE      | SSOP         | DL                 | 56   |                | TBD                        | Call TI                 | Call TI              | -40 to 85    |                         |                         |
| CY74FCT16646ETPVCT | OBSOLETE      | SSOP         | DL                 | 56   |                | TBD                        | Call TI                 | Call TI              | -40 to 85    |                         |                         |
| CY74FCT16646TPVCT  | OBSOLETE      | SSOP         | DL                 | 56   |                | TBD                        | Call TI                 | Call TI              | -40 to 85    |                         |                         |

<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.

<sup>(4)</sup> There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

<sup>(5)</sup> Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "-" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

<sup>(6)</sup> Lead/Ball Finish - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead/Ball Finish values may wrap to two lines if the finish value exceeds the maximum column width.

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**TAPE AND REEL INFORMATION**


\*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 |
|--------------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| 74FCT162646ATPACT  | TSSOP        | DGG             | 56   | 2000 | 330.0              | 24.4               | 8.6     | 15.6    | 1.8     | 12.0    | 24.0   | Q1            |
| 74FCT162646ATPVCT  | SSOP         | DL              | 56   | 1000 | 330.0              | 32.4               | 11.35   | 18.67   | 3.1     | 16.0    | 32.0   | Q1            |
| 74FCT162646CTPACT  | TSSOP        | DGG             | 56   | 2000 | 330.0              | 24.4               | 8.6     | 15.6    | 1.8     | 12.0    | 24.0   | Q1            |
| 74FCT162646CTPVCT  | SSOP         | DL              | 56   | 1000 | 330.0              | 32.4               | 11.35   | 18.67   | 3.1     | 16.0    | 32.0   | Q1            |
| CY74FCT16646ATPVCT | SSOP         | DL              | 56   | 1000 | 330.0              | 32.4               | 11.35   | 18.67   | 3.1     | 16.0    | 32.0   | Q1            |
| CY74FCT16646CTPVCT | SSOP         | DL              | 56   | 1000 | 330.0              | 32.4               | 11.35   | 18.67   | 3.1     | 16.0    | 32.0   | Q1            |

## TAPE AND REEL BOX DIMENSIONS

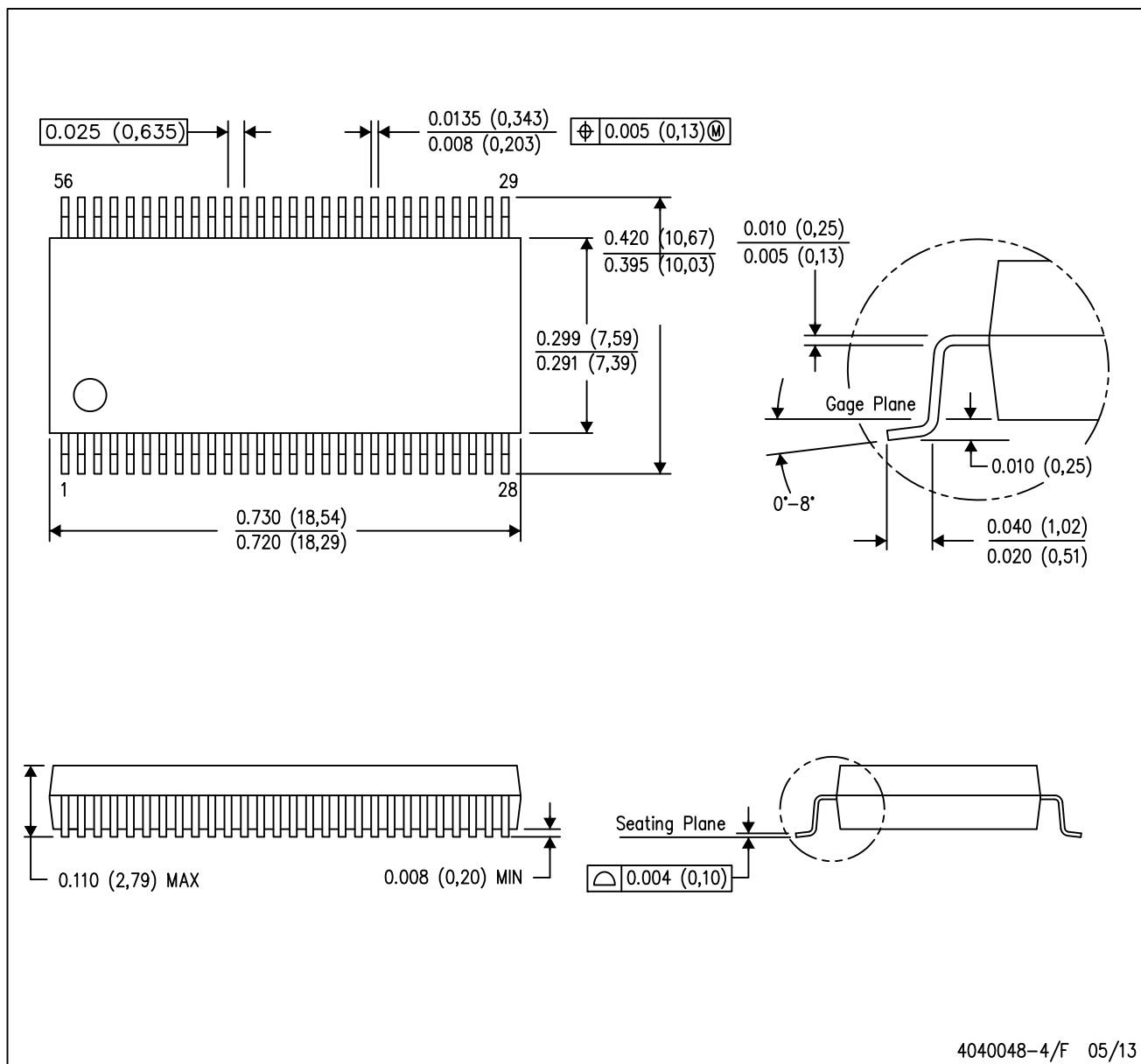


\*All dimensions are nominal

| Device             | Package Type | Package Drawing | Pins | SPQ  | Length (mm) | Width (mm) | Height (mm) |
|--------------------|--------------|-----------------|------|------|-------------|------------|-------------|
| 74FCT162646ATPACT  | TSSOP        | DGG             | 56   | 2000 | 367.0       | 367.0      | 45.0        |
| 74FCT162646ATPVCT  | SSOP         | DL              | 56   | 1000 | 367.0       | 367.0      | 55.0        |
| 74FCT162646CTPACT  | TSSOP        | DGG             | 56   | 2000 | 367.0       | 367.0      | 45.0        |
| 74FCT162646CTPVCT  | SSOP         | DL              | 56   | 1000 | 367.0       | 367.0      | 55.0        |
| CY74FCT16646ATPVCT | SSOP         | DL              | 56   | 1000 | 367.0       | 367.0      | 55.0        |
| CY74FCT16646CTPVCT | SSOP         | DL              | 56   | 1000 | 367.0       | 367.0      | 55.0        |

DL (R-PDSO-G56)

PLASTIC SMALL-OUTLINE PACKAGE



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

## 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

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| Data Converters              | <a href="http://dataconverter.ti.com">dataconverter.ti.com</a>                       |
| DLP® Products                | <a href="http://www.dlp.com">www.dlp.com</a>                                         |
| DSP                          | <a href="http://dsp.ti.com">dsp.ti.com</a>                                           |
| Clocks and Timers            | <a href="http://www.ti.com/clocks">www.ti.com/clocks</a>                             |
| Interface                    | <a href="http://interface.ti.com">interface.ti.com</a>                               |
| Logic                        | <a href="http://logic.ti.com">logic.ti.com</a>                                       |
| Power Mgmt                   | <a href="http://power.ti.com">power.ti.com</a>                                       |
| Microcontrollers             | <a href="http://microcontroller.ti.com">microcontroller.ti.com</a>                   |
| RFID                         | <a href="http://www.ti-rfid.com">www.ti-rfid.com</a>                                 |
| OMAP Applications Processors | <a href="http://www.ti.com/omap">www.ti.com/omap</a>                                 |
| Wireless Connectivity        | <a href="http://www.ti.com/wirelessconnectivity">www.ti.com/wirelessconnectivity</a> |

### Applications

|                               |                                                                                          |
|-------------------------------|------------------------------------------------------------------------------------------|
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| Communications and Telecom    | <a href="http://www.ti.com/communications">www.ti.com/communications</a>                 |
| Computers and Peripherals     | <a href="http://www.ti.com/computers">www.ti.com/computers</a>                           |
| Consumer Electronics          | <a href="http://www.ti.com/consumer-apps">www.ti.com/consumer-apps</a>                   |
| Energy and Lighting           | <a href="http://www.ti.com/energy">www.ti.com/energy</a>                                 |
| Industrial                    | <a href="http://www.ti.com/industrial">www.ti.com/industrial</a>                         |
| Medical                       | <a href="http://www.ti.com/medical">www.ti.com/medical</a>                               |
| Security                      | <a href="http://www.ti.com/security">www.ti.com/security</a>                             |
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