

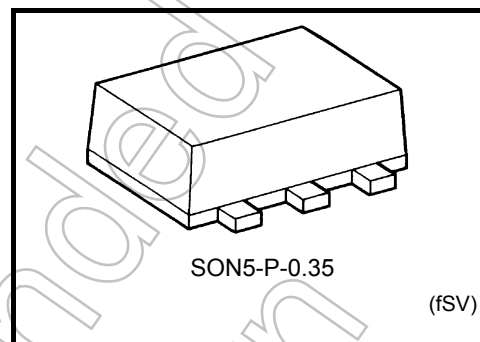
TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

TC7SH86FS

2-Input EXCLUSIVE OR Gate

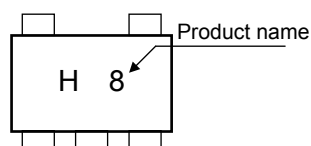
Features

- High speed : $t_{pd} = 4.8 \text{ ns (typ.)}$ at $V_{CC} = 5\text{V}$, $C_L = 15\text{pF}$
- Low power dissipation : $I_{CC} = 2\mu\text{A (max)}$ at $T_a = 25^\circ\text{C}$
- High noise immunity : $V_{NIH} = V_{NIL} = 28\% V_{CC} \text{ (min)}$
- 5.5-V tolerant inputs.
- Wide operating voltage range: $V_{CC} = 2 \text{ to } 5.5 \text{ V}$

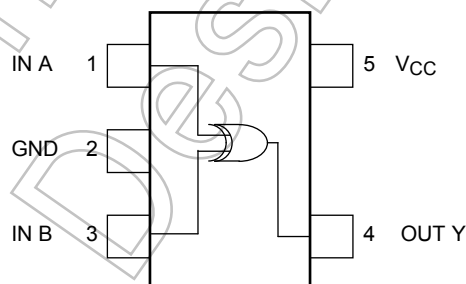


Weight : 0.001 g (typ.)

Marking



Pin Assignment (top view)



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

Characteristics	Symbol	Rating	Unit
Supply voltage	V_{CC}	-0.5 to 7	V
DC input voltage	V_{IN}	-0.5 to 7	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}	± 20 (Note 1)	mA
DC output current	I_{OUT}	± 25	mA
DC V_{CC} /ground current	I_{CC}	± 50	mA
Power dissipation	P_D	50	mW
Storage temperature	T_{stg}	-65 to 150	$^\circ\text{C}$

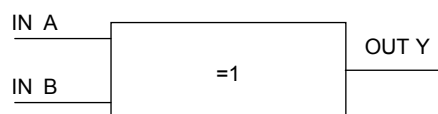
Note: Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.) 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: $V_{OUT} < \text{GND}$, $V_{OUT} > V_{CC}$

Start of commercial production
2003-08

IEC Logic Symbol



Truth Table

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

Operating Ranges

Characteristics	Symbol	Rating	Unit
Supply voltage	V_{CC}	2 to 5.5	V
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 100 ($V_{CC} = 3.3 \pm 0.3$ V)	ns/V
		0 to 20 ($V_{CC} = 5.0 \pm 0.5$ V)	

Electrical Characteristics
DC Characteristics

Characteristics	Symbol	Test Condition		Ta = 25°C			Ta = -40 to 85°C		Unit
				V _{CC} (V)	Min	Typ.	Max	Min	
High-level input voltage	V _{IH}	—		2.0	1.50	—	—	1.50	V
				3.0 to 5.5	V _{CC} × 0.7	—	—	V _{CC} × 0.7	
Low-level input voltage	V _{IL}	—		2.0	—	—	0.5	—	V
				3.0 to 5.5	—	—	V _{CC} × 0.3	—	
High-level output voltage	V _{OH}	V _{IN} = V _{IH} or V _{IL}	I _{OH} = -50 μA	2.0	1.9	2.0	—	1.9	V
				3.0	2.9	3.0	—	2.9	
				4.5	4.4	4.5	—	4.4	
			I _{OH} = -4 mA	3.0	2.58	—	—	2.48	
			I _{OH} = -8 mA	4.5	3.94	—	—	3.80	
Low-level output voltage	V _{OL}	V _{IN} = V _{IH} or V _{IL}	I _{OL} = 50 μA	2.0	—	0.0	0.1	0.1	V
				3.0	—	0.0	0.1	0.1	
				4.5	—	0.0	0.1	0.1	
			I _{OL} = 4 mA	3.0	—	—	0.36	0.44	
			I _{OL} = 8 mA	4.5	—	—	0.36	0.44	
Input leakage current	I _{IN}	V _{IN} = 5.5 V or GND		0 to 5.5	—	—	±0.1	—	μA
Quiescent supply current	I _{CC}	V _{IN} = V _{CC} or GND		5.5	—	—	2.0	—	μA

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

Characteristics	Symbol	Test Condition		Ta = 25°C			Ta = -40 to 85°C		Unit
		V _{CC} (V)	C _L (pF)	Min	Typ.	Max	Min	Max	
Propagation delay time	t_{pLH} t_{pHL}	3.3 ± 0.3	15	—	7.0	11.0	1.0	13.0	ns
			50	—	9.5	14.5	1.0	16.5	
		5.0 ± 0.5	15	—	4.8	6.8	1.0	8.0	
			50	—	6.3	8.8	1.0	10.0	
Input capacitance	C _{IN}	—		—	4	10	—	10	pF
Power dissipation capacitance	C _{PD}	(Note 2)		—	18	—	—	—	pF

Note 2 : C_{PD} is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load.

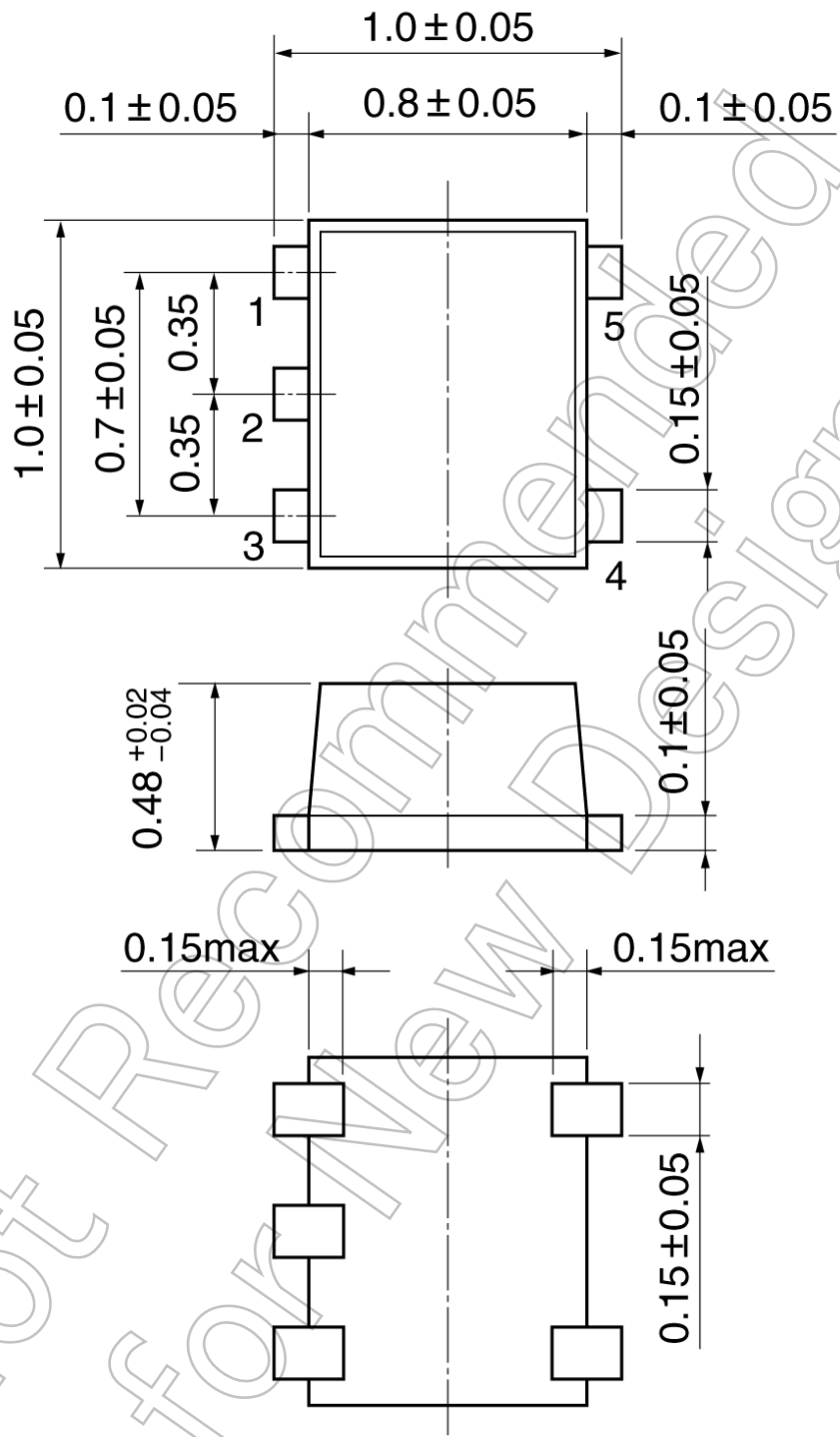
Average operating current can be obtained by the equation:

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

Package Dimensions

SON5-P-0.35

Unit: mm



Weight: 0.001 g (typ.)

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