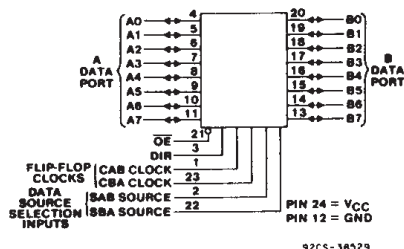


# CD54/74HC646, CD54/74HCT646 CD54/74HC648, CD54/74HCT648

File Number 1664

Data sheet acquired from Harris Semiconductor  
SCHS278

## High-Speed CMOS Logic



## Octal Bus Transceiver/Register, 3-State

### Type Features:

- Independent Registers for A and B Buses
- CD54/74HC/HCT646 Non-Inverting  
CD54/74HC/HCT648 Inverting
- 3-State Outputs
- Drives 15LSTTL loads
- Typical Propagation Delay = 12ns (A ↔ B)  
@  $V_{CC} = 5V$ ,  $C_L = 15pF$ ,  $T_A = 25^\circ C$

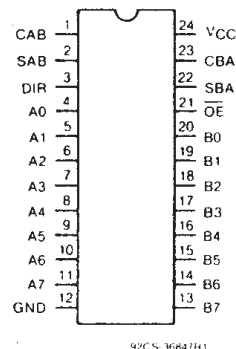
### FUNCTIONAL DIAGRAM

The RCA-CD54/74HC646 and CD54/74HCT646 are octal bus transceivers/registers with 3-state non-inverting outputs. The RCA-CD54/74HC648 and CD54/74HCT648 are octal bus transceivers/registers with 3-state inverting outputs. These devices are bus transceivers with D-type flip-flops which act as internal storage registers. Data on the A bus or the B bus can be clocked into the registers on the LOW-to-HIGH transition of either CAB or CBA clock inputs. Output enable ( $\overline{OE}$ ) and direction (DIR) inputs control the transceiver functions. Data present at the high impedance output can be stored in either register or both but only one of the two buses can be enabled as outputs at any one time. The select controls (SAB and SBA) can multiplex stored and transparent (real time) data. The direction control determines which data bus will receive data when the output enable ( $\overline{OE}$ ) is LOW. In the high impedance mode (output enable HIGH), A data can be stored in one register and B data can be stored in the other register. The clocks are not gated with the direction (DIR) and output enable ( $\overline{OE}$ ) terminals; data at the A or B terminals can be clocked into the storage flip-flops at any time.

The CD54HC646, 648 and CD54HCT646, 648 are supplied in 24-lead dual-in-line frit-seal ceramic packages (F suffix). The CD74HC646, 648 and CD74HCT646, 648 are supplied in 24-lead dual-in-line, narrow-body plastic packages (EN suffix), in 24-lead dual-in-line, wide-body plastic packages (E suffix), and in 24-lead dual-in-line surface-mount plastic packages (M suffix). Both types are also available in chip form (H suffix).

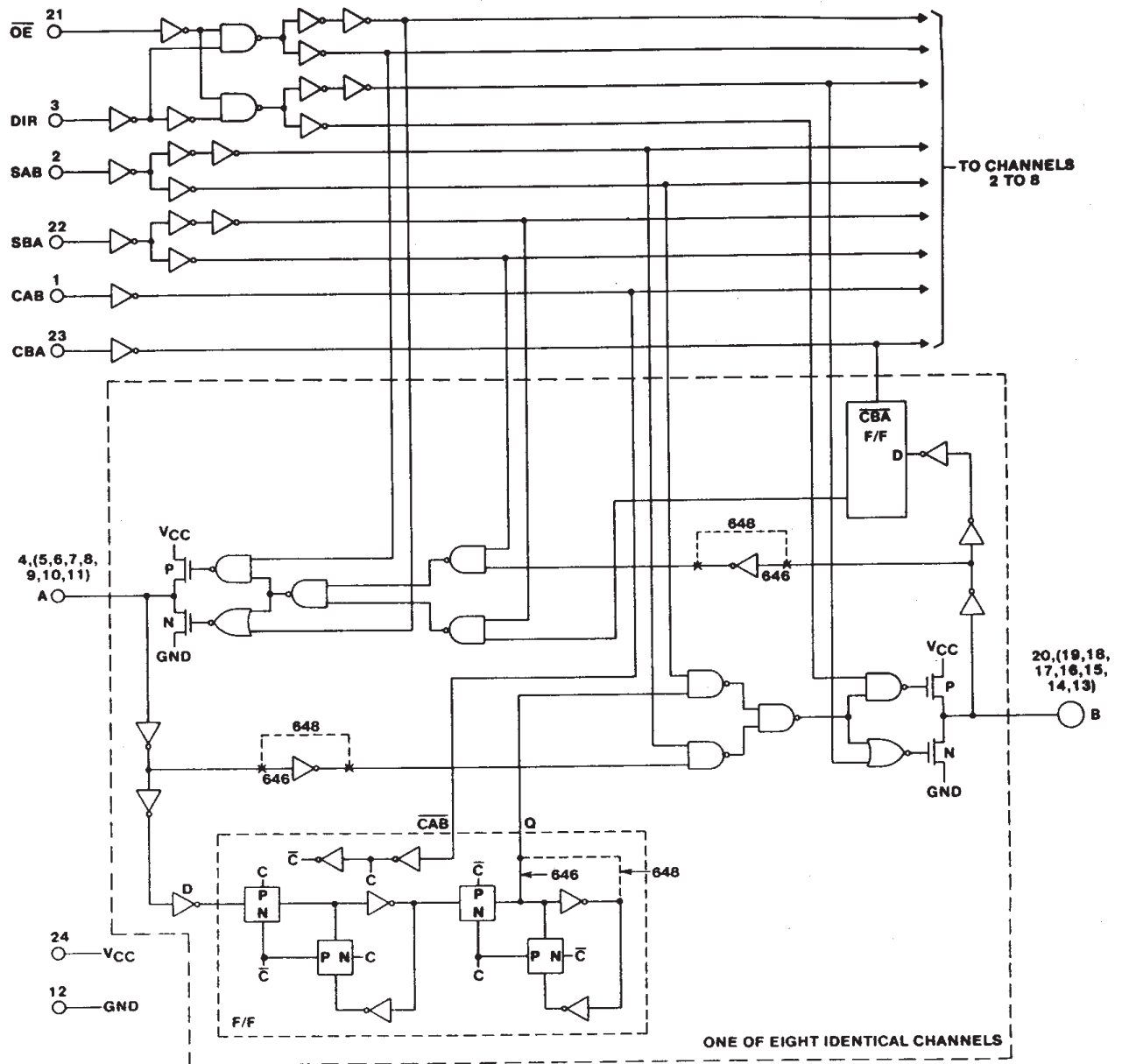
### Family Features:

- Fanout (Over Temperature Range):  
Standard Outputs - 10 LSTTL Loads  
Bus Driver Outputs - 15 LSTTL Loads
- Wide Operating Temperature Range:  
CD74HC/HCT:  $-40$  to  $+85^\circ C$
- Balanced Propagation Delay and Transition Times
- Significant Power Reduction Compared to LSTTL Logic ICs
- Alternate Source is Philips/Signetics
- CD54HC/CD74HC Types:  
2 to 6 V Operation  
High Noise Immunity:  
 $N_{IL} = 30\%$ ,  $N_{IH} = 30\%$  of  $V_{CC}$ ; @  $V_{CC} = 5V$
- CD54HCT/CD74HCT Types:  
4.5 to 5.5 V Operation  
Direct LSTTL Input Logic Compatibility  
 $V_{IL} = 0.8V$  Max.,  $V_{IH} = 2V$  Min.  
CMOS Input Compatibility  
 $I_i \leq 1\mu A$  @  $V_{OL}$ ,  $V_{OH}$



### TERMINAL ASSIGNMENT

# CD54/74HC646, CD54/74HCT646 CD54/74HC648, CD54/74HCT648



92CL-38530RI

Fig. 1 — Logic Diagram.

# CD54/74HC646, CD54/74HCT646

## CD54/74HC648, CD54/74HCT648

FUNCTION TABLE

| INPUTS |     |                                                                                   |                                                                                   |     |     | DATA I/O #    |               | OPERATION OR FUNCTION     |                                   |
|--------|-----|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----|-----|---------------|---------------|---------------------------|-----------------------------------|
| OE     | DIR | CAB                                                                               | CBA                                                                               | SAB | SBA | A0 THRU A7    | B0 THRU B7    | 646                       | 648                               |
| X      | X   |  | X                                                                                 | X   | X   | Input         | Not specified | Store A, B unspecified    | Store A, B unspecified            |
| X      | X   | X                                                                                 |  | X   | X   | Not specified | Input         | Store B, A unspecified    | Store B, A unspecified            |
| H      | X   |  |  | X   | X   | Input         | Input         | Store A and B Data        | Store A and B Data                |
| H      | X   | H or L                                                                            | H or L                                                                            | X   | X   |               |               | Isolation, hold storage   | Isolation, hold storage           |
| L      | L   | X                                                                                 | X                                                                                 | X   | L   | Output        | Input         | Real-Time B Data to A Bus | Real-Time $\bar{B}$ Data to A Bus |
| L      | L   | X                                                                                 | H or L                                                                            | X   | H   |               |               | Stored B Data to A Bus    | Stored $\bar{B}$ Data to A Bus    |
| L      | H   | X                                                                                 | X                                                                                 | L   | X   | Input         | Output        | Real-Time A Data to B Bus | Real-Time $\bar{A}$ Data to B Bus |
| L      | H   | H or L                                                                            | X                                                                                 | H   | X   |               |               | Stored A Data to B Bus    | Stored $\bar{A}$ Data to B Bus    |

# The data output functions may be enabled or disabled by various signals at the OE 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.

To prevent excess currents in the High-Z modes all I/O terminals should be terminated with 10KΩ resistors.

### MAXIMUM RATINGS, Absolute-Maximum Values:

#### DC SUPPLY-VOLTAGE, (V<sub>CC</sub>):

(Voltages referenced to ground) ..... -0.5 to +7 V

DC INPUT DIODE CURRENT, I<sub>IK</sub> (FOR V<sub>i</sub> < -0.5 V OR V<sub>i</sub> > V<sub>CC</sub> - 0.5V) ..... ±20mA

DC OUTPUT DIODE CURRENT, I<sub>OK</sub> (FOR V<sub>o</sub> < -0.5 V OR V<sub>o</sub> > V<sub>CC</sub> + 0.5V) ..... ±20mA

DC DRAIN CURRENT, PER OUTPUT (I<sub>o</sub>) (FOR -0.5 V < V<sub>o</sub> < V<sub>CC</sub> + 0.5V) ..... ±35mA

DC V<sub>CC</sub> OR GROUND CURRENT (I<sub>CC</sub>) ..... ±70mA

#### POWER DISSIPATION PER PACKAGE (P<sub>D</sub>):

For T<sub>A</sub> = -40 to +60°C (PACKAGE TYPE E) ..... 500 mW

For T<sub>A</sub> = +60 to +85°C (PACKAGE TYPE E) ..... Derate Linearly at 8 mW/°C to 300 mW

For T<sub>A</sub> = -55 to +100°C (PACKAGE TYPE F, H) ..... 500 mW

For T<sub>A</sub> = +100 to +125°C (PACKAGE TYPE F, H) ..... Derate Linearly at 8 mW/°C to 300 mW

For T<sub>A</sub> = -40 to +70°C (PACKAGE TYPE M) ..... 400 mW

For T<sub>A</sub> = +70 to +125°C (PACKAGE TYPE M) ..... Derate Linearly at 6 mW/°C to 70 mW

#### OPERATING-TEMPERATURE RANGE (T<sub>A</sub>):

PACKAGE TYPE E, M ..... -40 to -85°C

PACKAGE TYPE F, H ..... -55 to -125°C

STORAGE TEMPERATURE (T<sub>stg</sub>) ..... -65 to -150°C

#### LEAD TEMPERATURE (DURING SOLDERING):

At distance 1/16 ± 1/32 in. (1.59 ± 0.79 mm) from case for 10 s max. .... -265°C

Unit inserted into a PC Board (min. thickness 1/16 in., 1.59 mm)  
with solder contacting lead tips only ..... -300°C

### RECOMMENDED OPERATING CONDITIONS:

For maximum reliability, nominal operating conditions should be selected so that operation is always within the following ranges:

| CHARACTERISTIC                                                                                | LIMITS |                 | UNITS |
|-----------------------------------------------------------------------------------------------|--------|-----------------|-------|
|                                                                                               | MIN.   | MAX.            |       |
| Supply-Voltage Range (For T <sub>A</sub> = Full Package-Temperature Range) V <sub>CC</sub> .* |        |                 |       |
| CD54/74HC Types                                                                               | 2      | 6               | V     |
| CD54/74HCT Types                                                                              | 4.5    | 5.5             | V     |
| DC Input or Output Voltage V <sub>IN</sub> , V <sub>OUT</sub>                                 | 0      | V <sub>CC</sub> | V     |
| Operating Temperature T <sub>A</sub> :                                                        |        |                 |       |
| CD74 Types                                                                                    | -40    | +85             | °C    |
| CD54 Types                                                                                    | -55    | +125            | °C    |
| Input Rise and Fall Times t <sub>r</sub> , t <sub>f</sub>                                     |        |                 |       |
| at 2 V                                                                                        | 0      | 1000            | ns    |
| at 4.5 V                                                                                      | 0      | 500             | ns    |
| at 6 V                                                                                        | 0      | 400             | ns    |

\*Unless otherwise specified, all voltages are referenced to Ground.

# CD54/74HC646, CD54/74HCT646

## CD54/74HC648, CD54/74HCT648

### STATIC ELECTRICAL CHARACTERISTICS

| CHARACTERISTIC                                                                                | CD74HC646/CD54HC646<br>CD74HC648/CD54HC648 |                                  |                      |                 |     |      |               |      |                |      |                                                       | CD74HCT646/CD54HCT646<br>CD74HCT648/CD54HCT648 |                   |                 |             |               |             |                |     |     |   |  | UNITS |
|-----------------------------------------------------------------------------------------------|--------------------------------------------|----------------------------------|----------------------|-----------------|-----|------|---------------|------|----------------|------|-------------------------------------------------------|------------------------------------------------|-------------------|-----------------|-------------|---------------|-------------|----------------|-----|-----|---|--|-------|
|                                                                                               | TEST CONDITIONS                            |                                  |                      | 74HC/54HC TYPES |     |      | 74HC TYPES    |      | 54HC TYPES     |      | TEST CONDITIONS                                       |                                                | 74HCT/54HCT TYPES |                 |             | 74HCT TYPES   |             | 54HCT TYPES    |     |     |   |  |       |
|                                                                                               | V <sub>i</sub><br>V                        | I <sub>o</sub><br>mA             | V <sub>cc</sub><br>V | +25°C           |     |      | -40/<br>+85°C |      | -55/<br>+125°C |      | V <sub>i</sub><br>V                                   | V <sub>cc</sub><br>V                           | +25°C             |                 |             | -40/<br>+85°C |             | -55/<br>+125°C |     |     |   |  |       |
|                                                                                               |                                            |                                  |                      | Min             | Typ | Max  | Min           | Max  | Min            | Max  |                                                       |                                                | Min               | Typ             | Max         | Min           | Max         | Min            | Max |     |   |  |       |
| High-Level<br>Input Voltage V <sub>ih</sub>                                                   |                                            |                                  | 2                    | 1.5             | —   | —    | 1.5           | —    | 1.5            | —    | —                                                     | 4.5                                            | to                | 2               | —           | —             | 2           | —              | 2   | —   | V |  |       |
|                                                                                               |                                            |                                  | 4.5                  | 3.15            | —   | —    | 3.15          | —    | 3.15           | —    | —                                                     | to                                             | —                 | —               | —           | —             | —           | —              | —   | —   |   |  |       |
|                                                                                               |                                            |                                  | 6                    | 4.2             | —   | —    | 4.2           | —    | 4.2            | —    | —                                                     | 5.5                                            | —                 | —               | —           | —             | —           | —              | —   | —   |   |  |       |
| Low-Level<br>Input Voltage V <sub>il</sub>                                                    |                                            |                                  | 2                    | —               | —   | 0.5  | —             | 0.5  | —              | 0.5  | —                                                     | 4.5                                            | to                | —               | —           | 0.8           | —           | 0.8            | —   | 0.8 | V |  |       |
|                                                                                               |                                            |                                  | 4.5                  | —               | —   | 1.35 | —             | 1.35 | —              | 1.35 | —                                                     | to                                             | —                 | —               | —           | —             | —           | —              | —   | —   |   |  |       |
|                                                                                               |                                            |                                  | 6                    | —               | —   | 1.8  | —             | 1.8  | —              | 1.8  | —                                                     | 5.5                                            | —                 | —               | —           | —             | —           | —              | —   | —   |   |  |       |
| High-Level<br>Output Voltage V <sub>oh</sub>                                                  | V <sub>ih</sub>                            | -0.02                            | 2                    | 1.9             | —   | —    | 1.9           | —    | 1.9            | —    | V <sub>ih</sub>                                       |                                                | 4.5               | 4.4             | —           | —             | 4.4         | —              | 4.4 | —   | V |  |       |
| or                                                                                            |                                            |                                  | 4.5                  | 4.4             | —   | —    | 4.4           | —    | 4.4            | —    | or                                                    | 4.5                                            | —                 | —               | —           | —             | —           | —              | —   | —   |   |  |       |
| CMOS Loads                                                                                    | V <sub>ih</sub>                            |                                  | 6                    | 5.9             | —   | —    | 5.9           | —    | 5.9            | —    | V <sub>ih</sub>                                       |                                                | —                 | —               | —           | —             | —           | —              | —   | —   |   |  |       |
| TTL Loads<br>(Bus Driver)                                                                     | V <sub>ih</sub>                            |                                  |                      |                 |     |      |               |      |                |      | V <sub>ih</sub>                                       |                                                | 4.5               | 3.98            | —           | —             | 3.84        | —              | 3.7 | —   | V |  |       |
|                                                                                               | or                                         | -6                               | 4.5                  | 3.98            | —   | —    | 3.84          | —    | 3.7            | —    | or                                                    | 4.5                                            | —                 | —               | —           | —             | —           | —              | —   | —   |   |  |       |
|                                                                                               | V <sub>ih</sub>                            | -7.8                             | 6                    | 5.48            | —   | —    | 5.34          | —    | 5.2            | —    | V <sub>ih</sub>                                       |                                                | —                 | —               | —           | —             | —           | —              | —   | —   |   |  |       |
| Low-Level<br>Output Voltage V <sub>ol</sub>                                                   | V <sub>il</sub>                            | 0.02                             | 2                    | —               | —   | 0.1  | —             | 0.1  | —              | 0.1  | V <sub>il</sub>                                       |                                                | 4.5               | —               | —           | 0.1           | —           | 0.1            | —   | 0.1 | V |  |       |
| or                                                                                            |                                            |                                  | 4.5                  | —               | —   | 0.1  | —             | 0.1  | —              | 0.1  | —                                                     | or                                             | 4.5               | —               | —           | —             | —           | —              | —   | —   |   |  |       |
| CMOS Loads                                                                                    | V <sub>il</sub>                            |                                  | 6                    | —               | —   | 0.1  | —             | 0.1  | —              | 0.1  | —                                                     | V <sub>il</sub>                                |                   | —               | —           | —             | —           | —              | —   | —   |   |  |       |
| TTL Loads<br>(Bus Driver)                                                                     | V <sub>il</sub>                            |                                  |                      |                 |     |      |               |      |                |      | V <sub>il</sub>                                       |                                                | 4.5               | —               | —           | 0.26          | —           | 0.33           | —   | 0.4 | V |  |       |
|                                                                                               | or                                         | 6                                | 4.5                  | —               | —   | 0.26 | —             | 0.33 | —              | 0.4  | or                                                    | 4.5                                            | —                 | —               | —           | —             | —           | —              | —   | —   |   |  |       |
|                                                                                               | V <sub>il</sub>                            | 7.8                              | 6                    | —               | —   | 0.26 | —             | 0.33 | —              | 0.4  | V <sub>il</sub>                                       |                                                | —                 | —               | —           | —             | —           | —              | —   | —   |   |  |       |
| Input Leakage<br>Current I <sub>i</sub>                                                       | V <sub>cc</sub>                            |                                  | 6                    | —               | —   | ±0.1 | —             | ±1   | —              | ±1   | Any<br>Voltage<br>Between<br>V <sub>cc</sub><br>& Gnd | 5.5                                            | —                 | —               | ±0.1        | —             | ±1          | —              | ±1  | μA  |   |  |       |
| or                                                                                            | Gnd                                        |                                  |                      |                 |     |      |               |      |                |      |                                                       |                                                |                   |                 |             |               |             |                |     |     |   |  |       |
| Quiescent<br>Device<br>Current I <sub>cc</sub>                                                | V <sub>cc</sub>                            | 0                                | 6                    | —               | —   | 8    | —             | 80   | —              | 160  | V <sub>cc</sub>                                       | 5.5                                            | —                 | —               | 8           | —             | 80          | —              | 160 | μA  |   |  |       |
| or                                                                                            | Gnd                                        |                                  |                      |                 |     |      |               |      |                |      | Gnd                                                   |                                                |                   |                 |             |               |             |                |     |     |   |  |       |
| Additional<br>Quiescent<br>Device Current<br>per input pin:<br>1 unit load ΔI <sub>cc</sub> * |                                            |                                  |                      |                 |     |      |               |      |                |      | V <sub>cc</sub> -2.1                                  | 4.5<br>to<br>5.5                               | —<br>—<br>—       | 100<br>360<br>— | —<br>—<br>— | 450<br>—<br>— | —<br>—<br>— | 490<br>—<br>—  | μA  |     |   |  |       |
| 3-State<br>Leakage Current I <sub>oz</sub>                                                    | V <sub>ih</sub>                            | V <sub>o</sub> = V <sub>cc</sub> | 6                    | —               | —   | ±0.5 | —             | ±5.0 | —              | ±10  | V <sub>ih</sub>                                       | 5.5                                            | —                 | —               | ±0.5        | —             | ±5.0        | —              | ±10 | μA  |   |  |       |
|                                                                                               | or                                         |                                  |                      |                 |     |      |               |      |                |      | or                                                    |                                                |                   |                 |             |               |             |                |     |     |   |  |       |
|                                                                                               | V <sub>ih</sub>                            | Gnd                              |                      |                 |     |      |               |      |                |      | V <sub>ih</sub>                                       |                                                |                   |                 |             |               |             |                |     |     |   |  |       |

\*For dual-supply systems theoretical worst case ( $V_i = 2.4$  V,  $V_{cc} = 5.5$  V) specification is 1.8 mA.

#### HCT Input Loading Table

| Input               | Unit Loads* |
|---------------------|-------------|
| OE                  | 1.3         |
| DIR                 | 0.75        |
| Clock A → B, B → A  | 0.6         |
| Select A, Select B  | 0.45        |
| Inputs A0-A7, B0-B7 | 0.3         |

\*Unit Load is  $\Delta I_{cc}$  limit specified in Static Characteristic Chart. e.g., 360 μA max. @ 25°C.

# CD54/74HC646, CD54/74HCT646 CD54/74HC648, CD54/74HCT648

SWITCHING CHARACTERISTICS ( $V_{CC} = 5\text{ V}$ ,  $T_A = 25^\circ\text{C}$ , Input  $t_r, t_f = 6\text{ ns}$ )

| CHARACTERISTIC                      | $C_L$<br>(pF)      | TYPICAL |     | UNITS |
|-------------------------------------|--------------------|---------|-----|-------|
|                                     |                    | HC      | HCT |       |
| Propagation Delays                  | $t_{PLH}, t_{PHL}$ | 15      | 18  | ns    |
| Store A Data to B Bus (646)         | $t_{PLH}, t_{PHL}$ | 15      | 18  | ns    |
| Store B Data to A Bus (646)         | $t_{PLH}, t_{PHL}$ | 15      | 18  | ns    |
| Store $\bar{A}$ Data to B Bus (648) | $t_{PLH}, t_{PHL}$ | 15      | 20  | ns    |
| Store $\bar{B}$ Data to A Bus (648) | $t_{PLH}, t_{PHL}$ | 15      | 20  | ns    |
| A Data to B Bus (646)               | $t_{PLH}, t_{PHL}$ | 15      | 12  | ns    |
| B Data to A Bus (646)               | $t_{PLH}, t_{PHL}$ | 15      | 12  | ns    |
| $\bar{A}$ Data to B Bus (648)       | $t_{PLH}, t_{PHL}$ | 15      | 12  | ns    |
| $\bar{B}$ Data to A Bus (648)       | $t_{PLH}, t_{PHL}$ | 15      | 12  | ns    |
| Select to Data (646)                | $t_{PLH}, t_{PHL}$ | 15      | 14  | ns    |
| Select to Data (648)                | $t_{PLH}, t_{PHL}$ | 15      | 16  | ns    |
| 3-State Disabling Time              | $t_{PLZ}, t_{PHZ}$ | 15      | 14  | ns    |
| 3-State Enabling Time               | $t_{PZL}, t_{PZH}$ | 15      | 14  | ns    |
| Max Frequency                       | $f_{max}$          | 15      | 60  | MHz   |
| Power Dissipation Capacitance*      | $C_{PD}$           | —       | 52  | pF    |

\* $C_{PD}$  is used to determine the dynamic power consumption, per package.

$P_{DQ} = V_{CC}^2 C_{PD} f_i + \sum V_{CC}^2 C_L f_o$  where:

$C_L$  = output load capacitance

$V_{CC}$  = supply voltage

$f_i$  = input frequency

$f_o$  = output frequency

## PREREQUISITE FOR SWITCHING FUNCTION

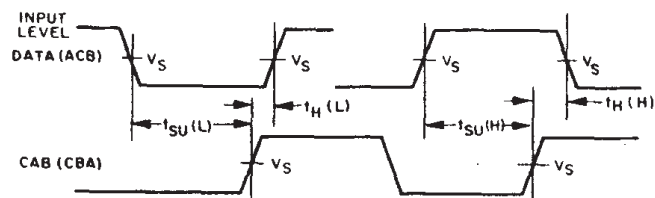
| CHARACTERISTIC                                  | V <sub>CC</sub> | 25°C |      |      |      | -40°C to +85°C |      |       |      | -55°C to +125°C |      |       |      | UNITS |
|-------------------------------------------------|-----------------|------|------|------|------|----------------|------|-------|------|-----------------|------|-------|------|-------|
|                                                 |                 | HC   |      | HCT  |      | 74HC           |      | 74HCT |      | 54HC            |      | 54HCT |      |       |
|                                                 |                 | Min. | Max. | Min. | Max. | Min.           | Max. | Min.  | Max. | Min.            | Max. | Min.  | Max. |       |
| Maximum Frequency<br>f <sub>MAX</sub>           | 2               | 6    | —    | —    | —    | 5              | —    | —     | —    | 4               | —    | —     | —    | MHZ   |
|                                                 | 4.5             | 30   | —    | 25   | —    | 25             | —    | 20    | —    | 20              | —    | 17    | —    |       |
|                                                 | 6               | 35   | —    | —    | —    | 29             | —    | —     | —    | 23              | —    | —     | —    |       |
| Set Up Time<br>Data to Clock<br>t <sub>SU</sub> | 2               | 60   | —    | —    | —    | 75             | —    | —     | —    | 90              | —    | —     | —    | ns    |
|                                                 | 4.5             | 12   | —    | 12   | —    | 15             | —    | 15    | —    | 18              | —    | 18    | —    |       |
|                                                 | 6               | 10   | —    | —    | —    | 13             | —    | —     | —    | 15              | —    | —     | —    |       |
| Hold Time<br>Data to Clock<br>t <sub>H</sub>    | 2               | 35   | —    | —    | —    | 45             | —    | —     | —    | 55              | —    | —     | —    | ns    |
|                                                 | 4.5             | 7    | —    | 5    | —    | 9              | —    | 5     | —    | 11              | —    | 5     | —    |       |
|                                                 | 6               | 6    | —    | —    | —    | 8              | —    | —     | —    | 9               | —    | —     | —    |       |
| Clock Pulse Width<br>t <sub>w</sub>             | 2               | 80   | —    | —    | —    | 100            | —    | —     | —    | 120             | —    | —     | —    | ns    |
|                                                 | 4.5             | 16   | —    | 25   | —    | 20             | —    | 31    | —    | 24              | —    | 38    | —    |       |
|                                                 | 6               | 14   | —    | —    | —    | 17             | —    | —     | —    | 20              | —    | —     | —    |       |

# CD54/74HC646, CD54/74HCT646

## CD54/74HC648, CD54/74HCT648

SWITCHING CHARACTERISTICS ( $C_L = 50$  pF, Input  $t_r, t_f = 6$  ns)

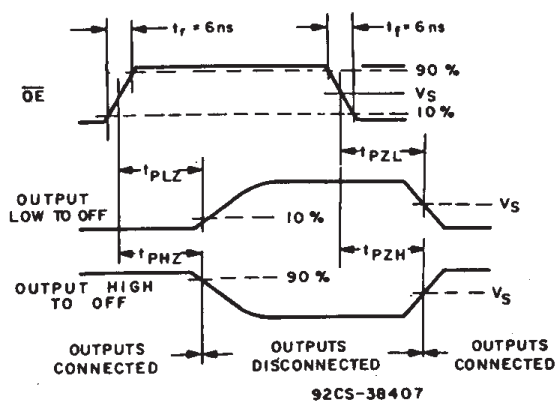
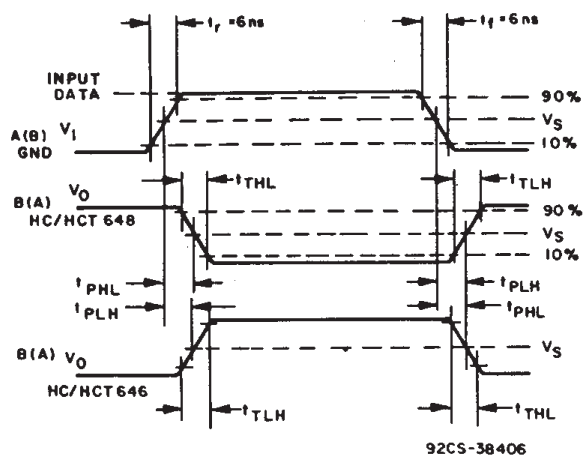
| CHARACTERISTIC                                                   | V <sub>CC</sub>  | 25°C |      |      |      | -40°C to +85°C |      |       |      | -55°C to +125°C |      |       |      | UNITS |    |
|------------------------------------------------------------------|------------------|------|------|------|------|----------------|------|-------|------|-----------------|------|-------|------|-------|----|
|                                                                  |                  | HC   |      | HCT  |      | 74HC           |      | 74HCT |      | 54HC            |      | 54HCT |      |       |    |
|                                                                  |                  | Min. | Max. | Min. | Max. | Min.           | Max. | Min.  | Max. | Min.            | Max. | Min.  | Max. |       |    |
| Propagation Delay,<br>Store A data to B bus                      | t <sub>PLH</sub> | 2    | —    | 220  | —    | —              | —    | 275   | —    | —               | —    | 330   | —    | —     | ns |
| Store A data to B bus                                            | t <sub>PLH</sub> | 4.5  | —    | 44   | —    | 44             | —    | 55    | —    | 55              | —    | 66    | —    | 66    |    |
| Store B data to B bus (646)                                      | t <sub>PHL</sub> | 6    | —    | 37   | —    | —              | —    | 47    | —    | —               | —    | 5.6   | —    | —     |    |
| Store $\bar{A}$ data to B bus                                    | t <sub>PLH</sub> | 2    | —    | 240  | —    | —              | —    | 300   | —    | —               | —    | 360   | —    | —     | ns |
| Store $\bar{B}$ data to A Bus                                    | t <sub>PHL</sub> | 4.5  | —    | 48   | —    | 54             | —    | 60    | —    | 68              | —    | 72    | —    | 81    |    |
| (648)                                                            | t <sub>PHL</sub> | 6    | —    | 41   | —    | —              | —    | 51    | —    | —               | —    | 61    | —    | —     |    |
| A data to B bus                                                  | t <sub>PLH</sub> | 2    | —    | 135  | —    | —              | —    | 170   | —    | —               | —    | 205   | —    | —     | ns |
| B data to A Bus                                                  | t <sub>PHL</sub> | 4.5  | —    | 27   | —    | 37             | —    | 34    | —    | 46              | —    | 41    | —    | 56    |    |
| (646)                                                            | t <sub>PHL</sub> | 6    | —    | 23   | —    | —              | —    | 29    | —    | —               | —    | 35    | —    | —     |    |
| $\bar{A}$ data to B bus                                          | t <sub>PLH</sub> | 2    | —    | 150  | —    | —              | —    | 190   | —    | —               | —    | 225   | —    | —     | ns |
| $\bar{B}$ data to A Bus                                          | t <sub>PHL</sub> | 4.5  | —    | 30   | —    | 37             | —    | 38    | —    | 46              | —    | 45    | —    | 56    |    |
| (648)                                                            | t <sub>PHL</sub> | 6    | —    | 26   | —    | —              | —    | 33    | —    | —               | —    | 38    | —    | —     |    |
| Select to Data                                                   | t <sub>PLH</sub> | 2    | —    | 170  | —    | —              | —    | 215   | —    | —               | —    | 255   | —    | —     | ns |
| (646)                                                            | t <sub>PLH</sub> | 4.5  | —    | 34   | —    | 46             | —    | 43    | —    | 58              | —    | 51    | —    | 69    |    |
|                                                                  | t <sub>PHL</sub> | 6    | —    | 29   | —    | —              | —    | 37    | —    | —               | —    | 43    | —    | —     |    |
| Select to Data                                                   | t <sub>PLH</sub> | 2    | —    | 190  | —    | —              | —    | 240   | —    | —               | —    | 285   | —    | —     | ns |
| (648)                                                            | t <sub>PLH</sub> | 4.5  | —    | 38   | —    | 46             | —    | 48    | —    | 58              | —    | 57    | —    | 69    |    |
|                                                                  | t <sub>PHL</sub> | 6    | —    | 32   | —    | —              | —    | 39    | —    | —               | —    | 48    | —    | —     |    |
| 3-State Disabling Time<br>Bus to Output or<br>Register to Output | t <sub>PLZ</sub> | 2    | —    | 175  | —    | —              | —    | 220   | —    | —               | —    | 265   | —    | —     | ns |
|                                                                  | t <sub>PLZ</sub> | 4.5  | —    | 35   | —    | 35             | —    | 44    | —    | 44              | —    | 53    | —    | 53    |    |
|                                                                  | t <sub>PHZ</sub> | 6    | —    | 30   | —    | —              | —    | 37    | —    | —               | —    | 45    | —    | —     |    |
| 3-State Enabling Time<br>Bus to Output or<br>Register to Output  | t <sub>PZL</sub> | 2    | —    | 175  | —    | —              | —    | 220   | —    | —               | —    | 265   | —    | —     | ns |
|                                                                  | t <sub>PZL</sub> | 4.5  | —    | 35   | —    | 45             | —    | 44    | —    | 56              | —    | 53    | —    | 68    |    |
|                                                                  | t <sub>PZH</sub> | 6    | —    | 30   | —    | —              | —    | 37    | —    | —               | —    | 45    | —    | —     |    |
| Output Transition Time                                           | t <sub>TLH</sub> | 2    | —    | 60   | —    | —              | —    | 75    | —    | —               | —    | 90    | —    | —     | ns |
|                                                                  | t <sub>TLH</sub> | 4.5  | —    | 12   | —    | 12             | —    | 15    | —    | 15              | —    | 18    | —    | 18    |    |
|                                                                  | t <sub>THL</sub> | 6    | —    | 10   | —    | —              | —    | 13    | —    | —               | —    | 15    | —    | —     |    |
| 3-State Output<br>Capacitance                                    | C <sub>O</sub>   | —    | —    | —    | —    | —              | —    | —     | —    | —               | —    | —     | —    | —     | pF |
| Input Capacitance                                                | C <sub>I</sub>   | —    | —    | 10   | —    | 10             | —    | 10    | —    | 10              | —    | 10    | —    | 10    | pF |



92CS-38405

Fig. 2 — Data setup and hold times.

# CD54/74HC646, CD54/74HCT646 CD54/74HC648, CD54/74HCT648



|                          | 54/74HC      | 54/74HCT |
|--------------------------|--------------|----------|
| Input Level              | $V_{CC}$     | 3V       |
| Switching Voltage, $V_S$ | 50% $V_{CC}$ | 1.3 V    |

Fig. 3 — Transition times and propagation delay times.

## IMPORTANT NOTICE

Texas Instruments and its subsidiaries (TI) reserve the right to make changes to their products or to discontinue any product or service without notice, and advise customers to obtain the latest version of relevant information to verify, before placing orders, that information being relied on is current and complete. All products are sold subject to the terms and conditions of sale supplied at the time of order acknowledgement, including those pertaining to warranty, patent infringement, and limitation of liability.

TI warrants performance of its semiconductor products to the specifications applicable at the time of sale in accordance with TI's standard warranty. Testing and other quality control techniques are utilized to the extent TI deems necessary to support this warranty. Specific testing of all parameters of each device is not necessarily performed, except those mandated by government requirements.

CERTAIN APPLICATIONS USING SEMICONDUCTOR PRODUCTS MAY INVOLVE POTENTIAL RISKS OF DEATH, PERSONAL INJURY, OR SEVERE PROPERTY OR ENVIRONMENTAL DAMAGE ("CRITICAL APPLICATIONS"). TI SEMICONDUCTOR PRODUCTS ARE NOT DESIGNED, AUTHORIZED, OR WARRANTED TO BE SUITABLE FOR USE IN LIFE-SUPPORT DEVICES OR SYSTEMS OR OTHER CRITICAL APPLICATIONS. INCLUSION OF TI PRODUCTS IN SUCH APPLICATIONS IS UNDERSTOOD TO BE FULLY AT THE CUSTOMER'S RISK.

In order to minimize risks associated with the customer's applications, adequate design and operating safeguards must be provided by the customer to minimize inherent or procedural hazards.

TI assumes no liability for applications assistance or customer product design. TI does not warrant or represent that any license, either express or implied, is granted under any patent right, copyright, mask work right, or other intellectual property right of TI covering or relating to any combination, machine, or process in which such semiconductor products or services might be or are used. TI's publication of information regarding any third party's products or services does not constitute TI's approval, warranty or endorsement thereof.