

### Features

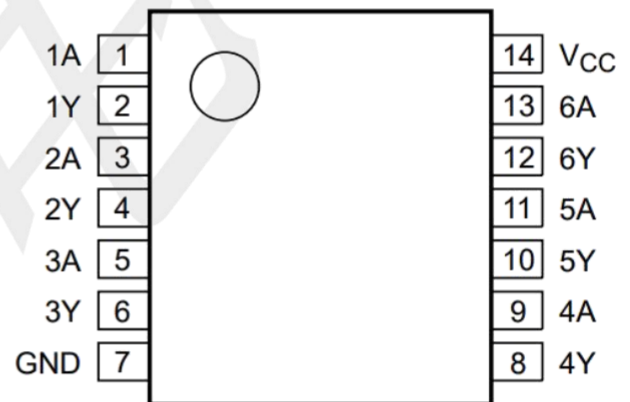
- Wide supply voltage range from 2 V to 5.5 V
- CMOS low power dissipation
- Overvoltage tolerant inputs to 5.5 V
- Latch-up performance exceeds 250 mA
- Direct interface with TTL levels
- ESD protection:  
HBM ANSI/ESDA/JEDEC JS-00  
Class 3A exceeds 6000 V  
CDM ANSI/ESDA/JEDEC JS-002  
Class C3 exceeds 2000 V
- I<sub>OFF</sub> circuitry provides partial Power-down mode operation
- Complies with JEDEC standard:  
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 hex inverter with Schmitt-trigger inputs. 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.

This device is fully specified for partial power down applications using IOFF. The IOFF circuitry disables the output, preventing the potentially damaging backflow current through the device when it is powered down.

### PIN CONFIGURATIONS (Top view)

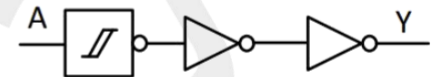
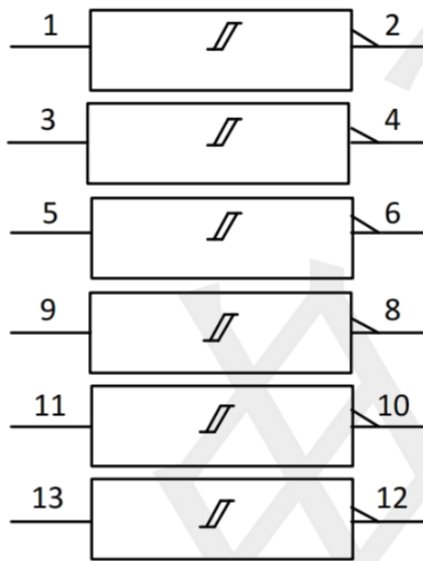
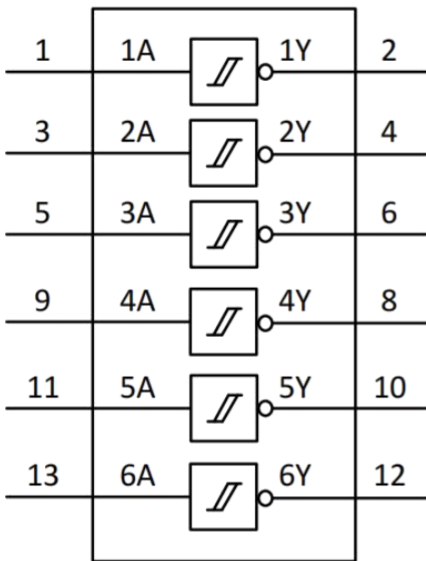


TSSOP-14

### PIN DESCRIPTION

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

## Functional diagram



## Functional Description

### Function table

Input nA	Output nY
L	H
H	L

H = HIGH voltage level; L = LOW voltage level

### ABSOLUTE MAXIMUM RATINGS

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

Symbol	Parameter	Conditions	Min	Max	Unit
V <sub>CC</sub>	supply voltage		-0.5	6.5	V
I <sub>IK</sub>	input clamping current	V <sub>I</sub> < 0 V	-50	--	mA
V <sub>I</sub>	input voltage	(1)	-0.5	6.5	V
I <sub>OK</sub>	output clamping current	V <sub>O</sub> > V <sub>CC</sub> or V <sub>O</sub> < 0 V	--	±50	mA
V <sub>O</sub>	output voltage	Active mode (1)	0	V <sub>CC</sub> + 0.5	V
		Power-down mode; V <sub>CC</sub> = 0 V (1)	0	6.5	V
I <sub>O</sub>	output current	V <sub>O</sub> = 0 V to V <sub>CC</sub>	--	±50	mA
I <sub>CC</sub>	supply current		--	100	mA
I <sub>GND</sub>	ground current		-100	--	mA
P <sub>tot</sub>	total power dissipation	T <sub>amb</sub> = -40 °C to + 125 °C	--	500	mW
T <sub>stg</sub>	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 <sub>CC</sub>	supply voltage		2	5.5	V
		functional	1.5	--	V
V <sub>I</sub>	input voltage		0	5.5	V
V <sub>O</sub>	output voltage	Active mode	0	V <sub>CC</sub>	V
		Power-down mode; V <sub>CC</sub> = 0 V	0	5.5	V
T <sub>amb</sub>	ambient temperature		-40	125	°C

### Static characteristics

At recommended operating conditions. Voltages are referenced to GND (ground = 0 V).

Symbol	Parameter	Conditions	-40 °C to +85 °C			-40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	
V <sub>OH</sub>	HIGH-level output voltage	V <sub>I</sub> = V <sub>T+</sub> or V <sub>T-</sub>						
		I <sub>O</sub> = -100μA; V <sub>CC</sub> = 2 V to 5.5 V	V <sub>CC</sub> - 0.1	--	--	V <sub>CC</sub> - 0.1	--	V
		I <sub>O</sub> = -4 mA; V <sub>CC</sub> = 2 V	1.4	--	--	1.5	--	V
		I <sub>O</sub> = -8 mA; V <sub>CC</sub> = 2.3 V	1.9	--	--	1.7	--	V
		I <sub>O</sub> = -12 mA; V <sub>CC</sub> = 2.7 V	2.2	--	--	2.05	--	V
		I <sub>O</sub> = -24 mA; V <sub>CC</sub> = 3.0 V	2.4	--	--	2.25	--	V
		I <sub>O</sub> = -32 mA; V <sub>CC</sub> = 4.5 V	3.8	--	--	3.5	--	V
V <sub>OL</sub>	LOW-level output voltage	V <sub>I</sub> = V <sub>T+</sub> or V <sub>T-</sub>						
		I <sub>O</sub> = 100μA; V <sub>CC</sub> = 2 V to 5.5 V	--	--	0.10	--	0.10	V
		I <sub>O</sub> = 4 mA; V <sub>CC</sub> = 2 V	--	--	0.45	--	0.65	V
		I <sub>O</sub> = 8 mA; V <sub>CC</sub> = 2.3 V	--	--	0.30	--	0.45	V
		I <sub>O</sub> = 12 mA; V <sub>CC</sub> = 2.7 V	--	--	0.40	--	0.60	V
		I <sub>O</sub> = 24 mA; V <sub>CC</sub> = 3.0 V	--	--	0.55	--	0.80	V
		I <sub>O</sub> = 32 mA; V <sub>CC</sub> = 4.5 V	--	--	0.55	--	0.80	V
I <sub>I</sub>	input leakage current	V <sub>I</sub> = 5.5 V or GND ; V <sub>CC</sub> = 0 V to 5.5 V	--	±0.1	±5	--	±20	μA
I <sub>OFF</sub>	power-off leakage current	V <sub>CC</sub> = 0V ; V <sub>I</sub> or V <sub>O</sub> = 5.5 V	--	±0.1	±10	--	±20	μA
I <sub>CC</sub>	supply current	V <sub>I</sub> = 5.5V or GND ; I <sub>O</sub> = 0A ; V <sub>CC</sub> = 2V to 5.5V	--	0.03	10	--	40	μA
ΔI <sub>CC</sub>	additional supply current	per input pin ; V <sub>CC</sub> = 2.3V to 5.5V ; V <sub>I</sub> = V <sub>CC</sub> -0.6V ; I <sub>O</sub> = 0A	--	0.8	500	--	5000	μA
C <sub>I</sub>	input capacitance	V <sub>CC</sub> = 3.3V ; V <sub>I</sub> = GND to V <sub>CC</sub>	--	4	--	--	--	pF

**Note:** All typical values are measured at V<sub>CC</sub> = 3.3V and T<sub>amb</sub> = 25 °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						
		$V_{CC} = 2\text{ V}$	--	46	--	--	--	ns
		$V_{CC} = 2\text{ V}$	4	12.3	24	4	25	ns
		$V_{CC} = 2.3\text{ V to }2.7\text{ V}$	2.5	7.4	12	2.5	13	ns
		$V_{CC} = 3.0\text{ V to }3.6\text{ V}$	1.5	5.7	8.5	1.5	9	ns
		$V_{CC} = 4.5\text{ V to }5.5\text{ V}$	1	3.5	6	1	6.5	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 buffer ; $V_i = \text{GND to } V_{CC}$						
		$V_{CC} = 2\text{ V}$	--	12.7	--	--	--	pF
		$V_{CC} = 2.3\text{ V to }2.7\text{ V}$	--	13.3	--	--	--	pF
		$V_{CC} = 3.0\text{ V to }3.6\text{ V}$	--	14.3	--	--	--	pF
		$V_{CC} = 4.5\text{ V to }5.5\text{ V}$	--	16.5	--	--	--	pF

**Note:**

Typical values are measured at  $T_{amb} = 25\text{ °C}$  and  $V_{CC} = 2\text{ V}, 2.5\text{ V}, 3.3\text{ V}$  and  $5.0\text{ V}$  respectively.

$t_{pd}$  is the same as  $t_{PLH}$  and  $t_{PHL}$ .

Skew between any two outputs of the same package switching in the same direction. This parameter is guaranteed by design.

$C_{PD}$  is used to determine the dynamic power dissipation ( $P_D$  in  $\mu\text{W}$ ).

$$P_D = C_{PD} \times V_{CC}^2 \times f_i \times N + \sum(C_L \times V_{CC}^2 \times f_o) \text{ where:}$$

$f_i$  = input frequency in MHz;

$f_o$  = output frequency in

MHz;

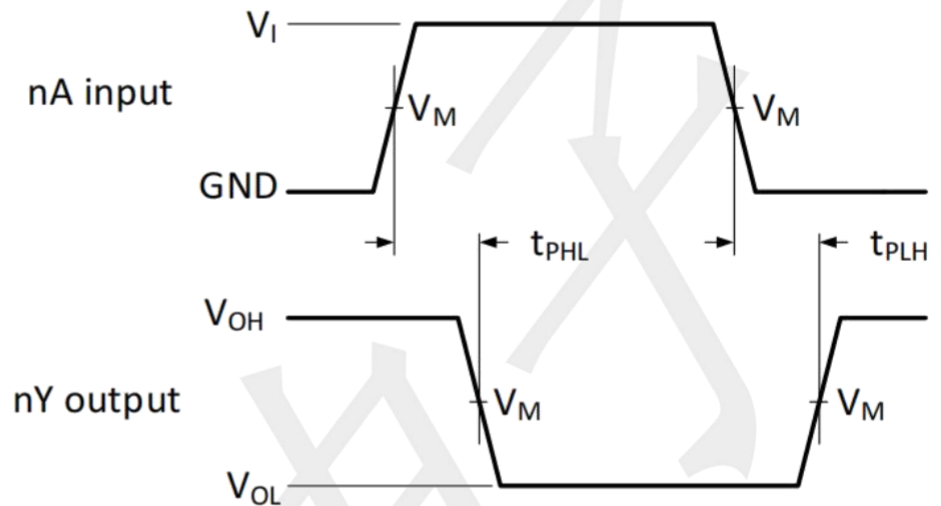
$C_L$  = output load capacitance in

pF;  $V_{CC}$  = supply voltage in V;

$N$  = number of inputs switching;

$\sum(C_L \times V_{CC}^2 \times f_o)$  = sum of outputs.

### Waveforms and test circuit



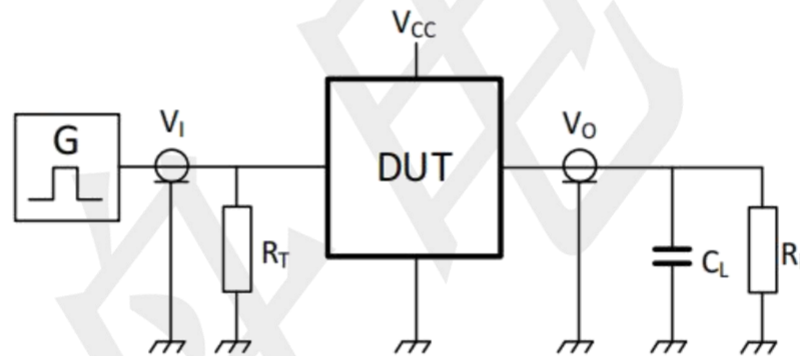
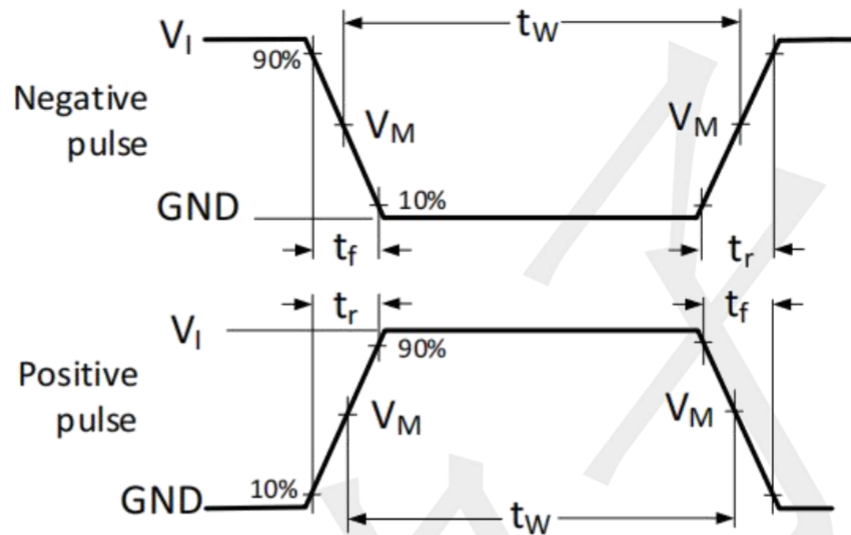
Measurement points are given in Table 8.

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

The input nA to output nY propagation delays

### Measurement points

Supply voltage	Input	Output
$V_{CC}$	$V_M$	$V_M$
2 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.

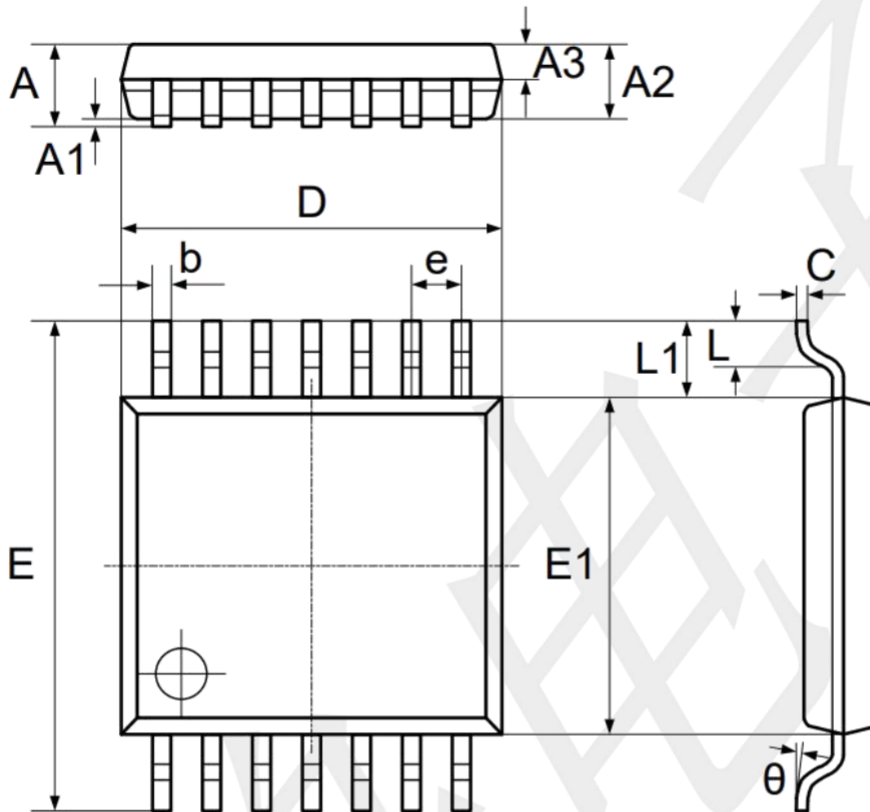
$C_L$  = Load capacitance including jig and probe capacitance.

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

### Test data

Supply voltage	Input		Load	
$V_{CC}$	$V_I$	$t_r = t_f$	$C_L$	$R_L$
2 V	$V_{CC}$	$\leq 2.0$ ns	15 pF	500 $\Omega$
2.3 V to 2.7 V	$V_{CC}$	$\leq 2.0$ ns	15 pF	500 $\Omega$
3.0 V to 3.6 V	3 V	$\leq 2.0$ ns	15 pF	500 $\Omega$
4.5 V to 5.5 V	$V_{CC}$	$\leq 2.0$ ns	15 pF	500 $\Omega$

Package information TSSOP-14



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	-	1.200	-	0.047
A1	0.050	0.150	0.002	0.006
A2	0.900	1.050	0.035	0.041
A3	0.390	0.490	0.015	0.019
b	0.200	0.290	0.008	0.011
C	0.130	0.180	0.005	0.007
D	4.860	5.060	0.191	0.199
E	6.200	6.600	0.244	0.260
E1	4.300	4.500	0.169	0.177
e	0.650 TYP.		0.026 TYP.	
L1	1.000 REF.		0.039 REF.	
L	0.450	0.750	0.018	0.030
θ	0°	8°	0°	8°