Market Elite

TFT LCD Approval Specification

MODEL NO.：EM150X1

Customer：_____

Approved by：__James Lee_____

Note：

Version 1.0

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REVISION HISTORY

Version	Date	Page (New)	Section	Description
Ver 0.0	Sept. 6, 04'	New	All	

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1. GENERAL DESCRIPTION

1.1 OVERVIEW

EM150X0 is a 15.0" TFT Liquid Crystal Display module with 2 CCFL Backlight units and 20 pins LVDS

interface. This module supports 1024 x 768 XGA mode and can display 16.2M colors. The optimum viewing

angle is at 6 o'clock direction. The inverter module for Backlight is not built in.

1.2 FEATURES

- XGA (1024 x 768 pixels) resolution

- DE(Data Enable) only mode

- LVDS Interface with 1pixel/clock

1.3 APPLICATION

- Desktop monitors

1.4 GENERAL SPECIFICATI0NS

Item	Specification	Unit	Note
Active Area	304.128(H) x 228.096(V) (15.0" diagonal)	mm	(1)
Bezel Opening Area	307.5(H) x 231.4(V)	mm	
Driver Element	a-Si TFT active matrix	-	-
Pixel Number	1024 x R.G.B. x 768	pixel	-
Pixel Pitch	0.297(H) x 0.297(W)	mm	-
Pixel Arrangement	RGB vertical stripe	-	-
Display Colors	16,194,277	color	-
Transmissive Mode	Normally white	-	-

1.5 MECHANICAL SPECIFICATIONS

Item		Min.	Typ.	Max.	Unit	Note
Module Size	Horizontal(H)	320.5	321.0	321.5	mm	(1)
	Vertical(V)	244.9	245.4	245.9	mm	
	Depth(D)	-	9.7	10	mm	(1)(2)
Weight		-	-	930	g	-

Note (1) Please refer to the attached drawings for more information of front and back outline dimensions.

Note (2) The depth is without connector.

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2. ABSOLUTE MAXIMUM RATINGS

2.1 ABSOLUTE RATINGS OF ENVIRONMENT

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Storage Temperature	T_{ST}	-20	+60	ºC	(1)
Operating Ambient Temperature	T_{OP}	0	+50	ºC	(1), (2)
Storage Humidity	H_{ST}	10	90	%	-
Operation Humidity	H_{OP}	10	90	%	-
Shock (Non-Operating)	S_{NOP}	-	50	G	(3), (5)
Vibration (Non-Operating)	V_{NOP}	-	1.5	G	(4), (5)

Note (1) Temperature and relative humidity range is shown in the figure below.

(a) 90 %RH Max. (Ta $\leq$ 40 ºC).

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

(c) No condensation of water.

Relative Humidity (%RH)
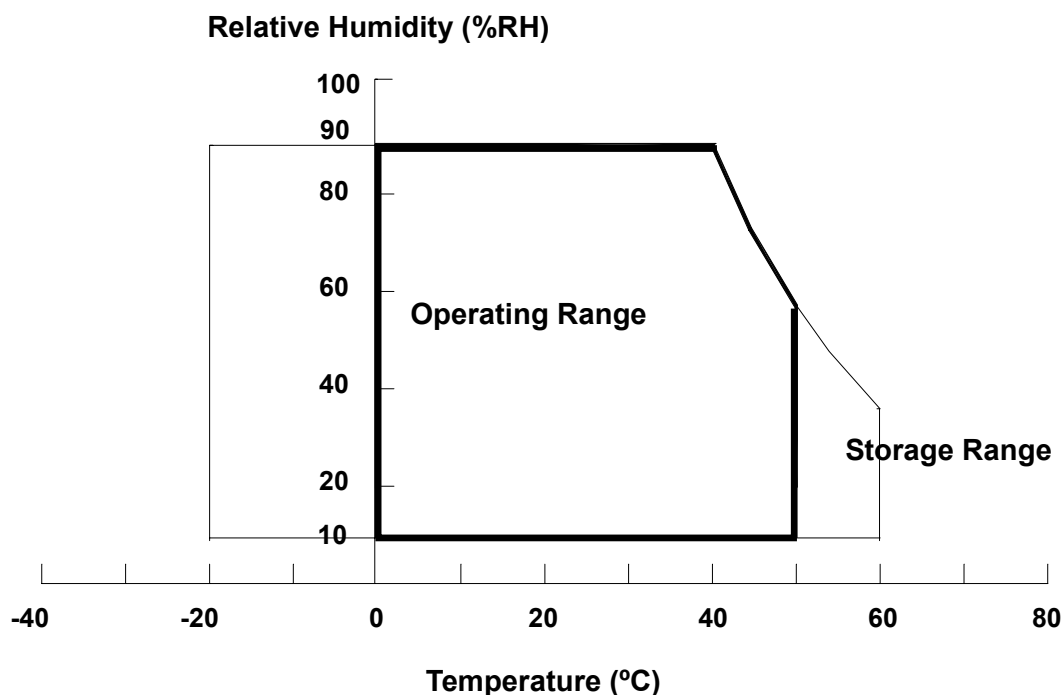
Temperature (ºC)

Note (2) The temperature of panel surface should be 0 ºC Min. and 60 ºC Max.

Note (3) 11ms, 1 time each $\pm$X,$\pm$Y and $\pm$Z directions

Note (4) 10 ~ 500 Hz, 1 cycle/20min. 1.5mm max, 1 hour each X, Y and Z directions

Note (5) 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.

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2.2 ELECTRICAL ABSOLUTE RATINGS

2.2.1 TFT LCD MODULE

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Power Supply Voltage	V_{DD}	-0.3	4.0	V	

2.2.2 BACKLIGHT UNIT

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Lamp Voltage	V_L	-	2.5K	V_{RMS}	(1), (2), I_L = 8 mA
Lamp Current	I_L	-	8.5	mA_{RMS}	(1), (2)
Lamp Frequency	F_L	-	80	KHz	

Note (1) Permanent damage to the device may occur if maximum values are exceeded. Function operation

should be restricted to the conditions described under Normal Operating Conditions.

Note (2) Specified values are for lamp (Refer to Section 3.2 for further information).

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3. ELECTRICAL CHARACTERISTICS

3.1 TFT LCD MODULE$_{(1)}$

Parameter		Symbol	Value			Unit	Note
			Min.	Typ.	Max.		
Power Supply Voltage		V_{DD}	3.0	3.3	3.6	V	-
Ripple Voltage		V_{RP}	-	-	100	mVp-p	
Rush Current		I_{RUSH}	-	-	2.0	A	(2)
Power Supply Current	White	Icc	-	400		mA	(3)a
	Black		-	550		mA	(3)b
Differential Input Voltage for LVDS Receiver Threshold	"H" Level	V_{IH}	-	-	100	mV	-
	"L" Level	V_{IL}	-100	-	-	mV	-
Terminating Resistor		R_T	-	100	-	Ohm	-

Note (1) The module should be always operated within above ranges.

Note (2) Measurement Conditions:

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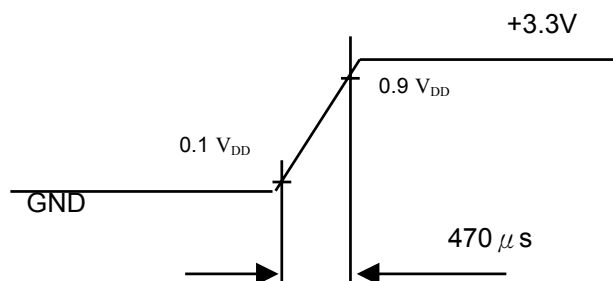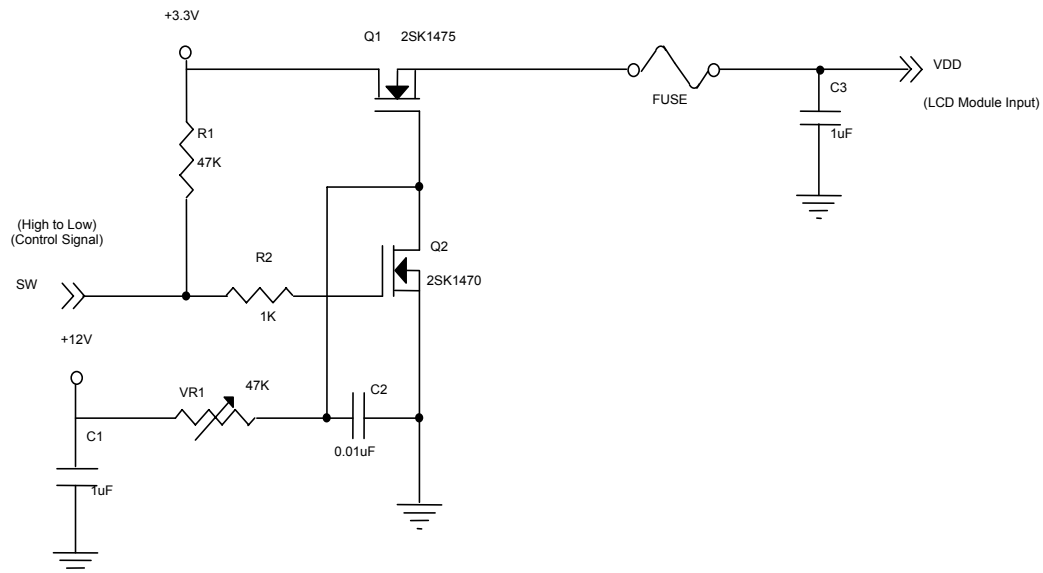
Note (3) The specified power supply current is under the conditions at V_{DD} =3.3V, Ta = 25 $\pm$ 2 ºC, DC Current and f_v = 60 Hz, whereas a power dissipation check pattern below is displayed.

a. White Pattern   b. Black Pattern

Active Area   Active Area

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3.2 BACKLIGHT UNIT

Ta = 25 ± 2 ºC

Parameter	Symbol	Value			Unit	Note
		Min.	Typ.	Max.		
Lamp Input Voltage	V_L	522	585	644	V_{RMS}	I_L = 8 mA
Lamp Current	I_L	2.0	8.0	8.5	mA_{RMS}	(1)
Lamp Turn On Voltage	V_S	-	-	1180 (25 ºC)	V_{RMS}	(2)
		-	-	1350 (0 ºC)	V_{RMS}	(2)
Operating Frequency	F_L	40	50	80	KHz	(3)
Lamp Life Time	L_{BL}	40000		-	Hrs	(5)
Power Consumption	P_L	-	9.36	-	W	(4), I_L =8 mA

Note (1) Lamp current is measured by utilizing a high frequency current meter as shown below:

Current Meter
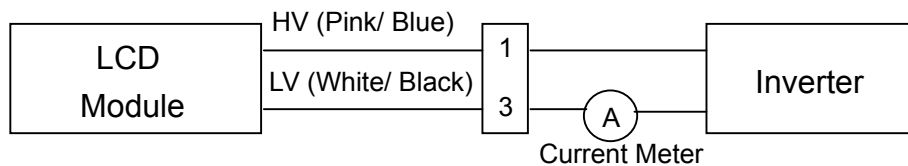
Note (2) The voltage shown above should be applied to the lamp for more than 1 second after startup. Otherwise the lamp may not be turned on.

Note (3) The lamp frequency may generate interference with horizontal synchronous frequency from the display, and this may cause line flow on the display. In order to avoid interference, the lamp frequency should be detached from the horizontal synchronous frequency and its harmonics as far as possible.
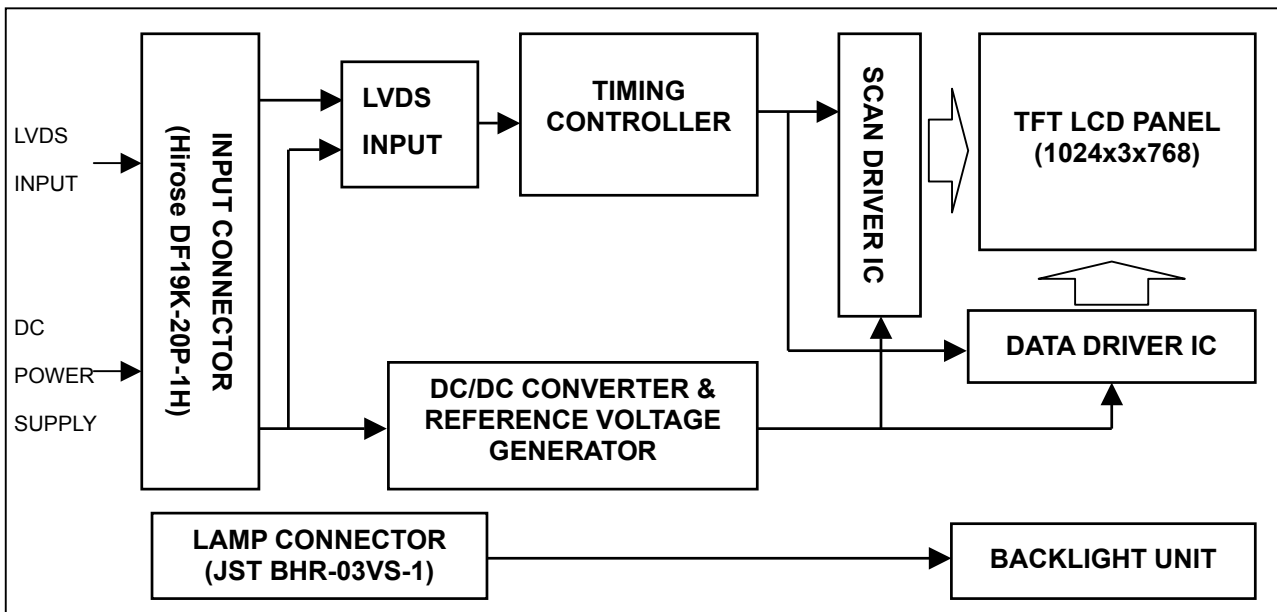
Note (4) P_L = I_L X V_L

Note (5) The lifetime of lamp is defined as the time when it continues to operate under the conditions at Ta = 25 ±2 ºC and I_L =8.0mA_{RMS} until one of the following events occurs:

(a) When the brightness becomes ≤ 50% of its original value.

(b) When the effective ignition length becomes ≤ 80% of its original value. (Effective ignition length is defined as an area that the brightness is less than 70% compared to the center point.)

Note (6) The waveform of the voltage output of inverter must be area-symmetric and the design of the inverter must have specifications for the modularized lamp. The performance of the Backlight, such as lifetime or brightness, is greatly influenced by the characteristics of the DC-AC inverter for the lamp. All the parameters of an inverter should be carefully designed to avoid generating too much current leakage from high voltage output of the inverter. When designing or ordering the inverter please make sure that a poor lighting caused by the mismatch of the Backlight and the inverter (miss-lighting, flicker, etc.) never occurs. If the above situation is confirmed, the module should be operated in the same manners when it is installed in your instrument.

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4. BLOCK DIAGRAM

4.1 TFT LCD MODULE

4.2 BACKLIGHT UNIT

1 HV (Pink)
3 LV (White)

1 HV (Pink)
3 LV (White)

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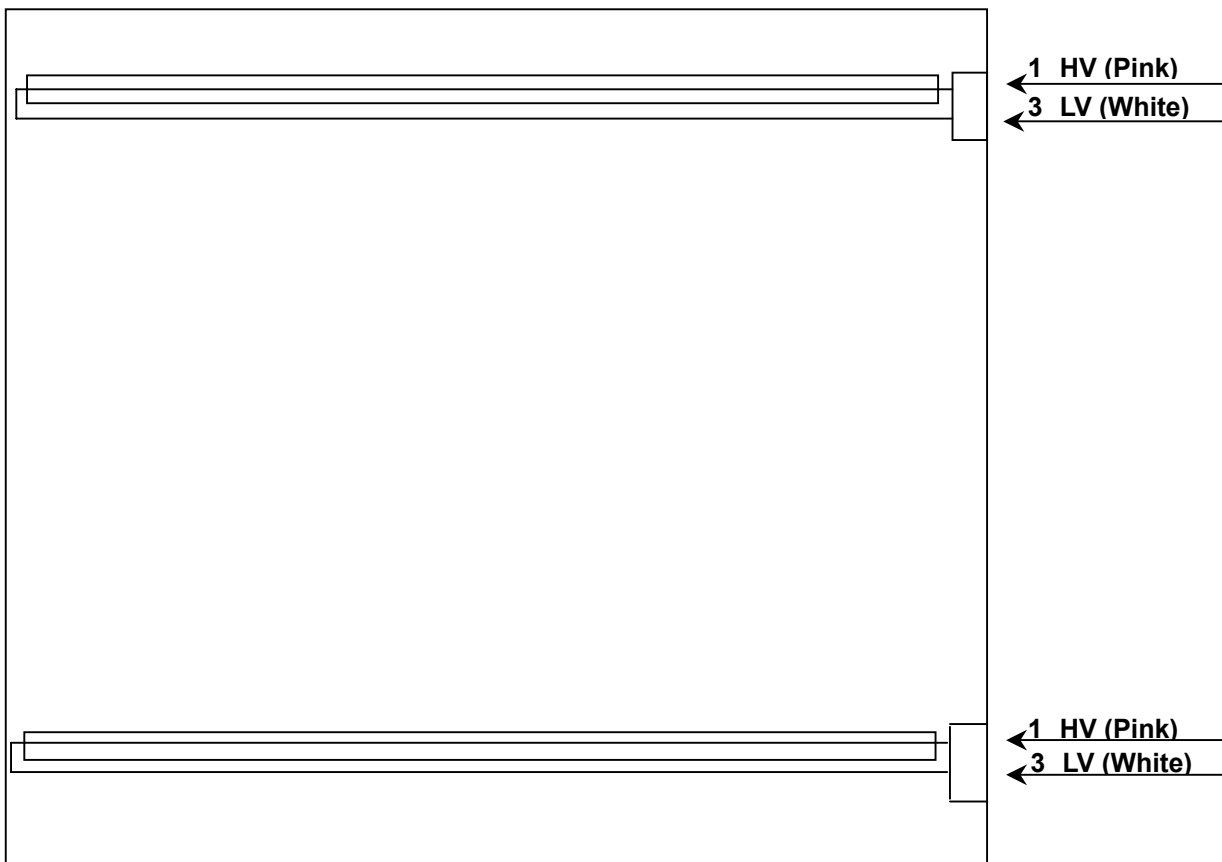
5. INPUT TERMINAL PIN ASSIGNMENT

5.1 TFT LCD MODULE

Pin No.	Symbol	Function	Polarity	Note
1	VDD	Power Supply +3.3V(typical)		
2	VDD	Power Supply +3.3V(typical)		
3	GND	Ground		
4	GND	Ground		
5	RX0-	LVDS Differential Data Input	Negative	
6	RX0+	LVDS Differential Data Input	Positive	
7	GND	Ground		
8	RX1-	LVDS Differential Data Input	Negative	
9	RX1+	LVDS Differential Data Input	Positive	
10	GND	Ground		
11	RX2-	LVDS Differential Data Input	Negative	
12	RX2+	LVDS Differential Data Input	Positive	
13	GND	Ground		
14	RXCLK-	LVDS Differential Data Input	Negative	
15	RXCLK+	LVDS Differential Data Input	Positive	
16	GND	Ground		
17	RX3-	LVDS Differential Data Input	Negative	
18	RX3+	LVDS Differential Data Input	Positive	
19	GND	GND		
20	NC	Reserved		

(1)Connector Part No.: [Hirose] DF19K-20P-1H

(2)Matching socket Part No.: [Hirose] DF19-20S-1C

5.2 BACKLIGHT UNIT

Pin	Symbol	Description	Color
1	HV1	High Voltage	Pink/ Blue
3	LV	Ground	White/ Black

Note (1) Connector Part No.: BHR-03VS-1 (JST) or equivalent

Note (2) Matching Connector Part No.: SM02B-BHS-1-TB (JST) or equivalent

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5.3 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	R7	R6	G5	G4	G3	G2	G1	G0	R7	R6	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
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Red(252)	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(252)	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(252)	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(252)	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(252)	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(252)	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(252)	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(252)	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(252)	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

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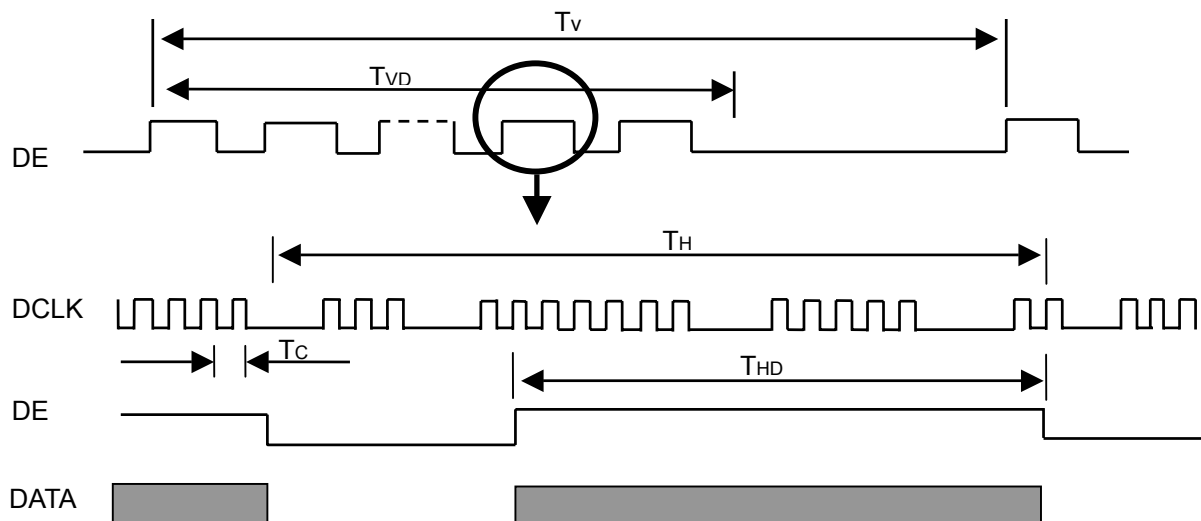
6. INTERFACE TIMING

6.1 INPUT SIGNAL TIMING SPECIFICATIONS

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

Signal	Item	Symbol	Min.	Typ.	Max.	Unit	Note
DCLK	Pixel Clock	$1/T_C$	-	65	80	MHz	-
DE	Vertical Total Time	T_V	769	806	1200	T_H	-
	Vertical Address Time	T_{VD}	768	768	768	T_H	-
	Horizontal Total Time	T_H	1120	1344	1600	T_C	-
	Horizontal Address Time	T_{HD}	1024	1024	1024	T_C	-

Note (1) Because this module is operated by DE only mode, Hsync and Vsync input signals should be set

to low logic level or ground. Otherwise, this module would operate abnormally.

INPUT SIGNAL TIMING DIAGRAM

TIMING DIAGRAM of LVDS

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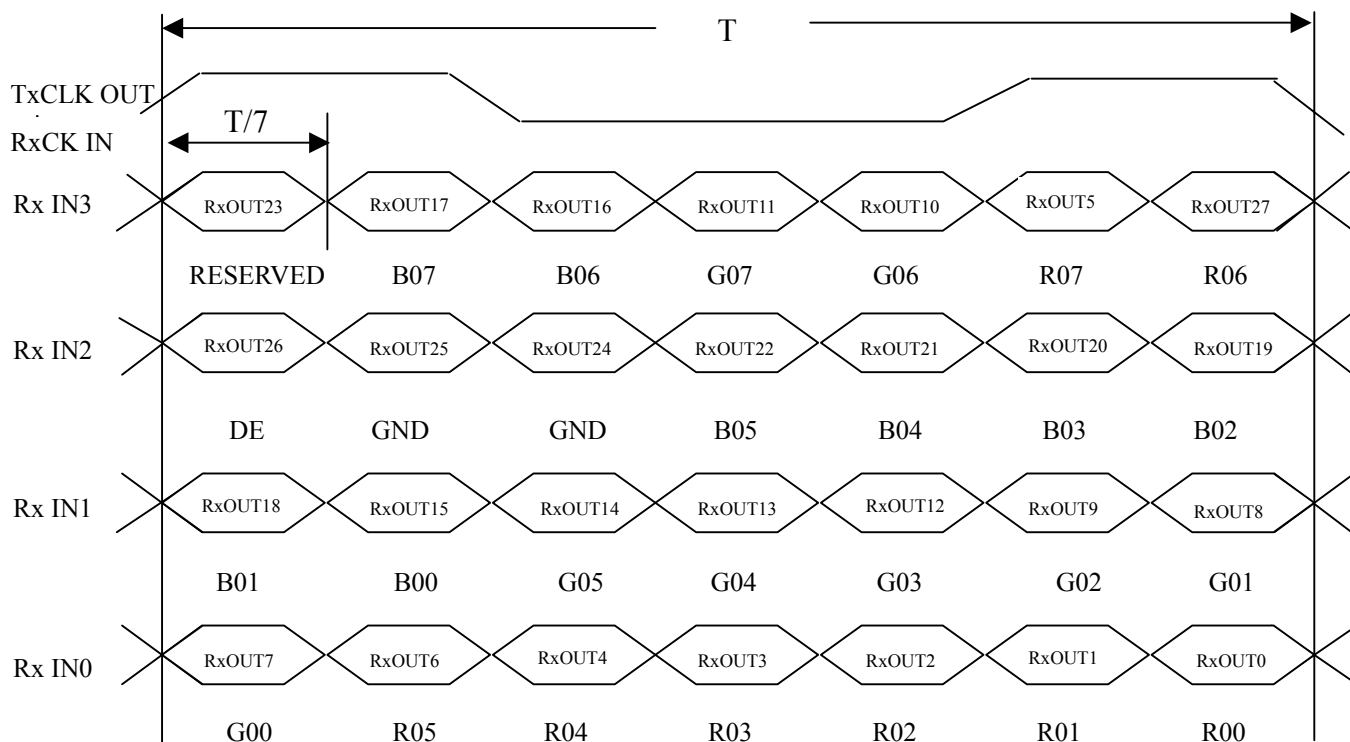
6.2 POWER ON/OFF SEQUENCE
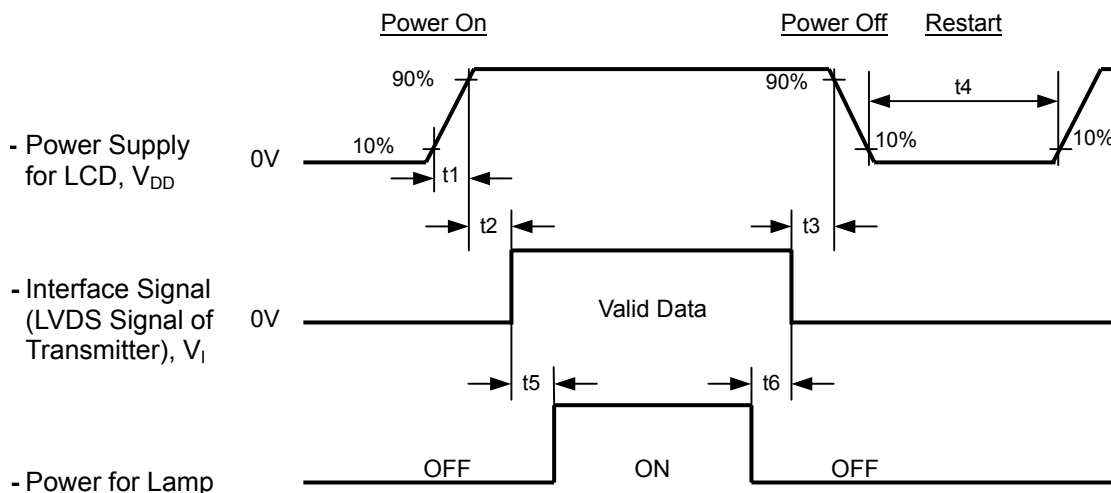
Timing Specifications:

$0 < t1 \leqq 10$ msec

$0 < t2 \leqq 50$ msec

$0 < t3 \leqq 50$ msec

$t4 \geqq 1$ sec

$t5 \geqq 100$ msec

$t6 \geqq 100$ msec

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 V_{DD} to 0 V.

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

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7. OPTICAL CHARACTERISTICS

7.1 TEST CONDITIONS

Item	Symbol	Value	Unit
Ambient Temperature	Ta	25±2	^{o}C
Ambient Humidity	Ha	50±10	%RH
Supply Voltage	V_{DD}	3.3	V
Input Signal	According to typical value in "3. ELECTRICAL CHARACTERISTICS"		
Inverter Current	I_L	8.0	mA

The measurement methods of optical characteristics are shown in Section 7.2. The following items should be measured under the test conditions described in Section 7.1 and stable environment shown in Note (4).

7.2 OPTICAL SPECIFICATIONS

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Contrast Ratio		CR		200	350	-	-	(2), (4)
Response Time		T_R		-	6	10	ms	(3)
		T_F		-	17	25	ms	
Luminance of White (Center point)		L		300	350	-	cd/m^2	(4),(5)
White Variation		δW		-	1.25	1.40	-	(4),(5)
Color Chromaticity	Red	Rx	θ_x=0°, θ_Y=0° Viewing Normal Angle	0.603	0.633	0.663	-	(1), (4)
		Ry		0.327	0.357	0.387	-	
	Green	Gx		0.270	0.300	0.330	-	
		Gy		0.556	0.586	0.616	-	
	Blue	Bx		0.112	0.142	0.172	-	
		By		0.064	0.094	0.124	-	
	White	Wx		0.283	0.313	0.343	-	
		Wy		0.299	0.329	0.359	-	
Viewing Angle	Horizontal	θ_x+	CR≥10	50	60	-	Deg.	
		θ_x-		50	60	-		
	Vertical	θ_Y+		30	40	-		
		θ_Y-		50	60	-		

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Note (1) Definition of Viewing Angle (θx, θy):
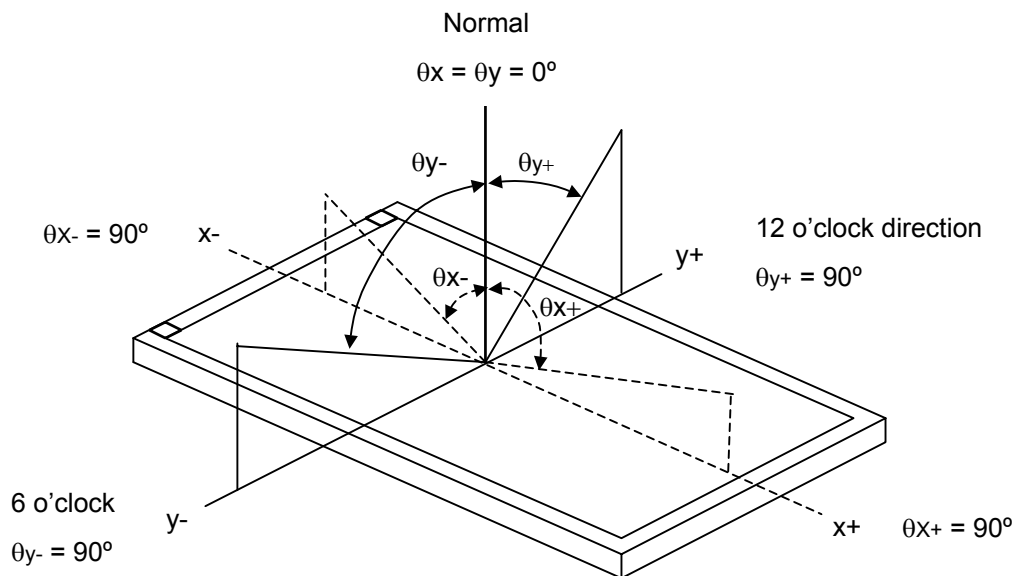
Note (2) Definition of Contrast Ratio (CR):

The contrast ratio can be calculated by the following expression.
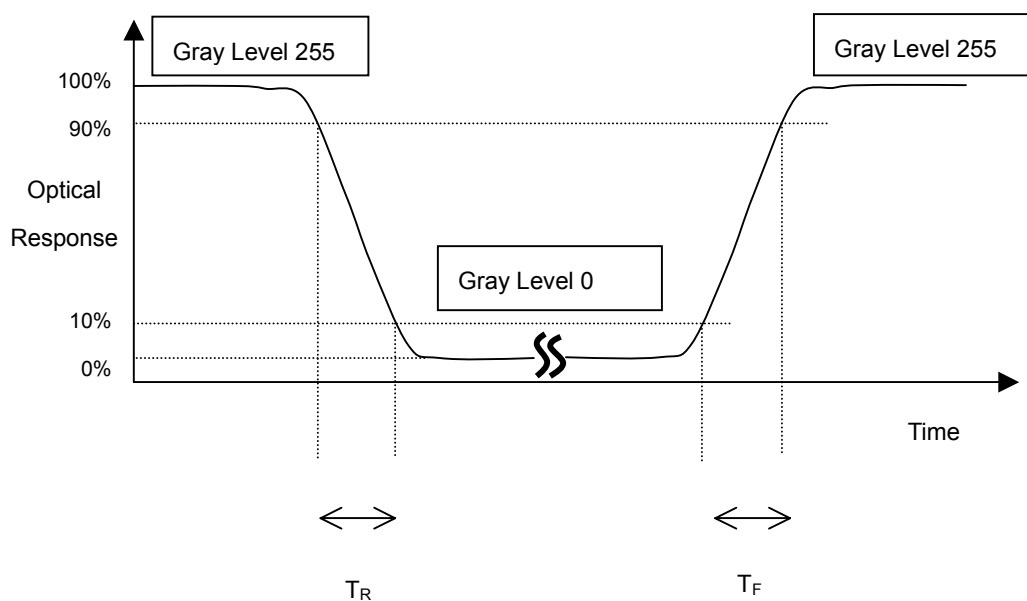
Contrast Ratio (CR) = L255 / L0

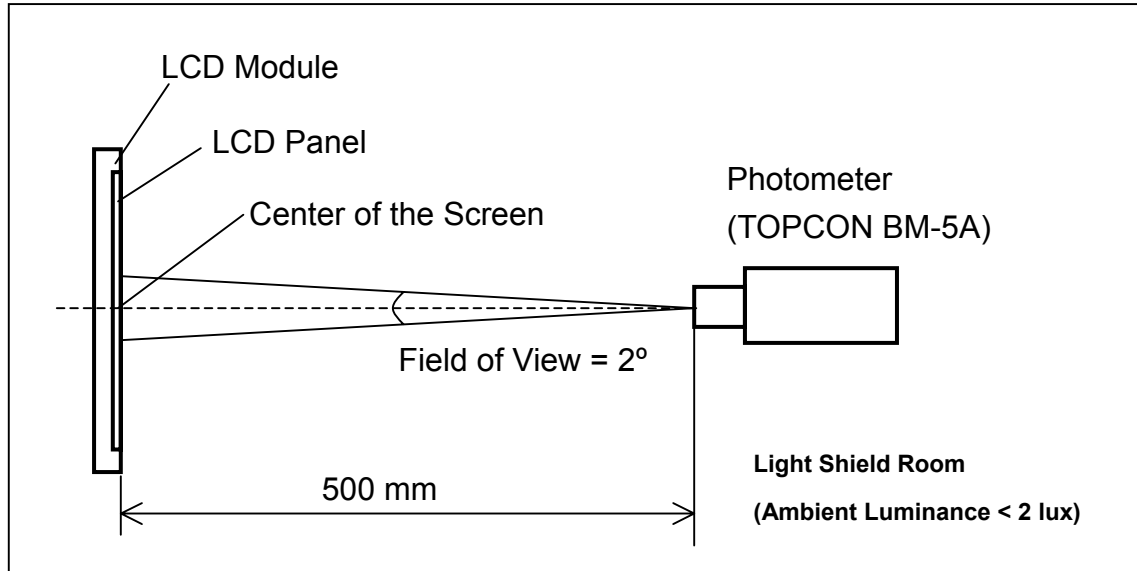L255: Luminance of gray level 255

L 0: Luminance of gray level 0

CR = CR (1)

CR (X) is corresponding to the Contrast Ratio of the point X at Figure in Note (5).

Note (3) Definition of Response Time (T_R, T_F):

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Note (4)   Measurement Setup:

The LCD module should be stabilized at given temperature 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
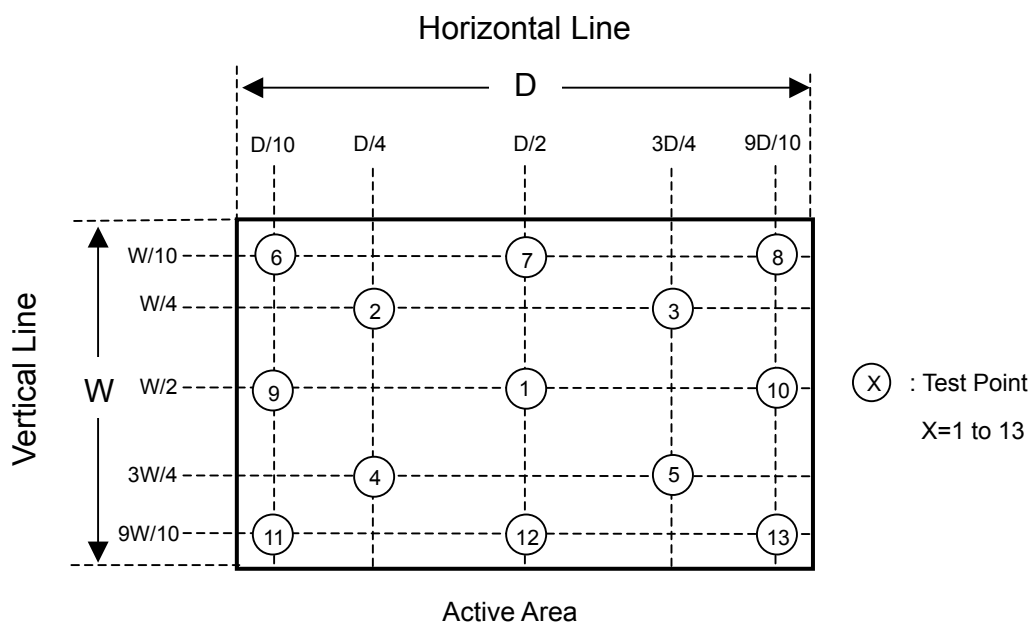

Note (5)   Definition of luminance measured points:

Measure the luminance of gray level 255 at point L(1)

Definition of White Variation (δW):

Measure the luminance of gray level 255 at 9 points

$$\delta W = \frac{\text{Maximum } [L\,(1), L\,(6), L\,(7), L\,(8), L\,(9), L\,(10), L\,(11), L\,(12), L\,(13)]}{\text{Minimum } [L\,(1), L\,(6), L\,(7), L\,(8), L\,(9), L\,(10), L\,(11), L\,(12), L\,(13)]}$$

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8. PRECAUTIONS

8.1 HANDLING PRECAUTIONS

(1) The module should be assembled into the system firmly by using every mounting hole. Be careful not to twist or bend the module.

(2) While assembling or installing modules, it can only be in the clean area. The dust and oil may cause electrical short or damage the polarizer.

(3) Use fingerstalls or soft gloves in order to keep display clean during the incoming inspection and assembly process.

(4) Do not press or scratch the surface harder than a HB pencil lead on the panel because the polarizer is very soft and easily scratched.

(5) If the surface of the polarizer is dirty, please clean it by some absorbent cotton or soft cloth. Do not use Ketone type materials (ex. Acetone), Ethyl alcohol, Toluene, Ethyl acid or Methyl chloride. It might permanently damage the polarizer due to chemical reaction.

(6) Wipe off water droplets or oil immediately. Staining and discoloration may occur if they left on panel for a long time.

(7) If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth. In case of contacting with hands, legs or clothes, it must be washed away thoroughly with soap.

(8) Protect the module from static electricity, it may cause damage to the C-MOS Gate Array IC.

(9) Do not disassemble the module.

(10) Do not pull or fold the lamp wire.

(11) Pins of I/F connector should not be touched directly with bare hands.

8.2 STORAGE PRECAUTIONS

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

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

(3) It may reduce the display quality if the ambient temperature is lower than 10 ºC. For example, the response time will become slowly, and the starting voltage of lamp will be higher than the room temperature.

8.3 OPERATION PRECAUTIONS

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

(2) Always follow the correct power on/off sequence when LCD module is connecting and operating. This can prevent the CMOS LSI chips from damage during latch-up.

(3) The startup voltage of Backlight is approximately 1000 Volts. It may cause electrical shock while assembling with inverter. Do not disassemble the module or insert anything into the Backlight unit.

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9. PACKAGING

9.1 PACKING SPECIFICATIONS

(1) 10 LCD modules / 1 Box

(2) Box dimensions : 511(L) X 420(W) X 360(H) mm

(3) Weight : approximately　11Kg (10 modules per box)

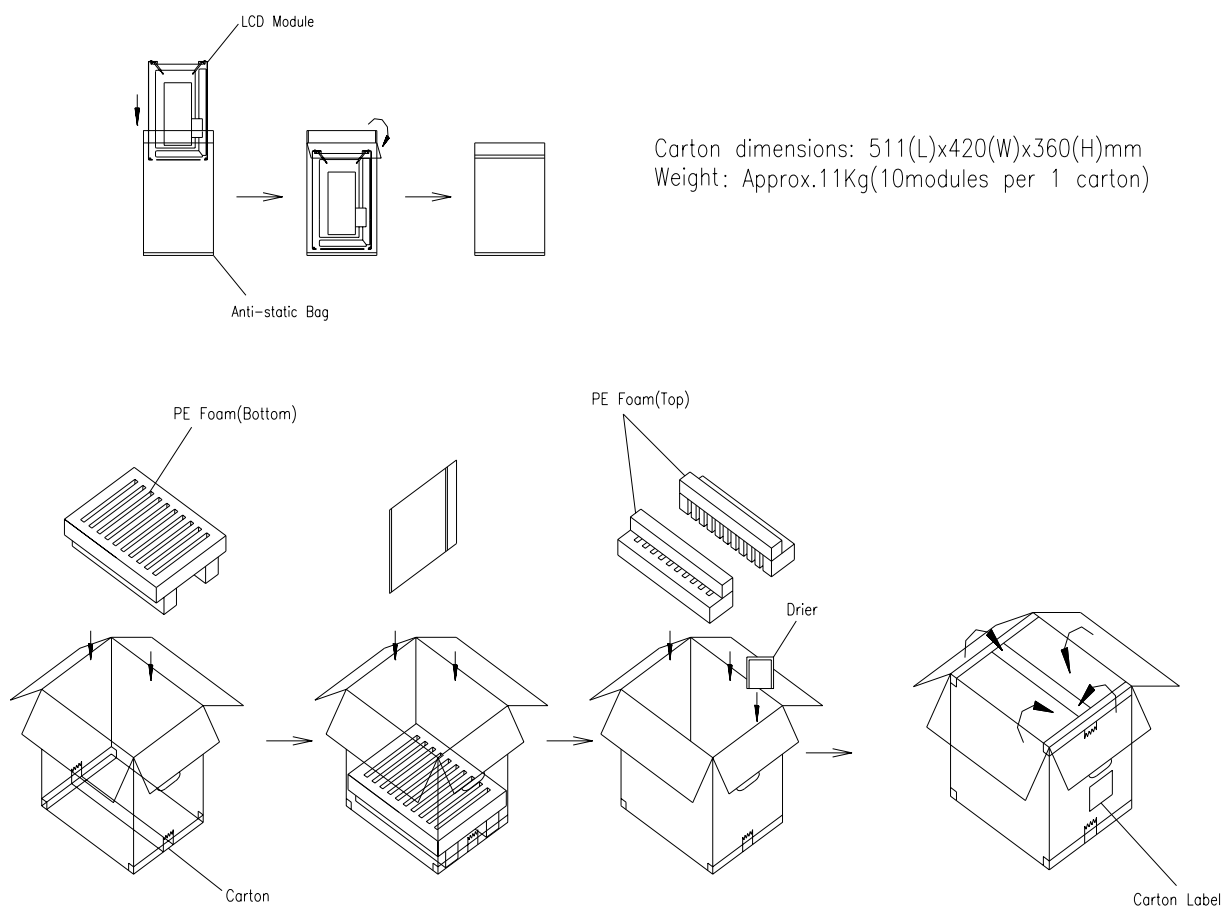### 9.2 PACKING Method

Figures 9-1and 9-2 are the packing method.

Carton dimensions: 511(L)x420(W)x360(H)mm
Weight: Approx.11Kg(10modules per 1 carton)

Figure. 9-1　Packing method

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Corner Protector:L1380mm*50mm*50mm

Pallet:L1050*W870*H135mm

Bottom Cap:L1050*W870*H120mm

Pallet Stock Dim:L1050*W870*H1530mm
weight: Approx.185kg

PE Sheet

Corner Protector

Film

PP Belt

Bottom Cap
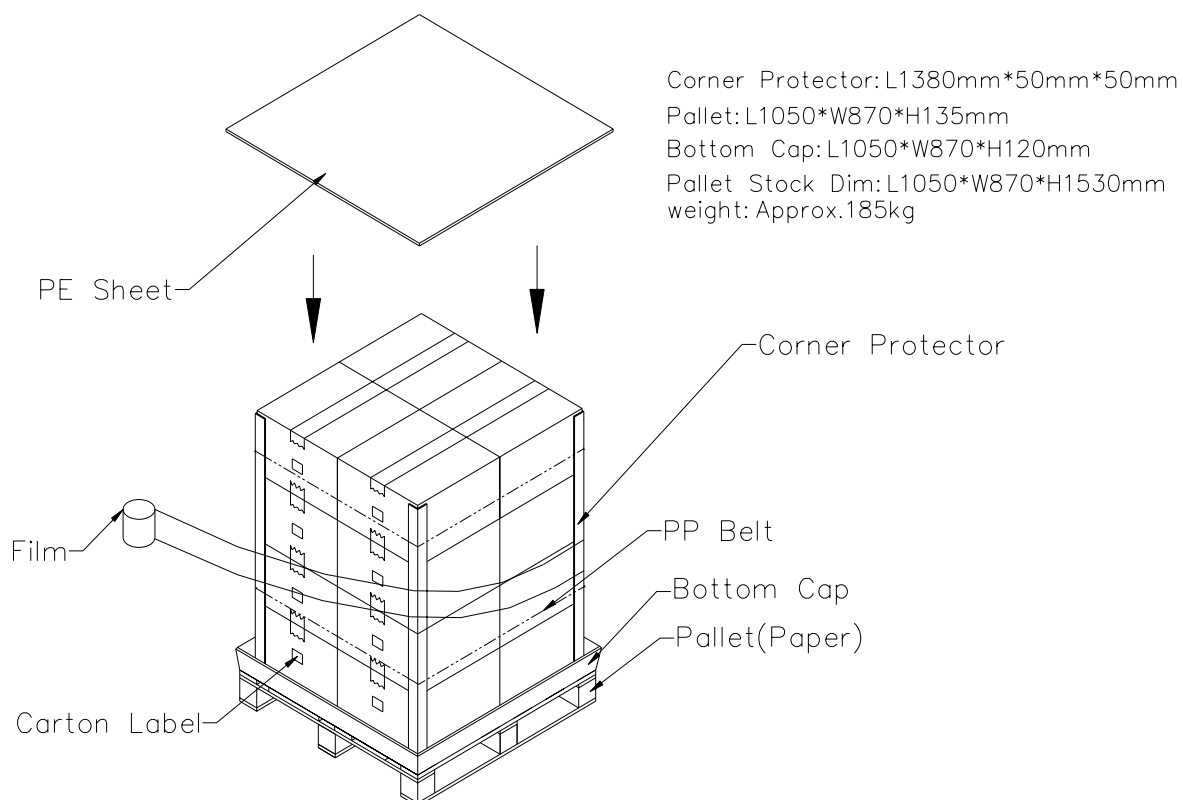
Pallet(Paper)

Carton Label

Figure. 9-2　Packing method

Approval

10. INCOMING INSPECTION DAY

The Supplier should be acquainted the inspection results (acceptance or rejection) by Customer, and the results are in accordance with the incoming inspection standard within 30 days after the date of the bills of lading.

Should Customer fail to so notify the Supplier within the said 30 days period. The Customer's right to reject the LCMS shall then lapse, and the said LCMS shall be deemed to have been accepted by the customer.

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Version 1.0

11. DEFINITION OF LABELS
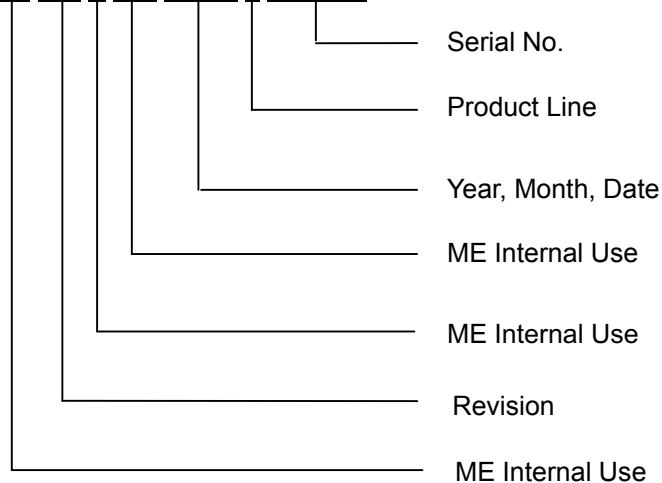
11.1 CMO MODULE LABEL

The barcode nameplate is pasted on each module as illustration, and its definitions are as following explanation.
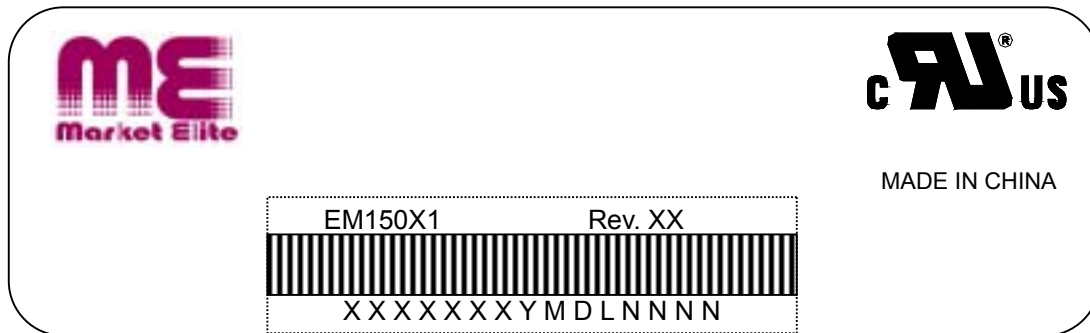
(a) Model Name: EM150X1

(b) Revision: Rev. XX, for example: C1, C2 …etc.

(c) Serial ID: X X X X X X X Y M D L N N N N

- Serial No.
- Product Line
- Year, Month, Date
- ME Internal Use
- ME Internal Use
- Revision
- ME Internal Use

Serial ID includes the information as below:

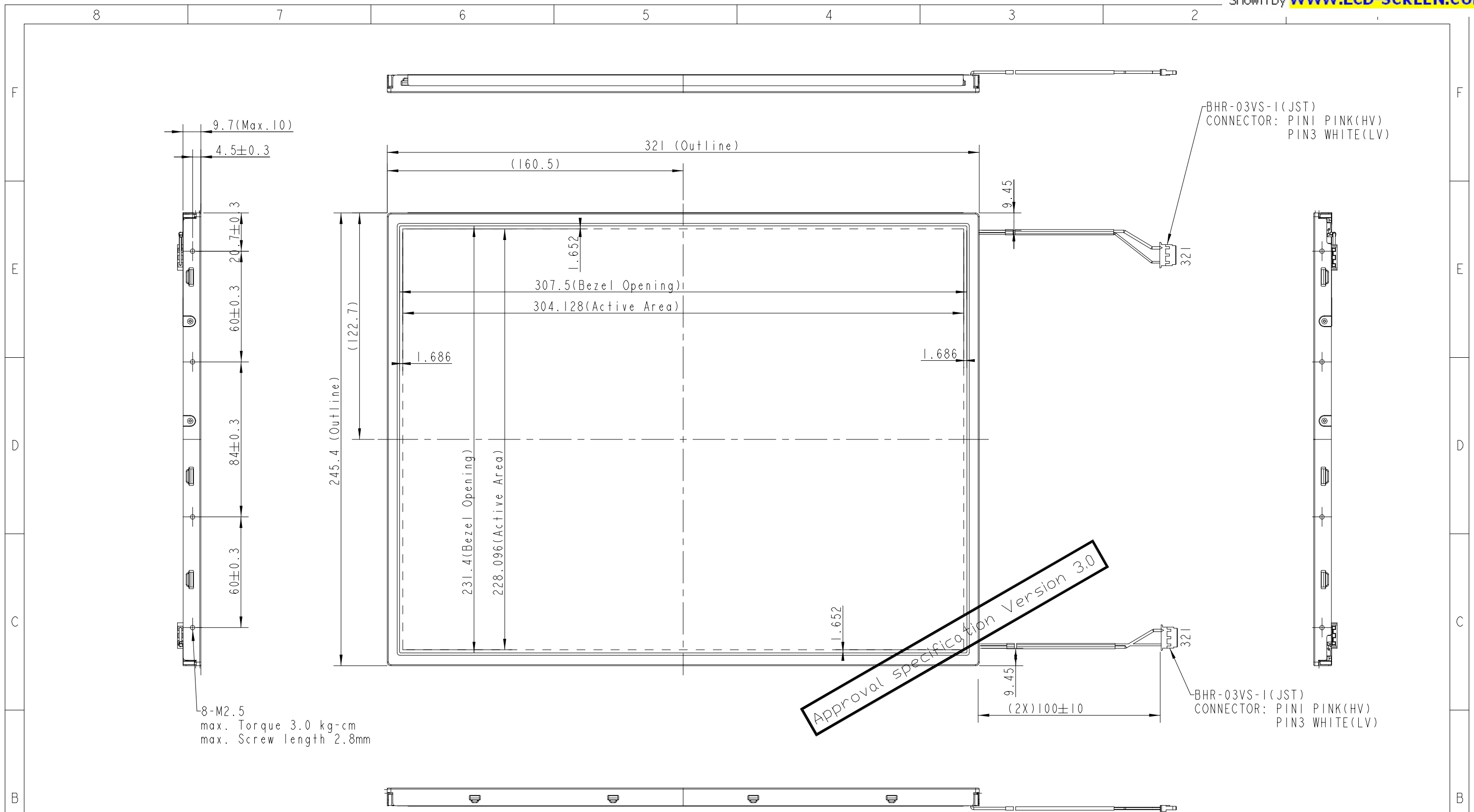(a) Manufactured Date: Year: 1~9, for 2000~2009

Month: 1~9, A~C, for Jan. ~ Dec.

Day: 1~9, A~Y, for 1st to 31st, exclude I and O
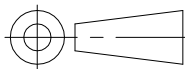
(b) Revision Code: cover all the change

(c) Serial No.: Manufacturing sequence of product

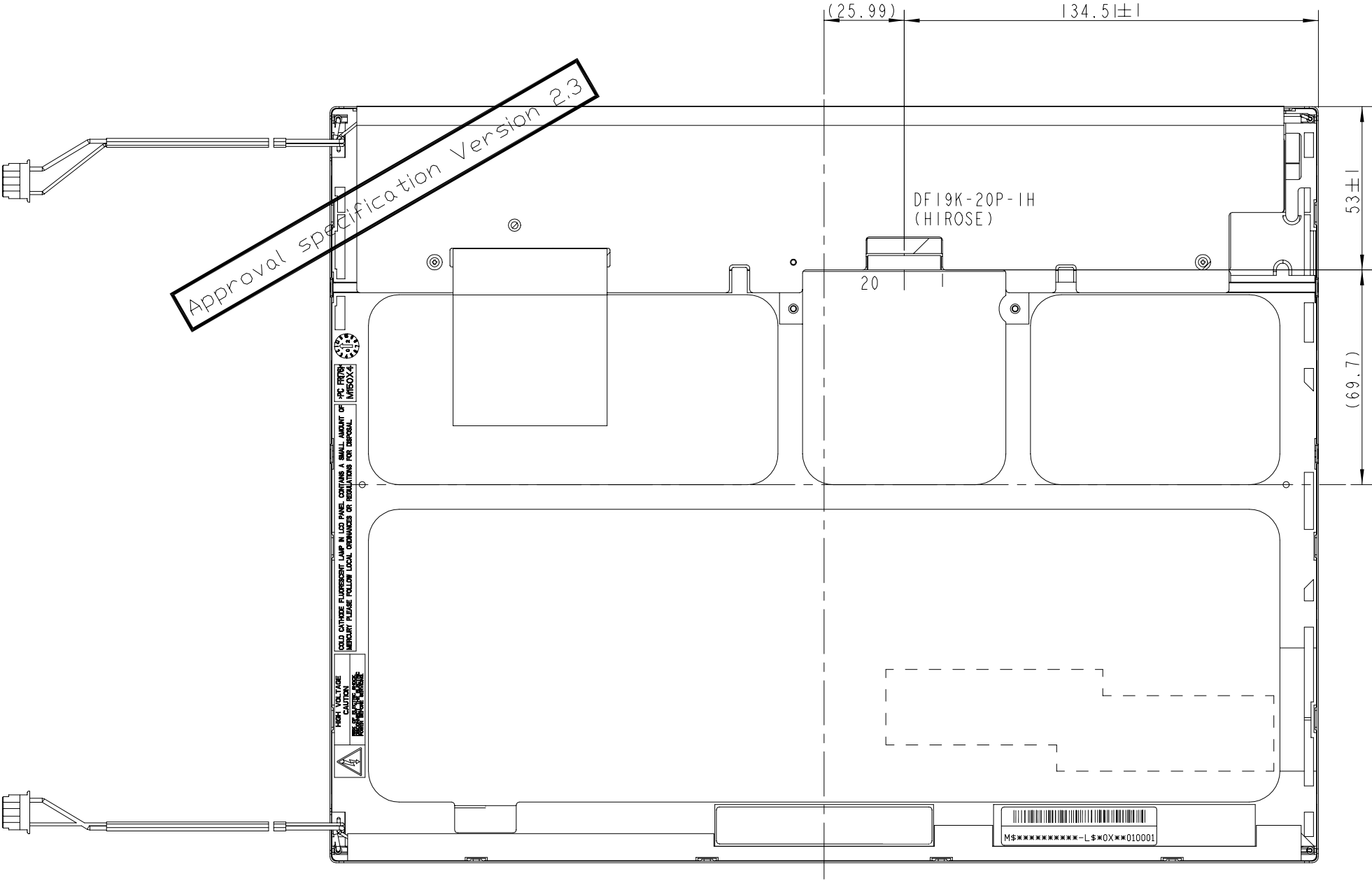(d) Product Line: 1 -> Line1, 2 -> Line 2, ¡Ketc.

9.7(Max.10)

4.5±0.3

20.7±0.3

60±0.3

84±0.3

60±0.3

8-M2.5
max. Torque 3.0 kg-cm
max. Screw length 2.8mm

321 (Outline)

(160.5)

1.652

307.5(Bezel Opening)

304.128(Active Area)

1.686

1.686

(122.7)

245.4 (Outline)

231.4(Bezel Opening)

228.096(Active Area)

1.652

9.45

(2X)100±10

BHR-03VS-I(JST)
CONNECTOR: PIN1 PINK(HV)
PIN3 WHITE(LV)

9.45

321

BHR-03VS-I(JST)
CONNECTOR: PIN1 PINK(HV)
PIN3 WHITE(LV)

321

Approval specification Version 3.0

NOTES:
1.GENERALTOLERENCE:±0.5

APPROVED:	DWG NO.:	
CHECKED:	DATE:	
DESIGNER:	PART NO.:	
DRAWER:	REV.: A	
TITLE:		UNIT: MM
		SCALE: 0.5/1
		SHEET: 1/2
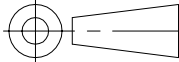
MARK	DESCRIPTION	DATE	CHANGE BY	APPROVAL BY	ECN NO.
B	Change label position for Fujitsu's request				

Approval specification Version 2.3

(25.99)

134.5±1

DF19K-20P-1H
(HIROSE)

20

53±1

(69.7)

COLD CATHODE FLUORESCENT LAMP IN LCD PANEL CONTAINS A SMALL AMOUNT OF MERCURY. PLEASE FOLLOW LOCAL, ORDINANCES OR REGULATIONS FOR DISPOSAL.

HIGH VOLTAGE CAUTION

M$*********-L$*0X***010001

NOTES:
  1.GENERALTOLERENCE:±0.5

APPROVED:	DWG NO.:	
CHECKED:	DATE:	
DESIGNER:	PART NO.:	
DRAWER:	REV.: A	UNIT:	SCALE:	SHEET:
TITLE:		MM	0.6/1	2/2

| MARK | DESCRIPTION | DATE | CHANGE BY | APPROVAL BY | ECN NO. |