DATA MODUL

SPECIFICATION

ORTUSTECH

GPM1992A0

1.3“ – RGB – SPI

Version: A
Date: 19.12.2022

Note: This specification is subject to change without prior notice

RoHS
COMPLIANT

Giantplus
Technology

DESIGN SHEET
設計規格書

Customer 客戶名稱	TOPPAN
Part No. 產品型號	GPM1992A0
Product type 產品內容	Mode: Active matrix TFT ,Transflective type. LCD Module: 176*RGB*176 dot-matrix Screen size(inch):1.28(Diagonal)
Remarks 備註欄	

■Preliminary Specification 暫行規格
□Final Specification 正式規格

Signature by Customer:
客戶確認簽章:

Issued by QA	Checked by QA	Checked by MD	Checked by PM	Approved By		
				PD	CS	BU

Giantplus
Technology

Specification of LCD Module

Product No.: GPM1992A0

Issue date: 2023/3/29

Giantplus Technology Co., LTD

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TABLE OF CONTENTS

1. GENERAL DESCRIPTION

The GPM1992A0 is a 176XRGBX176 dot-matrix TFT module. LCD color is determined with Dithering 8 Color signal for each pixel. This module can be easily accessed by 3wire SPI interfaces. The GPM1992A0 is intended to support applications such as smart watch.

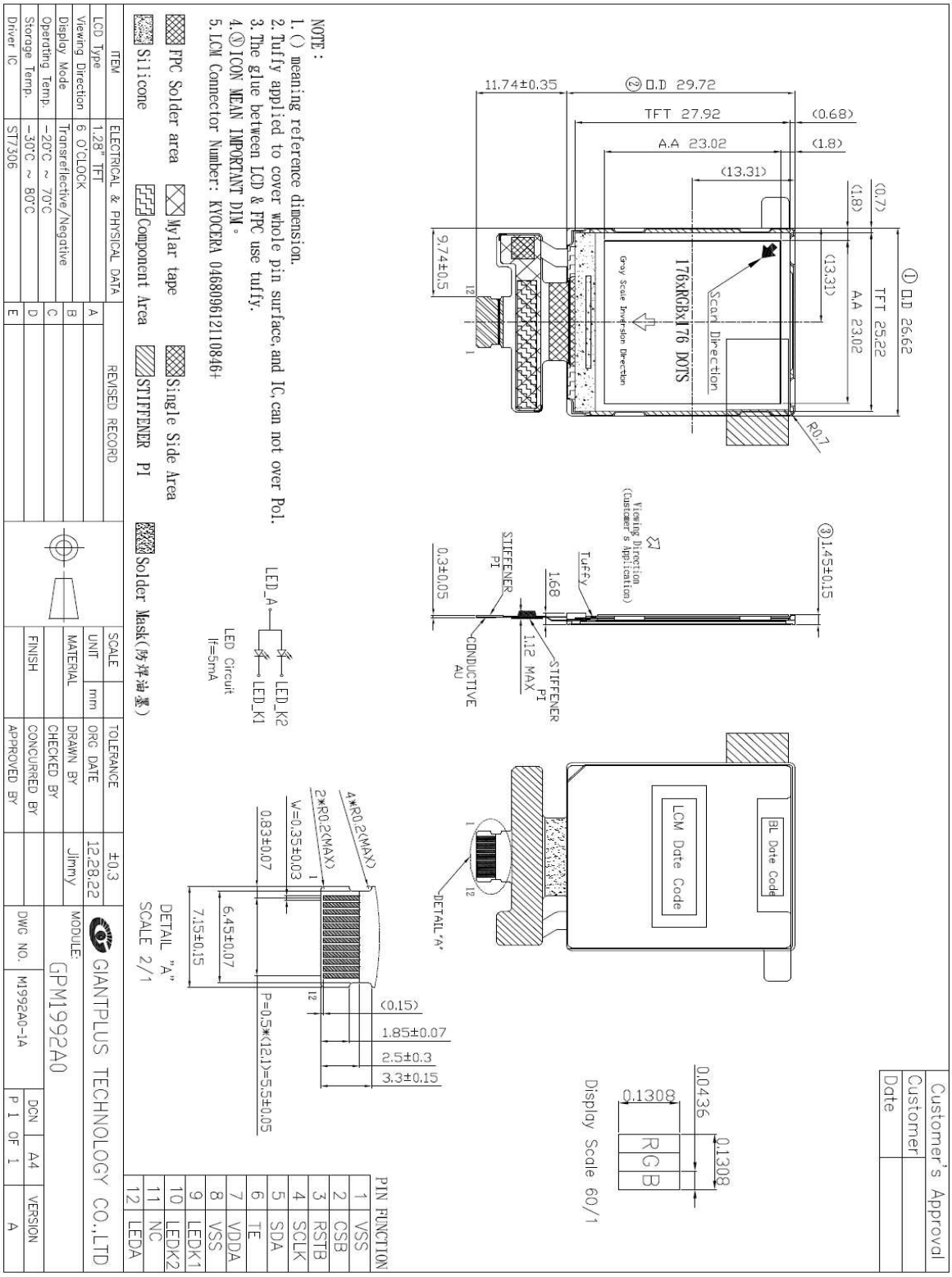
2. FEATURES

Display Mode	Normally Black
	Active matrix TFT ,Transflective type
Color Pixel Arrangement	RGB Stripe
Number of Pixel	176(H)*RGB*176(V)
Color	8
Input Data	3wire SPI interface
Viewing Direction	6’ o clock (Customer application)
Driver IC	ST7306

3. MECHANICAL SPECIFICATION

Item	Specifications	Unit
Dimensional outline	26.62(W)×29.72(L)×1.45(D) (Exclude FPC, Backlight Tape, Support Block)	mm
Number of Pixel	176(H)*RGB*176(V)	Pixel
LCD A.A	23.0208(W)×23.0208(L)	mm
Pixel Pitch	0.1308 (W)× 0.1308(L)	mm
Weight	2.0	g

4. MECHANICAL DIMENSION (FOR Reference)



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°C

Item	Symbol	Values		Unit	Condition
		Min.	Max.		
Supply voltage	VDDA	-0.3	4	V	
Interface signal voltage	-	-0.3	VDDA+0.5	V	SPI

6. ELECTRICAL CHARACTERISTICS

Item		Symbol	Condition	Min.	Typ.	Max.	Unit
System Voltage		VDDA	---	1.7	1.8	1.9	V
Power Consumption		I_{VDDA}	--	---	---	1.32	mA
Input Voltage	H level	V_{IH}	---	0.7VDDA	---	VDDA	V
	L level	V_{IL}		0	---	0.3VDDA	V
Output Voltage	H level	V_{OH}	IOH = -1.0mA	0.8VDDA		VDDA	V
	L level	V_{OL}	IOL = +1.0mA	0		0.2VDDA	

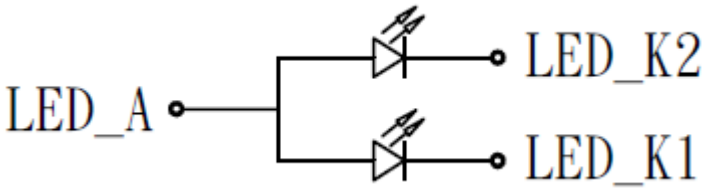
7. BACKLIGHT CHARACTERISTIC

Item	Symbol	Min.	Typ.	Max.	Unit	Condition
LED Forward voltage	$V_{f\ LED}$	2.4	-	3.4	V	Ta=25ºC
LED Forward Current	$I_{f\ LED}$	-	5	-	mA/2ch	Ta=25ºC
Power dissipation	P_d	12	-	17	mW	Ta=25ºC
LED life time	hr	83000				Note 3

Note1: LED 1A2K, Total 2 LED.

Note2: Constant current driving this backlight unit.

Note3:LED life time is defined as the time when the brightness become 50% of initial value. (Ta=25℃, I=5mA)

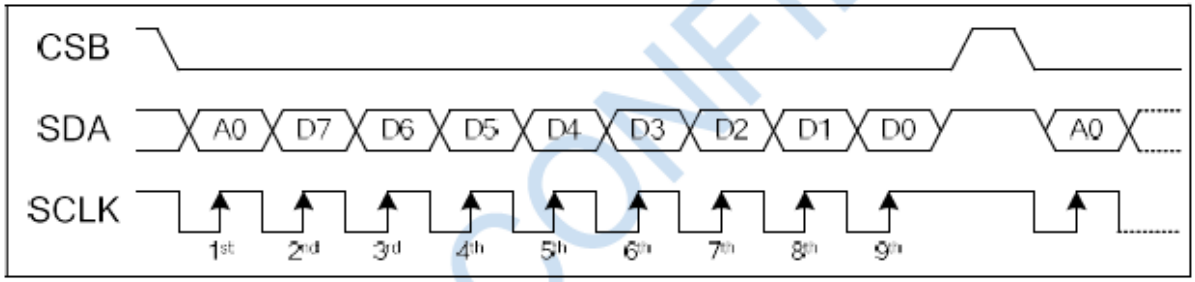


8. MODULE FUNCTION DESCRIPTION

Pin	Symbol	I/O	Function
1	VSS	P	Power GND
2	CSB	I	Chip select.
3	RSTB	I	Reset input pin. When RSTB is “L”, internal initialization procedure is executed.
4	SCLK	I	Serial input clock
5	SDA	I/O	Serial input data
6	TE	O	Tearing effect signal
7	VDDA	P	Power Supply Voltage.
8	VSS	P	System ground.(GND)
9	LEDK1	P	Cathode of LED.
10	LEDK2	P	Cathode of LED.
11	NC	-	No connect
12	LEDA	P	Anode of LED.

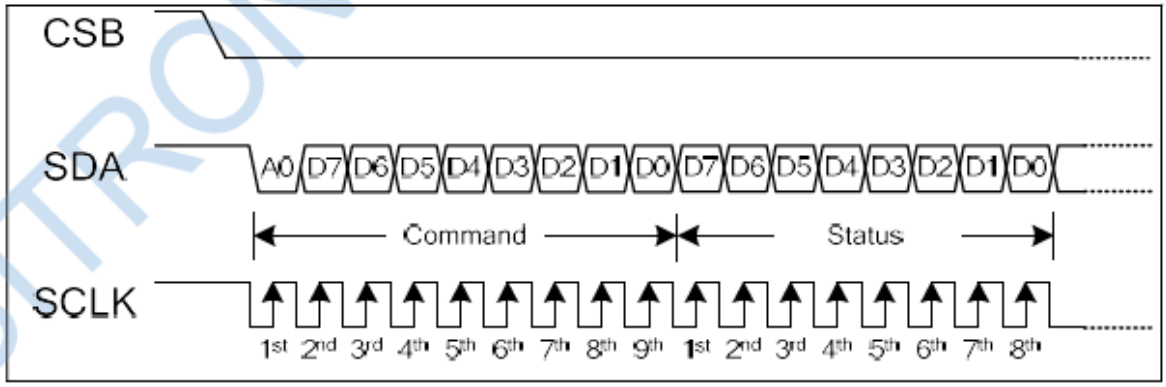
9. Data Input format

■ **3 Wire Serial Write format**



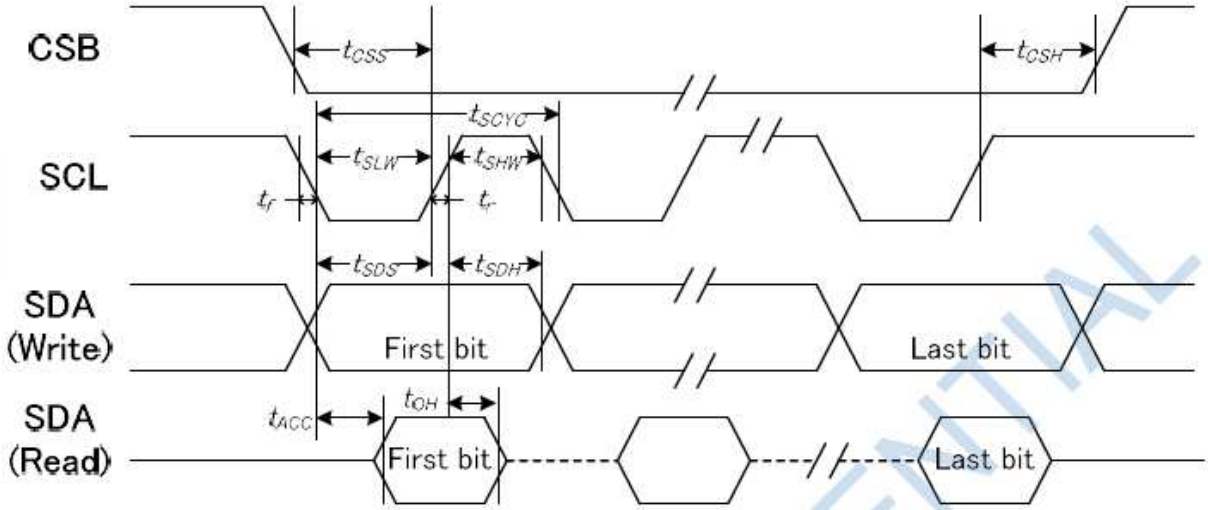
Write Operation of 3-Line SPI

■ **3 Wire Serial Read format**



Read Status Operation of 3-Line SPI

■ Serial Control timing



Item	Signal	Symbol	Condition	Min.	Max.	Unit
Serial clock period (Write)	SCL	tSCYC		30	—	ns
Serial clock period (Read)				150		
SCLK "H" pulse width (Write)		tSHW		15	—	
SCLK "H" pulse width (Read)				60		
SCLK "L" pulse width (Write)		tSLW		15	—	
SCLK "L" pulse width (Read)				60		
Data setup time	SDA (Write)	tSDS		10	—	
Data hold time		tSDH		10	—	
Data setup time	SDA (Read)	tACC	For maximum CL=30p	10	50	
Data hold time		tOH	For minimum CL=8p	15	50	
CSB-SCLK time	CSB	tCSS		10	—	
CSB-SCLK time		tCSH		10	—	

10. Data Color Coding

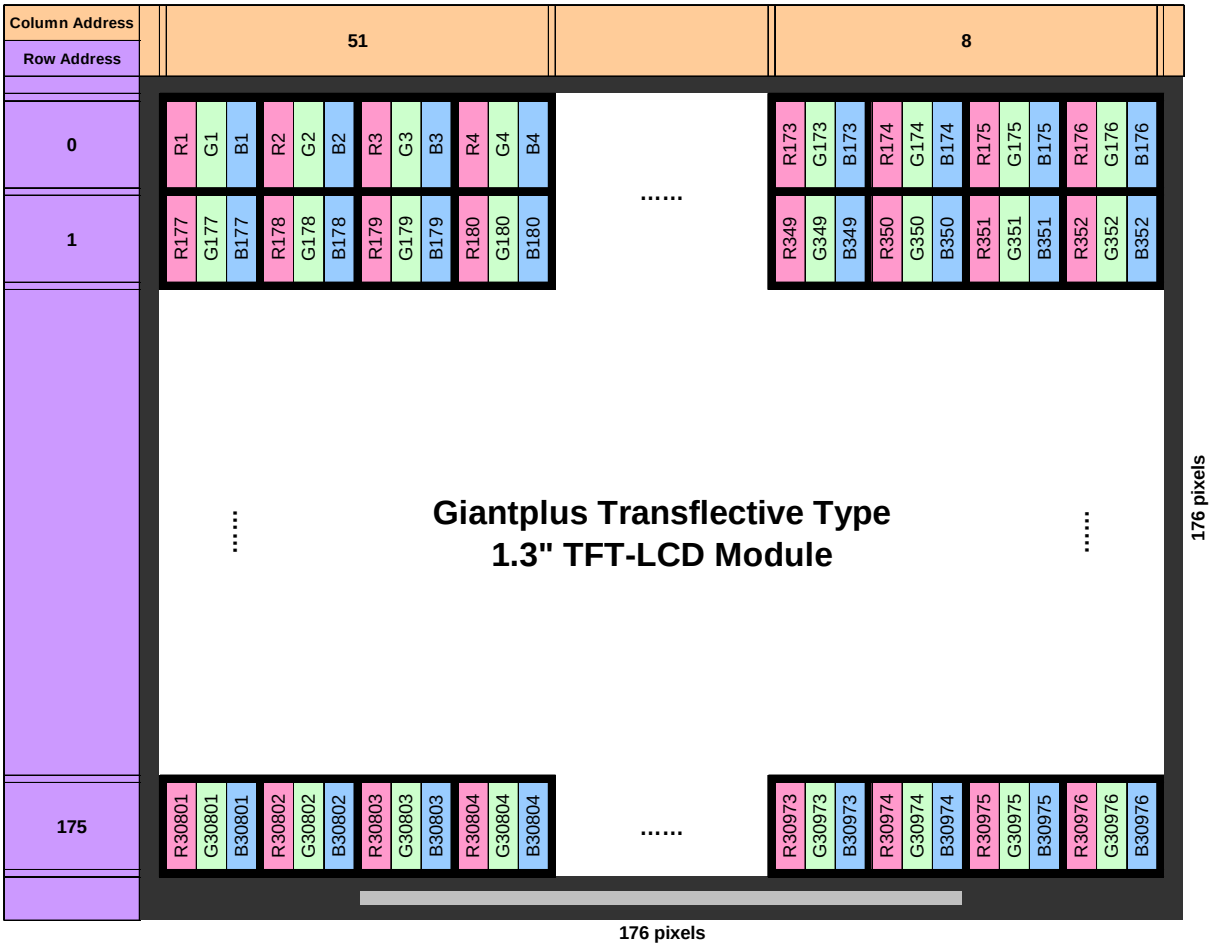
Data Input Format

8080/4SPI/3SPI Interface									
Command	A0	D7	D6	D5	D4	D3	D2	D1	D0
DDRAM write	0	0	0	1	0	1	1	0	0
1st write	1	R1[1]	R1[0]	G1[1]	G1[0]	B1[1]	B1[0]	-	-
2nd write	1	R2[1]	R2[0]	G2[1]	G2[0]	B2[1]	B2[0]	-	-
3rd write	1	R3[1]	R3[0]	G3[1]	G3[0]	B3[1]	B3[0]	-	-
4th write	1	R4[1]	R4[0]	G4[1]	G4[0]	B4[1]	B4[0]	-	-
				⋮					
30975th write	1	R30975[1]	R30975[0]	G30975[1]	G30975[0]	B30975[1]	B30975[0]	-	-
30976th write	1	R30976[1]	R30976[0]	G30976[1]	G30976[0]	B30976[1]	B30976[0]	-	-

Note: - don't care

Data to Display Mapping

The display mapping of 8 color is as below.



11. INITIAL CODE

Recommended Power On Sequence			
R/W	Reg. hex.	Data hex.	Description
VDDA		H	Rise time (0%-90%) < 1ms
delay > 1ms			
RSTB		H	
delay > 120ms			
W	0xD6	0x17	
W		0x02	
W	0xD1	0x01	
W	0xC0	0x0E	
W		0x0E	
W	0xC1	0x27	
W		0x27	
W		0x27	
W		0x27	
W	0xC2	0x1E	
W		0x1E	
W		0x1E	
W		0x1E	
W	0xC4	0x33	
W		0x33	
W		0x33	
W		0x33	
W	0xC5	0x32	
W		0x32	
W		0x32	
W		0x32	
W	0xB2	0x12	
W	0xB3	0xE5	
W		0xF6	
W		0x05	
W		0x46	
W		0x77	
W		0x77	
W		0x77	
W		0x76	
W		0x45	
W	0xB4	0x05	
W		0x46	
W		0x77	
W		0x77	
W		0x77	
W		0x77	
W		0x76	
W		0x45	
W	0xB0	0x58	
W	0x11		Sleep out
delay >300ms			
W	0xD8	0xB6	
W		0xE9	
W	0x36	0x48	
W	0x3A	0x00	
W	0xB8	0x08	
W	0x35	0x00	
W	0xBD	0x02	
W	0x2A	0x08	Column Address Setting
W		0x33	
W	0x2B	0x00	Row Address Setting
W		0xAF	
W	0xBB	0xCF	
delay >300ms			
W	0xBB	0x4F	
W	0x38		
W	0x29		DISPLAY ON
delay >100ms			
Backlight		ON	

Recommended Power Off Sequence			
R/W	Reg. hex.	Data hex.	Description
Backlight		OFF	
delay >34ms			
W	0x28		Display Off
delay >1ms			
W	0x10		Sleep In
delay >120ms			
RSTB		L	
delay >1ms			
VDDA		L	

12. ELECTRO-OPTICAL CHARACTERISTICS

Item		Symbol	Condition	Min	Typ	Max	Unit	Remark
Brightness		-	Ta=25℃, Φ=0,θ=0	TBD	TBD	-	cd/m^2	5mA/2ch
Uniformity		-	Ta=25℃,Φ=0,θ=0	75	80	-	%	Note 6
Response time		T_R+T_F	Ta=25℃,Φ=0,θ=0	-	25	40	ms	Note 3
Transmissive Contrast ratio		T_{CR}	Ta=25℃,Φ=0,θ=0	10	15	-	-	Note 4
Reflective Contrast ratio		R_{CR}	T=25℃	8	11	-	-	Note 4
Viewing Angle	Hor.	Θ_R	Ta=25℃,CR≧2	40	50	-	Deg.	Note 5
		Θ_L		40	50	-		
	Ver.	φ_H		40	50	-		
		φ_L		40	50	-		
Reflective		R%	Ta=25℃	6.5	7.4	-	%	CM-700D
Transmission		T%	Ta=25℃,Φ=0,θ=0	0.7	0.9	-	%	Only Panel
Color Filter Chromaticity (Transmissive)		Rx	Ta=25℃,Φ=0,θ=0	TBD	TBD	TBD	-	PR655
		Ry		TBD	TBD	TBD	-	
		Gx		TBD	TBD	TBD	-	
		Gy		TBD	TBD	TBD	-	
		Bx		TBD	TBD	TBD	-	
		By		TBD	TBD	TBD	-	
		Wx		TBD	TBD	TBD	-	
		Wy		TBD	TBD	TBD	-	
		NTSC		3.5	5	-	%	
Color Filter Chromaticity (Reflective)		Rx	Ta=25℃	TBD	TBD	TBD	-	CM-700D
		Ry		TBD	TBD	TBD	-	
		Gx		TBD	TBD	TBD	-	
		Gy		TBD	TBD	TBD	-	
		Bx		TBD	TBD	TBD	-	
		By		TBD	TBD	TBD	-	
		Wx		TBD	TBD	TBD	-	
		Wy		TBD	TBD	TBD	-	
		NTSC		15	20	-	%	

Note1: Ambient temperature = Ta = 25℃+/-2℃

Note2: Test equipment setup

After stabilizing and leaving the panel alone at a given temperature for the measurement should be executed. Measurement should be executed in a stable, windless, and dark room.

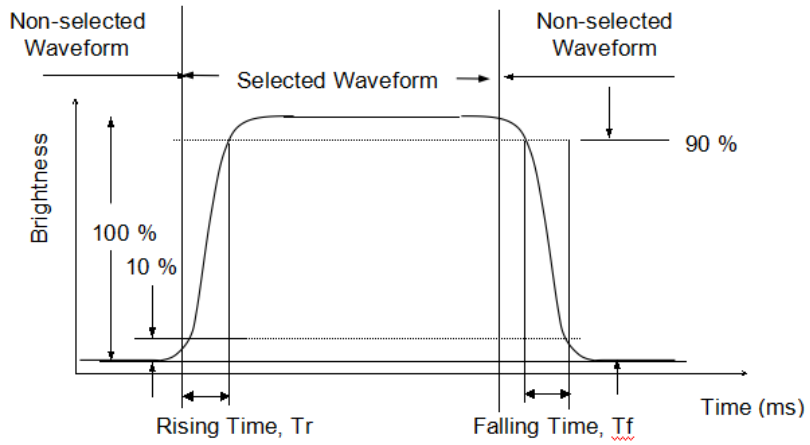
Measured at the center area of the panel when all the input terminals of LCD panel are Electrically opened.

To be measured on the center area of panel, after 10 minutes operation.

Note3: Definition of response time:

The output signals of photo detector are measured when the input signals

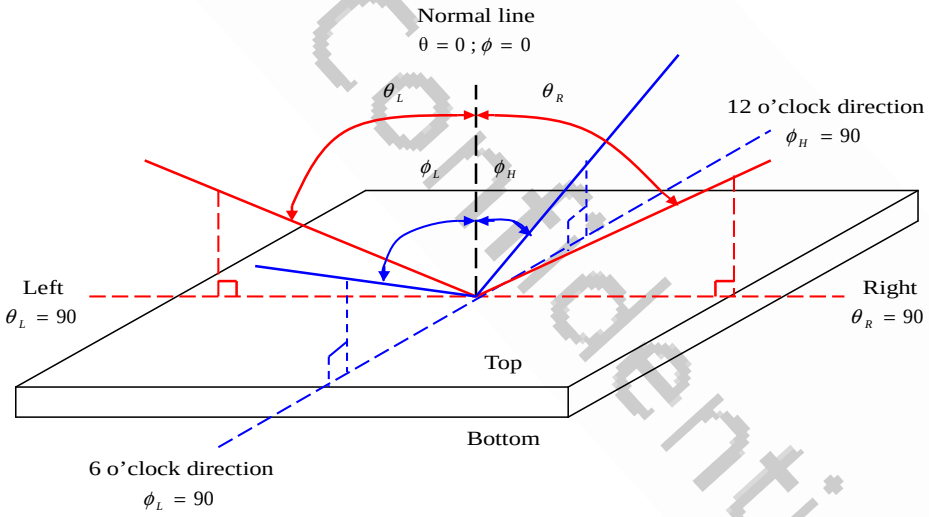
are changed from “black”to”white”(falling time) and from “white”to”black” (rising time),respectively.
The response time is defined as the time interval between the 10% and 90% of amplitudes. Refer to figure as below.



Note4: Definition of contrast ratio:
Contrast ratio is calculated with the following formula.

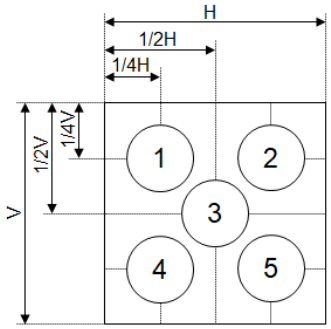
$$\text{Contrast ratio (CR)} = \frac{\text{Brightness measured when LCD is at “white state”}}{\text{Brightness measured when LCD is at “black state”}}$$

Note5: Definition of viewing angle:
Refer to figure as below.



Note6: Definition of Uniformity:

Refer to figure as below.



a. Test Instrument : BM -7 (Distance =500mm; Field = 1°)
b. Measure Brightness: 1 ~ 5 point
c. Uniformity = (Min. Brightness / Max. Brightness)*100%

13. RELIABILITY

Tests

NO.	ITEM	CONDITION	CRITERION
1	High Temperature Operating	70℃ 240 hrs	◦ No Defect Of Operational Function In Room Temperature Are Allowable. ◦ IDD of LCD in Pre-and post-test should follow specification
2	Low Temperature Operating	-20℃ 240 hrs	
3	High Temperature/ Humidity Non-Operating	60℃ ,90%RH ,240 hrs	
4	High Temperature Non-Operating	80℃ 240 hrs	
5	Low Temperature Non-Operating	-30℃ 240 hrs	
6	Temperature Shock Non-Operating	-30℃ ⟷ 80℃ (30min) (5min) (30min) 50CYCLES	
7	Electro-static Discharge	HBM: ±2kv	

Note 1: Test after 24 hours in room temperature.
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.

Color performance

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

14. INSPECTION CRITERIA

Inspection Conditions

Environmental conditions

The environmental conditions for inspection shall be as follows

Room temperature: 23±5℃

Humidity: 50±20%RH

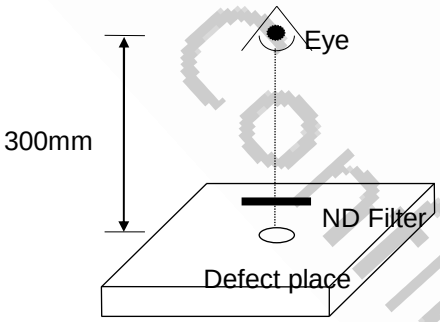
The external visual inspection

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.

Light Method

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

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



Classification Of Defects

Major defect

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

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.

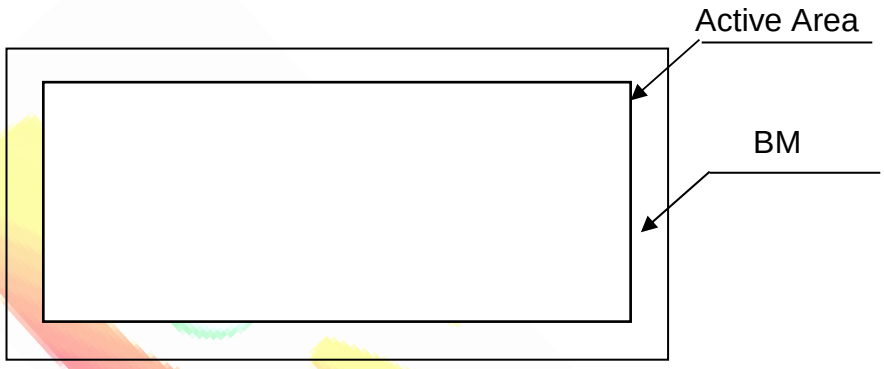
Notes: If the LCD/LCM 's cosmetic and display performance do not specify in inspection criterion", it should be based on these delivered samples.

Sampling & Acceptable Quality Level

Level II, ANSI / ASQ Z1.4

	Major	Minor
Cosmetic	1.0	1.5
Electrical-display	0.4	0.65

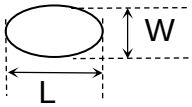
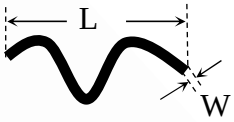
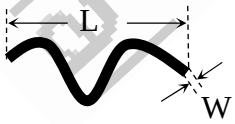
Definition Of Inspection Area
A.A: Active Area

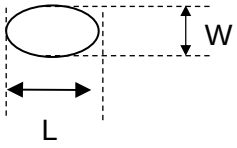
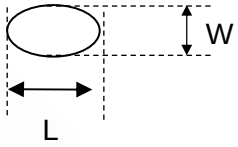


Items and Criteria

Visual inspection criterion in cosmetic

(1) LCM appearance defect with in A.A

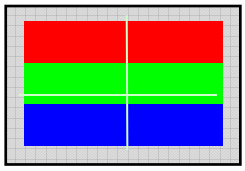
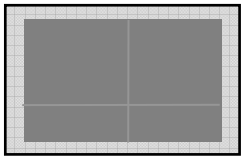
No	Defect	Criteria		Remark
1	Round type (Minor)	Spec.	Permissible Qty	Note1: ϕ=(L+W)/2, L: Length, W: Width D: Distance Note2: Disregard if out of A.A. Note3: Distance between two points > 5mm 
		$\phi \leqq$0.1mm	Disregard	
		0.1mm< $\phi \leqq$0.2mm	3	
		ϕ > 0.2mm	0	
2	Line type、Scratch (Minor)	Spec.	Permissible Qty	Note1:L: Length, W: Width Note2: Disregard if out of A.A Note3: Permissible quantity of 2 per cm2. 
		W$\leqq$0.03mm	Disregard	
		L$\leqq$3.0mm and 0.03mm<W$\leqq$0.05mm	2	
		L$\leqq$3.0mm and 0.05mm<W$\leqq$0.10mm	1	
		W>0.10mm or L>3.0mm	0	
3	Fiber (Minor)	Spec.	Permissible Qty	Note1:L: Length, W: Width Note2: Disregard if out of A.A Note3: Permissible quantity of 2 per cm2. 
		W$\leqq$0.03mm	Disregard	
		L$\leqq$3.0mm and 0.03mm<W$\leqq$0.05mm	2	
		L$\leqq$3.0mm and 0.05mm<W$\leqq$0.10mm	1	
		W>0.10mm or L>3.0mm	0	
4	Polarizer dent (Minor)	Spec.	Permissible Qty	Note1: ϕ=(L+W)/2, L: Length, W: Width Note2: Disregard when outside A.A Area if customer hadn't required Note3: Distance between two points > 5mm
		$\phi \leqq$0.20mm	Disregard	
		0.20mm< $\phi \leqq$0.30mm	2	

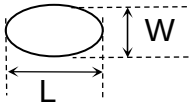
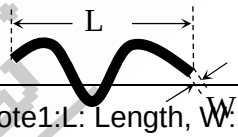
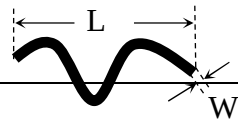
		0.30mm< ϕ ≦0.50mm	1	Note4: Permissible quantity of 3per cm^2 
		ϕ >0.5mm	0	
5	Polarizer bubble (Minor)	Spec.	Permissible Qty	Note1: ϕ =(L+W)/2, L: Length, W: Width Note2: Disregard when outside A.A Area if customer hadn't required Note3: Distance between two points > 5mm Note4: Permissible quantity of 3per cm^2 
		ϕ ≦0.20mm	Disregard	
		0.20mm< ϕ ≦0.30mm	2	
		0.30mm< ϕ ≦0.50mm	1	
		ϕ >0.5mm	0	

(2) FPC

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

Visual inspection criterion in electrical display

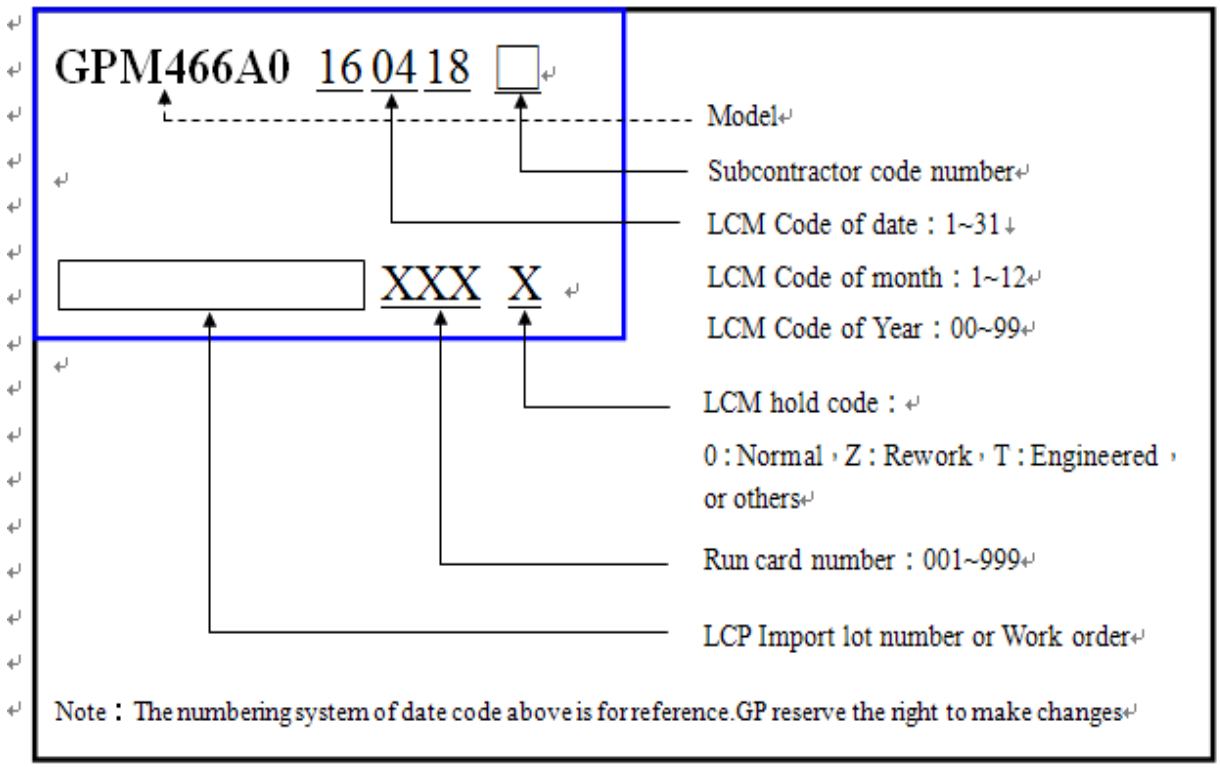
No	Defect	Criteria	Remark
1	No display (Major)	Not allowed	
2	Missing line (Major)	Not allowed	
3	Darker or lighter line (Major)	Not allowed	

<table>
<tr><td rowspan="5">4</td><td rowspan="5">Bright / Dark point (Minor)</td><td>Spec.</td><td>Permissible Qty</td><td rowspan="5">Note1:1dot :1R or 1G or 1B
Note2:Point defect area≧1/2 sub pixel.
Note3: Distance between two points > 5mm</td></tr>
<tr><td>Bright point</td><td>0</td></tr>
<tr><td>Dark point</td><td>2</td></tr>
<tr><td>Bright + Dark point</td><td>2</td></tr>
<tr><td></td><td></td></tr>
<tr><td rowspan="4">5</td><td rowspan="4">Round type (Minor)</td><td>Spec.</td><td>Permissible Qty</td><td rowspan="4">Note1: ϕ=(L+W)/2,
L: Length, W: Width
Note2:Disregard if out of A.A
Note3: Distance between two points > 5mm.
Note4: Backlight and polarizer included dirty spots.  </td></tr>
<tr><td>ϕ ≦0.1mm</td><td>Disregard</td></tr>
<tr><td>0.1mm< ϕ ≦0.2mm</td><td>3</td></tr>
<tr><td>ϕ >0.2mm</td><td>0</td></tr>
<tr><td rowspan="5">6</td><td rowspan="5">Line type、Scratch (Minor)</td><td>Spec.</td><td>Permissible Qty</td><td rowspan="5">Note1:L: Length, W: Width
Note2:Disregard if out of A.A.
Note3:Permissible quantity of 2 per cm2.  </td></tr>
<tr><td>W≦0.03mm</td><td>Disregard</td></tr>
<tr><td>L≦3.0mm and 0.03mm<W≦0.05mm</td><td>2</td></tr>
<tr><td>L≦3.0mm and 0.05mm<W≦0.10mm</td><td>1</td></tr>
<tr><td>W>0.10mm or L>3.0mm</td><td>0</td></tr>
<tr><td rowspan="5">7</td><td rowspan="5">Fiber (Minor)</td><td>Spec.</td><td>Permissible Qty</td><td rowspan="5">Note1:L: Length, W: Width
Note2:Disregard if out of A.A.
Note3:Permissible quantity of 2 per cm2  </td></tr>
<tr><td>W≦0.03mm</td><td>Disregard</td></tr>
<tr><td>L≦3.0mm and 0.03mm<W≦0.05mm</td><td>2</td></tr>
<tr><td>L≦3.0mm and 0.05mm<W≦0.10mm</td><td>1</td></tr>
<tr><td>W>0.10mm or L>3.0mm</td><td>0</td></tr>
<tr><td>8</td><td>Mura (Minor)</td><td colspan="2">By 5% ND filter invisible</td><td></td></tr>
</table>

Others

1. It shall be mutually conferred if nonconforming defect which result from unspecified cause in this specification arises.
2. If any issue arises as to information provided in this Specification or any other information,GP and TOPPAN shall discuss them in good faith and seek solution.

15. ILLUSTRATION OF LCD DATE CODE



16. 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

17. PRECAUTIONS FOR USE

Safety

Do not swallow any liquid crystal, even if there is no proof that liquid crystal is poisonous.

If the LCD panel breaks, be careful not to get liquid crystal to touch your skin.

If skin is exposed to liquid crystal, wash the area thoroughly with alcohol or soap.

Storage Conditions

Store the panel or module in a dark place where the temperature is 23±5℃ and the humidity is below 50±20%RH.

Store in anti-static electricity container.

Store in clean environment, free from dust, active gas, and solvent.

Do not place the module near organics solvents or corrosive gases.

Do not crush, shake, or jolt the module.

Do not exposed to direct sun light of fluorescent lamps.

Installing LCD Module

Attend to the following items when installing the LCM.

Cover the surface with a transparent protective plate or touch panel to protect the polarizer and LC cell.

Precautions For Operation

Viewing angle varies with the change of liquid crystal driving voltage (Vo). Adjust Vo to show the best contrast.

Driving the LCD in the voltage above the limit will shorten its lifetime.

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.

When turning the power on, input each signal after the positive/negative voltage becomes stable.

Do not apply mater or any liquid on product, which composed of T/P.

Handling Precautions

Avoid static electricity that can damage the CMOS LSI; please wear the wrist strap when handling.

The polarizing plate of the display is very fragile. So, please handle it very carefully.

Do not give external shock.

Do not apply excessive force on the surface; it may cause display abnormal.

Do not wipe the polarizing plate with a dry cloth, as it may easily scratch the surface of plate.

Do not use ketonics solvent & Aromatic solvent, use with a soft cloth soaked with a cleaning naphtha solvent.

Do not operate it above the absolute maximum rating.

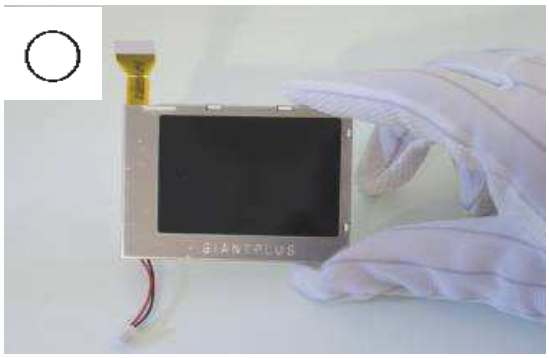
Do not remove the panel or frame from the module.

Do not apply mater or any liquid on product, which composed of T/P.

Handling precaution for LCM

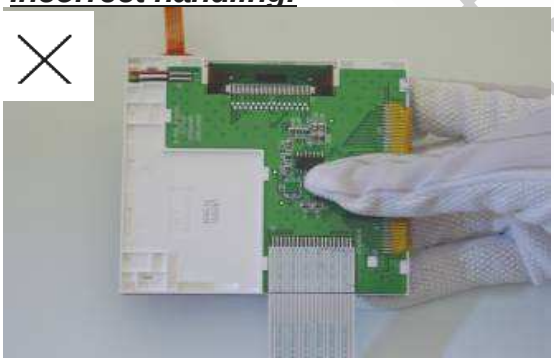
LCM is easy to be damaged.
Please note below and be careful for handling!

Correct handling:

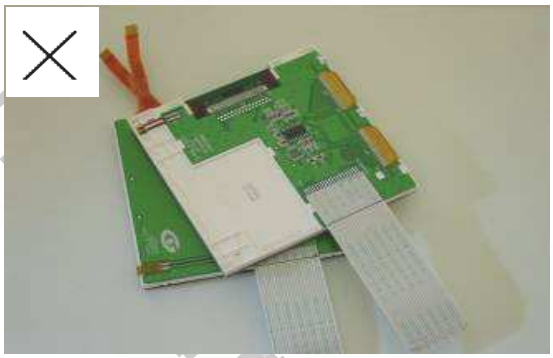


As above picture, please handle with anti-static gloves around LCM edges.

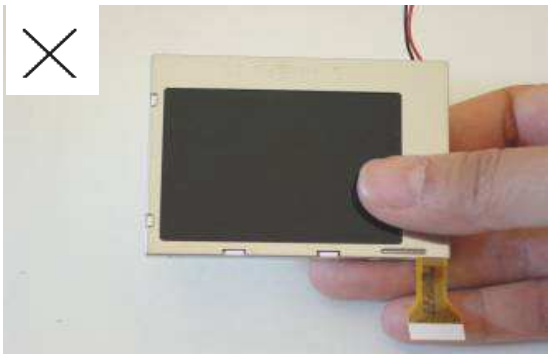
Incorrect handling:



Please don't touch IC directly.



Please don't stack LCM.



Please don't hold the surface of panel.

Please don't stretch interface of output, such as FPC cable.

Guarantee

17.7.1. The period is within 12 months since the date of shipping out under normal using and storage conditions.

17.7.2. Any defect not caused by Giantplus is not guaranteed to the customer. The defect phenomenon should be agreed by both parties

18. 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: 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: KunShan City, JiangShu Province, China.
FACTORY PHONE: TEL:86-512-57780-988 FAX : 86-512-57780-503

19. REVISION HISTORY

Version	Revise record	Date
A	New version	2022/11/30
B	ADD initial code	2023/3/2
C	Modify Data Color Coding and initial code	2023/3/29

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