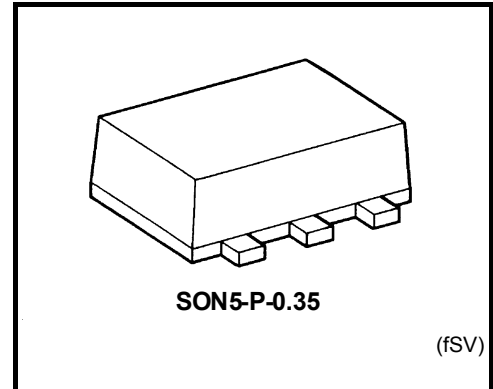


TC7SZ05AFS

INVERTER (Open Drain)

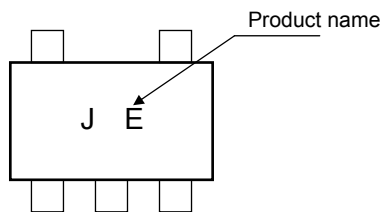
Features

- High output current : 24mA (min) at $V_{CC} = 3V$
- Super high speed operation : $t_{pd} = 2.0 \text{ ns}$ (typ.)
at $V_{CC} = 5V, 50pF$
- Operation voltage range : $V_{CC} \text{ (opr.)} = 1.65 \text{ to } 5.5V$
- 5.5-V tolerant input
- 5.5-V Power down protection output

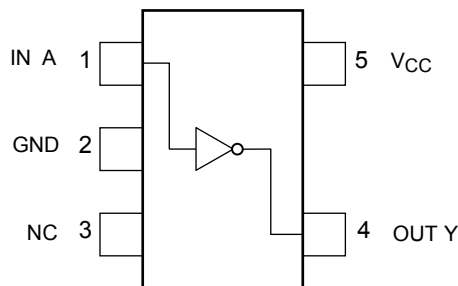


Weight : 0.001 g (typ.)

Marking



Pin Assignment (top view)



Absolute Maximum Ratings ($T_a = 25^\circ C$)

Characteristics	Symbol	Rating	Unit
Supply voltage range	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
Input diode current	I_{IK}	-20	mA
Output diode current	I_{OK}	± 20 (Note2)	mA
DC output current	I_{OUT}	50	mA
DC V_{CC} /ground current	I_{CC}	± 50	mA
Power dissipation	P_D	50	mW
Storage temperature	T_{stg}	-65 to 150	$^\circ C$

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.

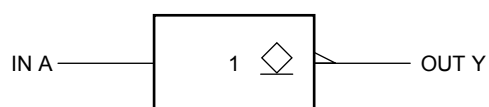
Please design the appropriate reliability upon reviewing the Toshiba Semiconductor Reliability Handbook ("Handling Precautions"/"Derating Concept and Methods") and individual reliability data (i.e. reliability test report and estimated failure rate, etc).

Note 1: Do not exceed I_{OUT} of absolute maximum ratings.

Note 2: $V_{OUT} < GND, V_{OUT} > V_{CC}$

Start of commercial production
2008-03

IEC Logic Symbol



Truth Table

A	Y
L	Z
H	L

Z: High Impedance

Operating Ranges

Characteristics	Symbol	Rating	Unit
Supply voltage	V_{CC}	1.65 to 5.5	V
		1.5 to 5.5 (Note 3)	
Input voltage	V_{IN}	0 to 5.5	V
Output voltage	V_{OUT}	0 to V_{CC}	V
Operating temperature	T_{opr}	-40 to 85	°C
Input rise and fall time	dt/dv	0 to 20 ($V_{CC} = 1.80\text{ V} \pm 0.15\text{ V}, 2.5\text{ V} \pm 0.2\text{ V}$)	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 3: Data retention only

Electrical Characteristics

DC Characteristics

Characteristics	Symbol	Test Condition	Ta = 25°C						Ta = -40 to 85°C		Unit
			V _{CC} (V)	Min	Typ.	Max	Min	Max			
High-level input voltage	V _{IH}	—	1.65 to 1.95	V _{CC} × 0.75	—	—	V _{CC} × 0.75	—	V		
			2.3 to 5.5	V _{CC} × 0.7	—	—	V _{CC} × 0.7	—			
Low-level input voltage	V _{IL}	—	1.65 to 1.95	—	—	V _{CC} × 0.25	—	V _{CC} × 0.25	V		
			2.3 to 5.5	—	—	V _{CC} × 0.3	—	V _{CC} × 0.3			
Z-state output leakage current	I _{LKG}	V _{IN} = V _{IL} V _{OUT} = 0 to 5.5 V	1.65 to 5.5	—	—	±5	—	±10	μA		
Low-level output voltage	V _{OL}	V _{IN} = V _{IH}	I _{OL} = 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 _{OL} = 4 mA	1.65	—	0.08	0.24	—	0.24		
			I _{OL} = 8 mA	2.3	—	0.1	0.3	—	0.3		
			I _{OL} = 16 mA	3.0	—	0.15	0.4	—	0.4		
			I _{OL} = 24 mA	3.0	—	0.22	0.55	—	0.55		
I _{OL} = 32 mA	4.5	—	0.22	0.55	—	0.55					
Input leakage current	I _{IN}	V _{IN} = 5.5 V or GND	0 to 5.5	—	—	±1	—	±10	μA		
Power off leakage current	I _{OFF}	V _{IN} or V _{OUT} = 5.5 V	0.0	—	—	1	—	10	μA		
Quiescent supply current	I _{CC}	V _{IN} = V _{CC} or GND	5.5	—	—	2	—	20	μA		

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

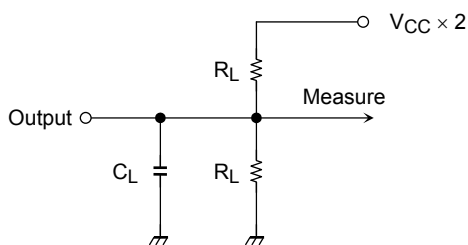
Characteristics	Symbol	Test Condition	Ta = 25°C			Ta = -40 to 85°C		Unit	
			V _{CC} (V)	Min	Typ.	Max	Min		Max
Propagation delay time	t _{pZL}	C _L = 50 pF, R _L = 500 Ω	1.80 ± 0.15	1.8	5.5	9.5	1.8	10.5	ns
			2.5 ± 0.2	1.2	3.7	5.8	1.2	6.4	
			3.3 ± 0.3	0.8	2.9	4.4	0.8	4.8	
			5.0 ± 0.5	0.5	2.3	3.5	0.5	3.9	
	t _{pLZ}	C _L = 50 pF, R _L = 500 Ω	1.8 ± 0.15	1.8	4.3	9.5	1.8	10.5	
			2.5 ± 0.2	1.2	2.8	5.8	1.2	6.4	
			3.3 ± 0.3	0.8	2.1	4.4	0.8	4.8	
			5.0 ± 0.5	0.5	1.4	3.5	0.5	3.9	
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 4)	3.3	—	4	—	—	—	pF
			5.5	—	10	—	—	—	

Note4: C_{PD} is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load.

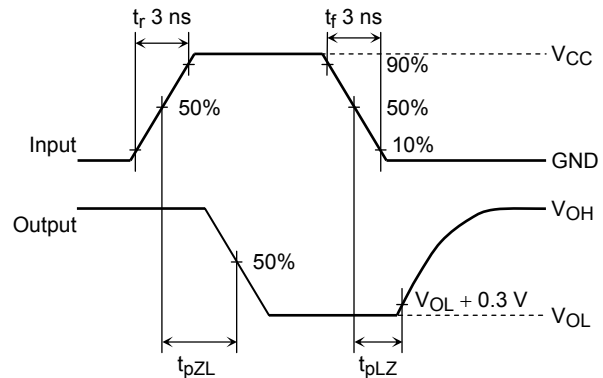
Average operating current can be obtained by the equation.

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

Test Circuit



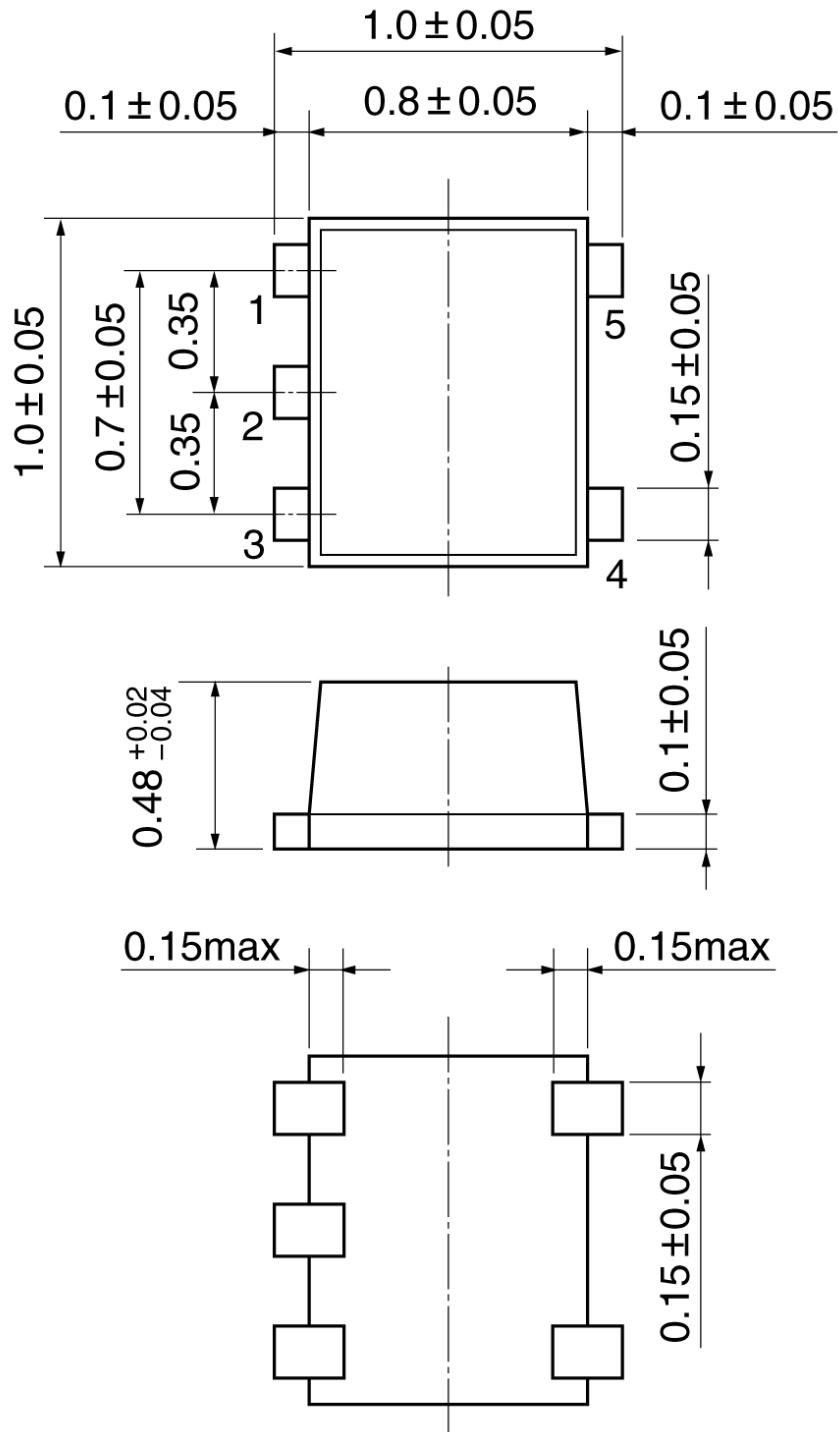
AC Waveform



Package Dimensions

SON5-P-0.35

Unit:mm



Weight: 0.001 g (typ.)

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