

To our customers,

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## Old Company Name in Catalogs and Other Documents

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Renesas Electronics website: <http://www.renesas.com>

April 1<sup>st</sup>, 2010  
Renesas Electronics Corporation

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# RD74LVC16244B

## 16-bit Buffers / Line Drivers with 3-state Outputs

REJ03D0527-0100

Rev.1.00

Mar. 14, 2005

### Description

The RD74LVC16244B has sixteen line drivers with three state outputs in a 48 pin package. This device is a non inverting buffer and has two active low enables ( $\overline{1G}$  to  $\overline{4G}$ ). Each enable independently controls four buffers. 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

- $V_{CC} = 1.65 \text{ V to } 5.5 \text{ V}$
- All inputs  $V_{IH} (\text{Max.}) = 5.5 \text{ V} (@V_{CC} = 0 \text{ V to } 5.5 \text{ V})$
- All outputs  $V_{OUT} (\text{Max.}) = 5.5 \text{ V} (@V_{CC} = 0 \text{ V or output off state})$
- Typical  $V_{OL}$  ground bounce  $< 0.8 \text{ V} (@V_{CC} = 3.3 \text{ V, } T_a = 25^\circ\text{C})$
- Typical  $V_{OH}$  undershoot  $> 2.0 \text{ V} (@V_{CC} = 3.3 \text{ V, } T_a = 25^\circ\text{C})$
- High output current
  - $\pm 4 \text{ mA} (@V_{CC} = 1.65 \text{ V})$
  - $\pm 8 \text{ mA} (@V_{CC} = 2.3 \text{ V})$
  - $\pm 12 \text{ mA} (@V_{CC} = 2.7 \text{ V})$
  - $\pm 24 \text{ mA} (@V_{CC} = 3.0 \text{ V to } 5.5 \text{ V})$
- Ordering Information

Part Name	Package Type	Package Code (Previous Code)	Package Abbreviation	Taping Abbreviation (Quantity)
RD74LVC16244BTEL	TSSOP-48 pin	PTSP0048KA-A (TTP-48DBV)	T	EL (1,000 pcs/reel)

### Function Table

Inputs		Output Y
$\overline{G}$	A	
H	X	Z
L	H	H
L	L	L

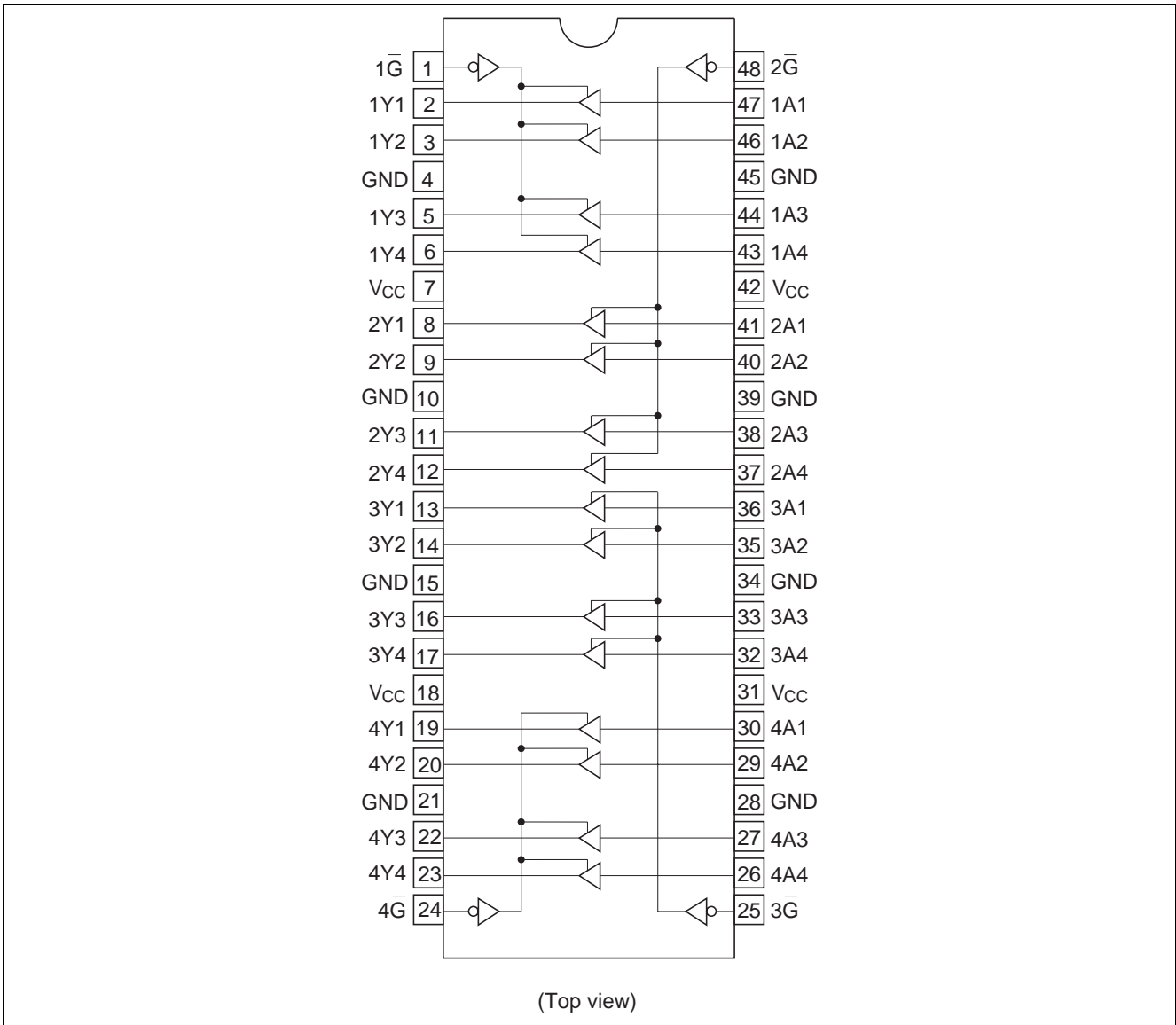
H: High level

L: Low level

X: Immaterial

Z: High impedance

Pin Arrangement



## Absolute Maximum Ratings

Item	Symbol	Ratings	Unit	Conditions
Supply voltage	$V_{CC}$	-0.5 to 7.0	V	
Input diode current	$I_{IK}$	-50	mA	$V_I = -0.5$ V
Input voltage	$V_I$	-0.5 to 7.0	V	
Output diode current	$I_{OK}$	-50	mA	$V_O = -0.5$ V
		50		$V_O = V_{CC} + 0.5$ V
Output voltage	$V_O$	-0.5 to $V_{CC} + 0.5$	V	Output "H" or "L"
		-0.5 to 7.0		Output "Z" or $V_{CC}: OFF$
Output current	$I_O$	$\pm 50$	mA	
$V_{CC}$ , GND current / pin	$I_{CC}$ or $I_{GND}$	100	mA	
Storage temperature	$T_{stg}$	-65 to +150	$^{\circ}C$	

Note: 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.

## Recommended Operating Conditions

Item	Symbol	Ratings	Unit	Conditions
Supply voltage	$V_{CC}$	1.5 to 5.5	V	Data hold
		1.65 to 5.5		At operation
Input / Output voltage	$V_I$	0 to 5.5	V	$\bar{G}$ , A
	$V_O$	0 to $V_{CC}$		Output "H" or "L"
		0 to 5.5		Output "Z" or $V_{CC}: OFF$
Operating temperature	$T_a$	-40 to 85	$^{\circ}C$	
Output current	$I_{OH}$	-4	mA	$V_{CC} = 1.65$ V
		-8		$V_{CC} = 2.3$ V
		-12		$V_{CC} = 2.7$ V
		-24		$V_{CC} = 3.0$ V to 5.5 V
	$I_{OL}$	4	mA	$V_{CC} = 1.65$ V
		8		$V_{CC} = 2.3$ V
		12		$V_{CC} = 2.7$ V
		24		$V_{CC} = 3.0$ V to 5.5 V
Input rise / fall time <sup>*1</sup>	$t_r, t_f$	20	ns/V	$V_{CC} = 1.65$ V to 2.7 V
		10		$V_{CC} = 3.0$ V to 5.5 V

Notes: 1. This item guarantees maximum limit when one input switches.

Waveform: Refer to test circuit of switching characteristics.

## Electrical Characteristics

Item	Symbol	V <sub>CC</sub> (V)	Ta = -40 to 85°C		Unit	Test Conditions
			Min	Max		
Input voltage	V <sub>IH</sub>	1.65 to 1.95	V <sub>CC</sub> ×0.65	—	V	
		2.3 to 2.7	1.7	—		
		2.7 to 3.6	2.0	—		
		4.5 to 5.5	V <sub>CC</sub> ×0.7	—		
	V <sub>IL</sub>	1.65 to 1.95	—	V <sub>CC</sub> ×0.35	V	
		2.3 to 2.7	—	0.7		
		2.7 to 3.6	—	0.8		
		4.5 to 5.5	—	V <sub>CC</sub> ×0.3		
Output voltage	V <sub>OH</sub>	1.65 to 5.5	V <sub>CC</sub> -0.2	—	V	I <sub>OH</sub> = -100 μA
		1.65	1.2	—		I <sub>OH</sub> = -4 mA
		2.3	1.7	—		I <sub>OH</sub> = -8 mA
		2.7	2.2	—		I <sub>OH</sub> = -12 mA
		3.0	2.4	—		
		3.0	2.2	—		I <sub>OH</sub> = -24 mA
		4.5	3.8	—		
	V <sub>OL</sub>	1.65 to 5.5	—	0.2	V	I <sub>OL</sub> = 100 μA
		1.65	—	0.45		I <sub>OL</sub> = 4 mA
		2.3	—	0.7		I <sub>OL</sub> = 8 mA
		2.7	—	0.4		I <sub>OL</sub> = 12 mA
		3.0	—	0.55		
		4.5	—	0.55		I <sub>OL</sub> = 24 mA
	Input current	I <sub>IN</sub>	0 to 5.5	—	±5.0	μA
Output leak current	I <sub>OFF</sub>	0	—	±5.0	μA	V <sub>IN</sub> / V <sub>OUT</sub> = 5.5 V
Off state output current	I <sub>oz</sub>	2.7 to 5.5	—	±5.0	μA	V <sub>IN</sub> = V <sub>CC</sub> or GND V <sub>O</sub> = 5.5 V or GND
Quiescent supply current	I <sub>CC</sub>	2.7 to 3.6	—	±10	μA	V <sub>IN</sub> = 3.6 V to 5.5 V
		2.7 to 5.5	—	10		V <sub>IN</sub> = V <sub>CC</sub> or GND
	ΔI <sub>CC</sub>	2.7 to 3.6	—	500	μA	V <sub>IN</sub> = one input at (V <sub>CC</sub> -0.6)V, other inputs at V <sub>CC</sub> or GND

## Switching Characteristics

Item	Symbol	V <sub>CC</sub> (V)	Ta = -40 to 85°C			Unit	From (Input)	To (Output)
			Min	Typ	Max			
Propagation delay time	t <sub>PLH</sub>	1.8±0.15	1.0	—	10.9	ns	A	Y
	t <sub>PHL</sub>	2.5±0.2	1.0	—	7.9			
		2.7	1.0	—	5.8			
		3.3±0.3	1.5	—	5.2			
		5.0±0.5	1.0	—	4.0			
Output enable time	t <sub>ZH</sub>	1.8±0.15	1.0	—	12.6	ns	$\bar{G}$	Y
	t <sub>ZL</sub>	2.5±0.2	1.0	—	9.6			
		2.7	1.0	—	8.2			
		3.3±0.3	1.5	—	7.5			
		5.0±0.5	1.0	—	5.5			
Output disable time	t <sub>HZ</sub>	1.8±0.15	1.0	—	12.1	ns	$\bar{G}$	Y
	t <sub>LZ</sub>	2.5±0.2	1.0	—	7.8			
		2.7	1.0	—	7.7			
		3.3±0.3	1.5	—	7.0			
		5.0±0.5	1.0	—	6.0			
Between output pins skew*1	t <sub>OSLH</sub>	1.8±0.15	—	—	—	ns		
	t <sub>OSHL</sub>	2.5±0.2	—	—	—			
		2.7	—	—	—			
		3.3±0.3	—	—	1.0			
		5.0±0.5	—	—	1.0			
Input capacitance	C <sub>IN</sub>	3.3	—	4.0	—	pF		
Output capacitance	C <sub>O</sub>	3.3	—	8.0	—	pF		

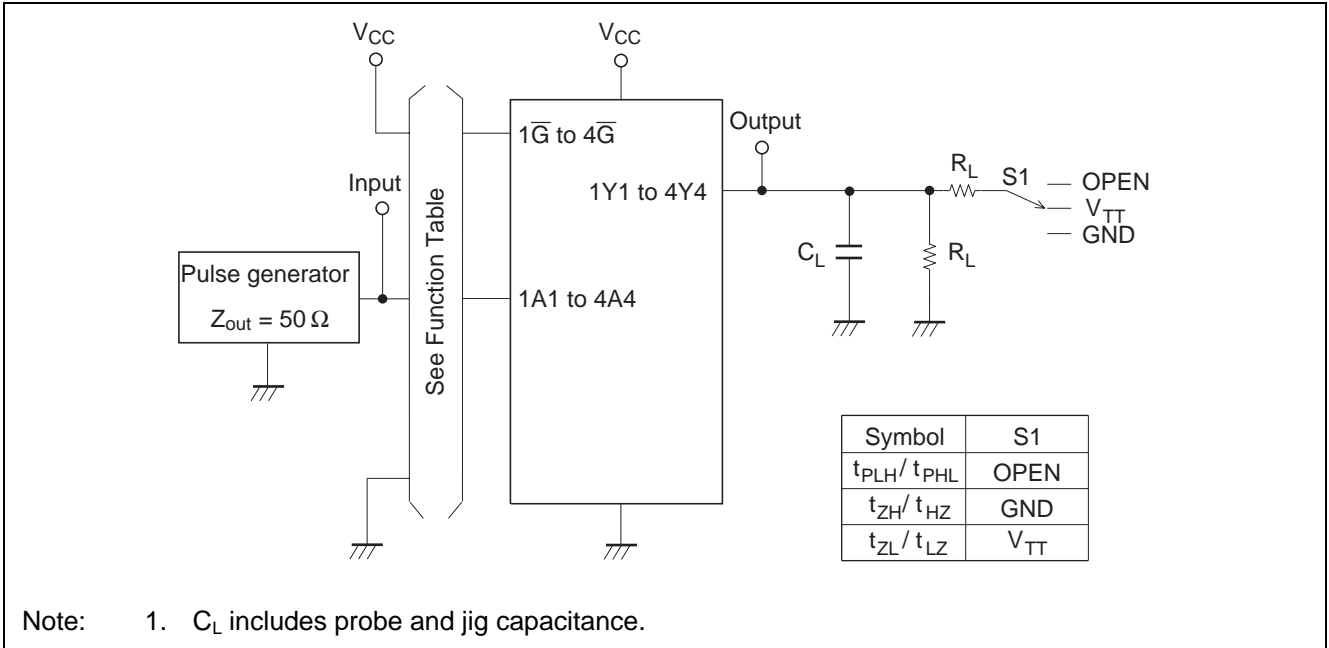
Note: 1. This parameter is characterized but not tested.

$$t_{OSLH} = |t_{PLHm} - t_{PLHn}|, t_{OSHL} = |t_{PHLm} - t_{PHLn}|$$

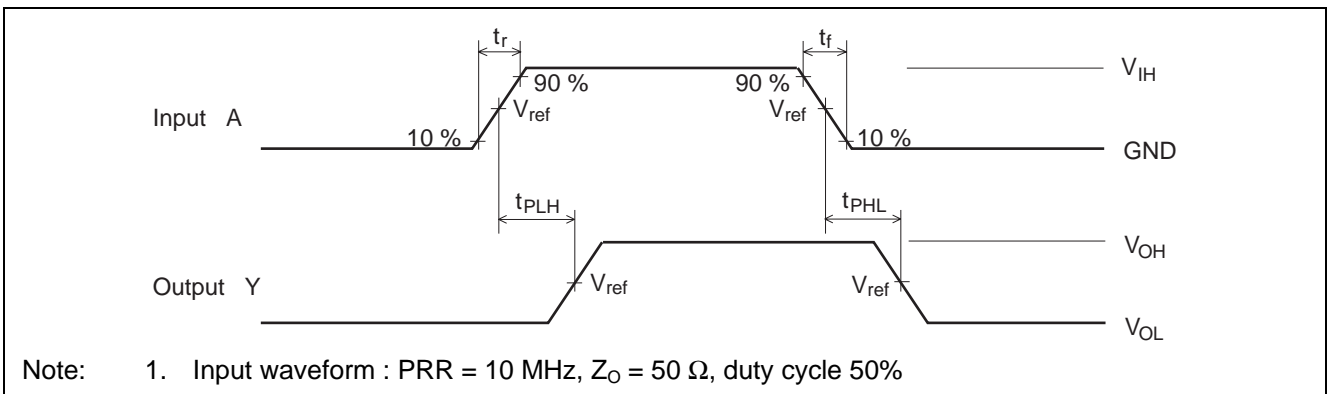
## Operating Characteristics

Item	Symbol	V <sub>CC</sub> (V)	Ta = 25°C			Unit	Test conditions
			Min	Typ	Max		
Power dissipation Capacitance	C <sub>PD</sub>	1.8	—	25.0	—	pF	f = 10 MHz
		2.5	—	25.0	—		
		3.3	—	27.0	—		
		5.0	—	32.0	—		

Test Circuit

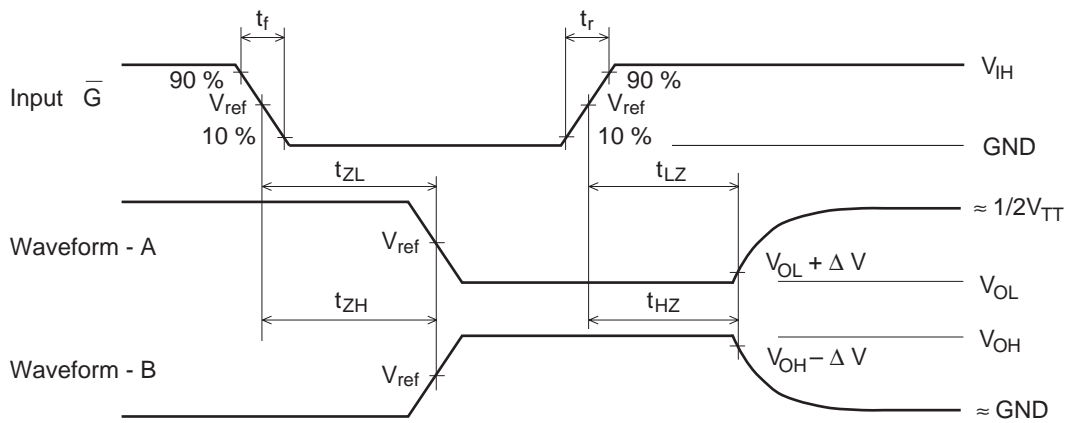


Waveforms – 1





Waveforms – 2



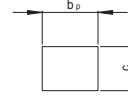
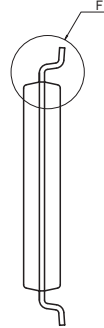
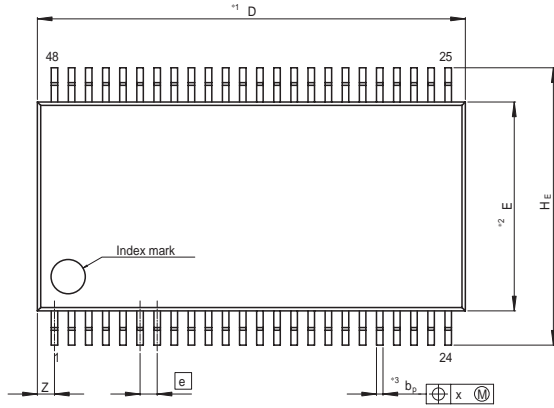
Vcc (V)	INPUTS		Vref	VTT	CL	RL	ΔV
	Vi	tr/tr					
Vcc = 1.8±0.15 V	Vcc	≤ 2 ns	1/2 Vcc	2× Vcc	30 pF	1.0 kΩ	0.15 V
Vcc = 2.5±0.2 V	Vcc	≤ 2 ns	1/2 Vcc	2× Vcc	30 pF	500 Ω	0.15 V
Vcc = 2.7 V	2.7 V	≤ 2.5 ns	1.5 V	6 V	50 pF	500 Ω	0.3 V
Vcc = 3.3±0.3 V	2.7 V	≤ 2.5 ns	1.5 V	6 V	50 pF	500 Ω	0.3 V
Vcc = 5.0±0.5 V	Vcc	≤ 2.5 ns	1/2 Vcc	2× Vcc	50 pF	500 Ω	0.3 V

- Notes:
1. Input waveform : PRR = 10 MHz,  $Z_o = 50 \Omega$ , duty cycle 50%
  2. Waveform – A shows input conditions such that the output is "L" level when enable by the output control.
  3. Waveform – B shows input conditions such that the output is "H" level when enable by the output control.

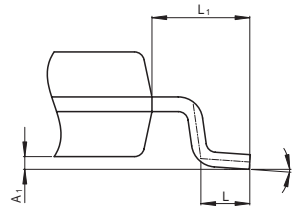
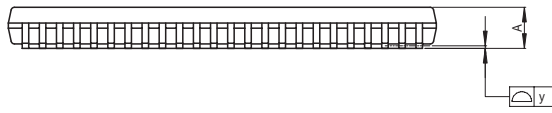
Package Dimensions

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 <sub>2</sub>	—	—	—
A <sub>1</sub>	0.08	0.13	0.18
A	—	—	1.20
b <sub>p</sub>	0.14	0.19	0.24
b <sub>1</sub>	—	—	—
c	0.10	0.15	0.20
c <sub>1</sub>	—	—	—
$\theta$	0°	—	8°
H <sub>E</sub>	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 <sub>1</sub>	—	1.0	—

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