M74LS247P

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

DESCRIPTION

The M74LS247P 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
- $\overline{RBI}$ input and $\overline{BI}/\overline{RBO}$ outputs for zero suppression
- $\overline{LT}$ input for lamp testing
- $\overline{BI}/\overline{RBO}$ input for extinguishing all segments
- Open collector outputs
- Wide operating temperature range (T_a=−20~+75°C)

APPLICATION

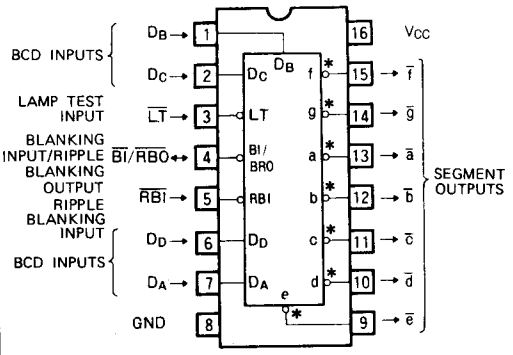
General purpose, for use in industrial and consumer equipment.

FUNCTIONAL DESCRIPTION

When a number is specified in BCD code for BCD inputs D_A, D_B, D_C and D_D, segment ouputs $\overline{a}$~$\overline{g}$ 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. $\overline{a}$~$\overline{g}$ are open collector outputs with a breakdown voltage of not less than 15V and a low-level output current of 24mA, therby making it possible to drive directly a 7-segment LED for the display of anode-common numbers.

Suppression of the unnecessary high-order zeroes is possible by setting the highest order $\overline{RBI}$ ripple blanking input low and connecting ripple blanking output $\overline{BI}/\overline{RBO}$ to the next-level $\overline{RBI}$ for each of the digits. Refer to the M74LS47P for the application example.

PIN CONFIGURATION (TOP VIEW)



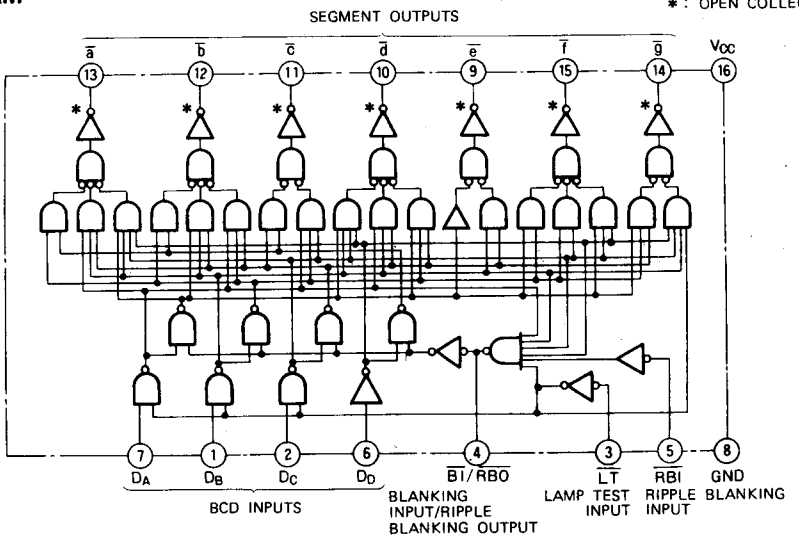
Outline 16P4

By setting blanking input $\overline{BI}/\overline{RBO}$ low, outputs $\overline{a}$~$\overline{g}$ are set high and the display element is extinguished irrespective of the status of the other inputs. Since $\overline{BI}/\overline{RBO}$ 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 $\overline{LT}$ low, $\overline{a}$~$\overline{g}$ are set low irrespective of the status of $\overline{BI}/\overline{RBO}$, D_A, D_B, D_C and D_D, all the segments in the display element are lighted and each segment can be tested. Refer to M74LS47P for the $\overline{BI}/\overline{RBO}$ and a~g circuits.

The only difference between the M74LS247P and M74LS47P is the configuration of the 6 and 9 numerals.

BLOCK DIAGRAM



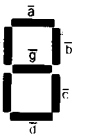
BCD-TO-7-SEGMENT DECODER/DRIVER(ACTIVE-LOW OUTPUT)

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	H	(1)
1	H	X	L	L	L	H		H	H	L	L	H	H	H	H	
2	H	X	L	L	H	L		H	L	L	H	L	L	H	L	
3	H	X	L	L	H	H		H	L	L	L	L	H	H	L	
4	H	X	L	H	L	L		H	H	L	L	H	H	L	L	
5	H	X	L	H	L	H		H	L	H	L	L	H	L	L	
6	H	X	L	H	H	L		H	L	H	L	L	L	L	L	
7	H	X	L	H	H	H		H	L	L	L	H	H	H	H	
8	H	X	H	L	L	L		H	L	L	L	L	L	L	L	
9	H	X	H	L	L	H		H	L	L	L	L	H	L	L	
10	H	X	H	L	H	L		H	H	H	H	L	L	H	L	
11	H	X	H	L	H	H		H	H	H	L	L	H	H	L	
12	H	X	H	H	L	L		H	H	L	H	H	H	L	L	
13	H	X	H	H	L	H		H	L	H	H	L	H	L	L	
14	H	X	H	H	H	L		H	H	H	H	L	L	L	L	
15	H	X	H	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	H	(2)
Ripple blanking	H	L	L	L	L	L		L	H	H	H	H	H	H	H	(3)
Lamp test	L	X	X	X	X	X		H	L	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 $\overline{RBI}$, D_A, D_B, D_C and D_D are set low with $\overline{LT}$ high.
(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	ɔ	u	⊏	t	

ABSOLUTE MAXIMUM RATINGS (Ta = −20 ~ +75°C, unless otherwise noted)

Symbol	Parameter		Conditions	Limits	Unit
V_{CC}	Supply voltage			−0.5 ~ +7	V
V_I	Input voltage	Input $\overline{BI}/\overline{RBO}$		−0.5 ~ V_{CC}	V
		Other inputs		−0.5 ~ +15	V
V_O	Output voltage	Output $\overline{BI}/\overline{RBO}$	High-level state	−0.5 ~ V_{CC}	V
		Other outputs		−0.5 ~ +15	V
$I_{O(peak)}$	Output current		tw ≤ 1ms, dutycycle ≤ 10%	200	mA
I_O	Output current		High-level state	1	mA
Topr	Operating free-air ambient temperature range			−20 ~ +75	°C
Tstg	Storage temperature range			−65 ~ +150	°C

RECOMMENDED OPERATING CONDITIONS (Ta = −20 ~ +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, outputs $\overline{a}$ ~ $\overline{g}$	V_{OH} = 15V	0		250	μA
I_{OH}	High-level output current, output $\overline{BI}/\overline{RBO}$	V_{OH} ≥ 2.4V	0		−50	μA
I_{OL}	Low-level output current, outputs $\overline{a}$ ~ $\overline{g}$	V_{OL} ≤ 0.4V	0		12	mA
		V_{OL} ≤ 0.5V	0		24	mA
I_{OL}	Low-level output current, output $\overline{BI}/\overline{RBO}$	V_{OL} ≤ 0.4V	0		1.6	mA
		V_{OL} ≤ 0.5V	0		3.2	mA

MITSUBISHI ELECTRIC

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

ELECTRICAL CHARACTERISTICS ($T_a = -20 \sim +70°C$, unless otherwise noted)

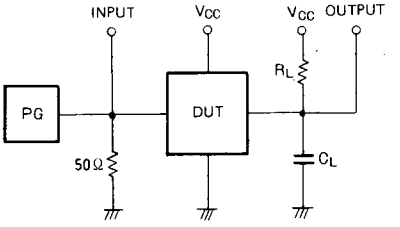
Symbol	Parameter		Test conditions		Limits Min	Limits Typ *	Limits Max	Unit
V_{IH}	High-level input voltage				2			V
V_{IL}	Low-level input voltage						0.8	V
V_{IC}	Input clamp voltage		$V_{CC}=4.75V$, $I_{IC}=-18mA$				-1.5	V
V_{OH}	High-level output voltage, output $\overline{BI}/\overline{RBO}$		$V_{CC}=4.75V$	$I_{OH}=-50\mu A$	2.4	4.2		V
I_{OH}	High-level output current, outputs $\bar{a} \sim \bar{g}$		$V_I=0.8V$, $V_I=2V$	$V_O=15V$			250	μA
V_{OL}	Low-level output voltage	Outputs $\bar{a} \sim \bar{g}$	$V_{CC}=4.75V$ $V_I=0.8V$, $V_I=2V$	$I_{OL}=12mA$		0.25	0.4	V
				$I_{OL}=24mA$		0.35	0.5	V
		Output $\overline{BI}/\overline{RBO}$		$I_{OL}=1.6mA$		0.25	0.4	V
				$I_{OL}=3.2mA$		0.35	0.5	V
I_{IH}	High-level input voltage, except input $\overline{BI}/\overline{RBO}$		$V_{CC}=5.25V$, $V_I=2.7V$				20	μA
			$V_{CC}=5.25V$, $V_I=10V$				0.1	mA
I_{IL}	Low-level input current	Input $\overline{BI}/\overline{RBO}$	$V_{CC}=5.25V$, $V_I=0.4V$				-1.2	mA
		Other inputs					-0.4	mA
I_{OS}	Short-circuit output current, output $\overline{BI}/\overline{RBO}$		$V_{CC}=5.25V$, $V_O=0V$		-0.3		-2	mA
I_{CC}	Supply current		$V_{CC}=5.25V$ (Note 2)			7	13	mA

* : All typical values are at $V_{CC}=5V$, $T_a=25°C$.
Note 2. I_{CC} is measured with all inputs at 4.5V.

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

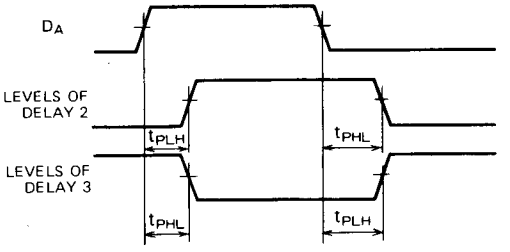
Symbol	Parameter	Test conditions	Limits Min	Limits Typ	Limits Max	Unit
t_{PLH}	Low-to-high-level, high-to-low-level output propagation time, from input D_A to outputs $\bar{a} \sim \bar{g}$	$R_L=665\Omega$ $C_L=15pF$ (Note 3)		35	100	ns
t_{PHL}				30	100	ns
t_{PLH}	Low-to-high-level, high-to-low-level output propagation time, from input $\overline{RBI}$ to outputs $\bar{a} \sim \bar{f}$			50	100	ns
t_{PHL}				45	100	ns

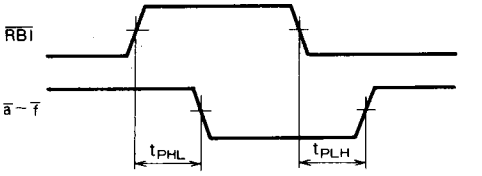
Note 3: Measurement circuit



(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)





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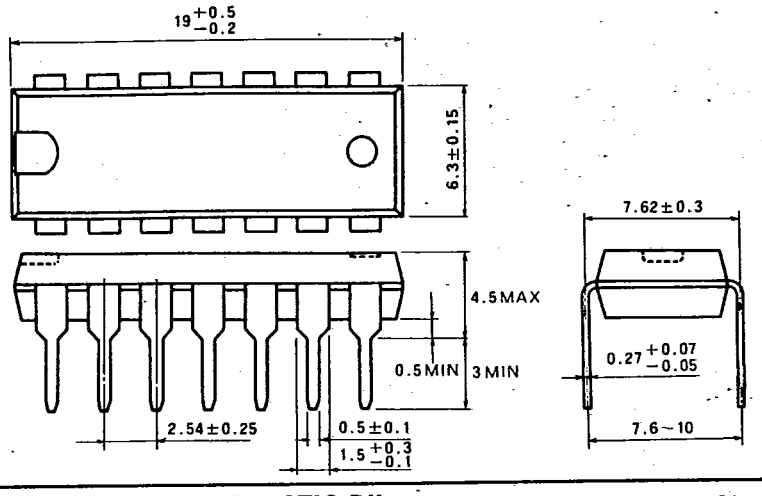
T-90-20

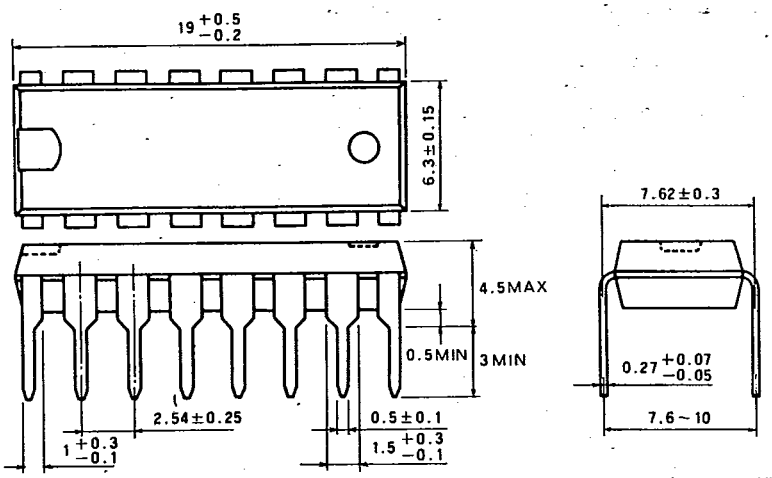
TYPE 14P4 14-PIN MOLDED PLASTIC DIL

Dimension in mm



TYPE 16P4 16-PIN MOLDED PLASTIC DIL

Dimension in mm



TYPE 20P4 20-PIN MOLDED PLASTIC DIL

Dimension in mm