RoHS COMPLIANT

Giantplus Technology

Specification of LCD Module

Product No.: GPM1421C0

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1. GENERAL DESCRIPTION

The model is a Color TFT LCD supplied by Giantplus. This main Module has 2.8 inch diagonally measured active display area with 240 X RGB X 320 resolution. Each pixel is divided into Red, Green and Blue sub-pixels and dots which are arranged in vertical stripes. LCD color is determined with 262K Color signal for each pixel. The GPM1421C0 has been designed to apply the interface method that enables low power, high speed, and high contrast. The GPM1421C0 is intended to support applications where thin thickness, wide viewing angle, low power are critical factors and graphic displays are important.

2. FEATURES

Display Mode	TFT module , Trans-missive Type, Positive mode
Display Format	RGB vertical stripe
Color	262K color
Input Data	RGB Mode：18 bits I/F
Viewing Direction	6 o'clock
Gray inversion Direction	12 o'clock
LED Numbers	4 White LEDs

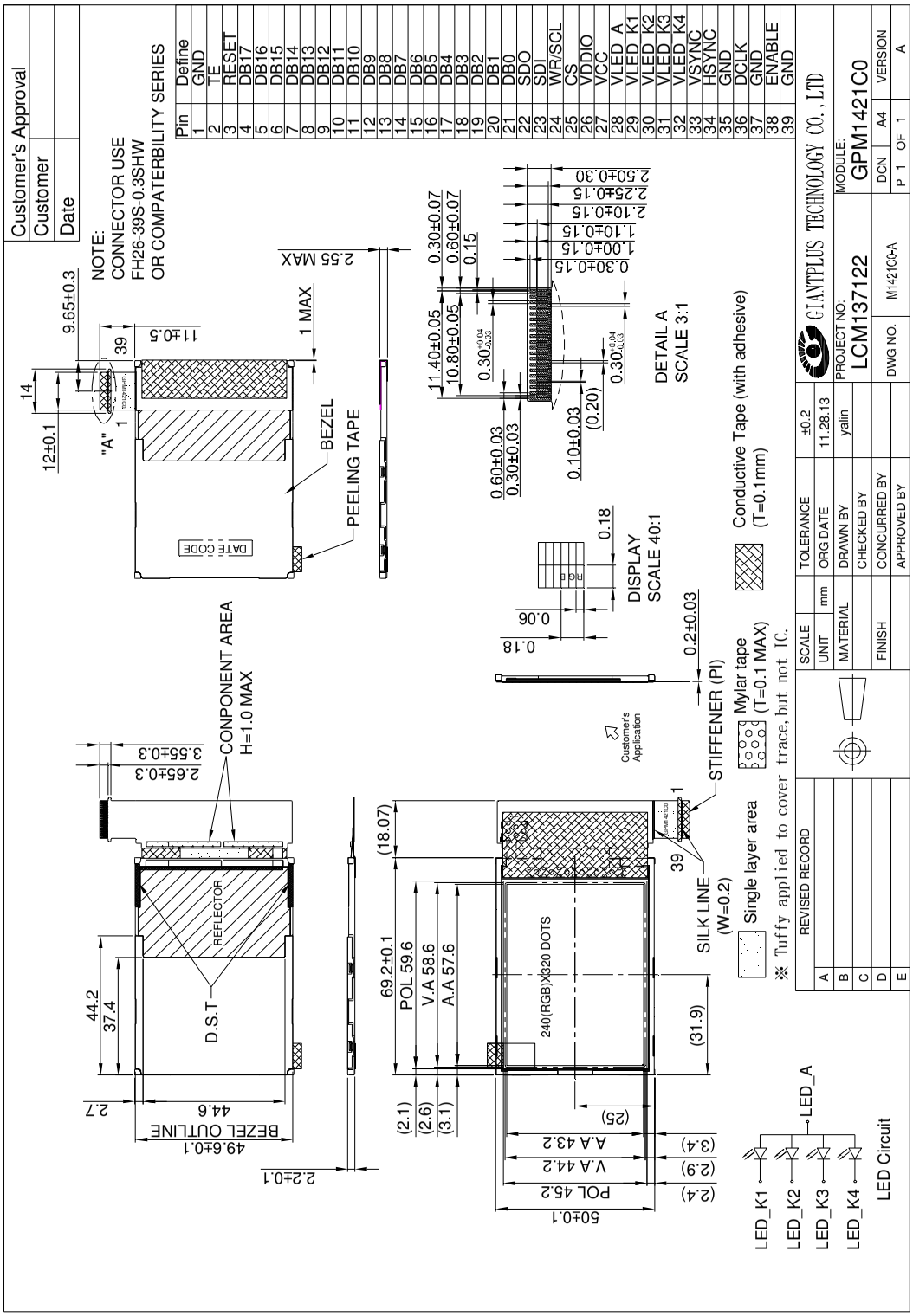
3. MECHANICAL SPECIFICATION

Item	Specifications	Unit
Dimensional outline	50.0 (W) × 69.2 (H) × 2.2 (D)	mm
Resolution	240 × RGB × 320	Pixel
Active area	43.2 (W) × 57.6 (H)	mm
Pixel pitch	0.18 (W) × 0.18 (H)	mm
Dots pitch	0.06 (W) × 0.18 (H)	mm

*Not Include FPC

*1 pixel = 3 dots = Red dot +Green dot +Blue dot

4. MECHANICAL DIMENSION



5. MAXIMUM RATINGS

If the operating condition exceeds the following absolute maximum ratings, the TFT LCD module maybe damaged permanently. GND=VSS=0V,Ta=25℃

Item	Symbol	Values		Unit	Condition
		Min.	Max.		
Supply voltage	VDD	-0.3	4.6	V	
Interface supply voltage	VDDIO	-0.3	VDD	V	
Input signal voltage	VIN	0.5	VDDIO+0.5	V	
Storage Temperature	T_{ST}	-30	80	℃	
Operating Temperature	T_{OP}	-20	70	℃	
Humidity	-	-	90	%RH	Note-1

Note1: $T_A \leqq 40℃$ Without dewing.

6. ELECTRICAL CHARACTERISTICS

Typical operating conditions (GND=AV_{SS}=0V)

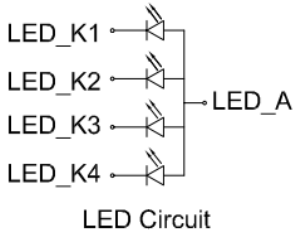
ITEM	SYMBOL	Min	Typ	Max	Units
Power Supply	VCI	2.4	2.8	3.3	V
	IOVCC	1.65	2.8	3.3	V
	IDD	---	---	20	mA
Input High level voltage	V_{IH}	0.7*IOVCC	---	IOVCC	V
Input Low level voltage	V_{IL}	VSS	---	0.3*IOVCC	V
Output High level voltage	V_{OH}	0.8*IOVCC	---	IOVCC	V
Output Low level voltage	V_{OL}	VSS	---	0.2*IOVCC	V
Operating Temperature	T_{OP}	-20	---	70	℃
Storage Temperature	T_{STG}	-30	---	80	℃
Power Consumption	8 Color Mode	---	20.72	29.7	mW
	Sleeping Mode	---	19.6	28.05	uW

7. BACKLIGHT CHARACTERISTIC

7.1.Backlight Characteristic

ITEM	SYMBOL	Min	Typ	Max	Units	Remark
LED Forward voltage	V_f	2.9	3.2	3.4	V	One LED
LED Forward current	I_f	---	20	---	mA	One LED
Surface brightness uniform（without LCD）	L_D	---	80	---	%	

★ 1 Backlight LED Circuit：



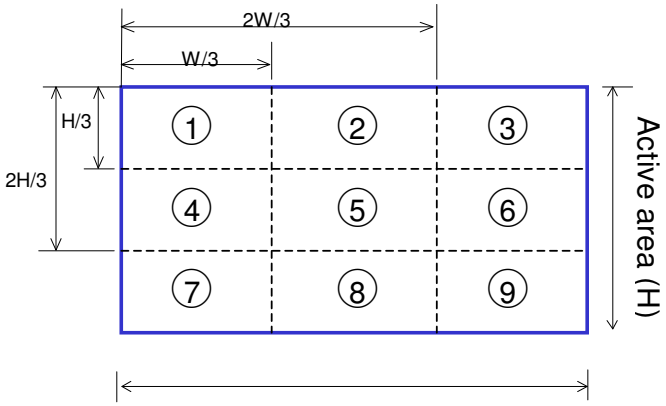
LED Circuit

★2 Uniform measure condition：

(a)Measure 9 point. Measure location is show below：

(b)Uniform = (Min. brightness / Max. brightness)×100%

(c)Best Contrast, Main and sub panel All dots turn ON (White screen)



8. MODULE FUNCTION DESCRIPTION

8.1.Pin Description

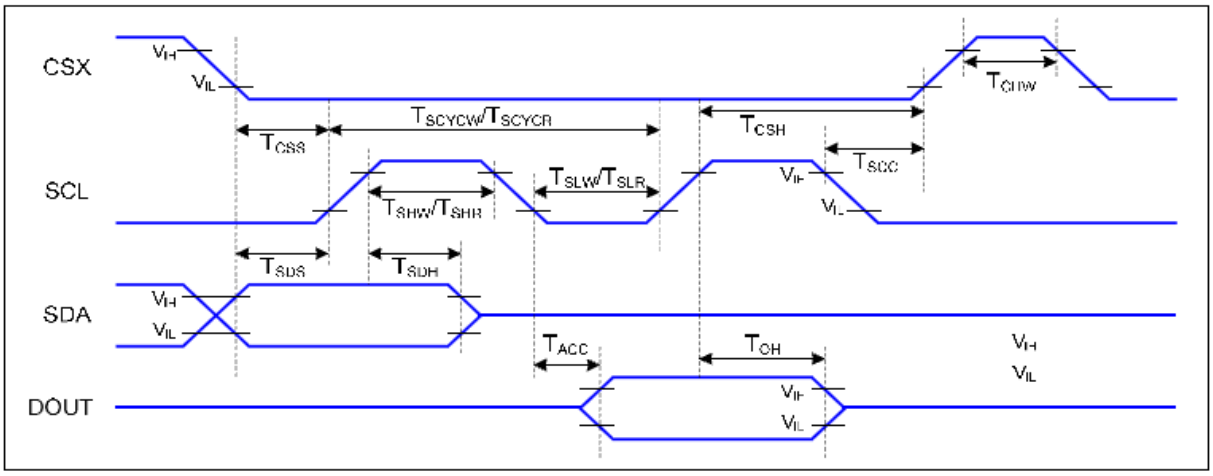
NO	Pin Name	Description
1	GND	Ground
2	TE	Tearing effect output signal
3	RESET	Reset signal
4	DB17	Data bus
5	DB16	Data bus
6	DB15	Data bus
7	DB14	Data bus
8	DB13	Data bus
9	DB12	Data bus
10	DB11	Data bus
11	DB10	Data bus
12	DB9	Data bus
13	DB8	Data bus
14	DB7	Data bus
15	DB6	Data bus
16	DB5	Data bus
17	DB4	Data bus
18	DB3	Data bus
19	DB2	Data bus
20	DB1	Data bus
21	DB0	Data bus
22	SDO	SPI interface output pin
23	SDI	SPI interface input/output pin
24	WR/SCL	Clock signal for SPI
25	CS	Chip select signal

26	IOVCC	Power Supply for I/O System
27	VCC	Power Supply for Analog, Digital System and Booster Circuit
28	VLED_A	LED Anode
29	VLED_K1	LED Cathode
30	VLED_K2	LED Cathode
31	VLED_K3	LED Cathode
32	VLED_K4	LED Cathode
33	VSYNC	Frame synchronizing signal for RGB interface operation
34	HSYNC	Line synchronizing signal for RGB interface operation
35	GND	Ground
36	DCLK	Dot clock signal for RGB interface operation
37	GND	Ground
38	ENABLE	Data enable signal for RGB interface operation
39	GND	Ground

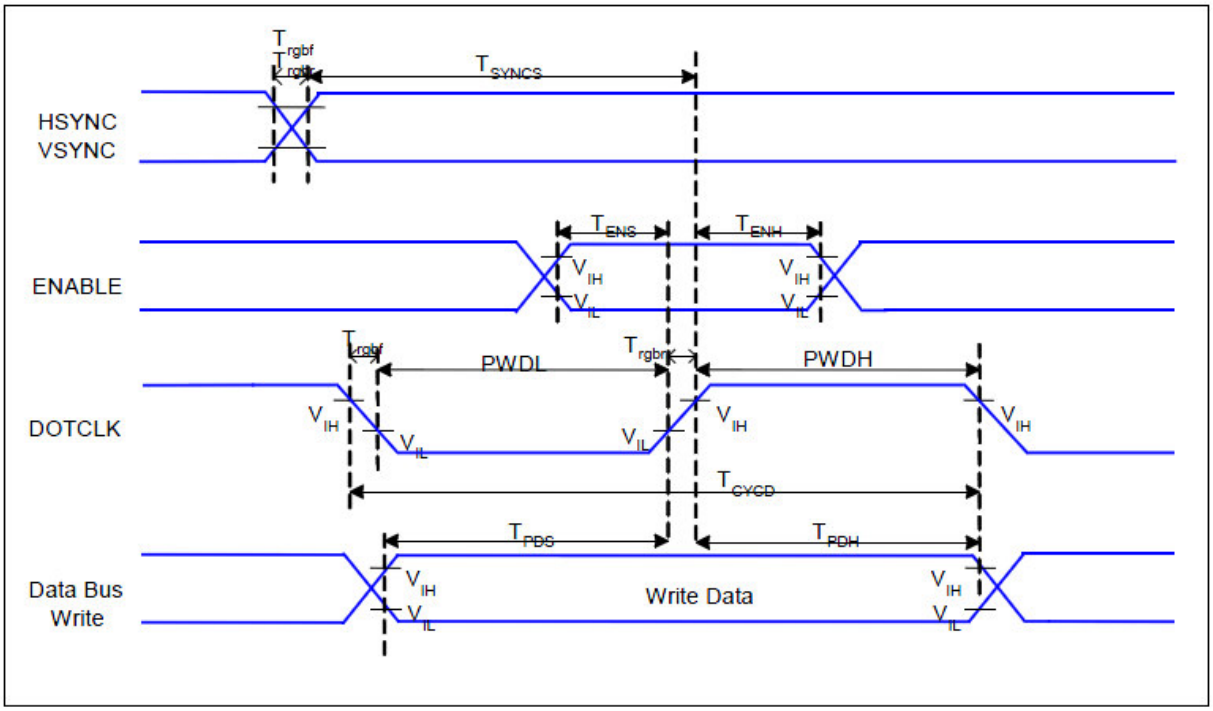
8.2.System Interface

8.2.1.Serial Interface Characteristics (3-line serial)

Signal	Symbol	Parameter	Min	Max	Unit	Description
CSX	T_{CSS}	Chip select setup time (write)	15		ns	
	T_{CSH}	Chip select hold time (write)	15		ns	
	T_{CSS}	Chip select setup time (read)	60		ns	
	T_{SCC}	Chip select hold time (read)	65		ns	
	T_{CHW}	Chip select "H" pulse width	40		ns	
SCL	T_{SCYCW}	Serial clock cycle (Write)	66		ns	
	T_{SHW}	SCL "H" pulse width (Write)	15		ns	
	T_{SLW}	SCL "L" pulse width (Write)	15		ns	
	T_{SCYCR}	Serial clock cycle (Read)	150		ns	
	T_{SHR}	SCL "H" pulse width (Read)	60		ns	
	T_{SLR}	SCL "L" pulse width (Read)	60		ns	
SDA (DIN)	T_{SDS}	Data setup time	10		ns	
	T_{SDH}	Data hold time	10		ns	
DOUT	T_{ACC}	Access time	10	50	ns	For maximum CL=30pF
	T_{OH}	Output disable time	15	50	ns	For minimum CL=8pF



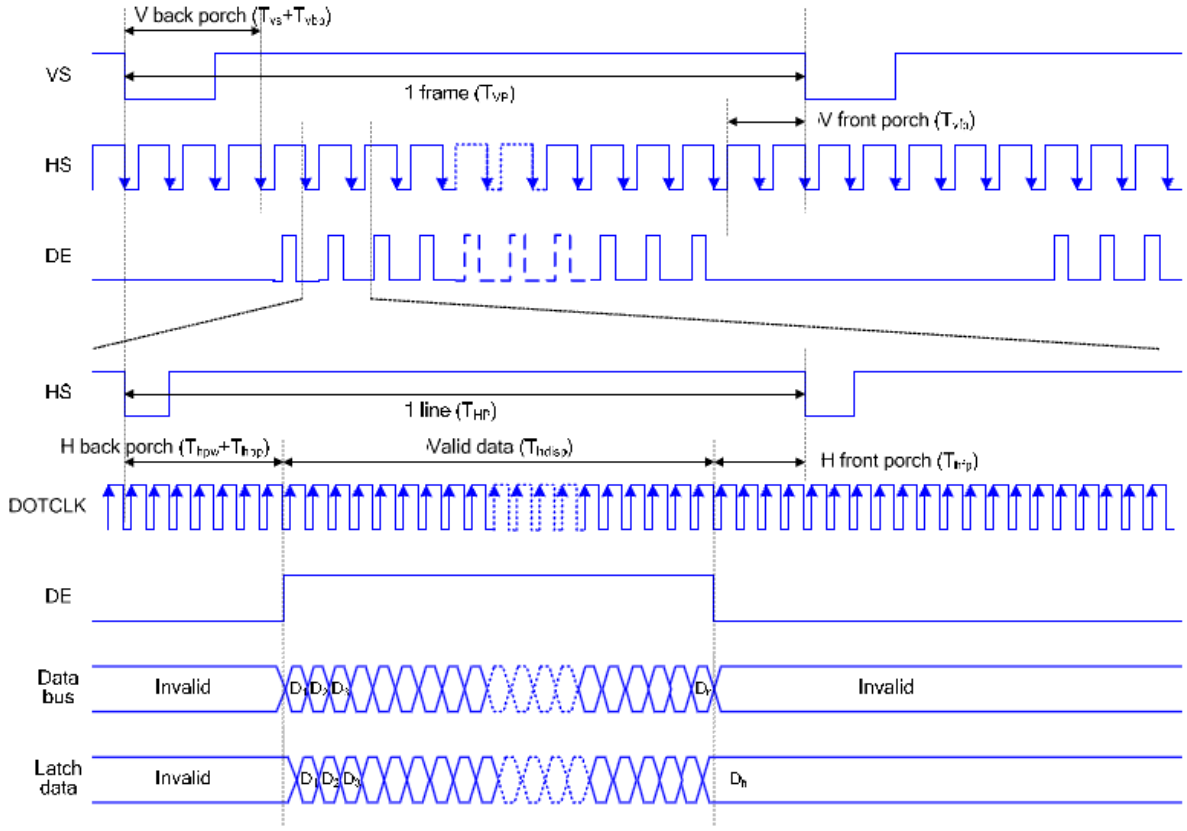
8.2.2.RGB Interface Characteristics



Signal	Symbol	Parameter	MIN	MAX	Unit	Description
HSYNC, VSYNC	T_{SYNCS}	VSYNC, HSYNC Setup Time	30	-	ns	
ENABLE	T_{ENS}	Enable Setup Time	25	-	ns	
	T_{ENH}	Enable Hold Time	25	-	ns	
DOTCLK	PWDH	DOTCLK High-level Pulse Width	60	-	ns	
	PWDL	DOTCLK Low-level Pulse Width	60	-	ns	
	T_{CYCD}	DOTCLK Cycle Time	120	-	ns	
	Trghr, Trghf	DOTCLK Rise/Fall time	-	20	ns	
DB	T_{PDS}	PD Data Setup Time	50	-	ns	
	T_{PDH}	PD Data Hold Time	50	-	ns	

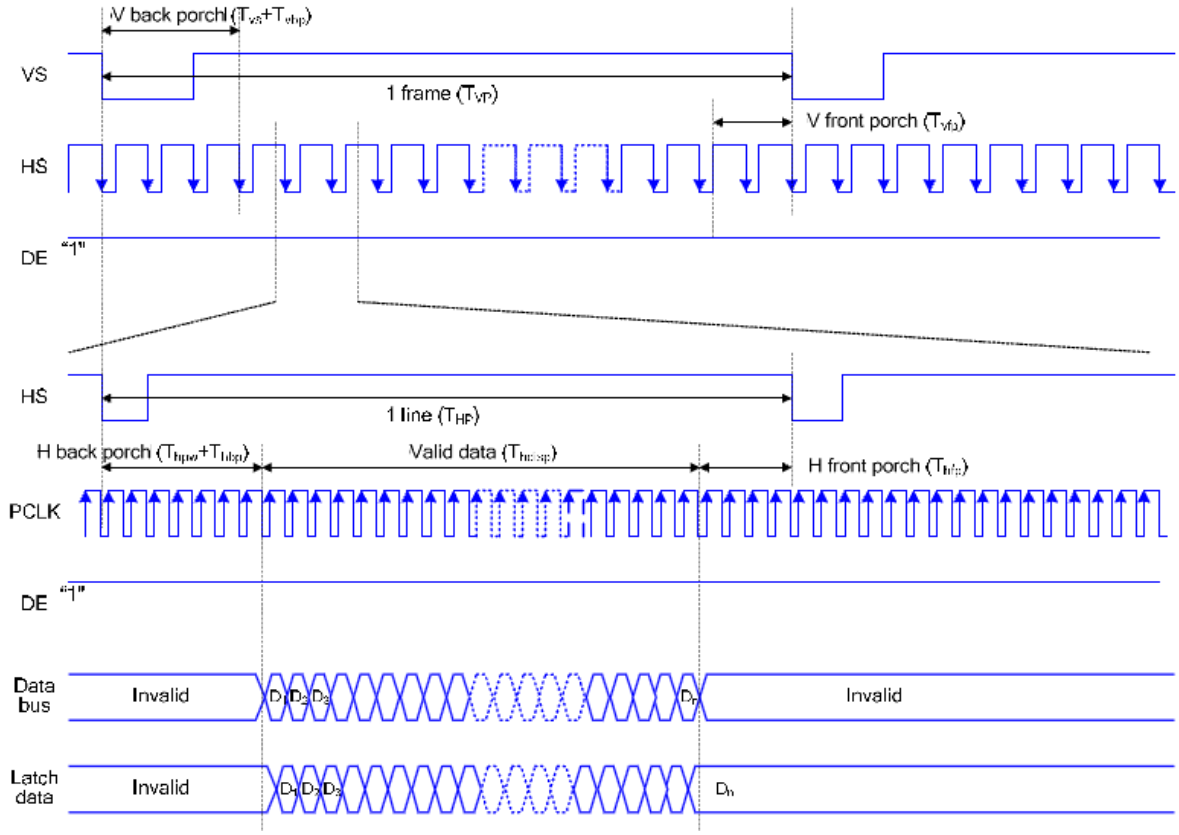
Parameter	Symbol	Min.	Typ.	Max.	Unit
Horizontal Sync. Width	hpw	2	10	hpw+hbp=31	Clock
Horizontal Sync. Back Porch	hbp	4	10		Clock
Horizontal Sync. Front Porch	hfp	2	38	-	Clock
Vertical Sync. Width	vs	1	4	vs+vbp=127	Line
Vertical Sync. Back Porch	vbp	1	4		Line
Vertical Sync. Front Porch	vfp	1	8	-	Line

The timing chart of RGB interface DE mode is shown as follows.

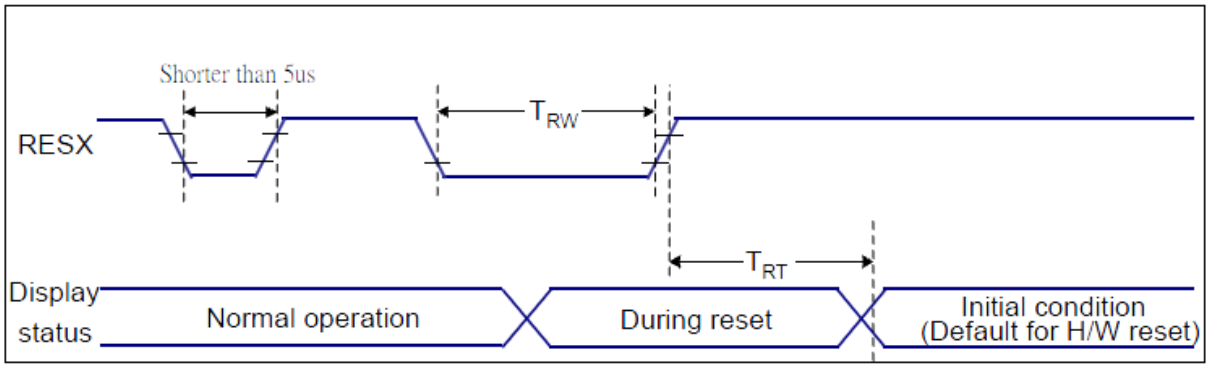


Note: The setting of front porch and back porch in host must match that in IC as this mode.

The timing chart of RGB interface HV mode is shown as follows.

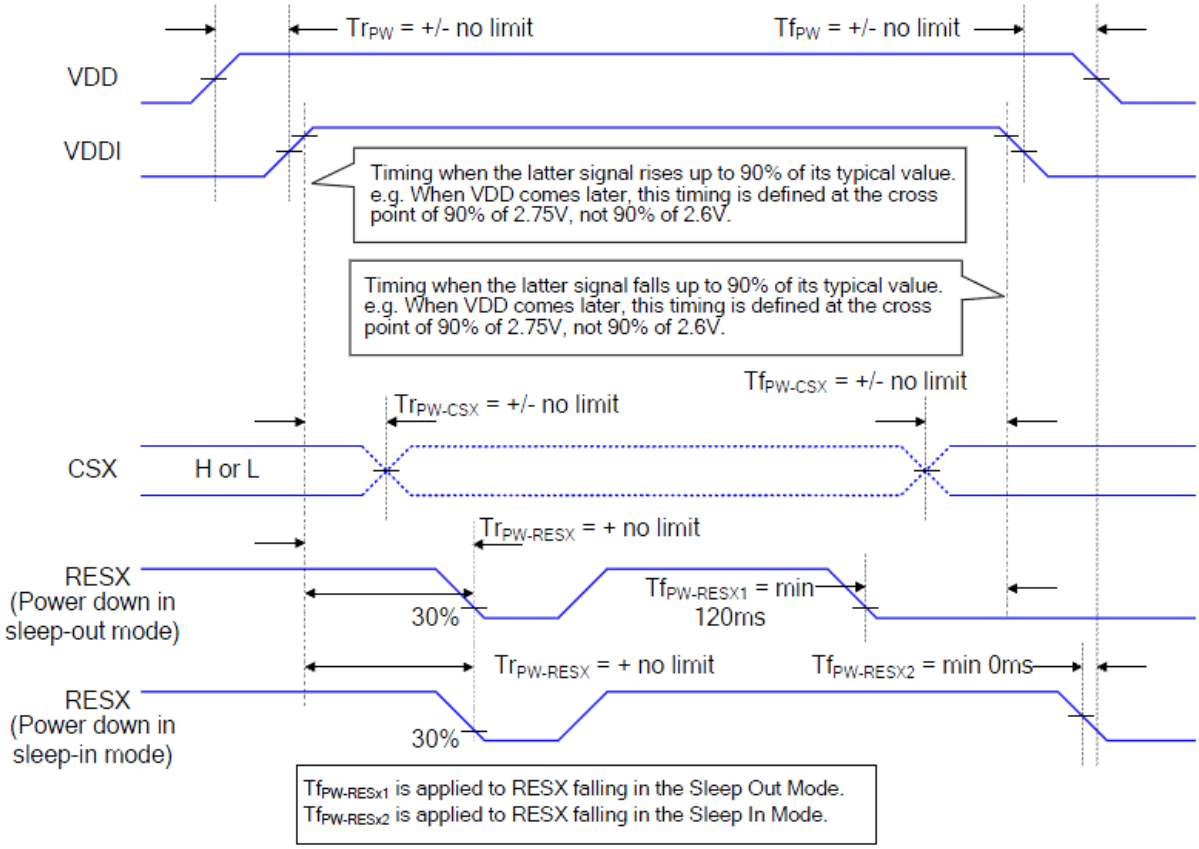


8.2.3.Reset Timing Characteristics



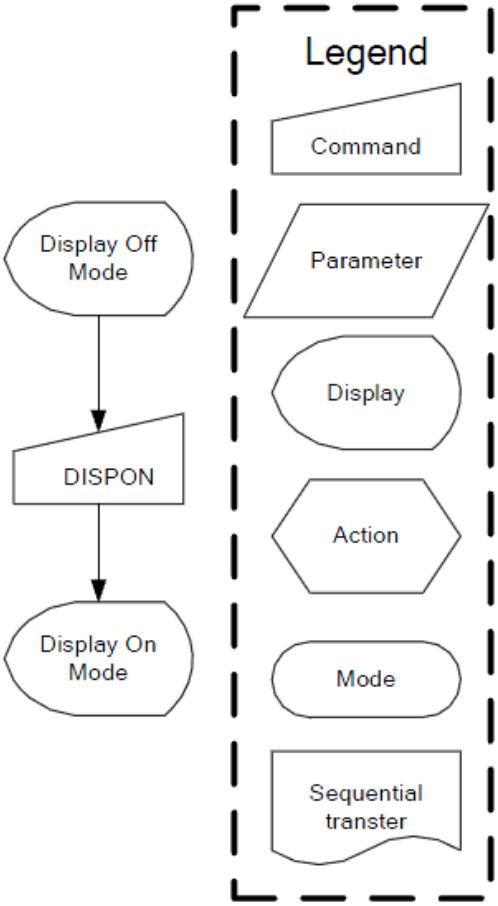
Related Pins	Symbol	Parameter	MIN	MAX	Unit
RESX	TRW	Reset pulse duration	10	-	us
	TRT	Reset cancel	-	5 (Note 1, 5)	ms
				120 (Note 1, 6, 7)	ms

8.2.4.Power ON/OFF

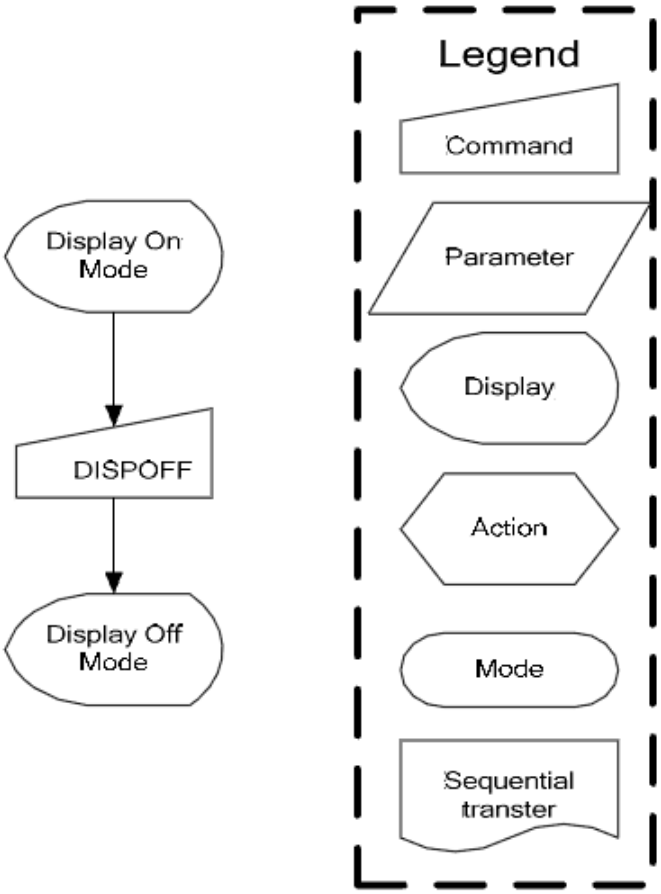


8.2.5.Display ON/OFF

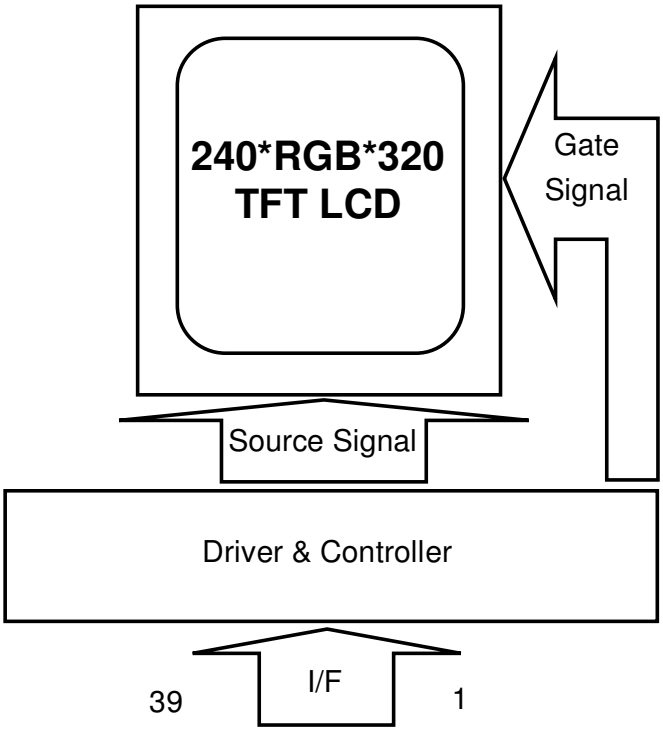
Display ON



Display OFF



8.2.6.Block Diagram Of LCM



9. ELECTRO-OPTICAL CHARACTERISTICS

Parameter		Symbol	Min.	Typ.	Max.	Units	Note
Luminance of white		Lwh	200	250	---	cd/m^2	*3)
Contrast Ratio		CR	400	500	---	-	*5)
Response Time (Tr+Tf)			---	20	30	ms	*4)
Viewing Angle (CR≧10)	X axis right (ψ=0°)	θ x	70	80	---	Degree	*6)
	X axis left (ψ=180°)	θ x	65	75	---		
	Y axis up (ψ=90°)	θ y	50	60	---		
	Y axis down (ψ=270°)	θ y	45	55	---		
CIE color Coordinates	White	Wx	0.257	0.307	0.357		BM5; 1° angle
		Wy	0.252	0.302	0.352		
	Red	Rx	0.581	0.631	0.681		
		Ry	0.296	0.346	0.396		
	Green	Gx	0.336	0.386	0.436		
		Gy	0.512	0.562	0.612		
	Blue	Bx	0.099	0.149	0.199		
		By	0.025	0.075	0.125		
NTSC		-		53		%	*7)
Uniformity		-	75	80		%	*8)

- For LCM

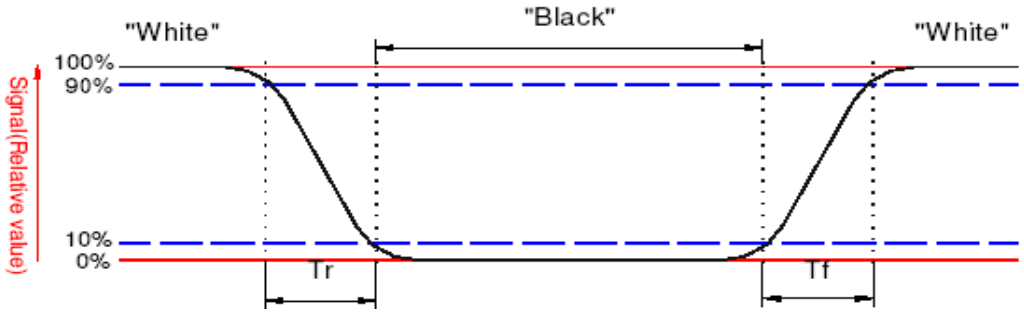
Note 1. Ambient temperature = 25℃±2℃.
Note 2. To be measured in the dark room.
Note 3. To be measured at the center area of panel with a viewing cone of 1° by Topcon luminance meter BM-5,after 10 minutes operation（module）.
Note 4. Definition of response time：

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：



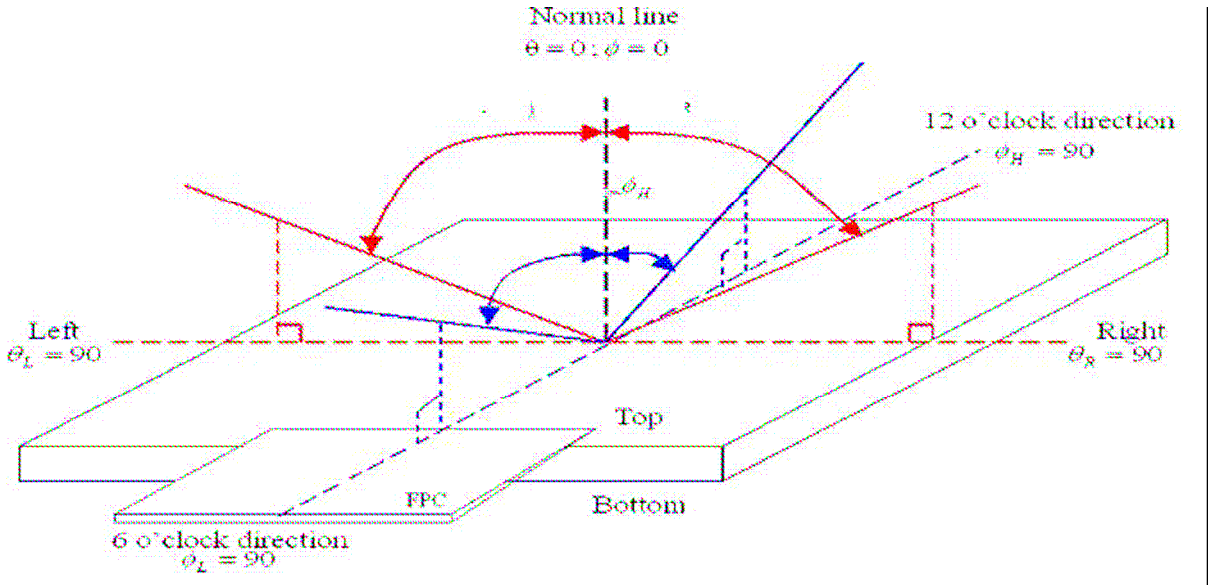
Note 5. Definition of contrast ratio：

Contrast ratio is calculated with the following formula.

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

Note 6. Definition of viewing angle：

Refer to the figure as below



Note 7. Definition of color chromaticity (CIE1931)

Color coordinates measured at center point of LCD.

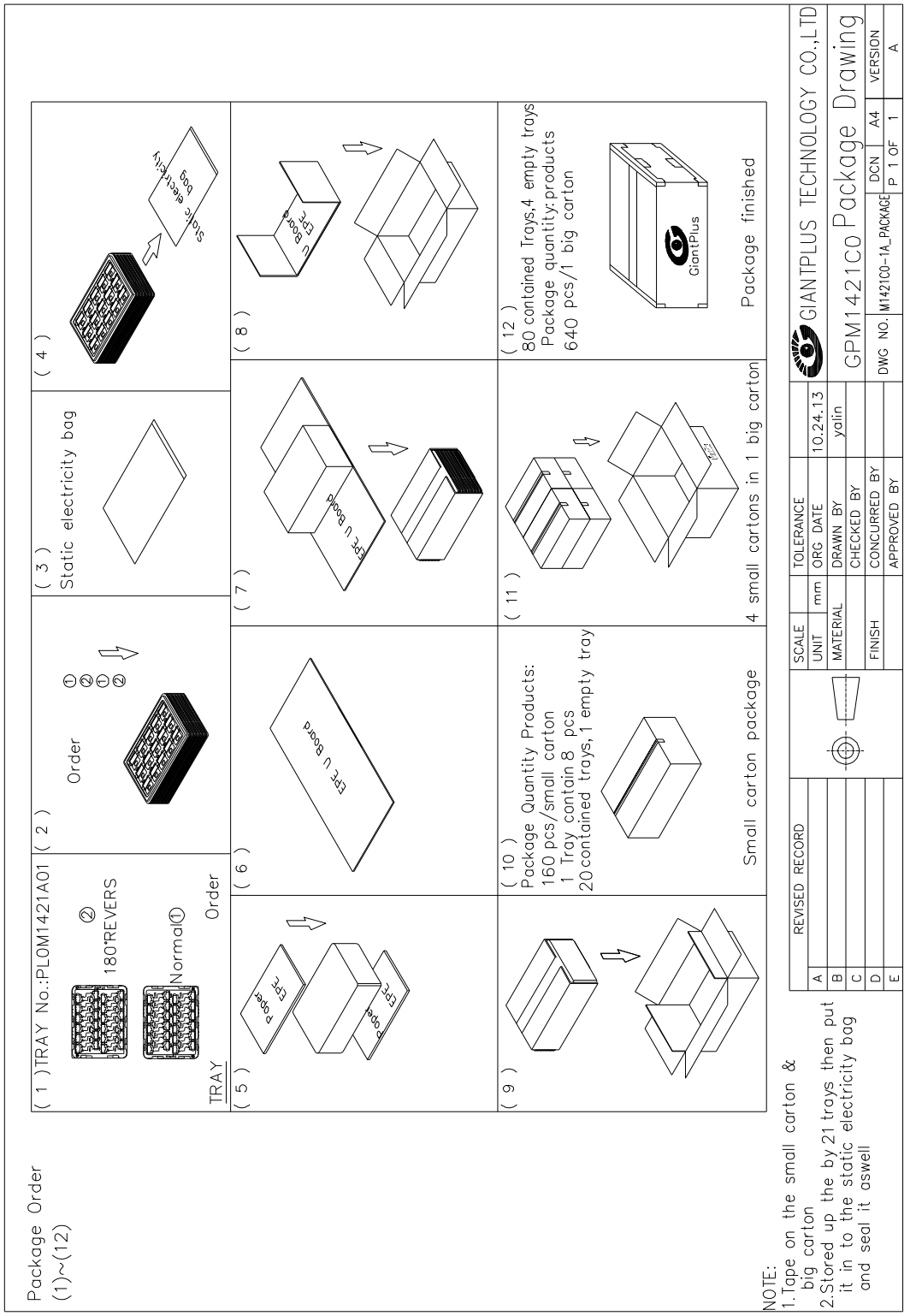
Note 8 Uniform measure condition：

(a) To Measure 9 point. Measure location is show below：

(b) Uniform = (Min. brightness / Max. brightness)×100%

(c) Best Contrast, Main and sub panel all dots turn ON (White screen)

10.PACKAGE DROWING



11.RELIABILITY

11.1.Tests

NO.	ITEM	CONDITION	CRITERION
1	High Temperature Operating	70℃ 240 hrs	◦ No Defect Of Operational Function In Room Temperature Are Allowable(23±5℃). ◦ ICC of LCD in Pre-and post-test should follow specification
2	Low Temperature Operating	-20℃ 240 hrs	
3	High Temperature Non-Operating	80℃ 240 hrs	
4	Low Temperature Non-Operating	-30℃ 240 hrs	
5	High Temperature/ Humidity Operating	60℃ ,90%RH 240 hrs	
6	Temperature Shock Non-Operating	-30℃ ⟷ 70℃ (30min) (5min) (30min) 20 CYCLES	
7	Electrostatic Discharge Test Operating	C=150pF,R=330Ω, 5 points/panel, Air : ±8KV, 5 times Contact : ±4KV, 5 times (Environment : 30%~60%, 86Kpa~106Kpa)	

Note 1: Test after 24 hours in room temperature(23±5℃).
Note 2: The sampling above is individually for each reliability testing condition.
Note 3: The color fading of polarizing filter should not care.
Note 4: All of the reliability testing chamber above, is using D.I. water. (Min value: 1.0 MΩ-cm)
Note 5: In case of malfunction defect caused by ESD damage, if it would be recovered to normal state after software resetting, it would be judged as a good part.

11.2.Color performance

No.	ITEM	Criterion (initial)
1	Luminance	>50%
2	NTSC	>70%
3	Contrast Ratio	>50%

12.INSPECTION CRITIRIA

12.1.Inspection Conditions

12.1.1.Environmental conditions

The environmental conditions for inspection shall be as follows

Room temperature: 23±5℃

Humidity: 50±20%RH

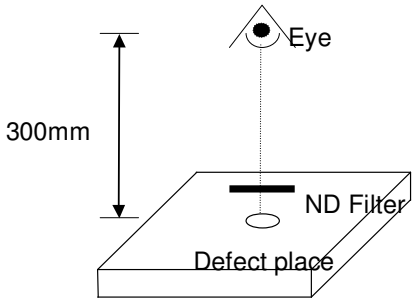
12.1.2.The external visual inspection

With a single 1000±200lux fluorescent lamp as the light source, the inspection was in the distance of 30cm or more from the LCD to the inspector's eyes.

12.2.Light Method

12.2.1.Environment lamp under 1000±200 lux, Viewing direction for inspection over 30cm

12.2.2.The distance from eye to defect around 300mm, the distance from ND Filter to defect around 25~30mm



12.3.Classification Of Defects

12.3.1.Major defect

A major defect refers to a defect that may substantially degrade usability for product applications.

12.3.2.Minor defect

A minor defect refers to a defect which is not considered to be able substantially degrade the product application or a defect that deviates from

existing standards almost unrelated to the effective use of the product or its operation.

Notes: If the LCD/LCM ’s cosmetic and display performance do not specify in “inspection criterion”, it should be based on these delivered samples.

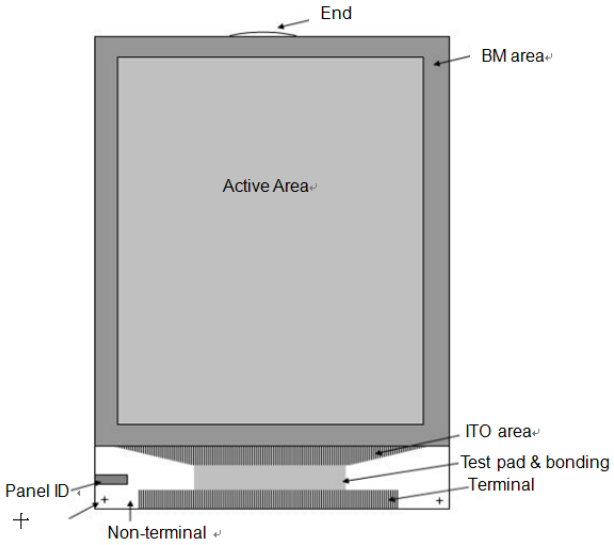
12.4.Sampling & Acceptable Quality Level

Level II, MIL-STD-105E

	Major	Minor
Cosmetic	0.65 %	1.0 %
Electrical-display	0.4%	0.4 %

12.5.Definition Of Inspection Area

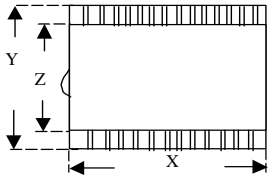
A.A: Active Area

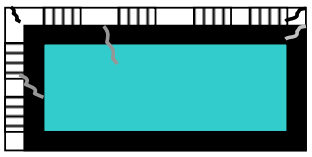


12.6.Items and Criteria

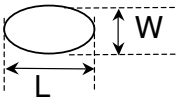
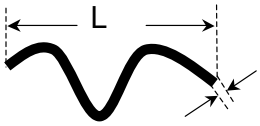
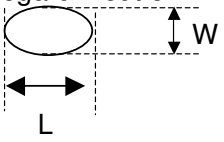
12.6.1.Visual inspection criterion in cosmetic

(1) Glass defect

No	Defect	Criteria	Remark
1	Dimension (Minor)	By engineering diagram	

No	Defect	Criteria	Remark
2	Cracks (Major)	Extensive crack 【Reject】	

(2) LCM appearance defect with in A.A

No	Defect	Criteria		Remark
1	Round type (Minor)	Spec.	Permissible Qty	1. ϕ =(L+W)/2, L: Length, W: Width 2. Disregard if out of A.A. 
		$\phi \leqq$0.10mm	Disregard	
		0.10mm< ϕ $\leqq$ 0.20mm	3	
		0.20mm< ϕ	0	
2	Line type (Minor)	Spec.	Permissible Qty	1. L: Length, W: Width 2. Disregard if out of A.A. 
		W$\leqq$0.02mm	Disregard	
		L$\leqq$3.0mm and 0.02mm<W$\leqq$0.05mm	2	
		W>0.05mm or L>3.0mm	0	
3	Polarizer dent (Minor)	Spec.	Permissible Qty	1. ϕ =(L+W)/2, L: Length, W: Width 2. Disregard if out of A.A. 
		$\phi \leqq$0.20mm	Disregard	
		0.20mm< ϕ $\leqq$ 0.30mm	2	
		0.30mm< ϕ $\leqq$ 0.50mm	1	
		0.50mm< ϕ	0	

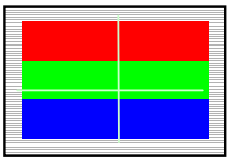
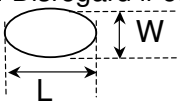
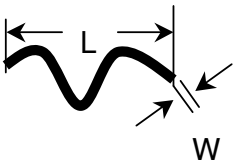
(3) FPC

No	Defect	Criteria	Remark
1	Copper peeling (Minor)	Copper peeling 【Reject】	

(4) Silicon

No	Defect	Criteria	Remark
1	Amount of silicon (Minor)	ITO exposed 【Reject】	

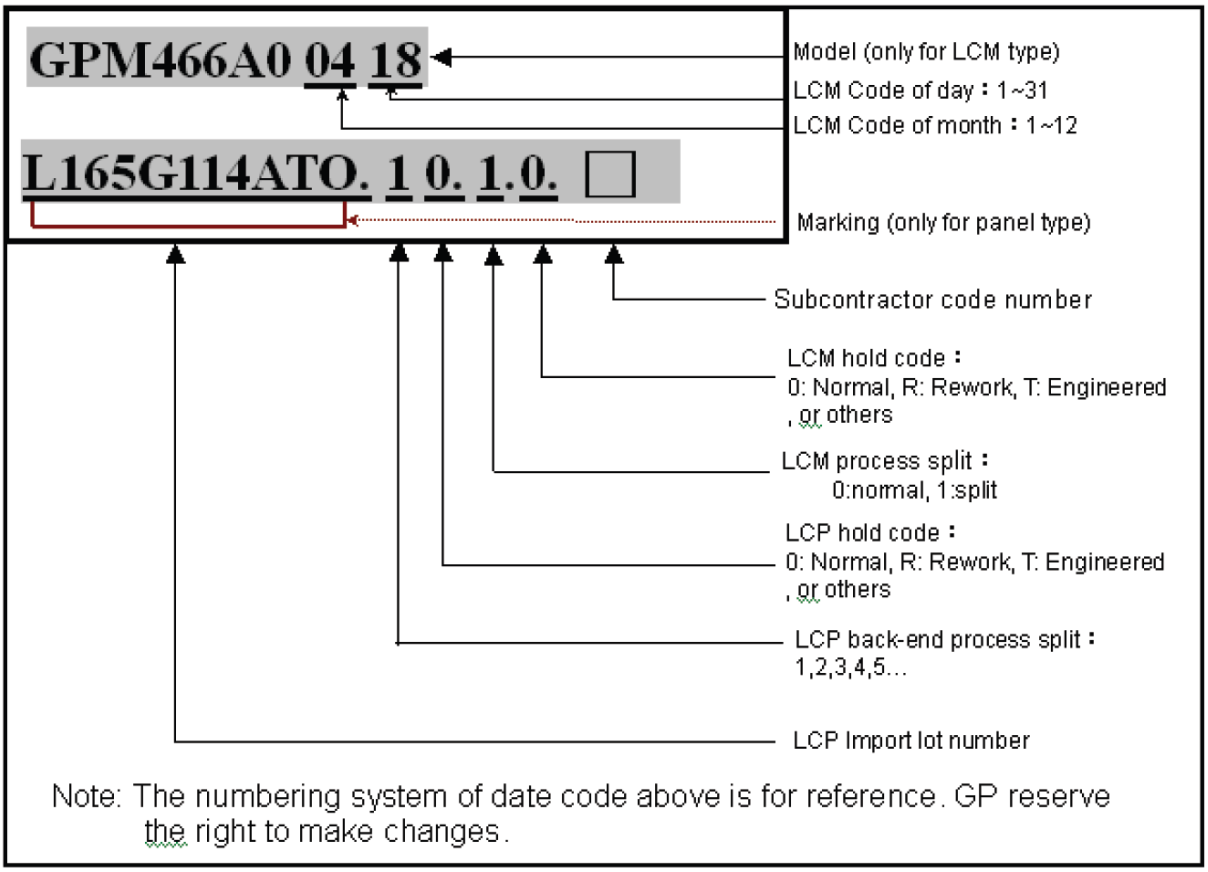
12.6.2.Visual inspection criterion in electrical display

No	Defect	Criteria		Remark
1	No display (Major)	Not allowed		
2	Missing line (Major)	Not allowed		
3	Darker or lighter line (Major)	Not allowed		
4	Weak line (Minor)	By limit sample		
5	Bright / Dark point (Minor)	Spec.	Permissible Qty	1:1sub-pixel: 1R or 1G or 1B 2:Point defect area≧1/2 sub pixel.
		Bright point	0	
		Dark point	2	
6	Round type (Minor)	Spec.	Permissible Qty	1. ϕ=(L+W)/2, L: Length, W: Width 2. Disregard if out of A.A. 
		$\phi \leqq$0.10mm	Disregard	
		0.10mm< $\phi \leqq$ 0.20mm	3	
		0.20mm< ϕ	0	
7	Line type (Minor)	Spec.	Permissible Qty	1. L: Length, W: Width 2. Disregard if out of A.A. 
		W≦0.02mm	Disregard	
		L≦3.0mm and 0.02mm<W≦0.05mm	2	
		W>0.05mm or L>3.0mm	0	
8	Mura (Minor)	By 5% ND filter invisible		

12.6.3.Others

1. Issues that are not defined in this document shall be discussed and agreed with both parties. (Customer and supplier)
2. Unless otherwise agreed upon in writing, the criteria shall be applied to both parties. (Customer and supplier)

13.ILLUSTRATION OF LCD DATE CODE



Note: The numbering system of date code above is for reference. GP reserve the right to make changes.

14.RoHS COMPLIANT WARRANTY

RoHs Hazardous substances including:

- Cd< 100 ppm
- Pb< 1000 ppm
- Hg< 1000 ppm
- Cr +6 < 1000 ppm
- PBDE < 1000 ppm
- PBB < 1000 ppm

15.RECAUTIONS FOR USE

15.1.Safety

(1) Do not swallow any liquid crystal, even if there is no proof that liquid crystal is poisonous.
(2) If the LCD panel breaks, be careful not to get liquid crystal to touch your skin.
(3) If skin is exposed to liquid crystal, wash the area thoroughly with alcohol or soap.

15.2.Storage Conditions

(1) Store the panel or module in a dark place where the temperature is 23±5℃ and the humidity is below 50±20%RH.
(2) Store in anti-static electricity container.
(3) Store in clean environment, free from dust, active gas, and solvent.
(4) Do not place the module near organics solvents or corrosive gases.
(5) Do not crush, shake, or jolt the module.
(6) Do not exposed to direct sun light of fluorescent lamps.

15.3.Installing LCD Module

Attend to the following items when installing the LCM.
(1) Cover the surface with a transparent protective plate or touch panel to protect the polarizer and LC cell.
(2) When assembling the LCM into other equipment, the spacer to the bit between the LCM and the fitting plate should have enough height to avoid causing stress to the module surface, refer to the individual specifications for measurements. The measurement tolerance should be ±0.1mm.

15.4.Precautions For Operation

(1) Viewing angle varies with the change of liquid crystal driving voltage (Vo). Adjust Vo to show the best contrast.
(2) Driving the LCD in the voltage above the limit will shorten its lifetime.
(3) Response time is greatly delayed at temperature below the operating temperature range. However, this does not mean the LCD will be out of the order. It will recover when it returns to the specified temperature range.
(4) When turning the power on, input each signal after the positive/negative voltage becomes stable.
(5) Do not apply water or any liquid on product which composed of T/P.

15.5.Handling Precautions

(1) Avoid static electricity which can damage the CMOS LSI; please wear the wrist strap when handling.
(2) The polarizing plate of the display is very fragile. so, please handle it very carefully.
(3) Do not give external shock.
(4) Do not apply excessive force on the surface; it may cause display abnormal .
(5) Do not wipe the polarizing plate with a dry cloth, as it may easily scratch the surface of plate.
(6) Do not use ketonics solvent & Aromatic solvent, use with a soft cloth soaked with a cleaning naphtha solvent.
(7) Do not operate it above the absolute maximum rating.
(8) Do not remove the panel or frame from the module.
(9) Do not apply water or any liquid on product, which composed of T/P.

15.6.Warranty

(1) The period is within 12 months since the date of shipping out under normal using and storage conditions.
(2) The warranty will be avoided in case of defect induced by customer.

16.FACTORY

For the consideration of mass production convenience, this model will be manufactured in the factories listed below.

FACTORY NAME: GIANTPLUS TECHNOLOGY CO., LTD
FACTORY ADDRESS: No.15 Industrial Rd., Lu-Chu Li, Toufen Town
351 Miao-Li County, Taiwan, R.O.C..
FACTORY PHONE: TEL: 886-37-611-611 FAX: 886-37-613-166
FACTORY ADDRESS: No.1127,Heping Rd.,Bade City,Taoyuan,334, Taiwan, R.O.C..
FACTORY PHONE: TEL: 886-3-3679978 FAX: 886-3-3670661

FACTORY NAME: KUNSHAN GIANTPLUS OPTOELECTRONICS
TECHNOLOGY CO., LTD.
FACTORY ADDRESS: No.88,HuanQing Rd., Hitech Industrial Park, Cheng-Bei Town,
KunShan City, JiangShu Province, China.
FACTORY PHONE: TEL:86-512-57780-988 FAX : 86-512-57780-503

FACTORY NAME: SHENZHEN GIANTPLUS OPTOELEC. DISPLAY CO., LTD.
FACTORY ADDRESS: Building A, Distict A ,MinZhu99 Industrial City,
ShaJing Industrial Park, BaoAn District, ShenZhen, China
FACTORY PHONE: TEL: 86-755-29720-088 FAX : 86-755-29720-828

17.REVISION HISTORY

Version	Revise record	Date
A	New version	2014/1/29
B	Modify Sleeping Mode Power Consumption page6	2014/2/25
C	Modify Sleeping Mode Power Consumption page6	2014/3/13