

# Am25LS2538

One-of-Eight Decoder  
with Three-State Outputs and Polarity Control

## DISTINCTIVE CHARACTERISTICS

- Three-state decoder outputs
- Buffered common output polarity control
- Inverting and non-inverting enable inputs
- A. C. parameters specified over operating temperature and power supply ranges

## GENERAL DESCRIPTION

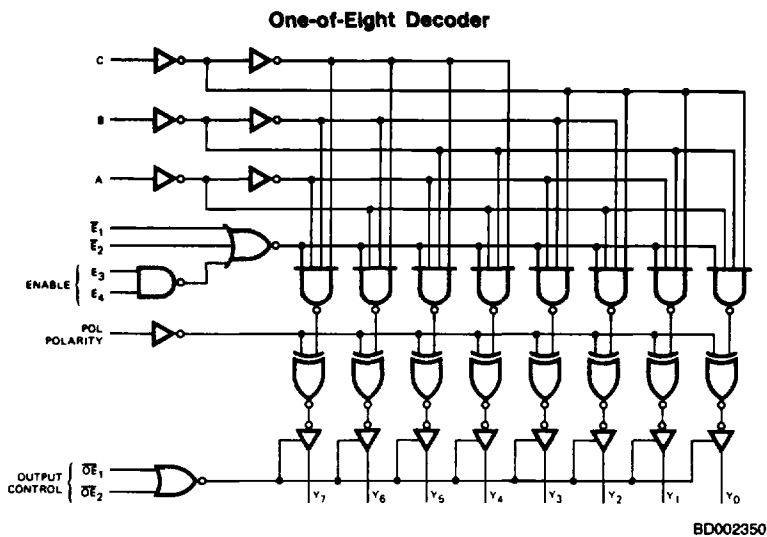
The Am25LS2538 is a three-line to eight-line decoder/demultiplexer fabricated using advanced Low-Power Schottky technology. The decoder has three buffered select inputs—A, B, and C—that are decoded to one-of-eight Y outputs. Two active-HIGH and two active-LOW enables can be used for gating the decoder or can be used with incoming data for demultiplexing applications.

A separate polarity (POL) input can be used to force the function active-HIGH or active-LOW at the output. Two separate active-LOW output enables ( $\overline{OE}$ ) inputs are pro-

vided. If either  $\overline{OE}$  input is HIGH, the output is in the high-impedance (off) state. When the POL input is LOW, the Y outputs are active-HIGH and when the POL input is HIGH, the Y outputs are active-LOW.

The device is packaged in a space saving (0.3-inch row spacing) 20-pin package. It also features Am25LS family improved switching specifications, higher noise margin, and twice the fan-out over the military temperature range when compared with Am54LS/74LS devices.

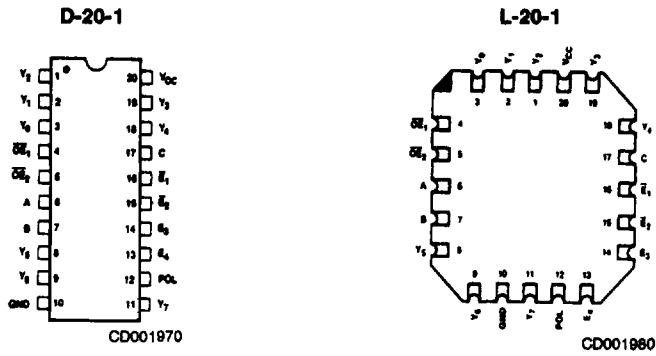
## BLOCK DIAGRAM



**RELATED PRODUCTS**

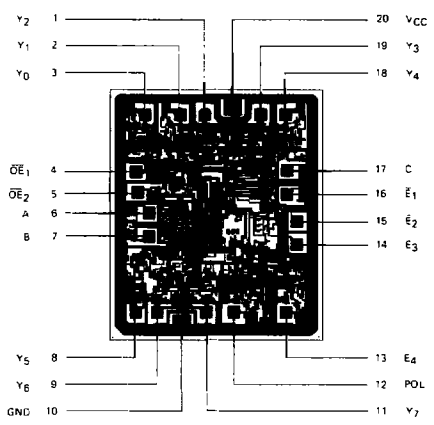
| <b>Part No.</b> | <b>Description</b>                |
|-----------------|-----------------------------------|
| Am25LS2536      | 8-Bit Decoder                     |
| Am25LS2537      | 1-of-10 Decoder                   |
| Am25LS2539      | Dual 1-of-4 Decoder               |
| Am25LS2548      | Chip Select Address Decoder       |
| Am2921          | 1-of-8 Decoder                    |
| Am2924          | 3-to-8 Line Decoder/Demultiplexer |

**CONNECTION DIAGRAM  
Top View**



Note: Pin 1 is marked for orientation

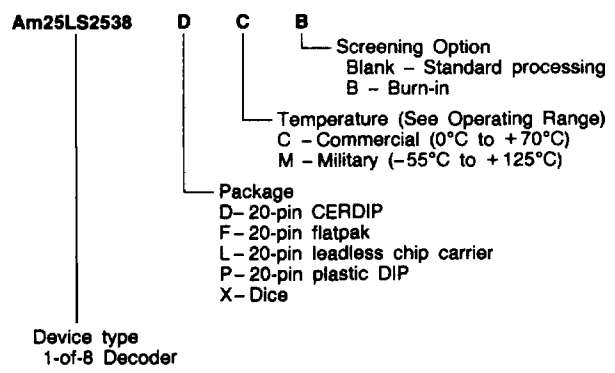
**METALLIZATION AND PAD LAYOUT**



DIE SIZE 0.081" x 0.096"

**ORDERING INFORMATION**

AMD products are available in several packages and operating ranges. The order number is formed by a combination of the following: Device number, speed option (if applicable), package type, operating range and screening option (if desired).



| Valid Combinations |        |
|--------------------|--------|
| Am25LS2538         | PC     |
|                    | DC, DM |
|                    | FM     |
|                    | LC, LM |
|                    | XC, XM |

**Valid Combinations**  
Consult the AMD sales office in your area to determine if a device is currently available in the combination you wish.

**PIN DESCRIPTION**

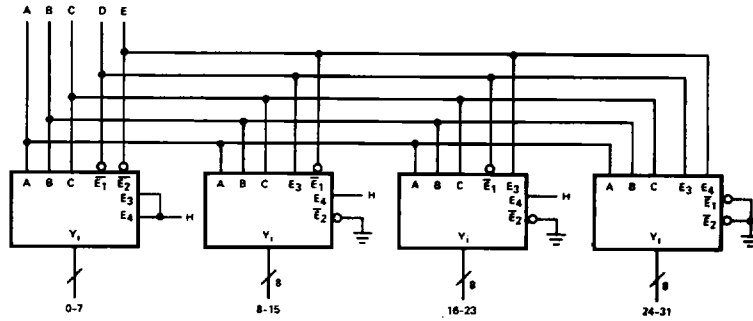
| Pin No.  | Name                     | I/O | Description  |
|----------|--------------------------|-----|--|
| 6, 7, 17 | A, B, C                  | I   | The three select inputs to the decoder/demultiplexer.  |
| 16, 15   | $\bar{E}_1, \bar{E}_2$   | I   | The active LOW enable inputs. A HIGH on either the $\bar{E}_1$ or $\bar{E}_2$ input forces all decoded functions to be disabled.   |
| 14, 13   | $E_3, E_4$               | I   | The active HIGH enable inputs. A LOW on either the $E_3$ or $E_4$ input forces all the decoded functions to be inhibited.  |
| 12       | POL                      | I   | Polarity Control. A LOW on the polarity control input forces the output to the active-HIGH state while a HIGH on the polarity control input forces the Y outputs to the active-LOW state.                  |
| 4, 5     | $\bar{OE}_1, \bar{OE}_2$ | I   | Output Enable. When both the $\bar{OE}_1$ and $\bar{OE}_2$ inputs are LOW, the Y outputs are enabled. If either $\bar{OE}_1$ or $\bar{OE}_2$ input is HIGH, the Y outputs are in the high-impedance state. |
|          | $Y_i$                    | O   | The eight outputs for the decoder/demultiplexer.   |

**FUNCTION TABLE**

| FUNCTION           | INPUTS       |              |       |             |       |       |     |   |   |   | OUTPUTS |       |       |       |       |       |       |       |
|--------------------|--------------|--------------|-------|-------------|-------|-------|-----|---|---|---|---------|-------|-------|-------|-------|-------|-------|-------|
|                    | $\bar{OE}_1$ | $\bar{OE}_2$ | $E_1$ | $\bar{E}_2$ | $E_3$ | $E_4$ | POL | C | B | A | $Y_0$   | $Y_1$ | $Y_2$ | $Y_3$ | $Y_4$ | $Y_5$ | $Y_6$ | $Y_7$ |
| High-Impedance     | H            | X            | X     | X           | X     | X     | X   | X | X | X | Z       | Z     | Z     | Z     | Z     | Z     | Z     | Z     |
|                    | X            | H            | X     | X           | X     | X     | X   | X | X | X | Z       | Z     | Z     | Z     | Z     | Z     | Z     | Z     |
| Disable            | L            | L            | H     | X           | X     | X     | L   | X | X | X | L       | L     | L     | L     | L     | L     | L     | L     |
|                    | L            | L            | H     | X           | X     | X     | H   | X | X | X | H       | H     | H     | H     | H     | H     | H     | H     |
|                    | L            | L            | X     | H           | X     | X     | L   | X | X | X | L       | L     | L     | L     | L     | L     | L     | L     |
|                    | L            | L            | X     | H           | X     | X     | H   | X | X | X | H       | H     | H     | H     | H     | H     | H     | H     |
|                    | L            | L            | X     | X           | L     | X     | L   | X | X | X | L       | L     | L     | L     | L     | L     | L     | L     |
|                    | L            | L            | X     | X           | L     | X     | H   | X | X | X | H       | H     | H     | H     | H     | H     | H     | H     |
|                    | L            | L            | X     | X           | L     | X     | L   | X | X | X | L       | L     | L     | L     | L     | L     | L     | L     |
|                    | L            | L            | X     | X           | L     | X     | H   | X | X | X | H       | H     | H     | H     | H     | H     | H     | H     |
| Active-HIGH Output | L            | L            | L     | L           | H     | H     | L   | L | L | L | H       | L     | L     | L     | L     | L     | L     | L     |
|                    | L            | L            | L     | L           | H     | H     | L   | L | L | H | L       | L     | L     | L     | L     | L     | L     | L     |
|                    | L            | L            | L     | L           | H     | H     | L   | L | L | H | L       | L     | L     | L     | L     | L     | L     | L     |
|                    | L            | L            | L     | L           | H     | H     | L   | L | L | H | L       | L     | L     | L     | L     | L     | L     | L     |
|                    | L            | L            | L     | L           | H     | H     | L   | L | L | H | L       | L     | L     | L     | L     | L     | L     | L     |
|                    | L            | L            | L     | L           | H     | H     | L   | L | L | H | L       | L     | L     | L     | L     | L     | L     | L     |
|                    | L            | L            | L     | L           | H     | H     | L   | L | L | H | L       | L     | L     | L     | L     | L     | L     | L     |
|                    | L            | L            | L     | L           | H     | H     | L   | L | L | H | L       | L     | L     | L     | L     | L     | L     | L     |
| Active-LOW Output  | L            | L            | L     | L           | H     | H     | H   | L | L | L | H       | H     | H     | H     | H     | H     | H     | H     |
|                    | L            | L            | L     | L           | H     | H     | H   | L | L | H | H       | H     | H     | H     | H     | H     | H     | H     |
|                    | L            | L            | L     | L           | H     | H     | H   | L | L | H | H       | H     | H     | H     | H     | H     | H     | H     |
|                    | L            | L            | L     | L           | H     | H     | H   | L | L | H | H       | H     | H     | H     | H     | H     | H     | H     |
|                    | L            | L            | L     | L           | H     | H     | H   | L | L | H | H       | H     | H     | H     | H     | H     | H     | H     |
|                    | L            | L            | L     | L           | H     | H     | H   | L | L | H | H       | H     | H     | H     | H     | H     | H     | H     |
|                    | L            | L            | L     | L           | H     | H     | H   | L | L | H | H       | H     | H     | H     | H     | H     | H     | H     |
|                    | L            | L            | L     | L           | H     | H     | H   | L | L | H | H       | H     | H     | H     | H     | H     | H     | H     |

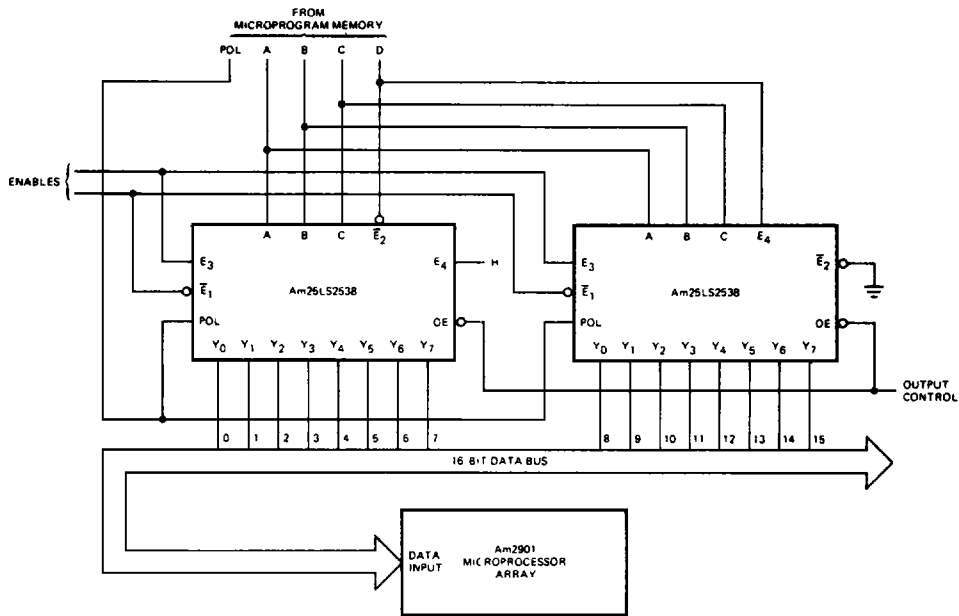
H = HIGH  
 L = LOW  
 X = Don't Care  
 Z = High-Impedance

APPLICATIONS



AF001091

One-of-thirty-two decoder without additional decoding devices.  
Can be used for I/O decoding in an Am9080A system.



AF001081

Two Am25LS2538s can be used to perform a one-of-sixteen-bit mask function or a one-of-sixteen-bit select function to perform bit manipulation in a microprocessor system.

Examples:

| D | C | B | A | POL | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | Function |            |
|---|---|---|---|-----|---|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----------|------------|
| 0 | 0 | 1 | 1 | 0   | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0  | 0  | 0  | 0  | 0  | 0  | 0        | Bit Select |
| 1 | 1 | 0 | 0 | 0   | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0  | 0  | 0  | 0  | 0  | 0  | 0        | Bit Select |
| 0 | 1 | 1 | 0 | 1   | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1  | 1  | 1  | 1  | 1  | 1  | 1        | Bit Mask   |
| 1 | 0 | 1 | 0 | 1   | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0  | 1  | 1  | 1  | 1  | 1  | 1        | Bit Mask   |

**ABSOLUTE MAXIMUM RATINGS**

|  |                               |
|--|-------------------------------|
| Storage Temperature .....                                    | -65°C to +150°C               |
| Ambient Temperature Under Bias .....                         | -55°C to +125°C               |
| Supply Voltage to Ground Potential<br>Continuous .....       | -0.5V to +7.0V                |
| DC Voltage Applied to Outputs For<br>High Output State ..... | -0.5V to +V <sub>CC</sub> max |
| DC Input Voltage .....                                       | -0.5V to +7.0V                |
| DC Output Current, Into Outputs .....                        | 30mA                          |
| DC Input Current .....                                       | -30mA to +5.0mA               |

Stresses above those listed under **ABSOLUTE MAXIMUM RATINGS** may cause permanent device failure. Functionality at or above these limits is not implied. Exposure to absolute maximum ratings for extended periods may affect device reliability.

**OPERATING RANGES**

|                        |                  |
|------------------------|------------------|
| Commercial (C) Devices |                  |
| Temperature .....      | 0°C to +70°C     |
| Supply Voltage .....   | +4.75V to +5.25V |
| Military (M) Devices   |                  |
| Temperature .....      | -55°C to +125°C  |
| Supply Voltage .....   | +4.5V to +5.5V   |

Operating ranges define those limits over which the functionality of the device is guaranteed.

**DC CHARACTERISTICS** over operating range unless otherwise specified

| Parameters      | Description                               | Test Conditions (Note 2)  | Min   | Typ<br>(Note 1) | Max                | Units |
|-----------------|---|---|---|-----------------|--------------------|-------|
| V <sub>OH</sub> | Output HIGH Voltage                       | V <sub>CC</sub> = MIN<br>V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub> | I <sub>OH</sub> = -1.0mA (MIL)<br>I <sub>OH</sub> = -2.6mA (COM'L)            | 2.4<br>2.4      | 3.4<br>3.4         | Volts |
| V <sub>OL</sub> | Output LOW Voltage<br>(Note 5)            | V <sub>CC</sub> = MIN<br>V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub> | I <sub>OL</sub> = 4.0 mA<br>I <sub>OL</sub> = 8.0mA<br>I <sub>OL</sub> = 12mA |                 | 0.4<br>0.45<br>0.5 | Volts |
| V <sub>IH</sub> | Input HIGH Level                          | Guaranteed input logical HIGH voltage for all inputs                          | 2.0   |                 |                    | Volts |
| V <sub>IL</sub> | Input LOW Level                           | Guaranteed input logical LOW voltage for all inputs.                          | MIL<br>COM'L  |                 | 0.7<br>0.8         | Volts |
| V <sub>I</sub>  | Input Clamp Voltage                       | V <sub>CC</sub> = MIN, I <sub>IN</sub> = -18mA                                |   |                 | -1.5               | Volts |
| I <sub>IL</sub> | Input LOW Current                         | V <sub>CC</sub> = MAX, V <sub>IN</sub> = 0.4V                                 |   |                 | -0.36              | mA    |
| I <sub>IH</sub> | Input HIGH Current                        | V <sub>CC</sub> = MAX, V <sub>IN</sub> = 2.7V                                 |   |                 | 20                 | μA    |
| I <sub>I</sub>  | Input HIGH Current                        | V <sub>CC</sub> = MAX, V <sub>IN</sub> = 7.0V                                 |   |                 | 0.1                | mA    |
| I <sub>OZ</sub> | Off-State (High-Impedance) Output Current | V <sub>CC</sub> = MAX   | V <sub>O</sub> = 0.4V<br>V <sub>O</sub> = 2.4V                                |                 | -20<br>20          | μA    |
| I <sub>SC</sub> | Output Short Circuit Current<br>(Note 3)  | V <sub>CC</sub> = MAX   | -15   |                 | -85                | mA    |
| I <sub>CC</sub> | Power Supply Current<br>(Note 4)          | V <sub>CC</sub> = MAX   |   | 21              | 34                 | mA    |

- Notes: 1. Typical limits are at V<sub>CC</sub> = 5.0V, 25°C ambient and maximum loading.  
 2. For conditions shown as MIN or MAX, use the appropriate value specified under Operating Ranges for the applicable device type.  
 3. Not more than one output should be shorted at a time. Duration of the short circuit test should not exceed one second.  
 4. Test conditions: A = B = C = D = E<sub>1</sub> = E<sub>2</sub> = GND; E<sub>3</sub> = E<sub>4</sub> = POL = OE<sub>1</sub> = OE<sub>2</sub> = 4.5V.  
 5. V<sub>OL</sub> is specified with total device I<sub>OL</sub> = 60mA (max).

**SWITCHING CHARACTERISTICS** ( $T_A = +25^\circ\text{C}$ ,  $V_{CC} = 5.0\text{V}$ )

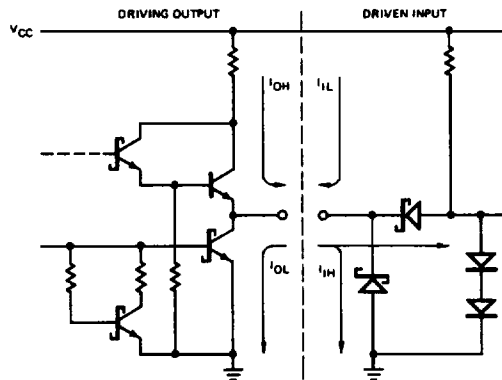
| Parameters | Description                                 | Test Conditions                                  | Min | Typ | Max | Units |
|------------|---|--|-----|-----|-----|-------|
| $t_{PLH}$  | A, B, C to $Y_i$                            | $C_L = 15\text{pF}$<br>$R_L = 2.0\text{k}\Omega$ |     | 20  | 30  | ns    |
| $t_{PHL}$  |   |  | 15  | 22  |     |       |
| $t_{PLH}$  | $E_1, E_2$ to $Y_i$                         |  | 19  | 28  | ns  |       |
| $t_{PHL}$  |   |  | 20  | 30  |     |       |
| $t_{PLH}$  | $E_3, E_4$ to $Y_i$                         |  | 21  | 31  | ns  |       |
| $t_{PHL}$  |   |  | 23  | 34  |     |       |
| $t_{PLH}$  | POL to $Y_i$                                |  | 16  | 24  | ns  |       |
| $t_{PHL}$  |   |  | 20  | 30  |     |       |
| $t_{ZH}$   | $\overline{OE}_1, \overline{OE}_2$ to $Y_i$ |  | 17  | 25  | ns  |       |
| $t_{ZL}$   |   |  | 14  | 21  |     |       |
| $t_{HZ}$   | $\overline{OE}_1, \overline{OE}_2$ to $Y_i$ | $C_L = 5.0\text{pF}$                             | 17  | 25  | ns  |       |
| $t_{LZ}$   |   | $R_L = 2.0\text{k}\Omega$                        | 20  | 30  |     |       |

**SWITCHING CHARACTERISTICS** over operating range unless otherwise specified\*

| Parameters | Description                                 | Test Conditions                                  | COMMERCIAL |     | MILITARY   |     | Units |
|------------|---|--|------------|-----|------------|-----|-------|
|            |   |  | Am25LS2538 |     | Am25LS2538 |     |       |
|            |   |  | Min        | Max | Min        | Max |       |
| $t_{PLH}$  | A, B, C to $Y_i$                            | $C_L = 50\text{pF}$<br>$R_L = 2.0\text{k}\Omega$ |            | 36  |            | 42  | ns    |
| $t_{PHL}$  |   |  | 29         | 37  |            |     |       |
| $t_{PLH}$  | $E_1, E_2$ to $Y_i$                         |  | 34         | 39  | ns         |     |       |
| $t_{PHL}$  |   |  | 38         | 45  |            |     |       |
| $t_{PLH}$  | $E_3, E_4$ to $Y_i$                         |  | 38         | 45  | ns         |     |       |
| $t_{PHL}$  |   |  | 43         | 52  |            |     |       |
| $t_{PLH}$  | POL to $Y_i$                                |  | 29         | 34  | ns         |     |       |
| $t_{PHL}$  |   |  | 39         | 49  |            |     |       |
| $t_{ZH}$   | $\overline{OE}_1, \overline{OE}_2$ to $Y_i$ |  | 38         | 45  | ns         |     |       |
| $t_{ZL}$   |   |  | 23         | 25  |            |     |       |
| $t_{HZ}$   | $\overline{OE}_1, \overline{OE}_2$ to $Y_i$ | $C_L = 5.0\text{pF}$                             | 29         | 33  | ns         |     |       |
| $t_{LZ}$   |   | $R_L = 2.0\text{k}\Omega$                        | 33         | 36  |            |     |       |

\*AC performance over the operating temperature range is guaranteed by testing defined in Group A, Subgroup 9.

### Am25LS2538 LOW-POWER SCHOTTKY INPUT/OUTPUT CURRENT INTERFACE CONDITIONS



IC000090

Note: Actual current flow direction shown.