LITEMAX
Sunlight Readable LCD!

ENRICH YOUR VISUAL WORLD...

DURApixel™ by LITEMAX Wide Temp LED Backlight

LITEMAX SLD&SLO1568

15” Sunlight Readable Smart Panel

Powered By Durapixel™ Technology

(Revision Edition 10/ 28/ 2010)

All information is subject to change without notice.

Approved by	Checked by	Prepared by

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Record of Revision

Version and Date	Page	Old Description	New Description	Remark
2009/6/12	All		Preliminary Spec. (First Draft)	
2009/7/7	5th	Operating Temp: -20°C~ 60 °C	Revised Operating Temp to -20°C~ 75 °C	
2010/10/28	5th	Operating Temp: -20°C~ 75 °C	Revised Operating Temp to -20°C~ 70 °C	

Contents

1.0 GENERAL DESCRIPTION

1.1 OVERVIEW

SLO1568 is Litemax's first smart panel design which is composed of the amorphous silicon thin film transistor liquid crystal display (a-Si TFT LCD) panel structure with built-in LED driving board for driving the TFT (Thin Film Transistor) array and a backlight module and also equips with Litemax AD5621GA AD board mounting holes and its upgradeable capability.

The SLO1568's a-Si TFT LCD panel structure is injected wide temperature liquid crystal material into a narrow gap between the TFT array glass substrate and a color-filter glass substrate. Color (Red, Green, Blue) data signals from a host system (e.g. PC, signal generator, etc.) are modulated into best form for active matrix system by a signal processing board, and sent to the driver LSIs which drive the individual TFT arrays. The TFT array as an electro-optical switch regulates the amount of transmitted light from the backlight assembly, when it is controlled by data signals. Color images are created by regulating the amount of transmitted light through the TFT array of red, green and blue dots. It has a 15 inch diagonally measured active display area with XGA solution (1024 horizontal by 768 vertical pixel array).

1.2 FEATURES

- 1,600 nits
- Long Life Time LED Backlight Powered by Durapixel™ Technology
- Wide viewing angle
- Wide operating temperature
- High response time: 8ms (typ.)
- High contrast ratio: 600:1 (typ.)
- XGA (1024 x 768 pixels) resolution
- LVDS interface (6 bit + FRC)
- High Performance Edge Light type backlight
- PSWG standard
- RoHs compliance
- TCO' 03 compliance

1.3 APPLICATION

- Outdoor Display
- Outdoor Digital Signage
- Quick Service Restaurant Display Product
- Transportation
- Gas Station Forecourt Displays

1.4 GENERAL SPECIFICATI0NS

Size (inch)	15”
Model	SLO1568
Pixel Format (pixel)	1024 horiz. by 768 vert. pixels RGB stripe arrangement
Active Area (mm)	304.128 (W) x 228.096 (H) mm (typ.)
Pixel Pitch (mm)	0.297 (W) x 0.297 (H) mm
LCD Surface Treatment	Hard coating(3H), Anti-glare treatment of the front polarizer
Number of Colors	16,777,216 colors (6bit+FRC)
Viewing Angle (CR>10)	• Horizontal: 160° (typ.) • Vertical: 160° (typ.)
Luminance, White	1,600 cd/m2
Contrast Ratio	600:1
Response Time (ms)	8 ms
LED Lamp Life (hrs)	70K
Power Consumption (W)	23 Watts
Supply Voltage (V)	3.3V
Storage Temp. (°C)	-30°~ 80°C
Operation Temp. (°C)	-20°C~ 70 °C

1.5 MECHANICAL SPECIFICATIONS

Mechanical specifications:

Item		Min.	Typ.	Max.	Unit	Note
Module Size	Horizontal(H)	-	326.5	-	mm	(1)
	Vertical(V)	-	253.5	-	mm	
	Depth(D)	-	31	-	mm	(1)(2)
Weight		-	1,200	-	g	-

Note (1) Please refer to the detail drawings in Section 5.0 for more information of front and back outline dimensions. Note

(2) The depth is without connector.

2.0 ABSOLUTE MAXIMUM RATINGS

Parameter		Symbol	Rating	Unit	Remarks
Power supply voltage	LCD panel signal board	VCC	-0.3 to +3.6	V	Ta = 25℃
Input voltage for signals	Display signals Note1	Vi	-0.3 to +3.6 and Vi<VCC +0.3	V	Ta = 25℃
	Function signals Note2				
Storage temperature		Tst	（-30~80）	℃	-
Operating temperature		Top	（-20~70）	℃	
Relative humidity Note3		RH	（≤ 95）	%	Ta ≤ 40℃
			（≤ 80）	%	40 <Ta ≤70℃
Operating altitude			≤4, 850	m	0° C≤Ta≤55° C
Storage altitude			≤13, 600	m	−20° C≤Ta≤60° C

Note1: Display signals are D0+/-, D1+/-, D2+/-, D3+/- and CK+/-.

Note2: Function signal is MSL.

Note3: No condensation

3.0 ELECTRICAL CHARACTERISTICS

3.1 ELECTRICAL CHARACTERISTICS

Driving for LCD panel signal processing board

Parameter		Symbol	min.	typ.	max.	Unit	Remarks
Power supply voltage		VCC	3.0	3.3	3.6	V	-
Power supply current		ICC	-	(400)※1	(600)※2	mA	at VCC = 3.3V
Permissible ripple voltage		VRP	-	-	100	mV	For VCC
Differential input threshold voltage for LVDS receiver	Low	VTL	-100	-		mV	at VCM = 1.2V
	High	VTH	-	-	100	mV	Note3
Input voltage width for LVDS receiver		Vi	0	-	2.4	V	-
Terminating resistor		RT	-	100	-	Ω	-
Input voltage for MSL signal	Low	VFL	0	-	0.8	V	-
	High	VFH	2.0	-	VCC	V	

※1: Checkered flag pattern (EIAJ ED-2522);

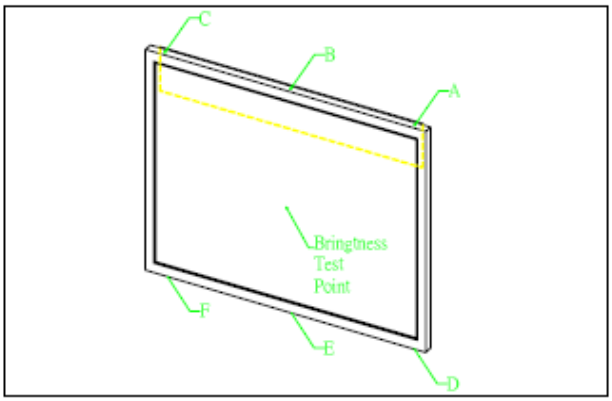
※2: 2H1V dot inverse pattern

※3: Common mode voltage for LVDS receiver

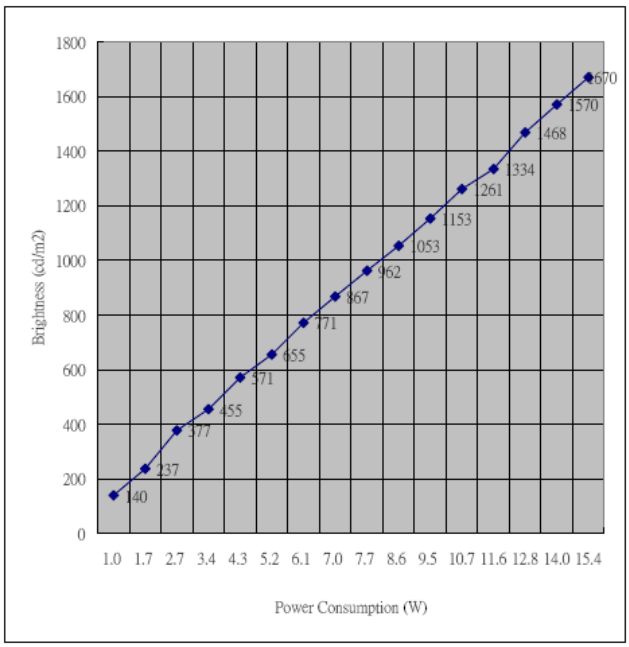
LID15A03 LED Driving Board Specification

Item	Symbol	Conditions	MIN.	TYP.	MAX.	Unit	Remark
Input Voltage	Vin		10.0	12.0	15.0	V	
Input Current (Low Brightness)	IinL	VIN=12V,Vadj=5V	0.0	-----	-----	mA	
Input Current (High Brightness)	IinH	VIN=12V,Vadj=0V	1.66	1.36	1.08	A	
LED Current (Low Brightness)	IoutL	VIN=12V,Vadj=5V	0.0	-----	-----	Arms	
LED Current (High Brightness)	IoutH	VIN=12V,Vadj=0V	0.667	0.667	0.667	A	
Working Frequency	Freq	VIN=12V,Vadj=0V	120	125	130	KHZ	
PWM Frequency	Freq	VIN=12V	180	200	220	HZ	
Brightness Control	Vadj	Connection of Voltage	0.5	-----	4.8	V	
ON/OFF Control	Von/off	Normal Operation	2	-----	5	V	
Output Voltage	Vout	VIN=12V,Vadj=0V	23.2	23.14	23.08	V	
Efficiency	η	VIN=12V,Vadj=0V	93.22	94.57	94.88	%	

LED Backlight Dimming & Power Consumption and Temperature Relationship Test Report



cd/㎡	Vin	Iin	W	Temp A	Temp B	Temp C	Temp D	Temp E	Temp F
140	20.6	0.05	1.0	25.7	26	25.8	25.5	25.5	27.3
237	20.8	0.08	1.7	27.3	27.2	26.8	26.6	29	26.6
377	21.1	0.13	2.7	27.5	27.8	27.7	27.4	29.1	27.6
455	21.2	0.16	3.4	26.9	27.5	27.2	26.7	26.6	26.8
571	21.4	0.2	4.3	28	28.5	27.5	28.5	29.5	27.7
655	21.6	0.24	5.2	28.7	28.7	28.4	29	29.3	29.4
771	21.7	0.28	6.1	29.1	29.7	28.7	29.1	29.2	28.9
867	21.8	0.32	7.0	29.8	31.3	30	30.2	30.6	30.3
962	21.9	0.35	7.7	30.2	31.2	30.7	30.9	31.5	30.6
1053	22	0.39	8.6	30.9	33.3	31.5	31.8	32.2	31.3
1153	22.1	0.43	9.5	30.7	32.8	32.4	31.3	32.3	32.2
1261	22.2	0.48	10.7	31.7	33.7	32.3	32.7	33	32.7
1334	22.4	0.52	11.6	32.8	33.7	31.7	33.9	34.1	32.8
1468	22.5	0.57	12.8	34.3	35.3	32.9	34	34.2	33.3
1570	22.6	0.62	14.0	34.7	36	34.3	35.4	35.3	33.5
1670	23	0.669	15.4	42.3	44.6	40.3	40.1	43.5	38.7



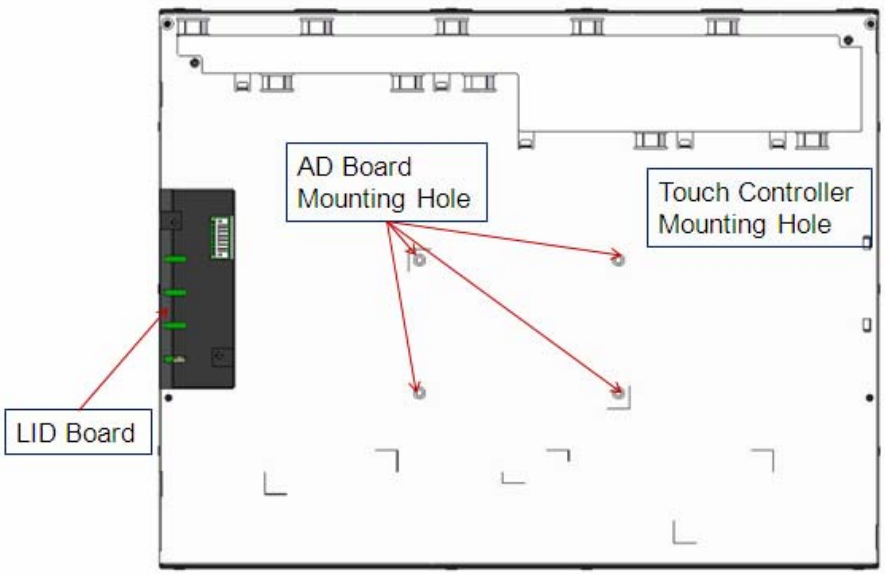
LCD panel signal processing board

CN1 socket(Module side): DF-14H-20P-1.25H（Hirose Electric Co., Ltd.）
Adaptable plug： DF14-20S-1.25C（Hirose Electric Co., Ltd.）

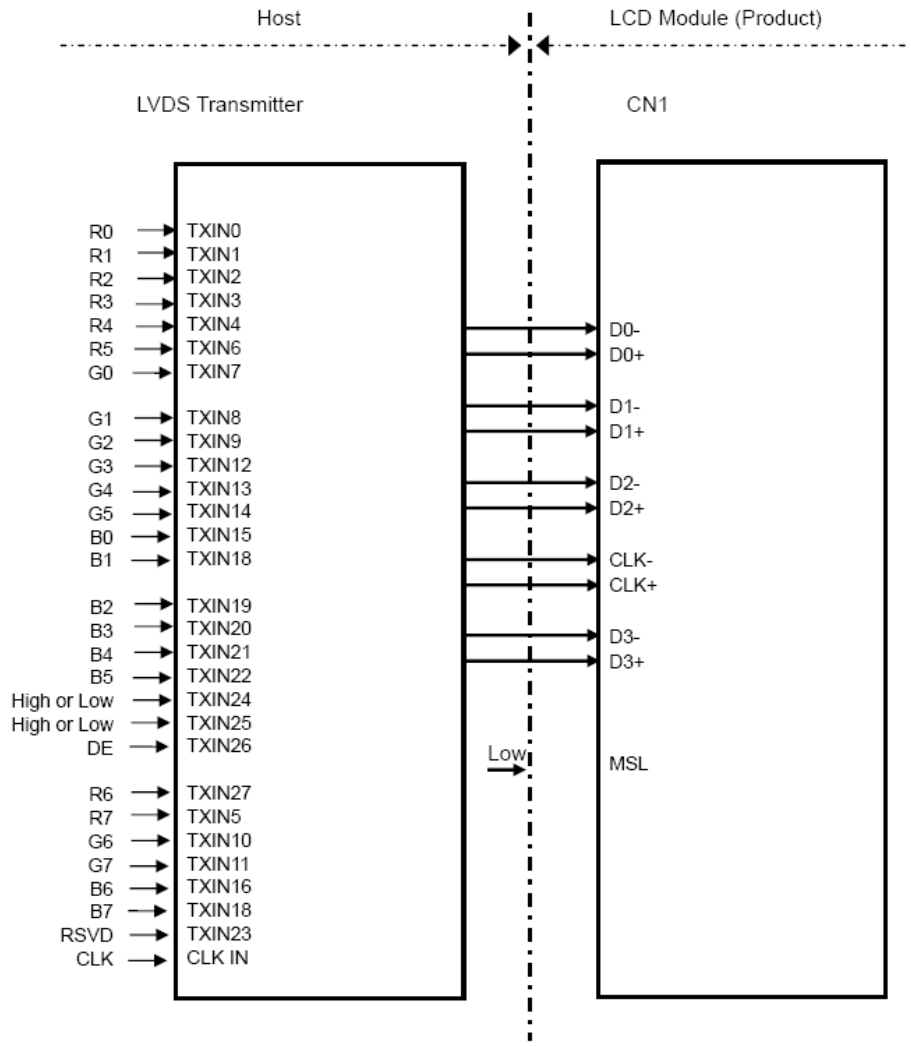
Pin No.	Symbol	Signal	Remarks
1	VCC	Power supply	-
2	VCC		
3	GND	Ground	-
4	GND		
5	D0-	Pixel data	Note2
6	D0+		
7	GND	Ground	-
8	D1-	Pixel data	Note2
9	D1+		
10	GND	Ground	-
11	D2-	Pixel data	Note2
12	D2+		
13	GND	Ground	-
14	CLK-	Pixel clock	Note2
15	CLK+		
16	GND	Ground	-
17	D3-	Pixel data	Note2
18	D3+		
19	GND	Ground	-
20	MSL	Selection of LVDS input Map	Low or Open: NOTE1

Note1：See **“Connection between receiver and transmitter For LVDS”.**

Note2：Twist pair wires with 100Ω (Characteristic impedance) should be connected between LCD panel signal processing board and LVDS transmitter.



Connection between receiver and transmitter for LVDS



Note1: Recommended transmitter

See the data sheet for DS90C383（National Semiconductor）.

Note2: LSB（Least Significant Bit）-R0,G0,B0 MSB（Most Significant Bit）-R7,G7,B7

3.3 COLOR INPUT DATA ASSIGNMENT

The brightness of each primary color (red, green, blue) is based on the 8bit gray scale data input for the color the higher the binary input, the brighter the color. The table below provides a reference for color versus data input.

Display colors		Data signal （0:Low level，1:High Level）																							
		R7	R6	R5	R4	R3	R2	R1	R0	G7	G6	G5	G4	G3	G2	G1	G0	B7	B6	B5	B4	B3	B2	B1	B0
Basic Color	Black	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	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
	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
	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
	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
	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
Red grayscale	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
		0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Dark ↑	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
						:								:								:			
	↓					:								:								:			
	Bright	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		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	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 grayscale	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
		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
	Dark ↑	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
						:								:								:			
	↓					:								:								:			
	Bright	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0
		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	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 grayscale	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
		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Dark ↑	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
						:								:								:			
	↓					:								:								:			
	Bright	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	1
		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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1

3.4 INPUT SIGNAL TIMING SPECIFICATIONS

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

(Note1)

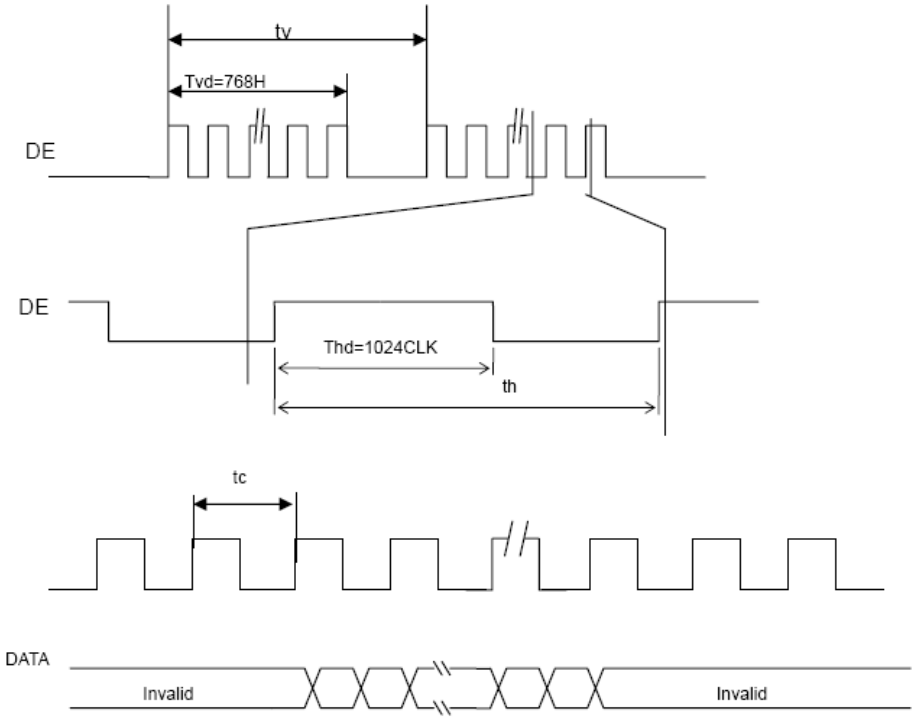
Parameter			Symbol	min.	typ.	max.	Unit	Remarks
CLK	Frequency		1/tc	60.0	65.0	70.0	MHz	15.384ns（typ.）
	Duty		—	—			—	Note2
	Rise time, Fall time		—				ns	
DATA	CLK-DATA	Setup time	—	—			ns	Note2
		Hold time	—				ns	
	Rise time, Fall time		—				ns	
DE	Horizontal	Cycle	th	12.3	20.676	30.00	μs	48.363KHz(typ.) Note3/ Note4
				1050	1344	1800	CLK	
		Display period	thd	1024				—
	Vertical (One frame)	Cycle	tv	13.1	16.666	20.0	ms	60.0Hz（typ.）
				770	806	1334	H	
		Display period	tvd	768			H	
	CLK-DE	Setup time	—	—			ns	Note2
		Hold time	—				ns	
	Rise time, Fall time		—				ns	

Note1: Definition of parameters is follows.
tc=1CLK,Th=1H

Note 2: See the data sheet of LVDS transmitter.

Note 3: Both of “time” and “CLK number” of the “th” must keep the Minimum value of specifications.

Note 4: “th” must keep the fluctuation within ±1 CLK, because of avoidance of image sticking.


tv
Tvd=768H
DE
DE
Thd=1024CLK
th
tc
DATA
Invalid
Invalid

4.0 OPTICAL CHARACTERISTICS

4.1 TEST CONDITIONS

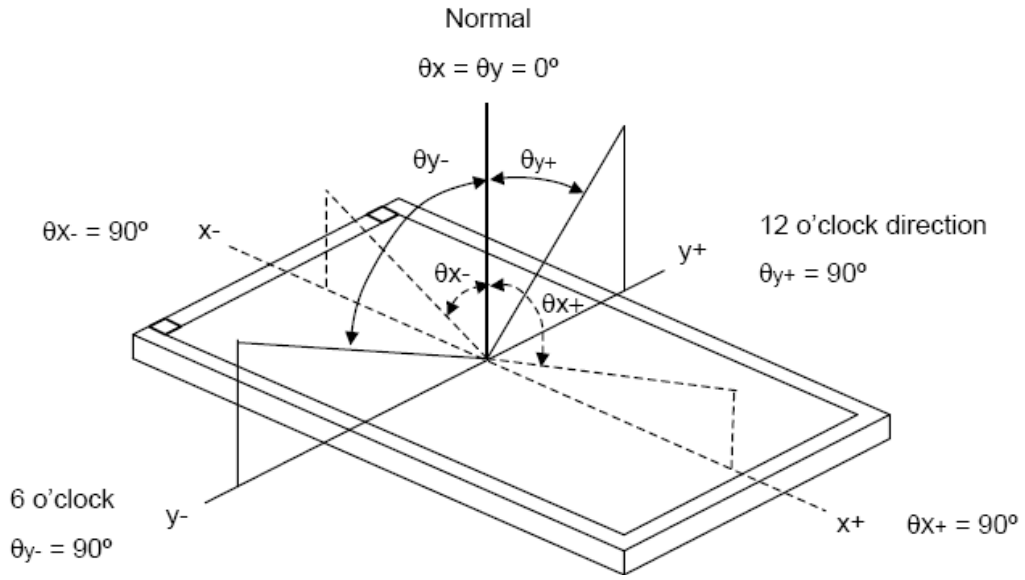
Item	Symbol	Value	Unit
Ambient Temperature	Ta	25±2	oC
Ambient Humidity	Ha	50±10	%RH
Supply Voltage	V_{DD}	23	V
Input Signal	According to typical value in "3. ELECTRICAL CHARACTERISTICS"		
LED Current	I_L	680	mA
LED Working Frequency	F_L		KHz
LED Driver Board	Litemax		

The measurement methods of optical characteristics are shown in optical Specifications .The following items should be measured under the test conditions described in Section 4.1

4.2 OPTICAL SPECIFICATIONS

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Contrast Ratio		CR	White/Black at center R=0, L=0, U=0,D=0	400	600	-	-	(2)
Response Time		T_{ON}	White to black	-	2	4	ms	(3)
		T_{OFF}	Black to white	-	6	8	ms	
Luminance of White		L_{AVE}	White at center R=0, L=0, U=0, D=0	-	1,600	-	cd/m2	(4)
Luminance uniformity		δW		-	1.2	1.3	-	(7)
Chromaticity	Red	Rx	X coordinate	0.60	0.63	0.66	-	
		Ry	Y coordinate	0.31	0.34	0.37	-	
	Green	Gx	X coordinate	0.27	0.30	0.33	-	
		Gy	Y coordinate	0.54	0.57	0.60	-	
	Blue	Bx	X coordinate	0.11	0.14	0.17	-	
		By	Y coordinate	0.07	0.10	0.13	-	
	White	Wx	X coordinate	0.283	0.313	0.343	-	
		Wy	Y coordinate	0.299	0.329	0.359	-	
Viewing Angle	Right	θR	θU=0°, θD=0°,CR=10	70	80	-	Deg.	(1)
	Left	θL	θU=0°, θD=0°,CR=10	70	80			
	Up	θU	θU=0°, θD=0°,CR=10	70	80			
	Down	θD	θU=0°, θD=0°,CR=10	70	80			

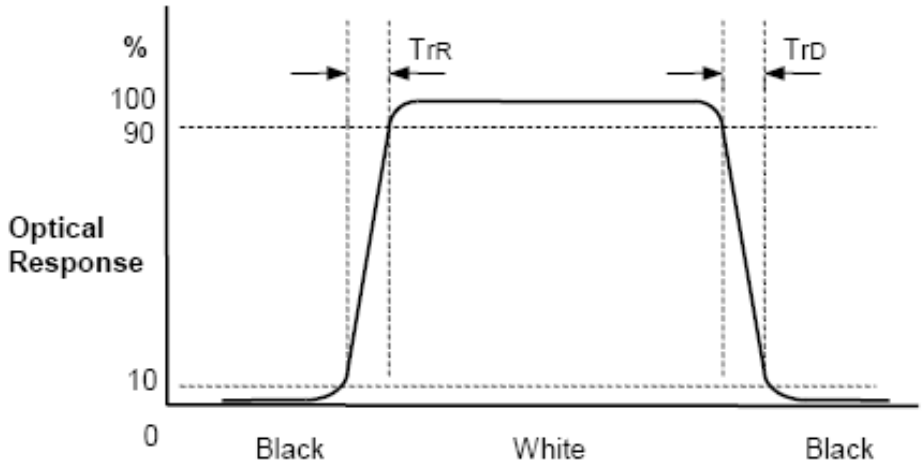
Note (1) Definition of Viewing Angle (θx, θy):



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):



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

Measure the luminance of gray level 255 at center point

L_{AVE} = L (5)

L (x) is corresponding to the luminance of the point X at Figure in Note (7).

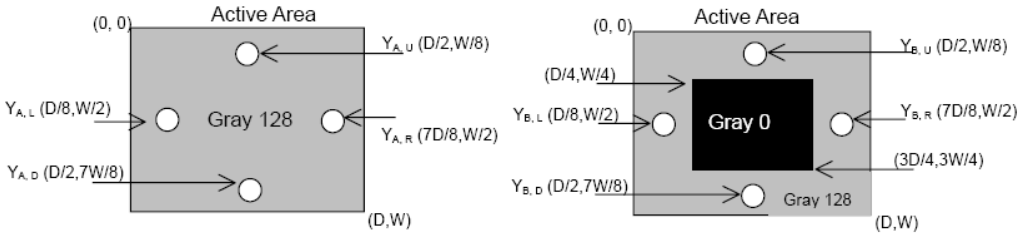
Note (5) Definition of Cross Talk (CT):

$CT = | Y_B - Y_A | / Y_A \times 100$ (%)

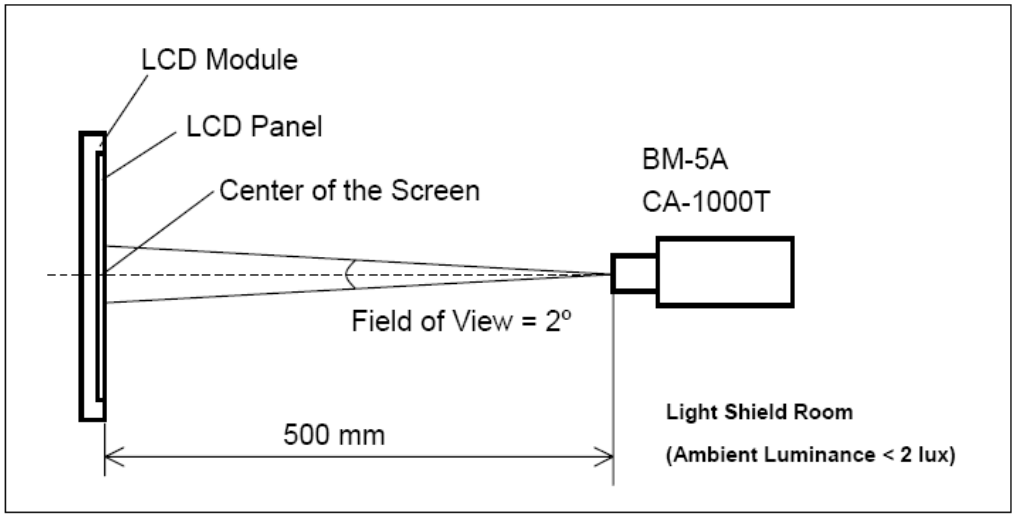
Where:

Y_A = Luminance of measured location without gray level 0 pattern (cd/m2)

Y_B = Luminance of measured location with gray level 0 pattern (cd/m2)

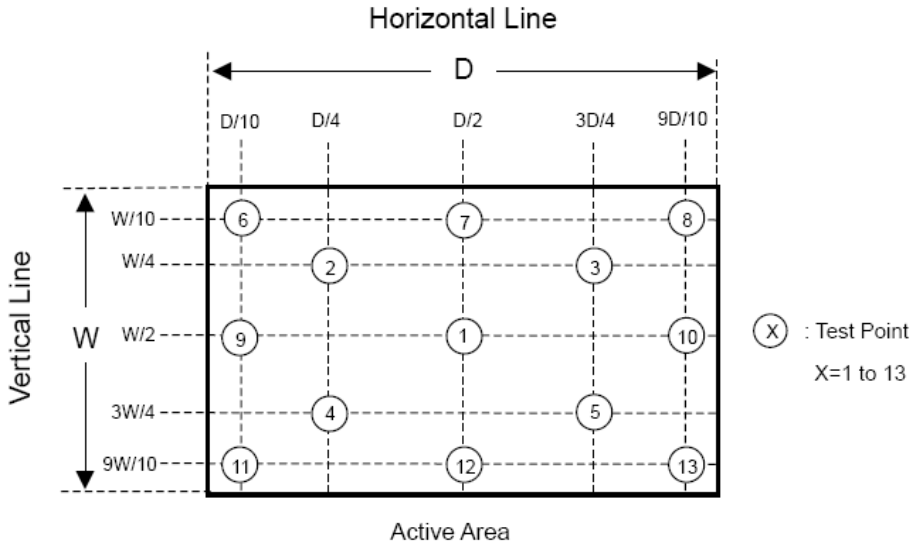


Note (6) Measurement Setup: The LCD module should be stabilized at given temperature for 20 minutes to avoid abrupt temperature change during measuring. In order to Stabilize the luminance, the measurement should be executed after lighting Backlight for 20 minutes in a windless room.



Note (7) 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

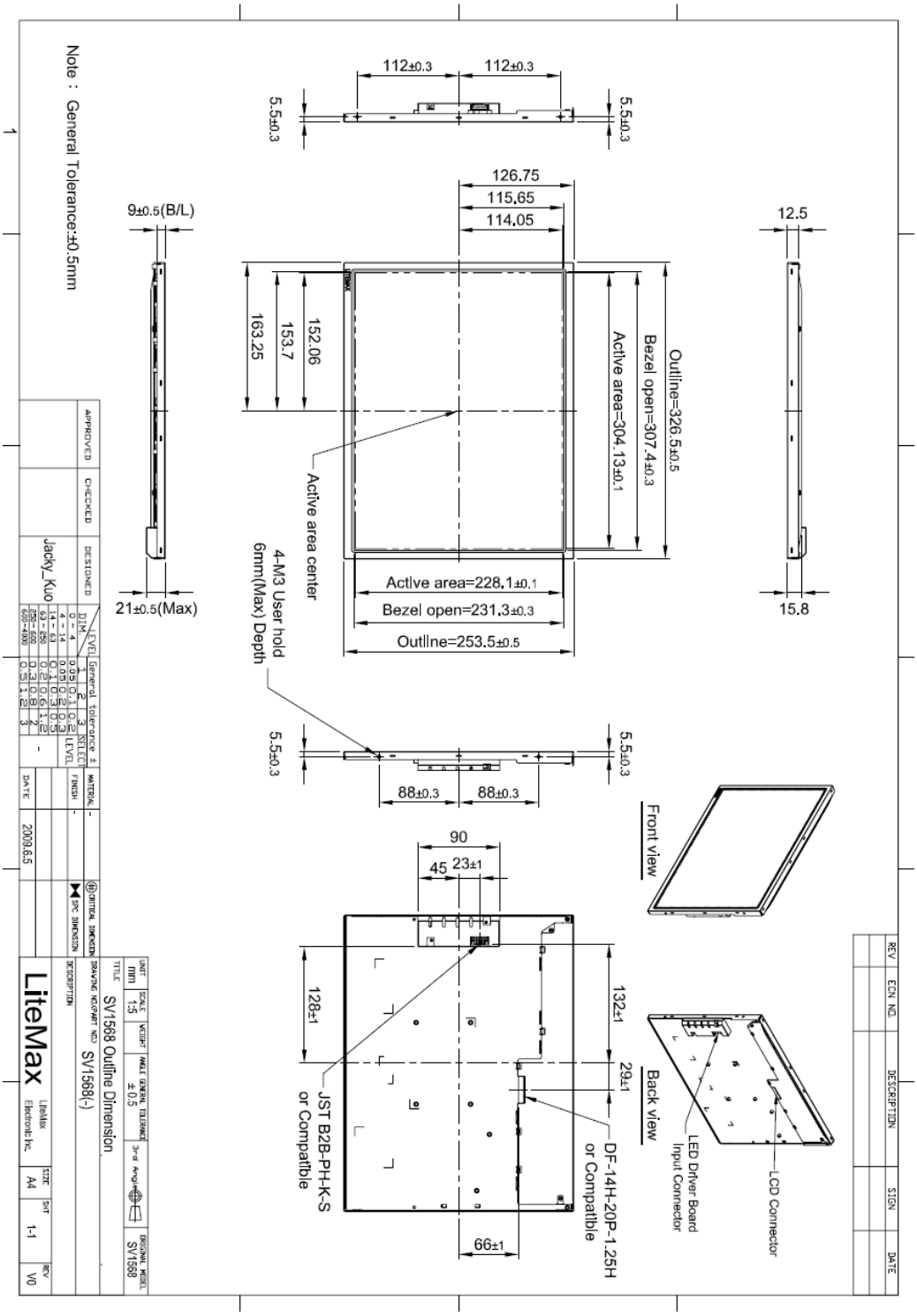
$$\delta W = \frac{\text{Maximum [L (1), L (6), L (7), L (8), L (9), L (10), L (11), L (12), L (13)]}}{\text{Minimum [L (1), L (6), L (7), L (8), L (9), L (10), L (11), L (12), L (13)]}}$$



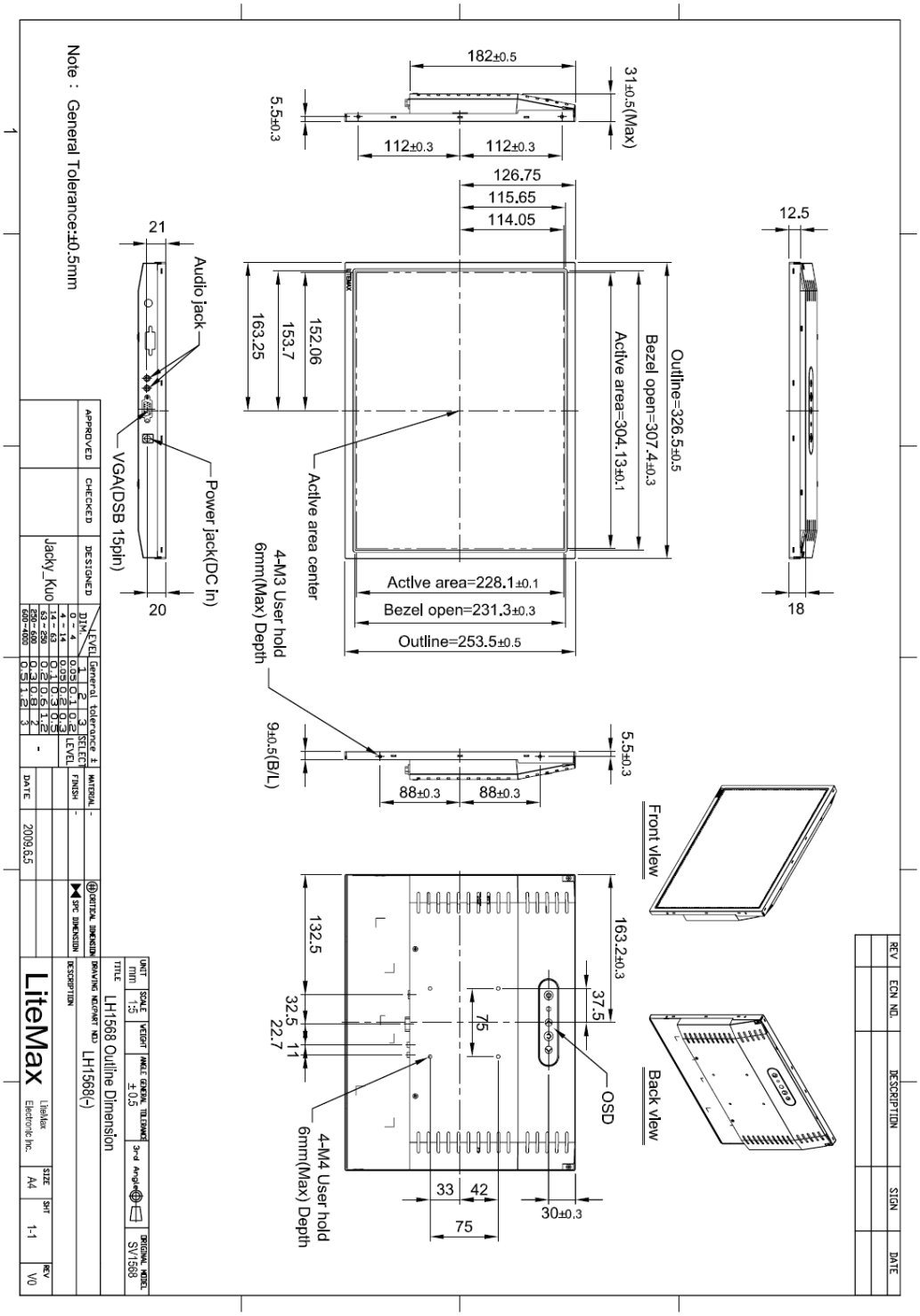
Note (8) TN type has Gray scale inversion occurs at θ_y: -40°

5.0 TECHNICAL DRAWING

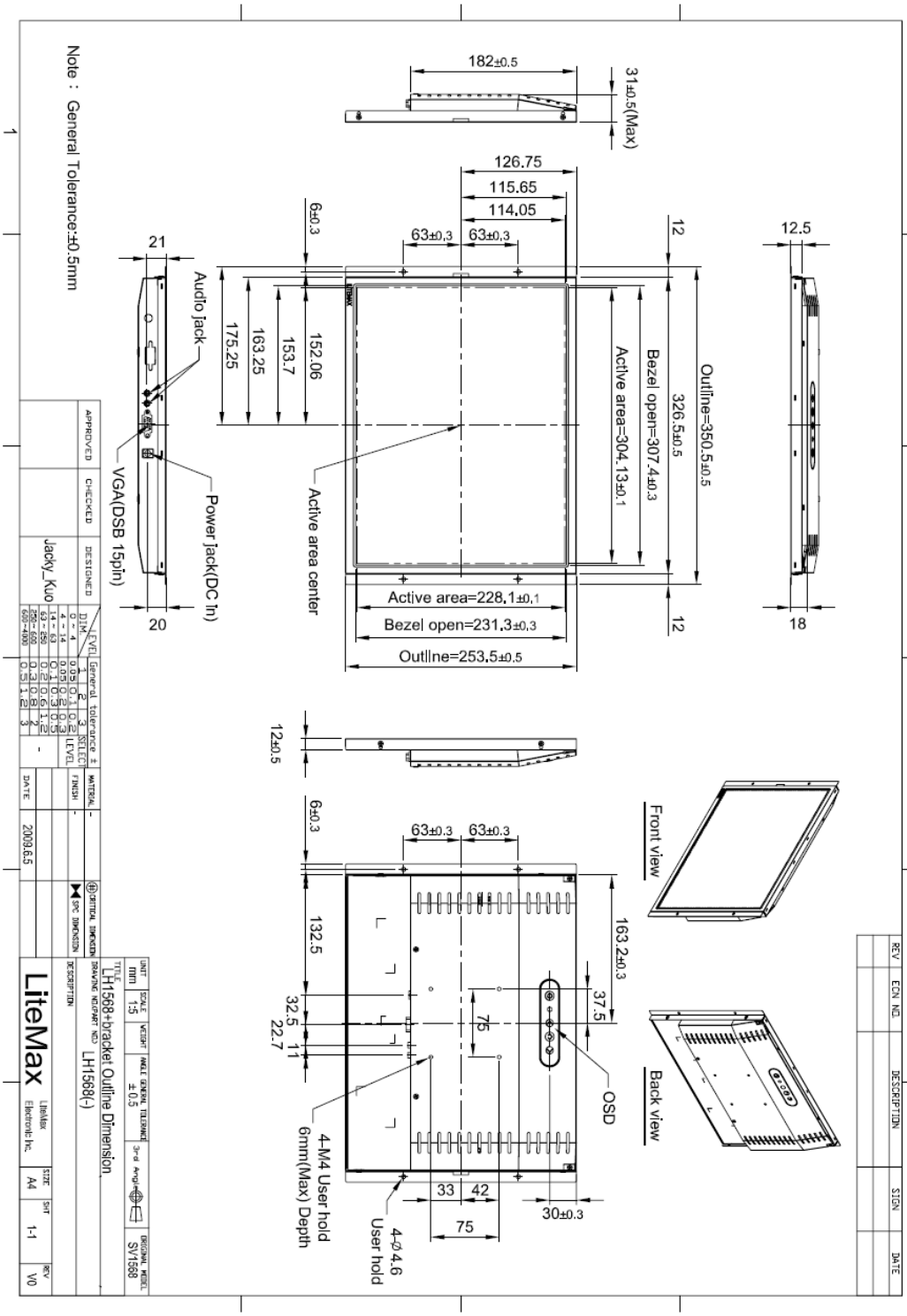
DLF1568-ENN-A01 ME Drawing



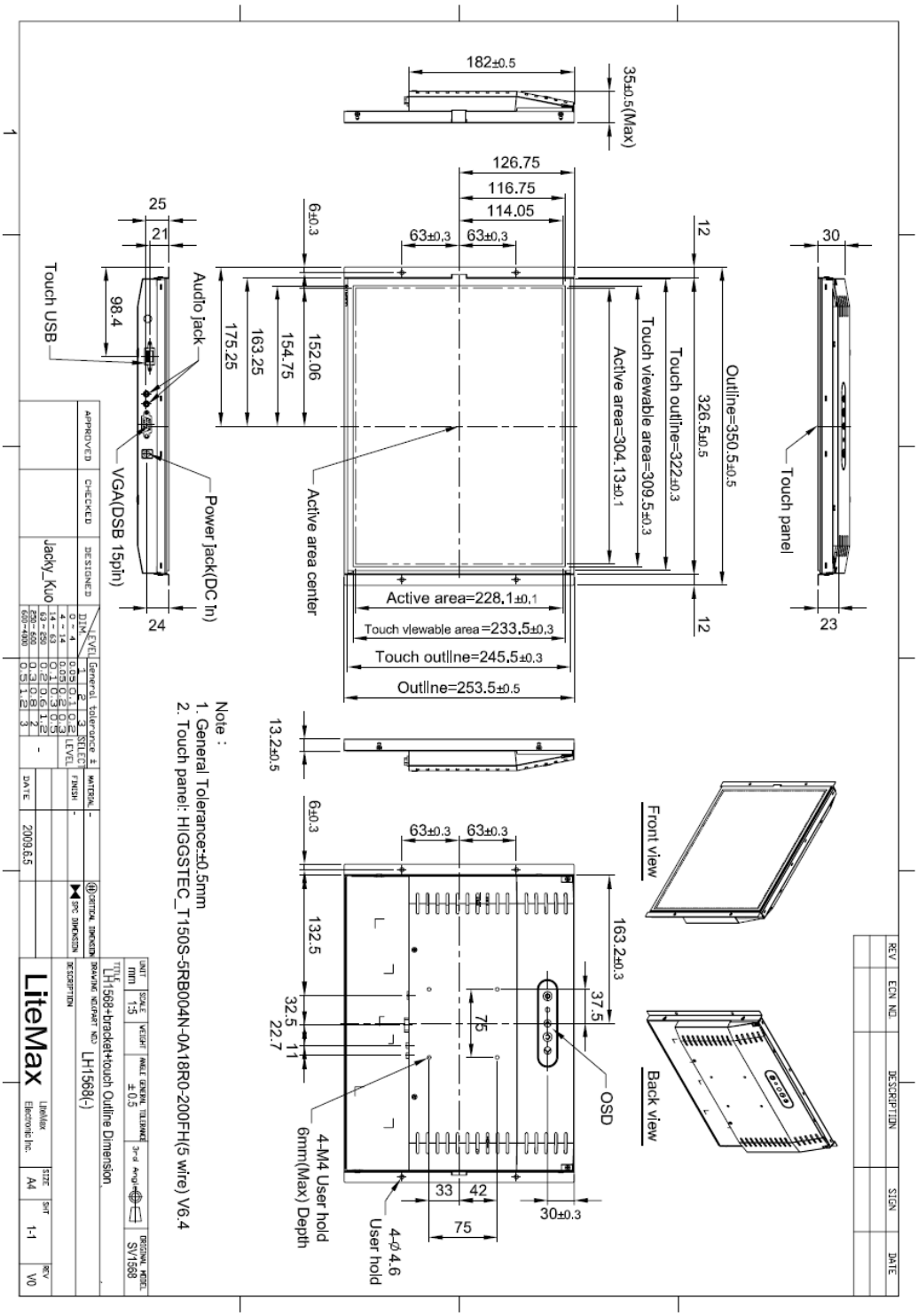
SLD1568-ENB-A01 ME Drawing



SLO1568-ENB-A01 ME Drawing



SLO1568-ETB-A01 ME Drawing



6.0 PRECAUTIONS

6.1 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.

6.2 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.

6.3 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.