



SPECIFICATION

Product Model: PV02419Y0140U

Designed by	Checked by	Approved by
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For Customer's Acceptance:

Comments:	Approved by:
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1. Scope

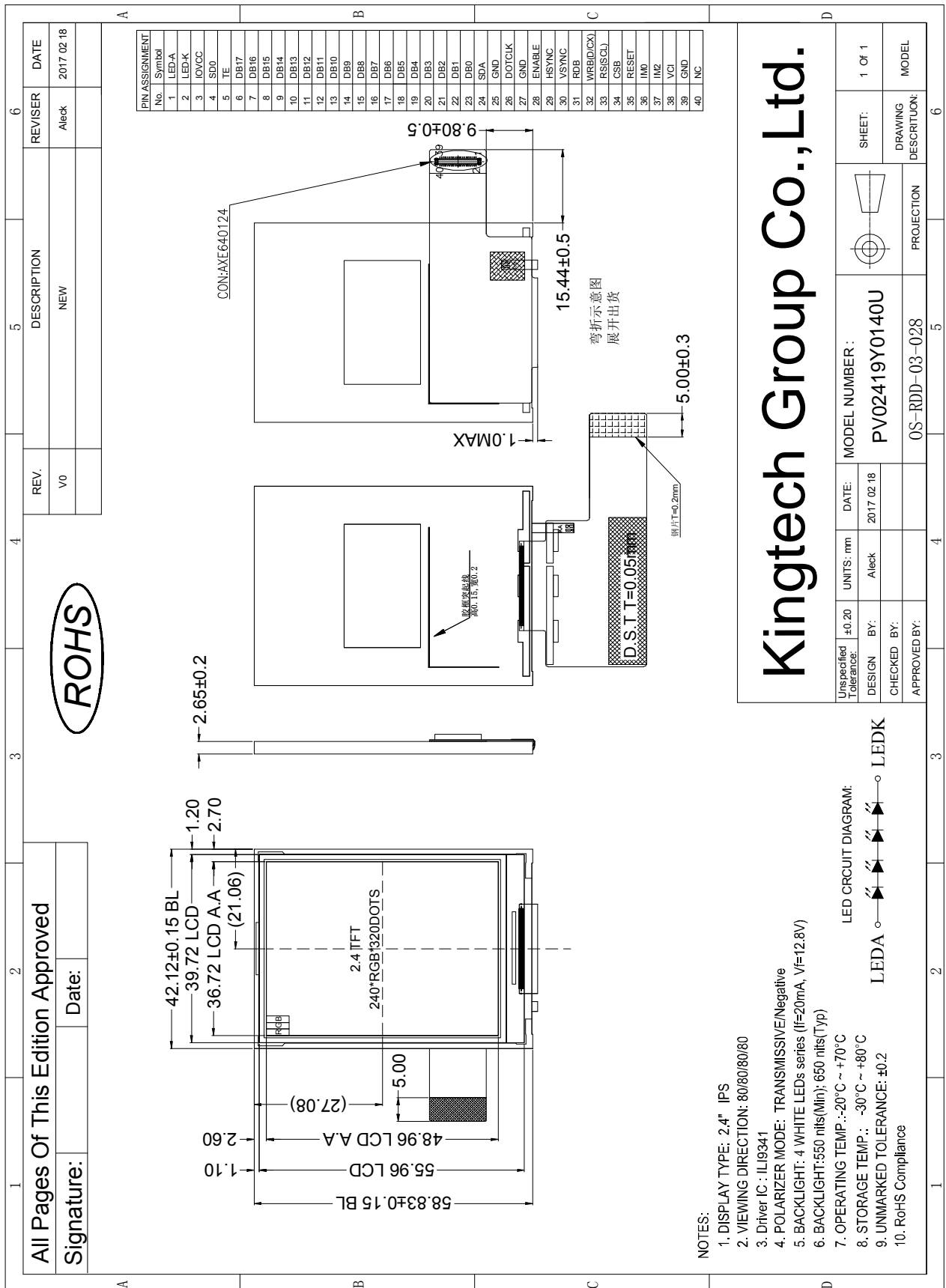
This specification defines general provisions as well as inspection standards for TFT module supplied by Kingtech Group Co.,Ltd.

2. General Information

ITEM	STANDARD VALUES	UNIT
LCD Type	2.4" TFT	--
Dot Arrangement	240(RGB) × 320	dots
Color Filter Array	RGB vertical stripe	--
Display Mode	IPS / Transmission / Normally Black	-
Gray Scale Inversion Direction	80/80/80/80 deg. (U/D/L/R @ C/R>10)	--
Viewing Direction	ALL	
Driver IC	ILI9341	--
Module Size	42.12(W) × 58.83(H) × 2.65(T)	mm
Active Area	48.96(W) × 36.72 (H)	mm
Dot Pitch	0.153(W) × 0.153(H)	mm
Interface	9/16BIT MCU, 4-wire SPI, 4-wire SPI + RGB interface	--
Operating Temperature	-20 ~ +70	°C
Storage Temperature	-30 ~ +80	°C
Back Light	4 White LEDs	--



3. External Dimensions





4. Interface Description

PIN	PIN NAME	DESCRIPTION
1	LEDA	LED backlight (Anode).
2	LEDK	LED backlight (Cathode).
3	IOVCC	A supply voltage to the logic circuit.
4	SDO	Serial output signal in SPI I/F.
5	TE	Tearing effect output pin (No connection)
6-23	DB17-DB0	Data bus
24	SDA	Serial input signal in SPI I/F.
25	GND	Power ground
26	DOTCLK	Pixel clock signal in RGB I/F.
27	GND	Power ground
28	ENABLE	Data enable signal in RGB I/F mode
29	HSYNC	Horizontal sync signal in RGB I/F.
30	VSYNC	Vertical sync signal in RGB I/F.
31	RDB	Read signal in 80-series parallel interface
32	WRB(D/CX)	Write signal in 80-series parallel interface
33	RS(SCL)	Command address or Command data select in 4-wire SPI interface.
34	CSB	Chip select pin for SPI interface.
35	RESET	Reset pin.
36	IM0	NOTE 1
37	IM2	
38	VCI	A supply voltage to the analog circuit.
39	GND	Power ground
40	NC	NC

Note 1:

Select MCU Interface Mode

IM3	IM2	IM1	IM0	MCU-Interface Mode	DB Pin in use	
					Register/content	GRAM
1	0	1	0	80 MCU 18-bit bus Interface II	D[8:1]	D[17:0]
1	0	1	1	80 MCU 9-bit bus Interface II	D[17:10]	D[17:9]
1	1	1	0	4-wire 8-bit Data Serial Interface II	SDI:in SOO:out	



5. Absolute Maximum Ratings

Item	Symbol	Min.	Max.	Unit
Analog Supply Voltage	VCI	-0.3	4.6	V
Input Voltage	Vin	-0.3	VCI +0.3	V
Operating Temperature	TOP	-20	70	°C
Storage Temperature	TST	-30	80	°C
Storage Humidity	HD	20	90	%RH

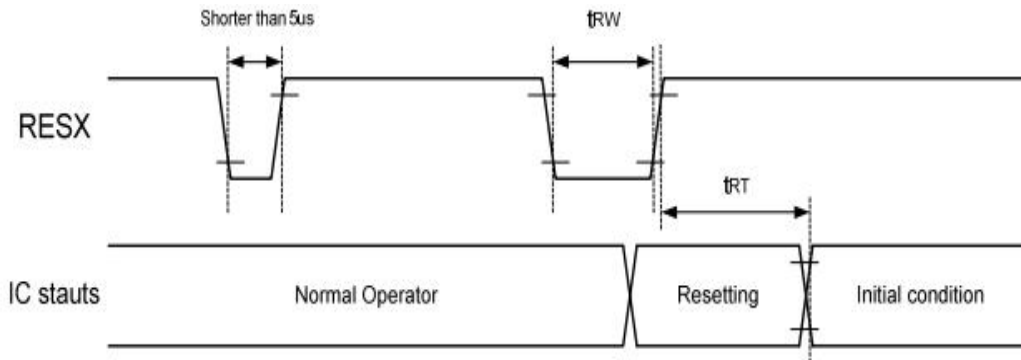
6. DC Characteristics

Item	Symbol	Min.	Typ.	Max.	Unit	Remark
Analog Supply Voltage	VCI	2.5	2.8	3.3	V	-
Input High Voltage	V _{IH}	0.7 VCI	-	VCI	V	-
Input Low Voltage	V _{IL}	GND	-	0.3 VCI	V	-
Output High Voltage	V _{OH}	0.8 VCI	-	VCI	V	-
Output Low Voltage	V _{OL}	GND	-	0.2 VCI	V	-
I/O Leak Current	ILI	-0.1	-	0.1	uA	-



7. Timing Characteristics

7.1 Reset Timing Characteristics



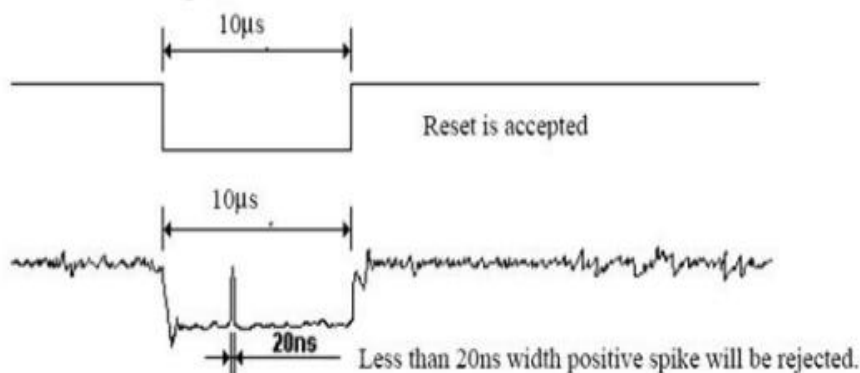
Reset input timings

Symbol	Parameter	Related pins	Min.	Max.	Unit
t_{RW}	Reset pulse width ⁽²⁾	RESX	10	-	μs
t_{RT}	Reset complete time ⁽³⁾	-	-	5 (Note 5)	ms
		-	-	120 (Note 6, 7)	ms

- Note:** (1) The reset complete time also required time for loading ID bytes from OTP 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 μs	Reset Rejected
Longer than 10 μs	Reset
Between 5 μs and 10 μs	Reset Start

- (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 returns to Default condition for H/W reset.
 (4) Spike Rejection also applies during a valid reset pulse as shown below:

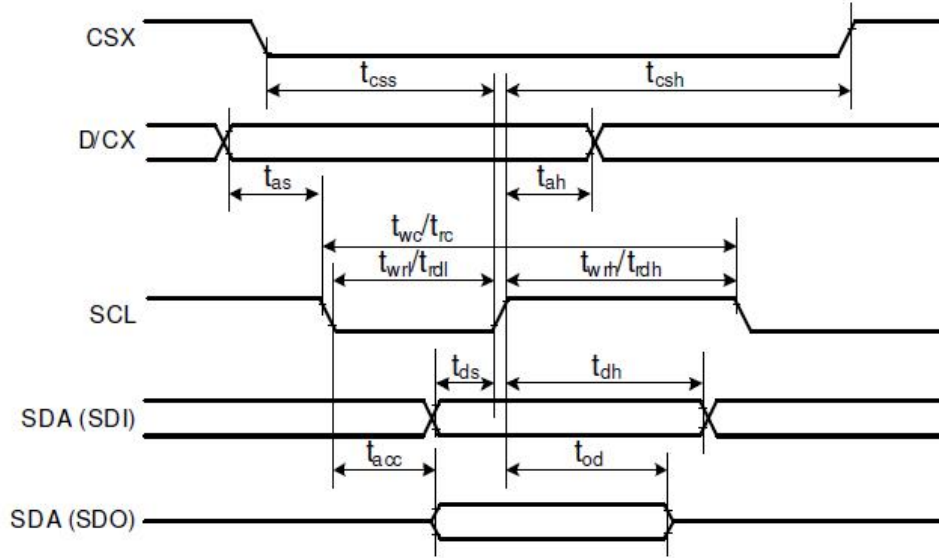


- (5) When Reset is applied during Sleep In Mode.
 (6) When Reset is applied during Sleep Out Mode.
 (7) It is necessary to wait 5msec after releasing RESX before sending commands. Also Sleep



Out command cannot be sent for 120msec.

7.2 Display Serial Interface Timing Characteristics (SPI system)



SPI interface AC characteristics

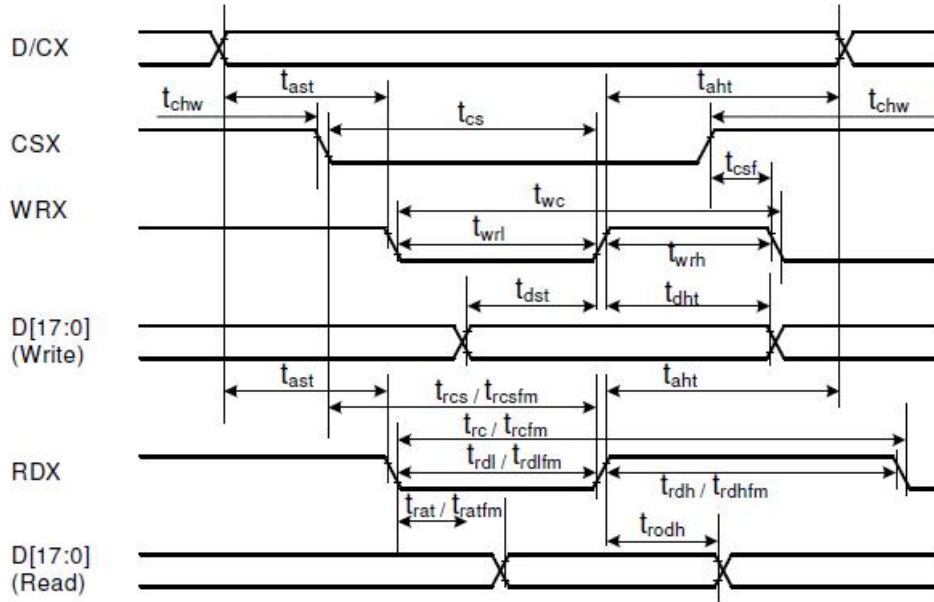
Signal	Symbol	Parameter	min	max	Unit	Description
CSX	t_{css}	Chip select time (Write)	40	-	ns	
	t_{csh}	Chip select hold time (Read)	40	-	ns	
SCL	t_{wc}	Serial clock cycle (Write)	100	-	ns	
	t_{wrh}	SCL "H" pulse width (Write)	40	-	ns	
	t_{wr}	SCL "L" pulse width (Write)	40	-	ns	
	t_{rc}	Serial clock cycle (Read)	150	-	ns	
	t_{rdh}	SCL "H" pulse width (Read)	60	-	ns	
	t_{rdl}	SCL "L" pulse width (Read)	60	-	ns	
D/CX	t_{as}	D/CX setup time	10	-		
	t_{ah}	D/CX hold time (Write / Read)	10	-		
SDA / SDI (Input)	t_{ds}	Data setup time (Write)	30	-	ns	
	t_{dh}	Data hold time (Write)	30	-	ns	
SDA / SDO (Output)	t_{acc}	Access time (Read)	10	-	ns	For maximum CL=30pF
	t_{od}	Output disable time (Read)	10	50	ns	For minimum CL=8pF

Note: $T_a = 25\text{ }^\circ\text{C}$, $V_{DDI}=1.65\text{V to }3.3\text{V}$, $V_{CI}=2.5\text{V to }3.3\text{V}$, $AGND=V_{SS}=0\text{V}$



7.3 I80 MCU Interface Timing Characteristics Data Input Format

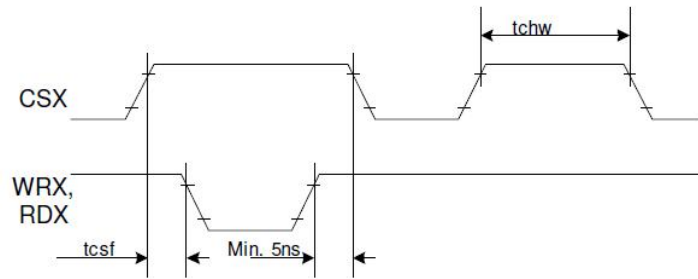
7.3.1 18/16/9/8-bit Interface Timing Characteristics(8080-II system)



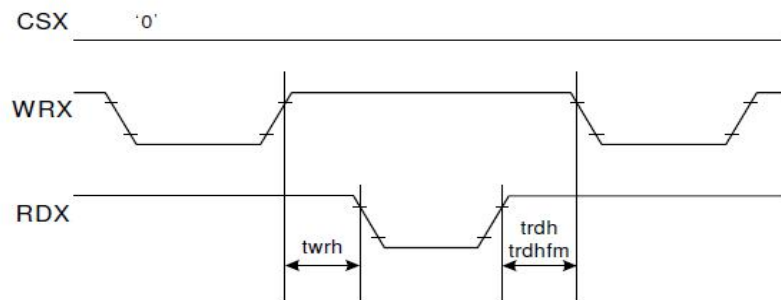
Signal	Symbol	Parameter	min	max	Unit	Description
DCX	tast	Address setup time	0	-	ns	
	taht	Address hold time (Write/Read)	0	-	ns	
CSX	tchw	CSX "H" pulse width	0	-	ns	
	tcs	Chip Select setup time (Write)	15	-	ns	
	trcs	Chip Select setup time (Read ID)	45	-	ns	
	trcsfm	Chip Select setup time (Read FM)	355	-	ns	
WRX	tcsf	Chip Select Wait time (Write/Read)	10	-	ns	
	twc	Write cycle	66	-	ns	
	twrh	Write Control pulse H duration	15	-	ns	
RDX (FM)	twrl	Write Control pulse L duration	15	-	ns	
	trcfm	Read Cycle (FM)	450	-	ns	
	trdhfm	Read Control H duration (FM)	90	-	ns	
RDX (ID)	trdlfm	Read Control L duration (FM)	355	-	ns	
	trc	Read cycle (ID)	160	-	ns	
	trdh	Read Control pulse H duration	90	-	ns	
D[17:0], D[17:10]&D[8:1], D[17:10], D[17:9]	trdl	Read Control pulse L duration	45	-	ns	
	tdst	Write data setup time	10	-	ns	For maximum CL=30pF For minimum CL=8pF
	tdht	Write data hold time	10	-	ns	
	trat	Read access time	-	40	ns	
	tratfm	Read access time	-	340	ns	
trodh	Read output disable time	20	80	ns		

Note: Ta = -30 to 70 °C, VDDI=1.65V to 3.3V, VCI=2.5V to 3.3V, VSS=0V.

CSX Timings

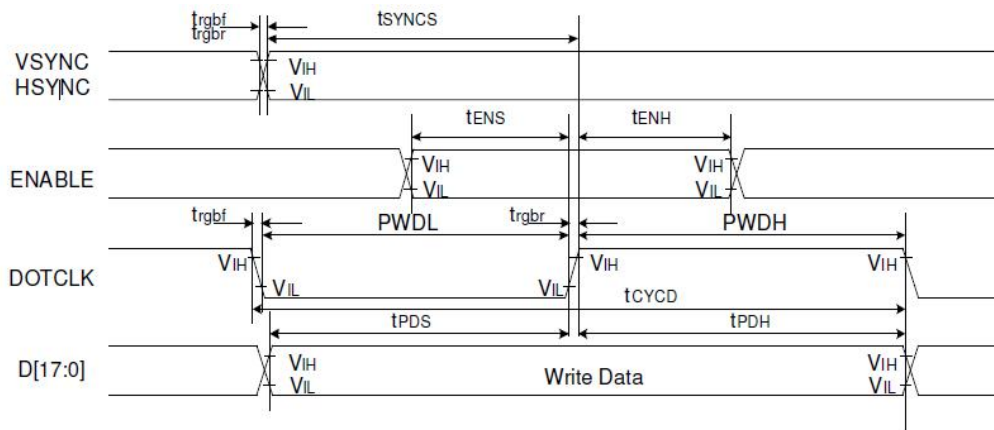


Write to read or read to write timings:



Note: Logic high and low levels are specified as 30% and 70% of VDDI for Input signals.

7.3.2 Parallel 18/16/6-bit RGB Interface Timing Characteristics

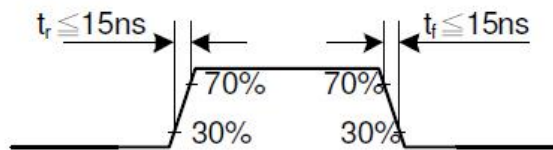




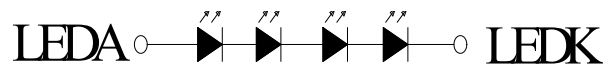
RGB I/F Horizontal Timings

Signal	Symbol	Parameter	min	max	Unit	Description
VSYNC / HSYNC	t_{SYNCS}	VSYNC/HSYNC setup time	15	-	ns	18/16-bit bus RGB interface mode
	t_{SYNCH}	VSYNC/HSYNC hold time	15	-	ns	
DE	t_{ENS}	DE setup time	15	-	ns	
	t_{ENH}	DE hold time	15	-	ns	
D[17:0]	t_{POS}	Data setup time	15	-	ns	
	t_{PDH}	Data hold time	15	-	ns	
DOTCLK	PWDH	DOTCLK high-level period	15	-	ns	
	PWDL	DOTCLK low-level period	15	-	ns	
	t_{CYCD}	DOTCLK cycle time	100	-	ns	
	t_{rgr}, t_{rgrb}	DOTCLK,HSYNC,VSYNC rise/fall time	-	15	ns	
VSYNC / HSYNC	t_{SYNCS}	VSYNC/HSYNC setup time	15	-	ns	6-bit bus RGB interface mode
	t_{SYNCH}	VSYNC/HSYNC hold time	15	-	ns	
DE	t_{ENS}	DE setup time	15	-	ns	
	t_{ENH}	DE hold time	15	-	ns	
D[17:0]	t_{POS}	Data setup time	15	-	ns	
	t_{PDH}	Data hold time	15	-	ns	
DOTCLK	PWDH	DOTCLK high-level pulse period	15	-	ns	
	PWDL	DOTCLK low-level pulse period	15	-	ns	
	t_{CYCD}	DOTCLK cycle time	100	-	ns	
	t_{rgr}, t_{rgrb}	DOTCLK,HSYNC,VSYNC rise/fall time	-	15	ns	

Note: $T_a = -30$ to 70 °C, $V_{DDI}=1.65V$ to $3.3V$, $V_{CI}=2.5V$ to $3.3V$, $AGND=VSS=0V$



8. Backlight Characteristics



Item	Symbol	Min.	Typ.	Max.	UNIT	Test Condition
Supply Voltage	V_f	11	12.6	14.0	V	$I_f=20mA$
Supply Current	I_f	-	20	-	mA	-
Luminous Intensity for LCM	-	550	650	-	cd/m ²	$I_f=20mA$
Uniformity for LCM	-	80	-	-	%	$I_f=20mA$
Lifetime	-	-	50,000	-	Hr	$I_f=20mA$
Backlight Color	White					

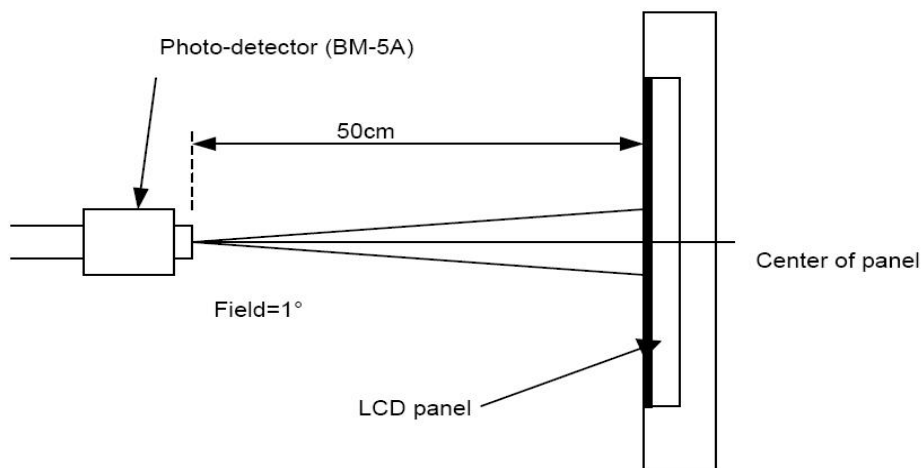


9. Optical Characteristics

Item	Conditions	Min.	Typ.	Max.	Unit	Note	
Viewing Angle (CR>10)	Horizontal	θ_L	70	80	-	degree	(1), (2), (6)
		θ_R	70	80	-		
	Vertical	θ_T	70	80	-		
		θ_B	70	80	-		
Contrast Ratio	Center	650	800	-	-	(1), (3), (6)	
Response Time	Rising + Falling	35		40	ms	(1), (4), (6)	
CF Color Chromaticity (CIE1931)	Red x	Typ. -0.05	TBD	Typ. +0.05	-	(1), (6)	
	Red y		TBD		-		
	Green x		TBD		-		
	Green y		TBD		-		
	Blue x		TBD		-		
	Blue y		TBD		-		
	White x		0.310		-		
	White y		0.346		-		

Note (1)

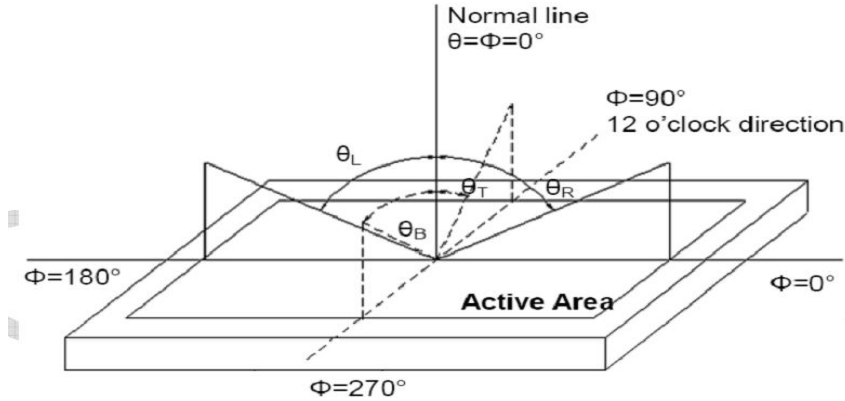
Measurement Setup: The LCD module should be stabilized at given temp. 25°C for 15 minutes to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting backlight for 15 minutes in a windless room.





Note (2)

Definition of Viewing Angle



Note (3)

Definition of Contrast Ratio (CR)

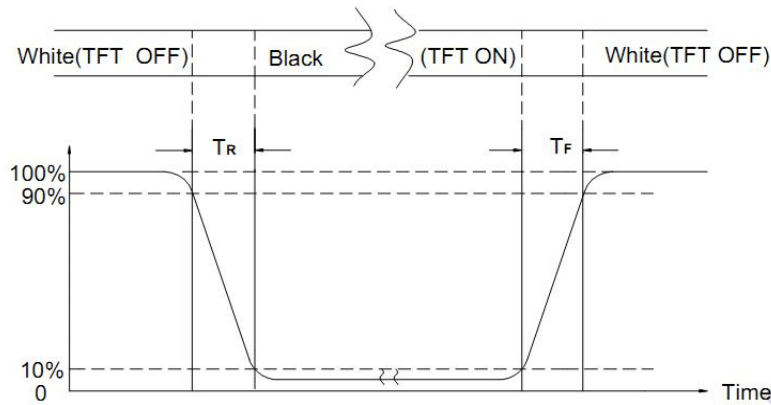
The contrast ratio can be calculated by the following expression:

$$\text{Contrast Ratio (CR)} = L63 / L0$$

L63: Luminance of gray level 63, L0: Luminance of gray level 0

Note (4)

Definition of Response Time



Note (5)

Definition of Transmittance (Module is without signal input)

$$\text{Transmittance} = \text{Center Luminance of LCD} / \text{Center Luminance of Back Light} \times 100\%$$

Note (6)

Definition of Color Chromaticity (CIE1931)

Color coordinates measured at the center point of LCD



10. Reliability Test Conditions and Methods

LCM

NO.	TEST ITEMS	TEST CONDITIONS	INSPECTION AFTER TEST
①	High Temperature Storage	80°C±2°C×96Hours	Inspection after 2~4hours storage at room temperature, the samples should be free from defects: 1. Air bubble in the LCD. 2. Seal leak. 3. Non-display. 4. Missing segments. 5. Glass crack. 6. Current IDD is twice higher than initial value. 7. The surface shall be free from damage. 8. The electric characteristic requirements shall be satisfied.
②	Low Temperature Storage	-30°C±2°C×96Hours	
③	High Temperature Operating	70°C±2°C×96Hours	
④	Low Temperature Operating	-20°C±2°C×96Hours	
⑤	Temperature Cycle (Storage)	-20°C (30min.) ↔ 25°C (5min.) ↔ 70°C (30min.) 1cycle Total 10cycle	
⑥	Damp Proof Test (Storage)	50°C±5°C×90%RH×120Hours	
⑦	Vibration Test	Frequency:10Hz~55Hz~10Hz Amplitude:1.5MM X, Y, Z direction for total 3hours (Packing condition test will be tested by a carton)	
⑧	Drooping Test	Drop to the ground from 1M height one time every side of carton. (Packing condition test will be tested by a carton)	
⑨	ESD Test	Voltage: ±8KV, R:330Ω, C:150PF, Air Mode,10times	

REMARKS:

- The Test samples should be applied to only one test item.
- Sample side for each test item is 5~10pcs.
- For Damp Proof Test, Pure water (Resistance > 10MΩ) should be used.
- 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.
- EL evaluation should be accepted from reliability test with humidity and temperature: Some defects such as black spot/blemish can happen by natural chemical reaction with humidity and Fluorescence EL has.
- Failure Judgment Criterion: Basic Specification Electrical Characteristic, Mechanical Characteristic, Optical Characteristic.

11. Inspection Standards

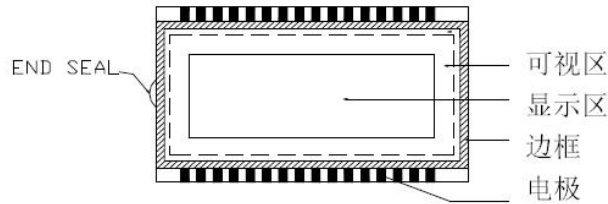


11.1. Quality

The quality of goods supplied

11.1.1. Inspection Tools and

Vernier calipers, film thickness meter and so on.



standards:

Performance

11.1.2. The Method of Preservation

After delivery of goods from Kingtech to purchaser, purchaser shall keep the LCM at -10°C to 30°C, and it might be desirable to keep at the normal room temperature and humidity until incoming inspection or throwing into process line.

11.1.3. Incoming Inspection

(A) The methods of Inspection

If purchaser makes an incoming inspection, a sampling plan shall be applied on the condition that quality of one delivery shall be regarded as one lot.

(B) The standard of quality:

ISO-2859-1 (same as MIL-STD-105E), Level: II

CLASS	AQL (%)
Critical	0.4 %
Major	0.65 %
Minor	1.5 %

Every item shall be inspected according to the class.

(C) Measure

If as the result of above receiving inspection, a lot out is discovered, purchaser shall inform seller of it within seven days. But first shipment within fourteen days.

11.1.4. Warranty Policy

Kingtech will provide one-year warranty for the products only if under Specification operating conditions. Kingtech will replace new products for these defect products which are under warranty period and belong to the responsibility of Kingtech.

11.2. Checking Condition

11.2.1 Checking direction shall be in the 45 degree area to face the sample.

11.2.2 Inspector shall see from over 300±25mm with bare eyes far from the sample.

11.2.3 Ambient Illumination:
 0 ~30 Lux for functional inspection
 500 ~ 1200 Lux for external appearance inspection.

11.2.4 Test Area:



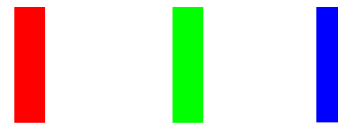
- 11.2.5 Inspection should be carried out with rope electrostatic ring and static finger cover (both hands except small fingers must be worn.)
- 11.2.6 The inspector may make a visual inspection or a comparative examination with a film ruler and a magnifying eyepiece. Individual defects shall be determined according to the limited samples.
- 11.2.7 Functional testing uses electrical testing fixtures or test fixtures required by customers.
- 11.2.8 The ion fan should be used when testing.
- 11.2.9 **The principle of judgement:**

11.2.9.1 If the defect outside the visual area does not affect the assembly and display, it will be judged as a good product.

11.2.9.2 **Poor definition:**
Pixel:
 A combination of three sub-pixels
 (Red + Green + Blue).



Dot:
 Any of the sub-pixels
 (Red or Green or Blue).



Bright and dark dots:
 A point pixel (sub-pixel: R, G, B pixels) is lit or turned off during the display function test.

Highlights:
 Usually considered to be shown on a black screen.

Dark spots:
 They are generally considered to be shown on R, G, B solid colors or white images.

Neighborhood:
 Two or three adjacent point pixels (dot: sub-pixel) connected together (R, G or G, B or B, R or RGB).

11.3 / 11.4 / 11.5 Inspection Plans:



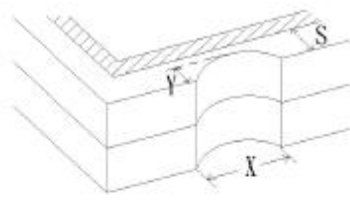
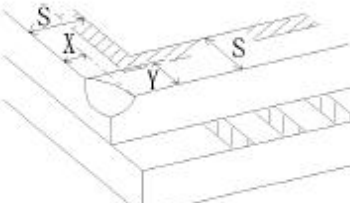
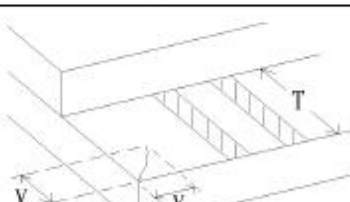

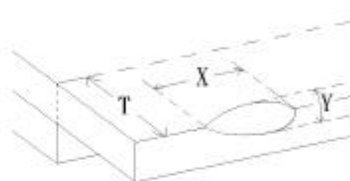
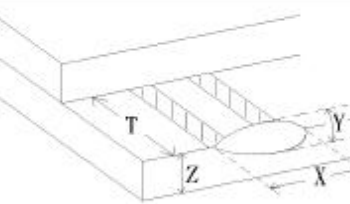
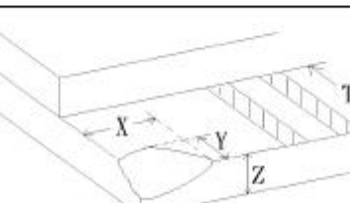
CLASS	ITEM	JUDGEMENT	CLASS
PACKING & INDICATE	1. OUTSIDE AND INSIDE PACKAGE	"MODEL NO." , "LOT NO." AND "QUANTITY" SHOULD INDICATE ON THE PACKAGE.	Minor
	2. MODEL MIXED AND QUANTITY	OTHER MODEL MIXED.....REJECTED QUANTITY SHORT OR OVER.....REJECTED	Critical
	3. PRODUCT INDICATION	"MODEL NO." SHOULD INDICATE ON THE PRODUCT	Major
ASSEMBLY	4. DIMENSION, LCD GLASS SCRATCH AND SCRIBE DEFECT.	ACCORDING TO SPECIFICATION OR DRAWING.	Major
APPEARANCE	5. VIEWING AREA	POLARIZER EDGE OR LCD'S SEALING LINE IS VISABLE IN THE VIEWING AREAREJECTED	Minor
	6. BLEMISH · BLACK SPOT · WHITE SPOT IN THE LCD AND LCD GLASS CRACKS	ACCORDING TO STANDARD OF VISUAL INSPECTION(INSIDE VIEWING AREA)	Minor
	7. BLEMISH · BLACK SPOT WHITE SPOT AND SCRATCH ON THE POLARIZER	ACCORDING TO STANDARD OF VISUAL INSPECTION(INSIDE VIEWING AREA)	Minor
	8. BUBBLE IN POLARIZER	ACCORDING TO STANDARD OF VISUAL INSPECTION(INSIDE VIEWING AREA)	Minor
	9. LCD'S RAINBOW COLOR	STRONG DEVIATION COLOR (OR NEWTON RING) OF LCD.....REJECTED. OR ACCORDING TO LIMITED SAMPLE (IF NEEDED, AND INSIDE VIEWING AREA)	Minor
ELECTRICAL	10. ELECTRICAL AND OPTICAL CHARACTERISTICS (CONTRAST· VOP · CHROMATICITY ... ETC)	ACCORDING TO SPECIFICATION OR DRAWING . (INSIDE VIEWING AREA)	Critical
	11.MISSING LINE	MISSING DOT · LINE · CHARACTERREJECTED	Critical
	12.SHORT CIRCUIT· WRONG PATTERN DISPLAY	NO DISPLAY · WRONG PATTERN DISPLAY · CURRENT CONSUMPTION OUT OF SPECIFICATION..... REJECTED	Critical
	13. DOT DEFECT (FOR COLOR AND TFT)	ACCORDING TO STANDARD OF VISUAL INSPECTION	Minor

NO.	CLASS	ITEM	JUDGEMENT
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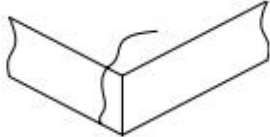
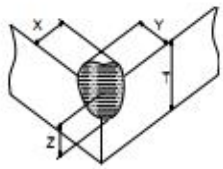
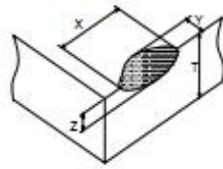


11.4.1	MINOR	BLACK AND WHITE SPOT FOREIGN MATERIEL DUST IN THE CELL BLEMISH SCRATCH	(A) ROUND TYPE: unit: mm									
			<table border="1"> <thead> <tr> <th>DIAMETER (mm.)</th> <th>ACCEPTABLE Q'TY</th> </tr> </thead> <tbody> <tr> <td>$\varnothing \leq 0.1$</td> <td>Disregard</td> </tr> <tr> <td>$0.1 < \varnothing \leq 0.25$</td> <td>3 (Distance \geq 5mm)</td> </tr> <tr> <td>$0.25 < \varnothing$</td> <td>0</td> </tr> </tbody> </table> <p>NOTE: $\varnothing = (\text{LENGTH} * \text{WIDTH}) / 2$</p>	DIAMETER (mm.)	ACCEPTABLE Q'TY	$\varnothing \leq 0.1$	Disregard	$0.1 < \varnothing \leq 0.25$	3 (Distance \geq 5mm)	$0.25 < \varnothing$	0	
DIAMETER (mm.)	ACCEPTABLE Q'TY											
$\varnothing \leq 0.1$	Disregard											
$0.1 < \varnothing \leq 0.25$	3 (Distance \geq 5mm)											
$0.25 < \varnothing$	0											
11.4.2	MINOR	BUBBLE IN POLARIZER DENT ON POLARIZER	(S) ROUND TYPE: unit: mm									
			<table border="1"> <thead> <tr> <th>LENGTH</th> <th>WIDTH</th> <th>ACCEPTABLE QTY</th> </tr> </thead> <tbody> <tr> <td>.....</td> <td>$W \leq 0.03$</td> <td>Disregard</td> </tr> <tr> <td>$L \leq 5.0$</td> <td>$0.03 < W \leq 0.07$</td> <td>3 (Distanced \geq 5mm)</td> </tr> <tr> <td>.....</td> <td>$0.07 < W$</td> <td>FOLLOW ROUND TYPE</td> </tr> </tbody> </table> <p>NOTE: $\varnothing = (\text{LENGTH} * \text{WIDTH}) / 2$</p>	LENGTH	WIDTH	ACCEPTABLE QTY	$W \leq 0.03$	Disregard	$L \leq 5.0$	$0.03 < W \leq 0.07$	3 (Distanced \geq 5mm)
LENGTH	WIDTH	ACCEPTABLE QTY										
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.....	$0.07 < W$	FOLLOW ROUND TYPE										
11.4.3	MINOR	Dot Defect	<table border="1"> <thead> <tr> <th>Items</th> <th>ACC. Q'TY</th> </tr> </thead> <tbody> <tr> <td>Bright dot</td> <td>$N \leq 4$ (Distance \geq 5mm)</td> </tr> <tr> <td>Dark dot</td> <td>$N \leq 4$ (Distance \geq 5mm)</td> </tr> </tbody> </table> <p>Pixel Define :</p> <p>Note:</p> <ol style="list-style-type: none"> The definition of dot: The size of a defective dot over 1 of whole dot is regarded as one defective dot. Definition: $< 1/2$ dot and visible by 5% ND filter Bright dot: Dots appear bright and unchanged in size m which LCD panel is displaying under black pattern. Dark dot: Dots appear dark and unchanged in size in which LCD panel is displaying under pure Red, Green, Blue pattern. 	Items	ACC. Q'TY	Bright dot	$N \leq 4$ (Distance \geq 5mm)	Dark dot	$N \leq 4$ (Distance \geq 5mm)			
Items	ACC. Q'TY											
Bright dot	$N \leq 4$ (Distance \geq 5mm)											
Dark dot	$N \leq 4$ (Distance \geq 5mm)											
11.4.3.1	MINOR	Mura	Not visible through 5% ND filter in 50% gray or judge by limit sample if necessary									



NO.	CLASS	ITEM	JUDGEMENT
11.4.4	MINOR	LCD GLASS CHIPPING	 $Y > S$ Reject
11.4.5	MINOR	LCD GLASS CHIPPING	 $X \text{ or } Y > S$ Reject
11.4.6	MAJOR	LCD GLASS GLASS CRACK	 $Y > (1/2) T$ Reject
11.4.7	MAJOR	LCD GLASS SCRIBE DEFECT	 <ol style="list-style-type: none"> $a > L/3$, $A > 1.5\text{mm}$. Reject B : ACCORDING TO DIMENSION
11.4.8	MINOR	LCD GLASS CHIPPING (ON THE TERMINAL AREA)	 $\Phi = (x+y)/2 > 2.5 \text{ mm}$ Reject
11.4.9	MINOR	LCD GLASS CHIPPING (ON THE TERMINAL SURFACE)	 $Y > (1/3) T$ Reject
11.4.10	MINOR	LCD GLASS CHIPPING	 $Y > T$ Reject



NO.	CLASS	ITEMS		JUDGEMENT							
11.5.1	MAJOR	Touch Panel Crack			Reject						
11.5.2	MINOR	Touch Panel Chipping	Corner		<table border="1"> <tr> <td>Not CNC Products</td> <td>$X \leq 2\text{mm}, Y \leq 2\text{mm}, Z < 1/2T$</td> <td>Accept</td> </tr> <tr> <td>CNC Products</td> <td>For CNC Outline Dimension</td> <td>Accept</td> </tr> </table>	Not CNC Products	$X \leq 2\text{mm}, Y \leq 2\text{mm}, Z < 1/2T$	Accept	CNC Products	For CNC Outline Dimension	Accept
			Not CNC Products	$X \leq 2\text{mm}, Y \leq 2\text{mm}, Z < 1/2T$	Accept						
CNC Products	For CNC Outline Dimension	Accept									
Edge		<table border="1"> <tr> <td>Not CNC Products</td> <td>$X \leq 3\text{mm}, Y \leq 3\text{mm}, Z < 1/2T$</td> <td>Accept</td> </tr> <tr> <td>CNC Products</td> <td>For CNC Outline Dimension</td> <td>Accept</td> </tr> </table>	Not CNC Products	$X \leq 3\text{mm}, Y \leq 3\text{mm}, Z < 1/2T$	Accept	CNC Products	For CNC Outline Dimension	Accept			
Not CNC Products	$X \leq 3\text{mm}, Y \leq 3\text{mm}, Z < 1/2T$	Accept									
CNC Products	For CNC Outline Dimension	Accept									
11.5.3	MINOR	Scratch Dust and Foreign material (Linear Type)		$W \leq 0.05, L \leq 10\text{mm}$	Accept						
				$0.05\text{mm} < W \leq 0.07\text{mm}; L \leq 5.0\text{mm}$ Distance between scratch $> 5.0\text{mm}$	Accept 3 ea Max.						
				$W > 0.07\text{mm}$	Reject						
11.5.4	MINOR	Scratch Dust and Foreign material (Round Type : $\Phi = (\text{Length} + \text{Width})/2$)		$\Phi \leq 0.15\text{mm}$	Accept						
				$0.15\text{mm} < \Phi \leq 0.25\text{mm}$ Distance between scratch $> 5.0\text{mm}$	Accept 5 ea Max.						
				$\Phi > 0.25\text{mm}$	Reject						
11.5.5	MINOR	Touch Panel Dent / Fish Eyes ($\Phi = (\text{Length} + \text{Width})/2$)		$\Phi \leq 0.35\text{mm}$	Accept						
				$0.35\text{mm} < \Phi \leq 1.0\text{mm}$ Distance $> 5.0\text{mm}$	Accept 3 ea Max.						
				$\Phi > 1.0\text{mm}$	Reject						
11.5.6	MINOR	Touch Panel Air Bubble ($\Phi = (\text{Length} + \text{Width})/2$)		$\Phi \leq 0.15\text{mm}$	Accept						
				$0.15\text{mm} < \Phi \leq 0.25\text{mm}$ Distance between bubbles $> 5.0\text{mm}$	Accept 3 ea Max.						
				$\Phi > 0.25\text{mm}$	Reject						
11.5.7	MINOR	Touch Panel Printing area Scratch		$W \leq 0.03, L \leq 10\text{mm}$	Accept						
				$0.03\text{mm} < W \leq 0.05\text{mm}, L \leq 5\text{mm}$	Accept 3 ea Max.						
				$W > 0.05\text{mm}$ or $L > 5\text{mm}$ ($W > 0.05$ Follow 8.5.4 Round type)	Reject						
11.5.8	MINOR	Touch Panel White Haze Mark / Dust		Can not be removed	Reject						



12. Handling Precautions

12.1 Mounting Method

The LCD panel of Kingtech module consists of two thin glass plates with polarizers which easily be damaged. And since the module is constructed as to be fixed by utilizing fitting holes in the printed circuit board, extreme care should be needed when handling the LCD modules.

12.2 Caution of LCD Handling and Cleaning

When cleaning the display surface, Use soft cloth with solvent [Recommended below] and wipe lightly

- Isopropyl alcohol
- Ethyl alcohol

Do not wipe the display surface with dry or hard materials that will damage the polarizer surface.

Do not use the following solvent:

- Water
- Aromatics

Do not wipe ITO pad area with the dry or hard materials that will damage the ITO patterns

Do not use the following solvent on the pad or prevent it from being contaminated:

- Soldering flux
- Chlorine (Cl) , Sulfur (S)

If goods were sent without being silicon coated on the pad, ITO patterns could be damaged due to the corrosion as time goes on.

If ITO corrosion happen by miss-handling or using some materials such as Chlorine (Cl), Sulfur (S) from customer, Responsibility is on customer.

12.3 Caution against Static Charge

The LCD module use C-MOS LSI drivers, so we recommended that you:

Connect any unused input terminal to POWER or GROUND, do not input any signals before power is turned on, and ground your body, work/assembly areas, and assembly equipment to protect against static electricity.

12.4 Packing

- Module employs LCD elements and must be treated as such.
- Avoid intense shock and falls from a height.
- To prevent modules from degradation, do not operate or store them exposed direct to sunshine or high temperature/humidity

12.5 Caution for Operation

- It is an indispensable condition to drive LCD's within the specified voltage limit since the higher voltage then the limit cause the shorter LCD life.
- An electrochemical reaction due to direct current causes LCD's undesirable deterioration, so that the use of direct current drive should be avoided.
- Response time will be extremely delayed at lower temperature then the operating temperature range and on the other hand at higher temperature LCD's how dark



color in them. However those phenomena do not mean malfunction or out of order with

LCD's, which will come back in the specified operation temperature.

- If the display area is pushed hard during operation, some font will be abnormally displayed but it resumes normal condition after turning off once.
- Slight dew depositing on terminals is a cause for electro-chemical reaction resulting in terminal open circuit.

Usage under the maximum operating temperature, 50%Rh or less is required.

12.6 Storing

In the case of storing for a long period of time for instance, for years for the purpose or replacement use, the following ways are recommended.

- Storage in a polyethylene bag with the opening sealed so as not to enter fresh air outside in it. And with no desiccant.
- Placing in a dark place where neither exposure to direct sunlight nor light's keeping the storage temperature range.
- Storing with no touch on polarizer surface by the anything else.
- [It is recommended to store them as they have been contained in the inner container at the time of delivery from us

12.7 Safety

- It is recommendable to crash damaged or unnecessary LCD's into pieces and wash off liquid crystal by either of solvents such as acetone and ethanol, which should be burned up later.
- When any liquid leaked out of a damaged glass cell comes in contact with your hands, please wash it off well with soap and water

13. Precaution for Use

13.1

A limit sample should be provided by the both parties on an occasion when the both parties agreed its necessity. Judgment by a limit sample shall take effect after the limit sample has been established and confirmed by the both parties.

13.2

On the following occasions, the handing of problem should be decided through discussion and agreement between responsible of both parties.

- When a question is arisen in this specification
- When a new problem is arisen which is not specified in this specification.
- When an inspection specification change or operating condition change in customer is reported to Kingtech, and some problem is arisen in this specification due to the change
- When a new problem is arisen at the customer's operating set for sample evaluation in the customer site.

14. Packing Method



TBD