TOSHIBA CMOS DIGITAL INTEGRATED CIRCUIT SILICON MONOLITHIC

# TC7WH00FU, TC7WH00FK

#### **DUAL 2-INPUT NAND GATE**

The TC7WH00 is an advanced high speed CMOS 2-INPUT NAND 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 is composed of 3 stages including buffer output, which provide high noise immunity and stable output. An input protection circuit ensures that 0 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 systems and two supply systems such as battery back up. This circuit prevents device destruction due to mismatched supply and input voltages.

#### **FEATURES**

• High Speed ..... t<sub>pd</sub> = 3.7ns (Typ.) at

 $\dot{V}_{CC} = 5V$ 

• Low Power Dissipation ......  $I_{CC} = 2\mu A$  (Max.) at

 $Ta = 25^{\circ}C$ 

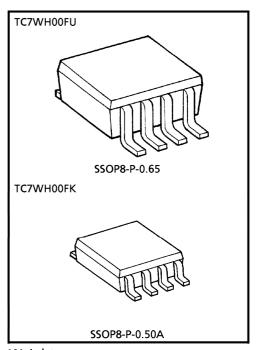
• High Noise Immunity ......  $V_{NIH} = V_{NIL} = 28\% V_{CC}$ 

(Min.)

Power Down Protection is provided on all inputs.

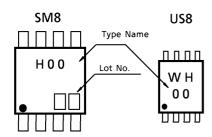
Balanced Propagation Delays ······ t<sub>pLH</sub>≒t<sub>pHL</sub>

• Wide Operating Voltage Range ···  $\dot{V}_{CC}$  (opr) = 2~5.5V

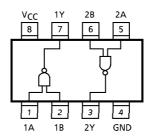


Weight SSOP8-P-0.65 : 0.02g (Typ.) SSOP8-P-0.50A : 0.01g (Typ.)

#### **MARKING**



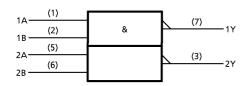
#### PIN ASSIGNMENT (TOP VIEW)



## **MAXIMUM RATINGS** (Ta = $25^{\circ}$ C)

CHARACTERISTIC	SYMBOL	RATING	UNIT	
Supply Voltage Range	Vcc	-0.5~7.0	V	
DC Input Voltage	VIN	-0.5~7.0	٧	
DC Output Voltage	Vout	-0.5~V <sub>CC</sub> +0.5	٧	
Input Diode Current	ΙΙΚ	- 20	mA	
Output Diode Current	<sup>I</sup> ОК	± 20	mA	
DC Output Current	IOUT	± 25	mA	
DC V <sub>CC</sub> /Ground Current	Icc	± 50	mA	
Dawar Dissination	D-	300 (SM8)	\//	
Power Dissipation	PD	200 (US8)	mW	
Storage Temperature	T <sub>stg</sub>	<b>-65∼150</b>	°C	
Lead Temperature (10 s)	TL	260	°C	

#### **LOGIC DIAGRAM**



#### TRUTH TABLE

А	В	Υ
L	L	Ι
L	Н	Н
Н	L	Н
Н	Η	L

#### **RECOMMENDED OPERATING CONDITIONS**

CHARACTERISTIC	SYMBOL	RATING	UNIT
Supply Voltage	Vcc	2.0~5.5	V
Input Voltage	V <sub>IN</sub>	0~5.5	V
Output Voltage	Vout	0~V <sub>CC</sub>	V
Operating Temperature	T <sub>opr</sub>	- 40~85	°C
Input Rise and Fall Time	dt/dv	$0\sim100 \text{ (V}_{CC} = 3.3 \pm 0.3 \text{V)}$	ns / V
input Rise and Fall Time	ut/dv	$0\sim20 \ (V_{CC} = 5 \pm 0.5V)$	115 / V

## DC ELECTRICAL CHARACTERISTICS

CILA DA CTEDICTIC	TERISTIC SYMBOL TEST CONDITION		Vcc	Ta = 25°C Ta = $-40 \sim 85^{\circ}$				.0∼85°C	LINUT	
CHARACTERISTIC	SYMBOL	IESI C	LEST CONDITION		MIN.	TYP.	MAX.	MIN.	MAX.	UNIT
High-Level				2.0	1.50	_		1.50		
Input Voltage	V <sub>IH</sub>		_	3.0~ 5.5	V <sub>CC</sub> ×0.7	_	_	V <sub>C</sub> C × 0.7		V
Low-Level				2.0	_	_	0.50		0.50	
Input Voltage	V <sub>IL</sub>		<del>-</del>	3.0~ 5.5	_	_	V <sub>C</sub> C × 0.3	_	V <sub>CC</sub> ×0.3	V
				2.0	1.9	2.0		1.9	_	
High Lovel		or V <sub>IL</sub>	$I_{OH} = -50\mu A$	3.0	2.9	3.0	_	2.9	_	V
High-Level Output Voltage	Voн			4.5	4.4	4.5		4.4		
Output Voltage			$I_{OH} = -4mA$	3.0	2.58	_		2.48		
			$I_{OH} = -8mA$	4.5	3.94	_		3.80		
			I <sub>OL</sub> = 50μΑ	2.0		0.0	0.1	_	0.1	V
Low-Level				3.0		0.0	0.1	_	0.1	
Output Voltage	VOL	$V_{IN} = V_{IH}$		4.5	_	0.0	0.1		0.1	
Catput Voltage			$I_{OL} = 4mA$	3.0	_	_	0.36	_	0.44	
			$I_{OL} = 8mA$	4.5	_	_	0.36	_	0.44	
Input Leakage Current	IIN	V <sub>IN</sub> = 5.5V d	or GND	0~ 5.5	_	_	± 0.1	_	± 1.0	$\mu$ A
Quiescent Supply Current	lcc	V <sub>IN</sub> = V <sub>CC</sub> o	or GND	5.5	_	_	2.0	_	20.0	$\mu$ A

<b>AC ELECTRICAL</b>	CHARACTERISTICS	(Input $t_r = t$	f = 3ns
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CHARACTERISTIC	SYMBOL	TEST CONDI		ONDITION		Ta = 25°C		Ta = -40~85°C		UNIT
CHARACTERISTIC STIMBOL	•	V <sub>CC</sub> (V)	C <sub>L</sub> (pF)	MIN.	TYP.	MAX.	MIN.	MAX.	UNIT	
Propagation Delay t <sub>pLH</sub> Time t <sub>pHL</sub>		3.3 ± 0.3	15		5.5	7.9	1.0	9.5	ns	
			50	_	8.0	11.4	1.0	13.0		
	5.0	5.0 ± 0.5	15	_	3.7	5.5	1.0	6.5		
			50		5.2	7.5	1.0	8.5		
Input Capacitance	CIN		_		_	4	10	_	10	рF
Power Dissipation Capacitance	C <sub>PD</sub>	(Note 1)				19	_	_	-	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.

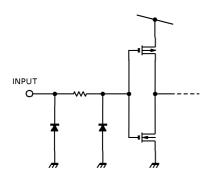
Average operating current can be obtained by the equation:

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

## **NOISE CHARACTERISTICS** (Ta = 25°C, Input $t_r = t_f = 3ns$ )

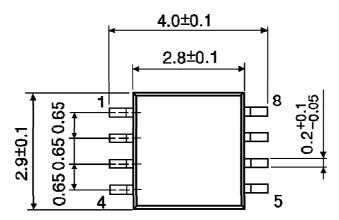
CHARACTERISTIC	SYMBOL	TEST CONDITION	V <sub>CC</sub> (V)	TYP.	LIMIT	UNIT
Quiet Output Maximum Dynamic V <sub>OL</sub>	V <sub>OLP</sub>	C <sub>L</sub> = 50pF	5.0	0.3	0.8	V
Quiet Output Minimum Dynamic V <sub>OL</sub>	V <sub>OLV</sub>	C <sub>L</sub> = 50pF	5.0	- 0.3	-0.8	V
Minimum High Level Dynamic Input Voltage	V <sub>IHD</sub>	C <sub>L</sub> = 50pF	5.0	_	3.5	V
Maximum Low Level Dynamic Input Voltage	V <sub>ILD</sub>	C <sub>L</sub> = 50pF	5.0	_	1.5	V

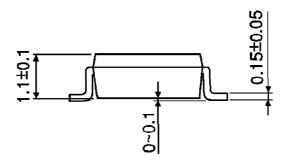
#### INPUT EQUIVALENT CIRCUIT



# PACKAGE DIMENSIONS

SSOP8-P-0.65 Unit: mm

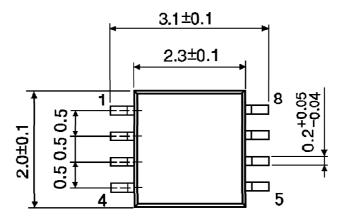


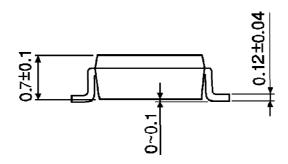


Weight: 0.02g (Typ.)

# PACKAGE DIMENSIONS

SSOP8-P-0.50A Unit: mm





Weight: 0.01g (Typ.)

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