

## 100307 Low Power Quint Exclusive OR/NOR Gate

### General Description

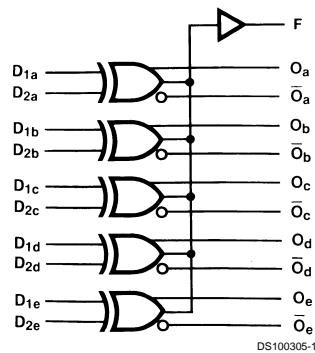
The 100307 is monolithic quint exclusive-OR/NOR gate. The Function output is the wire-OR of all five exclusive-OR outputs. All inputs have 50 kΩ pull-down resistors.

### Features

- Low Power Operation

- 2000V ESD protection
- Pin/function compatible with 100107
- Voltage compensated operating range = -4.2V to -5.7V
- Available to industrial grade temperature range
- Available to Standard Microcircuit Drawing (SMD) 5962-9459001

### Logic Symbol



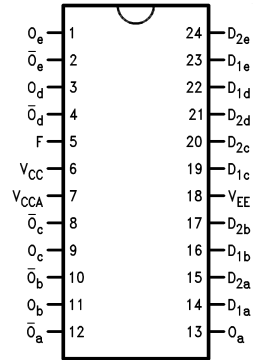
### Logic Equation

$$F = (D_{1a} \oplus D_{2a}) + (D_{1b} \oplus D_{2b}) + (D_{1c} \oplus D_{2c}) + (D_{1d} \oplus D_{2d}) + (D_{1e} \oplus D_{2e})$$

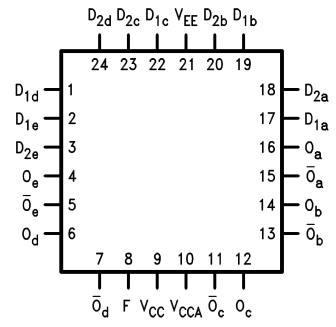
| Pin Names             | Description                |
|-----------------------|----------------------------|
| $D_{na}-D_{ne}$       | Data Inputs                |
| F                     | Function Output            |
| $O_a-O_e$             | Data Outputs               |
| $\bar{O}_a-\bar{O}_e$ | Complementary Data Outputs |

## Connection Diagrams

24-Pin DIP



24-Pin Quad Cerpak



## 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 Temperature ( $T_J$ )                |                   |
| Ceramic   | +175°C            |
| Plastic   | +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)                       | -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  $-5.7V$ ,  $V_{CC} = V_{CCA} = GND$ ,  $T_C = -55^\circ C$  to  $+125^\circ C$

| Symbol    | Parameter                             | Min   | Max   | Units | $T_C$           | Conditions                                   | Notes                     |         |
|-----------|---------------------------------------|-------|-------|-------|-----------------|--|---------------------------|---------|
| $V_{OH}$  | Output HIGH Voltage                   | -1025 | -870  | mV    | 0°C to +125°C   | $V_{IN} = V_{IH}$ (Max)<br>or $V_{IL}$ (Min) | Loading with 50Ω to -2.0V | 1, 2, 3 |
|           |                                       | -1085 | -870  | mV    | -55°C           |  |                           |         |
| $V_{OL}$  | Output LOW Voltage                    | -1830 | -1620 | mV    | 0°C to +125°C   | $V_{IN} = V_{IH}$ (Max)<br>or $V_{IL}$ (Min) | Loading with 50Ω to -2.0V | 1, 2, 3 |
|           |                                       | -1830 | -1555 | mV    | -55°C           |  |                           |         |
| $V_{OHC}$ | Output HIGH Voltage                   | -1035 |       | mV    | 0°C to +125°C   | $V_{IN} = V_{IH}$ (Min)<br>or $V_{IL}$ (Max) | Loading with 50Ω to -2.0V | 1, 2, 3 |
|           |                                       | -1085 |       | mV    | -55°C           |  |                           |         |
| $V_{OLC}$ | Output LOW Voltage                    |       | -1610 | mV    | 0°C to +125°C   | $V_{IN} = V_{IH}$ (Min)<br>or $V_{IL}$ (Max) | Loading with 50Ω to -2.0V | 1, 2, 3 |
|           |                                       |       | -1555 | mV    | -55°C           |  |                           |         |
| $V_{IH}$  | Input HIGH Voltage                    | -1165 | -870  | mV    | -55°C to +125°C | Guaranteed HIGH Signal for All Inputs        | 1, 2, 3, 4                |         |
| $V_{IL}$  | Input LOW Voltage                     | -1830 | -1475 | mV    | -55°C to +125°C | Guaranteed LOW Signal for All Inputs         | 1, 2, 3, 4                |         |
| $I_{IL}$  | Input LOW Current                     | 0.50  |       | μA    | -55°C to +125°C | $V_{EE} = -4.2V$<br>$V_{IN} = V_{IL}$ (Min)  | 1, 2, 3                   |         |
| $I_{IH}$  | Input High Current<br>$D_{2a}-D_{2e}$ |       | 250   | μA    | 0°C to +125°C   | $V_{EE} = -5.7V$<br>$V_{IN} = V_{IH}$ (Max)  | 1, 2, 3                   |         |
|           |                                       |       | 350   | μA    | -55°C           |  |                           |         |
|           | $D_{1a}-D_{1e}$                       |       | 350   | μA    | -55°C           |  |                           |         |
|           |                                       |       | 500   | μA    | -55°C           |  |                           |         |
| $I_{EE}$  | Power Supply Current                  | -75   | -25   | mA    | -55°C to +125°C | Inputs Open                                  | 1, 2, 3                   |         |

**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                       | $T_C = -55^\circ C$ |      | $T_C = +25^\circ C$ |      | $T_C = +125^\circ C$ |      | Units | Conditions   | Notes   |
|-----------|---------------------------------|---------------------|------|---------------------|------|----------------------|------|-------|--------------|---------|
|           |                                 | Min                 | Max  | Min                 | Max  | Min                  | Max  |       |              |         |
| $t_{PLH}$ | Propagation Delay               | 0.30                | 2.10 | 0.40                | 1.90 | 0.40                 | 2.40 | ns    | Figures 1, 2 | 1, 2, 3 |
| $t_{PHL}$ | $D_{2a}-D_{2e}$ to O, $\bar{O}$ |                     |      |                     |      |                      |      |       |              |         |
| $t_{PLH}$ | Propagation Delay               | 0.30                | 1.90 | 0.40                | 1.80 | 0.40                 | 2.20 | ns    |              |         |
| $t_{PHL}$ | $D_{1a}-D_{1e}$ to O, $\bar{O}$ |                     |      |                     |      |                      |      |       |              |         |
| $t_{PLH}$ | Propagation Delay               | 0.80                | 2.90 | 0.90                | 2.80 | 0.90                 | 3.40 | ns    |              |         |
| $t_{PHL}$ | Data to F                       |                     |      |                     |      |                      |      |       |              |         |
| $t_{TLH}$ | Transition Time                 | 0.20                | 1.70 | 0.30                | 1.60 | 0.20                 | 1.70 | ns    |              | 4       |
| $t_{THL}$ | 20% to 80%, 80% to 20%          |                     |      |                     |      |                      |      |       |              |         |

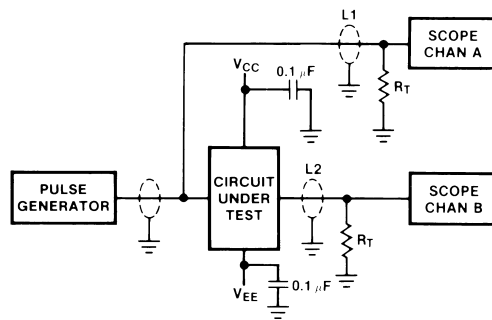
**Note 7:** F100K 300 Series cold temperature testing is performed by temperature soaking (to guarantee junction temperature equals  $-55^\circ C$ ), then testing immediately after power-up. This provides "cold start" specs which can be considered a worst case condition at cold temperatures.

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

**Note 9:** Sample tested (Method 5005, Table I) on each mfg. lot at  $+25^\circ C$ , Subgroup A9, and at  $+125^\circ C$  and  $-55^\circ C$  temperatures, Subgroups A10 and A11.

**Note 10:** Not tested at  $+25^\circ C$ ,  $+125^\circ C$ , and  $-55^\circ C$  temperature (design characterization data).

## Test Circuitry



DS100305-5

### Notes:

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

$L_1$  and  $L_2$  = equal length 50Ω impedance lines

$R_T = 50\Omega$  terminator internal to scope

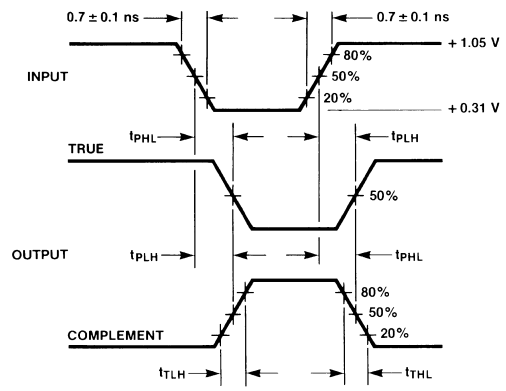
Decoupling  $0.1 \mu F$  from GND to  $V_{CC}$  and  $V_{EE}$

All unused outputs are loaded with  $50\Omega$  to GND

$C_L$  = Fixture and stray capacitance  $\leq 3 pF$

FIGURE 1. AC Test Circuit

## Switching Waveforms

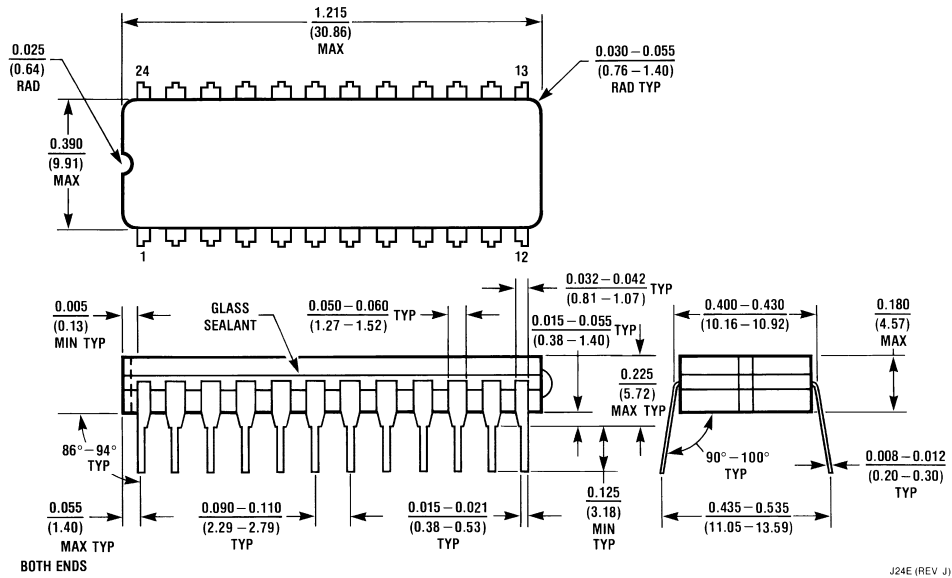


DS100305-6

FIGURE 2. Propagation Delay and Transition Times

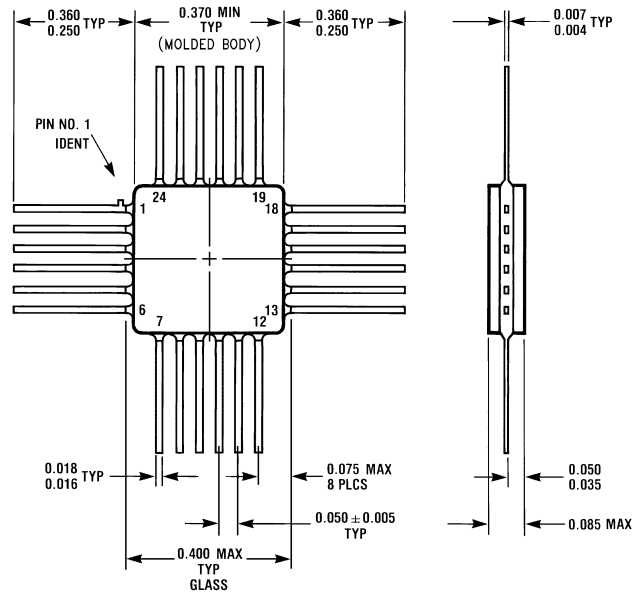


**Physical Dimensions** inches (millimeters) unless otherwise noted



J24E (REV J)

**24-Pin Ceramic Dual-In-Line Package (D)**  
NS Package Number J24E



W24B (REV D)

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

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