

## 100302 Low Power Quint 2-Input OR/NOR Gate

### General Description

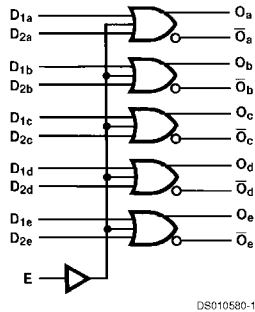
The 100302 is a monolithic quint 2-input OR/NOR gate with common enable. All inputs have 50 kΩ pull-down resistors and all outputs are buffered.

- 2000V ESD protection
- Pin/function compatible with 100102
- Voltage compensated operating range = -4.2V to -5.7V
- Available to MIL-STD-883
- Available to industrial grade temperature range

### Features

- 43% power reduction of the 100102

### Ordering Code: Logic Symbol



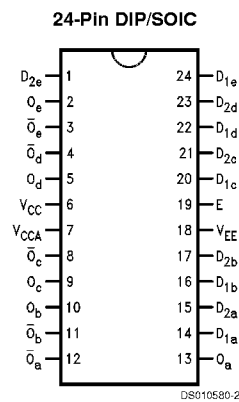
| Pin Names             | Description                |
|-----------------------|----------------------------|
| $D_{na}-D_{ne}$       | Data Inputs                |
| E                     | Enable Input               |
| $O_a-O_e$             | Data Outputs               |
| $\bar{O}_a-\bar{O}_e$ | Complementary Data Outputs |

### Truth Table

| $D_{1x}$ | $D_{2x}$ | E | $O_x$ | $\bar{O}_x$ |
|----------|----------|---|-------|-------------|
| L        | L        | L | L     | H           |
| L        | L        | H | H     | L           |
| L        | H        | L | H     | L           |
| L        | H        | H | H     | L           |
| H        | L        | L | H     | L           |
| H        | L        | H | H     | L           |
| H        | H        | L | H     | L           |
| H        | H        | H | H     | L           |

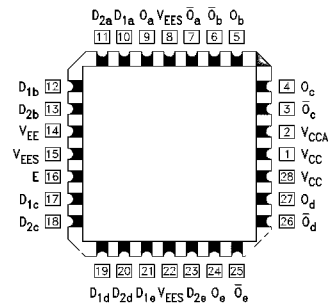
H = HIGH Voltage Level  
L = LOW Voltage Level

### Connection Diagrams

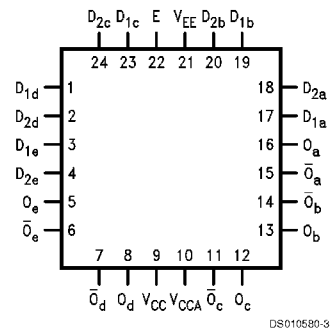


## Connection Diagrams (Continued)

### 28-Pin PCC



### 24-Pin Quad Cerpak



## Absolute Maximum Ratings (Note 1)

Above which the useful life may be impaired

|  |                   |
|--|-------------------|
| Storage Temperature ( $T_{STG}$ )      | -65°C to +150°C   |
| Maximum Junction Temperature ( $T_J$ ) |                   |
| Ceramic                                | +175°C            |
| Plastic                                | +150°C            |
| $V_{EE}$ Pin Potential to Ground Pin   | -7.0V to +0.5V    |
| Input Voltage (DC)                     | $V_{EE}$ to +0.5V |
| Output Current (DC Output HIGH)        | -50 mA            |
| ESD (Note 2)                           | ≥2000V            |

## Recommended Operating Conditions

|                             |                 |
|-----------------------------|-----------------|
| Case Temperature ( $T_C$ )  |                 |
| Commercial                  | 0°C to +85°C    |
| Industrial                  | -40°C to +85°C  |
| Military                    | -55°C to +125°C |
| Supply Voltage ( $V_{EE}$ ) | -5.7V to -4.2V  |

**Note 1:** Absolute maximum ratings are those values beyond which the device may be damaged or have its useful life impaired. Functional operation under these conditions is not implied.

**Note 2:** ESD testing conforms to MIL-STD-883, Method 3015.

## Commercial Version DC Electrical Characteristics

$V_{EE} = -4.2V$  to  $-5.7V$ ,  $V_{CC} = V_{CCA} = GND$ ,  $T_C = 0^\circ C$  to  $+85^\circ C$  (Note 3)

| Symbol    | Parameter            | Min   | Typ   | Max   | Units | Conditions                              |                           |
|-----------|----------------------|-------|-------|-------|-------|---|---------------------------|
| $V_{OH}$  | Output HIGH Voltage  | -1025 | -955  | -870  | mV    | $V_{IN} = V_{IH(Max)}$ or $V_{IL(Min)}$ | Loading with 50Ω to -2.0V |
| $V_{OL}$  | Output LOW Voltage   | -1830 | -1705 | -1620 | mV    |   |                           |
| $V_{OHC}$ | Output HIGH Voltage  | -1035 |       |       | mV    | $V_{IN} = V_{IH(Min)}$ or $V_{IL(Max)}$ | Loading with 50Ω to -2.0V |
| $V_{OLC}$ | Output LOW Voltage   |       |       | -1610 | mV    |   |                           |
| $V_{IH}$  | Input HIGH Voltage   | -1165 |       | -870  | mV    | Guaranteed HIGH Signal for All Inputs   |                           |
| $V_{IL}$  | Input LOW Voltage    | -1830 |       | -1475 | mV    | Guaranteed LOW Signal for All Inputs    |                           |
| $I_{IL}$  | Input LOW Current    | 0.50  |       |       | μA    | $V_{IN} = V_{IL(Min)}$                  |                           |
| $I_{IH}$  | Input HIGH Current   |       |       | 240   | μA    | $V_{IN} = V_{IH(Max)}$                  |                           |
| $I_{EE}$  | Power Supply Current | -45   | -36   | -20   | mA    | Inputs Open                             |                           |

**Note 3:** The specified limits represent the "worst case" value for the parameter. Since these values normally occur at the temperature extremes, additional noise immunity and guardbanding can be achieved by decreasing the allowable system operating ranges. Conditions for testing shown in the tables are chosen to guarantee operation under "worst case" conditions.

## DIP AC Electrical Characteristics

$V_{EE} = -4.2V$  to  $-5.7V$ ,  $V_{CC} = V_{CCA} = GND$

| Symbol    | Parameter              | $T_C = 0^\circ C$ |      | $T_C = +25^\circ C$ |      | $T_C = +85^\circ C$ |      | Units | Conditions               |
|-----------|------------------------|-------------------|------|---------------------|------|---------------------|------|-------|--------------------------|
|           |                        | Min               | Max  | Min                 | Max  | Min                 | Max  |       |                          |
| $t_{PLH}$ | Propagation Delay      | 0.50              | 1.15 | 0.50                | 1.15 | 0.50                | 1.25 | ns    | Figures 1, 2<br>(Note 4) |
| $t_{PHL}$ | Data to Output         |                   |      |                     |      |                     |      |       |                          |
| $t_{PLH}$ | Propagation Delay      | 0.70              | 1.90 | 0.70                | 1.90 | 0.80                | 2.00 | ns    | Figures 1, 2             |
| $t_{PHL}$ | Enable to Output       |                   |      |                     |      |                     |      |       |                          |
| $t_{TLH}$ | Transition Time        | 0.40              | 1.20 | 0.40                | 1.20 | 0.40                | 1.20 | ns    | Figures 1, 2             |
| $t_{THL}$ | 20% to 80%, 80% to 20% |                   |      |                     |      |                     |      |       |                          |

**Note 4:** The propagation delay specified is for single output switching. Delays may vary up to 100 ps with multiple outputs switching.

## SOIC, PCC and Cerpak AC Electrical Characteristics

$V_{EE} = -4.2V$  to  $-5.7V$ ,  $V_{CC} = V_{CCA} = GND$

| Symbol    | Parameter              | $T_C = 0^\circ C$ |      | $T_C = +25^\circ C$ |      | $T_C = +85^\circ C$ |      | Units | Conditions               |
|-----------|------------------------|-------------------|------|---------------------|------|---------------------|------|-------|--------------------------|
|           |                        | Min               | Max  | Min                 | Max  | Min                 | Max  |       |                          |
| $t_{PLH}$ | Propagation Delay      | 0.50              | 1.05 | 0.50                | 1.05 | 0.50                | 1.15 | ns    | Figures 1, 2<br>(Note 6) |
| $t_{PHL}$ | Data to Output         |                   |      |                     |      |                     |      |       |                          |
| $t_{PLH}$ | Propagation Delay      | 0.70              | 1.80 | 0.70                | 1.80 | 0.80                | 1.90 | ns    | Figures 1, 2             |
| $t_{PHL}$ | Enable to Output       |                   |      |                     |      |                     |      |       |                          |
| $t_{TLH}$ | Transition Time        | 0.40              | 1.10 | 0.40                | 1.10 | 0.40                | 1.10 | ns    | Figures 1, 2             |
| $t_{THL}$ | 20% to 80%, 80% to 20% |                   |      |                     |      |                     |      |       |                          |

## SOIC, PCC and Cerpak AC Electrical Characteristics (Continued)

$V_{EE} = -4.2V$  to  $-5.7V$ ,  $V_{CC} = V_{CCA} = GND$

| Symbol     | Parameter   | $T_C = 0^\circ C$ |     | $T_C = +25^\circ C$ |     | $T_C = +85^\circ C$ |     | Units | Conditions           |
|------------|---|-------------------|-----|---------------------|-----|---------------------|-----|-------|----------------------|
|            |   | Min               | Max | Min                 | Max | Min                 | Max |       |                      |
| $t_{OSHL}$ | Maximum Skew Common Edge<br>Output-to-Output Variation<br>Data to Output Path     |                   | 250 |                     | 250 |                     | 250 | ps    | PCC Only<br>(Note 5) |
| $t_{OSHL}$ | Maximum Skew Common Edge<br>Output-to-Output Variation<br>Enable to Output Path   |                   | 310 |                     | 310 |                     | 310 | ps    | PCC Only<br>(Note 5) |
| $t_{OSLH}$ | Maximum Skew Common Edge<br>Output-to-Output Variation<br>Data to Output Path     |                   | 200 |                     | 200 |                     | 200 | ps    | PCC Only<br>(Note 5) |
| $t_{OSLH}$ | Maximum Skew Common Edge<br>Output-to-Output Variation<br>Enable to Output Path   |                   | 330 |                     | 330 |                     | 330 | ps    | PCC Only<br>(Note 5) |
| $t_{OST}$  | Maximum Skew Opposite Edge<br>Output-to-Output Variation<br>Data to Output Path   |                   | 250 |                     | 250 |                     | 250 | ps    | PCC Only<br>(Note 5) |
| $t_{OST}$  | Maximum Skew Opposite Edge<br>Output-to-Output Variation<br>Enable to Output Path |                   | 330 |                     | 330 |                     | 330 | ps    | PCC Only<br>(Note 5) |
| $t_{PS}$   | Maximum Skew<br>Pin (Signal) Transition Variation<br>Data to Output Path          |                   | 200 |                     | 200 |                     | 200 | ps    | PCC Only<br>(Note 5) |
| $t_{PS}$   | Maximum Skew<br>Pin (Signal) Transition Variation<br>Enable to Output Path        |                   | 280 |                     | 280 |                     | 280 | ps    | PCC Only<br>(Note 5) |

**Note 5:** Output-to-Output Skew is defined as the absolute value of the difference between the actual propagation delay for any outputs within the same packaged device. The specifications apply to any outputs switching in the same direction either HIGH to LOW ( $t_{OSHL}$ ), or LOW to HIGH ( $t_{OSLH}$ ), or in opposite directions both HL and LH ( $t_{OST}$ ). Parameters  $t_{OST}$  and  $t_{PS}$  guaranteed by design.

**Note 6:** The propagation delay specified is for single output switching. Delays may vary up to 100 ps with multiple outputs switching.

## Industrial Version PCC DC Electrical Characteristics

$V_{EE} = -4.2V$  to  $-5.7V$ ,  $V_{CC} = V_{CCA} = GND$ ,  $T_C = -40^\circ C$  to  $+85^\circ C$  (Note 7)

| Symbol    | Parameter               | $T_C = -40^\circ C$ |       | $T_C = 0^\circ C$ to $+85^\circ C$ |       | Units | Conditions                                 |                                |
|-----------|-------------------------|---------------------|-------|------------------------------------|-------|-------|--|--------------------------------|
|           |                         | Min                 | Max   | Min                                | Max   |       |  |                                |
| $V_{OH}$  | Output HIGH Voltage     | -1085               | -870  | -1025                              | -870  | mV    | $V_{IN} = V_{IH(Max)}$<br>or $V_{IL(Min)}$ | Loading with<br>50Ω to $-2.0V$ |
| $V_{OL}$  | Output LOW Voltage      | -1830               | -1575 | -1830                              | -1620 |       |  |                                |
| $V_{OHC}$ | Output HIGH Voltage     | -1095               |       | -1035                              |       | mV    | $V_{IN} = V_{IH(Min)}$<br>or $V_{IL(Max)}$ | Loading with<br>50Ω to $-2.0V$ |
| $V_{OLC}$ | Output LOW Voltage      |                     | -1565 |                                    | -1610 |       |  |                                |
| $V_{IH}$  | Input HIGH Voltage      | -1170               | -870  | -1165                              | -870  | mV    | Guaranteed HIGH Signal for ALL Inputs      |                                |
| $V_{IL}$  | Input LOW Voltage       | -1830               | -1480 | -1830                              | -1475 | mV    | Guaranteed LOW Signal for ALL Inputs       |                                |
| $I_{IL}$  | Input LOW Current       | 0.05                |       | 0.05                               |       | μA    | $V_{IN} = V_{IL(Min)}$                     |                                |
| $I_{IH}$  | Input HIGH Current      |                     | 300   |                                    | 240   | μA    | $V_{IN} = V_{IH(Max)}$                     |                                |
| $I_{EE}$  | Power Supply<br>Current | -45                 | -20   | -45                                | -20   | mA    | Inputs Open                                |                                |

**Note 7:** The specified limits represent the "worst case" value for the parameter. Since these values normally occur at the temperature extremes, additional noise immunity and guardbanding can be achieved by decreasing the allowable system operating ranges. Conditions for testing shown in the tables are chosen to guarantee operation under the "worst case" conditions.

## PCC AC Electrical Characteristics

$V_{EE} = -4.2V$  to  $-5.7V$ ,  $V_{CC} = V_{CCA} = GND$

| Symbol                 | Parameter                                 | $T_C = -40^\circ C$ |      | $T_C = +25^\circ C$ |      | $T_C = +85^\circ C$ |      | Units | Conditions               |
|------------------------|---|---------------------|------|---------------------|------|---------------------|------|-------|--------------------------|
|                        |   | Min                 | Max  | Min                 | Max  | Min                 | Max  |       |                          |
| $t_{PLH}$<br>$t_{PHL}$ | Propagation Delay<br>Data to Output       | 0.40                | 1.05 | 0.50                | 1.05 | 0.50                | 1.15 | ns    | Figures 1, 2<br>(Note 8) |
| $t_{PLH}$<br>$t_{PHL}$ | Propagation Delay<br>Enable to Output     | 0.70                | 1.80 | 0.70                | 1.80 | 0.80                | 1.90 | ns    |                          |
| $t_{TLH}$<br>$t_{THL}$ | Transition Time<br>20% to 80%, 80% to 20% | 0.30                | 1.10 | 0.40                | 1.10 | 0.40                | 1.10 | ns    | Figures 1, 2             |

**Note 8:** The propagation delay specified is for single output switching. Delays may vary up to 200 ps with multiple outputs switching.

## Military Version DC Electrical Characteristics

$V_{EE} = -4.2V$  to  $-5.7V$ ,  $V_{CC} = V_{CCA} = GND$ ,  $T_C = -55^\circ C$  to  $+125^\circ C$  (Note 11)

| Symbol    | Parameter            | Min   | Max   | Units   | $T_C$                           | Conditions                                  | Notes                                 |                      |
|-----------|----------------------|-------|-------|---------|---------------------------------|---|---------------------------------------|----------------------|
| $V_{OH}$  | Output HIGH Voltage  | -1025 | -870  | mV      | $0^\circ C$ to $+125^\circ C$   | $V_{IN} = V_{IH(Max)}$<br>or $V_{IL} (Min)$ | Loading with<br>$50\Omega$ to $-2.0V$ | (Notes 9,<br>10, 11) |
|           |                      | -1085 | -870  | mV      | $-55^\circ C$                   |   |                                       |                      |
| $V_{OL}$  | Output LOW Voltage   | -1830 | -1620 | mV      | $0^\circ C$ to $+125^\circ C$   | $V_{IN} = V_{IH(Max)}$<br>or $V_{IL} (Min)$ | Loading with<br>$50\Omega$ to $-2.0V$ | (Notes 9,<br>10, 11) |
|           |                      | -1830 | -1555 | mV      | $-55^\circ C$                   |   |                                       |                      |
| $V_{OHC}$ | Output HIGH Voltage  | -1035 |       | mV      | $0^\circ C$ to $+125^\circ C$   | $V_{IN} = V_{IH(Max)}$<br>or $V_{IL} (Min)$ | Loading with<br>$50\Omega$ to $-2.0V$ | (Notes 9,<br>10, 11) |
|           |                      | -1085 |       | mV      | $-55^\circ C$                   |   |                                       |                      |
| $V_{OLC}$ | Output LOW Voltage   |       | -1610 | mV      | $0^\circ C$ to $+125^\circ C$   | $V_{IN} = V_{IH(Max)}$<br>or $V_{IL} (Min)$ | Loading with<br>$50\Omega$ to $-2.0V$ | (Notes 9,<br>10, 11) |
|           |                      |       | -1555 | mV      | $-55^\circ C$                   |   |                                       |                      |
| $V_{IH}$  | Input HIGH Voltage   | -1165 | -870  | mV      | $-55^\circ C$ to $+125^\circ C$ | Guaranteed HIGH Signal<br>for All Inputs    | (Notes 9,<br>10, 11, 12)              |                      |
| $V_{IL}$  | Input LOW Voltage    | -1830 | -1475 | mV      | $-55^\circ C$ to $+125^\circ C$ | Guaranteed LOW Signal<br>for All Inputs     | (Notes 9,<br>10, 11, 12)              |                      |
| $I_{IL}$  | Input LOW Current    | 0.50  |       | $\mu A$ | $-55^\circ C$ to $+125^\circ C$ | $V_{EE} = -4.2V$<br>$V_{IN} = V_{IH} (Max)$ | (Notes 9,<br>10, 11)                  |                      |
| $I_{IH}$  | Input HIGH Current   |       | 240   | $\mu A$ | $0^\circ C$ to $+125^\circ C$   | $V_{EE} = -5.7V$<br>$V_{IN} = V_{IL} (Min)$ | (Notes 9,<br>10, 11)                  |                      |
|           |                      |       | 340   | $\mu A$ | $-55^\circ C$                   |   |                                       |                      |
| $I_{EE}$  | Power Supply Current | -48   | -17   | mA      | $-55^\circ C$ to $+125^\circ C$ | Inputs Open                                 | (Notes 9,<br>10, 11, 12)              |                      |

**Note 9:** F100K 300 Series cold temperature testing is performed by temperature soaking (to guarantee junction temperature equals  $-55^\circ C$ ), then testing immediately without allowing for the junction temperature to stabilize due to heat dissipation after power-up. This provides "cold start" specs which can be considered a worst case condition at cold temperatures.

**Note 10:** Screen tested 100% on each device at  $-55^\circ C$ ,  $+25^\circ C$ , and  $+125^\circ C$ , Subgroups 1, 2, 3, 7, and 8.

**Note 11:** Sample tested (Method 5005, Table I) on each manufactured lot at  $-55^\circ C$ ,  $+25^\circ C$ , and  $+125^\circ C$ , Subgroups A1, 2, 3, 7, and 8.

**Note 12:** Guaranteed by applying specified input condition and testing  $V_{OH}/V_{OL}$ .

## AC Electrical Characteristics

$V_{EE} = -4.2V$  to  $-5.7V$ ,  $V_{CC} = V_{CCA} = GND$

| Symbol                 | Parameter                                 | $T_C = -55^\circ C$ |      | $T_C = +25^\circ C$ |      | $T_C = +125^\circ C$ |      | Units | Conditions   | Notes                            |
|------------------------|---|---------------------|------|---------------------|------|----------------------|------|-------|--------------|----------------------------------|
|                        |   | Min                 | Max  | Min                 | Max  | Min                  | Max  |       |              |                                  |
| $t_{PLH}$<br>$t_{PHL}$ | Propagation Delay<br>Data to Output       | 0.30                | 1.80 | 0.40                | 1.50 | 0.40                 | 1.70 | ns    | Figures 1, 2 | (Notes 13,<br>14, 15, 16,<br>17) |
| $t_{PLH}$<br>$t_{PHL}$ | Propagation Delay<br>Enable to Output     | 0.60                | 2.60 | 0.80                | 2.30 | 0.80                 | 2.80 | ns    |              |                                  |
| $t_{TLH}$<br>$t_{THL}$ | Transition Time<br>20% to 80%, 80% to 20% | 0.30                | 1.20 | 0.30                | 1.20 | 0.30                 | 1.20 | ns    |              | (Note 16)                        |

## AC Electrical Characteristics (Continued)

**Note 13:** F100K 300 Series cold temperature testing is performed by temperature soaking (to guarantee junction temperature equals  $-55^{\circ}\text{C}$ ), then testing immediately after power-up. This provides "cold start" specs which can be considered a worst case condition at cold temperatures.

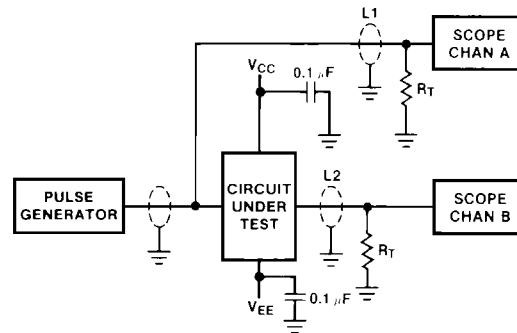
**Note 14:** Screen tested 100% on each device at  $+25^{\circ}\text{C}$  temperature only, Subgroup A9.

**Note 15:** Sample tested (Method 5005, Table I) on each manufactured lot at  $+25^{\circ}\text{C}$ , Subgroup A9, and at  $+125^{\circ}\text{C}$  and  $-55^{\circ}\text{C}$  temperatures, Subgroups A10 and A11.

**Note 16:** Not tested at  $+25^{\circ}\text{C}$ ,  $+125^{\circ}\text{C}$ , and  $-55^{\circ}\text{C}$  temperature (design characterization data).

**Note 17:** The propagation delay specified is for single output switching. Delays may vary up to 100 ps with multiple outputs switching.

## Test Circuitry



DS010580-5

### Notes:

$V_{CC}, V_{CCA} = +2\text{V}, V_{EE} = -2.5\text{V}$

L1 and L2 = equal length 50Ω impedance lines

$R_T = 50\Omega$  terminator internal to scope

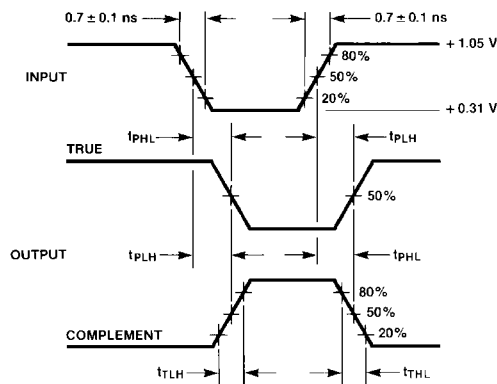
Decoupling 0.1 μF from GND to  $V_{CC}$  and  $V_{EE}$

All unused outputs are loaded with 50Ω to GND

$C_L$  = Fixture and stray capacitance  $\leq 3$  pF

FIGURE 1. AC Test Circuit

## Switching Waveforms

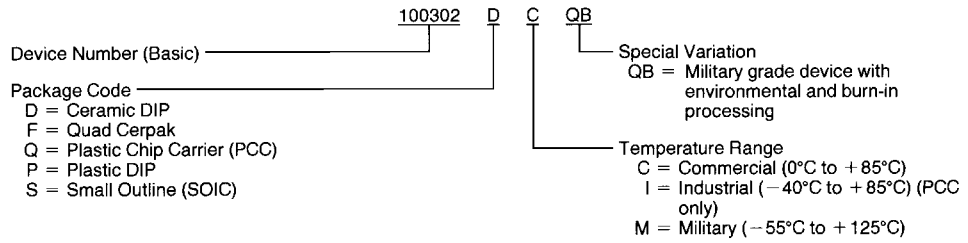


DS010580-6

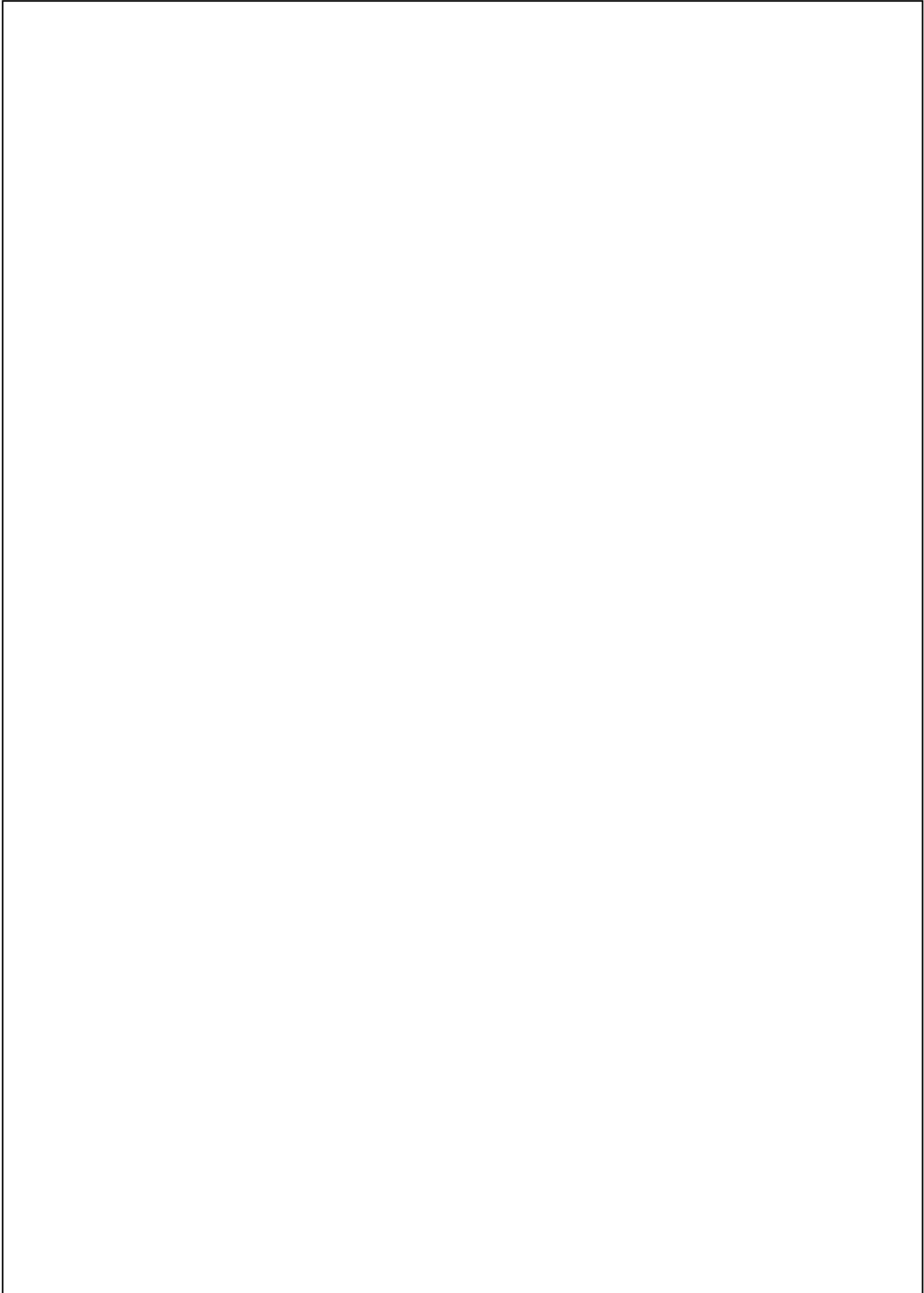
FIGURE 2. Propagation Delay and Transition Times

## Ordering Information

The device number is used to form part of a simplified purchasing code where a package type and temperature range are defined as follows:

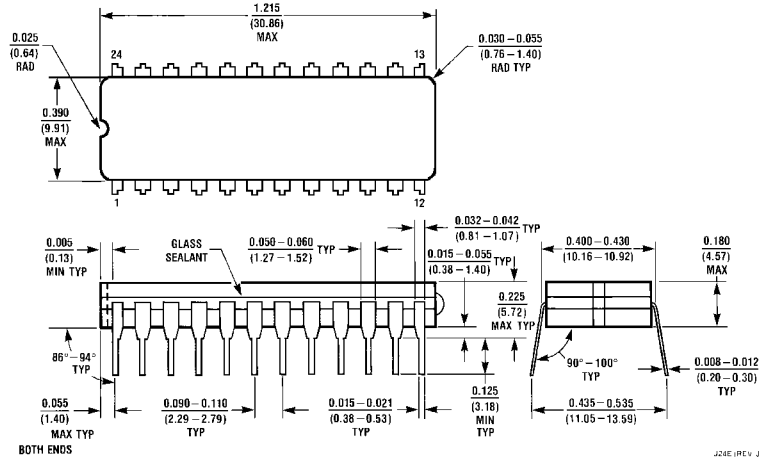


DS010580-7

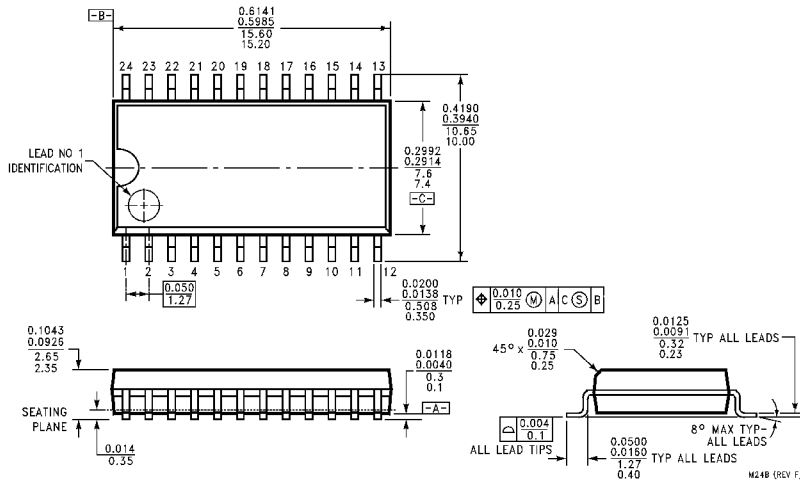




**Physical Dimensions** inches (millimeters) unless otherwise noted

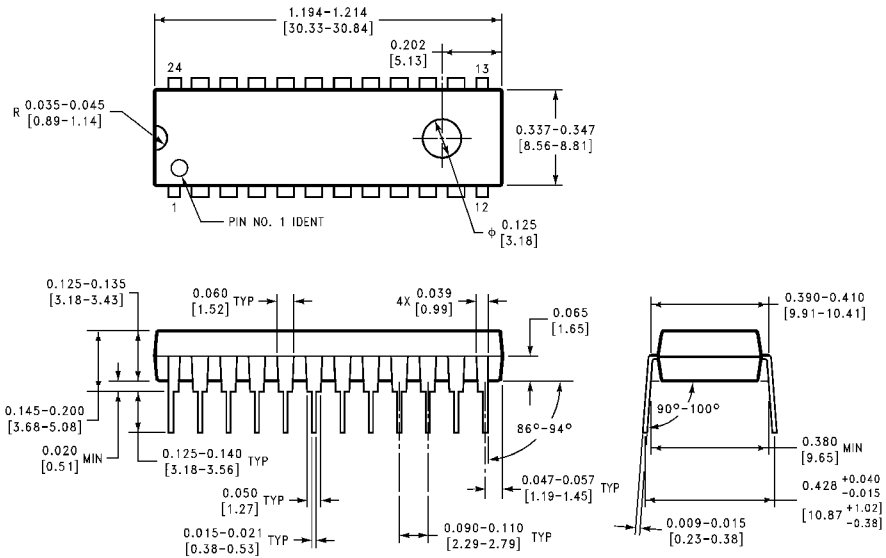


**24-Lead Ceramic Dual-In-Line Package (0.400" Wide) (D)  
Package Number J24E**



**24-Lead Molded Package (0.300" Wide) (S)  
Package Number M24B**

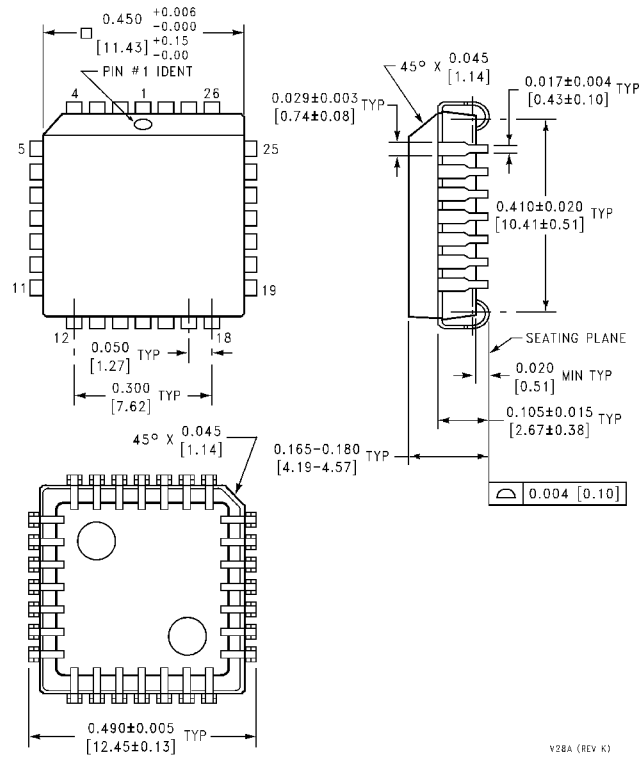
**Physical Dimensions** inches (millimeters) unless otherwise noted (Continued)



**24-Lead Plastic Dual-In-Line Package (P)**  
**Package Number N24E**

N24E (REV A)

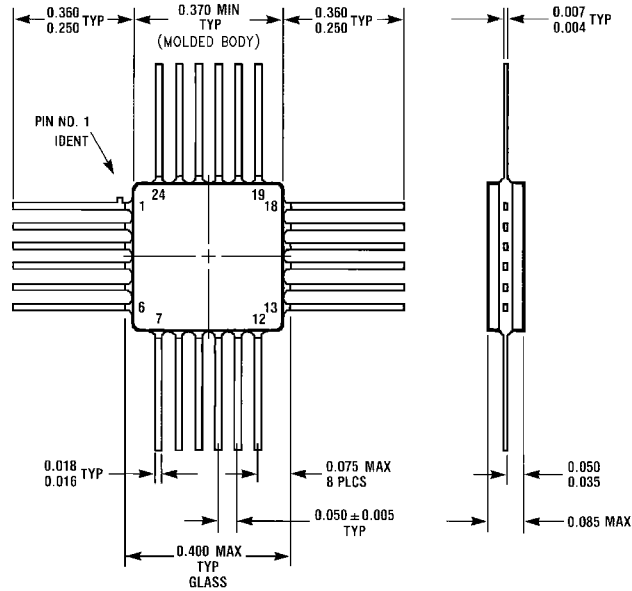
**Physical Dimensions** inches (millimeters) unless otherwise noted (Continued)



**28-Lead Plastic Chip Carrier (Q)  
Package Number V28A**

V28A (REV K)

**Physical Dimensions** inches (millimeters) unless otherwise noted (Continued)



W24B (REV D)

**24-Lead Quad Cerpak (F)  
Package Number W24B**

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