

TC7WH17FU

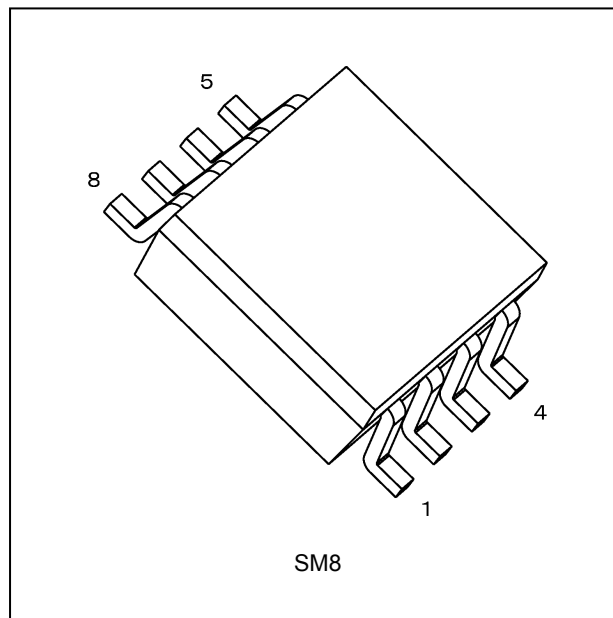
1. Functional Description

- Triple Schmitt Buffer

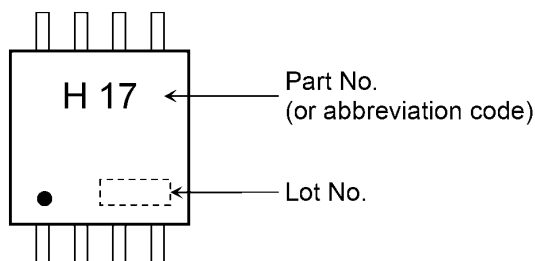
2. Features

- (1) Wide operating temperature range: $T_{opr} = -40$ to $85\text{ }^{\circ}\text{C}$
- (2) High speed operation: $t_{pd} = 5.5\text{ ns}$ (typ.) ($V_{CC} = 5.0\text{ V}$, $C_L = 15\text{ pF}$)
- (3) Low power dissipation: $I_{CC} = 2.0\text{ }\mu\text{A}$ (max) ($T_a = 25\text{ }^{\circ}\text{C}$)
- (4) Wide operating voltage range: $V_{CC} = 2.0$ to 5.5 V
- (5) High noise immunity: $V_{NIH} = V_{NIL} = 28\% V_{CC}$ (min)
- (6) Balanced propagation delays: $t_{PLH} \approx t_{PHL}$
- (7) 5.5 V tolerant inputs

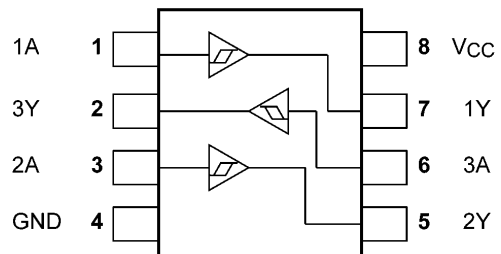
3. Packaging



4. Marking and Pin Assignment



Marking

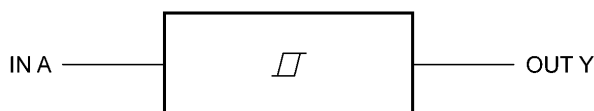


Pin Assignment (Top view)

Start of commercial production

2015-08

5. IEC Logic Symbol



6. Truth Table

A	Y
L	L
H	H

7. Absolute Maximum Ratings (Note) (Unless otherwise specified, T_a = 25 °C)

Characteristics	Symbol	Note	Rating	Unit
Supply voltage	V _{CC}		-0.5 to 7.0	V
Input voltage	V _{IN}		-0.5 to 7.0	
DC output voltage	V _{OUT}		-0.5 to V _{CC} + 0.5	
Input diode current	I _{IK}		-20	mA
Output diode current	I _{OK}	(Note 1)	±20	
DC output current	I _{OUT}		±25	
V _{CC} /ground current	I _{CC}		±50	
Power dissipation	P _D		300	mW
Storage temperature	T _{stg}		-65 to 150	°C

Note: Exceeding any of the absolute maximum ratings, even briefly, lead to deterioration in IC performance or even destruction.

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}

8. Operating Ranges (Note)

Characteristics	Symbol	Note	Test Condition	Rating	Unit
Supply voltage	V _{CC}		—	2.0 to 5.5	V
Input voltage	V _{IN}		—	0 to 5.5	
Output voltage	V _{OUT}		—	0 to V _{CC}	
Operating temperature	T _{opr}		—	-40 to 85	°C

Note: The operating ranges must be maintained to ensure the normal operation of the device. Unused inputs must be tied to either V_{CC} or GND.

9. Electrical Characteristics

9.1. DC Characteristics (Unless otherwise specified, $T_a = 25\text{ }^\circ\text{C}$)

Characteristics	Symbol	Test Condition	V_{CC} (V)	Min	Typ.	Max	Unit	
Positive threshold voltage	V_P	—	3.0	—	—	2.20	V	
			4.5	—	—	3.15		
			5.5	—	—	3.85		
Negative threshold voltage	V_N	—	3.0	0.90	—	—	V	
			4.5	1.35	—	—		
			5.5	1.65	—	—		
Hysteresis voltage	V_H	—	3.0	0.30	—	1.20	V	
			4.5	0.40	—	1.40		
			5.5	0.50	—	1.60		
High-level output voltage	V_{OH}	$V_{IN} = V_{IH}$	$I_{OH} = -50\text{ }\mu\text{A}$	2.0	1.9	2.0	—	V
				3.0	2.9	3.0	—	
				4.5	4.4	4.5	—	
			$I_{OH} = -4\text{ mA}$	3.0	2.58	—	—	
				4.5	3.94	—	—	
Low-level output voltage	V_{OL}	$V_{IN} = V_{IL}$	$I_{OL} = 50\text{ }\mu\text{A}$	2.0	—	0.0	0.1	V
				3.0	—	0.0	0.1	
				4.5	—	0.0	0.1	
			$I_{OL} = 4\text{ mA}$	3.0	—	—	0.36	
				4.5	—	—	0.36	
Input leakage current	I_{IN}	$V_{IN} = 5.5\text{ V or GND}$	0 to 5.5	—	—	± 0.1	μA	
Quiescent supply current	I_{CC}	$V_{IN} = V_{CC}\text{ or GND}$	5.5	—	—	2.0	μA	

9.2. DC Characteristics (Unless otherwise specified, $T_a = -40\text{ to }85\text{ }^\circ\text{C}$)

Characteristics	Symbol	Test Condition	V_{CC} (V)	Min	Max	Unit	
Positive threshold voltage	V_P	—	3.0	—	2.20	V	
			4.5	—	3.15		
			5.5	—	3.85		
Negative threshold voltage	V_N	—	3.0	0.90	—	V	
			4.5	1.35	—		
			5.5	1.65	—		
Hysteresis voltage	V_H	—	3.0	0.30	1.20	V	
			4.5	0.40	1.40		
			5.5	0.50	1.60		
High-level output voltage	V_{OH}	$V_{IN} = V_{IH}$	$I_{OH} = -50\text{ }\mu\text{A}$	2.0	1.9	—	V
				3.0	2.9	—	
				4.5	4.4	—	
			$I_{OH} = -4\text{ mA}$	3.0	2.48	—	
				4.5	3.80	—	
Low-level output voltage	V_{OL}	$V_{IN} = V_{IL}$	$I_{OL} = 50\text{ }\mu\text{A}$	2.0	—	0.1	V
				3.0	—	0.1	
				4.5	—	0.1	
			$I_{OL} = 4\text{ mA}$	3.0	—	0.44	
				4.5	—	0.44	
Input leakage current	I_{IN}	$V_{IN} = 5.5\text{ V or GND}$	0 to 5.5	—	± 1.0	μA	
Quiescent supply current	I_{CC}	$V_{IN} = V_{CC}\text{ or GND}$	5.5	—	20.0	μA	

9.3. AC Characteristics (Unless otherwise specified, $T_a = 25\text{ }^\circ\text{C}$, Input: $t_r = t_f = 3\text{ ns}$)

Characteristics	Symbol	Note	Test Condition	V_{CC} (V)	C_L (pF)	Min	Typ.	Max	Unit
Propagation delay time	t_{PLH}, t_{PHL}		—	3.3 ± 0.3	15	—	8.3	12.8	ns
					50	—	10.8	16.3	
				5.0 ± 0.5	15	—	5.5	8.6	
					50	—	7.0	10.6	
Input capacitance	C_{IN}		—		—	4	10	pF	
Power dissipation capacitance	C_{PD}	(Note 1)	—		—	21	—	pF	

Note 1: 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.

$$I_{CC(opr)} = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC}/3 \text{ (per 1 gate)}$$

9.4. AC Characteristics (Unless otherwise specified, $T_a = -40\text{ to }85\text{ }^\circ\text{C}$, Input: $t_r = t_f = 3\text{ ns}$)

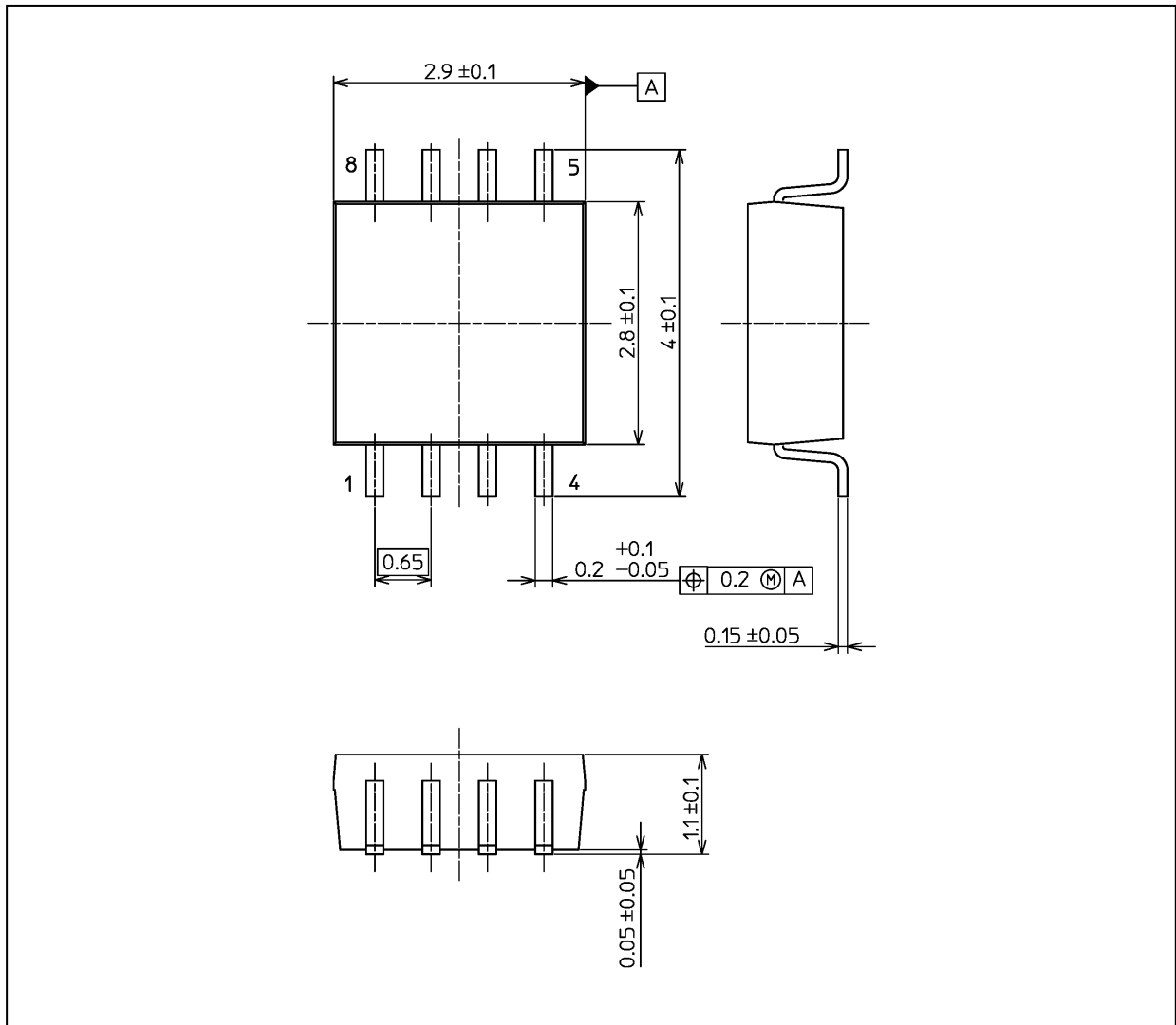
Characteristics	Symbol	Test Condition	V_{CC} (V)	C_L (pF)	Min	Max	Unit
Propagation delay time	t_{PLH}, t_{PHL}	—	3.3 ± 0.3	15	1.0	15.0	ns
				50	1.0	18.5	
			5.0 ± 0.5	15	1.0	10.0	
				50	1.0	12.0	
Input capacitance	C_{IN}	—		—	10	pF	

9.5. Noise Characteristics (Unless otherwise specified, $T_a = 25\text{ }^\circ\text{C}$, Input: $t_r = t_f = 3\text{ ns}$)

Characteristics	Symbol	Test Condition	V_{CC} (V)	Typ.	Limit	Unit
Quiet output maximum dynamic V_{OL}	V_{OLP}	$C_L = 50\text{ pF}$	5.0	0.3	0.8	V
Quiet output minimum dynamic V_{OL}	V_{OLV}	$C_L = 50\text{ pF}$	5.0	-0.3	-0.8	V
Minimum high-level dynamic input voltage	V_{IHD}	$C_L = 50\text{ pF}$	5.0	—	3.5	V
Maximum low-level dynamic input voltage	V_{ILD}	$C_L = 50\text{ pF}$	5.0	—	1.5	V

Package Dimensions

Unit: mm



Weight: 21 mg (typ.)

Package Name(s)
JEDEC: SOT-505
Nickname: SM8

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