M74LS156P

DUAL 2-BIT BINARY TO 4-LINE DECODER/DEMULTIPLEXER WITH OPEN COLLECTOR OUTPUT

DESCRIPTION

The M74LS156P is a semiconductor integrated circuit containing two 2-bit binary to 4-line decoders/demultiplexers with open collector outputs

FEATURES

- Usable in AND Tie connection
- Enable inputs provided
- 8-bit output decoder/demultiplexer function is provided without the use of external components
- Wide operating temperature range (T_a=−20~+75°C)

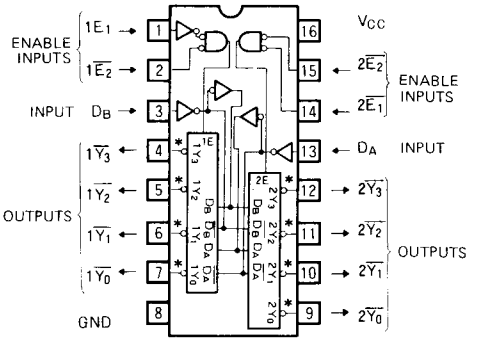
APPLICATION

General purpose, for use in industrial and consumer equipment.

FUNCTIONAL DESCRIPTION

When a 2-bit binary number is decoded as a quaternary number and the 2-bit binary number is applied to inputs D_A and D_B, the corresponding $\overline{Y_0}$~$\overline{Y_3}$ output is set low and all the other 3 outputs are set high. In this case, enable inputs $1E_1$ and $2\overline{E_1}$ are kept high and low, respectively, and enable inputs $1\overline{E_2}$ and $2\overline{E_2}$ are kept low. When $1\overline{E_2}$ and $2\overline{E_2}$ are set high, all the outputs are set high. When decoding a 3-bit binary number in octal numbers, $1E_1$ and $2\overline{E_2}$ are connected and by applying the third bit binary number to them, the outputs appear in $2\overline{Y_0}$~$2\overline{Y_3}$ and $1\overline{Y_0}$~$1\overline{Y_3}$, in accordance with the function table.

PIN CONFIGURATION (TOP VIEW)



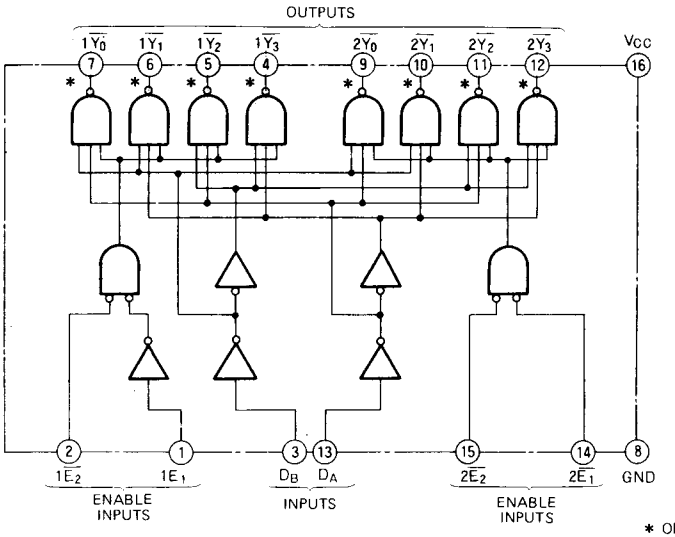
* OPEN COLLECTOR OUTPUT

Outline 16P4

For use as a 1-line to 4-line demultiplexer, the outputs appear in $\overline{Y_0}$~$\overline{Y_3}$ by making $1E_1$ and $2\overline{E_1}$ the data inputs and D_A and D_B the selection inputs. For use as a 1-line to 8-line demultiplexer, $1E_1$ and $1\overline{E_1}$ are connected to to be made the third bit selection input and $1\overline{E_2}$ and $2\overline{E_2}$ are connected to be made the data inputs so that the outputs appear in $2\overline{Y_0}$~$2\overline{Y_3}$ and $1\overline{Y_0}$~$1\overline{Y_3}$.

M74LS156P has the same functions and pin connections as M74LS155P but the latter is provided with active pull-up resistor outputs.

BLOCK DIAGRAM



* OPEN COLLECTOR OUTPUT

DUAL 2-BIT BINARY TO 4-LINE DECODER/DEMULTIPLEXER WITH OPEN COLLECTOR OUTPUT

FUNCTION TABLE (Note 1)

(2-bit binary to 4-line decoder/1 line to 4-line demultiplexer)

D_B	D_A	$1\overline{E}_2$	$1E_1$	$1\overline{Y}_0$	$1\overline{Y}_1$	$1\overline{Y}_2$	$1\overline{Y}_3$
X	X	H	X	H	H	H	H
L	L	L	H	L	H	H	H
L	H	L	H	H	L	H	H
H	L	L	H	H	H	L	H
H	H	L	H	H	H	H	L
X	X	X	L	H	H	H	H

D_B	D_A	$2\overline{E}_2$	$2\overline{E}_1$	$2\overline{Y}_0$	$2\overline{Y}_1$	$2\overline{Y}_2$	$2\overline{Y}_3$
X	X	H	X	H	H	H	H
L	L	L	L	L	H	H	H
L	H	L	L	H	L	H	H
H	L	L	L	H	H	L	H
H	H	L	L	H	H	H	L
X	X	X	H	H	H	H	H

(3-bit binary to 8-line decoder/1 line to 8 line demultiplexer)

D_C	D_B	D_A	$\overline{E}$	$2\overline{Y}_0$	$2\overline{Y}_1$	$2\overline{Y}_2$	$2\overline{Y}_3$	$1\overline{Y}_0$	$1\overline{Y}_1$	$1\overline{Y}_2$	$1\overline{Y}_3$
X	X	X	H	H	H	H	H	H	H	H	H
L	L	L	L	L	H	H	H	H	H	H	H
L	L	H	L	H	L	H	H	H	H	H	H
L	H	L	L	H	H	L	H	H	H	H	H
L	H	H	L	H	H	H	L	H	H	H	H
H	L	L	L	H	H	H	H	L	H	H	H
H	L	H	L	H	H	H	H	H	L	H	H
H	H	L	L	H	H	H	H	H	H	L	H
H	H	H	L	H	H	H	H	H	H	H	L

Note 1 X : Irrelevant
D_C : Pin connecting $1E_1$ and $2\overline{E}_1$
$\overline{E}$: Pin connecting $1\overline{E}_2$ and $2\overline{E}_2$

ABSOLUTE MAXIMUM RATINGS (Ta = −20 ~ +75℃, 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	℃
Tstg	Storage temperature range		−65 ~ +150	℃

RECOMMENDED OPERATING CONDITIONS (Ta = −20 ~ +75℃, 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_O=5.5V	0		100	μA
I_{OL}	Low-level output current	V_{OL}≦0.4V	0		4	mA
		V_{OL}≦0.5V	0		8	mA

ELECTRICAL CHARACTERISTICS (Ta = −20 ~ +75℃, 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
I_{OH}	High-level output current	V_{CC}=4.75V, V_I=0.8V V_I=2V, V_O=5.5V				100	μA
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_{CC}	Supply current	V_{CC}=5.25V (Note 2)			6.1	10	mA

* : All typical values are at V_{CC}= 5V, T_a= 25°C.
Note 2. I_{CC} is measured with inputs $1\overline{E}_2$, $2\overline{E}_1$ and $2\overline{E}_2$ at 0V and with D_A, D_B and $1E_1$ at 4.5V

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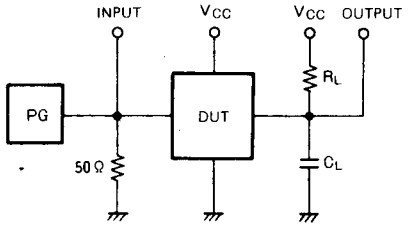
SWITCHING CHARACTERISTICS (V_{CC}=5V, Ta=25℃, unless otherwise noted)

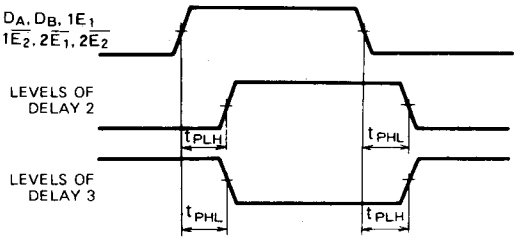
Symbol	Parameter		Test conditions	Limits			Unit
				Min	Typ	Max	
t_{PLH}	Low-to-high-level, high-to-low-level output propagation time, from inputs D_A, D_B to outputs $\overline{Y_0}$~$\overline{Y_3}$	delay gate stages 2	R_L=2kΩ, C_L=15pF (Note 3)		18	40	ns
t_{PHL}					18	51	ns
t_{PLH}		delay gate stages 3			20	46	ns
t_{PHL}					18	51	ns
t_{PLH}	Low-to-high-level, high-to-low-level output propagation time, from inputs $1\overline{E_2}$, $2\overline{E_1}$, $2\overline{E_2}$ to outputs $\overline{Y_0}$~$\overline{Y_3}$				16	40	ns
t_{PHL}					20	51	ns
t_{PLH}	Low-to-high-level, high-to-low-level output propagation time, from input $1E_1$ to outputs $1\overline{Y_0}$ ~ $1\overline{Y_3}$				20	48	ns
t_{PHL}					25	48	ns

Note 3: Measurement circuit



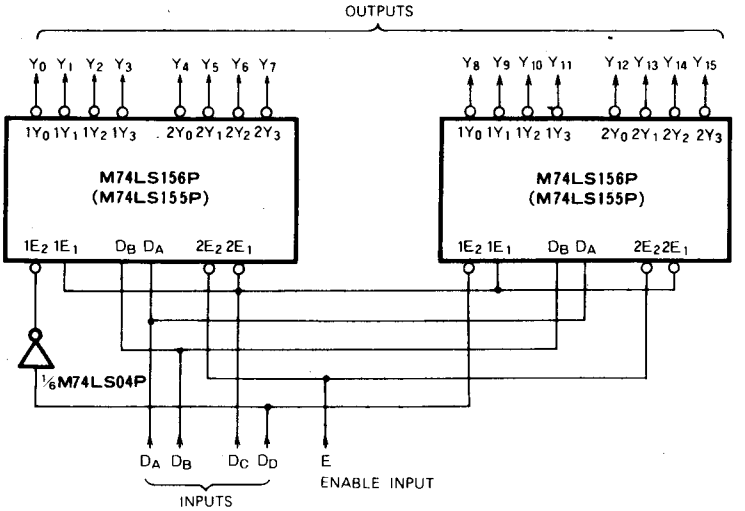
(1) The pulse generator (PG) has the following characteristics:
PRR=1MHz, t_r=6ns, t_f=6ns, t_w=500ns, V_P = $3V_{P-P}$, Z_O=50Ω.
(2) C_L includes probe and jig capacitance

TIMING DIAGRAM (Reference level = 1.3V)



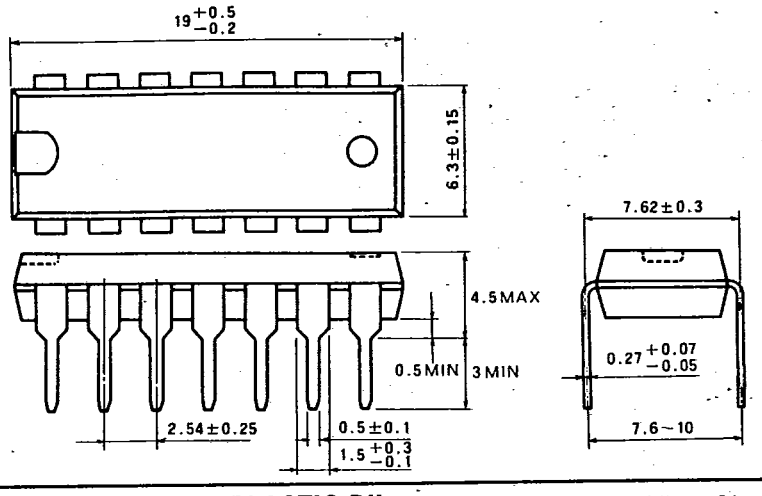
APPLICATION EXAMPLE

4-bit binary/hexadecimal decoder/demultiplexer



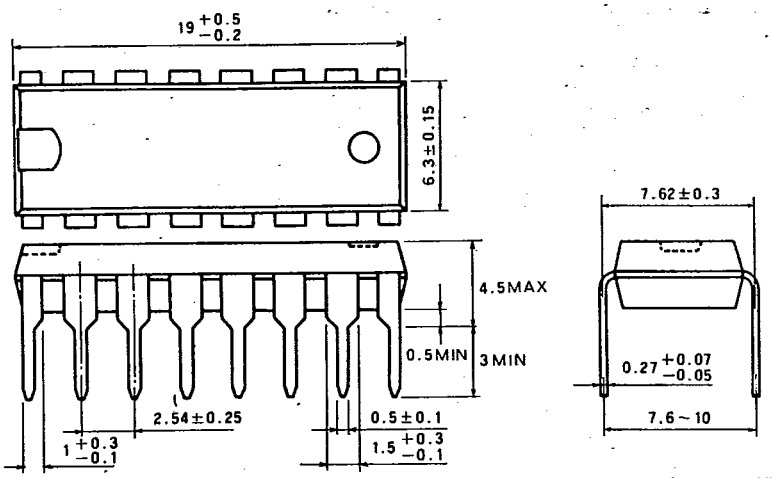
TYPE 14P4 14-PIN MOLDED PLASTIC DIL

Dimension in mm



TYPE 16P4 16-PIN MOLDED PLASTIC DIL

Dimension in mm



TYPE 20P4 20-PIN MOLDED PLASTIC DIL

Dimension in mm