GlobalTech Display
A Professional LCD Displays Provider

TFT LCD Display Specification
PN: GLT035320240TR2

Overview:

- 3.5" Diagonal
- View angle 12 O'clock
- Driver: NV3035GTC
- 16.7M Colors
- 320 Nits

- 320 x 240 Pixels
- Transmissive/Normally Black
- RGB-24bit+SPI Interface
- No Touch Panel
- RoHS Compliant

Records of Revision

DATE	REF.PAGE PARAGRAPH DRAWING No.	REVISED No.	SUMMARY	REMARK
2018-04-13		V01	First Issue	

Contents

1. General Specification

Item	Contents	Unit
LCD TYPE	TFT/TRANSMISSIVE	
MODULE SIZE (W*H*T)	76.90*63.90*3.15	MM
ACTIVE SIZE (W*H)	70.08*52.56	MM
PIXEL PITCH (W*H)	0.219*0.219	MM
NUMBER OF DOTS	320*240	
DIVER IC	NV3035GTC	
INTERFACE TYPE	24BIT RGB+SPI	
TOP POLARIZER TYPE	GLARE	
RECOMMEND VIEWING DIRECTION	12	O'CLOCK
GRAY SCALE INVERSION DIRECTION	6	O'CLOCK
COLORS	16.7M	
BACKLIGHT TYPE	6-DIES WHITE LED	
TOUCH PANEL TYPE	WITHOUT	

2. Mechanical Drawing

PIN DESCRIPTION

1	LEDK	29	D17
2	LEDK	30	D18
3	LEDA	31	D19
4	LEDA	32	D20
5	NC	33	D21
6	NC	34	D22
7	NC	35	D23
8	RESET	36	HSYNC
9	SPENA	37	VSYNC
10	SPCK	38	CLK
11	SPDA	39	NC
12	D00	40	NC
13	D01	41	VDD
14	D02	42	VDD
15	D03	43	NC
16	D04	44	NC
17	D05	45	NC
18	D06	46	NC
19	D07	47	NC
20	D08	48	NC
21	D09	49	NC
22	D10	50	NC
23	D11	51	NC
24	D12	52	DEN
25	D13	53	GND
26	D14	54	GND
27	D15		
28	D16		

Display Type	TFT 16.7M COLOR
	TRANSMISSIVE
Viewing Angle	12 O'CLOCK
LCD Driver IC	NV3035GTC
Operating Voltage	VDD=3.3V
Operation Temperature	-20℃ TO 70℃
Storage Temperature	-30℃ TO 80℃
Interface	24BIT -RGB+SPI
Backlight Driver Voltage	6-LED/19.2V@20mA
BL Surface luminance	320cd/m²
White X/Y	0.31±0.02/0.33±0.02

DRAWING NO.

GLT035320240TR2

UNIT	mm	SCALE	FIT
3rd Angle		SHEET 1 OF 1	

TITLE

MODULE SPEC.

GlobalTech Display

DETAIL A 50:1

RGB

DETAIL B 2:1

DRAWN	
ME.CHECKED	
EE.CHECKED	
APPROVED	

CUSTOMER'S APPROVAL

2013.11.8 DATE

SIGN

First issue

AMENDMENT

V00		
VER.	SYMBOL	

CIRCUIT DIAGRAM.(LED 1X6=6ies)

A • K

Contact side

Stiffener

NOTES:
1. General Tolerance: ±0.2
2. Recommended Case Open Area Should Be Less Than Module V.A
3. recommended cushion adherent area:TP V.A+1.6mm
4. UP Polaroid suface Treatment: Clear

320(RBG)*240

3.Block Diagram

VDD
GND

CLK
HSYNC
VSYNC
DEN
RESET

R[0:7]
G[0:7]
B[0:7]

24 BIT

SPENA
SPLK
SPDA

LED A
LED K

"NewVision"
NV3035GTC
(COG)
LCD
Controller/
Driver or
Equivalent

Gate:240

3.5″
TFT LCD Panel
320(RGB)*240

Source:320*RGB

BL Circuit(6-Dies LED)

4.Interface Pin Function

Pin No.	Symbol	Description
1	LEDK	Cathode of LED backlight
2	LEDK	Cathode of LED backlight
3	LEDA	Anode of LED backlight
4	LEDA	Anode of LED backlight
5	NC	No connect
6	NC	No connect
7	NC	No connect
8	RESET	RESET PIN
9	SPENA	Chip select of serial interface
10	SPCLK	Clock pin of serial interface
11	SPDA	Serial data input
12~35	D00~D23	Data bus
36	HSYNC	Horizontal sync signal
37	VSYNC	Vertical sync signal
38	DCLK	Clock signal; latching data at the falling edge
39	NC	No connect
40	NC	No connect
41	VDD	Power supply
42	VDD	Power supply
43~51	NC	No connect
52	DEN	Data enable
53	GND	Ground
54	GND	Ground

5.Absolute Maximum Ratings

Parameter	Symbol	Min	Max	Unit
Supply voltage for analog	VDD	-0.3	4.5	V
Supply voltage for logic	VDD	-0.3	4.5	V
Supply current (One LED)	I_{LED}		30	mA
Operating temperature	T_{OP}	-20	+70	°C
Storage temperature	T_{ST}	-30	+80	°C

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

6.Electrical Characteristics

6.1 Input Power

Item	Symbol	Min	Typ.	Max	Unit	Applicable terminal
Supply Voltage for Analog	VDD	3.0	3.3	3.6	V	
Supply Voltage for Logic	VDD	3.0	3.3	3.6	V	
Input Voltage	V_{IL}	GND	-	0.3VDD	V	
	V_{IH}	0.7 VDD	-	VDD		
Input leakage Current	I_{LKG}	-1		1	μA	

6.2 Backlight Driving Conditions

Item	Symbol	Value			Unit	Remark
		Min.	Typ.	Max.		
Voltage for LED Backlight	V_F	-	19.2	-	V	I_L =20mA
Current for LED Backlight	I_L		20		mA	
Power Consumption	P		0.384		W	
LED Life Time		30,000	50,000		Hr	Note

Note: Brightness to be decreased to 50% of the initial value at ambient temperature TA=25℃

7.Optical Characteristics

ITEM		SYMBOL	CONDITIONS	SPECIFICATIONS			UNIT	NOTE
				MIN	TYP.	MAX		
Luminance		L	I_L =20mA		320		Cd/m^2	Note 4
Contrast Ratio		CR	θ=0°	400	500			Note 2
Response Time		T_{ON}	25℃		20	30	ms	Note 3
		T_{OFF}						
CIE Color Coordinate	Red	X_R	Viewing normal angle		0.5934			
		Y_R			0.3436			
	Green	X_G			0.3340			
		Y_G			0.5923			
	Blue	X_B			0.1413			
		Y_B			0.0806			
	White	X_W			0.3114			
		Y_W			0.3327			
Viewing Angle	Hor.	θ_{X+}	CR≥10	60	70		Degree	Note 1
		θ_{X-}		60	70			
	Ver.	θ_{Y+}		50	60			
		θ_{Y-}		60	70			
Uniformity		Un		75	80		%	

Note 1: Definition of Viewing Angle θx and θy:
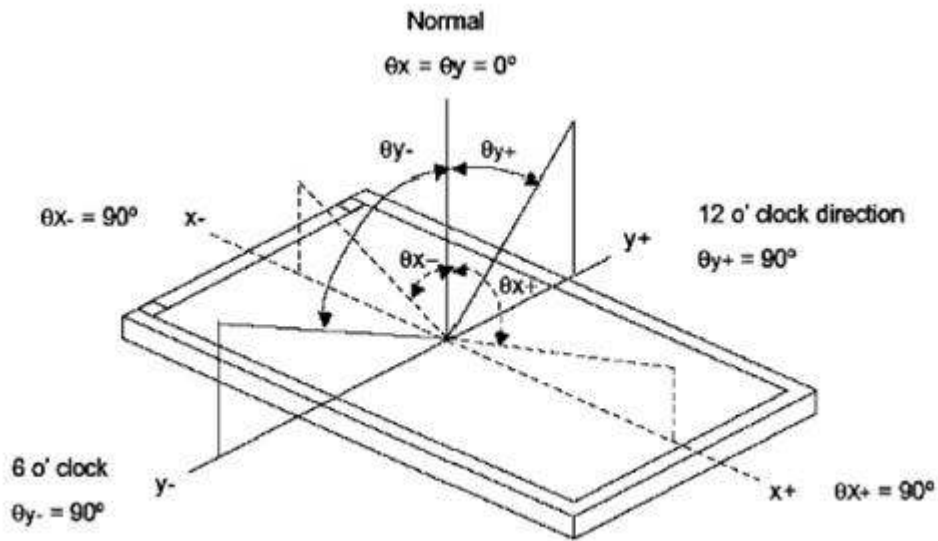
Note 2: Definition of contrast ratio CR:

$$CR = \frac{\text{Luminance of white state}}{\text{Luminance of black state}}$$

Note 3: Definition of Response Time(Tr,Tf)
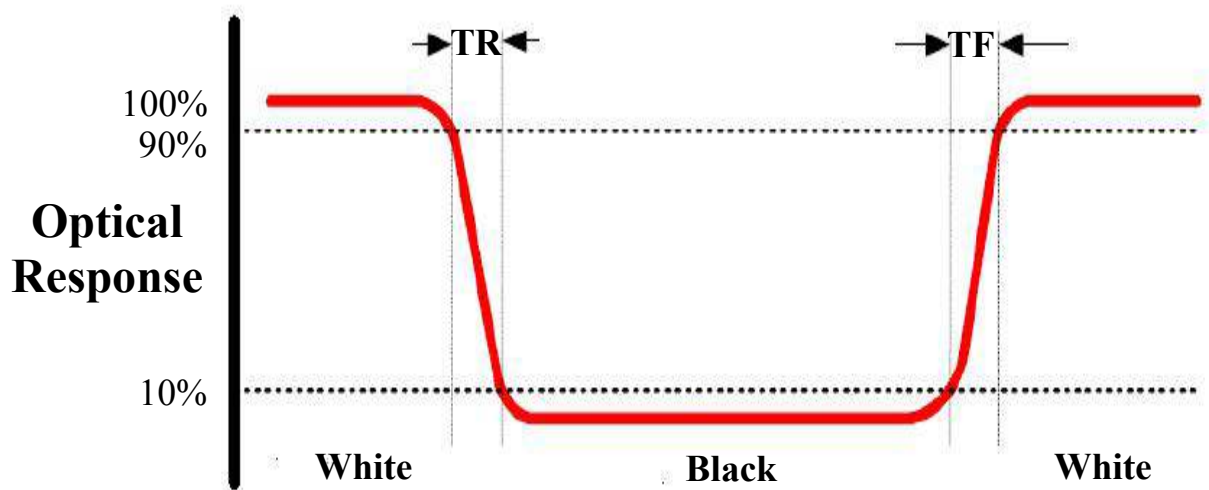
Note 4: Definition of Luminance

①The Brightness Test Equipment Setup

Field=2° (As measuring "black" image, field=2° is the best testing condition)

BM-7

Field=2°

50cm

TFT-LCD Panel

The center of the screen
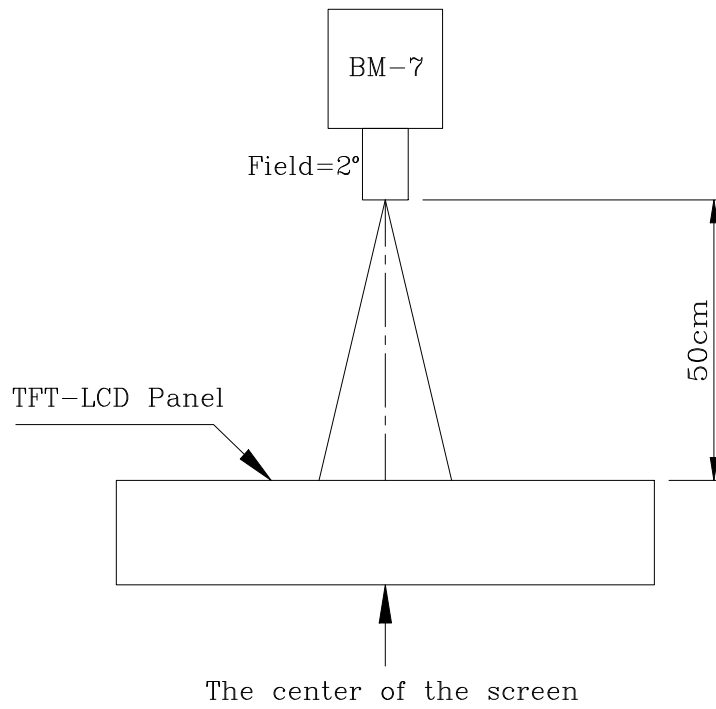
②The Brightness Test Point Setup

H/6

H/3

Active area
H

H/3

H/6

L/6   L/6   L/6   L/6

L

Active area

Unit: mm
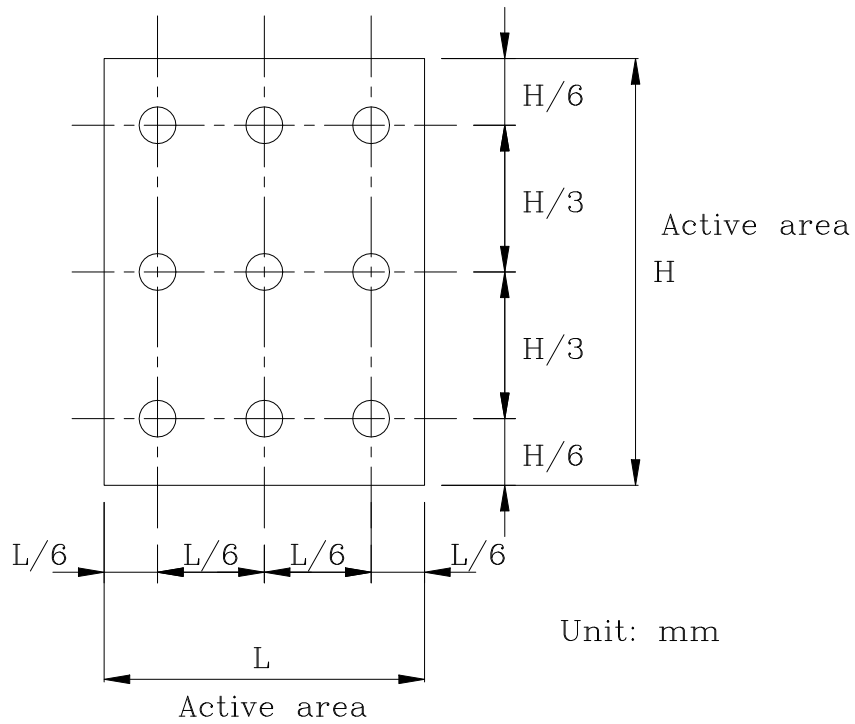
8.Timing Characteristics

8.1 3-wire SPI Timing Diagram
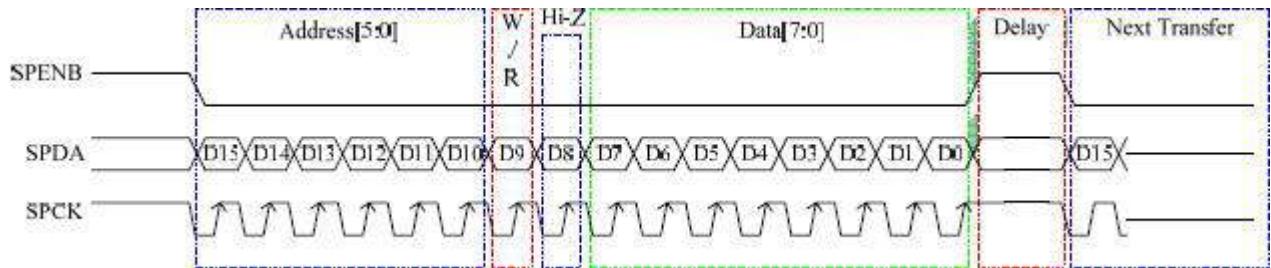
3-Wire Command Format:

Bit	Description
D15-D10	Register Address [5:0]
D9	W/R control bit. "1" for Write; "0" for Read
D8	Hi-Z bit during read mode. Any data within this bits will be ignored during write mode
D7-D0	Data for the W/R operation to the address indicated by Address phase

3-Wire Writer Format:

MSB															LSB
D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0
Register Address [5:0]						1	X	DATA (Issue by external controller)							

3-Wire Read Format:

MSB															LSB
D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0
Register Address [5:0]						0	Hi-Z	DATA (Issue by NV3035C)							

8.2 Input data format
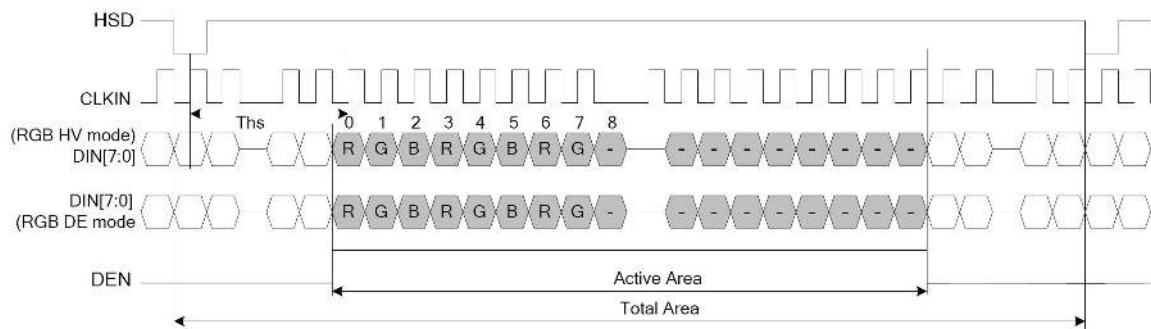
Input Format	Format Standard	CLKIN(MHz)	HSD(CLKIN)	Total Area (CLKIN)	Active Area (CLKIN)	Note
8bit RGB	8bit RGB	27	1	1716	960	960×240
24bit RGB	24bit RGB	6.4	1	408	320	

Clock and Data Input Timing Diagram

8.3 Timing Diagram

3-Wire Timing Diagram

Source Driver Output Timing Diagram
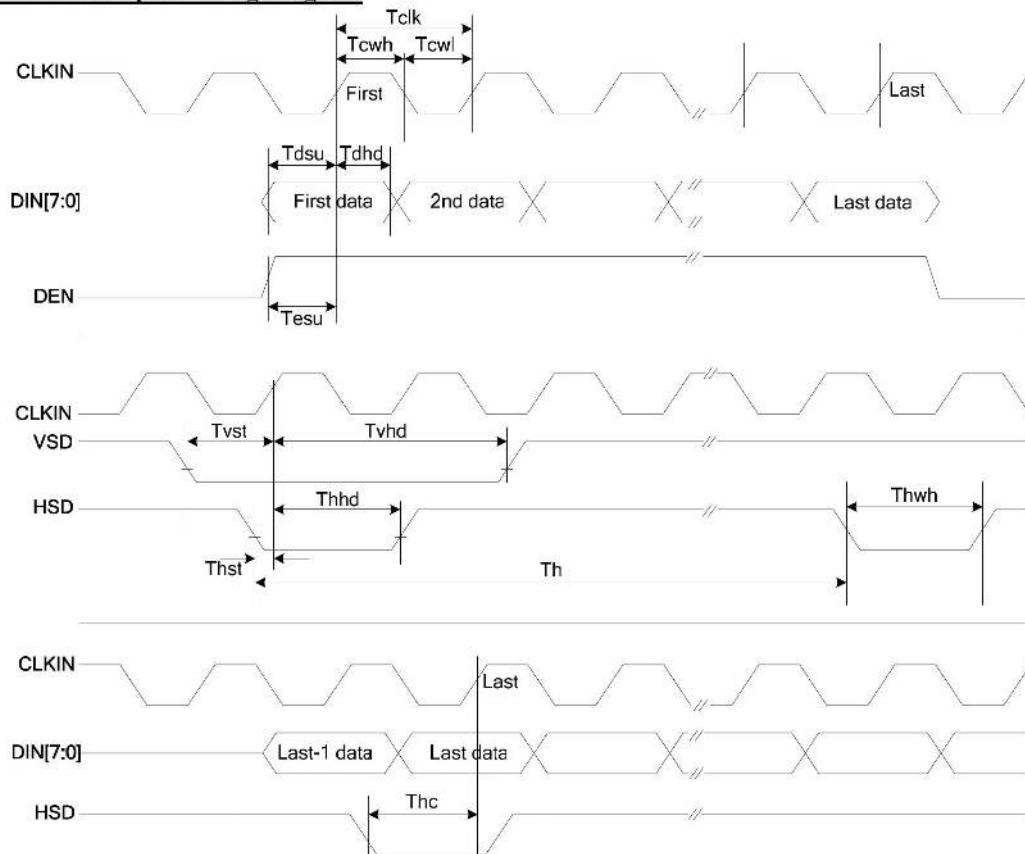
Gate Driver Output Timing Diagram
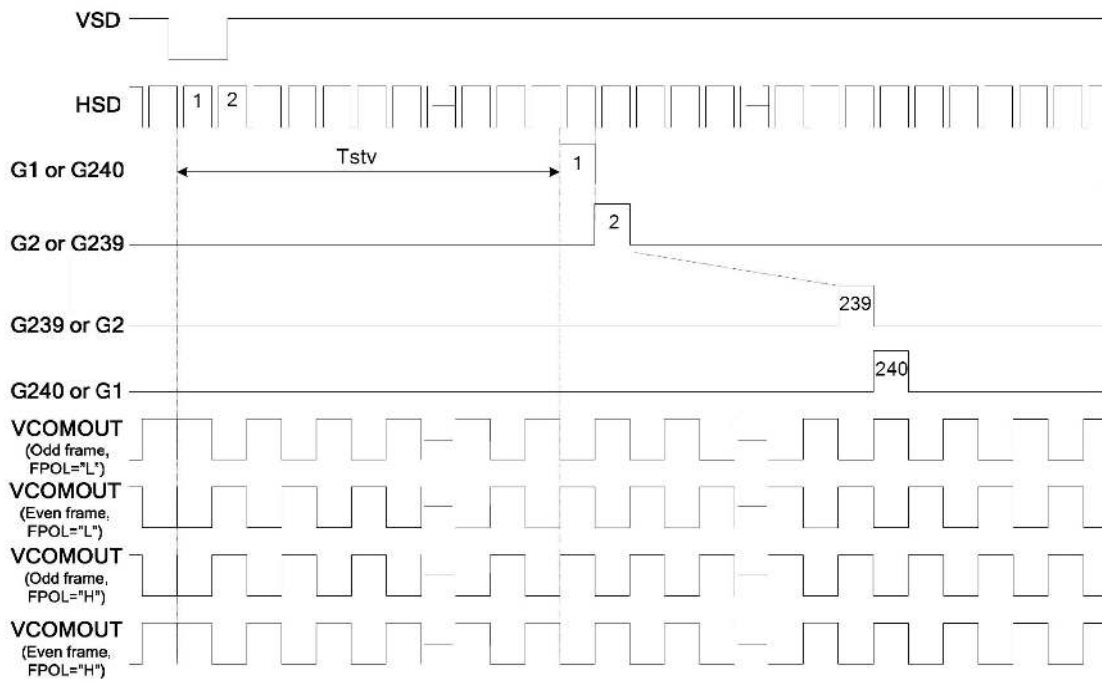
Vertical Timing Diagram (HV Mode)
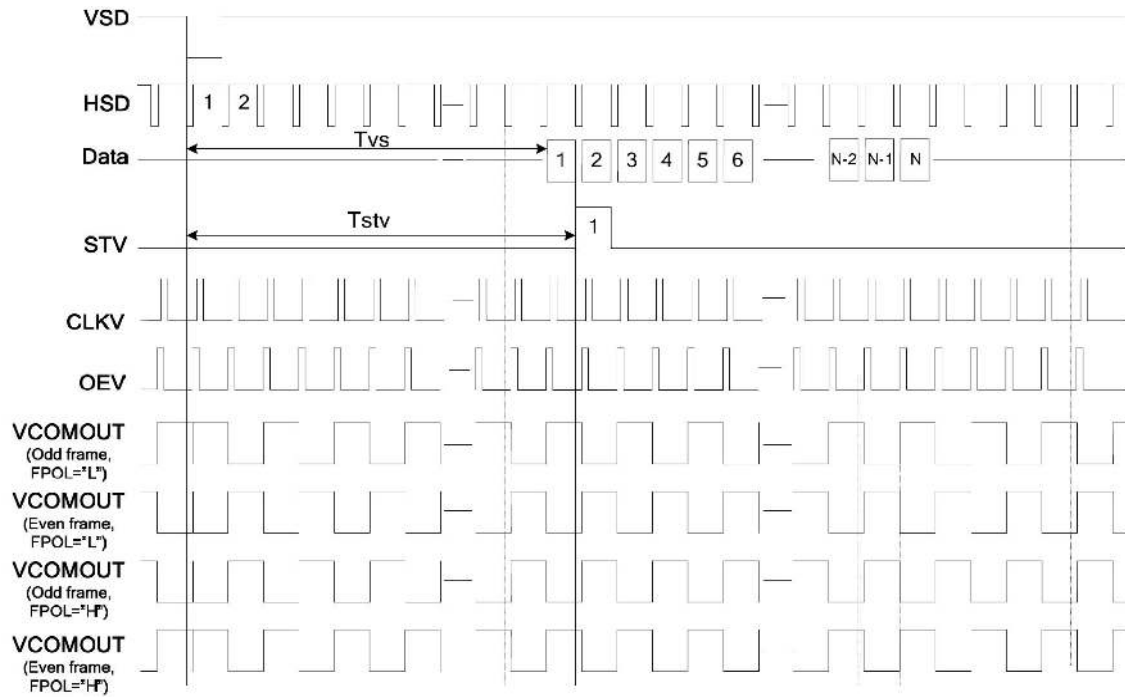
Vertical Timing Diagram (DE Mode)
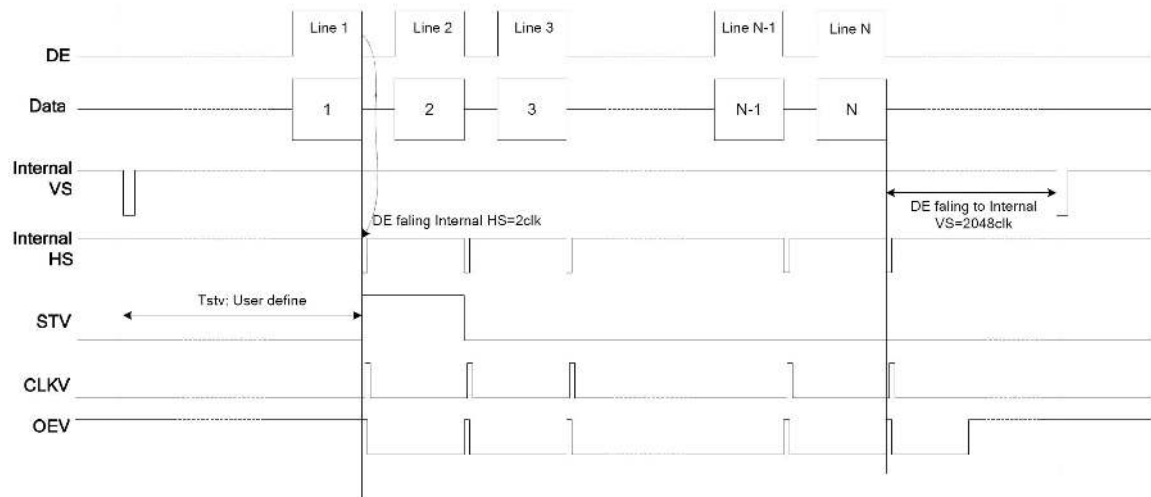
Input Data Timing (24 bit RGB mode for 960×240 @ SEL[3:0]=1100b)
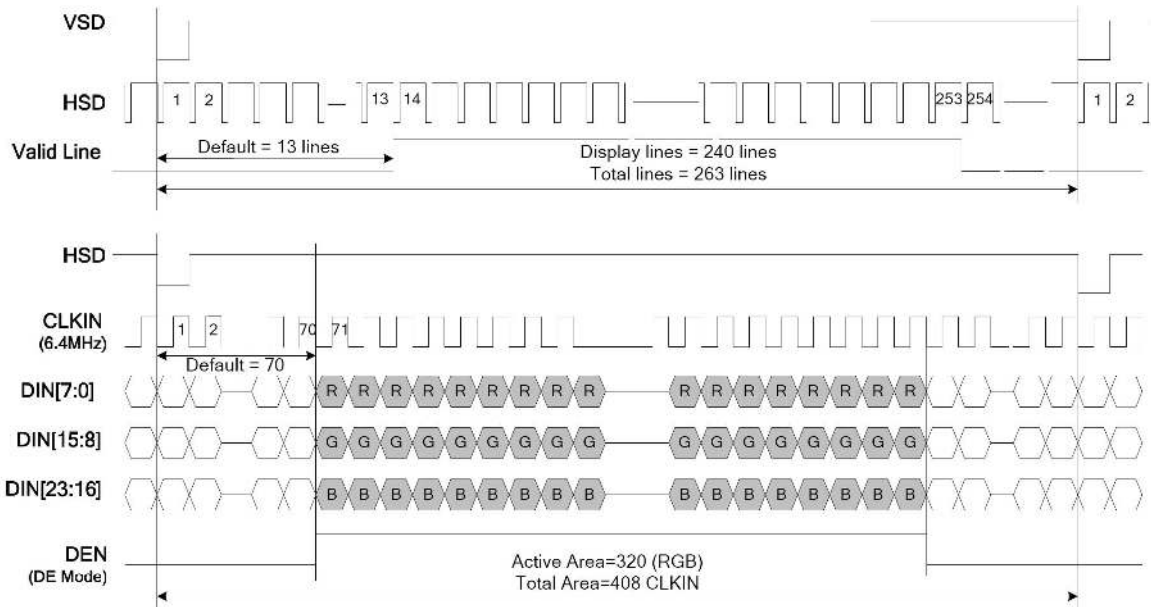
9.Standard Specification for Reliability

9.1 Standard Specification for Reliability of LCD Module

No.	Item	Description
01	High temperature operation	The sample should be allowed to stand at 70℃ for 120 hours under driving condition and then returning it to normal temperature condition, and allowing it stand for 2 hours.
02	Low temperature operation	The sample should be allowed to stand at -20℃ for 120 hours under driving condition and then returning it to normal temperature condition, and allowing it stand for 2 hours.
03	High temperature storage	The sample should be allowed to stand at 80℃ for 240 hours under no-load condition, and then returning it to normal temperature condition, and allowing it stand for 2 hours.
04	Low temperature storage	The sample should be allowed to stand at -30℃ for 240 hours under no-load condition, then returning it to normal temperature condition, and allowing it stand for 2 hours.
05	Moisture storage	The sample should be allowed to stand at 60℃,90%RH MAX for 240 hours under no-load condition, then taking it out and drying it at normal temperature for 2 hours.
06	Thermal shock storage	The sample should be allowed to stand the following 10 cycles : -30℃ for 30 minutes → normal temperature for 5 minutes → +80℃ for 30 minutes → normal temperature for 5 minutes, as one cycle.
07	Packing vibration	Frequency range : 10Hz ~ 55Hz Amplitude of vibration : 1.5mm Sweep time: 12 min X,Y,Z 2 hours for each direction.
08	Packing drop test	According to ASTM-D-5327.
09	Electrical Static Discharge	Air: ±4KV 150pF/330Ω 5 times
		Contact: ±2KV 150pF/330Ω 5 time

*Sample size for each test item is 3~5pcs

9.2 Testing Conditions and Inspection Criteria

For the final test, the testing sample must be stored at room temperature for 24 hours. After the tests listed in Table 9.2, standard specifications for reliability will be executed in order to ensure stability.

No.	Item	Test Model	In section Criteria
01	Current Consumption	Refer To Specification	The current consumption should conform to the product specification.
02	Contrast	Refer To Specification	After the tests have been executed, the contrast must be larger than half of its initial value prior to the tests.
03	Appearance	Visual inspection	Defect free.

9.3 MTBF

MTBF	Functions, performance, appearance, etc. shall be free from remarkable deterioration within 50,000 hours under ordinary operating and storage conditions room temperature (25±5℃), normal humidity (50±10% RH), and in area not exposed to direct sun light.

10.Specification of Quality Assurance

This standard of Quality Assurance confirms to the quality of LCD module products supplied by GlobalTech Dispaly.

10.1 Quality Test

Before delivering, the supplier should conduct the following tests to confirm the quality of products.

- Electrical-Optical Characteristics: According to the individual specification to test the product.
- Appearance Characteristics: According to the individual specification to test the product.
- Reliability Characteristics: According to the definition of reliability on the specification for testing products.

10.2 Delivery Test

Before delivering, the supplier should conduct the delivery test.

- Test method: According to MIL-STD105E.General Inspection Level Ⅱ take a single Time.
- The defects classify of AQL as following:
  Major defect: AQL = 0.65
  Minor defect: AQL = 2.5
  Total defects: AQL = 2.5

10.3 Non-conforming Analysis & Deal With Manners

10.3.1 Non-conforming Analysis

- Purchaser should provide the data detail of non-conforming sample and the non-conforming.
- After receiving the data detail from purchaser, the analysis of non-conforming should be finished within two weeks.
- If the analysis can't be finished on time, supplier must notice purchaser 3 days in advance.

10.3.2 Disposition of non-conforming

- If any product defect be found during assembling, supplier must change the good for every defect after confirmation.
- Both supplier and customer should analyze the reason and discuss the disposition of non-conforming when the reason of nonconforming is not sure.

10.4 Agreement items

Both parties should negotiate together when the following problems happen.
- There is any problem of standard of quality assurance, and both sides should agree that it must be modified.
- There is any argument item which does not record in the standard of quality assurance.
- Any other special problem.

10.5 Standard of The Product Appearance Test

10.5.1 Manner of appearance test

- The test must be under 20W × 2 or 40W fluorescent light, and the distance of view must be at 30±5cm.
- When test the model of transmissive product must add the reflective plate.
- The test direction is base on around 10° of vertical line.
- Temperature: 25±5℃   Humidity: 60±10%RH
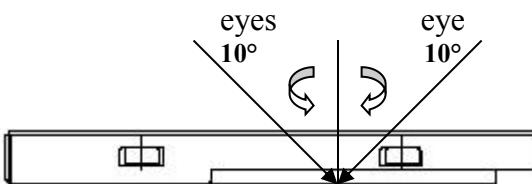
- Definition of area:
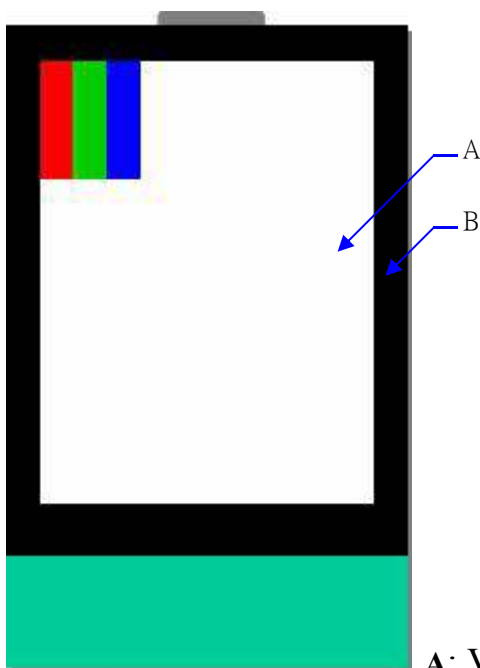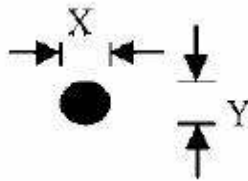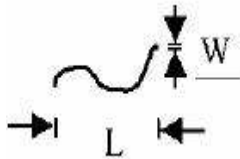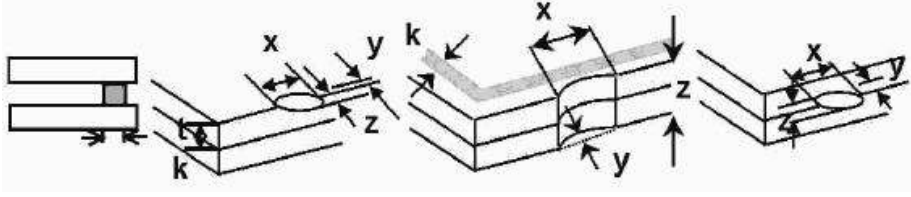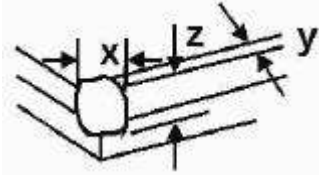
A: Viewing area B: Outside viewing area

10.5.2 Basic principle

- When the standard can not be described, AQL will be applied.
- The sample of the lowest acceptable quality level must be negotiated by both supplier and customer when any dispute happened.
- New item must be added on time when it is necessary.
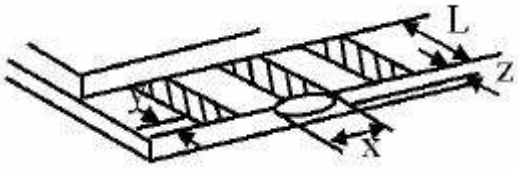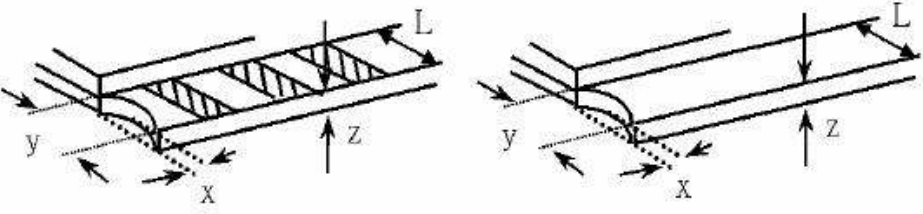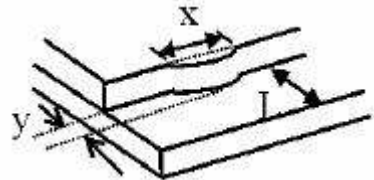
10.6 Inspection Specification
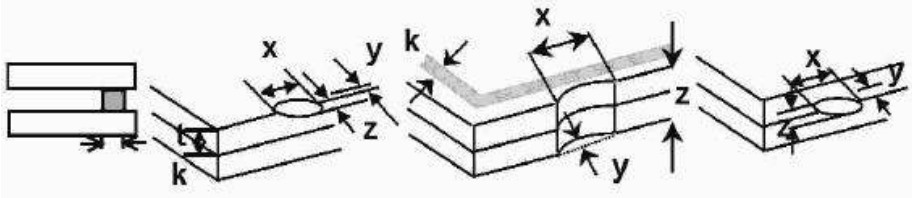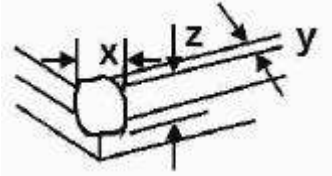
NO.	Item	Criterion	AQL
01	Electrical Testing	1.1 Missing vertical, horizontal segment, segment contrast defect. 1.2 Missing character, dot or icon. 1.3 Display malfunction. 1.4 No function or no display. 1.5 Current consumption exceeds product specifications. 1.6 LCD viewing angle defect. 1.7 Mixed product types. 1.8 Flicker	**0.65**
02	Black or White spots or Bright spots or Color spots on LCD (Display only)	2.1 White and black or color spots on display $\leqq$ 0.25mm, no more than Five spots. 2.2 Densely spaced: No more than three spots within 3mm.	**2.5**
03	LCD and Touch Panel black spots, white spots, contamination (non – display)	3.1 Round type: As following drawing $\Phi = (X+Y) / 2$ * Densely spaced: No more than two spots within 3mm.	**2.5**

Table for 3.1 Round type:

Size(mm)	Acceptable Q'ty
$\Phi \leqq 0.10$	Accept no dense
$0.10 < \Phi \leqq 0.20$	2
$0.20 < \Phi \leqq 0.25$	2
$0.25 < \Phi \leqq 0.30$	1
$0.30 < \Phi$	0

3.2 Line type: (As following drawing)

Length(mm)	Width(mm)	Acceptable Q'ty
---	$W \leqq 0.02$	Accept no dense
$L \leqq 3.0$	$0.02 < W \leqq 0.05$	2
$L \leqq 2.5$	$0.03 < W \leqq 0.08$	2
---	$0.08 < W$	Rejection

* Densely spaced: No more than two lines within 3mm.

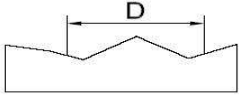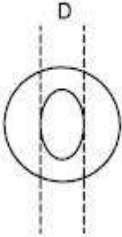(AQL for 3.2: **2.5**)

NO.	Item	Criterion			AQL
04	Polarizer bubbles	If bubbles are visible, judge using black spot specifications, not easy to find, must check in specify direction	Size Φ(mm)	Acceptable Q'ty	2.5
			Φ ≦ 0.20	Accept no dense	
			0.20< Φ ≦ 0.50	3	
			0.50< Φ ≦ 1.00	2	
			1.00< Φ	0	
			Total Q'ty	3	
05	Scratches	Follow NO.3 -2 Line Type.			
06	Chipped glass	Symbols: x: Chip length y: Chip width z: Chip thickness k: Seal width t: Glass thickness a: LCD side length L: Electrode pad length 6.1 General glass chip: 6.1.1 Chip on panel surface and crack between panels:			2.5

z: Chip thickness	y: Chip width	x: Chip length
Z ≦ 1/2t	Not over viewing area	x ≦ 1/8a
1/2t< z ≦ 2t	Not exceed 1/3k	x ≦ 1/8a

⊙ Unit: mm

⊙ If there are 2 or more chips, x is the total length of each chip

6.1.2 Corner crack:

z: Chip thickness	y: Chip width	x: Chip length
Z ≦ 1/2t	Not over viewing area	x ≦ 1/8a
1/2t< z ≦ 2t	Not exceed 1/3k	x ≦ 1/8a

⊙ Unit: mm

⊙ If there are 2 or more chips, x is the total length of each chip

NO.	Item	Criterion	AQL
08	Cracked glass	The LCD with extensive crack is not acceptable.	2.5
09	Backlight elements	9.1 Illumination source flickers when lit. 9.2 Spots or scratches that appear when lit must be judged. Using LCD spot, lines and contamination standards. 9.3 Backlight doesn't light or color is wrong.	2.5 2.5 0.65
10	Bezel	Bezel must comply with product specifications.	2.5
11	PCB、COB	11.1 COB seal may not have pinholes larger than 0.2mm or contamination. 11.2 COB seal surface may not have pinholes through to the IC. 11.3 The height of the COB should not exceed the height indicated in the assembly diagram. 11.4 There may not be more than 2mm of sealant outside the seal area on PCB. And there should be no more than three places. 11.5 Parts on PCB must be the same as on the production characteristic chart, There should be no wrong parts, missing parts or excess parts. 11.6 The jumper on the PCB should conform to the product characteristic chart.	2.5 2.5 2.5 2.5 0.65 0.65
12	FPC	12.1 FPC terminal damage ≦ 1/2 FPC terminal width and can not affect the function , we judge accept. 12.2 FPC alignment hole damage ≦ 1/2 alignment area and can not affect the function , we judge accept.	2.5 2.5
13	Soldering	13.1 No cold solder joints, missing solder connections, oxidation or icicle. 13.2 No short circuits in components on PCB or FPC.	2.5 0.65

NO.	Item	Criterion	AQL
07	Glass crack	Symbols: x: Chip length y: Chip width z: Chip thickness k: Seal width t: Glass thickness a: LCD side length L: Electrode pad length 7.2 Protrusion over terminal: 7.2.1 Chip on electrode pad: <table><tr><td>y: Chip width</td><td>x: Chip length</td><td>z: Chip thickness</td></tr><tr><td>y ≦ 0.5mm</td><td>x ≦ 1/8a</td><td>0 < z ≦ t</td></tr></table>7.2.2 Non-conductive portion: <table><tr><td>y: Chip width</td><td>x: Chip length</td><td>z: Chip thickness</td></tr><tr><td>y ≦ L</td><td>x ≦ 1/8a</td><td>0 < z ≦ t</td></tr></table>⊙ If there chipped area touches the ITO terminal, over 2/3 of the ITO must remain and be inspected according to electrode terminal specifications. ⊙ If the product will be heat sealed by the customer, the alignment mark must mot be damaged. 7.2.3 Substrate protuberance and internal crack <table><tr><td>y: width</td><td>x: length</td></tr><tr><td>y ≦ 1/3L</td><td>X ≦ a</td></tr></table>	2.5

NO.	Item	Criterion	AQL
14	Touch Panel Chipped glass	Symbols: x: Chip length y: Chip width z: Chip thickness k: Seal width t: Touch Panel Total thickness a: LCD side length L: Electrode pad length 14.1 General glass chip: 14.1.1 Chip on panel surface and crack between panels: 14.1.2 Corner crack: 	2.5

14.1.1 Chip on panel surface and crack between panels:

z: Chip thickness	y: Chip width	x: Chip length
$Z \leqq t$	$\leqq 1/2\ k$ and not over viewing area	$x \leqq 1/8a$

⊙ Unit: mm
⊙ If there are 2 or more chips, x is the total length of each chip

14.1.2 Corner crack:

z: Chip thickness	y: Chip width	x: Chip length
$z \leqq t$	$\leqq 1/2\ k$ and not over viewing area	$x \leqq 1/8a$

⊙ Unit: mm
⊙ If there are 2 or more chips, x is the total length of each chip

NO.	Item	Criterion	AQL
15	Touch Panel(Fish eye、dent and bubble on film)	<table><tr><td>SIZE(mm)</td><td>Acceptable Q'ty</td></tr><tr><td>Φ≦0.2</td><td>Accept no dense</td></tr><tr><td>0.2< D ≦0.4</td><td>5</td></tr><tr><td>0.4< D ≦0.5</td><td>2</td></tr><tr><td>0.5< D</td><td>0</td></tr></table> D	2.5
16	Touch Panel Newton ring	Newton ring dimension ≦ 1/2 touch panel area and not affect font and line distortion(≦2.5%) , it is acceptable.	2.5
17	Touch Panel Linearity	Less than 2.5% is acceptable.	2.5
18	LCD Ripple	Touch the touch panel , can not see the LCD ripple. Pen: R 1.0mm silicon rubber. Operation Force: 80g	2.5
19	General appearance	19.1 Pin type must match type in specification sheet. 19.2 LCD pin loose or missing pins. 19.3 Product packaging must the same as specified on packaging specification sheet. 19.4 Product dimension and structure must conform to product specification sheet.	0.65 0.65 0.65 0.65

11.Handling Precaution

11.1 Handling of LCM

- Avoid external shock.
- Don't apply excessive force on the surface.
- Liquid in LCD is hazardous substance, do not lick or swallow. When the liquid is attaching to your hand, skin, cloth, etc., wash it thoroughly and immediately.
- Don't operate it above the absolute maximum rating.
- Don't disassemble the LCM.
- The operators should wear protections whenever he/she comes into contact with the module. Never touch any of the conductive parts such as the LSI pads, the copper leads on the PCB and the interface terminals with any parts of the human body.
- The modules should be kept in antistatic bags or other containers resistant to static for storage.
- The module is coated with a film to protect the display surface, be careful when peeling off this protective film since static electricity may be generated.

11.2 Storage

- Store it in an ambient temperature of 25±10℃, and in a relative humidity of 50±10%RH. Don't expose to sunlight or fluorescent light.
- Store it in a clean environment, free from dust, active gas, and solvent.
- Store it in anti-static electricity container.
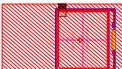- Store it without any physical load.

11.3 Soldering

- Use only soldering irons with proper grounding and no leakage.
- Iron: no higher than 280±10℃ and less than 3 sec during hand soldering.
- Rewiring: no more than 2 times.

12.Packing Method
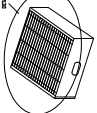
STEP 1: Finished assembly of LCM.
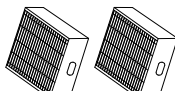
STEP 2: Put LCM into red color of anti-static bag.

STEP 3: Place the bag with LCM into the cavity of pallet. There are 2 strings in one pallet, and 68 cavities each string, so total 68*2=136 pcs modules each pallet. The whole pallet outline: 344*285*85mm;
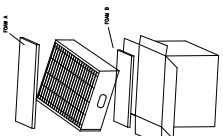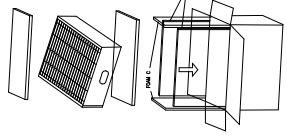
STEP 4: Two pallets ready.
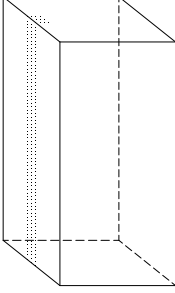
STEP 5: Place foams and one pallet into box.

STEP 6: Place foams and the other pallet into box.
Foam A size: 280*350*10mm 1pcs;
Foam B size: 375*300*10mm 2pcs.
Foam C size: 375*190*10mm 2pcs;
Foam D size: 280*190*10mm 2pcs.

STEP 7: Seal the box with adhesive tape.
The box outline:385*315*227mm.

STEP 1
STEP 2
STEP 3
STEP 4
STEP 5
STEP 6
STEP 7

			DRAWN		DRAWING NO.			
			ME.CHECKED					
			EE.CHECKED		TITLE			
			APPROVED		MODULE SPEC.			
			CUSTOMER'S APPROVAL			UNIT	mm	SCALE	FIT
						3rd Angle		SHEET 1 OF 1
V00	First issue	2016.04.05						
VER.	SYMBOL	AMENDMENT	SIGN	DATE				