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.

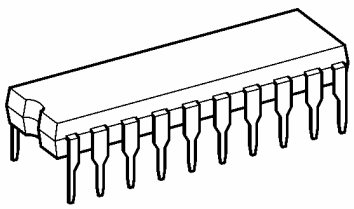
They achieve the high speed operation similar to equivalent LSTTL while maintaining the CMOS low power dissipation.

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.

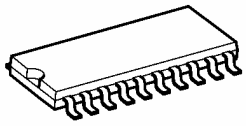
All inputs are equipped with protection circuits against static discharge or transient excess voltage.

TC74HC245AP, TC74HC640AP



DIP20-P-300-2.54A

TC74HC245AF, TC74HC640AF



SOP20-P-300-1.27A

Weight

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

## Features (Note 1)(Note 2)

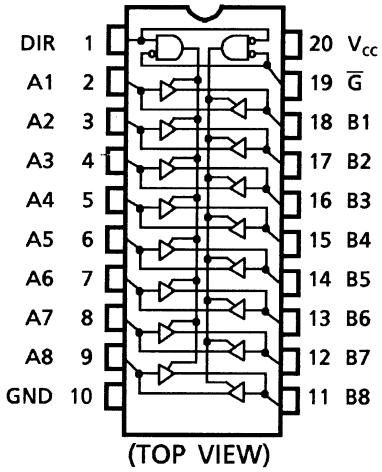
- High speed: $t_{pd}$ = 10 ns (typ.) at $V_{CC}$ = 5 V
- Low power dissipation: $I_{CC}$ = 4 μA (max) at Ta = 25°C
- High noise immunity: $V_{NIH} = V_{NIL}$ = 28% $V_{CC}$ (min)
- Output drive capability: 15 LSTTL loads
- Symmetrical output impedance: $|I_{OH}| = I_{OL}$ = 6 mA (min)
- Balanced propagation delays: $t_{pLH} \simeq t_{pHL}$
- Wide operating voltage range: $V_{CC}$ (opr) = 2~6 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.

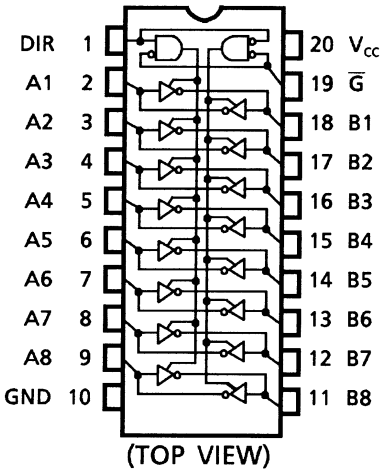
Note 2: All floating (high impedance) bus terminals must have their input levels fixed by means of pull up or pull down resistors.

## Pin Assignment

**TC74HC245A**

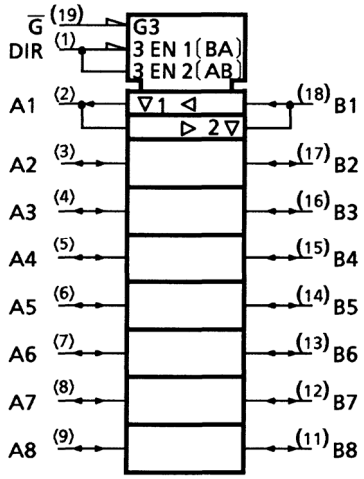



**TC74HC640A**

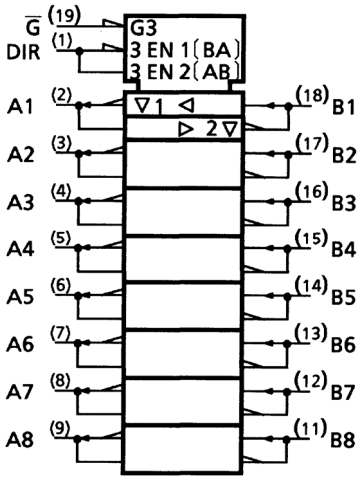



## IEC Logic Symbol

**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 Ta = −40 to 65°C. From Ta = 65 to 85°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)<br>0~500 ($V_{CC}$ = 4.5 V)<br>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 | | $V_{CC}$ (V) | Ta = 25°C Min | Ta = 25°C Typ. | Ta = 25°C Max | Ta = −40~85°C Min | Ta = −40~85°C Max | Unit |
|---|---|---|---|---|---|---|---|---|---|---|
| High-level input voltage | $V_{IH}$ | — | | 2.0 | 1.50 | — | — | 1.50 | — | V |
| | | | | 4.5 | 3.15 | — | — | 3.15 | — | |
| | | | | 6.0 | 4.20 | — | — | 4.20 | — | |
| Low-level input voltage | $V_{IL}$ | — | | 2.0 | — | — | 0.50 | — | 0.50 | V |
| | | | | 4.5 | — | — | 1.35 | — | 1.35 | |
| | | | | 6.0 | — | — | 1.80 | — | 1.80 | |
| High-level output voltage | $V_{OH}$ | $V_{IN}$ = $V_{IH}$ or $V_{IL}$ | $I_{OH}$ = −20 μA | 2.0 | 1.9 | 2.0 | — | 1.9 | — | V |
| | | | | 4.5 | 4.4 | 4.5 | — | 4.4 | — | |
| | | | | 6.0 | 5.9 | 6.0 | — | 5.9 | — | |
| | | | $I_{OH}$ = −6 mA | 4.5 | 4.18 | 4.31 | — | 4.13 | — | |
| | | | $I_{OH}$ = −7.8 mA | 6.0 | 5.68 | 5.80 | — | 5.63 | — | |
| Low-level output voltage | $V_{OL}$ | $V_{IN}$ = $V_{IH}$ or $V_{IL}$ | $I_{OL}$ = 20 μA | 2.0 | — | 0.0 | 0.1 | — | 0.1 | V |
| | | | | 4.5 | — | 0.0 | 0.1 | — | 0.1 | |
| | | | | 6.0 | — | 0.0 | 0.1 | — | 0.1 | |
| | | | $I_{OL}$ = 6 mA | 4.5 | — | 0.17 | 0.26 | — | 0.33 | |
| | | | $I_{OL}$ = 7.8 mA | 6.0 | — | 0.18 | 0.26 | — | 0.33 | |
| 3-state output off-state current | $I_{OZ}$ | $V_{IN}$ = $V_{IH}$ or $V_{IL}$<br>$V_{OUT}$ = $V_{CC}$ or GND | | 6.0 | — | — | ±0.5 | — | ±5.0 | μA |
| Input leakage current | $I_{IN}$ | $V_{IN}$ = $V_{CC}$ or GND | | 6.0 | — | — | ±0.1 | — | ±1.0 | μA |
| Quiescent supply current | $I_{CC}$ | $V_{IN}$ = $V_{CC}$ 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) | $V_{CC}$ (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 | $t_{pZL}$ $t_{pZH}$ | $R_L = 1k\Omega$ | 50 | 2.0 | — | 48 | 150 | — | 190 | ns |
| | | | | 4.5 | — | 16 | 30 | — | 38 | |
| | | | | 6.0 | — | 14 | 26 | — | 32 | |
| | | | 150 | 2.0 | — | 63 | 180 | — | 225 | |
| | | | | 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 | $C_{IN}$ | DIR, G | | | — | 5 | 10 | — | 10 | pF |
| Bus input capacitance | $C_{OUT}$ | An, Bn | | | — | 13 | — | — | — | pF |
| Power dissipation capacitance | $C_{PD}$ (Note) | TC74HC245A | | | — | 39 | — | — | — | pF |
| | | TC74HC640A | | | — | 37 | — | — | — | |

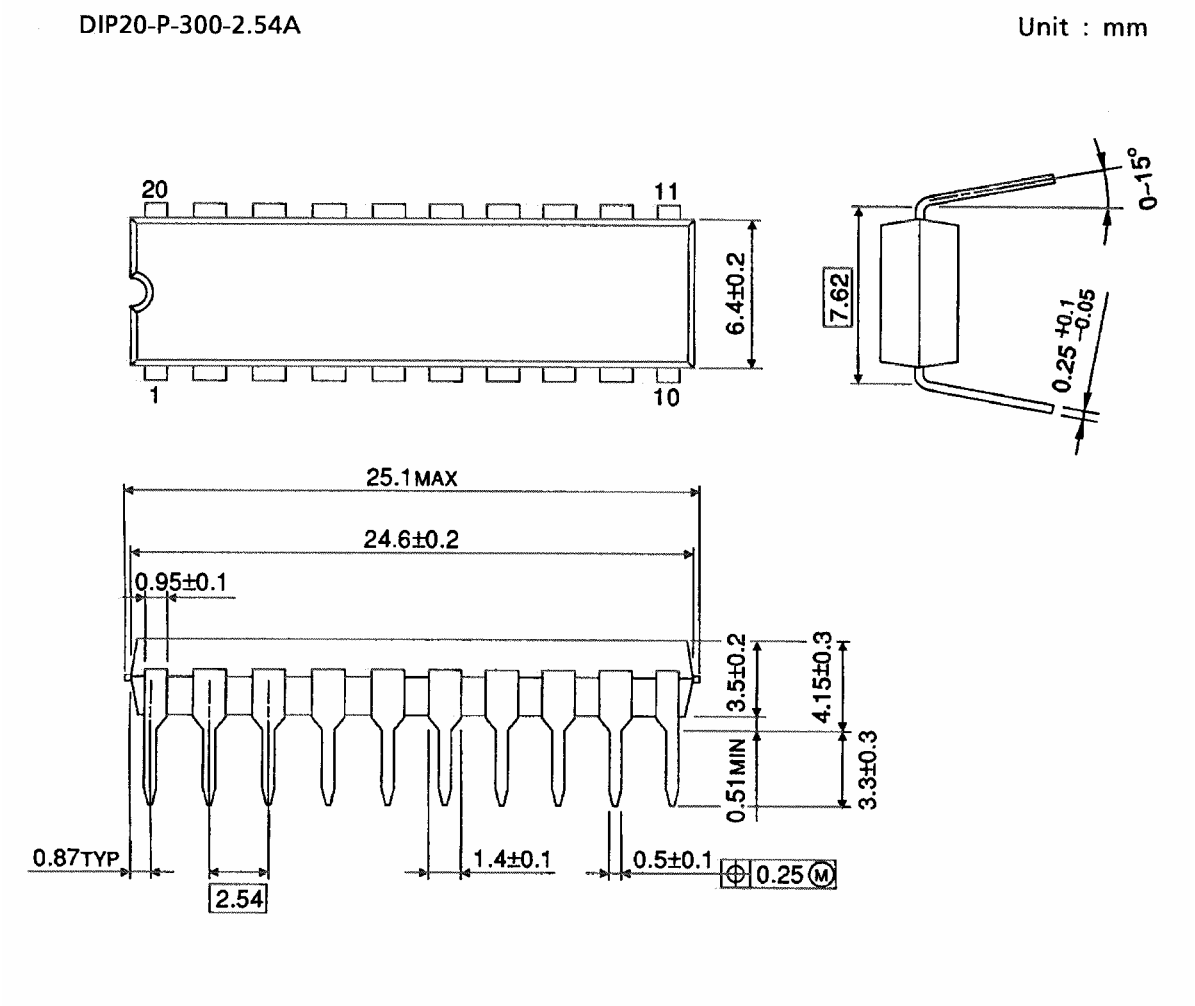
Note: $C_{PD}$ is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load.

Average operating current can be obtained by the equation:

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

## Package Dimensions

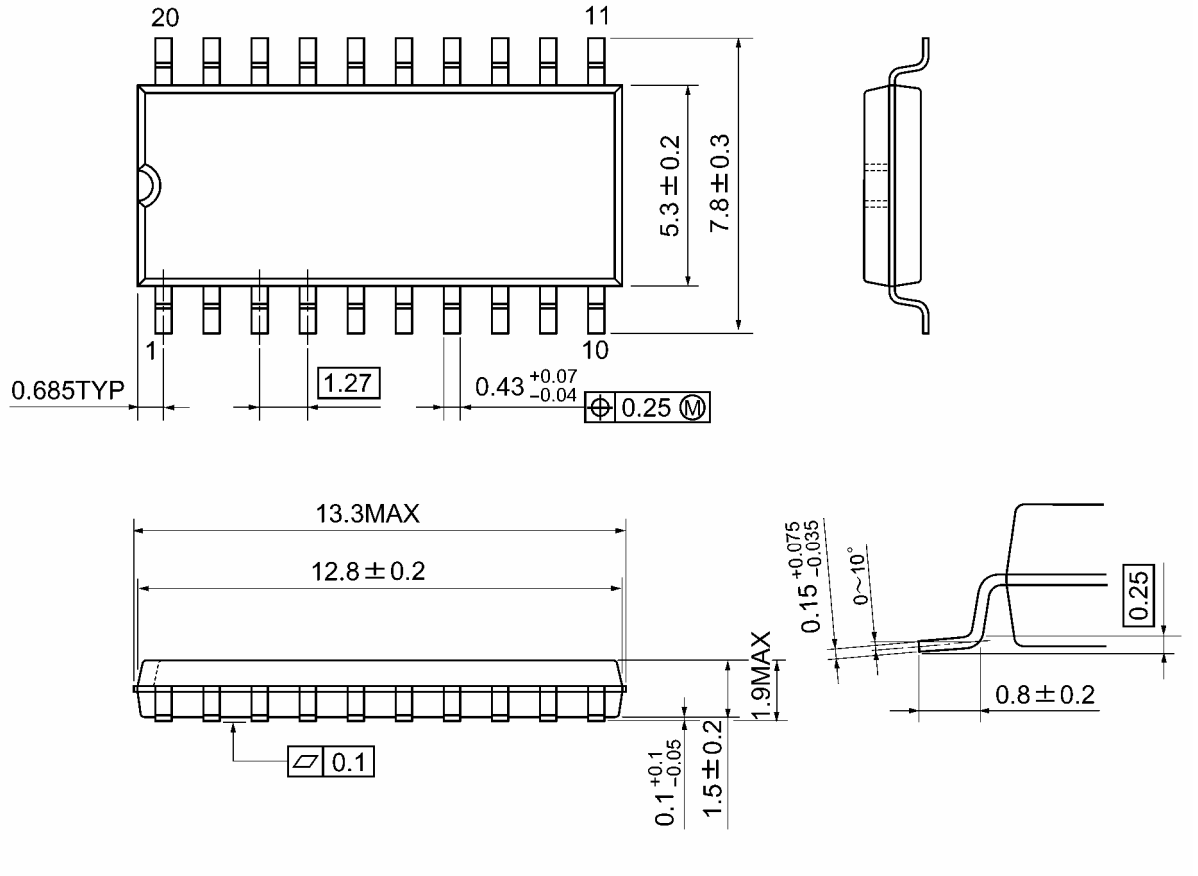
DIP20-P-300-2.54A Unit : mm




Weight: 1.30 g (typ.)

## Package Dimensions

SOP20-P-300-1.27A Unit: mm




Weight: 0.22 g (typ.)

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