CUSTOMER APPROVAL SHEET

Company Name	
MODEL	**A043VL01 V3**
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☐ **APPROVAL FOR SPECIFICATIONS ONLY (Spec. Ver. 2.2)**
☐ **APPROVAL FOR SPECIFICATIONS AND ES SAMPLE (Spec. Ver. 2.2)**
☐ **APPROVAL FOR SPECIFICATIONS AND CS SAMPLE (Spec. Ver. 2.2)**
☐ **CUSTOMER REMARK :**

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Product Specification
4.3" COLOR LTPS-LCD MODULE

Model Name : **A043VL01 V3**

Planned Lifetime:	From 2009/Jan To 2011/Dec
Phase-out Control:	From 2011/Jul To 2011/Dec
EOL Schedule:	2011/Dec

< >Preliminary Specification
< ◆ >Final Specification

Note: The content of this specification is subject to change.

Record of Revision

Version	Revise Date	Page	Content
0.0	2008/12/3		First draft.
0.1	2008/12/10	18	Add electrical characteristics for touch function
0.2	2009/1/10	27	Add default setting
		34	Add Cover Lens Suggestion
1.0	2009/2/27	15	LABC and CABC function
		21,23	Power on/off sequence, recommend register setting
		3	Update weight, power consumption,
1.1	2009/03/17	3	Update panel surface treamemt
		4	Update LCM thickness from 2.605mm to 2.505mm
1.2	2009/06/24	6,7	Modify Pin Assignment
		12,14,15	Modify RGB Interface Characteristics
		16,17,18	Modify Dynamic Backlight Control Function
		20 ~24	Update Command Register Map
1.3	2009/06/24	19	Modify Power On/Off Characteristics
		25	Modify LED lightbar current I_L = 20mA→40mA
1.4	2009/07/23	4	Outline Dimension
		6,7	Modify Pin Assignment
		23	Add register setting F103h=01h to Recommended Power On Register Setting.
1.5	2009/09/04	38	Add T/P ITO Drawing
		39	Modify Reliability Test Items/ Update NTSC Ratio
1.6	2009/10/07	18	Modify Light Sensor based Automatic Backlight Control
		22	Modify Command Register Map
		25~32	Add the description of register 5100h, 5300h, 5301h, 5302h, 5500h, 5E03h, 5E04h, 6A01h, 6A02h.
		33	Modify Recommended LABC On Register Setting
1.7	2009/12/15	34	Change VCOMDC setting from 8Bh to 91h.
1.8	2009/12/24	5	Modify Module drawing (add POL Transmission direction)

1.8	2009/12/24	8	Add ID Pins on FPC 50pin and 51pin
		36	Modify view angle
1.9	2010/01/06	9, 21	Modify typical of operatial voltage to 2.8V
		35	Modify Recommended Power On Register Setting for OTP panel
2.0	2010/1/12	0	Modify Planned Lifetime
2.1	2010/01/21	7~8	Add TFT-LCD glass only drawing
		22	Modify TP voltage from 4.5V to 1.8V
		35	Modify Brightness measure from center to average of 9 points
2.2	2010/08/02	5~8 22 34	Modify outline drawing Modify TP voltage. Modify optical specifiaction

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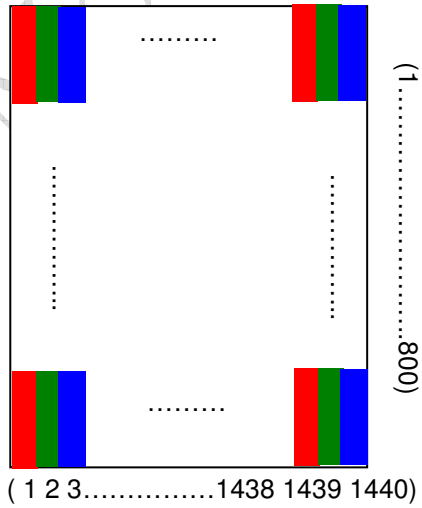
A. General Information

This product is for MID applications.

NO.	Item	Unit	Specification	Remark
1	Screen Size	inch	4.3(Diagonal)	
2	Display Resolution	dot	480RGB(H)×800(V)	
3	Overall Dimension	mm	62.5(H) × 105.9(V) × 2.5(T)	Note 1
4	Active Area	mm	56.16(H)×93.6(V)	
5	Pixel Pitch	mm	0.039(H)×0.117(V)	
6	Color Configuration	--	R. G. B. Stripe	Note 2
7	Color Depth	--	16.7M Colors	
8	NTSC Ratio	%	45	
9	Display Mode	--	Normally Black	
10	Panel Surface Treatment	--	Hard Coat, 3H	
11	Weight	g	36.5	
12	Panel Power Consumption	mW	704	Note 3
13	Interface		24 bit RGB	
14	Touch Panel		Charge-Sensing (Capacitive) Type	
15	Gray Scale Inversion		No GSI	

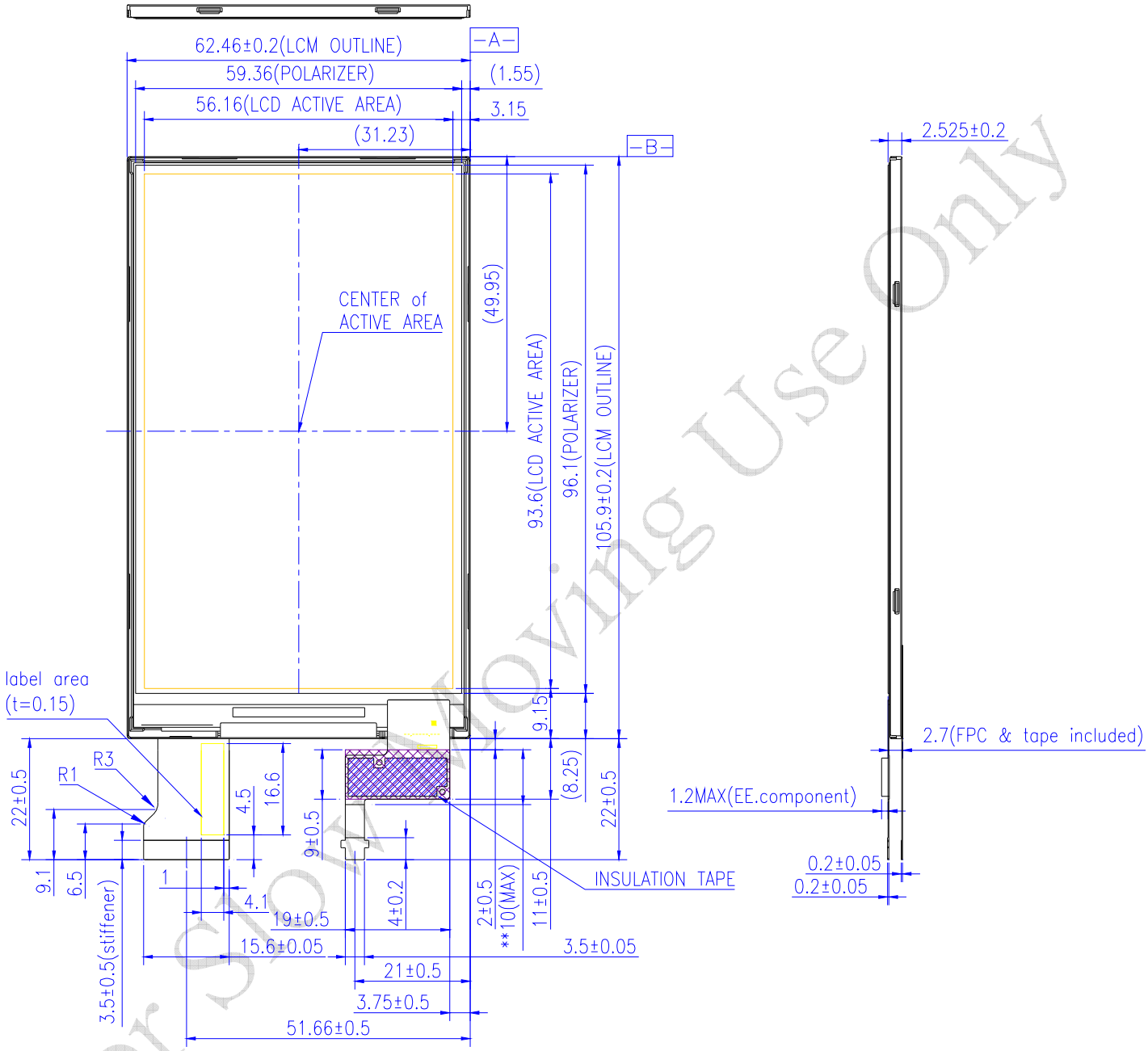
Note 1: Not include FPCs & Bezel extrude stucture. Refer next page to get further information.
Note 2: Below figure shows dot stripe arrangement.



Note 3: Please refer to Electrical Characteristics chapter.

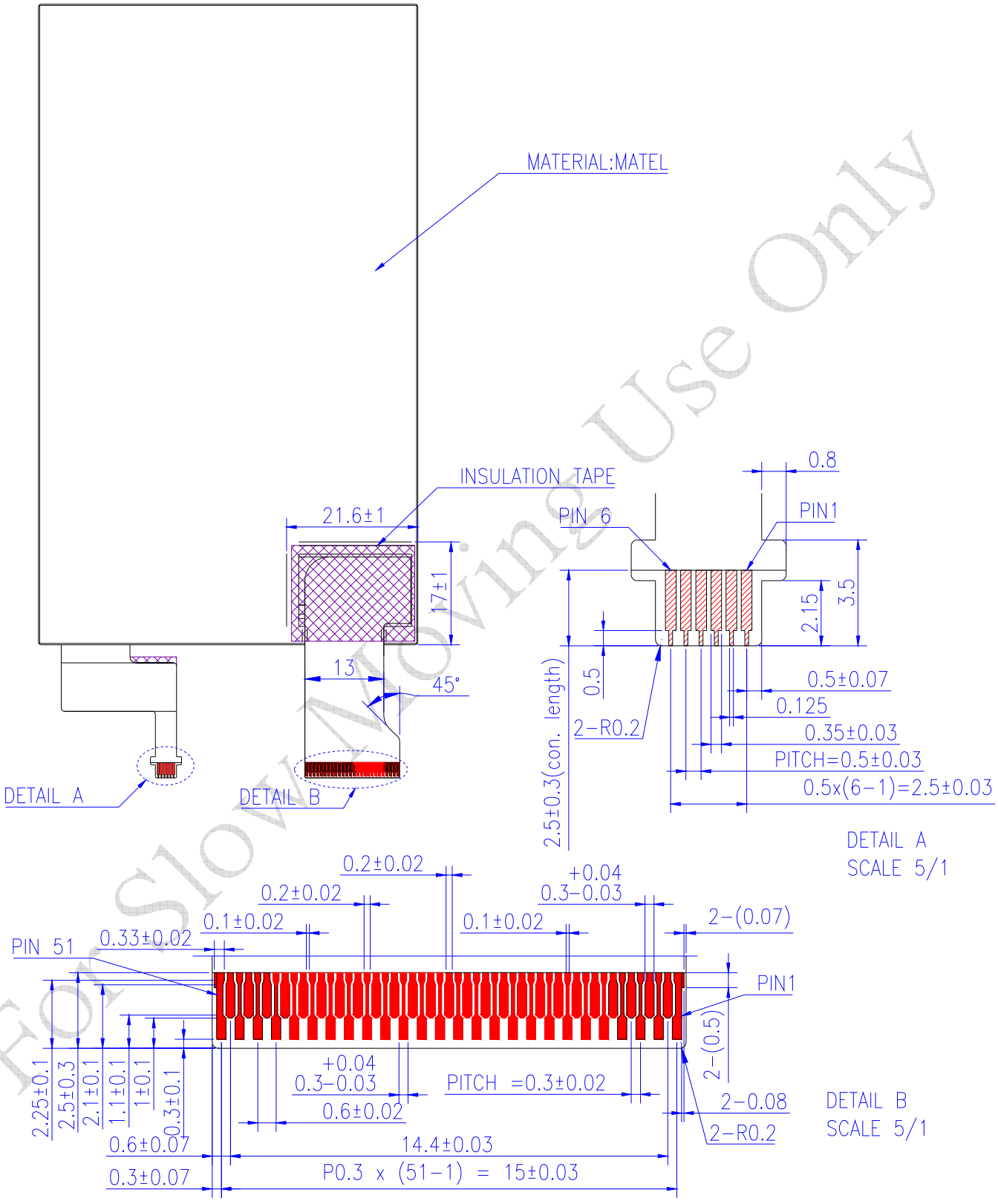
B. Outline Dimension

1. TFT-LCD Module – Front View



NOTES:
1. Gerneral tolerance ±0.3 .
2. The bending radius of FPC should be larger than 0.6 .
3. ** : component & unbending area .

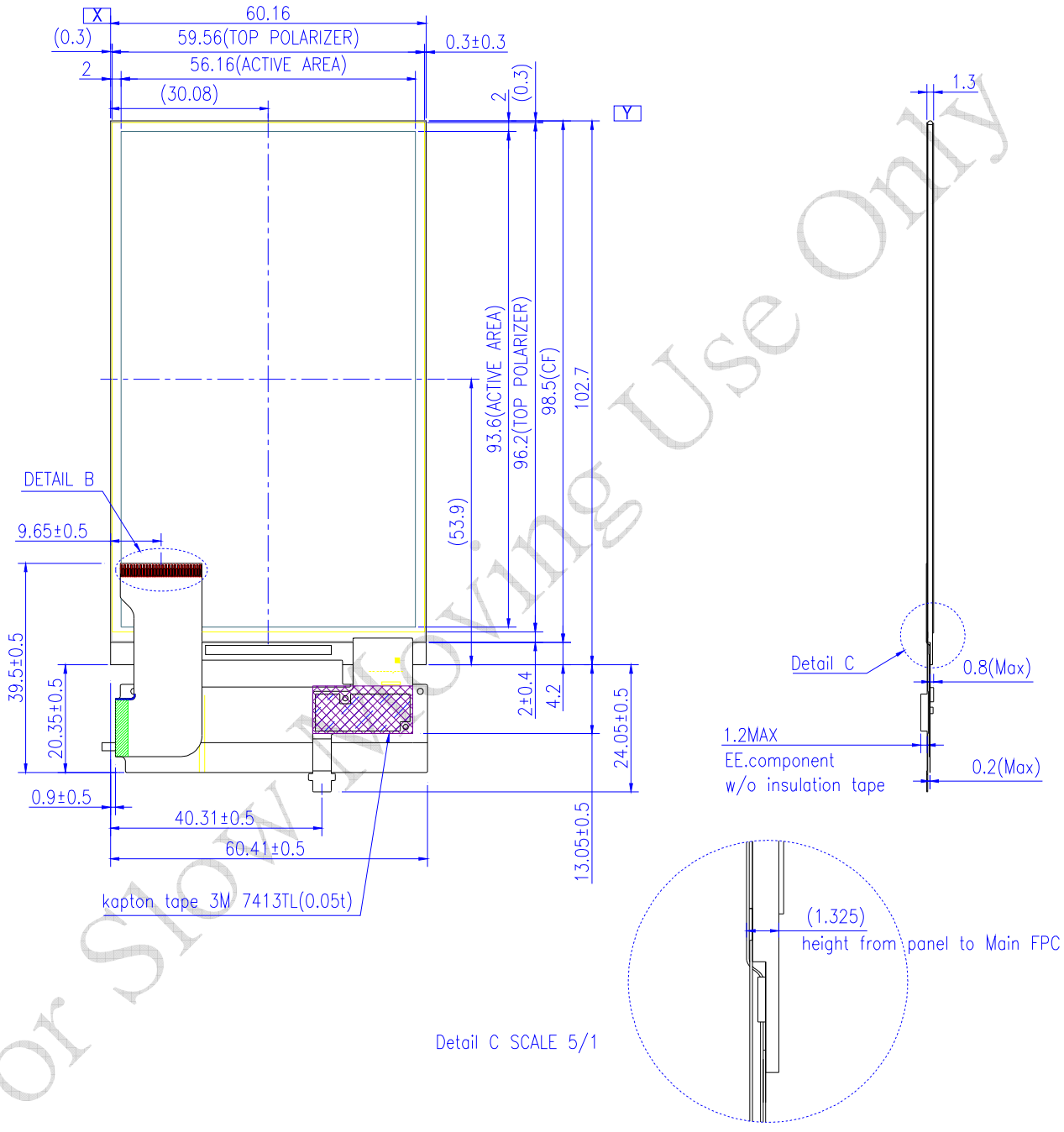
2. TFT-LCD Module – Rear View



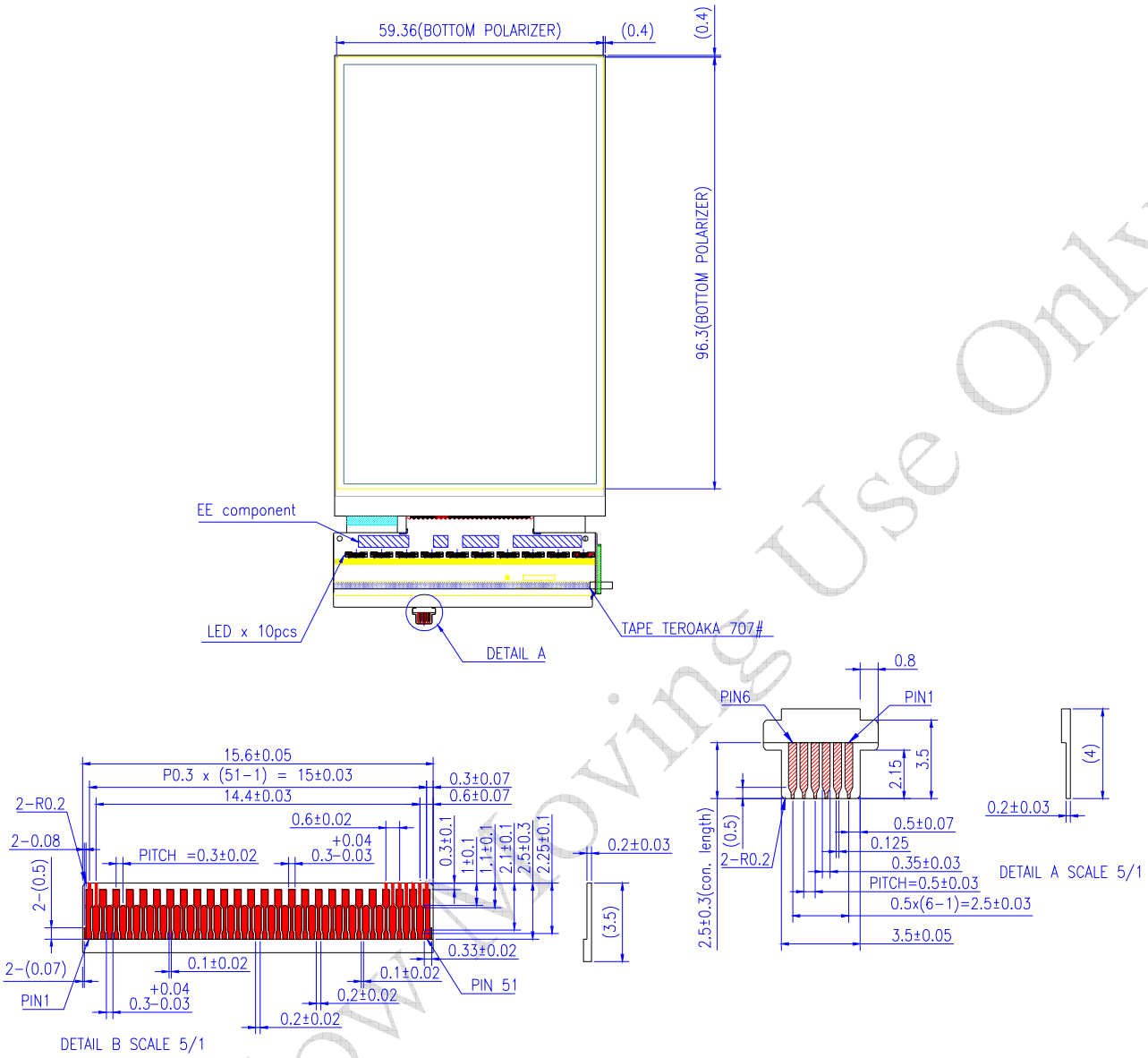
3. TFT-LCD Glass only – Front View

Notes:

1.General tolerance ±0.2mm



4. TFT-LCD Glass only –Rear View



C. Electrical Specifications

1. Pin Assignment

TFT LCD Panel Pin Assignment:

Recommended connector : FH26-51S-0.3SHW

Pin No.	Symbol	Type	Description	Remark
1	VLED-	P	LED backlight cathode	
2	VLED+	P	LED backlight anode	
3	VCI	P	DC-DC circuit supply voltage	
4	LED_PWM	O	PWM type control signal for brightness of the LED backlight	If not used, please open this pin.
5	VDDI	P	Digital interface supply voltage of digital	
6	VS	I	Vertical sync input	
7	HS	I	Horizontal sync input	
8	GND	P	Ground for digital circuit	
9	PCLK	I	Data clock Input	
10	GND	P	Ground for digital circuit	
11	DE	I	Data enable input. Active level is high.	Please connect to GND if do not use.
12	DB0	I	Blue Data input; LSB	
13	DB1	I	Blue Data input	
14	DB2	I	Blue Data input	
15	DB3	I	Blue Data input	
16	DB4	I	Blue Data input	
17	DB5	I	Blue Data input	
18	DB6	I	Blue Data input	
19	DB7	I	Blue Data input; MSB	
20	DG0	I	Green Data input; LSB	
21	DG1	I	Green Data input	
22	DG2	I	Green Data input	
23	DG3	I	Green Data input	
24	DG4	I	Green Data input	
25	DG5	I	Green Data input	
26	DG6	I	Green Data input	
27	DG7	I	Green Data input ; MSB	
28	DR0	I	Red Data input; LSB	
29	DR1	I	Red Data input	

30	DR2	I	Red Data input	
31	DR3	I	Red Data input	
32	DR4	I	Red Data input	
33	DR5	I	Red Data input	
34	DR6	I	Red Data input	
35	DR7	I	Red Data input; MSB	
36	GND	P	Ground for digital circuit	
37	SHUT	I	Display on/off hardware pin SHUT = '1', sleep in mode SHUT = '0', normal operation	If not used, please fix this pin at VDDI level.
38	RESX	I	Reset pin. (Low active)	
39	CSX	I	Chip select (Low active) of SPI	
40	SCL	I	Clock input of SPI	
41	SDI	I	Data input of SPI	
42	SDO	O	Data output of SPI	If not used, please open this pin.
43	GND	P	Ground for digital circuit	
44	ALS	I	Ambient light information from light sensor input	Please connect to GND if do not use.
45	NC	-	No connection. Please leave it open	
46	NC	-	No connection. Please leave it open	
47	NC	-	No connection. Please leave it open	
48	NC	-	No connection. Please leave it open	
49	NC	-	No connection. Please leave it open	
50	ID1	O	Connect to ground on FPC	
51	ID2	O	Connect to VDDI on FPC	

Note 1: I: Input; O: Output; P: Power.
Note 2: For correct power on sequence please refer to section 5 "Power On/Off Sequence"

Touch Sensor FPC Pin Assignment:

Recommended connector : FH19C-6S-0.5SH(0.5)

Pin No.	Symbol	Type	Description	Remark
1	VDD_TP	P	Touch Panel Power Supply	
2	NC	-	No connection. Please leave it open	
3	INT	O	Touched Interrupt Indicator	
4	I2C_SDA	I/O	Serial Communication data input/output	
5	I2C_SCL	I	Serial Communication Clock Input	
6	GND_TP	P	Touch Panel Ground	

Note 1: I: Input; O: Output; P: Power.

2. Absolute Maximum Ratings

Item	Symbol	Condition	Min.	Max.	Unit	Remark
Input power supply	VDDI	V_{SS}=0V	-0.3	+4.6	V	
Analog power supply	VCI	V_{SS}=0V	-0.3	+4.6	V	

Note 1: If the module exceeds the absolute maximum ratings, it may be damaged permanently. Also, if the module operates with the absolute maximum ratings for a long time, the reliability may drop.

3. Electrical DC Characteristics

a. Typical Operation Condition (GND = 0V)

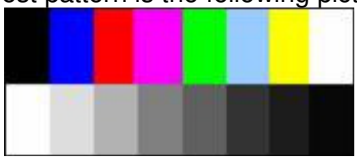
Item		Symbol	Min.	Typ.	Max.	Unit	Remark
Input power supply		VDDI	1.65	2.8	3.3	V	
Analog power supply		VCI	2.5	2.8	3.3	V	
Input Signal Voltage	H Level	V_{IH}	0.7VDDI	-	VDDI	V	
	L Level	V_{IL}	GND	-	0.3 VDDI	V	
Output Signal Voltage	H Level	V_{OH}	0.8 VDDI	-	VDDI	V	
	L Level	V_{OL}	GND	-	0.2 VDDI	V	

b. Current Consumption (GND=0V)

Mode	Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Normal	P_N	VCI(DC DC input) = 2.8V	-	100	150	mW	Note 1,2

Sleep	P_S	VDDI = 2.8V	-	8	10	mW	
Deep Stand-by	P_{DS}		-	0.04	0.06	mW	

Note 1: Test Condition is under typical Electrical DC and AC characteristics.
Note 2: Test pattern is the following picture (color bar).

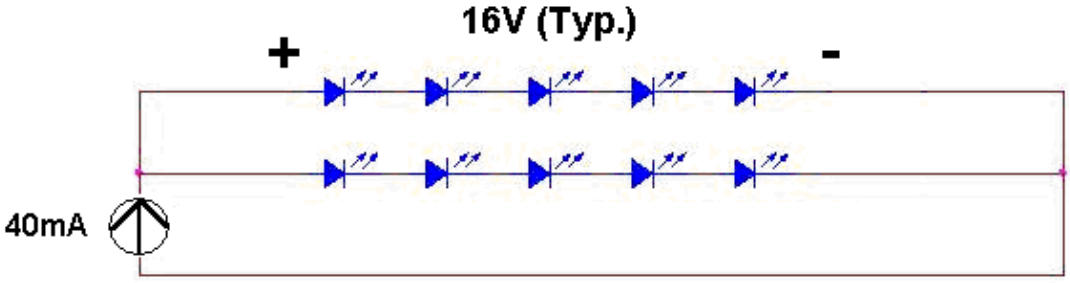


c. Backlight Driving Conditions

The backlight (LED module, Note 1) is suggested to drive by constant current with typical value.

Parameter	Symbol	Min.	Typ.	Max.	Unit	Remark
LED Current	I_L	--	20	22	mA	Note 1
Power Consumption	P_L	--	640	770	mW	
LED Life Time	L_L	10,000	--	--	Hr	Note 2, 3

Note 1: LED backlight is two parallel strings and one LED for each string is as the following figure. Suggestion is driven by current 20mA for each LED string.

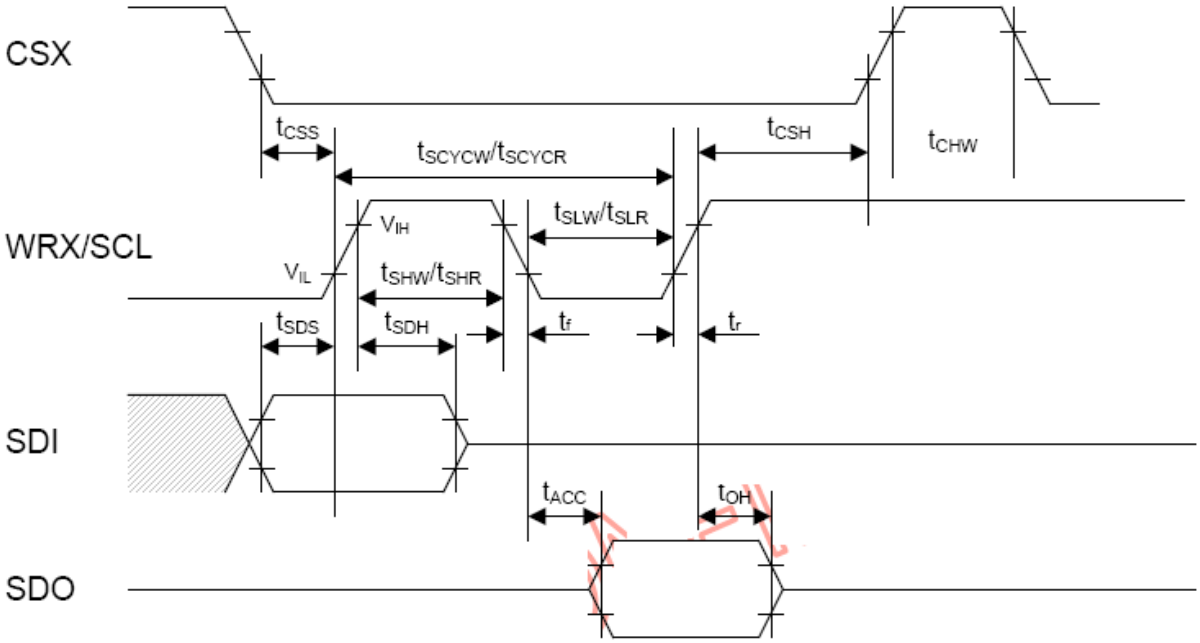


Note 2: Define “LED Lifetime”: brightness is decreased to 50% of the initial value. LED Lifetime is restricted under normal condition, ambient temperature = 25℃ and LED lightbar current = 20 mA.
Note 3: If it uses larger LED lightbar voltage/ current more than 20mA, it maybe decreases the LED lifetime.

4. Electrical AC Characteristics

a. SPI Interface Characteristics

(a) Signal AC Characterics

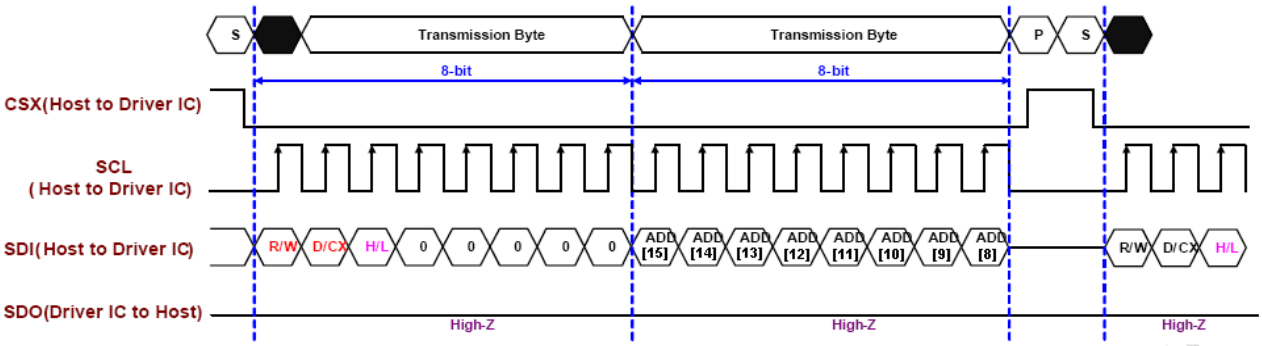


VDDI=1.65~3.3V, VCI=2.5~3.3V, TA=25℃

Item	Symbol	Timing Diagram	Min.	Typ.	Max.	Unit
SCL clock cycle time Write (received)	t_{SCYCW}	Figure 7.3.4	100	-	20,000	ns
SCL clock cycle time Read (transmitted)	t_{SCYCR}	Figure 7.3.4	300	-	20,000	ns
SCL "High" pulse width Write (received)	t_{SHW}	Figure 7.3.4	40	-	-	ns
SCL "High" pulse width Read (transmitted)	t_{SHR}	Figure 7.3.4	140	-	-	ns
SCL "Low" pulse width Write (received)	t_{SLW}	Figure 7.3.4	40	-	-	ns
SCL "Low" pulse width Read (transmitted)	t_{SLR}	Figure 7.3.4	140	-	-	ns
SCL clock rise/fall time	t_r, t_f	Figure 7.3.4	-	-	10	ns
Chip select setup time	t_{CSS}	Figure 7.3.4	20	-	-	ns
Chip select hold time	t_{CSH}	Figure 7.3.4	50	-	-	ns
Input data setup time	t_{SDS}	Figure 7.3.4	20	-	-	ns
Input data hold time	t_{SDH}	Figure 7.3.4	20	-	-	ns
Output data access time	t_{ACC}	Figure 7.3.4	-	-	120	ns
Output data hold time	t_{OH}	Figure 7.3.4	5	-	-	ns
Chip deselect "High" pulse width	t_{CHW}	Figure 7.3.4	45	-	-	ns

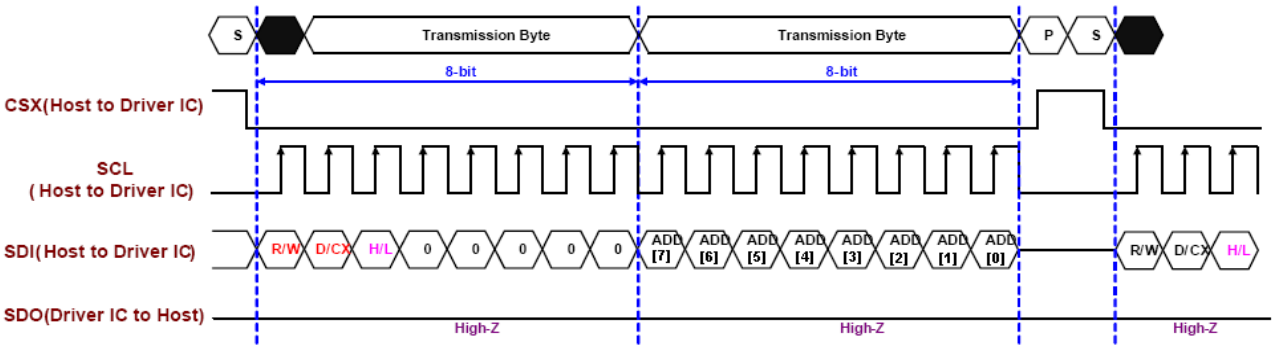
(b) Write Mode

First Transmit



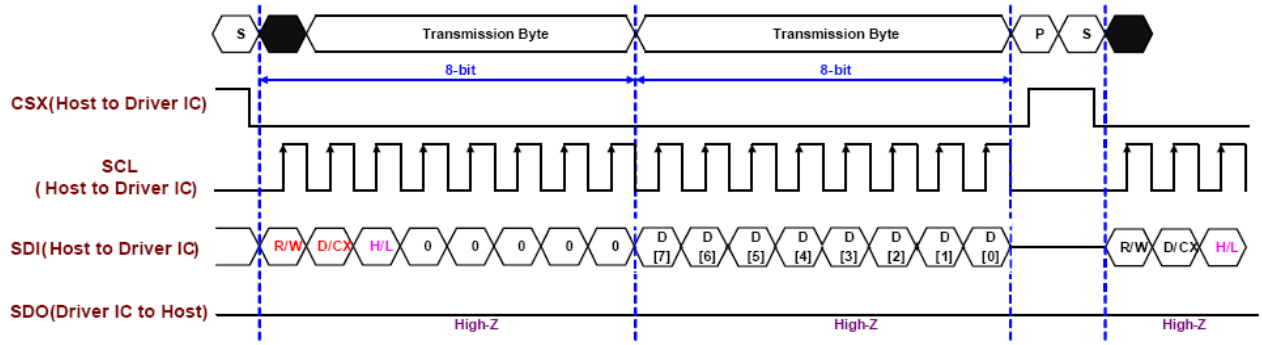
R/W = ‘ 0’ for Writing Command/ Address
D/ CX = ‘ 0 ' for Command / Address Transmission
H/L = ‘ 1 ' for Command / Address High Byte Transmission

Second Transmit



R/W = ‘ 0’ for Writing Command/ Address
D/ CX = ‘ 0 ' for Command / Address Transmission
H/L = ‘ 0 ' for Command / Address Low Byte Transmission

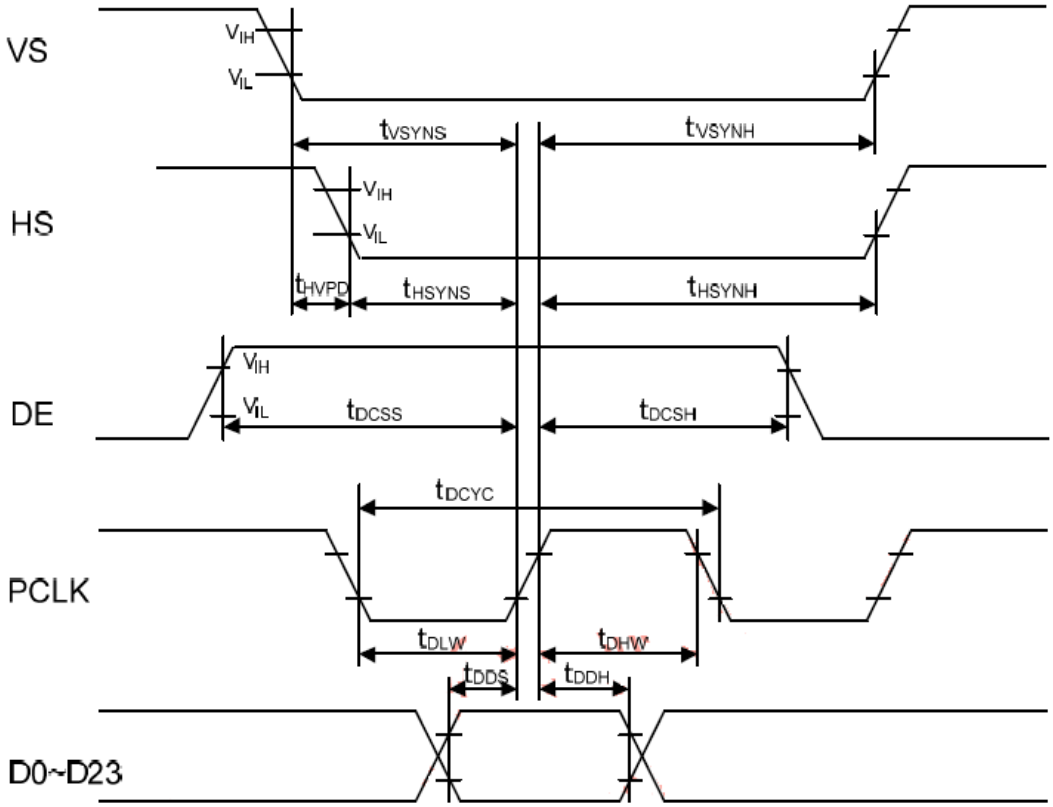
Third Transmit



R/W = ‘ 0’ for Writing Command/ Address
D/ CX = ‘ 1' for Parameter / Data Transmission
H/L = ‘ 0 ' for Parameter / Data Low Byte Transmission

b. RGB Interface Characteristics

(a) Signal AC Characterics

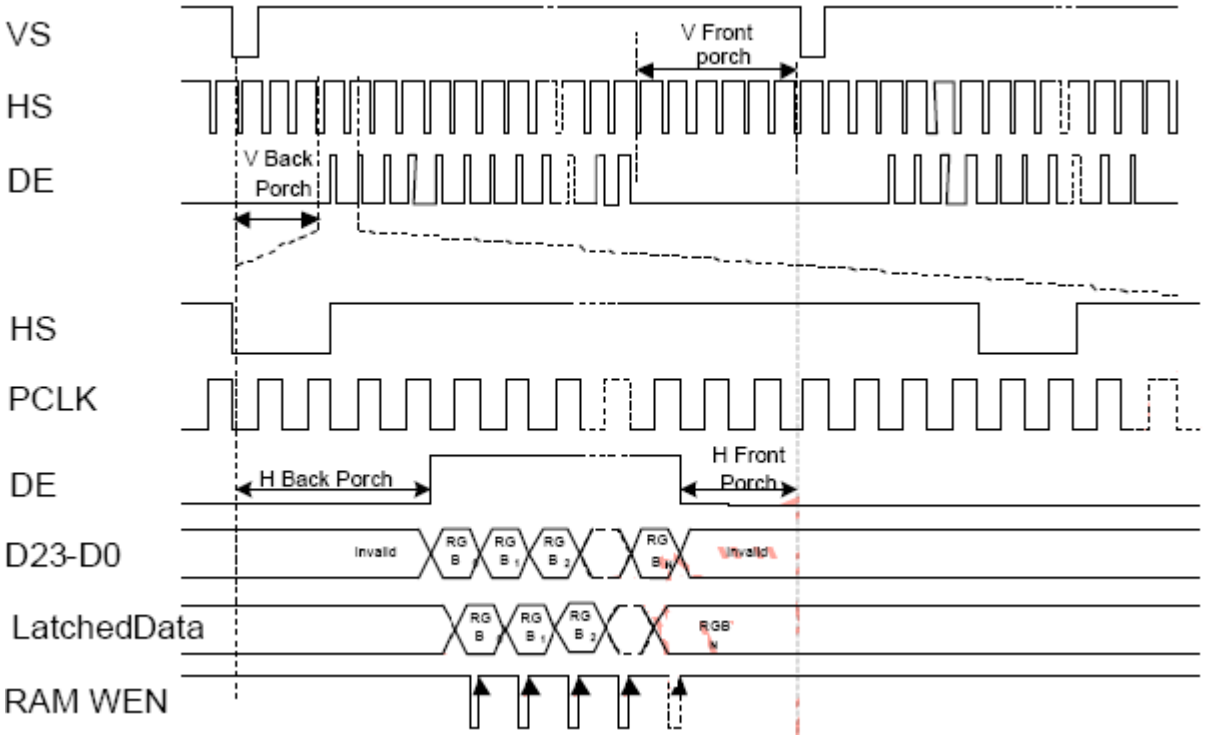


VDDI=1.65~3.3V, VCI=2.5~3.3V, TA=25℃

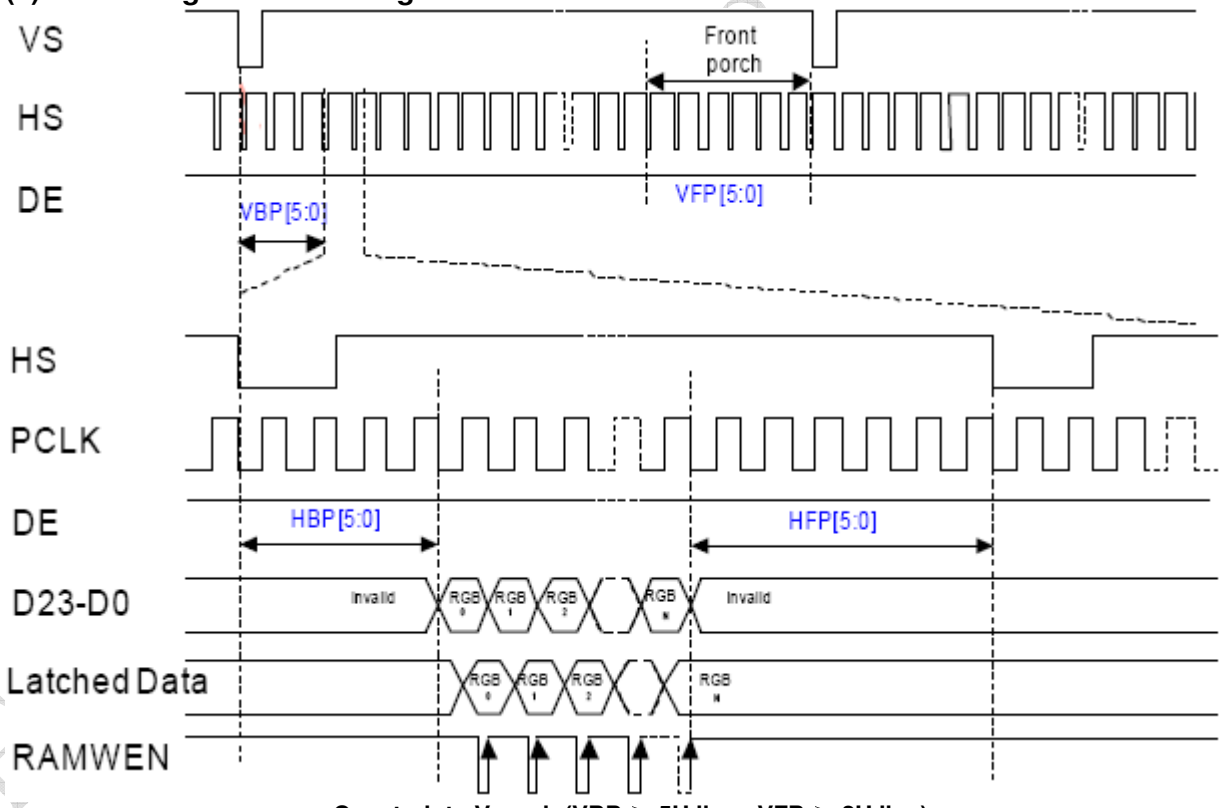
Signal	Symbol	Parameter	Min.	Typ.	Max.	Unit
VS	t_{VSYNS}	VSYNC setup time	5			ns
	t_{VSYNH}	VSYNC hold time	5			ns
HS	t_{HSYNS}	HSYNC setup time	5			ns
	t_{SCYCR}	HSYNC hold time	5			ns
PCLK	t_{DCYC}	PCLK cycle time	36.5	-	46.7	ns
	t_{DFREQ}	PCLK frequency	21.6	-	27.4	MHz
	t_{DLW}	PCLK “L” pulse width	11			ns
	t_{DHW}	PCLK “H” pulse width	11			ns
DE	t_{DCSS}	DE setup time	5			ns
	t_{DCSH}	DE hold time	5			ns
D0~D23	t_{DDS}	RGB Data setup time	5			ns
	t_{DDH}	RGB Data hold time	5			ns

Note 1: Signal rise and fall times are equal or less than 20ns.
Note 2: Measuring of input signals are 0.30 x VDDI for low state and 0.7 x VDDI for high state.

(b) Video signal data writing method in RGB Mode 1 Interface

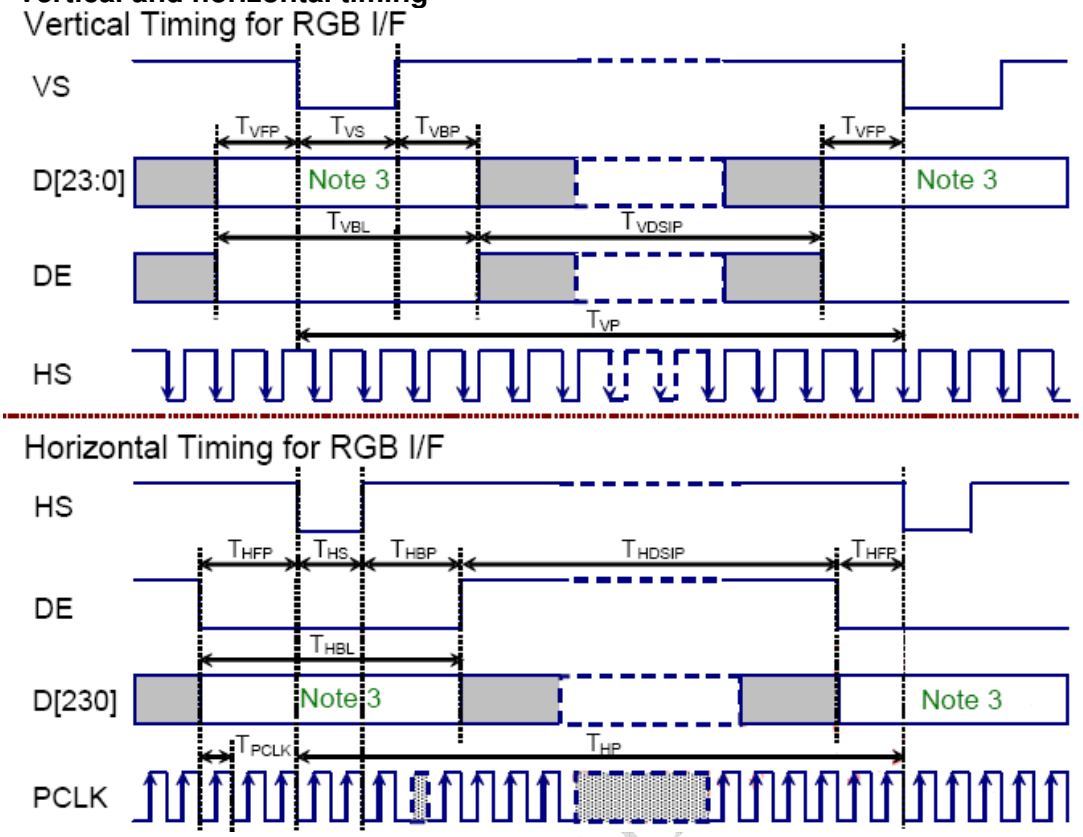


(c) Video signal data writing method in RGB Mode 2 Interface：



Constraint : Vporch (VBP ≧ 5H line , VFP ≧ 2H line)

(d) Vertical and horizontal timing



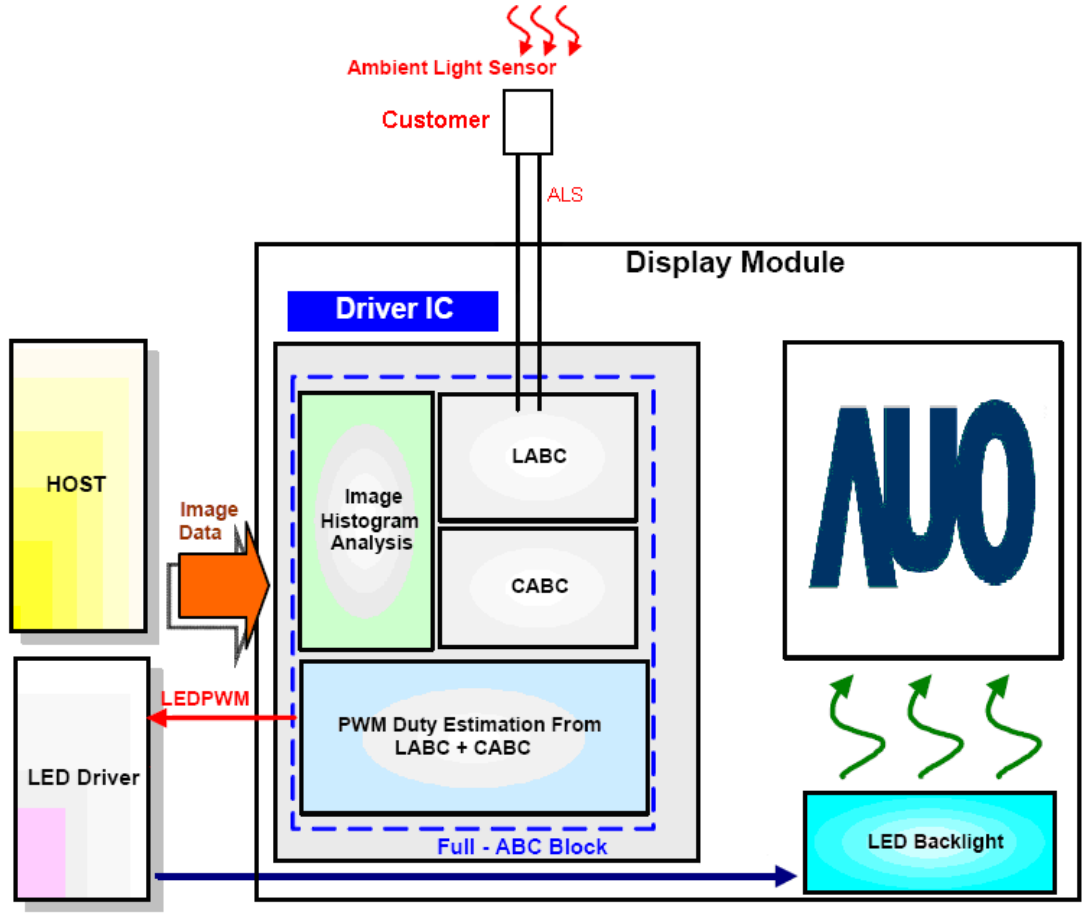
VDDI=1.65~3.3V, VCI=2.5~3.3V, TA=25℃

Veritcal Timing						
Item	**Symbol**	**Min.**	**Typ.**	**Max.**	**Unit**	**Remark**
Vertical cycle period	T_{VP}	806	-	930	HS	
Vertical low pulse width	T_{VS}	2	-	-	HS	
Vertical front porch	T_{VFP}	2	-	64	HS	VFP[5:0]
Vertical back porch	T_{VBP}	2	-	64	HS	
Vertical data start line	$T_{VS} + T_{VBP}$	4	-	128	HS	VBP[5:0]
Vertical blanking period	$T_{VBL} = T_{VS} + T_{VBP} + T_{VFP}$	6	-	-	HS	
Vertical active area	T_{VDISP}	-	800	-	HS	
Vertical refresh rate	T_{VRR}	55	60	70	Hz	
Horizontal Timing						
Item	**Symbol**	**Min.**	**Typ.**	**Max.**	**Unit**	
Horizontal cycle period	T_{HP}	486	-	610	PCLK	Note 2
Horizontal low pulse width	T_{HS}	2	-	-	PCLK	
Horizontal front porch	T_{HFP}	2	-	64	PCLK	HFP[5:0]
Horizontal back porch	T_{HBP}	2	-	64	PCLK	
Horizontal data start point	$T_{HS} + T_{HBP}$	4	-	128	PCLK	HBP[5:0]
Horizontal blanking period	$T_{HBL} = T_{HS} + T_{HBP} + T_{HFP}$	6	-	-		
Horizontal active area	T_{HDISP}	-	480	-		
Pixel clock cycle	$F_{PCLKCYC}$	21.6	23.5	27.4		

Note 1: HBP ≧ 2 PCLK , HS ≧ 2 PCLK
Note 2: HP is multiples of eight PCLK.

Note 3: Data lines can be set to “High” or “Low” during blanking time – Don’t care.

c. Dynamic Backlight Control Function



(a) PWM Control

The registers PWMDIV[7 : 0] can change the frequency of the PWM signal.
The PWM operation frequency “FOSC” can be selected by the register bit “PWMF”, so two PWM operation frequencies can be selected as shown in below table:

Register Bit “PWMF”	PWM Operation Frequency – “Fosc”
0	5.5 MHz
1	11 MHz (Default)

The PWM operation frequency “FOSC” is “not” the real PWM frequency, the “FOSC” is used to provide clock source for the internal PWM circuit. Actually, the real PWM frequency can be quickly estimated by the bellow formula:

PWM Frequency = Fosc/(256×PWMDIV[7.0])

So the relations between “PWMF”, “FOSC”, actually PWM frequency are shown in below table:

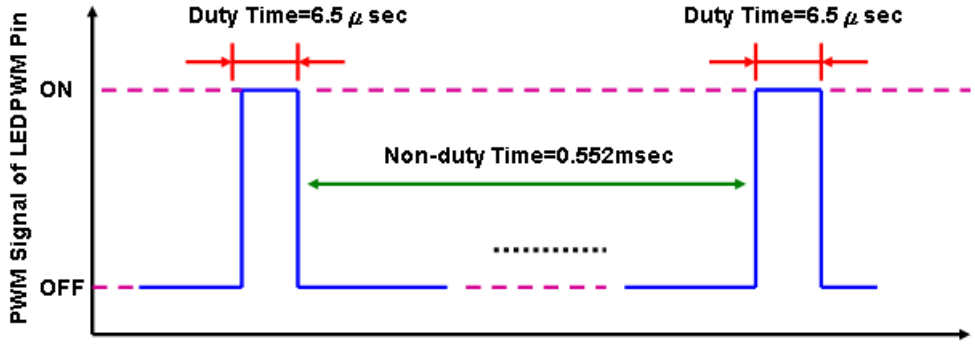
Register Bit “PWMF”	PWM Operation Freqency- “Fosc”	Real PWM Frequency
0	5.5 MHz	5.5 MHz/(256×PWMDIV[7.0])
1	11 MHz (Default)	11MHz/(256×PWMDIV[7.0])

For Example: If the “PWMDIV[7 : 0]” = 0Ch, and “PWMF” = “0”, then:
In this condition, when PWM duty is estimated as “3” , then the duty time of the PWM Signal can be estimated as shown in below:

PWM Duty Time= (3/256) × (1/1.79KHz) ≒ 6.54 μsec

PWM Non-duty Time= [(256-3)/256] × (1/1.79KHz) ≒ 0.552 msec

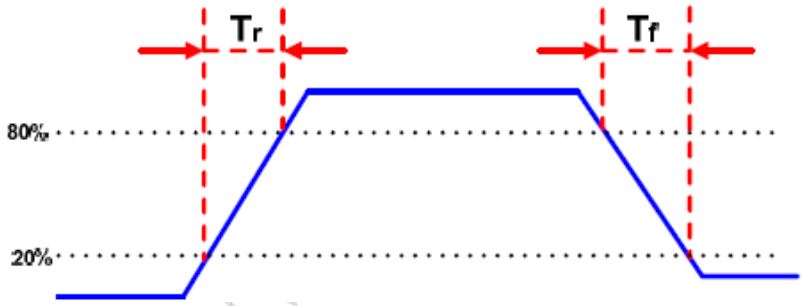
The above duty calculations can be illustrated in below for detailed:



In the other way, there are some registers are simply introduced in below (See the chapter 6 for details):

DBV[7 : 0]: Writing this register in address 5100h is used to adjust the backlight brightness value when LABC function is disabled (means the register bit "A" is set as "0").

Note: The rising time (Tr) and falling time (Tf) of the "LED_PWM" signal are stipulated to be equal to or less than 15ns.



(b) CABC(Content Adaptive Brightness Control (CABC)

A Content Adaptive Brightness Control (CABC) function can be used to reduce the power consumption of the luminance source. Content adaptation means that content grey level scale can be increased while simultaneously decreasing brightness of the backlight to achieve same perceived brightness. The adjusted grey level scale and thus the power consumption reduction depend on the content of the image.

See command "Write Content Adaptive Brightness Control (5500h)" (CABC_COND[1 : 0]) for more information.

These four modes are described as:

- Off Mode:

Content Adaptive Brightness Control functionality is completely turn-off. In this mode, panel will use the original Gamma 2.2 registers setting for display. And if the function of "forced PWM duty" is turn-off (i.e."FORCE_CABC_PWM" is set as '0'), the PWM duty of the "LEDPWM" pin is 100%.

-Still Picture Mode (Still Mode):

This mode is used to gain a better display quality for still picture. Some image quality degradation would be acceptable. Ideal power consumption reduction ratio is more than 30%. The panel will automatically estimate a better gamma setting and PWM duty based on different image contents, so the reduction ratio of the power consumption of backlight is not a constant ratio, this ratio will vary between 10% ~ 40% with different image contents.

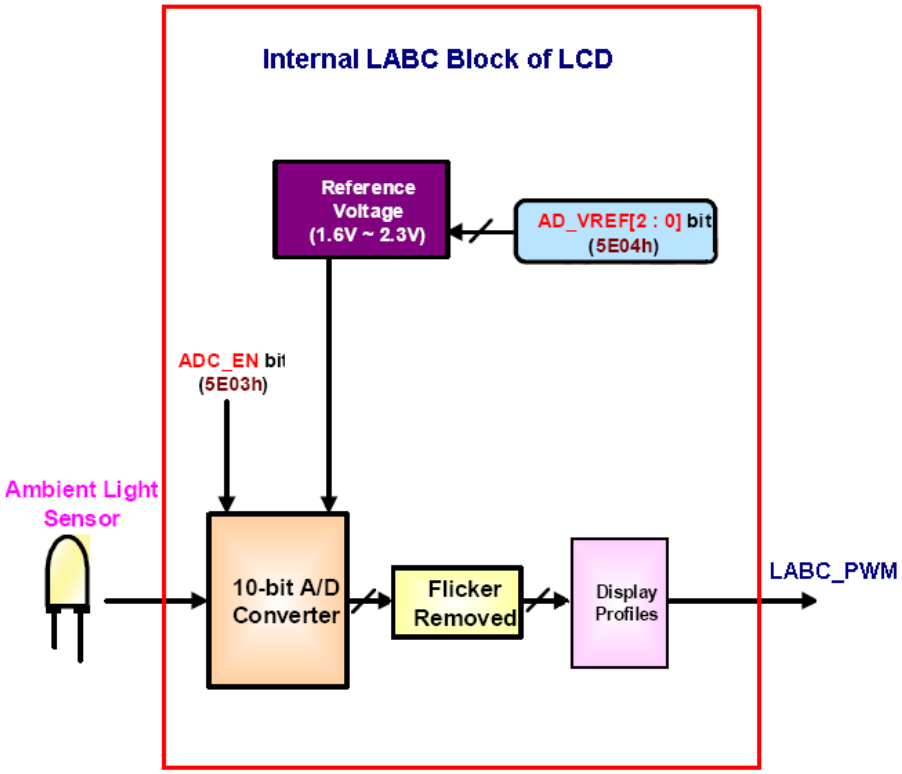
- Moving Image Mode (Moving Mode):

User can select this mode to keep the moving image quality and reduce the power consumption of backlight. It is focused on the biggest power reduction with image quality

degradation. Idea power consumption reduction ratio is more than 30%.

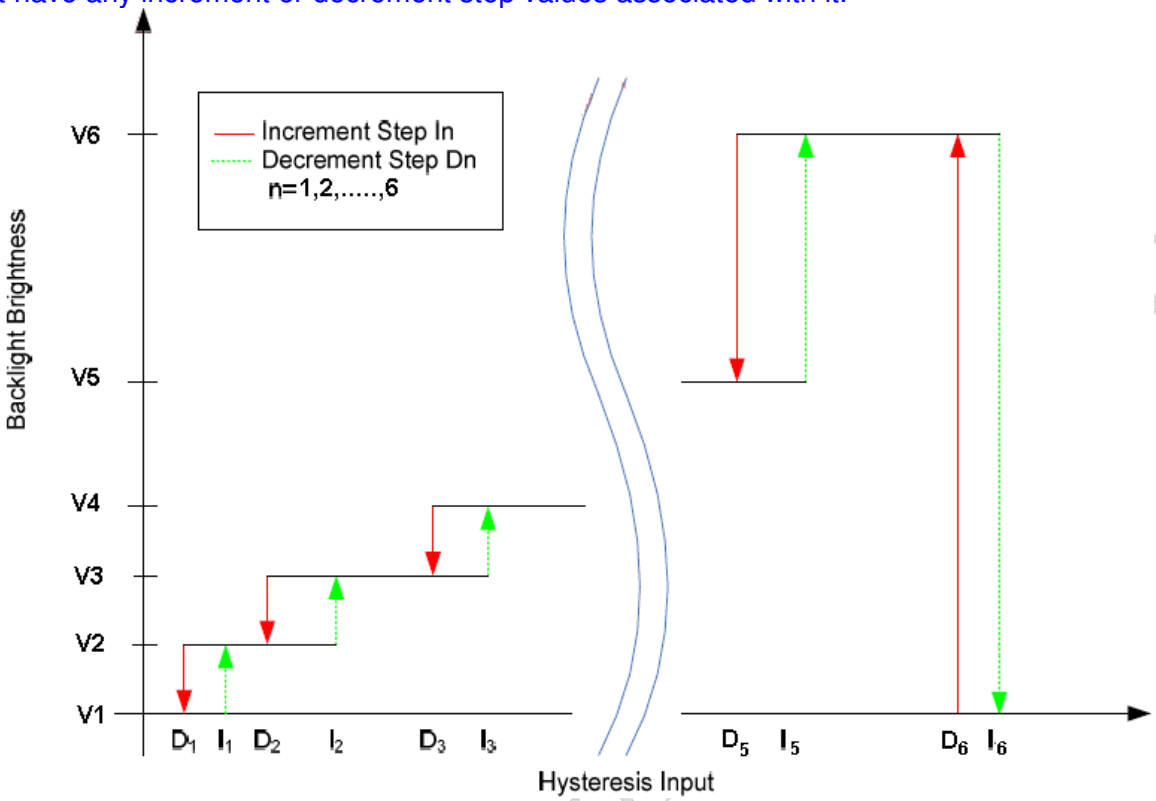
(c) Light Sensor based Automatic Backlight Control (LABC)

The LABC function of NT35582, includes several function blocks and is illustrated in below diagram:



The diagram of LABC function

The below diagram shows a graph of hysteresis input value vs. display backlight output for an arbitrary hysteresis curve. For this graph, step 5 is before the last step in the current profile, and so doesn't have any increment or decrement step values associated with it.



The graph of hysteresis input value vs. display backlight output

This curve can be split into two separate cases, one for increasing input, and the other for decreasing input. Once the hysteresis is known to be increasing or decreasing, the diagram shown in above can be separated into the two curves. Once the correct graph is chosen, it is relatively simple to go through each of the levels in turn, checking against the increment or decrement values as necessary.

The following table is specified the relationship between each parameters and step number using 6 steps (6 increment and 6 decrement) for hysteresis 6.

Step Number (n)	Increment Value (In)	Decrement Value (Dn)	Display Brightness (Vn)
1	60 (003Ch)	40 (0028h)	20 (14h)
2	264 (0108h)	224 (00E0h)	40 (28h)
3	400 (0190h)	320 (0140h)	80 (50h)
4	560 (0230h)	520 (0208h)	130 (82h)
5	764 (02FCh)	684 (02ACh)	200 (C8h)
6	1023 (3FFh)	1023 (3FFh)	255 (FFh)

5. Electrical AC Characteristics for Touch Function

a. Absolute Maximum Ratings

Items	Symbol	Values		Unit	Condition
		Min.	Max.		
Touch Panel Power Voltage	VDD_TP	-0.3	4.5	V	
Touch Panel Input Signal Voltage	VI_TP	-0.3	VDD_TP+0.3	V	

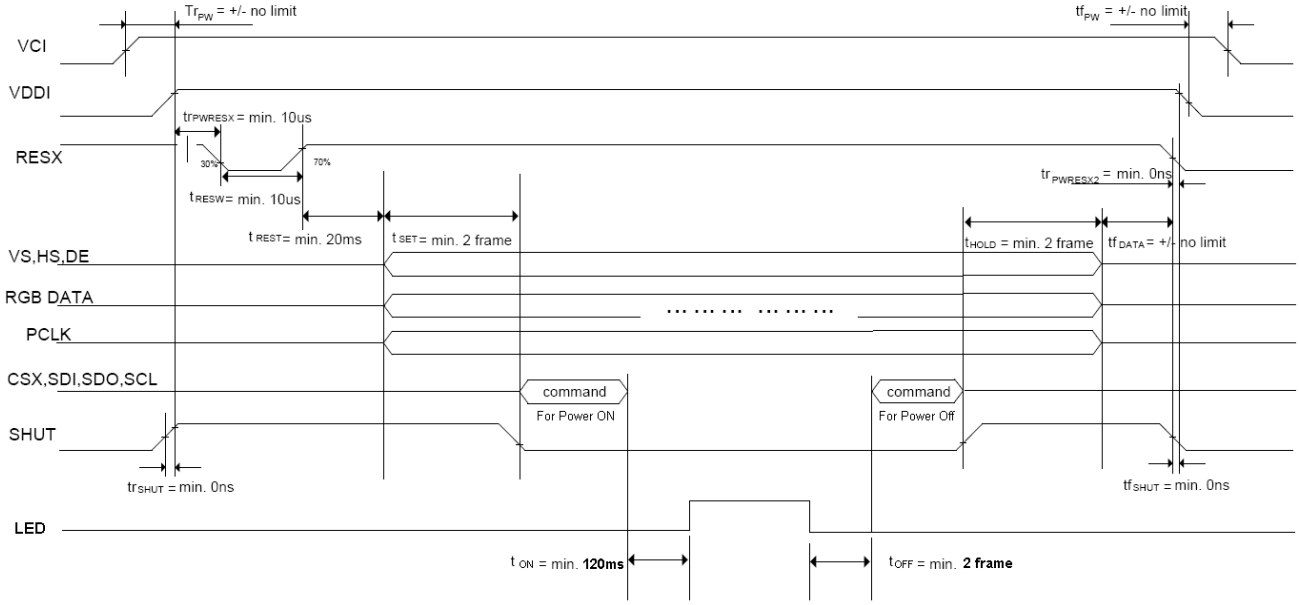
b. Electrical Characteristics

Parameter	Symbol	Min	Typ	Max	Unit	Notes
Touch Panel Power Supply	VDD_TP	1.8	2.8	3.6	V	
Touch Panel Input Signal Voltage	Vih_TP	0.8* VDD_TP	--	VDD_TP+0.3	V	
	Vil_TP	GND-0.3	--	0.2* VDD_TP	V	
Touch Panel Output Signal Voltage	Voh_TP	VDD_TP-0.7		VDD_TP		
	Vol-TP	GND		0.5		
Touch Function Sensing Rate	f_{TP}		60		Hz	Internally fixed

6. Power On/Off Characteristics

a. Recommended Power On/Off Sequence

The LCD adopts high voltage driver IC, so it could be permanently damaged under a wrong power on/off sequence. The suggested LCD power sequence is below:



7. Command Register Map

a. COMMAND DESCRIPTIONS

Addr.	Instruction	D15~D08	D07	D06	D05	D04	D03	D02	D01	D00
(1000h)	ENTER_SLEEP_MODE	-	-	-	-	-	-	-	-	-
(1100h)	EXIT_SLEEP_MODE	-	-	-	-	-	-	-	-	-
(2800h)	SET_DISPLAY_OFF	-	-	-	-	-	-	-	-	-
(2900h)	SET_DISPLAY_ON	-	-	-	-	-	-	-	-	-
(3600h)	SET_ADDRESS_MODE	-	0	0	0	0	0	0	CRL	CTB

Addr.	Instruction	D15~D08	D07	D06	D05	D04	D03	D02	D01	D00
(C000h)	PWCTR1	-	VGMP[7]	VGMP[6]	VGMP[5]	VGMP[4]	VGMP[3]	VGMP[2]	VGMP[1]	VGMP[0]
(C002h)	PWCTR2	-	VGMN[7]	VGMN[6]	VGMN[5]	VGMN[4]	VGMN[3]	VGMN[2]	VGMN[1]	VGMN[0]
(C100h)	PWCTR3		-	VGCLKA[2]	VGCLKA[1]	VGCLKA[0]	BTHA[1]	BTHA[0]	BTLA[1]	BTLA[0]
(C200h)	PWCTR4	-	-	VBPA[2]	VBPA[1]	VBPA[0]	-	-	BTPA[1]	BTPA[0]
(C202h)	PWCTR5	-	-	VBNA[2]	VBNA[1]	VBNA[0]	-	-	BTNA[1]	BTNA[0]
(C700h)	VCOM	-	VM[7]	VM[6]	VM[5]	VM[4]	VM[3]	VM[2]	VM[1]	VM[0]

Addr.	Instruction	D15~D08	D07	D06	D05	D04	D03	D02	D01	D00
(5000h)	WRPFD	-	STEP_OUTDP0[7]	STEP_OUTDP0[6]	STEP_OUTDP0[5]	STEP_OUTDP0[4]	STEP_OUTDP0[3]	STEP_OUTDP0[2]	STEP_OUTDP0[1]	STEP_OUTDP0[0]
(5001h)		-	STEP_OUTDP1[7]	STEP_OUTDP1[6]	STEP_OUTDP1[5]	STEP_OUTDP1[4]	STEP_OUTDP1[3]	STEP_OUTDP1[2]	STEP_OUTDP1[1]	STEP_OUTDP1[0]
(5002h)		-	STEP_OUTDP2[7]	STEP_OUTDP2[6]	STEP_OUTDP2[5]	STEP_OUTDP2[4]	STEP_OUTDP2[3]	STEP_OUTDP2[2]	STEP_OUTDP2[1]	STEP_OUTDP2[0]
(5003h)		-	STEP_OUTDP3[7]	STEP_OUTDP3[6]	STEP_OUTDP3[5]	STEP_OUTDP3[4]	STEP_OUTDP3[3]	STEP_OUTDP3[2]	STEP_OUTDP3[1]	STEP_OUTDP3[0]
(5004h)		-	STEP_OUTDP4[7]	STEP_OUTDP4[6]	STEP_OUTDP4[5]	STEP_OUTDP4[4]	STEP_OUTDP4[3]	STEP_OUTDP4[2]	STEP_OUTDP4[1]	STEP_OUTDP4[0]
(5005h)		-	STEP_OUTDP5[7]	STEP_OUTDP5[6]	STEP_OUTDP5[5]	STEP_OUTDP5[4]	STEP_OUTDP5[3]	STEP_OUTDP5[2]	STEP_OUTDP5[1]	STEP_OUTDP5[0]

Addr.	Instruction	D15~D08	D07	D06	D05	D04	D03	D02	D01	D00
(5300h)	WRCTRLD	0	0	0	BCTRL	A	DD	BL	0	0
(5301h)	CTRLEDPWM	0	0	0	0	PWM_ENH_OE	CLED_VOL	LEDPWPOL	LEDONPOL	LEDONR
(5302h)	DDL	0	0	0	0	0	0	0	0	DDL
(5500h)	WRCABC	0	0	0	0	0	0	0	CABC_COND[1]	CABC_COND[0]

Addr.	Instruction	D15~D08	D07	D06	D05	D04	D03	D02	D01	D00

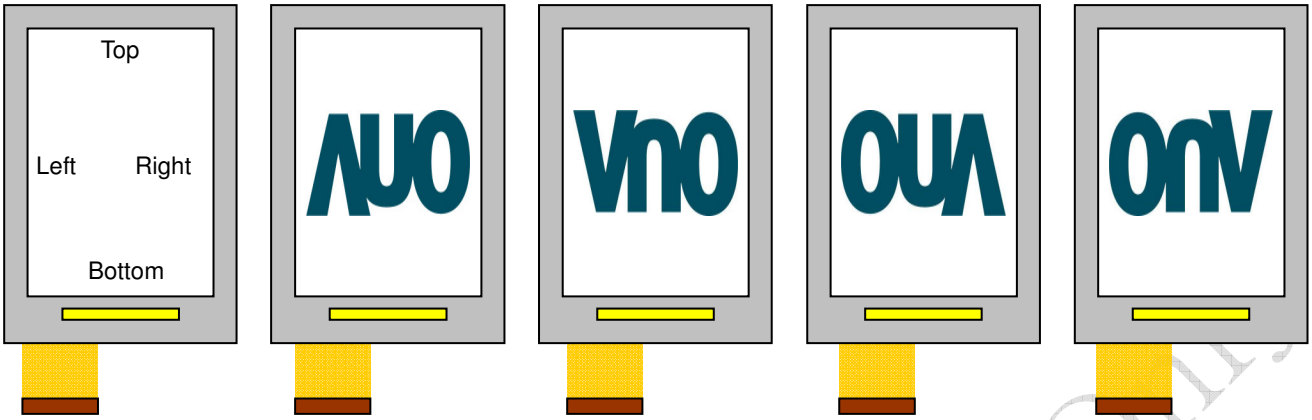
(5700h)	WRHYSTE	-	IO1[15 : 8]
(5701h)		-	IO1[7 : 0]
(5702h)		-	D01[15 : 8]
(5703h)			DO1[7 : 0]
⋮		⋮	⋮
(5714h)		-	IO5[15 : 8]
(5715h)		-	IO5[7 : 0]
(5716h)		-	D06[15 : 8]
(5717h)		-	IO6[7 : 0]

Addr.	Instruction	D15~D08	D07	D06	D05	D04	D03	D02	D01	D00
(5300h)	WRCTRLD	-	0	0	BCTRL	A	DD	BL	0	0
(5E03h)	LABC_CTRL		0	0	0	SR_SEL	0	1	0	ADC_EN
(5E04h)	AD_VREF	-	0	0	0	0	0	AD_VREF [2]	AD_VREF [1]	AD_VREF [0]
(6A01h)			PWMF	0	0	PWM_DUTY_OFFSET[4]	PWM_DUTY_OFFSET[3]	PWM_DUTY_OFFSET[2]	PWM_DUTY_OFFSET[1]	PWM_DUTY_OFFSET[0]
(6A02h)			PWMDIV[7]	PWMDIV[6]	PWMDIV[5]	PWMDIV[4]	PWMDIV[3]	PWMDIV[2]	PWMDIV[1]	PWMDIV[0]

SET_ADRESS_MODE : LCD refresh direction control.

(3600h)	D15~D08	D07	D06	D05	D04	D03	D02	D01	D00
	-	0	0	0	0	0	0	CRL	CTB

CTB: Selects the vertical scanning direction of the display.
When CTB = “0”, the scanning direction is from top to bottom.
When CTB = “1”, the scanning direction is from bottom to top.
CRL: Selects the horizontal scanning direction of the display.
When CRL = “0”, the scanning direction is from right to left.
When CRL = “1”, the scanning direction is from left to right.
Note:
1. When the display surface is upward, “top”, “bottom”, “left” and “right” are defined as in the picture below:



CTB = “0“
CRL = “0“

CTB = “1“
CRL = “0 “

CTB = “0“
CRL = “1“

CTB = “1“
CRL = “1 “

2. Please refer to our recommended register settings section for better performance.

WRPFD‥ Write Profile Values for Display (5000h~500Fh)

Addr.	D15~D08	D07	D06	D05	D04	D03	D02	D01	D00
(5000h)	0	STEP_OUTDP0[7]	STEP_OUTDP0[6]	STEP_OUTDP0[5]	STEP_OUTDP0[4]	STEP_OUTDP0[3]	STEP_OUTDP0[2]	STEP_OUTDP0[1]	STEP_OUTDP0[0]
(5001h)	0	STEP_OUTDP1[7]	STEP_OUTDP1[6]	STEP_OUTDP1[5]	STEP_OUTDP1[4]	STEP_OUTDP1[3]	STEP_OUTDP1[2]	STEP_OUTDP1[1]	STEP_OUTDP1[0]
(5002h)	0	STEP_OUTDP2[7]	STEP_OUTDP2[6]	STEP_OUTDP2[5]	STEP_OUTDP2[4]	STEP_OUTDP2[3]	STEP_OUTDP2[2]	STEP_OUTDP2[1]	STEP_OUTDP2[0]
(5003h)	0	STEP_OUTDP3[7]	STEP_OUTDP3[6]	STEP_OUTDP3[5]	STEP_OUTDP3[4]	STEP_OUTDP3[3]	STEP_OUTDP3[2]	STEP_OUTDP3[1]	STEP_OUTDP3[0]
(5004h)	0	STEP_OUTDP4[7]	STEP_OUTDP4[6]	STEP_OUTDP4[5]	STEP_OUTDP4[4]	STEP_OUTDP4[3]	STEP_OUTDP4[2]	STEP_OUTDP4[1]	STEP_OUTDP4[0]
(5005h)	0	STEP_OUTDP5[7]	STEP_OUTDP5[6]	STEP_OUTDP5[5]	STEP_OUTDP5[4]	STEP_OUTDP5[3]	STEP_OUTDP5[2]	STEP_OUTDP5[1]	STEP_OUTDP5[0]

This command is used to define Profile Values for display.
Default : 5000h~5005h

D15~D08	D07	D06	D05	D04	D03	D02	D01	D00
0	1	1	1	1	1	1	1	1

WRDISBV: Write Display Brightness (5100h)

Addr.	D15~D08	D07	D06	D05	D04	D03	D02	D01	D00
(5100h)	0	DBV7	DBV6	DBV5	DBV4	DBV3	DBV2	DBV1	DBV0

This command is used to adjust or return the brightness value of the display.
In principle relationship is that 00h value means the lowest brightness and FFh value means the highest brightness.

DBV[7:0]	PWM Duty
00	Off (Default)
01	2/256

02	3/256
: : :	: : :
FE	255/256
FF	1

Default : 5100h

D15~D08	D07	D06	D05	D04	D03	D02	D01	D00
0	0	0	0	0	0	0	0	0

WRCTRLD: Write CTRL Display (5300h)

Addr.	D15~D08	D07	D06	D05	D04	D03	D02	D01	D00
(5300h)	0	0	0	BCTRL	A	DD	BL	0	0

This command is used to control the “LEDPWM” pin, dimming function for CABC, ambient light sensing, and LABC mode switching.
BCTRL: Turn On/Off the brightness control block with thedimming effect.
About the registor “LEDPWPOL”, please refer to the register “CTRLEDPWM(5301h)”

BCTRL	LEDPWPOL	LEDPWM Pin Final State	Backlight Final State
0	0	Keep “LOW” (0% PWM Duty) (Default)	OFF
1	0	PWM Output (High level is duty)	ON
0	1	Keep “High” (0% PWM Duty)	OFF
1	1	Inversed PWM Output(Low level is duty)	ON

A: This command is used to control ambient light, brightness and gamma setting.

A	Ambient Light Sensing
0	OFF (Ambient Light Sensing OFF) (Default)
1	ON (Ambient Light Sensing ON)

DD: Enable/Disable dimming function only for CABC

DD	CABC Dimming Function
0	Disable
1	Enable(Default)

BL: Turn On/Off the backlight control without dimming effect

BL	Backlight Control
0	OFF
1	ON(Default)

When BL bit change from “1” to “0”, backlight is turned off without gradual dimming, even if timming-on(DD= “1”) are selected.

Default : 5300h

D15~D08	D07	D06	D05	D04	D03	D02	D01	D00
0	0	0	0	0	1	0	0	0

CTRLEDPWM: Set the States for LED Control Pins (5301h)

Addr.	D15~D08	D07	D06	D05	D04	D03	D02	D01	D00
(5301h)	0	0	0	0	PWM_ENH_OE	CLED_VOL	LEDPWPOL	LEDONPOL	LEDONR

This command is used to set states for LED control pins.

LEDONR: Turn On/Off the LEDON pin

BCTRL	LEDPWPOL	LEDON Pin Final State
0	0	Keep “LOW” (Default)
1	0	Keep “High”
0	1	Keep “High”
1	1	Keep “LOW”

LEDPWPOL: Set the PWM active polarity for external LED driver control

LEDPWPOL	Polarity of LEDPWM Pin	
	Lit period	Non-lit-period
0	High	Low
1	Low	High

In other words, **LEDPWPOL = “1”** is suitable setting for “Low-Active” LED driver IC.

LEDONPOL: Set the enable active polarity for external LED driver control

LEDPWPOL	Polarity of LEDON Pin	
	Lit period	Non-lit-period
0	High	Low
1	Low	High

In other words, **LEDONPOL = “1”** is suitable setting for “Low-Active” LED driver IC.

CLED_VOL: Set the logic voltage level for LEDPWM and LEDON pins

CLED_VOL	Logic Voltage Level for LEDPWM and LEDON
0	LEDPWM: Logic voltage level is VDDI <-> 0V
	LEDON: Logic voltage level is VDDI <-> 0V
1	LEDPWM: Logic voltage level is VCI <-> 0V
	LEDON: Logic voltage level is VCI <-> 0V

PWM_ENH_OE: This setting is used to enhance the driving ability of “LEDPWM” pin.

PWM_ENH_OE	Logic Voltage Level for LEDPWM and LEDON
0	1X driving ability of LEDPWM pin (Default)
1	2X driving ability of LEDPWM pin

Default : 5301h

D15~D08	D07	D06	D05	D04	D03	D02	D01	D00
0	0	0	0	0	0	0	0	0

CTRLDIM_L: Turn On/Off the Dimming Function for LABC (5302h)

Addr.	D15~D08	D07	D06	D05	D04	D03	D02	D01	D00
(5302h)	0	0	0	0	0	0	0	0	DDL

This command is used to disable/enable the dimming function for LABC

DDL: Turn On/Off the dimming function for LABC

DDL	Dimming Function for LABC
0	Disable
1	Enable (Default)

Default : 5302h

D15~D08	D07	D06	D05	D04	D03	D02	D01	D00
0	0	0	0	0	0	0	0	1

WRCABC: Write Content Adaptive Brightness Control (5500h)

Addr.	D15~D08	D07	D06	D05	D04	D03	D02	D01	D00
(5500h)	0	0	0	0	0	0	0	CABC_COND[1]	CABC_COND[0]

This command is used to set parameters for image content based adaptive brightness control functionality.

There is possible to use 3 different modes for content adaptive image functionality, which are defined on the table below.

CABC_COND[1:0]		LEDON Pin Final State
0	0	Off (Default)
0	1	-
1	0	Still Picture Image
1	1	Moving Image

Default : 5500h

D15~D08	D07	D06	D05	D04	D03	D02	D01	D00
0	0	0	0	0	0	0	0	0

WRHYSTE‥ Write Increment / Decrement Hysteresis (5700h~5717H)

Addr.	D15~D08	D07	D06	D05	D04	D03	D02	D01	D00
(5700h)	0	I01[15 : 8]							
(5701h)	0	I01[7 : 0]							
(5702h)	0	D01[15 : 8]							
(5703h)		D01[7 : 0]							
: :	: :	: :							
(5714h)	0	I05[15 : 8]							
(5715h)	0	I05[7 : 0]							
(5716h)	0	D06[15 : 8]							
(5717h)	0	I06[7 : 0]							

This command is used to define Hysteresis filter function.
I01[15 : 0] ~ I16[15 : 0] define increment values.
D01[15 : 0] ~ D16[15 : 0] define decrement values.
Although I01[15 : 0] ~ I6[15 : 0] and D01[15 : 0] ~ D6[15 : 0] are all 16-bit length registers, **the valid value range is 0 ~ 1023 (0000h ~ 03FFh), not 0 ~ 65535 (0000h ~ FFFFh).**
In other words, user don't care about the parameter values after "1023 (03FFh)".
I6[15 : 0] bits is always set to 1023 (03FFh)" internally, if I5[15 : 0] bits is still valid and less than "1023 (03FFh)".

Default : I01[15 : 0] ~ I06[15 : 0], D01[15 : 0 ~ D06[15 : 0]

D15	D14	D13	D12	D11	D10	D09	D08

0	0	0	0	0	0	1	1
D07	D06	D05	D04	D03	D02	D01	D00
1	1	1	1	1	1	1	1

LABC_CTRL: Control the Internal Function Block of LABC (5E03h)

Addr.	D15~D08	D07	D06	D05	D04	D03	D02	D01	D00
(5E03h)	0	0	0	0	SR_SEL	0	1	0	ADC_EN

This command is used to set the internal function block of LABC.

ADC_EN: Enable or disable the internal A/D converter

ADC_EN	A/D Converter
0	Disable
1	Enable

SR_SEL: Select the sample rate for internal A/D converter.

SR_SEL	Sample rate for Internal A/D Converter
0	110Hz
1	220Hz

Default : 5E03h

D15~D08	D07	D06	D05	D04	D03	D02	D01	D00
0	0	0	0	0	0	0	0	0

AD_VREF: Select The Reference Voltage For Internal A/D Converter (5E04h)

Addr.	D15~D08	D07	D06	D05	D04	D03	D02	D01	D00
(5E04h)	0	0	0	0	0	0	AD_VREF[2:0]		

This command is used to set the reference voltage for internal A/D converter.

AD_VREF[2 : 0]	Reference Voltage For Internal A/D Converter
0x00	1.6V
0x01	1.7V
0x02	1.8V(Default)
0x03	1.9V
0x04	2.0V
0x05	2.1V
0x06	2.2V
0x07	2.3V

Default : 5E04h

D15~D08	D07	D06	D05	D04	D03	D02	D01	D00
0	0	0	0	0	0	0	1	0

PWMSET: PWM Duty And Frequency Control (6A01h)

Addr.	D15~D08	D07	D06	D05	D04	D03	D02	D01	D00

(6A01h)	0	PWMF	0	0	PWM_DUTY_OFFSET[4:0]

This command is used to set duty offset and select the internal frequency source for generating PWM signal.

PWMF : Select the internal frequency source FOSC for generating the PWM signal.

PWMF	Internal Frequency Source FOSC For Generating PWM Signal
0	5.5MHz (Default)
1	11MHz

PWM_DUTY_OFFSET[4 : 0] : Compensate the effective PWM duty from +0 to +31.

PWM_DUTY_OFFSET[4:0]	PWM_DUTY_OFFSET
0x00	+0 (Default)
0x01	+1
0x02	+2
:	:
:	:
:	:
0x1D	+29
0x1E	+30
0x1F	+31

Default : 6A01h

D15~D08	D07	D06	D05	D04	D03	D02	D01	D00
0	0	0	0	0	0	0	1	0

WRPWMF: Write PWM Frequency (6A02h)

Addr.	D15~D08	D07	D06	D05	D04	D03	D02	D01	D00
(6A02h)	0	PWMDUTY[7:0]							

This command is used to set PWM frequency.
The PWM frequency is determined by below formula:

PWM Frequency = Fosc / (256×PWMDIV[7.0])

where the FOSC can be selected by setting register bit “PWMF”.

PWMF	Internal Frequency Source FOSC For Generating PWM Signal
0	5.5MHz (Default)
1	11MHz

If “PWMF” = “0”, then the FOSC = 5.5 MHz, and:

PWM Frequency = Fosc / (256×PWMDIV[7.0]) = 5.5 MHz / (256×PWMDIV[7.0])

And if “PWMF” = “1”, then the FOSC = 11 MHz, so:

PWM Frequency = Fosc / (256×PWMDIV[7.0]) = 11 MHz / (256×PWMDIV[7.0])

PWMF = "0"		PWMF = "1"	
PWMDIV[7:0]	PWM Frequency	PWMDIV[7:0]	PWM Frequency
0x00	Setting Disabled	0x00	Setting Disabled
0x01	21.48 KHz (Default)	0x01	42.97 KHz
0x02	10.74 KHz	0x02	21.48 KHz
0x03	7.16 KHz	0x03	14.32 KHz
:	:	:	:
0x56	249.82Hz	0x56	499.64Hz
:	:	:	:
0xFE	84.58Hz	0xFE	169.17Hz
0xFF	84.25Hz	0xFF	168.5Hz

Default : 6A02h

D15~D08	D07	D06	D05	D04	D03	D02	D01	D00
0	0	0	0	0	0	0	0	1

8. Command Register Map

a. Recommended Power On Register Setting

Number	Address	Data	Description
1	C000h	8Ah	Power Control 1
2	C001h	00h	Power Control 1
3	C002h	8Ah	Power Control 1
4	C003h	00h	Power Control 1
5	C100h	40h	Power Control 2
6	C200h	02h	Power Control 3
7	C202h	32h	Power Control 3
8	1100h	-	EXIT_SLEEP_MODE
Wait for more than 120ms			
9	2900h	-	SET_DISPLAY_ON

b. Recommended Power Off Register Setting

Number	Address	Data	Description
1	2800h	-	SET_DISPLAY_OFF
2	1000h	-	ENTER_SLEEP_MODE

c. Recommended CABC On Register Setting

Number	Address	Data
1	5300h	2Ch
2	5500h	03h

d. Recommended CABC Off Register Setting

Number	Address	Data
1	5300h	24h

e. Recommended LABC On Register Setting

Number	Address	Data
1	5300h	34h
2	5E03h	15h
3	5000h	14h
4	5001h	28h
5	5002h	50h

6	5003h	82h
7	5004h	C8h
8	5005h	FFh
9	5700h	00h
10	5701h	3Ch
11	5704h	01h
12	5705h	08h
13	5708h	01h
14	5709h	90h
15	570Ch	02h
16	570Dh	30h
17	5710h	02h
18	5711h	FCh
19	5714h	03h
20	5715h	FFh
21	5702h	00h
22	5703h	28h
23	5706h	00h
24	5707h	E0h
25	570Ah	01h
26	570Bh	40h
27	570Eh	02h
28	570Fh	08h
29	5712h	02h
30	5713h	ACh
31	5716h	03h
32	5717h	FFh

f. Recommended LABC Off Register Setting

Number	Address	Data
1	5300h	24h

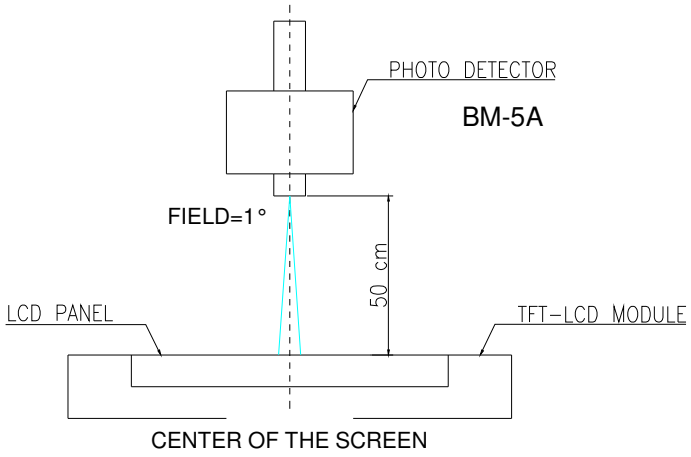
D. Optical Specification

All optical specification is measured under typical condition (Note 1, 2)

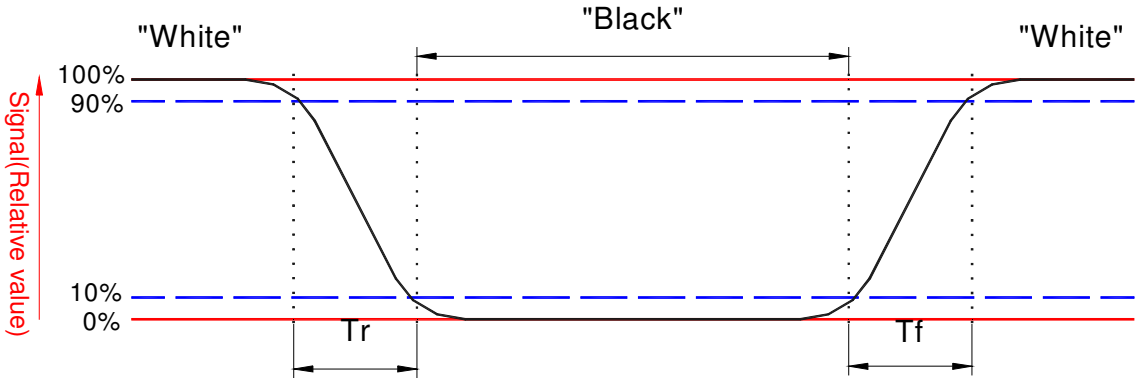
Item	Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Response Time Rise Fall	 Tr Tf	θ=0°	 -- --	 20 15	 35 35	 ms ms	Note 3
Contrast ratio	CR	At optimized viewing angle	640	800	--		Note 4
Viewing Angle Top Bottom Left Right		CR≧10	 40 40 40 40	 50 50 50 50	 -- -- -- --	deg.	Note 5
Brightness	Y_L	θ=0°	320	400	--	cd/m^2	Note 6

Note 1: Measured under Ambient temperature =25℃, and LED lightbar current I_L = 40mA in the dark room.

Note 2: To be measured on the center area of panel with a viewing cone of 1° by Topcon luminance meter BM-5A, after 15 minutes operation.



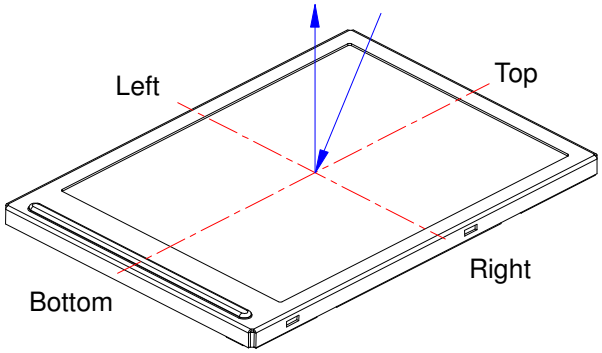
Note 3: Definition of response time:
The output signals of photo detector are measured when the input signals are changed from “black” to “white” (falling time) and from “white” to “black” (rising time), respectively.
The response time is defined as the time interval between the 10% and 90% of amplitudes. Refer to figure as below.



Note 4.Definition of contrast ratio:
Contrast ratio is calculated with the following formula.

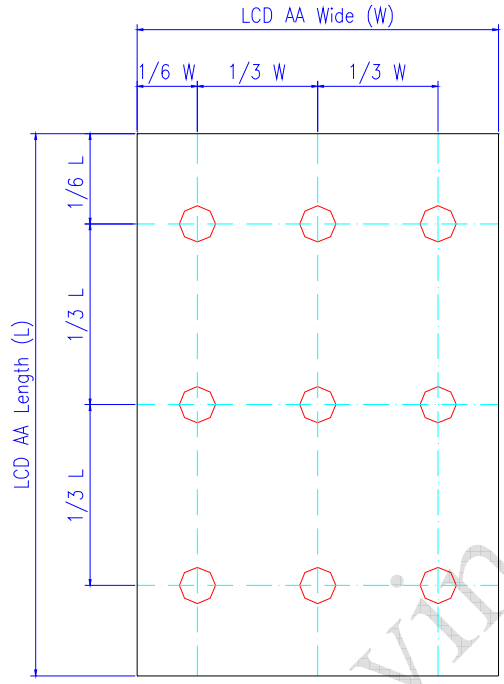
$$\text{Contrast ratio (CR)} = \frac{\text{Photo detector output when LCD is at "White" status}}{\text{Photo detector output when LCD is at "Black" status}}$$

Note 5. Definition of viewing angle, θ, Refer to figure as below.



Note 6: Measured at average of 9 points area of the panel when all the input terminals of LCD panel are electrically opened.

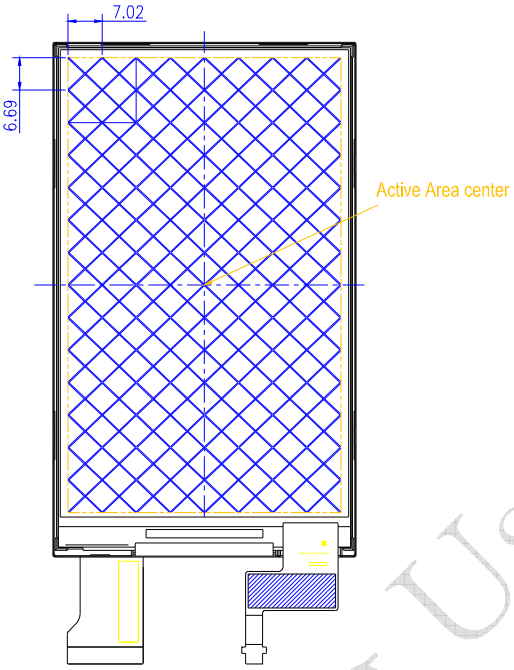
Note 7: Luminance Uniformity of these 9 points is defined as



below:

$$\text{Uniformity} = \frac{\text{minimum luminance in 9 points (1-9)}}{\text{maximum luminance in 9 points (1-9)}}$$

8. T/P ITO Drawing

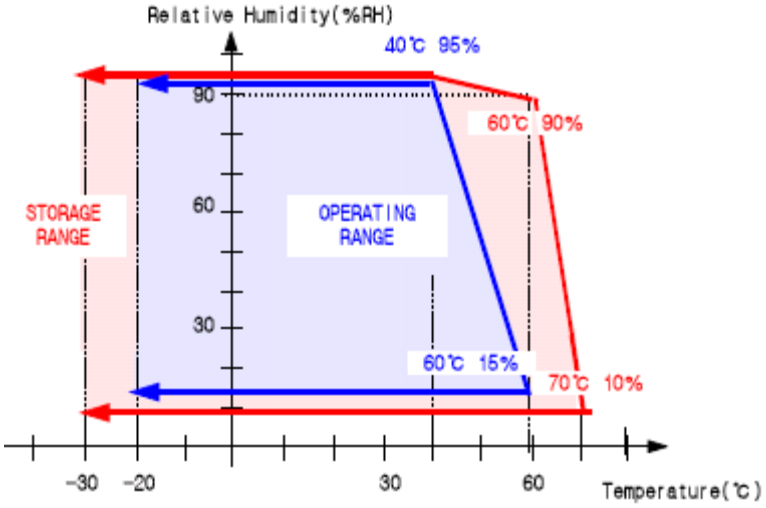


Note. 1. T/P resolution 800*480. 2. Refreshes data up to 60 times/sec by default.

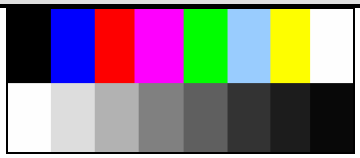
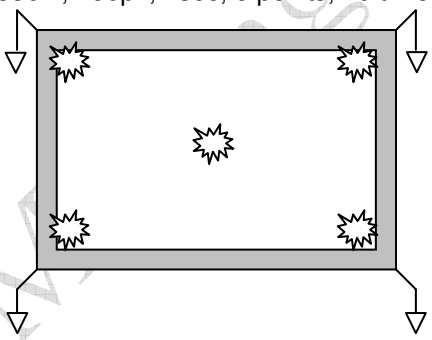
E. Reliability Test Items

No.	Test items	Conditions		Remark
1	High Temperature Storage	Ta= 85℃	240Hrs	
2	Low Temperature Storage	Ta= -40℃	240Hrs	
3	High Temperature Operation	Tp= 70℃	240Hrs	
4	Low Temperature Operation	Ta= -30℃	240Hrs	
5	High Temperature & High Humidity	Tp= 60℃. 90% RH	240Hrs	Operation
6	Heat Shock	-40℃~85℃, 20 cycle,	18min/cycle	Non-operation
7	Electrostatic Discharge	Contact = ± 4 kV, class B Air = ± 8 kV, class B		Note 5
8	Vibration	Frequency range : 10~55Hz Stoke : 1.5mm Sweep : 10Hz~55Hz~10Hz 2 hours for each direction of X,Y,Z		Non-operation JIS C7021, A-10 condition A : 15 minutes
9	Mechanical Shock	100G . 6ms, ±X,±Y,±Z 3 times for each direction		Non-operation JIS C7021, A-7 condition C
10	Vibration (With Carton)	Random vibration: $0.015G^2$/Hz from 5~200Hz –6dB/Octave from 200~500Hz		IEC 68-34
11	Drop (With Carton)	Height: 60cm 1 corner, 3 edges, 6 surfaces		
12	Pressure	5kg, 5sec		Note 6
13	Flicker	-30Db(TBD)		
14	Image Sticking	85℃	8hrs	Note 7
15	NTSC	Min.45 %	Typ.50 %	

Note 1: Ta: Ambient Temperature. Tp: Panel Surface Temperature
Note 2: In the standard conditions, there should not have display function NG issue occurred.
Note 3: All the cosmetic specification is judged before the reliability stress.
Note 4: Temperature and relative humidity range are shown in the following figure.

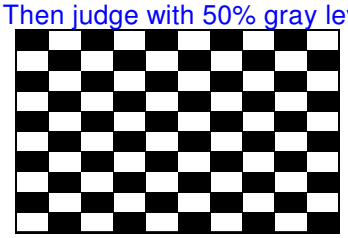


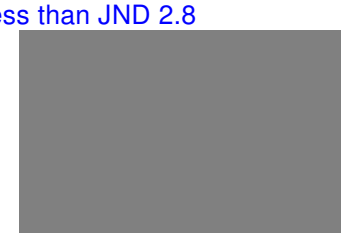
Note 5 : All test techniques follow IEC6100-4-2 standard.

Test Condition		Note
Pattern	 Color Bar + 8 Gray Scale	
Procedure And Set-up	Contact Discharge：330Ω, 150pF, 1sec, 5 points, 10 times/point Air Discharge：330Ω, 150pF, 1sec, 5 points, 10 times/point  Note : 1. The metal casing is connected to ground (0V) at four corners. 2. All register commands are repeating transferred. 3. Judge the result after discharging.	
Criteria	B – Some performance degradation allowed. No data lost. Self-recoverable hardware failure.	

Note 6: The panel is tested as figure. The jig is ϕ 10 mm made by Cu with rubber and the loading speed is 3mm/min on position A~E. After the condition, no glass crack will be found and panel function check is OK.(no guarantee LC mura、LC bubble)

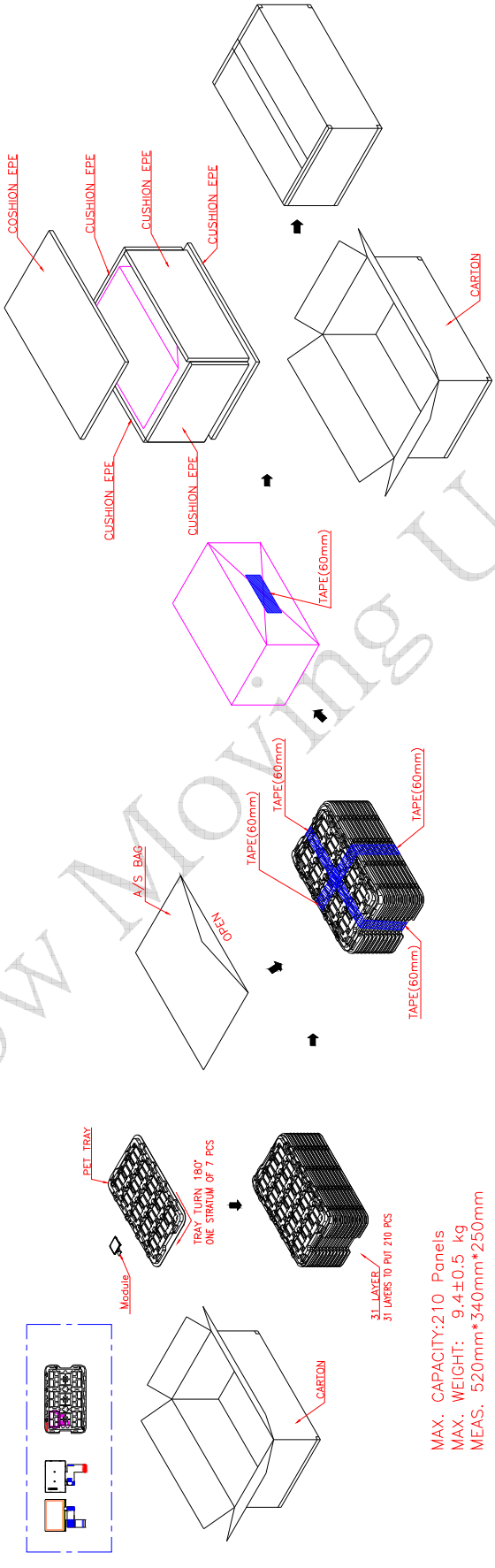
Note 7: Operate with chess board pattern as figure and lasting time and temperature as the conditions. Then judge with 50% gray level, the mura is less than JND 2.8





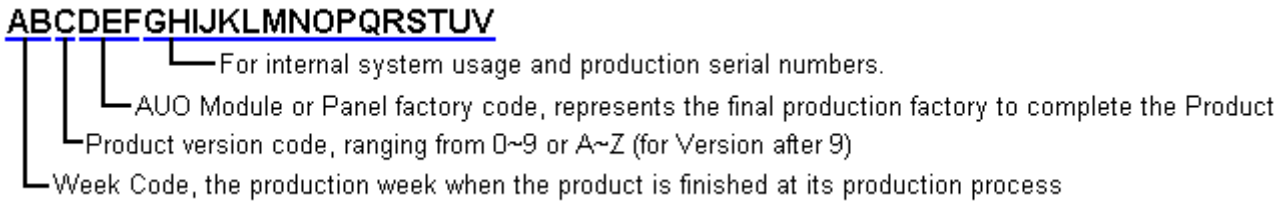
Packing and Marking

1. Packing Form



2. Module/Panel Label Information

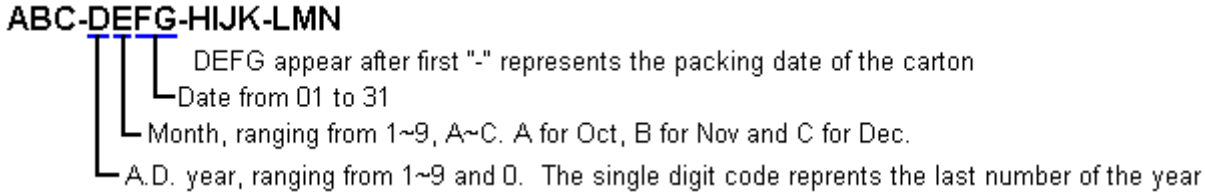
The module/panel (collectively called as the “Product”) will be attached with a label of Shipping Number which represents the identification of the Product at a specific location. Refer to the Product outline drawing for detailed location and size of the label. The label is composed of a 22-digit serial number with the following definition:



Example:
501M06ZL06123456781Z05:
Product Manufacturing Week Code: WK50
Product Version: Version 1
Product Manufactuing Factory: M06

3. Carton Label Information

The packing carton will be attached with a carton label where packing Q’ty, AUO Model Name, AUO Part Number, Customer Part Number (Optional) and a series of Carton Number in 13 or 14 digits are printed. The Carton Number is apparing in the following format:



Refer to the drawing of packing format for the location and size of the carton label.

F. Precautions

1. Do not twist or bend the module and prevent the unsuitable external force for display module during assembly.
2. Adopt measures for good heat radiation. Be sure to use the module with in the specified temperature.
3. Avoid dust or oil mist during assembly.
4. Follow the correct power sequence while operating. Do not apply the invalid signal, otherwise, it will cause improper shut down and damage the module.
5. Less EMI: it will be more safety and less noise.
6. Please operate module in suitable temperature. The response time & brightness will drift by different temperature.
7. Avoid to display the fixed pattern (exclude the white pattern) in a long period, otherwise, it will cause image sticking.
8. Be sure to turn off the power when connecting or disconnecting the circuit.
9. Polarizer scratches easily, please handle it carefully.
10. Display surface never likes dirt or stains.
11. A dewdrop may lead to destruction. Please wipe off any moisture before using module.
12. Sudden temperature changes cause condensation, and it will cause polarizer damaged.
13. High temperature and humidity may degrade performance. Please do not expose the module to the direct sunlight and so on.
14. Acetic acid or chlorine compounds are not friends with TFT display module.
15. Static electricity will damage the module, please do not touch the module without any grounded device.
16. Do not disassemble and reassemble the module by self.
17. Be careful do not touch the rear side directly.
18. No strong vibration or shock. It will cause module broken.
19. Storage the modules in suitable environment with regular packing.
20. Be careful of injury from a broken display module.
21. Please avoid the pressure adding to the surface (front or rear side) of modules, because it will cause the display non-uniformity or other function issue.