CMOS Digital Integrated Circuits Silicon Monolithic

TC74AC245P,TC74AC640P

1. Functional Description

・ Octal Bus Transceiver

TC74AC245P:3-State, Non-Inverting

TC74AC640P:3-State, Inverting

2. General

The TC74AC245P, TC74AC640P are advanced high speed CMOS OCTAL BUS TRANSCEIVERs fabricated with silicon gate and double-layer metal wiring C²MOS 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 ($\overline{G}$) 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.

3. Features (Note)

(1) High speed: t_{pd} = 3.9 ns (typ.) at V_{CC} = 5.0 V

(2) Low power dissipation: I_{CC} = 8.0 μA (max) at T_a = 25 °C

(3) High noise immunity: $V_{NIH} = V_{NIL}$ = 28 % V_{CC} (min)

(4) Output current: $|I_{OH}|/I_{OL}$ = 24 mA (min) (V_{CC} = 4.5 V)

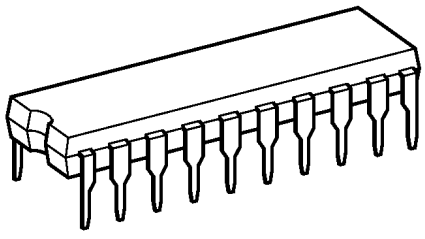
(5) Balanced propagation delays: $t_{PLH} \approx t_{PHL}$

(6) Wide operating voltage range: $V_{CC(opr)}$ = 2.0 V to 5.5 V

(7) Pin and function compatible with 74F245/640.

Note: Do not apply a signal to any bus pins when it is in the output mode. Damage may result.
All floating (high impedance) bus pins must have their input levels fixed by means of pull-up or pull-down resistors.

4. Packaging

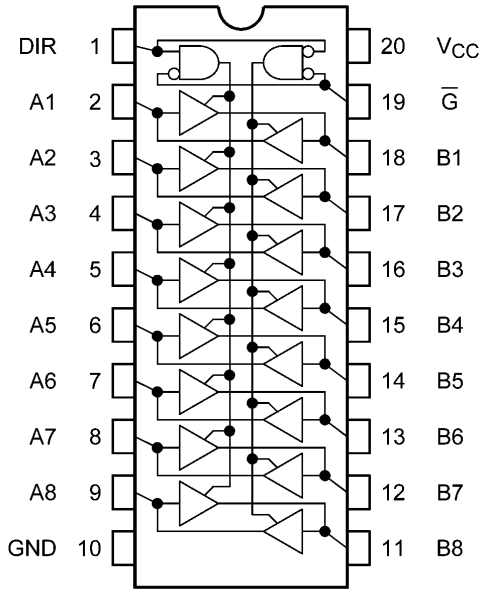


DIP20

Start of commercial production
1986-05

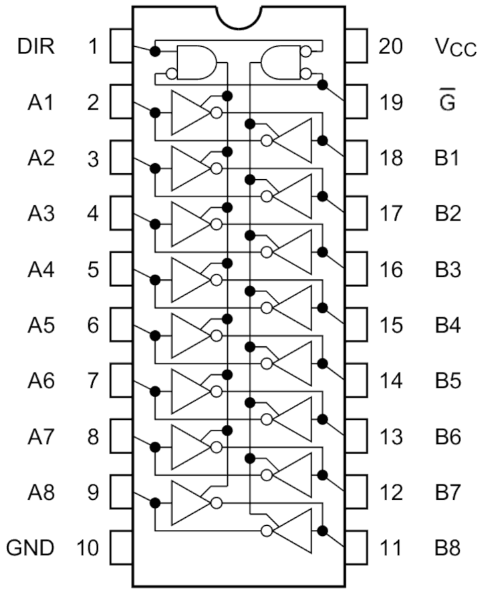
5. Pin Assignment

TC74AC245P



(top view)

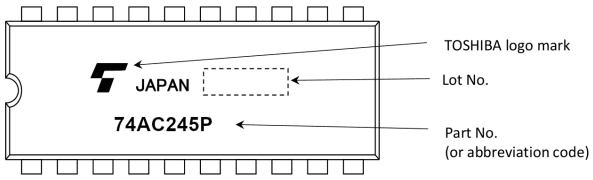
TC74AC640P



(top view)

6. Marking

TC74AC245P



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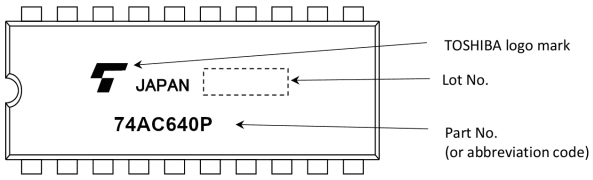
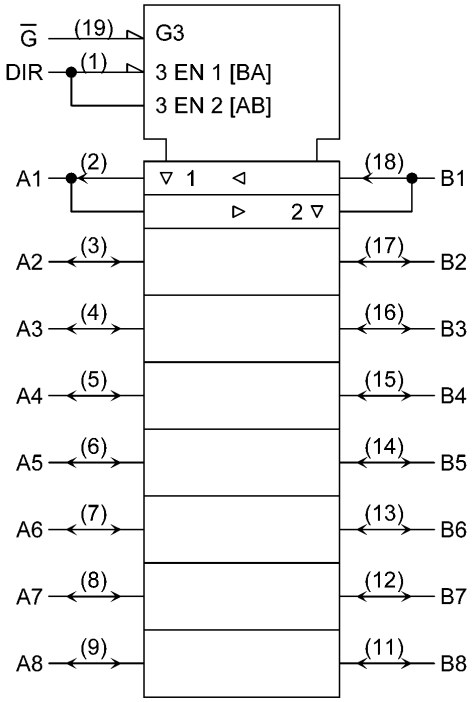


7. IEC Logic Symbol

TC74AC245P



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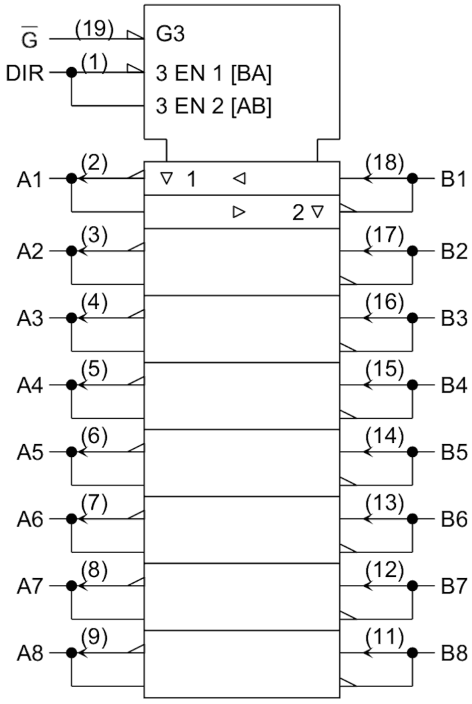


8. Truth Table

Input $\overline{G}$	Input DIR	A BUS	B BUS	Output TC74AC245P	Output TC74AC640P
L	L	Output	Input	A = B	A = $\overline{B}$
L	H	Input	Output	B = A	B = $\overline{A}$
H	X	Z	Z	Z	Z

X: Don't care
Z: High impedance

9. Absolute Maximum Ratings (Note)

Characteristics	Symbol	Note	Rating	Unit
Supply voltage	V_{CC}		-0.5 to 7.0	V
Input voltage	V_{IN}		-0.5 to V_{CC} + 0.5	V
Output voltage	V_{OUT}		-0.5 to V_{CC} + 0.5	V
Input diode current	I_{IK}		±20	mA
Output diode current	I_{OK}		±50	mA
Output current	I_{OUT}		±50	mA
V_{CC}/ground current	I_{CC}		±200	mA
Power dissipation	P_D	(Note 1)	500	mW
Storage temperature	T_{stg}		-65 to 150	°C

Note: 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 1: 500 mW in the range of T_a = -40 to 65 °C. From T_a = 65 to 85 °C a derating factor of -10 mW/°C shall be applied until 300 mW.

10. Operating Ranges (Note)

Characteristics	Symbol	Test Condition	Rating	Unit
Supply voltage	V_{CC}		2.0 to 5.5	V
Input voltage	V_{IN}		0 to V_{CC}	V
Bus I/O voltage	$V_{I/O}$		0 to V_{CC}	V
Operating temperature	T_{opr}		-40 to 85	°C
Input rise and fall times	dt/dv	V_{CC} = 3.3 ± 0.3 V	0 to 100	ns/V
		V_{CC} = 5.0 ± 0.5 V	0 to 20	

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.

11. Electrical Characteristics

11.1. DC Characteristics (Unless otherwise specified, T_a = 25 °C)

Characteristics	Symbol	Test Condition		V_{CC} (V)	Min	Typ.	Max	Unit
High-level input voltage	V_{IH}	—		2.0	1.50	—	—	V
				3.0	2.10	—	—	
				5.5	3.85	—	—	
Low-level input voltage	V_{IL}	—		2.0	—	—	0.50	V
				3.0	—	—	0.90	
				5.5	—	—	1.65	
High-level output voltage	V_{OH}	V_{IN} = V_{IH} or V_{IL}	I_{OH} = -50 μA	2.0	1.9	2.0	—	V
				3.0	2.9	3.0	—	
				4.5	4.4	4.5	—	
			I_{OH} = -4 mA	3.0	2.58	—	—	
			I_{OH} = -24 mA	4.5	3.94	—	—	
Low-level output voltage	V_{OL}	V_{IN} = V_{IH} or V_{IL}	I_{OL} = 50 μA	2.0	—	0.0	0.1	V
				3.0	—	0.0	0.1	
				4.5	—	0.0	0.1	
			I_{OL} = 12 mA	3.0	—	—	0.36	
			I_{OL} = 24 mA	4.5	—	—	0.36	
3-state output OFF-state leakage current	I_{OZ}	V_{IN} = V_{IH} or V_{IL} V_{OUT} = V_{CC} or GND		5.5	—	—	±0.5	μA
Input leakage current	I_{IN}	V_{IN} = V_{CC} or GND		5.5	—	—	±0.1	μA
Quiescent supply current	I_{CC}	V_{IN} = V_{CC} or GND		5.5	—	—	8.0	μA

11.2. DC Characteristics (Unless otherwise specified, T_a = -40 to 85 °C)

Characteristics	Symbol	Test Condition		Note	V_{CC} (V)	Min	Max	Unit
High-level input voltage	V_{IH}	—			2.0	1.50	—	V
					3.0	2.10	—	
					5.5	3.85	—	
Low-level input voltage	V_{IL}	—			2.0	—	0.50	V
					3.0	—	0.90	
					5.5	—	1.65	
High-level output voltage	V_{OH}	V_{IN} = V_{IH} or V_{IL}	I_{OH} = -50 μA		2.0	1.9	—	V
					3.0	2.9	—	
					4.5	4.4	—	
			I_{OH} = -4 mA		3.0	2.48	—	
			I_{OH} = -24 mA		4.5	3.80	—	
			I_{OH} = -75 mA	(Note 1)	5.5	3.85	—	
Low-level output voltage	V_{OL}	V_{IN} = V_{IH} or V_{IL}	I_{OL} = 50 μA		2.0	—	0.1	V
					3.0	—	0.1	
					4.5	—	0.1	
			I_{OL} = 12 mA		3.0	—	0.44	
			I_{OL} = 24 mA		4.5	—	0.44	
			I_{OL} = 75 mA	(Note 1)	5.5	—	1.65	
3-state output OFF-state leakage current	I_{OZ}	V_{IN} = V_{IH} or V_{IL} V_{OUT} = V_{CC} or GND			5.5	—	±5.0	μA
Input leakage current	I_{IN}	V_{IN} = V_{CC} or GND			5.5	—	±1.0	μA
Quiescent supply current	I_{CC}	V_{IN} = V_{CC} or GND			5.5	—	80.0	μA

Note 1: This spec indicates the capability of driving 50 Ω transmission lines.
One output should be tested within a 10 ms maximum duration.

11.3. AC Characteristics (Unless otherwise specified, T_a = 25 °C, Input: $t_r = t_f$ = 3 ns)

Characteristics	Symbol	Note	Test Condition	V_{CC} (V)	Min	Typ.	Max	Unit
Propagation delay time	t_{PLH},t_{PHL}	(Note 2)	C_L = 50 pF R_L = 500 Ω	3.3 ± 0.3	—	7.0	10.9	ns
				5.0 ± 0.5	—	5.0	7.5	
		(Note 3)	C_L = 50 pF R_L = 500 Ω	3.3 ± 0.3	—	6.4	10.0	ns
				5.0 ± 0.5	—	4.8	7.0	
3-state output enable time	t_{PZL},t_{PZH}		C_L = 50 pF R_L = 500 Ω	3.3 ± 0.3	—	9.3	15.3	ns
				5.0 ± 0.5	—	7.1	10.5	
3-state output disable time	t_{PLZ},t_{PHZ}		C_L = 50 pF R_L = 500 Ω	3.3 ± 0.3	—	7.1	11.4	ns
				5.0 ± 0.5	—	5.9	8.7	
Input capacitance	C_{IN}		DIR, $\overline{G}$		—	5	10	pF
Bus I/O capacitance	$C_{I/O}$		An, Bn		—	13	—	pF
Power dissipation capacitance	C_{PD}	(Note 1)	TC74AC245P		—	38	—	pF
			TC74AC640P		—	36	—	

Note 1: 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.

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

Note 2: For TC74AC245P only

Note 3: For TC74AC640P only

11.4. AC Characteristics (Unless otherwise specified, T_a = -40 to 85 °C, Input: $t_r = t_f$ = 3 ns)

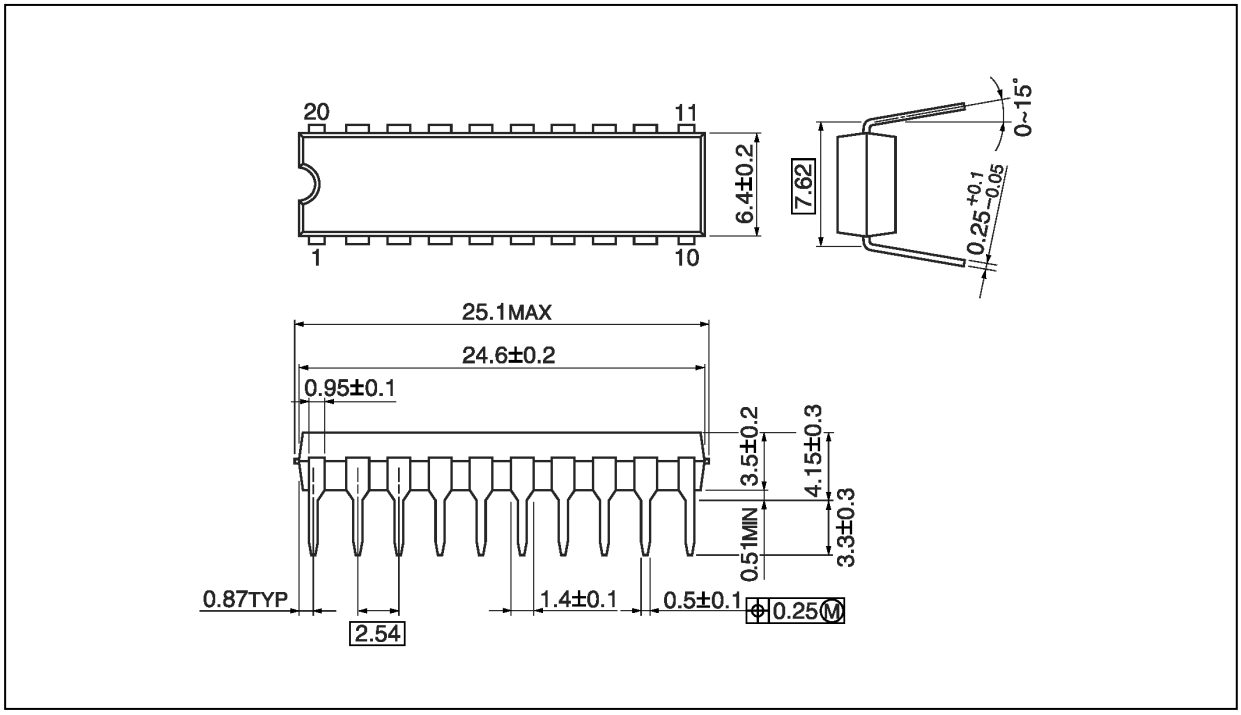
Characteristics	Symbol	Note	Test Condition	V_{CC} (V)	Min	Max	Unit
Propagation delay time	t_{PLH},t_{PHL}	(Note 1)	C_L = 50 pF R_L = 500 Ω	3.3 ± 0.3	1.0	12.4	ns
				5.0 ± 0.5	1.0	8.5	
		(Note 2)	C_L = 50 pF R_L = 500 Ω	3.3 ± 0.3	1.0	11.4	ns
				5.0 ± 0.5	1.0	8.0	
3-state output enable time	t_{PZL},t_{PZH}		C_L = 50 pF R_L = 500 Ω	3.3 ± 0.3	1.0	17.4	ns
				5.0 ± 0.5	1.0	12.0	
3-state output disable time	t_{PLZ},t_{PHZ}		C_L = 50 pF R_L = 500 Ω	3.3 ± 0.3	1.0	13.0	ns
				5.0 ± 0.5	1.0	10.0	
Input capacitance	C_{IN}		DIR, $\overline{G}$		—	10	pF

Note 1: For TC74AC245P only

Note 2: For TC74AC640P only

Package Dimensions

Unit: mm



Weight: 1.30 g (typ.)

Package Name(s)
Nickname: DIP20

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