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TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

TC4538BP, TC4538BF

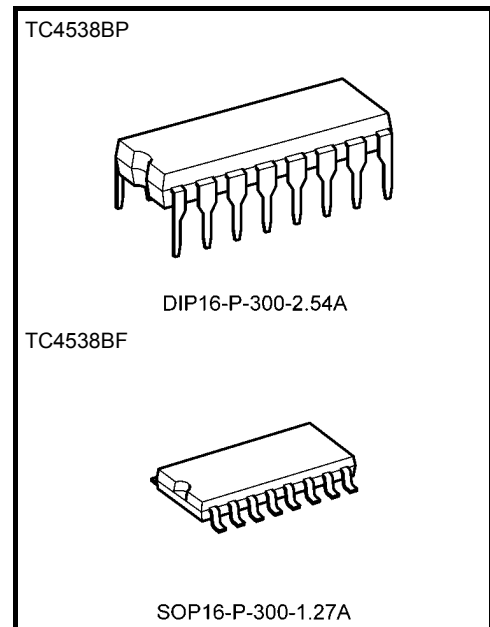
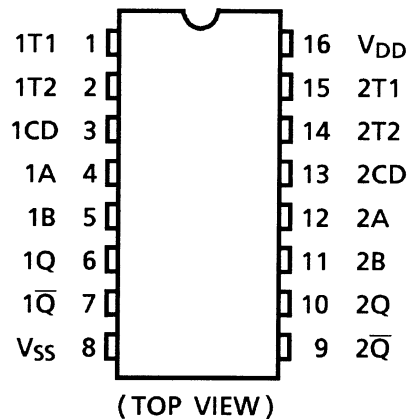
TC4538BP/TC4538BF Dual Precision Retriggerable/Resettable Monostable Multivibrator

The TC4538BP/BF is the retriggerable/resettable monostable multivibrator and the trigger operation can be made at either the leading or trailing edge by 2 inputs of A and B. Since the output monostable pulse width is decided by time constant of the external resistor (RX) and the external capacitor (CX), it becomes possible to set a broad range of output pulse widths.

Features

- $t_{wOUT} = 10 \text{ ms} \pm 5\%$ (at $R_X = 100 \text{ k}\Omega$ $C_X = 0.1 \mu\text{F}$, $V_{DD} = 10 \text{ V}$)

Pin Assignment



Weight
 DIP16-P-300-2.54A : 1.00 g (typ.)
 SOP16-P-300-1.27A : 0.18 g (typ.)

Truth Table (Note)

Inputs			Outputs		Note
A	B	CD	Q	Q̄	
	H	H			Output Enable
	L	H	L	H	Inhibit
H		H	L	H	Inhibit
L		H			Output Enable
*	*	L	L	H	Inhibit

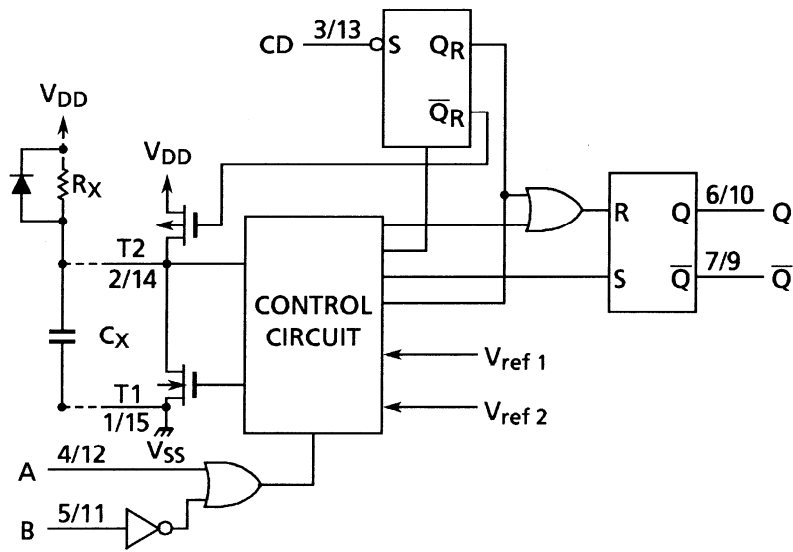
*: Don't care

Note: In the case of using only one circuit, CD should be tied to GND, T₂, T₁, Q, Q̄ should be tied to OPEN, and the other inputs should be tied to V_{CC} or GND.

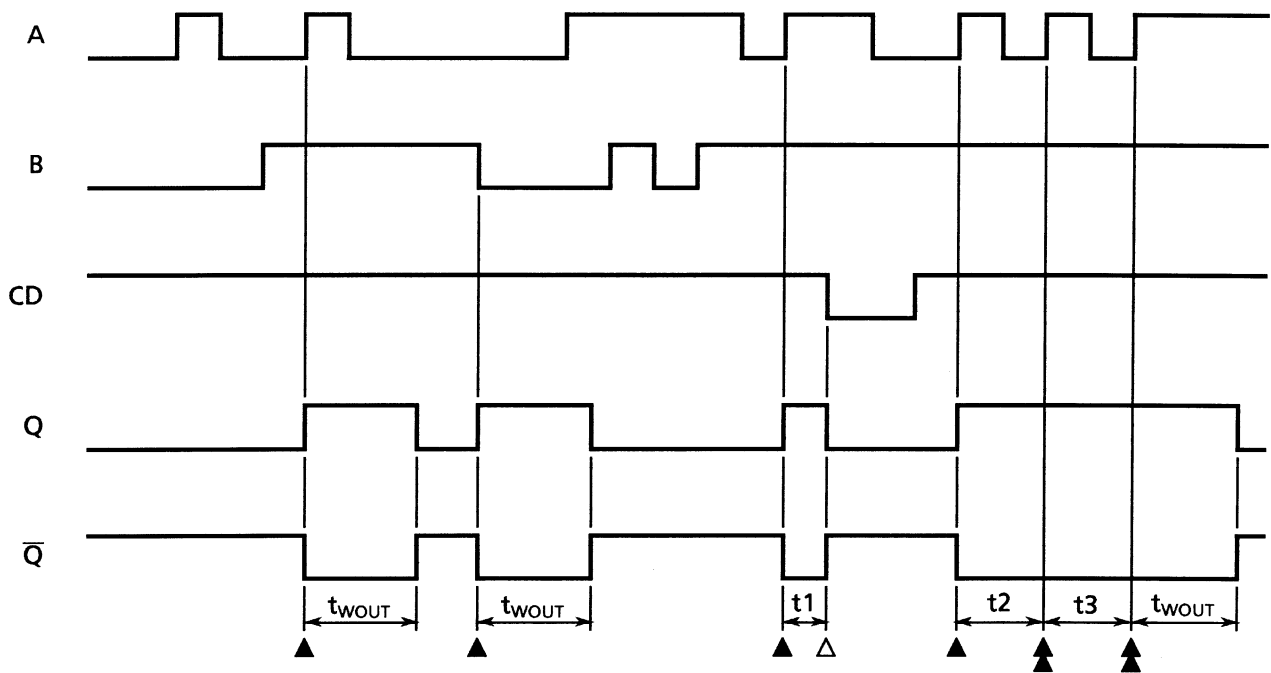
Start of commercial production
 1978-04

Logic Diagram

1/2 TC4538BP/BF



Timing Chart



- ▲ : TRIGGER
- ▲▲ : RETRIGGER
- △ : RESET

$$t_{WOUT} = C_X \cdot R_X$$

$$t_1 \cdot t_2 \cdot t_3 ; t_1 \cdot t_2 \cdot t_3 < t_{WOUT}$$

Absolute Maximum Ratings (Note)

Characteristics	Symbol	Rating	Unit
DC supply voltage	V_{DD}	$V_{SS} - 0.5$ to $V_{SS} + 20$	V
Input voltage	V_{IN}	$V_{SS} - 0.5$ to $V_{DD} + 0.5$	V
Output voltage	V_{OUT}	$V_{SS} - 0.5$ to $V_{DD} + 0.5$	V
DC input current	I_{IN}	± 10	mA
Power dissipation	P_D	300 (DIP)/180 (SOIC)	mW
Operating temperature range	T_{opr}	-40 to 85	°C
Storage temperature range	T_{stg}	-65 to 150	°C

Note: Exceeding any of the absolute maximum ratings, even briefly, lead to deterioration in IC performance or even destruction.

Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.) are within the absolute maximum ratings and the operating ranges.

Please design the appropriate reliability upon reviewing the Toshiba Semiconductor Reliability Handbook ("Handling Precautions"/"Derating Concept and Methods") and individual reliability data (i.e. reliability test report and estimated failure rate, etc).

Operating Ranges ($V_{SS} = 0$ V) (Note)

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
DC supply voltage	V_{DD}	—	3	—	18	V
Input voltage	V_{IN}	—	0	—	V_{DD}	V
External resistance	R_X	—	5	—	1000	$k\Omega$
External capacitance	C_X	—	No limits			μF

Note: The operating ranges must be maintained to ensure the normal operation of the device.
Unused inputs must be tied to either V_{DD} or V_{SS} .

Static Electrical Characteristics (V_{SS} = 0 V)

Characteristics	Sym- bol	Test Condition	V _{DD} (V)	-40°C		25°C			85°C		Unit	
				Min	Max	Min	Typ.	Max	Min	Max		
High-level output voltage	V _{OH}	I _{OUT} < 1 μA V _{IN} = V _{SS} , V _{DD}	5	4.95	—	4.95	5.00	—	4.95	—	V	
			10	9.95	—	9.95	10.00	—	9.95	—		
			15	14.95	—	14.95	15.00	—	14.95	—		
Low-level output voltage	V _{OL}	I _{OUT} < 1 μA V _{IN} = V _{SS} , V _{DD}	5	—	0.05	—	0.00	0.05	—	0.05	V	
			10	—	0.05	—	0.00	0.05	—	0.05		
			15	—	0.05	—	0.00	0.05	—	0.05		
Output high current	I _{OH}	V _{OH} = 4.6 V V _{OH} = 2.5 V V _{OH} = 9.5 V V _{OH} = 13.5 V V _{IN} = V _{SS} , V _{DD}	5	-0.61	—	-0.51	-1.0	—	-0.42	—	mA	
			5	-2.50	—	-2.10	-4.0	—	-1.70	—		
			10	-1.50	—	-1.30	-2.2	—	-1.10	—		
			15	-4.00	—	-3.40	-9.0	—	-2.80	—		
Output low current	I _{OL}	V _{OL} = 0.4 V V _{OL} = 0.5 V V _{OL} = 1.5 V V _{IN} = V _{SS} , V _{DD}	5	0.61	—	0.51	1.5	—	0.42	—	mA	
			10	1.50	—	1.30	3.8	—	1.10	—		
			15	4.00	—	3.40	15.0	—	2.80	—		
			—	—	—	—	—	—	—	—		
Input high voltage	V _{IH}	V _{OUT} = 0.5 V, 4.5 V V _{OUT} = 1.0 V, 9.0 V V _{OUT} = 1.5 V, 13.5 V I _{OUT} < 1 μA	5	3.5	—	3.5	2.75	—	3.5	—	V	
			10	7.0	—	7.0	5.50	—	7.0	—		
			15	11.0	—	11.0	8.25	—	11.0	—		
			—	—	—	—	—	—	—	—		
Input low voltage	V _{IL}	V _{OUT} = 0.5 V, 4.5 V V _{OUT} = 1.0 V, 9.0 V V _{OUT} = 1.5 V, 13.5 V I _{OUT} < 1 μA	5	—	1.5	—	2.25	1.5	—	1.5	V	
			10	—	3.0	—	4.50	3.0	—	3.0		
			15	—	4.0	—	6.75	4.0	—	4.0		
			—	—	—	—	—	—	—	—		
Input current	"H" level	I _{IH}	V _{IH} = 18 V	18	—	0.1	—	10 ⁻⁵	0.1	—	1.0	μA
	"L" level	I _{IL}	V _{IL} = 0 V	18	—	-0.1	—	-10 ⁻⁵	-0.1	—	-1.0	
Quiescent supply current	I _{DD}	V _{IN} = V _{SS} , V _{DD} (Note)	5	—	5	—	0.005	5	—	150	μA	
			10	—	10	—	0.010	10	—	300		
			15	—	20	—	0.015	20	—	600		

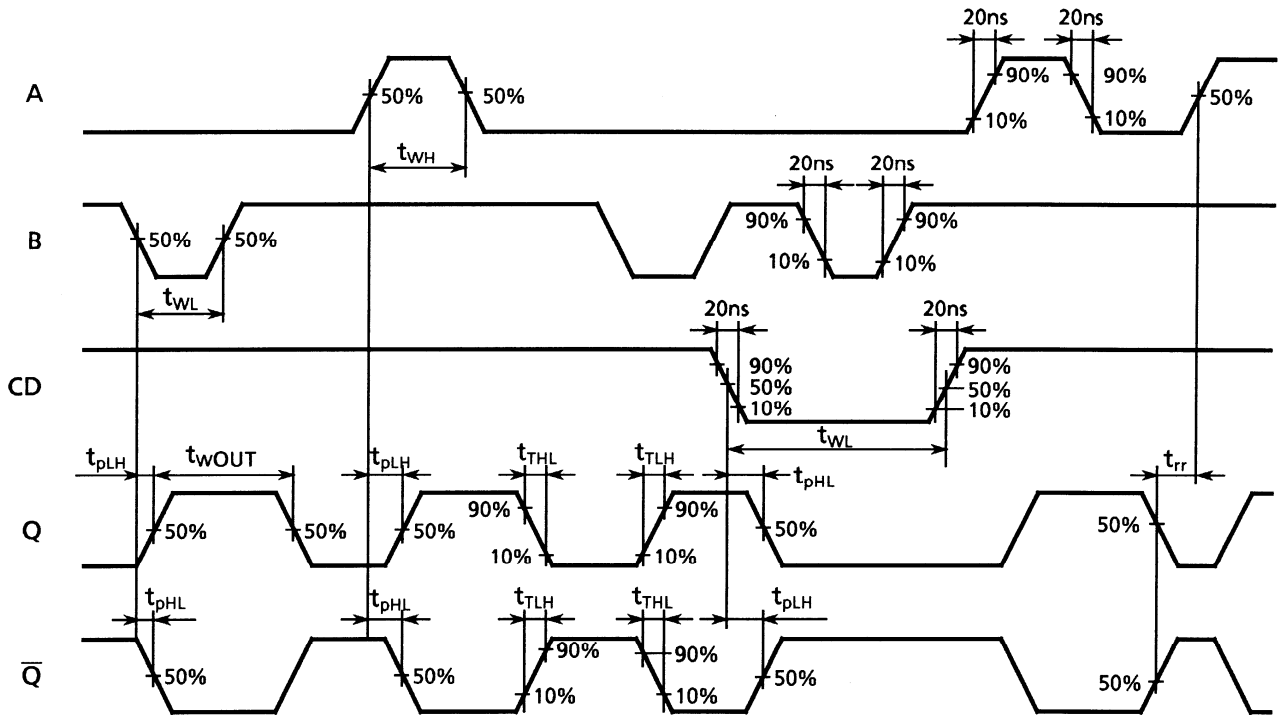
Note: All valid input combinations.

Dynamic Electrical Characteristics (Ta = 25°C, VSS = 0 V, CL = 50 pF)

Characteristics	Symbol	Test Condition	VDD (V)	Min	Typ.	Max	Unit
Output transition time (low to high)	t _{TLH}	—	5	—	80	200	ns
			10	—	50	100	
			15	—	40	80	
Output transition time (high to low)	t _{THL}	—	5	—	80	200	ns
			10	—	50	100	
			15	—	40	80	
Propagation delay time (A, B-Q, \bar{Q})	t _{pLH} t _{pHL}	—	5	—	380	760	ns
			10	—	150	300	
			15	—	100	220	
Propagation delay time (CD-Q, \bar{Q})	t _{pLH} t _{pHL}	—	5	—	280	560	ns
			10	—	110	250	
			15	—	75	190	
Min input pulse width (A, B)	t _{WH} t _{WL}	—	5	—	60	120	ns
			10	—	30	60	
			15	—	25	50	
Min pulse width (CD)	t _{WL}	—	5	—	95	190	ns
			10	—	45	90	
			15	—	35	70	
Min retrigger time	t _{rr}	—	5	—	0	—	ns
			10	—	0	—	
			15	—	0	—	
Output pulse width	t _{wOUT}	R _X = 100 kΩ C _X = 0.002 μF	5	—	206	—	μs
			10	—	204	—	
			15	—	205	—	
		R _X = 100 kΩ C _X = 0.1 μF	5	9.30	9.95	10.40	ms
			10	9.50	10.00	10.50	
			15	9.55	10.05	10.65	
		R _X = 100 kΩ C _X = 10 μF	5	—	0.98	—	s
			10	—	1.00	—	
			15	—	1.01	—	
Pulse width match between circuits in the same package	Δt _{wOUT}	$\frac{t_{wOUT}(Q2) - t_w(Q1)}{t_{wOUT}(Q1)} \times 100$	5	—	±1	—	%
			10	—	±1	—	
			15	—	±1	—	
Input capacitance	C _{IN}	—	—	5	7.5	pF	

Waveform for Measurement of Dynamic Characteristics

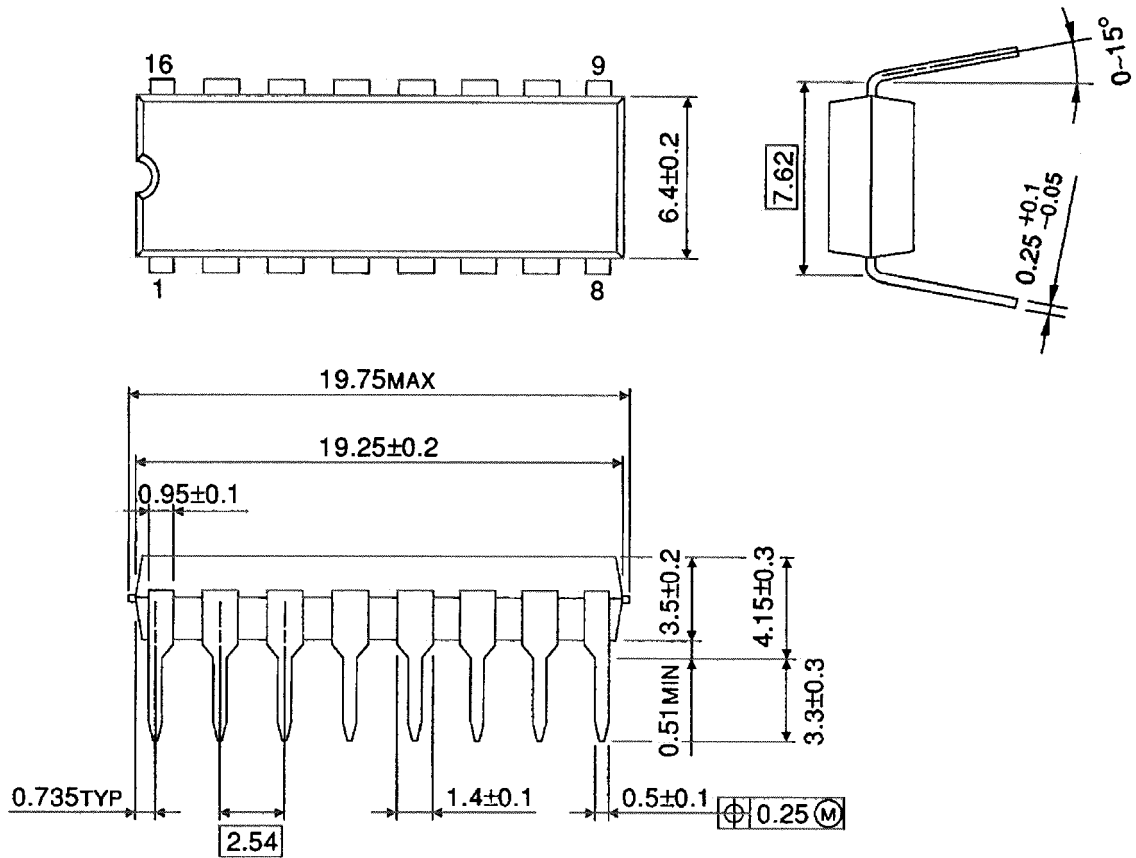
Waveform



Package Dimensions

DIP16-P-300-2.54A

Unit : mm

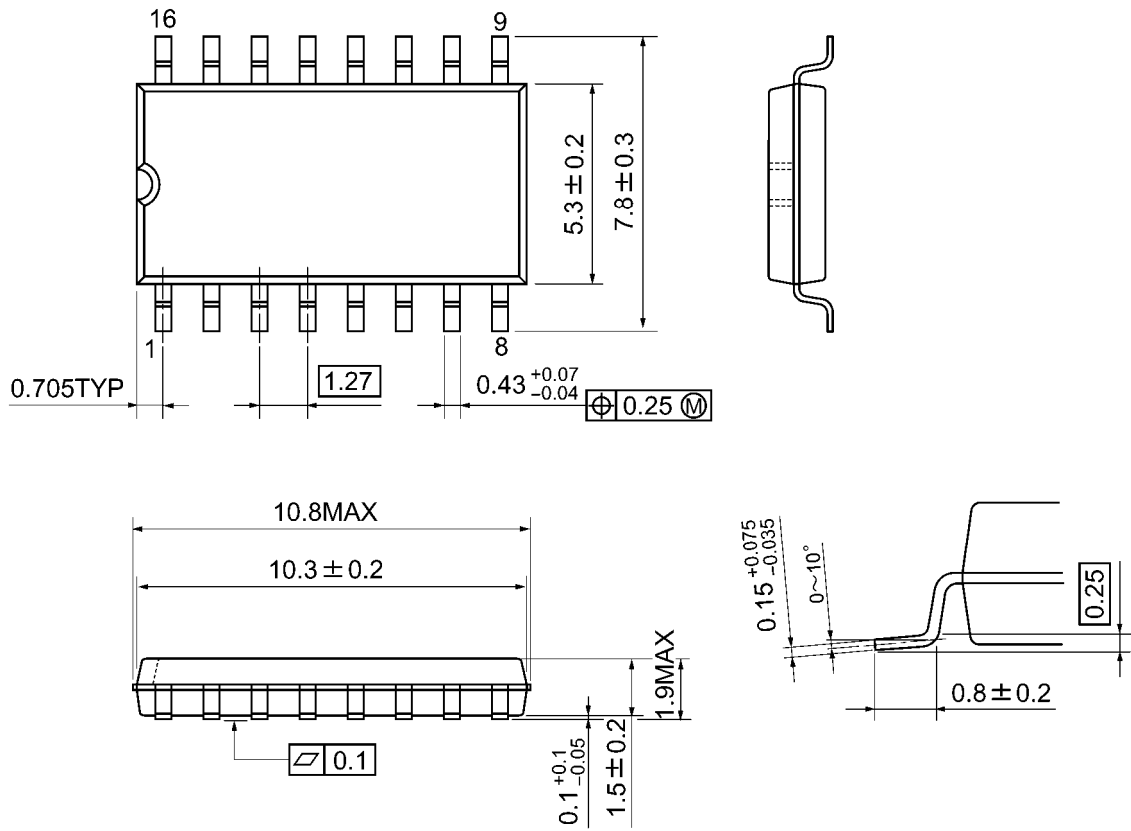


Weight: 1.00 g (typ.)

Package Dimensions

SOP16-P-300-1.27A

Unit: mm



Weight: 0.18 g (typ.)

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