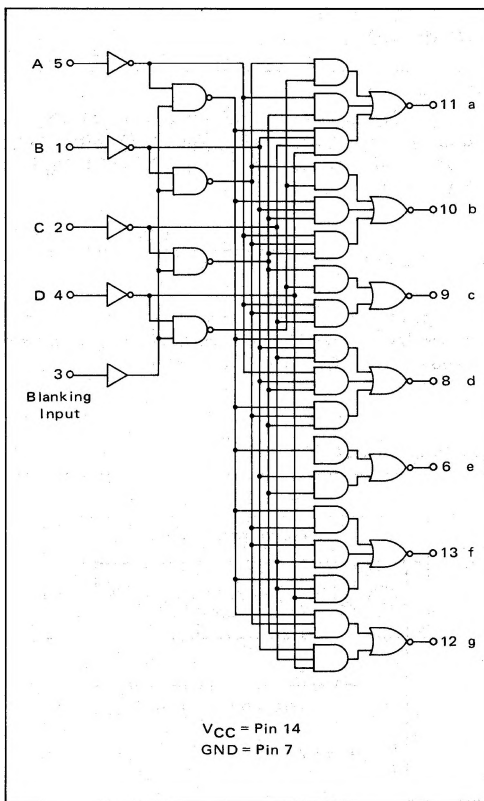


BCD-TO-SEVEN SEGMENT  
DECODER/DRIVER

MC5400/7400 series

MC5449F • MC7449F\*



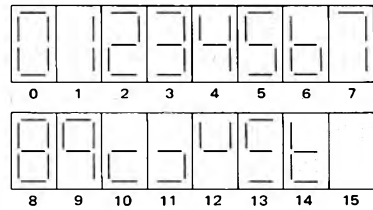
This device decodes 4-bit binary coded decimal input data in a format suitable for use with incandescent, seven-segment, display indicators. It is intended for use with other logic elements or discrete components rather than for the direct driving of display indicators as is the case with the MC5446/7446, which is similar.

Lamp intensity can be controlled by applying a variable duty cycle signal to the blanking input.



SEGMENT IDENTIFICATION

NUMERICAL DESIGNATION - SEGMENTS ILLUMINATED



Input Loading Factor:

BI = 2.6

Other Inputs = 1

Output Loading Factor:

a thru g = 6

Total Power Dissipation =  
165 mW typ/pkg

TRUTH TABLE

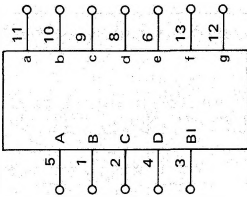
| DIGIT<br>OR<br>FUNCTION | INPUT      |            |            |            |             | OUTPUT      |             |            |            |            |             |             |
|-------------------------|------------|------------|------------|------------|-------------|-------------|-------------|------------|------------|------------|-------------|-------------|
|                         | D<br>Pin 4 | C<br>Pin 2 | B<br>Pin 1 | A<br>Pin 5 | BI<br>Pin 3 | a<br>Pin 11 | b<br>Pin 10 | c<br>Pin 9 | d<br>Pin 8 | e<br>Pin 6 | f<br>Pin 13 | g<br>Pin 12 |
| 0                       | 0          | 0          | 0          | 0          | 1           | 1           | 1           | 1          | 1          | 0          | 1           | 0           |
| 1                       | 0          | 0          | 0          | 1          | 1           | 0           | 1           | 1          | 0          | 0          | 0           | 0           |
| 2                       | 0          | 0          | 1          | 0          | 1           | 1           | 1           | 0          | 1          | 1          | 0           | 1           |
| 3                       | 0          | 0          | 1          | 1          | 1           | 1           | 1           | 1          | 1          | 0          | 0           | 1           |
| 4                       | 0          | 1          | 0          | 0          | 1           | 0           | 1           | 1          | 0          | 0          | 1           | 1           |
| 5                       | 0          | 1          | 0          | 1          | 1           | 0           | 0           | 1          | 1          | 0          | 1           | 1           |
| 6                       | 0          | 1          | 1          | 0          | 1           | 1           | 0           | 1          | 1          | 0          | 0           | 0           |
| 7                       | 0          | 1          | 1          | 1          | 1           | 1           | 1           | 1          | 0          | 0          | 0           | 0           |
| 8                       | 1          | 0          | 0          | 0          | 1           | 1           | 1           | 1          | 1          | 1          | 1           | 1           |
| 9                       | 1          | 0          | 0          | 1          | 1           | 1           | 1           | 1          | 0          | 0          | 1           | 1           |
| 10                      | 1          | 0          | 1          | 0          | 1           | 0           | 0           | 1          | 1          | 1          | 0           | 1           |
| 11                      | 1          | 0          | 1          | 1          | 1           | 0           | 0           | 0          | 1          | 0          | 0           | 1           |
| 12                      | 1          | 1          | 0          | 0          | 1           | 0           | 1           | 0          | 0          | 0          | 1           | 1           |
| 13                      | 1          | 1          | 0          | 1          | 1           | 1           | 0           | 0          | 1          | 0          | 1           | 1           |
| 14                      | 1          | 1          | 1          | 0          | 1           | 0           | 0           | 0          | 1          | 1          | 1           | 1           |
| 15                      | 1          | 1          | 1          | 1          | 1           | 0           | 0           | 0          | 0          | 0          | 0           | 0           |
| BI                      | X          | X          | X          | X          | 0           | 0           | 0           | 0          | 0          | 0          | 0           | 0           |

X = Don't care

\*F suffix = TO-86 ceramic flat package (Case 607).

ELECTRICAL CHARACTERISTICS

Test procedures are shown for only one data input and the blanking input, and for one driver output and the ripple blanking output. Test other inputs and outputs in the same manner according to the truth table. Test all input-output combinations according to the truth table.



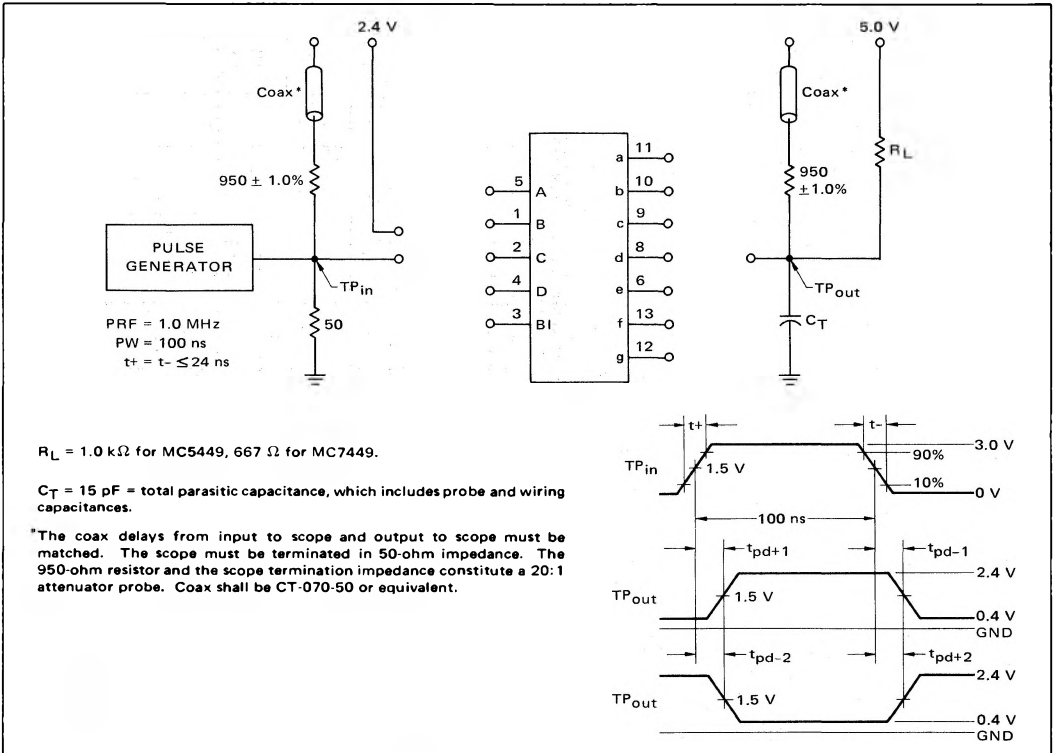
MC5449F, MC7449F (continued)

| TEST CURRENT/VOLTAGE VALUES (All Temperatures) |                   |                |                                     |                 |                 |                  |                                  |                  |                 |                 |  |                  |
|--|-------------------|----------------|-------------------------------------|-----------------|-----------------|------------------|----------------------------------|------------------|-----------------|-----------------|--|------------------|
|  |                   | Volts          |                                     |                 |                 |                  |                                  |                  |                 |                 |  |                  |
|  |                   | mA             |                                     | V <sub>IL</sub> | V <sub>IH</sub> | V <sub>IIH</sub> | V <sub>th1</sub>                 | V <sub>th0</sub> | V <sub>CC</sub> | V <sub>CC</sub> | V <sub>CC</sub>                                    | V <sub>IHX</sub> |
| Characteristic                                 | Symbol            | Pin Under Test | MC5449 Test Limits<br>-55 to +125°C |                 |                 |                  | MC7449 Test Limits<br>0 to +70°C |                  |                 |                 | TEST CURRENT/VOLTAGE APPLIED TO PINS LISTED BELOW: |                  |
|  |                   |                | Min                                 | Max             | Unit            | Min              | Max                              | Unit             | I <sub>OL</sub> | V <sub>IL</sub> | V <sub>IH</sub>                                    | V <sub>IHX</sub> |
| Input Forward Current                          | I <sub>F</sub>    | 1              | —                                   | -1.6            | mAdc            | —                | -1.6                             | mAdc             | —               | 1               | —  | —                |
| Leakage Current                                | I <sub>R1</sub>   | 1              | —                                   | 40              | μAdc            | —                | 40                               | μAdc             | —               | —               | 1  | —                |
|  | I <sub>R2</sub>   | 1              | —                                   | 1.0             | mAdc            | —                | 1.0                              | mAdc             | —               | —               | 1  | —                |
| Output Output Voltage                          | V <sub>OL</sub>   | 9              | —                                   | 0.4             | Vdc             | —                | 0.4                              | Vdc              | 9               | —               | 12,3,4,5   | —                |
| Power Requirements (Total Device)              |                   |                |                                     |                 |                 |                  |                                  |                  |                 |                 |  |                  |
| Power Supply Drain                             | I <sub>PD</sub>   | 14             | —                                   | 47              | mAdc            | —                | 56                               | mAdc             | —               | —               | 12,3,4,5   | —                |
| Switching Parameters                           |                   |                |                                     |                 |                 |                  |                                  |                  |                 |                 |  |                  |
| Turn-On Delay                                  | t <sub>pd-1</sub> | 5,9            | —                                   | 100#            | ns              | —                | 100#                             | ns               | Pulse In        | 9               | —  | 12,3             |
|  | t <sub>pd+1</sub> | 5,9            | —                                   | 100#            | ns              | —                | 100#                             | ns               | Pulse Out       | 5               | 9  | 4,7              |
| Turn-On Delay                                  | t <sub>pd-2</sub> | 3,13           | —                                   | 100#            | ns              | —                | 100#                             | ns               | 3               | 13              | —  | 12,4,5,7         |
| Turn-Off Delay                                 | t <sub>pd+2</sub> | 3,13           | —                                   | 100#            | ns              | —                | 100#                             | ns               | 3               | 13              | —  | 12,4,5,7         |

#Tested only at 25°C.

## MC5449F, MC7449F (continued)

### SWITCHING TIME TEST CIRCUIT AND VOLTAGE WAVEFORMS



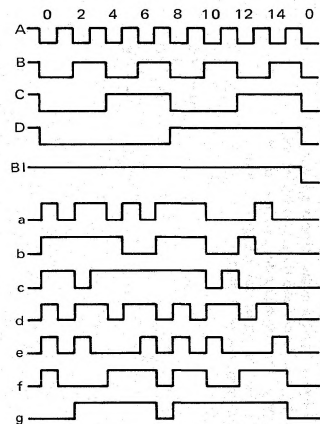
### OPERATING CHARACTERISTICS

This monolithic integrated circuit provides the logic necessary to decode a BCD input and drive a seven-segment numerical indicator. It is intended for use primarily as a driver for discrete, active components or logic elements. Open collector outputs provide the capability for wire ORing the outputs with other devices.

If direct driving of display indicators is desired, the MC5446/7446 (30 volts maximum output voltage) or the MC5447/7447 (15 volts) should be used, since they are designed to handle the relatively high voltages and sink currents (20 mA) of incandescent indicators.

Ripple blanking and lamp test inputs are not available, due to the pin limitations of the 14-pin flat package. The blanking input can be used in conjunction with external gates to obtain suppression of non-significant zeros in a multiple digit display. Design of zero-suppression systems is discussed in Application Note AN-516.

### INPUT/OUTPUT VOLTAGE WAVEFORMS



## MC5449F, MC7449F (continued)

### TYPICAL APPLICATION

This open-collector output device may be used to drive other logic circuits by adding an external pull-up resistor as shown. Maximum and minimum values for the external resistor,  $R_L$ , must be determined for the particular circuit configuration. The maximum value will be determined by the requirements for sufficient current to external loads when the decoder/driver output is high (logic "1"). The minimum value must be selected to ensure that the current through the resistor plus the current from external loads will not cause the low output voltage (logic "0") of the decoder/driver to rise above the specified value.

The allowable drop across the load resistor,  $R_L$ , for the high state is the difference between  $V_{CC}$  (5.0 volts), and the required output voltage,  $V_{OH}$  (2.4 volts) for the MTTL gates. The current through the resistor is the sum of the load currents,  $NI_R1$ , where  $N$  is the number of gates being driven and  $I_{R1}$  is the leakage current, 40  $\mu A$  for a typical MTTL gate. From this, the maximum value of  $R_L$  is

$$R_L(\max) = \frac{V_{CC} - V_{OH}}{NI_R1} = \frac{5.0 - 2.4}{2(40) \cdot 10^{-6}} \approx 33 \text{ k}\Omega$$

for two loads. Since the MC5449/7449 sink current,  $I_{OL}$ , is 10 mA, the minimum value of  $R_L$  in this case is given by:

$$R_L(\min) = \frac{V_{CC} - V_{OL}}{I_{OL} - NI_F} = \frac{5.0 - 0.4}{10 - 2(1.6) \cdot 10^{-3}} = 680 \Omega$$

