

# TC7SET14FU

## 1. Functional Description

- Schmitt Inverter

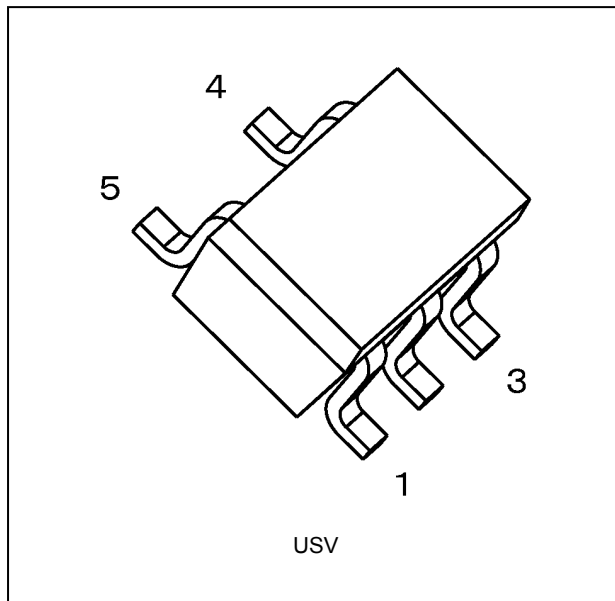
## 2. Features

- (1) AEC-Q100 (Rev. H) (Note 1)
- (2) Wide operating temperature range:  $T_{opr} = -40$  to  $125$  °C (Note 2)
- (3) High speed operation:  $t_{pd} = 5.0$  ns (typ.) ( $V_{CC} = 5.0$  V,  $C_L = 15$  pF)
- (4) Low power dissipation:  $I_{CC} = 2.0$   $\mu$ A (max) ( $T_a = 25$  °C)
- (5) Compatible with TTL outputs
- (6) 5.5 V tolerant inputs

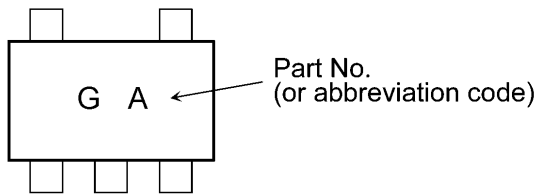
Note 1: This device is compliant with the reliability requirements of AEC-Q100. For details, contact your Toshiba sales representative.

Note 2: For devices with the ordering part number ending in J(CT).  $T_{opr} = -40$  to  $85$  °C for the other devices.

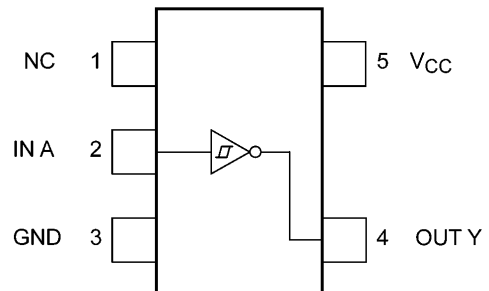
## 3. Packaging



## 4. Marking and Pin Assignment



Marking

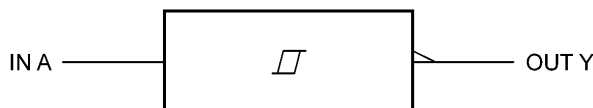


Pin Assignment (Top view)

Start of commercial production

2004-02

**5. IEC Logic Symbol**



**6. Truth Table**

A	Y
L	H
H	L

**7. Absolute Maximum Ratings (Note) (Unless otherwise specified,  $T_a = 25\text{ }^\circ\text{C}$ )**

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)	$\pm 20$	
DC output current	$I_{OUT}$		$\pm 25$	
$V_{CC}$ /ground current	$I_{CC}$		$\pm 50$	
Power dissipation	$P_D$		200	mW
Storage temperature	$T_{stg}$		-65 to 150	$^\circ\text{C}$

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	Rating	Unit
Supply voltage	$V_{CC}$		4.5 to 5.5	V
Input voltage	$V_{IN}$		0 to 5.5	
Output voltage	$V_{OUT}$		0 to $V_{CC}$	
Operating temperature	$T_{opr}$	(Note 1)	-40 to 125	$^\circ\text{C}$
		(Note 2)	-40 to 85	

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,  $T_a = 25\text{ }^\circ\text{C}$ )**

Characteristics	Symbol	Test Condition	$V_{CC}$ (V)	Min	Typ.	Max	Unit
Positive threshold voltage	$V_P$	—	4.5	—	—	1.9	V
			5.5	—	—	2.1	
Negative threshold voltage	$V_N$	—	4.5	0.5	—	—	V
			5.5	0.6	—	—	
Hysteresis voltage	$V_H$	—	4.5	0.4	—	1.4	V
			5.5	0.4	—	1.5	
High-level output voltage	$V_{OH}$	$V_{IN} = V_{IL}$	$I_{OH} = -50\text{ }\mu\text{A}$	4.5	4.4	4.5	V
			$I_{OH} = -8\text{ mA}$	4.5	3.94	—	
Low-level output voltage	$V_{OL}$	$V_{IN} = V_{IH}$	$I_{OL} = 50\text{ }\mu\text{A}$	4.5	—	0.0	V
			$I_{OL} = 8\text{ mA}$	4.5	—	0.36	
Input leakage current	$I_{IN}$	$V_{IN} = 5.5\text{ V or GND}$	0 to 5.5	—	—	$\pm 0.1$	$\mu\text{A}$
Quiescent supply current	$I_{CC}$	$V_{IN} = V_{CC}\text{ or GND}$	5.5	—	—	2.0	$\mu\text{A}$
	$I_{CCT}$	$V_{IN} = 3.4\text{ V}$	5.5	—	—	1.35	mA

**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	$V_P$	—	4.5	—	1.9	V	
			5.5	—	2.1		
Negative threshold voltage	$V_N$	—	4.5	0.5	—	V	
			5.5	0.6	—		
Hysteresis voltage	$V_H$	—	4.5	0.4	1.4	V	
			5.5	0.4	1.5		
High-level output voltage	$V_{OH}$	$V_{IN} = V_{IL}$	$I_{OH} = -50\text{ }\mu\text{A}$	4.5	4.4	—	V
			$I_{OH} = -8\text{ mA}$	4.5	3.80	—	
Low-level output voltage	$V_{OL}$	$V_{IN} = V_{IH}$	$I_{OL} = 50\text{ }\mu\text{A}$	4.5	—	0.1	V
			$I_{OL} = 8\text{ mA}$	4.5	—	0.44	
Input leakage current	$I_{IN}$	$V_{IN} = 5.5\text{ V or GND}$	0 to 5.5	—	—	$\pm 1.0$	$\mu\text{A}$
Quiescent supply current	$I_{CC}$	$V_{IN} = V_{CC}\text{ or GND}$	5.5	—	—	20.0	$\mu\text{A}$
	$I_{CCT}$	$V_{IN} = 3.4\text{ V}$	5.5	—	—	1.50	mA

**9.3. DC Characteristics (Note) (Unless otherwise specified,  $T_a = -40$  to  $125$  °C)**

Characteristics	Symbol	Test Condition	$V_{CC}$ (V)	Min	Max	Unit	
Positive threshold voltage	$V_P$	—	4.5	—	1.9	V	
			5.5	—	2.1		
Negative threshold voltage	$V_N$	—	4.5	0.5	—	V	
			5.5	0.6	—		
Hysteresis voltage	$V_H$	—	4.5	0.4	1.4	V	
			5.5	0.4	1.5		
High-level output voltage	$V_{OH}$	$V_{IN} = V_{IL}$	$I_{OH} = -50 \mu A$	4.5	4.4	—	V
			$I_{OH} = -8 \text{ mA}$	4.5	3.70	—	
Low-level output voltage	$V_{OL}$	$V_{IN} = V_{IH}$	$I_{OL} = 50 \mu A$	4.5	—	0.1	V
			$I_{OL} = 8 \text{ mA}$	4.5	—	0.55	
Input leakage current	$I_{IN}$	$V_{IN} = 5.5 \text{ V or GND}$	0 to 5.5	—	$\pm 2.0$	$\mu A$	
Quiescent supply current	$I_{CC}$	$V_{IN} = V_{CC} \text{ or GND}$	5.5	—	40.0	$\mu A$	
	$I_{CCT}$	$V_{IN} = 3.4 \text{ V}$	5.5	—	1.50	mA	

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	$V_{CC}$ (V)	$C_L$ (pF)	Min	Typ.	Max	Unit
Propagation delay time	$t_{PLH}, t_{PHL}$		—	$5.0 \pm 0.5$	15	—	5.0	7.6	ns
					50	—	6.5	9.6	
Input capacitance	$C_{IN}$		—			—	4	10	pF
Power dissipation capacitance	$C_{PD}$	(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.

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

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

Characteristics	Symbol	Test Condition	$V_{CC}$ (V)	$C_L$ (pF)	Min	Max	Unit
Propagation delay time	$t_{PLH}, t_{PHL}$	—	$5.0 \pm 0.5$	15	1.0	9.0	ns
				50	1.0	11.0	
Input capacitance	$C_{IN}$	—			—	10	pF

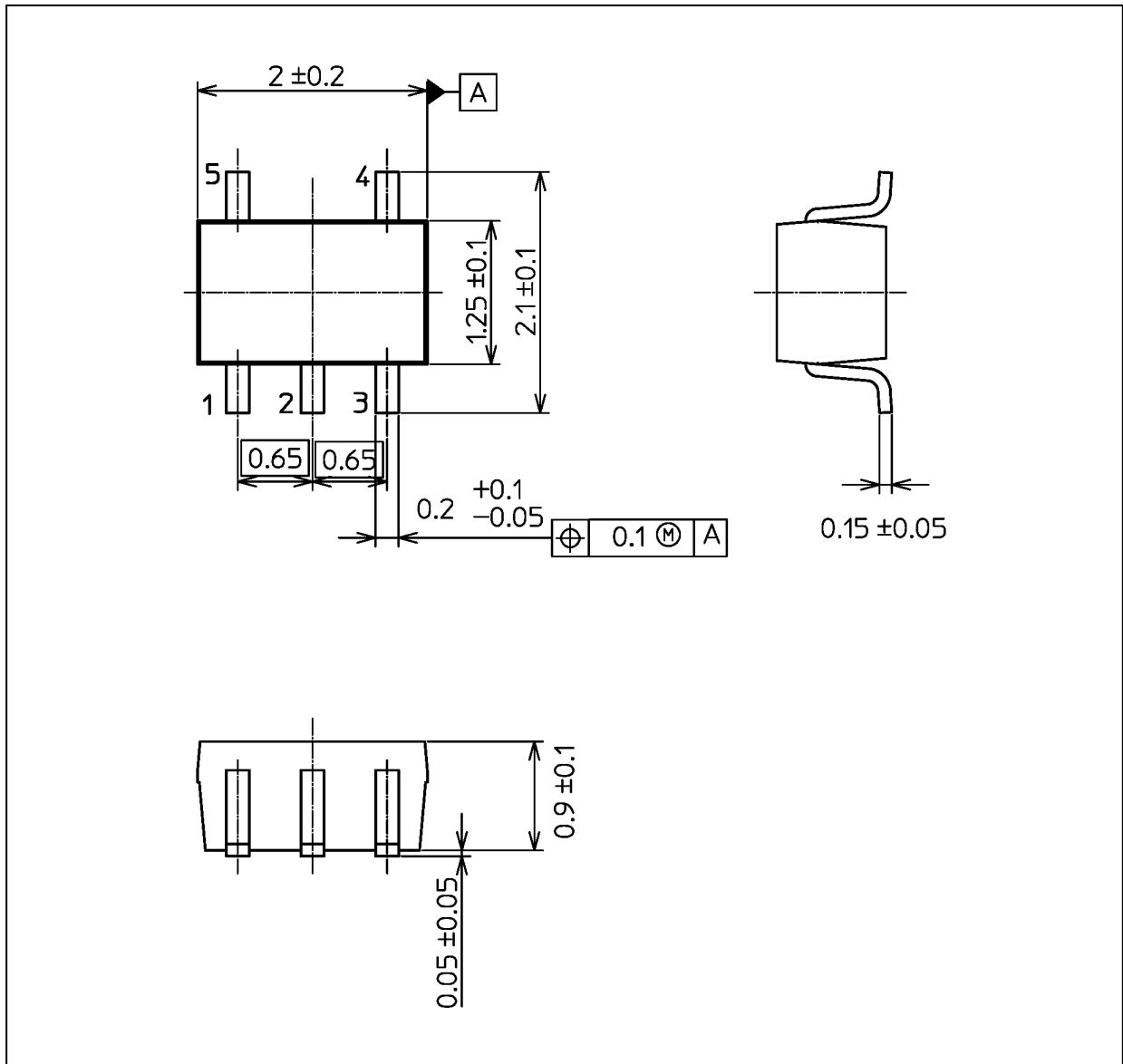
**9.6. AC Characteristics (Note) (Unless otherwise specified,  $T_a = -40$  to  $125$  °C, Input:  $t_r = t_f = 3$  ns)**

Characteristics	Symbol	Test Condition	$V_{CC}$ (V)	$C_L$ (pF)	Min	Max	Unit
Propagation delay time	$t_{PLH}, t_{PHL}$	—	$5.0 \pm 0.5$	15	1.0	9.5	ns
				50	1.0	12.0	
Input capacitance	$C_{IN}$	—			—	10	pF

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

Package Dimensions

Unit: mm



Weight: 0.006 g (typ.)

Package Name(s)
JEDEC: SOT-353
Nickname: USV

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