

MITSUBISHI (DGTL LOGIC)

M54405P**4-BIT BINARY-TO-SEVEN-SEGMENT DECODER/DRIVER****DESCRIPTION**

The M54405P is a semiconductor integrated circuit with a 4-bit binary-to-seven-segment decoder/driver. It contains a TTL open collector output driver.

FEATURES

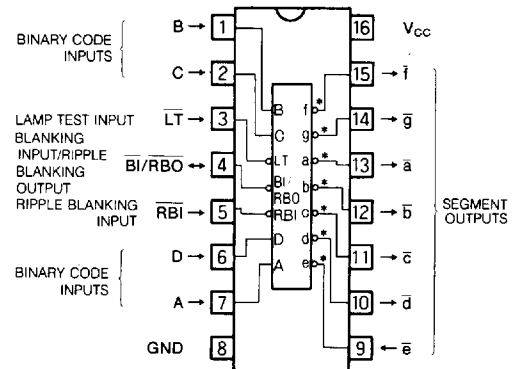
- High output breakdown voltage ($V_O=15V$)
- Output current ($I_O=16mA$)
- Displays 16 characters (0, 1~9, A, b, C, d, E, F)
- Zero-suppression input/output ($\overline{RBI}$, $\overline{BI/RBO}$)
- Lamp-test ($\overline{LT}$) provided

APPLICATION

General-purpose industrial and consumer electronic digital equipment.

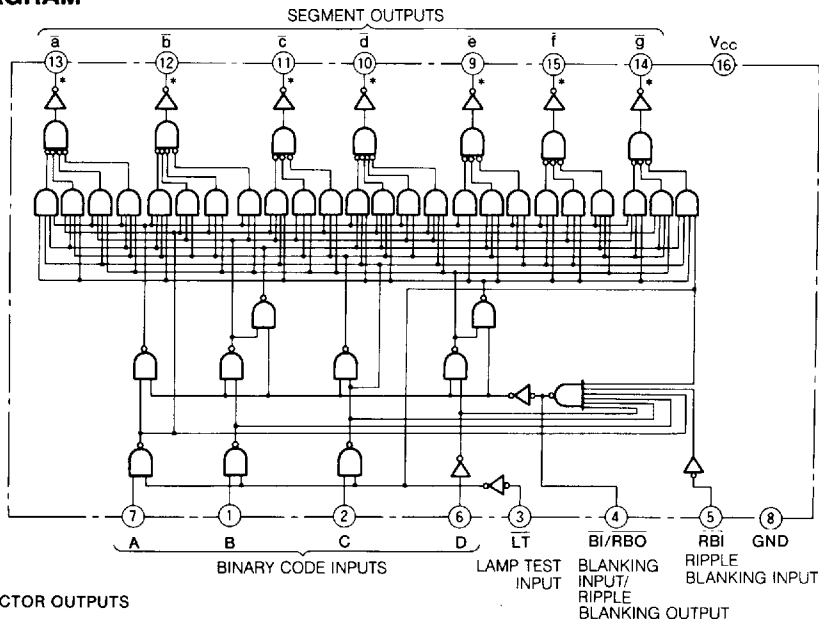
FUNCTION

The M54405P is a 4-bit binary-to-7-segment decoder/driver which can directly drive a mosaic type of display tube. In particular, it features English alphabet indication when numbers 10~15 are applied to inputs A, B, C and D in 4-bit pure binary code. The circuitry employs a TTL configuration and open collector outputs (15V breakdown voltage, 16mA load current, active low) are used in the output stage so that a display tube can be lighted directly. Auxiliary inputs include the lamp test input ($\overline{LT}$) which lights all the segments, regardless of the status of the inputs, the blanking input ($\overline{BI/RBO}$) that blanks the segments, and the ripple blanking input ($\overline{RBI}$) which blanks the segments only with a decimal "0" and which can be used for zero masking.

PIN CONFIGURATION (TOP VIEW)

Outline 16P4

* : OPEN COLLECTOR OUTPUTS

LOGIC DIAGRAM

* : OPEN COLLECTOR OUTPUTS

4-BIT BINARY-TO-SEVEN-SEGMENT DECODER/DRIVER

FUNCTION TABLE

Decimal number of function	LT	RBI	D	C	B	A	BI/RBO	$\bar{a}$	$\bar{b}$	$\bar{c}$	$\bar{d}$	$\bar{e}$	$\bar{f}$	$\bar{g}$	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	L	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	L	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	L	L	L	H	L	L	L	
11	H	X	H	L	H	H	H	H	H	L	L	L	L	L	
12	H	X	H	H	L	L	H	L	H	H	L	L	L	H	
13	H	X	H	H	L	H	H	H	L	L	L	L	H	L	
14	H	X	H	H	H	L	H	L	H	H	L	L	L	L	
15	H	X	H	H	H	H	H	L	H	H	H	L	L	L	
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 : LT is normally kept high.

RBI should be kept open or high with a decimal 0 output.

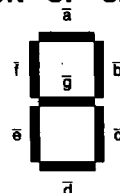
2 : When BI is low, all the segment outputs are set high regardless of the status of the other inputs.

3 : When RBI, A, B, C, D are low, all the segment outputs are set high and BI/RBO is set low.

4 : When LT is low, all the segment outputs are set low.

5 : X : Irrelevant.

DEFINITION OF SEGMENTS



SEGMENT IDENTIFICATION

Hexadecimal 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	A	b	C	d	E	F

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

Symbol	Parameter	Conditions	Ratings	Unit
V_{CC}	Supply voltage		7	V
V_i	Input voltage		5.5	V
I_o	Output current	Output high	1	mA
P_d	Power dissipation		500	mW
T_{opr}	Operating temperature		$-20 \sim +75$	$^\circ\text{C}$
T_{stg}	Storage temperature		$-65 \sim +150$	$^\circ\text{C}$

RECOMMENDED OPERATING CONDITIONS ($T_a = -20 \sim +75^\circ\text{C}$, unless otherwise noted)

Symbol	Parameter	Limits			Unit
		Min	Typ	Max	
V_{CC}	Supply voltage	4.75	5	5.25	V
V_o	Output breakdown voltage			15	V
I_{OL}	Low-level state output current			16	mA
F_o	Fan out			5	—

4-BIT BINARY-TO-SEVEN-SEGMENT DECODER/DRIVER

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

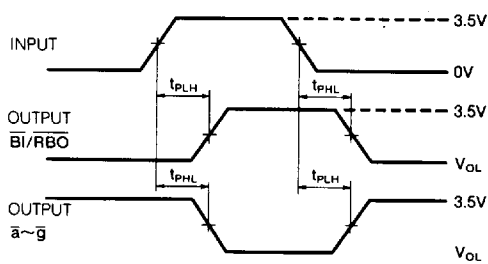
Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ*	Max	
V _{IH}	High-level input voltage		2			V
V _{IL}	Low-level input voltage				0.8	V
V _{IC}	Input clamp voltage	V _{CC} = 4.75V, I _C = -12mA			-1.5	V
I _{OH}	High-level output current ($\bar{a}\sim\bar{g}$)	V _{CC} = 5.25V, V _{IH} = 2V, V _{IL} = 0.8V V _{OH} = 15V			250	μA
V _{OH}	High-level output voltage ($\bar{B}i/\bar{R}B\bar{O}$)	V _{CC} = 4.75V, I _{OH} = -0.2mA	2.4	3.3		V
V _{OL}	Low-level output voltage ($\bar{a}\sim\bar{g}$)	V _{CC} = 4.75V, V _{IH} = 2V, V _{IL} = 0.8V I _{OL} = 16mA		0.22	0.4	V
V _{OL}	Low-level output voltage ($\bar{B}i/\bar{R}B\bar{O}$)	V _{CC} = 4.75V, V _{IH} = 2V, V _{IL} = 0.8V I _{OL} = 8mA		0.22	0.4	V
I _{IH}	High-level input current (except $\bar{B}i/\bar{R}B\bar{O}$)	V _{CC} = 5.25V, V _I = 2.4V			40	μA
I _{IL}	Low-level input current (except $\bar{B}i/\bar{R}B\bar{O}$)	V _{CC} = 5.25V, V _I = 0.4V			-1.6	mA
I _{IL}	Low-level current ($\bar{B}i/\bar{R}B\bar{O}$)	V _{CC} = 5.25V, V _I = 0.4V			-4.2	mA
I _{OS}	Output short-circuit current ($\bar{B}i/\bar{R}B\bar{O}$)	V _{CC} = 5.25V			-4	mA
I _{CC}	Supply current	V _{CC} = 5.25V			90	mA

* : A typical value at T_a = 25°C.

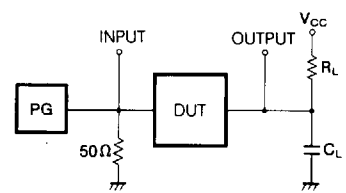
SWITCHING CHARACTERISTICS (V_{CC} = 5V, T_a = 25°C, unless otherwise noted)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
t _{PLH} (A- $\bar{a}$)	Output low-to-high, high-to-low propagation time, from input A, $\bar{R}B\bar{i}$ to outputs $\bar{a}$ thru $\bar{g}$	C _L = 15pF, R _L = 280Ω			130	ns
t _{PHL} (A- $\bar{a}$)					130	ns

TIMING DIAGRAM (Reference level = 1.5V)



Note 6 : TEST CIRCUIT

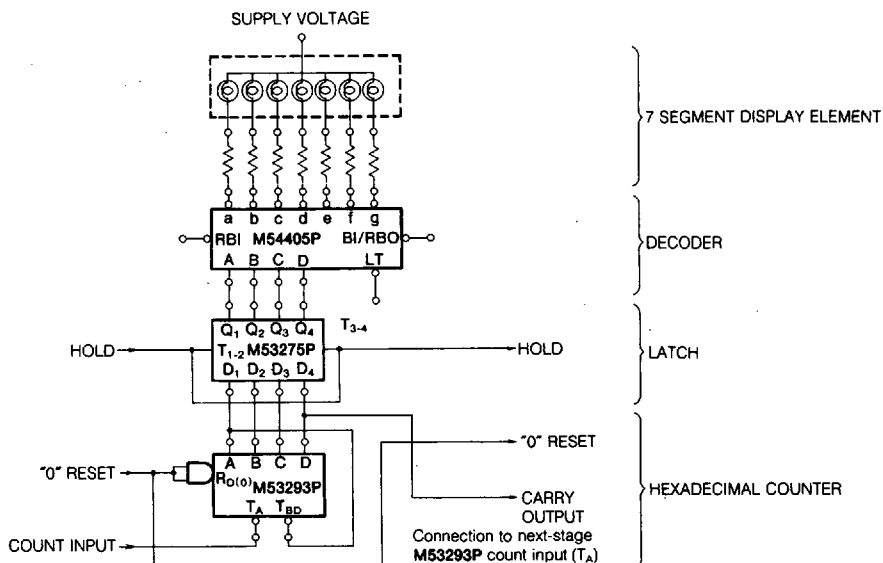


1. The pulse generator (PG) characteristics : $t_r \leq 10\text{ns}$, $t_f \leq 10\text{ns}$, PRR = 1MHz, $t_{pw} = 500\text{ns}$, $V_p = 3.5V_{p-p}$, $Z_o = 50\Omega$.
2. C_L includes probe and jig capacitance.

4-BIT BINARY-TO-SEVEN-SEGMENT DECODER/DRIVER

APPLICATION EXAMPLES

7-SEGMENT DISPLAY DRIVE CIRCUIT



ZERO SUPPRESSION AND LIGHT CONTROL

