Preliminary TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

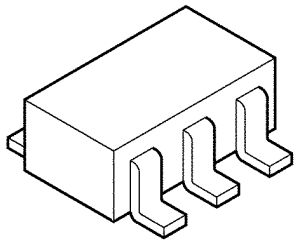
TC7SZ14F,TC7SZ14FU

Schmitt Inverter

Features

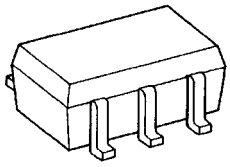
- High output drive: ±24 mA (min) @V_{CC} = 3 V
- High speed: t_{pd} = 3.7 ns (typ.) @V_{CC} = 5 V, 50 pF
- Wide operating voltage range: $V_{CC\ (opr)}$ = 1.65 to 5.5 V
- High latch-up immunity: Higher than or equal to ±500 mA
- High ESD : Higher than or equal to ±200 V (JEITA)
  : Higher than or equal to ±2000 V (MIL)
- Power-down protection is provided on all inputs and outputs.
- Matches the performance of TC74LCX Series when operated at 3.3 V

TC7SZ14F



SSOP5-P-0.95 (SMV)

TC7SZ14FU



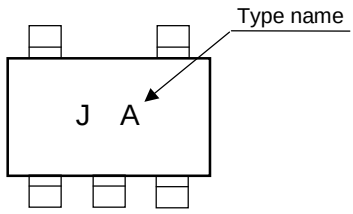
SSOP5-P-0.65A (USV)

Weight:
SSOP5-P-0.95 : 0.016 g (typ.)
SSOP5-P-0.65A : 0.006 g (typ.)

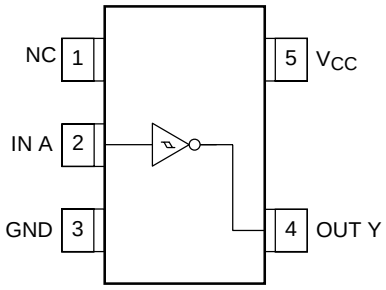
Maximum Ratings (Ta = 25°C)

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	V
Input diode current	I_{IK}	−20	mA
Output diode current	I_{OK}	−20	mA
DC output current	I_{OUT}	±50	mA
DC V_{CC}/ground current	I_{CC}	±50	mA
Power dissipation	P_D	200	mW
Storage temperature	T_{stg}	−65 to 150	°C
Lead temperature (10 s)	T_L	260	°C

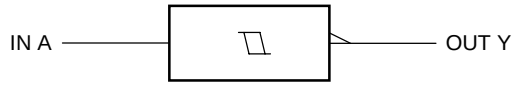
Marking



Pin Assignment (top view)



Logic Diagram



Truth Table

A	Y
L	H
H	L

Recommended Operating Conditions

Characteristics	Symbol	Rating	Unit
Supply voltage	V_{CC}	1.65 to 5.5	V
		1.5 to 5.5 (Note 1)	
Input voltage	V_{IN}	0 to 5.5	V
Output voltage	V_{OUT}	0 to 5.5 (Note 2)	V
		0 to V_{CC} (Note 3)	
Operating temperature	T_{opr}	−40 to 85	°C

Note 1: Date retention only

Note 2: V_{CC} = 0 V

Note 3: High or Low State

Electrical Characteristics

DC Electrical Characteristics

Characteristics	Symbol	Test Condition		Ta = 25°C			Ta = −40~85°C		Unit
			V_{CC} (V)	Min	Typ.	Max	Min	Max	
Positive threshold voltage	V_P	—	1.65	0.6	1.0	1.4	0.65	1.4	V
			1.8	0.7	1.1	1.5	0.7	1.5	
			2.3	1.0	1.4	1.8	1.0	1.8	
			3.0	1.3	1.75	2.2	1.3	2.2	
			4.5	1.9	2.45	3.1	1.9	3.1	
			5.5	2.2	2.9	3.6	2.2	3.6	
Negative threshold voltage	V_N	—	1.65	0.2	0.5	0.8	0.2	0.8	
			1.8	0.25	0.55	0.9	0.25	0.9	
			2.3	0.40	0.75	1.15	0.40	1.15	
			3.0	0.6	1.0	1.5	0.6	1.5	
			4.5	1.0	1.43	2.0	1.0	2.0	
			5.5	1.2	1.70	2.4	1.2	2.4	
Hysteresis voltage	V_H	—	1.65	0.1	0.48	0.9	0.1	1.0	V
			1.8	0.15	0.54	1.0	0.15	1.0	
			2.3	0.25	0.65	1.1	0.25	1.1	
			3.0	0.4	0.77	1.2	0.4	1.2	
			4.5	0.6	1.01	1.5	0.6	1.5	
			5.5	0.7	1.18	1.7	0.7	1.7	

Characteristics	Symbol	Test Condition		V_{CC} (V)	Ta = 25°C Min	Ta = 25°C Typ.	Ta = 25°C Max	Ta = −40~85°C Min	Ta = −40~85°C Max	Unit
High-level output voltage	V_{OH}	V_{IN} = V_{IL}	I_{OH} = −100 μA	1.65	1.55	1.65	—	1.55	—	V
				1.8	1.7	1.8	—	1.7	—	
				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	
				1.8	—	0	0.1	—	0.1	
				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		0~5.5	—	—	±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} = 5.5 V or GND		1.65~5.5	—	—	1	—	10	μA

AC Electrical Characteristics (Unless otherwise specified Input: $t_r = t_f = 3$ ns)

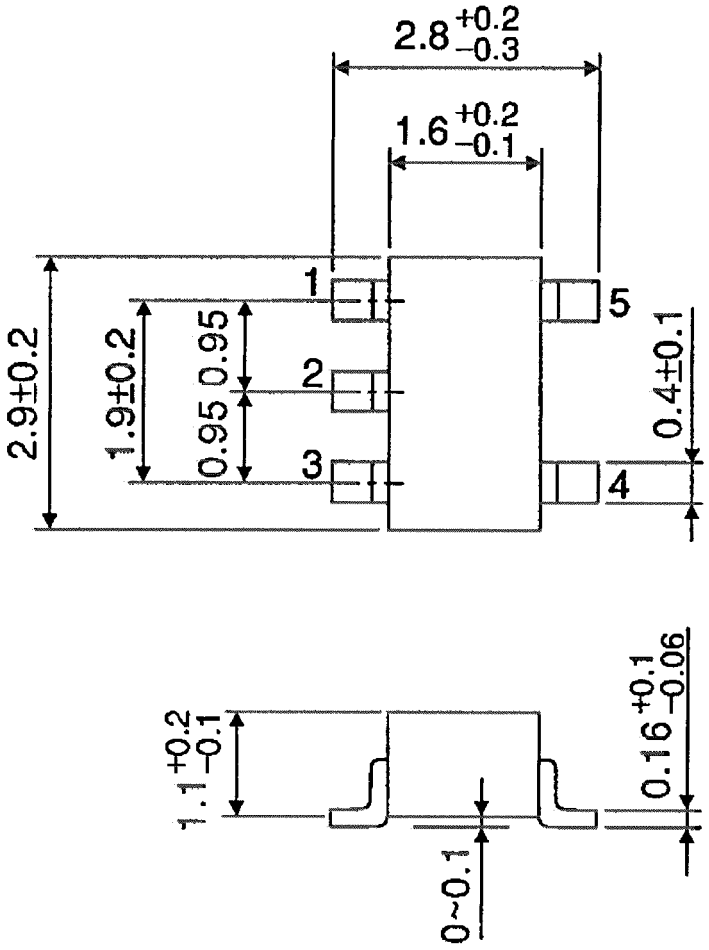
Characteristics	Symbol	Test Condition		V_{CC} (V)	Ta = 25°C Min	Ta = 25°C Typ.	Ta = 25°C Max	Ta = −40~85°C Min	Ta = −40~85°C Max	Unit
Propagation delay time	t_{pLH} t_{pHL}	C_L = 15 pF, R_L = 1 MΩ		1.65	2.0	9.1	15.0	2.0	15.6	ns
				1.8	2.0	7.6	12.5	2.0	13	
				2.5 ± 0.2	1.0	5.0	9.0	1.0	9.5	
				3.3 ± 0.3	1.0	3.7	6.3	1.0	6.5	
				5.0 ± 0.5	0.5	3.1	5.2	0.5	5.5	
		C_L = 50 pF, R_L = 500 Ω		3.3 ± 0.3	1.5	4.4	7.2	1.5	7.5	
				5.0 ± 0.5	0.5	3.7	5.9	0.8	6.2	
Input capacitance	C_{IN}	—			—	—	—	—	—	pF
Power dissipation capacitance	C_{PD}	(Note 4)			—	—	—	—	—	pF

Note 4: CPD 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

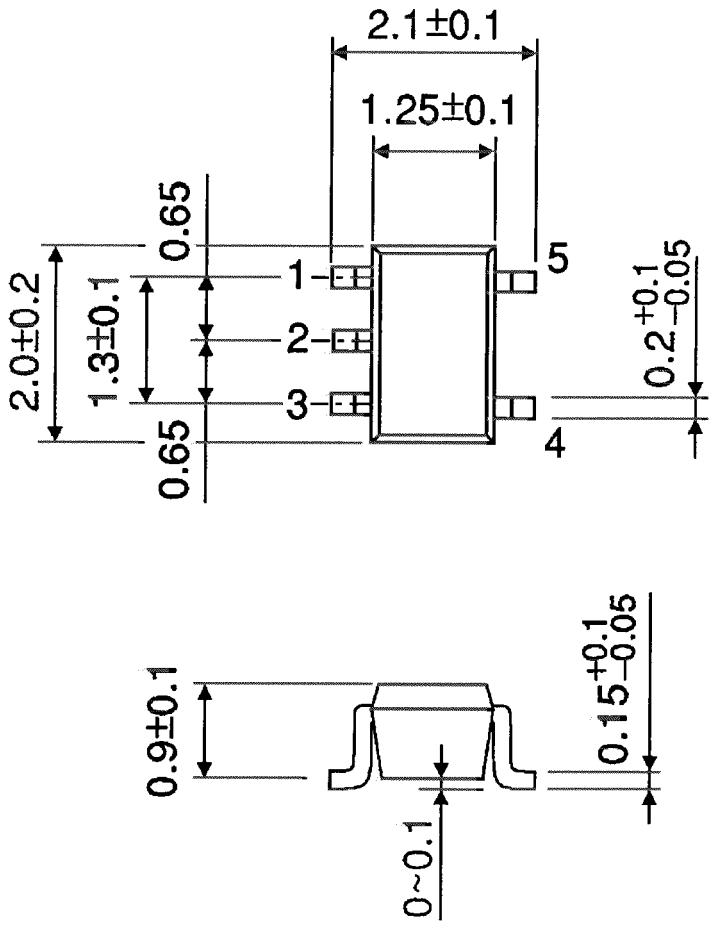
SSOP5-P-0.95 Unit : mm



Weight: 0.016 g (typ.)

Package Dimensions

SSOP5-P-0.65A Unit : mm



Weight: 0.006 g (typ.)

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