

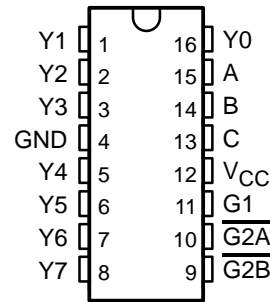
74AC11138

3-LINE TO 8-LINE DECODER/DEMULTIPLEXER

SCAS042B – MAY 1988 – REVISED APRIL 1996

- Designed Specifically for High-Speed Memory Decoders and Data Transmission Systems
- Incorporates Three Enable Inputs to Simplify Cascading and/or Data Reception
- Center-Pin V_{CC} and GND Configurations Minimize High-Speed Switching Noise
- **EPIC™** (Enhanced-Performance Implanted CMOS) 1- μ m Process
- 500-mA Typical Latch-Up Immunity at 125°C
- Package Options Include Plastic Small-Outline (D) and Thin Shrink Small-Outline (PW) Packages, and Standard Plastic 300-mil DIPs (N)

D, N, OR PW PACKAGE
(TOP VIEW)



description

The 74AC11138 circuit is designed to be used in high-performance memory-decoding or data-routing applications requiring very short propagation delay times. In high-performance memory systems, this decoder can be used to minimize the effects of system decoding. When employed with high-speed memories utilizing a fast enable circuit, the delay times of this decoder and the enable time of the memory are usually less than the typical access time of the memory. This means that the effective system delay introduced by the decoder is negligible.

The conditions at the binary-select (A, B, C) inputs and the three enable ($G1$, $\overline{G2A}$, $\overline{G2B}$) inputs select one of eight output lines. Two active-low and one active-high enable inputs reduce the need for external gates or inverters when expanding. A 24-line decoder can be implemented without external inverters and a 32-line decoder requires only one inverter. An enable input can be used as a data input for demultiplexing applications.

The 74AC11138 is characterized for operation from -40°C to 85°C.

FUNCTION TABLE

| ENABLE INPUTS | | | SELECT INPUTS | | | OUTPUTS | | | | | | | |
|---------------|------------------|------------------|---------------|---|---|---------|----|----|----|----|----|----|----|
| $G1$ | $\overline{G2A}$ | $\overline{G2B}$ | C | B | A | Y0 | Y1 | Y2 | Y3 | Y4 | Y5 | Y6 | Y7 |
| X | H | X | X | X | X | H | H | H | H | H | H | H | H |
| X | X | H | X | X | X | H | H | H | H | H | H | H | H |
| L | X | X | X | X | X | H | H | H | H | H | H | H | H |
| H | L | L | L | L | L | L | H | H | H | H | H | H | H |
| H | L | L | L | L | H | H | L | H | H | H | H | H | H |
| H | L | L | L | H | L | H | H | L | H | H | H | H | H |
| H | L | L | L | H | H | H | H | L | H | H | H | H | H |
| H | L | L | H | L | L | H | H | H | H | L | H | H | H |
| H | L | L | H | L | H | H | H | H | H | H | L | H | H |
| H | L | L | H | H | L | H | H | H | H | H | H | L | H |
| H | L | L | H | H | H | H | H | H | H | H | H | H | L |



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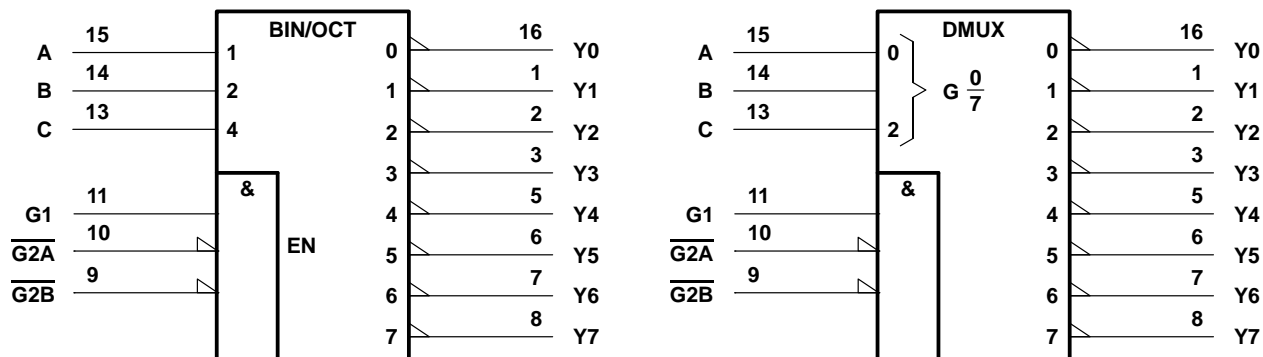
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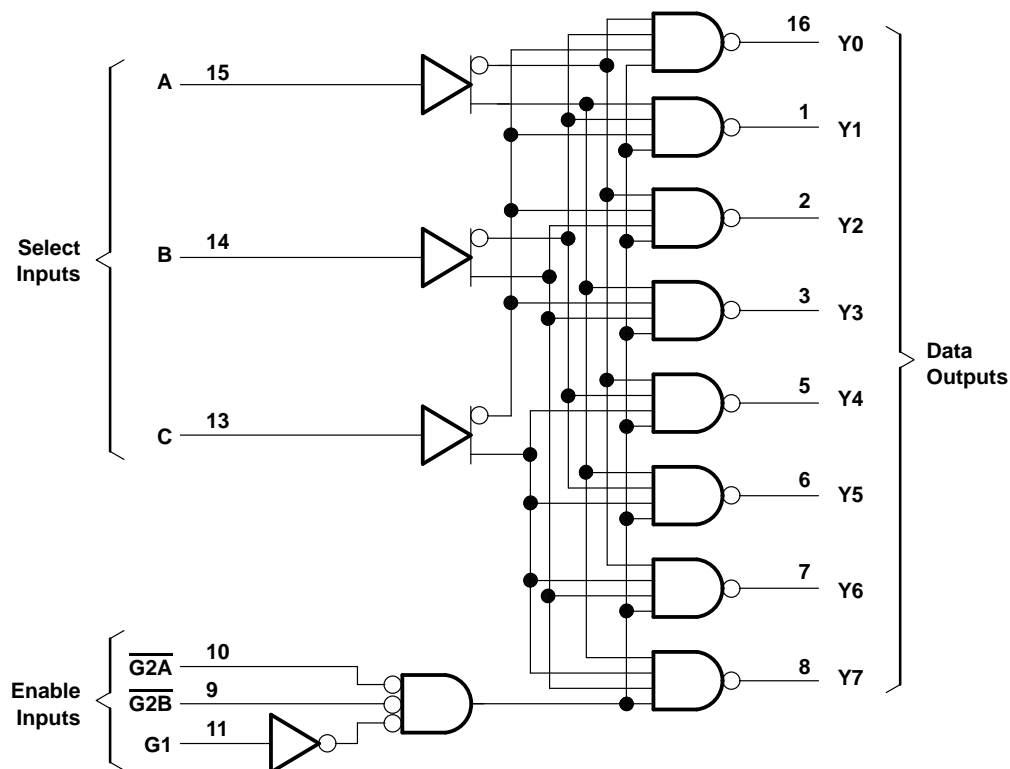
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logic symbols (alternatives)†



† These symbols are in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.

logic diagram (positive logic)



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absolute maximum ratings over operating free-air temperature range (unless otherwise noted)[†]

| | |
|--|----------------------------|
| Supply voltage range, V_{CC} | –0.5 V to 7 V |
| Input voltage range, V_I (see Note 1) | –0.5 V to $V_{CC} + 0.5$ V |
| Output voltage range, V_O (see Note 1) | –0.5 V to $V_{CC} + 0.5$ V |
| Input clamp current, I_{IK} ($V_I < 0$ or $V_I > V_{CC}$) | ±20 mA |
| Output clamp current, I_{OK} ($V_O < 0$ or $V_O > V_{CC}$) | ±50 mA |
| Continuous output current, I_O ($V_O = 0$ to V_{CC}) | ±50 mA |
| Continuous current through V_{CC} or GND | ±200 mA |
| Maximum power dissipation at $T_A = 55^\circ\text{C}$ (in still air) (see Note 2): | |
| D package | 1.3 W |
| N package | 1.1 W |
| PW package | 0.5 W |
| Storage temperature range, T_{stg} | –65°C to 150°C |

[†] Stresses beyond those listed under “absolute maximum ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

- NOTES: 1. The input and output voltage ratings may be exceeded if the input and output current ratings are observed.
2. The maximum package power dissipation is calculated using a junction temperature of 150°C and a board trace length of 750 mils, except for the N package, which has a trace length of zero.

recommended operating conditions

| | | MIN | NOM | MAX | UNIT |
|---------------------|------------------------------------|------------------|------|----------|------|
| V_{CC} | Supply voltage | 3 | 5 | 5.5 | V |
| V_{IH} | High-level input voltage | $V_{CC} = 3$ V | 2.1 | | V |
| | | $V_{CC} = 4.5$ V | 3.15 | | |
| | | $V_{CC} = 5.5$ V | 3.85 | | |
| V_{IL} | Low-level input voltage | $V_{CC} = 3$ V | | 0.9 | V |
| | | $V_{CC} = 4.5$ V | | 1.35 | |
| | | $V_{CC} = 5.5$ V | | 1.65 | |
| V_I | Input voltage | 0 | | V_{CC} | V |
| V_O | Output voltage | 0 | | V_{CC} | V |
| I_{OH} | High-level output current | $V_{CC} = 3$ V | | –4 | mA |
| | | $V_{CC} = 4.5$ V | | –24 | |
| | | $V_{CC} = 5.5$ V | | –24 | |
| I_{OL} | Low-level output current | $V_{CC} = 3$ V | | 12 | mA |
| | | $V_{CC} = 4.5$ V | | 24 | |
| | | $V_{CC} = 5.5$ V | | 24 | |
| $\Delta t/\Delta v$ | Input transition rise or fall rate | 0 | | 10 | ns/V |
| T_A | Operating free-air temperature | –40 | | 85 | °C |



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electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)

| PARAMETER | TEST CONDITIONS | V _{CC} | T _A = 25°C | | | MIN | MAX | UNIT |
|-----------------|---|-----------------|-----------------------|-----|------|------|------|------|
| | | | MIN | TYP | MAX | | | |
| V _{OH} | I _{OH} = -50 µA | 3 V | 2.9 | | | 2.9 | | V |
| | | 4.5 V | 4.4 | | | 4.4 | | |
| | | 5.5 V | 5.4 | | | 5.4 | | |
| | I _{OH} = -4 mA | 3 V | 2.58 | | | 2.48 | | |
| | | 4.5 V | 3.94 | | | 3.8 | | |
| | | 5.5 V | 4.94 | | | 4.8 | | |
| | | 5.5 V | | | | 3.85 | | |
| V _{OL} | I _{OL} = 50 µA | 3 V | | | 0.1 | | 0.1 | V |
| | | 4.5 V | | | 0.1 | | 0.1 | |
| | | 5.5 V | | | 0.1 | | 0.1 | |
| | I _{OL} = 12 mA | 3 V | | | 0.36 | | 0.44 | |
| | | 4.5 V | | | 0.36 | | 0.44 | |
| | I _{OL} = 24 mA | 5.5 V | | | 0.36 | | 0.44 | |
| | | 5.5 V | | | | | 1.65 | |
| I _I | V _I = V _{CC} or GND | 5.5 V | | | ±0.1 | | ±1 | µA |
| I _{CC} | V _I = V _{CC} or GND, I _O = 0 | 5.5 V | | | 4 | | 40 | µA |
| C _i | V _I = V _{CC} or GND | 5 V | | 3.5 | | | | pF |

† Not more than one output should be tested at a time, and the duration of the test should not exceed 10 ms.

switching characteristics over recommended operating free-air temperature range, V_{CC} = 3.3 V ± 0.3 V (unless otherwise noted) (see Figure 1)

| PARAMETER | FROM (INPUT) | TO (OUTPUT) | T _A = 25°C | | | MIN | MAX | UNIT |
|------------------|-------------------------------------|-------------|-----------------------|-----|------|-----|------|------|
| | | | MIN | TYP | MAX | | | |
| t _{PLH} | A, B, C | Any Y | 1.5 | 8.3 | 10.2 | 1.5 | 11.4 | ns |
| t _{PHL} | | | 1.5 | 8.9 | 10.9 | 1.5 | 12.2 | |
| t _{PLH} | G1 | Any Y | 1.5 | 7.2 | 9.2 | 1.5 | 10.2 | ns |
| t _{PHL} | | | 1.5 | 7.3 | 9.4 | 1.5 | 10.5 | |
| t _{PLH} | $\overline{G2A}$, $\overline{G2B}$ | Any Y | 1.5 | 8.2 | 10.4 | 1.5 | 11.5 | ns |
| t _{PHL} | | | 1.5 | 8.3 | 10.4 | 1.5 | 11.6 | |

switching characteristics over recommended operating free-air temperature range, V_{CC} = 5 V ± 0.5 V (unless otherwise noted) (see Figure 1)

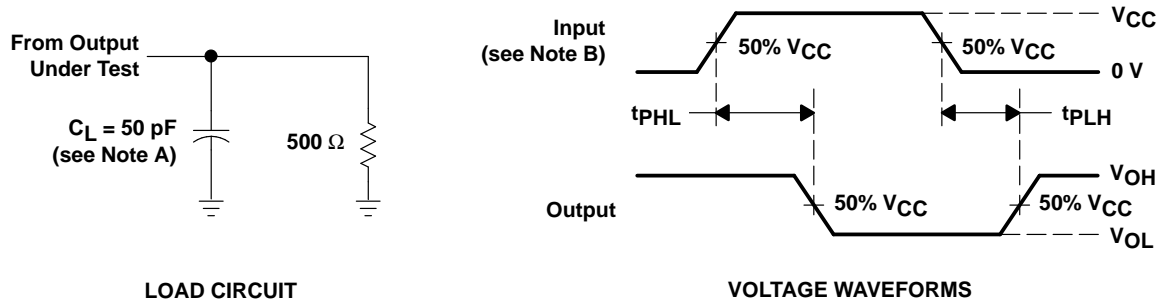
| PARAMETER | FROM (INPUT) | TO (OUTPUT) | T _A = 25°C | | | MIN | MAX | UNIT |
|------------------|-------------------------------------|-------------|-----------------------|-----|-----|-----|-----|------|
| | | | MIN | TYP | MAX | | | |
| t _{PLH} | A, B, C | Any Y | 1.5 | 5.7 | 7.3 | 1.5 | 8.1 | ns |
| t _{PHL} | | | 1.5 | 6.2 | 7.9 | 1.5 | 8.8 | |
| t _{PLH} | G1 | Any Y | 1.5 | 5.1 | 6.9 | 1.5 | 7.5 | ns |
| t _{PHL} | | | 1.5 | 5.2 | 6.9 | 1.5 | 7.7 | |
| t _{PLH} | $\overline{G2A}$, $\overline{G2B}$ | Any Y | 1.5 | 5.8 | 7.6 | 1.5 | 8.3 | ns |
| t _{PHL} | | | 1.5 | 5.6 | 7.5 | 1.5 | 8.3 | |



operating characteristics, $V_{CC} = 5\text{ V}$, $T_A = 25^\circ\text{C}$

| PARAMETER | TEST CONDITIONS | TYP | UNIT |
|---|---|-----|------|
| C_{pd} Power dissipation capacitance per gate | $C_L = 50\text{ pF}$, $f = 1\text{ MHz}$ | 51 | pF |

PARAMETER MEASUREMENT INFORMATION



- NOTES: A. C_L includes probe and jig capacitance.
 B. Input pulses are supplied by generators having the following characteristics: $PRR \leq 1\text{ MHz}$, $Z_O = 50\ \Omega$, $t_r = 3\text{ ns}$, $t_f = 3\text{ ns}$.
 C. The outputs are measured one at a time with one input transition per measurement.

Figure 1. Load Circuit and Voltage Waveforms

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APPLICATION INFORMATION

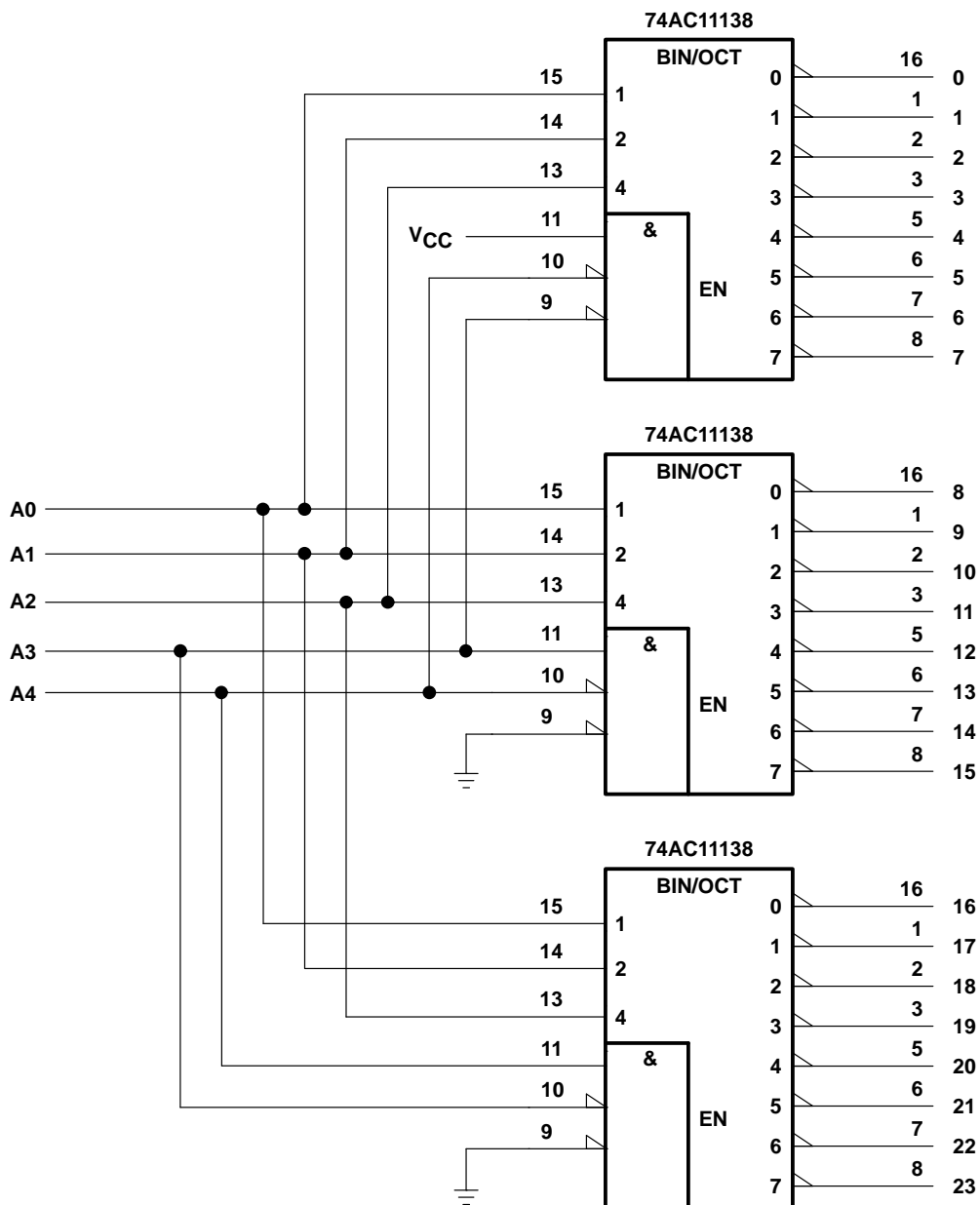


Figure 2. 24-Bit Decoding Scheme

APPLICATION INFORMATION

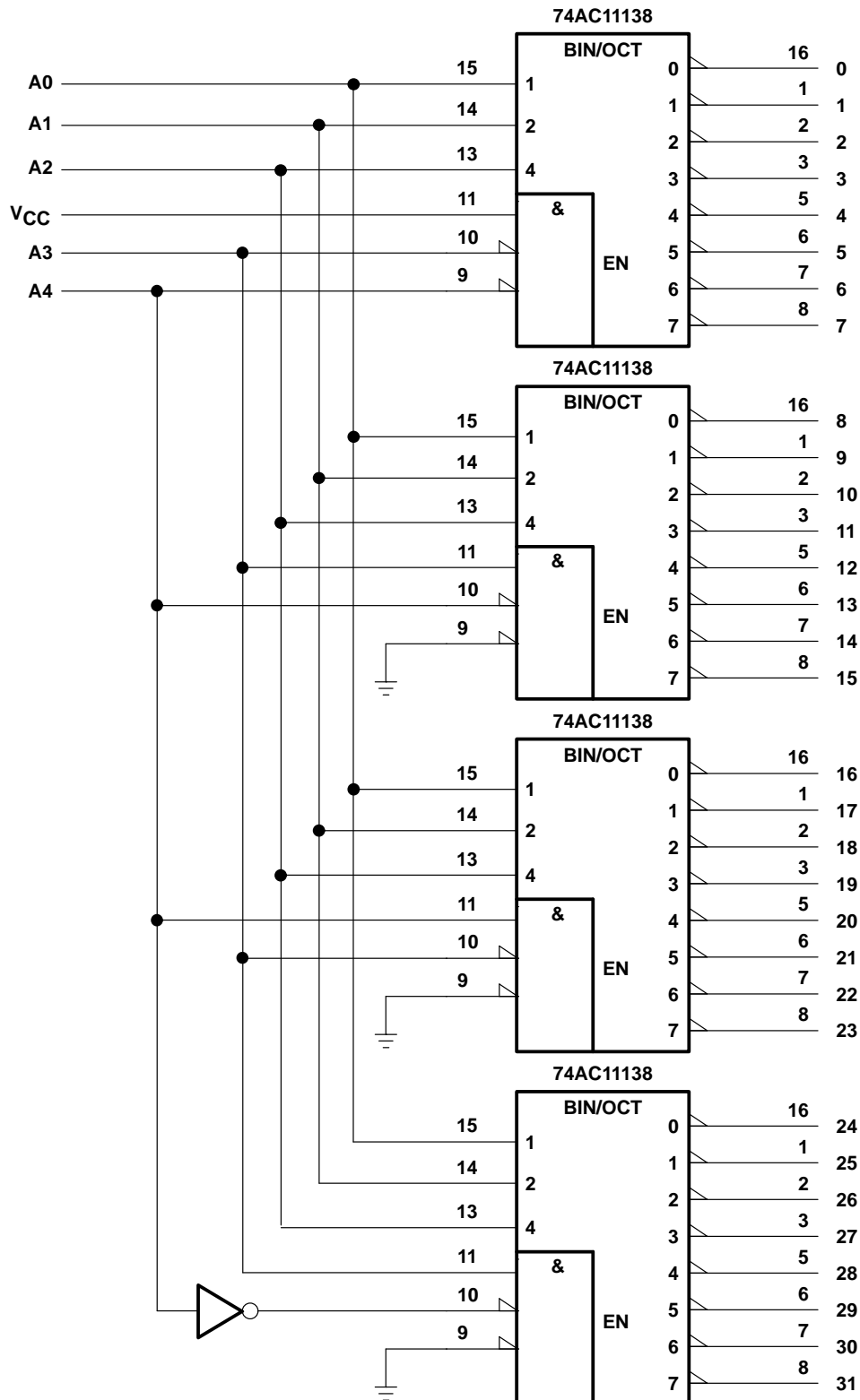


Figure 3. 32-Bit Decoding Scheme

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