



# F100114

## Quint Differential Line Receiver

### General Description

The F100114 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.

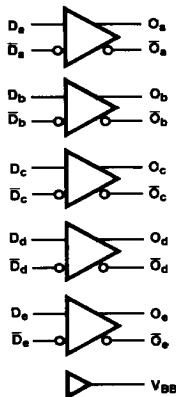
Active current sources provide common-mode rejection of 1.0V in either the positive or negative direction. A defined output state exists if both inverting and non-inverting inputs are at the same potential between  $V_{EE}$  and  $V_{CC}$ . The defined state is logic HIGH on the  $\bar{O}_a-\bar{O}_e$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

Refer to the F100314 datasheet for:

- PCC packaging
- Lower power
- Military versions
- Extended voltage specs ( $-4.2V$  to  $-5.7V$ )

**Ordering Code:** See Section 8

### Logic Symbol

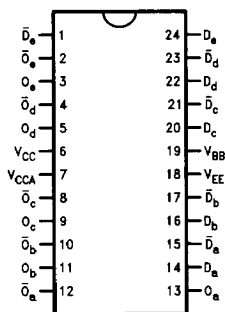


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| Pin Names             | Description                |
|-----------------------|----------------------------|
| $D_a-D_e$             | Data Inputs                |
| $\bar{D}_a-\bar{D}_e$ | Inverting Data Inputs      |
| $O_a-O_e$             | Data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

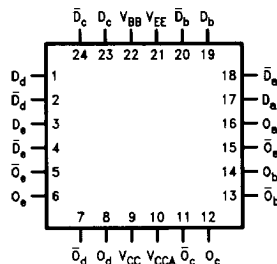
### Connection Diagrams

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  $-65^{\circ}\text{C}$  to  $+150^{\circ}\text{C}$   
Maximum Junction Temperature ( $T_J$ )  $+150^{\circ}\text{C}$

Case Temperature under Bias ( $T_C$ )  $0^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$   
 $V_{EE}$  Pin Potential to Ground Pin  $-7.0\text{V}$  to  $+0.5\text{V}$   
Input Voltage (DC)  $V_{EE}$  to  $+0.5\text{V}$   
Output Current (DC Output HIGH)  $-50\text{mA}$   
Operating Range (Note 2)  $-5.7\text{V}$  to  $-4.2\text{V}$

## DC Electrical Characteristics

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

| Symbol    | Parameter                          | Min     | Typ     | Max     | Units | Conditions (Note 4)                                                         |                                              |
|-----------|------------------------------------|---------|---------|---------|-------|-----------------------------------------------------------------------------|----------------------------------------------|
| $V_{OH}$  | Output HIGH Voltage                | $-1025$ | $-955$  | $-880$  | mV    | $V_{IN} = V_{IH}(\text{Max})$<br>or $V_{IL}(\text{Min})$                    | Loading with<br>$50\Omega$ to $-2.0\text{V}$ |
| $V_{OL}$  | Output LOW Voltage                 | $-1810$ | $-1705$ | $-1620$ |       |                                                                             |                                              |
| $V_{OHC}$ | Output HIGH Voltage                | $-1035$ |         |         | mV    | $V_{IN} = V_{IH}(\text{Min})$<br>or $V_{IL}(\text{Max})$                    | Loading with<br>$50\Omega$ to $-2.0\text{V}$ |
| $V_{OLC}$ | Output LOW Voltage                 |         |         | $-1610$ |       |                                                                             |                                              |
| $V_{BB}$  | Output Reference Voltage           | $-1380$ | $-1320$ | $-1260$ | mV    | $I_{VBB} = -250\mu\text{A}$                                                 |                                              |
| $V_{IH}$  | Single-Ended<br>Input HIGH Voltage | $-1165$ |         |         | mV    | Guaranteed HIGH Signal for All<br>Inputs (with one input tied to $V_{BB}$ ) |                                              |
| $V_{IL}$  | Single-Ended<br>Input LOW Voltage  |         |         | $-1475$ | mV    | Guaranteed LOW Signal for All<br>Inputs (with one input tied to $V_{BB}$ )  |                                              |

## DC Electrical Characteristics

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

| Symbol    | Parameter                          | Min     | Typ     | Max     | Units | Conditions (Note 4)                                                         |                                              |
|-----------|------------------------------------|---------|---------|---------|-------|-----------------------------------------------------------------------------|----------------------------------------------|
| $V_{OH}$  | Output HIGH Voltage                | $-1020$ |         | $-870$  | mV    | $V_{IN} = V_{IH}(\text{Max})$<br>or $V_{IL}(\text{Min})$                    | Loading with<br>$50\Omega$ to $-2.0\text{V}$ |
| $V_{OL}$  | Output LOW Voltage                 | $-1810$ |         | $-1605$ |       |                                                                             |                                              |
| $V_{OHC}$ | Output HIGH Voltage                | $-1030$ |         |         | mV    | $V_{IN} = V_{IH}(\text{Min})$<br>or $V_{IL}(\text{Max})$                    | Loading with<br>$50\Omega$ to $-2.0\text{V}$ |
| $V_{OLC}$ | Output LOW Voltage                 |         |         | $-1595$ |       |                                                                             |                                              |
| $V_{BB}$  | Output Reference Voltage           | $-1396$ | $-1320$ | $-1244$ | mV    | $I_{VBB} = -250\mu\text{A}$                                                 |                                              |
| $V_{IH}$  | Single-Ended<br>Input HIGH Voltage | $-1150$ |         |         | mV    | Guaranteed HIGH Signal for All<br>Inputs (with one input tied to $V_{BB}$ ) |                                              |
| $V_{IL}$  | Single-Ended<br>Input LOW Voltage  |         |         | $-1475$ | mV    | Guaranteed LOW Signal for All<br>Inputs (with one input tied to $V_{BB}$ )  |                                              |

## DC Electrical Characteristics

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

| Symbol    | Parameter                          | Min     | Typ     | Max     | Units | Conditions (Note 4)                                                         |                                              |
|-----------|------------------------------------|---------|---------|---------|-------|-----------------------------------------------------------------------------|----------------------------------------------|
| $V_{OH}$  | Output HIGH Voltage                | $-1035$ |         | $-880$  | mV    | $V_{IN} = V_{IH}(\text{Max})$<br>or $V_{IL}(\text{Min})$                    | Loading with<br>$50\Omega$ to $-2.0\text{V}$ |
| $V_{OL}$  | Output LOW Voltage                 | $-1830$ |         | $-1620$ |       |                                                                             |                                              |
| $V_{OHC}$ | Output HIGH Voltage                | $-1045$ |         |         | mV    | $V_{IN} = V_{IH}(\text{Min})$<br>or $V_{IL}(\text{Max})$                    | Loading with<br>$50\Omega$ to $-2.0\text{V}$ |
| $V_{OLC}$ | Output LOW Voltage                 |         |         | $-1610$ |       |                                                                             |                                              |
| $V_{BB}$  | Output Reference Voltage           | $-1396$ | $-1320$ | $-1244$ | mV    | $I_{VBB} = -250\mu\text{A}$                                                 |                                              |
| $V_{IH}$  | Single-Ended<br>Input HIGH Voltage | $-1165$ |         |         | mV    | Guaranteed HIGH Signal for All<br>Inputs (with one input tied to $V_{BB}$ ) |                                              |
| $V_{IL}$  | Single-Ended<br>Input LOW Voltage  |         |         | $-1490$ | mV    | Guaranteed LOW Signal for All<br>Inputs (with one input tied to $V_{BB}$ )  |                                              |

**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  $-4.2\text{V}$  to  $-4.8\text{V}$ .

**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.

**DC Electrical Characteristics**
 $V_{EE} = -4.2V$  to  $-4.8V$  unless otherwise specified,  $V_{CC} = V_{CCA} = GND$ ,  $T_C = 0^\circ C$  to  $+85^\circ C$ 

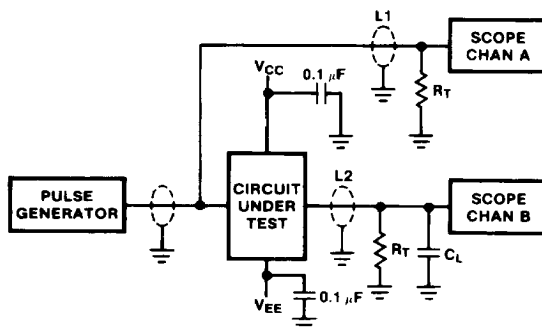
| Symbol     | Parameter                  | Min  | Typ | Max | Units   | Conditions                                                                              |
|------------|----------------------------|------|-----|-----|---------|-----------------------------------------------------------------------------------------|
| $V_{DIFF}$ | 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         |      |     | 50  | $\mu A$ | $V_{IN} = V_{IH} (Max)$ , $D_a - D_e = V_{BB}$ , $\bar{D}_a - \bar{D}_e = V_{IL} (Min)$ |
| $I_{CBO}$  | Input Leakage Current      | -10  |     |     | $\mu A$ | $V_{IN} = V_{EE}$ , $D_a - D_e = V_{BB}$ , $\bar{D}_a - \bar{D}_e = V_{IL} (Min)$       |
| $I_{EE}$   | Power Supply Current       | -106 | -73 | -51 | mA      | $D_a - D_e = V_{BB}$ , $\bar{D}_a - \bar{D}_e = V_{IL} (Min)$                           |

**Ceramic Dual-In-Line Package AC Electrical Characteristics**
 $V_{EE} = -4.2V$  to  $-4.8V$ ,  $V_{CC} = V_{CCA} = GND$ 

| 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  |       |                 |
| $t_{PLH}$<br>$t_{PHL}$ | Propagation Delay<br>Data to Output       | 0.55              | 1.90 | 0.60                | 2.00 | 0.70                | 2.40 | ns    | Figures 1 and 2 |
| $t_{TLH}$<br>$t_{THL}$ | Transition Time<br>20% to 80%, 80% to 20% | 0.55              | 1.30 | 0.45                | 1.20 | 0.45                | 1.40 | ns    |                 |

**Cerpak AC Electrical Characteristics**
 $V_{EE} = -4.2V$  to  $-4.8V$ ,  $V_{CC} = V_{CCA} = GND$ 

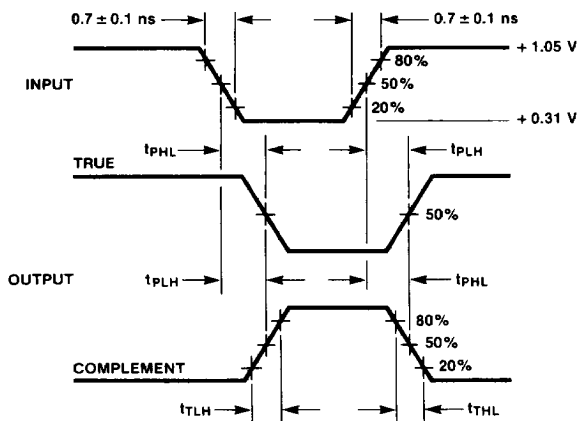
| Symbol                 | Parameter                                 | $T_C = 0^\circ C$ |      | $T_C = +25^\circ C$ |      | $T_C = +85^\circ C$ |      | Units | Conditions      |
|------------------------|-------------------------------------------|-------------------|------|---------------------|------|---------------------|------|-------|-----------------|
|                        |                                           | Min               | Max  | Min                 | Max  | Min                 | Max  |       |                 |
| $t_{PLH}$<br>$t_{PHL}$ | Propagation Delay<br>Data to Output       | 0.55              | 1.70 | 0.60                | 1.80 | 0.70                | 2.20 | ns    | Figures 1 and 2 |
| $t_{TLH}$<br>$t_{THL}$ | Transition Time<br>20% to 80%, 80% to 20% | 0.55              | 1.20 | 0.45                | 1.10 | 0.45                | 1.30 | ns    |                 |



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**Notes:**

$V_{CC}, V_{CCA} = +2V$ ,  $V_{EE} = -2.5V$   
 $L1$  and  $L2 =$  equal length  $50\Omega$  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  $50\Omega$  to GND  
 $C_L =$  Fixture and stray capacitance  $\leq 3 pF$

**FIGURE 1. AC Test Circuit****FIGURE 2. Propagation Delay and Transition Times**

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