

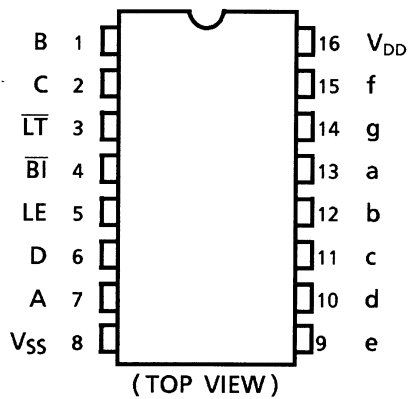
TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

TC4511BP, TC4511BF

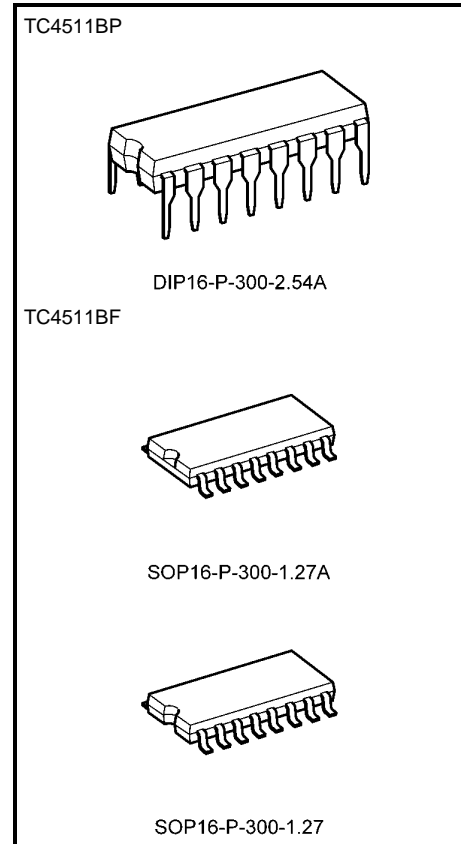
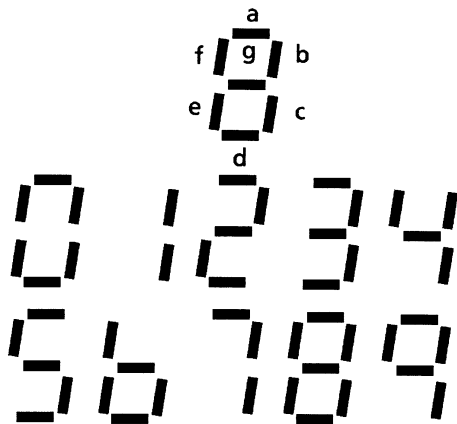
TC4511B BCD-to-Seven Segment Latch/Decoder/Driver

TC4511B is decoder which converts the input of BCD code into the 7 segment display element driving signal and the output has complementary connection of NPN bipolar transistor and N-channel MOS FET. Therefore, not only capability of directly driving cathode common type LED, this has capability of driving various display elements with simple interface circuits. \overline{LT} input and \overline{BI} input are to force all the outputs to be "H" (illuminated) and "L" (not illuminated) respectively regardless of BCD input. As the latch controlled by common LE input is inserted in each of four input lines, static display of dynamic information can be achieved. When an invalid BCD input, "10" or higher is applied, all the outputs become "L" (not illuminated).

Pin Assignment



Display



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

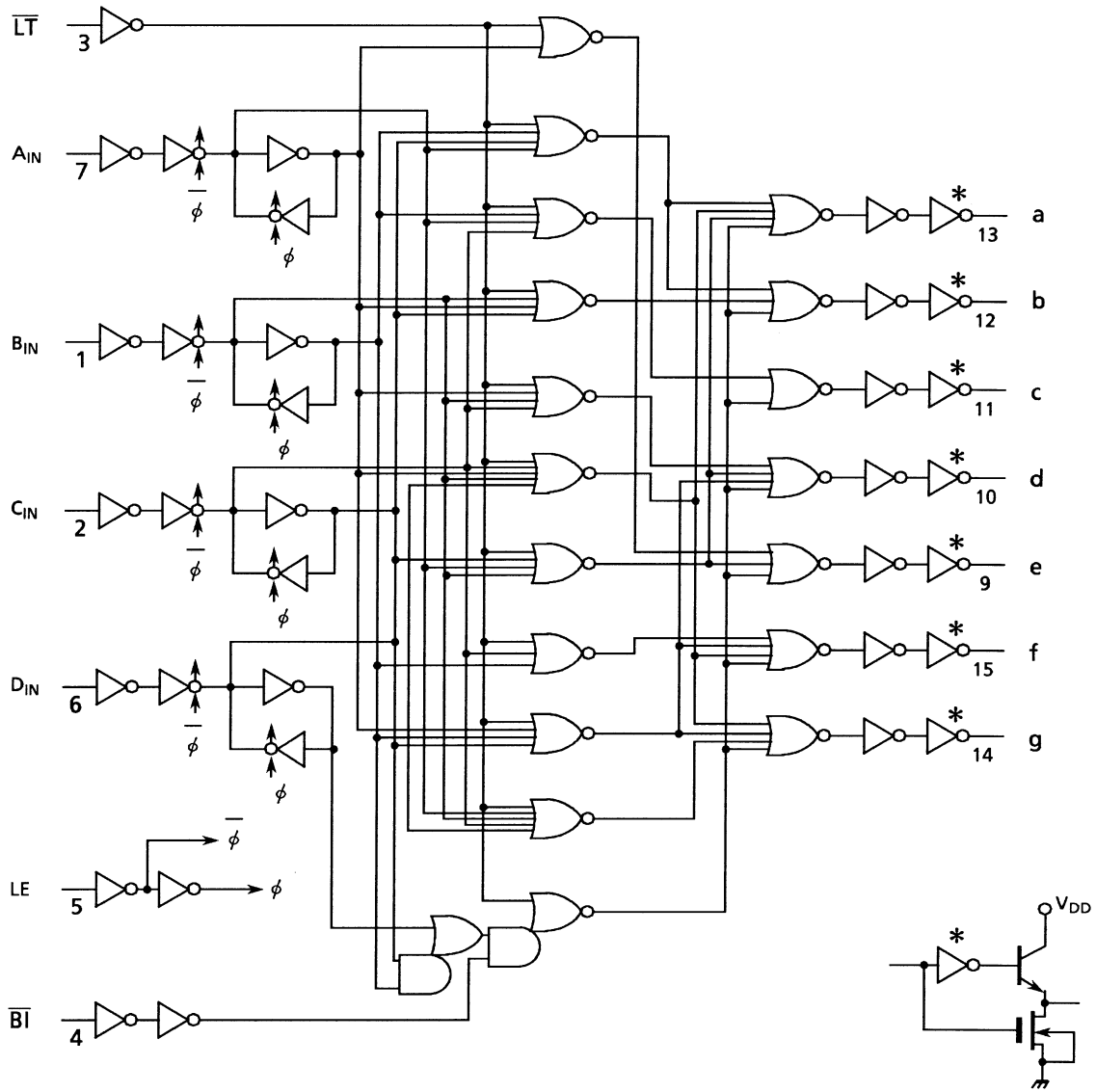
Truth Table

Inputs							Outputs							Display Mode
LE	$\overline{\text{BI}}$	$\overline{\text{LT}}$	D	C	B	A	a	b	c	d	e	f	g	
*	*	L	*	*	*	*	H	H	H	H	H	H	H	8
*	L	H	*	*	*	*	L	L	L	L	L	L	L	Blank
L	H	H	L	L	L	L	H	H	H	H	H	H	L	0
L	H	H	L	L	L	H	L	H	H	L	L	L	L	1
L	H	H	L	L	H	L	H	H	L	H	H	L	H	2
L	H	H	L	L	H	H	H	H	H	H	L	L	H	3
L	H	H	L	H	L	L	L	H	H	L	L	H	H	4
L	H	H	L	H	L	H	H	L	H	H	L	H	H	5
L	H	H	L	H	H	L	L	L	H	H	H	H	H	6
L	H	H	L	H	H	H	H	H	H	L	L	L	L	7
L	H	H	H	L	L	L	H	H	H	H	H	H	H	8
L	H	H	H	L	L	H	H	H	H	L	L	H	H	9
L	H	H	H	L	H	L	L	L	L	L	L	L	L	Blank
L	H	H	H	L	H	H	L	L	L	L	L	L	L	Blank
L	H	H	H	H	*	*	L	L	L	L	L	L	L	Blank
H	H	H	*	*	*	*	ΔΔ							

*: Don't care

ΔΔ: Depends upon the BCD code previously applied when LE "L"

Logic Diagram



Absolute Maximum Ratings (Note)

Characteristics	Symbol	Rating	Unit
DC supply voltage	V_{DD}	$V_{SS} - 0.5 - V_{SS} + 20$	V
Input voltage	V_{IN}	$V_{SS} - 0.5 - V_{DD} + 0.5$	V
Output voltage	V_{OUT}	$V_{SS} - 0.5 - V_{DD} + 0.5$	V
DC input current	I_{IN}	± 10	mA
Output high current	I_{OH}	-50	mA
Power dissipation	P_D	300 (DIP)/180 (SOIC)	mW
Operating 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.

Recommended Operating Conditions ($V_{SS} = 0$ 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 recommended operating conditions are required to ensure the normal operation of the device. Unused inputs must be tied to either VCC or GND.

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	4.1	—	4.1	4.41	—	4.2	—	V			
			10	9.1	—	9.1	9.41	—	9.2	—				
			15	14.1	—	14.1	14.41	—	14.2	—				
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 voltage	V _{OH}	I _{OH} = 0 mA I _{OH} = 10 mA I _{OH} = 20 mA V _{IN} = V _{DD} , V _{SS}	5	4.10	—	4.10	4.41	—	4.20	—	V			
				3.90	—	3.90	4.25	—	3.90	—				
				3.55	—	3.55	4.19	—	3.30	—				
		I _{OH} = 0 mA I _{OH} = 10 mA I _{OH} = 20 mA V _{IN} = V _{DD} , V _{SS}	10	9.10	—	9.10	9.41	—	9.20	—				
				9.00	—	9.00	9.25	—	9.00	—				
				8.70	—	8.70	9.20	—	8.40	—				
		I _{OH} = 0 mA I _{OH} = 10 mA I _{OH} = 20 mA V _{IN} = V _{DD} , V _{SS}	15	14.10	—	14.10	14.41	—	14.20	—				
				14.00	—	14.00	14.26	—	14.00	—				
				13.75	—	13.75	14.21	—	13.50	—				
		Output low voltage	I _{OL}	V _{OUT} = 0.4 V	5	0.61	—	0.51	1.2	—		0.42	—	mA
				V _{OUT} = 0.5 V	10	1.5	—	1.3	3.2	—		1.1	—	
				V _{OUT} = 1.5 V	15	4.0	—	3.4	12.0	—		2.8	—	
V _{IN} = V _{DD} , V _{SS}														
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	—	4.5	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	—	0.3	—	10 ⁻⁵	0.3	—	1.0	μA		
	"L" level	I _{IL}	V _{IL} = 0 V	18	—	-0.3	—	-10 ⁻⁵	-0.3	—	-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				

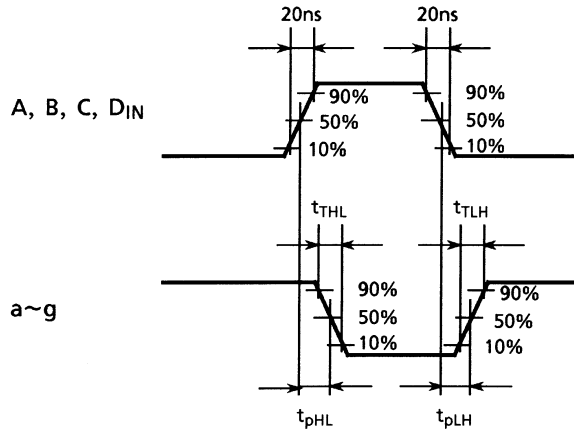
Note: All valid input combinations.

Dynamic Electrical Characteristics (Ta = 25°C, VSS = 0 V, CL = 50 pF, RL = 10 kΩ)

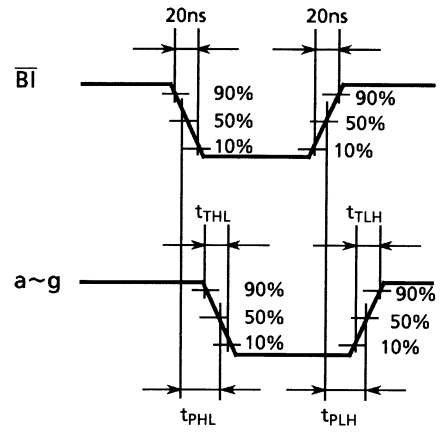
Characteristics	Symbol	Test Condition	VDD (V)	Min	Typ.	Max	Unit
Output transition time (low to high)	t _{TLH}	—	5	—	25	80	ns
			10	—	15	60	
			15	—	15	50	
Output transition time (high to low)	t _{THL}	—	5	—	70	200	ns
			10	—	35	100	
			15	—	30	80	
Propagation delay time (DATA-OUT)	t _{pLH}	—	5	—	200	1040	ns
			10	—	90	420	
			15	—	65	300	
Propagation delay time (DATA-OUT)	t _{pHL}	—	5	—	230	1040	ns
			10	—	110	420	
			15	—	80	300	
Propagation delay time ($\overline{\text{BI}}$ -OUT)	t _{pLH}	—	5	—	75	640	ns
			10	—	45	260	
			15	—	35	200	
Propagation delay time ($\overline{\text{BI}}$ -OUT)	t _{pHL}	—	5	—	90	640	ns
			10	—	50	260	
			15	—	45	200	
Propagation delay time ($\overline{\text{LT}}$ -OUT)	t _{pLH}	—	5	—	60	300	ns
			10	—	40	150	
			15	—	35	100	
Propagation delay time ($\overline{\text{LT}}$ -OUT)	t _{pHL}	—	5	—	75	300	ns
			10	—	45	150	
			15	—	35	100	
Propagation delay time (LE-OUT)	t _{pLH}	—	5	—	180	600	ns
			10	—	90	300	
			15	—	65	250	
Propagation delay time (LE-OUT)	t _{pHL}	—	5	—	230	600	ns
			10	—	110	300	
			15	—	85	250	
Min pulse time (LE)	t _{WL}	—	5	—	40	300	ns
			10	—	20	150	
			15	—	15	120	
Min set-up time (DATA-LE)	t _{SU}	—	5	—	35	150	ns
			10	—	15	70	
			15	—	10	40	
Min hold time (DATA-LE)	t _H	—	5	—	—	0	ns
			10	—	—	0	
			15	—	—	0	
Input capacitance	C _{IN}	—	—	—	5	7.5	pF

Waveform for Measurement of Dynamic Characteristics

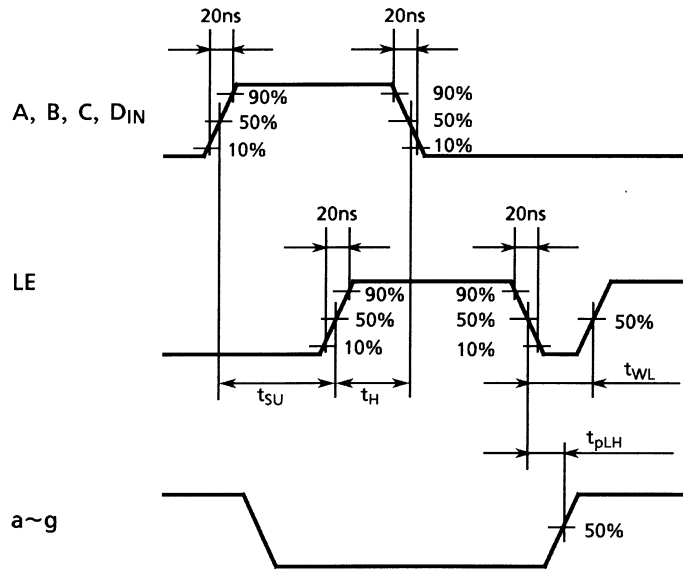
Waveform 1



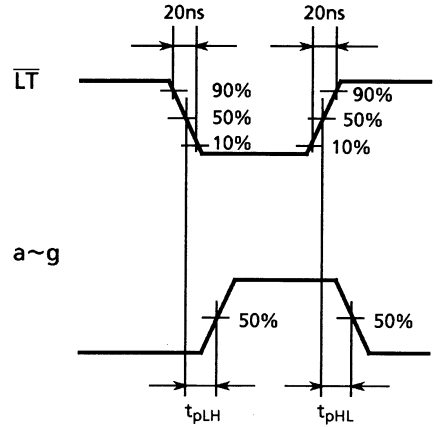
Waveform 2



Waveform 3



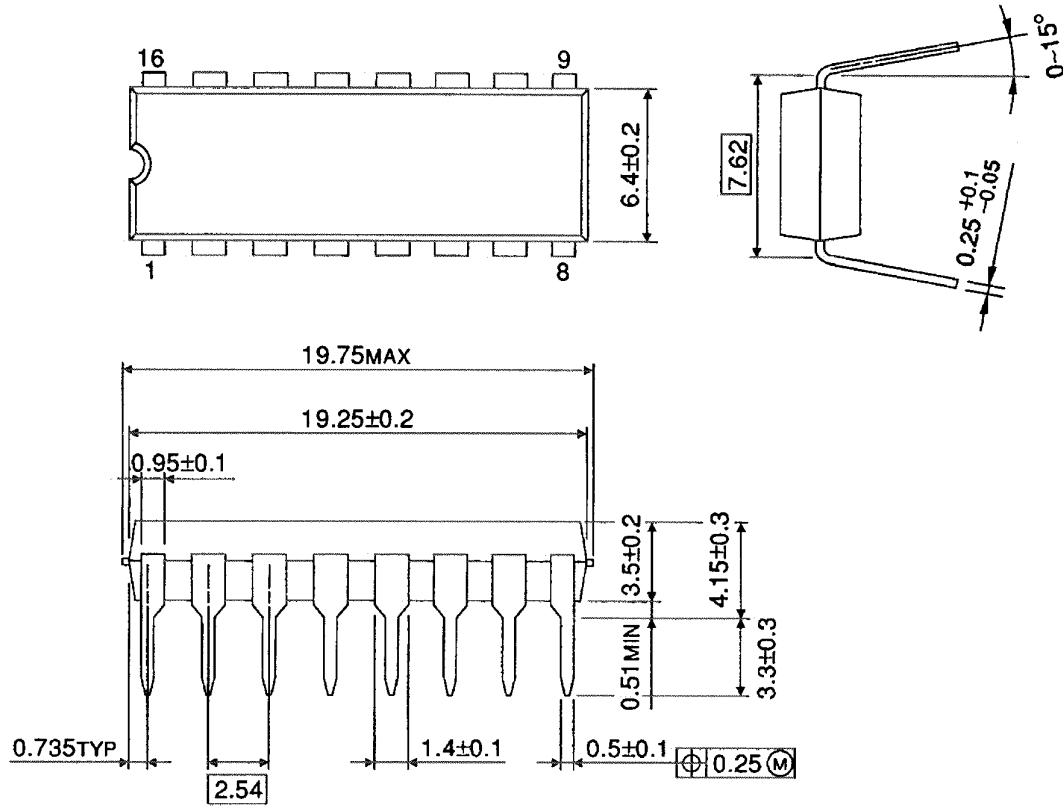
Waveform 4



Package Dimensions

DIP16-P-300-2.54A

Unit : mm

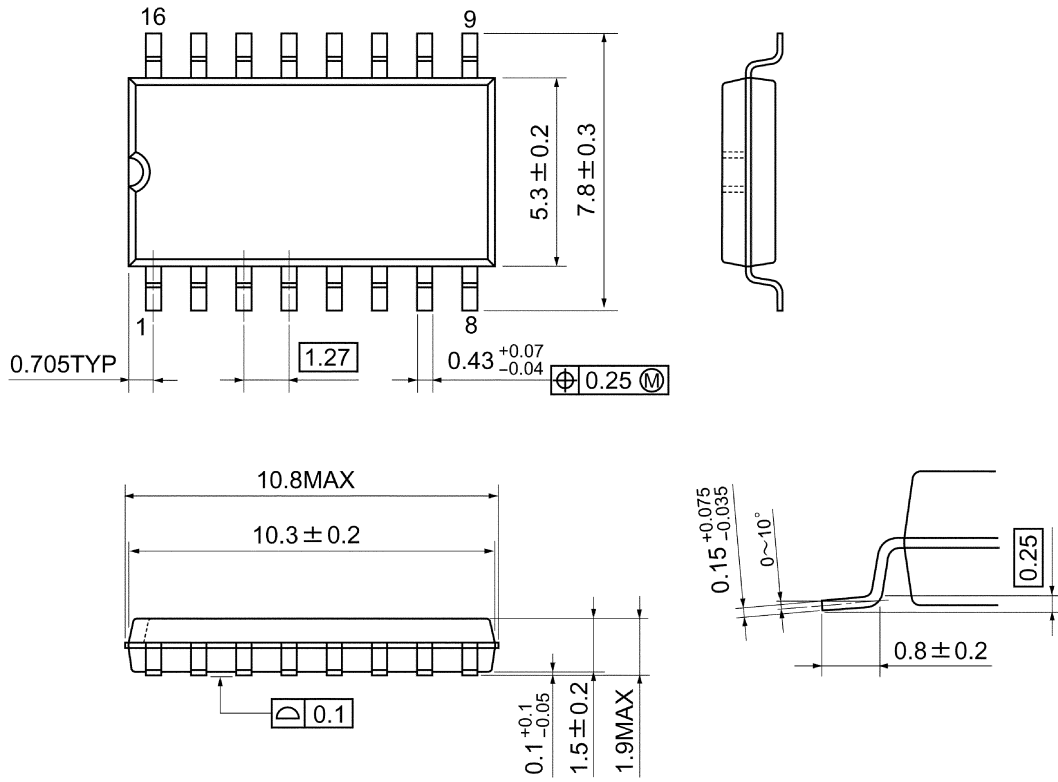


Weight: 1.00 g (typ.)

Package Dimensions

SOP16-P-300-1.27A

Unit: mm

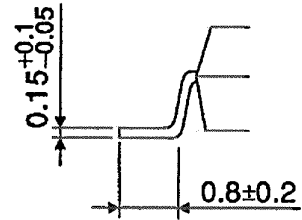
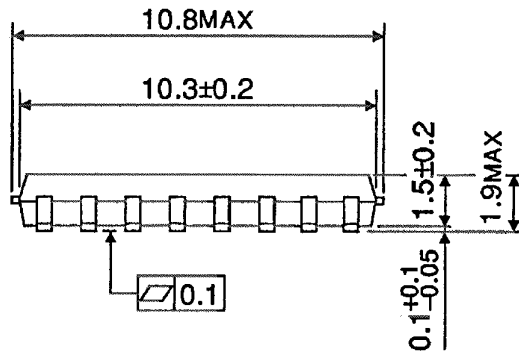
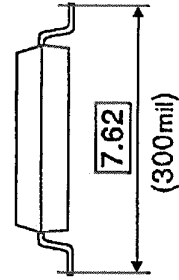
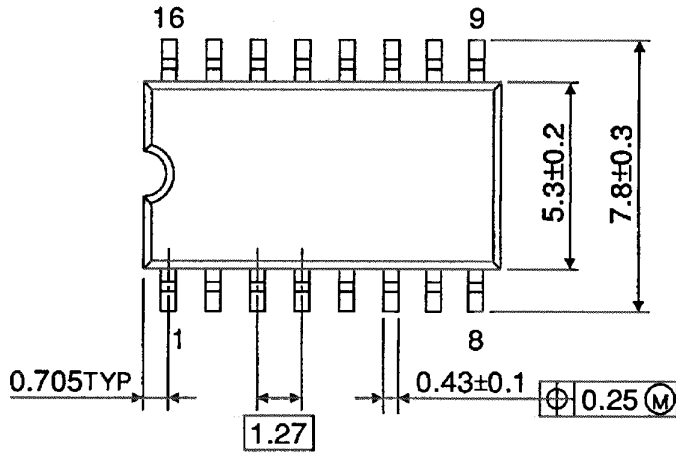


Weight: 0.18 g (typ.)

Package Dimensions

SOP16-P-300-1.27

Unit : mm



Weight: 0.18 g (typ.)

Note: Lead (Pb)-Free Packages**DIP16-P-300-2.54A SOP16-P-300-1.27A****RESTRICTIONS ON PRODUCT USE**

060116EBA

- The information contained herein is subject to change without notice. 021023_D
- TOSHIBA is continually working to improve the quality and reliability of its products. Nevertheless, semiconductor devices in general can malfunction or fail due to their inherent electrical sensitivity and vulnerability to physical stress. It is the responsibility of the buyer, when utilizing TOSHIBA products, to comply with the standards of safety in making a safe design for the entire system, and to avoid situations in which a malfunction or failure of such TOSHIBA products could cause loss of human life, bodily injury or damage to property.
In developing your designs, please ensure that TOSHIBA products are used within specified operating ranges as set forth in the most recent TOSHIBA products specifications. Also, please keep in mind the precautions and conditions set forth in the "Handling Guide for Semiconductor Devices," or "TOSHIBA Semiconductor Reliability Handbook" etc. 021023_A
- The TOSHIBA products listed in this document are intended for usage in general electronics applications (computer, personal equipment, office equipment, measuring equipment, industrial robotics, domestic appliances, etc.). These TOSHIBA products are neither intended nor warranted for usage in equipment that requires extraordinarily high quality and/or reliability or a malfunction or failure of which may cause loss of human life or bodily injury ("Unintended Usage"). Unintended Usage include atomic energy control instruments, airplane or spaceship instruments, transportation instruments, traffic signal instruments, combustion control instruments, medical instruments, all types of safety devices, etc. Unintended Usage of TOSHIBA products listed in this document shall be made at the customer's own risk. 021023_B
- The products described in this document shall not be used or embedded to any downstream products of which manufacture, use and/or sale are prohibited under any applicable laws and regulations. 060106_Q
- The information contained herein is presented only as a guide for the applications of our products. No responsibility is assumed by TOSHIBA for any infringements of patents or other rights of the third parties which may result from its use. No license is granted by implication or otherwise under any patent or patent rights of TOSHIBA or others. 021023_C
- The products described in this document are subject to the foreign exchange and foreign trade laws. 021023_E