TOSHIBA CMOS Digital Integrated Circuit   Silicon Monolithic

TC4015BP,TC4015BF,TC4015BFN
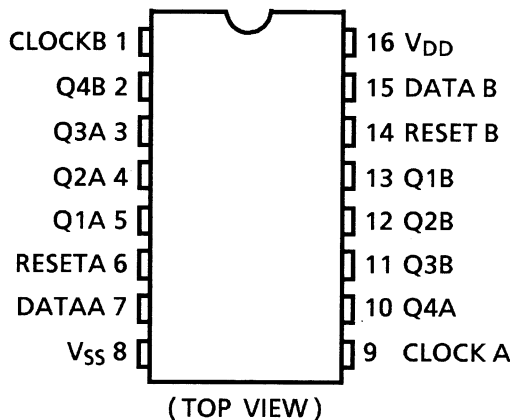
TC4015B Dual 4-Stage Static Shift Register
(with serial input/parallel output)

Note: xxxFN (JEDEC SOP) is not available in Japan.

   TC4015B contains two circuits of 4 stage shift registers and the independent output is drived from each stage. As all the D type flip-flops of every stage have common RESET input, asynchronous clear operation can be achieved by an external signal at arbitrary timing. The flip-flop of each stage is triggered by rising edge of CLOCK input.

   RESET input of "H" level resets the contents of all the stages to "L" regardless of CLOCK and DATA inputs and all of data outputs Q1 through Q4 become "L".

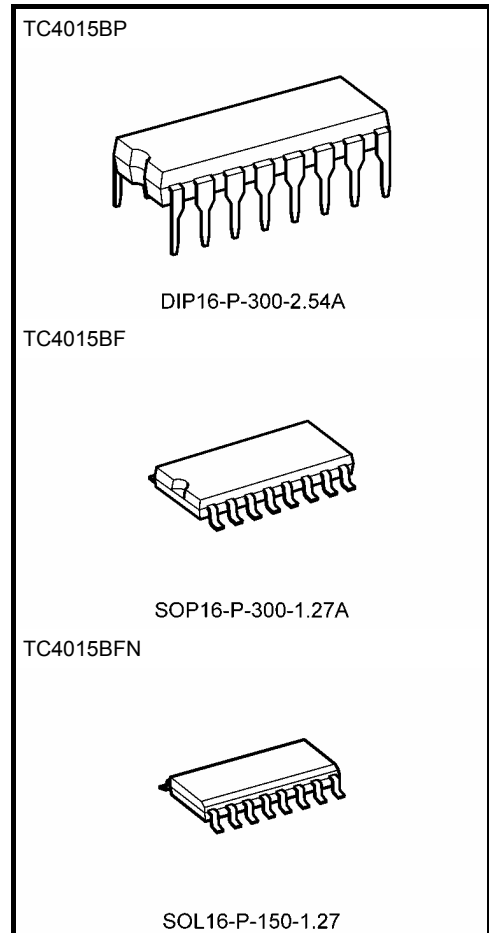   This can be used for converting serial data to palallel one and for ring counters of any numbering systems.

TC4015BP

DIP16-P-300-2.54A

TC4015BF

SOP16-P-300-1.27A

TC4015BFN

SOL16-P-150-1.27

Pin Assignment

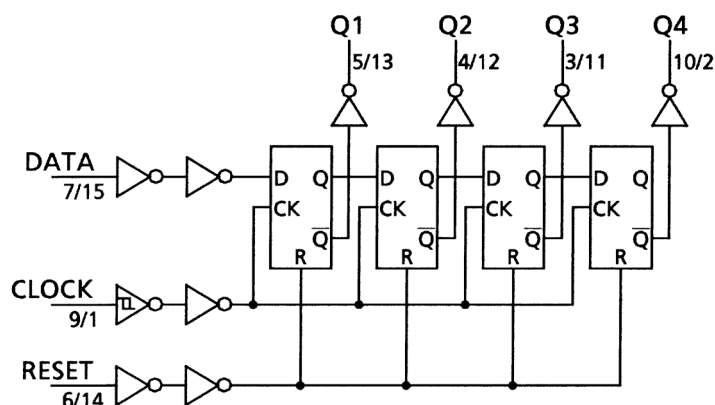| CLOCKB 1 | | 16 V$_{DD}$ |
Q4B 2		15 DATA B
Q3A 3		14 RESET B
Q2A 4		13 Q1B
Q1A 5		12 Q2B
RESETA 6		11 Q3B
DATAA 7		10 Q4A
V$_{SS}$ 8		9 CLOCK A

(TOP VIEW)

Weight
DIP16-P-300-2.54A   : 1.00 g (typ.)
SOP16-P-300-1.27A   : 0.18 g (typ.)
SOL16-P-150-1.27   : 0.13 g (typ.)

Truth Table

Inputs			Outputs			
CLOCK△	DATA	RESET	Q1	Q2	Q3	Q4
⌐	L	L	L	Q1	Q2	Q3
⌐	H	L	H	Q1	Q2	Q3
⌐	*	L	No Change			
*	*	H	L	L	L	L

△: Level change

*: Don't care

Logic Diagram

1/2 TC4015B

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 temperature range	T_{opr}	$-40 \sim 85$	°C
Storage temperature range	T_{stg}	$-65 \sim 150$	°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		Symbol	Test Condition	V_{DD} (V)	−40°C Min	−40°C Max	25°C Min	25°C Typ.	25°C Max	85°C Min	85°C Max	Unit
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 (CLOCK-Q)	t$_{pLH}$ t$_{pHL}$	—	5	—	130	320	ns
			10	—	60	160	
			15	—	50	120	
Propagation delay time (RESET-Q)	t$_{pHL}$	—	5	—	90	400	ns
			10	—	45	200	
			15	—	40	160	
Max clock frequency	f$_{CL}$	—	5	3.0	8	—	MHz
			10	6.0	17	—	
			15	8.5	20	—	
Min clock pulse width	t$_W$	—	5	—	35	180	ns
			10	—	25	80	
			15	—	20	50	
Min pulse width (RESET)	t$_{WH}$	—	5	—	50	200	ns
			10	—	25	80	
			15	—	20	60	
Min set-up time (DATA-CLOCK)	t$_{SU}$	—	5	—	8	70	ns
			10	—	4	40	
			15	—	0	30	
Min hold time (DATA-CLOCK)	t$_H$	—	5	—	6	60	ns
			10	—	5	30	
			15	—	4	20	
Min removal time (RESET-CLOCK)	t$_{rem}$	—	5	—	0	80	ns
			10	—	0	30	
			15	—	0	20	
Max clock input rise time Max clock input fall time	t$_{rCL}$ t$_{fCL}$	—	5 10 15	No limit			μs
Input capacitance	C$_{IN}$	—	—	—	5	7.5	pF

Waveforms for Measurement of Dynamic Characteristics

Waveform 1
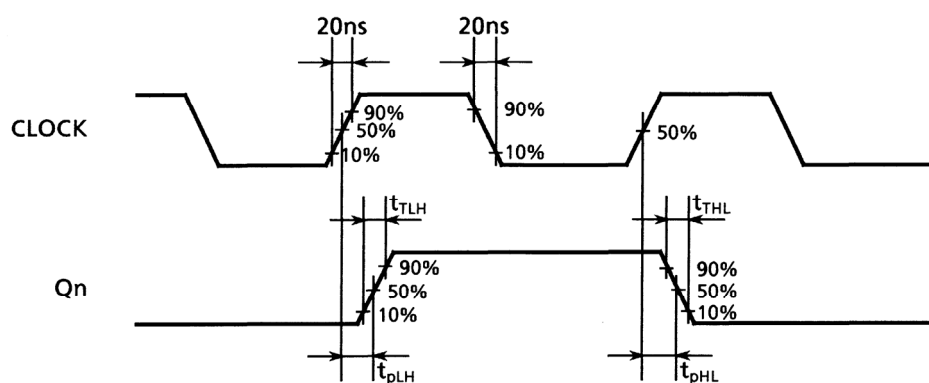
Waveform 2
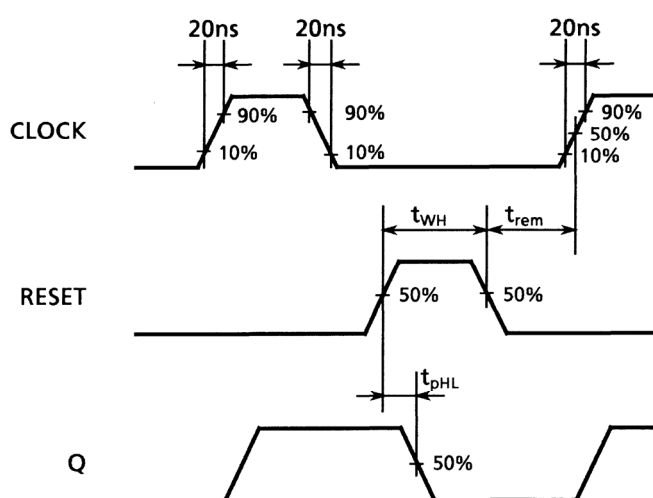
Waveform 3
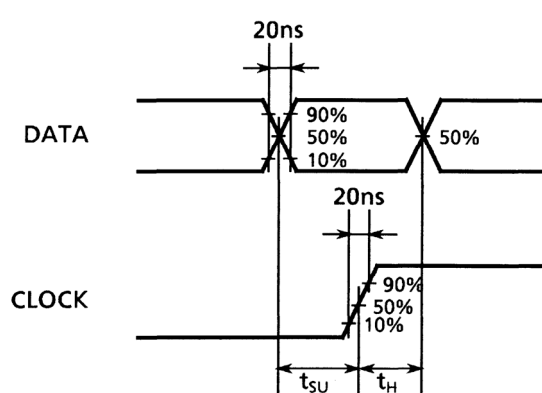
Package Dimensions

DIP16-P-300-2.54A   Unit : mm
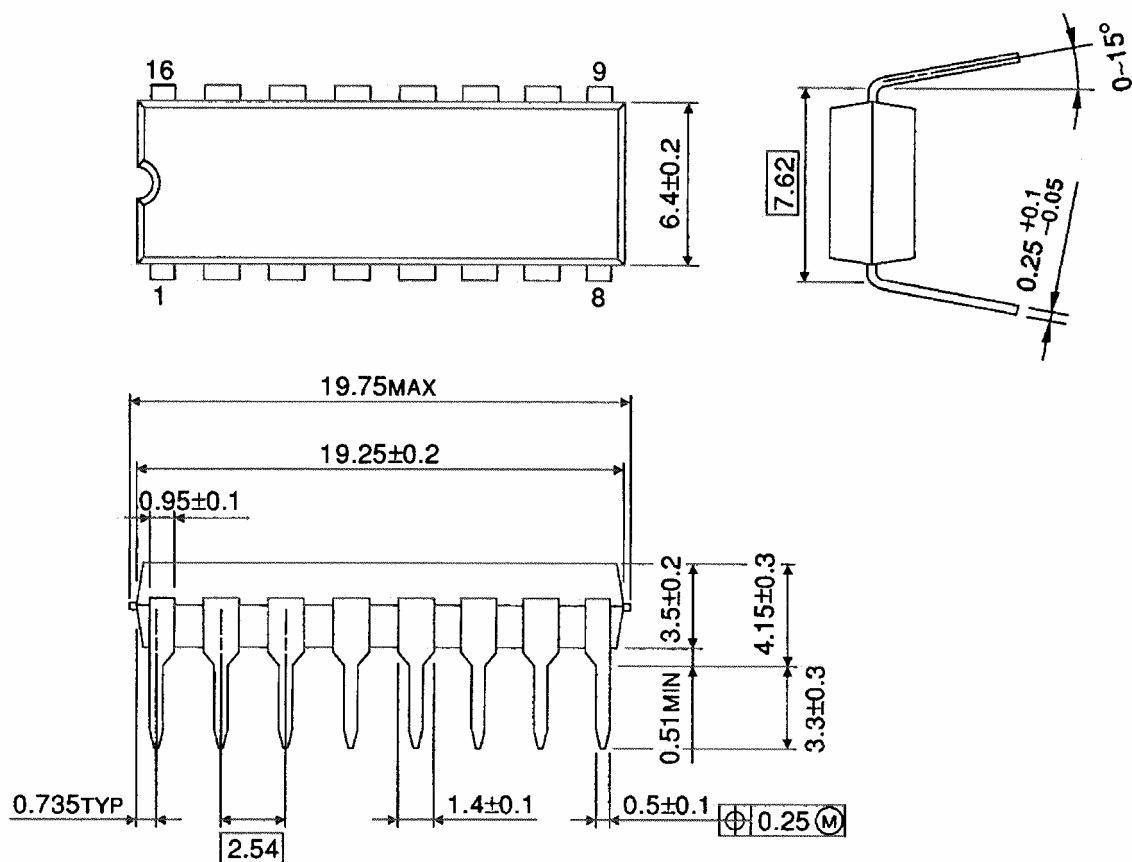
Weight: 1.00 g (typ.)

Package Dimensions

SOP16-P-300-1.27A   Unit: mm
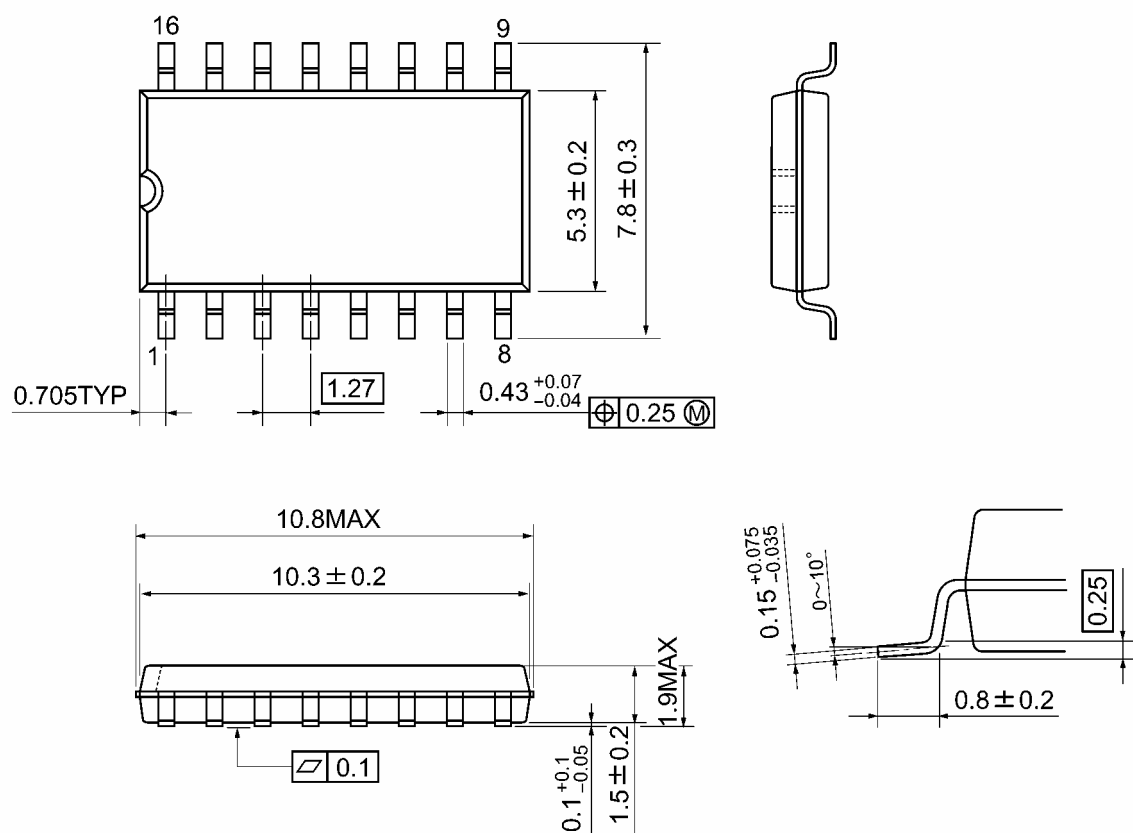
Weight: 0.18 g (typ.)

Package Dimensions (Note)

SOL16-P-150-1.27   Unit : mm

16   9

3.9±0.1   6.0±0.2

1   8

0.505TYP   0.42±0.07   ⊕ 0.25 Ⓜ

1.27

9.9±0.1   1.375±0.2   1.75MAX

0.1

0.175±0.075   0.15 +0.1/−0.05   45°

0~8°   0.7±0.3
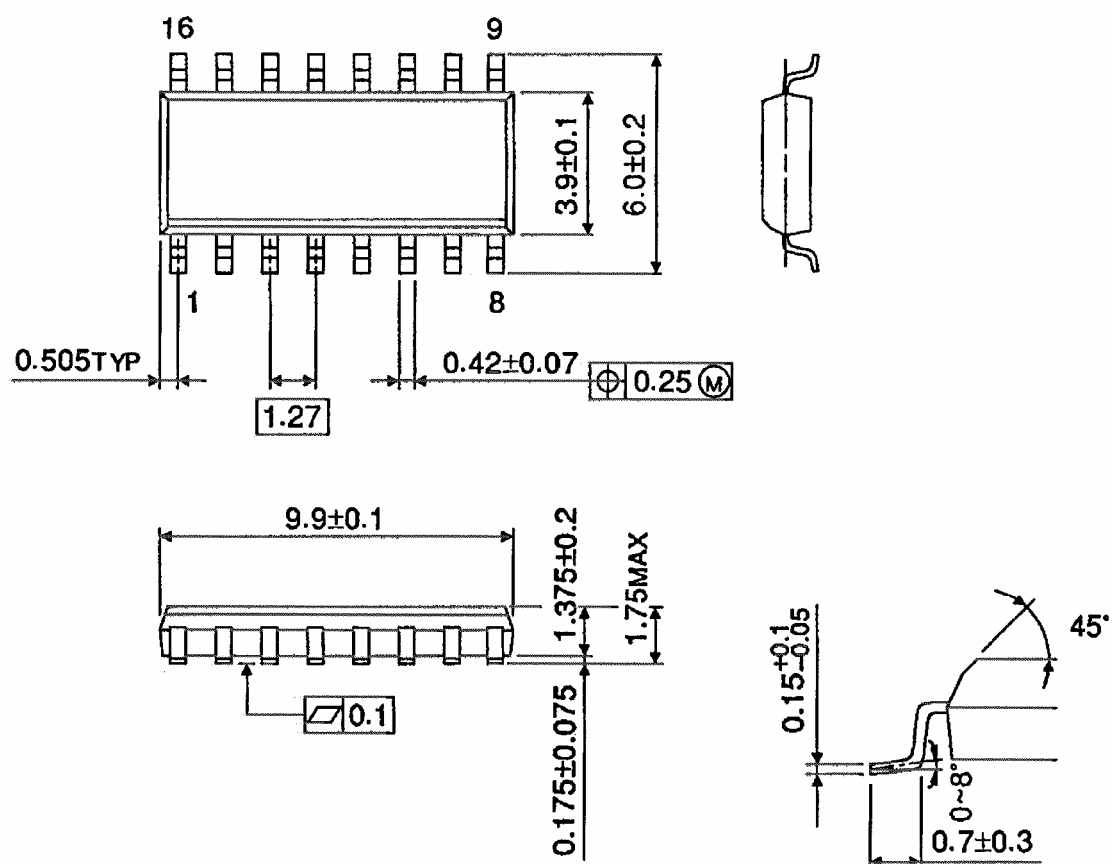
Note: This package is not available in Japan.

Weight: 0.13 g (typ.)

RESTRICTIONS ON PRODUCT USE