CMOS Digital Integrated Circuits Silicon Monolithic

74AVCH4T245FT

1. Functional Description

- 2-Bit×2 Dual-Supply Bus Transceiver with Bushold and Configurable Power Supply

2. General

The 74AVCH4T245FT is a dual-supply, high-speed CMOS 2-bit × 2-circuit bus transceiver with bus hold circuitry that allows interfacing between two systems with 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 bus hold function holds the voltage at the bus terminal input. When the enable input $\overline{OE}$ is set to "H", the internal buffer is in a high impedance mode and the bus pins (nA, nB) are in bus hold mode. 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. By setting one or both power supplies to GND, the internal buffer is placed in a high-impedance mode, and the bus terminals supplied with power are placed in bus hold mode.

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)

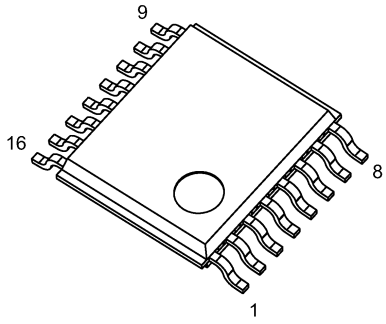
(5) Output current: $|I_{OH}|/I_{OL}$ = ±12 mA (min) (V_{CC} = 3.0 V)
$|I_{OH}|/I_{OL}$ = ±9 mA (min) (V_{CC} = 2.3 V)
$|I_{OH}|/I_{OL}$ = ±6 mA (min) (V_{CC} = 1.65 V)
$|I_{OH}|/I_{OL}$ = ±4 mA (min) (V_{CC} = 1.4 V)
$|I_{OH}|/I_{OL}$ = ±2 mA (min) (V_{CC} = 1.1 V)

(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.

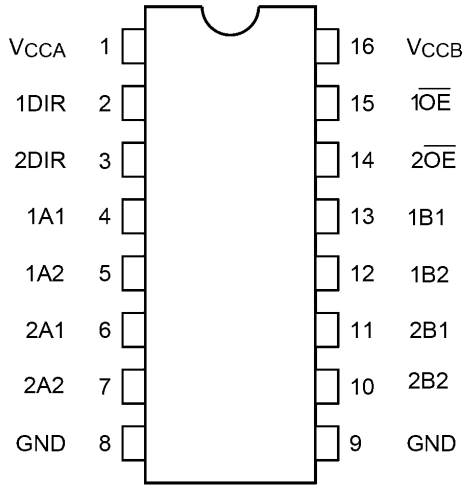
4. Packaging



TSSOP16B

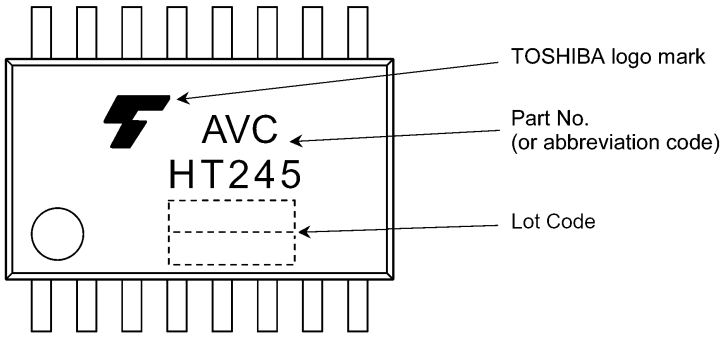
Start of commercial production
2024-09

5. Pin Assignment

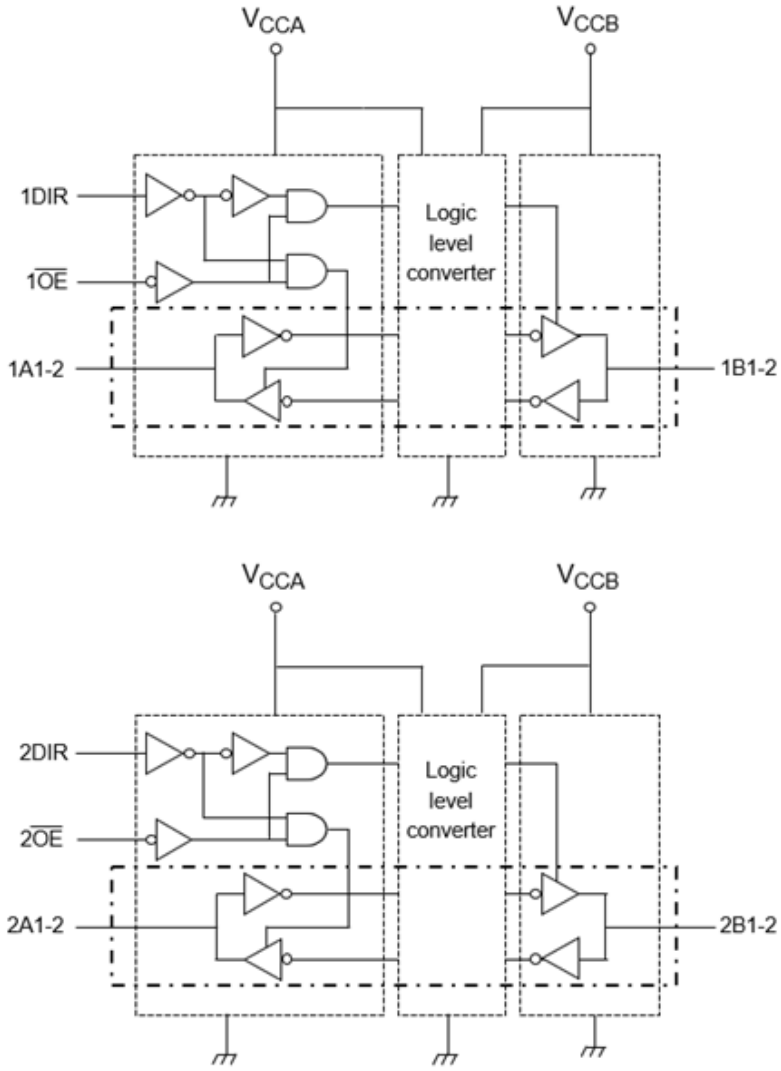


(top view)

6. Marking



7. Block Diagram



8. Truth Table

Supply voltage V_{CCA}, V_{CCB}	Input $\overline{nOE}$	Input nDIR	Input/Output Bus nA1, nA2	Input/Output Bus nB1, nB2	Function
0.8 to 3.6 V	L	L	Output	Input (Bus-Hold)	A = B
0.8 to 3.6 V	L	H	Input (Bus-Hold)	Output	B = A
0.8 to 3.6 V	H	X	Bus-Hold	Bus-Hold	Z (Bus-Hold)
GND (Note)	X	X	Z or Bus-Hold	Z or Bus-Hold	Z (Bus-Hold)

X: Don't care
Z: High impedance
Note: If either V_{CCA} or V_{CCB} is at GND level, the device is in bus hold mode; if both V_{CCA} and V_{CCB} are at GND level, the device is in 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
Note 2: High (H) or Low (L) state or output high impedance 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	(Note 3)	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

Note 2: High (H) or Low (L) state or output high impedance state. I_{OUT} absolute maximum rating must be observed.

Note 3: V_{CC} = V_{CCA}, V_{CCB}

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	—	
				0.8 to 3.6	1.1 to 1.95	V_{CCB} × 0.70	—	
				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	Test Condition	V_{CCA} (V)	V_{CCB} (V)	Min	Typ.	Max	Unit
Input leakage current	I_{IN}	Input = 0 V to 3.6 V	0.8 to 3.6	0 to 3.6	—	—	±1	μA
Bushold input minimum drive hold current	$I_{I(HOLD)}$	V_I = 0.24 V	0.8	0.8	—	10	—	μA
		V_I = 0.56 V	0.8	0.8	—	-10	—	
		V_I = 0.33 V	1.1	1.1	10	—	—	
		V_I = 0.77 V	1.1	1.1	-10	—	—	
		V_I = 0.42 V	1.4	1.4	15	—	—	
		V_I = 0.98 V	1.4	1.4	-15	—	—	
		V_I = 0.50 V	1.65	1.65	25	—	—	
		V_I = 1.15 V	1.65	1.65	-25	—	—	
		V_I = 0.7 V	2.3	2.3	45	—	—	
		V_I = 1.6 V	2.3	2.3	-45	—	—	
		V_I = 0.8 V	3.0	3.0	100	—	—	
		V_I = 2.0 V	3.0	3.0	-100	—	—	
Bushold input over-drive current to change state	$I_{I(OD)}$	V_I = L → H	0.8	0.8	—	15	—	μA
		V_I = H → L	0.8	0.8	—	-15	—	
		V_I = L → H	1.3	1.3	110	—	—	
		V_I = H → L	1.3	1.3	-110	—	—	
		V_I = L → H	1.6	1.6	150	—	—	
		V_I = H → L	1.6	1.6	-150	—	—	
		V_I = L → H	1.95	1.95	250	—	—	
		V_I = H → L	1.95	1.95	-250	—	—	
		V_I = L → H	2.7	2.7	400	—	—	
		V_I = H → L	2.7	2.7	-400	—	—	
		V_I = L → H	3.6	3.6	600	—	—	
		V_I = H → L	3.6	3.6	-600	—	—	
Power-OFF leakage current	I_{OFFA}	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}	—	0.8 to 3.6	0.8 to 3.6	—	—	8	μA
		—	3.6	0	—	—	8	
	I_{CCB}	—	0.8 to 3.6	0.8 to 3.6	—	—	8	μA
		—	0	3.6	—	—	8	

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} × 0.70	—	
				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	Test Condition	V_{CCA} (V)	V_{CCB} (V)	Min	Typ.	Max	Unit
Input leakage current	I_{IN}	Input = 0 V to 3.6 V	0.8 to 3.6	0 to 3.6	—	—	±5	μA
Bushold input minimum drive hold current	$I_{I(HOLD)}$	V_I = 0.24 V	0.8	0.8	—	10	—	μA
		V_I = 0.56 V	0.8	0.8	—	-10	—	
		V_I = 0.33 V	1.1	1.1	10	—	—	
		V_I = 0.77 V	1.1	1.1	-10	—	—	
		V_I = 0.42 V	1.4	1.4	15	—	—	
		V_I = 0.98 V	1.4	1.4	-15	—	—	
		V_I = 0.50 V	1.65	1.65	25	—	—	
		V_I = 1.15 V	1.65	1.65	-25	—	—	
		V_I = 0.7 V	2.3	2.3	45	—	—	
		V_I = 1.6 V	2.3	2.3	-45	—	—	
		V_I = 0.8 V	3.0	3.0	100	—	—	
		V_I = 2.0 V	3.0	3.0	-100	—	—	
Bushold input over-drive current to change state	$I_{I(OD)}$	V_I = L → H	0.8	0.8	—	15	—	μA
		V_I = H → L	0.8	0.8	—	-15	—	
		V_I = L → H	1.3	1.3	110	—	—	
		V_I = H → L	1.3	1.3	-110	—	—	
		V_I = L → H	1.6	1.6	150	—	—	
		V_I = H → L	1.6	1.6	-150	—	—	
		V_I = L → H	1.95	1.95	250	—	—	
		V_I = H → L	1.95	1.95	-250	—	—	
		V_I = L → H	2.7	2.7	400	—	—	
		V_I = H → L	2.7	2.7	-400	—	—	
		V_I = L → H	3.6	3.6	600	—	—	
		V_I = H → L	3.6	3.6	-600	—	—	
Power-OFF leakage current	I_{OFFA}	V_{IOA} = 0 V to 3.6 V	0	0.8 to 3.6	—	—	±10	μA
	I_{OFFB}	V_{IOB} = 0 V to 3.6 V	0.8 to 3.6	0	—	—	±10	
Quiescent supply current	I_{CCA}	—	0.8 to 3.6	0.8 to 3.6	—	—	18	μA
			3.6	0	—	—	18	
	I_{CCB}	—	0.8 to 3.6	0.8 to 3.6	—	—	18	μA
			0	3.6	—	—	18	

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}	4.9	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

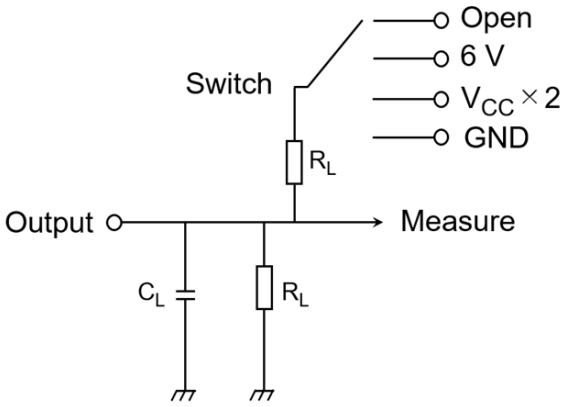


Fig. 12.1 AC Test Circuit

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

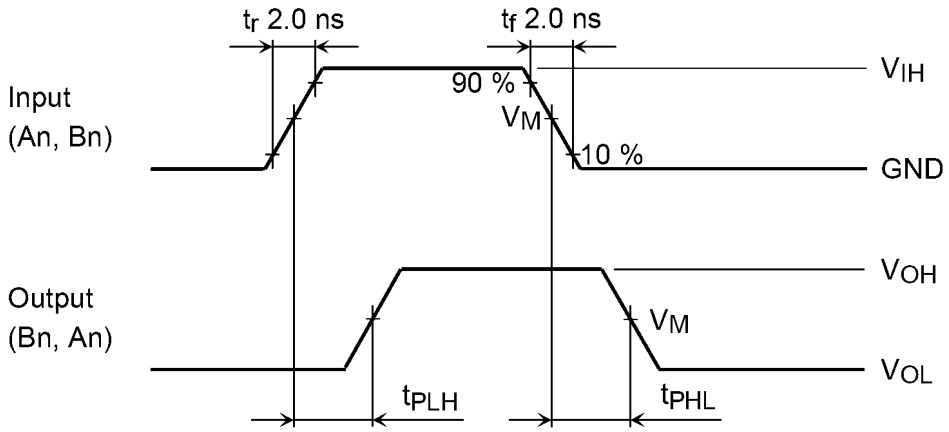


Fig. 13.1 t_{PLH}, t_{PHL}

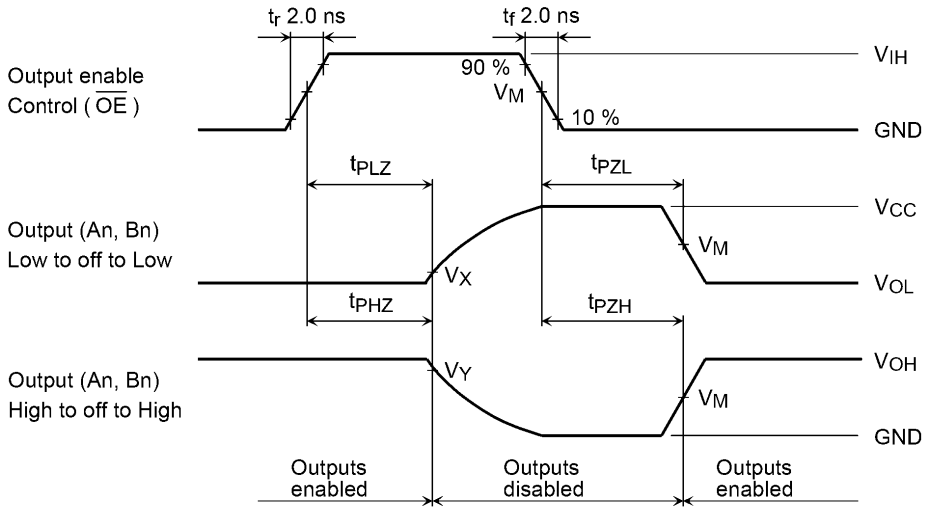


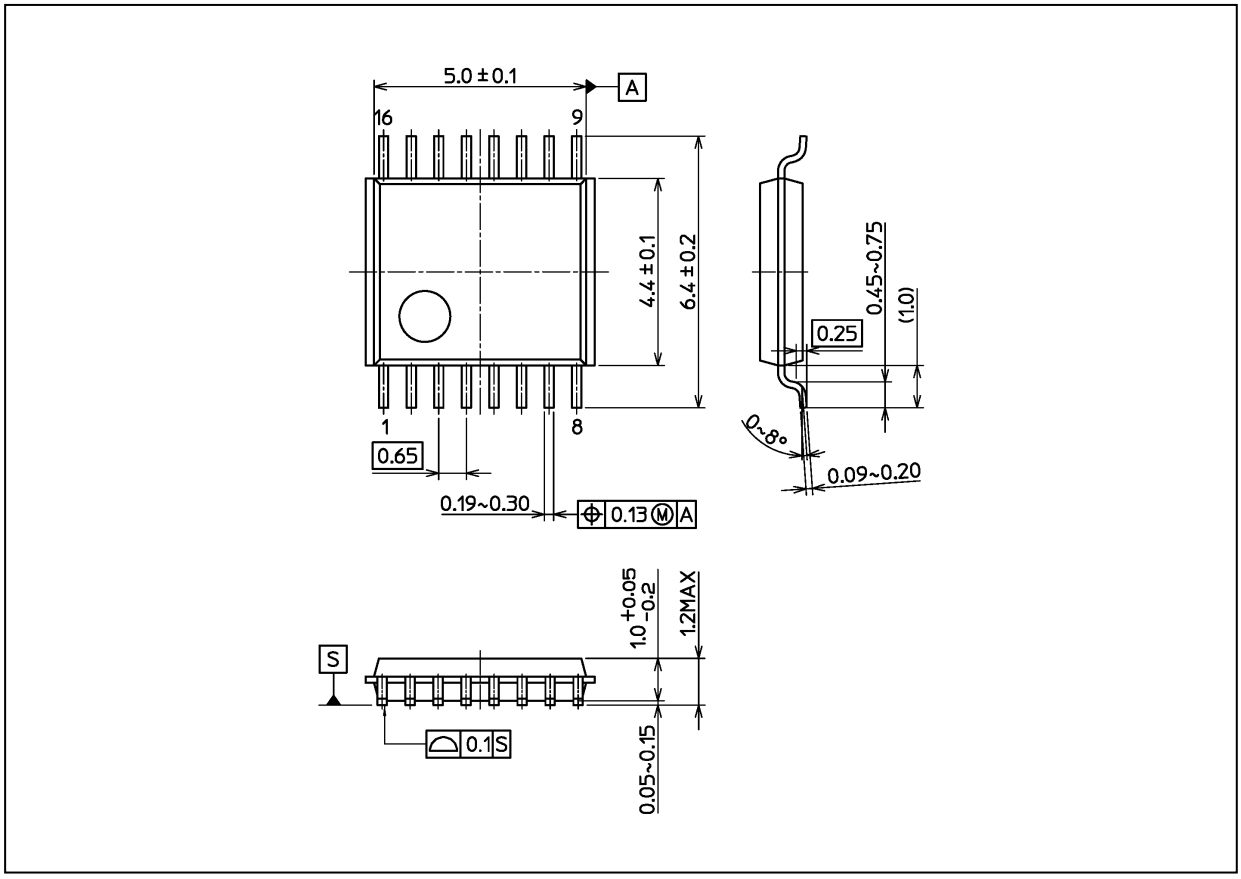
Fig. 13.2 t_{PLZ}, t_{PHZ}, t_{PZL}, t_{PZH}

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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