

TOSHIBA CMOS DIGITAL INTEGRATED CIRCUIT SILICON MONOLITHIC

# TC7SH86F, TC7SH86FU

## EXCLUSIVE OR GATE

The TC7SH86 is an advanced high speed CMOS EXCLUSIVE OR GATE fabricated with silicon gate CMOS technology.

It achieves the high speed operation similar to equivalent Bipolar Schottky TTL while maintaining the CMOS low power dissipation.

The internal circuit includes an output buffer, which provides high noise immunity and stable output.

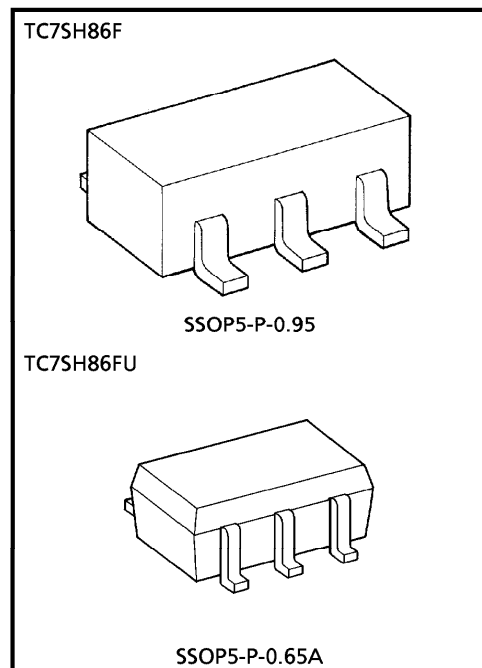
An input protection circuit ensures that 0V to 7V can be applied to the input pins without regard to the supply voltage. This device can be used to interface 5V to 3V system and two supply system such as battery back up. This circuit prevents device destruction due to mismatched supply and input voltages.

### FEATURES

- High Speed .....  $t_{pd} = 4.8\text{ns}$  (Typ.) at  $V_{CC} = 5\text{V}$
- Low Power Dissipation .....  $I_{CC} = 2\mu\text{A}$  (Max.) at  $T_a = 25^\circ\text{C}$
- High Noise Immunity .....  $V_{NIH} = V_{NIL} = 28\% V_{CC}$  (Min.)
- Power Down Protection is provided on all inputs.
- Balanced Propagation Delays .....  $t_{pLH} = t_{pHL}$
- Wide Operation Voltage Range ...  $V_{CC}(\text{opr}) = 2\text{V} \sim 5.5\text{V}$

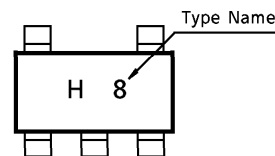
### MAXIMUM RATINGS

CHARACTERISTIC	SYMBOL	RATING	UNIT
Supply Voltage Range	$V_{CC}$	-0.5~7.0	V
DC Input Voltage	$V_{IN}$	-0.5~7.0	V
DC Output Voltage	$V_{OUT}$	-0.5~ $V_{CC} + 0.5$	V
Input Diode Current	$I_{IK}$	-20	mA
Output Diode Current	$I_{OK}$	±20	mA
DC Output Current	$I_{OUT}$	±25	mA
DC $V_{CC}$ /Ground Current	$I_{CC}$	±50	mA
Power Dissipation	$P_D$	200	mW
Storage Temperature	$T_{stg}$	-65~150	°C
Lead Temperature (10 s)	$T_L$	260	°C



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

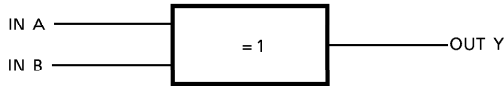
### MARKING



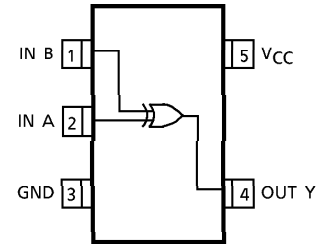
### TRUTH TABLE

A	B	Y
L	L	L
L	H	H
H	L	H
H	H	L

**LOGIC DIAGRAM**



**PIN ASSIGNMENT (TOP VIEW)**



**RECOMMENDED OPERATING CONDITIONS**

CHARACTERISTIC	SYMBOL	RATING	UNIT
Supply Voltage	$V_{CC}$	2.0~5.5	V
Input Voltage	$V_{IN}$	0~5.5	V
Output Voltage	$V_{OUT}$	0~ $V_{CC}$	V
Operating Temperature	$T_{opr}$	-40~85	°C
Input Rise and Fall Time	dt / dv	0~100 ( $V_{CC} = 3.3 \pm 0.3V$ )	ns / V
		0~20 ( $V_{CC} = 5 \pm 0.5V$ )	

**DC ELECTRICAL CHARACTERISTICS**

CHARACTERISTIC	SYMBOL	TEST CONDITION	$T_a = 25^\circ C$			$T_a = -40 \sim 85^\circ C$		UNIT		
			$V_{CC}$	MIN.	TYP.	MAX.	MIN.		MAX.	
High-Level Input Voltage	$V_{IH}$		2.0	1.50	—	—	1.50	—	V	
			3.0~5.5	$V_{CC} \times 0.7$	—	—	$V_{CC} \times 0.7$	—		
Low-Level Input Voltage	$V_{IL}$		2.0	—	—	0.50	—	0.50	V	
			3.0~5.5	—	—	$V_{CC} \times 0.3$	—	$V_{CC} \times 0.3$		
High-Level Output Voltage	$V_{OH}$	$V_{IN} = V_{IH}$ or $V_{IL}$	$I_{OH} = -50 \mu A$	2.0	1.9	2.0	—	1.9	—	V
				3.0	2.9	3.0	—	2.9	—	
				4.5	4.4	4.5	—	4.4	—	
				3.0	2.58	—	—	2.48	—	
Low-Level Output Voltage	$V_{OL}$	$V_{IN} = V_{IH}$ or $V_{IL}$	$I_{OL} = 50 \mu A$	2.0	—	0.0	0.1	—	0.1	V
				3.0	—	0.0	0.1	—	0.1	
				4.5	—	0.0	0.1	—	0.1	
				3.0	—	—	0.36	—	0.44	
Input Leakage Current	$I_{IN}$	$V_{IN} = 5.5V$ or GND	0~5.5	—	—	$\pm 0.1$	—	$\pm 1.0$	$\mu A$	
			5.5	—	—	2.0	—	20.0	$\mu A$	

**AC ELECTRICAL CHARACTERISTICS (Input  $t_r = t_f = 3ns$ )**

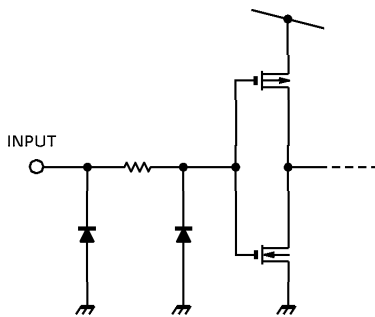
CHARACTERISTIC	SYMBOL	TEST CONDITION		Ta = 25°C			Ta = -40~85°C		UNIT
		V <sub>CC</sub> (V)	C <sub>L</sub> (pF)	MIN.	TYP.	MAX.	MIN.	MAX.	
Propagation Delay Time	t <sub>pLH</sub>	3.3 ± 0.3	15	—	7.0	11.0	1.0	13.0	ns
			50	—	9.5	14.5	1.0	16.5	
	t <sub>pHL</sub>	5.0 ± 0.5	15	—	4.8	6.8	1.0	8.0	
			50	—	6.3	8.8	1.0	10.0	
Input Capacitance	C <sub>IN</sub>			—	4	10	—	10	pF
Power Dissipation Capacitance	C <sub>PD</sub>	(Note 1)		—	18	—	—	—	pF

(Note 1) : C<sub>PD</sub> 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 :

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

**INPUT EQUIVALENT CIRCUIT**



PACKAGE DIMENSIONS  
SSOP5-P-0.95

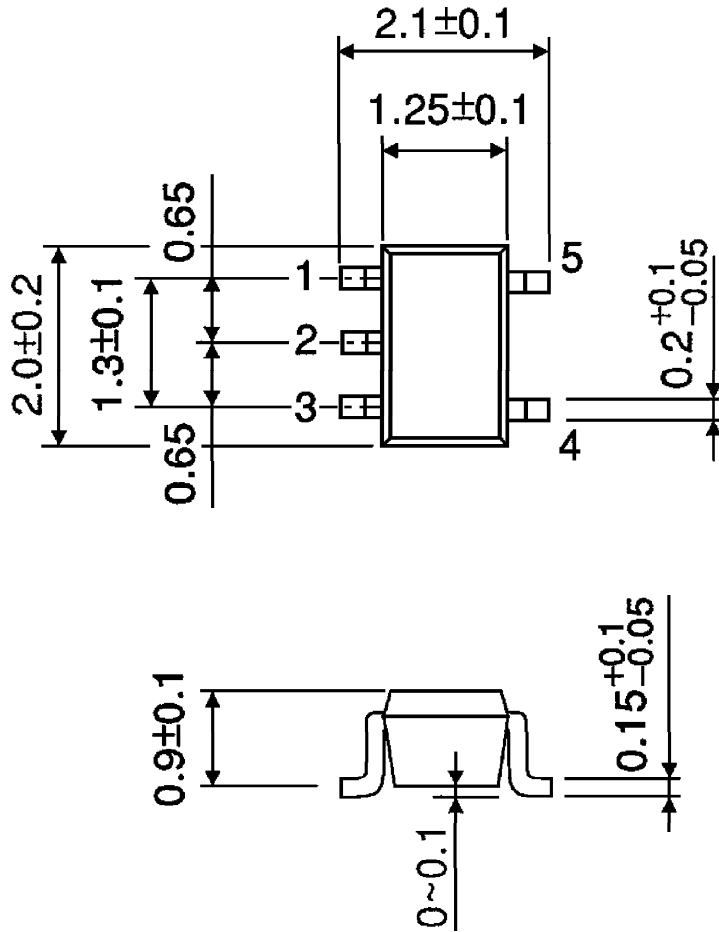
Unit : mm



Weight : 0.016g (Typ.)

PACKAGE DIMENSIONS  
SSOP5-P-0.65A

Unit : mm



Weight : 0.006g (Typ.)

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000707EBA

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