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One Stop Display Solution

Product Specification

SPECIFICATION
FOR
APPROVAL

(●) Preliminary Specification
( ) Final Specification

Title	8.4”XGA (1024 X RGB X 768) TFT- LCD

BUYER	
MODEL	

SUPPLIER	
MODEL	FB084LXV122-A
SUFFIX	SL01

SIGNATURE	DATE
/	
/	
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Please return 1 copy for your confirmation
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PREPARED BY

Contents

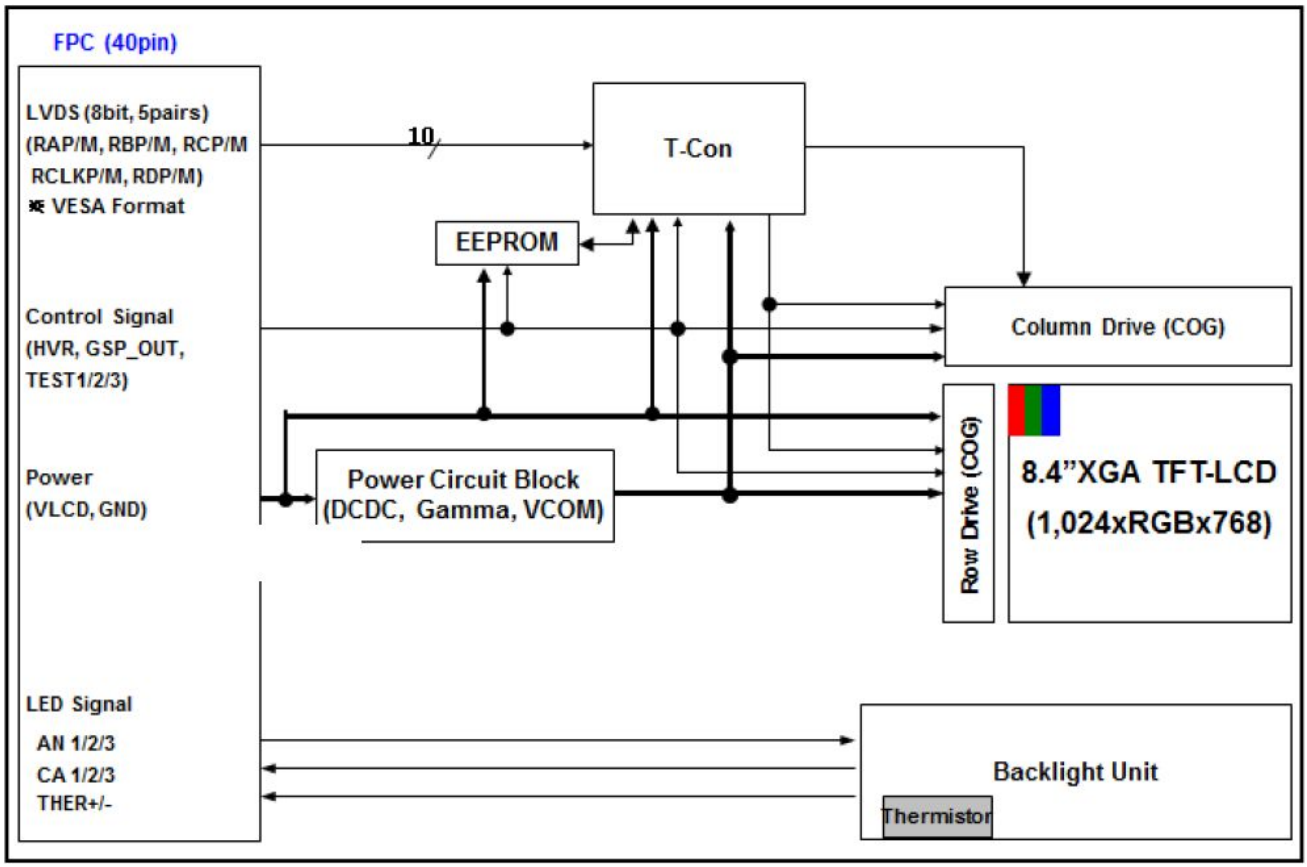
Product Specification

1. Summary

This module utilizes amorphous silicon thin film transistors and a 4:3 aspect ratio. The 8.4” active matrix liquid crystal display allows 16,777,216 colors to be displayed by LVDS interface is available.
The applications are CID(Center Information Display), RSE(Rear Seat Entertainment) and Instrument Cl uster for a vehicle.

2. Features

- Utilizes a panel with a 4:3 aspect ratio.
- The 8.4” screen produces a high resolution image that is composed of 786,432 pixel elements in a stripe arrangement.
- By adopting In Plane Switching (IPS) technology, provide a wide viewing angle.
- By adopting an active matrix drive, a picture with high contrast is realized.
- By using of COG mounting technology, the module became thin, light and compact.
- By adopting a high aperture panel, high transmittance color filter and high transmission polarizing plates, transmittance ratio is realized.
- Gray scale or the brightness of the sub-pixel color is determined with a 8-bit gray scale signal.



3. General Description

Active Screen Size	8.4 inches(213.12mm) diagonal
Outline Dimension	184.5mm (H) × 143.0mm (V) X 7.25mm (D) (Typ.)
Pixel Pitch	0.1665mm x 0.1665mm (1Dot: 0.0555mm x 0.1665mm)
Pixel Format	1024 horiz. By 768 vert. Pixels, RGB stripe arrangement
Color Depth	8bit(D), 16,777,216 colors
Luminance, White	1200 cd/m^2 (Center 1point ,Min.)
Viewing Angle (CR>10)	Viewing angle free (R/L 178 (Min.), U/D 178 (Min.))
Weight	255g (Typ.), 260g (Max.)
Display Mode	Transmissive mode, Normally Black
Backlight Type	LED

4. Absolute Maximum Ratings

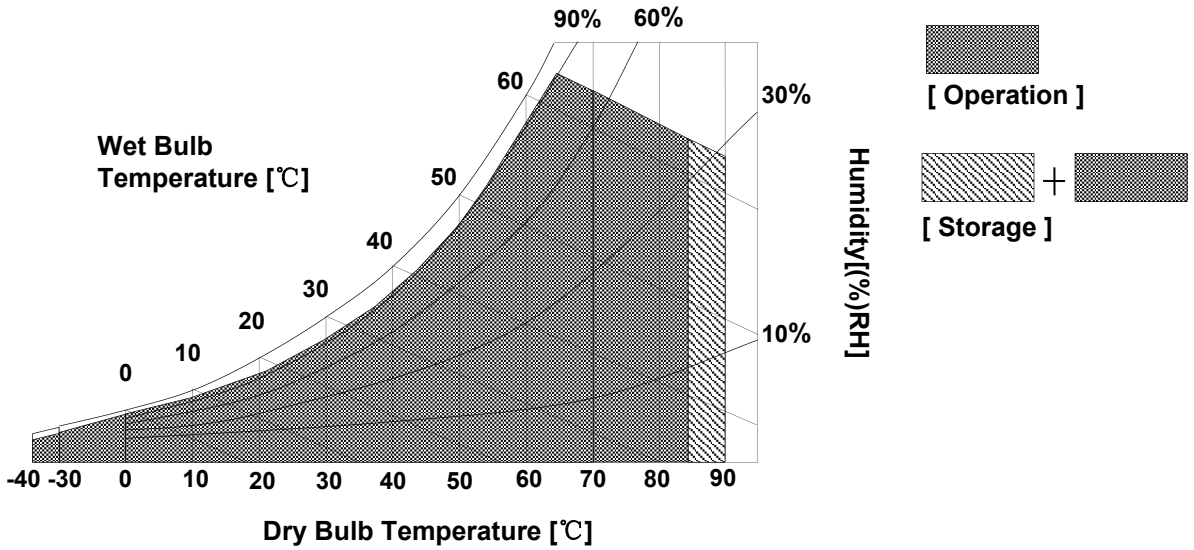
The following items are maximum values which, if exceeded, may cause faulty operation or damage to t he LCD module.

Table 1. ABSOLUTE MAXIMUM RATINGS

Parameter		Symbol	Value		Unit	Remarks
			Min.	Max.		
Power Supply Voltage		V_{LCD}	-0.2	4.0	V	1
LVDS Signal Voltage		V_{LVDS}	-0.2	3.6	V	2
LED Current Per Chain		I_{LED}	-	105	mA	
Operating Te mperature	Ambient Temperatur e	T_A	-25	75	°C	3,4,5
Storage Temp erature	Ambient Temperatur e	T_{ST}	-30	70	°C	3

Note 1. The system should supply enough current for TFT LCD module's stable operation at -25~+75℃.

2. V_{LVDS}: LVDS input signal (RAM/P, RBM/P, RCM/P, RCLKM/P, RDM/P)
3. Temperature and relative humidity range are shown in the figure below.
   Wet bulb temperature should be Max. 62℃. Condensation of dew must be avoided,
   because it may cause electrical current leakage, and deterioration of performance and quality.
4. The operating temperature means that LCD Module guarantees operation of the circuit.
   All the contents of Electro-optical specifications are guaranteed under the room temperature condition.
5. This temperature is ambient temperature with regard to the heat which is generated under operation of circuit and backlight on. (reference value)



5. Electrical Specifications

5-1. Electrical Characteristics

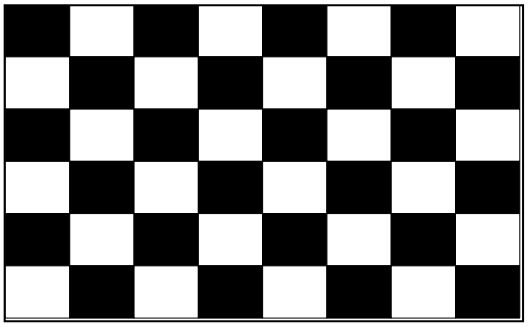
It requires two power inputs. One is employed to power for the LCD circuit. The other is used for the LED bac klight.

Table 2. LCD DRIVING CIRCUIT ELECTRICAL CHARACTERISTICS

Parameter			Symbol	Min.	Typ.	Max.	Unit	Note
LVDS Characteristics	Minimum differential threshold Common mode volta ge		VTH	-	-	+/-100	mV	
			VCM	(-0.3)	-	(2.1)	V	
	input leakage Driver current		IL	(-10)	-	(10)	uA	
	Clock duty cycle			(45)	(50)	(55)	%	
Power Supply	Voltage		VCC	(3.0)	(3.3)	(3.6)	V	
	Current	Mosaic	ICC	-	(350)	(540)	mA	1
		White		-	(440)	(540)	mA	
	Power Consumption		PLCD	-	(1.452)	(1.782)	W	
Inrush Current			ICC	-	-	(1500)	mA	2
Permissive input ripple			VRF	-	-	(200)	mVpp	

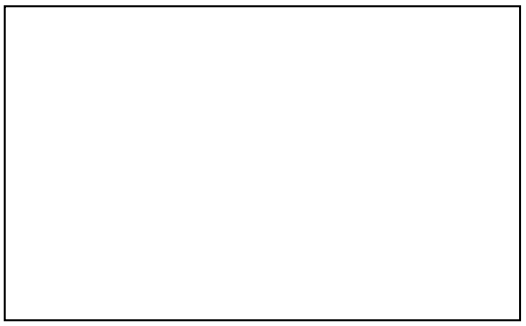
Note 1. The specified current and power consumption are under the V_{LCD} = 3.3V, Ta = 25 ± 2°C, f_V = 60Hz condition whereas mosaic pattern(8 x 6) and white pattern are displayed and fV is the frame frequency.
2. The duration of rush current is about 2ms and rising time of power input is 0.5ms (min.).
(V_{LCD} = 3.3V, Ta = 25 ± 2°C, f_V = 60Hz)

White : 255 Gray
Black : 0 Gray



Mosaic Pattern(8 x 6)

White : 255 Gray

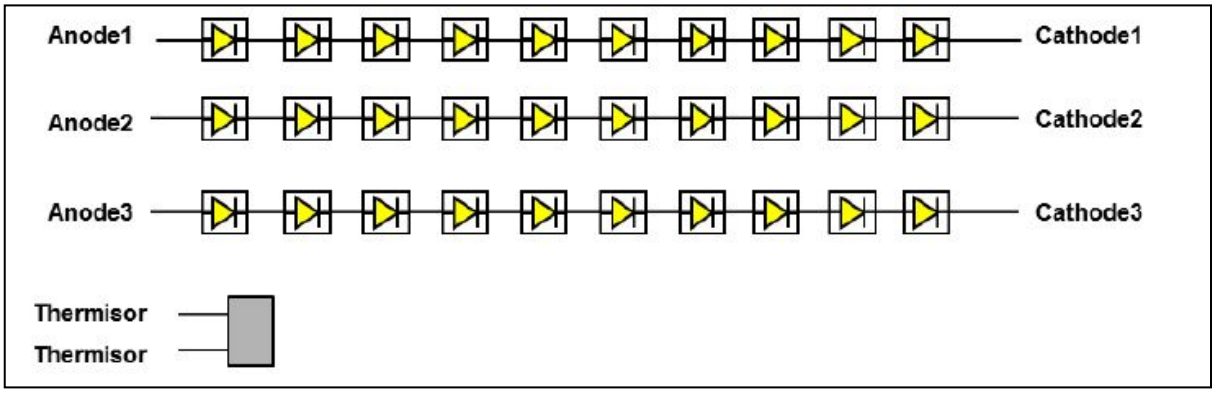


White Pattern

Table 3. BACKLIGHT ELECTRICAL CHARACTERISTICS

Parameter	Min.	Typ	Max.	Unit	Remarks
Number of LED Chains	-	-	3	-	
Number of LED per Chain	-	-	10	-	
Backlight Voltage	27	30	34	V	Ta=25℃
Backlight Current	-	100	105	mA	Ta=25℃
Power consumption	-	9.0	10.7	W	Ta=25℃
Max. Voltage difference Between the LED chains	-	-	2.5	V	Ta=25℃

Note. LED Chain Diagram



5-2. Interface Connections

This LCD employs one interface connector and one interface connection. One connector(68pin) is used for module electronics interface. One interface connection is used for TSP interface.

5-2-1. User Connector Pin Configuration

The matching connector model name is AVX 6288 040 000 846 manufactured by Kyocera or equivalent

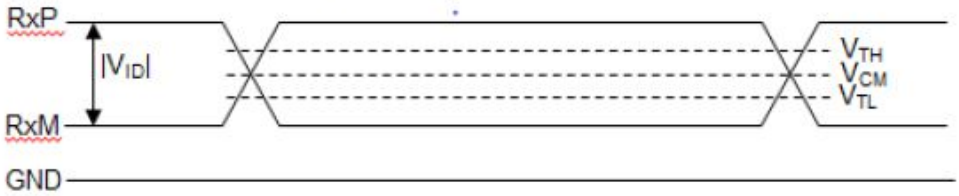
Table 4. Connector PIN CONFIGURATION

Pin No.	Name	I/O	Description	Note
40	A1	I	Backlight Anode 1	
39	A1	I	Backlight Anode 1	
38	C1	O	Backlight Cathode 1	
37	C1	O	Backlight Cathode 1	
36	A2	I	Backlight Anode 2	
35	A2	I	Backlight Anode 2	
34	C2	O	Backlight Cathode 2	
33	C2	O	Backlight Cathode 2	
32	A3	I	Backlight Anode 3	
31	A3	I	Backlight Anode 3	
30	C3	O	Backlight Cathode 3	
29	C3	O	Backlight Cathode 3	
28	NTC1	O	Temperature Sensor Pin 1 LED FPC	
27	NTC2	O	Temperature Sensor Pin 2 LED FPC	
26	HVR	I	Horizontally and Vertically Inverted	
25	N.C.	-	Not Connected	
24	ASIL FB	O	ASIL Feedback Signal (GSP_OUT)	
23	GND	I	Ground	
22	RDP	I	LVDS Data 3 +	
21	RDM	I	LVDS Data 3 -	
20	GND	I	Ground	
19	RCLKP	I	LVDS Clock +	
18	RCLKM	I	LVDS Clock -	
17	GND	I	Ground	
16	RCP	I	LVDS Data 2 +	
15	RCM	I	LVDS Data 2 -	
14	GND	I	Ground	
13	RBP	I	LVDS Data 1 +	
12	RBM	I	LVDS Data 1 -	
11	GND	I	Ground	
10	RAP	I	LVDS Data 0 +	
9	RAM	I	LVDS Data 0 -	
8	GND	I	Ground	
7	GND	I	Ground	
6	VCC	I	Power Supply (3.3V)	
5	VCC	I	Power Supply (3.3V)	
4	TEST 1	I	Test pin #1	
3	TEST 2	I	Test pin #2	
2	TEST 3	I	Test pin #3	
1	N.C.	-	Not Connected	

5-3. LVDS Signal Specifications

5-3-1. DC Characteristics

Parameter	Symbol	Min	Typ	Max	Unit	Notes
LVDS Differential Voltage	$\|V_{ID}\|$	250	400	550	mV	1
LVDS Input Common Mode Voltage	V_{CM}	1.0	1.2	1.4	V	
Positive-going Input Threshold Voltage	V_{TH}	-	-	100	mV	
Negative-going Input Threshold Voltage	V_{TL}	-100	-	-	mV	



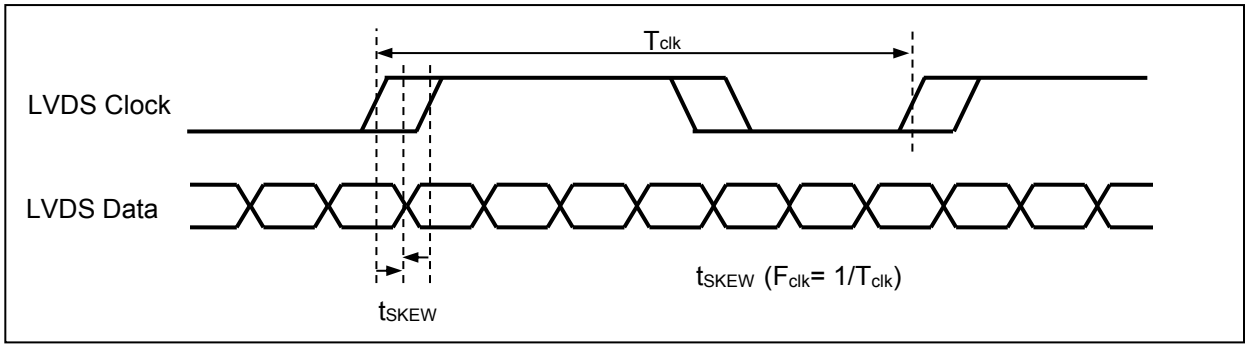
Note 1. The LVDS termination resistors(100Ω) are integrated at LCD TCON.

5-3-3. AC Characteristics (2/2)

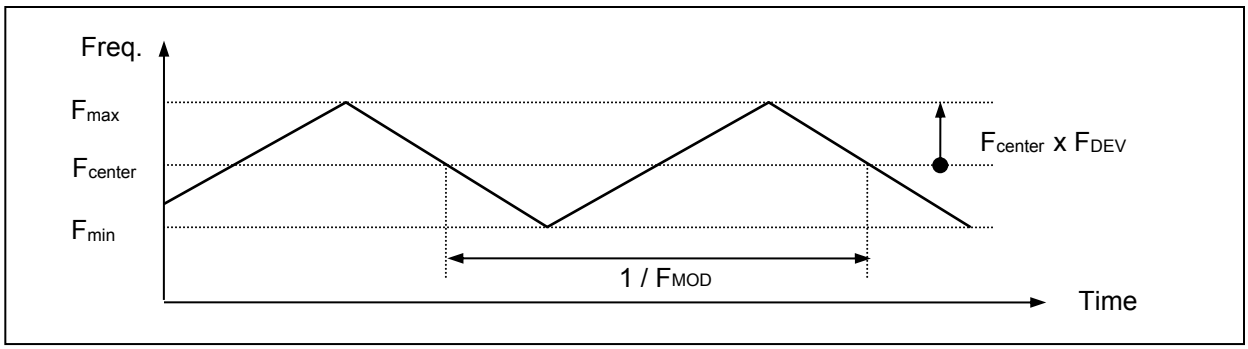
Parameter	Symbol	Min	Typ	Max	Unit	Notes
LVDS Clock to Data Skew Margin	t_{SKEW}	-300	-	+300	ps	1
Maximum deviation of input clock frequency during SSC	F_{DEW}	-	-	±3	%	2
Maximum modulation frequency of input clock during SSC	F_{MOD}		-	150	KHz	

Note:

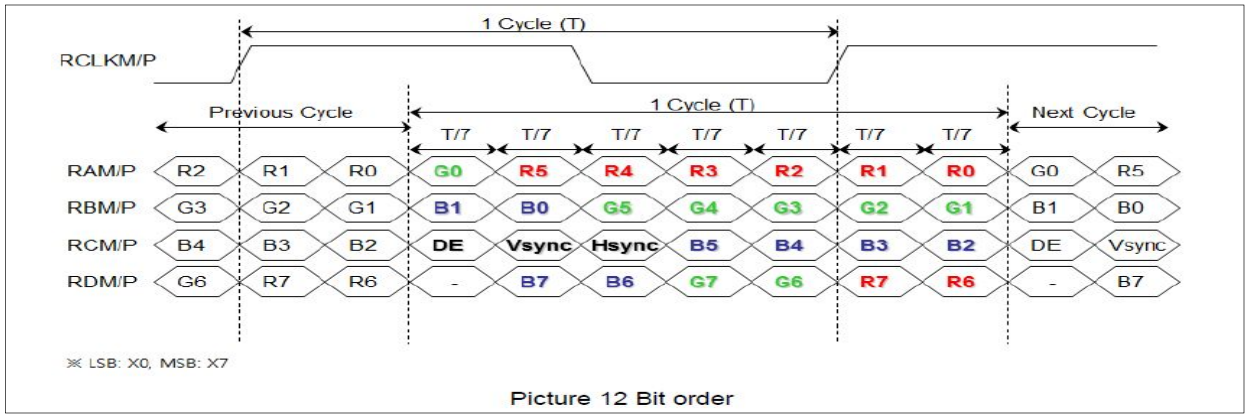
1. LVDS Clock to Data Skew Margin between channel



2. Spread spectrum



5-3-4. LVDS Bit assignment (LVDS VESA Format)



Picture 12 Bit order

5-4. Signal Timing Specifications

Table 5 shows the signal timing required at the input of the LVDS transmitter. All of the interface signal timings should be satisfied with the following specification for normal operation.

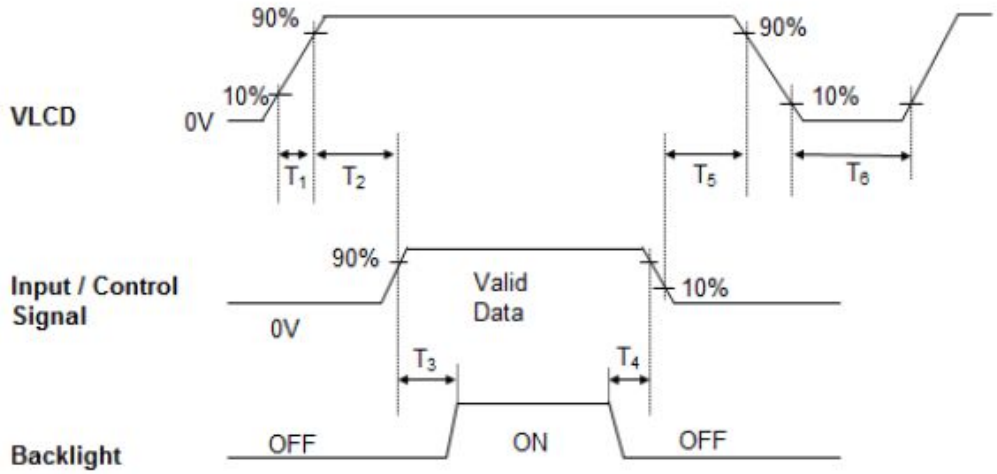
Table 5. SIGNAL TIMING CHARACTERISTICS fv = 60Hz

Parameter		Symbol	Min	Typ	Max	Unit	Note
DCLK	Frequency	f_{CLK}	54.26	56.12	58.08	MHz	
	Period	t_{CLK}	18.43	17.82	17.22	ns	
HSYNC	Period	t_{HP}	1152	1184	1216	t_{CLK}	Fig.1
	Width	t_{WH}	32	32	32		
	Horizontal Valid	t_{HV}	1024	1024	1024		
	Horizontal Back Porch	t_{HBP}	64	80	96		
	Horizontal Front Porch	t_{HFP}	32	48	64		
VSYNC	Period	t_{VP}	785	790	796	t_{HP}	
	Width	t_{WV}	7	7	7		
	Vertical Valid	t_{VV}	768	768	768		
	Vertical Back Porch	t_{VBP}	8	12	16		
	Vertical Front Porch	t_{VFP}	2	3	5		

Note 1. The performance of the electro-optical characteristics may be influenced by variance of the vertical refresh rates.

5-6. Power Sequence

For LCD's normal operation, it is recommended to keep below power supply sequence.



Parameter	Value			Unit	Notes
	Min	Typ	Max		
T1	0.5	-	10	ms	
T2	100	-	-	ms	
T3	300	-	-	ms	
T4	100	-	-	ms	1
T5	0	-	-	ms	
T6	500	-	-	ms	

Note 1. It needs to insert black pattern(G0) to discharge DC in pixel.

6. Electro-optical Characteristics

Electro-optical characteristics are determined after the unit has been 'ON' and stable in a dark environment at 25±2°C. The values are specified at an approximate distance 50cm from the LCD surface at a viewing angle of and equal to 0°. Measured value at the center point of LCD panel after more than 15 minutes while backlight turning on.

It is presented additional information concerning the measurement equipment and method in FIG. 1.

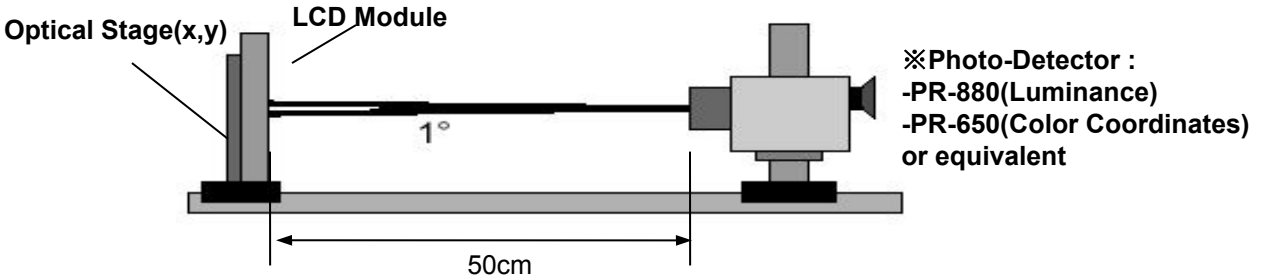


FIG. 1 Electro-optical Characteristic Measurement Equipment and Method

Table 8. ELECTRO-OPTICAL CHARACTERISTICS

VDD=typ., Clock freq.=typ., ILED=typ., Ta=+25°C, measured at 20min. after turning on

Require. Ref	Parameter	Symbol	Conditions	MIN	TYP	MAX	Unit	Remarks
2.1.01	Contrast ratio @25°C	CR	θh = 0° θv = 0°	700	1000	-		
2.1.02			Phi / Theta 0° 40° 45° 25° 90° 40° 135° 25° 180° 40° 225° 20° 270° 40° 315° 20°	300	-	-		
2.1.03	Contrast ratio @85°C	CR	Phi / Theta 0° 40° 45° 25° 90° 40° 135° 25° 180° 40° 225° 20° 270° 40° 315° 20°	100	-	-		
2.1.04	Contrast ratio vs. Temperature (perpendicular)	ΔCR	T= -30°C	-	-	30	%	Note 2-11
2.1.05			T= -10°C	-	-	20		
2.1.06			T= +60°C	-	-	30		
2.1.07			T= +80°C	-	-	35		
2.1.08	Response time Rise + Fall (white: 90% / black : 10%) (perpendicular)	Σ ($t_R + t_F$)	T_S= 25°C	-	-	40	ms	Note 2-5
2.1.09			T_S= 0°C	-	-	120		
2.1.10			T_S= -20°C	-	-	250		
2.1.11			T_S= -30°C	-	-	600		
2.1.12	Luminance @25°C	L	θh = 0° θv = 0°	1000	(1200)	-	cd/m²	Note 2-5 Typical value only for reference
2.1.13			θh= +40°…-40° θv= +27°…-27°	600	(720)	-	cd/m²	
2.1.14	Luminance @85°C (no derating applied)	L	θh= +40°…-40° θv= +27°…-27°	300	(360)	-	cd/m²	
2.1.15	Luminance homogeneity / White VESA 9-point	H	θh = 0° θv = 0°	80	-	-	%	Note 2-16
2.1.16	Luminance homogeneity / Black VESA 9-point		θh = 0° θv = 0°	75	-	-	%	Note 2-16
2.1.17	Luminance homogeneity / Black Area Scan method according to <BlackMURA_Display_V115>		θh = 0° θv = 0°	50	-	-	%	Note 2-17
		Gradient	Relative to White	-	-	0.004	% / pixel	Note 2-17
			Relative to Black	-	-	2.0		

2.1.18	White chromaticity	x		0.275	0.300	0.325		Note 2-12
2.1.19 a		y		0.280	0.305	0.330		
2.1.20	Red chromaticity	x		0.618	0.643	0.668		Note 2-12
2.1.21		y		0.309	0.334	0.359		
2.1.22	Green chromaticity	x		0.287	0.312	0.337		
2.1.23		y		0.574	0.599	0.624		
2.1.24	Blue chromaticity	x		0.124	0.149	0.174		
2.1.25		y		0.033	0.058	0.083		
2.1.26	Black chromaticity – only reference value	x		0.270	0.300	0.330		
2.1.27		y		0.275	0.305	0.335		
2.1.28	Colour gamut	-		60	-	-	%	
2.1.29	Colour homogeneity White	Δu'v'	$\theta_h = 0°$ $\theta_v = 0°$	-	-	0.01		Note 2-4 Reference Value
2.1.30	Colour shift over viewing angle	Δu'v'	$\theta_h = 45°$ $\theta_v = 45°$	-	-	0.01		Reference Value
2.1.31	Gamma			2.0	2.2	2.4		Note 2-20
2.1.32	Surface Reflection	HC or AG			4.5		%	Typ. of polarizer
						6.0		Max. of LCM
2.1.33	Flicker Ratio		Ta=+25°C		10	20	%	No visible Flickering allowed. Final value to be confirm

Note Polarizer surface has a hard coating and cleaning with dry cotton is recommended.
Readability with polaroid sunglasses must be guaranteed.

Note 2-4 Colour homogeneity

Measuring procedure according chapter 3.7 (Luminance homogeneity in CQR A2C00052911 based on VESA standard)

u'v' has to be evaluated based on CIE-1976

Δu'v' has to be evaluated based on CIE-1976

$$\Delta u'v' = \sqrt{(\Delta u')^2 + (\Delta v')^2}$$

$$\Delta u' = u'_1 - u'_2$$

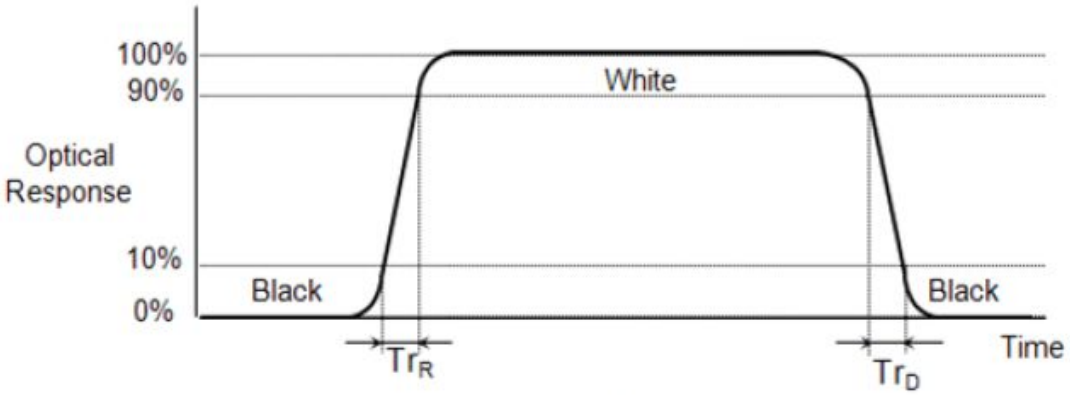
$$\Delta v' = v'_1 - v'_2$$

Note 2-5 Response time

The 3-dimensional diagram of response time vs. greyscale should be provided by the display supplier for reference only.

The dimming of the display has to be as low as measureable.

This response time has to be reached in stable temperature situation (30 min after start-up).



Picture 3 Response time

Note 2-8 Color chromaticities

Colour shift over viewing angle, temperature, dimming and lifetime must be within given tolerances for every colour.

Note 2-11

Contrast ratio against temperature

ΔCR defines the allowed contrast reduction at the defined temperature based on the CR at room temperature.
For example: ΔCR (-30°C) = (CR@25°C – CR@-30°C) / CR@25°C x 100%

Note 2-12

Chromaticity: Based on the specified backlight a colour gamut of min.60% based on NTSC must be provided.

Note 2-16

Luminance homogeneity (9 points measurement refer to VESA and Family specific **CQR**)

Note 2-17

Area scan:

The uniformity is calculated using the virtual spot **area scan method**, which simulates a conventional luminance meter with a single measurement spot (which however is rectangular in this case and therefore named "Box") that is automatically moved in steps of one camera pixel over the display area DA1.

$$u = \frac{\min(Y_{Box}(i,j))}{\max(Y_{Box}(k,l))} \quad (i,j),\ (k,l) \in (\mathrm{DA1})$$

$Y_{Box}\ (l, j)$ Box filtered luminance in the image. For each camera pixel (i,j) use the arithmetic mean value over NLE * NLE pixels around (i,j). This simulates the spot size of a conventional luminance meter (virtual spot size).

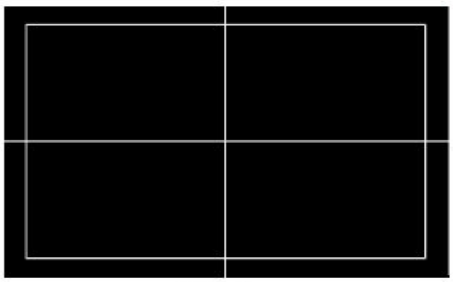
N_{DE} Number of display pixels (hor/vert) for averaging

N_{LE} Number of camera pixels (hor/vert) for averaging

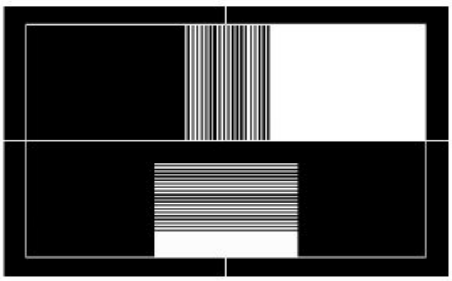
To ensure that no part of the box ever leaves DA the evaluation is only carried out in the centre region DA1 which is the region DA minus LE *N* pixels on every border. This omits handling the border cases for the NLE * NLE box operator while calculating Box *Y* .

Value	Symbol	Value	Unit
Display pixels for averaging	N_{DE}	10	Pixels
Average Luminance of Black; White	$\overline{L}_B$, $\overline{L}_W$		cd/m²
Uniformity of Black; White	u_B, u_W		%

For the uniformity measurement the following patterns are necessary:

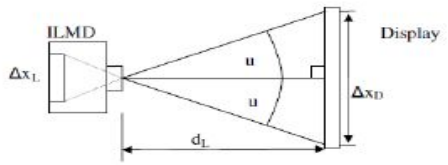


CROSS



GRILL_4_4

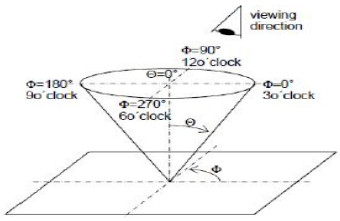
Pattern File	Description	Use
CROSS	White lines of one or three pixel thickness on black background. Centred cross and centred big rectangle of known size M_{DR}, N_{DR}.	• Setup of the geometrical centre • Measurement of the reproduction scale • Directional setup of the camera/display
GRILL_4_4	Horizontal and vertical white lines and black spacings of equal width of four pixels with a black and a white shoulder	Setup of focus point
BLACK	R=G=B=0% for all pixels	Uniformity measurement black
WHITE	R=G=B=100% for all pixels	Uniformity measurement white



Picture 4 Uniformity measurement

Measurement field angle 2u: 10°
Display pixel for average: 10 pixel x/y

Note 2-18 (Picture 5)
Definition of viewing angle Θ_{AZ} and of azimuth angle Φ_{Polar}
Θ_{AZ} = viewing-angle - declination angle between observer position and display normal
Φ_{Polar}= azimuth-angle - counter clockwise angle in the display surface between observer position and positive x-axis



Picture 5 Viewing angles

Note 2-19
In case of optical bonding referring to "Optical Bonding Specification of Continental" the polarizer coating must be HC (hard-coated).

Note 2-20 LGD Proposal : Gamma value is calculated based on log-log determination@IDMS standard 9 level

7. Mechanical Characteristics

The contents provide general mechanical characteristics for this module. In addition the figures in the next page are detailed mechanical drawing of the LCD.

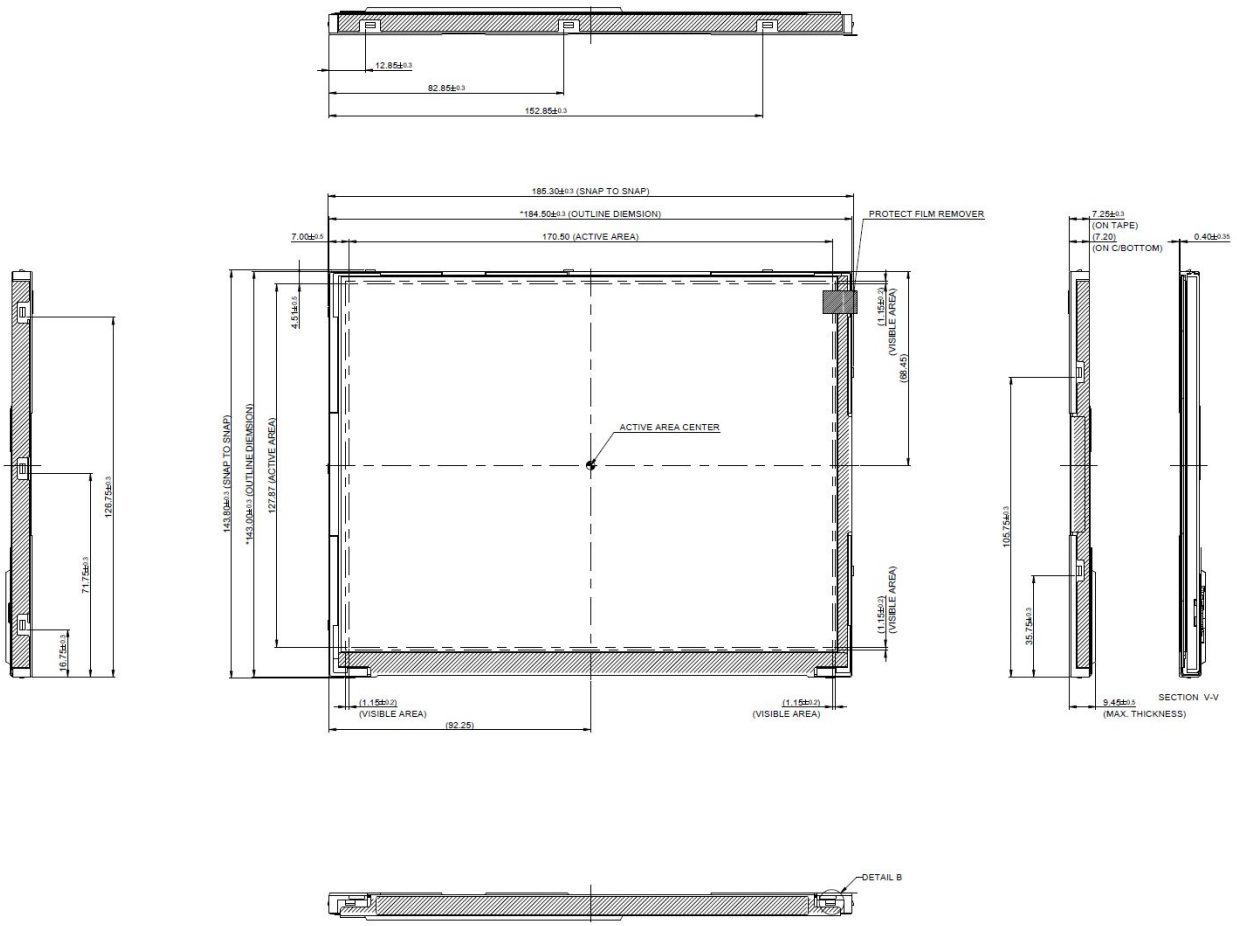
Table 9. MECHANICAL CHARACTERISTICS

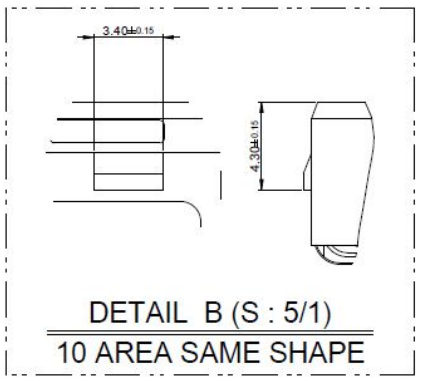
Parameter	Value	
Outline Dimension	Horizontal	184.50 ± 0.3 mm
	Vertical	143.00 ± 0.3 mm
	Depth	7.25 ± 0.3 mm
Active Display Area	Horizontal	170.50 ± 0.3 mm
	Vertical	127.87 ± 0.3 mm
Weight	255g (Typ.), 260g (Max.)	

<FRONT VIEW>

Note. Unit:[mm], General tolerance: ± 0.3mm

NOTES
1. UNSPECIFIED DIMENSIONAL TOLERANCES ARE ±0.3mm.
2. EACH PART'S SPECIFICATION REFER TO THE EACH DRAWING.
3. COMPROMISE WITH DESIGNER ON DETAIL MATTERS.
4. ALL MATERIAL SHOULD BE APPLIED HALOGEN FREE MATERIAL.
5. WEIGHT SPEC : Typ. 255g, Max 260g.

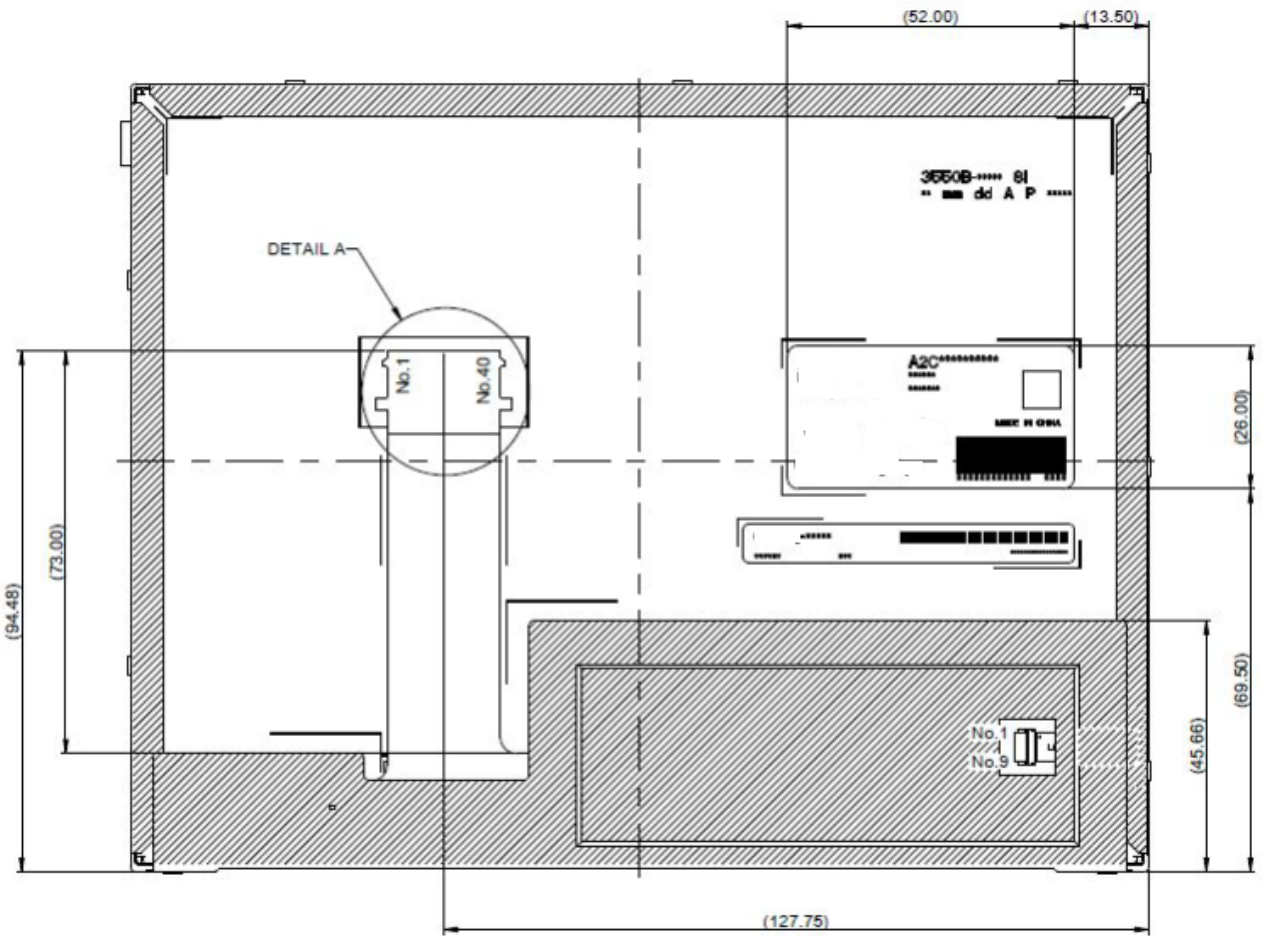


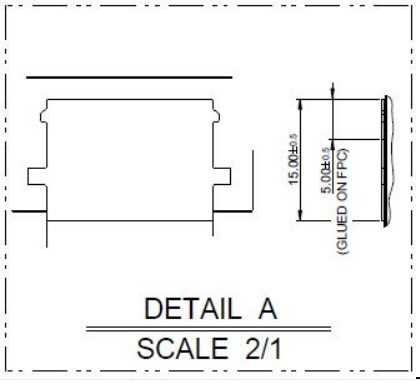


<REAR VIEW>

Note. Unit:[mm], General tolerance: ± 0.3mm

NOTES
1. UNSPECIFIED DIMENSIONAL TOLERANCES ARE ±0.3mm.
2. EACH PART'S SPECIFICATION REFER TO THE EACH DRAWING.
3. COMPROMISE WITH DESIGNER ON DETAIL MATTERS.
4. ALL MATERIAL SHOULD BE APPLIED HALOGEN FREE MATERIAL.
5. WEIGHT SPEC : Typ. 255g, Max 260g.





8. Reliability

Table 10. ENVIRONMENT TEST CONDITION

No.	Test Item	Test Condition	Note
1	High Temperature Operation Test	• Ta = +75℃ 500h	
2	Low Temperature Operation Test	• Ta = -25℃ 48h	
3	High Temperature and High Humidity Operation Test	• Ta = +65℃ 93%RH 500h	
4	Thermal Shock Test (non-operating)	• 1cycle : Ta=-25℃(0.5h) ~ 75℃(0.5h) • 300Cycles	
5	Power Thermal Cycle Endurance	• 1cycle : Ta=-25℃(1.5h) ~ 75℃(1.5h) • 100Cycles	
6	Damp Heat Cyclic	•Ta = -10℃ to 65℃, 93%RH •10cycle (240hr)	
7	Electro Static Discharge Test	• Panel Surface : ±4kV, Air, Power Off • Cover Bottom : ±8kV, Air, Direct, Power Off ※ Air/ Direct : 150pF,330Ω / 5 times	
8	Shock Test (non-operating)	• Half sine wave, 6ms • Acceleration [m/s2]: 500 • 10 times shock of each six faces	
9	Mixed Vibration Test	• Tmin = -25℃, Tmax = 75℃ •Duration: 12h per axis = 36hrs total •2.84g RMS acceleratioiin	

Note. Result Evaluation Criteria:

1. There should be no particular problems that may affect the display function at room temperature after 2 hours from the reliability tests finish.
2. TFT-LCD panels should take place at room temperature for 24 hours after the reliability tests finish. Then, all of optical and electrical test should be performed.
3. Display performance quality is monitored before, in the middle of, and after the test, and will be verified after turning into room temperature. (No abnormal display found)

9. International Standards

9-1. Safety

a) UL 60950-1, Underwriters Laboratories Inc.
Information Technology Equipment - Safety - Part 1 : General Requirements.
b) CAN/CSA-C22.2 No. 60950-1-07, Canadian Standards Association.
Information Technology Equipment - Safety - Part 1 : General Requirements.
c) EN 60950-1, European Committee for Electrotechnical Standardization (CENELEC).
Information Technology Equipment - Safety - Part 1 : General Requirements.

9-2. Environment

a) RoHS, Directive 2011/65/EU of the European Parliament and of the council of 8 June 2011

10. Packing

10-1. Designation of Lot Mark

a) Lot Mark

A	B	C	D	E	F	G	H	I	J	K	L	M

A,B,C : SIZE(INCH)
D : YEAR
E : MONTH
F ~ M : SERIAL NO.

Note

1. YEAR

Year	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Mark	A	B	C	D	E	F	G	H	J	K

2. MONTH

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mark	1	2	3	4	5	6	7	8	9	A	B	C

b) Location of Lot Mark

Serial No. is printed on the label. The label is attached to the backside of the LCD module.
This is subject to change without prior notice.

11. PRECAUTIONS

Please pay attention to the following when you use this TFT LCD module.

11-1. MOUNTING PRECAUTIONS

(1) You must mount a module using specified mounting structure.(Details refer to the drawings)
(2) You should consider the mounting structure so that uneven force(ex. Twisted stress) is not applied to the module.
And the case on which a module is mounted should have sufficient strength so that external force are not transmitted directly to the module.
(3) Please attach a transparent protective plate to the surface in order to protect the polarizer.
Transparent protective plate should have sufficient strength in order to the resist external force.
(4) You should adopt radiation structure to satisfy the temperature specification.
(5) Acetic acid type and chlorine type materials for the cover case are not desirable because the former generates corrosive gas of attacking the polarizer at high temperature and the latter causes circuit break by electro-chemical reaction.
(6) Do not touch, push or rub the exposed polarizers with glass, tweezers or anything harder than HB pencil lead. And please do not rub with dust clothes with chemical treatment.
Do not touch the surface of polarizer for bare hand or greasy cloth.(Some cosmetics deteriorate the polarizer.)
(7) When the surface becomes dusty, please wipe gently with absorbent cotton or other soft materials like chamois soaks with petroleum benzine. Normal-hexane is recommended for cleaning the adhesives used to attach front / rear polarizers. Do not use acetone, toluene and alcohol because they cause chemical damage to the polarizer.
(8) Wipe off saliva or water drops as soon as possible. Their long time contact with polarizer causes deformations and color fading.
(9) Do not open the case because inside circuits do not have sufficient strength.
(10) The metal case of a module should be contacted to electrical ground of your system.

11-2. OPERATING PRECAUTIONS

(1) The spike noise causes the mis-operation of circuits. It should be lower than following voltage :
V=±200mV(Over and under shoot voltage)
(2) Response time depends on the temperature.(In lower temperature, it becomes longer.)
(3) Brightness depends on the temperature. (In higher temperature, it becomes lower.)
(4) Be careful for condensation at sudden temperature change. Condensation makes damage to polarizer or electrical contacted parts. And after fading condensation, smear or spot will occur.
(5) When fixed patterns are displayed for a long time, remnant image is likely to occur.
(6) Module has high frequency circuits. Sufficient suppression to the electromagnetic interference shall be done by system manufacturers. Grounding and shielding methods may be important to minimize the interference.

11-3. ELECTROSTATIC DISCHARGE CONTROL

Since a module is composed of electronic circuits, it is not strong to electrostatic discharge. Make certain that handling persons are connected to ground through wrist band etc. And don't touch interface pin directly.

11-4. PRECAUTIONS FOR STRONG LIGHT EXPOSURE

Strong light exposure causes degradation of polarizer and color filter.

11-5. STORAGE

When storing modules as spares for a long time, the following precautions are necessary.

(1) Store them in a dark place. Do not expose the module to sunlight or fluorescent light. Keep the temperature between 5°C and 35°C at normal humidity.

(2) The polarizer surface should not come in contact with any other object.
It is recommended that they be stored in the container in which they were shipped.

11-6. HANDLING PRECAUTIONS FOR PROTECTION FILM

(1) The protection film is attached to the bezel with a small masking tape or a double side tape.
When the protection film is peeled off, static electricity is generated between the film and polarizer.
This should be peeled off slowly and carefully by people who are electrically grounded and with well ion-blown equipment or in such a condition, etc.

(2) When the module with protection film attached is stored for a long time, sometimes there remains a very small amount of glue still on the bezel after the protection film is peeled off.

(3) You can remove the glue easily. When the glue remains on the bezel surface or its vestige is recognized, please wipe them off with absorbent cotton waste or other soft material like chamois soaked with normal-hexane.