芯伯乐®
XINBOLE

Product Specification

XBLW CD4093

Quad 2-input Nand Schmitt Gate

WEB | www.xinboleic.com

Description

The CD4093 is a quad two-input NAND gate. Each input has a Schmitt trigger circuit.

The gate switches at different points for positive-going and negative-going signals. The difference between the positive voltage (V_{T+}) and the negative voltage (V_{T-}) is defined as hysteresis voltage (V_H).

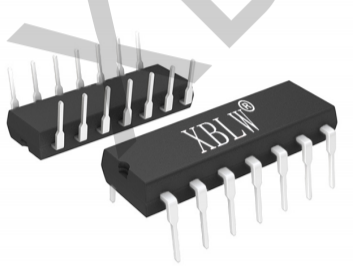
It operates over a recommended V_{DD} power supply range of 3V to 15V referenced to V_{SS}(usually ground). Unused inputs must be connected to V_{DD}, V_{SS}, or another input.

Features

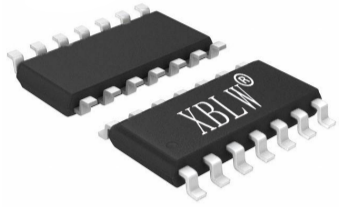
- Wide supply voltage range from 3V to 15V
- Schmitt trigger input discrimination
- Fully static operation
- 5V, 10V, and 15V parametric ratings
- Standardized symmetrical output characteristics
- Specified from -40°C to +125°C
- Packaging information: DIP14/SOP14/TSSOP14

Applications

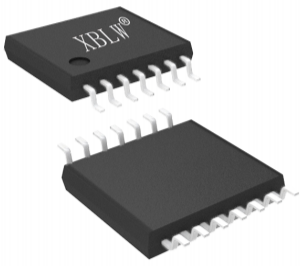
- Wave and pulse shapers
- High-noise-environment systems
- Monostable multivibrators
- Astable multivibrators
- NAND logic



DIP-14



SOP-14



TSSOP-14

Ordering Information

Product Model	Package Type	Marking	Packing	Packing Qty
XBLW CD4093BE	DIP-14	CD4093BE	Tube	1000Pcs/Box
XBLW CD4093BDTR	SOP-14	CD4093B	Tape	2500Pcs/Reel
XBLW CD4093BTDTR	TSSOP-14	CD4093B	Tape	3000Pcs/Reel

BlocDiagram

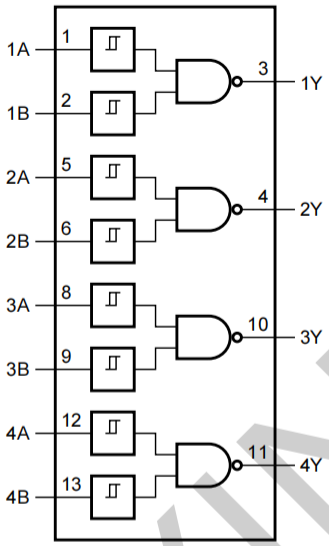


Figure 1. Functional diagram

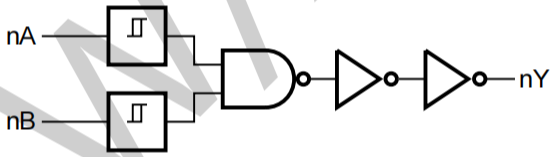
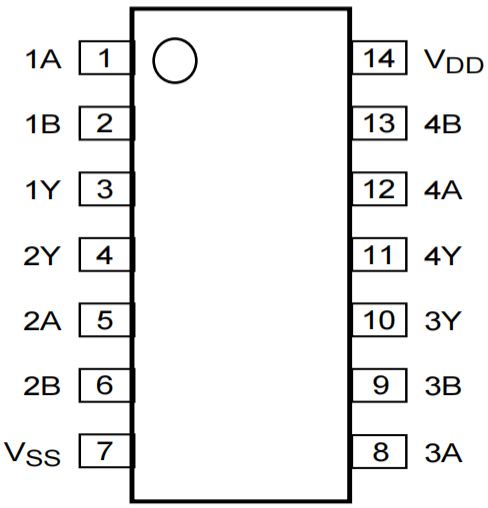


Figure 2. Logic diagram (one gate)

Pin Configurations



Pin Description

Pin No.	Pin Name	Description
1	1A	data input
2	1B	data input
3	1Y	data output
4	2Y	data output
5	2A	data input
6	2B	data input
7	V_{SS}	ground (0V)
8	3A	data input
9	3B	data input
10	3Y	data output
11	4Y	data output
12	4A	data input
13	4B	data input
14	V_{DD}	supply voltage

Function Table

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

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

Electrical Parameter

Absolute Maximum Ratings

(Voltages are referenced to V_{SS} (ground=0V), unless otherwise specified.)

Parameter	Symbol	Conditions		Min.	Max.	Unit
supply voltage	V_{DD}	-		-0.5	+18	V
DC input current	I_{IK}	anyone input		-	±10	mA
input voltage	V_I	all inputs		-0.5	V_{DD}+0.5	V
storage temperature	T_{stg}	-		-65	+150	℃
total power dissipation	P_{tot}	-		-	500	mW
device dissipation	P	per output transistor		-	100	mW
Soldering temperature	T_L	10s	DIP	245		℃
			SOP/TSSOP	260		℃

Recommended Operating Conditions

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
supply voltage	V_{DD}	-	3	-	15	V
ambient temperature	T_{amb}	in free air	-40	-	+125	℃

Electrical Characteristics

DC Characteristics 1

(T_{amb}=25℃, voltages are referenced to V_{SS} (ground=0V), unless otherwise specified.)

Parameter	Symbol	Conditions (V)			T_{amb}=25℃			Unit
		V_O	V_{IN}	V_{DD}	Min.	Typ.	Max.	
supply current	I_{DD}	-	0, 5	5	-	-	1	uA
		-	0, 10	10	-	-	2	uA
		-	0, 15	15	-	-	4	uA
LOW-level output current	I_{OL}	0.4	0, 5	5	0.51	1	-	mA
		0.5	0, 10	10	1.3	2.6	-	mA
		1.5	0, 15	15	3.4	6.8	-	mA
HIGH-level output current	I_{OH}	4.6	0, 5	5	-0.51	-1	-	mA
		2.5	0, 5	5	-1.6	-3.2	-	mA
		9.5	0, 10	10	-1.3	-2.6	-	mA
		13.5	0, 15	15	-3.4	-6.8	-	mA
LOW-level output voltage	V_{OL}	-	0, 5	5	-	0	0.05	V
		-	0, 10	10	-	0	0.05	V
		-	0, 15	15	-	0	0.05	V
HIGH-level output voltage	V_{OH}	-	0, 5	5	4.95	5	-	V
		-	0, 10	10	9.95	10	-	V
		-	0, 15	15	14.95	15	-	V
input leakage current	I_I	-	0, 15	15	-	-	±1	uA

DC Characteristics 2

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

Parameter	Symbol	Conditions (V)			T_{amb}=-40°C		T_{amb}=+85°C		T_{amb}=+125°C		Unit
		V_O	V_{IN}	V_{DD}	Min.	Max.	Min.	Max.	Min.	Max.	
supply current	I_{DD}	-	0, 5	5	-	1	-	30	-	30	uA
		-	0, 10	10	-	2	-	60	-	60	uA
		-	0, 15	15	-	4	-	120	-	120	uA
LOW-level output current	I_{OL}	0.4	0, 5	5	0.61	-	0.42	-	0.36	-	mA
		0.5	0, 10	10	1.5	-	1.1	-	0.9	-	mA
		1.5	0, 15	15	4	-	2.8	-	2.4	-	mA
HIGH-level output current	I_{OH}	4.6	0, 5	5	-0.61	-	-0.42	-	-0.36	-	mA
		2.5	0, 5	5	-1.8	-	-1.3	-	-1.15	-	mA
		9.5	0, 10	10	-1.5	-	-1.1	-	-0.9	-	mA
		13.5	0, 15	15	-4	-	-2.8	-	-2.4	-	mA
LOW-level output voltage	V_{OL}	-	0, 5	5	-	0.05	-	0.05	-	0.05	V
		-	0, 10	10	-	0.05	-	0.05	-	0.05	V
		-	0, 15	15	-	0.05	-	0.05	-	0.05	V
HIGH-level output voltage	V_{OH}	-	0, 5	5	4.95	-	4.95	-	4.95	-	V
		-	0, 10	10	9.95	-	9.95	-	9.95	-	V
		-	0, 15	15	14.95	-	14.95	-	14.95	-	V
input leakage current	I_I	-	0, 15	15	-	±1	-	±1	-	±1	uA

AC Characteristics

(T_{amb}=25°C, V_{SS}=0V, t_r, t_f=20ns, C_L=50pF, R_L=200kΩ, unless otherwise specified.)

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Unit
propagation delay time	t_{PHL}, t_{PLH}	see Figure 4	V_{DD}=5V	-	45	100	ns
			V_{DD}=10V	-	25	60	ns
			V_{DD}=15V	-	20	50	ns
transition time	t_{THL}, t_{TLH}	see Figure 4	V_{DD}=5V	-	30	70	ns
			V_{DD}=10V	-	25	60	ns
			V_{DD}=15V	-	20	50	ns
input capacitance	C_I	any input		-	5	7.5	pF

Transfer Characteristics 1

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

Parameter	Symbol	Conditions (V)			T_{amb}=25°C			Unit
		V_O	V_{IN}	V_{DD}	Min.	Typ.	Max.	
positive-going threshold voltage	V_{T+}	-	[1]	5	2.2	2.9	3.6	V
		-	[1]	10	4.6	5.9	7.1	V
		-	[1]	15	6.8	8.8	10.8	V
		-	[2]	5	2.6	3.3	4	V
		-	[2]	10	5.6	7	8.2	V
		-	[2]	15	6.3	9.4	12.7	V
negative-going threshold voltage	V_{T-}	-	[1]	5	0.9	1.9	2.8	V
		-	[1]	10	2.5	3.9	5.2	V
		-	[1]	15	4	5.8	7.4	V
		-	[2]	5	1.4	2.3	3.2	V
		-	[2]	10	3.4	5.1	6.6	V
		-	[2]	15	4.8	7.3	9.6	V
hysteresis voltage	V_H	-	[1]	5	0.3	0.9	1.6	V
		-	[1]	10	1.2	2.3	3.4	V
		-	[1]	15	1.6	3.5	5	V
		-	[2]	5	0.3	0.9	1.6	V
		-	[2]	10	1.2	2.3	3.4	V
		-	[2]	15	1.6	3.5	5	V

Note:

[1] Input on terminals 1, 5, 8, 12 or 2, 6, 9, 13; other inputs to V_{DD}.

[2] Input on terminals 1 and 2, 5 and 6, 8 and 9 or 12 and 13; other inputs to V_{DD}.

[3] See Figure 5 and Figure 6.

Transfer Characteristics 2

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

Parameter	Symbol	Conditions (V)			T_{amb}=-40°C		T_{amb}=+85°C		T_{amb}=+125°C		Unit
		V_O	V_{IN}	V_{DD}	Min.	Max.	Min.	Max.	Min.	Max.	
positive-going threshold voltage	V_{T+}	-	[1]	5	2.2	3.6	2.2	3.6	2.2	3.6	V
		-	[1]	10	4.6	7.1	4.6	7.1	4.6	7.1	V
		-	[1]	15	6.8	10.8	6.8	10.8	6.8	10.8	V
		-	[2]	5	2.6	4	2.6	4	2.6	4	V
		-	[2]	10	5.6	8.2	5.6	8.2	5.6	8.2	V
		-	[2]	15	6.3	12.7	6.3	12.7	6.3	12.7	V
negative-going threshold voltage	V_{T-}	-	[1]	5	0.9	2.8	0.9	2.8	0.9	2.8	V
		-	[1]	10	2.5	5.2	2.5	5.2	2.5	5.2	V
		-	[1]	15	4	7.4	4	7.4	4	7.4	V
		-	[2]	5	1.4	3.2	1.4	3.2	1.4	3.2	V
		-	[2]	10	3.4	6.6	3.4	6.6	3.4	6.6	V
		-	[2]	15	4.8	9.6	4.8	9.6	4.8	9.6	V
hysteresis voltage	V_H	-	[1]	5	0.3	1.6	0.3	1.6	0.3	1.6	V
		-	[1]	10	1.2	3.4	1.2	3.4	1.2	3.4	V
		-	[1]	15	1.6	5	1.6	5	1.6	5	V
		-	[2]	5	0.3	1.6	0.3	1.6	0.3	1.6	V
		-	[2]	10	1.2	3.4	1.2	3.4	1.2	3.4	V
		-	[2]	15	1.6	5	1.6	5	1.6	5	V

Note:

[1] Input on terminals 1, 5, 8, 12 or 2, 6, 9, 13; other inputs to V_{DD}.

[2] Input on terminals 1 and 2, 5 and 6, 8 and 9 or 12 and 13; other inputs to V_{DD}.

[3] See Figure 5 and Figure 6.

Testing Circuit

AC Testing Circuit

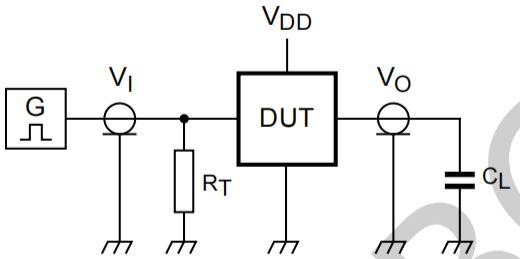


Figure 3. Test circuit for switching times

Definitions for test circuit: DUT=Device Under Test.
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.

AC Testing Waveforms

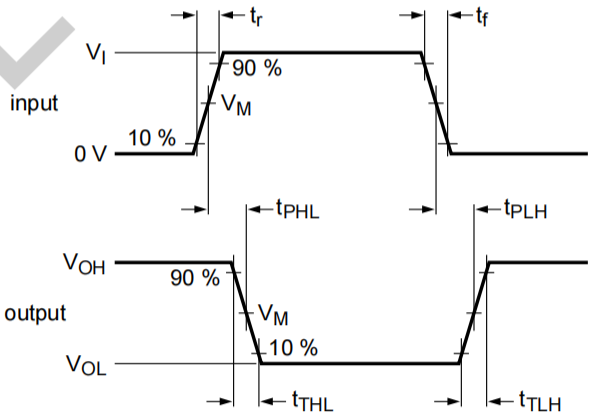


Figure 4. Propagation delay and output transition time

Transfer Characteristics Waveforms

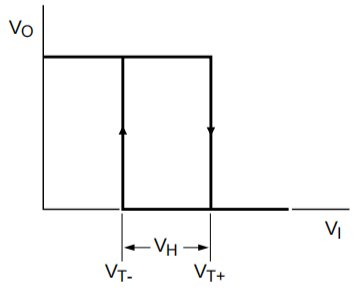


Figure 5. Transfer characteristic

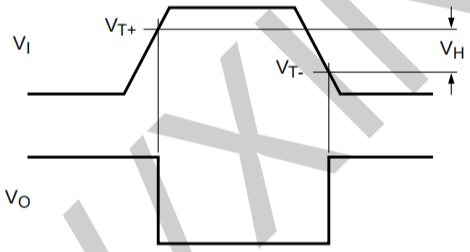
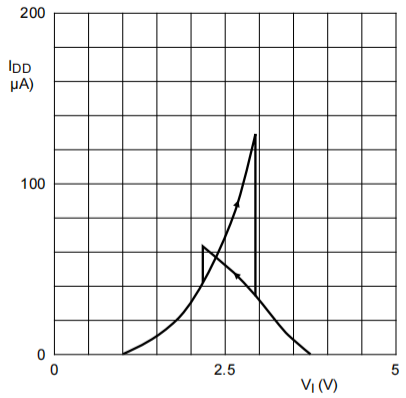
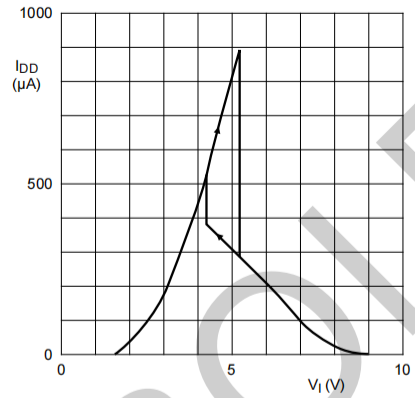


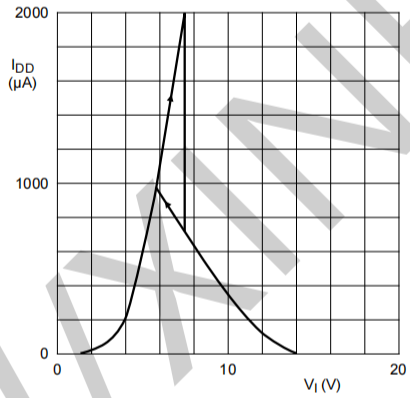
Figure 6. Waveforms showing definition of V_{T+} and V_{T-} (between limits at 30% and 70%) and V_H



a. V_{DD} = 5 V; T_{amb} = 25 °C



b. V_{DD} = 10 V; T_{amb} = 25 °C



c. V_{DD} = 15 V; T_{amb} = 25 °C

Figure 7. Typical drain current as a function of input

Measurement Points

Supply voltage	Input	Output
V_{DD}	V_M	V_M
5V to 15V	0.5×V_{DD}	0.5×V_{DD}

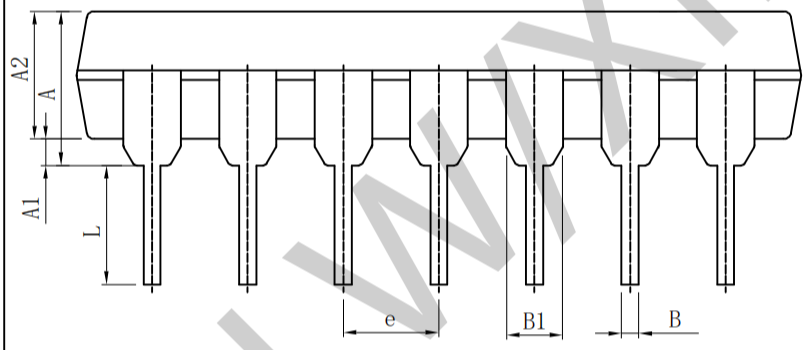
Test Data

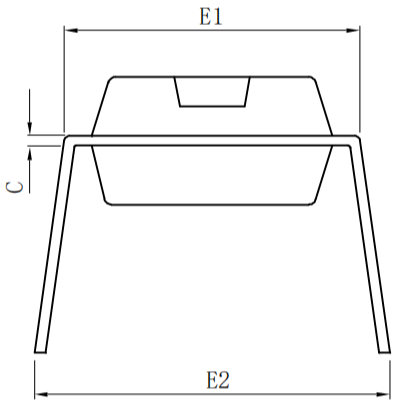
Supply voltage	Input		Load
V_{DD}	V_I	t_r ,t_f	C_L
5V to 15V	V_{SS} orV_{DD}	≤ 20ns	50pF

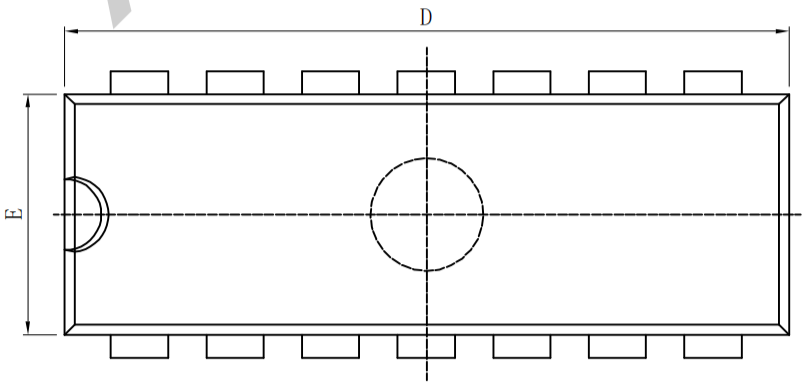
Package Information

· DIP-14

Size / Symbol	Dimensions In Millimeters		Size / Symbol	Dimensions In Inches	
	Min(mm)	Max(mm)		Min(in)	Max(in)
A	3.710	4.310	A	0.146	0.170
A1	0.510		A1	0.020	
A2	3.200	3.600	A2	0.126	0.142
B	0.380	0.570	B	0.015	0.022
B1	1.524(BSC)		B1	0.060(BSC)	
C	0.204	0.360	C	0.008	0.014
D	18.800	19.200	D	0.740	0.756
E	6.200	6.600	E	0.244	0.260
E1	7.320	7.920	E1	0.288	0.312
e	2.540(BSC)		e	0.100(BSC)	
L	3.000	3.600	L	0.118	0.142
E2	8.400	9.000	E2	0.331	0.354

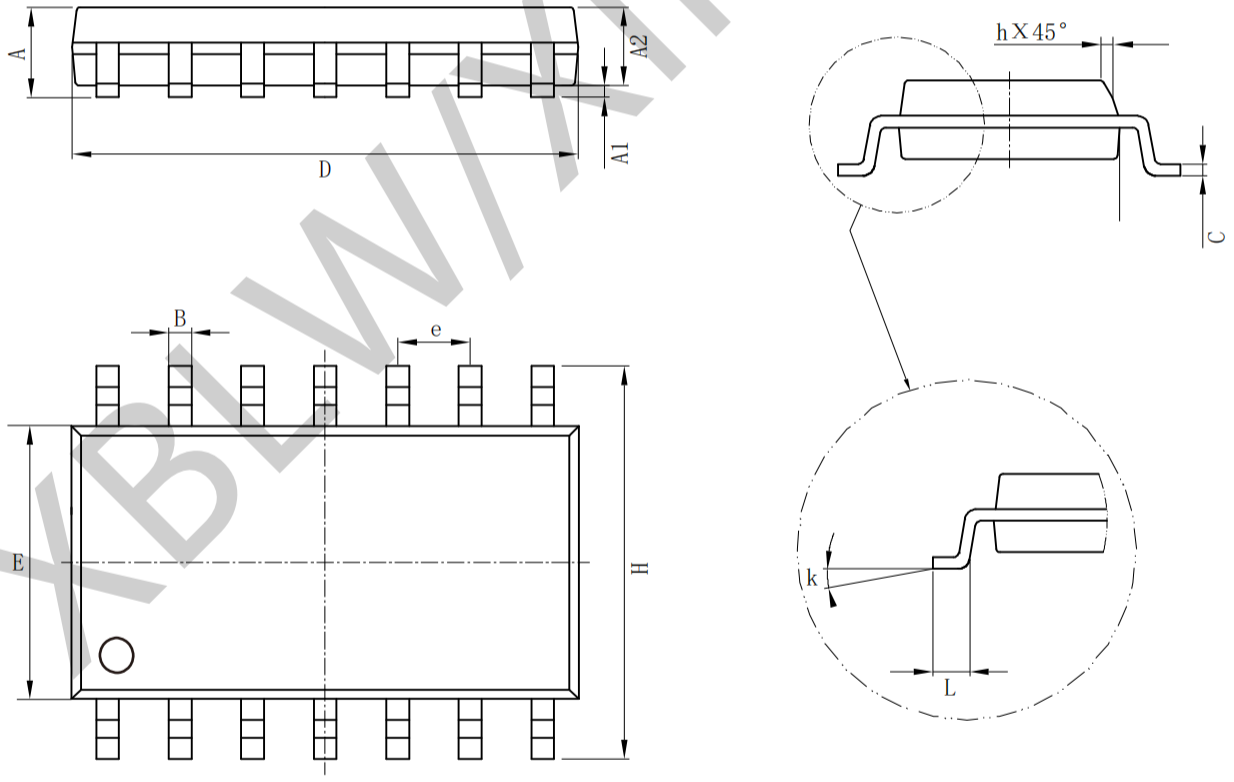






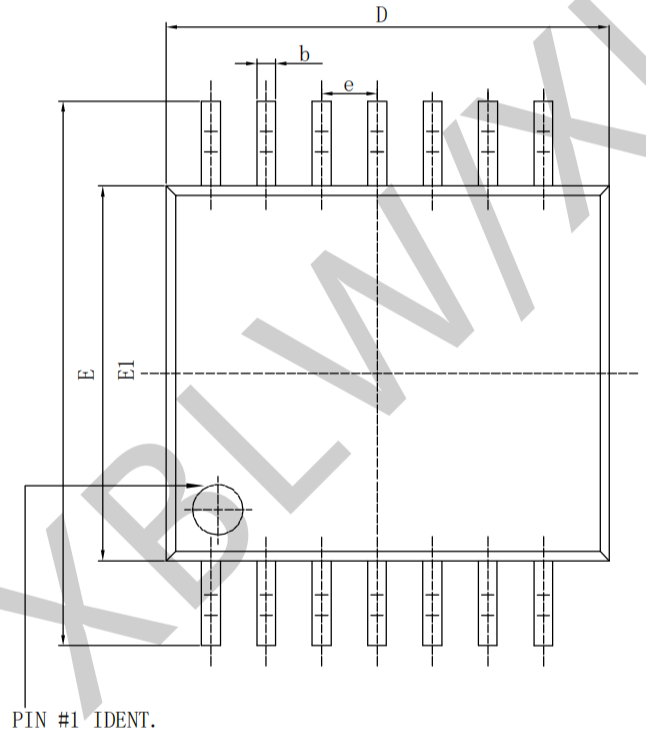
· SOP-14

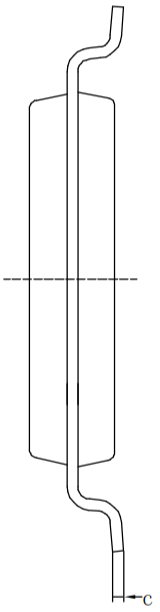
Size / Symbol	Dimensions In Millimeters		Size / Symbol	Dimensions In Inches	
	Min(mm)	Max(mm)		Min(in)	Max(in)
A	1.350	1.750	A	0.050	0.068
A1	0.100	0.250	A1	0.004	0.009
A2	1.100	1.650	A2	0.040	0.060
B	0.330	0.510	B	0.010	0.020
C	0.190	0.250	C	0.007	0.009
D	8.550	8.750	D	0.330	0.340
E	3.800	4.000	E	0.150	0.150
e	1.27		e	0.05	
H	5.800	6.200	H	0.220	0.240
h	0.250	0.500	h	0.009	0.020
L	0.400	1.270	L	0.015	0.050
k	8° (max)		k	8° (max)	

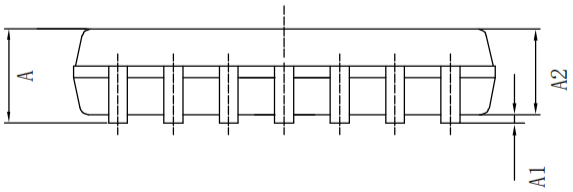


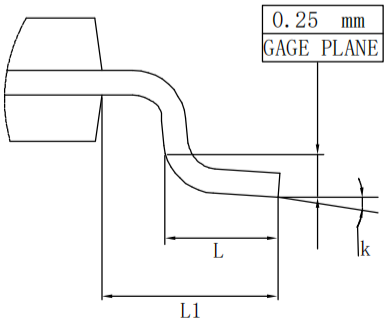
· TSSOP-14

Size / Symbol	Dimensions In Millimeters		Size / Symbol	Dimensions In Inches	
	Min(mm)	Max(mm)		Min(in)	Max(in)
A		1.200	A		0.047
A1	0.050	0.150	A1	0.002	0.006
A2	0.800	1.050	A2	0.031	0.041
b	0.190	0.300	b	0.007	0.012
c	0.090	0.200	c	0.004	0.0089
D	4.900	5.100	D	0.193	0.201
E	6.200	6.600	E	0.244	0.260
E1	4.300	4.500	E1	0.169	0.176
e	0.65		e	0.0256	
L	0.450	0.750	L	0.018	0.030
L1	1.00		L1	0.039	
k	0°	8°	k	0°	8°









Statement

- XBLW reserves the right to modify the product manual without prior notice! Before placing an order, customers need to confirm whether the obtained information is the latest version and verify the completeness of the relevant information.
- Any semi-guide product is subject to failure or malfunction under specified conditions. It is the buyer's responsibility to comply with safety standards when using XBLW products for system design and whole machine manufacturing. And take the appropriate safety measures to avoid the potential in the risk of loss of personal injury or loss of property situation!
- XBLW product has not been licensed for life support, military and aerospace applications, and therefore XBLW is not responsible for any consequences arising from its use in these areas.
- If any or all XBLW products (including technical data, services) described or contained in this document are subject to any applicable local export control laws and regulations, they may not be exported without an export license from the relevant authorities in accordance with such laws.
- The specifications of any and all XBLW products described or contained in this document specify the performance, characteristics, and functionality of said products in their standalone state, but do not guarantee the performance, characteristics, and functionality of said products installed in Customer's products or equipment. In order to verify symptoms and conditions that cannot be evaluated in a standalone device, the Customer should ultimately evaluate and test the device installed in the Customer's product device.
- XBLW documentation is only allowed to be copied without any alteration of the content and with the relevant authorization. XBLW assumes no responsibility or liability for altered documents.
- XBLW is committed to becoming the preferred semiconductor brand for customers, and XBLW will strive to provide customers with better performance and better quality products.