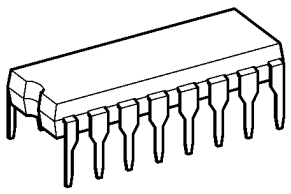
TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

TC4538BP, TC4538BF

TC4538BP/TC4538BF Dual Precision Retriggerable/Resettable Monostable Multivibrator

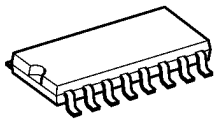
The TC4538BP/BF is the retriggerable/resettable monostable multivibrator and the trigger operation can be made at either the leading or trailing edge by 2 inputs of A and B. Since the output monostable pulse width is decided by time constant of the external resistor (R_X) and the external capacitor (C_X),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

TC4538BP



DIP16-P-300-2.54A

TC4538BF



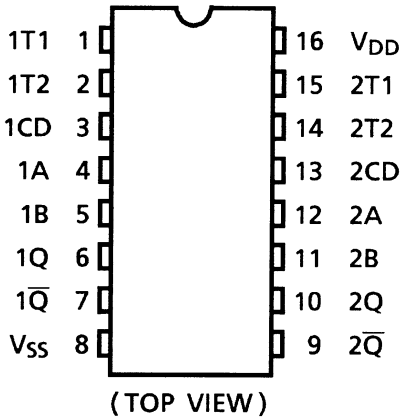
SOP16-P-300-1.27A

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

Features

- t_{wOUT} = 10 ms ± 5% (at R_X = 100 kΩ C_X = 0.1 μF, V_{DD} = 10 V)

Pin Assignment



(TOP VIEW)

Truth Table (Note)

Inputs			Outputs		Note
A	B	CD	Q	$\overline{Q}$	
↑	H	H	⊓	⊔	Output Enable
↑	L	H	L	H	Inhibit
H	↓	H	L	H	Inhibit
L	↓	H	⊓	⊔	Output Enable
*	*	L	L	H	Inhibit

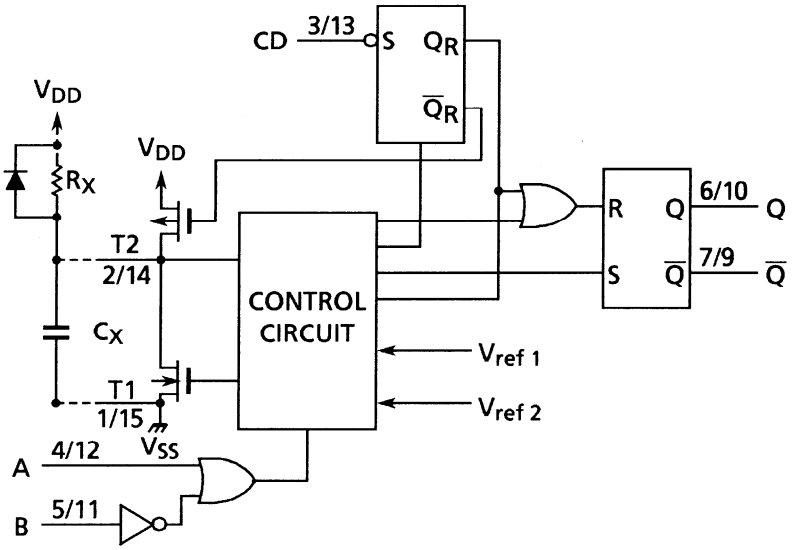
*: Don't care

Note: In the case of using only one circuit, CD should be tied to GND, T_2, T_1, Q, $\overline{Q}$ should be tied to OPEN, and the other inputs should be tied to V_{CC} or GND.

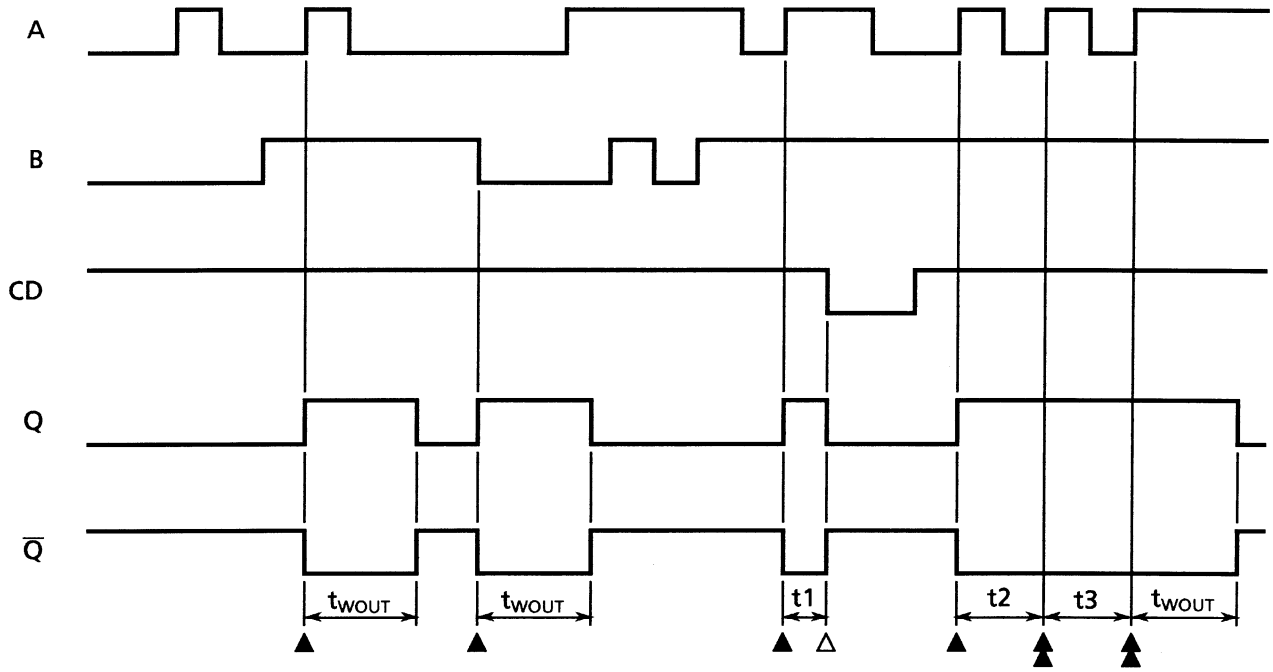
Start of commercial production
1978-04

Logic Diagram

1/2 TC4538BP/BF



Timing Chart



▲ : TRIGGER
⇑ : RETRIGGER
△ : RESET

$t_{WOUT} = C_X \cdot R_X$

$t1 \cdot t2 \cdot t3$; $t1 \cdot t2 \cdot t3 < t_{WOUT}$

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	kΩ
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		−40°C		25°C			85°C		Unit
			V_{DD} (V)	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	5	−0.61	—	−0.51	−1.0	—	−0.42	—	mA
		V_{OH} = 2.5 V	5	−2.50	—	−2.10	−4.0	—	−1.70	—	
		V_{OH} = 9.5 V	10	−1.50	—	−1.30	−2.2	—	−1.10	—	
		V_{OH} = 13.5 V	15	−4.00	—	−3.40	−9.0	—	−2.80	—	
		$V_{IN} = V_{SS}, V_{DD}$									
Output low current	I_{OL}	V_{OL} = 0.4 V	5	0.61	—	0.51	1.5	—	0.42	—	mA
		V_{OL} = 0.5 V	10	1.50	—	1.30	3.8	—	1.10	—	
		V_{OL} = 1.5 V	15	4.00	—	3.40	15.0	—	2.80	—	
		$V_{IN} = V_{SS}, V_{DD}$									
Input high voltage	V_{IH}	V_{OUT} = 0.5 V, 4.5 V	5	3.5	—	3.5	2.75	—	3.5	—	V
		V_{OUT} = 1.0 V, 9.0 V	10	7.0	—	7.0	5.50	—	7.0	—	
		V_{OUT} = 1.5 V, 13.5 V	15	11.0	—	11.0	8.25	—	11.0	—	
		$\|I_{OUT}\| < 1$ μA									
Input low voltage	V_{IL}	V_{OUT} = 0.5 V, 4.5 V	5	—	1.5	—	2.25	1.5	—	1.5	V
		V_{OUT} = 1.0 V, 9.0 V	10	—	3.0	—	4.50	3.0	—	3.0	
		V_{OUT} = 1.5 V, 13.5 V	15	—	4.0	—	6.75	4.0	—	4.0	
		$\|I_{OUT}\| < 1$ μA									
Input current "H" level	I_{IH}	V_{IH} = 18 V	18	—	0.1	—	10^{-5}	0.1	—	1.0	μA
Input current "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	

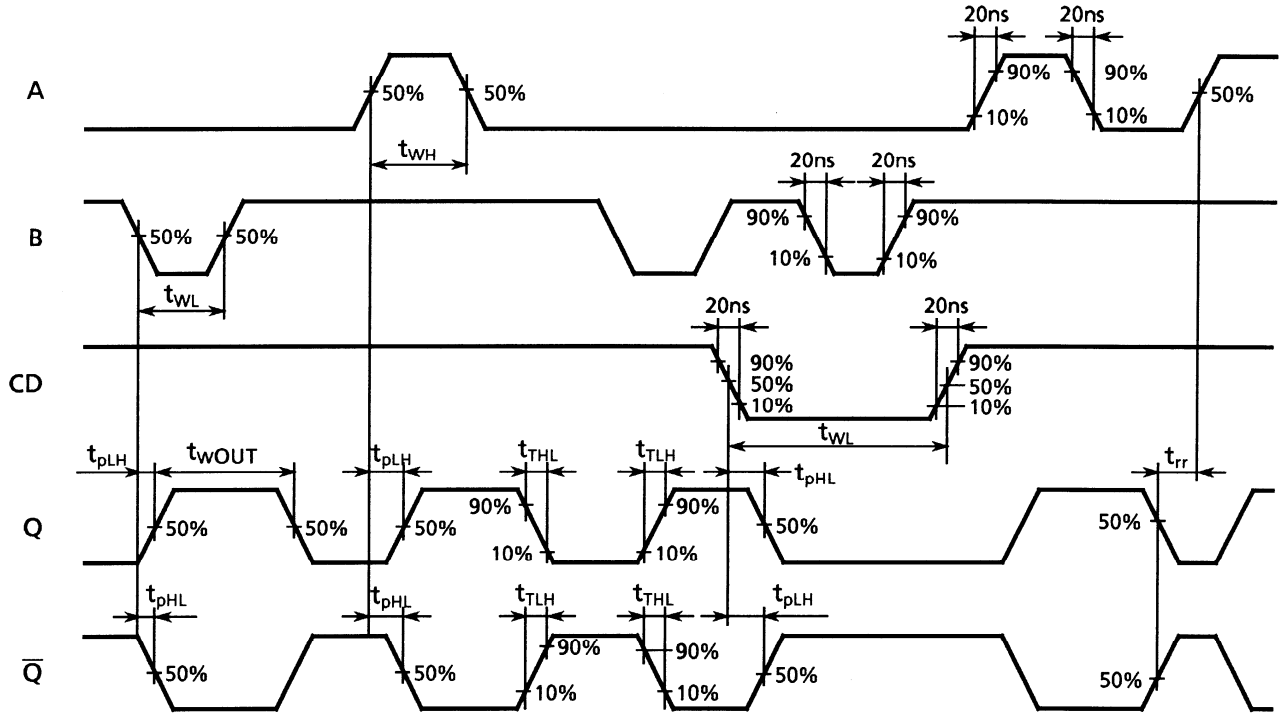
Note: All valid input combinations.

Dynamic Electrical Characteristics (Ta = 25°C, V_{SS} = 0 V, C_L = 50 pF)

Characteristics	Symbol	Test Condition	V_{DD} (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, $\overline{Q}$)	t_{pLH} t_{pHL}	—	5	—	380	760	ns
			10	—	150	300	
			15	—	100	220	
Propagation delay time (CD-Q, $\overline{Q}$)	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

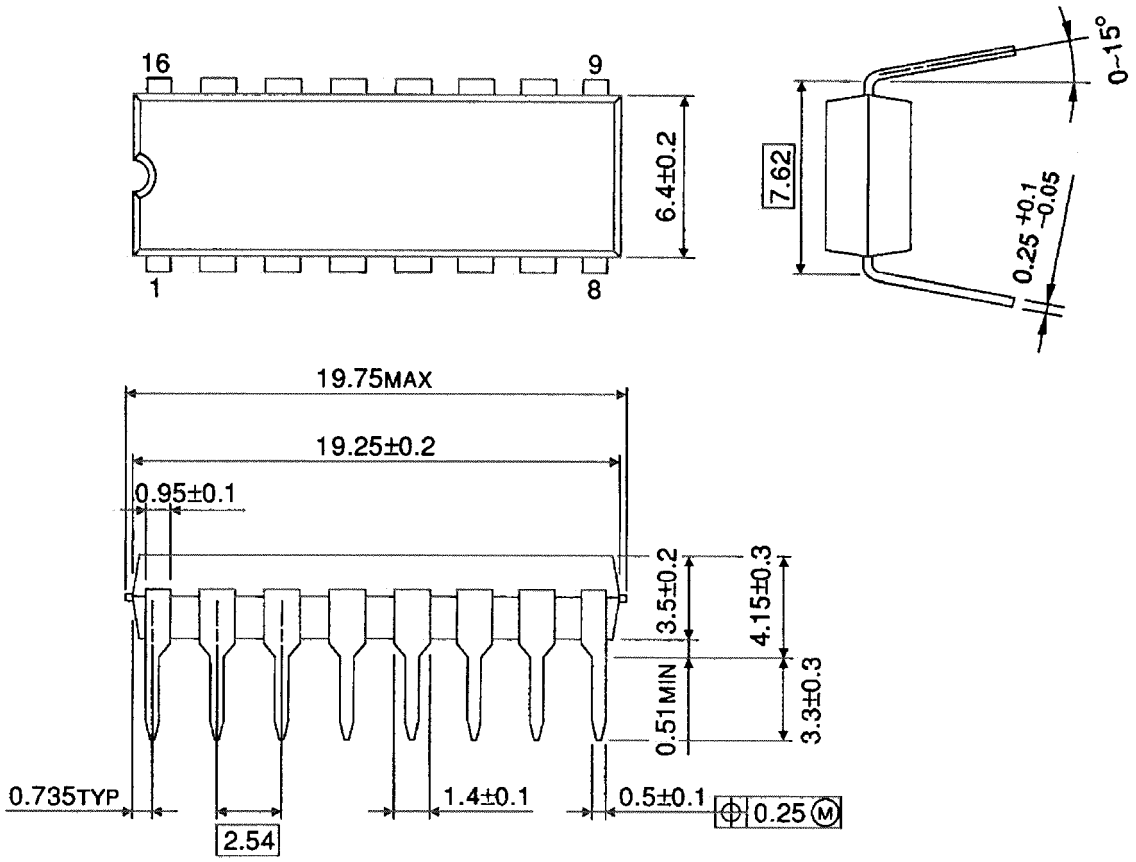
Waveform for Measurement of Dynamic Characteristics

Waveform



Package Dimensions

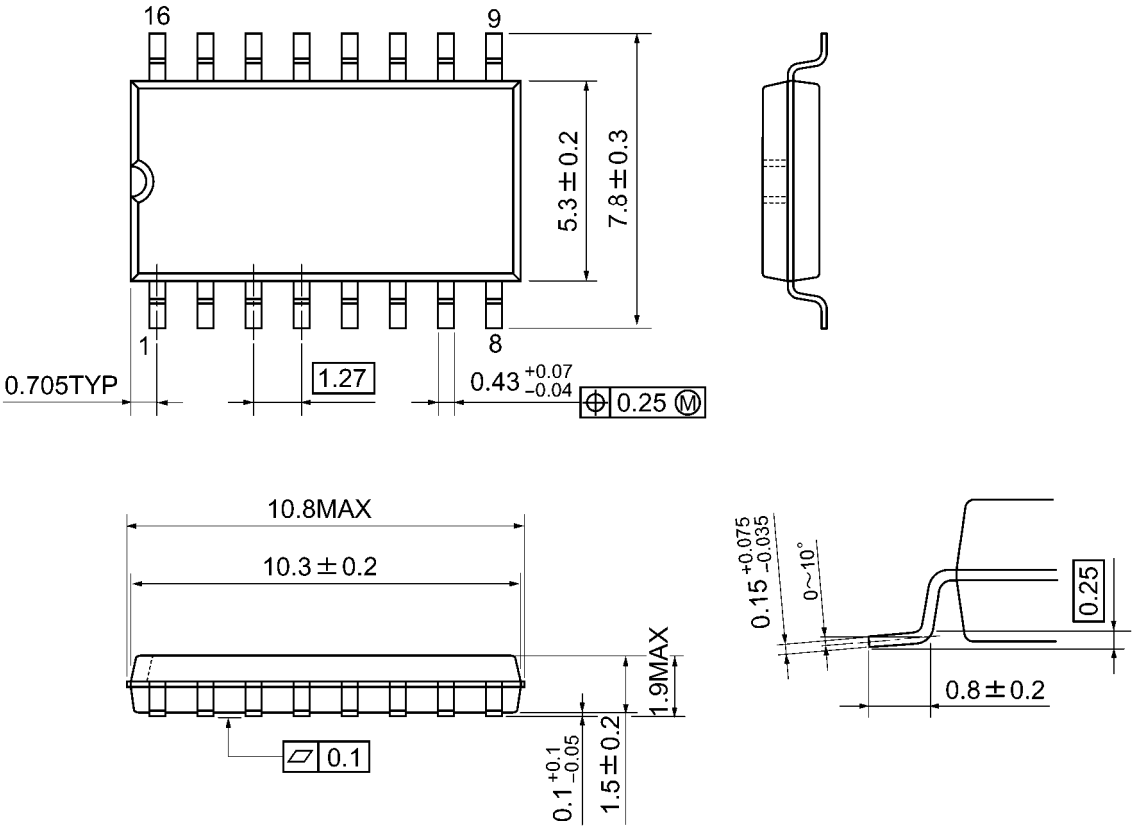
DIP16-P-300-2.54A Unit : mm



Weight: 1.00 g (typ.)

Package Dimensions

SOP16-P-300-1.27A Unit: mm



Weight: 0.18 g (typ.)

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