

# SPECIFICATION FOR TFT MODULE

**MODULE NO: YB-TG240320S45A-N-A0**

**Doc.Version:00**

Customer Approval:

<input type="checkbox"/> Accept	<input type="checkbox"/> Reject
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YEEBO	NAME	SIGNATURE	DATE
Prepare	Electronic Engineer	黄松	2025-03-28
Check	Mechanical Engineer	张雷	2025/3/28
Verify			
Approval		孙玉菊	<div style="border: 1px solid green; padding: 2px; display: inline-block; font-size: 8px;">           APPROVED Sunray, 2025/3/31, 17:27:31         </div>

■ APPROVAL FOR SPECIFICATIONS ONLY

□ APPROVAL FOR SPECIFICATIONS AND SAMPLE

WIMRD005-02-D



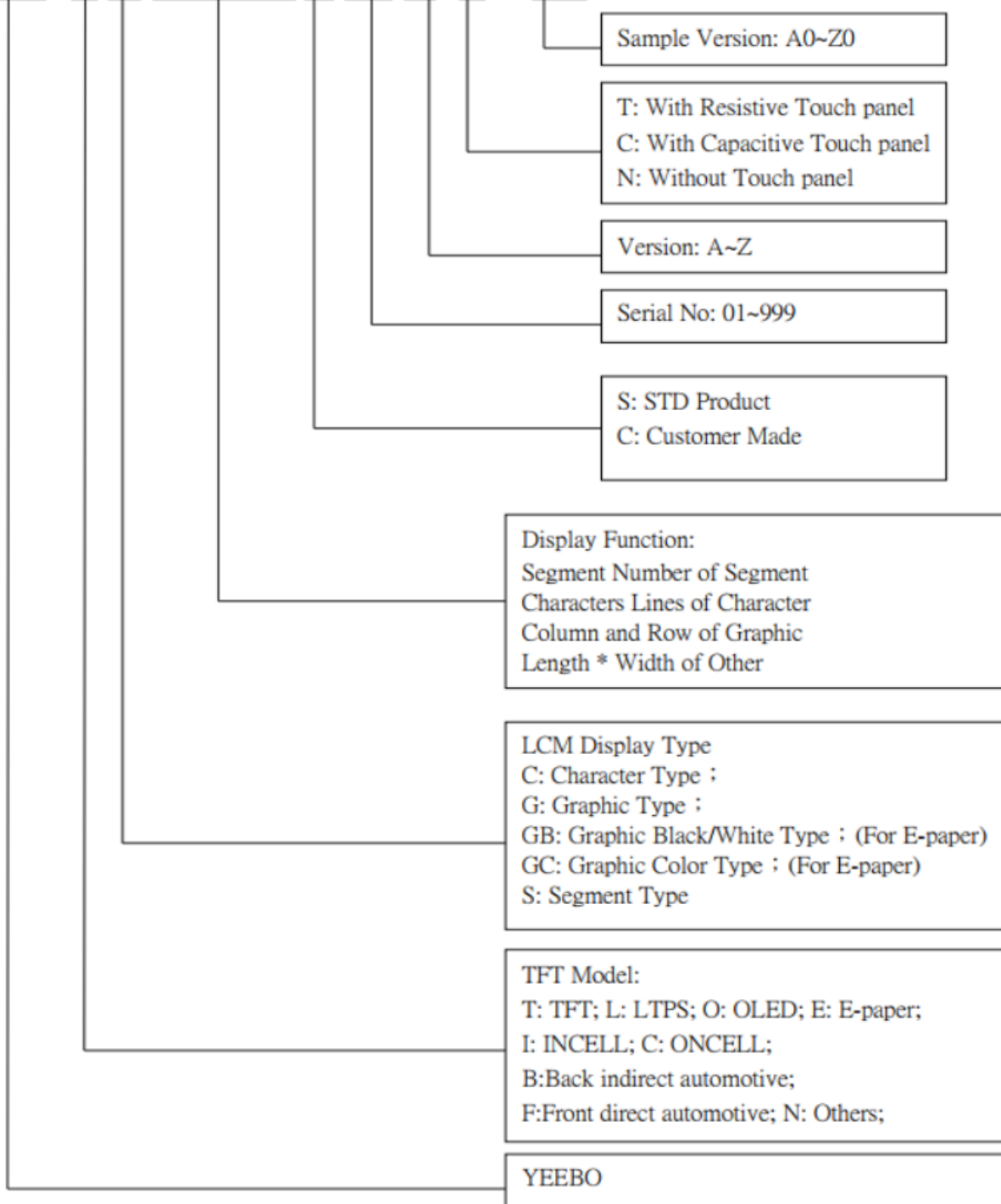
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### 3. Module Numbering System:

(Example)

**YB- T G 240320 S 01 D -T - A0**

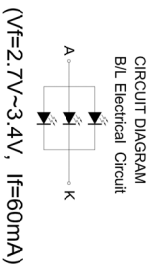
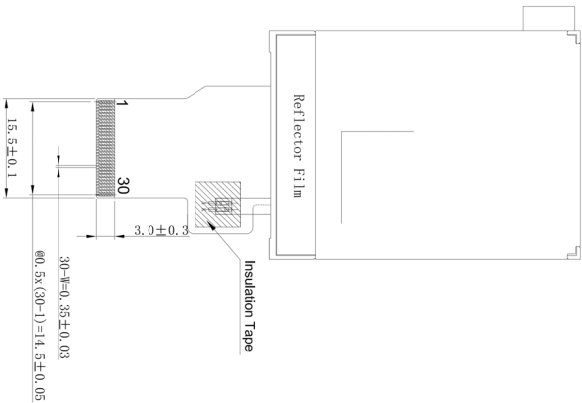
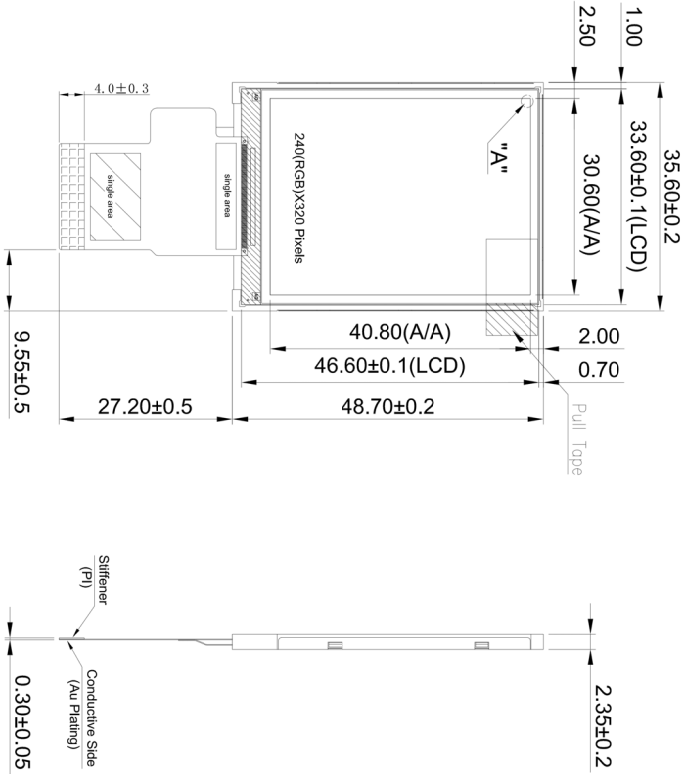


#### **4. General Specification:**

ITEM	CONTENTS
Module Size	35.6 (W) * 48.7 (H) * 2.35 (T) mm
Display Size(Diagonal)	2.0 inch
Display Format	240(RGB) * 320 Pixels
Active Area	30.6 (W) * 40.8 (H) mm
Pixel Pitch	0.0425*0.1275 mm
LCD Type	262K Color / Transmissive / Normal Black
View Direction	Free
Controller IC	ST7789P3
Weight	TBD

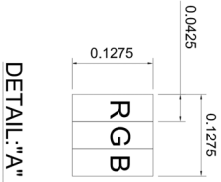
## 5. LCM drawing:

Count drawing & Spec:revision record during discussion with customer	
Rec. #1	Revision content description
FIRST ISSUE	Date
	2025-03-28



PIN	Pin Assignment
1	IM3
2	IM2
3	IM1
4	IM0
5	RESX
6	CSX
7	DCX/SCL
8	WRX/DCX
9	RDX
10	VSYNCG
11	HSYNG
12	ENABLE
13	DOTCLK
14	SDA
15	DB00
16	DB01
17	DB02
18	DB03
19	DB04
20	DB05
21	DB06
22	DB07
23	DB08
24	TE
25	SDO
26	VDD
27	VDDI
28	GND
29	LEDA
30	LEDK

- Specification:**
1. Display mode: 2.0" TFT(262K) / Normally Black / Transmissive
  2. Viewing direction: FULL
  3. Operating temperature: -20°C to +70°C  
Storage temperature: -30°C to +80°C
  4. Driver IC is: ST7789P3 or Compatible
  5. Backlight: 3 CHIP WHITE LED
  6. Unspecified tolerance: ±0.30mm
  7. ROHS compliant
  8. Luminous Intensity for LCM: 250cd/m2(min.), 300cd/m2(tp.)
  9. 产品结构: TFT



		MOD. Name	YB-TG240320S45A-N-A	Sheet	1
		DESIGNED	张雷	FILE NAME	Count Dwg.
UNIT	SIZE	SCALE	CHECKED	VERIFIED	APPROVED
mm	A4	N-T-S			
					

## 6. Electrical Characteristics

### 6-1 Absolute Maximum Ratings

(Ta=25°C)

Item	Symbol	Values			Unit
		Min	Type.	Max	
TFT Operation Frame rate	Hz	50	60	70	Hz
TFT common electrode voltage	VCOM	-1.4	-1	-0.4	V
TFT gate on voltage	VGH	12.2	15	14.97	V
TFT gate off voltage	VGL	-12.5	-10.5	-7.6	V
Vgh-Vgl	Vgh-Vgl	19.36	25.5	27.47	V

Note 1:

VCOM value should be adjusted by different condition to optimize Flicker Value.

Note 2:

VGH and VGL are the operating voltages of TFT gate.

### 6-2 Operating Conditions

(Ta=25°C )

Item	Symbol	Condition	Min.	Type	Max.	Unit	Remark
Power Supply Voltage	V <sub>DD</sub>	-	2.4	2.8	3.3	V	
Supply Voltage(Logic)	V <sub>DDI</sub>	-	1.65	1.8	3.3	V	
IO Supply Voltage	V <sub>IH</sub>	-	0.7 V <sub>DDI</sub>	-	V <sub>DDI</sub>	V	
	V <sub>IL</sub>	-	V <sub>SS</sub>	-	0.3 V <sub>DDI</sub>	V	
	V <sub>OH</sub>	-	0.8 V <sub>DDI</sub>	-	V <sub>DDI</sub>	mA	
	V <sub>OL</sub>	-	V <sub>SS</sub>	-	0.2 V <sub>DDI</sub>	V	
Power Supply Current	I <sub>DD</sub>	V <sub>DD</sub> =2.8V	-	TBD	-	mA	



### 6-3 DC Characteristics

Parameter	Symbol	Condition	Specification			Unit	Related Pins
			MIN.	TYP.	MAX.		
Power & Operation Voltage							
System Voltage	VDD	Operating voltage	2.4	2.75	3.3	V	
Interface Operation Voltage	VDDI	I/O Supply Voltage	1.65	1.8	3.3	V	
Gate Driver High Voltage	VGH		12.2		14.97	V	Note 4
Gate Driver Low Voltage	VGL		-12.5		-7.16	V	
Gate Driver Supply Voltage		VGH-VGL	19.36		27.47	V	Note 5
Input / Output							
Logic-High Input Voltage	VIH		0.7VDDI		VDDI	V	Note 1
Logic-Low Input Voltage	VIL		VSS		0.3VDDI	V	Note 1
Logic-High Output Voltage	VOH	IOH = -1.0mA	0.8VDDI		VDDI	V	Note 1
Logic-Low Output Voltage	VOL	IOL = +1.0mA	VSS		0.2VDDI	V	Note 1
Logic-High Input Current	IIH	VIN = VDDI			1	uA	Note 1
Logic-Low Input Current	IIL	VIN = VSS	-1			uA	Note 1
Input Leakage Current	IIL	IOH = -1.0mA	-0.1		+0.1	uA	Note 1
VCOM Voltage							
VCOM amplitude	VCOM			VSS		V	
Source Driver							
Source Output Range	Vsout		VAN		VAP	V	
Gamma Reference Voltage(Positive)	VAP		4.45		6.4	V	Note 6
Gamma Reference Voltage(Negative)	VAN		-4.6		-2.65	V	
Source Output Settling Time	Tr	Below with 99% precision			20	us	Note 2
Output Offset Voltage	VOFFSET				35	mV	Note 3

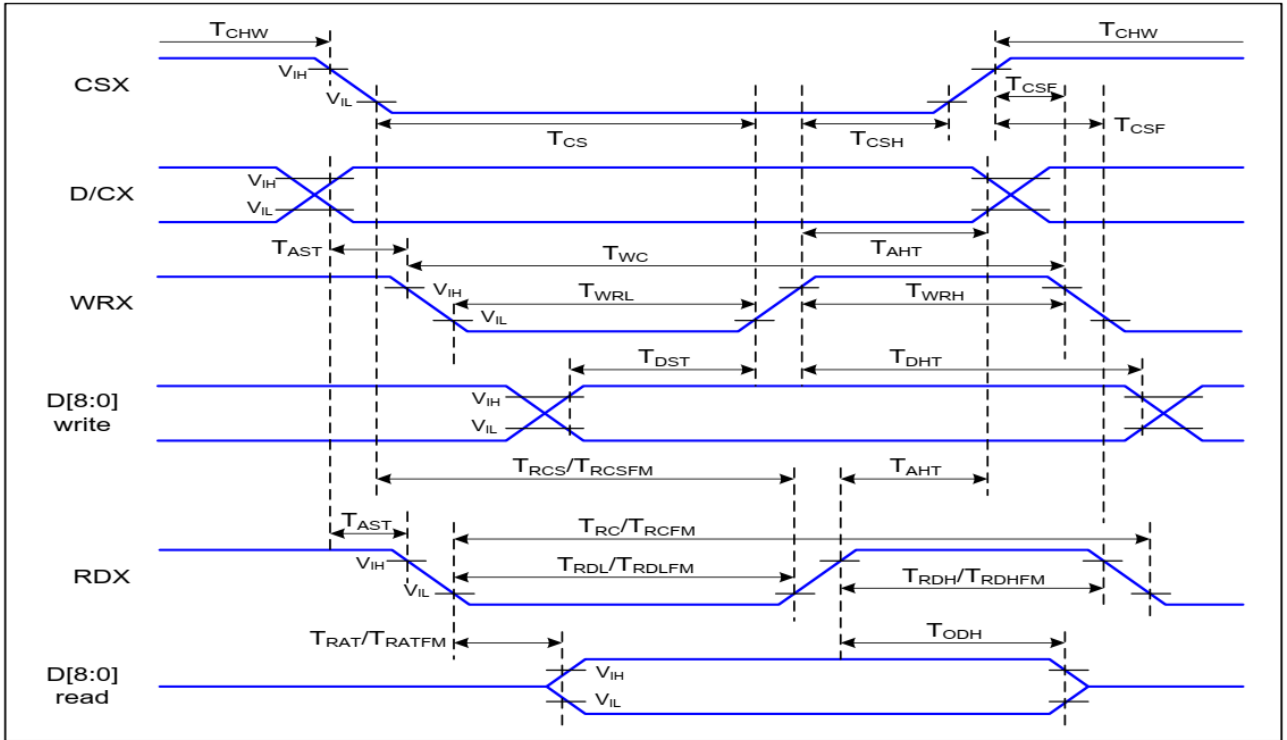
#### Basic DC Characteristics

Notes:

1. TA= -30 to 70 °C (to +85 °C no damage).
2. Source channel loading= 2KΩ+12pF/channel, Gate channel loading=5KΩ+40pF/channel.
3. The Max. Value is between measured point of source output and gamma setting value.
4. When evaluating the maximum and minimum of VGH, VDD=2.8V.
5. The maximum value of |VGH-VGL| cannot over 30V.
6. Default register setting of Vcom and Vcomoffset is 20h

## 6-4 AC Characteristics

### 8080 Series MCU Parallel Interface Characteristics: 9/8-bit Bus



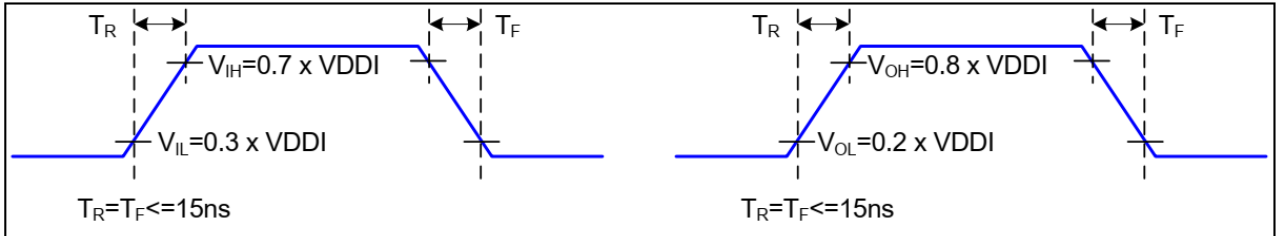
Parallel Interface Timing Characteristics (8080-Series MCU Interface)

VDDI=1.65 to 3.3V, VDD=2.4 to 3.3V, AGND=DGND=0V, Ta=25°C

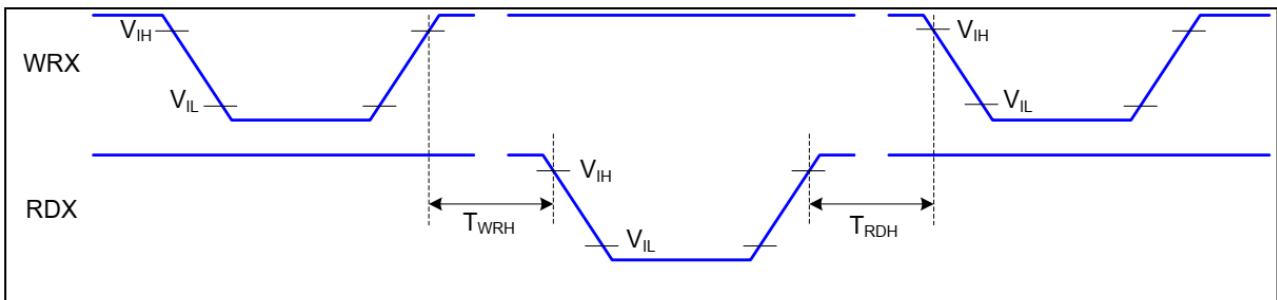
Signal	Symbol	Parameter	Min	Max	Unit	Description
D/CX	T <sub>AST</sub>	Address setup time	0	-	ns	-
	T <sub>AHT</sub>	Address hold time (Write/Read)	10	-	ns	
CSX	T <sub>CHW</sub>	Chip select "H" pulse width	0	-	ns	-
	T <sub>CS</sub>	Chip select setup time (Write)	15	-	ns	
	T <sub>RCS</sub>	Chip select setup time (Read ID)	45	-	ns	
	T <sub>RCSFM</sub>	Chip select setup time (Read FM)	355	-	ns	
	T <sub>CSF</sub>	Chip select wait time (Write/Read)	10	-	ns	
	T <sub>CSH</sub>	Chip select hold time	10	-	ns	
WRX	T <sub>WC</sub>	Write cycle	66	-	ns	-
	T <sub>WRH</sub>	Control pulse "H" duration	15	-	ns	
	T <sub>WRL</sub>	Control pulse "L" duration	15	-	ns	
RDX (ID)	T <sub>RC</sub>	Read cycle (ID)	160	-	ns	When read ID data
	T <sub>RDH</sub>	Control pulse "H" duration (ID)	90	-	ns	
	T <sub>RDL</sub>	Control pulse "L" duration (ID)	45	-	ns	
RDX (FM)	T <sub>RCFM</sub>	Read cycle (FM)	450	-	ns	When read from frame memory
	T <sub>RDHFM</sub>	Control pulse "H" duration (FM)	90	-	ns	
	T <sub>RDLFM</sub>	Control pulse "L" duration (FM)	355	-	ns	
D[8:0]	T <sub>DST</sub>	Data setup time	10	-	ns	For CL=30pF

$T_{DHT}$	Data hold time	10	-	ns
$T_{RAT}$	Read access time (ID)	-	40	ns
$T_{RATFM}$	Read access time (FM)	-	340	ns
$T_{ODH}$	Output disable time	20	80	ns

### 8080 Parallel Interface Characteristics



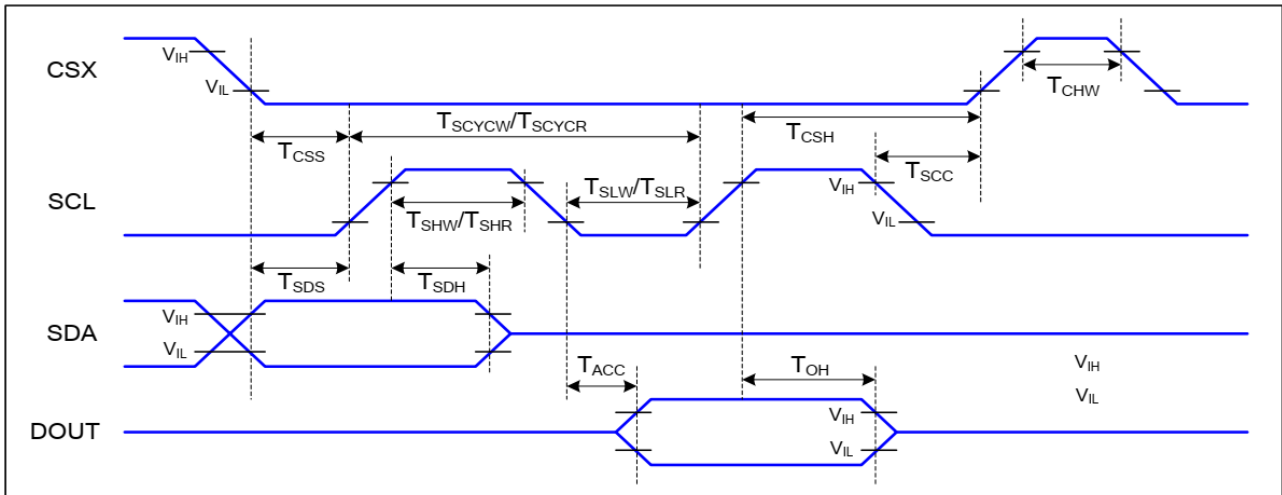
### Rising and Falling Timing for I/O Signal



### Write-to-Read and Read-to-Write Timing

**Note:** The rising time and falling time ( $T_r$ ,  $T_f$ ) of input signal and fall time are specified at 15 ns or less. Logic high and low levels are specified as 30% and 70% of VDDI for Input signals.

### Serial Interface Characteristics (3-line serial):

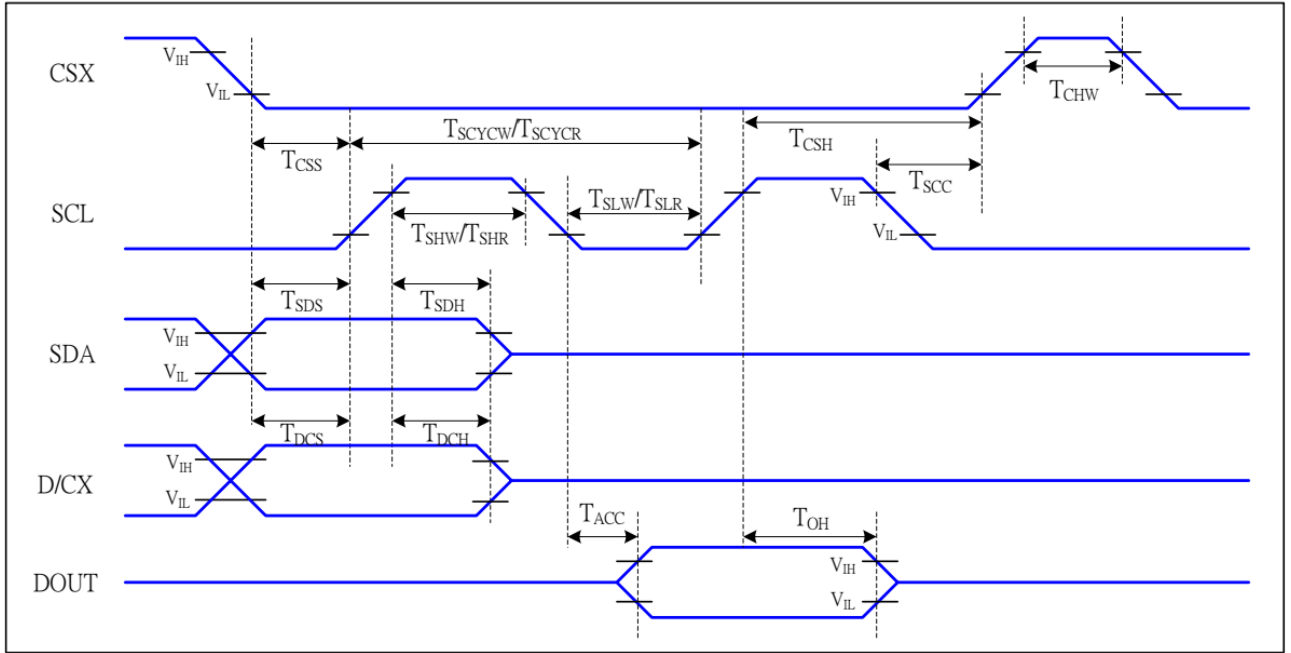


### 3-line serial interface timing characteristics

Signal	Symbol	Parameter	Min	Max	Unit	Description
CSX	T <sub>CSS</sub>	Chip select setup time (write)	15	-	ns	
	T <sub>CSH</sub>	Chip select hold time (write)	15	-	ns	
	T <sub>CSS</sub>	Chip select setup time (read)	60	-	ns	
	T <sub>SCC</sub>	Chip select hold time (read)	65	-	ns	
	T <sub>CHW</sub>	Chip select "H" pulse width	40	-	ns	
SCL	T <sub>SCYCW</sub>	Serial clock cycle (Write)	16	-	ns	
	T <sub>SHW</sub>	SCL "H" pulse width (Write)	7	-	ns	
	T <sub>SLW</sub>	SCL "L" pulse width (Write)	7	-	ns	
	T <sub>SCYCR</sub>	Serial clock cycle (Read)	150	-	ns	
	T <sub>SHR</sub>	SCL "H" pulse width (Read)	60	-	ns	
	T <sub>SLR</sub>	SCL "L" pulse width (Read)	60	-	ns	
SDA (DIN)	T <sub>SDS</sub>	Data setup time	7	-	ns	
	T <sub>SDH</sub>	Data hold time	7	-	ns	
DOUT	T <sub>ACC</sub>	Access time	10	50	ns	For maximum CL=30pF
	T <sub>OH</sub>	Output disable time	15	50	ns	For minimum CL=8pF

3-line serial interface timing characteristics

### Serial Interface Characteristics (4-line serial):



4-line serial interface timing characteristics

VDDI=1.65 to 3.3V, VDD=2.4 to 3.3V, AGND=DGND=0V, Ta=25°C

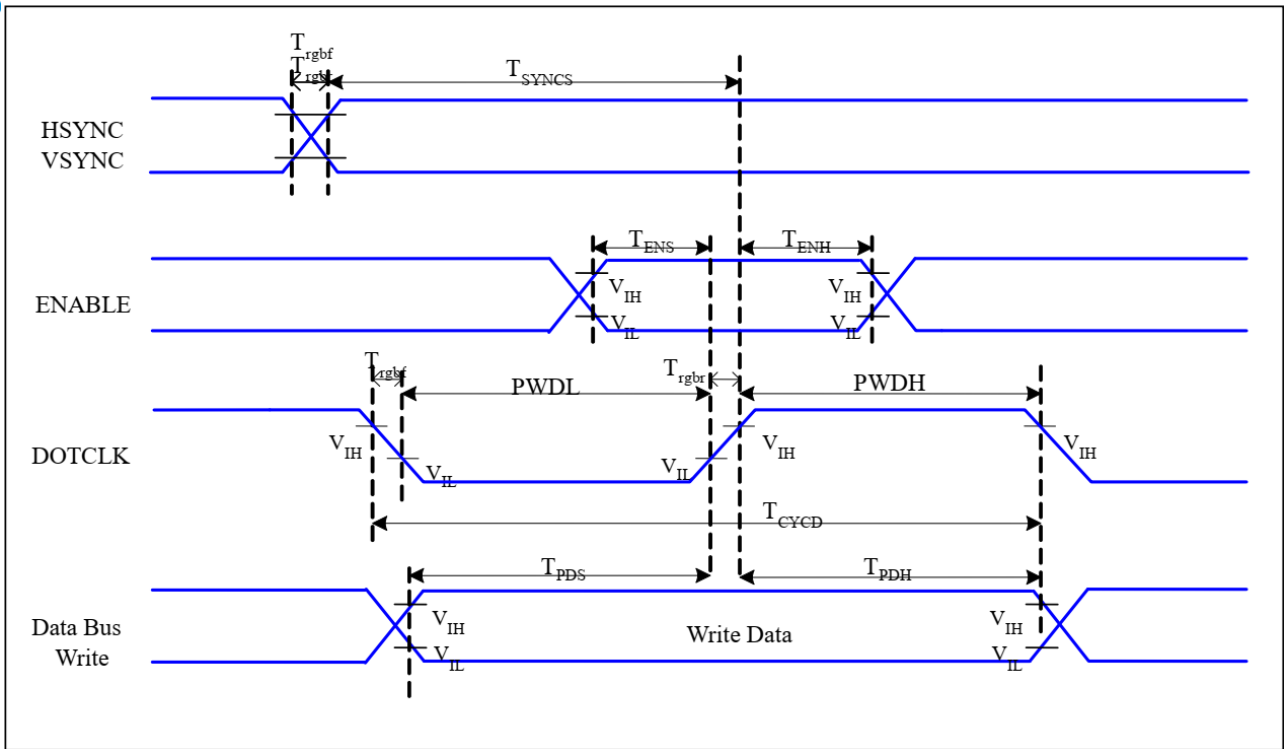
Signal	Symbol	Parameter	MIN	MAX	Unit	Description
CSX	T <sub>CSS</sub>	Chip select setup time (write)	15	-	ns	
	T <sub>CCH</sub>	Chip select hold time (write)	15	-	ns	
	T <sub>CSS</sub>	Chip select setup time (read)	60	-	ns	
	T <sub>SCC</sub>	Chip select hold time (read)	65	-	ns	
	T <sub>CHW</sub>	Chip select "H" pulse width	40	-	ns	
SCL	T <sub>SCYCW</sub>	Serial clock cycle (Write)	16	-	ns	-write command & data ram
	T <sub>SHW</sub>	SCL "H" pulse width (Write)	7	-	ns	
	T <sub>SLW</sub>	SCL "L" pulse width (Write)	7	-	ns	
	T <sub>SCYCR</sub>	Serial clock cycle (Read)	150	-	ns	-read command & data ram
	T <sub>SHR</sub>	SCL "H" pulse width (Read)	60	-	ns	
	T <sub>SLR</sub>	SCL "L" pulse width (Read)	60	-	ns	
D/CX	T <sub>DCS</sub>	D/CX setup time	10	-	ns	
	T <sub>DCH</sub>	D/CX hold time	10	-	ns	
SDA (DIN)	T <sub>SDS</sub>	Data setup time	7	-	ns	
	T <sub>SDH</sub>	Data hold time	7	-	ns	
DOUT	T <sub>ACC</sub>	Access time	10	50	ns	For maximum CL=30pF
	T <sub>OH</sub>	Output disable time	15	50	ns	For minimum CL=8pF

4-line serial interface timing characteristics

### Serial Interface Characteristics (RGB):

Module P/N: YB-TG240320S45A-N-A0

Doc.Version:00



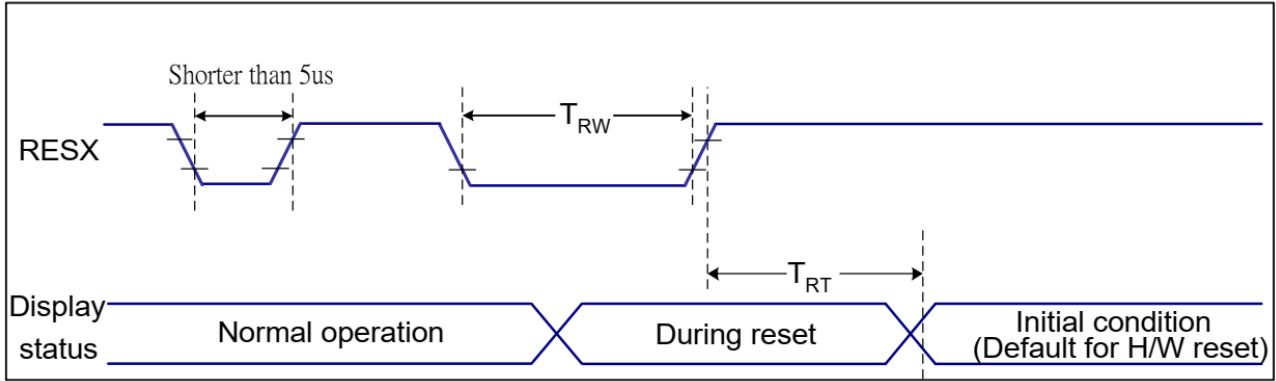
RGB interface timing characteristics

$V_{DDI}=1.65$  to  $3.3V$ ,  $V_{DD}=2.4$  to  $3.3V$ ,  $AGND=DGND=0V$ ,  $T_a=25^\circ C$

Signal	Symbol	Parameter	MIN	MAX	Unit	Description
HSYNC, VSYNC	$T_{SYNCS}$	VSYNC, HSYNC Setup Time	25	-	ns	
	$T_{ENS}$	Enable Setup Time	25	-	ns	
ENABLE	$T_{ENH}$	Enable Hold Time	25	-	ns	
	$PWDH$	DOTCLK High-level Pulse Width	25	-	ns	
DOTCLK	$PWDL$	DOTCLK Low-level Pulse Width	25	-	ns	
	$T_{CYCD}$	DOTCLK Cycle Time	55	-	ns	
	$T_{rgbr}$	DOTCLK Rise/Fall time	-	10	ns	
DB	$T_{PDS}$	PD Data Setup Time	25	-	ns	
	$T_{PDH}$	PD Data Hold Time	25	-	ns	

6 Bits RGB interface timing characteristics

## Reset Timing



$V_{DD1}=1.65$  to  $3.3V$ ,  $V_{DD}=2.4$  to  $3.3V$ ,  $AGND=DGND=0V$ ,  $T_a=25^{\circ}C$

Related Pins	Symbol	Parameter	MIN	MAX	Unit
RESX	TRW	Reset pulse duration	10	-	us
	TRT	Reset cancel	-	5 (Note 1, 5)	ms
			-	120 (Note 1, 6, 7)	ms

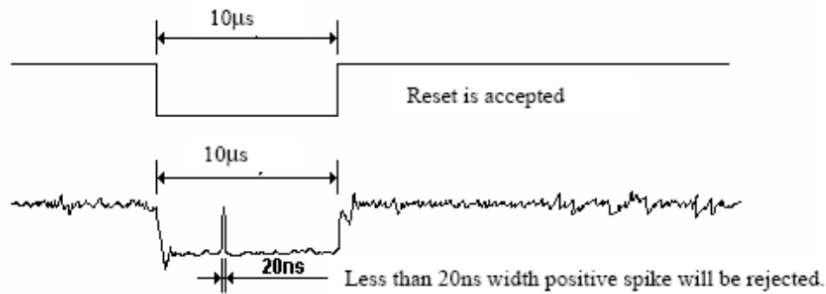
Notes:

1. The reset cancel includes also required time for loading ID bytes, VCOM setting and other settings from NVM (or similar device) to registers. This loading is done every time when there is HW reset cancel time ( $t_{RT}$ ) within 5 ms after a rising edge of RESX.
2. Spike due to an electrostatic discharge on RESX line does not cause irregular system reset according to the table below:

RESX Pulse	Action
Shorter than 5 $\mu$ s	Reset Rejected
Longer than 9 $\mu$ s	Reset
Between 5 $\mu$ s and 9 $\mu$ s	Reset starts

3. During the Resetting period, the display will be blanked (The display is entering blanking sequence, which maximum time is 120 ms, when Reset Starts in Sleep Out –mode. The display remains the blank state in Sleep In –mode.) and then return to Default condition for Hardware Reset.

4. Spike Rejection also applies during a valid reset pulse as shown below:



5. When Reset applied during Sleep In Mode.
6. When Reset applied during Sleep Out Mode.
7. It is necessary to wait 5msec after releasing RESX before sending commands. Also Sleep Out command cannot be sent for 120msec.

## Power ON/OFF Sequence

VDDI and VDD can be applied in any order.

In CABC function application, VDDI power on need delay 5ms after VDD has been supplied.

VDD and VDDI can be power down in any order.

During power off, if LCD is in the Sleep Out mode, VDD and VDDI must be powered down minimum 120msec after RESX has been released.

During power off, if LCD is in the Sleep In mode, VDDI or VDD can be powered down minimum 0msec after RESX has been released.

CSX can be applied at any timing or can be permanently grounded. RESX has priority over CSX.

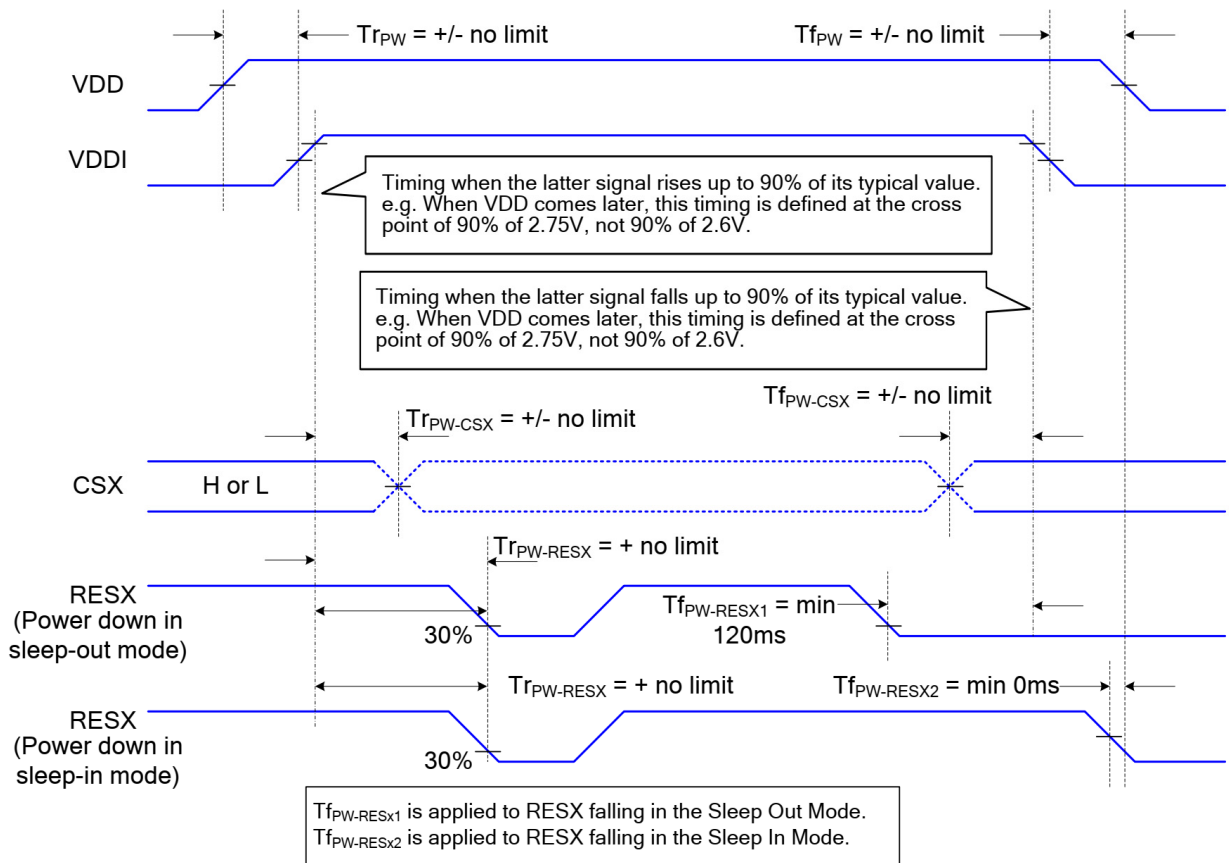
*Note 1: There will be no damage to the display module if the power sequences are not met.*

*Note 2: There will be no abnormal visible effects on the display panel during the Power On/Off Sequences.*

*Note 3: There will be no abnormal visible effects on the display between end of Power On Sequence and before receiving Sleep Out command. Also between receiving Sleep In command and Power Off Sequence.*

*Note 4: If RESX line is not held stable by host during Power On Sequence as defined in the sequence below, then it will be necessary to apply a Hardware Reset (RESX) after Host Power On Sequence is complete to ensure correct operation. Otherwise function is not guaranteed.*

The power on/off sequence is illustrated below



### Uncontrolled Power Off

The uncontrolled power-off means a situation which removed a battery without the controlled power off sequence. It will neither damage the module or the host interface.

If uncontrolled power-off happened, the display will go blank and there will not any visible effect on the display (blank display) and remains blank until “Power On Sequence” powers it up.

## 7. Optical Characteristics:

Item	Symbol	Conditions	Specifications			Unit	Note	
			Min	Typ	Max			
Transmittance	T(%)	-	3.8	4.5	-	-	-	
Contrast Ratio	CR	$\theta=0^\circ$ Normal Viewing Angle	640	800	-		(1) (2)	
Response time	TR+TF		-	30	40	ms	(1) (3)	
NTSC	-	-	-	-	-	%	Note 1	
Viewing Angle	Hor.	$\theta_{x+}$	CR $\geq$ 10	75	85	-	deg.	(1)
		$\theta_{x-}$		75	85	-		
	Ver.	$\theta_{y+}$		75	85	-		
		$\theta_{y-}$		75	85	-		

### Measuring Condition

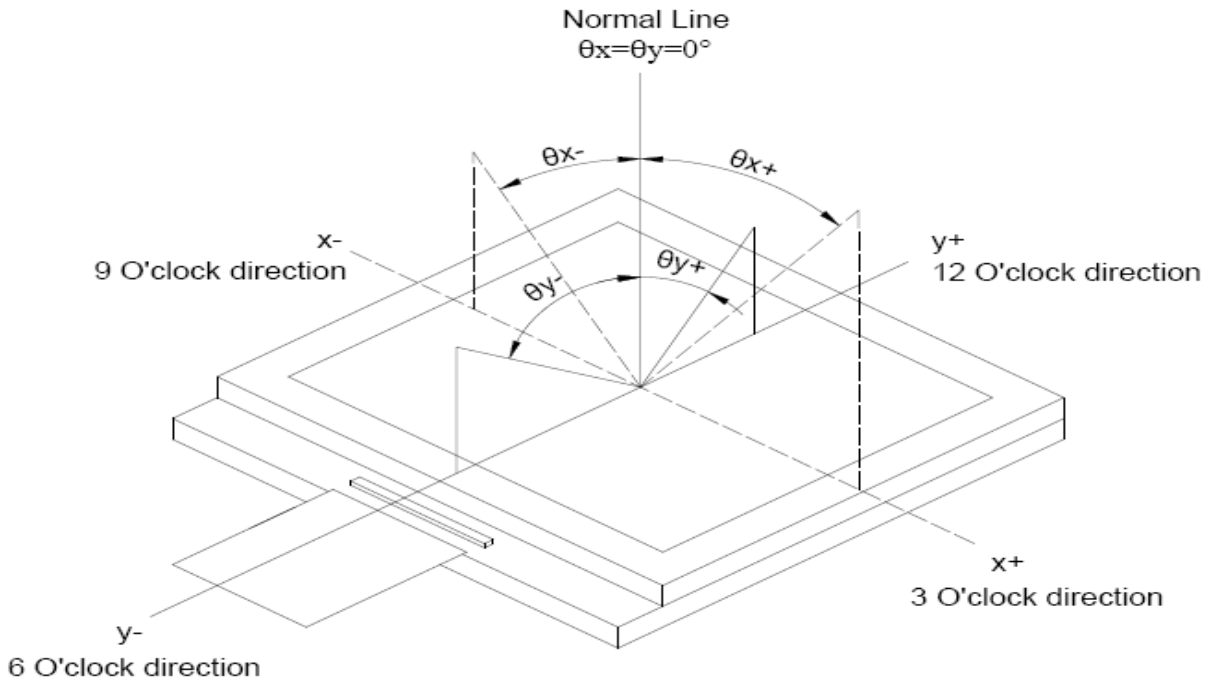
1. Measuring surrounding: dark room
2. Ambient temperature:  $25\pm 2^\circ\text{C}$
3. 30 min. Warm-up time.

### Color of CIE Coordinate:

( $T_a=25^\circ\text{C}$ )

Item	Symbol	Condition	Min.	Typ.	Max.	
Chromaticity Coordinates (Transmissive)	Red	x	$\theta = \varphi = 0^\circ$ LED Backlight	TBD	TBD	TBD
		y		TBD	TBD	TBD
	Green	x		TBD	TBD	TBD
		y		TBD	TBD	TBD
	Blue	x		TBD	TBD	TBD
		y		TBD	TBD	TBD
	White	x		TBD	TBD	TBD
		y		TBD	TBD	TBD

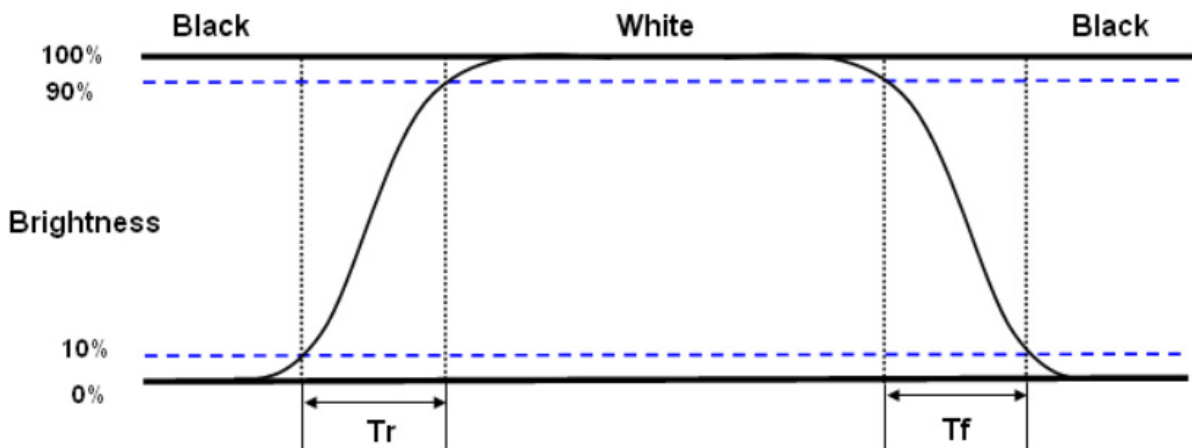
Note (1) Definition of Viewing Angle :



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

$$\text{Contrast ratio (CR)} = \frac{\text{Photo detector output when LCD is at "White" state}}{\text{Photo detector output when LCD is at "Black" state}}$$

Note (3) Definition of Response Time : Sum of TR and TF

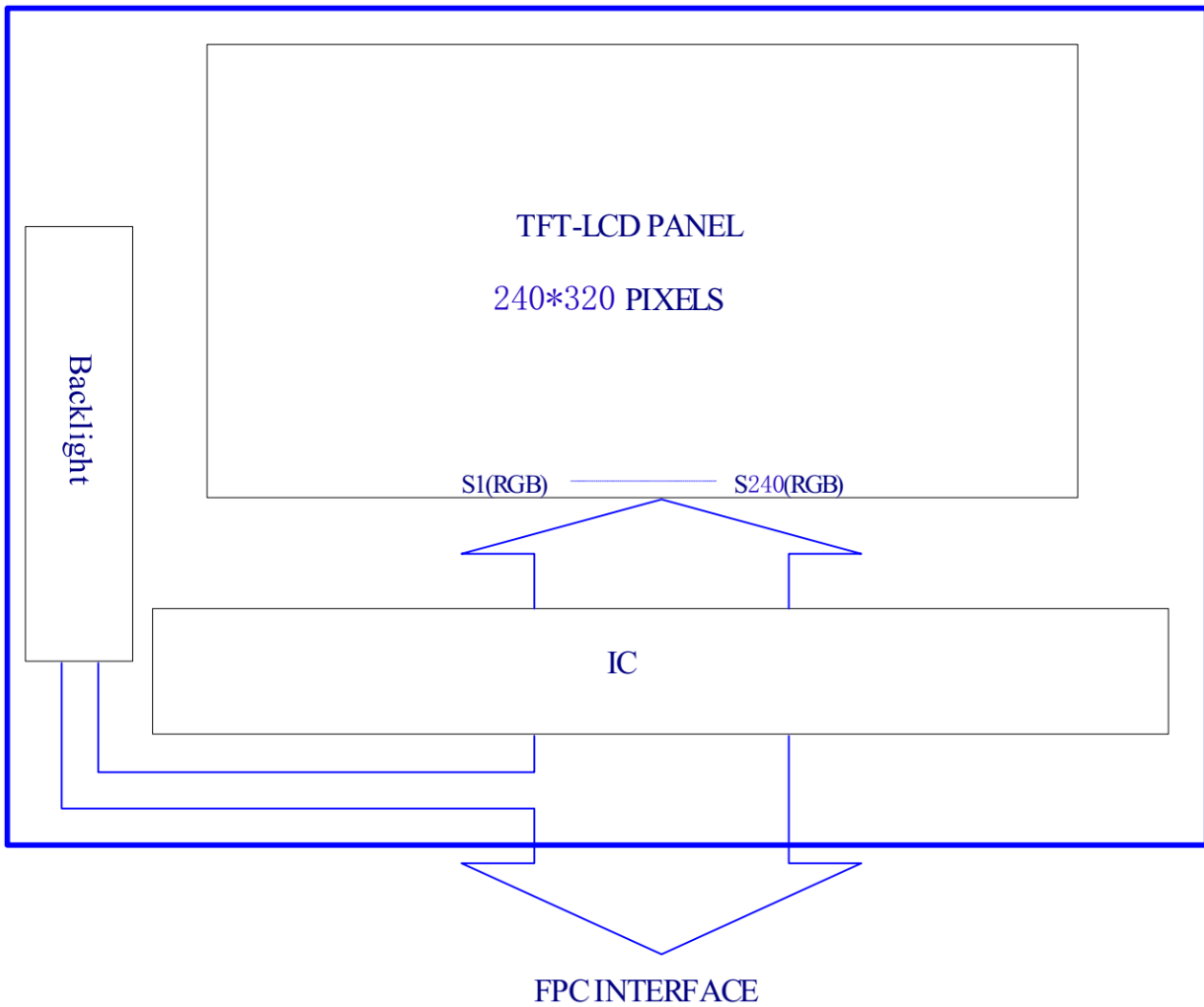


## 8. Interface Pin Assignment:

No.	Symbol	Function																																												
1-4	IM0-3	<p>-The MCU interface mode select.</p> <table border="1"> <thead> <tr> <th>IM3</th> <th>IM2</th> <th>IM1</th> <th>IM0</th> <th>MPU Interface Mode</th> <th>Data pin</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>80-8bit parallel I/F</td> <td>DB[7:0]</td> </tr> <tr> <td>0</td> <td>0</td> <td>1</td> <td>0</td> <td>80-9bit parallel I/F</td> <td>DB[8:0]</td> </tr> <tr> <td rowspan="2">0</td> <td rowspan="2">1</td> <td rowspan="2">0</td> <td rowspan="2">1</td> <td>3-line 9bit serial I/F</td> <td>SDA: in/out</td> </tr> <tr> <td>2 data lane serial I/F</td> <td>SDA: in/out WRX: in</td> </tr> <tr> <td>0</td> <td>1</td> <td>1</td> <td>0</td> <td>4-line 8bit serial I/F</td> <td>SDA: in/out</td> </tr> <tr> <td>1</td> <td>1</td> <td>0</td> <td>1</td> <td>3-line 9bit serial I/F II</td> <td>SDA: in SDO: out</td> </tr> <tr> <td>1</td> <td>1</td> <td>1</td> <td>0</td> <td>4-line 8bit serial I/F II</td> <td>SDA: in SDO: out</td> </tr> </tbody> </table>	IM3	IM2	IM1	IM0	MPU Interface Mode	Data pin	0	0	0	0	80-8bit parallel I/F	DB[7:0]	0	0	1	0	80-9bit parallel I/F	DB[8:0]	0	1	0	1	3-line 9bit serial I/F	SDA: in/out	2 data lane serial I/F	SDA: in/out WRX: in	0	1	1	0	4-line 8bit serial I/F	SDA: in/out	1	1	0	1	3-line 9bit serial I/F II	SDA: in SDO: out	1	1	1	0	4-line 8bit serial I/F II	SDA: in SDO: out
IM3	IM2	IM1	IM0	MPU Interface Mode	Data pin																																									
0	0	0	0	80-8bit parallel I/F	DB[7:0]																																									
0	0	1	0	80-9bit parallel I/F	DB[8:0]																																									
0	1	0	1	3-line 9bit serial I/F	SDA: in/out																																									
				2 data lane serial I/F	SDA: in/out WRX: in																																									
0	1	1	0	4-line 8bit serial I/F	SDA: in/out																																									
1	1	0	1	3-line 9bit serial I/F II	SDA: in SDO: out																																									
1	1	1	0	4-line 8bit serial I/F II	SDA: in SDO: out																																									
5	RESX	Signal is active low																																												
6	CSX	Chip selection pin																																												
7	DCX/SCL	<p>-Display data/command selection pin in parallel interface.          -This pin is used to be serial interface clock.          DCX='1': display data or parameter.          DCX='0': command data.          -If not used, please fix this pin at VDDI or DGND.</p>																																												
8	WRX/DCX	<p>-Write enable in MCU parallel interface.          - Display data/command selection pin in 4-line serial interface.          - Second Data lane in 2 data lane serial interface.          -If not used, please fix this pin at VDDI or DGND.</p>																																												
9	RDX	Read enable in 8080 MCU parallel interface																																												
10	VSYNC	Vertical (Frame) synchronizing input signal for RGB interface operation																																												
11	HSYNC	Horizontal (Line) synchronizing input signal for RGB interface operation.																																												
12	ENABLE	Data enable signal for RGB interface operation.																																												
13	DOTCLK	Dot clock signal for RGB interface operation.																																												
14	SDA	The data is latched on the rising edge of the SCL signal																																												
15-23	DB00-DB08	Data bus.																																												
24	TE	Tearing effect signal is used to synchronize MCU to frame memory writing.																																												
25	SDO	SPI interface output pin																																												
26	VDD	Power Supply for Analog, Digital System and Booster Circuit.																																												
27	VDDI	Power Supply for I/O System																																												

28	GND	System Ground
29	LEDA	Backlight cathode
30	LEDK	Backlight anode

**9. Block Diagram:**



## 10. Backlight:

1. Standard Lamp Styles (Edge Lighting Type):  
The LED chips are distributed over the edge light area of the illumination unit, which gives the less power consumption:
2. The Main Advantages of the LED Backlight are as following:
  - 2.1 The brightness of the backlight can simply be adjusted.  
By a resistor or a potentiometer.

### 3. Data About LED Backlight:

(Ta=25°C)

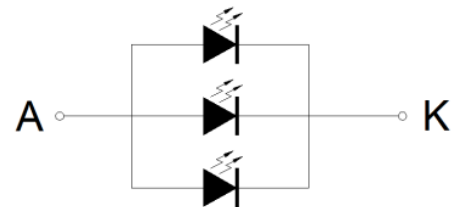
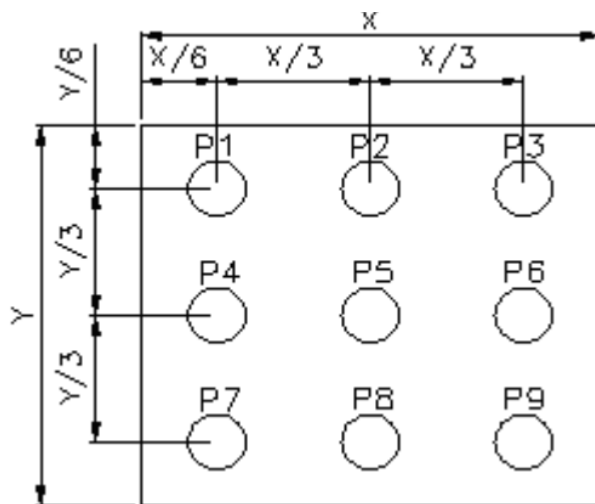
PARAMETER	Sym.	Min.	Typ.	Max.	Unit	Test Condition	Note
Supply Current	I	-	60	-	mA	V=3.2V	
Supply Voltage	V	3.0	3.2	3.5	V	If=60mA	
Luminous Intensity for LCM	IV	250	300	-	cd/m <sup>2</sup>		2
Uniformity for LCM	-	70	-	-	%		3
Life Time	-	20000	-	-	Hr.		4
Color	White						

#### NOTE:

1. Backlight Only
2. Average Luminous Intensity of P1-P9
3. Uniformity = Min/Max \* 100%
4. LED life time defined as follows: The final brightness is at 50% of original brightness

#### Measured Method: (X\*Y: Light Area)

#### Internal Circuit Diagram



#### (Effective spatial Distribution)

Using aperture of 1°, distance 50cm

## **11. Standard Specification for Reliability:**

### 11-1. Standard Specifications for Reliability of LCD Module

No	Item	Description
01	High temperature operation	The sample should be allowed to stand at 70°C for 240 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°C for 240 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°C 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°C 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°C,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 : -20°C for 30 minutes → normal temperature for 5 minutes → +60°C 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 ISTA 1A 2001.
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



## 11 - 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 11.2, Standard specifications for Reliability have been 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.

## 11- 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 ( $25\pm 5^{\circ}\text{C}$ ), normal humidity ( $50\pm 10\%$ RH), and in area not exposed to direct sun light.
------	---

## 12. Specification of Quality Assurance:

### 12-1. Purpose

This standard for Quality Assurance should affirm the quality of LCD module products to supply to purchaser by YEEBO CORPORATION (Supplier).

### 12-2. Standard for Quality Test

#### a. Inspection:

Before delivering, the supplier should take the following tests, and affirm the quality of product.

#### b. Electro-Optical Characteristics:

According to the individual specification to test the product.

#### c. Test of Appearance Characteristics:

According to the individual specification to test the product.

#### d. Test of Reliability Characteristics:

According to the definition of reliability on the specification for testing products.

#### e. Delivery Test:

Before delivering, the supplier should take the delivery test.

(i) Test method: According to **ISO2859-1**.General Inspection Level II take a single time.

(ii) The defects classify of AQL as following:

Major defect: AQL =0.65

Minor defect: AQL =2.5

Total defects: AQL =2.5

### 12-3. Non- conforming Analysis & Deal with Manners

#### a. Non- conforming Analysis:

(i) Purchaser should supply the detail data of non- conforming sample and the non-conforming.

(ii) After accepting the detail data from purchaser, the analysis of non- conforming should be finished in two weeks.

(iii) If supplier can not finish analysis on time, must announce purchaser before 3 days.

#### b. Disposition of non- conforming:

(i) If find any product defect of supplier during assembly time, supplier must change the good product for every defect after recognition.

(ii) Both supplier and customer should analyze the reason and discuss the disposition of non- conforming when the reason of nonconforming is not sure.

### 12-4. Agreement items

Both sides should discuss together when the following problems happen.

a. There is any problem of standard of quality assurance, and both sides should think that must be modified.

b. There is any argument item which does not record in the standard of quality assurance.

c. Any other special problem.

12-5. Standard of the Product Appearance Test

a. Manner of appearance test:

(i) Illumination: External Appearance Inspection :  $1000 \pm 200$  Lux ; Light on inspection :  $200 \pm 50$  Lux.

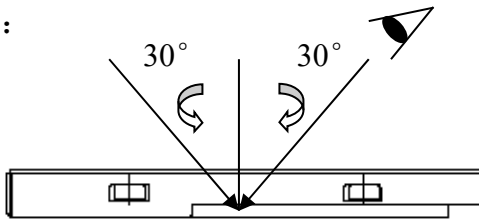
(ii) To be a distance about  $30 \pm 5$  cm in front of LCD unit, viewing line should be perpendicular to the surface of the module judge the visual appearance with human's eyes.

(iii) Scope of inspection perspective:

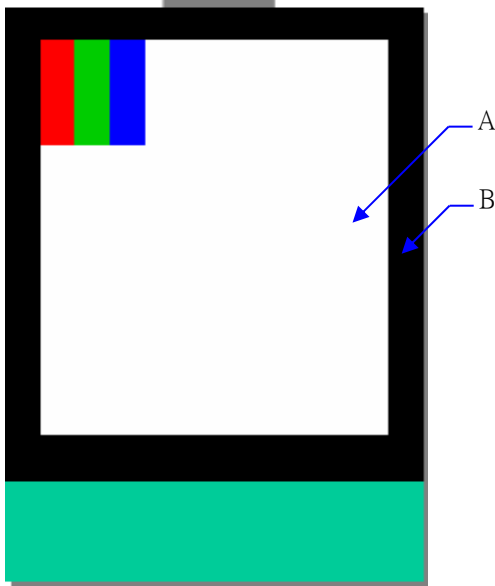
The inspection angle of IPS screen is within  $\pm 30^\circ$  of the vertical line on the product surface; The TN screen inspection angle is  $-15^\circ$  from the vertical line of the product surface in the 12 o'clock direction to  $30^\circ$  from the vertical line of the product surface in the 6 o'clock direction.

(iii) Temperature:  $25 \pm 5^\circ\text{C}$       Humidity:  $60 \pm 10\% \text{RH}$

IPS:



(iv) Definition of area:



A. Area: Viewing area.

B. Area: Out of viewing area.

(Outside viewing area)

b. Basic principle:

(i) It will accord to the AQL when the standard cannot be described.

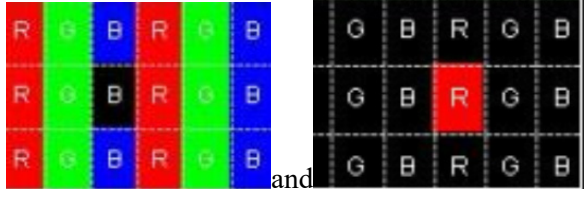
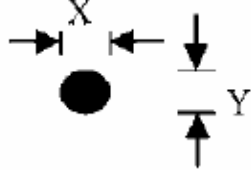
(ii) The sample of the lowest acceptable quality level must be discussed by both supplier and customer when any dispute happened.

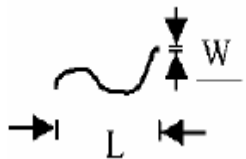
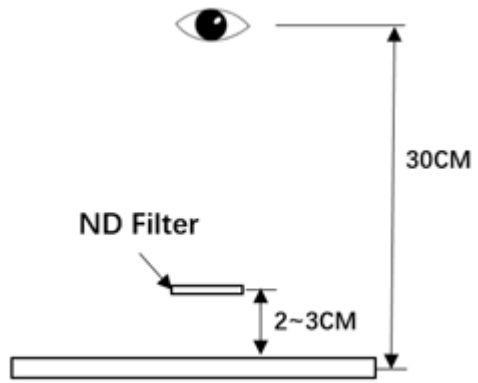
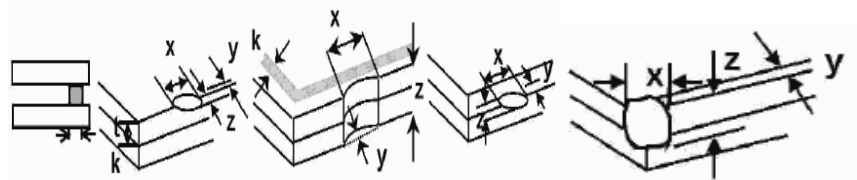
(iii) Must add new item on time when it is necessary.

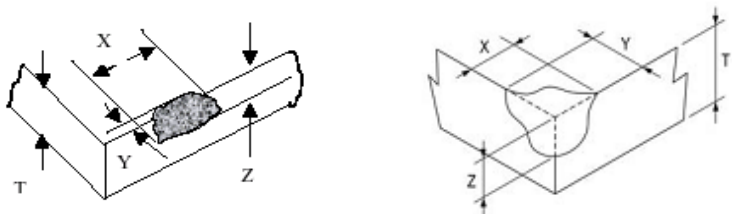
c. Standard of inspection: (Unit: mm)

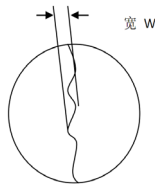
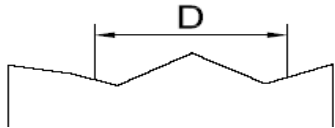
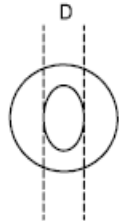
**12-6. Inspection specification**

Defect out of viewing area can be neglected.

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.	0.65														
02	Pixel Defect	Bright and Black dot define:  and Pixel Defect as below drawing: <table border="1" data-bbox="427 862 1098 1137"> <thead> <tr> <th>Type</th> <th>Acceptable Q'ty</th> </tr> </thead> <tbody> <tr> <td>Bright Dot</td> <td><math>N \leq 1</math></td> </tr> <tr> <td>Two bright dots</td> <td><math>N \leq 0</math></td> </tr> <tr> <td>Dark Dot</td> <td><math>N \leq 2</math></td> </tr> <tr> <td>Two Dark dots</td> <td><math>N \leq 0</math></td> </tr> <tr> <td>Three Dark dots</td> <td><math>N \leq 0</math></td> </tr> <tr> <td>Total(Bright+Dark dot)</td> <td><math>N \leq 2</math></td> </tr> </tbody> </table> *Densely spaced: No more than two spots within 10mm.	Type	Acceptable Q'ty	Bright Dot	$N \leq 1$	Two bright dots	$N \leq 0$	Dark Dot	$N \leq 2$	Two Dark dots	$N \leq 0$	Three Dark dots	$N \leq 0$	Total(Bright+Dark dot)	$N \leq 2$	2.5
Type	Acceptable Q'ty																
Bright Dot	$N \leq 1$																
Two bright dots	$N \leq 0$																
Dark Dot	$N \leq 2$																
Two Dark dots	$N \leq 0$																
Three Dark dots	$N \leq 0$																
Total(Bright+Dark dot)	$N \leq 2$																
03	LCD , Touch Panel and Backlight  Black and white spots/lines contamination  (Foreign Material)	3.1 Dot type: As following drawing $\Phi = (X+Y) / 2$  <table border="1" data-bbox="858 1361 1391 1518"> <thead> <tr> <th>Size(mm)</th> <th>Acceptable Q'ty</th> </tr> </thead> <tbody> <tr> <td><math>\Phi \leq 0.10</math></td> <td>Accept no dense</td> </tr> <tr> <td><math>0.10 &lt; \Phi \leq 0.30</math></td> <td>2</td> </tr> <tr> <td><math>0.30 &lt; \Phi</math></td> <td>0</td> </tr> </tbody> </table> 3.1.1 Not visible through 5% ND filter 3.1.2 Densely spaced: No more than two spots within 5mm. 3.1.3 This is acceptable when surface dirt can be removed by wiping.	Size(mm)	Acceptable Q'ty	$\Phi \leq 0.10$	Accept no dense	$0.10 < \Phi \leq 0.30$	2	$0.30 < \Phi$	0	2.5						
Size(mm)	Acceptable Q'ty																
$\Phi \leq 0.10$	Accept no dense																
$0.10 < \Phi \leq 0.30$	2																
$0.30 < \Phi$	0																
		3.2 Tiny bright dot、Dense tiny highlights: Definition of Tiny bright dot: $\Phi < 0.10\text{mm}$ ; Ignore, clustered is not allowed( $N \leq 5, D \leq 5$ )  *Not visible through 5% ND filter	2.5														

NO	Item	Criterion	AQL												
03	LCD , Touch Panel and Backlight  Black and white spots/lines contamination(Foreign Material)	<p>3.3 Line type: (As following drawing)</p>  <table border="1" data-bbox="750 246 1324 459"> <thead> <tr> <th>Length(mm)</th> <th>Width(mm)</th> <th>Acceptable Q'ty</th> </tr> </thead> <tbody> <tr> <td>---</td> <td><math>W \leq 0.03</math></td> <td>Accept no dense</td> </tr> <tr> <td><math>L \leq 5.0</math></td> <td><math>0.03 &lt; W \leq 0.075</math></td> <td>2</td> </tr> <tr> <td>---</td> <td><math>0.075 &lt; W</math></td> <td>Rejection</td> </tr> </tbody> </table> <p>* Densely spaced: No more than two spots within 5mm.</p>	Length(mm)	Width(mm)	Acceptable Q'ty	---	$W \leq 0.03$	Accept no dense	$L \leq 5.0$	$0.03 < W \leq 0.075$	2	---	$0.075 < W$	Rejection	2.5
Length(mm)	Width(mm)	Acceptable Q'ty													
---	$W \leq 0.03$	Accept no dense													
$L \leq 5.0$	$0.03 < W \leq 0.075$	2													
---	$0.075 < W$	Rejection													
04	Polarizer bubbles	<p>If bubbles are visible, Judge using black spot specifications, not easy to find, must check in specify direction.</p> <table border="1" data-bbox="790 616 1324 795"> <thead> <tr> <th>Size <math>\Phi</math>(mm)</th> <th>Acceptable Q'ty</th> </tr> </thead> <tbody> <tr> <td><math>\Phi \leq 0.15</math></td> <td>ignored (Dense NG)</td> </tr> <tr> <td><math>0.15 &lt; \Phi \leq 1.00</math></td> <td>2</td> </tr> <tr> <td><math>1.00 &lt; \Phi</math></td> <td>0</td> </tr> </tbody> </table> <p>* Densely spaced: No more than two spots within 5mm. * Outside of the V.A. is disregard.</p>	Size $\Phi$ (mm)	Acceptable Q'ty	$\Phi \leq 0.15$	ignored (Dense NG)	$0.15 < \Phi \leq 1.00$	2	$1.00 < \Phi$	0	2.5				
Size $\Phi$ (mm)	Acceptable Q'ty														
$\Phi \leq 0.15$	ignored (Dense NG)														
$0.15 < \Phi \leq 1.00$	2														
$1.00 < \Phi$	0														
05	Mura	<p>Not visible through 5% ND filter.</p> <p>*ND card is 2~3cm from the panel, human eye is 30±5cm from the panel; The line of sight is moved to the ND card for judgment: if it is not visible for 2-3 seconds - OK, visible - NG</p> 	2.5												
06	Chipped glass	<p>Symbols: x: Chip length      y: Chip width      z: Chip thickness k: Seal width      t: Single-layer glass thickness a: LCD side length      L: Electrode pad length</p> <p>8.1 Chip on panel surface and crack between panels and Corner crack:</p>  <table border="1" data-bbox="375 1736 1197 1848"> <tbody> <tr> <td>z: Chip thickness</td> <td>y: Chip width</td> <td>x: Chip length</td> </tr> <tr> <td><math>z \leq t</math></td> <td>Not over BM glue area</td> <td><math>x \leq 1/8a</math></td> </tr> </tbody> </table> <p>⊙ Unit: mm ⊙ If there are 2 or more chips, x is the total length of each chip. ⊙ If there chipped area touches the ITO terminal, over 2/3 of the ITO must remain and do not affect the function.</p>	z: Chip thickness	y: Chip width	x: Chip length	$z \leq t$	Not over BM glue area	$x \leq 1/8a$	2.5						
z: Chip thickness	y: Chip width	x: Chip length													
$z \leq t$	Not over BM glue area	$x \leq 1/8a$													

NO	Item	Criterion	AQL								
07	Scratches	Follow NO.3 -3 Line Type.	2.5								
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. 11.7 PCBA cosmetic control base on latest IPC standard, IPC-A-610, acceptalbe limit of grade 2.	2.5 2.5 2.5 2.5 0.65 0.65 2.5								
12	FPC	Affect function rejection, do not affect function acceptance.	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								
14	Touch Panel Chipped glass	Edge breakage can't affect visual effection (edge breakage can't cause damage to circuit); over lens have no visual damage   <table border="1" data-bbox="375 1836 1276 1971"> <thead> <tr> <th>x: Chip length</th> <th>y: Chip width</th> <th>z: Chip thickness</th> <th>Acceptable numbers</th> </tr> </thead> <tbody> <tr> <td><math>x \leq 1\text{mm}</math></td> <td><math>Y \leq 0.5\text{mm}</math></td> <td><math>z \leq t</math></td> <td>2</td> </tr> </tbody> </table>	x: Chip length	y: Chip width	z: Chip thickness	Acceptable numbers	$x \leq 1\text{mm}$	$Y \leq 0.5\text{mm}$	$z \leq t$	2	2.5
x: Chip length	y: Chip width	z: Chip thickness	Acceptable numbers								
$x \leq 1\text{mm}$	$Y \leq 0.5\text{mm}$	$z \leq t$	2								

NO	Item	Criterion	AQL								
15	V/A printed edges sawtooth inspected according to this standard  LOGO's sawtooth	<p>Some contentious defect judged according to samples.</p> <table border="1"> <thead> <tr> <th>Product type</th> <th>Conditions</th> </tr> </thead> <tbody> <tr> <td>Same size</td> <td>1、width below 0.2mm (included) ignored, above 0.2mm NG 2、 Length not accounted</td> </tr> </tbody> </table> 	Product type	Conditions	Same size	1、width below 0.2mm (included) ignored, above 0.2mm NG 2、 Length not accounted	2.5				
Product type	Conditions										
Same size	1、width below 0.2mm (included) ignored, above 0.2mm NG 2、 Length not accounted										
16	Touch Panel(Fish eye、dent and bubble on film)	<table border="1"> <thead> <tr> <th>SIZE(mm)</th> <th>Acceptable Q'ty</th> </tr> </thead> <tbody> <tr> <td><math>\Phi \leq 0.2</math></td> <td>Accept no dense</td> </tr> <tr> <td><math>0.2 &lt; D \leq 0.40</math></td> <td>2</td> </tr> <tr> <td><math>0.40 &lt; D</math></td> <td>0</td> </tr> </tbody> </table>  	SIZE(mm)	Acceptable Q'ty	$\Phi \leq 0.2$	Accept no dense	$0.2 < D \leq 0.40$	2	$0.40 < D$	0	2.5
SIZE(mm)	Acceptable Q'ty										
$\Phi \leq 0.2$	Accept no dense										
$0.2 < D \leq 0.40$	2										
$0.40 < D$	0										
17	Touch Panel Newton ring	Newton ring dimension $\leq 1/2$ touch panel area and not affect font and line distortion ( $\leq 2.5\%$ ), it is acceptable.	2.5								
18	Touch Panel Linearity	Less than 2.5% is acceptable.	2.5								
19	LCD Ripple	Touch the touch panel, cannot see the LCD ripple. Pen: R 1.0mm silicon rubber. Operation Force: 80g	2.5								
20	General appearance	20.1 Product packaging must the same as specified on packaging specification sheet. 20.2 Product dimension and structure must conform to product Specification sheet.	0.65 0.65								

## 13. Handling Precaution:

### 13-1 Handling of LCM

- Don't give external shock.
- Don't apply excessive force on the surface.
- Liquid in LCD is hazardous substance. Must not lick and swallow. When the liquid is attach to your hand, skin, cloth etc. Wash it out thoroughly and immediately.
- Don't operate it above the absolute maximum rating.
- Don't disassemble the LCM.
- The operators should be grounded 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 care when peeling off this protective film since static electricity may be generated.

### 13-2 Storage

- Store in an ambient temperature of  $25\pm 10^{\circ}\text{C}$ , and in a relative humidity of  $50\pm 10\%\text{RH}$ . Don't expose to sunlight or fluorescent light.
- Storage in a clean environment, free from dust, active gas, and solvent.
- Store in anti-static electricity container.
- Store without any physical load.

### 13-3 Soldering

- Use only soldering irons with proper grounding and no leakage.
- Iron: No higher than  $310\pm 10^{\circ}\text{C}$  and less than 3 sec during Hand soldering.
- Rewiring: no more than 2 times.

## 14. Warranty

This product has been manufactured to specifications as a part for use in your company's general electronic products. It is guaranteed to perform according to delivery specifications. For any other use apart from general electronic equipment, we will not take responsibility if the product is used in medical devices, nuclear power control equipment, aerospace equipment, fire and security systems, or any other applications in which there is a direct risk to human life and where extremely high levels of reliability are required. If the product is to be used in any of the above applications, we will need to enter into a separate product liability agreement.

1. We cannot accept responsibility for any defect arise after additional process of the product (Including disassembly and reassembly), after product delivery.
2. We cannot accept responsibility for any defect, which may arise after the application of strong External force to the product.
3. We cannot accept responsibility for any defect, which may arise due to the application of static Electricity after the product has passed your company's acceptance inspection procedures.
4. We cannot accept responsibility for industrial property, which may arise through the use of your product, with exception to those issues relating directly to the structure or method of manufacturing of our product within one year from YEEBO shipment.
5. For Heatseal Product which required to heatseal by customer side, parts must be used within three months after delivery from factory.
6. For TAB Product which required to solder by customer side, parts must be used within three Months after delivery from factory.
7. The liability of YB is limited to repair or replacement on the terms set forth below. YB will not be responsible for any subsequent or consequential events or injury or damage to any personnel or user including third party personnel and/or user. Unless otherwise agreed in writing between YB and the customer, YB will only replace or repair any of its LCD which is found defective electrically or visually when inspected in accordance with YB GENERAL LCD INSPECTION STANDARD.

## 15. Guarantee:

Our products meet requirements of the environment.  
YEEBO ROHS requirement is based on European Union Directive 2011/65/EU (ROHS) Requirements and Update.