DATA MODUL

POWERTIP

Specification

PH128128T041-LAA07
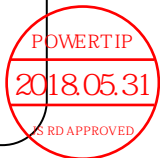
1.4" - 128 x 128 – 8 bit Parallel

Spec Revision: 1.2
Revision Date: 16.04.2018

Note: This specification is subject to change without prior notice

Passion Displayed

SPECIFICATIONS

CUSTOMER	:	**PTC**
SAMPLE CODE	:	**SH128128T041-LAA07**
MASS PRODUCTION CODE	:	**PH128128T041-LAA07**
SAMPLE VERSION	:	**01**
SPECIFICATIONS EDITION	:	**002**
DRAWING NO. (Ver.)	:	**JLMD-PH128128T041-LAA07_002**
PACKAGING NO. (Ver.)	:	**JPKG-PH128128T041-LAA07_001**

Customer Approved

Date:

POWERTIP
2018.05.31
RD APPROVED

Approved	Checked	Designer
閆偉	劉進	夏子豪

☐ Preliminary specification for design input

■ Specification for sample approval

POWERTIP TECH. CORP.

NO.PT-A-005-8

History of Version

Date	Ver.	Edi.	Description	Page	Design by
2018/2/26	01	001	New Drawing	-	夏子豪
2018/4/16	01	002	New Sample	-	夏子豪

Total: 29 Pages

Contents

1. SPECIFICATIONS

1.1 Features

Main LCD Panel

Item	Standard Value
Display Type	128(R、G、B) * 128 Dots
LCD Type	Normally white TN, Transmissive type
Screen size(inch)	1.44 inch
Viewing Direction	12 O'clock
Color configuration	R.G.B. vertical stripe
Backlight	White LED
Interface	8 bit Parallel Interface
Other(controller / driver IC)	Sitronix: ST7735S
ROHS	THIS PRODUCT CONFORMS THE ROHS OF PTC Detail information please refer web side : http://www.powertip.com.tw/news.php?area_id_view=1085560481/

1.2 Mechanical Specifications

Item	Standard Value	Unit
Outline Dimension	31.1（W）* 36.9（L）* 2.85（H）	mm

TFT LCD Panel

Item	Standard Value	Unit
Viewing Area	26.498 (W) *27.496 (L)	mm
Active Area	25.498 (W) * 26.496 (L)	mm

Note : For detailed information please refer to LCM drawing.

1.3 Absolute Maximum Ratings

Module

Item	Symbol	Condition	Min.	Max.	Unit
Supply Voltage	VDD	-	-0.3	+4.8	V
Supply Voltage(Logic)	VDDI	-	-0.3	+4.6	V
Driver supply voltage	VGH-VGL	-	-0.3	+30.0	V
Logic input voltage range	VIN	-	-0.3	VDDI+0.3	V
Logic output voltage range	VO	-	-0.3	VDDI+0.3	V
Operating Temperature	TOP	-	-20	+70	°C
Storage Temperature	TST	-	-30	+80	°C
Storage Humidity	HD	Ta ≦ 60 °C	-	90	%RH

1.4 DC Electrical Characteristics

Module   GND = 0V, Ta = 25°C

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
System voltage	VDD	-	2.7	3.0	3.3	V
Interface operation voltage	VDDI	-	1.65	1.8	3.7	V
Logic-high input voltage	VIH	-	0.7VDDI	-	VDDI	V
Logic-low input voltage	VIL	-	VSS	-	0.3VDDI	V
Logic-high output voltage	VOH	IOH=-1.0mA	0.8VDDI	-	VDDI	V
Logic-low output voltage	VOL	IOL=+1.0mA	VSS	-	0.2VDDI	V
Supply Current	IDD	VDD=3.0V	-	1.6	2.5	mA

1.5 Optical Characteristics

TFT LCD Panel VDD=3.0V, Ta=25°C

| Item		Symbol	Condition	Min.	Typ.	Max.	unit	-
Response time		Tr+ Tf	-	-	-	-	ms	Note2
Viewing angle	Top	θY+	CR≥(10)	-	15	-	Deg.	Note4
	Bottom	θY-		-	45	-		
	Left	θX-		-	45	-		
	Right	θX+		-	45	-		
Contrast ratio		CR	-	150	200	-	-	Note3
Color of CIE Coordinate (With B/L)	White	X	IF=20mA	0.25	0.30	0.35	-	Note1
		Y		0.26	0.31	0.36		
	Red	X		0.59	0.64	0.69		
		Y		0.29	0.34	0.39		
	Green	X		0.27	0.32	0.37		
		Y		0.52	0.57	0.62		
	Blue	X		0.09	0.14	0.19		
		Y		0.05	0.10	0.15		
Average Brightness Pattern=white display (With B/L)		IV	IF=20mA	200	310	-	cd/m2	Note1
Uniformity (With B/L)		△B	IF=20mA	80	-	-	%	Note1

Note1:

1：△B= B(min) / B(max) × 100%.

2：Measurement Condition for Optical Characteristics:

  a：Environment: 25℃±5℃ / 60±20%R.H, no wind, dark room below 10 Lux at typical lamp current and typical operating frequency.

  b：Measurement Distance: 500 ± 50 ㎜, (θ= 0°).

 c：Equipment: TOPCON BM-7 fast, (field 1°), after 10 minutes operation.

  d：The uncertainty of the C.I.E coordinate measurement ±0.01, Average Brightness ± 4%.

Colorimeter=BM-7 fast
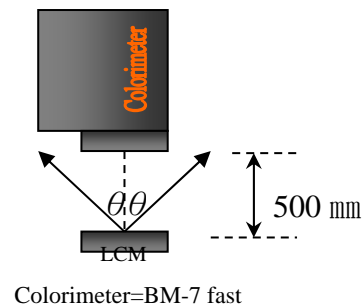
Note2: Definition of response time:

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.
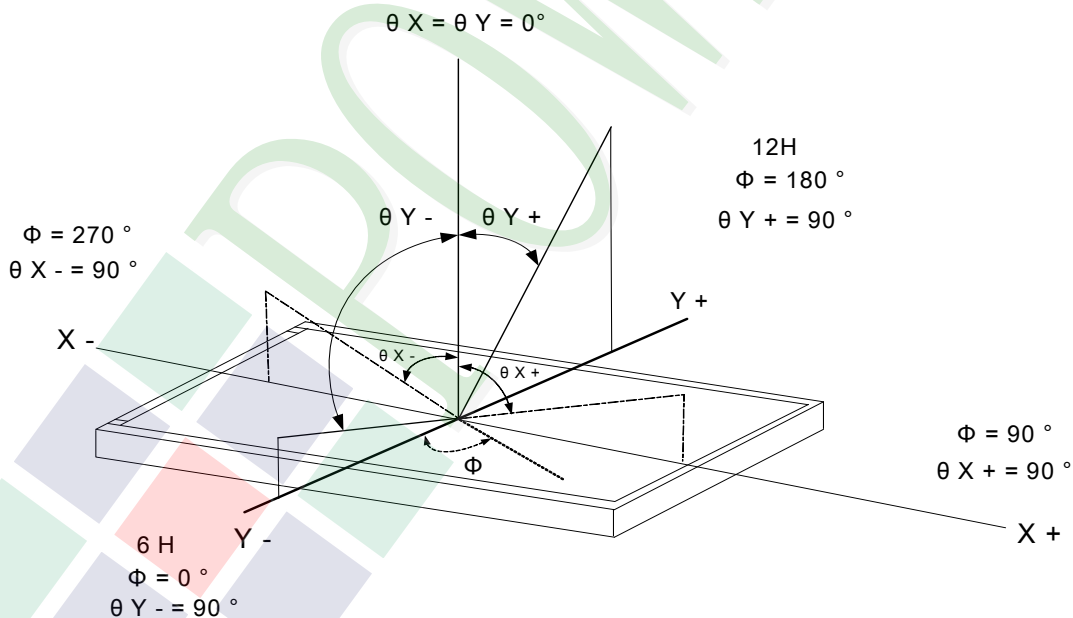
Refer to figure as below:
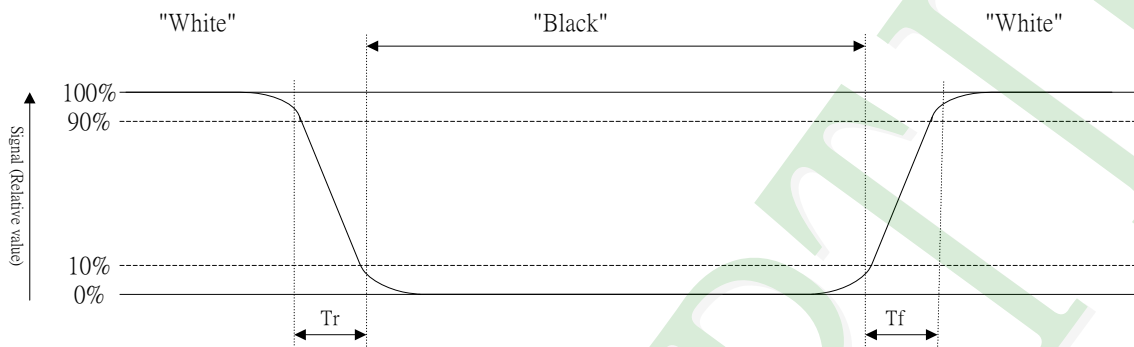
Note3: Definition of contrast ratio:

Contrast ratio is calculated with the following formula

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

Note4: Definition of viewing angle:

Refer to figure as below:

1.6 Backlight Characteristics

Maximum Ratings

Item	Symbol	Conditions	Min.	Max.	Unit
Forward Current	IF	Ta =25℃	-	30	mA
Reverse Voltage	VR	Ta =25℃	-	5.0	V
Power Dissipation	PD	Ta =25℃	-	90	mW

Electrical / Optical Characteristics

Item	Symbol	Conditions	Min.	Typ.	Max.	Unit
Forward Voltage	VF	IF= 20mA	2.8	3.2	3.6	V
Average Brightness	IV	IF= 20mA	4000	5000	-	cd/m^2
Color of CIE Coordinate	X	IF= 20mA	0.27	0.30	0.33	-
	Y		0.27	0.30	0.33	
Color	White					

Circuit diagram

LED+ o———▷|———o LED-

Other Description

Item	Conditions	Description
Life Time	Ta =25℃ IF= 20mA	20000 hrs

2. MODULE STRUCTURE

2.1 Counter Drawing

2.1.1 LCM Mechanical Diagram

* See Appendix

2.1.2 Block Diagram
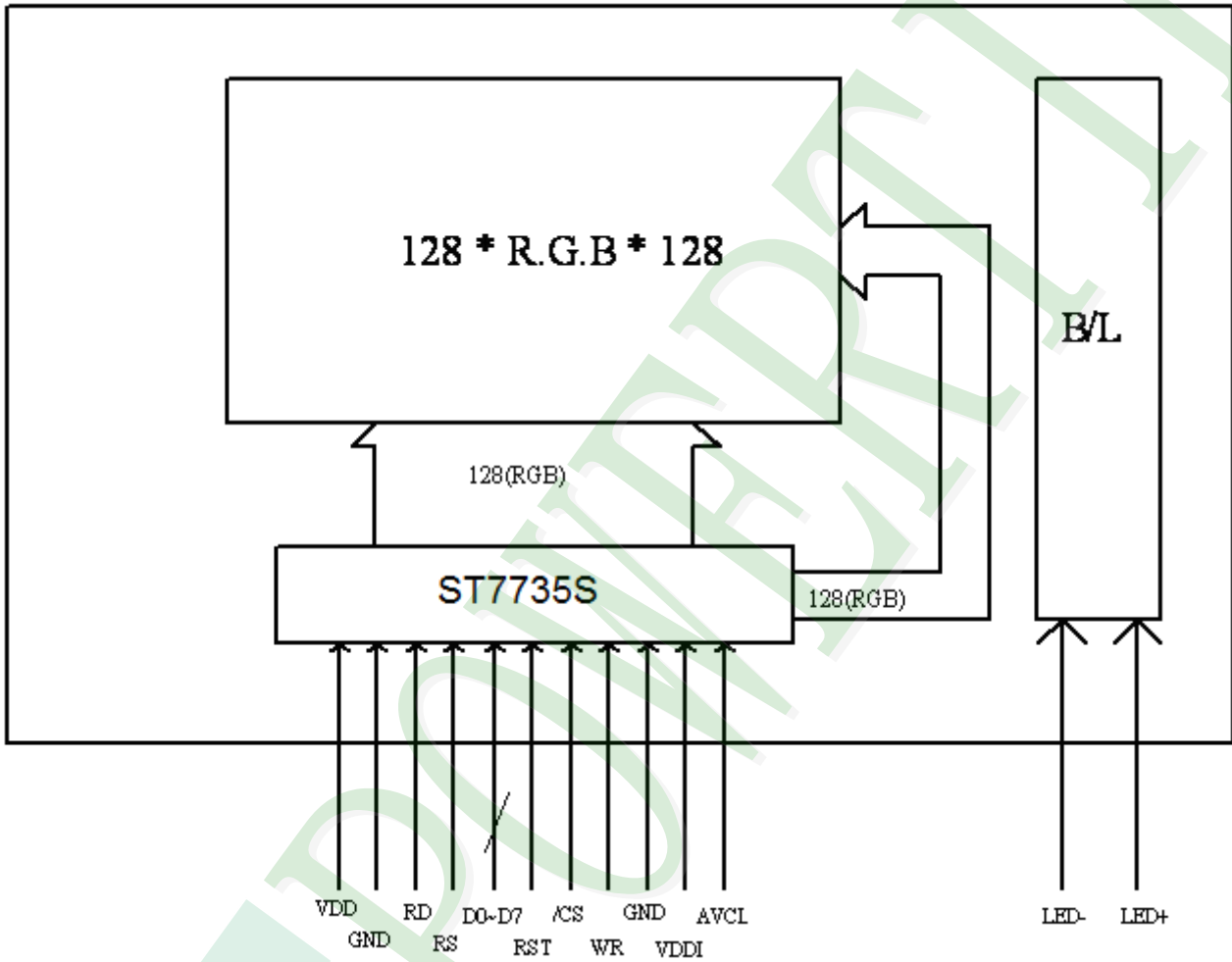
2.2 Interface Pin Description

Pin NO	Symbol	Function
1	LED+	Backlight LED anode input pin.
2	LED-	Backlight LED cathode input pin.
3	GND	System ground
4	VDD	Power supply for analog, digital system and booster circuit.
5	VDD	
6	RD	Read enable in 8080 MCU parallel interface.
7	RS	Display data/command selection pin in MCU interface. RS ='1': display data or parameter. RS ='0': command data.
8	D1	D[7:0] are used as MCU parallel interface data bus.
9	D3	
10	D5	
11	D7	
12	RST	This signal will reset the device and it must be applied to properly initialize the chip. Signal is active low.
13	/CS	Chip selection pin, Low enable
14	D6	D[7:0] are used as MCU parallel interface data bus.
15	D4	
16	D2	
17	D0	
18	WR	Write enable in MCU parallel interface.
19	GND	System ground
20	GND	
21	VDDI	Power supply for I/O system.
22	AVCL	A power supply pin for generating GVCL.Connect a capacitor for stabilization.

2.3 Timing Characteristics

Parallel interface characteristics: 8-bit bus (8080 series MCU interface)
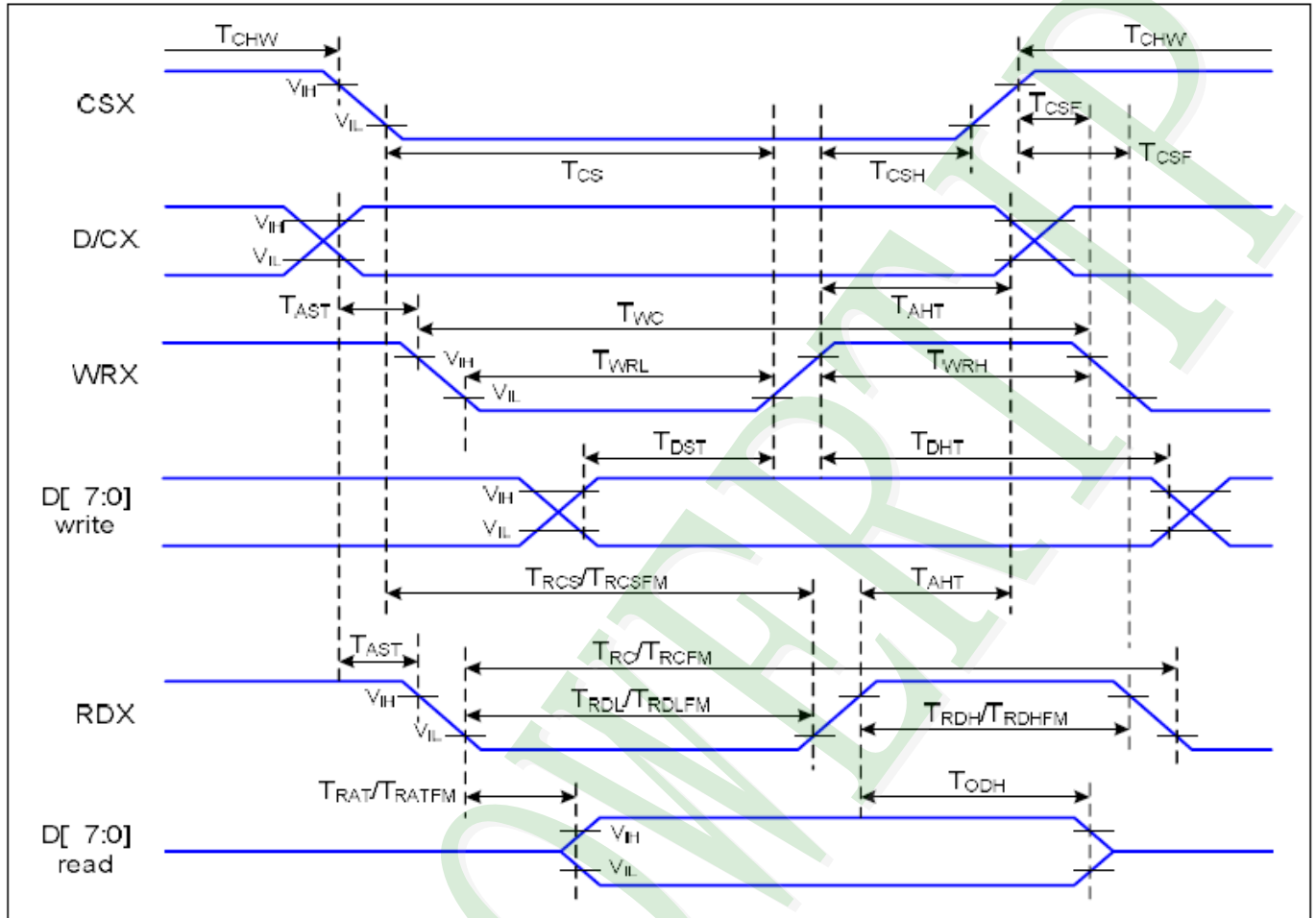
Parallel Interface Timing Characteristics (8080 Ceries MCU Interface)
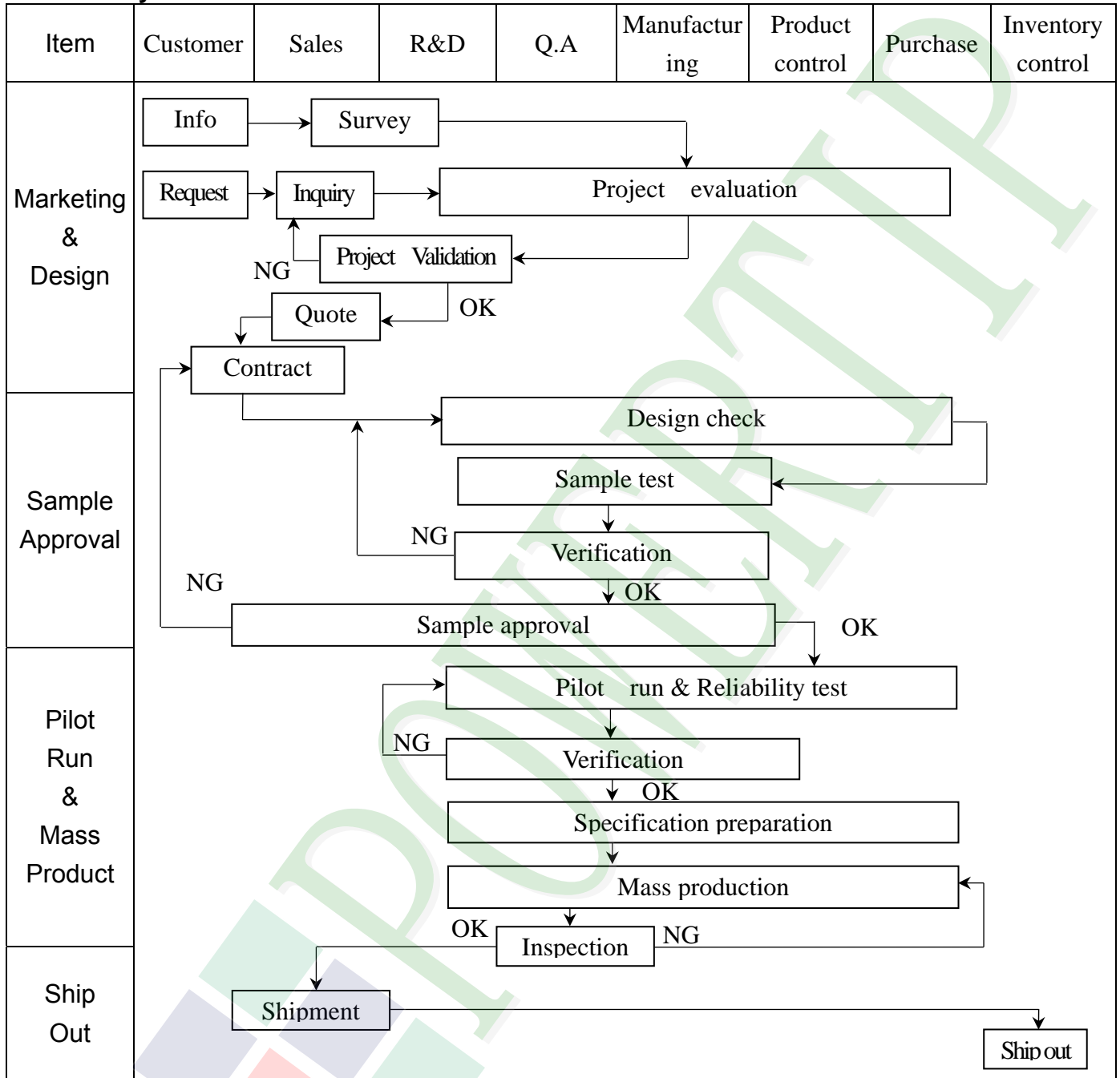
Ta=25 ℃, VDDI=1.65~3.7V, VDD=2.5~4.8V

Signal	Symbol	Parameter	Min	Max	Unit	Description
D/CX	TAST	Address Setup Ttime	0		ns	-
	TAHT	Address Hold Time (Write/Read)	10		ns	
CSX	TCHW	Chip Select "H" Pulse Width	0		ns	-
	TCS	Chip Select Setup Time (Write)	15		ns	
	TRCS	Chip Select Setup Time (Read ID)	45		ns	
	TRCSFM	Chip Select Setup time (Read FM)	355		ns	
	TCSF	Chip Select Wait Time (Write/Read)	10		ns	
	TCSH	Chip Select Hold Time	10		ns	
WRX	TWC	Write Cycle	66		ns	
	TWRH	Control Pulse "H" Duration	15		ns	
	TWRL	Control Pulse "L" Duration	15		ns	
RDX (ID)	TRC	Read Cycle (ID)	160		ns	When Read ID Data
	TRDH	Control Pulse "H" Duration (ID)	90		ns	
	TRDL	Control Pulse "L" Duration (ID)	45		ns	
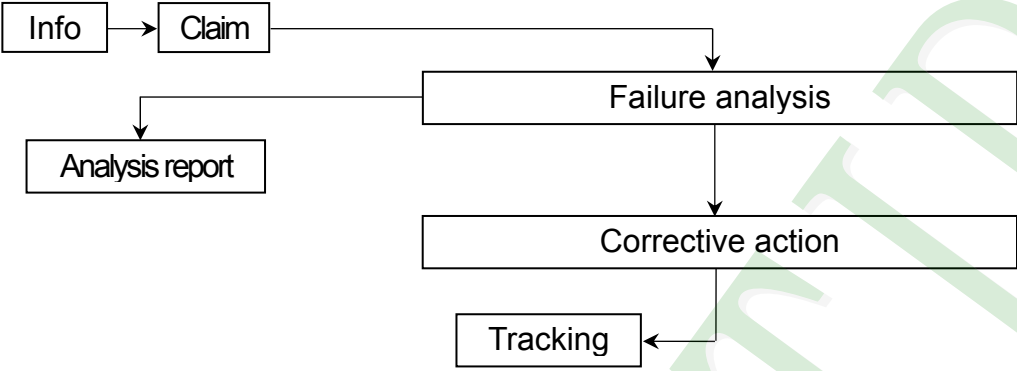
Signal	Symbol	Parameter	Min	Max	Unit	Description
RDX (FM)	TRCFM	Read Cycle (FM)	450		ns	When Read from Frame Memory
	TRDHFM	Control Pulse "H" Duration (FM)	90		ns	
	TRDLFM	Control Pulse "L" Duration (FM)	355		ns	
D[7:0]	TDST	Data Setup Time	10		ns	For CL=30pF
	TDHT	Data Hold Time	10		ns	
	TRAT	Read Access Time (ID)		40	ns	
	TRATFM	Read Access Time (FM)		340	ns	
	TODH	Output Disable Time	20	80	ns	

8080 Parallel Interface Characteristics

3. QUALITY ASSURANCE SYSTEM

3.1 Quality Assurance Flow Chart

Item	Customer	Sales	R&D	Q.A	Manufacturing	Product control	Purchase	Inventory control
Marketing & Design								
Sample Approval								
Pilot Run & Mass Product								
Ship Out								

Info → Survey

Request → Inquiry   Project   evaluation

Project   Validation   NG   OK

Quote

Contract

Design check

Sample test

NG   Verification   OK

Sample approval   OK

Pilot   run & Reliability test

NG   Verification   OK

Specification preparation

Mass production

OK   Inspection   NG

Shipment   Ship out

Item	Customer	Sales	R&D	Q.A	Manufact uring	Product control	Purchase	Inventory control
Sales Service								
Q.A Activity	1. ISO 9001 Maintenance Activities 2. Process improvement proposal 3. Equipment calibration 4. Education And Training Activities 5. Standardization Management							

Sales Service flow:

Info → Claim → Failure analysis

Failure analysis → Analysis report

Failure analysis → Corrective action → Tracking

3.2. Inspection Specification

◆Scope ：The document shall be applied to TFT-LCD Module for less than 3.5″ (Ver.B01).

◆Inspection Standard：MIL-STD-105E Table Normal Inspection Single Sampling Level Ⅱ.

◆Equipment：Gauge、MIL-STD、Powertip Tester、Sample

◆Defect Level：Major Defect AQL：0.4 ； Minor Defect AQL：1.5

◆OUT Going Defect Level：Sampling.

◆Standard of the product appearance test：

    a. Manner of appearance test：

    （1）. The test best be under 20W×2 fluorescent light，and distance of view must be at 30 cm.

    （2）. The test direction is base on about around 45˚ of vertical line.
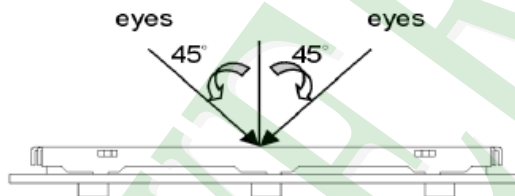
    （3）. Definition of area.
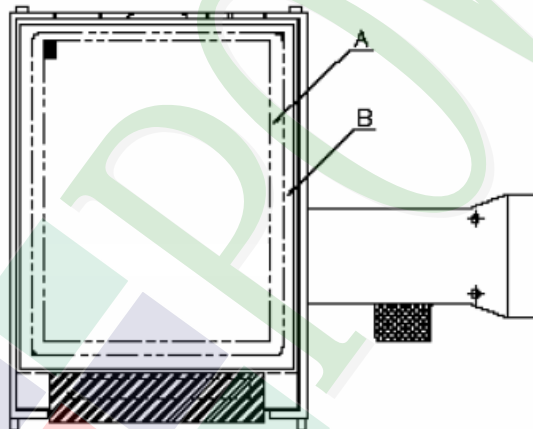
A area : viewing area

B area : Outside of viewing area

    （4）. Standard of inspection： (Unit：mm)
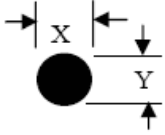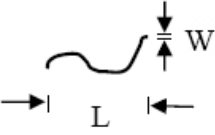
NO	Item	Criterion	Level
01	Product condition	1.1 The part number is inconsistent with work order of production.	Major
		1.2 Mixed product types.	Major
		1.3 Assembled in inverse direction.	Major
02	Quantity	2.1 The quantity is inconsistent with work order of production.	Major
03	Outline dimension	3.1 Product dimension and structure must conform to structure diagram.	Major
04	Electrical Testing	4.1 Missing line character and icon.	Major
		4.2 No function or no display.	Major
		4.3 Display malfunction.	Major
		4.4 LCD viewing angle defect.	Major
		4.5 Current consumption exceeds product specifications.	Major
05	Dot defect (Bright dot、 Dark dot) On -display	<table><tr><th colspan="2">Item</th><th>Acceptance (Q'ty)</th></tr><tr><td rowspan="4">Dot Defect</td><td>Bright Dot</td><td>≦ 2</td></tr><tr><td>Dark Dot</td><td>≦ 3</td></tr><tr><td>Joint Dot</td><td>≦ 2</td></tr><tr><td>Total</td><td>≦ 3</td></tr></table> 5.1 Inspection pattern：full white , full black , Red , Green and blue screens. 5.2 It is defined as dot defect if defect area ＞1/2 dot. 5.3 The distance between two dot defect ≧5 mm.	Minor
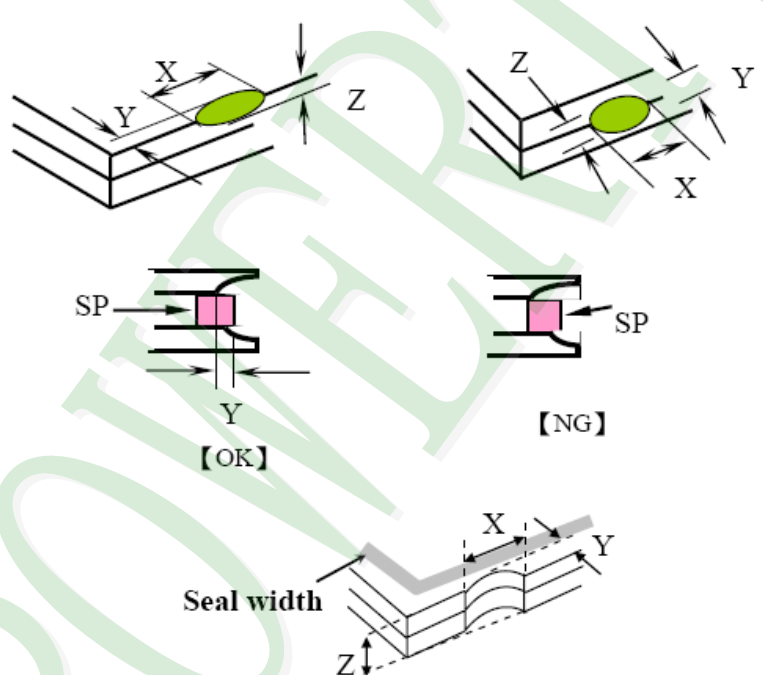
NO	Item	Criterion	Level
06	Black or white dot、scratch、contamination Round type $\Phi=(x+y)/2$ Line type	**6.1 Round type (Non-display or display)：** **6.2 Line type(Non-display or display)：**	Minor
07	Polarizer Bubble		Minor

6.1 Round type (Non-display or display)：

Dimension (diameter：Φ)	Acceptance (Q'ty)	
	A area	B area
$\Phi \leqq 0.15$	Ignore	
$0.15 < \Phi \leqq 0.20$	2	
$0.20 < \Phi \leqq 0.30$	2	Ignore
$\Phi > 0.30$	0	
Total	3	

6.2 Line type(Non-display or display)：

Dimension		Acceptance (Q'ty)	
Length (L)	Width (W)	A area	B area
---	$W \leqq 0.03$	Ignore	
$L \leqq 5.0$	$0.03 < W \leqq 0.05$	3	Ignore
---	$W > 0.05$	As round type	
	Total	3	

Dimension (diameter：Φ)	Acceptance (Q'ty)	
	A area	B area
$\Phi \leqq 0.20$	Ignore	
$0.20 < \Phi \leqq 0.50$	3	Ignore
$\Phi > 0.50$	0	
Total	3	
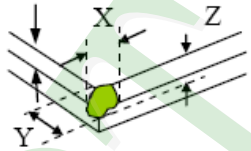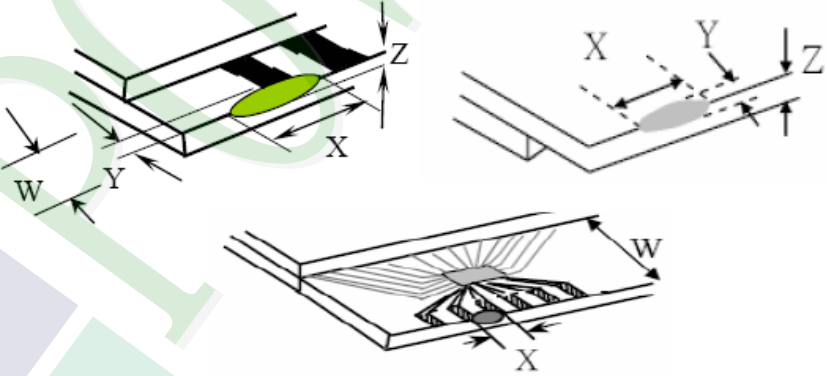
NO	Item	Criterion	Level
08	The crack of glass	Symbols： X : The length of crack Y : The width of crack. Z : The thickness of crack W : terminal length t : The thickness of glass a : LCD side length 8.1 General glass chip： 8.1.1 Chip on panel surface and crack between panels： 	Minor

X	Y	Z
$\leqq a$	Crack can't enter viewing area	$\leqq 1/2\ t$
$\leqq a$	Crack can't exceed the half of SP width.	$1/2\ t < Z \leqq 2\ t$
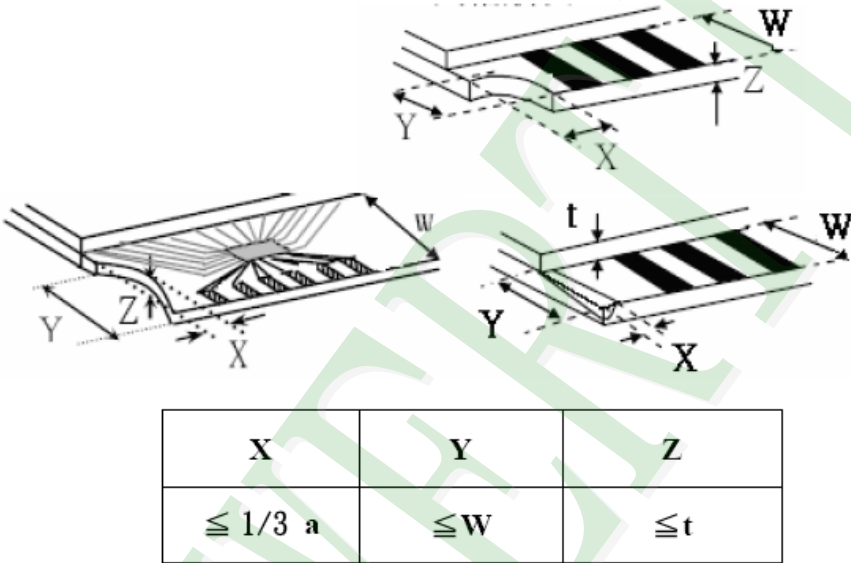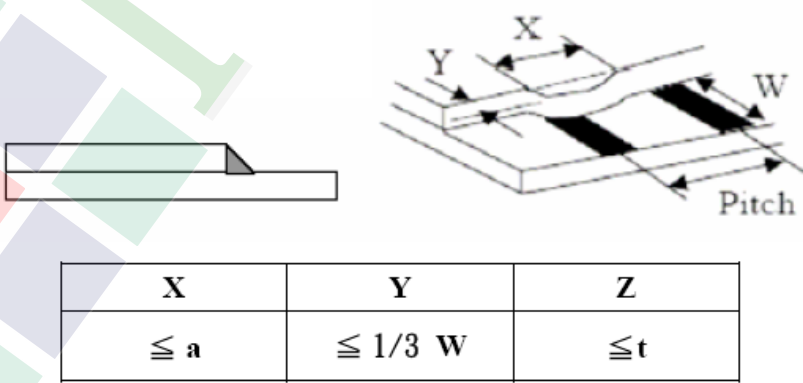
NO	Item	Criterion	Level
08	The crack of glass	Symbols : X : The length of crack Y : The width of crack. Z : The thickness of crack W : terminal length t : The thickness of glass a : LCD side length 8.1.2 Corner crack : 8.2 Protrusion over terminal : 8.2.1 Chip on electrode pad :	Minor

8.1.2 Corner crack table:

X	Y	Z
≦1/5 a	Crack can't enter viewing area	Z ≦ 1/2 t
≦1/5 a	Crack can't exceed the half of SP width.	1/2 t < Z ≦ 2 t

8.2.1 table:

	X	Y	Z
Front	≦ a	≦ 1/2 W	≦ t
Back	≦ a	≦ W	≦ 1/2 t

NO	Item	Criterion	Level
08	The crack of glass	Symbols : X : The length of crack Y : The width of crack. Z : The thickness of crack W : terminal length t : The thickness of glass a : LCD side length 8.2.2 Non-conductive portion : <table><tr><td>X</td><td>Y</td><td>Z</td></tr><tr><td>≦ 1/3 a</td><td>≦W</td><td>≦t</td></tr></table> ⊙ If the chipped area touches the ITO terminal, over 2/3 of the ITO must remain and be inspected according to electrode terminal specifications. 8.2.3 Glass remain : <table><tr><td>X</td><td>Y</td><td>Z</td></tr><tr><td>≦ a</td><td>≦ 1/3 W</td><td>≦t</td></tr></table>	Minor

NO	Item	Criterion	Level
09	Backlight elements	9.1 Backlight can't work normally.	Major
		9.2 Backlight doesn't light or color is wrong.	Major
		9.3 Illumination source flickers when lit.	Major
10	General appearance	10.1 Pin type、quantity、dimension must match type in structure diagram.	Major
		10.2 No short circuits in components on PCB or FPC .	Major
		10.3 Parts on PCB or FPC must be the same as on the production characteristic chart .There should be no wrong parts , missing parts or excess parts.	Major
		10.4 Product packaging must the same as specified on packaging specification sheet.	Minor
		10.5 The folding and peeled off in polarizer are not acceptable.	Minor
		10.6 The PCB or FPC between B/L assembled distance(PCB or FPC) is ≦1.5 mm.	Minor

4. RELIABILITY TEST

4.1 Reliability Test Condition (Ver.B01)

NO.	TEST ITEM	TEST CONDITION
1	**High Temperature Storage Test**	**Keep in +80℃ ±2℃ 240hrs** **Surrounding temperature, then storage at normal condition 4hrs.**
2	**Low Temperature Storage Test**	**Keep in −30℃ ±2℃ 240hrs** **Surrounding temperature, then storage at normal condition 4hrs.**
3	**High Temperature / High Humidity Storage Test**	**Keep in +60 ℃ / 90% R.H duration for 240hrs** **Surrounding temperature, then storage at normal condition 4hrs.** **(Excluding the polarizer)**
4	**Temperature Cycling Storage Test**	**−30℃ → +25℃ → +80℃ → +25℃** (30mins) (5mins) (30mins) (5mins) **10 Cycle** **Surrounding temperature, then storage at normal condition 4hrs.**
5	**ESD Test**	**Air Discharge:** **Contact Discharge:** **Apply 2 KV with 5 times** **Apply 250 V with 5 times** **Discharge for each polarity +/-** **discharge for each polarity +/-** 1. **Temperature ambiance : 15℃～35℃** 2. **Humidity relative : 30%～60%** 3. **Energy Storage Capacitance(Cs+Cd) : 150pF±10%** 4. **Discharge Resistance(Rd) : 330Ω±10%** 5. **Discharge, mode of operation :** **Single Discharge (time between successive discharges at least 1 sec)** **(Tolerance if the output voltage indication : ±5%)**
6	**Vibration Test (Packaged)**	1. **Sine wave 10～55 Hz frequency (1 min/sweep)** 2. **The amplitude of vibration :1.5 mm** 3. **Each direction (X、Y、Z) duration for 2 Hrs**
7	**Drop Test (Packaged)**	<table><tr><td>**Packing Weight (Kg)**</td><td>**Drop Height (cm)**</td></tr><tr><td>0 ~ 45.4</td><td>122</td></tr><tr><td>45.4 ~ 90.8</td><td>76</td></tr><tr><td>90.8 ~ 454</td><td>61</td></tr><tr><td>Over 454</td><td>46</td></tr></table> **Drop Direction :※1 corner / 3 edges / 6 sides each 1time**

5. PRECAUTION RELATING PRODUCT HANDLING

5.1 SAFETY

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

5.1.2   If the liquid crystal touches your skin or clothes , please wash it off immediately by using soap and water.

5.2 HANDLING

5.2.1   Avoid any strong mechanical shock which can break the glass.

5.2.2   Avoid static electricity which can damage the CMOS LSI—When working with the module , be sure to ground your body and any electrical equipment you may be using.

5.2.3   Do not remove the panel or frame from the module.

5.2.4   The polarizing plate of the display is very fragile. So , please handle it very carefully,do not touch , push or rub the exposed polarizing with anything harder than an HB pencil lead (glass , tweezers , etc.)

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

5.2.6   Do not touch the display area with bare hands , this will stain the display area.

5.2.7   Do not use ketonics solvent & aromatic solvent. Use with a soft cloth soaked with a cleaning naphtha solvent.

5.2.8   To control temperature and time of soldering is $320 \pm 10°C$ and 3-5 sec.

5.2.9   To avoid liquid (include organic solvent) stained on LCM

5.2.10   Caution!(LCM products with Capacitive Touch Panel)

Strong EMI-sources such as switch-mode power supplies (SMPS) can lead to touch malfunction (e.g. ghost-touches).

Therefore, the touch needs to be thoroughly tested inside the target application.

5.3 STORAGE

5.3.1   Store the panel or module in a dark place where the temperature is $25°C \pm 5°C$ and the humidity is below 65% RH.

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

5.3.3   Do not crush , shake , or jolt the module.

5.4 TERMS OF WARRANTY

5.4.1   Applicable warrant period The period is within thirteen months since the date of shipping out under normal using and storage conditions.

5.4.2   Unaccepted responsibility

This product has been manufactured to your company's specification as a part for use in your company's general electronic products. It is guaranteed to perform according to delivery specifications. For any other use apart from general electronic equipment, we cannot take responsibility if the product is used in nuclear power control equipment, aerospace equipment , fire and security systems or any other applications in which there is a direct risk to human life and where extremely high levels of reliability are required.
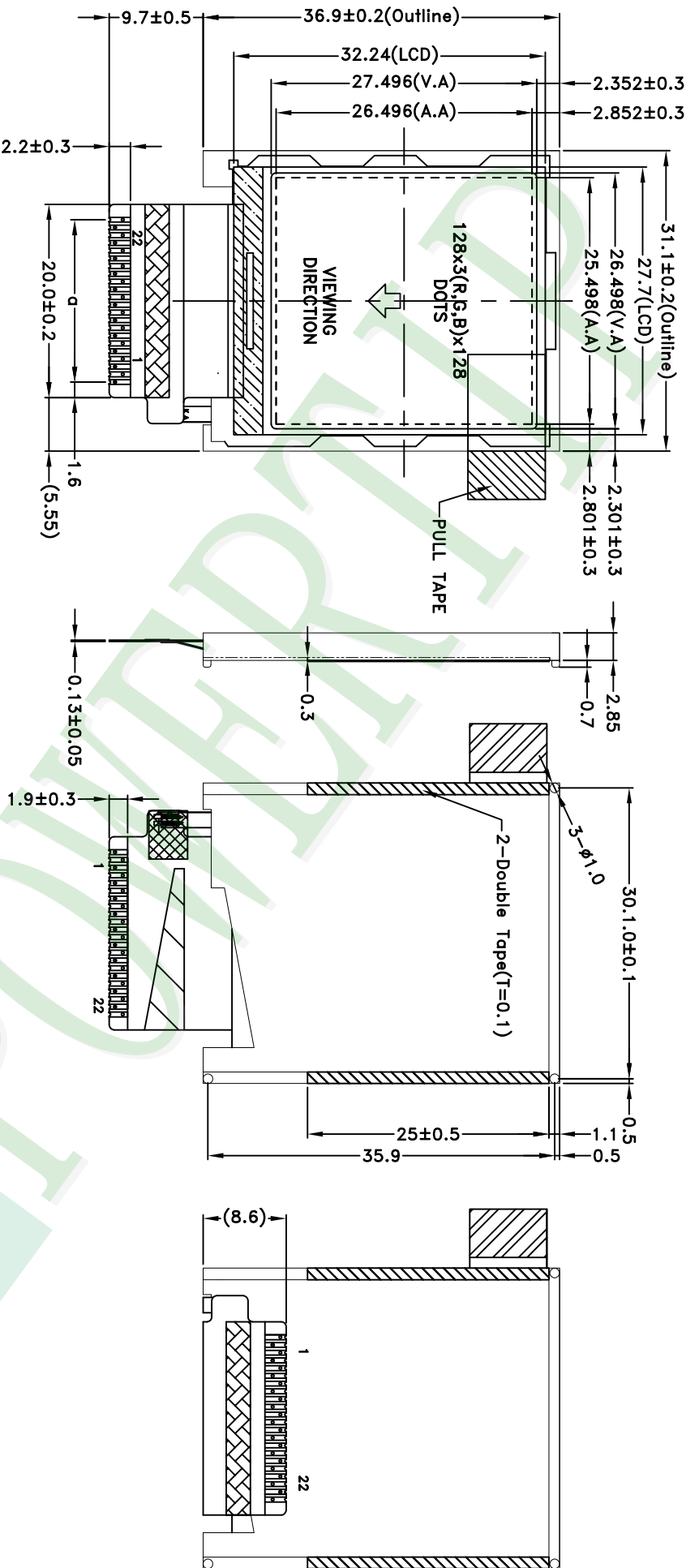
NOTE:
1.DRIVING ELEMENT : 65K COLOR α-Si TFT
2.THE TOLERANCE UNLESS CLASSIFIED±0.2mm
3.DRIVER IC:ST7735S
4.α:P0.8X21=16.8±0.1
5.Top: −20~70°C Tst:-30~80°C

Dimensions/labels:
- 9.7±0.5
- 36.9±0.2(Outline)
- 32.24(LCD)
- 27.496(V.A)
- 2.352±0.3
- 26.496(A.A)
- 2.852±0.3
- 2.2±0.3
- 31.1±0.2(Outline)
- 27.7(LCD)
- 26.498(V.A)
- 25.498(A.A)
- 2.301±0.3
- 2.801±0.3
- 20.0±0.2
- α
- 1.6
- (5.55)
- 128x3(R,G,B)x128 DOTS
- VIEWING DIRECTION
- PULL TAPE
- 0.13±0.05
- 2.85
- 0.3
- 0.7
- 1.9±0.3
- 2−Double Tape(T=0.1)
- 3−φ1.0
- 30.1.0±0.1
- 25±0.5
- 35.9
- 1.1
- 0.5
- (8.6)

PART NO.: PH128128T041-LAA07
DRAWING NAME: JLMD-PH128128T041-LAA07
TITLE: LCD MODULE DRAWING

REV		REV BY	REVISER	DATE
001	NEW DRAWING	Air		2018/02/28
002	UPDATE DRAWING			2018/03/01
003				
004				
005				
006				
007				

	Design	Check	Approve				
	Air	Terry	Ryan				

POWERTIP TECHNOLOGY CORPORATION
久正光電股份有限公司

Surface	Material	Thickness	Quantity
Page	Scale	Unit	
	3:5	MM	1/1

最小程度(mm)	公差精度等級
1 ~ 4	-
4 ~ 16	-
16 ~ 63	-
63 ~ 250	-
250 ~ 1000	-
精級

PT-A-054-01

LCM包裝規格書
LCM Packaging Specifications
(For Tray)

1.包裝材料規格表 (Packaging Material) : (per carton)

No.	Item	Model	Dimensions (mm)	1Pcs Weight	Quantity	Total Weight
1	成品 (LCM)	PH128128T041-LAA07	31.1 X 36.9 X 2.85	0.0045	1440	6.48
2	多層薄膜(1)POF	OTFILM0BA03ABA	19"X350X0.015	——	6	——
3	TRAY 盤 (2)Tray	TY00000000068	352 X 260 X 10.8	0.096	54	5.184
4	內盒(3)Product Box	BX36627063ABBA	393 X 274 X 68	0.2692	6	1.6152
5	保利龍板(4)Polylon board	OTPLB00PL08ABA	550 X 393 X 20	0.0284	2	0.0568
6	外紙箱(5)Carton	BX57041027CCBA	570 X 410 X 265	1.4208	1	1.4208
7						
8						
9						

2.一 整箱總重量 (Total LCD Weight in carton) :　14.76　Kg±10%

3.單箱數量規格表 (Packaging Specifications and Quantity) :

(1)LCM quantity per box : no per tray 　　30　　x no of tray 　8　 = 　240

(2)Total LCM quantity in carton : quantity per box 　240　 x no of boxes 　6　 = 　1440

Use empty tray
空 盤

+

Put products into the tray

Tray stacking

A
B

(1)多層薄膜
POF

(2)TRAY 盤
Tray

(3)內盒
Product Box

(4)保利龍板
Polylon board

(4)保利龍板
Polylon board

(5)外紙箱
Carton

特　記　事　項 (REMARK)

A
斜角
Detail B
Tray 2
Tray 1
圓角

4.TRAY盤相疊時,需旋轉180度,請詳見B視圖
Rotate tray 180 degrees and place on top of stack.
Check the tray stack using Fig. B.

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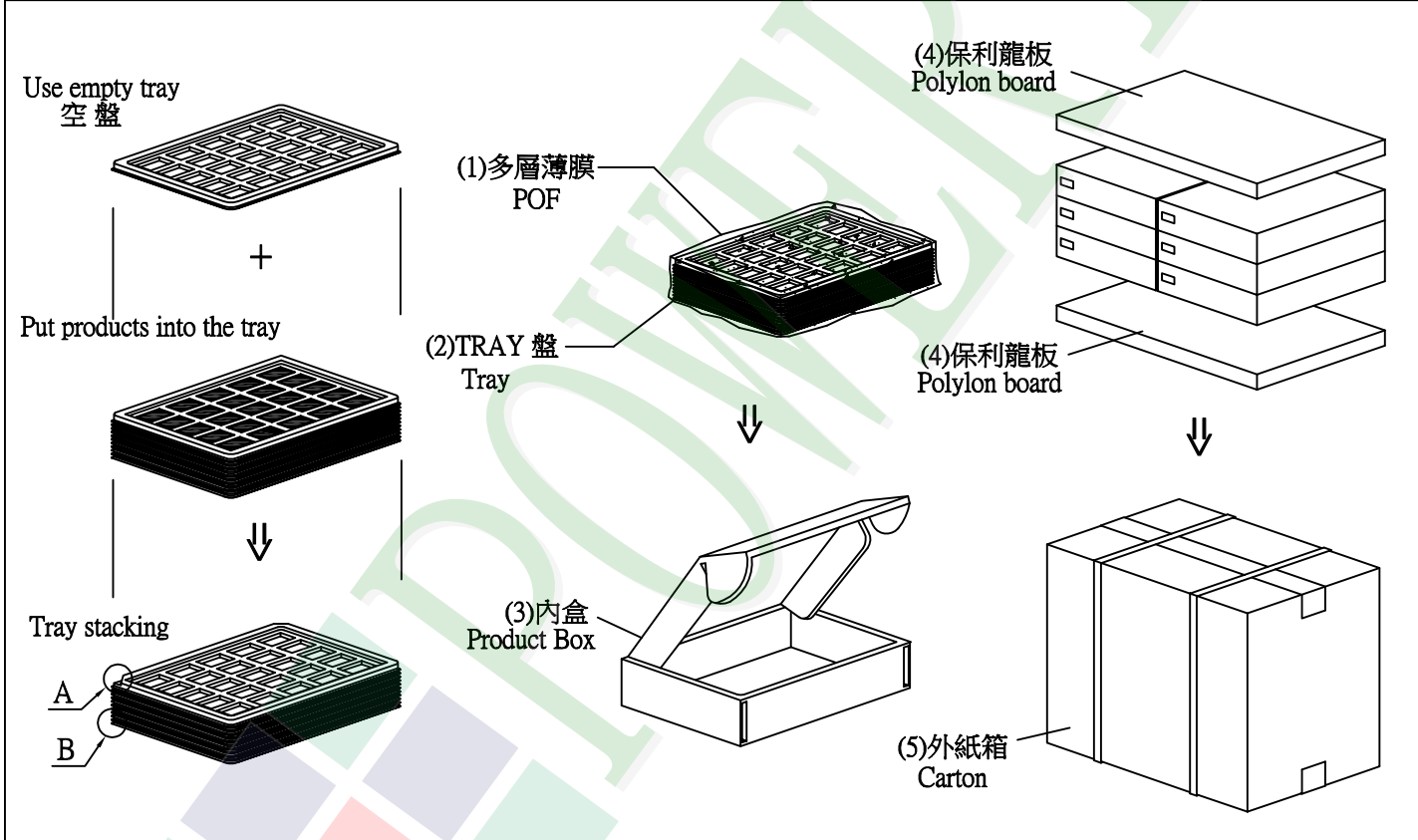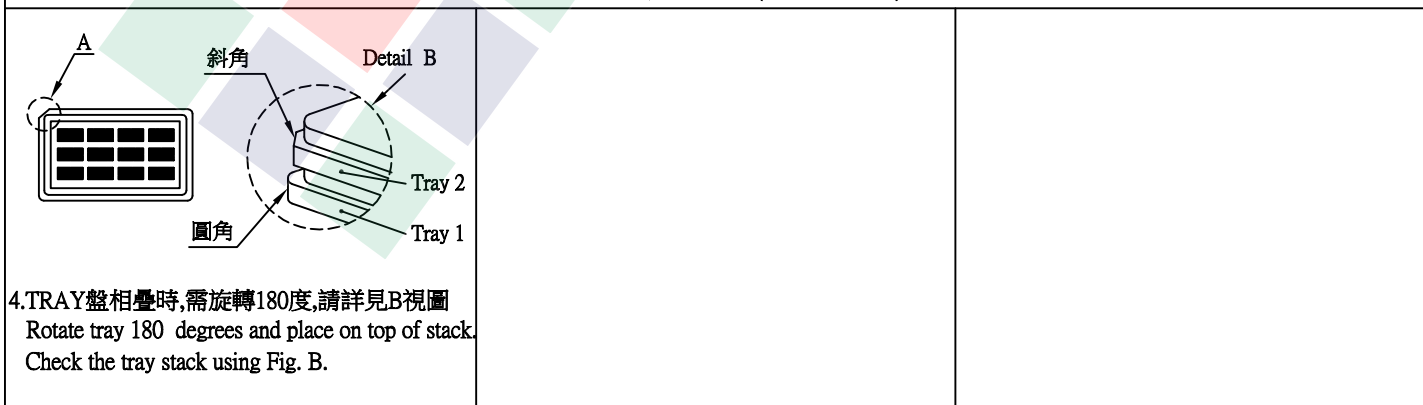
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