AZ DISPLAYS

SPECIFICATIONS FOR LIQUID CRYSTAL DISPLAY

CUSTOMER APPROVAL			
※ **PART NO. :** ATM1560L1K-CT (AZ DISPLAYS) VER1.1			
APPROVAL		**COMPANY CHOP**	
CUSTOMER COMMENTS			

AZ DISPLAYS ENGINEERING APPROVAL		
DESIGNED BY	**CHECKED BY**	**APPROVED BY**
Marcus Weber		

REVISION RECORD

REVISION	REVISION DATE	PAGE	CONTENTS
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VER1.1	12/15/2020	3	Added touch IC information

※ CONTENTS

1. GENERAL SPECIFICATIONS

ATM1560L1K-CT is a 15.6" TFT Liquid Crystal Display module with LED backlight unit and a 40-pin LVDS interface. It features a tape attached PCAP touch sensor that can be connected via USB or I2C bus. The LCD has a 1920 x 1080 FHD resolutions and is based the an IPS technology supporting 16,194,277 colors.

Item	Specification	Remark
1. LCD size	15.6 inch(Diagonal)	
2. Driver element	a-Si TFT active matrix	
3. Resolution	1920 x 1080	
4. Display mode	Normally black	
5. Dot Pitch (W*H)	0.17925 (H) x 0.17925 (V)	
6. Active Area (W*H)	344.16 (H) x 193.59 (V)	
7. Module size (W*H)	387.73mm(W) x 237.09mm(H) x 12.05 mm(D)	Note 1
8. Surface treatment	Glare	
9. Color arrangement	RGB-stripe	
10. Interface LCD	LVDS	
11. Interface touch	USB, I2C	
12. Interface Controller	EXC 80H60	
13. Backlight power consumption	17.28 W	
14. Panel power consumption	4 W	
15. Weight	1520 g	
16. RoHS	ROHS compliant	

Note 1: Please refer to mechanical drawing.

2.0 MECHANICAL SPECIFICATION

Item		Min.	Typ.	Max.	Unit
LCD Module Size	Horizontal (H)	363.3	363.8	364.3	mm
	Vertical (V)	215.4	215.9	216.4	mm
Assembly Size	Horizontal (H)	387.43	387.73	388.03	mm
	Vertical (V)	236.79	237.09	237.39	mm
	Thickness (T)	11.1	12.05	13.0	mm

3. PIN ASSIGNMENT

3.1 LVDS CONNECTOR

Pin	Name	Description
1	LED _Vcc	+12V Vi power supply
2	LED _Vcc	+12V Vi power supply
3	LED _Vcc	+12V Vi power supply
4	LED _Vcc	+12V Vi power supply
5	GND	Ground
6	GND	Ground
7	GND	Ground
8	GND	Ground
9	LED_EN	Enable pin
10	LED_PWM	Backlight Adjust
11	LCD_VCC	LCD logic and driver power 3.3V
12	LCD_VCC	LCD logic and driver power 3.3V
13	LCD_VCC	LCD logic and driver power 3.3V
14	NC	Not connection, this pin should be open
15	NC	Not connection, this pin should be open
16	NC	Not connection, this pin should be open
17	LCD GND	LCD logic and driver ground
18	RXO0-	Negative LVDS differential data input. Channel O0 (odd)
19	RXO0+	Positive LVDS differential data input. Channel O0 (odd)
20	RXO1-	Negative LVDS differential data input. Channel O1 (odd)
21	RXO1+	Positive LVDS differential data input. Channel O1 (odd)
22	RXO2-	Negative LVDS differential data input. Channel O2 (odd)
23	RXO2+	Positive LVDS differential data input. Channel O2 (odd)
24	LCD GND	LCD logic and driver ground
25	RXOC-	Negative LVDS differential clock input. (odd)
26	RXOC+	Positive LVDS differential clock input. (odd)
27	LCD GND	LCD logic and driver ground
28	RXO3-	Negative LVDS differential data input. Channel O3(odd)
29	RXO3+	Positive LVDS differential data input. Channel O3 (odd)
30	RXE0-	Negative LVDS differential data input. Channel E0 (even)
31	RXE0+	Positive LVDS differential data input. Channel E0 (even)
32	RXE1-	Negative LVDS differential data input. Channel E1 (even)
33	RXE1+	Positive LVDS differential data input. Channel E1 (even)
34	LCD GND	LCD logic and driver ground
35	RXE2-	Negative LVDS differential data input. Channel E2 (even)
36	RXE2+	Positive LVDS differential data input. Channel E2 (even)
37	RXEC-	Negative LVDS differential clock input. (even)
38	RXEC+	Positive LVDS differential clock input. (even)
39	RXE3-	Negative LVDS differential data input. Channel E3 (even)
40	RXE3+	Positive LVDS differential data input. Channel E3 (even)

Note (1) Connector Part No.: I-PEX 20455-040E-76 or equivalent.
Note (2) User's connector Part No.: I-PEX 20453-040T-03 or equivalent.

3.2 TOUCH PANEL

Pin No.	Symbol	Function
1	GND	Ground
2	I^2C-SDA	SDA
3	I^2C-SCL	SCL
4	VDD	5V
5	I^2C-INT	INT
6	/RST	RESET

Connector: E&T (3802K-E06N-01X)

Pin No.	Symbol	Function
1	GND-EARTH	GROUND EARTH
2	VDD	5V
3	GND	Ground
4	D+	USB signal +
5	D-	USB signal -

Connector: E&T (3802K-E05N-01X)

4. OPERATING SPECIFICATIONS

4.1 ABSOLUTE MAXIMUM RATINGS

Item	Symbol	Values		Unit	Remark
		Min.	Max.		
Power Voltage	V_{CC}	-0.3	3.6	V	Note 1
Logic Input Voltage	V_{IN}	-0.3	4.0	V	Note 1
Operation Temperature	T_{OP}	-30	80	ºC	
Storage Temperature	T_{ST}	-40	80	ºC	Note 1, 2

Note 1: The absolute maximum rating values of this product are not allowed to be exceeded at any times. Should a module be used with any of the absolute maximum ratings exceeded, the characteristics of the module may not be recovered, or in an extreme case, the module may be permanently destroyed.

Note 2: Temperature and relative humidity range is shown in the figure below.

(a) 85 %RH Max. (Ta ≦ 40 ºC).

(b) Wet-bulb temperature should be 39 ºC Max. (Ta > 40 ºC).

(c) No condensation.

4.1.1 Typical Operation Conditions

Item	Symbol	Values			Unit	Remark
		Min.	Typ.	Max.		
Power Voltage	DV_{DD}	3.15	3.3	3.6	V	
	V_{RP}	-	-	150	V	
	I_{RP}	-	-	3	A	
POWER CONSUMPTION	PLCD	-	4	5	Watt	
LVDS differential input voltage	V_{id}	200		600	mV	
LVDS common input voltage	V_{ic}	1.0	1.2	1.4	V	
LVDS terminating resistor	Rt		100		Ohm	

4.1.2 Backlight driving conditions

Item	Symbol	Values			Unit	Remark
		Min.	Typ.	Max.		
LED String Current	Is	-	80		mA	1, 2, 6
LED String Voltage	V_s		54		V	1, 3, 6
Power Consumption	P_{Bar}		17.28		W	1, 2, 5
LED Lifetime	LED_LT		50,000		Hrs	4

Notes) The LED Bar consists of 36 LED packages, 4 strings (parallel) x 9 packages (serial)

LED driver design guide:

The design of the LED driver must have specifications for the LED in LCD Assembly.
The performance of the LED in LCM, for example life time or brightness, is extremely influenced by the characteristics of the LED driver.
So all the parameters of an LED driver should be carefully designed and output current should be Constant current control.
Please control feedback current of each string individually to compensate the current variation among the strings of LEDs.
When you design or order the LED driver, please make sure unwanted lighting caused by the mismatch of the LED and the LED driver (no lighting, flicker, etc) never occurs.
When you confirm it, the LCD module should be operated in the same condition as installed in your instrument.

1. The specified values are for a single LED bar.

2. The specified current is defined as the input current for a single LED string with 100% duty cycle.

3. The specified voltage is input LED string and Bar voltage at typical Current 100% duty current. 4. The LED life time is defined as the time when brightness of LED packages become 50% or less than the initial value under the conditions at Ta = 25 ± 2°C and LED string current is typical value.

5. The power consumption shown above does not include loss of external driver. The typical power consumption is calculated as PBar = Vs(Typ.) x Is(Typ.) x No. of strings. The maximum power consumption is calculated as PBar = Vs(Max.) x Is(Typ.) x No. of strings.

6. LED operating conditions are must not exceed Max. ratings.

4.1.3 LED driver specification

Item	Condition	Min.	Typ.	Max.	Unit
Input Voltage	-	11	12	13.5	V
Input Current	Vin = 12.0V, PWM= 100%	-	-	5	A
Brightness control	Duty = 100%		Max. brightness		V
	Duty = 0.75%		Min. brightness		
PWM	100 ~ 20k		1k		Hz
Backlight On/Off	On		2.4 ~ 5.25		V
	Off		0 ~ 0.8		

4.1.4 Backlight PIN ASSIGNMENT

CN1 INPUT CONNECTOR : 20022WR-06(YEONHO)

Pin No.	Symbol	Remarks
1	BRT_ADJ	Brightness Control
2	ON/OFF	On/Off Control
3, 4	GND	Ground
5, 6	Vin	DC Input Power

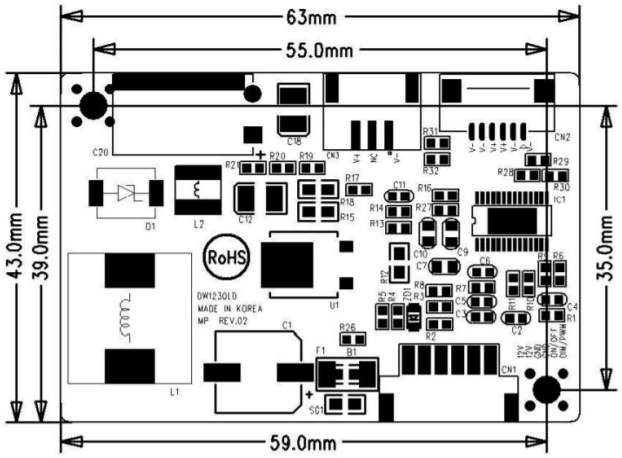
CN3 OUTPUT CONNECTOR : 20037WR-03(YEONHO)

Pin No.	Symbol	Remarks
1	Io	ILED (current out)
2	NC	Not Connected
3	Vin	VLED (LED Input voltage)

CN2 OUTPUT CONNECTOR : 12505WR-06(YEONHO)

Pin No.	Symbol	Remarks
1	Io	ILED (current out)
2		
3	Vin	VLED (LED Input voltage)
4		
5	Io	ILED (current out)
6		

MECHANICAL DRAWING



4.2 LVDS INPUT SIGNAL SPECIFICATIONS

LVDS Channel O0	LVDS output	D7	D6	D4	D3	D2	D1	D0
	Data order	OG0	OR5	OR4	OR3	OR2	OR1	OR0
LVDS Channel O1	LVDS output	D18	D15	D14	D13	D12	D9	D8
	Data order	OB1	OB0	OG5	OG4	OG3	OG2	OG1
LVDS Channel O2	LVDS output	D26	D25	D24	D22	D21	D20	D19
	Data order	DE	NA	NA	OB5	OB4	OB3	OB2
LVDS Channel O3	LVDS output	D23	D17	D16	D11	D10	D5	D27
	Data order	NA	OB7	OB6	OG7	OG6	OR7	OR6
LVDS Channel E0	LVDS output	D7	D6	D4	D3	D2	D1	D0
	Data order	EG0	ER5	ER4	ER3	ER2	ER1	ER0
LVDS Channel E1	LVDS output	D18	D15	D14	D13	D12	D9	D8
	Data order	EB1	EB0	EG5	EG4	EG3	EG2	EG1
LVDS Channel E2	LVDS output	D26	D25	D24	D22	D21	D20	D19
	Data order	DE	NA	NA	EB5	EB4	EB3	EB2
LVDS Channel E3	LVDS output	D23	D17	D16	D11	D10	D5	D27
	Data order	NA	EB7	EB6	EG7	EG6	ER7	ER6

4.3 COLOR DATA INPUT ASSIGNMENT

The brightness of each primary color (red, green and blue) is based on the 8-bit gray scale data input for the color. The higher the binary input, the brighter the color. The table below provides the assignment of color versus data input.

Color		Data Signal																							
		Red								Green								Blue							
		R7	R6	R5	R4	R3	R2	R1	R0	G7	G6	G5	G4	G3	G2	G1	G0	B7	B6	B5	B4	B3	B2	B1	B0
Basic Colors	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Green	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	Cyan	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Magenta	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	Yellow	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	White	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Gray Scale Of Red	Red(0) / Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(1)	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(2)	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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	Red(253)	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(254)	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(255)	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gray Scale Of Green	Green(0)/Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Green(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
	Green(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
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	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Green(253)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0
	Green(254)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0
	Green(255)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
Gray Scale Of Blue	Blue(0) / Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Blue(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Blue(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Blue(253)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	1
	Blue(254)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0
	Blue(255)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1

Note (1) 0: Low Level Voltage, 1: High Level Voltage

4.4 DISPLAY TIMING SPECIFICATIONS

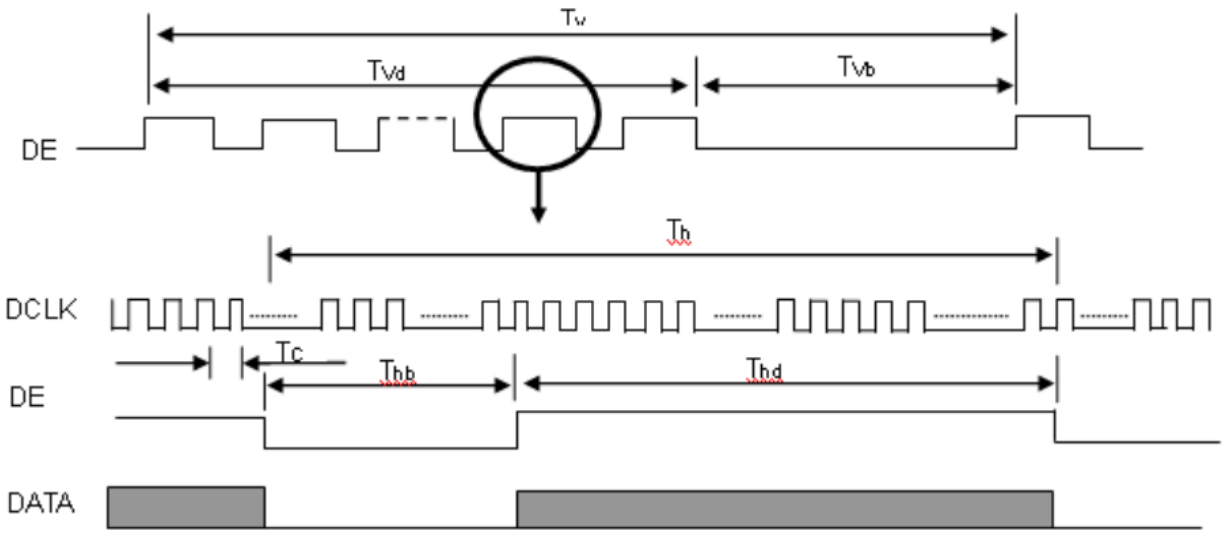
The input signal timing specifications are shown as the following table and timing diagram.

Signal	Item	Symbol	Min.	Typ.	Max.	Unit	Note
LVDS Clock	Frequency	Fc	(60)	70.93	(75)	MHz	-
	Period	Tc		14.1		ns	
	Input cycle to cycle jitter	T_{rcl}	-0.02*Tc		0.02*Tc	ns	(3)
	Input clock to data skew	TLVCCS	-0.02*Tc		0.02*Tc	ns	(4)
	Spread spectrum modulation range	Fclkin_mod	FC*98%		FC*102%	MHz	(5)
	Spread spectrum modulation frequency	F_{SSM}			200	KHz	
Vertical Display Term	Frame Rate	Fr	(50)	60	60	Hz	Tv=Tvd+Tvb
	Total	Tv	(1090)	1110	(1130)	Th	-
	Active Display	Tvd	1080	1080	1080	Th	-
	Blank	Tvb	Tv-Tvd	30	Tv-Tvd	Th	-
Horizontal Display Term	Total	Th	(1050)	1065	(1075)	Tc	Th=Thd+Thb
	Active Display	Thd	960	960	960	Tc	-
	Blank	Thb	Th-Thd	105	Th-Thd	Tc	-

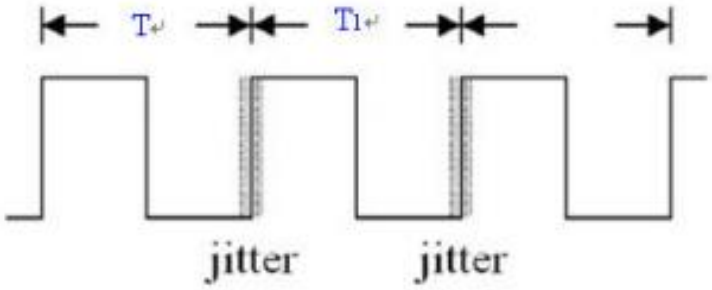
Note (1) Because this module is operated by DE only mode, Hsync and Vsync input signals are ignored.

Note (2) The Tv(Tvd+Tvb) must be integer, otherwise, this module would operate abnormally.

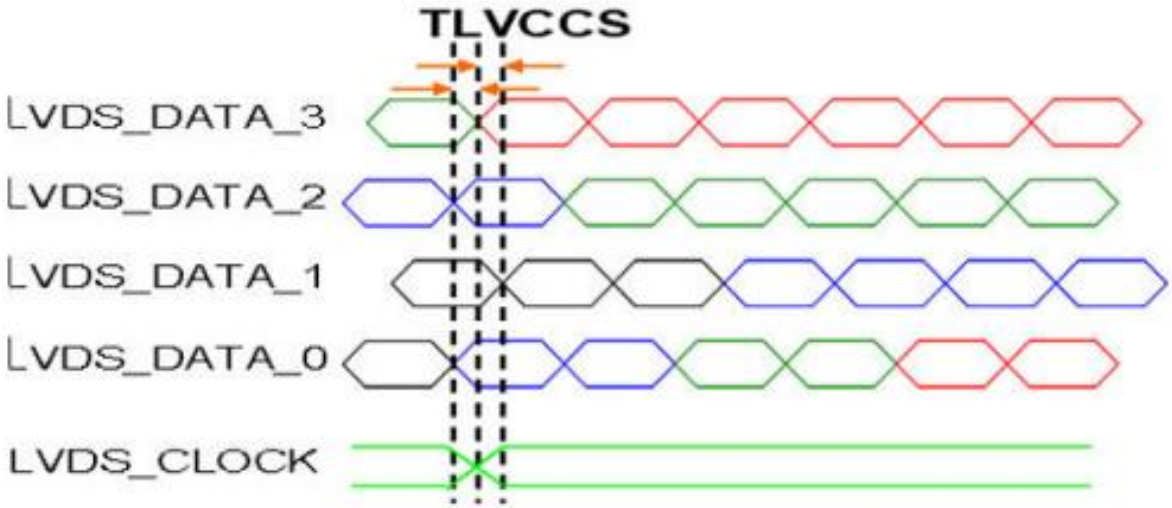
INPUT SIGNAL TIMING DIAGRAM



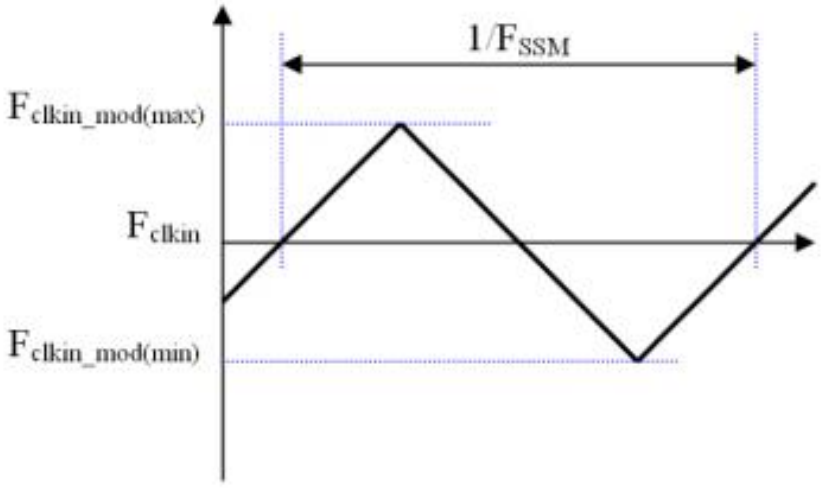
Note (3) The input clock cycle-to-cycle jitter is defined as below figures. Trcl = I T_1 – TI



Note (4) Input Clock to data skew is defined as below figures.

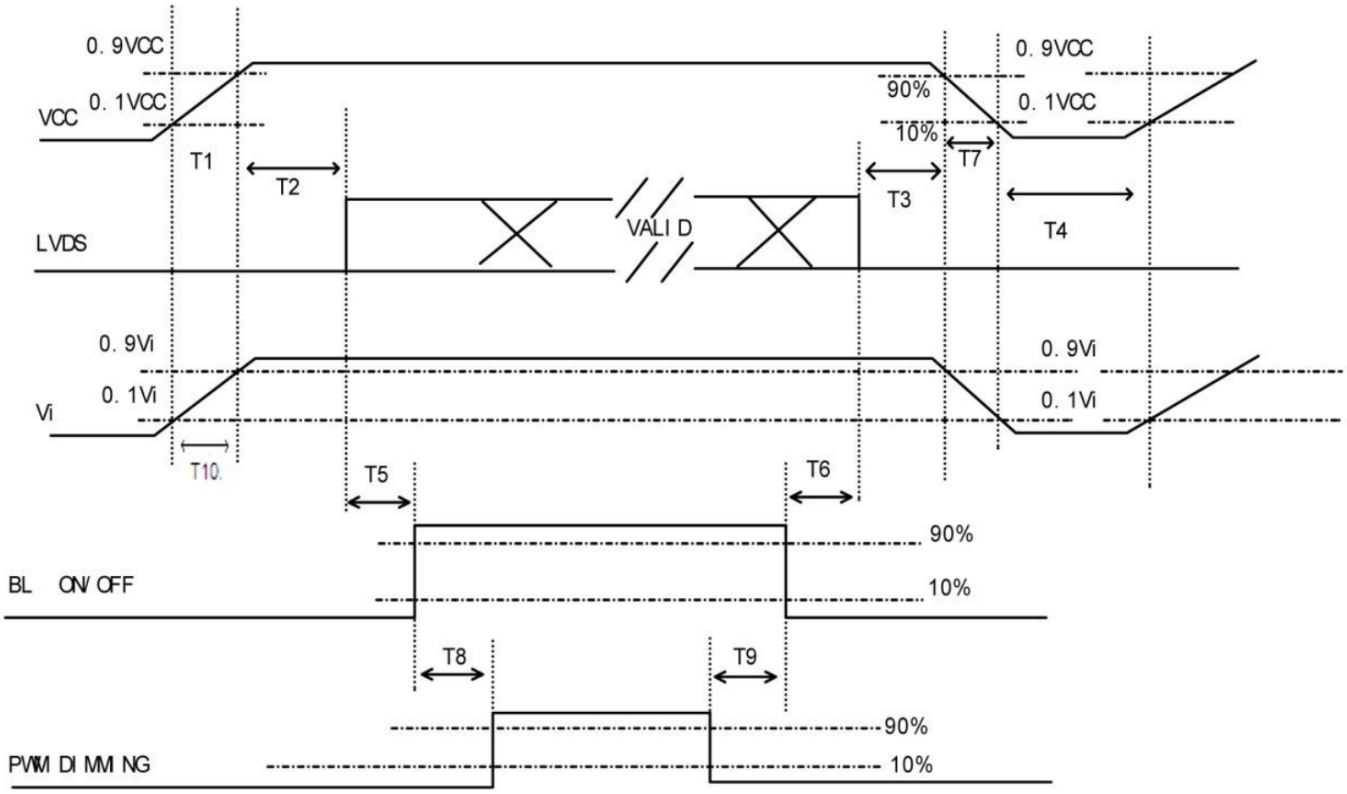


Note (5) The SSCG (Spread spectrum clock generator) is defined as below figures.



4.5 POWER ON/OFF SEQUENCE

The power sequence specification are shown as the following table and diagram.



Timing Specifications:

Parameter	Value			Units
	Min	Typ	Max	
T1	0.5	-	10	ms
T2	0	-	50	ms
T3	0	-	50	ms
T4	500	-	-	ms
T5	450	-	-	ms
T6	20	-	-	ms
T7	10	-	300	ms
T8	10	-	-	ms
T9	10	-	-	ms
T10	20	-	-	ms

Note (1) Please avoid floating state of interface signal at invalid period.

Note (2) When the interface signal is invalid, be sure to pull down the power supply of LCD VCC to 0 V.

Note (3) The Backlight converter power must be turned on after the power supply for the logic and the interface signal is valid. The Backlight converter power must be turned off before the power supply for the logic and the interface signal is invalid.

5.0 OPTICAL SPECIFICATIONS

5.1 TEST CONDITIONS

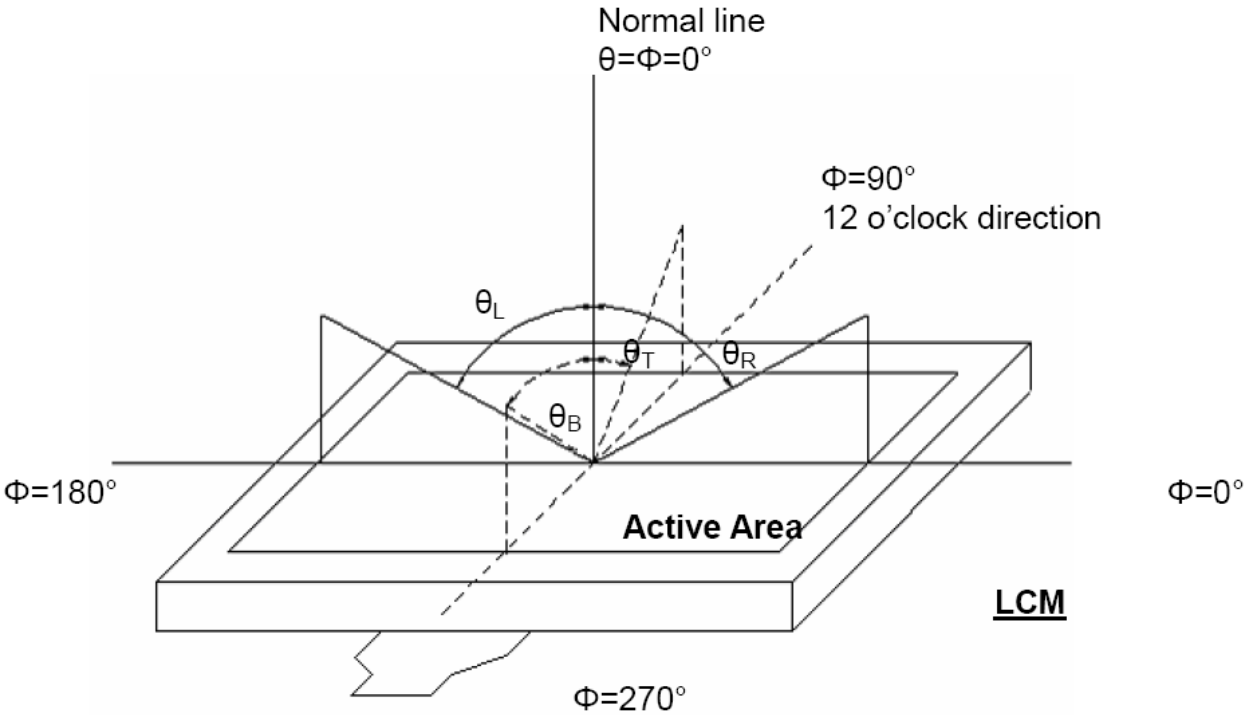
Item	Symbol	Value	Unit
Ambient Temperature	Ta	25±2	℃
Ambient Humidity	Ha	50±10	%RH
Supply Voltage	According to typical value in "ELECTRICAL CHARACTERISTICS"		
Input Signal			
LED Light Bar Input Current Per Input Pin			

5.2 OPTICAL SPECIFICATIONS

The relative measurement methods of optical characteristics are shown in 5.2 and all items are measured at the center point of screen except white variation. The following items should be measured under the test conditions described in 5.1 and stable environment shown in Note (5).

Item	Symbol	Condition	Values			Unit	Remark
			Min.	Typ.	Max.		
Viewing Angle (CR≥ 10)	θ_L	Φ=180°(9 O'CLOCK)	80	85	--	degree	Note 1, 5
	θ_R	Φ=0°(3 O'CLOCK)	80	85	--		
	θ_T	Φ=90°(12 O'CLOCK)	80	85	--		
	θ_B	Φ=270°(6 O'CLOCK)	80	85	--		
Response Time	T_{ON}	Normal Θ=Φ=0°	--	12	17	msec	Note 3
	T_{OFF}		--	13	18	msec	Note 3
Contrast Ratio	CR		4000	5000	--	--	Note 2,5
Color Chromaticity	W_X		0.26	0.31	0.36	--	Note 2
	W_Y		0.28	0.33	0.38	--	Note 5 Note 6
Luminance center	L		1200	1350	--	cd/m^2	Note 4, 5
Luminance Uniformity	YU		70	-	--	%	Note 5, 6

Note 1: Definition of viewing angle range



Note 2: Definition of Contrast Ratio (CR):

The contrast ratio can be calculated by the following expression.

Contrast Ratio (CR) = L255 / L0

L255: Luminance of gray level 255

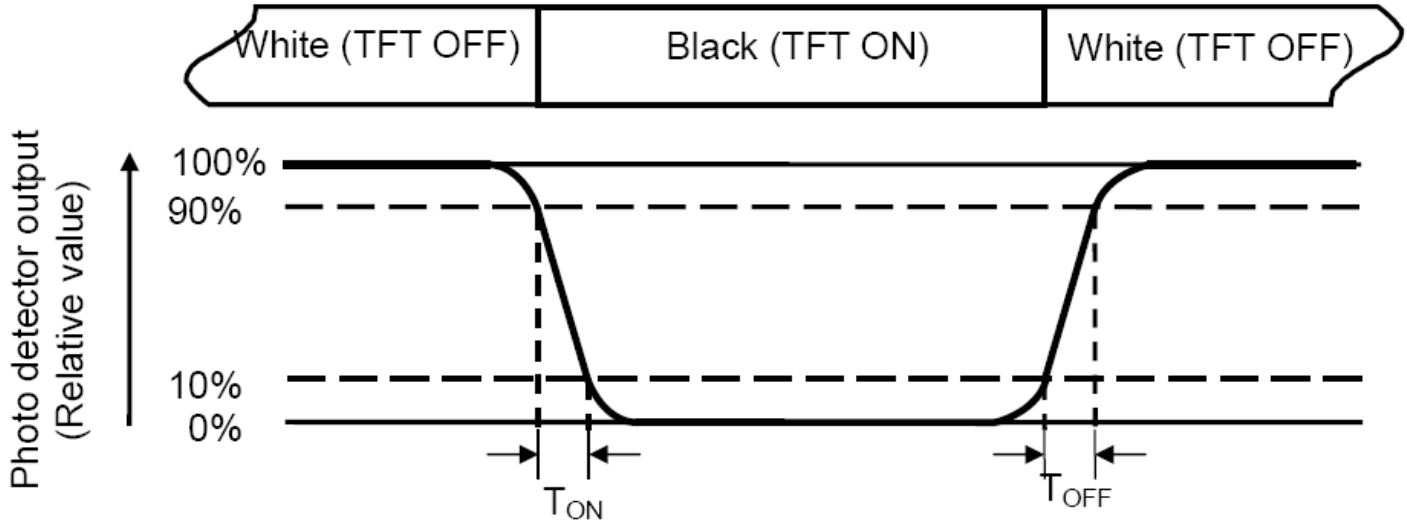
L 0: Luminance of gray level 0

CR = CR (5)

CR (X) is corresponding to the Contrast Ratio of the point X at Figure in Note (6).

Note 3: Definition of Response time

The response time is defined as the LCD optical switching time interval between "White" state and "Black" state. Rise time (TON) is the time between photo detector output intensity changed from 90% to 10%. And fall time (TOFF) is the time between photo detector output intensity changed from 10% to 90%.



Note 4: Definition of Luminance of White (LC):

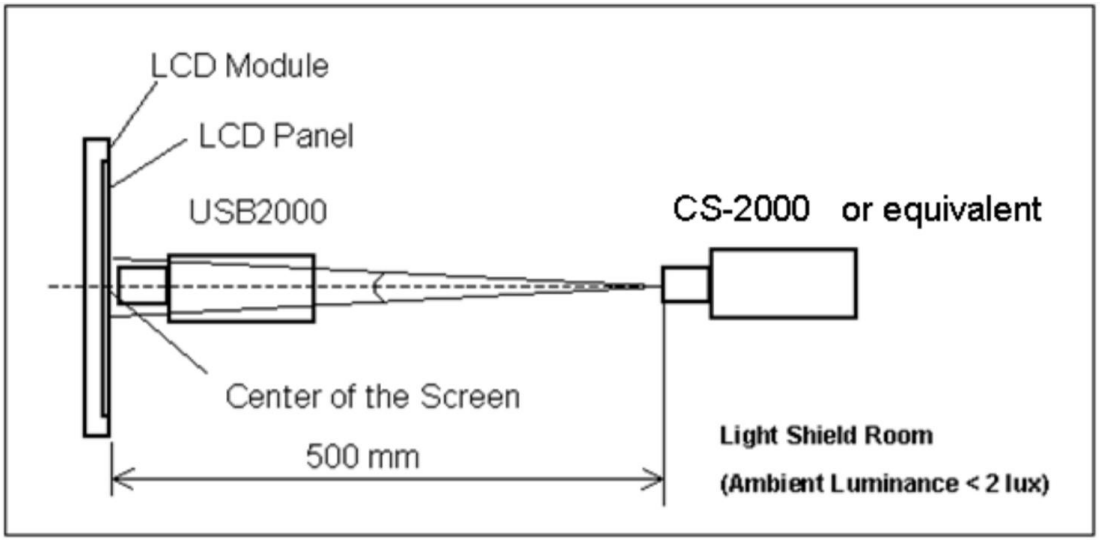
Measure the luminance of gray level 255 at center point

LC = L (5)

L (x) is corresponding to the luminance of the point X at Figure in Note (6).

Note 5: Measurement Setup:

The LCD module should be stabilized at given temperature for 30 minutes to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting Backlight for 30 minutes in a windless room.

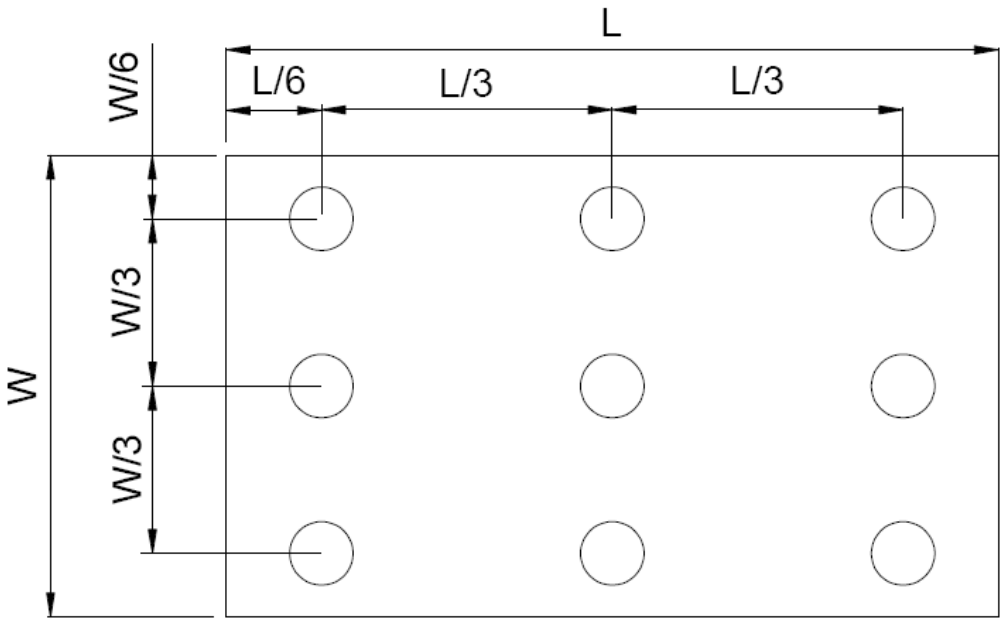


Note 6: Definition of White Variation (δW):

Active area is divided into 9 measuring areas (Refer to Fig. below). Every measuring point is placed at the center of each measuring area.

$$Luminance\ \ Uniformity\ (Yu) = \frac{B_{min}}{B_{max}}$$

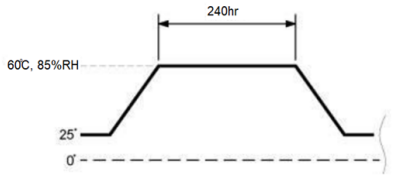
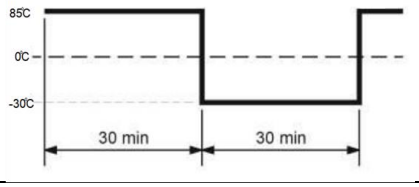
L-------Active area length W----- Active area width



BMAX: THE MEASURED MAXIMUM LUMINANCE OF ALL MEASUREMENT POSITION.

BMIN: THE MEASURED MINIMUM LUMINANCE OF ALL MEASUREMENT POSITION.

6. RELIABILITY TEST

Item		Symbol	Condition
(1)	**Constant Temperature / Humidity**	60℃, 85%RH for 240 hours	(1), (2), (4), (6)
			
(2)	**High Temperature Storage Test**	85℃ for 240 hours	(1), (2), (4), (5)
(3)	**Low Temperature Storage Test**	-40℃ for 240 hours	
(4)	**High Temperature Storage Test**	80℃ for 240 hours	
(5)	**Low Temperature Storage Test**	-30℃ for 240 hours	
(6)	**Thermal Cycle Test**	-30℃ ~ 85℃, 1 hour cycles, 100 cycles	
			
(7)	**Daylight Exposure**	UV Sensor：340nm UV Filter：Daylight-Q or B/B Black Panel：Insulated Applicable Models： Xe-3-HS/HSC/HDS/HBS 50%RH, 0.51w/m2 Irrad, 65℃ BP temp, 38℃ Air temp, Duration 1,000 hours	Comply with ISO 4892-2 Cycle 1 (Spray test is Excluded)

Note (1) There should be no condensation on the surface of panel during test.

Note (2) Temperature of panel display surface area should be 90 ºC Max.

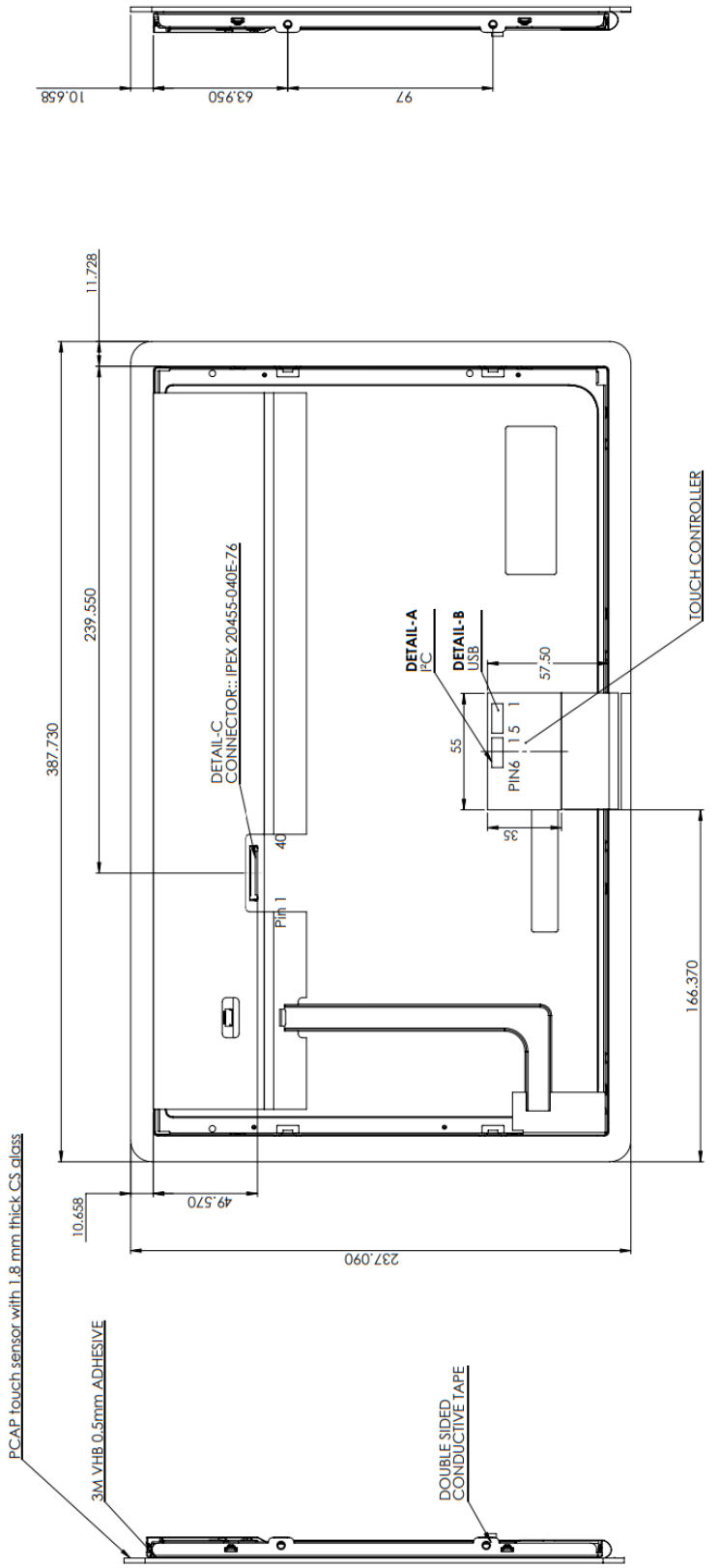
Note (3) At testing Vibration and Shock, the fixture in holding the module has to be hard and rigid enough so that the module would not be twisted or bent by the fixture.

Note (4) In the standard conditions, there is no function failure issue occurred. All the cosmetic specification is judged before reliability test.

Note (5) Before cosmetic and function test, the product must have enough recovery time, at least 2 hours at room temperature.

Note (6) Before cosmetic and function test, the product must have enough recovery time, at least 24 hours at room temperature.

7. MECHANICAL DRAWINGS



8. PRECAUTIONS

8.1 ASSEMBLY AND HANDLING PRECAUTIONS

(1) Do not apply rough force such as bending or twisting to the module during assembly.

(2) To assemble or install module into user's system can be only in clean working areas. The dust and oil may cause electrical short or worsen the polarizer.

(3) It's not permitted to have pressure or impulse on the module because the LCD panel and Backlight will be damaged.

(4) Always follow the correct power sequence when LCD module is connecting and operating. This can prevent damage to the CMOS LSI chips during latch-up.

(5) Do not pull the I/F connector in or out while the module is operating.

(6) Do not disassemble the module.

(7) Use a soft dry cloth without chemicals for cleaning, because the surface of polarizer is very soft and easily scratched.

(8) It is dangerous that moisture come into or contacted the LCD module, because moisture may damage LCD module when it is operating.

(9) High temperature or humidity may reduce the performance of module. Please store LCD module within the specified storage conditions.

(10) When ambient temperature is lower than 10℃ may reduce the display quality. For example, the response time will become slowly.

8.2 STORAGE PRECAUTIONS

(1) Do not leave the module 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 should be stored in dark place. It is prohibited to apply sunlight or fluorescent light in storing

8.3 OPERATION PRECAUTIONS

(1) The LCD product should be operated under normal condition. Normal condition is defined as below : Temperature : 20±15℃ Humidity: 65±20% Display pattern : continually changing pattern(Not stationary)

(2) If the product will be used in extreme conditions such as high temperature, high humidity, high altitude ,display pattern or operation time etc…It is strongly recommended to contact AZD for application engineering advice . Otherwise , Its reliability and function may not be guaranteed.

8.4 SAFETY PRECAUTIONS

(1) 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, skin or clothes, it has to be washed away thoroughly with soap.

(2) After the module's end of life, it is not harmful in case of normal operation and storage.

8.5 SAFETY STANDARDS

The LCD module should be certified with safety regulations as follows:

(1) UL60950-1 or updated standard.

(2) IEC60950-1 or updated standard.

8.6 OTHER

When fixed patterns are displayed for a long time, remnant image is likely to occur

9. INSPECTION SPECIFICATION

1. SCOPE SPECIFICATIONS CONTAIN

1.1 DISPLAY QUALITY EVALUATION
1.2 MECHANICS SPECIFICATION

2. SAMPLING PLAN

UNLESS THERE IS OTHER AGREEMENT, THE SAMPLING PLAN FOR INCOMING INSPECTION SHALL FOLLOW MIL-STD-105E.

2.1 LOT SIZE: QUANTITY PER SHIPMENT AS ONE LOT (DIFFERENT MODEL AS DIFFERENT LOT).
2.2 SAMPLING TYPE: NORMAL INSPECTION, SINGLE SAMPLING.
2.3 SAMPLING LEVEL: LEVEL II.
2.4 AQL: ACCEPTABLE QUALITY LEVEL
MAJOR DEFECT: AQL=0.65
MINOR DEFECT: AQL=1.0

3. PANEL INSPECTION CONDITION

3.1 ENVIRONMENT:
ROOM TEMPERATURE: 25±5°C.
HUMIDITY: 65±5% RH.
ILLUMINATION: 300 ~ 700 LUX.
3.2 INSPECTION DISTANCE:
35±5 CM
3.3 INSPECTION ANGLE:
THE VISION OF INSPECTOR SHOULD BE PERPENDICULAR TO THE SURFACE OF THE MODULE.
3.4 INSPECTION TIME：
PERCEPTIBILITY TEST TIME: 20 SECONDS MAX.

4. DISPLAY QUALITY

4.1 FUNCTION RELATED:
THE FUNCTION DEFECTS OF LINE DEFECT, ABNORMAL DISPLAY, AND NO DISPLAY ARE CONSIDERED MAJOR DEFECTS.
4.2 BRIGHT/DARK DOTS:

Defect Type	Specification	Major	Minor
Bright Dots	N≤ 2		●
Dark Dots	N≤ 3		●
Total Bright and Dark Dots	N≤ 4		●

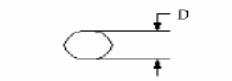
Note: 1:
The definition of dot: The size of a defective dot over 1/2 of whole dot is regarded as one defective dot.
Bright dot: Dots appear bright and unchanged in size in which LCD panel is displaying under black pattern.
The bright dot defect must be visible through 2% ND filter
Dark dot: Dots appear dark and unchanged in size in which LCD panel is displaying under pure red, green, blue pattern.
4.3 Pixel Definition:

R	G	B	R	G	B	R	G	B			Dot Defect
R	G	B	R	G	B	R	G	B			Adjacent Dot Defect
R	G	B	R	G	B	R	G	B			Cluster

Note 1:
If pixel or partial sub-pixel defects exceed 50% of the affected pixel or sub-pixel area, it shall be considered as1 defect.
Note 2:

There should be no distinct non-uniformity visible through 2% ND Filter within 2 sec inspection times.

4.4Visual Inspection specifications:

Defect Type		Specification Size	Count(N)	Major	Minor
Dot Shape (Particle、Scratch and Bubbles in display area) 		D ≤0.25 mm	Ignored		●
		0.25mm < D ≤ 0.5mm	N ≤ 3		
		D > 0.5mm	N=0		
Newton Ring (Only for Touch panel)		D≤70mm	N≤4		●
		D>70mm	N=0		
TSP Fish Eyes (Only for Touch panel) (Bubble/Dent)		0.1mm<D≤0.2mm	N≤4		●
		0.2mm<D≤0.3mm	N≤3		
		0.3<D≤0.4	N≤2		
Line Shape (Particles、Scratch、Lint and Bubbles in display area) 		W ≤ 0.01 mm	Ignored		●
		0.01mm< W ≤ 0.05mm and L ≤ 3mm	N ≤ 3		
		W > 0.05mm or L > 3 mm	N=0		
Bubble in cell (active area)		It should be found by eyes			●
Bezel	Scratch	No harm			●
	Dirt				●
	Wrap	No harm			●
	Sunken	No harm			●
Label	No label	No			●
	Inverted label				●
	Broken				●
	Dirt	Word can be read.			●
	Not clear	No			●
	Word out of shape				●
	Mistake	No			●
	Position	Be attached on right position			●
Screw	Not enough	No			●
	Limp	No			●

Connector	Connection status	No bend on pins and damage		•
FPC/FFC	Broken	No		•

Note: Extraneous substance and scratch not affecting the display of image, for instance, extraneous substance under polarizer film but outside the display area, or scratch on metal bezel and backlight module or polarizer film outside the display area, shall not be considered as defective or non-conforming.

10. PACKGING

10.1 PACKING SPECIFICATIONS

(1) 18 pcs LCD modules / 1 Box

(2) Box dimensions: 465 (L) X 362 (W) X 314 (H) mm

(3) Weight: approximately 29 Kg (18 modules per box)

(1) Carton dimensions : 465(L)x362(W)x314(H)mm
(2) 18 Modules/Carton