

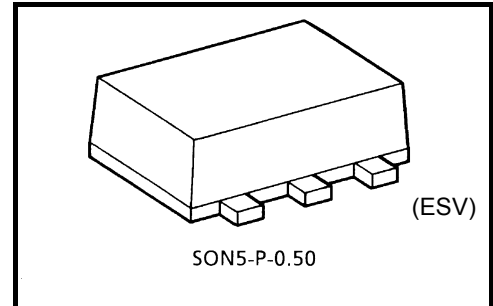
TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

# TC7SZ126FE

Bus Buffer 3-State Output

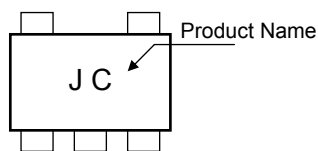
## Features

- High output current :  $\pm 24\text{mA}$  (min) at  $V_{CC} = 3\text{V}$
- Super high speed operation :  $t_{pd} = 2.6\text{ns}$  (typ.)  
at  $V_{CC} = 5\text{V}$ ,  $C_L = 50\text{pF}$
- Operation voltage range :  $V_{CC} = 1.65$  to  $5.5\text{V}$
- 5.5-V tolerant inputs
- 5.5-V power down protection output
- ESD performance : Machine model  $\geq \pm 200\text{V}$   
Human body model  $\geq \pm 2000\text{V}$
- Matches the performance of TC74LCX series when operated at  $3.3\text{-V } V_{CC}$

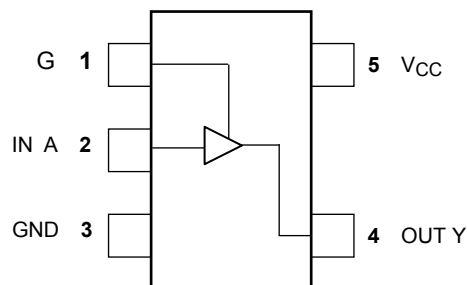


Weight: 0.003 g (typ.)

## Marking



## Pin Assignment (top view)



## Absolute Maximum Ratings (Ta = 25°C)

Characteristic	Symbol	Rating	Unit
Supply voltage	$V_{CC}$	-0.5 to 6	V
DC input voltage	$V_{IN}$	-0.5 to 6	V
DC output voltage	$V_{OUT}$	-0.5 to 6 (Note 1)	V
		-0.5 to $V_{CC} + 0.5$ (Note 2)	
Input diode current	$I_{IK}$	-20	mA
Output diode current	$I_{OK}$	-20 (Note3)	mA
DC output current	$I_{OUT}$	$\pm 50$	mA
DC $V_{CC}$ /ground current	$I_{CC}$	$\pm 50$	mA
Power dissipation	$P_D$	150	mW
Storage temperature	$T_{stg}$	-65 to 150	°C

Note: 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).

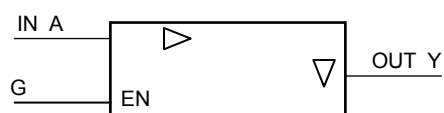
Note 1:  $V_{CC} = 0\text{V}$  or High impedance condition.

Note 2: High or Low state. Do not exceed  $I_{OUT}$  of absolute maximum ratings.

Note 3:  $V_{OUT} < GND$

Start of commercial production  
2008-10

## IEC Logic Symbol



## Truth Table

G	A	Y
L	X	Z
H	L	L
H	H	H

X: Don't Care

Z: High Impedance

## Operating Ranges

Characteristic	Symbol	Rating	Unit
Supply voltage	$V_{CC}$	1.65 to 5.5	V
		1.5 to 5.5 (Note 4)	
Input voltage	$V_{IN}$	0 to 5.5	V
Output voltage	$V_{OUT}$	0 to 5.5 (Note 5)	V
		0 to $V_{CC}$ (Note 6)	
Operating temperature	$T_{opr}$	-40 to 85	°C
Input rise time and fall time	dt/dv	0 to 20 ( $V_{CC} = 1.8\text{ V} \pm 0.15\text{ V}$ , $2.5\text{ V} \pm 0.2\text{ V}$ )	ns/V
		0 to 10 ( $V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$ )	
		0 to 5 ( $V_{CC} = 5.0\text{ V} \pm 0.5\text{ V}$ )	

Note 4: Data retention only

Note 5:  $V_{CC} = 0\text{ V}$  or High impedance condition

Note 6: High or Low State

## Electrical Characteristics

### DC Characteristics

Characteristic	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>	—	1.65 to 1.95	V <sub>CC</sub> × 0.75	—	—	V <sub>CC</sub> × 0.75	—	V	
			2.3 to 5.5	V <sub>CC</sub> × 0.7	—	—	V <sub>CC</sub> × 0.7	—		
Low-level input voltage	V <sub>IL</sub>	—	1.65 to 1.95	—	—	V <sub>CC</sub> × 0.25	—	V <sub>CC</sub> × 0.25	V	
			2.3 to 5.5	—	—	V <sub>CC</sub> × 0.3	—	V <sub>CC</sub> × 0.3		
High-level output voltage	V <sub>OH</sub>	V <sub>IN</sub> = V <sub>IH</sub>	I <sub>OH</sub> = -100 μA	1.65	1.55	1.65	—	1.55	—	V
				2.3	2.2	2.3	—	2.2	—	
				3.0	2.9	3.0	—	2.9	—	
				4.5	4.4	4.5	—	4.4	—	
			I <sub>OH</sub> = -4 mA	1.65	1.29	1.52	—	1.29	—	
			I <sub>OH</sub> = -8 mA	2.3	1.9	2.15	—	1.9	—	
			I <sub>OH</sub> = -16 mA	3.0	2.4	2.8	—	2.4	—	
			I <sub>OH</sub> = -24 mA	3.0	2.3	2.68	—	2.3	—	
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> = 100 μA	1.65	—	0	0.1	—	0.1	V
				2.3	—	0	0.1	—	0.1	
				3.0	—	0	0.1	—	0.1	
				4.5	—	0	0.1	—	0.1	
			I <sub>OL</sub> = 4 mA	1.65	—	0.08	0.24	—	0.24	
			I <sub>OL</sub> = 8 mA	2.3	—	0.1	0.3	—	0.3	
			I <sub>OL</sub> = 16 mA	3.0	—	0.15	0.4	—	0.4	
			I <sub>OL</sub> = 24 mA	3.0	—	0.22	0.55	—	0.55	
			I <sub>OL</sub> = 32 mA	4.5	—	0.22	0.55	—	0.55	
			Input leakage current	I <sub>IN</sub>	V <sub>IN</sub> = 5.5 V or GND	0 to 5.5	—	—	±1	
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> = 0 to 5.5V	1.65 to 5.5	—	—	±1	—	±10	μA	
Power off leakage current	I <sub>OFF</sub>	V <sub>IN</sub> or V <sub>OUT</sub> = 5.5 V	0.0	—	—	1	—	10	μA	
Quiescent supply current	I <sub>CC</sub>	V <sub>IN</sub> = V <sub>CC</sub> or GND	5.5	—	—	2	—	20	μA	

**AC Characteristics (unless otherwise specified, Input:  $t_r = t_f = 3$  ns)**

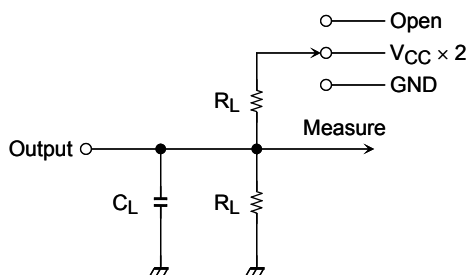
Characteristic	Symbol	Test Condition	Ta = 25°C			Ta = -40 to 85°C		Unit	
			V <sub>CC</sub> (V)	Min	Typ.	Max	Min		Max
Propagation delay time	t <sub>pLH</sub> t <sub>pHL</sub>	C <sub>L</sub> = 15 pF, R <sub>L</sub> = 1MΩ	1.8 ± 0.15	2.0	5.3	11.0	2.0	11.5	ns
			2.5 ± 0.2	0.8	3.4	7.5	0.8	8.0	
	3.3 ± 0.3		0.5	2.5	5.2	0.5	5.5		
	C <sub>L</sub> = 50 pF, R <sub>L</sub> = 500Ω	5.0 ± 0.5	0.5	2.1	4.5	0.5	4.8		
		3.3 ± 0.3	1.5	3.2	5.7	1.5	6.0		
		5.0 ± 0.5	0.8	2.6	5.0	0.8	5.3		
Output enable time	t <sub>pZL</sub> t <sub>pZH</sub>	C <sub>L</sub> = 50 pF, R <sub>L</sub> = 500 Ω	1.8 ± 0.15	2.0	7.0	14.9	2.0	16.6	ns
			2.5 ± 0.2	1.5	4.6	8.5	1.5	9.0	
	3.3 ± 0.3		1.5	3.5	6.2	1.5	6.5		
	5.0 ± 0.5		0.8	2.8	5.5	0.8	5.8		
Output disable time	t <sub>pLZ</sub> t <sub>pHZ</sub>	C <sub>L</sub> = 50 pF, R <sub>L</sub> = 500 Ω	1.8 ± 0.15	2.0	5.4	11.8	2.0	12.7	ns
			2.5 ± 0.2	1.5	4.0	8.0	1.5	8.5	
	3.3 ± 0.3		1.0	3.5	5.7	1.0	6.0		
	5.0 ± 0.5		0.5	2.5	4.7	0.5	5.0		
Input capacitance	C <sub>IN</sub>	—	0 to 5.5	—	4	—	—	—	pF
Power dissipation capacitance	C <sub>PD</sub>	(Note 7)	3.3	—	17	—	—	—	pF
			5.5	—	24	—	—	—	

Note 7: 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:

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

**AC Characteristics Measurement Circuit**

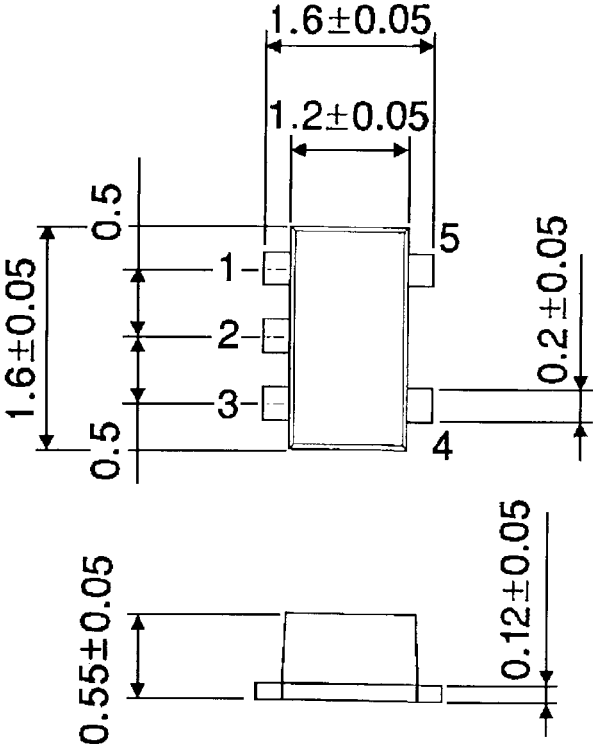


Characteristics	Switch
t <sub>pLH</sub> , t <sub>pHL</sub>	Open
t <sub>pLZ</sub> , t <sub>pZL</sub>	V <sub>CC</sub> × 2
t <sub>pHZ</sub> , t <sub>pZH</sub>	GND

**Package Dimensions**

SON5-P-0.50

Unit : mm



Weight: 0.003 g (typ.)

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