



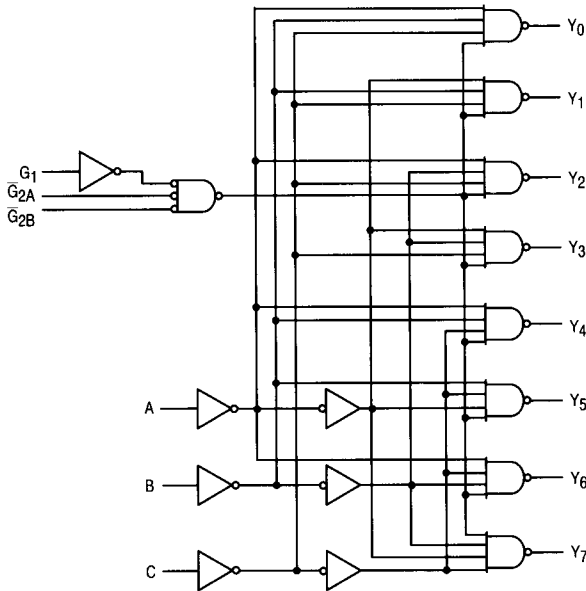
Single 3-of-8 Line Decoder

ELECTRICALLY TESTED PER:
MIL-M-38510/30701

The 54LS138 is a high-speed 1-of-8 Decoder/Demultiplexer. This device is ideally suited for high-speed bipolar memory chip select address decoding. The multiple input enables allow parallel expansion to a 1-of-24 decoder using just three 'LS138 devices or to a 1-of-32 decoder using four 'LS138's and one inverter. The 'LS138 is fabricated with the Schottky barrier diode process for high speed and is completely compatible with all Motorola TTL families.

- Demultiplexing Capability
- Multiple Input Enable For Easy Expansion
- Typical Power Dissipation of 32 mW
- Active Low Mutually Exclusive Outputs
- Input Clamp Diodes Limit High-Speed Termination Effect

LOGIC DIAGRAM



Military 54LS138



AVAILABLE AS:

- 1) JAN: JM38510/30701BXA
- 2) SMD: 760051
- 3) 883: 54LS138/BXAJC

X = CASE OUTLINE AS FOLLOWS:
PACKAGE: CERDIP: E
CERFLAT: F
LCC: 2

THE LETTER "M" APPEARS BEFORE THE / ON LCC.

PIN ASSIGNMENTS

| FUNCT. | DIL 620-09 | FLATS 650-05 | LCC 756A-02 | BURN-IN (COND. A) |
|-------------|------------|--------------|-------------|-------------------|
| A | 1 | 1 | 2 | VCC |
| B | 2 | 2 | 3 | VCC |
| C | 3 | 3 | 4 | VCC |
| $\bar{G}2A$ | 4 | 4 | 5 | VCC |
| $\bar{G}2B$ | 5 | 5 | 7 | VCC |
| G1 | 6 | 6 | 8 | VCC |
| Y7 | 7 | 7 | 9 | VCC |
| GND | 8 | 8 | 10 | GND |
| Y6 | 9 | 9 | 12 | VCC |
| Y5 | 10 | 10 | 13 | VCC |
| Y4 | 11 | 11 | 14 | VCC |
| Y3 | 12 | 12 | 15 | VCC |
| Y2 | 13 | 13 | 17 | VCC |
| Y1 | 14 | 14 | 18 | VCC |
| Y0 | 15 | 15 | 19 | VCC |
| VCC | 16 | 16 | 20 | VCC |

BURN-IN CONDITIONS:
VCC = 5.0 V MIN/6.0 V MAX

FUNCTIONAL DESCRIPTION

The 'LS138 is a high-speed dual 1-of-8 Decoder/ Demultiplexer fabricated with the low power Schottky barrier diode process. The decoder accepts three binary weighted inputs (A, B, C) and when enabled provides eight mutually exclusive active LOW outputs (\bar{Y}_0 , \bar{Y}_7). The 'LS138 features three Enable inputs, two active LOW (\bar{G}_{2A} , \bar{G}_{2B}) and one active HIGH (G_1). All outputs will be HIGH unless \bar{G}_{2A} and \bar{G}_{2B} are LOW and G_1 is HIGH. This multiple enable function allows

easy parallel expansion of the device to a 1-of-32 (5 lines to 32 lines) decoder with just four 'LS138s and one inverter.

The 'LS138 can be used as an 8-output demultiplexer by using one of the active LOW enable inputs as a data input and the other Enable inputs as strobes. The Enable inputs which are not used must be permanently tied to their appropriate active HIGH or active LOW state.

| TRUTH TABLE | | | | | | | | | | | | | |
|----------------|----------------|-------|---|---|---|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| Inputs | | | | | | Outputs | | | | | | | |
| \bar{G}_{2A} | \bar{G}_{2B} | G_1 | A | B | C | \bar{Y}_0 | \bar{Y}_1 | \bar{Y}_2 | \bar{Y}_3 | \bar{Y}_4 | \bar{Y}_5 | \bar{Y}_6 | \bar{Y}_7 |
| H | X | X | X | X | X | H | H | H | H | H | H | H | H |
| X | H | X | X | X | X | H | H | H | H | H | H | H | H |
| X | X | L | X | X | X | H | H | H | H | H | H | H | H |
| L | L | H | L | L | L | L | H | H | H | H | H | H | H |
| L | L | H | H | L | L | H | L | H | H | H | H | H | H |
| L | L | H | L | H | L | H | H | L | H | H | H | H | H |
| L | L | H | H | H | L | H | H | H | L | H | H | H | H |
| L | L | H | L | L | 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 | L | H | H | H | H | H | H | H | H | L | H |
| L | L | H | H | H | H | H | H | H | H | H | H | H | L |

H = HIGH Voltage Levels

L = LOW Voltage Levels

X = Don't Care

| Pin Names | Loading (Note a) | |
|--|------------------|-------------|
| | HIGH | LOW |
| A, B, C Address Inputs | 0.5 U.L. | 0.25 U.L. |
| $\bar{G}_{2A,B}$ Enable (Active LOW) Input | 0.5 U.L. | 0.25 U.L. |
| G_1 Enable (Active HIGH) Inputs | 0.5 U.L. | 0.25 U.L. |
| \bar{Y}_0, \bar{Y}_3 Active Low Outputs | 10 U.L. | 5(2.5) U.L. |

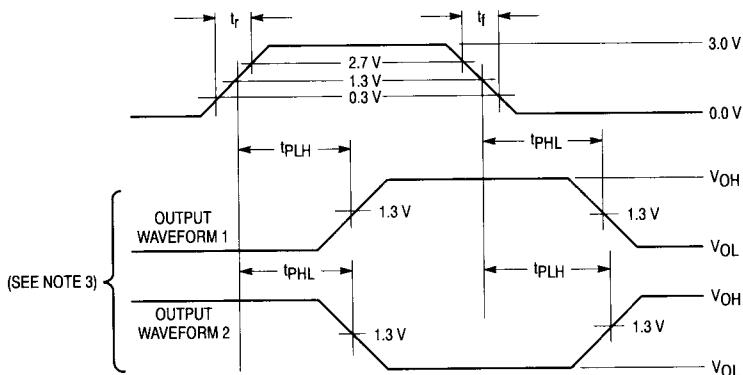
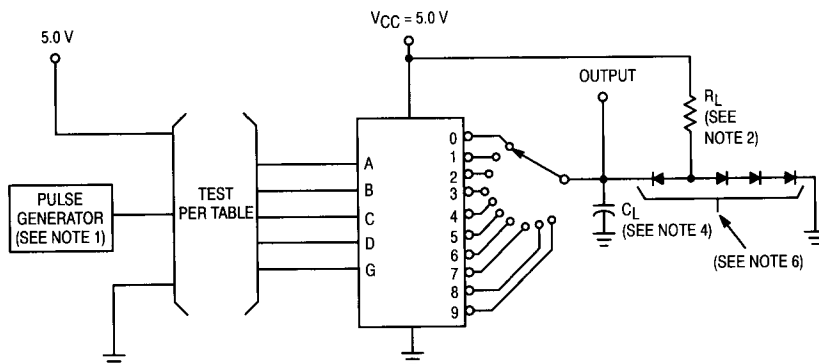
NOTES:

a. One TTL Unit Load (U.L.) = 40 μ A HIGH/1.6 mA LOW.

b. The Output LOW drive factor is 2.5 U.L. for Military (54) Temperature Ranges.

54LS138

TEST CIRCUIT AND WAVEFORM



NOTES:

1. Input pulse has the following characteristics:
 $t_r \leq 15 \text{ ns}$, $t_f \leq 6.0 \text{ ns}$, $\text{PRR} \leq 1.0 \text{ MHz}$ and minimum duty cycle = 50%.
2. $R_L = 2.0 \text{ k}\Omega \pm 10\%$.
3. Input-output waveform combination in accordance with truth table.
4. $C_L = 50 \text{ pF} \pm 10\%$, including scope probe, wiring and stray capacitance.
5. Voltage measurements are to be made with respect to network ground terminal.
6. All diodes are 1N3064 or equivalent.
7. The limits specified for $C_L = 15 \text{ pF}$ are guaranteed but not tested.

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| Symbol | Parameter | Limits | | | | | | Unit | Test Condition (Unless Otherwise Specified) |
|------------------|------------------------------|------------|-------|-------------|-------|-------------|-------|------|---|
| | | + 25°C | | + 125°C | | - 55°C | | | |
| | | Subgroup 1 | | Subgroup 2 | | Subgroup 3 | | | |
| | | Min | Max | Min | Max | Min | Max | | |
| V _{OH} | Logical "1" Output Voltage | 2.5 | | 2.5 | | 2.5 | | V | V _{CC} = 4.5 V, I _{OH} = -0.4 mA, G ₁ = 0.7 V, other inputs are open. |
| V _{OL} | Logical "0" Output Voltage | | 0.4 | | 0.4 | | 0.4 | V | V _{CC} = 4.5 V, I _{OL} = 4.0 mA, V _{IL} = 0.7 V, V _{IH} = 2.0 V, G ₁ = 0.7 V, G _{2A,B} = 0.7 V. |
| V _{IC} | Input Clamping Voltage | | -1.5 | | | | | V | V _{CC} = 4.5 V, I _{IJ} = -18 mA, other inputs are open. |
| I _{IH} | Logical "1" Input Current | | 20 | | 20 | | 20 | μA | V _{CC} = 5.5 V, V _{IH} = 2.7 V (all inputs). |
| I _{IHH} | Logical "1" Input Current | | 100 | | 100 | | 100 | μA | V _{CC} = 5.5 V, V _{IHH} = 5.5 V (all inputs). |
| I _{IL} | Logical "0" Input Current | -0.12 | -0.36 | -0.12 | -0.36 | -0.12 | -0.36 | mA | V _{CC} = 5.5 V, V _{IN} = 0.4 V (all inputs). |
| I _{OS} | Output Short Circuit Current | -15 | -100 | -15 | -100 | -15 | -100 | mA | V _{CC} = 5.5 V, V _{IN} = 5.5 V (G _{2A,B}), V _{OUT} = GND, other inputs are open. |
| I _{CC} | Power Supply Current Off | | 10 | | 10 | | 10 | mA | V _{CC} = 5.5 V, V _{IN} = 5.5 V (G ₁), G _{2A/B} = GND |
| V _{IH} | Logical "1" Input Voltage | 2.0 | | 2.0 | | 2.0 | | V | V _{CC} = 4.5 V. |
| V _{IL} | Logical "0" Input Voltage | | 0.7 | | 0.7 | | 0.7 | V | V _{CC} = 4.5 V. |
| | Functional Tests | Subgroup 7 | | Subgroup 8A | | Subgroup 8B | | | per Truth Table with V _{CC} = 5.0 V, V _{INL} = 0.4 V, and V _{INH} = 2.5 V. |
| | | | | | | | | | |

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| Symbol | Parameter | Limits | | | | | | Unit | Test Condition (Unless Otherwise Specified) |
|--|---|------------|----------|-------------|----------|-------------|----------|------|---|
| | | + 25°C | | + 125°C | | - 55°C | | | |
| | | Subgroup 9 | | Subgroup 10 | | Subgroup 11 | | | |
| | | Min | Max | Min | Max | Min | Max | | |
| t _{PHL2} t _{PLH2} | Propagation Delay /Data-Output High-Low | 5.0 — | 46 41 | 5.0 — | 69 64 | 5.0 — | 69 64 | ns | V _{CC} = 5.0 V, C _L = 50 pF, R _L = 2.0 kΩ. V _{CC} = 5.0 V, C _L = 15 pF. |
| t _{PLH2} t _{PLH2} | Propagation Delay /Data-Output Low-High | 5.0 — | 25 20 | 5.0 — | 38 33 | 5.0 — | 38 33 | ns | V _{CC} = 5.0 V, C _L = 50 pF, R _L = 2.0 kΩ. V _{CC} = 5.0 V, C _L = 15 pF. |
| t _{PHL3} t _{PLH3} | Propagation Delay /Data-Output High-Low | 5.0 — | 37 39 | 5.0 — | 56 51 | 5.0 — | 56 51 | ns | V _{CC} = 5.0 V, C _L = 50 pF, R _L = 2.0 kΩ. V _{CC} = 5.0 V, C _L = 15 pF. |
| t _{PLH3} t _{PLH3} | Propagation Delay /Data-Output Low-High | 5.0 — | 23 27 | 5.0 — | 35 30 | 5.0 — | 35 30 | ns | V _{CC} = 5.0 V, C _L = 50 pF, R _L = 2.0 kΩ. V _{CC} = 5.0 V, C _L = 15 pF. |
| t _{PHL4} t _{PLH4} | Propagation Delay /Data-Output High-Low | 5.0 — | 54 32 | 5.0 — | 81 76 | 5.0 — | 81 76 | ns | V _{CC} = 5.0 V, C _L = 50 pF, R _L = 2.0 kΩ. V _{CC} = 5.0 V, C _L = 15 pF. |
| t _{PLH4} t _{PLH4} | Propagation Delay /Data-Output Low-High | 5.0 — | 32 18 | 5.0 — | 48 43 | 5.0 — | 48 43 | ns | V _{CC} = 5.0 V, C _L = 50 pF, R _L = 2.0 kΩ. V _{CC} = 5.0 V, C _L = 15 pF. |
| t _{PHL5} t _{PLH5} | Propagation Delay /Data-Output High-Low | 5.0 — | 43 38 | 5.0 — | 65 61 | 5.0 — | 65 61 | ns | V _{CC} = 5.0 V, C _L = 50 pF, R _L = 2.0 kΩ. V _{CC} = 5.0 V, C _L = 15 pF. |
| t _{PLH5} t _{PLH5} | Propagation Delay /Data-Output Low-High | 5.0 — | 31 26 | 5.0 — | 47 42 | 5.0 — | 47 42 | ns | V _{CC} = 5.0 V, C _L = 50 pF, R _L = 2.0 kΩ. V _{CC} = 5.0 V, C _L = 15 pF. |