

BCD-TO-7-SEGMENT DECODER/DRIVER (ACTIVE LOW OUTPUT)

DESCRIPTION

The M74LS47P is a semiconductor integrated circuit provided with BCD-to-7-segment decoder/driver function and open collector outputs.

FEATURES

- Suitable for 7-segment display element lighting
- $\overline{\text{RBI}}$ input and $\overline{\text{BI}}/\overline{\text{RBO}}$ outputs for zero suppression
- $\overline{\text{LT}}$ input for lamp testing
- $\overline{\text{BI}}/\overline{\text{RBO}}$ input for extinguishing all segments
- Open collector outputs
- Wide operating temperature range ($T_a = -20 \sim +75^\circ\text{C}$)

APPLICATION

General purpose, for use in industrial and consumer equipment.

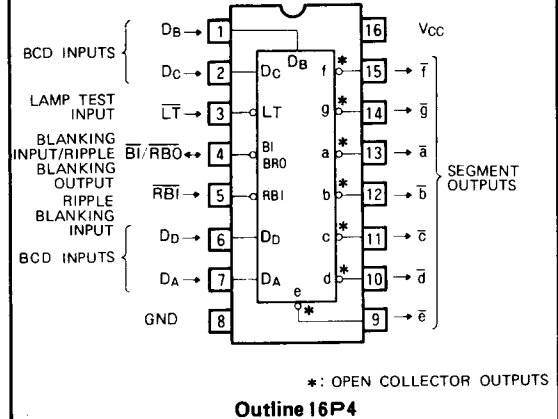
FUNCTIONAL DESCRIPTION

When a number is designed in BCD code for BCD inputs D_A , D_B , D_C and D_D , segment outputs $\overline{a} \sim \overline{g}$ are set low in accordance with that number. By connecting the 7-segment display element to each of the outputs, the character indicated on the display character can be displayed. $\overline{a} \sim \overline{g}$ are open collector outputs with a breakdown voltage of not less than 15V and a low-level output current of 24mA, thereby making it possible to directly drive a 7-segment LED for the display of anode-common numbers.

Suppression of the high-order unnecessary zeroes is possible by setting the highest order $\overline{\text{RBI}}$ ripple blanking input low and connecting ripple blanking output $\overline{\text{BI}}/\overline{\text{RBO}}$ to the next-order $\overline{\text{RBI}}$ for each of the digits. (Refer to the application example.)

By setting blanking input $\overline{\text{BI}}/\overline{\text{RBO}}$ low, outputs $\overline{a} \sim \overline{g}$ are set high and the display element is extinguished irrespective

PIN CONFIGURATION (TOP VIEW)



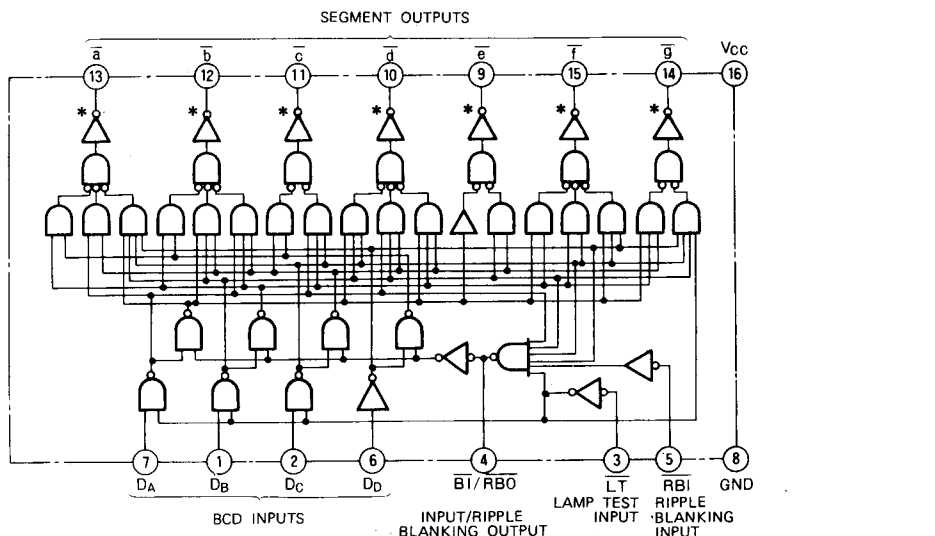
of the status of the other inputs. The luminous intensity can be controlled by applying pulses.

Since $\overline{\text{BI}}/\overline{\text{RBO}}$ serves as both an input and output pin, only ICs with open collector outputs can be connected to this pin.

By setting lamp test input $\overline{\text{LT}}$ low, $\overline{a} \sim \overline{g}$ are set low irrespective of the status of $\overline{\text{BI}}/\overline{\text{RBO}}$, D_A , D_B , D_C and D_D , all the segments in the display element are lighted and each segment can be tested.

Except for that pins 6 and 9 differ in character from the M74LS47P has exactly the same functions, pin connections and characteristics as the M75LS247P.

BLOCK DIAGRAM



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FUNCTION TABLE (Note 1)

Decimal number or function	$\overline{LT}$	$\overline{RBI}$	D_D	D_C	D_B	D_A	$\overline{BI}/\overline{RBO}$	$\overline{a}$	$\overline{b}$	$\overline{c}$	$\overline{d}$	$\overline{e}$	$\overline{f}$	$\overline{g}$	Note
0	H	H	L	L	L	L		H	L	L	L	L	L	L	(1)
1	H	X	L	L	L	H		H	H	L	L	H	H	H	
2	H	X	L	L	H	L		H	L	L	H	L	L	H	
3	H	X	L	L	H	H		H	L	L	L	L	H	H	
4	H	X	L	H	L	L		H	H	L	L	H	H	L	
5	H	X	L	H	L	H		H	L	H	L	L	L	L	
6	H	X	L	H	H	L		H	H	H	L	L	L	L	
7	H	X	L	H	H	H		H	L	L	L	H	H	H	
8	H	X	H	L	L	L		H	L	L	L	L	L	L	
9	H	X	H	L	L	H		H	L	L	L	H	H	L	
10	H	X	H	L	H	L		H	H	H	H	L	L	H	
11	H	X	H	L	H	H		H	H	H	L	L	H	H	
12	H	X	H	H	L	L		H	H	L	H	H	H	L	
13	H	X	H	H	L	H		H	L	H	H	L	H	L	
14	H	X	H	H	H	L		H	H	H	H	L	L	L	
15	H	X	H	H	H	H		H	H	H	H	H	H	H	
Blanking	X	X	X	X	X	X	L		H	H	H	H	H	H	(2)
Ripple blanking	H	L	L	L	L	L		L	H	H	H	H	H	H	(3)
Lamp test	L	X	X	X	X	X		H	L	L	L	L	L	L	(4)

Note 1. (1) $\overline{LT}$ is normally kept in high

$\overline{RBI}$ is kept open or in high with a decimal 0 output.

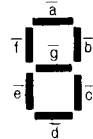
(2) When $\overline{BI}/\overline{RBO}$ is low, all the segment outputs are high irrespective of the status of the other inputs.

(3) All the segment outputs are set high and $\overline{BI}/\overline{RBO}$ is set low when $\overline{LT}$ is high and $\overline{RBI}$, D_A , D_B , D_C and D_D are low.

(4) When $\overline{LT}$ is low, all the segment outputs are low.

X: Irrelevant

DEFINITION OF SEGMENTS



CHARACTERS DISPLAYED

Decimal number	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Character	0	1	2	3	4	5	6	7	8	9	c	d	e	f		

ABSOLUTE MAXIMUM RATINGS ($T_a = -20 \sim +75^\circ\text{C}$, unless otherwise noted)

Symbol	Parameter	Conditions	Limits	Unit
V_{CC}	Supply voltage		$-0.5 \sim +7$	V
V_i	Input voltage	Input $\overline{BI}/\overline{RBO}$	$-0.5 \sim V_{CC}$	V
		Other inputs	$-0.5 \sim +15$	V
V_O	Output voltage	Output $\overline{BI}/\overline{RBO}$	$-0.5 \sim V_{CC}$	V
		Other outputs	$-0.5 \sim +15$	V
$I_{O(\text{peak})}$	Output current	$t_w \leq 1\text{ms}$, duty cycle $\leq 10\%$	200	mA
I_O	Output current	High-level state	1	mA
T_{opr}	Operating free-air ambient temperature range		$-20 \sim +75$	$^\circ\text{C}$
T_{stg}	Storage temperature range		$-65 \sim +150$	$^\circ\text{C}$

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ABSOLUTE MAXIMUM RATINGS ($T_a = -20 \sim +75^\circ\text{C}$, 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, outputs $\bar{a} \sim \bar{g}$	$V_{OH} = 15\text{ V}$	0	250	μA
I_{OH}	High-level output current, output $\bar{BI}/\bar{RBO}$	$V_{OH} \geq 2.4\text{ V}$	0	-50	μA
I_{OL}	Low-level output current, outputs $\bar{a} \sim \bar{g}$	$V_{OL} \leq 0.4\text{ V}$	0	12	mA
		$V_{OL} \leq 0.5\text{ V}$	0	24	mA
I_{OL}	Low-level output current, output $\bar{BI}/\bar{RBO}$	$V_{OL} \leq 0.4\text{ V}$	0	1.6	mA
		$V_{OL} \leq 0.5\text{ V}$	0	3.2	mA

ELECTRICAL CHARACTERISTICS ($T_a = -20 \sim +75^\circ\text{C}$, 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	$V_{CC} = 4.75\text{ V}$, $I_{IC} = -18\text{ mA}$			-1.5	V
V_{OH}	High-level output voltage, output $\bar{BI}/\bar{RBO}$	$V_{CC} = 4.75\text{ V}$				V
I_{OH}	High-level output current, outputs $\bar{a} \sim \bar{g}$	$V_i = 0.8\text{ V}$, $V_i = 2\text{ V}$			250	μA
V_{OL}	Low-level output voltage	$V_{CC} = 4.75\text{ V}$ $V_i = 0.8\text{ V}$, $V_i = 2\text{ V}$				V
I_{IH}	High-level input current, except input $\bar{BI}/\bar{RBO}$	$V_{CC} = 5.25\text{ V}$, $V_i = 2.7\text{ V}$ $V_{CC} = 5.25\text{ V}$, $V_i = 10\text{ V}$			20	μA
I_{IL}	Low-level input current	Input $\bar{BI}/\bar{RBO}$			0.1	mA
		Other inputs			-1.2	mA
I_{OS}	Short-circuit output current, output $\bar{BI}/\bar{RBO}$	$V_{CC} = 5.25\text{ V}$, $V_o = 0\text{ V}$			-0.4	mA
I_{CC}	Supply current	$V_{CC} = 5.25\text{ V}$ (Note 2)			-2	mA

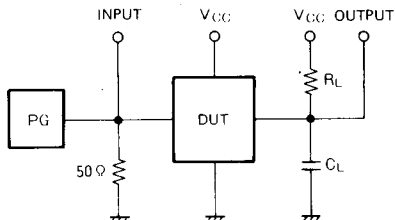
* : All typical values are at $V_{CC} = 5\text{ V}$, $T_a = 25^\circ\text{C}$.

Note 2: I_{CC} is measured with all inputs at 4.5V.

SWITCHING CHARACTERISTICS ($T_a = -20 \sim +75^\circ\text{C}$, 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 input D_A to outputs $\bar{a} \sim \bar{g}$	$R_L = 665\Omega$ $C_L = 15\text{ pF}$ (Note 3)		35	100	ns
t_{PHL}	High-to-low-level, high-to-low-level output propagation time, from input D_A to outputs $\bar{a} \sim \bar{g}$			30	100	ns
t_{PLH}	Low-to-high-level, high-to-low-level output propagation time, from input $\bar{RBI}$ to outputs $\bar{a} \sim \bar{f}$			50	100	ns
t_{PHL}	High-to-low-level, high-to-low-level output propagation time, from input $\bar{RBI}$ to outputs $\bar{a} \sim \bar{f}$			45	100	ns

Note 3: Measurement circuit



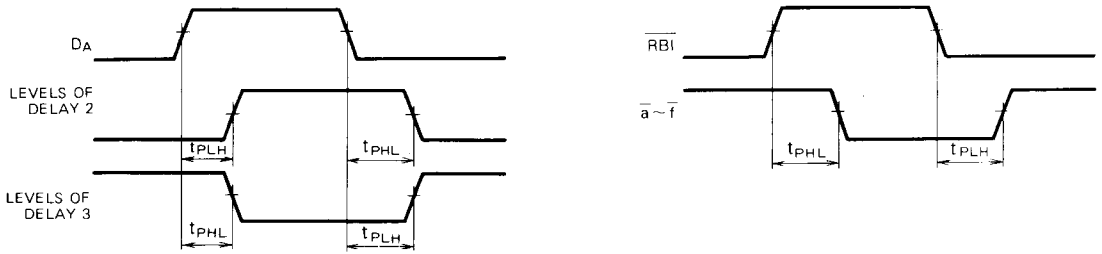
(1) The pulse generator (PG) has the following characteristics:

PRR = 1MHz, $t_r = 6\text{ ns}$, $t_f = 6\text{ ns}$, $t_w = 500\text{ ns}$,
 $V_P = 3V_{P-P}$, $Z_O = 50\Omega$.

(2) C_L includes probe and jig capacitance.

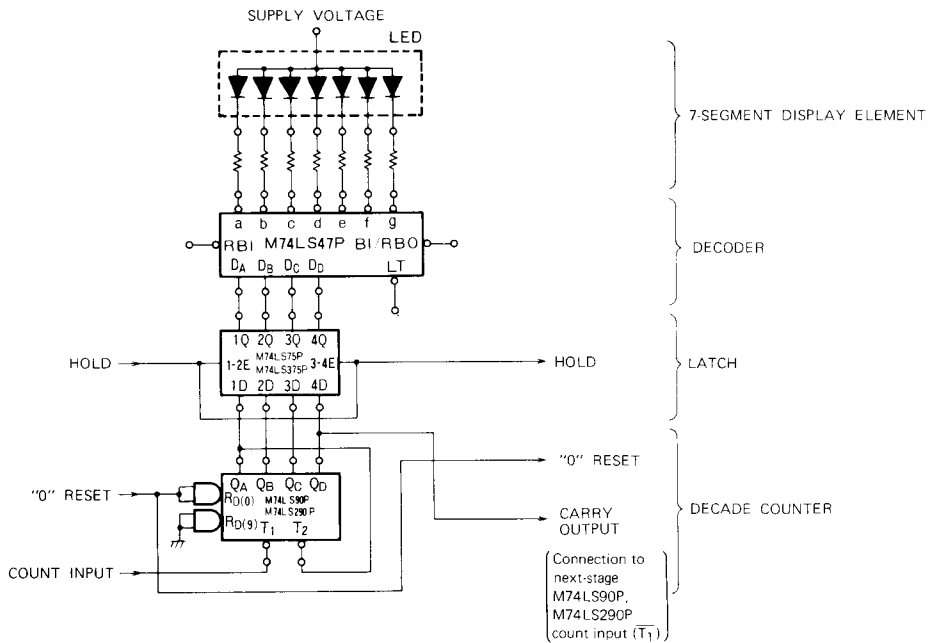
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TIMING DIAGRAM (Reference level = 1.3V)

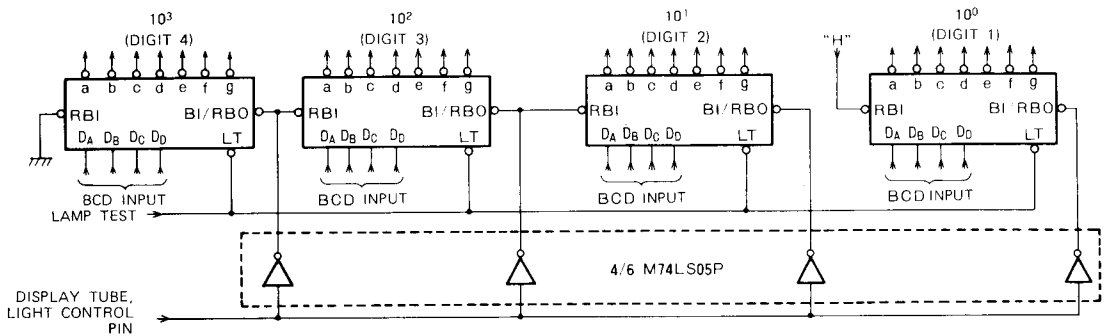


APPLICATION EXAMPLES

(1) Counter using M74LS47P

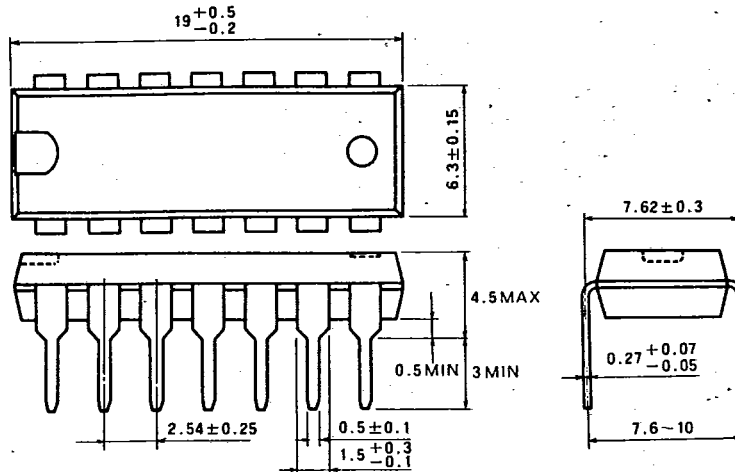


(2) Zero suppression and light control



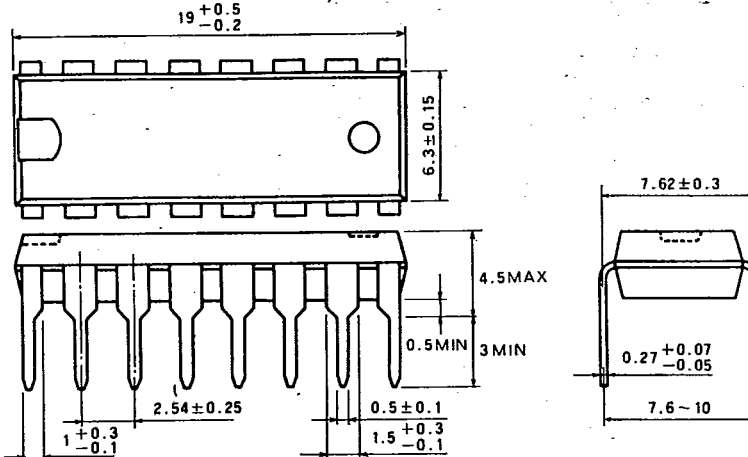
TYPE 14P4 14-PIN MOLDED PLASTIC DIL

Dimension in mm



TYPE 16P4 16-PIN MOLDED PLASTIC DIL

Dimension in mm



TYPE 20P4 20-PIN MOLDED PLASTIC DIL

Dimension in mm

