

---

# HD74ALVC166245A

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

REJ03D0158–0200Z

Rev.2.00

Jan.07.2004

---

### Description

The HD74ALVC166245A 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 1.2 V to 2.7 V, and the B port is designed to track  $V_{CCB}$ , which operates at 1.4 V to 3.6 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  $V_{CCB}$ .
- $V_{CCA} = 1.2\text{ V to }2.7\text{ V}$ ,  $V_{CCB} = 1.4\text{ V to }3.6\text{ V}$  ( $V_{CCA} < V_{CCB}$ )
- All control input  $V_I$  (max) = 3.6 V (@ $V_{CCB} = 0\text{ V to }3.6\text{ V}$ )
- All A bus side input outputs  $V_{IO}$  (max) = 3.6 V (@ $V_{CCA} = 0\text{ V}$  or output off state)
- All B bus side input outputs  $V_{IO}$  (max) = 3.6 V (@ $V_{CCB} = 0\text{ V}$  or output off state)
- High output current
 

A bus side: $\pm 2\text{ mA}$ (@ $V_{CCA} = 1.2\text{ V}$ )	B bus side: $\pm 4\text{ mA}$ (@ $V_{CCB} = 1.5\pm 0.1\text{ V}$ )
$\pm 4\text{ mA}$ (@ $V_{CCA} = 1.5\pm 0.1\text{ V}$ )	$\pm 6\text{ mA}$ (@ $V_{CCB} = 1.8\pm 0.15\text{ V}$ )
$\pm 6\text{ mA}$ (@ $V_{CCA} = 1.8\pm 0.15\text{ V}$ )	$\pm 18\text{ mA}$ (@ $V_{CCB} = 2.5\pm 0.2\text{ V}$ )
$\pm 18\text{ mA}$ (@ $V_{CCA} = 2.5\pm 0.2\text{ V}$ )	$\pm 24\text{ mA}$ (@ $V_{CCB} = 3.3\pm 0.3\text{ V}$ )
- Ordering Information

Part Name	Package Type	Package Code	Package	Taping
			Abbreviation	Abbreviation (Quantity)
HD74ALVC166245ATEL	TSSOP-48Pin	TTP-48DBV	T	EL (1,000pcs / Reel)

## Function Table

### Inputs

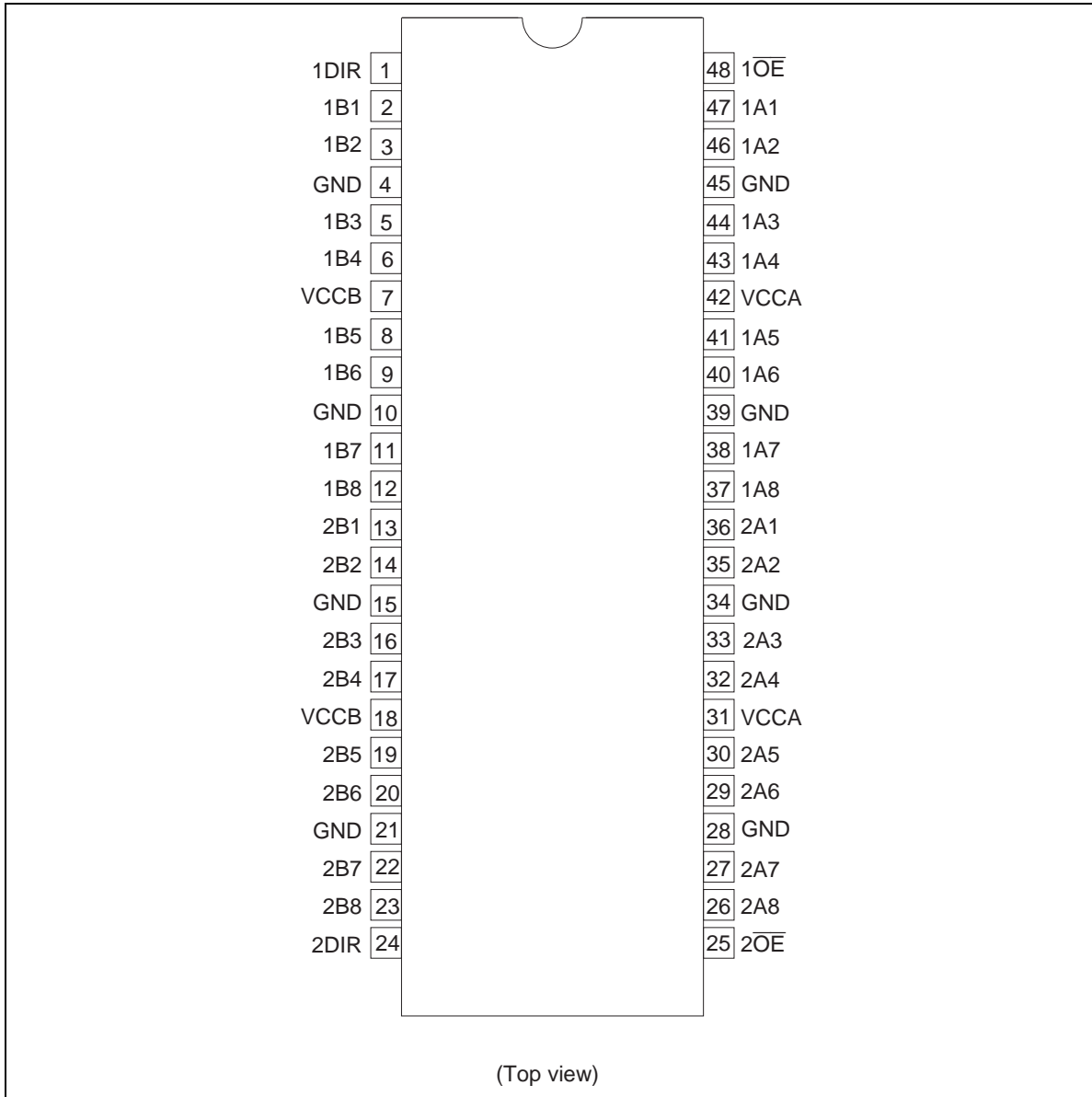
$\overline{1OE}$	1DIR	Operation
L	L	1B1-1B8 data to 1A1-1A8 bus
L	H	1A1-1A8 data to 1B1-1B8 bus
H	X	Z

### Inputs

$\overline{2OE}$	2DIR	Operation
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



**Absolute Maximum Ratings**

Item	Symbol	Ratings	Unit	Conditions
Supply voltage	$V_{CCA}, V_{CCB}$	-0.5 to 4.6	V	
Input voltage <sup>*1</sup>	$V_I$	-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 $V_{CCA} : \text{OFF}$
		-0.5 to $V_{CCB}+0.5$		B port output "H" or "L"
		-0.5 to 4.6		B port output "Z" or $V_{CCB} : \text{OFF}$
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	$I_O$	$\pm 50$	mA	
$V_{CCA}, V_{CCB}, \text{GND}$ current	$I_{CCA}, I_{CCB}, I_{GND}$	100	mA	
Maximum power dissipation at $T_a = 55^\circ\text{C}$ (in still air) <sup>*2</sup>	$P_T$	850	mW	TSSOP
Storage temperature	$T_{stg}$	-65 to 150	$^\circ\text{C}$	

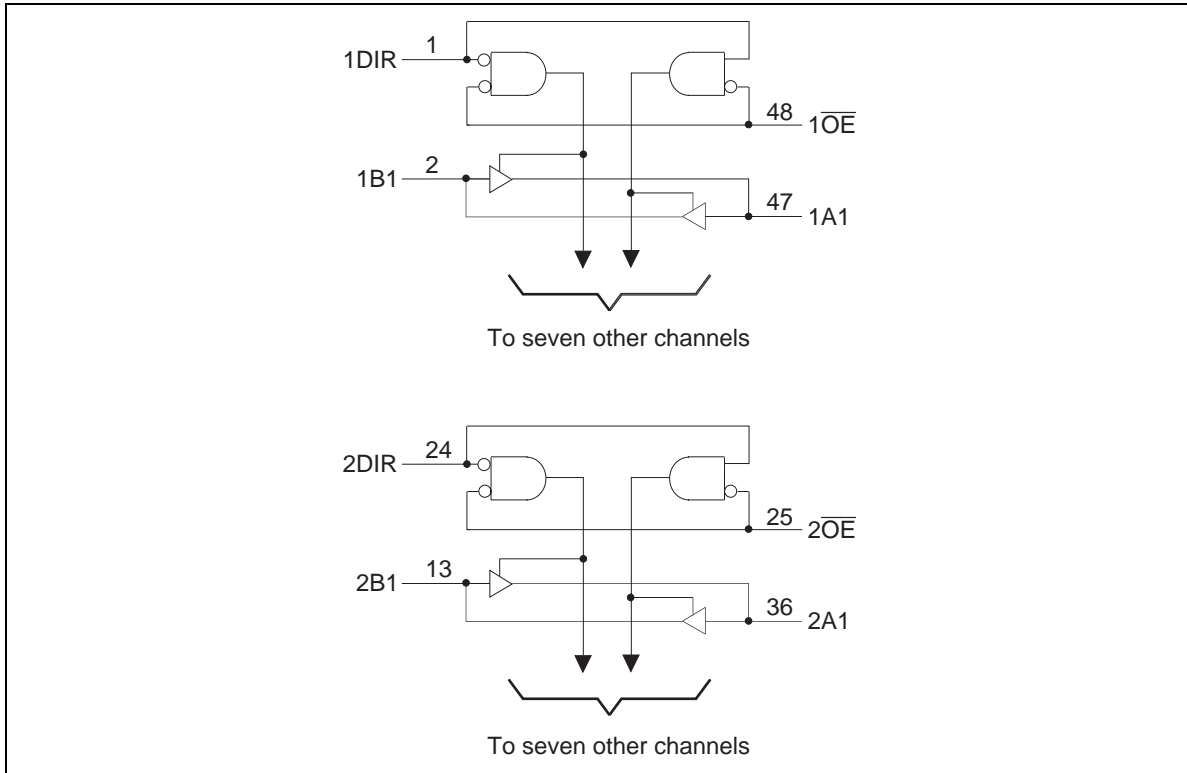
- Notes: The absolute maximum ratings are values, which must not individually be exceeded, and furthermore, no two of which may be realized at the same time.
1. The input and output voltage ratings may be exceeded even if the input and output clamp-current ratings are observed.
  2. The maximum package power dissipation was calculated using a junction temperature of  $150^\circ\text{C}$ .

**Recommended Operating Conditions**

Item	Symbol	Ratings	Unit	Conditions
Supply voltage	$V_{CCB}$	1.4 to 3.6	V	
	$V_{CCA}$	1.2 to 2.7		
Input / output voltage	$V_I$	0 to 3.6	V	DIR, $\overline{OE}$
	$V_{IO}$	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	$I_{OHB}$	-4	mA	$V_{CCB} = 1.5 \pm 0.1$ V
		-6		$V_{CCB} = 1.8 \pm 0.15$ V
		-18		$V_{CCB} = 2.5 \pm 0.2$ V
		-24		$V_{CCB} = 3.3 \pm 0.3$ V
	$I_{OHA}$	-2		$V_{CCA} = 1.2$ V
		-4		$V_{CCA} = 1.5 \pm 0.1$ V
		-6		$V_{CCA} = 1.8 \pm 0.15$ V
		-18		$V_{CCA} = 2.5 \pm 0.2$ V
	$I_{OLB}$	4		$V_{CCB} = 1.5 \pm 0.1$ V
		6		$V_{CCB} = 1.8 \pm 0.15$ V
		18		$V_{CCB} = 2.5 \pm 0.2$ V
		24		$V_{CCB} = 3.3 \pm 0.3$ V
	$I_{OLA}$	2		$V_{CCA} = 1.2$ V
		4		$V_{CCA} = 1.5 \pm 0.1$ V
		6		$V_{CCA} = 1.8 \pm 0.15$ V
		18		$V_{CCA} = 2.5 \pm 0.2$ V
Input transition rise or fall time	$\Delta t / \Delta v$	10	ns / V	
Operating temperature	$T_a$	-40 to 85	°C	

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

Block Diagram



**Electrical Characteristics**

(Ta = -40 to 85°C)

Item	Symbol	V <sub>CCB</sub> (V)	V <sub>CCA</sub> (V)	Min	Max	Unit	Test Conditions
Input voltage	V <sub>IHB</sub>	1.5±0.1	1.2	V <sub>CCB</sub> ×0.70	—	V	B port
		1.8±0.15	1.2 to 1.6	V <sub>CCB</sub> ×0.65	—		Control input
		2.5±0.2	1.2 to 1.95	1.6	—		
		3.3±0.3	1.2 to 2.7	2.0	—		
	V <sub>IHA</sub>	1.4 to 3.6	1.2	V <sub>CCA</sub> ×0.75	—		A port
		1.65 to 3.6	1.5±0.1	V <sub>CCA</sub> ×0.70	—		
		2.3 to 3.6	1.8±0.15	V <sub>CCA</sub> ×0.65	—		
		3.0 to 3.6	2.5±0.2	1.6	—		
	V <sub>ILB</sub>	1.5±0.1	1.2	—	V <sub>CCB</sub> ×0.30		B port
		1.8±0.15	1.2 to 1.6	—	V <sub>CCB</sub> ×0.35		Control input
		2.5±0.2	1.2 to 1.95	—	0.7		
		3.3±0.3	1.2 to 2.7	—	0.8		
	V <sub>ILA</sub>	1.4 to 3.6	1.2	—	V <sub>CCA</sub> ×0.25		A port
		1.65 to 3.6	1.5±0.1	—	V <sub>CCA</sub> ×0.30		
		2.3 to 3.6	1.8±0.15	—	V <sub>CCA</sub> ×0.35		
		3.0 to 3.6	2.5±0.2	—	0.7		
Output voltage	V <sub>OHB</sub>	1.5±0.1	1.2	V <sub>CCB</sub> -0.2	—	V	I <sub>OH</sub> = -100 μA
				1.1	—		I <sub>OH</sub> = -4 mA
		1.8±0.15	1.2 to 1.6	V <sub>CCB</sub> -0.2	—		I <sub>OH</sub> = -100 μA
				1.25	—		I <sub>OH</sub> = -6 mA
		2.5±0.2	1.2 to 1.95	V <sub>CCB</sub> -0.2	—		I <sub>OH</sub> = -100 μA
				1.70	—		I <sub>OH</sub> = -18 mA
		3.3±0.3	1.2 to 2.7	V <sub>CCB</sub> -0.2	—		I <sub>OH</sub> = -100 μA
				2.20	—		I <sub>OH</sub> = -24 mA
	V <sub>OHA</sub>	1.4 to 3.6	1.2	V <sub>CCA</sub> -0.2	—		I <sub>OH</sub> = -100 μA
				0.90	—		I <sub>OH</sub> = -2 mA
		1.65 to 3.6	1.5±0.1	V <sub>CCA</sub> -0.2	—		I <sub>OH</sub> = -100 μA
				1.10	—		I <sub>OH</sub> = -4 mA
		2.3 to 3.6	1.8±0.15	V <sub>CCA</sub> -0.2	—		I <sub>OH</sub> = -100 μA
				1.25	—		I <sub>OH</sub> = -6 mA
		3.0 to 3.6	2.5±0.2	V <sub>CCA</sub> -0.2	—		I <sub>OH</sub> = -100 μA
				1.70	—		I <sub>OH</sub> = -18 mA

**Electrical Characteristics (Cont)**

(Ta = -40 to 85°C)

Item	Symbol	V <sub>CCB</sub> (V)	V <sub>CCA</sub> (V)	Min	Max	Unit	Test Conditions
Output voltage	V <sub>OLB</sub>	1.5±0.1	1.2	—	0.2	V	I <sub>OL</sub> = 100 µA
				—	0.3		I <sub>OL</sub> = 4 mA
		1.8±0.15	1.2 to 1.6	—	0.2	I <sub>OL</sub> = 100 µA	
				—	0.3	I <sub>OL</sub> = 6 mA	
		2.5±0.2	1.2 to 1.95	—	0.2	I <sub>OL</sub> = 100 µA	
				—	0.6	I <sub>OL</sub> = 18 mA	
		3.3±0.3	1.2 to 2.7	—	0.2	I <sub>OL</sub> = 100 µA	
	—			0.55	I <sub>OL</sub> = 24 mA		
	V <sub>OLA</sub>	1.4 to 3.6	1.2	—	0.2	I <sub>OL</sub> = 100 µA	
				—	0.3	I <sub>OL</sub> = 2 mA	
		1.65 to 3.6	1.5±0.1	—	0.2	I <sub>OL</sub> = 100 µA	
				—	0.3	I <sub>OL</sub> = 4 mA	
		2.3 to 3.6	1.8±0.15	—	0.2	I <sub>OL</sub> = 100 µA	
				—	0.3	I <sub>OL</sub> = 6 mA	
3.0 to 3.6		2.5±0.2	—	0.2	I <sub>OL</sub> = 100 µA		
	—		0.6	I <sub>OL</sub> = 18 mA			
Input current	I <sub>IN</sub>	3.6	2.7	—	±5.0	µA	V <sub>I</sub> = GND or V <sub>CCB</sub> Control input
Off state output current	I <sub>OZ</sub>	3.6	2.7	—	±10	µA	V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub>
Output leak current	I <sub>OFF</sub>	0	0	—	10	µA	V <sub>IN</sub> , V <sub>OUT</sub> = 0 to 3.6 V
Quiescent supply current	I <sub>CCB</sub>	3.6	2.7	—	20	µA	I <sub>O</sub> (B port) = 0, A <sub>IN</sub> = V <sub>CCA</sub> or GND
	I <sub>CCA</sub>	3.6	2.7	—	20		I <sub>O</sub> (A port) = 0, B <sub>IN</sub> = V <sub>CCB</sub> or GND
	I <sub>CCB</sub>	3.6	2.7	—	±20	V <sub>CCB</sub> ≤ (V <sub>IN</sub> , V <sub>OUT</sub> ) ≤ 3.6 V	
	I <sub>CCA</sub>	3.6	2.7	—	±20	V <sub>CCA</sub> ≤ (V <sub>IN</sub> , V <sub>OUT</sub> ) ≤ 3.6 V	
Increase in I <sub>CC</sub> per Input* <sup>1</sup>	ΔI <sub>CCB</sub>	3.6	2.7	—	750	µA	B port or control input One input at V <sub>CCB</sub> -0.6 V Other input at V <sub>CCB</sub> or GND
	ΔI <sub>CCA</sub>	3.6	2.7	—	750	µA	A port One input at V <sub>CCA</sub> -0.6 V Other input at V <sub>CCA</sub> 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<sub>CC</sub> or GND.



## Capacitance

(Ta = 25°C)

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

## Switching Characteristics

(Ta = -40 to 85°C)

- V<sub>CCB</sub> = 3.3±0.3 V, V<sub>CCA</sub> = 2.5±0.2 V

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

**Switching Characteristics (cont)**

(Ta = -40 to 85°C)

- $V_{CCB} = 3.3 \pm 0.3$  V,  $V_{CCA} = 1.8 \pm 0.15$  V

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

- $V_{CCB} = 3.3 \pm 0.3$  V,  $V_{CCA} = 1.5 \pm 0.1$  V

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

**Switching Characteristics (cont)**

(Ta = -40 to 85°C)

- $V_{CCB} = 3.3 \pm 0.3$  V,  $V_{CCA} = 1.2$  V

Item	Symbol	Min	Typ	Max	Unit	Test conditions	From(Input)	To(Output)
Propagation delay time	$t_{PLH}$	—	4.0	—	ns	$C_L = 30$ pF	B	A
	$t_{PHL}$	—	4.0	—		$R_L = 500$ $\Omega$		
	$t_{PLH}$	—	3.5	—			A	B
	$t_{PHL}$	—	3.5	—				
Output enable time	$t_{ZH}$	—	5.0	—	ns	$C_L = 30$ pF	$\overline{OE}$	A
	$t_{ZL}$	—	5.0	—		$R_L = 500$ $\Omega$		
	$t_{ZH}$	—	2.5	—			$\overline{OE}$	B
	$t_{ZL}$	—	2.5	—				
Output disable time	$t_{HZ}$	—	3.0	—	ns	$C_L = 30$ pF	$\overline{OE}$	A
	$t_{LZ}$	—	3.0	—		$R_L = 500$ $\Omega$		
	$t_{HZ}$	—	2.5	—			$\overline{OE}$	B
	$t_{LZ}$	—	2.5	—				

- $V_{CCB} = 2.5 \pm 0.2$  V,  $V_{CCA} = 1.8 \pm 0.15$  V

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

**Switching Characteristics (cont)**

(Ta = -40 to 85°C)

- $V_{CCB} = 2.5 \pm 0.2$  V,  $V_{CCA} = 1.5 \pm 0.1$  V

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 $R_L = 500$ $\Omega$	B	A
	$t_{PHL}$	1.5	—	6.0				
	$t_{PLH}$	0.8	—	6.0	ns	$C_L = 30$ pF $R_L = 500$ $\Omega$	A	B
	$t_{PHL}$	0.8	—	6.0				
Output enable time	$t_{ZH}$	1.5	—	10.0	ns	$C_L = 30$ pF $R_L = 500$ $\Omega$	$\overline{OE}$	A
	$t_{ZL}$	1.5	—	10.0				
	$t_{ZH}$	1.5	—	7.0	ns	$C_L = 30$ pF $R_L = 500$ $\Omega$	$\overline{OE}$	B
	$t_{ZL}$	1.5	—	7.0				
Output disable time	$t_{HZ}$	1.5	—	6.0	ns	$C_L = 30$ pF $R_L = 500$ $\Omega$	$\overline{OE}$	A
	$t_{LZ}$	1.5	—	6.0				
	$t_{HZ}$	1.5	—	6.0	ns	$C_L = 30$ pF $R_L = 500$ $\Omega$	$\overline{OE}$	B
	$t_{LZ}$	1.5	—	6.0				

- $V_{CCB} = 2.5 \pm 0.2$  V,  $V_{CCA} = 1.2$  V

Item	Symbol	Min	Typ	Max	Unit	Test conditions	From(Input)	To(Output)
Propagation delay time	$t_{PLH}$	—	4.0	—	ns	$C_L = 30$ pF $R_L = 500$ $\Omega$	B	A
	$t_{PHL}$	—	4.0	—				
	$t_{PLH}$	—	3.5	—	ns	$C_L = 30$ pF $R_L = 500$ $\Omega$	A	B
	$t_{PHL}$	—	3.5	—				
Output enable time	$t_{ZH}$	—	5.5	—	ns	$C_L = 30$ pF $R_L = 500$ $\Omega$	$\overline{OE}$	A
	$t_{ZL}$	—	5.5	—				
	$t_{ZH}$	—	3.5	—	ns	$C_L = 30$ pF $R_L = 500$ $\Omega$	$\overline{OE}$	B
	$t_{ZL}$	—	3.5	—				
Output disable time	$t_{HZ}$	—	3.0	—	ns	$C_L = 30$ pF $R_L = 500$ $\Omega$	$\overline{OE}$	A
	$t_{LZ}$	—	3.0	—				
	$t_{HZ}$	—	2.5	—	ns	$C_L = 30$ pF $R_L = 500$ $\Omega$	$\overline{OE}$	B
	$t_{LZ}$	—	2.5	—				

**Switching Characteristics (cont)**

(Ta = -40 to 85°C)

- $V_{CCB} = 1.8 \pm 0.15 \text{ V}$ ,  $V_{CCA} = 1.5 \pm 0.1 \text{ V}$

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

- $V_{CCB} = 1.8 \pm 0.15 \text{ V}$ ,  $V_{CCA} = 1.2 \text{ V}$

Item	Symbol	Min	Typ	Max	Unit	Test conditions	From(Input)	To(Output)
Propagation delay time	$t_{PLH}$	—	4.5	—	ns	$C_L = 30 \text{ pF}$ $R_L = 500 \Omega$	B	A
	$t_{PHL}$	—	4.5	—				
	$t_{PLH}$	—	4.0	—			A	B
	$t_{PHL}$	—	4.0	—				
Output enable time	$t_{ZH}$	—	6.0	—	ns	$C_L = 30 \text{ pF}$ $R_L = 500 \Omega$	$\overline{OE}$	A
	$t_{ZL}$	—	6.0	—				
	$t_{ZH}$	—	4.5	—			$\overline{OE}$	B
	$t_{ZL}$	—	4.5	—				
Output disable time	$t_{HZ}$	—	3.5	—	ns	$C_L = 30 \text{ pF}$ $R_L = 500 \Omega$	$\overline{OE}$	A
	$t_{LZ}$	—	3.5	—				
	$t_{HZ}$	—	3.5	—			$\overline{OE}$	B
	$t_{LZ}$	—	3.5	—				

## HD74ALVC166245A

### Switching Characteristics (cont)

( $T_a = -40$  to  $85^\circ\text{C}$ )

- $V_{CCB} = 1.5 \pm 0.1 \text{ V}$ ,  $V_{CCA} = 1.2 \text{ V}$

Item	Symbol	Min	Typ	Max	Unit	Test conditions	From(Input)	To(Output)
Propagation delay time	$t_{PLH}$	—	5.0	—	ns	$C_L = 30 \text{ pF}$	B	A
	$t_{PHL}$	—	5.0	—		$R_L = 500 \Omega$		
	$t_{PLH}$	—	5.0	—			A	B
	$t_{PHL}$	—	5.0	—				
Output enable time	$t_{ZH}$	—	7.0	—	ns	$C_L = 30 \text{ pF}$	$\overline{OE}$	A
	$t_{ZL}$	—	7.0	—		$R_L = 500 \Omega$		
	$t_{ZH}$	—	6.0	—			$\overline{OE}$	B
	$t_{ZL}$	—	6.0	—				
Output disable time	$t_{HZ}$	—	4.5	—	ns	$C_L = 30 \text{ pF}$	$\overline{OE}$	A
	$t_{LZ}$	—	4.5	—		$R_L = 500 \Omega$		
	$t_{HZ}$	—	4.0	—			$\overline{OE}$	B
	$t_{LZ}$	—	4.0	—				

### Operating Characteristics

Item	Symbol	$V_{CCA}$ (V)	$V_{CCB}$ (V)	Min	Typ	Max	Unit	Test Conditions
Power dissipation capacitance	$C_{PD}$	2.5	3.3	—	40	—	pF	$f = 10 \text{ MHz}$ $C_L = 0$

### 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.

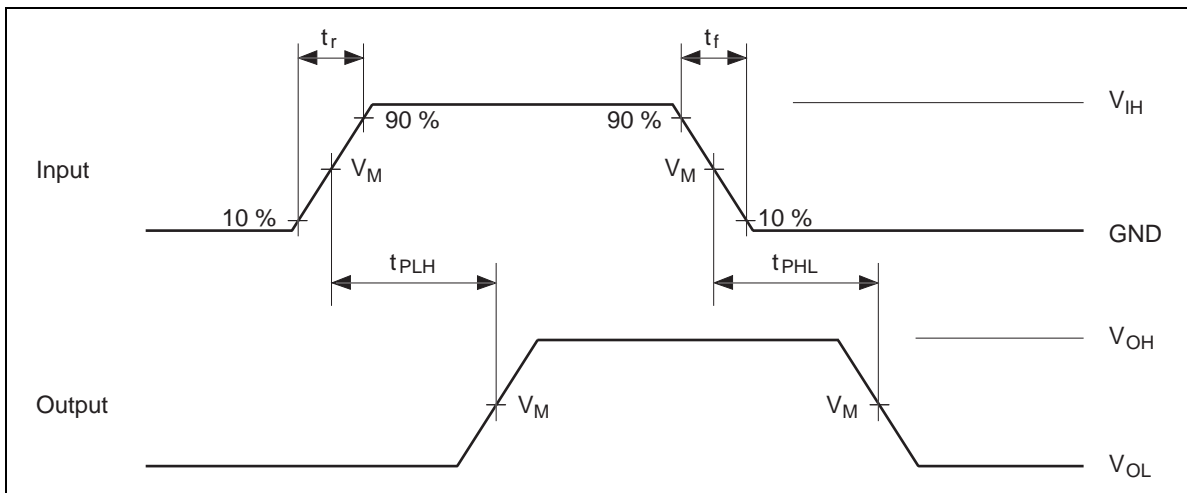
Test Circuit

Load circuit for outputs

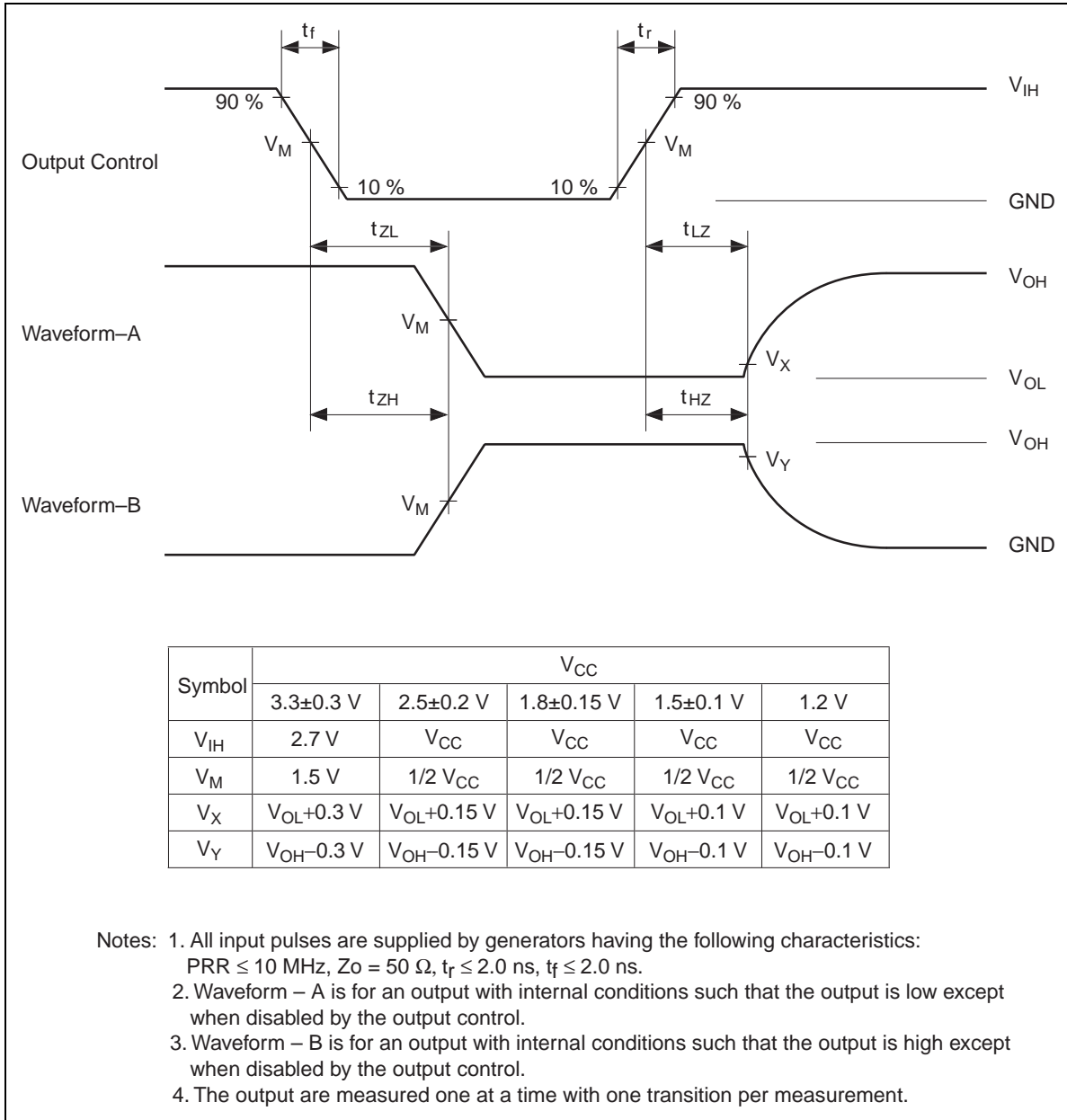
Symbol	$V_{CCB} = 3.3 \pm 0.3 \text{ V}$ $V_{CCA} = 2.5 \pm 0.2 \text{ V}$ $= 1.8 \pm 0.15 \text{ V}$ $= 1.5 \pm 0.1 \text{ V}$ $= 1.2 \text{ V}$		$V_{CCB} = 2.5 \pm 0.2 \text{ V}$ $V_{CCA} = 1.8 \pm 0.15 \text{ V}$ $= 1.5 \pm 0.1 \text{ V}$ $= 1.2 \text{ V}$		$V_{CCB} = 1.8 \pm 0.15 \text{ V}$ $V_{CCA}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

Note: 1.  $C_L$  includes probe and jig capacitance.

Waveforms – 1

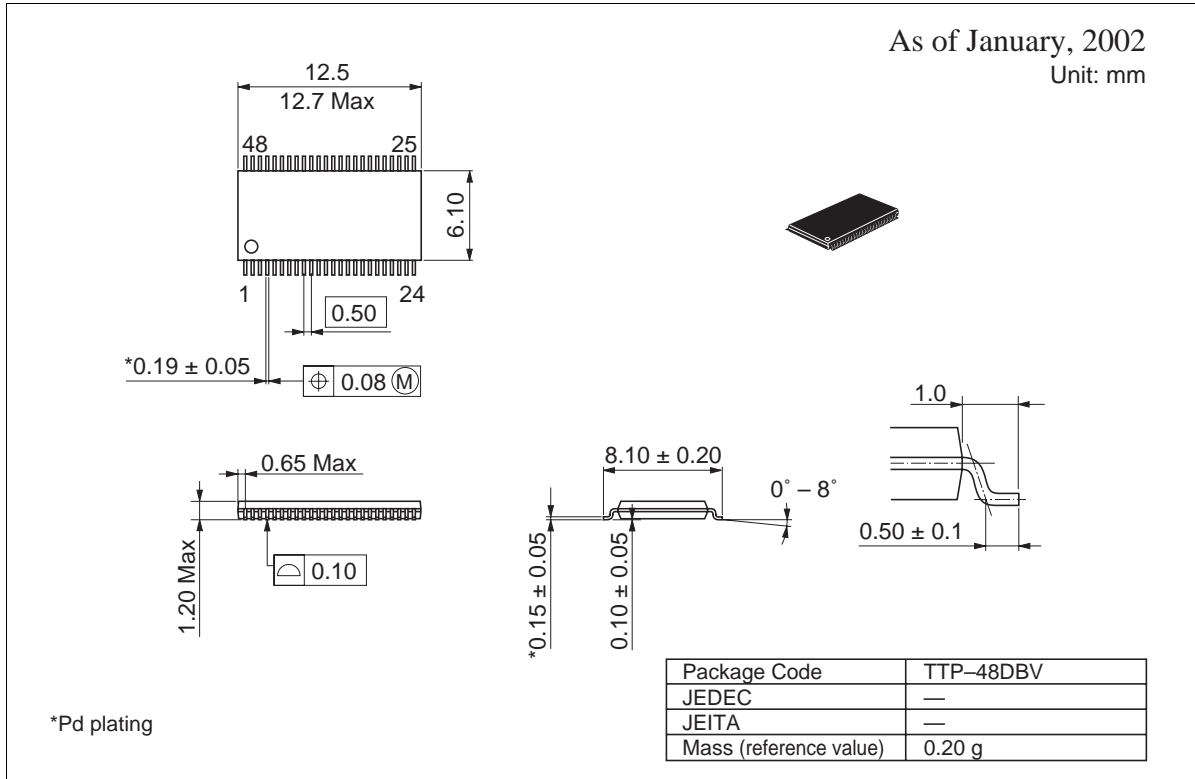


Waveforms – 2





Package Dimensions



**Renesas Technology Corp.** Sales Strategic Planning Div. Nippon Bldg., 2-6-2, Ohte-machi, Chiyoda-ku, Tokyo 100-0004, Japan

---

**Keep safety first in your circuit designs!**

1. Renesas Technology Corp. puts the maximum effort into making semiconductor products better and more reliable, but there is always the possibility that trouble may occur with them. Trouble with semiconductors may lead to personal injury, fire or property damage. Remember to give due consideration to safety when making your circuit designs, with appropriate measures such as (i) placement of substitutive, auxiliary circuits, (ii) use of nonflammable material or (iii) prevention against any malfunction or mishap.

**Notes regarding these materials**

1. These materials are intended as a reference to assist our customers in the selection of the Renesas Technology Corp. product best suited to the customer's application; they do not convey any license under any intellectual property rights, or any other rights, belonging to Renesas Technology Corp. or a third party.
  2. Renesas Technology Corp. assumes no responsibility for any damage, or infringement of any third-party's rights, originating in the use of any product data, diagrams, charts, programs, algorithms, or circuit application examples contained in these materials.
  3. All information contained in these materials, including product data, diagrams, charts, programs and algorithms represents information on products at the time of publication of these materials, and are subject to change by Renesas Technology Corp. without notice due to product improvements or other reasons. It is therefore recommended that customers contact Renesas Technology Corp. or an authorized Renesas Technology Corp. product distributor for the latest product information before purchasing a product listed herein.  
The information described here may contain technical inaccuracies or typographical errors.  
Renesas Technology Corp. assumes no responsibility for any damage, liability, or other loss rising from these inaccuracies or errors.  
Please also pay attention to information published by Renesas Technology Corp. by various means, including the Renesas Technology Corp. Semiconductor home page (<http://www.renesas.com>).
  4. When using any or all of the information contained in these materials, including product data, diagrams, charts, programs, and algorithms, please be sure to evaluate all information as a total system before making a final decision on the applicability of the information and products. Renesas Technology Corp. assumes no responsibility for any damage, liability or other loss resulting from the information contained herein.
  5. Renesas Technology Corp. semiconductors are not designed or manufactured for use in a device or system that is used under circumstances in which human life is potentially at stake. Please contact Renesas Technology Corp. or an authorized Renesas Technology Corp. product distributor when considering the use of a product contained herein for any specific purposes, such as apparatus or systems for transportation, vehicular, medical, aerospace, nuclear, or undersea repeater use.
  6. The prior written approval of Renesas Technology Corp. is necessary to reprint or reproduce in whole or in part these materials.
  7. If these products or technologies are subject to the Japanese export control restrictions, they must be exported under a license from the Japanese government and cannot be imported into a country other than the approved destination.  
Any diversion or reexport contrary to the export control laws and regulations of Japan and/or the country of destination is prohibited.
  8. Please contact Renesas Technology Corp. for further details on these materials or the products contained therein.
- 



**RENESAS SALES OFFICES**

<http://www.renesas.com>

**Renesas Technology America, Inc.**

450 Holger Way, San Jose, CA 95134-1368, U.S.A  
Tel: <1> (408) 382-7500 Fax: <1> (408) 382-7501

**Renesas Technology Europe Limited.**

Dukes Meadow, Millboard Road, Bourne End, Buckinghamshire, SL8 5FH, United Kingdom  
Tel: <44> (1628) 585 100, Fax: <44> (1628) 585 900

**Renesas Technology Europe GmbH**

Dornacher Str. 3, D-85622 Feldkirchen, Germany  
Tel: <49> (89) 380 70 0, Fax: <49> (89) 929 30 11

**Renesas Technology Hong Kong Ltd.**

7/F., North Tower, World Finance Centre, Harbour City, Canton Road, Hong Kong  
Tel: <852> 2265-6688, Fax: <852> 2375-6836

**Renesas Technology Taiwan Co., Ltd.**

FL 10, #99, Fu-Hsing N. Rd., Taipei, Taiwan  
Tel: <886> (2) 2715-2888, Fax: <886> (2) 2713-2999

**Renesas Technology (Shanghai) Co., Ltd.**

26/F., Ruijin Building, No.205 Maoming Road (S), Shanghai 200020, China  
Tel: <86> (21) 6472-1001, Fax: <86> (21) 6415-2952

**Renesas Technology Singapore Pte. Ltd.**

1, Harbour Front Avenue, #06-10, Keppel Bay Tower, Singapore 098632  
Tel: <65> 6213-0200, Fax: <65> 6278-8001

