LCD MODULE
SPECIFICATION

Module Size： **8.0” 800x1280**

Spec Part No： **N080ICE-GB1**

Date： **2014-3-19**

Version： **Ver1.0**

□Preliminary Specification

■Final Specification

PREPARED	CHECKED	VERIFIED BY QA DEPT	VERIFIED BY R&D DEPT

Revision History

Version	Revise Date	Page	Content	Prepared by
1.0	2014-3-19	ALL	First release.	Innolux

Table of Contents

1 General Specification

1.1 Features

N080ICE-GB1 is a 8” (8” diagonal) TFT Liquid Crystal Display module with LED Backlight unit and 31 pins MIPI interface. This module supports 800 x 1280 WXGA mode.

1.2 Application

Display terminals for Tablet

1.3 General Specification

No.	Item	Specification	Huawei request	Unit	Remark
1	Screen Size	8	8	Inch	
2	Driver Element	a-si TFT active matrix	a-si TFT active matrix		
3	Pixel Number	800 x R.G.B. x 1280	800 x R.G.B. x 1280	pixel	
4	Pixel Pitch	0.13455(W)×0.13455(H)	0.13455(W)×0.13455(H)	mm	
5	Pixel Arrangement	RGB vertical stripe	RGB vertical stripe		
6	Display Colors	16,777,216 (8bit color depth)	16,777,216 (8bit color depth)	color	
7	Transmissive Mode	Normally black	Normally black		
8	Surface Treatment	Glare	Glare		
9	Luminance, White	350	350	Cd/m2	
10	Power Consumption	***Total 1.65 W (Max.) (panel 0.45 W (Max.), BL 1.2W (Max.))***	***Total 1.65 W (Max.) (panel 0.45 W (Max.), BL 1.2W (Max.))***		(1)

Remark：The Specification which is different from Huawei request must mark in red。

Note (1) The specified power consumption (with converter efficiency) is under the conditions at **VCI = 3.3 V, VDDI= 1.8V, fv = 60 Hz, Brightness = 350nits, I_{F_LED} = 20mA** and Ta = 25 ± 2 °C, whereas **white** pattern is displayed.

2 Pin Assignments

Pin No.	Symbol	I/O	Function	Remark
1	SCL	I	For EDID	3.3V
2	GND	P	Ground	
3	SDA	I/O	For EDID	3.3V
4	D2_P	I	MIPI differential data2 input (Positive)	
5	LED1	P	Cathode for light bar	
6	D2_N	I	MIPI differential data2 input (Negative)	
7	LED2	P	Cathode for light bar	
8	GND	P	Ground	
9	LED3	P	Cathode for light bar	
10	D1_P	I	MIPI differential data1 input (Positive)	
11	GND	P	Ground	
12	D1_N	I	MIPI differential data1 input (Negative)	
13	VLED	P	Anode for light bar	18V~19.2V
14	GND	P	Ground	
	VLED	P	Anode for light bar	18V~19.2V
16	CLK_P	I	MIPI differential clock input (Positive)	
17	NC		No connection	
18	CLK_N	I	MIPI differential clock input (Negative)	
19	VCI	P	3.3V input	3.0V~3.6V
20	GND	P	Ground	
21	VCI	P	3.3V input	3.0V~3.6V
22	D0_P	I	MIPI differential data0 input (Positive)	
23	Hsync	O	Per scan line signal	
24	D0_N	I	MIPI differential data0 input (Negative)	
25	VDDI	P	1.8V input	1.7V~1.9V
26	GND	P	Ground	
27	VDDI	P	1.8V input	1.7V~1.9V

28	D3_P	I	MIPI differential data3 input (Positive)	
29	RST	I	Device reset signal	1.7V~1.9V
30	D3_N	I	MIPI differential data3 input (Negative)	
31	LEDPWM	O	PWM control signal for LED driver (CABC)	1.7V~1.9V

3 Module data for customer

3.1 Mechanical Drawing

NO	Document No.	Type	Format	Attachment file
1	DN0382086	2D	pdf	C:\Documents and Settings\F382
2	DN0382086	2D	dwg	C:\Documents and Settings\F382
3	DN0382086	3D	igs	C:\Documents and Settings\F382
4	華爲結構設計規範	Excel		

Double-Click the "Attachment Icon" above for opening attachment file.

3.2 Code of module

NO	Document No.	Type	Attachment file
1	Initial code	initialization	1115 For Huawei Initial code_for N080
2		sleep in	
3		sleep out	

Double-Click the "Attachment Icon" above for opening attachment file.

Remark：initialization code must include the code for GAMMA 2.2 in the Power Supply condition for the module。

3.3 Electrical circuit

NO	Document No.	Type	Attachment file
1	circuit	principium	N080ICE-GB1 schematic for Huawei.
2	layout	layout	N080ICE-GB1.pcb
3	EE checklist	checklist	EE checklist 簽核檔.pdf

Double-Click the "Attachment Icon" above for opening attachment file.

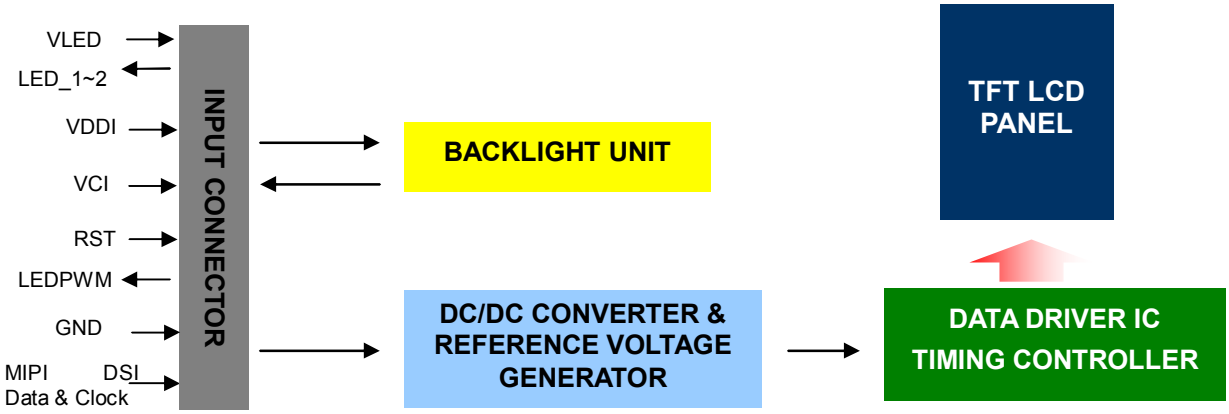
3.4 IC spec

NO	Document No.	Revision	IC supplier	Attachment file
1	NT35521		NOVATEK	NT35521_V1.0_20130625_INX.pdf

Double-Click the "Attachment Icon" above for opening attachment file.

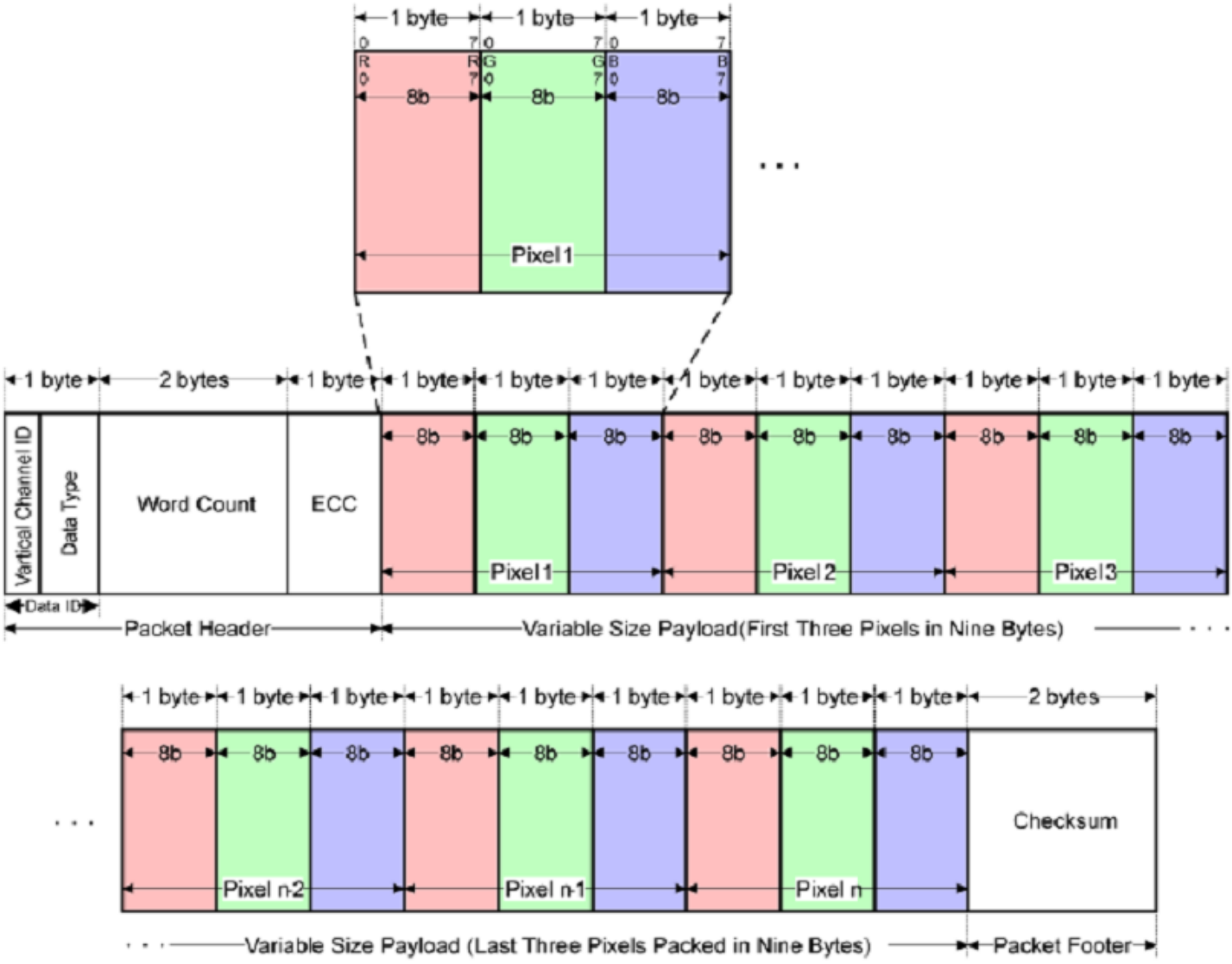
Remark: Inform Huawei for any change of IC include revision.

4 Schematic Circuit Diagram



5 Register& Pixel Data Format

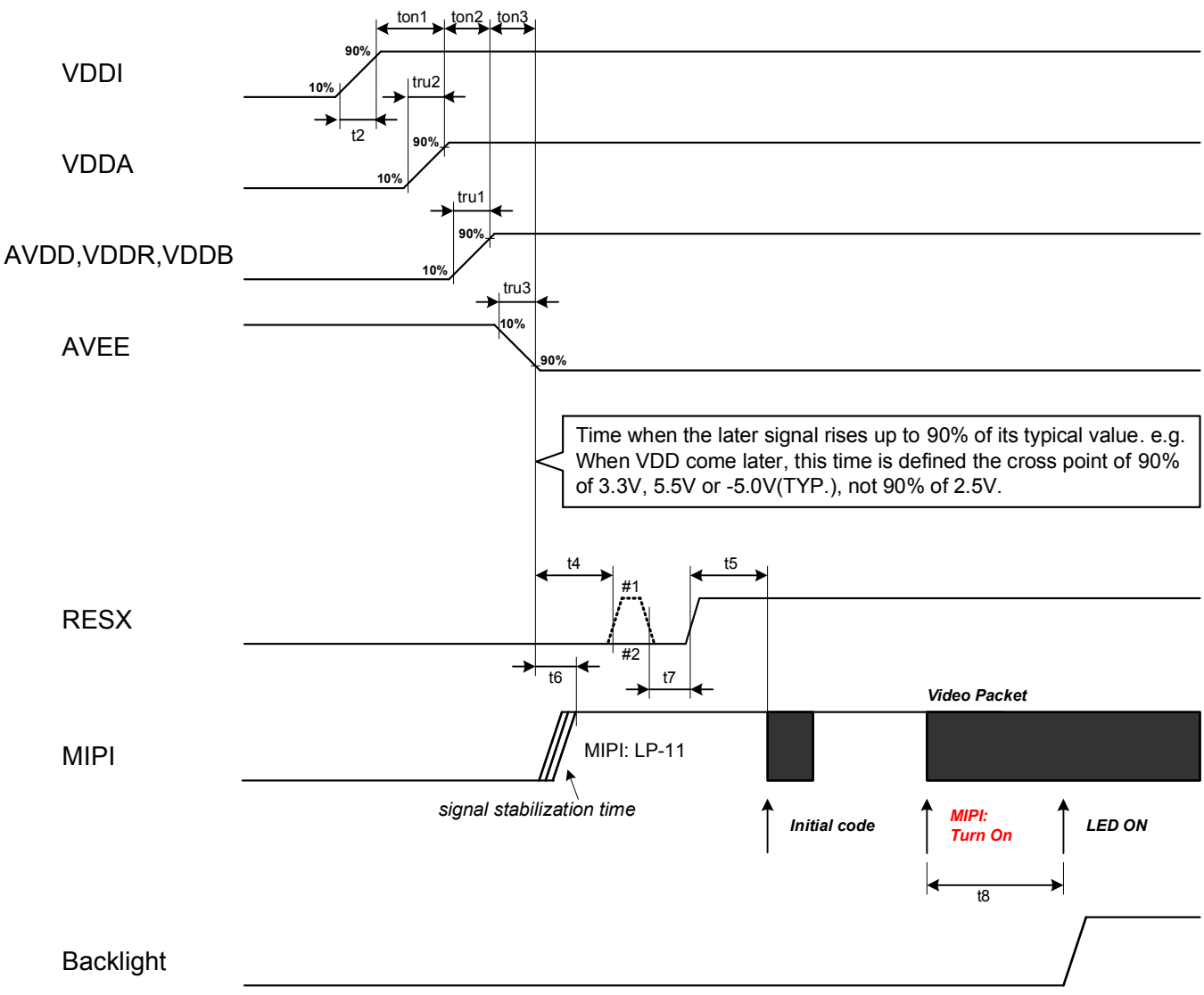
MIPI 24 bits RGB Data Format



6 Timing Characteristics

6.1 Power on Sequence

VDDI=1.7~1.9V, VCI(VDDA)=3.0 to 3.6V, **, AVDD=4.5~6.0V, AVEE=-4.5~-6.0V,**



Note 1: Unless otherwise specified, timings herein show cross point at 50% of signal/power level.

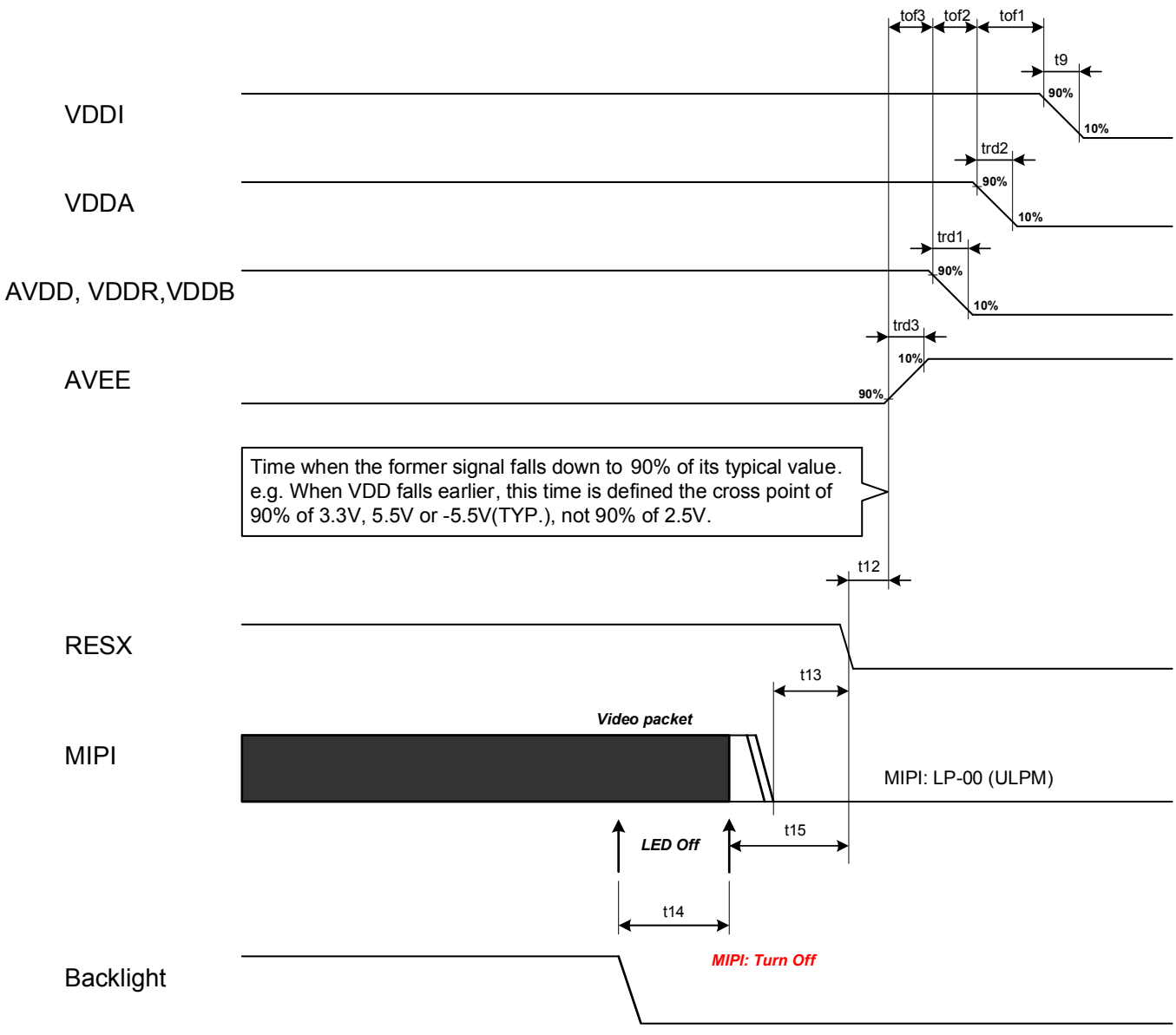
Note 2: This power-on sequence is based on adding schottky diode on VGLX pin to ground.

Note 3: Reset signal H to L to H (#1) is better than only L to H (#2).

Symbol	Value			Unit	Remark
	Min.	Typ.	Max.		
ton1		No limit		ms	Schottky diode should add on VGLX
ton2		0 (Note)		ms	
ton3		No limit		ms	
t2			150	μs	
tru1			150	μs	
tru2			150	μs	
tru3			150	μs	
t4	40			ms	
t5	120			ms	
t6	0		**t4**	ms	
t7	10			μs	
t8	8			VS	Keep data more than 8 frames (VS)(1 frame=16.67 ms)

6.2 Power off Sequence

VDDI=1.7~1.9V, VCI(VDDA)=3.0 to 3.6V, **, AVDD=4.5~6.0V, AVEE=-4.5~-6.0V,**



Note 1: Unless otherwise specified, timings herein show cross point at 50% of signal/power level.

Symbol	Value			Unit	Remark
	Min.	Typ.	Max.		
t9	150			µs	
tof1		No limit		ms	
tof2		0 (Note)		ms	
tof3		No limit		ms	
trd1	150			µs	
trd2	150			µs	
trd3	150			µs	
t12	0			ms	
t13	0			ms	
t14	0			ms	
t15	100			ms	

6.3 MIPI Interface characteristics

The Display Serial Interface standard defines protocols between a host processor and peripheral devices that adhere to MIPI Alliance standards for mobile device interfaces. The DSI standard builds on existing standards by adopting pixel formats and command set defined in MIPI Alliance standards.

DSI-compliant peripherals support either of two basic modes of operation: Command Mode and Video Mode.

Note: The product only supports Video Mode operation.

Video Mode refers to operation in which transfers from the host processor to the peripheral take the form of a real-time pixel stream. In normal operation, the display module relies on the host processor to provide image data at sufficient bandwidth to avoid flicker or other visible artifacts in the displayed image. Video information should only be transmitted using High Speed Mode. To reduce complexity and cost, systems that only operate in Video Mode may use a unidirectional data path.

6.3.1 MIPI Lane Configuration

	MCU (Master)	Display Module (Slave)

Clock Lane+/-	Unidirectional Lane ■ Clock Only ■ Escape Mode(ULPS Only)
Data Lane0+/-	Bi-directional Lane ■ Forward High-Speed ■ Bi-directional Escape Mode ■ Bi-directional LPDT
Data Lane1+/-	Unidirectional ■ Forward High speed
Data Lane2+/-	Unidirectional ■ Forward High speed
Data Lane3+/-	Unidirectional ■ Forward High speed

The connection between host device and display module is as reference.

7 Electrical Specifications

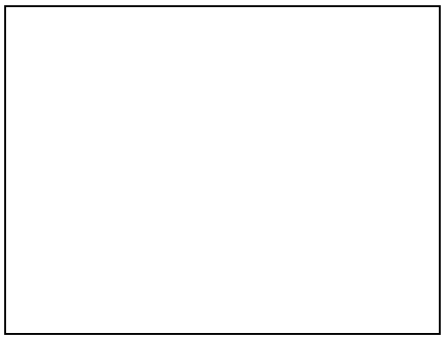
7.1 DC Characteristics Requirements

Item		Symbol	Values			Huawei request			Unit	Remark
			Min	Typ	max	Min	Typ	max		
Power supply voltage		VCI	3.0	3.3	3.6	3.0	3.3	3.6	V	
		VDDI	1.7	1.8	1.9	3.0	3.3	3.6	V	
VDDI High level input voltage		V_{IH2}	0.7 VDDI	-	VDDI	0.7 VDDI	-	VDDI	V	For I/O circuit
VDDI Low level input voltage		V_{IL2}	0	-	0.3 VDDI				V	
Power Supply Current	White	I_{VCI}		35	50		TBD		V	**Note (2)**
		I_{VDDI}		30	45		TBD		V	

Note (1) The ambient temperature is Ta = 25 ± 2 ºC.

Note (2) The specified power supply current is under the conditions at VCI = 3.3 V, VDDI = 1.8 V, Ta = 25 ± 2 ºC, DC Current and f_v = 60 Hz, whereas a power dissipation check White pattern below is displayed.

White Pattern



Active Area

7.2 Power Consumption of TFT Panel

Power Supply: VDDI=1.8V, VCI(VDDA)=3.3V, AVDD=6.0V, VEE=--6.0V,
Frame Frequency: f_{FRAME}=60HZ @ 25degC

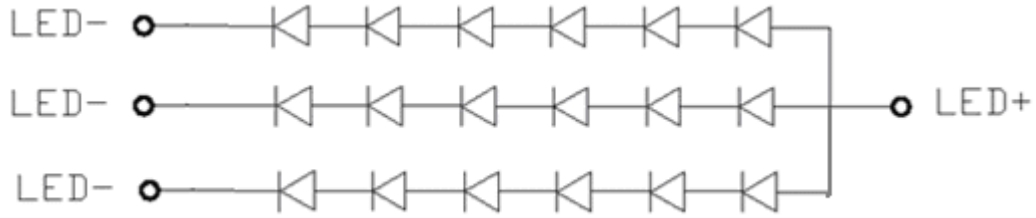
Display Mode	Item	Symbol	Value		Huawei request		Unit	Remark
			Typ	Max	Typ	Max		
Display White	Current of VCI	I_{VCI}	31	50	NA	NA	mA	
	Current of VDDI	I_{VDDI}	29	45	NA	NA	mA	
Display Black	Current of VCI	I_{VCI}	29	50	NA	NA	mA	
	Current of VDDI	I_{VDDI}	29	45	NA	NA	mA	

7.3 Power Consumption of Backlight

Test Condition : I_{LED}=20mA

Worning: LCM Brightness must match Optical Spec requirement when I_{LED}=20mA

Backlight Unit Schematic:



BACKLIGHT UNIT

Ta = 25 ± 2 ºC

Parameter	Symbol	Value			Unit	Note
		Min.	Typ.	Max.		
LED Light Bar Power Supply Voltage	V_L	16.8	18	19.2	V	(1)(2)(Duty100%)
LED Light Bar Power Supply Current	I_L	-	60	-	mA	
Power Consumption	P_L	-	1.08	1.16	W	(3)
LED Life Time	L_{BL}	15,000	-	-	Hrs	(4)

Note (1) LED light-bar Voltage & Current is provide by customer

Note (2) For better LED light bar driving quality, it is recommended to utilize the adaptive boost converter with current balancing function to drive LED light-bar.

Note (3) $P_L = I_L \times V_L$ (Without LED converter transfer efficiency)

Note (4) The lifetime of LED is defined as the time when it continues to operate under the conditions at Ta = 25 ±2 °C and I_L = 20 mA(Per EA) until the brightness becomes ≦ 50% of its original value.

8 Optical Specifications

Test condition：IOVCC=1.8V , Ta=25℃

Supplier must adjust their test equipments based on Huawei's test equipment parameters.

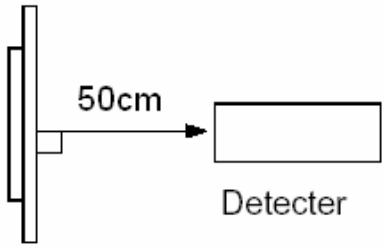
Item		Symbol	Condition	Value			Huawei request			Unit	Note
				Min	Typ	Max	Mi	Typ	Max		
luminance		Bp	θ=0° Φ=0°	300	350	-	300	350	-	cd/m^2	Note 7
Uniformity		△Bp		80	85	-	80	85	-	%	Note 8
Viewing Angle	Left	θL	Cr≥10	75	85	-	75	85	-	deg	Note 9
	Right	θR		75	85	-	75	85	-		
	Top	ψT		75	85	-	75	85	-		
	Bottom	ψB		75	85	-	75	85	-		
Contrast Ratio		Cr	θ=0° Φ=0°	600	800	-	600	800	-	-	Note 10
Response Time		Tr		-	15	25	-	15	25	ms	Note 11
		Tf		-	15	25	-	15	25	ms	
		Tgray		-	-	TBD	-	-	TBD	ms	
Color Coordinate of CIE1931	Red	x	θ=0° Φ=0°	Typ-0.03	0.62	Typ+0.03	0.61	0.64	0.67	-	Note 12
		y			0.33		0.30	0.33	0.36		
	Green	x			0.33		0.27	0.30	0.33		
		y			0.59		0.57	0.60	0.63		
	Blue	x			0.14		0.12	0.15	0.18		
		y			0.07		0.03	0.06	0.09		
	White	x		Typ-0.04	0.313	Typ+0.04	0.273	0.313	0.353		
		y		Typ-0.04	0.329	Typ+0.04	0.289	0.329	0.369		
NTSC Ratio		NTSC	CIE1931	55	60	-	55	60	-	%	Note 13
Flicker		amount	-	-	-	-30	-	-	-30	dB	Note 14
Gamma		-	-	1.9	2.2	2.5	1.9	2.2	2.5		Note 15

Crosstalk	△CT	-	-	-	2.0%	-	-	2.0%		Note 16
Transmittance	Tm	-	/	TBD /	-				%	
Reflectance	Rf		-	TBD	/	-			%	
Polarization direction of front polarizer	PdF	-		TBD			TBD		Deg	Note 17
Polarization direction of rear polarizer	PdR	-		TBD			TBD		Deg	
Sticking				TBD				TBD	Minute	Note18
CABC Test				TBD				TBD		Note19
Hot spot	**△Bp**	θ=0; Ψ= 0		/ TBD	/		TBD	TBD	%	Note20

Note 7: Luminance measurement

The test condition is at I_{LED}=20mA and measured on the surface of LCD module at 25℃.

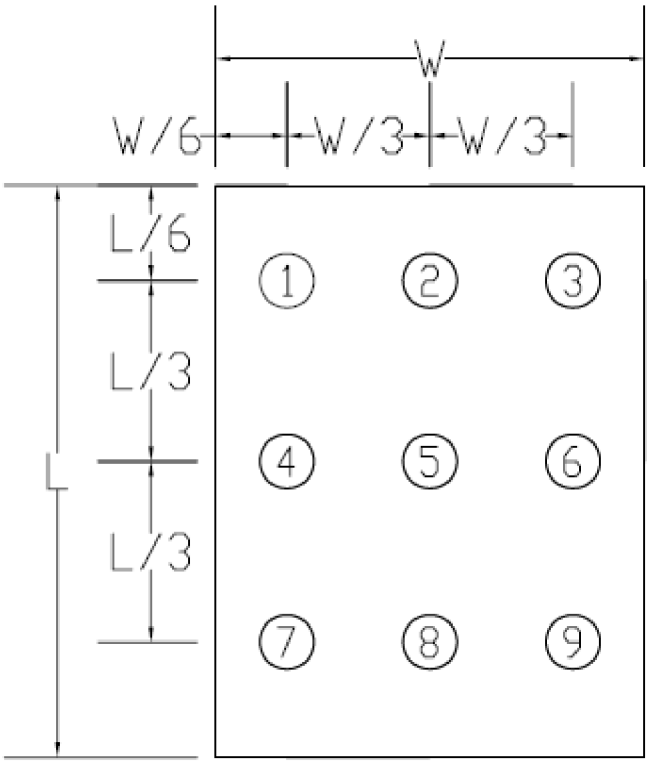
- The data are measured after LEDs are lighted on for more than 5 minutes and LCM displays are fully white. The brightness is the average value of 9 measured spots. Measurement equipment CS2000 or similar equipment (Field of view:1deg,Distance:50cm)
- Measuring surroundings: Dark room.
- Measuring temperature: Ta=25℃.
- Adjust operating voltage to get optimum contrast at the center of the display.
- Measured value at the center point of LCD panel must be after more than 5 minutes while backlight turning on.



Note 8: Uniformity

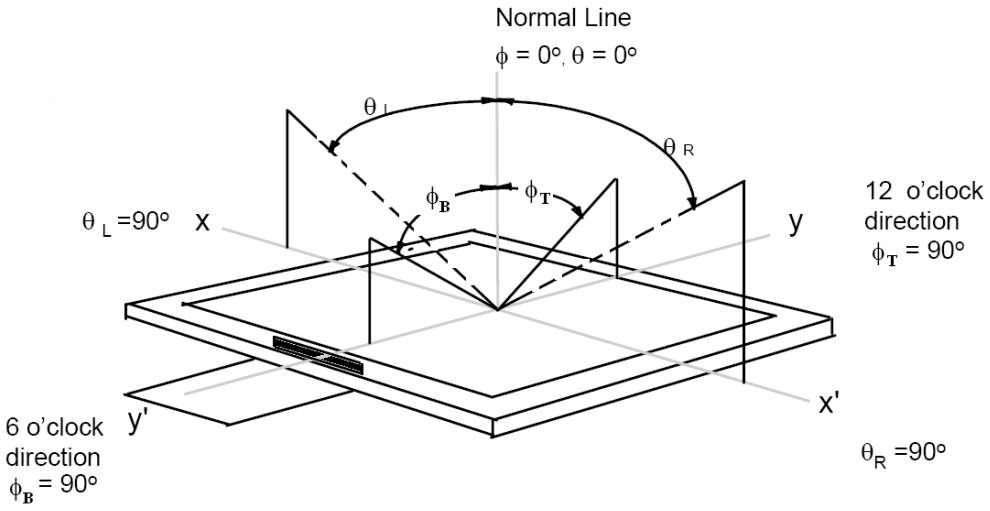
- The test condition is at I_{LED}=20mA and measured on the surface of LCD module at 25℃.
- Measurement equipment：CS2000 or similar equipment
- The luminance uniformity is calculated by using following formula:

- △Bp = Bp (Min.) / Bp (Max.)×100 (%)
- Bp (Max.) = Maximum brightness in 9 measured spots
- Bp (Min.) = Minimum brightness in 9 measured spots.



Note 9: **The definition of Viewing Angle**

Refer to the graph below marked by *θ* and *Φ*



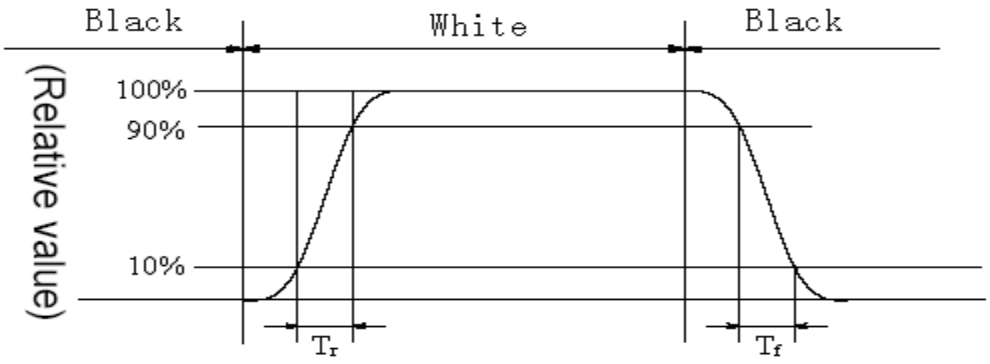
Note 10: **The definition of Contrast Ratio** (Test LCM using CS2000 or similar equipment):

$$\text{Contrast Ratio(CR)} = \frac{\text{Luminance When LCD is at “White” state}}{\text{Luminance When LCD is at “Black” state}}$$

(Contrast Ratio is measured in optimum common electrode voltage)

Note 11: **Definition of Response time.** (Test LCD using DMS501 or similar equipment):

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



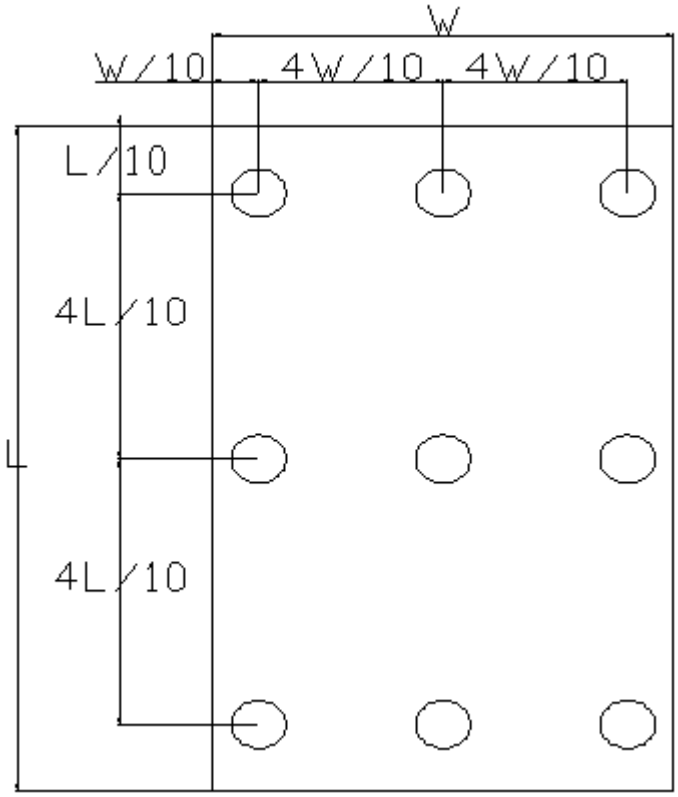
Response time of gray to gray:

- Measurement equipment: DMS501 or similar equipment or similar equipments.
- Test method :we define 8 grays L0-L7, the grays of L0-L7 were defined as:0,36,73, 109, 146, 182, 219, 255. The output signals of photo detector are measured when the input signals are changed from “Lx” to “Ly”, x, y= [0, 7]. The response time is defined as the time interval between the 10% and 90% of amplitudes. The result of the test can be noted as below:

	L0	L1	L2	L3	L4	L5	L6	L7
L0	■							
L1		■						
L2			■					
L3				■				
L4					■			
L5						■		
L6							■	
L7								■

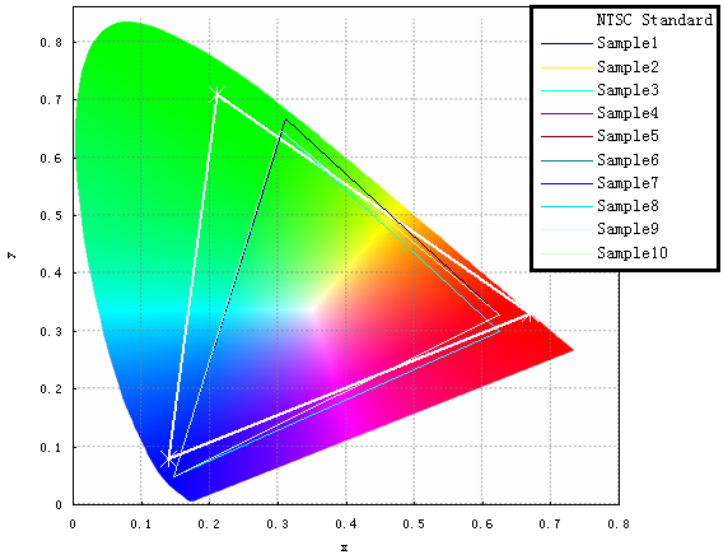
Note 12: Color Coordinates of CIE 1931 or similar equipment

- The test condition is at I_{LED}=20mA and measured on the surface of LCD module at 25℃.
- Measurement equipment：CS2000 or similar equipment
- The Color Coordinate (CIE 1931) is center of active area of the module.



Note 13: **Definition of Color of CIE Coordinate and NTSC Ratio.**

$$S = \frac{\text{area of RGB triangle}}{\text{area of NTSC triangle}} \times 100\%$$



Note 14: **Flicker**

No visual flicker will be allowed. The flicker level should be measured on GS127, The output signal is measured by Minolta CA210 immediately while Vcom is optimized. The flicker is essentially a ratio of the Amplitude in the frequency spectrum at 30 Hz (A30) and 0 Hz (A0), i.e.,

$$F = 20 \text{ Log } (A30 / A0).$$

Note 15: gamma curve control

For gamma curve control, HUAWEI's request as below:
the whole curve's tolerance must control within +/-0.3, HUAWEI will test the gray scale below:
0, 8, 16, 25, 33, 41, 49, 58, 66, 74, 82, 90, 99, 107, 115, 123, 132, 140, 148, 156, 165, 173, 181, 189, 197,206, 214, 222, 230, 239, 247, 255

Note 16: **Crosstalk**

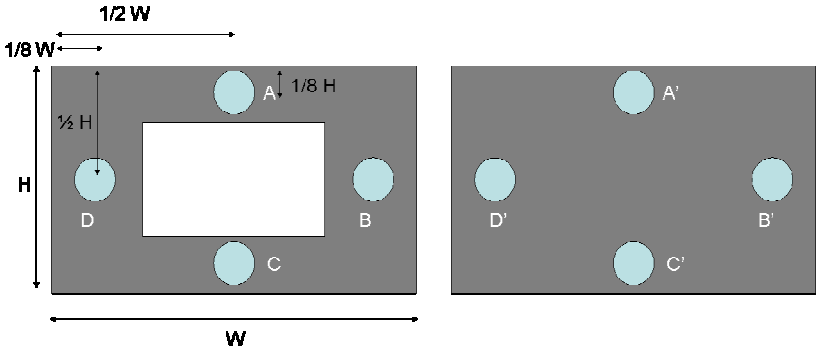
No visual cross-talk will be allowed. Two luminance values are measured at the same position (i.e. A and A'). The cross-talk, is defined as,

$$C(A, B, C, D)=| (L(A', B', C', D') – L(A, B, C, D))/L(A, B, C, D) | • 100\%,$$

Where, L(A, B, C, D) = Luminance in Position A, B, C, D

L(A', B', C', D') = Luminance in Position A', B', C', D'

Crosstalk=max (C(A), C(B), C(C), C(D))

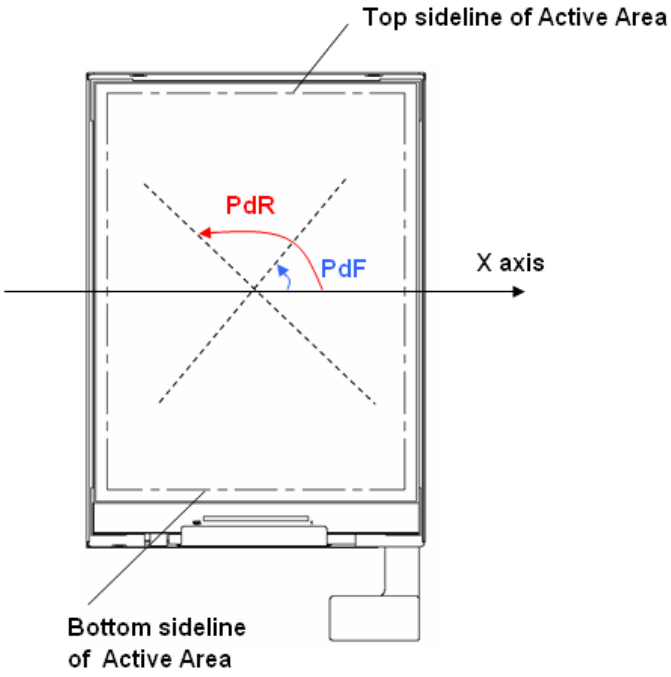


Background : GS 127

Center Pattern: GS 255, 1/2(W) x 1/2(H).

Note 17: Polarization Direction Definition

- Viewing direction is normal user viewing direction which is vertical to the display surface
- The polarizer which is closer to viewer is defined as Front Polarizer
- The polarizer which is on the rear side of viewer is defined as Rear Polarizer
- The X axis is defined as parallel line to top&bottom sidelines of the Active Area
- PdF which is marked in blue arrow is polarization degree of Front polarizer
- PdB which is marked in red arrow is polarization degree of Back polarizer
- The polarization degree parameter must be indicated in range of 0deg to 180deg according to above definition



Note 18: Afterimage judugement

- Power on the LCD 1 hour at tessellated picture(8*8)，then switch to 128 gray picture or Flicker picture, if the afterimage can't be seen within 3 minutes, the LCD is OK.

Note 19: CABC Test

- Measurement equipment :CS-2000 or similar equipments
- Testing picture: CABC Brightness-Gray and APL FIX gamma test picture.
- Test method:
- Power on LCD, test Brightness-Gray picture, drawing the brightness-gray curve, confirm save the power's scale.
- Test APL FIX gamma picture, drawing the APL FIX gamma curve, assurance the curve is smooth.

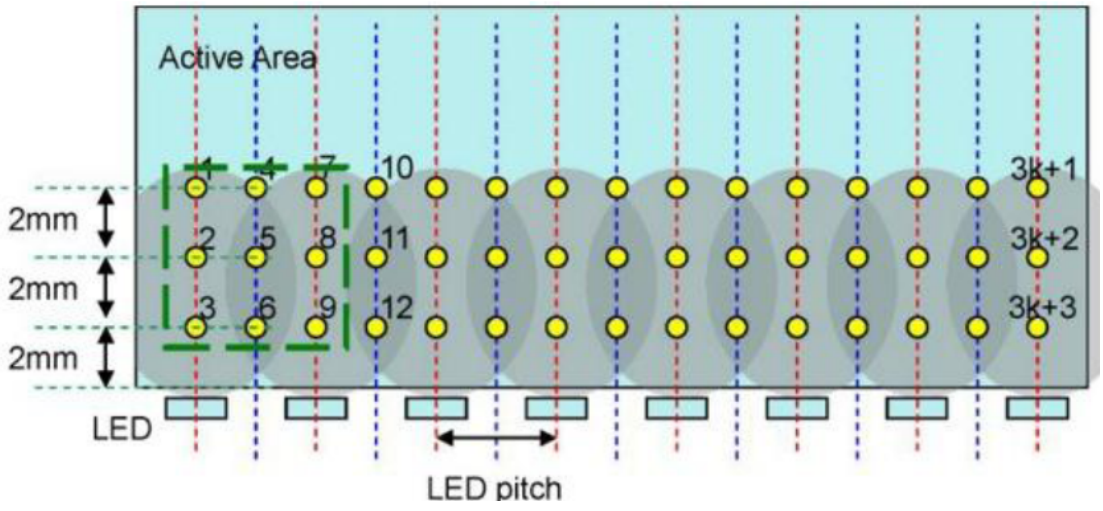
Note 20: Hot spot test

(Base on VESA-2.0-306-1)

Equipment used by: Imaging photometer system

The goal of the measurement is to evaluate the uniformity of between the worst-case bright and dark sports found along the LED launching area of the module.

1. The backlight is to be measured at the module level using the drive circuit contained on the LCD module or the recommended circuit
2. The backlight shall be allowed to warm up for 1 minute for this test.
3. The display shall be driven with all white pixels with the contrast set to optimal.
4. The luminance shall be measured directly in front of the LEDs ("Hot areas") and directly between the LEDs ("Dark areas") along the launching area edge of the panel. The measurement spot size of the "hot" and "dark" locations shall be 5mm in diameter.
   - Hot spot uniformity is defined as



Hot spot uniformity = L Min / L Max

9 Packing Method

9.1 MODULE LABEL

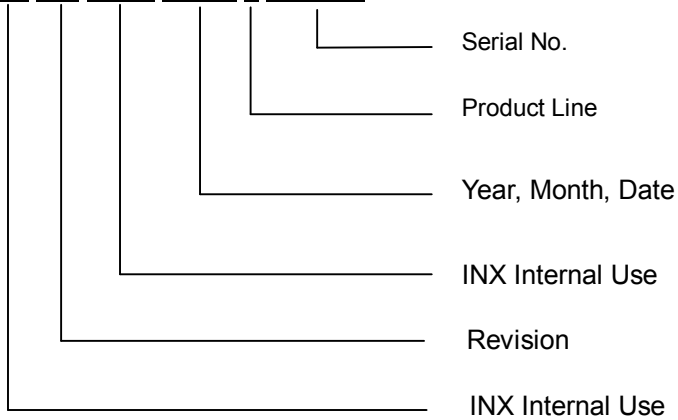
The barcode nameplate is pasted on each module as illustration, and its definitions are as

following explanation.

Model Name: N080ICE – GB1

(a) Revision: Rev. XX, for example: C1, C2 …etc.

(b) Serial ID: X X X X X X X Y M D L N N N N



Serial ID includes the information as below:

(a) Manufactured Date: Year: 0~9, for 2010~2019
Month: 1~9, A~C, for Jan. ~ Dec.
Day: 1~9, A~Y, for 1st to 31st, exclude I , O and U

(b) Revision Code: cover all the change

(c) Serial No.: Manufacturing sequence of product

(d) Product Line: 1 -> Line1, 2 -> Line 2, …etc.

9.2 CARTON

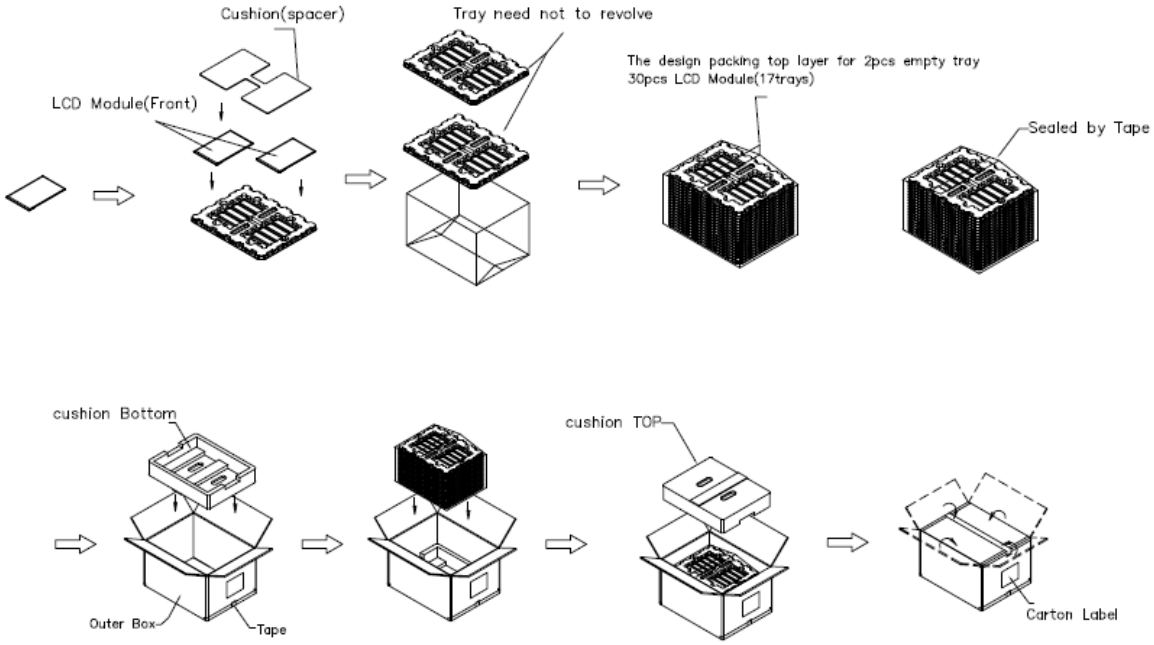


Figure. 9-2 Packing method

9.3 PALLET

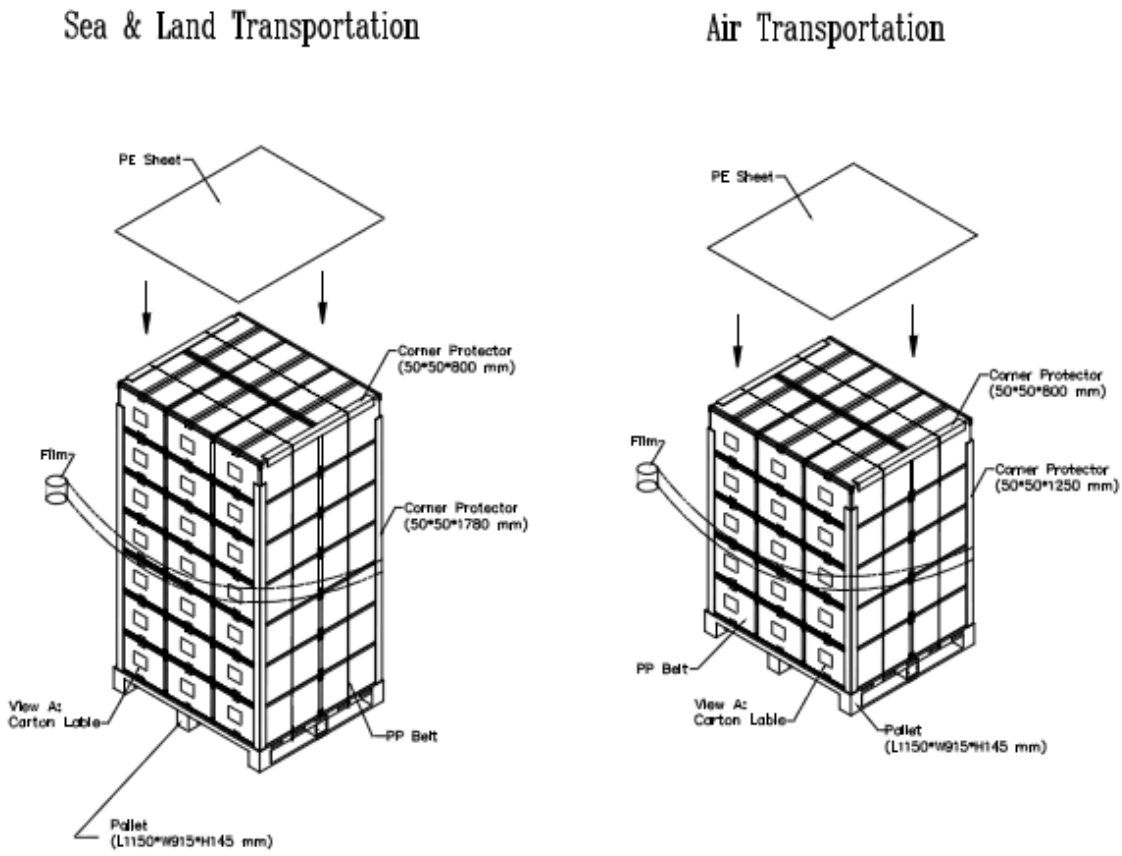


Figure. 9-3 Packing method

9.4 Un-Packing

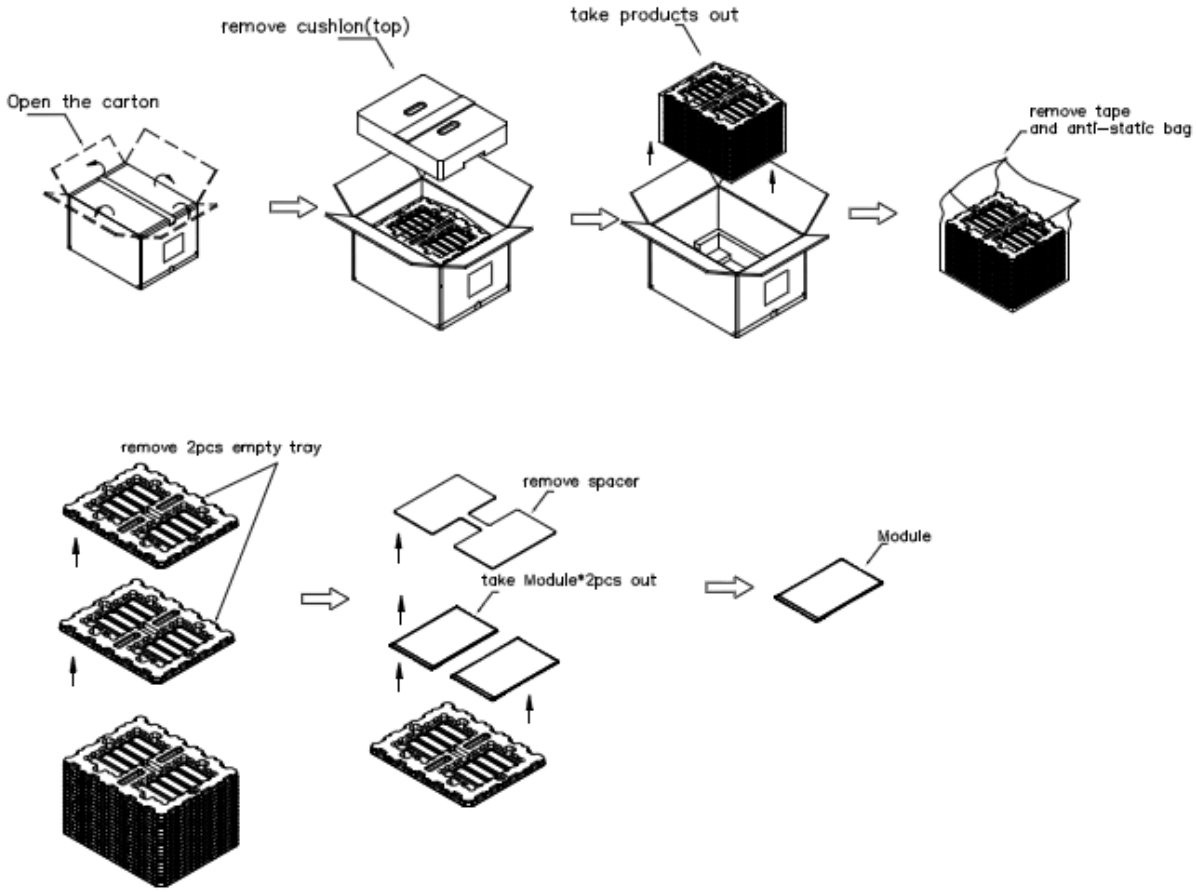


Figure. 9-4 Un-Packing method

10 Reliability Requirement

10.1 General Reliability Requirement

Test item	Test condition	Note
High Temperature Storage Test	70ºC, 240 hours	(1) (2)
Low Temperature Storage Test	-20ºC, 240 hours	
Thermal Shock Storage Test	-20ºC, 0.5hour←→70℃, 0.5hour; 100cycles, 1hour/cycle	
High Temperature Operation Test	60ºC, 240 hours	
Low Temperature Operation Test	-10ºC, 240 hours	
High Temperature & High Humidity Operation Test	50ºC, RH 90%, 240hours	
ESD Test (Operation)	150pF, 330Ω, 1sec/cycle Condition 1 : Contact Discharge, ±8KV Condition 2 : Air Discharge, ±15KV	(1)
Shock (Non-Operating)	220G, 2ms, half sine wave,1 time for each direction of ±X,±Y,±Z	(1)(3)
Vibration (Non-Operating)	1.5G / 10-500 Hz, Sine wave, 30 min/cycle, 1cycle for each X, Y, Z	(1)(3)

Note (1) Criteria : Normal display image with no obvious non-uniformity and no line defect.

Note (2) Evaluation should be tested after storage at room temperature for more than two hour

Note (3) At testing Vibration and Shock, the fixture in holding the module has to be hard and rigid enough so that the module would not be twisted or bent by the fixture.

10.2 Incoming Inspection Requirement

1. Refer to “终端显示屏来料通用检验标准V3.0”
2, “终端来料包装及标识工艺规范”

10.3 Module Unit Reliability Test

Refer to “華為终端平板显示屏单体认证技术规范V1.0”