FAIRCHILD SEMICONDUCTOR™

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# 100324
# Low Power Hex TTL-to-ECL Translator

## General Description

The 100324 is a hex translator, designed to convert TTL logic levels to 100K ECL logic levels. The inputs are compatible with standard or Schottky TTL. A common Enable (E), when LOW, holds all inverting outputs HIGH and holds all true outputs LOW. The differential outputs allow each circuit to be used as an inverting/non-inverting translator, or as a differential line driver. The output levels are voltage compensated over the full –4.2V to –5.7V range.

When the circuit is used in the differential mode, the 100324, due to its high common mode rejection, overcomes voltage gradients between the TTL and ECL ground systems. The $V_{EE}$ and $V_{TTL}$ power may be applied in either order.

The 100324 is pin and function compatible with the 100124 with similar AC performance, but features power dissipation roughly half of the 100124 to ease system cooling requirements.

## Features

- Pin/function compatible with 100124
- Meets 100124 AC specifications
- 50% power reduction of the 100124
- Differential outputs
- 2000V ESD protection
- –4.2V to –5.7V operating range
- Available to MIL-STD-883
- Available to industrial grade temperature range (PLCC package only)

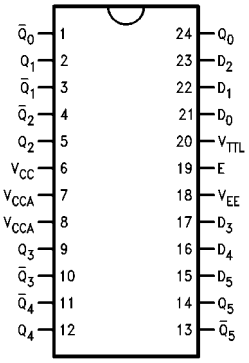
## Ordering Code:

| Order Number | Package Number | Package Description |
|---|---|---|
| 100324SC | M24B | 24-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-013, 0.300 Wide |
| 100324PC | N24E | 24-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-010, 0.400 Wide |
| 100324QC | V28A | 28-Lead Plastic Lead Chip Carrier (PLCC), JEDEC MO-047, 0.450 Square |
| 100324QI | V28A | 28-Lead Plastic Lead Chip Carrier (PLCC), JEDEC MO-047, 0.450 Square Industrial Temperature Range (–40°C to +85°C) |

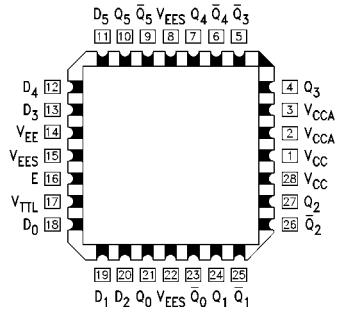
Devices also available in Tape and Reel. Specify by appending the suffix letter "X" to the ordering code.

## Connection Diagrams

**24-Pin DIP/SOIC**




**28-Pin PLCC**



## Pin Descriptions

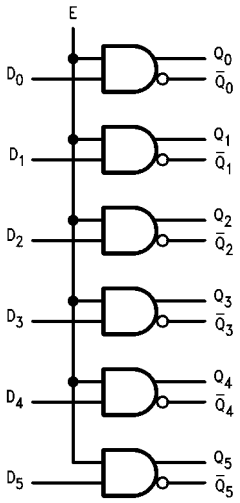
| Pin Names | Description |
|---|---|
| $D_0$–$D_5$ | Data Inputs |
| E | Enable Input |
| $Q_0$–$Q_5$ | Data Outputs |
| $\overline{Q}_0$–$\overline{Q}_5$ | Complementary Data Outputs |

## Truth Table

| Inputs | | Outputs | |
|---|---|---|---|
| $D_n$ | E | $Q_n$ | $\overline{Q}_n$ |
| X | L | L | H |
| L | H | L | H |
| H | H | H | L |

H = HIGH Voltage Level
L = LOW Voltage Level

## Logic Diagram



## 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 |
| $V_{TTL}$ Pin Potential to Ground Pin | −0.5V to +6.0V |
| Input Voltage (DC) | −0.5V to +6.0V |
| 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 |
| 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°C to +85°C, $V_{TTL}$ = +4.5V to +5.5V

| Symbol | Parameter | Min | Typ | Max | Units | Conditions | |
|---|---|---|---|---|---|---|---|
| $V_{OH}$ | Output HIGH Voltage | −1025 | −955 | −870 | mV | $V_{IN}$ = $V_{IH\ (Max)}$ | Loading with |
| $V_{OL}$ | Output LOW Voltage | −1830 | −1705 | −1620 | | or $V_{IL\ (Min)}$ | 50Ω to −2.0V |
| $V_{OHC}$ | Output HIGH Voltage | −1035 | | | mV | $V_{IN}$ = $V_{IH(Min)}$ | Loading with |
| $V_{OLC}$ | Output LOW Voltage | | | −1610 | | or $V_{IL\ (Max)}$ | 50Ω to −2.0V |
| $V_{IH}$ | Input HIGH Voltage | 2.0 | | 5.0 | V | Guaranteed HIGH Signal for All Inputs | |
| $V_{IL}$ | Input LOW Voltage | 0 | | 0.8 | V | Guaranteed LOW Signal for All Inputs | |
| $V_{CD}$ | Input Clamp Diode Voltage | −1.2 | | | V | $I_{IN}$ = −18 mA | |
| $I_{IH}$ | Input HIGH Current | | | | | $V_{IN}$ = +2.4V, | |
| | Data | | | 20 | μA | All Other Inputs $V_{IN}$ = GND | |
| | Enable | | | 120 | | | |
| | Input HIGH Current | | | 1.0 | mA | $V_{IN}$ = +5.5V, | |
| | Breakdown Test, All Inputs | | | | | All Other Inputs = GND | |
| $I_{IL}$ | Input LOW Current | | | | | $V_{IN}$ = +0.4V, | |
| | Data | −0.9 | | | mA | All Other Inputs $V_{IN}$ = $V_{IH}$ | |
| | Enable | −5.4 | | | | | |
| $I_{EE}$ | $V_{EE}$ Power Supply Current | −70 | −45 | −22 | mA | All Inputs $V_{IN}$ = +4.0V | |
| $I_{TTL}$ | $V_{TTL}$ Power Supply Current | | 25 | 38 | mA | All Inputs $V_{IN}$ = GND | |

**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 Electric Characteristics

$V_{EE}$ = −4.2V to −5.7V, $V_{CC}$ = $V_{CCA}$ = GND, $V_{TTL}$ = +4.5V to +5.5V

| Symbol | Parameter | $T_C$ = 0°C | | $T_C$ = +25°C | | $T_C$ = +85°C | | Units | Conditions |
|---|---|---|---|---|---|---|---|---|---|
| | | Min | Max | Min | Max | Min | Max | | |
| $t_{PLH}$ | Propagation Delay | 0.50 | 3.00 | 0.50 | 2.90 | 0.50 | 3.00 | ns | Figures 1, 2 |
| $t_{PHL}$ | Data and Enable to Output | | | | | | | | |
| $t_{TLH}$ | Transition Time | 0.45 | 1.80 | 0.45 | 1.80 | 0.45 | 1.80 | ns | |
| $t_{THL}$ | 20% to 80%, 80% to 20% | | | | | | | | |

## Commercial Version (Continued)
## SOIC and PLCC AC Electrical Characteristics

$V_{EE}$ = –4.2V to –5.7V, $V_{CC}$ = $V_{CCA}$ = GND, $V_{TTL}$ = +4.5V to +5.5V

| Symbol | Parameter | $T_C$ = 0°C | | $T_C$ = +25°C | | $T_C$ = +85°C | | Units | Conditions |
|---|---|---|---|---|---|---|---|---|---|
| | | Min | Max | Min | Max | Min | Max | | |
| $t_{PLH}$<br>$t_{PHL}$ | Propagation Delay<br>Data and Enable to Output | 0.50 | 2.80 | 0.50 | 2.70 | 0.50 | 2.80 | ns | Figures 1, 2 |
| $t_{TLH}$<br>$t_{THL}$ | Transition Time<br>20% to 80%, 80% to 20% | 0.45 | 1.70 | 0.45 | 1.70 | 0.45 | 1.70 | ns | |
| $t_{OSHL}$ | Maximum Skew Common Edge<br>Output-to-Output Variation<br>Data to Output Path | | 0.95 | | 0.95 | | 0.95 | ns | PLCC Only<br>(Note 4) |
| $t_{OSLH}$ | Maximum Skew Common Edge<br>Output-to-Output Variation<br>Data to Output Path | | 0.70 | | 0.70 | | 0.70 | ns | PLCC Only<br>(Note 4) |
| $t_{OST}$ | Maximum Skew Opposite Edge<br>Output-to-Output Variation<br>Data to Output Path | | 1.60 | | 1.60 | | 1.60 | ns | PLCC Only<br>(Note 4) |
| $t_{PS}$ | Maximum Skew<br>Pin (Signal) Transition Variation<br>Data to Output Path | | 1.20 | | 1.20 | | 1.20 | ns | PLCC Only<br>(Note 4) |

**Note 4:** 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

## DC Electrical Characteristics (Note 5)

$V_{EE}$ = −4.2V to −5.7V, $V_{CC}$ = $V_{CCA}$ = GND, $T_C$ = −40°C to +85°C, $V_{TTL}$ = +4.5V to +5.5V

| Symbol | Parameter | $T_C$ = −40°C | | $T_C$ = 0°C to +85°C | | Units | Conditions | |
|---|---|---|---|---|---|---|---|---|
| | | Min | Max | Min | Max | | | |
| $V_{OH}$ | Output HIGH Voltage | −1085 | −870 | −1025 | −870 | mV | $V_{IN}$ = $V_{IH\ (Max)}$ or $V_{IL\ (Min)}$ | Loading with 50Ω to −2.0V |
| $V_{OL}$ | Output LOW Voltage | −1830 | −1575 | −1830 | −1620 | | | |
| $V_{OHC}$ | Output HIGH Voltage | −1095 | | −1035 | | mV | $V_{IN}$ = $V_{IH(Min)}$ or $V_{IL\ (Max)}$ | Loading with 50Ω to −2.0V |
| $V_{OLC}$ | Output LOW Voltage | | −1565 | | −1610 | | | |
| $V_{IH}$ | Input HIGH Voltage | 2.0 | 5.0 | 2.0 | 5.0 | V | Guaranteed HIGH Signal for All Inputs | |
| $V_{IL}$ | Input LOW Voltage | 0 | 0.8 | 0 | 0.8 | V | Guaranteed LOW Signal for All Inputs | |
| $V_{CD}$ | Input Clamp Diode Voltage | −1.2 | | −1.2 | | V | $I_{IN}$ = −18 mA | |
| $I_{IH}$ | Input HIGH Current | | | | | | $V_{IN}$ = +2.4V, | |
| | Data | | 20 | | 20 | μA | All Other Inputs $V_{IN}$ = GND | |
| | Enable | | 120 | | 120 | | | |
| | Input HIGH Current Breakdown Test, All Inputs | | 1.0 | | 1.0 | mA | $V_{IN}$ = +5.5V, All Other Inputs = GND | |
| $I_{IL}$ | Input LOW Current | | | | | | $V_{IN}$ = +0.4V, | |
| | Data | −0.9 | | −0.9 | | mA | All Other Inputs $V_{IN}$ = $V_{IH}$ | |
| | Enable | −5.4 | | −5.4 | | | | |
| $I_{EE}$ | $V_{EE}$ Power Supply Current | −70 | −22 | −70 | −22 | mA | All Inputs $V_{IN}$ = +4.0V | |
| $I_{TTL}$ | $V_{TTL}$ Power Supply Current | | 38 | | 38 | mA | All Inputs $V_{IN}$ = GND | |

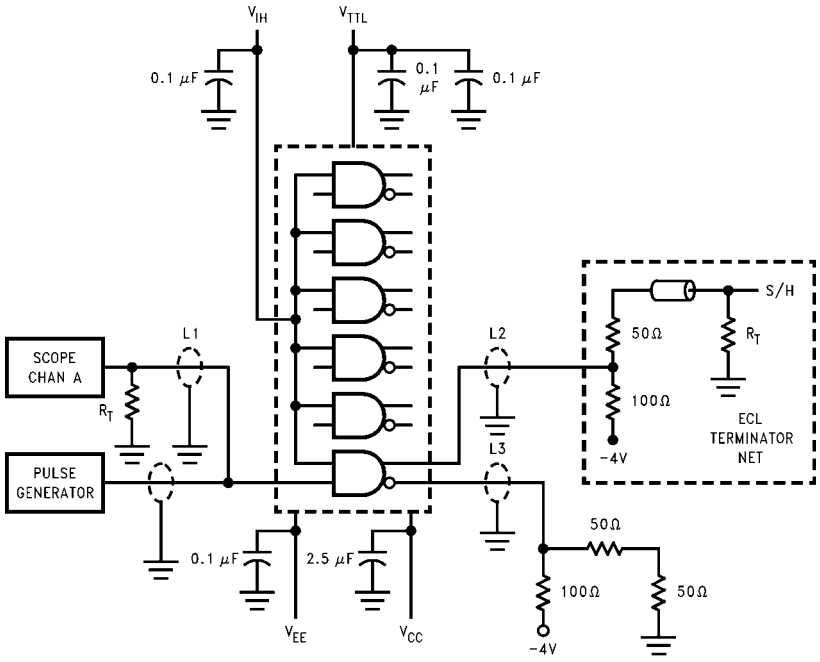
**Note 5:** The specified limits represent the "worst case" value for the parameter. Since these values normally occur at the temperature extremes, additional noise immunity and guardbanding can be achieved by decreasing the allowable system operating ranges. Conditions for testing shown in the tables are chosen to guarantee operation under "worst case" conditions.

## AC Electrical Characteristics

$V_{EE}$ = −4.2V to −5.7V, $V_{CC}$ = $V_{CCA}$ = GND, $V_{TTL}$ = +4.5V to +5.5V

| Symbol | Parameter | $T_C$ = −40°C | | $T_C$ = +25°C | | $T_C$ = +85°C | | Units | Conditions |
|---|---|---|---|---|---|---|---|---|---|
| | | Min | Max | Min | Max | Min | Max | | |
| $t_{PLH}$ $t_{PHL}$ | Propagation Delay Data and Enable to Output | 0.50 | 2.80 | 0.50 | 2.70 | 0.50 | 2.80 | ns | Figures 1, 2 |
| $t_{TLH}$ $t_{THL}$ | Transition Times 20% to 80%, 80% to 20% | 0.35 | 1.80 | 0.45 | 1.70 | 0.45 | 1.70 | ns | Figures 1, 2 |

## Test Circuit




**Note:**

- $V_{CC}$, $V_{CCA}$ = 0V, $V_{EE}$ = −4.5V, $V_{TTL}$ = +5.0V, $V_{IH}$ = +3.0V
- L1, L2 and L3 = equal length 50Ω impedance lines
- $R_T$ = 50Ω terminator internal to scope
- Decoupling 0.1 μF from GND to $V_{CC}$, $V_{EE}$ and $V_{TTL}$
- All unused outputs are loaded with 50Ω to −2V or with equivalent ECL terminator network
- $C_L$ = Fixture and stray capacitance ≤ 3 pF

**FIGURE 1. AC Test Circuit**

## Switching Waveform

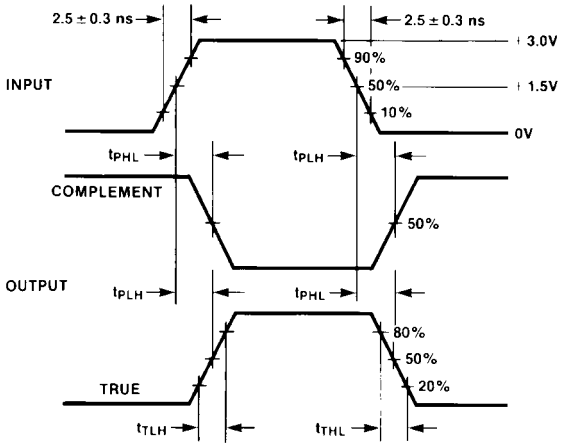
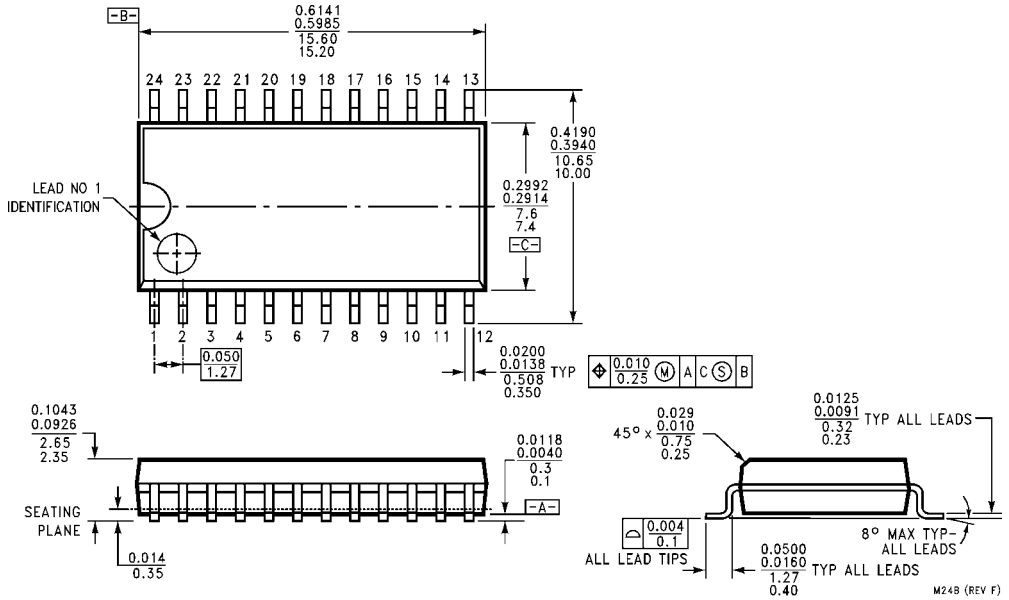
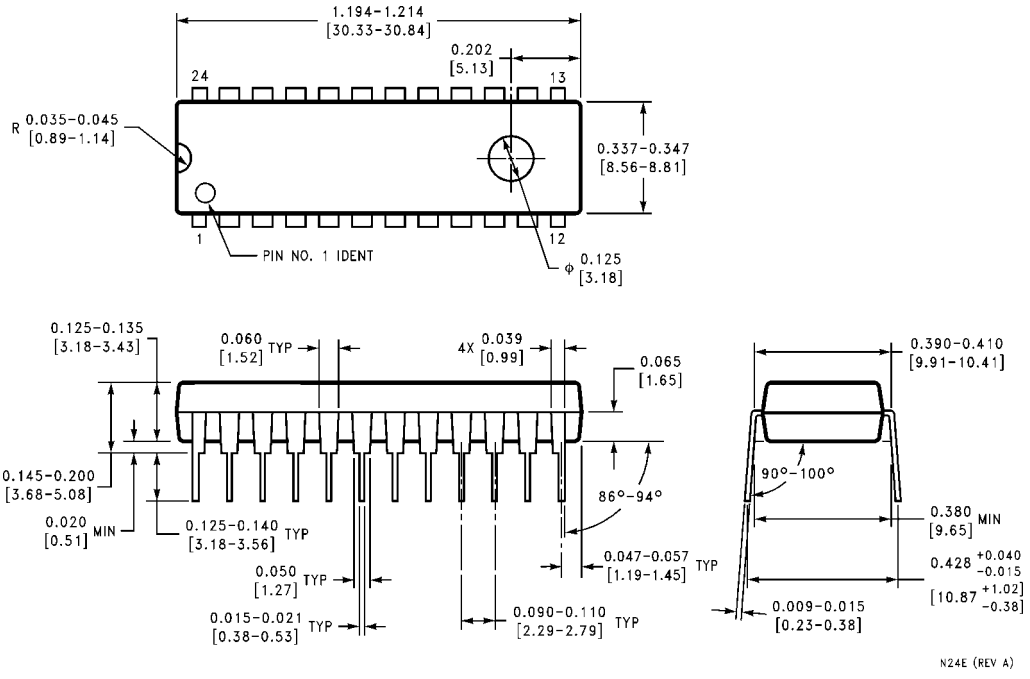



**FIGURE 2. Propagation Delay and Transition Times**

## Physical Dimensions inches (millimeters) unless otherwise noted

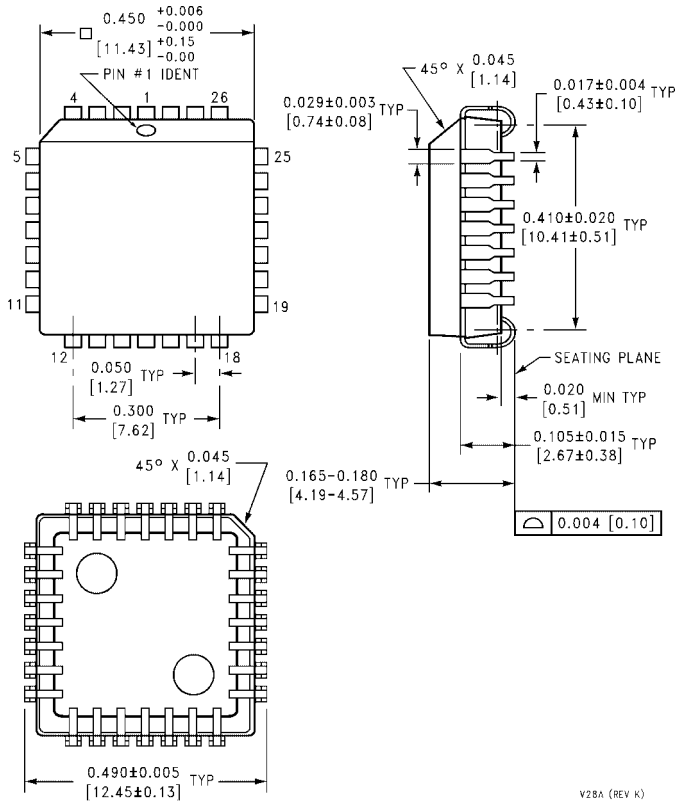



**24-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-013, 0.300 Wide**
**Package Number M24B**




**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**