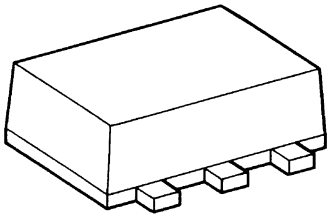
TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

TC7SZ00AFS

2-Input NAND Gate

Features

- High output current :±24 mA (min) at V_{CC} = 3 V
- Super high speed operation : t_{pd} = 2.4 ns (typ.) at V_{CC} = 5 V, 50 pF
- Operating voltage range : V_{CC} = 1.65 to 5.5 V
- 5.5-V tolerant inputs

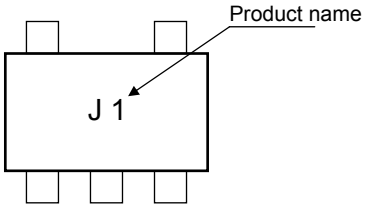


SON5-P-0.35

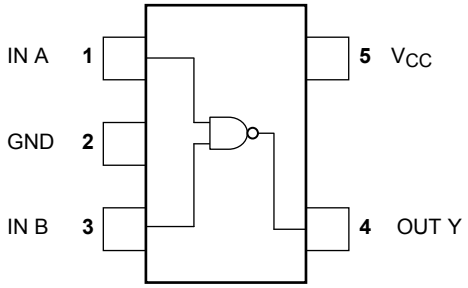
(fSV)

Weight : 0.001 g (typ.)

Marking



Pin Assignment (top view)



Absolute Maximum Ratings (Ta = 25°C)

Characteristics	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 V_{CC} +0.5V	V
Input diode current	I_{IK}	−20	mA
Output diode current	I_{OK}	±20 (Note1)	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	°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).

Note1: V_{OUT} < GND, V_{OUT} > V_{CC}

IEC Logic Symbol

Truth Table

A	B	Y
L	L	H
L	H	H
H	L	H
H	H	L

Operating Ranges

Characteristics	Symbol	Rating	Unit
Supply voltage	V_{CC}	1.65 to 5.5	V
		1.5 to 5.5 (Note 2)	
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 V ± 0.15 V, 2.5 V ± 0.2 V)	ns/V
		0 to 10 (V_{CC} = 3.3 V ± 0.3 V)	
		0 to 5 (V_{CC} = 5.0 V ± 0.5 V)	

Note 2: 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	
High-level output voltage	V_{OH}	V_{IN} = V_{IL} or V_{IH}	I_{OH} = −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_{OH} = −4 mA	1.65	1.29	1.52	—	1.29	—	
			I_{OH} = −8 mA	2.3	1.9	2.15	—	1.9	—	
			I_{OH} = −16 mA	3.0	2.4	2.8	—	2.4	—	
			I_{OH} = −24 mA	3.0	2.3	2.68	—	2.3	—	
			I_{OH} = −32 mA	4.5	3.8	4.2	—	3.8	—	
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
Quiescent supply current	I_{CC}	V_{IN} = 5.5V or GND		1.65 to 5.5	—	—	1	—	10	μA

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

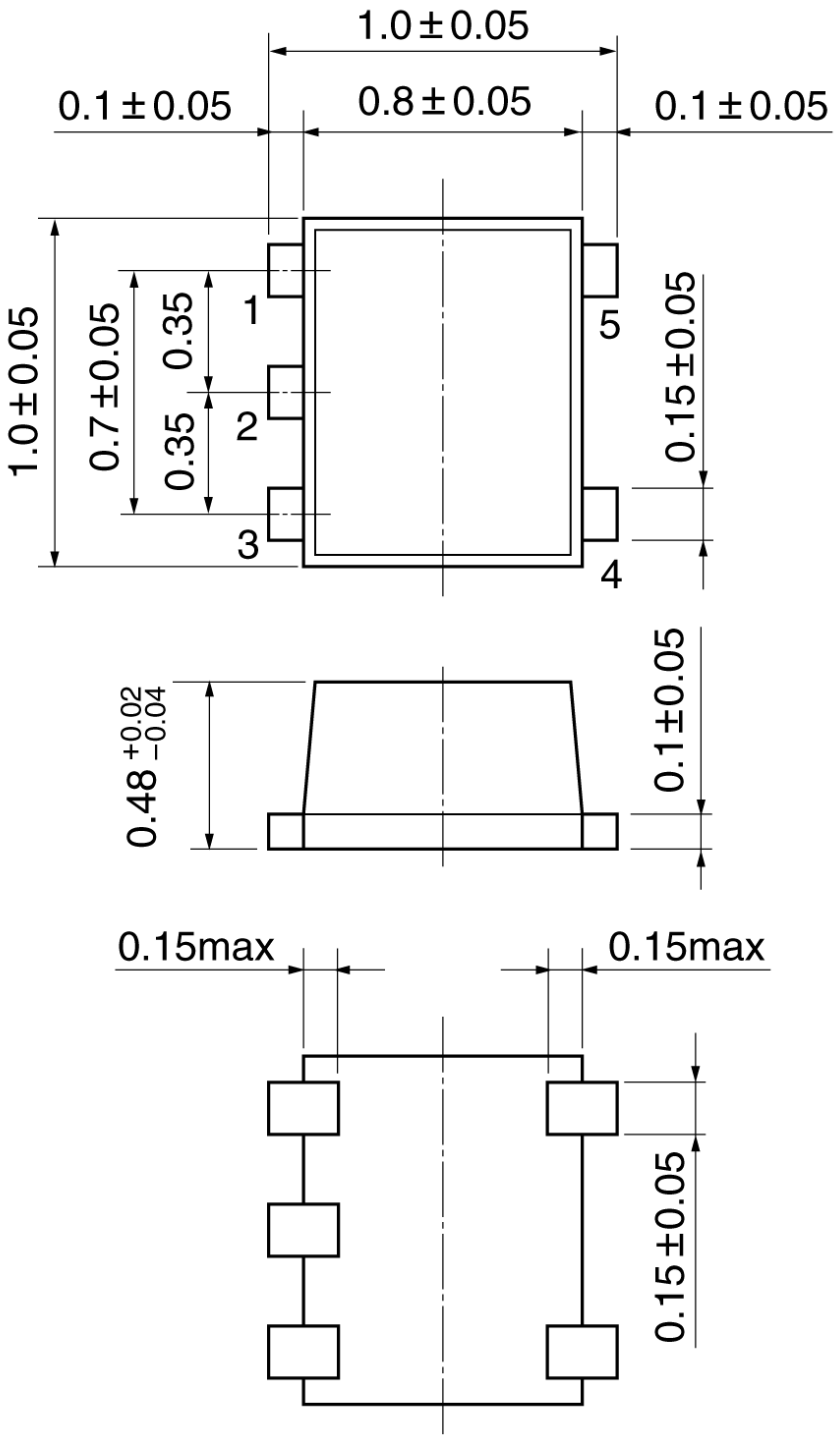
Characteristics	Symbol	Test Condition		Ta = 25°C			Ta = −40 to 85°C		Unit
			V_{CC} (V)	Min	Typ.	Max	Min	Max	
Propagation delay time	t_{pLH} t_{pHL}	C_L = 15 pF, R_L = 1 MΩ	1.80 ± 0.15	2.0	5.3	9.6	2.0	9.8	ns
			2.5 ± 0.2	0.8	3.2	5.3	0.8	5.7	
			3.3 ± 0.3	0.5	2.4	3.7	0.5	4.0	
			5.0 ± 0.5	0.5	1.9	2.9	0.5	3.2	
		C_L = 50 pF, R_L = 500 Ω	3.3 ± 0.3	1.5	3.0	4.6	1.5	4.9	
			5.0 ± 0.5	0.8	2.4	3.6	0.8	3.9	
Input capacitance	C_{IN}	—	0 to 5.5	—	4	—	—	—	pF
Power dissipation capacitance	C_{PD}	(Note 3)	3.3	—	19	—	—	—	pF
			5.5	—	27	—	—	—	

Note 3: 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.

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

Package Dimensions

SON5-P-0.35 **Unit: mm**



Weight: 0.001 g (typ.)

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