National Semiconductor

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# 100314
# Low Power Quint Differential Line Receiver

## General Description

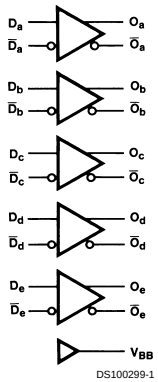
The 100314 is a monolithic quint differential line receiver with emitter-follower outputs. An internal reference supply ($V_{BB}$) is available for single-ended reception. When used in single-ended operation the apparent input threshold of the true inputs is 25 mV to 30 mV higher (positive) than the 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 $\overline{O}_a$–$\overline{O}_e$ 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
- Standard Microcircuit Drawing (SMD) 5962-9162901

## Logic Symbol



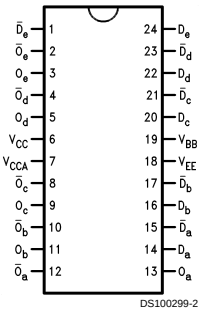

DS100299-1

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

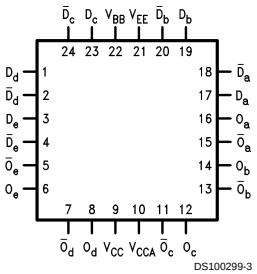
## Connection Diagrams

**24-Pin DIP**




DS100299-2

**24-Pin Quad Cerpak**




DS100299-3

## Absolute Maximum Ratings (Note 1)

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

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

| | |
|---|---|
| Storage Temperature ($T_{STG}$) | −65˚C to +150˚C |
| Maximum Junction Temperture ($T_J$) | |
| Ceramic | +175˚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) | ≥2000V |

## Recommended Operating Conditions

| | |
|---|---|
| Case Temperature ($T_C$) | |
| Military | −55˚C to +125˚C |
| Supply Voltage ($V_{EE}$) | −5.7V to −4.2V |

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

## Military Version DC Electrical Characteristics

$V_{EE}$ = −4.2V to −5.7V, $V_{CC}$ = $V_{CCA}$ = GND, $T_C$ = −55˚C to +125˚C (Note 5)

| Symbol | Parameter | Min | Typ | Max | Units | $T_C$ | Conditions | | Notes |
|---|---|---|---|---|---|---|---|---|---|
| $V_{OH}$ | Output HIGH Voltage | −1025 | | −870 | mV | 0˚C to +125˚C | $V_{IN}$ = $V_{IH}$ (Max) or $V_{IL}$ (Min) | Loading with 50Ω to −2.0V | |
| | | −1085 | | −870 | mV | −55˚C | | | (Notes 3, 4, 5) |
| $V_{OL}$ | Output LOW Voltage | −1830 | | −1620 | mV | 0˚C to +125˚C | | | |
| | | −1830 | | −1555 | mV | −55˚C | | | |
| $V_{OHC}$ | Output HIGH Voltage | −1035 | | | mV | 0˚C to +125˚C | $V_{IN}$ = $V_{IH}$ (Max) or $V_{IL}$ (Min) | Loading with 50Ω to −2.0V | |
| | | −1085 | | | mV | −55˚C | | | (Notes 3, 4, 5) |
| $V_{OLC}$ | Output LOW Voltage | | | −1610 | mV | 0˚C to +125˚C | | | |
| | | | | −1555 | mV | −55˚C | | | |
| $V_{BB}$ | Output Reference Voltage | | | −1260 | mV | 0˚C to +125˚C | $I_{VBB}$ = 0 µA, $V_{EE}$ = 4.2V | | (Notes 3, 4, 5) |
| | | −1380 | | −1260 | mV | 0˚C to +125˚C | $I_{VBB}$ = −250 µA, $V_{EE}$ = −5.7V | | (Notes 3, 4, 5) |
| | | −1396 | | | mV | −55˚C | $I_{VBB}$ = −350 µA, $V_{EE}$ = −5.7V | | |
| $V_{DIFF}$ | Input Voltage Differential | 150 | | | mV | −55˚C to +125˚C | Required for Full Output Swing | | (Notes 3, 4, 5) |
| $V_{CM}$ | Common Mode Voltage | $V_{CC}$ − 2.0 | | $V_{CC}$ − 0.5 | V | −55˚C to +125˚C | | | (Notes 3, 4, 5) |
| $V_{IH}$ | Single-Ended Input High Voltage | −1165 | | −870 | mV | −55˚C to +125˚C | Guaranteed HIGH Signal for All Inputs (with $\overline{D_n}$ tied to $V_{BB}$) | | (Notes 3, 4, 5, 6) |
| $V_{IL}$ | Single-Ended Input Low Voltage | −1830 | | −1475 | mV | −55˚C to +125˚C | Guaranteed LOW Signal for All Inputs (with $\overline{D_n}$ tied to $V_{BB}$) | | (Notes 3, 4, 5, 6) |
| $I_{IH}$ | Input HIGH Current | | | 50 | µA | 0˚C to +125˚C | $V_{IN}$ = $V_{IH\ (Max)}$, $D_a$–$D_e$ = $V_{BB}$, $\overline{D_a}$–$\overline{D_e}$ = $V_{IL\ (Min)}$ | | (Notes 3, 4, 5) |
| | | | | 70 | µA | −55˚C | | | |
| $I_{CBO}$ | Input Leakage Current | −10 | | | µA | −55˚C to +125˚C | $V_{IN}$ = $V_{EE}$, $D_a$–$D_e$ = $V_{BB}$, $\overline{D_a}$–$\overline{D_e}$ = $V_{IL\ (Min)}$ | | (Notes 3, 4, 5) |
| $I_{EE}$ | Power Supply Current | −65 | | −25 | mA | −55˚C to +125˚C | $D_a$–$D_e$ = $V_{BB}$, $\overline{D_a}$–$\overline{D_e}$ = $V_{IL\ (Min)}$ | | (Notes 3, 4, 5) |

**Note 3:** F100K 300 Series cold temperature testing is performed by temperature soaking (to guarantee junction temperature equals −55˚C), then testing immediately without allowing for the junction temperature to stabilize due to heat dissipation after power-up. This provides "cold start" specs which can be considered a worst case condition at cold temperatures.

**Note 4:** Screen tested 100% on each device at −55˚C, +25˚C, and +125˚C, Subgroups 1, 2, 3, 7, and 8.

**Note 5:** Sample tested (Method 5005, Table I) on each manufactured lot at −55˚C, +25˚C, and +125˚C, Subgroups A1, 2, 3, 7, and 8.

**Note 6:** Guaranteed by applying specified input condition and testing $V_{OH}$/$V_{OL}$.

## AC Electrical Characteristics

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

| Symbol | Parameter | $T_C$ = −55°C | | $T_C$ = +25°C | | $T_C$ = +125°C | | Units | Conditions | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Min | Max | Min | Max | Min | Max | | | |
| $t_{PLH}$<br>$t_{PHL}$ | Propagation Delay<br>Data to Output | 0.40 | 2.30 | 0.60 | 2.20 | 0.60 | 2.70 | ns | *Figures 1, 2* | (Notes 7, 8, 9) |
| $t_{TLH}$<br>$t_{THL}$ | Transition Time<br>20% to 80%, 80% to 20% | 0.20 | 1.40 | 0.20 | 1.40 | 0.20 | 1.40 | ns | | (Note 10) |

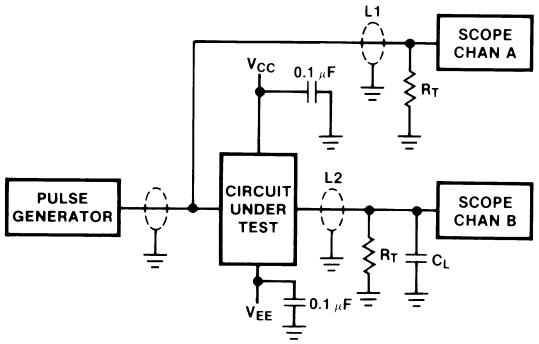
**Note 7:** F100K 300 Series cold temperature testing is performed by temperature soaking (to guarantee junction temperature equals −55°C), then testing immediately after power-up. This provides "cold start" specs which can be considered a worst case condition at cold temperatures.

**Note 8:** Screen tested 100% on each device at +25°C temperature only, Subgroup A9.

**Note 9:** Sample tested (Method 5005, Table I) on each manufactured lot at +25°C, Subgroup A9, and at +125°C and −55°C temperatures, Subgroups A10 and A11.

**Note 10:** Not tested at +25°C, +125°C and −55°C temperature (design characterization data).

## Test Circuit




**Note:** $V_{CC}$, $V_{CCA}$ = +2V, $V_{EE}$ = −2.5V
L1 and L2 = equal length 50Ω impedance lines
$R_T$ = 50Ω terminator internal to scope
Decoupling 0.1 µF from GND to $V_{CC}$ and $V_{EE}$
All unused outputs are loaded with 50Ω to GND
$C_L$ = Fixture and stray capacitance ≤ 3 pF

**FIGURE 1. AC Test Circuit**

## Switching Waveforms

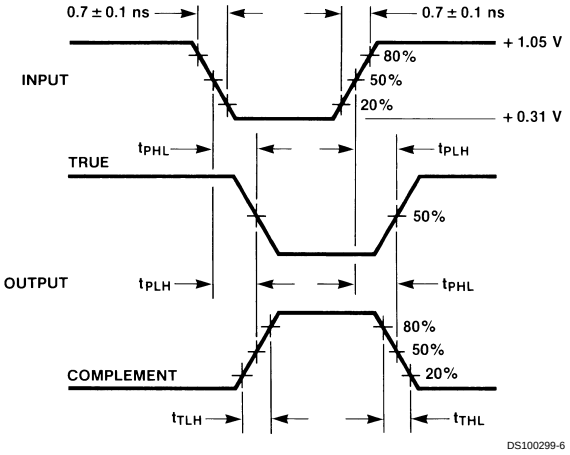
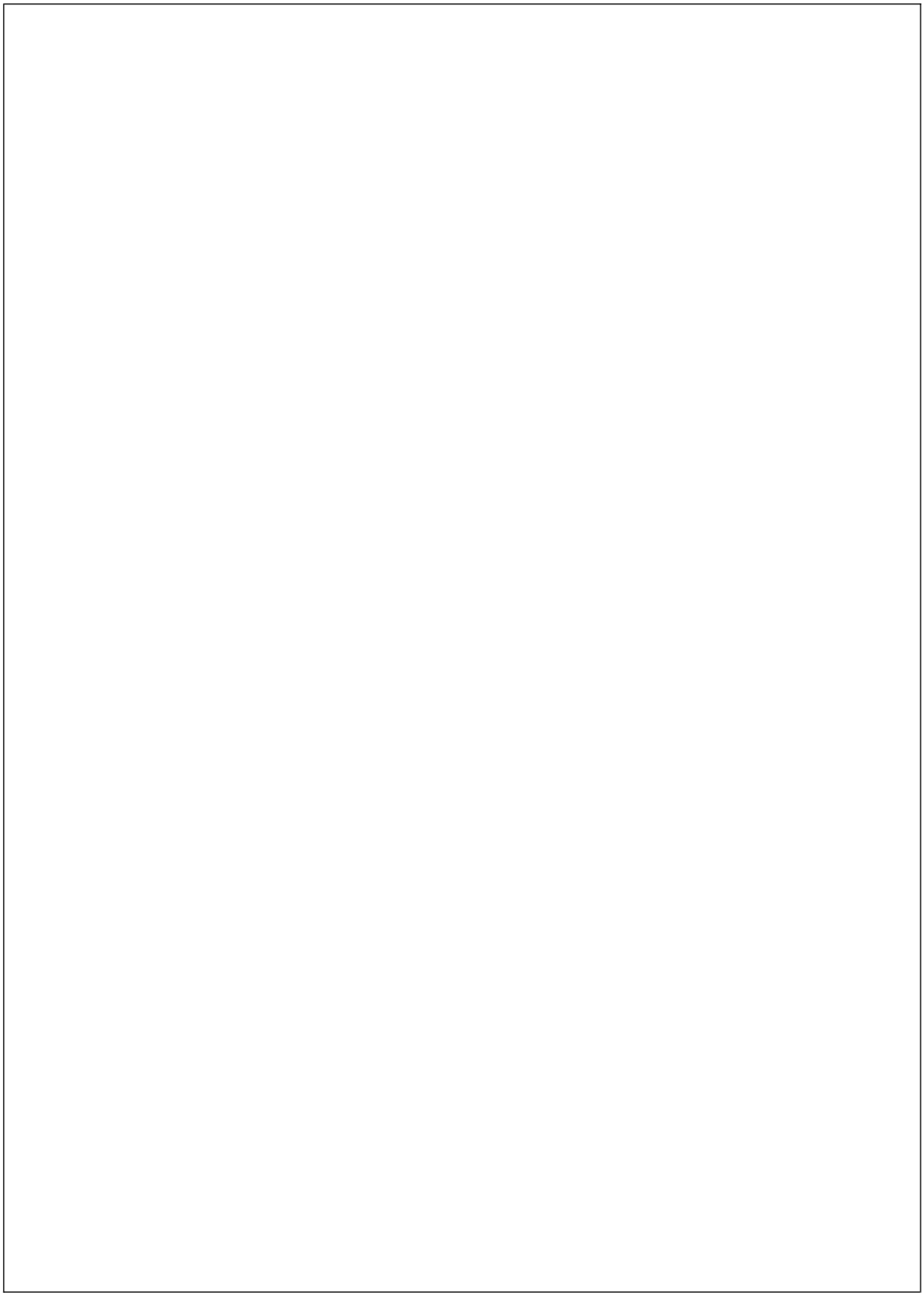
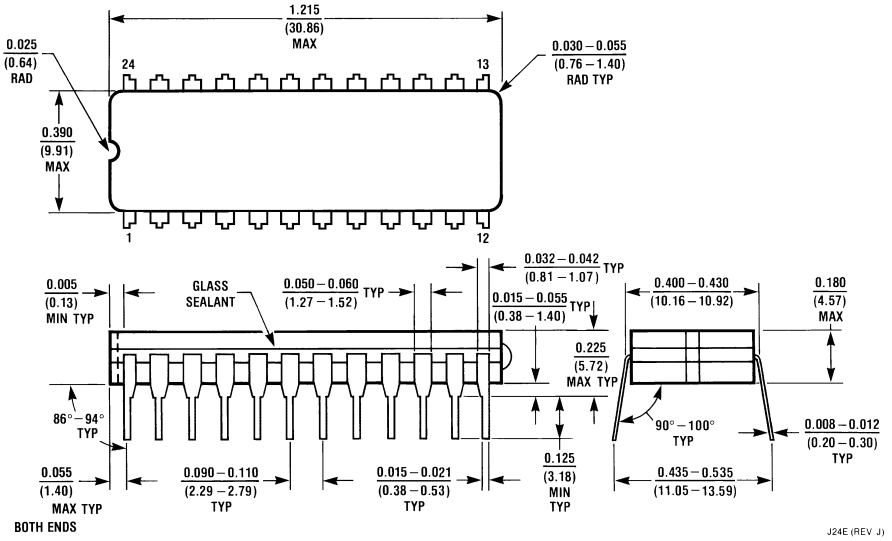


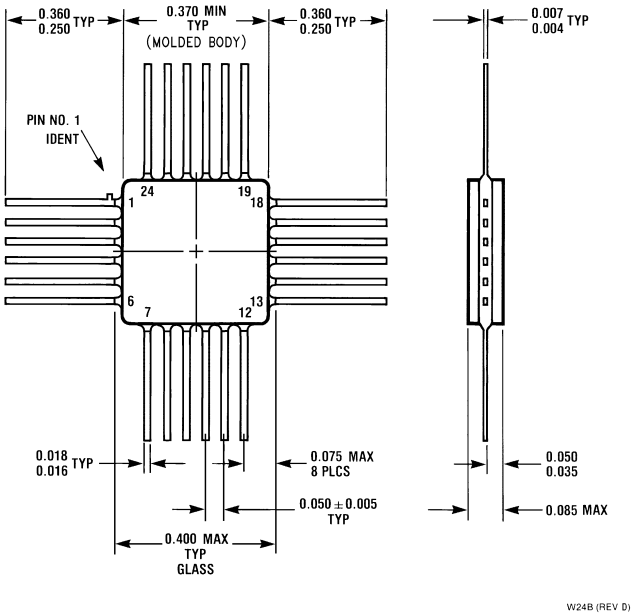

**FIGURE 2. Propagation Delay and Transition Times**



## Physical Dimensions inches (millimeters) unless otherwise noted




**24-Lead Ceramic Dual-In-Line Package (0.400" Wide) (D)**
**NS Package Number J24E**




**24-Lead Quad Cerpak (F)**
**NS Package Number W24B**

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