

# 100304

## 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

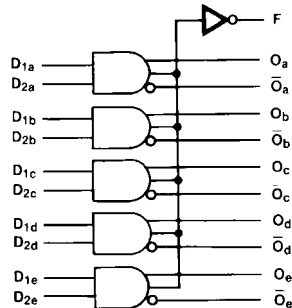
- Low Power Operation
- 2000V ESD protection
- Pin/function compatible with 100104
- Voltage compensated operating range = -4.2V to -5.7V
- Available to industrial grade temperature range (PLCC package only)

### Ordering Code:

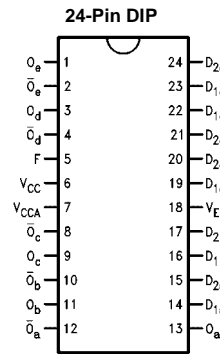
Order Number	Package Number	Package Description
100304PC	N24E	24-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-010, 0.400 Wide
100304QC	V28A	28-Lead Plastic Lead Chip Carrier (PLCC), JEDEC MO-047, 0.450 Square
100304QI	V28A	28-Lead Plastic Lead Chip Carrier (PLCC), JEDEC MO-047, 0.450 Square Industrial Temperature Range (-40°C to +85°C)

Devices also available in Tape and Reel. Specify by appending the suffix letter "X" to the ordering code.

### Logic Symbol



### Connection Diagrams

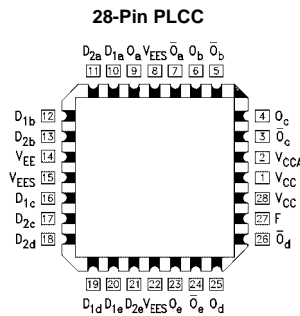


### Pin Descriptions

Pin Names	Description
D <sub>na</sub> -D <sub>ne</sub>	Data Inputs
F	Function Output
O <sub>a</sub> -O <sub>e</sub>	Data Outputs
$\bar{O}_a$ - $\bar{O}_e$	Complementary Data Outputs

### Logic Equation

$$F = (\bar{D}_{1a} \cdot \bar{D}_{2a}) + (\bar{D}_{1b} \cdot \bar{D}_{2b}) + (\bar{D}_{1c} \cdot \bar{D}_{2c}) + (\bar{D}_{1d} \cdot \bar{D}_{2d}) + (\bar{D}_{1e} \cdot \bar{D}_{2e})$$



**Absolute Maximum Ratings** (Note 1)

Storage Temperature ( $T_{STG}$ )	-65°C to +150°C
Maximum Junction Temperature ( $T_J$ )	+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)	$\geq 2000V$

**Recommended Operating Conditions**

Case Temperature ( $T_C$ )	Commercial	0°C to +85°C
	Industrial	-40°C to +85°C
Supply Voltage ( $V_{EE}$ )		-5.7V to -4.2V

**Note 1:** The "Absolute Maximum Ratings" are those values beyond which the safety of the device cannot be guaranteed. The device should not be operated at these limits. The parametric values defined in the Electrical Characteristics tables are not guaranteed at the absolute maximum rating. The "Recommended Operating Conditions" table will define the conditions for actual device operation.

**Note 2:** ESD testing conforms to MIL-STD-883, Method 3015.

**Commercial Version****DC Electrical Characteristics** (Note 3)

$V_{EE} = -4.2V$  to  $-5.7V$ ,  $V_{CC} = V_{CCA} = GND$ ,  $T_C = 0^\circ C$  to  $+85^\circ C$

Symbol	Parameter	Min	Typ	Max	Units	Conditions
$V_{OH}$	Output HIGH Voltage	-1025	-955	-870	mV	$V_{IN} = V_{IH}(\text{Max})$ or $V_{IL}(\text{Min})$
$V_{OL}$	Output LOW Voltage	-1830	-1705	-1620	mV	
$V_{OHC}$	Output HIGH Voltage	-1035			mV	$V_{IN} = V_{IH}(\text{Min})$ or $V_{IL}(\text{Max})$
$V_{OLC}$	Output LOW Voltage			-1610	mV	
$V_{IH}$	Input HIGH Voltage	-1165		-870	mV	Guaranteed HIGH Signal for All Inputs
$V_{IL}$	Input LOW Voltage	-1830		-1475	mV	Guaranteed LOW Signal for All Inputs
$I_{IL}$	Input LOW Current	0.50			$\mu A$	$V_{IN} = V_{IL}(\text{Min})$
$I_{IH}$	Input High Current $D_{2a}-D_{2e}$ $D_{1a}-D_{1e}$			250 350	$\mu A$	$V_{IN} = V_{IH}(\text{Max})$
$I_{EE}$	Power Supply Current	-69	-43	-30	mA	Inputs open

**Note 3:** The specified limits represent the "worst case" value for the parameter. Since these values normally occur at the temperature extremes, additional noise immunity and guardbanding can be achieved by decreasing the allowable system operating ranges. Conditions for testing shown in the tables are chosen to guarantee operation under "worst case" conditions.

**DIP AC Electrical Characteristics**

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

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		
$t_{PLH}$	Propagation Delay	0.40	1.75	0.40	1.65	0.40	1.75	ns	Figures 1, 2
$t_{PHL}$	$D_{na}-D_{ne}$ to $O, \bar{O}$								
$t_{PLH}$	Propagation Delay	1.00	2.60	1.00	2.60	1.15	3.20	ns	
$t_{PHL}$	Data to F								
$t_{TLH}$	Transition Time	0.35	1.20	0.35	1.20	0.35	1.20	ns	
$t_{THL}$	20% to 80%, 80% to 20%								

**PLCC AC Electrical Characteristics**

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

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		
$t_{PLH}$	Propagation Delay	0.40	1.55	0.40	1.45	0.40	1.55	ns	Figures 1, 2
$t_{PHL}$	$D_{na}-D_{ne}$ to $O, \bar{O}$								
$t_{PLH}$	Propagation Delay	1.00	2.40	1.00	2.40	1.15	3.00	ns	
$t_{PHL}$	Data to F								
$t_{TLH}$	Transition Time	0.35	1.10	0.35	1.15	0.35	1.10	ns	
$t_{THL}$	20% to 80%, 80% to 20%								

**Industrial Version****PLCC DC Electrical Characteristics** (Note 4)
 $V_{EE} = -4.2V$  to  $-5.7V$ ,  $V_{CC} = V_{CCA} = GND$ ,  $T_C = -40^{\circ}C$  to  $+85^{\circ}C$ 

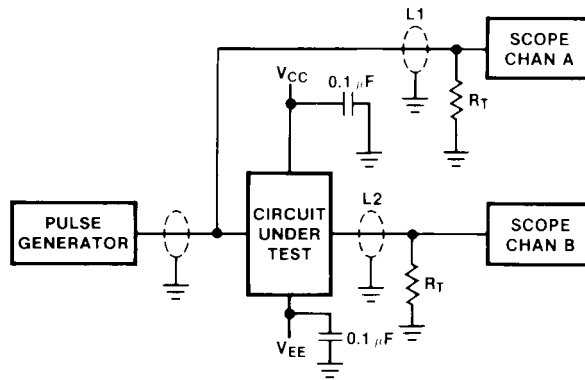
Symbol	Parameter	$T_C = -40^{\circ}C$		$T_C = 0^{\circ}C$ to $+85^{\circ}C$		Units	Conditions
		Min	Max	Min	Max		
$V_{OH}$	Output HIGH Voltage	-1085	-870	-1025	-870	mV	$V_{IN} = V_{IH} (Max)$ or $V_{IL} (Min)$ Loading with $50\Omega$ to $-2.0V$
$V_{OL}$	Output LOW Voltage	-1830	-1575	-1830	-1620		
$V_{OHC}$	Output HIGH Voltage	-1095		-1035		mV	$V_{IN} = V_{IH} (Min)$ or $V_{IL} (Max)$ Loading with $50\Omega$ to $-2.0V$
$V_{OLC}$	Output LOW Voltage		-1565		-1610		
$V_{IH}$	Input HIGH Voltage	-1170	-870	-1165	-870	mV	Guaranteed HIGH Signal for All Inputs
$V_{IL}$	Input LOW Voltage	-1830	-1480	-1830	-1475		
$I_{IL}$	Input LOW Current	0.50		0.50		$\mu A$	$V_{IN} = V_{IL} (Min)$
$I_{IH}$	Input HIGH Current					$\mu A$	$V_{IN} = V_{IH} (Max)$
	$D_{2a}-D_{2e}$		250		250		
	$D_{1a}-D_{1e}$		350		350		
$I_{EE}$	Power Supply Current	-69	-30	-69	-30	mA	Inputs OPEN

**Note 4:** The specified limits represent the "worst case" value for the parameter. Since these values normally occur at the temperature extremes, additional noise immunity and guardbanding can be achieved by decreasing the allowable system operating ranges. Conditions for testing shown in the tables are chosen to guarantee operation under "worst case" conditions.

**PLCC AC Electrical Characteristics**
 $V_{EE} = -4.2V$  to  $-5.7V$ ,  $V_{CC} = V_{CCA} = GND$ 

Symbol	Parameter	$T_C = 40^{\circ}C$		$T_C = +25^{\circ}C$		$T_C = +85^{\circ}C$		Units	Conditions
		Min	Max	Min	Max	Min	Max		
$t_{PLH}$	Propagation Delay	0.35	1.55	0.40	1.45	0.40	1.55	ns	Figures 1, 2
$t_{PHL}$	$D_{na}-D_{ne}$ to $O, \bar{O}$								
$t_{PLH}$	Propagation Delay	1.00	2.40	1.00	2.40	1.15	3.00	ns	
$t_{PHL}$	Data to F								
$t_{TLH}$	Transition Time	0.35	1.10	0.35	1.15	0.35	1.10	ns	
$t_{THL}$	20% to 80%, 80% to 20%								

### Test Circuitry



**Notes:**

- $V_{CC}, V_{CCA} = +2V, V_{EE} = -2.5V$
- L1 and L2 = equal length 50Ω impedance lines
- $R_T = 50\Omega$  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  $\leq 3$  pF

FIGURE 1. AC Test Circuit

### Switching Waveforms

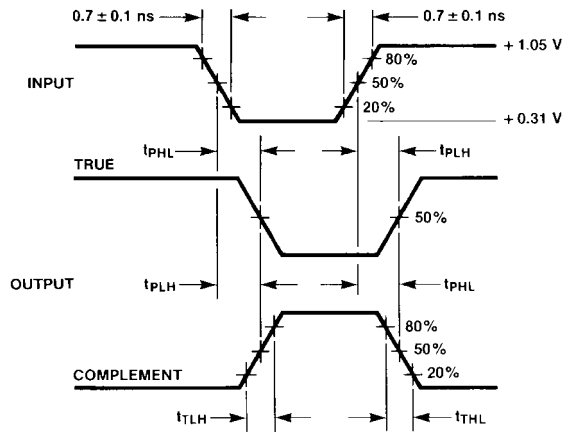
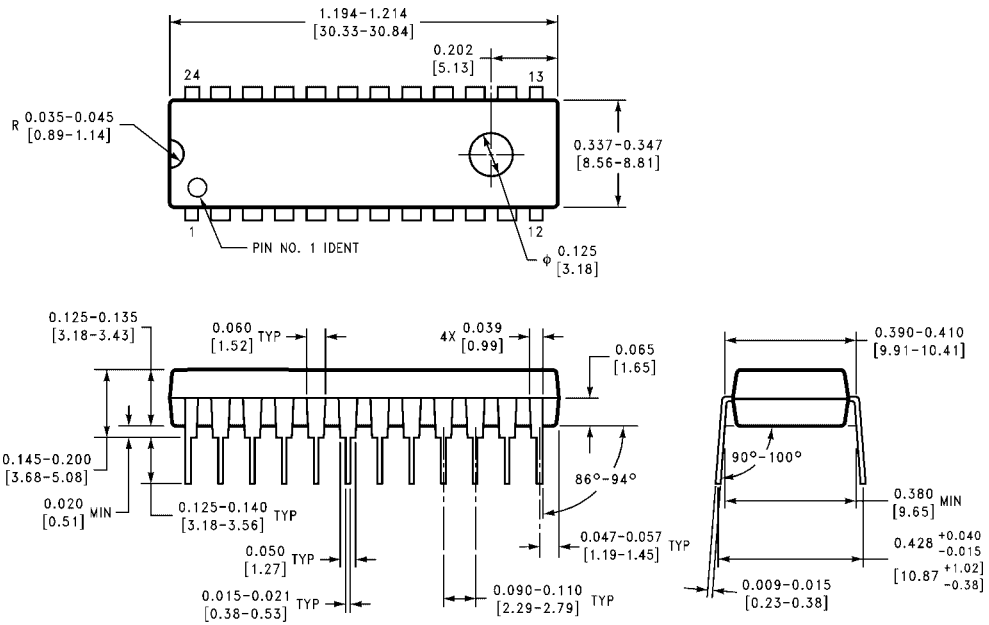


FIGURE 2. Propagation Delay and Transition Times

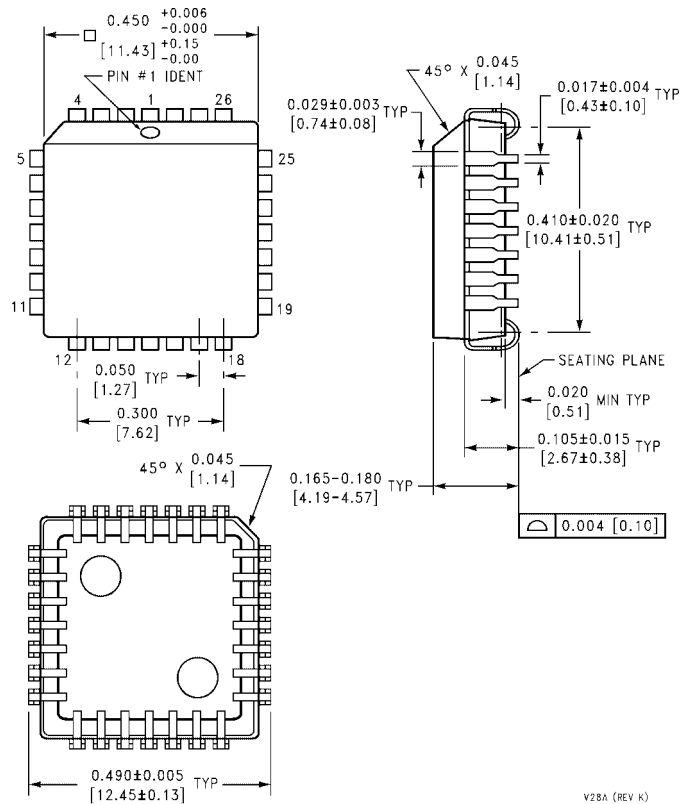
**Physical Dimensions** inches (millimeters) unless otherwise noted



**24-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-010, 0.400 Wide  
Package Number N24E**

N24E (REV A)

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



**28-Lead Plastic Lead Chip Carrier (PLCC), JEDEC MO-047, 0.450 Square Package Number V28A**

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