

TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

# TC74VCX163245FT

## 16-Bit Dual Supply Bus Transceiver

The TC74VCX163245FT is a dual supply, advanced high-speed CMOS 16-bit dual supply voltage interface bus transceiver fabricated with silicon gate CMOS technology.

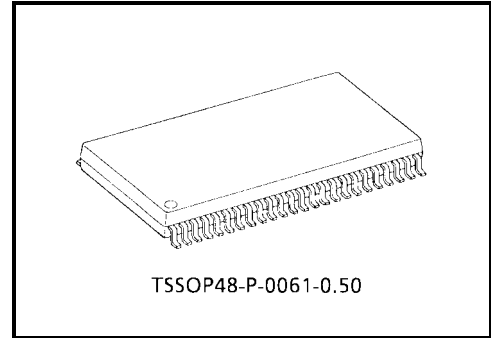
It is also designed with over voltage tolerant inputs and outputs up to 3.6 V.

Designed for use as an interface between a 1.8-V or 2.5-V bus and a 2.5-V or 3.6-V bus in mixed 1.8-V or 2.5-V/2.5-V or 3.6-V supply systems.

The B-port interfaces with the 1.8-V or 2.5-V bus, the A-port with the 2.5-V or 3.6-V bus.

The direction of data transmission is determined by the level of the DIR input. The enable input ( $\overline{OE}$ ) can be used to disable the device so that the buses are effectively isolated.

All inputs are equipped with protection circuits against static discharge or transient excess voltage.



Weight: 0.25 g (typ.)

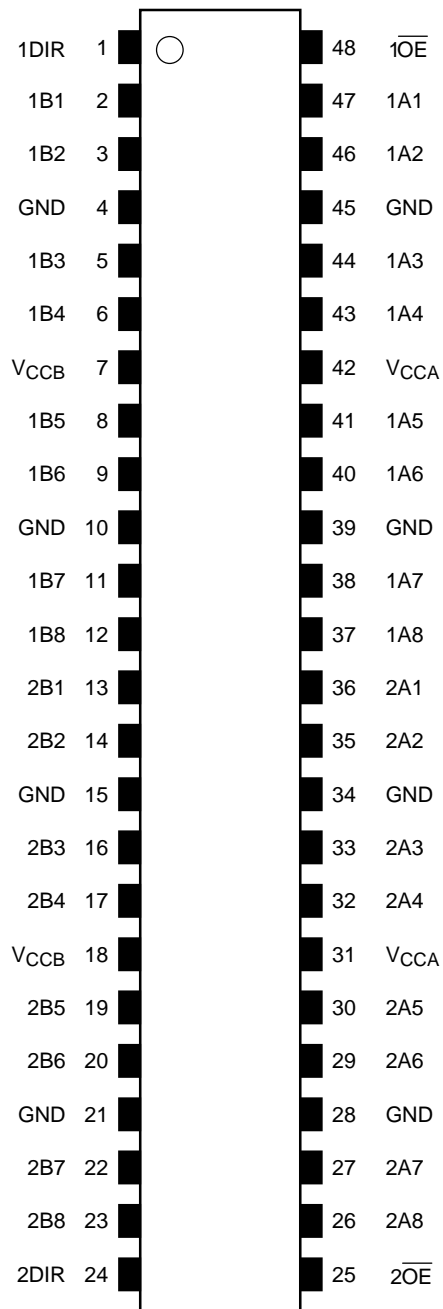
## Features

- Bidirectional interface between 1.8-V and 2.5 V, 1.8-V and 3.6-V or 2.5 V and 3.6-V buses
- High-speed operation:  $t_{pd} = 7.0 \text{ ns (max)}$  ( $V_{CCB} = 1.8 \pm 0.15 \text{ V}$ ,  $V_{CCA} = 2.5 \pm 0.2 \text{ V}$ )  
     :  $t_{pd} = 7.1 \text{ ns (max)}$  ( $V_{CCB} = 1.8 \pm 0.15 \text{ V}$ ,  $V_{CCA} = 3.3 \pm 0.3 \text{ V}$ )  
     :  $t_{pd} = 4.6 \text{ ns (max)}$  ( $V_{CCB} = 2.5 \pm 0.2 \text{ V}$ ,  $V_{CCA} = 3.3 \pm 0.3 \text{ V}$ )
- Output current:  $I_{OH}/I_{OL} = \pm 24 \text{ mA (min)}$  ( $V_{CC} = 3.0 \text{ V}$ )  
     :  $I_{OH}/I_{OL} = \pm 18 \text{ mA (min)}$  ( $V_{CC} = 2.3 \text{ V}$ )  
     :  $I_{OH}/I_{OL} = \pm 6 \text{ mA (min)}$  ( $V_{CC} = 1.65 \text{ V}$ )
- Latch-up performance:  $\pm 300 \text{ mA}$
- ESD performance: Machine model  $> \pm 200 \text{ V}$   
     : Human body model  $> \pm 2000 \text{ V}$
- Package: TSSOP (thin shrink small outline package)
- 3.6-V tolerant function and power-down protection provided on all inputs and outputs

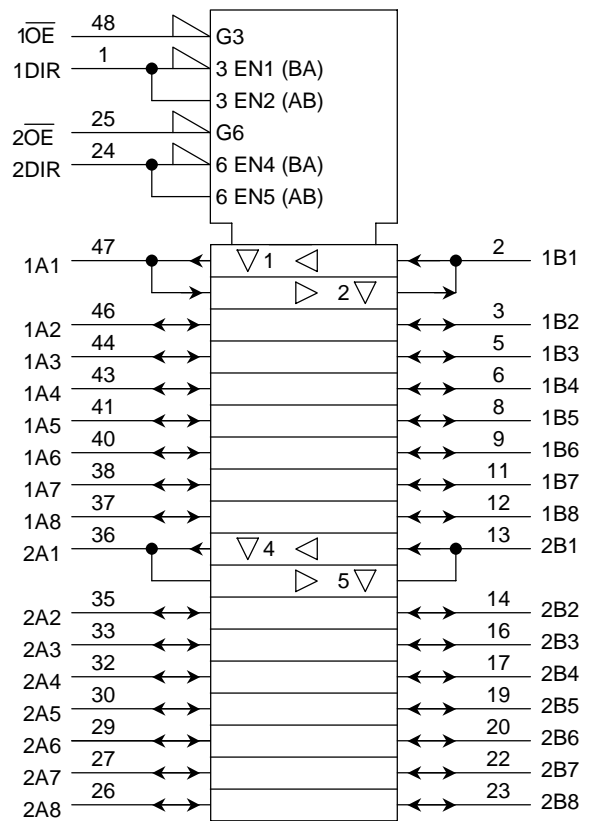
Note 1: Do not apply a signal to any bus pins when it is in the output mode. Damage may result.

All floating (high impedance) bus pins must have their input level fixed by means of pull-up or pull-down resistors.

## Pin Assignment (top view)



## IEC Logic Symbol



## Truth Table

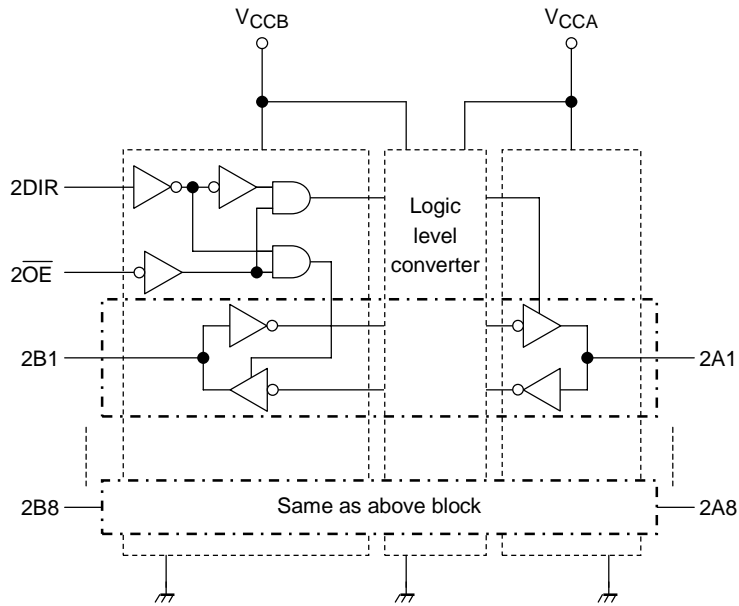
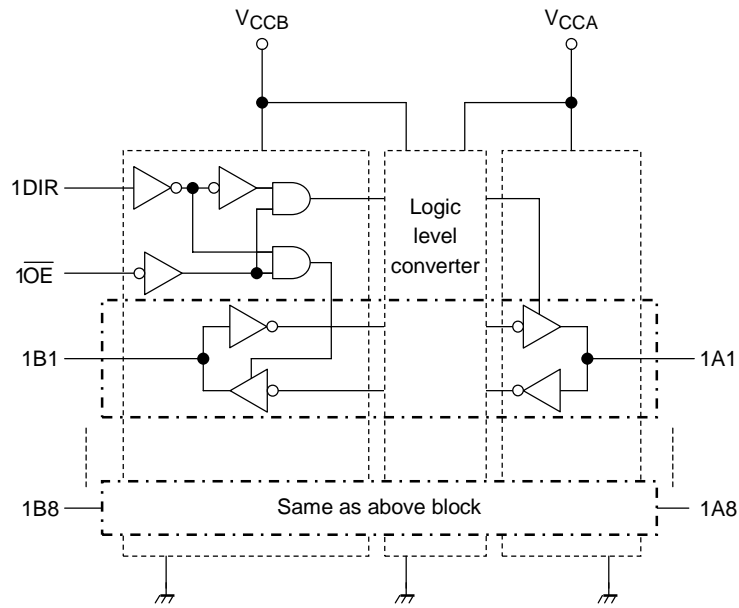
Inputs		Function		Outputs
$\overline{1OE}$	1DIR	Bus 1A1-1A8	Bus 1B1-1B8	
L	L	Output	Input	A = B
L	H	Input	Output	B = A
H	X	Z		Z

Inputs		Function		Outputs
$\overline{2OE}$	2DIR	Bus 2A1-2A8	Bus 2B1-2B8	
L	L	Output	Input	A = B
L	H	Input	Output	B = A
H	X	Z		Z

X: Don't care

Z: High impedance

**Block Diagram**



## Maximum Ratings

Characteristics	Symbol	Rating	Unit
Power supply voltage (Note 2)	$V_{CCB}$	-0.5 to 4.6	V
	$V_{CCA}$	-0.5 to 4.6	
DC input voltage (DIR, $\overline{OE}$ )	$V_{IN}$	-0.5 to 4.6	V
DC bus I/O voltage	$V_{I/OB}$	-0.5 to 4.6 (Note 3)	V
		-0.5 to $V_{CCB} + 0.5$ (Note 4)	
	$V_{I/OA}$	-0.5 to 4.6 (Note 3)	
		-0.5 to $V_{CCA} + 0.5$ (Note 4)	
Input diode current	$I_{IK}$	-50	mA
Output diode current	$I_{I/OK}$	$\pm 50$ (Note 5)	mA
DC output current	$I_{OUTB}$	$\pm 50$	mA
	$I_{OUTA}$	$\pm 50$	
DC $V_{CC}$ /ground current per supply pin	$I_{CCB}$	$\pm 100$	mA
	$I_{CCA}$	$\pm 100$	
Power dissipation	$P_D$	400	mW
Storage temperature	$T_{stg}$	-65 to 150	$^{\circ}C$

Note 2: Don't supply a voltage to  $V_{CCA}$  pin when  $V_{CCB}$  is in the OFF state.

Note 3: Output in OFF state

Note 4: High or low state.  $I_{OUT}$  absolute maximum rating must be observed.

Note 5:  $V_{OUT} < GND$ ,  $V_{OUT} > V_{CC}$

## Recommended Operating Conditions

Characteristics	Symbol	Rating	Unit
Power supply voltage	$V_{CCB}$	1.65 to 2.7	V
	$V_{CCA}$	2.3 to 3.6	
Input voltage (DIR, $\overline{OE}$ )	$V_{IN}$	0 to 3.6	V
Bus I/O voltage	$V_{IOB}$	0 to 3.6 (Note 6)	V
		0 to $V_{CCB}$ (Note 7)	
	$V_{IOA}$	0 to 3.6 (Note 6)	
		0 to $V_{CCA}$ (Note 7)	
Output current	$I_{OUTB}$	$\pm 18$ (Note 8)	mA
		$\pm 6$ (Note 9)	
	$I_{OUTA}$	$\pm 24$ (Note 10)	
		$\pm 18$ (Note 11)	
Operating temperature	$T_{opr}$	-40 to 85	$^{\circ}\text{C}$
Input rise and fall time	dt/dv	0 to 10 (Note 12)	ns/V

Note 6: Output in OFF state

Note 7: High or low state

Note 8:  $V_{CCB} = 2.3$  to  $2.7$  V

Note 9:  $V_{CCB} = 1.65$  to  $1.95$  V

Note 10:  $V_{CCA} = 3.0$  to  $3.6$  V

Note 11:  $V_{CCA} = 2.3$  to  $2.7$  V

Note 12:  $V_{IN} = 0.8$  to  $2.0$  V,  $V_{CCB} = 2.5$  V,  $V_{CCA} = 3.0$  V

## Electrical Characteristics

### DC Characteristics ( $V_{CCB} = 1.8 \pm 0.15 \text{ V}$ , $V_{CCA} = 2.5 \pm 0.2 \text{ V}$ )

Characteristics	Symbol	Test Condition	$V_{CCB} \text{ (V)}$	$V_{CCA} \text{ (V)}$	$T_a = -40 \sim 85^\circ\text{C}$		Unit	
					Min	Max		
H-level input voltage	$V_{IHB}$	DIR, $\overline{OE}$ , Bn	$1.8 \pm 0.15$	$2.5 \pm 0.2$	$0.65 \times V_{CC}$	—	V	
	$V_{IHA}$	An	$1.8 \pm 0.15$	$2.5 \pm 0.2$	1.6	—		
L-level input voltage	$V_{ILB}$	DIR, $\overline{OE}$ , Bn	$1.8 \pm 0.15$	$2.5 \pm 0.2$	—	$0.35 \times V_{CC}$	V	
	$V_{ILA}$	An	$1.8 \pm 0.15$	$2.5 \pm 0.2$	—	0.7		
H-level output voltage	$V_{OHB}$	$V_{IN} = V_{IH} \text{ or } V_{IL}$	$I_{OHB} = -100 \mu\text{A}$	$1.8 \pm 0.15$	$2.5 \pm 0.2$	$V_{CCB} - 0.2$	—	V
			$I_{OHB} = -6 \text{ mA}$	1.65	$2.5 \pm 0.2$	1.25	—	
	$V_{OHA}$		$I_{OHA} = -100 \mu\text{A}$	$1.8 \pm 0.15$	$2.5 \pm 0.2$	$V_{CCA} - 0.2$	—	
			$I_{OHA} = -18 \text{ mA}$	$1.8 \pm 0.15$	2.3	1.7	—	
L-level output voltage	$V_{OLB}$	$V_{IN} = V_{IH} \text{ or } V_{IL}$	$I_{OLB} = 100 \mu\text{A}$	$1.8 \pm 0.15$	$2.5 \pm 0.2$	—	0.2	V
			$I_{OLB} = 6 \text{ mA}$	1.65	$2.5 \pm 0.2$	—	0.3	
	$V_{OLA}$		$I_{OLA} = 100 \mu\text{A}$	$1.8 \pm 0.15$	$2.5 \pm 0.2$	—	0.2	
			$I_{OLA} = 18 \text{ mA}$	$1.8 \pm 0.15$	2.3	—	0.6	
3-state output OFF state current	$I_{OZB}$	$V_{IN} = V_{IH} \text{ or } V_{IL}$ $V_{OUT} = 0 \text{ to } 3.6 \text{ V}$	$1.8 \pm 0.15$	$2.5 \pm 0.2$	—	$\pm 10$	$\mu\text{A}$	
	$I_{OZA}$	$V_{IN} = V_{IH} \text{ or } V_{IL}$ $V_{OUT} = 0 \text{ to } 3.6 \text{ V}$	$1.8 \pm 0.15$	$2.5 \pm 0.2$	—	$\pm 10$		
Input leakage current	$I_{IN}$	$V_{IN} \text{ (DIR, } \overline{OE}) = 0 \text{ to } 3.6 \text{ V}$	$1.8 \pm 0.15$	$2.5 \pm 0.2$	—	$\pm 5.0$	$\mu\text{A}$	
Power-off leakage current	$I_{OFF}$	$V_{IN}, V_{OUT} = 0 \text{ to } 3.6 \text{ V}$	0	0	—	10	$\mu\text{A}$	
Quiescent supply current	$I_{CCB}$	$V_{INA} = V_{CCA} \text{ or GND}$ $V_{INB} = V_{CCB} \text{ or GND}$	$1.8 \pm 0.15$	$2.5 \pm 0.2$	—	20	$\mu\text{A}$	
	$I_{CCA}$	$V_{INA} = V_{CCA} \text{ or GND}$ $V_{INB} = V_{CCB} \text{ or GND}$	$1.8 \pm 0.15$	$2.5 \pm 0.2$	—	20		
	$I_{CCB}$	$V_{CCB} < (V_{IN}, V_{OUT}) \leq 3.6 \text{ V}$	$1.8 \pm 0.15$	$2.5 \pm 0.2$	—	$\pm 20$	$\mu\text{A}$	
	$I_{CCA}$	$V_{CCA} \leq (V_{IN}, V_{OUT}) \leq 3.6 \text{ V}$	$1.8 \pm 0.15$	$2.5 \pm 0.2$	—	$\pm 20$		
	$I_{CCTB}$	$V_{INB} = V_{CCB} - 0.6 \text{ V per input}$	$1.8 \pm 0.15$	$2.5 \pm 0.2$	—	750	$\mu\text{A}$	
	$I_{CCTA}$	$V_{INA} = V_{CCA} - 0.6 \text{ V per input}$	$1.8 \pm 0.15$	$2.5 \pm 0.2$	—	750	$\mu\text{A}$	

**DC Characteristics ( $V_{CCB} = 1.8 \pm 0.15$  V,  $V_{CCA} = 3.3 \pm 0.3$  V)**

Characteristics	Symbol	Test Condition	$V_{CCB}$ (V)	$V_{CCA}$ (V)	$T_a = -40 \sim 85^\circ\text{C}$		Unit	
					Min	Max		
H-level input voltage	$V_{IHB}$	DIR, $\overline{OE}$ , Bn	$1.8 \pm 0.15$	$3.3 \pm 0.3$	$0.65 \times V_{CC}$	—	V	
	$V_{IHA}$	An	$1.8 \pm 0.15$	$3.3 \pm 0.3$	2.0	—		
L-level input voltage	$V_{ILB}$	DIR, $\overline{OE}$ , Bn	$1.8 \pm 0.15$	$3.3 \pm 0.3$	—	$0.35 \times V_{CC}$	V	
	$V_{ILA}$	An	$1.8 \pm 0.15$	$3.3 \pm 0.3$	—	0.8		
H-level output voltage	$V_{OHB}$	$V_{IN} = V_{IH}$ or $V_{IL}$	$I_{OHB} = -100 \mu\text{A}$	$1.8 \pm 0.15$	$3.3 \pm 0.3$	$V_{CCB} - 0.2$	—	V
			$I_{OHB} = -6 \text{ mA}$	1.65	$3.3 \pm 0.3$	1.25	—	
	$V_{OHA}$		$I_{OHA} = -100 \mu\text{A}$	$1.8 \pm 0.15$	$3.3 \pm 0.3$	$V_{CCA} - 0.2$	—	
			$I_{OHA} = -24 \text{ mA}$	$1.8 \pm 0.15$	3.0	2.2	—	
L-level output voltage	$V_{OLB}$	$V_{IN} = V_{IH}$ or $V_{IL}$	$I_{OLB} = 100 \mu\text{A}$	$1.8 \pm 0.15$	$3.3 \pm 0.3$	—	0.2	V
			$I_{OLB} = 6 \text{ mA}$	1.65	$3.3 \pm 0.3$	—	0.3	
	$V_{OLA}$		$I_{OLA} = 100 \mu\text{A}$	$1.8 \pm 0.15$	$3.3 \pm 0.3$	—	0.2	
			$I_{OLA} = 24 \text{ mA}$	$1.8 \pm 0.15$	3.0	—	0.55	
3-state output OFF state current	$I_{OZB}$	$V_{IN} = V_{IH}$ or $V_{IL}$ $V_{OUT} = 0$ to 3.6 V	$1.8 \pm 0.15$	$3.3 \pm 0.3$	—	$\pm 10$	$\mu\text{A}$	
	$I_{OZA}$	$V_{IN} = V_{IH}$ or $V_{IL}$ $V_{OUT} = 0$ to 3.6 V	$1.8 \pm 0.15$	$3.3 \pm 0.3$	—	$\pm 10$		
Input leakage current	$I_{IN}$	$V_{IN}$ (DIR, $\overline{OE}$ ) = 0 to 3.6 V	$1.8 \pm 0.15$	$3.3 \pm 0.3$	—	$\pm 5.0$	$\mu\text{A}$	
Power-off leakage current	$I_{OFF}$	$V_{IN}, V_{OUT} = 0$ to 3.6 V	0	0	—	10	$\mu\text{A}$	
Quiescent supply current	$I_{CCB}$	$V_{INA} = V_{CCA}$ or GND $V_{INB} = V_{CCB}$ or GND	$1.8 \pm 0.15$	$3.3 \pm 0.3$	—	20	$\mu\text{A}$	
	$I_{CCA}$	$V_{INA} = V_{CCA}$ or GND $V_{INB} = V_{CCB}$ or GND	$1.8 \pm 0.15$	$3.3 \pm 0.3$	—	20		
	$I_{CCB}$	$V_{CCB} < (V_{IN}, V_{OUT}) \leq 3.6$ V	$1.8 \pm 0.15$	$3.3 \pm 0.3$	—	$\pm 20$	$\mu\text{A}$	
	$I_{CCA}$	$V_{CCA} \leq (V_{IN}, V_{OUT}) \leq 3.6$ V	$1.8 \pm 0.15$	$3.3 \pm 0.3$	—	$\pm 20$		
	$I_{CCTB}$	$V_{INB} = V_{CCB} - 0.6$ V per input	$1.8 \pm 0.15$	$3.3 \pm 0.3$	—	750	$\mu\text{A}$	
	$I_{CCTA}$	$V_{INA} = V_{CCA} - 0.6$ V per input	$1.8 \pm 0.15$	$3.3 \pm 0.3$	—	750	$\mu\text{A}$	



## DC Characteristics ( $V_{CCB} = 2.5 \pm 0.2$ V, $V_{CCA} = 3.3 \pm 0.3$ V)

Characteristics	Symbol	Test Condition	$V_{CCB}$ (V)	$V_{CCA}$ (V)	$T_a = -40 \sim 85^\circ\text{C}$		Unit	
					Min	Max		
H-level input voltage	$V_{IHB}$	DIR, $\overline{OE}$ , Bn	$2.5 \pm 0.2$	$3.3 \pm 0.3$	1.6	—	V	
	$V_{IHA}$	An	$2.5 \pm 0.2$	$3.3 \pm 0.3$	2.0	—		
L-level input voltage	$V_{ILB}$	DIR, $\overline{OE}$ , Bn	$2.5 \pm 0.2$	$3.3 \pm 0.3$	—	0.7	V	
	$V_{ILA}$	An	$2.5 \pm 0.2$	$3.3 \pm 0.3$	—	0.8		
H-level output voltage	$V_{OHB}$	$V_{IN} = V_{IH}$ or $V_{IL}$	$I_{OHB} = -100 \mu\text{A}$	$2.5 \pm 0.2$	$3.3 \pm 0.3$	$V_{CCB} - 0.2$	—	V
			$I_{OHB} = -18 \text{ mA}$	2.3	$3.3 \pm 0.3$	1.7	—	
	$V_{OHA}$		$I_{OHA} = -100 \mu\text{A}$	$2.5 \pm 0.2$	$3.3 \pm 0.3$	$V_{CCA} - 0.2$	—	
			$I_{OHA} = -24 \text{ mA}$	$2.5 \pm 0.2$	3.0	2.2	—	
L-level output voltage	$V_{OLB}$	$V_{IN} = V_{IH}$ or $V_{IL}$	$I_{OLB} = 100 \mu\text{A}$	$2.5 \pm 0.2$	$3.3 \pm 0.3$	—	0.2	V
			$I_{OLB} = 18 \text{ mA}$	2.3	$3.3 \pm 0.3$	—	0.6	
	$V_{OLA}$		$I_{OLA} = 100 \mu\text{A}$	$2.5 \pm 0.2$	$3.3 \pm 0.3$	—	0.2	
			$I_{OLA} = 24 \text{ mA}$	$2.5 \pm 0.2$	3.0	—	0.55	
3-state output OFF state current	$I_{OZB}$	$V_{IN} = V_{IH}$ or $V_{IL}$ $V_{OUT} = 0$ to $3.6$ V	$2.5 \pm 0.2$	$3.3 \pm 0.3$	—	$\pm 10$	$\mu\text{A}$	
	$I_{OZA}$	$V_{IN} = V_{IH}$ or $V_{IL}$ $V_{OUT} = 0$ to $3.6$ V	$2.5 \pm 0.2$	$3.3 \pm 0.3$	—	$\pm 10$		
Input leakage current	$I_{IN}$	$V_{IN}$ (DIR, $\overline{OE}$ ) = $0$ to $3.6$ V	$2.5 \pm 0.2$	$3.3 \pm 0.3$	—	$\pm 5.0$	$\mu\text{A}$	
Power-off leakage current	$I_{OFF}$	$V_{IN}, V_{OUT} = 0$ to $3.6$ V	0	0	—	10	$\mu\text{A}$	
Quiescent supply current	$I_{CCB}$	$V_{INA} = V_{CCA}$ or GND $V_{INB} = V_{CCB}$ or GND	$2.5 \pm 0.2$	$3.3 \pm 0.3$	—	20	$\mu\text{A}$	
	$I_{CCA}$	$V_{INA} = V_{CCA}$ or GND $V_{INB} = V_{CCB}$ or GND	$2.5 \pm 0.2$	$3.3 \pm 0.3$	—	20		
	$I_{CCB}$	$V_{CCB} < (V_{IN}, V_{OUT}) \leq 3.6$ V	$2.5 \pm 0.2$	$3.3 \pm 0.3$	—	$\pm 20$	$\mu\text{A}$	
	$I_{CCA}$	$V_{CCA} \leq (V_{IN}, V_{OUT}) \leq 3.6$ V	$2.5 \pm 0.2$	$3.3 \pm 0.3$	—	$\pm 20$		
	$I_{CCTB}$	$V_{INB} = V_{CCB} - 0.6$ V per input	$2.5 \pm 0.2$	$3.3 \pm 0.3$	—	750	$\mu\text{A}$	
	$I_{CCTA}$	$V_{INA} = V_{CCA} - 0.6$ V per input	$2.5 \pm 0.2$	$3.3 \pm 0.3$	—	750	$\mu\text{A}$	

## AC Characteristics (Ta = -40~85°C, Input: tr = tf = 2.0 ns, CL = 30 pF, RL = 500 Ω)

VCCB = 1.8 ± 0.15 V, VCCA = 2.5 ± 0.2 V

Characteristics	Symbol	Test Condition	Min	Max	Unit
Propagation delay time (Bn → An)	t <sub>pLH</sub> t <sub>pHL</sub>	Figure 1, Figure 2	0.8	5.8	ns
3-state output enable time ( $\overline{OE}$ → An)	t <sub>pZL</sub> t <sub>pZH</sub>	Figure 1, Figure 3	0.8	6.9	
3-state output disable time ( $\overline{OE}$ → An)	t <sub>pLZ</sub> t <sub>pHZ</sub>	Figure 1, Figure 3	0.8	6.4	
Propagation delay time (An → Bn)	t <sub>pLH</sub> t <sub>pHL</sub>	Figure 1, Figure 2	1.5	7.0	ns
3-state output enable time ( $\overline{OE}$ → Bn)	t <sub>pZL</sub> t <sub>pZH</sub>	Figure 1, Figure 3	1.5	11.0	
3-state output disable time ( $\overline{OE}$ → Bn)	t <sub>pLZ</sub> t <sub>pHZ</sub>	Figure 1, Figure 3	0.8	7.0	
Output to output skew	t <sub>osLH</sub> t <sub>osHL</sub>	(Note 12)	—	0.5	ns

Note 13: Parameter guaranteed by design.

$$(t_{osLH} = |t_{pLHm} - t_{pLHn}|, t_{osHL} = |t_{pHLm} - t_{pHLn}|)$$

VCCB = 1.8 ± 0.15 V, VCCA = 3.3 ± 0.3 V

Characteristics	Symbol	Test Condition	Min	Max	Unit
Propagation delay time (Bn → An)	t <sub>pLH</sub> t <sub>pHL</sub>	Figure 1, Figure 2	0.6	5.5	ns
3-state output enable time ( $\overline{OE}$ → An)	t <sub>pZL</sub> t <sub>pZH</sub>	Figure 1, Figure 3	0.6	6.9	
3-state output disable time ( $\overline{OE}$ → An)	t <sub>pLZ</sub> t <sub>pHZ</sub>	Figure 1, Figure 3	0.6	7.1	
Propagation delay time (An → Bn)	t <sub>pLH</sub> t <sub>pHL</sub>	Figure 1, Figure 2	1.5	7.1	ns
3-state output enable time ( $\overline{OE}$ → Bn)	t <sub>pZL</sub> t <sub>pZH</sub>	Figure 1, Figure 3	1.5	10.3	
3-state output disable time ( $\overline{OE}$ → Bn)	t <sub>pLZ</sub> t <sub>pHZ</sub>	Figure 1, Figure 3	0.8	7.1	
Output to output skew	t <sub>osLH</sub> t <sub>osHL</sub>	(Note 12)	—	0.5	ns

Note 13: Parameter guaranteed by design.

$$(t_{osLH} = |t_{pLHm} - t_{pLHn}|, t_{osHL} = |t_{pHLm} - t_{pHLn}|)$$

$V_{CCB} = 2.5 \pm 0.2 \text{ V}$ ,  $V_{CCA} = 3.3 \pm 0.3 \text{ V}$

Characteristics	Symbol	Test Condition	Min	Max	Unit
Propagation delay time (Bn → An)	$t_{pLH}$	Figure 1, Figure 2	0.6	4.4	ns
	$t_{pHL}$				
3-state output enable time ( $\overline{OE}$ → An)	$t_{pZL}$	Figure 1, Figure 3	0.6	4.8	
	$t_{pZH}$				
3-state output disable time ( $\overline{OE}$ → An)	$t_{pLZ}$	Figure 1, Figure 3	0.6	4.9	
	$t_{pHZ}$				
Propagation delay time (An → Bn)	$t_{pLH}$	Figure 1, Figure 2	0.8	4.6	
	$t_{pHL}$				
3-state output enable time ( $\overline{OE}$ → Bn)	$t_{pZL}$	Figure 1, Figure 3	0.8	6.2	
	$t_{pZH}$				
3-state output disable time ( $\overline{OE}$ → Bn)	$t_{pLZ}$	Figure 1, Figure 3	0.8	4.9	
	$t_{pHZ}$				
Output to output skew	$t_{oS LH}$	(Note 12)	—	0.5	ns
	$t_{oS HL}$				

Note 13: Parameter guaranteed by design.

( $t_{oS LH} = |t_{pLHm} - t_{pLHn}|$ ,  $t_{oS HL} = |t_{pHLm} - t_{pHLn}|$ )

### Dynamic Switching Characteristics (Ta = 25°C, Input: $t_r = t_f = 2.0 \text{ ns}$ , $C_L = 30 \text{ pF}$ )

Characteristics	Symbol	Test Condition	V <sub>CCB</sub> (V)		V <sub>CCA</sub> (V)	Typ.	Unit
Quiet output maximum dynamic V <sub>OL</sub>	B → A	$V_{IH} = V_{CC}, V_{IL} = 0 \text{ V}$	1.8	2.5	0.25	V	
			1.8	3.3	0.25		
			2.5	3.3	0.6		
	A → B		1.8	2.5	0.6		
			1.8	3.3	0.8		
			2.5	3.3	0.8		
Quiet output minimum dynamic V <sub>OL</sub>	B → A	$V_{IH} = V_{CC}, V_{IL} = 0 \text{ V}$	1.8	2.5	-0.25	V	
			1.8	3.3	-0.25		
			2.5	3.3	-0.6		
	A → B		1.8	2.5	-0.6		
			1.8	3.3	-0.8		
			2.5	3.3	-0.8		
Quiet output minimum dynamic V <sub>OH</sub>	B → A	$V_{IH} = V_{CC}, V_{IL} = 0 \text{ V}$	1.8	2.5	1.3	V	
			1.8	3.3	1.3		
			2.5	3.3	1.7		
	A → B		1.8	2.5	1.7		
			1.8	3.3	2.0		
			2.5	3.3	2.0		

**Capacitive Characteristics (Ta = 25°C)**

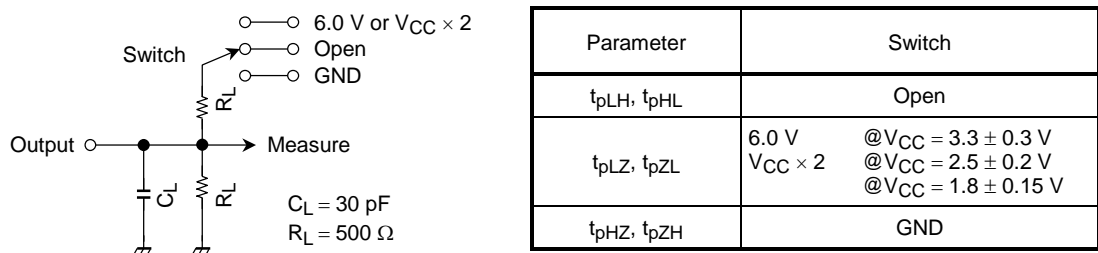
Characteristics	Symbol	Test Circuit	Test Condition	VCC (V)		Typ.	Unit
				VCCB (V)	VCCA (V)		
Input capacitance	C <sub>IN</sub>	—	DIR, $\overline{OE}$	2.5	3.3	7	pF
Output capacitance	C <sub>I/O</sub>	—	An, Bn	2.5	3.3	8	pF
Power dissipation capacitance (Note 13)	C <sub>PD</sub> A	—	A ⇒ B (DIR = "H")	2.5	3.3	2	pF
			B ⇒ A (DIR = "L")	2.5	3.3	23	
	C <sub>PD</sub> B	—	A ⇒ B (DIR = "H")	2.5	3.3	26	
			B ⇒ A (DIR = "L")	2.5	3.3	2	

Note 14: C<sub>PD</sub> 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:

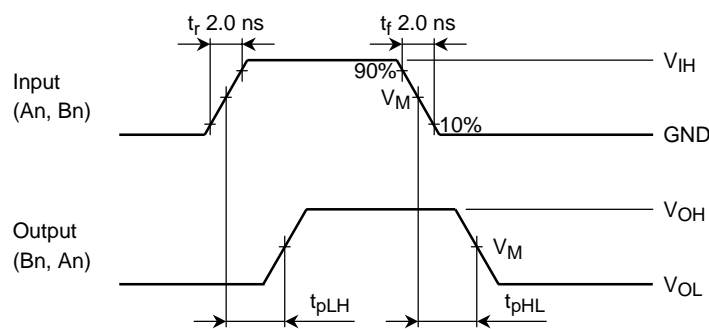
$$I_{CC (opr)} = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC}/16 \text{ (per bit)}$$

## AC Test Circuit

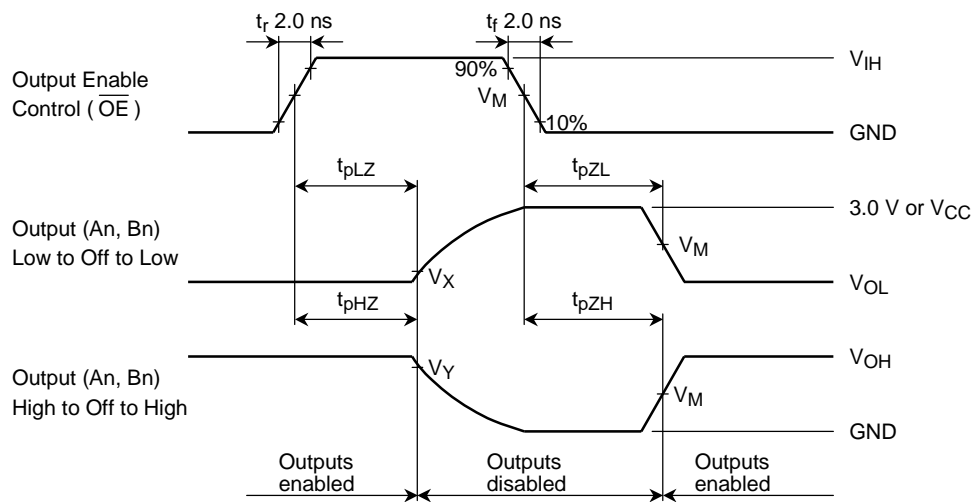


**Figure 1**

## AC Waveform



**Figure 2  $t_{pLH}$ ,  $t_{pHL}$**



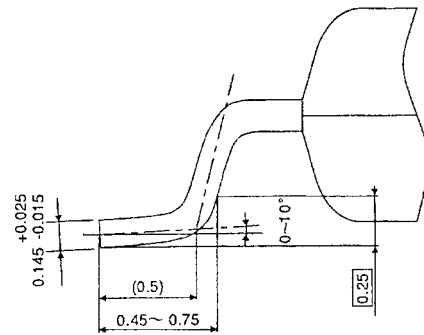
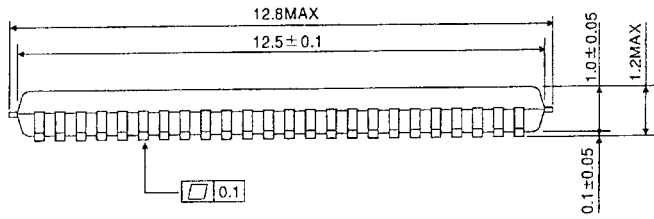
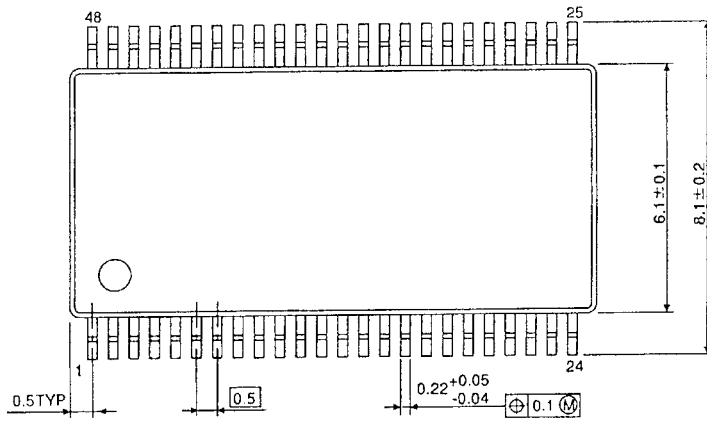
**Figure 3  $t_{pLZ}$ ,  $t_{pHZ}$ ,  $t_{pZL}$ ,  $t_{pZH}$**

Symbol	$V_{CC}$		
	$3.3 \pm 0.3$ V	$2.5 \pm 0.2$ V	$1.8 \pm 0.15$ V
$V_{IH}$	2.7 V	$V_{CC}$	$V_{CC}$
$V_M$	1.5 V	$V_{CC}/2$	$V_{CC}/2$
$V_X$	$V_{OL} + 0.3$ V	$V_{OL} + 0.15$ V	$V_{OL} + 0.15$ V
$V_Y$	$V_{OH} - 0.3$ V	$V_{OH} - 0.15$ V	$V_{OH} - 0.15$ V

**Package Dimensions**

TSSOP48-P-0061-0.50

Unit : mm



Weight: 0.25 g (typ.)

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000707EBA

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