Quad 2-input NOR Gate

CJ74HC/HCT02 Logic

1 Introduction

The CJ74HC/HCT02 is a quad 2-input NOR gate. Inputs include clamp diodes. This enables the use of current limiting resistors to interface inputs to voltages in excess of V_{CC}.

2 Available Packages

PART NUMBER	PACKAGE
CJ74HC02	SOP14
	TSSOP14
	QFN3x2.5-14L
CJ74HCT02	SOP14
	TSSOP14
	QFN3x2.5-14L

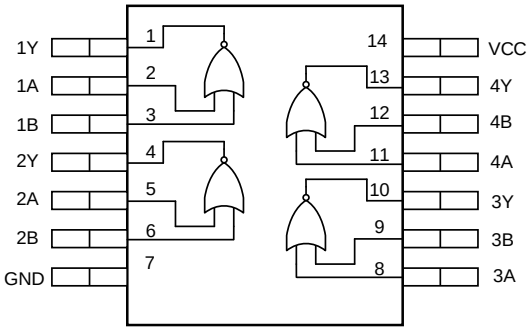
Note: For all available packages, please refer to the part Orderable Information.

3 Features

- Input levels:
  - For CJ74HC02: CMOS level
  - For CJ74HCT02: TTL level
- Specified from -40°C to +125°C

4 Applications

- Alarm/tamper detect circuit
- S-R latch



Device functional pinout

5 Orderable Information

DEVICE	PACKAGE	OP TEMP	ECO PLAN	MSL	PACKING OPTION	SORT
CJ74HC02ADN	SOP14	-40~125°C	RoHS & Green	Level 3 168HR	Tape and Reel 4000 Units / Reel	Active
CJ74HCT02ADN	SOP14	-40~125°C	RoHS & Green	Level 3 168HR	Tape and Reel 4000 Units / Reel	Active
CJ74HC02BDN	TSSOP14	-40~125°C	RoHS & Green	Level 3 168HR	Tape and Reel 5000 Units / Reel	Active
CJ74HCT02BDN	TSSOP14	-40~125°C	RoHS & Green	Level 3 168HR	Tape and Reel 5000 Units / Reel	Active
CJ74HC02QBN	QFN3x2.5-14L	-40~125°C	RoHS & Green	Level 3 168HR	Tape and Reel 3000 Units / Reel	Active
CJ74HCT02QBN	QFN3x2.5-14L	-40~125°C	RoHS & Green	Level 3 168HR	Tape and Reel 3000 Units / Reel	Active

Note:

ECO PLAN: For the RoHS and Green certification standards of this product, please refer to the official report provided by JSCJ.

MSL: Moisture Sensitivity Level. Determined according to JEDEC industry standard classification.

SORT: Specifically defined as follows:
Active: Recommended for new products;
Customized: Products manufactured to meet the specific needs of customers;
Preview: The device has been released and has not been fully mass produced. The sample may or may not be available;
NoRD: It is not recommended to use the device for new design. The device is only produced for the needs of existing customers;
Obsolete: The device has been discontinued.

6 Pin Configuration and Marking Information

6.1 Pin Configuration

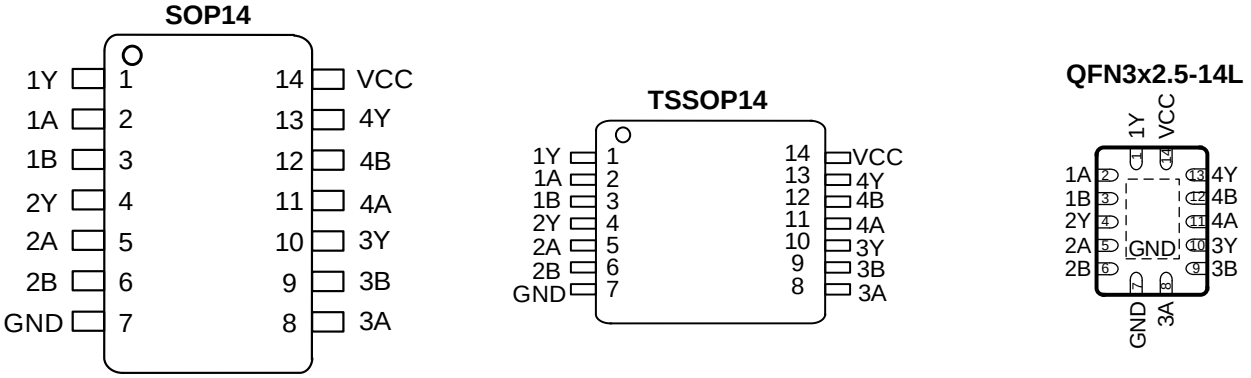


Figure 6-1 Pin configuration

6.2 Pin Function

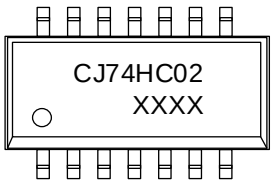
PIN		I/O(1)	DESCRIPTION
No.	NAME		
1	1Y	O	Data output
2	1A	I	Data input
3	1B	I	Data input
4	2Y	O	Data output
5	2A	I	Data input
6	2B	I	Data input
7	GND	G	Ground (0V)
8	3A	I	Data input
9	3B	I	Data input
10	3Y	O	Data output
11	4A	I	Data input
12	4B	I	Data input
13	4Y	O	Data output
14	VCC	P	Supply voltage

(1) I-Input, O-Output, P-Power, G-Ground

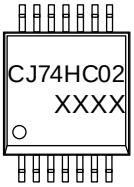
6.3 Marking Information

6.3.1 CJ74HC02

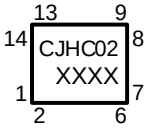
SOP14



TSSOP14



QFN3x2.5-14L



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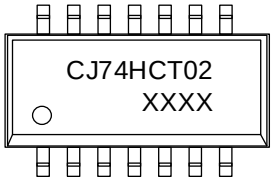
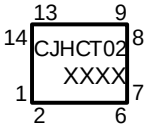
6.3.2 CJ74HCT02

SOP14



TSSOP14

QFN3x2.5-14L



XXXX: Code, indicates weekly record information.

7 Specifications

7.1 Absolute Maximum Ratings

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CC}	Supply voltage	-	-0.5	+7	V
I_{IK}	Input clamping current	V_I < -0.5V or V_I > V_{CC}+0.5V	-	±20	mA
I_{OK}	Output clamping current	V_O < -0.5V or V_O > V_{CC}+0.5V	-	±20	mA
I_O	Output current	-0.5V < V_O < V_{CC}+0.5V	-	±25	mA
I_{CC}	Supply current	-	-	50	mA
I_{GND}	Ground current	-	-50	-	mA
P_{tot}	Total power dissipation	-	-	500	mW
T_{stg}	Storage temperature	-	-65	+150	°C
T_L	Soldering temperature	10s	-	260	°C

Note: Absolute maximum ratings indicate sustained limits beyond which damage to the device may occur. All voltage parameters are absolute voltages referenced to GND. The thermal resistance and power dissipation ratings are measured under board mounted and still air conditions.

7.2 Recommended Operating Conditions

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
CJ74HC02						
V_{CC}	Supply voltage	-	2.0	5.0	6.0	V
V_I	Input voltage	-	0	-	V_{CC}	V
V_O	Output voltage	-	0	-	V_{CC}	V
Δt/ΔV	Input transition rise and fall rate	V_{CC}=2.0V	-	-	625	ns/V
		V_{CC}=4.5V	-	1.67	139	ns/V
		V_{CC}=6.0V	-	-	83	ns/V
T_{amb}	Ambient temperature	-	-40	-	+125	°C
CJ74HCT02						
V_{CC}	Supply voltage	-	4.5	5.0	5.5	V
V_I	Input voltage	-	0	-	V_{CC}	V
V_O	Output voltage	-	0	-	V_{CC}	V
Δt/ΔV	Input transition rise and fall rate	V_{CC}=2.0V	-	-	-	ns/V
		V_{CC}=4.5V	-	1.67	139	ns/V
		V_{CC}=6.0V	-	-	-	ns/V
T_{amb}	Ambient temperature	-	-40	-	+125	°C

7.3 ESD Ratings

SYMBOL	ESD RATINGS		VALUE	UNIT
$V_{ESD-HBM}$	Electrostatic discharge	Human body model (HBM)(1)	±2000	V

(1) JEDEC document JEP155 states that 500-V HBM allows safe manufacturing with a standard ESD control process.

7.4 Electrical Characteristics

7.4.1 DC Characteristics 1

T_{amb}=25°C, voltages are referenced to GND (ground=0V), unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS		MIN.	TYP.	MAX.	UNIT
CJ74HC02							
V_{IH}	HIGH-level input voltage	V_{CC}=2.0V		1.5	-	-	V
		V_{CC}=4.5V		3.15	-	-	V
		V_{CC}=6.0V		4.2	-	-	V
V_{IL}	LOW-level input voltage	V_{CC}=2.0V		-	-	0.5	V
		V_{CC}=4.5V		-	-	1.35	V
		V_{CC}=6.0V		-	-	1.8	V
V_{OH}	HIGH-level output voltage	V_I = V_{IH} or V_{IL}	I_O=-20uA; V_{CC}=2.0V	1.9	2.0	-	V
			I_O=-20uA; V_{CC}=4.5V	4.4	4.5	-	V
			I_O=-20uA; V_{CC}=6.0V	5.9	6.0	-	V
			I_O=-4.0mA; V_{CC}=4.5V	3.98	4.32	-	V
			I_O=-5.2mA; V_{CC}=6.0V	5.48	5.81	-	V
V_{OL}	LOW-level output voltage	V_I = V_{IH} or V_{IL}	I_O=20uA; V_{CC}=2.0V	-	0	0.1	V
			I_O=20uA; V_{CC}=4.5V	-	0	0.1	V
			I_O=20uA; V_{CC}=6.0V	-	0	0.1	V
			I_O=4.0mA; V_{CC}=4.5V	-	0.15	0.26	V
			I_O=5.2mA; V_{CC}=6.0V	-	0.16	0.26	V
I_I	Input leakage current	V_I=V_{CC} or GND; V_{CC}=6.0V		-	-	±1	uA
I_{CC}	Supply current	V_I=V_{CC} or GND; I_O=0A; V_{CC}=6.0V		-	-	2.0	uA
C_I	Input capacitance	-		-	3.5	-	pF
CJ74HCT02							
V_{IH}	HIGH-level input voltage	V_{CC}=4.5V to 5.5V		2.0	-	-	V
V_{IL}	LOW-level input voltage	V_{CC}=4.5V to 5.5V		-	-	0.8	V
V_{OH}	HIGH-level output voltage	V_I = V_{IH} or V_{IL}	I_O=-20uA; V_{CC}=4.5V	4.4	4.5	-	V
			I_O=-4.0mA; V_{CC}=4.5V	3.98	4.32	-	V
V_{OL}	LOW-level output voltage	V_I = V_{IH} or V_{IL}	I_O=20uA; V_{CC}=4.5V	-	0	0.1	V
			I_O=5.2mA; V_{CC}=4.5V	-	0.15	0.26	V
I_I	Input leakage current	V_I=V_{CC} or GND; V_{CC}=5.5V		-	-	±1	uA
I_{CC}	Supply current	V_I=V_{CC} or GND; I_O=0A; V_{CC}=5.5V		-	-	2.0	uA

ΔI_{CC}	Additional supply current	Per input pin; $V_I=V_{CC}$-2.1V; I_O=0A; Other inputs at V_{CC} or GND; V_{CC}=4.5V to 5.5V	-	-	540	uA
C_I	Input capacitance	-	-	3.5	-	pF

7.4.2 DC Characteristics 2

T_{amb}=-40°C to +85°C, voltages are referenced to GND (ground=0V), unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS		MIN.	TYP.	MAX.	UNIT
CJ74HC02							
V_{IH}	HIGH-level input voltage	V_{CC}=2.0V		1.5	-	-	V
		V_{CC}=4.5V		3.15	-	-	V
		V_{CC}=6.0V		4.2	-	-	V
V_{IL}	LOW-level input voltage	V_{CC}=2.0V		-	-	0.5	V
		V_{CC}=4.5V		-	-	1.35	V
		V_{CC}=6.0V		-	-	1.8	V
V_{OH}	HIGH-level output voltage	$V_I = V_{IH}$ or V_{IL}	I_O=-20uA; V_{CC}=2.0V	1.9	-	-	V
			I_O=-20uA; V_{CC}=4.5V	4.4	-	-	V
			I_O=-20uA; V_{CC}=6.0V	5.9	-	-	V
			I_O=-4.0mA; V_{CC}=4.5V	3.84	-	-	V
			I_O=-5.2mA; V_{CC}=6.0V	5.34	-	-	V
V_{OL}	LOW-level output voltage	$V_I = V_{IH}$ or V_{IL}	I_O=20uA; V_{CC}=2.0V	-	-	0.1	V
			I_O=20uA; V_{CC}=4.5V	-	-	0.1	V
			I_O=20uA; V_{CC}=6.0V	-	-	0.1	V
			I_O=4.0mA; V_{CC}=4.5V	-	-	0.33	V
			I_O=5.2mA; V_{CC}=6.0V	-	-	0.33	V
I_I	Input leakage current	$V_I=V_{CC}$ or GND; V_{CC}=6.0V		-	-	±1	uA
I_{CC}	Supply current	$V_I=V_{CC}$ or GND; I_O=0A; V_{CC}=6.0V		-	-	20	uA
CJ74HCT02							
V_{IH}	HIGH-level input voltage	V_{CC}=4.5V to 5.5V		2.0	-	-	V
V_{IL}	LOW-level input voltage	V_{CC}=4.5V to 5.5V		-	-	0.8	V
V_{OH}	HIGH-level output voltage	$V_I = V_{IH}$ or V_{IL}	I_O=-20uA; V_{CC}=4.5V	4.4	-	-	V
			I_O=-4.0mA; V_{CC}=4.5V	3.84	-	-	V
V_{OL}	LOW-level output voltage	$V_I = V_{IH}$ or V_{IL}	I_O=20uA; V_{CC}=4.5V	-	-	0.1	V
			I_O=5.2mA; V_{CC}=4.5V	-	-	0.33	V
I_I	Input leakage current	$V_I=V_{CC}$ or GND; V_{CC}=5.5V		-	-	±1	uA
I_{CC}	Supply current	$V_I=V_{CC}$ or GND; I_O=0A; V_{CC}=5.5V		-	-	20	uA
ΔI_{CC}	Additional supply current	Per input pin; $V_I=V_{CC}$-2.1V; I_O=0A; Other inputs at V_{CC} or GND; V_{CC}=4.5V to 5.5V		-	-	675	uA

7.4.3 DC Characteristics 3

T_{amb}=-40°C to +125°C, voltages are referenced to GND (ground=0V), unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS		MIN.	TYP.	MAX.	UNIT
CJ74HC02							
V_{IH}	HIGH-level input voltage	V_{CC}=2.0V		1.5	-	-	V
		V_{CC}=4.5V		3.15	-	-	V
		V_{CC}=6.0V		4.2	-	-	V
V_{IL}	LOW-level input voltage	V_{CC}=2.0V		-	-	0.5	V
		V_{CC}=4.5V		-	-	1.35	V
		V_{CC}=6.0V		-	-	1.8	V
V_{OH}	HIGH-level output voltage	V_I = V_{IH} or V_{IL}	I_O=-20uA; V_{CC}=2.0V	1.9	-	-	V
			I_O=-20uA; V_{CC}=4.5V	4.4	-	-	V
			I_O=-20uA; V_{CC}=6.0V	5.9	-	-	V
			I_O=-4.0mA; V_{CC}=4.5V	3.7	-	-	V
			I_O=-5.2mA; V_{CC}=6.0V	5.2	-	-	V
V_{OL}	LOW-level output voltage	V_I = V_{IH} or V_{IL}	I_O=20uA; V_{CC}=2.0V	-	-	0.1	V
			I_O=20uA; V_{CC}=4.5V	-	-	0.1	V
			I_O=20uA; V_{CC}=6.0V	-	-	0.1	V
			I_O=4.0mA; V_{CC}=4.5V	-	-	0.4	V
			I_O=5.2mA; V_{CC}=6.0V	-	-	0.4	V
I_I	Input leakage current	V_I=V_{CC} or GND; V_{CC}=6.0V		-	-	±1	uA
I_{CC}	Supply current	V_I=V_{CC} or GND; I_O=0A; V_{CC}=6.0V		-	-	40	uA
CJ74HCT02							
V_{IH}	HIGH-level input voltage	V_{CC}=4.5V to 5.5V		2.0	-	-	V
V_{IL}	LOW-level input voltage	V_{CC}=4.5V to 5.5V		-	-	0.8	V
V_{OH}	HIGH-level output voltage	V_I = V_{IH} or V_{IL}	I_O=-20uA; V_{CC}=4.5V	4.4	-	-	V
			I_O=-4.0mA; V_{CC}=4.5V	3.7	-	-	V
V_{OL}	LOW-level output voltage	V_I = V_{IH} or V_{IL}	I_O=20uA; V_{CC}=4.5V	-	-	0.1	V
			I_O=5.2mA; V_{CC}=4.5V	-	-	0.4	V
I_I	Input leakage current	V_I=V_{CC} or GND; V_{CC}=5.5V		-	-	±1	uA
I_{CC}	Supply current	V_I=V_{CC} or GND; I_O=0A; V_{CC}=5.5V		-	-	40	uA
ΔI_{CC}	Additional supply current	Per input pin; V_I=V_{CC}-2.1V; I_O=0A; Other inputs at V_{CC} or GND; V_{CC}=4.5V to 5.5V		-	-	735	uA

7.4.4 AC Characteristics 1

T_{amb}=25°C, voltages are referenced to GND (ground=0V), unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS		MIN.	TYP.	MAX.	UNIT
CJ74HC02							
t_{pd}	nA, nB to nY propagation delay	See Figure 8-5(1)	V_{CC}=2.0V	-	25	90	ns
			V_{CC}=4.5V	-	9	18	ns
			V_{CC}=5.0V; C_L=15pF	-	7	-	ns
			V_{CC}=6.0V	-	7	15	ns
t_t	Transition time	See Figure 8-5(2)	V_{CC}=2.0V	-	19	75	ns
			V_{CC}=4.5V	-	7	15	ns
			V_{CC}=6.0V	-	6	13	ns
C_{PD}	Power dissipation capacitance	Per package; V_I= GND to V_{CC}(3)		-	22	-	pF
CJ74HCT02							
t_{pd}	nA, nB to nY propagation delay	See Figure 8-5(1)	V_{CC}=4.5V	-	11	19	ns
			V_{CC}=5.0V; C_L=15pF	-	9	-	ns
t_t	Transition time	See Figure 8-5(2)	V_{CC}=4.5V	-	7	15	ns
C_{PD}	Power dissipation capacitance	Per package; V_I= GND to V_{CC}-1.5V(3)		-	24	-	pF

(1) t_{pd} is the same as t_{PLH} and t_{PHL}.

(2) t_t is the same as t_{THL} and t_{TLH}.

(3) C_{PD} is used to determine the dynamic power dissipation (P_D in uW).

$P_D=(C_{PD}xV_{CC}^2xf_ixN)+\sum(C_LxV_{CC}^2xf_o)$ where:

f_i=input frequency in MHz;

f_o=output frequency in MHz;

C_L=output load capacitance in pF;

V_{CC}=supply voltage in V;

N=number of inputs switching;

$\sum(C_LxV_{CC}^2xf_o)$=sum of outputs.

7.4.5 AC Characteristics 2

T_{amb}=-40°C to +85°C, voltages are referenced to GND (ground=0V), unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS		MIN.	TYP.	MAX.	UNIT
CJ74HC02							
t_{pd}	nA, nB to nY propagation delay	See Figure 8-5(1)	V_{CC}=2.0V	-	-	115	ns
			V_{CC}=4.5V	-	-	23	ns
			V_{CC}=6.0V	-	-	20	ns
t_t	Transition time	See Figure 8-5(2)	V_{CC}=2.0V	-	-	95	ns
			V_{CC}=4.5V	-	-	19	ns
			V_{CC}=6.0V	-	-	16	ns
CJ74HCT02							
t_{pd}	nA, nB to nY propagation delay	See Figure 8-5(1)	V_{CC}=4.5V	-	-	24	ns
t_t	Transition time	See Figure 8-5(2)	V_{CC}=4.5V	-	-	19	ns

(1) t_{pd} is the same as t_{PLH} and t_{PHL}.

(2) t_t is the same as t_{THL} and t_{TLH}.

7.4.6 AC Characteristics 3

T_{amb}=-40°C to +125°C, voltages are referenced to GND (ground=0V), unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS		MIN.	TYP.	MAX.	UNIT
CJ74HC02							
t_{pd}	nA, nB to nY propagation delay	See Figure 8-5(1)	V_{CC}=2.0V	-	-	135	ns
			V_{CC}=4.5V	-	-	27	ns
			V_{CC}=6.0V	-	-	23	ns
t_t	Transition time	See Figure 8-5(2)	V_{CC}=2.0V	-	-	110	ns
			V_{CC}=4.5V	-	-	22	ns
			V_{CC}=6.0V	-	-	19	ns
CJ74HCT02							
t_{pd}	nA, nB to nY propagation delay	See Figure 8-5(1)	V_{CC}=4.5V	-	-	29	ns
t_t	Transition time	See Figure 8-5(2)	V_{CC}=4.5V	-	-	22	ns

(1) t_{pd} is the same as t_{PLH} and t_{PHL}.

(2) t_t is the same as t_{THL} and t_{TLH}.

8 Detailed Description

8.1 Overview

The CJ74HC/HCT02 is a quad 2-input NOR gate. Inputs include clamp diodes. This enables the use of current limiting resistors to interface inputs to voltages in excess of V_{CC}.

8.2 Functional Block Diagram

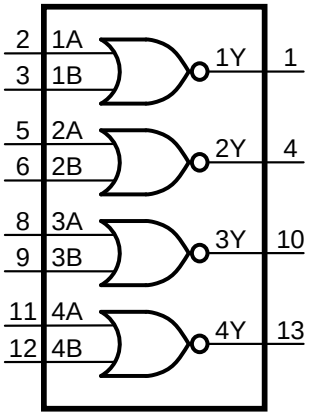


Figure 8-1 Logic symbol

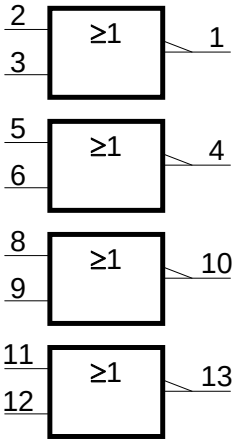


Figure 8-2 IEC logic symbol

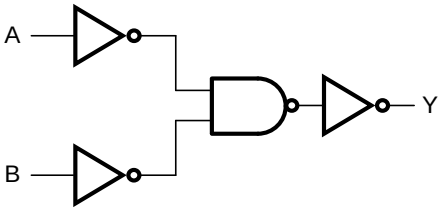


Figure 8-3 Logic diagram for one gate

8.3 Function Table(1)

INPUT		OUTPUT
nA	**nB**	**nY**
L	L	H
X	H	L
H	X	L

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

8.4 Testing Circuit

8.4.1 AC Testing Circuit

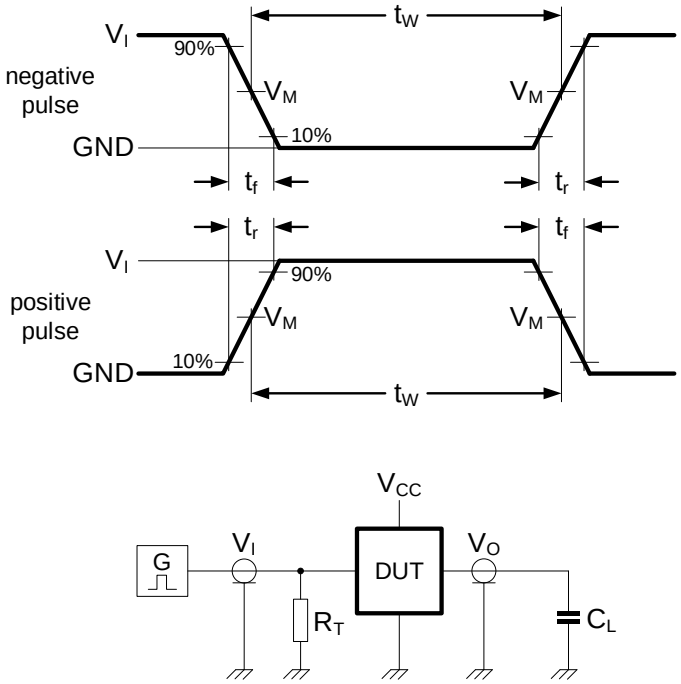


Figure 8-4 Test circuit for measuring switching times

Definitions for test circuit:

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.

8.4.2 AC Testing Waveforms

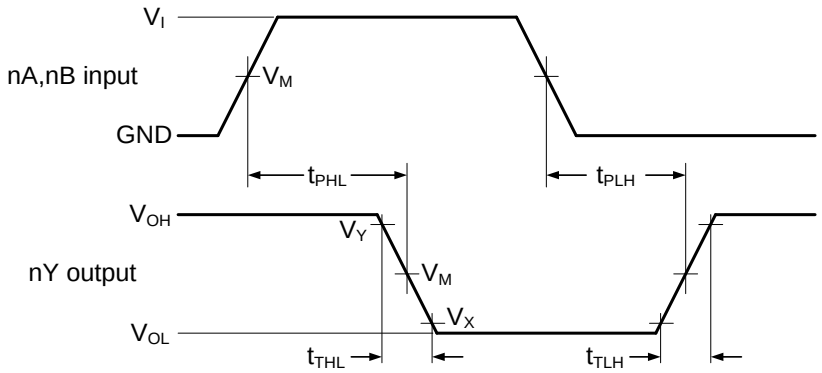


Figure 8-5 Input to output propagation delays

8.4.3 Measurement Points

TYPE	INPUT	OUTPUT		
	V_M	V_M	V_X	V_Y
CJ74HC02	0.5xV_{CC}	0.5xV_{CC}	0.1xV_{CC}	0.9xV_{CC}
CJ74HCT02	1.3V	1.3V	0.1xV_{CC}	0.9xV_{CC}

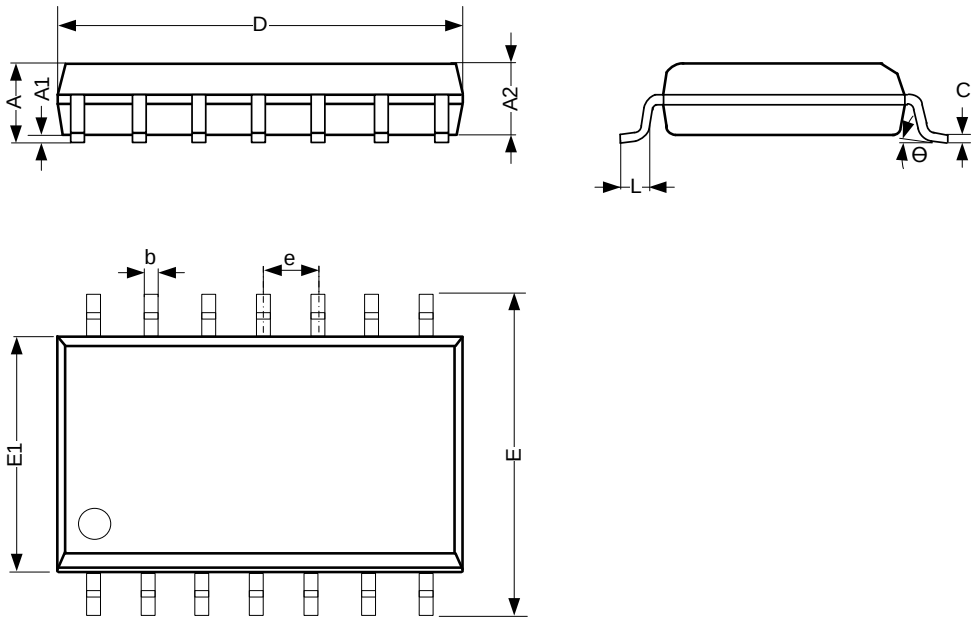
8.4.4 Test Data

TYPE	INPUT		LOAD	TEST
	V_I	t_r, t_f	C_L	
CJ74HC02	V_{CC}	6.0ns	15pF, 50pF	t_{PLH}, t_{PHL}
CJ74HCT02	3.0V	6.0ns	15pF, 50pF	t_{PLH}, t_{PHL}

9 Mechanical Information

9.1 SOP14 Mechanical Information

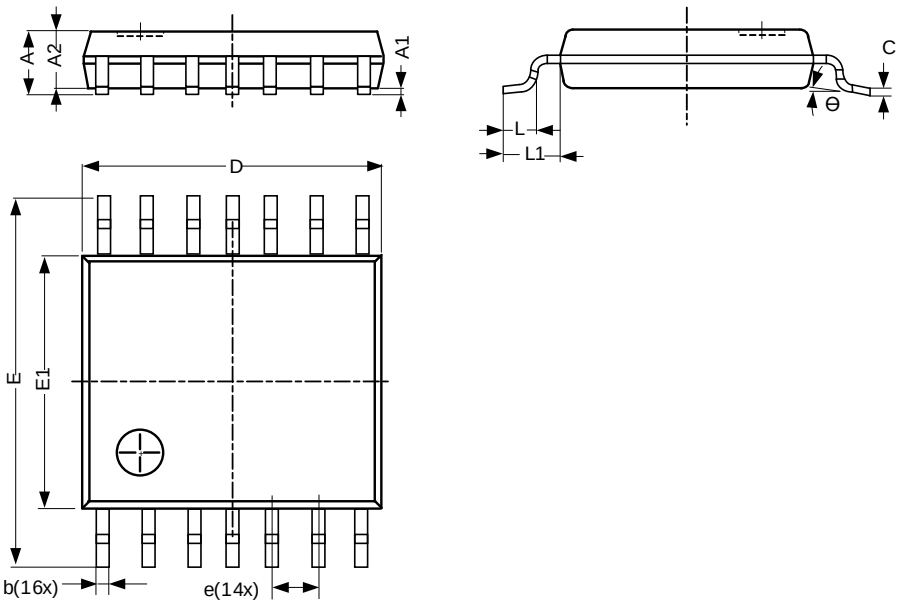
9.1.1 SOP14 Outline Dimensions



SYMBOL	Dimensions In Millimeters		
	Min.	Typ.	Max.
A	1.50	-	1.75
A1	0.05	-	0.25
A2	1.30	-	-
b	0.33	-	0.50
c	0.19	-	0.25
D	8.43	-	8.76
E	5.80	-	6.25
E1	3.75	-	4.00
e	1.27 BSC		
L	0.40	-	0.89
Θ	0°	-	8°
Unit: mm			

9.2 TSSOP14 Mechanical Information

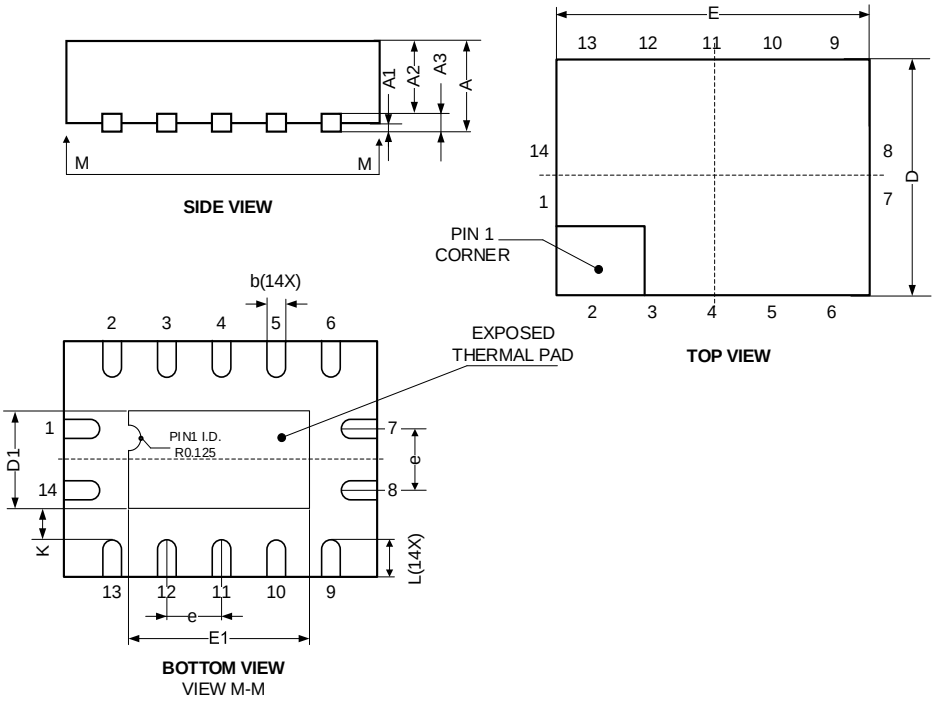
9.2.1 TSSOP14 Outline Dimensions



SYMBOL	Dimensions In Millimeters		
	Min.	Typ.	Max.
A	-	-	1.20
A1	0.05	-	0.15
A2	0.80	-	1.05
b	0.19	-	0.30
c	0.09	-	0.20
D	4.90	-	5.10
E	6.20	-	6.60
E1	4.30	-	4.50
e	0.65 BSC		
L	0.45	-	0.75
L1	-	1.00	-
Θ	0°	-	8°
Unit: mm			

9.3 QFN3x2.5-14L Mechanical Information

9.3.1 QFN3x2.5-14L Outline Dimensions



SYMBOL	Dimensions In Millimeters		
	Min.	Typ.	Max.
A	0.80	-	1.00
A1	0.00	-	0.05
A2	0.60	-	0.70
A3	-	0.203	-
D	2.40	-	2.60
E	2.90	-	3.10
e	0.50 BSC		
b	0.18	-	0.30
L	0.30	-	0.50
D1	0.85	-	1.15
E1	1.35	-	1.65
K	-	0.35	-
Unit: mm			

10 Notes and Revision History

10.1 Associated Product Family and Others

To view other products of the same type or IC products of other types, click the official website of JSCJ -- ***https:www.jscj-elec.com*** for more details.

10.2 Notes

Electrostatic Discharge Caution

This IC may be damaged by ESD. Relevant personnel shall comply with correct installation and use specifications to avoid ESD damage to the IC. If appropriate measures are not taken to prevent ESD damage, the hazards caused by ESD include but are not limited to degradation of integrated circuit performance or complete damage of integrated circuit. For some precision integrated circuits, a very small parameter change may cause the whole device to be inconsistent with its published specifications.

10.3 Revision History

June, 2025: rev - 1.2, Correct the device number in 5 Orderable Information.

September, 2025: rev - 1.3, Change marking information.

DISCLAIMER

IMPORTANT NOTICE, PLEASE READ CAREFULLY

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