

TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

## TC74AC245P, TC74AC245F, TC74AC245FT TC74AC640P, TC74AC640F, TC74AC640FT

### Octal Bus Transceiver

TC74AC245P/F/FT 3-State, Non-Inverting

TC74AC640P/F/FT 3-State, Inverting

The TC74AC245, 640 are advanced high speed CMOS OCTAL BUS TRANSCEIVERS fabricated with silicon gate and double-layer metal wiring C<sup>2</sup>MOS technology.

They achieve the high speed operation similar to equivalent Bipolar Schottky TTL 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.

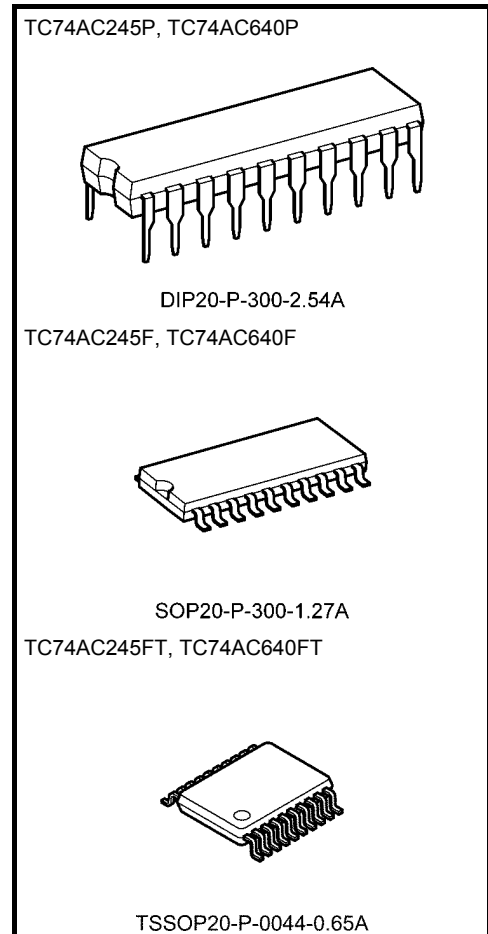
All inputs are equipped with protection circuits against static discharge or transient excess voltage.

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

- High speed:  $t_{pd} = 3.9$  ns (typ.) at  $V_{CC} = 5$  V
- Low power dissipation:  $I_{CC} = 8$   $\mu$ A (max) at  $T_a = 25^\circ$ C
- High noise immunity:  $V_{NIH} = V_{NIL} = 28\%$   $V_{CC}$  (min)
- Symmetrical output impedance:  
 $|I_{OH}| = |I_{OL}| = 24$  mA (min)  
 Capability of driving 50  $\Omega$  transmission lines.
- Balanced propagation delays:  $t_{pLH} \approx t_{pHL}$
- Wide operating voltage range:  $V_{CC} (opr) = 2$  V to 5.5 V
- Pin and function compatible with 74F245/640

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

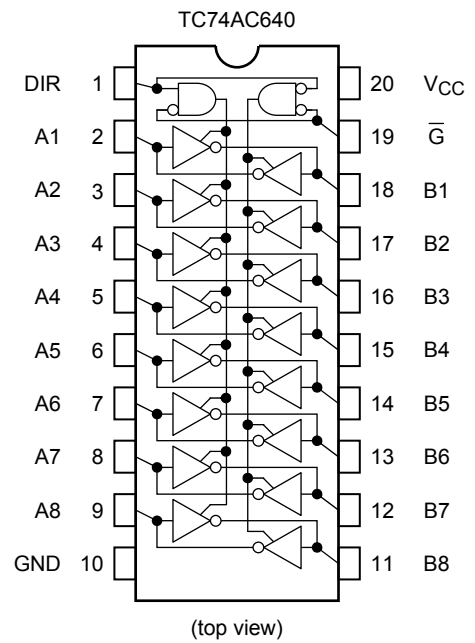
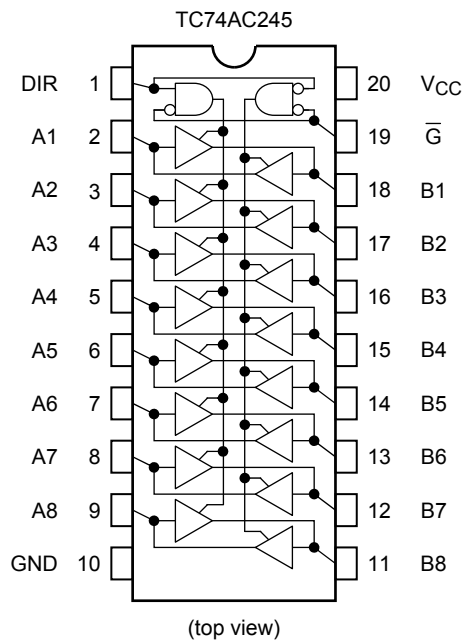
Note 2: All floating (high impedance) bus terminals must have their input levels fixed by means of pull up or pull down resistors.



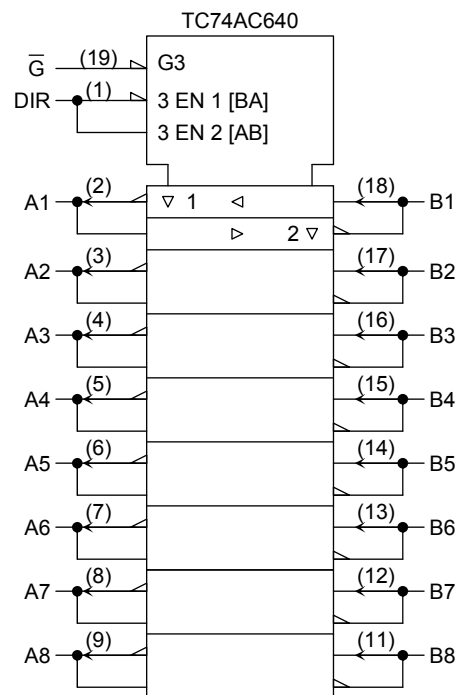
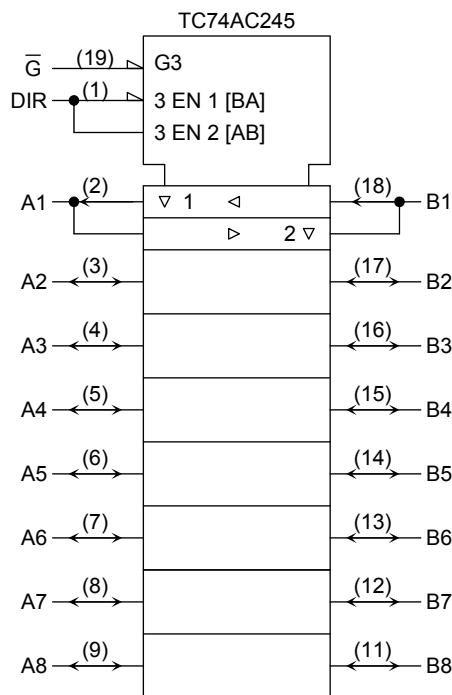
#### Weight

DIP20-P-300-2.54A	: 1.30 g (typ.)
SOP20-P-300-1.27A	: 0.22 g (typ.)
TSSOP20-P-0044-0.65A	: 0.08 g (typ.)

## Pin Assignment



## IEC Logic Symbol



## Truth Table

Inputs		Function		Outputs	
$\bar{G}$	DIR	A Bus	B Bus	AC245	AC640
L	L	Output	Input	A = B	A = $\bar{B}$
L	H	Input	Output	B = A	B = $\bar{A}$
H	X	Z		Z	Z

X: Don't care

Z: High impedance

## Absolute Maximum Ratings (Note 1)

Characteristics	Symbol	Rating	Unit
Supply voltage range	$V_{CC}$	-0.5 to 7.0	V
DC input voltage	$V_{IN}$	-0.5 to $V_{CC} + 0.5$	V
DC output voltage	$V_{OUT}$	-0.5 to $V_{CC} + 0.5$	V
Input diode current	$I_{IK}$	$\pm 20$	mA
Output diode current	$I_{OK}$	$\pm 50$	mA
DC output current	$I_{OUT}$	$\pm 50$	mA
DC $V_{CC}$ /ground current	$I_{CC}$	$\pm 200$	mA
Power dissipation	$P_D$	500 (DIP) (Note 2)/180 (SOP/TSSOP)	mW
Storage temperature	$T_{stg}$	-65 to 150	$^{\circ}C$

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  $T_a = -40^{\circ}C$  to  $65^{\circ}C$ . From  $T_a = 65^{\circ}C$  to  $85^{\circ}C$  a derating factor of  $-10 \text{ mW}/^{\circ}C$  should be applied up to 300 mW.

## Operating Ranges (Note)

Characteristics	Symbol	Rating	Unit
Supply voltage	$V_{CC}$	2.0 to 5.5	V
Input voltage	$V_{IN}$	0 to $V_{CC}$	V
Output voltage	$V_{OUT}$	0 to $V_{CC}$	V
Operating temperature	$T_{opr}$	-40 to 85	$^{\circ}C$
Input rise and fall time	dt/dV	0 to 100 ( $V_{CC} = 3.3 \pm 0.3 \text{ V}$ ) 0 to 20 ( $V_{CC} = 5 \pm 0.5 \text{ V}$ )	ns/V

Note: The operating ranges are required to ensure the normal operation of the device. Unused inputs and bus inputs must be tied to either  $V_{CC}$  or GND. Please connect both bus inputs and the bus outputs with  $V_{CC}$  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 to 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
				3.0	2.10	—	—	2.10	—	
				5.5	3.85	—	—	3.85	—	
Low-level input voltage	V <sub>IL</sub>	—		2.0	—	—	0.50	—	0.50	V
				3.0	—	—	0.90	—	0.90	
				5.5	—	—	1.65	—	1.65	
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> = -50 μA	2.0	1.9	2.0	—	1.9	—	V
				3.0	2.9	3.0	—	2.9	—	
			I <sub>OH</sub> = -4 mA I <sub>OH</sub> = -24 mA I <sub>OH</sub> = -75 mA (Note)	3.0	2.58	—	—	2.48	—	
				4.5	3.94	—	—	3.80	—	
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> = 50 μA	2.0	—	0.0	0.1	—	0.1	V
				3.0	—	0.0	0.1	—	0.1	
				4.5	—	0.0	0.1	—	0.1	
			I <sub>OL</sub> = 12 mA I <sub>OL</sub> = 24 mA I <sub>OL</sub> = 75 mA (Note)	3.0	—	—	0.36	—	0.44	
				4.5	—	—	0.36	—	0.44	
5.5	—	—	—	—	1.65	—				
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		5.5	—	—	±0.5	—	±5.0	μA
Input leakage current	I <sub>IN</sub>	V <sub>IN</sub> = V <sub>CC</sub> or GND		5.5	—	—	±0.1	—	±1.0	μA
Quiescent supply current	I <sub>CC</sub>	V <sub>IN</sub> = V <sub>CC</sub> or GND		5.5	—	—	8.0	—	80.0	μA

Note: This spec indicates the capability of driving 50 Ω transmission lines.

One output should be tested at a time for a 10 ms maximum duration.

## AC Characteristics (C<sub>L</sub> = 50 pF, R<sub>L</sub> = 500 Ω, input: t<sub>r</sub> = t<sub>f</sub> = 3 ns)

Characteristics	Symbol	Test Condition	Ta = 25°C			Ta = -40 to 85°C		Unit	
			V <sub>CC</sub> (V)	Min	Typ.	Max	Min		Max
Propagation delay time (Note 2)	t <sub>pLH</sub>	—	3.3 ± 0.3	—	7.0	10.9	1.0	12.4	ns
	t <sub>pHL</sub>		5.0 ± 0.5	—	5.0	7.5	1.0	8.5	
Propagation delay time (Note 3)	t <sub>pLH</sub>	—	3.3 ± 0.3	—	6.4	10.0	1.0	11.4	ns
	t <sub>pHL</sub>		5.0 ± 0.5	—	4.8	7.0	1.0	8.0	
Output enable time	t <sub>pZL</sub>	—	3.3 ± 0.3	—	9.3	15.3	1.0	17.4	ns
	t <sub>pZH</sub>		5.0 ± 0.5	—	7.1	10.5	1.0	12.0	
Output disable time	t <sub>pLZ</sub>	—	3.3 ± 0.3	—	7.1	11.4	1.0	13.0	ns
	t <sub>pHZ</sub>		5.0 ± 0.5	—	5.9	8.7	1.0	10.0	
Input capacitance	C <sub>IN</sub>	DIR, $\bar{G}$	—	5	10	—	10	pF	
Bus input capacitance	C <sub>I/O</sub>	A <sub>n</sub> , B <sub>n</sub>	—	13	—	—	—	pF	
Power dissipation capacitance (Note 1)	C <sub>PD</sub>	TC74AC245	—	38	—	—	—	pF	
		TC74AC640	—	36	—	—	—		

Note 1: 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:

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

Note 2: For TC74AC245 only

Note 3: For TC74AC640 only

## Package Dimensions

DIP20-P-300-2.54A

Unit : mm



Weight: 1.30 g (typ.)

## Package Dimensions

SOP20-P-300-1.27A

Unit: mm

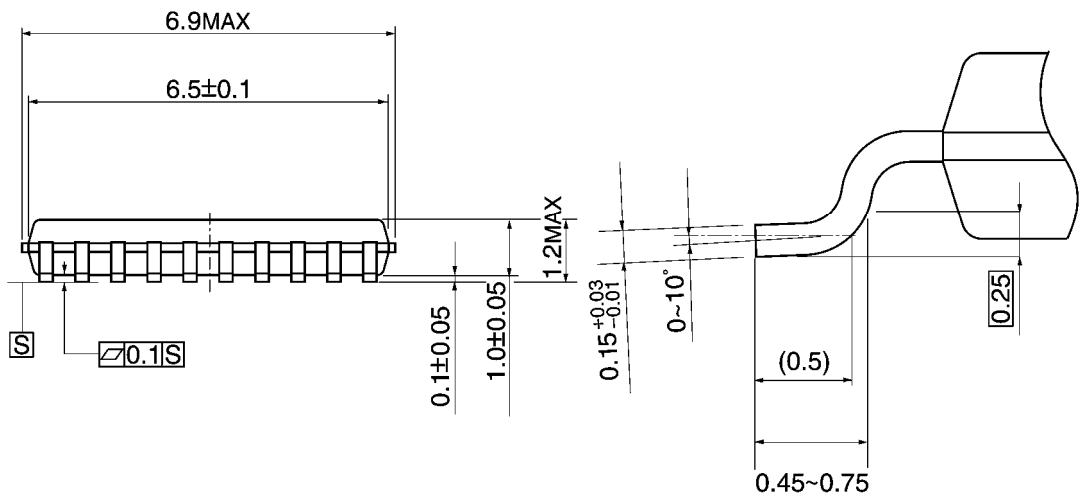
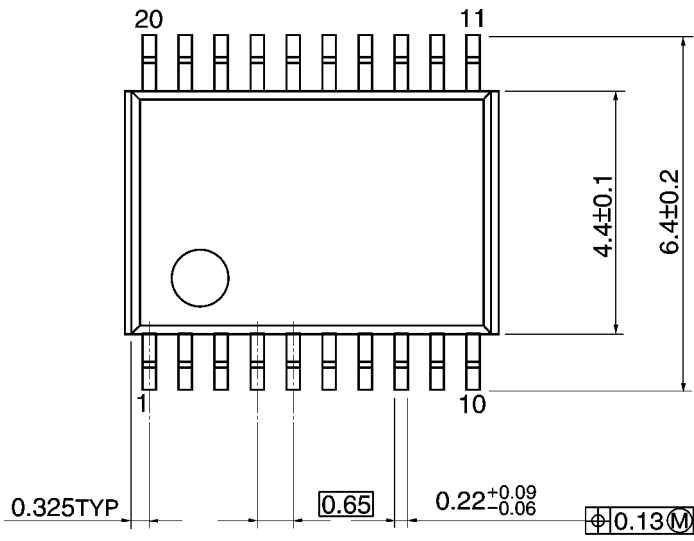


Weight: 0.22 g (typ.)

**Package Dimensions**

TSSOP20-P-0044-0.65A

Unit: mm



Weight: 0.08 g (typ.)

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