SPECIFICATION

Graphic Type STN Dot Matrix LCD Module

JM24064A (COB Version)

Kentec GmbH - Elektronische Bauelemente - www.kentec.net

● GENERAL SPECIFICATION

240 X 64 dots display

SAM SUNG LCD driver S6B0107(KS0107B) and S6B0108(KS0108B)

Interface with 8-bit MPU (directly connected to M6800 serial MPU)

Display Specification

Display Dot: 240 X 64

Display type: STN and FSTN

Display color-Display background color: Black-Yellow Green,Blue-Gray, Black-White

Polarizer mode: Positive,Negative;Reflective ,Transflective,Transmissive

Viewing angle: 6:00 and 12:00

Display duty: 1/64

Driving bias: 1/9

Display RAM: 16384 bits

Mechanical characteristics (Unit:mm)

External dimension: 180.0 X 75.0 X 10.0 (15.0 for LED Backlight)

View area: 132.0 X 39.0

Dot size: 0.48 X 0.48

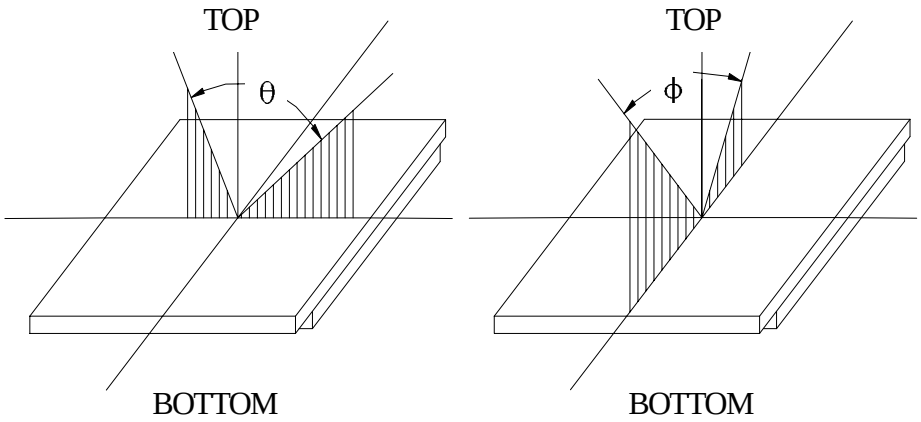
Dot pitch: 0.53 X 0.53

Weight: 110g (150g for Bottom LED Backlight; 135g for Side LED Backlight)

POWER: negative power, +5V power

● Optical Characteristics

(1) Definition of viewing Angle



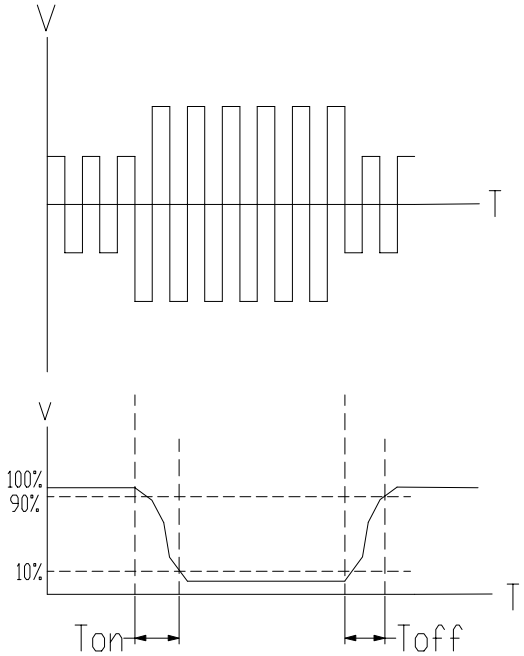
(2) Definition of Contrast Ratio:

$$\text{Contrast Ratio} = \frac{\text{Reflectance value of non-selected state brightness}}{\text{Reflectance value of selected state brightness}}$$

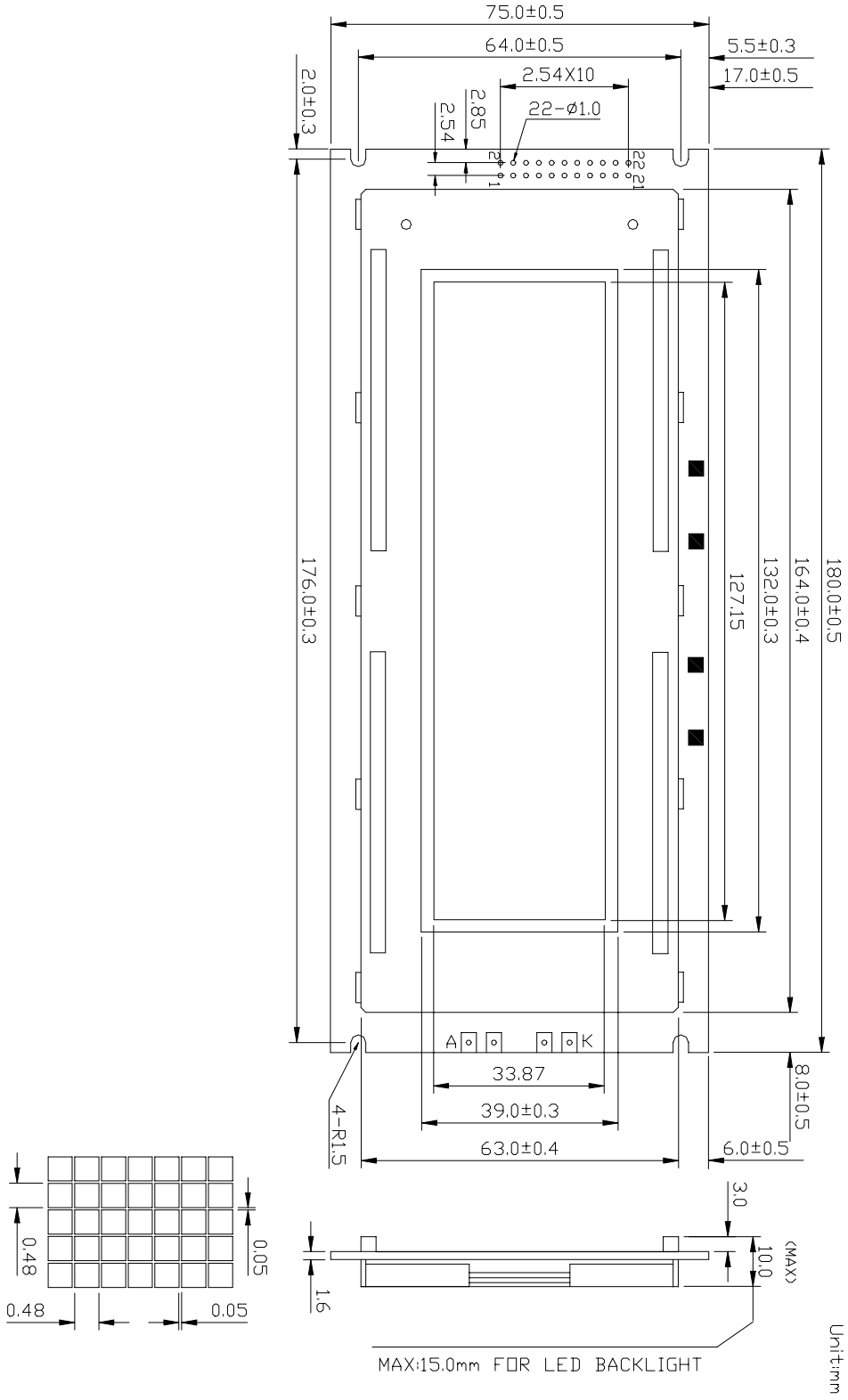
Test condition : standard A light source

(3) Response Time

Response time is measured as the shortest period of time possible between the change in state of an LCD segment as demonstrated below



● External Dimension



● Absolute Maximum Ratings For Side LED Backlight

Parameter	Symbol	Test condition	Min	Type	Max	Unit
LED Forward Consumption Current	I_f	Ta=25℃ Vf=4.1V		225	-	mA
LED Allowable Dissipation	P_d			920	-	mW

● Absolute Maximum Ratings For Bottom LED Backlight

Parameter	Symbol	Test condition	Min	Type	Max	Unit
LED Forward Consumption Current	I_f	Ta=25℃ Vf=4.1 V	-	520	-	mA
LED Allowable Dissipation	P_d		-	2500	-	mW

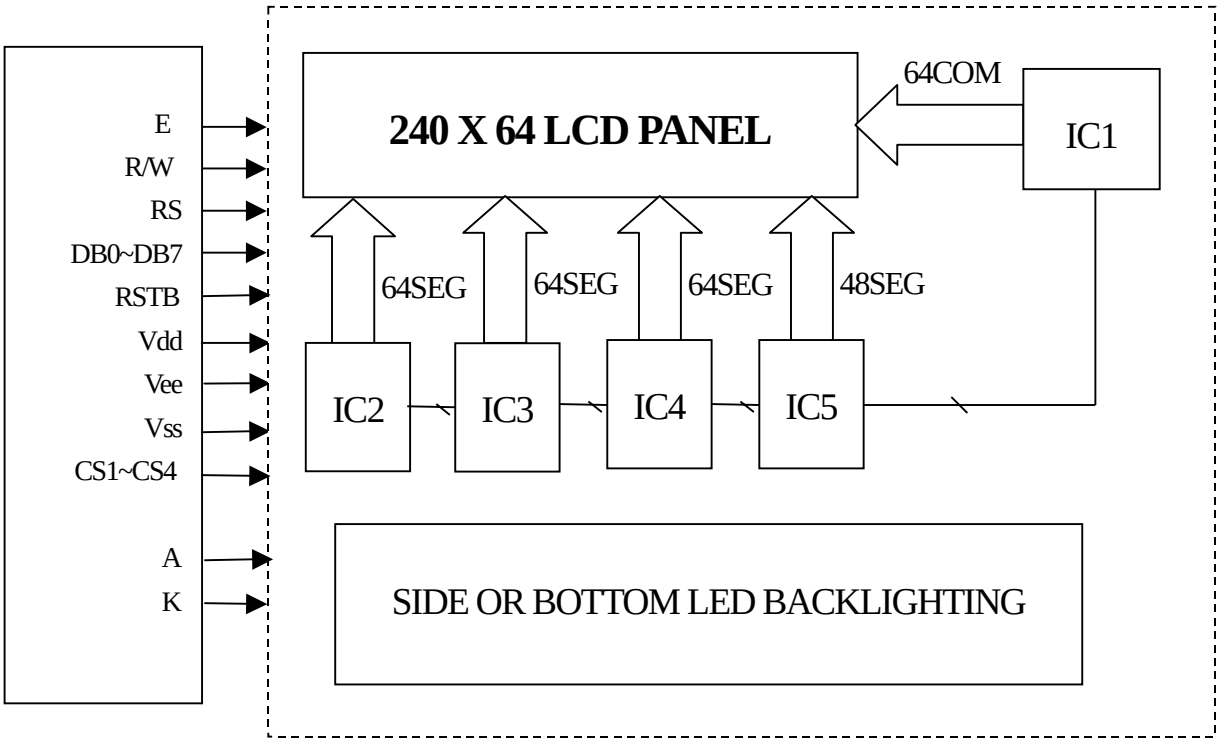
● Absolute Maximum Ratings

Item	Symbol	Condition	Standard Value		Unit
			Min	Max	
Supply Voltage for logic	Vdd	Ta=25℃	-0.3	7.0	V
Supply Voltage for LCD	Vee		Vdd-19.0	Vdd+0.3	V
Input Voltage	Vi		-0.3	Vdd+0.3	V
Operating Temp(T)	Top	-	0	50	℃
Storage Temp(T)	Tstg	-	-20	70	℃
Operating Temp(HT)	HTop	-	-20	70	℃
Storage Temp(HT)	HTstg	-	-30	80	℃
Operating Temp(EHT)	EHTop	-	-30	80	℃
Storage Temp(EHT)	EHTstg	-	-40	80	℃

● Electrical Characteristics (Ta=25℃, Vdd= 5.0V)

Item	Symbol	Condition	Standard Value			Unit
			Min	Type	Max	
Supply Voltage for logic	Vdd-Vss	-	4.5	5.0	5.5	V
Supply Current for logic	Idd	Vdd=5.0	-	8.0	-	mA
Driving Current for LCD	Iee	Vee=-7.8	-	2.0	-	mA
Driving Voltage for LCD	Vdd-Vee	25℃	-	12.8	-	V
Input Voltage"H" level	V_{IH}	H	0.7Vdd	-	Vdd	V
Input Voltage "L" level	V_{IL}	L	0	-	0.8	V

● Block Diagram

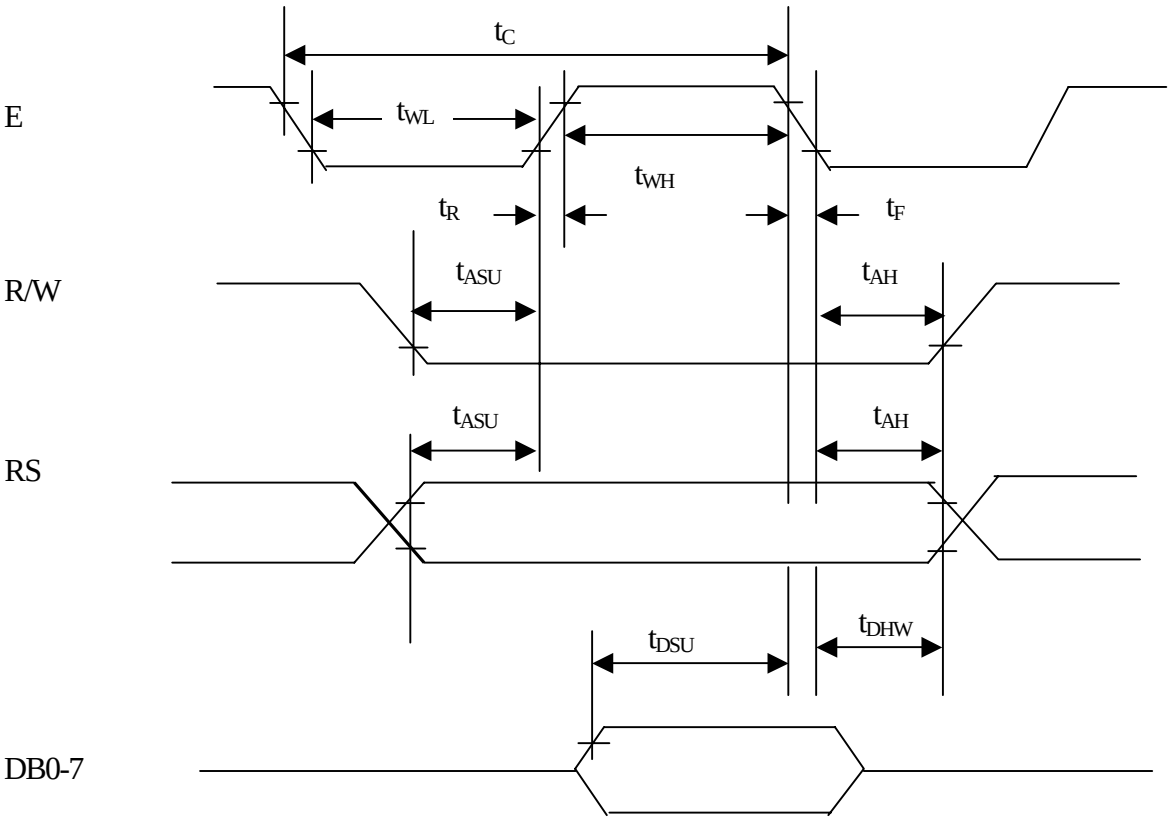


● Pin assignment

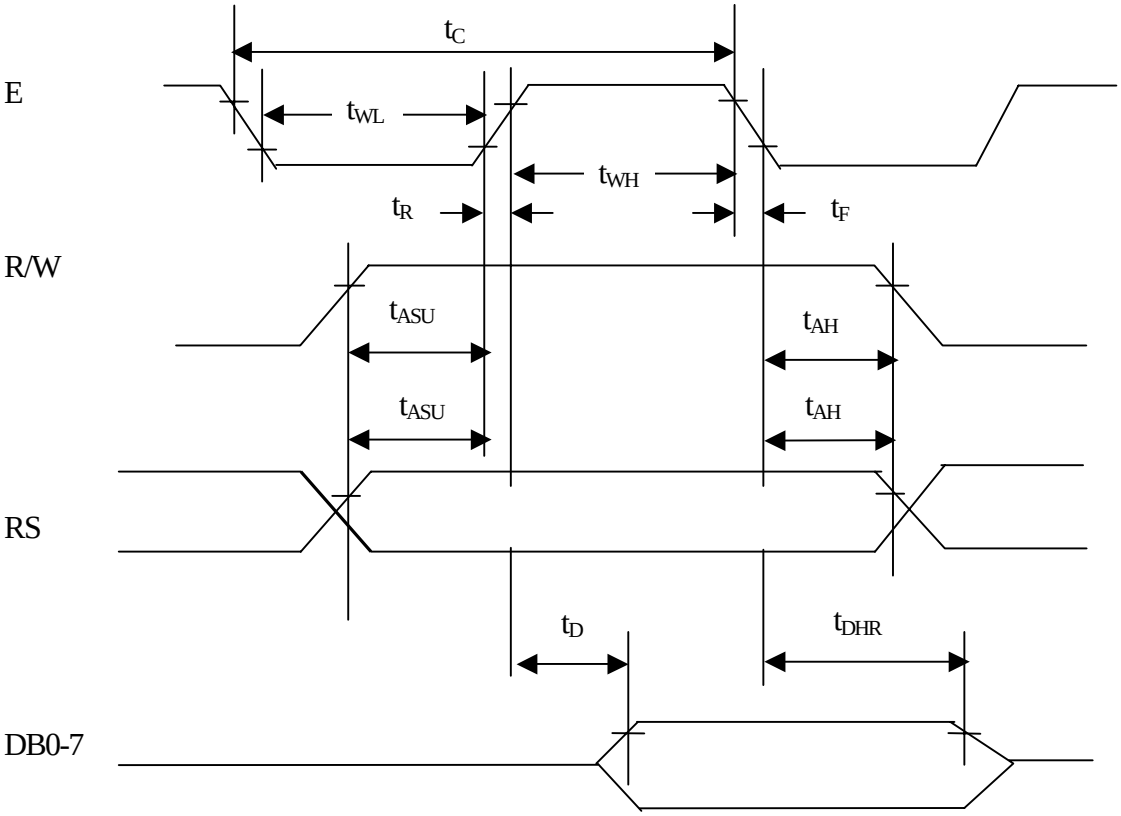
Pin NO.	Symbol	Function		Remark
1	Vss	Power Supply	0V	
2	Vdd		+5V	
3	Vee		For LCD	Variable
4	RS	Register Select (H:Data L:Instruction)		
5	R/W	L:MPU to LCM H:LCM to MPU		
6	E	Enable		
7	RSTB	Reset Signal when "L"		
8	DB0	Data Bit 0		
9	DB1	Data Bit 1		
10	DB2	Data Bit 2		
11	DB3	Data Bit 3		
12	DB4	Data Bit 4		
13	DB5	Data Bit 5		
14	DB6	Data Bit 6		
15	DB7	Data Bit 7		
16	CS1	Chip select signal for IC2 When L		
17	CS2	Chip select signal for IC3 When L		
18	CS3	Chip select signal for IC4 When L		
19	CS4	Chip select signal for IC5 When L		
20	NC	No connection		
21	A	Anode of LED Unit		
22	K	Cathode of LED Unit		

● MPU Interface

Characteristic	Symbol	Min	Typ	Max	Unit
E Cycle	t_C	1000	-	-	ns
E High Level Width	t_{WH}	450	-	-	ns
E Low Level Width	t_{WL}	450	-	-	ns
E Rise Time	t_R	-	-	25	ns
E Fall Time	t_F	-	-	25	ns
Address Set-Up Time	t_{ASU}	140	-	-	ns
Address Hold Time	t_{AH}	10	-	-	ns
Data Set-Up Time	t_{DSU}	200	-	-	ns
Data Delay Time	t_D	-	-	320	ns
Data Hold Time(Write)	t_{DHW}	10	-	-	ns
Data Hold Time(Read)	t_{DHR}	20	-	-	ns



MPU writing timing



MPU read timimg

● Reflector of Screen and Display RAM

Y address 0 ..... 63 0 ..... 63 0 ..... 63 0 48

Display start Line(Z address)

0	0	0	0
1	1	1	1
⋮	⋮	⋮	⋮
7 (Page)	7	7	7

Correspondence with data bits and arrow direction

→ DB0 DB1 DB2 DB3 DB4 DB5 DB6 DB7

● DISPLAY CONTROL INSTRUCTION

Instruction	RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	Function
Display ON/OFF	L	L	L	L	H	H	H	H	H	L/H	Controls the display on or off. Internal status and display RAM data is not affected. L:OFF，H:ON
Set address (Y address)	L	L	L	H	Y address（0~63）						Sets the Y address in the Y address counter.
Set Page (X address）	L	L	H	L	H	H	H	Page（0~7）			Sets the X address at the X address register.
Display Start Line (Z address）	L	L	H	H	Display start line						Indicates the display data RAM displayed at the top of the screen.
Status Read	L	H	BUSY	L	ON/OFF	RESET	L	L	L	L	BUSY L:Ready H:In operation ON/OFF L:Display ON H:Display OFF RESET L:Normal H:Reset
Write Display Data	H	L	Write Data								Writes data (DB0:7) into display data RAM,After writing instruction,Y address is increased by 1 automatically.
Read Display Data	H	H	Read Data								Reads data (DB0:7) from display data RAM to the data bus.

1.Display On/Off

RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	0	0	0	1	1	1	1	1	D

The display data appears when D is 1 and disappears when D is 0.
Though the data is not on the screen with D=0,it remains in the display data RAM.
Therefore, you can make it appear by changing D=0 into D=1.

2.Set Address(Y Address)

RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	0	0	1	AC5	AC4	AC3	AC2	AC1	AC0

Y address (AC0-AC5) of the display data RAM is set in the Y address counter.
An address is set by instruction and increased by 1 automatically by read or write operations of display data.

3.Set Page(X Address)

RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	0	1	0	1	1	1	AC2	AC1	AC0

X address (AC0-AC2) of the display data RAM is set in the X address register.
Writing or reading to or from MPU is executed in this specified page until the next page is set.

4.Display Start Line(Z Address)

RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	0	1	1	AC5	AC4	AC3	AC2	AC1	AC0

Z address (AC0-AC5) of the display data RAM is set in the display start line register and displayed at the top of the screen.
When the display duty cycle is 1/64 or others(1/32-1/64),the data of total line number of LCD screen, from the line specified by display start line instruction ,is displayed.

5.Status Read

RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
1	0	BUSY	0	ON/OFF	RESET	0	0	0	0

- BUSY
  When BUSY is 1,the Chip is executing internal operation and no instructions are accepted.
  When BUSY is 0,the Chip is ready to accept any instructions.

- ON/OFF
  When ON/OFF is 1,the display is on.
  When ON/OFF is 0,the display is off.

- RESET
  When RESET is 1,the system is being initialized.
  In this condition, no instructions except status read can be accepted.
  When RESET is 0,initializing has finished and the system is in the usual operation condition.

6.Write Display Data

RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	1	D7	D6	D5	D4	D3	D2	D1	D0

Writes data (D0-D7) into the display data RAM.
After writing instruction, Y address is increased by 1 automatically.

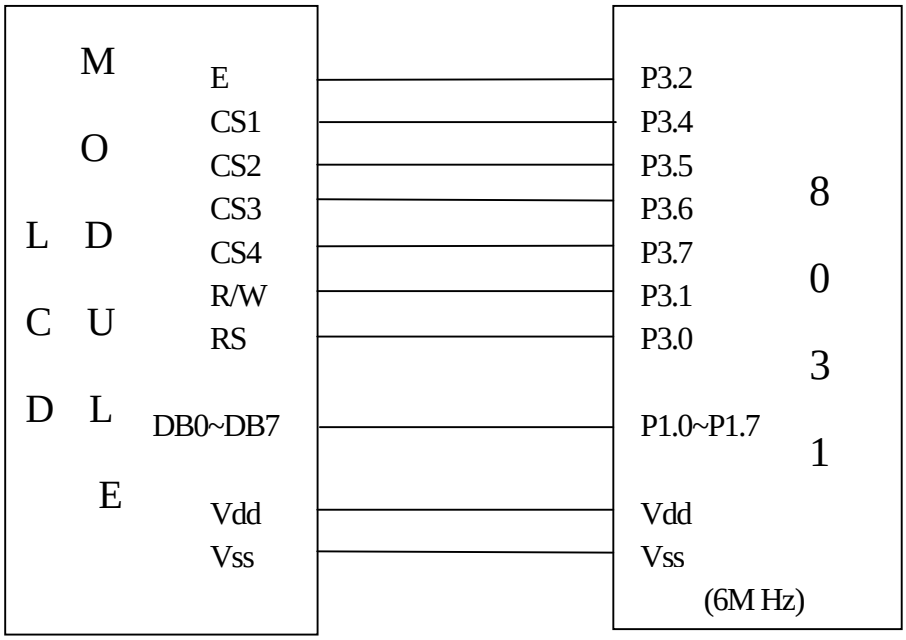
7.Read Display Data

RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
1	1	D7	D6	D5	D4	D3	D2	D1	D0

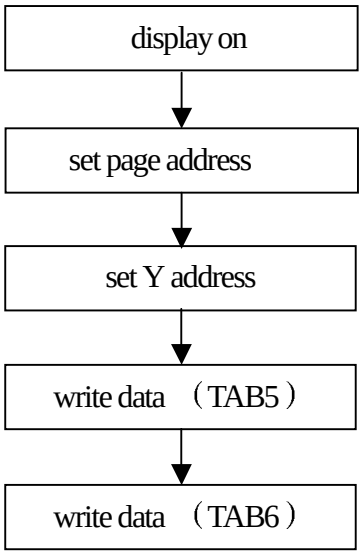
Reads data (D0-D7) from the display data RAM.
After reading instruction, Y address is increased by 1 automatically.

● APPLICATION EXAMPLE

Application Circuit



Application Flowchart



Program Example

```
      RS        EQU     P3.0
      R/W       EQU     P3.1
      E         EQU     P3.2
      C1        EQU     P3.4
      C2        EQU     P3.5
      C3        EQU     P3.6
      C4        EQU     P3.7
          ORG     0000H
INIT:   LCALL   BUSY2
          SETB    RSTB
          CLR    RS
          SETB    R/W
          CLR    E
          SETB    C1
          SETB    C2
          SETB    C3
          SETB    C4
;--------------DISP ON,DISP BLANK
MAIN: CLR    C1
          CLR C2
          CLR    C3
          CLR    C4
          MOV    R2,#3FH
          LCALL    WINS
          MOV    R2,#0C0H
          LCALL    WINS
          MOV    R2,#0B8H
          LCALL    WINS
          MOV    R1,#00H
          MOV    R5,#08H
LOOP1:MOV    DPTR,#TAB6
          LCALL    RAM
          DJNZ    R5,LOOP1
;--------------DISP TAB3
          MOV    R5,#08H
          MOV    R1,#00H
          MOV    R2,#0B8H
          LCALL    WINS
```

```
LOOP4:MOV    DPTR,#TAB3
        LCALL    RAM
        DJNZ    R5,LOOP4
        LCALL    DELAY2
;----------------DISP SHENZHEN JINGHUA
JH:     CLR    C1
        SETB    C2
        SETB    C3
        SETB    C4
        MOV    R5,#08H
        MOV    R1,#00H
        MOV    R2,#0B8H
        LCALL    WINS
        MOV    DPTR,#T111
LOOP8:LCALL    RAM
        DJNZ    R5,LOOP8

        SETB    C1
        CLR    C2
        SETB    C3
        SETB    C4
        MOV    R5,#08H
        MOV    R1,#00H
        MOV    R2,#0B8H
        LCALL    WINS
        MOV    DPTR,#T211
LOOP9:LCALL    RAM
        DJNZ    R5,LOOP9
        SETB    C1
        STEB    C2
        CLR    C3
        SETB    C4
        MOV    R5,#08H
        MOV    R1,#00H
        MOV    R2,#0B8H
        LCALL    WINS
        MOV    DPTR,#T311
LOOPA: LCALL    RAM
        DJNZ    R5,LOOPA
```

```
        SETB   C1
        SETB   C2
        SETB   C3
        CLR    C4
        MOV    R5,#08H
        MOV    R1,#00H
        MOV    R2,#0B8H
        LCALL  WINS
        MOV    DPTR,#T411
LOOPB:LCALL    RAM
        DJNZ   R5,LOOPB
        LCALL  DELAY2
        LCALL  DELAY2
        LCALL  DELAY2
        LJMP   MAIN
;--------------WRITE TO X:00 TO 07
;--------------WRITE TO Y:00 TO 63
RAM:   MOV     R2,#40H
        LCALL  WINS
        CLR    A
        MOV    R3,#40H
RAM3:MOVC      A,@A+DPTR
        MOV    R2,A
        LCALL  WDAT
        INC    DPTR
        CLR    A
        DJNZ   R3,RAM3
        INC    R1
        MOV    A,#0B8H
        ADD    A,R1
        MOV    R2,A
        LCALL  WINS
        RET
WDAT:  LCALL   BUSY1
         MOV   P1,R2
         SETB  RS
         CLR   R/W
         SETB  E
         CLR   E
```

```
        RET
WINS: LCALL   BUSY1
      MOV   P1,R2
      CLR   RS
      CLR   R/W
      SETB   E
      CLR   E
      RET
BUSY1:CLR   A
      ORL   P1,#0FFH
      SETB   R/W
      CLR   RS
      SETB   E
      MOV   A,P1
      SETB   E
      CLR   E
      JB   ACC.7,BUSY1
      RET
BUSY2:ORL   P1,#0FFH
      CLR   A
      SETB   R/W
      CLR   RS
      SETB   E
      MOV   A,P1
      LCALL   DELAY1
      SETB   E
      CLR   E
      JB   ACC.4,BUSY2
      RET
BUSY3:ORL   P1,#0FFH
      CLR   A
      SETB   R/W
      CLR   RS
      SETB   E
      MOV   A,P1
      SETB   E
      JB   ACC.5,BUSY3
      RET
```

```
;-----------------DELAY 120us
            MOV   R6,#01H
DELAY1: MOV   R7,#09H
D1:         DJNZ   R7,D1
            DJNZ   R6,DELAY1
            RET
;-----------------DELAY 1S
DELAY2: MOV   R6,#0BFH
DELAY3: MOV   R7,#0FFH
D2:         DJNZ   R7,D2
            DJNZ   R6,DELAY3
            RET
TAB3:   DB 55H,55H,55H,55H,55H,55H,55H,55H,55H,55H,55H,55H
        DB 55H,55H,55H,55H,55H,55H,55H,55H,55H,55H,55H,55H
        DB 55H,55H,55H,55H,55H,55H,55H,55H,55H,55H,55H,55H
        DB 55H,55H,55H,55H,55H,55H,55H,55H,55H,55H,55H,55H
        DB 55H,55H,55H,55H,55H,55H,55H,55H,55H,55H,55H,55H
        DB 55H,55H,55H,55H,55H,55H,55H,55H,55H,55H,55H,55H
        DB 55H,55H,55H,55H
TAB6:   DB 00H,00H,00H,00H,00H,00H,00H,00H,00H,00H,00H,00H
        DB 00H,00H,00H,00H,00H,00H,00H,00H,00H,00H,00H,00H
        DB 00H,00H,00H,00H,00H,00H,00H,00H,00H,00H,00H,00H
        DB 00H,00H,00H,00H,00H,00H,00H,00H,00H,00H,00H,00H
        DB 00H,00H,00H,00H,00H,00H,00H,00H,00H,00H,00H,00H
        DB 00H,00H,00H,00H,00H,00H,00H,00H,00H,00H,00H,00H
        DB 00H,00H,00H,00H

T111:   DB 00H,00H,00H,00H,00H,00H,00H,00H
        DB 00H,00H,00H,00H,00H,00H,00H,00H
        DB 00H,00H,00H,00H,00H,00H,00H,00H
        DB 00H,00H,00H,00H,00H,00H,00H,00H
        DB 00H,00H,00H,00H,00H,00H,00H,00H
        DB 00H,00H,00H,00H,00H,00H,00H,00H
        DB 00H,00H,00H,00H,00H,00H,00H,00H
        DB 00H,00H,00H,00H,00H,00H,00H,00H
T121:   DB 00H,00H,00H,00H,00H,00H,00H,00H
        DB 00H,00H,00H,00H,00H,00H,00H,00H
        DB 00H,00H,00H,00H,00H,00H,00H,00H
        DB 00H,00H,00H,00H,00H,00H,00H,00H
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        DB 00H,00H,00H,00H,00H,00H,00H,00H
        DB 00H,00H,00H,00H,00H,00H,00H,00H
        DB 08H,18H,78H,70H,00H,00H,0E0H,78H
        DB 10H,10H,90H,10H,10H,10H,90H,10H
T131:   DB 00H,00H,00H,00H,00H,00H,00H,00H
        DB 00H,00H,00H,00H,00H,00H,00H,00H
        DB 00H,00H,00H,00H,00H,00H,00H,00H
        DB 00H,00H,00H,00H,00H,00H,00H,00H
        DB 00H,00H,00H,00H,00H,00H,00H,00H
        DB 00H,00H,00H,00H,00H,01H,02H,07H
        DB 1CH,08H,0C0H,3CH,03H,0C0H,0A0H,98H
        DB 8CH,87H,83H,81H,0F8H,0F0H,0A0H,81H
T141:   DB 00H,00H,00H,00H,00H,00H,00H,00H
        DB 00H,00H,00H,00H,00H,00H,00H,00H
        DB 00H,00H,00H,00H,00H,00H,00H,00H
        DB 00H,00H,00H,00H,00H,00H,00H,00H
        DB 00H,00H,00H,00H,00H,00H,00H,00H
        DB 00H,00H,00H,00H,00H,04H,04H,04H
        DB 0FCH,0FEH,01H,00H,00H,80H,0C0H,60H
        DB 30H,1CH,0FH,03H,0FFH,0FFH,03H,1CH
T151:   DB 00H,00H,00H,00H,00H,00H,00H,00H
        DB 00H,00H,00H,00H,00H,00H,00H,00H
        DB 00H,00H,00H,00H,00H,00H,00H,00H
        DB 00H,00H,00H,00H,00H,00H,00H,00H
       DB 00H,00H,00H,00H,00H,00H,00H,00H
       DB 00H,00H,00H,00H,00H,00H,00H,01H
       DB 03H,07H,00H,01H,01H,00H,00H,00H
       DB 00H,00H,00H,00H,0FH,07H,00H,00H
T161: DB 00H,00H,00H,00H,00H,00H,00H,00H
       DB 00H,00H,00H,00H,00H,00H,00H,00H
       DB 00H,00H,00H,00H,00H,00H,00H,00H
       DB 00H,00H,00H,00H,00H,00H,00H,00H
       DB 00H,00H,00H,00H,00H,00H,00H,00H
       DB 00H,00H,00H,00H,00H,00H,00H,00H
       DB 00H,00H,00H,00H,00H,00H,00H,00H
       DB 00H,00H,00H,00H,00H,00H,00H,00H
T171: DB 00H,00H,00H,00H,00H,00H,00H,66H
       DB 89H,89H,92H,67H,00H,00H,0FFH,10H
       DB 10H,0FFH,00H,00H,0FFH,89H,9DH,81H
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```
        DB 0E3H,00H,0FFH,02H,1CH,20H,0FFH,00H
        DB 0C7H,0A1H,91H,8DH,83H,0E1H,00H,0FFH
        DB 08H,08H,0FFH,00H,00H,0FFH,89H,9DH
        DB 81H,0E3H,00H,0FFH,02H,1CH,20H,0FFH
        DB 00H,00H,00H,00H,00H,00H,00H,00H
T181:   DB 00H,00H,00H,00H,00H,00H,00H,00H
        DB 00H,00H,00H,00H,00H,00H,00H,00H
        DB 00H,00H,00H,00H,00H,00H,00H,00H
        DB 00H,00H,00H,00H,00H,00H,00H,00H
        DB 00H,00H,00H,00H,00H,00H,00H,00H
        DB 00H,00H,00H,00H,00H,00H,00H,00H
        DB 00H,00H,00H,00H,00H,00H,00H,00H
        DB 00H,00H,00H,00H,00H,00H,00H,00H
T211:   DB 00H,00H,00H,00H,00H,00H,00H,00H
        DB 00H,00H,00H,00H,00H,00H,00H,00H
        DB 00H,00H,00H,00H,00H,00H,00H,00H
        DB 00H,00H,00H,00H,00H,00H,00H,00H
        DB 00H,00H,00H,00H,00H,00H,00H,00H
        DB 00H,00H,00H,00H,00H,00H,00H,00H
        DB 00H,00H,00H,00H,00H,00H,00H,00H
        DB 00H,00H,00H,00H,00H,00H,00H,00H
T221:   DB 10H,10H,0D0H,78H,30H,20H,00H,00H
        DB 00H,00H,00H,00H,00H,00H,00H,00H
        DB 00H,00H,00H,00H,00H,00H,00H,00H
        DB 00H,00H,0F8H,0F0H,20H,00H,00H,00H
        DB 00H,0F8H,0F0H,20H,00H,00H,0E0H,0C0H
        DB 80H,00H,00H,00H,0F8H,0F0H,20H,00H
        DB 00H,00H,00H,00H,00H,00H,00H,00H
        DB 00H,00H,00H,00H,00H,00H,00H,00H
T231:   DB 83H,86H,8EH,9CH,0C0H,80H,00H,00H
        DB 00H,00H,00H,00H,00H,00H,00H,00H
        DB 00H,00H,00H,00H,00H,00H,00H,08H
        DB 08H,08H,0FFH,0FFH,08H,08H,0CH,0EH
        DB 08H,0FFH,0FFH,00H,00H,00H,0FFH,0FFH
        DB 00H,00H,00H,00H,0FFH,0FFH,00H,00H
        DB 00H,00H,00H,00H,00H,00H,00H,00H
        DB 00H,00H,00H,00H,00H,00H,00H,00H
T241:   DB 38H,60H,0E0H,0C0H,80H,80H,00H,00H
        DB 00H,00H,00H,00H,00H,00H,00H,00H
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        DB 00H,00H,00H,00H,00H,00H,20H,60H
        DB 60H,30H,3FH,1FH,18H,08H,08H,84H
        DB 40H,3FH,1FH,00H,00H,00H,0FFH,7FH
        DB 00H,00H,00H,00H,0FFH,0FFH,00H,00H
        DB 00H,00H,00H,00H,00H,00H,00H,00H
        DB 00H,00H,00H,00H,00H,00H,00H,0FFH
T251: DB 00H,00H,00H,01H,01H,01H,01H,00H
        DB 00H,00H,00H,00H,00H,00H,00H,00H
        DB 00H,00H,00H,00H,00H,00H,00H,00H
        DB 00H,00H,00H,04H,04H,02H,01H,00H
        DB 00H,00H,00H,00H,00H,00H,00H,00H
        DB 00H,00H,00H,00H,0FH,07H,00H,00H
        DB 00H,00H,00H,00H,00H,00H,00H,00H
        DB 00H,00H,00H,00H,00H,00H,00H,0FH
T261: DB 00H,00H,00H,00H,00H,00H,00H,00H
        DB 00H,00H,00H,00H,00H,00H,00H,00H
        DB 00H,00H,00H,00H,00H,00H,00H,00H
        DB 00H,00H,00H,00H,00H,00H,00H,00H
        DB 00H,00H,00H,00H,00H,00H,00H,00H
        DB 00H,00H,00H,00H,00H,00H,00H,00H
        DB 00H,00H,00H,00H,00H,00H,00H,00H
        DB 00H,00H,00H,00H,00H,00H,00H,00H
T271: DB 00H,00H,00H,00H,00H,60H,80H,81H
        DB 81H,7FH,01H,00H,00H,81H,0FFH,81H
        DB 00H,00H,0FFH,02H,1CH,20H,0FFH,00H
        DB 3CH,42H,81H,0A1H,62H,0E7H,00H,00H
        DB 0FFH,08H,08H,0FFH,00H,00H,7FH,80H
        DB 80H,80H,7FH,00H,0E0H,1CH,13H,1CH
        DB 0E0H,00H,00H,00H,00H,00H,00H,00H
        DB 00H,00H,00H,00H,00H,00H,81H,0FFH
T281: DB 00H,00H,00H,00H,00H,00H,00H,00H
        DB 00H,00H,00H,00H,00H,00H,00H,00H
        DB 00H,00H,00H,00H,00H,00H,00H,00H
        DB 00H,00H,00H,00H,00H,00H,00H,00H
        DB 00H,00H,00H,00H,00H,00H,00H,00H
        DB 00H,00H,00H,00H,00H,00H,00H,00H
        DB 00H,00H,00H,00H,00H,00H,00H,00H
        DB 00H,00H,00H,00H,00H,00H,00H,00H
T311: DB 00H,00H,00H,00H,00H,00H,00H,00H
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        DB 00H,00H,00H,00H,00H,00H,00H,00H
        DB 00H,00H,00H,00H,00H,00H,00H,00H
        DB 00H,00H,00H,00H,00H,00H,00H,00H
        DB 00H,00H,00H,00H,00H,00H,00H,00H
        DB 00H,00H,00H,00H,00H,00H,00H,00H
        DB 00H,00H,00H,00H,00H,00H,00H,00H
        DB 00H,00H,00H,00H,00H,00H,00H,00H
T321:   DB 00H,00H,00H,00H,0F8H,0F0H,10H,10H
        DB 10H,10H,10H,10H,10H,10H,0F0H,0F8H
        DB 10H,00H,00H,00H,00H,00H,00H,00H
        DB 00H,00H,00H,00H,00H,00H,00H,00H
        DB 00H,00H,00H,00H,00H,00H,00H,00H
        DB 00H,00H,00H,80H,0C0H,0F0H,0BCH,18H
        DB 00H,00H,00H,00H,0FCH,0FCH,08H,00H
        DB 80H,80H,0C0H,60H,70H,60H,00H,00H
T331:   DB 80H,00H,00H,00H,3FH,1FH,91H,0D1H
        DB 91H,11H,11H,0D1H,91H,91H,0BFH,9FH
        DB 80H,80H,80H,0C0H,0C0H,80H,00H,00H
        DB 00H,00H,00H,00H,00H,00H,00H,00H
        DB 00H,00H,00H,00H,00H,00H,00H,00H
        DB 08H,04H,03H,01H,0FFH,0FFH,01H,10H
        DB 08H,08H,08H,84H,7FH,0FFH,0C2H,0C3H
        DB 0C1H,0C1H,0C0H,0C0H,0C0H,0E0H,0FFH,60H
T341:   DB 0FFH,11H,11H,11H,11H,11H,0FFH,0FFH
        DB 00H,00H,00H,0FFH,0FFH,10H,10H,10H
        DB 10H,10H,10H,0FFH,0FFH,00H,00H,00H
        DB 00H,00H,00H,00H,00H,00H,00H,00H
        DB 00H,00H,00H,00H,00H,00H,00H,00H
        DB 10H,10H,10H,10H,11H,10H,10H,10H
        DB 10H,10H,10H,0FFH,0FFH,12H,10H,10H
        DB 10H,10H,10H,10H,10H,18H,1CH,18H
T351:   DB 07H,02H,02H,02H,02H,02H,07H,03H
        DB 00H,00H,00H,07H,03H,01H,01H,01H
        DB 01H,01H,01H,07H,03H,00H,00H,00H
        DB 00H,00H,00H,00H,00H,00H,00H,00H
        DB 00H,00H,00H,00H,00H,00H,00H,00H
        DB 00H,00H,00H,00H,00H,00H,00H,00H
        DB 00H,00H,00H,0FH,07H,00H,00H,00H
        DB 00H,00H,00H,00H,00H,00H,00H,00H
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T361: DB 00H,00H,00H,00H,00H,00H,00H,00H
      DB 00H,00H,00H,00H,00H,00H,00H,00H
      DB 00H,00H,00H,00H,00H,00H,00H,00H
      DB 00H,00H,00H,00H,00H,00H,00H,00H
      DB 00H,00H,00H,00H,00H,00H,00H,00H
      DB 00H,00H,00H,00H,00H,00H,00H,00H
      DB 00H,00H,00H,00H,00H,00H,00H,00H
      DB 00H,00H,00H,00H,00H,00H,00H,00H
T371: DB 81H,81H,42H,3CH,00H,00H,81H,0FFH
      DB 81H,00H,00H,066H,89H,89H,92H,77H
      DB 00H,81H,0FFH,91H,11H,09H,06H,81H
      DB 0FFH,81H,81H,80H,0C0H,00H,80H,0E0H
      DB 9CH,13H,9CH,0E0H,81H,03H,8DH,0F8H
      DB 8DH,03H,01H,00H,066H,89H,89H,92H
      DB 77H,00H,00H,00H,00H,00H,00H,00H
      DB 00H,00H,00H,00H,00H,3CH,42H,81H
T381: DB 00H,00H,00H,00H,00H,00H,00H,00H
      DB 00H,00H,00H,00H,00H,00H,00H,00H
      DB 00H,00H,00H,00H,00H,00H,00H,00H
      DB 00H,00H,00H,00H,00H,00H,00H,00H
      DB 00H,00H,00H,00H,00H,00H,00H,00H
      DB 00H,00H,00H,00H,00H,00H,00H,00H
      DB 00H,00H,00H,00H,00H,00H,00H,00H
      DB 00H,00H,00H,00H,00H,00H,00H,00H
T411: DB 00H,00H,00H,00H,00H,00H,00H,00H
      DB 00H,00H,00H,00H,00H,00H,00H,00H
      DB 00H,00H,00H,00H,00H,00H,00H,00H
      DB 00H,00H,00H,00H,00H,00H,00H,00H
      DB 00H,00H,00H,00H,00H,00H,00H,00H
      DB 00H,00H,00H,00H,00H,00H,00H,00H
      DB 00H,00H,00H,00H,00H,00H,00H,00H
      DB 00H,00H,00H,00H,00H,00H,00H,00H
T421: DB 00H,00H,00H,00H,00H,00H,00H,00H
      DB 00H,00H,00H,00H,00H,00H,00H,00H
      DB 00H,00H,00H,00H,00H,00H,00H,00H
      DB 00H,00H,00H,00H,00H,00H,00H,00H
      DB 00H,00H,00H,00H,00H,00H,00H,00H
      DB 00H,00H,00H,00H,00H,00H,00H,00H
      DB 00H,00H,00H,00H,00H,00H,00H,00H
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        DB 00H,00H,00H,00H,00H,00H,00H,00H
T431: DB 00H,00H,00H,00H,00H,00H,00H,00H
        DB 00H,00H,00H,00H,00H,00H,00H,00H
        DB 00H,00H,00H,00H,00H,00H,00H,00H
        DB 00H,00H,00H,00H,00H,00H,00H,00H
        DB 00H,00H,00H,00H,00H,00H,00H,00H
        DB 00H,00H,00H,00H,00H,00H,00H,00H
        DB 00H,00H,00H,00H,00H,00H,00H,00H
        DB 00H,00H,00H,00H,00H,00H,00H,00H
T441: DB 00H,00H,00H,00H,00H,00H,00H,00H
        DB 00H,00H,00H,00H,00H,00H,00H,00H
        DB 00H,00H,00H,00H,00H,00H,00H,00H
        DB 00H,00H,00H,00H,00H,00H,00H,00H
        DB 00H,00H,00H,00H,00H,00H,00H,00H
        DB 00H,00H,00H,00H,00H,00H,00H,00H
        DB 00H,00H,00H,00H,00H,00H,00H,00H
        DB 00H,00H,00H,00H,00H,00H,00H,00H
T451: DB 00H,00H,00H,00H,00H,00H,00H,00H
        DB 00H,00H,00H,00H,00H,00H,00H,00H
        DB 00H,00H,00H,00H,00H,00H,00H,00H
        DB 00H,00H,00H,00H,00H,00H,00H,00H
        DB 00H,00H,00H,00H,00H,00H,00H,00H
        DB 00H,00H,00H,00H,00H,00H,00H,00H
        DB 00H,00H,00H,00H,00H,00H,00H,00H
        DB 00H,00H,00H,00H,00H,00H,00H,00H
T461: DB 00H,00H,00H,00H,00H,00H,00H,00H
        DB 00H,00H,00H,00H,00H,00H,00H,00H
        DB 00H,00H,00H,00H,00H,00H,00H,00H
        DB 00H,00H,00H,00H,00H,00H,00H,00H
        DB 00H,00H,00H,00H,00H,00H,00H,00H
        DB 00H,00H,00H,00H,00H,00H,00H,00H
        DB 00H,00H,00H,00H,00H,00H,00H,00H
        DB 00H,00H,00H,00H,00H,00H,00H,00H
T471: DB 81H,81H,62H,00H,3CH,42H,81H,81H
        DB 42H,3CH,00H,0C0H,0C0H,00H,00H,00H
        DB 00H,00H,00H,00H,00H,00H,00H,81H
        DB 0FFH,81H,80H,80H,0E0H,07H,81H,0FFH
        DB 0FFH,81H,03H,00H,81H,0FFH,81H,81H
        DB 42H,3CH,00H,00H,00H,00H,00H,00H
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        DB 00H,00H,00H,00H,00H,00H,00H,00H
        DB 00H,00H,00H,00H,00H,00H,00H,00H
T481: DB 00H,00H,00H,00H,00H,00H,00H,00H
        DB 00H,00H,00H,00H,00H,00H,00H,00H
        DB 00H,00H,00H,00H,00H,00H,00H,00H
        DB 00H,00H,00H,00H,00H,00H,00H,00H
        DB 00H,00H,00H,00H,00H,00H,00H,00H
        DB 00H,00H,00H,00H,00H,00H,00H,00H
        DB 00H,00H,00H,00H,00H,00H,00H,00H
        DB 00H,00H,00H,00H,00H,00H,00H,00H

        END
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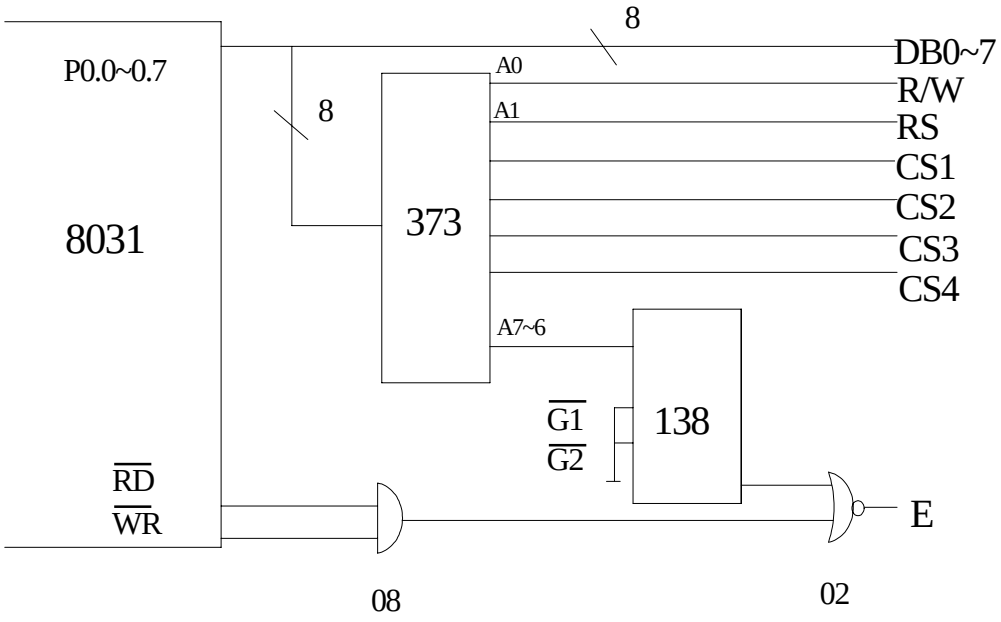
- **Application Circuit 1**



- **Application Circuit 2**