

100354

Low Power 8-Bit Register with Cut-Off Drivers

General Description

The 100354 contains eight D-type edge triggered, master/slave flip-flops with individual inputs (D_n), true outputs (Q_n), a clock input (CP), an output enable pin (\overline{OEN}), and a common clock enable pin (\overline{CEN}). Data enters the master when CP is LOW and transfers to the slave when CP goes HIGH. When the \overline{CEN} input goes HIGH it overrides all other inputs, disables the clock, and the Q outputs maintain the last state.

A Q output follows its D input when the \overline{OEN} pin is LOW. A HIGH on \overline{OEN} holds the outputs in a cut-off state. The cut-off state is designed to be more negative than a normal ECL LOW level. This allows the output emitter-followers to turn off when the termination supply is $-2.0V$, presenting a high impedance to the data bus. This high impedance

reduces termination power and prevents loss of low state noise margin when several loads share the bus.

The 100354 outputs are designed to drive a doubly terminated 50Ω transmission line (25Ω load impedance). All inputs have $50\text{ k}\Omega$ pull-down resistors.

Features

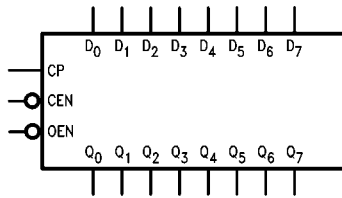
- Cut-off drivers
- Drives 25Ω load
- Low power operation
- 2000V ESD protection
- Voltage compensated operating range = $-4.2V$ to $-5.7V$
- Available to industrial grade temperature range

Ordering Code:

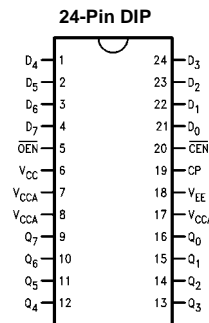
| Order Number | Package Number | Package Description |
|--------------|----------------|--|
| 100354PC | N24E | 24-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-010, 0.400 Wide |
| 100354QC | V28A | 28-Lead Plastic Lead Chip Carrier (PLCC), JEDEC MO-047, 0.450 Square |
| 100354QI | V28A | 28-Lead Plastic Lead Chip Carrier (PLCC), JEDEC MO-047, 0.450 Square Industrial Temperature Range (-40°C to $+85^\circ\text{C}$) |

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

Logic Symbol

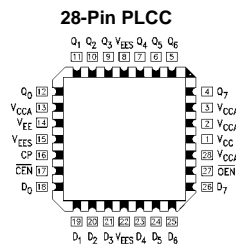


Connection Diagrams



Pin Descriptions

| Pin Names | Description |
|------------------|----------------------------------|
| D_0 - D_7 | Data Inputs |
| \overline{CEN} | Clock Enable Input |
| CP | Clock Input (Active Rising Edge) |
| \overline{OEN} | Output Enable Input |
| Q_0 - Q_7 | Data Outputs |

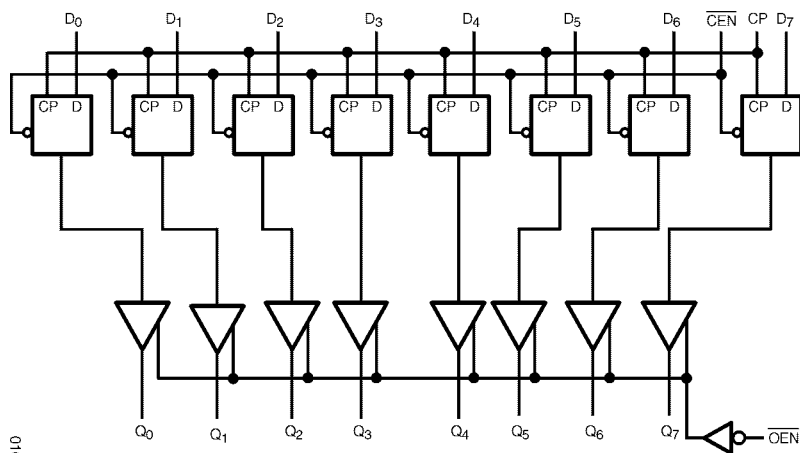


Truth Table

| Inputs | | | | Outputs |
|----------------|-------------------------|----|-------------------------|----------------|
| D _n | $\overline{\text{CEN}}$ | CP | $\overline{\text{OEN}}$ | Q _n |
| L | L | ↗ | L | L |
| H | L | ↗ | L | H |
| X | X | L | L | NC |
| X | X | H | L | NC |
| X | H | X | L | NC |
| X | X | X | H | Cutoff |

H = HIGH Voltage Level
 L = LOW Voltage Level
 NC = No Change
 X = Don't Care
 Cutoff = Lower-than-LOW State
 ↗ = LOW-to-HIGH Transition

Logic Diagram



81019010

Absolute Maximum Ratings(Note 1)

| | |
|--|-------------------|
| Storage Temperature (T_{STG}) | -65°C to +150°C |
| Maximum Junction Temperature (T_J) | +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) | -100 mA |
| ESD (Note 2) | ≥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 | $V_{IN} = V_{IH} (Max)$ or $V_{IL} (Min)$ |
| V_{OL} | Output LOW Voltage | -1830 | -1705 | -1620 | | mV |
| V_{OHC} | Output HIGH Voltage | -1035 | | | mV | |
| V_{OLC} | Output LOW Voltage | | | -1610 | | $V_{IN} = V_{IH} (Min)$ or $V_{IL} (Max)$ |
| V_{OLZ} | Cutoff LOW Voltage | | | -1950 | mV | $V_{IN} = V_{IH} (Min)$ or $V_{IL} (Max)$ |
| 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 | -202 -209 | | -105 -105 | mA | Inputs Open $V_{EE} = -4.2V$ to $-4.8V$ $V_{EE} = -4.2V$ to $-5.7V$ |

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_{MAX} | Toggle Frequency | 250 | | 250 | | 250 | | MHz | Figures 1, 4 |
| t_{PLH} t_{PHL} | Propagation Delay CP to Output | 1.40 | 3.00 | 1.40 | 3.00 | 1.50 | 3.10 | ns | Figures 1, 4 (Note 4) |
| t_{PZH} t_{PHZ} | Propagation Delay \overline{OEN} to Output | 1.60 | 4.20 | 1.60 | 4.20 | 1.60 | 4.20 | ns | Figures 3, 7 (Note 4) |
| t_{TLH} t_{THL} | Transition Time 20% to 80%, 80% to 20% | 0.45 | 2.00 | 0.45 | 2.00 | 0.45 | 2.00 | ns | Figures 1, 4 |
| t_S | Setup Time D_n \overline{CEN} (Disable Time) \overline{CEN} (Release Time) | 1.10 0.40 1.10 | | 1.10 0.40 1.10 | | 1.10 0.40 1.10 | | ns | Figures 2, 5 |
| t_H | Hold Time D_n | 0.10 | | 0.10 | | 0.10 | | ns | Figures 1, 6 |
| $t_{PW(H)}$ | Pulse Width HIGH CP | 2.00 | | 2.00 | | 2.00 | | ns | Figures 1, 4 |

Note 4: The propagation delay specified is for single output switching. Delays may vary up to 300 ps with multiple outputs switching.

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_{MAX} | Toggle Frequency | 250 | | 250 | | 250 | | MHz | Figures 1, 4 |
| t_{PLH} t_{PHL} | Propagation Delay CP to Output | 1.40 | 2.80 | 1.40 | 2.80 | 1.50 | 2.90 | ns | Figures 1, 4 (Note 5) |
| t_{PZH} t_{PHZ} | Propagation Delay \overline{OEN} to Output | 1.60 | 4.00 | 1.60 | 4.00 | 1.60 | 4.00 | ns | Figures 3, 7 (Note 5) |
| t_{TLH} t_{THL} | Transition Time 20% to 80%, 80% to 20% | 0.45 | 1.90 | 0.45 | 1.90 | 0.45 | 1.90 | ns | Figures 1, 4 |
| t_S | Setup Time D_n \overline{CEN} (Disable Time) \overline{CEN} (Release Time) | 1.00 0.30 1.00 | | 1.00 0.30 1.00 | | 1.00 0.30 1.00 | | ns | Figures 2, 5 |
| t_H | Hold Time D_n | 0.00 | | 0.00 | | 0.00 | | ns | Figures 1, 6 |
| $t_{PW(H)}$ | Pulse Width HIGH CP | 2.00 | | 2.00 | | 2.00 | | ns | Figures 1, 4 |
| t_{OSHL} | Maximum Skew Common Edge Output-to-Output Variation Clock to Output Path | | 280 | | 280 | | 280 | ps | (Note 6) |
| t_{OSLH} | Maximum Skew Common Edge Output-to-Output Variation Clock to Output Path | | 340 | | 340 | | 340 | ps | (Note 6) |
| t_{OST} | Maximum Skew Opposite Edge Output-to-Output Variation Clock to Output Path | | 340 | | 340 | | 340 | ps | (Note 6) |
| t_{PS} | Maximum Skew Pin (Signal) Transition Variation Clock to Output Path | | 250 | | 250 | | 250 | ps | (Note 6) |

Note 5: The propagation delay specified is for single output switching. Delays may vary up to 300 ps with multiple outputs switching.

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.

Industrial Version**PLCC DC Electrical Characteristics** (Note 7)
 $V_{EE} = -4.2V$ to $-5.7V$, $V_{CC} = V_{CCA} = GND$, $T_C = -40^\circ C$ to $+85^\circ C$

| Symbol | Parameter | $T_C = -40^\circ C$ | | $T_C = 0^\circ$ 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) or V_{IL} (Min) |
| V_{OL} | Output LOW Voltage | -1830 | -1575 | -1830 | -1620 | | |
| V_{OHC} | Output HIGH Voltage | -1095 | | -1035 | | mV | $V_{IN} = V_{IH}$ (Min) or V_{IL} (Max) |
| V_{OLC} | Output LOW Voltage | | -1565 | | -1610 | | |
| V_{OLZ} | Cutoff LOW Voltage | | -1900 | | -1950 | mV | $V_{IN} = V_{IH}$ (Min) or V_{IL} (Max) |
| 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 | 0.50 | | 0.50 | | μA | $V_{IN} = V_{IL}$ (Min) |
| I_{IH} | Input HIGH Current | | 240 | | 240 | μA | $V_{IN} = V_{IH}$ (Max) |
| I_{EE} | Power Supply Current | | | | | mA | Inputs Open $V_{EE} = -4.2V$ to $-4.8V$ $V_{EE} = -4.2V$ to $-5.7V$ |
| | | -202 -209 | -105 -105 | -202 -209 | -105 -105 | | |

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 "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_{MAX} | Toggle Frequency | 250 | | 250 | | 250 | | MHz | Figures 1, 4 |
| t_{PLH} | Propagation Delay | 1.40 | 2.80 | 1.40 | 2.80 | 1.50 | 2.90 | ns | Figures 1, 4 (Note 8) |
| t_{PHL} | CP to Output | | | | | | | | |
| t_{PZH} | Propagation Delay | 1.50 | 4.10 | 1.60 | 4.00 | 1.60 | 4.00 | ns | Figures 3, 5 (Note 8) |
| t_{PHZ} | OEN to Output | | | | | | | | |
| t_{TLH} | Transition Time | 0.45 | 1.90 | 0.45 | 1.90 | 0.45 | 1.90 | ns | Figures 1, 4 |
| t_{THL} | 20% to 80%, 80% to 20% | | | | | | | | |
| t_s | Setup Time | | | | | | | ns | Figures 2, 5 |
| | \overline{D}_n | 1.00 | | 1.00 | | 1.00 | | | |
| | \overline{CEN} (Disable Time) | 0.30 | | 0.30 | | 0.30 | | | |
| | \overline{CEN} (Release Time) | 1.00 | | 1.00 | | 1.00 | | | |
| t_H | Hold Time | \overline{D}_n | | \overline{D}_n | | \overline{D}_n | | ns | Figures 1, 6 |
| $t_{PW(H)}$ | Pulse Width High | CP | | CP | | CP | | ns | Figures 1, 4 |

Note 8: The propagation delay specified is for single output switching. Delays may vary up to 300 ps with multiple outputs switching.

Test Circuitry

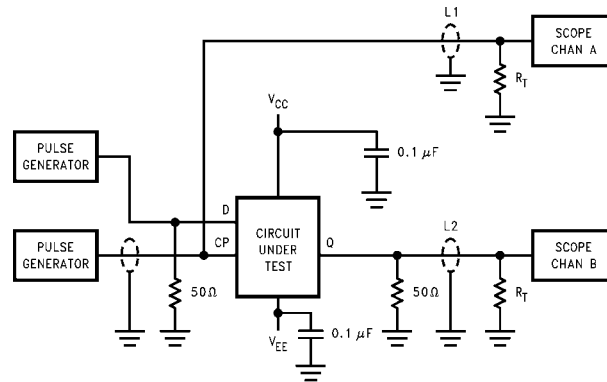


FIGURE 1. Toggle Frequency Test Circuit

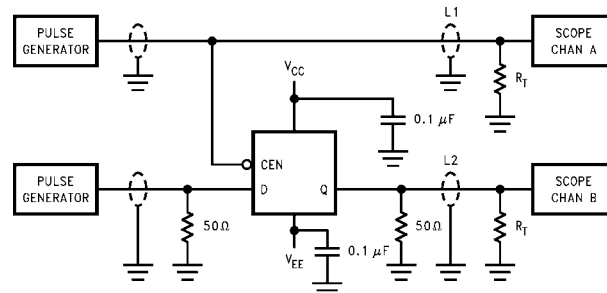


FIGURE 2. AC Test Circuit

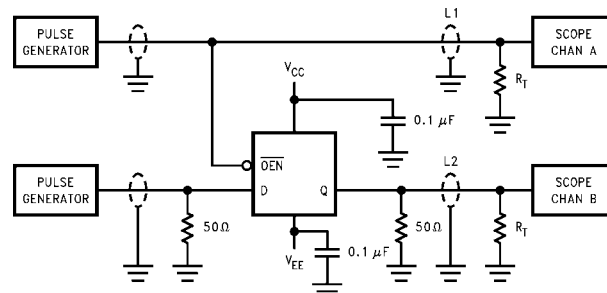


FIGURE 3. AC Test Circuit

Notes:

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

L1 and L2 = equal length 50Ω impedance lines

$R_T = 50\Omega$ terminator internal to scope

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

All unused outputs are loaded with 25Ω to GND

C_L = Fixture and stray capacitance ≤ 3 pF

Switching Waveforms

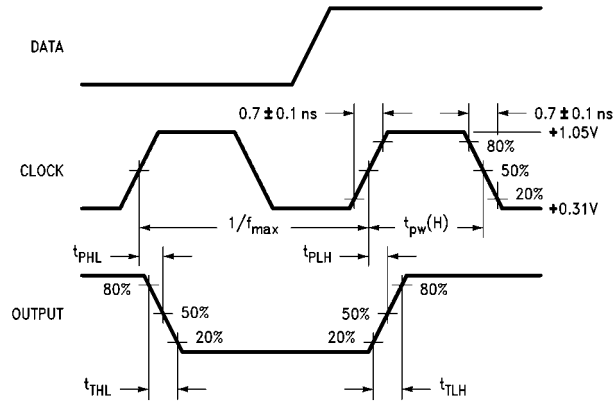


FIGURE 4. Propagation Delay (Clock) and Transition Times

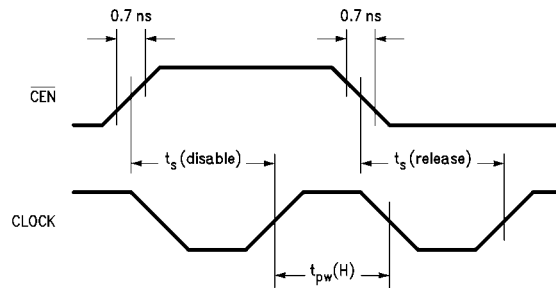
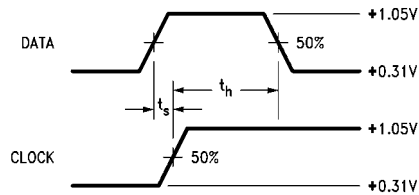


FIGURE 5. Setup and Pulse Width Times

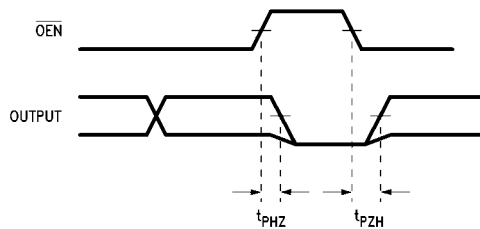


Notes:

t_s is the minimum time before the transition of the clock that information must be present at the data input.

t_h is the minimum time after the transition of the clock that information must remain unchanged at the data input.

FIGURE 6. Data Setup and Hold Time



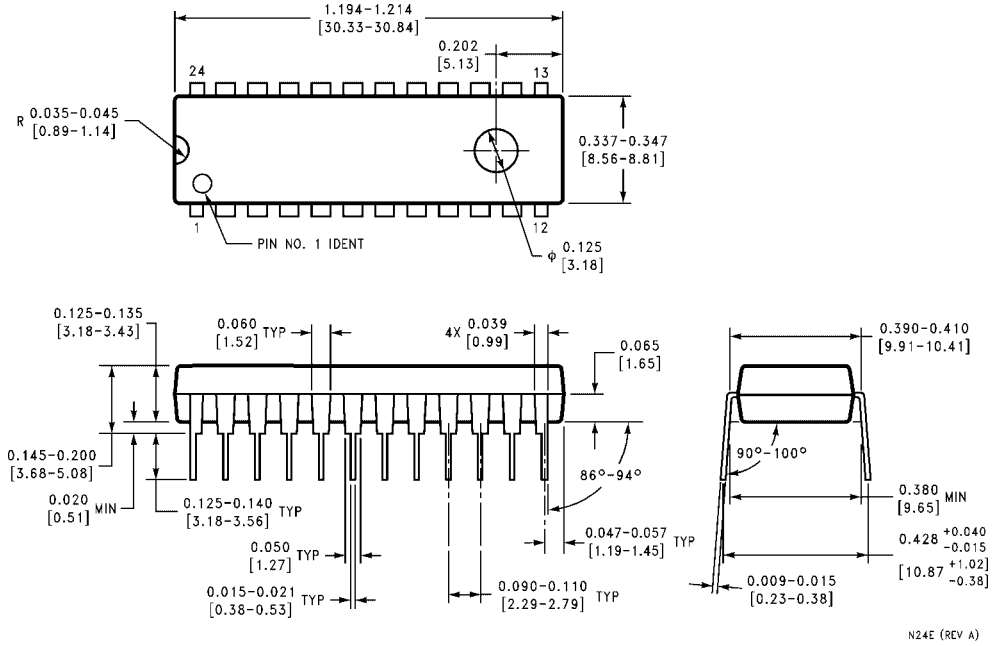
Note:

The output AC measurement point for cut-off propagation delay testing = the 50% voltage point between active V_{OL} and V_{OH} .

FIGURE 7. Cutoff Times

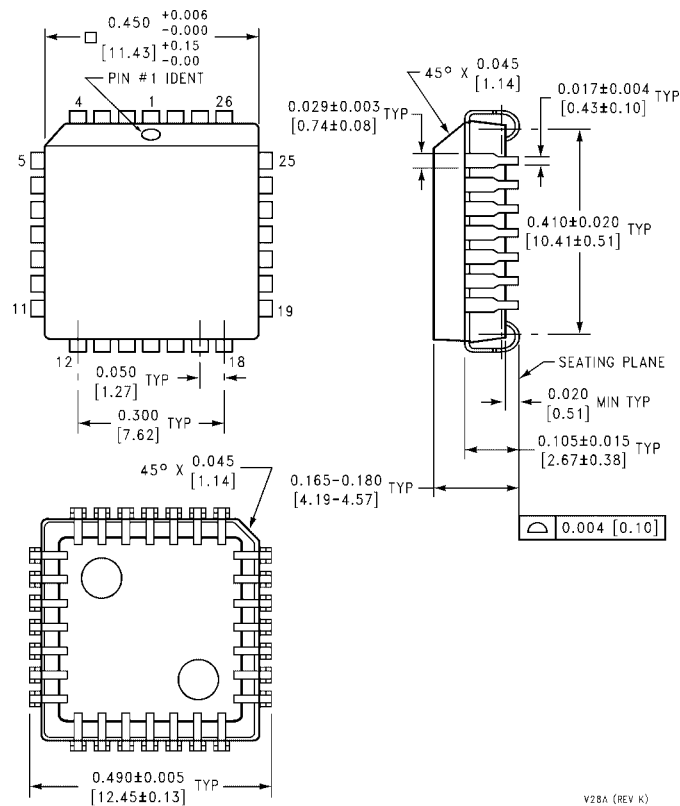
100354

Physical Dimensions inches (millimeters) unless otherwise noted



**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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