TFT-Display Datasheet

AUO
Model: G050VVN01.0

Brief spec.:

Main Feature	Portrait Type
	White LED Backlight
	Wide Viewing Angle

Active Screen Area	64.8 x 108 (mm)
Diagonal | Format	5" | 9:15
Resolution	480 x 800
Colors	16.7M (8-bit)
Backlight	LED, White
Brightness	450 cd/m²
LED Life Time	10.000 (Typ)
Interface	RGB
Viewing Angle	-80~80H), -80~80(V)
Touchscreen	No
Power Supply	3.3V (Typ.)
Module Outline	71.2 x 119.5 x 2.5 (mm)
Operation Temperature	-10... +70 °C
Storage Temperature	-20... +80 °C
Surface Treatment	Antiglare Hard Coating

□   **Preliminary Specification**

■   **Final Specification**

Module	5.0 Inch Color TFT-LCD
Model Name	G050VVN01.0

Customer	Date		Approved by	Date
			Grace Hung	2014/06/25
Checked & Approved by	Date		Prepared by	Date
			Elaine Hsu	2014/06/25
Note: This Specification is subject to change without notice.			General Display Business Division / AU Optronics corporation	

APPROVAL FOR SPECIFICATIONS ONLY (Spec. Ver. 1.4)
APPROVAL FOR SPECIFICATIONS AND ES SAMPLE (Spec. Ver. 1.4)
APPROVAL FOR SPECIFICATIONS AND CS SAMPLE (Spec. Ver. 1.4)
CUSTOMER REMARK :

Contents

Record of Revision

Version	Revise Date	Page	Old description
0.0	2013/4/19	-	First draft of preliminary specification.
0.1	2013/4/25	14,15	Modify 6.3 TFT- LCD Pin Assignment Description
0.2	2013/5/15	26	Modify FPC drawing of 8. Mechanical Characteristics
0.3	2013/7/18	5	Modify Outline Dimension
		11	Modify VCI max.voltage. (3.3V to 3.7V)
		18	Modify PCLK frequency. (cycle)
		19	Delete RGB mode 2 interface
		20	Update input timing setting
		22,23	Update Recommended Power On Register Setting
0.4	2013/8/30	5	Update 2.2 Display Characteristics – Typical Power Consumption
		11	Update 5.1 TFT-LCD Driving Condition – Power consumption
		17	Modify 6.4 Electrical AC Characteristics - (b) Write Mode
		26	Modify 8. Mechanical Characteristics
0.5	2013/9/23	10	Update 4.2 Absolute Ratings of Environment
		20	Modify (c) Vertical and horizontal timing
1.0	2013/11/25	6	Update 2.3 Optical Characteristics
		24, 25	Update 6.6 Command Descriptions b. Recommended Power On Register Setting c. Gamma Setting
		25	Modify 7. Reliability Test Criteria – ESD test condition
1.1	2014/01/08	14	Modify I/O symbol – pin 20 and 29
1.2	2014/04/21	27	Update Shipping Label
1.3	2014/05/12	5	Modify Temperature Range
		10	4.2 Absolute Ratings of Environment
		25	7. Reliability Test Criteria
1.4	2014/06/25	8	Modify Luminance uniformity formula
		27	Modify 9.3 Palletizing sequence

1. Operating Precautions

1) Display area (Polarizer) of TFT-LCD Module is easily to be damaged, please be cautious and not to scratch it.
2) Be sure to power off your machine before connecting or disconnecting your signal cable to TFT-LCD Module.
3) Wipe off water drop on display area immediately. Long contact with water may cause discoloration or spots.
4) When the panel surface is soiled, wipe it with absorbent cotton or soft cloth.
5) Display area (Glass) of TFT-LCD Module may be broken or cracked if bump Module against hard object.
6) To avoid ESD (Electro Static Discharge) damage, be sure to ground yourself before handling TFT-LCD Module.
7) Do not open nor modify the TFT-LCD module assembly.
8) Do not press the reflector sheet at the back of the module to any direction.
9) In case if TFT-LCD module has to be put back into the packing container slot after it was taken out from the container, do not press the center of the LED Reflector edge. Instead, press at the far ends of the LED Reflector edge softly. Otherwise the TFT-LCD Module may be damaged.
10) When inserting or removing of your signal cable to TFT-LCD Module, be sure not to apply abnormal force (rotate, tilt…etc.) to the Connector of the TFT-LCD Module.
11) TFT-LCD Module is not allowed to be twisted & bent even force is added on module in a very short time. Please design your display product well to avoid external force applying to module by end-user directly.
12) Small amount of materials without flammability grade are used in the TFT-LCD module. The TFT-LCD module should be supplied by power complied with requirements of Limited Power Source (IEC60950 or UL1950), or be applied exemption.
13) Severe temperature condition may result in different luminance, response time.
14) Continuous operating TFT-LCD Module under high temperature environment may accelerate LED light bar exhaustion and reduce luminance dramatically.
15) The data on this specification sheet is applicable when TFT-LCD module is placed in landscape position.
16) Continuous displaying fixed pattern may induce image sticking. It's recommended to use screen saver or moving content periodically if fixed pattern is displayed on the screen.

2. General Description

This specification applies to the 5.0 inch color TFT LCD with MVA technology module G050VVN01.0. It composed of a TFT-LCD panel, driver ICs, FPC with power supply circuit and backlight unit.

The screen format is intended to support the WVGA (480(H) x 800(V)) screen and 16.7M (8-bits) by digital parallel RGB interface.

2.1 Features

- 5.0 inch (15:9) display
- WVGA (480(H) × 800(V)) resolution
- Digital parallel RGB 8bit interface
- High brightness
- High Contrast ratio
- Wide viewing angle with MVA technology
- RoHs compliance

2.2 Display Characteristics

The following items are G050VVN01.0 characteristics summary at 25 (Room Temperature).

Items		Unit	Specifications
Screen Diagonal		inch	5.0
Outline Dimension		mm	71.2(H)X119.5(V)X2.5(T)
Active Area Size		mm	64.8(H)×108.0(V)
Resolution		dots	480RGB(H)×800(V)
Pixel Pitch		mm	0.135(H)×0.135(V)
Pixel Arrangement			R.G.B. Vertical Stripe
Display Mode			MVA, Normally Black
Color Depth			16.7M (8bit)
Nominal Input Power	LCD VCI / VDDI	V	3 (typ.)
	Backlight	mA	40
Typical Power Consumption		mW	LCD 90mW / Backlight 720mW
Typical Weight		g	48.0±5
Surface Treatment			Anti-Glare, Hardness 3H
Temperature Range	Operating	°C	-10 to +70
	Storage(Non-Operating)	°C	-20 to +80

2.3 Optical Characteristics

The optical characteristics are measured under stable conditions at 25 (Room Temperature).

Item	Conditions		Min.	Typ.	Max.	Unit	Remark
White Luminance	$\Theta x = 0°$; $\Theta y = 0°$		360	450		cd/m2	Note 1
Contrast Ratio			450	700			Note 1, 2
Response Time	$\Theta x = 0°$ $\Theta y = 0°$	Rising (Tr)		20	35	ms	Note 1, 3
		Falling (Tf)		15	35		
		Tr + Tf		35	70		
Viewing Angle	Horizontal CR 10	Right	60	80		degree	Note 1, 4
		Left	60	80			
	Vertical CR 10	Top	60	80			
		Bottom	60	80			
Color / Chromaticity Coordinates (CIE 1931)	White x		0.281	0.331	0.381		Note 1
	White y		0.315	0.365	0.415		
	Red x		0.548	0.598	0.648		
	Red y		0.297	0.347	0.397		
	Green x		0.292	0.342	0.392		
	Green y		0.546	0.596	0.646		
	Blue x		0.104	0.154	0.204		
	Blue y		0.093	0.143	0.193		
Color Gamut				50		%	Note 1
Uniformity	9 Points		70	80		%	Note 1, 5

Note 1 Measurement method and condition

Equipment	Pattern Generator, Power Supply, Digital Voltmeter, Topcon luminance meter BM-5A
Test Point	Aperture = 1° with 50cm viewing distance at center of active area
Condition	1. Performed in the dark and windless room (Ambient light < 1 lux) 2. Measured after 15 minutes operation under backlight current I_{BL} = 40mA.
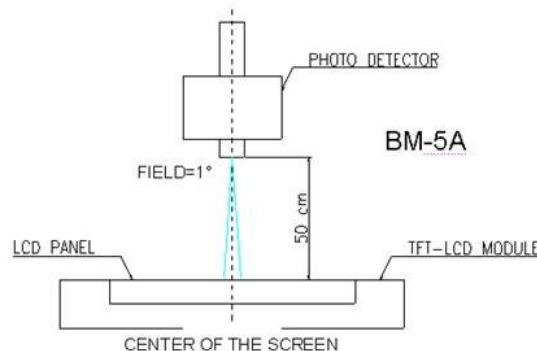
Fig. 2-1

Note 2   Definition of contrast ratio (CR)

$$\text{Contrast ratio (CR)} = \frac{\text{Brightness @ "White" state}}{\text{Brightness @ "Black" state}}$$

Note 3   Definition of response time

The output signals of photo detector are measured when the input signals are changed from "White" to "Black" (falling time) and from "Black" to "White" (rising time), respectively. The response time interval definition is between 10% and 90% of amplitude. Please refer to the figure as below.
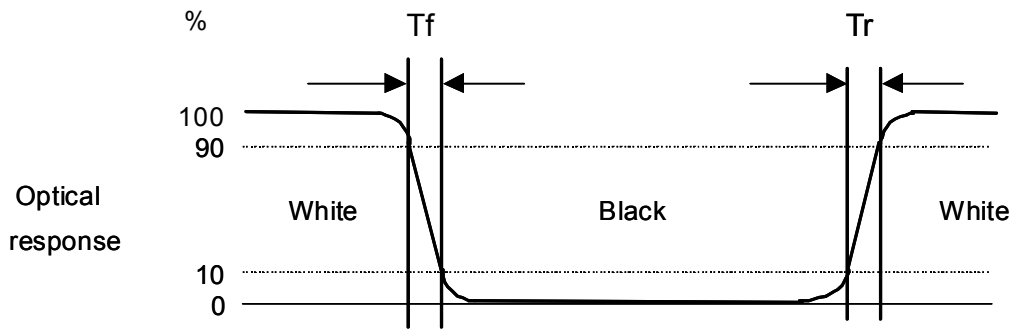
Fig. 2-2

Note 4   Definition of viewing angle

Viewing angle is the measurement of contrast ratio $\geq$ 10, at the screen center, over 180° horizontal and 180° vertical range. The 180° horizontal (θL, θR) and 180° vertical (ΦH, ΦL) range are illustrated as following figure.
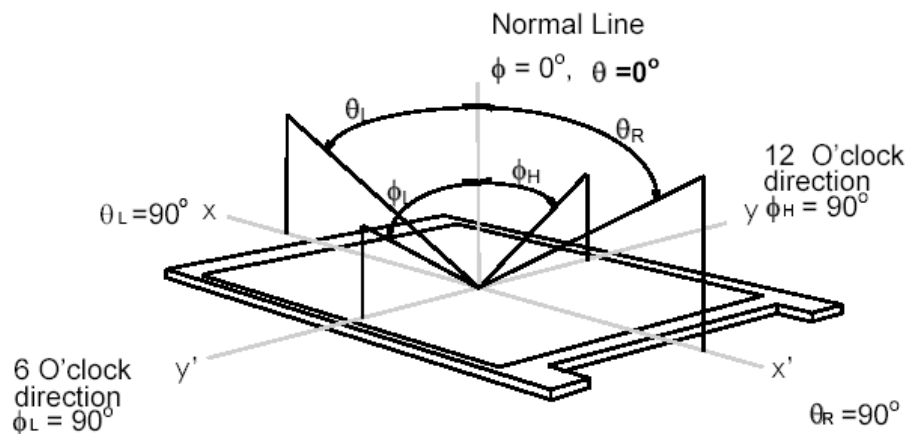
Fig. 2-3

Note 5 Definition of 9 points position on Active Area

The luminance uniformity of 9 points is defined by dividing the maximum luminance value by the minimum luminance value at full white condition.

$$\text{Luminance Uniformity (\%)} = \frac{\text{Minimum Brightness of nine points}}{\text{Maximum Brightness of nine points}}$$
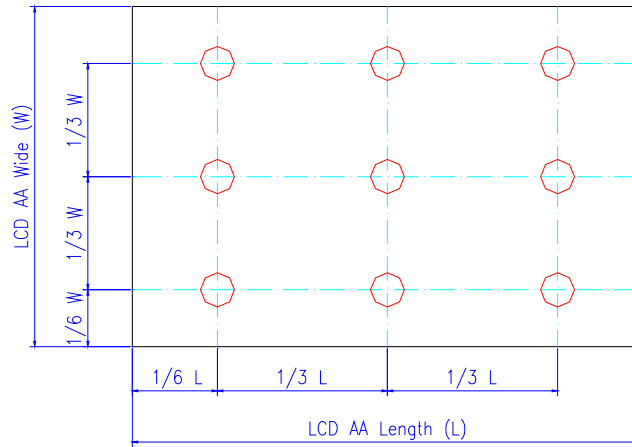
Fig.2-4

3. Functional Block Diagram

The following diagram shows the functional block of the G050VVN01.0 color TFT/LCD module.

TFT-LCD
480RGB x 800

All-in-one IC

component

pin1   pin50

Power   Timing Signals

SPI

RGB Data
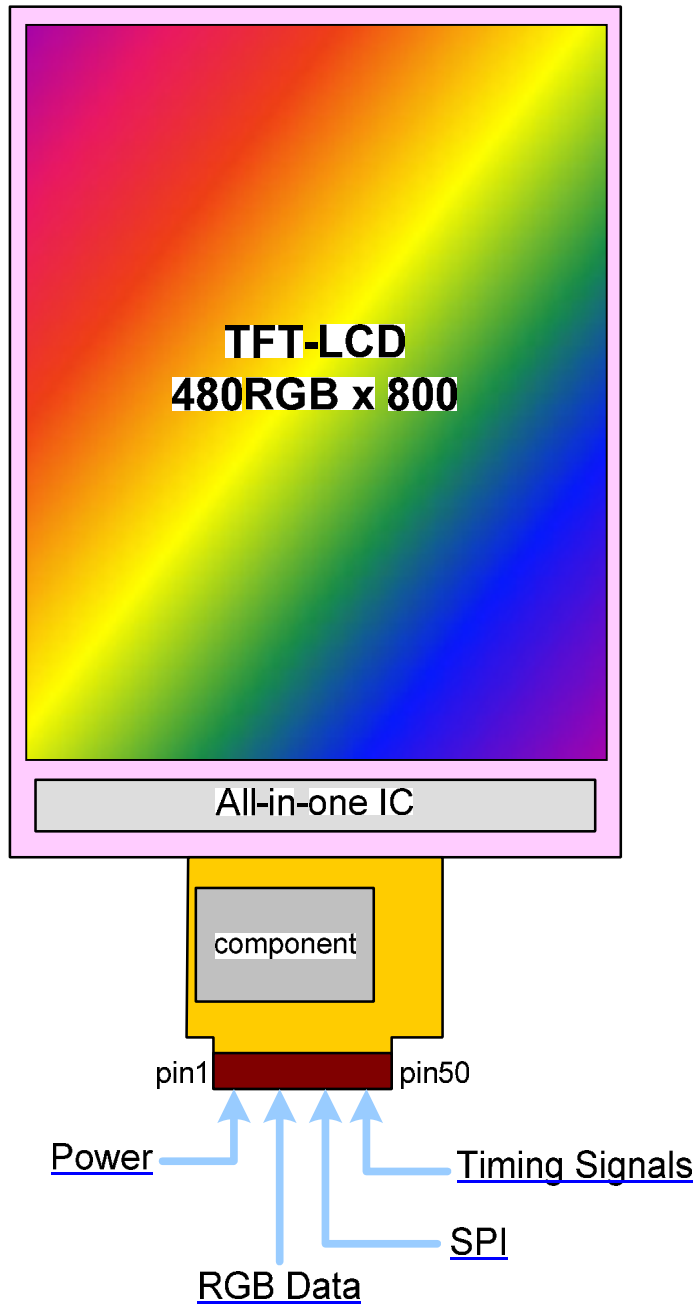
Fig. 3-1

4. Absolute Maximum Ratings

4.1 Absolute Ratings of Driving Condition

Following characteristics are measured under stable condition at 25   (Room Temperature).

Parameter	Symbol	Min	Max	Unit	Remark
Supply Voltage	VCI	-0.3	+5.5	V	
Supply Voltage	VDDI	-0.3	+5.5	V	
LED BLU Driving Current	I_{BL}	0	70	mA	

4.2 Absolute Ratings of Environment

Parameter	Symbol	Min	Max	Unit	Remark
Operating Temperature	TOP	-10	70		Note 1, 2
Storage Temperature	TST	-20	80		Note 1

Note 1   Maximum Wet-Bulb should be 39   and no condensation.

Note 2   Only operation is guaranteed. Optical performance should be evaluated at 25   only.

5. Electrical Characteristics

5.1 TFT-LCD Driving Condition

Following characteristics are measured under stable condition at 25   (Room Temperature).

Parameter	Symbol	Min	Typ	Max	Units	Remark
Analog operating voltage	VCI	2.7	3.0	3.7	V	
Logic operating voltage	VDDI	1.8	3.0	3.3	V	
Logic high level input voltage	VIH	0.7 VDDI	-	VDDI	V	
Logic low level input voltage	VIL	0	-	0.3 VDDI	V	

Mode	Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Normal	P_N	VCI = 3.0V VDDI = 3.0V	-	90	130	mW	Note 1,2
Sleep	P_S		-	4.5	6.5	mW	

Note 1: Test Condition is under typical Electrical DC and AC characteristics.

Note 2: Test pattern is the following picture (color bar).
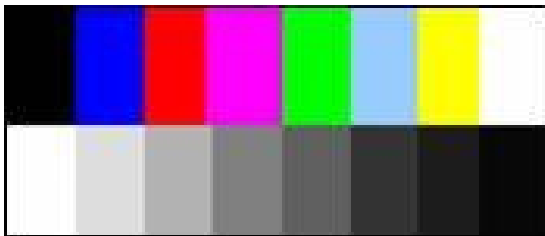
5.2 Backlight Unit Driving Condition

Following characteristics are measured under stable condition at 25   (Room Temperature).

Parameter	Symbol	Min	Typ	Max	Units	Remark
Input Voltage	V_{BL}		18	19.8	V	
Input Current	I_{BL}		40		mA	
Power Consumption	P_{BL}		720	792	W	
LED Lifetime	LED_L	10000			Hrs	

Note 1   Backlight unit composed of 12 LEDs. (2 stings, 6 pcs for each string)

Note 2   The definition of LED lifetime is when B/L continues to operate under typical driving current, duty 100% and ambient temperature = 25   until the brightness becomes   50% of its original value.

Note 3   Operating LED under high temperature, humidity environment and driving current will reduce lifetime and lead to color shift.

Fig. 5-1

6. Signal Characteristic

6.1 Pixel Format Image

Following figure shows the relationship between input signal and LCD pixel format.
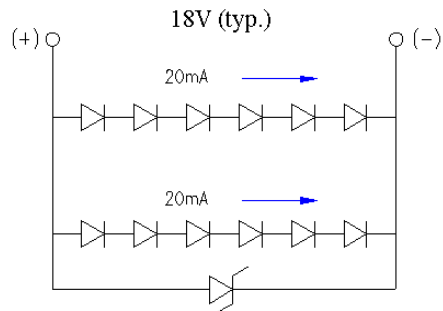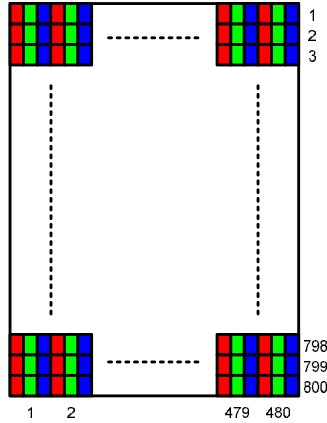

Fig 6-1

6.2 The Input Data Format

This product displays 16.7M colors in terms of the 256 grey levels on RGB respectively.

Display colors		R7	R6	R5	R4	R3	R2	R1	R0	G7	G6	G5	G4	G3	G2	G1	G0	B7	B6	B5	B4	B3	B2	B1	B0
										Data signal (0 : Low level, 1: High level)														
Basic colors	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	Red	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Magenta	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	Green	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	Cyan	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Yellow	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	White	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Red grayscale	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Dark	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	↑ ↓ bright																								
		1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Green grayscale	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
	Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
	↑ ↓ bright																								
		0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0
	Green	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
Blue grayscale	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
	↑ ↓ bright																								
		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	1
		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1

6.3 TFT- LCD Pin Assignment Description

Recommended connector: 50FHY-RSM1-GAN-TF (JST)

Pin no	Symbol	I/O	Description	Remark
1	VCI	P	Power supply for analog circuit	
2	VDDI	P	Power supply for digital interface	
3	GND	G	Ground	
4	GND	G	Ground	
5	VS	I	Vertical sync input	
6	GND	G	Ground	
7	HS	I	Horizontal sync input	
8	GND	G	Ground	
9	PCLK	I	Data clock Input	
10	GND	G	Ground	
11	DE	I	Data enable input. Active level is high.	
12	GND	G	Ground	
13	DB0	I	Blue Data input; LSB	
14	DB1	I	Blue Data input	
15	DB2	I	Blue Data input	
16	DB3	I	Blue Data input	
17	DB4	I	Blue Data input	
18	DB5	I	Blue Data input	
19	DB6	I	Blue Data input	
20	DB7	I	Blue Data input; MSB	
21	GND	G	Ground	
22	DG0	I	Green Data input; LSB	
23	DG1	I	Green Data input	
24	DG2	I	Green Data input	
25	DG3	I	Green Data input	
26	DG4	I	Green Data input	
27	DG5	I	Green Data input	
28	DG6	I	Green Data input	
29	DG7	I	Green Data input ; MSB	
30	GND	G	Ground	
31	DR0	I	Red Data input; LSB	
32	DR1	I	Red Data input	
33	DR2	I	Red Data input	
34	DR3	I	Red Data input	
35	DR4	I	Red Data input	

| 36	DR5	I	Red Data input	
37	DR6	I	Red Data input	
38	DR7	I	Red Data input; MSB	
39	GND	G	Ground	
40	GND	G	Ground	
41	VDDI	P	Power supply for digital interface	
42	VCI	P	Power supply for analog circuit	
43	RESX	I	Reset pin. (Low active)	
44	GND	G	Ground	
45	CSX	I	Chip select (Low active) of SPI	
46	SCL	I	Clock input of SPI	
47	SDI	I	Data input of SPI	
48	GND	G	Ground	
49	LED-	P	LED backlight cathode	
50	LED+	P	LED backlight anode	

Note 1   I: Digital signal input pin; P: Power pin; G: Ground pin;

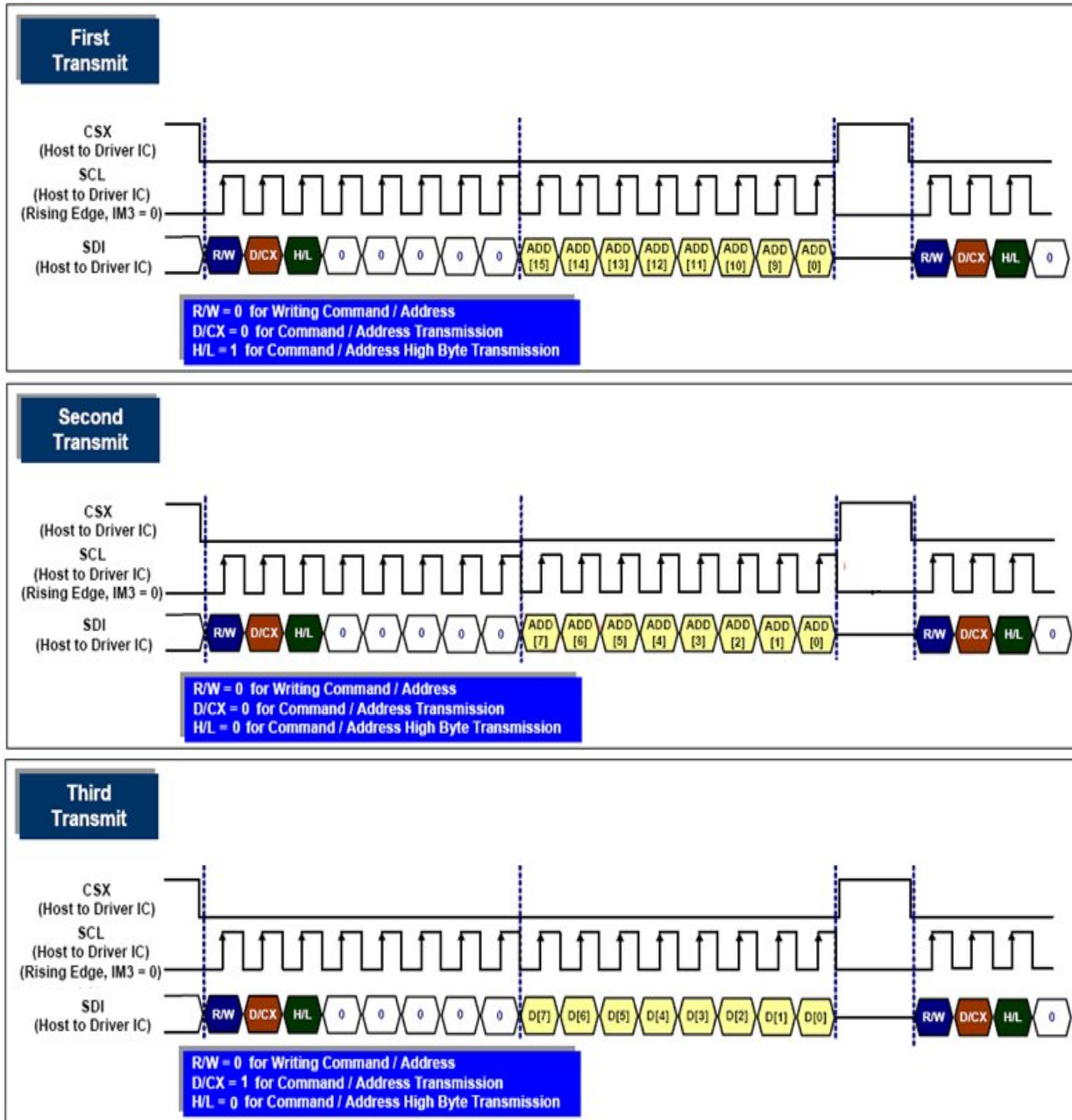## 6.4 Electrical AC Characteristics

a. SPI Interface Characteristics

(a)   Signal AC Characteristics
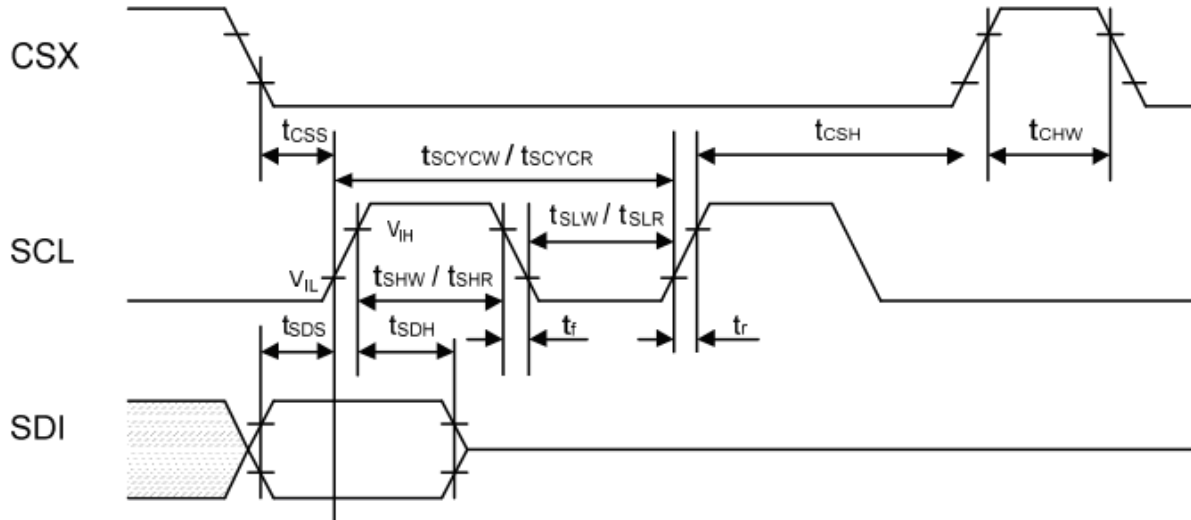
VDDI=1.8~3.3V, VCI=2.7~3.7V, TA=25
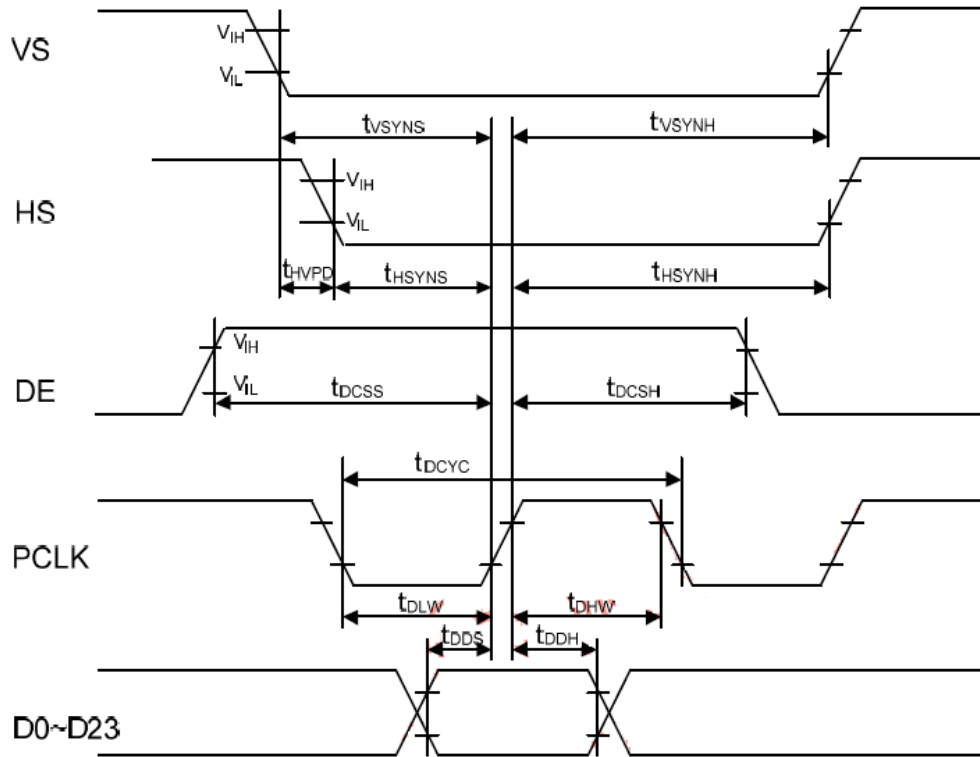
Signal	Symbol	Parameter	Min.	Max.	Unit	Description
SCL	t_{SCYCW}	Serial clock cycle (Write)	100	-	ns	
	t_{SHW}	SCL "H" pulse width (Write)	40	-	ns	
	t_{SLW}	SCL "L" pulse width (Write)	40	-	ns	
	t_{SCYCR}	Serial clock cycle (Read GRAM)	300	-	ns	
	t_{SHR}	SCL "H" pulse width (Read GRAM)	140	-	ns	
	t_{SLR}	SCL "L" pulse width (Read GRAM)	140	-	ns	
	t_{SCYCR}	Serial clock cycle (Read ID)	300	-	ns	
	t_{SHR}	SCL "H" pulse width (Read ID)	140	-	ns	
	t_{SLR}	SCL "L" pulse width (Read ID)	140	-	ns	
SDI	t_{SDS}	DE setup time	20	-	ns	
	t_{SDH}	DE hold time	20	-	ns	
CSX	t_{CHW}	Chip select "H" pulse width	45	-	ns	
	t_{CSS}	Chip select setup time	20	-	ns	
	t_{CSH}	Chip select hold time	50	-	ns	

(b) Write Mode

**b. RGB Interface Characteristics**

(a) Signal AC Characteristics

VDDI=1.8~3.3V, VCI=2.7~3.7V, TA=25

Signal	Symbol	Parameter	Min.	Max.	Unit	Description
VS	t_{VSYNS}	VSYNC setup time	10		ns	
	t_{VSYNH}	VSYNC hold time	10		ns	
HS	t_{HSYNS}	HSYNC setup time	10		ns	
	t_{SCYCR}	HSYNC hold time	10		ns	
	t_{HVPD}	HSYNC to VSYNC falling edge	400		ns	
PCLK	t_{DCYC}	PCLK cycle time	33.1	42.2	ns	
	t_{DFREQ}	PCLK frequency	23.7	30.2	MHz	
	t_{DLW}	PCLK "L" pulse width	11		ns	
	t_{DHW}	PCLK "H" pulse width	11		ns	
DE	t_{DCSS}	DE setup time	10		ns	
	t_{DCSH}	DE hold time	10		ns	
D0~D23	t_{DDS}	RGB Data setup time	10		ns	
	t_{DDH}	RGB Data hold time	10		ns	

Note 1   The input signal rise time and fall time (tr, tf) is specified at 15 ns or less.

Note 2   Measuring of input signals are 0.3 x VDDI for low state and 0.7 x VDDI for high state.

(b) Video signal data writing method in RGB Interface
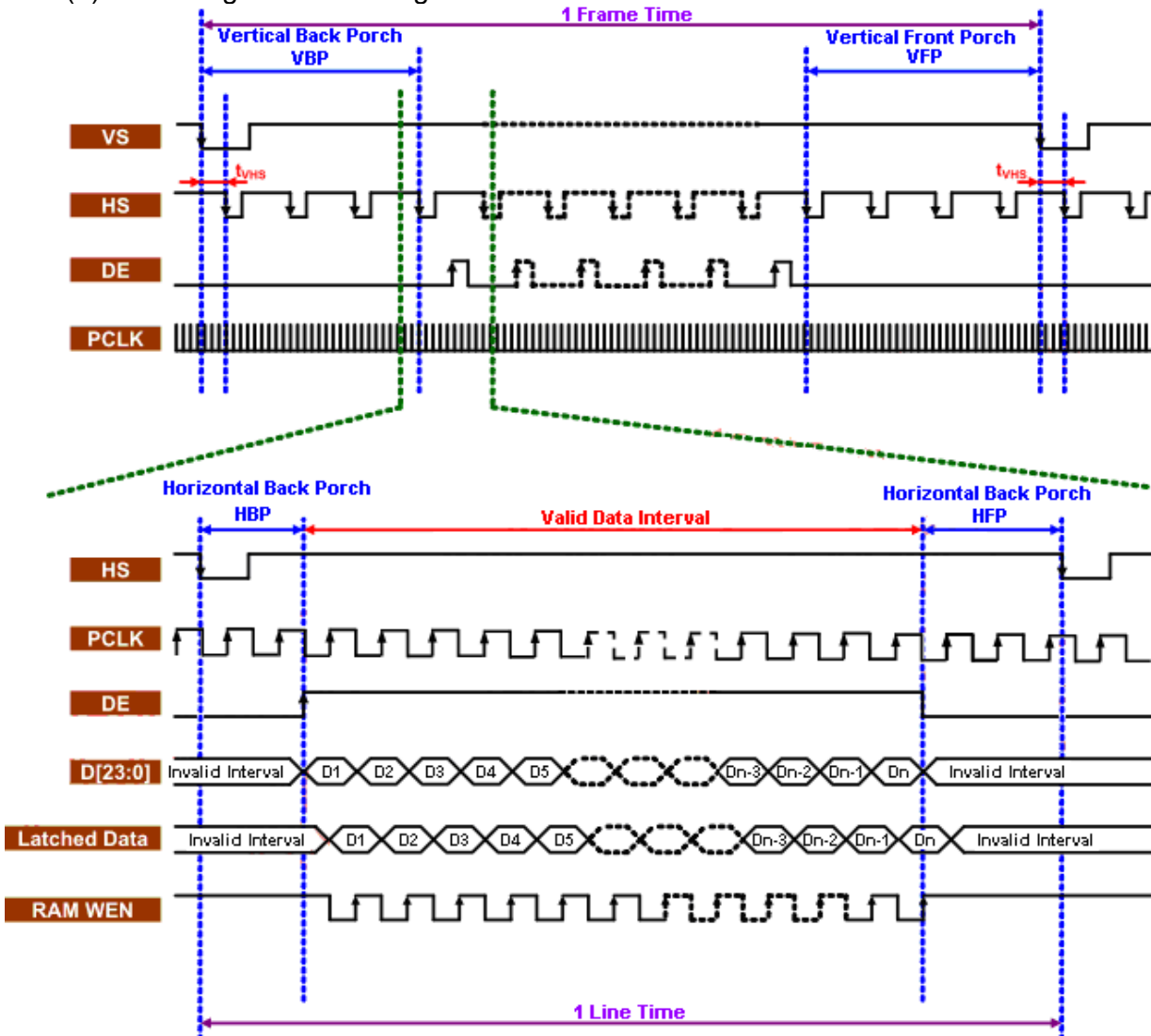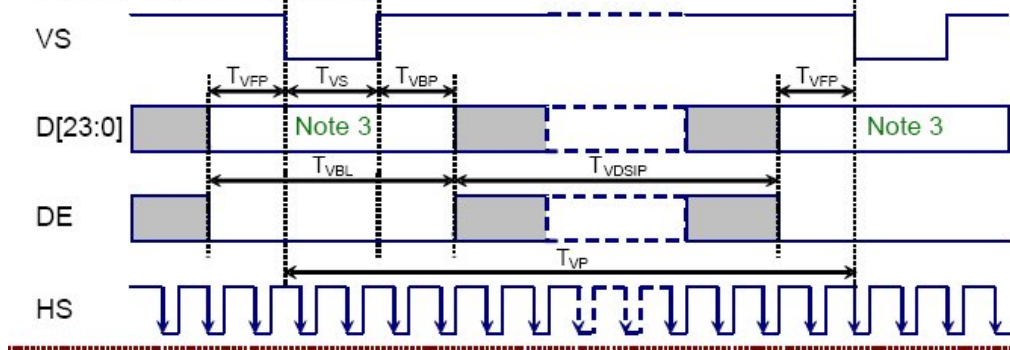

Notes
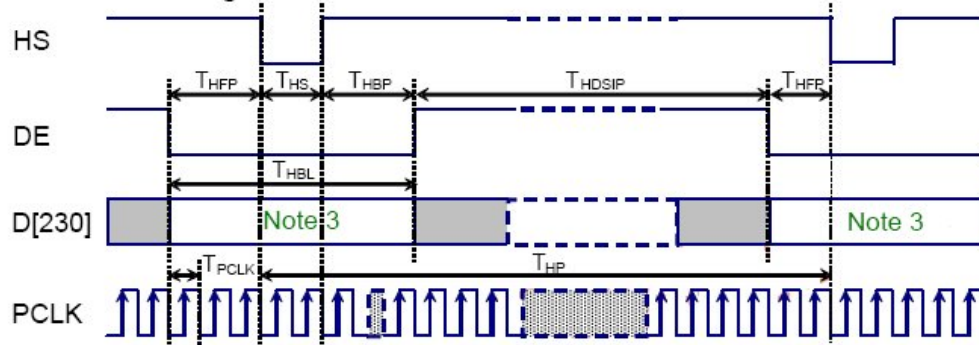1. Constraint:
   V-Back Porch (Vsync+VBP)   5 HS lines, V-Front-Borch (VFP)   5 HS lines
   H-Back Porch (Hsync+HBP)   5 PCLK clocks, H-Front-Porch (HFP)   2 PCLK clocks
2. t VHS   400ns
3. D[23:0] (DR[7:0], DG[7:0], DB[7:0])

(c) Vertical and horizontal timing

Vertical Timing for RGB I/F

Horizontal Timing for RGB I/F

VDDI=1.8~3.3V, VCI=2.7~3.7V, TA=25

Vertical Timing						
Item	**Symbol**	**Min.**	**Typ.**	**Max.**	**Unit**	**Remark**
Vertical cycle period	T_{VP}	832	836	930	HS	
Vertical low pulse width	T_{VS}	2	2	-	HS	
Vertical front porch	T_{VFP}	5	16	64	HS	
Vertical back porch	T_{VBP}	3	18	64	HS	
Vertical data start line	$T_{VS} + T_{VBP}$	5	20	128	HS	
Vertical blanking period	$T_{VBL} = T_{VS} + T_{VBP} + T_{VFP}$	32	36	-	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**	**Remark**
Horizontal cycle period	T_{HP}	491	516	610	PCLK	
Horizontal low pulse width	T_{HS}	2	2	-	PCLK	
Horizontal front porch	T_{HFP}	2	16	64	PCLK	
Horizontal back porch	T_{HBP}	3	18	64	PCLK	
Horizontal data start point	$T_{HS} + T_{HBP}$	5	20	128	PCLK	
Horizontal blanking period	$T_{HBL} = T_{HS} + T_{HBP} + T_{HFP}$	11	36	-	PCLK	
Horizontal active area	T_{HDISP}	-	480	-	PCLK	
Pixel clock cycle	$F_{PCLKCYC}$	23.7	25.9	30.2	MHz	

6.5 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:
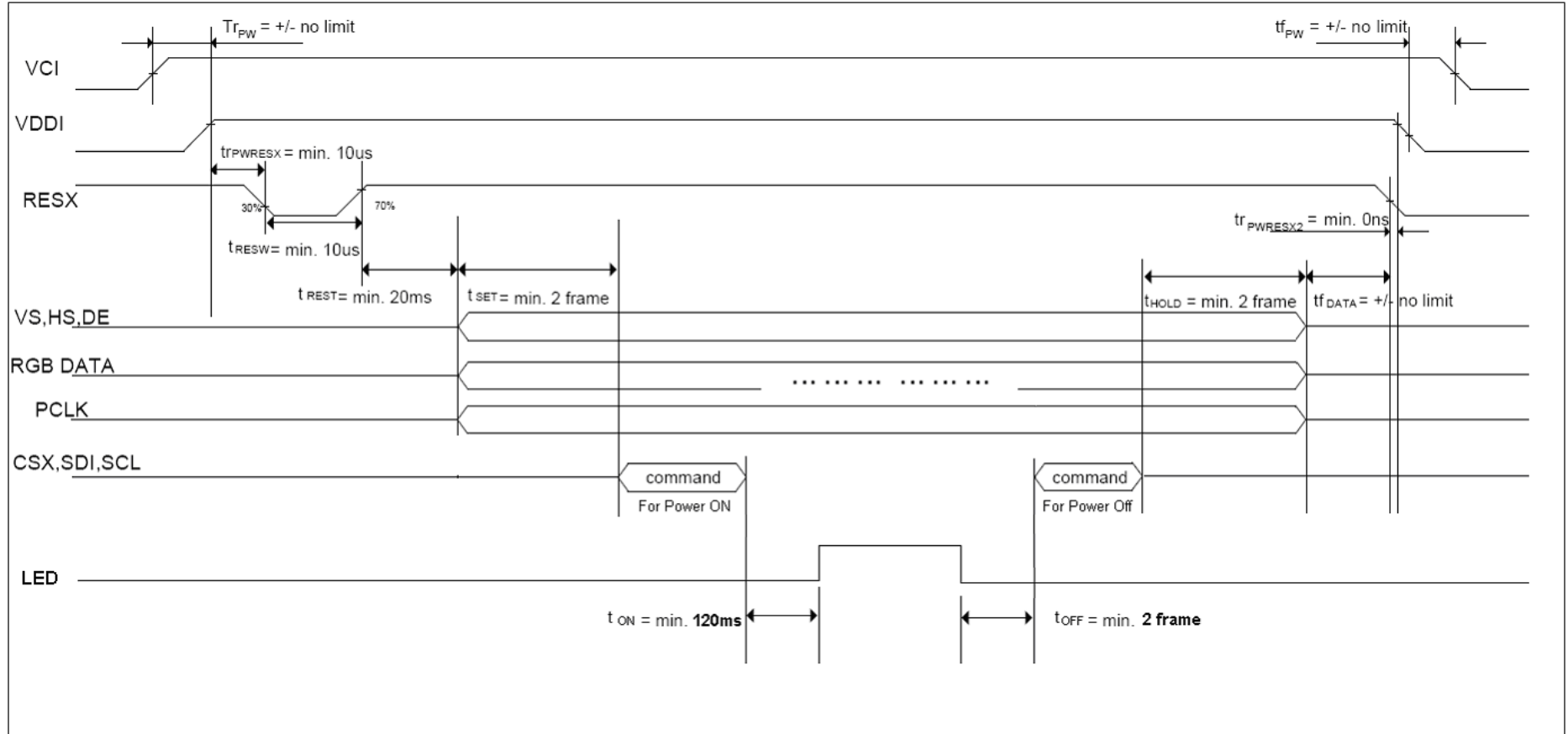
6.6 Command Descriptions

a. User Command Set

Instruction	Address	Data	Function
SLPIN	1000h	No Argument	Sleep in & booster off
SLPOUT	1100h	No Argument	Sleep out & booster on
DISPOFF	2800h	No Argument	Display off
DISPON	2900h	No Argument	Display on

b. Recommended Power On Register Setting

No.	Address	Data	Description
1	F000h	55h	Enable Manufacture Command for Page 0
2	F001h	AAh	
3	F002h	52h	
4	F003h	08h	
5	F004h	00h	
6	B100h	0Ch	Display Option Control
7	B101h	00h	
8	BC00h	05h	Inversion Driving Control
9	BC01h	05h	
10	BC02h	05h	
11	B700h	22h	Gate Output Control
12	B701h	22h	
13	B800h	01h	Source Output Control
14	B801h	03h	
15	B802h	03h	
16	B803h	03h	
17	C803h	96h	Display Timing Control
18	C805h	96h	
19	C807h	96h	
20	C809h	96h	
21	C80Bh	2Ah	
22	C80Ch	2Ah	
23	C80Fh	2Ah	
24	C810h	2Ah	
25	F000h	55h	Enable Manufacture Command for Page1
26	F001h	AAh	
27	F002h	52h	

28	F003h	08h	
29	F004h	01h	
30	B900h	34h	Power Control for VGH
31	B901h	34h	
32	B902h	34h	
33	BA00h	14h	Power Control for VGL
34	BA01h	14h	
35	BA02h	14h	
36	BE00h	00h	Power Control for VCOM
37	BE01h	8Ch	
38	B000h	00h	Power Control for AVDD
39	B001h	00h	
40	B002h	00h	
41	B800h	24h	Power Control for VCL
42	B801h	24h	
43	B802h	24h	
44	BC00h	00h	Power Control for VGMP / VGSP
45	BC01h	88h	
46	BC02h	01h	
47	BD00h	00h	Power Control for VGMN / VGSN
48	BD01h	88h	
49	BD02h	01h	
50~101	D100h~D133h	Gamma Setting	Gamma Correction for Positive Red
102~153	D200h~D233h	Gamma Setting	Gamma Correction for Positive Green
154~205	D300h~D333h	Gamma Setting	Gamma Correction for Positive Blue
206~257	D400h~D433h	Gamma Setting	Gamma Correction for Negative Red
258~309	D500h~D533h	Gamma Setting	Gamma Correction for Negative Green
310~361	D600h~D633h	Gamma Setting	Gamma Correction for Negative Blue
362	1100h		EXIT_SLEEP_MODE
Wait for more than 120ms			
363	2900h	-	SET_DISPLAY_ON

c. Gamma Setting

No.	Data	No.	Data	No.	Data
1	00h	19	01h	37	02h
2	00h	20	36h	38	5Dh
3	00h	21	01h	39	02h
4	10h	22	59h	40	BCh
5	00h	23	01h	41	02h
6	31h	24	90h	42	E9h
7	00h	25	01h	43	03h
8	5Ah	26	BDh	44	16h
9	00h	27	01h	45	03h
10	78h	28	BEh	46	48h
11	00h	29	01h	47	03h
12	9Bh	30	E5h	48	ACh
13	00h	31	02h	49	03h
14	BEh	32	0Dh	50	E8h
15	00h	33	02h	51	03h
16	E6h	34	29h	52	FFh
17	01h	35	02h		
18	04h	36	44h		

d. Recommended Power Off Register Setting

No.	Address	Data	Description
1	2800h	-	SET_DISPLAY_OFF
2	1000h	-	ENTER_SLEEP_MODE

7. Reliability Test Criteria

Test Items	Required Condition			Remark
High Temperature Operation	70	240Hours	Operation	
Low Temperature Operation	-10	240Hours	Operation	
High Temperature Storage	80	240Hours	Non-operation	
Low Temperature Storage	-20	240Hours	Non-operation	
High temperature and high humidity	60 , 90% RH	240Hours	Operation	
Thermal Shock	-10 /60 min ,80 /60 min ,50cycles		Non-operation	
Mechanical shock	50G, 20ms, Half-sine wave, Once for each direction. (±x, ±y, ±z)		Non-operation	
Vibration	1.5G, 10~200~10Hz, Sine wave, 30min/axis (X, Y, Z)		Non-operation	
On/off	On/10 sec, off/10 sec, 30,000 cycles, 25			
Electrostatic discharge	Contact = ± 4 kV, class B (R=330,C=150pF) Air = ± 8 kV, class B (R=330,C=150pF) 1sec, 5 points, 10times/point			

Note 1 Each test is done by new TFT-LCD module. Don't use the same TFT-LCD module repeatedly for reliability test.

Note 2 The reliability test is performed only to examine the TFT-LCD module capability.

Note 3 In the standard condition, there is not display function NG issue occurred. All cosmetic specifications are judged before the reliability stress. To inspect TFT-LCD module after reliability test, please store it at room temperature and room humidity for 24 hours at least in advance.

Note 4 There should be no condensation on the surface of module during test.

Note 5 Short time operation between -10 ~-0 doesn't provide full performance but a correct image on the LCD. The LCD is guaranteed to suffer no permanent damage.

Note 6 The fixture of Vibration and Shock test should be hard and rigid enough in order to protect from module twisting or bending issue.

Note 7 ESD criteria is as below

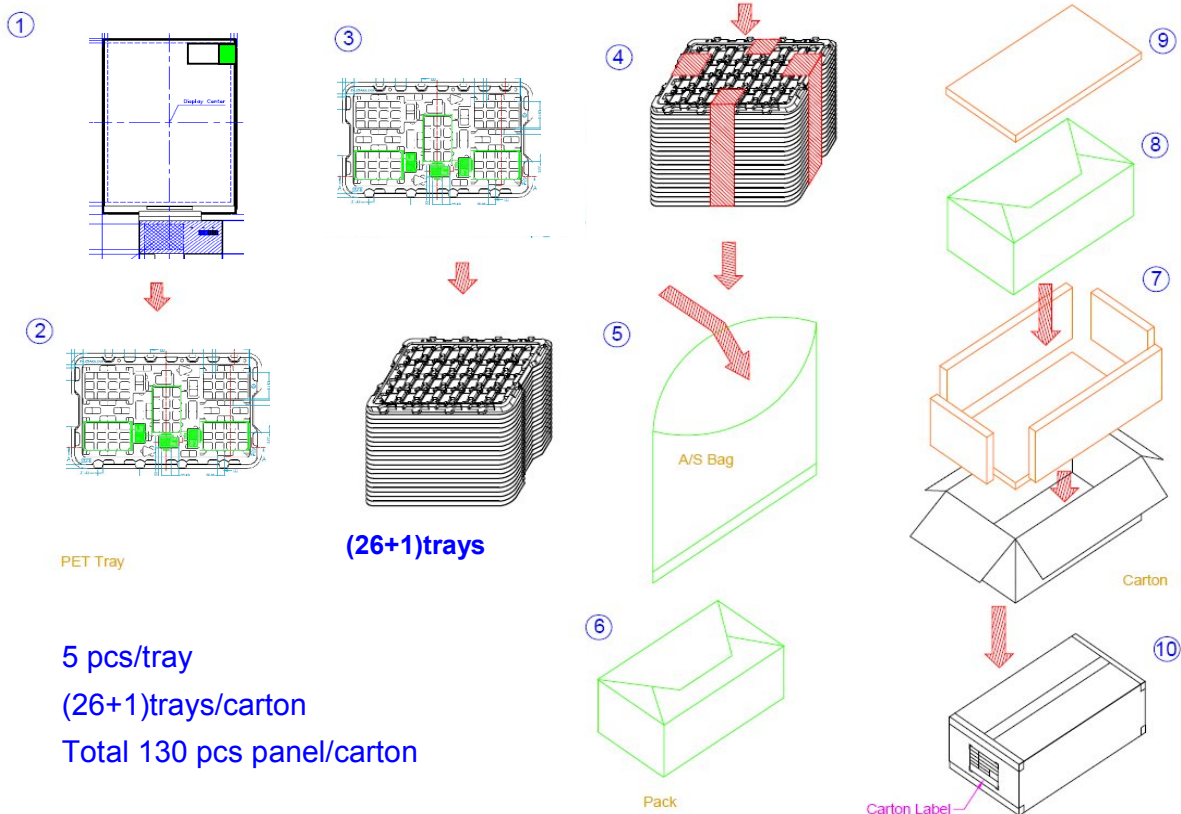|	
Class A	Normal operation. No degradation. No failures
Class B	Some performance degradation allowed. No data lost. Self-recoverable. No hardware failures.
Class C	Temporary performance degradation. Recovery by operator is acceptable. No hardware failures.
Class D	Hardware failures.

8. Mechanical Characteristics

1mm
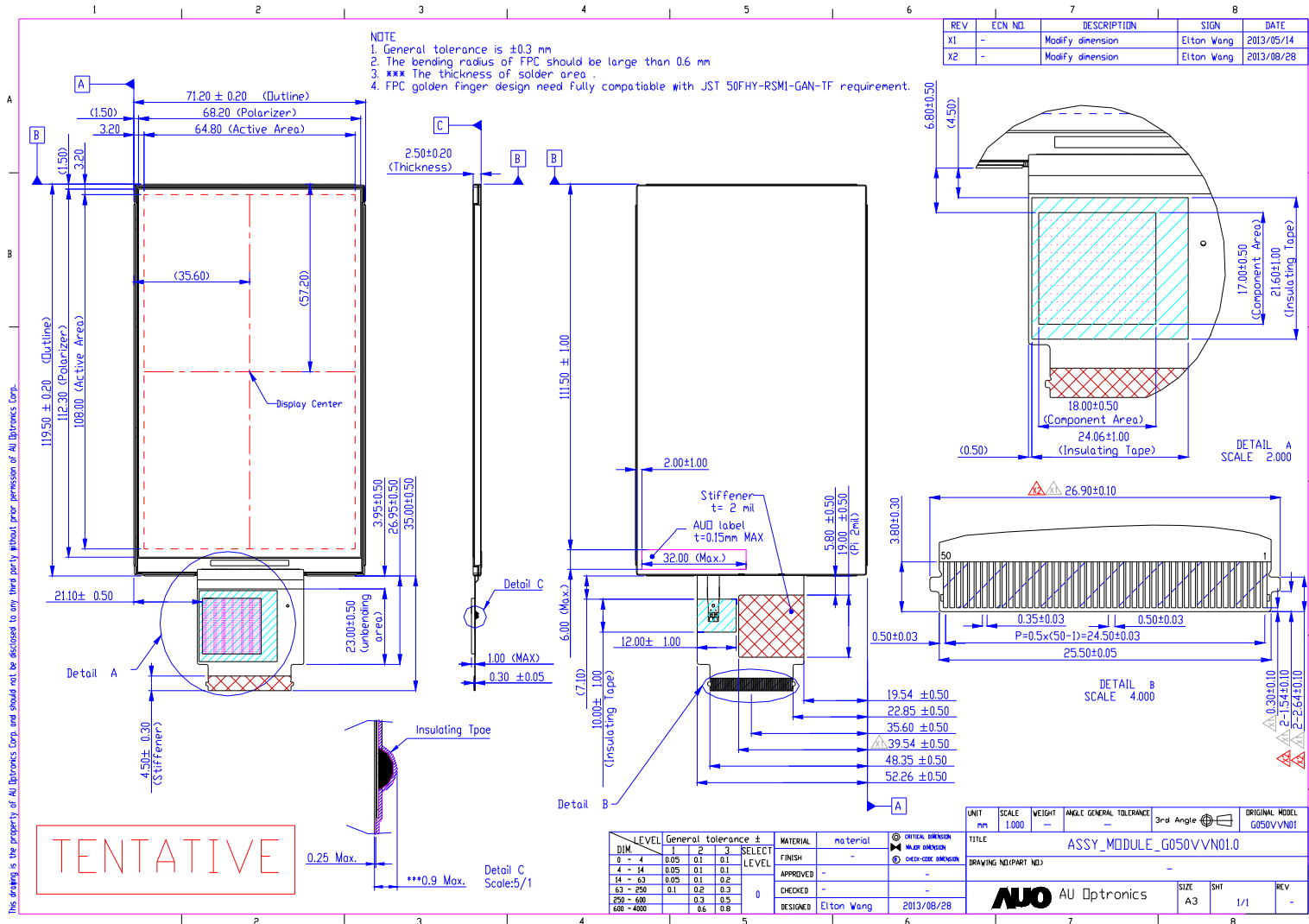
9. Label and Packaging

9.1 Shipping Label (on the rear side of TFT-LCD display)

027S7Z00014(xxx)   G050VVN01

Fig. 9-1 Label size:30*5mm

9.2 Packing form

PET Tray

5 pcs/tray

(26+1)trays/carton

Total 130 pcs panel/carton

(26+1)trays

A/S Bag

Pack

Carton

Carton Label

Max. capacity: 130 pieces TFT-LCD module per carton
Max. weight: 11.5 kg per carton
Outside dimension of carton:528(L)mm* 348(W)mm* 266(H)mm
Pallet : 1070(L)mm* 1070(W)mm* 135(H)mm

9.3 Palletizing sequence

Module by air   (2 *3) *5 layers   one pallet put 30 boxes   total 3900pcs module

Module by sea   (2 *3) *5 layers   one pallet put 30 boxes   total 3900pcs module

Module by sea_HQ   (2 *3) *5 layers   one pallet put 30 boxes   total 3900pcs module

10 Safety

10.1 Standard
The TFT-LCD Module will be satisfied all requirements for compliance with UL 60950-1 (U.S.A. Information Technology Equipment).

10.1.1 Keen Edge Requirements
There will be no keen edges or corners on the display assembly that could cause injury.

10.1.2 Flammability
All components including electrical components that do not meet the flammability grade UL94-V1 in the TFT-LCD Module.

The critical components of safety will be compliance with UL 60950 requirement exception approval process.

The printed circuit board will be made from material rated 94-V1 or better. The actual UL flammability rating will be printed on the printed circuit board.

10.2 Capacitors
If any polarized capacitors are used in the TFT-LCD module, provisions will be made to keep them from being inserted backwards.

10.3 National Test Lab Requirement
The TFT-LCD Module will satisfy all requirements for compliance to UL 60950 (U.S.A. Information Technology Equipment).