

SPECIFICATIONS						
CUSTOMER	:					
SAMPLE CODE	SH320240T028-ZHC					
MASS PRODUCTION CODE	PH320240T028-ZHC					
PCAP FIRMWARE VERSION	CW035012_V2_20171117.bin					
SAMPLE VERSION	. 01					
SPECIFICATIONS EDITION	009					
DRAWING NO. (Ver.)	LMD-PH320240T028-ZHC (Ver.003)					
PACKAGING NO. (Ver.)	PKG- PH320240T028-ZHC (Ver.001)					

Customer Approved

Date	
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Approved	Checked	Designer
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 Preliminary specificatio Specification for sample 	POWERTIP 2023.03.00 TW RD APR	
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History of Version

Date (mm / dd / yyyy)	Ver.	Edi.	Description	Page	Design by
06/14/2019	01	001	New Drawing		Howard
10/31/2019	01	002	New Sample Add Ts Note1 & Ta Note 2 Modify Component height and Add Print Line	- 5 Appendix	Howard
04/20/2020	01	003	According to customer request modify Contents	-	Howard
05/29/2020	01	004	According to customer request modify Contents	-	Howard
06/08/2020	01	005	Modify Outline Dimension	4	Howard
05/06/2021	01	006	Add Dimension	Appendix	Howard
08/05/2022	01	007	Modify System Bus Timing for RGB Interface	16	Howard
08/22/2022	01	008	DCLK polarity from falling modify to rising	13	Howard
03/02/2023	01	009	Modify ID Pins Definition	13	Howard



Contents

1. SPECIFICATIONS

1.1 Features

- 1.2 Mechanical Specifications
- 1.3 Absolute Maximum Ratings
- 1.4 DC Electrical Characteristics
- 1.5 Optical Characteristics
- **1.6 Backlight Characteristics**
- 1.7 Touch Panel Specification

2. MODULE STRUCTURE

- 2.1 Counter Drawing
- 2.2 Interface Pin Description
- 2.3 Timing Characteristics
- 2.4 3-wire Serial Interface (SPI)

3. QUALITY ASSURANCE SYSTEM

- 3.1 Quality Assurance Flow Chart
- 3.2 Inspection Specification

4. RELIABILITY TEST

4.1 Reliability Test Condition

5. PRECAUTION RELATING PRODUCT HANDLING

- 5.1 Safety
- 5.2 Handling
- 5.3 Storage
- 5.4 Terms of Warranty

Appendix: 1. LCM Drawing 2. Packing Specification

Note: For detailed information please refer to IC data sheet: Primacy(TFT LCD): Sitronix: ST7272A



1. SPECIFICATIONS

1.1 Features

<u>Item</u>	Standard Value				
Display Type	320 * 3 (RGB) * 240 Dots				
LCD Type	Full Viewing Angle, Normally Black, Transmissive type				
Screen size(inch)	3.5 inch				
Surface treatment	Anti-Glare				
Color configuration	RGB-Strip				
Backlight Type	White LED B/L				
Interface	Parallel RGB (Data), SPI (Configuration)				
Other(controller/driver IC)	ST7272A (Or Compatible IC)				
	THIS PRODUCT CONFORMS THE ROHS OF PTC				
ROHS	Detail information please refer website :				
	http://www.powertip.com.tw/news_detail.php?Key=1&cID=1				

1.2 Mechanical Specifications

Item	Standard Value	<u>Unit</u>
Outline Dimension	84.02(W) * 75.36(L) * 5.05(H)	mm

LCD Panel

ltem	Standard Value	<u>Unit</u>
Active Area	70.08(W) * 52.56(L)	mm
Pixel Size	0.219(W) * 0.219(H)	mm

Note: For detailed information please refer to LCM drawing



1.3 Absolute Maximum Ratings

Module

<u>ltem</u>	<u>Symbol</u>	Condition	<u>Min.</u>	<u>Max.</u>	Unit	<u>Remark</u>
Power Supply for TFT Panel	VDD	GND=0	-0.3	4.5	V	
Power Supply for Backlight Unit	VCC	GND=0	-0.3	+20.0	V	-
Operating Temperature	Top (Ts)	Note 1	-20	70	°C	
Storage Temperature	T _{S⊺} (Ta)	Note 2	-30	80	°C	

The absolute maximum rating values of this product are not allowed to be exceeded at any time. Should a module be used with any of the absolute maximum ratings exceeded, the characteristics of the module may not be recovered, or in an extreme case, the module may be permanently destroyed.

Note 1: Ts is the temperature of panel's surface

Note 2: Ta is the ambient temperature of samples

1.4 DC Electrical Characteristics

Module

GND = 0V, Ta = 25°C

<u>ltem</u>	<u>Symbol</u>	<u>Condition</u>	<u>Min.</u>	<u>Typ.</u>	<u>Max.</u>	<u>Unit</u>
Power Supply for TFT Panel	VDD	GND=0V	3.0	3.3	3.6	V
Power Supply for Backlight Unit	VCC	GND=0V	5	12	15	V
Input Voltage for	VIH	GND=0V	0.7VDD	-	VDD	
TFT Panel	VIL	GND=0V	0	-	0.3VDD	V
Supply Current for TFT Panel	IDD	IDD@VDD=3.3V	-	25	40	
Supply Current for Backlight Unit	ICC	ICC@VCC=5V	-	170	260	mA
Supply Current for Backlight Unit	ICC	ICC@VCC=12V	-	70	105	
Input Voltage for	VPH	GND=0V	1.2	-	-	V
PWM Signal VPL		GND=0V	-	-	0.4	V
Dimming Clock Rate	fP	GND=0V	5	-	100	KHz



1.5 Optical Characteristics

TFT LCD Module

VDD = 3.3 V, Ta=25°C

<u>ltem</u>	<u>Syr</u>	nbol	<u>Condition</u>	<u>Min.</u>	<u>Typ.</u>	<u>Max.</u>	<u>unit</u>	
Response time	Tr	+Tf	Ta = 25°C θX, θY = 0°	-	30	40	ms	Note 2
	Тор	θΥ+			80	1		
Viewing angle	Bottom	θY-			80	1	Dog	Noto 4
viewing angle	Left	θХ-	CR 2 10	-	80	-	Deg.	NOLE 4
	Right	θΧ+		-	80	-		
Contrast ratio)	CR		650	800	-		Note 3
	\A/bita	Х		0.23	0.28	0.33		
	vvnite	Y		0.27	0.32 0.37			
	Red	Х		0.58	0.63	0.68	-	
Color of CIE		Y	$a = 25^{\circ}C$ AX AY = 0°	0.31	0.36	0.41		Natad
(With B/L)	Green	Х	0, 01 - 0	0.29	0.34	0.39		Note
(•••••• =)		Y		0.55	0.60	0.65		
	Dhia	X		0.09	0.14	0.19		
	Blue			0.04	0.09	0.14		
Average Brightness			VCC=12.0V					
Pattern=white display		F	PWM="High"	800	1000	-	cd/m²	Note1
(With LCD)*1			(Duty=100%)					
Uniformity			VCC=12.0V					
		B	PWM="High"	70	-	-	%	Note1
			(Duty=100%)					



Note 1:

- *1: △B=B(min) / B(max) * 100%
- *2: Measurement Condition for Optical Characteristics:

a: Environment: $25^{\circ}C \pm 5^{\circ}C$ / $60\pm 20^{\circ}R$.H, no wind, dark room below 10 Lux at typical lamp current and typical operating frequency

- b: Measurement Distance: 500 \pm 50 mm, (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%





To be measured at the center area of panel with a viewing cone of 1° by Topcon luminance meter BM-7, after 10 minutes operation (module)

Note 2: 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:





Normally Black





1.6 Backlight Characteristics

Maximum Ratings

<u>ltem</u>	<u>Symbol</u>	<u>Min.</u>	<u>Max.</u>	<u>Unit</u>	<u>Remark</u>	
LED Forward Current	lF	3	0	mA	One LED	
LED Reverse Voltage	VR	5	5.0			

Electrical / Optical Characteristics

<u>ltem</u>	<u>Symbol</u>	<u>Min.</u>	<u>Тур.</u>	<u>Max.</u>	<u>Unit</u>	<u>Remark</u>
LED Voltage	VL	18.0	19.0	-	V	Note1
LED Current	١L		40	-	mA	-
LED life time	-	50,000	-		Hr	Note2

Note 1: The LED Supply Voltage is defined by the number of LED at Ta=25 $^\circ\!\!{\rm C}$ and IL =40 mA

Note 2: The "LED life time" is defined as the module brightness decrease to 50% original brightness at Ta=25℃ and I_L=40 mA. The LED life time could be decreased if operating I_L is larger than 40 mA





1.7 Touch Panel Characteristics

Features

	Item				Star	ndard Value			
Touc	h Panel Size			3.5"					
Тс	ouch type		True Multi-Touch Capacitive Touch Panel						
Inp	ut Method		True Multi-touch with up to 5 Points of Absolution X and Y Coordinate					Coordinates	
Outp	out Interface		l ² C						
	IC				4	HY4635			
I ² C Add	Iress								
Bit 7	Bit 6	Bi	t 5	Bit 4 Bit 3 Bit 2 Bit 1 Bit					
0	1		1	1	0	0	0	R/W	
Bit 0.0	for Write /	1 for D	load						

Bit 0: 0 for Write / 1 for Read

Absolute Maximum Ratings

Item	Symbol	Condition	Min.	Max.	Unit
Supply voltage	TPVDD	-	-0.3	3.6	V
Operating Temperature	Тор	Non condensing	-20	70	°C
Storage Temperature	Тѕт	Non condensing	-30	80	°C

DC Electrical Characteristics

Item	Symbol	Condition	Min.	Тур.	Max.	Unit
Power Supply Voltage	TPVDD	-	-	3.3	-	V

Optical Characteristics

Item	Standard Value	Unit
Total light transmittance	85% or more	-
Hardness	≥6H	-

PCAP Firmware Information

File: CW035012_V2_20171117.bin

SHA-256: F73E1631AD350878F3A179D8C8B3BF0C5C50DB10CBC82BCC84CE396FF45E929E Remark: None



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

TFT LCM Interface

Pin#	<u>Name</u>	Description
1	GND	Power ground.
2	VDD	Power for Digital Circuit.
3	VDD	Power for Digital Circuit.
4	VCC	Power For LED backlight.
5	VCC	Power For LED backlight.
6	PWM	Shutdown & Dimming control input for backlight. Do not allow this pin to float. "Hi" =100%, "Low" = 0%.
7	GND	Power ground.
8	R0	Red Data.
9	R1	Red Data.
10	R2	Red Data.
11	R3	Red Data.
12	GND	Power ground.
13	R4	Red Data.
14	R5	Red Data.
15	R6	Red Data.
16	R7	Red Data.
17	GND	Power ground.
18	G0	Green Data.
19	G1	Green Data.
20	G2	Green Data.
21	G3	Green Data.
22	GND	Power ground.
23	G4	Green Data.
24	G5	Green Data.
25	G6	Green Data.
26	G7	Green Data.
27	GND	Power ground.
28	В0	Blue Data.
29	B1	Blue Data.



Pin#	<u>Name</u>	DESCRIPTION
30	B2	Blue Data.
31	B3	Blue Data.
32	GND	Power ground.
33	B4	Blue Data.
34	B5	Blue Data.
35	B6	Blue Data.
36	B7	Blue Data.
37	GND	Power ground.
38	HS	Line synchronization signal. Horizontal Sync Input.
39	VS	Frame synchronization signal. Vertical Sync Input.
40	GND	Power ground.
41	DE	Data Enable.
42	GND	Power ground.
43	DCLK	Sample clock. Data will be latched at the rising edge of DCLK.
44	GND	Power ground.
45	CS/ ID1	Serial communication chip selection/ID[4:1]These pins select LCM type. See NOTE1
46	SDIN/ ID2	Serial communication data/ ID[4:1]These pins select LCM type. See NOTE1
47	SCK/ ID3	Serial communication clock/ ID[4:1]These pins select LCM type. See NOTE1
48	DISPLAY CONTROL / ID4	Display Enable(Hi Active)./ ID[4:1]These pins select LCM type. See NOTE1
49	/RESET	Global Reset (Low Active).
50	GND	Power ground.

Note1:

ID Pins Definition:

	PIN 45 ID1	<u>PIN 46 ID2</u>	<u>PIN 47 ID3</u>	<u>PIN 48 ID4</u>
3.5" Module	X	0	0	Х
4.3" Module	X	1	0	Х
5.0" Module	X	0	1	Х
7.0" Module	X	1	1	Х

1. Resistor = 10k ohm

2. "X" = No use



Touch Panel Driving

Pin No.	Symbol	Function					
1	GND	Ground.					
2	TPVDD	Power Supply Voltage (3.3V)					
3	SCL	I2C Clock					
4	SDA	I2C Data					
5	INT	Active Low					
6	RESET	Active low global reset signal input.					



2.3 Timing Characteristics

2.3.1 RGB Mode Selection Table

RGB Mode Selection Table	<u>DCLK</u>	<u>HSYNC</u>	<u>VSYNC</u>	DE
SYNC - DE Mode	Input	Input	Input	Input
SYNC Mode	Input	Input	Input	GND
DE Mode	Input	GND	GND	Input



2.3.2 System Bus Timing for RGB Interface



						VDD= 3.3V, Ta=25 ℃
<u>ltem</u>	<u>Symbol</u>	<u>Min</u>	<u>Тур.</u>	Max	<u>Unit</u>	Conditions
CLK Pulse Duty	Tclk	40	50	60	%	
HSYNC Width	Thw	2	-	-	DCLK	
HSYNC Period	Th	55	60	65	us	
VSYNC Setup Time	Tvst	12	-	-	ns	
VSYNC Hold Time	Tvhd	12	-	-	ns	
HSYNC Setup Time	Thst	12	-	-	ns	
HSYNC Hold Time	Thhd	12	-	-	ns	
Data Setup Time	Tdsu	12	-	-	ns	
Data Hold Time	Tdhd	12	-	-	ns	
DE Setup Time	Tdest	12	-	-	ns	
DE Hold Time	Tdehd	12	-	-	ns	



2.3.3 Parallel RGB SYNC Mode





2.3.4 Parallel RGB SYNC-DE Mode





2.3.5 Parallel RGB DE Mode





2.3.6 Parallel RGB Input Timing Table

	Parallel 24-bit RGB Input Timing Table							
<u>P</u> a	arameter	<u>Symbol</u>	<u>Min</u>	Тур	<u>Max</u>	<u>Unit</u>	Note	
DCL	K frequency	Fclk	5	6	8	MHz		
DC	LK Period	Tclk	125	167	200	ns		
	Period Time	Th	325	371	438			
	Display Period	Thdisp		320				
HSYNC	Back Porch	Thbp	3	43	43	DCLK	SYNC mode back porch control by H_BLANKING[7:0] setting Thbp= H_BLANKING[7:0]	
	Front Porch	Thfb	2	8	75			
	Pulse Width	Thw	2	4	43			
	Period Time	Τv	244	260	289			
	Display Period	Tvdisp		240				
VSYNC	Back Porch	Tvbp	2	12	12	HSYNC	SYNC mode back porch control by V_BLANKING[7:0] setting Thbp= V_BLANKING[7:0]	
	Front Porch	Tvfb	2	8	37			
	Pulse Width	Tvw	2	4	12			



2.3.7 Power ON/OFF Sequence

Power ON Sequence



<u>Symbol</u>	Description	<u>Min. Time</u>	<u>Unit</u>				
Т0	Analog power on delay time	0	ms				
T1	System power stability to DISP= "High"	0	ms				
T2	DISP= "High" to display signal output	10	ms				
Т3	Display signal output to backlight power on	250	ms				
T4	Display signal output to source output	100	ms				
T5	Source/ Gate blanking time	30	ms				
T6	Source/ Gate automatic output VSS	80	ms				
T1'	DISP= "High" to AVDD/GVDD voltage stable time	20	ms				
T2'	DISP= "High" to VGH/VGL/AVCL/GVCL voltage stable time 60						



Power OFF Sequence



<u>Symbol</u>	Description	<u>Min. Time</u>	<u>Unit</u>			
Т0	Backlight power off to DISP off	5	ms			
T1	Source voltage output VSS and Gate voltage output VGL	30	ms			
T2	Source/ Gate blanking time	30	ms			
Т3	Source voltage output VSS and Gate voltage output VGL	20	ms			
T4	AVDD/ GVDD/ VGH discharge time	5	ms			
T5	Analog power off to digital power off time	0	ms			
Т0'	Source and Gate voltage discharge complete width	80	ms			



2.4 3-wire Serial Interface (SPI)



a. Each serial command consists of 16 bits of data which is loaded one bit a time at the rising edge of serial clock SCL.

b. Common loading operation starts from the falling edge of CS and is completed at the next rising edge of CS.

c. The serial control block is operational after power on reset, but commands are established by the VSYNC signal. If command is transferred multiple times for the same register, the last command before the VSYNC signal is valid.

d. If less than 16 bits of SCL are input while CS is low, the transferred data is ignored.

e. If 16 bits or more of SCL are input while CS is low, the previous 16 bits of transferred data before then rising edge of CS pulse are valid data.

- f. Serial block operates with SCL clock.
- g. Serial data can be accepted in the power save mode.

h. After power on reset or GRB reset, it is required 100ms delay to begin SPI communication.



3. Quality Assurance System

3.1 Quality Assurance Flow Chart





<u>ltem</u>	<u>Customer</u>	<u>Sales</u>	<u>R&D</u>	<u>Q.A</u>	<u>Manufactur</u> <u>ing</u>	Product control	Purchase	Inventory control
<u>Sales</u> <u>Service</u>	Info →	Claim -		Trac	Failure a	nalysis re action		
<u>Q.A</u> <u>Activity</u>	 ISO 9001 Process i Equipmer Education Standardi 	Mainten mproven าt calibra า And Tra zation M	nance Activ nent propo ation aining Activ lanagemen	rities sal vities nt				

POWERTIP

3.2 Inspection Specification

Scope: The document shall be applied to TFT-LCD Module for 3. 5" -15″ (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(about 300lux ~500lux)

and distance of view must be at 30~40 cm.

(2). The test direction is base on about around 45° of vertical line.





◆Specification For TFT-LCD Module 3. 5"~15": (Ver.B01) NO Item Criterion 1.1 The part number is inconsistent with work order of production. 01 **Product condition** 1.2 Mixed product types. 1. 3 Assembled in inverse direction. 02 2.1 The quantity is inconsistent with work order of production. Quantity 3.1 Product dimension and structure must conform to structure 03 **Outline dimension** diagram. 4.1 Missing line character and icon. 4. 2 No function or no display. 4. 3 Display malfunction. 04 **Electrical Testing** 4. 4 LCD viewing angle defect. 4.5 Current consumption exceeds product specifications. 4.6 Mura cannot be seen through 5% ND filter at 50% Gray, should be judged by the viewing angle of 90 degree. Acceptance (Q'ty) Item **Bright Dot** ≤ 4

			8				
	Dot defect	Dot	Dark Dot	≦ 5			
		Defect	Joint Dot	≦ 3			
	(Bright dot,		Total	≦ 7			
05	Dark dot)				Minor		
	On -display 5. 1 Inspection pattern: full white, full black, Red, Green and blue screens.						
		5. 2 It is defined	as dot defect if defe	ct area > 1/2 dot.			
		5. 3 The distanc	e between two dot d	efect ≧5 mm.			
		5.4 Bright dot	that can not be seen	through 5% ND filter.			

Level

Major

Minor



<u>NO</u>	<u>Item</u>		Criterion				Level			
		6. 1 Round type	(Non-displa	ıy or d	isplay):					
		Dimonsion	. (diamatar	መ	Accepta	nce (Q'ty)				
		Dimension	i (diameter	<u>:Ψ)</u>	<u>A area</u>	B arc	ea			
			$\Phi \leq 0.2$	25	Ignore					
	Black or white	0.25	$< \Phi \leq 0.5$	50	5	Igno	re			
	Dot, scratch,	Dot, scratch,		.50	0	Ignore				
	contamination		Total		5					
	Round type → _x ← _⊥	6. 2 Line type(No	on-display o	or disp	lay):					
	Y	<u>module size</u>	Length (L)	W	<u>'idth (W)</u>	Acceptant A area	ce (Q'ty) B area			
06	↑				W ≦ 0.03	Ignore		Mino		
	$\Phi = (x+y)/2$		L ≦10.0	0.03	$<$ W \leq 0.05	4				
	Line type	Line type		3.5" to less	L ≦5.0	0.05	$<$ W \leq 0.10	2	Ignoro	
			<u> </u>			W >	As	Ignore		
							0.10	round		
		4		Tota		<u>type</u> 5	-			
					$W \leq 0.05$	Ignore				
			L ≦10.0	0.05	<w 0.10<="" td="" ≦=""><td>5</td><td>1</td><td></td></w>	5	1			
		9" to 15"			W >	As	Ignore			
					0.10	round	Ignore			
				Tota	1	<u>type</u> 5	-			
				1014	•	5				
		Dimonsion (diamatar d	<u>()</u>	Accept	tance (Q'ty	/)			
		Dimension (<u>A area</u>	B	area			
07	Polarizer		$\Phi \leq 0.25$		Ignore			Mino		
01	Bubble	0.25 < 0	$\Phi \leq 0.50$		4			NIIIO		
		0.50 < 0	$\Phi \leq 0.80$		1	Iş	gnore			
			$\Phi > 0.80$		0					
		To	tal		5					



Speci	Specification For TFT-LCD Module 3. 5" ~15":(Ver.							
<u>NO</u>	Item	Criterion						
		Symbols :X: The length of crackY: The width of crack.Z: The thickness of crackW: terminal lengthT: The thickness of glassa : LCD side length						
		8.1 General glass chip:8.1.1 Chip on panel surface and crack between panels:						
		Y Y X X X X X X X X						
08	The crack of glass	SP Y (OK) SP SP SP SP (NG)	Minor					
		Seal width						
		<u>X</u> <u>Y</u> <u>Z</u>						
		$\leq a \qquad \begin{array}{c} Crack \ can't \ enter \\ viewing \ area \end{array} \qquad \leq 1/2 \ t$						
		$\leq a \qquad \begin{array}{ c c } Crack can't exceed the \\ half of SP width. \end{array} \qquad 1/2 \ t < Z \leq 2 \ t$						
		<i>^y</i>						



Specifi	cation For TFT-LCD	D Module 3. 5" ~15" : (Ver.						
NO	Item	Criterion						
		Symbols :X: The length of crack Z: The thickness of crack t: The thickness of glassY: The width of crack. W: terminal length a: LCD side length8. 1. 2 Corner crack: $X = \frac{X}{Y}$ Z						
		$\leq 1/5$ aCrack can't enter viewing areaZ $\leq 1/2$ t $\leq 1/5$ aCrack can't exceed the half of SP width. $1/2$ tZ ≤ 2 t						
08	The crack of glass	8 2 Protrusion over terminal:	Minor					
		8. 2. 1 Chip on electrode pad: X Y Y Z X Y Z X Y Z Z X Y Z Z Z X Y Z Z Z X Y Y Z Z Z X Y Y Z Z Z X Y Y Z Z Z Z X Y Y Z						
		XYZFront $\leq a$ $\leq 1/2 W$ $\leq t$ Back $\leq a$ $\leq W$ $\leq 1/2 t$						







Specific	Specification For TFT-LCD Module 3. 5" ~15" :				
<u>NO</u>	<u>Item</u>	<u>Criterion</u>	Level		
	Backlight elements	9. 1 Backlight can't work normally.	Major		
09		9. 2 Backlight doesn't light or color is wrong.	Major		
		9. 3 Illumination source flickers when lit.	Major		
	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: no wrong parts, missing parts or excess parts.	Major		
10		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)

<u>NO.</u>	TEST ITEM	TEST CONDITION				
1	High Temperature Storage Test	Keep in 80 ±5℃ 240 hrs				
2	Low Temperature Storage Test	Keep in −30 ±5°C 240 hrs				
3	High Temperature / High Humidity Storage Test	Keep in 60 ℃ / 90% R.H duration for 240 hrs (Excluding the polarizer)				
4	Temperature Cycling Storage Test	$-30^{\circ}C \rightarrow +25^{\circ}C \rightarrow 80^{\circ}C \rightarrow +25^{\circ}C$ (30mins) (5mins) (30mins) (5mins) 20 Cycle				
	ESD Test	Air Discharge: Apply 2 KV with 5 times Discharge for each polarity +/-	Contact Discharge: Apply 250 V with 5 times discharge for each polarity +/-			
5		 Temperature ambiance: 15 C ~ Humidity relative: 30%~60% Energy Storage Capacitance(C Discharge Resistance(Rd): 330 Discharge, mode of operation: Single Discharge (time between s (Tolerance if the output voltage in 	s+Cd): 150pF±10% Ω±10% uccessive discharges at least 1 sec) dication: ±5%)			
6	Vibration Test (Packaged)	 Sine wave 10~55 Hz frequency (1 min/sweep) The amplitude of vibration: 1.5 mm Each direction (X, Y, Z) duration for 2 hrs 				
7	Drop Test (Packaged)	Packing Weight (Kg 0 ~ 45.4 45.4 ~ 90.8 90.8 ~ 454 Over 454	Drop Height (cm) 122 76 61 46			

©Result Evaluation Criteria :

Under the display quality test conditions with normal operations with normal operation state. Do not change these conditions as such changes may affect practical display function. (Normal operation state) Temperature : +20~30°C Humidity : 50~70% Atmospheric pressure : 86~106Kpa



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 $320 \pm 10^{\circ}$ 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.

5.2.11 Caution: Continuously displaying same static image will result in high possibility of image sticking/image burn-in effect due to TFT panel characteristic.

5.3 Storage

- 5.3.1 Store the panel or module in a dark place where the temperature is $25^{\circ}C \pm 5^{\circ}C$ 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.



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