

TC7SZ126AFS

1. Functional Description

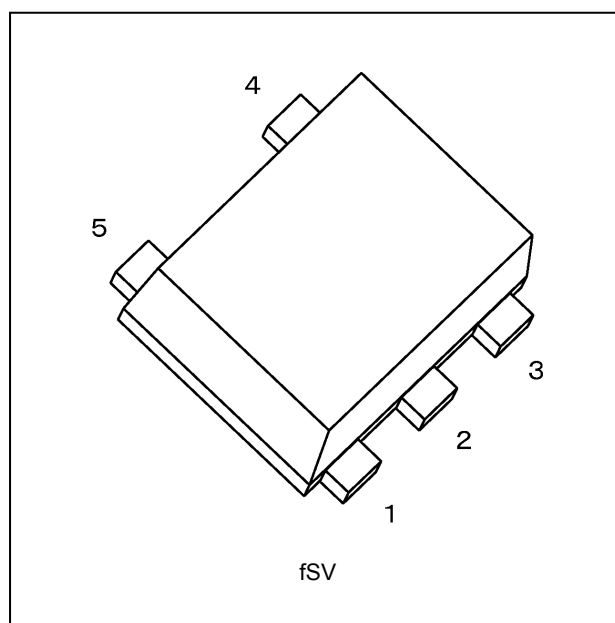
- Bus Buffer with 3-State Output

2. Features

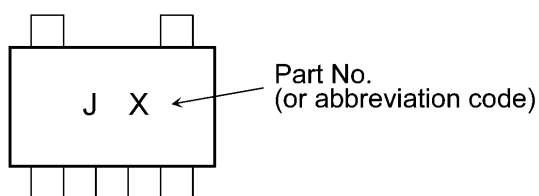
- (1) Wide operating temperature range: $T_{opr} = -40$ to 125°C (Note 1)
- (2) High output current: ± 24 mA (min) at $V_{CC} = 3.0$ V
- (3) Super high speed operation: $t_{pd} = 2.6$ ns (typ.) at $V_{CC} = 5.0$ V, $C_L = 50$ pF
- (4) Operation voltage range: $V_{CC} = 1.65$ to 5.5 V
- (5) 5.5 V tolerant inputs

Note 1: For devices with the ordering part number ending in J(T. $T_{opr} = -40$ to 85°C for the other devices.

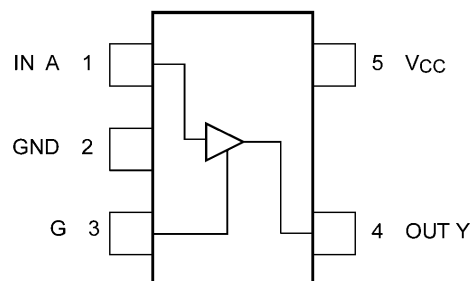
3. Packaging



4. Marking and Pin Assignment



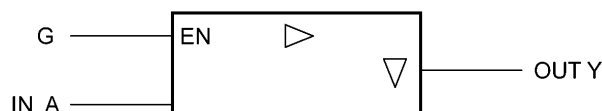
Marking



Pin Assignment (Top view)

Start of commercial production
2008-05

5. IEC Logic Symbol



6. Truth Table

Input A	Input G	Output Y
X	L	Z
L	H	L
H	H	H

X: Don't care

Z: High impedance

7. Absolute Maximum Ratings (Note) (Unless otherwise specified, $T_a = 25\text{ }^{\circ}\text{C}$)

Characteristics	Symbol	Note	Rating	Unit
Supply voltage	V_{CC}		-0.5 to 6.0	V
Input voltage	V_{IN}		-0.5 to 6.0	V
DC output voltage	V_{OUT}		-0.5 to $V_{CC} + 0.5$	V
Input diode current	I_{IK}		-20	mA
Output diode current	I_{OK}	(Note 1)	± 20	mA
DC output current	I_{OUT}		± 50	mA
V_{CC} /ground current	I_{CC}		± 50	mA
Power dissipation	P_D		50	mW
Storage temperature	T_{stg}		-65 to 150	$^{\circ}\text{C}$

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

8. Operating Ranges (Note)

Characteristics	Symbol	Note	Test Condition	Rating	Unit
Supply voltage	V_{CC}		—	1.65 to 5.5	V
		(Note 1)	—	1.5 to 5.5	
Input voltage	V_{IN}		—	0 to 5.5	V
Output voltage	V_{OUT}		—	0 to V_{CC}	V
Operating temperature	T_{opr}	(Note 2)	—	-40 to 125	°C
		(Note 3)	—	-40 to 85	
Input rise and fall time	dt/dv		$V_{CC} = 1.8 \pm 0.15 \text{ V}, 2.5 \pm 0.2 \text{ V}$	0 to 20	ns/V
			$V_{CC} = 3.3 \pm 0.3 \text{ V}$	0 to 10	
			$V_{CC} = 5.0 \pm 0.5 \text{ V}$	0 to 5	

Note: 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 1: Data retention only

Note 2: For devices with the ordering part number ending in J(T).

Note 3: For devices except those with the ordering part number ending in J(T).

9. Electrical Characteristics

9.1. DC Characteristics (Unless otherwise specified, $T_a = 25^\circ\text{C}$)

Characteristics	Symbol	Test Condition		V_{CC} (V)	Min	Typ.	Max	Unit
High-level input voltage	V_{IH}	—		1.65 to 1.95	$V_{CC} \times 0.75$	—	—	V
				2.3 to 5.5	$V_{CC} \times 0.7$	—	—	
Low-level input voltage	V_{IL}	—		1.65 to 1.95	—	—	$V_{CC} \times 0.25$	V
				2.3 to 5.5	—	—	$V_{CC} \times 0.3$	
High-level output voltage	V_{OH}	$V_{IN} = V_{IH}$	$I_{OH} = -100 \mu\text{A}$	1.65	1.55	1.65	—	V
				2.3	2.2	2.3	—	
				3.0	2.9	3.0	—	
				4.5	4.4	4.5	—	
			$I_{OH} = -4 \text{ mA}$	1.65	1.29	1.52	—	
			$I_{OH} = -8 \text{ mA}$	2.3	1.9	2.15	—	
			$I_{OH} = -16 \text{ mA}$	3.0	2.4	2.8	—	
			$I_{OH} = -24 \text{ mA}$	3.0	2.3	2.68	—	
Low-level output voltage	V_{OL}	$V_{IN} = V_{IH} \text{ or } V_{IL}$	$I_{OL} = 100 \mu\text{A}$	1.65	—	0.0	0.1	V
				2.3	—	0.0	0.1	
				3.0	—	0.0	0.1	
				4.5	—	0.0	0.1	
			$I_{OL} = 4 \text{ mA}$	1.65	—	0.08	0.24	
			$I_{OL} = 8 \text{ mA}$	2.3	—	0.1	0.3	
			$I_{OL} = 16 \text{ mA}$	3.0	—	0.15	0.4	
			$I_{OL} = 24 \text{ mA}$	3.0	—	0.22	0.55	
Input leakage current	I_{IN}	$V_{IN} = 5.5 \text{ V or GND}$		0 to 5.5	—	—	± 1	μA
3-state output OFF-state leakage current	I_{OZ}	$V_{IN} = V_{IH} \text{ or } V_{IL}$ $V_{OUT} = 0 \text{ to } 5.5 \text{ V}$		1.65 to 5.5	—	—	± 1	μA
Quiescent supply current	I_{CC}	$V_{IN} = 5.5 \text{ V or GND}$		5.5	—	—	2	μA

9.2. DC Characteristics (Unless otherwise specified, $T_a = -40$ to $85\text{ }^\circ\text{C}$)

Characteristics	Symbol	Test Condition		V_{CC} (V)	Min	Max	Unit
High-level input voltage	V_{IH}	—		1.65 to 1.95	$V_{CC} \times 0.75$	—	V
				2.3 to 5.5	$V_{CC} \times 0.7$	—	
Low-level input voltage	V_{IL}	—		1.65 to 1.95	—	$V_{CC} \times 0.25$	V
				2.3 to 5.5	—	$V_{CC} \times 0.3$	
High-level output voltage	V_{OH}	$V_{IN} = V_{IH}$	$I_{OH} = -100\text{ }\mu\text{A}$	1.65	1.55	—	V
				2.3	2.2	—	
				3.0	2.9	—	
				4.5	4.4	—	
			$I_{OH} = -4\text{ mA}$	1.65	1.29	—	V
			$I_{OH} = -8\text{ mA}$	2.3	1.9	—	
			$I_{OH} = -16\text{ mA}$	3.0	2.4	—	
			$I_{OH} = -24\text{ mA}$	3.0	2.3	—	
			$I_{OH} = -32\text{ mA}$	4.5	3.8	—	
Low-level output voltage	V_{OL}	$V_{IN} = V_{IH}$ or V_{IL}	$I_{OL} = 100\text{ }\mu\text{A}$	1.65	—	0.1	V
				2.3	—	0.1	
				3.0	—	0.1	
				4.5	—	0.1	
			$I_{OL} = 4\text{ mA}$	1.65	—	0.24	
			$I_{OL} = 8\text{ mA}$	2.3	—	0.3	
			$I_{OL} = 16\text{ mA}$	3.0	—	0.4	
			$I_{OL} = 24\text{ mA}$	3.0	—	0.55	
			$I_{OL} = 32\text{ mA}$	4.5	—	0.55	
Input leakage current	I_{IN}	$V_{IN} = 5.5\text{ V}$ or GND		0 to 5.5	—	± 10	μA
3-state output OFF-state leakage current	I_{OZ}	$V_{IN} = V_{IH}$ or V_{IL} $V_{OUT} = 0$ to 5.5 V		1.65 to 5.5	—	± 10	μA
Quiescent supply current	I_{CC}	$V_{IN} = 5.5\text{ V}$ or GND		5.5	—	20	μA

9.3. DC Characteristics (Note) (Unless otherwise specified, $T_a = -40$ to 125 °C)

Characteristics	Symbol	Test Condition		V_{CC} (V)	Min	Max	Unit
High-level input voltage	V_{IH}	—		1.65 to 1.95	$V_{CC} \times 0.75$	—	V
				2.3 to 5.5	$V_{CC} \times 0.7$	—	
Low-level input voltage	V_{IL}	—		1.65 to 1.95	—	$V_{CC} \times 0.25$	V
				2.3 to 5.5	—	$V_{CC} \times 0.3$	
High-level output voltage	V_{OH}	$V_{IN} = V_{IH}$	$I_{OH} = -100 \mu A$	1.65	1.55	—	V
				2.3	2.2	—	
				3.0	2.9	—	
				4.5	4.4	—	
			$I_{OH} = -4$ mA	1.65	0.95	—	
			$I_{OH} = -8$ mA	2.3	1.7	—	
			$I_{OH} = -16$ mA	3.0	2.2	—	
			$I_{OH} = -24$ mA	3.0	2.0	—	
			$I_{OH} = -32$ mA	4.5	3.4	—	
Low-level output voltage	V_{OL}	$V_{IN} = V_{IH}$ or V_{IL}	$I_{OL} = 100 \mu A$	1.65	—	0.1	V
				2.3	—	0.1	
				3.0	—	0.1	
				4.5	—	0.1	
			$I_{OL} = 4$ mA	1.65	—	0.7	
			$I_{OL} = 8$ mA	2.3	—	0.45	
			$I_{OL} = 16$ mA	3.0	—	0.6	
			$I_{OL} = 24$ mA	3.0	—	0.8	
			$I_{OL} = 32$ mA	4.5	—	0.8	
Input leakage current	I_{IN}	$V_{IN} = 5.5$ V or GND		0 to 5.5	—	± 20	μA
3-state output OFF-state leakage current	I_{OZ}	$V_{IN} = V_{IH}$ or V_{IL} $V_{OUT} = 0$ to 5.5 V		1.65 to 5.5	—	± 20	μA
Quiescent supply current	I_{CC}	$V_{IN} = 5.5$ V or GND		5.5	—	200	μA

Note: For devices with the ordering part number ending in J(T).

9.4. AC Characteristics (Unless otherwise specified, $T_a = 25\text{ }^{\circ}\text{C}$, Input: $t_r = t_f = 3\text{ ns}$)

Characteristics	Symbol	Note	Test Condition	V_{CC} (V)	C_L (pF)	Min	Typ.	Max	Unit
Propagation delay time	t_{PLH}, t_{PHL}		$R_L = 1\text{ M}\Omega$ See 9.7 AC Test Circuit, Table 9.7.1	1.8 ± 0.15	15	2.0	5.3	13.0	ns
						0.8	3.4	7.5	
						0.5	2.5	5.2	
						0.5	2.1	4.5	
			$R_L = 500\text{ }\Omega$ See 9.7 AC Test Circuit, Table 9.7.1	3.3 ± 0.3	50	1.5	3.2	5.7	ns
						0.8	2.6	5.0	
Output enable time	t_{PZL}, t_{PZH}		$R_L = 500\text{ }\Omega$ See 9.7 AC Test Circuit, Table 9.7.1	1.8 ± 0.15	50	2.0	8.0	14.5	ns
						1.5	4.6	8.5	
						1.5	3.5	6.2	
						0.8	2.8	5.5	
Output disable time	t_{PLZ}, t_{PHZ}		$R_L = 500\text{ }\Omega$ See 9.7 AC Test Circuit, Table 9.7.1	1.8 ± 0.15	50	2.0	7.0	13.0	ns
						1.5	3.5	8.0	
						1.0	2.8	5.7	
						0.5	2.1	4.7	
Input capacitance	C_{IN}		—	0 to 5.5	—	—	4	—	pF
Output capacitance	C_{OUT}		—	0 to 5.5	—	—	4	—	pF
Power dissipation capacitance	C_{PD}	(Note 1)	—	3.3	—	—	12	—	pF
				5.5		—	22	—	

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.

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

9.5. AC Characteristics (Unless otherwise specified, $T_a = -40\text{ to }85\text{ }^{\circ}\text{C}$, Input: $t_r = t_f = 3\text{ ns}$)

Characteristics	Symbol	Test Condition	V_{CC} (V)	C_L (pF)	Min	Max	Unit
Propagation delay time	t_{PLH}, t_{PHL}	$R_L = 1\text{ M}\Omega$ See 9.7 AC Test Circuit, Table 9.7.1	1.8 ± 0.15	15	2.0	13.5	ns
					0.8	8.0	
					0.5	5.5	
					0.5	4.8	
		$R_L = 500\text{ }\Omega$ See 9.7 AC Test Circuit, Table 9.7.1	3.3 ± 0.3	50	1.5	6.0	ns
					0.8	5.3	
Output enable time	t_{PZL}, t_{PZH}	$R_L = 500\text{ }\Omega$ See 9.7 AC Test Circuit, Table 9.7.1	1.8 ± 0.15	50	2.0	15.0	ns
					1.5	9.0	
					1.5	6.5	
					0.8	5.8	
Output disable time	t_{PLZ}, t_{PHZ}	$R_L = 500\text{ }\Omega$ See 9.7 AC Test Circuit, Table 9.7.1	1.8 ± 0.15	50	2.0	13.5	ns
					1.5	8.5	
					1.0	6.0	
					0.5	5.0	

9.6. AC Characteristics (Note)
(Unless otherwise specified, $T_a = -40$ to $125\text{ }^{\circ}\text{C}$, Input: $t_r = t_f = 3\text{ ns}$)

Characteristics	Symbol	Test Condition	V_{CC} (V)	C_L (pF)	Min	Max	Unit
Propagation delay time	t_{PLH}, t_{PHL}	$R_L = 1\text{ M}\Omega$ See 9.7 AC Test Circuit, Table 9.7.1	1.8 ± 0.15	15	2.0	15.0	ns
			2.5 ± 0.2		0.8	9.0	
			3.3 ± 0.3		0.5	6.5	
			5.0 ± 0.5		0.5	5.5	
		$R_L = 500\text{ }\Omega$ See 9.7 AC Test Circuit, Table 9.7.1	3.3 ± 0.3	50	1.5	7.0	ns
			5.0 ± 0.5		0.8	6.0	
Output enable time	t_{PZL}, t_{PZH}	$R_L = 500\text{ }\Omega$ See 9.7 AC Test Circuit, Table 9.7.1	1.8 ± 0.15	50	2.0	16.5	ns
			2.5 ± 0.2		1.5	10.0	
			3.3 ± 0.3		1.5	7.5	
			5.0 ± 0.5		0.8	6.5	
Output disable time	t_{PLZ}, t_{PHZ}	$R_L = 500\text{ }\Omega$ See 9.7 AC Test Circuit, Table 9.7.1	1.8 ± 0.15	50	2.0	15.0	ns
			2.5 ± 0.2		1.5	9.5	
			3.3 ± 0.3		1.0	7.0	
			5.0 ± 0.5		0.5	5.5	

Note: For devices with the ordering part number ending in J(T).

9.7. AC Test Circuit

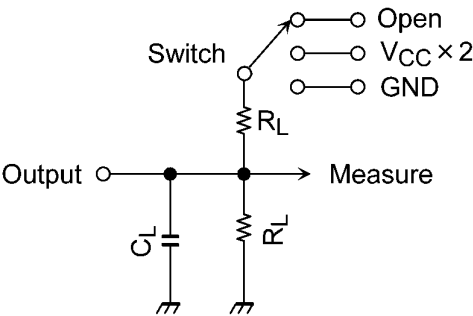
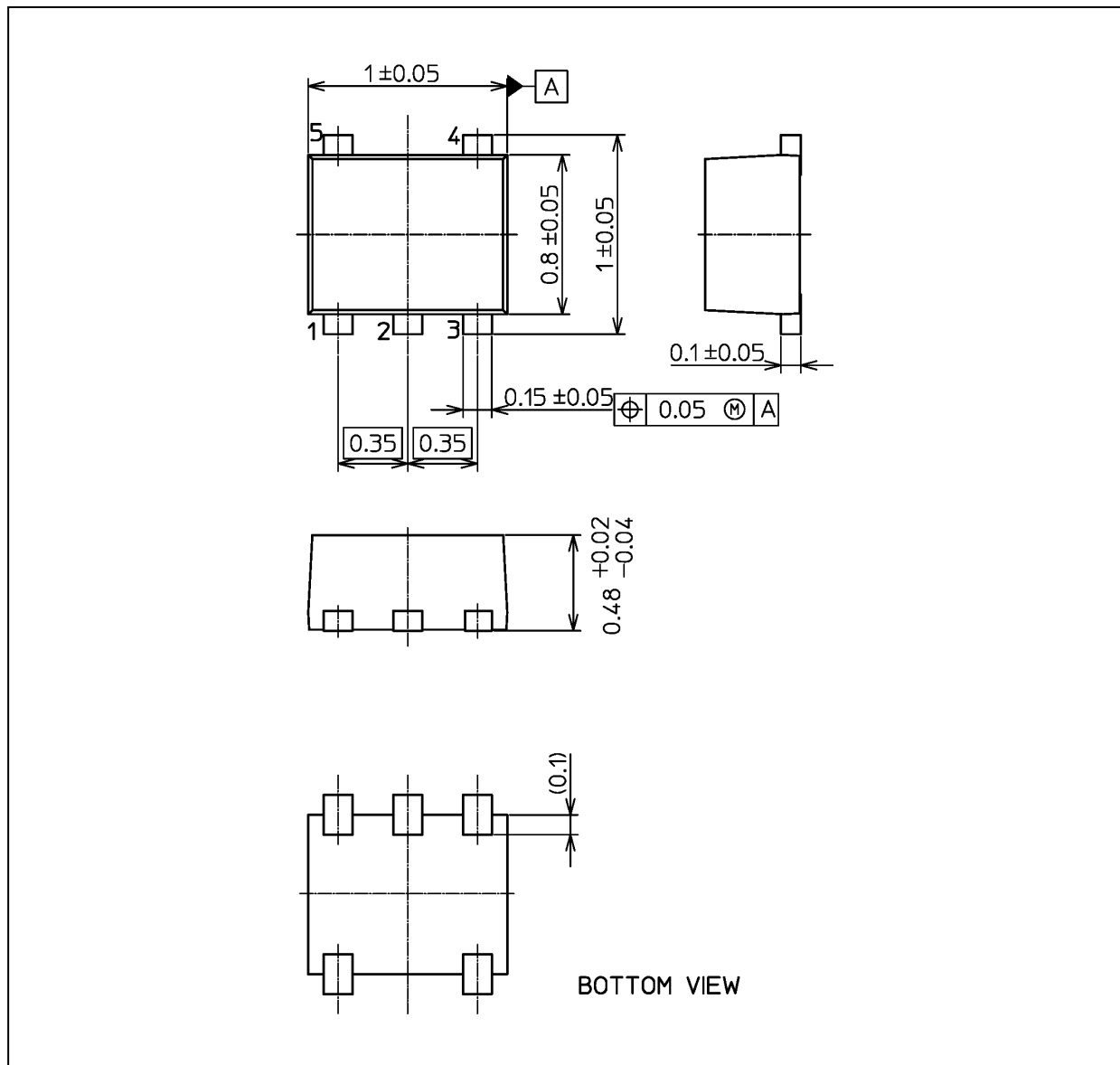


Table 9.7.1 Parameter for AC Test Circuit

Characteristics	Switch
t_{PLH}, t_{PHL}	Open
t_{PLZ}, t_{PZL}	$V_{CC} \times 2$
t_{PHZ}, t_{PZH}	GND

Package Dimensions

Unit: mm



Weight: 1.0 mg (typ.)

Package Name(s)
JEDEC: SOT-953
Nickname: fSV

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