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# HD74LVC16541

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

## HITACHI

ADE-205-058B(Z)

Rev.2

September 1995

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### Description

The HD74LVC16541 has sixteen buffers with three state outputs in a 48 pin package. When  $\bar{G}1$  and  $\bar{G}2$  is low level, this drivers set up output is enable. 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

- $V_{CC} = 2.0\text{ V to }5.5\text{ V}$
- All inputs  $V_{IH}(\text{Max.}) = 5.5\text{ V} (@V_{CC} = 0\text{ V to }5.5\text{ V})$
- 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  $\pm 24\text{ mA} (@V_{CC} = 3.0\text{ V to }5.5\text{ V})$

### Function Table

| Inputs     |            |   | Output Y |
|------------|------------|---|----------|
| $\bar{G}1$ | $\bar{G}2$ | A |          |
| L          | L          | L | L        |
| L          | L          | H | H        |
| H          | X          | X | Z        |
| X          | H          | X | Z        |

H : High level

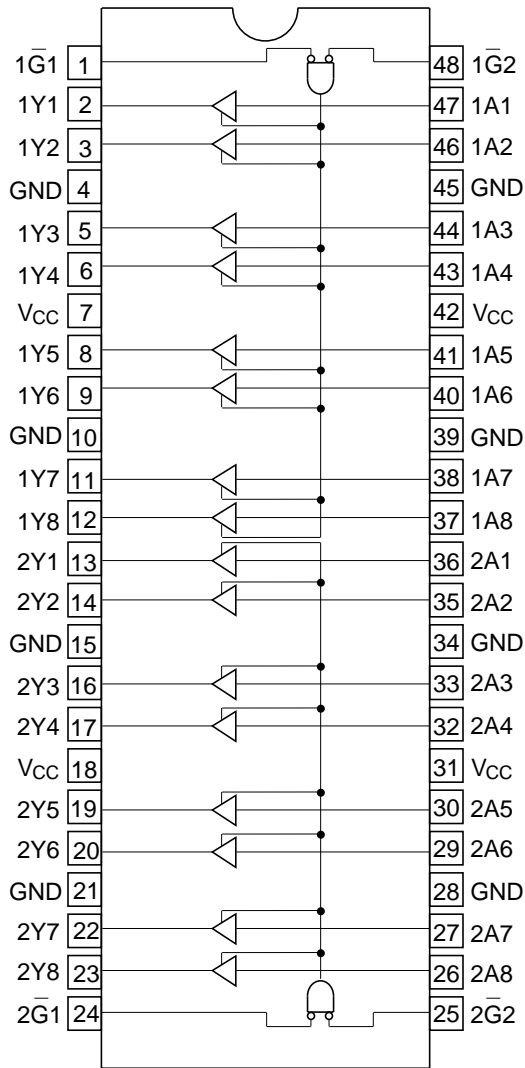
L : Low level

X : Immaterial

Z : High impedance

# HD74LVC16541

## Pin Arrangement



(Top view)

### Absolute Maximum Ratings

| Item                         | Symbol                | Ratings                | Unit               | Conditions                    |
|------------------------------|-----------------------|------------------------|--------------------|-------------------------------|
| Supply voltage               | $V_{CC}$              | -0.5 to 6.0            | V                  |                               |
| Input diode current          | $I_{IK}$              | -50                    | mA                 | $V_I = -0.5\text{ V}$         |
| Input voltage                | $V_I$                 | -0.5 to 6.0            | V                  |                               |
| Output diode current         | $I_{OK}$              | -50                    | mA                 | $V_O = -0.5\text{ V}$         |
|                              |                       | 50                     | mA                 | $V_O = V_{CC} + 0.5\text{ V}$ |
| Output voltage               | $V_O$                 | -0.5 to $V_{CC} + 0.5$ | V                  |                               |
| 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            | $^{\circ}\text{C}$ |                               |

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 retention                           |
|                                      |            | 2.0 to 5.5    | V                  | At operation                             |
| Input / output voltage               | $V_I$      | 0 to 5.5      | V                  | $\bar{G}$ , A                            |
|                                      | $V_O$      | 0 to $V_{CC}$ | V                  | Y  |
| Operating temperature                | $T_a$      | -40 to 85     | $^{\circ}\text{C}$ |  |
| Output current                       | $I_{OH}$   | -12           | mA                 | $V_{CC} = 2.7\text{ V}$                  |
|                                      |            | $-24^{*2}$    | mA                 | $V_{CC} = 3.0\text{ V to } 5.5\text{ V}$ |
|                                      | $I_{OL}$   | 12            | mA                 | $V_{CC} = 2.7\text{ V}$                  |
|                                      |            | $24^{*2}$     | mA                 | $V_{CC} = 3.0\text{ V to } 5.5\text{ V}$ |
| Input rise / fall time <sup>*1</sup> | $t_r, t_f$ | 10            | ns/V               |  |

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

Waveform : Refer to test circuit of switching characteristics.

2. duty cycle  $\leq 50\%$

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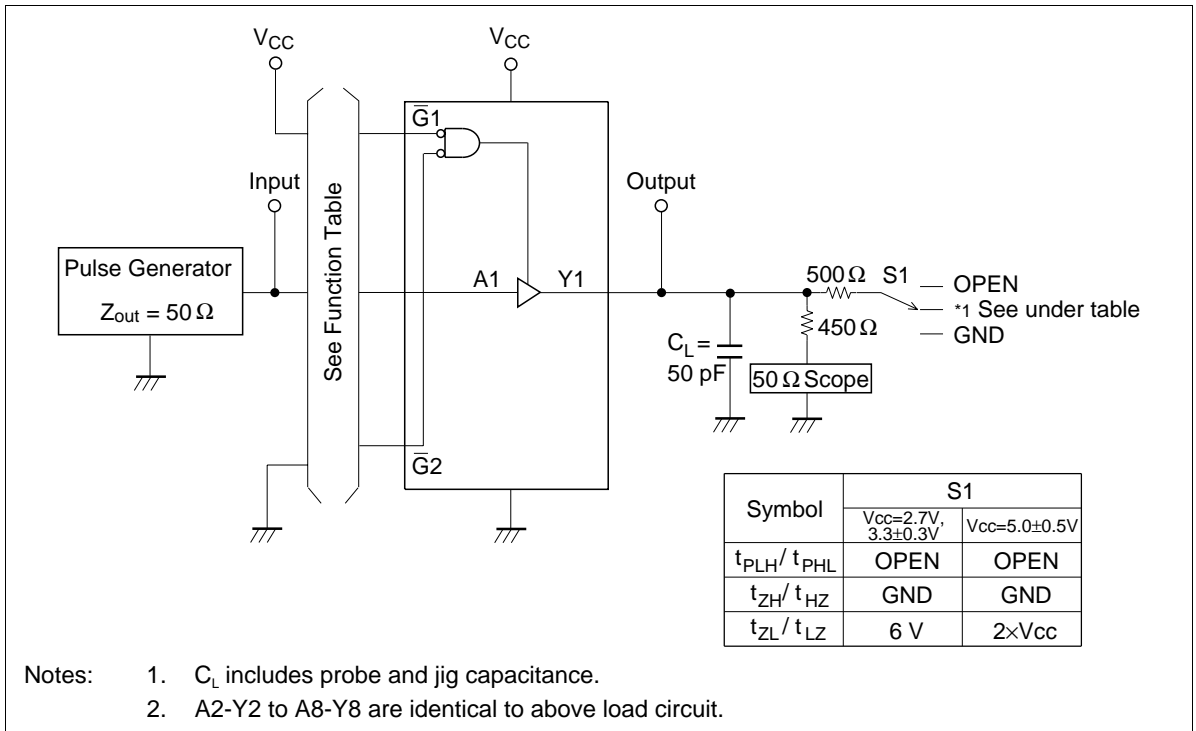
## Electrical Characteristics

| Item                     | Symbol          | $V_{CC}$ (V) | $T_a = -40 \text{ to } 85^\circ\text{C}$ |                     | Unit          | Test Conditions  |
|--------------------------|-----------------|--------------|--|---------------------|---------------|--|
|                          |                 |              | Min                                      | Max                 |               |  |
| Input voltage            | $V_{IH}$        | 2.7 to 3.6   | 2.0                                      | —                   | V             |  |
|                          |                 | 4.5 to 5.5   | $V_{CC} \times 0.7$                      | —                   | V             |  |
|                          | $V_{IL}$        | 2.7 to 3.6   | —  | 0.8                 | V             |  |
|                          |                 | 4.5 to 5.5   | —  | $V_{CC} \times 0.3$ | V             |  |
| Output voltage           | $V_{OH}$        | 2.7 to 5.5   | $V_{CC} - 0.2$                           | —                   | V             | $I_{OH} = -100 \mu\text{A}$  |
|                          |                 | 2.7          | 2.2                                      | —                   | V             | $I_{OH} = -12 \text{ mA}$  |
|                          |                 | 3.0          | 2.4                                      | —                   | V             |  |
|                          |                 | 3.0          | 2.0                                      | —                   | V             | $I_{OH} = -24 \text{ mA}$  |
|                          |                 | 4.5          | 3.8                                      | —                   | V             |  |
|                          | $V_{OL}$        | 2.7 to 5.5   | —  | 0.2                 | V             | $I_{OL} = 100 \mu\text{A}$   |
|                          |                 | 2.7          | —  | 0.4                 | V             | $I_{OL} = 12 \text{ mA}$   |
|                          |                 | 3.0          | —  | 0.55                | V             | $I_{OL} = 24 \text{ mA}$   |
|                          |                 | 4.5          | —  | 0.55                | V             |  |
|                          |                 |              |  |                     |               |  |
| Input current            | $I_{IN}$        | 0 to 5.5     | —  | $\pm 5.0$           | $\mu\text{A}$ | $V_{IN} = 5.5 \text{ V or GND}$  |
| Off state output current | $I_{OZ}$        | 5.5          | —  | $\pm 10$            | $\mu\text{A}$ | $V_{IN} = V_{CC}, \text{ GND}$<br>$V_{OUT} = V_{CC} \text{ or GND}$                                |
| Quiescent supply current | $I_{CC}$        | 5.5          | —  | 40                  | $\mu\text{A}$ | $V_{IN} = V_{CC} \text{ or GND}$   |
|                          | $\Delta I_{CC}$ | 3.0 to 3.6   | —  | 500                 | $\mu\text{A}$ | $V_{IN} = \text{one input at } (V_{CC} - 0.6)\text{V},$<br>other inputs at $V_{CC} \text{ or GND}$ |

Switching Characteristics

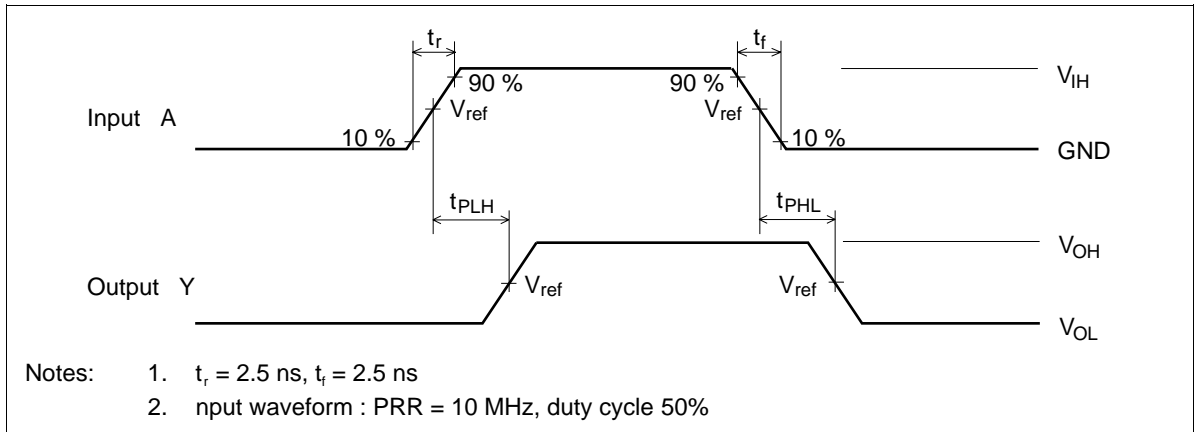
| Item                   | Symbol           | V <sub>CC</sub> (V) | Ta = -40 to 85°C |      |     | Unit | From (Input) | To (Output) |
|------------------------|------------------|---------------------|------------------|------|-----|------|--------------|-------------|
|                        |                  |                     | Min              | Typ  | Max |      |              |             |
| Propagation delay time | t <sub>PLH</sub> | 2.7                 | —                | 4.5  | 7.5 | ns   | A            | Y           |
|                        | t <sub>PHL</sub> | 3.3±0.3             | 1.5              | 3.5  | 6.5 | ns   |              |             |
|                        |                  | 5.0±0.5             | —                | 2.5  | 5.0 | ns   |              |             |
| Output enable time     | t <sub>ZH</sub>  | 2.7                 | —                | 5.5  | 9.0 | ns   | $\bar{G}$    | Y           |
|                        | t <sub>ZL</sub>  | 3.3±0.3             | 1.5              | 4.0  | 8.0 | ns   |              |             |
|                        |                  | 5.0±0.5             | —                | 3.0  | 6.5 | ns   |              |             |
| Output disable time    | t <sub>HZ</sub>  | 2.7                 | —                | 4.0  | 8.5 | ns   | $\bar{G}$    | Y           |
|                        | t <sub>LZ</sub>  | 3.3±0.3             | 1.5              | 3.5  | 7.5 | ns   |              |             |
|                        |                  | 5.0±0.5             | —                | 2.5  | 6.0 | ns   |              |             |
| Input capacitance      | C <sub>IN</sub>  | 2.7                 | —                | 3.0  | —   | pF   |              |             |
| Output capacitance     | C <sub>O</sub>   | 2.7                 | —                | 15.0 | —   | pF   |              |             |

Test Circuit

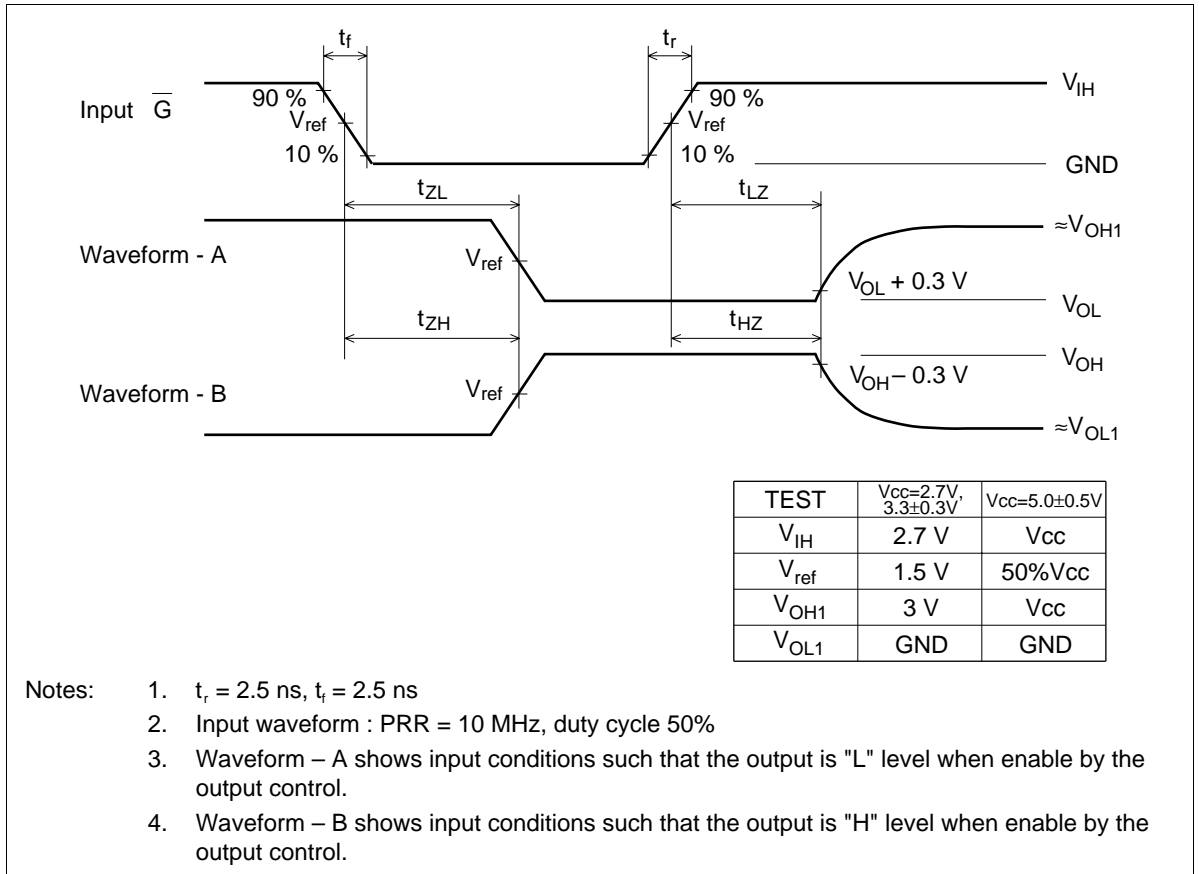


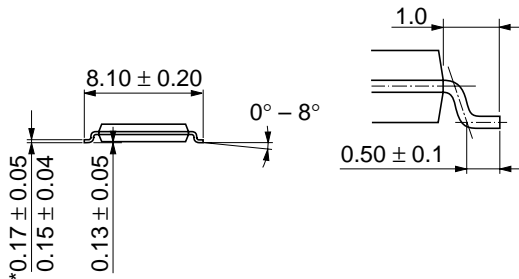
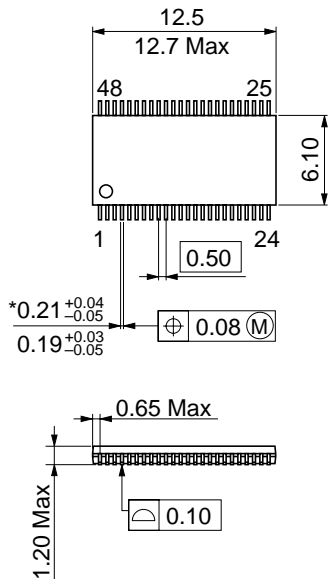
# HD74LVC16541

## Waveforms – 1



## Waveforms – 2





\*Dimension including the plating thickness  
 Base material dimension

|                          |          |
|--------------------------|----------|
| Hitachi Code             | TTP-48DB |
| JEDEC                    | —        |
| EIAJ                     | —        |
| Weight (reference value) | 0.20 g   |

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