

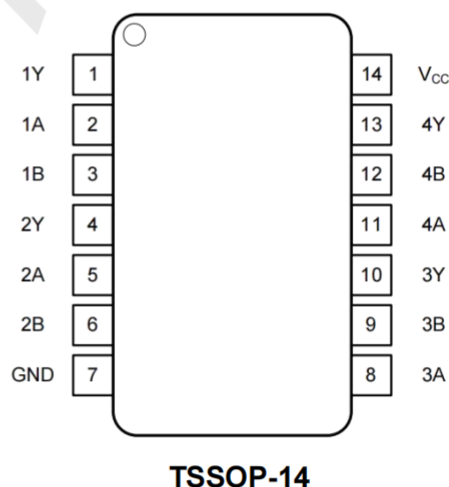
Features

- Wide supply voltage range from 1.2 V to 5.5 V
- CMOS low power dissipation
- Overvoltage tolerant inputs to 5.5 V
- Latch-up performance exceeds 250 mA
- Direct interface with TTL levels
- ESD protection:
HBM ANSI/ESDA/JEDEC JS-00
Class 3A exceeds 6000 V
CDM ANSI/ESDA/JEDEC JS-002
Class C3 exceeds 2000 V
- I_{OFF} circuitry provides partial Power-down mode operation
- Complies with JEDEC standard:
JESD8-7 (1.65 V to 1.95 V)
JESD8-5 (2.3 V to 2.7 V)
JESD8C (2.7 V to 3.6 V)
JESD36 (4.5 V to 5.5 V)
- Packaging: TSSOP-14

General Description

The is a quad 2-input NOR gate. Inputs can be driven from either 3.3 V or 5 V devices. This feature allows the use of these devices as translators in mixed 3.3 V and 5 V environments. Schmitt-trigger action at all inputs makes the circuit tolerant of slower input rise and fall times. This device is fully specified for partial power down applications using I_{OFF}. The I_{OFF} circuitry disables the output, preventing the potentially damaging backflow current through the device when it is powered down.

PIN CONFIGURATIONS (Top view)



PIN DESCRIPTION

PIN NO.	PIN NAME	DESCRIPTION	PIN NO.	PIN NAME	DESCRIPTION
1	1Y	Data output	8	3A	Data input
2	1A	Data input	9	3B	Data input
3	1B	Data input	10	3Y	Data output
4	2Y	Data output	11	4A	Data input
5	2A	Data input	12	4B	Data input
6	2B	Data input	13	4Y	Data output
7	GND	ground (0 V)	14	V _{CC}	supply voltage

Functional diagram

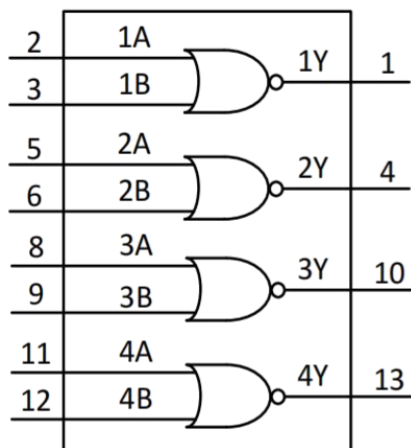


Fig. 1. Logic symbol

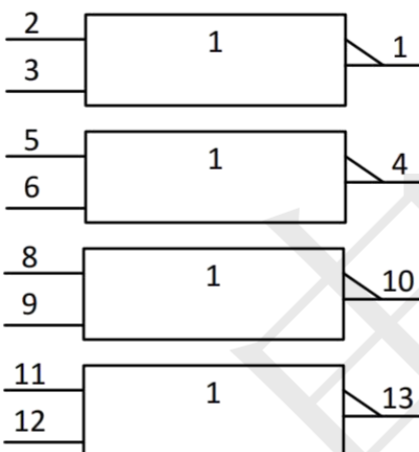


Fig. 2. IEC logic symbol

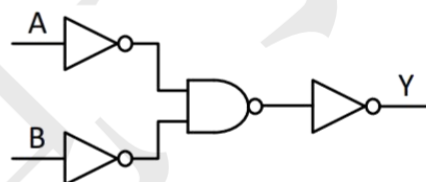


Fig. 3. Logic diagram (one gate)

Functional Description

Function table

Input nA	Input nB	Output nY
L	L	H
X	H	L
H	X	L

H = HIGH voltage level; L = LOW voltage level; X = don't care.

ABSOLUTE MAXIMUM RATINGS

In accordance with the Absolute Maximum Rating System. Voltages are referenced to GND.

Symbol	Parameter	Conditions	Min	Max	Unit
V _{CC}	supply voltage		-0.5	6.5	V
I _{IK}	input clamping current	V _I < 0 V	-50	--	mA
V _I	input voltage	(1)	-0.5	6.5	V
I _{OK}	output clamping current	V _O > V _{CC} or V _O < 0 V	--	±50	mA
V _O	output voltage	Active mode (1)	0	V _{CC} + 0.5	V
		Power-down mode; V _{CC} = 0 V (1)	0	6.5	V
I _O	output current	V _O = 0 V to V _{CC}	--	±50	mA
I _{CC}	supply current		--	100	mA
I _{GND}	ground current		-100	--	mA
P _{tot}	total power dissipation	T _{amb} = -40 °C to + 125 °C	--	500	mW
T _{stg}	storage temperature		-65	150	°C

Note:1. The input and output voltage ratings may be exceeded if the input and output current ratings are observed.

Recommended operating conditions

Symbol	Parameter	Conditions	Min	Max	Unit
V _{CC}	supply voltage		1.65	5.5	V
		functional	1.2	--	V
V _I	input voltage		0	5.5	V
V _O	output voltage	Active mode	0	V _{CC}	V
		Power-down mode; V _{CC} = 0 V	0	5.5	V
T _{amb}	ambient temperature		-40	125	°C
Δt/ΔV	input transition rise and fall rate	V _{CC} = 1.65 V to 2.7 V	0	20	ns/V
		V _{CC} = 2.7 V to 3.6 V	0	10	ns/V
		V _{CC} = 4.5 V to 5.5 V	0	5	ns/V

Static characteristics

(Voltages are referenced to GND (ground=0V), unless otherwise specified.)

Symbol	Parameter	Conditions	-40 °C to +85 °C			-40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	
V_{IH}	HIGH-level input voltage	$V_{CC} = 1.2 \text{ V}$	1.08	--	--	1.08	--	V
		$V_{CC} = 1.65 \text{ V to } 1.95 \text{ V}$	$0.65V_{CC}$	--	--	$0.65V_{CC}$	--	V
		$V_{CC} = 2.3 \text{ V to } 2.7 \text{ V}$	1.7	--	--	1.7	--	V
		$V_{CC} = 2.7 \text{ V to } 3.6 \text{ V}$	2.0	--	--	2.0	--	V
		$V_{CC} = 4.5 \text{ V to } 5.5 \text{ V}$	$0.7V_{CC}$	--	--	$0.7V_{CC}$	--	V
V_{IL}	LOW-level input voltage	$V_{CC} = 1.2 \text{ V}$	--	--	0.12	--	0.12	V
		$V_{CC} = 1.65 \text{ V to } 1.95 \text{ V}$	--	--	$0.35V_{CC}$	--	$0.35V_{CC}$	V
		$V_{CC} = 2.3 \text{ V to } 2.7 \text{ V}$	--	--	0.7	--	0.7	V
		$V_{CC} = 2.7 \text{ V to } 3.6 \text{ V}$	--	--	0.8	--	0.8	V
		$V_{CC} = 4.5 \text{ V to } 5.5 \text{ V}$	--	--	$0.3V_{CC}$	--	$0.3V_{CC}$	V
V_{OH}	HIGH-level output voltage	$V_I = V_{IH} \text{ or } V_{IL}$						
		$I_O = -100 \mu\text{A}; V_{CC} = 1.65 \text{ V to } 5.5 \text{ V}$	$V_{CC} - 0.1$	--	--	$V_{CC} - 0.1$	--	V
		$I_O = -4 \text{ mA}; V_{CC} = 1.65 \text{ V}$	1.2	--	--	1.05	--	V
		$I_O = -8 \text{ mA}; V_{CC} = 2.3 \text{ V}$	1.9	--	--	1.7	--	V
		$I_O = -12 \text{ mA}; V_{CC} = 2.7 \text{ V}$	2.2	--	--	2.05	--	V
		$I_O = -24 \text{ mA}; V_{CC} = 3.0 \text{ V}$	2.4	--	--	2.25	--	V
		$I_O = -32 \text{ mA}; V_{CC} = 4.5 \text{ V}$	3.8	--	--	3.5	--	V
V_{OL}	LOW-level output voltage	$V_I = V_{IH} \text{ or } V_{IL}$						
		$I_O = 100 \mu\text{A}; V_{CC} = 1.65 \text{ V to } 5.5 \text{ V}$	--	--	0.10	--	0.10	V
		$I_O = 4 \text{ mA}; V_{CC} = 1.65 \text{ V}$	--	--	0.45	--	0.65	V
		$I_O = 8 \text{ mA}; V_{CC} = 2.3 \text{ V}$	--	--	0.30	--	0.45	V
		$I_O = 12 \text{ mA}; V_{CC} = 2.7 \text{ V}$	--	--	0.40	--	0.60	V
		$I_O = 24 \text{ mA}; V_{CC} = 3.0 \text{ V}$	--	--	0.55	--	0.80	V
		$I_O = 32 \text{ mA}; V_{CC} = 4.5 \text{ V}$	--	--	0.55	--	0.80	V
I_I	input leakage current	$V_I = 5.5 \text{ V or GND}; V_{CC} = 0 \text{ V to } 5.5 \text{ V}$	--	± 0.1	± 5	--	± 20	μA

Static characteristics

(Voltages are referenced to GND (ground=0V), unless otherwise specified.)

Symbol	Parameter	Conditions	-40 °C to +85 °C			-40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	
I_{OFF}	power-off leakage current	$V_{CC} = 0 \text{ V}$; V_I or $V_O = 5.5 \text{ V}$	--	± 0.1	± 10	--	± 20	μA
I_{CC}	supply current	$V_{CC} = 1.65 \text{ V to } 5.5 \text{ V}$; $V_I = V_{CC}$ or GND ; $I_O = 0 \text{ A}$;	--	0.01	10	--	40	μA
ΔI_{CC}	additional supply current	per input pin ; $V_{CC} = 2.3 \text{ V to } 5.5 \text{ V}$; $V_I = V_{CC} - 0.6 \text{ V}$; $I_O = 0 \text{ A}$	--	0.2	500	--	5000	μA
C_i	input capacitance	$V_{CC} = 3.3 \text{ V}$; $V_I = \text{GND to } V_{CC}$	--	4	--	--	--	pF

Note: All typical values are measured at $V_{CC} = 3.3\text{V}$ and $T_{amb} = 25^\circ\text{C}$.

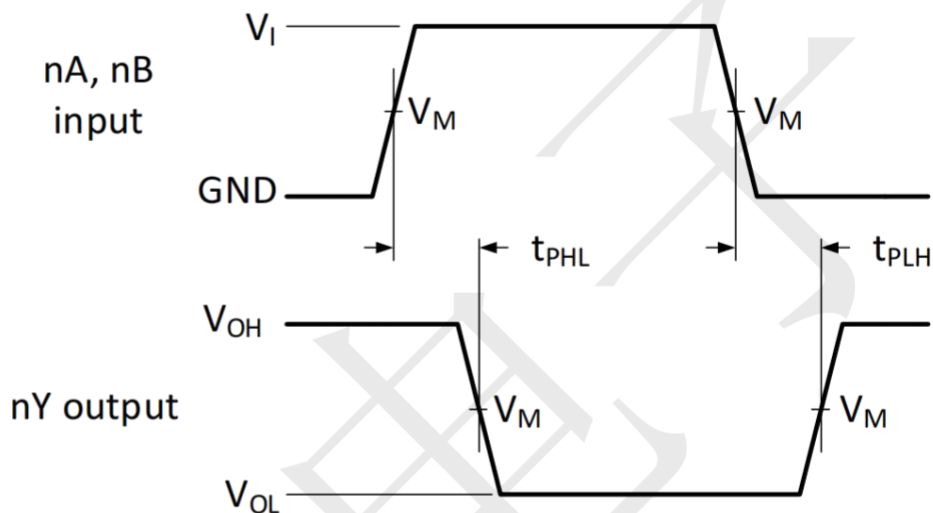
Dynamic Characteristics

Voltages are referenced to GND (ground = 0 V); for test circuit see

Symbol	Parameter	Conditions	-40 °C to +85 °C			-40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	
t_{pd}	propagation delay	nA to nY;						
		$V_{CC} = 1.2 \text{ V}$	--	36	--	--	--	ns
		$V_{CC} = 1.65 \text{ V to } 1.95 \text{ V}$	3.4	11.4	22	3.4	22.5	ns
		$V_{CC} = 2.3 \text{ V to } 2.7 \text{ V}$	2.7	6.3	10.5	2.7	11	ns
		$V_{CC} = 3.0 \text{ V to } 3.6 \text{ V}$	2.0	4.6	7.5	2.0	8.0	ns
		$V_{CC} = 4.5 \text{ V to } 5.5 \text{ V}$	1.5	3.3	5	1.5	5.5	ns
$t_{sk(o)}$	output skew time	$V_{CC} = 3.0 \text{ V to } 3.6 \text{ V}$	--	--	1.0	--	1.5	ns
C_{PD}	power dissipation capacitance	per gate ; $V_I = \text{GND to } V_{CC}$						
		$V_{CC} = 1.65 \text{ V to } 1.95 \text{ V}$	--	12.7	--	--	--	pF
		$V_{CC} = 2.3 \text{ V to } 2.7 \text{ V}$	--	13.4	--	--	--	pF
		$V_{CC} = 3.0 \text{ V to } 3.6 \text{ V}$	--	14.3	--	--	--	pF
		$V_{CC} = 4.5 \text{ V to } 5.5 \text{ V}$	--	16.2	--	--	--	pF

Note: Typical values are measured at $T_{amb} = 25^\circ\text{C}$ and $V_{CC} = 1.2 \text{ V}, 1.8 \text{ V}, 2.5 \text{ V}, 3.3 \text{ V}$ and 5.0 V respectively.

Waveforms and test circuit

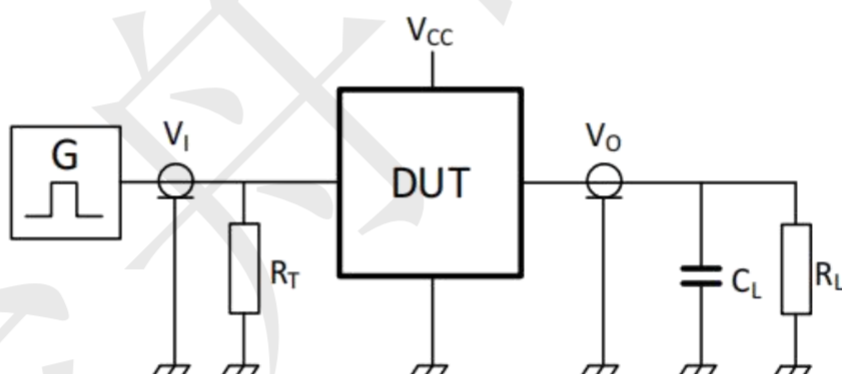
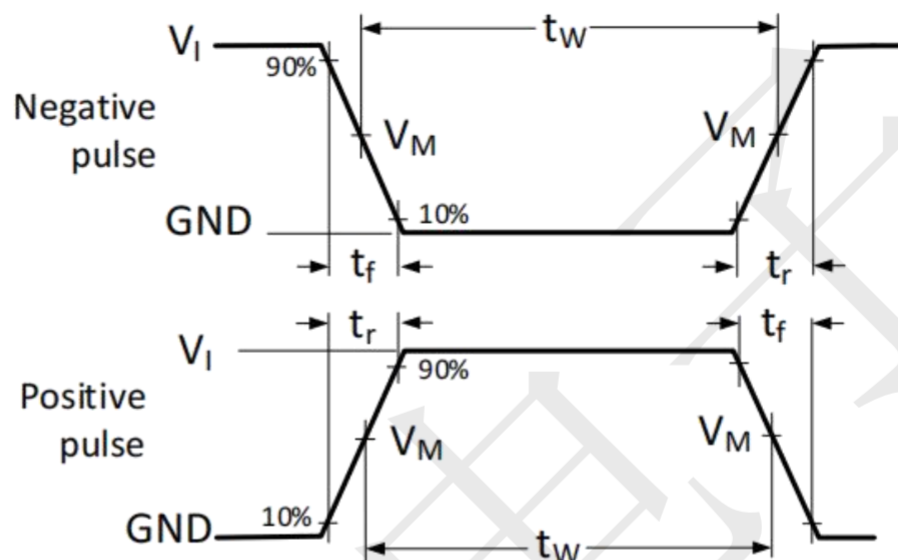


Measurement points are given in Table 8.

V_{OL} and V_{OH} are typical output voltage levels that occur with the output load.

Measurement points

Supply voltage	Input	Output
V_{CC}	V_M	V_M
1.2 V	$0.5V_{CC}$	$0.5V_{CC}$
1.65 V to 1.95 V	$0.5V_{CC}$	$0.5V_{CC}$
2.3 V to 2.7 V	$0.5V_{CC}$	$0.5V_{CC}$
3.0 V to 3.6 V	1.5 V	1.5 V
4.5 V to 5.5 V	$0.5V_{CC}$	$0.5V_{CC}$



Test data is given in Table 9.

Definitions for test circuit:

R_L = Load resistance.

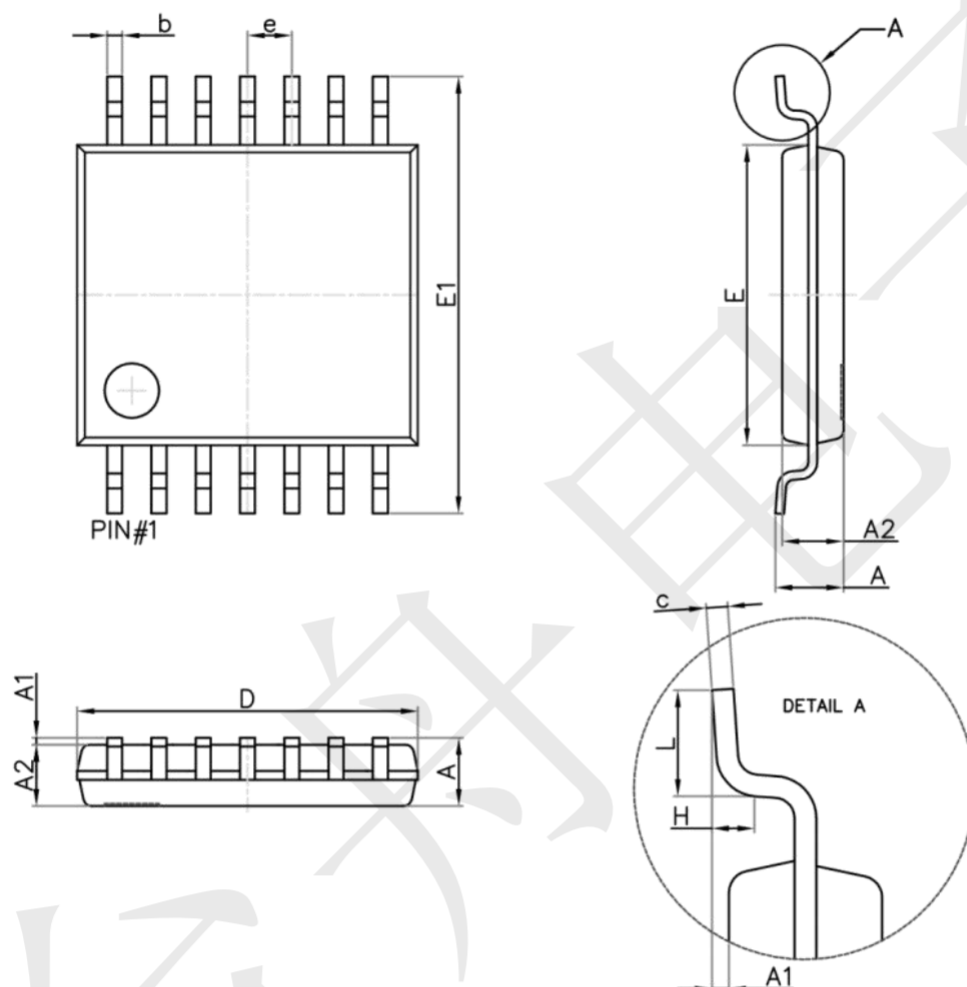
C_L = Load capacitance including jig and probe capacitance.

R_T = Termination resistance should be equal to the output impedance Z_o of the pulse generator.

Test data

Supply voltage	Input		Load	
V_{CC}	V_I	$t_r = t_f$	C_L	R_L
1.2 V	V_{CC}	≤ 2.0 ns	15 pF	500 Ω
1.65 V to 1.95 V	V_{CC}	≤ 2.0 ns	15 pF	500 Ω
2.3 V to 2.7 V	V_{CC}	≤ 2.0 ns	15 pF	500 Ω
3.0 V to 3.6 V	3 V	≤ 2.0 ns	15 pF	500 Ω
4.5 V to 5.5 V	V_{CC}	≤ 2.0 ns	15 pF	500 Ω

Package information TSSOP-14



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
D	4.900	5.100	0.193	0.201
E	4.300	4.500	0.169	0.177
b	0.190	0.300	0.007	0.012
c	0.090	0.200	0.004	0.008
E1	6.250	6.550	0.246	0.258
A	—	1.200	—	0.047
A2	0.800	1.000	0.031	0.039
A1	0.050	0.150	0.002	0.006
e	0.65 (BSC)		0.026 (BSC)	
L	0.500	0.700	0.020	0.028
H	0.25(TYP)		0.01(TYP)	
θ	1°	7°	1°	7°