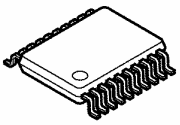
TOSHIBA CMOS Digital Integrated Circuit
Silicon Monolithic

TC7MP85410FT

Octal Bus Buffer with Output Series Resistor

The TC7MP85410 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 to the TC7MP85410 can be used as a level converter for interfacing 3.3-V systems to 5-V systems.
The TC7MP85410 is a non-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.
Since power-down protection is provided on both inputs and outputs, the TC7MP85410 can be used in a wide range of applications, such as interfacing between two different voltage systems, backup battery systems and so on.



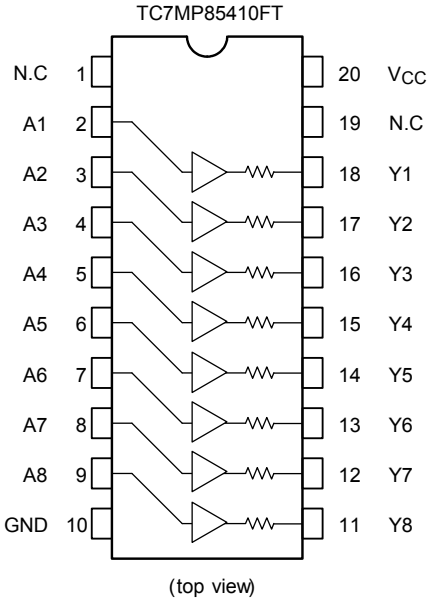
TSSOP20-P-0044-0.65A

Weight: 0.08 g (typ.)

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)

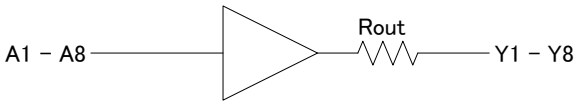
Pin Assignment



Truth Table

Inputs	Outputs
An	Yn
L	L
H	H

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 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} t_{pHL}	—	5.0 ± 0.5	15	—	4.5	6.0	1.0	7.0	ns
				50	—	6.5	8.5	1.0	10.0	
Output to output skew	t_{osLH} 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:

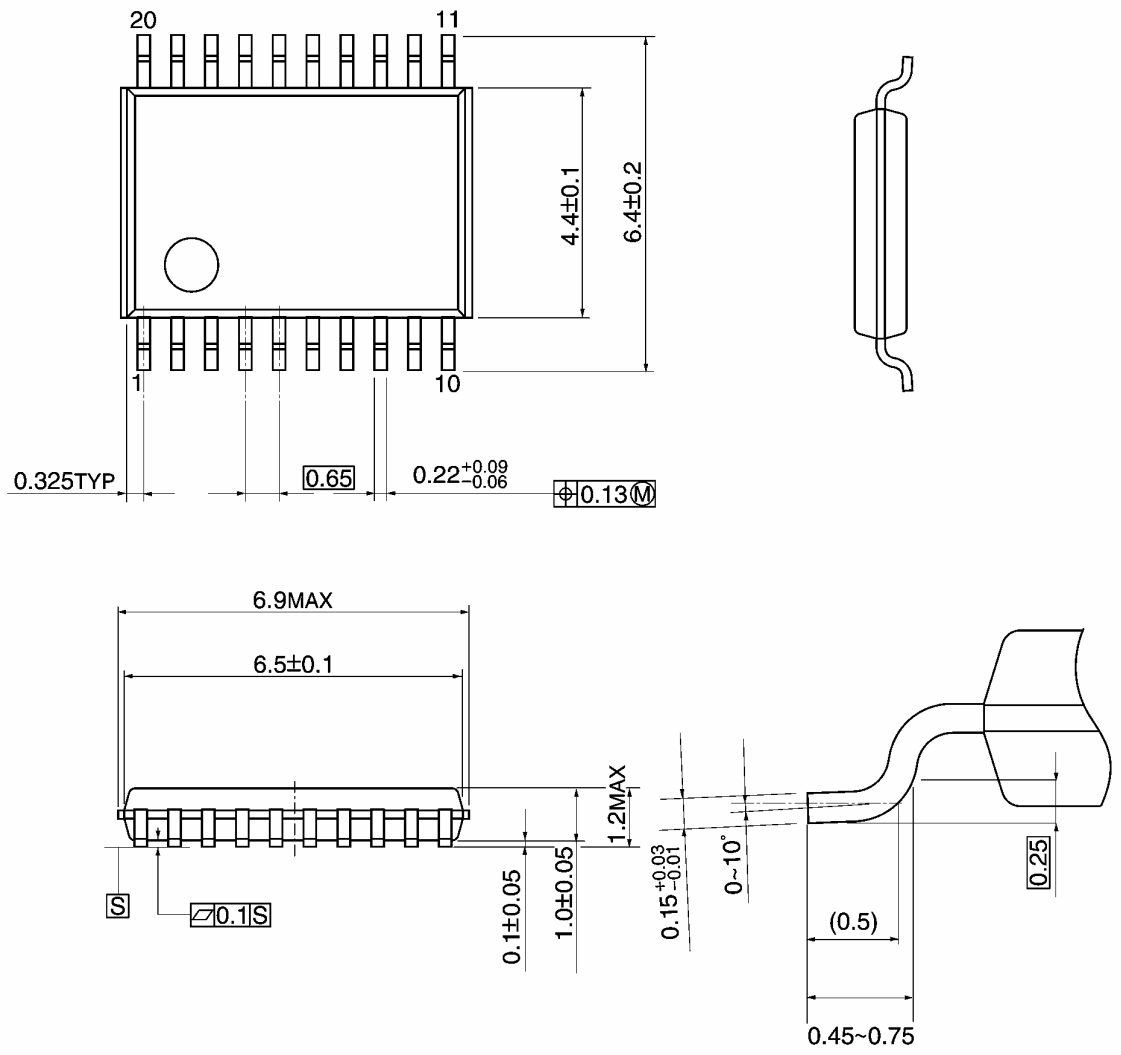
$$I_{CC\ (opr)} = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC}/8 \text{ (per bit)}$$

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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