SHENZHEN APTUS TECHNOLOGY CO., LIMITED

PRODUCT SPECIFICATION

14inch TFT-LCD 1600x1200 MODULE

MODEL NAME: AS140HL02

DOC VERSION: 1.0

TOTAL PAGES: 25

DATE: 2022.02.22

FOR CUSTOMER	
CUSTOMER APPROVED	

NOTE: THE CONTENT OF THIS SPECIFICATION IS SUBJECT TO CHANGE WITHOUT NOTICE.

DESCRIPTION

specifications are applied to the following TFT LCD module.

Product Name : AS140HL02

1.0 General Specifications

Effective display area	:(H) 2 1 3 . 1 2 × (V) 284.16	(mm)
Number of pixels	:(H) 1200 ×RGB×(V) 1600	(pixels)
Pixel pitch	:(H) 0.1776×(V) 0.1776	(mm)
Color pixel arrangement	: R+G+B vertical stripe	
Display mode	: Transmissive mode Normally black mode	
Top polarizer type	: Anti-glare& hardness 3H	
Number of colors	16.7M(8 bit/color)	
Input signal	:2-Channel LVDS(8bit)	
Backlight	:white LED	
External dimensions	:230.15(Typ.)×305.5(Typ.)×12.4(Max.)	(mm)
Weight	:825g	

1.1 Functional Block Diagram

Figure 1 shows the functional block diagram of the LCD module.

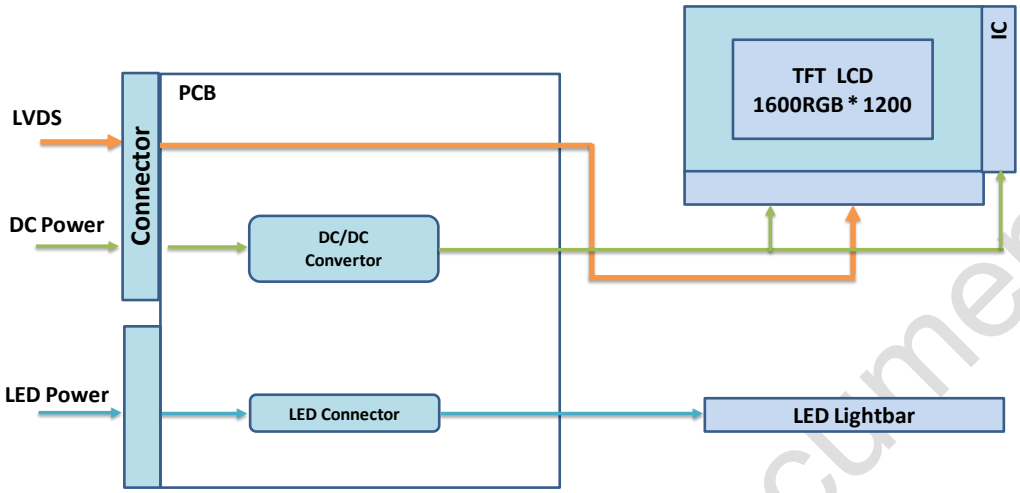

Figure 1 Block Diagram

1.2 Pixel Mapping

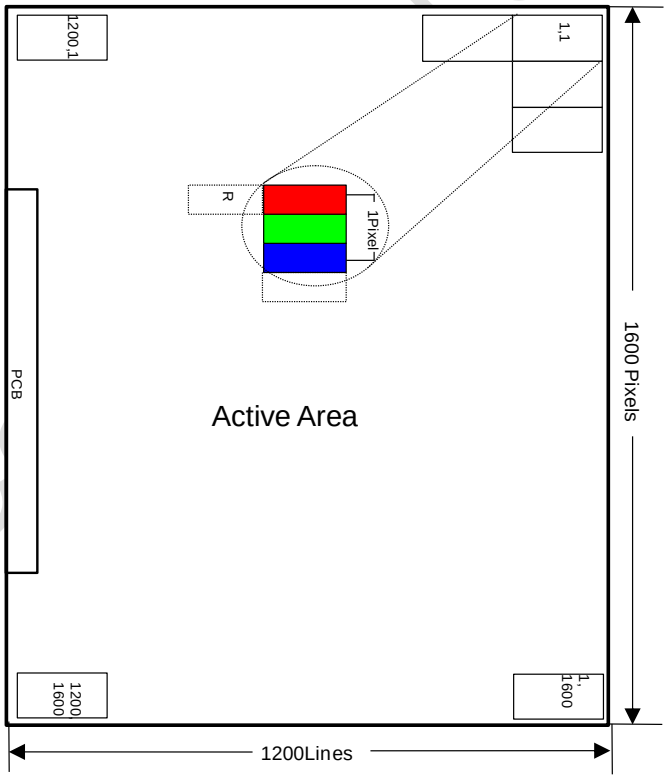

Figure2 Pixel Mapping

2.0 Absolute Maximum Ratings

Table 1 Electrical & Environment Absolute Rating

Item	Symbol	Min.	Max.	Unit	Note
Logic Supply Voltage	V_{DD}	-0.5	6	V	(1),(2), (3),(4)
Logic Input Signal Voltage	V_{Signal}	-0.5	6	V	
Operating Temperature	T_{gs}	-40	85	℃	
Storage Temperature	T_a	-40	90	℃	

Note (1) All the parameters specified in the table are absolute maximum rating values that may cause faulty operation or unrecoverable damage, if exceeded. It is recommended to follow the typical value.

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℃, Humidity: 55± 10%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. Wet bulb temperature should be lower than 57.8℃, and no condensation of water. Besides, protect the module from static electricity. Only functionality is guaranteed from -40~-30℃.

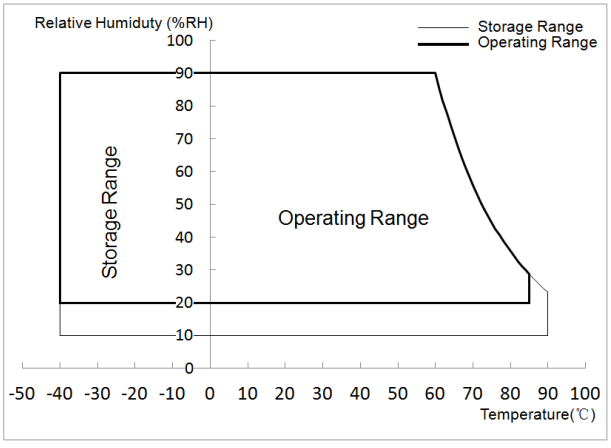

Figure 3 Absolute Ratings of Environment of the LCD Module

3.0 Optical Characteristics

The optical characteristics are measured under stable conditions as following notes.

Table 2 Optical Characteristics

Item	Conditions		Min.	Typ.	Max.	Unit	Note
Viewing Angle （CR≥10）	Horizontal	θ_{x+}	80	85	-	degree	(1),(2),(3),(4)(8)
		θ_{x-}	80	85	-		
	Vertical	θ_{y+}	80	85	-		
		θ_{y-}	80	85	-		
Contrast Ratio	Center		900	1,100	-	-	(1),(2),(4),(8) θx=θy=0°
Response Time	Rising + Falling	@25℃	-	-	35	ms	(1),(2),(5),(8) θx=θy=0°
		@-30℃	-	-	380		
Color Chromaticity (CIE1931)	Red x		Typ. -0.04	0.635	Typ. +0.04	-	(1),(2),(3),(8) θx=θy=0°
	Red y			0.334		-	
	Green x			0.306		-	
	Green y			0.622		-	
	Blue x			0.150		-	
	Blue y			0.070		-	
	White x			0.301		-	
	White y			0.317		-	
NTSC	-		65	70	-	%	(1),(2),(3),(8) θx=θy=0°
White Luminance	Center		750	800	-	cd/m^2	(1),(2),(6),(8) θx=θy=0°
Luminance Uniformity	9 Points		80		- -	%	(1),(2),(7),(8) θx=θy=0°

Note (1) Measurement Setup:

The LCD module should be stabilized at given ambient temperature (25℃) for 30 minutes to avoid abrupt temperature changing during measuring. In order to stabilize the luminance, the measurement should be executed after lighting backlight for 30 minutes in the windless room.

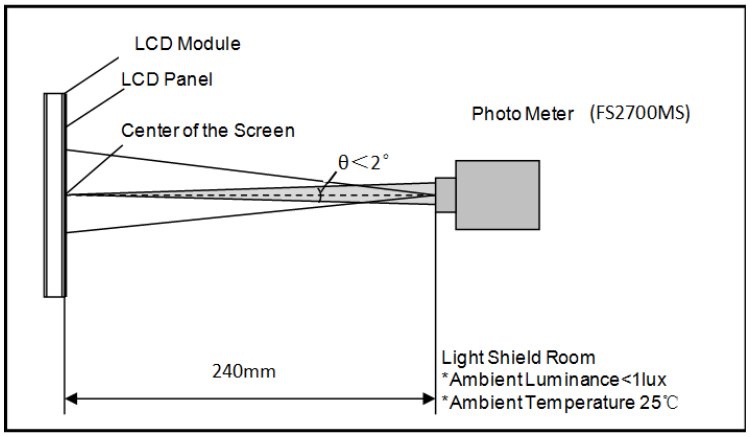

Figure 4 Measurement Setup

Note (2) The LED input parameter setting as:

Total I_{LED}: 6*90=540mA.

Note (3) Definition of Viewing Angle

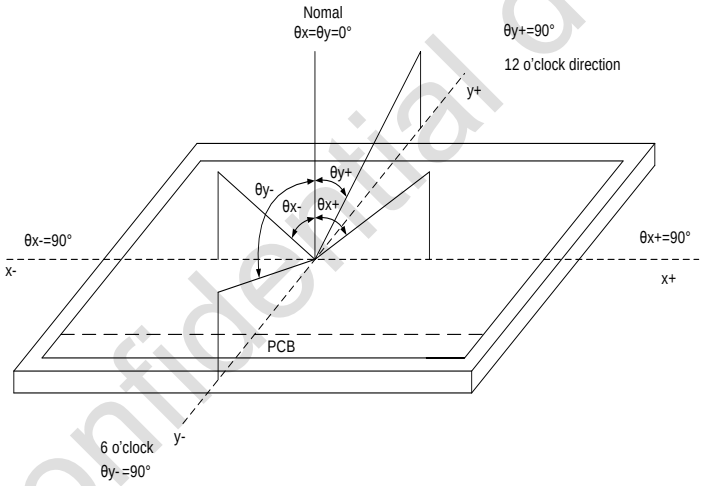

Figure 5 Definition of Viewing Angle

Note (4) Definition of Contrast Ratio (CR)

The contrast ratio can be calculated by the following expression:

Contrast Ratio (CR) = The luminance of White pattern/ The luminance of Black pattern

Note (5) Definition of Response Time (T_R, T_F)

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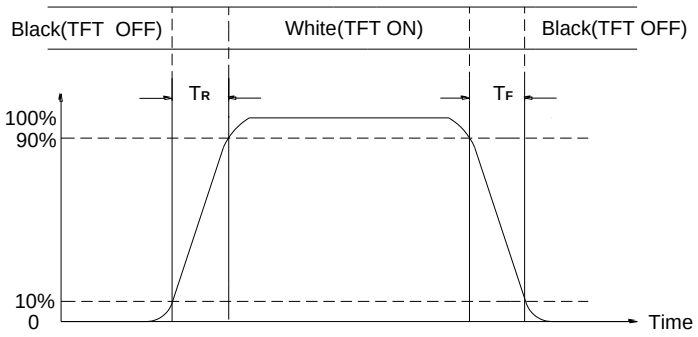


Figure 6 Definition of Response Time

Note (6) Definition of Luminance of White

Measure the luminance of White pattern (Ref.: Active Area)

Display Luminance=L1（center point）

H—Active Area Width, V—Active Area Height, L—Luminance

Note (7) Definition of Luminance Uniformity (Ref.: Active Area)

Measure the luminance of White pattern at 9 points.

Luminance Uniformity= Min.(L1, L2, ... L9) / Max.(L1, L2, ... L9)

H—Active Area Width, V—Active Area Height, L—Luminance

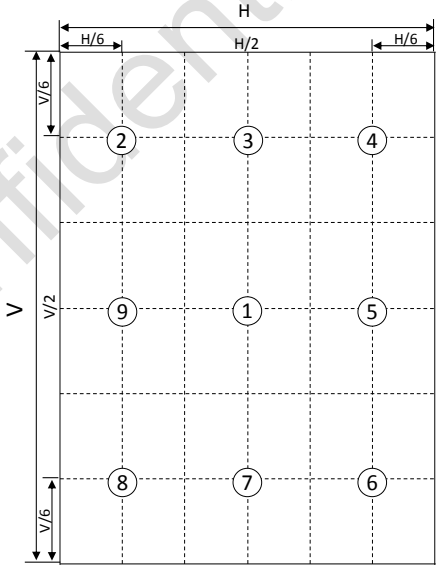


Figure 7 Measurement Locations of 9 Points

Note (8) All optical data are based on Muze given system & nominal parameter & testing machine in this document.

4.0 Electrical Characteristics

4.1 Interface Connector

Table 3 Signal Connector Type

Item	Description
Manufacturer / Type	STM/FFSKL05023G50B

Table 4 Signal Connector Pin Assignment

Pin No.	Symbol	Description	Remarks
1	GND	Ground	-
2	GND	Ground	-
3	SCLK	Input clock used by OTP	-
4	SDAT	Input data used by OTP	-
5	GND	Ground	-
6	ELV3P	Even pixel LVDS differential data3 pairs.	-
7	ELV3N		-
8	GND	Ground	-
9	ELVCLKP	Even pixel LVDS differential clock pairs.	-
10	ELVCLKN		-
11	GND	Ground	-
12	ELV2P	Even pixel LVDS differential data2 pairs.	-
13	ELV2N		-
14	GND	Ground	-
15	ELV1P	Even pixel LVDS differential data1 pairs.	-
16	ELV1N		-
17	GND	Ground	-
18	ELV0P	Even pixel LVDS differential data 0 pairs.	-
19	ELV0N		-
20	GND	Ground	-
21	OLV3P	Odd pixel LVDS differential data3 pairs.	-
22	OLV3N		-
23	GND	Ground	-
24	OLVCLKP	Odd pixel LVDS differential clock pairs.	-
25	OLVCLKN		-
26	GND	Ground	-
27	OLV2P	Odd pixel LVDS differential data2 pairs.	-

28	OLV2N		-
29	GND	Ground	-
30	OLV1P	Odd pixel LVDS differential data1 pairs.	-
31	OLV1N		-
32	GND	Ground	-
33	OLV0P	Odd pixel LVDS differential data0 pairs.	-
34	OLV0N		-
35	GND	Ground	-
36	STBYB	Needn't standby function，please open it.	-
37	HWRSTZ	Use internal reset circuit，please open it.	-
38	VDD	POWER SUPPLY（3.3V）	-
39	VDD		-
40	GND	Ground	-
41	VDD_OTP	Power input for OTP programming(8.6V).Floating if not used.	-
42	NC	NC	-
43	BIST	Bist function. Default L. Floating if not used.	-
44	RL	Source Scan. Default H. Floating if not used.	-
45	UD	Gate Scan. Default H. Floating if not used.	-
46	FAIL	Fail Detect. Default H. Floating if not used.	-
47	P_SCL	I2C clock input for Power IC. Floating if not used.	-
48	P_SDA	I2C data input for Power IC. Floating if not used.	-
49	WP	MTP write protection. Floating if not used.	-
50	ATERN	Enable dynamic gamma control function when reversing.	-

Table 5 LED Connector Name / Designation

Item	Description
Manufacturer / Type	STM/FFSKL05023G20B

Table 6 LED Connector Pin Assignment

Pin No.	Symbol	Description	Remarks
1	GND	Ground	-
2	NTC1	Thermistor Pin 1	-
3	NTC2	Thermistor Pin 2	-
4	NC	NC	-
5	LEDA1	Backlight Anode 1	-
6	LEDA2	Backlight Anode 2	-
7	LEDA3	Backlight Anode 3	-
8	NC	NC	-
9	LEDK1	Backlight Cathode 1	-
10	LEDK2	Backlight Cathode 2	-
11	LEDK3	Backlight Cathode 3	-
12	NC	NC	-
13	LEDK4	Backlight Cathode 4	-
14	LEDK5	Backlight Cathode 5	-
15	LEDK6	Backlight Cathode 6	-
16	NC	NC	-
17	LEDA4	Backlight Anode 4	-
18	LEDA5	Backlight Anode 5	-
19	LEDA6	Backlight Anode 6	-
20	GND	Ground	-

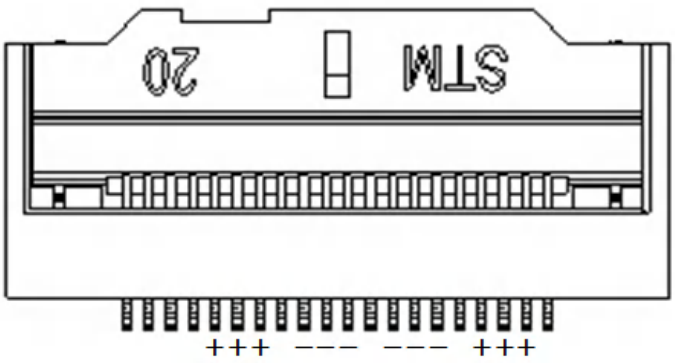


Figure 8 LED Connector

4.2 Signal Electrical Characteristics

4.2.1 Signal Electrical Characteristics For LVDS Receiver

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

Table 7 LVDS Receiver Electrical Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit
Input voltage range（signaled-end）	RXVIN	0	-	VDD-1.2	V
Differential Input common Mode	RXVCM	|VID|/2	-	VDD-1.2-|VID|/2	V
Differential Input voltage	|VID|	0.25	-	0.6	V
Differential Input leakage Current	RVXliz	-10	-	10	uA
Input voltage range（signaled-end）	RXVIN	0	-	VDD-1.2	V

Note (1) Input signals shall be low or Hi- resistance state when VDD is off.

Note (2) All electrical characteristics for LVDS signal are defined and shall be measured at the interface connector of LCD.

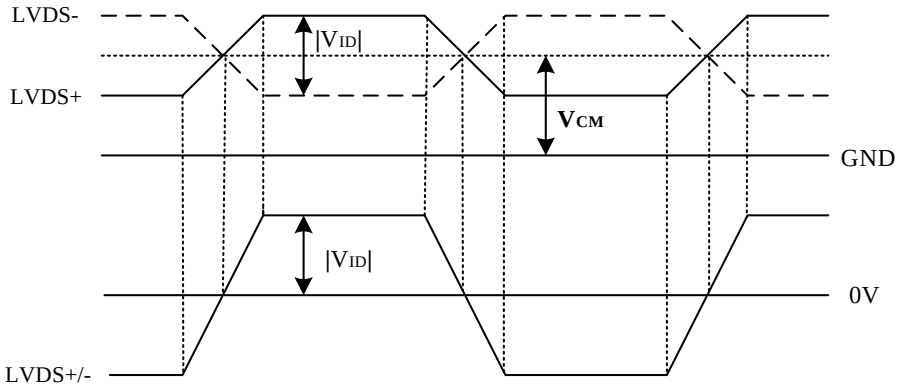


Figure 9 Voltage Definitions

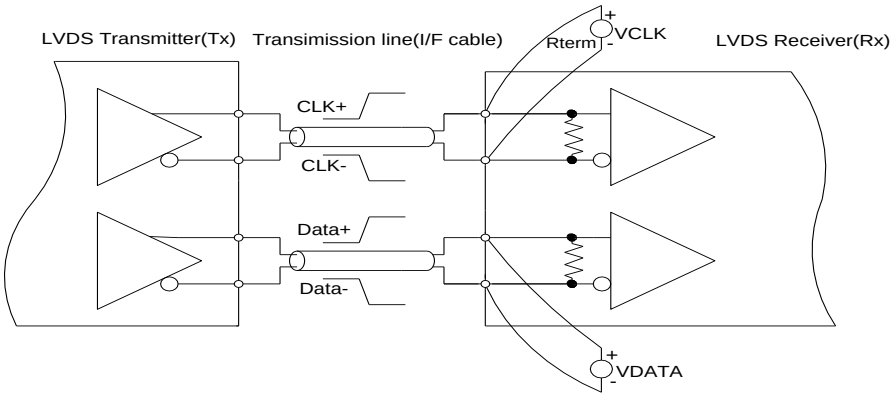


Figure 10 Measurement System

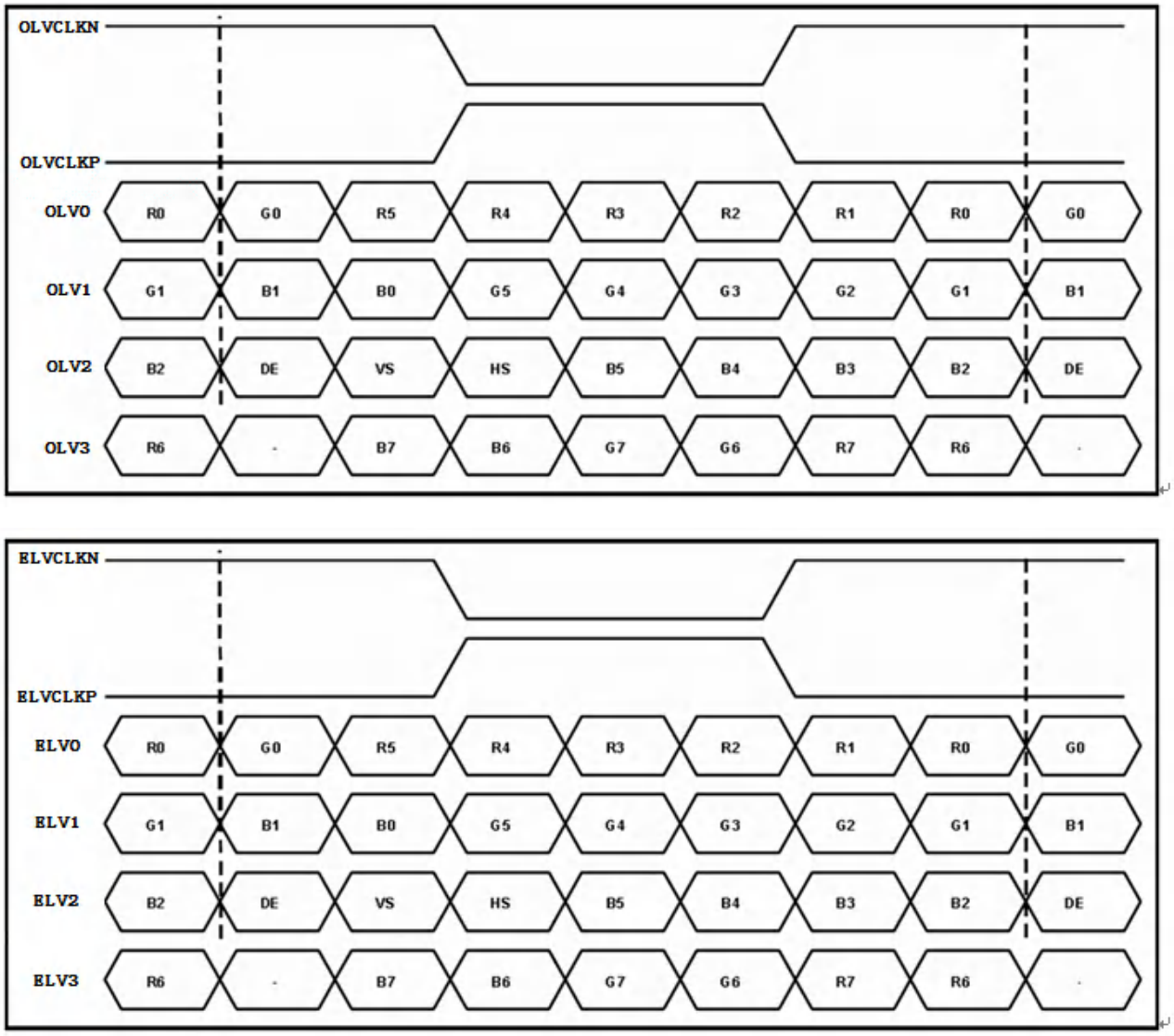


Figure 11 Data Mapping

4.2.2 LVDS Receiver Internal Circuit

Figure 12 shows the internal block diagram of the LVDS receiver. This LCD module equips termination resistors for LVDS link.

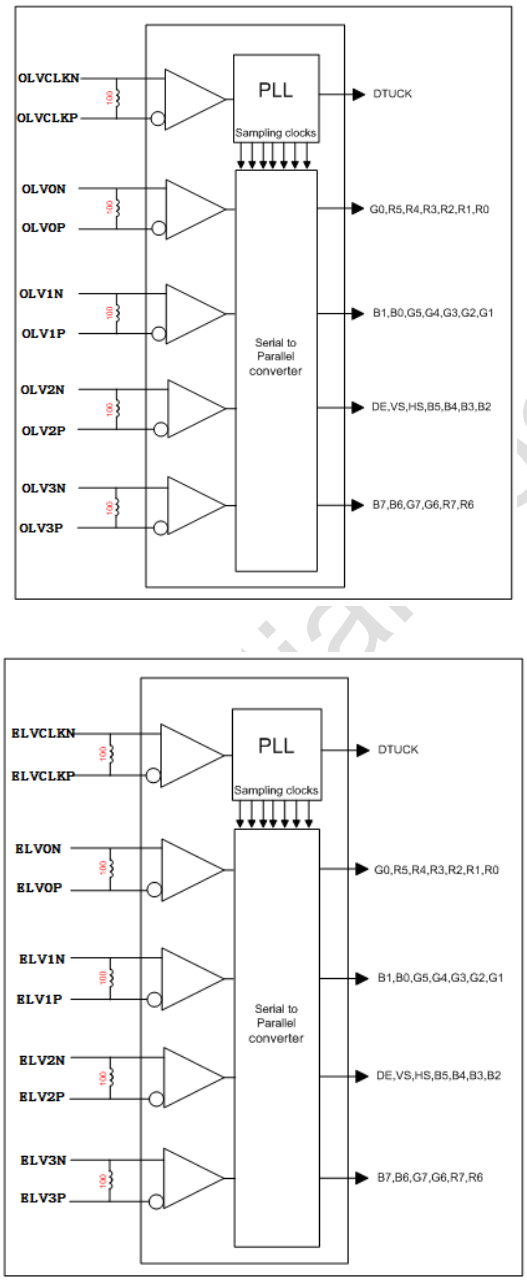


Figure 12 LVDS Receiver Internal Circuit

4.3 Interface Timings

Table 8 Interface Timings

Parameter	Symbol	Min.	Typ.	Max.	Unit
LVDS Clock Frequency	Fclk	-	81	85	MHz
H Total Time	HT	900	1,080	1,170	Clocks
H Active Time	HA		800		Clocks
HSYNC Blanking	TH_{BLANK}	100	280	370	Clocks
V Total Time	VT	1,210	1,250	1,460	Lines
V Active Time	VA		1,200		Lines
VSYNC Blanking	TV_{BLANK}	10	50	260	Lines
Frame Rate	FV	-	60	-	Hz

Note1: This module actually uses 2-port.

Note2:HT * VT *Frame Frequency≤85 MHz

Note3:.All reliabilities are specified for timing specification based on refresh rate of 60Hz.

AS140HL02 is secured only for function under lower refresh rate; 60Hz at Normal mode.

4.4 Input Power Specifications

Input power specifications are as follows.

Table 9 Input Power Specifications

Parameter		Symbol	Min.	Typ.	Max.	Unit	Note
System Power Supply							
LCD Drive Voltage (Logic)		V_{DD}	3.0	3.3	3.6	V	(1),(2)
VDD Current	White Pattern	I_{DD}	-	-	225.455	mA	(1),(3)
VDD Power Consumption	White Pattern	P_{DD}	-	-	744	mW	
Rush Current		I_{Rush}	-	-	2	A	(1),(4)
Allowable Logic/LCD Drive Ripple Voltage		V_{VDD-RP}	-	-	200	mV	(1),(3)
LED Power Supply							
LED Input Voltage		V_{LED}	27	30	33	V	(1),(2),(6)
LED Power Consumption		P_{LED}	-	-	17.82	W	(1),(6)
LED Forward Voltage		V_F	27	3.0	3.3	V	(1),(2)
LED Forward Current		I_F	-	90	-	mA	
LED Life Time		LT	30,000	-	-	Hours	(1),(5)

Note (1) All of the specifications are guaranteed under normal conditions. Normal conditions are defined as follow: Temperature: 25℃, Humidity: 55± 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_{DD} current and power consumption are measured under the V_{DD} = 3.3 V, FV= 60 Hz condition and White pattern.

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

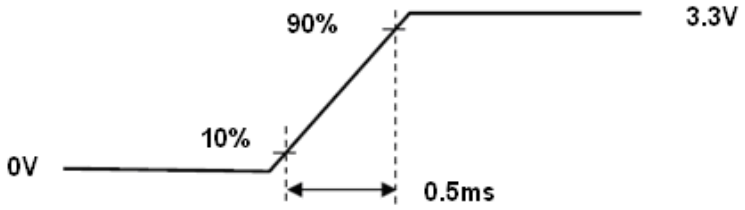


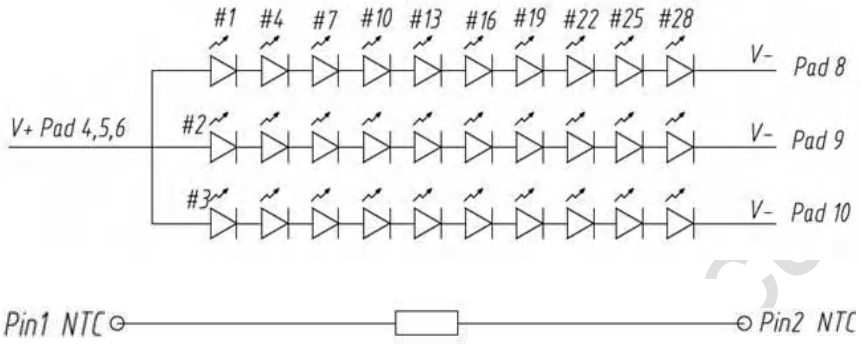
Figure 13 V_{DD} Rising Time

Note (5) The life time is determined as the sum of the lighting time till the luminance of LCD at the typical LED current reducing to 50% of the minimum value under normal operating condition.

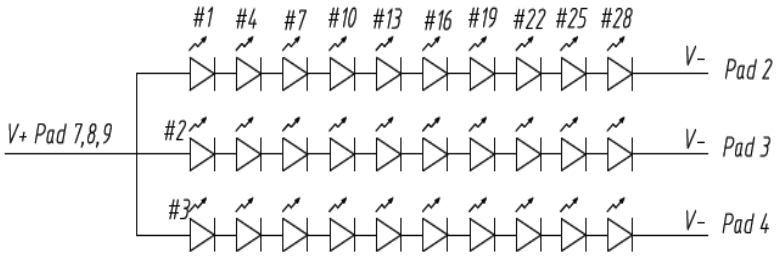
Note (6) Definition of VLED and PLED and drawing of double light bar.

$V_{LED} = V_F \times 10$, $I_{LED} = I_F \times 3$, $PLED = V_{LED} \times I_{LED}$

Upper side light bar:



Lower side light bar:



Note (7) The allowable forward current of LED vary with environmental temperature

NTC Type: NCP18XH103F03RB

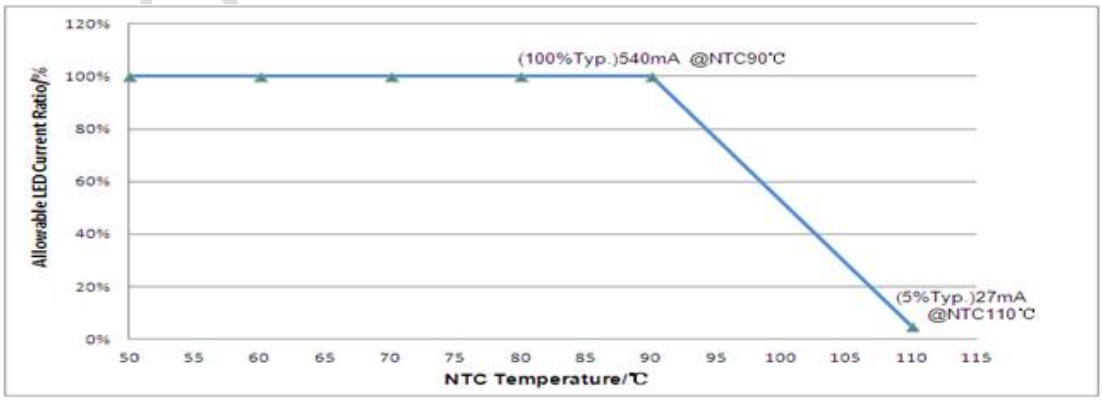


Figure 14 Backlight Current De-rating Curve

Table 10 The relationship of temperature and resistance for NTC

Temperature/℃	Resistance/Kohm	Temperature/℃	Resistance/Kohm
-40	195.652	50	4.1609
-35	148.171	55	3.535
-30	113.3471	60	3.0143
-25	87.5588	65	2.5861
-20	68.2367	70	2.2275
-15	53.6496	75	1.9245
-10	42.5062	80	1.6685
-5	33.8922	85	1.4521
0	27.2186	90	1.268
5	22.0211	95	1.1096
10	17.9255	100	0.9738
15	14.6735	105	0.858
20	12.0805	110	0.758
25	10	115	0.671
30	8.3145	120	0.5964
35	6.9479	125	0.5311
40	5.8336	/	/
45	4.9169	/	/

4.5 Power ON/OFF Sequence

1. Interface signals are also shown in the chart. Signals from any system shall be Hi-resistance state or low level when VDD voltage is off.
2. When system first start up, should keep the VDD high time longer than 200ms, otherwise may cause image sticking when VDD drop off.

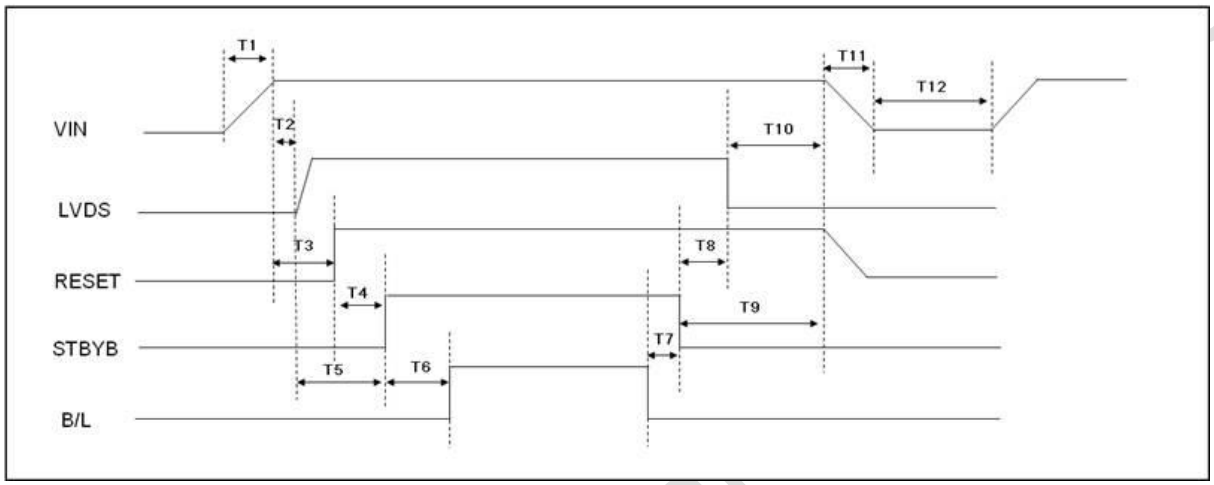


Figure 15 Power Sequence

Table 11 Power Sequencing Requirements

Parameter	Symbol	Min.	Typ.	Max.	Unit	Remark
VIN Rising Time	T1	0.5	-	10	ms	-
VIN ready to LVDS Enable	T2	0	-	50	ms	-
VIN ready to RESET	T3	100	-	-	us	-
RESET to STBYB pull H	T4	36	-	-	ms	-
LVDS Enable to STBYB pull H	T5	1	10	-	ms	-
STBYB pull H to Backlight On	T6	200	-	-	ms	-
Backlight Off to STBYB pull L	T7	200	-	-	ms	-
STBYB pull L to LVDS Disable	T8	100	117	133	ms	-
STBYB pull L to VIN start to fall	T9	100	-	-	ms	-
LVDS Disable to VIN start to fall	T10	0	26	50	ms	-
RESET to VIN fall	T11	10	-	30	ms	-
VIN power off	T12	0.5	-	-	s	-

Note：T2<T3

5.0 Mechanical Characteristics

5.1 Outline Drawing

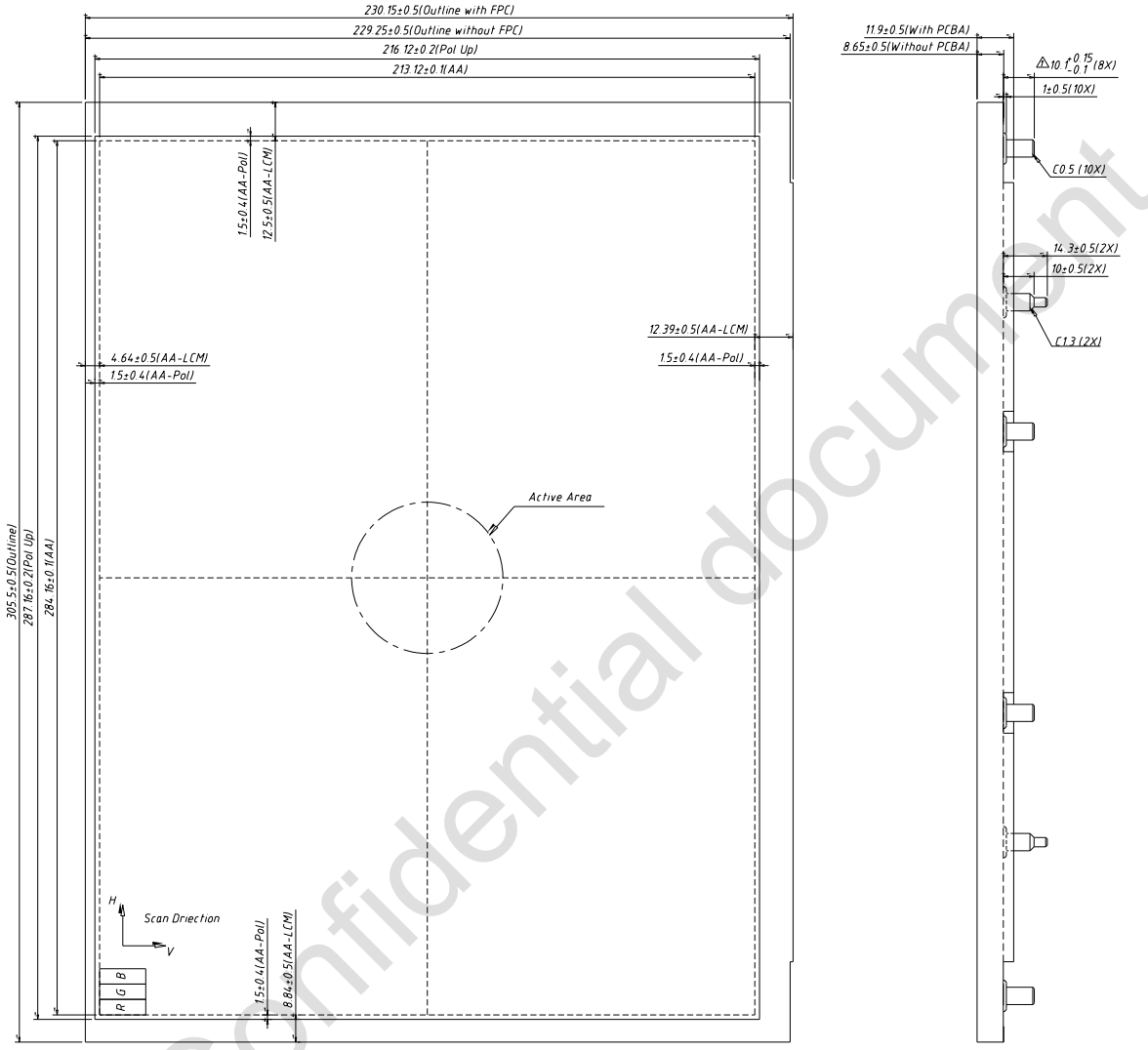


Figure 16 Reference Outline Drawing (Front Side)

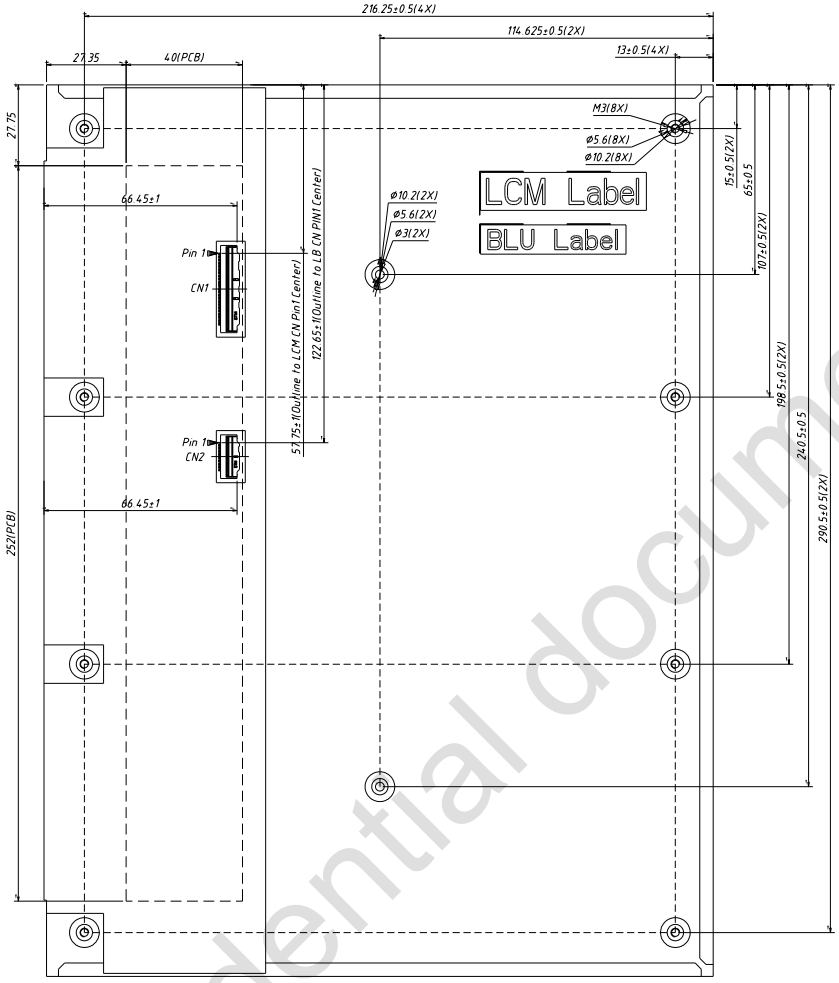


Figure 17 Reference Outline Drawing (Back Side)

Notes：Unmarked tolerance±0.5

5.2 Dimension Specifications

Table 12 Module Dimension Specifications

Item		Min.	Typ.	Max.	Unit
Width		229.65	230.15	230.65	mm
Height		305	305.5	306	mm
Thickness	Without PCBA	8.15	8.65	9.15	mm
	With PCBA	11.4	11.9	12.4	mm
Weight		-	-	825	g

Note：Outline dimension measure instrument: Vernier Caliper.

6.0 Reliability Conditions

Table 13 Reliability Condition

Item		Package	Test Conditions		Note
High Temperature/High Humidity Operating Test		Module	T_{gs}=60℃, 90%RH, 504 hours		(1),(2),(3),(4) ,(7)
High Temperature Operating Test		Module	T_{gs}=85℃, 500 hours		
Low Temperature Operating Test		Module	T_a=-30℃, 500 hours		(1),(2),(3),(4)
High Temperature Storage Test		Module	T_a=90℃, 500 hours		(1),(3),(4) ,(7)
Low Temperature Storage Test		Module	T_a=-40℃, 500 hours		(1),(3),(4)
Shock Non-operating Test		Module	half-sine，Frequency: 8Hz ~ 33Hz，Stroke: 1.3mm，Sweep: 2.9G 33.3Hz ~ 400Hz X,Z ，Cycle : 15 minutes，2 hrs for each direction of X,Z ， 4 hours for Y direction		(1),(3),(5)
Vibration Non-operating Test		Module	3 directions: X, Y and Z axes; 10 repeats; peak acceleration = 50G puls duration = 6ms; 0.5 sine wave		
ESD Test	Operating	Module	Contact	±8KV, 150pF(330Ohm)	(1),(2),(6)
			Air	±15KV, 150pF(330Ohm)	

Note (1) A sample can only have one test. Outward appearance, image quality and optical data can only be checked at normal conditions according to the Muze document before reliable test. Only check the function of the module after reliability test.

Note (2) The setting of electrical parameters should follow the typical value before reliability test.

Note (3) During the test, it is unaccepted to have condensate water remains. Besides, protect the module from static electricity.

Note (4) The sample must be released for 24 hours under normal conditions before judging. Furthermore, all the judgment must be made under normal conditions. Normal conditions are defined as follow: Temperature: 25℃, Humidity: 55± 10%RH. T_a= Ambient Temperature, T_{gs}= Glass Surface Temperature.

Note (5) The module should be fixed firmly in order to avoid twisting and bending.

Note (6) It could be regarded as pass, when the module recovers from function fault caused by ESD after resetting.

Note (7) LED forward current should follow the current of LED vary with environmental temperature (Figure 14 Backlight De-rating Curve)

7.0 Package Specification

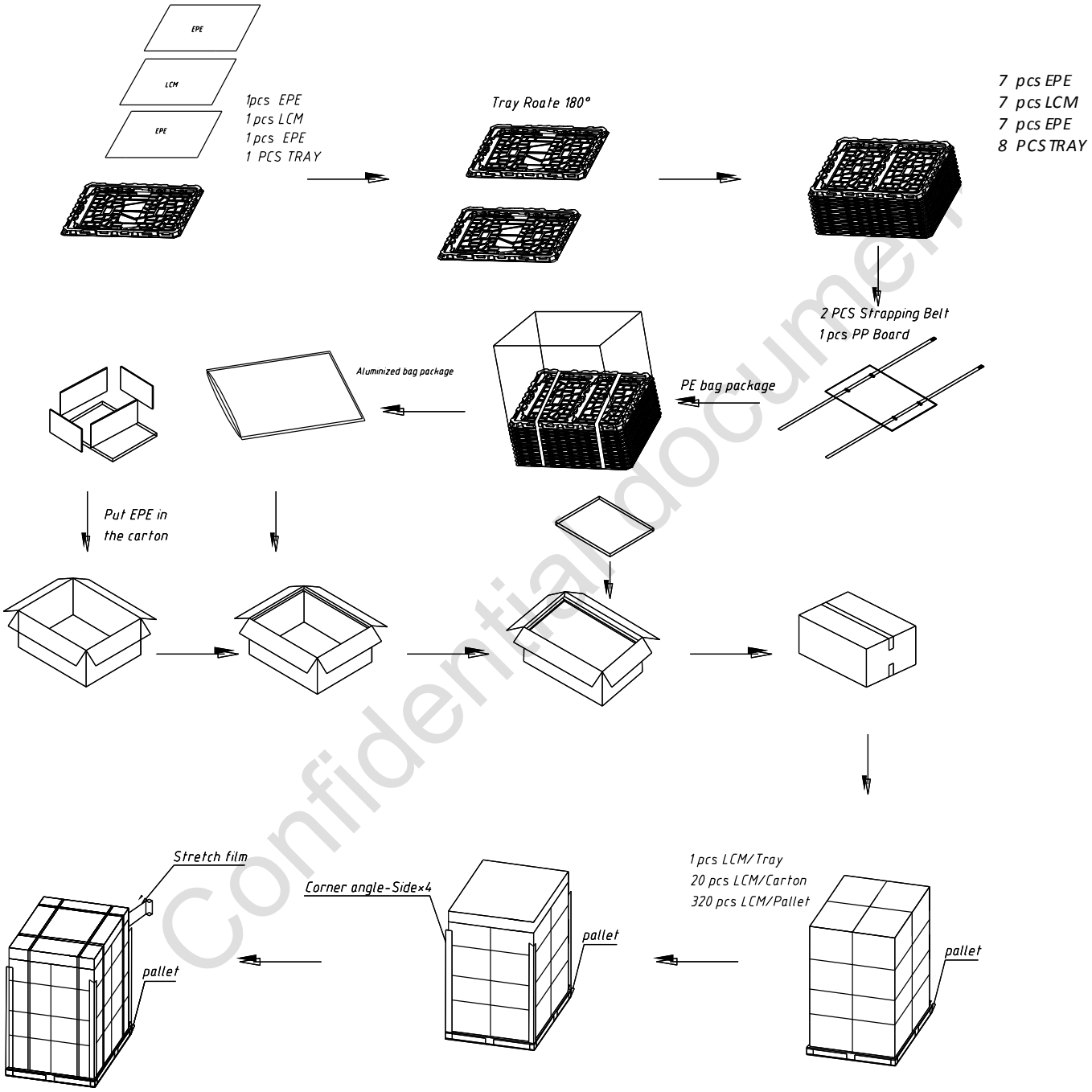


Figure 18 Packing Method

8.0 General Precaution

8.1 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.

8.2 Operation Precaution

(1)The LCD product should be operated under normal conditions.
Normal conditions are defined as below:

Temperature: 25℃

Humidity: 55±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.

8.3 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) So as to acquire higher luminance, the cable of the power supply should be connected directly with a minimize length.

(6) 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.

(7) A transparent protective film needs to be attached to the surface of the module.
(8) 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.
(9) Clean the polarizer gently with absorbent cotton or soft cloth when it is dirty.
(10) Wipe off saliva or water droplet as soon as possible. Otherwise, it may cause deformation and fading of color.
(11) Clean the panel gently with absorbent cotton or soft cloth when it is dirty. Ethanol(C_2H_5OH) is allowed to be used. Ketone (ex. Acetone), Toluene, Ethyl acid, Methyl chloride, etc are not allowed to be used for cleaning the panel, which might react with the polarizer to cause permanent damage.
(12) Do not disassemble or modify the module. It may damage sensitive parts in the LCD module, and cause scratches or dust remains. Muze does not warrant the module, if you disassemble or modify the module.

8.4 **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.

8.5 **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℃ and 35℃ 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.

8.6 **Others**

When disposing LCD module, obey the local environmental regulations.