

RD74LVC16374B

16-bit D-type Flip Flops with 3-state Outputs

REJ03D0501-0100

Rev.1.00

Jan. 24, 2005

Description

The RD74LVC16374B has sixteen edge trigger D type flip flops with three state outputs in a 48 pin package. Data at the D inputs meeting set up requirements are transferred to the Q outputs on positive going transitions of the clock input. 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, 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)
RD74LVC16374BTEL	TSSOP-48 pin	PTSP0048KA-A (TTP-48DBV)	T	EL (1,000 pcs/reel)

Function Table

Inputs			Output Q
\bar{G}	CK	D	
H	X	X	Z
L	\uparrow	L	L
L	\uparrow	H	H
L	L	X	Q_0

H: High level

L: Low level

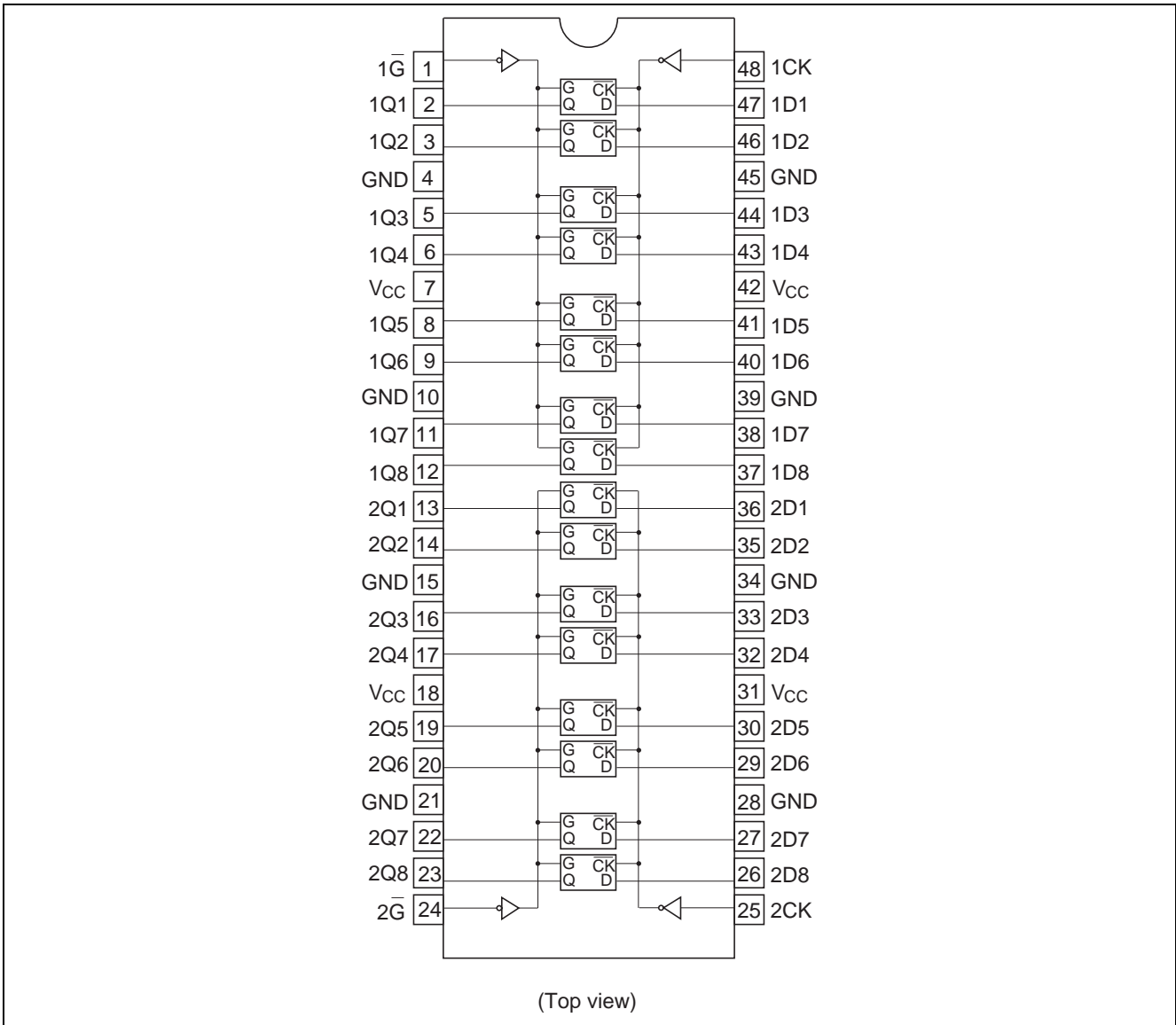
X: Immaterial

Z: High impedance

\uparrow : Low to high transition

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	± 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} , CK, 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 ^{**1}	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 _{CC} (V)	Ta = -40 to 85°C		Unit	Test Conditions
			Min	Max		
Input voltage	V _{IH}	1.65 to 1.95	V _{CC} ×0.65	—	V	
		2.3 to 2.7	1.7	—		
		2.7 to 3.6	2.0	—		
		4.5 to 5.5	V _{CC} ×0.7	—		
	V _{IL}	1.65 to 1.95	—	V _{CC} ×0.35		
		2.3 to 2.7	—	0.7		
		2.7 to 3.6	—	0.8		
		4.5 to 5.5	—	V _{CC} ×0.3		
Output voltage	V _{OH}	1.65 to 5.5	V _{CC} -0.2	—	V	I _{OH} = -100 μA
		1.65	1.2	—		I _{OH} = -4 mA
		2.3	1.7	—		I _{OH} = -8 mA
		2.7	2.2	—		I _{OH} = -12 mA
		3.0	2.4	—		
		3.0	2.2	—		I _{OH} = -24 mA
		4.5	3.8	—		
	V _{OL}	1.65 to 5.5	—	0.2		I _{OL} = 100 μA
		1.65	—	0.45		I _{OL} = 4 mA
		2.3	—	0.7		I _{OL} = 8 mA
		2.7	—	0.4		I _{OL} = 12 mA
		3.0	—	0.55		
		4.5	—	0.55		I _{OL} = 24 mA
Input current	I _{IN}	0 to 5.5	—	±5.0	μA	V _{IN} = 5.5 V or GND
Output leak current	I _{OFF}	0	—	±5.0	μA	V _{IN} / V _{OUT} = 5.5 V
Off state output current	I _{OZ}	2.7 to 5.5	—	±5.0	μA	V _{IN} = V _{CC} or GND V _{OUT} = 5.5 V or GND
Quiescent supply current	I _{CC}	2.7 to 3.6	—	±10.0	μA	V _{IN} = 3.6 to 5.5 V
		2.7 to 5.5	—	10.0	μA	V _{IN} = V _{CC} or GND
	ΔI _{CC}	2.7 to 3.6	—	500	μA	V _{IN} = one input at (V _{CC} -0.6)V, other inputs at V _{CC} or GND

Switching Characteristics

Item	Symbol	V _{CC} (V)	Ta = -40 to 85°C			Unit	From (Input)	To (Output)
			Min	Typ	Max			
Maximum clock frequency	f _{max}	1.8±0.15	—	—	55.0	MHz		
		2.5±0.2	—	—	95.0			
		2.7	—	—	150.0			
		3.3±0.3	—	—	150.0			
		5.0±0.5	—	—	150.0			
Propagation delay time	t _{PLH}	1.8±0.15	1.0	—	19.1	ns	CK	Q
	t _{PHL}	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 _{ZH}	1.8±0.15	1.0	—	20.0	ns	\bar{G}	Q
	t _{ZL}	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 _{HZ}	1.8±0.15	1.0	—	20.0	ns	\bar{G}	Q
	t _{LZ}	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 _{su}	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 _h	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 _w	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 ¹	t _{OSLH}	1.8±0.15	—	—	—	ns		
	t _{OSHL}	2.5±0.2	—	—	—			
	2.7	—	—	—				
	3.3±0.3	—	—	1.0				
	5.0±0.5	—	—	1.0				
Input capacitance	C _{IN}	3.3	—	4.0	—	pF		
Output capacitance	C _O	3.3	—	8.0	—	pF		

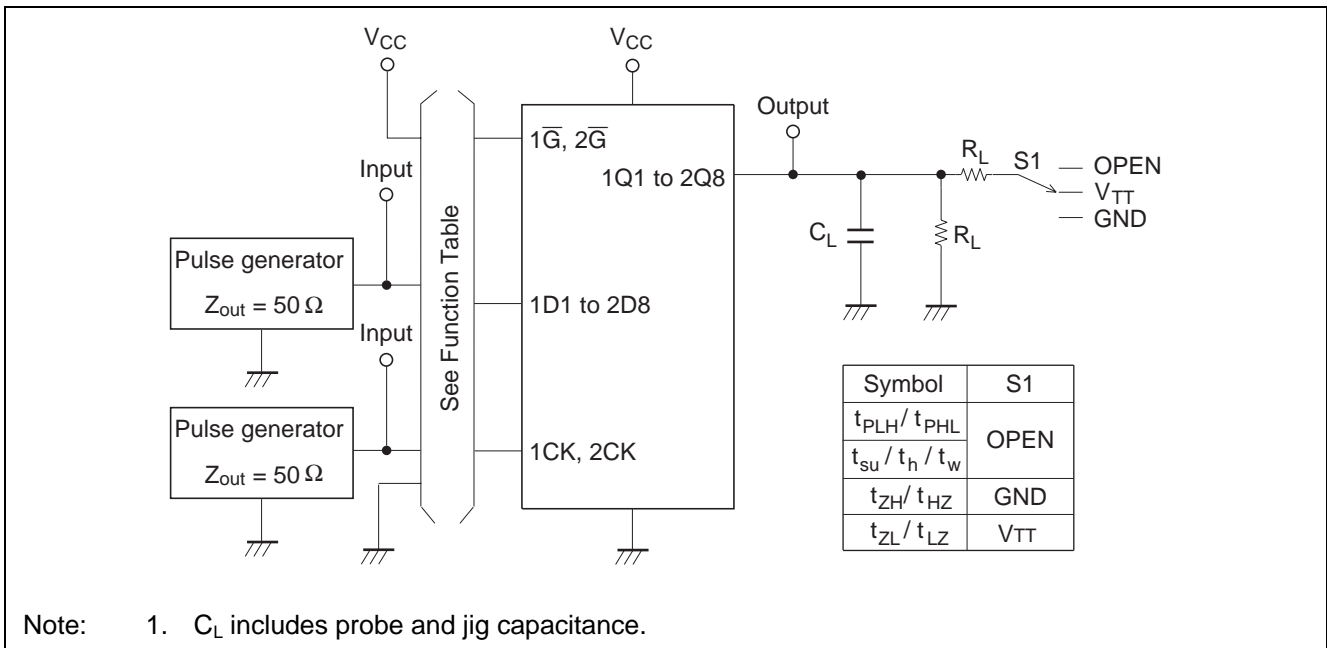
Note: 1. This parameter is characterized but not tested.

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

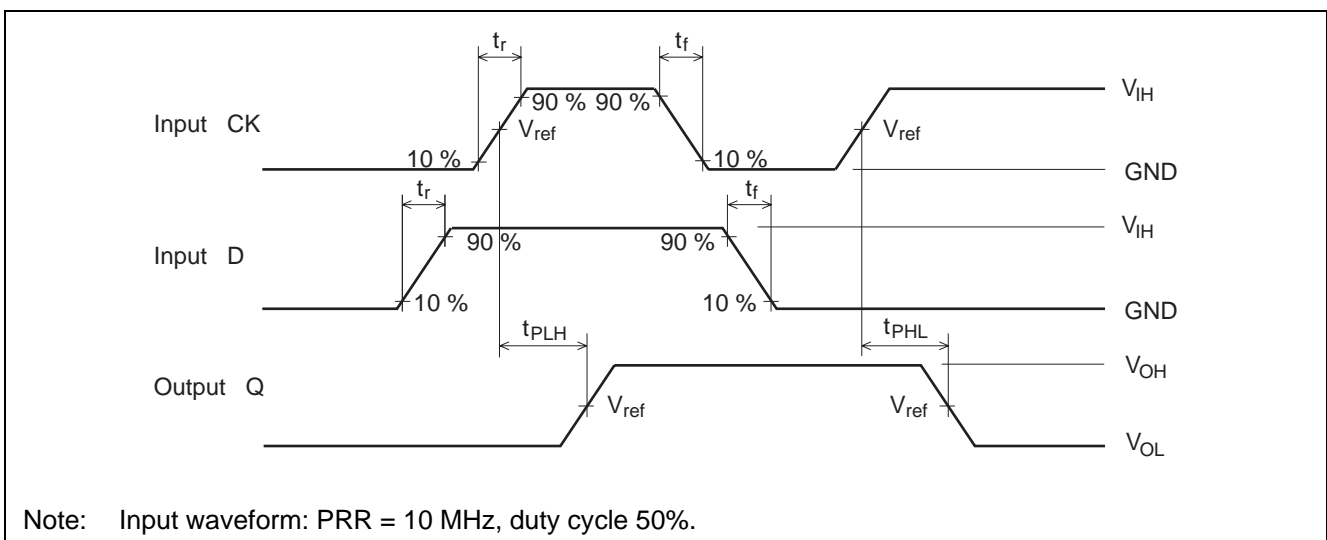
Operating Characteristics

Item	Symbol	V _{CC} (V)	Ta = 25°C			Unit	Test Conditions
			Min	Typ	Max		
Power dissipation capacitance	C _{PD}	1.8	—	25	—	pF	f = 10 MHz
		2.5	—	26	—		
		3.3	—	28	—		
		5.0	—	32	—		

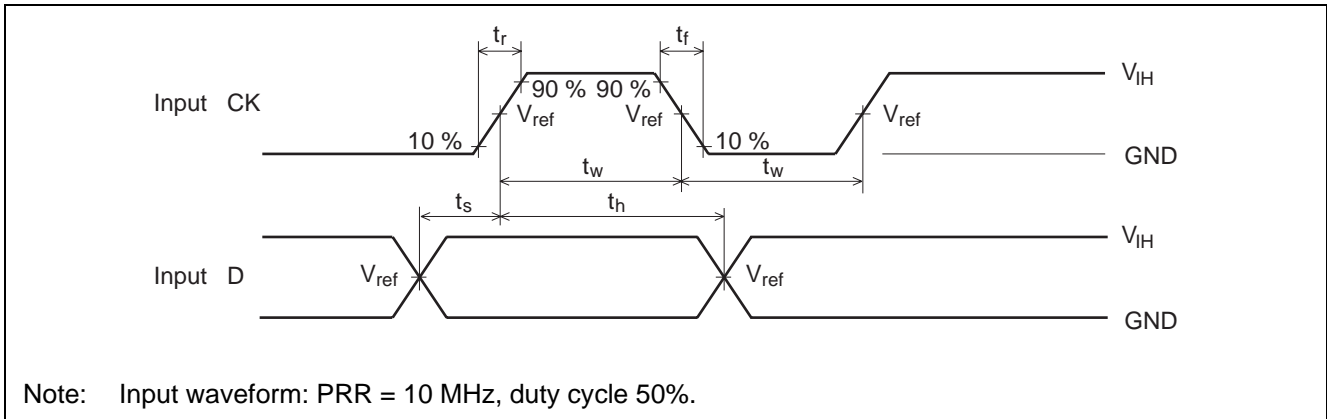
Test Circuit



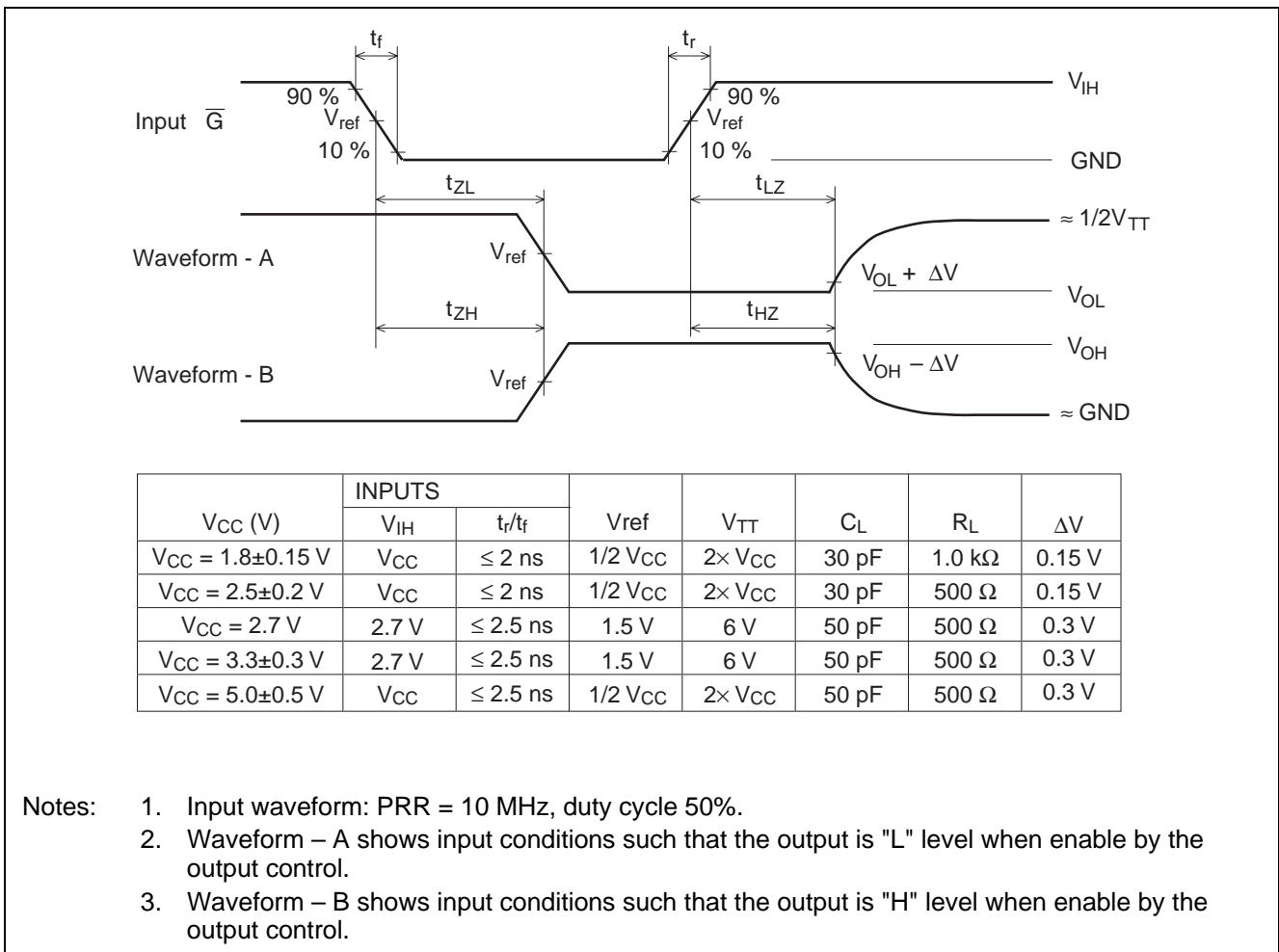
Waveforms – 1



Waveforms – 2

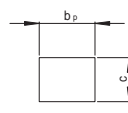
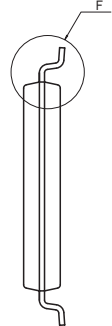
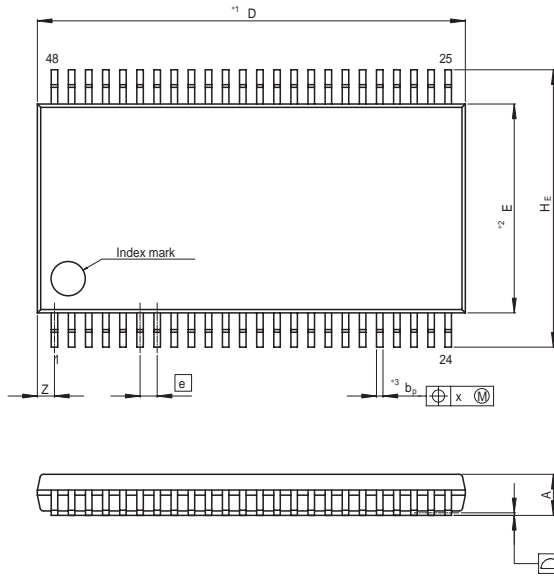


Waveforms – 3

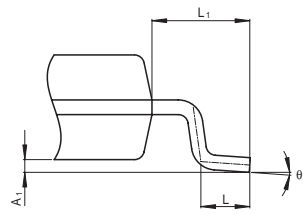


Package Dimensions

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)



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 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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