M74LS138P

3-LINE TO 8-LINE DECODER/DEMULTIPLEXER

DESCRIPTION

The M74LS138P is a semiconductor integrated circuit consisting of a 3-bit binary-octal decoder/demultiplexer with enable inputs.

FEATURES

- 3 classes of enable inputs
- 4 to 16 decorder/demultiplexer functions are provided without use of external components.
- Wide operating temperature range (T_a = -20 ~ +75°C)

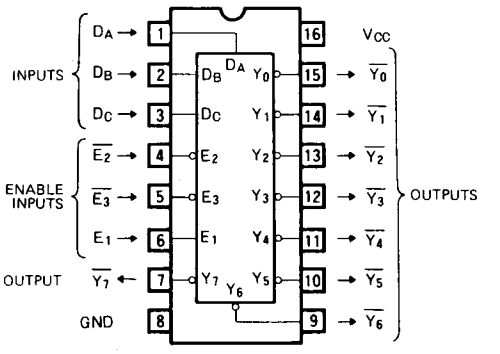
APPLICATION

General purpose, for use in industrial and consumer equipment.

FUNCTIONAL DESCRIPTION

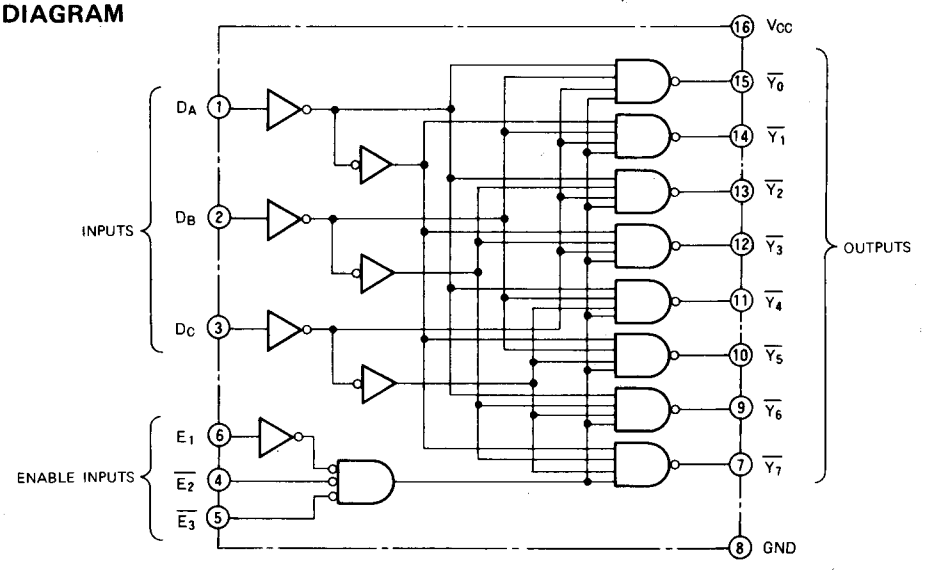
For use as a decoder, specify inputs D_A, D_B, and D_C in 3-bit binary code. In the case of decoding function, the E_1 is kept in high state while $\overline{E_2}$ and $\overline{E_3}$ are kept low. If E_1, $\overline{E_2}$ and $\overline{E_3}$ are not in these conditions, all the outputs become high, irrespective of the status of D_A~D_C. For use as a demultiplexer, $\overline{E_1}$, $\overline{E_2}$ and E_3 are used as data inputs and D_A, D_B, and D_C as selection inputs. This forms a 1-line to 8-line demultiplexer.

PIN CONFIGURATION (TOP VIEW)



Outline 16P4

BLOCK DIAGRAM



3-LINE TO 8-LINE DECODER/DEMULTIPLEXER

FUNCTION TABLE (Note 1)

E_1	$\overline{E_X}$	D_C	D_B	D_A	$\overline{Y_0}$	$\overline{Y_1}$	$\overline{Y_2}$	$\overline{Y_3}$	$\overline{Y_4}$	$\overline{Y_5}$	$\overline{Y_6}$	$\overline{Y_7}$
X	H	X	X	X	H	H	H	H	H	H	H	H
L	X	X	X	X	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

Note 1: $\overline{E_X}=\overline{E_2}+\overline{E_3}$
X : irrelevant

ABSOLUTE MAXIMUM RATINGS ($T_a=-20\sim+75°C$, unless otherwise noted)

Symbol	Parameter	Conditions	Limits	Unit
V_{CC}	Supply voltage		−0.5 ~ +7	V
V_I	Input voltage		−0.5 ~ +15	V
V_O	Output voltage	High-level state	−0.5 ~ V_{CC}	V
Topr	Operating free-air ambient temperature range		−20 ~ +75	°C
Tstg	Storage temperature range		−65 ~ +150	°C

RECOMMENDED OPERATING CONDITIONS ($T_a=-20\sim+75°C$, unless otherwise noted)

Symbol	Parameter		Limits			Unit
			Min	Typ	Max	
V_{CC}	Supply voltage		4.75	5	5.25	V
I_{OH}	High-level output current	$V_{OH}\geqq 2.7V$	0		−400	μA
I_{OL}	Low-level output current	$V_{OL}\leqq 0.4V$	0		4	mA
		$V_{OL}\leqq 0.5V$	0		8	mA

ELECTRICAL CHARACTERISTICS ($T_a=-20\sim+75°C$, unless otherwise noted)

Symbol	Parameter	Test conditions		Limits			Unit
				Min	Typ*	Max	
V_{IH}	High-level input voltage			2			V
V_{IL}	Low-level input voltage					0.8	V
V_{IC}	Input clamp voltage	$V_{CC}=4.75V$, $I_{IC}=-18mA$				−1.5	V
V_{OH}	High-level output voltage	$V_{CC}=4.75V$, $V_I=0.8V$ $V_I=2V$, $I_{OH}=-400\mu A$		2.7	3.4		V
V_{OL}	Low-level output voltage	$V_{CC}=4.75V$	$I_{OL}=4mA$		0.25	0.4	V
		$V_I=0.8V$, $V_I=2V$	$I_{OL}=8mA$		0.35	0.5	V
I_{IH}	High-level input current	$V_{CC}=5.25V$, $V_I=2.7V$				20	μA
		$V_{CC}=5.25V$, $V_I=10V$				0.1	mA
I_{IL}	Low-level input current	$V_{CC}=5.25V$, $V_I=0.4V$				−0.4	mA
I_{OS}	Short-circuit output current (Note 2)	$V_{CC}=5.25V$, $V_O=0V$		−20		−100	mA
I_{CC}	Supply current	$V_{CC}=5.25V$ (Note 3)			6.3	10	mA

* : All typical values are at $V_{CC}=5V$, $Ta=25°C$.

Note 2: All measurements should be done quickly, and not more than one output should be shorted at a time.

Note 3: I_{CC} is measured with all output off-state.

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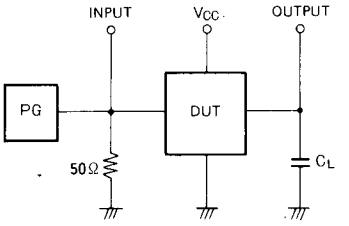
SWITCHING CHARACTERISTICS (V_{CC} = 5V, T_a = 25°C, unless otherwise noted)

Symbol	Parameter		Test conditions	Limits			Unit
				Min	Typ	Max	
t_{PLH}	Low-to-high-level, high-to-low-level output propagation time, from inputs D_A, D_B, D_C to output $\overline{Y_0}$–$\overline{Y_7}$	delay gate stages 2	C_L = 15pF (Note 4)		9	20	ns
t_{PHL}					12	41	ns
t_{PLH}		delay gate stages 3			16	27	ns
t_{PHL}					14	39	ns
t_{PLH}	Low-to-high-level, high-to-low-level output propagation time, from inputs $\overline{E_2}$, $\overline{E_3}$ to outputs $\overline{Y_0}$–$\overline{Y_7}$	delay gate stages 2			10	18	ns
t_{PHL}					15	32	ns
t_{PLH}	Low-to-high-level, high-to-low-level output propagation time, from input E_1 to outputs $\overline{Y_0}$–$\overline{Y_7}$	delay gate stages 3			8	26	ns
t_{PHL}					15	38	ns

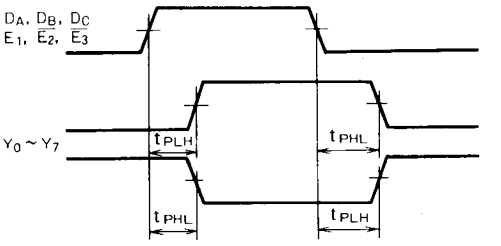
Note 4: Measurement circuit



(1) The pulse generator (PG) has the following characteristics:
PRR = 1MHz, t_r = 6ns, t_f = 6ns, t_w = 500ns,
V_P = 3V_{P-P}, Z_O = 50Ω

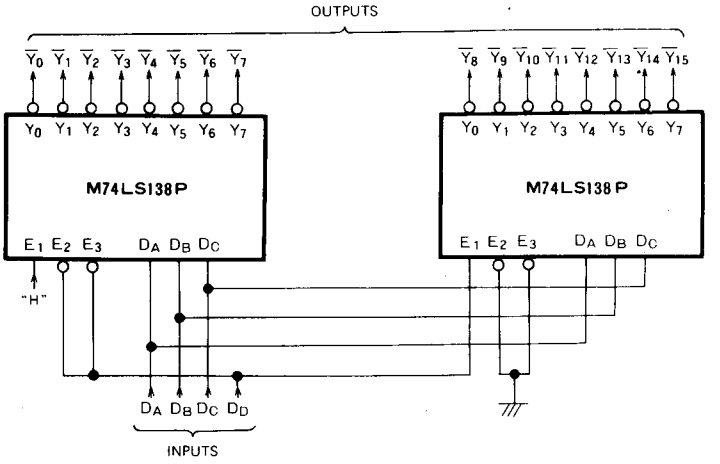
(2) C_L includes probe and jig capacitance.

TIMING DIAGRAM (Reference level = 1.3V)



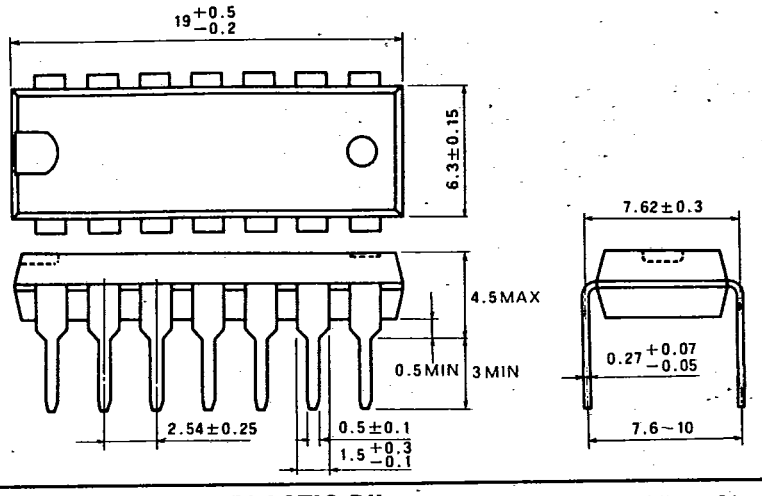
APPLICATION EXAMPLE

4-line to 16-line decorder/demultiplexer



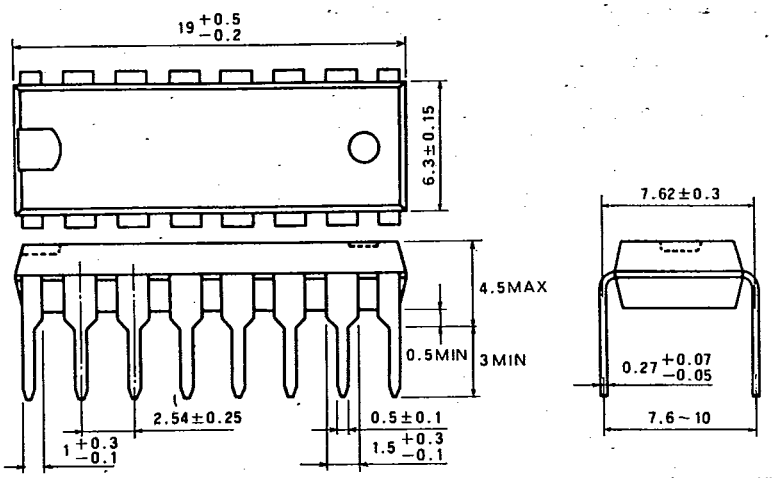
TYPE 14P4 14-PIN MOLDED PLASTIC DIL

Dimension in mm



TYPE 16P4 16-PIN MOLDED PLASTIC DIL

Dimension in mm



TYPE 20P4 20-PIN MOLDED PLASTIC DIL

Dimension in mm