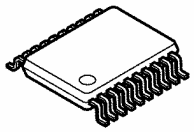
TOSHIBA CMOS Digital Integrated Circuit
Silicon Monolithic

# TC7MP85400FT

## Octal Bus Buffer with Output Series Resistor

The TC7MP85400 is an advanced high-speed CMOS octal bus buffer fabricated with silicon-gate CMOS technology. It achieves high-speed operation similar to the equivalent bipolar Schottky TTL while maintaining the CMOS low power dissipation. The inputs are compatible with TTL voltage levels, so the TC7MP85400 can be used as a level converter for interfacing 3.3-V systems to 5-V systems.
The TC7MP85400 is an inverting bus buffer.
The outputs have 47-Ω (typ.) resistors connected in series, which can reduce reflection noise without using external resistors.
Input and output protection circuits ensure that 0 to 5.5V can be applied to the input and output*1 pins without regard to the supply voltage.



TSSOP20-P-0044-0.65A

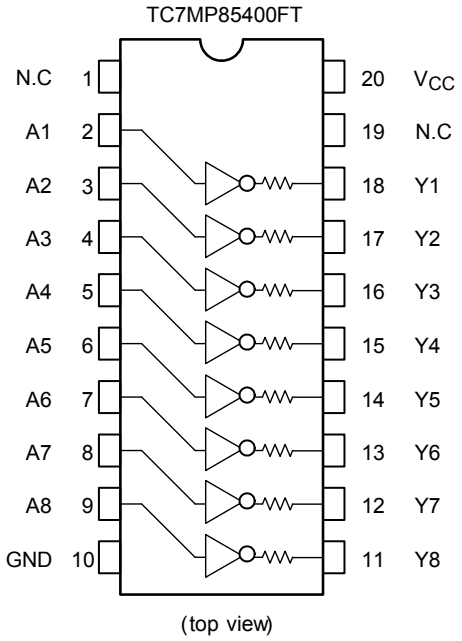
Weight: 0.08 g (typ.)

Since power-down protection is provided on both inputs and outputs, the TC7MP85400 can be used in a wide range of applications, such as interfacing between two different voltage systems, backup battery systems and so on.

## Features

- Outputs have 47-Ω (typ.) resistors connected in series.
- High speed: tpd = 4.5 ns (typ.) at $V_{CC}$ = 5 V
- TTL-level inputs: $V_{IL}$ = 0.8 V (max)
  $V_{IH}$ = 2.0 V (max)
- Power-down protection is provided on all inputs.
- Low noise: $V_{OLP}$ = 0.35 V (typ)

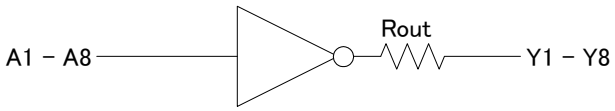
## Pin Assignment




## Truth Table

| Inputs | Outputs |
|---|---|
| An | Yn |
| L | H |
| H | L |

## Circuit Schematic (1/8 Package)



## 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 7.0 | | V |
| DC output voltage | $V_{OUT}$ | −0.5 to 7.0 | (Note 2) | V |
| | | −0.5 to $V_{CC}$ + 0.5 | (Note 3) | |
| Input diode current | $I_{IK}$ | −20 | | mA |
| Output diode current | $I_{OK}$ | ±20 | (Note 4) | mA |
| DC output current | $I_{OUT}$ | ±25 | | mA |
| DC $V_{CC}$/ground current | $I_{CC}$ | ±75 | | mA |
| Power dissipation | $P_D$ | 180 | | mW |
| Storage temperature | $T_{stg}$ | −65 to 150 | | °C |

Note 1: Exceeding any of the absolute maximum ratings, even briefly, may 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: $V_{CC}$ = 0 V

Note 3: High or Low stats. $I_{OUT}$ absolute maximum rating must be observed.

Note 4: $V_{OUT} < GND$, $V_{OUT} > V_{CC}$

## Operating Ranges (Note 1)

| Characteristics | Symbol | Rating | | Unit |
|---|---|---|---|---|
| Supply voltage | $V_{CC}$ | 4.5 to 5.5 | | V |
| Input voltage | $V_{IN}$ | 0 to 5.5 | | V |
| Output voltage | $V_{OUT}$ | 0 to 5.5 | (Note 2) | V |
| | | 0 to $V_{CC}$ | (Note 3) | V |
| Operating temperature | $T_{opr}$ | −40 to 85 | | °C |
| Input rise and fall time | dt/dv | 0 to 20 | | ns/V |

Note 1: The operating ranges must be maintained to ensure the normal operation of the device.
Unused inputs must be tied to either $V_{CC}$ or GND.

Note 2: $V_{CC}$ = 0 V

Note 3: High or low state

## 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 to 85°C Min | Ta = −40 to 85°C Max | Unit |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Input voltage | High level | $V_{IH}$ | — | | 4.5 to 5.5 | 2.0 | — | — | 2.0 | — | V |
| | Low level | $V_{IL}$ | — | | 4.5 to 5.5 | — | — | 0.8 | — | 0.8 | |
| Output voltage | High level | $V_{OH}$ | $V_{IN}$ = $V_{IH}$ or $V_{IL}$ | $I_{OH}$ = −50 μA | 4.5 | 4.4 | 4.5 | — | 4.4 | — | V |
| | | | | $I_{OH}$ = −4 mA | 4.5 | 3.94 | — | — | 3.8 | — | |
| | Low level | $V_{OL}$ | $V_{IN}$ = $V_{IH}$ or $V_{IL}$ | $I_{OL}$ = 50 μA | 4.5 | — | 0.0 | 0.1 | — | 0.1 | |
| | | | | $I_{OL}$ = 4 mA | 4.5 | — | — | 0.36 | — | 0.44 | |
| Input leakage current | | $I_{IN}$ | $V_{IN}$ = GND | | 0 to 5.5 | — | — | 0.1 | — | 1.0 | μA |
| Quiescent supply current | | $I_{CCL}$ | $V_{IN}$ = GND | | 5.5 | — | — | 4.0 | — | 40.0 | μA |
| | | $I_{CCT}$ | Per input: $V_{IN}$ = 3.4 V<br>Other input: GND | | 5.5 | — | — | 1.35 | — | 1.5 | mA |
| Output leakage current | | $I_{OPD}$ | $V_{OUT}$ = 5.5 V | | 0 | — | — | 0.5 | — | 5.0 | μA |

### AC Characteristics (input: $t_r = t_f = 3$ ns)

| Characteristics | Symbol | Test Condition | $V_{CC}$ (V) | $C_L$ (pF) | Ta = 25°C Min | Ta = 25°C Typ. | Ta = 25°C Max | Ta = −40 to 85°C Min | Ta = −40 to 85°C Max | Unit |
|---|---|---|---|---|---|---|---|---|---|---|
| Propagation delay time | $t_{pLH}$ | — | 5.0 ± 0.5 | 15 | — | 4.5 | 6.0 | 1.0 | 7.0 | ns |
| | $t_{pHL}$ | | | 50 | — | 6.5 | 8.5 | 1.0 | 10.0 | |
| Output to output skew | $t_{osLH}$<br>$t_{osHL}$ | (Note 1) | 5.0 ± 0.5 | 50 | — | — | 1.0 | — | 1.0 | ns |
| Power dissipation capacitance | $C_{PD}$ | (Note 2) | | | — | 19 | — | — | — | pF |

Note 1: Parameter guaranteed by design.

$t_{osLH} = |t_{pLHm} - t_{pLHn}|$, $t_{osHL} = |t_{pHLm} - t_{pHLn}|$

Note 2: $C_{PD}$ 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:

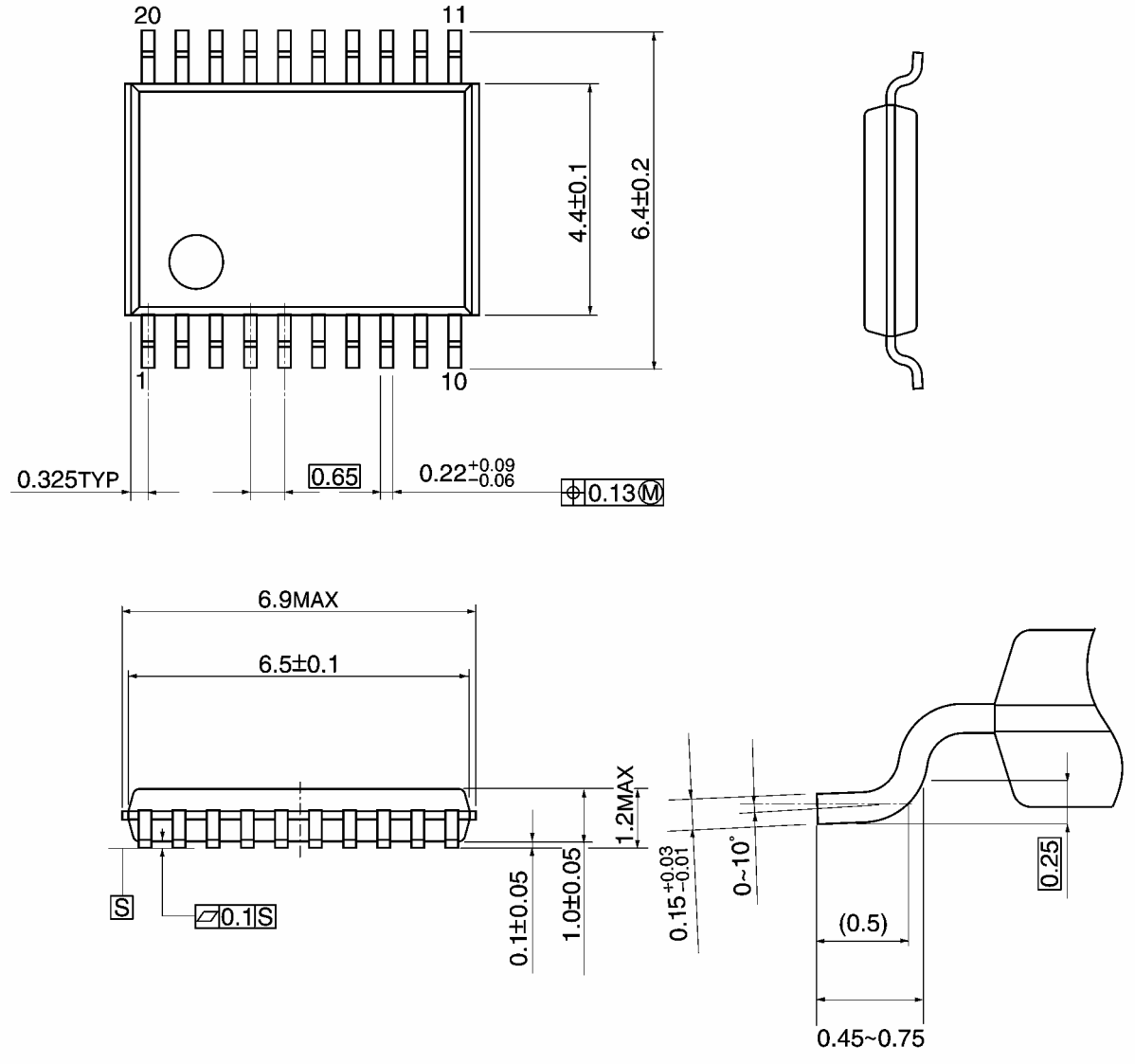
$I_{CC\ (opr)} = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC}/8$ (per bit)

**Noise Characteristics (input: $t_r = t_f = 3$ ns)**

| Characteristics | Symbol | Test Condition | Ta = 25°C | | Unit |
|---|---|---|---|---|---|
| | | | $V_{CC}$ (V) | Typ. | Limit | |
| Quiet output maximum dynamic $V_{OL}$ | $V_{OLP}$ | $C_L$ = 50 pF | 5.0 | 0.35 | — | V |
| Quiet output minimum dynamic $V_{OL}$ | $V_{OLV}$ | $C_L$ = 50 pF | 5.0 | −0.35 | — | V |
| Minimum high level dynamic input voltage | $V_{IHD}$ | $C_L$ = 50 pF | 5.0 | — | 2.0 | V |
| Maximum low level dynamic input voltage | $V_{ILD}$ | $C_L$ = 50 pF | 5.0 | — | 0.8 | V |

## Package Dimensions

TSSOP20-P-0044-0.65A Unit: mm




Weight: 0.08 g (typ.)

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20070701-EN GENERAL

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