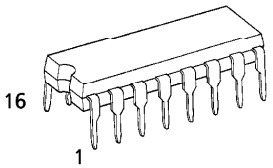
TOSHIBA CMOS DIGITAL INTEGRATED CIRCUIT SILICON MONOLITHIC

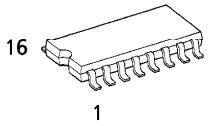
TC4511BP, TC4511BF

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).



P (DIP16-P-300-2.54A)
Weight : 1.00g (Typ.)

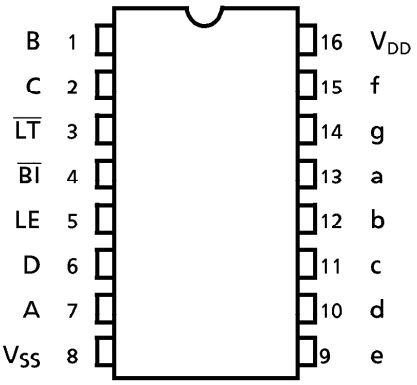


F (SOP16-P-300-1.27)
Weight : 0.18g (Typ.)

MAXIMUM RATINGS

CHARACTERISTIC	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
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

PIN ASSIGNMENT



(TOP VIEW)

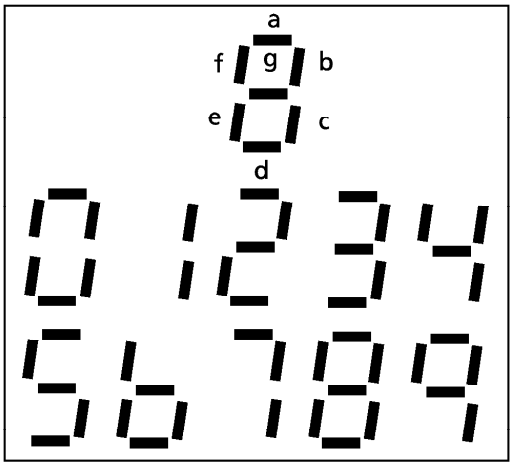
TRUTH TABLE

INPUT							OUTPUT							DISPLAY MODE
LE	$\overline{BI}$	$\overline{LT}$	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	*	*	*	*	△△							

* : DON'T CARE

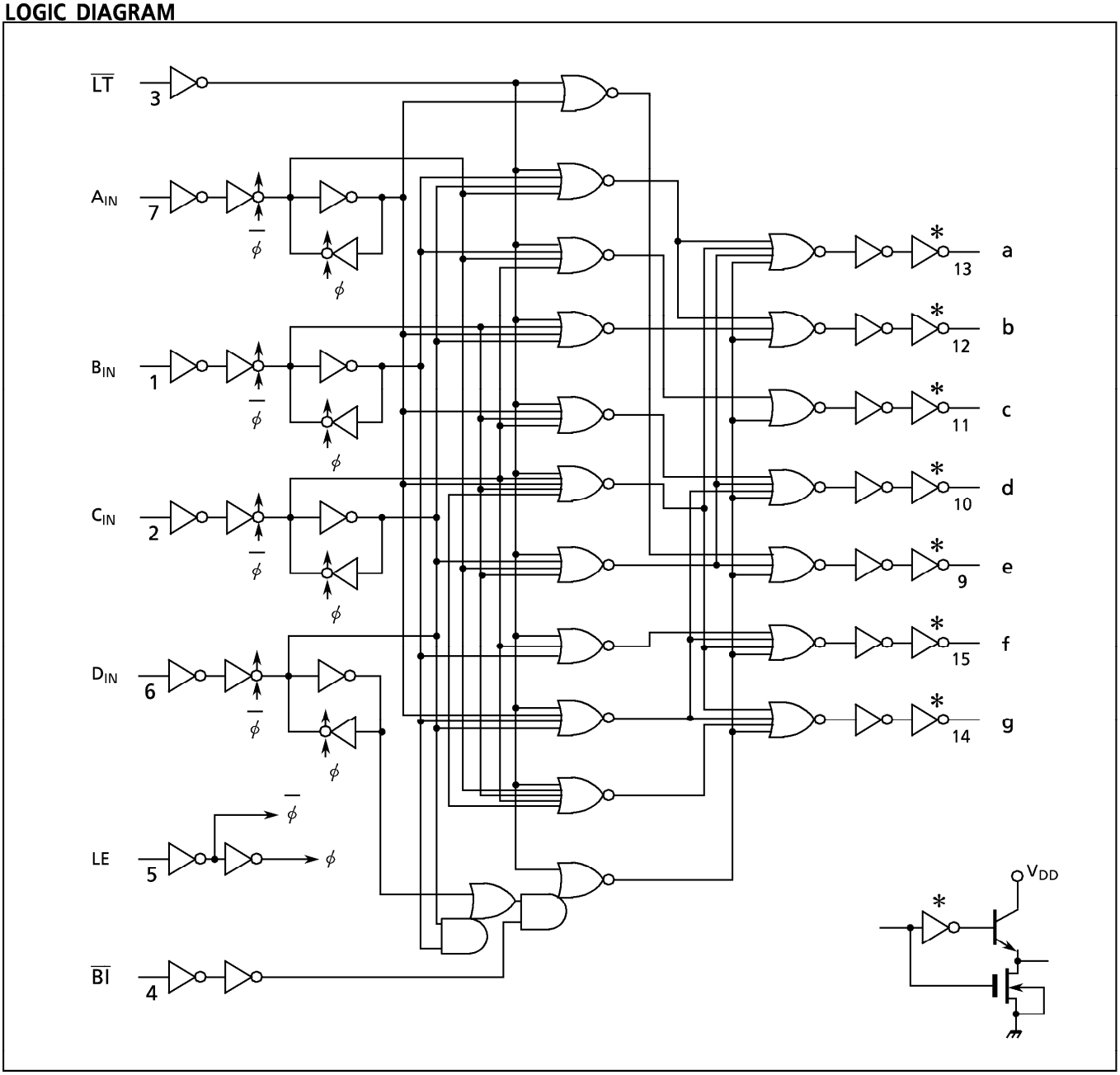
△△ : DEPENDS UPON THE BCD CODE PREVIOUSLY APPLIED WHEN LE "L"

DISPLAY



961001EBA2

LOGIC DIAGRAM



RECOMMENDED OPERATING CONDITIONS (V_{SS} = 0V)

CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNITS
DC Supply Voltage	V_{DD}		3	—	18	V
Input Voltage	V_{IN}		0	—	V_{DD}	V

STATIC ELECTRICAL CHARACTERISTICS (V_{SS} = 0V)

CHARACTERISTIC	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	4.1	—	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}	$\|I_{OUT}\| < 1\mu A$ $V_{IN} = V_{SS}$, V_{DD}	5	—	0.05	—	0.00	0.05	—	0.05	
			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} = 0mA I_{OH} = 10mA I_{OH} = 20mA $V_{IN} = V_{DD}$, V_{SS}	5	4.10 3.90 3.55	—	4.10 3.90 3.55	4.41 4.25 4.19	—	4.20 3.90 3.30	—	V
		I_{OH} = 0mA I_{OH} = 10mA I_{OH} = 20mA $V_{IN} = V_{DD}$, V_{SS}	10	9.10 9.00 8.70	—	9.10 9.00 8.70	9.41 9.25 9.20	—	9.20 9.00 8.40	—	
		I_{OH} = 0mA I_{OH} = 10mA I_{OH} = 20mA $V_{IN} = V_{DD}$, V_{SS}	15	14.10 14.00 13.75	—	14.10 14.00 13.75	14.41 14.26 14.21	—	14.20 14.00 13.50	—	
Output Low Voltage	I_{OL}	V_{OUT} = 0.4V V_{OUT} = 0.5V V_{OUT} = 1.5V $V_{IN} = V_{DD}$, V_{SS}	5	0.61	—	0.51	1.2	—	0.42	—	mA
			10	1.5	—	1.3	3.2	—	1.1	—	
			15	4.0	—	3.4	12.0	—	2.8	—	
Input High Voltage	V_{IH}	V_{OUT} = 0.5V, 4.5V V_{OUT} = 1.0V, 9.0V V_{OUT} = 1.5V, 13.5V $\|I_{OUT}\| < 1\mu A$	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} = 0.5V, 4.5V V_{OUT} = 1.0V, 9.0V V_{OUT} = 1.5V, 13.5V $\|I_{OUT}\| < 1\mu A$	5	—	1.5	—	2.25	1.5	—	1.5	
			10	—	3.0	—	4.5	3.0	—	3.0	
			15	—	4.0	—	6.75	4.0	—	4.0	
Input Current "H" Level	I_{IH}	V_{IH} = 18V	18	—	0.3	—	10^{-5}	0.3	—	1.0	μA
Input Current "L" Level	I_{IL}	V_{IL} = 0V	18	—	−0.3	—	-10^{-5}	−0.3	—	−1.0	
Quiescent Supply Current	I_{DD}	$V_{IN} = V_{SS}$, V_{DD} *	5	—	5	—	0.005	5	—	150	μA
			10	—	10	—	0.010	10	—	300	
			15	—	20	—	0.015	20	—	600	

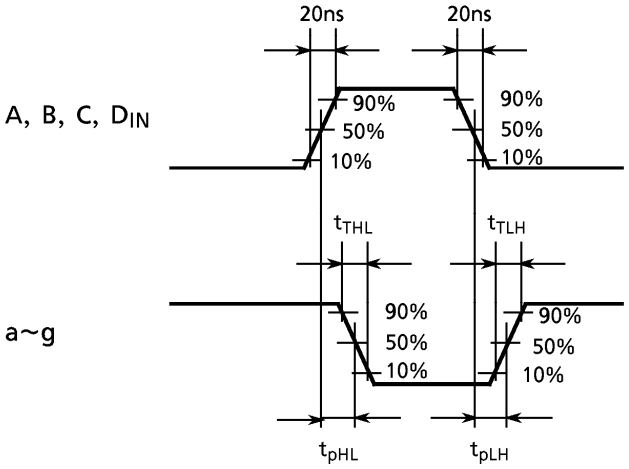
* All valid input combinations.

DYNAMIC ELECTRICAL CHARACTERISTICS (Ta = 25°C, Vss = 0V, C_L = 50pF, R_L = 10kΩ)

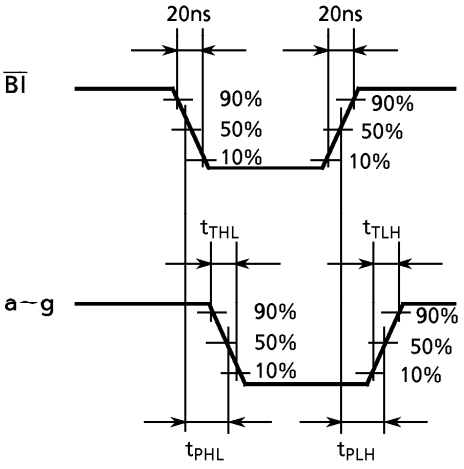
CHARACTERISTIC	SYMBOL	TEST CONDITION V_{DD}(V)	MIN.	TYP.	MAX.	UNIT
Output Transition Time (Low to High)	t_{TLH}	5	—	25	80	ns
		10	—	15	60	
		15	—	15	50	
Output Transition Time (High to Low)	t_{THL}	5	—	70	200	
		10	—	35	100	
		15	—	30	80	
Propagation Delay Time (DATA - OUT)	t_{pLH}	5	—	200	1040	
		10	—	90	420	
		15	—	65	300	
Propagation Delay Time (DATA - OUT)	t_{pHL}	5	—	230	1040	
		10	—	110	420	
		15	—	80	300	
Propagation Delay Time ($\overline{BI}$ - OUT)	t_{pLH}	5	—	75	640	
		10	—	45	260	
		15	—	35	200	
Propagation Delay Time ($\overline{BI}$ - OUT)	t_{pHL}	5	—	90	640	
		10	—	50	260	
		15	—	45	200	
Propagation Delay Time ($\overline{LT}$ - OUT)	t_{pLH}	5	—	60	300	
		10	—	40	150	
		15	—	35	100	
Propagation Delay Time ($\overline{LT}$ - OUT)	t_{pHL}	5	—	75	300	
		10	—	45	150	
		15	—	35	100	
Propagation Delay Time (LE - OUT)	t_{pLH}	5	—	180	600	
		10	—	90	300	
		15	—	65	250	
Propagation Delay Time (LE - OUT)	t_{pHL}	5	—	230	600	
		10	—	110	300	
		15	—	85	250	
Min. Pulse Time (LE)	t_{WL}	5	—	40	300	
		10	—	20	150	
		15	—	15	120	
Min. Set - up Time (DATA - LE)	t_{SU}	5	—	35	150	
		10	—	15	70	
		15	—	10	40	
Min. Hold Time (DATA - LE)	t_H	5	—	—	0	
		10	—	—	0	
		15	—	—	0	
Input Capacitance	C_{IN}		—	5	7.5	pF

WAVEFORM FOR MEASUREMENT OF DYNAMIC CHARACTERISTICS

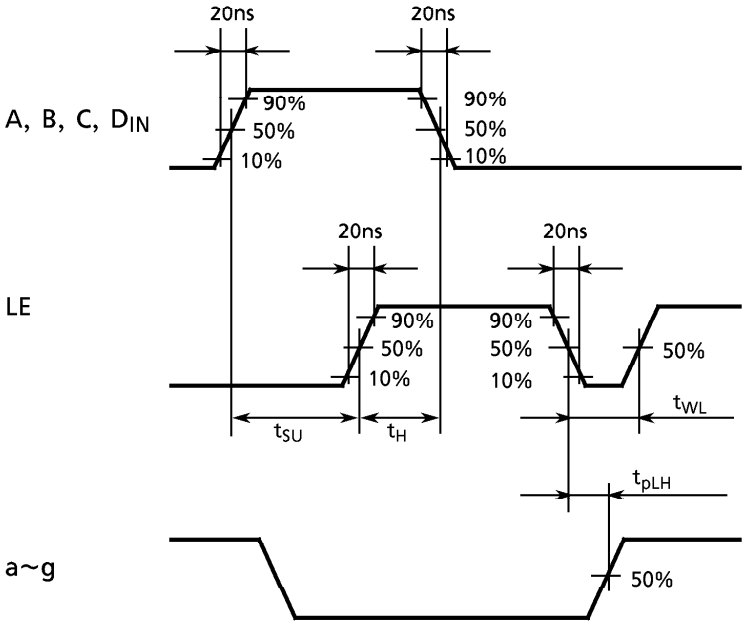
WAVEFORM 1



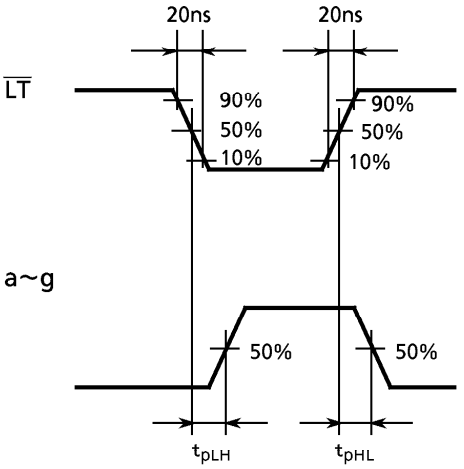
WAVEFORM 2



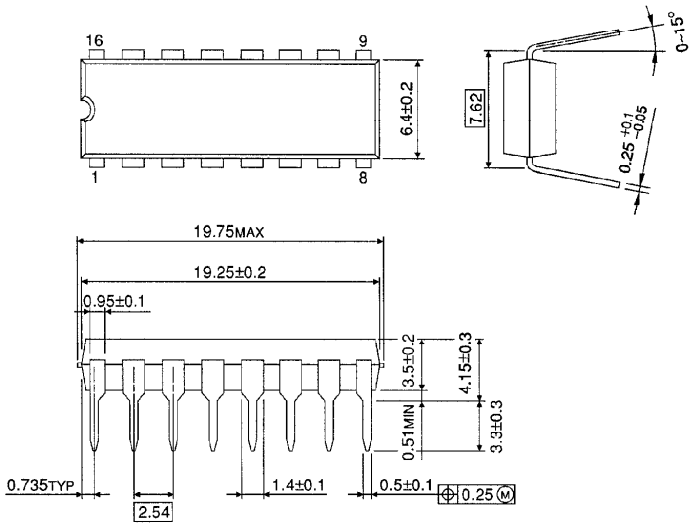
WAVEFORM 3



WAVEFORM 4

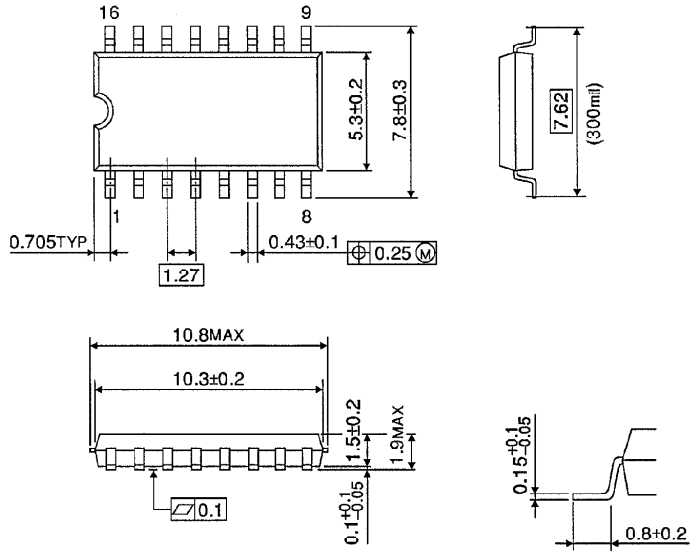


DIP 16PIN OUTLINE DRAWING (DIP16-P-300-2.54A) Unit in mm



Weight : 1.00g (Typ.)

SOP 16PIN (200mil BODY) OUTLINE DRAWING (SOP16-P-300-1.27) Unit in mm



Weight : 0.18g (Typ.)