



深圳市拓普微科技开发有限公司

SHENZHEN TOPWAY TECHNOLOGY CO., LTD.

# LMT050DNCFWU-NGN

## LCD Module User Manual

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Rev.	Descriptions	Release Date
0.1	Preliminary	2014-09-01
0.2	Revise Terminal Functions & Add TFT Controller Reset Timing	2014-11-03
0.3	Update section 2,7	2018-2-7

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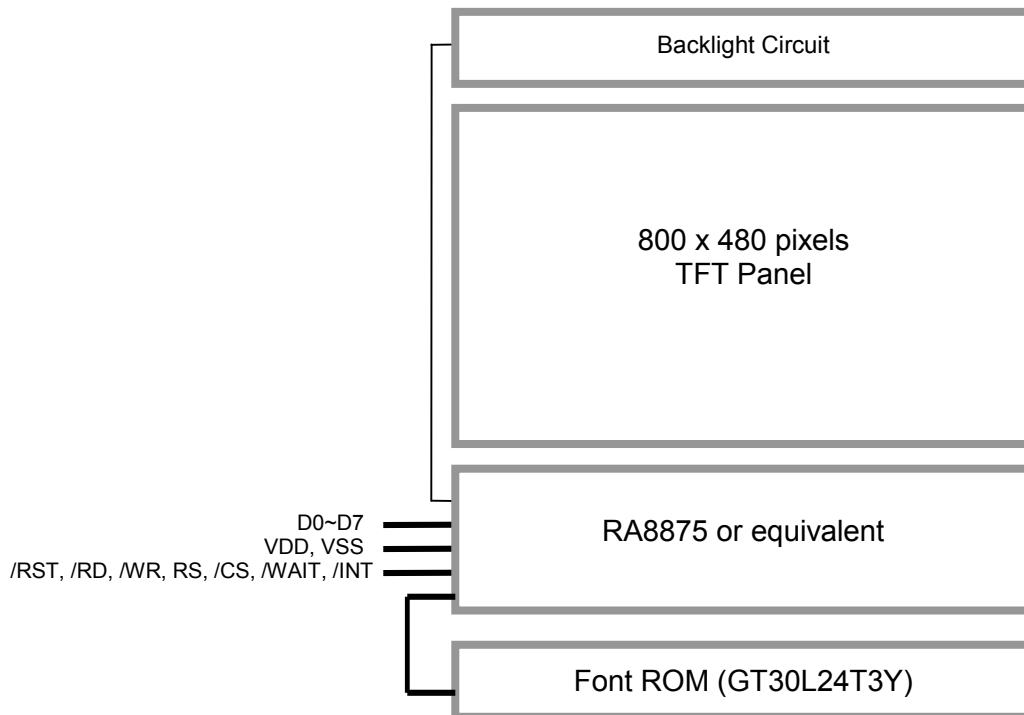
**1. General Specification**

Screen Size(Diagonal) :	5.0"
Outline Dimension :	142.0 x 79.0x 9.6max (mm) (see attached drawing for details)
Active Area :	108.0 x 64.8 (mm)
Color Depth:	65k
Number of dots :	800 x 480
Pixel Pitch :	0.135 x 0.135 (mm)
Pixel Configuration :	RGB Stripe
Backlight :	LED
Surface Treatment :	Anti-Glare Treatment
Viewing Direction :	6H (gray scale inverse)(*2) 12H(*3)
Operating Temperature :	-20 ~ +70°C
Storage Temperature :	-30 ~ +80°C

**Note:**

- \*1 Color tune may slightly changed by temperature and driving voltage.
- \*2. For saturated color display content (eg. pure-red, pure-green, pure-blue, or pure-colors-combinations)
- \*3. For "color scales" display content

**2. Block Diagram**



**3.**

## Terminal Functions

### 3.1 Interface

Pin No.	Pin Name	I/O	Descriptions	Note
1	VSS	P	Power Ground	
2	VSS			
3	VDD	P	Positive Power Supply	
4	VDD			
5	RS	I	Register Select RS = H, status read/command write cycle is selected. RS = L, data Read/Write cycle is selected.	
6	/CS	I	Chip Select /CS=L, enable access to the LCD interface /CS=H, disable access to the LCD interface	
7	/RST	I	Reset signal /RST = L, Initialization is executed /RST = H, Normal running.	
8	D0	I/O	Data Input	
:	:	:	:	
15	D7	I/O	Data Input	
16	/WAIT	O	Controller busy signal output, MCU should poll this signal before accessing the LCD module	
17	/INT	O	Leave Open	
18	/WR	I	/WR=L→H, RD=H; Data or Instruction latch into the LCD module	
19	VSS	P	Power Ground	
20	/RD	I	/WR=H, /RD=L; Data or Status read form the LCD module	
21	NC	--	No Connection	
:	:	:	:	
26	NC	--	No Connection	

### 4. Absolute Maximum Ratings

Items	Symbol	Min.	Max.	Unit	Condition
Supply Voltage	V <sub>DD</sub>	-0.3	+7.0	V	GND = 0V
Operating Temperature	T <sub>OP</sub>	-20	+70	°C	No Condensation
Storage Temperature	T <sub>ST</sub>	-30	+80	°C	No Condensation

Cautions:

Any Stresses exceeding the Absolute Maximum Ratings may cause substantial damage to the device. Functional operation of this device at other conditions beyond those listed in the specification is not implied and prolonged exposure to extreme conditions may affect device reliability.

### 5. Electrical Characteristics

#### 5.1 DC Characteristics (MCU terminal)

VDD=5.0V, VSS=0V, T<sub>OP</sub> =25°C

Items	Symbol	MIN.	TYP.	MAX.	Unit	Applicable Pin
Operating Voltage	VDD	4.7	5.0	5.3	V	VDD
Input High Voltage	V <sub>IH</sub>	3.0V	-	3.3	V	/RD, /WR, RS, /CS, D0~D7, /RST
Input Low Voltage	V <sub>IL</sub>	VSS	-	0.5	V	
Output Signal High Voltage	V <sub>OH</sub>	-	-	3.3	V	D0~D7, /WAIT, /INT
Output Signal Low Voltage	V <sub>OL</sub>	VSS	-	-	V	
Operating Current	I <sub>DD</sub>	-	365	-	mA	All black, Backlight ON
		-	155	-	mA	All black, Backlight OFF

### 6. AC Characteristics

#### 6.1 AC Timing

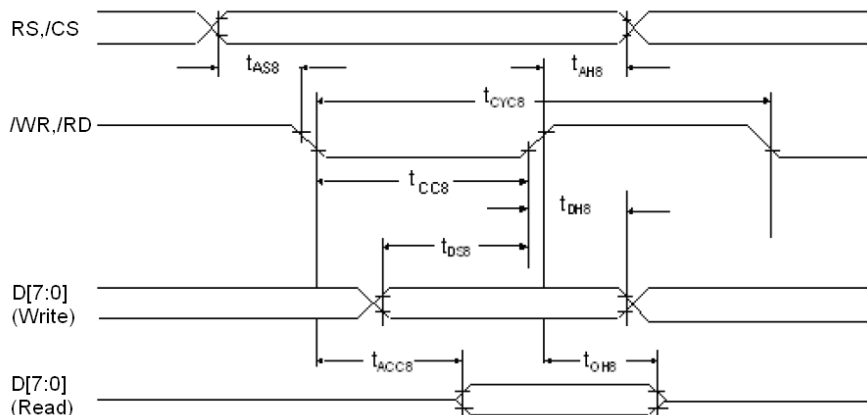
VDD=5.0V, VSS=0V, TOP =25°C

Parameter	Symbol	Spec.			Unit	Description
		Min.	Typ	Max.		
Cycle time	t <sub>CYC8</sub>	71	-	-	ns	tc is one system clock period: tc = 1/SYS_CLK
Strobe Pulse width	t <sub>CC8</sub>	28	-	-		
Address setup time	t <sub>AS8</sub>	5	-	-		
Address hold time	t <sub>AH8</sub>	14	-	-		
Data setup time	t <sub>DS8</sub>	28	-	-		
Data hold time	t <sub>DH8</sub>	14	-	-		
Data output access time	t <sub>ACC8</sub>	0	-	14		
Data output hold time	t <sub>OH8</sub>	0	-	14		

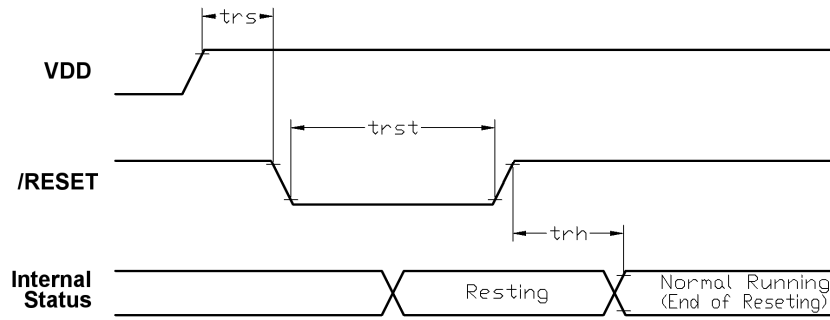
Note:1. Refer to the RA8875 datasheet for more details.

2. SYS\_CLK (System clock) = 30MHz

#### Register Write/Read timing (for CPU 8 Bit)



**6.2 TFT Controller Reset Timing**



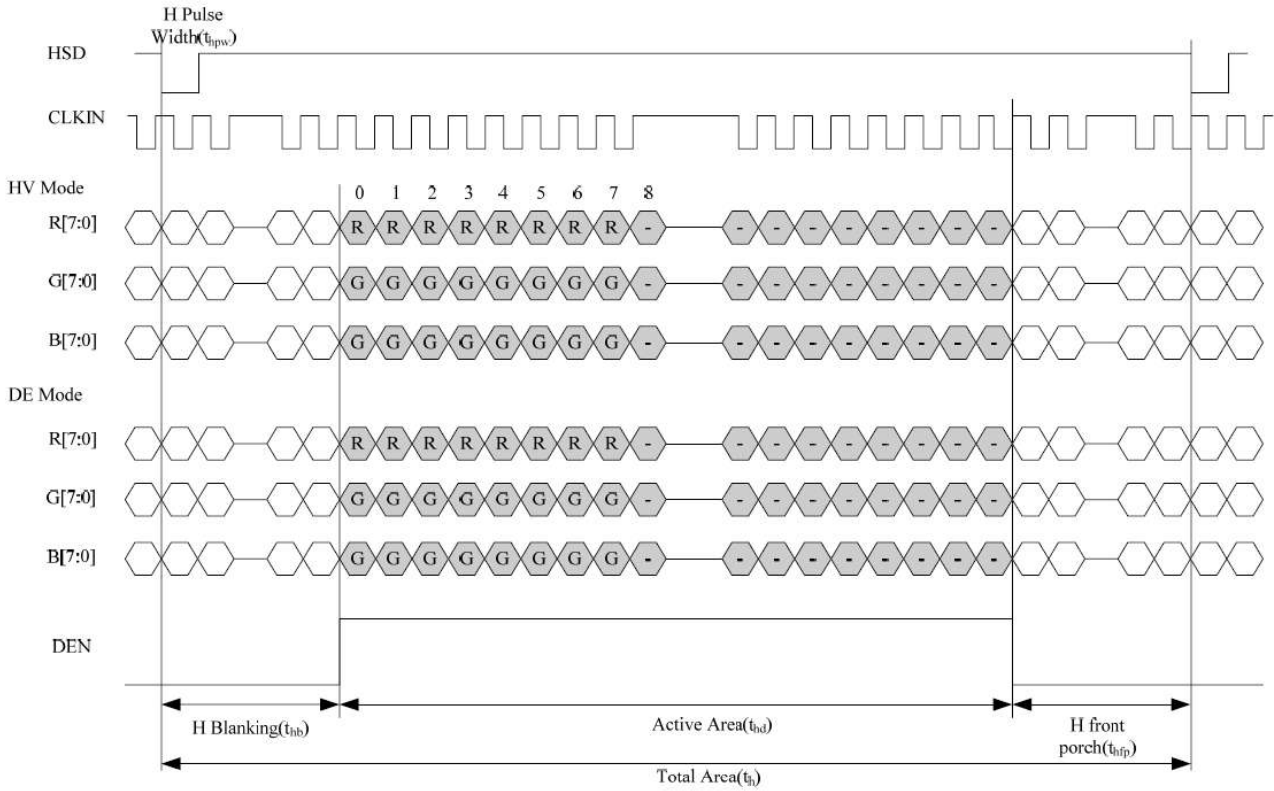
VSS=0V, VDD=5.0V, T<sub>OP</sub>=25°C

Item	Symbol	MIN.	TYP.	MAX.	Unit
Reset setup time	trs	2	-	-	ms
Reset pulse	trst	0.2	-	-	ms
Reset hold time	trh	2	-	-	ms

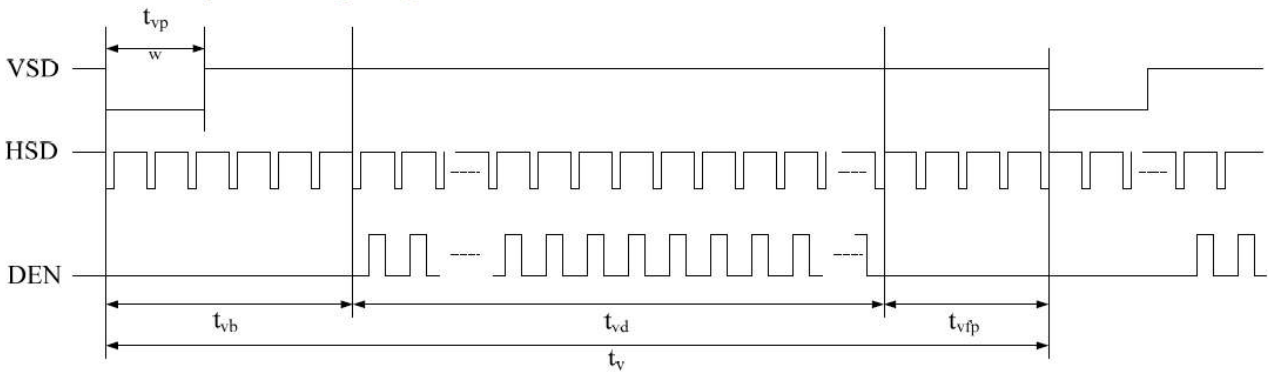
**6.3 Panel Setting of Timing**

Parameter	Symbol	Spec			Unit	Remark
		MIN.	TYP.	MAX.		
Horizontal Display Area	thd	-	800	-	CLKIN	
CLKIN Frequency(60HZ)	fclk	-	30	50	MHZ	
One Horizontal Line	th	889	928	1143	CLKIN	
HSD pulse width	thpw	1	48	255	CLKIN	
HSD Blanking	thb	88			CLKIN	
HSD Front Porch	thfp	1	40	255	CLKIN	
Vertical Display Area	tvd	480			TH	
VSD period time	tv	513	525	767	TH	
VSD pulse width	tvpw	3	3	255	TH	
VSD Blanking(tvb)	tvb	32			TH	
VSD Front Porch(tvfp)	tvfp	1	13	255	TH	

**Horizontal Input Timing Diagram**



**Vertical Input Timing Diagram**



## 7. Commands

### REG[01h] Power and Display Control Register (PWRR)

Bit	Description	Default	Access
7	LCD Display Off 0:display off. 1:display on.	0	RW
6-2	NA	0	RO
1	<b>Sleep Mode</b> 0:Normal mode. 1:Sleep mode. <b>Note:</b> 1. There are 3 ways to wake up from sleep mode: Touch Panel wake up, Key Scan wake up, Software wake up. 2. When using IIC, this function is not supported. 3. When using SPI, it has its particular steps to use this function, refer to section 6-1-2-3 please.	0	RW
0	<b>Software Reset</b> 0 : No action. 1 : Software Reset. <b>Note:</b> The bit must be set to 1 and then set to 0 to complete a software reset	0	WO

### REG[02h] Memory Read/Write Command (MRWC)

Bit	Description	Default	Access
7-0	<b>Write Function : Memory Write Data</b> Data to write in memory corresponding to the setting of MWCR1[3:2]. Continuous data write cycle can be accepted in bulk data write case. <b>Read Function : Memory Read Data</b> Data to read from memory corresponding to the setting of MWCR1[3:2]. Continuous data read cycle can be accepted in bulk data read case. Note that the first data read cycle is dummy read and need to be ignored.	--	RW

### REG[04h] Pixel Clock Setting Register (PCSR)

Bit	Description	Default	Access
7	<b>PCLK Inversion</b> 0 : PDAT is fetched at PCLK rising edge. 1 : PDAT is fetched at PCLK falling edge.	0	RW
6-2	NA	0	RO
1-0	<b>PCLK Period Setting</b> pixel clock (PCLK) period setting. 00b: PCLK period = System Clock period. 01b: PCLK period = 2 times of System Clock period. 10b: PCLK period = 4 times of System Clock period. 11b: PCLK period = 8 times of System Clock period.	0	RW



**REG[05h] Serial Flash/ROM Configuration Register (SROC)**

Bit	Description	Default	Access
7	<b>Serial Flash/ROM I/F # Select</b> 0: Serial Flash/ROM 0 I/F is selected. 1: Serial Flash/ROM 1 I/F is selected.	0	RW
6	<b>Serial Flash/ROM Address Mode</b> 0: 24 bits address mode This bit must set to 0 for serial flash .	0	RW
5	<b>Serial Flash/ROM Waveform Mode</b> Mode 0. Mode 3.	0	RW
4-3	<b>Serial Flash /ROM Read Cycle</b> 00b: 4 bus → no dummy cycle 01b: 5 bus → 1 byte dummy cycle 1xb: 6 bus → 2 byte dummy cycle	0	RW
2	<b>Serial Flash /ROM Access Mode</b> 0: Font mode 1: DMA mode	0	RW
1-0	<b>Serial Flash /ROM I/F Data Latch Mode Select</b> 0xb: Single Mode 10b: Dual Mode 0. 11b: Dual Mode 1.	0	RW

**REG[06h] Serial Flash/ROM CLK Setting Register(SFCLR)**

Bit	Description	Default	Access
7-2	NA	0	RO
1-0	<b>Serial Flash/ROM Clock Frequency Setting</b> 0xb: SFCL frequency = System clock frequency (When DMA enable and Color depth = 256 color) SFCL frequency = System clock frequency / 2) 10b: SFCL frequency = System clock frequency / 2 11b: SFCL frequency = System clock frequency / 4	0	RW

**REG[10h] System Configuration Register (SYSR)**

Bit	Description	Default	Access
7-4	N/A	0	RO
3-2	<b>Color Depth Setting</b> 00b : 8-bpp generic TFT, i.e. 256 colors. 1xb : 16-bpp generic TFT, i.e. 65K colors.	0	RW
1-0	<b>MCUIF Selection</b> 00b : 8-bit MCU Interface. 1xb : 16-bit MCU Interface.	0	RW

**REG[12h] GPI**

Bit	Description	Default	Access
7-5	NA	0	RO
4-0	<b>GPI[4:0] : General Purpose Input.</b> KEY_EN = 0: General Purpose Input from pin KIN[4:0] KEY_EN = 1: NC	NA	RO

Note:KEY\_EN : REG[C0h] bit 7

**REG[13h] GPO**

Bit	Description	Default	Access
7-4	NA	0	RO
3-0	<b>GPO[3:0] : General Purpose Output</b> KEY_EN = 0: General Purpose Output to KOUT[3:0] KEY_EN = 1: NC	0	RW

Note: KxY\_EN : REG[C0h] bit 7

**REG[14h] LCD Horizontal Display Width Register (HDWR)**

Bit	Description	Default	Access
7	NA	0	RO
6-0	<b>Horizontal Display Width Setting Bit[6:0]</b> The register specifies the LCD panel horizontal display width in the unit of 8 pixels resolution. Horizontal display width(pixels) = (HDWR + 1)x8	0	RW

Note : HDWR must be set less than 64h because that the maximum horizontal display width is 800 pixels.

**REG[15h] Horizontal Non-Display Period Fine Tuning Option Register (HNDFTR)**

Bit	Description	Default	Access
7	<b>DE Polarity</b> 0 : high active. 1 : low active.	0	RW
6-4	NA	0	RO
3-0	<b>Horizontal Non-Display Period Fine Tuning(HNDFT) [3:0]</b> This register specifies the fine tuning for horizontal non-display period; it is used to support the SYNC mode panel. Each level of this modulation is 2-pixel.	0	RW

**REG[16h] LCD Horizontal Non-Display Period Register (HNDR)**

Bit	Description	Default	Access
7-5	NA	0	RO
4-0	<b>Horizontal Non-Display Period(HNDP) Bit[4:0]</b> This register specifies the horizontal non-display period. Horizontal Non-Display Period (pixels) =(HNDR + 1)x8+(HNDFTR/2+1)x2 + 2	0	RW

**REG[17h] HSYNC Start Position Register (HSTR)**

Bit	Description	Default	Access
7-5	NA	0	RO
4-0	<b>HSYNC Start Position[4:0]</b> The starting position from the end of display area to the beginning of HSYNC. Each level of this modulation is 8-pixel. HSYNC Start Position(pixels) = (HSTR + 1)x8	0	RW

**REG[18h] HSYNC Pulse Width Resister (HPWR)**

Bit	Description	Default	Access
7	<b>HSYNC Polarity</b> 0 : Low active. 1 : High active.	0	RW
6-5	NA	0	RO
4-0	<b>HSYNC Pulse Width(HPW) [4:0]</b> The period width of HSYNC. HSYNC Pulse Width(pixels) = (HPW + 1)x8	0	RW

**REG[19h] LCD Vertical Display Height Register (VDHR0)**

Bit	Description	Default	Access
7-0	<b>Vertical Display Height Bit[7:0]</b> Vertical display Height(Line) = VDHR + 1	0	RW

**REG[1Ah] LCD Vertical Display Height Register0 (VDHR1)**

Bit	Description	Default	Access
7-1	NA	0	RO
0	<b>Vertical Display Height bit[8]</b> Vertical Display Height(Line) = VDHR + 1	0	RW

Note : The VDHR must be set less than 1E0h, because the maximum vertical display height is 480.

**REG[1Bh] LCD Vertical Non-Display Period Register (VNDR0)**

Bit	Description	Default	Access
7-0	<b>Vertical Non-Display Period Bit[7:0]</b> Vertical Non-Display Period(Line) = (VNDR + 1)	0	RW

**REG[1Ch] LCD Vertical Non-Display Period Register (VNDR1)**

Bit	Description	Default	Access
7-1	NA	0	RO
0	<b>Vertical Non-Display Period bit[8]</b> Vertical Non-Display Period(Line) = (VNDR + 1)	0	RW

**REG[1Dh] VSYNC Start Position Register (VSTR0)**

Bit	Description	Default	Access
7-0	<b>VSYNC Start Position[7:0]</b> The starting position from the end of display area to the beginning of VSYNC. VSYNC Start Position(Line) = (VSTR + 1)	0	RW

**REG[1Eh] VSYNC Start Position Register (VSTR1)**

Bit	Description	Default	Access
7-1	NA	0	RO
0	<b>VSYNC Start Position[8]</b> The starting from the end of display area to the beginning of VSYNC. VSYNC Start Position(Line) = (VSTR + 1)	0	RW

**REG[1Fh] VSYNC Pulse Width Register (VPWR)**

Bit	Description	Default	Access
7	<b>VSYNC Polarity</b> 0 : Low active. 1 : High active.	0	RW
6-0	<b>VSYNC Pulse Width[6:0]</b> The pulse width of VSYNC in lines. VSYNC Pulse Width(Line) = (VPWR + 1)	0	RW

**REG[20h] Display Configuration Register (DPCR)**

Bit	Description	Default	Access
7	<b>Layer Setting Control</b> 0 : One layer configuration is selected. 1 : Two layers configuration is selected.	0	RW
6-4	NA	0	RO
3	<b>HDIR</b> Horizontal Scan Direction, for n = SEG number. 0 : SEG0 to SEG(n-1). 1 : SEG(n-1) to SEG0.	0	RW
2	<b>VDIR</b> Vertical Scan direction, for n = COM number 0 : COM0 to COM(n-1). 1 : COM(n-1) to COM0.	0	RW
1-0	NA	0	RO

**REG[21h] Font Control Register 0 (FNCR0)**

Bit	Description	Default	Access
7	<b>CGRAM/CGROM Font Selection Bit in Text Mode</b> 0 : CGROM font is selected. 1 : CGRAM font is selected. <b>Note:</b> 1. The bit is used to select the bit-map source when text-mode is active(REG[40h] bit 7 is 1), when CGRAM is writing(REG[41h] bit 3-2 =01b), the bit must be set as "0". 2. When CGRAM font is select, REG[21h] bit 5 must be set as 1.	0	RW
6	NA	0	RO
5	<b>External/Internal CGROM Selection Bit</b> 0 : Internal CGROM is selected.(REG[2Fh] must be set 00h ) 1 : External CGROM is selected. (REG[2Eh] bit6 & bit7 must be set 0)	0	RW
4-2	NA	0	RO
1-0	<b>Font Selection for internal CGROM</b> When FNCR0 B7 = 0 and B5 = 0, Internal CGROM supports the 8x16 character sets with the standard coding of ISO/IEC 8859- 1~4, which supports English and most of European country languages. 00b : ISO/IEC 8859-1. 01b : ISO/IEC 8859-2. 10b : ISO/IEC 8859-3. 11b : ISO/IEC 8859-4.	0	RW

**REG[22h] Font Control Register1 (FNCR1)**

Bit	Description	Default	Access
7	<b>Full Alignment Selection Bit</b> 0 : Full alignment is disable. 1 : Full alignment is enable.	0	RW
6	<b>Font Transparency</b> 0 : Font with background color. 1 : Font with background transparency.	0	RW
5	NA	0	RO
4	<b>Font Rotation</b> 0 : Normal. 1 : 90 degree display.	0	RW
3-2	<b>Horizontal Font Enlargement</b> 00b : X1. 01b : X2. 10b : X3. 11b : X4.	0	RW
1-0	<b>Vertical Font Enlargement</b> 00b : X1. 01b : X2. 10b : X3. 11b : X4.	0	RW

**REG[23h] CGRAM Select Register (CGSR)**

Bit	Description	Default	Access
7-0	<b>CGRAM No.</b> The setting of the number of the character in CGRAM. It's used to write the user-defined character bitmap data into CGRAM. 16 continuous data write cycles complete the bitmap writing of a 8x16 character. Note that the MWCR1 bit 3-2 must be set as 01b(CGRAM) first. And more than 16 data write cycles will loop back to the 1 <sup>st</sup> data and cover the bitmap.	0	RW

**REG[24h] Horizontal Scroll Offset Register 0 (HOF0)**

Bit	Description	Default	Access
7-0	<b>Horizontal Display Scroll Offset [7:0]</b> The display offset of the horizontal direction, changing the value will cause the effect of scrolling at horizontal direction.	0	RW

**REG[25h] Horizontal Scroll Offset Register 1 (HOFS1)**

Bit	Description	Default	Access
7-3	NA	0	RO
2-0	<b>Horizontal Display Scroll Offset [10:8]</b> The display offset of the horizontal direction, changing the value will cause the effect of scrolling at horizontal direction.	0	RW

**REG[26h] Vertical Scroll Offset Register 0 (VOFS0)**

Bit	Description	Default	Access
7-0	<b>Vertical Display Scroll Offset [7:0]</b> The display offset of the vertical direction, changing the value will cause the effect of scrolling at vertical direction.	0	RW

**REG[27h] Vertical Scroll Offset Register 1 (VOFS1)**

Bit	Description	Default	Access
7-2	NA	0	RO
1-0	<b>Vertical Display Scroll Offset [9:8]</b> The display offset of the vertical direction, changing the value will cause the effect of scrolling at vertical direction.	0	RW

**REG[29h] Font Line Distance Setting Register (FLDR)**

Bit	Description	Default	Access
7-5	NA	0	RO
4-0	<b>Font Line Distance Setting</b> Setting the font character line distance when setting memory font write cursor auto move. (Unit: pixel)	0	RW

**REG[2Ah] Font Write Cursor Horizontal Position Register 0 (F\_CURXL)**

Bit	Description	Default	Access
7-0	<b>Font Write Cursor Horizontal Position[7:0]</b> The setting of the horizontal cursor position for font writing.	0	RW

**REG[2Bh] Font Write Cursor Horizontal Position Register 1 (F\_CURXH)**

Bit	Description	Default	Access
7-2	NA	0	RO
1-0	<b>Font Write Cursor Horizontal Position[9:8]</b> The setting of the horizontal cursor position for font writing.	0	RW

**REG[2Ch] Font Write Cursor Vertical Position Register 0 (F\_CURYL)**

Bit	Description	Default	Access
7-0	<b>Font Write Cursor Vertical Position[7:0]</b> The setting of the vertical cursor position for font writing.	0	RW

**REG[2Dh] Font Write Cursor Vertical Position Register 1 (F\_CURYH)**

Bit	Description	Default	Access
7-1	NA	0	RO
0	<b>Font Write Cursor Vertical Position[8]</b> The setting of the vertical cursor position for font writing.	0	RW

**REG[2Eh] Font Write Type Setting Resister**

Bit	Description	Default	Access			
7-6	<b>Font Size Setting(* 1)</b>	0	RW			
				<b>Full Size</b>	<b>Half-Size</b>	<b>Variable Width</b>
	00b			16x16	8x16	NX16
	01b			24x24	12x24	NX24
	1Xb(* 2)			32x32	16x32	NX32
<b>Note:</b> * 1 The font width indicated by "N" depends on the character code of the FONT. * 2 The command is invalid , GT30L24T3Y does not support size of 32x32						
5-0	<b>Font to Font Width Setting</b> 00h : Font width off 01h : Font to Font width = 1 pixel 02h : Font to Font width = 2 pixels : 3Fh : Font to Font width = 63 pixels	0	RW			

**REG[2Fh] Serial Font ROM Setting**

Bit	Description	Default	Access			
7-5	<b>GT Serial Font ROM Select</b> 000b: GT21L16TW / GT21H16T1W 001b: GT30L16U2W 010b: GT30L24T3Y / GT30H24T3Y 011b: GT30L24M1Z 100b: GT30L32S4W / GT30H32S4W	0	RW			
4-2	<b>FONT ROM Coding Setting</b> For specific GT serial Font ROM, the coding method must be set for decoding. 000b: GB2312 001b: GB12345/GB18030 010b: BIG5 011b: UNICODE 100b: ASCII 101b: UNI-Japanese 110b: JIS0208 111b: Latin/Greek/ Cyrillic / Arabic	0	RW			
1-0	<b>ASCII / Latin/Greek/ Cyrillic / Arabic Latin</b>	0	RW			
				<b>ASCII</b>	<b>Latin/Greek/ Cyrillic</b>	<b>Arabic Latin</b>
	00b			Normal	Normal	NA
	01b			Arial	Variable Width	Presentation forms-A
	10b			Roman	NA	Forms-B
11b	Bold	NA	NA			

**REG[30h] Horizontal Start Point 0 of Active Window (HSAW0)**

Bit	Description	Default	Access
7-0	<b>Horizontal Start Print of active Window [7:0]</b>	0	RW

**REG[31h] Horizontal Start Point 1 of active Window (HSAW1)**

Bit	Description	Default	Access
7-2	NA	0	RO
1-0	<b>Horizontal Start Point of Active Window [9:8]</b>	0	RW

**REG[32h] Vertical Start Point 0 of Active Window (VSAW0)**

Bit	Description	Default	Access
7-0	<b>Vertical Start Point of Active Window [7:0]</b>	0	RW

**REG[33h] Vertical Start Point 1 of Active Window (VSAW1)**

Bit	Description	Default	Access
7-1	NA	0	RO
0	Vertical Start Point of Active Window [8]	0	RW

**REG[34h] Horizontal End Point 0 of Active Window (HEAW0)**

Bit	Description	Default	Access
7-0	Horizontal End Point of Active Window [7:0]	0	RW

**REG[35h] Horizontal End Point 1 of Active Window (HEAW1)**

Bit	Description	Default	Access
7-2	NA	0	RO
1-0	Horizontal End Point of Active Window [9:8]	0	RW

**REG[36h] Vertical End Point of Active Window 0 (VEAW0)**

Bit	Description	Default	Access
7-0	Vertical End Point of Active Window [7:0]	0	RW

**REG[37h] Vertical End Point of Active Window 1 (VEAW1)**

Bit	Description	Default	Access
7-1	NA	0	RO
0	Vertical End Point of Active Window [8]	0	RW

**REG[38h] Horizontal Start Point 0 of Scroll Window (HSSW0)**

Bit	Description	Default	Access
7-0	Horizontal Start Point of Scroll Window [7:0]	0	RW

**REG[39h] Horizontal Start Point 1 of Scroll Window (HSSW1)**

Bit	Description	Default	Access
7-2	NA	0	RO
1-0	Horizontal Start Point of Scroll Window [9:8]	0	RW

**REG[3Ah] Vertical Start Point 0 of Scroll Window (VSSW0)**

Bit	Description	Default	Access
7-0	Vertical Start Point of Scroll Window [7:0]	0	RW

**REG[3Bh] Vertical Start Point 1 of Scroll Window (VSSW1)**

Bit	Description	Default	Access
7-1	NA	0	RO
0	Vertical Start Point of Scroll Window [8]	0	RW

**REG[3Ch] Horizontal End Point 0 of Scroll Window (HESW0)**

Bit	Description	Default	Access
7-0	Horizontal End Point of Scroll Window [7:0]	0	RW

**REG[3Dh] Horizontal End Point 1 of Scroll Window (HESW1)**

Bit	Description	Default	Access
7-2	NA	0	RO
1-0	Horizontal End Point of Scroll Window [9:8]	0	RW

**REG[3Eh] Vertical End Point 0 of Scroll Window (VESW0)**

Bit	Description	Default	Access
7-0	Vertical End Point of Scroll Window [7:0]	0	RW

**REG[3Fh] Vertical End Point 1 of Scroll Window (VESW1)**

Bit	Description	Default	Access
7-1	NA	0	RO
0	Vertical End Point of Scroll Window [8]	0	RW

**REG[40h] Memory Write Control Register 0 (MWCR0)**

Bit	Description	Default	Access
7	<b>Text Mode enable</b> 0 : Graphic mode. 1 : Text mode.	0	RW
6	<b>Font Write Cursor/ Memory Write Cursor Enable</b> 0 : Font write cursor/ Memory Write Cursor is not visible. 1 : Font write cursor/ Memory Write Cursor is visible.	0	RW
5	<b>Font Write Cursor/ Memory Write Cursor Blink Enable</b> 0 : Normal display. 1 : Blink display.	0	RW
4	<b>NA</b>	0	RO
3-2	<b>Memory Write Direction (Only for Graphic Mode)</b> 00b : Left → Right then Top → Down. 01b : Right → Left then Top → Down. 10b : Top → Down then Left → Right. 11b : Down → Top then Left → Right.	0	RW
1	<b>Memory Write Cursor Auto-Increase Disable</b> 0 : Cursor auto-increases when memory write. 1 : Cursor doesn't auto-increases when memory write.	0	RW
0	<b>Memory Read Cursor Auto-Increase Disable</b> 0 : Cursor auto-increases when memory read. 1 : Cursor doesn't auto-increases when memory read.	0	RW

**REG[41h] Memory Write Control Register 1 (MWCR1)**

Bit	Description	Default	Access
7	<b>Graphic Cursor Enable</b> 0 : Graphic Cursor disable. 1 : Graphic Cursor enable.	0	RW
6-4	<b>Graphic Cursor Selection Bit</b> Select one from eight graphic cursor types.(000b to 111b) 000b : Graphic Cursor Set 1. 001b : Graphic Cursor Set 2. 010b : Graphic Cursor Set 3. ∴ 111b : Graphic Cursor Set 8.	0	RW
3-2	<b>Write Destination Selection</b> 00b : Layer 1~2. 01b : CGRAM. 10b : Graphic Cursor. 11b : Pattern. <b>Note</b> : When CGRAM is selected (01b), REG[21h] bit 7 must be set as "0".	0	RW
1	<b>NA</b>	0	RO
0	<b>Layer No. for Read/Write Selection</b> <b>When resolution ≤ 480x400 or color depth = 8bpp:</b> 0 : Layer 1. 1 : Layer 2. <b>When resolution &gt; 480x400 and color depth &gt; 8bpp:</b> NA, always writing to Layer 1.	0	RW

**REG[44h] Blink Time Control Register (BTCR)**

Bit	Description	Default	Access
7-0	<b>Text Blink Time Setting (Unit: Frame)</b> 00h : 1 frame time. 01h : 2 frames time. 02h : 3 frames time. ∴ ∴ ∴ FFh : 256 frames time.	0	RW



**REG[45h] Memory Read Cursor Direction (MRCD)**

Bit	Description	Default	Access
7-2	NA	0	RO
1-0	<b>Memory Read Direction (Only for Graphic Mode)</b> 00b : Left → Right then Top → Down. 01b : Right → Left then Top → Down. 10b : Top → Down then Left → Right. 11b : Down → Top then Left → Right.	0	RW

**REG[46h] Memory Write Cursor Horizontal Position Register 0 (CURH0)**

Bit	Description	Default	Access
7-0	<b>Memory Write Cursor Horizontal Location[7:0]</b>	0	RW

**REG[47h] Memory Write Cursor Horizontal Position Register 1 (CURH1)**

Bit	Description	Default	Access
7-2	NA	0	RO
1-0	<b>Memory Write Cursor Horizontal Location[9:8]</b>	0	RW

**REG[48h] Memory Write Cursor Vertical Position Register 0 (CURV0)**

Bit	Description	Default	Access
7-0	<b>Memory Write Cursor Vertical Location[7:0]</b>	0	RW

**REG[49h] Memory Write Cursor Vertical Position Register 1 (CURV1)**

Bit	Description	Default	Access
7-1	NA	0	RO
0	<b>Memory Write Cursor Vertical Location[8]</b>	0	RW

**REG[4Ah] Memory Read Cursor Horizontal Position Register 0 (RCURH0)**

Bit	Description	Default	Access
7-0	<b>Memory Read Cursor Horizontal Location[7:0]</b>	0	RW

**REG[4Bh] Memory Read Cursor Horizontal Position Register 1 (RCURH01)**

Bit	Description	Default	Access
7-2	NA	0	RO
1-0	<b>Memory Read Cursor Horizontal Location[9:8]</b>	0	RW

**REG[4Ch] Memory Read Cursor Vertical Position Register 0 (RCURV0)**

Bit	Description	Default	Access
7-0	<b>Memory Read Cursor Vertical Location[7:0]</b>	0	RW

**REG[4Dh] Memory Read Cursor Vertical Position Register 1 (RCURV1)**

Bit	Description	Default	Access
7-1	NA	0	RO
0	<b>Memory Read Cursor Vertical Location[8]</b>	0	RW

**REG[4Eh] Font Write Cursor and Memory Write Cursor Horizontal Size Register (CURHS)**

Bit	Description	Default	Access
7-5	NA	0	RO
4-0	<b>Font Write Cursor Horizontal Size Setting[4:0]</b> Unit : Pixel <b>Note</b> : When font is enlarged, the cursor setting will multiply the same times as the font enlargement.	7h	RW

**REG[4Fh] Font Write Cursor Vertical Size Register (CURVS)**

Bit	Description	Default	Access
7-5	NA	0	RO
4-0	<b>Font Write Cursor Vertical Size Setting[4:0]</b> Unit : Pixel <b>Note</b> : When font is enlarged, the cursor setting will multiply the same times as the font enlargement.	0	RW

**REG[50h] BTE Function Control Register 0 (BECR0)**

Bit	Description	Default	Access
7	<b>BTE Function Enable / Status Write</b> 0 : No action. 1 : BTE function enable. <b>Read</b> 0 : BTE function is idle. 1 : BTE function is busy.	0	RW
6	<b>BTE Source Data Select</b> 0 : Block mode, the Source BTE is stored as a rectangular region of memory. 1 : Linear mode, the Source BTE is stored as a continuous block of memory.	0	RW
5	<b>BTE Destination Data Type Select</b> 0 : Block mode, the Destination BTE is stored as a rectangular region of memory. 1 : Linear mode, the Destination BTE is stored as a continuous block of memory.	0	RW
4-0	NA	0	RO

**REG[51h] BTE Function Control Register1 (BECR1)**

Bit	Description	Default	Access
7-5	<b>BTE ROP Code Bit[3:0]</b> ROP is the acronym for Raster Operation. Some of BTE operation code has to collocate with ROP for the detailed function. (Please refer to the Section 7-6)	0	RW
4-0	<b>BTE Operation Code Bit[3:0]</b> RA8875 includes a 2D BTE Engine, it can execute 13 BTE functions, the operation code range is from 1100b to 0000b and 1111b to 1101b are not used. Some of BTE Operation Code has to collocate with the ROP code for the advance function. (Please refer to the Section 7-6)	0	RW

**REG[68h] Background Color Register for Transparent 1 (BGTR1)**

Bit	Description	Default	Access
7-6	NA	0	RO
5-0	<b>Foreground Color Green[5:0]</b> If REG[10h] Bit[3:2] is set to 256 colors, the register only uses Bit[2:0]. If REG[10h] Bit[3:2] is set to 65K colors, the register uses Bit[5:0].	0	RW

**REG[69h] Background Color Register for Transparent 2 (BGTR2)**

Bit	Description	Default	Access
7-5	NA	0	RO
4-0	<b>Foreground Color Blue[4:0]</b> If REG[10h] Bit[3:2] is set to 256 colors, the register only uses Bit[1:0]. If REG[10h] Bit[3:2] is set to 65K colors, the register uses Bit[4:0].	0	RW

**REG[80h] Graphic Cursor Horizontal Position Register 0 (GCHP0)**

Bit	Description	Default	Access
7-0	Graphic Cursor Horizontal Location[7:0]	0	RW

**REG[81h] Graphic Cursor Horizontal Position Register 1 (GCHP1)**

Bit	Description	Default	Access
7-2	NA	0	RO
1-0	Graphic Cursor Horizontal Location[9:8]	0	RW

**REG[82h] Graphic Cursor Vertical Position Register 0 (GCVP0)**

Bit	Description	Default	Access
7-0	Graphic Cursor Vertical Location[7:0]	0	RW

**REG[83h] Graphic Cursor Vertical Position Register 1 (GCVP1)**

Bit	Description	Default	Access
7-1	NA	0	RO
0	Graphic Cursor Vertical Location[8]	0	RW

**REG[84h] Graphic Cursor Color 0 (GCC0)**

Bit	Description	Default	Access
7-0	Graphic Cursor Color 0 with 256 colors RGB Format [7:0] = RRRGGGBB.	0	RW

**REG[85h] Graphic Cursor Color 1 (GCC1)**

Bit	Description	Default	Access
7-0	Graphic Cursor Color 1 with 256 Colors RGB Format [7:0] = RRRGGGBB.	0	RW

**REG[88h] PLL Control Register 1 (PLL1)**

Bit	Description	Default	Access
7	<b>PLLDIVM</b> PLL Pre-driver parameter. 0 : divided by 1. 1 : divided by 2.	0	RW
6-5	NA	0	RO
4-0	<b>PLLDIVN[4:0]</b> PLL input parameter, the value should be 1~31. (i.e. value 0 is forbidden).	0	RW

**REG[89h] PLL Control Register 2 (PLL2)**

Bit	Description	Default	Access
7-3	NA	0	RO
2-0	<b>PLLDIVK[2:0]</b> PLL Output divider 000b : divided by 1. 001b : divided by 2. 010b : divided by 4. 011b : divided by 8. 100b : divided by 16. 101b : divided by 32. 110b : divided by 64. 111b : divided by 128.	03h	RW

**REG[8Ah] PWM1 Control Register (P1CR)**

Bit	Description	Default	Access																
7	<b>PWM1 Enable</b> 0 : Disable, PWM1_OUT level depends on P1CR bit6. 1 : Enable.	0	RW																
6	<b>PWM1 Disable Level</b> 0 : PWM1_OUT is Normal L when PWM disable or Sleep mode. 1 : PWM1_OUT is Normal H when PWM disable or Sleep mode. The bit is only usable when P1CR bit 4 is 0	0	RW																
5	Reserved	0	RO																
4	<b>PWM1 Function Selection</b> 0 : PWM1 function. 1 : PWM1 output a fixed frequency signal and it is equal to 1 /16 oscillator clock. PWM1 = FOSC / 16( <b>Note</b> )	0	RW																
3-0	<p><b>PWM1 Clock Source Divide Ratio</b></p> <table border="1"> <tr> <td>0000b : SYS_CLK / 1</td> <td>1000b : SYS_CLK / 256</td> </tr> <tr> <td>0001b : SYS_CLK / 2</td> <td>1001b : SYS_CLK / 512</td> </tr> <tr> <td>0010b : SYS_CLK / 4</td> <td>1010b : SYS_CLK / 1024</td> </tr> <tr> <td>0011b : SYS_CLK / 8</td> <td>1011b : SYS_CLK / 2048</td> </tr> <tr> <td>0100b : SYS_CLK / 16</td> <td>1100b : SYS_CLK / 4096</td> </tr> <tr> <td>0101b : SYS_CLK / 32</td> <td>1101b : SYS_CLK / 8192</td> </tr> <tr> <td>0110b : SYS_CLK / 64</td> <td>1110b : SYS_CLK / 16384</td> </tr> <tr> <td>0111b : SYS_CLK / 128</td> <td>1111b : SYS_CLK / 32768</td> </tr> </table> <p>For example, if the system clock is 20MHz and Bit[3:0] =0001b, when the clock source of PWM1 is 10MHz.</p>	0000b : SYS_CLK / 1	1000b : SYS_CLK / 256	0001b : SYS_CLK / 2	1001b : SYS_CLK / 512	0010b : SYS_CLK / 4	1010b : SYS_CLK / 1024	0011b : SYS_CLK / 8	1011b : SYS_CLK / 2048	0100b : SYS_CLK / 16	1100b : SYS_CLK / 4096	0101b : SYS_CLK / 32	1101b : SYS_CLK / 8192	0110b : SYS_CLK / 64	1110b : SYS_CLK / 16384	0111b : SYS_CLK / 128	1111b : SYS_CLK / 32768	0	RW
0000b : SYS_CLK / 1	1000b : SYS_CLK / 256																		
0001b : SYS_CLK / 2	1001b : SYS_CLK / 512																		
0010b : SYS_CLK / 4	1010b : SYS_CLK / 1024																		
0011b : SYS_CLK / 8	1011b : SYS_CLK / 2048																		
0100b : SYS_CLK / 16	1100b : SYS_CLK / 4096																		
0101b : SYS_CLK / 32	1101b : SYS_CLK / 8192																		
0110b : SYS_CLK / 64	1110b : SYS_CLK / 16384																		
0111b : SYS_CLK / 128	1111b : SYS_CLK / 32768																		

Note : FOSC is the frequency of external oscillator.

**REG[8Bh] PWM1 Duty cycle Register (P1DCR)**

Bit	Description	Default	Access
7-0	<b>PWM Cycle Duty Selection Bit</b> 00h → 1 / 256 Duty with PWM1 clock source. 01h → 2 / 256 Duty with PWM1 clock source. 02h → 3 / 256 Duty with PWM1 clock source. : : FEh → 255 / 256 Duty with PWM1 clock source. FFh → 256 / 256 Duty with PWM1 clock source.	0	RW

**REG[8Ch] PWM2 Control Register (P2CR)**

Bit	Description	Default	Access																
7	<b>PWM2 Enable</b> 0 : Disable, PWM_OUT level depends on P2CR bit6. 1 : Enable.	0	RW																
6	<b>PWM2 Disable Level</b> 0 : PWM2_OUT is Normal L when PWM disable or Sleep mode. 1 : PWM2_OUT is Normal H when PWM disable or Sleep mode. The bit is only usable when P2CR bit 4 is 0	0	RW																
5	Reserved	0	RO																
4	<b>PWM2 Function Selection</b> 0 : PWM2 function. 1 : PWM2 output a signal which is the same with system clock. PWM2 = SYS_CLK / 16 .	0	RW																
3-0	<b>PWM2 Clock Source Divide Ratio</b> <table border="1" style="width: 100%; border-collapse: collapse;"> <tbody> <tr> <td>0000b : SYS_CLK / 1</td> <td>1000b : SYS_CLK / 256</td> </tr> <tr> <td>0001b : SYS_CLK / 2</td> <td>1001b : SYS_CLK / 512</td> </tr> <tr> <td>0010b : SYS_CLK / 4</td> <td>1010b : SYS_CLK / 1024</td> </tr> <tr> <td>0011b : SYS_CLK / 8</td> <td>1011b : SYS_CLK / 2048</td> </tr> <tr> <td>0100b : SYS_CLK / 16</td> <td>1100b : SYS_CLK / 4096</td> </tr> <tr> <td>0101b : SYS_CLK / 32</td> <td>1101b : SYS_CLK / 8192</td> </tr> <tr> <td>0110b : SYS_CLK / 64</td> <td>1110b : SYS_CLK / 16384</td> </tr> <tr> <td>0111b : SYS_CLK / 128</td> <td>1111b : SYS_CLK / 32768</td> </tr> </tbody> </table> For example, if the system clock is 20MHz and Bit[3:0] =0010b, then the clock source of PWM2 is 5MHz.	0000b : SYS_CLK / 1	1000b : SYS_CLK / 256	0001b : SYS_CLK / 2	1001b : SYS_CLK / 512	0010b : SYS_CLK / 4	1010b : SYS_CLK / 1024	0011b : SYS_CLK / 8	1011b : SYS_CLK / 2048	0100b : SYS_CLK / 16	1100b : SYS_CLK / 4096	0101b : SYS_CLK / 32	1101b : SYS_CLK / 8192	0110b : SYS_CLK / 64	1110b : SYS_CLK / 16384	0111b : SYS_CLK / 128	1111b : SYS_CLK / 32768	0	RW
0000b : SYS_CLK / 1	1000b : SYS_CLK / 256																		
0001b : SYS_CLK / 2	1001b : SYS_CLK / 512																		
0010b : SYS_CLK / 4	1010b : SYS_CLK / 1024																		
0011b : SYS_CLK / 8	1011b : SYS_CLK / 2048																		
0100b : SYS_CLK / 16	1100b : SYS_CLK / 4096																		
0101b : SYS_CLK / 32	1101b : SYS_CLK / 8192																		
0110b : SYS_CLK / 64	1110b : SYS_CLK / 16384																		
0111b : SYS_CLK / 128	1111b : SYS_CLK / 32768																		

**REG[8Dh] PWM2 Control Register (P2DCR)**

Bit	Description	Default	Access
7-0	<b>PWM Cycle Duty Selection Bit</b> 00h → 1 / 256 Duty with PWM2 clock source. 01h → 2 / 256 Duty with PWM2 clock source. 02h → 3 / 256 Duty with PWM2 clock source. ⋮ ⋮ FEh → 255 / 256 Duty with PWM2 clock source. FFh → 256 / 256 Duty with PWM2 clock source.	0	RW

**REG[8Eh] Memory Clear Control Register (MCLR)**

Bit	Description	Default	Access
7	<b>Memory Clear Function</b> 0 : End or Stop. When write 0 to this bit RA8875 will stop the Memory clear function. Or if read back this bit is 0, it indicates than Memory clear function is complete. 1 : Start the memory clear function.	0	RW
6	<b>Memory Clear Area Setting</b> 0 : Clear the full window. (Please refer to the setting of REG[14h], [19h], [1Ah]) 1 : Clear the active window(Please refer to the setting of REG[30h~37h]). The layer to be cleared is according to the setting REG[41h] Bit0.	0	RW
5-0	NA	0	RO

**REG[90h] Draw Line/Circle/Square Control Register (DCR)**

Bit	Description	Default	Access
7	<b>Draw Line/Square/Triangle Start Signal</b> <b>Write Function</b> 0 : Stop the drawing function. 1 : Start the drawing function. <b>Read Function</b> 0 : Drawing function complete. 1 : Drawing function is processing.	0	RW
6	<b>Draw Circle Start Signal</b> <b>Write Function</b> 0 : Stop the circle drawing function. 1 : Start the circle drawing function. <b>Read Function</b> 0 : Circle drawing function complete. 1 : Circle drawing function is processing.	0	RW
5	<b>Fill the Circle/Square/Triangle Signal</b> 0 : Non fill. 1 : Fill.	0	RW
4	<b>Draw Line or Square Select Signal</b> 0 : Draw line. 1 : Draw square.	0	RW
3-1	NA	0	RO
0	<b>Draw Triangle or Line/Square Select Signal</b> 0 : Draw Line or square 1 : Draw Triangle	0	RW

**REG[91h] Draw Line/square Horizontal Start Address Register0 (DLHSR0)**

Bit	Description	Default	Access
7-0	Draw Line/Square Horizontal Start Address[7:0]	0	RW

**REG[92h] Draw Line/Square Horizontal Start Address Register1 (DLHSR1)**

Bit	Description	Default	Access
7-2	NA	0	RO
1-0	Draw Line/Square Horizontal Start Address[9:8]	0	RW

**REG[93h] Draw Line/Square Vertical Start Address Register0 (DLVSR0)**

Bit	Description	Default	Access
7-0	Draw Line/Square Vertical Start Address[7:0]	0	RW

**REG[94h] Draw Line/Square Vertical Start Address Register1 (DLVSR1)**

Bit	Description	Default	Access
7-1	NA	0	RO
0	Draw Line/square Vertical Start Address[8]	0	RW

**Note:** start point and end point cannot equal.

**REG[95h] Draw Line/Square Horizontal End Address Register0 (DLHER0)**

Bit	Description	Default	Access
7-0	Draw Line/Square Horizontal End Address[7:0]	0	RW

**REG[96h] Draw Line/Square Horizontal End Address Register1 (DLHER1)**

Bit	Description	Default	Access
7-2	NA	0	RO
1-0	Draw Line/Square Horizontal End Address[9:8]	0	RW

**REG[97h] Draw Line/Square Vertical End Address Register0 (DLVER0)**

Bit	Description	Default	Access
7-0	Draw Line/Square Vertical End Address[7:0]	0	RW

**REG[98h] Draw Line/Square Vertical End Address Register1 (DLVER1)**

Bit	Description	Default	Access
7-1	NA	0	RO
0	Draw Line/Square Vertical End Address[8]	0	RW

Note: start point and end point cannot equal.

**REG[99h] Draw Circle Center Horizontal Address Register0 (DCHR0)**

Bit	Description	Default	Access
7-0	Draw Circle Center Horizontal Address[7:0]	0	RW

**REG[9Ah] Draw Circle Center Horizontal Address Register1 (DCHR1)**

Bit	Description	Default	Access
7-2	NA	0	RO
1-0	Draw Circle Center Horizontal Address[9:8]	0	RW

**REG[9Bh] Draw Circle Center Vertical Address Register0 (DCVR0)**

Bit	Description	Default	Access
7-0	Draw Circle Center Vertical Address[7:0]	0	RW

**REG[9Ch] Draw Circle Center Vertical Address Register1 (DCVR1)**

Bit	Description	Default	Access
7-1	NA	0	RO
0	Draw Circle Center Vertical Address[8]	0	RW

**REG[9Dh] Draw Circle Radius Register (DCRR)**

Bit	Description	Default	Access
7-0	Draw Circle Radius[7:0]	0	RW

**REG[A0h] Draw Ellipse/Ellipse Curve/Circle Square Control Register**

Bit	Description	Default	Access
7	<b>Draw Ellipse/Circle Square start Signal Write Function</b> 0 : Stop the drawing function. 1 : Start the drawing function. <b>Read Function</b> 0 : Drawing function complete. 1 : Drawing function is processing.	0	RW
6	<b>Fill the Ellipse/Circle Square Signal</b> 0 : Non fill. 1 : fill.	0	RW
5	<b>Draw Ellipse/ Ellipse Curve or Circle Square Select Signal</b> 0 : Draw Ellipse/ Ellipse curve.(Depend on bit4) 1 : Draw Circle Square.	0	RW
4	<b>Draw Ellipse or Ellipse Curve Select Signal</b> 0 : Draw Ellipse 1 : Draw Ellipse Curve	0	RW
3-2	NA	0	RO
1-0	Draw Ellipse Curve Part Select(DECP)	0	RW

**REG[A1h] Draw Ellipse/Circle Square Long axis Setting Register (ELL\_A0)**

Bit	Description	Default	Access
7-0	Draw Ellipse/Circle Square Long axis[7:0]	0	RW

**REG[A2h] Draw Ellipse/Circle Square Long axis Setting Register (ELL\_A1)**

Bit	Description	Default	Access
7-2	NA	0	RO
1-0	Draw Ellipse/Circle Square Long axis[9:8]	0	RW

**REG[A3h] Draw Ellipse/Circle Square Short axis Setting Register (ELL\_B0)**

Bit	Description	Default	Access
7-0	Draw Ellipse/Circle Square Short axis[7:0]	0	RW

**REG[A4h] Draw Ellipse/Circle Square Short axis Setting Register (ELL\_B1)**

Bit	Description	Default	Access
7-1	NA	0	RO
0	Draw Ellipse/Circle Square Short axis[8]	0	RW

**REG[A5h] Draw Ellipse/Circle Square Center Horizontal Address Register0 (DEHR0)**

Bit	Description	Default	Access
7-0	Draw Ellipse/Circle Square Center Horizontal Address[7:0]	0	RW

**REG[A6h] Draw Ellipse/Circle Square Center Horizontal Address Register1 (DEHR1)**

Bit	Description	Default	Access
7-2	NA	0	RO
1-0	Draw Ellipse/Circle Square Center Horizontal Address[9:8]	0	RW

**REG[A7h] Draw Ellipse/Circle Square Center Vertical Address Register0 (DEVRO)**

Bit	Description	Default	Access
7-0	Draw Ellipse/Circle Square Center Vertical Address[7:0]	0	RW

**REG[A8h] Draw Ellipse/Circle Square Center Vertical Address Register1 (DEVRI)**

Bit	Description	Default	Access
7-1	NA	0	RO
0	Draw Ellipse/Circle Square Center Vertical Address[8]	0	RW

**REG[A9h] Draw Triangle Point 2 Horizontal Address Register0 (DTPH0)**

Bit	Description	Default	Access
7-0	Draw Triangle Point 2 Horizontal Address[7:0]	0	RW

**REG[AAh] Draw Triangle Point 2 Horizontal Address Register1 (DTPH1)**

Bit	Description	Default	Access
7-2	NA	0	RO
1-0	Draw Triangle Point 2 Horizontal Address[9:8]	0	RW

**REG[ABh] Draw Triangle Point 2 Vertical Address Register0 (DTPV0)**

Bit	Description	Default	Access
7-0	Draw Triangle Point 2 Vertical Address [7:0]	0	RW

**REG[ACH] Draw Triangle Point 2 Vertical Address Register1 (DTPV1)**

Bit	Description	Default	Access
7-1	NA	0	RO
0	Draw Triangle Point 2 Vertical Address [8]	0	RW

**REG[B0h] Source Starting Address REG0 (SSAR0)**

Bit	Description	Default	Access
7-0	DMA Source START ADDRESS [7:0]	0	RW

**REG[B1h] Source Starting Address REG 1 (SSAR1)**

Bit	Description	Default	Access
7-0	DMA Source START ADDRESS [15:8]	0	RW

**REG[B2h] Source Starting Address REG 2 (SSAR2)**

Bit	Description	Default	Access
7-0	DMA Source START ADDRESS [23:16]	0	RW



**REG[B4h] Block Width REG 0(BWR0) / DMA Transfer Number REG 0 (DTNR0)**

Bit	Description	Default	Access
7-0	When REG[BFh] bit 1 = 0 (Continuous Mode) DMA Transfer Number [7:0] When REG[BFh] bit 1 = 1 (Block Mode) DMA Block Width [7:0]	0	RW

**REG[B5h] Block Width REG 1 (BWR1)**

Bit	Description	Default	Access
7-2	NA	0	RO
1-0	DMA Block Width [9:8]	0	RW

**REG[B6h] Block Height REG 0(BHR0) /DMA Transfer Number REG 1 (DTNR1)**

Bit	Description	Default	Access
7-0	When REG[BFh] bit 1 = 0 (Continuous Mode) DMA Transfer Number [15:8] When REG[BFh] bit 1 = 1 (Block Mode) DMA Block Height [7:0]	0	RW

**REG[B7h] Block Height REG 1 (BHR1)**

Bit	Description	Default	Access
7-2	NA	0	RO
1-0	DMA Block Height [9:8]	0	RW

**REG[ B8h] Source Picture Width REG 0(SPWR0) / DMA Transfer Number REG 2(DTNR2)**

Bit	Description	Default	Access
7-3	DMA Source Picture Width [7:3]	0	RW
2-0	When REG[BFh] bit 1 = 0 (Continuous Mode) DMA Transfer Number [18:16] When REG[BFh] bit 1 = 1 (Block Mode) DMA Source Picture Width [2:0]	0	RW

**REG[B9h] Source Picture Width REG 1 (SPWR1)**

Bit	Description	Default	Access
7-2	NA	0	RO
1-0	DMA Source Picture Width [9:8]	0	RW

**REG[BFh] DMA Configuration REG (DMACR)**

Bit	Description	Default	Access
7-2	NA	0	RO
1	DMA Continuous or Block Read/Write Select Bit 0: Continuous / 1: Block	0	RW
0	Write Function→ DMA Start Bit Set to 1 by MCU and reset to 0 automatically Read Function→ DMA Busy Check Bit 0:Idle / 1:Busy	0	RW

**Registers REG [D0h] Floating Windows Start Address XA 0 (FWSAXA0)**

Bit	Description	Default	Access
7-0	Floating Windows Start Address XA [7:0]	0	RW

**REG [D1h] Floating Windows Start Address XA 1 (FWSAXA1)**

Bit	Description	Default	Access
7-2	NA	0	RO
1-0	Floating Windows Start Address XA [9:8]	0	RW

**REG [D2h] Floating Windows Start Address YA 0 (FWSAYA0)**

Bit	Description	Default	Access
7-0	Floating Windows Start Address YA [7:0]	0	RW

**REG [D3h] Floating Windows Start Address YA 1 (FWSAYA1)**

Bit	Description	Default	Access
7-1	NA	0	RO
0	Floating Windows Start Address YA [8]	0	RW

**REG [D4h] Floating Windows Width 0 (FWW0)**

Bit	Description	Default	Access
7-0	Floating Windows Width Setting [7:0]	0	RW

**REG [D5h] Floating Windows Width 1 (FWW1)**

Bit	Description	Default	Access
7-2	NA	0	RO
1-0	Floating Windows Width Setting [9:8]	0	RW

**REG [D6h] Floating Windows Height 0 (FWH0)**

Bit	Description	Default	Access
7-0	Floating Windows Height Setting[7:0]	0	RW

**REG [D7h] Floating Windows Height 1 (FWH1)**

Bit	Description	Default	Access
7-2	NA	0	RO
1-0	Floating Windows Height Setting [9:8]	0	RW

**REG [D8h] Floating Windows Display X Address 0 (FWDXA0)**

Bit	Description	Default	Access
7-0	Floating Windows Display X Address [7:0]	0	RW

**REG [D9h] Floating Windows Display X Address 1 (FWDXA1)**

Bit	Description	Default	Access
7-2	NA	0	RO
1-0	Floating Windows Display X Address [9:8]	0	RW

**REG [DAh] Floating Windows Display Y Address 0 (FWDYA0)**

Bit	Description	Default	Access
7-0	Floating Windows Display X Address [7:0]	0	RW

**REG [DBh] Floating Windows Display Y Address 1 (FWDYA1)**

Bit	Description	Default	Access
7-1	NA	0	RO
0	Floating Windows Display Y Address [8]	0	RW

**SACS\_MODE REG [E0h] Serial Flash/ROM Direct Access Mode**

Bit	Description	Default	Access
7-1	NA	0	RO
0	0: direct access mode disable, then user can use for FONT/DMA mode. 1: direct access mode enable, then FONT/DMA mode disable	0	RW

**SACS\_ADDR REG [E1h] Serial Flash/ROM Direct Access Mode Address**

Bit	Description	Default	Access
7-0	Direct access mode Address Serial Flash/ROM have 24 bit address data, user must be write 3 times E1 for address setting.	0	WO

**SACS\_DATA [E2h] Serial Flash/ROM Direct Access Data Read**

Bit	Description	Default	Access
7-0	Direct access mode Read Data buffer	0	RO

## REG[F0h] Interrupt Control Register1 (INTC1)

Bit	Description	Default	Access
7-5	NA	0	RO
4	<b>KEYSCAN Interrupt Enable Bit</b> 0 : Disable KEYSCAN interrupt. 1 : Enable KEYSCAN interrupt.	0	RW
3	<b>DMA Interrupt Enable Bit</b> 0 : Disable DMA interrupt. 1 : Enable DMA interrupt.	0	RW
2	<b>Touch Panel Interrupt Enable Bit</b> 0 : Disable Touch interrupt. 1 : Enable Touch interrupt.	0	RW
1	<b>BTE Process complete Interrupt Enable Bit</b> 0 : Disable BTE process complete interrupt. 1 : Enable BTE process complete interrupt.	0	RW
0	<b>When MCU-relative BTE operation is selected(*1) and BTE Function is Enabled(REG[50h] Bit7 = 1), this bit is used to Enable the BTE Interrupt for MCU R/W:</b> 0 : Disable BTE interrupt for MCU R/W. 1 : Enable BTE interrupt for MCU R/W. <b>When the BTE Function is disabled, this bit is used to Enable the Interrupt of Font Write Function:</b> 0 : Disable font write interrupt. 1 : Enable font write interrupt.	0	RW

Note : 1. MCU-relative BTE operations include "Write BTE with ROP", "Read BTE", "Transparent Write BTE", "Color Expand", "Color Expand with Transparency".  
2. Font Write Interrupt indicates the completion of the font character writing to the DDRAM.

## REG[F1h] Interrupt Control Register2 (INTC2)

Bit	Description	Default	Access
7-5	NA	0	RO
4	<b>Write Function → KEYSKAN Interrupt Clear Bit</b> 0 : No operation. 1 : Clear the keyscan interrupt. <b>Read Function → KEYSKAN Interrupt Status</b> 0 : No keyscan interrupt happens. 1 : Keyscan interrupt happens.	0	RW
3	<b>Write Function → DMA Interrupt Clear Bit</b> 0 : No operation. 1 : Clear the DMA interrupt. <b>Read Function → DMA Interrupt Status</b> 0 : No DMA interrupt happens. 1 : DMA interrupt happens.	0	RW
2	<b>Write Function → Touch Panel Interrupt Clear Bit</b> 0 : No operation. 1 : Clear the touch interrupt. <b>Read Function → Touch Panel Interrupt Status</b> 0 : No Touch Panel interrupt happens. 1 : Touch Panel interrupt happens.	0	RW
1	<b>Write Function → BTE Process Complete Interrupt Clear Bit</b> 0 : No operation. 1 : Clear BTE process complete interrupt. <b>Read Function → BTE Interrupt Status</b> 0 : No BTE process complete interrupt happens. 1 : BTE process complete interrupt happens.	0	RW
0	<b>When MCU-relative BTE operation is selected (*1) and BTE Function is Enabled ( REG[50h] Bit7 = 1 )</b> <b>Write Function → BTE Interrupt for MCU R/W Enable Bit</b> 0 : No operation. 1 : Clear BTE MCU R/W interrupt. <b>Read Function → BTE R/W Interrupt Status</b> 0 : No BTE interrupt for MCU R/W happens. 1 : BTE interrupt for MCU R/W happens. <b>When BTE is not Enable and Text Mode is Enable Write Function → Font Write Interrupt (*2) Enable Bit</b> 0 : No operation. 1 : Clear font write interrupt. <b>Read Function → Font Write Interrupt Status</b> 0 : No font write interrupt happens. 1 : Font write interrupt happens.	0	RW

**Note:**

Please refer to RA8875 data sheet for details

**8. Optical Characteristics**

Item	Symbol	Condition	MIN.	TYP.	MAX.	UNIT	Note.
Viewing angle	$\theta_T$	(CR $\geq$ 10)	40	50	-	degree	Note 2
	$\theta_B$		60	70	-		
	$\theta_L$		60	70	-		
	$\theta_R$		60	70	-		
Contrast ratio	CR	$\theta=0^\circ$	500	600	-	-	Note 1,3
Response Time	$T_{on}$	25°C	-	20	30	msec	Note 1,4
	$T_{off}$		-	-	-	msec	
Chromaticity	White	Backlight is on	X	0.260	0.310	0.360	Note 1,5
			Y	0.280	0.330	0.380	
	Red		X	0.540	0.590	0.640	
			Y	0.300	0.350	0.400	
	Green		X	0.298	0.348	0.398	
			Y	0.520	0.570	0.620	
	Blue		X	0.095	0.145	0.195	
			Y	0.060	0.110	0.160	
Luminance	L		200	250	-	cd/m <sup>2</sup>	Note 1,6
NTSC			-	50		%	Note 5
Luminance uniformity	U		75	80	-	%	Note 1,7

Test Conditions:

1. IF= 40 mA, VF=23.1V, and the ambient temperature is 25. °C
2. The test systems refer to Note 1 and Note 2.

Note 1:

Note 2:

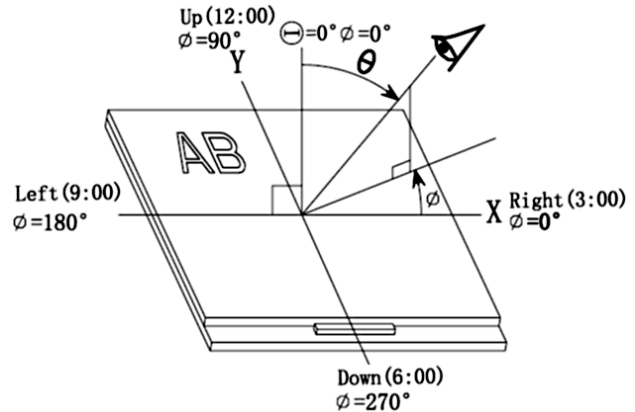
The data are measured after LEDs are turned on for 5 minutes. LCM displays full white. The brightness is the average value of 9 measured spots. Measurement equipment SR-3A (1°)

Measuring condition:

- Measuring surroundings: Dark room
- Measuring temperature: Ta=25°C.
- Adjust operating voltage to get optimum contrast at the center of the display.

The definition of viewing angle:

Refer to the graph below marked by  $\theta$  and  $\phi$



Note 3:

The definition of contrast ratio (Test LCM using SR-3A (1°)):

$$\text{Contrast Ratio (CR)} = \frac{\text{Luminance When LCD is at "White" state}}{\text{Luminance When LCD is at "Black" state}}$$

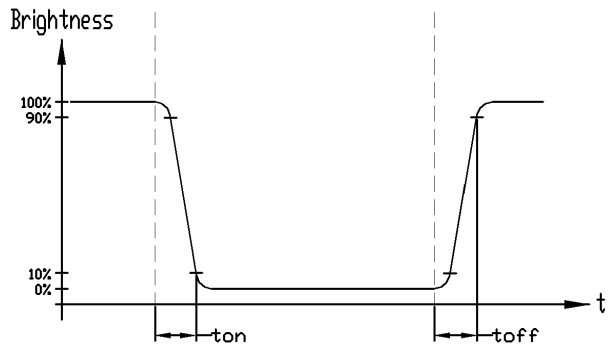
(Contrast Ratio is measured in optimum common electrode voltage)

Note 4:

Definition of Response time. (Test LCD using BM-7A(2°)):

The output signals of photo detector are measured when the input signals are changed from "black" to "white"(falling time) and from "white" to "black"(rising time), respectively.

The response time is defined as the time interval between the 10% and 90% of amplitudes. Refer to figure as below.

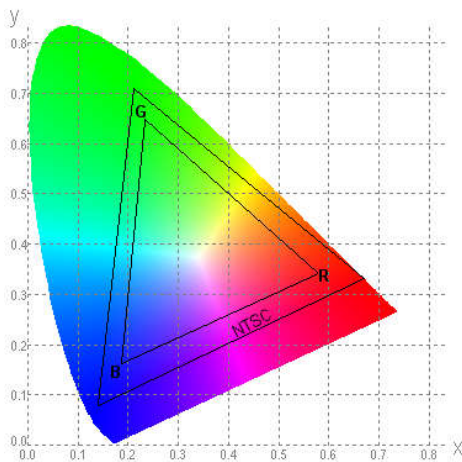


Note 5:

Definition of Color of CIE1931 Coordinate and NTSC Ratio.

Color gamut:

$$S = \frac{\text{Area of RGB triangle}}{\text{Area of NTSC triangle}} \times 100\%$$



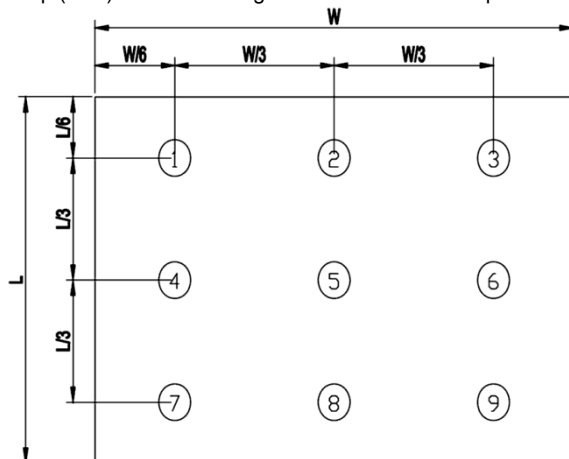
Note 6:

The luminance uniformity is calculated by using following formula.

$$\Delta Bp = Bp (\text{Min.}) / Bp (\text{Max.}) \times 100 (\%)$$

Bp (Max.) = Maximum brightness in 9 measured spots

Bp (Min.) = Minimum brightness in 9 measured spots.



Note 7:

Measured the luminance of white state at center point

## 9. Precautions of using LCD Modules

### Mounting

- Mounting must use holes arranged in four corners or four sides.
- The mounting structure so provide even force on to LCD module. Uneven force (ex. Twisted stress) should not applied to the module. And the case on which a module is mounted should have sufficient strength so that external force is not transmitted directly to the module.
- It is suggested to attach a transparent protective plate to the surface in order to protect the polarizer. It should have sufficient strength in order to the resist external force.
- The housing should adopt radiation structure to satisfy the temperature specification.
- Acetic acid type and chlorine type materials for the cover case are not desirable because the former generates corrosive gas of attacking the polarizer at high temperature and the latter causes circuit break by electro-chemical reaction.
- Do not touch, push or rub the exposed polarizers with glass, tweezers or anything harder than HB pencil lead. Never rub with dust clothes with chemical treatment. Do not touch the surface of polarizer for bare hand or greasy cloth.(Some cosmetics deteriorate the polarizer.)
- When the surface becomes dusty, please wipe gently with absorbent cotton or other soft materials like chamois soaks with petroleum benzine. Normal-hexane is recommended for cleaning the adhesives used to attach front / rear polarizers. Do not use acetone, toluene and alcohol because they cause chemical damage to the polarizer.
- Wipe off saliva or water drops as soon as possible. Their long time contact with polarizer

### Operating

- The spike noise causes the mis-operation of circuits. It should be within the  $\pm 200\text{mV}$  level (Over and under shoot voltage)
- Response time depends on the temperature.(In lower temperature, it becomes longer.)
- Brightness depends on the temperature. (In lower temperature, it becomes lower.) And in lower temperature, response time(required time that brightness is stable after turned on) becomes longer.
- Be careful for condensation at sudden temperature change. Condensation makes damage to polarizer or electrical contacted parts. And after fading condensation, smear or spot will occur.
- When fixed patterns are displayed for a long time, remnant image is likely to occur.
- Module has high frequency circuits. Sufficient suppression to the electromagnetic interference shall be done by system manufacturers. Grounding and shielding methods may be important to minimized the interference

### Electrostatic Discharge Control

Since a module is composed of electronic circuits, it is not strong to electrostatic discharge. Make certain that treatment persons are connected to ground through wrist band etc. And don't touch interface pin directly.

### Strong Light Exposure

Strong light exposure causes degradation of polarizer and color filter.

### Storage

When storing modules as spares for a long time, the following precautions are necessary.

- Store them in a dark place. Do not expose the module to sunlight or fluorescent light. Keep the temperature between  $5^{\circ}\text{C}$  and  $35^{\circ}\text{C}$  at normal humidity.
- The polarizer surface should not come in contact with any other object. It is recommended that they be stored in the container in which they were shipped.

### Protection Film

- When the protection film is peeled off, static electricity is generated between the film and polarizer. This should be peeled off slowly and carefully by people who are electrically grounded and with well ion-blown equipment or in such a condition, etc.
- The protection film is attached to the polarizer with a small amount of glue. If some stress is applied to rub the protection film against the polarizer during the time you peel off the film, the glue is apt to be main on the polarizer. Please carefully peel off the protection film without rubbing it against the polarizer.
- When the module with protection film attached is stored for a long time, sometimes there remains a very small amount of glue still on the polarizer after the protection film is peeled off.
- You can remove the glue easily. When the glue remains on the polarizer surface or its vestige is recognized, please wipe them off with absorbent cotton waste or other soft material like chamois soaked with normal-hexane.

### Transportation

The LCD modules should be no falling and violent shocking during transportation, and also should avoid excessive press, water, damp and sunshine.