TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

TC74VHC9151P,TC74VHC9151FT,TC74VHC9151FK
TC74VHC9152P,TC74VHC9152FT,TC74VHC9152FK

TC74VHC9151P/FT/FK 9-Bit Schmitt Buffer

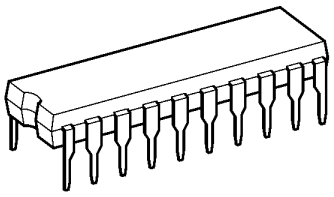
TC74VHC9152P/FT/FK 9-Bit Schmitt Inverter

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

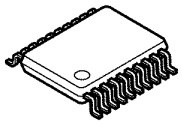
- High speed: t_{pd} = 3.6 ns (typ.) (V_{CC} = 5 V)
- Low supply current: I_{CC} = 4 μA (max) (Ta = 25°C)
- High noise immunity: $V_{NIH} = V_{NIL}$ = 28% V_{CC} (min)
- All inputs are provided with power-down protection.
- Symmetrical rise and fall delays: $t_{pLH} \approx t_{pHL}$
- Wide operating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

TC74VHC9151P,TC74VHC9152P



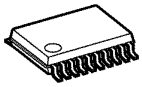
DIP20-P-300-2.54A

TC74VHC9151FT,TC74VHC9152FT



TSSOP20-P-0044-0.65A

TC74VHC9151FK,TC74VHC9152FK

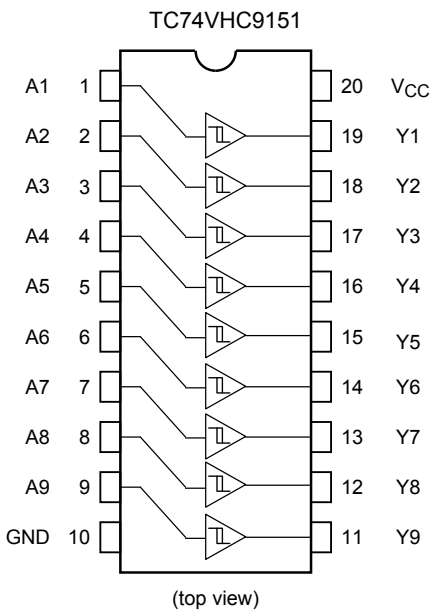


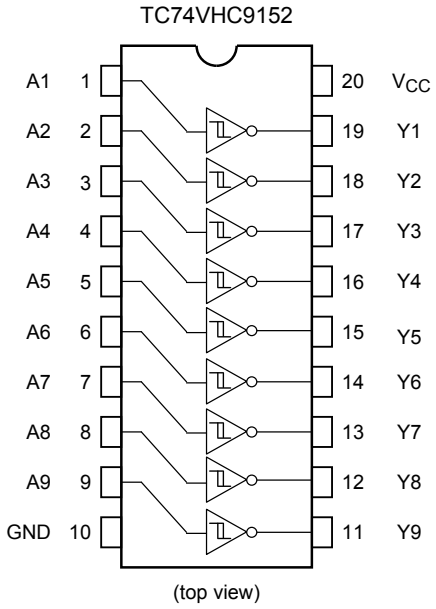
VSSOP20-P-0030-0.50

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	°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 Ta = −40 to 65°C. From Ta = 65 to 85°C a derating factor of −10 mW/°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	°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		V_{CC} (V)	Ta = 25°C Min	Ta = 25°C Typ	Ta = 25°C Max	Ta = −40~85°C Min	Ta = −40~85°C Max	Unit
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} t_{pHL}	—	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} t_{pHL}	—	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} t_{osLH}	(Note 1)	3.3 ± 0.3	50	—	—	1.5	—	1.5	ns
			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.

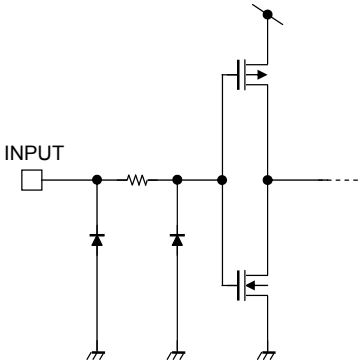
$t_{osLH} = |t_{pLHm} - t_{pLHn}|$, $t_{osHL} = |t_{pHLm} - t_{pHLn}|$

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:

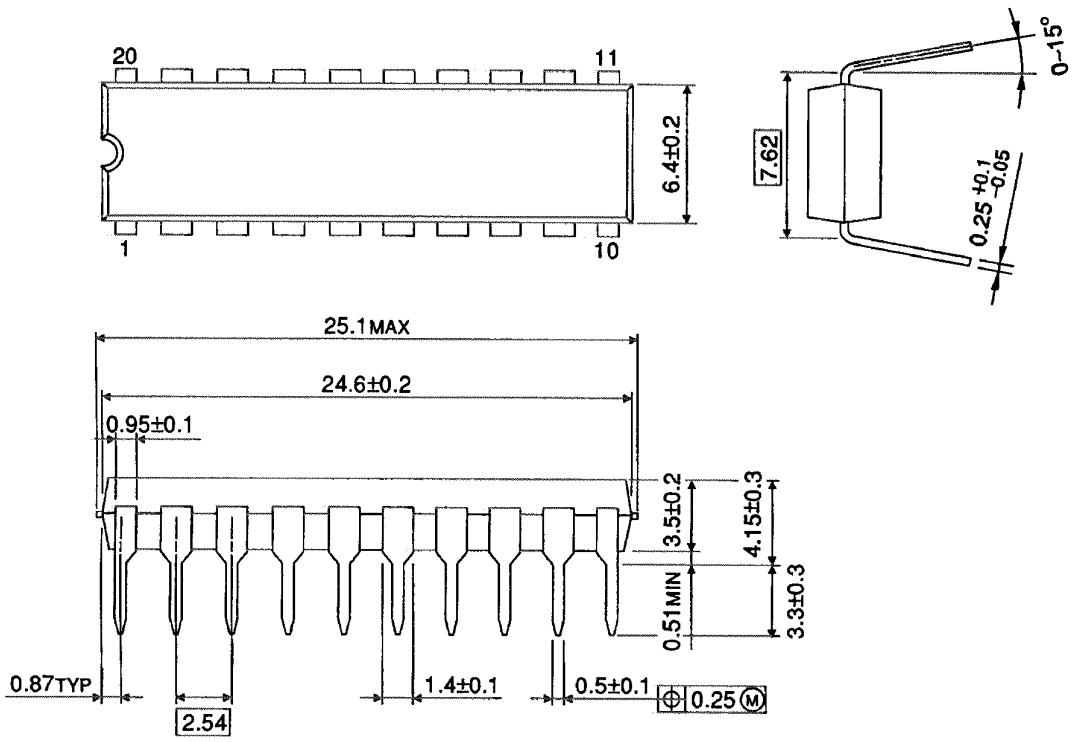
$I_{CC\ (opr)} = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC} / 9$ (per bit)

Input Equivalent Circuit



Package Dimensions

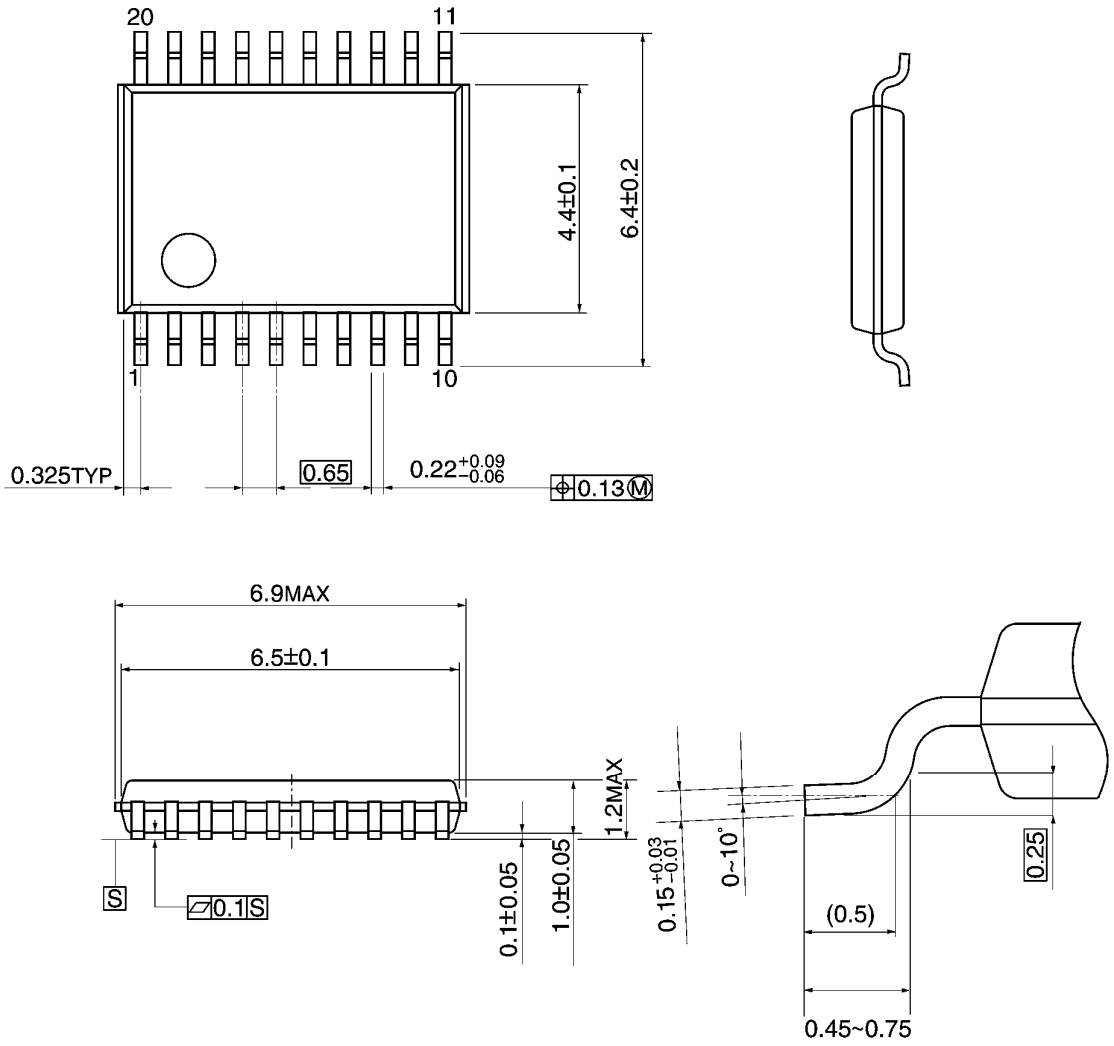
DIP20-P-300-2.54A Unit : mm



Weight: 1.30 g (typ.)

Package Dimensions

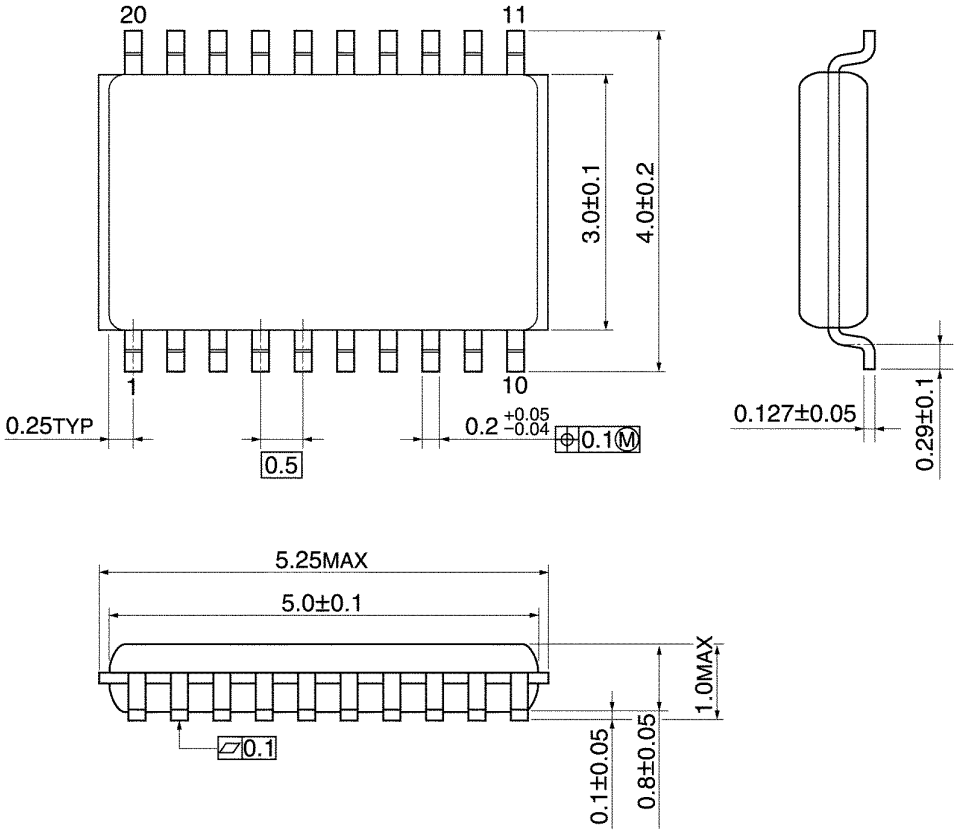
TSSOP20-P-0044-0.65A Unit: mm



Weight: 0.08 g (typ.)

Package Dimensions

VSSOP20-P-0030-0.50 Unit: mm



Weight: 0.03 g (typ.)

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