TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

TC4017BP,TC4017BF

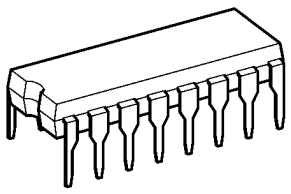
TC4017BP/TC4017BF Decade Counter/Divider

TC4017BP/BF is decimal Johnson counter consisting of 5 stage D-type flip-flop equipped with the decoder to convert the output to decimal.

Depending on the number of count pulses fed to CLOCK or CLOCK INHIBIT one output among 10 output lines “Q0” through “Q9” becomes “H” level.

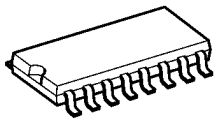
The counter advances its state at rising edge of CLOCK (CLOCK INHIBIT = “L”) or falling edge of CLOCK INHIBIT (CLOCK = “H”). RESET input to “H” level resets the counter to Q0 = “H” and Q1 through Q9 = “L” regardless of CLOCK and CLOCK INHIBIT.

TC4017BP



DIP16-P-300-2.54A

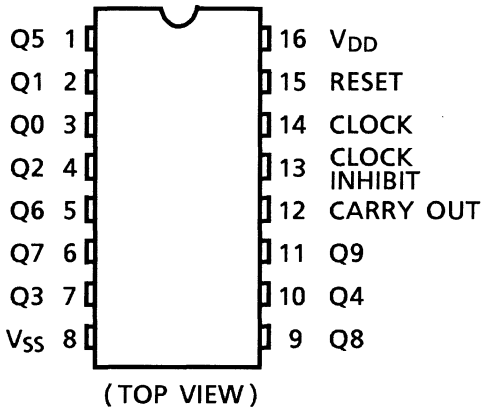
TC4017BF



SOP16-P-300-1.27A

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

Pin Assignment



Truth Table

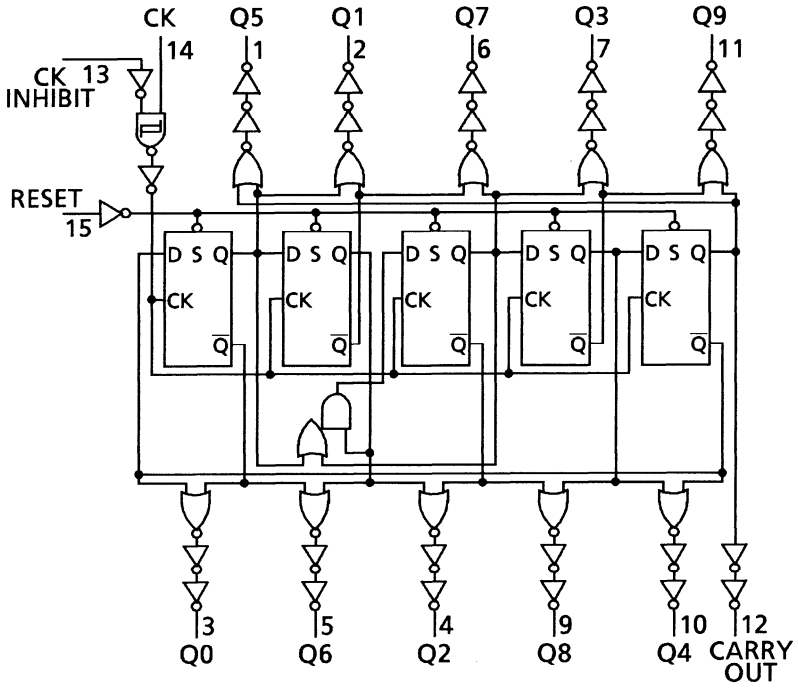
Inputs			Selected Output
CLOCK∆	CLOCK INHIBIT∆	RESET	
*	*	H	Q0
*	H	L	Qn (NC)
L	*	L	Qn (NC)
↑	L	L	Qn + 1
↓	L	L	Qn (NC)
H	↑	L	Qn (NC)
H	↓	L	Qn + 1

∆: Level change

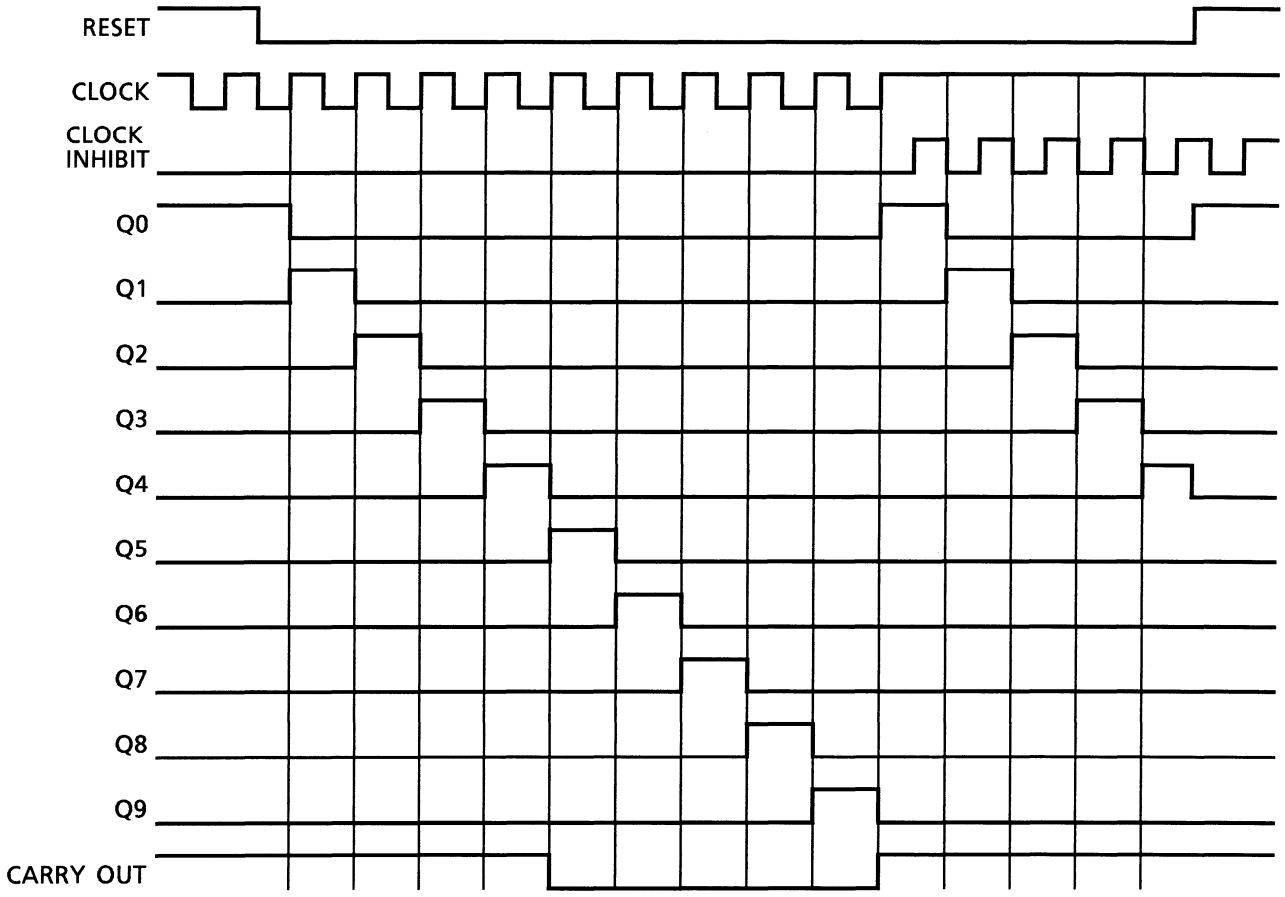
*: Don’t care

NC: No change
carry out “H”..... Q0~Q4 = “H”
“L” ..... Q5~Q9 = “H”

Logic Diagram



Timing Chart



Absolute Maximum Ratings (Note)

Characteristics	Symbol	Rating	Unit
DC supply voltage	V_{DD}	$V_{SS} - 0.5 \sim V_{SS} + 20$	V
Input voltage	V_{IN}	$V_{SS} - 0.5 \sim V_{DD} + 0.5$	V
Output voltage	V_{OUT}	$V_{SS} - 0.5 \sim V_{DD} + 0.5$	V
DC input current	I_{IN}	± 10	mA
Power dissipation	P_D	300 (DIP)/180 (SOIC)	mW
Operating ambient temperature range	T_{opr}	−40~85	°C
Storage temperature range	T_{stg}	−65~150	°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}	$\|I_{OUT}\| < 1$ 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
	"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	—	15	—	0.015	20	—	600	

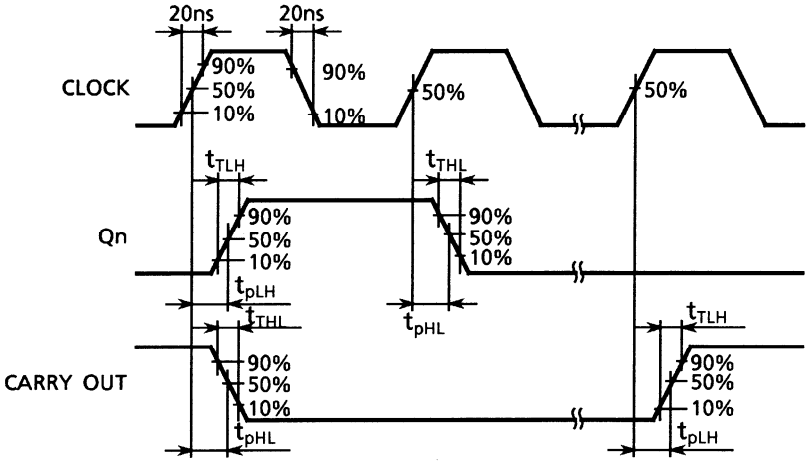
Note: All valid input combinations.

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

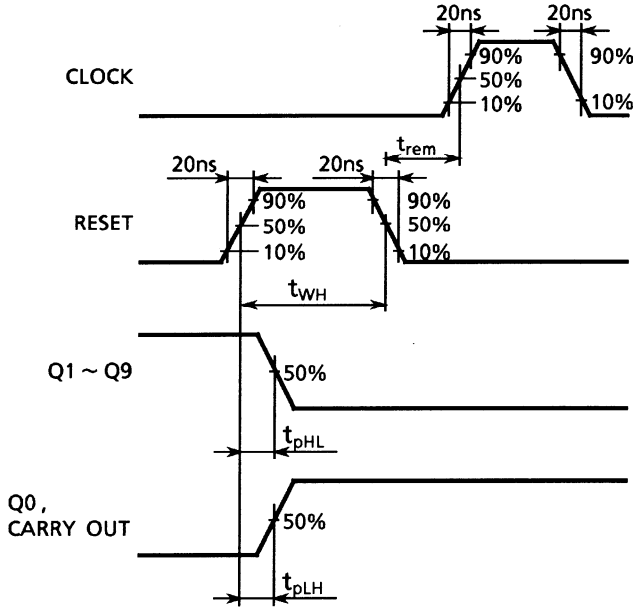
Characteristics	Symbol	Test Condition	V_{DD} (V)	Min	Typ.	Max	Unit
Output transition time (low to high)	t_{TLH}	—	5	—	80	200	ns
			10	—	50	100	
			15	—	40	80	
Output transition time (high to low)	t_{THL}	—	5	—	80	200	ns
			10	—	50	100	
			15	—	40	80	
Propagation delay time (CLOCK-Qn)	t_{pLH} t_{pHL}	—	5	—	325	650	ns
			10	—	135	270	
			15	—	85	170	
Propagation delay time (CLOCK-CARRY OUT)	t_{pLH} t_{pHL}	—	5	—	280	600	ns
			10	—	110	250	
			15	—	75	160	
Propagation delay time (RESET-Qn, RESET-CARRY OUT)	t_{pLH} t_{pHL}	—	5	—	265	530	ns
			10	—	115	230	
			15	—	85	170	
Max clock frequency	f_{CL}	—	5	2.5	6.0	—	MHz
			10	5.0	12.0	—	
			15	6.7	13.5	—	
Min clock pulse width	t_W	—	5	—	85	200	ns
			10	—	40	90	
			15	—	35	60	
Min pulse width (RESET)	t_{WH}	—	5	—	50	260	ns
			10	—	20	110	
			15	—	15	60	
Max clock rise time Max clock fall time	t_{rCL} t_{fCL}	—	5	No limit			μs
			10				
			15				
Min set-up time (CLOCK INHIBIT-CLOCK)	t_{SU}	—	5	—	30	230	ns
			10	—	15	100	
			15	—	10	70	
Min removal time (RESET-CLOCK)	t_{rem}	—	5	—	−55	400	ns
			10	—	−20	275	
			15	—	−15	150	
Input capacitance	C_{IN}	—		—	5	7.5	pF

Waveforms for Measurement of Dynamic Characteristics

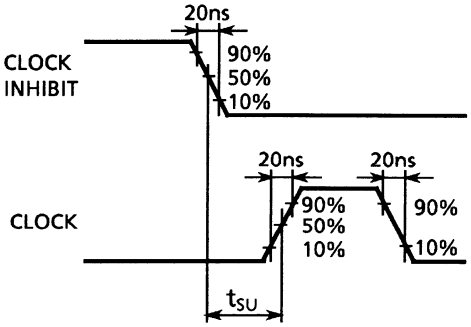
Waveform 1



Waveform 2

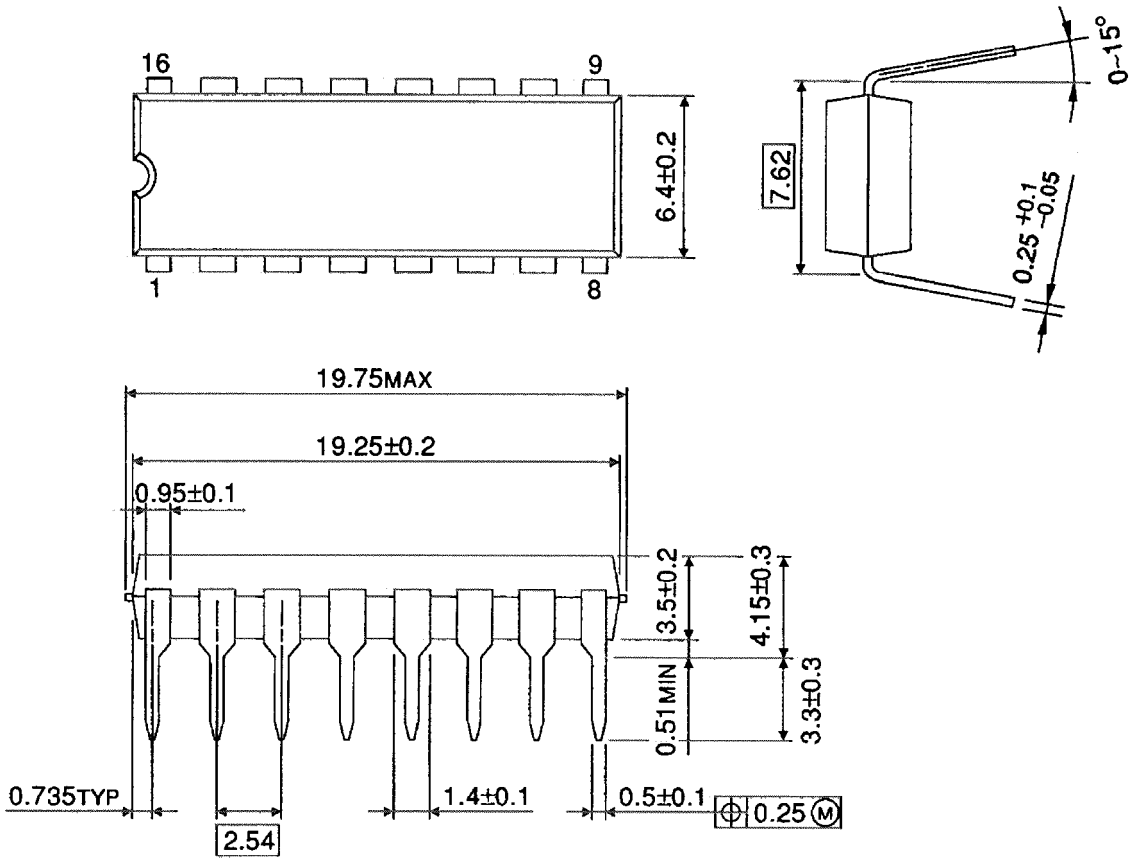


Waveform 3



Package Dimensions

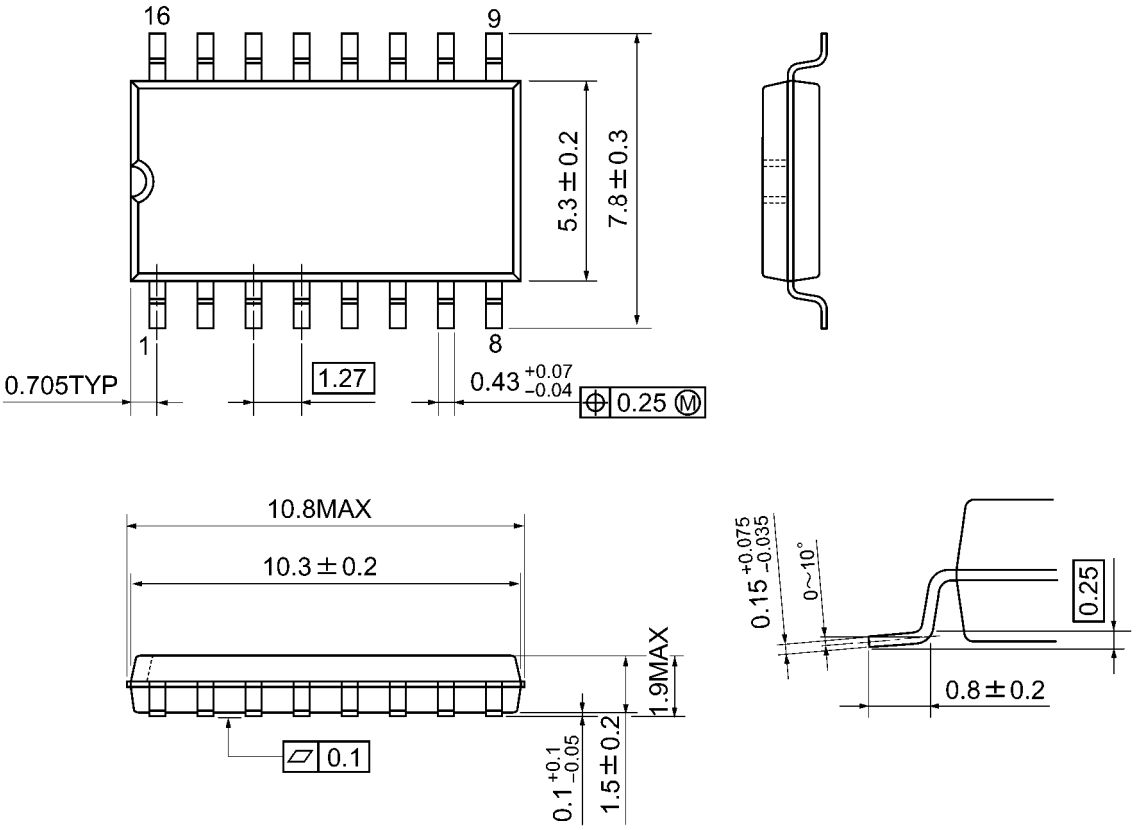
DIP16-P-300-2.54A Unit : mm



Weight: 1.00 g (typ.)

Package Dimensions

SOP16-P-300-1.27A Unit: mm



Weight: 0.18 g (typ.)

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