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# BCD-To-Seven Segment Latch/Decoder/Driver

## CMOS MSI (Low-Power Complementary MOS)

The MC14513B BCD-to-seven segment latch/decoder/driver is constructed with complementary MOS (CMOS) enhancement mode devices and NPN bipolar output drivers in a single monolithic structure. The circuit provides the functions of a 4-bit storage latch, an 8421 BCD-to-seven segment decoder, and has output drive capability. Lamp test ( $\overline{LT}$ ), blanking ( $\overline{BI}$ ), and latch enable (LE) inputs are used to test the display, to turn-off or pulse modulate the brightness of the display, and to store a BCD code, respectively. The Ripple Blanking Input (RBI) and Ripple Blanking Output (RBO) can be used to suppress either leading or trailing zeroes. It can be used with seven-segment light emitting diodes (LED), incandescent, fluorescent, gas discharge, or liquid crystal readouts either directly or indirectly.

Applications include instrument (e.g., counter, DVM, etc.) display driver, computer/calculator display driver, cockpit display driver, and various clock, watch, and timer uses.

- Low Logic Circuit Power Dissipation
- High-current Sourcing Outputs (Up to 25 mA)
- Latch Storage of Binary Input
- Blanking Input
- Lamp Test Provision
- Readout Blanking on all Illegal Input Combinations
- Lamp Intensity Modulation Capability
- Time Share (Multiplexing) Capability
- Adds Ripple Blanking In, Ripple Blanking Out to MC14511B
- Supply Voltage Range = 3.0 V to 18 V
- Capable of Driving Two Low-Power TTL Loads, One Low-power Schottky TTL Load to Two HTL Loads Over the Rated Temperature Range.

### MAXIMUM RATINGS\* (Voltages Referenced to $V_{SS}$ )

| Rating  | Symbol      | Value                   | Unit |
|---|-------------|-------------------------|------|
| DC Supply Voltage   | $V_{DD}$    | - 0.5 to + 18           | V    |
| Input Voltage, All Inputs                                   | $V_{in}$    | - 0.5 to $V_{DD} + 0.5$ | V    |
| DC Current Drain per Input Pin                              | I           | 10                      | mA   |
| Operating Temperature Range                                 | $T_A$       | - 55 to + 125           | °C   |
| Power Dissipation, per Package†                             | $P_D$       | 500                     | mW   |
| Storage Temperature Range                                   | $T_{stg}$   | - 65 to + 150           | °C   |
| Maximum Continuous Output Drive Current (Source) per Output | $I_{OHmax}$ | 25                      | mA   |
| Maximum Continuous Output Power (Source) per Output ‡       | $P_{OHmax}$ | 50                      | mW   |

‡ $P_{OHmax} = I_{OH} (V_{DD} - V_{OH})$

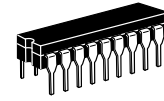
\* Maximum Ratings are those values beyond which damage to the device may occur.

† Temperature Derating:

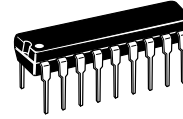
Plastic "P and D/DW" Packages: - 7.0 mW/°C From 65°C To 125°C

Ceramic "L" Packages: - 12 mW/°C From 100°C To 125°C

## MC14513B



**L SUFFIX**  
CERAMIC  
CASE 726



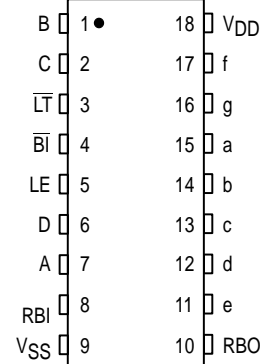
**P SUFFIX**  
PLASTIC  
CASE 707

### ORDERING INFORMATION

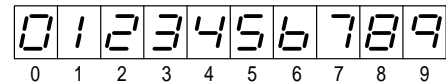
MC14XXXBCP Plastic  
MC14XXXBCL Ceramic

$T_A = -55^\circ$  to  $125^\circ\text{C}$  for all packages.

### PIN ASSIGNMENT



### DISPLAY



### TRUTH TABLE

| Inputs |    |                 |                 |   |   |   |   | Outputs |   |   |   |   |   |   |   |         |
|--------|----|-----------------|-----------------|---|---|---|---|---------|---|---|---|---|---|---|---|---------|
| RBI    | LE | $\overline{BI}$ | $\overline{LT}$ | D | C | B | A | RBO     | a | b | c | d | e | f | g | Display |
| X      | X  | X               | 0               | X | X | X | X | +       | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 8       |
| X      | X  | 0               | 1               | X | X | X | X | +       | 0 | 0 | 0 | 0 | 0 | 0 | 0 | Blank   |
| 1      | 0  | 1               | 1               | 0 | 0 | 0 | 0 | 1       | 0 | 0 | 0 | 0 | 0 | 0 | 0 | Blank   |
| 0      | 0  | 1               | 1               | 0 | 0 | 0 | 0 | 0       | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0       |
| X      | 0  | 1               | 1               | 0 | 0 | 0 | 1 | 0       | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 1       |
| X      | 0  | 1               | 1               | 0 | 0 | 1 | 0 | 0       | 1 | 1 | 0 | 1 | 0 | 1 | 0 | 2       |
| X      | 0  | 1               | 1               | 0 | 0 | 1 | 1 | 0       | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 3       |
| X      | 0  | 1               | 1               | 0 | 1 | 0 | 0 | 0       | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 4       |
| X      | 0  | 1               | 1               | 0 | 1 | 0 | 1 | 0       | 1 | 0 | 1 | 1 | 0 | 1 | 1 | 5       |
| X      | 0  | 1               | 1               | 0 | 1 | 1 | 0 | 0       | 0 | 1 | 0 | 1 | 1 | 1 | 1 | 6       |
| X      | 0  | 1               | 1               | 0 | 1 | 1 | 1 | 0       | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 7       |
| X      | 0  | 1               | 1               | 1 | 0 | 0 | 0 | 0       | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 8       |
| X      | 0  | 1               | 1               | 1 | 0 | 0 | 1 | 0       | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 9       |
| X      | 0  | 1               | 1               | 1 | 0 | 1 | 0 | 0       | 0 | 0 | 0 | 0 | 0 | 0 | 0 | Blank   |
| X      | 0  | 1               | 1               | 1 | 0 | 1 | 1 | 0       | 0 | 0 | 0 | 0 | 0 | 0 | 0 | Blank   |
| X      | 0  | 1               | 1               | 1 | 1 | 0 | 0 | 0       | 0 | 0 | 0 | 0 | 0 | 0 | 0 | Blank   |
| X      | 0  | 1               | 1               | 1 | 1 | 1 | 1 | 0       | 0 | 0 | 0 | 0 | 0 | 0 | 0 | Blank   |
| X      | 1  | 1               | 1               | 1 | X | X | X | X       | † | * | * | * | * | * | * | *       |

X = Don't Care

†RBO =  $RBI (\overline{D} \overline{C} \overline{B} \overline{A})$ , indicated by other rows of table

\*Depends upon the BCD code previously applied when LE = 0

**ELECTRICAL CHARACTERISTICS** (Voltages Referenced to  $V_{SS}$ )

| Characteristic   | Symbol   | $V_{DD}$<br>Vdc | - 55°C               |      | 25°C  |       |       | 125°C |      | Unit |     |   |
|--|----------|-----------------|----------------------|------|-------|-------|-------|-------|------|------|-----|---|
|  |          |                 | Min                  | Max  | Min   | Typ # | Max   | Min   | Max  |      |     |   |
| Output Voltage — Segment Outputs<br>"0" Level<br>$V_{in} = V_{DD}$ or 0  | $V_{OL}$ | 5.0             | —                    | 0.05 | —     | 0     | 0.05  | —     | 0.05 | Vdc  |     |   |
|  |          | 10              | —                    | 0.05 | —     | 0     | 0.05  | —     | 0.05 |      |     |   |
|  |          | 15              | —                    | 0.05 | —     | 0     | 0.05  | —     | 0.05 |      |     |   |
|  | $V_{OH}$ | 5.0             | 4.1                  | —    | 4.1   | 5.0   | —     | 4.1   | —    |      | Vdc |   |
|  |          | 10              | 9.1                  | —    | 9.1   | 10    | —     | 9.1   | —    |      |     |   |
|  |          | 15              | 14.1                 | —    | 14.1  | 15    | —     | 14.1  | —    |      |     |   |
| Output Voltage — RBO Output<br>"0" Level<br>$V_{in} = V_{DD}$ or 0   | $V_{OL}$ | 5.0             | —                    | 0.05 | —     | 0     | 0.05  | —     | 0.05 | Vdc  |     |   |
|  |          | 10              | —                    | 0.05 | —     | 0     | 0.05  | —     | 0.05 |      |     |   |
|  |          | 15              | —                    | 0.05 | —     | 0     | 0.05  | —     | 0.05 |      |     |   |
|  | $V_{OH}$ | 5.0             | 4.95                 | —    | 4.95  | 5.0   | —     | 4.95  | —    |      | Vdc |   |
|  |          | 10              | 9.95                 | —    | 9.95  | 10    | —     | 9.95  | —    |      |     |   |
|  |          | 15              | 14.95                | —    | 14.95 | 15    | —     | 14.95 | —    |      |     |   |
| Input Voltage #<br>"0" Level<br>( $V_O = 3.8$ or $0.5$ Vdc)<br>( $V_O = 8.8$ or $1.0$ Vdc)<br>( $V_O = 13.8$ or $1.5$ Vdc) | $V_{IL}$ | 5.0             | —                    | 1.5  | —     | 2.25  | 1.5   | —     | 1.5  | Vdc  |     |   |
|  |          | 10              | —                    | 3.0  | —     | 4.50  | 3.0   | —     | 3.0  |      |     |   |
|  |          | 15              | —                    | 4.0  | —     | 6.75  | 4.0   | —     | 4.0  |      |     |   |
|  | $V_{IH}$ | 5.0             | 3.5                  | —    | 3.5   | 2.75  | —     | 3.5   | —    |      | Vdc |   |
|  |          | 10              | 7.0                  | —    | 7.0   | 5.50  | —     | 7.0   | —    |      |     |   |
|  |          | 15              | 11                   | —    | 11    | 8.25  | —     | 11    | —    |      |     |   |
| Output Drive Voltage — Segments<br>Source  | $V_{OH}$ | 5.0             | 4.1                  | —    | 4.1   | 4.57  | —     | 4.1   | —    | Vdc  |     |   |
|  |          |                 | ( $I_{OH} = 5.0$ mA) | —    | —     | —     | 4.24  | —     | —    |      |     | — |
|  |          |                 | ( $I_{OH} = 10$ mA)  | 3.9  | —     | 3.9   | 4.12  | —     | 3.5  |      |     | — |
|  |          |                 | ( $I_{OH} = 15$ mA)  | —    | —     | —     | 3.94  | —     | —    |      | —   |   |
|  |          |                 | ( $I_{OH} = 20$ mA)  | 3.4  | —     | 3.4   | 3.70  | —     | 3.0  |      | —   |   |
|  |          |                 | ( $I_{OH} = 25$ mA)  | —    | —     | —     | 3.54  | —     | —    |      | —   |   |
|  | $V_{OH}$ | 10              | 9.1                  | —    | 9.1   | 9.58  | —     | 9.1   | —    | Vdc  |     |   |
|  |          |                 | ( $I_{OH} = 5.0$ mA) | —    | —     | —     | 9.26  | —     | —    |      | —   |   |
|  |          |                 | ( $I_{OH} = 10$ mA)  | 9.0  | —     | 9.0   | 9.17  | —     | 8.6  |      | —   |   |
|  |          |                 | ( $I_{OH} = 15$ mA)  | —    | —     | —     | 9.04  | —     | —    |      | —   |   |
|  |          |                 | ( $I_{OH} = 20$ mA)  | 8.6  | —     | 8.6   | 8.90  | —     | 8.2  |      | —   |   |
|  |          |                 | ( $I_{OH} = 25$ mA)  | —    | —     | —     | 8.75  | —     | —    |      | —   |   |
|  | $V_{OH}$ | 15              | 14.1                 | —    | 14.1  | 14.59 | —     | 14.1  | —    | Vdc  |     |   |
|  |          |                 | ( $I_{OH} = 5.0$ mA) | —    | —     | —     | 14.27 | —     | —    |      | —   |   |
|  |          |                 | ( $I_{OH} = 10$ mA)  | 14   | —     | 14    | 14.18 | —     | 13.6 |      | —   |   |
|  |          |                 | ( $I_{OH} = 15$ mA)  | —    | —     | —     | 14.07 | —     | —    |      | —   |   |
|  |          |                 | ( $I_{OH} = 20$ mA)  | 13.6 | —     | 13.6  | 13.95 | —     | 13.2 |      | —   |   |
|  |          |                 | ( $I_{OH} = 25$ mA)  | —    | —     | —     | 13.80 | —     | —    |      | —   |   |

(continued)

This device contains protection circuitry to protect the inputs against damage due to high static voltages or electric fields; however, it is advised that normal precautions be taken to avoid application of any voltage higher than maximum rated voltages to this high-impedance circuit. A destructive high current mode may occur if  $V_{in}$  and  $V_{out}$  is not constrained to the range  $V_{SS} \leq (V_{in} \text{ or } V_{out}) \leq V_{DD}$ .

Due to the sourcing capability of this circuit, damage can occur to the device if  $V_{DD}$  is applied, and the outputs are shorted to  $V_{SS}$  and are at a logical 1 (See Maximum Ratings).

Unused inputs must always be tied to an appropriate logic voltage level (e.g., either  $V_{SS}$  or  $V_{DD}$ ).

**ELECTRICAL CHARACTERISTICS — continued** (Voltages Referenced to V<sub>SS</sub>)

| Characteristic   | Symbol          | V <sub>DD</sub><br>Vdc | - 55°C  |      | 25°C  |          |      | 125°C |      | Unit |      |
|--|-----------------|------------------------|---|------|-------|----------|------|-------|------|------|------|
|  |                 |                        | Min   | Max  | Min   | Typ #    | Max  | Min   | Max  |      |      |
| Output Drive Current — RBO Output<br>(V <sub>OH</sub> = 2.5 V)<br>(V <sub>OH</sub> = 9.5 V)<br>(V <sub>OH</sub> = 13.5 V)<br><br>(V <sub>OL</sub> = 0.4 V)<br>(V <sub>OL</sub> = 0.5 V)<br>(V <sub>OL</sub> = 1.5 V) | Source          | 5.0                    | -0.40   | —    | -0.32 | -0.64    | —    | -0.22 | —    | mAdc |      |
|  |                 | 10                     | -0.21   | —    | -0.17 | -0.34    | —    | -0.12 | —    |      |      |
|  |                 | 15                     | -0.81   | —    | -0.66 | -1.30    | —    | -0.46 | —    |      |      |
|  | Sink            | I <sub>OL</sub>        | 5.0   | 0.18 | —     | 0.15     | 0.29 | —     | 0.10 | —    | mAdc |
|  |                 |                        | 10  | 0.47 | —     | 0.38     | 0.75 | —     | 0.26 | —    |      |
|  |                 |                        | 15  | 1.80 | —     | 1.50     | 2.90 | —     | 1.0  | —    |      |
| Output Drive Current — Segments<br>(V <sub>OL</sub> = 0.4 V)<br>(V <sub>OL</sub> = 0.5 V)<br>(V <sub>OL</sub> = 1.5 V)   | Sink            | I <sub>OL</sub>        | 5.0   | 0.64 | —     | 0.51     | 0.88 | —     | 0.36 | —    | mAdc |
|  |                 |                        | 10  | 1.6  | —     | 1.3      | 2.25 | —     | 0.9  | —    |      |
|  |                 |                        | 15  | 4.2  | —     | 3.4      | 8.8  | —     | 2.4  | —    |      |
| Input Current  | I <sub>in</sub> | 15                     | —   | ±0.1 | —     | ±0.00001 | ±0.1 | —     | ±1.0 | μAdc |      |
| Input Capacitance  | C <sub>in</sub> | —                      | —   | —    | —     | 5.0      | 7.5  | —     | —    | pF   |      |
| Quiescent Current<br>(Per Package) V <sub>in</sub> = 0 or V <sub>DD</sub> ,<br>I <sub>out</sub> = 0 μA   | I <sub>DD</sub> | 5.0                    | —   | 5.0  | —     | 0.005    | 5.0  | —     | 150  | μAdc |      |
|  |                 | 10                     | —   | 10   | —     | 0.010    | 10   | —     | 300  |      |      |
|  |                 | 15                     | —   | 20   | —     | 0.015    | 20   | —     | 600  |      |      |
| Total Supply Current**†<br>(Dynamic plus Quiescent,<br>Per Package)<br>(C <sub>L</sub> = 50 pF on all outputs, all<br>buffers switching)   | I <sub>T</sub>  | 5.0                    | I <sub>T</sub> = (1.9 μA/kHz) f + I <sub>DD</sub> |      |       |          |      |       |      | μAdc |      |
|  |                 | 10                     | I <sub>T</sub> = (3.8 μA/kHz) f + I <sub>DD</sub> |      |       |          |      |       |      |      |      |
|  |                 | 15                     | I <sub>T</sub> = (5.7 μA/kHz) f + I <sub>DD</sub> |      |       |          |      |       |      |      |      |

#Noise immunity specified for worst-case input combination.

Noise Margin for both "1" and "0" level =  
 1.0 Vdc min @ V<sub>DD</sub> = 5.0 Vdc  
 2.0 Vdc min @ V<sub>DD</sub> = 10 Vdc  
 2.5 Vdc min @ V<sub>DD</sub> = 15 Vdc

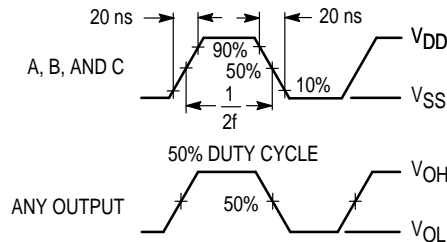
\*\*The formulas given are for the typical characteristics only at 25°C.

†To calculate total supply current at loads other than 50 pF:

$$I_T(C_L) = I_T(50 \text{ pF}) + 3.5 \times 10^{-3} (C_L - 50) V_{DD}f$$

where: I<sub>T</sub> is in μA (per package), C<sub>L</sub> in pF, V<sub>DD</sub> in Vdc, and f in kHz is input frequency.

Input LE and RBI low, and Inputs D,  $\overline{B}$ I and  $\overline{L}$ T high.  
 f in respect to a system clock.  
 All outputs connected to respective C<sub>L</sub> loads.

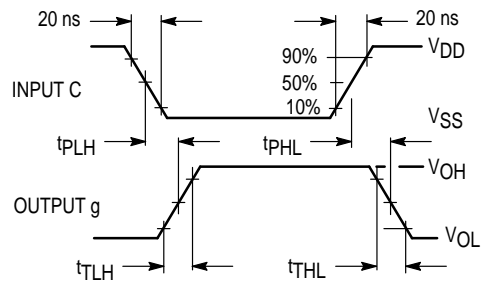


**Figure 1. Dynamic Power Dissipation Signal Waveforms**

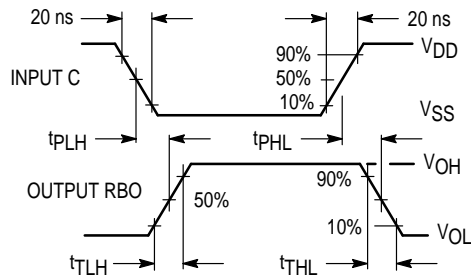
**SWITCHING CHARACTERISTICS\*** ( $C_L = 50 \text{ pF}$ ,  $T_A = 25^\circ\text{C}$ )

| Characteristic   | Symbol       | $V_{DD}$<br>Vdc | All Types         |                   |                    | Unit |
|--|--------------|-----------------|-------------------|-------------------|--------------------|------|
|  |              |                 | Min               | Typ               | Max                |      |
| Output Rise Time — Segment Outputs   | $t_{TLH}$    | 5.0<br>10<br>15 | —<br>—<br>—       | 40<br>30<br>25    | 80<br>60<br>50     | ns   |
| Output Rise Time — RBO Output  | $t_{TLH}$    | 5.0<br>10<br>15 | —<br>—<br>—       | 480<br>240<br>190 | 960<br>480<br>380  | ns   |
| Output Fall Time — Segment Outputs*<br>$t_{THL} = (1.5 \text{ ns/pF}) C_L + 50 \text{ ns}$<br>$t_{THL} = (0.75 \text{ ns/pF}) C_L + 37.5 \text{ ns}$<br>$t_{THL} = (0.55 \text{ ns/pF}) C_L + 37.5 \text{ ns}$   | $t_{THL}$    | 5.0<br>10<br>15 | —<br>—<br>—       | 125<br>75<br>65   | 250<br>150<br>130  | ns   |
| Output Fall Time — RBO Outputs<br>$t_{THL} = (3.25 \text{ ns/pF}) C_L + 107.5 \text{ ns}$<br>$t_{THL} = (1.35 \text{ ns/pF}) C_L + 67.5 \text{ ns}$<br>$t_{THL} = (0.95 \text{ ns/pF}) C_L + 62.5 \text{ ns}$  | $t_{THL}$    | 5.0<br>10<br>15 | —<br>—<br>—       | 270<br>135<br>110 | 540<br>270<br>220  | ns   |
| Propagation Delay Time — A, B, C, D Inputs*<br>$t_{PLH} = (0.40 \text{ ns/pF}) C_L + 620 \text{ ns}$<br>$t_{PLH} = (0.25 \text{ ns/pF}) C_L + 237.5 \text{ ns}$<br>$t_{PLH} = (0.20 \text{ ns/pF}) C_L + 165 \text{ ns}$<br><br>$t_{PHL} = (1.3 \text{ ns/pF}) C_L + 655 \text{ ns}$<br>$t_{PHL} = (0.60 \text{ ns/pF}) C_L + 260 \text{ ns}$<br>$t_{PHL} = (0.35 \text{ ns/pF}) C_L + 182.5 \text{ ns}$                     | $t_{PLH}$    | 5.0<br>10<br>15 | —<br>—<br>—       | 640<br>250<br>175 | 1280<br>500<br>350 | ns   |
|  | $t_{PHL}$    | 5.0<br>10<br>15 | —<br>—<br>—       | 720<br>290<br>200 | 1440<br>580<br>400 | ns   |
| Propagation Delay Time — RBI and $\overline{BI}$ Inputs*<br>$t_{PLH} = (1.05 \text{ ns/pF}) C_L + 547.5 \text{ ns}$<br>$t_{PLH} = (0.45 \text{ ns/pF}) C_L + 177.5 \text{ ns}$<br>$t_{PLH} = (0.30 \text{ ns/pF}) C_L + 135 \text{ ns}$<br><br>$t_{PHL} = (0.85 \text{ ns/pF}) C_L + 442.5 \text{ ns}$<br>$t_{PHL} = (0.45 \text{ ns/pF}) C_L + 177.5 \text{ ns}$<br>$t_{PHL} = (0.35 \text{ ns/pF}) C_L + 142.5 \text{ ns}$ | $t_{PLH}$    | 5.0<br>10<br>15 | —<br>—<br>—       | 600<br>200<br>150 | 750<br>300<br>220  | ns   |
|  | $t_{PHL}$    | 5.0<br>10<br>15 | —<br>—<br>—       | 485<br>200<br>160 | 970<br>400<br>320  | ns   |
| Propagation Delay Time — $\overline{LT}$ Input*<br>$t_{PLH} = (0.45 \text{ ns/pF}) C_L + 290.5 \text{ ns}$<br>$t_{PLH} = (0.25 \text{ ns/pF}) C_L + 112.5 \text{ ns}$<br>$t_{PLH} = (0.20 \text{ ns/pF}) C_L + 80 \text{ ns}$<br><br>$t_{PHL} = (1.3 \text{ ns/pF}) C_L + 248 \text{ ns}$<br>$t_{PHL} = (0.45 \text{ ns/pF}) C_L + 102.5 \text{ ns}$<br>$t_{PHL} = (0.35 \text{ ns/pF}) C_L + 72.5 \text{ ns}$               | $t_{PLH}$    | 5.0<br>10<br>15 | —<br>—<br>—       | 313<br>125<br>90  | 625<br>250<br>180  | ns   |
|  | $t_{PHL}$    | 5.0<br>10<br>15 | —<br>—<br>—       | 313<br>125<br>90  | 625<br>250<br>180  | ns   |
| Setup Time   | $t_{su}$     | 5.0<br>10<br>15 | 100<br>40<br>30   | —<br>—<br>—       | —<br>—<br>—        | ns   |
| Hold Time  | $t_h$        | 5.0<br>10<br>15 | 60<br>40<br>30    | —<br>—<br>—       | —<br>—<br>—        | ns   |
| Latch Enable Pulse Width   | $t_{WL(LE)}$ | 5.0<br>10<br>15 | 520<br>220<br>130 | 260<br>110<br>65  | —<br>—<br>—        | ns   |

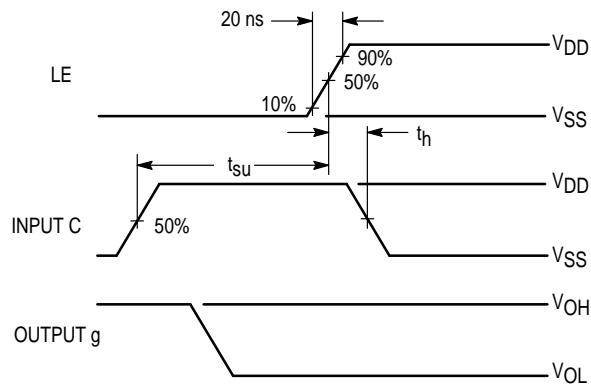
\* The formulas given are for the typical characteristics only.



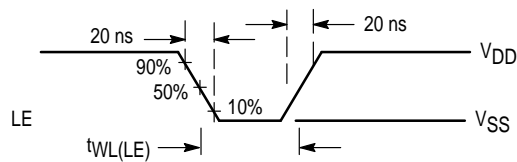
a. Data Propagation Delay: Inputs RBI, D and LE low, and Inputs A, B,  $\overline{BI}$  and  $\overline{LT}$  high.



b. Inputs A, B, D and LE low, and Inputs RBI,  $\overline{BI}$  and  $\overline{LT}$  high.



c. Setup and Hold Times: Input RBI and D low, Inputs A, B,  $\overline{BI}$  and  $\overline{LT}$  high.

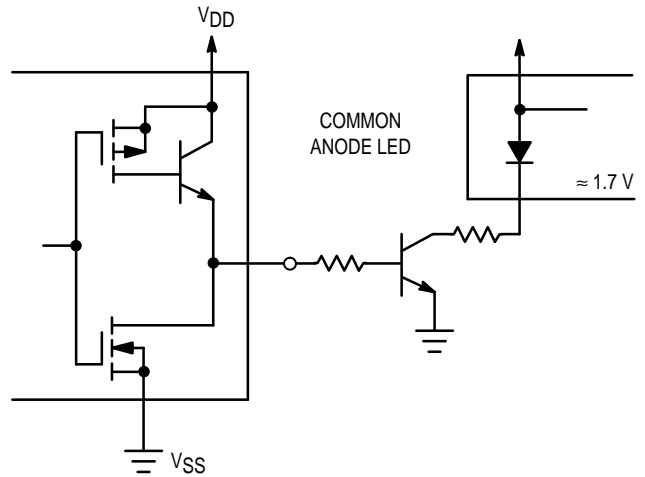
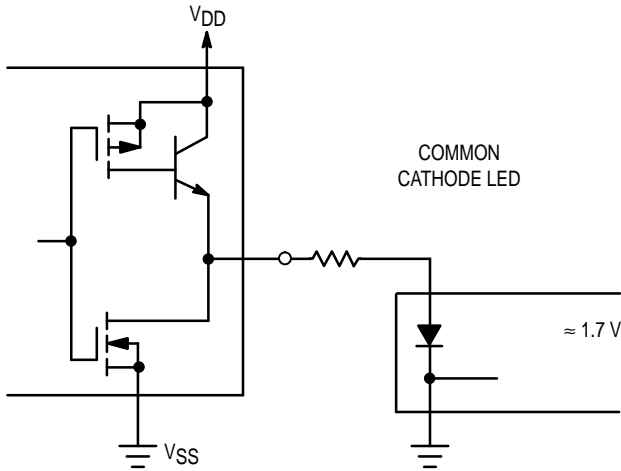


d. Pulse Width: Data DCBA strobed into latches.

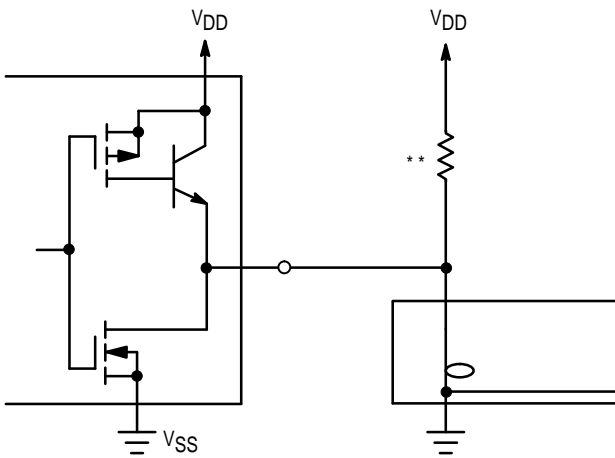
Figure 2. Dynamic Signal Waveforms

## CONNECTIONS TO VARIOUS DISPLAY READOUTS

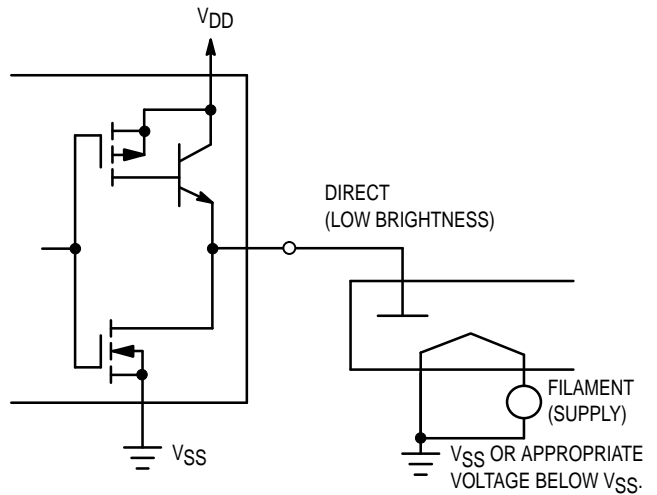
### LIGHT EMITTING DIODE (LED) READOUT



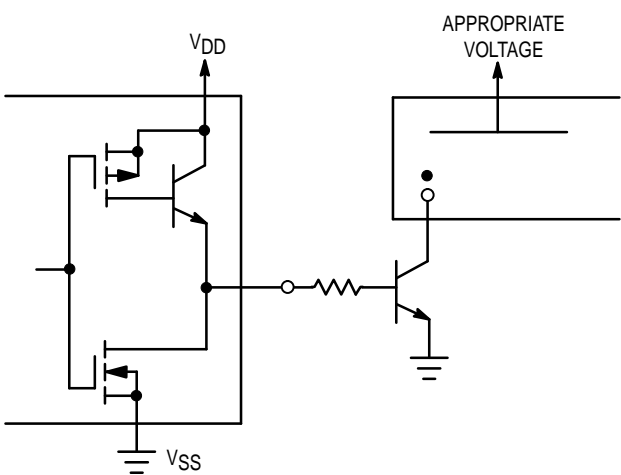
### INCANDESCENT READOUT



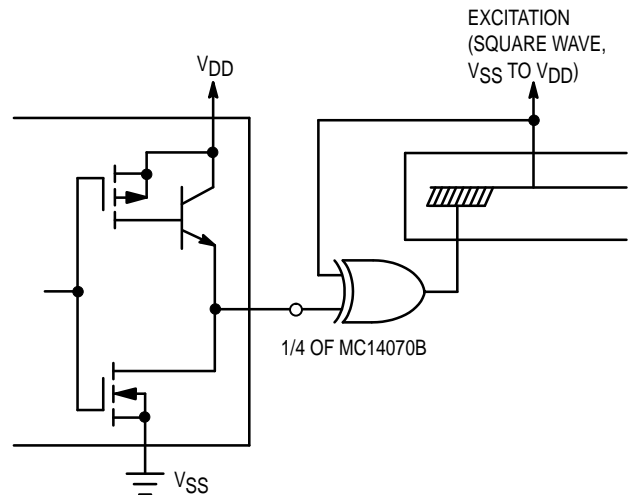
### FLUORESCENT READOUT



### GAS DISCHARGE READOUT



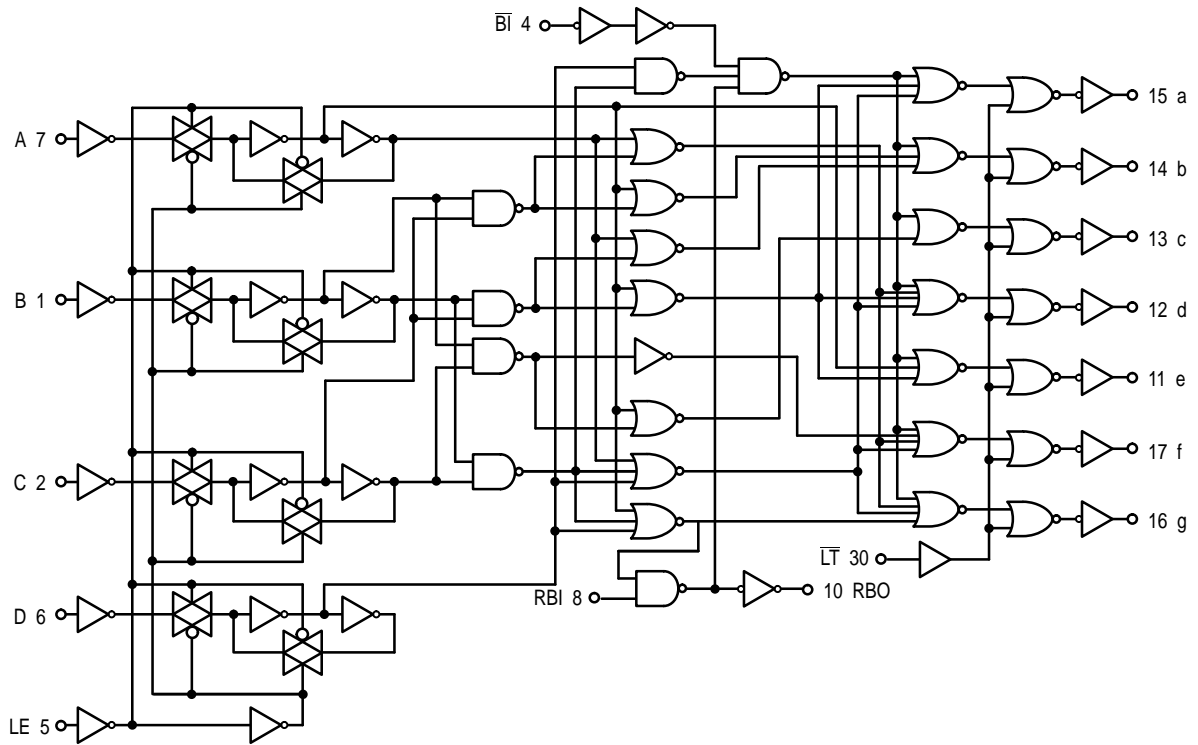
### LIQUID CRYSTAL (LC) READOUT



\*\* A filament pre-warm resistor is recommended to reduce filament thermal shock and increase the effective cold resistance of the filament.

Direct dc drive of LC's not recommended for life of LC readouts.

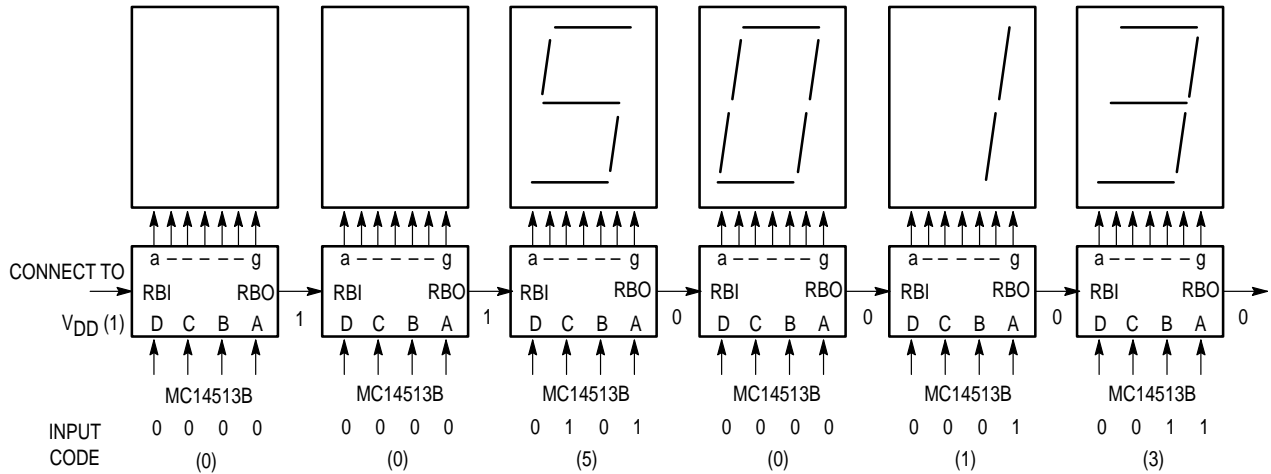
### LOGIC DIAGRAM



### TYPICAL APPLICATIONS FOR RIPPLE BLANKING

#### LEADING EDGE ZERO SUPPRESSION

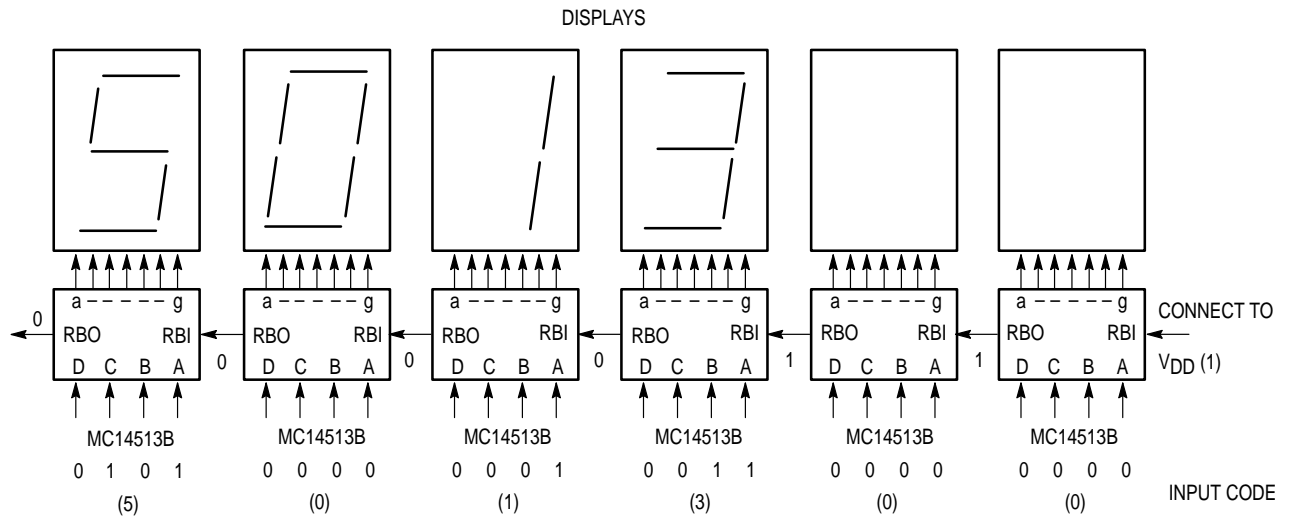
#### DISPLAYS





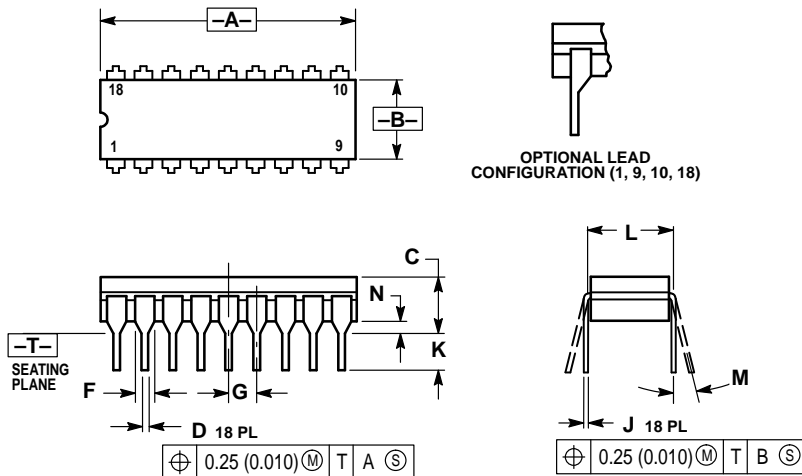
# TYPICAL APPLICATIONS FOR RIPPLE BLANKING (Cont)

## TRAILING EDGE ZERO SUPPRESSION



## OUTLINE DIMENSIONS

### L SUFFIX CERAMIC DIP PACKAGE CASE 726-04 ISSUE G

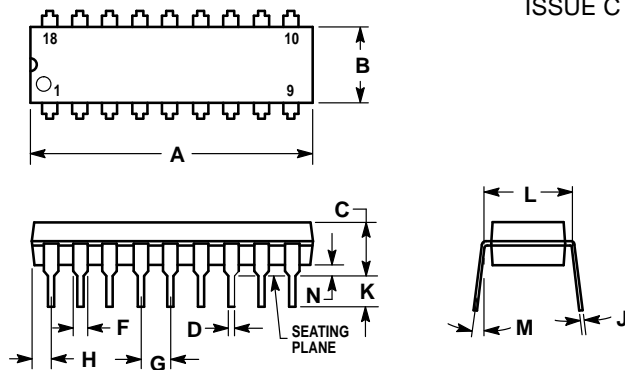


**NOTES:**

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSION L TO CENTER OF LEAD WHEN FORMED PARALLEL.
4. DIMENSION F FOR FULL LEADS. HALF LEADS OPTIONAL AT LEAD POSITIONS 1, 9, 10, AND 18.

| DIM | INCHES    |       | MILLIMETERS |       |
|-----|-----------|-------|-------------|-------|
|     | MIN       | MAX   | MIN         | MAX   |
| A   | 0.880     | 0.910 | 22.35       | 23.11 |
| B   | 0.240     | 0.295 | 6.10        | 7.49  |
| C   | —         | 0.200 | —           | 5.08  |
| D   | 0.015     | 0.021 | 0.38        | 0.53  |
| F   | 0.055     | 0.070 | 1.40        | 1.78  |
| G   | 0.100 BSC |       | 2.54 BSC    |       |
| J   | 0.008     | 0.012 | 0.20        | 0.30  |
| K   | 0.125     | 0.170 | 3.18        | 4.32  |
| L   | 0.300 BSC |       | 7.62 BSC    |       |
| M   | 0°        | 15°   | 0°          | 15°   |
| N   | 0.020     | 0.040 | 0.51        | 1.02  |

### P SUFFIX PLASTIC DIP PACKAGE CASE 707-02 ISSUE C



**NOTES:**

1. POSITIONAL TOLERANCE OF LEADS (D), SHALL BE WITHIN 0.25 (0.010) AT MAXIMUM MATERIAL CONDITION, IN RELATION TO SEATING PLANE AND EACH OTHER.
2. DIMENSION L TO CENTER OF LEADS WHEN FORMED PARALLEL.
3. DIMENSION B DOES NOT INCLUDE MOLD FLASH.

| DIM | MILLIMETERS |       | INCHES    |       |
|-----|-------------|-------|-----------|-------|
|     | MIN         | MAX   | MIN       | MAX   |
| A   | 22.22       | 23.24 | 0.875     | 0.915 |
| B   | 6.10        | 6.60  | 0.240     | 0.260 |
| C   | 3.56        | 4.57  | 0.140     | 0.180 |
| D   | 0.36        | 0.56  | 0.014     | 0.022 |
| F   | 1.27        | 1.78  | 0.050     | 0.070 |
| G   | 2.54 BSC    |       | 0.100 BSC |       |
| H   | 1.02        | 1.52  | 0.040     | 0.060 |
| J   | 0.20        | 0.30  | 0.008     | 0.012 |
| K   | 2.92        | 3.43  | 0.115     | 0.135 |
| L   | 7.62 BSC    |       | 0.300 BSC |       |
| M   | 0°          | 15°   | 0°        | 15°   |
| N   | 0.51        | 1.02  | 0.020     | 0.040 |

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