芯伯乐®
XINBOLE

Product Specification

XBLW - CD4060

14-stage Ripple-carry Binary
Counter/Divider and Oscillator

WEB | www.xinboleic.com

Description

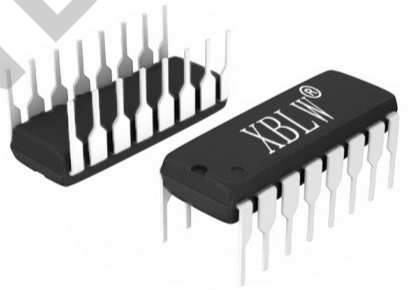
CD4060 is a 14-stage ripple-carry binary counter/divider and oscillator with three oscillator terminals (RS, REXT and CEXT), ten buffered outputs (Q3 to Q9 and Q11 to Q13) and an overriding asynchronous master reset input (MR).

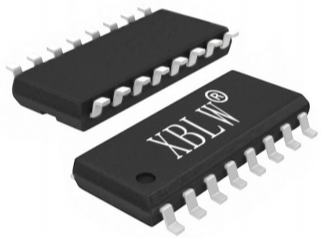
The oscillator configuration allows design of either RC or crystal oscillator circuits. The oscillator maybe replaced by an external clock signal at input RS. The counter advances on the negative-going transition of RS. A HIGH level on MR resets the counter (Q3 to Q9 and Q11 to Q13=LOW), independent of other input conditions.

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

Features

- Wide supply voltage range from 3V to 15V
- Tolerant of slow clock rise and fall times
- Fully static operation
- 5V, 10V, and 15V parametric ratings
- Standardized symmetrical output characteristics
- Inputs and outputs are protected against electrostatic effects
- Specified from -40°C to +125°C
- Packaging information: DIP16/SOP16/TSSOP16

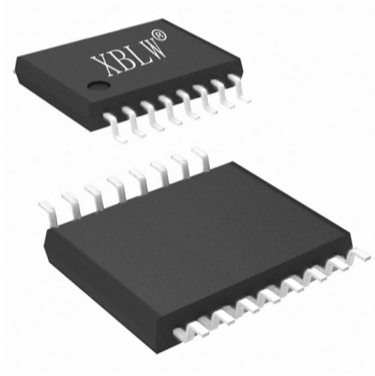




SOP-16

Applications

- Control counters
- Timers
- Frequency dividers
- Time-delay circuits



TSSOP-16

Ordering Information

Product Model	Package Type	Marking	Packing	Packing Qty
XBLW CD4060BE	DIP-16	CD4060BE	Tube	1000Pcs/Box
XBLW CD4060BDTR	SOP-16	CD4060B	Tape	2500Pcs/Reel
XBLW CD4060BTDTR	TSSOP-16	CD4060B	Tape	3000Pcs/Reel

Block Diagram

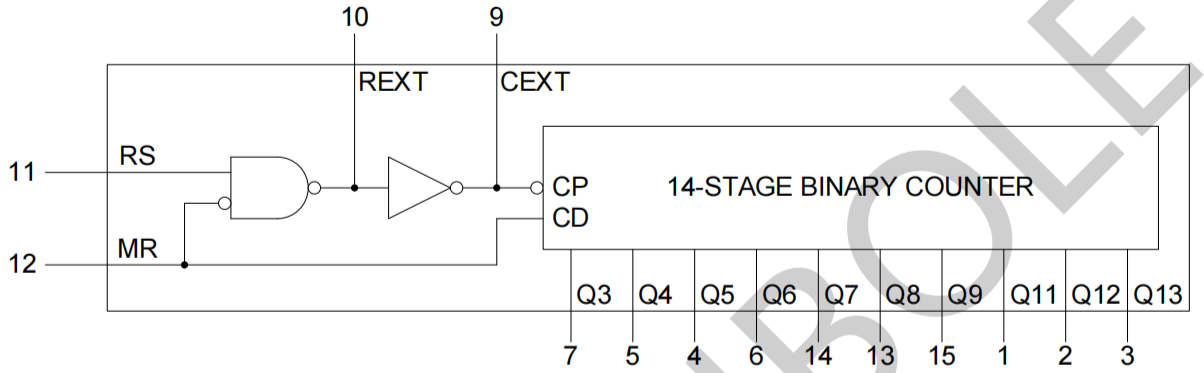


Figure 1. Functional diagram

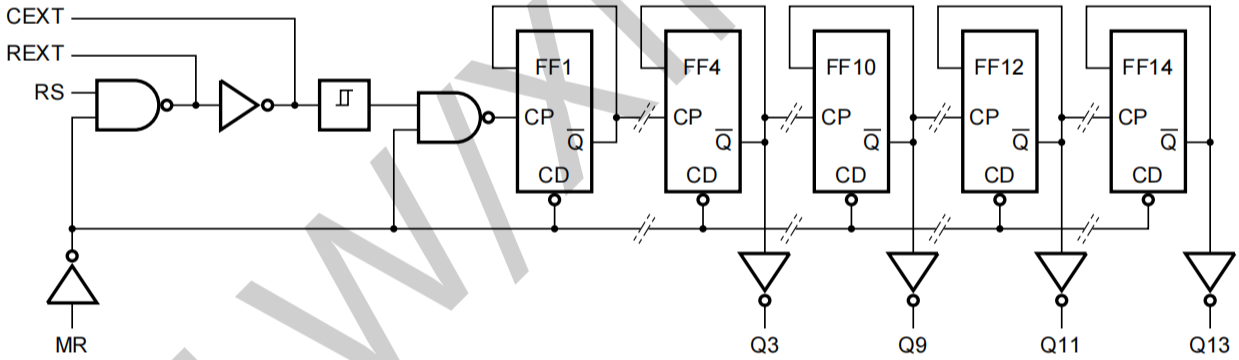
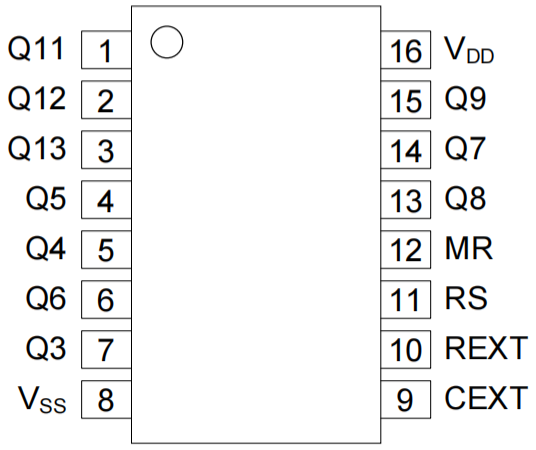


Figure 2. Logic diagram

Pin Configurations



Pin Description

Pin No.	Pin Name	Description
1	Q11	counter output
2	Q12	counter output
3	Q13	counter output
4	Q5	counter output
5	Q4	counter output
6	Q6	counter output
7	Q3	counter output
8	V_{SS}	ground (0V)
9	CEXT	external capacitor connection
10	REXT	oscillator pin
11	RS	clock input/oscillator pin
12	MR	master reset
13	Q8	counter output
14	Q7	counter output
15	Q9	counter output
16	V_{DD}	supply voltage

Function Table

Input		Output
RS	**MR**	**Q3 to Q9 and Q11 to Q13**
↑	L	no change
↓	L	count
X	H	L

Note: H=HIGH voltage level; L=LOW voltage level; X=don't care; ↑=LOW-to-HIGH clock transition.

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	°C
input pulse width	t_w	f=100kHz	V_{DD}=5V	100	-	-	ns
			V_{DD}=10V	40	-	-	ns
			V_{DD}=15V	30	-	-	ns
input pulse rise and fall time	t_{rIN}, t_{fIN}	V_{DD}=5V		unlimited			-
		V_{DD}=10V					-
		V_{DD}=15V					-
input pulse frequency	f_{RS}	external pulse source	V_{DD}=5V	-	-	3.5	MHz
			V_{DD}=10V	-	-	8	MHz
			V_{DD}=15V	-	-	12	MHz
reset pulse width	t_{WR}	V_{DD}=5V		120	-	-	ns
		V_{DD}=10V		60	-	-	ns
		V_{DD}=15V		40	-	-	ns

Electrical Characteristics

DC 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.	
supply current	I_{DD}	-	0, 5	5	-	-	5	uA
		-	0, 10	10	-	-	10	uA
		-	0, 15	15	-	-	20	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-leve 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
LOW-level input voltage	V_{IL}	0.5, 4.5	-	5	-	-	1.5	V
		1, 9	-	10	-	-	3	V
		1.5, 13.5	-	15	-	-	4	V
HIGH-level input voltage	V_{IH}	0.5, 4.5	-	5	3.5	-	-	V
		1, 9	-	10	7	-	-	V
		1.5, 13.5	-	15	11	-	-	V
input leakage current	I_I	-	0, 15	15	-	-	±1	uA

DC Characteristics 2

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

Parameter	Symbol	Conditions (V)			T_{amb}=-40°C		T_{amb}=+85°C		Unit
		V_O	V_{IN}	V_{DD}	Min.	Max.	Min.	Max.	
supply current	I_{DD}	-	0, 5	5	-	5	-	150	uA
		-	0, 10	10	-	10	-	300	uA
		-	0, 15	15	-	20	-	600	uA
LOW-level output current	I_{OL}	0.4	0, 5	5	0.61	-	0.42	-	mA
		0.5	0, 10	10	1.5	-	1.1	-	mA
		1.5	0, 15	15	4	-	2.8	-	mA
HIGH-level output current	I_{OH}	4.6	0, 5	5	-0.61	-	-0.42	-	mA
		2.5	0, 5	5	-1.8	-	-1.3	-	mA
		9.5	0, 10	10	-1.5	-	-1.1	-	mA
		13.5	0, 15	15	-4	-	-2.8	-	mA
LOW-level output voltage	V_{OL}	-	0, 5	5	-	0.05	-	0.05	V
		-	0, 10	10	-	0.05	-	0.05	V
		-	0, 15	15	-	0.05	-	0.05	V
HIGH-level output voltage	V_{OH}	-	0, 5	5	4.95	-	4.95	-	V
		-	0, 10	10	9.95	-	9.95	-	V
		-	0, 15	15	14.95	-	14.95	-	V
LOW-level input voltage	V_{IL}	0.5, 4.5	-	5	-	1.5	-	1.5	V
		1, 9	-	10	-	3	-	3	V
		1.5, 13.5	-	15	-	4	-	4	V
HIGH-level input voltage	V_{IH}	0.5, 4.5	-	5	3.5	-	3.5	-	V
		1, 9	-	10	7	-	7	-	V
		1.5, 13.5	-	15	11	-	11	-	V
input leakage current	I_I	-	0, 15	15	-	±1	-	±1	uA

DC Characteristics 3

(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}=+125°C		Unit
		V_O	V_{IN}	V_{DD}	Min.	Max.	Min.	Max.	
supply current	I_{DD}	-	0, 5	5	-	5	-	150	uA
		-	0, 10	10	-	10	-	300	uA
		-	0, 15	15	-	20	-	600	uA
LOW-level output current	I_{OL}	0.4	0, 5	5	0.61	-	0.36	-	mA
		0.5	0, 10	10	1.5	-	0.9	-	mA
		1.5	0, 15	15	4	-	2.4	-	mA
HIGH-level output current	I_{OH}	4.6	0, 5	5	-0.61	-	-0.36	-	mA
		2.5	0, 5	5	-1.8	-	-1.15	-	mA
		9.5	0, 10	10	-1.5	-	-0.9	-	mA
		13.5	0, 15	15	-4	-	-2.4	-	mA
LOW-level output voltage	V_{OL}	-	0, 5	5	-	0.05	-	0.05	V
		-	0, 10	10	-	0.05	-	0.05	V
		-	0, 15	15	-	0.05	-	0.05	V
HIGH-level output voltage	V_{OH}	-	0, 5	5	4.95	-	4.95	-	V
		-	0, 10	10	9.95	-	9.95	-	V
		-	0, 15	15	14.95	-	14.95	-	V
LOW-level input voltage	V_{IL}	0.5, 4.5	-	5	-	1.5	-	1.5	V
		1, 9	-	10	-	3	-	3	V
		1.5, 13.5	-	15	-	4	-	4	V
HIGH-level input voltage	V_{IH}	0.5, 4.5	-	5	3.5	-	3.5	-	V
		1, 9	-	10	7	-	7	-	V
		1.5, 13.5	-	15	11	-	11	-	V
input leakage current	I_I	-	0, 15	15	-	±1	-	±1	uA

AC Characteristics 1

(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}	RS to Q3 out; see Figure 4	V_{DD}=5V	-	370	740	ns
			V_{DD}=10V	-	150	300	ns
			V_{DD}=15V	-	100	200	ns
		Q_n to Q_{n+1}; see Figure 4	V_{DD}=5V	-	100	200	ns
			V_{DD}=10V	-	50	100	ns
			V_{DD}=15V	-	40	80	ns
		MR to Qn; see Figure 4	V_{DD}=5V	-	180	360	ns
			V_{DD}=10V	-	80	160	ns
			V_{DD}=15V	-	50	100	ns
transition time	t_t	see Figure 4	V_{DD}=5V	-	100	200	ns
			V_{DD}=10V	-	50	100	ns
			V_{DD}=15V	-	40	80	ns
pulse width	t_W	minimum width; f=100kHz; RS HIGH;	V_{DD}=5V	-	50	100	ns
			V_{DD}=10V	-	20	40	ns
			V_{DD}=15V	-	15	30	ns
		minimum width; MR HIGH; see Figure 4	V_{DD}=5V	-	60	120	ns
			V_{DD}=10V	-	30	60	ns
			V_{DD}=15V	-	20	40	ns
input pulse rise And fall time	t_{rIN}, t_{fIN}	-	V_{DD}=5V	unlimited			-
			V_{DD}=10V				-
			V_{DD}=15V				-
maximum clock frequency	f_{max}	input RS; see Figure 4	V_{DD}=5V	3.5	7	-	MHz
			V_{DD}=10V	8	16	-	MHz
			V_{DD}=15V	12	24	-	MHz
input capacitance	C_I	any input		-	5	7.5	pF

Note: t_t is the same as t_{TLH} and t_{THL}.

AC Characteristics 2

(RC Operation, 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
variation of Frequency (unit to unit)	-	C_X=200pF R_S=560kΩ R_X=50kΩ	V_{DD}=5V	-	23±10%	-	kHz
			V_{DD}=10V	-	24±10%	-	kHz
			V_{DD}=15V	-	25±10%	-	kHz
variation of frequency with voltage change (same unit)	-	C_X=200pF R_S=560kΩ R_X=50kΩ	5V to 10V	-	1.5	-	kHz
			10V to 15V	-	0.5	-	kHz
R_X max	-	C_X=10uF, V_{DD}=5V		-	-	20	MΩ
		C_X=50uF, V_{DD}=10V		-	-	20	MΩ
		C_X=10uF, V_{DD}=15V		-	-	10	MΩ
C_X max	-	R_X=500kΩ, V_{DD}=5V		-	-	1000	uF
		R_X=300kΩ, V_{DD}=10V		-	-	50	uF
		R_X=300kΩ, V_{DD}=15V		-	-	50	uF
Maximum oscillator frequency	-	C_X=15pF R_S=30kΩ R_X=15kΩ	V_{DD}=10V	530	650	810	kHz
			V_{DD}=15V	690	800	940	kHz
drive current at CEXT (for oscillator design)	I_{OL}	V_O=0.4V, V_{DD}=5V		0.16	0.35	-	mA
		V_O=0.5V, V_{DD}=10V		0.42	0.8	-	mA
		V_O=1.5V, V_{DD}=15V		1	2	-	mA
	I_{OH}	V_O=4.6V, V_{DD}=5V		-0.16	-0.35	-	mA
		V_O=9.5V, V_{DD}=10V		-0.42	-0.8	-	mA
		V_O=13.5V, V_{DD}=15V		-1	-2	-	mA

Note: RC oscillator applications are not recommended at supply voltages below 7V for R_X<50kΩ.

Testing Circuit

AC Testing Circuit

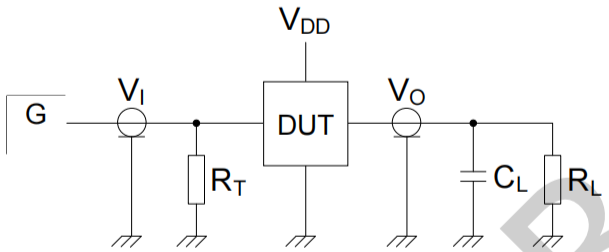


Figure 3. Test circuit for switching times

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. R_L= Load resistance.

AC Testing Waveforms

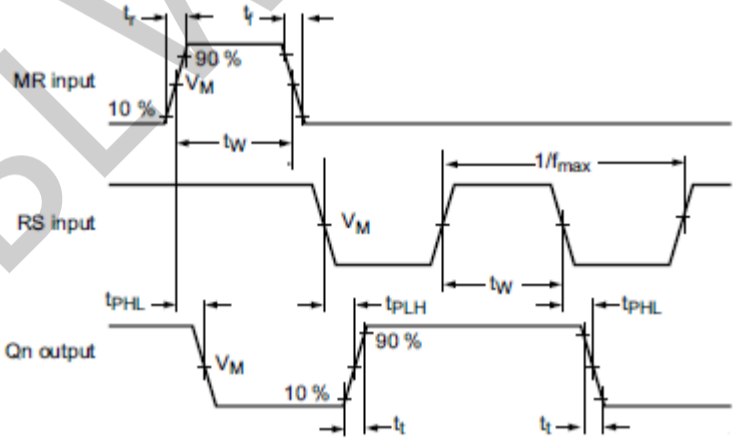


Figure 4. Waveforms showing propagation delays

Measurement Points

Supply voltage	Input	Output
V_{DD}	V_M	V_M
5V to 15V	$0.5\times V_{DD}$	$0.5\times V_{DD}$

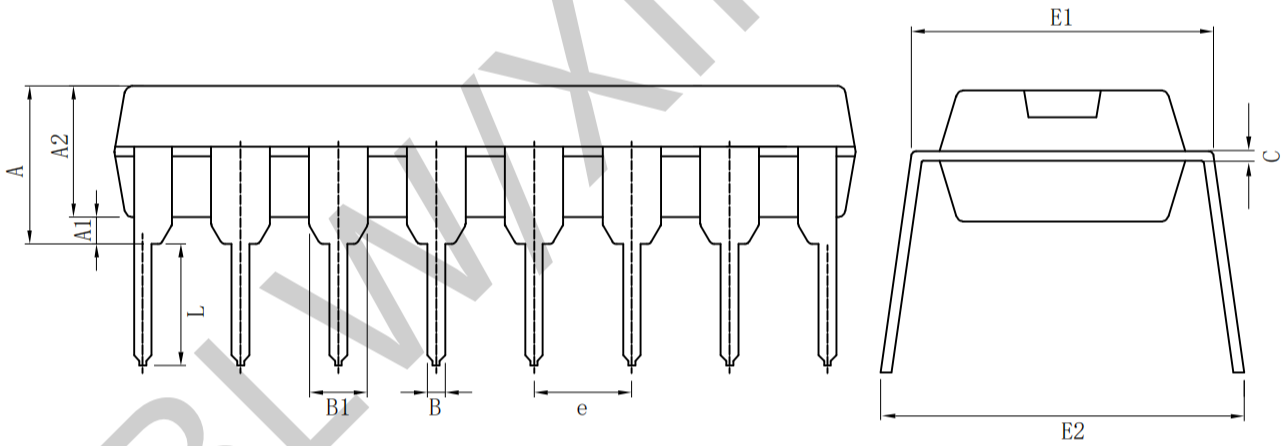
Test Data

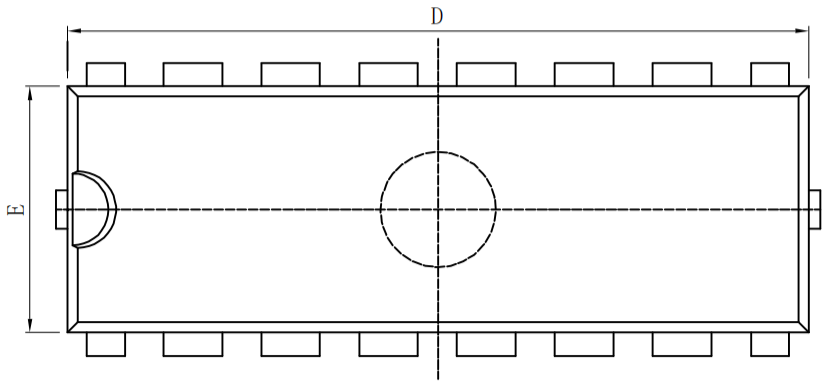
Supply voltage	Input		Load
V_{DD}	V_I	t_r ,t_f	C_L
5V to 15V	V_{SS} orV_{DD}	≤ 20ns	50pF

Package Information

· DIP-16

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	18.80	19.20	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





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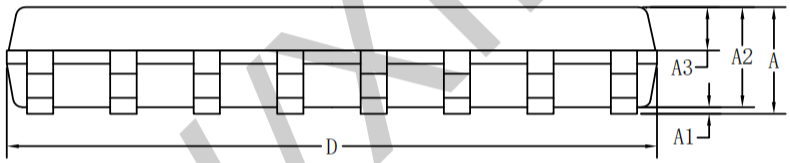
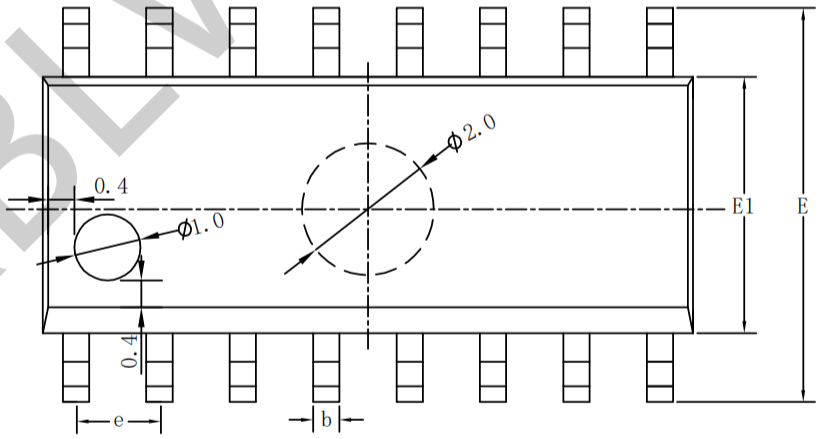
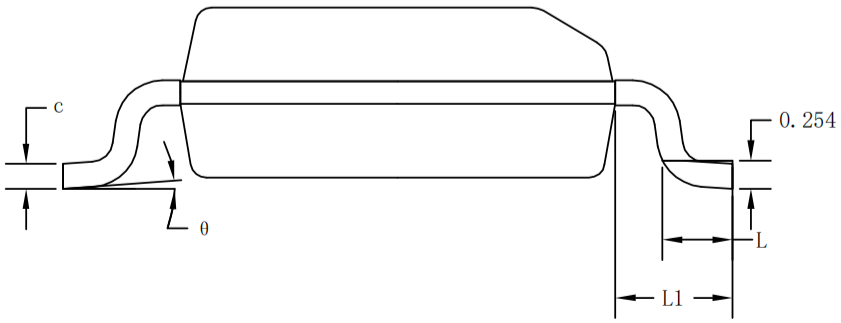
Size / Symbol	Dimensions In Millimeters			Size / Symbol	Dimensions In Inches		
	Min(mm)	Nom(mm)	Max(mm)		Min(in)	Nom(in)	Max(in)
A	1.500	1.600	1.700	A	0.059	0.063	0.067
A1	0.100	0.150	0.250	A1	0.004	0.006	0.010
A2	1.400	1.450	1.500	A2	0.055	0.057	0.059
A3	0.600	0.650	0.700	A3	0.024	0.026	0.028
b	0.300	0.400	0.500	b	0.012	0.016	0.020
c	0.150	0.200	0.250	c	0.006	0.008	0.010
D	9.800	9.900	10.00	D	0.386	0.390	0.394
E	5.800	6.000	6.200	E	0.228	0.236	0.244
E1	3.850	3.900	3.950	E1	0.152	0.154	0.156
e	1.27(BSC)			e	0.050(BSC)		
L	0.500	0.600	0.700	L	0.020	0.024	0.028
L1	1.05(BSC)			L1	0.041(BSC)		
θ	0°	4°	8°	θ	0°	4°	8°







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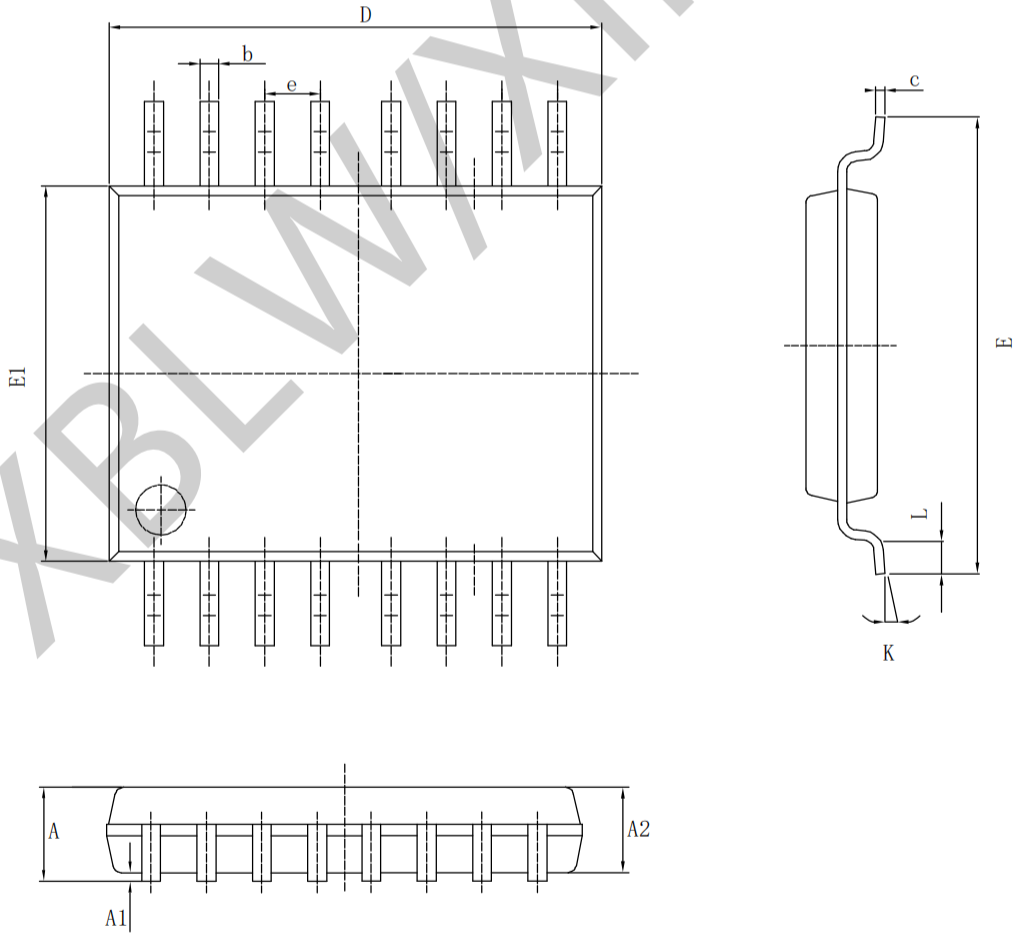
Size / Symbol	Dimensions In Millimeters		Size / Symbol	Dimensions In Inches	
	Min(mm)	Max(mm)		Min(in)	Max(in)
A		1.200	A		0.047
A1	0.050	0.150	A1	0.002	0.006
A2	0.800	1.050	A2	0.031	0.041
b	0.190	0.300	b	0.007	0.012
c	0.090	0.200	c	0.004	0.0089
D	4.900	5.100	D	0.193	0.201
E	6.200	6.600	E	0.244	0.260
E1	4.300	4.480	E1	0.169	0.176
e	0.65(BSC)		e	0.0256(BSC)	
K	0°	8°	K	0°	8°
L	0.450	0.750	L	0.018	0.030



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.
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