

L → KOP

Picvue

PVG121202YE02

(PVG121202BYE)

Graphic type LCD module

128x128 dots

STN yellow mode with EL backlight



Components

REIN Components GmbH · Postfach 1463 · 41304 Nettetal
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1. INTRODUCTION

This user's manual is introduced the outside dimensions, optical characteristics, electrical characteristics, interface specifications, instructions, etc. of the standard product.

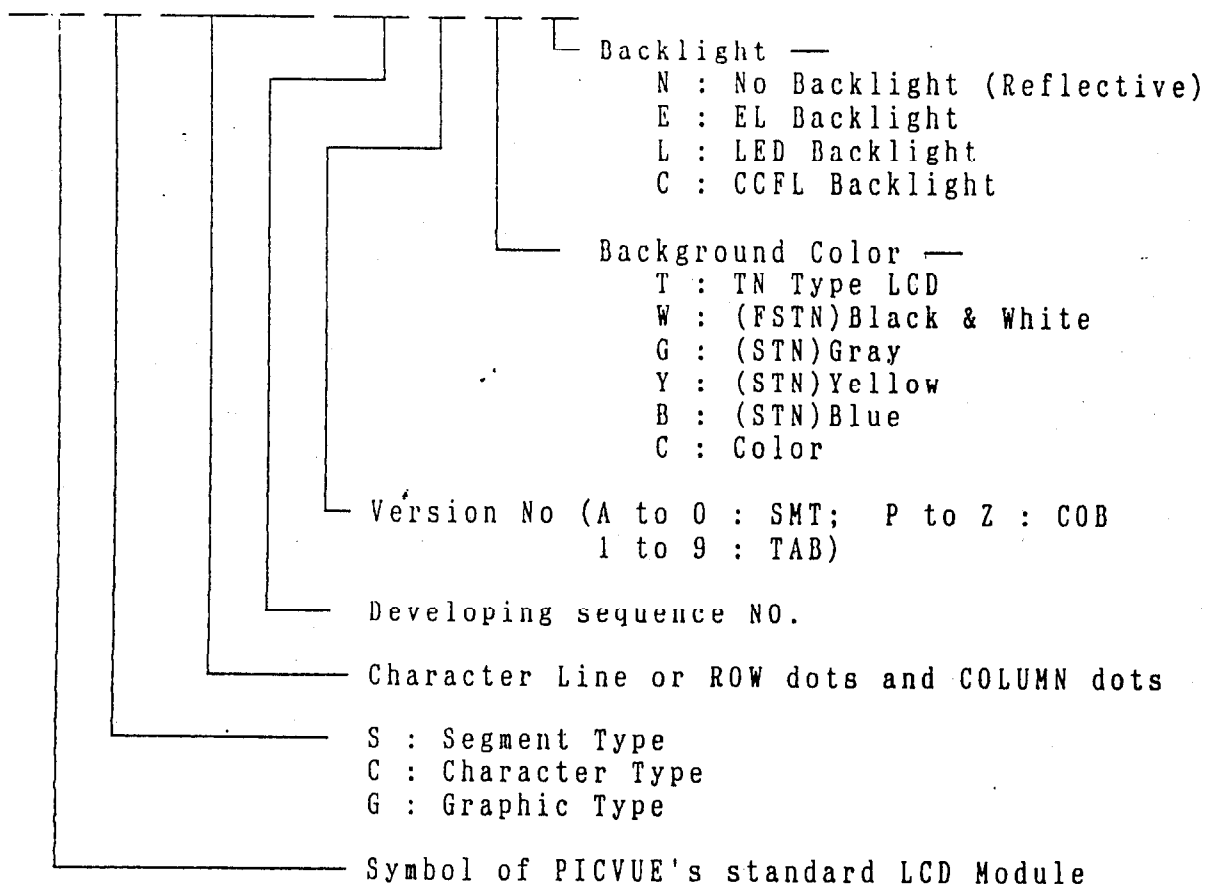
PICVUE's dot matrix LCD modules, consist of a newly developed STN/FSTN type liquid crystal display with high contrast and wide viewing angle, CMOS LCD driver (and controller). The combination of LCD and semiconductor technology features high reliability and low power consumption.

1-1. FEATURE

- (1) Compact, integrated display module.
- (2) High contrast, clear display with large character.
- (3) Low voltage.
- (4) Wide operating temperature range.

2. CLASSIFICATION OF MODEL

P V G 1 2 1 2 0 2 B Y E



3. MECHANICAL SPECIFICATION :

ITEM	STANDARD VALUE	UNIT
NUMBER OF DOTS	128(W) × 128(H)	dots
MODULE DIMENSION	88.4(W) × 88.4(H) × 9.5(D)	mm
EFFECTIVE DISPLAY AREA	77.4(W) × 77.4(H)	mm
DOT SIZE	0.46(W) × 0.46(H)	mm
DOT PITCH	0.50(W) × 0.50(H)	mm
DUTY	1/128	
LCD	File type Yellow (Positive type)	
VIEWING DIRECTION	6 0'clock	
BACK LIGHT	EL (cool white)	

4. ABSOLUTE MAXIMUM RATINGS

ITEM	SYMBOL	MIN	MAX	UNIT
OPERATING TEMPERATURE	TOP	0	+ 50	°C
STORAGE TEMPERATURE	TST	- 20	+ 60	°C
SUPPLY VOLTAGE FOR LOGIC	VDD-VSS	0	6.5	V
SUPPLY VOLTAGE FOR LCD	VDD-V0	0	22.0	V
INPUT VOLTAGE	Vi	VSS	VDD	V
STATIC ELECTRICITY	Be sure that user are grounded when handing LCM			

5.0 ELECTRICAL CHARACTERISTICS :

ITEM	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
SUPPLY VOLTAGE FOR LOGIC	VCC-GND	————	4.75	5.0	5.25	V
SUPPLY VOLTAGE FOR LCD DRIVE	VEE-GND	————	————	-11.0	-15.0	V
INPUT VOLTAGE	V _I	H LEVEL	0.8VDD	————	VDD	V
		L LEVEL	0	————	0.2VDD	V
POWER SUPPLY FOR LOGIC CURRENT	I _{CC}	VCC = 5V VEE = -11V fFLM = 75Hz	————	6.0	————	m A
POWER SUPPLY FOR LCD DRIVING	I _{EE}		————	2.0	————	m A
FRAME FREQUENCY	FR	————	————	75	85	H z

6.0 OPTICAL CHARACTERISTICS :

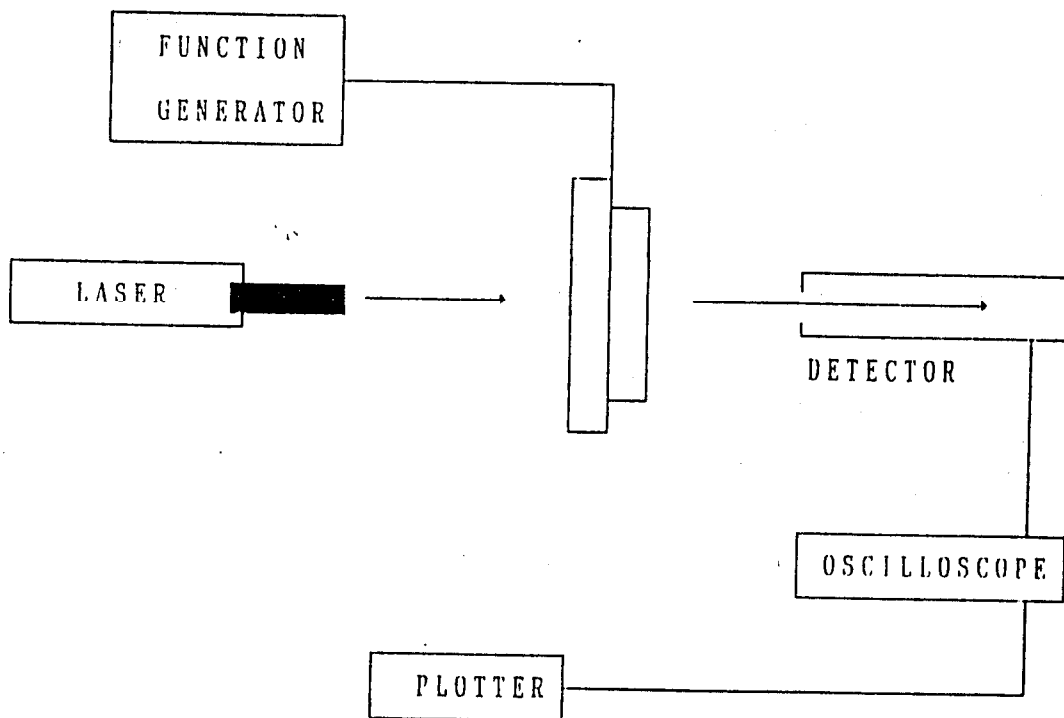
ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
VIEW ANGLE (H)	θX	$CR \geq 2.0$	-25	————	25	DEG
VIEW ANGLE (V)	θY		-30	————	30	DEG
CONTRAST RATIO	CR	$\theta X = 0^\circ$ $\theta Y = 0^\circ$	—	6	—	—
RESPONSE TIME (RISE)	T _{ON}		————	180	280	ms
RESPONSE TIME (FALL)	T _{OFF}		————	230	330	ms

6-1. OPTICAL MEASUREMENT SYSTEM :

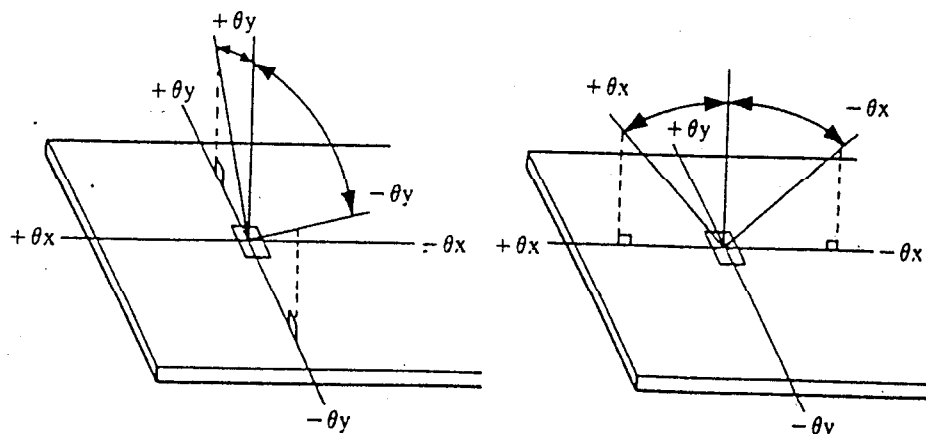
LASER 633nm : SIEMENS LGK 7628
 OSCILLOSCOPE : TEKTRONIX 2211
 FUNCTION GENERATOR : WAVETEK MODEL 75
 PLOTTER : TEKTRONIX HC-100

MEASUREMENT CONDITION

MEASUREMENT SPOT : $\phi = 0.4 \text{ mm}$

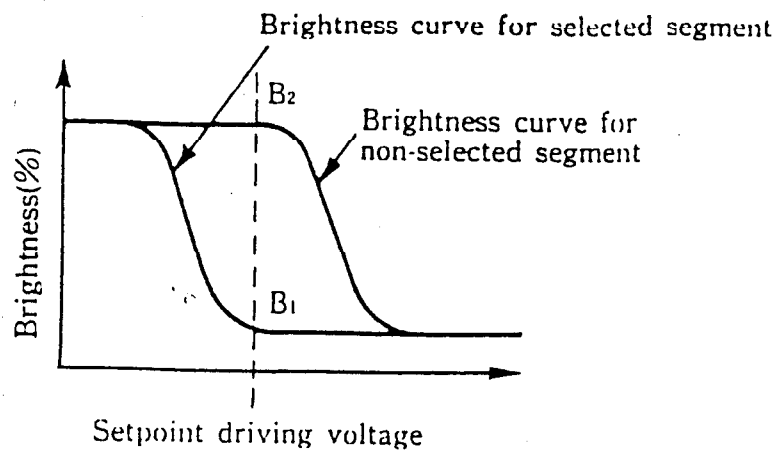


6-2. DEFINITION OF θ_x AND θ_y :

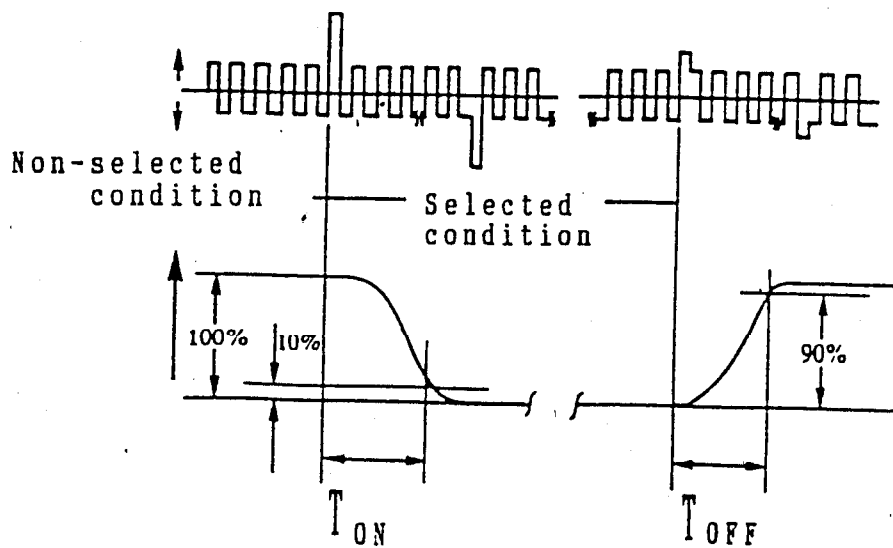


6-3. DEFINITION OF CONTRAST RATIO C_R :

$$C_R = \frac{\text{Brightness of non-selected segment (B}_2\text{)}}{\text{Brightness of selected segment (B}_1\text{)}}$$

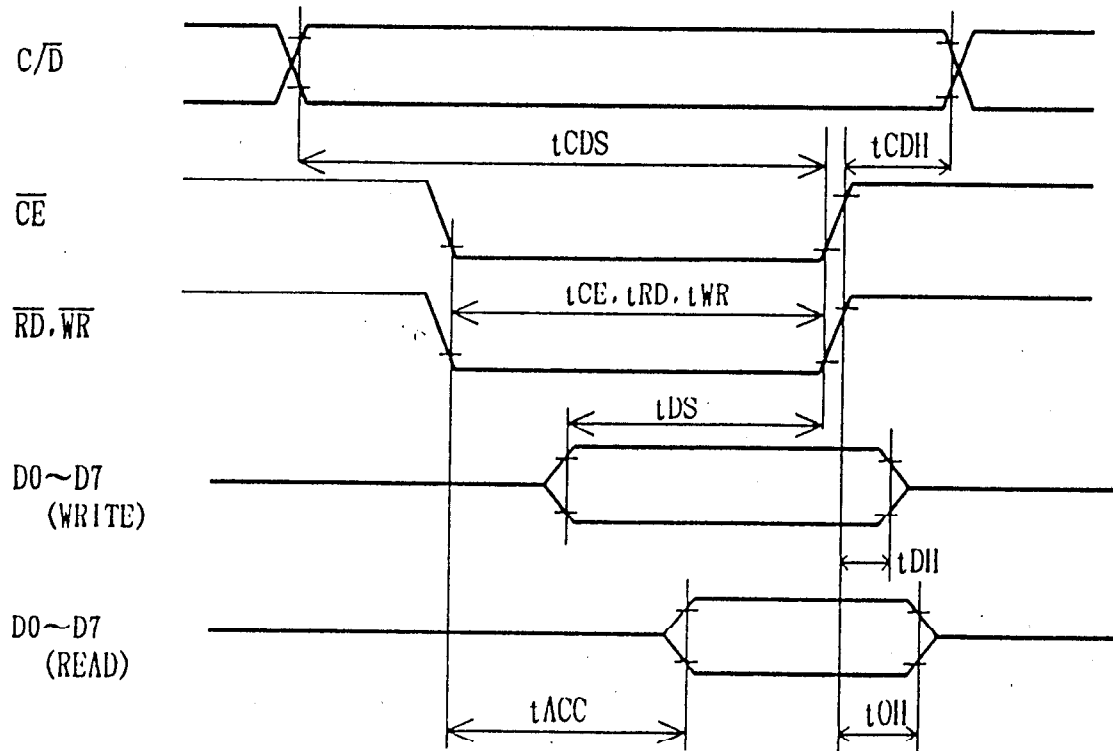


6-4. DEFINITION OF OPTICAL RESPONSE TIME :



7. INTERFACE TIMING CHART :

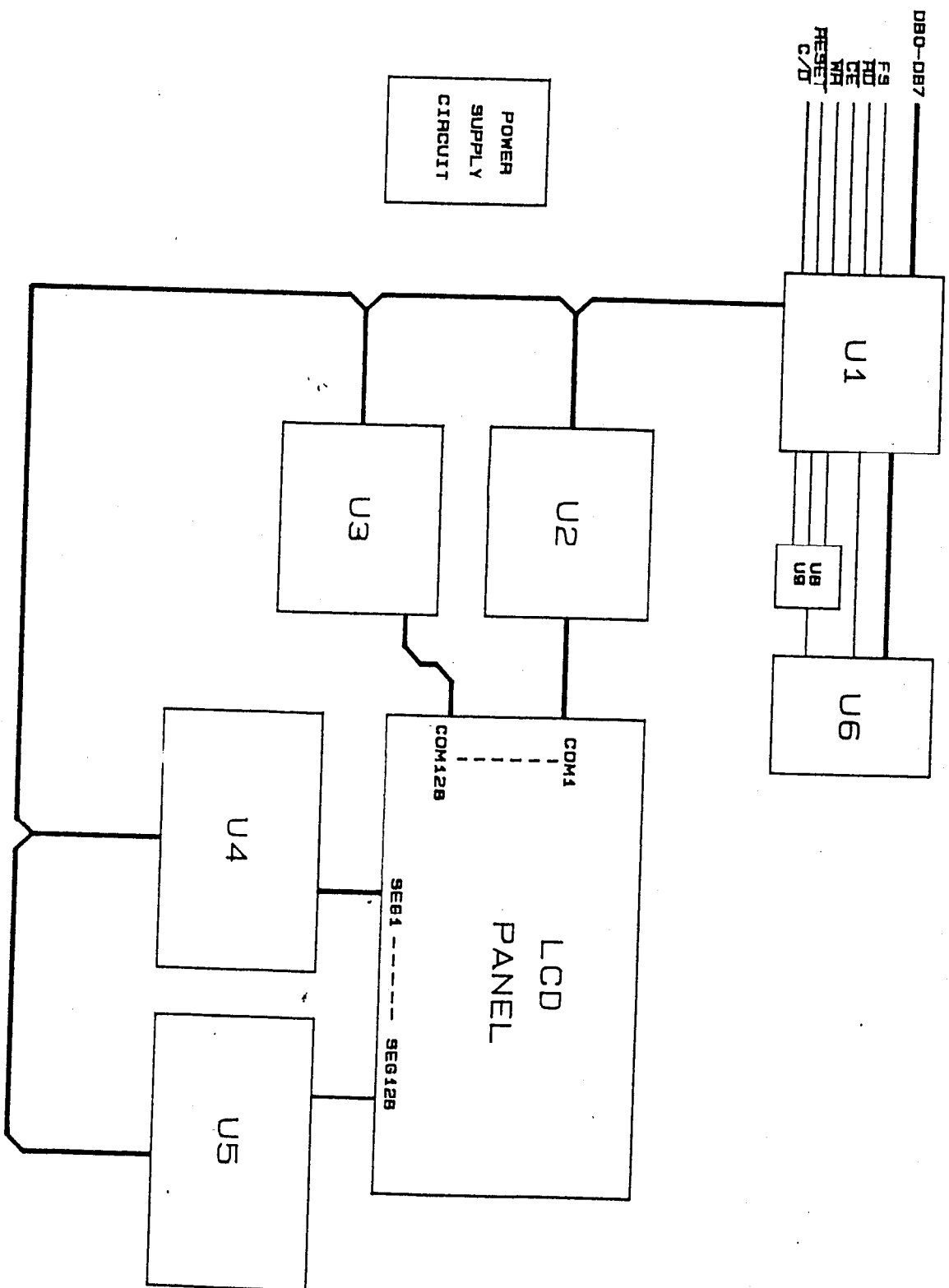
7-1 TIMING CHART :



7-2 TIMING CHARACTERISTICS :

P A R A M E T E R	SYMBOL	MIN.	MAX.	UNIT
C/D set up time	tCDS	100	—	ns
C/D hold time	tCDH	10	—	ns
CE,RD,WR pulse width	tCE,tRD,tWR	80	—	ns
Data set up time	tDS	80	—	ns
Data hold time	tDH	40	—	ns
Access time	tACC	—	150	ns
Output hold time	tOH	10	50	ns

8. BLOCK DIAGRAM :

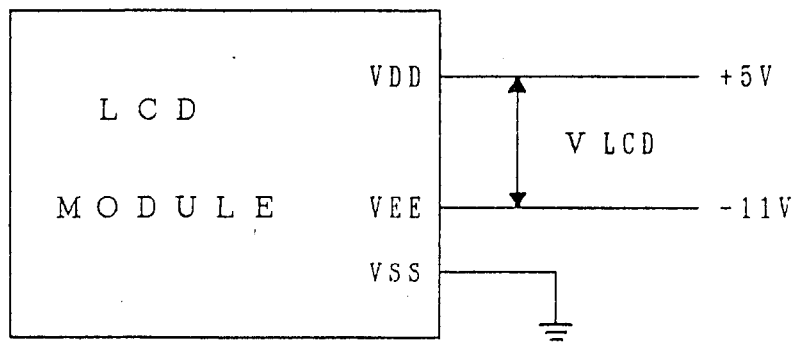


9. I/O TERMINAL :

9.1 INTERFACE PIN CONNECTIONS :

PIN NO.	SYMBOL	LEVEL	FUNCTION
1	FGND	—	FRAME GROUND (CONNECTED TO BEZEL)
2	VSS	—	GROUND
3	VDD	—	POWER SUPPLY FOR LOGIC CIRCUIT
4	VEE	—	POWER SUPPLY FOR LCD
5	$\overline{\text{WR}}$	INPUT	DATA WRITE
6	$\overline{\text{RD}}$	INPUT	DATA READ
7	$\overline{\text{CE}}$	INPUT	CHIP ENABLE
8	C/D	INPUT	CODE/DATA
9	$\overline{\text{RESET}}$	INPUT	CONTROLLER RESET
10-17	D0-D7	I/O	DATA BUS (D0:LSB ; D7:MSB)
18	FS	INPUT	FONT SELECT FS="H":6*8 CHARACTER FONT FS="L":8*8 CHARACTER FONT

9. POWER SUPPLY CIRCUIT DIAGRAM:



10. APPLICATION OF LCD MODULE

10-1. INTERFACE BETWEEN LCM AND MPU

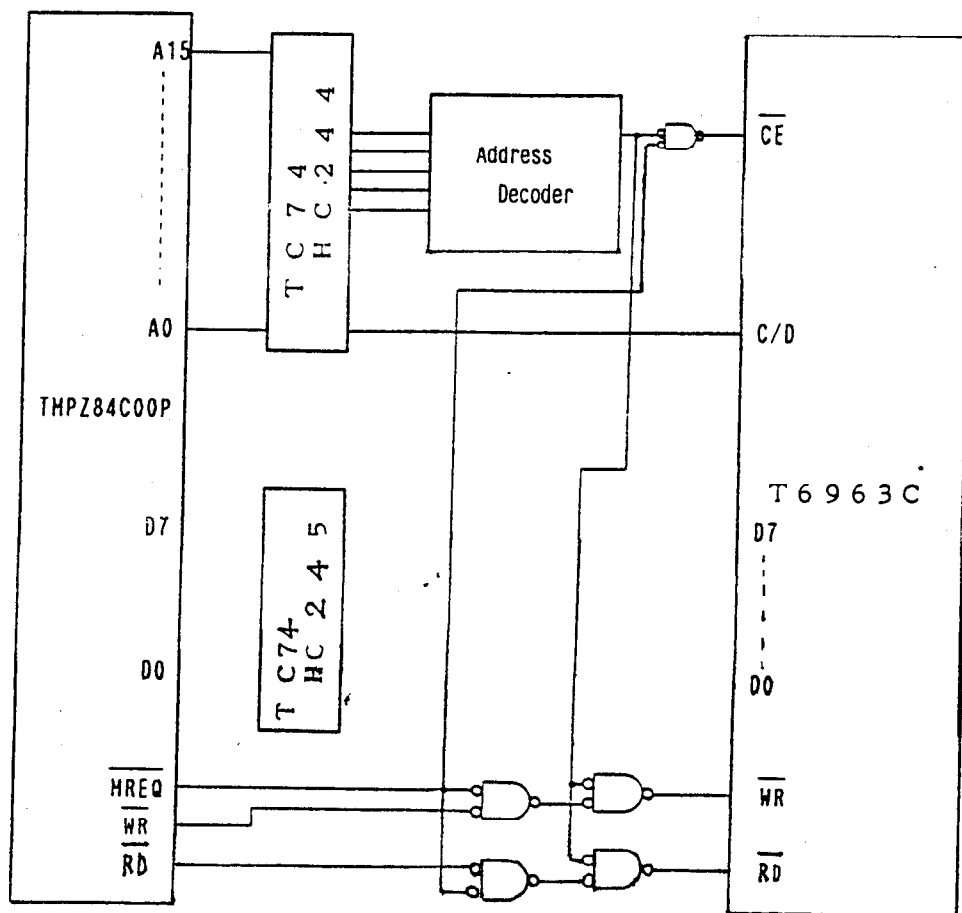
EXAMPLE OF APPLICATION CIRCUITS

T6963C is directly connected TMPZ84C00A (Z80 NOTE1 CMOS). T6963C Application circuit can be used with TMPZ84C00A in the following case.

[1] The setting of MPU's address (MAPPED I/O)

T6963C is addressed in a MPU's address by the address decode circuit.

	address
DATA (I/O)	XXXXH
Command/Status	XXXX+1H

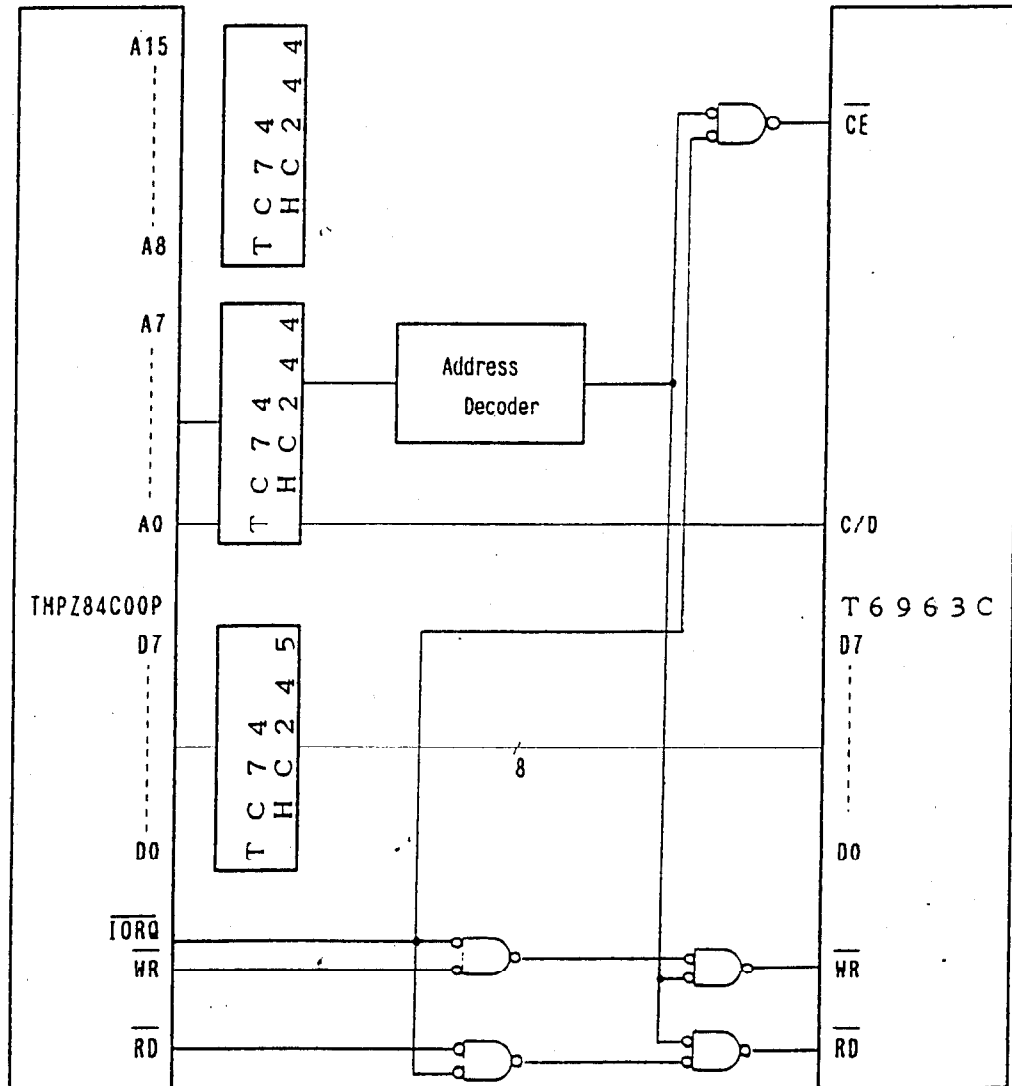


note1: Z80 is a trademark of Zilog Inc.

[2] The setting of MPU I/O address

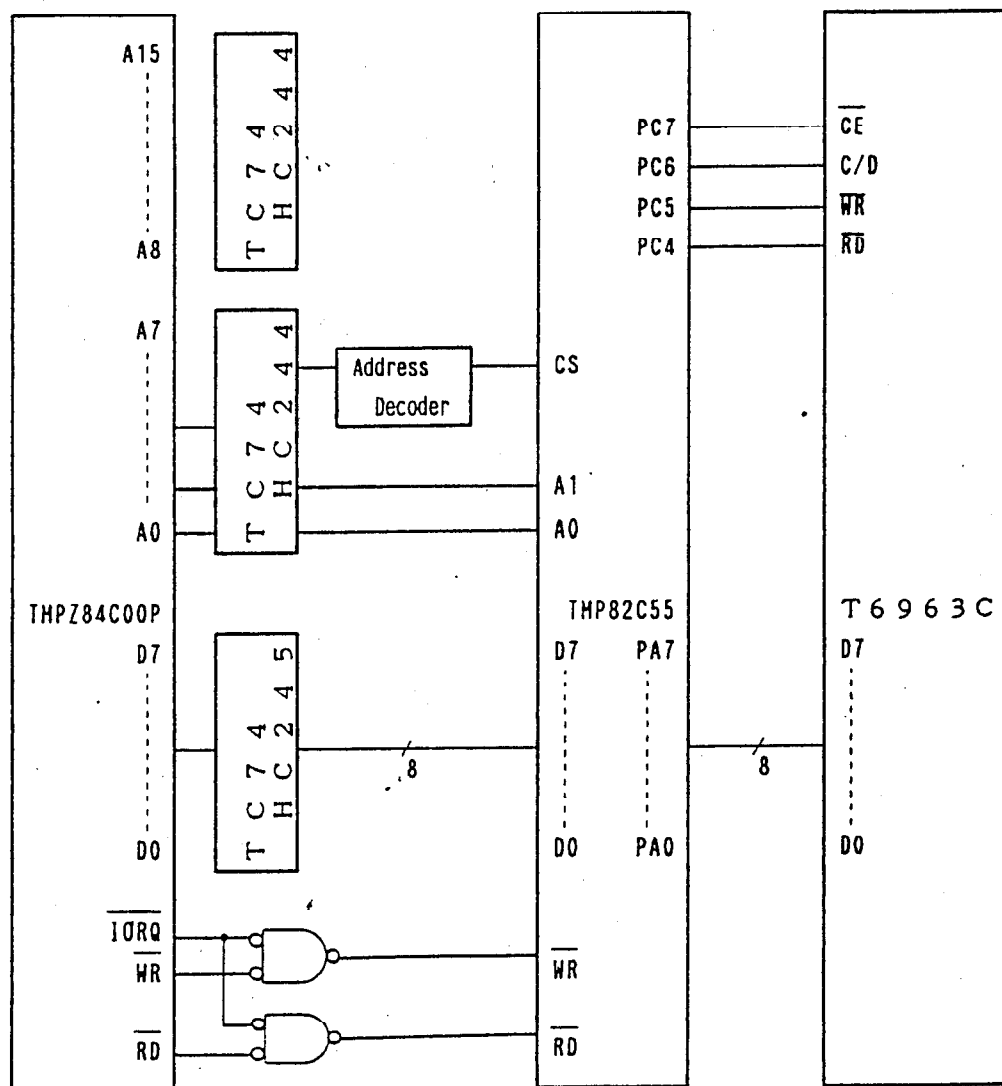
T6963C is addressed in an I/O address by the I/O address decoder.

	I/O address
DATA	XXH
Command/Status	XX+1H



[3] The case of using PPI LSI (TMP82C55)

T6963C can be connected with PPI LSI.
 The portA connects data bus.
 The portC connects control bus.
 (C/D, $\overline{CE}$, $\overline{WR}$, $\overline{RD}$)



10-2. CONTROL INSTRUCTIONS

FLOWCHART OF COMMUNICATIONS WITH MPU

1) Status read

Before sending data (read/write), command it is necessary to check the status.

Status check

Status of T6963C can be read from data lines.

<u>RD</u>	L
<u>WR</u>	H
<u>CE</u>	L
C/D	H

D0-D7 Status word

T6963C. Status word format is following.

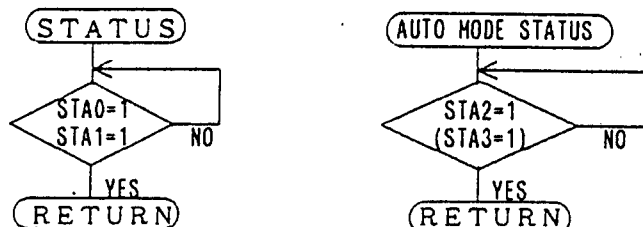
MSB				LSB			
STA7	STA6	STA5	STA4	STA3	STA2	STA1	STA0
D7	D6	D5	D4	D3	D2	D1	D0

STA0	check capability of command execution	0: disable 1: enable
STA1	check capability of data read/write	0: disable 1: enable
STA2	check capability of auto mode data read	0: disable 1: enable
STA3	check capability of auto mode data write	0: disable 1: enable
STA4	not use	
STA5	check capability of controller operation	0: disable 1: enable
STA6	error flag. using screen peek/copy command	0: no error 1: error
STA7	Check the condition blink	0: display off 1: normal display

Note)

1. It is necessary to check STA0 and STA1 at the same time. The error is happened by sending data, at executing command.
2. The status check will be enough to check STA0/STA1.
3. The STA2/STA3 are valid in auto mode STA0/STA1 are invalid.

Status checking flow



4. It is impossible to save status check in the case of command that is MSB 0. To have the delay time cannot be save status check.

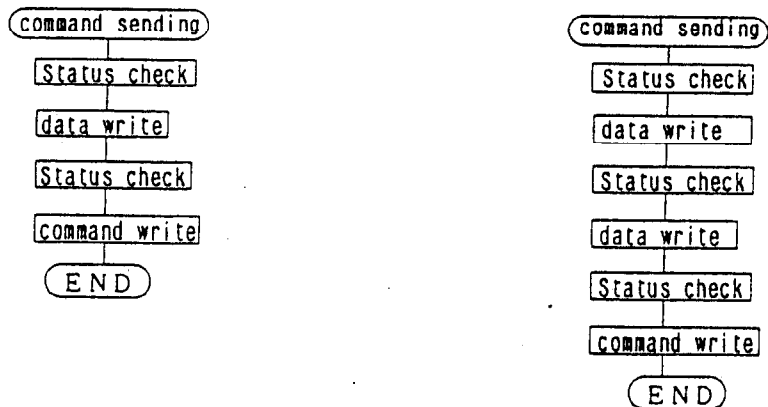
The interrupt of hardware is happened at the end of lines. If command of MSB 0 is send in this period, the command executing is waited. The state of waiting doesn't be known without to check status. The sending next command or data is disregarded or rewrites data of waiting command.

2] Data set

In T6963C, the data have been set and command executes.

The order of procedure of command sending

- ① the case of 1data ② the case of 2data



Note: In case of over 2data sending, the last data (or last 2data) is valid.

COMMAND	CODE	D1	D2	FUNCTION
REGISTER SET	00100001	X adrs	Y adrs	CURSOR POINTER SET
	00100010	data	00H	OFFSET REGISTER SET
	00100100	Low adrs	High adrs	ADDRESS POINTER SET
CONTROL WORD SET	01000000	Low adrs	High adrs	TEXT HOME ADDRESS SET
	01000001	Columns	00H	TEXT AREA SET
	01000010	Low adrs	High adrs	GRAPHIC HOME ADDRESS SET
	01000011	Columns	00H	GRAPHIC AREA SET
MODE SET	1000X000	-	-	"OR" mode
	1000X001	-	-	"EXOR" mode
	1000X011	-	-	"AND" mode
	1000X100	-	-	"TEXT ATTRIBUTE" mode
	10000XXX	-	-	INTERNAL CG ROM mode
	10001XXX	-	-	EXTERNAL CG RAM mode
DISPLAY MODE	10010000	-	-	DISPLAY OFF
	1001XX10	-	-	CURSOR ON , BLINK OFF
	1001XX11	-	-	CURSOR ON , BLINK ON
	100101XX	-	-	TEXT ON , GRAPHIC OFF
	100110XX	-	-	TEXT OFF, GRAPHIC ON
	100111XX	-	-	TEXT ON , GRAPHIC ON
CURSOR PATTERN SELECT	10100000	-	-	1LINE CURSOR
	10100001	-	-	2LINES CURSOR
	10100010	-	-	3LINES CURSOR
	10100011	-	-	4LINES CURSOR
	10100100	-	-	5LINES CURSOR
	10100101	-	-	6LINES CURSOR
	10100110	-	-	7LINES CURSOR
	10100111	-	-	8LINES CURSOR
DATA AUTO READ/WRITE	10110000	-	-	DATA AUTO WRITE SET
	10110001	-	-	DATA AUTO READ SET
	10110010	-	-	AUTO RESET

COMMAND	CODE	D1	D2	FUNCTION
DATA READ WRITE	11000000	data	-	DATA WRITE AND ADP INCREMENT
	11000001	-	-	DATA READ AND ADP INCREMENT
	11000010	data	-	DATA WRITE AND ADP DECREMENT
	11000011	-	-	DATA READ AND ADP DECREMENT
	11000100	data	-	DATA WRITE AND ADP NONVARIABLE
	11000101	-	-	DATA READ AND ADP NONVARIABLE
SCREEN PEEK	11100000	-	-	SCREEN PEEK
SCREEN COPY	11101000			SCREEN COPY
BIT SET/ RESET	11110XXX	-	-	BIT RESET
	11111XXX	-	-	BIT SET
	1111X000	-	-	BIT0 (LSB)
	1111X001	-	-	BIT1
	1111X010	-	-	BIT2
	1111X011	-	-	BIT3
	1111X100	-	-	BIT4
	1111X101	-	-	BIT5
	1111X110	-	-	BIT6
	1111X111	-	-	BIT7 (MSB)

Description of command

1) Register set

CODE		FUNCTION	D1	D2
00100001	21H	CURSOR POINTER SET	XADRS	YADRS
00100010	22H	OFFSET REGISTER SET	data	00H
00100100	24H	ADDRESS POINTER SET	LOW ADRS	HIGH ADRS

① CURSOR POINTER SET

The position of cursor is specified by XADRS, YADRS. The cursor position is moved only by this command. The cursor pointer doesn't have the function of increment and decrement. The shift of cursor are set by this command.

XADRS, YADRS are specified following

XADRS 00H~4FH (lower 7bits are valid)

YADRS 00H~1FH (lower 5bits are valid)

A) 1screen drive
XADRS 00~4FH

B) 2screen drive
XADRS 00~4FH

YADRS 00H~0FH

YADRS 00H~0FH

UPPER SCREEN

YADRS 10H~1FH

LOWER SCREEN

② OFFSET REGISTER SET

The offset register is used to determine external character generator RAM area. T6963C has 16bit address lines as follow

MSB	ad15	ad14	ad13	ad12	ad11	ad10	ad9	ad8	ad7	ad6	ad5	ad4	ad3	ad2	ad1	ad0	LSB
-----	------	------	------	------	------	------	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

The upper 5bit (ad15~ad11) are determined by offset register.

The middle 8bit (ad10~ad3) are determined by character code.

The lower 3bit (ad2~ad0) are determined by vertical counter.

The lower 5bit of D1 (data) are valid.

The data format of external character generator RAM

1] The relationship of display RAM address and offset register

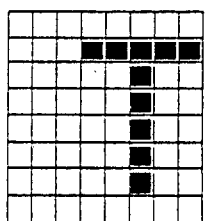
data of offset register	CG RAM HEX. address(start-end)
00000	0000-07FFH
00001	0800-0FFFH
00010	1000-17FFH

11100	E000-E7FFH
11101	E800-EFFFH
11110	F000-F7FFH
11111	F800-FFFFH

ex1) offset register 02H
character code 80H

character generator RAM start address

0001 0100 0000 0000
1 4 0 0 H

	address	data
	1400H	00H
	1401H	1FH
	1402H	04H
	1403H	04H
	1404H	04H
	1405H	04H
	1406H	04H
	1407H	00H

ex2) The relationship of display RAM data and display character

	RAM DATA	character
ABγDEζGHIJKLM	21H	A
	22H	B
	83H	γ
	24H	D
	25H	E
	86H	ζ

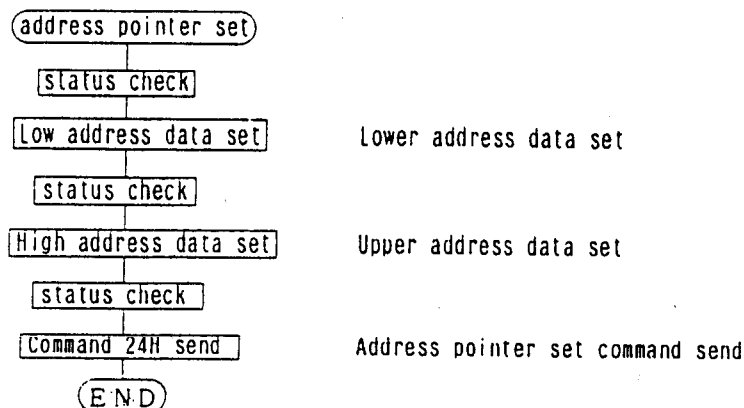
display character

γ and ζ are displayed by character generator RAM.

③ Address pointer set

The address pointer set command is used to indicate the start address for writing (or reading) to external RAM.

The flow chart of address pointer set command



2] Control word set

CODE	FUNCTION	D1	D2
01000000	40H TEXT HOME ADDRESS SET	Low adrs	High adrs
01000001	41H TEXT AREA SET	Columns	00H
01000010	42H GRAPHIC HOME ADDRESS SET	Low adrs	High adrs
01000011	43H GRAPHIC AREA SET	Columns	00H

The home address and column size are defined by this command.

① Text home address set

The starting address of external display RAM for Text display is defined by this command. The text home address shows the left end and most upper position.

The relationship of external display RAM address and display position

TH		TH+CL
TH+TA		TH+TA+CL
(TH+TA)+TA		TH+2TA+CL
(TH+2TA)+TA		TH+3TA+CL
TH+(n-1)TA		TH+(n-1)TA+CL

TH: Text Home address
TA: Text area number(columns)
CL: Columns are fixed by hardware, pin-programmable

ex) Text home address 0000H
Text area 0020H
MD2=H, MD3=H :32columns
DUAL=H, MDS=L, MD0=L, MD1=H :4lines

0000H	0001H	001EH	001FH
0020H	0021H	003EH	003FH
0040H	0041H	005EH	005FH
0060H	0061H	007EH	007FH

② Graphic home address set

The starting address of external display RAM for Graphic display is defined by this command. The graphic home address shows the left end and most upper line.

The relationship of external display RAM address and display position

GH		GH+CL
GH+GA		GH+GA+CL
(GH+GA)+GA		GH+2GA+CL
(GH+2GA)+GA		GH+3GA+CL
GH+(n-1)GA		GH+(n-1)GA+CL

GH:Graphic Home address

GA:Graphic area number(columns)

CL:Columns are fixed by hardware. (pin-programmable)

ex) Graphic home address 0000H
 Graphic area 0020H
 MD2=H, MD3=H :32columns
 DUAL=H, MDS=L, MD0=H, MD1=H :2lines

0000H	0001H	001EH	001FH
0020H	0021H	003EH	003FH
0040H	0041H	005EH	005FH
0060H	0061H	007EH	007FH
0080H	0081H	009EH	009FH
00A0H	00A1H	00BEH	00BFH
00C0H	00C1H	00DEH	00DFH
00E0H	00E1H	00FEH	00FFH
0100H	0101H	011EH	011FH
0120H	0121H	013EH	013FH
0140H	0141H	015EH	015FH
0160H	0161H	017EH	017FH
0180H	0181H	019EH	019FH
01A0H	01A1H	01BEH	01BFH
01C0H	01C1H	01DEH	01DFH
01E0H	01E1H	01FEH	01FFH

③ Text area set

The columns of display are defined by the hardware setting. This command can be used to adjust columns of display.

ex) LCD size:20columns, 4lines
 Text home address :0000H
 Text Area:0014H
 MD2=H, MD3=H :32columns
 DUAL=H, MDS=L, MD0=L, MD1=H:4lines

0000	0001	.....	0013	0014	.....	001F
0014	0015	.....	0027	0028	.....	0033
0028	0029	.....	003B	003C	.....	0047
003C	003D	.....	004F	0050	.....	005B

→LCD←

④ Graphic area set

The columns of display are defined by the hardware setting. This command can be used to adjust columns of graphic display.

ex) LCD size: 20 columns, 21 lines
 Text home address : 0000H
 Text Area: 0014H
 MD2=H, MD3=H : 32 columns
 DUAL=H, MDS=L, MD0=H, MD1=H: 21 lines

0000	0001	.....	0013	0014	.....	001F
0014	0015	.....	0027	0028	.....	0033
0028	0029	.....	003B	003C	.....	0047
003C	003D	.....	004F	0050	.....	005B
0050	0051	.....	0063	0064	.....	006F
0064	0065	.....	0077	0078	.....	0083
0078	0079	.....	008B	008C	.....	0097
008C	008D	.....	009F	00A0	.....	00AB
00A0	00A1	.....	00B3	00B4	.....	00BF
00B4	00B5	.....	00C7	00C8	.....	00D3
00C8	00C9	.....	00DB	00DC	.....	00E7
00DC	00DD	.....	00EF	00F0	.....	00FD
00F0	00F1	.....	0103	0104	.....	011F
0104	0105	.....	0127	0128	.....	0123
0128	0129	.....	013B	013C	.....	0147
013C	013D	.....	014F	0150	.....	015B

→ LCD ←

The address in graphic area can be continuous and RAM area can be used without uneffective area, if graphic area is defined the same number as the actual column number of LCD display.

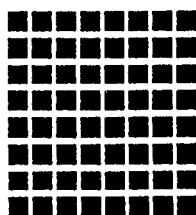
3) Mode set

CODE	FUNCTION	OPERAND
1000X000	"OR" mode	-
1000X001	"EXOR" mode	-
1000X011	"AND" mode	-
1000X100	"TEXT ATTRIBUTE" mode	-
10000XXX	INTERNAL CHARACTER GENERATOR MODE	-
10001XXX	EXTERNAL CHARACTER GENERATOR MODE	-

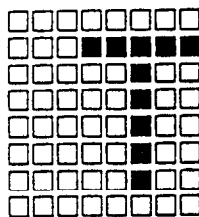
The display mode is defined by this command. The display mode don't have changed until to send next this command. Logically "OR", "EXOR", "AND" of text and graphic display can be displayed.

When internal character generator mode is selected, character code 00H~7FH are selected from built-in character generator ROM. The character code 80H~FFH are automatically selected from external character generator RAM.

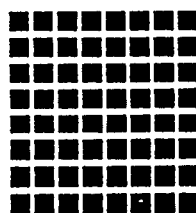
ex)



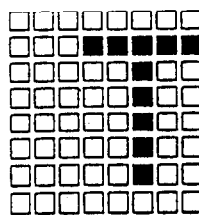
Graphic



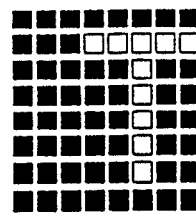
Text



"OR"



"AND"



"EXOR"

Note: Only text display is attributed, because attribute data is located in graphic RAM area.

Attribute function

"Reverse display", "Character blink" and "Inhibit" are called "Attribute".

The attribute data is written in the graphic area defined by Control word set command. The mode set command selects text display only and graphic display cannot be displayed.

The attribute data of the 1st character in text area is written at the 1st byte in graphic area, and attribute data of n-th character is written at the n-th byte in graphic area. Attribute function is defined as follow.

Attribute RAM 1byte

X	X	X	X	d3	d2	d1	d0
---	---	---	---	----	----	----	----

d3	d2	d1	d0	FUNCTION
0	0	0	0	normal display
0	1	0	1	reverse display
0	0	1	1	inhibit display
1	0	0	0	blink of normal display
1	1	0	1	blink of reverse display
1	0	1	1	blink of inhibit display

X: don't care

4) Display mode

CODE	FUNCTION	OPERAND
10010000	display off	-
1001XX10	cursor on, blink off	-
1001XX11	cursor on, blink on	-
100101XX	text on, graphic off	-
100110XX	text off, graphic on	-
100111XX	text on, graphic on	-

11001032110

cursor blink	on:1, off:0
cursor display	on:1, off:0
text display	on:1, off:0
graphic display	on:1, off:0

Note: It is necessary to turn on "text display" and "graphic display" in following case.

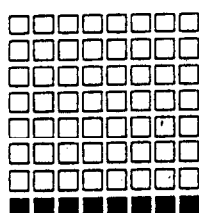
1) Combination of text/graphic display

2) Attribute function

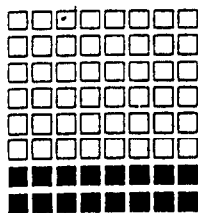
5) Cursor pattern select

CODE	FUNCTION	OPERAND
10100000	1 line cursor	-
10100001	2 lines cursor	-
10100010	3 lines cursor	-
10100011	4 lines cursor	-
10100100	5 lines cursor	-
10100101	6 lines cursor	-
10100110	7 lines cursor	-
10100111	8 lines cursor	-

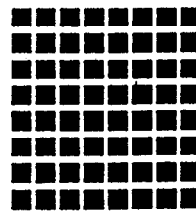
When cursor display is ON, this command selects the cursor pattern from 1 line to 8 lines. The cursor address is defined by cursor pointer set command.



1 line
cursor



2 lines
cursor



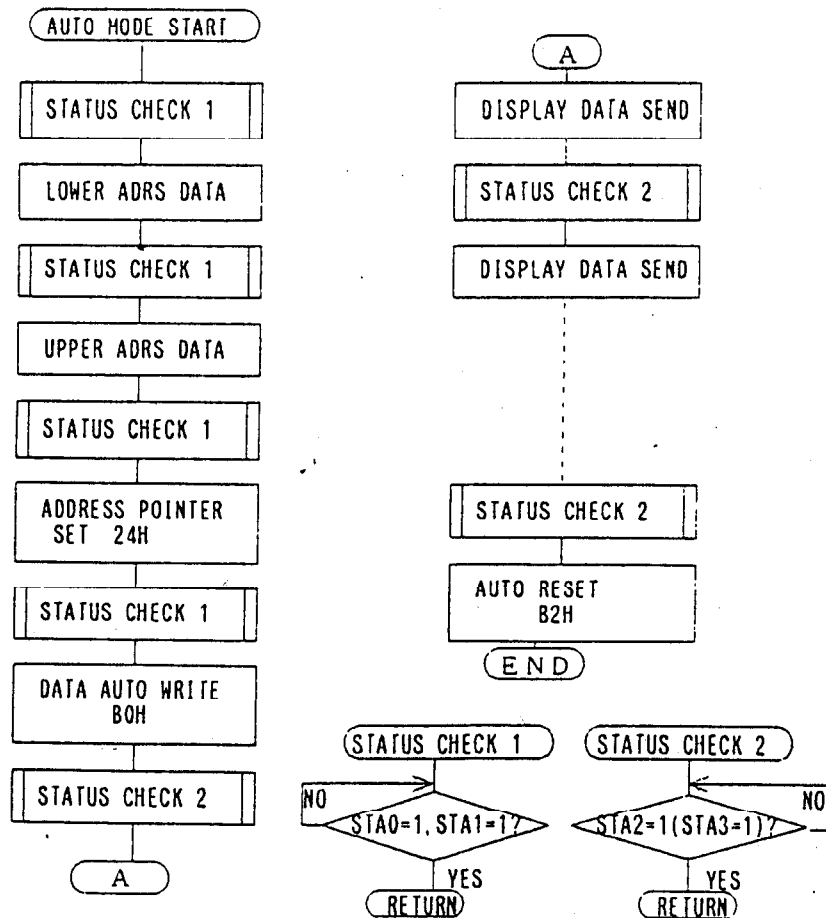
8 lines
cursor

6) Data auto read/write

CODE	FUNCTION	OPERAND
10110000	B0H data auto write set	-
10110001	B1H data auto read set	-
10110010	B2H auto reset	-

This command is convenient to send full screen data from external display RAM. After setting auto mode, "data write(or read)" command is not necessary between each data. "Data auto write(or read)" command should follow the "Address pointer set" and address pointer is automatically increment by +1 after each data. After sending(or receiving) all data "auto reset" is necessary to return normal operation because all data is regarded "display data" and no command can be accepted in the auto mode.

Note: Status check for auto mode (STA2, STA3) should be checked between each data. Auto reset should be performed after checking STA3=1 (STA2=1). Refer following flow chart.



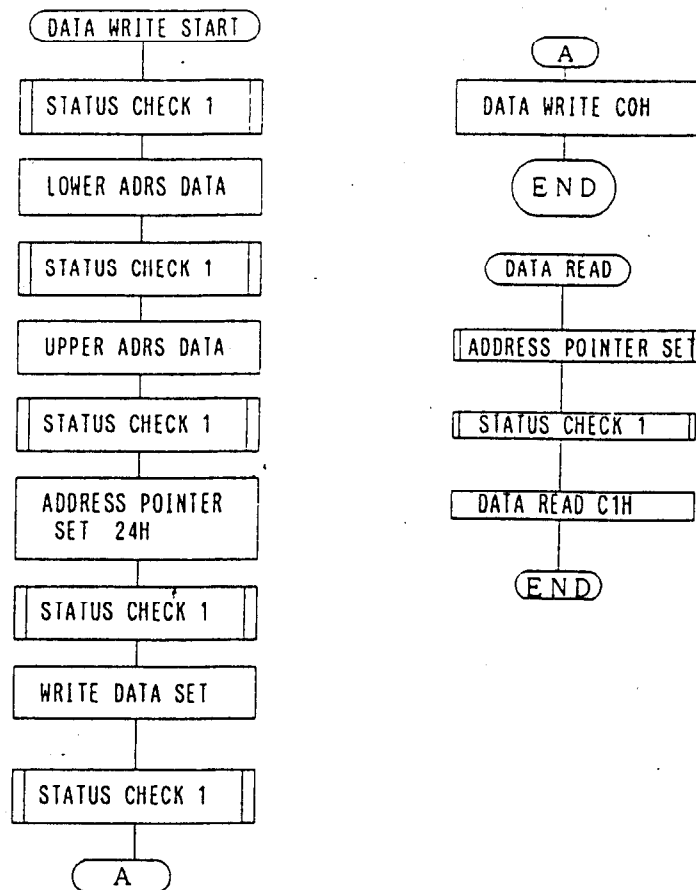
7) Data read write

CODE		FUNCTION	OPERAND
11000000	C0H	DATA WRITE AND ADP INCREMENT	data
11000001	C1H	DATA READ AND ADP INCREMENT	-
11000010	C2H	DATA WRITE AND ADP DECREMENT	data
11000011	C3H	DATA READ AND ADP DECREMENT	-
11000100	C4H	DATA WRITE AND ADP NONVARIABLE	data
11000101	C5H	DATA READ AND ADP NONVARIABLE	-

This command is used for data write from MPU to external display RAM, and data read from external display RAM to MPU. Data write/data read should be executed after setting address by address pointer set command. Address pointer can be automatically increment or decrement by setting this command.

Note: This command is necessary for each 1byte data.

Refer following flow chart.



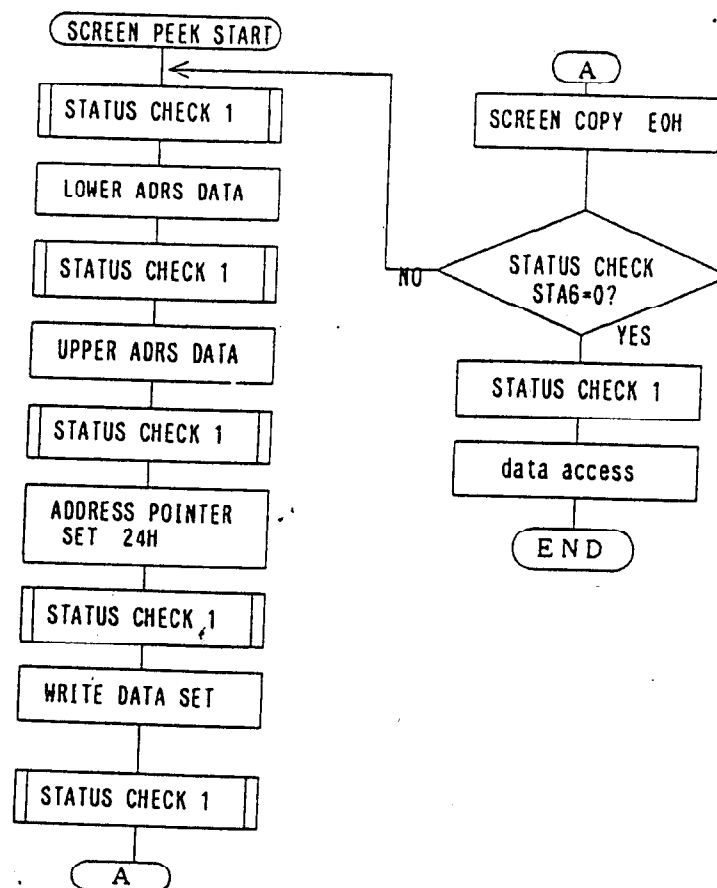
8) Screen peek

CODE	FUNCTION	OPERAND
11100000 EOH	screen peek	-

This command is used to transfer displayed lbyte data to data stack, and this lbyte data can be read from MPU by data access. The logical combination data of text and graphic display on LCD screen can be read by this command.

The status (STA6) should be checked just after "screen peek" command. If the address determined by "address pointer set" command is not in graphic area, this command ignored and status flag (STA6) is set.

Refer following flow chart.



9) Screen copy

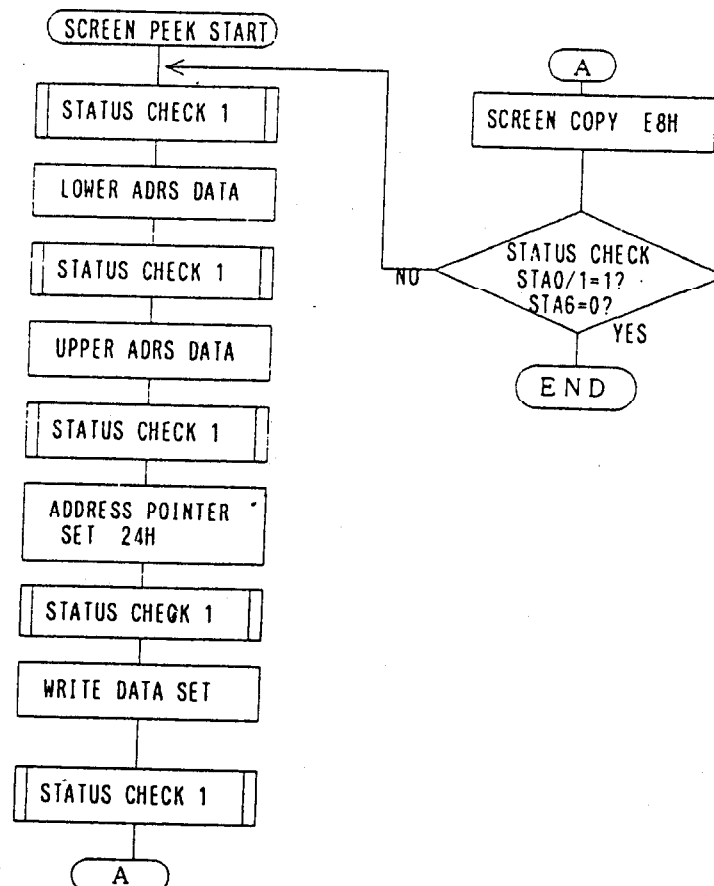
CODE	FUNCTION	OPERAND
11101000 E8H	screen copy	-

This command is used to copy displayed lline data to graphic area. The start point of lline data in the screen is determined by the address pointer.

Note: ①When the attribute of text is used this command cannot be used. (because attribute data is in the graphic area.)

②In case of 2screen drive, this command cannot be used. (because T6963C cannot separate upper screen data and lower screen data.)

Refer following flow chart.

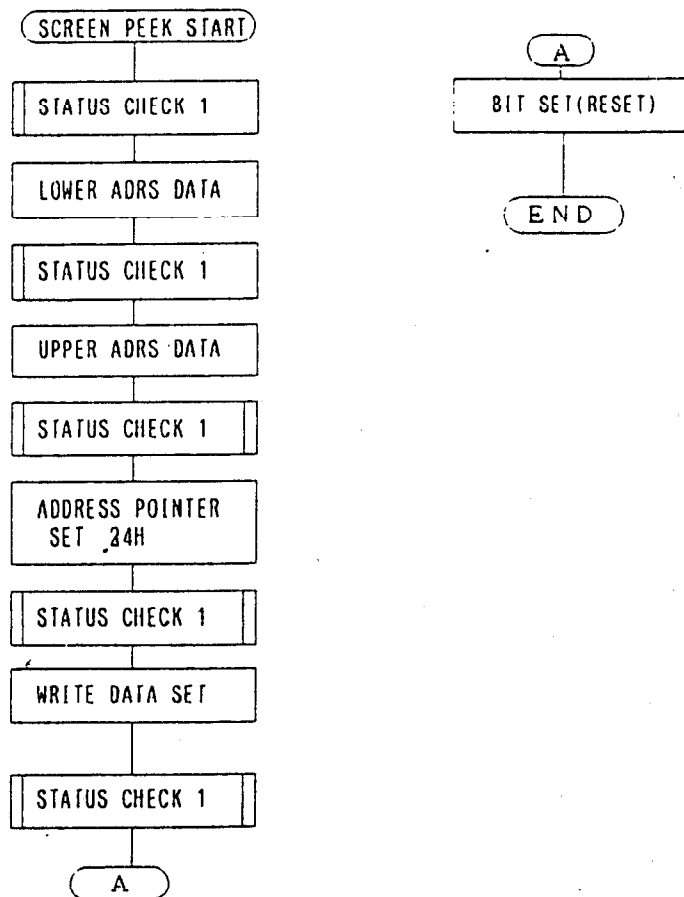


10) Bit set/reset

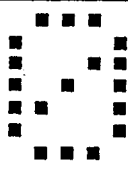
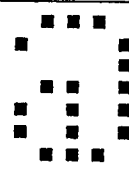
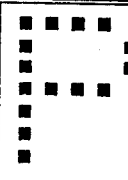
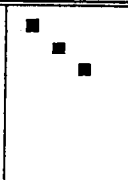
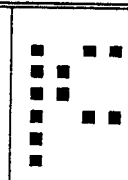
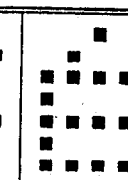
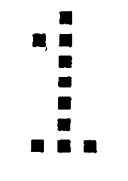
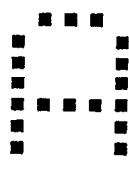
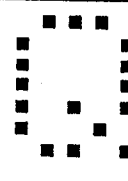
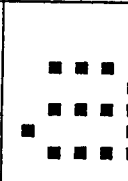
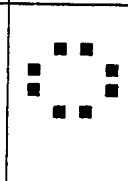
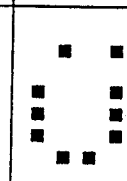
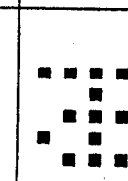
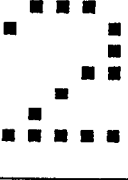
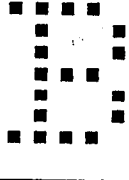
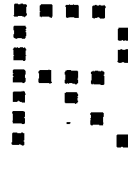
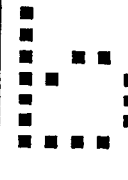
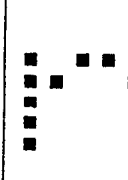
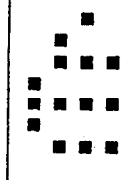
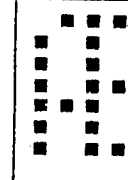
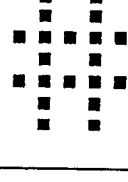
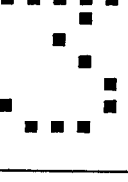
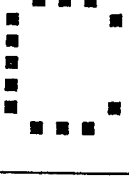
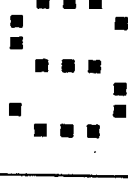
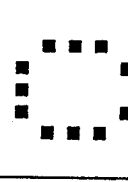
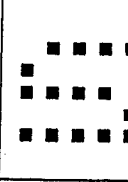
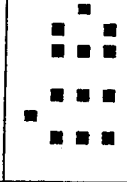
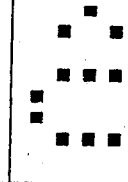
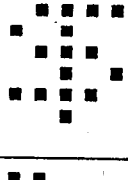
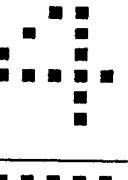
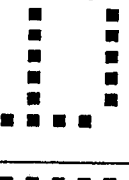
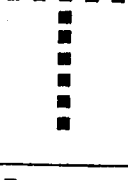
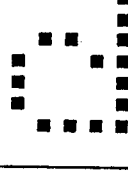
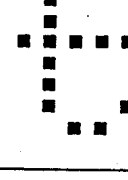
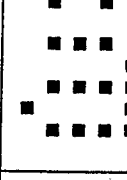
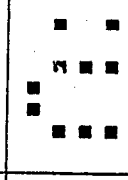
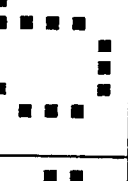
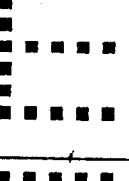
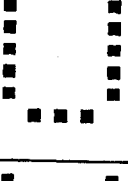
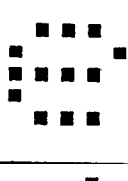
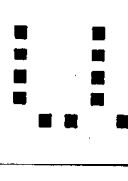
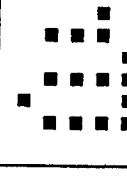
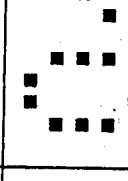
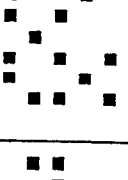
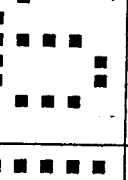
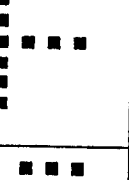
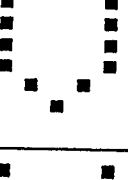
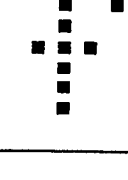
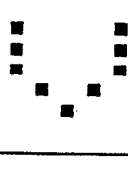
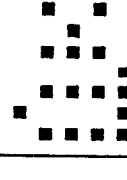
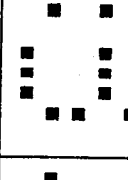
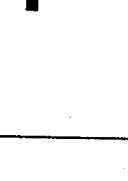
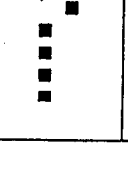
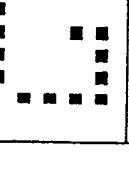
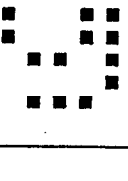
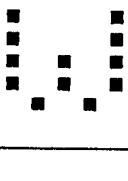
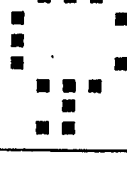
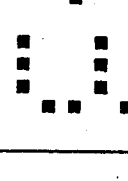
CODE	FUNCTION	OPERAND
11110XXX	bit reset	-
11111XXX	bit set	-
1111X000	bit 0 (LSB)	-
1111X001	bit 1	-
1111X010	bit 2	-
1111X011	bit 3	-
1111X100	bit 4	-
1111X101	bit 5	-
1111X110	bit 6	-
1111X111	bit 7 (MSB)	-

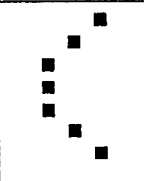
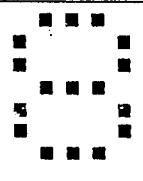
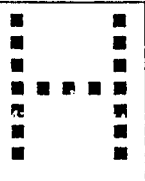
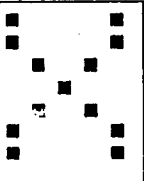
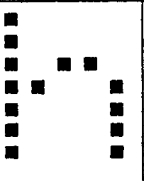
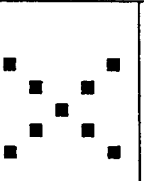
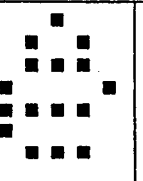
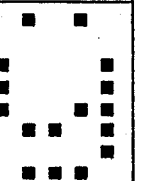
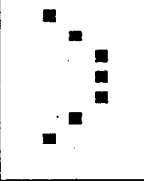
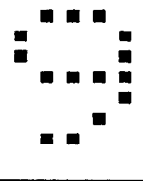
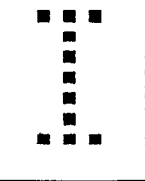
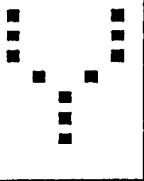
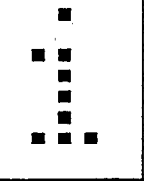
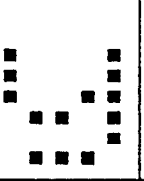
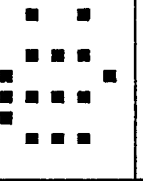
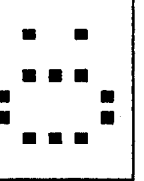
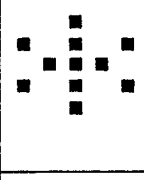
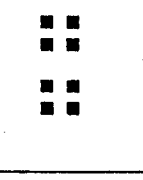
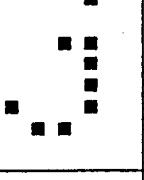
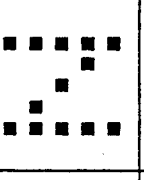
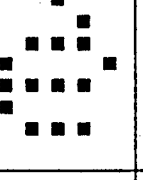
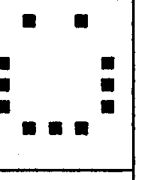
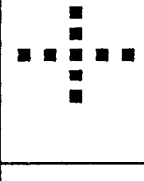
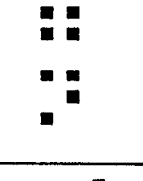
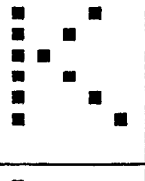
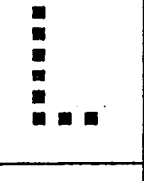
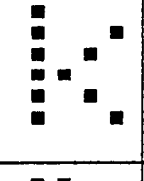
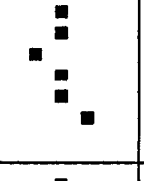
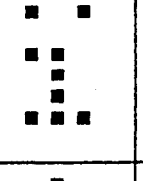
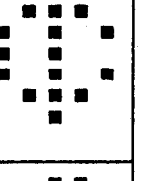
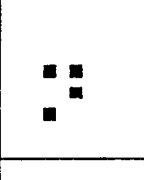
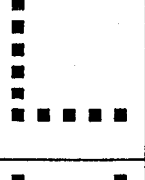
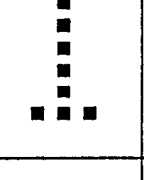
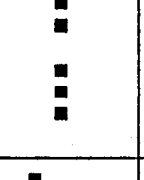
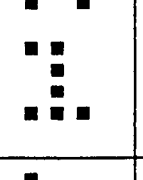
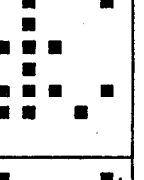
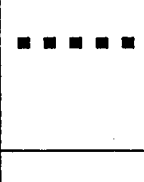
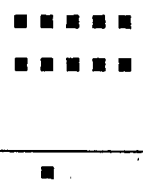
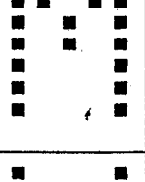
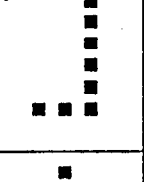
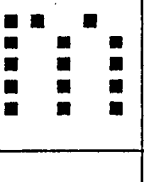
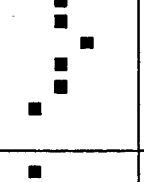
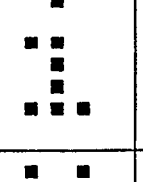
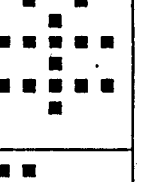
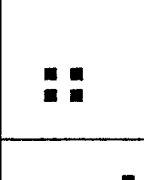
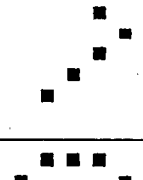
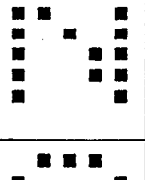
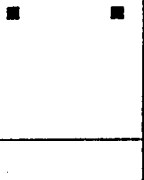
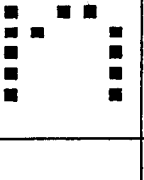
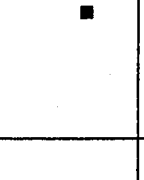
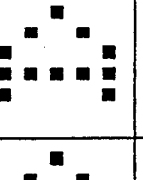
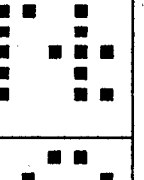
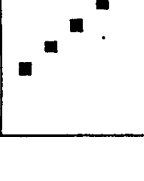
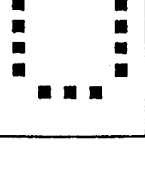
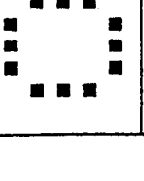
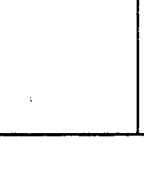
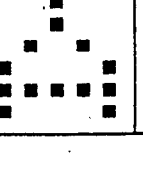
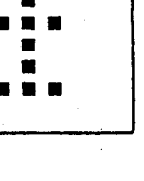
This command is used to set or reset a bit of 1byte is specified by address pointer. Plural bits in the 1byte data cannot be set/reset at a time.

Refer following flow chart.

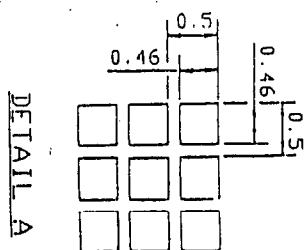
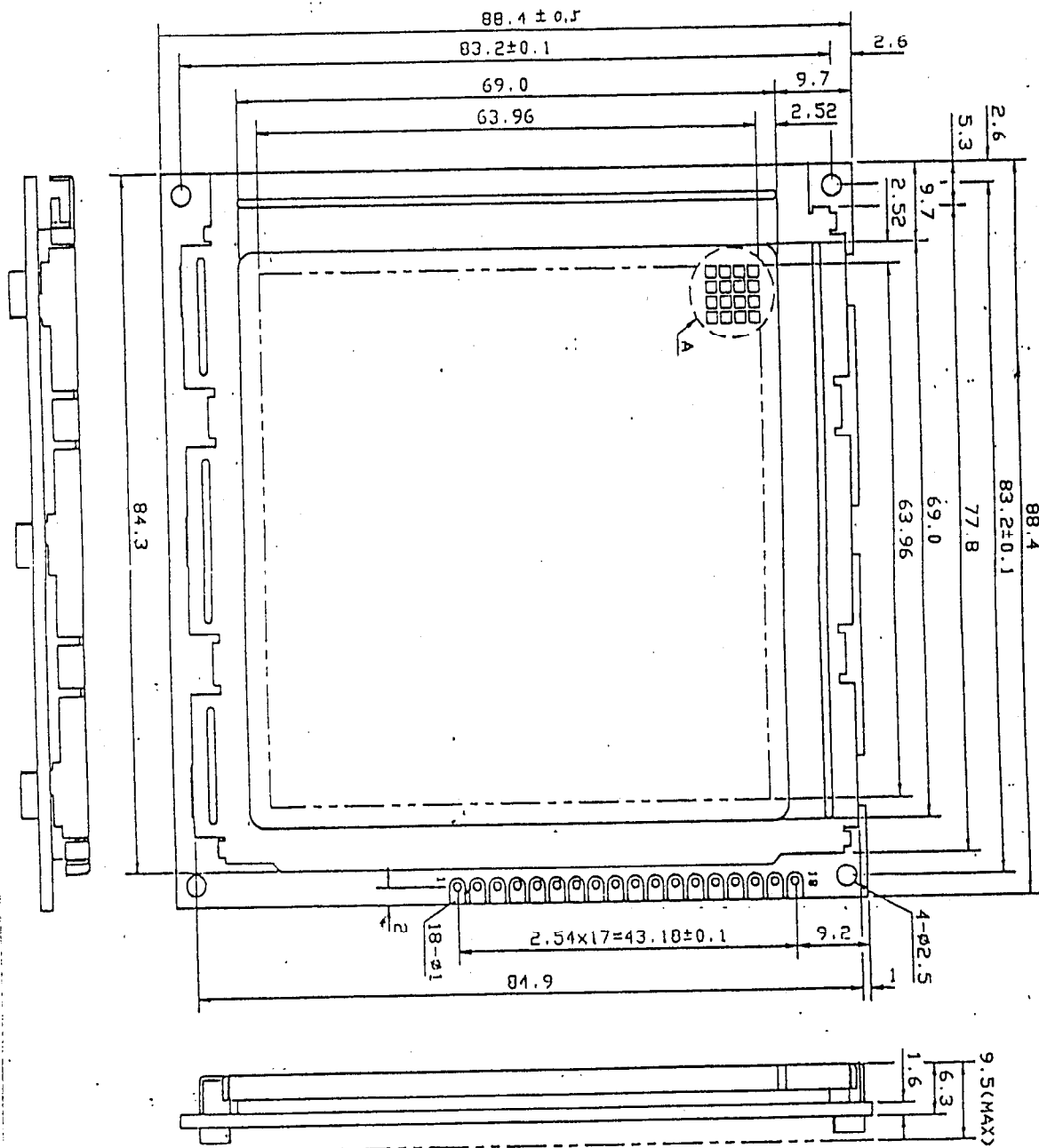


10-3. CHARACTER CODE MAP

	0	1	2	3	4	5	6	7
0								
1								
2								
3								
4								
5								
6								
7								

	0	1	2	3	4	5	6	7
8								
9								
A								
B								
C								
D								
E								
F								

11. DIMENTION OUTLINE :



12. PRECAUTION IN DESIGN

12.1 LCD driving voltage and viewing angle range

Setting V_O out of the recommended condition will be a cause for a change of viewing angle range.

12.2 Caution against static charge

As this module is provided with C-MOS LSI, precautions must be taken when handling it.

12.3 Power On Sequence

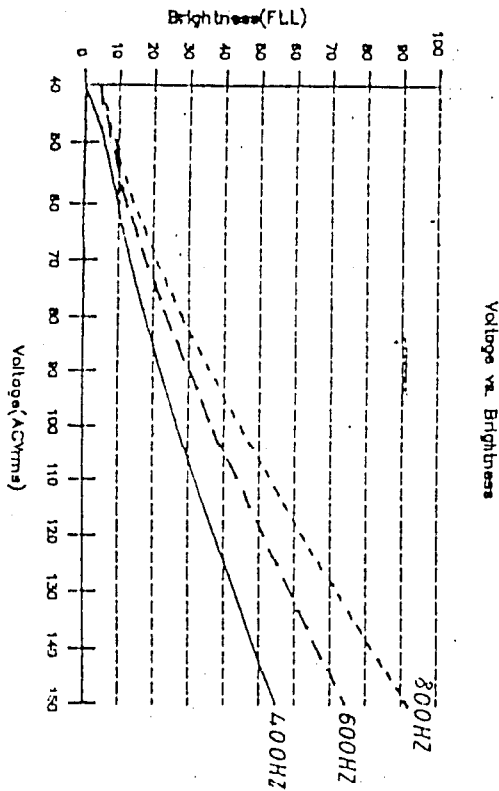
Input signals should not be applied to LCD module before power supply voltage is applied and reaches to specified voltage ($5V \pm 0.25V$).

If above sequence is not kept, C-MOS LSIs of LCD modules may be damaged.

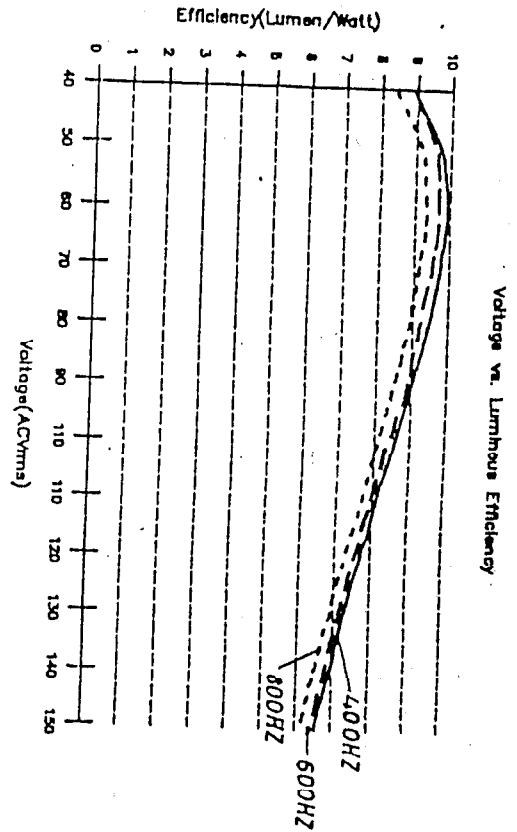
12.4 Packaging

- (1) Don't leave the product in the place of high humidity for a long period of time. For their storage in the place where temperature is 35°C or higher, special care to prevent them from high humidity is required. A combination of high temperature and high humidity may cause them polarization and degradation as well as bubble generation and polarizer peel-off. Please keep the temperature and humidity within the specified range for use and storing.
- (2) Since upper polarizers and lower aluminum plates tend to be easily damaged, they should be handled with full care so as not to get them touched, pushed or rubbed by a piece of glass, tweezers and anything else which harder than a pencil lead 3H.
- (3) As the adhesives used for adhering upper/lower polarizers and aluminum plates are made of organic substances which will be deteriorated by a chemical reaction with such chemicals as acetone, toluene, ethanol and isopropylalcohol. The following solvents are recommended for use :
Please contact us when it is necessary for you to use chemicals other than the above.

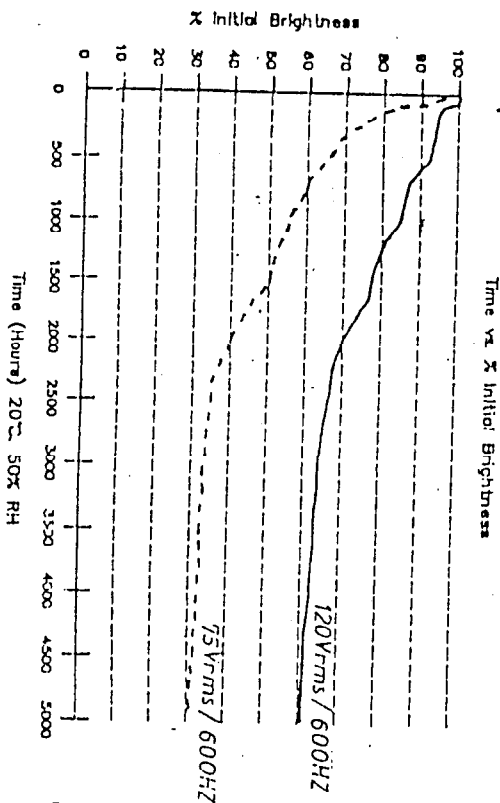
10. EL Lamp Data (Yellow Green Color):
(1) Brightness:



10. EL Lamp Data (Yellow Green Color):
(2) Efficiency:



10. EL Lamp Data (Yellow Green Color):
(3) Initial Brightness:



PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT	TEST CONDITION
Supply Voltage	V	80	120	150	Volt rms A.C.	Without Inverter
Operating Frequency	F _{op}	300	400	600	Hz	Without Inverter
Average Luminous Intensity	I _v	—	120	—	Cd/m ²	F _{op} =400Hz V = 120 V
Current Density	I _d	—	1	—	mA/sq. in.	F _{op} =400Hz V = 120 V Without Inverter
Color	Cool White					

10. EL Lamp Data (Yellow Green Color):
(4) EL Specifications:

- (4) Lightly wipe to clean the dirty surface with absorbent cotton waste or other soft material like chamois, soaked in the chemicals recommended without scrubbing it hardly. To prevent the display surface from damage and keep the appearance in good state, it is sufficient, in general, to wipe it with absorbent cotton.
- (5) Immediately wipe off saliva or water drop attached on the display area because its long period adherence may cause deformation or faded color on the spot.
- (6) Foggy dew deposited on the surface and contact terminals due to coldness will be a cause for polarizer damage, stain and dirt on product. When necessary to take out the products from some place at low temperature for test, etc. It is required for them to be warmed up in a container once at the temperature higher than that of room.
- (7) Touching the display area and contact terminals with bare hands and contaminating them are prohibited, because the stain on the display area and poor insulation between terminals are often caused by being touched by bare hands. (There are some cosmetics detrimental to polarizers.)
- (8) In general the quality of glass is fragile that it tends to be cracked or chipped in handling, specially on its periphery. Please be careful not to give it sharp shock caused by dropping down, etc.

12.5 Caution for operation

- (1) It is an indispensable condition to drive LCD's within the specified voltage limit since the higher voltage than the limit causes the shorter LCD life. An electrochemical reaction due to direct current causes LCD's undesirable deterioration, so that the use of direct current driver should be avoided.
- (2) Response time will be extremely delayed at lower temperature than the operating temperature range and on the hand at higher temperature LCD's show dark blue color in them. However those phenomena do not mean malfunction or out of order with LCD whenever come back in the specified operating temperature range.
- (3) If the display area is pushed hard during operation, some font will be abnormally displayed but it resumes normal condition after turning off once.

- (4) A slight dew depositing on terminals is a cause for electro-chemical reaction resulting in terminal open circuit, under the relative condition of 40°C 50% RH or less is required.

12.6 Storage

In case of storing for a long period of time (for instance, for years) for the purpose of replacement use, the following ways are recommended.

- (1) Storage in a polyethylene bag with the opening sealed so as not to enter fresh air outside in it, and with no desiccant.
- (2) Placing in a dark place where neither exposure to direct sunlight nor light, keeping temperature in the range from 0°C to 35°C.
- (3) Storing with no touch on polarizer surface by anything else. (It is recommended to store them as they have been contained in the inner container at the time of delivery from us.)

12.7 Safety

- (1) It is recommendable to crash damaged or unnecessary LCD's into pieces and wash off liquid crystal by either of solvents such as acetone or ethanol, which should be burned up later.
- (2) When any liquid leaked out of a damaged glass cell comes in contact with your hands, Please wash it off well with soap and water.

13. PRECAUTION FOR USE

- (1) A limit sample should be provided by the both parties on an occasion when the both parties agreed its necessity. Judgement by a limit sample shall take effect after the limit sample has been established and confirmed by the both parties.
- (2) On the following occasions, the handling of the problem should be decided through discussion and agreement between responsible persons of the both parties.
 - (a) When a question is arisen in this specifications.
 - (b) When a new problem is arisen which is not specified in this specifications.
 - (c) When an inspection specifications change or operating condition change in customer is reported to PICVUE, and some problems are arisen in this specification due to the change.
 - (d) When a new problem is arisen at the customer's operating set for sample evaluation in the customer site.

The precaution that should be observed when handling LCM have been explained above. If any points are unclear or if you have any requests, please contact PICVUE.