SPECIFICATION
FOR
LCM+UART Module

MODULE No:	KD034WXFPD002-RS232
CUSTOMER:	

STARTEK	INITIAL	DATE
PREPARED BY		
CHECKED BY		
APPROVED BY		

CUSTOMER	INITIAL	DATE
APPROVED BY		

Revision History

Date	Rev. No.	Page	Summary
2024.03.15	V1.0	ALL	FIRST ISSUE

Contents

1. Basic Specifications

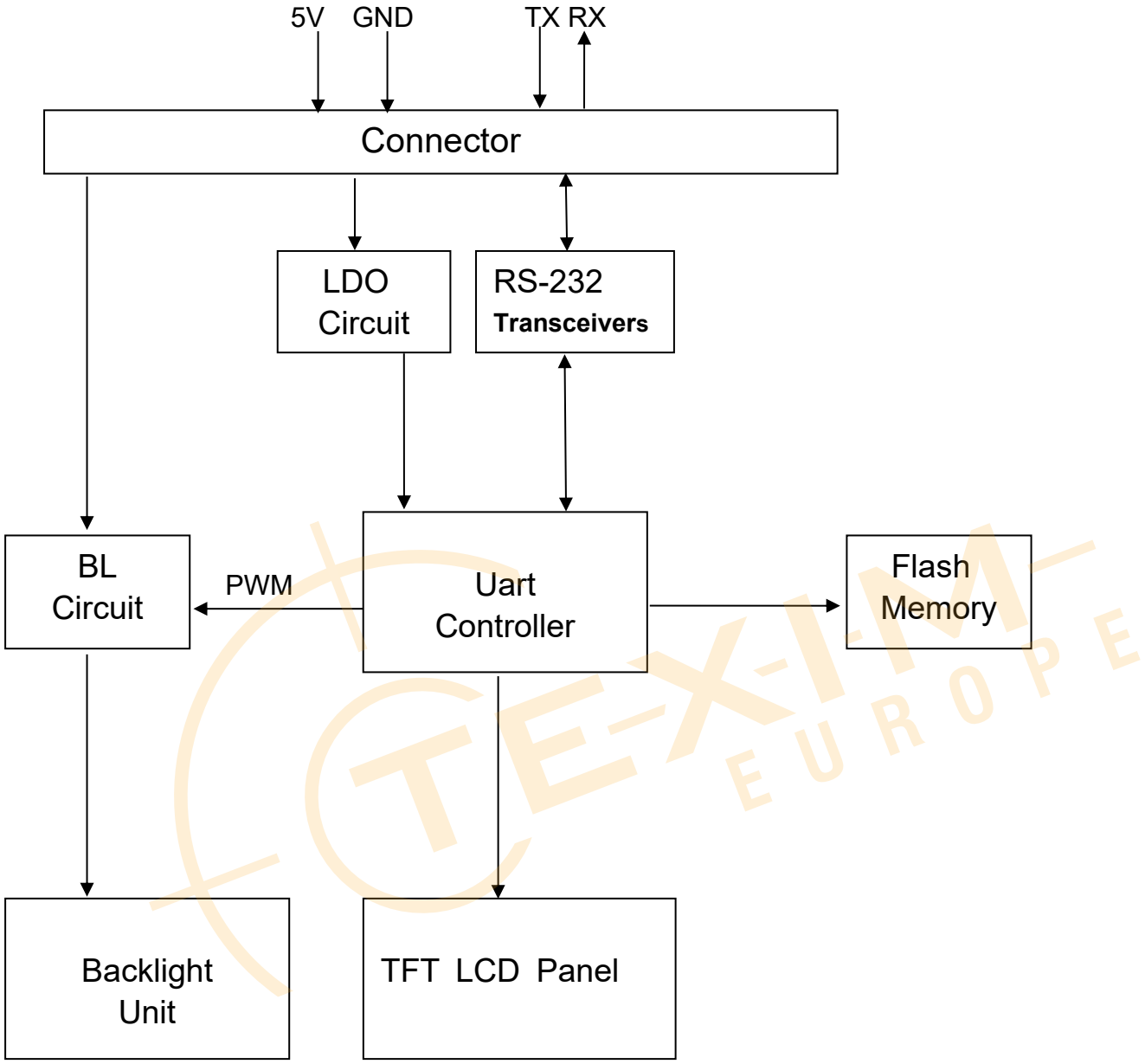
Description

This is a color active matrix TFT (Thin Film Transistor) LCD (liquid crystal display) that uses amorpho us silicon TFT as a switching device. This module is composed of a Transmissive type TFT-LCD Pan el, driver circuit,back-light unit, uart board. The resolution of a 3.4 " TFT-LCD contains 480x480 pixels, and can display up to 16.7M colors.

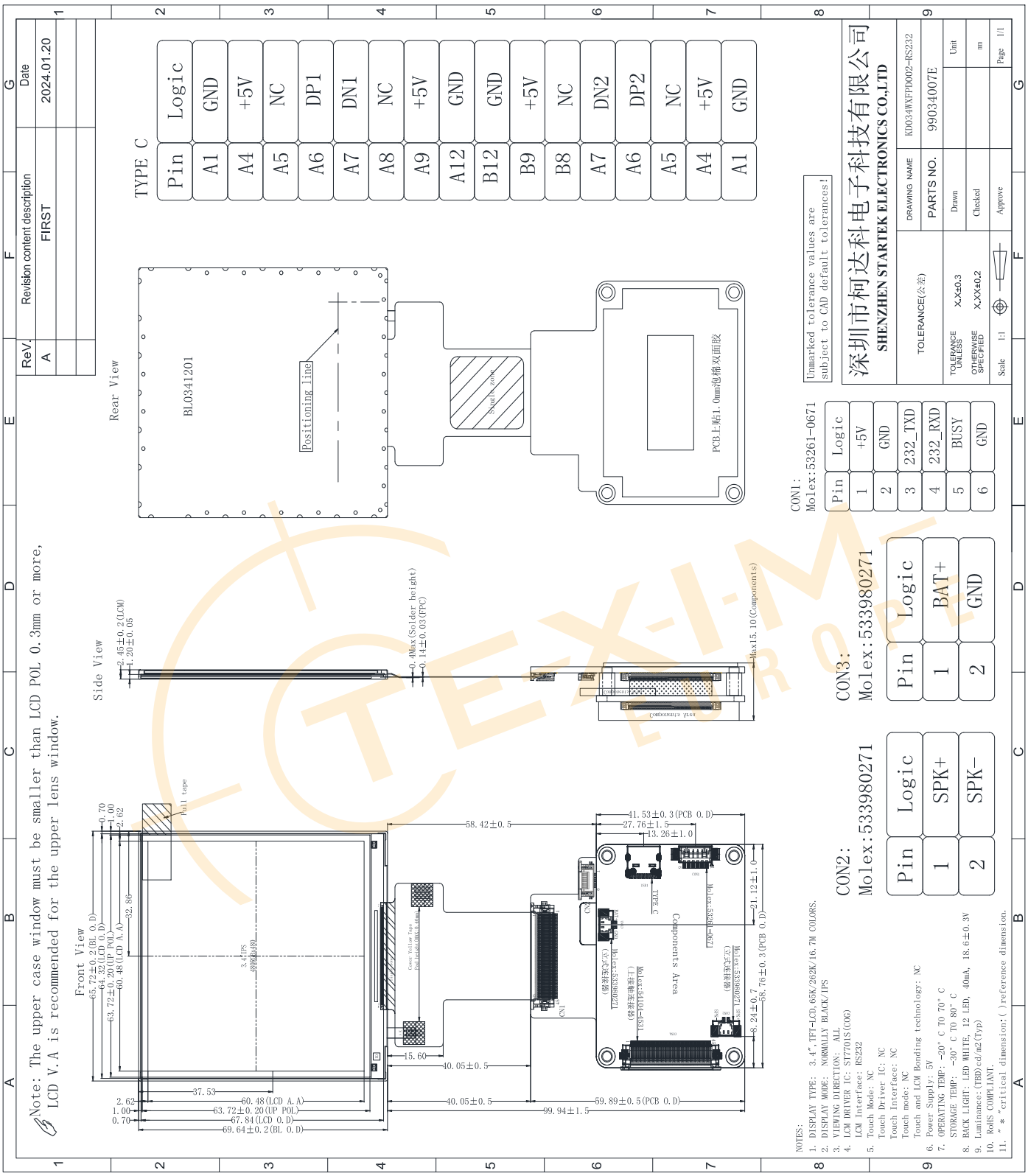
Features

General Information Items	Specification	Unit	Note
	Main Panel		
Display area(AA)	60.48(H)*60.48V) (3.4 inch)	mm	
Driver element	TFT active matrix	-	
Display colors	16.7M	colors	
Number of pixels	480(RGB)*480	dots	
Pixel arrangement	RGB vertical stripe	-	
Pixel pitch	0.042(H)*0.042(V)	mm	
Viewing angle	ALL	o'clock	
Display mode	Transmissive/Normally Black	-	
Touch type	NA	-	
Module Interface	RS232 (Support Modbus RTU Protocol)	-	
Flash Memory	128M-byte	-	
Operating temperature	-20～+70	℃	
Storage temperature	-30～+80	℃	
Module bonding technology	NA	-	

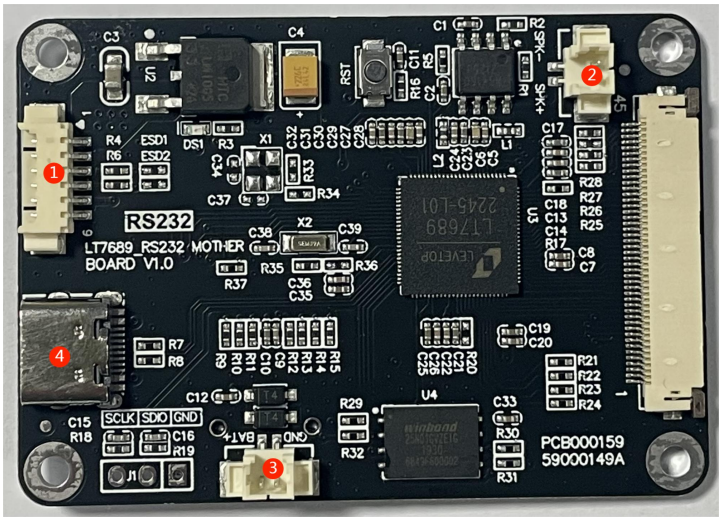
2. Block Diagram



3. Outline dimension



4. Input terminal Pin Assignment



①Communication port: CON1: Molex:53261-0671

NO.	SYMBOL	DISCRIPTION	I/O
1	5V	Power supply.	P
2	GND	Ground.	P
3	232_TXD	RS-232 driver output.	O
4	232_RXD	RS-232 receiver input.	I
5	BUSY	No function.	/
6	GND	Ground.	P

②Speaker port: CON2: Molex:533980271

NO.	SYMBOL	DISCRIPTION	I/O
1	SPK+	Speaker positive.	O
2	SPK-	Speaker cathode.	O

③RTC battery port: CON3: Molex:533980271

NO.	SYMBOL	DISCRIPTION	I/O
1	BAT+	Battery positive.	P
2	GND	Battery cathode.	P

④Type C connector only for power supply.

5. LCD Optical Characteristics

5.1 Optical specification

Item		Symbol	Condition	Min.	Typ.	Max.	Unit.	Note
Contrast Ratio		CR	Θ=0 Normal viewing angle	640	800	--		(1)(2)
Response time	Rising	$T_{R+}T_F$		--	30	35	msec	
	Falling							(1)(3)
Color gamut		S(%)		60	66.8	--	%	
Luminance		Lv		750	900	-	cd/m2	
Color Filter Chromacicity	White	W_X		-0.04	0.298	+0.04		(1)(4) CA-310
		W_Y			0.339			
	Red	R_X			0.637			
		R_Y			0.344			
	Green	G_X			0.307			
		G_Y			0.589			
	Blue	B_X			0.149			
		B_Y			0.066			
Viewing angle	Hor.	ΘL	CR>10	75	85	--		(1)(4)
		ΘR		75	85	--		
	Ver.	ΘU		75	85	--		
		ΘD		75	85	--		
Option View Direction		ALL						

*The data comes from the LCD specification.

Measuring Condition

Measuring surrounding : dark room

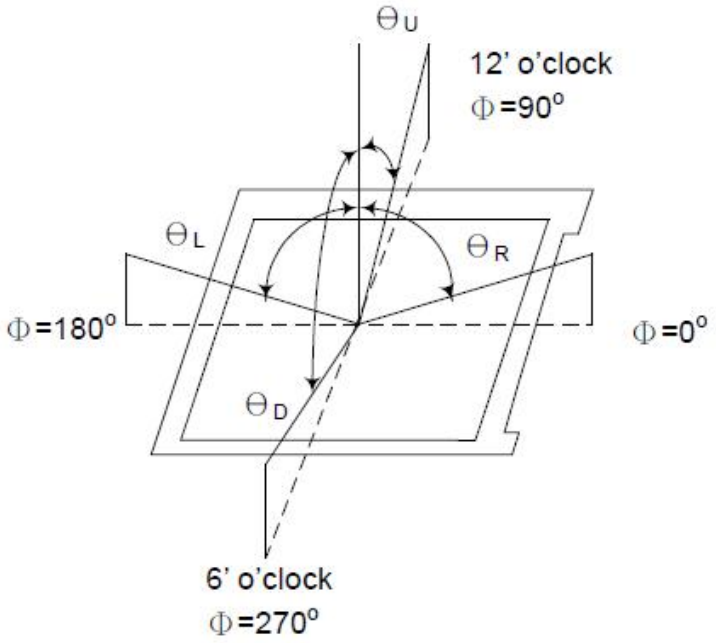
Ambient temperature : 25±2oC

15min. warm-up time.

Measuring Equipment

FPM520 of Westar Display technologies, INC., which utilized SR-3 for Chromaticity and BM-5A for other optical characteristics.

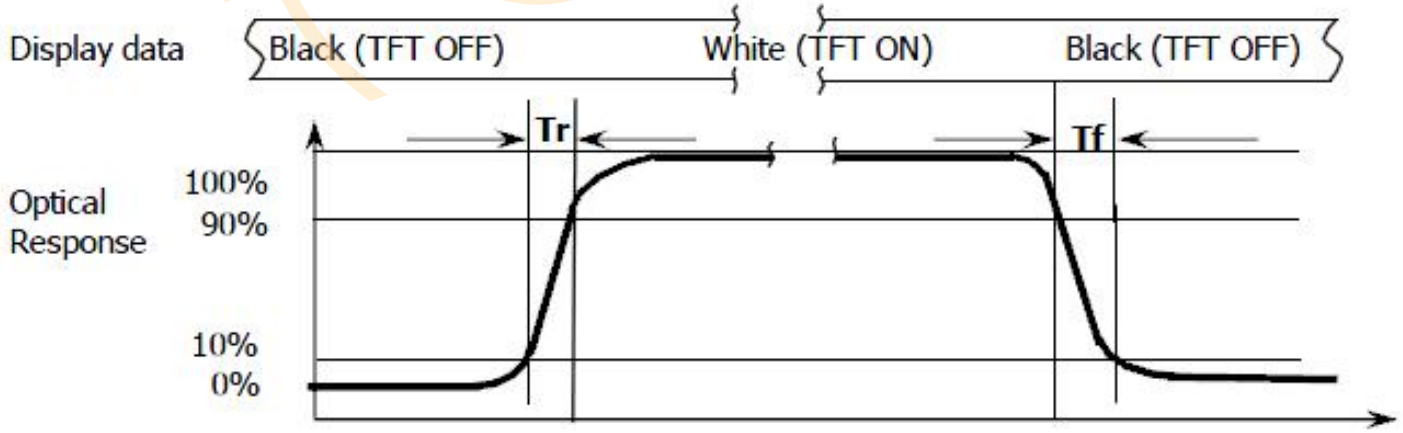
Note (1): Definition of Viewing Angle :



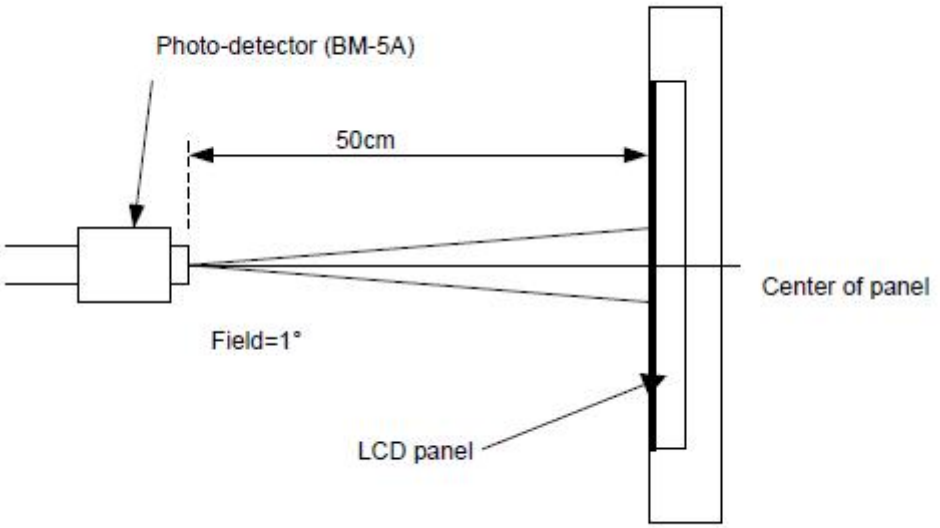
Note (2): Definition of Contrast Ratio(CR) :measured at the center point of panel

$$CR = \frac{\text{Luminance with all pixels white}}{\text{Luminance with all pixels black}}$$

Note (3): Response Time



Note (4): Definition of optical measurement setup



6. Electrical Characteristics

6.1 Absolute Maximum Rating

Characteristics	Symbol	Min.	Max.	Unit	Note
Power supply	5V	2.2	6	V	Note1
Operating temperature	T_{OP}	-20	+70	℃	
Storage temperature	T_{ST}	-30	+80	℃	

NOTE1: Stresses greater than those listed under Maximum Ratings may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions above those indicated in the operation is not implied. Exposure to absolute maximum rating conditions for extended periods may affect reliability.

6.2 DC Electrical Characteristics

Characteristics	Symbol	Min.	Typ.	Max.	Unit	Note
Power supply	5V	4.5	5	5.5	V	
Normal mode Current	I_{5V}	--	250	--	mA	
Baudrate	Br	--	115200	--	bps	

PARAMETER	MIN.	TYP.	MAX.	UNITS	CONDITIONS
DC CHARACTERISTICS					
Supply Current		0.3	1.0	mA	no load, T_{AMB} = +25°C, V_{CC} = 3.3V
Shutdown Supply Current		1.0	10	µA	$\overline{SHDN}$ = GND, T_{AMB} = +25°C, V_{CC} = +3.3V
LOGIC INPUTS AND RECEIVER OUTPUTS					
Input Logic Threshold LOW			0.8	V	TxIN, $\overline{EN}$, $\overline{SHDN}$, Note 2
Input Logic Threshold HIGH	2.0 2.4			V	V_{CC} = 3.3V, Note 2 V_{CC} = 5.0V, Note 2
Input Leakage Current		±0.01	±1.0	µA	TxIN, $\overline{EN}$, $\overline{SHDN}$, T_{AMB} = +25°C
Output Leakage Current		±0.05	±10	µA	receivers disabled
Output Voltage LOW			0.4	V	I_{OUT} = 1.6mA
Output Voltage HIGH	V_{CC}-0.6	V_{CC}-0.1		V	I_{OUT} = -1.0mA
DRIVER OUTPUTS					
Output Voltage Swing	±5.0	±5.4		V	3kΩ load to ground at all driver outputs, T_{AMB} = +25°C
Output Resistance	300			Ω	V_{CC} = V+ = V- = 0V, T_{OUT} = ±2V
Output Short-Circuit Current		±35 ±70	±60 ±100	mA mA	V_{OUT} = 0V V_{OUT} = ±15V
Output Leakage Current			±25	µA	V_{OUT} = ±12V, V_{CC} = 0V to 5.5V, drivers disabled

PARAMETER	MIN.	TYP.	MAX.	UNITS	CONDITIONS
RECEIVER INPUTS					
Input Voltage Range	-15		+15	V	
Input Threshold LOW	0.6 0.8	1.2 1.5		V	V_{CC}=3.3V V_{CC}=5.0V
Input Threshold HIGH		1.5 1.8	2.4 2.4	V	V_{CC}=3.3V V_{CC}=5.0V
Input Hysteresis		0.3		V	
Input Resistance	3	5	7	kΩ	
TIMING CHARACTERISTICS					
Maximum Data Rate	120	235		kbps	R_L=3kΩ, C_L=1000pF, one driver switching
Driver Propagation Delay		1.0 1.0		µs µs	t_{PHL}, R_L = 3KΩ, C_L = 1000pF t_{PLH}, R_L = 3KΩ, C_L = 1000pF
Receiver Propagation Delay		0.3 0.3		µs	t_{PHL}, RxIN to RxOUT, C_L=150pF t_{PLH}, RxIN to RxOUT, C_L=150pF
Receiver Output Enable Time		200		ns	
Receiver Output Disable Time		200		ns	
Driver Skew		100	500	ns	$\lvert t_{PHL} - t_{PLH} \rvert$, T_{AMB} = 25°C
Receiver Skew		200	1000	ns	$\lvert t_{PHL} - t_{PLH} \rvert$
Transition-Region Slew Rate			30	V/µs	V_{CC} = 3.3V, R_L = 3KΩ, T_{AMB} = 25°C, measurements taken from -3.0V to +3.0V or +3.0V to -3.0V

NOTE 2: Driver input hysteresis is typically 250mV.

7. Development Environment Introduction

UI_Editor II is a graphic compiler, its function is according the customer's requirements to pack the font、image、configuration parameters etc and produce a BIN file finally.

Startek will provide it for customer.

Main Screen

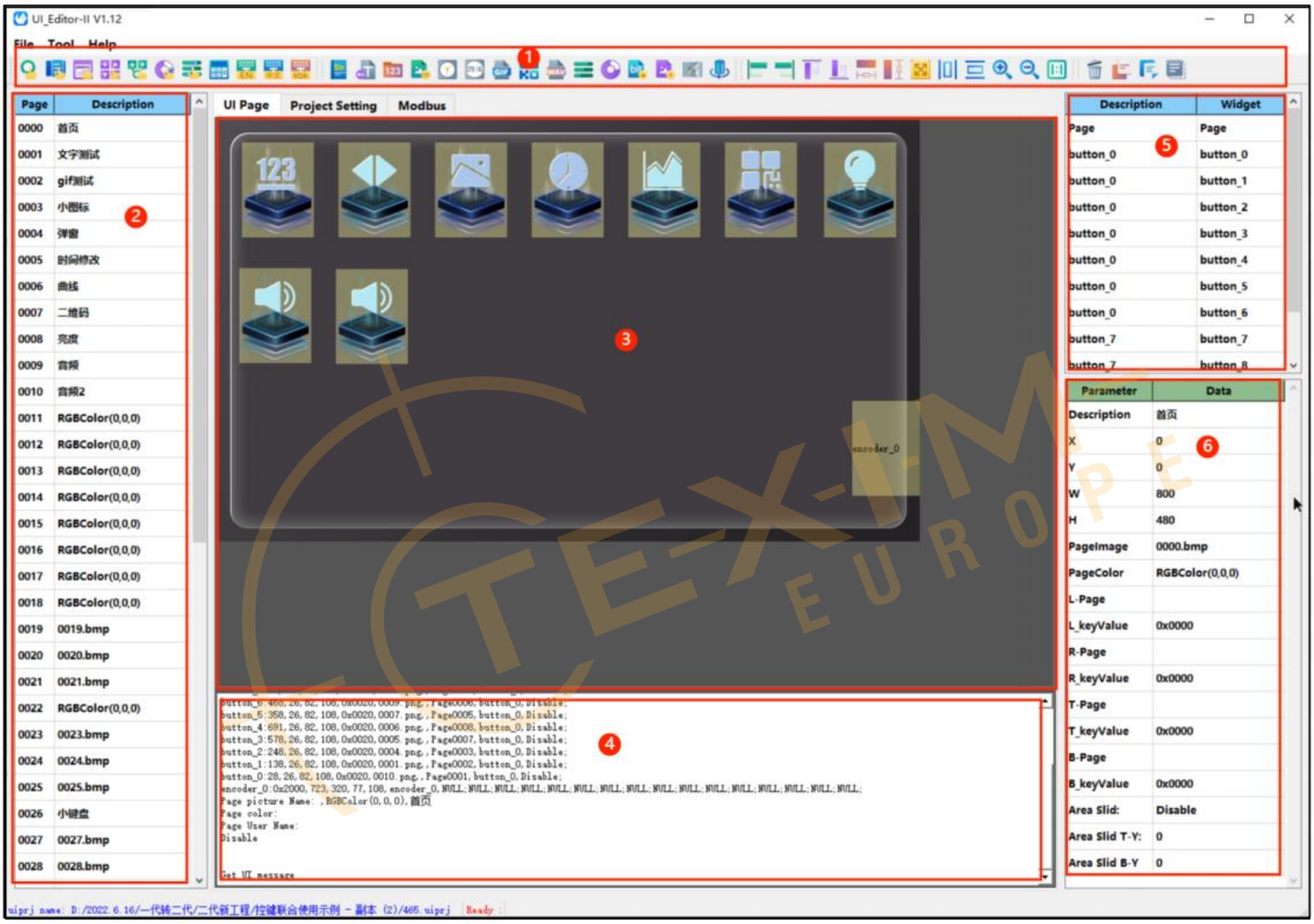


Figure 2-24: Main Screen

7.1 Tool bar

As shown in Figure 2-24, ❶, developers may click on the icons to add various widgets, such as button, picture, text, and more. Hover the mouse cursor on an icon, the name of the icon will pop-up. Left click on an icon, the mouse cursor will then be switched to Cross style. Developers may then start to add the designated widget to the editing area, and drag it to adjust its width and height. Widgets may be added continuously as long as the mouse cursor remains Cross style. Right click the mouse on the editing area to exit the selection mode, and the mouse cursor will be switched back to Arrow style.

The tool bar can be classified into 4 parts, as illustrated in Figure 2-25:

❶ Widgets with touch function

❷ Widgets with display function

❸ Widgets for layout and alignment

❹ Widgets for delete/copy operations

Figure 2-25: Tool bar

7.2 Page ID and Name List

As shown in Figure 2-24, ❷, the left column represents Page ID (unchangeable), and the right column represents the name of the page (user definable)

7.3 Page Editing Window

As shown in Figure 2-24, ❸, developers may edit (e.g. adding widgets) within the basemap.

7.4 Status Window

As shown in Figure 2-24, ❹, every operation process will be listed here in a timely manner. Developers may check the process results in the status window when making bin files.

7.5 Widget List

As shown in Figure 2-24, ❺, this area lists all the available widgets in the designated page. Click the listed name to quickly locate the desired widget in the page editing window

7.6 Widget – Parameter Setting Window

As shown in Figure 2-24, ❻, parameters for selected widget can be setup here, including but not limted to name, address, and coordinates etc.

8. Update Users Flash Code

Users need to update own UartTFT-II_Flash.bin into the uart TFT module after finish all design in the UI_Editor II .

There is a micro SD card slot in the backside of PCB(**Figure 2-26**), we will do the update via it.

SD card requirements

It requests a SD card which is from 4GB to 32GB, and the format is FAT32.

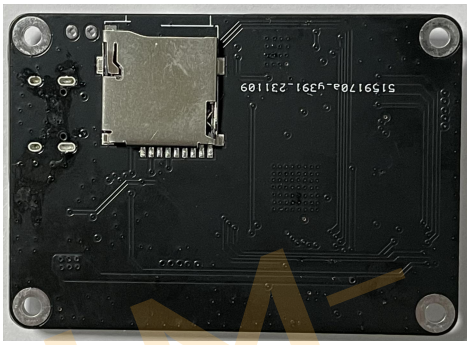


Figure 2-26

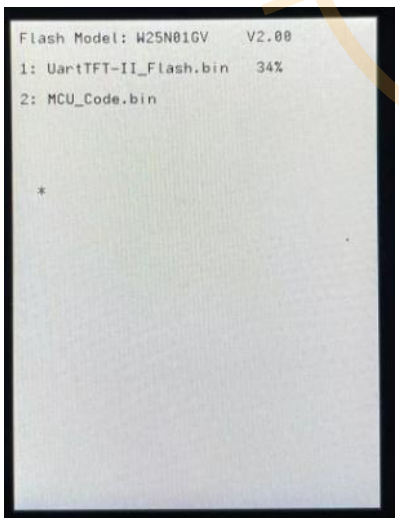
Update step

① We need to create a folder in the root directory of SD card, and the name must be“**UartTFT_Flash**” .

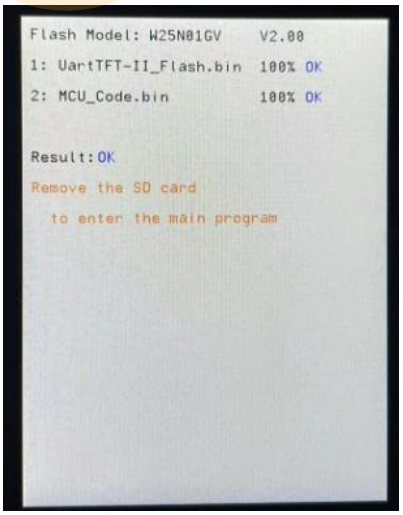
② Copy your “**UartTFT-II_Flash.bin**” into this folder, UI_Editor II will generate the “**UartTFT-II_Flash.bin”** after build your project.

③ Plug in SD card and power on, uart TFT will start to do the update,we need to remove the SD card make the uart TFT enter the main program after finish update.

Updating



Update finished



9. LCD Module Out-Going Quality Level

9.1 VISUAL & FUNCTION INSPECTION STANDARD

9.1.1 Inspection conditions

Inspection performed under the following conditions is recommended.

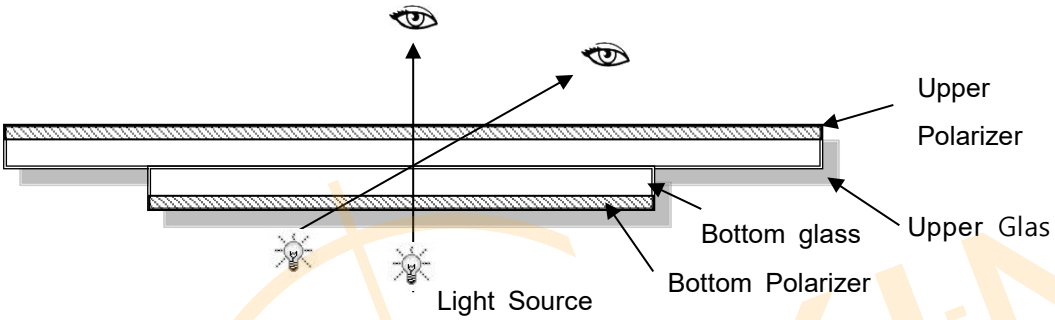
Temperature : 25±5℃

Humidity : 65%±10%RH

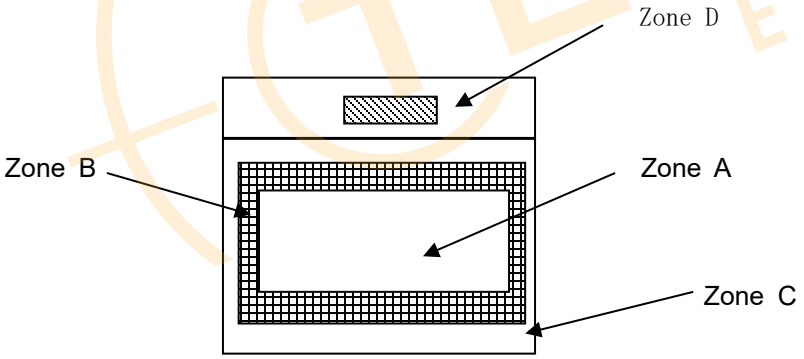
Viewing Angle : Normal viewing Angle.

Illumination: Single fluorescent lamp (300 to 700Lux)

Viewing distance:30-50cm



9.1.2 Definition



Zone A : Effective Viewing Area(Character or Digit can be seen)

Zone B : Viewing Area except Zone A

Zone C : Outside (Zone A+Zone B) which can not be seen after assembly by customer .)

Zone D : IC Bonding Area

Note:As a general rule ,visual defects in Zone C can be ignored when it doesn't effect product function or appearance after assembly by customer

9.1.3 Sampling Plan

According to GB/T 2828-2012 ; , normal inspection, Class Ⅱ

AQL:

Major defect	Minor defect
0.65	1.5

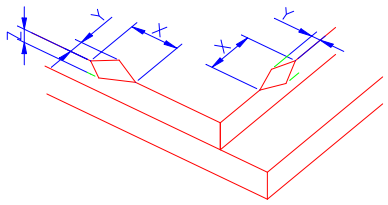
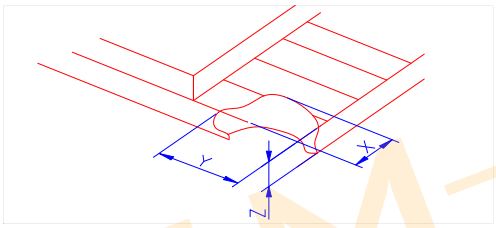
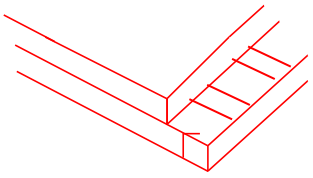
LCD: Liquid Crystal Display , LCM: Liquid Crystal Module, CTP: Capacitive Touch Panel

No	Items to be inspected	Criteria	Classification of defects
1	Functional defects	1) No display, Open or miss line 2) Display abnormally, Short 3) Backlight no lighting, abnormal lighting. etc	Major
2	Missing	Missing components and etc	
3	Outline dimension	Overall outline dimension beyond the drawing is not allowed,deformation and etc	
4	Color tone	Color unevenness, refer to limited sample	Minor
5	Spot/Line defect	Light dot,Dim spot,(Note1) Polarizer Air Bubble, Polarizer accidented spot and etc	
6	Soldering appearance	Good soldering , Peeling off is not allowed and etc	
7	LCD/Polarizer/CTP	Black/White spot/line, scratch, crack, etc.	

Note1: a) Light dot：Dots appear bright and unchanged in size in which LCD panel is displaying under black pattern.

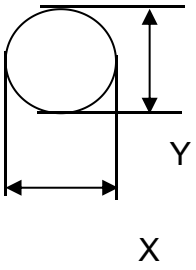
b) Dim dot: Dots appear dark and unchanged in size in which LCD panel is displaying under pure red, green, blue picture.

9.1.4 Criteria (Visual)

<table>
<tr><th>Number</th><th>Items</th><th>Criteria(mm)</th></tr>
<tr><td rowspan="3">1.0 LCD Crack/Broken
NOTE:
X: Length
Y: Width
Z: Height
L: Length of ITO,
T: Height of LCD</td><td>(1) The edge of LCD broken</td><td> 
<table><tr><th>X</th><th>Y</th><th>Z</th></tr><tr><td>≤3.0mm</td><td><Inner border line of the seal</td><td>≤T</td></tr></table></td></tr>
<tr><td>(2)LCD corner broken</td><td> 
<table><tr><th>X</th><th>Y</th><th>Z</th></tr><tr><td>≤3.0mm</td><td>≤L</td><td>≤T</td></tr></table></td></tr>
<tr><td>(3) LCD crack</td><td> 
Crack
Not allowed</td></tr>
</table>

2.0

Spot defect



Φ=(X+Y)/2

① light dot (black/white spot , pinhole, stain, etc.)

Zone / Size (mm)	Acceptable Qty		
	A	B	C
Φ≤0.15	Ignore	Ignore	
0.15<Φ≤0.25	3(distance≧10mm)		
0.25<Φ≤0.4	2(distance≧10mm)		
Φ>0.4	0		

② Dim spot (light leakage、dent、dark spot, etc)

Zone / Size (mm)	Acceptable Qty		
	A	B	C
Φ≤0.15	Ignore	Ignore	
0.15<Φ≤0.25	3(distance≧10mm)		
0.25<Φ≤0.4	2(distance≧10mm)		
Φ>0.4	0		

③ Polarizer accidented spot

Zone / Size (mm)	Acceptable Qty		
	A	B	C
Φ≤0.2	Ignore		Ignore
0.2<Φ≤0.5	2(distance≧10mm)		
Φ>0.5	0		

④Polarizer Bubble

Zone / Size (mm)	Acceptable Qty		
	A	B	C
Φ≤0.2	Ignore		Ignore
0.2<Φ≤0.4	3(distance≧10mm)		
Φ>0.4	0		

3.0 LCD Pixel defect

Pixel bad points

Item	Zone A	Acceptable Qt
Bright dot	Random	N≤2
	2 dots adjacent	N≤0
	3 dots adjacent	N≤0
Dark dot	Random	N≤2
	2 dots adjacent	N≤0
	3 dots adjacent	N≤0
Distance	1. Minimum Distance Between Bright dots. 2. Minimum Distance Between dark dots 3. Minimum Distance Between dark and bright dot.	5mm
Total bright and dark dot		N≤4

Note:

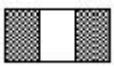
A) Bright dot：Dots appear bright and unchanged in size in which LCD panel is displaying under black pattern.

B) Dark dot: Dots appear dark and unchanged in size in which LCD panel is displaying under pure red, green, blue picture.

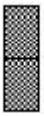
C) 2 dot adjacent = 1 pair = 2 dots

Picture:

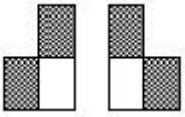
2 dot adjacent



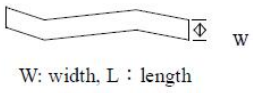
2 dot adjacent



2 dot adjacent (vertical)



2 dot adjacent (slant)

<table>
<tr>
<td>4.0</td>
<td>Line defect (LCD /Polarizer backlight black/white line, scratch, stain)
 

N : Count</td>
<td>
<table>
<tr><th rowspan="2">Width(mm)</th><th rowspan="2">Length(mm)</th><th colspan="3">Acceptable Qty</th></tr>
<tr><th>A</th><th>B</th><th>C</th></tr>
<tr><td>Φ≤0.05</td><td>Ignore</td><td colspan="2">Ignore</td><td rowspan="3">Ignore</td></tr>
<tr><td>0.05<W≤0.06</td><td>L≤4.0</td><td colspan="2">N≤3</td></tr>
<tr><td>0.06<W≤0.08</td><td>L≤3.0</td><td colspan="2">N≤2</td></tr>
<tr><td>W>0.08</td><td colspan="4">Define as spot defect</td></tr>
</table>
</td>
</tr>
<tr>
<td>5.0</td>
<td>Electronic Components SMT.</td>
<td>Not allow missing parts，solderless connection，cold solder joint，mismatch，The positive and negative polarity opposite</td>
</tr>
<tr>
<td>6.0</td>
<td>Display color& Brightness.</td>
<td>1. Color：Measuring the color coordinates, The measurement standard according to the datasheet or samples.
2. Brightness：Measuring the brightness of White screen, The measurement standard according to the datasheet or Samples.</td>
</tr>
<tr>
<td>7.0</td>
<td>LCD Mura/Waving/ Hot spot</td>
<td>Not visible through 5% ND filter in 50% gray or judge by limit sample if necessary.</td>
</tr>
</table>

Criteria (functional items)

Number	Items	Criteria (mm)
1	No display	Not allowed
2	Missing segment	Not allowed
3	Short	Not allowed
4	Backlight no lighting	Not allowed
5	CTP no function	Not allowed

10. Reliability Test Result

Item	Condition	Inspection after test
High Temperature Operating	70℃, 96HR	Inspection after 2~4hours storage at room temperature, the sample shall be free from defects: 1.Air bubble in the LCD; 2.Non-display; 3.Missing segments/line; 4.Glass crack; 5.Current IDD is twice higher than initial value.
Low Temperature Operating	-20℃, 96HR	
High Temperature Storage	80℃, 96HR	
Low Temperature Storage	-30℃, 96HR	
High Temperature & High Humidity Operating	+60℃, 90% RH ,96 hours.	
Thermal Shock (Non-operation)	-10℃,30 min ↔ 60℃,30 min, Change time:5min 20CYC.	
ESD test	C=150pF, R=330,5points/panel Air:±8KV, 5times; Contact:±6KV, 5 times; (Environment: 15℃~35℃, 30%~60%).	
Vibration (Non-operation)	Frequency range:10~55Hz, Stroke:1.5mm Sweep:10Hz~55Hz~10Hz 2 hours for each direction of X.Y.Z. (6 hours for total) (Package condition).	
Box Drop Test	1 Corner 3 Edges 6 faces,80㎝(MEDIUM BOX)	

Remark:

1.The test samples should be applied to only one test item.

2.Sample size for each test item is 5~10pcs.

3.For Damp Proof Test, Pure water(Resistance > 10MΩ) should be used.

4.In case of malfunction defect caused by ESD damage, if it would be recovered to normal state after resetting, it would be judged as a good part.

5.Failure Judgment Criterion: Basic Specification, Electrical Characteristic, Mechanical Characteristic, Optical Characteristic.

6. The color fading mura of polarizing filter should not care.

11. Cautions and Handling Precautions

11.1 Handling and Operating the Module

(1) When the module is assembled, it should be attached to the system firmly.
Do not warp or twist the module during assembly work.
(2) Protect the module from physical shock or any force. In addition to damage, this may cause improper operation or damage to the module and back-light unit.
(3) Note that polarizer is very fragile and could be easily damaged. Do not press or scratch the surface.
(4) Do not allow drops of water or chemicals to remain on the display surface.
If you have the droplets for a long time, staining and discoloration may occur.
(5) If the surface of the polarizer is dirty, clean it using some absorbent cotton or soft cloth.
(6) The desirable cleaners are water, IPA (Isopropyl Alcohol) or Hexane.
Do not use ketene type materials (ex. Acetone), Ethyl alcohol, Toluene, Ethyl acid or Methyl chloride. It might permanent damage to the polarizer due to chemical reaction.
(7) If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth. In case of contact with hands, legs, or clothes, it must be washed away thoroughly with soap.
(8) Protect the module from static; it may cause damage to the CMOS ICs.
(9) Use finger-stalls with soft gloves in order to keep display clean during the incoming inspection and assembly process.
(10) Do not disassemble the module.
(11) Protection film for polarizer on the module shall be slowly peeled off just before use so that the electrostatic charge can be minimized.
(12) Pins of I/F connector shall not be touched directly with bare hands.
(13) Do not connect, disconnect the module in the “Power ON” condition.

11.2 Storage and Transportation.

(1) Do not leave the panel in high temperature, and high humidity for a long time.
It is highly recommended to store the module with temperature from 0 to 35 ℃ and relative humidity of less than 70%
(2) Do not store the TFT-LCD module in direct sunlight.
(3) The module shall be stored in a dark place. When storing the modules for a long time, be sure to adopt effective measures for protecting the modules from strong ultraviolet radiation, sunlight, or fluorescent light.
(4) It is recommended that the modules should be stored under a condition where no condensation is allowed. Formation of dewdrops may cause an abnormal operation or a failure of the module.
In particular, the greatest possible care should be taken to prevent any module from being operated where condensation has occurred inside.

(5) This panel has its circuitry FPC on the bottom side and should be handled carefully in order not to be stressed.

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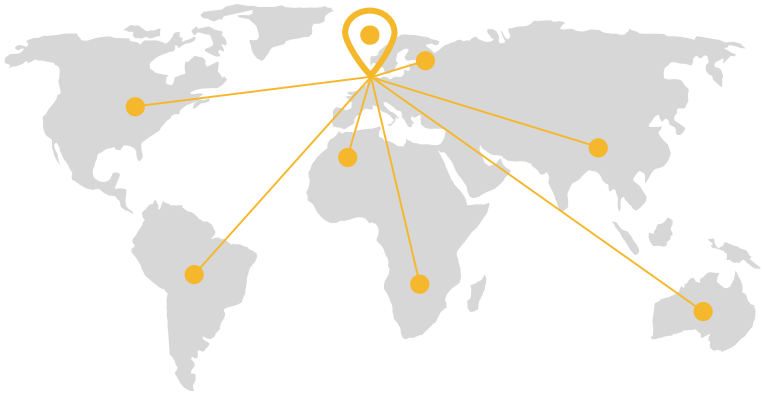

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