

TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

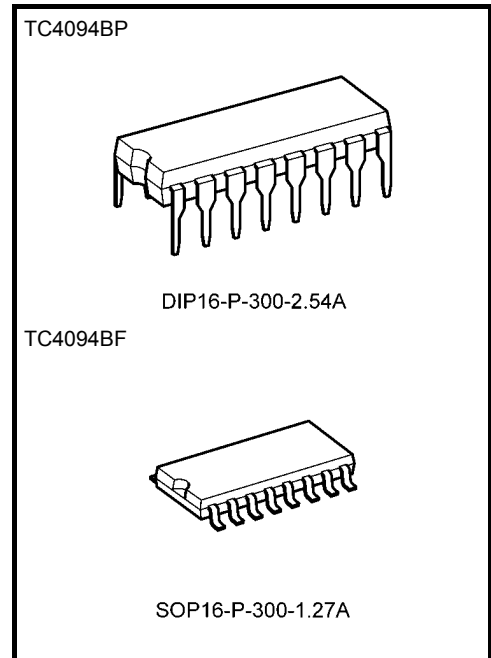
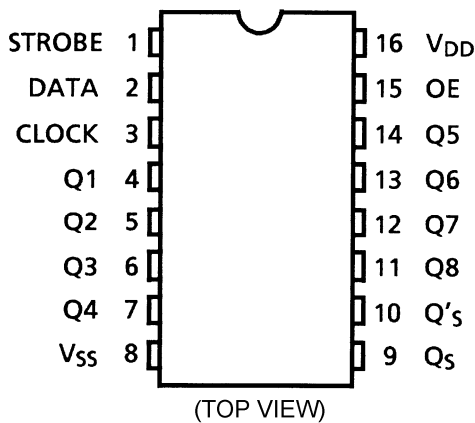
TC4094BP, TC4094BF

TC4094B 8-Stage Shift-and-Store Bus-Register

TC4094B is a SHIFT and STORE REGISTER that consists of an 8-bit shift register and an 8-bit latch. The read data in the shift register can be taken in the latch through the asynchronous STROBE input; therefore, the data transfer mode can hold output. And, since the parallel outputs is of 3-state construction, it can be directly connected to the 8-bit busline.

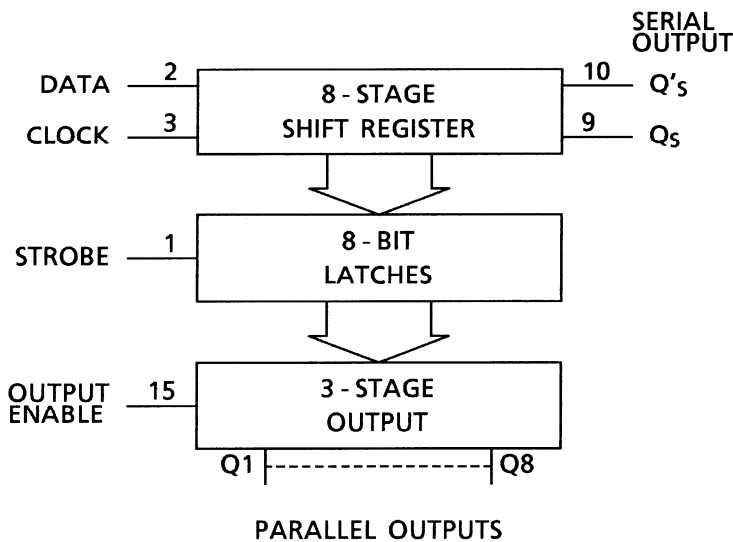
This register can be applied to Serial-to-parallel conversion, data receivers, etc.

Pin Assignment



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

Block Diagram



Start of commercial production
1978-12

Truth Table

CL	OE	ST	D	PO		SO	
				Q1	Qn	Qs	Q's
	H	H	L	L	Qn - 1	Q7	NC
	H	H	H	H	Qn - 1	Q7	NC
	H	L	X	NC	NC	Q7	NC
	L	X	X	HZ	HZ	Q7	NC
	H	X	X	NC	NC	NC	Qs
	L	X	X	HZ	HZ	NC	Qs

CL = Clock

X = Don't care

OE = Output enable

NC = No change

ST = Strobe

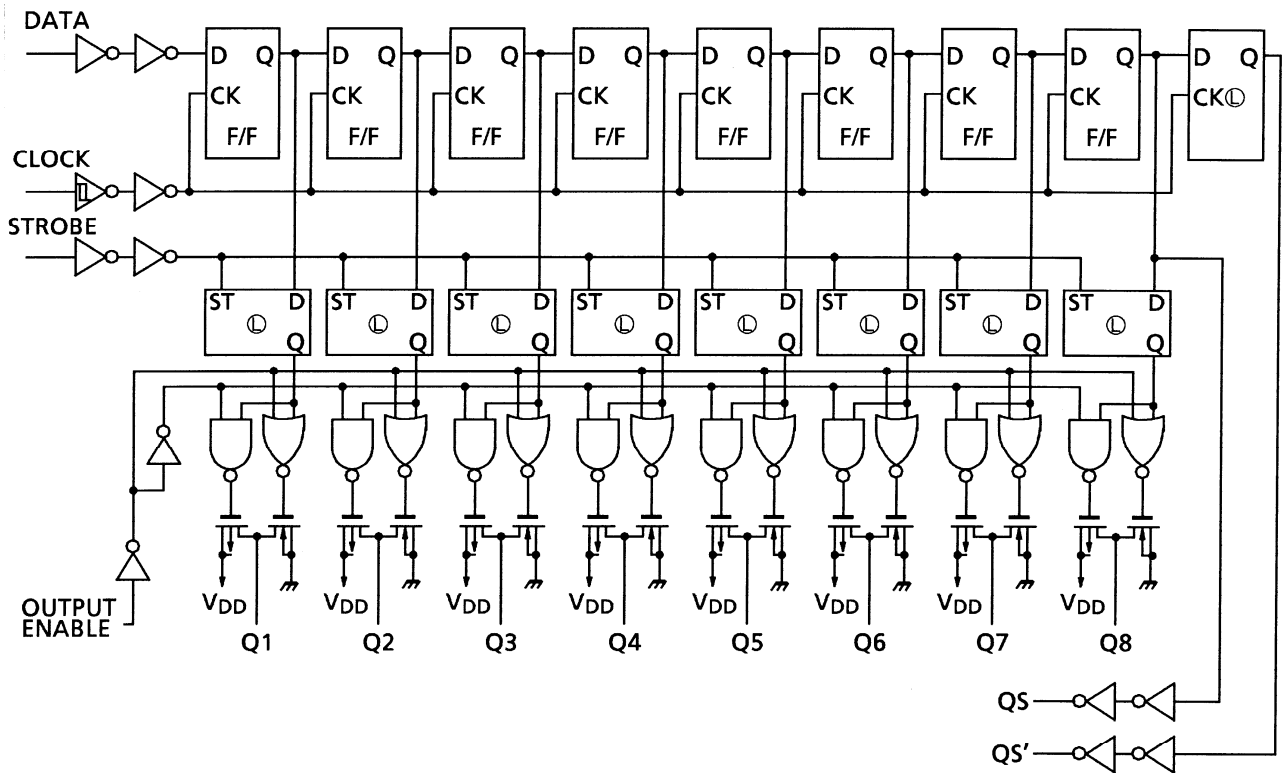
HZ = High impedance

D = Data

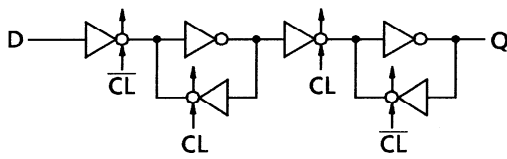
PO = Parallel outputs

SO = Serial outputs

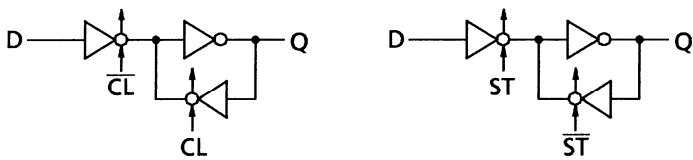
Logic Diagram



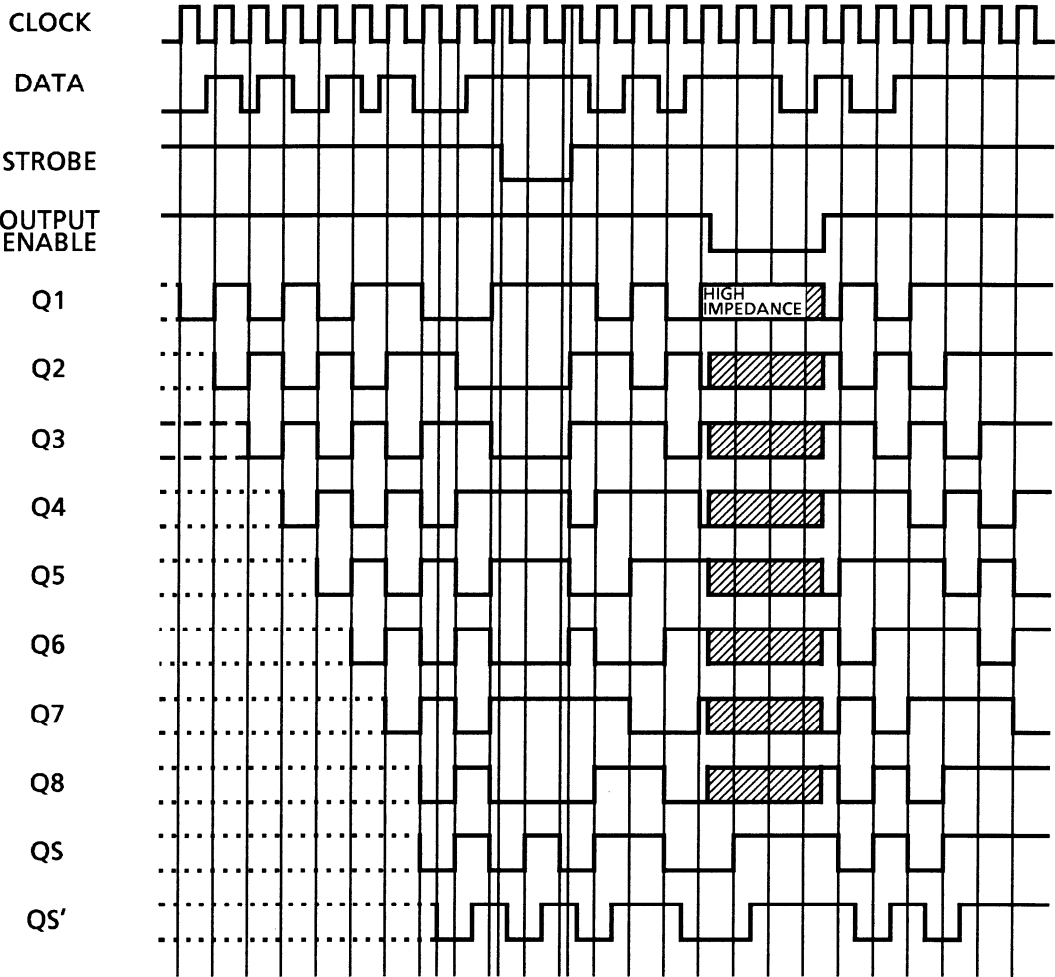
F/F



LATCH



Timing Chart



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	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	1.2	—	0.42	—	mA	
			10	1.50	—	1.30	3.2	—	1.10	—		
			15	4.00	—	3.40	12.0	—	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	
3-state output leakage current	"H" level	I _{DH}	V _{out} = 18 V	18	—	0.4	—	10 ⁻⁴	0.4	—	12	μA
	"L" level	I _{DL}	V _{out} = 0 V	18	—	-0.4	—	-10 ⁻⁴	-0.4	—	-12	
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.

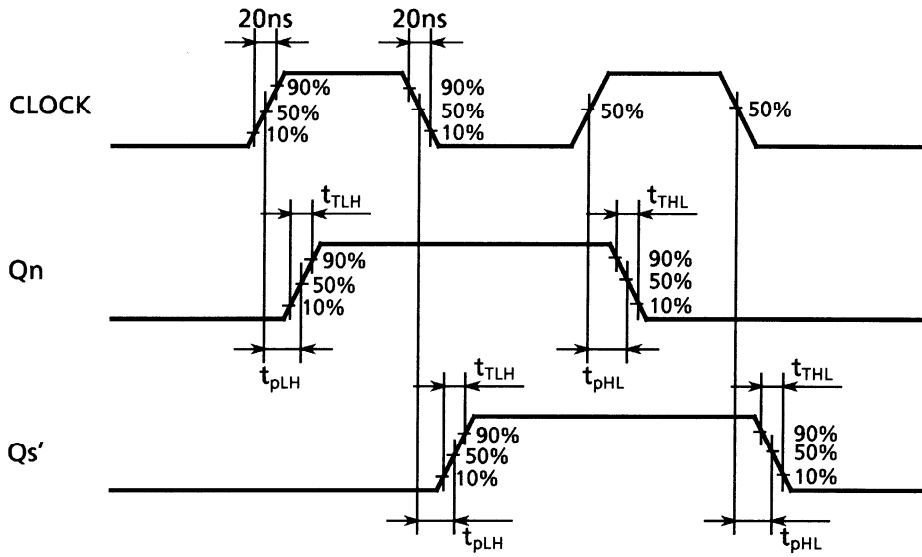
Dynamic Electrical Characteristics (Ta = 25°C, VSS = 0 V, CL = 50 pF)

Characteristics	Symbol	Test Condition	VDD (V)	Min	Typ.	Max	Unit
Output transition time (low to high)	t _{TLH}	—	5	—	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 _S)	t _{pLH} t _{pHL}	—	5	—	150	600	ns
			10	—	75	250	
			15	—	55	190	
Propagation delay time (CLOCK-Q _S ')	t _{pLH} t _{pHL}	—	5	—	155	460	ns
			10	—	75	220	
			15	—	55	150	
Propagation delay time (CLOCK-Q _n)	t _{pLH} t _{pHL}	—	5	—	190	840	ns
			10	—	90	390	
			15	—	65	270	
Propagation delay time (STROBE-Q _n)	t _{pLH} t _{pHL}	—	5	—	150	580	ns
			10	—	70	290	
			15	—	50	200	
Three state disable time (OUTPUT ENABLE-Q _n)	t _{PHZ} t _{PZH}	R _L = 1 kΩ	5	—	60	200	ns
			10	—	35	100	
			15	—	30	80	
Three state disable time (OUTPUT ENABLE-Q _n)	t _{PLZ} t _{PZL}	R _L = 1 kΩ	5	—	70	200	ns
			10	—	40	100	
			15	—	35	80	
Min clock pulse width	t _w	—	5	—	45	200	ns
			10	—	20	100	
			15	—	15	80	
Min pulse width (STROBE)	t _{WH}	—	5	—	40	200	ns
			10	—	20	80	
			15	—	15	70	
Max clock frequency	f _{CL}	—	5	1.25	6	—	MHz
			10	2.50	12	—	
			15	3.00	16	—	
Min set-up time (DATA-CLOCK)	t _{SU}	—	5	—	0	120	ns
			10	—	0	55	
			15	—	0	35	
Min hold time (DATA-CLOCK)	t _H	—	5	—	10	40	ns
			10	—	10	20	
			15	—	5	15	
Min set-up time (CLOCK-STROBE)	t _{SU}	—	5	—	90	200	ns
			10	—	40	100	
			15	—	30	80	

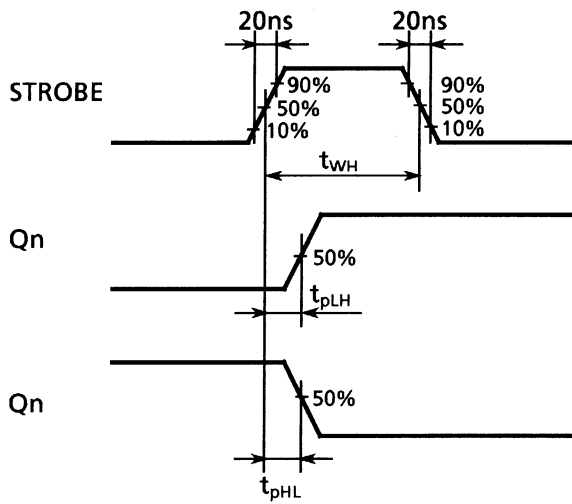
Characteristics	Symbol	Test Condition	V _{DD} (V)	Min	Typ.	Max	Unit
Min hold time (CLOCK-STROBE)	t _H	—	5	—	—	0	ns
			10	—	—	0	
			15	—	—	0	
Max clock input rise time	t _{rCL}	—	5	No limit			μs
Max clock input fall time	t _{fCL}		10				
			15				
Input capacitance	C _{IN}	—		—	5	7.5	pF

Waveforms for Measurement of Dynamic Characteristics

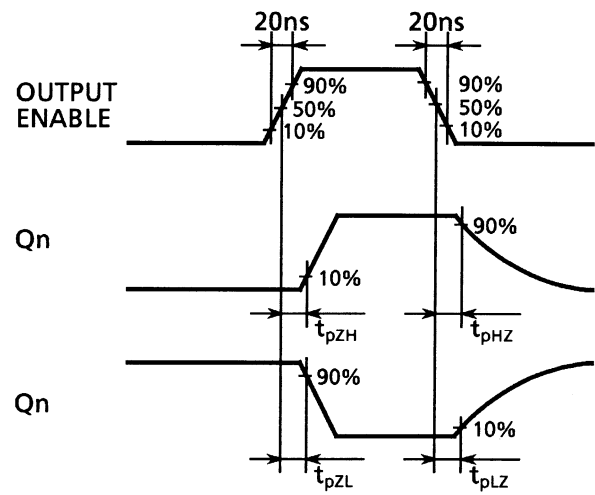
Waveform 1



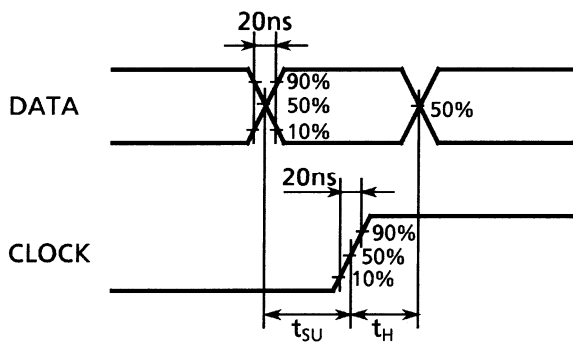
Waveform 2



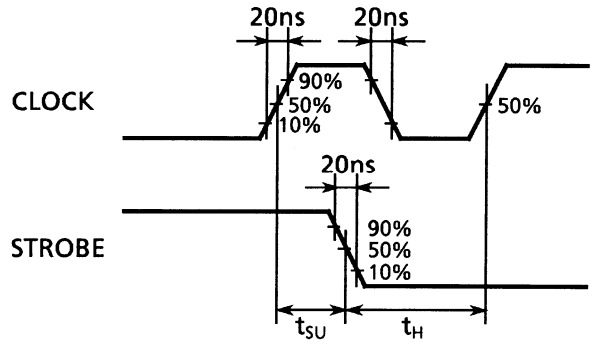
Waveform 3



Waveform 4



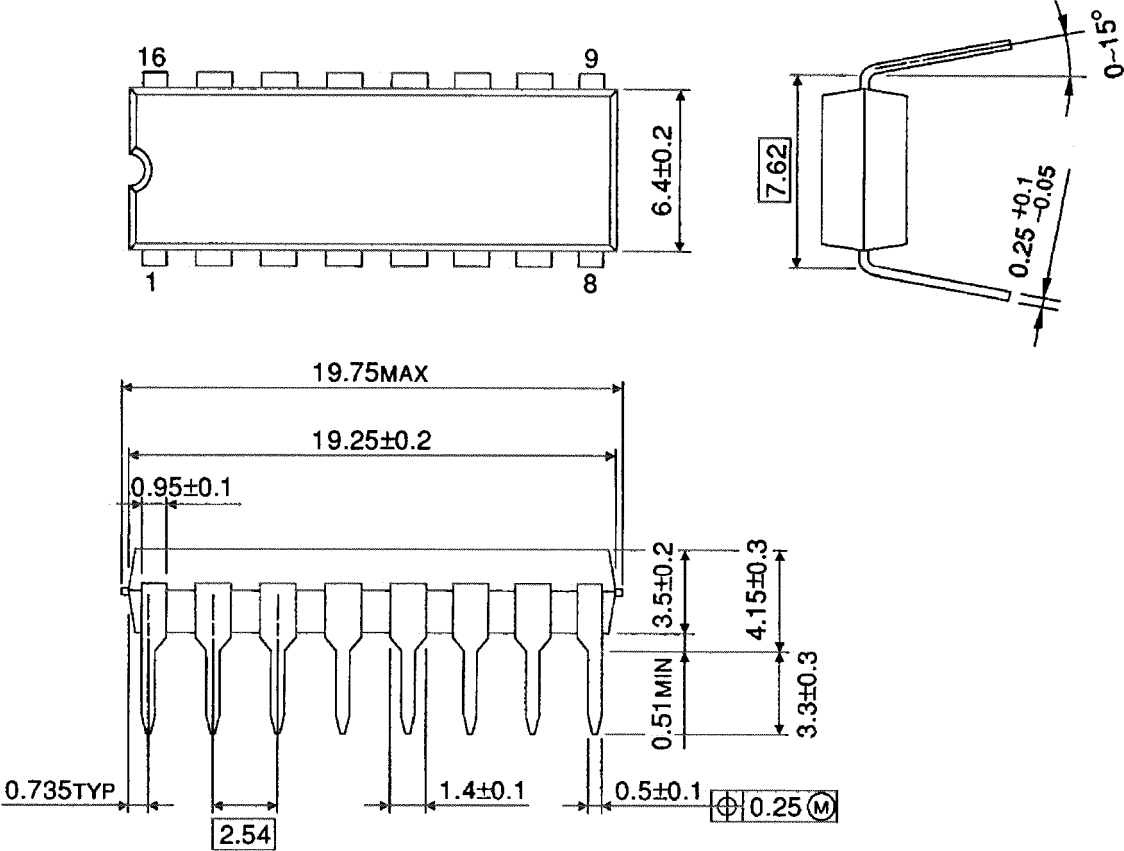
Waveform 5



Package Dimensions

DIP16-P-300-2.54A

Unit : mm

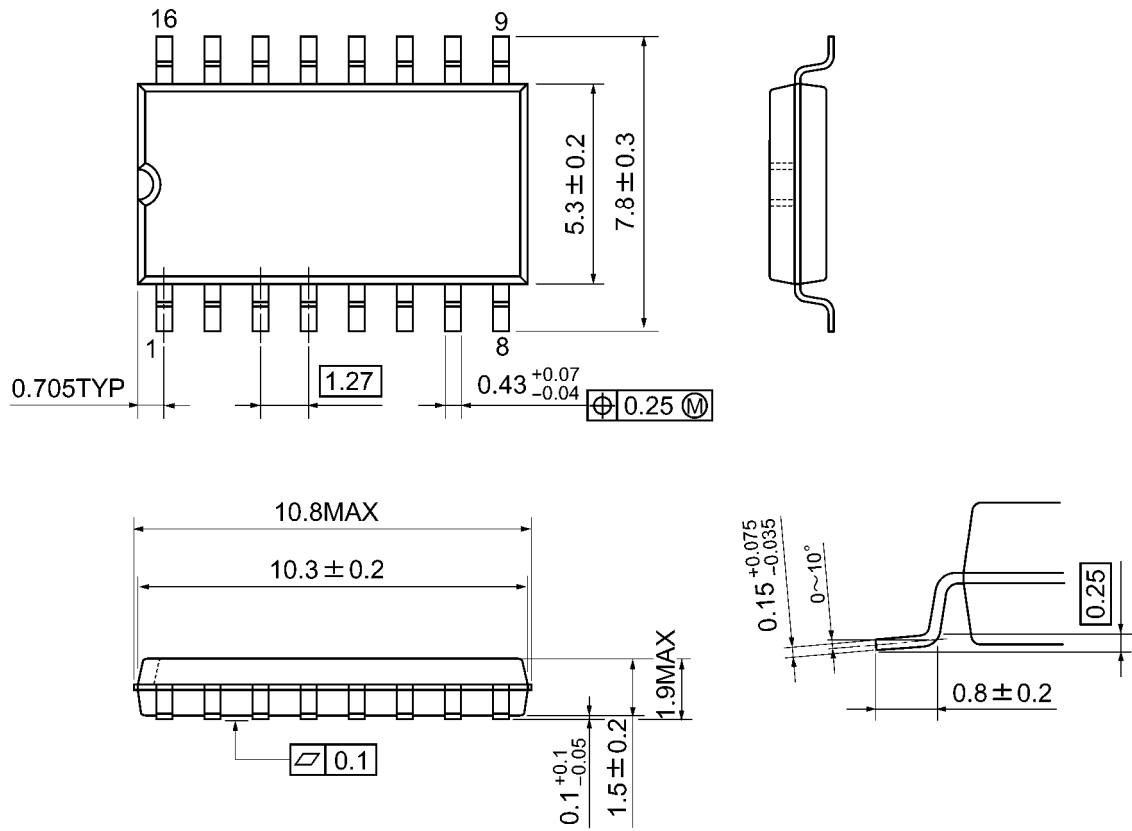


Weight: 1.00 g (typ.)

Package Dimensions

SOP16-P-300-1.27A

Unit: mm



Weight: 0.18 g (typ.)

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