

TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

TC74VHC9151P, TC74VHC9151FK TC74VHC9152P, TC74VHC9152FK

TC74VHC9151P/FK 9-Bit Schmitt Buffer TC74VHC9152P/FK 9-Bit Schmitt Inverter

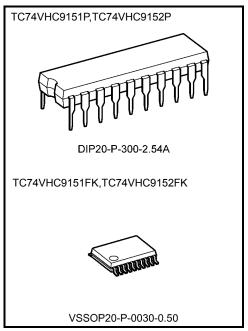
The TC74VHC9151/9152 are an ultra-high-speed 9-bit Schmitt Buffer / Inverter fabricated using silicon-gate CMOS technology. The TC74VHC9151/9152 combines low power consumption of CMOS with Schottky TTL speeds.

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 $V_{\rm CC}$. 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: $ICC = 4 \mu A \text{ (max) (Ta} = 25 \text{°C)}$
- All inputs are provided with power-down protection.
- Symmetrical rise and fall delays: t_{pLH} ≈ t_{pHL}
- Wide operating voltage range: $V_{CC \text{ (opr)}} = 2 \text{ to } 5.5 \text{ V}$

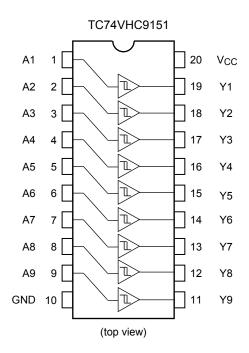


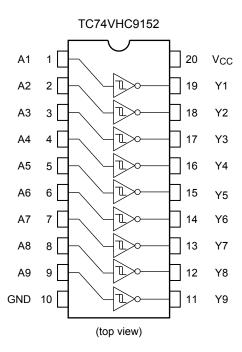
Weight

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



Pin Assignment





Truth Table

	Υ					
A	TC74VHC9151	TC74VHC9152				
L	L	Н				
Н	Н	L				



Absolute Maximum Ratings (Note1)

Characteristics	Symbol	Rating	Unit
Supply voltage range	Vcc	−0.5 to 7.0	V
DC input voltage	VIN	−0.5 to 7.0	V
DC output voltage	Vout	-0.5 to V _{CC} + 0.5	V
Input diode current	lıĸ	-20	mA
Output diode current	Іок	±20	mA
DC output current	lout	±25	mA
DC V _{CC} /ground current	Icc	±75	mA
Power dissipation	PD	500 (DIP) (Note 2)/180(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 = $-40 \text{ to } 65^{\circ}\text{C}$. From Ta = $65 \text{ to } 85^{\circ}\text{C}$ a derating factor of $-10 \text{ mW}/^{\circ}\text{C}$ shall be applied until 300 mW.

Operating Ranges (Note)

Characteristics	Symbol	Rating	Unit
Supply voltage	Vcc	2.0 to 5.5	V
Input voltage	VIN	0 to 5.5	V
Output voltage	Vout	0 to Vcc	V
Operating temperature	Topr	-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 VCC or GND.



Electrical Characteristics

DC Characteristics

Characteristics Symbol		Test Condition			Ta = 25°C			Ta = −40 to 85°C		Unit
				V _{CC} (V)	Min	Тур	Max	Min	Max	
		_		3.0	_	_	2.20	_	2.20	٧
Positive threshold voltage	VP			4.5	l	ı	3.15	I	3.15	
ŭ				5.5	1	1	3.85	I	3.85	
		_		3.0	0.90	_	-	0.90	_	
Negative threshold voltage	V_N			4.5	1.35	_	_	1.35	_	V
Ů				5.5	1.65		1	1.65		
		_		3.0	0.30	_	1.20	0.30	1.20	٧
Hysteresis voltage	V_{H}			4.5	0.40	_	1.40	0.40	1.40	
				5.5	0.50	_	1.60	0.50	1.60	
		V _{IN} = V _{IH} or V _{IL}		2.0	1.9	2.0	-	1.9	_	
			I _{OH} = -50 μA	3.0	2.9	3.0	_	2.9	_	
High-level output voltage	Voн			4.5	4.4	4.5	l	4.4	I	V
3			I _{OH} = -4 mA	3.0	2.58	_	-	2.48	1	
			I _{OH} = -8 mA	4.5	3.94	_	_	3.80	_	
Low-level output voltage V		V _{IN} = V _{IH} or V _{IL}	I _{OL} = 50 μA	2.0	1	0.0	0.1	1	0.1	V
				3.0	1	0.0	0.1	1	0.1	
	V_{OL}			4.5	1	0.0	0.1	1	0.1	
			I _{OL} = 4 mA	3.0	1	1	0.36	1	0.44	
			I _{OL} = 8 mA	4.5	1		0.36	1	0.44	
Input leakage current	lin	V _{IN} = 5.5 V or GND		0 to 5.5	_	_	±0.1	_	±1.0	μΑ
Quiescent supply current	Icc	V _{IN} = V _{CC} or GND		5.5	_	_	4.0	_	40.0	μΑ



AC Characteristics (input: tr = tf = 3 ns)

Characteristics SymI	Symbol	Tes	st Condition		Ta = 25°C			Ta = -40 to 85°C		Unit
			V _{CC} (V)	C _L (pF)	Min	Тур.	Max	Min	Max]
	t _{рLН}	-	3.3 ± 0.3	15	_	4.8	9.4	1.0	10.7	- ns
Propagation delay time				50	_	8.1	16.1	1.0	18.4	
(TC74VHC9151)	t _{pHL}		5.0 ± 0.5	15	_	3.3	6.0	1.0	6.8	
				50	_	5.7	10.5	1.0	11.9	
	t _р LН t _р HL	-	3.3 ± 0.3	15	_	4.8	9.3	1.0	10.6	- ns
Propagation delay time (TC74VHC9152)				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	tosHL tosLH	(Note 1)	3.3 ± 0.3	50	_	_	1.5	_	1.5	20
			5.0 ± 0.5	50	_	_	1.0	_	1.0	ns
Input capacitance	CIN	_			_	4	10	_	10	pF
Power dissipation capacitance (Note 2)	CPD	TC74VHC9151	1 (f _{IN} = 1 MHz)		_	11	_	_	_	~F
		TC74VHC9152	(f _{IN} = 1 MHz)		_	10	_	_	_	pF

Note 1: Parameter guaranteed by design.

tosLH = |tpLHm - tpLHn|, tosHL = |tpHLm - tpHLn|

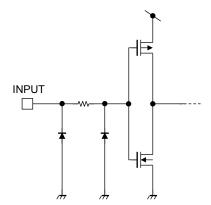
Note 2: CPD is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load.

Average operating current can be obtained by the equation:

ICC (opr) = CPD·VCC·fIN + ICC / 9 (per bit)



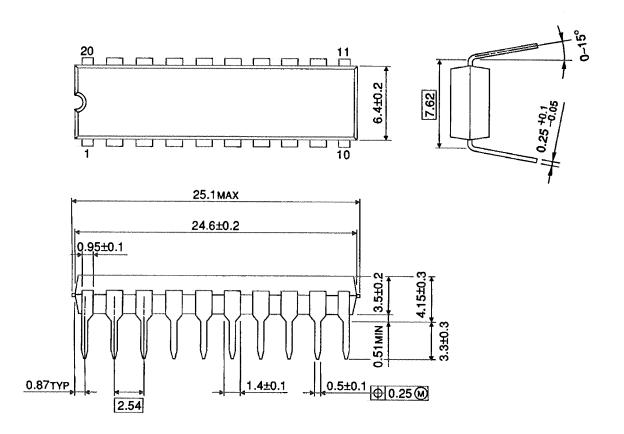
Input Equivalent Circuit





Package Dimensions

DIP20-P-300-2.54A Unit: mm

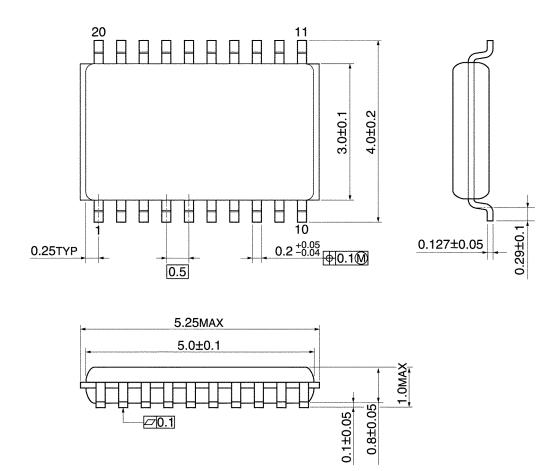


Weight: 1.30 g (typ.)



Package Dimensions

VSSOP20-P-0030-0.50 Unit: mm



Weight: 0.03 g (typ.)



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