

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

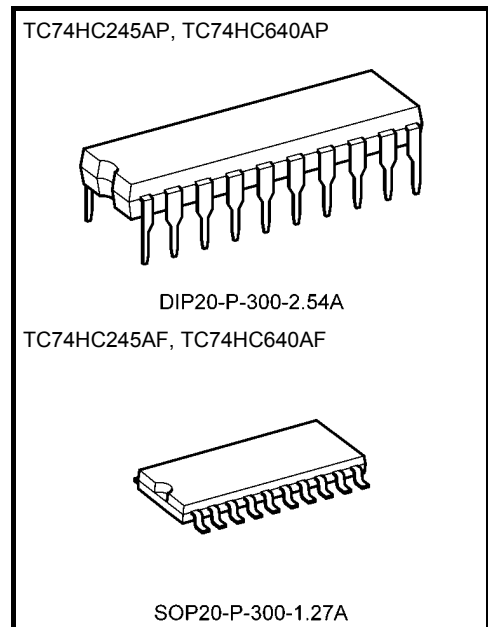
All inputs are equipped with protection circuits against static discharge or transient excess voltage.

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.

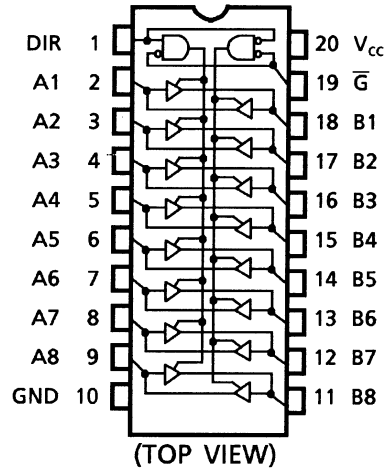


Weight

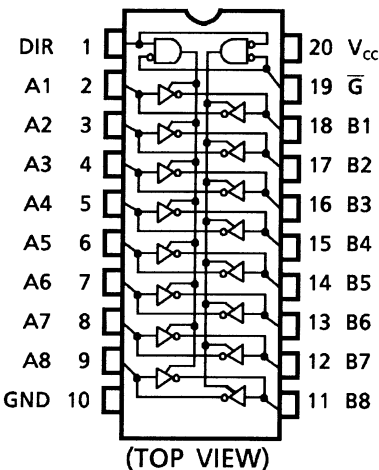
DIP20-P-300-2.54A	: 1.30 g (typ.)
SOP20-P-300-1.27A	: 0.22 g (typ.)

Pin Assignment

TC74HC245A

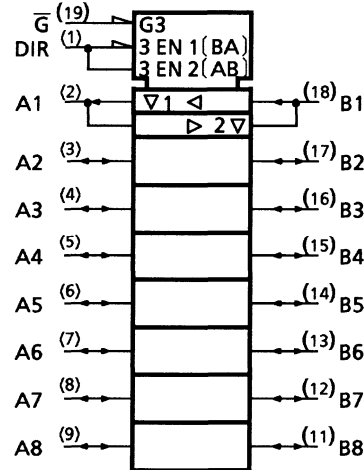


TC74HC640A

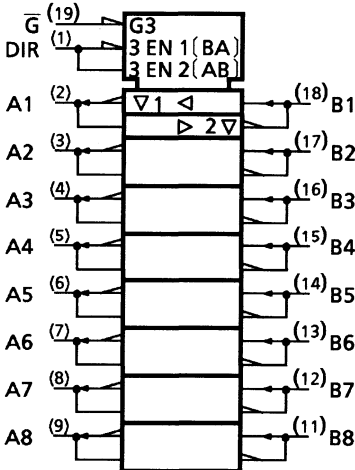


IEC Logic Symbol

TC74HC245A



TC74HC640A



Truth Table

Inputs		Function		Outputs	
$\overline{G}$	DIR	A Bus	B Bus	HC245A	HC640A
L	L	Output	Input	A = B	A = $\overline{B}$
L	H	Input	Output	B = A	B = $\overline{A}$
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}	± 20	mA
Output diode current	I_{OK}	± 20	mA
DC output current	I_{OUT}	± 35	mA
DC V_{CC} /ground current	I_{CC}	± 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°C . From $T_a = 65$ to 85°C a derating factor of $-10\text{ mW}/^\circ\text{C}$ 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 ($V_{CC} = 2.0\text{ V}$) 0~500 ($V_{CC} = 4.5\text{ V}$) 0~400 ($V_{CC} = 6.0\text{ V}$)	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	
				VCC (V)	Min	Typ.	Max	Min		Max
High-level input voltage	VIH	—		2.0 4.5 6.0	1.50 3.15 4.20	— — —	— — —	1.50 3.15 4.20	V	
Low-level input voltage	VIL	—		2.0 4.5 6.0	— — —	— — —	0.50 1.35 1.80	— — —	V	
High-level output voltage	VOH	VIN = VIH or VIL	IOH = -20 μA	2.0	1.9	2.0	—	1.9	—	V
				4.5	4.4	4.5	—	4.4	—	
			IOH = -6 mA	6.0	5.9	6.0	—	5.9	—	
				IOH = -7.8 mA	4.5	4.18	4.31	—	4.13	
Low-level output voltage	VOL	VIN = VIH or VIL	IOL = 20 μA	6.0	5.68	5.80	—	5.63	—	V
				4.5	4.18	4.31	—	4.13	—	
			IOL = 6 mA	6.0	5.68	5.80	—	5.63	—	
				IOL = 7.8 mA	4.5	4.18	4.31	—	4.13	
3-state output off-state current	IOZ	VIN = VIH or VIL VOUT = VCC or GND		6.0	—	—	±0.5	—	±5.0	μA
Input leakage current	IIN	VIN = VCC or GND		6.0	—	—	±0.1	—	±1.0	μA
Quiescent supply current	ICC	VIN = VCC or GND		6.0	—	—	4.0	—	40.0	μA

AC Characteristics (input: $t_r = t_f = 6 \text{ ns}$)

Characteristics	Symbol	Test Condition			Ta = 25°C			Ta = -40~85°C		Unit
			CL (pF)	VCC (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	
				4.5	—	16	24	—	30	
				6.0	—	14	20	—	26	
3-state output enable time	t_{pZL} t_{pZH}	$R_{\text{L}} = 1\text{k}\Omega$	50	2.0	—	48	150	—	190	ns
				4.5	—	16	30	—	38	
				6.0	—	14	26	—	32	
			150	2.0	—	63	180	—	225	
				4.5	—	21	36	—	45	
				6.0	—	18	31	—	38	
3-state output disable time	t_{pLZ} t_{pHZ}	$R_{\text{L}} = 1\text{k}\Omega$	50	2.0	—	37	150	—	190	ns
				4.5	—	17	30	—	38	
				6.0	—	15	26	—	32	
Input capacitance	C_{IN}	DIR, G			—	5	10	—	10	pF
Bus input capacitance	C_{OUT}	An, Bn			—	13	—	—	—	pF
Power dissipation capacitance	C_{PD}	TC74HC245A			—	39	—	—	—	pF
	(Note)	TC74HC640A			—	37	—	—	—	

Note: C_{PD} is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load.

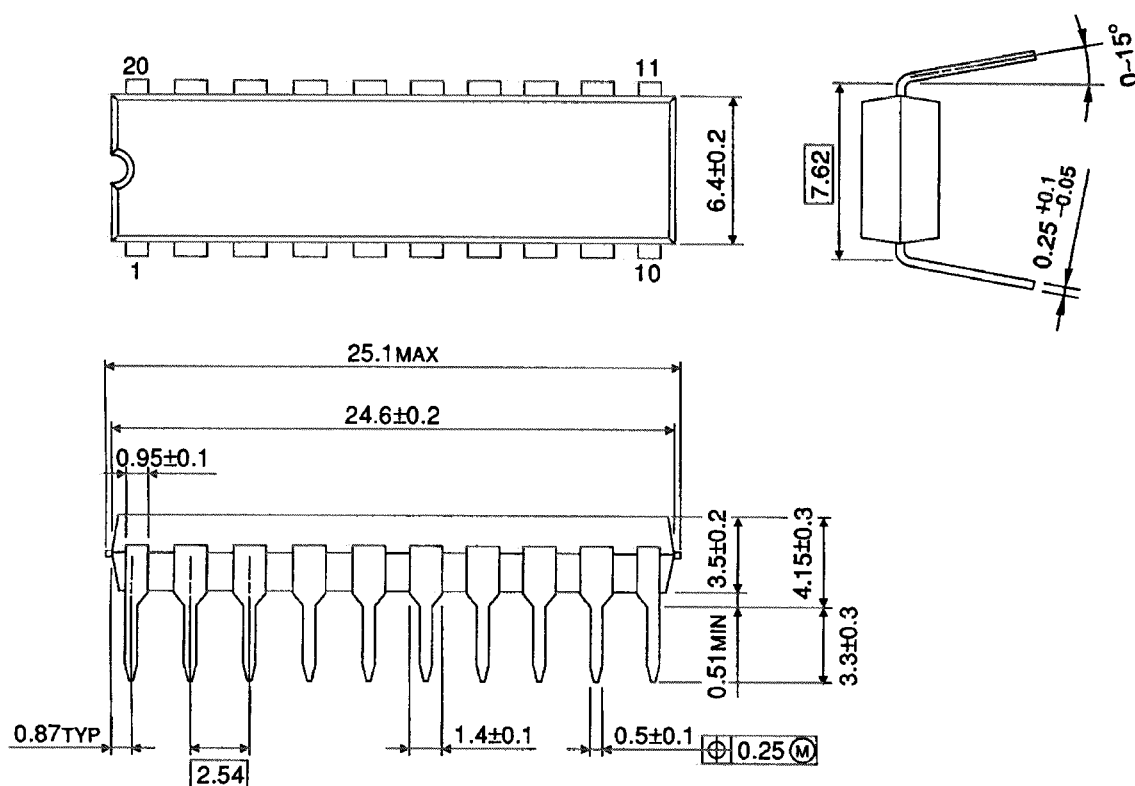
Average operating current can be obtained by the equation:

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

Package Dimensions

DIP20-P-300-2.54A

Unit : mm

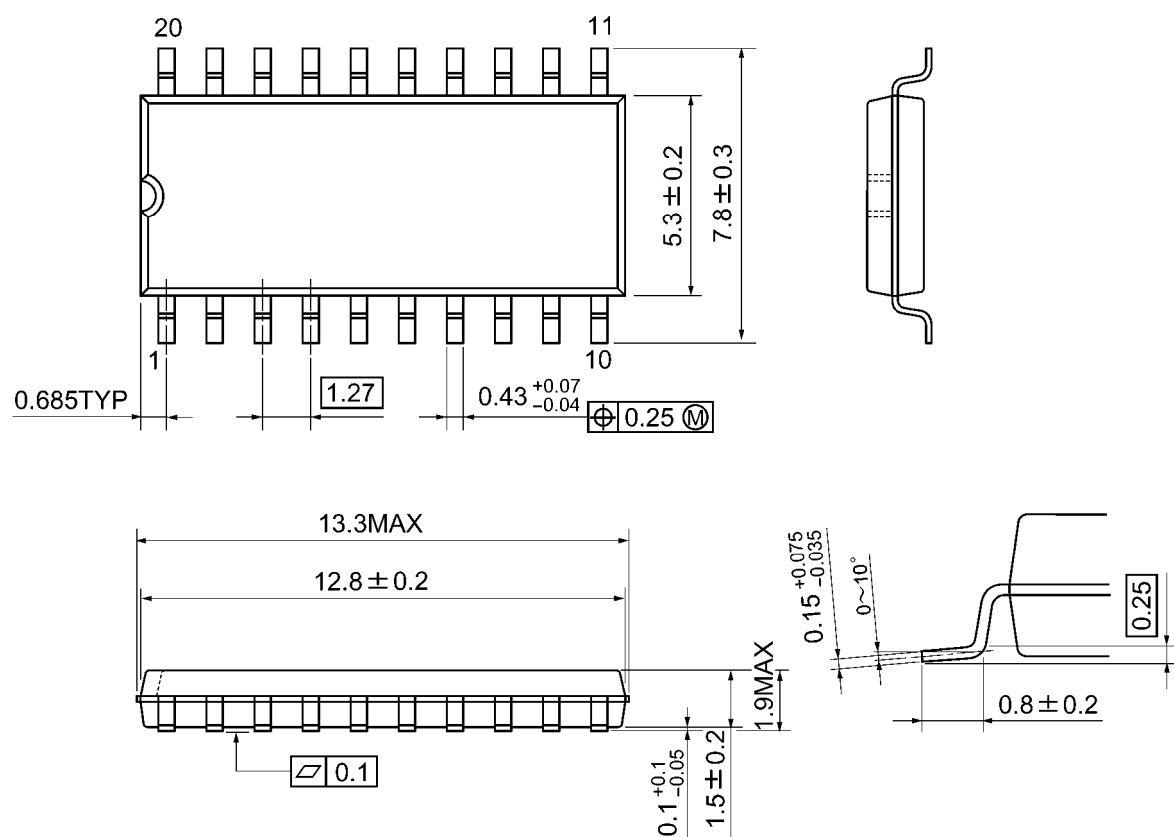


Weight: 1.30 g (typ.)

Package Dimensions

SOP20-P-300-1.27A

Unit: mm



Weight: 0.22 g (typ.)

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