RENESAS

# HD74AC153

## Dual 4-Input Multiplexer

REJ03D0251–0200Z
(Previous ADE-205-370 (Z))
Rev.2.00
Jul.16.2004

## Description

The HD74AC153 is a high-speed dual 4-input multiplexer with common select inputs and individual enable inputs for each section. It can select two lines of data from four sources. The two buffered outputs present data in the true (noninverted) form. In addition to multiplexer operation, the HD74AC153 can act as a function generator and generate any two functions of three variables.

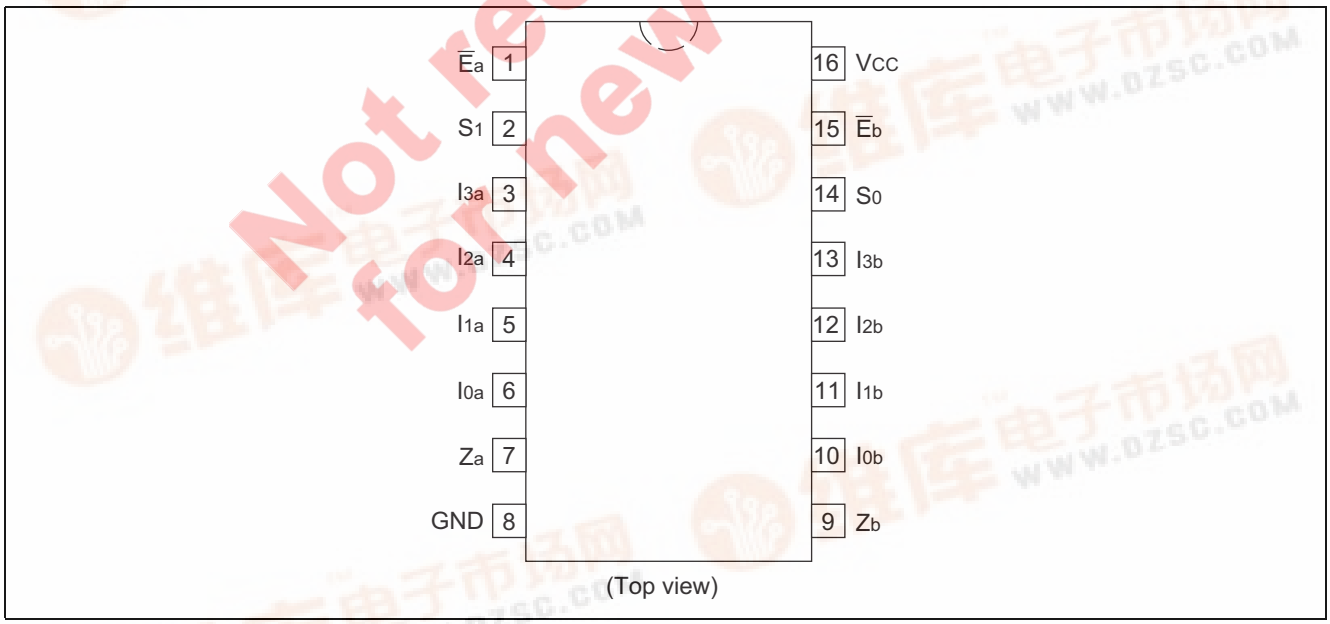
## Features

- Outputs Source/Sink 24 mA
- Ordering Information

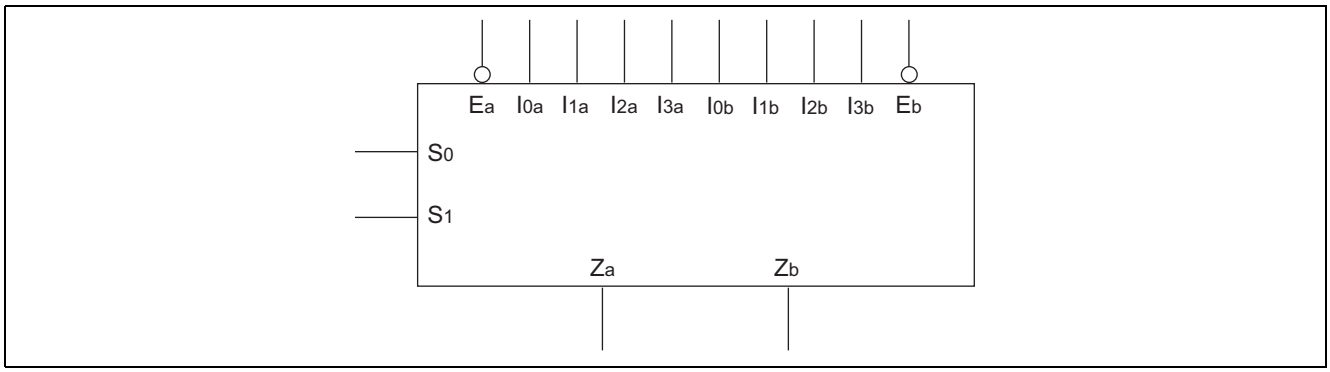
| Part Name | Package Type | Package Code | Package Abbreviation | Taping Abbreviation (Quantity) |
|---|---|---|---|---|
| HD74AC153FPEL | SOP-16 pin (JEITA) | FP-16DAV | FP | EL (2,000 pcs/reel) |
| HD74AC153RPEL | SOP-16 pin (JEDEC) | FP-16DNV | RP | EL (2,500 pcs/reel) |

Notes: 1. Please consult the sales office for the above package availability.
2. The packages with lead-free pins are distinguished from the conventional products by adding V at the end of the package code.

## Pin Arrangement



## Logic Symbol




## Pin Names

| | |
|---|---|
| $I_{0a}$ to $I_{3a}$ | Side A Data Inputs |
| $I_{0b}$ to $I_{3b}$ | Side B Data Inputs |
| $S_0$, $S_1$ | Common Select Inputs |
| $\overline{E}_a$ | Side A Enable Input |
| $\overline{E}_b$ | Side B Enable Input |
| $Z_a$ | Side A Output |
| $Z_b$ | Side B Output |

## Functional Description

The HD74AC153 is a dual 4-input multiplexer. It can select two bits of data from up to four sources under the control of the common Select inputs ($S_0$, $S_1$). The two 4-input multiplexer circuits have individual active-Low Enables ($\overline{E}_a$, $\overline{E}_b$) which can be used to strobe the outputs independently. When the Enables ($\overline{E}_a$, $\overline{E}_b$) are High, the corresponding outputs ($Z_a$, $Z_b$) are forced Low. The HD74AC153 is the logic implementation of a 2-pole, 4-position switch, where the position of the switch is determined by the logic levels supplied to the two Select inputs. The logic equations for the outputs are shown below.

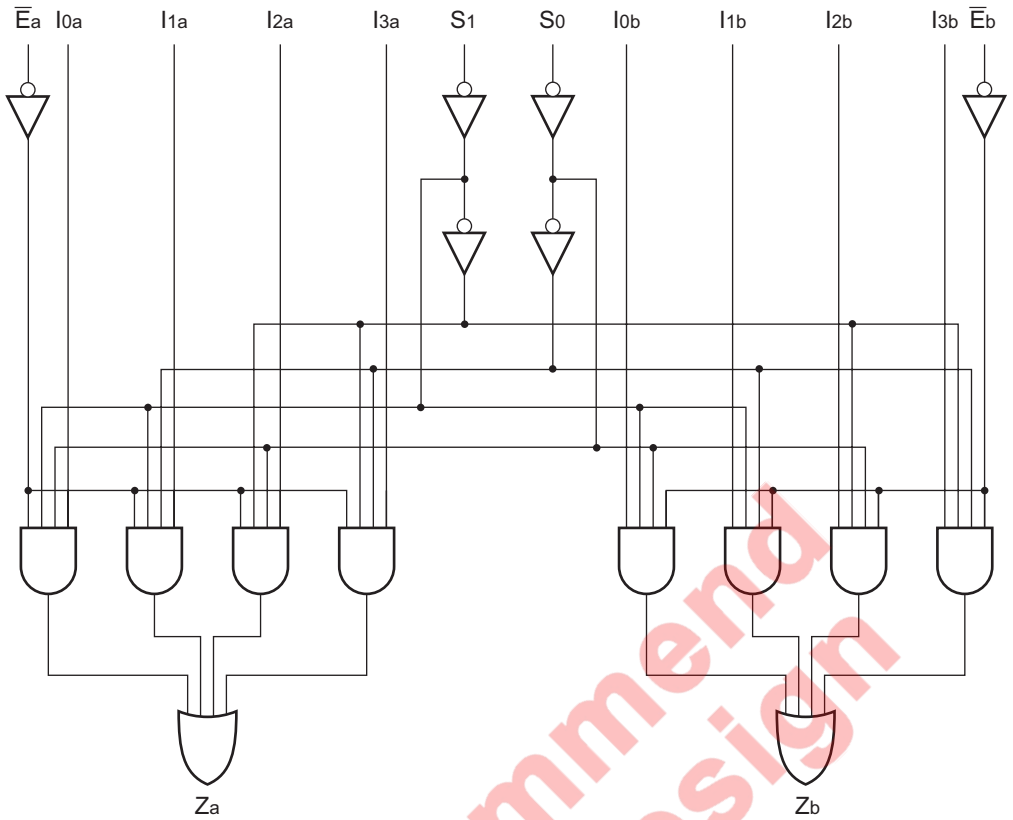
$$Z_a = \overline{E}_a \bullet (I_{0a} \bullet \overline{S}_1 \bullet \overline{S}_0 + I_{1a} \bullet \overline{S}_1 \bullet S_0 + I_{2a} \bullet S_1 \bullet \overline{S}_0 + I_{3a} \bullet S_1 \bullet S_0)$$
$$Z_b = \overline{E}_b \bullet (I_{0b} \bullet \overline{S}_1 \bullet \overline{S}_0 + I_{1b} \bullet \overline{S}_1 \bullet S_0 + I_{2b} \bullet S_1 \bullet \overline{S}_0 + I_{3b} \bullet S_1 \bullet S_0)$$

## Truth Table

| Select Inputs | | Input (a or b) | | | | | Output |
|---|---|---|---|---|---|---|---|
| $S_0$ | $S_1$ | $\overline{E}$ | $I_0$ | $I_1$ | $I_2$ | $I_3$ | Z |
| X | X | H | X | X | X | X | L |
| L | L | L | L | X | X | X | L |
| L | L | L | H | X | X | X | H |
| H | L | L | X | L | X | X | L |
| H | L | L | X | H | X | X | H |
| L | H | L | X | X | L | X | L |
| L | H | L | X | X | H | X | H |
| H | H | L | X | X | X | L | L |
| H | H | L | X | X | X | H | H |

H : High Voltage Level
L : Low Voltage Level
X : Immaterial

## Logic Diagram




Please note that this diagram is provided only for the understanding of logic operations and should not be used to estimate propagation delays.



## Absolute Maximum Ratings

| Item | Symbol | Ratings | Unit | Condition |
|---|---|---|---|---|
| Supply voltage | $V_{CC}$ | –0.5 to 7 | V | |
| DC input diode current | $I_{IK}$ | –20 | mA | $V_I$ = –0.5V |
| | | 20 | mA | $V_I$ = Vcc+0.5V |
| DC input voltage | $V_I$ | –0.5 to Vcc+0.5 | V | |
| DC output diode current | $I_{OK}$ | –50 | mA | $V_O$ = –0.5V |
| | | 50 | mA | $V_O$ = Vcc+0.5V |
| DC output voltage | $V_O$ | –0.5 to Vcc+0.5 | V | |
| DC output source or sink current | $I_O$ | ±50 | mA | |
| DC $V_{CC}$ or ground current per output pin | $I_{CC}$, $I_{GND}$ | ±50 | mA | |
| Storage temperature | Tstg | –65 to +150 | °C | |

## Recommended Operating Conditions

| Item | Symbol | Ratings | Unit | Condition |
|---|---|---|---|---|
| Supply voltage | $V_{CC}$ | 2 to 6 | V | |
| Input and output voltage | $V_I$, $V_O$ | 0 to $V_{CC}$ | V | |
| Operating temperature | Ta | –40 to +85 | °C | |
| Input rise and fall time (except Schmitt inputs) $V_{IN}$ 30% to 70% $V_{CC}$ | tr, tf | 8 | ns/V | $V_{CC}$ = 3.0V |
| | | | | $V_{CC}$ = 4.5 V |
| | | | | $V_{CC}$ = 5.5 V |

## DC Characteristics

| Item | Sym-bol | Vcc (V) | Ta = 25°C | | | Ta = –40 to +85°C | | Unit | Condition | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | min. | typ. | max. | min. | max. | | | |
| Input Voltage | $V_{IH}$ | 3.0 | 2.1 | 1.5 | — | 2.1 | — | V | $V_{OUT}$ = 0.1 V or $V_{CC}$ –0.1 V | |
| | | 4.5 | 3.15 | 2.25 | — | 3.15 | — | | | |
| | | 5.5 | 3.85 | 2.75 | — | 3.85 | — | | | |
| | $V_{IL}$ | 3.0 | — | 1.50 | 0.9 | — | 0.9 | | $V_{OUT}$ = 0.1 V or $V_{CC}$ –0.1 V | |
| | | 4.5 | — | 2.25 | 1.35 | — | 1.35 | | | |
| | | 5.5 | — | 2.75 | 1.65 | — | 1.65 | | | |
| Output voltage | $V_{OH}$ | 3.0 | 2.9 | 2.99 | — | 2.9 | — | V | $V_{IN}$ = $V_{IL}$ or $V_{IH}$<br>$I_{OUT}$ = –50 µA | |
| | | 4.5 | 4.4 | 4.49 | — | 4.4 | — | | | |
| | | 5.5 | 5.4 | 5.49 | — | 5.4 | — | | | |
| | | 3.0 | 2.58 | — | — | 2.48 | — | | $V_{IN}$ = $V_{IL}$ or $V_{IH}$ | $I_{OH}$ = –12 mA |
| | | 4.5 | 3.94 | — | — | 3.80 | — | | | $I_{OH}$ = –24 mA |
| | | 5.5 | 4.94 | — | — | 4.80 | — | | | $I_{OH}$ = –24 mA |
| | $V_{OL}$ | 3.0 | — | 0.002 | 0.1 | — | 0.1 | | $V_{IN}$ = $V_{IL}$ or $V_{IH}$<br>$I_{OUT}$ = 50 µA | |
| | | 4.5 | — | 0.001 | 0.1 | — | 0.1 | | | |
| | | 5.5 | — | 0.001 | 0.1 | — | 0.1 | | | |
| | | 3.0 | — | — | 0.32 | — | 0.37 | | $V_{IN}$ = $V_{IL}$ or $V_{IH}$ | $I_{OL}$ = 12 mA |
| | | 4.5 | — | — | 0.32 | — | 0.37 | | | $I_{OL}$ = 24 mA |
| | | 5.5 | — | — | 0.32 | — | 0.37 | | | $I_{OL}$ = 24 mA |
| Input leakage current | $I_{IN}$ | 5.5 | — | — | ±0.1 | — | ±1.0 | µA | $V_{IN}$ = $V_{CC}$ or GND | |
| Dynamic output current* | $I_{OLD}$ | 5.5 | — | — | — | 86 | — | mA | $V_{OLD}$ = 1.1 V | |
| | $I_{OHD}$ | 5.5 | — | — | — | –75 | — | mA | $V_{OHD}$ = 3.85 V | |
| Quiescent supply current | $I_{CC}$ | 5.5 | — | — | 8.0 | — | 80 | µA | $V_{IN}$ = $V_{CC}$ or ground | |

*Maximum test duration 2.0 ms, one output loaded at a time.

## AC Characteristics: HD74AC153

| Item | Symbol | $V_{CC}$ (V)*1 | Ta = +25°C $C_L$ = 50 pF | | | Ta = –40°C to +85°C $C_L$ = 50 pF | | Unit |
|---|---|---|---|---|---|---|---|---|
| | | | Min | Typ | Max | Min | Max | |
| Propagation delay $S_n$ to $Z_n$ | $t_{PLH}$ | 3.3 | 1.0 | 9.5 | 15.0 | 1.0 | 17.5 | ns |
| | | 5.0 | 1.0 | 6.5 | 11.0 | 1.0 | 12.5 | |
| Propagation delay $S_n$ to $Z_n$ | $t_{PHL}$ | 3.3 | 1.0 | 8.5 | 14.5 | 1.0 | 16.5 | ns |
| | | 5.0 | 1.0 | 6.5 | 11.0 | 1.0 | 12.0 | |
| Propagation delay $\overline{E}_n$ to $Z_n$ | $t_{PLH}$ | 3.3 | 1.0 | 8.0 | 13.5 | 1.0 | 16.0 | ns |
| | | 5.0 | 1.0 | 5.5 | 9.5 | 1.0 | 11.0 | |
| Propagation delay $\overline{E}_n$ to $Z_n$ | $t_{PHL}$ | 3.3 | 1.0 | 7.0 | 11.0 | 1.0 | 12.5 | ns |
| | | 5.0 | 1.0 | 5.0 | 8.0 | 1.0 | 9.0 | |
| Propagation delay $I_n$ to $Z_n$ | $t_{PLH}$ | 3.3 | 1.0 | 7.5 | 12.5 | 1.0 | 14.5 | ns |
| | | 5.0 | 1.0 | 5.5 | 9.0 | 1.0 | 10.5 | |
| Propagation delay $I_n$ to $Z_n$ | $t_{PHL}$ | 3.3 | 1.0 | 7.0 | 11.5 | 1.0 | 13.0 | ns |
| | | 5.0 | 1.0 | 5.0 | 8.5 | 1.0 | 10.0 | |

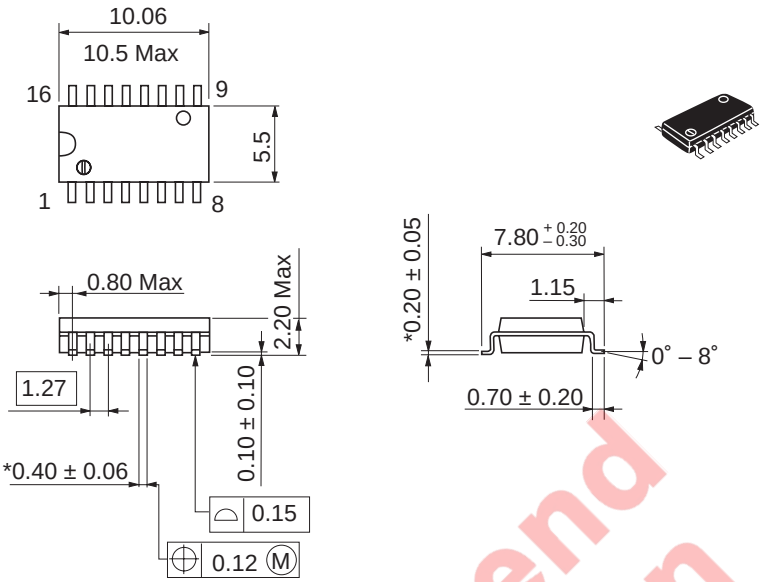
Note: 1. Voltage Range 3.3 is 3.3 V ± 0.3 V
Voltage Range 5.0 is 5.0 V ± 0.5 V

## Capacitance

| Item | Symbol | Typ | Unit | Condition |
|---|---|---|---|---|
| Input capacitance | $C_{IN}$ | 4.5 | pF | $V_{CC}$ = 5.5 V |
| Power dissipation capacitance | $C_{PD}$ | 65.0 | pF | $V_{CC}$ = 5.0 V |

## Package Dimensions

As of January, 2003
Unit: mm

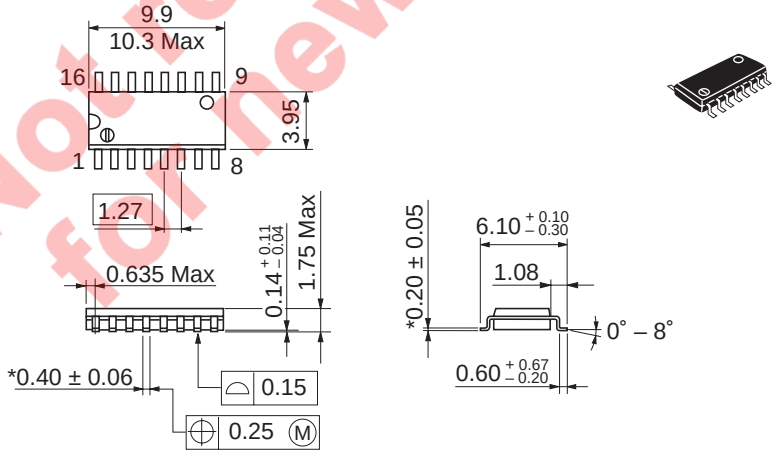



| | |
|---|---|
| Package Code | FP-16DAV |
| JEDEC | — |
| JEITA | Conforms |
| Mass (reference value) | 0.24 g |

*Ni/Pd/Au plating



As of January, 2003
Unit: mm




| | |
|---|---|
| Package Code | FP-16DNV |
| JEDEC | Conforms |
| JEITA | Conforms |
| Mass (reference value) | 0.15 g |

*Ni/Pd/Au plating

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