

## Low Power Quint AND/NAND Gate

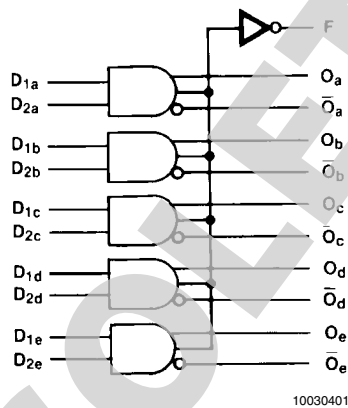
### General Description

The 100304 is monolithic quint AND/NAND gate. The Function output is the wire-NOR of all five AND gate outputs. All inputs have 50 kΩ pull-down resistors.

### Features

- Low Power Operation
- 2000V ESD protection
- Pin/function compatible with 100104
- Voltage compensated operating range = -4.2V to -5.7V
- Available to industrial grade temperature range
- Available to Standard Microcircuit Drawing (SMD) 5962-9153701

### Logic Symbol

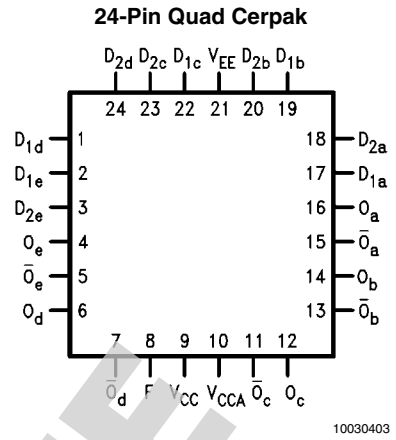
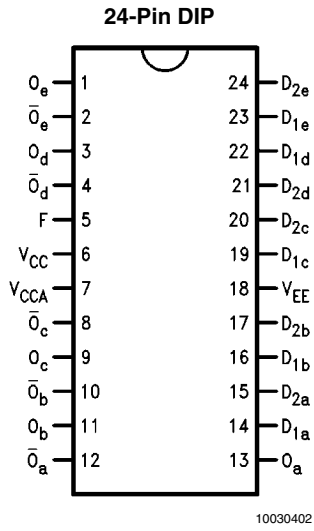


### Logic Equation

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

Pin Names	Description
D <sub>1a</sub> –D <sub>1e</sub>	Data Inputs
F	Function Output
O <sub>a</sub> –O <sub>e</sub>	Data Outputs
$\overline{O}_a$ – $\overline{O}_e$	Complementary Data Outputs

## Connection Diagrams



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## 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

Storage Temperature ( $T_{STG}$ )	-65°C to +150°C
Maximum Junction Temperature ( $T_J$ )	
Ceramic	+175°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  $-5.7V$ ,  $V_{CC} = V_{CCA} = GND$ ,  $T_C = -55°C$  to  $+125°C$

Symbol	Parameter	Min	Max	Units	$T_C$	Conditions	Notes
$V_{OH}$	Output HIGH Voltage	-1025	-870	mV	0°C to +125°C	$V_{IN} = V_{IH} (Max)$ or $V_{IL} (Min)$	Loading with 50Ω to -2.0V
		-1085	-870	mV	-55°C		
$V_{OL}$	Output LOW Voltage	-1830	-1620	mV	0°C to +125°C	$V_{IN} = V_{IH} (Min)$ or $V_{IL} (Max)$	Loading with 50Ω to -2.0V
		-1830	-1555	mV	-55°C		
$V_{OHC}$	Output HIGH Voltage	-1035		mV	0°C to +125°C	$V_{IN} = V_{IH} (Min)$ or $V_{IL} (Max)$	Loading with 50Ω to -2.0V
		-1085		mV	-55°C		
$V_{OLC}$	Output LOW Voltage		-1610	mV	0°C to +125°C	$V_{IN} = V_{IH} (Min)$ or $V_{IL} (Max)$	Loading with 50Ω to -2.0V
			-1555	mV	-55°C		
$V_{IH}$	Input HIGH Voltage	-1165	-870	mV	-55°C to +125°C	Guaranteed HIGH Signal for All Inputs	(Notes 3, 4, 5, 6)
$V_{IL}$	Input LOW Voltage	-1830	-1475	mV	-55°C to +125°C	Guaranteed LOW Signal for All Inputs	(Notes 3, 4, 5, 6)
$I_{IL}$	Input LOW Current	0.50		μA	-55°C to +125°C	$V_{EE} = -4.2V$ $V_{IN} = V_{IL} (Min)$	(Notes 3, 4, 5)
$I_{IH}$	Input High Current $D_{2a}-D_{2e}$ $D_{1a}-D_{1e}$		250	μA	0°C to +125°C	$V_{EE} = -5.7V$ $V_{IN} = V_{IH} (Max)$	(Notes 3, 4, 5)
			350	μA	-55°C		
$I_{IH}$	Input High Current $D_{2a}-D_{2e}$ $D_{1a}-D_{1e}$		350	μA	-55°C	$V_{EE} = -5.7V$ $V_{IN} = V_{IH} (Max)$	(Notes 3, 4, 5)
			500	μA	-55°C		
$I_{EE}$	Power Supply Current	-75	-25	mA	-55°C to +125°C	Inputs Open	(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	$T_C = -55^\circ C$		$T_C = +25^\circ C$		$T_C = +125^\circ C$		Units	Conditions	Notes
		Min	Max	Min	Max	Min	Max			
$t_{PLH}$	Propagation Delay	0.30	1.90	0.40	1.80	0.30	2.30	ns	Figures 1, 2	(Notes 7, 8, 9)
$t_{PHL}$	$D_{na}-D_{ne}$ 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	1.80	0.30	1.60	0.20	2.00	ns		(Note 10)
$t_{THL}$	20% to 80%, 80% to 20%									

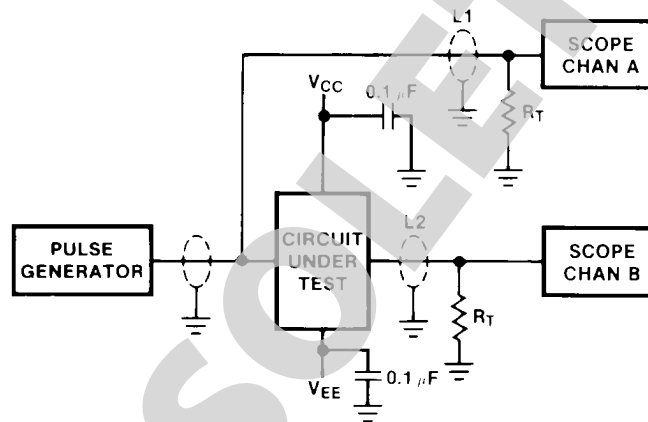
**Note 7:** F100K 300 Series cold temperature testing is performed by temperature soaking (to guarantee junction temperature equals  $-55^\circ C$ ), then testing immediately after power-up. This provides "cold start" specs which can be considered a worst case condition at cold temperatures.

**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



10030405

### 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

## Switching Waveforms

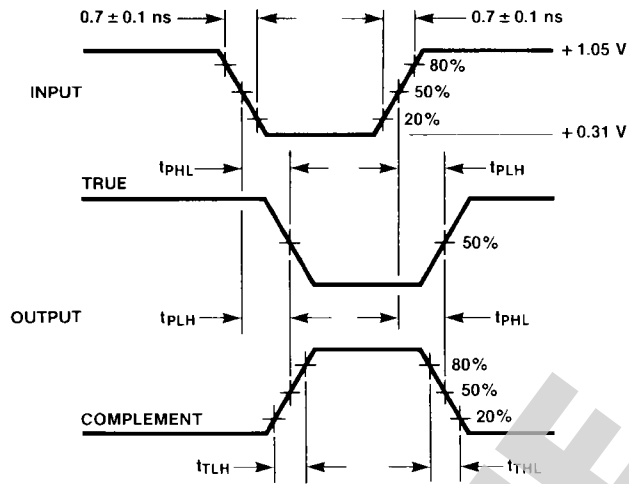
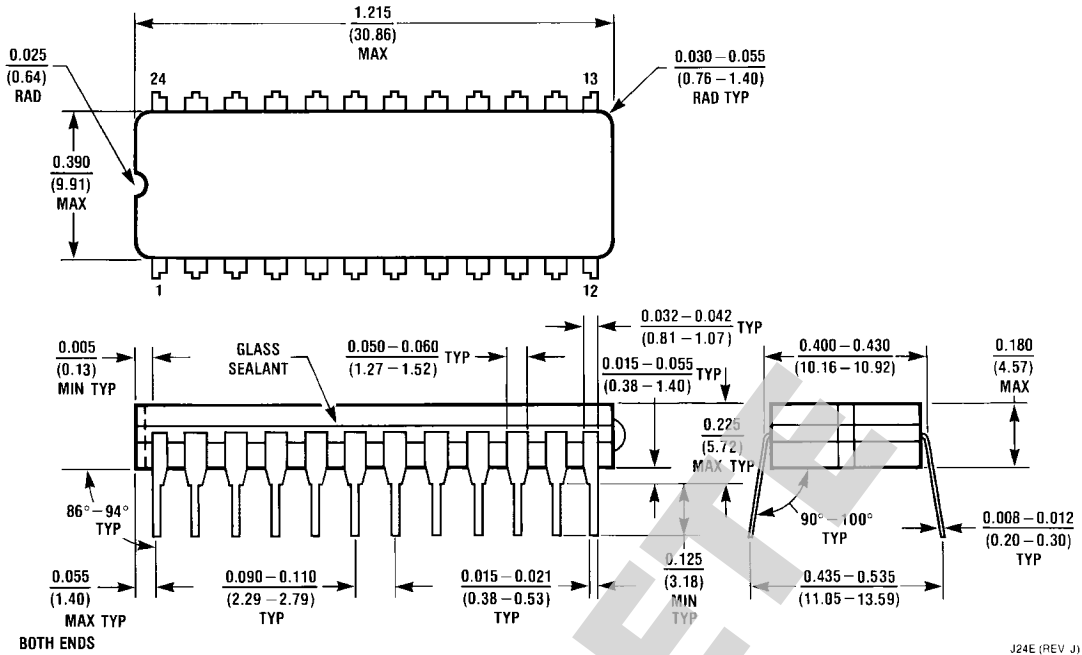


FIGURE 2. Propagation Delay and Transition Times

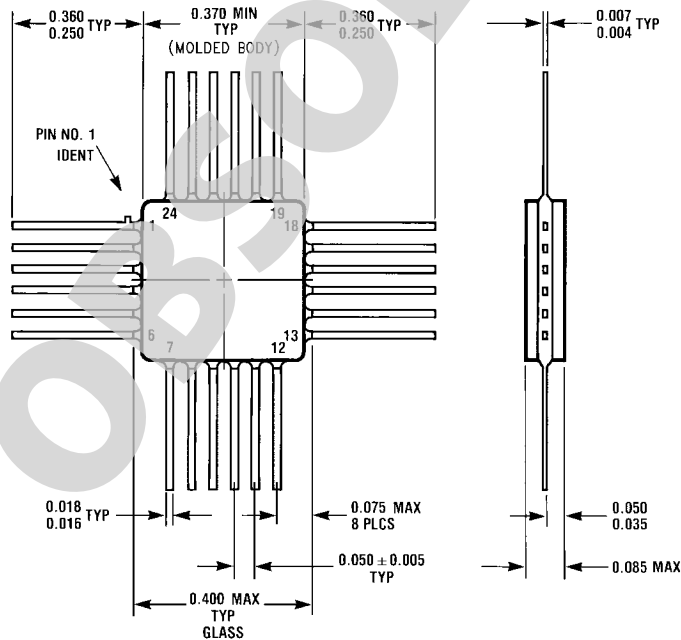
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**Physical Dimensions** inches (millimeters) unless otherwise noted



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

J24E (REV J)



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

W24B (REV D)

# Notes

100304

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## Notes

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Power Management	<a href="http://www.national.com/power">www.national.com/power</a>	Green Compliance	<a href="http://www.national.com/quality/green">www.national.com/quality/green</a>
Switching Regulators	<a href="http://www.national.com/switchers">www.national.com/switchers</a>	Distributors	<a href="http://www.national.com/contacts">www.national.com/contacts</a>
LDOs	<a href="http://www.national.com/ldo">www.national.com/ldo</a>	Quality and Reliability	<a href="http://www.national.com/quality">www.national.com/quality</a>
LED Lighting	<a href="http://www.national.com/led">www.national.com/led</a>	Feedback/Support	<a href="http://www.national.com/feedback">www.national.com/feedback</a>
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