

TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

TC74VHC9151P,TC74VHC9151FT,TC74VHC9151FK TC74VHC9152P,TC74VHC9152FT,TC74VHC9152FK

TC74VHC9151P/FT/FK 9-Bit Schmitt Buffer

TC74VHC9152P/FT/FK 9-Bit Schmitt Inverter

The TC74VHC9151/9152 are an ultra-high-speed 9-bit Schmitt Buffer / Inverter fabricated using silicon-gate CMOS technology. The TC74VHC9151/9152 combines low power consumption of CMOS with Schottky TTL speeds.

TC74VHC9151 output is a non-inverting type and the TC74VHC9152 output is an inverting type.

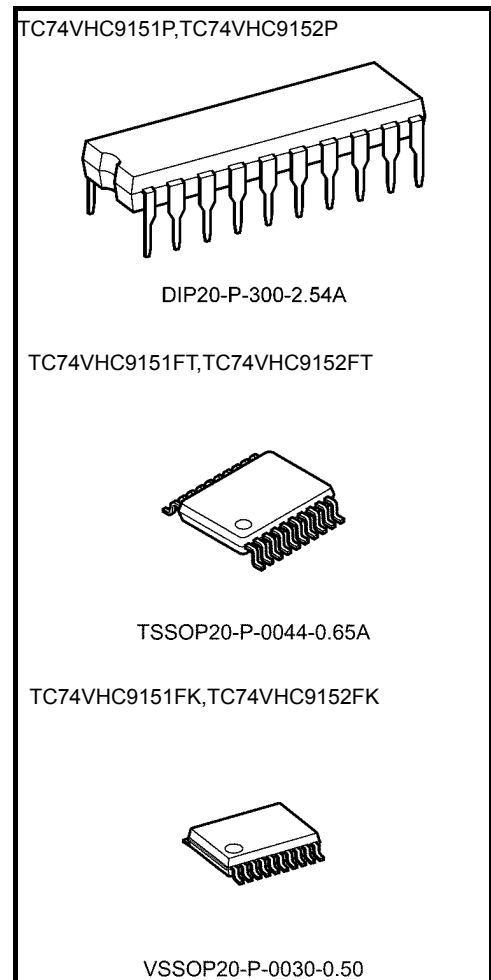
All the inputs have hysteresis between the positive-going and negative-going thresholds. Thus the TC74VHC9151/9152 are capable of squaring up transitions of slowly changing input signals and provides an improved noise immunity.

Additionally, all the inputs have a newly developed protection circuit without a diode returned to V_{CC} . This enables the inputs to be tolerant of up to 5 volts even when power supply is down.

The input power-down protection capability makes the TC74VHC9151/9152 ideal for a wide range of applications, such as interfacing between different voltages, voltage translation from 5 V to 3 V and battery back-up circuits.

Features

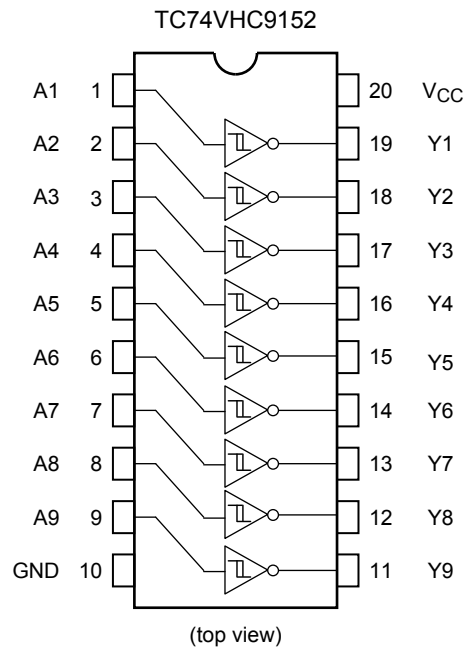
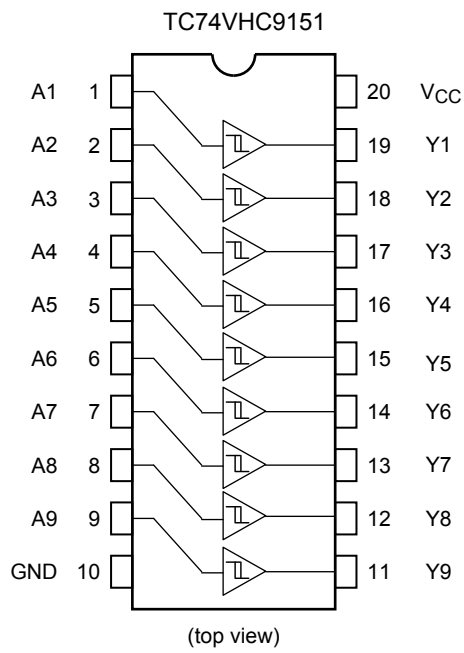
- High speed: $t_{pd} = 3.6 \text{ ns (typ.)}$ ($V_{CC} = 5 \text{ V}$)
- Low supply current: $I_{CC} = 4 \mu\text{A (max)}$ ($T_a = 25^\circ\text{C}$)
- High noise immunity: $V_{NIH} = V_{NIL} = 28\% V_{CC}$ (min)
- All inputs are provided with power-down protection.
- Symmetrical rise and fall delays: $t_{pLH} \approx t_{pHL}$
- Wide operating voltage range: $V_{CC (opr)} = 2 \text{ to } 5.5 \text{ V}$



Weight

DIP20-P-300-2.54A	: 1.30 g (typ.)
TSSOP20-P-0044-0.65A	: 0.08 g (typ.)
VSSOP20-P-0030-0.50	: 0.03 g (typ.)

Pin Assignment



Truth Table

A	Y	
	TC74VHC9151	TC74VHC9152
L	L	H
H	H	L

Absolute Maximum Ratings (Note1)

Characteristics	Symbol	Rating	Unit
Supply voltage range	V_{CC}	-0.5 to 7.0	V
DC input voltage	V_{IN}	-0.5 to 7.0	V
DC output voltage	V_{OUT}	-0.5 to $V_{CC} + 0.5$	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}	± 75	mA
Power dissipation	P_D	500 (DIP) (Note 2)/180(TSSOP/VSSOP)	mW
Storage temperature	T_{stg}	-65 to 150	$^{\circ}C$

Note 1: 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 2: 500 mW in the range of $T_a = -40$ to $65^{\circ}C$. From $T_a = 65$ to $85^{\circ}C$ a derating factor of -10 mW/ $^{\circ}C$ shall be applied until 300 mW.

Operating Ranges (Note)

Characteristics	Symbol	Rating	Unit
Supply voltage	V_{CC}	2.0 to 5.5	V
Input voltage	V_{IN}	0 to 5.5	V
Output voltage	V_{OUT}	0 to V_{CC}	V
Operating temperature	T_{opr}	-40 to 85	$^{\circ}C$

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.

Electrical Characteristics

DC Characteristics

Characteristics	Symbol	Test Condition		Ta = 25°C			Ta = -40~85°C		Unit	
				V _{CC} (V)	Min	Typ	Max	Min		Max
Positive threshold voltage	V _P	—		3.0	—	—	2.20	—	2.20	V
				4.5	—	—	3.15	—	3.15	
				5.5	—	—	3.85	—	3.85	
Negative threshold voltage	V _N	—		3.0	0.90	—	—	0.90	—	V
				4.5	1.35	—	—	1.35	—	
				5.5	1.65	—	—	1.65	—	
Hysteresis voltage	V _H	—		3.0	0.30	—	1.20	0.30	1.20	V
				4.5	0.40	—	1.40	0.40	1.40	
				5.5	0.50	—	1.60	0.50	1.60	
High-level output voltage	V _{OH}	V _{IN} = V _{IH} or V _{IL}	I _{OH} = -50 μA	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	—		
			I _{OH} = -4 mA	3.0	2.58	—	—	2.48	—	
			I _{OH} = -8 mA	4.5	3.94	—	—	3.80	—	
Low-level output voltage	V _{OL}	V _{IN} = V _{IH} or V _{IL}	I _{OL} = 50 μA	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	
			I _{OL} = 4 mA	3.0	—	—	0.36	—	0.44	
			I _{OL} = 8 mA	4.5	—	—	0.36	—	0.44	
Input leakage current	I _{IN}	V _{IN} = 5.5 V or GND	0 to 5.5	—	—	±0.1	—	±1.0	μA	
Quiescent supply current	I _{CC}	V _{IN} = V _{CC} or GND	5.5	—	—	4.0	—	40.0	μA	

AC Characteristics (input: $t_r = t_f = 3$ ns)

Characteristics	Symbol	Test Condition		Ta = 25°C			Ta = -40 to 85°C		Unit	
		V _{CC} (V)	C _L (pF)	Min	Typ.	Max	Min	Max		
Propagation delay time (TC74VHC9151)	t _{pLH}	—	3.3 ± 0.3	15	—	4.8	9.4	1.0	10.7	ns
				50	—	8.1	16.1	1.0	18.4	
	5.0 ± 0.5		15	—	3.3	6.0	1.0	6.8		
			50	—	5.7	10.5	1.0	11.9		
Propagation delay time (TC74VHC9152)	t _{pLH}	—	3.3 ± 0.3	15	—	4.8	9.3	1.0	10.6	ns
				50	—	7.8	15.4	1.0	17.6	
	5.0 ± 0.5		15	—	3.6	6.3	1.0	7.1		
			50	—	5.7	10.2	1.0	11.6		
Output to output skew	t _{osHL}	(Note 1)	3.3 ± 0.3	50	—	—	1.5	—	1.5	ns
	t _{osLH}		5.0 ± 0.5	50	—	—	1.0	—	1.0	
Input capacitance	C _{IN}	—		—	4	10	—	10	pF	
Power dissipation capacitance (Note 2)	C _{PD}	TC74VHC9151 (f _{IN} = 1 MHz)		—	11	—	—	—	pF	
		TC74VHC9152 (f _{IN} = 1 MHz)		—	10	—	—	—		

Note 1: Parameter guaranteed by design.

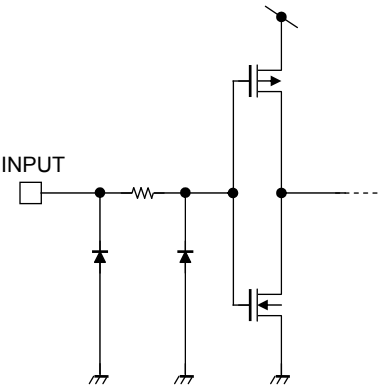
$$t_{osLH} = |t_{pLHm} - t_{pLHn}|, t_{osHL} = |t_{pHLm} - t_{pHLn}|$$

Note 2: 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:

$$I_{CC (opr)} = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC} / 9 \text{ (per bit)}$$

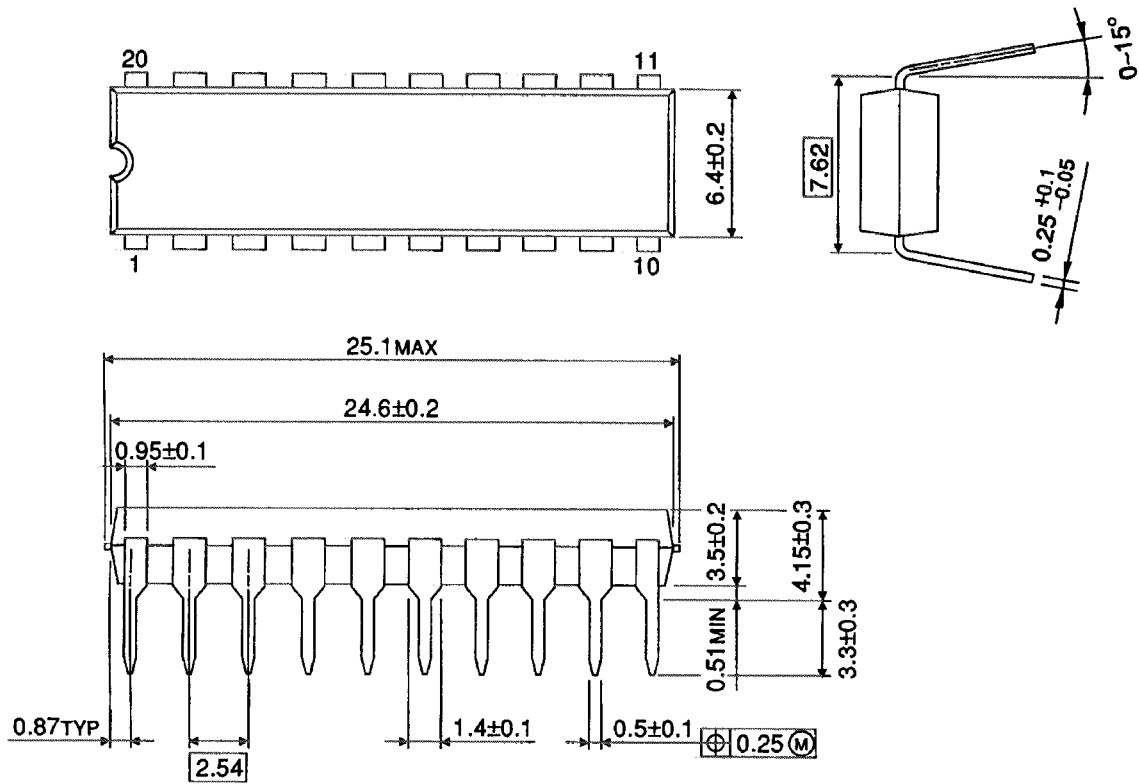
Input Equivalent Circuit



Package Dimensions

DIP20-P-300-2.54A

Unit : mm

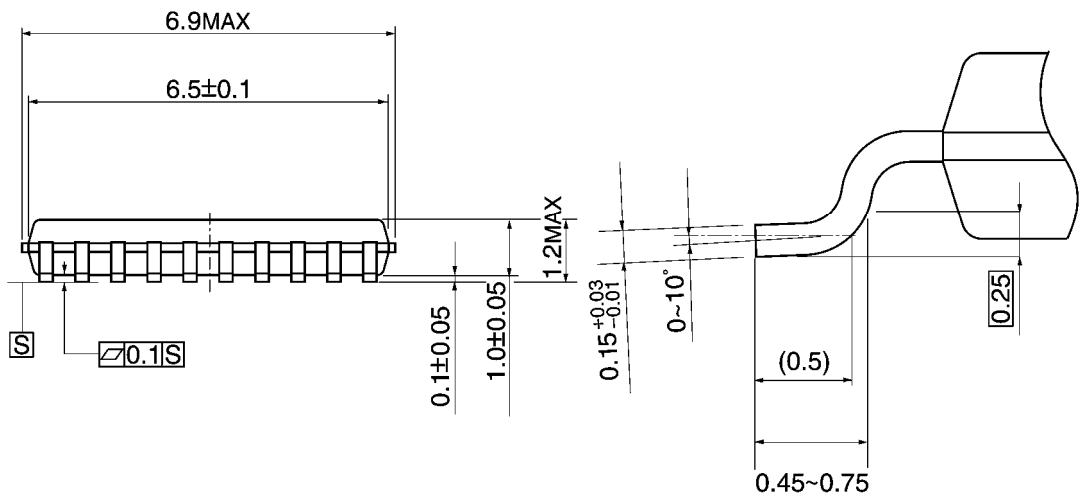
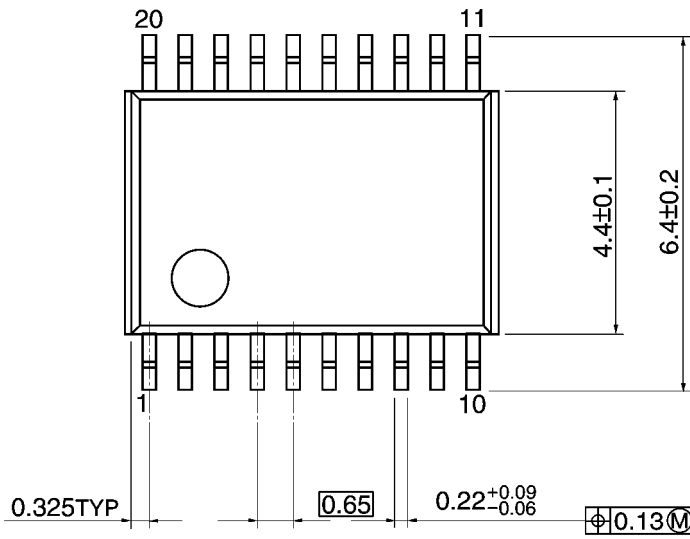


Weight: 1.30 g (typ.)

Package Dimensions

TSSOP20-P-0044-0.65A

Unit: mm

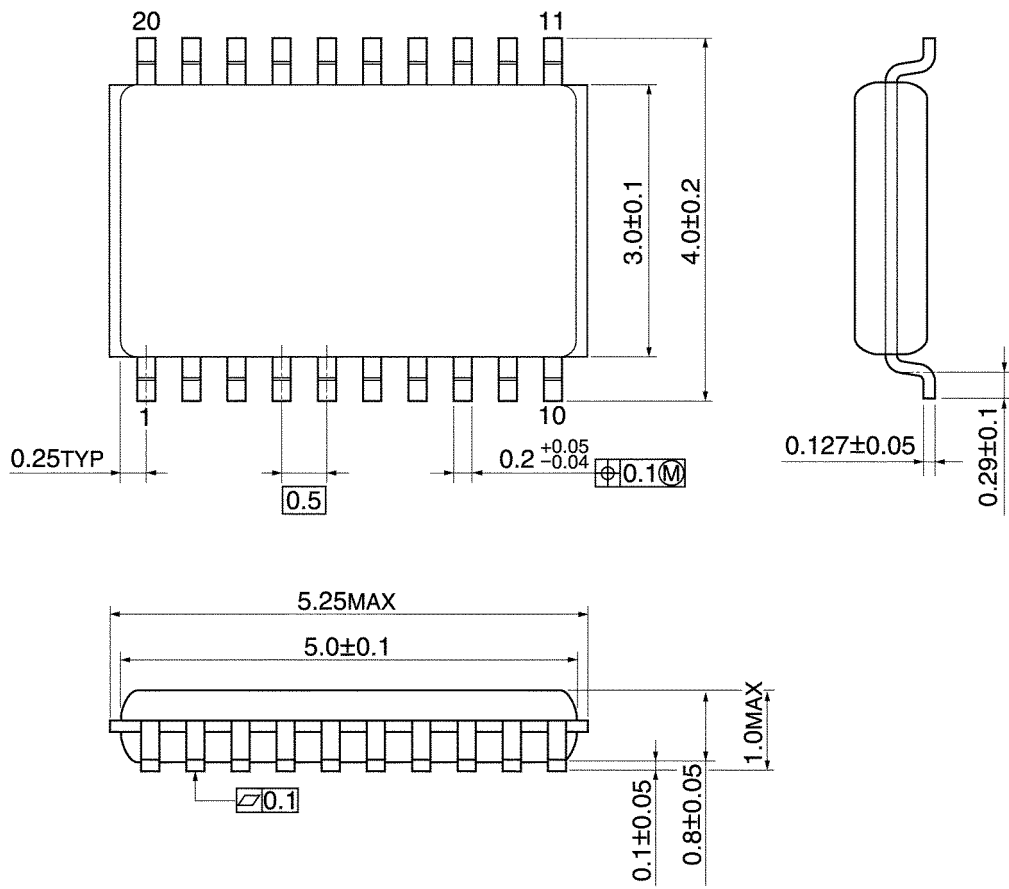


Weight: 0.08 g (typ.)

Package Dimensions

VSSOP20-P-0030-0.50

Unit: mm



Weight: 0.03 g (typ.)

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