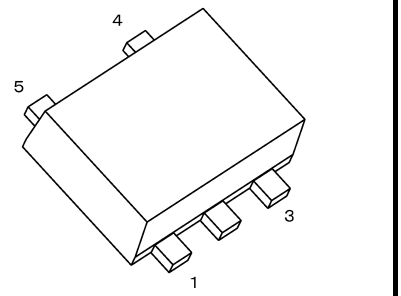
TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

TC7SZ05FE

Inverter (Open Drain)

Features

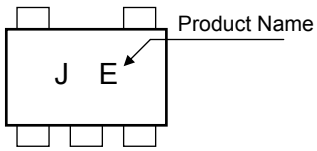
- High Output current : 24mA (min) at V_{CC} = 3V
- Super high speed operation : t_{pZL} = 2.3ns (typ.) at V_{CC} = 5V, C_L = 50pF
- Operation voltage range : V_{CC} = 1.65 to 5.5V
- 5.5-V tolerant input
- 5.5-V power down protection output
- ESD performance : Machine model ≥ ±200 V
  Human body model ≥ ±2000 V
- Matches the performance of TC74LCX series when operated at 3.3- V V_{CC}



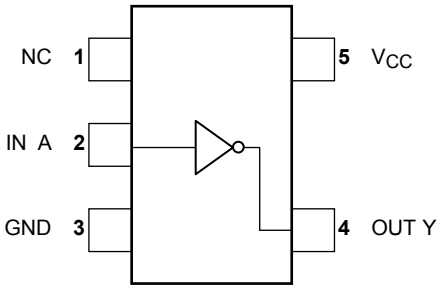
SON5-P-0.50S (ESV)

Weight : 3.0 mg (typ.)

Marking



Pin Assignment (top view)



Absolute Maximum Ranges (Ta = 25°C)

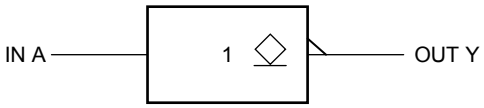
Characteristics	Symbol	Rating	Unit
Supply voltage	V_{CC}	−0.5 to 6	V
DC input voltage	V_{IN}	−0.5 to 6	V
DC output voltage	V_{OUT}	−0.5 to 6 (Note 1)	V
Input diode current	I_{IK}	−20	mA
Output diode current	I_{OK}	−20 (Note 2)	mA
DC output current	I_{OUT}	50	mA
DC V_{CC}/ground current	I_{CC}	±50	mA
Power dissipation	P_D	150	mW
Storage temperature	T_{stg}	−65 to 150	°C
Lead temperature (10 s)	T_L	260	°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

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 5.5	V
Operating temperature	T_{opr}	−40 to 85	°C
Input rise and fall time	dt/dv	0 to 20 (V_{CC} = 1.80V± 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 3 : Date 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	
Input Voltage	High level	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	V_{IL}	—	1.65 to 1.95	—	—	V_{CC} × 0.25	—	V_{CC} × 0.25	
				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 5.5V	1.65 to 5.5	—	—	±5	—	±10	μA
Output voltage	Low level	V_{OL}	V_{IN} = V_{IH}	1.65	—	0	0.1	—	0.1	V
			I_{OL} = 100 μA	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} = 5.5V	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)

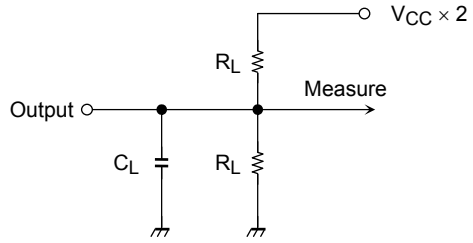
Characteristics	Symbol	Test Condition		Ta = 25°C			Ta = −40 to 85°C		Unit
			V_{CC} (V)	Min	Typ.	Max	Min	Max	
Propagation delay time	t_{pZL}	C_L = 50 pF, R_L = 500 Ω	1.80 ± 0.15	1.8	5.5	9.5	1.8	10.5	ns
			2.5 ± 0.2	1.2	3.7	5.8	1.2	6.4	
			3.3 ± 0.3	0.8	2.9	4.4	0.8	4.8	
			5.0 ± 0.5	0.5	2.3	3.5	0.5	3.9	
	t_{pLZ}	C_L = 50 pF, R_L = 500 Ω	1.80 ± 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	—	8	—	—	—	pF
Power dissipation capacitance	C_{PD}	(Note 4)	3.3	—	20	—	—	—	pF
			5.5	—	26	—	—	—	

Note 4: C_{PD} is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load.

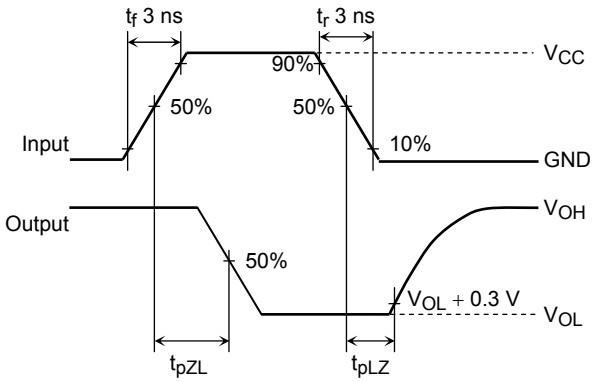
Average operating current can be obtained by the equation.

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

AC Characteristics Measurement Circuit

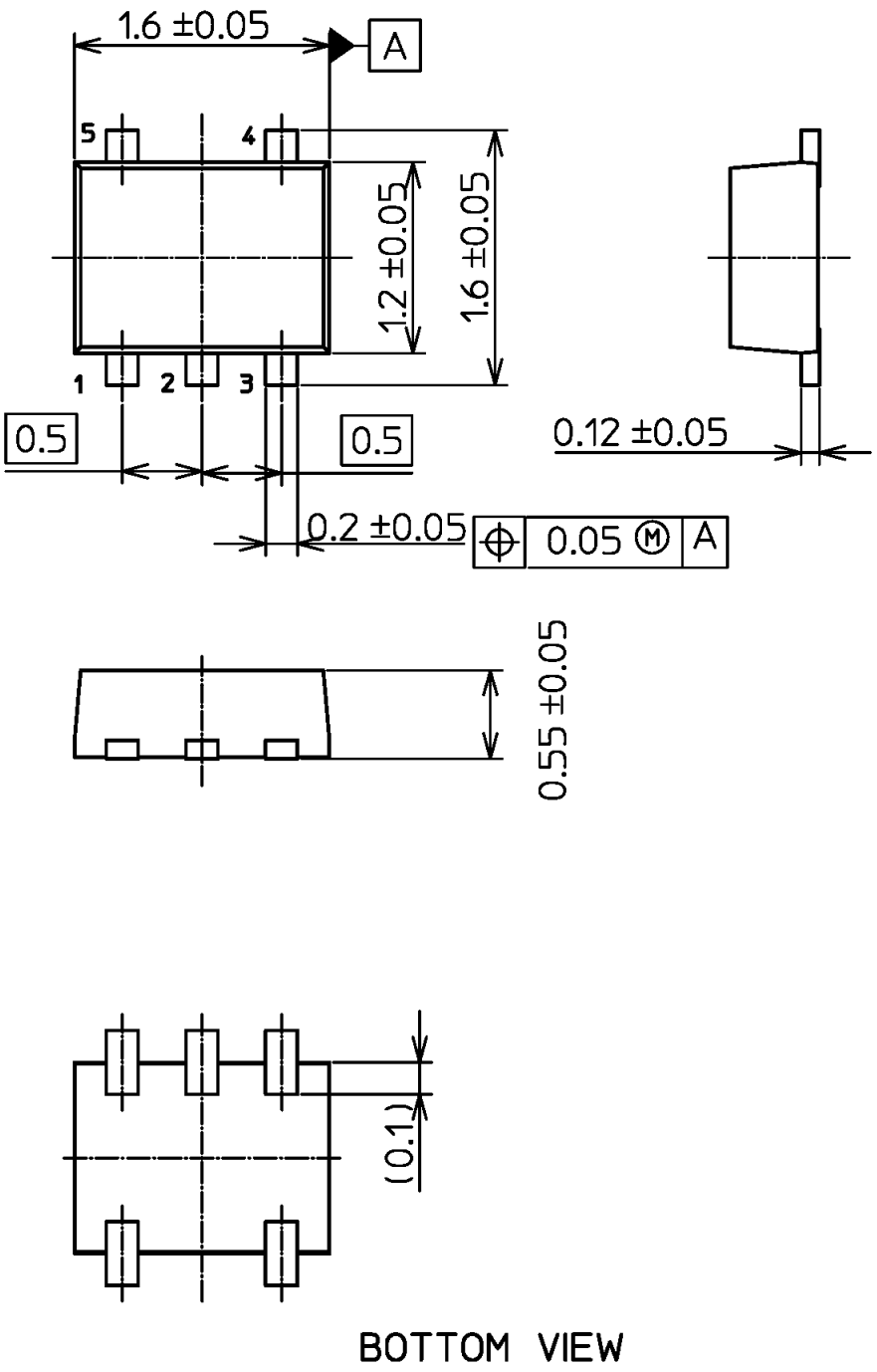


AC Waveforms



Package Dimensions

SON5-P-0.50S Unit: mm



Weight: 3.0 mg (typ.)

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