

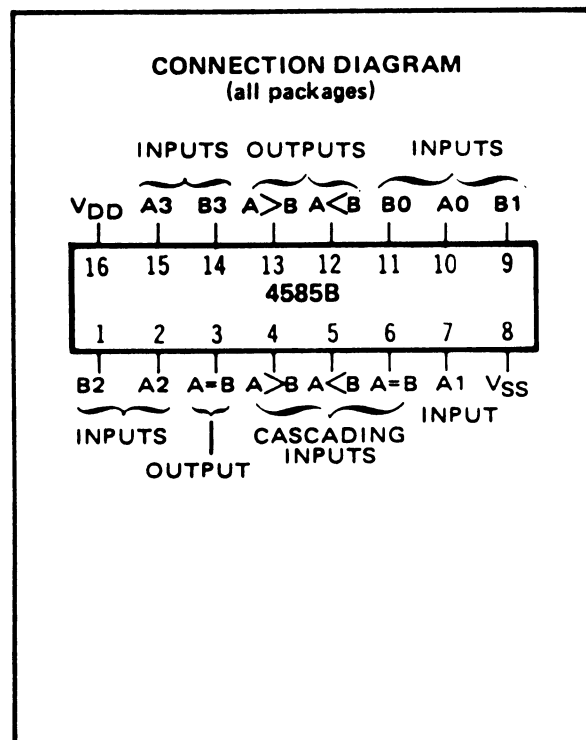
## CMOS 4-BIT MAGNITUDE COMPARATOR

### FEATURES

- ◆ Binary or BCD Comparison
- ◆ Expandable
- ◆  $A < B$ ,  $A = B$ ,  $A > B$  Outputs Available

### DESCRIPTION

This 4-Bit Magnitude Comparator performs comparison of straight binary and straight BCD (8-4-2-1) codes. Three decisions about two 4-bit words (A, B) are made and are externally available at three outputs. These devices are fully expandable to any number of bits without external gates. Words of greater length may be compared by connecting comparators in cascade. The  $A < B$  and  $A = B$  outputs of a stage handling less-significant bits are connected to the corresponding  $A < B$  and  $A = B$  inputs of the next stage handling more-significant bits. The  $A > B$  cascading input is connected to a high level. The stage handling the least-significant bits must have a high-level voltage applied to the  $A = B$  and  $A > B$  inputs. An alternate method of cascading which reduces the comparison time is shown under Applications Information.



### RECOMMENDED OPERATING CONDITIONS

For maximum reliability:

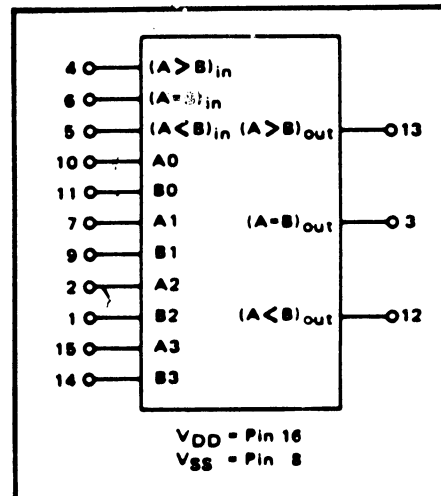
|                       |                   |             |     |
|-----------------------|-------------------|-------------|-----|
| DC Supply Voltage     | $V_{DD} - V_{SS}$ | 3 to 15     | Vdc |
| Operating Temperature | $T_A$             | -55 to +125 | °C  |
|                       |                   | -40 to +85  | °C  |

### TRUTH TABLE

| Inputs    |         |         |         |           |         |         | Outputs |         |         |
|-----------|---------|---------|---------|-----------|---------|---------|---------|---------|---------|
| Comparing |         |         |         | Cascading |         |         | $A < B$ | $A = B$ | $A > B$ |
| A3, B3    | A2, B2  | A1, B1  | A0, B0  | $A < B$   | $A = B$ | $A > B$ |         |         |         |
| A3 > B3   | X       | X       | X       | X         | X       | 1       | 0       | 0       | 1       |
| A3 = B3   | A2 > B2 | X       | X       | X         | X       | 1       | 0       | 0       | 1       |
| A3 = B3   | A2 = B2 | A1 > B1 | X       | X         | X       | 1       | 0       | 0       | 1       |
| A3 = B3   | A2 = B2 | A1 = B1 | A0 > B0 | X         | X       | 1       | 0       | 0       | 1       |
| A3 = B3   | A2 = B2 | A1 = B1 | A0 = B0 | 0         | 0       | 1       | 0       | 0       | 1       |
| A3 = B3   | A2 = B2 | A1 = B1 | A0 = B0 | 0         | 1       | X       | 0       | 1       | 0       |
| A3 = B3   | A2 = B2 | A1 = B1 | A0 = B0 | 1         | 0       | X       | 1       | 0       | 0       |
| A3 = B3   | A2 = B2 | A1 = B1 | A0 < B0 | X         | X       | X       | 1       | 0       | 0       |
| A3 = B3   | A2 = B2 | A1 < B1 | X       | X         | X       | X       | 1       | 0       | 0       |
| A3 = B3   | A2 < B2 | X       | X       | X         | X       | X       | 1       | 0       | 0       |
| A3 < B3   | X       | X       | X       | X         | X       | X       | 1       | 0       | 0       |
| X         | X       | X       | X       | X         | X       | 0       | -       | -       | 0       |

X = Don't Care

### BLOCK DIAGRAM



## ELECTRICAL CHARACTERISTICS

### STATIC CHARACTERISTICS<sup>1</sup>

| PARAMETER                   | V <sub>DD</sub><br>(Vdc) | CONDITIONS                                                                              | T <sub>LOW</sub> <sup>2</sup> |      | +25°C |      |      | T <sub>HIGH</sub> <sup>2</sup> |      | Units |
|-----------------------------|--------------------------|-----------------------------------------------------------------------------------------|-------------------------------|------|-------|------|------|--------------------------------|------|-------|
|                             |                          |                                                                                         | Min.                          | Max. | Min.  | Typ. | Max. | Min.                           | Max. |       |
| QUIESCENT DEVICE<br>CURRENT | I <sub>DD</sub>          | V <sub>IN</sub> = V <sub>SS</sub> or V <sub>DD</sub><br>All valid input<br>combinations | —                             | 5    | —     | 0.05 | 5    | —                              | 150  | μAdc  |
|                             |                          |                                                                                         | —                             | 10   | —     | 0.1  | 10   | —                              | 300  |       |
|                             |                          |                                                                                         | —                             | 20   | —     | 0.2  | 20   | —                              | 600  |       |

NOTES: <sup>1</sup> Remaining Static Electrical Characteristics are listed under "4000B Series Family Specifications".

<sup>2</sup> T<sub>LOW</sub> = -55°C for C

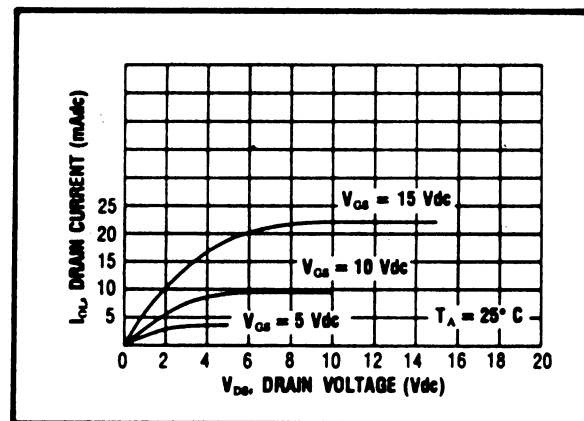
= -40°C for E

T<sub>HIGH</sub> = +125°C for C

= + 85°C for E

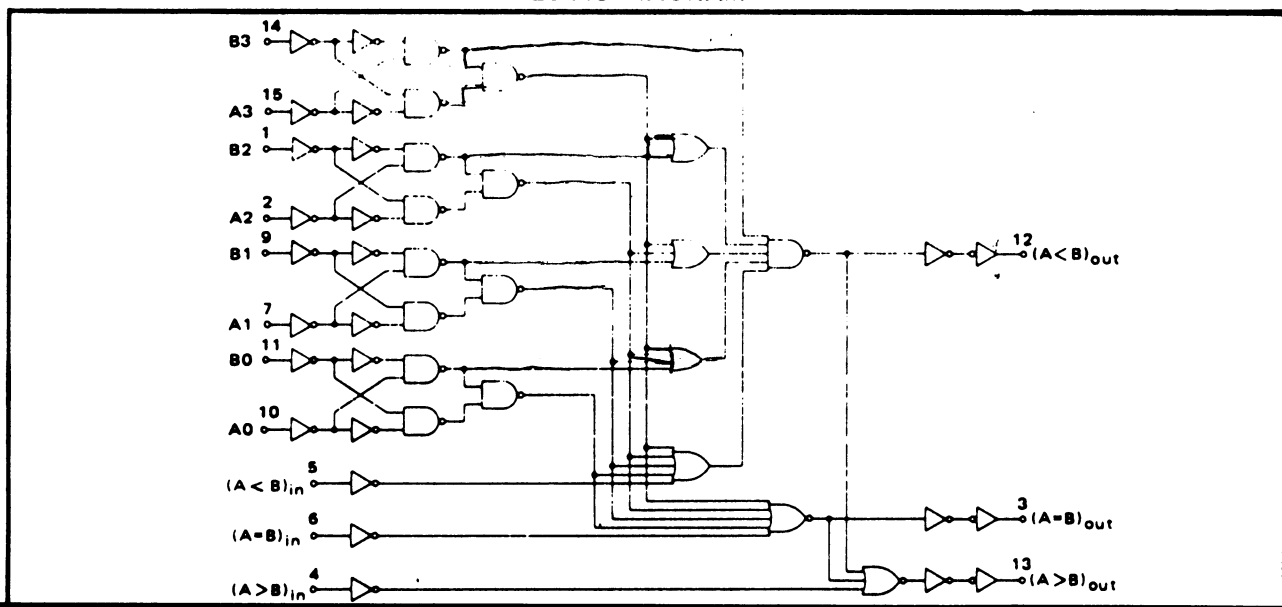
### DYNAMIC CHARACTERISTICS (C<sub>L</sub> = 50pF, T<sub>A</sub> = 25°C)

| PARAMETER              |                                     | V <sub>DD</sub><br>(Vdc) | Min. | Typ. | Max. | Units |
|------------------------|-------------------------------------|--------------------------|------|------|------|-------|
| PROPAGATION DELAY TIME | t <sub>PLH</sub> , t <sub>PHL</sub> | 5                        | —    | 300  | 600  | ns    |
|                        |                                     | 10                       | —    | 125  | 250  |       |
|                        |                                     | 15                       | —    | 80   | 160  |       |
| OUTPUT TRANSITION TIME | t <sub>TLH</sub> , t <sub>THL</sub> | 5                        | —    | 100  | 200  | ns    |
|                        |                                     | 10                       | —    | 50   | 100  |       |
|                        |                                     | 15                       | —    | 40   | 80   |       |



Typical N-Channel  
Sink Current Characteristics

### LOGIC DIAGRAM



# APPLICATIONS INFORMATION

## COMPARISON OF TWO N-BIT WORDS

