

ZETTLER DISPLAYS

SPECIFICATIONS FOR LIQUID CRYSTAL DISPLAY

CUSTOMER APPROVAL			
※ PART NO. : <u>ATM1025L1(ZETTLER DISPLAYS)</u> PRELIMINARY			
APPROVAL		COMPANY CHOP	
CUSTOMER COMMENTS			

ZETTLER DISPLAYS ENGINEERING APPROVAL		
DESIGNED BY	CHECKED BY	APPROVED BY
XW		

REVISION RECORD

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1. GENERAL SPECIFICATIONS

Item	Specification	Remark
1. LCD size	10.25 inch(Diagonal)	
2. Driver element	a-Si TFT active matrix	
3. Resolution	1920*(RGB)*720	
4. Display mode	Normally black, IPS, Transmissive	
5. Dot Pitch (W*H)	0.0423mm(W) x 0.1269mm(H)	
6. Pixel pitch(W*H)	0.1269mm(W) x 0.1269mm(H)	
7. Active Area(W*H)	243.648mm(W) x 91.368mm(H)	
8. Module size (W*H)	259.8mm(W) x 112.0mm(H) x 8.5mm(D)	Note 1
9. Surface treatment	Antiglare, Hard-Coating (3H)	
10. Color arrangement	RGB-stripe	
11. Color	16.7M	
12. Viewing angle (L/R/T/B)	80/80/80/80	
13. Interface	LVDS (two port) interface	
14. LCD controller	N.A.	
15. LCM brightness	850cd/m2 Typ	
16. Backlight	Single LED (Side-Light type)	
17. Logic System(White Pattern)	2W (Max)	
18. Power consumption of BL Unit	7.722W (Max)	
19. Operation temperature	-30~85 °C	
20. Weight	360g	
21. RoHS	RoHS compliant	

Note 1: Please refer to mechanical drawing.

2.0 ABSOLUTE MAXIMUM RATINGS

2.1 Electrical Absolute Rating

2.1.1 TFT LCD Module

Item	Symbol	Min.	Max.	Unit	Note
Logic Supply Voltage	VDD	-0.3	+5.0	V	-

2.2 Environment Absolute Rating

Item	Symbol	Min.	Max.	Unit	Note
Operating Temperature	T _{opa}	-30	85	°C	
Storage Temperature	T _{stg}	-40	90	°C	

3.0 OPTICAL CHARACTERISTICS

3.1 Optical specification

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Contrast		CR	$\Theta=0$ Normal viewing angle	800	1000	—		(1)(2)
Response time	25°C	TR+TF		—	—	30	msec	(1)(3)
	-20°C			—	—	250		
	-30°C			—	—	500		
White luminance (Center)		Y_L	$\Theta=0$	650	850	—	cd/m ²	(1)(4) ($I_L=240mA$)
Color chromaticity (CIE1931)	White	W_x	Normal viewing angle	0.273	0.313	0.353		(1)(4)
		W_y		0.289	0.329	0.369		
	Red	R_x			0.647			
		R_y			0.333			
	Green	G_x			0.293			
		G_y			0.611			
	Blue	B_x			0.148			
		B_y			0.059			
Viewing angle	Hor.	Θ_L	$CR>10$	80	85	—		
		Θ_R		80	85	—		
	Ver.	Θ_U		80	85	—		
		Θ_D		80	85	—		
Brightness uniformity		B_{UNI}	$\Theta=0$	75	80	—	%	(5)
Optima View Direction		Free						(6)
Reflection	%	R (%)	—	—	5.0	5.5	%	(7)

3.2 Measuring Condition

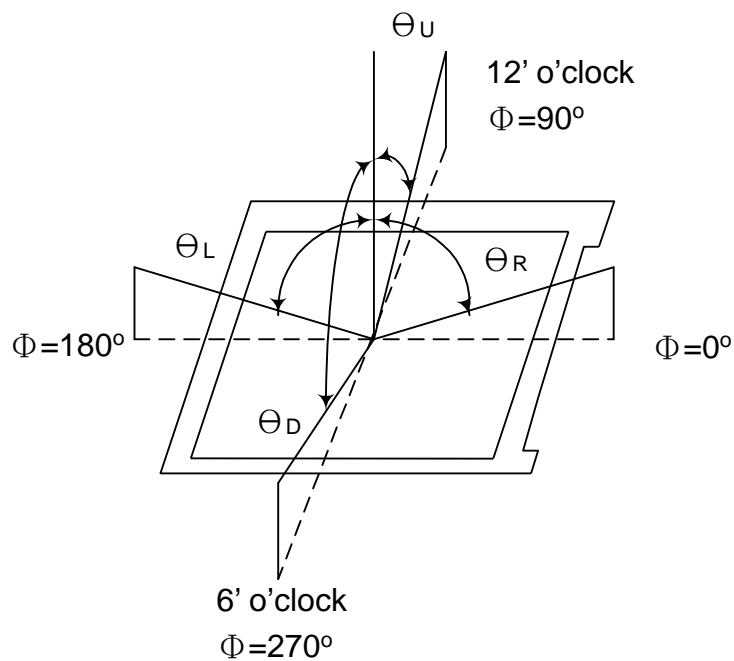
- Measuring surrounding : dark room
- LED current I_L : 240mA
- Ambient temperature : 25±2°C
- 15min. warm-up time.

3.3 Measuring Equipment

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

- Measuring spot size : 20 ~ 21 mm

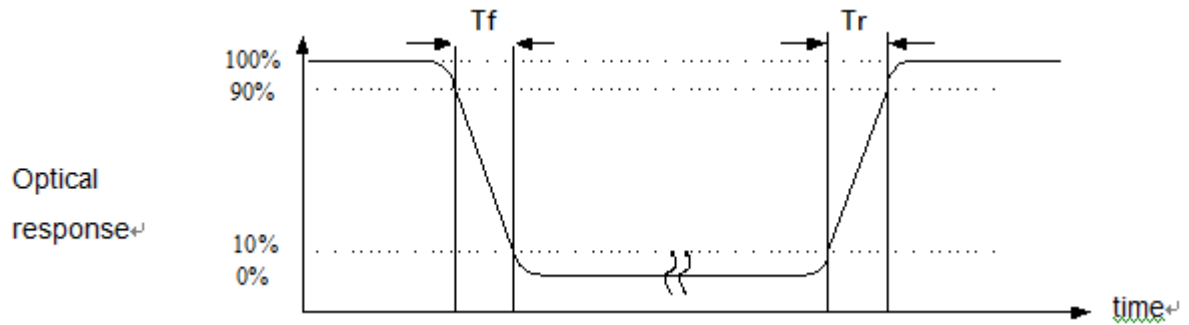
Note (1) Definition of Viewing Angle:



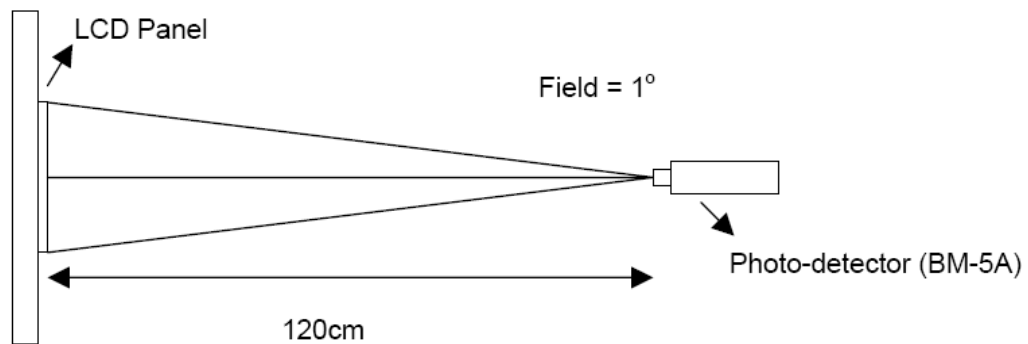
Note (2) Definition of Contrast Ratio (CR) :
measured at the center point of panel

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

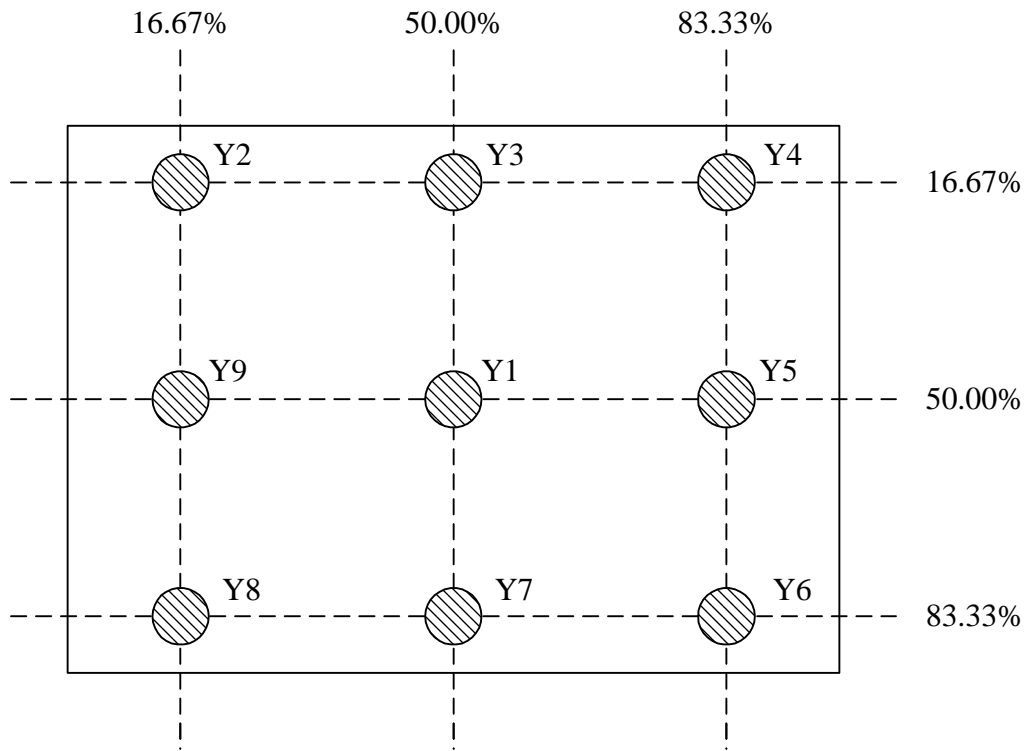
Note (3) Definition of Response Time : Sum of T_R and T_F



Note (4) Definition of optical measurement setup



Note (5) Definition of brightness uniformity



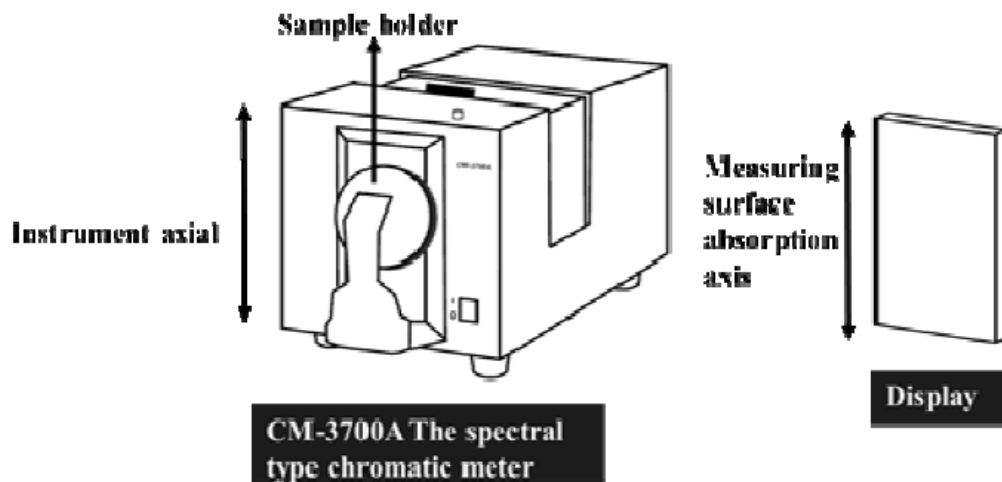
$$\text{Luminance uniformity} = \frac{(\text{Min Luminance of 9 points})}{(\text{Max Luminance of 9 points})} \times 100\%$$

Note (6) : Rubbing Direction (The different Rubbing Direction will cause the different optima view direction.)

Note (7) Definition of CM-3700A(Konica Minolta) Measurement specification

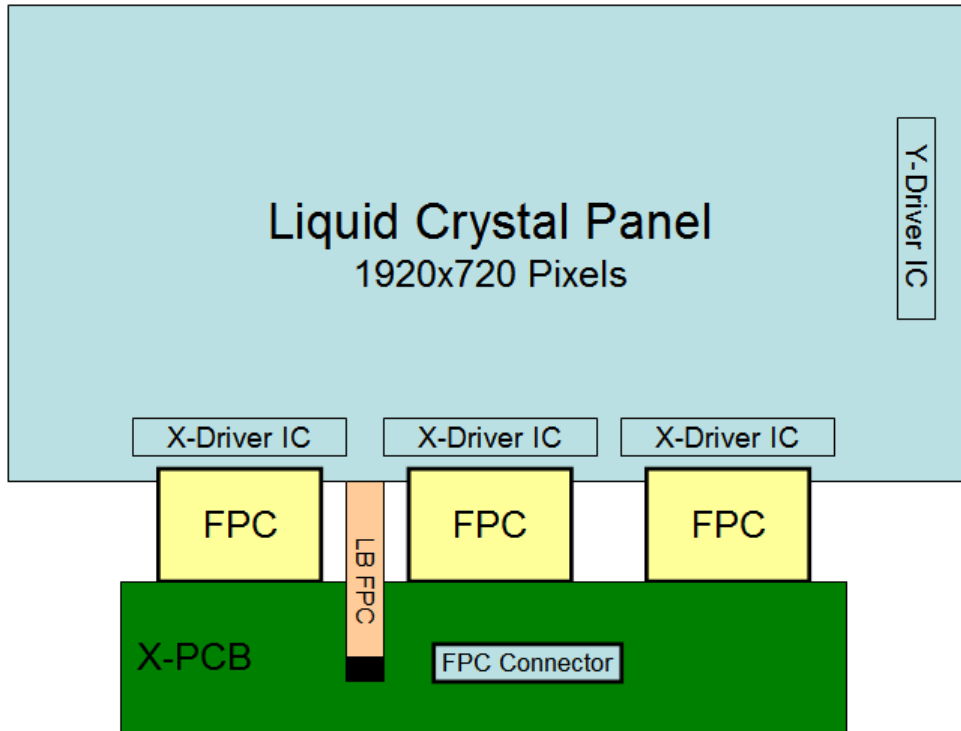
- The Settings of the instrument :
 - A. reflection rate;
 - B. Measuring the aperture: MAV(8mm);
 - C. Observer perspective: 2°;
 - D. Specular light: SCI;
 - E. The light source: D65.

- The definition of measurement way
Chromatic meter will display the absorption of shaft and spectral type axial parallel alignment, and placed the sample frame for photometry.

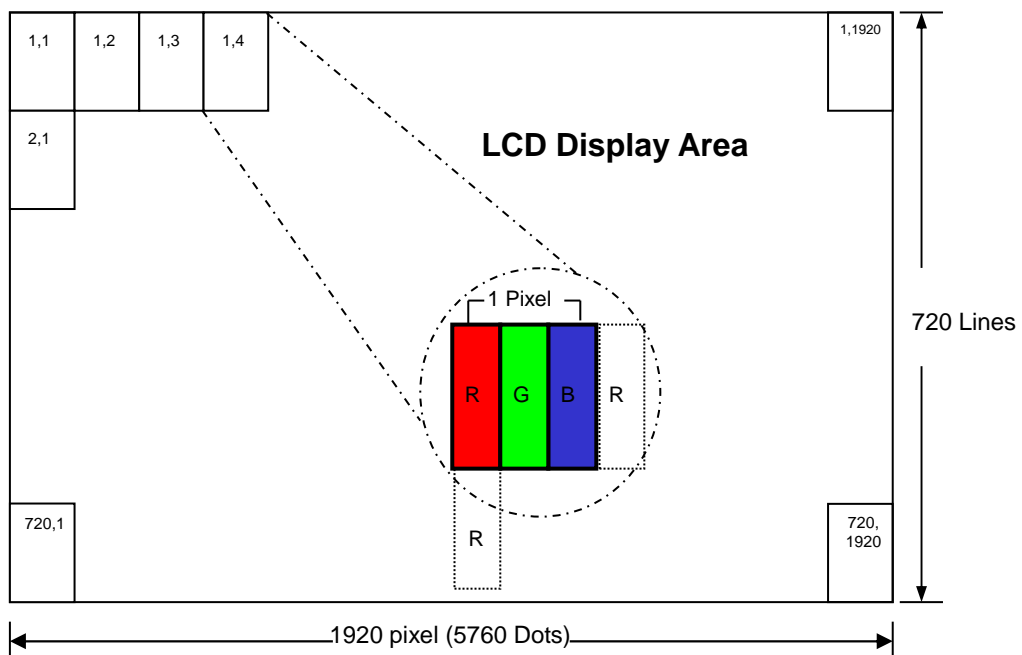


4.0 BLOCK DIAGRAM

4.1 TFT LCD Module:



4.2 Pixel Format



4.3 Relationship Between Displayed Color and Input

	Display	MSB								LSB								Gray scale Level								
		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 color	Black	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	-
	Blue	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	H	H	H	H	H	H	H	H	-
	Green	L	L	L	L	L	L	L	L	H	H	H	H	H	H	H	H	L	L	L	L	L	L	L	L	-
	Light Blue	L	L	L	L	L	L	L	L	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	-
	Red	H	H	H	H	H	H	H	H	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	-
	Purple	H	H	H	H	H	H	H	H	L	L	L	L	L	L	L	L	H	H	H	H	H	H	H	H	-
	Yellow	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	L	L	L	L	L	L	L	L	-
	White	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	-
Gray scale of Red	Black	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L0
	Dark ↑ ↓ Light	L	L	L	L	L	L	L	H	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L1
		L	L	L	L	L	L	H	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L2
		:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	L3...L251
		H	H	H	H	H	H	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L252
	H	H	H	H	H	H	L	H	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L253	
	H	H	H	H	H	H	H	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L254	
Red	H	H	H	H	H	H	H	H	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	Red L255	
Gray scale of Green	Black	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L0
	Dark ↑ ↓ Light	L	L	L	L	L	L	L	L	L	L	L	L	L	L	H	L	L	L	L	L	L	L	L	L	L1
		L	L	L	L	L	L	L	L	L	L	L	L	L	H	L	L	L	L	L	L	L	L	L	L2	
		:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	L3...L251
		L	L	L	L	L	L	L	L	H	H	H	H	H	L	L	L	L	L	L	L	L	L	L	L252	
	L	L	L	L	L	L	L	L	H	H	H	H	H	L	H	L	L	L	L	L	L	L	L	L253		
	L	L	L	L	L	L	L	L	H	H	H	H	H	H	L	L	L	L	L	L	L	L	L	L254		
Green	L	L	L	L	L	L	L	L	H	H	H	H	H	H	H	H	L	L	L	L	L	L	L	L	Green L255	
Gray scale of Blue	Black	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L0
	Dark ↑ ↓ Light	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	H	L	L1
		L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	H	L	L2	
		:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	L3...L251
		L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	H	H	H	H	H	L	L	L252	
	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	H	H	H	H	H	L	H	L253		
	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	H	H	H	H	H	H	L	L254		
Blue	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	H	H	H	H	H	H	H	H	Blue L255	
Gray scale of White & Black	Black	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L0
	Dark ↑ ↓ Light	L	L	L	L	L	L	L	H	L	L	L	L	L	L	H	L	L	L	L	L	L	H	L	L1	
		L	L	L	L	L	L	H	L	L	L	L	L	L	H	L	L	L	L	L	L	H	L	L2		
		:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	L3...L251	
		H	H	H	H	H	H	L	L	H	H	H	H	H	L	L	H	H	H	H	H	L	L	L252		
	H	H	H	H	H	H	L	H	H	H	H	H	H	L	H	H	H	H	H	H	L	H	L253			
	H	H	H	H	H	H	H	L	H	H	H	H	H	H	L	H	H	H	H	H	H	L	L254			
White	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	White L255	

5.0 INTERFACE PIN CONNECTION

5.1 FPC Pin Assignment:

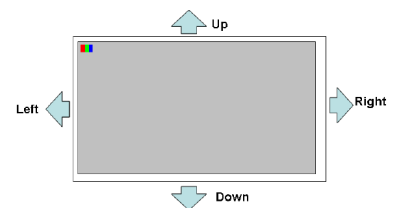
FPC connector is used for electronics interface. The recommended model is CN1 (Input signal): IRISO 12003S-50Y900

Pin NO.	Symbol	I/O	Description	Note
1	GND	P	Ground	
2	VDD	P	External main and I/O power supply ; +3.3V	
3	VDD	P	External main and I/O power supply ; +3.3V	
4	NC	-	Keep floating	
5	RESET	I	Global reset pin RESET="H",normal operation.(Default) RESET="L",LCM is in reset state.	
6	STBYB	I	Standby mode control. STBYB="H",normal operation. STBYB="L",LCM is in standby state.(Default)	
7	GND	P	Ground	
8	OLV0N	I	LVDS odd data 0-	
9	OLV0P	I	LVDS odd data 0+	
10	GND	P	Ground	
11	OLV1N	I	LVDS odd data 1-	
12	OLV1P	I	LVDS odd data 1+	
13	GND	P	Ground	
14	OLV2N	I	LVDS odd data 2-	
15	OLV2P	I	LVDS odd data 2+	
16	GND	P	Ground	
17	OLVCLKN	I	LVDS odd clk -	
18	OLVCLKP	I	LVDS odd clk +	
19	GND	P	Ground	
20	OLV3N	I	LVDS odd data 3-	
21	OLV3P	I	LVDS odd data 3+	
22	GND	P	Ground	
23	ELV0N	I	LVDS even data 0-	
24	ELV0P	I	LVDS even data 0+	
25	GND	P	Ground	
26	ELV1N	I	LVDS even data 1-	
27	ELV1P	I	LVDS even data 1+	
28	GND	P	Ground	

29	ELV2N	I	LVDS even data 2-	
30	ELV2P	I	LVDS even data 2+	
31	GND	P	Ground	
32	ELVCLKN	I	LVDS even clk -	
33	ELVCLKP	I	LVDS even clk +	
34	GND	P	Ground	
35	ELV3N	I	LVDS even data 3-	
36	ELV3P	I	LVDS even data 3+	
37	GND	P	Ground	
38	GND	P	Ground	
39	RL	I	Horizontal shift direction (source output) selection. RL = "H": Left -> Right(default) RL = "L": Right -> Left	
40	TB	I	Vertical shift direction (gate output) selection. TB = "H": Top ->Bottom (default) TB = "L": Bottom->Top	
41	NC	-	Keep floating	
42	NC	-	Keep floating,internal used for LCM maker.	
43	NC	-	Keep floating	
44	VDD	P	External main and I/O power supply ; +3.3V	
45	NC	-	Keep floating,internal used for LCM maker.	
46	NC	-	Keep floating,internal used for LCM maker.	
47	NC	-	Keep floating,internal used for LCM maker.	
48	NC	-	Keep floating,internal used for LCM maker.	
49	NC	-	Keep floating,internal used for LCM maker.	
50	NC	-	Keep floating,internal used for LCM maker.	

Note 1 : UPDN and SHLR control function

SHLR	UPDN	Data shifting
DVDD	GND	Left→Right→Down→Up
GND	GND	Right→Left ; Down→Up
DVDD	DVDD	Left→Right ; Up→Down(default)
GND	DVDD	Right→Left ; Up→Down



5.2 LED Board Pin Assignment:

CN2: IRISO 12001S-10Y901

Pin NO.	Symbol	Description
1	PLED	Power LED anode power supply
2	PLED	Power LED anode power supply
3	PLED	Power LED anode power supply
4	NC	
5	NTC1	heat sensor
6	NTC2(GND)	heat sensor
7	NLED	Power LED cathode power supply
8	NLED	Power LED cathode power supply
9	NLED	Power LED cathode power supply
10	NLED	Power LED cathode power supply

6.0 ELECTRICAL CHARACTERISTICS

6.1 TFT LCD Module

Item	Symbol	Min.	Typ.	Max.	Unit	Note
Supply Voltage	VDD	+3.0	+3.3	+3.6		Note (1)
Input Signal Voltage	V _{IH}	0.7xVDD	-	VDD	V	Note (2)
	V _{IL}	GND	-	0.3xVDD	V	
Current of VDD	IDD	-	-	600	mA	@White Pattern

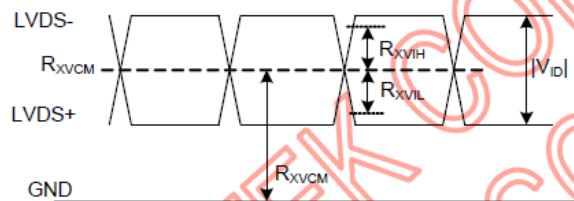
Note :

- (1) : VDD setting should match the signals output voltage of customer's system board.
- (2) : RESET,STBYB,R/L,T/B

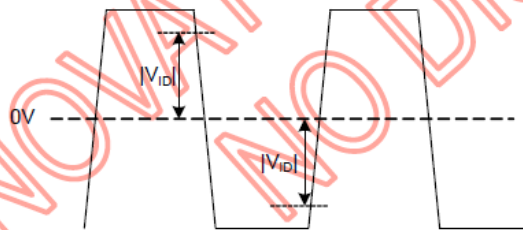
6.2 Switching Characteristics for LVDS Receiver

Item	Symbol	Min.	Typ.	Max.	Unit	Conditions
Differential Input High Threshold	R _{xVTH}	+100		+300	mV	
Differential Input Low Threshold	R _{xVTL}	-300		-100	mV	
Differential input common mode voltage	R _{xVCM}	1.0	1.2	1.7- V _{ID} /2	V	
Input leakage Current	I _{IN}	-10		10	uA	RX+/-, RXC+/-
Differential input Voltage	V _{ID}	200		600	mV	

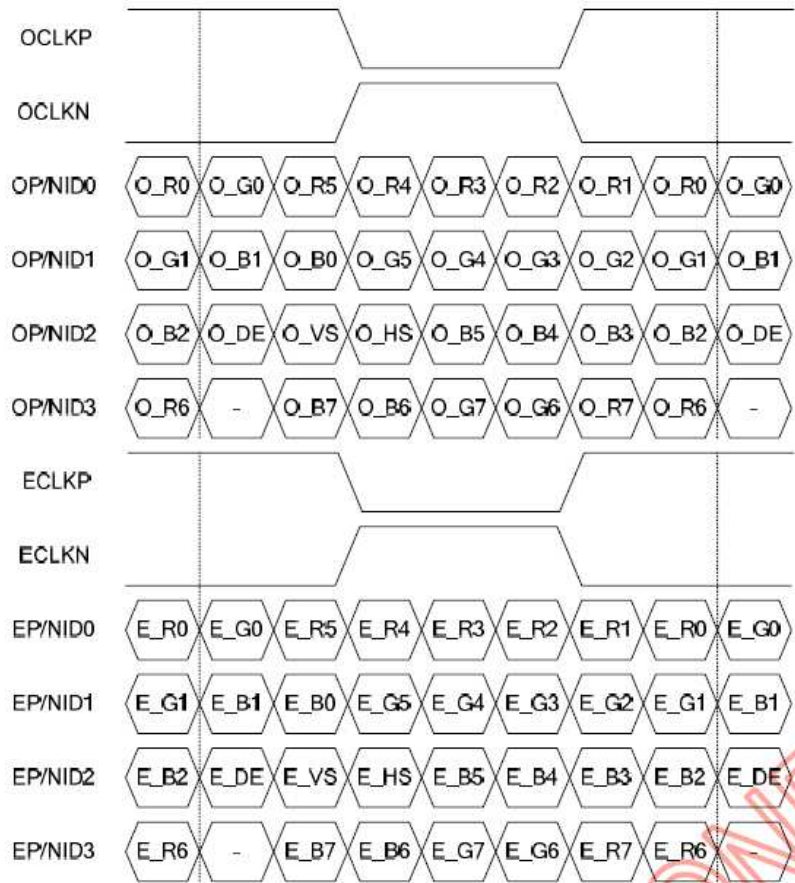
Single-end Signal



Differential Signal



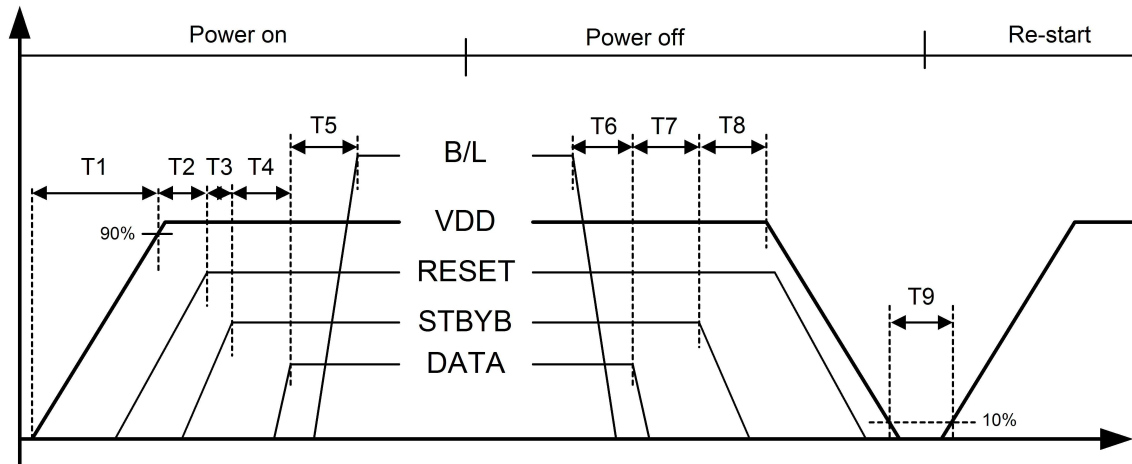
6.3 8Bit LVDS input



6.4 Interface Timing (DE mode)

Item	Symbol	Min.	Typ.	Max.	Unit
Frame Rate	--	55	60	65	Hz
Vertical Total Time	T _v	730	732	764	line
Vertical Display Time	T _{VD}	720			
Vertical Blanking Time	T _{VB}	10	12	44	line
Horizontal Total Time	T _H	1022	1045	1080	clock
Horizontal Display Time	T _{HD}	960			
Horizontal Blanking Time	T _{HB}	62	85	120	clock
Clock Rate	1/ T _{clock}	45.4	45.9	48.5	MHz

6.5 Power On / Off Sequence



Item	Min.	Typ.	Max.	Unit
T1	0.5	--	20	ms
T2	1	--	--	ms
T3	1	--	--	ms
T4	200	--	--	ms
T5	50	--	--	ms
T6	50	--	--	ms
T7	16	--	--	ms
T8	16	--	--	ms
T9	1000	--	--	ms

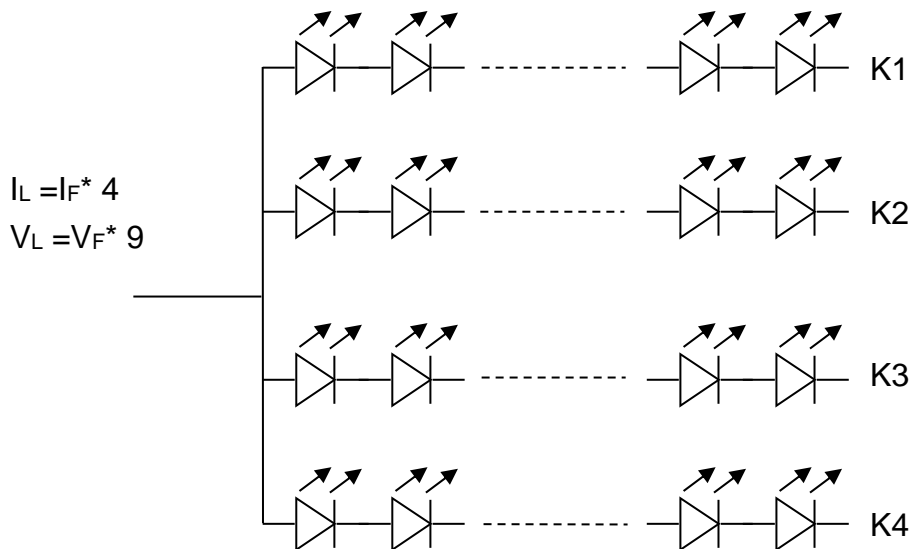
6.6 Backlight Unit

Parameter	Symbol	Min	Typ	Max	Units	Condition
LED Current	I_L	--	240	--	mA	$T_a=25^{\circ}\text{C}$
LED Voltage	V_L	--	27.9	29.7	Volt	$T_a=25^{\circ}\text{C}$
LED Life-Time	N/A	20,000	--	--	Hour	$T_a=25^{\circ}\text{C}$ $I_F=60\text{mA}$ Note (2)

Note (1) LED life time (Hr) can be defined as the time in which it continues to operate under the condition: $T_a=25\pm 3^{\circ}\text{C}$, typical I_L value indicated in the above table until the brightness becomes less than 50%.

Note (2) The “LED life time” is defined as the module brightness decrease to 50% original brightness at $T_a=25^{\circ}\text{C}$ and $I_L=240\text{mA}$. The LED lifetime could be decreased if operating I_L is larger than 240mA. The constant current driving method is suggested.

Note (3) LED Light Bar Circuit



7.0 RELIABILITY TEST ITEMS

No.	Item	Conditions	Remark
1	High Temperature Storage	Ta=+90°C, 240hrs	1,2,3
2	Low Temperature Storage	Ta=-40°C, 240hrs	1,2,3
3	High Temperature Operation	Ta=+85°C, 240hrs	1,2,3
4	Low Temperature Operation	Ta=-30°C, 240hrs	1,2,3
5	High Temperature and High Humidity (operation)	Ta=+60°C, 90%RH, 240hrs	1,2,3
6	Thermal Cycling Test (non operation)	-30°C(30min) → +85°C(30min), 100 cycles	1,2,3
7	Electrostatic Discharge	±200V,200pF(0Ω) 1 time/connector	
8	Vibration	1.Random: 1.04G, 10~500Hz, XYZ, 30min/each direction 2.Sine: Freq.1.5G, 8~33.3Hz, Stoke: 1.3mmhz Sweep: 2.9G, 33.3~400 X/Z: 2hrs, Y:4hrs	
9	Shock	Half-Sine, 100G, 6ms, ±XYZ, 1time	
10	Vibration (with carton)	Random: 0.015G ² /Hz, 5~200Hz -6dB/Octave, 200~400Hz XYZ 2hrs/each direction	
11	Drop (with carton)	Drop height condition, basis on the product weight and follow QB100-0027 1 corner, 3 edges, 6 surfaces	

Note1: There is no display function NG issue occurred, all the cosmetic specification is judged before the reliability stress.

Note2: All of the function & cosmetic Judgment basis base on room temperature.

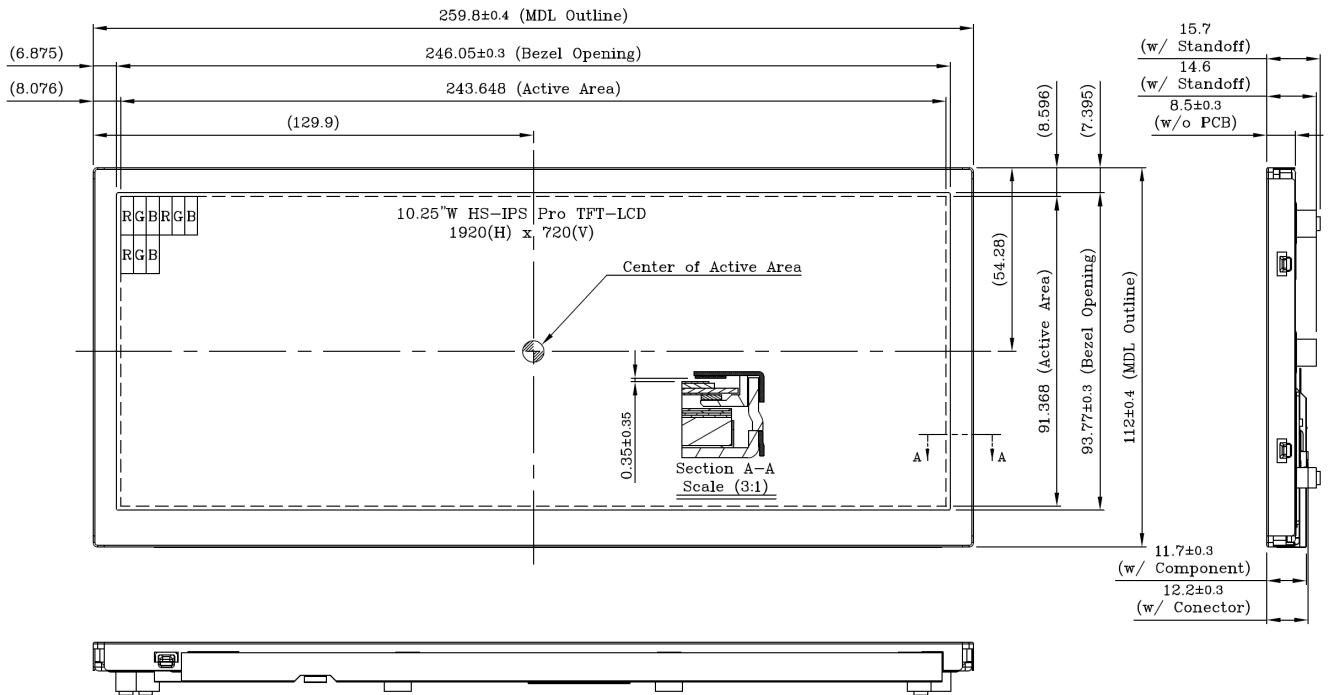
(The tested module must have enough recovery time at least 2 hours at room temperature.)

Note3 : The test condition definition panel's surface temperature.

8.0 OUTLINE DIMENSION

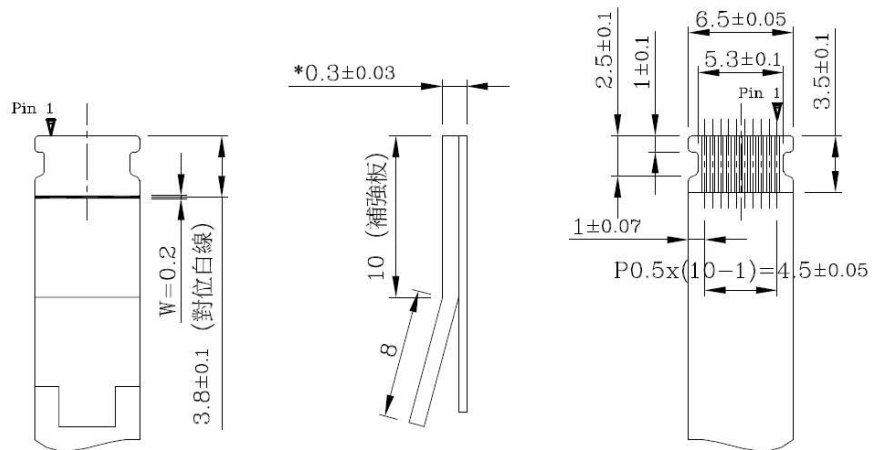
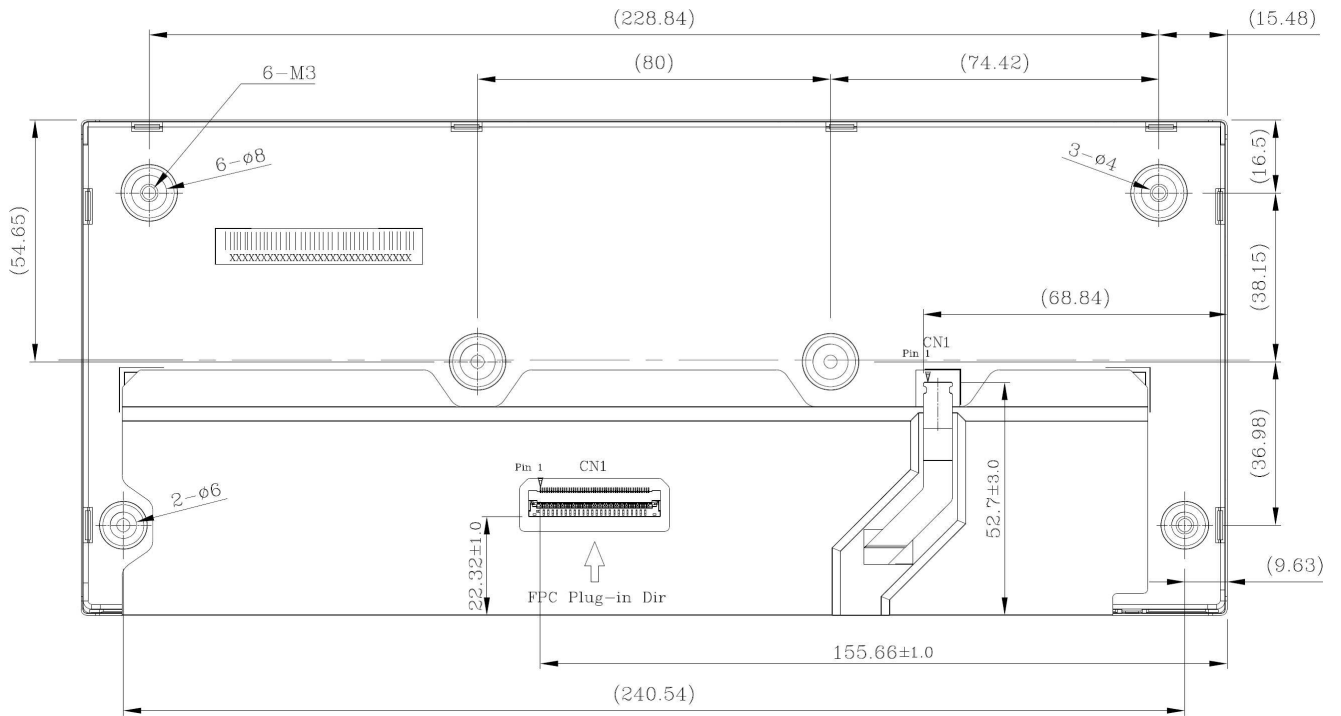
Unit : mm

8.1 Front View:



8.1 Rear View:

General tolerance: $\pm 0.3\text{mm}$



CN2(Scale: 2:1)

8.1.PACKAGEDRAWING
T.B.D

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	$N \leq 2$		●
Dark Dots	$N \leq 3$		●
Total Bright and Dark Dots	$N \leq 4$		●

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:

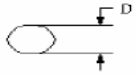
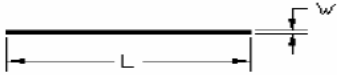
If pixel or partial sub-pixel defects exceed 50% of the affected pixel or sub-pixel area, it shall be considered as 1 defect.

Note 2:

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

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4.4 Visual Inspection specifications:

<u>Defect Type</u>		<u>Specification Size</u>	<u>Count(N)</u>	Major	Minor
Dot Shape (Particle · Scratch and Bubbles in display area) 		$D \leq 0.25 \text{ mm}$	Ignored		•
		$0.25\text{mm} < D \leq 0.5\text{mm}$	$N \leq 3$		
		$D > 0.5\text{mm}$	$N=0$		
Newton Ring (Only for Touch panel)		$D \leq 70\text{mm}$	$N \leq 4$		•
		$D > 70\text{mm}$	$N=0$		
TSP Fish Eyes (Only for Touch panel) (Bubble/Dent)		$0.1\text{mm} < D \leq 0.2\text{mm}$	$N \leq 4$		•
		$0.2\text{mm} < D \leq 0.3\text{mm}$	$N \leq 3$		
		$0.3 < D \leq 0.4$	$N \leq 2$		
Line Shape (Particles · Scratch · Lint and Bubbles in display area) 		$W \leq 0.01 \text{ mm}$	Ignored		•
		$0.01\text{mm} < W \leq 0.05\text{mm}$ and $L \leq 3\text{mm}$	$N \leq 3$		
		$W > 0.05\text{mm}$ or $L > 3 \text{ mm}$	$N=0$		
Bubble in cell (active area)		It should be found by eyes			•
Bezel	Scratch	No harm			•
	Dirt				•
	Wrap				•
	Sunken				•
Label	No label				•
	Inverted label	No			•
	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			•

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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.