



LCM-TFT070T1

产品名称 (Product name) : 彩色 TFT 模组
型 号 (Model) : LCM-TFT070T1SVP16R40D
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Table of Content

1	Basic Specifications	-----
1.1	Drive Specifications	-----
1.2	Mechanical Specifications	-----
1.3	Absolute Maximum Ratings	-----
1.4	DC Electrical Characteristics	-----
1.5	Optical Characteristics	-----
1.6	Backlight & LED Characteristics	-----
2	Structure Block	-----
3	Terminal Function	-----
4	Interface specifications	-----
5	Command Table	-----
6	Commands Descriptions	-----
7	AC Characteristics	-----
8	Inspection Standard	-----
9	Handling Precautions	-----
10	Packaging Descriptions	-----

7 Inch TFT Display Module LCM-TFT070T1

Product characteristics

- 1, Contains SSD1963, TP driver(XPT2046), booster circuit.
- 2, Backlight brightness can be adjusted by PWM from SSD1963。
- 3, Interface width can be selected: 8/16 bits。
- 4, Can realize part of a display vertical scrolling。
- 5, Order of the columns and pages can be selected。
- 6, Order of the RGB can be selected。
- 7, Display color depth can be selected。

1. Basic Specifications

1.1 Drive Specifications

1>LCD Display Mode	a-Si, TFT, 7.0', Transmissive
2>Viewing Angle	Full View
3>Driving Method	Graphic 800 (R+G+B) x 480 Dots-matrix
4>Interface	8080 MPU parallel interface(8/16 Bits Bus)
5>Backlight:	24 Pcs White LED
6>Controller/Driver	SSD1963

1.2 Mechanical Specifications

1>Outline Dimension	181.5(L)x104.3 (W)x10.6(H)mm (Detailed Information refer to LCM Drawing)
2>Active Area	153.84(L)x85.63(W)
3>Pixel Pitch	0.153(L)x0.153(W)

1.3 Absolute Maximum Ratings

Items	Symbol	MIN.	MAX.	Unit	Condition
Power Supply Voltage	V _{CC}	-0.3	5.5	V	-
Input Voltage	V _{IN}	-0.3	3.5	V	-
LCD Driver Supply Voltage	V _{GH-VSS}	-0.3	18.0	V	-
Operating Temperature	T _{OP}	-20	+70	°C	-
Storage Temperature	T _{st}	-30	+85	°C	-
Storage Humidity	H _d	-	Ta<40	°C	-

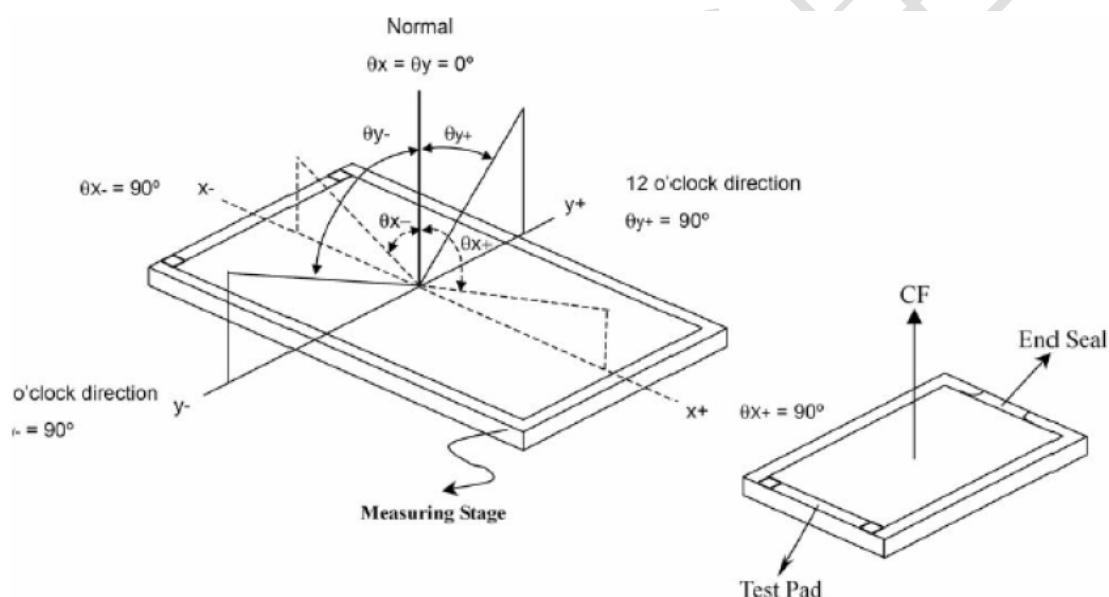
1.4 DC Electrical Characteristics

Items	Symb	MIN.	TYP.	MAX.	Unit	Condition
Logic Supplay	IOVC	2.7	3.3	3.6	V	-
Input High Voltage	V _{IH}	0.8 IOVCC	--	IOVCC	V	-
Input Low Voltage	V _{IL}	-0.3	-	0.2 IOVCC	V	-
Output H Voltage	V _{OH}	0.8 IOVCC		IOVCC	V	-
Output L Voltage	V _{OL}	-0.3	-	0.2 IOVCC	V	-
Supply Current	I	-	260	-	mA	VCC=5V

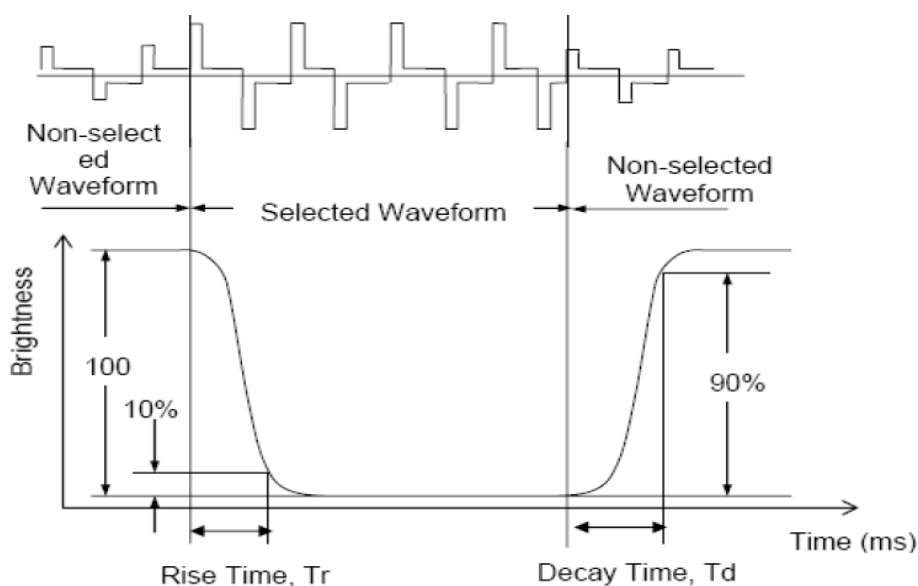
1.5 Optical Characteristics

Items	Symbol	MIN.	TYP.	MAX.	Reference	Condition
View Angle	Hor	θL	-	85	-	CR $\geq$ 10 B / L on
		θR	-	85	-	
	Ver	ϕH	-	85	-	
		ϕL	-	85	-	
Contrast Ratio	C	-	300	-	-	$\theta = 0^\circ$, $\phi = 0$
Response	tr	-	TBD	-	Note5-2	$\theta = 0^\circ$, $\phi = 0$
Response Time(fall)	tf	-	TBD	-	Note5-2	$\theta = 0^\circ$, $\phi = 0$
Luminance	B	-	800	-	Cd/m ²	$\theta = 0^\circ$, $\phi = 0$

Note 5-1 The definitions of viewing angles:



Note 5-2 Response time is defined as follow



1.6 Backlight & LED Characteristics

Maximum Ratings

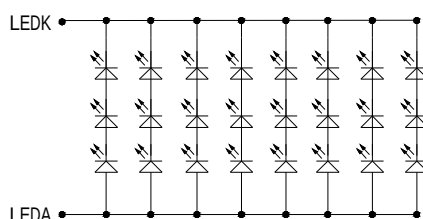
Items	Symbol	MIN.	TYP.	MAX.	Unit	Condition
Forward Voltage	V_F	-	9.6	-	V	$I_F = 240\text{mA}$
Forward Current	I_F	-	240	-	mA	PWM=255
Power Dissipation	P_{WF}		2304	-	mW	$W=9.6\text{V} \times 240\text{mA}$

Electrical/Optical Characteristics

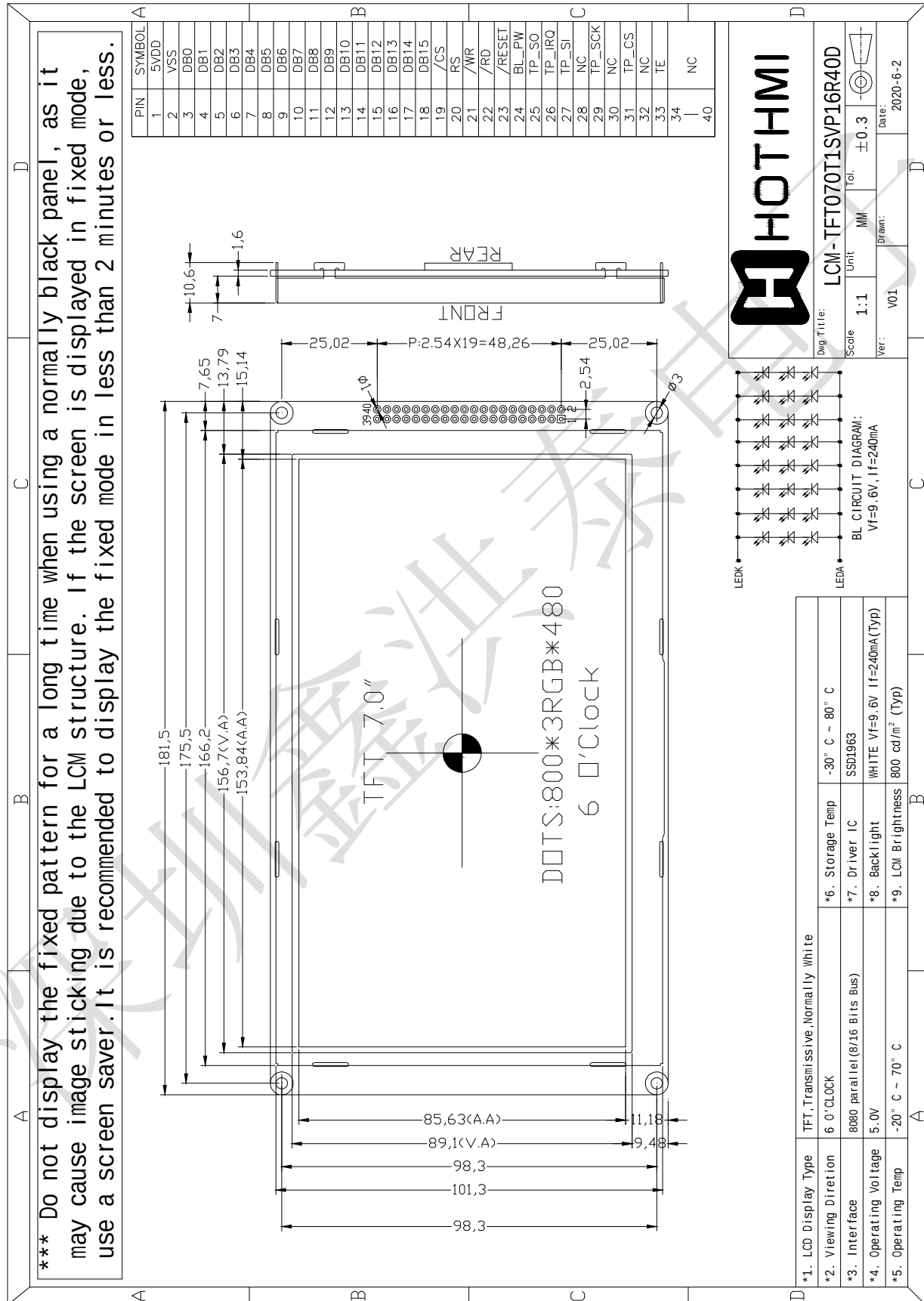
$V_{SS}=0\text{V}, T_a=25^\circ\text{C}$

Items	Symbol	MIN.	TYP.	MAX.	Unit	Condition
Forword Voltage	VF	-	9.6	-	V	IF=240Ma
Reverse Current	IR	-	-	10	uA	VR=10V
Average Brightness (without LCD)	IV	-	800	-	cd/m ²	IF=240mA
CIE Color Coordinate (without LCD)	X	0.26	-	0.300	-	IF=15mA
	Y	0.26	-	0.300		
Color	WHITE					

*1 This value will change while mass production.



2. Structure Block



3 Terminal Function

Pin No.	Pin Name	I/O	Function
1	VDD	P	Power Supply (5V)
2	GND	P	Ground (0V)
3	DB0-DB15	I/O	16-Bit parallel interface
18			
19	/CS	I	Chip Select Signal /CS = L, enable Access To The LCD module
20	RS	I	Data Type Select RS=L, Command Write, RS=H, Data Write
21	/WR	I	Write Enable Input
22	/RD	I	Read Enable Input
23	/RESET	I	/RESET = H, Normal Running /RESET = L, Initialization is executed
24	BL_EN	I	--
25	RTP_SO	O	Serial Data Output. Data is shifted on the falling
26	RTP_IRQ	O	Pen Interrupt.
27	RTP_SI	I	Serial Data Input. If CS is LOW, data is latched on
28	-		
29	RTP_SCK	I	External Clock Input to RTP
30	-		
31	RTP_CS	I	Chip Select Input
32	-		
33	TE	O	Tearing effect
34	-		
40			

4. Interface specifications

TBD

5 Command Table

Hex Code	Command	Description
0x 00	nop	No operation
0x 01	soft_reset	Software Reset
0x 0A	get_power_mode	Get the current power mode
0x 0B	get_address_mode	Get the frame memory to the display panel read order
0x 0C	get_pixel_format	Get the current pixel format
0x 0D	get_display_mode	The display module returns the Display Signal Mode.
0x 0E	get_signal_mode	Get the current display mode from the peripheral
0x 0F	Reserved	Reserved
0x 10	enter_sleep_mode	Turn off the panel. This command will pull low the GPIO0. If GPIO0 is configured as normal GPIO or LCD miscellaneous signal with command set_gpio_conf, this command will be ignored.
0x 11	exit_sleep_mode	Turn on the panel. This command will pull high the GPIO0. If GPIO0 is configured as normal GPIO or LCD miscellaneous signal with command set_gpio_conf, this command will be ignored.
0x 12	enter_partial_mode	Part of the display area is used for image display.
0x 13	enter_normal_mode	The whole display area is used for image display.
0x 20	exit_invert_mode	Displayed image colors are not inverted.
0x 21	enter_invert_mode	Displayed image colors are inverted.
0x 26	set_gamma_curve	Selects the gamma curve used by the display device.
0x 28	set_display_off	Blanks the display device
0x 29	set_display_on	Show the image on the display device
0x 2A	set_column_address	Set the column extent
0x 2B	set_page_address	Set the page extent
0x 2C	write_memory_start	Transfer image information from the host processor interface to the peripheral starting at the location provided by set_column_address and set_page_address
0x 2E	read_memory_start	Transfer image data from the peripheral to the host processor interface starting at the location provided by set_column_address and set_page_address
0x 30	set_partial_area	Defines the partial display area on the display device
0x 33	set_scroll_area	Defines the vertical scrolling and fixed area on display area
0x 34	set_tear_off	Synchronization information is not sent from the display module to the host processor
0x 35	set_tear_on	Synchronization information is sent from the display module to the host processor at the start of VFP
0x 36	set_address_mode	Set the read order from frame buffer to the display panel
0x 37	set_scroll_start	Defines the vertical scrolling starting point
0x 38	exit_idle_mode	Full color depth is used for the display panel
0x 39	enter_idle_mode	Reduce color depth is used on the display panel.
0x 3A	set_pixel_format	Defines how many bits per pixel are used in the interface
0x 3C	write_memory_continue	Transfer image information from the host processor interface to the peripheral from the last written location
0x 3E	read_memory_continue	Read image data from the peripheral continuing after the last read_memory_continue or read_memory_start
0x 44	set_tear_scanline	Synchronization information is sent from the display module to the host processor when the display device refresh reaches the provided scanline

Hex Code	Command	Description
0x 45	get_scanline	Get the current scan line
0x A1	read_ddb	Read the DDB from the provided location
0x A8	Reserved	Reserved
0x B0	set_lcd_mode_	Set the LCD panel mode (RGB TFT or TTL)
0x B1	get_lcd_mode	Get the current LCD panel mode, pad strength and resolution
0x B4	set_hori_period	Set front porch
0x B5	get_hori_period	Get current front porch settings
0x B6	set_vert_period	Set the vertical blanking interval between last scan line and next LFRAME pulse
0x B7	get_vert_period	Set the vertical blanking interval between last scan line and next LFRAME pulse
0x B8	set_gpio_conf	Set the GPIO configuration. If the GPIO is not used for LCD, set the direction. Otherwise, they are toggled with LCD signals.
0x B9	get_gpio_conf	Get the current GPIO configuration
0x BA	set_gpio_value	Set GPIO value for GPIO configured as output
0x BB	get_gpio_status	Read current GPIO status. If the individual GPIO was configured as input, the value is the status of the corresponding pin. Otherwise, it is the programmed value.
0x BC	set_post_proc	Set the image post processor
0x BD	get_post_proc	Set the image post processor
0x BE	set_pwm_conf	Set the image post processor
0x BF	get_pwm_conf	Set the image post processor
0x C0	set_lcd_gen0	Set the rise, fall, period and toggling properties of LCD signal generator 0
0x C1	get_lcd_gen0	Get the current settings of LCD signal generator 0
0x C2	set_lcd_gen1	Set the rise, fall, period and toggling properties of LCD signal generator 1
0x C3	get_lcd_gen1	Get the current settings of LCD signal generator 1
0x C4	set_lcd_gen2	Set the rise, fall, period and toggling properties of LCD signal generator 2
0x C5	get_lcd_gen2	Get the current settings of LCD signal generator 2
0x C6	set_lcd_gen3	Set the rise, fall, period and toggling properties of LCD signal generator 3
0x C7	get_lcd_gen3	Get the current settings of LCD signal generator 3
0x C8	set_gpio0_rop	Set the GPIO0 with respect to the LCD signal generators using ROP3 operation. No effect if the GPIO0 is configured as general GPIO.
0x C9	get_gpio0_rop	Get the GPIO0 properties with respect to the LCD signal generators.
0x CA	set_gpio1_rop	Set the GPIO1 with respect to the LCD signal generators using ROP3 operation. No effect if the GPIO1 is configured as general GPIO.
0x CB	get_gpio1_rop	Get the GPIO1 properties with respect to the LCD signal generators.
0x CC	set_gpio2_rop	Set the GPIO2 with respect to the LCD signal generators using ROP3 operation. No effect if the GPIO2 is configured as general GPIO.
0x CD	get_gpio2_rop	Get the GPIO2 properties with respect to the LCD signal generators.

Hex Code	Command	Description
0x CE	set_gpio3_rop	Set the GPIO3 with respect to the LCD signal generators using ROP3 operation. No effect if the GPIO3 is configured as general GPIO.
0x CF	get_gpio3_rop	Get the GPIO3 properties with respect to the LCD signal generators.
0x D0	set_dbc_conf	Set the dynamic back light configuration
0x D1	get_dbc_conf	Get the current dynamic back light configuration
0x D4	set_dbc_th	Set the threshold for each level of power saving
0x D5	get_dbc_th	Get the threshold for each level of power saving
0x E0	set_pll	Start the PLL. Before the start, the system was operated with the crystal oscillator or clock input
0x E2	set_pll_mn	Set the PLL
0x E3	get_pll_mn	Get the PLL settings
0x E4	get_pll_status	Get the current PLL status
0x E5	set_deep_sleep	Set deep sleep mode
0x E6	set_lshift_freq	Set the LSHIFT (pixel clock) frequency
0x E7	get_lshift_freq	Get current LSHIFT (pixel clock) frequency setting
0x E8	Reserved	Reserved
0x E9	Reserved	Reserved
0x F0	set_pixel_data_interface	Set the pixel data format of the parallel host processor interface
0x F1	get_pixel_data_interface	Get the current pixel data format settings
0x FF	Reserved	Reserved

6 Command Descriptions

6.1 Software Reset

	D/C	D7	D6	D5	D4	D3	D2	D1	D0	Hex
Command	0	0	0	0	0	0	0	0	1	01

The display module performs a software reset. Only the configuration register will be reset.

6.2 Enter Sleep Mode

	D/C	D7	D6	D5	D4	D3	D2	D1	D0	Hex
Command	0	0	0	0	1	0	0	0	0	10

Turn off the panel. This command causes the display panel to enter sleep mode and pull low the GPIO0.

If GPIO0 is configured as normal GPIO or LCD miscellaneous signal with command Set GPIO Conf(0xB8), this command will not affect the GPIO0.

6.3 Enter Partial Mode

	D/C	D7	D6	D5	D4	D3	D2	D1	D0	Hex
Command	0	0	0	0	1	0	0	1	0	12

6.4 Enter Normal Mode

	D/C	D7	D6	D5	D4	D3	D2	D1	D0	Hex
Command	0	0	0	0	1	0	0	1	1	13

6.5 Enter Normal Mode

	D/C	D7	D6	D5	D4	D3	D2	D1	D0	Hex
Command	0	0	0	0	1	0	0	1	1	13

This command causes the display module to stop inverting the image data on the display device. The frame buffer contents remain unchanged

6.6 Enter Invert Mode

	D/C	D7	D6	D5	D4	D3	D2	D1	D0	Hex
Command	0	0	0	1	0	0	0	0	1	21

This command causes the display module to invert the image data only on the display device. The frame buffer contents remain unchanged.

6.7 Set Gamma Curve

	D/C	D7	D6	D5	D4	D3	D2	D1	D0	Hex
Command	0	0	0	1	0	0	1	1	0	26
Parameter 1	1	0	0	0	0	A ₃	A ₂	A ₁	A ₀	xx

Selects the gamma curve used by the display device.

A[3:0]	Gamma curve selection (POR = 1000)	GAMAS[1]	GAMAS[0]
0000	No gamma curve selected (Same as 0001b)	0	0
0001	Gamma curve 0	0	0
0010	Gamma curve 1	0	1
0100	Gamma curve 2	1	0
1000	Gamma curve 3	1	1
Others	Reserved		

6.8 Set Display On/Off

	D/C	D7	D6	D5	D4	D3	D2	D1	D0	Hex
Command	0	0	0	1	0	1	0	0	S	28/29

If S=1, Show the image on the display device;

If S=0, Blanks the display device. The frame buffer contents remain unchanged.

6.9 Set Column Address

	D/C	D7	D6	D5	D4	D3	D2	D1	D0	Hex
Command	0	0	0	1	0	1	0	1	0	2A
Parameter 1	1	SC ₁₅	SC ₁₄	SC ₁₃	SC ₁₂	SC ₁₁	SC ₁₀	SC ₉	SC ₈	xx
Parameter 2	1	SC ₇	SC ₆	SC ₅	SC ₄	SC ₃	SC ₂	SC ₁	SC ₀	xx
Parameter 3	1	EC ₁₅	EC ₁₄	EC ₁₃	EC ₁₂	EC ₁₁	EC ₁₀	EC ₉	EC ₈	xx
Parameter 4	1	EC ₇	EC ₆	EC ₅	EC ₄	EC ₃	EC ₂	EC ₁	EC ₀	xx

Set the column extent of frame buffer accessed by the host processor with the Read Memory Continue, 0x3E and Write Memory Continue, 0x3C

SC[15:8] : Start column number high byte (POR = 00000000)

SC[7:0] : Start column number low byte (POR = 00000000)

EC[15:8] : End column number high byte (POR = 00000000)

EC[7:0] : End column number low byte (POR = 00000000)

6.10 Set Page Address

	D/C	D7	D6	D5	D4	D3	D2	D1	D0	Hex
Command	0	0	0	1	0	1	0	0	1	2B
Parameter 1	1	SP ₁₅	SP ₁₄	SP ₁₃	SP ₁₂	SP ₁₁	SP ₁₀	SP ₉	SP ₈	xx
Parameter 2	1	SP ₇	SP ₆	SP ₅	SP ₄	SP ₃	SP ₂	SP ₁	SP ₀	xx
Parameter 3	1	EP ₁₅	EP ₁₄	EP ₁₃	EP ₁₂	EP ₁₁	EP ₁₀	EP ₉	EP ₈	xx
Parameter 4	1	EP ₇	EP ₆	EP ₅	EP ₄	EP ₃	EP ₂	EP ₁	EP ₀	xx

Set the page extent of the frame buffer accessed by the host processor with the Read Memory Continue, 0x3E and Write

Memory Continue, 0x3C.

SP[15:8] : Start page (row) number high byte (POR = 00000000)

SP[7:0] : Start page (row) number low byte (POR = 00000000)

EP[15:8] : End page (row) number high byte (POR = 00000000)

EP[7:0] : End page (row) number low byte (POR = 00000000)

6.11 Write Memory Start

	D/C	D7	D6	D5	D4	D3	D2	D1	D0	Hex
Command	0	0	0	1	0	1	1	0	0	2C

Transfer image information from the host processor interface to the SSD1963 starting at the location provided by Set Column Address, 0x2A and Set Page Address, 0x2B.

6.12 Read Memory Start

	D/C	D7	D6	D5	D4	D3	D2	D1	D0	Hex
Command	0	0	0	1	0	1	1	1	0	2E

Transfer image data from the SSD1963 to the host processor interface starting at the location provided by Set Column Address, 0x2A and Set Page Address, 0x2B.

6.13 Set Partial Area

	D/C	D7	D6	D5	D4	D3	D2	D1	D0	Hex
Command	0	0	0	1	1	0	0	0	0	30
Parameter 1	1	SR ₁₅	SR ₁₄	SR ₁₃	SR ₁₂	SR ₁₁	SR ₁₀	SR ₉	SR ₈	xx
Parameter 2	1	SR ₇	SR ₆	SR ₅	SR ₄	SR ₃	SR ₂	SR ₁	SR ₀	xx
Parameter 3	1	ER ₁₅	ER ₁₄	ER ₁₃	ER ₁₂	ER ₁₁	ER ₁₀	ER ₉	ER ₈	xx
Parameter 4	1	ER ₇	ER ₆	ER ₅	ER ₄	ER ₃	ER ₂	ER ₁	ER ₀	xx

This command defines the Partial Display mode's display area. There are two parameters associated with this command, the first defines the Start Row (SR) and the second the End Row (ER). SR and ER refer to the Frame Buffer Line Pointer.

SR[15:8] : Start display row number high byte (POR = 00000000)

SR[7:0] : Start display row number low byte (POR = 00000000)

ER[15:8] : End display row number high byte (POR = 00000000)

ER[7:0] : End display row number low byte (POR = 00000000)

Note : SR[15:0] and ER[15:0] cannot be 0000h nor exceed the last vertical line number.

6.14 Set Scroll Area

	D/C	D7	D6	D5	D4	D3	D2	D1	D0	Hex
Command	0	0	0	1	1	0	0	1	1	33
Parameter 1	1	TFA ₁₅	TFA ₁₄	TFA ₁₃	TFA ₁₂	TFA ₁₁	TFA ₁₀	TFA ₉	TFA ₈	xx
Parameter 2	1	TFA ₇	TFA ₆	TFA ₅	TFA ₄	TFA ₃	TFA ₂	TFA ₁	TFA ₀	xx
Parameter 3	1	VSA ₁₅	VSA ₁₄	VSA ₁₃	VSA ₁₂	VSA ₁₁	VSA ₁₀	VSA ₉	VSA ₈	xx
Parameter 4	1	VSA ₇	VSA ₆	VSA ₅	VSA ₄	VSA ₃	VSA ₂	VSA ₁	VSA ₀	xx
Parameter 5	1	BFA ₁₅	BFA ₁₄	BFA ₁₃	BFA ₁₂	BFA ₁₁	BFA ₁₀	BFA ₉	BFA ₈	xx
Parameter 6	1	BFA ₇	BFA ₆	BFA ₅	BFA ₄	BFA ₃	BFA ₂	BFA ₁	BFA ₀	xx

Defines the vertical scrolling and fixed area on display area

TFA[15:8] : High byte of Top Fixed Area number in lines from the top of the frame buffer (POR = 00000000) TFA[7:0] : Low byte of Top Fixed Area number in lines from the top of the frame buffer (POR = 00000000)

VSA[15:8] : High byte of Vertical scrolling area in number of lines of the frame buffer (POR =

00000000) VSA[7:0] : Low byte of Vertical scrolling area in number of lines of the frame buffer (POR = 00000000)

BFA[15:8] : High byte of Bottom Fixed Area in number of lines from the bottom of the frame buffer (POR = 00000000) BFA[7:0] : Low byte of Bottom Fixed Area in number of lines from the bottom of the frame buffer (POR = 00000000)

6.15 Set Tear Off

	D/C	D7	D6	D5	D4	D3	D2	D1	D0	Hex
Command	0	0	0	1	1	0	1	0	0	34

TE signal is not sent from the display module to the host processor.

6.16 Set Tear On

	D/C	D7	D6	D5	D4	D3	D2	D1	D0	Hex
Command	0	0	0	1	1	0	1	0	1	35
Parameter 1	1	0	0	0	0	0	0	0	A ₀	xx

TE signal is sent from the display module to the host processor at the start of VFP.

A[0] : Tearing effect line mode (POR = 0)

- 0 The tearing effect output line consists of V-blanking information only.
- 1 The tearing effect output line consists of both V-blanking and H-blanking information.

The TE signal shall be active low when the display panel is in Sleep mode.

6.17 Set Address Mode

	D/C	D7	D6	D5	D4	D3	D2	D1	D0	Hex
Command	0	0	0	1	1	0	1	1	0	36
Parameter 1	1	A ₇	A ₆	A ₅	A ₄	A ₃	A ₂	A ₁	A ₀	xx

Set the read order from host processor to frame buffer by A[7:5] and A[3] and from frame buffer to the display panel by A[2:0] and A[4].

A[7] : Page address order (POR = 0)

This bit controls the order that pages of data are transferred from the host processor to the SSD1963's frame buffer.

- 0 Top to bottom, pages transferred from SP (Start Page) to EP (End Page).
- 1 Bottom to top, pages transferred from EP (End Page) to SP (Start Page).

A[6] : Column address order (POR = 0)

This bit controls the order that columns of data are transferred from the host processor to the SSD1963's frame buffer.

- 0 Left to right, columns transferred from SC (Start Column) to EC (End Column).
- 1 Right to left, columns transferred from EC (End Column) to SC (Start Column).

A[5] : Page / Column order (POR = 0)

This bit controls the order that columns of data are transferred from the host processor to the SSD1963's frame buffer.

- 0 Normal mode
- 1 Reverse mode

A[4] : Line address order (POR = 0)

This bit controls the display panel's horizontal line refresh order. The image shown on the display panel is unaffected, regardless of the bit setting.

- 0 LCD refresh from top line to bottom line.
- 1 LCD refresh from bottom line to top line.

A[3] : RGB / BGR order (POR = 0)

This bit controls the RGB data order transferred from the SSD1963's frame buffer to the display panel.

- 0 RGB
- 1 BGR

A[2] : Display data latch data (POR = 0)

This bit controls the display panel's vertical line data latch order. The image shown on the display panel is unaffected, regardless of the bit setting.

- 0 LCD refresh from left side to right side
- 1 LCD refresh from right side to left side

A[1] : Flip Horizontal (POR = 0)

This bit flips the image shown on the display panel left to right. No change is made to the frame memory.

- 0 Normal
- 1 Flipped

A[0] : Flip Vertical (POR = 0)

This bit flips the image shown on the display panel top to bottom. No change is made to the frame memory.

- 0 Normal
- 1 Flipped

6.18 Set Scroll Start

	D/C	D7	D6	D5	D4	D3	D2	D1	D0	Hex
Command	0	0	0	1	1	0	1	1	1	37
Parameter 1	1	VSP ₁₅	VSP ₁₄	VSP ₁₃	VSP ₁₂	VSP ₁₁	VSP ₁₀	VSP ₉	VSP ₈	xx
Parameter 2	1	VSP ₇	VSP ₆	VSP ₅	VSP ₄	VSP ₃	VSP ₂	VSP ₁	VSP ₀	xx

This command sets the start of the vertical scrolling area in the frame buffer. The vertical scrolling area is fully defined when this command is used with the Set Scroll Area 0x33.

VSP[15:8] : High byte of Vertical Scroll Pointer to define the line number in frame buffer that is written to the display as the first line of the vertical scrolling area (POR = 00000000)

VSP[7:0] : Low byte of Vertical Scroll Pointer to define the line number in frame buffer that is written to the display as the first line of the vertical scrolling area (POR = 00000000)

6.19 Exit Idle Mode

	D/C	D7	D6	D5	D4	D3	D2	D1	D0	Hex
Command	0	0	0	1	1	1	0	0	S	38/39

If S=0, This command causes the display module to exit Idle Mode. Full color depth is used for the display panel.

If S=1, This command causes the display module to enter Idle Mode.

In Idle Mode, color depth is reduced. Colors are shown on the display panel using the MSB of each of the R, G and B color components in the frame buffer.

6.20 Set Pixel Format

	D/C	D7	D6	D5	D4	D3	D2	D1	D0	Hex
Command	0	0	0	1	1	1	0	1	0	3A
Parameter 1	1	0	A ₆	A ₅	A ₄	0	0	0	0	xx

Set the current pixel format for RGB image data

A[6:4] : Display pixel format (POR = 000)

- 000 Reserved
- 001 3-bit/pixel
- 010 8-bit/pixel
- 011 12-bit/pixel
- 100 Reserved
- 101 16-bit/pixel
- 110 18-bit/pixel
- 111 24-bit/pixel

6.21 Write Memory Continue

	D/C	D7	D6	D5	D4	D3	D2	D1	D0	Hex
Command	0	0	0	1	1	1	1	0	0	3C

Transfer image information from the host processor interface to the SSD1963 from the last Write Memory Continue, 0x3C or Write Memory Start, 0x2C.

6.22 Read Memory Continue

	D/C	D7	D6	D5	D4	D3	D2	D1	D0	Hex
Command	0	0	0	1	1	1	1	1	0	3E

Read image data from the SSD1963 to host processor continuing after the last Read Memory Continue, 0x3E or Read Memory Start, 0x2E.

6.23 Set LCD Mode

	D/C	D7	D6	D5	D4	D3	D2	D1	D0	Hex
Command	0	1	0	1	1	0	0	0	0	B0
Parameter 1	1	0	0	A ₅	A ₄	A ₃	A ₂	A ₁	A ₀	xx
Parameter 2	1	B ₇	B ₆	B ₅	0	0	0	0	0	xx
Parameter 3	1	0	0	0	0	0	HPS ₁₀	HPS ₉	HPS ₈	xx
Parameter 4	1	HPS ₇	HPS ₆	HPS ₅	HPS ₄	HPS ₃	HPS ₂	HPS ₁	HPS ₀	xx
Parameter 5	1	0	0	0	0	0	VPS ₁₀	VPS ₉	VPS ₈	xx
Parameter 6	1	VPS ₇	VPS ₆	VPS ₅	VPS ₄	VPS ₃	VPS ₂	VPS ₁	VPS ₀	xx
Parameter 7	1	0	0	G ₅	G ₄	G ₃	G ₂	G ₁	G ₀	xx

Set the LCD panel mode (RGB TFT or TTL) and pad strength

A[5] : TFT panel data width (POR = 0)

- 0 18-bit
- 1 24-bit

A[4] : TFT color depth enhancement enable (POR = 0)

- 0 Disable FRC or dithering
- 1 Enable FRC or dithering for color depth enhancement

If the panel data width was set to 24-bit, FRC and dithering feature will be disabled automatic

regardless the value of this register.

A[3] : TFT FRC enable (POR = 0)

- 0 TFT dithering enable
- 1 TFT FRC enable

A[2] : LSHIFT polarity (POR = 0)

Set the dot clock pulse polarity.

- 0 Data latch in rising edge
- 1 Data latch in falling edge

A[1] : LLINE polarity (POR = 0)

Set the horizontal sync pulse polarity.

- 0 Active low
- 1 Active high

A[0] : LFRAME polarity (POR = 0)

Set the vertical sync pulse polarity.

- 0 Active low
- 1 Active high

B[7] : LCD panel mode (POR = 0)

- 0 Hsync+Vsync +DE mode
- 1 TTL mode

B[6:5] : TFT type (POR = 01)

- 00, 01 TFT mode
- 10 Serial RGB mode
- 11 Serial RGB+dummy mode

HPS[10:8] : Set the horizontal panel size (POR = 010)

HPS[7:0] : Set the horizontal panel size (POR = 01111111)

Horizontal panel size = (HPS + 1) pixels

VPS[10:8] : Set the vertical panel size (POR = 001)

VPS[7:0] : Set the vertical panel size (POR = 11011111)

Vertical panel size = (VPS + 1) lines

G[5:3] : Even line RGB sequence (POR = 000)

- 000 RGB
- 001 RBG
- 010 GRB
- 011 GBR
- 100 BRG

101 BGR
11x Reserved

G[2:1] : Odd line RGB sequence (POR = 000)

000 RGB
001 RBG
010 GRB
011 GBR
100 BRG
101 BGR
11x Reserved

6.24 Set Horizontal Period

	D/C	D7	D6	D5	D4	D3	D2	D1	D0	Hex
Command	0	1	0	1	1	0	1	0	0	B4
Parameter 1	1	0	0	0	0	0	HT ₁₀	HT ₉	HT ₈	xx
Parameter 2	1	HT ₇	HT ₆	HT ₅	HT ₄	HT ₃	HT ₂	HT ₁	HT ₀	xx
Parameter 3	1	0	0	0	0	0	HPS ₁₀	HPS ₉	HPS ₈	xx
Parameter 4	1	HPS ₇	HPS ₆	HPS ₅	HPS ₄	HPS ₃	HPS ₂	HPS ₁	HPS ₀	xx
Parameter 5	1	0	HPW ₆	HPW ₅	HPW ₄	HPW ₃	HPW ₂	HPW ₁	HPW ₀	xx
Parameter 6	1	0	0	0	0	0	LPS ₁₀	LPS ₉	LPS ₈	xx
Parameter 7	1	LPS ₇	LPS ₆	LPS ₅	LPS ₄	LPS ₃	LPS ₂	LPS ₁	LPS ₀	xx
Parameter 8	1	0	0	0	0	0	0	LPSP ₁	LPSP ₀	xx

Set front porch

HT[10:8] : High byte of horizontal total period (display + non-display) in pixel clock (POR = 010)

HT[7:0] :

Low byte of the horizontal total period (display + non-display) in pixel clock (POR = 10101111)

Horizontal total period = (HT + 1) pixels

HPS[10:8] : High byte of the non-display period between the start of the horizontal sync (LLINE) signal and the first display data. (POR = 000)

HPS[7:0] : Low byte of the non-display period between the start of the horizontal sync (LLINE) signal and the first display data. (POR = 00100000)

For TFT : Horizontal Sync Pulse Start Position = (HPS + 1) pixels

For Serial TFT : Horizontal Sync Pulse Start Position = (HPS + 1) pixels + LPSP subpixels

HPW[6:0] : Set the horizontal sync pulse width (LLINE) in pixel clock. (POR = 000111)

Horizontal Sync Pulse Width = (HPW + 1) pixels

LPS[10:8] : Set the horizontal sync pulse (LLINE) start location in pixel clock. (POR = 000)

LPS[7:0] : Set the horizontal sync pulse width (LLINE) in start. (POR = 00000000)

Horizontal Display Period Start Position = LPS pixels

LPSP[1:0] : Set the horizontal sync pulse subpixel start position (POR = 00)

6.25 Set Vertical Period

	D/C	D7	D6	D5	D4	D3	D2	D1	D0	Hex
Command	0	1	0	1	1	0	1	1	0	B6
Parameter 1	1	0	0	0	0	0	VT ₁₀	VT ₉	VT ₈	xx
Parameter 2	1	VT ₇	VT ₆	VT ₅	VT ₄	VT ₃	VT ₂	VT ₁	VT ₀	xx
Parameter 3	1	0	0	0	0	0	VPS ₁₀	VPS ₉	VPS ₈	xx
Parameter 4	1	VPS ₇	VPS ₆	VPS ₅	VPS ₄	VPS ₃	VPS ₂	VPS ₁	VPS ₀	xx
Parameter 5	1	0	VPW ₆	VPW ₅	VPW ₄	VPW ₃	VPW ₂	VPW ₁	VPW ₀	xx
Parameter 6	1	0	0	0	0	0	FPS ₁₀	FPS ₉	FPS ₈	xx
Parameter 7	1	FPS ₇	FPS ₆	FPS ₅	FPS ₄	FPS ₃	FPS ₂	FPS ₁	FPS ₀	xx

Set the vertical blanking interval between last scan line and next LFRAME pulse

VT[10:8] : High byte of the vertical total (display + non-display) period in lines (POR = 001)

VT[7:0] : Low byte of the vertical total (display + non-display) period in lines (POR = 11101111)
Vertical Total = (VT + 1) lines

VPS[10:8] : High byte the non-display period in lines between the start of the frame and the first display data in line. (POR = 000)

VPS[7:0] : The non-display period in lines between the start of the frame and the first display data in line. (POR = 00000100)
Vertical Sync Pulse Start Position = VPS lines

VPW[6:0] : Set the vertical sync pulse width (LFRAME) in lines. (POR = 000001)
Vertical Sync Pulse Width = (VPW + 1) lines

FPS[10:8] : High byte of the vertical sync pulse (LFRAME) start location in lines. (POR = 000)

FPS[7:0] : Low byte of the vertical sync pulse (LFRAME) start location in lines. (POR = 00000000)
Vertical Display Period Start Position = FPS lines

6.26 Set Post Proc

	D/C	D7	D6	D5	D4	D3	D2	D1	D0	Hex
Command	0	1	0	1	1	1	1	0	0	BC
Parameter 1	1	A ₇	A ₆	A ₅	A ₄	A ₃	A ₂	A ₁	A ₀	xx
Parameter 2	1	B ₇	B ₆	B ₅	B ₄	B ₃	B ₂	B ₁	B ₀	xx
Parameter 3	1	C ₇	C ₆	C ₅	C ₄	C ₃	C ₂	C ₁	C ₀	xx
Parameter 4	1	0	0	0	0	0	0	0	D ₀	xx

Set the image post processor

A[7:0] : Set the contrast value (POR = 01000000)

B[7:0] : Set the brightness value (POR = 10000000)

C[7:0] : Set the saturation value (POR = 01000000)

D[0] : Post Processor Enable (POR = 0)

0 Disable the postprocessor

1 Enable the postprocessor

6.27 Set PWM Configuration

	D/C	D7	D6	D5	D4	D3	D2	D1	D0	Hex
Command	0	1	0	1	1	1	1	1	0	BE
Parameter 1	1	PWMF ₇	PWMF ₆	PWMF ₅	PWMF ₄	PWMF ₃	PWMF ₂	PWMF ₁	PWMF ₀	xx
Parameter 2	1	PWM ₇	PWM ₆	PWM ₅	PWM ₄	PWM ₃	PWM ₂	PWM ₁	PWM ₀	xx
Parameter 3	1	0	0	0	0	C ₃	0	0	C ₀	xx
Parameter 4	1	D ₇	D ₆	D ₅	D ₄	D ₃	D ₂	D ₁	D ₀	xx
Parameter 5	1	E ₇	E ₆	E ₅	E ₄	E ₃	E ₂	E ₁	E ₀	xx
Parameter 6	1	0	0	0	0	F ₃	F ₂	F ₁	F ₀	xx

Set the PWM configuration

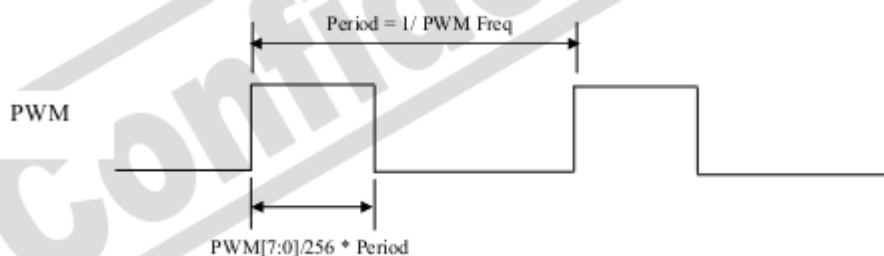
PWMF[7:0] : Set the PWM frequency in system clock (POR = 00000000)

PWM signal frequency = PLL clock / (256 * PWMF[7:0]) / 256

PWM[7:0] : Set the PWM duty cycle (POR = 00000000)

PWM duty cycle = PWM[7:0] / 256

Note : PWM always 0 if PWM[7:0] = 00h



C[3] : PWM configuration (POR = 0)

- 0 PWM controlled by host
- 1 PWM controlled by DBC

C[0] : PWM enable (POR = 0)

- 0 PWM disable
- 1 PWM enable

D[7:0] : DBC manual brightness (POR = 00000000)

Set the brightness level

- 00 Dimmest
- FF brightest

E[7:0] : DBC minimum brightness (POR = 00000000)

Set the minimum brightness level

- 00 Dimmest
- FF Brightest

F[3:0] : Brightness prescaler (POR = 0000)

Set the brightness prescaler

- 0 Dimmest
- F Brightest

6.28 Set LCD Gen0

	D/C	D7	D6	D5	D4	D3	D2	D1	D0	Hex
Command	0	1	1	0	0	0	0	0	0	C0
Parameter 1	1	A ₇	0	0	0	0	0	0	0	xx
Parameter 2	1	0	0	0	0	0	GF0 ₂	GF0 ₁	GF0 ₀	xx
Parameter 3	1	GF0 ₇	GF0 ₆	GF0 ₅	GF0 ₄	GF0 ₃	GF0 ₂	GF0 ₁	GF0 ₀	xx
Parameter 4	1	0	0	0	0	0	GR0 ₂	GR0 ₁	GR0 ₀	xx
Parameter 5	1	GR0 ₇	GR0 ₆	GR0 ₅	GR0 ₄	GR0 ₃	GR0 ₂	GR0 ₁	GR0 ₀	xx
Parameter 6	1	F ₇	F ₆	F ₅	F ₄	F ₃	GP0 ₂	GP0 ₁	GP0 ₀	xx
Parameter 7	1	GP0 ₇	GP0 ₆	GP0 ₅	GP0 ₄	GP0 ₃	GP0 ₂	GP0 ₁	GP0 ₀	xx

Set the rise, fall, period and toggling properties of LCD signal generator 0

A[7] : Reset LCD generator 0 at every frame start

- 0 The generator 0 will not reset in the starting point of a frame
- 1 The generator 0 will reset in the starting point of a frame

GF0[10:8] : The highest 3 bits of the generator 0 falling position (POR = 000)

GF0[7:0] : The lower byte of the generator 0 falling position (POR = 00000001)

GR0[10:8] : The highest 3 bits of the generator 0 rising position (POR = 000)

GR0[7:0] : The lower byte of the generator 0 rising position (POR = 00000000)

F[7] : Force the generator 0 output to 0 in non-display period

- 0 generator 0 is normal
- 1 generator 0 output is forced to zero in non-display period

F[6:5] : Force the generator 0 output to 0 in odd or even lines

- 00 generator 0 is normal in both odd and even lines
- 01 generator 0 output is force to 0 in odd lines
- 10 generator 0 output is force to 0 in even lines
- 11 generator 0 is normal in both odd and even line

F[4:3] : Generator 0 toggle mode

- 00 Disable
- 01 Toggle by pixel clock (LSHIFT)
- 10 Toggle by Line (LLINE)
- 11 Toggle by Frame (LFRAME)

GP0[10:8] : The highest 3 bits of the generator 0 period (POR = 100)

GP0[7:0] : The lower byte of the generator 0 period (POR = 00000000)

6.29 Set LCD Gen1

	D/C	D7	D6	D5	D4	D3	D2	D1	D0	Hex
Command	0	1	1	0	0	0	0	1	0	C2
Parameter 1	1	A ₇	0	0	0	0	0	0	0	xx
Parameter 2	1	0	0	0	0	0	GF1 ₂	GF1 ₁	GF1 ₀	xx
Parameter 3	1	GF1 ₇	GF1 ₆	GF1 ₅	GF1 ₄	GF1 ₃	GF1 ₂	GF1 ₁	GF1 ₀	xx
Parameter 4	1	0	0	0	0	0	GR1 ₂	GR1 ₁	GR1 ₀	xx
Parameter 5	1	GR1 ₇	GR1 ₆	GR1 ₅	GR1 ₄	GR1 ₃	GR1 ₂	GR1 ₁	GR1 ₀	xx
Parameter 6	1	F ₇	F ₆	F ₅	F ₄	F ₃	GP1 ₂	GP1 ₁	GP1 ₀	xx
Parameter 7	1	GP1 ₇	GP1 ₆	GP1 ₅	GP1 ₄	GP1 ₃	GP1 ₂	GP1 ₁	GP1 ₀	xx

6.30 Set LCD Gen2

	D/C	D7	D6	D5	D4	D3	D2	D1	D0	Hex
Command	0	1	1	0	0	0	1	0	0	C4
Parameter 1	1	A ₇	0	0	0	0	0	0	0	xx
Parameter 2	1	0	0	0	0	0	GF2 ₂	GF2 ₁	GF2 ₀	xx
Parameter 3	1	GF2 ₇	GF2 ₆	GF2 ₅	GF2 ₄	GF2 ₃	GF2 ₂	GF2 ₁	GF2 ₀	xx
Parameter 4	1	0	0	0	0	0	GR2 ₂	GR2 ₁	GR2 ₀	xx
Parameter 5	1	GR2 ₇	GR2 ₆	GR2 ₅	GR2 ₄	GR2 ₃	GR2 ₂	GR2 ₁	GR2 ₀	xx
Parameter 6	1	F ₇	F ₆	F ₅	F ₄	F ₃	GP2 ₂	GP2 ₁	GP2 ₀	xx
Parameter 7	1	GP2 ₇	GP2 ₆	GP2 ₅	GP2 ₄	GP2 ₃	GP2 ₂	GP2 ₁	GP2 ₀	xx

6.31 Set LCD Gen3

	D/C	D7	D6	D5	D4	D3	D2	D1	D0	Hex
Command	0	1	1	0	0	0	1	1	0	C6
Parameter 1	1	A ₇	0	0	0	0	0	0	0	xx
Parameter 2	1	0	0	0	0	0	GF3 ₂	GF3 ₁	GF3 ₀	xx
Parameter 3	1	GF3 ₇	GF3 ₆	GF3 ₅	GF3 ₄	GF3 ₃	GF3 ₂	GF3 ₁	GF3 ₀	xx
Parameter 4	1	0	0	0	0	0	GR3 ₂	GR3 ₁	GR3 ₀	xx
Parameter 5	1	GR3 ₇	GR3 ₆	GR3 ₅	GR3 ₄	GR3 ₃	GR3 ₂	GR3 ₁	GR3 ₀	xx
Parameter 6	1	F ₇	F ₆	F ₅	F ₄	F ₃	GP3 ₂	GP3 ₁	GP3 ₀	xx
Parameter 7	1	GP3 ₇	GP3 ₆	GP3 ₅	GP3 ₄	GP3 ₃	GP3 ₂	GP3 ₁	GP3 ₀	xx

6.32 Set DBC Configuration

	D/C	D7	D6	D5	D4	D3	D2	D1	D0	Hex
Command	0	1	1	0	1	0	0	0	0	D0
Parameter 1	1	0	A ₆	A ₅	0	A ₃	A ₂	0	A ₀	xx

Description

Set the Dynamic Backlight Control configuration.

A[6] : DBC Manual Brightness enable (POR = 1)

0	Enable
1	Disable

A[5] : Transition effect (POR = 0)

0	Transition effect disable
1	Transition effect enable

Transition effect is used to remove visible backlight flickering. If rapid brightness change is required, it is recommended to enable this bit.

A[3:2] : Energy saving selection for DBC (POR = 00)

00	DBC is disable
01	Conservative mode
10	Normal mode
11	Aggressive mode

A[0] : Master enable of DBC (POR = 0)

0	DBC disable
1	DBC enable

6.33 Get Pixel Data Interface

	D/C	D7	D6	D5	D4	D3	D2	D1	D0	Hex
Command	0	1	1	1	1	0	0	0	0	F0
Parameter 1	1	0	0	0	0	0	A ₂	A ₁	A ₀	xx

Description

Set the pixel data format to 8-bit / 9-bit / 12-bit / 16-bit / 16-bit(565) / 18-bit / 24-bit in the parallel host processor interface

A[2:0] : Pixel Data Interface Format (POR = 101)

000	8-bit
001	12-bit
010	16-bit packed
011	16-bit (565 format)
100	18-bit
101	24-bit
110	9-bit
Others	Reserved

6.34 Set LSHIFT Frequency

	D/C	D7	D6	D5	D4	D3	D2	D1	D0	Hex
Command	0	1	1	1	0	0	1	1	0	E6
Parameter 1	1	0	0	0	0	LCDC_FPR ₁₉	LCDC_FPR ₁₈	LCDC_FPR ₁₇	LCDC_FPR ₁₆	xx
Parameter 2	1	LCDC_FPR ₁₅	LCDC_FPR ₁₄	LCDC_FPR ₁₃	LCDC_FPR ₁₂	LCDC_FPR ₁₁	LCDC_FPR ₁₀	LCDC_FPR ₉	LCDC_FPR ₈	xx
Parameter 3	1	LCDC_FPR ₇	LCDC_FPR ₆	LCDC_FPR ₅	LCDC_FPR ₄	LCDC_FPR ₃	LCDC_FPR ₂	LCDC_FPR ₁	LCDC_FPR ₀	xx

Description

Set the LSHIFT (pixel clock) frequency

LCDC_FPR[19:16] : The highest 4 bits for the pixel clock frequency settings. (POR = 0111)

LCDC_FPR[15:8] : The higher byte for the pixel clock frequency settings. (POR = 11111111)

LCDC_FPR[7:0] : The low byte for the pixel clock frequency settings. (POR = 11111111)

Configure the pixel clock to PLL freq $x ((LCDC\_FPR + 1) / 2^{20})$

To obtain PCLK = 5.3MHz with PLL Frequency = 120MHz,

$5.3MHz = 120MHz * LCDC\_FPR / 2^{20}$

LCDC_FPR = 46312

WRITE COMMAND "0xE6"

WRITE DATA "0x00" (LCDC_FPR = 46312)

WRITE DATA "0xB4"

WRITE DATA "0xE7"

6.35 Set Deep Sleep

	D/C	D7	D6	D5	D4	D3	D2	D1	D0	Hex
Command	0	1	1	1	0	0	1	0	1	E5

Set deep sleep mode. PLL would be stopped.

It needs to issue 2 dummy read to exit Deep Sleep mode.

6.36 Set PLL

	D/C	D7	D6	D5	D4	D3	D2	D1	D0	Hex
Command	0	1	1	1	0	0	0	0	0	E0
Parameter 1	1	0	0	0	0	0	0	A ₁	A ₀	xx

Description

Start the PLL. Before the start, the system was operated with the crystal oscillator or clock input.

➤ A[1] : Lock PLL (POR = 0)

After PLL enabled for 100us, can start to lock PLL

0 Use reference clock as system clock

1 Use PLL output as system clock

A[0] : Enable PLL (POR = 0)

0 Disable PLL

1 Enable PLL

SSD1963 needed to switch to PLL output as system clock after PLL is locked. The following is the program sequence.

WRITE COMMAND "0xE0"

WRITE DATA "0x01"

Wait 100us to let the PLL stable

WRITE DATA "0x03"

6.37 Set PLL MN

	D/C	D7	D6	D5	D4	D3	D2	D1	D0	Hex
Command	0	1	1	1	0	0	0	1	0	E2
Parameter 1	1	N ₇	N ₆	N ₅	N ₄	N ₃	N ₂	N ₁	N ₀	xx
Parameter 2	1	0	0	0	0	M ₃	M ₂	M ₁	M ₀	xx
Parameter 3	1	0	0	0	0	0	C ₂	0	0	xx

Description

Set the MN of PLL

N[7:0] : Multiplier (N) of PLL. (POR = 00101101)

M[3:0] : Divider (M) of PLL. (POR = 0011)

C[2] : Effectuate MN value (POR = 0)

0 Ignore the multiplier (N) and divider (M) values in A[7:0] and B[7:0]

1 Effectuate the multiplier and divider value

VCO = Reference input clock x N

PLL frequency = VCO / M

* Note : 250MHz < VCO < 800MHz

For a 10MHz reference clock to obtain 115MHz PLL frequency, user cannot program N = 23 and M = 2. The closet setting in this situation is setting N=34 and M=3, where $10 \times 34 / 3 = 113.33\text{MHz}$.

WRITE COMMAND "0xE2"

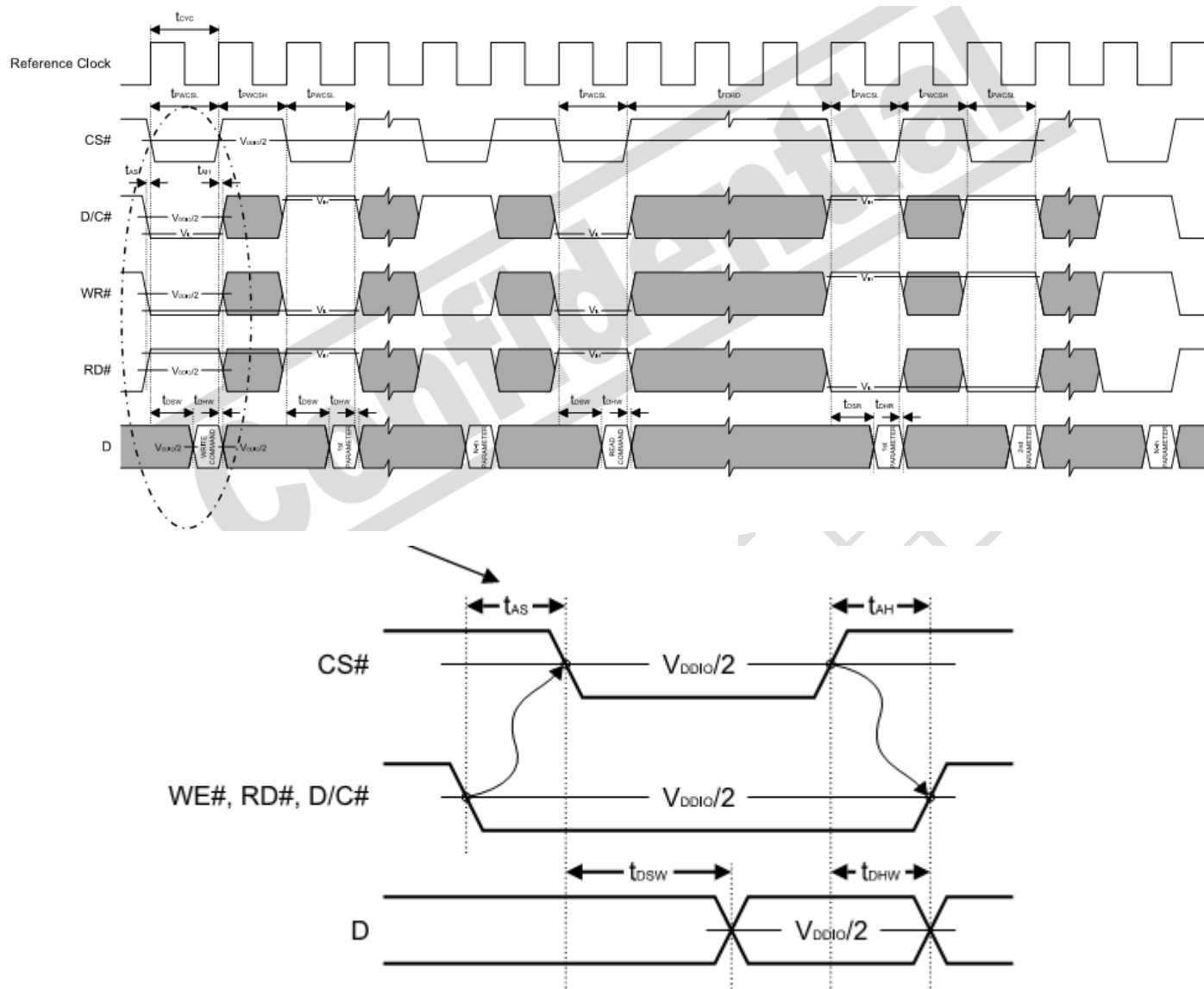
WRITE DATA "0x21" (N=34)

WRITE DATA "0x02" (M=3)

WRITE DATA "0x54" (Dummy Byte)

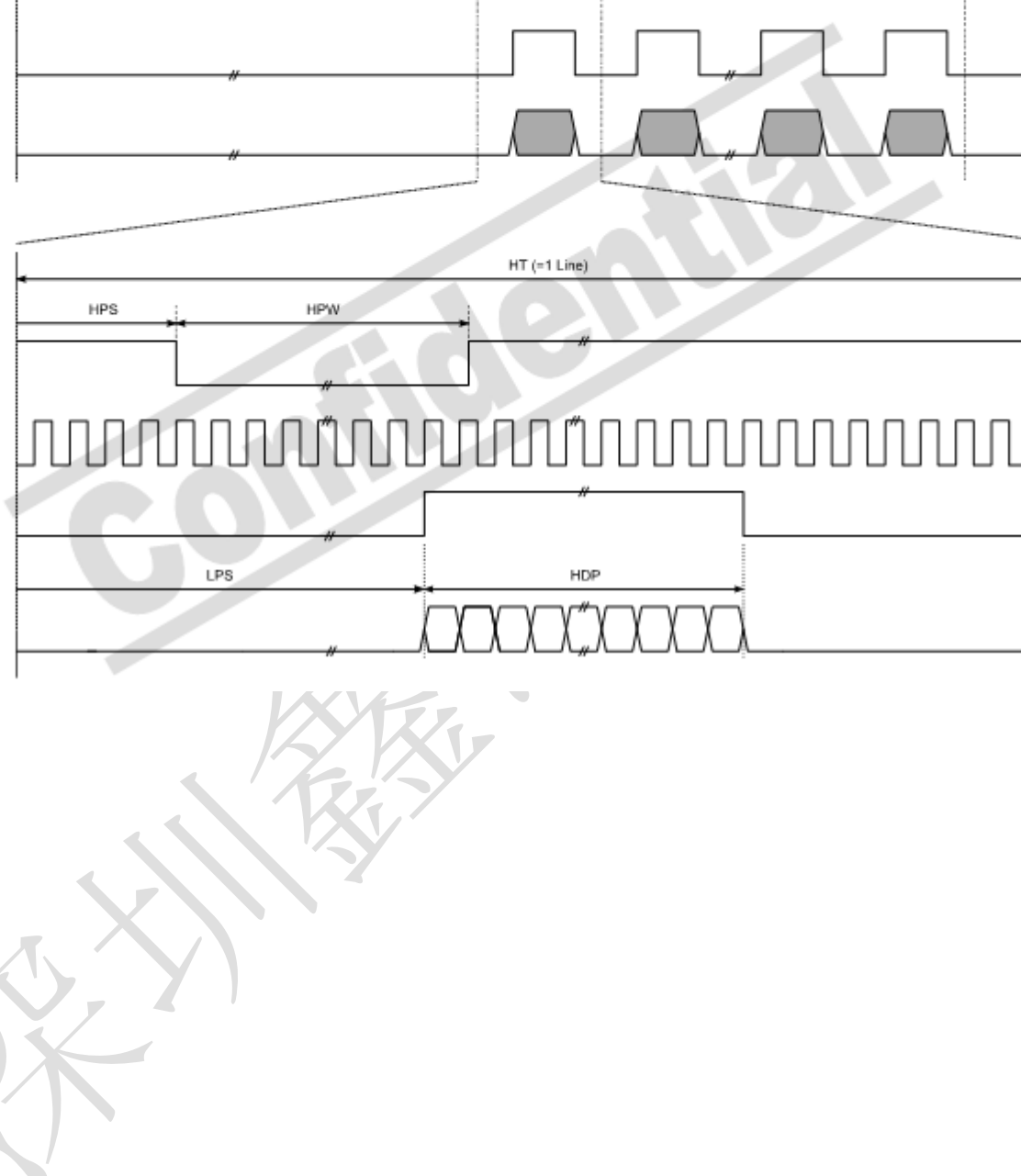
7. AC characteristics

7.1 MCU Interface Timing(8080)

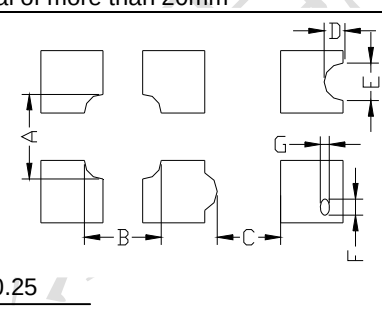


Symbol	Parameter	Min	Typ	Max	Unit
t_{CYC}	Reference Clock Cycle Time	9	-	-	ns
t_{PWCSL}	Pulse width CS# low	1	-	-	t_{CYC}
t_{PWCSH}	Pulse width CS# high	1	-	-	t_{CYC}
t_{FDRD}	First Read Data Delay	5	-	-	t_{CYC}
t_{AS}	Address Setup Time	1	-	-	ns
t_{AH}	Address Hold Time	1	-	-	ns
t_{DSW}	Data Setup Time	4	-	-	ns
t_{DHW}	Data Hold Time	1	-	-	ns
t_{DSR}	Data Access Time	-	-	5	ns
t_{DHR}	Output Hold time	1	-	-	ns

7.2 LCD Interface Timing



8 Inspection Standards

Item	Criterion for defects	Defect type
1) Display on inspection	(1) Non display (2) Vertical line is deficient (3) Horizontal line is deficient (4) Cross line is deficient	Major
2) Black / White spot	Size Φ (mm) $\Phi \leq 0.3$ Acceptable number $0.3 < \Phi \leq 0.45$ Ignore (note) $0.45 < \Phi \leq 0.6$ 3 $0.6 < \Phi$ 1 0	Minor
3) Black / White line	Length (mm) Width (mm) Acceptable number $L \leq 10$ $W \leq 0.03$ Ignore $5.0 \leq L \leq 10$ $0.03 < W \leq 0.04$ 3 $5.0 \leq L \leq 10$ $0.04 < W \leq 0.05$ 2 $1.0 \leq L \leq 10$ $0.05 < W \leq 0.06$ 2 $1.0 \leq L \leq 10$ $0.06 < W \leq 0.08$ 1 $L \leq 10$ $0.08 < W$ follows 2) point defect Defects separate with each other at an interval of more than 20mm	Minor
4) Display pattern	 $\frac{A+B \leq 0.28}{2}$ $0 < C$ $\frac{D+E \leq 0.25}{2}$ $\frac{F+G \leq 0.25}{2}$ Note: 1) Up to 3 damages acceptable 2) Not allowed if there are two or more pinholes every three-fourth inch.	Minor
5) Spot-like contrast irregularity	Size Φ (mm) Acceptable Number $\Phi \leq 0.7$ Ignore (note) $0.7 < \Phi \leq 1.0$ 3 $1.0 < \Phi \leq 1.5$ 1 $1.5 < \Phi$ 0 Note: 1) Conformed to limit samples. 2) Intervals of defects are more than 30mm.	Minor
6) Bubbles in polarizer	Size Φ (mm) Acceptable Number $\Phi \leq 0.4$ Ignore (note) $0.4 < \Phi \leq 0.65$ 2 $0.65 < \Phi \leq 1.2$ 1 $1.2 < \Phi$ 0	Minor
7) Scratches and dent on the polarizer	Scratches and dent on the polarizer shall be in the accordance with "2) Black/white spot", and "3) Black/White line".	Minor
8) Stains on the surface of LCD panel	Stains which cannot be removed even when wiped lightly with a soft cloth or similar cleaning.	Minor
9) Rainbow color	No rainbow color is allowed in the optimum contrast on state within the active area.	Minor
10) Viewing area encroachment	Polarizer edge or line is visible in the opening viewing area due to polarizer shortness or sealing line.	Minor
11) Bezel appearance	Rust and deep damages that are visible in the bezel are rejected.	Minor
12) Defect of land surface contact	Evident crevices that are visible are rejected.	Minor
13) Parts mounting	(1) Failure to mount parts (2) Parts not in the specifications are mounted (3) For example: Polarity is reversed, HSC or TCP falls off.	Minor
14) Part alignment	(1) LSI, IC lead width is more than 50% beyond pad outline. (2) More than 50% of LSI, IC leads is off the pad outline.	Minor
15) Conductive foreign matter (solder ball,	(1) $0.45 < \Phi$, $N \geq 1$ (2) $0.3 < \Phi \leq 0.45$, $N \geq 1$, Φ : Average diameter of solder ball (unit: mm)	Minor

solder hips)	(3) $0.5 < L$, $N \geq 1$, L: Average length of solder chip (unit: mm)	
16) Bezel flaw	Bezel claw missing or not bent	Minor
17) Indication on name plate (sampling indication label)	(1) Failure to stamp or label error, or not legible.(all acceptable if legible) (2) The separation is more than 1/3 for indication discoloration, in which the characters can be checked.	Minor

9. Handling Precautions

9.1 Mounting method

A panel of LCD module made by our company consists of two thin glass plates with polarizers that easily get damaged.

And since the module is so constructed as to be fixed by utilizing fitting holes in the printed circuit board (PCB), extreme care should be used when handling the LCD modules.

9.2 Cautions of LCD handling and cleaning

When cleaning the display surface, use soft cloth with solvent (recommended below) and wipe lightly.

- Isopropyl alcohol
- Ethyl alcohol
- Trichlorotrifluoroethane

Do not wipe the display surface with dry or hard materials that will damage the polarizer surface.

Do not use the following solvent:

- Water
- Ketene
- Aromatics

9.3 Caution against static charge

The LCD module uses C-MOS LSI drivers. So we recommend you:

Connect any unused input terminal to V_{dd} or V_{ss} . Do not input any signals before power is turned on, and ground your body, work/assembly areas, assembly equipment to protect against static electricity.

9.4 Packaging

- Module employs LCD elements, and must be treated as such. Avoid intense shock and falls from a height.
- To prevent modules from degradation, do not operate or store them exposed directly to sunshine or high temperature/humidity.

9.5 Caution for operation

-It is an indispensable condition to drive LCD module within the limits of the specified voltage since the higher voltage over the limits may cause the shorter life of LCD module.

-An electrochemical reaction due to DC (direct current) causes LCD undesirable deterioration so that the use of DC (direct current) drive should be avoided.

-Response time will be extremely delayed at lower temperature than the operating temperature range and on the other hand at higher temperature LCD module may show dark color in them. However those phenomena do not mean malfunction or out of order of LCD module, which will come back in the specified operating temperature.

9.6 Storage

In the case of storing for a long period of time, the following ways are recommended:

- Storage in polyethylene bag with the opening sealed so as not to enter fresh air outside in it. And with not desiccant.
- Placing in a dark place where neither exposure to direct sunlight nor light is. Keeping the storage temperature range.
- Storing with no touch on polarizer surface by any thing else.

9.7 Safety

-It is recommendable to crush damaged or unnecessary LCD into pieces and to wash off liquid crystal by either of solvents such as acetone and ethanol, which should be burned up later.

-When any liquid leaked out of a damaged glass cell comes in contact with your hands, please wash it off well at once with soap and water.

10. Packaging Specifications

TBD