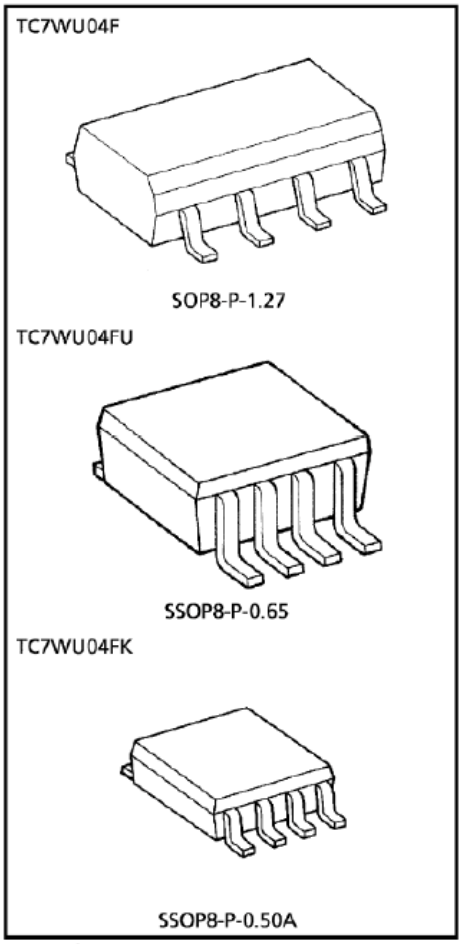
TOSHIBA CMOS DIGITAL INTEGRATED CIRCUIT SILICON MONOLITHIC

TC7WU04F, TC7WU04FU, TC7WU04FK

TRIPLE INVERTER

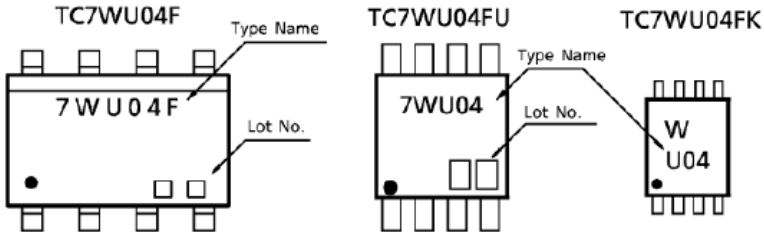
The TC7WU04 is a high speed C²MOS INVERTER fabricated with silicon gate C²MOS technology.
It achives the high speed operation similar to equivalent LSTTL while maintaining the C²MOS low power dissipation.
As the internal circuit is composed of single stage inverter, it can be applied for crystal oscillation.
All inputs are equipped with protection circuits against static discharge or transient excess voltage.



FEATURES

- High Speed ..... t_{pd} = 6ns (Typ.) at V_{CC} = 4.5V
- Low Power Dissipation ..... I_{CC} = 1μA (Max.) at Ta = 25°C
- High Noise Immunity ..... $V_{NIH} = V_{NIL}$ = 10% V_{CC} (Min.)
- Output Drive Capability ..... 10 LSTTL Loads
- Symmetrical Output Impedance ... $|I_{OH}| = I_{OL}$ = 4mA (Min.)
- Balanced Propagation Delays ..... $t_{pLH} \fallingdotseq t_{pHL}$
- Wide Operating Voltage Range ... $V_{CC\,(opr)}$ = 2~6V

MARKING



Weight
SOP8-P-1.27 : 0.05g (Typ.)
SSOP8-P-0.65 : 0.02g (Typ.)
SSOP8-P-0.50A : 0.01g (Typ.)

ABSOLUTE MAXIMUM RATINGS (Ta = 25°C)

CHARACTERISTIC	SYMBOL	RATING	UNIT
Supply Voltage Range	V_{CC}	−0.5~7	V
DC Input Voltage	V_{IN}	−0.5~V_{CC}+0.5	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}	±25	mA
Power Dissipation	P_D	300 (FM8, SM8) 200 (US8)	mW
Storage Temperature	T_{stg}	−65~150	°C
Lead Temperature (10s)	T_L	260	°C

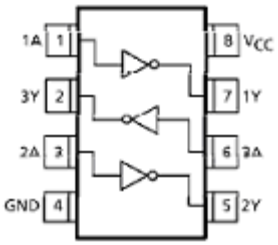
Note: Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.) 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).

LOGIC DIAGRAM

TRUTH TABLE

A	Y
L	H
H	L

PIN ASSIGNMENT (TOP VIEW)



OPERATING RANGE

CHARACTERISTIC	SYMBOL	RATING	UNIT
Supply Voltage	V_{CC}	2~6	V
Input Voltage	V_{IN}	0~V_{CC}	V
Output Voltage	V_{OUT}	0~V_{CC}	V
Operating Temperature	T_{opr}	−40~85	°C

DC ELECTRICAL CHARACTERISTICS

CHARACTERISTIC	SYMBOL	TEST CONDITION		V_{CC}	Ta = 25°C MIN.	Ta = 25°C TYP.	Ta = 25°C MAX.	Ta = −40~85°C MIN.	Ta = −40~85°C MAX.	UNIT
High-Level Input Voltage	V_{IH}	—		2.0	1.7	—	—	1.7	—	V
				4.5	3.6	—	—	3.6	—	
				6.0	4.8	—	—	4.8	—	
Low-Level Input Voltage	V_{IL}	—		2.0	—	—	0.3	—	0.3	V
				4.5	—	—	0.9	—	0.9	
				6.0	—	—	1.2	—	1.2	
High-Level Output Voltage	V_{OH}	$V_{IN} = V_{IL}$	$I_{OH} = -20\mu A$	2.0	1.8	2.0	—	1.8	—	V
				4.5	4.0	4.5	—	4.0	—	
				6.0	5.5	5.9	—	5.5	—	
		$V_{IN} = GND$	$I_{OH} = -4mA$	4.5	4.18	4.31	—	4.13	—	
			$I_{OH} = -5.2mA$	6.0	5.68	5.80	—	5.63	—	
Low-Level Output Voltage	V_{OL}	$V_{IN} = V_{IH}$	$I_{OL} = 20\mu A$	2.0	—	0.0	0.2	—	0.2	V
				4.5	—	0.0	0.5	—	0.5	
				6.0	—	0.1	0.5	—	0.5	
		$V_{IN} = V_{CC}$	$I_{OL} = 4mA$	4.5	—	0.17	0.26	—	0.33	
			$I_{OL} = 5.2mA$	6.0	—	0.18	0.26	—	0.33	
Input Leakage Current	I_{IN}	$V_{IN} = V_{CC}$ or GND		6.0	—	—	±0.1	—	±1.0	μA
Quiescent Supply Current	I_{CC}	$V_{IN} = V_{CC}$ or GND		6.0	—	—	1.0	—	10.0	

AC ELECTRICAL CHARACTERISTICS ($C_L = 15pF$, $V_{CC} = 5V$, Ta = 25°C)

CHARACTERISTIC	SYMBOL	TEST CONDITION	Ta = 25°C MIN.	Ta = 25°C TYP.	Ta = 25°C MAX.	UNIT
Output Transition Time	t_{TLH} t_{THL}	—	—	4	8	ns
Propagation Delay Time	t_{pLH} t_{pHL}	—	—	4	8	ns

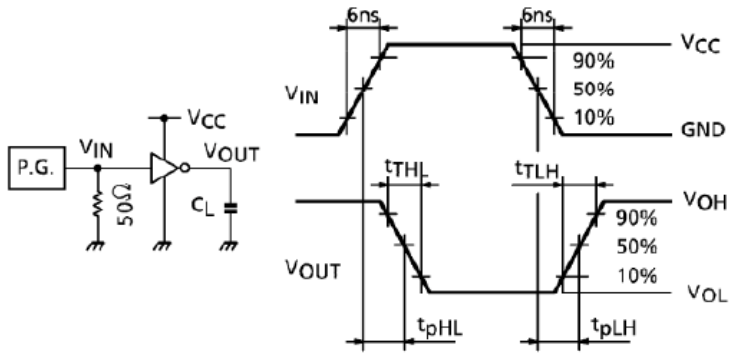
AC ELECTRICAL CHARACTERISTICS ($C_L = 50pF$, Input $t_r = t_f = 6ns$)

CHARACTERISTIC	SYMBOL	TEST CONDITION	V_{CC}	Ta = 25°C MIN.	Ta = 25°C TYP.	Ta = 25°C MAX.	Ta = −40~85°C MIN.	Ta = −40~85°C MAX.	UNIT
Output Transition Time	t_{TLH} t_{THL}	—	2.0	—	30	75	—	95	ns
			4.5	—	8	15	—	19	
			6.0	—	7	13	—	16	
Propagation Delay Time	t_{pLH} t_{pHL}	—	2.0	—	18	60	—	75	ns
			4.5	—	6	12	—	15	
			6.0	—	5	10	—	13	
Input Capacitance	C_{IN}	—		—	9	15	—	15	pF
Power Dissipation Capacitance	C_{PD}	(Note 1)		—	13	—	—	—	

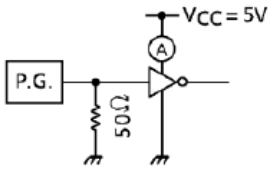
Note 1 : C_{PD} is defined as the value of internal equivalent capacitance of IC which is calculated from the operating current consumption without load (refer to Test Circuit). Average operating current can be obtained by the equation hereunder.

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

SWITCHING CHARACTERISTICS TEST CIRCUIT



OPERATING CURRENT CONSUMPTION TEST CIRCUIT

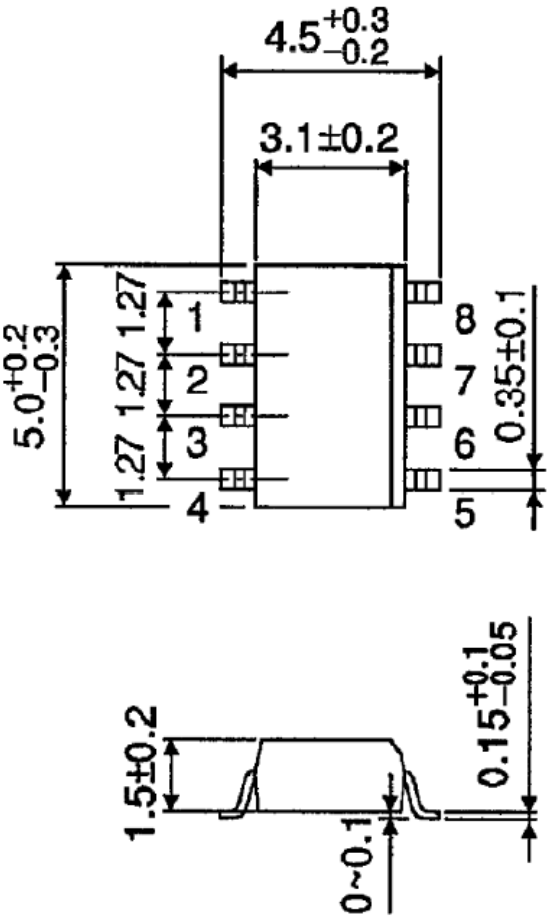


This input waveform is equal to SWITCHING CHARACTERISTICS TEST CIRCUIT input waveform.

PACKAGE DIMENSIONS

SOP8-P-1.27

Unit : mm

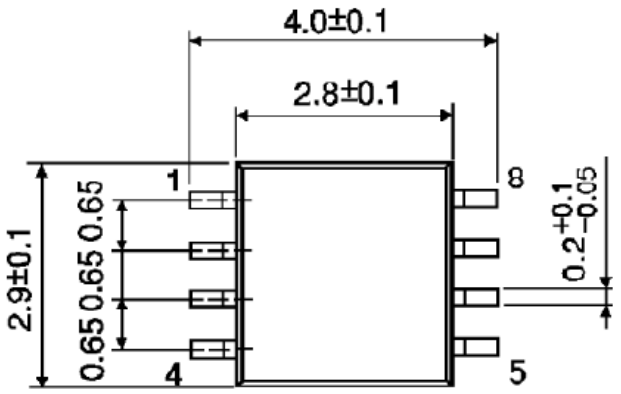


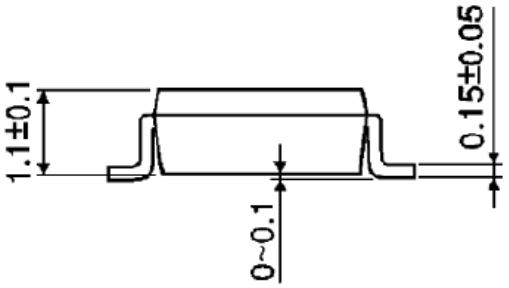
Weight : 0.05g (Typ.)

PACKAGE DIMENSIONS

SSOP8-P-0.65

Unit : mm



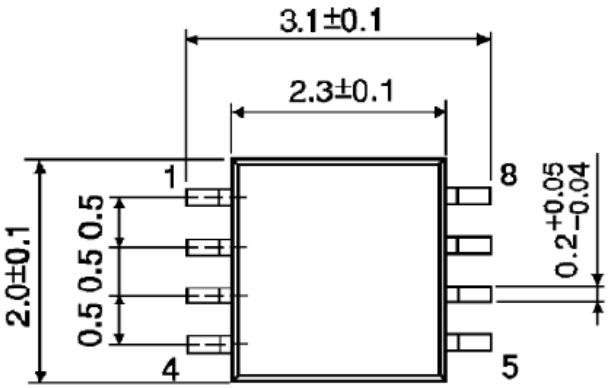


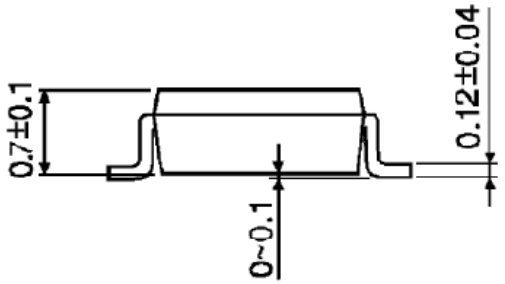
Weight : 0.02g (Typ.)

PACKAGE DIMENSIONS

SSOP8-P-0.50A

Unit : mm





Weight : 0.01g (Typ.)

RESTRICTIONS ON PRODUCT USE

20070701-EN GENERAL

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- TOSHIBA is continually working to improve the quality and reliability of its products. Nevertheless, semiconductor devices in general can malfunction or fail due to their inherent electrical sensitivity and vulnerability to physical stress. It is the responsibility of the buyer, when utilizing TOSHIBA products, to comply with the standards of safety in making a safe design for the entire system, and to avoid situations in which a malfunction or failure of such TOSHIBA products could cause loss of human life, bodily injury or damage to property.
  In developing your designs, please ensure that TOSHIBA products are used within specified operating ranges as set forth in the most recent TOSHIBA products specifications. Also, please keep in mind the precautions and conditions set forth in the “Handling Guide for Semiconductor Devices,” or “TOSHIBA Semiconductor Reliability Handbook” etc.
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