

EVVOSEMI[®]

THINK CHANGE DO



ESD



TVS



MOS



LDO



Diode



Sensor



DC-DC

Product Specification

▶ Domestic	Part Number	74HC04 / 74HCT04 Series
▶ Overseas	Part Number	74HC04 / 74HCT04 Series
▶ Equivalent	Part Number	74HC04 / 74HCT04 Series

EV is the abbreviation of name EVVO

1. General Description

The 74HC04; 74HCT04 is a hex inverter. Inputs include clamp diodes. This enables the use of current limiting resistors to interface inputs to voltages in excess of V_{CC} .

2. Features and Benefits

- Wide supply voltage range from 2.0 V to 6.0 V
- High noise immunity
- CMOS low power dissipation
- Latch-up performance exceeds 250 mA
- Complies with JEDEC standards:
 - JESD8C (2.7 V to 3.6 V)
 - JESD7A (2.0 V to 6.0 V)
- Input levels:
 - For 74HC04: CMOS level
 - For 74HCT04: TTL level
- ESD protection:
 - HBM ANSI/ESDA/JEDEC JS-001 Class 2 exceeds 3500 V
 - CDM ANSI/ESDA/JEDEC JS-002 Class C3 exceeds 2000 V
- Multiple package options

3.Ordering Information

Table 1. Ordering information

Type number	Package		
	Name	Description	Quantity
74HC04D	SOP-14L	plastic small outline package; 14 leads; body width 3.9 mm	2500
74HCT04D			
74HC04PW	TSSOP-14L	plastic thin shrink small outline package; 14 leads; body width 4.4 mm	2500
74HCT04PW			

4.Function Diagram

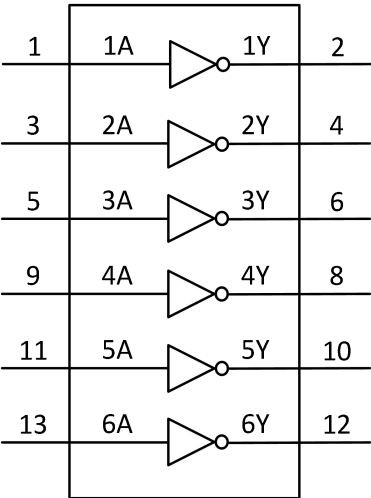


Fig. 1. Logic symbol

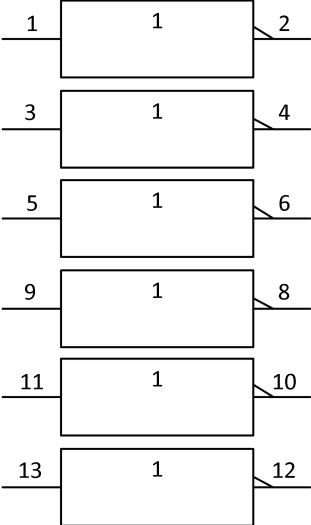


Fig. 2. IEC logic symbol

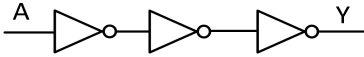
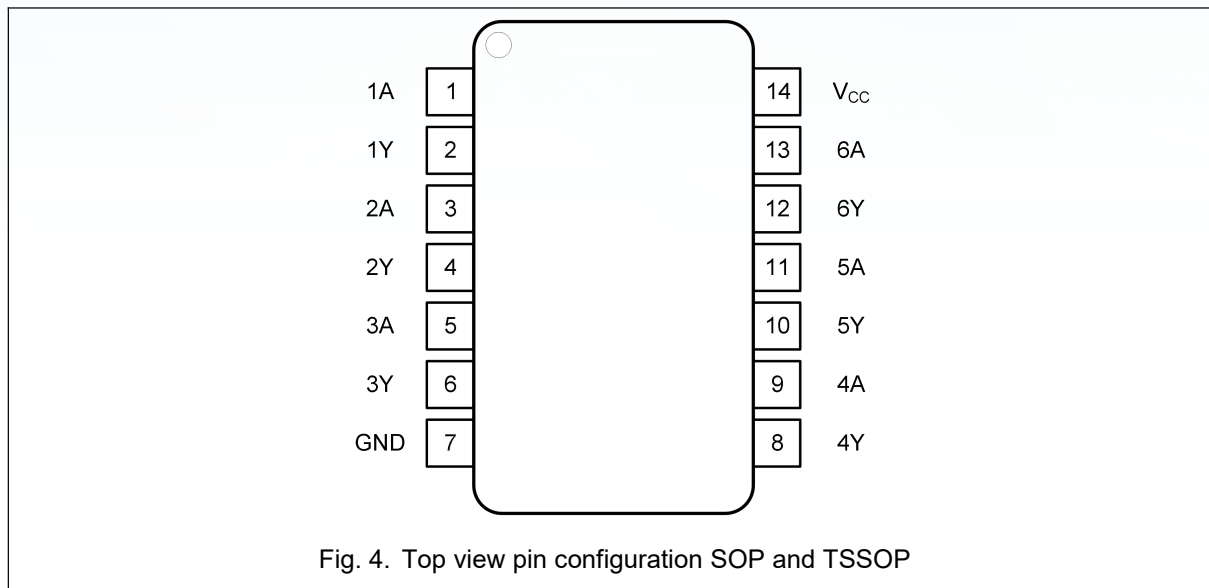


Fig. 3. Logic diagram(one inverter)

5. Pinning Information

5.1. Pinning



5.2. Pin description

Table 2. Pin description

Symbol	Pin	Description
1A, 2A, 3A, 4A, 5A, 6A	1, 3, 5, 9, 11, 13	Data input
1Y, 2Y, 3Y, 4Y, 5Y, 6Y	2, 4, 6, 8, 10, 12	Data output
GND	7	Ground (0V)
V _{CC}	14	Supply voltage

6. Functional Description

Table 3. Function table

H = HIGH voltage level; L = LOW voltage level.

Control	Output
nA	nY
L	H
H	L

7. Absolute Maximum Ratings

Stresses exceeding the absolute maximum ratings may damage the device. The device may not function or be operable above the recommended operating conditions and stressing the parts to these levels is not recommended. In addition, extended exposure to stresses above the recommended operating conditions may affect device reliability. The absolute maximum ratings are stress ratings only.

Table 4. Absolute Maximum Ratings

In accordance with the Absolute Maximum Rating System (IEC 60134). Voltages are referenced to GND.

Symbol	Parameter	Conditions	Min	Max	Unit
V_{CC}	supply voltage		-0.5	7.0	V
I_{IK}	input clamping current	$V_I < -0.5\text{ V}$ or $V_I > V_{CC} + 0.5\text{ V}$ [1]		± 20	mA
I_{OK}	output clamping current	$V_O < -0.5\text{ V}$ or $V_O > V_{CC} + 0.5\text{ V}$ [1]		± 20	mA
I_O	output current	$V_O = -0.5\text{ V}$ to $(V_{CC} + 0.5\text{ V})$		± 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

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

8. Recommended Operating Conditions

The Recommended Operating Conditions table defines the conditions for actual device operation. Recommended operating conditions are specified to ensure optimal performance to the datasheet specifications. MDD does not recommend exceeding them or designing to Absolute Maximum Ratings.

Table 5. Recommended Operating Conditions

Symbol	Parameter	Conditions	74HC04			74HCT04			Unit
			Min	Typ	Max	Min	Typ	Max	
V_{CC}	supply voltage		2.0	5.0	6.0	4.5	5.0	5.5	V
V_I	input voltage		0		V_{CC}	0		V_{CC}	V
V_O	output voltage		0		V_{CC}	0		V_{CC}	V
T_{amb}	ambient temperature		-40		125	-40		125	°C
$\Delta t/\Delta V$	input transition rise and fall rate	$V_{CC} = 2.0\text{ V}$			625				ns/V
		$V_{CC} = 4.5\text{ V}$		1.67	139		1.67	139	ns/V
		$V_{CC} = 6.0\text{ V}$			83				ns/V

9. Static Characteristics

Table 6. Static characteristics

At recommended operating conditions. Voltages are referenced to GND (ground = 0 V). Typical values measured at $T_{amb} = 25^{\circ}\text{C}$ (unless otherwise noted).

Measured at T _{amb} = 25 °C (unless otherwise noted).								
Symbol	Parameter	Conditions	-40 °C to +85 °C			-40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	
74HC04								
V _{IH}	HIGH-level input voltage	V _{CC} = 2.0 V	1.5			1.5		V
		V _{CC} = 4.5 V	3.15			3.15		V
		V _{CC} = 6.0 V	4.2			4.2		V
V _{IL}	LOW-level input voltage	V _{CC} = 2.0 V			0.5		0.5	V
		V _{CC} = 4.5 V			1.35		1.35	V
		V _{CC} = 6.0 V			1.8		1.8	V
V _{OH}	HIGH-level output voltage	V _I = V _{IH} or V _{IL}						
		I _O = -20 µA; V _{CC} = 2.0 V	1.9			1.9		V
		I _O = -20 µA; V _{CC} = 4.5 V	4.4			4.4		V
		I _O = -20 µA; V _{CC} = 6.0 V	5.9			5.9		V
		I _O = -4.0 mA; V _{CC} = 4.5 V	3.84			3.7		V
		I _O = -5.2 mA; V _{CC} = 6.0 V	5.34			5.2		V
V _{OL}	LOW-level output voltage	V _I = V _{IH} or V _{IL}						
		I _O = 20 µA; V _{CC} = 2.0 V			0.1		0.1	V
		I _O = 20 µA; V _{CC} = 4.5 V			0.1		0.1	V
		I _O = 20 µA; V _{CC} = 6.0 V			0.1		0.1	V
		I _O = 4.0 mA; V _{CC} = 4.5 V			0.33		0.4	V
		I _O = 5.2 mA; V _{CC} = 6.0 V			0.33		0.4	V
I _I	input leakage current	V _I = V _{CC} or GND ; V _{CC} = 6.0 V			±1		±1	µA
I _{CC}	supply current	V _I = V _{CC} or GND ; I _O = 0 A ; V _{CC} = 6.0 V			20		40	µA
C _I	input capacitance			7				pF

Symbol	Parameter	Conditions	-40 °C to +85 °C			-40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	
74HCT04								
V _{IH}	HIGH-level input voltage	V _{CC} = 4.5 V to 5.5 V	2.0			2.0		V
V _{IL}	LOW-level input voltage	V _{CC} = 4.5 V to 5.5 V			0.8		0.8	V
V _{OH}	HIGH-level output voltage	V _I = V _{IH} or V _{IL} ; V _{CC} = 4.5 V						
		I _O = -20 μA;	4.4		4.4		V	
		I _O = -4.0 mA;	3.84		3.7		V	
V _{OL}	LOW-level output voltage	V _I = V _{IH} or V _{IL} ; V _{CC} = 4.5 V						
		I _O = 20 μA;			0.1		0.1	V
		I _O = 4.0 mA;			0.33		0.4	V
I _I	input leakage current	V _I = V _{CC} or GND ; V _{CC} = 5.5 V			±1		±1	μA
I _{CC}	supply current	V _I = V _{CC} or GND; I _O = 0 A; V _{CC} = 5.5 V			20		40	μA
ΔI _{CC}	additional supply current	per pin ; V _I = V _{CC} - 2.1 V; I _O = 0 A; other inputs at V _{CC} or GND; V _{CC} = 4.5 V to 5.5 V			1.55		1.85	mA
C _I	input capacitance			10				pF

10. Dynamic Characteristics

Table 7. Dynamic characteristics

Voltages are referenced to GND (ground = 0 V); for test circuit see Fig. 6. Typical values measured at $T_{amb} = 25^{\circ}\text{C}$ (unless otherwise noted).

Symbol	Parameter	Conditions	-40 °C to +85 °C			-40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	
74HC04								
t _{pd}	propagation delay	nA to nY; see Fig. 5 [1]						
		V _{CC} = 2.0 V			35		40	ns
		V _{CC} = 4.5 V			20		25	ns
		V _{CC} = 6.0 V			15		20	ns
t _t	transition time	see Fig. 5 [2]						
		V _{CC} = 2.0 V			9		11	ns
		V _{CC} = 4.5 V			6		8	ns
		V _{CC} = 6.0 V			4		5	ns
C _{PD}	power dissipation capacitance	C _L = 15 pF; f = 1 MHz; V _I = GND to V _{CC} [3]		18				pF
74HCT04								
t _{pd}	propagation delay	nA to nY; V _{CC} = 4.5 V; see Fig. 5 [1]			16		19	ns
t _t	transition time	V _{CC} = 4.5 V; see Fig. 5 [2]			6		8	ns
C _{PD}	power dissipation capacitance	C _L = 15 pF; f = 1 MHz; V _I = GND to (V _{CC} -1.5 V) [3]		37				pF

[1] t_{pd} is the same as t_{PHL} and t_{PLH} .

[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 μW).

$P_D = C_{PD} \times V_{CC}^2 \times f_i \times N + \Sigma(C_L \times V_{CC}^2 \times f_o)$ 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;

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

10.1. Waveforms and test circuit

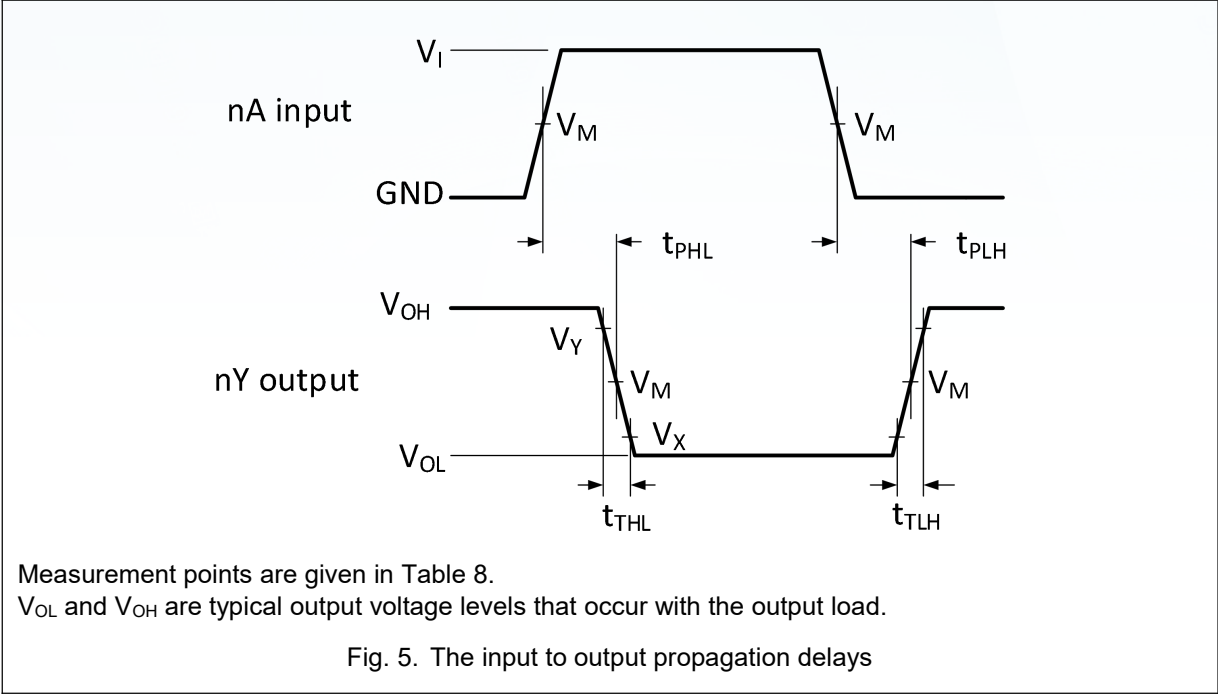


Table 8. Measurement points

Type	Input	Output		
	V_M	V_M	V_X	V_Y
74HC04	$0.5V_{CC}$	$0.5V_{CC}$	$0.1V_{CC}$	$0.9V_{CC}$
74HCT04	1.3 V	1.3 V	$0.1V_{CC}$	$0.9V_{CC}$

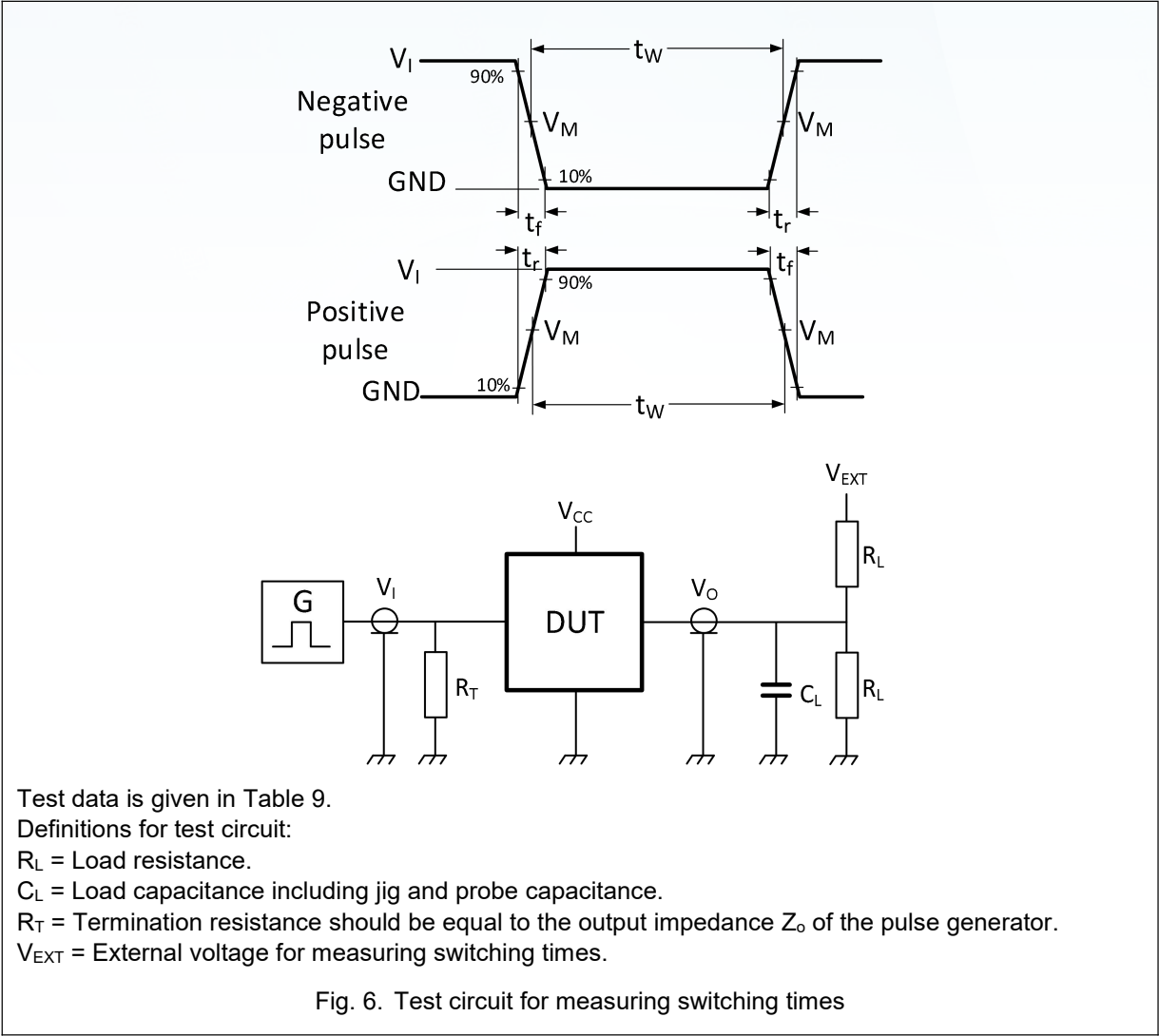
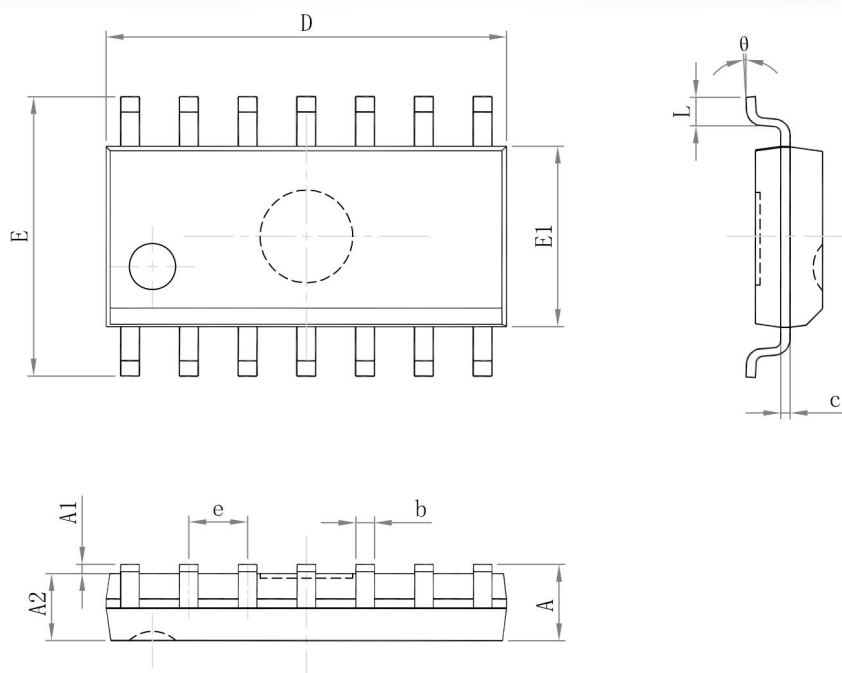


Table 9. Test data

Type	Input		Load		V_{EXT}
	V_I	$t_r = t_f$	C_L	R_L	t_{PLH}, t_{PHL}
74HC04	V_{CC}	$\leq 2.5 \text{ ns}$	15 pF	500Ω	open
74HCT04	3 V	$\leq 2.5 \text{ ns}$	15 pF	500Ω	open

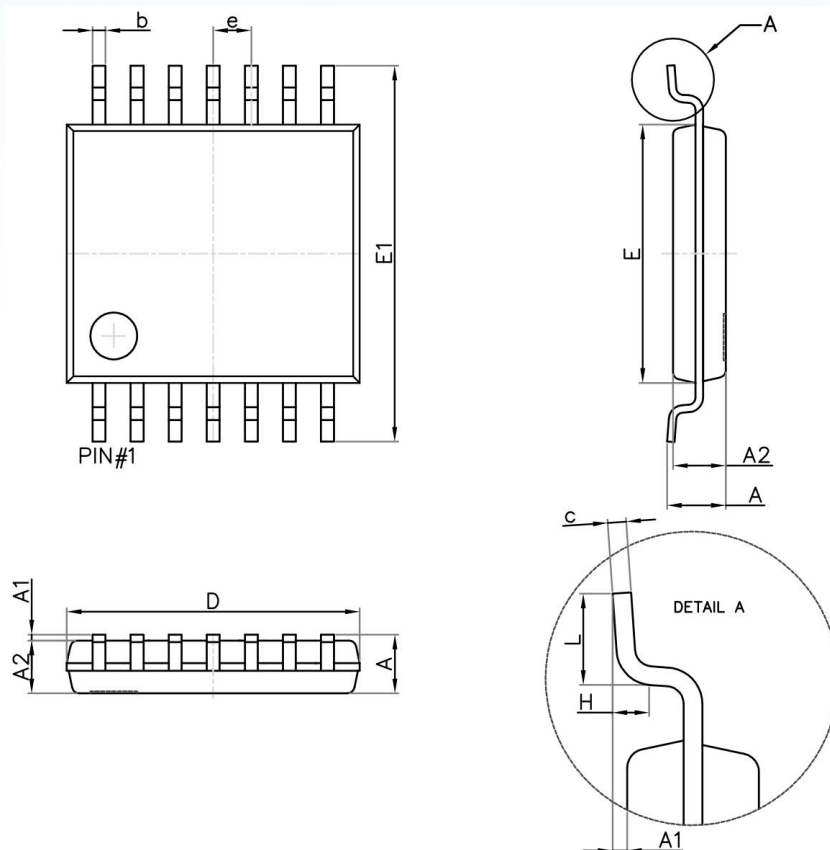
11. Package Outline

SOP-14L



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	—	1.750	—	0.069
A1	0.100	0.250	0.004	0.010
A2	1.250	—	0.049	—
b	0.310	0.510	0.012	0.020
c	0.100	0.250	0.004	0.010
D	8.450	8.850	0.333	0.348
E	5.800	6.200	0.228	0.244
E1	3.800	4.000	0.150	0.157
e	1.270(BSC)		0.050(BSC)	
L	0.400	1.270	0.016	0.050
θ	0°	8°	0°	8°

TSSOP-14L



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°

12. Abbreviations

Table 10. Abbreviations

Acronym	Description
CMOS	Complementary Metal-Oxide Semiconductor
DUT	Device Under Test
ESD	ElectroStatic Discharge
HBM	Human Body Model
CDM	Charged Device Model
TTL	Transistor-Transistor Logic

Disclaimer

EVVOSEMI ("EVVO") reserves the right to make corrections, enhancements, improvements, and other changes to its products and services at any time, and to discontinue any product or service without notice.

EVVO warrants the performance of its hardware products to the specifications applicable at the time of sale in accordance with its standard warranty. Testing and other quality control techniques are used as deemed necessary by EVVO to support this warranty. Except where mandated by government requirements, testing of all parameters of each product is not necessarily performed.

Customers should obtain and confirm the latest product information and specifications before final design, purchase, or use. EVVO makes no warranty, representation, or guarantee regarding the suitability of its products for any particular purpose, nor does EVVO assume any liability for application assistance or customer product design. EVVO does not warrant or accept any liability for products that are purchased or used for any unintended or unauthorized application.

EVVO products are not authorized for use as critical components in life support devices or systems without the express written approval of EVVOSEMI.

The EVVO logo and EVVOSEMI are trademarks of EVVOSEMI or its subsidiaries in relevant jurisdictions. EVVO reserves the right to make changes without further notice to any products herein.