TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

TC7SG86FE

2-Input EXCLUSIVE OR Gate

Features

• High output current : ±8 mA (min) at V_{CC} = 3 V

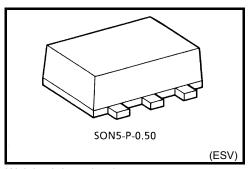
• Super high speed operation : t_{pd} = 2.6 ns (typ.)

at $V_{CC} = 3.3 \text{ V}, 15 \text{pF}$

• Operating voltage range: V_{CC} = 0.9 to 3.6 V

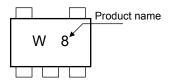
• 5.5-V tolerant inputs.

3.6-V power down protection output.



Weight: 3.0 mg (typ.)

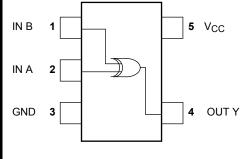
Marking



Absolute Maximum Ratings (Ta = 25°C)

Characteristic	Symbol	Rating	Unit
Supply voltage	V _{CC}	−0.5 to 4.6	V
DC input voltage	V _{IN}	−0.5 to 7.0	V
DC output voltage	Vour	-0.5 to 4.6 (Note 1)	V
	V _{OUT}	-0.5 to V _{CC} + 0.5 (Note 2)	
Input diode current	I _{IK}	-20	mA
Output diode current	lok	-20 (Note 3)	mA
DC output current	lout	±25	mA
DC V _{CC} /ground current	Icc	±50	mA
Power dissipation	PD	150	mW
Storage temperature	T _{stg}	−65 to 150	°C

Pin Assignment (top view)



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).

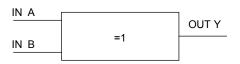
Note 1: $V_{CC} = 0V$

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

Note 3: V_{OUT} < GND

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IEC Logic Symbol



Truth Table

Α	В	Υ
L	L	L
L	Н	Н
Н	L	Н
Н	Н	L

Operating Ranges

Characteristic	Symbol	Rating	Unit		
Supply voltage	V _{CC}	0.9 to 3.6	V		
Input voltage	V _{IN}	0 to 5.5	V		
Output voltage	Vour	0 to 3.6 (Note 4)	V		
	V _{OUT}	0 to V _{CC} (Note 5)			
		± 8.0 (Note 6)			
	loh/lot	± 4.0 (Note 7)			
Output current		± 3.0 (Note 8)	mA		
		± 1.7 (Note 9)	IIIA		
		± 0.3 (Note 10)			
		± 0.02 (Note 11)			
Operating temperature	T _{opr}	-40 to 85	°C		
Input rise and fall time	dt/dv	0 to 10 (Note 12)	ns/V		

Note 4: $V_{CC} = 0V$

Note 5: High or Low state.

Note 6: $V_{CC} = 3.0 \text{ to } 3.6 \text{ V}$

Note 7: $V_{CC} = 2.3 \text{ to } 2.7 \text{ V}$

Note 8: $V_{CC} = 1.65 \text{ to } 1.95 \text{ V}$

Note 9: $V_{CC} = 1.4 \text{ to } 1.6 \text{ V}$

Note 10: $V_{CC} = 1.1$ to 1.3 V

Note 11: $V_{CC} = 0.9 \text{ V}$

Note 12: $V_{IN} = 0.8$ to 2.0 V, $V_{CC} = 3.0$ V

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Electrical Characteristics

DC Characteristics

Characteristic Symbol Test Condition			Ta = 25°C		Ta = -40 to 85°C		Unit			
		1650	Condition	V _{CC} (V)	Min	Тур.	Max	Min	Max	Offic
High-level VIH			0.9	V _{CC}	_	_	V _{CC}	_		
				1.1 to 1.3	V _{CC} × 0.7	ı	_	V _{CC} × 0.7		_
	V_{IH}		_	1.4 to 1.6	V _{CC} × 0.65	ı	_	V _{CC} × 0.65	_	V
				1.65 to 1.95	V _{CC} × 0.65	ı	_	V _{CC} × 0.65	_	
				2.3 to 2.7	1.7	_	_	1.7	_	
				3.0 to 3.6	2.0	_	_	2.0	_	
				0.9	_	_	GND	_	GND	
Low-level V _{IL}				1.1 to 1.3	_	ı	V _{CC} × 0.3	_	V _{CC} × 0.3	
	V _{IL}		_	1.4 to 1.6		١	V _{CC} × 0.35	_	V _{CC} × 0.35	V
				1.65 to 1.95		١	V _{CC} × 0.35	_	V _{CC} × 0.35	
				2.3 to 2.7	_		0.7		0.7	
				3.0 to 3.6	_		0.8		0.8	
		V _{IN} = V _{IH} or V _{IL}	I _{OH} =-0.02 mA	0.9	0.75		_	0.75	_	V
			$I_{OH} = -0.3 \text{ mA}$	1.1 to 1.3	V _{CC} × 0.75		_	V _{CC} × 0.75	_	
High-level V	V _{OH}		$I_{OH} = -1.7 \text{ mA}$	1.4 to 1.6	V _{CC} × 0.75	١	_	V _{CC} × 0.75	_	
output voltage		OI VIL	$I_{OH} = -3.0 \text{ mA}$	1.65 to 1.95	V _{CC} -0.45	l	_	V _{CC} -0.45	_	
			$I_{OH} = -4.0 \text{ mA}$	2.3 to 2.7	2.0		_	2.0		
			$I_{OH} = -8.0 \text{ mA}$	3.0 to 3.6	2.48		_	2.48	_	
			$I_{OL} = 0.02 \text{ mA}$	0.9	_	_	0.1	_	0.1	V
			I _{OL} = 0.3 mA	1.1 to 1.3	_		V _{CC} × 0.25	_	V _{CC} × 0.25	
Low-level voltage	V _{OL}	V _{IN} = V _{IH} or V _{IL}	I _{OL} = 1.7 mA	1.4 to 1.6	_		V _{CC} × 0.25	_	V _{CC} × 0.25	
	-	OI VIL	I _{OL} = 3.0 mA	1.65 to 1.95	_	_	0.45	_	0.45	
			I _{OL} = 4.0 mA	2.3 to 2.7	_		0.4	_	0.4	
			I _{OL} = 8.0 mA	3.0 to 3.6	_	_	0.4	_	0.4	
Input leakage current	I _{IN}	V _{IN} = 0 to 5.5V		0 to 3.6	_	_	±0.1	_	±1.0	μА
Power off leakage current	l _{OFF}	V _{IN} = 0 to 5.5V V _{OUT} = 0 to 3.6V		0	_	_	1.0	_	10.0	μΑ
Quiescent supply current	Icc	V _{IN} = V _{CC} or GND		3.6	_	_	1.0	_	10.0	μΑ

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

Characteristics	Symbol	Test Condition		Ta = 25°C		$Ta = -40 \text{ to } 85^{\circ}C$		Unit	
Characteristics			V _{CC} (V)	Min	Тур.	Max	Min	Max	Ullit
		$C_L = 10 \text{ pF},$ $R_L = 1 \text{ M}\Omega$	0.9	_	23.0		_	_	
			1.1 to 1.3	_	11.7	20.9	1.0	39.1	
			1.4 to 1.6	_	6.7	10.0	1.0	11.8	
			1.65 to 1.95	_	5.1	6.6	1.0	7.6	
			2.3 to 2.7	_	3.4	4.1	1.0	4.7	
			3.0 to 3.6	_	2.7	3.3	1.0	3.9	
			0.9	_	23.7		_	_	
	tplн tpнL	C_L = 15 pF, R_L = 1 M Ω	1.1 to 1.3	_	11.9	22.8	1.0	39.4	ns
			1.4 to 1.6	_	6.7	9.9	1.0	11.9	
Propagation delay time			1.65 to 1.95	_	5.1	7.3	1.0	7.5	
			2.3 to 2.7	_	3.4	4.7	1.0	5.3	
			3.0 to 3.6	_	2.7	3.6	1.0	4.1	
		$C_L=30$ pF, $R_L=1$ M Ω	0.9	_	32.1		_	_	
			1.1 to 1.3	_	15.7	31.4	1.0	59.4	
			1.4 to 1.6	_	8.7	13.9	1.0	16.9	
			1.65 to 1.95	_	6.5	9.8	1.0	10.2	
			2.3 to 2.7	_	4.2	6.0	1.0	6.5	
			3.0 to 3.6	_	3.4	4.7	1.0	5.1	
Input capacitance	C _{IN}	_	3.6	_	3	_	_	_	pF
Power dissipation capacitance	C _{PD}	(Note 13)	0.9 to 3.6	_	9	_	_	_	pF

Note 13: C_{PD} is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load.

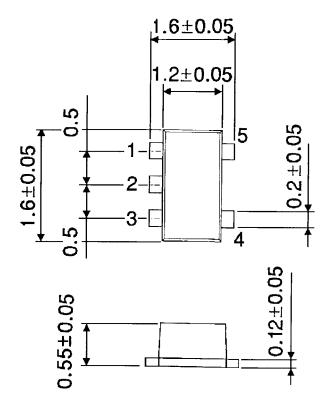
Average operating current can be obtained by the equation:

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

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Package Dimensions

SON5-P-0.50 Unit: mm



Weight: 3.0 mg (typ.)

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