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# 100314

## Low Power Quint Differential Line Receiver

### General Description

The 100314 is a monolithic quint differential line receiver with emitter-follower outputs. An internal reference supply ( $V_{BB}$ ) is available for single-ended reception. When used in single-ended operation the apparent input threshold of the true inputs is 25 mV to 30 mV higher (positive) than the threshold of the complementary inputs. Unlike other F100K ECL devices, the inputs do not have input pull-down resistors.

Active current sources provide common-mode rejection of 1.0V in either the positive or negative direction. A defined output state exists if both inverting and non-inverting inputs are at the same potential between  $V_{EE}$  and  $V_{CC}$ . The defined state is logic HIGH on the  $\bar{O}_a$ - $\bar{O}_e$  outputs.

### Features

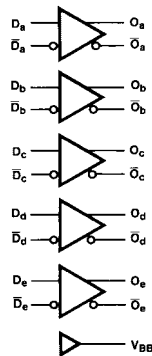
- 35% power reduction of the 100114
- 2000V ESD protection
- Pin/function compatible with 100114
- Voltage compensated operating range = -4.2V to -5.7V
- Available to industrial grade temperature range (PLCC package only)

### Ordering Code:

| Order Number | Package Number | Package Description  |
|--------------|----------------|--|
| 100314SC     | M24B           | 24-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-013, 0.300 Wide  |
| 100314PC     | N24E           | 24-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-010, 0.400 Wide  |
| 100314QC     | V28A           | 28-Lead Plastic Lead Chip Carrier (PLCC), JEDEC MO-047, 0.450 Square   |
| 100314QI     | V28A           | 28-Lead Plastic Lead Chip Carrier (PLCC), JEDEC MO-047, 0.450 Square Industrial Temperature Range (-40°C to +85°C) |

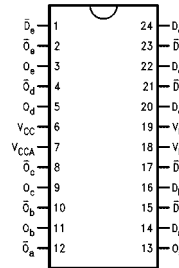
Devices also available in Tape and Reel. Specify by appending the suffix letter "X" to the ordering code.

### Logic Symbol

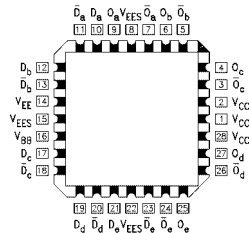


### Connection Diagrams

24-Pin DIP/SOIC



28-Pin PLCC



### Pin Descriptions

| Pin Names                 | Description                |
|---------------------------|----------------------------|
| $D_a$ - $D_e$             | Data Inputs                |
| $\bar{D}_a$ - $\bar{D}_e$ | Inverting Data Inputs      |
| $O_a$ - $O_e$             | Data Outputs               |
| $\bar{O}_a$ - $\bar{O}_e$ | Complementary Data Outputs |

**Absolute Maximum Ratings** (Note 1)

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

**Recommended Operating Conditions**

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

**Note 1:** The "Absolute Maximum Ratings" are those values beyond which the safety of the device cannot be guaranteed. The device should not be operated at these limits. The parametric values defined in the Electrical Characteristics tables are not guaranteed at the absolute maximum rating. The "Recommended Operating Conditions" table will define the conditions for actual device operation.

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

**Commercial Version****DC Electrical Characteristics** (Note 3)

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

| Symbol     | Parameter                       | Min            | Typ   | Max            | Units   | Conditions  |
|------------|---------------------------------|----------------|-------|----------------|---------|---|
| $V_{OH}$   | Output HIGH Voltage             | -1025          | -955  | -870           | mV      | $V_{IN} = V_{IH} (Max)$<br>Loading with $50\Omega$ to $-2.0V$   |
| $V_{OL}$   | Output LOW Voltage              | -1830          | -1705 | -1620          | mV      | or $V_{IL} (Min)$   |
| $V_{OHC}$  | Output HIGH Voltage             | -1035          |       |                | mV      | $V_{IN} = V_{IH}$<br>Loading with $50\Omega$ to $-2.0V$   |
| $V_{OLC}$  | Output LOW Voltage              |                |       | -1610          | mV      | or $V_{IL} (Max)$   |
| $V_{BB}$   | Output Reference Voltage        | -1380          | -1320 | -1260          | mV      | $I_{V_{BB}} = -250 \mu A$   |
| $V_{DIFF}$ | Input Voltage Differential      | 150            |       |                | mV      | Required for Full Output Swing  |
| $V_{CM}$   | Common Mode Voltage             | $V_{CC} - 2.0$ |       | $V_{CC} - 0.5$ | V       |   |
| $V_{IH}$   | Single-Ended Input HIGH Voltage | -1110          |       | -870           | mV      | Guaranteed HIGH Signal for All Inputs (with one input tied to $V_{BB}$ )<br>$V_{BB} (Max) + V_{DIFF}$ |
| $V_{IL}$   | Single-Ended Input LOW Voltage  | -1830          |       | -1530          | mV      | Guaranteed LOW Signal for All Inputs (with one input tied to $V_{BB}$ )<br>$V_{BB} (Min) - V_{DIFF}$  |
| $I_{IL}$   | Input LOW Current               | 0.50           |       |                | $\mu A$ | $V_{IN} = V_{IL} (Min)$   |
| $I_{IH}$   | Input HIGH Current              |                |       | 240            | $\mu A$ | $V_{IN} = V_{IH} (Max)$ , $D_a - D_e = V_{BB}$ ,<br>$\overline{D}_a - \overline{D}_e = V_{IL} (Min)$  |
| $I_{CBO}$  | Input Leakage Current           | -10            |       |                | $\mu A$ | $V_{IN} = V_{EE}$ , $D_a - D_e = V_{BB}$ ,<br>$\overline{D}_a - \overline{D}_e = V_{IL} (Min)$        |
| $I_{EE}$   | Power Supply Current            | -60            |       | -30            | mA      | $D_a - D_e = V_{BB}$ , $\overline{D}_a - \overline{D}_e = V_{IL} (Min)$                               |

**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.

### Commercial Version (Continued) 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  |       |              |
| $f_{MAXFS}$            | Toggle Frequency<br>(Full Swing)          | 250               |      | 250                 |      | 250                 |      | MHz   | (Note 2)     |
| $f_{MAXRS}$            | Toggle Frequency<br>(Reduced Swing)       | 700               |      | 700                 |      | 700                 |      | MHz   | (Note 3)     |
| $t_{PLH}$<br>$t_{PHL}$ | Propagation Delay<br>Data to Output       | 0.65              | 1.90 | 0.65                | 2.00 | 0.70                | 2.00 | ns    | Figures 1, 2 |
| $t_{TLH}$<br>$t_{THL}$ | Transition Time<br>20% to 80%, 80% to 20% | 0.35              | 1.20 | 0.35                | 1.20 | 0.35                | 1.20 | ns    |              |

### SOIC and PLCC 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  |       |                               |
| $f_{MAXFS}$            | Toggle Frequency<br>(Full Swing)  | 250               |      | 250                 |      | 250                 |      | MHz   | (Note 4)                      |
| $f_{MAXRS}$            | Toggle Frequency<br>(Reduced Swing)   | 700               |      | 700                 |      | 700                 |      | MHz   | (Note 5)                      |
| $t_{PLH}$<br>$t_{PHL}$ | Propagation Delay<br>Data to Output   | 0.65              | 1.70 | 0.65                | 1.80 | 0.70                | 1.80 | ns    | Figures 1, 2                  |
| $t_{TLH}$<br>$t_{THL}$ | Transition Time<br>20% to 80%, 80% to 20%                                       | 0.35              | 1.10 | 0.35                | 1.10 | 0.35                | 1.10 | ns    |                               |
| $t_{PLH}$<br>$t_{PHL}$ | Propagation Delay<br>Data to Output   | 0.70              | 1.50 | 0.80                | 1.60 | 0.90                | 1.80 | ns    |                               |
| $t_{OSHL}$             | Maximum Skew Common Edge<br>Output-to-Output Variation<br>Data to Output Path   |                   | 280  |                     | 280  |                     | 280  | ps    | PLCC only<br>(Note 6)(Note 7) |
| $t_{OSLH}$             | Maximum Skew Common Edge<br>Output-to-Output Variation<br>Data to Output Path   |                   | 330  |                     | 330  |                     | 330  | ps    | PLCC only<br>(Note 6)(Note 7) |
| $t_{OST}$              | Maximum Skew Opposite Edge<br>Output-to-Output Variation<br>Data to Output Path |                   | 330  |                     | 330  |                     | 330  | ps    | PLCC only<br>(Note 6)(Note 7) |
| $t_{PS}$               | Maximum Skew<br>Pin (Signal) Transition Variation<br>Data to Output Path        |                   | 320  |                     | 320  |                     | 320  | ps    | PLCC only<br>(Note 6)(Note 7) |

**Note 4:** Maximum toggle frequency at which  $V_{OH}$  and  $V_{OL}$  DC specifications are maintained.

**Note 5:** Maximum toggle frequency at which outputs maintain 150 mV swing.

**Note 6:** 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 7:** All skews calculated using input crossing point to output crossing point propagation delays.

## Industrial Version

## PLCC DC Electrical Characteristics (Note 8)

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

| 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      | $V_{IN} = V_{IH} (Max)$  | Loading with<br>$50\Omega$ to $-2.0V$ |
| $V_{OL}$   | Output LOW Voltage                 | -1830                         | -1575 | -1830                              | -1620 | mV      | or $V_{IL} (Min)$  |                                       |
| $V_{OHC}$  | Output HIGH Voltage                | -1095                         |       | -1035                              |       | mV      | $V_{IN} = V_{IH}$  | Loading with<br>$50\Omega$ to $-2.0V$ |
| $V_{OLC}$  | Output LOW Voltage                 |                               | -1565 |                                    | -1610 | mV      | or $V_{IL} (Min)$  |                                       |
| $V_{BB}$   | Output Reference Voltage           | -1395                         | -1255 | -1380                              | -1260 | mV      | $I_{VBB} = -250 \mu A$   |                                       |
| $V_{DIFF}$ | Input Voltage Differential         | 150                           |       | 150                                |       | mV      | Required for Full Output Swing   |                                       |
| $V_{CM}$   | Common Mode Voltage                | $V_{CC} - 2.0$ $V_{CC} - 0.5$ |       | $V_{CC} - 2.0$ $V_{CC} - 0.5$      |       | V       |  |                                       |
| $V_{IH}$   | Single-Ended<br>Input HIGH Voltage | -1115                         | -870  | -1110                              | -870  | mV      | Guaranteed HIGH Signal for All<br>Inputs (with one input tied to $V_{BB}$ )<br>$V_{BB} (Max) + V_{DIFF}$ |                                       |
| $V_{IL}$   | Single-Ended<br>Input LOW Voltage  | -1830                         | -1535 | -1830                              | -1530 | mV      | Guaranteed LOW Signal for All<br>Inputs (with one input tied to $V_{BB}$ )<br>$V_{BB} (Min) - V_{DIFF}$  |                                       |
| $I_{IL}$   | Input LOW Current                  | 0.50                          |       | 0.50                               |       | $\mu A$ | $V_{IN} = V_{IL} (Min)$  |                                       |
| $I_{IH}$   | Input HIGH Current                 | 240                           |       | 240                                |       | $\mu A$ | $V_{IN} = V_{IH} (Max)$ , $D_a - D_e = V_{BB}$ ,<br>$\bar{D}_a - \bar{D}_e = V_{IL} (Min)$               |                                       |
| $I_{CBO}$  | Input Leakage Current              | -10                           |       | -10                                |       | $\mu A$ | $V_{IN} = V_{EE}$ , $D_a - D_e = V_{BB}$<br>$\bar{D}_a - \bar{D}_e = V_{IL} (Min)$                       |                                       |
| $I_{EE}$   | Power Supply Current               | -60                           | -30   | -60                                | -30   | mA      | $D_a - D_e = V_{BB}$ , $\bar{D}_a - \bar{D}_e = V_{IL} (Min)$  |                                       |

**Note 8:** 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.

## PLCC AC Electrical Characteristics

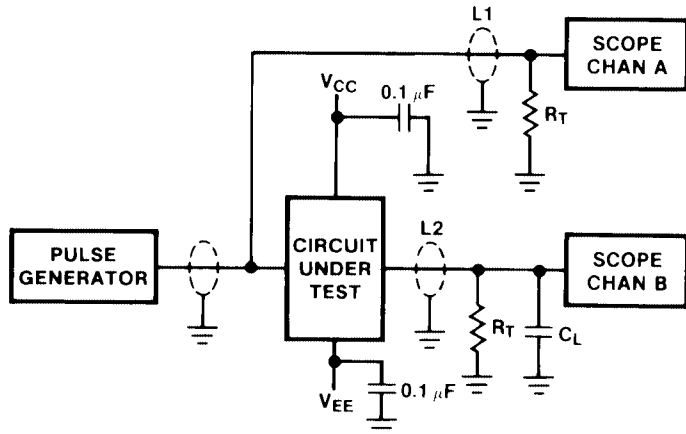
 $V_{EE} = -4.2V$  to  $-5.7V$ ,  $V_{CC} = V_{CCA} = GND$ 

| 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  |       |              |
| $f_{MAXFS}$ | Toggle Frequency<br>(Full Swing)    | 250                 |      | 250                 |      | 250                 |      | MHz   | (Note 9)     |
| $f_{MAXRS}$ | Toggle Frequency<br>(Reduced Swing) | 700                 |      | 700                 |      | 700                 |      | MHz   | (Note 10)    |
| $t_{PLH}$   | Propagation Delay                   | 0.65                | 1.70 | 0.65                | 1.80 | 0.70                | 1.80 | ns    | Figures 1, 2 |
| $t_{PHL}$   | Data to Output                      |                     |      |                     |      |                     |      |       |              |
| $t_{TLH}$   | Transition Time                     | 0.20                | 1.40 | 0.35                | 1.10 | 0.35                | 1.10 | ns    |              |
| $t_{THL}$   | 20% to 80%, 80% to 20%              |                     |      |                     |      |                     |      |       |              |

**Note 9:** Maximum toggle frequency at which  $V_{OH}$  and  $V_{OL}$  DC specifications are maintained.

**Note 10:** Maximum toggle frequency at which outputs maintain 150 mV swing.

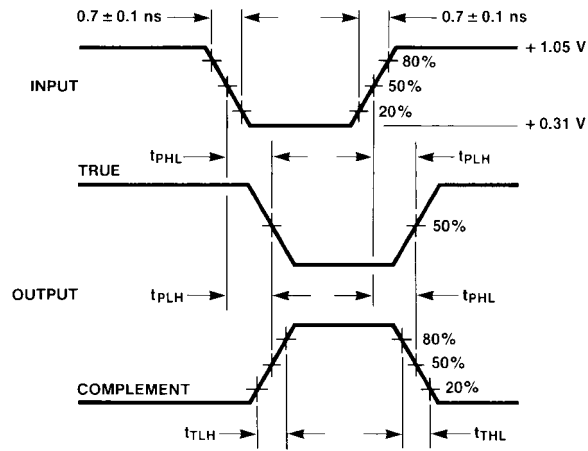
**Test Circuit**



- Note:**
- $V_{CC}, V_{CCA} = +2V, V_{EE} = -2.5V$
  - L1 and L2 = equal length 50Ω impedance lines
  - $R_T = 50\Omega$  terminator internal to scope
  - Decoupling 0.1  $\mu F$  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**

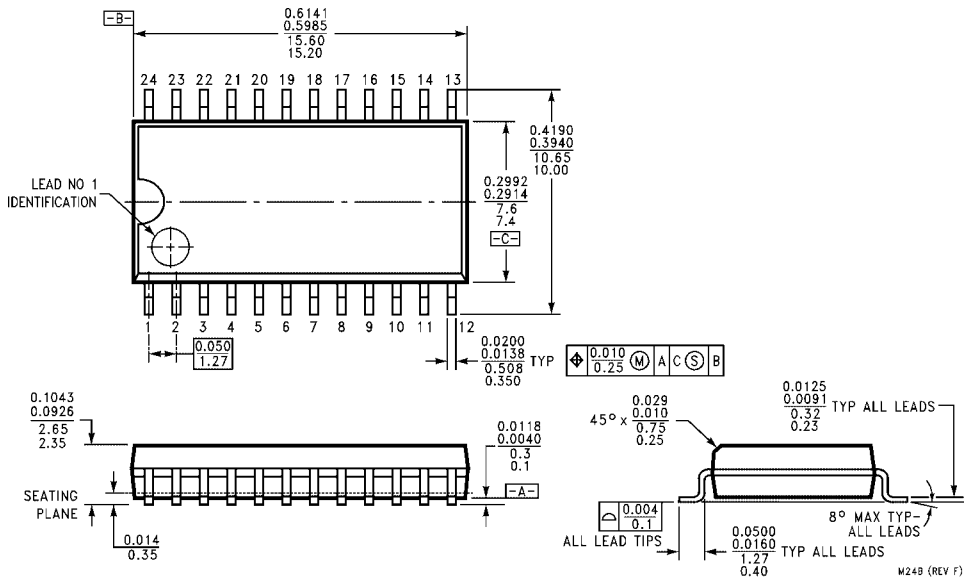
**Switching Waveforms**



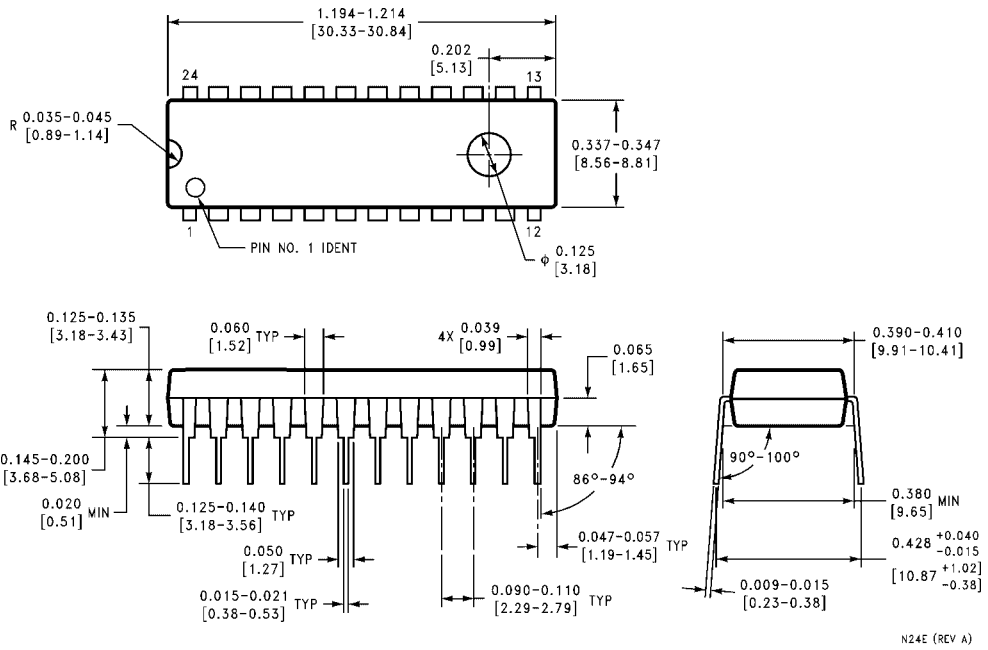
**FIGURE 2. Propagation Delay and Transition Times**

100314

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

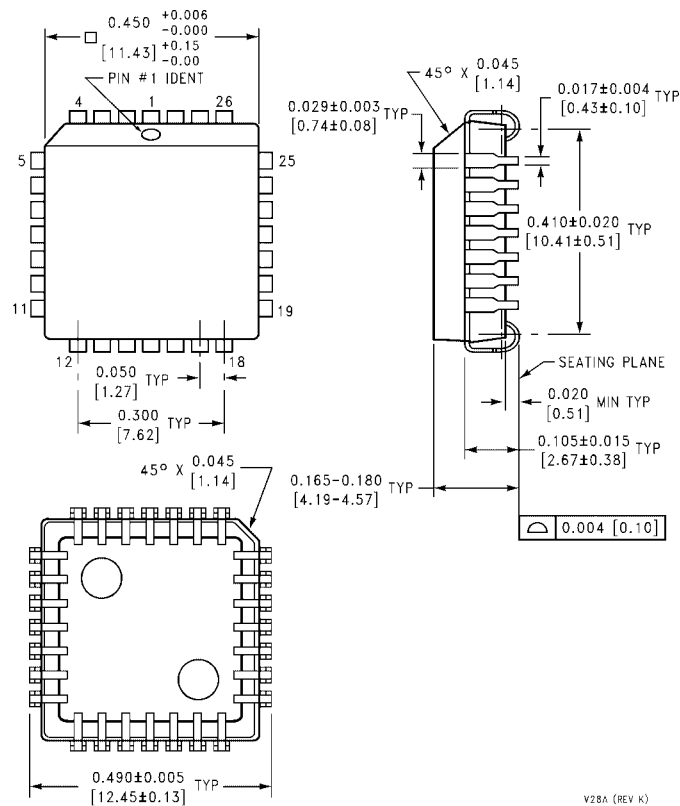


**24-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-013, 0.300 Wide Package Number M24B**



**24-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-010, 0.400 Wide Package Number N24E**

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



**28-Lead Plastic Lead Chip Carrier (PLCC), JEDEC MO-047, 0.450 Square  
Package Number V28A**

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