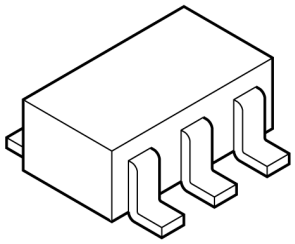
TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

TC7SZU04F, TC7SZU04FU

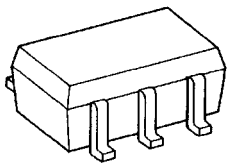
Inverter (Unbuffered)

TC7SZU04F



SSOP5-P-0.95 (SMV)

TC7SZU04FU



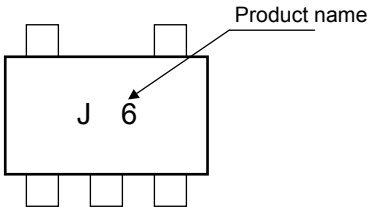
SSOP5-P-0.65A (USV)

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

Features

- High output drive: ±16 mA (min) at V_{CC} = 4.5 V
- Low quiescent power: I_{CC} = 2 μA (max) at V_{CC} = 5.5 V, Ta = 25°C
- Operation voltage range: $V_{CC\ (opr)}$ = 1.8 to 5.5 V
- 5.5-V tolerant input

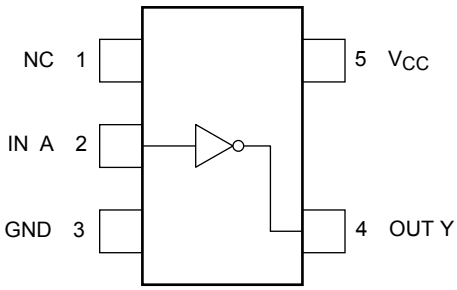
Marking



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} + 0.5	V
Input diode current	I_{IK}	−20	mA
Output diode current	I_{OK}	±20 (Note 1)	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

Pin Assignment (top view)

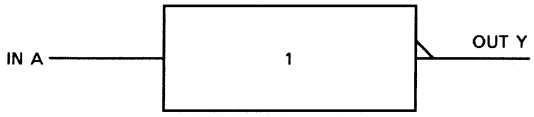


Note: Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.)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

Start of commercial production
1998-08

IEC Logic Symbol



Truth Table

A	Y
L	H
H	L

Operating Ranges

Characteristics	Symbol	Rating	Unit
Supply voltage	V_{CC}	1.8 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

Note 2: Data retention only

Electrical Characteristics

DC Characteristics

Characteristics	Symbol	Test Condition		V_{CC} (V)	Ta = 25°C			Ta = −40 to 85°C		Unit
					Min	Typ.	Max	Min	Max	
High-level input voltage	V_{IH}	—		1.8	V_{CC} × 0.85	—	—	V_{CC} × 0.85	—	V
				2.3 to 5.5	V_{CC} × 0.8	—	—	V_{CC} × 0.8	—	
Low-level input voltage	V_{IL}	—		1.8	—	—	V_{CC} × 0.15	—	V_{CC} × 0.15	V
				2.3 to 5.5	—	—	V_{CC} × 0.2	—	V_{CC} × 0.2	
High-level output voltage	V_{OH}	V_{IN} = V_{IL}	I_{OH} = −100 μA	1.8	1.6	1.8	—	1.6	—	V
				2.3	2.1	2.3	—	2.1	—	
				3.0	2.7	3.0	—	2.7	—	
				4.5	4.0	4.4	—	4.0	—	
		V_{IN} = GND	I_{OH} = −4 mA	2.3	1.9	2.14	—	1.9	—	
			I_{OH} = −8 mA	3.0	2.4	2.75	—	2.4	—	
			I_{OH} = −12 mA	3.0	2.3	2.61	—	2.3	—	
			I_{OH} = −16 mA	4.5	3.8	4.13	—	3.8	—	
Low-level output voltage	V_{OL}	V_{IN} = V_{IH}	I_{OL} = 100 μA	1.8	—	0	0.2	—	0.2	V
				2.3	—	0	0.2	—	0.2	
				3.0	—	0	0.3	—	0.3	
				4.5	—	0	0.5	—	0.5	
		V_{IN} = V_{CC}	I_{OL} = 4 mA	2.3	—	0.1	0.3	—	0.3	
			I_{OL} = 8 mA	3.0	—	0.17	0.4	—	0.4	
			I_{OL} = 12 mA	3.0	—	0.25	0.55	—	0.55	
			I_{OL} = 16 mA	4.5	—	0.26	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} = 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_{PLH} t_{PHL}	C_L = 15 pF, R_L = 1 MΩ	1.8	1.0	—	8.5	1.0	9.0	ns
			2.5 ± 0.2	0.8	—	6.2	0.8	6.5	
			3.3 ± 0.3	0.5	—	4.5	0.5	4.8	
			5.0 ± 0.5	0.5	—	3.9	0.5	4.1	
		C_L = 50 pF, R_L = 500 Ω	3.3 ± 0.3	1.0	—	6.0	1.5	6.5	
			5.0 ± 0.5	0.8	—	5.0	0.8	5.5	
Input capacitance	C_{IN}	—	0 to 5.5	—	4.5	—	—	—	pF
Power dissipation capacitance	C_{PD}	(Note 3)	3.3	—	6.3	—	—	—	pF
			5.5	—	9.5	—	—	—	

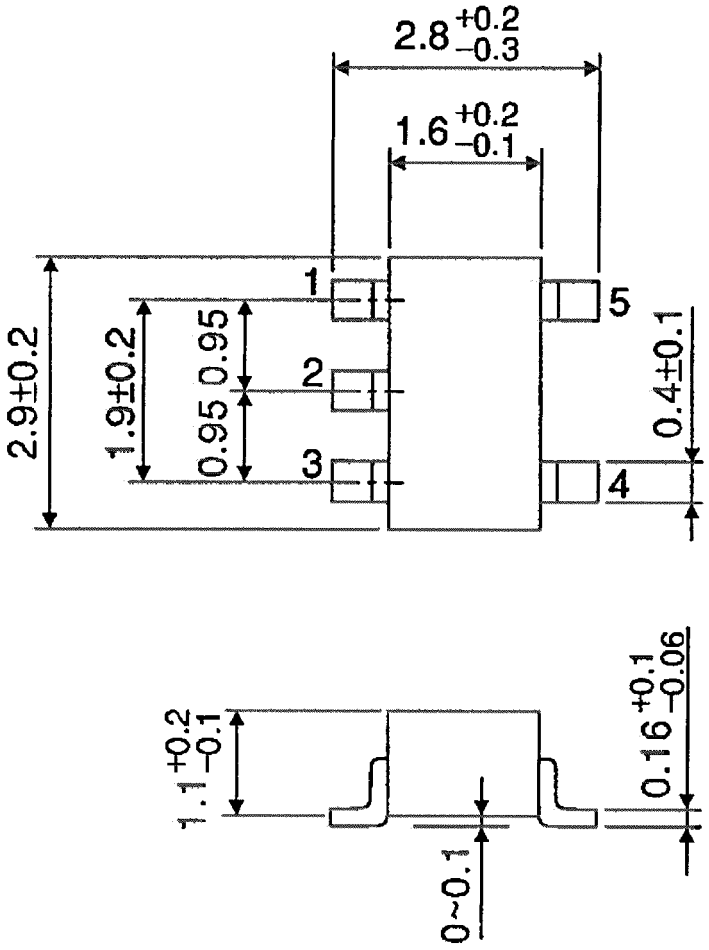
Note3: C_{PD} is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load.

Average operating current can be obtained by the equation.

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

Package Dimensions

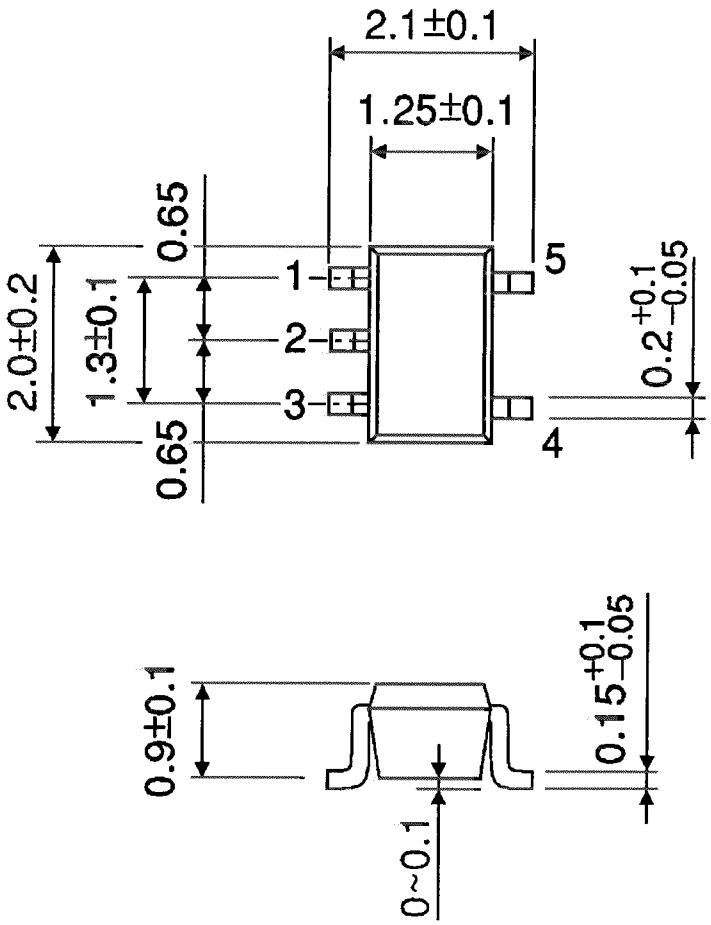
SSOP5-P-0.95 Unit : mm



Weight: 0.016 g (typ.)

Package Dimensions

SSOP5-P-0.65A Unit : mm



Weight: 0.006 g (typ.)

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