Hex Inverting Schmitt Trigger

CJ74HC/HCT14 Logic

1 Introduction

The CJ74HC/HCT14 is a hex inverter with Schmitt-trigger inputs. This device features reduced input threshold levels to allow interfacing to TTL logic levels. Inputs include clamp diodes. This enables the use of current limiting resistors to interface inputs to voltages in excess of V_{CC}. Schmitt trigger inputs transform slowly changing input signals into sharply defined jitter-free output signals.

2 Available Packages

PART NUMBER	PACKAGE
CJ74HC14	SOP14
	TSSOP14
CJ74HCT14	SOP14
	TSSOP14

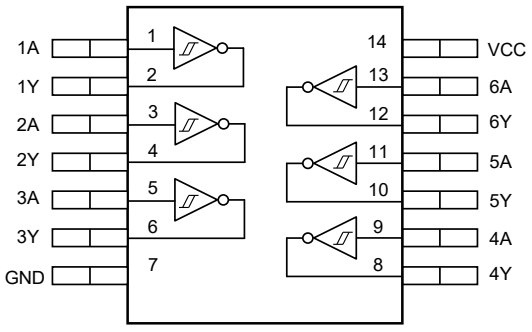
Note: For all available packages, please refer to the part Orderable Information.

3 Features

- Input levels:
  - For CJ74HC14: CMOS level
  - For CJ74HCT14: TTL level
- Low-power dissipation
- Specified from -40°C to +125°C

4 Applications

- Synchronize inverted clock inputs
- Debounce a switch
- Invert a digital signal



Functional pinout

5 Orderable Information

DEVICE	PACKAGE	OP TEMP	ECO PLAN	MSL	PACKING OPTION	SORT
CJ74HC14ADN	SOP14	-40~125°C	RoHS & Green	Level 3 168HR	Tape and Reel 4000 Units/Reel	Active
CJ74HCT14ADN	SOP14	-40~125°C	RoHS & Green	Level 3 168HR	Tape and Reel 4000 Units/Reel	Active
CJ74HC14BDN	TSSOP14	-40~125°C	RoHS & Green	Level 3 168HR	Tape and Reel 5000 Units/Reel	Active
CJ74HCT14BDN	TSSOP14	-40~125°C	RoHS & Green	Level 3 168HR	Tape and Reel 5000 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

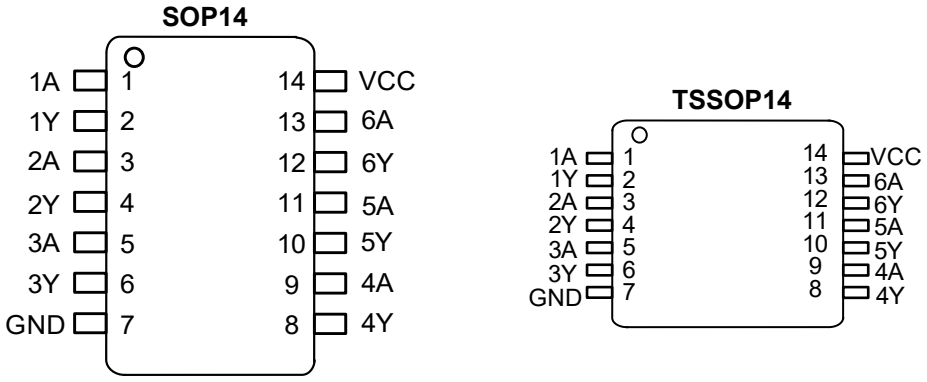


Figure 6-1 Pin configuration

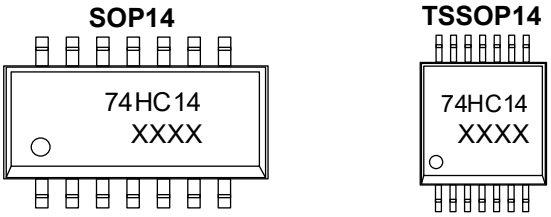
6.2 Pin Function

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

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

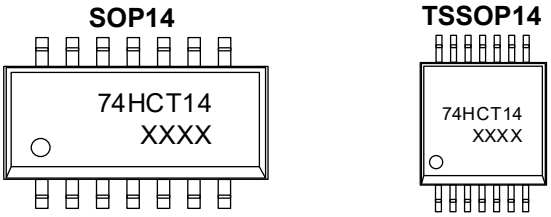
6.3 Marking Information

6.3.1 CJ74HC14



XXXX: Code, indicates weekly record information.

6.3.2 CJ74HCT14



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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	SOP/TSSOP	-	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
CJ74HC14						
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
T_{amb}	Ambient temperature	-	-40	-	+125	°C
CJ74HCT14						
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
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
CJ74HC14							
V_{OH}	HIGH-level output voltage	V_I=V_{T+} or V_{T-}	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_{T+} or V_{T-}	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
CJ74HCT14							
V_{OH}	HIGH-level output voltage	V_I=V_{T+} or V_{T-}	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_{T+} or V_{T-}	I_O=20uA; V_{CC}=4.5V	-	0	0.1	V
			I_O=4.0mA; 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		-	30	108	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
CJ74HC14							
V_{OH}	HIGH-level output voltage	V_I=V_{T+} or V_{T-}	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_{T+} or V_{T-}	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
CJ74HCT14							
V_{OH}	HIGH-level output voltage	V_I=V_{T+} or V_{T-}	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_{T+} or V_{T-}	I_O=20uA; V_{CC}=4.5V	-	-	0.1	V
			I_O=4.0mA; 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		-	-	135	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
CJ74HC14							
V_{OH}	HIGH-level output voltage	V_I=V_{T+} or V_{T-}	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_{T+} or V_{T-}	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
CJ74HCT14							
V_{OH}	HIGH-level output voltage	V_I=V_{T+} or V_{T-}	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_{T+} or V_{T-}	I_O=20uA; V_{CC}=4.5V	-	-	0.1	V
			I_O=4.0mA; 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		-	-	147	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
CJ74HC14							
t_{PLH}, t_{PHL}	nA, nB to nY propagation delay	See Figure 8-5	V_{CC}=2.0V	-	41	125	ns
			V_{CC}=4.5V	-	15	25	ns
			V_{CC}=5.0V; C_L=15pF	-	12	-	ns
			V_{CC}=6.0V	-	12	21	ns
t_{THL}, t_{TLH}	Transition time	See Figure 8-5	V_{CC}=2.0V	-	19	75	ns
			V_{CC}=4.5V	-	7	15	ns
			V_{CC}=6.0V	-	6	13	ns
CJ74HCT14							
t_{PLH}, t_{PHL}	nA, nB to nY propagation	See Figure 8-5	V_{CC}=4.5V	-	20	34	ns

	delay		V_{CC}=5.0V; C_L=15pF	-	17	-	ns
t_{THL}, t_{TLH}	Transition time	See Figure 8-5	V_{CC}=4.5V	-	7	15	ns

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
CJ74HC14							
t_{PLH}, t_{PHL}	nA, nB to nY propagation delay	See Figure 8-5	V_{CC}=2.0V	-	-	155	ns
			V_{CC}=4.5V	-	-	31	ns
			V_{CC}=6.0V	-	-	26	ns
t_{THL}, t_{TLH}	Transition time	See Figure 8-5	V_{CC}=2.0V	-	-	95	ns
			V_{CC}=4.5V	-	-	19	ns
			V_{CC}=6.0V	-	-	15	ns
CJ74HCT14							
t_{PLH}, t_{PHL}	nA, nB to nY propagation delay	See Figure 8-5	V_{CC}=4.5V	-	-	43	ns
t_{THL}, t_{TLH}	Transition time	See Figure 8-5	V_{CC}=4.5V	-	-	19	ns

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
CJ74HC14							
t_{PLH}, t_{PHL}	nA, nB to nY propagation delay	See Figure 8-5	V_{CC}=2.0V	-	-	190	ns
			V_{CC}=4.5V	-	-	38	ns
			V_{CC}=6.0V	-	-	32	ns
t_{THL}, t_{TLH}	Transition time	See Figure 8-5	V_{CC}=2.0V	-	-	110	ns
			V_{CC}=4.5V	-	-	22	ns
			V_{CC}=6.0V	-	-	19	ns
CJ74HCT14							
t_{PLH}, t_{PHL}	nA, nB to nY propagation delay	See Figure 8-5	V_{CC}=4.5V	-	-	51	ns
t_{THL}, t_{TLH}	Transition time	See Figure 8-5	V_{CC}=4.5V	-	-	22	ns

7.4.7 Transfer Characteristics 1

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
CJ74HC14						
V_{T+}	Positive-going threshold voltage	V_{CC}=2.0V	0.7	1.18	1.5	V
		V_{CC}=4.5V	1.7	2.38	3.15	V
		V_{CC}=6.0V	2.1	3.14	4.2	V
V_{T-}	Negative-going threshold voltage	V_{CC}=2.0V	0.3	0.52	0.9	V
		V_{CC}=4.5V	0.9	1.4	2.0	V
		V_{CC}=6.0V	1.2	1.89	2.6	V
V_H	Hysteresis voltage	V_{CC}=2.0V	-	0.66	-	V
		V_{CC}=4.5V	-	0.98	-	V
		V_{CC}=6.0V	-	1.25	-	V
CJ74HCT14						
V_{T+}	Positive-going threshold voltage	V_{CC}=4.5V	1.2	1.41	1.9	V
		V_{CC}=5.5V	1.4	1.59	2.1	V
V_{T-}	Negative-going threshold voltage	V_{CC}=4.5V	0.5	0.85	1.2	V
		V_{CC}=5.5V	0.6	0.99	1.4	V
V_H	Hysteresis voltage	V_{CC}=4.5V	-	0.56	-	V
		V_{CC}=5.5V	-	0.6	-	V

7.4.8 Transfer 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
CJ74HC14						
V_{T+}	Positive-going threshold voltage	V_{CC}=2.0V	0.7	-	1.5	V
		V_{CC}=4.5V	1.7	-	3.15	V
		V_{CC}=6.0V	2.1	-	4.2	V
V_{T-}	Negative-going threshold voltage	V_{CC}=2.0V	0.3	-	0.9	V
		V_{CC}=4.5V	0.9	-	2.0	V
		V_{CC}=6.0V	1.2	-	2.6	V
V_H	Hysteresis voltage	V_{CC}=2.0V	-	0.66	-	V
		V_{CC}=4.5V	-	0.98	-	V
		V_{CC}=6.0V	-	1.25	-	V
CJ74HCT14						
V_{T+}	Positive-going threshold voltage	V_{CC}=4.5V	1.2	-	1.9	V
		V_{CC}=5.5V	1.4	-	2.1	V
V_{T-}	Negative-going threshold	V_{CC}=4.5V	0.5	-	1.2	V

	voltage	V_{CC}=5.5V	0.6	-	1.4	V
V_H	Hysteresis voltage	V_{CC}=4.5V	-	0.56	-	V
		V_{CC}=5.5V	-	0.6	-	V

7.4.9 Transfer 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
CJ74HC14						
V_{T+}	Positive-going threshold voltage	V_{CC}=2.0V	0.7	-	1.5	V
		V_{CC}=4.5V	1.7	-	3.15	V
		V_{CC}=6.0V	2.1	-	4.2	V
V_{T-}	Negative-going threshold voltage	V_{CC}=2.0V	0.3	-	0.9	V
		V_{CC}=4.5V	0.9	-	2.0	V
		V_{CC}=6.0V	1.2	-	2.6	V
V_H	Hysteresis voltage	V_{CC}=2.0V	-	0.66	-	V
		V_{CC}=4.5V	-	0.98	-	V
		V_{CC}=6.0V	-	1.25	-	V
CJ74HCT14						
V_{T+}	Positive-going threshold voltage	V_{CC}=4.5V	1.2	-	1.9	V
		V_{CC}=5.5V	1.4	-	2.1	V
V_{T-}	Negative-going threshold voltage	V_{CC}=4.5V	0.5	-	1.2	V
		V_{CC}=5.5V	0.6	-	1.4	V
V_H	Hysteresis voltage	V_{CC}=4.5V	-	0.56	-	V
		V_{CC}=5.5V	-	0.6	-	V

8 Detailed Description

8.1 Overview

The CJ74HC/HCT14 is a hex inverter with Schmitt-trigger inputs. This device features reduced input threshold levels to allow interfacing to TTL logic levels. Inputs include clamp diodes. This enables the use of current limiting resistors to interface inputs to voltages in excess of V_{CC}. Schmitt trigger inputs transform slowly changing input signals into sharply defined jitter-free output signals.

8.2 Functional Block Diagram

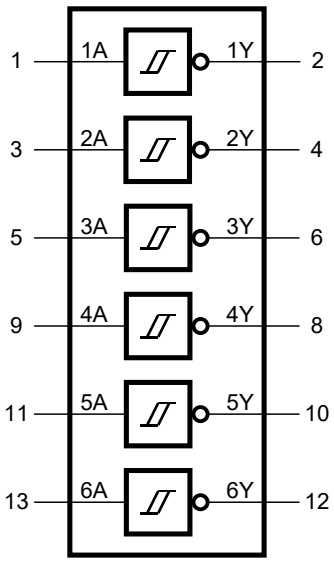


Figure 8-1 Logic symbol

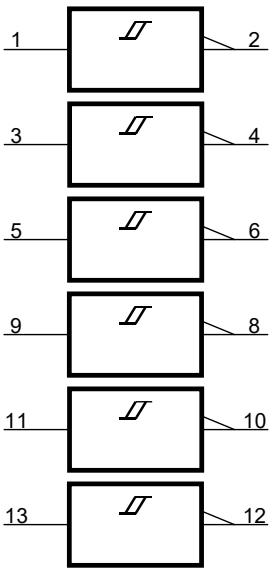


Figure 8-2 IEC logic symbol

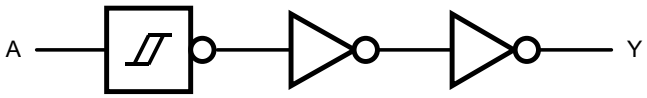


Figure 8-3 Logic diagram for one gate

8.3 Function Table(1)

INPUT	OUTPUT
nA	nY
L	H
H	L

(1) H=HIGH voltage level; L=LOW voltage level.

8.4 Testing Circuit

8.4.1 AC Testing Circuit

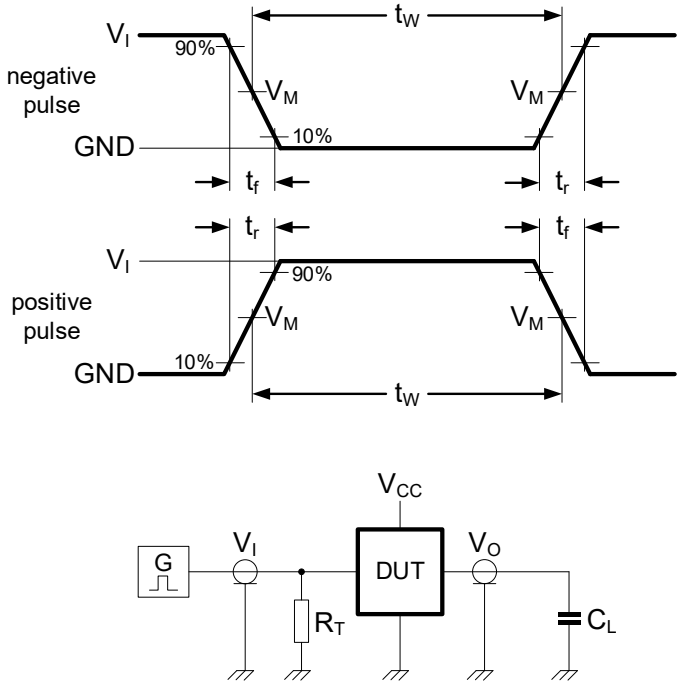


Figure 8-4 Test circuit for measuring switching times

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

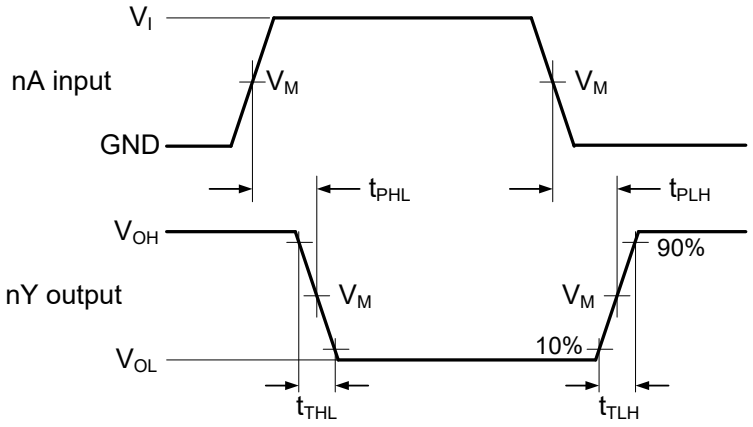


Figure 8-5 Input to output propagation delays

8.4.3 Transfer Characteristics Waveforms

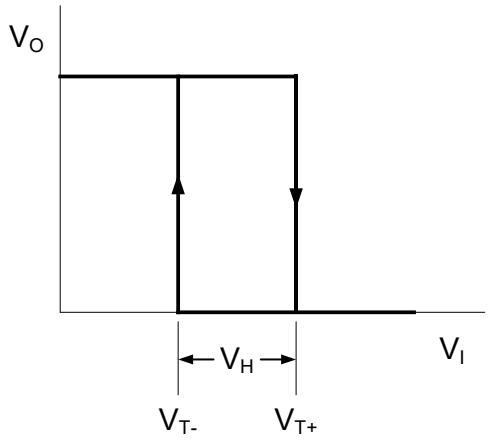


Figure 8-6 Transfer characteristics

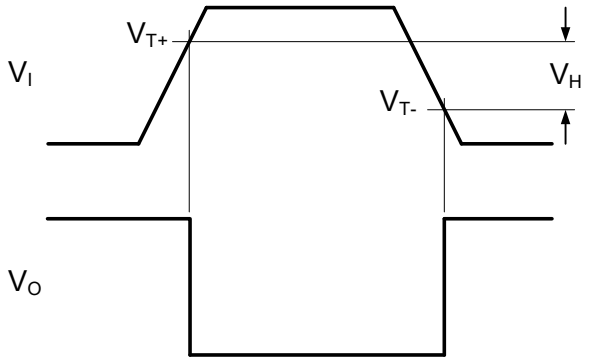


Figure 8-7 Transfer characteristics definitions

8.4.4 Measurement Points

TYPE	INPUT	OUTPUT		
	V_M	V_M	V_X	V_Y
CJ74HC14	0.5xV_{CC}	0.5xV_{CC}	0.1xV_{CC}	0.9xV_{CC}
CJ74HCT14	1.3V	1.3V	0.1xV_{CC}	0.9xV_{CC}

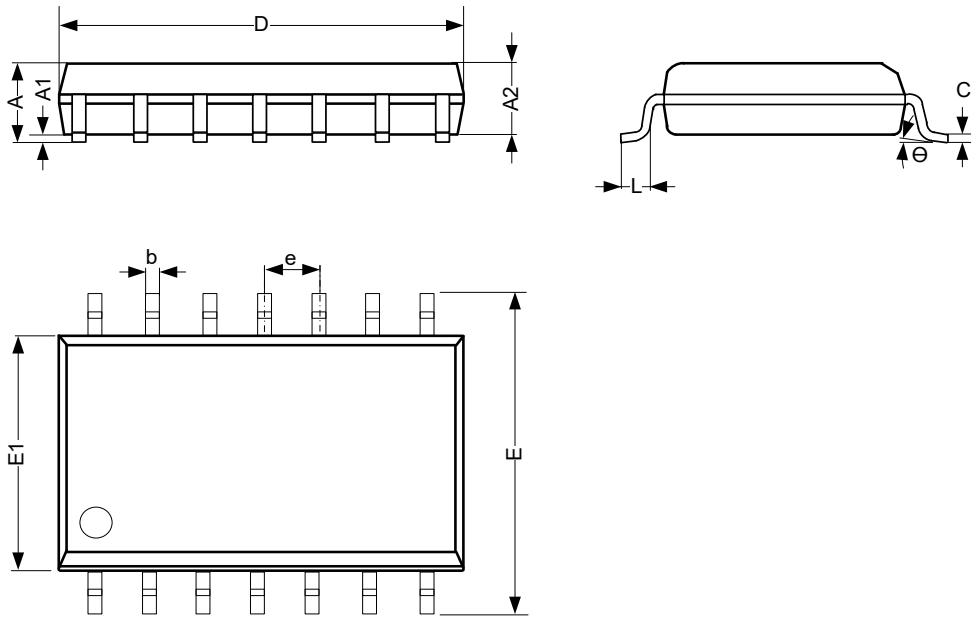
8.4.5 Test Data

TYPE	INPUT		LOAD	TEST
	V_I	t_r, t_f	C_L	
CJ74HC14	V_{CC}	6.0ns	15pF, 50pF	t_{PLH}, t_{PHL}
CJ74HCT14	3.0V	6.0ns	15pF, 50pF	t_{PLH}, t_{PHL}

9 Mechanical Information

9.1 SOP14 Mechanical Information

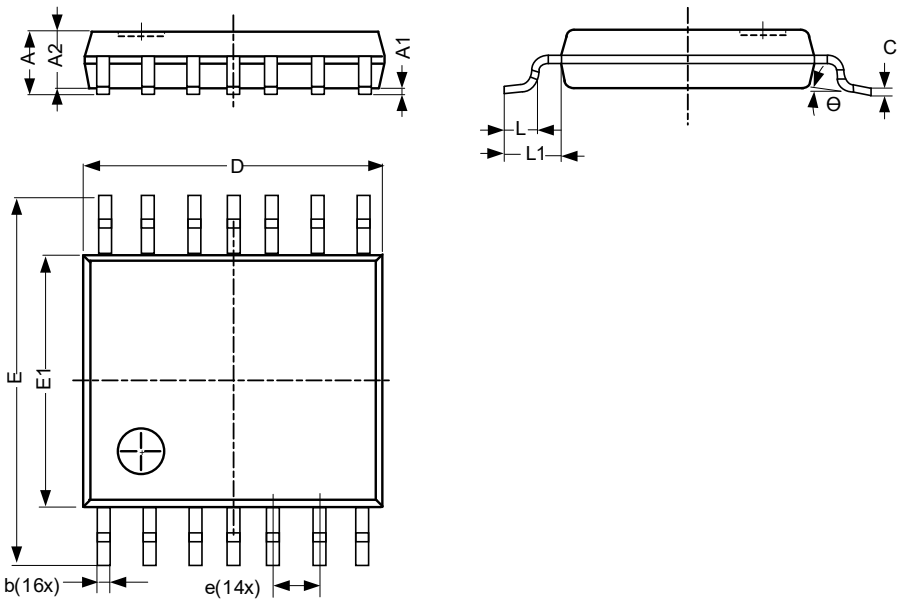
9.1.1 SOP14 Outline Dimensions



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			

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.

DISCLAIMER

IMPORTANT NOTICE, PLEASE READ CAREFULLY

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Any person who purchases or uses JSCJ products for design shall: 1. Select products suitable for circuit application and design; 2. Design, verify and test the rationality of circuit design; 3. Procedures to ensure that the design complies with relevant laws and regulations and the requirements of such laws and regulations. JSCJ makes no warranty or representation as to the accuracy or completeness of the information contained in this data sheet and assumes no responsibility for the application or use of any of the products described in this data sheet.

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