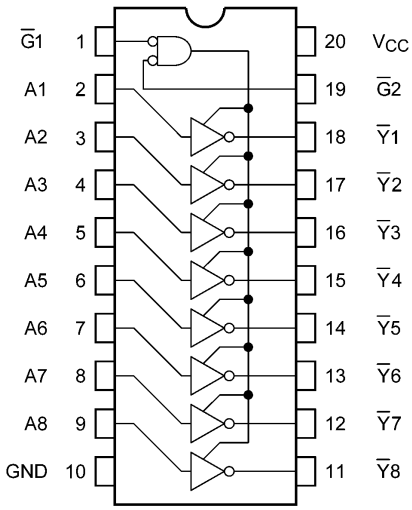
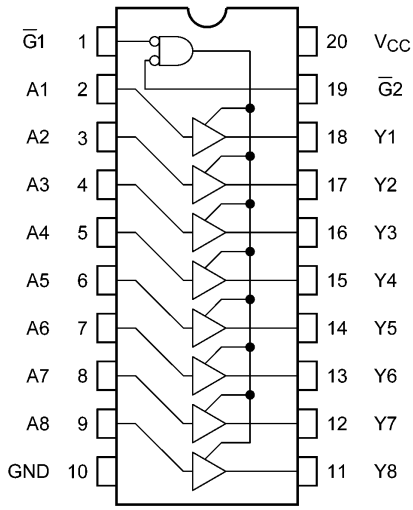
5. Pin Assignment

74VHC540FT



(top view)

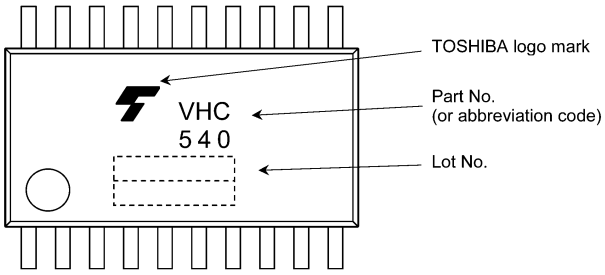
74VHC541FT



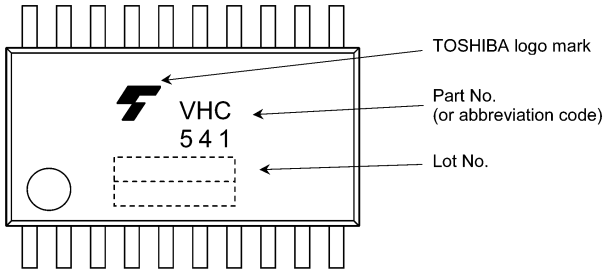
(top view)

6. Marking

74VHC540FT

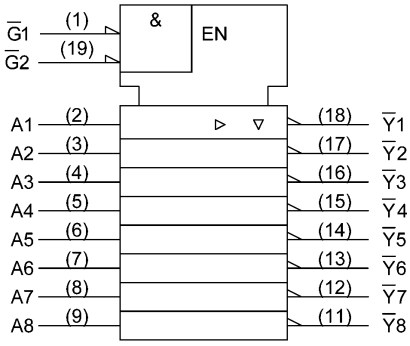


74VHC541FT

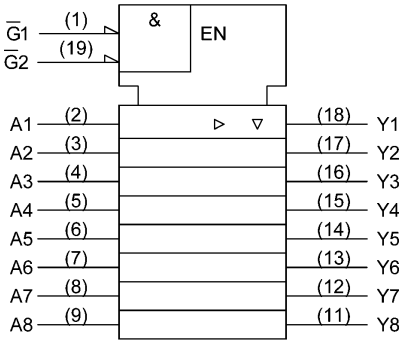


7. IEC Logic Symbol

74VHC540FT



74VHC541FT



8. Truth Table

Input $\overline{G}1$	Input $\overline{G}2$	Input An	Output Yn	Output $\overline{Y}n$
H	X	X	Z	Z
X	H	X	Z	Z
L	L	H	H	L
L	L	L	L	H

X: Don't care
Z: High impedance
Yn: 74VHC541FT
$\overline{Y}n$: 74VHC540FT

9. Absolute Maximum Ratings (Note)

Characteristics	Symbol	Note	Rating	Unit
Supply voltage	V_{CC}		-0.5 to 7.0	V
Input voltage	V_{IN}		-0.5 to 7.0	V
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
Output current	I_{OUT}		±25	mA
V_{CC}/ground current	I_{CC}		±75	mA
Power dissipation	P_D	(Note 1)	180	mW
Storage temperature	T_{stg}		-65 to 150	°C

Note: 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 1: 180 mW in the range of T_a = -40 to 85 °C. From T_a = 85 to 125 °C a derating factor of -3.25 mW/°C shall be applied until 50 mW.

10. Operating Ranges (Note)

Characteristics	Symbol	Test Condition	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 125	°C
Input rise and fall times	dt/dv	V_{CC} = 3.3 ± 0.3 V	0 to 100	ns/V
		V_{CC} = 5.0 ± 0.5 V	0 to 20	

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.

11. Electrical Characteristics

11.1. DC Characteristics (Unless otherwise specified, T_a = 25 °C)

Characteristics	Symbol	Test Condition		V_{CC} (V)	Min	Typ.	Max	Unit
High-level input voltage	V_{IH}	—		2.0	1.50	—	—	V
				3.0 to 5.5	V_{CC} × 0.7	—	—	
Low-level input voltage	V_{IL}	—		2.0	—	—	0.50	V
				3.0 to 5.5	—	—	V_{CC} × 0.3	
High-level output voltage	V_{OH}	V_{IN} = V_{IH} or V_{IL}	I_{OH} = -50 μA	2.0	1.9	2.0	—	V
				3.0	2.9	3.0	—	
				4.5	4.4	4.5	—	
			I_{OH} = -4 mA	3.0	2.58	—	—	
			I_{OH} = -8 mA	4.5	3.94	—	—	
Low-level output voltage	V_{OL}	V_{IN} = V_{IH} or V_{IL}	I_{OL} = 50 μA	2.0	—	0.0	0.1	V
				3.0	—	0.0	0.1	
				4.5	—	0.0	0.1	
			I_{OL} = 4 mA	3.0	—	—	0.36	
			I_{OL} = 8 mA	4.5	—	—	0.36	
3-state output OFF-state leakage current	I_{OZ}	V_{IN} = V_{IH} or V_{IL} V_{OUT} = V_{CC} or GND		5.5	—	—	±0.25	μA
Input leakage current	I_{IN}	V_{IN} = 5.5 V or GND		0 to 5.5	—	—	±0.1	μA
Quiescent supply current	I_{CC}	V_{IN} = V_{CC} or GND		5.5	—	—	4.0	μA

11.2. DC Characteristics (Unless otherwise specified, T_a = -40 to 85 °C)

Characteristics	Symbol	Test Condition		V_{CC} (V)	Min	Max	Unit
High-level input voltage	V_{IH}	—		2.0	1.50	—	V
				3.0 to 5.5	V_{CC} × 0.7	—	
Low-level input voltage	V_{IL}	—		2.0	—	0.50	V
				3.0 to 5.5	—	V_{CC} × 0.3	
High-level output voltage	V_{OH}	V_{IN} = V_{IH} or V_{IL}	I_{OH} = -50 μA	2.0	1.9	—	V
				3.0	2.9	—	
				4.5	4.4	—	
			I_{OH} = -4 mA	3.0	2.48	—	
			I_{OH} = -8 mA	4.5	3.80	—	
Low-level output voltage	V_{OL}	V_{IN} = V_{IH} or V_{IL}	I_{OL} = 50 μA	2.0	—	0.1	V
				3.0	—	0.1	
				4.5	—	0.1	
			I_{OL} = 4 mA	3.0	—	0.44	
			I_{OL} = 8 mA	4.5	—	0.44	
3-state output OFF-state leakage current	I_{OZ}	V_{IN} = V_{IH} or V_{IL} V_{OUT} = V_{CC} or GND		5.5	—	±2.50	μA
Input leakage current	I_{IN}	V_{IN} = 5.5 V or GND		0 to 5.5	—	±1.0	μA
Quiescent supply current	I_{CC}	V_{IN} = V_{CC} or GND		5.5	—	40.0	μA

11.3. DC Characteristics (Unless otherwise specified, T_a = -40 to 125 °C)

Characteristics	Symbol	Test Condition		V_{CC} (V)	Min	Max	Unit
High-level input voltage	V_{IH}	—		2.0	1.50	—	V
				3.0 to 5.5	V_{CC} × 0.7	—	
Low-level input voltage	V_{IL}	—		2.0	—	0.50	V
				3.0 to 5.5	—	V_{CC} × 0.3	
High-level output voltage	V_{OH}	V_{IN} = V_{IH} or V_{IL}	I_{OH} = -50 μA	2.0	1.9	—	V
				3.0	2.9	—	
				4.5	4.4	—	
			I_{OH} = -4 mA	3.0	2.40	—	
			I_{OH} = -8 mA	4.5	3.70	—	
Low-level output voltage	V_{OL}	V_{IN} = V_{IH} or V_{IL}	I_{OL} = 50 μA	2.0	—	0.1	V
				3.0	—	0.1	
				4.5	—	0.1	
			I_{OL} = 4 mA	3.0	—	0.55	
			I_{OL} = 8 mA	4.5	—	0.55	
3-state output OFF-state leakage current	I_{OZ}	V_{IN} = V_{IH} or V_{IL} V_{OUT} = V_{CC} or GND		5.5	—	±10.0	μA
Input leakage current	I_{IN}	V_{IN} = 5.5 V or GND		0 to 5.5	—	±2.0	μA
Quiescent supply current	I_{CC}	V_{IN} = V_{CC} or GND		5.5	—	80.0	μA

11.4. AC Characteristics (Unless otherwise specified, T_a = 25 °C, Input: $t_r = t_f$ = 3 ns)

Characteristics	Part Number	Symbol	Note	Test Condition	V_{CC} (V)	C_L (pF)	Min	Typ.	Max	Unit
Propagation delay time	74VHC540FT	t_{PLH},t_{PHL}		—	3.3 ± 0.3	15	—	4.8	7.0	ns
						50	—	7.3	10.5	
					5.0 ± 0.5	15	—	3.7	5.0	
						50	—	5.2	7.0	
	74VHC541FT	t_{PLH},t_{PHL}		—	3.3 ± 0.3	15	—	5.0	7.0	ns
						50	—	7.5	10.5	
					5.0 ± 0.5	15	—	3.5	5.0	
						50	—	5.0	7.0	
3-state output enable time		t_{PZL},t_{PZH}		R_L = 1 kΩ	3.3 ± 0.3	15	—	6.8	10.5	ns
						50	—	9.3	14.0	
					5.0 ± 0.5	15	—	4.7	7.2	
						50	—	6.2	9.2	
3-state output disable time		t_{PLZ},t_{PHZ}		R_L = 1 kΩ	3.3 ± 0.3	50	—	11.2	15.4	ns
					5.0 ± 0.5	50	—	6.0	8.8	
Output skew		t_{osLH},t_{osHL}	(Note 1)	—	3.3 ± 0.3	50	—	—	1.5	ns
					5.0 ± 0.5	50	—	—	1.0	
Input capacitance		C_{IN}		—			—	4	10	pF
Output capacitance		C_{OUT}		—			—	6	—	pF
Power dissipation capacitance	74VHC540FT	C_{PD}	(Note 2)	—			—	17	—	pF
	74VHC541FT						—	18	—	

Note 1: Parameter guaranteed by design. (t_{osLH} = $|t_{PLH}m - t_{PLH}n|$, t_{osHL} = $|t_{PHL}m - t_{PHL}n|$)

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.

$I_{CC(opr)} = C_{PD} \times V_{CC} \times f_{IN} + I_{CC}/8$ (per bit)

11.5. AC Characteristics (Unless otherwise specified, T_a = -40 to 85 °C, Input: $t_r = t_f$ = 3 ns)

Characteristics	Part Number	Symbol	Note	Test Condition	V_{CC} (V)	C_L (pF)	Min	Max	Unit
Propagation delay time	74VHC540FT	t_{PLH},t_{PHL}		—	3.3 ± 0.3	15	1.0	8.5	ns
						50	1.0	12.0	
					5.0 ± 0.5	15	1.0	6.0	
						50	1.0	8.0	
	74VHC541FT	t_{PLH},t_{PHL}		—	3.3 ± 0.3	15	1.0	8.5	ns
						50	1.0	12.0	
					5.0 ± 0.5	15	1.0	6.0	
						50	1.0	8.0	
3-state output enable time		t_{PZL},t_{PZH}		R_L = 1 kΩ	3.3 ± 0.3	15	1.0	12.5	ns
						50	1.0	16.0	
					5.0 ± 0.5	15	1.0	8.5	
						50	1.0	10.5	
3-state output disable time		t_{PLZ},t_{PHZ}		R_L = 1 kΩ	3.3 ± 0.3	50	1.0	17.5	ns
					5.0 ± 0.5	50	1.0	10.0	
Output skew		t_{osLH},t_{osHL}	(Note 1)	—	3.3 ± 0.3	50	—	1.5	ns
					5.0 ± 0.5	50	—	1.0	
Input capacitance		C_{IN}		—			—	10	pF

Note 1: Parameter guaranteed by design. (t_{osLH} = $|t_{PLH}m - t_{PLH}n|$, t_{osHL} = $|t_{PHL}m - t_{PHL}n|$)

11.6. AC Characteristics (Unless otherwise specified, T_a = -40 to 125 °C, Input: $t_r = t_f$ = 3 ns)

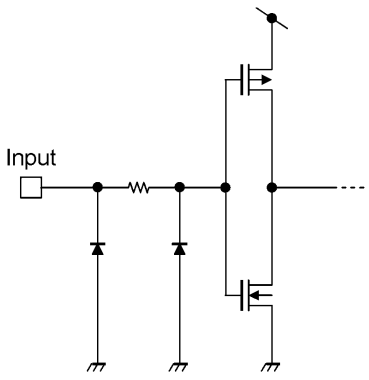
Characteristics	Part Number	Symbol	Note	Test Condition	V_{CC} (V)	C_L (pF)	Min	Max	Unit
Propagation delay time	74VHC540FT	t_{PLH},t_{PHL}		—	3.3 ± 0.3	15	1.0	10.0	ns
						50	1.0	13.5	
					5.0 ± 0.5	15	1.0	7.0	
						50	1.0	9.0	
Propagation delay time	74VHC541FT	t_{PLH},t_{PHL}		—	3.3 ± 0.3	15	1.0	10.0	ns
						50	1.0	13.5	
					5.0 ± 0.5	15	1.0	7.0	
						50	1.0	9.0	
3-state output enable time		t_{PZL},t_{PZH}		R_L = 1 kΩ	3.3 ± 0.3	15	1.0	14.0	ns
						50	1.0	17.5	
					5.0 ± 0.5	15	1.0	9.5	
						50	1.0	11.5	
3-state output disable time		t_{PLZ},t_{PHZ}		R_L = 1 kΩ	3.3 ± 0.3	50	1.0	19.5	ns
					5.0 ± 0.5	50	1.0	11.0	
Output skew		t_{osLH},t_{osHL}	(Note 1)	—	3.3 ± 0.3	50	—	1.5	ns
					5.0 ± 0.5	50	—	1.0	
Input capacitance		C_{IN}		—			—	10	pF

Note 1: Parameter guaranteed by design. ($t_{osLH} = |t_{PLH}m-t_{PLH}n|$, $t_{osHL} = |t_{PHL}m-t_{PHL}n|$)

11.7. Noise Characteristics (Unless otherwise specified, T_a = 25 °C, Input: $t_r = t_f$ = 3 ns)

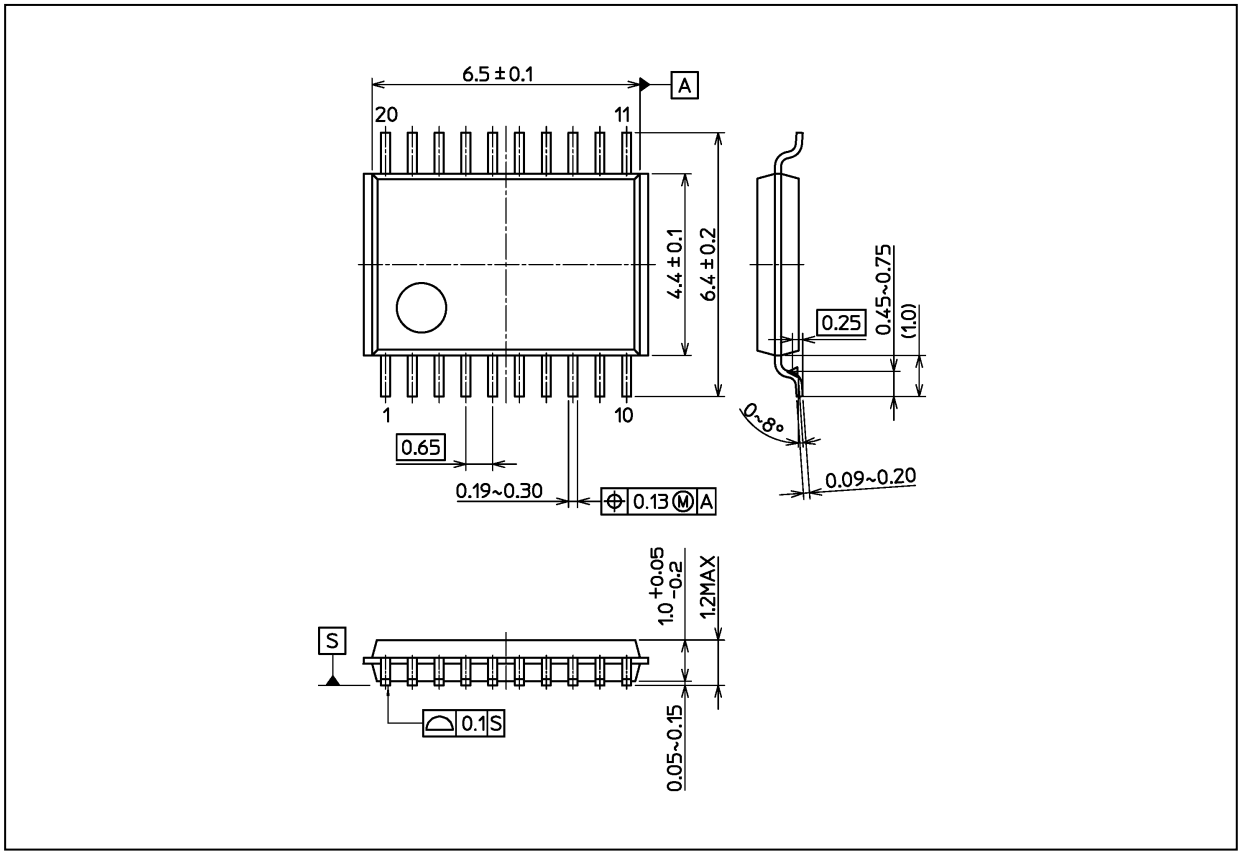
Characteristics	Symbol	Test Condition	V_{CC} (V)	Typ.	Limit	Unit
Quiet output maximum dynamic V_{OL}	V_{OLP}	C_L = 50 pF	5.0	0.7	1.0	V
Quiet output minimum dynamic V_{OL}	V_{OLV}	C_L = 50 pF	5.0	-0.7	-1.0	V
Minimum high-level dynamic input voltage	V_{IHD}	C_L = 50 pF	5.0	—	3.5	V
Maximum low-level dynamic input voltage	V_{ILD}	C_L = 50 pF	5.0	—	1.5	V

12. Internal Equivalent Circuit



Package Dimensions

Unit: mm



Weight: 0.071 g (typ.)

Package Name(s)
Nickname: TSSOP20B

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