



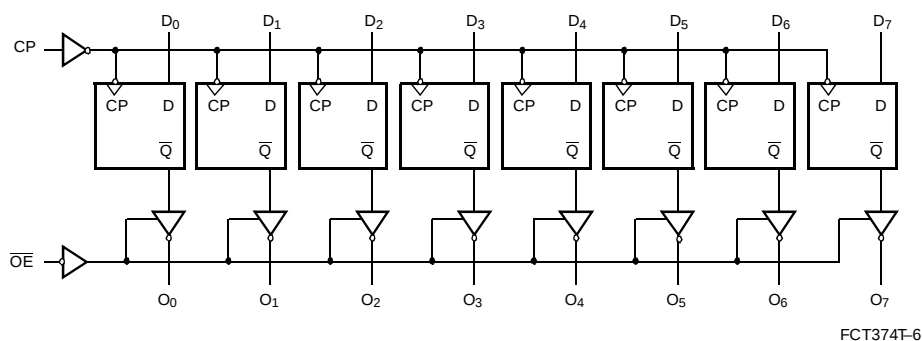
# CY54/74FCT374T CY54/74FCT574T

## 8-Bit Registers

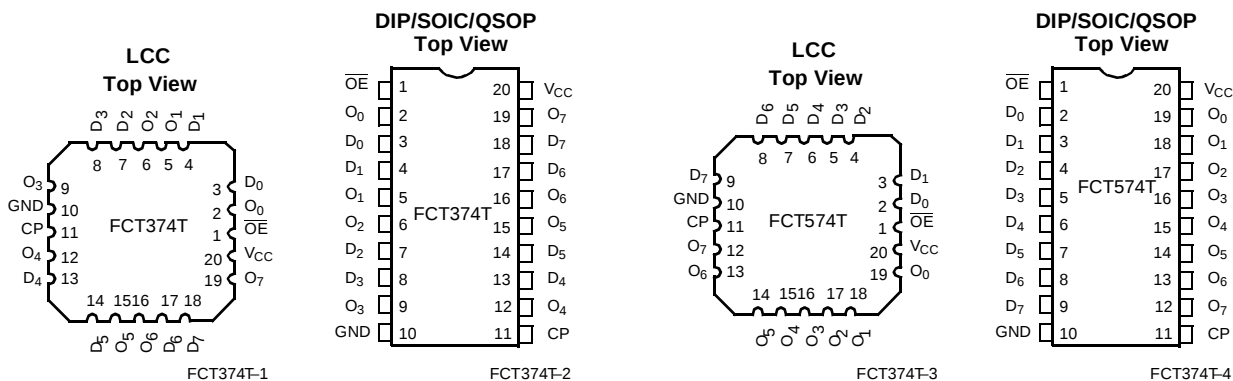
### Features

- Function, pinout, and drive compatible with FCT and F logic
- FCT-C speed at 5.2 ns max. (Com'l)  
FCT-A speed at 6.5 ns max. (Com'l)
- Reduced  $V_{OH}$  (typically = 3.3V) versions of equivalent FCT functions
- Edge-rate control circuitry for significantly improved noise characteristics
- Power-off disable feature
- Matched rise and fall times
- Fully compatible with TTL input and output logic levels
- ESD > 2000V
- Extended commercial range of  $-40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$
- Sink Current 64 mA (Com'l), 32 mA (Mil)  
Source Current 32 mA (Com'l), 12 mA (Mil)
- Edge-triggered D-type inputs
- 250 MHz typical toggle rate

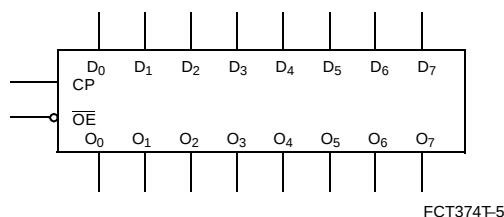
### Logic Block Diagram



### Pin Configurations



### Logic Symbol



## Functional Description

The FCT374T and FCT574T are high-speed low-power octal D-type flip-flops featuring separate D-type inputs for each flip-flop. Both devices have three-state outputs for bus oriented applications. A buffered clock (CP) and output enable ( $\overline{OE}$ ) are common to all flip-flops. The FCT574T is identical to FCT374T except for flow-through pinout to simplify board design. The eight flip-flops contained in the FCT374T and FCT574T will store the state of their individual D inputs that meet the set-up and hold time requirements on the LOW-to-HIGH clock (CP) transition. When  $\overline{OE}$  is LOW, the contents of the eight flip-flops are available at the outputs. When  $\overline{OE}$  is HIGH, the outputs will be in the high-impedance state. The state of output enable does not affect the state of the flip-flops.

The outputs are designed with a power-off disable feature to allow for live insertion of boards.

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

| Inputs |              |    | Outputs |
|--------|--------------|----|---------|
| D      | CP           | OE | O       |
| H      | $\downarrow$ | L  | H       |
| L      | $\downarrow$ | L  | L       |
| X      | X            | H  | Z       |

## Maximum Ratings<sup>[2, 3]</sup>

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

|                                                    |                                       |
|----------------------------------------------------|---------------------------------------|
| Storage Temperature .....                          | -65°C to +150°C                       |
| Ambient Temperature with Power Applied .....       | -65°C to +135°C                       |
| Supply Voltage to Ground Potential .....           | -0.5V to +7.0V                        |
| DC Input Voltage .....                             | -0.5V to +7.0V                        |
| DC Output Voltage .....                            | -0.5V to +7.0V                        |
| DC Output Current (Maximum Sink Current/Pin) ..... | 120 mA                                |
| Power Dissipation.....                             | 0.5W                                  |
| Static Discharge Voltage .....                     | >2001V (per MIL-STD-883, Method 3015) |

## Operating Range

| Range                   | Range     | Ambient Temperature | V <sub>CC</sub> |
|-------------------------|-----------|---------------------|-----------------|
| Commercial              | DT        | 0°C to +70°C        | 5V ± 5%         |
| Commercial              | T, AT, CT | -40°C to +85°C      | 5V ± 5%         |
| Military <sup>[4]</sup> | All       | -55°C to +125°C     | 5V ± 10%        |

## Electrical Characteristics Over the Operating Range

| 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> =-32 mA          | Com'l | 2.0                 |      | V      |
|                  |                                             | V <sub>CC</sub> =Min., I <sub>OH</sub> =-15 mA          | Com'l | 2.4                 | 3.3  | V      |
|                  |                                             | V <sub>CC</sub> =Min., I <sub>OH</sub> =-12 mA          | Mil   | 2.4                 | 3.3  | V      |
| V <sub>OL</sub>  | Output LOW Voltage                          | V <sub>CC</sub> =Min., I <sub>OL</sub> =64 mA           | Com'l |                     | 0.3  | 0.55 V |
|                  |                                             | V <sub>CC</sub> =Min., I <sub>OL</sub> =32 mA           | Mil   |                     | 0.3  | 0.55 V |
| V <sub>IH</sub>  | Input HIGH Voltage                          |                                                         | 2.0   |                     |      | V      |
| V <sub>IL</sub>  | Input LOW Voltage                           |                                                         |       |                     | 0.8  | V      |
| V <sub>H</sub>   | Hysteresis <sup>[6]</sup>                   | All inputs                                              |       | 0.2                 |      | V      |
| 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>I</sub>   | Input HIGH Current                          | V <sub>CC</sub> =Max., V <sub>IN</sub> =V <sub>CC</sub> |       |                     | 5    | μA     |
| I <sub>IH</sub>  | Input HIGH Current                          | V <sub>CC</sub> =Max., V <sub>IN</sub> =2.7V            |       |                     | ±1   | μA     |
| I <sub>IL</sub>  | Input LOW Current                           | V <sub>CC</sub> =Max., V <sub>IN</sub> =0.5V            |       |                     | ±1   | μA     |
| I <sub>OZH</sub> | Off State HIGH-Level Output Current         | V <sub>CC</sub> = Max., V <sub>OUT</sub> = 2.7V         |       |                     | 10   | μA     |
| I <sub>OZL</sub> | Off State LOW-Level Output Current          | V <sub>CC</sub> = Max., V <sub>OUT</sub> = 0.5V         |       |                     | -10  | μA     |
| I <sub>OS</sub>  | Output Short Circuit Current <sup>[7]</sup> | V <sub>CC</sub> =Max., V <sub>OUT</sub> =0.0V           | -60   | -120                | -225 | mA     |
| I <sub>OFF</sub> | Power-Off Disable                           | V <sub>CC</sub> =0V, V <sub>OUT</sub> =4.5V             |       |                     | ±1   | μA     |

### Notes:

- H = HIGH Voltage Level. L = LOW Voltage Level X = Don't Care Z = HIGH Impedance = LOW-to-HIGH clock transition
- 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.
- T<sub>A</sub> is the "instant on" case temperature.
- Typical values are at V<sub>CC</sub>=5.0V, T<sub>A</sub>=+25°C ambient.
- This parameter is guaranteed 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 parameters tests. In any sequence of parameter tests, I<sub>OS</sub> tests should be performed last.

## Capacitance<sup>[2]</sup>

| Parameter        | Description        | Typ. <sup>[5]</sup> | Max. | Unit |
|------------------|--------------------|---------------------|------|------|
| C <sub>IN</sub>  | Input Capacitance  | 5                   | 10   | pF   |
| C <sub>OUT</sub> | Output Capacitance | 9                   | 12   | pF   |

## Power Supply Characteristics

| Parameter        | Description                                      | Test Conditions                                                                                                                                                                                               | Typ. <sup>[5]</sup> | Max.                 | Unit   |
|------------------|--------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|----------------------|--------|
| I <sub>CC</sub>  | Quiescent Power Supply Current                   | V <sub>CC</sub> =Max., V <sub>IN</sub> ≤0.2V, V <sub>IN</sub> ≥V <sub>CC</sub> -0.2V                                                                                                                          | 0.1                 | 0.2                  | mA     |
| ΔI <sub>CC</sub> | Quiescent Power Supply Current (TTL inputs HIGH) | V <sub>CC</sub> =Max., V <sub>IN</sub> =3.4V, <sup>[8]</sup><br>f <sub>1</sub> =0, Outputs Open                                                                                                               | 0.5                 | 2.0                  | mA     |
| I <sub>CCD</sub> | Dynamic Power Supply Current <sup>[9]</sup>      | V <sub>CC</sub> =Max., One Bit Toggling,<br>50% Duty Cycle, Outputs Open,<br>OE=GND, V <sub>IN</sub> ≤0.2V or V <sub>IN</sub> ≥V <sub>CC</sub> -0.2V                                                          | 0.06                | 0.12                 | mA/MHz |
| I <sub>C</sub>   | Total Power Supply Current <sup>[10]</sup>       | V <sub>CC</sub> =Max., f <sub>0</sub> =10 MHz,<br>50% Duty Cycle, Outputs Open,<br>One Bit Toggling at f <sub>1</sub> =5 MHz,<br>OE=GND, V <sub>IN</sub> ≤0.2V or V <sub>IN</sub> ≥V <sub>CC</sub> -0.2V      | 0.7                 | 1.4                  | mA     |
|                  |                                                  | V <sub>CC</sub> =Max., f <sub>0</sub> =10 MHz,<br>50% Duty Cycle, Outputs Open,<br>One Bit Toggling at f <sub>1</sub> =5 MHz,<br>OE=GND, V <sub>IN</sub> =3.4V or V <sub>IN</sub> =GND                        | 1.2                 | 3.4                  | mA     |
|                  |                                                  | V <sub>CC</sub> =Max., f <sub>0</sub> =10 MHz,<br>50% Duty Cycle, Outputs Open,<br>Eight Bits Toggling at f <sub>1</sub> =2.5 MHz,<br>OE=GND, V <sub>IN</sub> ≤0.2V or V <sub>IN</sub> ≥V <sub>CC</sub> -0.2V | 1.6                 | 3.2 <sup>[11]</sup>  | mA     |
|                  |                                                  | V <sub>CC</sub> =Max., f <sub>0</sub> =10 MHz,<br>50% Duty Cycle, Outputs Open,<br>Eight Bits Toggling at f <sub>1</sub> =2.5 MHz,<br>OE=GND, V <sub>IN</sub> =3.4V or V <sub>IN</sub> =GND                   | 3.9                 | 12.2 <sup>[11]</sup> | mA     |

### Notes:

8. Per TTL driven input (V<sub>IN</sub>=3.4V); all other inputs at V<sub>CC</sub> or GND.
9. This parameter is not directly testable, but is derived for use in Total Power Supply calculations.
10. I<sub>C</sub> = I<sub>QUIESCENT</sub> + I<sub>INPUTS</sub> + I<sub>DYNAMIC</sub>  
I<sub>C</sub> = I<sub>CC</sub> + ΔI<sub>CC</sub>D<sub>H</sub>N<sub>T</sub> + I<sub>CCD</sub>(f<sub>0</sub>/2 + f<sub>1</sub>N<sub>1</sub>)  
I<sub>CC</sub> = Quiescent Current with CMOS input levels  
ΔI<sub>CC</sub> = Power Supply Current for a TTL HIGH input (V<sub>IN</sub>=3.4V)  
D<sub>H</sub> = Duty Cycle for TTL inputs HIGH  
N<sub>T</sub> = Number of TTL inputs at D<sub>H</sub>  
I<sub>CCD</sub> = Dynamic Current caused by an input transition pair (HLH or LHL)  
f<sub>0</sub> = Clock frequency for registered devices, otherwise zero  
f<sub>1</sub> = Input signal frequency  
N<sub>1</sub> = Number of inputs changing at f<sub>1</sub>  
All currents are in milliamps and all frequencies are in megahertz.
11. Values for these conditions are examples of the I<sub>CC</sub> formula. These limits are guaranteed but not tested.

**Switching Characteristics<sup>[12]</sup>** Over the Operating Range

| Parameter                            | Description                                         | FCT374T/FCT574T |      |            |      | FCT374AT/FCT574AT |      |            |      | Unit | Fig. No. <sup>[13]</sup> |
|--------------------------------------|-----------------------------------------------------|-----------------|------|------------|------|-------------------|------|------------|------|------|--------------------------|
|                                      |                                                     | Military        |      | Commercial |      | Military          |      | Commercial |      |      |                          |
|                                      |                                                     | Min.            | Max. | Min.       | Max. | Min.              | Max. | Min.       | Max. |      |                          |
| t <sub>PLH</sub><br>t <sub>PHL</sub> | Propagation Delay<br>Clock to Output                | 2.0             | 11.0 | 2.0        | 10.0 | 2.0               | 7.2  | 2.0        | 6.5  | ns   | 1, 5                     |
| t <sub>PZH</sub><br>t <sub>PZL</sub> | Output Enable Time                                  | 1.5             | 14.0 | 1.5        | 12.5 | 1.5               | 7.5  | 1.5        | 6.5  | ns   | 1, 7, 8                  |
| t <sub>PHZ</sub><br>t <sub>PLZ</sub> | Output Disable<br>Time                              | 1.5             | 8.0  | 1.5        | 8.0  | 1.5               | 6.5  | 1.5        | 5.5  | ns   | 1, 7, 8                  |
| t <sub>S</sub>                       | Set–Up Time<br>HIGH or LOW<br>D to CP               | 2.0             |      | 2.0        |      | 2.0               |      | 2.0        |      | ns   | 4                        |
| t <sub>H</sub>                       | Hold Time<br>HIGH or LOW<br>D to CP                 | 1.5             |      | 1.5        |      | 1.5               |      | 1.5        |      | ns   | 4                        |
| t <sub>W</sub>                       | Clock Pulse<br>Width <sup>[14]</sup> HIGH or<br>LOW | 7.0             |      | 7.0        |      | 6.0               |      | 5.0        |      | ns   | 5                        |

| Parameter                            | Description                                   | FCT374CT/FCT574CT |      |            |      | FCT374DT/<br>FCT574DT |      | Unit | Fig. No. <sup>[13]</sup> |
|--------------------------------------|-----------------------------------------------|-------------------|------|------------|------|-----------------------|------|------|--------------------------|
|                                      |                                               | Military          |      | Commercial |      | Commercial            |      |      |                          |
|                                      |                                               | Min.              | Max. | Min.       | Max. | Min.                  | Max. |      |                          |
| t <sub>PLH</sub><br>t <sub>PHL</sub> | Propagation Delay Clock to Output             | 2.0               | 6.2  | 2.0        | 5.2  | 2.0                   | 4.2  | ns   | 1, 5                     |
| t <sub>PZH</sub><br>t <sub>PZL</sub> | Output Enable Time                            | 1.5               | 6.2  | 1.5        | 5.5  | 1.5                   | 4.8  | ns   | 1, 7, 8                  |
| t <sub>PHZ</sub><br>t <sub>PLZ</sub> | Output Disable Time                           | 1.5               | 5.7  | 1.5        | 5.0  | 1.5                   | 4.0  | ns   | 1, 7, 8                  |
| t <sub>S</sub>                       | Set-Up Time, HIGH or LOW D to CP              | 2.0               |      | 2.0        |      | 2.0                   |      | ns   | 4                        |
| t <sub>H</sub>                       | Hold Time, HIGH or LOW D to CP                | 1.5               |      | 1.5        |      | 1.5                   |      | ns   | 4                        |
| t <sub>W</sub>                       | Clock Pulse Width <sup>[14]</sup> HIGH or LOW | 6.0               |      | 5.0        |      | 3.0                   |      | ns   | 5                        |

Shaded areas contain preliminary information.

**Notes:**

12. Minimum limits are guaranteed but not tested on Propagation Delays.
13. See "Parameter Measurement Information" in the General Information section.
14. With one data channel toggling, t<sub>W</sub>(L)=t<sub>W</sub>(H)=4.0 ns and t<sub>r</sub>=t<sub>f</sub>=1.0 ns.



**Ordering Information—FCT374T**

| Speed (ns) | Ordering Code   | Package Name | Package Type                         | Operating Range |
|------------|-----------------|--------------|--------------------------------------|-----------------|
| 4.2        | CY74FCT374DTQC  | Q5           | 20-Lead (150-Mil) QSOP               | Commercial      |
|            | CY74FCT374DTSOC | S5           | 20-Lead (300-Mil) Molded SOIC        |                 |
| 5.2        | CY74FCT374CTQC  | Q5           | 20-Lead (150-Mil) QSOP               | Commercial      |
|            | CY74FCT374CTSOC | S5           | 20-Lead (300-Mil) Molded SOIC        |                 |
| 6.2        | CY54FCT374CTDMB | D6           | 20-Lead (300-Mil) CerDIP             | Military        |
|            | CY54FCT374CTLMB | L61          | 20-Pin Square Leadless Chip Carrier  |                 |
| 6.5        | CY74FCT374ATPC  | P5           | 20-Lead (300-Mil) Molded DIP         | Commercial      |
|            | CY74FCT374ATQC  | Q5           | 20-Lead (150-Mil) QSOP               |                 |
|            | CY74FCT374ATSOC | S5           | 20-Lead (300-Mil) Molded SOIC        |                 |
| 7.2        | CY54FCT374ATLMB | L61          | 20-Pin Square Leadless Chip Carrier  | Military        |
| 10.0       | CY74FCT374TQC   | Q5           | 20-Lead (150-Mil) QSOP               | Commercial      |
|            | CY74FCT374TSOC  | S5           | 20-Lead (300-Mil) Molded SOIC        |                 |
| 11.0       | CY54FCT374TDMB  | D6           | 20-Lead (300-Mil) CerDIP             | Military        |
|            | CY54FCT374TLMB  | L61          | 20-Pin Square Leadless Chip Carrier- |                 |

**Ordering Information—FCT574T**

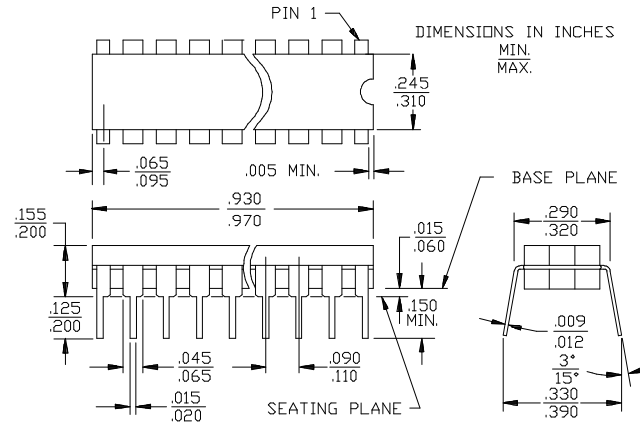
| Speed (ns) | Ordering Code   | Package Name | Package Type                  | Operating Range |
|------------|-----------------|--------------|-------------------------------|-----------------|
| 4.2        | CY74FCT574DTQC  | Q5           | 20-Lead (150-Mil) QSOP        | Commercial      |
|            | CY74FCT574DTSOC | S5           | 20-Lead (300-Mil) Molded SOIC |                 |
| 5.2        | CY74FCT574CTQC  | Q5           | 20-Lead (150-Mil) QSOP        | Commercial      |
|            | CY74FCT574CTSOC | S5           | 20-Lead (300-Mil) Molded SOIC |                 |
| 6.2        | CY54FCT574CTDMB | D6           | 20-Lead (300-Mil) CerDIP      | Military        |
| 6.5        | CY74FCT574ATPC  | P5           | 20-Lead (300-Mil) Molded DIP  | Commercial      |
|            | CY74FCT574ATQC  | Q5           | 20-Lead (150-Mil) QSOP        |                 |
|            | CY74FCT574ATSOC | S5           | 20-Lead (300-Mil) Molded SOIC |                 |
| 7.2        | CY54FCT574ATDMB | D6           | 20-Lead (300-Mil) CerDIP      | Military        |
| 10.0       | CY74FCT574TQC   | Q5           | 20-Lead (150-Mil) QSOP        | Commercial      |
|            | CY74FCT574TSOC  | S5           | 20-Lead (300-Mil) Molded SOIC |                 |
| 11.0       | CY54FCT574TDMB  | D6           | 20-Lead (300-Mil) CerDIP      | Military        |

Shaded areas contain preliminary information.

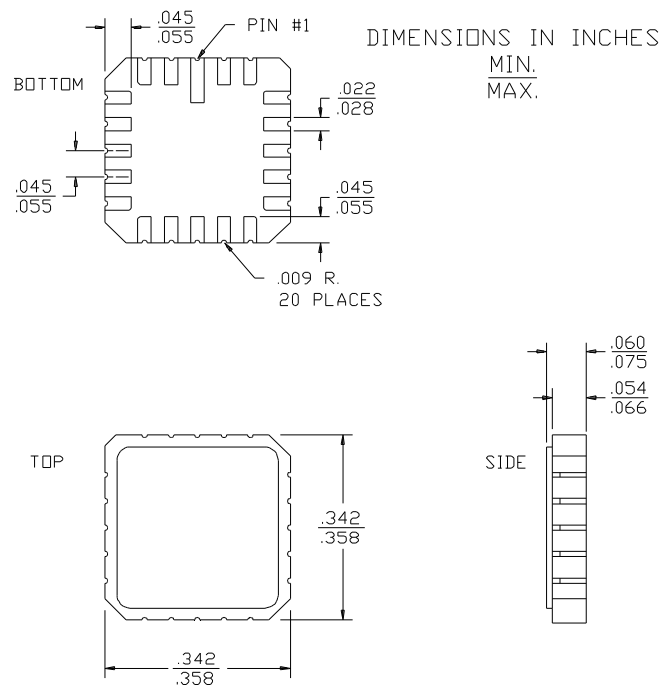
Document #: 38-00278-B

## Package Diagrams

**20-Lead (300-Mil) CerDIP D6**  
MIL-STD-1835 D-8Config.A

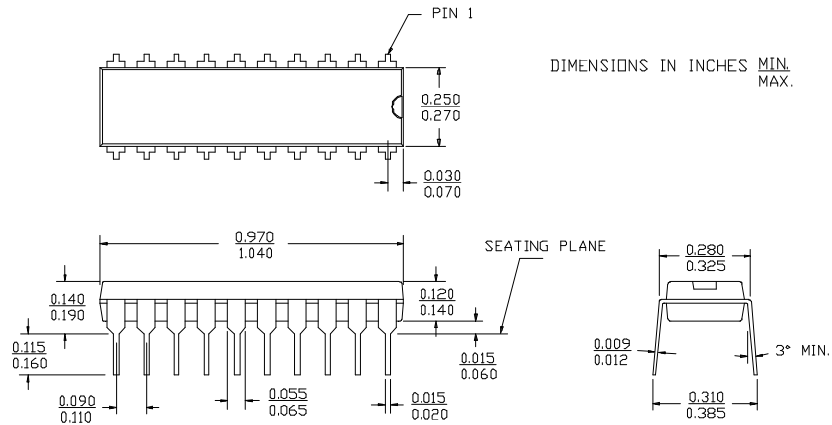


**20-Pin Square Leadless Chip Carrier L61**  
MIL-STD-1835 C-2A

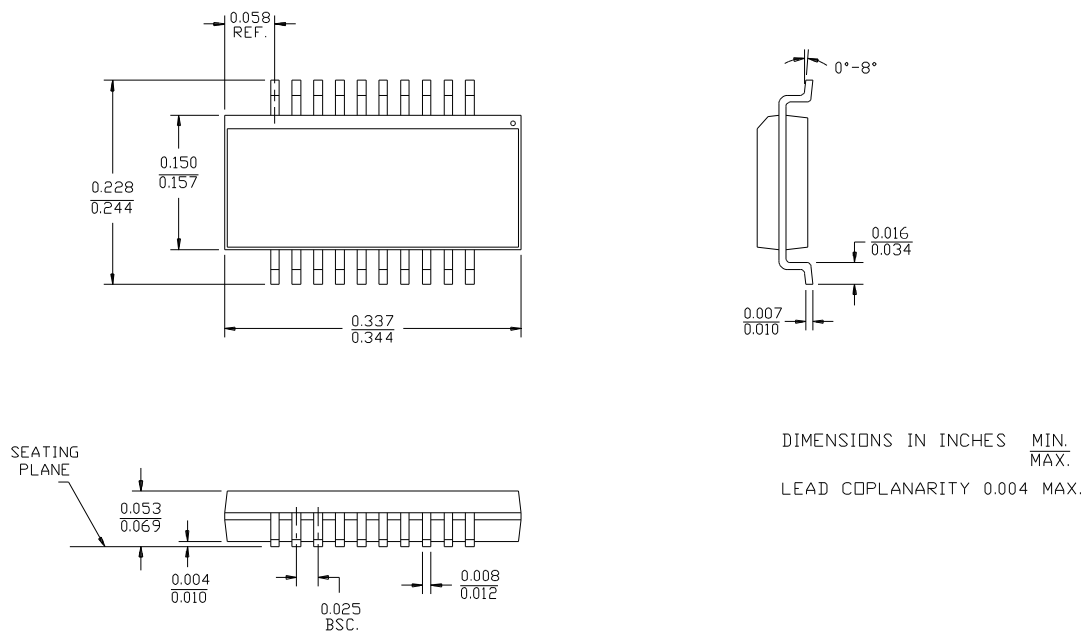


**Package Diagrams (continued)**

**20-Lead (300-Mil) Molded DIP P5**



**20-Lead Quarter Size Outline Q5**



**Package Diagrams** (continued)

**20-Lead (300-Mil) Molded SOIC S5**

