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# HD74HC651/HD74HC652

Octal Bus Transceivers/Registers (with inverted 3-state outputs)  
Octal Bus Transceivers/Registers (with 3-state outputs)

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### Description

This device consists of bus transceiver circuits, D-type flip-flops, and control circuitry arranged for multiplexed transmission of data directly from the data bus or from the internal storage registers. Enable GAB and  $\overline{\text{GBA}}$  are provided to control the transceiver functions. Select AB and Select BA control pins are provided to select whether real-time or stored data is transferred. A low input level selects real-time data, and a high selects stored data. The following examples demonstrate the four fundamental bus-management functions that can be performed with the HD74HC651 and HD74HC652.

Data on the A or B data bus, or both, can be stored in the internal D flip-flops by low-to-high transition at the appropriate clock pins (Clock AB or Clock BA) regardless of the select or enable control pins. When Select AB and Select BA are in the real-time transfer mode, it is also possible to store data without using the internal D-type flip-flops by simultaneously enabling Enable GAB and  $\overline{\text{GBA}}$ . In this configuration each output reinforces its input. Thus, when all other data sources to the two sets of bus lines are at high impedance, each set of bus lines will remain at its last state.

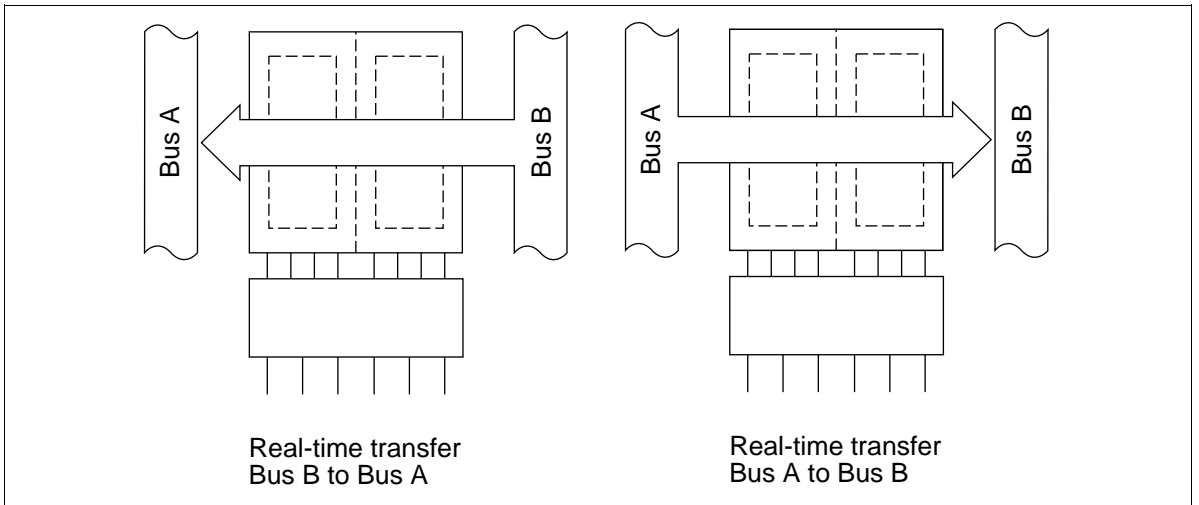
### Features

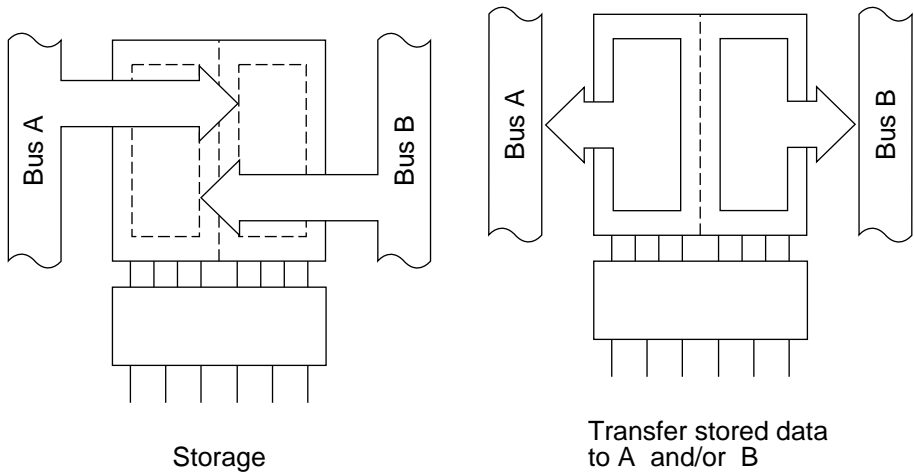
- High Speed Operation:  $t_{pd}$  (Bus to Bus) = 16 ns typ ( $C_L = 50$  pF)
- High Output Current: Fanout of 15 LSTTL Loads
- Wide Operating Voltage:  $V_{CC} = 2$  to 6 V
- Low Input Current: 1  $\mu\text{A}$  max
- Low Quiescent Supply Current:  $I_{CC}$  (static) = 4  $\mu\text{A}$  max ( $T_a = 25^\circ\text{C}$ )

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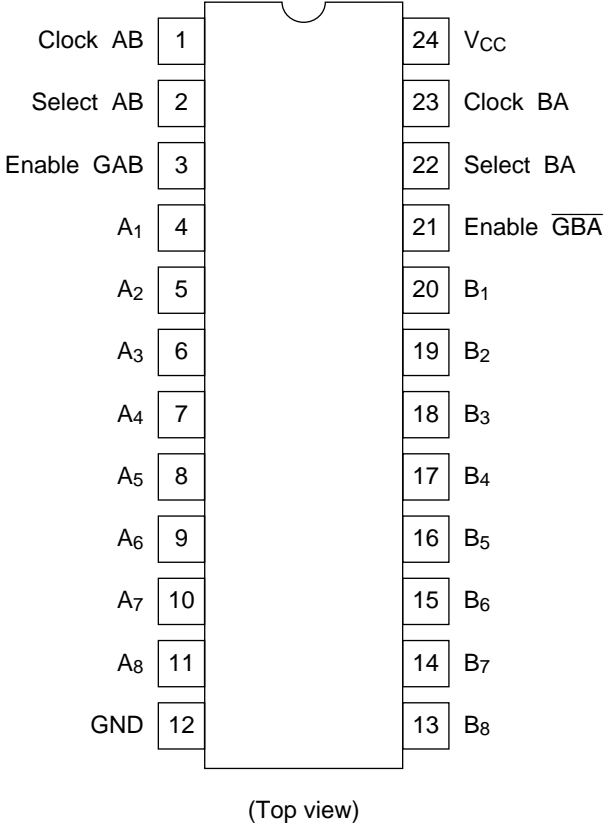
## Function Table

|            | Real-Time Transfer<br>Bus B to Bus A | Real-Time Transfer<br>Bus A to Bus B | Storage | Transfer Stored<br>Data to A and/or B |
|------------|--------------------------------------|--------------------------------------|---------|---------------------------------------|
| Clock AB   | X                                    | X                                    |         | L or H                                |
| Select AB  | X                                    | L                                    | X       | H                                     |
| Enable GAB | L                                    | H                                    | L       | H                                     |
| Clock BA   | X                                    | X                                    |         | L or H                                |
| Select BA  | L                                    | X                                    | X       | H                                     |
| Enable GBA | L                                    | H                                    | H       | L                                     |





Pin Arrangement



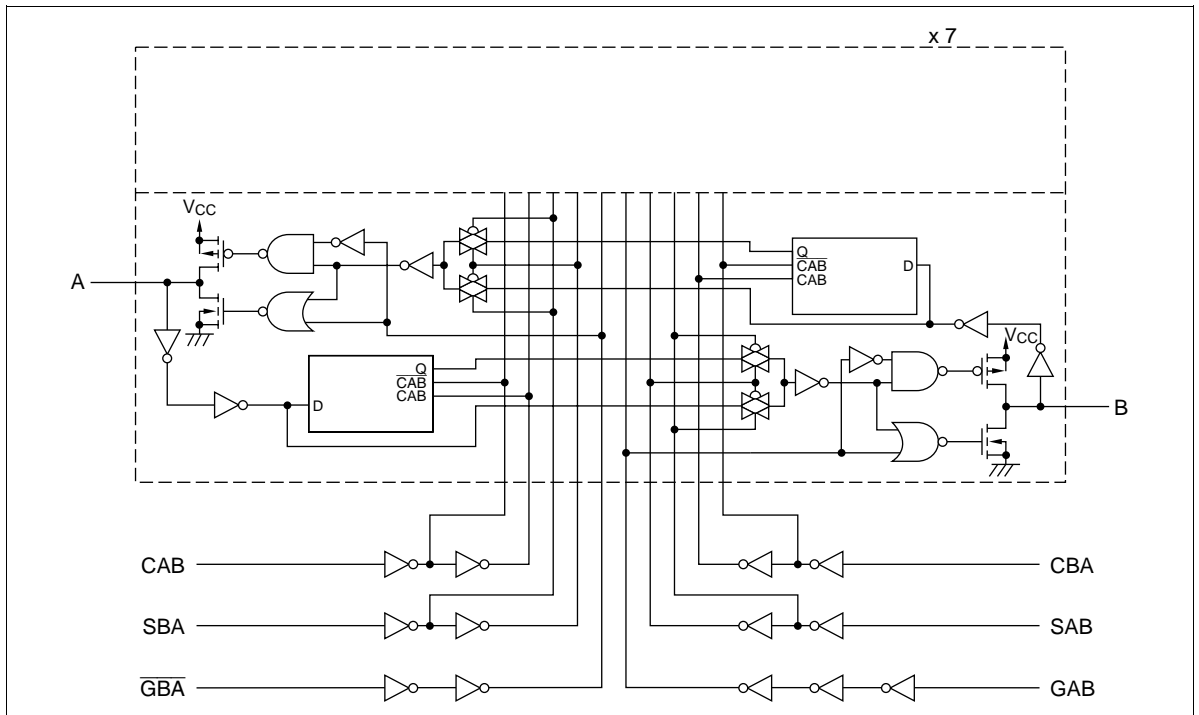
# HD74HC651/HD74HC652

## Absolute Maximum Ratings

| Item                                | Symbol               | Rating                 | Unit        |
|-------------------------------------|----------------------|------------------------|-------------|
| Supply voltage range                | $V_{CC}$             | -0.5 to +7.0           | V           |
| Input voltage                       | $V_{IN}$             | -0.5 to $V_{CC} + 0.5$ | V           |
| Output voltage                      | $V_{OUT}$            | -0.5 to $V_{CC} + 0.5$ | V           |
| Output current                      | $I_{OUT}$            | $\pm 35$               | mA          |
| DC current drain per $V_{CC}$ , GND | $I_{CC}$ , $I_{GND}$ | $\pm 75$               | mA          |
| DC input diode current              | $I_{IK}$             | $\pm 20$               | mA          |
| DC output diode current             | $I_{OK}$             | $\pm 20$               | mA          |
| Power Dissipation per package       | $P_T$                | 500                    | mW          |
| Storage temperature                 | $T_{stg}$            | -65 to +150            | $^{\circ}C$ |

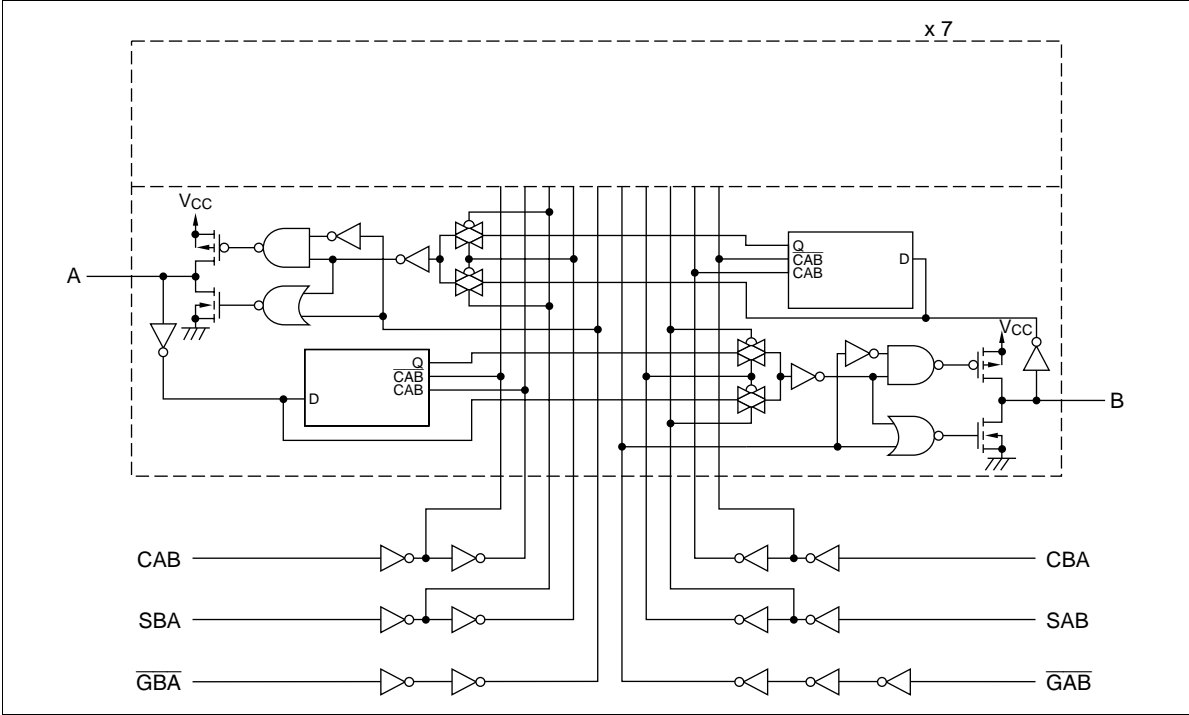
## Logic Diagram

### HD74HC651



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HD74HC652

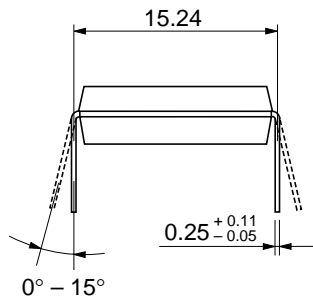
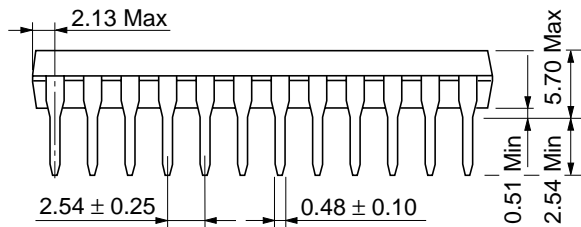
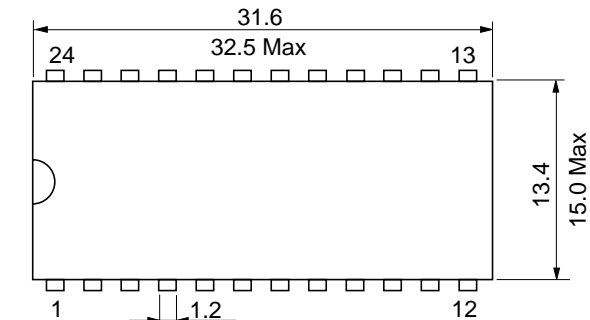
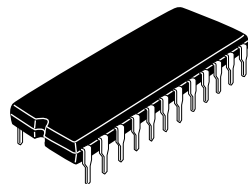


## DC Characteristics

| Item                     | Symbol          | V <sub>CC</sub> (V) | Ta = 25°C |     | Ta = -40 to +85°C |      | Unit | Test Conditions   |   |
|--------------------------|-----------------|---------------------|-----------|-----|-------------------|------|------|---|---|
|                          |                 |                     | Min       | Typ | Max               | Min  |      |   | Max   |
| Input voltage            | V <sub>IH</sub> | 2.0                 | 1.5       | —   | —                 | 1.5  | —    | V   |   |
|                          |                 | 4.5                 | 3.15      | —   | —                 | 3.15 | —    |   |   |
|                          |                 | 6.0                 | 4.2       | —   | —                 | 4.2  | —    |   |   |
|                          | V <sub>IL</sub> | 2.0                 | —         | —   | 0.5               | —    | 0.5  |   | V   |
|                          |                 | 4.5                 | —         | —   | 1.35              | —    | 1.35 |   |   |
|                          |                 | 6.0                 | —         | —   | 1.8               | —    | 1.8  |   |   |
| Output voltage           | V <sub>OH</sub> | 2.0                 | 1.9       | 2.0 | —                 | 1.9  | —    | Vin = V <sub>IH</sub> or V <sub>IL</sub> I <sub>OH</sub> = -20 μA |   |
|                          |                 | 4.5                 | 4.4       | 4.5 | —                 | 4.4  | —    |   |   |
|                          |                 | 6.0                 | 5.9       | 6.0 | —                 | 5.9  | —    |   |   |
|                          |                 | 4.5                 | 4.18      | —   | —                 | 4.13 | —    |   | I <sub>OH</sub> = -6 mA   |
|                          |                 | 6.0                 | 5.68      | —   | —                 | 5.63 | —    |   | I <sub>OH</sub> = -7.8 mA   |
|                          | V <sub>OL</sub> | 2.0                 | —         | 0.0 | 0.1               | —    | 0.1  | Vin = V <sub>IH</sub> or V <sub>IL</sub> I <sub>OL</sub> = 20 μA  |   |
|                          |                 | 4.5                 | —         | 0.0 | 0.1               | —    | 0.1  |   |   |
|                          |                 | 6.0                 | —         | 0.0 | 0.1               | —    | 0.1  |   |   |
|                          |                 | 4.5                 | —         | —   | 0.26              | —    | 0.33 |   | I <sub>OL</sub> = 6 mA  |
|                          |                 | 6.0                 | —         | —   | 0.26              | —    | 0.33 |   | I <sub>OL</sub> = 7.8 mA  |
| Off-state output current | I <sub>OZ</sub> | 6.0                 | —         | —   | ±0.5              | —    | ±5.0 | μA  | Vin = V <sub>IH</sub> or V <sub>IL</sub> ,<br>Vout = V <sub>CC</sub> or GND |
| Input current            | I <sub>in</sub> | 6.0                 | —         | —   | ±0.1              | —    | ±1.0 | μA  | Vin = V <sub>CC</sub> or GND  |
| Quiescent supply current | I <sub>CC</sub> | 6.0                 | —         | —   | 4.0               | —    | 40   | μA  | Vin = V <sub>CC</sub> or GND, Iout = 0 μA                                   |

**AC Characteristics** ( $C_L = 50$  pF, Input  $t_r = t_f = 6$  ns)

| Item                   | Symbol    | $V_{CC}$ (V) | $T_a = 25^\circ\text{C}$ |     | $T_a = -40$ to $+85^\circ\text{C}$ |     | Unit | Test Conditions |              |               |
|------------------------|-----------|--------------|--------------------------|-----|------------------------------------|-----|------|-----------------|--------------|---------------|
|                        |           |              | Min                      | Typ | Max                                | Min |      |                 | Max          |               |
| Propagation delay time | $t_{PLH}$ | 2.0          | —                        | —   | 170                                | —   | 215  | ns              | Clock to Bus |               |
|                        |           | 4.5          | —                        | 19  | 34                                 | —   | 43   |                 |              |               |
|                        |           | 6.0          | —                        | —   | 29                                 | —   | 37   |                 |              |               |
|                        |           | $t_{PHL}$    | 2.0                      | —   | —                                  | 135 | —    | 170             | ns           | Bus to Bus    |
|                        |           |              | 4.5                      | —   | 16                                 | 27  | —    | 34              |              |               |
|                        |           |              | 6.0                      | —   | —                                  | 23  | —    | 29              |              |               |
|                        |           |              | 2.0                      | —   | —                                  | 190 | —    | 240             | ns           | Select to Bus |
|                        |           |              | 4.5                      | —   | 18                                 | 38  | —    | 48              |              |               |
|                        |           |              | 6.0                      | —   | —                                  | 32  | —    | 41              |              |               |
| Output enable time     | $t_{ZL}$  | 2.0          | —                        | —   | 150                                | —   | 190  | ns              |              |               |
|                        | $t_{ZH}$  | 4.5          | —                        | 14  | 30                                 | —   | 38   |                 |              |               |
|                        |           | 6.0          | —                        | —   | 26                                 | —   | 33   |                 |              |               |
| Output disable time    | $t_{LZ}$  | 2.0          | —                        | —   | 150                                | —   | 190  | ns              |              |               |
|                        | $t_{HZ}$  | 4.5          | —                        | 18  | 30                                 | —   | 38   |                 |              |               |
|                        |           | 6.0          | —                        | —   | 26                                 | —   | 33   |                 |              |               |
| Pulse width            | $t_w$     | 2.0          | 80                       | —   | —                                  | 100 | —    | ns              |              |               |
|                        |           | 4.5          | 16                       | 7   | —                                  | 20  | —    |                 |              |               |
|                        |           | 6.0          | 14                       | —   | —                                  | 17  | —    |                 |              |               |
| Setup time             | $t_{su}$  | 2.0          | 100                      | —   | —                                  | 125 | —    | ns              |              |               |
|                        |           | 4.5          | 20                       | 4   | —                                  | 25  | —    |                 |              |               |
|                        |           | 6.0          | 17                       | —   | —                                  | 21  | —    |                 |              |               |
| Hold time              | $t_h$     | 2.0          | 5                        | —   | —                                  | 5   | —    | ns              |              |               |
|                        |           | 4.5          | 5                        | -1  | —                                  | 5   | —    |                 |              |               |
|                        |           | 6.0          | 5                        | —   | —                                  | 5   | —    |                 |              |               |
| Output rise/fall time  | $t_{TLH}$ | 2.0          | —                        | —   | 60                                 | —   | 75   | ns              |              |               |
|                        | $t_{THL}$ | 4.5          | —                        | 4   | 12                                 | —   | 15   |                 |              |               |
|                        |           | 6.0          | —                        | —   | 10                                 | —   | 13   |                 |              |               |
| Input capacitance      | $C_{in}$  | —            | —                        | 5   | 10                                 | —   | 10   | pF              |              |               |



|                          |          |
|--------------------------|----------|
| Hitachi Code             | DP-24    |
| JEDEC                    | Conforms |
| EIAJ                     | Conforms |
| Weight (reference value) | 3.1 g    |



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