

# HD74LVC1G04

## Inverter

REJ03D0018-0300Z

Rev.3.00

Jun. 30, 2004

### Description

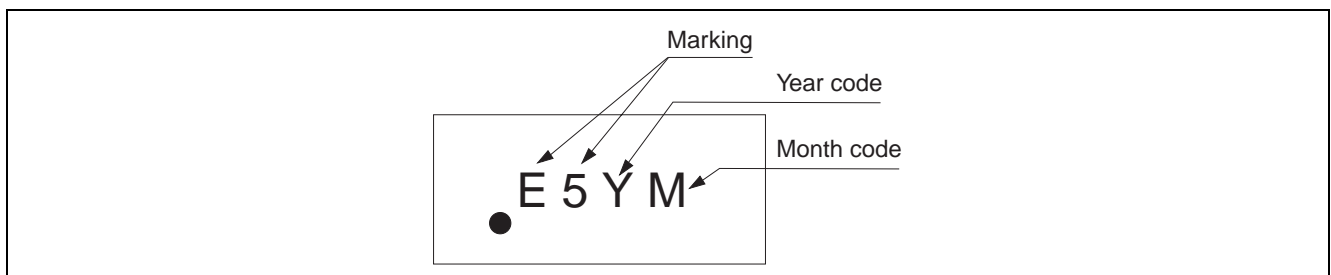
The HD74LVC1G04 has an inverter in a 5-pin package. Low voltage and high-speed operation is suitable for the battery powered products (e.g., notebook computers), and the low power consumption extends the battery life.

### Features

- The basic gate function is lined up as Renesas uni logic series.
- Supply voltage range : 1.65 to 5.5 V  
Operating temperature range: -40 to +85°C
- All inputs:  $V_{IH}(\text{Max.}) = 5.5 \text{ V} (@V_{CC} = 0 \text{ V to } 5.5 \text{ V})$   
All outputs:  $V_O(\text{Max.}) = 5.5 \text{ V} (@V_{CC} = 0 \text{ V})$
- Output current:  $\pm 4 \text{ mA} (@V_{CC} = 1.65 \text{ V})$   
 $\pm 8 \text{ mA} (@V_{CC} = 2.3 \text{ V})$   
 $\pm 24 \text{ mA} (@V_{CC} = 3.0 \text{ V})$   
 $\pm 32 \text{ mA} (@V_{CC} = 4.5 \text{ V})$
- Ordering Information

Part Name	Package Type	Package Code	Package Abbreviation	Taping Abbreviation (Quantity)
HD74LVC1G04CPE	WCSP-5 pin	TBS-5V	CP	E (3,000 pcs/reel)
HD74LVC1G04CLE		TBS-5AV	CL	

### Article Indication



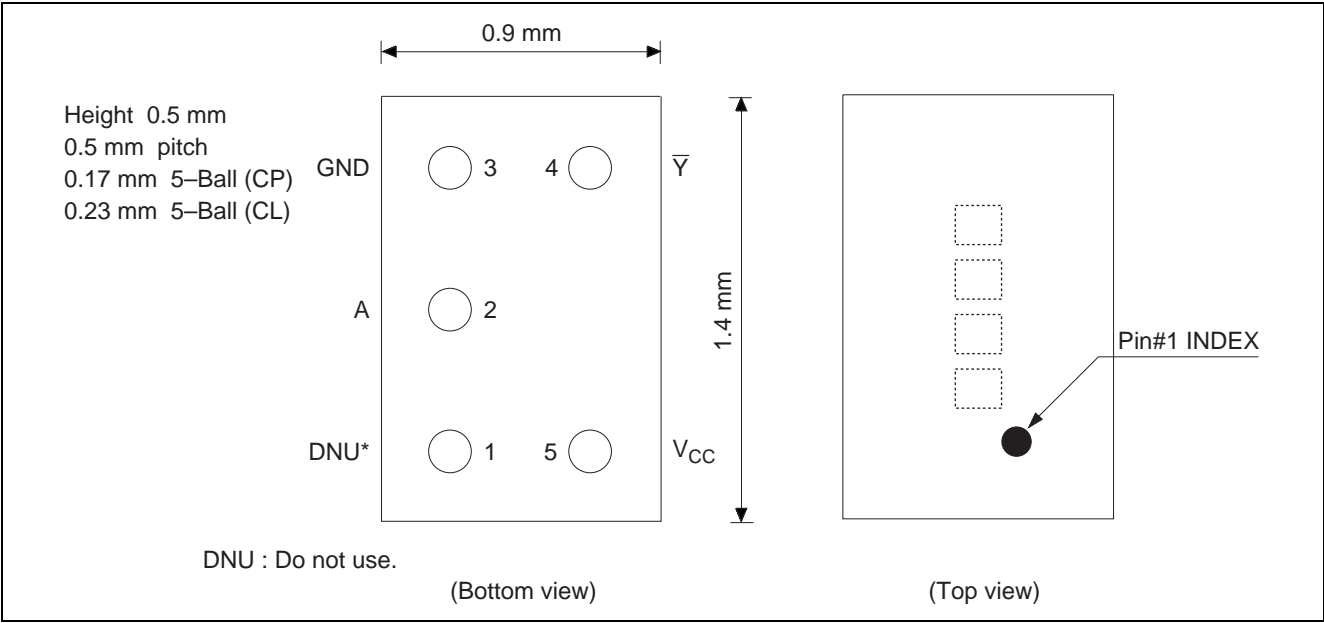
Function Table

Input A	Output $\bar{Y}$
H	L
L	H

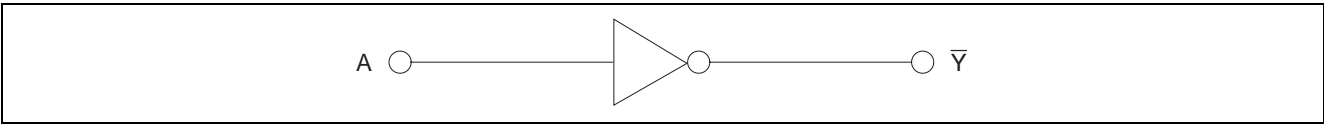
H: High level

L: Low level

Pin Arrangement



Logic Diagram



## Absolute Maximum Ratings

Item	Symbol	Ratings	Unit	Test Conditions
Supply voltage range	$V_{CC}$	-0.5 to 6.5	V	
Input voltage range <sup>*1</sup>	$V_I$	-0.5 to 6.5	V	
Output voltage range <sup>*1, 2</sup>	$V_O$	-0.5 to $V_{CC} + 0.5$	V	Output : H or L
		-0.5 to 6.5		$V_{CC}$ : OFF
Input clamp current	$I_{IK}$	-50	mA	$V_I < 0$
Output clamp current	$I_{OK}$	-50	mA	$V_O < 0$
Continuous output current	$I_O$	$\pm 50$	mA	$V_O = 0$ to $V_{CC}$
Continuous current through $V_{CC}$ or GND	$I_{CC}$ or $I_{GND}$	$\pm 100$	mA	
Package Thermal impedance	$\theta_{ja}$	154	°C/W	CP
		132		CL
Storage temperature	$T_{stg}$	-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 if the input and output clamp-current ratings are observed.
2. This value is limited to 5.5 V maximum.

## Recommended Operating Conditions

Item	Symbol	Min	Max	Unit	Conditions
Supply voltage range	$V_{CC}$	1.65	5.5	V	
Input voltage range	$V_I$	0	5.5	V	
Output voltage range	$V_O$	0	$V_{CC}$	V	
Output current	$I_{OL}$	—	4	mA	$V_{CC} = 1.65$ V
		—	8		$V_{CC} = 2.3$ V
		—	16		$V_{CC} = 3.0$ V
		—	24		
		—	32		$V_{CC} = 4.5$ V
	$I_{OH}$	—	-4		$V_{CC} = 1.65$ V
		—	-8		$V_{CC} = 2.3$ V
		—	-16		$V_{CC} = 3.0$ V
		—	-24		
		—	-32		$V_{CC} = 4.5$ V
Input transition rise or fall rate	$\Delta t / \Delta v$	0	20	ns / V	$V_{CC} = 1.65$ to $1.95$ V, 2.3 to $2.7$ V
		0	10		$V_{CC} = 3.0$ to $3.6$ V
		0	5		$V_{CC} = 4.5$ to $5.5$ V
Operating free-air temperature	$T_a$	-40	85	°C	

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

## Electrical Characteristics

Ta = -40 to 85°C

Item	Symbol	V <sub>CC</sub> (V)	Min	Typ	Max	Unit	Test condition
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	—	—		
		3.0 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		
		3.0 to 3.6	—	—	0.8		
		4.5 to 5.5	—	—	V <sub>CC</sub> ×0.3		
Output voltage	V <sub>OH</sub>	Min to Max	V <sub>CC</sub> -0.1	—	—	V	I <sub>OH</sub> = -100 μA
		1.65	1.2	—	—		I <sub>OH</sub> = -4 mA
		2.3	1.9	—	—		I <sub>OH</sub> = -8 mA
		3.0	2.4	—	—		I <sub>OH</sub> = -16 mA
			2.3	—	—		I <sub>OH</sub> = -24 mA
		4.5	3.8	—	—		I <sub>OH</sub> = -32 mA
	V <sub>OL</sub>	Min to Max	—	—	0.1		I <sub>OL</sub> = 100 μA
		1.65	—	—	0.45		I <sub>OL</sub> = 4 mA
		2.3	—	—	0.3		I <sub>OL</sub> = 8 mA
		3.0	—	—	0.4		I <sub>OL</sub> = 16 mA
			—	—	0.55		I <sub>OL</sub> = 24 mA
		4.5	—	—	0.55		I <sub>OL</sub> = 32 mA
Input current	I <sub>IN</sub>	0 to 5.5	—	—	±5	μA	V <sub>IN</sub> = 5.5 V or GND
Quiescent supply current	I <sub>CC</sub>	5.5	—	—	10	μA	V <sub>IN</sub> = V <sub>CC</sub> or GND, I <sub>O</sub> = 0
	ΔI <sub>CC</sub>	3 to 5.5	—	—	500		One input at V <sub>CC</sub> -0.6 V, Other input at V <sub>CC</sub> or GND
Output leakage current	I <sub>OFF</sub>	0	—	—	±10	μA	V <sub>IN</sub> or V <sub>O</sub> = 0 to 5.5 V
Input capacitance	C <sub>IN</sub>	3.3	—	3.5	—	pF	V <sub>IN</sub> = V <sub>CC</sub> or GND

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

## Switching Characteristics

$$V_{CC} = 1.8 \pm 0.15 \text{ V}$$

Item	Symbol	Ta = -40 to 85°C		Unit	Test Conditions	FROM (Input)	TO (Output)
		Min	Max				
Propagation delay time	t <sub>PLH</sub>	2.0	6.4	ns	C <sub>L</sub> = 15 pF, R <sub>L</sub> = 1 MΩ	A	$\bar{Y}$
	t <sub>PHL</sub>	3.0	7.5		C <sub>L</sub> = 30 pF, R <sub>L</sub> = 1.0 kΩ		

$$V_{CC} = 2.5 \pm 0.2 \text{ V}$$

Item	Symbol	Ta = -40 to 85°C		Unit	Test Conditions	FROM (Input)	TO (Output)
		Min	Max				
Propagation delay time	t <sub>PLH</sub>	1.0	4.2	ns	C <sub>L</sub> = 15 pF, R <sub>L</sub> = 1 MΩ	A	$\bar{Y}$
	t <sub>PHL</sub>	1.4	5.2		C <sub>L</sub> = 30 pF, R <sub>L</sub> = 500 Ω		

$$V_{CC} = 3.3 \pm 0.3 \text{ V}$$

Item	Symbol	Ta = -40 to 85°C		Unit	Test Conditions	FROM (Input)	TO (Output)
		Min	Max				
Propagation delay time	t <sub>PLH</sub>	0.7	3.3	ns	C <sub>L</sub> = 15 pF, R <sub>L</sub> = 1 MΩ	A	$\bar{Y}$
	t <sub>PHL</sub>	1.0	4.2		C <sub>L</sub> = 50 pF, R <sub>L</sub> = 500 Ω		

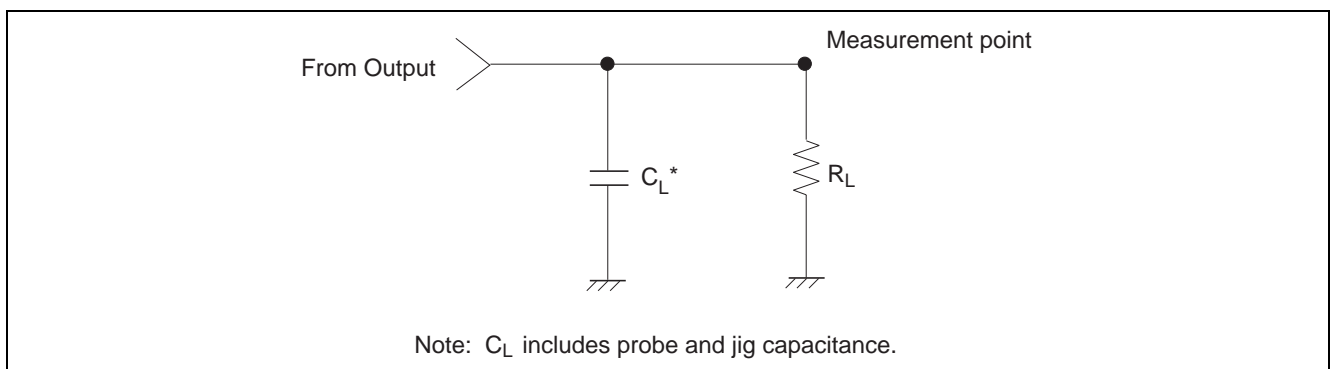
$$V_{CC} = 5.0 \pm 0.5 \text{ V}$$

Item	Symbol	Ta = -40 to 85°C		Unit	Test Conditions	FROM (Input)	TO (Output)
		Min	Max				
Propagation delay time	t <sub>PLH</sub>	0.7	3.1	ns	C <sub>L</sub> = 15 pF, R <sub>L</sub> = 1 MΩ	A	$\bar{Y}$
	t <sub>PHL</sub>	1.0	3.7		C <sub>L</sub> = 50 pF, R <sub>L</sub> = 500 Ω		

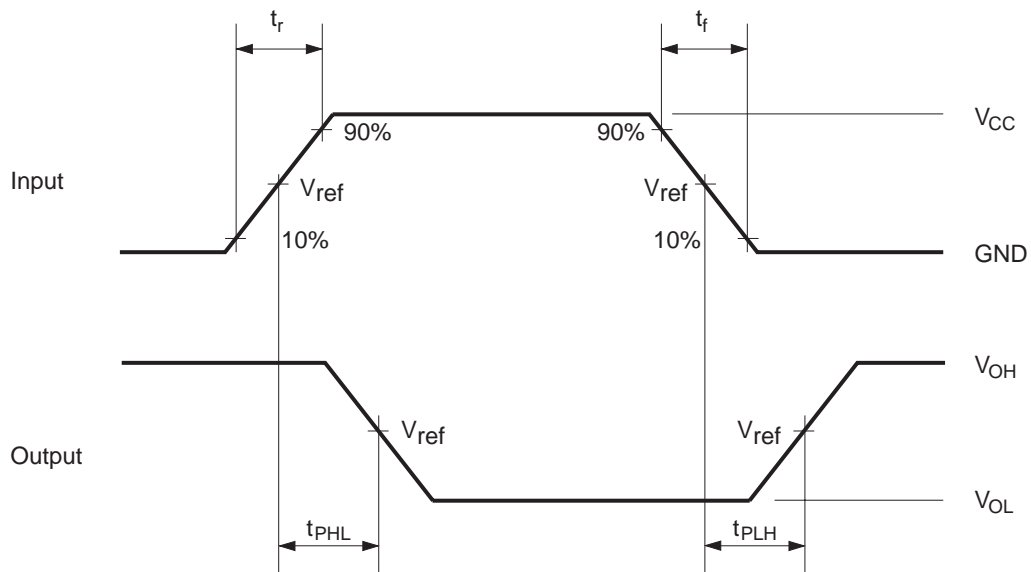
## Operating Characteristics

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	—	16	—	pF	f = 10 MHz
		2.5	—	18	—		
		3.3	—	18	—		
		5.0	—	20	—		

## Test Circuit



• Waveforms



$V_{CC}$ (V)	INPUTS		$V_{ref}$	$C_L$	$R_L$
	$V_I$	$t_r / t_f$			
$1.8 \pm 0.15$	$V_{CC}$	$\leq 2 \text{ ns}$	$V_{CC} / 2$	15 pF	1 M $\Omega$
$2.5 \pm 0.2$	$V_{CC}$	$\leq 2 \text{ ns}$	$V_{CC} / 2$	15 pF	1 M $\Omega$
$3.3 \pm 0.3$	3 V	$\leq 2.5 \text{ ns}$	1.5 V	15 pF	1 M $\Omega$
$5.0 \pm 0.5$	$V_{CC}$	$\leq 2.5 \text{ ns}$	$V_{CC} / 2$	15 pF	1 M $\Omega$

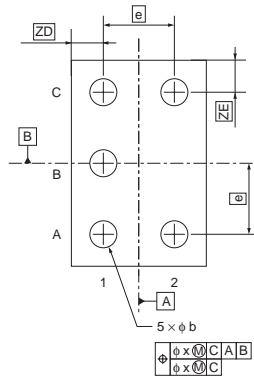
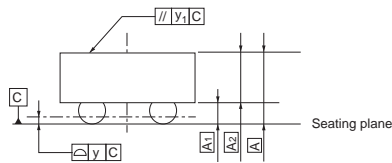
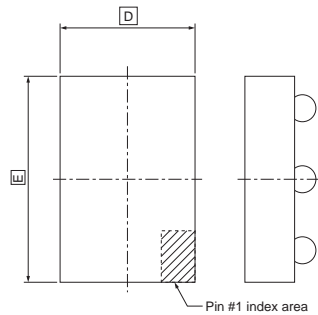
$V_{CC}$ (V)	INPUTS		$V_{ref}$	$C_L$	$R_L$
	$V_I$	$t_r / t_f$			
$1.8 \pm 0.15$	$V_{CC}$	$\leq 2 \text{ ns}$	$V_{CC} / 2$	30 pF	1.0 k $\Omega$
$2.5 \pm 0.2$	$V_{CC}$	$\leq 2 \text{ ns}$	$V_{CC} / 2$	30 pF	500 $\Omega$
$3.3 \pm 0.3$	3 V	$\leq 2.5 \text{ ns}$	1.5 V	50 pF	500 $\Omega$
$5.0 \pm 0.5$	$V_{CC}$	$\leq 2.5 \text{ ns}$	$V_{CC} / 2$	50 pF	500 $\Omega$

- Notes: 1. Input waveform: PRR  $\leq 10 \text{ MHz}$ ,  $Z_o = 50 \Omega$ .  
 2. The output are measured one at a time with one transition per measurement.

Package Dimensions

TBS-5V

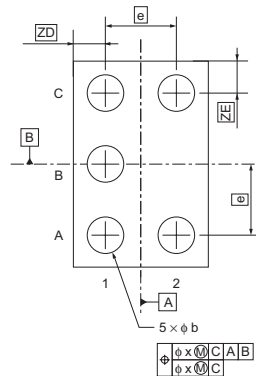
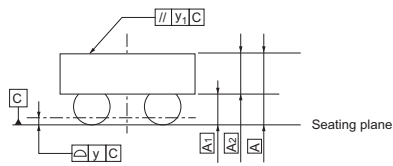
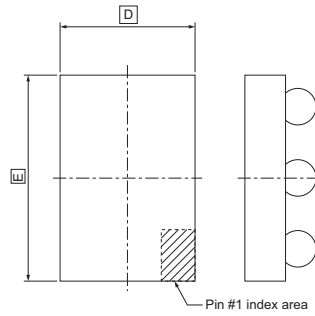
EIAJ Package Code	JEDEC Code	Mass (g)	Lead Material
—	—	0.001	—



Symbol	Dimension in Millimeters		
	Min	Typ	Max
A	—	—	0.50
A <sub>1</sub>	0.10	—	0.15
A <sub>2</sub>	—	—	0.35
b	0.15	0.17	0.19
D	—	0.90	—
E	—	1.40	—
e	—	0.50	—
x	—	—	0.05
y	—	—	0.05
y <sub>1</sub>	—	—	0.20
ZD	—	0.20	—
ZE	—	0.20	—

TBS-5AV

EIAJ Package Code	JEDEC Code	Mass (g)	Lead Material
—	—	0.001	—



Symbol	Dimension in Millimeters		
	Min	Nom	Max
A	—	—	0.50
A <sub>1</sub>	0.155	—	0.185
A <sub>2</sub>	—	—	(0.315)*
b	0.20	—	0.25
D	—	0.90	—
E	—	1.40	—
e	—	0.50	—
x	—	—	0.05
y	—	—	0.05
y <sub>1</sub>	—	—	0.20
ZD	—	0.20	—
ZE	—	0.20	—



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