General Description

The CD40 1 7 is a 5 - stage Johnson decade counter with ten spike- free decoded active HIGH outputs (Q0 to Q9) , an active LOW carry output from the most significant flip- flop (Q5— - 9) , active HIGH and active LOW clock inputs (CP0 , —CP1) and an overriding asynchronous master reset input (MR) .

The counter is advanced by either a LOW- to- HIGH transition at CP0 while P1 is LOW or a HIGH- to- LOW transition at CP1 while CP0 is HIGH.

When cascading counters, the Q5 - 9 output, which is LOW while the counter is in states 5 , 6 , 7 , 8 , and 9 , can be used to drive the CP0 input of the next counter. A HIGH on MR resets the counter to zero (Q0= Q—

5 -9= HIGH; Q1 to Q9= LOW) independent of the clock inputs (CP0 , CP1) .

Automatic counter code correction is provided by an internal circuit: following any illegal code the counter returns to a proper counting mode within 1 1 clock pulses.

It operates over a recommended VDD power supply range of 3 V to 1 5 V referenced to VSS (usually ground) . Unused inputs must be connected to VDD, VSS, or another input.

Features

- Wide supply voltage range from 3V to 15V
- Automatic counter correction
- Tolerant of slow clock rise and fall times
- 5V, 10V, and 15V parametric ratings
- Standardized symmetrical output characteristics
- Specified from -40℃ to +85℃
- Packaging information: DIP16/ SOP16/ TSSOP16

Ordering Information

Product Model	Package Type	Marking	Packing	Packing Qty
CD4017BE	DIP-16	CD4017BE	Tube	1000/Box
CD4017BDTR	SOP-16	CD4017B	Tape	2500/Reel
CD4017BTDTR	TSSOP-16	CD4017B	Tape	3000/Reel

2、Block Diagram And Pin Description

2.1 Block Diagram

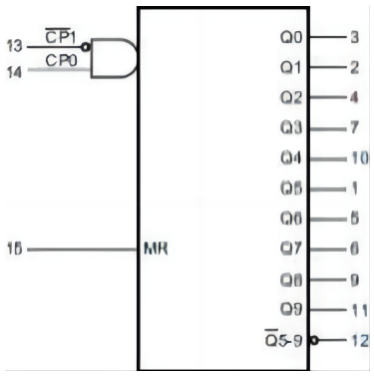


Figure 1 . Logic symbol

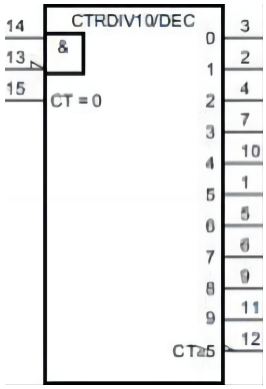


Figure 2 . IEE logic symbol

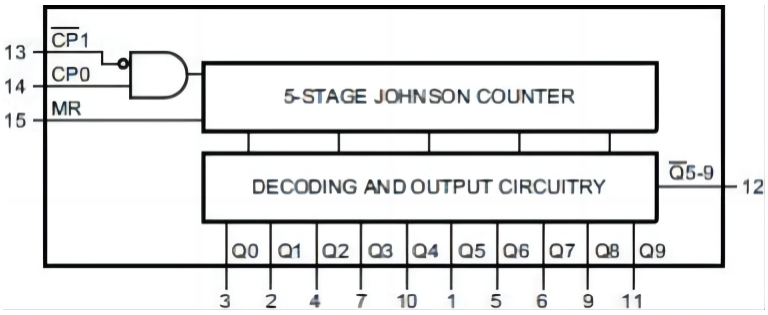


Figure 3 . Functional diagram

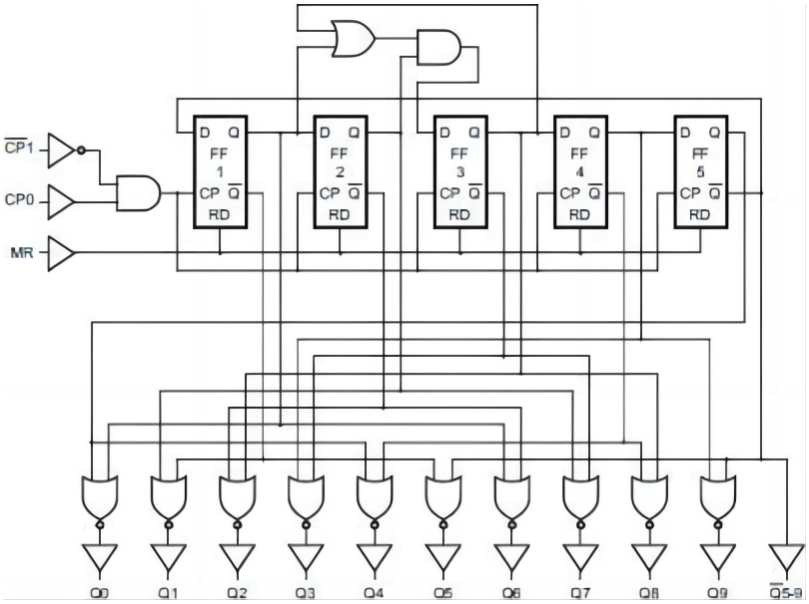


Figure 4 . Logic diagram

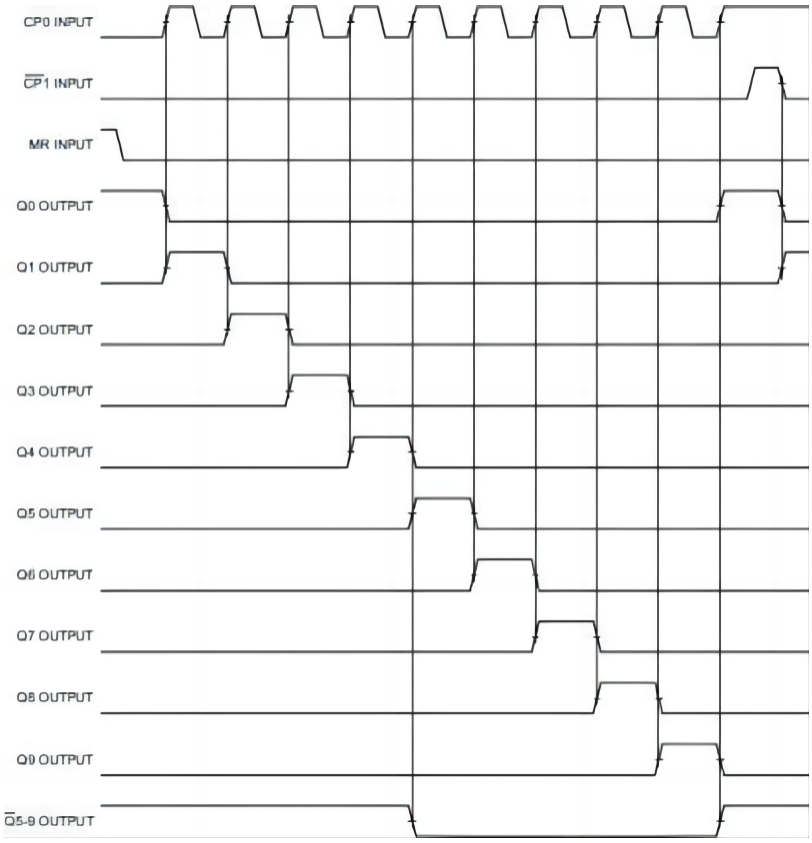
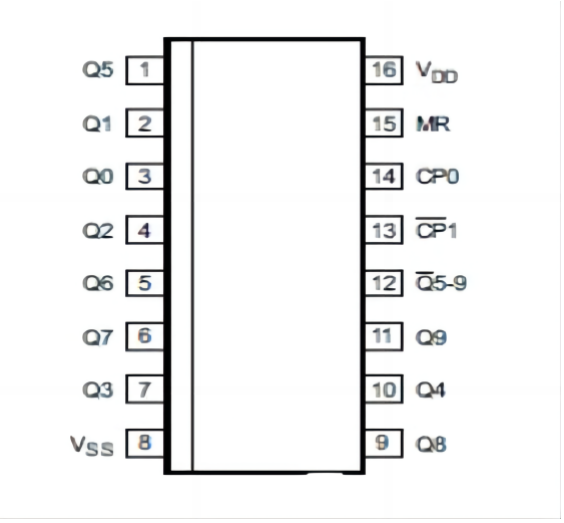


Figure 5 . Timing diagram

2.2 Pin Configurations



2.3 Pin Description

Pin No.	Pin Name	Description
1	Q5	decoded output
2	Q1	decoded output
3	Q0	decoded output
4	Q2	decoded output
5	Q6	decoded output
6	Q7	decoded output
7	Q3	decoded output
8	V_{SS}	ground (0 V)
9	Q8	decoded output
10	Q4	decoded output
11	Q9	decoded output
12	$\overline{Q5\text{-}9}$	carry output (active LOW)
13	$\overline{CP1}$	clock input (HIGH- to- LOW edge- triggered)
14	CP0	clock input (LOW- to- HIGH edge- triggered)
15	MR	master reset input
16	V_{DD}	supply voltage

2.4 Function Table

Input			Operation
MR	CP0	$\overline{CP1}$	
H	X	X	Q0= $\overline{Q}$5 - 9 = H; Q1 to Q9= L
L	H	↓	counter advances
L	↑	L	counter advances
L	L	X	no change
L	X	H	no change
L	H	↑	no change
L	↓	L	no change

Note: H= HIGH voltage level; L= LOW voltage level; X= don't care;
↑ =positive- going transition; ↓=negative- going transition.

3 Electrical Parameter

3.1 Absolute Maximum Ratings

(Voltages are referenced to Vss (ground=0 V) , unless otherwise specified.)

Parameter	Symbol	Conditions		Min.	Max.	Unit
supply voltage	V_{DD}	-		-0.5	+18	V
DC input current	I_{IK}	any one 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	250		

Note:

[1] For DIP16 packages: above 70℃ the value of P_{tot} derates linearly with 12 mW/ K.

[2] For SOP16 packages: above 70℃ the value of P_{tot} derates linearly with 8mW/ K.

[3] For (T) SSOP16 packages: above 60℃ the value of P_{tot} derates linearly with 5 . 5mW/K.

3.2 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	-	+85	℃
clock input frequency	f_{CL}	V_{DD}= 5V	-	-	2.5	MHz
		V_{DD}= 10V	-	-	5	MHz
		V_{DD}= 15V	-	-	5.5	MHz
clock pulse width	t_w	V_{DD}= 5V	200	-	-	ns
		V_{DD}= 10V	90	-	-	ns
		V_{DD}= 15V	60	-	-	ns
clock rise and fall time	t_{rCL}, t_{fCL}	V_{DD}= 5V	unlimited			-
		V_{DD}= 10V				-
		V_{DD}= 15V				-
clock inhibit setup time	t_s	V_{DD}= 5V	230	-	-	ns
		V_{DD}= 10V	100	-	-	ns
		V_{DD}= 15V	70	-	-	ns
reset pulse width	t_{RW}	V_{DD}= 5V	260	-	-	ns
		V_{DD}= 10V	110	-	-	ns
		V_{DD}= 15V	60	-	-	ns
reset removal time	t_{rec}	V_{DD}= 5V	400	-	-	ns
		V_{DD}= 10V	280	-	-	ns
		V_{DD}= 15V	150	-	-	ns

		-	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	-	±0. 1	-	±1	uA

3.3.3 、AC Characteristics

(T_{amb}=25℃, 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}	CP0, $\overline{CP1}$ to Q0 to Q9; see Figure 7	V_{DD}=5V	-	325	650	ns
			V_{DD}=10V	-	135	270	ns
			V_{DD}=15V	-	85	170	ns
		CP0, $\overline{CP1}$ to Q5-9; see Figure 7	V_{DD}=5V	-	300	600	ns
			V_{DD}=10V	-	125	250	ns
			V_{DD}=15V	-	80	160	ns
		MR to Q0 to Q9; see Figure 7	V_{DD}=5V	-	265	530	ns
			V_{DD}=10V	-	115	230	ns
			V_{DD}=15V	-	85	170	ns
transition time	t_t	see Figure 7	V_{DD}=5V	-	100	200	ns
			V_{DD}=10V	-	50	100	ns
			V_{DD}=15V	-	40	80	ns
pulse width	t_W	see Figure 8	V_{DD}=5V	-	100	200	ns
			V_{DD}=10V	-	45	90	ns
			V_{DD}=15V	-	30	60	ns
clock rise and fall time	t_{rCL}, t_{fCL}	-	V_{DD}=5V	unlimited			-
			V_{DD}=10V				-
			V_{DD}=15V				-
maximum clock frequency	f_{CL}	see Figure 8	V_{DD}=5V	2.5	5	-	MHz
			V_{DD}=10V	5	10	-	MHz
			V_{DD}=15V	5.5	11	-	MHz
setup time	t_s	CP0 to $\overline{CP1}$; see Figure 9	V_{DD}=5V	-	115	230	ns
			V_{DD}=10V	-	50	100	ns
			V_{DD}=15V	-	35	70	ns
reset removal time	t_{rec}	MR input; see Figure 8	V_{DD}=5V	-	200	400	ns
			V_{DD}=10V	-	140	280	ns
			V_{DD}=15V	-	75	150	ns
input capacitance	C_I	any input		-	5	-	pF

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

4、Testing Circuit

4.1 、AC Testing Circuit

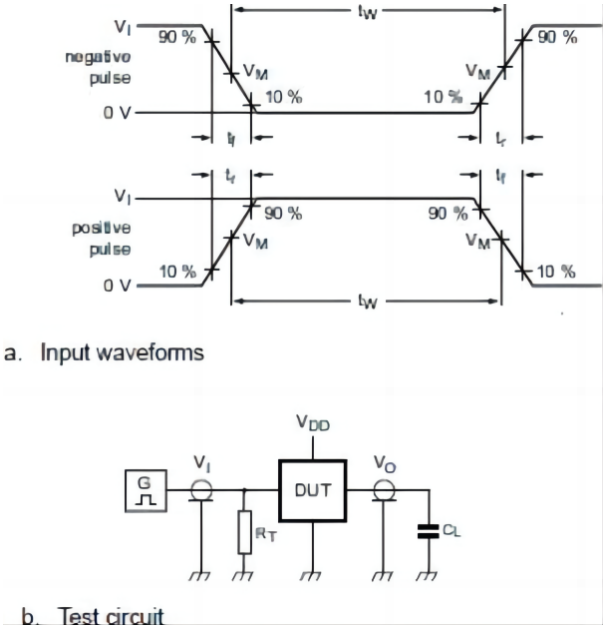


Figure 6. Test circuit for switching times

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.

4.2 、AC Testing Waveforms

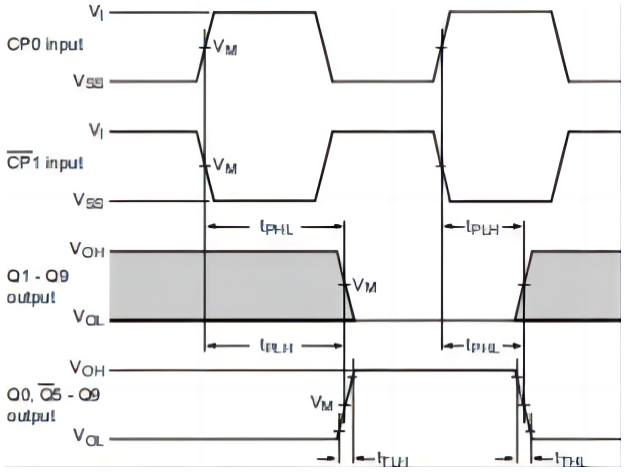


Figure 7. Waveforms showing the propagation delays for CP0, CP1 to Qn, Q5-9 outputs and the output transition times

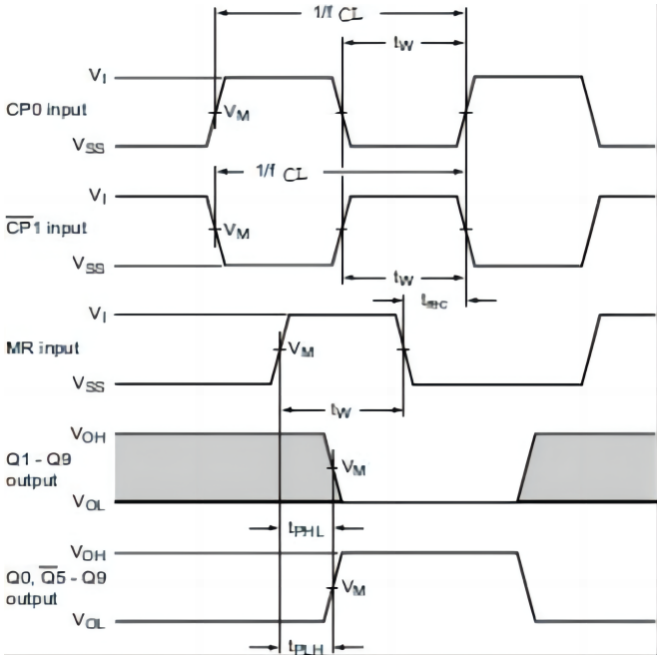


Figure 8. Waveforms showing the minimum pulse width for CP0, $\overline{CP1}$ and MR input; the maximum frequency for CP0 and $\overline{CP1}$ input; the recovery time for MR and the MR input to Qn and Q5-9 output propagation dela

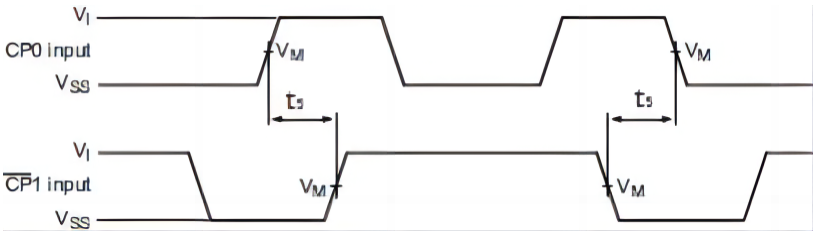


Figure 9. Waveforms showing hold times for CP0 to $\overline{CP1}$ and $\overline{CP1}$ to CP0

4.3 、 Measurement Points

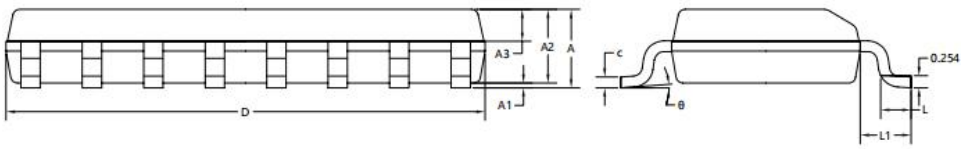
Supply voltage	Input	Output
V_{DD}	V_M	V_M
5V to 15V	$0.5\times V_{DD}$	$0.5\times V_{DD}$

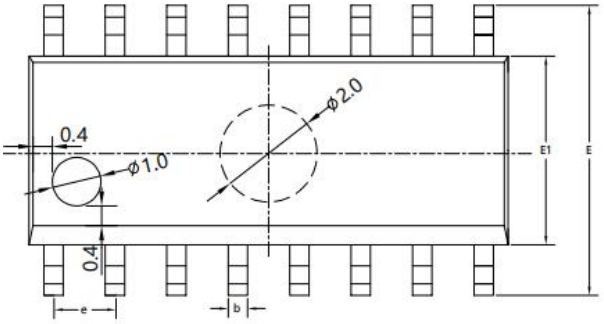
4.4 、 Test Data

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

5、Physical Dimensions

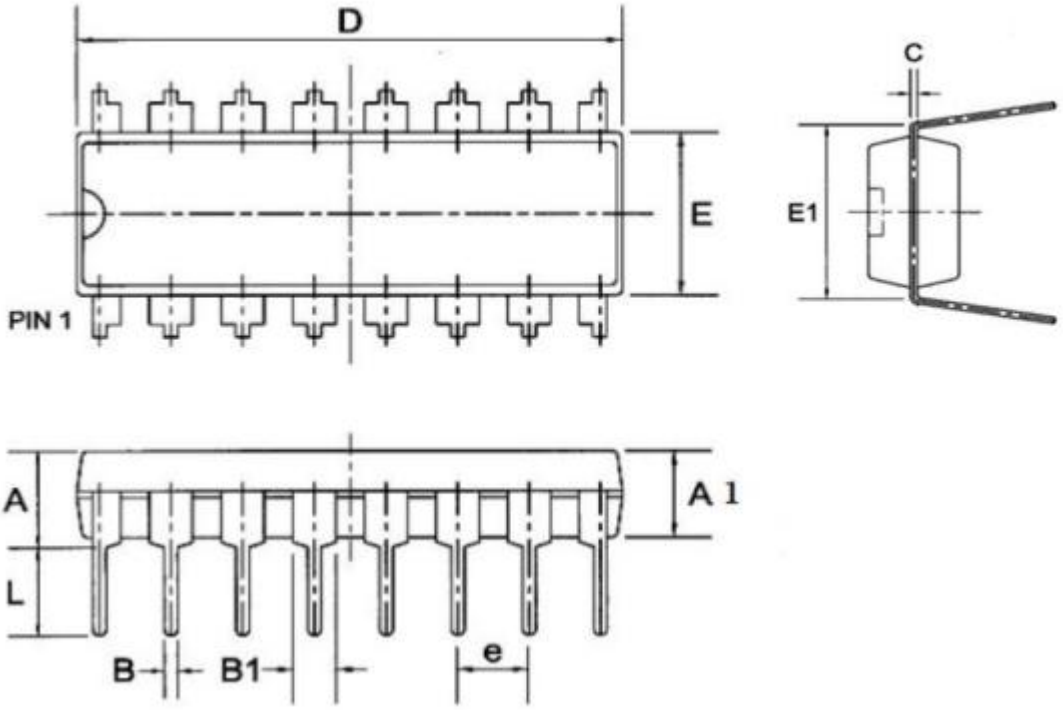
SOP-16





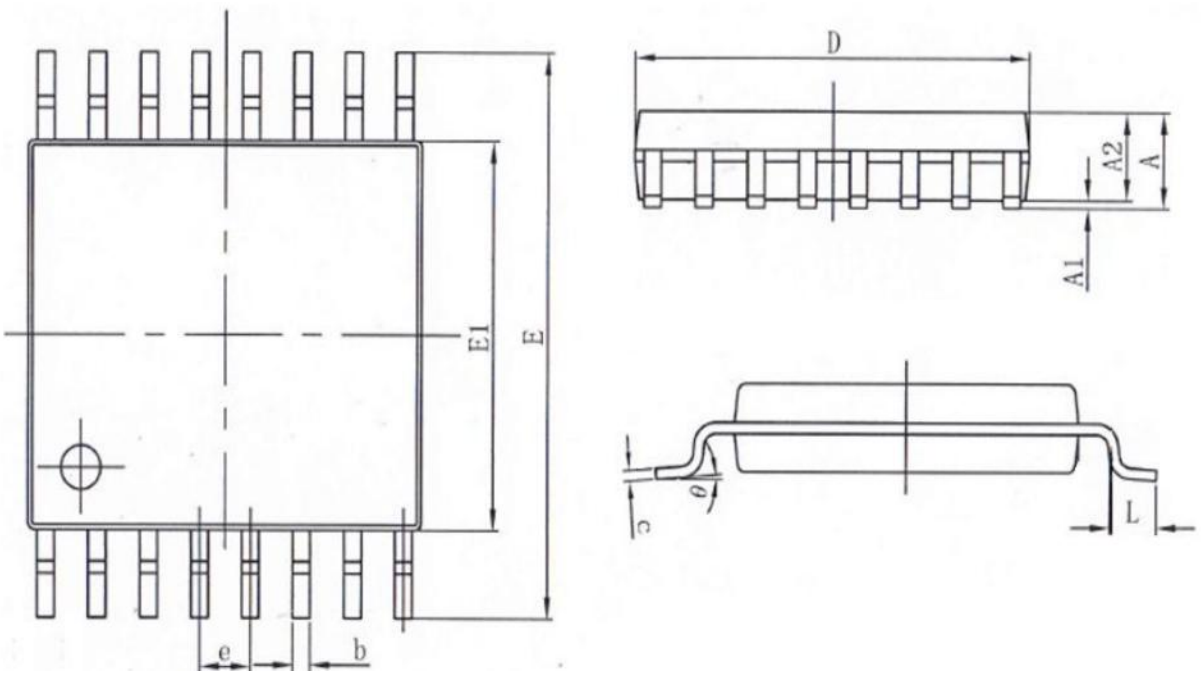
SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	1.50	1.60	1.70
A1	0.10	0.15	0.25
A2	1.40	1.45	1.50
A3	0.60	0.65	0.70
b	0.30	0.40	0.50
c	0.15	0.20	0.25
D	9.80	9.90	10.00
E	5.80	6.00	6.20
E1	3.85	3.90	3.95
e	1.27BSC		
L	0.50	0.60	0.70
L1	1.05BSC		
θ	0°	4°	8°

DIP-16



Symbol	Dimensions in Millimeters		
	Min	Nom	Max
A	--	--	4.31
A1	3.15	3.30	3.65
B	--	0.50	--
B1	--	1.6	--
C	--	0.27	--
D	19.00	19.20	19.60
E	6.20	6.50	6.60
E1	--	8.0	--
e	--	2.3	--
L	3.00	3.20	3.60

TSSOP-16



SYMBOL	MILLIMETER	
	MIN	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
E1	4.30	4.50
E	6.20	6.60
e	0.65	
L	0.45	0.75
θ	0°	8°

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