

1-of-10 decoder (3-State)

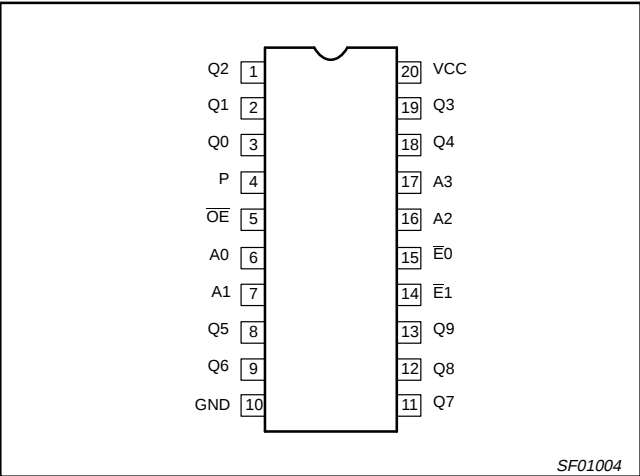
74F537

DESCRIPTION

The 74F537 is a one-of-ten decoder/demultiplexer with four active High BCD inputs and ten mutually exclusive outputs. A Polarity control (P) input determines whether the outputs are active Low or active High. The 74F537 has 3-State outputs and a High signal on the Output Enables (OE) input forces all outputs to the high impedance state. Two input Enables, active High (E1) and active Low (E0), are available for demultiplexing data to the selected output in either non-inverted or inverted form. Input codes greater than BCD nine causes all outputs to go to the inactive state (i.e., same polarity as the P input).

| TYPE   | TYPICAL PROPAGATION DELAY | TYPICAL SUPPLY CURRENT (TOTAL) |
|--------|---------------------------|--------------------------------|
| 74F537 | 9ns                       | 44mA                           |

PIN CONFIGURATION



ORDERING INFORMATION

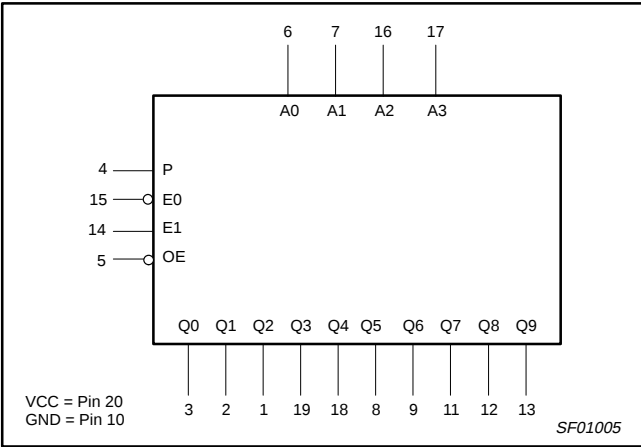
| DESCRIPTION        | COMMERCIAL RANGE<br>V <sub>CC</sub> = 5V ±10%, T <sub>amb</sub> = 0°C to +70°C |
|--------------------|--------------------------------------------------------------------------------|
| 20-Pin Plastic DIP | N74F537N                                                                       |
| 20-Pin Plastic SOL | N74F537D                                                                       |

INPUT AND OUTPUT LOADING AND FAN-OUT TABLE

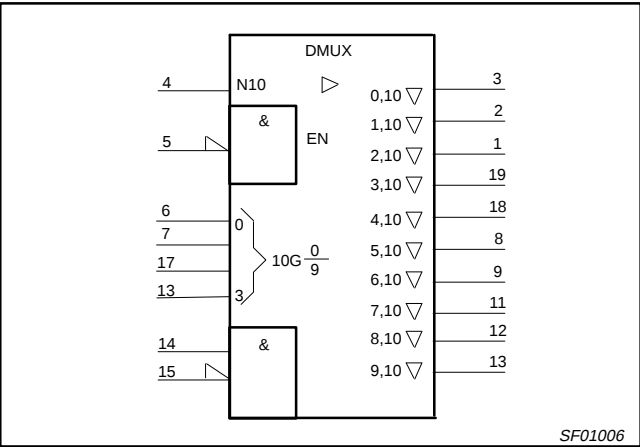
| PINS    | DESCRIPTION                | 74F(U.L.)<br>HIGH/LOW | LOAD VALUE<br>HIGH/LOW |
|---------|----------------------------|-----------------------|------------------------|
| A0 - A3 | Data inputs                | 1.0/1.0               | 20µA/0.6mA             |
| E0      | Enable input (active Low)  | 1.0/1.0               | 20µA/0.6mA             |
| E1      | Enable input (active High) | 1.0/1.0               | 20µA/0.6mA             |
| P       | Polarity control input     | 1.0/1.0               | 20µA/0.6mA             |
| OE      | Output Enable input        | 1.0/1.0               | 20µA/0.6mA             |
| Q0 - Q9 | Data outputs               | 150/40                | 3.0mA/24mA             |

NOTE: One (1.0) FAST Unit Load is defined as: 20µA in the High state and 0.6mA in the Low state.

LOGIC SYMBOL



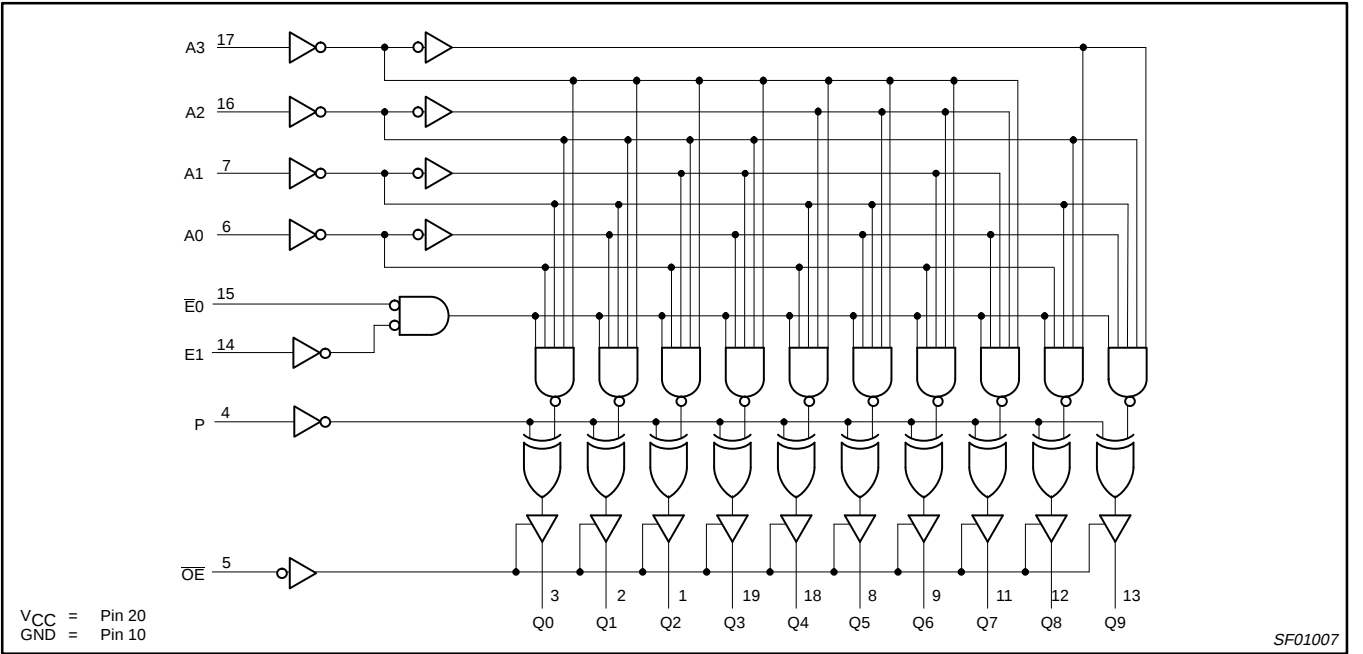
LOGIC SYMBOL (IEEE/IEC)



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LOGIC DIAGRAM



FUNCTION TABLE

| INPUTS |    |    |    |    |    |    | OUTPUTS               |    |    |    |    |    |    |    |    |    | OPERATING MODE                |
|--------|----|----|----|----|----|----|-----------------------|----|----|----|----|----|----|----|----|----|-------------------------------|
| OE     | E0 | E1 | A3 | A2 | A1 | A0 | Q0                    | Q1 | Q2 | Q3 | Q4 | Q5 | Q6 | Q7 | Q8 | Q9 |                               |
| H      | X  | X  | X  | X  | X  | X  | Z                     | Z  | Z  | Z  | Z  | Z  | Z  | Z  | Z  | Z  | High Impedance                |
| L      | H  | X  | X  | X  | X  | X  | Outputs equal P input |    |    |    |    |    |    |    |    |    | Disable                       |
| L      | X  | L  | X  | X  | X  | X  |                       |    |    |    |    |    |    |    |    |    |                               |
| L      | L  | H  | L  | L  | L  | L  | H                     | L  | L  | L  | L  | L  | L  | L  | L  | L  | Active High output<br>(P = L) |
| L      | L  | H  | L  | L  | L  | H  | L                     | H  | L  | L  | L  | L  | L  | L  | L  | L  |                               |
| L      | L  | H  | L  | L  | H  | L  | L                     | L  | H  | L  | L  | L  | L  | L  | L  | L  |                               |
| L      | L  | H  | L  | L  | H  | H  | L                     | L  | L  | H  | L  | L  | L  | L  | L  | L  |                               |
| L      | L  | H  | L  | H  | L  | L  | L                     | L  | L  | L  | H  | L  | L  | L  | L  | L  |                               |
| L      | L  | H  | L  | H  | L  | H  | L                     | L  | L  | L  | L  | H  | L  | L  | L  | L  |                               |
| L      | L  | H  | L  | H  | H  | L  | L                     | L  | L  | L  | L  | L  | H  | L  | L  | L  |                               |
| L      | L  | H  | L  | H  | H  | H  | L                     | L  | L  | L  | L  | L  | L  | H  | L  | L  |                               |
| L      | L  | H  | H  | L  | L  | L  | L                     | L  | L  | L  | L  | L  | L  | L  | H  | L  |                               |
| L      | L  | H  | H  | L  | L  | H  | L                     | L  | L  | L  | L  | L  | L  | L  | L  | H  |                               |
| L      | L  | H  | H  | L  | L  | H  | L                     | L  | L  | L  | L  | L  | L  | L  | L  | H  |                               |
| L      | L  | H  | H  | L  | H  | L  | L                     | L  | L  | L  | L  | L  | L  | L  | L  | H  |                               |
| L      | L  | H  | H  | L  | H  | H  | L                     | L  | L  | L  | L  | L  | L  | L  | L  | H  | Active Low output<br>(P = H)  |
| L      | L  | H  | L  | H  | L  | L  | H                     | H  | H  | H  | L  | H  | H  | H  | H  | H  |                               |
| L      | L  | H  | L  | H  | L  | H  | H                     | H  | H  | H  | H  | H  | H  | H  | H  | H  |                               |
| L      | L  | H  | L  | H  | H  | L  | H                     | H  | H  | H  | H  | H  | H  | H  | H  | H  |                               |
| L      | L  | H  | H  | L  | L  | L  | H                     | H  | H  | H  | H  | H  | H  | H  | L  | H  | Active Low output<br>(P = H)  |
| L      | L  | H  | H  | L  | L  | H  | H                     | H  | H  | H  | H  | H  | H  | H  | H  | L  |                               |
| L      | L  | H  | H  | X  | H  | X  | H                     | H  | H  | H  | H  | H  | H  | H  | H  | H  |                               |
| L      | L  | H  | H  | H  | X  | X  | H                     | H  | H  | H  | H  | H  | H  | H  | H  | H  |                               |

H = High voltage level  
L = Low voltage level  
X = Don't care  
Z = High impedance "off" state

## 1-of-10 decoder (3-State)

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**ABSOLUTE MAXIMUM RATINGS**

(Operation beyond the limits set forth in this table may impair the useful life of the device.

Unless otherwise noted these limits are over the operating free-air temperature range.)

| SYMBOL    | PARAMETER                                      | RATING             | UNIT |
|-----------|------------------------------------------------|--------------------|------|
| $V_{CC}$  | Supply voltage                                 | -0.5 to +7.0       | V    |
| $V_{IN}$  | Input voltage                                  | -0.5 to +7.0       | V    |
| $I_{IN}$  | Input current                                  | -30 to +5.0        | mA   |
| $V_{OUT}$ | Voltage applied to output in High output state | -0.5 to + $V_{CC}$ | V    |
| $I_{OUT}$ | Current applied to output in Low output state  | 48                 | mA   |
| $T_{amb}$ | Operating free-air temperature range           | 0 to +70           | °C   |
| $T_{stg}$ | Storage temperature                            | -65 to +150        | °C   |

**RECOMMENDED OPERATING CONDITIONS**

| SYMBOL    | PARAMETER                            | LIMITS |     |      | UNIT |
|-----------|--------------------------------------|--------|-----|------|------|
|           |                                      | MIN    | NOM | MAX  |      |
| $V_{CC}$  | Supply voltage                       | 4.5    | 5.0 | 5.5  | V    |
| $V_{IH}$  | High-level input voltage             | 2.0    |     |      | V    |
| $V_{IL}$  | Low-level input voltage              |        |     | 0.8  | V    |
| $I_{IK}$  | Input clamp current                  |        |     | -18  | mA   |
| $I_{OH}$  | High-level output current            |        |     | -3.0 | mA   |
| $I_{OL}$  | Low-level output current             |        |     | 24   | mA   |
| $T_{amb}$ | Operating free-air temperature range | 0      |     | 70   | °C   |

**DC ELECTRICAL CHARACTERISTICS**

(Over recommended operating free-air temperature range unless otherwise noted.)

| SYMBOL           | PARAMETER                                       | TEST CONDITIONS <sup>1</sup>                                                                  |                     | LIMITS |                  |      | UNIT |
|------------------|-------------------------------------------------|-----------------------------------------------------------------------------------------------|---------------------|--------|------------------|------|------|
|                  |                                                 |                                                                                               |                     | MIN    | TYP <sup>2</sup> | MAX  |      |
| V <sub>OH</sub>  | High-level output voltage                       | V <sub>CC</sub> = MIN, V <sub>IL</sub> = MAX,<br>V <sub>IH</sub> = MIN, I <sub>OH</sub> = MAX | ±10%V <sub>CC</sub> | 2.4    |                  |      | V    |
|                  |                                                 |                                                                                               | ±5%V <sub>CC</sub>  | 2.7    | 3.3              |      | V    |
| V <sub>OL</sub>  | Low-level output voltage                        | V <sub>CC</sub> = MIN, V <sub>IL</sub> = MAX,<br>V <sub>IH</sub> = MIN, I <sub>OL</sub> = MAX | ±10%V <sub>CC</sub> |        | 0.35             | 0.50 | V    |
|                  |                                                 |                                                                                               | ±5%V <sub>CC</sub>  |        | 0.35             | 0.50 | V    |
| V <sub>IK</sub>  | Input clamp voltage                             | V <sub>CC</sub> = MIN, I <sub>I</sub> = I <sub>IK</sub>                                       |                     |        | −0.73            | −1.2 | V    |
| I <sub>I</sub>   | Input current at maximum input voltage          | V <sub>CC</sub> = MAX, V <sub>I</sub> = 7.0V                                                  |                     |        |                  | 100  | μA   |
| I <sub>IH</sub>  | High-level input current                        | V <sub>CC</sub> = MAX, V <sub>I</sub> = 2.7V                                                  |                     |        |                  | 20   | μA   |
| I <sub>IL</sub>  | Low-level input current                         | V <sub>CC</sub> = MAX, V <sub>I</sub> = 0.5V                                                  |                     |        |                  | −0.6 | mA   |
| I <sub>OZH</sub> | Off-state current<br>High-level voltage applied | V <sub>CC</sub> = MAX, V <sub>O</sub> = 2.7V                                                  |                     |        |                  | 50   | μA   |
| I <sub>OZL</sub> | Off-state current<br>Low-level voltage applied  | V <sub>CC</sub> = MAX, V <sub>O</sub> = 0.5V                                                  |                     |        |                  | −50  | μA   |
| I <sub>OS</sub>  | Short-circuit output current <sup>3</sup>       | V <sub>CC</sub> = MAX                                                                         |                     | −60    |                  | −150 | mA   |
| I <sub>CC</sub>  | Supply current (total)                          | V <sub>CC</sub> = MAX                                                                         |                     |        | 44               | 66   | mA   |

**NOTES:**

- For conditions shown as MIN or MAX, use the appropriate value under the recommended operating conditions for the applicable type.
- All typical values are at  $V_{CC} = 5\text{V}$ ,  $T_{amb} = 25^\circ\text{C}$ .
- Not more than one output should be shorted at a time. For testing  $I_{OS}$ , the use of high-speed test apparatus and/or sample-and-hold techniques are preferable in order to minimize internal heating and more accurately reflect operational values. Otherwise, prolonged shorting of a High output may raise the chip temperature well above normal and thereby cause invalid readings in other parameter tests. In any sequence of parameter tests,  $I_{OS}$  should be performed last.

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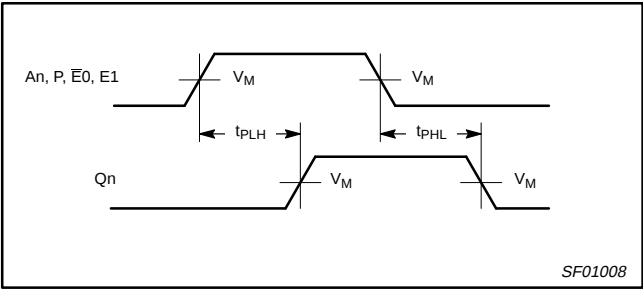
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AC ELECTRICAL CHARACTERISTICS

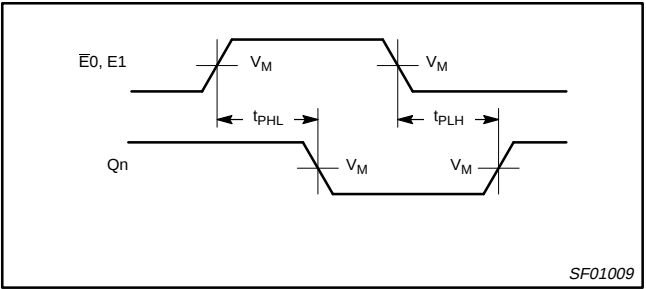
| SYMBOL                               | PARAMETER                       | TEST CONDITIONS          | LIMITS                                                                                              |             |              |                                                                                                                  |              | UNIT     |
|--------------------------------------|---------------------------------|--------------------------|-----------------------------------------------------------------------------------------------------|-------------|--------------|------------------------------------------------------------------------------------------------------------------|--------------|----------|
|                                      |                                 |                          | T <sub>amb</sub> = +25°C<br>V <sub>CC</sub> = +5.0V<br>C <sub>L</sub> = 50pF, R <sub>L</sub> = 500Ω |             |              | T <sub>amb</sub> = 0°C to +70°C<br>V <sub>CC</sub> = +5.0V ± 10%<br>C <sub>L</sub> = 50pF, R <sub>L</sub> = 500Ω |              |          |
|                                      |                                 |                          | MIN                                                                                                 | TYP         | MAX          | MIN                                                                                                              | MAX          |          |
| t <sub>PLH</sub><br>t <sub>PHL</sub> | Propagation delay<br>An to Qn   | Waveform 1               | 4.5<br>3.0                                                                                          | 9.0<br>7.5  | 14.0<br>11.0 | 4.5<br>3.0                                                                                                       | 16.0<br>12.0 | ns<br>ns |
| t <sub>PLH</sub><br>t <sub>PHL</sub> | Propagation delay<br>E0 to Qn   | Waveform 2               | 4.0<br>3.0                                                                                          | 8.0<br>8.0  | 11.0<br>11.0 | 4.0<br>3.0                                                                                                       | 12.0<br>12.0 | ns<br>ns |
| t <sub>PLH</sub><br>t <sub>PHL</sub> | Propagation delay<br>E1 to Qn   | Waveform 2               | 6.0<br>4.0                                                                                          | 8.5<br>8.5  | 11.5<br>11.5 | 6.0<br>4.0                                                                                                       | 13.0<br>12.5 | ns<br>ns |
| t <sub>PLH</sub><br>t <sub>PHL</sub> | Propagation delay<br>P to Qn    | Waveform 1               | 5.0<br>3.5                                                                                          | 12.5<br>6.5 | 16.0<br>10.0 | 5.0<br>3.5                                                                                                       | 17.0<br>11.0 | ns<br>ns |
| t <sub>PZH</sub><br>t <sub>PZL</sub> | Output Enable time<br>OE to Qn  | Waveform 3<br>Waveform 4 | 2.5<br>4.0                                                                                          | 4.5<br>5.5  | 7.0<br>8.0   | 2.5<br>4.0                                                                                                       | 8.0<br>9.0   | ns<br>ns |
| t <sub>PHZ</sub><br>t <sub>PLZ</sub> | Output Disable time<br>OE to Qn | Waveform 3<br>Waveform 4 | 1.5<br>2.0                                                                                          | 3.0<br>4.0  | 6.0<br>6.5   | 1.0<br>2.0                                                                                                       | 7.0<br>7.0   | ns<br>ns |

AC WAVEFORMS

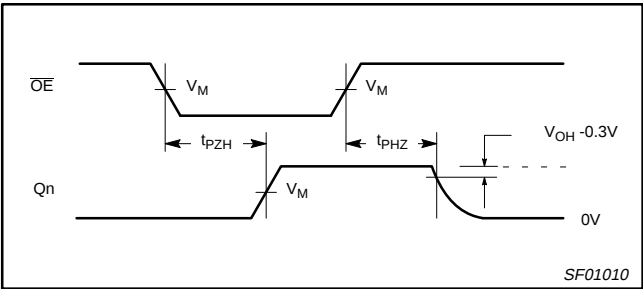
For all waveforms, V<sub>M</sub> = 1.5V.



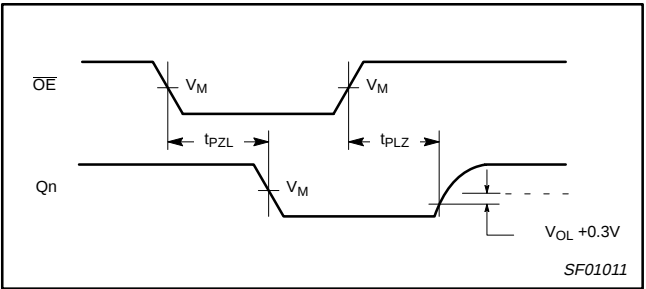
Waveform 1. Propagation Delay for Non-Inverting Outputs



Waveform 2. Propagation Delay for Inverting Outputs



Waveform 3. 3-State Output Enable Time to High Level and Output Disable Time from High Level



Waveform 4. 3-State Output Enable Time to Low Level and Output Disable Time from Low Level

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TEST CIRCUIT AND WAVEFORM

