

Product Specification

Customer	
Model Name	PV128CS01-2
Ver(HW)	Ver 1.0

Date: 4.Apr. 2023

 Preliminary Specification Final Specification

Any modification is not allowed without HKC's permission

Customer's Approval		MianYang HKC	
Signature	Date	Approved By RD Director	Date:
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Revision History

Version	Date	Page (New)	Section	Description	Revision by
01	2023/04/04	-	All	Preliminary Specification	

1. GENERAL DESCRIPTION

1.1 General Description

The specification is applied to 12.8 inch model (PV128CS01-2) TFT Liquid Crystal Display.

The matrix uses a-Si Thin Film Transistor as a switching device. This TFT LCD has a 12.8 inch diagonally measured active display area with FHD resolution (1920 horizontal by 1080 vertical pixels array). All input signals are LVDS interface compatible.

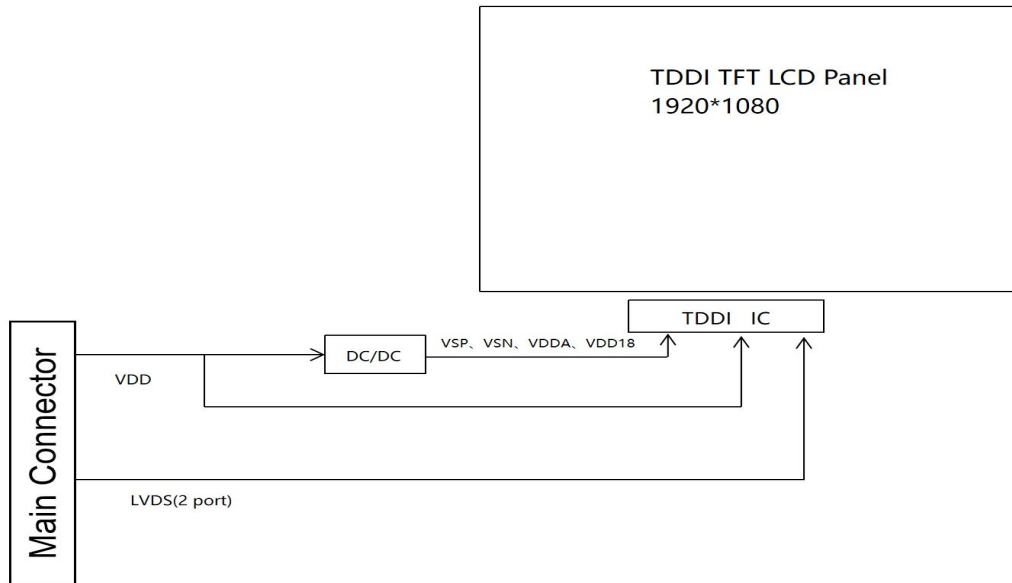


Figure 1. Drive Architecture

Dual Gate+2DOT Inversion:Column(1920RGB*1080)

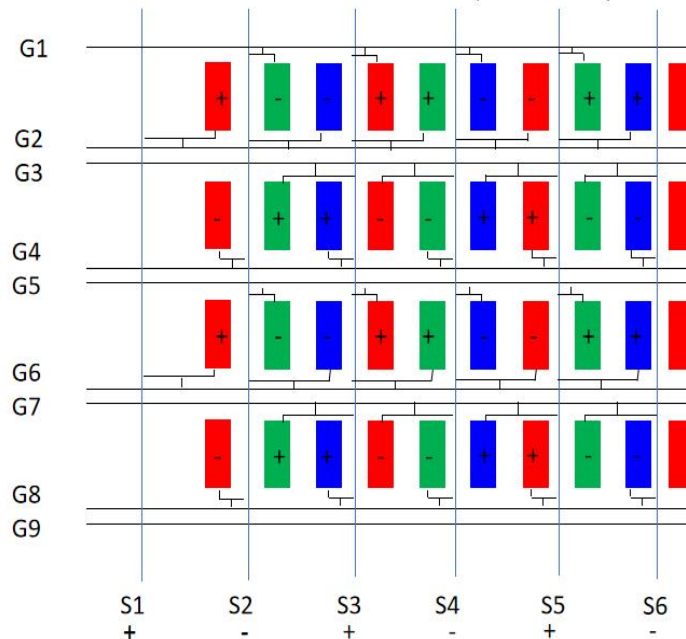


Figure 2. Pixel Mapping

1.2 Features

- (1) 2 Port LVDS interface
- (2) 16.7M (8bit) color depth, color gamut 90%
- (3) Green product (RoHS & Halogen free product)

1.3 General Specifications

The followings are general specifications at the model PV128CS01-2. (listed in Table 1)

Table 1.General Specifications

Item		Specification	Unit	Note
Active area		283.392(H) x 159.408(V)	mm	-
Number of pixels		1920(H) ×1080(V)	pixels	-
Pixel pitch		0.1476 (H) ×0.1476 (V)	mm	-
Pixel arrangement		Dual gate + Z	-	-
Display colors		16.7M(8bits)	-	-
Color gamut		Typ 72@ C light	%	-
Display mode		Normally black	-	-
IC model		HX82108A	-	-
Outline Dimension	Without PCBA	288.992±0.2(H)*169.108±0.2(V)*1.248±0.1	mm	-
	With PCBA	288.992±0.2(H)* (238.508) (V)*3.25Max	mm	
Surface hardness		3H	-	-
Logic Power Consumption		PD:TBD (Max.)	W	@Mosaic

1.4 Touch Specifications

Table 2.Touch Specifications

Item	Specification	Remark
Accuracy	central region $\leq 1.0\text{mm}$ edge region $\leq 1.5\text{mm}$	
Linearity	central region $\leq 1.0\text{mm}$ edge region $\leq 1.5\text{mm}$	
Sensitivity	无断线，且中心区域 $\leq 1.0\text{mm}$	
Uniformity	$\geq 85\%$	TBD
Response Latency	AVG:25ms MAX:30ms	TBD
Multi-Points Minimum Distance	Minimum distance $\leq 12\text{mm}$	
Jitter	1.0 center	
Touch Gestures	Display Off: Support one click or double clicks	
Glove	CG+OCA+Glove < 6.5mm SNR > 20dB with glove touch	
Moisture	<0.2ml	
Multi Touch Support	10	
I2C address	TBD	TBD

2. ABSOLUTE MAXIMUM RATINGS

2.1 Absolute Maximum Ratings

The followings are maximum values which, if exceed, may cause faulty operation or damage to the unit.

Table 3. Absolute Maximum Ratings
 $T_a=25\pm 5^{\circ}\text{C}$

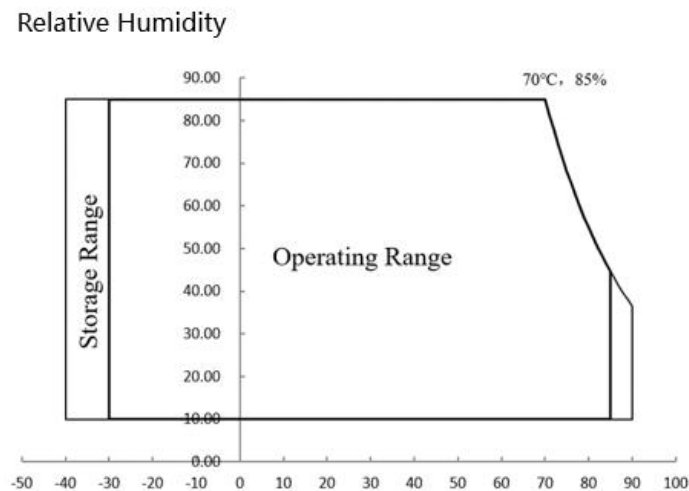
Parameter	Symbol	Min.	Max.	Unit	Remarks
Power Supply Voltage	V_{DD}	-0.3	4	V	(1),(2),(3),(4)
Logic Supply Voltage	V_{IN}	- 0.3	$V_{DD} + 0.3$	V	
Operating Temperature	T_{OP}	-40	85	$^{\circ}\text{C}$	
Storage Temperature	T_{ST}	-40	90	$^{\circ}\text{C}$	

Note (1) All the parameters specified in the table are absolute maximum rating values that may cause faulty operation or unrecoverable damage, if exceeded.

Note (2) All the contents of electro-optical specifications and display fineness are guaranteed under Normal Conditions. All the display fineness should be inspected under normal conditions. Normal conditions are defined as follow: Temperature: 25°C , Humidity: $50\pm 10\%\text{RH}$.

Note (3) Unpredictable results may occur when it was used in extreme conditions. T_a = Ambient Temperature, T_{gs} = Glass Surface Temperature. All the display fineness should be inspected under normal conditions.

Note (4) Temperature and relative humidity range are shown in the figure below, it should be noticed that only functional uses can be guaranteed from -40°C to -30°C .


Figure 3. Absolute Ratings of Environment of the LCD Module

3. ELECTRICAL SPECIFICATIONS

3.1 Interface Connector

Table 4. Signal Connector Type

Item	Description
Manufacturer / Type	HRS/ FH28K-60S-0.5SH

Table 5. Signal Connector Pin Assignment

PIN NO.	SIGNAL NAME	DESCRIPTION
1	GND	Ground
2	FAIL_DET	Abnormal detect
3	VDD	3.3+/-0.3V
4	VDD	3.3+/-0.3V
5	VDD	3.3+/-0.3V
6	NC	no connect
7	RESET	LCD global reset signal. Active low
8	NC	no connect
9	PON	Digital input: SLPIN/SLPOUT hardware control signal PON=L: SLPIN mode PON=H: SLPOUT mode
10	BIST	LCD Panel Self Test Enable, When it is not used, Connecting to GND is recommended
11	NC	no connect
12	GND	Ground
13	OLV0P	Positive LVDS data input 0+(Odd data)
14	OLV0N	Negative LVDS data input 0-(Odd data)
15	GND	Ground
16	OLV1P	Positive LVDS data input 1+(Odd data)
17	OLV1N	Negative LVDS data input 1-(Odd data)
18	GND	Ground
19	OLV2P	Positive LVDS data input 2+(Odd data)
20	OLV2N	Negative LVDS data input 2-(Odd data)
21	GND	Ground
22	OLVCKP	Positive LVDS CLK input+(Odd data)
23	OLVCKN	Negative LVDS CLK input-(Odd data)
24	GND	Ground
25	OLV3P	Positive LVDS data input 3+(Odd data)

26	OLV3N	Negative LVDS data input 3-(Odd data)
27	GND	Ground
28	ELV0P	Positive LVDS data input 0+(Even data)
29	ELV0N	Negative LVDS data input 0-(Even data)
30	GND	Ground
31	ELV1P	Positive LVDS data input 1+(Even data)
32	ELV1N	Negative LVDS data input 1-(Even data)
33	GND	Ground
34	ELV2P	Positive LVDS data input 2+(Even data)
35	ELV2N	Negative LVDS data input 2-(Even data)
36	GND	Ground
37	ELVCKP	Positive LVDS CLK input+(Even data)
38	ELVCKN	Negative LVDS CLK input-(Even data)
39	GND	Ground
40	ELV3P	Positive LVDS data input 3+(Even data)
41	ELV3N	Negative LVDS data input 3-(Even data)
42	GND	Ground
43	NC	no connect
44	NC	no connect
45	NC	no connect
46	SPI_SCL	Serial Interface clock input for SPI interface.
47	SPI_SDA	Serial interface address and data input/output for SPI interface
48	SPI_CS	Serial Interface chip enable signal for SPI interface.
49	NC	no connect
50	VOTP	Used for external power input for OTP Program.
51	NC	no connect
52	NC	no connect
53	TP_EXT_RSTN	TP External reset signal. Active low.IC internal pull high
54	GND	Ground
55	TP_INT	Touch screen interrupt line
56	TP_I2C_SCL	I2C interface CLK for TP control
57	TP_I2C_SDA	I2C interface data signal for TP control
58	NC	no connect

59	NC	no connect
60	NC	no connect

3.2 Signal Electrical Characteristics

The built-in LVDS receiver is compatible with (ANSI/TIA/TIA-644) standard.

Table 6. LVDS Receiver Input DC Specifications

Parameter	Symbol	Spec.			Unit
		Min.	Typ.	Max.	
Positive-going input threshold voltage	V_{TH}	-	-	90	mV
Negative-going input threshold voltage	V_{TL}	-90	-	-	mV
LVDS differential voltage	$ V_{ID} $	90	350	800	mV
LVDS input common mode voltage ^{(1),(2)}	V_{CMLV}	$0.3+ V_{ID} /2$		$2.3-(V_{ID})/2$	V

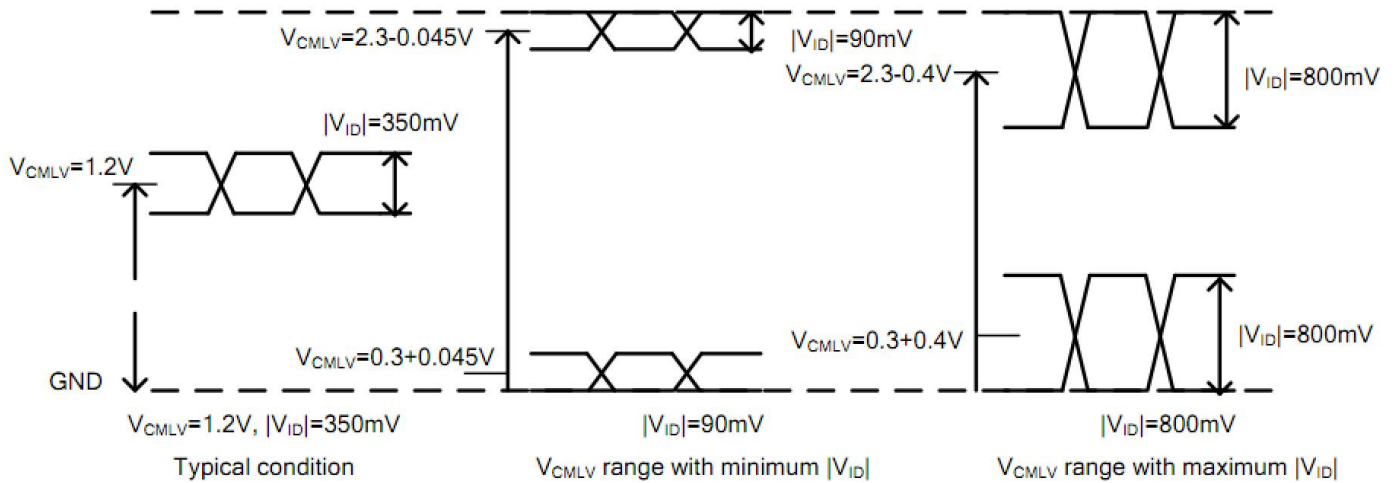
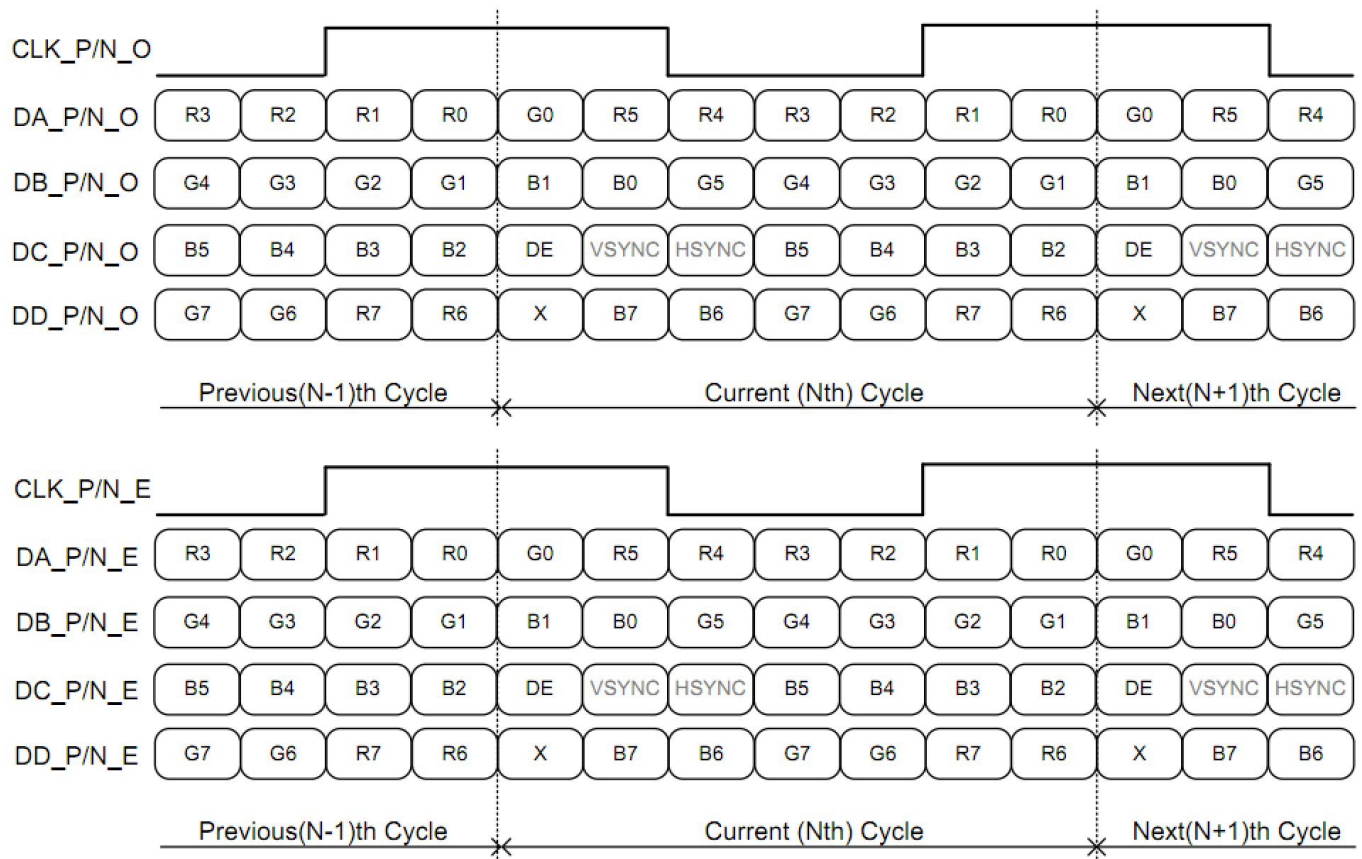


Figure 4. LVDS receiver input signal levels


Figure 5. 2-port LVDS signals, VESA format (8-bit)

3.3 Interface Timings

Table 7. Interface Timings

Parameter		Symbol	1920x1080, fv=60Hz			Unit	
			Min	Typ	Max		
DCLK	Frequency	f_{CLK}	80.78	81.19	81.6	MHz	
	Period	t_{CLK}	12.38	12.32	12.25	ns	
HSYNC	Period	t_{HP}	990	995	1000	t_{CLK}	
	Width	t_{WH}	10	10	10		
	Horizontal Valid		t_{HV}	960			
	Horizontal	Horizontal Back Porch	t_{HBP}	10	10		10
		Invalid	Horizontal Front Porch	t_{HFP}	10		15
VSYNC	Period	t_{VP}	1110	1110	1110	t_{HP}	

Width		t_{wv}	2	2	2
Vertical Valid		t_{vV}	1080		
Vertical Invalid	Vertical Back Porch	t_{vBP}	8	8	8
	Vertical Front Porch	t_{vFP}	270	270	270

3.4 Input Power Specifications

Input power specifications are as follows.

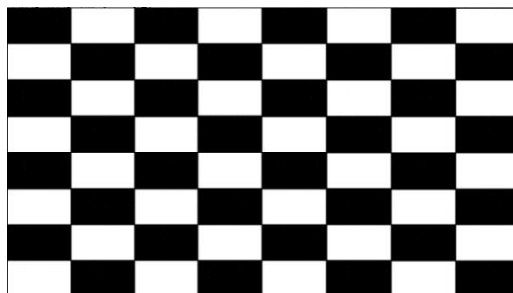
Table 8. Input Power Specifications

Parameter	Symbol	Min.	Typ.	Max.	Unit	Note	
System Power Supply							
LCD Drive Voltage (Logic)	V_{CC}	-	3.3	-	V	(1),(2)	
V_{CC} Current	mosaic Pattern	I_{VCC}	-	-	TBD	A	(1),(3)
V_{CC} Power Consumption	mosaic Pattern	P_{VCC}	-	-	TBD	W	
Rush Current	I_{rush}	-	-	1.0	A	(1),(4)	
Allowable Logic/LCD Drive Ripple Voltage	V_{VCC-RP}	-	-	200	mV	(1)	

Note (1) All of the specifications are guaranteed under normal conditions. Normal conditions are defined as follow: Temperature: 25°C, Humidity: 50± 10%RH.

Note (2) All of the absolute maximum ratings specified in the table, if exceeded, may cause faulty operation or unrecoverable damage. It is recommended to follow the typical value.

Note (3) The specified V_{CC} current and power consumption are measured under the $V_{CC}=3.3V$, $F_V=60Hz$ condition and 10*8 mosaic Pattern.



Note (4) The figures below is the measuring condition of V_{CC} Rush current can be measured when T_{rush} is 0.5ms.

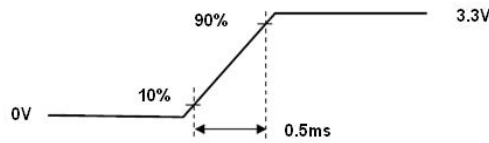


Figure 6. V_{CC} Rising Time

3.5 Power ON/OFF Sequence(B/L Ref.)

Interface signals are also shown in the chart. Signals from any system shall be Hi-Z state or low level when V_{CC} voltage is off.

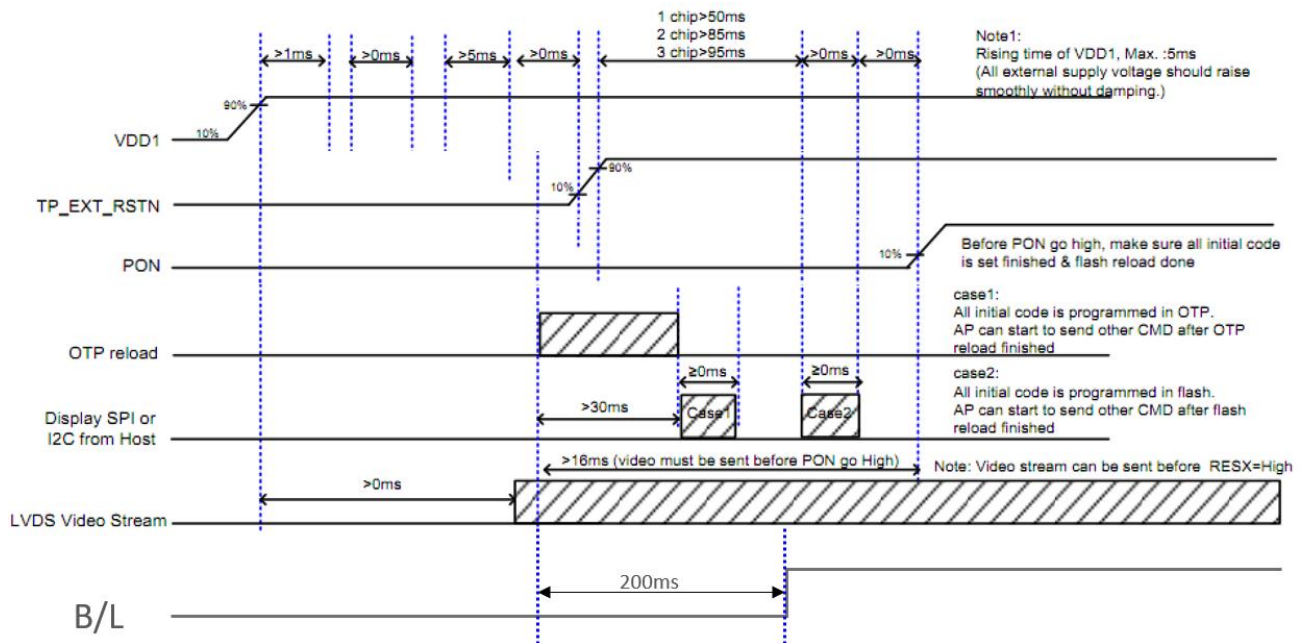
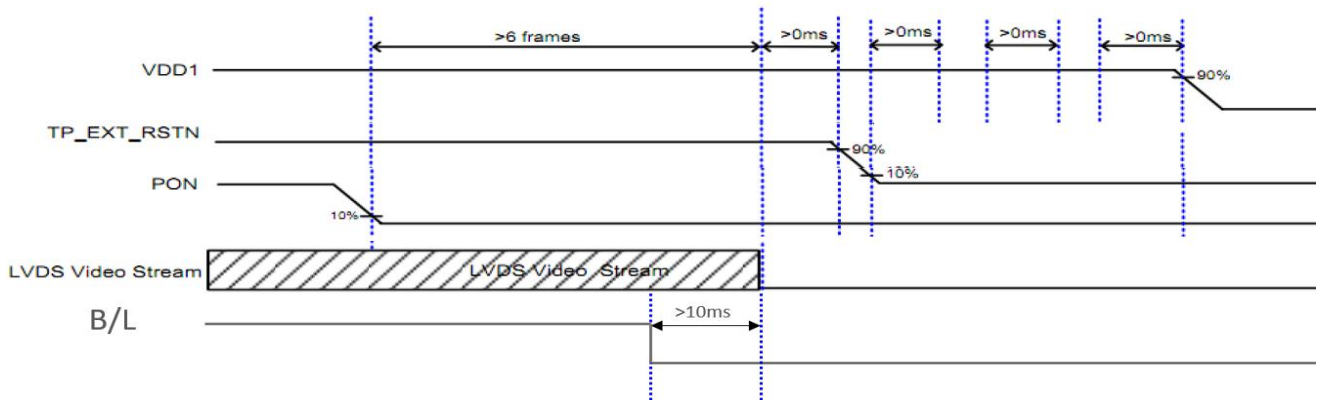


Figure 7. Power-on Sequence


Figure 8. Power-off Sequence

4. OPTICAL SPECIFICATION

4.1 The table below is the test condition of optical measurement.

Table 9. Test condition of optical measurement

Item	Symbol	Value	Unit
Ambient Temperature	TA	23±5	°C
Ambient Humidity	HA	50±10	% RH
Supply Voltage	V _{CC}	3.3	V
Driving Signal	Refer to the typical value in Chapter 3: ELECTRICAL SPECIFICATIONS		
Vertical Refresh Rate	F _v	60	Hz
Warm up time	T _{warm}	>15 min	min
Dark room	ED	<1 lux	lux

4.2 Optical Specifications

Table 10. Optical Specifications

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	Note	
Chromaticity(CIE1931)	Red	R _x	θ _x =0°, θ _y =0°	Typ. -0.03	(0.671)	Typ. +0.03	-	(1)(2)
		R _y			(0.314)			
	Green	G _x			(0.270)			
		G _y			(0.671)			
	Blue	B _x			(0.144)			
		B _y			(0.066)			

	White	W _x			(0.293)			
		W _y			(0.317)			
Color Gamut		CG		-	72	-	%	(3)
Contrast Ratio		CR	θ _x =0°,θ _y =0°	1000:1	1200:1	-	-	(2)(4)
Response Time		T _g =25°C	-	-	-	30	ms	(5)
Viewing Angle	Horizontal	θ _{x+}	CR ≥ 10	80	85	-	Deg.	(6)
		θ _{x-}		80	85	-		
	Vertical	θ _{y+}		80	85	-		
		θ _{y-}		80	85	-		
Transmittance		Tr	θ _x =0°,θ _y =0°	-	3.3	-	%	(3)
Gamma		--	θ _x =0°,θ _y =0°	2.0	2.2	2.4	-	

Notes:

(1) The chromaticity coordinates specified in Table 10 should be calculated from the measurement spectrum of all pixels in red, green, blue, and white, and should be measured at the center of the panel.

(2) Based on HKC Btd 74 backlight with diffuser +BEF +DBEF films

(3) Based on C light

(4) Definition of Contrast Ratio (CR):

The contrast ratio can be calculated by the following formulation

$$\text{Contrast Ratio (CR): } CR = \frac{CR_w}{CR_D}$$

CR_w : Luminance of LCD module with full screen white pattern (255,255, 255) at center point.

CR_D : Luminance of LCD module with full screen Dark pattern (0, 0, 0) at center point.

The measure point of the Contrast Ratio is the center of the panel.

(5) Definition of Response time (RT):

The response time is defined as the LCD optical switching time interval between “Bright state” and “Dark state”, TR is the rise time between Luminance rate changed from 10% to 90%, TF is the fall time between Luminance rate changed from 90% to 10%. RT should be measured at atmosphere temperature at center point.

<Table 13. Switching time of luminance ratios matrix>

Measured Response time		T ₀	
		10%	90%
From	10%		T _{10%to90%}
	90%	T _{90% to 10%}	

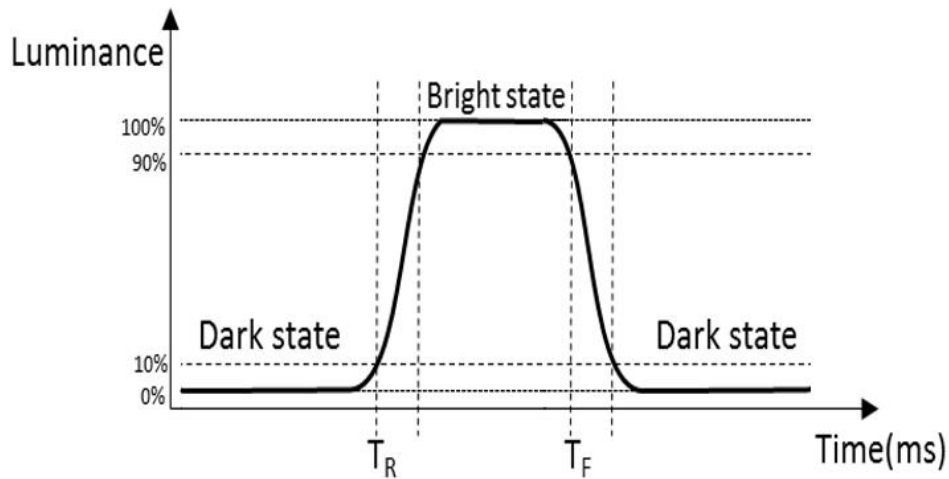


Figure 9. The definition of TR and TF

Measured response time is determined by rise time (T_R) and fall time (T_F), and shown in Figure 9

(6) Definition of Viewing angle:

As CR definition stated in Note (4), the viewing angles are defined when the viewing angle is larger than 10° in four directions relative to the perpendicular direction of the HKC's module (two vertical angles: up θ_{y+} and down θ_{y-} ; and two horizontal angles: right θ_{x+} and left θ_{x-}). The standard setup of measurement is shown in Figure 10.

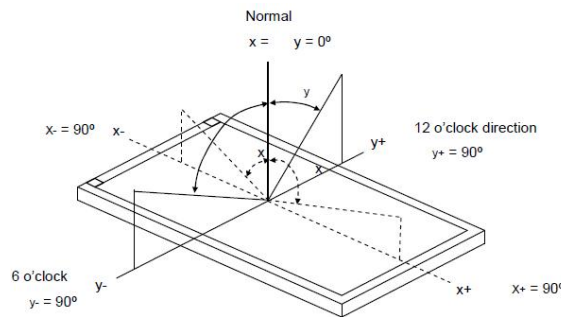


Figure 10. Definition of Viewing angle

4.3 Optical Measurements

SR-UL2

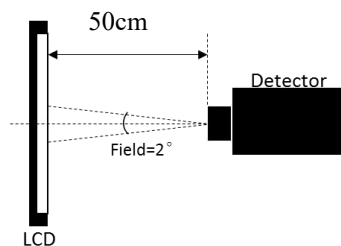
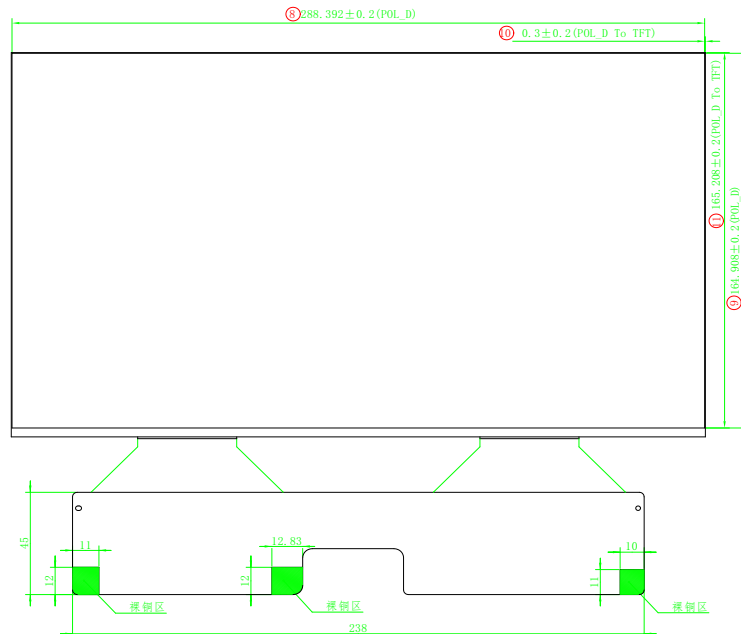
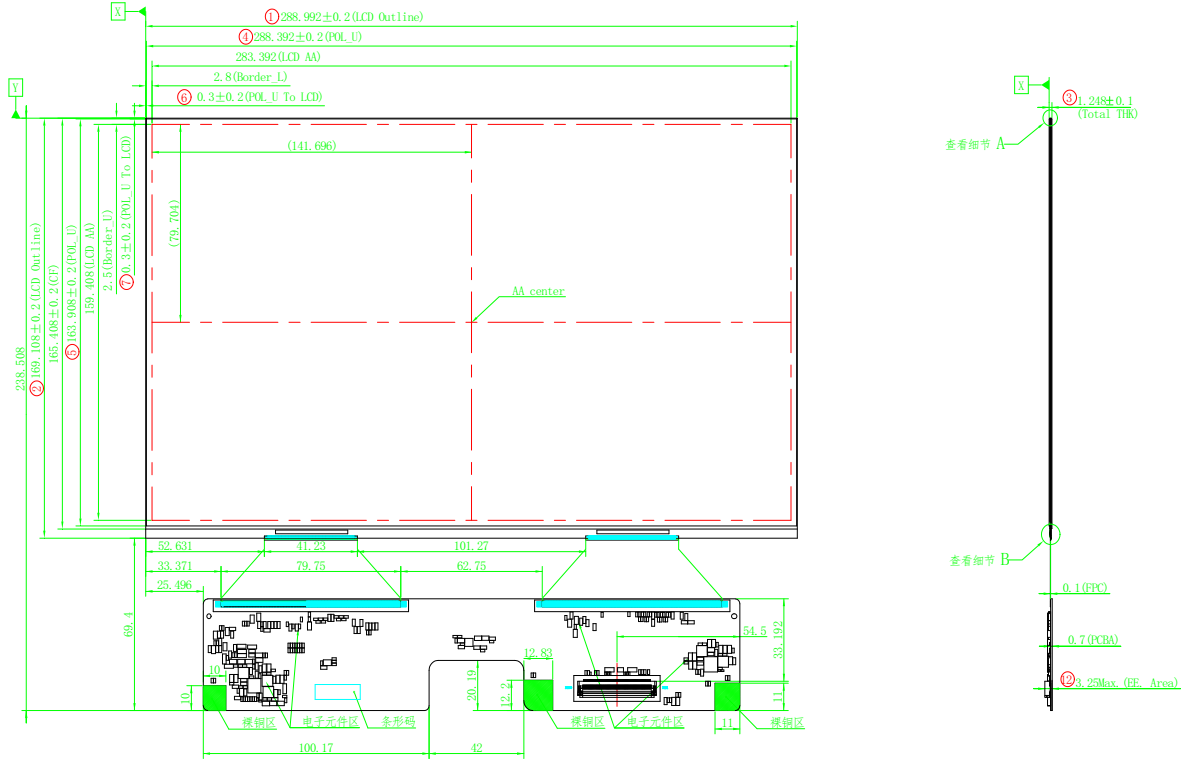
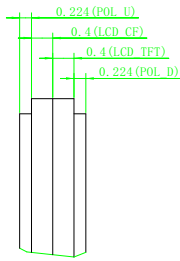


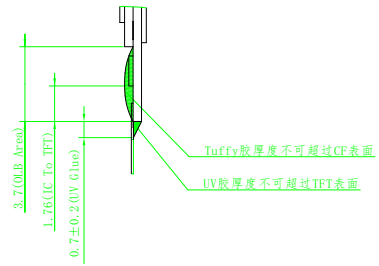
Figure 11.Measurement equipment

5. MECHANICAL OUTLINE DIMENSION





细节 A
比例 20:1



细节 B
比例 8:1

Table 14. Module Dimension Specifications

Item	Min.	Typ.	Max.	Unit
Width	288.792	288.992	289.192	mm
Height	Without PCBA	168.908	169.108	mm
	With PCBA	-	238.508	mm
Weight	-	137.2	-	g

Note:

Outline dimension measure instrument: Vernier Caliper.

6. SPI Interface

In normal write mode, the read/write control bit must be set to 0, and SAI is address input and data pin.

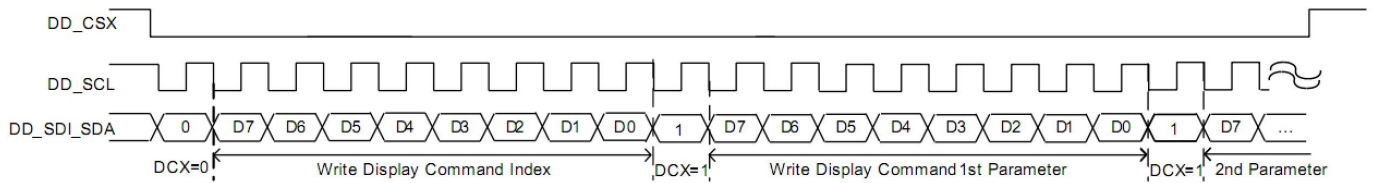


Figure 14. SPI Signals, normal write mode

In normal read mode, the read/write control bit must be set to 1. The SAI is address input pin and SDAO is data output pin

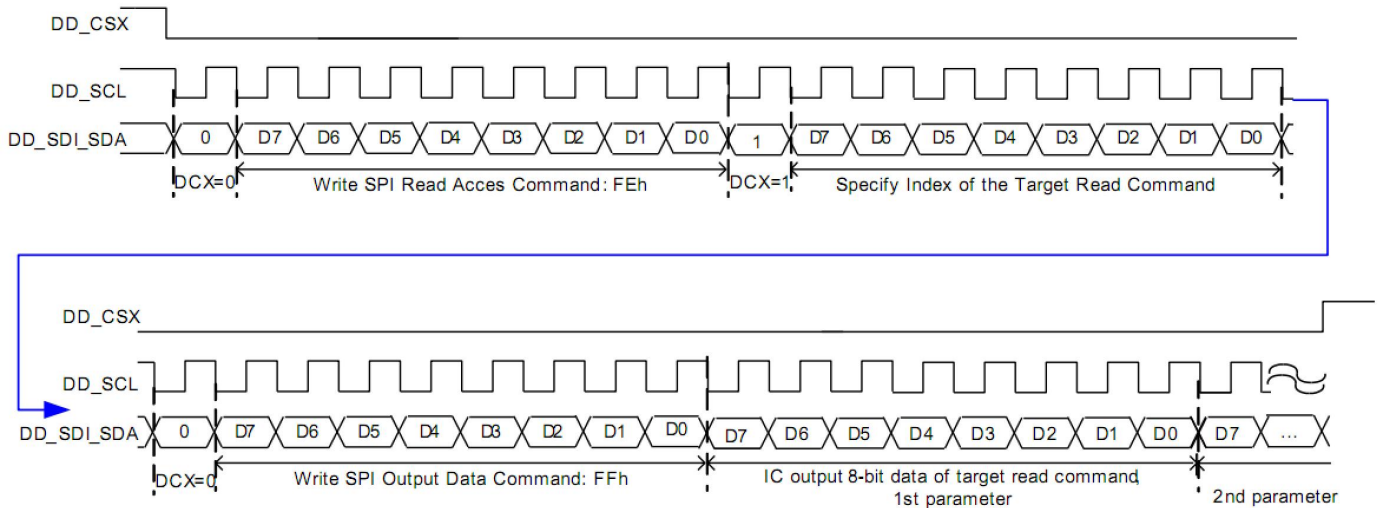


Figure 15. SPI Signals, normal read mode

7. RELIABILITY TEST

The reliability test items and its conditions are shown in below.

Table 15. Reliability Test

No	Test Items	Conditions
1	High temperature storage test	95°C, Storage, 504hrs
2	Low temperature storage test	-40°C, Storage, 504hrs
3	High temperature operating test	85°C, Operation, 504hrs
4	Low temperature operating test	-30°C, Operation, 504hrs
5	Thermal shock	-40~85°C(切换时间<30s), per 60min, 250cycle, Storage

Note (1) There is no display function NG issue occurred , all the cosmetic specification is judged before the reliability stress.

Note (2) after taking the samples out of the chamber and returning to room temperature and humidity, wait at least two hours before inspecting and measuring data. No condensation shall be accepted. The sample shall be free from defects:

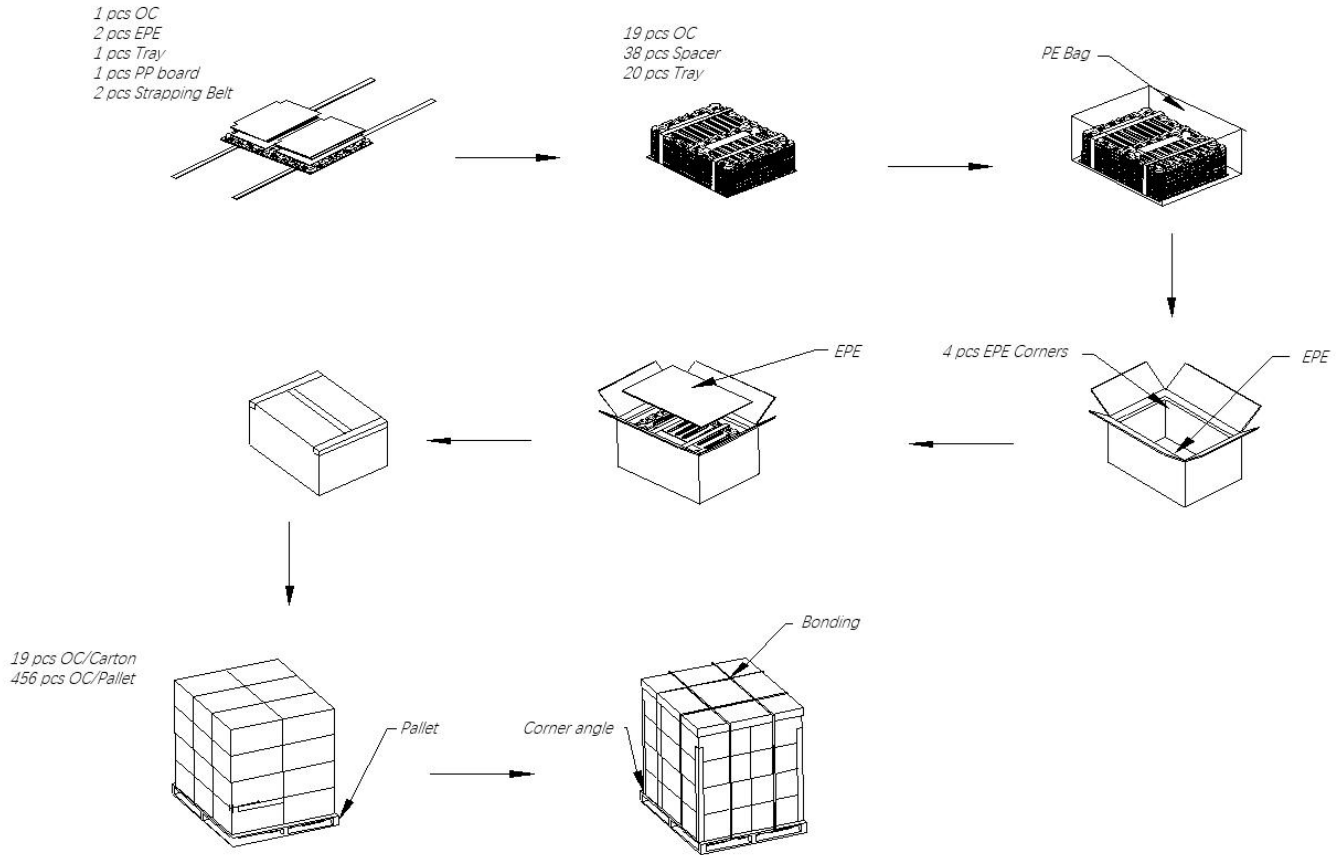
(Air bubble in the LCD , seal leak , Non display , missing segments , glass crack)

Note (3) The test condition definition panel's surface temperature.

Note (4) The setting of electrical parameters should follow the typical value before reliability test.

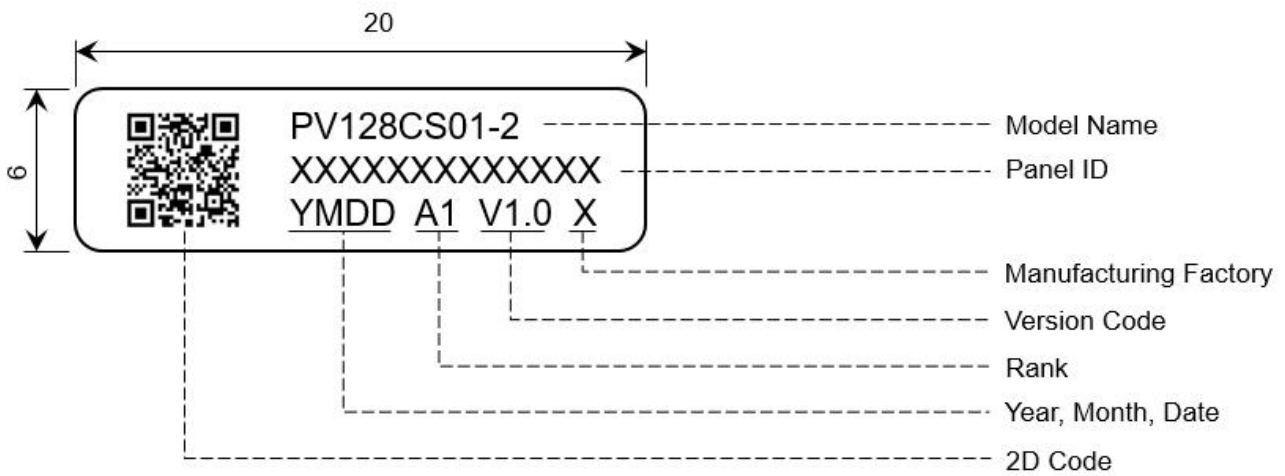
Note (5) During the test , it's unaccepted to have condensate water remains. Besides , protect the LCD from static electricity.

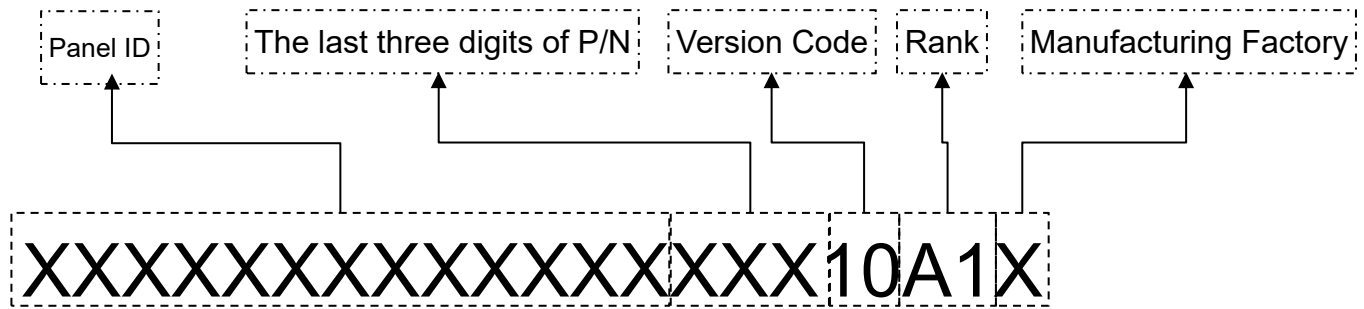
8. PACKAGE SPECIFICATION



9. LABEL

9.1 OC label




Figure 12. 2D Code Rule
Table 19. Year/Month/Date Rule

Year	2021	2022	2023	2024	2025	2026	2027	2028	...
code	1	2	3	4	5	6	7	8	...

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
code	1	2	3	4	5	6	7	8	9	X	Y	Z

Date	1 st	2 nd	3 rd	4 th	5 th	6 th	7 th	8 th	9 th	10 th	11 th	12 th	13 th	14 th	15 th	16 th
code	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16
Day	17 th	18 th	19 th	20 th	21 th	22 th	23 th	24 th	25 th	26 th	27 th	28 th	29 th	30 th	31 th	
code	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	

10. GENERAL PRECAUTION

10.1 Using Restriction

This product is not authorized for using in life supporting systems, aircraft navigation control systems, military systems and any other appliance where performance failure could be life-threatening or lead to be catastrophic.

10.2 Operation Precaution

(1)The LCD product should be operated under normal conditions.

Normal conditions are defined as below:

Temperature: 25°C

Humidity: 50±10%

Display pattern: continually changing pattern (Not stationary)

(2) Brightness and response time depend on the temperature. (It needs more time to reach normal brightness in low temperature.)

(3) It is necessary for you to pay attention to condensation when the ambient temperature drops suddenly. Condensate water would damage the polarizer and electrical contacted parts of the module. Besides, smear or spot will remain after condensate water evaporating.

(4) If the absolute maximum rating value was exceeded, it may damage the module.

(5) Do not adjust the variable resistor located on the module.

(6) Sufficient suppression to the electromagnetic interference shall be done by system manufacturers.

Grounding and shielding may be important to minimize the interference.

(7) Image sticking may occur when the module displayed the same pattern for long time.

(8) Do not connect or disconnect the module in the “power on” condition. Power supply should always be turned on/off by the “power on/off sequence”

(9) Ultra-violet ray filter is necessary for outdoor operation.

10.3 Mounting Precaution

(1) All the operators should be electrically grounded and with Ion-blown equipment turning on when mounting or handling. Dressing finger-stalls out of the gloves is important for keeping the panel clean during the incoming inspection and the process of assembly.

(2) It is unacceptable that the material of cover case contains acetic or chloric. Besides, any other material that could generate corrosive gas or cause circuit break by electro-chemical reaction is not desirable.

(3) The case on which a module is mounted should have sufficient strength so that external force is not transmitted to the module directly.

(4) It is obvious that you should adopt radiation structure to satisfy the temperature specification.

(5) It should be attached to the system tightly by using all holes for mounting, when the module is assembled. Be careful not to apply uneven force to the module, especially to the PCB on the back.

(6) A transparent protective film needs to be attached to the surface of the module.

(7) Do not press or scratch the polarizer exposed with anything harder than HB pencil lead. In addition, don't touch the pin exposed with bare hands directly.

(8) Clean the polarizer gently with absorbent cotton or soft cloth when it is dirty.

(9) Wipe off saliva or water droplet as soon as possible. Otherwise, it may cause deformation and fading of color.

(10) Desirable cleaners are IPA (Isopropyl Alcohol) or hexane. Do not use Ketone type materials (ex. Acetone), Ethyl alcohol, Toluene, Ethyl acid or Methyl chloride. It might permanent damage to the polarizer due to chemical reaction.

(11) Do not disassemble or modify the module. It may damage sensitive parts in the LCD module, and

cause scratches or dust remains. HKC does not warrant the module, if you disassemble or modify the module.

10.4 Handling Precaution

(1) Static electricity will generate between the film and polarizer, when the protection film is peeled off. It should be peeled off slowly and carefully by operators who are electrically grounded and with Ion-blown equipment turning on. Besides, it is recommended to peel off the film from the bonding area.

(2) The protection film is attached to the polarizer with a small amount of glue. When the module with protection film attached is stored for a long time, a little glue may remain after peeling.

(3) If the liquid crystal material leaks from the panel, keep it away from the eyes and mouth. In case of contact with hands, legs or clothes, it must be clean with soap thoroughly.

10.5 Storage Precaution

When storing modules as spares for long time, the following precautions must be executed.

(1) Store them in a dark place. Do not expose to sunlight or fluorescent light. Keep the temperature between 5°C and 35°C at normal humidity.

(2) The polarizer surface should not come in contact with any other object. It is recommended that they be stored in the container in which they were shipped.

(3) It is recommended to use it in a short-time period, after it's unpacked. Otherwise, we would not guarantee the quality.

10.6 Others

When disposing LCD module, obey the local environmental regulations.