

TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

## TC74HC245AP, TC74HC245AF, TC74HC640AP, TC74HC640AF

### Octal Bus Transceiver

TC74HC245AP/AF	3-State, Non-Inverting
TC74HC640AP/AF	3-State, Inverting

The TC74HC245A, 640A are high speed CMOS OCTAL BUS TRANSCEIVERS fabricated with silicon gate C2MOS technology.

They achieve the high speed operation similar to equivalent LSTTL while maintaining the CMOS low power dissipation.

They are intended for two-way asynchronous communication between data busses. The direction of data transmission is determined by the level of the DIR input.

The enable input ( $\bar{G}$ ) can be used to disable the device so that the busses are effectively isolated.

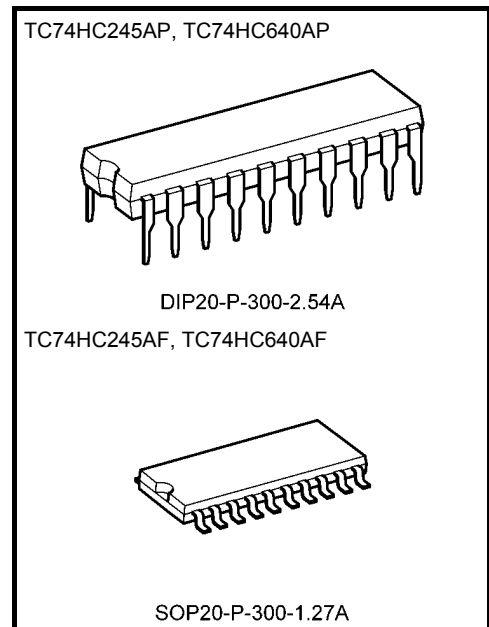
All inputs are equipped with protection circuits against static discharge or transient excess voltage.

### Features (Note 1)(Note 2)

- High speed:  $t_{pd} = 10 \text{ ns}$  (typ.) at  $V_{CC} = 5 \text{ V}$
- Low power dissipation:  $I_{CC} = 4 \mu\text{A}$  (max) at  $T_a = 25^\circ\text{C}$
- High noise immunity:  $V_{NIH} = V_{NIL} = 28\% V_{CC}$  (min)
- Output drive capability: 15 LSTTL loads
- Symmetrical output impedance:  $|I_{OH}| = I_{OL} = 6 \text{ mA}$  (min)
- Balanced propagation delays:  $t_{pLH} \approx t_{pHL}$
- Wide operating voltage range:  $V_{CC} (\text{opr}) = 2\sim 6 \text{ V}$
- Pin and function compatible with 74LS245/640

Note 1: Do not apply a signal to any bus terminal when it is in the output mode. Damage may result.

Note 2: All floating (high impedance) bus terminals must have their input levels fixed by means of pull up or pull down resistors.

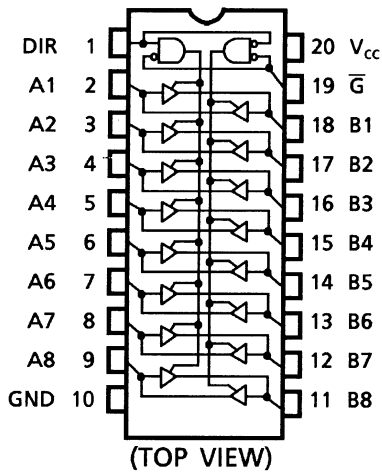


Weight

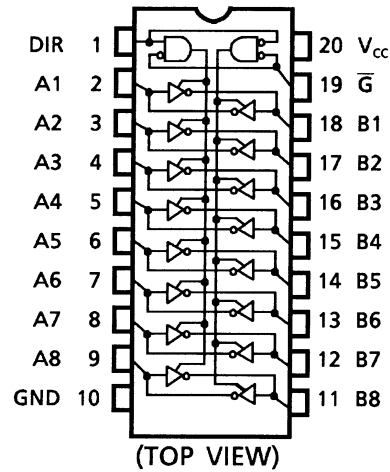
DIP20-P-300-2.54A	: 1.30 g (typ.)
SOP20-P-300-1.27A	: 0.22 g (typ.)

## Pin Assignment

### TC74HC245A

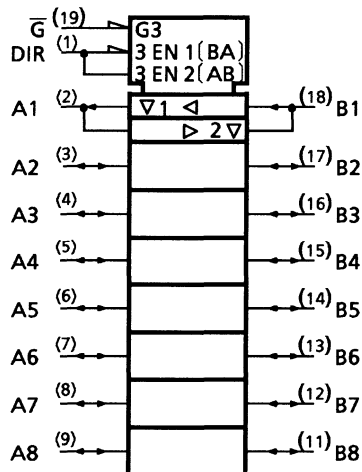


### TC74HC640A

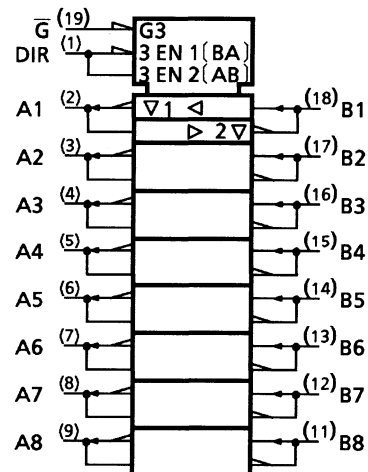


## IEC Logic Symbol

### TC74HC245A



### TC74HC640A



## Truth Table

Inputs		Function		Outputs	
$\bar{G}$	DIR	A Bus	B Bus	HC245A	HC640A
L	L	Output	Input	A = B	A = $\bar{B}$
L	H	Input	Output	B = A	B = $\bar{A}$
H	X	Z		Z	Z

X: "H" or "L"

Z: High impedance

## Absolute Maximum Ratings (Note 1)

Characteristics	Symbol	Rating	Unit
Supply voltage range	$V_{CC}$	-0.5~7	V
DC input voltage	$V_{IN}$	-0.5~ $V_{CC} + 0.5$	V
DC output voltage	$V_{OUT}$	-0.5~ $V_{CC} + 0.5$	V
Input diode current	$I_{IK}$	$\pm 20$	mA
Output diode current	$I_{OK}$	$\pm 20$	mA
DC output current	$I_{OUT}$	$\pm 35$	mA
DC $V_{CC}$ /ground current	$I_{CC}$	$\pm 75$	mA
Power dissipation	$P_D$	500 (DIP) (Note 2)/180 (SOP)	mW
Storage temperature	$T_{stg}$	-65~150	°C

Note 1: 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).

Note 2: 500 mW in the range of  $T_a = -40$  to  $65^\circ\text{C}$ . From  $T_a = 65$  to  $85^\circ\text{C}$  a derating factor of  $-10$  mW/°C shall be applied until 300 mW.

## Operating Ranges (Note)

Characteristics	Symbol	Rating	Unit
Supply voltage	$V_{CC}$	2~6	V
Input voltage	$V_{IN}$	0~ $V_{CC}$	V
Output voltage	$V_{OUT}$	0~ $V_{CC}$	V
Operating temperature	$T_{opr}$	-40~85	°C
Input rise and fall time	$t_r, t_f$	0~1000 ( $V_{CC} = 2.0$ V) 0~500 ( $V_{CC} = 4.5$ V) 0~400 ( $V_{CC} = 6.0$ V)	ns

Note: The operating ranges must be maintained to ensure the normal operation of the device. Unused inputs and bus inputs must be tied to either VCC or GND. Please connect both bus inputs and the bus outputs with VCC or GND when the I/O of the bus terminal changes by the function. In this case, please note that the output is not short-circuited.

## Electrical Characteristics

### DC Characteristics

Characteristics	Symbol	Test Condition		Ta = 25°C			Ta = -40~85°C		Unit	
				V <sub>CC</sub> (V)	Min	Typ.	Max	Min		Max
High-level input voltage	V <sub>IH</sub>	—		2.0	1.50	—	—	1.50	—	V
				4.5	3.15	—	—	3.15	—	
				6.0	4.20	—	—	4.20	—	
Low-level input voltage	V <sub>IL</sub>	—		2.0	—	—	0.50	—	0.50	V
				4.5	—	—	1.35	—	1.35	
				6.0	—	—	1.80	—	1.80	
High-level output voltage	V <sub>OH</sub>	V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub>	I <sub>OH</sub> = -20 μA	2.0	1.9	2.0	—	1.9	—	V
				4.5	4.4	4.5	—	4.4	—	
			I <sub>OH</sub> = -6 mA I <sub>OH</sub> = -7.8 mA	4.5	4.18	4.31	—	4.13	—	
				6.0	5.68	5.80	—	5.63	—	
Low-level output voltage	V <sub>OL</sub>	V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub>	I <sub>OL</sub> = 20 μA	2.0	—	0.0	0.1	—	0.1	V
				4.5	—	0.0	0.1	—	0.1	
			I <sub>OL</sub> = 6 mA I <sub>OL</sub> = 7.8 mA	4.5	—	0.17	0.26	—	0.33	
				6.0	—	0.18	0.26	—	0.33	
3-state output off-state current	I <sub>OZ</sub>	V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub> V <sub>OUT</sub> = V <sub>CC</sub> or GND		6.0	—	—	±0.5	—	±5.0	μA
Input leakage current	I <sub>IN</sub>	V <sub>IN</sub> = V <sub>CC</sub> or GND		6.0	—	—	±0.1	—	±1.0	μA
Quiescent supply current	I <sub>CC</sub>	V <sub>IN</sub> = V <sub>CC</sub> or GND		6.0	—	—	4.0	—	40.0	μA

## AC Characteristics (input: $t_r = t_f = 6$ ns)

Characteristics	Symbol	Test Condition		Ta = 25°C			Ta = -40~85°C		Unit		
		CL (pF)	V <sub>CC</sub> (V)	Min	Typ.	Max	Min	Max			
Output transition time	$t_{TLH}$ $t_{THL}$	—	50	2.0	—	52	60	—	75	ns	
				4.5	—	7	12	—	15		
				6.0	—	6	10	—	13		
Propagation delay time	$t_{pLH}$ $t_{pHL}$	—	50	2.0	—	33	90	—	115	ns	
				4.5	—	12	18	—	23		
				6.0	—	10	15	—	20		
			150	2.0	—	48	120	—	150		ns
				4.5	—	16	24	—	30		
				6.0	—	14	20	—	26		
3-state output enable time	$t_{pZL}$ $t_{pZH}$	$R_L = 1k\Omega$	50	2.0	—	48	150	—	190	ns	
				4.5	—	16	30	—	38		
				6.0	—	14	26	—	32		
			150	2.0	—	63	180	—	225		ns
				4.5	—	21	36	—	45		
				6.0	—	18	31	—	38		
3-state output disable time	$t_{pLZ}$ $t_{pHZ}$	$R_L = 1k\Omega$	50	2.0	—	37	150	—	190	ns	
				4.5	—	17	30	—	38		
				6.0	—	15	26	—	32		
Input capacitance	C <sub>IN</sub>	DIR, G		—	5	10	—	10	pF		
Bus input capacitance	C <sub>OUT</sub>	An, Bn		—	13	—	—	—	pF		
Power dissipation capacitance	C <sub>PD</sub> (Note)	TC74HC245A		—	39	—	—	—	pF		
		TC74HC640A		—	37	—	—	—			

Note: C<sub>PD</sub> is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load.

Average operating current can be obtained by the equation:

$$I_{CC}(\text{opr}) = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC}/8 \text{ (per bit)}$$

## Package Dimensions

DIP20-P-300-2.54A

Unit : mm

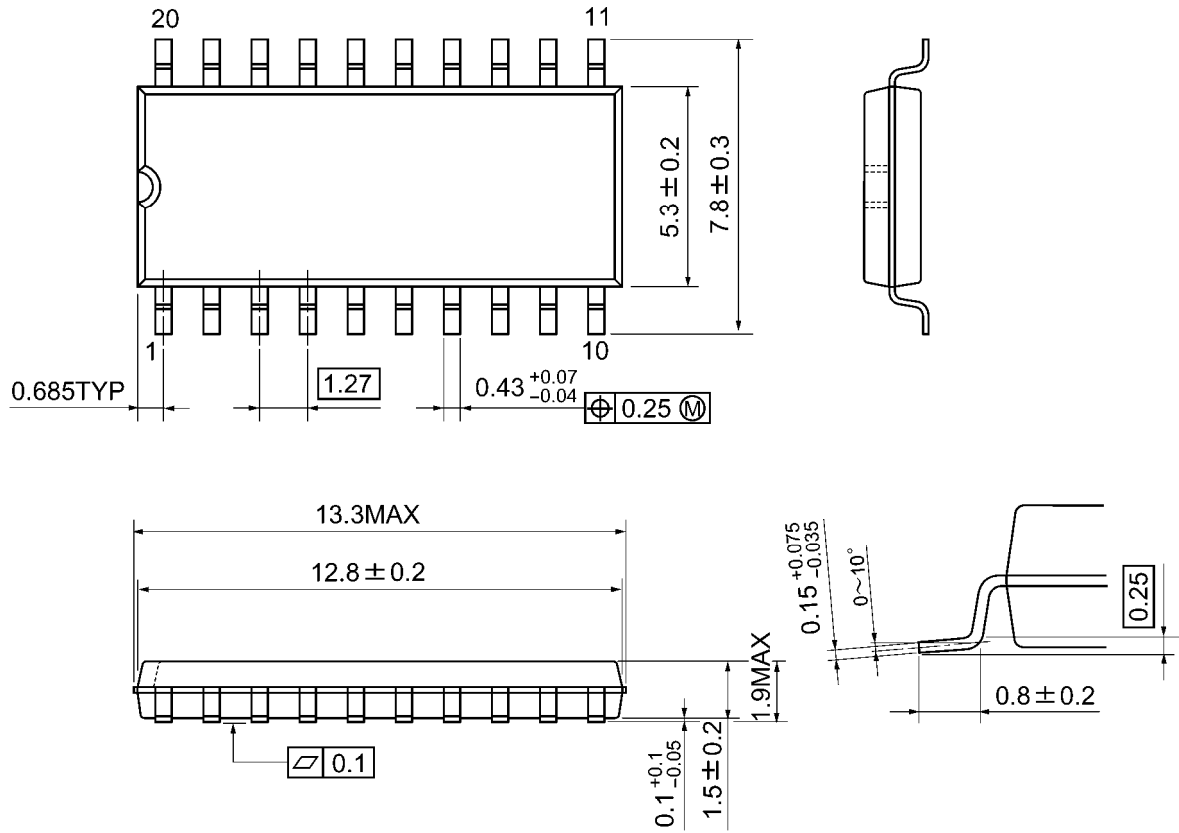


Weight: 1.30 g (typ.)

**Package Dimensions**

SOP20-P-300-1.27A

Unit: mm



Weight: 0.22 g (typ.)

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