



## DM74ALS646

### Octal 3-STATE Bus Transceiver and Register

#### General Description

This device incorporates an octal bus transceiver and an octal D-type register configured to enable multiplexed transmission of data from bus to bus or internal register to bus.

This bus transceiver features totem-pole 3-STATE outputs designed specifically for driving highly-capacitive or relatively low-impedance loads. The high-impedance state and increased high-logic level drive provides this device with the capability of being connected directly to and driving the bus lines in a bus-organized system without the need for interface or pull-up components. They are particularly attractive for implementing buffer registers, I/O ports, bidirectional bus drivers, and working registers.

The registers in the DM74ALS646 are edge-triggered D-type flip-flops. On the positive transition of the clock (CAB or CBA), the input bus data is stored into the appropriate register. The CAB input controls the transfer of data into the A register and the CBA input controls the B register.

The SAB and SBA control pins are provided to select whether real-time data or stored data is transferred. A LOW input level selects real-time data, and a HIGH level selects stored data. The select controls have a "make before break" configuration to eliminate a glitch which would normally occur in a typical multiplexer during the transition between store and real-time data.

The enable  $\bar{G}$  and direction control pins provide four modes of operation: real-time data transfer from bus A to B, real-time data transfer from bus B to A, real-time bus A and/or B data transfer to internal storage, or internally stored data transfer to bus A or B.

When the enable  $\bar{G}$  pin is LOW, the direction pin selects which bus receives data. When the enable G pin is HIGH, both buses become disabled yet their input function is still enabled.

#### Features

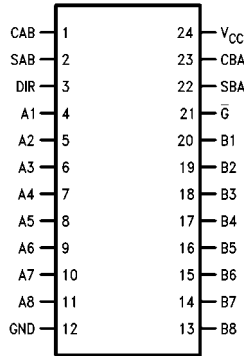
- Switching specifications at 50 pF
- Switching specifications guaranteed over full temperature and  $V_{CC}$  range
- Advanced oxide-isolated, ion-implanted Schottky TTL process
- 3-STATE buffer outputs drive bus lines directly
- Multiplexed real-time and stored data
- Independent registers for A and B buses

#### Ordering Code

| Order Number | Package Number | Package Description  |
|--------------|----------------|--|
| DM74ALS646WM | M24B           | 24-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-013, 0.300" Wide |
| DM74ALS646NT | N24C           | 24-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300" Wide     |

Devices also available in Tape and Reel. Specify by appending the suffix letter "X" to the ordering code.

### Connection Diagram



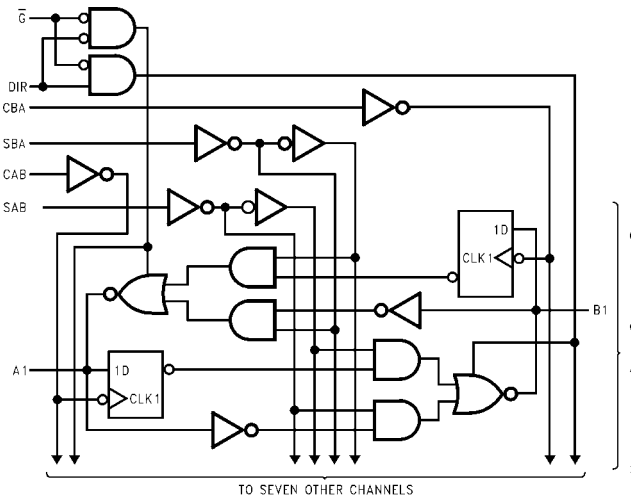
### Function Table

| Inputs    |     |     |     |     |     | Data I/O (Note 1) |               | Operation or Function     |
|-----------|-----|-----|-----|-----|-----|-------------------|---------------|---------------------------|
| $\bar{G}$ | DIR | CAB | CBA | SAB | SBA | A1 thru A8        | B1 thru B8    |                           |
| X         | X   | ↑   | X   | X   | X   | Input             | Not Specified | Store A, B Unspecified    |
| X         | X   | X   | ↑   | X   | X   | Not Specified     | Input         | Store B, A Unspecified    |
| H         | X   | ↑   | ↑   | X   | X   | Input             | Input         | Store A and B Data        |
| H         | X   | H/L | H/L | X   | X   | Input             | Input         | Isolation, Hold Storage   |
| L         | L   | X   | X   | X   | L   | Output            | Input         | Real-Time B Data to a Bus |
| L         | L   | X   | H/L | X   | H   | Output            | Input         | Stored B Data to a Bus    |
| L         | H   | X   | X   | L   | X   | Input             | Output        | Real-Time A Data to B Bus |
| L         | H   | H/L | X   | H   | X   | Input             | Output        | Stored A Data to B Bus    |

H = HIGH Logic Level  
 L = LOW Logic Level  
 X = Don't Care (Either LOW or HIGH Logic Levels including transitions)  
 H/L = Either LOW or HIGH Logic Level excluding transitions  
 ↑ = Positive going edge of pulse

**Note 1:** The data output functions may be enabled or disabled by various signals at the  $\bar{G}$  and DIR inputs. Data input functions are always enabled, i.e., data at the bus pins will be stored on every LOW-to-HIGH transition on the clock inputs.

### Logic Diagram



**Absolute Maximum Ratings**(Note 2)

|                                      |                 |
|--------------------------------------|-----------------|
| Supply Voltage                       | 7V              |
| Input Voltage                        |                 |
| Control Inputs                       | 7V              |
| I/O Ports                            | 5.5V            |
| Operating Free-Air Temperature Range | 0°C to +70°C    |
| Storage Temperature Range            | -65°C to +150°C |
| Typical $\theta_{JA}$                |                 |
| N Package                            | 44.5°C/W        |
| M Package                            | 80.5°C/W        |

**Note 2:** The "Absolute Maximum Ratings" are those values beyond which the safety of the device cannot be guaranteed. The device should not be operated at these limits. The parametric values defined in the Electrical Characteristics tables are not guaranteed at the absolute maximum ratings. The "Recommended Operating Conditions" table will define the conditions for actual device operation.

**Recommended Operating Conditions**

| Symbol    | Parameter  | Min           | Nom | Max | Units |
|-----------|--|---------------|-----|-----|-------|
| $V_{CC}$  | Supply Voltage   |               | 5   | 5.5 | V     |
| $V_{IH}$  | HIGH Level Input Voltage                               |               |     |     | V     |
| $V_{IL}$  | LOW Level Input Voltage                                |               |     | 0.8 | V     |
| $I_{OH}$  | HIGH Level Output Current                              |               |     | -15 | mA    |
| $I_{OL}$  | LOW Level Output Current                               |               |     | 24  | mA    |
| $f_{CLK}$ | Clock Frequency  |               |     | 40  | MHz   |
| $t_W$     | Pulse Duration, Clocks LOW or HIGH                     |               |     |     | ns    |
| $t_{SU}$  | Data Setup Time, A before CAB or B before CBA (Note 3) | 10 $\uparrow$ |     |     | ns    |
| $t_H$     | Data Hold Time, A after CAB or B after CBA (Note 3)    | 0 $\uparrow$  |     |     | ns    |
| $T_A$     | Free Air Operating Temperature                         |               |     | 70  | °C    |

**Note 3:**  $\uparrow$  = With reference to the LOW-to-HIGH transition of the respective clock.

**Electrical Characteristics**

over recommended free air temperature range

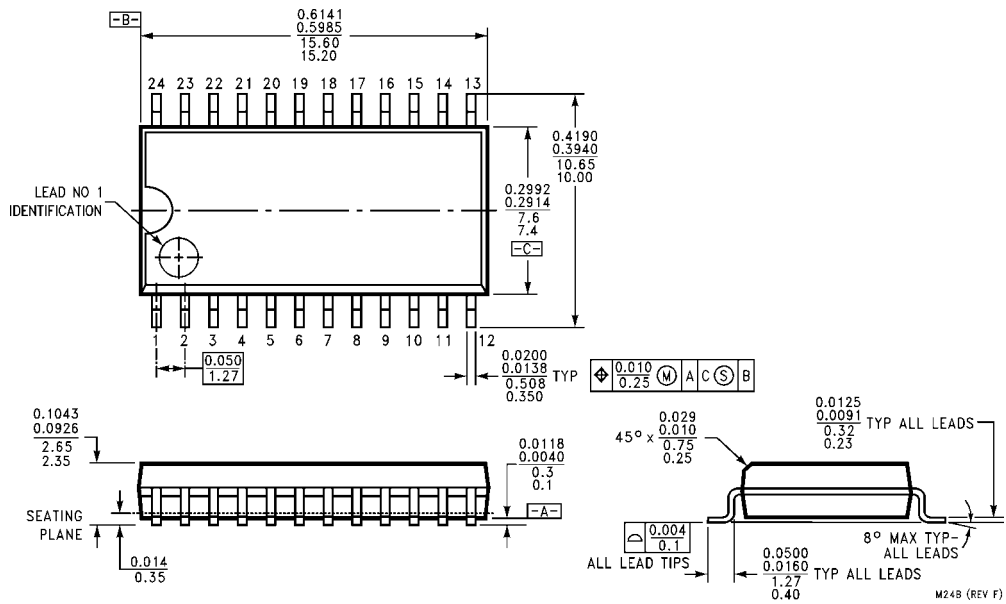
| Symbol   | Parameter                                 | Test Conditions   | Min   | Typ          | Max  | Units         |   |
|----------|---|---|---|--------------|------|---------------|---|
| $V_{IC}$ | Input Clamp Voltage                       | $V_{CC} = \text{Min}$ , $I_I = -18 \text{ mA}$            |   |              | -1.2 | V             |   |
| $V_{OH}$ | HIGH Level                                | $V_{CC} = 4.5\text{V to } 5.5\text{V}$                    | $I_{OH} = -0.4 \text{ mA}$                        | $V_{CC} - 2$ |      | V             |   |
|          | Output Voltage                            | $V_{CC} = \text{Min}$                                     | $I_{OH} = -3 \text{ mA}$<br>$I_{OH} = \text{Max}$ | 2.4<br>2     | 3.2  |               |   |
| $V_{OL}$ | LOW Level<br>Output Voltage               | $V_{CC} = \text{Min}$                                     | $I_{OL} = 12 \text{ mA}$                          |              | 0.25 | 0.4           | V |
|          |   |   | $I_{OL} = 24 \text{ mA}$                          |              | 0.35 | 0.5           |   |
|          |   |   | $I_{OL} = 48 \text{ mA}$                          |              | 0.35 | 0.5           |   |
| $I_I$    | Input Current at Maximum<br>Input Voltage | $V_{CC} = \text{Max}$                                     | I/O Ports, $V_I = 5.5\text{V}$                    |              | 100  | $\mu\text{A}$ |   |
|          |   |   | Control Inputs, $V_I = 7\text{V}$                 |              | 100  |               |   |
| $I_{IH}$ | HIGH Level Input Current                  | $V_{CC} = \text{Max}$ , $V_I = 2.7\text{V}$ (Note 4)      |   |              | 20   | $\mu\text{A}$ |   |
| $I_{IL}$ | LOW Level<br>Input Current                | $V_{CC} = \text{Max}$ ,<br>$V_I = 0.4\text{V}$ , (Note 4) | Control Inputs                                    |              | -200 | $\mu\text{A}$ |   |
|          |   |   | I/O Ports   |              | -200 |               |   |
| $I_O$    | Output Drive Current                      | $V_{CC} = \text{Max}$ , $V_O = 2.25\text{V}$              | -30   |              | -112 | mA            |   |
| $I_{CC}$ | Supply Current                            | $V_{CC} = \text{Max}$                                     | Outputs HIGH                                      | 47           | 76   | mA            |   |
|          |   |   | Outputs LOW                                       | 55           | 88   |               |   |
|          |   |   | Outputs Disabled                                  | 55           | 88   |               |   |

**Note 4:** For I/O ports the 3-STATE output currents ( $I_{OZH}$  and  $I_{OZL}$ ) are included in the  $I_{IH}$  and  $I_{IL}$  parameters.

| Switching Characteristics                             |   |   |                             |     |     |       |
|---|---|---|-----------------------------|-----|-----|-------|
| over recommended operating free air temperature range |   |   |                             |     |     |       |
| Symbol  | Parameter   | Conditions  | From (Input)                | Min | Max | Units |
|   |   |   | To (Output)                 |     |     |       |
| $t_{PLH}$   | Propagation Delay Time<br>LOW-to-HIGH Level Output                                | $V_{CC} = 4.5V$ to $5.5V$ ,<br>$C_L = 50$ pF,<br>$R_1 = R_2 = 500\Omega$ ,<br>$T_A = \text{Min to Max}$ | CBA or CAB<br>to A or B     | 10  | 30  | ns    |
| $t_{PHL}$   | Propagation Delay Time<br>HIGH-to-LOW Level Output                                |   | CBA or CAB<br>to A or B     | 5   | 17  | ns    |
| $t_{PLH}$   | Propagation Delay Time<br>LOW-to-HIGH Level Output                                |   | A or B to<br>B or A         | 5   | 20  | ns    |
| $t_{PHL}$   | Propagation Delay Time<br>HIGH-to-LOW Level Output                                |   | A or B to<br>B or A         | 3   | 12  | ns    |
| $t_{PLH}$   | Propagation Delay Time<br>LOW-to-HIGH Level Output<br>(with A or B LOW) (Note 5)  |   | SBA or SAB<br>to A or B     | 12  | 35  | ns    |
| $t_{PHL}$   | Propagation Delay Time<br>HIGH-to-LOW Level Output<br>(with A or B LOW) (Note 5)  |   | SBA or SAB<br>to A or B     | 5   | 20  | ns    |
| $t_{PLH}$   | Propagation Delay Time<br>LOW-to-HIGH Level Output<br>(with A or B HIGH) (Note 5) |   | SBA or SAB<br>to A or B     | 6   | 25  | ns    |
| $t_{PHL}$   | Propagation Delay Time<br>HIGH-to-LOW Level Output<br>(with A or B HIGH) (Note 5) |   | SBA or SAB<br>to A or B     | 5   | 20  | ns    |
| $t_{PZH}$   | Output Enable Time<br>to HIGH Level Output  |   | $\overline{G}$ to<br>A or B | 3   | 17  | ns    |
| $t_{PZL}$   | Output Enable Time<br>to LOW Level Output   |   | $\overline{G}$ to<br>A or B | 5   | 20  | ns    |
| $t_{PHZ}$   | Output Disable Time<br>from HIGH Level Output                                     |   | $\overline{G}$ to<br>A or B | 1   | 10  | ns    |
| $t_{PLZ}$   | Output Disable Time<br>from LOW Level Output                                      |   | $\overline{G}$ to<br>A or B | 2   | 16  | ns    |
| $t_{PZH}$   | Output Enable Time<br>to HIGH Level Output  |   | DIR to<br>A or B            | 6   | 30  | ns    |
| $t_{PZL}$   | Output Enable Time<br>to LOW Level Output   |   | DIR to<br>A or B            | 5   | 25  | ns    |
| $t_{PHZ}$   | Output Disable Time<br>from HIGH Level Output                                     |   | DIR to<br>A or B            | 1   | 10  | ns    |
| $t_{PLZ}$   | Output Disable Time<br>from LOW Level Output                                      |   | DIR to<br>A or B            | 2   | 16  | ns    |

**Note 5:** These parameters are measured with the internal output state of the storage register opposite to that of the bus input.

**Physical Dimensions** inches (millimeters) unless otherwise noted





**24-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-013, 0.300" Wide  
Package Number M24B**

M24B (REV F)



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