## National Semiconductor

# F100125
# Hex ECL-to-TTL Translator

## General Description

The F100125 is a hex translator for converting F100K logic levels to TTL logic levels. Differential inputs allow each circuit to be used as an inverting, non-inverting or differential receiver. An internal reference voltage generator provides $V_{BB}$ for single-ended operation or for use in Schmitt trigger applications. All inputs have 50 kΩ pull-down resistors; therefore, the outputs will go LOW when the inputs are left unconnected.

When used in the differential mode, the inputs have a common mode rejection of +1V, making this device tolerant of ground offsets and transients between the signal source and the translator. The $V_{EE}$ and $V_{TTL}$ power may be applied in either order.

Refer to the F100325 datasheet for:
  PCC packaging
  Lower power
  Military versions
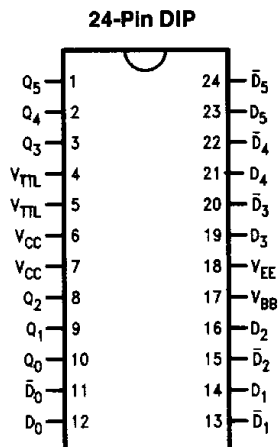  Extended voltage specs (−4.2V to −5.7V)

## Ordering Code: See Section 8

## Logic Symbol
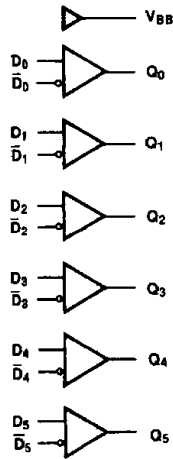


| Pin Names | Description |
|-----------|-------------|
| $D_0$–$D_5$ | Data Inputs |
| $\overline{D}_0$–$\overline{D}_5$ | Inverting Data Inputs |
| $Q_0$–$Q_5$ | Data Outputs |

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## Connection Diagrams

### 24-Pin DIP



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### 24-Pin Quad Cerpak
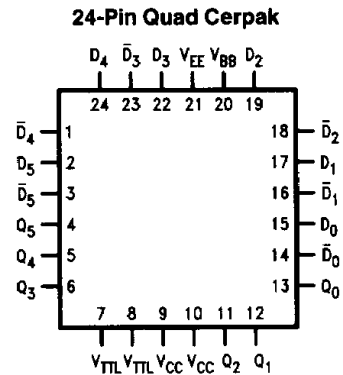


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# Absolute Maximum Ratings

Above which the useful life may be impaired. (Note 1)

**If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/Distributors for availability and specifications.**

| | |
|---|---|
| Storage Temperature | $-65°C$ to $+150°C$ |
| Maximum Junction Temperature ($T_J$) | $+150°C$ |
| Case Temperature under Bias ($T_C$) | $0°C$ to $+85°C$ |

| | |
|---|---|
| $V_{EE}$ Pin Potential to Ground Pin | $-7.0V$ to $+0.5V$ |
| $V_{TTL}$ Pin Potential to Ground Pin | $+6.0V$ to $-0.5V$ |
| Input Voltage (DC) | $V_{EE}$ to $+0.5V$ |
| Output Current (DC Output HIGH) | $-50$ mA |
| Operating Range (Note 2) | $-5.7V$ to $-4.2V$ |

## DC Electrical Characteristics

$V_{EE} = -4.5V$, $V_{CC} = V_{CCA} = $ GND, $T_C = 0°C$ to $+85°C$ (Note 3)

| Symbol | Parameter | Min | Typ | Max | Units | Conditions (Note 4) |
|---|---|---|---|---|---|---|
| $V_{BB}$ | Output Reference Voltage | $-1380$ | $-1320$ | $-1260$ | mV | $I_{VBB} = -2.1$ mA |
| $V_{IH}$ | Single-Ended Input HIGH Voltage | $-1165$ | | $-880$ | mV | Guaranteed HIGH Signal for All Inputs (with One Input Tied to $V_{BB}$) |
| $V_{IL}$ | Single-Ended Input LOW Voltage | $-1810$ | | $-1475$ | mV | Guaranteed LOW Signal for All Inputs (with One Input Tied to $V_{BB}$) |
| $I_{IL}$ | Input LOW Current | 0.50 | | | $\mu$A | $V_{IN} = V_{IL\ (Min)}$ |

## DC Electrical Characteristics

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

| Symbol | Parameter | Min | Typ | Max | Units | Conditions (Note 4) |
|---|---|---|---|---|---|---|
| $V_{BB}$ | Output Reference Voltage | $-1396$ | $-1320$ | $-1244$ | mV | $I_{VBB} = -2.1$ mA |
| $V_{IH}$ | Single-Ended Input HIGH Voltage | $-1150$ | | $-880$ | mV | Guaranteed HIGH Signal for All Inputs (with One Input Tied to $V_{BB}$) |
| $V_{IL}$ | Single-Ended Input LOW Voltage | $-1810$ | | $-1490$ | mV | Guaranteed LOW Signal for All Inputs (with One Input Tied to $V_{BB}$) |
| $I_{IL}$ | Input LOW Current | 0.50 | | | $\mu$A | $V_{IN} = V_{IL\ (Min)}$ |

## DC Electrical Characteristics

$V_{EE} = -4.8V$, $V_{CC} = V_{CCA} = $ GND, $T_C = 0°C$ to $+85°C$ (Note 3)

| Symbol | Parameter | Min | Typ | Max | Units | Conditions (Note 4) |
|---|---|---|---|---|---|---|
| $V_{BB}$ | Output Reference Voltage | $-1396$ | $-1320$ | $-1244$ | mV | $I_{VBB} = -2.1$ mA |
| $V_{IH}$ | Single-Ended Input HIGH Voltage | $-1150$ | | $-880$ | mV | Guaranteed HIGH Signal for All Inputs (with One Input Tied to $V_{BB}$) |
| $V_{IL}$ | Single-Ended Input LOW Voltage | $-1810$ | | $-1490$ | mV | Guaranteed LOW Signal for All Inputs (with One Input Tied to $V_{BB}$) |
| $I_{IL}$ | Input LOW Current | 0.50 | | | $\mu$A | $V_{IN} = V_{IL\ (Min)}$ |

**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:** Parametric values specified at $-4.2V$ to $-4.8V$.

**Note 3:** The specified limits represent the "worst case" value for the parameter. Since these "worst case" values normally occur at the temperature extremes, additional noise immunity and guard banding can be achieved by decreasing the allowable system operating ranges.

**Note 4:** Conditions for testing shown in the tables are chosen to guarantee operation under "worst case" conditions.

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## DC Electrical Characteristics

$V_{EE} = -4.2V$ to $-4.8V$ unless otherwise specified, $V_{CC} = GND$, $V_{TTL} = +4.5V$ to $+5.5V$, $T_C = 0°C$ to $+85°C$

| Symbol | Parameter | Min | Typ | Max | Units | Conditions | |
|---|---|---|---|---|---|---|---|
| $V_{OH}$ | Output HIGH Voltage | 2.5 | | | V | $I_{OH} = -2.0$ mA | $V_{IN} = V_{IH\ (Max)}$ |
| $V_{OL}$ | Output LOW Voltage | | | 0.5 | V | $I_{OL} = 20$ mA | or $V_{IL\ (Min)}$ |
| $V_{DIFF}$ | Input Voltage Differential | 150 | | | mV | Required for Full Output Swing | |
| $V_{CM}$ | Common Mode Voltage | | | 1.0 | V | Permissible $\pm V_{CM}$ with Respect to $V_{BB}$ | |
| $I_{IH}$ | Input HIGH Current | | | 350 | $\mu$A | $V_{IN} = V_{IH\ (Max)}$, $D_0-D_5 = V_{BB}$, $\overline{D}_0-\overline{D}_5 = V_{IL\ (Min)}$ | |
| $I_{IL}$ | Input LOW Current | 0.5 | | | $\mu$A | $V_{IN} = V_{IL\ (Min)}$, $D_0-D_5 = V_{BB}$ | |
| $I_{OS}$ | Output Short-Circuit Current | -100 | | -40 | mA | $V_{OUT} = GND^*$ | |
| $I_{EE}$ | $V_{EE}$ Power Supply Current | -85 | -60 | -40 | mA | $D_0-D_5 = V_{BB}$ | |
| $I_{TTL}$ | $V_{TTL}$ Power Supply Current | | 75 | 115 | mA | $D_0-D_5 = V_{BB}$ | |

*Test one output at a time.

## Ceramic Dual-In-Line Package AC Electrical Characteristics

$V_{EE} = -4.2V$ to $-4.8V$, $V_{CC} = GND$, $V_{TTL} = +4.5V$ 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 | | |
| $t_{PLH}$ $t_{PHL}$ | Propagation Delay Data to Output | 0.80 | 3.50 | 0.90 | 3.70 | 1.00 | 4.00 | ns | *Figures 1* and *2* |

## Cerpak AC Electrical Characteristics

$V_{EE} = -4.2V$ to $-4.8V$, $V_{CC} = GND$, $V_{TTL} = +4.5V$ 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 | | |
| $t_{PLH}$ $t_{PHL}$ | Propagation Delay Data to Output | 0.80 | 3.30 | 0.90 | 3.50 | 1.00 | 3.80 | ns | *Figures 1* and *2* |

## Truth Table

| Inputs | | Outputs |
|---|---|---|
| $D_n$ | $\overline{D}_n$ | $Q_n$ |
| L | H | L |
| H | L | H |
| L | L | U |
| H | H | U |
| | | |
| Open | Open | L |
| $V_{EE}$ | $V_{EE}$ | L |
| L | $V_{BB}$ | L |
| H | $V_{BB}$ | H |
| $V_{BB}$ | L | H |
| $V_{BB}$ | H | L |

H = HIGH Voltage Level
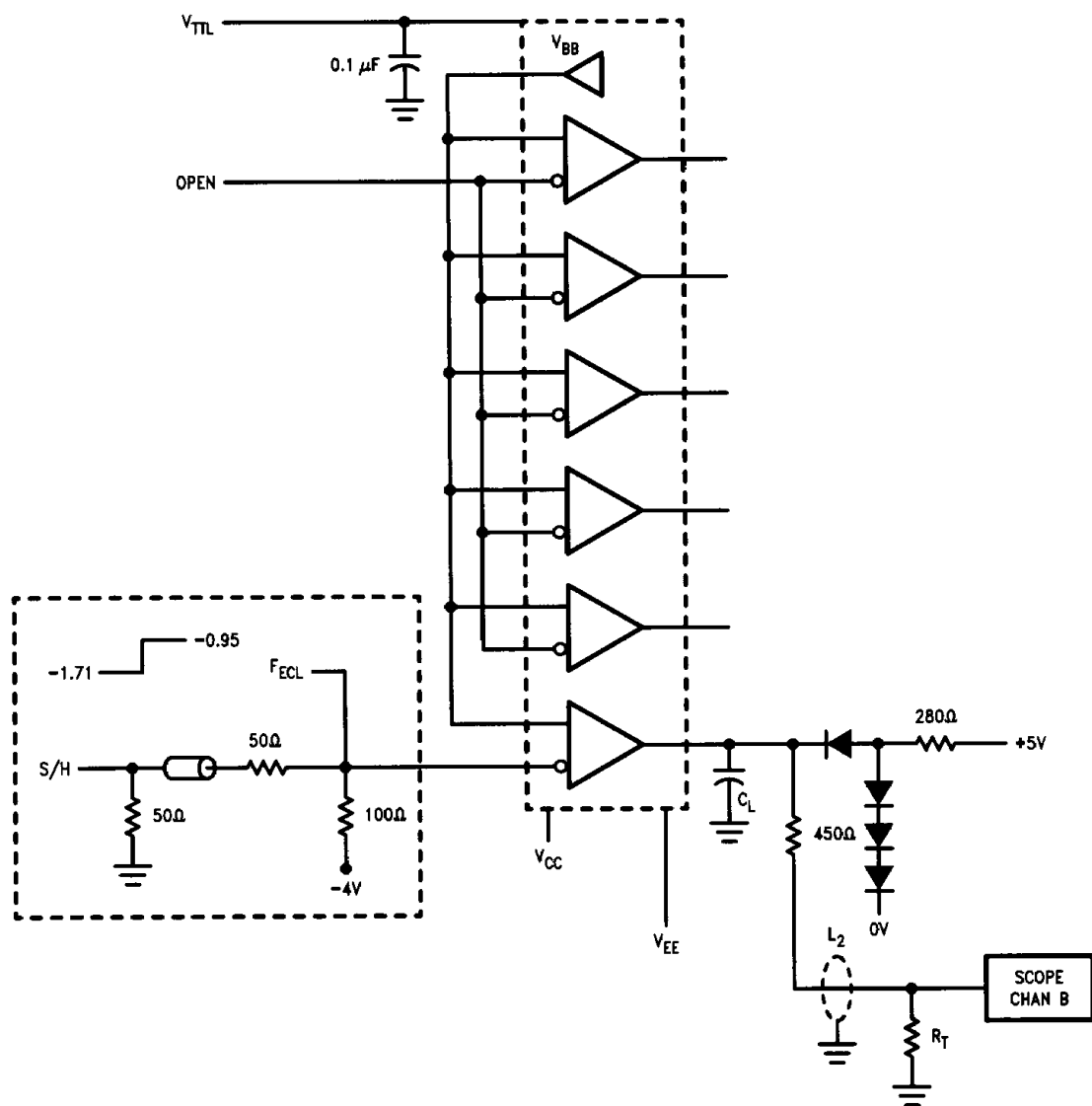L = LOW Voltage Level
U = Undefined

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**FIGURE 1. AC Test Circuit**

**Notes:**

$V_{CC}$ = 0V, $V_{EE}$ = $-4.5$V, $V_{TTL}$ = $+5$V

L1 and L2 = 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 500Ω to GND

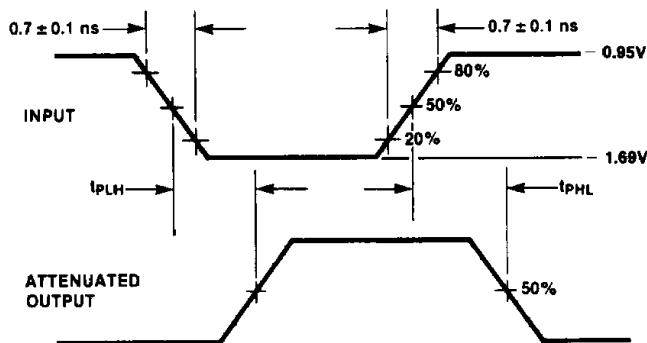$C_L$ = Fixture and stray capacitance = 15 pF



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**FIGURE 2. Propagation Delay Times**