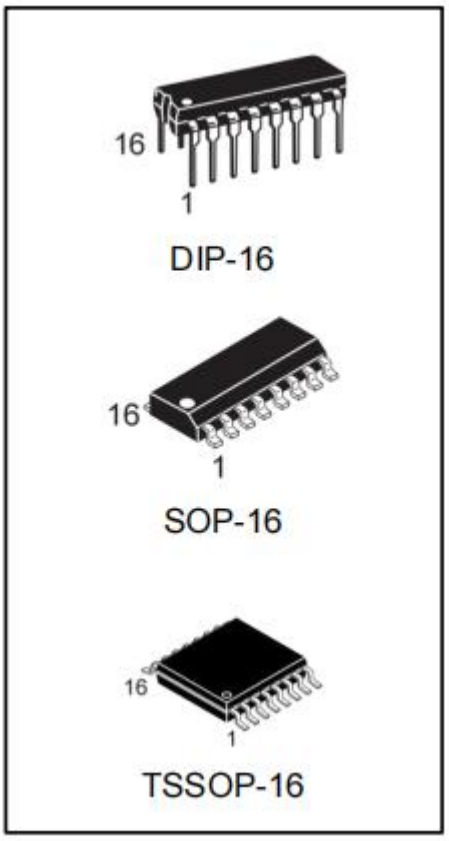
General Description

he CD4538B is a dual,precision mono stable muli vibrator with independent trigger and reset controls.The device is re trigger able and reset table,and the control inputs are inter-nally latched.Two trigger inputs are provided to allow either rising or falling edge triggering.The reset inputs are active low and prevent triggering while active.Precise control of output pulse-width has been achieved using linear CMOS techniques. The pulse duration and accuracy are deter-mined by external components Rx and Cx.The device does not allow the timing capacitor to discharge through the tim-ing pin on power-down condition.For this reason,no exter-nal protection resistor is required in series with the timing pin.Input protection from static discharge is provided on all pins.



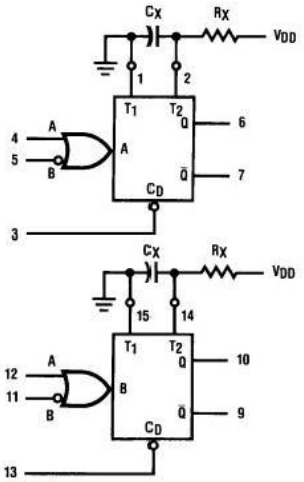
Features

- Wide supply voltage range:5.0V to 15V
- High noise immunity:0.45 Vcc (typ.)
- Low power TTL compatibility:Fan out of 2 driving 74L or 1 driving74LS
- New formula:PWour =RC(PW in seconds,R in Ohms,C in Farads)
- ±1.0%pulse-width variation from part to part (typ.)
- Wide pulse-width rang:1 μS to ∞
- Separate latched reset inputs
- Symmetrical output sink and source capability
- Low standby current:5 nA (typ.)@ 5 VDC
- Pin compatible to CD4528B

Ordering Information

DEVICE	Package Type	MARKING	Packing	Packing Qty
CD4538BE/ CD4538BN	DIP-16	CD4538B	TUBE	1000pcs/box
CD4538BM/TR	SOP-16	CD4538B	REEL	2500pcs/reel
CD4538BMT/TR	TSSOP-16	CD4538B	REEL	2500pcs/reel

Block and Connection Diagrams



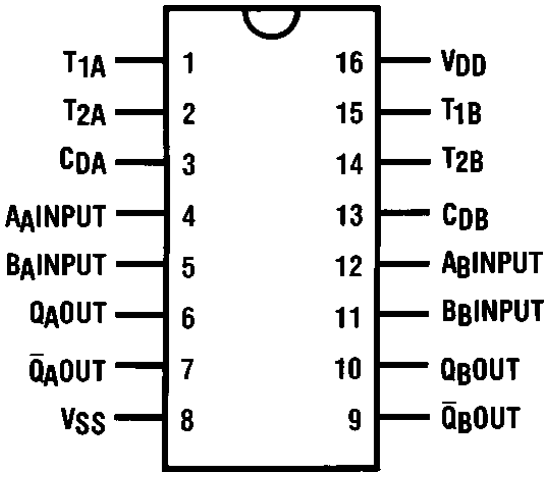
RX and CX are External Components

Vbp-Pin 16

Vss-Pin 8

Dual-In-Line Package

CD4538B



Top View

Truth Table

Inputs			Outputs	
Clear	A	B	Q	Q
L	X	X	L	H
X	H	X	L	H
X	X	L	L	H
H	L	↓	⎍	⎍
H	↑	H	⎍	⎍

H= High Level L

L= Low Level

↑= Transition from Low to High

↓= Transition from High to Low

⎍= One High Level Pulse

⎍= One Low Level Pulse

X= Irrelevant

Maximum Ratings

Symbol	Parameter		Min	Max	Unit
VDD	DC Supply Voltage		-0.5	+18	VDc
Vin	Input Voltage		-0.5	0.5	Vpc
Ts	Storage Temperature Range		-65	+150	℃
PD	Power Dissipation	Dual-In-Line	700		mW
		Small Outline	500		mW
TL	Lead Temperature	Soldering,10 seconds	**245**		℃

Note 1:"Absolute Maximum Ratings"are those values beyond which the safety of the device cannot be guaranteed,they are not meant to imply that the devices should be operated at these limits.The tables of "Recommended Operating Conditions"and "Electrical Characeristics"provide conditions for acutal device operation.
Note 2:VSS e OV unless otherwise specified.

Recommended Operating Conditions

Symbol	Parameter	Min	Max	Unit
VDD	DC Supply Voltage	5	15	Vbc
ViN	Input Voltage	0		Vpc
TA	Operating Temperature Range	-40	+85	℃

DC Electrical Characteristics

Symbol	Parameter	Conditions	-40℃		+25℃			+85℃		Units
			Min	Max	Min	Typ	Max	Min	Max	
IDD	Quiescent Device Current	VDD=5V] VDD=10V{ VDD=15VJ VIH=VDD VIL=VSS All Outputs Open		20 40 80		0.005 0.010 0.015	20 40 80		150 300 600	μA
VOL	Low Leve Output Voltage	VDD=5V VDD=10V(VDD=15VJ Iol<1 μA VIH=VDD,ViL=Vss		0.05 0.05 0.05		0 0 0	0.05 0.05 0.05		0.05 0.05 0.05	V
VOH	High Level Output Voltage	VDD=5V VDD=10V VDD=15VJ Ilol<1 μA VIH=VDD,ViL=Vss	4.95 9.95 14.95		4.95 9.95 14.95	5 10 15		4.95 9.95 14.95		V
VIL	Low Level Input Voltage	Ilol<1 μA VDD=5V,VO=0.5V of 4.5V VDD=10V,VO=1.0V of 9.0V VDD=15V,VO=1.5V of 13.5V		1.5 3.0 4.0		2.25 4.50 6.75	1.5 3.0 4.0		1.5 3.0 4.0	V
VIH	High Level Input Voltage	Ilol<1 μA VDD=5V,VO=0.5V of 4.5V VDD=10V,VO=1.0V of 9.0V VDD=15V,VO=1.5V of 13.5V	3.5 7.0 11.0		3.5 7.0 11.0	2.75 5.50 8.25		3.5 7.0 11.0		V
IOL	Low Leve Output Current (Note 3)	VDD=5V,VO 0.4V VDD=10V,VO=0.5 V VDD=15V,VO=1.5 V⌋ VIH=VDD VIL=VSS	0.52 1.3 3.6		0.44 1.1 3.0	0.88 2.25 8.8		0.36 0.9 2.4		mA
IOH	High Leve Output Current (Note 3)	VDD=5V,VO=4.6 VDD=10V,VO=9.5V VDD=15V,VO=13.5V } VIL=VSS	-0.52 -1.3 -3.6		-0.44 -1.1 -3.0	-0.88 -2.25 -8.8		0.36 -0.9 -2.4		mA
IIN	Input Current, Pin2 or 14	VDD=15V,VIN=0V or 15V		±0.02		±10-5	±0.05		±0.5	μA
IIN	Input Current Other Inputs	VDD=15V,VIN=0V or 15V		±0.3		±10-5	±0.3		±1.0	μA

Note 3:IOH and IOL are tested one output at a time.

AC Electrical Characteristics

*TA=25℃,CL=50 pF,and tr=tf=20 ns unless otherwise specified

Symbol	Parameter	Conditions	Min	Typ	Max	Units
tTLH, tTHL	Output Transition Time	Vpp=5V Vpp=10V Vpp=15V		100 50 40	200 100 80	NS
tPLH, tPHL	Propagation Delay Time	Trigger Operation— A orB toQ orQ Vpp=5V Vpp=10V Vpp=15V Reset Operation— Cp toQ orQ Vpp=5V Vpp=10V Vpp=15V		 300 150 100 250 125 95	 600 300 220 500 250 190	NS ns
tWL tWH	Minimum Input Pulse Width A,B,or Cp	Vpp=5V Vpp=10V Vpp=15V		35 30 25	70 60 50	nS
tRR	Minimum Retrigger Time	Vpp=5V Vpp=10V Vpp=15V		 0	0 0	ns
CIN	nput Capacitance	Pin 2 or 14 Other Inputs		10 5	 7.5	pF
PWOUT	Output Pulse Width (Q or Q) (**Note**:For Typical Distribution,see Figure 9)	Rx=100 kQ VDp=5V Vpp=10V Vpp=15V	208 211 216	226 230 235	244 248 254	μS
		RX=100 kΩ CX=0.1μF Vpp=5 V Vpp=10 V Vpp=15 V	8.83 9.02 9.20	9.60 9.80 10.00	10.37 10.59 10.80	ms
		RX=100kΩ CX=10.0μF Vpp=5 V Vpp=10 V VDp=1 5V	0.87 0.89 0.91	0.95 0.97 0.99	1.03 1.05 1.07	S
Pulse Width Match between Circuits in the Same Package CX=0.1 μF,Rx=100 kQ		RX=100 kQ CX=0.1 μF VDp=5V VDp=1 0V Vpp=15 V		±1 ±1 ±1		%
Operating Conditions						
RX Cx	External Timing Resistance External Timing Capacitance		5.0 0		** No Limit	kQ pF

Note 4:AC parameters are guaranteed by DC correlated testing.

Note 5:The maximum usable resistance Rx is a function of the leakage of the Capacitor Cx,leakage of the CD4538B,and eakage due to board layout,surface resistance,etc.

Logic Diagram

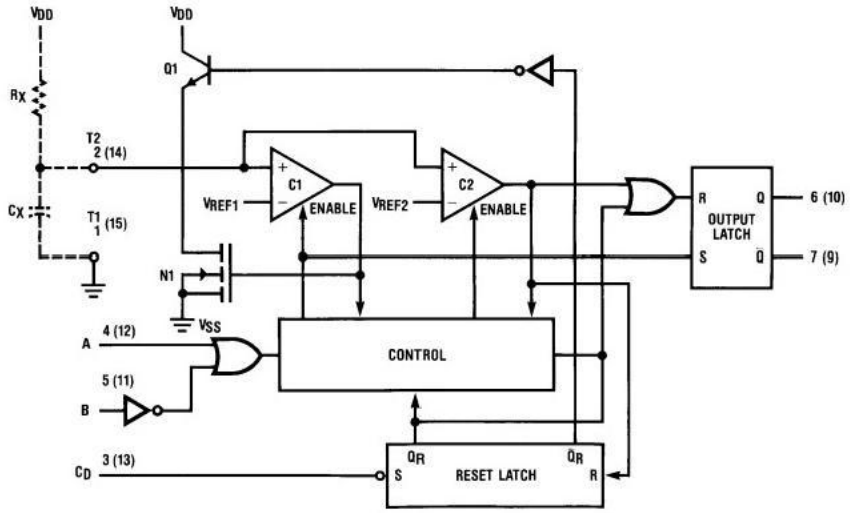
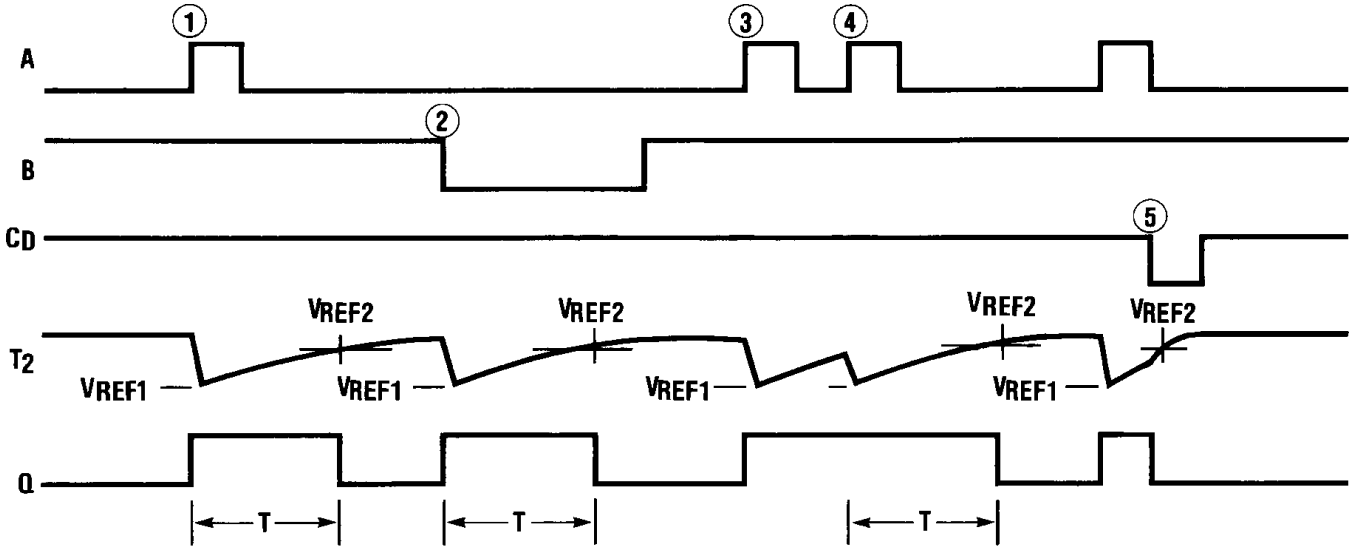


FIGURE 1

Theory of Operation



① POSITIVE EDGE TRIGGER
② NEGATIVE EDGE TRIGGER
③ POSITIVE EDGE TRIGGER
④ POSITIVE EDGE RE-TRIGGER (PULSE LENGTHENING)
⑤ RESET (PULSE SHORTENING)

FIGURE 2

Trigger Operation

The block diagram of the CD4538B is shown in Figure 1,with circuit operation following.

As shown in Figures 1 and 2,before an input trigger occurs,the monostable is in the quiescent state with the Q output low,and the timing capacitor Cx completely charged to Vpd.When the trigger input A goes from Vss to Voo(while inputs B and Co are held to Vop)a valid tigger is recog-nized,which turns on comparator C1 and N-Channel tran-sistor N1".At the same time the output latch is set.With transistor N1 on,the capacitor Cx rapidly discharges toward Vss until VrEF1 is reached.At this point the output of com-parator C1 changes state and transistor N1 turns off.Com-parator C1 then turns off while at the same time comparator C2 turns on.With transistor N1 off,the capacitor Cx begins to charge through the timing resistor,RX,toward Vbo.When the voltage across Cx equals VREF2,comparator C2 changes state causing the output latch to reset (Q goes low)while at the same time disabling comparator C2.This ends the timing cycle with the monostable in the quiescent state,waiting for the next trigger.

A valid trigger is also recognized when trigger input B goes from Vbo to Vss(while input A is at VSS and input CD is at Vop)

It should be noted that in the quiescent state Cx is fully charged to Vbo,causing the current through resistor Rx to be zero.Both comparators are“off”with the total device current due only to reverse junction leakages.An added feature of the CD4538B is that the output latch is set via the input trigger without regard to the capacitor voltage.Thus,propagation delay from trigger to Q is independent of the value of Cx,Rx,or the duty cycle of the input waveform.

Retrigger Operation

The CD4538B is retriggered if a valid trigger occurs fol lowed by another valid triggerm before the Q output has returned to the quiescent (zero)state.Any retrigger,after the timing node voltage at pin 2 or 14 has begun to rise from VREF1,but has not yet reached VREF2,will cause an in crease in output pulse width T.When a valid retrigger is initiatedm°,the voltage at T2 will again drop to VREF1 before progressing along the RC charging curve toward VDD.The Q output will remain high until time T,after the last valid retrigger.

Reset Operation

The CD4538B may be reset during the generation of the output pulse.In the reset mode of operation, an input pulse on CD sets the reset latch and causes the capacitor to be fast charged to VDD by turning on transistor Q1 When the voltage on the capacitor reaches VREF2,the reset latch will clear and then be ready to accept another pulse.If the CD input is held low,any trigger inputs that occur will be inhibited and the Q and Q outputs of the output latch will not change.Since the Q output is reset when an input low level is detected on the CD input,the output pulse T can be made significantly shorter than the minimum pulse width specification

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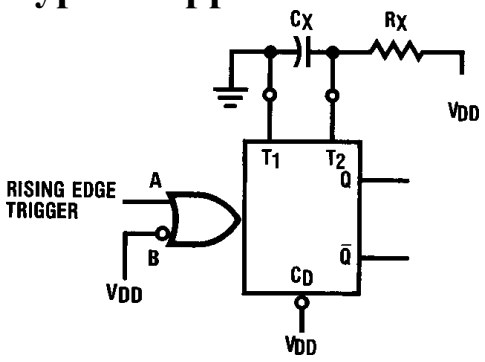
Typical Applications



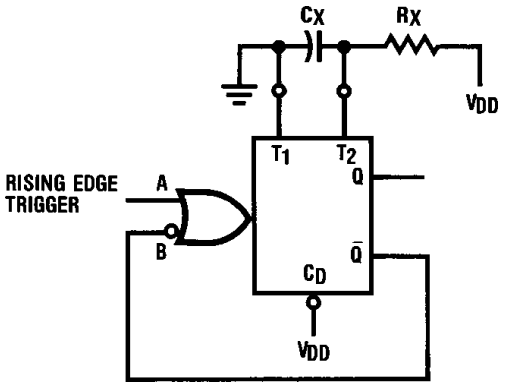
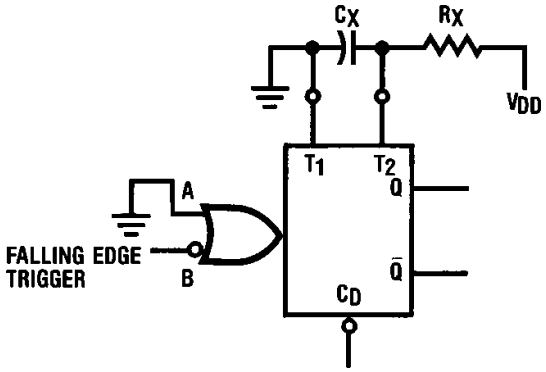


FIGURE 3. Retriggerable Monostables Circuitry



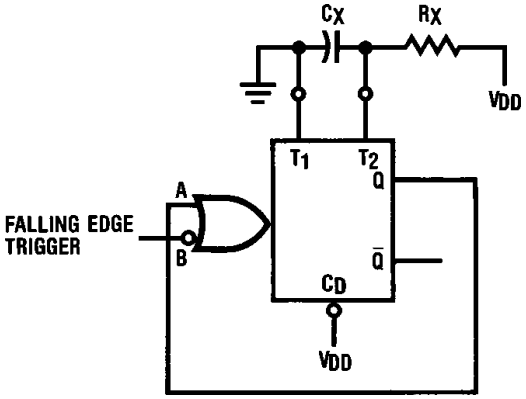


FIGURE 4. Non-Retriggerable Monostables Circuitry

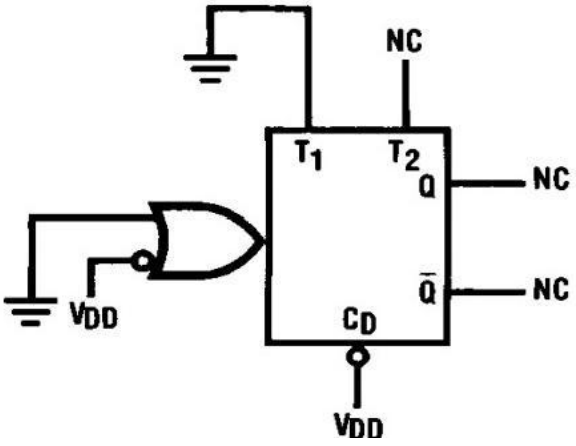


FIGURE 5. Connection of Unused Sections

Typical Applications

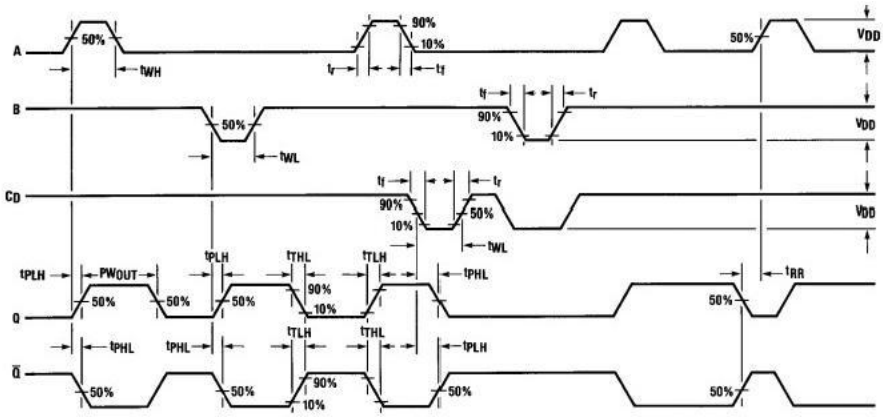
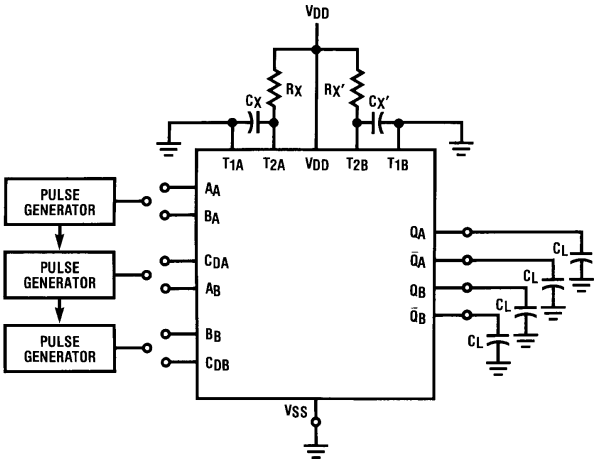
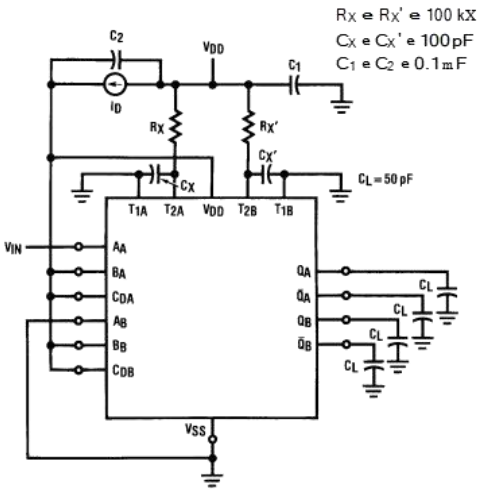


FIGURE 6.Switching Test Waveforms

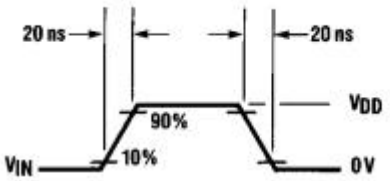




Input Connections

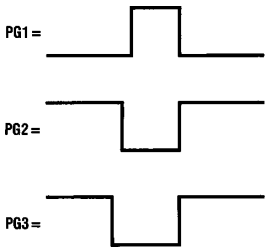
Characteristics	CD	A	B
tpLH,tpHL,tTLH.trHL PWOUT,tWH,twL	VDD	PG1	VDD
tPLH,tPHL,tTLH,trHL PWoUT,tWH,twl	VDD	Vss	PG2
tpLH(R),tPHL(R),twH,twl	PG3	PG1	PG2

ncludes capacitance of probes, wiring,and fixture parasitic
Note Switching test wave forms for PG1,PG2,PG3 are shown in Figure 6



Duty Cycle = 50%

FIGURE8.Power Dissipation Test Circuit and Waveforms



Typical Applications

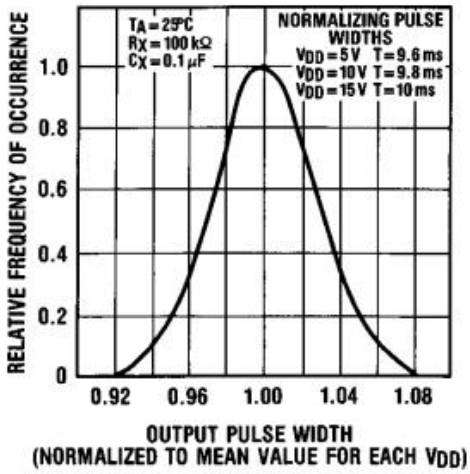


FIGURE 9. Typical Normalized Distribution of Units for Output Pulse Width

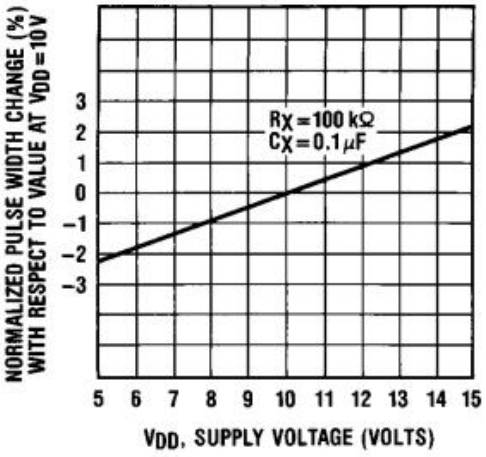


FIGURE 10. Typical Pulse Width Variation as a Function of Supply Voltage V_{DD}

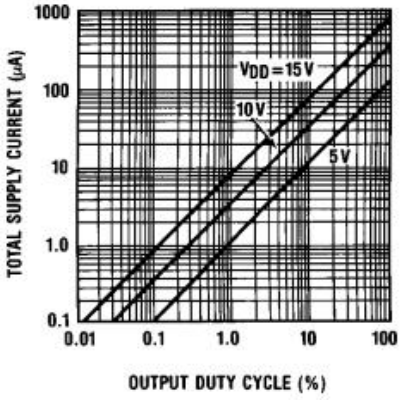


FIGURE 11. Typical Total Supply Current VersusFIGURE Output Duty Cycle, R_X = 100 kΩ, C_L = 50 pF, C_X = 100 pF, One Monostable Switching Only

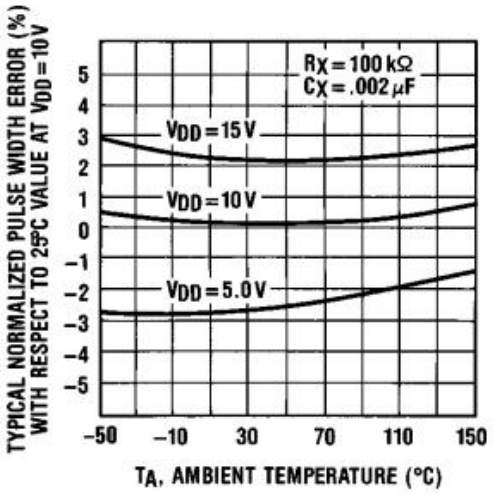


FIGURE 12. Typical Pulse Width Error Versus Temperature

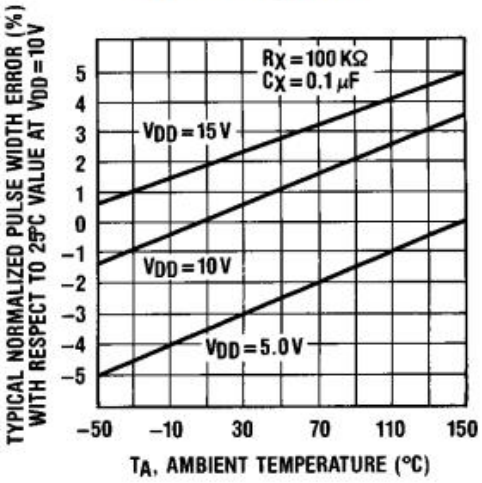


FIGURE 13. Typical Pulse Width Error Versus Temperature

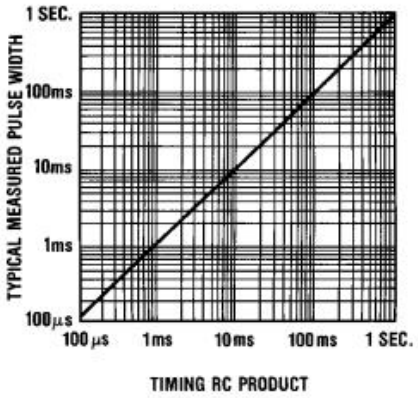
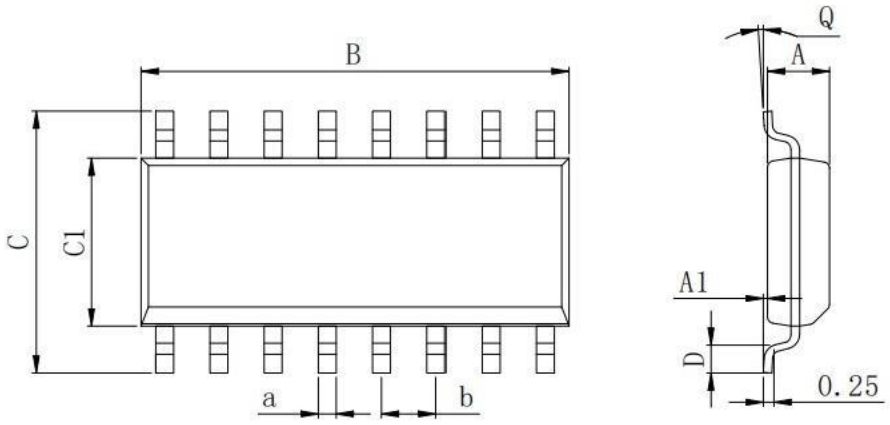


FIGURE 14. Typical Pulse Width Versus Timing RC Product

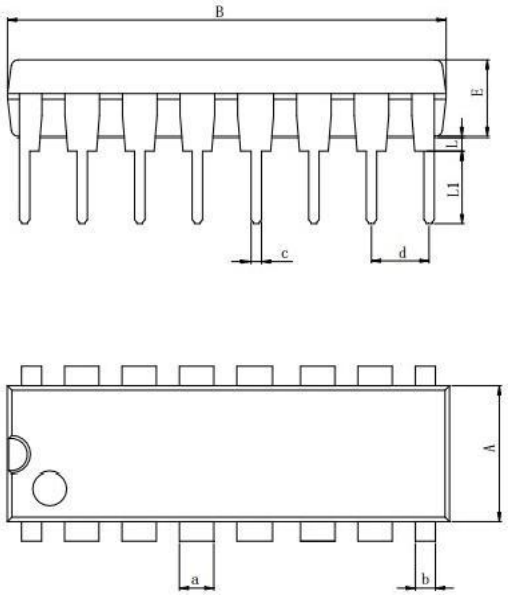
Physical Dimensions

SOP-16



Dimensions In Millimeters(SOP-16)									
Symbol:	**A**	A1	B	C	C1	**D**	**Q**	**a**	**b**
Min:	1.35	0.05	9.80	5.80	3.80	**0.40**	**0°**	**0.35**	**1.27 BSC**
Max:	1.55	0.20	10.0	6.20	4.00	**0.80**	**8°**	**0.45**	

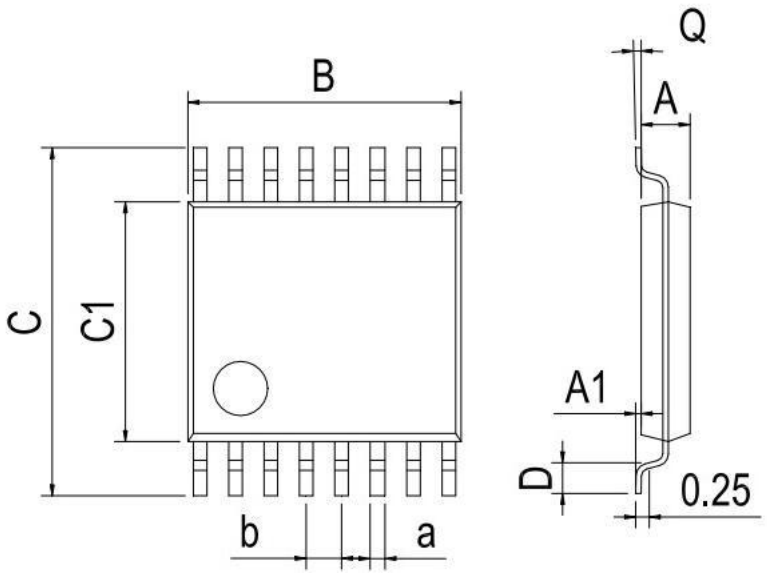
DIP-16



Dimensions In Millimeters(DIP-16)											
Symbol:	**A**	B	D	D1	E	L	L1	**a**	**b**	C	d
Min:	6.10	18.94	8.10	7.42	3.10	0.50	3.00	**1.50**	**0.85**	**0.40**	**2.54 BSC**
Max:	6.68	19.56	10.9	7.82	3.55	0.70	3.60	**1.55**	**0.90**	**0.50**	

Physical Dimensions

TSSOP-16



Dimensions In Millimeters(TSSOP-16)									
Symbol:	**A**	A1	**B**	C	**C1**	**D**	**Q**	**a**	**b**
Min:	0.85	0.05	4.90	6.20	4.30	**0.40**	**0°**	0.20	0.65 BSC
Max:	0.95	0.20	5.10	6.60	4.50	0.80	8°	**0.25**	