CHI MEI
OPTOELECTRONICS CORP.

TFT LCD Preliminary Specification

MODEL NO.: N089A1 - L01

Customer : _____

Approved by : _____

Note :

FOR BEYONDINFINITE.COM INTERNAL PURPOSE ONLY

2008-02-01 10:59:28 CST	PMMD Director	cs_lee(/56510/44926)	Director	Accept

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REVISION HISTORY

Version	Date	Page (New)	Section	Description
Ver. 0.0	Jul. 27, '07	All	All	Tentative Specification was first issued
Ver. 1.0	Jan. 22, '08	P.9	3.2	BACKLIGHT UNIT
		P.20	7.2	OPTICAL SPECIFICATIONS
		P.24	9	PACKING

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1. GENERAL DESCRIPTION

1.1 OVERVIEW

N089A1 - L01 is a 8.9" TFT Liquid Crystal Display module with single CCFL Backlight unit and 40 pins LVDS interface. This module supports 1280 x 768 Wide-XGA+ mode and can display 262,144 colors. The optimum viewing angle is at 6 o'clock direction. The inverter module for Backlight is not built in.

1.2 FEATURES

- Thin and High Brightness

- WXGA (1280 x 768 pixels) resolution

- DE only mode

- 3.3V LVDS (Low Voltage Differential Signaling) interface with 1 pixel/clock

- 1 CCFL

1.3 APPLICATION

- TFT LCD Notebook

1.4 GENERAL SPECIFICATI0NS

Item	Specification	Unit	Note
Active Area	193.92(H) x 116.352(V)	mm	(1)
Bezel Opening Area	196.92(H) x 119.352(V)	mm	
Driver Element	a-si TFT active matrix	-	-
Pixel Number	1280 x R.G.B. x 768	pixel	-
Pixel Pitch	0.1515(H) X 0.1515(V)	mm	-
Pixel Arrangement	RGB vertical stripe	-	-
Display Colors	262,144	color	-
Transmissive Mode	Normally white	-	-
Surface Treatment	Hard coating (3H), Anti-Glare Type	-	-

1.5 MECHANICAL SPECIFICATIONS

Item		Min.	Typ.	Max.	Unit	Note
Module Size	Horizontal (H)	205.6	206	206.4	mm	(1)
	Vertical (V)	132.6	133	133.4	mm	
	Depth (D)	---	5.4	5.7	mm	
Weight		---	170	185	g	-

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

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)
Shock (Non-Operating)	S_{NOP}	-	220/2	G/ms	(3), (5)
Vibration (Non-Operating)	V_{NOP}	-	1.5	G	(4), (5)

Note (1) (a) 90 %RH Max. (Ta   40 ºC).

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

(c) No condensation.

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

Relative Humidity (%RH)

Temperature (ºC)
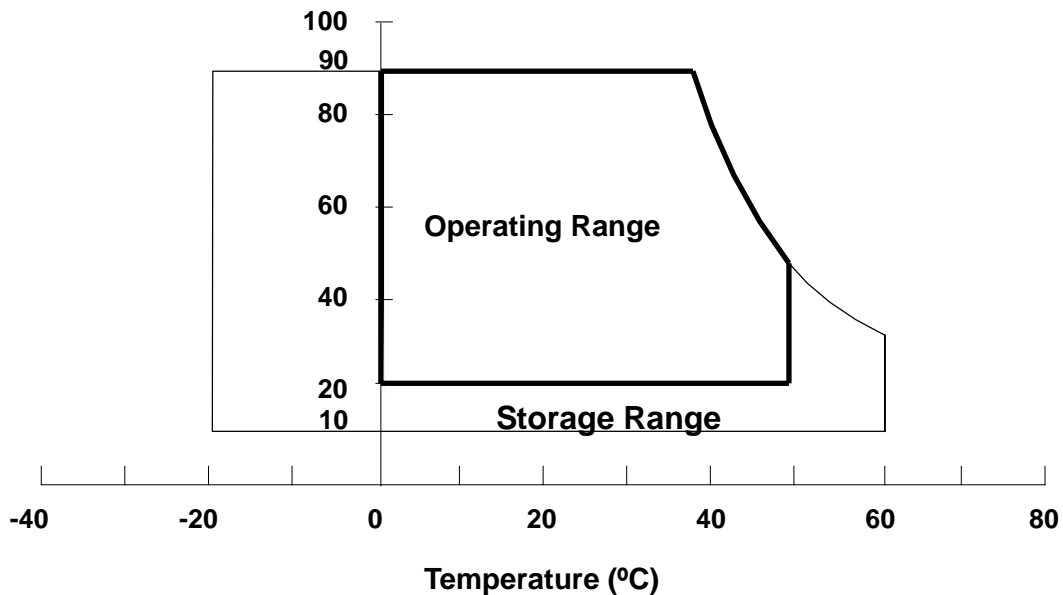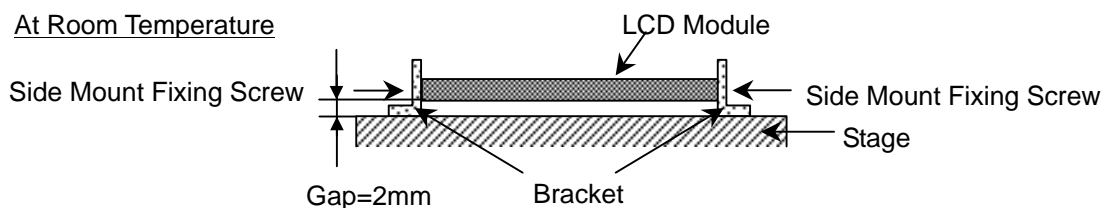
Note (3) 1 time for ± X, ± Y, ± Z. for Condition (220G / 2ms) is half Sine Wave,.

Note (4) 10 ~ 500 Hz, 30 min/cycle,1cycles for each X, Y, Z axis.

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.

The fixing condition is shown as below:

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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_{CC}	-0.3	+4.0	V	(1)
Logic Input Voltage	V_{IN}	-0.3	V_{CC}+0.3	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 = 6.0 mA
Lamp Current	I_L	3.0	7.0	mA_{RMS}	(1), (2)
Lamp Frequency	F_L	40	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 3.2 for further information).

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3. ELECTRICAL CHARACTERISTICS

3.1 TFT LCD MODULE

Ta = 25 ± 2 °C

| Parameter		Symbol	Value			Unit	Note
			Min.	Typ.	Max.		
Power Supply Voltage		Vcc	3.0	3.3	3.6	V	-
Ripple Voltage		V_{RP}	-	100	-	mV	-
Rush Current		I_{RUSH}	-	-	1.5	A	(2)
Power Supply Current	White	Lcc	-	(180)	(210)	mA	(3)a
	Black		-	(250)	(270)	mA	(3)b
LVDS Differential Input High Threshold		$V_{TH(LVDS)}$	-	-	+100	mV	(5), V_{CM}=1.2V
LVDS Differential Input Low Threshold		$V_{TL(LVDS)}$	-100	-	-	mV	(5), V_{CM}=1.2V
LVDS Common Mode Voltage		V_{CM}	1.125	-	1.375	V	(5)
LVDS Differential Input Voltage		$|V_{ID}|$	100	-	600	mV	(5)
Terminating Resistor		R_T	-	100	-	Ohm	
Power per EBL WG		P_{EBL}	-	(2.33)	-	W	(4)

Note (1) The ambient temperature is Ta = 25 ± 2 °C.

Note (2) I_{RUSH}: the maximum current when VCC is rising

I_{IS}: the maximum current of the first 100ms after power-on

Measurement Conditions: Shown as the following figure. Test pattern: black.
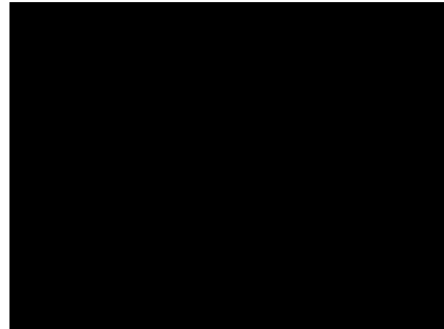

Vcc rising time is 470us

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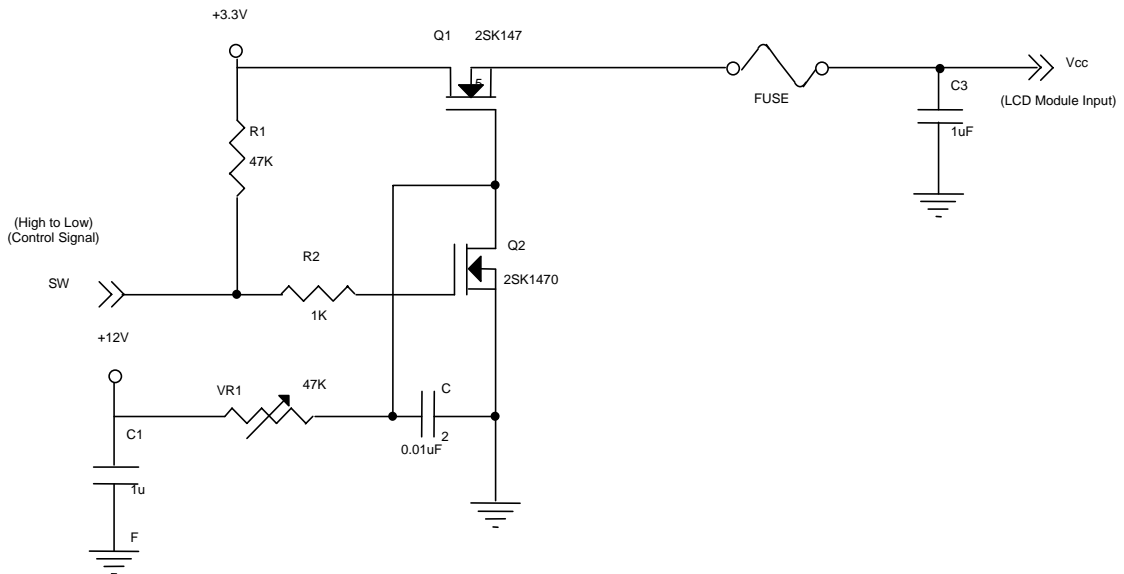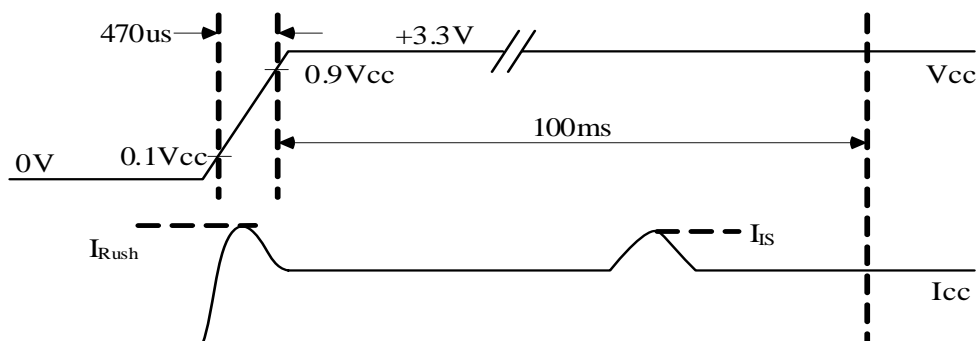
Note (3) The specified power supply current is under the conditions at Vcc = 3.3 V, Ta = 25 ± 2 ºC, f_v = 60 Hz, whereas a power dissipation check pattern below is displayed.

a. White Pattern

b. Black Pattern

Active Area

Active Area

Note (4) The specified power are the sum of LCD panel electronics input power and the inverter input power. Test conditions are as follows.

(a) Vcc = 3.3 V, Ta = 25 ± 2 ºC, f_v = 60 Hz,

(b) The pattern used is a black and white 32 x 36 checkerboard, slide #100 from the VESA file "Flat Panel Display Monitor Setup Patterns", FPDMSU.ppt.

(c) Luminance: 60 nits.

(d) The inverter used is provided from _____. Please contact them for detail information. CMO doesn't provide the inverter in this product.

Note (5) The parameters of LVDS signals are defined as the following figures.

Single Ended

VCM

$|V_{ID}|$

0V

Differential

$V_{TH(LVDS)}$

$|V_{ID}|$

0V

$V_{TL(LVDS)}$

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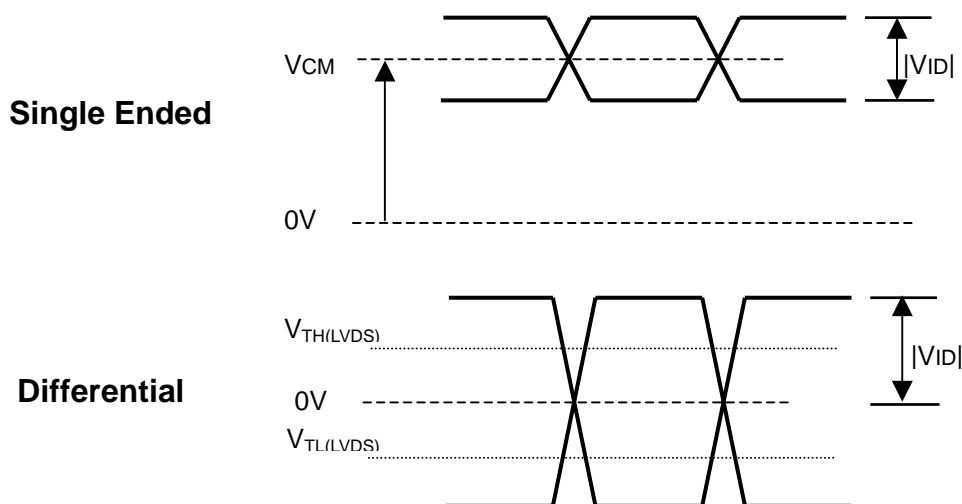
3.2 BACKLIGHT UNIT

Ta = 25 ± 2 ºC

| Parameter	Symbol	Value			Unit	Note
		Min.	Typ.	Max.		
Lamp Input Voltage	V_L	432	480	528	V_{RMS}	I_L = 6.0 mA
Lamp Current	I_L	3.0	6.0	7.0	mA_{RMS}	(1)
Lamp Turn On Voltage	V_S	-	-	900 (25 ^{o}C)	V_{RMS}	(2)
		-	-	1150 (0 ^{o}C)	V_{RMS}	(2)
Operating Frequency	F_L	40	-	80	KHz	(3)
Lamp Life Time	L_{BL}	12,000	-	-	Hrs	(5)
Power Consumption	P_L	2.6	2.88	3.16	W	(4), I_L = 6.0 mA

Note (1) Lamp current is measured by utilizing a high frequency current meter as shown below:
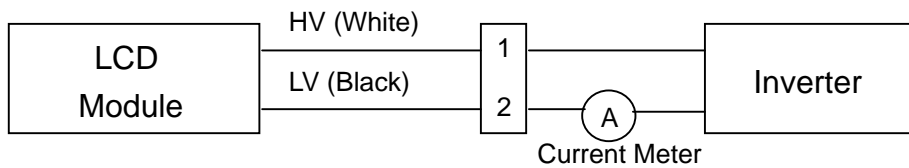
Note (2) The voltage that must be larger than Vs should be applied to the lamp for more than 1 second after startup. Otherwise the lamp may not be turned on.

Note (3) The lamp frequency may produce 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) $P_L = I_L \times V_L$

Note (5) The lifetime of lamp is defined as the time in which it continues to operate under the condition at Ta = 25 ±2 ^{o}C and I_L = 6.0 mArms 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.

(The effective ignition length is a scope that luminance is over 70% of that at 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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The output of the inverter must have symmetrical (negative and positive) voltage waveform and symmetrical current waveform.(Unsymmetrical ratio is less than 10%) Please do not use the inverter, which has unsymmetrical voltage and unsymmetrical current and spike wave. Lamp frequency may produce interface with horizontal synchronous frequency and as a result this may cause beat on the display. Therefore lamp frequency shall be as away possible from the horizontal synchronous frequency and from its harmonics in order to prevent interference.

Requirements for a system inverter design, which is intended to have a better display performance, a better power efficiency and a more reliable lamp. It shall help increase the lamp lifetime and reduce its leakage current.

a. The asymmetry rate of the inverter waveform should be 10% below;

b. The distortion rate of the waveform should be within   2 ± 10%;

c.   The ideal sine wave form shall be symmetric in positive and negative polarities.
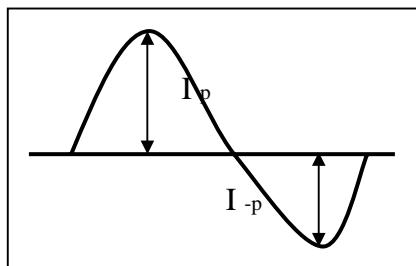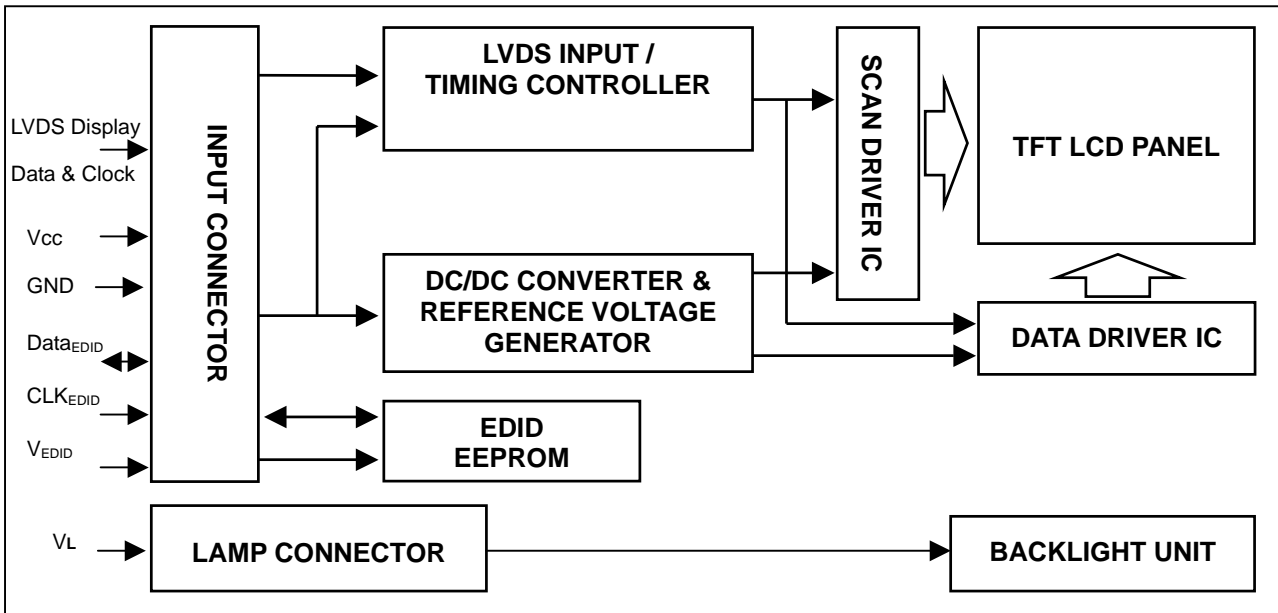

* Asymmetry rate:

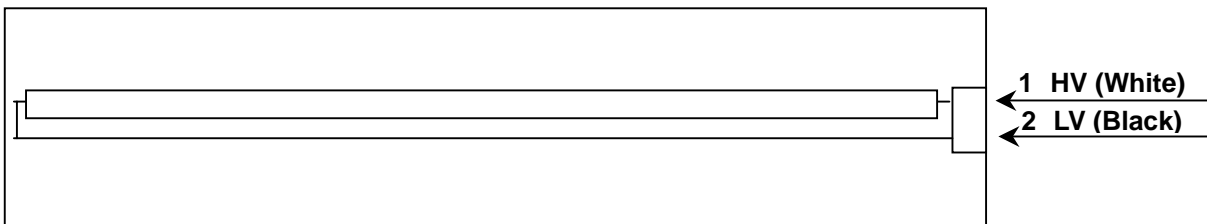$$| I_p - I_{-p} | / I_{rms} * 100\%$$

* Distortion rate

$$I_p \text{ (or } I_{-p}) / I_{rms}$$

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4. BLOCK DIAGRAM

4.1 TFT LCD MODULE

4.2 BACKLIGHT UNIT

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5. INPUT TERMINAL PIN ASSIGNMENT

5.1 TFT LCD MODULE

Pin	Symbol	Description	Polarity	Remark
1	BIST/CT1	Built In Self Test		Connector Test
2	VDD	Power Supply (+3.3V typ.)		
3	VDD	Power Supply (+3.3V typ.)		
4	V_{EDID}	DDC 3.3V power		
5	CLK_{EDID}	DDC clock / SMBus clock		
6	$DATA_{EDID}$	DDC data / SMBus data		
7	Rxin0-	LVDS Differential Data Input	Negative	R0~R5,G0
8	Rxin0+	LVDS Differential Data Input	Positive	
9	VSS	Ground		
10	Rxin1-	LVDS Differential Data Input	Negative	G1~G5,B0,B1
11	Rxin1+	LVDS Differential Data Input	Positive	
12	VSS	Ground		
13	Rxin2-	LVDS Differential Data Input	Negative	B2~B5,DE,Hsync,Vsync
14	Rxin2+	LVDS Differential Data Input	Positive	
15	VSS	Ground		
16	CLK-	LVDS Clock Data Input	Negative	LVDS Level Clock
17	CLK+	LVDS Clock Data Input	Positive	
18	VSS	Ground		
19	NC	No Connection		
20	NC	No Connection		
21	NC	No Connection		
22	NC	No Connection		
23	NC	No Connection		
24	NC	No Connection		
25	NC	No Connection		
26	NC	No Connection		
27	NC	No Connection		
28	NC	No Connection		
29	NC	No Connection		
30	VSS	Ground		
31	VSS	Ground		
32	VSS	Ground		
33	VSS	Ground		
34	NC	No Connection		
35	NC	No Connection		
36	NC	No Connection		
37	NC	No Connection		
38	NC	No Connection		
39	NC	No Connection		
40	BIST/CT2	Built In Self Test		Connector Test

Note (1) Connector Part No.: I-PEX 20347-340E-12 or equivalent

Note (2) User's connector Part No: I-PEX 20345-040T-31 or equivalent

Note (3) The first pixel is odd as shown in the following figure.

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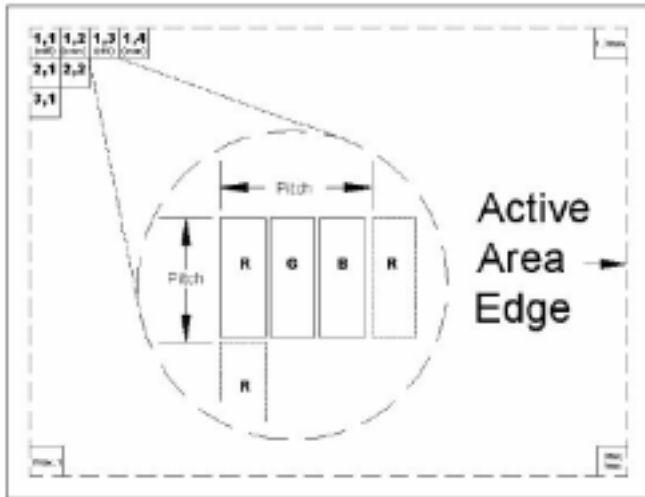
5.2 BACKLIGHT UNIT

Pin	Symbol	Description	Color
1	HV	High Voltage	White
2	LV	Ground	Black

Note (1) Connector Part No.: JST-BHSR-02VS-1 or equivalent

Note (2) User's connector Part No.: JST-SM02B-BHSS-1-TB or equivalent

5.3 TIMING DIAGRAM OF LVDS INPUT SIGNAL

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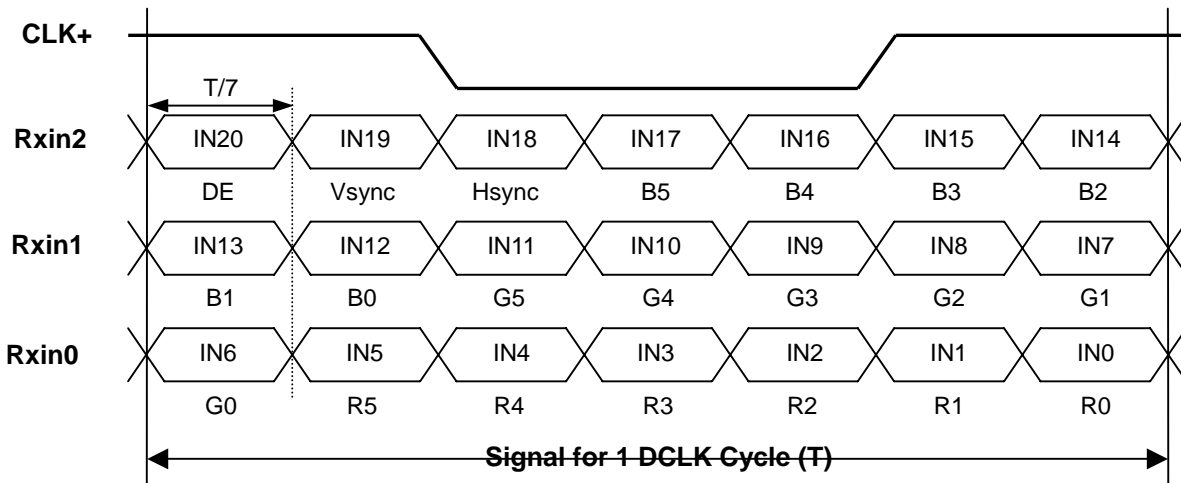
5.4 COLOR DATA INPUT ASSIGNMENT

The brightness of each primary color (red, green and blue) is based on the 6-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						
		R5	R4	R3	R2	R1	R0	G5	G4	G3	G2	G1	G0	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
	Red	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	Green	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
	Cyan	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1
	Magenta	1	1	1	1	1	1	0	0	0	0	0	0	1	1	1	1	1	1
	Yellow	1	1	1	1	1	1	1	1	1	1	1	1	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
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
	Red(1)	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
	Red(2)	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Red(61)	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0
	Red(62)	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(63)	1	1	1	1	1	1	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
	Green(1)	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
	Green(2)	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Green(61)	0	0	0	0	0	0	1	1	1	1	0	1	0	0	0	0	0	0
	Green(62)	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0	0
	Green(63)	0	0	0	0	0	0	1	1	1	1	1	1	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
	Blue(1)	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	1	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Blue(61)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	0	1
	Blue(62)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0
	Blue(63)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1

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

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Model No.: N089A1 - L01

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5.5 EDID DATA STRUCTURE

The EDID (Extended Display Identification Data) data formats are to support displays as defined in the

VESA Plug & Display and FPDI standards.

Byte # (decimal)	Byte # (hex)	Field Name and Comments	Value (hex)	Value (binary)
0	0	Header	00	00000000
1	1	Header	FF	11111111
2	2	Header	FF	11111111
3	3	Header	FF	11111111
4	4	Header	FF	11111111
5	5	Header	FF	11111111
6	6	Header	FF	11111111
7	7	Header	00	00000000
8	8	EISA ID manufacturer name ("CMO")	0D	00001101
9	9	EISA ID manufacturer name (Compressed ASCII)	AF	10101111
10	0A	ID product code	00	00000000
11	0B	ID product code	08	00001000
12	0C	ID S/N (fixed "0")	00	00000000
13	0D	ID S/N (fixed "0")	00	00000000
14	0E	ID S/N (fixed "0")	00	00000000
15	0F	ID S/N (fixed "0")	00	00000000
16	10	Week of manufacture (fixed week code)	32	00110010
17	11	Year of manufacture (fixed year code)	11	00010001
18	12	EDID structure version # ("1")	01	00000001
19	13	EDID revision # ("3")	03	00000011
20	14	Video I/P definition ("digital")	80	10000000
21	15	Max H image size ("19.392 cm")	13	00010011
22	16	Max V image size ("11.635 cm")	0B	00001011
23	17	Display Gamma (Gamma = "2.2")	78	01111000
24	18	Feature support ("Active off, RGB Color")	0A	00001010
25	19	Red/Green (Rx1, Rx0, Ry1, Ry0, Gx1, Gx0, Gy1, Gy0)	65	01100101
26	1A	Blue/White (Bx1, Bx0, By1, By0, Wx1, Wx0, Wy1, Wy0)	25	00100101
27	1B	Red-x (Rx = "0.622")	9F	10011111
28	1C	Red-y (Ry = "0.346")	58	01011000
29	1D	Green-x (Gx = "0.333")	55	01010101
30	1E	Green-y (Gy = "0.528")	87	10000111
31	1F	Blue-x (Bx = "0.164")	2A	00101010
32	20	Blue-y (By = "0.162")	29	00101001
33	21	White-x (Wx = "0.313")	50	01010000
34	22	White-y (Wy = "0.329")	54	01010100
35	23	Established timings 1	00	00000000
36	24	Established timings 2	00	00000000
37	25	Manufacturer's reserved timings	00	00000000
38	26	Standard timing ID # 1	01	00000001
39	27	Standard timing ID # 1	01	00000001
40	28	Standard timing ID # 2	01	00000001
41	29	Standard timing ID # 2	01	00000001

Byte # (decimal)	Byte # (hex)	Field Name and Comments	Value (hex)	Value (binary)
42	2A	Standard timing ID # 3	01	00000001
43	2B	Standard timing ID # 3	01	00000001
44	2C	Standard timing ID # 4	01	00000001
45	2D	Standard timing ID # 4	01	00000001
46	2E	Standard timing ID # 5	01	00000001
47	2F	Standard timing ID # 5	01	00000001
48	30	Standard timing ID # 6	01	00000001
49	31	Standard timing ID # 6	01	00000001
50	32	Standard timing ID # 7	01	00000001
51	33	Standard timing ID # 7	01	00000001
52	34	Standard timing ID # 8	01	00000001
53	35	Standard timing ID # 8	01	00000001
54	36	Detailed timing description # 1 Pixel clock ("68.25 MHz")	A9	10101001
55	37	# 1 Pixel clock (hex LSB first)	1A	00011010
56	38	# 1 H active ("1280")	00	00000000
57	39	# 1 H blank ("160")	A0	10100000
58	3A	# 1 H active : H blank ("1280 : 160")	50	01010000
59	3B	# 1 V active ("768")	00	00000000
60	3C	# 1 V blank ("22")	16	00010110
61	3D	# 1 V active : V blank ("768 : 22")	30	00110000
62	3E	# 1 H sync offset ("48")	30	00110000
63	3F	# 1 H sync pulse width ("32")	20	00100000
64	40	# 1 V sync offset : V sync pulse width ("3 : 7")	37	00110111
65	41	# 1 H sync offset : H sync pulse width : V sync offset : V sync width ("48 : 32 : 3 : 7")	00	00000000
66	42	# 1 H image size ("193.92 mm")	C1	11000001
67	43	# 1 V image size ("116.352 mm")	74	01110100
68	44	# 1 H image size : V image size ("193.92 : 116.352")	00	00000000
69	45	# 1 H boarder ("0")	00	00000000
70	46	# 1 V boarder ("0")	00	00000000
71	47	# 1 Non-interlaced, Normal, no stereo, Separate sync, H/V pol Negatives	18	00011000
72	48	Detailed timing description # 2	00	00000000
73	49	# 2 Flag	00	00000000
74	4A	# 2 Reserved	00	00000000
75	4B	# 2 FE (hex) defines ASCII string (Model Name "N089A1-L01", ASCII)	FE	11111110
76	4C	# 2 Flag	00	00000000
77	4D	# 2 1st character of name ("N")	4E	01001110
78	4E	# 2 2nd character of name ("0")	30	00110000
79	4F	# 2 3rd character of name ("8")	38	00111000
80	50	# 2 4th character of name ("9")	39	00111001
81	51	# 2 5th character of name ("A")	41	01000001
82	52	# 2 6th character of name ("1")	31	00110001
83	53	# 2 7th character of name ("-")	2D	00101101
84	54	# 2 8th character of name ("L")	4C	01001100
85	55	# 2 9th character of name ("0")	30	00110000

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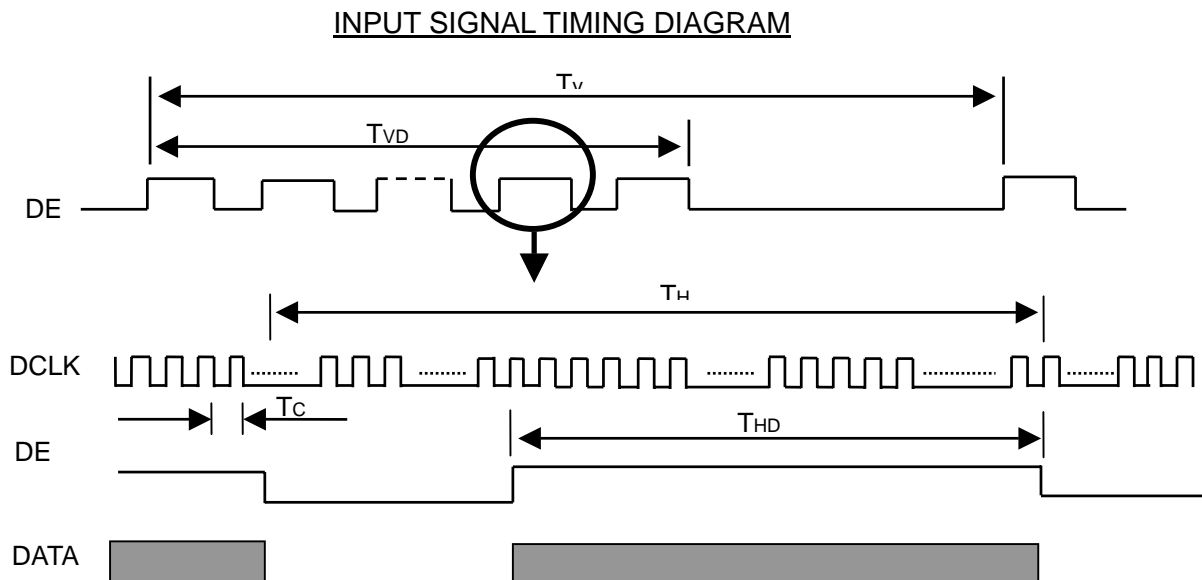| Byte # (decimal)	Byte # (hex)	Field Name and Comments	Value (hex)	Value (binary)
86	56	# 2 10th character of name ("1")	31	00110001
87	57	(If <13 char, then terminate with ASCII code 0Ah, set remaining char = 20h)	0A	00001010
88	58	(If <13 char, then terminate with ASCII code 0Ah, set remaining char = 20h)	20	00100000
89	59	(If <13 char, then terminate with ASCII code 0Ah, set remaining char = 20h)	20	00100000
90	5A	Detailed timing description # 3	00	00000000
91	5B	# 3 Flag	00	00000000
92	5C	# 3 Reserved	00	00000000
93	5D	# 3 FE (hex) defines ASCII string (Vendor "CMO", ASCII)	FE	11111110
94	5E	# 3 Flag	00	00000000
95	5F	# 3 1st character of string ("C")	43	01000011
96	60	# 3 2nd character of string ("M")	4D	01001101
97	61	# 3 3rd character of string ("O")	4F	01001111
98	62	(If <13 char, then terminate with ASCII code 0Ah, set remaining char = 20h)	0A	00001010
99	63	(If <13 char, then terminate with ASCII code 0Ah, set remaining char = 20h)	20	00100000
100	64	(If <13 char, then terminate with ASCII code 0Ah, set remaining char = 20h)	20	00100000
101	65	(If <13 char, then terminate with ASCII code 0Ah, set remaining char = 20h)	20	00100000
102	66	(If <13 char, then terminate with ASCII code 0Ah, set remaining char = 20h)	20	00100000
103	67	(If <13 char, then terminate with ASCII code 0Ah, set remaining char = 20h)	20	00100000
104	68	(If <13 char, then terminate with ASCII code 0Ah, set remaining char = 20h)	20	00100000
105	69	(If <13 char, then terminate with ASCII code 0Ah, set remaining char = 20h)	20	00100000
106	6A	(If <13 char, then terminate with ASCII code 0Ah, set remaining char = 20h)	20	00100000
107	6B	(If <13 char, then terminate with ASCII code 0Ah, set remaining char = 20h)	20	00100000
108	6C	Detailed timing description # 4	00	00000000
109	6D	# 4 Flag	00	00000000
110	6E	# 4 Reserved	00	00000000
111	6F	# 4 FE (hex) defines ASCII string (Model Name"N089A1-L01", ASCII)	FE	11111110
112	70	# 4 Flag	00	00000000
113	71	# 4 1st character of name ("N")	4E	01001110
114	72	# 4 2nd character of name ("0")	30	00110000
115	73	# 4 3rd character of name ("8")	38	00111000
116	74	# 4 4th character of name ("9")	39	00111001
117	75	# 4 5th character of name ("A")	41	01000001
118	76	# 4 6th character of name ("1")	31	00110001
119	77	# 4 7th character of name ("-")	2D	00101101
120	78	# 4 8th character of name ("L")	4C	01001100
121	79	# 4 9th character of name ("0")	30	00110000
122	7A	# 4 10th character of name ("1")	31	00110001
123	7B	(If <13 char, then terminate with ASCII code 0Ah, set remaining char = 20h)	0A	00001010
124	7C	(If <13 char, then terminate with ASCII code 0Ah, set remaining char = 20h)	20	00100000
125	7D	(If <13 char, then terminate with ASCII code 0Ah, set remaining char = 20h)	20	00100000
126	7E	Extension flag	00	00000000
127	7F	Checksum	9D	10011101

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6. INTERFACE TIMING

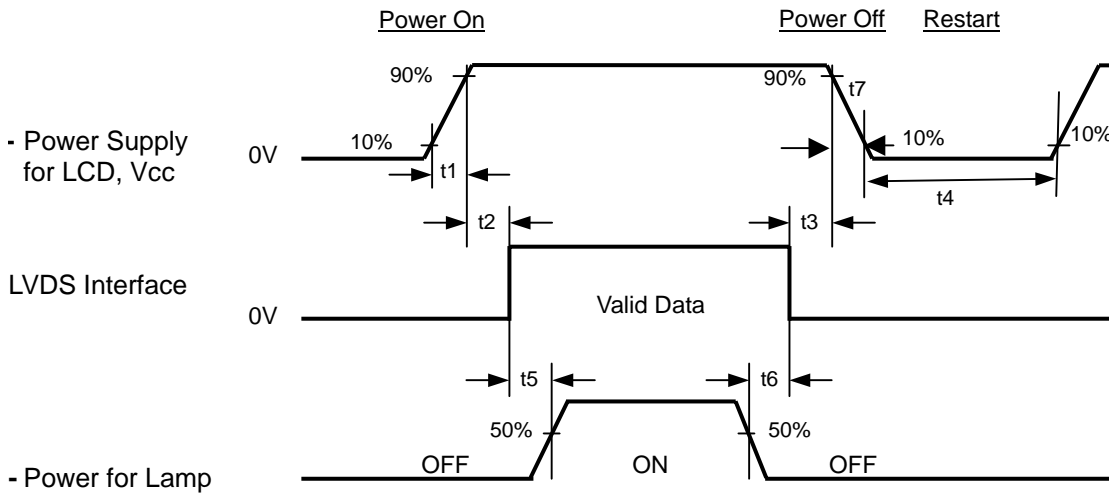### 6.1 INPUT SIGNAL TIMING SPECIFICATIONS

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

Signal	Item	Symbol	Min.	Typ.	Max.	Unit	Note
DCLK	Frequency	1/Tc	50	68.25	80	MHz	-
DE	Vertical Total Time	TV	771	790	960	TH	-
	Vertical Active Display Period	TVD	768	768	768	TH	-
	Vertical Active Blanking Period	TVB	TV-TVD	22	TV-TVD	TH	
	Horizontal Total Time	TH	810	1440	1900	Tc	-
	Horizontal Active Display Period	THD	1280	1280	1280	Tc	-
	Horizontal Active Blanking Period	THB	TH-THD	160	TH-THD	Tc	-

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

INPUT SIGNAL TIMING DIAGRAM

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6.2 POWER ON/OFF SEQUENCE

Power On   Power Off   Restart

Timing Specifications:

0.5 < t1	10 ms	
0 < t2	50 ms	
0 < t3	50 ms	
	t4	500 ms
	t5	200 ms
	t6	200 ms

Note (1) Please follow the power on/off sequence described above. Otherwise, the LCD module might be damaged.

Note (2) Please avoid floating state of interface signal at invalid period. When the interface signal is invalid, be sure to pull down the power supply of LCD Vcc 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.

Note (4) Sometimes some slight noise shows when LCD is turned off (even backlight is already off). To avoid this phenomenon, we suggest that the Vcc falling time is better to follow 5 t7 300 ms.

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7. OPTICAL CHARACTERISTICS

7.1 TEST CONDITIONS

Item	Symbol	Value	Unit
Ambient Temperature	Ta	25±2	°C
Ambient Humidity	Ha	50±10	%RH
Supply Voltage	V_{CC}	3.3	V
Input Signal	According to typical value in "3. ELECTRICAL CHARACTERISTICS"		
Inverter Current	I_L	6.0	mA
Inverter Driving Frequency	F_L	61	KHz
Inverter	Sumida-H05-4915		

7.2 OPTICAL SPECIFICATIONS

The relative measurement methods of optical characteristics are shown in 7.2. The following items should be measured under the test conditions described in 7.1 and stable environment shown in Note (5).

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Contrast Ratio		CR		200	300	-	-	(2), (5)
Response Time		T_R		-	5	10	ms	(3)
		T_F		-	11	16	ms	
Average Luminance of White		L_{5p}		170	200	-	cd/m²	(4), (5)
Luminance Non-Uniformity		δW_{5p}		-	-	1.4		(5), (6)
Color Chromaticity	Red	Rx	$\theta_x=0°, \theta_Y=0°$ Viewing Normal Angle	TYP -0.03	0.613	TYP +0.03	-	(1), (5)
		Ry			0.346		-	
	Green	Gx			0.327		-	
		Gy			0.549		-	
	Blue	Bx			0.159		-	
		By			0.138		-	
	White	Wx			0.313		-	
		Wy			0.329		-	
Viewing Angle	Horizontal	θ_x+	CR≥10	40	45	-	Deg.	
		θ_x-		40	45	-		
	Vertical	θ_Y+		15	20	-		
		θ_Y-		40	45	-		

Note (1) Definition of Viewing Angle ($\theta x, \theta y$):

Normal

$\theta x = \theta y = 0°$

$\theta y-$ $\theta y+$

$\theta X- = 90°$ x-

$\theta x-$ $\theta x+$

12 o'clock direction

$\theta y+ = 90°$

y+

6 o'clock

y-

$\theta y- = 90°$

x+ $\theta X+ = 90°$

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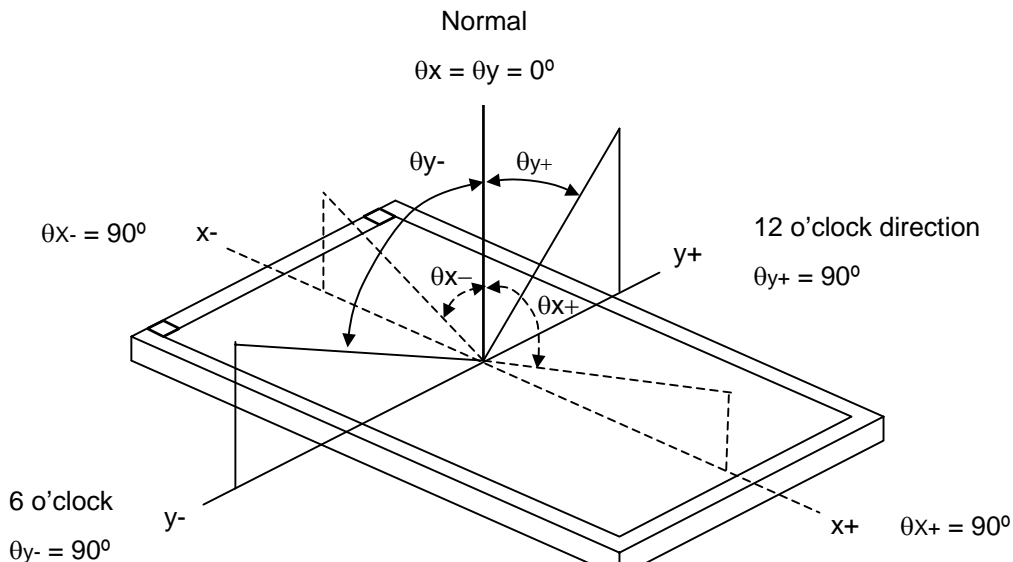
Note (2) Definition of Contrast Ratio (CR):

The contrast ratio can be calculated by the following expression.
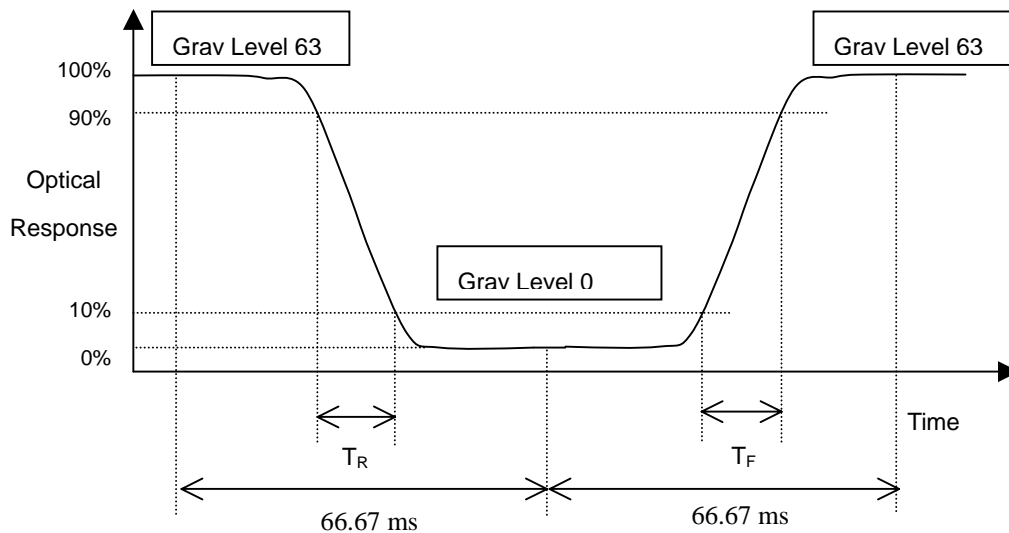
Contrast Ratio (CR) = L63 / L0

L63: Luminance of gray level 63

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 (6).

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

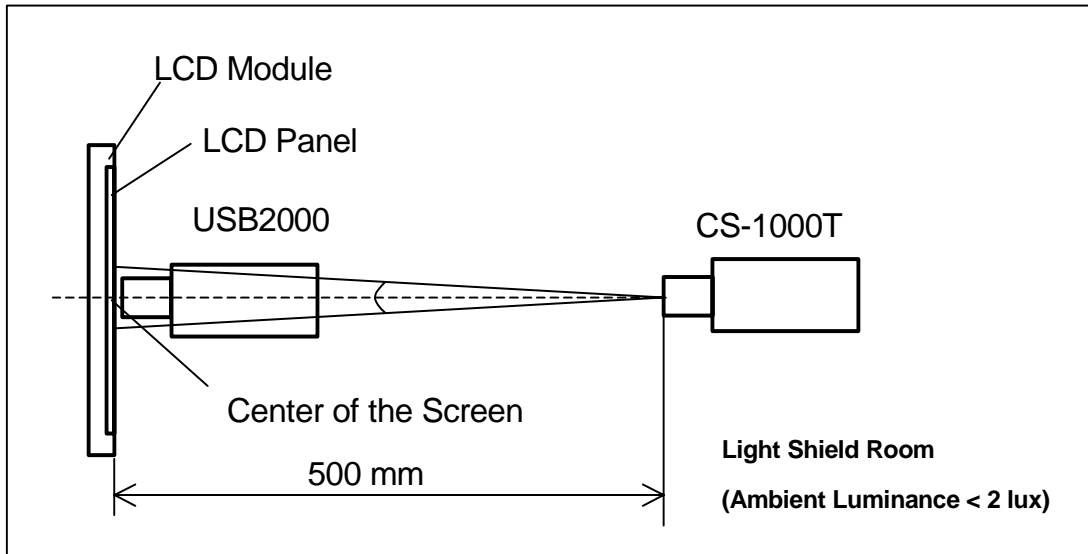Note (4) Definition of Average Luminance of White (L_{AVE}):

Measure the luminance of gray level 63 at 5 points

L_{AVE} = [L (1)+ L (2)+ L (3)+ L (4)+ L (5)] / 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 20 minutes to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting Backlight for 20 minutes in a windless room.

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LCD Module
LCD Panel
USB2000
CS-1000T
Center of the Screen
500 mm
Light Shield Room
(Ambient Luminance < 2 lux)

Note (6) Definition of White Variation (δW):

Measure the luminance of gray level 63 at 5 points

δW = { Maximum [L (1), L (2), L (3), L (4), L (5)] / Minimum [L (1), L (2), L (3), L (4), L (5)]

Horizontal Line

W

W/4   W/2   3W/4

Vertical Line

H

H/4
H/2
3H/4

2   3
1
4   5

$\bigcirc$ X : Test Point
X=1 to 5

Active Area
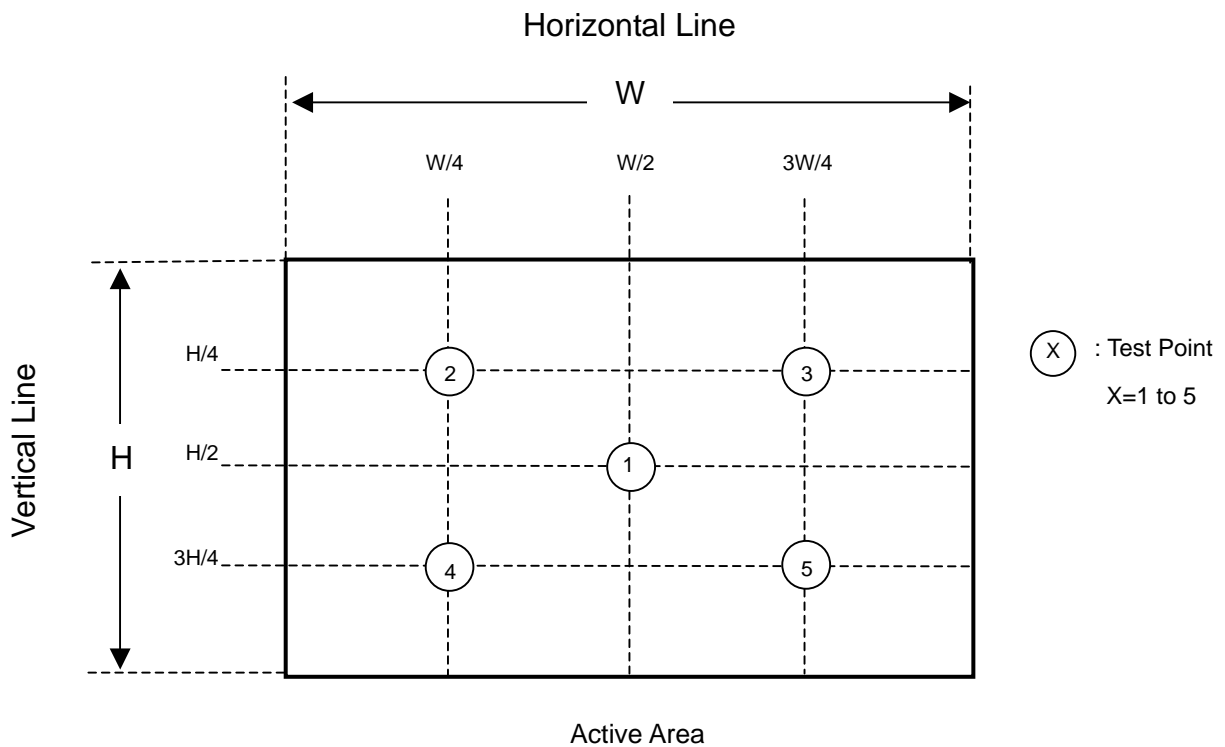
8. PRECAUTIONS

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 10ºC may reduce the display quality. For example, the response time will become slowly, and the starting voltage of CCFL will be higher than room temperature.

8.2 SAFETY PRECAUTIONS

(1) 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.

(2) 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.

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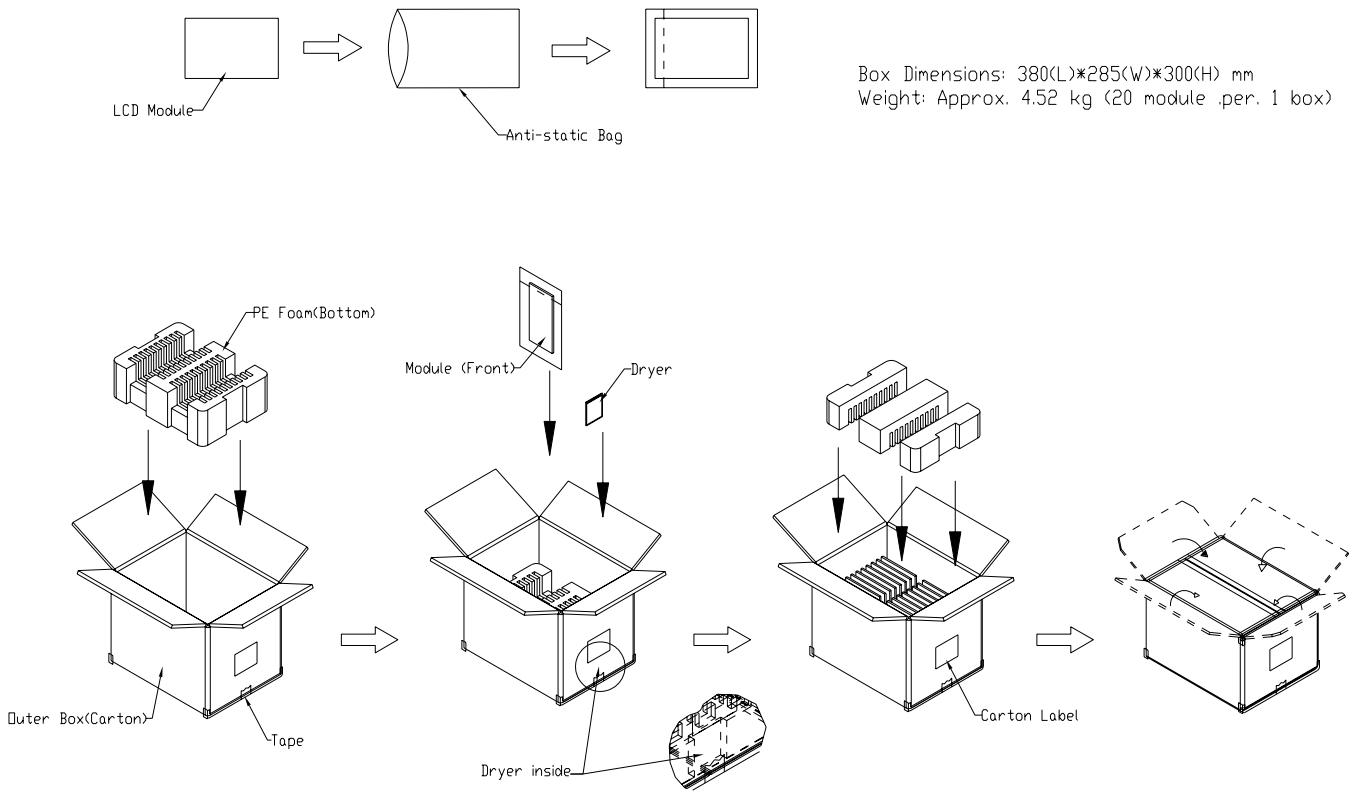
9. PACKING

9.1 CARTON

Box Dimensions: 380(L)*285(W)*300(H) mm
Weight: Approx. 4.52 kg (20 module .per. 1 box)

Figure. 9-1 Packing method

9.2 PALLET

Sea & Land Transportation

Air Transportation

PE Sheet

Corner Protector
(50*50*1130mm)

Corner Protector
(50*50*1650mm)

Film

PP Belt

CMO Carton Lable

Pallet
(L1150*W1150*H135mm)

PE Sheet

Corner Protector
(50*50*1130mm)

Corner Protector
(50*50*1130mm)

Film

PP Belt

Pallet
(L1150*W1150*H135mm)
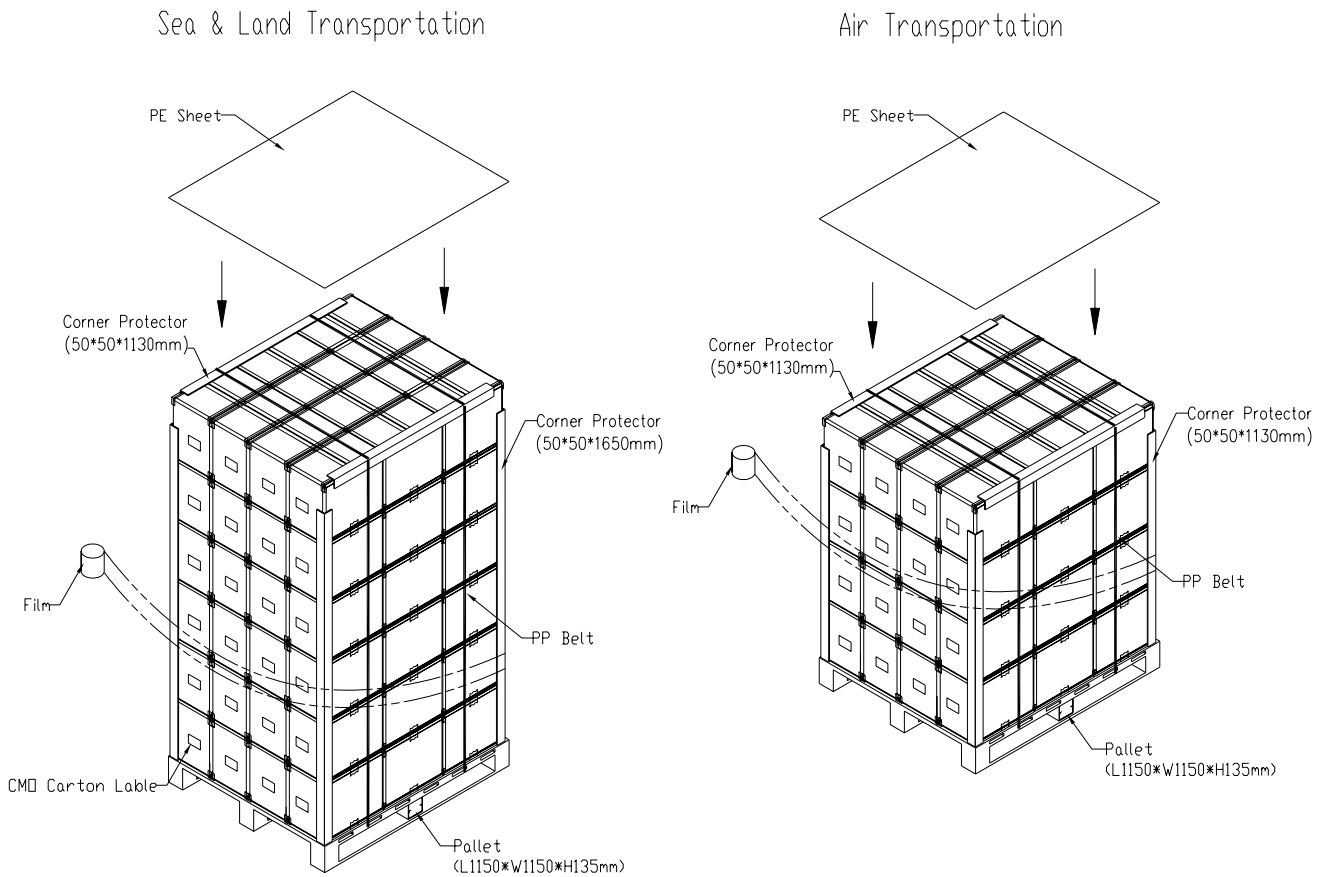
Figure. 9-2 Packing method

10. DEFINITION OF LABELS

10.1 CMO MODULE LABEL

The barcode nameplate is pasted on each module as illustration, and its definitions are as following explanation.

(a) Model Name: N089A1 - L01

(b) Revision: Rev. XX, for example: A1, …, C1, C2 …etc.

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

           Serial No.

           CMO Internal Use

           Year, Month, Date

           CMO Internal Use

           Revision

           CMO Internal Use
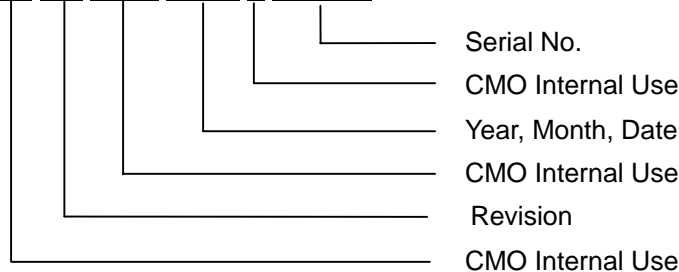
(d) Production Location: MADE IN XXXX. XXXX stands for production location.

(e) UL logo: LEOO especially stands for panel manufactured by CMO NingBo satisfying UL requirement.

The panel without LEOO mark stands for manufactured by CMO Taiwan satisfying UL requirement.

Serial ID includes the information as below:

(a) Manufactured Date: Year: 1~9, for 2001~2009

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

                Day: 1~9, A~Y, for 1st to 31st, exclude I , O and U

(b) Revision Code: cover all the change

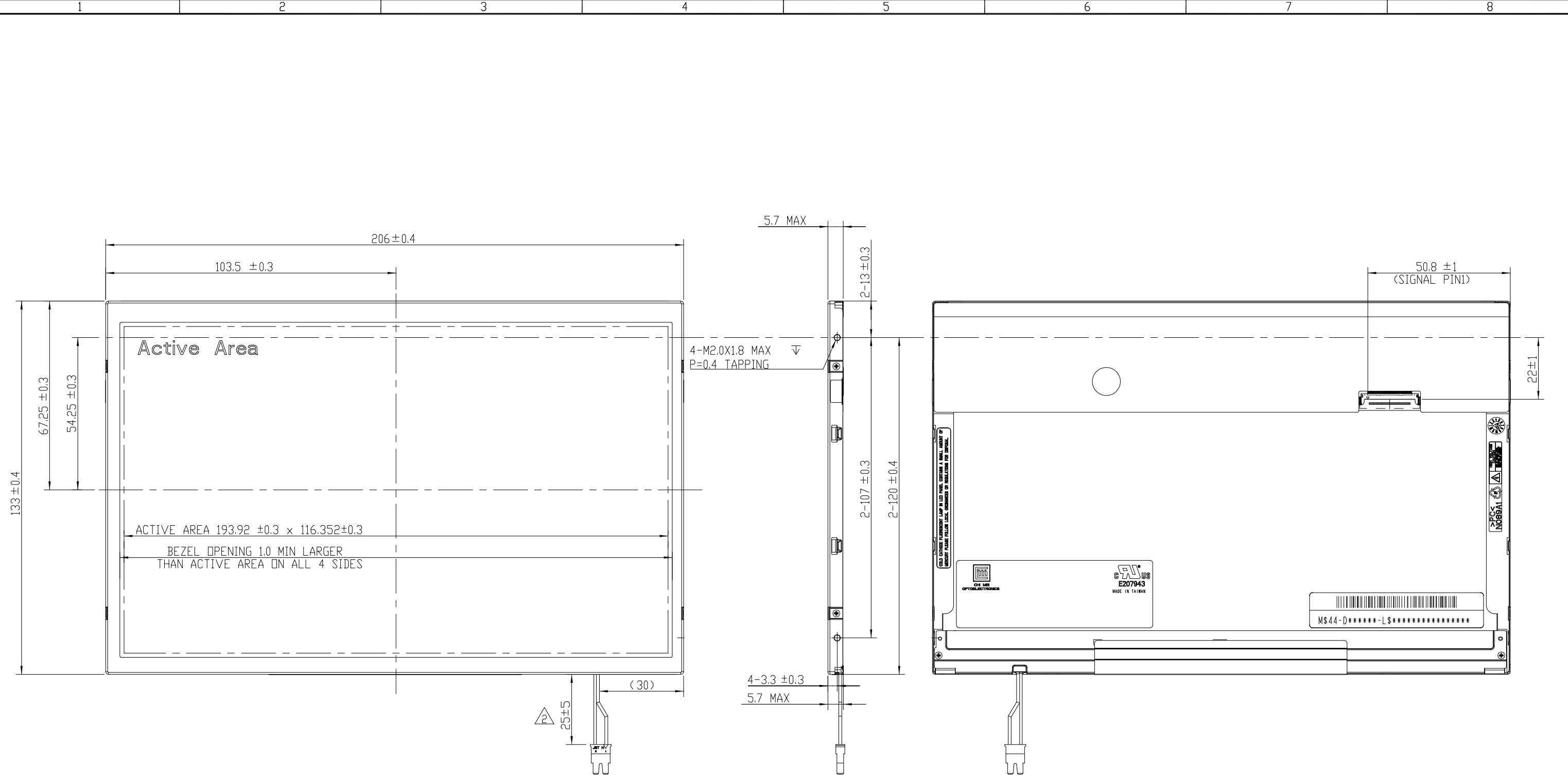(c) Serial No.: Manufacturing sequence of product

HP CT label bar code definition:

      C: Consistent display module code

      AAAA: Consistent assembly code for this CMO model

      00: Revision code, begin from "01" and so on when version updated

      DD: Production location code, UR stands for CMO Tainan, K5 or K6 stands for CMO NingBo

      WW: production week

      XXX: serial numbers

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10.2 CMO CARTON LABEL

(a) Production location: Made In XXXX. XXXX stands for production location.

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Active Area

206±0.4
103.5 ±0.3

5.7 MAX

50.8 ±1
(SIGNAL PIN1)

2-13±0.3

22±1

4-M2.0X1.8 MAX
P=0.4 TAPPING

67.25 ±0.3
54.25 ±0.3
133±0.4

2-107 ±0.3
2-120 ±0.4

ACTIVE AREA 193.92 ±0.3 x 116.352±0.3

BEZEL OPENING 1.0 MIN LARGER
THAN ACTIVE AREA ON ALL 4 SIDES

MS44-D★★★★★★-L$★★★★★★★★★★★★★★★★★

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E207943
MADE IN TAIWAN

(30)

25±5

4-3.3 ±0.3
5.7 MAX

Notes:
1.MAX. SCREW LENGTH: 1.8 mm.
2.MAX. SCREW TORQUE: 2.0 kgf-cm.
3.BACKLIGHT LAMP CONNECTOR: BHSR-02-VS-1 (JST).
4.LCD MODULE INPUT CONNECTOR: 20347-340E-12 (I-PEX).
5.GAP BETWEEN BEZEL AND PANEL: MAX 0.5 mm.

| 2 | Modify wire length. | 2007/09/03 | KAIJEN KE | | | |
| Mark | Description | Date | Changed_By | Approved_By | ECN No. | Remark |

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