# DN74LS138

## 3-line to 8-line Decoders / Demultiplexers

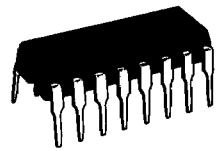
### ■ Description

DN74LS138 is a 3-bit decimal to octal decoder/demultiplexer with enable inputs.

### ■ Features

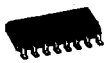
- Three types of enable inputs
- Quaternary to hexadecimal decoder/demultiplexer capability with no externally connected parts
- Wide operating temperature range (Ta = −20 to +75°C)

P-2



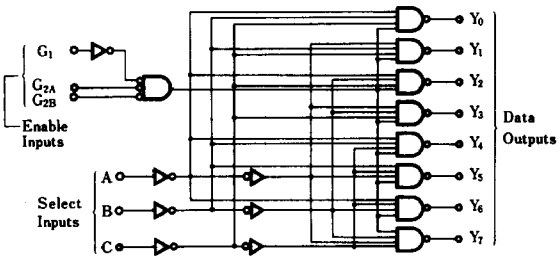
16-pin plastic DIL package

P-5

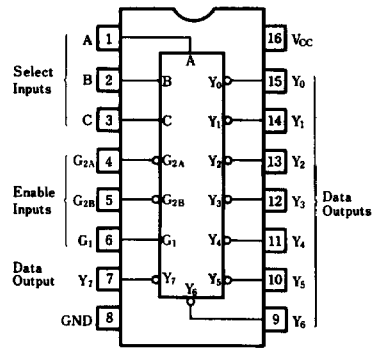


16-pin Panaflat package (SO-16D)

### ■ Logic diagram




### Pin configuration (top view)




### ■ Recommended operating conditions

| Parameter | Sym | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| Supply voltage | $V_{CC}$ | 4.75 | 5.00 | 5.25 | V |
| Output current | $I_{OH}$ | | | −400 | μA |
| | $I_{OL}$ | | | 8 | mA |
| Operating temperature range | Topr | −20 | 25 | 75 | ℃ |

## ■ DC characteristics ($Ta = -20 \sim +75℃$)

| Parameter | Sym | Test conditions | | Min | Typ* | Max | Unit |
|---|---|---|---|---|---|---|---|
| Input voltage | $V_{IH}$ | | | 2.0 | | | V |
| | $V_{IL}$ | | | | | 0.8 | V |
| Output voltage | $V_{OH}$ | $V_{CC}=4.75V$, $V_{IH}=2V$, $V_{IL}=0.8V$, $I_{OH}=-400\mu A$ | | 2.7 | 3.4 | | V |
| | $V_{OL1}$ | $V_{CC}=4.75V$, $V_{IH}=2V$, $V_{IL}=0.8V$ | $I_{OL}=4mA$ | | 0.25 | 0.4 | V |
| | $V_{OL2}$ | | $I_{OL}=8mA$ | | 0.35 | 0.5 | V |
| Input current | $I_{IH}$ | $V_{CC}=5.25V$, $V_I=2.7V$ | | | | 20 | $\mu A$ |
| | $I_{IL}$ | $V_{CC}=5.25V$, $V_I=0.4V$ | | | | −0.4 | mA |
| | $I_I$ | $V_{CC}=5.25V$, $V_I=7V$ | | | | 0.1 | mA |
| Output short circuit current** | $I_{OS}$ | $V_{CC}=5.25V$, $V_O=0V$ | | −15 | | −100 | mA |
| Input clamp voltage | $V_{IK}$ | $V_{CC}=4.75V$, $I_I=-18mA$ | | | | −1.5 | V |
| Supply current*** | $I_{CC}$ | $I_{CC}=5.25V$ | | | 6.3 | 10 | mA |

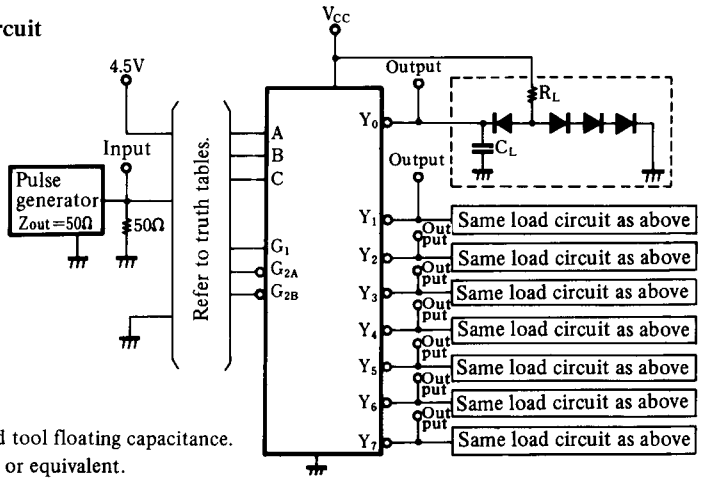
* When constant at $V_{CC}$ = 5V, Ta = 25°C.
** Only one output at a time short circuited to GND. Also, short circuit time to GND within 1 second.
*** Measured with all outputs open and in enable condition.

## ■ Switching characteristics ($V_{CC}=5V$, $Ta=25℃$)

| Parameter | Sym | Inputs | Outputs | Delay level | Test conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|---|---|
| Propagation delay time | $t_{PLH}$ | Binary Select A, B, C | Y | 2 | $C_L=15pF$, $R_L=2k\Omega$ | | 13 | 20 | ns |
| | $t_{PHL}$ | | | | | | 27 | 41 | ns |
| | $t_{PLH}$ | | | 3 | | | 18 | 27 | ns |
| | $t_{PHL}$ | | | | | | 26 | 39 | ns |
| | $t_{PLH}$ | Enable $G_{2A}$, $G_{2B}$ | Y | 2 | | | 12 | 18 | ns |
| | $t_{PHL}$ | | | | | | 21 | 32 | ns |
| | $t_{PLH}$ | Enable $G_1$ | | 3 | | | 17 | 26 | ns |
| | $t_{PHL}$ | | | | | | 25 | 38 | ns |

※ Switching parameter measurement information

### 1. Measurement circuit

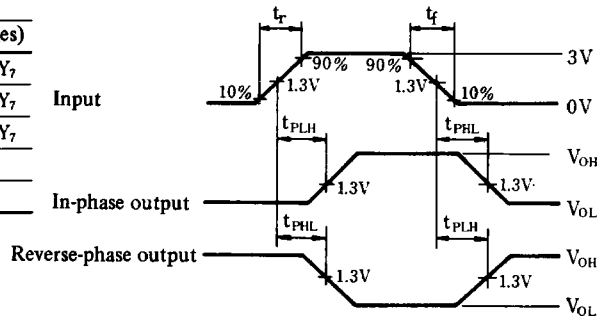



Notes
1. $C_L$ includes probe and tool floating capacitance.
2. Diodes are all MA161 or equivalent.

2. Relationships of inputs/outputs to delay level

| Input | Output | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Delay level (2-stages) | | | | Delay level (3-stages) | | | |
| A | $Y_0$ | $Y_2$ | $Y_4$ | $Y_6$ | $Y_1$ | $Y_3$ | $Y_5$ | $Y_7$ |
| B | $Y_0$ | $Y_1$ | $Y_4$ | $Y_5$ | $Y_2$ | $Y_3$ | $Y_6$ | $Y_7$ |
| C | $Y_0$ | $Y_1$ | $Y_2$ | $Y_3$ | $Y_4$ | $Y_5$ | $Y_6$ | $Y_7$ |
| $G_1$ | | | | | $Y_0 \sim Y_7$ | | | |
| $G_{2A}$, $G_{2B}$ | $Y_0 \sim Y_7$ | | | | | | | |

3.Waveforms




Notes

1. Input waveform: $t_r \leqq 15$ns, $t_f \leqq 6$ns, PRR = 1MHz, duty cycle = 50%.

## ■ Truth tables

| Inputs | | | | | Outputs | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Enable | | Select | | | | | | | | | | |
| $G_1$ | $G_2$* | C | B | A | $Y_0$ | $Y_1$ | $Y_2$ | $Y_3$ | $Y_4$ | $Y_5$ | $Y_6$ | $Y_7$ |
| × | H | × | × | × | H | H | H | H | H | H | H | H |
| L | × | × | × | × | H | H | H | H | H | H | H | H |
| H | L | L | L | L | L | H | H | H | H | H | H | H |
| H | L | L | L | H | H | L | H | H | H | H | H | H |
| H | L | L | H | L | H | H | L | H | H | H | H | H |
| H | L | L | H | H | H | H | H | L | H | H | H | H |
| H | L | H | L | L | H | H | H | H | L | H | H | H |
| H | L | H | L | H | H | H | H | H | H | L | H | H |
| H | L | H | H | L | H | H | H | H | H | H | L | H |
| H | L | H | H | H | H | H | H | H | H | H | H | L |

Notes

1. * $G_2 = G_{2A} + G_{2B}$
2. H: HIGH voltage level.
   L: LOW voltage level.
   X: Either HIGH or LOW; doesn't matter.