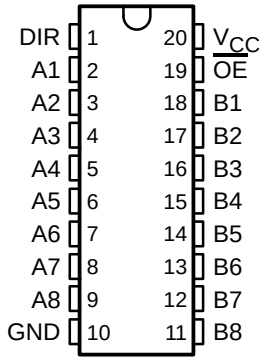
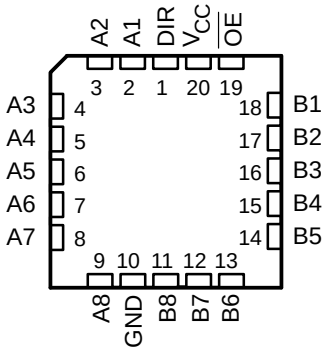
- **Bidirectional Bus Transceivers in High-Density 20-Pin Packages**
- **Inverting Logic**
- **Package Options Include Plastic Small-Outline (DW) Packages, Ceramic Chip Carriers (FK), and Standard Plastic (N) and Ceramic (J) 300-mil DIPs**

**SN54ALS640B, SN54AS640 . . . J PACKAGE**
**SN74ALS640B, SN74AS640 . . . DW OR N PACKAGE**
**(TOP VIEW)**




**SN54ALS640B, SN54AS640 . . . FK PACKAGE**
**(TOP VIEW)**




## description

These octal bus transceivers are designed for asynchronous two-way communication between data buses. These devices transmit data from the A bus to the B bus or from the B bus to the A bus, depending upon the level at the direction-control (DIR) input. The output-enable ($\overline{OE}$) input can be used to disable the device so that the buses are effectively isolated.

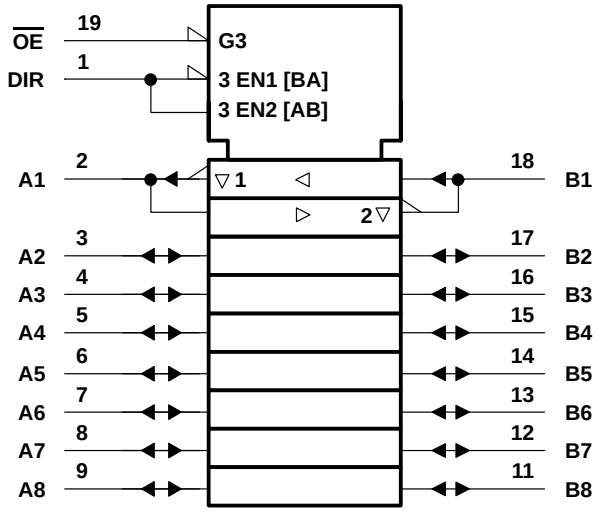
The -1 version of the SN74ALS640B is identical to the standard version, except that the recommended maximum $I_{OL}$ for the -1 version is increased to 48 mA. There is no -1 version of the SN54ALS640B.

The SN54ALS640B and SN54AS640 are characterized for operation over the full military temperature range of −55°C to 125°C. The SN74ALS640B and SN74AS640 are characterized for operation from 0°C to 70°C.

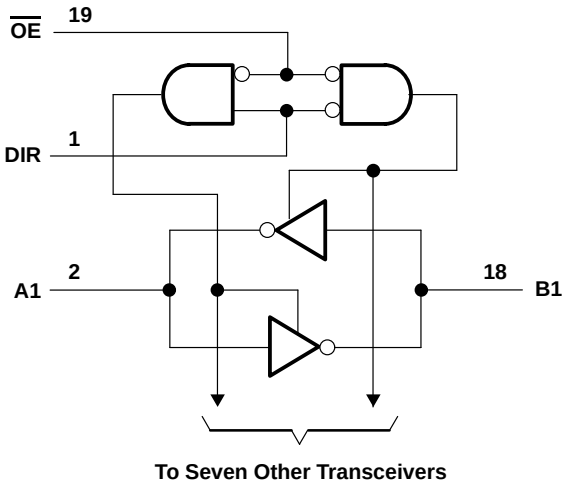
**FUNCTION TABLE**

| INPUTS | | OPERATION |
|---|---|---|
| $\overline{OE}$ | DIR | |
| L | L | $\overline{B}$ data to A bus |
| L | H | $\overline{A}$ data to B bus |
| H | X | Isolation |

### logic symbol†




### logic diagram (positive logic)




† This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.

### absolute maximum ratings over operating free-air temperature range (unless otherwise noted)‡

Supply voltage, $V_{CC}$ . . . . . 7 V
Input voltage, $V_I$: All inputs . . . . . 7 V
I/O ports . . . . . 5.5 V
Operating free-air temperature range, $T_A$: SN54ALS640B . . . . . –55°C to 125°C
SN74ALS640B . . . . . 0°C to 70°C
Storage temperature range . . . . . –65°C to 150°C

‡ Stresses beyond those listed under “absolute maximum ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

### recommended operating conditions

| | | SN54ALS640B | | | SN74ALS640B | | | UNIT |
|---|---|---|---|---|---|---|---|---|
| | | MIN | NOM | MAX | MIN | NOM | MAX | |
| $V_{CC}$ | Supply voltage | 4.5 | 5 | 5.5 | 4.5 | 5 | 5.5 | V |
| $V_{IH}$ | High-level input voltage | 2 | | | 2 | | | V |
| $V_{IL}$ | Low-level input voltage | | | 0.7 | | | 0.8 | V |
| $I_{OH}$ | High-level output current | | | –12 | | | –15 | mA |
| $I_{OL}$ | Low-level output current | | | 12 | | | 24 | mA |
| | | | | | | | 48§ | |
| $T_A$ | Operating free-air temperature | –55 | | 125 | 0 | | 70 | °C |

§ Applies only to the -1 version and only if $V_{CC}$ is between 4.75 V and 5.25 V

## electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)

| PARAMETER | | TEST CONDITIONS | | SN54ALS640B | | | SN74ALS640B | | | UNIT |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | MIN | TYP† | MAX | MIN | TYP† | MAX | |
| $V_{IK}$ | | $V_{CC}$ = 4.5 V, | $I_I$ = –18 mA | | | –1.5 | | | –1.5 | V |
| $V_{OH}$ | | $V_{CC}$ = 4.5 V to 5.5 V, | $I_{OH}$ = –0.4 mA | $V_{CC}$ –2 | | | $V_{CC}$ –2 | | | V |
| | | $V_{CC}$ = 4.5 V | $I_{OH}$ = –3 mA | 2.4 | 3.2 | | 2.4 | 3.2 | | |
| | | | $I_{OH}$ = –12 mA | 2 | | | | | | |
| | | | $I_{OH}$ = –15 mA | | | | 2 | | | |
| $V_{OL}$ | | $V_{CC}$ = 4.5 V | $I_{OL}$ = 12 mA | | 0.25 | 0.4 | | 0.25 | 0.4 | V |
| | | | $I_{OL}$ = 24 mA | | | | | 0.35 | 0.5 | |
| | | | $I_{OL}$ = 48 mA‡ | | | | | 0.35 | 0.5 | |
| $I_I$ | Control inputs | $V_{CC}$ = 5.5 V | $V_I$ = 7 V | | | 0.1 | | | 0.1 | mA |
| | A or B ports | | $V_I$ = 5.5 V | | | 0.1 | | | 0.1 | |
| $I_{IH}$ | Control inputs | $V_{CC}$ = 5.5 V, | $V_I$ = 2.7 V | | | 20 | | | 20 | µA |
| | A or B ports§ | | | | | 20 | | | 20 | |
| $I_{IL}$ | Control inputs | $V_{CC}$ = 5.5 V, | $V_I$ = 0.4 V | | | –0.1 | | | –0.1 | mA |
| | A or B ports§ | | | | | –0.1 | | | –0.1 | |
| $I_O$¶ | | $V_{CC}$ = 5.5 V, | $V_O$ = 2.25 V | –20 | | –112 | –30 | | –112 | mA |
| $I_{CC}$ | | $V_{CC}$ = 5.5 V | Outputs high | | 19 | 50 | | 19 | 45 | mA |
| | | | Outputs low | | 27 | 60 | | 27 | 55 | |
| | | | Outputs disabled | | 28 | 55 | | 28 | 50 | |

† All typical values are at $V_{CC}$ = 5 V, $T_A$ = 25°C.
‡ Applies only to the -1 version and only if $V_{CC}$ is between 4.75 V and 5.25 V
§ For I/O ports, the parameters $I_{IH}$ and $I_{IL}$ include the off-state output current.
¶ The output conditions have been chosen to produce a current that closely approximates one half of the true short-circuit output current, $I_{OS}$.

## switching characteristics (see Figure 1)

| PARAMETER | FROM (INPUT) | TO (OUTPUT) | $V_{CC}$ = 4.5 V to 5.5 V, $C_L$ = 50 pF, R1 = 500 Ω, R2 = 500 Ω, $T_A$ = MIN to MAX# | | | | UNIT |
|---|---|---|---|---|---|---|---|
| | | | SN54ALS640B | | SN74ALS640B | | |
| | | | MIN | MAX | MIN | MAX | |
| $t_{PLH}$ | A or B | B or A | 2 | 14 | 2 | 11 | ns |
| $t_{PHL}$ | | | 2 | 13 | 2 | 10 | |
| $t_{PZH}$ | $\overline{OE}$ | A or B | 4 | 25 | 4 | 21 | ns |
| $t_{PZL}$ | | | 5 | 27 | 5 | 24 | |
| $t_{PHZ}$ | $\overline{OE}$ | A or B | 2 | 12 | 2 | 10 | ns |
| $t_{PLZ}$ | | | 3 | 20 | 3 | 15 | |

# For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.

### absolute maximum ratings over operating free-air temperature range (unless otherwise noted)†

Supply voltage, $V_{CC}$ . . . . . 7 V
Input voltage, $V_I$: All inputs . . . . . 7 V
I/O ports . . . . . 5.5 V
Operating free-air temperature range, $T_A$: SN54AS640 . . . . . –55°C to 125°C
SN74AS640 . . . . . 0°C to 70°C
Storage temperature range . . . . . –65°C to 150°C

† Stresses beyond those listed under "absolute maximum ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under "recommended operating conditions" is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

### recommended operating conditions

| | | SN54AS640 | | | SN74AS640 | | | UNIT |
|---|---|---|---|---|---|---|---|---|
| | | MIN | NOM | MAX | MIN | NOM | MAX | |
| $V_{CC}$ | Supply voltage | 4.5 | 5 | 5.5 | 4.5 | 5 | 5.5 | V |
| $V_{IH}$ | High-level input voltage | 2 | | | 2 | | | V |
| $V_{IL}$ | Low-level input voltage | | | 0.8 | | | 0.8 | V |
| $I_{OH}$ | High-level output current | | | –12 | | | –15 | mA |
| $I_{OL}$ | Low-level output current | | | 48 | | | 64 | mA |
| $T_A$ | Operating free-air temperature | –55 | | 125 | 0 | | 70 | °C |

### electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)

| PARAMETER | | TEST CONDITIONS | | SN54AS640 | | | SN74AS640 | | | UNIT |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | MIN | TYP‡ | MAX | MIN | TYP‡ | MAX | |
| $V_{IK}$ | | $V_{CC}$ = 4.5 V, | $I_I$ = –18 mA | | | –1.2 | | | –1.2 | V |
| $V_{OH}$ | | $V_{CC}$ = 4.5 V, | $I_{OH}$ = –2 mA | $V_{CC}$ –2 | | | | | | V |
| | | $V_{CC}$ = 4.5 V to 5.5 V, | $I_{OH}$ = –2 mA | | | | $V_{CC}$ –2 | | | |
| | | $V_{CC}$ = 4.5 V | $I_{OH}$ = –3 mA | 2.4 | 3.2 | | 2.4 | 3.2 | | |
| | | | $I_{OH}$ = –12 mA | 2.4 | | | | | | |
| | | | $I_{OH}$ = –15 mA | | | | 2.4 | | | |
| $V_{OL}$ | | $V_{CC}$ = 4.5 V | $I_{OL}$ = 48 mA | | 0.3 | 0.55 | | | | V |
| | | | $I_{OL}$ = 64 mA | | | | | 0.35 | 0.55 | |
| $I_I$ | Control inputs | $V_{CC}$ = 5.5 V | $V_I$ = 7 V | | | 0.1 | | | 0.1 | mA |
| | A or B ports | | $V_I$ = 5.5 V | | | 0.1 | | | 0.1 | |
| $I_{IH}$ | Control inputs | $V_{CC}$ = 5.5 V, | $V_I$ = 2.7 V | | | 20 | | | 20 | µA |
| | A or B ports§ | | | | | 70 | | | 70 | |
| $I_{IL}$ | Control inputs | $V_{CC}$ = 5.5 V, | $V_I$ = 0.4 V | | | –0.5 | | | –0.5 | mA |
| | A or B ports§ | | | | | –0.75 | | | –0.75 | |
| $I_O$¶ | | $V_{CC}$ = 5.5 V, | $V_O$ = 2.25 V | –50 | | –150 | –50 | | –150 | mA |
| $I_{CC}$ | | $V_{CC}$ = 5.5 V | Outputs high | | 37 | 58 | | 37 | 58 | mA |
| | | | Outputs low | | 78 | 123 | | 78 | 123 | |
| | | | Outputs disabled | | 51 | 80 | | 51 | 80 | |

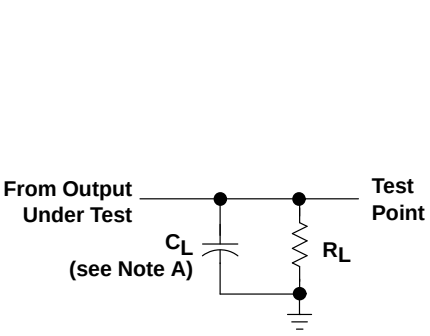
‡ All typical values are at $V_{CC}$ = 5 V, $T_A$ = 25°C.
§ For I/O ports, the parameters $I_{IH}$ and $I_{IL}$ include the off-state output current.
¶ The output conditions have been chosen to produce a current that closely approximates one half of the true short-circuit output current, $I_{OS}$.

## switching characteristics (see Figure 1)

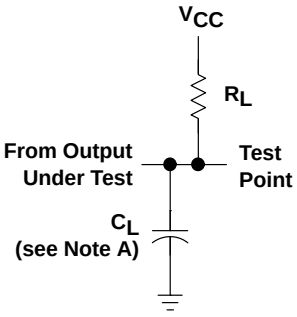
| PARAMETER | FROM (INPUT) | TO (OUTPUT) | $V_{CC}$ = 4.5 V to 5.5 V, $C_L$ = 50 pF, R1 = 500 Ω, R2 = 500 Ω, $T_A$ = MIN to MAX† | | | | UNIT |
|---|---|---|---|---|---|---|---|
| | | | SN54AS640 | | SN74AS640 | | |
| | | | MIN | MAX | MIN | MAX | |
| $t_{PLH}$ | A or B | B or A | 1 | 8 | 2 | 7 | ns |
| $t_{PHL}$ | | | 1 | 7 | 2 | 6 | |
| $t_{PZH}$ | $\overline{OE}$ | A or B | 2 | 10 | 2 | 8 | ns |
| $t_{PZL}$ | | | 2 | 12 | 2 | 10 | |
| $t_{PHZ}$ | $\overline{OE}$ | A or B | 2 | 9 | 2 | 8 | ns |
| $t_{PLZ}$ | | | 2 | 16 | 2 | 13 | |

† For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.

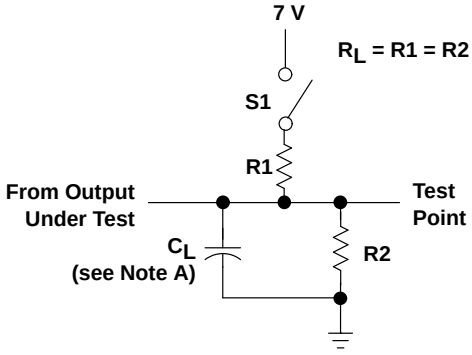
## PARAMETER MEASUREMENT INFORMATION
## SERIES 54ALS/74ALS AND 54AS/74AS DEVICES



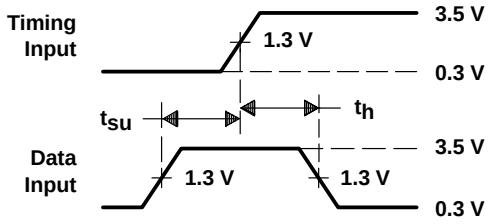

LOAD CIRCUIT FOR
BI-STATE
TOTEM-POLE OUTPUTS



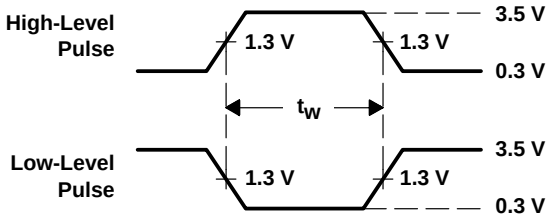

LOAD CIRCUIT
FOR OPEN-COLLECTOR OUTPUTS



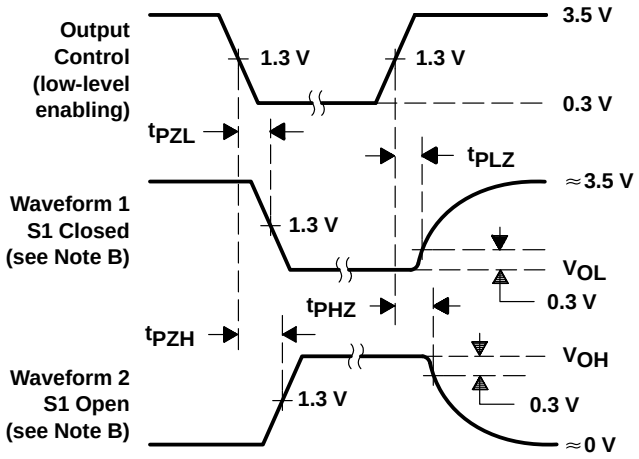

LOAD CIRCUIT
FOR 3-STATE OUTPUTS



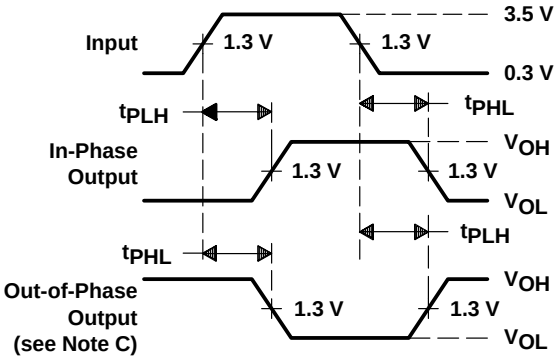

VOLTAGE WAVEFORMS
SETUP AND HOLD TIMES




VOLTAGE WAVEFORMS
PULSE DURATIONS




VOLTAGE WAVEFORMS
ENABLE AND DISABLE TIMES, 3-STATE OUTPUTS




VOLTAGE WAVEFORMS
PROPAGATION DELAY TIMES

NOTES: A. $C_L$ includes probe and jig capacitance.
B. Waveform 1 is for an output with internal conditions such that the output is low except when disabled by the output control. Waveform 2 is for an output with internal conditions such that the output is high except when disabled by the output control.
C. When measuring propagation delay items of 3-state outputs, switch S1 is open.
D. All input pulses have the following characteristics: PRR ≤ 1 MHz, $t_r = t_f = 2$ ns, duty cycle = 50%.
E. The outputs are measured one at a time with one transition per measurement.

**Figure 1. Load Circuits and Voltage Waveforms**

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