

CMOS Digital Integrated Circuits Silicon Monolithic

## TC7WH34FU

#### 1. Functional Description

Triple Non-Inverter

## 2. Features

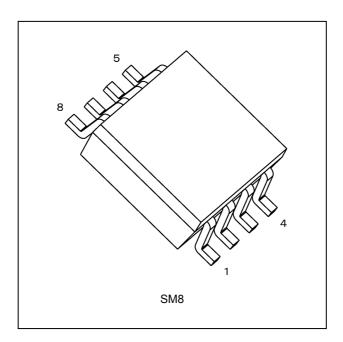
- (1) Wide operating temperature range:  $T_{opr} = -40$  to 125 °C (Note 1)
- High speed operation:  $t_{pd}$  = 3.8 ns (typ.) ( $V_{CC}$  = 5.0 V,  $C_{L}$  = 15 pF)
- Low power dissipation:  $I_{CC} = 2.0 \mu A \text{ (max) (} T_a = 25 \text{ °C)}$
- (4) High noise immunity:  $V_{NIH} = V_{NIL} = 28 \% V_{CC}$  (min)
- (5) 5.5 V tolerant inputs
- (6)Balanced propagation delays: t<sub>PLH</sub> ≈ t<sub>PHL</sub>

Toshiba Electronic Devices & Storage Corporation

- (7)Wide operating voltage range:  $V_{\rm CC}$  = 2.0 to 5.5 V
- Identical pin assignment and function with TC7W34

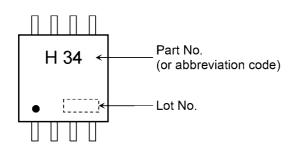
Note 1: For devices with the ordering part number ending in J(CT.  $T_{opr}$  = -40 to 85 °C for the other devices.

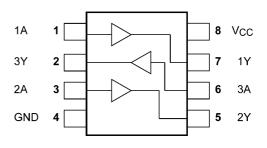
#### 3. Packaging





#### 4. Marking and Pin Assignment





Marking

Pin Assignment (Top view)

### 5. IEC Logic Symbol



#### 6. Truth Table

А	Y
L	L
Н	Н

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

Characteristics	Symbol	Note	Rating	Unit
Supply voltage	V <sub>CC</sub>		-0.5 to 7.0	V
Input voltage	$V_{IN}$		-0.5 to 7.0	
DC output voltage	V <sub>OUT</sub>		-0.5 to V <sub>CC</sub> + 0.5	
Input diode current	I <sub>IK</sub>		-20	mA
Output diode current	l <sub>ok</sub>	(Note 1)	±20	
DC output current	l <sub>out</sub>		±25	
V <sub>CC</sub> /ground current	I <sub>CC</sub>		±50	
Power dissipation	P <sub>D</sub>		300	mW
Storage temperature	T <sub>stg</sub>		-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 <sub>CC</sub>		_	2.0 to 5.5	V
Input voltage	V <sub>IN</sub>		_	0 to 5.5	
Output voltage	V <sub>OUT</sub>		_	0 to V <sub>CC</sub>	
Operating temperature	T <sub>opr</sub>	(Note 1)	_	-40 to 125	°C
		(Note 2)	_	-40 to 85	
Input rise and fall time	dt/dv		$V_{CC}$ = 3.3 ± 0.3 V	0 to 100	ns/V
			V <sub>CC</sub> = 5.0 ± 0.5 V	0 to 20	

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.

Note 1: For devices with the ordering part number ending in J(CT.

Note 2: For devices except those with the ordering part number ending in J(CT.

#### 9. Electrical Characteristics

## 9.1. DC Characteristics (Unless otherwise specified, T<sub>a</sub> = 25 °C)

Characteristics	Symbol	Test Condition		V <sub>CC</sub> (V)	Min	Тур.	Max	Unit
High-level input voltage	V <sub>IH</sub>	_		2.0	1.5	_	_	V
				3.0 to 5.5	$V_{CC} \times 0.7$	_	_	
Low-level input voltage	V <sub>IL</sub>	_		2.0	_		0.5	V
				3.0 to 5.5	_	_	$V_{CC} \times 0.3$	
High-level output voltage	V <sub>OH</sub>	V <sub>IN</sub> = V <sub>IH</sub>	I <sub>OH</sub> = -50 μA	2.0	1.9	2.0	_	V
				3.0	2.9	3.0	_	
				4.5	4.4	4.5	_	
			I <sub>OH</sub> = -4 mA	3.0	2.58	_	_	
			I <sub>OH</sub> = -8 mA	4.5	3.94	_	_	
Low-level output voltage	V <sub>OL</sub>	V <sub>IN</sub> = V <sub>IL</sub>	I <sub>OL</sub> = 50 μA	2.0	_	0.0	0.1	V
				3.0	_	0.0	0.1	
				4.5	_	0.0	0.1	
			I <sub>OL</sub> = 4 mA	3.0	_	_	0.36	
			I <sub>OL</sub> = 8 mA	4.5	_	_	0.36	
Input leakage current	I <sub>IN</sub>	V <sub>IN</sub> = 5.5 V or GND		0 to 5.5	_	_	±0.1	μΑ
Quiescent supply current	I <sub>CC</sub>	$V_{IN} = V_{CC}$ or GND		5.5	_	_	2.0	μΑ



## 9.2. DC Characteristics (Unless otherwise specified, T<sub>a</sub> = -40 to 85 °C)

Characteristics	Symbol	Test Condition	V <sub>CC</sub> (V)	Min	Max	Unit	
High-level input voltage	V <sub>IH</sub>	_		2.0	1.5	_	V
				3.0 to 5.5	$V_{CC} \times 0.7$	_	
Low-level input voltage	V <sub>IL</sub>	_		2.0		0.5	V
				3.0 to 5.5		$V_{CC} \times 0.3$	
High-level output voltage	V <sub>OH</sub>	$V_{IN} = V_{IH}$	I <sub>OH</sub> = -50 μA	2.0	1.9	_	V
				3.0	2.9	_	
				4.5	4.4	_	
			$I_{OH}$ = -4 mA	3.0	2.48	_	
			$I_{OH}$ = -8 mA	4.5	3.80	_	
Low-level output voltage	V <sub>OL</sub>	$V_{IN} = V_{IL}$	I <sub>OL</sub> = 50 μA	2.0		0.1	V
				3.0	_	0.1	
				4.5	_	0.1	
			I <sub>OL</sub> = 4 mA	3.0	_	0.44	
			I <sub>OL</sub> = 8 mA	4.5	_	0.44	
Input leakage current	I <sub>IN</sub>	V <sub>IN</sub> = 5.5 V or GND		0 to 5.5		±1.0	μΑ
Quiescent supply current	I <sub>CC</sub>	V <sub>IN</sub> = V <sub>CC</sub> or GND		5.5	_	20.0	μΑ

## 9.3. DC Characteristics (Note) (Unless otherwise specified, T<sub>a</sub> = -40 to 125 °C)

Characteristics	Symbol	Test Condition	n	V <sub>CC</sub> (V)	Min	Max	Unit
High-level input voltage	V <sub>IH</sub>	_		2.0	1.5	_	V
				3.0 to 5.5	$V_{CC} \times 0.7$	_	
Low-level input voltage	V <sub>IL</sub>	_		2.0	_	0.5	٧
				3.0 to 5.5	_	$V_{CC} \times 0.3$	
High-level output voltage	V <sub>OH</sub>	$V_{IN} = V_{IH}$	I <sub>OH</sub> = -50 μA	2.0	1.9	_	٧
				3.0	2.9	_	
				4.5	4.4	_	
			$I_{OH} = -4 \text{ mA}$	3.0	2.40	_	
			$I_{OH}$ = -8 mA	4.5	3.70	_	
Low-level output voltage	V <sub>OL</sub>	V <sub>IN</sub> = V <sub>IL</sub>	I <sub>OL</sub> = 50 μA	2.0	_	0.1	٧
				3.0	_	0.1	
				4.5	_	0.1	
			I <sub>OL</sub> = 4 mA	3.0	_	0.55	
			I <sub>OL</sub> = 8 mA	4.5	_	0.55	
Input leakage current	I <sub>IN</sub>	V <sub>IN</sub> = 5.5 V or GND		0 to 5.5	_	±2.0	μΑ
Quiescent supply current	Icc	V <sub>IN</sub> = V <sub>CC</sub> or GND		5.5	_	40.0	μΑ

Note: For devices with the ordering part number ending in J(CT.



## 9.4. AC Characteristics (Unless otherwise specified, $T_a = 25$ °C, Input: $t_r = t_f = 3$ ns)

Characteristics	Symbol	Note	Test Condition	V <sub>CC</sub> (V)	C <sub>L</sub> (pF)	Min	Тур.	Max	Unit
Propagation delay time	t <sub>PLH</sub> ,t <sub>PHL</sub>		_	$3.3 \pm 0.3$	15	_	5.0	7.1	ns
					50	_	7.5	10.6	
				$5.0 \pm 0.5$	15	_	3.8	5.5	
					50	_	5.3	7.5	
Input capacitance	C <sub>IN</sub>		_			_	4	10	pF
Power dissipation capacitance	C <sub>PD</sub>	(Note 1)	_				18		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.  $I_{CC(opr)} = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC}/3 \text{ (per 1 gate)}$ 

## 9.5. AC Characteristics (Unless otherwise specified, $T_a = -40$ to 85 °C, Input: $t_r = t_f = 3$ ns)

Characteristics	Symbol	Test Condition	V <sub>CC</sub> (V)	C <sub>L</sub> (pF)	Min	Max	Unit
Propagation delay time	t <sub>PLH</sub> ,t <sub>PHL</sub>	_	$3.3 \pm 0.3$	15	1.0	8.5	ns
				50	1.0	12.0	
			5.0 ± 0.5	15	1.0	6.5	
				50	1.0	8.5	
Input capacitance	C <sub>IN</sub>				_	10	pF

# 9.6. AC Characteristics (Note) (Unless otherwise specified, $T_a$ = -40 to 125 °C, Input: $t_r$ = $t_f$ = 3 ns)

Characteristics	Symbol	Test Condition	V <sub>CC</sub> (V)	C <sub>L</sub> (pF)	Min	Max	Unit
Propagation delay time	t <sub>PLH</sub> ,t <sub>PHL</sub>	_	$3.3\pm0.3$	15	1.0	10.0	ns
				50	1.0	13.5	
			5.0 ± 0.5	15	1.0	7.5	
				50	1.0	9.5	
Input capacitance	C <sub>IN</sub>	_			_	10	pF

Note: For devices with the ordering part number ending in J(CT.

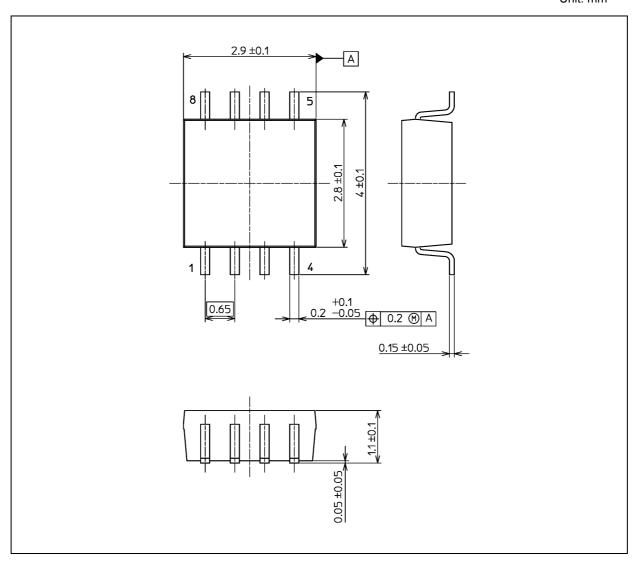
#### 9.7. Noise Characteristics (Unless otherwise specified, $T_a = 25$ °C, Input: $t_f = t_f = 3$ ns)

Characteristics	Symbol	Test Condition	V <sub>CC</sub> (V)	Тур.	Limit	Unit
Quiet output maximum dynamic V <sub>OL</sub>	V <sub>OLP</sub>	C <sub>L</sub> = 50 pF	5.0	0.3	0.8	V
Quiet output minimum dynamic V <sub>OL</sub>	V <sub>OLV</sub>	C <sub>L</sub> = 50 pF	5.0	-0.3	-0.8	V
Minimum high-level dynamic input voltage	$V_{IHD}$	C <sub>L</sub> = 50 pF	5.0	_	3.5	V
Maximum low-level dynamic input voltage	$V_{ILD}$	C <sub>L</sub> = 50 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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