CMOS Digital Integrated Circuits Silicon Monolithic

74AVC4T345FT

1. Functional Description

- 3-Bit+1-Bit Dual-Supply Bus Transceiver with Configurable Power Supply

2. General

The 74AVC4T345FT is a dual power supply type high-speed CMOS 3-bit +1-bit bus transceiver that enables interfacing between two systems with power supply voltages from 0.8 V to 3.6 V.

The two supply voltages can be user-configurable within the operating range and the sequence of supply voltage ON/OFF can be freely set.

The Enable input $\overline{OE}$ is H level, both A-bus and B-bus become floating state (high-impedance). When the transmission direction switching input DIR is set to "H", bus A becomes an input and bus B becomes an output, and when set to "L", bus A becomes an output and bus B becomes an input. The input (DIR and $\overline{OE}$) has a tolerant function that allows input of up to 3.6 V regardless of the supply voltage. When either power supply is at the GND level, the bus terminals are placed in a high impedance mode and a voltage of up to 3.6 V is allowed to be applied.

This function enables application to partial power-down interfaces.

All inputs are equipped with protection circuits to protect the devices from electrostatic discharge damage.

3. Features

(1) Wide operating temperature range: T_{opr} = -40 to 125 °C

(2) Wide supply voltage value: V_{CCA} = 0.8 to 3.6 V, V_{CCB} = 0.8 to 3.6 V

(3) Bidirectional interface

(4) High-speed operation: t_{pd} = 3.6 ns (max) (V_{CCA} = 3.3 ± 0.3 V, V_{CCB} = 3.3 ± 0.3 V)

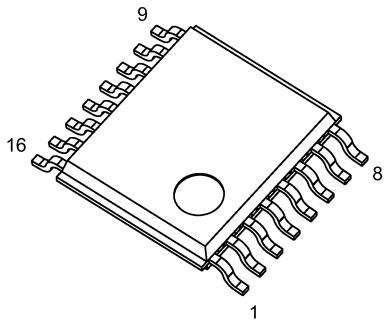
(5) Output current: $|I_{OH}|/I_{OL}$ = ±12 mA (min) (V_{CC} = 3.0 V)
$|I_{OH}|/I_{OL}$ = ±9 mA (min) (V_{CC} = 2.3 V)
$|I_{OH}|/I_{OL}$ = ±6 mA (min) (V_{CC} = 1.65 V)
$|I_{OH}|/I_{OL}$ = ±4 mA (min) (V_{CC} = 1.4 V)
$|I_{OH}|/I_{OL}$ = ±2 mA (min) (V_{CC} = 1.1 V)

(6) Small package: TSSOP16B

(7) Low power dissipation: Suitable for battery-driven applications such as PDAs and cellular phones.

(8) 3.6 V tolerance and power-down protection are provided to all inputs and outputs.

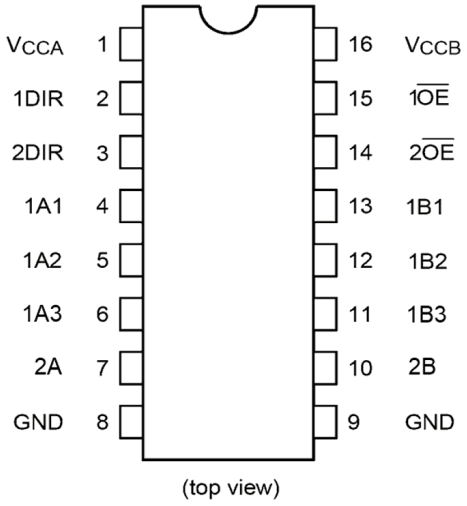
4. Packaging



TSSOP16B

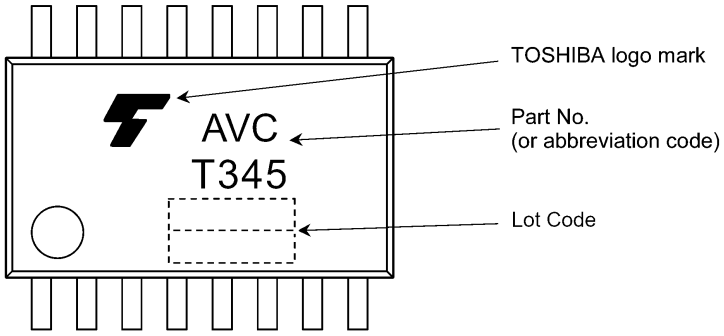
Start of commercial production
2024-09

5. Pin Assignment

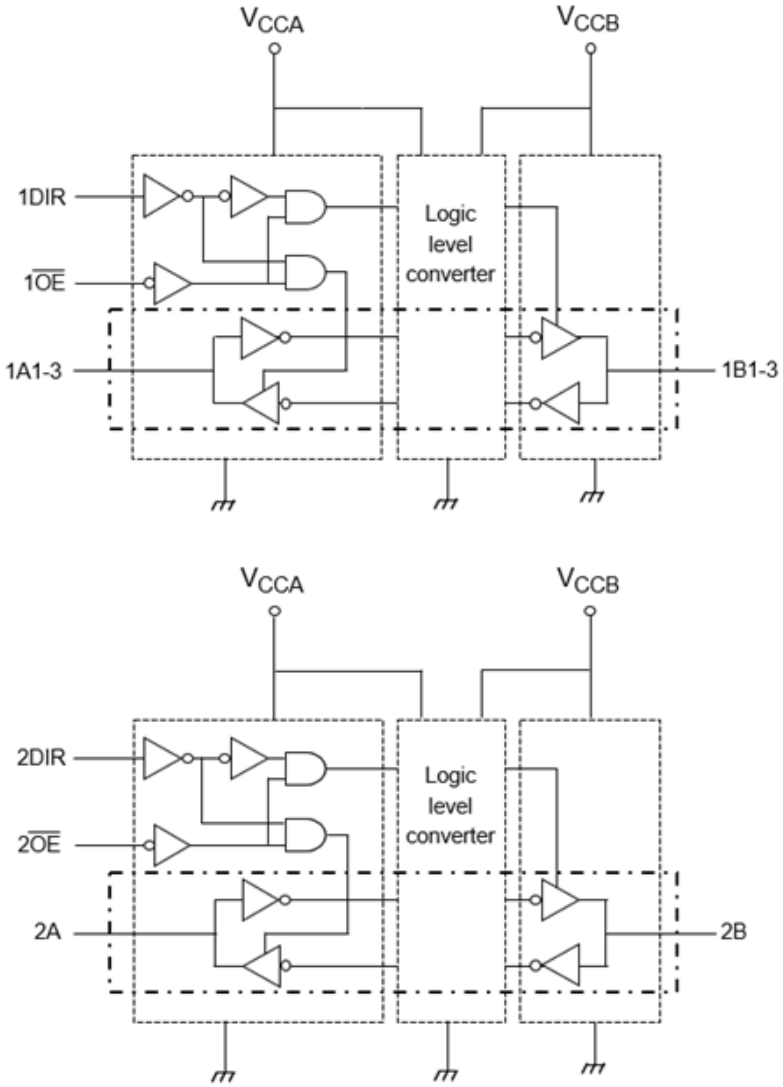


(top view)

6. Marking



7. Block Diagram



8. Truth Table

Supply voltage V_{CCA}, V_{CCB}	Input $\overline{nOE}$	Input nDIR	Input/Output Bus nA	Input/Output Bus nB	Function
0.8 to 3.6 V	L	L	Output	Input	A = B
0.8 to 3.6 V	L	H	Input	Output	B = A
0.8 to 3.6 V	H	X	Z	Z	Z
GND (Note)	X	X	Z	Z	Z

X: Don't care
Z: High impedance
Note: If either V_{CCA} or V_{CCB} is at GND level, the device enters suspend mode (high impedance mode for input and output).

9. Absolute Maximum Ratings (Note)

Characteristics	Symbol	Note	Rating	Unit
Supply voltage	V_{CCA}		-0.5 to 4.6	V
	V_{CCB}		-0.5 to 4.6	
Input voltage (nDIR, $\overline{nOE}$)	V_{IN}		-0.5 to 4.6	V
Bus I/O voltage	$V_{I/OA}$	(Note 1)	-0.5 to 4.6	V
		(Note 2)	-0.5 to V_{CCA} + 0.5	
	$V_{I/OB}$	(Note 1)	-0.5 to 4.6	V
		(Note 2)	-0.5 to V_{CCB} + 0.5	
Input diode current	I_{IK}		-50	mA
I/O diode current	$I_{I/OK}$	(Note 3)	-50	mA
Output current	I_{OUTA}		±50	mA
	I_{OUTB}		±50	
V_{CC}/ground current per supply pin	I_{CCA}		100	mA
	I_{CCB}		100	
Power dissipation	P_D	(Note 4)	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: V_{CCA}, V_{CCB} = 0 V or output high impedance state.
Note 2: High (H) or Low (L) state. I_{OUT} absolute maximum rating must be observed.
Note 3: V_{OUT} < GND
Note 4: 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	Note	Test Condition	Rating	Unit
Supply voltage	V_{CCA}		—	0.8 to 3.6	V
	V_{CCB}			0.8 to 3.6	
Input voltage (nDIR, $n\overline{OE}$)	V_{IN}		—	0 to 3.6	V
Bus I/O voltage	$V_{I/OA}$	(Note 1)	—	0 to 3.6	V
		(Note 2)		0 to V_{CCA}	
	$V_{I/OB}$	(Note 1)		0 to 3.6	
		(Note 2)		0 to V_{CCB}	
Output current	I_{OUTA}		V_{CCA} = 3.0 to 3.6 V	±12	mA
			V_{CCA} = 2.3 to 2.7 V	±9	
			V_{CCA} = 1.65 to 1.95 V	±6	
			V_{CCA} = 1.4 to 1.6 V	±4	
			V_{CCA} = 1.1 to 1.3 V	±2	
	I_{OUTB}		V_{CCB} = 3.0 to 3.6 V	±12	
			V_{CCB} = 2.3 to 2.7 V	±9	
			V_{CCB} = 1.65 to 1.95 V	±6	
			V_{CCB} = 1.4 to 1.6 V	±4	
			V_{CCB} = 1.1 to 1.3 V	±2	
Operating temperature	T_{opr}		—	-40 to 125	°C
Input rise and fall times	dt/dv		V_{CC} = 0.9 V	0 to 20	ns/V
			V_{CC} = 1.2 V	0 to 20	
			V_{CC} = 1.65 to 1.95 V	0 to 20	
			V_{CC} = 2.3 to 2.7 V	0 to 20	
			V_{CC} = 3.0 to 3.6 V	0 to 10	

Note: The operating ranges must be maintained to ensure the normal operation of the device.
Unused inputs and bus inputs must be tied to either V_{CC} or GND.

Note 1: V_{CCA}, V_{CCB} = 0 V or output high impedance state.

Note 2: High (H) or Low (L) state.

11. Electrical Characteristics

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

Characteristics	Symbol	Test Condition		V_{CCA} (V)	V_{CCB} (V)	Min	Max	Unit
High-level input voltage	V_{IHA}	nA, nDIR, $n\overline{OE}$		0.8	0.8 to 3.6	V_{CCA} × 0.70	—	V
				1.1 to 1.95	0.8 to 3.6	V_{CCA} × 0.70	—	
				2.3 to 2.7	0.8 to 3.6	1.6	—	
				3.0 to 3.6	0.8 to 3.6	2.0	—	
	V_{IHB}	nB		0.8 to 3.6	0.8	V_{CCB} × 0.70	—	V
				0.8 to 3.6	1.1 to 1.95	V_{CCB} × 0.65	—	
				0.8 to 3.6	2.3 to 2.7	1.6	—	
				0.8 to 3.6	3.0 to 3.6	2.0	—	
Low-level input voltage	V_{ILA}	nA, nDIR, $n\overline{OE}$		0.8	0.8 to 3.6	—	V_{CCA} × 0.30	V
				1.1 to 1.95	0.8 to 3.6	—	V_{CCA} × 0.30	
				2.3 to 2.7	0.8 to 3.6	—	0.7	
				3.0 to 3.6	0.8 to 3.6	—	0.9	
	V_{ILB}	nB		0.8 to 3.6	0.8	—	V_{CCB} × 0.30	V
				0.8 to 3.6	1.1 to 1.95	—	V_{CCB} × 0.30	
				0.8 to 3.6	2.3 to 2.7	—	0.7	
				0.8 to 3.6	3.0 to 3.6	—	0.9	
High-level output voltage	V_{OHA}	Output H	I_{OH} = -0.1 mA	0.8 to 3.6	0.8 to 3.6	V_{CCA} -0.1	—	V
			I_{OH} = -2 mA	1.1	1.1	0.85	—	
			I_{OH} = -4 mA	1.4	1.4	1.05	—	
			I_{OH} = -6 mA	1.65	1.65	1.2	—	
			I_{OH} = -9 mA	2.3	2.3	1.75	—	
			I_{OH} = -12 mA	3.0	3.0	2.3	—	
	V_{OHB}	Output H	I_{OH} = -0.1 mA	0.8 to 3.6	0.8 to 3.6	V_{CCB} -0.1	—	
			I_{OH} = -2 mA	1.1	1.1	0.85	—	
			I_{OH} = -4 mA	1.4	1.4	1.05	—	
			I_{OH} = -6 mA	1.65	1.65	1.2	—	
			I_{OH} = -9 mA	2.3	2.3	1.75	—	
			I_{OH} = -12 mA	3.0	3.0	2.3	—	
Low-level output voltage	V_{OLA}	Output L	I_{OL} = 0.1 mA	0.8 to 3.6	0.8 to 3.6	—	0.1	V
			I_{OL} = 2 mA	1.1	1.1	—	0.25	
			I_{OL} = 4 mA	1.4	1.4	—	0.35	
			I_{OL} = 6 mA	1.65	1.65	—	0.45	
			I_{OL} = 9 mA	2.3	2.3	—	0.55	
			I_{OL} = 12 mA	3.0	3.0	—	0.7	
	V_{OLB}	Output L	I_{OL} = 0.1 mA	0.8 to 3.6	0.8 to 3.6	—	0.1	
			I_{OL} = 2 mA	1.1	1.1	—	0.25	
			I_{OL} = 4 mA	1.4	1.4	—	0.35	
			I_{OL} = 6 mA	1.65	1.65	—	0.45	
			I_{OL} = 9 mA	2.3	2.3	—	0.55	
			I_{OL} = 12 mA	3.0	3.0	—	0.7	

Characteristics	Symbol	Note	Test Condition	V_{CCA} (V)	V_{CCB} (V)	Min	Max	Unit
3-state output OFF-state leakage current	I_{OZA}	(Note 1)	Function OFF State, V_{IOA} = 0 V or 3.6 V	0.8 to 3.6	0.8 to 3.6	—	±5	μA
	I_{OZB}		Function OFF State, V_{IOB} = 0 V or 3.6 V	0.8 to 3.6	0.8 to 3.6	—	±5	
Input leakage current	I_{IN}	(Note 1)	Input = 0 V to 3.6 V	0.8 to 3.6	0 to 3.6	—	±1	μA
Power-OFF leakage current	I_{OFFA}	(Note 1)	V_{IOA} = 0 V to 3.6 V	0	0.8 to 3.6	—	±5	μA
	I_{OFFB}		V_{IOB} = 0 V to 3.6 V	0.8 to 3.6	0	—	±5	
Quiescent supply current	I_{CCA}	(Note 1)	—	0.8 to 3.6	0.8 to 3.6	—	8	μA
				3.6	0	—	8	
	I_{CCB}	(Note 1)	—	0.8 to 3.6	0.8 to 3.6	—	8	μA
				0	3.6	—	8	
	I_{CCTA}		V_{CCA} - 0.6V (per input)	3.0 to 3.6	0.8 to 3.6	—	500	μA
	I_{CCTB}		V_{CCB} - 0.6V (per input)	0.8 to 3.6	3.0 to 3.6	—	500	

Note 1: Fix the input terminal to each power supply terminal or 0 V.

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

Characteristics	Symbol	Test Condition		V_{CCA} (V)	V_{CCB} (V)	Min	Max	Unit
High-level input voltage	V_{IHA}	nA, nDIR, $n\overline{OE}$		0.8	0.8 to 3.6	V_{CCA} × 0.70	—	V
				1.1 to 1.95	0.8 to 3.6	V_{CCA} × 0.70	—	
				2.3 to 2.7	0.8 to 3.6	1.6	—	
				3.0 to 3.6	0.8 to 3.6	2.0	—	
	V_{IHB}	nB		0.8 to 3.6	0.8	V_{CCB} × 0.70	—	
				0.8 to 3.6	1.1 to 1.95	V_{CCB} × 0.65	—	
				0.8 to 3.6	2.3 to 2.7	1.6	—	
				0.8 to 3.6	3.0 to 3.6	2.0	—	
Low-level input voltage	V_{ILA}	nA, nDIR, $n\overline{OE}$		0.8	0.8 to 3.6	—	V_{CCA} × 0.30	V
				1.1 to 1.95	0.8 to 3.6	—	V_{CCA} × 0.30	
				2.3 to 2.7	0.8 to 3.6	—	0.7	
				3.0 to 3.6	0.8 to 3.6	—	0.9	
	V_{ILB}	nB		0.8 to 3.6	0.8	—	V_{CCB} × 0.30	
				0.8 to 3.6	1.1 to 1.95	—	V_{CCB} × 0.30	
				0.8 to 3.6	2.3 to 2.7	—	0.7	
				0.8 to 3.6	3.0 to 3.6	—	0.9	
High-level output voltage	V_{OHA}	Output H	I_{OH} = -0.1 mA	0.8 to 3.6	0.8 to 3.6	V_{CCA} -0.1	—	V
			I_{OH} = -2 mA	1.1	1.1	0.85	—	
			I_{OH} = -4 mA	1.4	1.4	1.05	—	
			I_{OH} = -6 mA	1.65	1.65	1.2	—	
			I_{OH} = -9 mA	2.3	2.3	1.75	—	
			I_{OH} = -12 mA	3.0	3.0	2.3	—	
	V_{OHB}	Output H	I_{OH} = -0.1 mA	0.8 to 3.6	0.8 to 3.6	V_{CCB} -0.1	—	
			I_{OH} = -2 mA	1.1	1.1	0.85	—	
			I_{OH} = -4 mA	1.4	1.4	1.05	—	
			I_{OH} = -6 mA	1.65	1.65	1.2	—	
			I_{OH} = -9 mA	2.3	2.3	1.75	—	
			I_{OH} = -12 mA	3.0	3.0	2.3	—	
Low-level output voltage	V_{OLA}	Output L	I_{OL} = 0.1 mA	0.8 to 3.6	0.8 to 3.6	—	0.1	V
			I_{OL} = 2 mA	1.1	1.1	—	0.25	
			I_{OL} = 4 mA	1.4	1.4	—	0.35	
			I_{OL} = 6 mA	1.65	1.65	—	0.45	
			I_{OL} = 9 mA	2.3	2.3	—	0.55	
			I_{OL} = 12 mA	3.0	3.0	—	0.7	
	V_{OLB}	Output L	I_{OL} = 0.1 mA	0.8 to 3.6	0.8 to 3.6	—	0.1	
			I_{OL} = 2 mA	1.1	1.1	—	0.25	
			I_{OL} = 4 mA	1.4	1.4	—	0.35	
			I_{OL} = 6 mA	1.65	1.65	—	0.45	
			I_{OL} = 9 mA	2.3	2.3	—	0.55	
			I_{OL} = 12 mA	3.0	3.0	—	0.7	

Characteristics	Symbol	Note	Test Condition	V_{CCA} (V)	V_{CCB} (V)	Min	Max	Unit
3-state output OFF-state leakage current	I_{OZA}	(Note 1)	Function OFF State, V_{IOA} = 0 V or 3.6 V	0.8 to 3.6	0.8 to 3.6	—	±7.5	μA
	I_{OZB}		Function OFF State, V_{IOB} = 0 V or 3.6 V	0.8 to 3.6	0.8 to 3.6	—	±7.5	
Input leakage current	I_{IN}	(Note 1)	Input = 0 V to 3.6 V	0.8 to 3.6	0 to 3.6	—	±5	μA
Power-OFF leakage current	I_{OFFA}	(Note 1)	V_{IOA} = 0 V to 3.6 V	0	0.8 to 3.6	—	±10	μA
Power-OFF leakage current	I_{OFFB}		V_{IOA} = 0 V to 3.6 V	0.8 to 3.6	0	—	±10	
Quiescent supply current	I_{CCA}	(Note 1)	—	0.8 to 3.6	0.8 to 3.6	—	18	μA
				3.6	0	—	18	
	I_{CCB}	(Note 1)	—	0.8 to 3.6	0.8 to 3.6	—	18	μA
				0	3.6	—	18	
	I_{CCTA}		V_{CCA} - 0.6 V (per input)	3.0 to 3.6	0.8 to 3.6	—	500	μA
	I_{CCTB}		V_{CCB} - 0.6 V (per input)	0.8 to 3.6	3.0 to 3.6	—	500	

Note 1: Fix the input terminal to each power supply terminal or 0 V.

11.3. AC Characteristics (Note) (V_{CCA} = 0.8 V, T_a = 25 °C)

Characteristics	Symbol	V_{CCB} (V) 0.8 V typ.	V_{CCB} (V) 1.2 V typ.	V_{CCB} (V) 1.5 V typ.	V_{CCB} (V) 1.8 V typ.	V_{CCB} (V) 2.5 V typ.	V_{CCB} (V) 3.3 V typ.	Unit
Propagation delay time(B → A)	t_{PLH}/t_{PHL}	14.0	10.5	9.6	9.1	8.8	8.9	ns
Propagation delay time (B → A)		14.0	9.5	8.7	8.3	7.9	7.7	
3-state output disable time ($\overline{OE}$ → A)	t_{PLZ}/t_{PHZ}	20.9	21.1	21.1	21.2	21.4	21.7	
3-state output disable time ($\overline{OE}$ → B)		23.4	14.5	12.6	11.8	10.5	10.1	
3-state output enable time ($\overline{OE}$ → A)	t_{PZL}/t_{PZH}	22.6	22.7	22.8	22.8	22.8	22.7	
3-state output enable time ($\overline{OE}$ → B)		37.6	20.6	17.6	16.2	15.0	14.7	

Note: See Figure 12.1, 13.1, 13.2, table 12.1.1, 12.1.2, 13.1.1 for the measurement circuit.

11.4. AC Characteristics (Note) (V_{CCB} = 0.8 V, T_a = 25 °C)

Characteristics	Symbol	V_{CCA} (V) 0.8 V typ.	V_{CCA} (V) 1.2 V typ.	V_{CCA} (V) 1.5 V typ.	V_{CCA} (V) 1.8 V typ.	V_{CCA} (V) 2.5 V typ.	V_{CCA} (V) 3.3 V typ.	Unit
Propagation delay time (A → B)	t_{PLH}/t_{PHL}	14.0	9.5	8.7	8.3	7.9	7.7	ns
Propagation delay time (B → A)		14.0	10.5	9.6	9.1	8.8	8.9	
3-state output disable time ($\overline{OE}$ → A)	t_{PLZ}/t_{PHZ}	20.9	10.6	7.9	6.3	3.8	2.6	
3-state output disable time ($\overline{OE}$ → B)		23.4	19.4	18.4	18.0	17.4	17.1	
3-state output enable time ($\overline{OE}$ → A)	t_{PZL}/t_{PZH}	22.6	9.4	6.9	5.8	4.7	4.4	
3-state output enable time ($\overline{OE}$ → B)		37.6	32.2	31.4	31.2	31.1	31.1	

Note: See Figure 12.1, 13.1, 13.2, table 12.1.1, 12.1.2, 13.1.1 for the measurement circuit.

11.5. AC Characteristics (Note) (V_{CCA} = 1.2 ± 0.1 V, T_a = -40 to 85 °C)

Characteristics	Symbol	V_{CCB} (V) 1.2 ± 0.1 V Max	V_{CCB} (V) 1.5 ± 0.1 V Max	V_{CCB} (V) 1.8 ± 0.15 V Max	V_{CCB} (V) 2.5 ± 0.2 V Max	V_{CCB} (V) 3.3 ± 0.3 V Max	Unit
Propagation delay time (A → B)	t_{PLH}/t_{PHL}	10.2	9.0	8.5	7.6	7.3	ns
Propagation delay time (B → A)		10.2	8.2	7.5	6.7	6.4	
3-state output disable time ($\overline{OE}$ → A)	t_{PLZ}/t_{PHZ}	12.2	12.2	12.2	12.2	12.3	
3-state output disable time ($\overline{OE}$ → B)		13.6	10.8	9.5	7.9	7.3	
3-state output enable time ($\overline{OE}$ → A)	t_{PZL}/t_{PZH}	17.7	18.0	18.0	18.0	18.1	
3-state output enable time ($\overline{OE}$ → B)		27.7	20.0	17.0	13.7	12.5	

Note: See Figure 12.1, 13.1, 13.2, table 12.1.1, 12.1.2, 13.1.1 for the measurement circuit.

11.6. AC Characteristics (Note) (V_{CCA} = 1.5 ± 0.1 V, T_a = -40 to 85 °C)

Characteristics	Symbol	V_{CCB} (V) 1.2 ± 0.1 V Max	V_{CCB} (V) 1.5 ± 0.1 V Max	V_{CCB} (V) 1.8 ± 0.15 V Max	V_{CCB} (V) 2.5 ± 0.2 V Max	V_{CCB} (V) 3.3 ± 0.3 V Max	Unit
Propagation delay time (A → B)	t_{PLH}/t_{PHL}	8.2	6.9	6.5	5.9	5.5	ns
Propagation delay time (B → A)		9.0	6.9	6.0	5.2	4.9	
3-state output disable time ($\overline{OE}$ → A)	t_{PLZ}/t_{PHZ}	8.4	8.4	8.4	8.3	8.2	
3-state output disable time ($\overline{OE}$ → B)		12.1	9.1	7.6	6.1	5.4	
3-state output enable time ($\overline{OE}$ → A)	t_{PZL}/t_{PZH}	11.6	11.7	11.9	11.8	11.8	
3-state output enable time ($\overline{OE}$ → B)		25.1	17.4	14.4	11.0	9.7	

Note: See Figure 12.1, 13.1, 13.2, table 12.1.1, 12.1.2, 13.1.1 for the measurement circuit.

11.7. AC Characteristics (Note) (V_{CCA} = 1.8 ± 0.15 V, T_a = -40 to 85 °C)

Characteristics	Symbol	V_{CCB} (V) 1.2 ± 0.1 V Max	V_{CCB} (V) 1.5 ± 0.1 V Max	V_{CCB} (V) 1.8 ± 0.15 V Max	V_{CCB} (V) 2.5 ± 0.2 V Max	V_{CCB} (V) 3.3 ± 0.3 V Max	Unit
Propagation delay time (A → B)	t_{PLH}/t_{PHL}	7.5	6.0	5.5	5.1	4.8	ns
Propagation delay time (B → A)		8.5	6.5	5.5	4.6	4.3	
3-state output disable time ($\overline{OE}$ → A)	t_{PLZ}/t_{PHZ}	7.3	7.3	7.3	7.3	7.2	
3-state output disable time ($\overline{OE}$ → B)		12.6	9.3	7.7	6.0	5.2	
3-state output enable time ($\overline{OE}$ → A)	t_{PZL}/t_{PZH}	9.2	9.2	9.3	9.3	9.3	
3-state output enable time ($\overline{OE}$ → B)		24.2	16.5	13.4	10.0	8.6	

Note: See Figure 12.1, 13.1, 13.2, table 12.1.1, 12.1.2, 13.1.1 for the measurement circuit.

11.8. AC Characteristics (Note) (V_{CCA} = 2.5 ± 0.2 V, T_a = -40 to 85 °C)

Characteristics	Symbol	V_{CCB} (V) 1.2 ± 0.1 V Max	V_{CCB} (V) 1.5 ± 0.1 V Max	V_{CCB} (V) 1.8 ± 0.15 V Max	V_{CCB} (V) 2.5 ± 0.2 V Max	V_{CCB} (V) 3.3 ± 0.3 V Max	Unit
Propagation delay time (A → B)	t_{PLH}/t_{PHL}	6.7	5.2	4.6	4.0	3.9	ns
Propagation delay time (B → A)		7.6	5.9	5.1	4.0	3.5	
3-state output disable time ($\overline{OE}$ → A)	t_{PLZ}/t_{PHZ}	4.6	4.9	4.9	4.9	4.9	
3-state output disable time ($\overline{OE}$ → B)		11.8	8.5	7.0	5.3	4.5	
3-state output enable time ($\overline{OE}$ → A)	t_{PZL}/t_{PZH}	6.7	6.5	6.5	6.5	6.5	
3-state output enable time ($\overline{OE}$ → B)		23.7	15.8	12.5	9.0	7.5	

Note: See Figure 12.1, 13.1, 13.2, table 12.1.1, 12.1.2, 13.1.1 for the measurement circuit.

11.9. AC Characteristics (Note) (V_{CCA} = 3.3 ± 0.3 V, T_a = -40 to 85 °C)

Characteristics	Symbol	V_{CCB} (V) 1.2 ± 0.1 V Max	V_{CCB} (V) 1.5 ± 0.1 V Max	V_{CCB} (V) 1.8 ± 0.15 V Max	V_{CCB} (V) 2.5 ± 0.2 V Max	V_{CCB} (V) 3.3 ± 0.3 V Max	Unit
Propagation delay time (A → B)	t_{PLH}/t_{PHL}	6.4	4.9	4.3	3.5	3.3	ns
Propagation delay time (B → A)		7.3	5.5	4.8	3.9	3.3	
3-state output disable time ($\overline{OE}$ → A)	t_{PLZ}/t_{PHZ}	5.0	5.0	5.0	5.0	5.0	
3-state output disable time ($\overline{OE}$ → B)		15.7	11.4	9.3	6.5	5.3	
3-state output enable time ($\overline{OE}$ → A)	t_{PZL}/t_{PZH}	5.9	5.3	5.3	5.2	5.2	
3-state output enable time ($\overline{OE}$ → B)		23.7	15.5	12.1	8.6	7.1	

Note: See Figure 12.1, 13.1, 13.2, table 12.1.1, 12.1.2, 13.1.1 for the measurement circuit.

11.10. AC Characteristics (Note) (V_{CCA} = 1.2 ± 0.1 V, T_a = -40 to 125 °C)

Characteristics	Symbol	V_{CCB} (V) 1.2 ± 0.1 V Max	V_{CCB} (V) 1.5 ± 0.1 V Max	V_{CCB} (V) 1.8 ± 0.15 V Max	V_{CCB} (V) 2.5 ± 0.2 V Max	V_{CCB} (V) 3.3 ± 0.3 V Max	Unit
Propagation delay time (A → B)	t_{PLH}/t_{PHL}	10.5	9.4	8.9	7.9	7.6	ns
Propagation delay time (B → A)		10.5	8.6	7.9	7.0	6.7	
3-state output disable time ($\overline{OE}$ → A)	t_{PLZ}/t_{PHZ}	12.5	12.5	12.5	12.5	12.6	
3-state output disable time ($\overline{OE}$ → B)		14.1	11.3	10.0	8.2	7.6	
3-state output enable time ($\overline{OE}$ → A)	t_{PZL}/t_{PZH}	18.3	18.5	18.6	18.6	18.7	
3-state output enable time ($\overline{OE}$ → B)		28.6	21.0	18.0	14.5	13.1	

Note: See Figure 12.1, 13.1, 13.2, table 12.1.1, 12.1.2, 13.1.1 for the measurement circuit.

11.11. AC Characteristics (Note) (V_{CCA} = 1.5 ± 0.1 V, T_a = -40 to 125 °C)

Characteristics	Symbol	V_{CCB} (V) 1.2 ± 0.1 V Max	V_{CCB} (V) 1.5 ± 0.1 V Max	V_{CCB} (V) 1.8 ± 0.15 V Max	V_{CCB} (V) 2.5 ± 0.2 V Max	V_{CCB} (V) 3.3 ± 0.3 V Max	Unit
Propagation delay time (A → B)	t_{PLH}/t_{PHL}	8.6	7.3	6.9	6.3	5.8	ns
Propagation delay time (B → A)		9.4	7.3	6.4	5.5	5.2	
3-state output disable time ($\overline{OE}$ → A)	t_{PLZ}/t_{PHZ}	8.8	8.9	8.8	8.8	8.7	
3-state output disable time ($\overline{OE}$ → B)		12.8	9.6	8.0	6.4	5.7	
3-state output enable time ($\overline{OE}$ → A)	t_{PZL}/t_{PZH}	12.3	12.5	12.6	12.5	12.5	
3-state output enable time ($\overline{OE}$ → B)		26.2	18.4	15.4	11.8	10.3	

Note: See Figure 12.1, 13.1, 13.2, table 12.1.1, 12.1.2, 13.1.1 for the measurement circuit.

11.12. AC Characteristics (Note) (V_{CCA} = 1.8 ± 0.15 V, T_a = -40 to 125 °C)

Characteristics	Symbol	V_{CCB} (V) 1.2 ± 0.1 V Max	V_{CCB} (V) 1.5 ± 0.1 V Max	V_{CCB} (V) 1.8 ± 0.15 V Max	V_{CCB} (V) 2.5 ± 0.2 V Max	V_{CCB} (V) 3.3 ± 0.3 V Max	Unit
Propagation delay time (A → B)	t_{PLH}/t_{PHL}	7.9	6.4	5.9	5.5	5.1	ns
Propagation delay time (B → A)		8.9	6.9	5.9	4.9	4.6	
3-state output disable time ($\overline{OE}$ → A)	t_{PLZ}/t_{PHZ}	7.7	7.7	7.6	7.6	7.5	
3-state output disable time ($\overline{OE}$ → B)		13.4	9.8	8.1	6.3	5.5	
3-state output enable time ($\overline{OE}$ → A)	t_{PZL}/t_{PZH}	9.9	9.9	9.9	10.0	10.0	
3-state output enable time ($\overline{OE}$ → B)		25.1	17.5	14.4	10.7	9.2	

Note: See Figure 12.1, 13.1, 13.2, table 12.1.1, 12.1.2, 13.1.1 for the measurement circuit.

11.13. AC Characteristics (Note) (V_{CCA} = 2.5 ± 0.2 V, T_a = -40 to 125 °C)

Characteristics	Symbol	V_{CCB} (V) 1.2 ± 0.1 V Max	V_{CCB} (V) 1.5 ± 0.1 V Max	V_{CCB} (V) 1.8 ± 0.15 V Max	V_{CCB} (V) 2.5 ± 0.2 V Max	V_{CCB} (V) 3.3 ± 0.3 V Max	Unit
Propagation delay time (A → B)	t_{PLH}/t_{PHL}	7.0	5.5	4.9	4.3	4.2	ns
Propagation delay time (B → A)		7.9	6.3	5.5	4.3	3.8	
3-state output disable time ($\overline{OE}$ → A)	t_{PLZ}/t_{PHZ}	5.2	5.2	5.2	5.2	5.2	
3-state output disable time ($\overline{OE}$ → B)		12.6	8.9	7.3	5.6	4.7	
3-state output enable time ($\overline{OE}$ → A)	t_{PZL}/t_{PZH}	7.2	7.0	6.9	6.9	7.0	
3-state output enable time ($\overline{OE}$ → B)		24.5	16.8	13.4	9.6	8.0	

Note: See Figure 12.1, 13.1, 13.2, table 12.1.1, 12.1.2, 13.1.1 for the measurement circuit.

11.14. AC Characteristics (Note) (V_{CCA} = 3.3 ± 0.3 V, T_a = -40 to 125 °C)

Characteristics	Symbol	V_{CCB} (V) 1.2 ± 0.1 V Max	V_{CCB} (V) 1.5 ± 0.1 V Max	V_{CCB} (V) 1.8 ± 0.15 V Max	V_{CCB} (V) 2.5 ± 0.2 V Max	V_{CCB} (V) 3.3 ± 0.3 V Max	Unit
Propagation delay time (A → B)	t_{PLH}/t_{PHL}	6.7	5.2	4.6	3.8	3.6	ns
Propagation delay time (B → A)		7.6	5.8	5.1	4.2	3.6	
3-state output disable time ($\overline{OE}$ → A)	t_{PLZ}/t_{PHZ}	5.2	5.2	5.2	5.2	5.2	
3-state output disable time ($\overline{OE}$ → B)		16.3	11.8	9.6	6.7	5.5	
3-state output enable time ($\overline{OE}$ → A)	t_{PZL}/t_{PZH}	6.3	5.7	5.7	5.6	5.6	
3-state output enable time ($\overline{OE}$ → B)		24.5	16.5	13.0	9.2	7.6	

Note: See Figure 12.1, 13.1, 13.2, table 12.1.1, 12.1.2, 13.1.1 for the measurement circuit.

11.15. Capacitive Characteristics (Unless otherwise specified, T_a = 25 °C)

Characteristics	Symbol	Note	Test Condition	V_{CCA}, V_{CCB} 0.8 V Typ.	V_{CCA}, V_{CCB} 1.2 V Typ.	V_{CCA}, V_{CCB} 1.5 V Typ.	V_{CCA}, V_{CCB} 1.8 V Typ.	V_{CCA}, V_{CCB} 2.5 V Typ.	V_{CCA}, V_{CCB} 3.3 V Typ.	Unit
Input capacitance	C_{IN}		V_{IN} = 0 V or 3.3 V	—	—	—	—	—	4	pF
Bus I/O capacitance	$C_{I/OA}$		An = OFF, V_{IOA} = 0 V or 3.3 V	—	—	—	—	—	5	pF
	$C_{I/OB}$		Bn = OFF, V_{IOB} = 0 V or 3.3 V	—	—	—	—	—	5	
Power dissipation capacitance	C_{PDA}	(Note 1)	A → B	1	2	2	2	2	2	pF
			B → A	9	11	11	12	14	17	
	C_{PDB}	(Note 1)	A → B	9	11	11	12	14	17	pF
			B → A	1	2	2	2	2	2	

Note 1: 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.

$I_{CC(opr)} = C_{PD} \times V_{CC} \times f_{IN} + I_{CC}/4$ (per bit)

12. AC Test Circuit

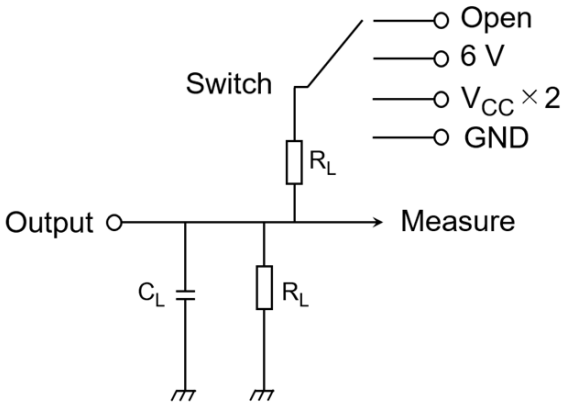


Fig. 12.1 AC Test Circuit

Table 12.1.1 Parameter for AC Test Circuit

Parameter	Switch
t_{PLH}, t_{PHL}	Open
t_{PLZ}, t_{PZL}	$V_{CC} \times 2$
t_{PHZ}, t_{PZH}	GND

Table 12.1.2 Parameter for AC Test Circuit

Symbol	V_{CC} = 3.3 ± 0.3 V	V_{CC} = 2.5 ± 0.2 V	V_{CC} = 1.8 ± 0.15 V	V_{CC} = 1.5 ± 0.1 V	V_{CC} = 1.2 ± 0.1 V	V_{CC} = 0.8 V
R_L	2 kΩ	2 kΩ	2 kΩ	2 kΩ	2 kΩ	10 kΩ
C_L	15 pF	15 pF	15 pF	15 pF	15 pF	5 pF

13. AC Waveform

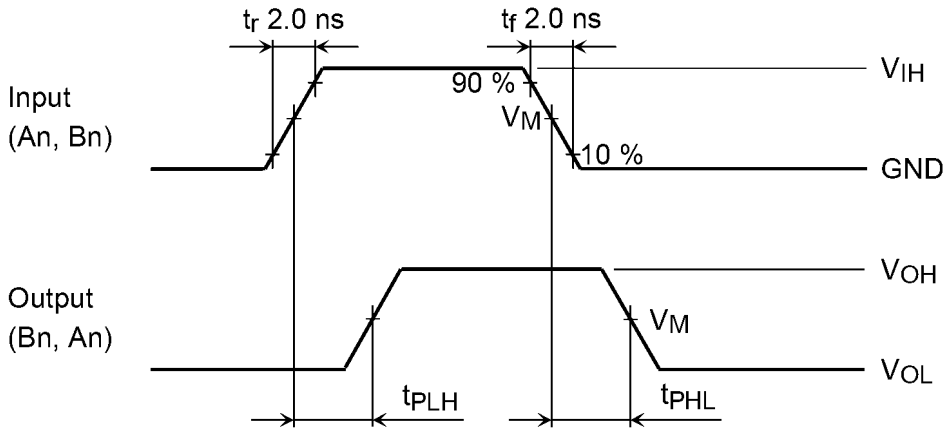


Fig. 13.1 t_{PLH}, t_{PHL}

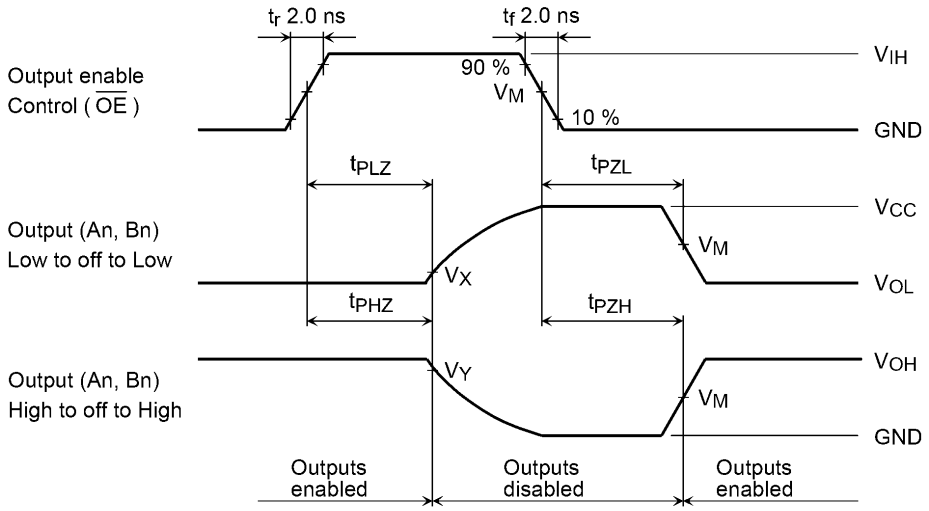


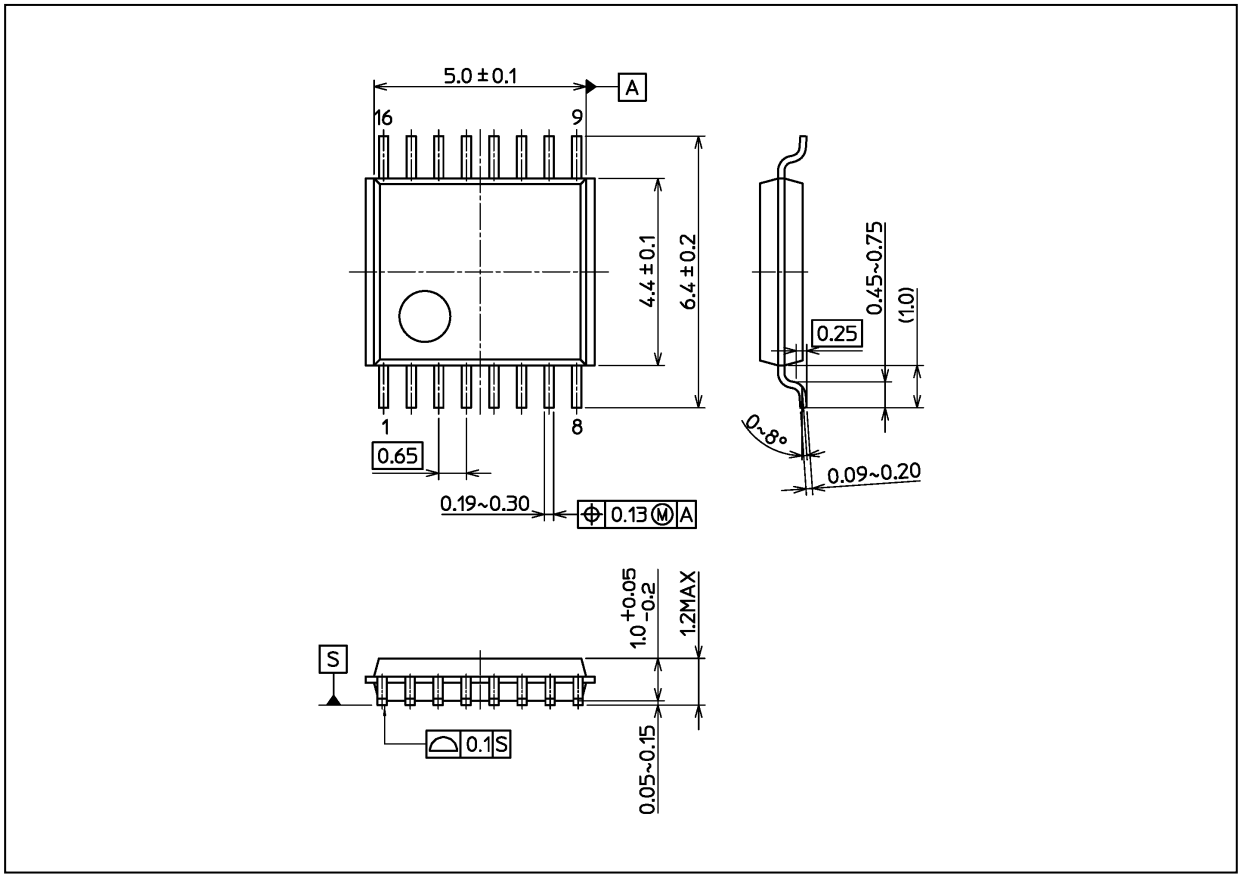
Fig. 13.2 t_{PLZ}, t_{PHZ}, t_{PZL}, t_{PZH}

Table 13.1.1 AC Waveform Symbols

Symbol	V_{CC} = 3.3 ± 0.3 V	V_{CC} = 2.5 ± 0.2 V V_{CC} = 1.8 ± 0.15 V	V_{CC} = 1.5 ± 0.1 V V_{CC} = 1.2 ± 0.1 V	V_{CC} = 0.8 V
V_{IH}	V_{CC}	V_{CC}	V_{CC}	V_{CC}
V_M	$V_{CC}/2$	$V_{CC}/2$	$V_{CC}/2$	$V_{CC}/2$
V_X	V_{OL} + 0.3 V	V_{OL} + 0.15 V	V_{OL} + 0.1 V	V_{OL} + 0.1 V
V_Y	V_{OH} - 0.3 V	V_{OH} - 0.15 V	V_{OH} - 0.1 V	V_{OH} - 0.1 V

Package Dimensions

Unit: mm



Weight: 0.055 g (typ.)

Package Name(s)
Nickname: TSSOP16B

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