National Semiconductor

August 1998

100304
Low Power Quint AND/NAND Gate

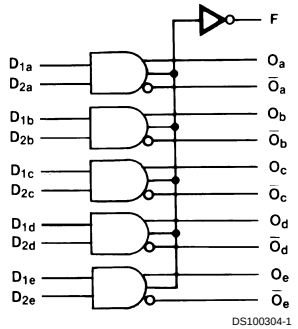
General Description

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
- Available to Standard Microcircuit Drawing (SMD) 5962-9153701

Logic Symbol



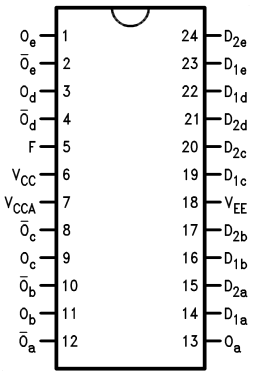
Logic Equation

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

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

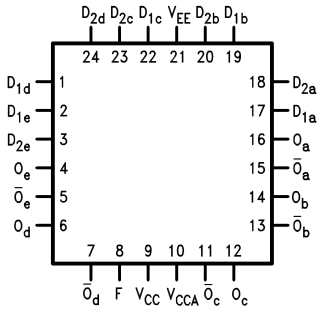
Connection Diagrams

24-Pin DIP



DS100304-2

24-Pin Quad Cerpak



DS100304-3

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

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 50Ω0 to −2.0V	(Notes 3, 4, 5)
		−1085	−870	mV	−55˚C			
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} (Min) or V_{IL} (Max)	Loading with 50Ω to −2.0V	(Notes 3, 4, 5)
		−1085		mV	−55˚C			
V_{OLC}	Output LOW Voltage		−1610	mV	0˚C to +125˚C			
			−1555	mV	−55˚C			
V_{IH}	Input HIGH Voltage	−1165	−870	mV	−55˚C +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					V_{EE} = −5.7V V_{IN} = V_{IH} (Max)		(Notes 3, 4, 5)
	D_{2a}–D_{2e} D_{1a}–D_{1e}		250 350	µA	0˚C to +125˚C			
	D_{2a}–D_{2e} D_{1a}–D_{1e}		350 500	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˚C		T_C = +25˚C		T_C = +125˚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		(Notes 7, 8, 9)
t_{PHL}	D_{na}–D_{ne} to O, $\overline{O}$									
t_{PLH}	Propagation Delay	0.80	2.90	0.90	2.80	0.90	3.40	ns	*Figures 1, 2*	
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%									

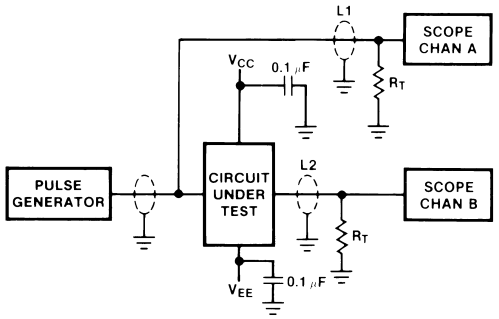
Note 7: F100K 300 Series cold temperature testing is performed by temperature soaking (to guarantee junction temperature equals −55˚C), then testing immediately after power-up. This provides "cold start" specs which can be considered a worst case condition at cold temperatures.

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 mfg. 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 Circuitry



Notes:
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

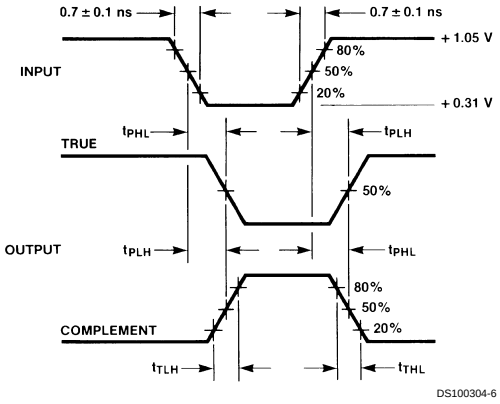
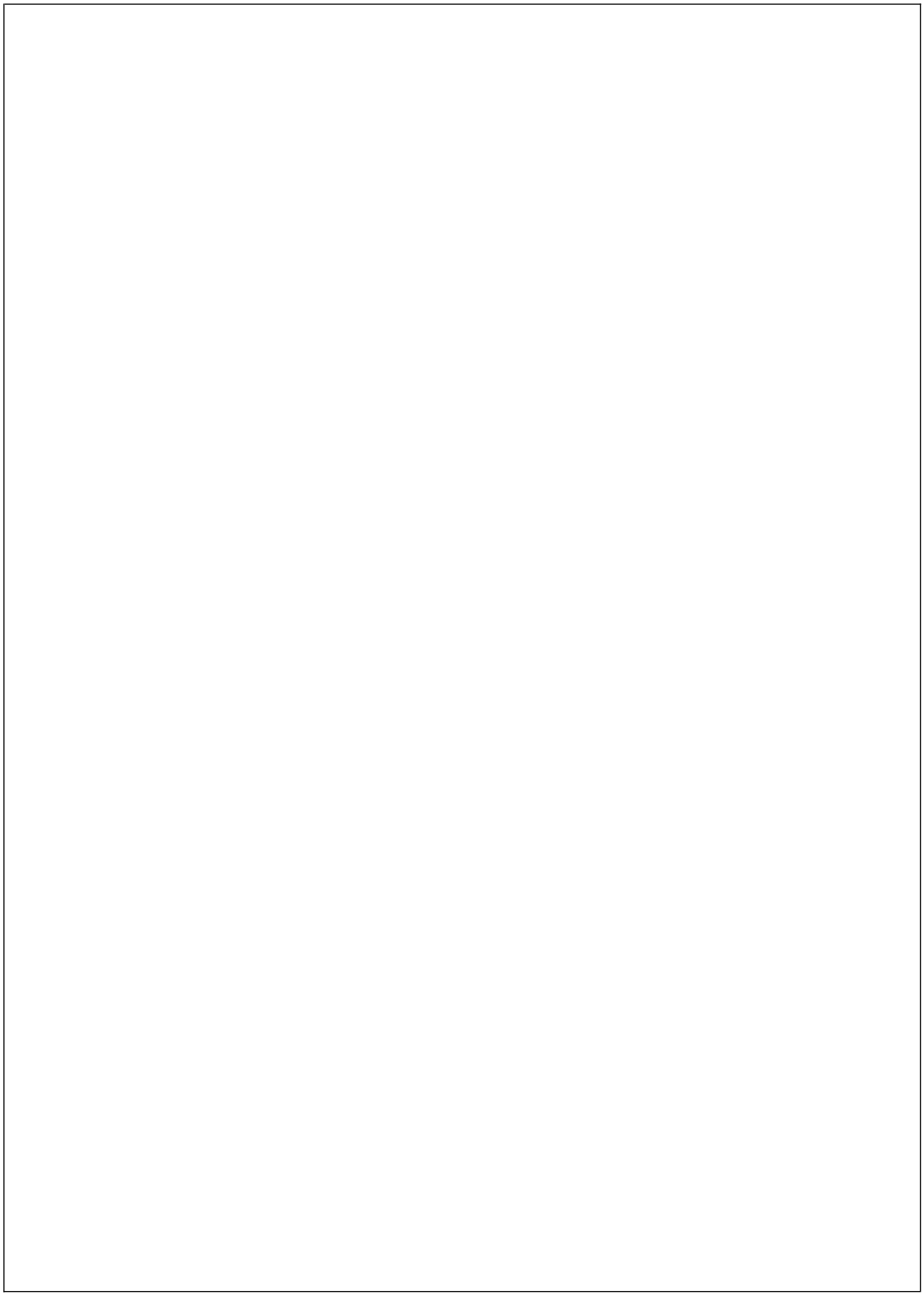
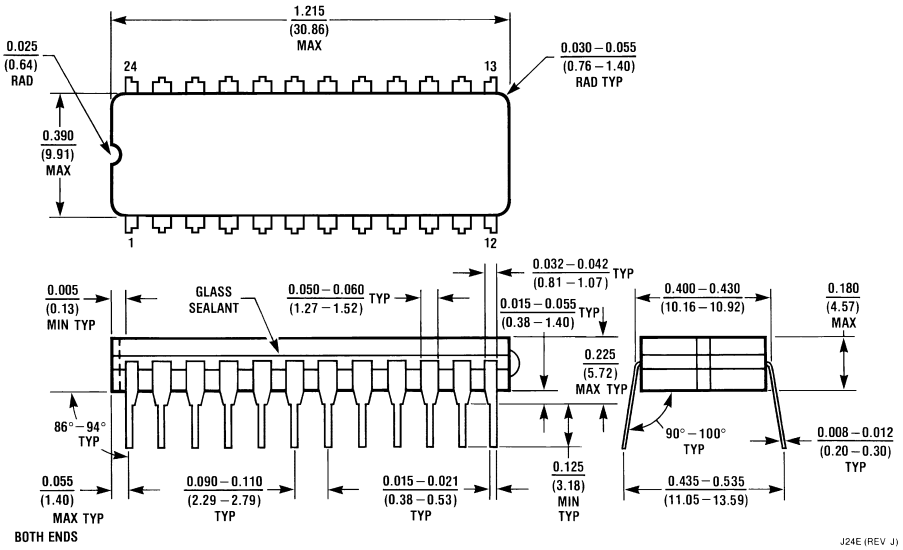


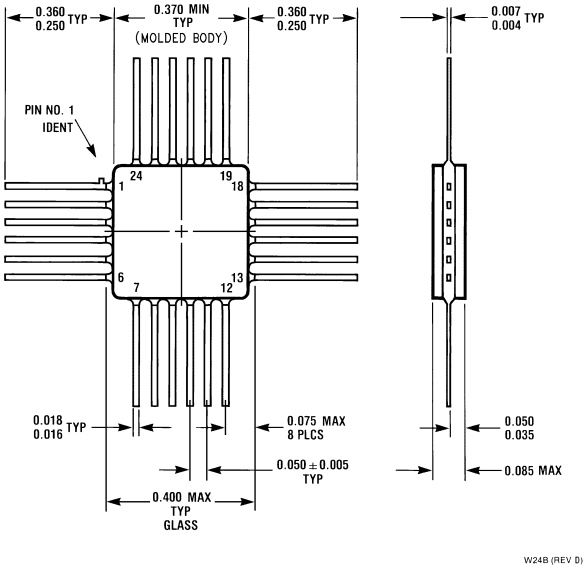
FIGURE 2. Propagation Delay and Transition Times



Physical Dimensions inches (millimeters) unless otherwise noted



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



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

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Datasheet

Title	Size (in Kbytes)	Date	View Online	Download	Receive via Email
100304 Low Power Quint AND/NAND Gate	109 Kbytes	4-Sep-98	View Online	Download	Receive via Email
100304 Mil-Aero Datasheet MN100304-X	105 Kbytes		View Online	Download	Receive via Email

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Package Availability, Models, Samples & Pricing

Part Number	Package		Status	Models		Samples & Electronic Orders	Budgetary Pricing		Std Pack Size	Package Marking
	Type	# pins		SPICE	IBIS		Quantity	$US each		
5962-9153701MXA	Cerdip	24	Full production	N/A	N/A	.	50+	$19.9000	tube of 15	[logo]¢Z¢S¢4¢A$E 100304DMQB /Q 5962-9153701MXA
5962-9153701MYA	Cerquad	24	Full production	N/A	N/A	.	50+	$21.0000	tube of 14	[logo]¢Z¢S¢4¢A Q$E 100304 FMQB 5962 -9153701 MYA
5962-9153701VXA	Cerdip	24	Full production	N/A	N/A	.	50+	$265.0000	tube of 15	[logo]¢Z¢S¢4¢A$E 100304J-QMLV 5962-9153701VXA
5962-9153701VYA	Cerquad	24	Full production	N/A	N/A	.	50+	$265.0000	tube of 14	[logo]¢Z¢S¢4¢A 100304W-QMLV 5962 -9153701 VYA $E
100304 MW8	wafer		Full production	N/A	N/A	.			N/A	-

[Information as of 1-Sep-2000]