

# RD74LVC16373B

## 16-bit D-type Transparent Latches with 3-state Outputs

REJ03D0500-0100

Rev.1.00

Jan. 24, 2005

### Description

The RD74LVC16373B has sixteen D type latches with three state outputs in a 48 pin package. When the latch enable input is high, the Q outputs will follow the D inputs. When the latch enable goes low, data at the D inputs will be retained at the outputs until latch enable returns high again. When a high logic level is applied to the output control input ( $\overline{1G}$ ,  $\overline{2G}$ ), all outputs go to a high impedance state, regardless of what signals are present at the other inputs and the state of the storage elements. 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)
RD74LVC16373BTEL	TSSOP-48 pin	PTSP0048KA-A (TTP-48DBV)	T	EL (1,000 pcs/reel)

### Function Table

$\overline{G}$	Inputs		Output Q
	LE	D	
H	X	X	Z
L	H	L	L
L	H	H	H
L	L	X	$Q_0$

H: High level

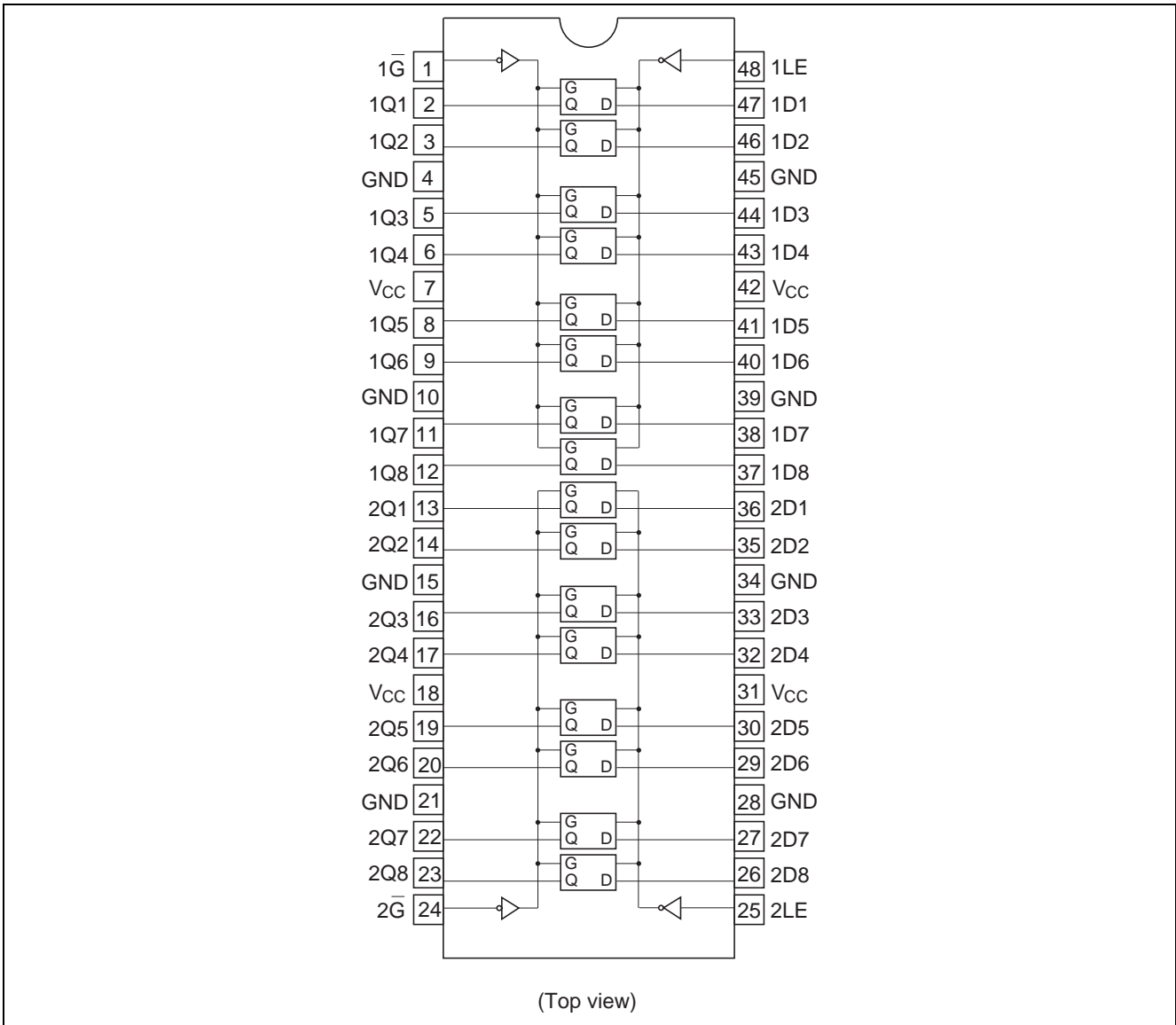
L: Low level

X: Immaterial

Z: High impedance

$Q_0$ : Level of Q before the indicated steady input conditions were established.

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	$\bar{G}$ , LE, D
	$V_O$	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		
		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		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		
		3.0	—	0.55		I <sub>OL</sub> = 24 mA
		4.5	—	0.55		
Input current	I <sub>IN</sub>	0 to 5.5	—	±5.0	μA	V <sub>IN</sub> = 5.5 V or GND
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>OUT</sub> = 5.5 V or GND
Quiescent supply current	I <sub>CC</sub>	2.7 to 3.6	—	±10.0	μA	V <sub>IN</sub> = 3.6 to 5.5 V
		2.7 to 5.5	—	10.0	μA	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> t <sub>PHL</sub>	1.8±0.15	1.0	—	19.1	ns	D	Q
		2.5±0.2	1.0	—	9.6			
		2.7	1.0	—	7.7			
		3.3±0.3	1.5	—	7.0			
		5.0±0.5	1.0	—	5.5			
	t <sub>PLH</sub> t <sub>PHL</sub>	1.8±0.15	1.0	—	19.1	ns	LE	Q
		2.5±0.2	1.0	—	9.6			
		2.7	1.0	—	7.7			
		3.3±0.3	1.5	—	7.0			
		5.0±0.5	1.0	—	5.5			
Output enable time	t <sub>ZH</sub> t <sub>ZL</sub>	1.8±0.15	1.0	—	20.0	ns	$\bar{G}$	Q
		2.5±0.2	1.0	—	10.5			
		2.7	1.0	—	8.0			
		3.3±0.3	1.5	—	7.0			
		5.0±0.5	1.0	—	6.0			
Output disable time	t <sub>HZ</sub> t <sub>LZ</sub>	1.8±0.15	1.0	—	20.0	ns	$\bar{G}$	Q
		2.5±0.2	1.0	—	10.5			
		2.7	1.0	—	8.0			
		3.3±0.3	1.5	—	7.0			
		5.0±0.5	1.0	—	6.0			
Setup time	t <sub>su</sub>	1.8±0.15	6.0	—	—	ns		
		2.5±0.2	4.0	—	—			
		2.7	2.0	—	—			
		3.3±0.3	2.0	—	—			
		5.0±0.5	2.0	—	—			
Hold time	t <sub>h</sub>	1.8±0.15	4.0	—	—	ns		
		2.5±0.2	2.0	—	—			
		2.7	1.5	—	—			
		3.3±0.3	1.5	—	—			
		5.0±0.5	1.5	—	—			
Pulse width	t <sub>w</sub>	1.8±0.15	9.0	—	—	ns		
		2.5±0.2	4.0	—	—			
		2.7	3.3	—	—			
		3.3±0.3	3.3	—	—			
		5.0±0.5	3.3	—	—			
Between output pins skew <sup>1</sup>	t <sub>OSLH</sub> t <sub>OSHL</sub>	1.8±0.15	—	—	—	ns		
		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		

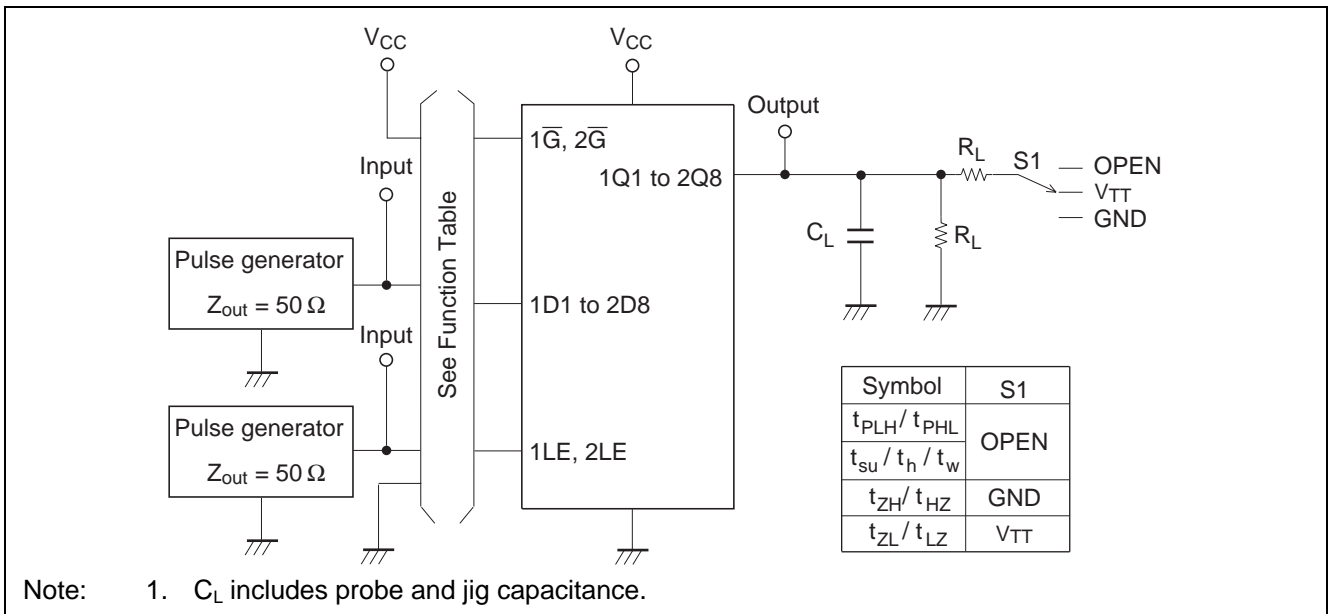
Note: 1. This parameter is characterized but not tested.

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

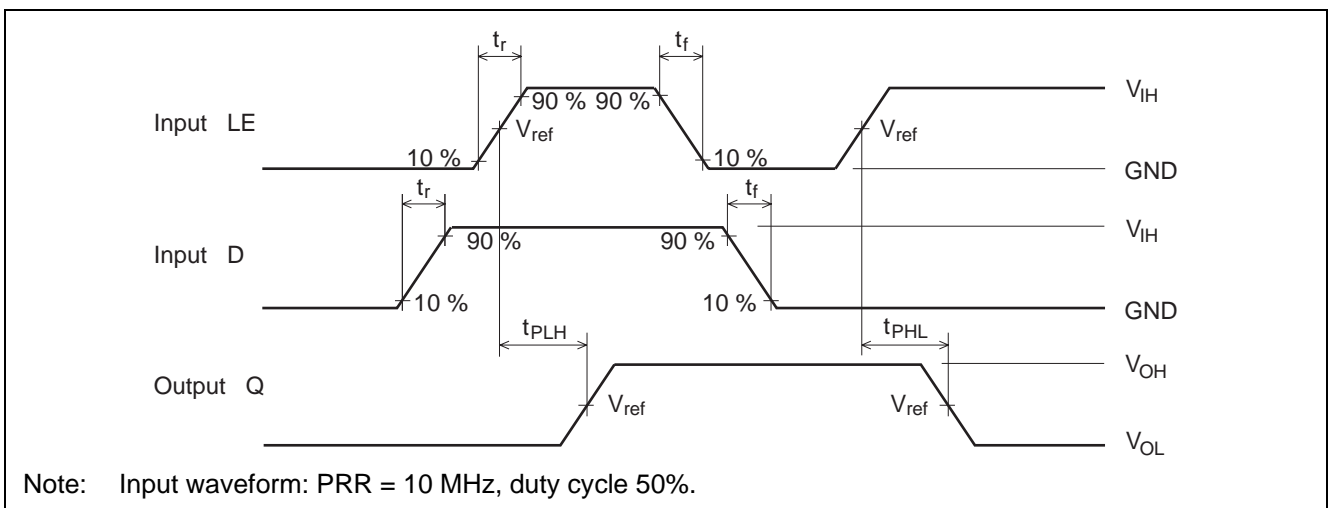
### Operating Characteristics

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	—	27	—	pF	f = 10 MHz
		2.5	—	28	—		
		3.3	—	30	—		
		5.0	—	35	—		

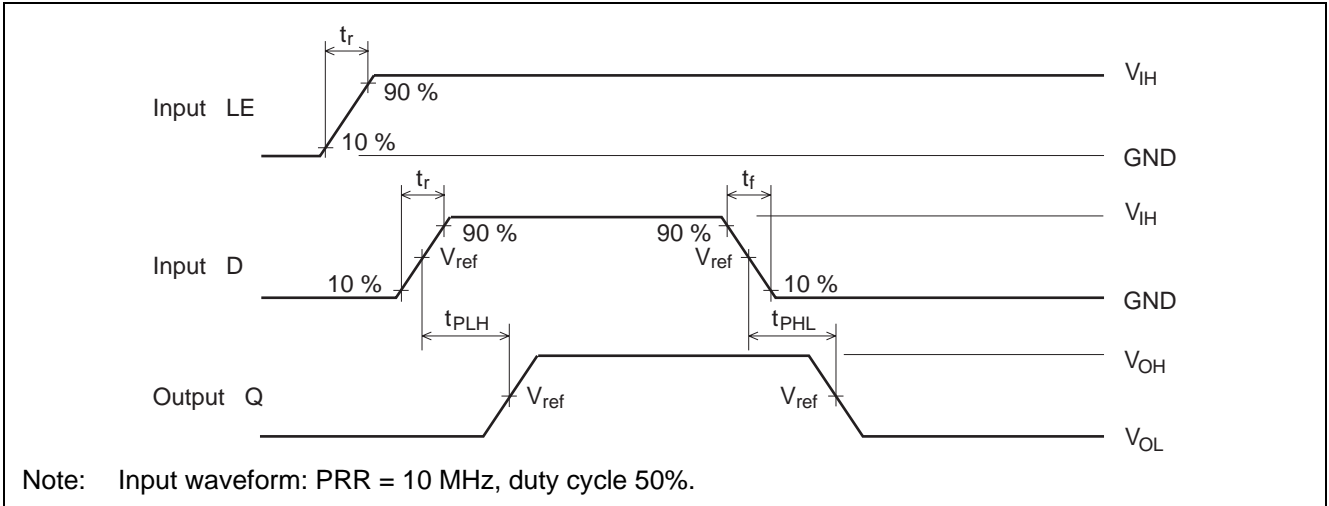
### Test Circuit



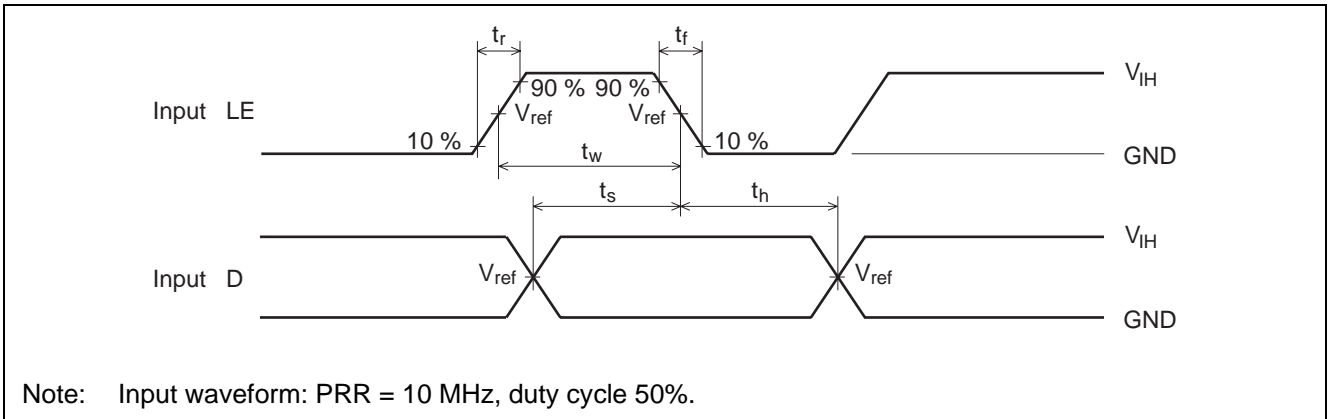
### Waveforms – 1



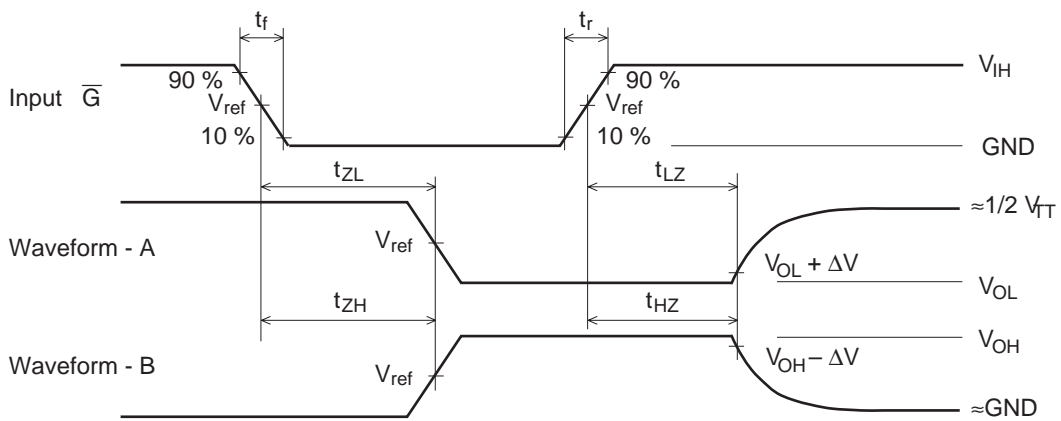
Waveforms – 2



Waveforms – 3



Waveforms – 4



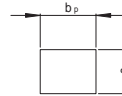
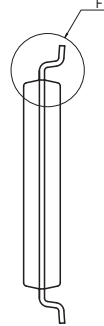
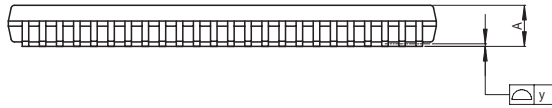
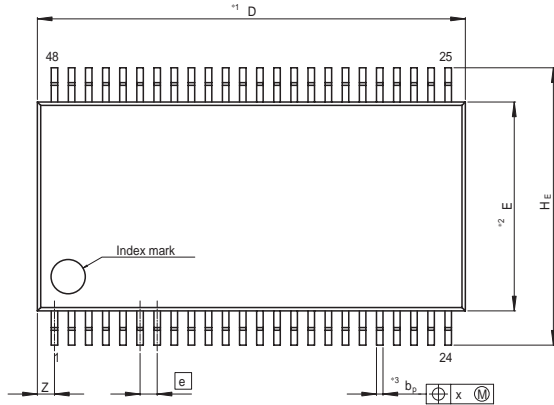
V <sub>CC</sub> (V)	INPUTS		V <sub>ref</sub>	V <sub>TT</sub>	C <sub>L</sub>	R <sub>L</sub>	ΔV
	V <sub>IH</sub>	t <sub>r</sub> /t <sub>f</sub>					
V <sub>CC</sub> = 1.8±0.15 V	V <sub>CC</sub>	≤ 2 ns	1/2 V <sub>CC</sub>	2× V <sub>CC</sub>	30 pF	1.0 kΩ	0.15 V
V <sub>CC</sub> = 2.5±0.2 V	V <sub>CC</sub>	≤ 2 ns	1/2 V <sub>CC</sub>	2× V <sub>CC</sub>	30 pF	500 Ω	0.15 V
V <sub>CC</sub> = 2.7 V	2.7 V	≤ 2.5 ns	1.5 V	6 V	50 pF	500 Ω	0.3 V
V <sub>CC</sub> = 3.3±0.3 V	2.7 V	≤ 2.5 ns	1.5 V	6 V	50 pF	500 Ω	0.3 V
V <sub>CC</sub> = 5.0±0.5 V	V <sub>CC</sub>	≤ 2.5 ns	1/2 V <sub>CC</sub>	2× V <sub>CC</sub>	50 pF	500 Ω	0.3 V

- Notes:
1. Input waveform :PRR = 10 MHz, 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.

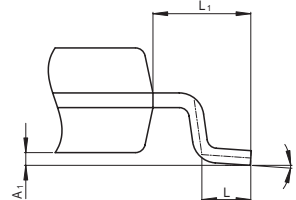


# Package Dimensions

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



Terminal cross section  
( Ni/Pd/Au plating )



Detail F

NOTE)  
1. DIMENSIONS\*1 (Nom)\*AND\*2\*  
DO NOT INCLUDE MOLD FLASH  
2. DIMENSION\*3\*DOES NOT  
INCLUDE TRIM OFFSET.

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>	—	—	—
θ	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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