**UNISONIC TECHNOLOGIES CO., LTD**

# U74HC238

*CMOS IC*

# 3 TO 8 LINE DECODER/DEMULTIPLEXER

■ **DESCRIPTION**

The **U74HC238** decodes three binary weighted address inputs (A0, A1 and A2) to eight mutually exclusive outputs (Y0 to Y7). The device features three enable inputs ($\overline{E}1$ and $\overline{E}2$ and E3). Every output will be LOW unless $\overline{E}1$ and $\overline{E}2$ are LOW and E3 is HIGH. This multiple enable function allows easy parallel expansion to a 1-of-32 (5 to 32 lines) decoder with just four **U74HC238** ICs and one inverter. The **U74HC238** can be used as an eight output demultiplexer by using one of the active LOW enable inputs as the data input and the remaining enable inputs as strobes. Inputs include clamp diodes. This enables the use of current limiting resistors to interface inputs to voltages in excess of $V_{CC}$.
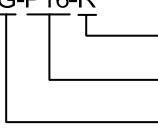
TSSOP-16

■ **FEATURES**
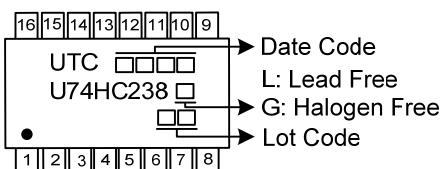
* Demultiplexing capability
* Multiple input enable for easy expansion
* Ideal for memory chip select decoding
* Active HIGH mutually exclusive outputs

■ **ORDERING INFORMATION**
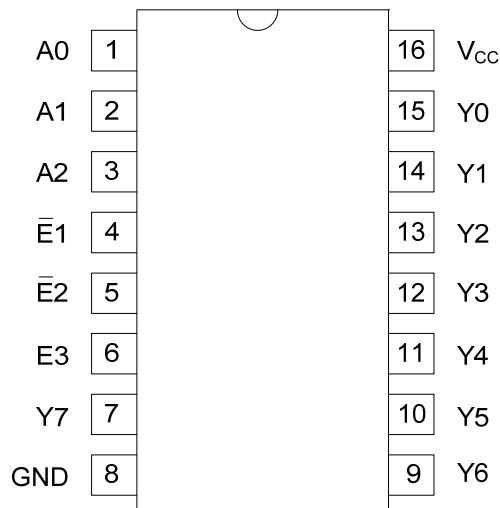
| Ordering Number | | Package | Packing |
|---|---|---|---|
| Lead Free | Halogen Free | | |
| U74HC238L-P16-R | U74HC238G-P16-R | TSSOP-16 | Tape Reel |

U74HC238G-P16-R

- (1)Packing Type
- (2)Package Type
- (3)Green Package

(1) R: Tape Reel

(2) P16: TSSOP-16

(3) G: Halogen Free and Lead Free, L: Lead Free

■ **MARKING**

UTC ☐☐☐☐
U74HC238 ☐

→ Date Code
L: Lead Free
→ G: Halogen Free
→ Lot Code

# U74HC238

CMOS IC

■ **PIN CONFIGURATION**

```
        ┌──────⌣──────┐
 A0 │ 1            16 │ V_CC
 A1 │ 2            15 │ Y0
 A2 │ 3            14 │ Y1
 Ē1 │ 4            13 │ Y2
 Ē2 │ 5            12 │ Y3
 E3 │ 6            11 │ Y4
 Y7 │ 7            10 │ Y5
GND │ 8             9 │ Y6
        └─────────────┘
```
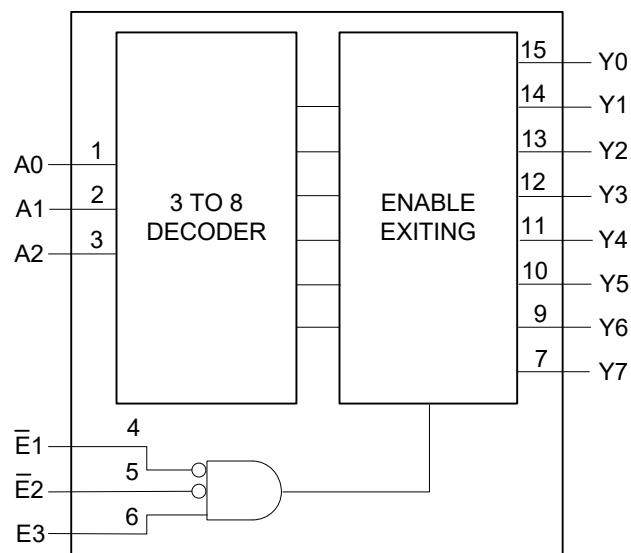
■ **FUNCTION TABLE**
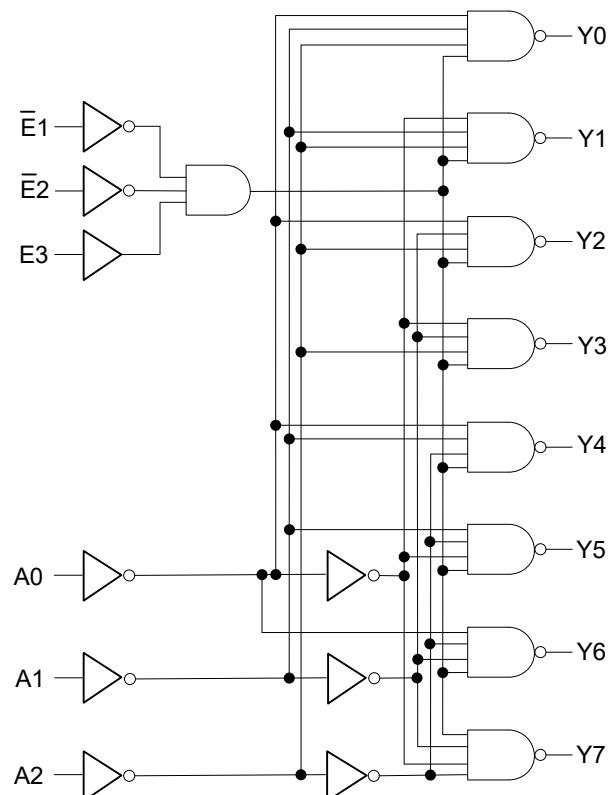
| $\overline{E}1$ | $\overline{E}2$ | E3 | A0 | A1 | A2 | Y0 | Y1 | Y2 | Y3 | Y4 | Y5 | Y6 | Y7 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| H | X | X | X | X | X | L | L | L | L | L | L | L | L |
| X | H | X | X | X | X | L | L | L | L | L | L | L | L |
| X | X | L | X | X | X | L | L | L | L | L | L | L | L |
| L | L | H | L | L | L | H | L | L | L | L | L | L | L |
| L | L | H | H | L | L | L | H | L | L | L | L | L | L |
| L | L | H | L | H | L | L | L | H | L | L | L | L | L |
| L | L | H | H | H | L | L | L | L | H | L | L | L | L |
| L | L | H | L | L | H | L | L | L | L | H | L | L | L |
| L | L | H | H | L | H | L | L | L | L | L | H | L | L |
| L | L | H | L | H | H | L | L | L | L | L | L | H | L |
| L | L | H | H | H | H | L | L | L | L | L | L | L | H |

H = High Voltage level；L = Low Voltage level；X = Don't care

# U74HC238

■ **LOGIC SYMBOL**



■ **FUNCTION DIAGRAM**

# U74HC238

■ **ABSOLUTE MAXIMUM RATING**

| PARAMETER | SYMBOL | CONDITIONS | RATINGS | UNIT |
|---|---|---|---|---|
| Supply Voltage | $V_{CC}$ | | -0.5 ~ 7 | V |
| Continuous Output Current | $I_{OUT}$ | $-0.5V < V_{OUT} < V_{CC} + 0.5V$ | ±25 | mA |
| Input Clamp Current | $I_{IK}$ | $V_{IN} < -0.5V$ or $V_{IN} > V_{CC} + 0.5V$ | ±20 | mA |
| Output Clamp Current | $I_{OK}$ | $V_{OUT} < -0.5V$ or $V_{OUT} > V_{CC} + 0.5V$ | ±20 | mA |
| Supply Current | $I_{CC}$ | | 50 | mA |
| Ground Current | $I_{GND}$ | | -50 | mA |
| Storage Temperature Range | $T_{STG}$ | | -65 ~ +150 | °C |

Note: Absolute maximum ratings are those values beyond which the device could be permanently damaged. Absolute maximum ratings are stress ratings only and functional device operation is not implied.

■ **RECOMMENDED OPERATING CONDITIONS**

| PARAMETER | SYMBOL | CONDITIONS | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|---|
| Supply Voltage | $V_{CC}$ | | 2.0 | 5.0 | 6.0 | V |
| High-Level Input Voltage | $V_{IH}$ | $V_{CC}=2V$ | 1.5 | 1.2 | | V |
| | | $V_{CC}=4.5V$ | 3.15 | 2.4 | | V |
| | | $V_{CC}=6V$ | 4.2 | 3.2 | | V |
| Low-Level Input Voltage | $V_{IL}$ | $V_{CC}=2V$ | | 0.8 | 0.5 | V |
| | | $V_{CC}=4.5V$ | | 2.1 | 1.35 | V |
| | | $V_{CC}=6V$ | | 2.8 | 1.8 | V |
| Input Voltage | $V_{IN}$ | | 0 | | $V_{CC}$ | V |
| Output Voltage | $V_{OUT}$ | | 0 | | $V_{CC}$ | V |
| Input Transition Rise or Fall Rate | $\Delta t/\Delta v$ | $V_{CC}=2V$ | | | 625 | ns/V |
| | | $V_{CC}=4.5V$ | | 1.67 | 139 | ns/V |
| | | $V_{CC}=6V$ | | | 83 | ns/V |
| Operating Temperature | $T_A$ | | -40 | | +125 | °C |

■ **ELECTRICAL CHARACTERISTICS** ($T_A = 25°C$, unless otherwise specified)

| PARAMETER | SYMBOL | TEST CONDITIONS | | MIN | TYP[1] | MAX | UNIT |
|---|---|---|---|---|---|---|---|
| High-Level Output Voltage | $V_{OH}$ | $V_{CC}=2V$, $I_{OH}=-20\mu A$ | $V_{IN}=V_{IH}$ or $V_{IL}$ | 1.9 | 2.0 | | V |
| | | $V_{CC}=4.5V$, $I_{OH}=-20\mu A$ | | 4.4 | 4.5 | | V |
| | | $V_{CC}=6V$, $I_{OH}=-20\mu A$ | | 5.9 | 6.0 | | V |
| | | $V_{CC}=4.5V$, $I_{OH}=-4mA$ | | 3.98 | 4.32 | | V |
| | | $V_{CC}=6V$, $I_{OH}=-5.2mA$ | | 5.48 | 5.81 | | V |
| Low-Level Output Voltage | $V_{OL}$ | $V_{CC}=2V$, $I_{OL}=20\mu A$ | | | 0 | 0.1 | V |
| | | $V_{CC}=4.5V$, $I_{OL}=20\mu A$ | | | 0 | 0.1 | V |
| | | $V_{CC}=6V$, $I_{OL}=20\mu A$ | | | 0 | 0.1 | V |
| | | $V_{CC}=4.5V$, $I_{OL}=4mA$ | | | 0.15 | 0.26 | V |
| | | $V_{CC}=6V$, $I_{OL}=5.2mA$ | | | 0.16 | 0.26 | V |
| Input Leakage Current | $I_{I(LEAK)}$ | $V_{CC}=6V$, $V_I=V_{CC}$ or GND | | | | ±0.1 | µA |
| Quiescent Supply Current | $I_{CC}$ | $V_{CC}=6V$, $V_I=V_{CC}$ or GND, $I_{OUT}=0A$ | | | | 8 | µA |
| Input Capacitance | $C_I$ | | | | 3.5 | | pF |

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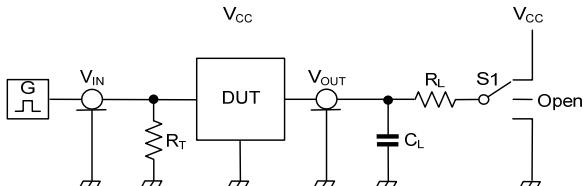
■ **SWITCHING CHARACTERISTICS** (T$_A$=25°C, unless otherwise specified)

| PARAMETER | SYMBOL | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|---|
| Propagation delay from input (An) to output (Yn) | t$_{PD}$ | V$_{CC}$=2.0V | | 25 | 150 | ns |
| | | V$_{CC}$=4.5V | | 17 | 30 | ns |
| | | V$_{CC}$=5.0V, C$_L$=15pF | | 14 | | ns |
| | | V$_{CC}$=6.0V | | 10 | 26 | ns |
| Propagation delay from input (E3) to output (Yn) | | V$_{CC}$=2.0V | | 22 | 160 | ns |
| | | V$_{CC}$=4.5V | | 19 | 32 | ns |
| | | V$_{CC}$=5.0V, C$_L$=15pF | | 16 | | ns |
| | | V$_{CC}$=6.0V | | 8 | 27 | ns |
| Propagation delay from input ($\bar{E}$n) to output (Yn) | | V$_{CC}$=2.0V | | 20 | 155 | ns |
| | | V$_{CC}$=4.5V | | 18 | 31 | ns |
| | | V$_{CC}$=5.0V, C$_L$=15pF | | 17 | | ns |
| | | V$_{CC}$=6.0V | | 6 | 26 | ns |
| Transition Time | t$_t$ | V$_{CC}$=2.0V | | 19 | 75 | ns |
| | | V$_{CC}$=4.5V | | 7 | 15 | ns |
| | | V$_{CC}$=6.0V | | 6 | 13 | ns |
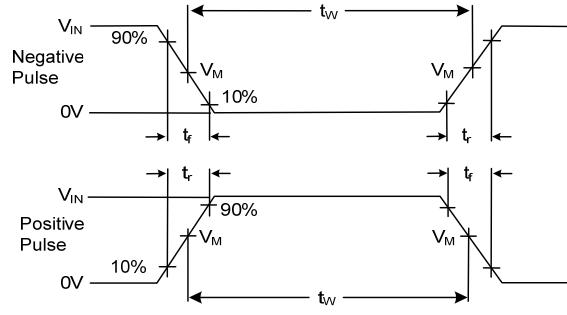
■ **OPERATING CHARACTERISTICS** (T$_A$=25°C, unless otherwise specified)

| PARAMETER | SYMBOL | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|---|
| Power Dissipation Capacitance | C$_{PD}$ | V$_{IN}$=GND or V$_{CC}$ | | 76 | | pF |

■ **TEST CIRCUIT AND WAVEFORMS**



**Load Circuit**



**Test Circuit For Measuring Switching Times**
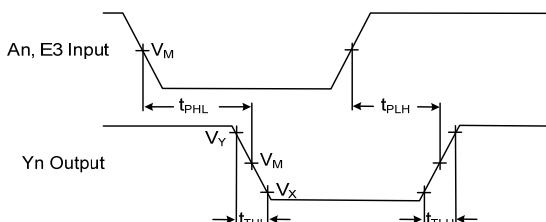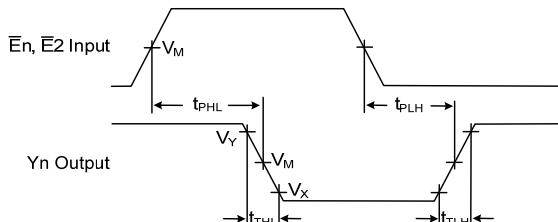


**Input ($\overline{A}$n, $\overline{E}$3) to Output (Yn) Propagation Delays And Output Transition Times**



**Input (E1, E2) to Output (Yn) Propagation Delays And Output Transition Times**

**Table 1. Measurement Points**

| Input | Output | | |
|---|---|---|---|
| $V_M$ | $V_M$ | $V_X$ | $V_Y$ |
| $0.5 \times V_{CC}$ | $0.5 \times V_{CC}$ | $0.1 \times V_{CC}$ | $0.9 \times V_{CC}$ |

**Table 2. Test data**

| Input | | Load | | S1 Position |
|---|---|---|---|---|
| $V_{IN}$ | $t_r$, $t_f$ | $C_L$ | $R_L$ | $t_{PHL}$, $t_{PLH}$ |
| $V_{CC}$ | 6nS | 15pF, 50pF | 1kΩ | Open |

Note: $V_{OL}$ and $V_{OH}$ are typical voltage output levels that occur with the output load.