CMOS Digital Integrated Circuits Silicon Monolithic

74AVC2T45FK

1. Functional Description

- 2-Bit Dual-Supply Bus Transceiver with Configurable Power Supply

2. General

The 74AVC2T45FK is a dual-supply, high-speed CMOS 2-bit bus transceiver that can interface 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.

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) 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 feature allows for partial power-down interface applications.

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} = 4.1 ns (max) (V_{CCA} = 3.3 ± 0.3 V, V_{CCB} = 3.3 ± 0.3 V)

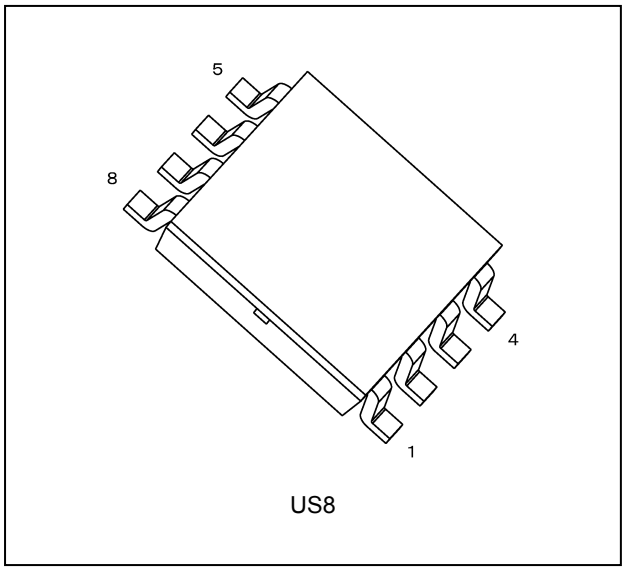
(5) Output current: $|I_{OH}|/I_{OL}$ = ± 12 mA (min) (V_{CC} = 3.0 V)
$|I_{OH}|/I_{OL}$ = ± 9 mA (min) (V_{CC} = 2.3 V)
$|I_{OH}|/I_{OL}$ = ± 6 mA (min) (V_{CC} = 1.65 V)
$|I_{OH}|/I_{OL}$ = ± 4 mA (min) (V_{CC} = 1.4 V)
$|I_{OH}|/I_{OL}$ = ± 2 mA (min) (V_{CC} = 1.1 V)

(6) Small package: US8 (Package code: SOT-765)

(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.

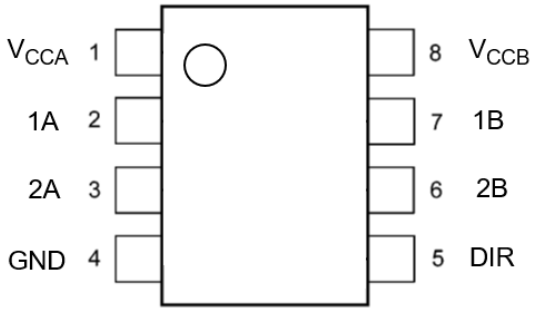
4. Packaging



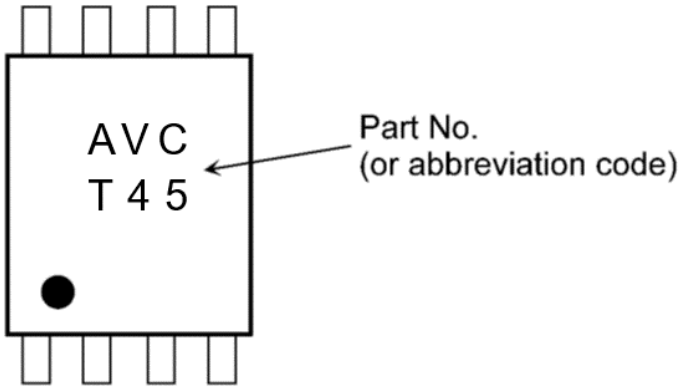
US8

Start of commercial production
2025-08

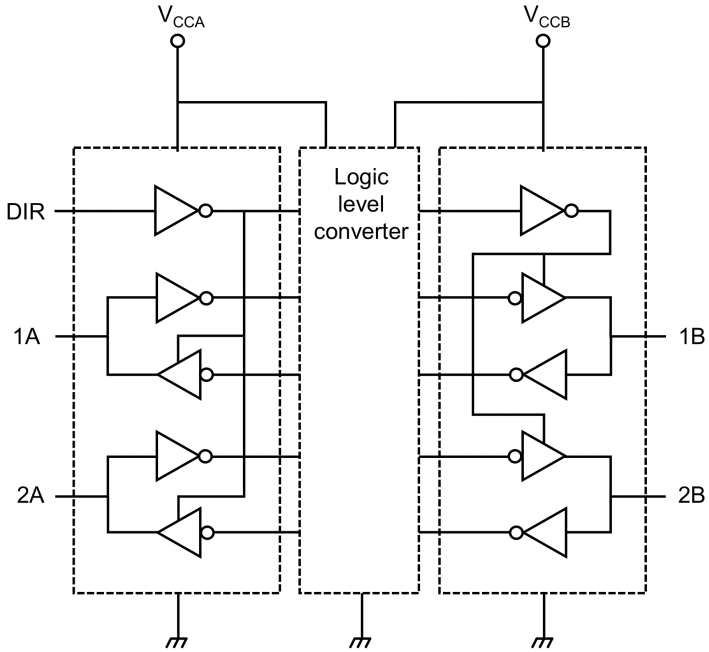
5. Pin Assignment



6. Marking



7. Block Diagram



8. Truth Table

Supply voltage V_{CCA}	Supply voltage V_{CCB}	Input DIR	Input/Output Bus A	Input/Output Bus B	Function
0.8 to 3.6 V	0.8 to 3.6 V	L	Output	Input	A = B
0.8 to 3.6 V	0.8 to 3.6 V	H	Input	Output	B = A
GND	0.8 to 3.6 V	X	Z	Z	Z
0.8 to 3.6 V	GND	X	Z	Z	Z
GND	GND	X	Z	Z	Z

X: Don't care
Z: High impedance

9. Absolute Maximum Ratings (Note) (Unless otherwise specified, T_a = 25 °C)

Characteristics	Symbol	Note	Rating	Unit
Supply voltage	V_{CCA}		-0.5 to 4.6	V
	V_{CCB}		-0.5 to 4.6	
Input voltage (DIR)	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	
		(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		200	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: Input state or high impedance state.
Note 2: Output state. I_{OUT} absolute maximum rating must be observed.
Note 3: V_{OUT} < GND

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 (DIR)	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 1.2 V	±2	
			V_{CCA} = 0.95 to 1.05 V	±1	
			V_{CCA} = 0.85 to 0.95 V	±0.5	
	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 1.2 V	±2	
			V_{CCB} = 0.95 to 1.05 V	±1	
			V_{CCB} = 0.85 to 0.95 V	±0.5	
Operating temperature	T_{opr}		—	-40 to 125	°C
Input rise and fall times	dt/dv	(Note 3)	V_{CC} = 0.8 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: Input state or high impedance state.

Note 2: Output 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}	A, DIR		0.8 to 1.95	0.8 to 3.6	V_{CCA} × 0.70	—	V
				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}	B		0.8 to 3.6	0.8 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}	A, DIR		0.8 to 1.95	0.8 to 3.6	—	V_{CCA} × 0.30	V
				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}	B		0.8 to 3.6	0.8 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_{OH}	A, B Output H	I_{OH} = -0.1 mA	0.8 to 3.6	0.8 to3.6	V_{CCO} -0.1	—	V
			I_{OH} = -0.5 mA	0.85	0.85	0.65	—	
			I_{OH} = -1 mA	0.95	0.95	0.75	—	
			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_{OL}	A, B Output L	I_{OL} = 0.1 mA	0.8 to 3.6	0.8 to 3.6	—	0.1	V
			I_{OL} = 0.5 mA	0.85	0.85	—	0.2	
			I_{OL} = 1 mA	0.95	0.95	—	0.2	
			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	Max	Unit
3-state output OFF-state leakage current	I_{OZA}	Function OFF State, V_{OA} = 0 V or 3.6 V	0.8 to 3.6	0.8 to 3.6	—	±1	μA
		V_{OA} = 0 V or 3.6 V	0.8 to 3.6	0	—	±1	
	I_{OZB}	Function OFF State, V_{OB} = 0 V or 3.6 V	0.8 to 3.6	0.8 to 3.6	—	±1	
		V_{OB} = 0 V or 3.6 V	0	0.8 to 3.6	—	±1	
Input leakage current	I_{IN}	V_{IN}(DIR) = 0 V to 3.6 V	0.8 to 3.6	0 to 3.6	—	±1	μA
Power-OFF leakage current	I_{OFFA}	V_{OA} = 0 V to 3.6 V	0	0.8 to 3.6	—	±1	μA
	I_{OFFB}	V_{OB} = 0 V to 3.6 V	0.8 to 3.6	0	—	±1	
Quiescent supply current	I_{CCA}	Fix the input to V_{CC} or GND.	0.8 to 3.6	0.8 to 3.6	—	5	μA
			3.6	0	—	5	
	I_{CCB}	Fix the input to V_{CC} or GND.	0.8 to 3.6	0.8 to 3.6	—	5	
			0	3.6	—	5	
	I_{CCTA}	V_{IN}(DIR) = V_{CCA}, V_{IOA} = V_{CCA} - 0.6 V (per input)	3.0 to 3.6	0.8 to 3.6	—	500	
	I_{CCTB}	V_{IN}(DIR) = V_{CCB}, V_{IOB} = V_{CCB} - 0.6 V (per input)	0.8 to 3.6	3.0 to 3.6	—	500	

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}	A, DIR		0.8 to 1.95	0.8 to 3.6	V_{CCA} × 0.70	—	V
				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}	B		0.8 to 3.6	0.8 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}	A, DIR		0.8 to 1.95	0.8 to 3.6	—	V_{CCA} × 0.30	V
				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}	B		0.8 to 3.6	0.8 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_{OH}	A, B Output H	I_{OH} = -0.1 mA	0.8 to 3.6	0.8 to 3.6	V_{CCO} -0.1	—	V
			I_{OH} = -0.5 mA	0.85	0.85	0.65	—	
			I_{OH} = -1 mA	0.95	0.95	0.75	—	
			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_{OL}	A, B Output L	I_{OL} = 0.1 mA	0.8 to 3.6	0.8 to 3.6	—	0.1	V
			I_{OL} = 0.5 mA	0.85	0.85	—	0.2	
			I_{OL} = 1 mA	0.95	0.95	—	0.2	
			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	Max	Unit
3-state output OFF-state leakage current	I_{OZA}	Function OFF State, V_{OA} = 0 V or 3.6 V	0.8 to 3.6	0.8 to 3.6	—	±4	μA
		V_{OA} = 0 V or 3.6 V	0.8 to 3.6	0	—	±4	
	I_{OZB}	Function OFF State, V_{OB} = 0 V or 3.6 V	0.8 to 3.6	0.8 to 3.6	—	±4	
		V_{OB} = 0 V or 3.6 V	0	0.8 to 3.6	—	±4	
Input leakage current	I_{IN}	V_{IN}(DIR) = 0 V to 3.6 V	0.8 to 3.6	0 to 3.6	—	±2.5	μA
Power-OFF leakage current	I_{OFFA}	V_{IOA} = 0 V to 3.6 V	0	0.8 to 3.6	—	±4	μA
	I_{OFFB}	V_{IOB} = 0 V to 3.6 V	0.8 to 3.6	0	—	±4	
Quiescent supply current	I_{CCA}	Fix the input to V_{CC} or GND.	0.8 to 3.6	0.8 to 3.6	—	10	μA
			3.6	0	—	10	
	I_{CCB}	Fix the input to V_{CC} or GND.	0.8 to 3.6	0.8 to 3.6	—	10	
			0	3.6	—	10	
	I_{CCTA}	V_{IN}(DIR) = V_{CCA}, V_{IOA} = V_{CCA} - 0.6 V (per input)	3.0 to 3.6	0.8 to 3.6	—	500	
	I_{CCTB}	V_{IN}(DIR) = GND, V_{IOB} = V_{CCB} - 0.6 V (per input)	0.8 to 3.6	3.0 to 3.6	—	500	

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

Characteristics	Symbol	V_{CCB} 0.8 V Typ.	V_{CCB} 0.9 V Typ.	V_{CCB} 1.0 V Typ.	V_{CCB} 1.2 V Typ.	V_{CCB} 1.5 V Typ.	V_{CCB} 1.8 V Typ.	V_{CCB} 2.5 V Typ.	V_{CCB} 3.3 V Typ.	Unit
Propagation delay time (A → B)	t_{PLH}/t_{PHL}	11.4	10.4	9.8	9.8	9.2	9.0	9.7	11.7	ns
Propagation delay time (B → A)		11.4	10.0	9.1	8.0	7.2	6.8	6.2	5.9	
3-state output disable time (DIR → A)	t_{PLZ}/t_{PHZ}	18.7	18.7	18.7	18.6	18.6	18.6	18.7	18.7	
3-state output disable time (DIR → B)		22.0	19.7	17.8	12.4	10.8	10.7	9.9	11.0	
3-state output enable time (DIR → A)	t_{PZL}/t_{PZH} (Note 1)	33.4	29.7	26.9	20.4	18.0	17.5	16.1	16.9	
3-state output enable time (DIR → B)		30.1	29.1	28.5	28.4	27.8	27.6	28.4	30.4	

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

Note1: Output enable time is obtained from the following formula.

Output enable time (DIR → A) = Output disable time (DIR → B) + Propagation delay time (B → A)

Output enable time (DIR → B) = Output disable time (DIR → A) + Propagation delay time (A → B)

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

Characteristics	Symbol	V_{CCA} 0.8 V Typ.	V_{CCA} 0.9 V Typ.	V_{CCA} 1.0 V Typ.	V_{CCA} 1.2 V Typ.	V_{CCA} 1.5 V Typ.	V_{CCA} 1.8 V Typ.	V_{CCA} 2.5 V Typ.	V_{CCA} 3.3 V Typ.	Unit
Propagation delay time (A → B)	t_{PLH}/t_{PHL}	11.4	10.0	9.1	8.0	7.2	6.8	6.2	5.9	ns
Propagation delay time (B → A)		11.4	10.4	9.8	9.8	9.2	9.0	9.7	11.7	
3-state output disable time (DIR → A)	t_{PLZ}/t_{PHZ}	18.7	15.1	12.8	6.9	5.1	4.8	3.3	3.7	
3-state output disable time (DIR → B)		22.0	20.0	19.0	18.6	19.3	19.3	20.6	21.9	
3-state output enable time (DIR → A)	t_{PZL}/t_{PZH} (Note 1)	33.4	30.4	28.8	28.4	28.5	28.3	30.3	33.6	
3-state output enable time (DIR → B)		30.1	25.1	21.9	14.9	12.3	11.6	9.5	9.6	

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

Note 1: Output enable time is obtained from the following formula.

Output enable time (DIR → A) = Output disable time (DIR → B) + Propagation delay time (B → A)

Output enable time (DIR → B) = Output disable time (DIR → A) + Propagation delay time (A → B)

11.5. AC Characteristics (Note) (V_{CCA} = 0.9 ± 0.045 V, T_a = -40 to 85 °C)

Characteristics	Symbol	V_{CCB} 0.9 ± 0.045 V Max	V_{CCB} 1.0 ± 0.05 V Max	V_{CCB} 1.2 ± 0.1 V Max	V_{CCB} 1.5 ± 0.1 V Max	V_{CCB} 1.8 ± 0.15 V Max	V_{CCB} 2.5 ± 0.2 V Max	V_{CCB} 3.3 ± 0.3 V Max	Unit
Propagation delay time (A → B)	t_{PLH}/t_{PHL}	17.7	15.8	15.2	13.8	13.2	13.5	16.7	ns
Propagation delay time (B → A)		17.7	15.2	13.1	11.7	10.7	10.1	10.4	
3-state output disable time (DIR → A)	t_{PLZ}/t_{PHZ}	24.7	24.7	24.7	24.7	24.7	24.8	25.8	
3-state output disable time (DIR → B)		28.1	24.8	18.6	16.1	15.4	13.9	14.6	
3-state output enable time (DIR → A)	t_{PZL}/t_{PZH} (Note 1)	45.8	40.0	31.7	27.8	26.1	24.0	25.0	
3-state output enable time (DIR → B)		42.4	40.5	39.9	38.5	37.9	38.3	42.5	

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

Note 1: Output enable time is obtained from the following formula.

Output enable time (DIR → A) = Output disable time (DIR → B) + Propagation delay time (B → A)

Output enable time (DIR → B) = Output disable time (DIR → A) + Propagation delay time (A → B)

11.6. AC Characteristics (Note) (V_{CCA} = 1.0 ± 0.05 V, T_a = -40 to 85 °C)

Characteristics	Symbol	V_{CCB} 0.9 ± 0.045 V Max	V_{CCB} 1.0 ± 0.05 V Max	V_{CCB} 1.2 ± 0.1 V Max	V_{CCB} 1.5 ± 0.1 V Max	V_{CCB} 1.8 ± 0.15 V Max	V_{CCB} 2.5 ± 0.2 V Max	V_{CCB} 3.3 ± 0.3 V Max	Unit
Propagation delay time (A → B)	t_{PLH}/t_{PHL}	15.2	13.6	12.8	11.6	11.4	10.9	11.1	ns
Propagation delay time (B → A)		15.8	13.6	11.2	10.1	9.1	8.6	8.7	
3-state output disable time (DIR → A)	t_{PLZ}/t_{PHZ}	19.6	19.6	19.6	19.6	19.6	19.6	19.6	
3-state output disable time (DIR → B)		25.8	22.6	16.2	14.0	13.3	12.0	12.3	
3-state output enable time (DIR → A)	t_{PZL}/t_{PZH} (Note 1)	41.6	36.2	27.4	24.1	22.4	20.6	21.0	
3-state output enable time (DIR → B)		34.8	33.2	32.4	31.2	31.0	30.5	30.7	

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

Note 1: Output enable time is obtained from the following formula.

Output enable time (DIR → A) = Output disable time (DIR → B) + Propagation delay time (B → A)

Output enable time (DIR → B) = Output disable time (DIR → A) + Propagation delay time (A → B)

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

Characteristics	Symbol	V_{CCB} 0.9 ± 0.045 V Max	V_{CCB} 1.0 ± 0.05 V Max	V_{CCB} 1.2 ± 0.1 V Max	V_{CCB} 1.5 ± 0.1 V Max	V_{CCB} 1.8 ± 0.15 V Max	V_{CCB} 2.5 ± 0.2 V Max	V_{CCB} 3.3 ± 0.3 V Max	Unit
Propagation delay time (A → B)	t_{PLH}/t_{PHL}	13.1	11.2	10.7	9.3	8.7	8.7	8.6	ns
Propagation delay time (B → A)		15.2	12.8	10.7	9.1	8.5	7.8	7.6	
3-state output disable time (DIR → A)	t_{PLZ}/t_{PHZ}	12.2	12.2	12.2	12.2	12.2	12.2	12.2	
3-state output disable time (DIR → B)		24.3	20.2	14.9	12.0	11.4	9.7	9.8	
3-state output enable time (DIR → A)	t_{PZL}/t_{PZH} (Note 1)	39.5	33.0	25.6	21.1	19.9	17.5	17.4	
3-state output enable time (DIR → B)		25.3	23.4	22.9	21.5	20.9	20.9	20.8	

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

Note 1: Output enable time is obtained from the following formula.

Output enable time (DIR → A) = Output disable time (DIR → B) + Propagation delay time (B → A)

Output enable time (DIR → B) = Output disable time (DIR → A) + Propagation delay time (A → B)

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

Characteristics	Symbol	V_{CCB} 0.9 ± 0.045 V Max	V_{CCB} 1.0 ± 0.05 V Max	V_{CCB} 1.2 ± 0.1 V Max	V_{CCB} 1.5 ± 0.1 V Max	V_{CCB} 1.8 ± 0.15 V Max	V_{CCB} 2.5 ± 0.2 V Max	V_{CCB} 3.3 ± 0.3 V Max	Unit
Propagation delay time (A → B)	t_{PLH}/t_{PHL}	11.7	10.1	9.1	7.4	6.9	6.6	6.5	ns
Propagation delay time (B → A)		13.8	11.6	9.3	7.4	6.8	5.9	5.7	
3-state output disable time (DIR → A)	t_{PLZ}/t_{PHZ}	8.5	8.4	8.4	8.4	8.4	8.3	8.2	
3-state output disable time (DIR → B)		24.2	19.7	11.6	10.1	9.6	7.8	7.9	
3-state output enable time (DIR → A)	t_{PZL}/t_{PZH} (Note 1)	38.0	31.3	20.9	17.5	16.4	13.7	13.6	
3-state output enable time (DIR → B)		20.2	18.5	17.5	15.8	15.3	14.9	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.

Note 1: Output enable time is obtained from the following formula.

Output enable time (DIR → A) = Output disable time (DIR → B) + Propagation delay time (B → A)

Output enable time (DIR → B) = Output disable time (DIR → A) + Propagation delay time (A → B)

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

Characteristics	Symbol	V_{CCB} 0.9 ± 0.045 V Max	V_{CCB} 1.0 ± 0.05 V Max	V_{CCB} 1.2 ± 0.1 V Max	V_{CCB} 1.5 ± 0.1 V Max	V_{CCB} 1.8 ± 0.15 V Max	V_{CCB} 2.5 ± 0.2 V Max	V_{CCB} 3.3 ± 0.3 V Max	Unit
Propagation delay time (A → B)	t_{PLH}/t_{PHL}	10.7	9.1	8.5	6.8	6.2	5.8	5.7	ns
Propagation delay time (B → A)		13.2	11.4	8.7	6.9	6.2	5.3	4.7	
3-state output disable time (DIR → A)	t_{PLZ}/t_{PHZ}	7.3	7.3	7.3	7.3	7.3	7.3	7.2	
3-state output disable time (DIR → B)		25.2	21.6	11.0	8.9	8.6	7.0	7.0	
3-state output enable time (DIR → A)	t_{PZL}/t_{PZH} (Note 1)	38.4	33.0	19.7	15.8	14.8	12.3	11.7	
3-state output enable time (DIR → B)		18.0	16.4	15.8	14.1	13.5	13.1	12.9	

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

Note 1: Output enable time is obtained from the following formula.

Output enable time (DIR → A) = Output disable time (DIR → B) + Propagation delay time (B → A)

Output enable time (DIR → B) = Output disable time (DIR → A) + Propagation delay time (A → B)

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

Characteristics	Symbol	V_{CCB} 0.9 ± 0.045 V Max	V_{CCB} 1.0 ± 0.05 V Max	V_{CCB} 1.2 ± 0.1 V Max	V_{CCB} 1.5 ± 0.1 V Max	V_{CCB} 1.8 ± 0.15 V Max	V_{CCB} 2.5 ± 0.2 V Max	V_{CCB} 3.3 ± 0.3 V Max	Unit
Propagation delay time (A → B)	t_{PLH}/t_{PHL}	10.1	8.6	7.8	5.9	5.3	4.7	4.5	ns
Propagation delay time (B → A)		13.5	10.9	8.7	6.6	5.8	4.7	4.1	
3-state output disable time (DIR → A)	t_{PLZ}/t_{PHZ}	5.6	5.6	5.6	5.6	5.6	5.6	5.6	
3-state output disable time (DIR → B)		28.5	22.9	10.9	7.6	7.1	5.9	6.1	
3-state output enable time (DIR → A)	t_{PZL}/t_{PZH} (Note 1)	42.0	33.8	19.6	14.2	12.9	10.6	10.2	
3-state output enable time (DIR → B)		15.7	14.2	13.4	11.5	10.9	10.3	10.1	

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

Note 1: Output enable time is obtained from the following formula.

Output enable time (DIR → A) = Output disable time (DIR → B) + Propagation delay time (B → A)

Output enable time (DIR → B) = Output disable time (DIR → A) + Propagation delay time (A → B)

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

Characteristics	Symbol	V_{CCB} 0.9 ± 0.045 V Max	V_{CCB} 1.0 ± 0.05 V Max	V_{CCB} 1.2 ± 0.1 V Max	V_{CCB} 1.5 ± 0.1 V Max	V_{CCB} 1.8 ± 0.15 V Max	V_{CCB} 2.5 ± 0.2 V Max	V_{CCB} 3.3 ± 0.3 V Max	Unit
Propagation delay time (A → B)	t_{PLH}/t_{PHL}	10.4	8.7	7.6	5.7	4.7	4.1	3.9	ns
Propagation delay time (B → A)		16.7	11.1	8.6	6.5	5.7	4.5	3.9	
3-state output disable time (DIR → A)	t_{PLZ}/t_{PHZ}	5.7	5.7	5.7	5.7	5.7	5.7	5.7	
3-state output disable time (DIR → B)		27.6	24.6	11.5	6.7	6.3	5.4	5.6	
3-state output enable time (DIR → A)	t_{PZL}/t_{PZH} (Note 1)	44.3	35.7	20.1	13.2	12.0	9.9	9.5	
3-state output enable time (DIR → B)		16.1	14.4	13.3	11.4	10.4	9.8	9.6	

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

Note 1: Output enable time is obtained from the following formula.

Output enable time (DIR → A) = Output disable time (DIR → B) + Propagation delay time (B → A)

Output enable time (DIR → B) = Output disable time (DIR → A) + Propagation delay time (A → B)

11.12. AC Characteristics (Note) (V_{CCA} = 0.9 ± 0.045 V, T_a = -40 to 125 °C)

Characteristics	Symbol	V_{CCB} 0.9 ± 0.045 V Max	V_{CCB} 1.0 ± 0.05 V Max	V_{CCB} 1.2 ± 0.1 V Max	V_{CCB} 1.5 ± 0.1 V Max	V_{CCB} 1.8 ± 0.15 V Max	V_{CCB} 2.5 ± 0.2 V Max	V_{CCB} 3.3 ± 0.3 V Max	Unit
Propagation delay time (A → B)	t_{PLH}/t_{PHL}	17.7	15.8	15.3	13.9	13.4	13.6	16.7	ns
Propagation delay time (B → A)		17.7	15.2	13.1	11.7	10.7	10.1	10.4	
3-state output disable time (DIR → A)	t_{PLZ}/t_{PHZ}	24.7	24.7	24.7	24.7	24.7	24.8	25.8	
3-state output disable time (DIR → B)		28.1	24.8	18.8	16.3	15.6	13.9	14.6	
3-state output enable time (DIR → A)	t_{PZL}/t_{PZH} (Note 1)	45.8	40.0	31.9	28.0	26.3	24.0	25.0	
3-state output enable time (DIR → B)		42.4	40.5	40.0	38.6	38.1	38.4	42.5	

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

Note 1: Output enable time is obtained from the following formula.

Output enable time (DIR → A) = Output disable time (DIR → B) + Propagation delay time (B → A)

Output enable time (DIR → B) = Output disable time (DIR → A) + Propagation delay time (A → B)

11.13. AC Characteristics (Note) (V_{CCA} = 1.0 ± 0.05 V, T_a = -40 to 125 °C)

Characteristics	Symbol	V_{CCB} 0.9 ± 0.045 V Max	V_{CCB} 1.0 ± 0.05 V Max	V_{CCB} 1.2 ± 0.1 V Max	V_{CCB} 1.5 ± 0.1 V Max	V_{CCB} 1.8 ± 0.15 V Max	V_{CCB} 2.5 ± 0.2 V Max	V_{CCB} 3.3 ± 0.3 V Max	Unit
Propagation delay time (A → B)	t_{PLH}/t_{PHL}	15.2	13.7	13.1	11.9	11.7	11.2	11.3	ns
Propagation delay time (B → A)		15.8	13.7	11.4	10.4	9.3	8.8	8.9	
3-state output disable time (DIR → A)	t_{PLZ}/t_{PHZ}	19.8	19.8	19.8	19.8	19.8	20.2	19.9	
3-state output disable time (DIR → B)		25.8	23.0	16.6	14.4	13.7	12.3	12.5	
3-state output enable time (DIR → A)	t_{PZL}/t_{PZH} (Note 1)	41.6	36.7	28.0	24.8	23.0	21.1	21.4	
3-state output enable time (DIR → B)		35.0	33.5	32.9	31.7	31.5	31.4	31.2	

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

Note 1: Output enable time is obtained from the following formula.

Output enable time (DIR → A) = Output disable time (DIR → B) + Propagation delay time (B → A)

Output enable time (DIR → B) = Output disable time (DIR → A) + Propagation delay time (A → B)

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

Characteristics	Symbol	V_{CCB} 0.9 ± 0.045 V Max	V_{CCB} 1.0 ± 0.05 V Max	V_{CCB} 1.2 ± 0.1 V Max	V_{CCB} 1.5 ± 0.1 V Max	V_{CCB} 1.8 ± 0.15 V Max	V_{CCB} 2.5 ± 0.2 V Max	V_{CCB} 3.3 ± 0.3 V Max	Unit
Propagation delay time (A → B)	t_{PLH}/t_{PHL}	13.1	11.4	11.1	9.7	9.1	9.1	9.0	ns
Propagation delay time (B → A)		15.3	13.1	11.1	9.6	8.9	8.2	8.0	
3-state output disable time (DIR → A)	t_{PLZ}/t_{PHZ}	12.6	12.6	12.6	12.6	12.6	12.6	12.6	
3-state output disable time (DIR → B)		24.3	20.9	15.9	12.5	11.8	10.1	10.2	
3-state output enable time (DIR → A)	t_{PZL}/t_{PZH} (Note 1)	39.6	34.0	27.0	22.1	20.7	18.3	18.2	
3-state output enable time (DIR → B)		25.7	24.0	23.7	22.3	21.7	21.7	21.6	

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

Note 1: Output enable time is obtained from the following formula.

Output enable time (DIR → A) = Output disable time (DIR → B) + Propagation delay time (B → A)

Output enable time (DIR → B) = Output disable time (DIR → A) + Propagation delay time (A → B)

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

Characteristics	Symbol	V_{CCB} 0.9 ± 0.045 V Max	V_{CCB} 1.0 ± 0.05 V Max	V_{CCB} 1.2 ± 0.1 V Max	V_{CCB} 1.5 ± 0.1 V Max	V_{CCB} 1.8 ± 0.15 V Max	V_{CCB} 2.5 ± 0.2 V Max	V_{CCB} 3.3 ± 0.3 V Max	Unit
Propagation delay time (A → B)	t_{PLH}/t_{PHL}	11.7	10.4	9.6	7.8	7.3	7.0	6.9	ns
Propagation delay time (B → A)		13.9	11.9	9.7	7.8	7.2	6.3	6.0	
3-state output disable time (DIR → A)	t_{PLZ}/t_{PHZ}	8.8	8.8	8.8	8.8	8.8	8.7	8.7	
3-state output disable time (DIR → B)		24.8	19.9	12.0	10.6	10.1	8.3	8.3	
3-state output enable time (DIR → A)	t_{PZL}/t_{PZH} (Note 1)	38.7	31.8	21.7	18.4	17.3	14.6	14.3	
3-state output enable time (DIR → B)		20.5	19.2	18.4	16.6	16.1	15.7	15.6	

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

Note 1: Output enable time is obtained from the following formula.

Output enable time (DIR → A) = Output disable time (DIR → B) + Propagation delay time (B → A)

Output enable time (DIR → B) = Output disable time (DIR → A) + Propagation delay time (A → B)

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

Characteristics	Symbol	V_{CCB} 0.9 ± 0.045 V Max	V_{CCB} 1.0 ± 0.05 V Max	V_{CCB} 1.2 ± 0.1 V Max	V_{CCB} 1.5 ± 0.1 V Max	V_{CCB} 1.8 ± 0.15 V Max	V_{CCB} 2.5 ± 0.2 V Max	V_{CCB} 3.3 ± 0.3 V Max	Unit
Propagation delay time (A → B)	t_{PLH}/t_{PHL}	10.7	9.3	8.9	7.2	6.5	6.1	6.0	ns
Propagation delay time (B → A)		7.7	11.7	9.1	7.3	6.5	5.7	5.0	
3-state output disable time (DIR → A)	t_{PLZ}/t_{PHZ}	7.7	7.7	7.7	7.7	7.6	7.6	7.5	
3-state output disable time (DIR → B)		25.8	21.8	11.4	9.4	9.1	7.5	7.4	
3-state output enable time (DIR → A)	t_{PZL}/t_{PZH} (Note 1)	39.2	33.5	20.5	16.7	15.6	13.2	12.4	
3-state output enable time (DIR → B)		18.4	17.0	16.6	14.9	14.1	13.7	13.5	

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

Note 1: Output enable time is obtained from the following formula.

Output enable time (DIR → A) = Output disable time (DIR → B) + Propagation delay time (B → A)

Output enable time (DIR → B) = Output disable time (DIR → A) + Propagation delay time (A → B)

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

Characteristics	Symbol	V_{CCB} 0.9 ± 0.045 V Max	V_{CCB} 1.0 ± 0.05 V Max	V_{CCB} 1.2 ± 0.1 V Max	V_{CCB} 1.5 ± 0.1 V Max	V_{CCB} 1.8 ± 0.15 V Max	V_{CCB} 2.5 ± 0.2 V Max	V_{CCB} 3.3 ± 0.3 V Max	Unit
Propagation delay time (A → B)	t_{PLH}/t_{PHL}	10.1	8.8	8.2	6.3	5.7	5.0	4.7	ns
Propagation delay time (B → A)		13.6	11.2	9.1	7.0	6.1	5.0	4.4	
3-state output disable time (DIR → A)	t_{PLZ}/t_{PHZ}	5.8	5.8	5.8	5.8	5.8	5.8	5.8	
3-state output disable time (DIR → B)		29.1	23.1	11.3	8.0	7.5	6.4	6.5	
3-state output enable time (DIR → A)	t_{PZL}/t_{PZH} (Note 1)	42.7	34.3	20.4	15.0	13.6	11.4	10.9	
3-state output enable time (DIR → B)		15.9	14.6	14.0	12.1	11.5	10.8	10.5	

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

Note 1: Output enable time is obtained from the following formula.

Output enable time (DIR → A) = Output disable time (DIR → B) + Propagation delay time (B → A)

Output enable time (DIR → B) = Output disable time (DIR → A) + Propagation delay time (A → B)

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

Characteristics	Symbol	V_{CCB} 0.9 ± 0.045 V Max	V_{CCB} 1.0 ± 0.05 V Max	V_{CCB} 1.2 ± 0.1 V Max	V_{CCB} 1.5 ± 0.1 V Max	V_{CCB} 1.8 ± 0.15 V Max	V_{CCB} 2.5 ± 0.2 V Max	V_{CCB} 3.3 ± 0.3 V Max	Unit
Propagation delay time (A → B)	t_{PLH}/t_{PHL}	10.4	8.9	8.0	6.0	5.0	4.4	4.1	ns
Propagation delay time (B → A)		16.7	11.3	9.0	6.9	6.0	4.7	4.1	
3-state output disable time (DIR → A)	t_{PLZ}/t_{PHZ}	6.0	6.0	6.0	6.0	6.0	6.0	5.9	
3-state output disable time (DIR → B)		27.6	24.7	11.8	7.3	6.8	5.7	6.0	
3-state output enable time (DIR → A)	t_{PZL}/t_{PZH} (Note 1)	44.3	36.0	20.8	14.2	12.8	10.4	10.1	
3-state output enable time (DIR → B)		16.4	14.9	14.0	12.0	11.0	10.4	10.0	

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

Note 1: Output enable time is obtained from the following formula.

Output enable time (DIR → A) = Output disable time (DIR → B) + Propagation delay time (B → A)

Output enable time (DIR → B) = Output disable time (DIR → A) + Propagation delay time (A → B)

11.19. 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} 0.9 V Typ.	V_{CCA}, V_{CCB} 1.0 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	$C_{I/OA}$		A = OFF, V_{IOA} = 0 V or 3.3 V	—	—	—	—	—	—	—	5	pF
	$C_{I/OB}$		B = OFF, V_{IOB} = 0 V or 3.3 V	—	—	—	—	—	—	—	5	
Power dissipation capacitance	C_{PDA}	(Note 1)	A → B	1.5	1.5	1.5	1.5	2	2	2	2.5	pF
			B → A	13	13	13	13.5	13.5	14	14.5	15	
	C_{PDB}	(Note 1)	A → B	13	13	13	13.5	13.5	14	14.5	15	
			B → A	1.5	1.5	1.5	1.5	2	2	2	2.5	

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.

$I_{CC(opr)} = C_{PD} \times V_{CC} \times f_{IN} + I_{CC} / 2$ (per bit)

12. AC Test Circuit

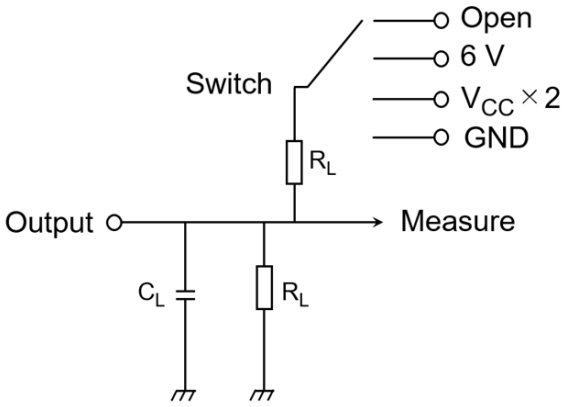


Fig. 12.1 AC Test Circuit

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 Circui

Symbol	V_{CC} = 0.8 V	V_{CC} = 0.9 ± 0.045 V V_{CC} = 1.0 ± 0.05 V	V_{CC} = 1.2 ± 0.1 V V_{CC} = 1.5 ± 0.1 V	V_{CC} = 1.8 ± 0.15 V V_{CC} = 2.5 ± 0.2 V	V_{CC} = 3.3 ± 0.3 V
R_L	10 kΩ	10 kΩ	2 kΩ	2 kΩ	2 kΩ
C_L	5 pF	5 pF	15 pF	15 pF	15 pF

13. AC Waveform

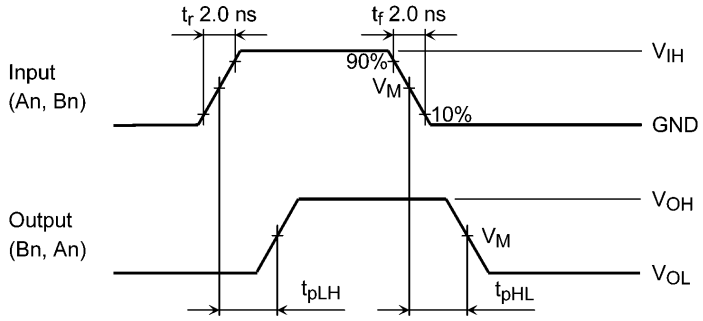


Fig. 13.1 t_{PLH}, t_{PHL}

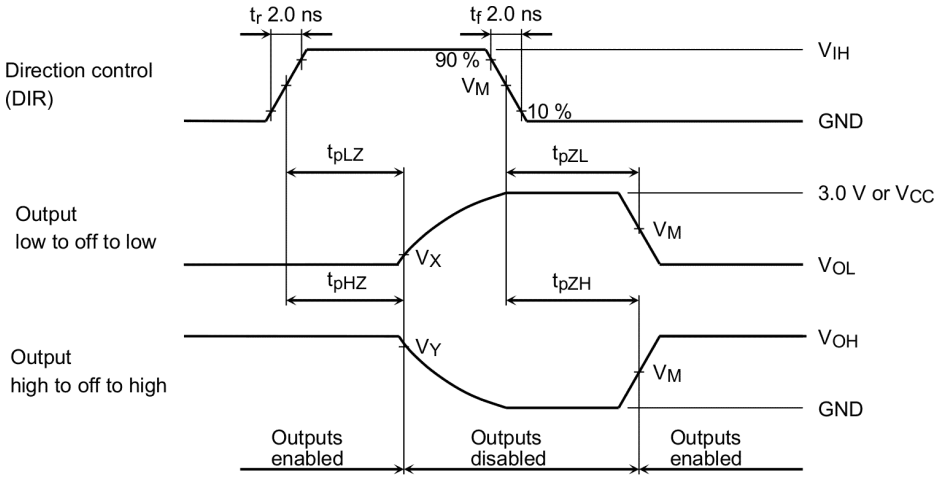


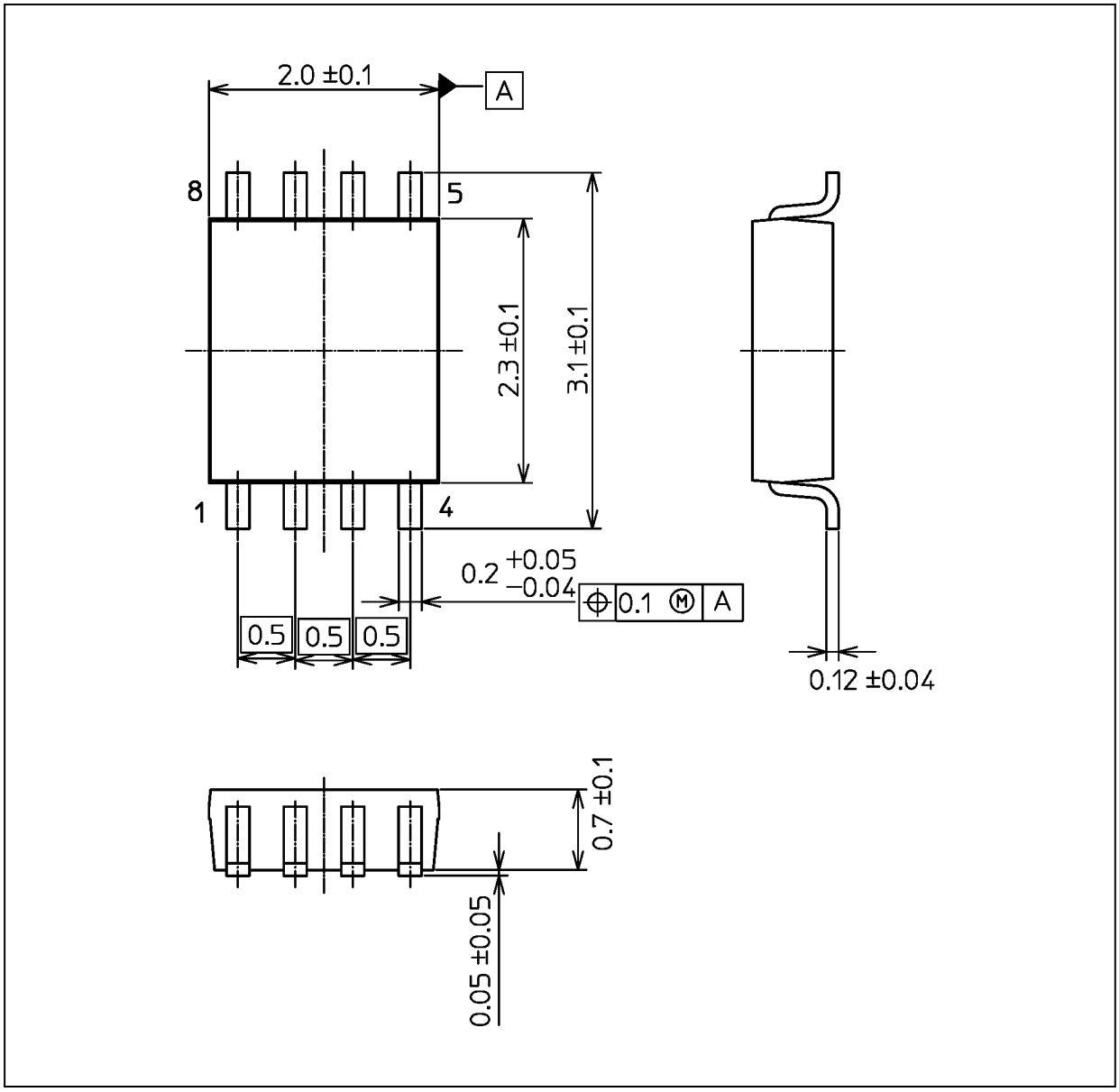
Fig. 13.2 t_{PLZ}, t_{PHZ}, t_{PZL}, t_{PZH}

Table 13.1.1 AC Waveform Symbols

Symbol	V_{CC} = 0.8 V	V_{CC} = 1.0 ± 0.05 V V_{CC} = 0.9 ± 0.045 V	V_{CC} = 1.5 ± 0.1 V V_{CC} = 1.2 ± 0.1 V	V_{CC} = 2.5 ± 0.2 V V_{CC} = 1.8 ± 0.15 V	V_{CC} = 3.3 ± 0.3 V
V_{IH}	V_{CC}	V_{CC}	V_{CC}	V_{CC}	V_{CC}
V_M	V_{CC} / 2	V_{CC} / 2	V_{CC} / 2	V_{CC} / 2	V_{CC} / 2
V_X	V_{OL} + 0.1 V	V_{OL} + 0.1 V	V_{OL} + 0.1 V	V_{OL} + 0.15 V	V_{OL} + 0.3 V
V_Y	V_{OH} - 0.1 V	V_{OH} - 0.1 V	V_{OH} - 0.1 V	V_{OH} - 0.15 V	V_{OH} - 0.3 V

Package Dimensions

Unit: mm



Weight: 0.01 g (typ.)

Package Name(s)
JEDEC: SOT-765
Nickname: US8

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