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HD74ALVC165245A

16–Bit Dual–supply Bus Transceiver with 3–state Outputs

Description

The HD74ALVC165245A has 16 bus transceivers with three state outputs in a 48-pin package. When (DIR) is high, data flows from the A inputs to the B outputs, and when (DIR) is low, data flows from the B inputs to the A outputs. A and B bus are separated by making enable input ($\overline{OE}$) high level. This 16-bit non-inverting bus transceiver uses two separate power-supply rails.

And this product has two terminals (V_{CCA}, V_{CCB}), V_{CCA} is connected with A bus side, V_{CCB} is connected with control input and B bus. V_{CCA} and V_{CCB} are isolated.

The A port is designed to track V_{CCA}, which accepts voltages from 1.4 V to 3.6 V, and the B port is designed to track V_{CCB}, which operates at 1.2 V to 2.7 V. Therefore, Bidirectional broad voltage conversion is possible.

Low voltage and high-speed operation is suitable at the battery drive product (note type personal computer) and low power consumption extends the life of a battery for long time operation.

Features

- This product function as level shift transceiver that change V_{CCA} input level to V_{CCB} output level, V_{CCB} Input level to V_{CCA} output level by providing different supply voltage to V_{CCA} and V_{CCB}.
- V_{CCA} = 1.4 V to 3.6 V, V_{CCB} = 1.2 V to 2.7 V ($V_{CCA} > V_{CCB}$)
- All control input V_I (max) = 3.6 V (@V_{CCB} = 0 V to 3.6 V)
- All A bus side input outputs $V_{I/O}$ (max) = 3.6 V (@V_{CCA} = 0 V or output off state)
- All B bus side input outputs $V_{I/O}$ (max) = 3.6 V (@V_{CCB} = 0 V or output off state)
- High output current
  A bus side: ±4 mA (@V_{CCA} = 1.5±0.1 V)   B bus side: ±2 mA (@V_{CCB} = 1.2 V)
     ±6 mA (@V_{CCA} = 1.8±0.15 V)   ±4 mA (@V_{CCB} = 1.5±0.1 V)
     ±18 mA (@V_{CCA} = 2.5±0.2 V)   ±6 mA (@V_{CCB} = 1.8±0.15 V)
     ±24mA (@V_{CCA} = 3.3±0.3 V)   ±18 mA (@V_{CCB} = 2.5±0.2 V)
- Ordering Information

Part Name	Package Type	Package Code (Previous Code)	Package Abbreviation	Taping Abbreviation (Quantity)
HD74ALVC165245ATEL	TSSOP–48Pin	PTSP0048KA–A (TTP–48DBV)	T	EL (1,000pcs / Reel)

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Function Table

Inputs		Operation
1$\overline{\text{OE}}$	1DIR	
L	L	1B1–1B8 data to 1A1–1A8 bus
L	H	1A1–1A8 data to 1B1–1B8 bus
H	X	Z

Inputs		Operation
2$\overline{\text{OE}}$	2DIR	
L	L	2B1–2B8 data to 2A1–2A8 bus
L	H	2A1–2A8 data to 2B1–2B8 bus
H	X	Z

H: High level

L: Low level

X: Immaterial

Z: High impedance

Pin Arrangement

1DIR	1		48	1$\overline{\text{OE}}$
1B1	2		47	1A1
1B2	3		46	1A2
GND	4		45	GND
1B3	5		44	1A3
1B4	6		43	1A4
VCCB	7		42	VCCA
1B5	8		41	1A5
1B6	9		40	1A6
GND	10		39	GND
1B7	11		38	1A7
1B8	12		37	1A8
2B1	13		36	2A1
2B2	14		35	2A2
GND	15		34	GND
2B3	16		33	2A3
2B4	17		32	2A4
VCCB	18		31	VCCA
2B5	19		30	2A5
2B6	20		29	2A6
GND	21		28	GND
2B7	22		27	2A7
2B8	23		26	2A8
2DIR	24		25	2$\overline{\text{OE}}$

(Top view)

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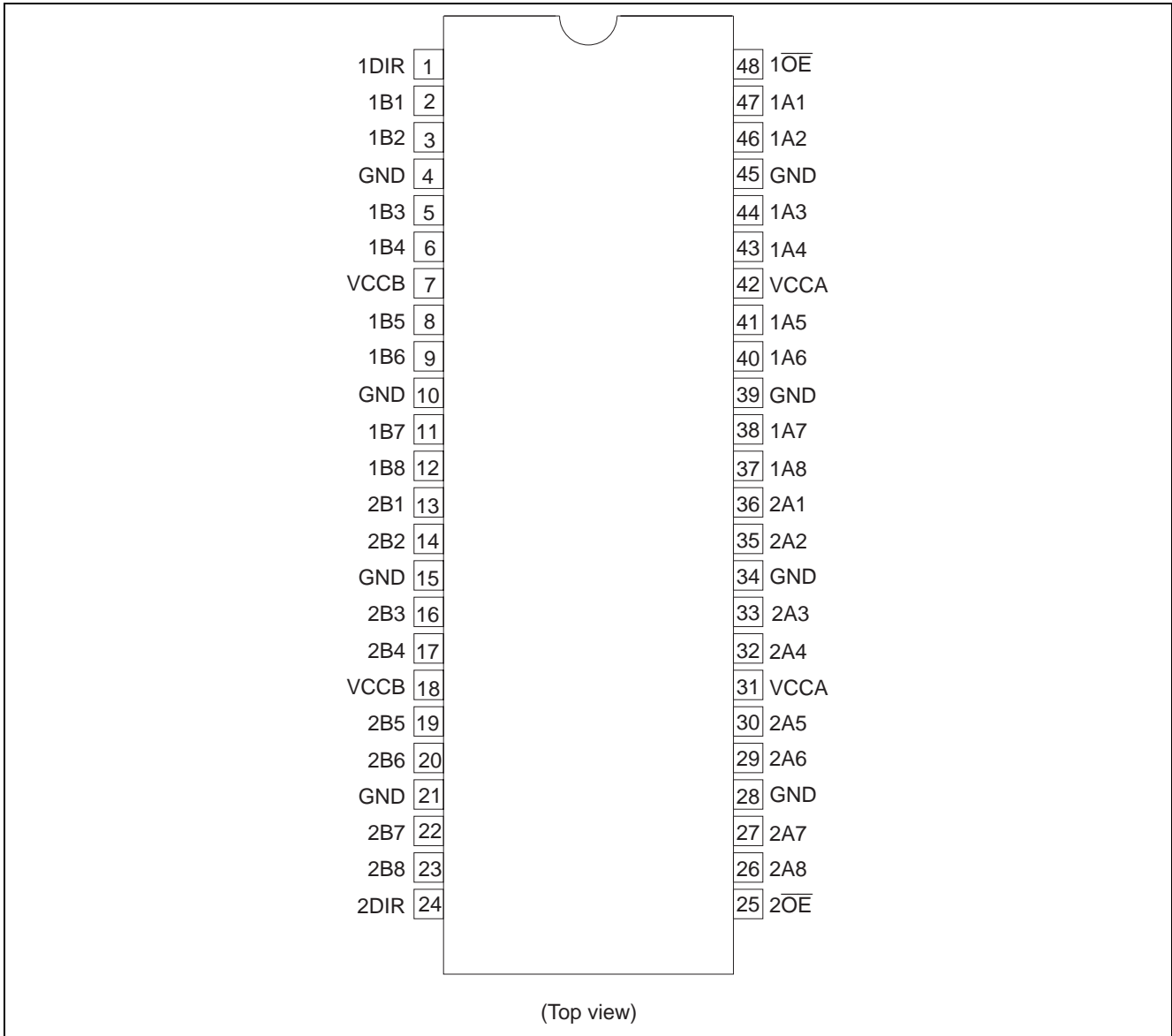
Absolute Maximum Ratings

Item	Symbol	Ratings	Unit	Conditions
Supply voltage	V_{CCA}, V_{CCB}	−0.5 to 4.6	V	
Input voltage[*1]	V_I	−0.5 to 4.6	V	DIR, $\overline{OE}$
Input / output voltage	$V_{I/O}$	−0.5 to V_{CCA}+0.5	V	A port output "H" or "L"
		−0.5 to 4.6		A port output "Z" or V_{CCA} : OFF
		−0.5 to V_{CCB}+0.5		B port output "H" or "L"
		−0.5 to 4.6		B port output "Z" or V_{CCB} : OFF
Input diode current	I_{IK}	−50	mA	$V_I < 0$
Output diode current	I_{OK}	−50	mA	$V_O < 0$
		50		$V_O > V_{CC}$+0.5
Output current	I_O	±50	mA	
V_{CCA}, V_{CCB}, GND current	I_{CCA}, I_{CCB}, I_{GND}	100	mA	
Maximum power dissipation at Ta = 55°C (in still air)[*2]	P_T	850	mW	TSSOP
Storage temperature	Tstg	−65 to 150	°C	

Notes: The absolute maximum ratings are values which must not individually be exceeded, and furthermore, no two of which may be realized at the same time.

1. The input and output voltage ratings may be exceeded even if the input and output clamp-current ratings are observed.

2. The maximum package power dissipation was calculated using a junction temperature of 150°C.

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Recommended Operating Conditions

Item	Symbol	Ratings	Unit	Conditions
Supply voltage	V_{CCB}	1.2 to 2.7	V	
	V_{CCA}	1.4 to 3.6		
Input / output voltage	V_I	0 to 3.6	V	DIR, $\overline{OE}$
	$V_{I/O}$	0 to V_{CCA}		A port output "H" or "L"
		0 to 3.6		A port output "Z" or V_{CCA} : OFF
		0 to V_{CCB}		B port output "H" or "L"
		0 to 3.6		B port output "Z" or V_{CCB} : OFF
Output current	I_{OHB}	−2	mA	V_{CCB} = 1.2 V
		−4		V_{CCB} = 1.5±0.1 V
		−6		V_{CCB} = 1.8±0.15 V
		−18		V_{CCB} = 2.5±0.2 V
	I_{OHA}	−4		V_{CCA} = 1.5±0.1 V
		−6		V_{CCA} = 1.8±0.15 V
		−18		V_{CCA} = 2.5±0.2 V
		−24		V_{CCA} = 3.3±0.3 V
	I_{OLB}	2		V_{CCB} = 1.2 V
		4		V_{CCB} = 1.5±0.1 V
		6		V_{CCB} = 1.8±0.15 V
		18		V_{CCB} = 2.5±0.2 V
	I_{OLA}	4		V_{CCA} = 1.5±0.1 V
		6		V_{CCA} = 1.8±0.15 V
		18		V_{CCA} = 2.5±0.2 V
		24		V_{CCA} = 3.3±0.3 V
Input transition rise or fall time	$\Delta t / \Delta v$	10	ns / V	
Operating temperature	Ta	−40 to 85	°C	

Note: Unused or floating inputs must be held high or low.

Block Diagram

To seven other channels

To seven other channels
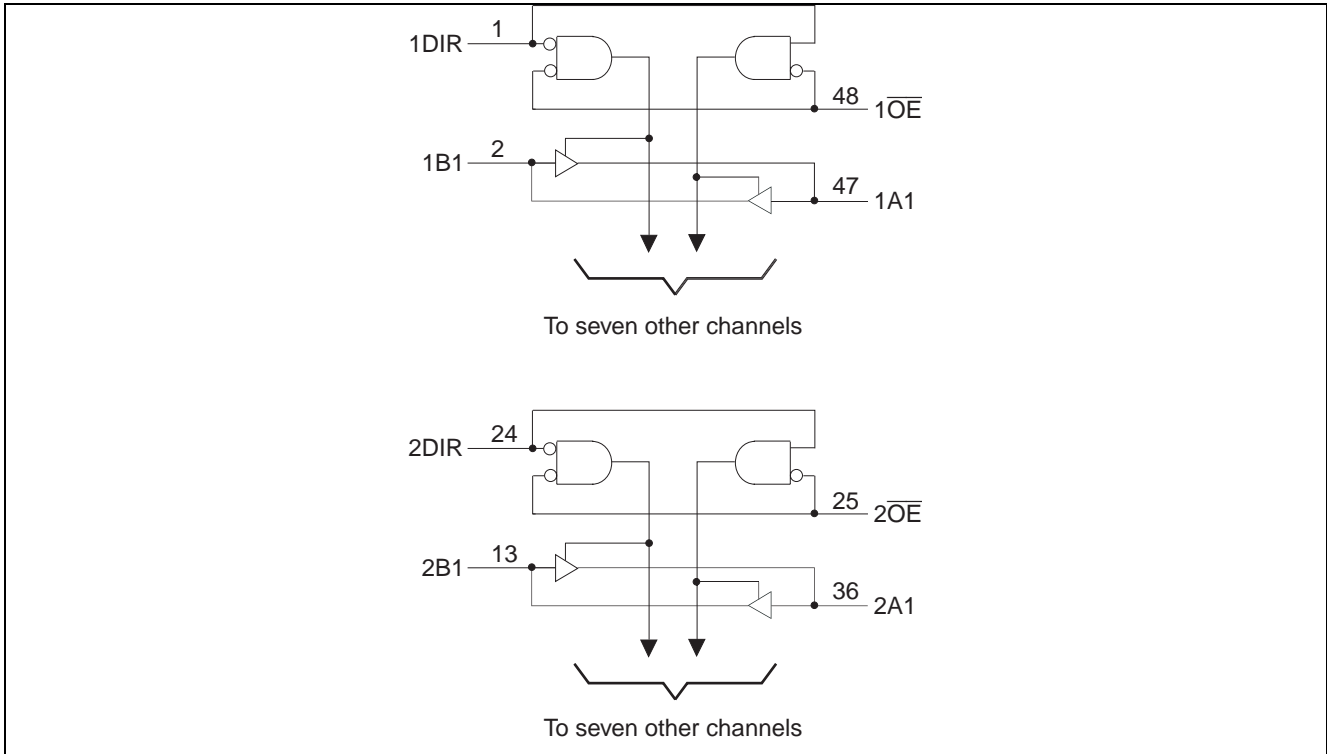
Electrical Characteristics

(Ta = –40 to 85°C)

Item	Symbol	V$_{CCB}$ (V)	V$_{CCA}$ (V)	Min	Max	Unit	Test Conditions
Input voltage	V$_{IHB}$	1.2	1.4 to 3.6	V$_{CCB}$×0.75	—	V	B port
		1.5±0.1	1.65 to 3.6	V$_{CCB}$×0.70	—		Control input
		1.8±0.15	2.3 to 3.6	V$_{CCB}$×0.65	—		
		2.5±0.2	3.0 to 3.6	1.6	—		
	V$_{IHA}$	1.2	1.5±0.1	V$_{CCA}$×0.70	—		A port
		1.2 to 1.6	1.8±0.15	V$_{CCA}$×0.65	—		
		1.2 to 1.95	2.5±0.2	1.6	—		
		1.2 to 2.7	3.3±0.3	2.0	—		
	V$_{ILB}$	1.2	1.4 to 3.6	—	V$_{CCB}$×0.25		B port
		1.5±0.1	1.65 to 3.6	—	V$_{CCB}$×0.30		Control input
		1.8±0.15	2.3 to 3.6	—	V$_{CCB}$×0.35		
		2.5±0.2	3.0 to 3.6	—	0.7		
	V$_{ILA}$	1.2	1.5±0.1	—	V$_{CCA}$×0.30		A port
		1.2 to 1.6	1.8±0.15	—	V$_{CCA}$×0.35		
		1.2 to 1.95	2.5±0.2	—	0.7		
		1.2 to 2.7	3.3±0.3	—	0.8		

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Electrical Characteristics (Cont.)

(Ta = –40 to 85°C)

				Min	Max	Unit	
Output voltage	V$_{OHB}$	1.2	1.4 to 3.6	V$_{CCB}$–0.2	—	V	I$_{OH}$ = –100 µA
				0.9	—		I$_{OH}$ = –2 mA
		1.5±0.1	1.65 to 3.6	V$_{CCB}$–0.2	—		I$_{OH}$ = –100 µA
				1.1	—		I$_{OH}$ = –4 mA
		1.8±0.15	2.3 to 3.6	V$_{CCB}$–0.2	—		I$_{OH}$ = –100 µA
				1.25	—		I$_{OH}$ = –6 mA
		2.5±0.2	3.0 to 3.6	V$_{CCB}$–0.2	—		I$_{OH}$ = –100 µA
				1.7	—		I$_{OH}$ = –18 mA
	V$_{OHA}$	1.2	1.5±0.1	V$_{CCA}$–0.2	—		I$_{OH}$ = –100 µA
				1.1	—		I$_{OH}$ = –4 mA
		1.2 to 1.6	1.8±0.15	V$_{CCA}$–0.2	—		I$_{OH}$ = –100 µA
				1.25	—		I$_{OH}$ = –6 mA
		1.2 to 1.95	2.5±0.2	V$_{CCA}$–0.2	—		I$_{OH}$ = –100 µA
				1.7	—		I$_{OH}$ = –18 mA
		1.2 to 2.7	3.3±0.3	V$_{CCA}$–0.2	—		I$_{OH}$ = –100 µA
				2.2	—		I$_{OH}$ = –24 mA
Output voltage	V$_{OLB}$	1.2	1.4 to 3.6	—	0.2	V	I$_{OL}$ = 100 µA
				—	0.3		I$_{OL}$ = 2 mA
		1.5±0.1	1.65 to 3.6	—	0.2		I$_{OL}$ = 100 µA
				—	0.3		I$_{OL}$ = 4 mA
		1.8±0.15	2.3 to 3.6	—	0.2		I$_{OL}$ = 100 µA
				—	0.3		I$_{OL}$ = 6 mA
		2.5±0.2	3.0 to 3.6	—	0.2		I$_{OL}$ = 100 µA
				—	0.6		I$_{OL}$ = 18 mA
	V$_{OLA}$	1.2	1.5±0.1	—	0.2		I$_{OL}$ = 100 µA
				—	0.3		I$_{OL}$ = 4 mA
		1.2 to 1.6	1.8±0.15	—	0.2		I$_{OL}$ = 100 µA
				—	0.3		I$_{OL}$ = 6 mA
		1.2 to 1.95	2.5±0.2	—	0.2		I$_{OL}$ = 100 µA
				—	0.6		I$_{OL}$ = 18 mA
		1.2 to 2.7	3.3±0.3	—	0.2		I$_{OL}$ = 100 µA
				—	0.55		I$_{OL}$ = 24 mA
Input current	I$_{IN}$	2.7	3.6	—	±5.0	µA	V$_I$ = GND or VCCB Control input
Off state output current	I$_{OZ}$	2.7	3.6	—	±10	µA	V$_{IN}$ = V$_{IH}$ or V$_{IL}$
Output leak current	I$_{OFF}$	0	0	—	10	µA	V$_{IN}$, V$_{OUT}$ = 0 to 3.6 V
Quiescent supply current	I$_{CCB}$	2.7	3.6	—	20	µA	I$_O$ (B port) = 0, A$_{IN}$ = V$_{CCA}$ or GND
	I$_{CCA}$	2.7	3.6	—	20		I$_O$ (A port) = 0, B$_{IN}$ = V$_{CCB}$ or GND
	I$_{CCB}$	2.7	3.6	—	±20		V$_{CCB}$ ≤ (V$_{IN}$, V$_{OUT}$) ≤ 3.6 V
	I$_{CCA}$	2.7	3.6	—	±20		V$_{CCA}$ ≤ (V$_{IN}$, V$_{OUT}$) ≤ 3.6 V
Increase in I$_{CC}$ per Input[1]	ΔI$_{CCB}$	2.7	3.6	—	750	µA	B port or control input One input at V$_{CCB}$–0.6 V Other input at V$_{CCB}$ or GND
	ΔI$_{CCA}$	2.7	3.6	—	750	µA	A port One input at V$_{CCA}$–0.6 V Other input at V$_{CCA}$ or GND

Notes: For condition shown as Min or Max use the appropriate values under recommended operating conditions.

1. This is the increase in supply current for each input that is at the specified TTL voltage level rather than V$_{CC}$ or GND.

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Capacitance

(Ta = 25°C)

Item	Symbol	V$_{CCA}$ (V)	V$_{CCB}$ (V)	Min	Typ	Max	Unit	Test Conditions
Control Input capacitance	C$_{IN}$	3.3	2.5	—	4	—	pF	V$_I$ = V$_{CCB}$ or GND
Input / output capacitance	C$_{I/O}$	3.3	2.5	—	9	—	pF	A port, V$_I$ = V$_{CCA}$ or GND, B port, V$_I$ = V$_{CCB}$ or GND

Switching Characteristics

(V$_{CCB}$ = 2.5±0.2 V, V$_{CCA}$ = 3.3±0.3 V, Ta = –40 to 85°C)

Item	Symbol	Min	Typ	Max	Unit	Test conditions	From(Input)	To(Output)
Propagation delay time	t$_{PLH}$	0.6	—	4.0	ns	C$_L$ = 30 pF R$_L$ = 500 Ω	B	A
	t$_{PHL}$	0.6	—	4.0				
	t$_{PLH}$	0.8	—	4.4			A	B
	t$_{PHL}$	0.8	—	4.4				
Output enable time	t$_{ZH}$	0.6	—	4.0	ns	C$_L$ = 30 pF R$_L$ = 500 Ω	$\overline{OE}$	A
	t$_{ZL}$	0.6	—	4.0				
	t$_{ZH}$	0.8	—	4.6			$\overline{OE}$	B
	t$_{ZL}$	0.8	—	4.6				
Output disable time	t$_{HZ}$	0.6	—	4.8	ns	C$_L$ = 30 pF R$_L$ = 500 Ω	$\overline{OE}$	A
	t$_{LZ}$	0.6	—	4.8				
	t$_{HZ}$	0.8	—	4.4			$\overline{OE}$	B
	t$_{LZ}$	0.8	—	4.4				

(V$_{CCB}$ = 1.8±0.15 V, V$_{CCA}$ = 3.3±0.3 V, Ta = –40 to 85°C)

Item	Symbol	Min	Typ	Max	Unit	Test conditions	From(Input)	To(Output)
Propagation delay time	t$_{PLH}$	0.6	—	5.1	ns	C$_L$ = 30 pF R$_L$ = 500 Ω	B	A
	t$_{PHL}$	0.6	—	5.1				
	t$_{PLH}$	1.5	—	6.2			A	B
	t$_{PHL}$	1.5	—	6.2				
Output enable time	t$_{ZH}$	0.6	—	5.1	ns	C$_L$ = 30 pF R$_L$ = 500 Ω	$\overline{OE}$	A
	t$_{ZL}$	0.6	—	5.1				
	t$_{ZH}$	1.5	—	8.2			$\overline{OE}$	B
	t$_{ZL}$	1.5	—	8.2				
Output disable time	t$_{HZ}$	0.6	—	5.6	ns	C$_L$ = 30 pF R$_L$ = 500 Ω	$\overline{OE}$	A
	t$_{LZ}$	0.6	—	5.6				
	t$_{HZ}$	0.8	—	4.5			$\overline{OE}$	B
	t$_{LZ}$	0.8	—	4.5				

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Switching Characteristics (Cont.)

(V_{CCB} = 1.5±0.1 V, V_{CCA} = 3.3±0.3 V, Ta = –40 to 85°C)

Item	Symbol	Min	Typ	Max	Unit	Test conditions	From(Input)	To(Output)
Propagation delay time	t_{PLH}	0.6	—	5.5	ns	C_L = 30 pF R_L = 500 Ω	B	A
	t_{PHL}	0.6	—	5.5				
	t_{PLH}	1.5	—	5.5			A	B
	t_{PHL}	1.5	—	5.5				
Output enable time	t_{ZH}	0.6	—	6.0	ns	C_L = 30 pF R_L = 500 Ω	$\overline{OE}$	A
	t_{ZL}	0.6	—	6.0				
	t_{ZH}	1.5	—	10.0			$\overline{OE}$	B
	t_{ZL}	1.5	—	10.0				
Output disable time	t_{HZ}	0.6	—	6.0	ns	C_L = 30 pF R_L = 500 Ω	$\overline{OE}$	A
	t_{LZ}	0.6	—	6.0				
	t_{HZ}	1.5	—	6.0			$\overline{OE}$	B
	t_{LZ}	1.5	—	6.0				

(V_{CCB} = 1.2 V, V_{CCA} = 3.3±0.3 V, Ta = –40 to 85°C)

Item	Symbol	Min	Typ	Max	Unit	Test conditions	From(Input)	To(Output)
Propagation delay time	t_{PLH}	—	3.5	—	ns	C_L = 30 pF R_L = 500 Ω	B	A
	t_{PHL}	—	3.5	—				
	t_{PLH}	—	4.5	—			A	B
	t_{PHL}	—	4.5	—				
Output enable time	t_{ZH}	—	5.5	—	ns	C_L = 30 pF R_L = 500 Ω	$\overline{OE}$	A
	t_{ZL}	—	5.5	—				
	t_{ZH}	—	9.0	—			$\overline{OE}$	B
	t_{ZL}	—	9.0	—				
Output disable time	t_{HZ}	—	4.5	—	ns	C_L = 30 pF R_L = 500 Ω	$\overline{OE}$	A
	t_{LZ}	—	4.5	—				
	t_{HZ}	—	5.5	—			$\overline{OE}$	B
	t_{LZ}	—	5.5	—				

(V_{CCB} = 1.8±0.15 V, V_{CCA} = 2.5±0.2 V, Ta = –40 to 85°C)

Item	Symbol	Min	Typ	Max	Unit	Test conditions	From(Input)	To(Output)
Propagation delay time	t_{PLH}	0.8	—	5.5	ns	C_L = 30 pF R_L = 500 Ω	B	A
	t_{PHL}	0.8	—	5.5				
	t_{PLH}	1.5	—	5.8			A	B
	t_{PHL}	1.5	—	5.8				
Output enable time	t_{ZH}	0.8	—	5.3	ns	C_L = 30 pF R_L = 500 Ω	$\overline{OE}$	A
	t_{ZL}	0.8	—	5.3				
	t_{ZH}	1.5	—	8.3			$\overline{OE}$	B
	t_{ZL}	1.5	—	8.3				
Output disable time	t_{HZ}	0.8	—	5.2	ns	C_L = 30 pF R_L = 500 Ω	$\overline{OE}$	A
	t_{LZ}	0.8	—	5.2				
	t_{HZ}	0.8	—	4.6			$\overline{OE}$	B
	t_{LZ}	0.8	—	4.6				

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Switching Characteristics (Cont.)

($V_{CCB} = 1.5\pm0.1$ V, $V_{CCA} = 2.5\pm0.2$ V, Ta = –40 to 85°C)

Item	Symbol	Min	Typ	Max	Unit	Test conditions	From(Input)	To(Output)
Propagation delay time	t_{PLH}	1.5	—	6.0	ns	C_L = 30 pF R_L = 500 Ω	B	A
	t_{PHL}	1.5	—	6.0				
	t_{PLH}	1.5	—	6.0			A	B
	t_{PHL}	1.5	—	6.0				
Output enable time	t_{ZH}	0.8	—	7.0	ns	C_L = 30 pF R_L = 500 Ω	$\overline{OE}$	A
	t_{ZL}	0.8	—	7.0				
	t_{ZH}	1.5	—	10.0			$\overline{OE}$	B
	t_{ZL}	1.5	—	10.0				
Output disable time	t_{HZ}	1.5	—	6.0	ns	C_L = 30 pF R_L = 500 Ω	$\overline{OE}$	A
	t_{LZ}	1.5	—	6.0				
	t_{HZ}	1.5	—	6.0			$\overline{OE}$	B
	t_{LZ}	1.5	—	6.0				

($V_{CCB} = 1.2$ V, $V_{CCA} = 2.5\pm0.2$ V, Ta = –40 to 85°C)

Item	Symbol	Min	Typ	Max	Unit	Test conditions	From(Input)	To(Output)
Propagation delay time	t_{PLH}	—	3.5	—	ns	C_L = 30 pF R_L = 500 Ω	B	A
	t_{PHL}	—	3.5	—				
	t_{PLH}	—	4.5	—			A	B
	t_{PHL}	—	4.5	—				
Output enable time	t_{ZH}	—	6.0	—	ns	C_L = 30 pF R_L = 500 Ω	$\overline{OE}$	A
	t_{ZL}	—	6.0	—				
	t_{ZH}	—	9.0	—			$\overline{OE}$	B
	t_{ZL}	—	9.0	—				
Output disable time	t_{HZ}	—	5.0	—	ns	C_L = 30 pF R_L = 500 Ω	$\overline{OE}$	A
	t_{LZ}	—	5.0	—				
	t_{HZ}	—	5.5	—			$\overline{OE}$	B
	t_{LZ}	—	5.5	—				

($V_{CCB} = 1.5\pm0.1$ V, $V_{CCA} = 1.8\pm0.15$ V, Ta = –40 to 85°C)

Item	Symbol	Min	Typ	Max	Unit	Test conditions	From(Input)	To(Output)
Propagation delay time	t_{PLH}	1.5	—	7.0	ns	C_L = 30 pF R_L = 500 Ω	B	A
	t_{PHL}	1.5	—	7.0				
	t_{PLH}	1.5	—	7.0			A	B
	t_{PHL}	1.5	—	7.0				
Output enable time	t_{ZH}	1.5	—	8.0	ns	C_L = 30 pF R_L = 500 Ω	$\overline{OE}$	A
	t_{ZL}	1.5	—	8.0				
	t_{ZH}	1.5	—	10.0			$\overline{OE}$	B
	t_{ZL}	1.5	—	10.0				
Output disable time	t_{HZ}	1.5	—	7.0	ns	C_L = 30 pF R_L = 500 Ω	$\overline{OE}$	A
	t_{LZ}	1.5	—	7.0				
	t_{HZ}	1.5	—	6.0			$\overline{OE}$	B
	t_{LZ}	1.5	—	6.0				

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Switching Characteristics (cont.)

(V$_{CCB}$ = 1.2 V, V$_{CCA}$ = 1.8±0.15 V, Ta = –40 to 85°C)

Item	Symbol	Min	Typ	Max	Unit	Test conditions	From(Input)	To(Output)
Propagation delay time	t$_{PLH}$	—	4.5	—	ns	C$_L$ = 30 pF R$_L$ = 500 Ω	B	A
	t$_{PHL}$	—	4.5	—				
	t$_{PLH}$	—	5.0	—			A	B
	t$_{PHL}$	—	5.0	—				
Output enable time	t$_{ZH}$	—	6.5	—	ns	C$_L$ = 30 pF R$_L$ = 500 Ω	$\overline{OE}$	A
	t$_{ZL}$	—	6.5	—				
	t$_{ZH}$	—	9.0	—			$\overline{OE}$	B
	t$_{ZL}$	—	9.0	—				
Output disable time	t$_{HZ}$	—	5.5	—	ns	C$_L$ = 30 pF R$_L$ = 500 Ω	$\overline{OE}$	A
	t$_{LZ}$	—	5.5	—				
	t$_{HZ}$	—	5.5	—			$\overline{OE}$	B
	t$_{LZ}$	—	5.5	—				

(V$_{CCB}$ = 1.2 V, V$_{CCA}$ = 1.5±0.1 V, Ta = –40 to 85°C)

Item	Symbol	Min	Typ	Max	Unit	Test conditions	From(Input)	To(Output)
Propagation delay time	t$_{PLH}$	—	5.5	—	ns	C$_L$ = 30 pF R$_L$ = 500 Ω	B	A
	t$_{PHL}$	—	5.5	—				
	t$_{PLH}$	—	5.5	—			A	B
	t$_{PHL}$	—	5.5	—				
Output enable time	t$_{ZH}$	—	7.5	—	ns	C$_L$ = 30 pF R$_L$ = 500 Ω	$\overline{OE}$	A
	t$_{ZL}$	—	7.5	—				
	t$_{ZH}$	—	9.0	—			$\overline{OE}$	B
	t$_{ZL}$	—	9.0	—				
Output disable time	t$_{HZ}$	—	6.5	—	ns	C$_L$ = 30 pF R$_L$ = 500 Ω	$\overline{OE}$	A
	t$_{LZ}$	—	6.5	—				
	t$_{HZ}$	—	5.5	—			$\overline{OE}$	B
	t$_{LZ}$	—	5.5	—				

Operating Characteristics

Item	Symbol	V$_{CCA}$ (V)	V$_{CCB}$ (V)	Min	Typ	Max	Unit	Test Conditions
Power dissipation capacitance	C$_{PD}$	3.3	2.5	—	40	—	pF	f = 10 MHz C$_L$ = 0

Power-up considerations

Level-translation devices offer an opportunity for successful mixed-voltage signal design.

A proper power-up sequence always should be followed to avoid excessive supply current, bus contention, oscillations, or other anomalies caused by improperly biased device pins.

Take these precautions to guard against such power-up problems.

1. Connect ground before any supply voltage is applied.
2. Next, power up the control side of the device.
   (Power up of V$_{CCB}$ is first. Next power up is V$_{CCA}$.)
3. Tie $\overline{OE}$ to V$_{CCB}$ with a pullup resistor so that it ramps with V$_{CCB}$.
4. Depending on the direction of the data path, DIR can be high or low.
   If DIR high is needed (A data to B bus), ramp it with V$_{CCB}$. Otherwise, DIR low is needed (B data to A bus), ramp it with GND.

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Test Circuit
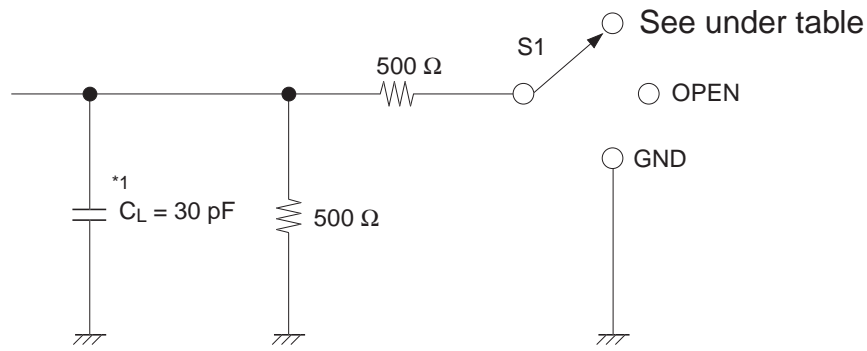
Load circuit for outputs

Symbol	V_{CCB} = 2.5±0.2 V = 1.8±0.15 V = 1.5±0.1 V = 1.2 V V_{CCA} = 3.3±0.3 V		V_{CCB} = 1.8±0.15 V = 1.5±0.1 V = 1.2 V V_{CCA} = 2.5±0.2 V		V_{CCB} = 1.5±0.1 V = 1.2 V V_{CCA} = 1.8±0.15 V		V_{CCB} = 1.2 V V_{CCA} = 1.5±0.1 V	
	B/$\overline{OE}$ to A	A/$\overline{OE}$ to B	B/$\overline{OE}$ to A	A/$\overline{OE}$ to B	B/$\overline{OE}$ to A	A/$\overline{OE}$ to B	B/$\overline{OE}$ to A	A/$\overline{OE}$ to B
t_{PLH}/ t_{PHL}	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN
t_{ZH} / t_{HZ}	GND	GND	GND	GND	GND	GND	GND	GND
t_{ZL} / t_{LZ}	6 V	$2 \times V_{CCB}$	$2 \times V_{CCA}$	$2 \times V_{CCB}$	$2 \times V_{CCA}$	$2 \times V_{CCB}$	$2 \times V_{CCA}$	$2 \times V_{CCB}$

Note: 1. C_L includes probe and jig capacitance.

Waveforms – 1
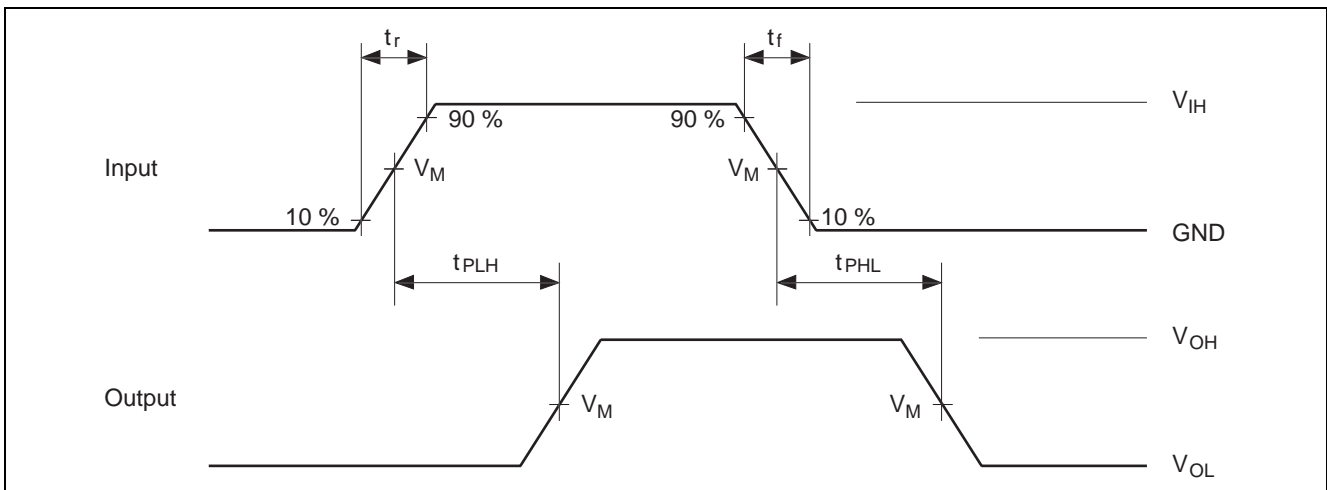
Waveforms – 2
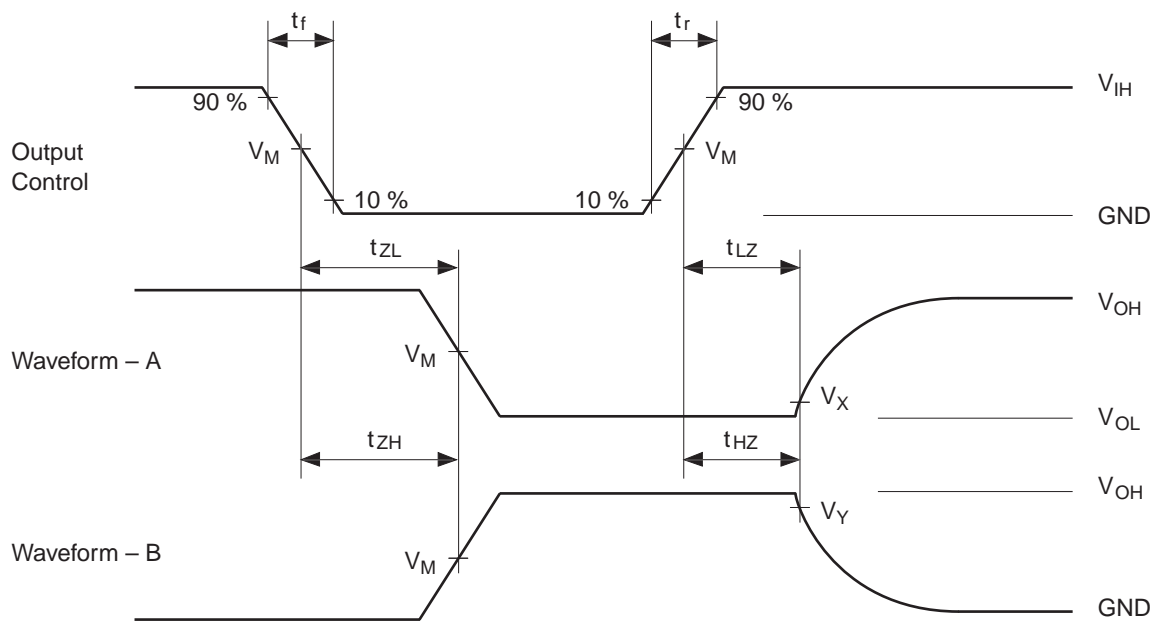
Symbol	V_{CC}				
	3.3±0.3 V	2.5±0.2 V	1.8±0.15 V	1.5±0.1 V	1.2 V
V_{IH}	2.7 V	V_{CC}	V_{CC}	V_{CC}	V_{CC}
V_M	1.5 V	1/2 V_{CC}	1/2 V_{CC}	1/2 V_{CC}	1/2 V_{CC}
V_X	V_{OL}+0.3 V	V_{OL}+0.15 V	V_{OL}+0.15 V	V_{OL}+0.1 V	V_{OL}+0.1 V
V_Y	V_{OH}–0.3 V	V_{OH}–0.15 V	V_{OH}–0.15 V	V_{OH}–0.1 V	V_{OH}–0.1 V

Notes: 1. All input pulses are supplied by generators having the following characteristics:
   PRR ≤ 10MHz, Zo = 50 Ω, t_r ≤ 2.0 ns, t_f ≤ 2.0 ns.
   2. Waveform–A is for an output with internal conditions such that the output is low except
   when disabled by the output control.
   3. Waveform–B is for an output with internal conditions such that the output is high except
   when disabled by the output control.
   4. The output are measured one at a time with one transition per measurement.

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Package Dimensions

JEITA Package Code	RENESAS Code	Previous Code	MASS[Typ.]
P-TSSOP48-6.1x12.5-0.50	PTSP0048KA-A	TTP-48DBV	0.2g

NOTE)
1. DIMENSIONS"*1 (Nom)"AND"*2"
   DO NOT INCLUDE MOLD FLASH
2. DIMENSION"*3"DOES NOT
   INCLUDE TRIM OFFSET.
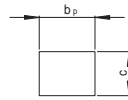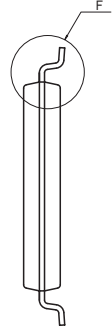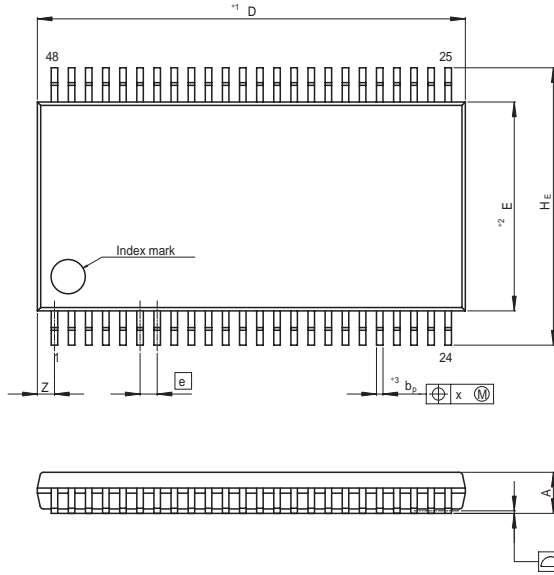
Terminal cross section
(Ni/Pd/Au plating)

Detail F

Reference Symbol	Dimension in Millimeters		
	Min	Nom	Max
D	——	12.5	12.7
E	——	6.10	——
A_2	——	——	——
A_1	0.08	0.13	0.18
A	——	——	1.20
b_p	0.14	0.19	0.24
b_1	——	——	——
c	0.10	0.15	0.20
c_1	——	——	——
θ	0°	——	8°
H_E	7.90	8.10	8.30
e	——	0.50	——
x	——	——	0.08
y	——	——	0.10
Z	——	——	0.65
L	0.4	0.5	0.6
L_1	——	1.0	——

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