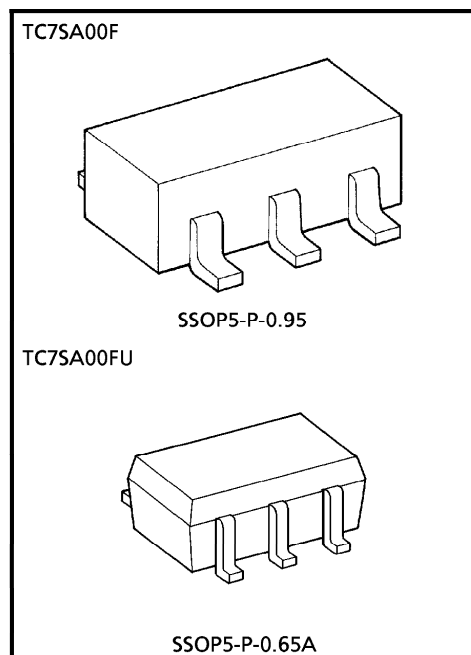


TC7SA08F, TC7SA08FU

LOW-VOLTAGE 2-INPUT AND GATE WITH 3.6 V TOLERANT INPUTS AND OUTPUTS

FEATURES

- Low Voltage Operation : $V_{CC} = 1.8 \sim 3.6$ V
- High Speed Operation : $t_{pd} = 2.8$ ns (max.)
at $V_{CC} = 3.0 \sim 3.6$ V
 $t_{pd} = 3.7$ ns (max.)
at $V_{CC} = 2.3 \sim 2.7$ V
 $t_{pd} = 7.4$ ns (max.)
at $V_{CC} = 1.8$ V
- 3.6 V Tolerant inputs and outputs.
- Output Current : $I_{OH}/I_{OL} = \pm 24$ mA (min.)
at $V_{CC} = 3.0$ V
 $I_{OH}/I_{OL} = \pm 18$ mA (min.) at
 $V_{CC} = 2.3$ V
 $I_{OH}/I_{OL} = \pm 6$ mA (min.) at
 $V_{CC} = 1.8$ V
- Latch-up Performance : ± 300 mA
- ESD Performance : Human Body Model $> \pm 2000$ V
Machine Model $> \pm 200$ V
- Power Down Protection is provided on all inputs and outputs.
- TC74VCX08FT Equivalent



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

PRELIMINARY

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MAXIMUM RATINGS

PARAMETER	SYMBOL	RATING	UNIT
Power Supply Voltage	V_{CC}	$-0.5 \sim 4.6$	V
DC Input Voltage	V_{IN}	$-0.5 \sim 4.6$	V
DC Output Voltage	V_{OUT}	$-0.5 \sim 4.6$ (Note 1)	V
		$-0.5 \sim V_{CC} + 0.5$ (Note 2)	
Input Diode Current	I_{IK}	-50	mA
Output Diode Current	I_{OK}	± 50 (Note 3)	mA
DC Output Current	I_{OUT}	± 50	mA
Power Dissipation	P_D	200	mW
DC V_{CC} / Ground Current	I_{CC} / I_{GND}	± 100	mA
Storage Temperature	T_{stg}	$-65 \sim 150$	$^{\circ}\text{C}$

(Note 1) $V_{CC} = 0\text{ V}$ (Note 2) High or Low State. I_{OUT} absolute maximum rating must be observed.(Note 3) $V_{OUT} < \text{GND}$, $V_{OUT} > V_{CC}$

PRELIMINARY

RECOMMENDED OPERATING RANGE

PARAMETER	SYMBOL	RATING	UNIT
Supply Voltage	V_{CC}	1.8~3.6	V
		1.2~3.6 (Note 4)	
Input Voltage	V_{IN}	$-0.3 \sim 3.6$	V
Output Voltage	V_{OUT}	0~3.6 (Note 5)	V
		0~ V_{CC} (Note 6)	
Output Current	I_{OH} / I_{OL}	± 24 (Note 7)	mA
		± 18 (Note 8)	
		± 6 (Note 9)	
Operating Temperature	T_{opr}	$-40 \sim 85$	$^{\circ}\text{C}$
Input Rise And Fall Time	dt/dv	0~10 (Note 10)	ns/V

(Note 4) Data Retention Only

(Note 5) $V_{CC} = 0\text{ V}$

(Note 6) High or Low State

(Note 7) $V_{CC} = 3.0 \sim 3.6\text{ V}$ (Note 8) $V_{CC} = 2.3 \sim 2.7\text{ V}$ (Note 9) $V_{CC} = 1.8\text{ V}$ (Note 10) $V_{IN} = 0.8 \sim 2.0\text{ V}$, $V_{CC} = 3.0\text{ V}$

ELECTRICAL CHARACTERISTICS

DC characteristics ($T_a = -40\sim 85^\circ\text{C}$, $2.7\text{ V} < V_{CC} \leq 3.6\text{ V}$)

PARAMETER		SYMBOL	TEST CONDITION		V _{CC} (V)	MIN.	MAX.	UNIT
Input Voltage	“H” Level	V _{IH}			2.7~3.6	2.0	—	V
	“L” Level	V _{IL}			2.7~3.6	—	0.8	
Output Voltage	“H” Level	V _{OH}	V _{IN} = V _{IH}	I _{OH} = - 100 μA	2.7~3.6	V _{CC} - 0.2	—	V
				I _{OH} = - 12 mA	2.7	2.2	—	
				I _{OH} = - 18 mA	3.0	2.4	—	
				I _{OH} = - 24 mA	3.0	2.2	—	
	“L” Level	V _{OL}	V _{IN} = V _{IH} or V _{IL}	I _{OL} = 100 μA	2.7~3.6	—	0.2	
				I _{OL} = 12 mA	2.7	—	0.4	
				I _{OL} = 18 mA	3.0	—	0.4	
				I _{OL} = 24 mA	3.0	—	0.55	
Input Leakage Current		I _{IN}	V _{IN} = 0~3.6 V		2.7~3.6	—	± 5.0	μA
Power Off Leakage Current		I _{OFF}	V _{IN} , V _{OUT} = 0~3.6 V		0	—	10.0	μA
Quiescent Supply Current		I _{CC}	V _{IN} = V _{CC} or GND		2.7~3.6	—	20.0	μA
			V _{CC} ≤ (V _{IN} , V _{OUT}) ≤ 3.6 V		2.7~3.6	—	± 20.0	
Increase In I _{CC} Per Input		ΔI _{CC}	V _{IH} = V _{CC} - 0.6 V		2.7~3.6	—	750	μA

PRELIMINARY

ELECTRICAL CHARACTERISTICS

DC characteristics ($T_a = -40\sim 85^\circ\text{C}$, $2.3\text{ V} \leq V_{CC} \leq 2.7\text{ V}$)

PARAMETER		SYMBOL	TEST CONDITION		V _{CC} (V)	MIN.	MAX.	UNIT
Input Voltage	“H” Level	V _{IH}			2.3~2.7	1.6	—	V
	“L” Level	V _{IL}			2.3~2.7	—	0.7	
Output Voltage	“H” Level	V _{OH}	V _{IN} = V _{IH}	I _{OH} = - 100 μA	2.3~2.7	V _{CC} - 0.2	—	V
				I _{OH} = - 6 mA	2.3	2.0	—	
				I _{OH} = - 12 mA	2.3	1.8	—	
				I _{OH} = - 18 mA	2.3	1.7	—	
	“L” Level	V _{OL}	V _{IN} = V _{IH} or V _{IL}	I _{OL} = 100 μA	2.3~2.7	—	0.2	
				I _{OL} = 12 mA	2.3	—	0.4	
				I _{OL} = 18 mA	2.3	—	0.6	
Input Leakage Current		I _{IN}	V _{IN} = 0~3.6 V		2.3~2.7	—	± 5.0	μA
Power Off Leakage Current		I _{OFF}	V _{IN} , V _{OUT} = 0~3.6 V		0	—	10.0	μA
Quiescent Supply Current		I _{CC}	V _{IN} = V _{CC} or GND		2.3~2.7	—	20.0	μA
			V _{CC} ≤ (V _{IN} , V _{OUT}) ≤ 3.6 V _{CC}		2.3~2.7	—	± 20.0	

ELECTRICAL CHARACTERISTICS

DC characteristics ($T_a = -40\sim 85^\circ\text{C}$, $1.8\text{ V} \leq V_{CC} < 2.3\text{ V}$)

PARAMETER		SYMBOL	TEST CONDITION		V _{CC} (V)	MIN.	MAX.	UNIT
Input Voltage	“H” Level	V _{IH}			1.8~2.3	0.7 × V _{CC}	—	V
	“L” Level	V _{IL}			1.8~2.3	—	0.2 × V _{CC}	
Output Voltage	“H” Level	V _{OH}	V _{IN} = V _{IH}	I _{OH} = − 100 μA	1.8	V _{CC} − 0.2	—	V
				I _{OH} = − 6 mA	1.8	1.4	—	
	“L” Level	V _{OL}	V _{IN} = V _{IH} or V _{IL}	I _{OL} = 100 μA	1.8	—	0.2	
				I _{OL} = 6 mA	1.8	—	0.3	
Input Leakage Current		I _{IN}	V _{IN} = 0~3.6 V		1.8	—	± 5.0	μA
Power Off Leakage Current		I _{OFF}	V _{IN} , V _{OUT} = 0~3.6 V		0	—	10.0	μA
Quiescent Supply Current		I _{CC}	V _{IN} = V _{CC} or GND		1.8	—	20.0	μA
			V _{CC} ≤ (V _{IN} , V _{OUT}) ≤ 3.6 V		1.8	—	± 20.0	

AC characteristics ($T_a = -40\sim 85^\circ\text{C}$, Input $t_r = t_f = 2.0\text{ ns}$, $C_L = 30\text{ pF}$, $R_L = 500\text{ }\Omega$)

PARAMETER		SYMBOL	TEST CONDITION		$V_{CC}(\text{V})$	MIN.	MAX.	UNIT
Propagation Delay Time		t_{pLH} t_{pHL}	(Fig.1, 2)		1.8	1.5	7.4	ns
					2.5 ± 0.2	1.0	3.7	
					3.3 ± 0.3	0.8	2.8	

For $C_L = 50\text{ pF}$, add approximately 300 ps to the AC maximum specification.

PRELIMINARY

Dynamic switching characteristics ($T_a = 25^\circ\text{C}$, Input $t_r = t_f = 2.0\text{ ns}$, $C_L = 30\text{ pF}$)

PARAMETER		SYMBOL	TEST CONDITION		$V_{CC}(\text{V})$	TYP.	UNIT
Quiet Output Maximum Dynamic V_{OL}		V_{OLP}	$V_{IH} = 1.8\text{ V}, V_{IL} = 0\text{ V}$ (Note 11)		1.8	0.25	V
			$V_{IH} = 2.5\text{ V}, V_{IL} = 0\text{ V}$ (Note 11)		2.5	0.6	
			$V_{IH} = 3.3\text{ V}, V_{IL} = 0\text{ V}$ (Note 11)		3.3	0.8	
Quiet Output Minimum Dynamic V_{OL}		V_{OLV}	$V_{IH} = 1.8\text{ V}, V_{IL} = 0\text{ V}$ (Note 11)		1.8	-0.25	V
			$V_{IH} = 2.5\text{ V}, V_{IL} = 0\text{ V}$ (Note 11)		2.5	-0.6	
			$V_{IH} = 3.3\text{ V}, V_{IL} = 0\text{ V}$ (Note 11)		3.3	-0.8	
Quiet Output Minimum Dynamic V_{OH}		V_{OHV}	$V_{IH} = 1.8\text{ V}, V_{IL} = 0\text{ V}$ (Note 11)		1.8	1.5	V
			$V_{IH} = 2.5\text{ V}, V_{IL} = 0\text{ V}$ (Note 11)		2.5	1.9	
			$V_{IH} = 3.3\text{ V}, V_{IL} = 0\text{ V}$ (Note 11)		3.3	2.2	

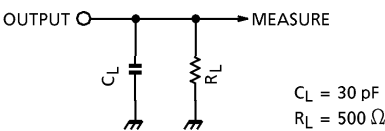
(Note 11) Parameter guaranteed by design.

Capacitive characteristics (Ta = 25°C)

PARAMETER	SYMBOL	TEST CONDITION	V _{CC} (V)	TYP.	UNIT
			1.8, 2.5, 3.3		
Input Capacitance	C _{IN}	—	1.8, 2.5, 3.3	6	pF
Power Dissipation Capacitance	C _{PD}	f _{IN} = 10 MHz (Note 12)	1.8, 2.5, 3.3	20	pF

(Note 12) 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 :
 $I_{CC (opr.)} = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC}$

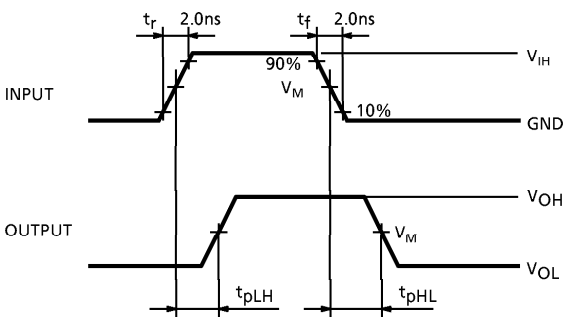
TEST CIRCUIT
Fig.1



PRELIMINARY

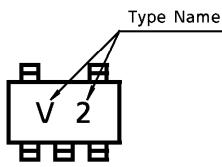
AC WAVEFORM

Fig.2 t_{pLH}, t_{pHL}

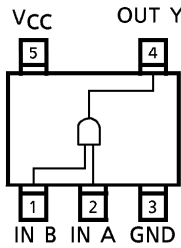


SYMBOL	V _{CC}		
	3.3 ± 0.3 V	2.5 ± 0.2 V	1.8 V
V _{IH}	2.7 V	V _{CC}	V _{CC}
V _M	1.5 V	V _{CC} /2	V _{CC} /2

MARKING



PIN ASSIGNMENT (TOP VIEW)



TRUTH TABLE

INPUTS		OUTPUTS
A	B	Y
L	L	L
L	H	L
H	L	L
H	H	H

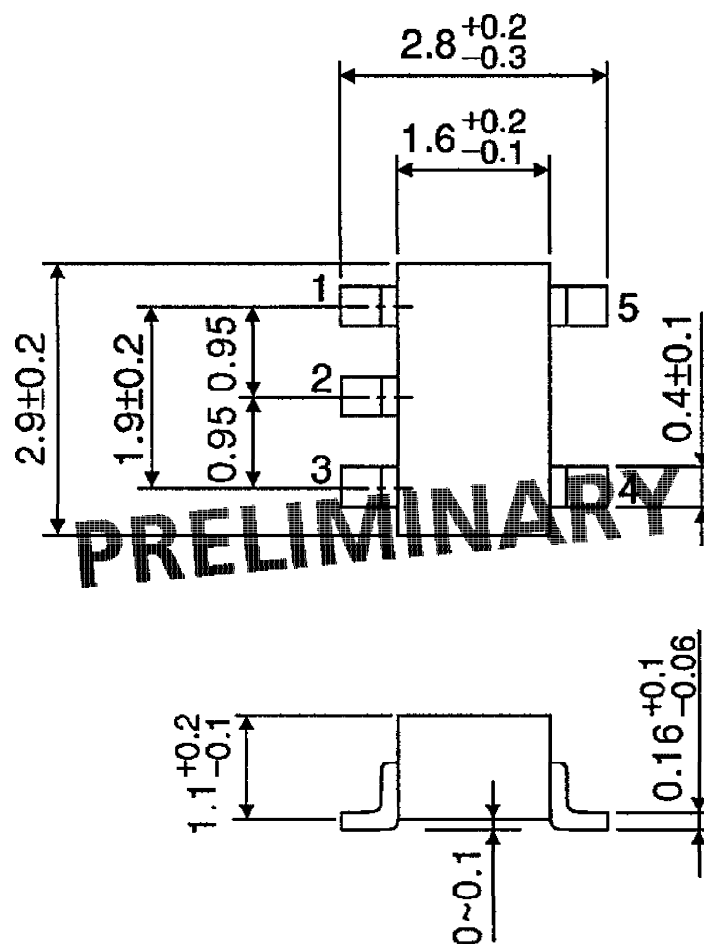
LOGIC DIAGRAM



PRELIMINARY

OUTLINE DRAWING
SSOP5-P-0.95

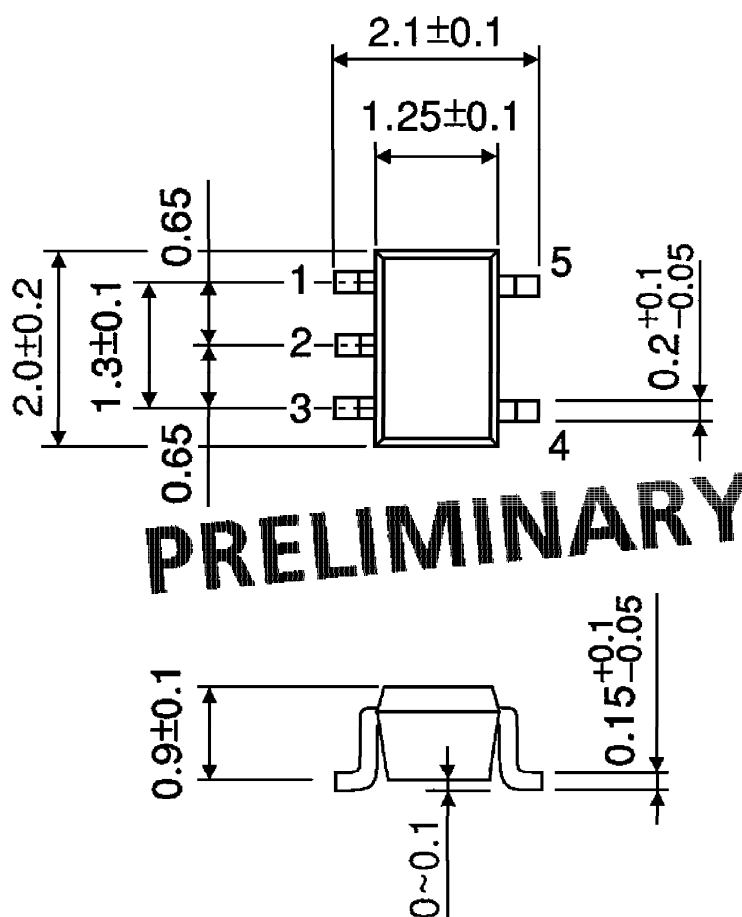
Unit : mm



Weight : 0.016 g (Typ.)

OUTLINE DRAWING
SSOP5-P-0.65A

Unit : mm



Weight : 0.006 g (Typ.)