

TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

TC4024BP, TC4024BF

TC4024B 7 Stage Ripple-Carry Binary Counter/Dividers

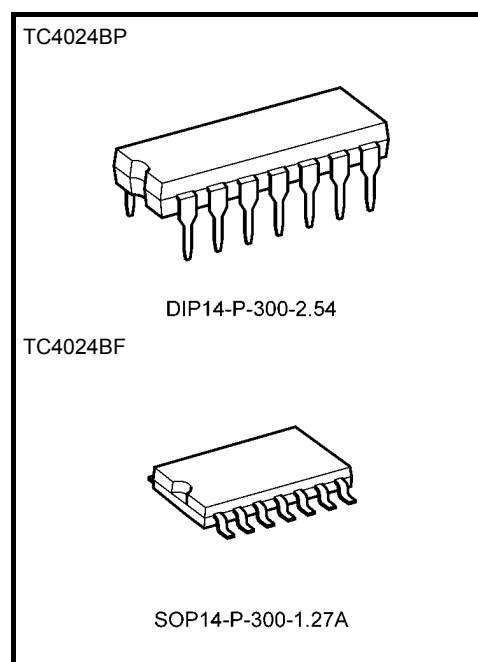
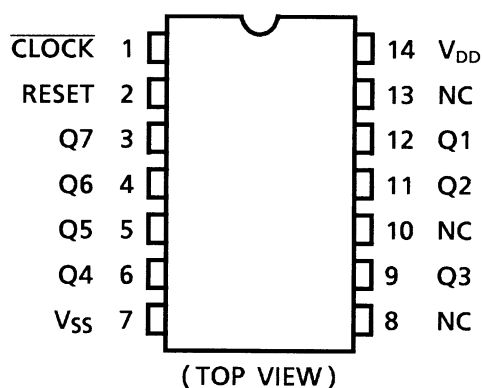
TC4024B is 7 stage ripple carry type binary counter having asynchronous clear function.

The counter advances its counting state by falling edge of $\overline{\text{CLOCK}}$ input.

When RESET input is placed at "H", all the internal flip-flop are reset making all the outputs Q1 through Q7 to be "L" regardless of $\overline{\text{CLOCK}}$ input.

This is suitable for frequency divider circuits and control circuits.

Pin Assignment



Weight
 DIP14-P-300-2.54 : 0.96 g (typ.)
 SOP14-P-300-1.27A : 0.18 g (typ.)

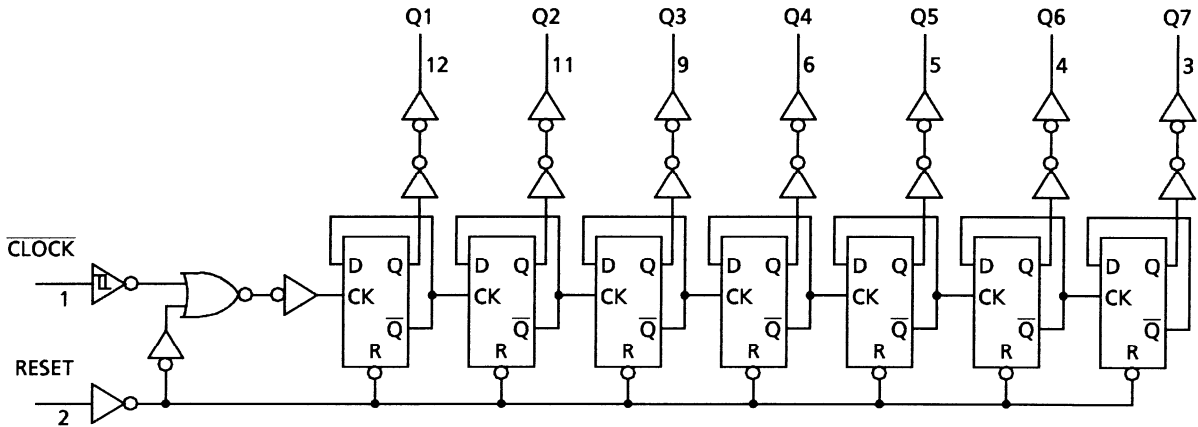
Truth Table

$\overline{\text{CLOCK}} \Delta$	RESET	Output State
*	H	All Outputs = "L"
	L	No Change
	L	Advance to Next State

Δ : Level change

*: Don't care

Logic Diagram



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

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 \mu A$ $V_{IN} = V_{SS}, V_{DD}$	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 \mu A$ $V_{IN} = V_{SS}, V_{DD}$	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	1.2	—	0.42	—	mA
			$V_{OL} = 0.5$ V	10	1.50	—	1.30	3.2	—	1.10	—	
			$V_{OL} = 1.5$ V	15	4.00	—	3.40	12.0	—	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 \mu A$									
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 \mu A$									
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	

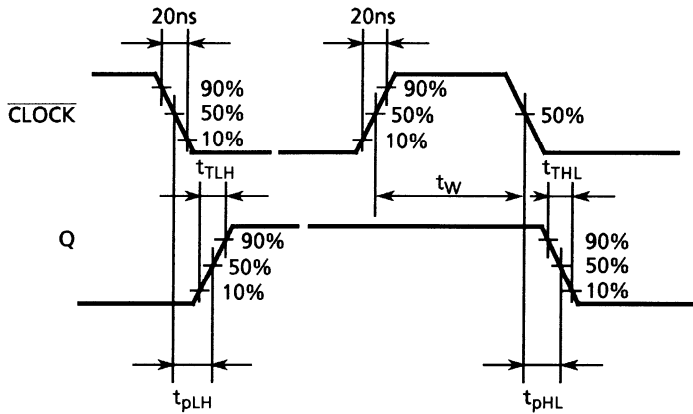
Note: All valid input combinations.

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

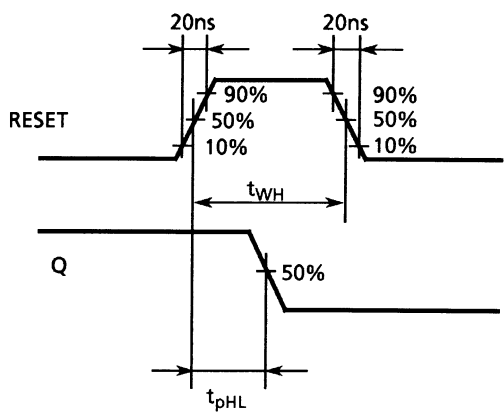
Characteristics	Symbol	Test Condition	V _{DD} (V)	Min	Typ.	Max	Unit
Output transition time (low to high)	t _{TLH}	—	5	—	70	200	ns
			10	—	35	100	
			15	—	30	80	
Output transition time (high to low)	t _{THL}	—	5	—	70	200	ns
			10	—	35	100	
			15	—	30	80	
Propagation delay time ($\overline{\text{CLOCK}}$ - Q1)	t _{pLH}	—	5	—	140	360	ns
			10	—	70	160	
			15	—	50	130	
Propagation delay time ($\overline{\text{CLOCK}}$ - Q1)	t _{pHL}	—	5	—	140	360	ns
			10	—	70	160	
			15	—	50	130	
Propagation delay time ($\overline{\text{CLOCK}}$ - Q7)	t _{pLH}	—	5	—	400	1200	ns
			10	—	160	520	
			15	—	115	430	
Propagation delay time ($\overline{\text{CLOCK}}$ - Q7)	t _{pHL}	—	5	—	400	1200	ns
			10	—	160	520	
			15	—	115	430	
Propagation delay time (RESET-Q)	t _{pHL}	—	5	—	140	280	ns
			10	—	70	120	
			15	—	50	100	
Max clock frequency	f _{CL}	—	5	3.5	14	—	MHz
			10	8.0	30	—	
			15	12.0	40	—	
Max clock input rise time Max clock input fall time	t _{rCL} t _{fCL}	—	5	No limit			μs
			10				
			15				
Max clock pulse width	t _w	—	5	—	40	140	ns
			10	—	20	60	
			15	—	15	40	
Max pulse width (RESET)	t _{WH}	—	5	—	40	200	ns
			10	—	20	80	
			15	—	15	60	
Minimum removal time	t _{rem}	—	5	—	0	350	ns
			10	—	0	150	
			15	—	0	100	
Input capacitance	C _{IN}	—		—	5	7.5	pF

Waveforms for Measurement of Dynamic Characteristics

Waveform 1



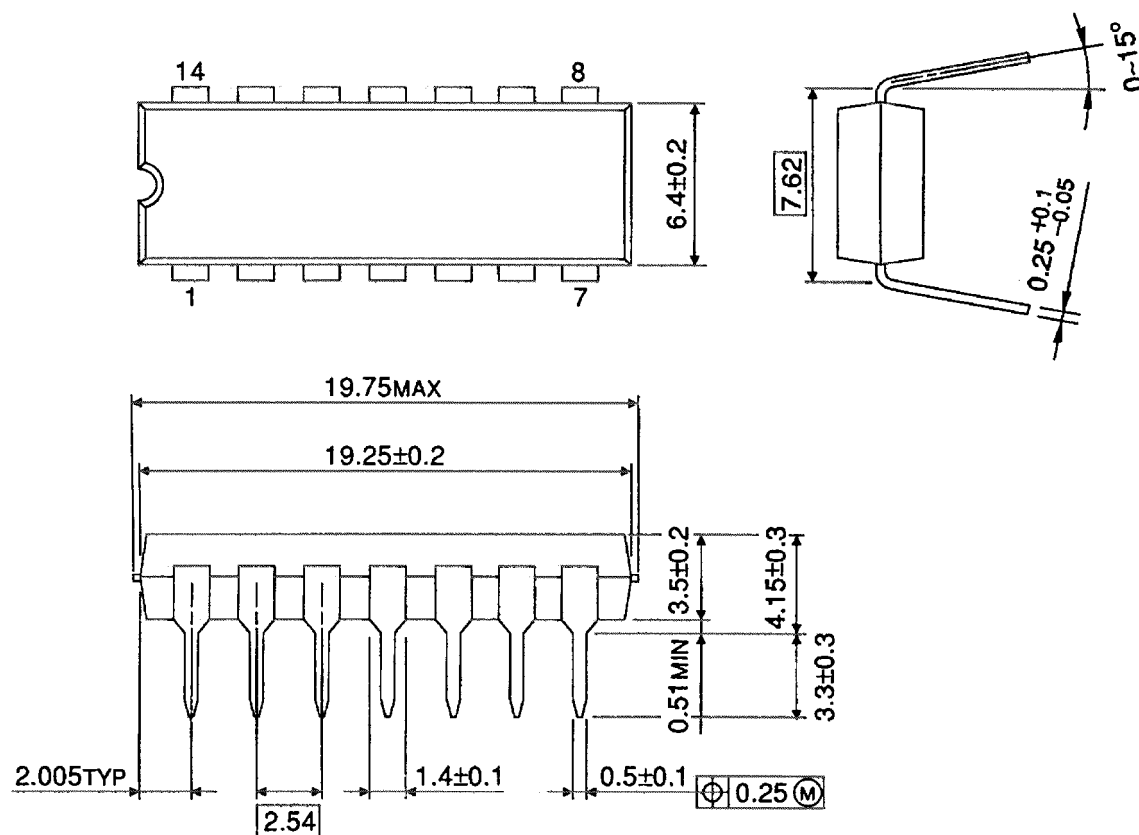
Waveform 2



Package Dimensions

DIP14-P-300-2.54

Unit : mm

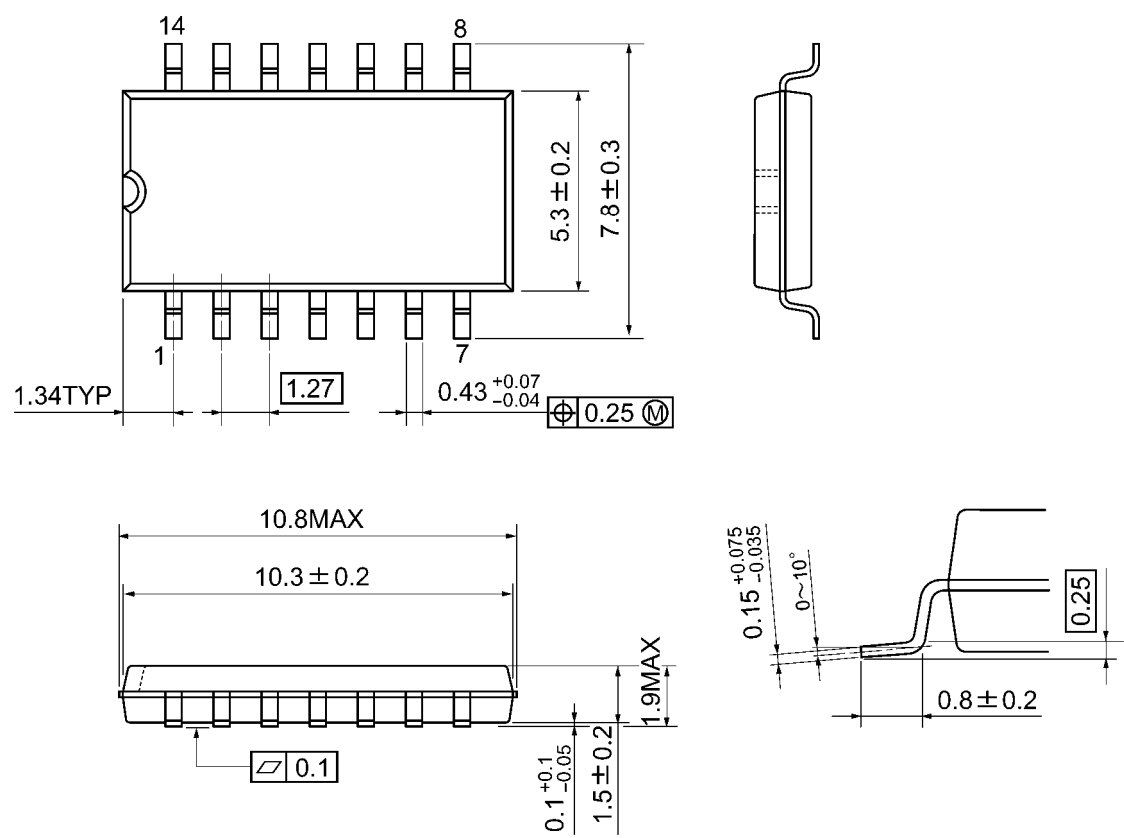


Weight: 0.96 g (typ.)

Package Dimensions

SOP14-P-300-1.27A

Unit: mm



Weight: 0.18 g (typ.)

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