

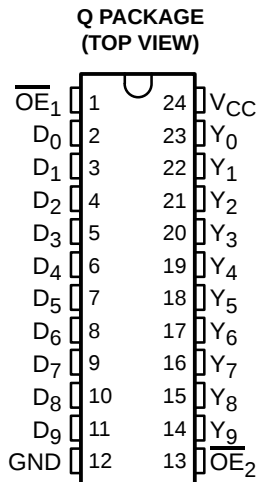
# CY74FCT2827T

## 10-BIT BUFFER

### WITH 3-STATE OUTPUTS

SCCS045A – MAY 1994 – REVISED SEPTEMBER 2001

- Function and Pinout Compatible With FCT, F, and AM29827 Logic
- 25-Ω Output Series Resistors Reduce Transmission-Line Reflection Noise
- Reduced  $V_{OH}$  (Typically = 3.3 V) Versions of Equivalent FCT Functions
- Edge-Rate Control Circuitry for Significantly Improved Noise Characteristics
- $I_{off}$  Supports Partial-Power-Down Mode Operation
- ESD Protection Exceeds JESD 22
  - 2000-V Human-Body Model (A114-A)
  - 200-V Machine Model (A115-A)
  - 1000-V Charged-Device Model (C101)
- Matched Rise and Fall Times
- Fully Compatible With TTL Input and Output Logic Levels
- 12-mA Output Sink Current  
15-mA Output Source Current
- 3-State Outputs



#### description

The CY74FCT2827T 10-bit buffer provides high-performance bus-interface buffering for wide data/address paths or buses carrying parity. This 10-bit buffer has NANDed output-enable ( $\overline{OE}$ ) inputs for maximum control flexibility. The CY74FCT2827T is designed for high-capacitance-load drive capability, while providing low-capacitance bus loading at both inputs and outputs. All inputs have clamp diodes and all outputs are designed for low-capacitance bus loading in the high-impedance state. On-chip termination resistors at the outputs reduce system noise caused by reflections. The CY74FCT2827T can replace the CY74FCT827T to reduce noise in an existing design.

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.

#### ORDERING INFORMATION

| TA            | PACKAGE <sup>†</sup> |               | SPEED (ns) | ORDERABLE PART NUMBER | TOP-SIDE MARKING |
|---------------|----------------------|---------------|------------|-----------------------|------------------|
| –40°C to 85°C | QSOP – Q             | Tape and reel | 4.4        | CY74FCT2827CTQCT      | FCT2827C         |
|               | QSOP – Q             | Tape and reel | 8          | CY74FCT2827ATQCT      | FCT2827A         |

<sup>†</sup> Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at [www.ti.com/sc/package](http://www.ti.com/sc/package).



Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.

PRODUCTION DATA information is current as of publication date. Products conform to specifications per the terms of Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.

**TEXAS  
INSTRUMENTS**

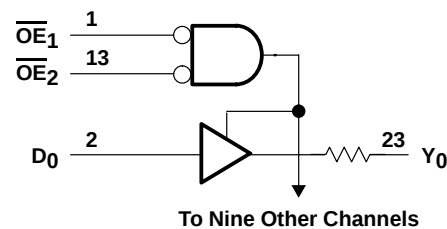
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| FUNCTION TABLE    |                   |   |             |             |
|-------------------|-------------------|---|-------------|-------------|
| INPUTS            |                   |   | OUTPUT<br>Y | FUNCTION    |
| $\overline{OE_1}$ | $\overline{OE_2}$ | D |             |             |
| L                 | L                 | L | L           | Transparent |
| L                 | L                 | H | H           |             |
| H                 | X                 | X | Z           | 3-State     |
| X                 | H                 | X | Z           |             |

H = High logic level, L = Low logic level, X = Don't care,  
Z = High-impedance state

logic diagram (positive logic)



absolute maximum ratings over operating free-air temperature range (unless otherwise noted)<sup>†</sup>

|                                                       |                |
|-------------------------------------------------------|----------------|
| Supply voltage range to ground potential              | −0.5 V to 7 V  |
| DC input voltage range                                | −0.5 V to 7 V  |
| DC output voltage range                               | −0.5 V to 7 V  |
| DC output current (maximum sink current/pin)          | 120 mA         |
| Package thermal impedance, $\theta_{JA}$ (see Note 1) | 61°C/W         |
| Ambient temperature range with power applied, $T_A$   | −65°C to 135°C |
| Storage temperature range, $T_{stg}$                  | −65°C to 150°C |

<sup>†</sup> Stresses beyond those listed under “absolute maximum ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

NOTE 1: The package thermal impedance is calculated in accordance with JESD 51-7.

recommended operating conditions (see Note 2)

|                                      | MIN  | NOM | MAX  | UNIT |
|--------------------------------------|------|-----|------|------|
| $V_{CC}$ Supply voltage              | 4.75 | 5   | 5.25 | V    |
| $V_{IH}$ High-level input voltage    | 2    |     |      | V    |
| $V_{IL}$ Low-level input voltage     |      |     | 0.8  | V    |
| $I_{OH}$ High-level output current   |      |     | −15  | mA   |
| $I_{OL}$ Low-level output current    |      |     | 12   | mA   |
| $T_A$ Operating free-air temperature | −40  |     | 85   | °C   |

NOTE 2: All unused inputs of the device must be held at  $V_{CC}$  or GND to ensure proper device operation.

**electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)**

| PARAMETER             | TEST CONDITIONS                                                                                                                                       |                                                         | MIN                                                 | TYP <sup>†</sup> | MAX                | UNIT     |
|-----------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------|-----------------------------------------------------|------------------|--------------------|----------|
| $V_{IK}$              | $V_{CC} = 4.75$ ,                                                                                                                                     | $I_{IN} = -18$ mA                                       |                                                     | -0.7             | -1.2               | V        |
| $V_{OH}$              | $V_{CC} = 4.75$ ,                                                                                                                                     | $I_{OH} = -15$ mA                                       | 2.4                                                 | 3.3              |                    | V        |
| $V_{OL}$              | $V_{CC} = 4.75$ ,                                                                                                                                     | $I_{OL} = 12$ mA                                        |                                                     | 0.3              | 0.55               | V        |
| $R_{out}$             | $V_{CC} = 4.75$ ,                                                                                                                                     | $I_{OL} = 12$ mA                                        | 20                                                  | 25               | 40                 | $\Omega$ |
| $V_{hys}$             | All inputs                                                                                                                                            |                                                         |                                                     | 0.2              |                    | V        |
| $I_I$                 | $V_{CC} = 5.25$ V,                                                                                                                                    | $V_{IN} = V_{CC}$                                       |                                                     |                  | 5                  | $\mu$ A  |
| $I_{IH}$              | $V_{CC} = 5.25$ V,                                                                                                                                    | $V_{IN} = 2.7$ V                                        |                                                     |                  | $\pm 1$            | $\mu$ A  |
| $I_{IL}$              | $V_{CC} = 5.25$ V,                                                                                                                                    | $V_{IN} = 0.5$ V                                        |                                                     |                  | $\pm 1$            | $\mu$ A  |
| $I_{OS}^{\ddagger}$   | $V_{CC} = 5.25$ V,                                                                                                                                    | $V_{OUT} = 0$ V                                         | -60                                                 | -120             | -225               | mA       |
| $I_{off}$             | $V_{CC} = 0$ V,                                                                                                                                       | $V_{OUT} = 4.5$ V                                       |                                                     |                  | $\pm 1$            | $\mu$ A  |
| $I_{OZH}$             | $V_{CC} = 5.25$ V,                                                                                                                                    | $V_{OUT} = 2.7$ V                                       |                                                     |                  | 10                 | $\mu$ A  |
| $I_{OZL}$             | $V_{CC} = 5.25$ V,                                                                                                                                    | $V_{OUT} = 0.5$ V                                       |                                                     |                  | -10                | $\mu$ A  |
| $I_{CC}$              | $V_{CC} = 5.25$ V,                                                                                                                                    | $V_{IN} \leq 0.2$ V, $V_{IN} \geq V_{CC} - 0.2$ V       |                                                     | 0.1              | 0.2                | mA       |
| $\Delta I_{CC}$       | $V_{CC} = 5.25$ V, $V_{IN} = 3.4$ V <sup>§</sup> , $f_1 = 0$ , Outputs open                                                                           |                                                         |                                                     | 0.5              | 2                  | mA       |
| $I_{CCD}^{\parallel}$ | $V_{CC} = 5.25$ V, One input switching at 50% duty cycle, Outputs open, $OE_1$ or $OE_2 = GND$ , $V_{IN} \leq 0.2$ V or $V_{IN} \geq V_{CC} - 0.2$ V, |                                                         |                                                     | 0.06             | 0.12               | mA/MHz   |
| $I_C^{\#}$            | $V_{CC} = 5.25$ V, Outputs open, $OE_1$ or $OE_2 = GND$                                                                                               | One bit switching at $f_1 = 10$ MHz at 50% duty cycle   | $V_{IN} \leq 0.2$ V or $V_{IN} \geq V_{CC} - 0.2$ V | 0.7              | 1.4                | mA       |
|                       |                                                                                                                                                       |                                                         | $V_{IN} = 3.4$ V or GND                             | 1                | 2.4                |          |
|                       |                                                                                                                                                       | Ten bits switching at $f_1 = 2.5$ MHz at 50% duty cycle | $V_{IN} \leq 0.2$ V or $V_{IN} \geq V_{CC} - 0.2$ V | 1.6              | 3.2 <sup>  </sup>  |          |
|                       |                                                                                                                                                       |                                                         | $V_{IN} = 3.4$ V or GND                             | 4.1              | 13.2 <sup>  </sup> |          |
| $C_i$                 |                                                                                                                                                       |                                                         |                                                     | 5                | 10                 | pF       |
| $C_o$                 |                                                                                                                                                       |                                                         |                                                     | 9                | 12                 | pF       |

<sup>†</sup> Typical values are at  $V_{CC} = 5$  V,  $T_A = 25^\circ\text{C}$ .

<sup>‡</sup> 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 to minimize internal chip heating and more accurately reflect operational values. Otherwise, prolonged shorting of a high output can raise the chip temperature well above normal and cause invalid readings in other parametric tests. In any sequence of parameter tests,  $I_{OS}$  tests should be performed last.

<sup>§</sup> Per TTL-driven input ( $V_{IN} = 3.4$  V); all other inputs at  $V_{CC}$  or GND

<sup>||</sup> This parameter is derived for use in total power-supply calculations.

<sup>#</sup>  $I_C = I_{CC} + \Delta I_{CC} \times D_H \times N_T + I_{CCD} (f_0/2 + f_1 \times N_1)$

Where:

$I_C$  = Total supply current

$I_{CC}$  = Power-supply current with CMOS input levels

$\Delta I_{CC}$  = Power-supply current for a TTL high input ( $V_{IN} = 3.4$  V)

$D_H$  = 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 milliamperes and all frequencies are in megahertz.

<sup>||</sup> Values for these conditions are examples of the  $I_{CC}$  formula.

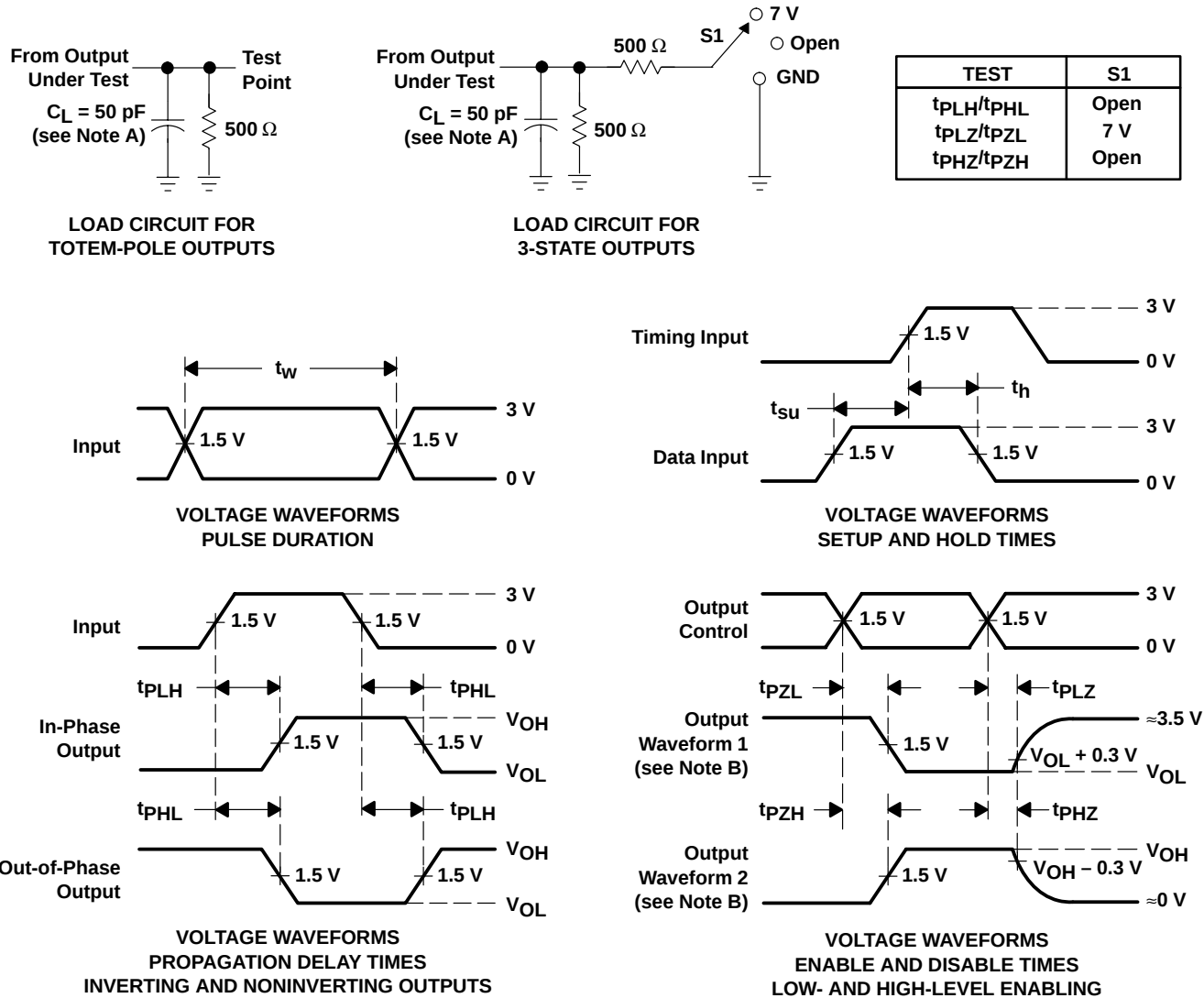
**CY74FCT2827T**  
**10-BIT BUFFER**  
**WITH 3-STATE OUTPUTS**

SCCS045A – MAY 1994 – REVISED SEPTEMBER 2001

**switching characteristics over operating free-air temperature range (see Figure 1)**

| PARAMETER        | FROM<br>(INPUT) | TO<br>(OUTPUT) | TEST LOAD                                          | CY74FCT2827AT |     | CY74FCT2827CT |     | UNIT |
|------------------|-----------------|----------------|----------------------------------------------------|---------------|-----|---------------|-----|------|
|                  |                 |                |                                                    | MIN           | MAX | MIN           | MAX |      |
| t <sub>PLH</sub> | D               | Y              | C <sub>L</sub> = 50 pF,<br>R <sub>L</sub> = 500 Ω  | 1.5           | 8   | 1.5           | 4.4 | ns   |
| t <sub>PHL</sub> |                 |                |                                                    | 1.5           | 8   | 1.5           | 4.4 |      |
| t <sub>PLH</sub> | D               | Y              | C <sub>L</sub> = 300 pF,<br>R <sub>L</sub> = 500 Ω | 1.5           | 15  | 1.5           | 10  | ns   |
| t <sub>PHL</sub> |                 |                |                                                    | 1.5           | 15  | 1.5           | 10  |      |
| t <sub>PZH</sub> | $\overline{OE}$ | Y              | C <sub>L</sub> = 50 pF,<br>R <sub>L</sub> = 500 Ω  | 1.5           | 12  | 1.5           | 7   | ns   |
| t <sub>PZL</sub> |                 |                |                                                    | 1.5           | 12  | 1.5           | 7   |      |
| t <sub>PZH</sub> | $\overline{OE}$ | Y              | C <sub>L</sub> = 300 pF,<br>R <sub>L</sub> = 500 Ω | 1.5           | 23  | 1.5           | 14  | ns   |
| t <sub>PZL</sub> |                 |                |                                                    | 1.5           | 23  | 1.5           | 14  |      |
| t <sub>PHZ</sub> | $\overline{OE}$ | Y              | C <sub>L</sub> = 5 pF,<br>R <sub>L</sub> = 500 Ω   | 1.5           | 9   | 1.5           | 5.7 | ns   |
| t <sub>PLZ</sub> |                 |                |                                                    | 1.5           | 9   | 1.5           | 5.7 |      |
| t <sub>PHZ</sub> | $\overline{OE}$ | Y              | C <sub>L</sub> = 50 pF,<br>R <sub>L</sub> = 500 Ω  | 1.5           | 9   | 1.5           | 6   | ns   |
| t <sub>PLZ</sub> |                 |                |                                                    | 1.5           | 9   | 1.5           | 6   |      |

## PARAMETER MEASUREMENT INFORMATION



- NOTES: A.  $C_L$  includes probe and jig capacitance.  
 B. Waveform 1 is for an output with internal conditions such that the output is low except when disabled by the output control. Waveform 2 is for an output with internal conditions such that the output is high except when disabled by the output control.  
 C. The outputs are measured one at a time with one input transition per measurement.

**Figure 1. Load Circuit and Voltage Waveforms**

## 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> |
|--------------------|-----------------------|--------------|-----------------|------|-------------|-------------------------|------------------|------------------------------|
| CY74FCT2827ATQCT   | ACTIVE                | SSOP/QSOP    | DBQ             | 24   | 2500        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-2-260C-1 YEAR          |
| CY74FCT2827ATQCTE4 | ACTIVE                | SSOP/QSOP    | DBQ             | 24   | 2500        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-2-260C-1 YEAR          |
| CY74FCT2827ATQCTG4 | ACTIVE                | SSOP/QSOP    | DBQ             | 24   | 2500        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-2-260C-1 YEAR          |
| CY74FCT2827CTQCT   | ACTIVE                | SSOP/QSOP    | DBQ             | 24   | 2500        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-2-260C-1 YEAR          |
| CY74FCT2827CTQCTE4 | ACTIVE                | SSOP/QSOP    | DBQ             | 24   | 2500        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-2-260C-1 YEAR          |
| CY74FCT2827CTQCTG4 | ACTIVE                | SSOP/QSOP    | DBQ             | 24   | 2500        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-2-260C-1 YEAR          |

<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.

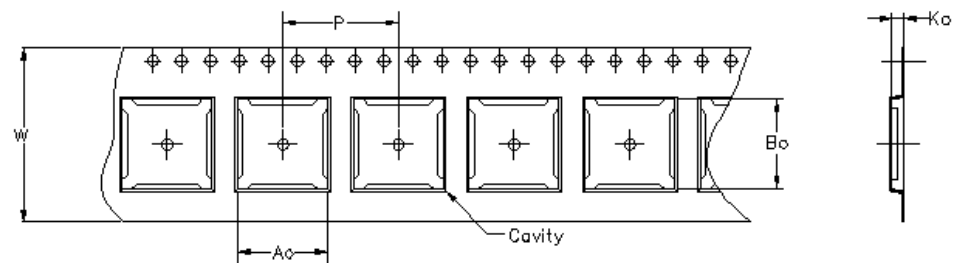
**Pb-Free (RoHS Exempt):** This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.

**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.

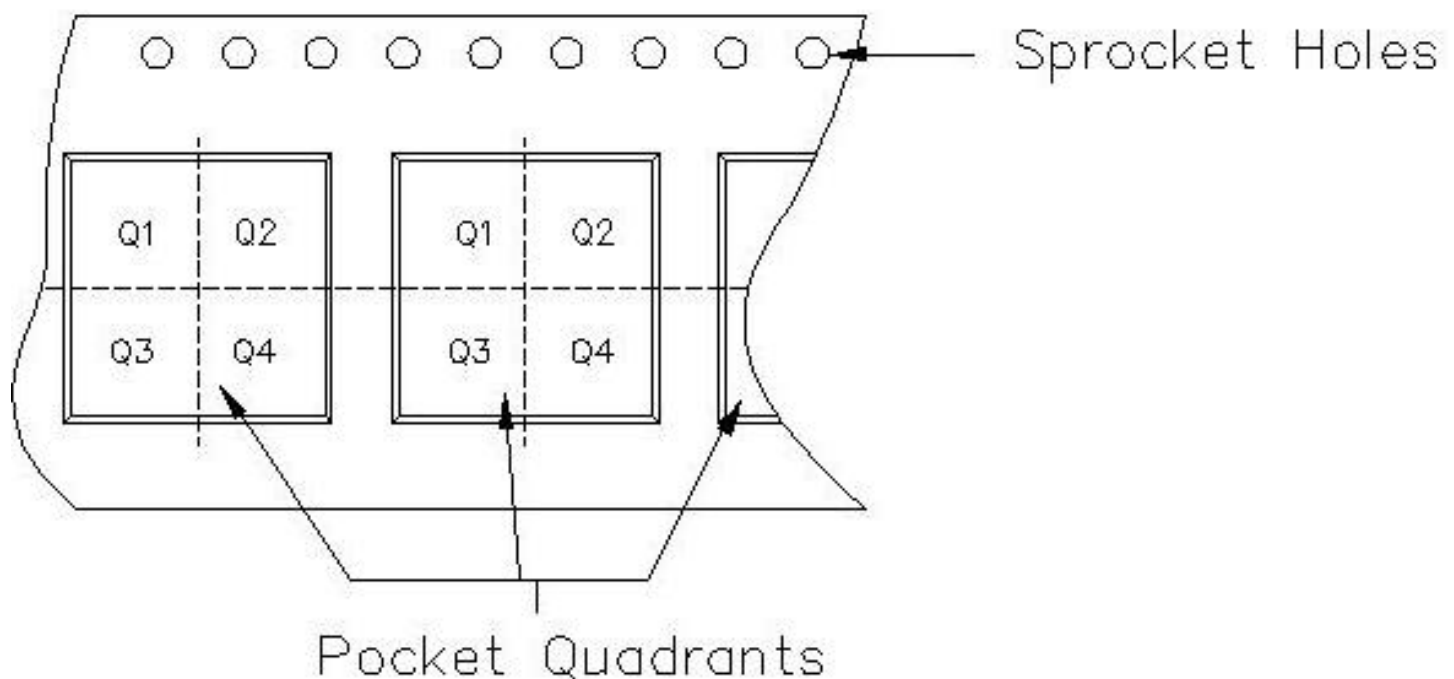
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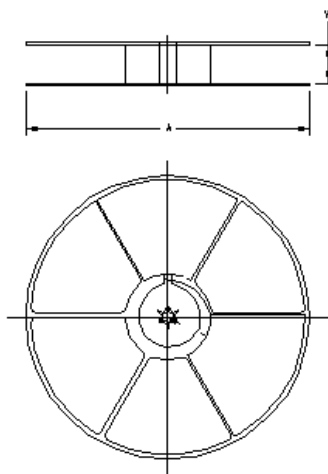
Carrier tape design is defined largely by the component length, width, and thickness.

|                                                                    |
|--------------------------------------------------------------------|
| $A_0$ = Dimension designed to accommodate the component width.     |
| $B_0$ = Dimension designed to accommodate the component length.    |
| $K_0$ = Dimension designed to accommodate the component thickness. |
| $W$ = Overall width of the carrier tape.                           |
| $P$ = Pitch between successive cavity centers.                     |



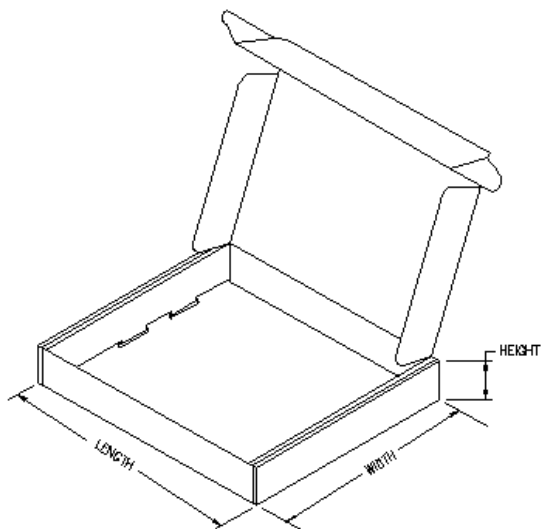
## TAPE AND REEL INFORMATION

| Device           | Package | Pins | Site | Reel Diameter (mm) | Reel Width (mm) | A0 (mm) | B0 (mm) | K0 (mm) | P1 (mm) | W (mm) | Pin1 Quadrant |
|------------------|---------|------|------|--------------------|-----------------|---------|---------|---------|---------|--------|---------------|
| CY74FCT2827ATQCT | DBQ     | 24   | MLA  | 330                | 16              | 6.5     | 9.0     | 2.1     | 8       | 16     | Q1            |
| CY74FCT2827CTQCT | DBQ     | 24   | MLA  | 330                | 16              | 6.5     | 9.0     | 2.1     | 8       | 16     | Q1            |



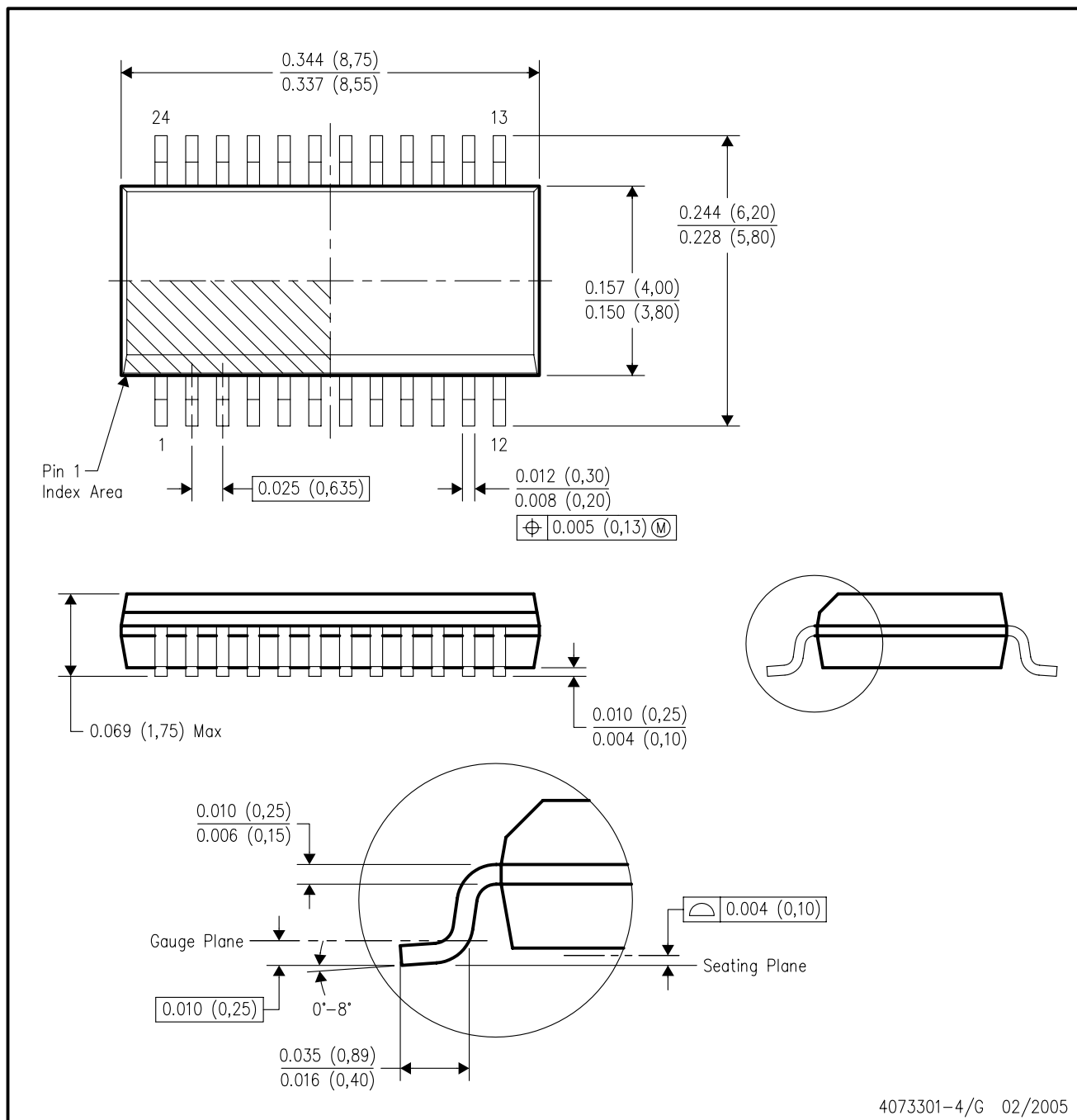
## TAPE AND REEL BOX INFORMATION

| Device           | Package | Pins | Site | Length (mm) | Width (mm) | Height (mm) |
|------------------|---------|------|------|-------------|------------|-------------|
| CY74FCT2827ATQCT | DBQ     | 24   | MLA  | 346.0       | 346.0      | 33.0        |
| CY74FCT2827CTQCT | DBQ     | 24   | MLA  | 346.0       | 346.0      | 33.0        |



## DBQ (R-PDSO-G24)

## PLASTIC SMALL-OUTLINE PACKAGE



4073301-4/G 02/2005

- 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) per side.
  - Falls within JEDEC MO-137 variation AE.

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| Low Power Wireless | <a href="http://www.ti.com/lpw">www.ti.com/lpw</a>                 | Video & Imaging    | <a href="http://www.ti.com/video">www.ti.com/video</a>                   |
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