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Distar Technology Limited
Http://www.distarltd.com
Tel:86-755-26645997 Fax:86-755-26645987

SPECIFICATIONS FOR LCD MODULE

DS-G160128STBWW

PIXELS: 160 X 128 DOTS
OUTLINE DIMENSION: 129.0 X 102.0 MM
VIEWING AREA: 101.0 X 82.0 MM
DOT SIZE: 0.54 X 0.54 MM
DOT PITCH: 0.58 X 0.58 MM

REVISION RECORD

REV.	DATE	PAGE	COMMENT
A	2007-3-15		NEW RELEASE

CONTENTS

1. LCD MODULE NUMBERING SYSTEM

FOR DS-G160128STBWW

DS	DISTAR TECHNOLOGY LIMITED
G	DISPLAY CONTENTS G---GRAPHIC TYPE
160128	160X128 PIXELS LCD PANEL
ST	LCD TYPE:STN
B	BACKGROUND COLOUR : BULE
W	BACKLIGHT COLOR : WHITE
W	WIDE TEMPRETURE

K: DENOTE CHARACTER TABLE IS 00

2. DISPLAY MODE AND MECHANICAL CHARACTERISTICS

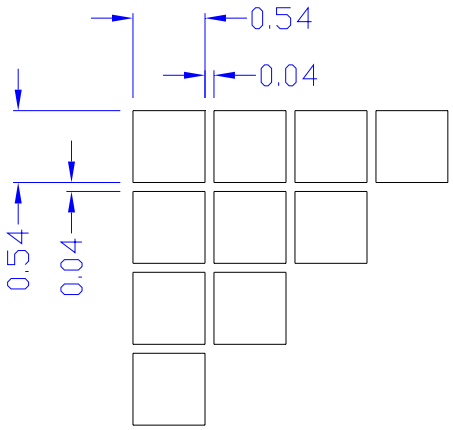
2.1 DISPLAY SPECIFICATIONS

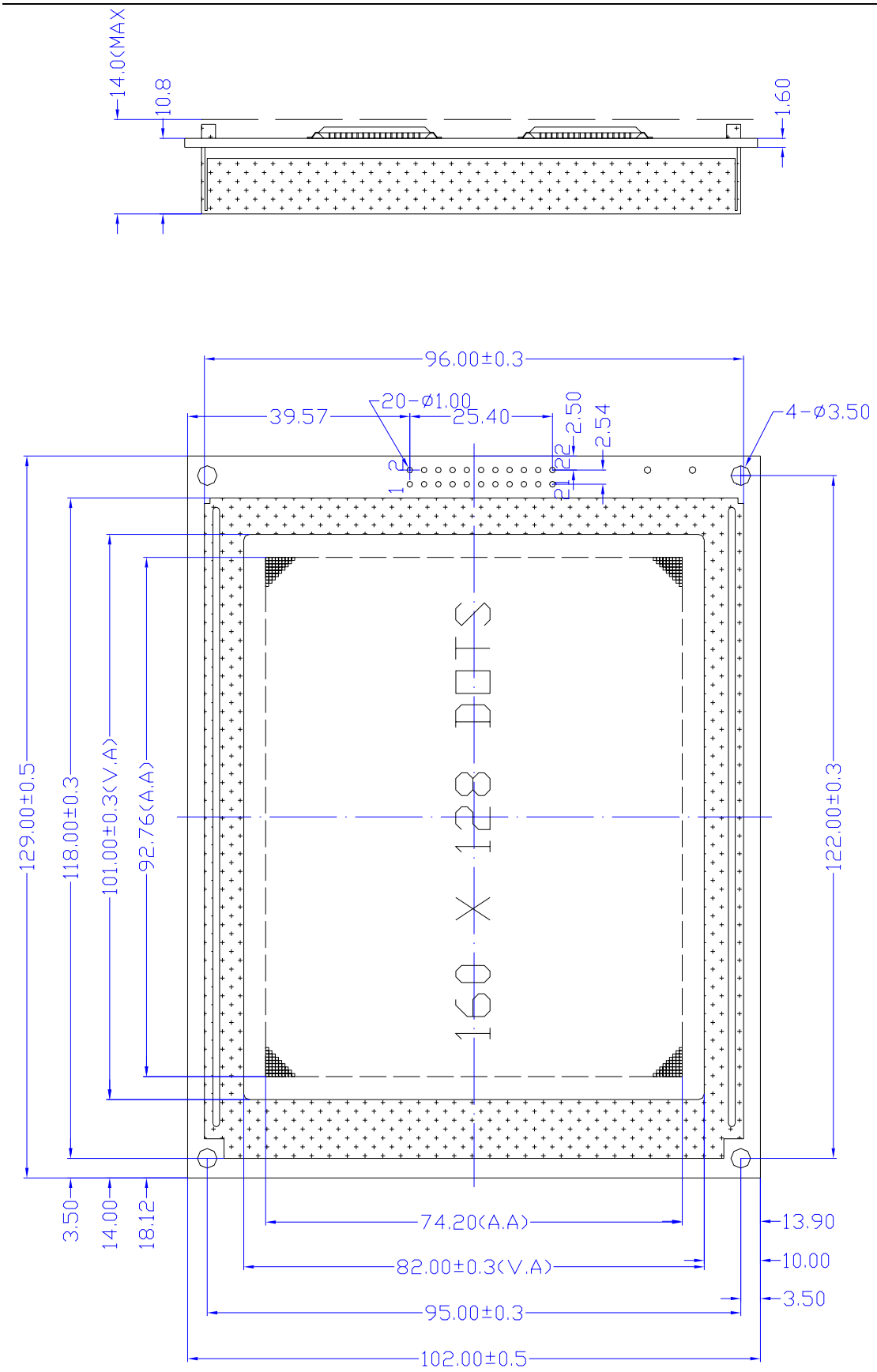
LCD MODE : STN-NEGATIVE-TRANSMISSIVE
DISPLAY COLOR : WHITE
BACKGROUND COLOUR : BLUE
DRIVING DUTY : 1/128DUTY
BIAS : 1/9 BIAS
VIEWING DIRECTION : 6 O'CLOCK
BACKLIGHT : SIDE LED BACKLIGHT
BACKLIGHT COLOR : WHITE

2.2 MECHANICAL DATA

ITEM	STANDARD VALUE	UNIT
NUMBER OF PIXELS	160(COLUMNS) X128(ROWS)	
OUTLINE DIMENSIONS	129.0(W)X102.0(H) X 14.0(T)	mm
EFFECTTVE VIEWING AREA	101.0(W) X 82.0(H)	mm
DOT SIZE	0.54(W) X 0.54(H)	mm
DOT PITCH	0.58(W) X 0.58(H)	mm
APPROX WEIGHT	260	g

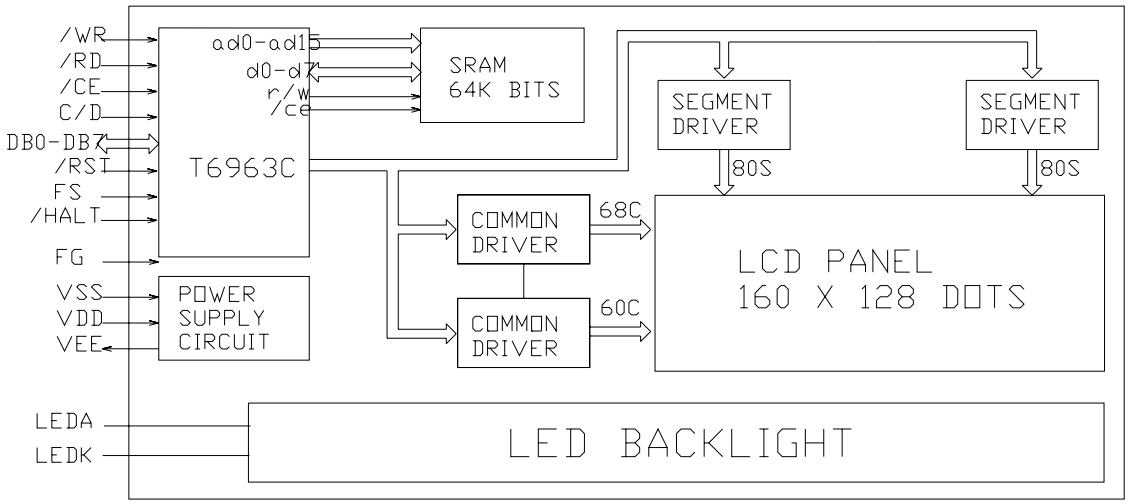
2.3 MECHANICAL DRAWINGS




14.0(MAX)
10.8
1.60
96.00±0.3
39.57
20-ø1.00
25.40
2.50
2.54
4-ø3.50
160 × 128 DOTS
129.00±0.5
118.00±0.3
101.00±0.3(V.A)
92.76(A.A)
122.00±0.3
3.50
14.00
18.12
74.20(A.A)
82.00±0.3(V.A)
95.00±0.3
102.00±0.5
13.90
10.00
3.50

3. CIRCUIT BLOCK DIAGRAM

3.1 Electrical Block Diagram



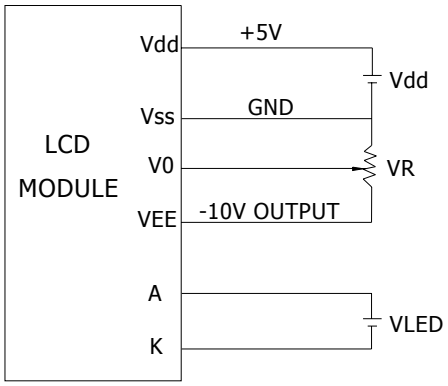
3.2 Pins Definition

PIN	SYMBOL	FUNCTION
1	FG	FRAME GROUND
2	Vss	Power Supply(GND)
3	Vdd	Power Supply For Logic(+5V)
4	Vo	Power Supply For LCD Driving (Contrast Adjust)
5	VEE	NEGATIVE VOLTAGE INPUT/OUTPUT
6	/WR	DATA WRITE
7	/RD	DATA READl
8	/CE	CHIP ENABLE FOR T6963C
9	C/D	COMMAND/DATA SELECTION
10	/HALT	CLOCK OPERATING STOP SIGNAL
11	/RST	RESET T6963C(LOW EFFECTIVE)
12--19	DB0—DB7	DATA BUS
20	NC	NO CONNECTION
21	LEDA	LED BACKLIGHT POWER SUPPLY(+)(+5V)

22	LEDK	LED BACKLIGHT POWER SUPPLY(-)(0V)

3.3 Power Supply For LCM Driving

3.3.1 For LCM With DC/DC on Board(Internal Negative Voltage)

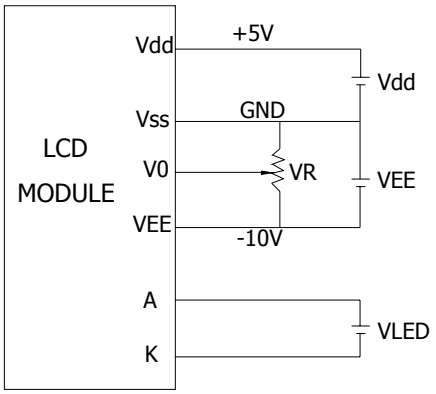


NOTES:

Vdd-V0: LCD Driving Voltage
VR: 10K - 20K
VEE: Genarated By On Board DC-DC

VLED: LED BACKLIGHT DRIVING VOLTAGE
4.2V For Yellow/Green LED Backlight
3.2V For White LED Backlight

3.3.2 For LCM without DC/DC on Board(Negative Voltage input)



NOTES:

Vdd-V0: LCD Driving Voltage
VR: 10K - 20K
VEE: Need External Negative Voltage

VLED: LED BACKLIGHT DRIVING VOLTAGE
4.2V For Yellow/Green LED Backlight
3.2V For White LED Backlight

4. ABSOLUTE MAXIMUN RATINGS

4.1 Electrical Absolute Maximum Ratings

ITEM	SYMBOL	CONDITION	MIN	MAX	UNIT
Supply Voltage (Logic)	Vdd – Vss	-	-0.3	7.0	V
Supply Voltage (LCD Drive)	Vdd – V0	-	0	25.0	V

Input Voltage	Vi	-	-0.3	Vdd +0.3	V

4.2 Enviromental Absolute Maximum Ratings

ITEM	SYMBOL	CONDITIONS	MIN	MAX	UNIT
Operating Temp	Topr	-Normal temp. version-	-20	70	deg C
Storage Temp	Ttsg		-30	80	deg C
Humidity Endurance	RH	no ondensation Ta<=40 deg	-	95	%
Vibration	-	100-300Hz, X/Y/Z directions, 1 hour	-	4.9m/ss 0.5g	-
Shock	-	10 mS X/Y/Z direction 1 time each		29.4m/ss 3.0g	-

5. ELECTRICAL CHARACTERISTICS

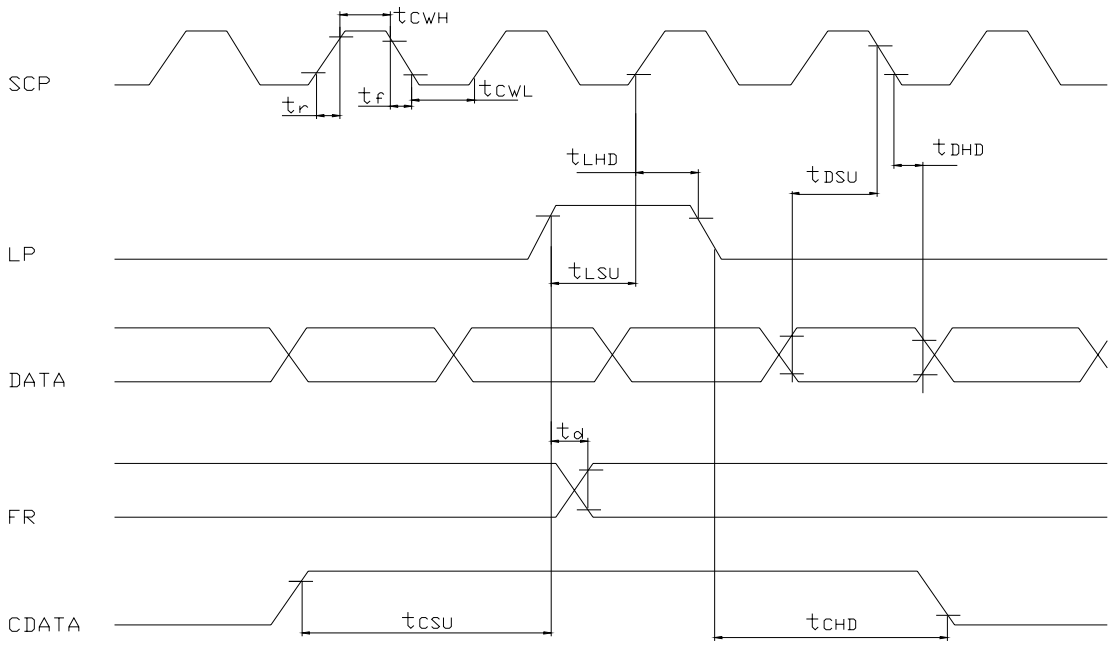
5.1 DC Characteristics

Electrical Characteristics at Ta=25 deg C, Vdd = 5V + / - 5%

ITEM	SYMBOL	CONDITION	MIN	TYP	MAX	UNIT
Supply Voltage (logic)	Vdd-Vss	-	4.5	5.0	5.5	V
Supply Voltage (LCD)	Vdd-V0	Vdd = 5V	-	18	-	V
Input signalVoltage (for CD, DB0-7,/WR,/R/ CS)	V-ih	"H" level	2.2	-	Vdd	V
	V-il	"L" level	0	-	0.6	V
Supply Current (logic)	Icc	-	-	1	1.2	mA
Supply Current	Io	-	0.15	0.22	0.27	mA

5.2 AC Characteristics

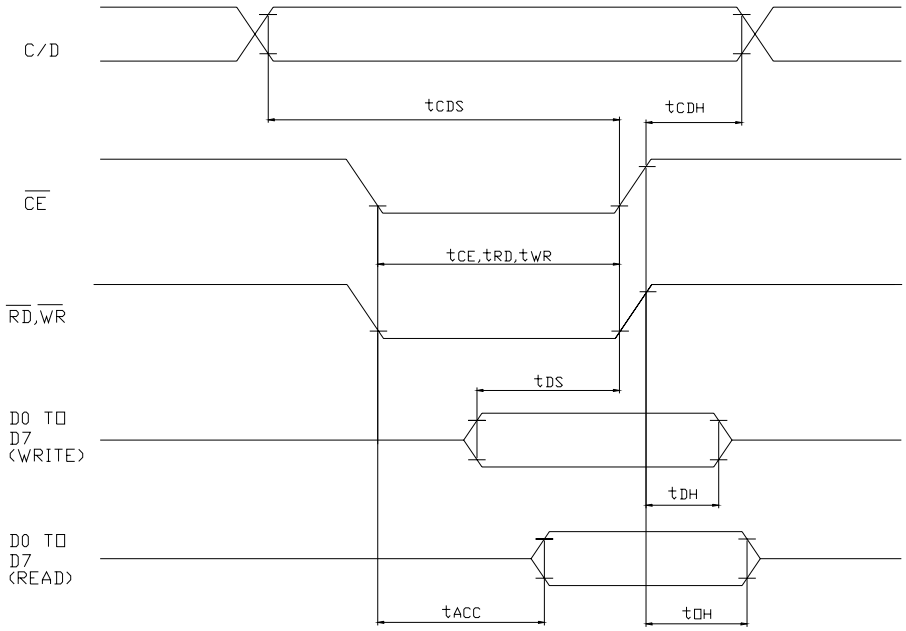
（1） SWITCHING CHARACTERISTICS（1）



TIMING SPECIFICATIONS at Ta = 25 deg C, Vdd = 5V+/-10%, Vss =0V

ITEM	SYMBOL	MIN	MAX	UNIT
OPERATING FREQUENCY	f_{SCP}	-	2.75	MHZ
SCP PULSE WIDTH	$T_{CWH,}T_{CWL}$	150	-	ns
SCP RISE/FALL TIME	t_r, t_f	-	30	ns
LP SET-UP TIME	t_{lsu}	150	290	ns
LP HOLD TIME	t_{lHD}	5	40	ns
DATA SET-UP TIME	t_{DSU}	170	-	ns
DATA HOLD TIME	t_{DHD}	80	-	ns
FR DELAY TIME	T_d	0	90	ns
CDATA SET-UP TIME	T_{CSU}	450	850	ns
CDATA HOLD TIME	T	450	950	ns

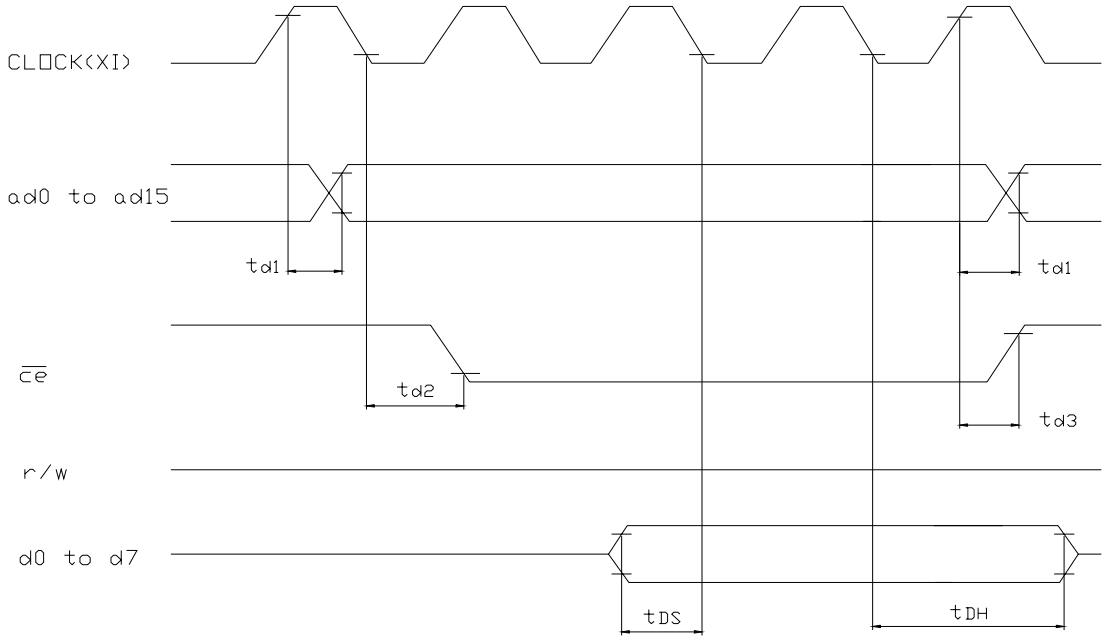
（2） BUS TIMING



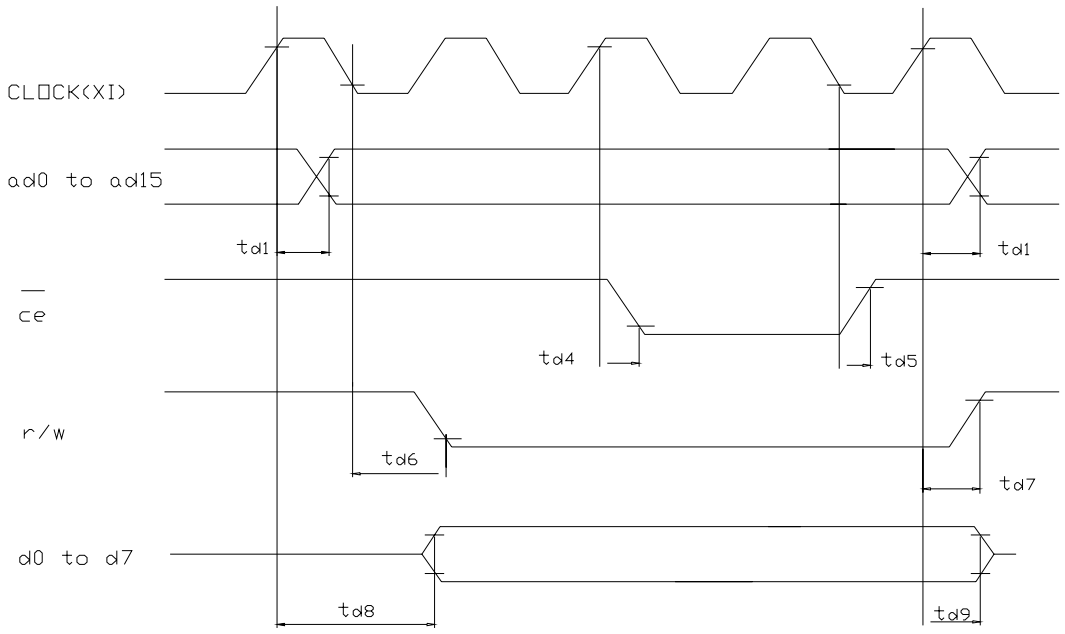
ITEM	SYMBOL	MIN	MAX	UNIT
C/D SET-UP TIME	T_{CDS}	100	-	ns
C/D HOLD TIME	T_{CDH}	10	-	ns
/CE，/RD，/WR PULSE WIDTH	T_{CE} ， T_{RD} ， T_{WR}	80	-	ns
DATA SET-UP TIME	T_{DS}	80	-	ns
DATA HOLD TIME	T_{DH}	40	-	ns
ACCESS TIME	T_{ACC}	-	150	ns
OUTPUT HOLD TIME	T_{OH}	10	50	ns

（3）EXTERNAL RAM TIMING

EXTERNAL RAM READ TIMING



EXTERNAL RAM WRITE TIMING



ITEM	SYMB0L	MINI	MAX	UNIT
ADDRESS DELAY TIME	t_{d1}	-	250	ns
/CE FALL DELAY TIME	t_{d2}	-	180	ns
/CE RISE DELAY TIME	t_{d3}	-	180	ns
DATA SET-UP TIME	t_{DS}	0	-	ns
DATA HOLD TIME	t_{DH}	30	-	ns
/CE FALL DELAY TIME	t_{d4}	-	200	ns
/CE RISE DELAY TIME	t_{d5}	-	200	ns
R/W FALL DELAY TIME	t_{d6}	-	180	ns
R/W RISE DELAY TIME	t_{d7}	-	180	ns
DATA STABLE TIME	t_{d8}	-	450	ns
DATA HOLD TIME	t_{d9}	-	200	ns

6. BACKLIGHT CHARACTERISTICS

6.1 Absolute Maximum Ratings

ITEM	SYMBOL	CONDITION	MIN	MAX	UNIT
Forward Current	Ifm	-	-	200	mA
Reverse Voltage	Vr	-	-	5.3	V
Power Dissipation	Pd	-	-	1000	mW

6.2 Operating Parameters

ITEM	SYMBOL	CONDITION	MIN	TYP.	MAX	UNIT
Forward Voltage	Vf*	If=90mA-	-	5.0	5.3	V
Peak Wavelength	λ	If=90mA-	-	-	-	nm

*Vf is the voltage applied to Pin15 and Pin16.

7. ELECTRO-OPTICAL CHARACTERISTICS

ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	REF.
Contrast	CR	25℃	--	12	--		Note1
Rise Time	tr	25℃	--	160	240	ms	Note2
Fall Time	tf	25℃	--	100	150	ms	note 2
Viewing Angle	θ1-θ2	25℃	--	--	60	DEG	Note 3
	Ø1, Ø2		-40	--	40		
Frame Frequency	Ff	25℃	--	70	--	Hz	note 2

Note(1): Contrast ratio is defined under the following condition:

CR= brightness of selected condition
brightness of non-selected condition

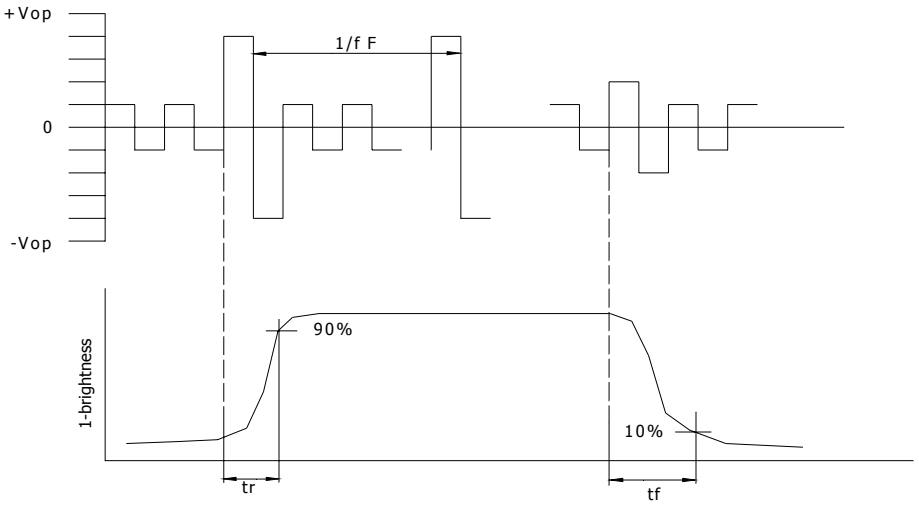
(a). Temperature----------25C

(b). Frame Frequency------64Hz

(c). Viewing angle---------- θ =0, Ø=0

(d). Operating Voltage---5.0V

Note(2): definition of response time:



Condition:

(a). Temperature----------25C

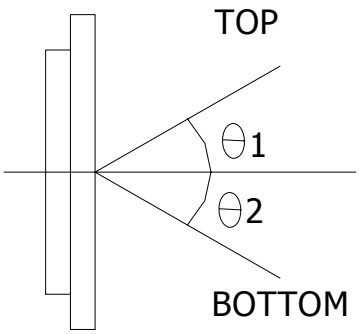
(b). Frame Frequency------64Hz

(c). Viewing angle---------- θ =0, Ø=0

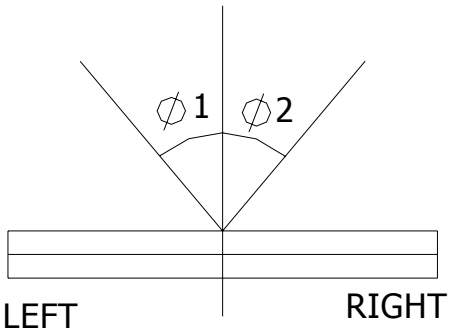
(d). Operating Voltage---5.0V

Note(3): definition of view angle:

TOP-BOTTOM DIRECTION



RIGHT-LEFT DIRECTION



8. DISPLAY CONTROL INSTRUCTION

8.1 INSTRUCTION TABLE

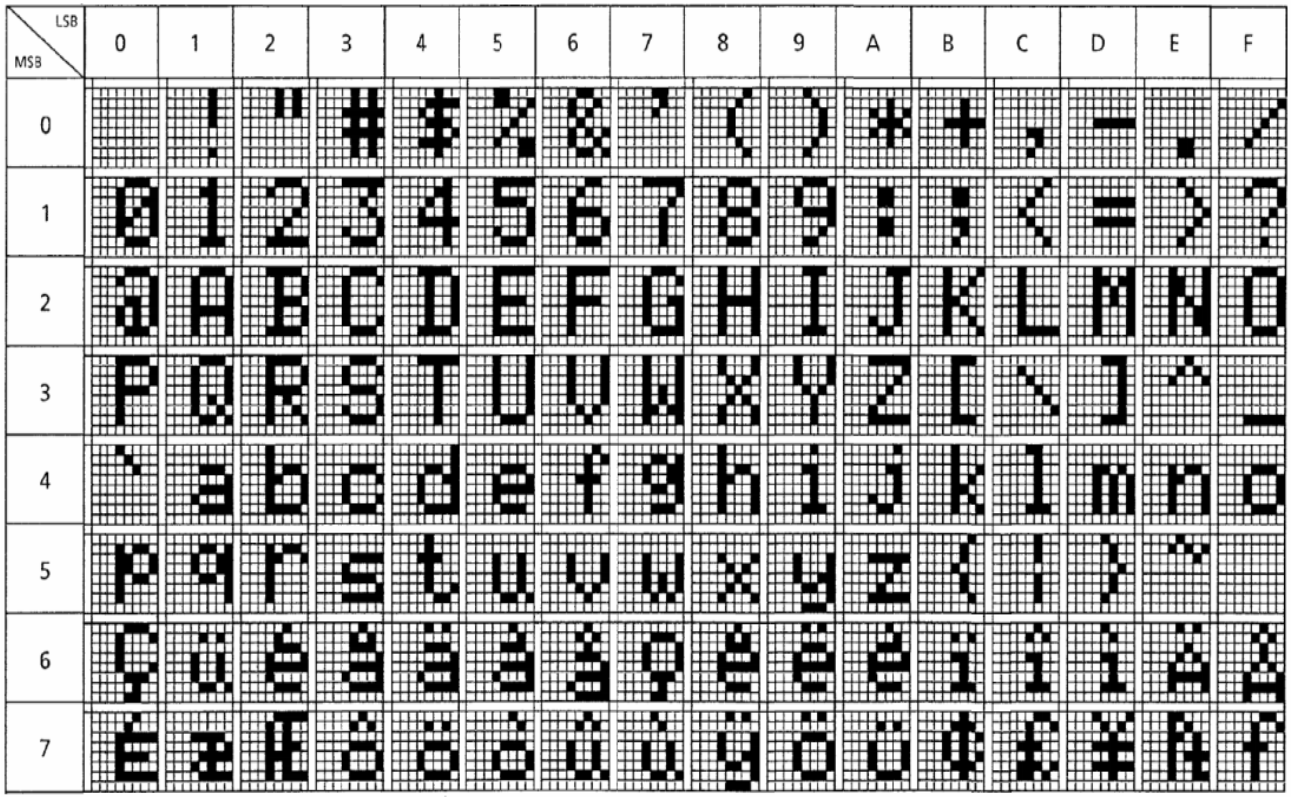
COMMAND	CODE								PARA	FUNCTION	EXECUTE TIME
	D7	D6	D5	D4	D3	D2	D1	D0			
REGISTERS SETTING	0	0	1	0	0	N2	N1	N0	2	N2 N1 N0 0 0 1 SET CURSOR POINTER 0 1 0 SET OFFSET REGISTER 1 0 0 SET ADDRESS POINTER	STATUS CHECK
SET CONTROL WORD	0	1	0	0	0	0	N1	N0	2	N1 N0 0 0 SET TEXT HOME ADDRESS 0 1 SET TEXT AREA 1 0 SET GRAPHIC AREA 1 1 图形区域设置	STATUS CHECK
MODE SET	1	0	0	0	C	N2	N1	N0	-	CG=0：CGROM MODE	

					G					CG=1：CGTAM MODE N2 N1 N0 GRAPHIC AND TEXT 0 0 0 “OR” 0 0 1 “EXOR” 0 1 1 “AND” 1 0 0 TEXT ATTRIBUTE MODE	
DISPLAY MODE	1	0	0	1	N3	N2	N1	N0	-	N3=0：GRAPHIC OFF N3=1：GRAPHIC ON N2=0：TEXT OFF N2=1：TEXTON N1=0：CURSOR OFF N1=1：CURSOR ON N0=0：BLINK OFF N0=1：BLINK ON	32× 1/fosc
CURSOR PATTERN SELECT	1	0	1	0	0	N2	N1	N0	-	N2，N1，N0 SET THE LINES OF CURSOR N2 N1 N0 0 0 0 1-LINE CURSOR . . . 1 1 1 8-LINE CURSOR	
DATA AUTO READ/ WRITE	1	0	1	1	0	0	N1	N0	-	N1 N0 0 0 SET DATA AUTO WRITE 0 1 SET DATA AUTO READ 1 * AUTO RESET	
DATA READ/ WRITE	1	1	0	0	0	N2	N1	N0	1	DATA WRITE AND READ BY 1 N2=0：INCREMENT /DECREMENT ADP =1：NONVARIABLE ADP N1=0：INCREMENT ADP 1 =1：DECREMENT ADP 1 N0=0：DATA WRITE =1：	

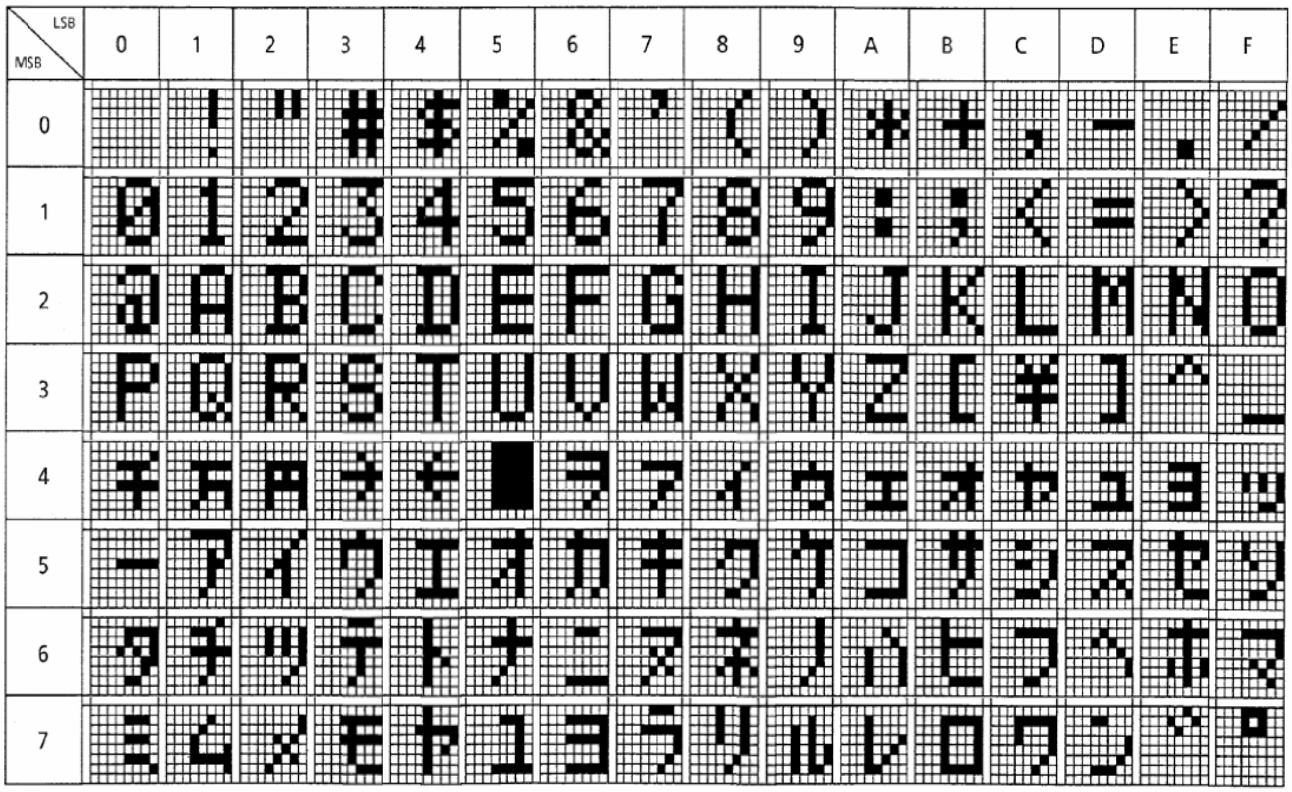
SCREEN PEEK	1	1	1	0	0	0	0	0	-	SCREEN PEEK	
SCREEN COPY	1	1	1	0	1	0	0	0	-	SCREEN COPY	
BIT SET/RESET	1	1	1	1	N3	N2	N1	N0	-	BIT RESET N3=0：BIT 0 =1：BIT 1	

8.2 Character Table

THE RELATION BETWEEN CHARACTER CODE AND CHARACTER PATTERN（CG ROM TYPE 0101）



THE RELATION BETWEEN CHARACTER CODE AND CHARACTER PATTERN（CG ROM TYPE 0101）



8.3 SOFTWARE EXAMPLES

```
;*********************************************************************
        ; CONTROLLER IC IS T6963C
        ;BUSYCHK,WRDAT,WRCOM,RDDAT,CLRSCR,ALLON
        ;THE MCU IS AT89C52

         WR EQU P1.1
         RD EQU P3.6
         CE EQU P3.7
         CD EQU P2.7
         RST EQU P2.0
         ;HALT EQU VDD
         ;DB0--DB7 EQU P0.0--P0.7
```

```
DAT     EQU 30H
DAT_R   EQU 31H
CDAT1   EQU 32H
CDAT2   EQU 33H
COM     EQU 34H
CLR1    EQU 35H
CLR2    EQU 36H
DL1     EQU 37H
DL2     EQU 38H
DL3     EQU 39H
;-----------------------------------------------
        ORG 30H

        CLR RST
        LCALL DELAY
        SETB RST
        LCALL DELAY
                    ;INITIAL
        MOV CDAT1,#00H    ;SET SAD(FIRST ADDRESS) OF THE TEXT AREA:0000H
        MOV CDAT2,#00H
        MOV COM,#40H
        LCALL WRCOM
        MOV CDAT1,#14H    ;SET TEXT AREA WIDTH: 14H
        MOV CDAT2,#00H
        MOV COM, #41H
        LCALL WRCOM
        MOV CDAT1,#00H    ;SET SAD(FIRST ADDRESS) OF GRAPHIC AREA:0800H
        MOV CDAT2,#08H
        MOV COM,#42H
        LCALL WRCOM
        MOV CDAT1,#14H    ;SET GRAPHIC AREA WIDTH: 14H
        MOV CDAT2,#00H
        MOV COM,#43H
```

```
        LCALL WRCOM
        MOV COM,#80H      ;MODE SET: OR, INTERAL CGROM
        LCALL WRCOM
        MOV COM,#0A0H     ;SET SHAPE OF THE CURSOR
        LCALL WRCOM
        MOV COM,#9CH      ;TEXT,GRAPHIC,CURSOR ON
        LCALL WRCOM
                          ;END OF INITIAL

        LCALL CLRSCR
        LCALL DELAY

                          ;DRAWING THE BORDER(3LINES EACH SIDE)
        MOV CDAT1,#00H    ;SET D-RAM   ADDRESS
        MOV CDAT2,#08H
        MOV COM,#24H
        LCALL WRCOM
        MOV COM,#0B0H     ;SET AUTO-WRITE MODE
        LCALL WRCOM

        MOV R1,#03H       ;R1: ROW
LPR1_6: MOV R2,#14H       ;R2: COLUMN
        MOV DAT,#0FFH
LPR2_6: LCALL BUSYCHK3
        LCALL WRDAT
        DJNZ R2,LPR2_6
        DJNZ R1,LPR1_6

        MOV R1,#122D      ;R1: ROW
LPR1_7: MOV DAT,#0E0H
        LCALL BUSYCHK3
        LCALL WRDAT
        MOV R2,#12H       ;R2: COLUMN
```

```
        MOV DAT,#00H
LPR2_7: LCALL BUSYCHK3
        LCALL WRDAT
        DJNZ R2,LPR2_7
        MOV DAT,#07H
        LCALL BUSYCHK3
        LCALL WRDAT
        DJNZ R1,LPR1_7

        MOV R1,#03H          ;R1: ROW
LPR1_8: MOV R2,#14H          ;R2: COLUMN
        MOV DAT,#0FFH
LPR2_8: LCALL BUSYCHK3
        LCALL WRDAT
        DJNZ R2,LPR2_8
        DJNZ R1,LPR1_8

        MOV COM,#0B2H        ;TURN OFF AUTO-WRITE MODE
        LCALL WRCOM

        LCALL DELAY
        LCALL DELAY
        LCALL DELAY
        LCALL DELAY
        LCALL DELAY

                             ;DISPLAY DISP1
        LCALL CLRSCR
        MOV DPTR,#DISP1
        MOV R0,#04H
LPR0_1: CLR A
        MOVC A,@A+DPTR
        MOV R6,A
```

```
        INC DPTR
        CLR A
        MOVC A,@A+DPTR
        MOV R7,A

        MOV CDAT1,#00H      ;SET D-RAM   ADDRESS
        MOV CDAT2,#08H
        MOV COM,#24H
        LCALL WRCOM
        MOV COM,#0B0H       ;SET AUTO-WRITE MODE
        LCALL WRCOM

        MOV R1,#40H         ;R1: ROW
LPR1_1: MOV R2,#14H         ;R2: COLUMN
        MOV DAT,R6
LPR2_1: LCALL BUSYCHK3
        LCALL WRDAT
        DJNZ R2,LPR2_1

        MOV R2,#14H
        MOV DAT,R7
LPR2_2: LCALL BUSYCHK3
        LCALL WRDAT
        DJNZ R2,LPR2_2
        DJNZ R1,LPR1_1

        MOV COM,#0B2H       ;TURN OFF AUTO-WRITE MODE
        LCALL WRCOM
        LCALL DELAY
        LCALL DELAY
        LCALL DELAY

        INC DPTR
```

```
        DJNZ R0,LPR0_1

        LCALL DELAY

        LCALL CLRSCR
        MOV CDAT1,#00H      ;SET D-RAM   ADDRESS
        MOV CDAT2,#00H
        MOV COM,#24H
        LCALL WRCOM
        MOV COM,#0B0H       ;SET AUTO-WRITE MODE
        LCALL WRCOM
                            ;DISPLAY *
                            ;WRITE CHARACTER--CGROM
        MOV R1,#14H         ;R1: ROW
LPR1_B: MOV R2,#1EH         ;R2: COLUMN
        MOV DAT,#0AH
LPR2_B: NOP
        LCALL BUSYCHK3
        LCALL WRDAT
        DJNZ R2,LPR2_B
        DJNZ R1,LPR1_B

        MOV COM,#0B2H
        LCALL WRCOM
        LCALL DELAY
        LCALL DELAY
        LCALL DELAY

        LCALL CLRSCR
        MOV CDAT1,#00H      ;SET D-RAM   ADDRESS
        MOV CDAT2,#00H
        MOV COM,#24H
        LCALL WRCOM
```

```
        MOV COM,#0B0H       ;SET AUTO-WRITE MODE
        LCALL WRCOM
                            ;WRITE CHARACTER--CGROM
        MOV R1,#20H         ;R1: ROW
LPR1_2: MOV R2,#1EH         ;R2: COLUMN
        MOV R7,#21H
LPR2_3: MOV DAT,R7
        LCALL BUSYCHK3
        LCALL WRDAT
        INC R7
        CJNE R7,#3BH,NEXT1
        MOV R7,#41H
NEXT1:   DJNZ R2,LPR2_3

        MOV R2,#20H
        MOV R7,#41H
LPR2_4: MOV DAT,R7
        LCALL BUSYCHK3
        LCALL WRDAT
        INC R7
        CJNE R7,#5BH,NEXT2
        MOV R7,#21H
NEXT2:   DJNZ R2,LPR2_4
        DJNZ R1,LPR1_2

        MOV COM,#0B2H
        LCALL WRCOM
        LCALL DELAY
        LCALL DELAY
        LCALL DELAY
        LCALL DELAY
        SJMP $
```

```
;*******************************************
;-------------BUSY CHECK(NON-AUTO MODE)-------
BUSYCHK: SETB CD                    ;CHECK ST0 AND ST1
         CLR CE
         SETB WR
         CLR RD
         MOV P0,#0FFH
         NOP
         JNB P0.0,$
         NOP
         JNB P0.1,$
         NOP
         SETB RD
         RET
;---------------BUSY CHECK(AUTO READ)-----------
BUSYCHK2: SETB CD              ;CHECK ST2
          CLR CE
          SETB WR
          CLR RD
          MOV P0,#0FFH
          NOP
          JNB P0.2,$
          SETB RD
          RET
;---------------BUSY CHECK(AUTO WRITE)--------------
BUSYCHK3: SETB CD              ;CHECK ST3
          CLR CE
          SETB WR
          CLR RD
          MOV P0,#0FFH
          NOP
          JNB P0.3,$
          SETB RD
```

```
            RET
;-------------WRITE DATA-----------------------
WRDAT:    CLR CD                    ;WRITE DAT TO DATA STACK
          CLR CE
          SETB RD
          MOV P0,DAT
          CLR WR
          NOP
          SETB WR
          RET
;--------------READ DATA-----------------------
RDDAT:    CLR CD                    ;READ DATA FROM DATA STACK
          CLR CE
          MOV P0,#0FFH
          SETB WR
          CLR RD
          MOV DAT_R,P0
          SETB RD
          RET
;--------------WRITE COMMAND--------------------
WRCOM:    ACALL BUSYCHK      ;WRITE COMMAND: COM--COMMAND
          MOV DAT,CDAT1      ;CDAT1--PARAMETER 1
          ACALL WRDAT        ;CDAT2--PARAMETER 2
          ACALL BUSYCHK
          MOV DAT,CDAT2
          ACALL WRDAT
          ACALL BUSYCHK
          SETB CD
          CLR CE
          SETB RD
          MOV P0,COM
          CLR WR
          NOP
```