LCD TFT Module Specification

Riverdi
Intelligent Display Solutions

RVT70AQFFWN01

LCD TFT Datasheet

Rev.1.0

2019-03-29

ITEM	CONTENTS	UNIT
LCD Type	TFT/Transmissive/Normally white	/
Size	7.0	Inch
Viewing Direction	12:00 (without image inversion)	O' Clock
Gray Scale Inversion Direction	6:00	O' Clock
LCM (W × H × D)	165.60 ×100.60 × 9.68	mm^3
Active Area (W × H)	154.08 × 85.92	mm^2
Dot Pitch (W × H)	0.1926 × 0.179	mm^2
Number of Dots	800 (RGB) × 480	/
Driver IC	FT812	/
Backlight Type	21 LEDs	/
Surface Luminance	1000	cd/m^2
Interface Type	SPI/QSPI	/
Color Depth	16.7M	/
Pixel Arrangement	RGB Vertical Stripe	/
Surface Treatment	Anti-glare	
Input Voltage	3.3	V
With/Without TSP	Without Touch Panel	/
Weight	203.55	g

Note 1: RoHS compliant

Note 2: LCM weight tolerance: ± 5%.

REVISION RECORD

REVNO.	REVDATE	CONTENTS	REMARKS
1.0	2019-03-29	Initial Release	

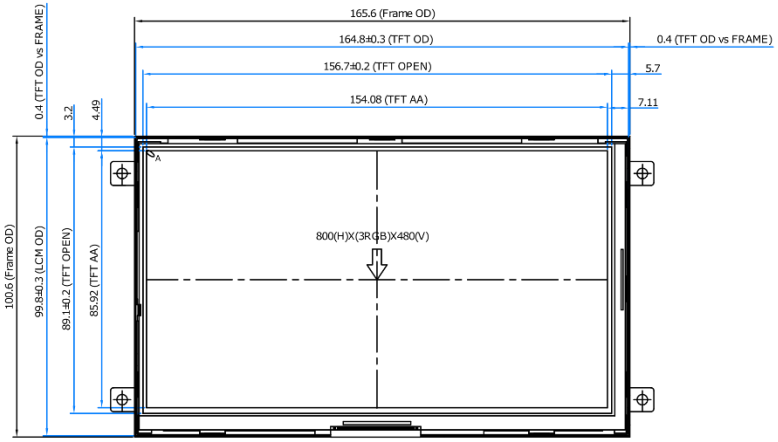
CONTENTS

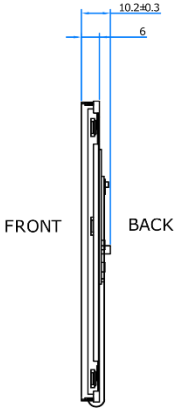
1 MODULE CLASSIFICATION INFORMATION

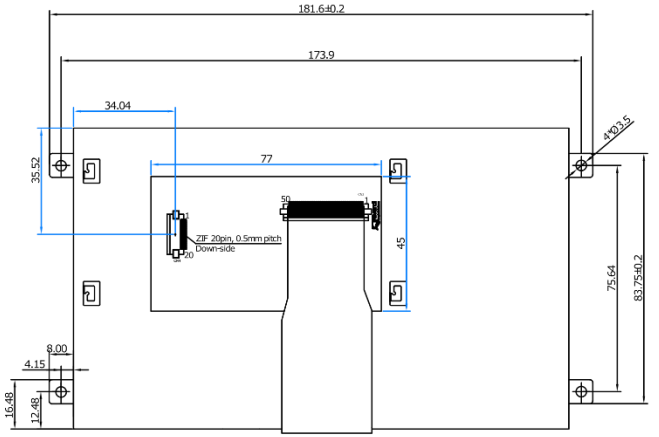
RV	T	70	A	Q	F	F	W	N	01
1.	2.	3.	4.	5.	6.	7.	8.	9.	10.

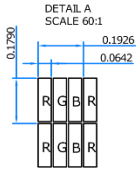
1.	**BRAND**	**RV** – Riverdi
2.	**PRODUCT TYPE**	**T – TFT Standard**
3.	**DISPLAY SIZE**	**70 – 7.0”**
4.	**MODEL SERIAL NO.**	**A**(A-Z)
5.	**RESOLUTION**	**Q – 800x480 px**
6.	**INTERFACE**	**F – TFT + Controller FT812**
7.	**FRAME**	**F – Mounting Frame**
8.	**BACKLIGHT TYPE**	**W** – LED White
9.	**TOUCH PANEL**	**N – No Touch Panel**
10.	**VERSION**	**00** (00-99)

PIN	DESC
1	VDD
2	GND
3	SPI_SCLK
4	MISO/IO1
5	MOSI/IO0
6	CS
7	INT
8	PD
9	NC
10	AUDIO_OUT
11	GPIO0/IO2
12	GPIO1/IO3
13	GPIO2
14	GPIO3
15	NC
16	NC
17	BLVDD
18	BLVDD
19	BLGND
20	BLGND

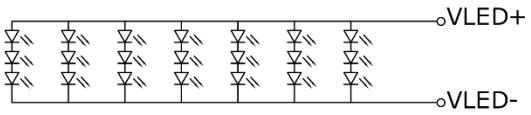








Internal Backlight LED Circuit



NOTES:
1. DISPLAY TYPE: TFT,TRANSMISSIVE,POSITIVE
2. OPERATING VOLTAGE: VDD=3.3V
3. VIEWING DIRECTION: 12 O'CLOCK.
4. IC DRIVER: FT812
5. OPERATING TEMP: -20℃～70℃.
6. STORAGE TEMP: -30℃～80℃.
7. LED BACKLIGHT: 21-CHIP WHITE LED, BUILT-IN INVERTER.
8. LCM SURFACE LUMINANCE: 1000cd/m^2.
9. GENERAL TOLERANCE: ±0.2.
10. RoHS COMPLIANT.

1.0	Initial case	2019.02.11
Ver.	DESCRIPTION	DATE

CUSTOMER		DATE	2019.02.11
DRAWN	SCALE 1:1	TITLE	RVT70AQFFWN01
DFTG CHK	UNIT mm		
ENGR CHK		MODEL	
APPROVAL	RIVERDI	DWG NO	Rev.1.0
		PAGE	1/1

3 ABSOLUTE MAXIMUM RATINGS

PARAMETER	SYMBOL	MIN	MAX	UNIT
Supply Voltage For Logic	VDD	-0.3	3.6	V
Input Voltage For Logic	VIN	-0.3	VDD	V
Input Voltage For LED Inverter	BLVDD	-0.3	7.0	V
Operating Temperature	T_{OP}	-20	70	°C
Storage Temperature	T_{ST}	-30	80	°C
Humidity	RH	-	90% (Max 60°C)	RH

4 ELECTRICAL CHARACTERISTICS

PARAMETER	SYMBOL	MIN	TYP	MAX	UNIT
Supply Voltage For Module	VDD	3.0	3.3	3.6	V
Input Voltage for LED Inverter	BLVDD	2.8	5	5.5	V
Input Current (Exclude LED Backlight)	IDD	-	TBD	-	mA
LED Backlight Current	$IDD_{backlight}$ (@ 5V)	555	580	630	mA
Input Voltage ' H ' level	V_{IH}	0.7VDD	-	VDD	V
Input Voltage ' L ' level	V_{IL}	0	-	0.2VDD	V
LED Life Time	-	30000	50000	-	Hrs

Note: The LED life time is defined as the module brightness decrease to 50% original brightness at Ta=25°C

5 ELECTRO-OPTICAL CHARACTERISTICS

ITEM		SYMBOL	CONDITION	MIN	TYP	MAX	UNIT	REMARK	NOTE
Response Time		Tr+Tf	θ=0°	-	20	35	ms	FIG 1.	4
Contrast Ratio		Cr	Ø=0°	400	500	-	---	FIG 2.	1
Luminance Uniformity		δ WHITE	Ta=25	70	75	-	%	FIG 2.	3
Surface Luminance		Lv		-	1000	-	cd/m^2	FIG 2.	2
Viewing Angle Range		θ	Ø = 90°	40	50	-	deg	FIG 3.	6
			Ø = 270°	60	70	-	deg	FIG 3.	
			Ø = 0°	60	70	-	deg	FIG 3.	
			Ø = 180°	60	70	-	deg	FIG 3.	
CIE (x, y) Chromaticity	Red	x	θ=0° Ø=0° Ta=25	-	-	-	FIG 2.		5
		y		-	-	-			
	Green	x		-	-	-			
		y		-	-	-			
	Blue	x		-	-	-			
		y		-	-	-			
	White	x		-	0.280	-			
		y		-	0.310	-			

Note 1. Contrast Ratio(CR) is defined mathematically as below, for more information see Figure 1.

$$\text{Contrast Ratio} = \frac{\text{Average Surface Luminance with all white pixels (P1, P2, P3, P4, P5)}}{\text{Average Surface Luminance with all black pixels (P1, P2, P3, P4, P5)}}$$

Note 2. Surface luminance is the LCD surface from the surface with all pixels displaying white. For more information see Figure 2.

Lv = Average Surface Luminance with all white pixels (P1, P2, P3, P4, P5)

Note 3. The uniformity in surface luminance δ WHITE is determined by measuring luminance at each test position 1 through 5, and then dividing the maximum luminance of 5 points luminance by minimum luminance of 5 points luminance. For more information see Figure 2.

$$\delta \text{ WHITE} = \frac{\text{Minimum Surface Luminance with all white pixels (P1, P2, P3, P4, P5)}}{\text{Maximum Surface Luminance with all white pixels (P1, P2, P3, P4, P5)}}$$

Note 4. Response time is the time required for the display to transition from white to black (Rise Time, Tr) and from black to white (Decay Time, Tf). For additional information see Figure 1. The test equipment is Autronic-Melchers's ConoScope series.

Note 5. CIE (x, y) chromaticity, the x, y value is determined by measuring luminance at each test position 1 through 5, and then make average value.

Note 6. Viewing angle is the angle at which the contrast ratio is greater than 2. For TFT module the contrast ratio is greater than 10. The angles are determined for the horizontal or x axis and the vertical or y axis with respect to the z axis which is normal to the LCD surface. For more information see Figure 3.

Note 7. For viewing angle and response time testing, the testing data is based on Autronic-Melchers's ConoScope series. Instruments for Contrast Ratio, Surface Luminance, Luminance Uniformity, CIE the test data is based on TOPCON's BM-5 photo detector.

Figure 1. The definition of response time

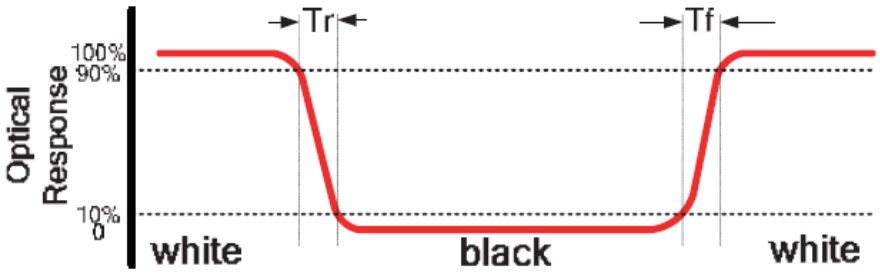


Figure 2.Measuring method for Contrast ratio, surface luminance, Luminance uniformity, CIE (x, y) chromaticity

A : 5 mm
B : 5 mm
H, V : Active Area
Light spot size ∅=5mm, 500mm distance from the LCD surface to detector lens
measurement instrument is TOPCON's luminance meter BM-5

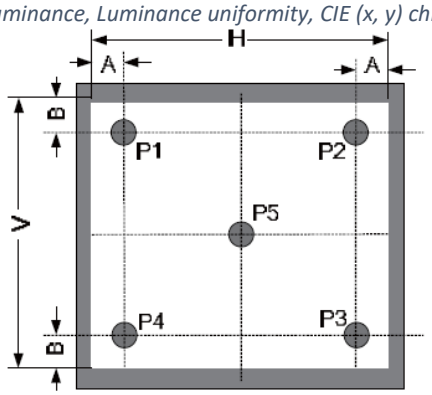
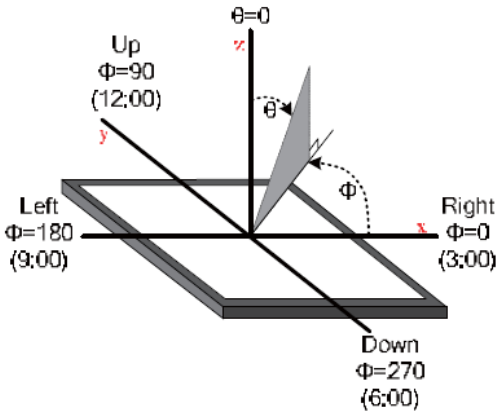


Figure 3.The definition of viewing angle



6 INTERFACE DESCRIPTION

PIN NO.	SYMBOL	DESCRIPTION
1	VDD	Power Supply
2	GND	Ground
3	SPI_SCLK	SPI SCK Signal, Internally 47k Pull UP
4	MISO/ IO1	SPI MISO Signal / SPI Quad mode: SPI data line 1
5	MOSI/ IO0	SPI MOSI Signal / SPI Quad mode: SPI data line 0
6	CS	SPI Chip Select Signal , Internally 47k Pull UP
7	INT	Interrupt Signal, Active Low, Internally 47k Pull UP
8	PD	Power Down Signal, Active Low, Internally 47k Pull UP
9	NC	Not Connected
10	AUDIO_OUT	Audio Out Signal
11	GPIO0/IO2	SPI Single mode: General purpose IO0/ SPI Quad mode: SPI data line 2
12	GPIO1/IO3	SPI Single mode: General purpose IO1/ SPI Quad mode: SPI data line 3
13	GPIO2	General purpose IO2
14	GPIO3	General purpose IO3 or analog input for ADC
15	NC	Not Connected
16	NC	Not Connected
17	BLVDD	Backlight Power Supply, Can Be Connected to VDD
18	BLVDD	Backlight Power Supply, Can Be Connected to VDD
19	BLGND	Backlight Ground, Internally connected to GND
20	BLGND	Backlight Ground, Internally connected to GND

7 FT812 CONTROLLER SPECIFICATIONS

FT812 or EVE (Embedded Video Engine) simplifies the system architecture for advanced human machine interfaces (HMIs) by providing functionality for display, audio, and touch as well as an object oriented architecture approach that extends from display creation to the rendering of the graphics.

7.1 Serial host interface

Figure 4.SPI interface connection

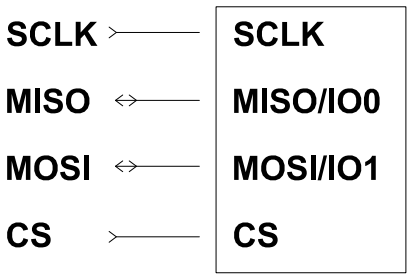
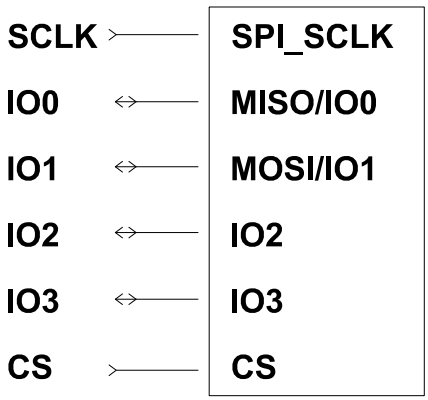


Figure 5. .SPI interface connection



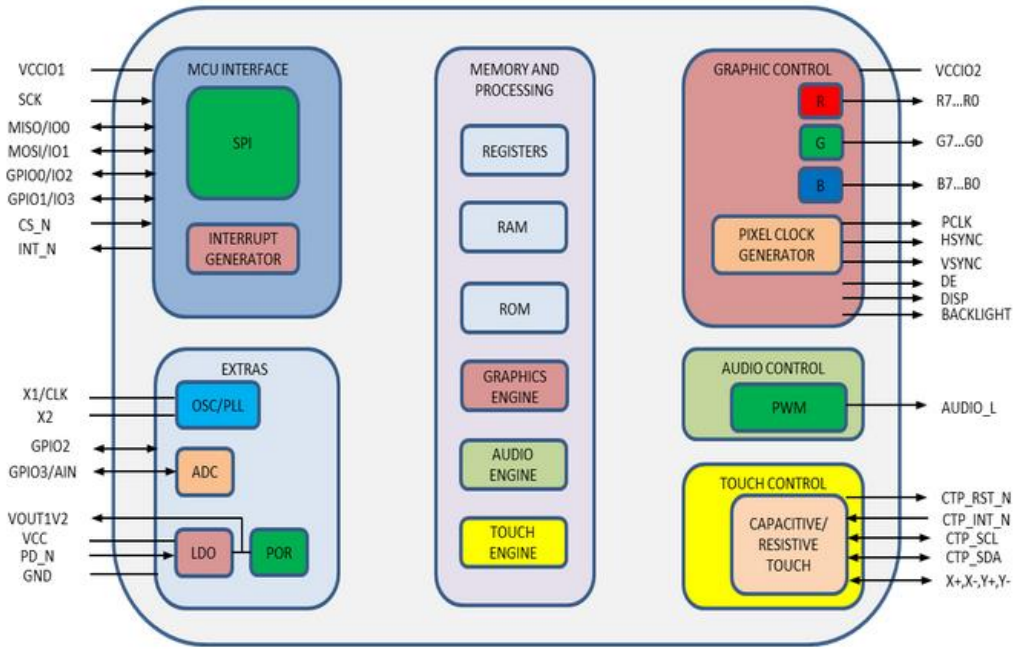
SPI Interface – the SPI slave interface operates up to 30MHz.
Only SPI mode 0 is supported. The SPI interface is selected by default (MODE pin is internally pulled low by 47k resistor).

QSPI Interface – the QSPI slave interface operates up to 30MHz. Only SPI mode 0 is supported. The QSPI can be configured as a SPI slave in SINGLE, DUAL or QUAD data bus modes.

By default the SPI slave operates in the SINGLE channel mode with MOSI as input from the master and MISO as output to the master. DUAL and QUAD channel modes can be configured through the SPI slave itself. To change the channel modes, write to register REG_SPI_WIDTH.

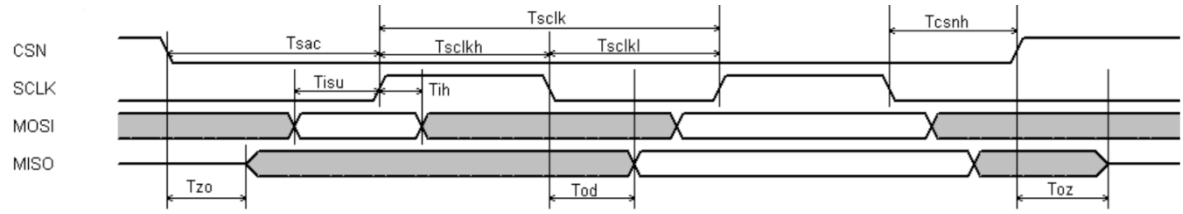
7.2 Block Diagram

Figure 6. FT812 Block diagram



7.3 Host interface SPI mode 0

Figure 7. SPI timing diagram

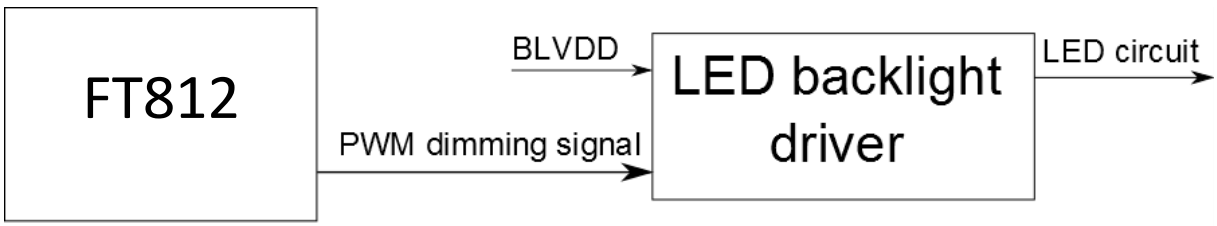


For more information about FT812 controller please go to official FT81x website.
http://www.ftdichip.com/Products/ICs/FT81X.html

7.4 Backlight driver block diagram

Backlight enable signal is internally connected to FT812 Backlight control pin. This pin is controlled by two FT812's registers. One of them specifies the PWM output frequency, second one specifies the duty cycle. Refer to FT812 datasheet for more information.

Figure 8. Backlight driver block diagram

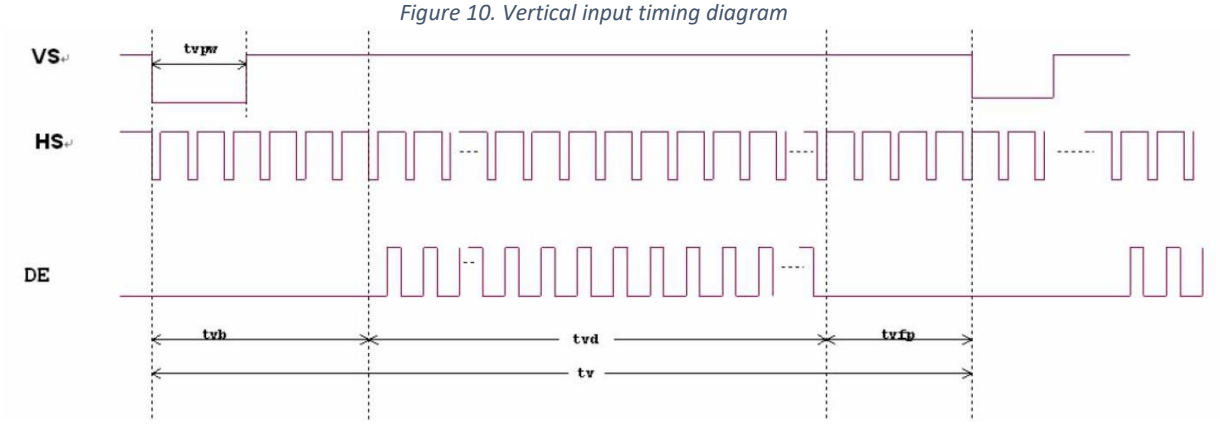


8 LCD TIMING CHARACTERISTICS

8.1 Clock and data input time diagram

Figure 9. Horizontal input timing diagram

Figure 10. Vertical input timing diagram



8.2 Parallel RGB input timing table

PARAMETER	SYMBOL	MIN	TYP	MAX	UNIT
DCLK Frequency	Fclk	26.4	33.3	46.8	MHz
VSD Period Time	tv	510	525	650	TH
VSD Display Area	tvd		480		TH
VSD Blanking	tvb		23		TH
VSD Front Porch	tvfp	7	22	147	TH
VSD Pulse Width	tvpw	1	-	20	TH
HSD Pulse Width	thpw	1	-	40	DCLK
HSD Period Time	th	862	1056	1200	DCLK
HSD Display Area	thd		800		DCLK
HSD Blanking	thb		46		DCLK
HSD Front Porch	thfp	16	210	354	DCLK

9 INSPECTION

Standard acceptance/rejection criteria for TFT module.

9.1 Inspection condition

Ambient conditions:

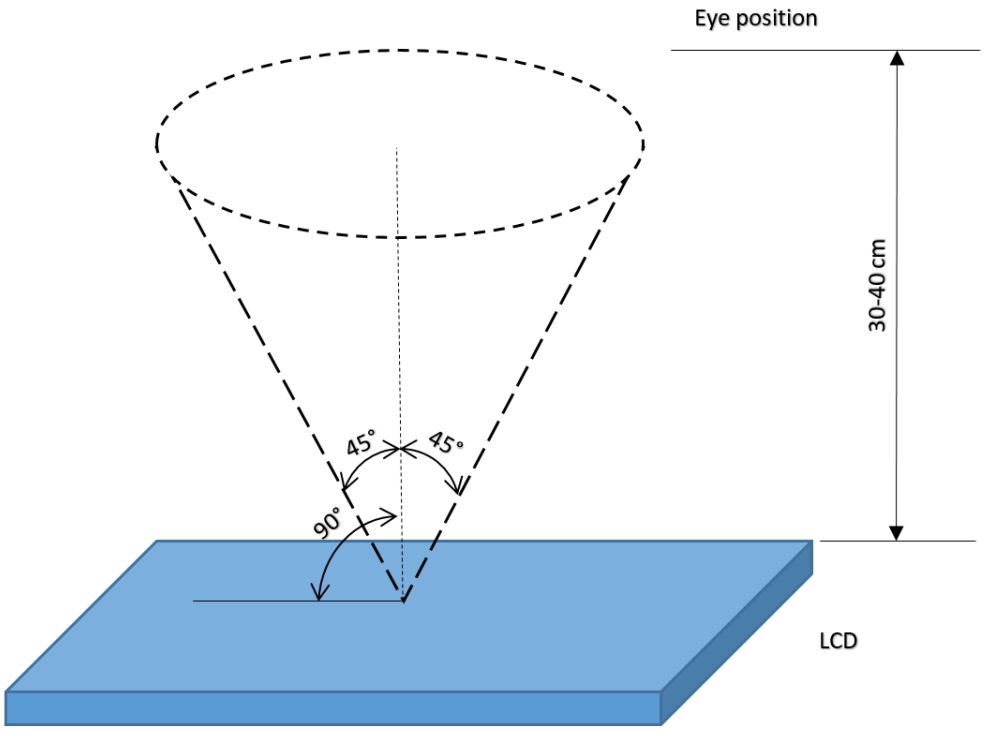
- Temperature: 25±°C
- Humidity: (60±10) %RH
- Illumination: Single fluorescent lamp non-directive (300 to 700 lux)

Viewing distance:

35±5cm between inspector bare eye and LCD.

Viewing Angle:

U/D: 45°/45°, L/R 45°/45°



9.2 Inspection standard

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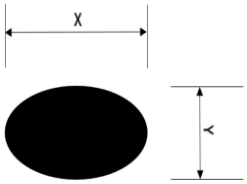
<tr><th>Item</th><th>Criterion</th></tr>
<tr><td>Black spots, white spots, light leakage, Foreign Particle (round Type)</td><td>


$$D = \frac{(x + y)}{2}$$
*Spots density: 10 mm
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<tr><td>Average Diameter</td><td>Qualified Qty</td></tr>
<tr><td>D < 0.2 mm</td><td>Ignored</td></tr>
<tr><td>0.2 mm < D < 0.3 mm</td><td>3</td></tr>
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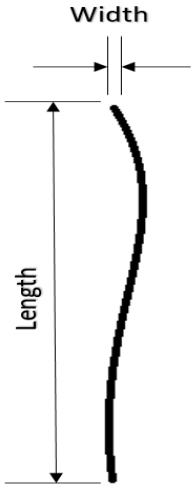

*Spots density: 10 mm
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<tr><td>Length</td><td>Width</td><td>Qualified Qty</td></tr>
<tr><td>-</td><td>W< 0.03</td><td>Ignored</td></tr>
<tr><td>L < 5.0</td><td>0.03 < W <0.05</td><td>2</td></tr>
<tr><td>-</td><td>0.05 < W</td><td>0</td></tr>
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10 RELIABILITY TEST

NO.	TEST ITEM	TEST CONDITION
1	High Temperature Storage	80±2°C/240hours
2	Low Temperature Storage	-30±2°C/240hours
3	High Temperature Operating	70±2°C/240hours
4	Low Temperature Operating	-20±2°C/240hours
5	Temperature Cycle	-30±2°C~25~80±2°C × 20 cycles (30min.) (5min.) (30min.)
6	Damp Proof Test	60°C ±5°C × 90%RH/240hours
7	Vibration Test	Frequency 10Hz~55Hz Amplitude of vibration : 1.5mm Sweep: 10Hz~55Hz~10Hz X, Y, Z 2 hours for each direction.
8	Package Vibration Test	Random vibration :0.15G*G/HZ from 5-200HZ,-6dB/Octave from 200-500HZ of each direction of X.Y. Z (6 hours for total)
9	Package Drop Test	Height:60 cm 1 corner,3 edges,6 surfaces
10	ESD Test	± 2KV, Human body mode,100pF/1500Ω
11	Mechanical Shock	100G 6ms, X, Y, Z 3 times for each direction

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