	Quanta Display Inc. **SPECIFICATION**	**Doc No. QD32HL0201** **Doc. REV.: 05** **Issue Date:Sep 27,'05** **With RoHS compliant**

Specification for TFT LCD Module

Model No.
QD32HL02 Rev.:01

☐ **Customer's Approval**

Date _____

by _____

Approved By _____

The device listed in these technical literature sheets was designed and manufactured for use in OA equipment.

In case of using the device for applications such as control and safety equipment for transportation (aircraft, trains, automobiles, etc.), rescue and security equipment and various safety related equipment which require higher reliability and safety, take into consideration that appropriate measures such as fail-safe functions and redundant system design should be taken.

Do not use the device for equipment that requires an extreme level of reliability, such as aerospace applications, telecommunication equipment (trunk lines), nuclear power control equipment and medical or other equipment for life support.

QDI assumes no responsibility for any damage resulting from the use of the device, which does not comply with the instructions, and the precautions specified in these technical literature sheets.

Contact and consult with a QDI sales representative for any questions about this device.

Revision History			
REV.	**Date**	**ECN NO.**	**Change Content**
1	**Jan.24,'05**	**N/A**	**Preliminary specification Initiate**
2	**Jun.3,'05**	**N/A**	**Page 10, update inverter typ. current, page 15, update response time.**
3	**Jun 30,'05**	**N/A**	**Page 6, pin 28 change defition to be no connection(NC), page 8, pin 14 change Definition to be GND=PWM, Open or High=analog voltage control, page 10, change max. inverter voltage from 25.2 to 26.2.**
4	**Aug 29,'05**	**N/A**	**Page 15, update color coordinates and uniformity**
5	**Sep 27,'05**	**N/A**	**Page 5, update weight, page 15, update response time, page 20, update barcode label position**

Content List

1. Application

This specification applies to a color TFT-LCD module, QD32HL02

2. Overview

This module is a color active matrix LCD module incorporating amorphous silicon TFT (Thin Film Transistor). It is composed of a color TFT-LCD panel; driver ICs, control circuit and power supply circuit and a backlight unit. Graphics and texts can be displayed on a 1366×3×768 dots panel with 16.7 million colors by using the LVDS (Low Voltage Differential Signaling) interface, 8-bit driving method and supplying +12V DC supply voltage for TFT-LCD panel driving.

The TFT-LCD panel used for this module has fast response time. A low-reflection and higher-color-saturation type color filter is also used for this panel. Therefore, high-brightness and high-contrast image, which is suitable for multimedia use, can be obtained by using this module.

[Features]

1) Brilliant and high contrast image.
2) Wide viewing angle.
3) Fast response time
4) WXGA resolution.
5) LVDS interface.
6) High color saturation

3. General Specifications

Parameter	Specifications	Unit
Display size	80.04 (31.51") Diagonal	cm
Active area	697.685 (H)×392.256 (V)	mm
Pixel format	1366 (H)×768 (V)	Pixel
	(1 pixel = R+G+B dots)	
Pixel pitch	0.5107(H) × 0.5107 (V)	mm
Pixel configuration	R,G,B vertical stripe	
Display mode	Normally Black	
Unit outline dimensions	760 (W)×450 (H)	mm
Thickness	48 max.	mm
Weight	Max. 6000	g
Surface treatment	Anti-glare and hard-coating 3H	
Lamp Quantity	Direct 16 lamps	pcs

4. Input Terminals

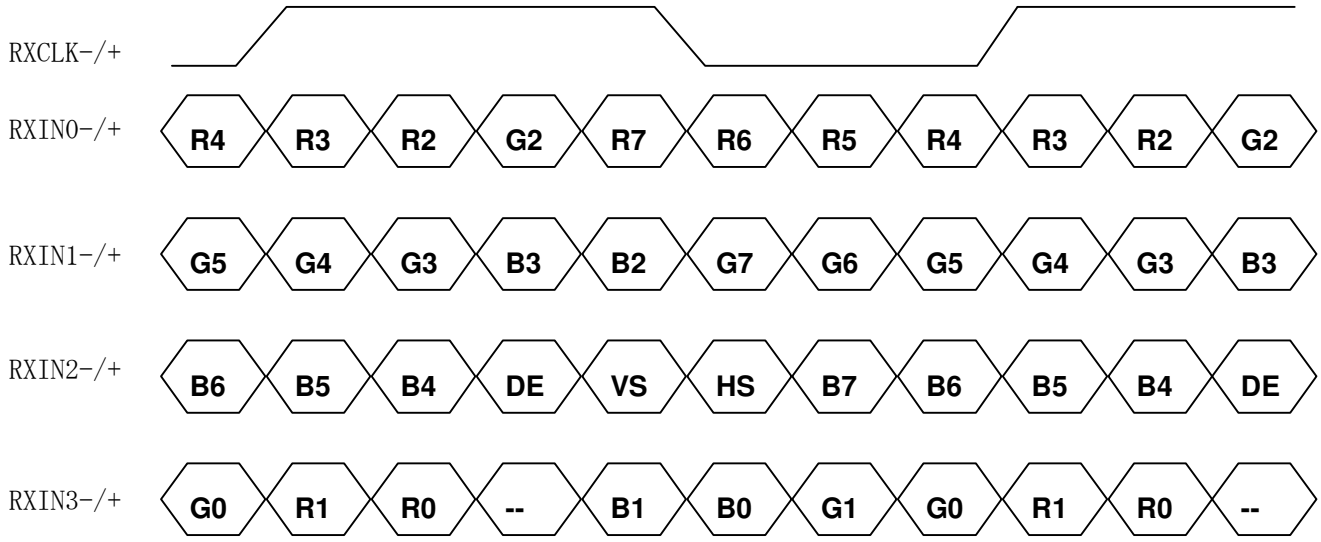
4-1. TFT-LCD pin assignment of panel

Mating connector of CN1 : FI-X30SSL-HF(JAE) or equivalent

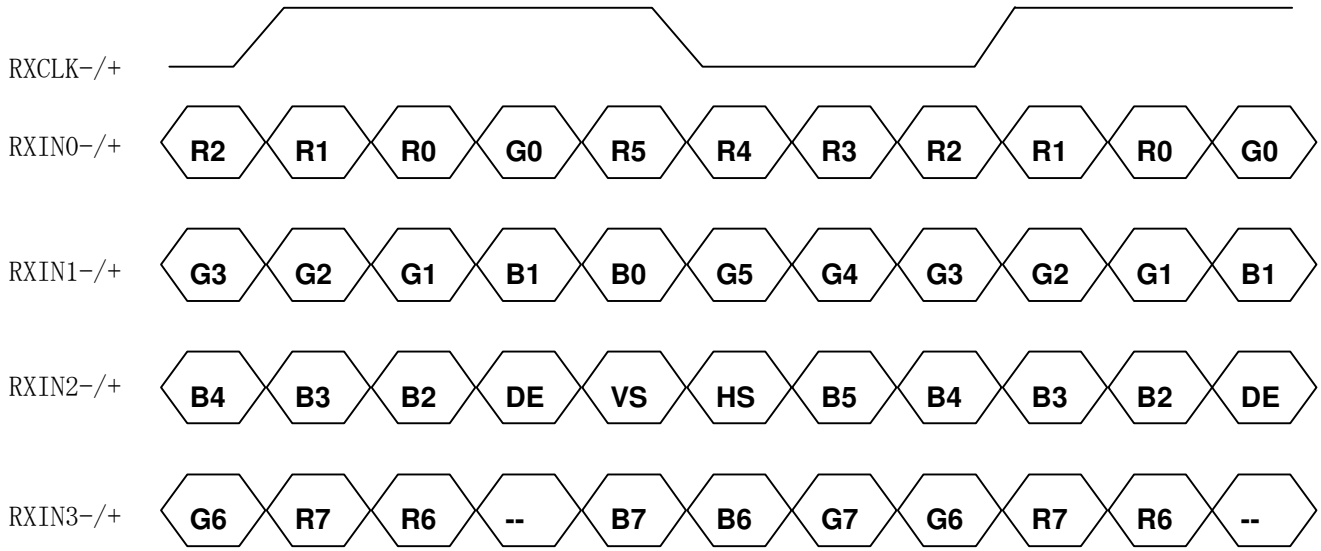
Pin NO.	Symbol	Function	Remark
1	VDD	+12V input	
2	VDD	+12V input	
3	VDD	+12V input	
4	VDD	+12V input	
5	GND	Power Groung	
6	GND	Power Groung	
7	GND	Power Groung	
8	GND	Power Groung	
9	LVDS OPTION	LVDS data mapping	Low/Open for Normal(NS), Hight for JEIDA
10	RESERVED	N.C.	
11	GND	Ground	
12	RXIN0-	LVDS data input	
13	RXIN0+	LVDS data input	
14	GND	Ground	
15	RXIN1-	LVDS data input	
16	RXIN1+	LVDS data input	
17	GND	Ground	
18	RXIN2-	LVDS data input	
19	RXIN2+	LVDS data input	
20	GND	Ground	
21	RXCLK-	LVDS clock input	
22	RXCLK+	LVDS clock input	
23	GND	Ground	
24	RXIN3-	LVDS data input	
25	RXIN3+	LVDS data input	
26	GND	Ground	
27	RESERVED	N.C.	
28	RESERVED	N.C.	
29	GND	Ground	
30	GND	Ground	

4-2 LVDS data mapping

LVDS OPTION=LOW/N.C.



LVDS OPTION=High (3.3V)



4-3. Backlight driving

Connector	Type	Manufactured
CN1	S14 B-PH-SM3 TB	JST
CN2	SM02(12B)-BHS-1-TB	JST
CN3	S2B-ZR-SM3A-TF	JST

Mating connector of CN1 : PHR-14(JST) or Equivalent

Pin No.	Symbol	Description	Remark
1	VDDB	+24V DC	
2	VDDB	+24V DC	
3	VDDB	+24V DC	
4	VDDB	+24V DC	
5	VDDB	+24V DC	
6	GND	Ground	
7	GND	Ground	
8	GND	Ground	
9	GND	Ground	
10	GND	Ground	
11	ADIM(1)	GND (0V) 80% Lum / Open (1.6V) 100% Lum / High (3.3V) 120% Lum	
12	ON/OFF	BL On-Off: Open/High (3.3V) for BL On as default	On : High, Off : Low
13	PDIM(2)	PWM Dimming Control: Open/High (3.3V) for 100% Lum	
14	PWM Selection(3)	GND: Duty Signal to 13pin, Open/High: Analog Voltage to 13 pin	

(1) ADIM is control signal for Inverter's output Power to Back Light Lamp Bulb. Input Signal should be able to control Amplitude of Inverter Output voltage. From 0V to 3.3V, Inverter Output Voltage should be able to vary to control Brightness of Lamp from 80% to 120% Luminescence variation.

(2) PDIM is PWM control input; i.e. for the given ADIM, this PDIM input should be able to control Width of Voltage Burst of inverter output for Lamp Driving. This input can have two type of input; Ordinary default setting is Duty Signal Input with 3.3V TTL specification. The other setting will be DC level signal using Saw Tooth Wave control for PWM duty control. These two method should be decided by 14th Pin input setting.

(3) 14 Pin is selection pin for PWM control method; if this pin GND, PDIM input of 13th Pin should be direct Duty Signal Input for PWM control. If this is set to Open or High, 13th Pin should have DC level signal and inverter should have Saw Tooth Wave Generator for PWM.

5. Absolute Maximum Ratings

LCD module

Parameter	Symbol	Condition	Ratings	Unit	Remark
+3.3V Input Voltage	V_{CC}	Ta=25℃	－ 0.3 ～ ＋14.0	V_{DC}	
Storage temperature	Tstg	－	－20 ～ ＋60	℃	【Note1】
Operating temperature (Ambient)	Topa	－	0 ～ ＋50	℃	

【Note1】Humidity：90%RH Max. at Ta≦40℃.

Maximum wet-bulb temperature at 39℃ or less at Ta>40℃.

No condensation.

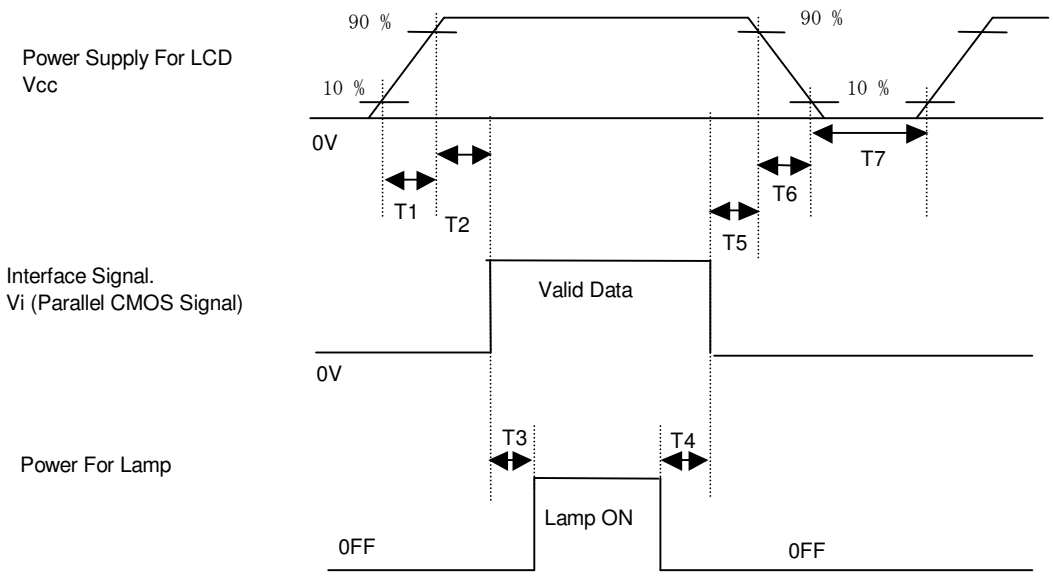
6. Electrical Characteristics

Parameter			Symbol	Min.	Typ.	Max.	Unit	Remark
Vcc	Supply voltage		Vcc	+11.4	+12	+12.6	V	【Note2】
	Current dissipation		Icc	－	400	700	mA	【Note3】
	Rush current		Iccs			3.0	A	
	Permissive Input Ripple Voltage		Vrp			120	mV	
Differential input threshold voltage		High	V_{TH}	－	－	+100	mV	V_{CM}=+1.2V 【Note1】
		Low	V_{TL}	–100	－	－	mV	
Input current (High)			I_{OH}	－	－	+/-10	μA	V_I=2.4V Vcc=3.6V
Input current (Low)			I_{OL}	－	－	+/-10	μA	V_I=0V Vcc=3.6V
Terminal resistor			R_T	－	100	－	Ω	Differential input

【Note1】V_{CM} : Common mode voltage of LVDS driver.

【Note2】

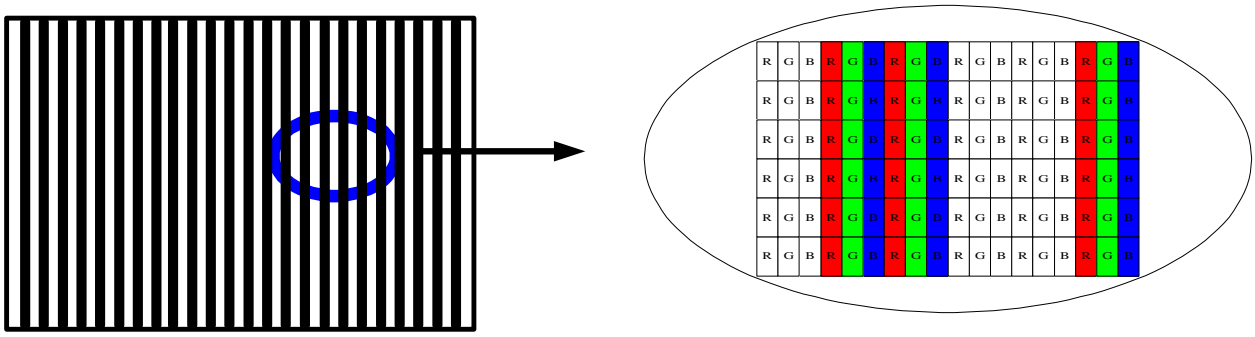
On-off conditions for supply voltage



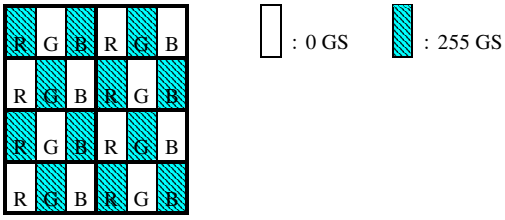
0＜t1≦10 ms ; 0＜t2≦50 ms ; 200 ms≦t3 ; 200 ms≦t4 ; 0＜t5≦50 ms ; 0＜t6≦10 ms ;
400 ms＜t7

【Note3】

Typical current condition: 2-line vertical stripe pattern (0,255GS). V_{CC}=+12V



Max current condition: 1x1dot Checker Board Pattern (0, 255GS). V_{CC}=+12V



6-2. Backlight driving

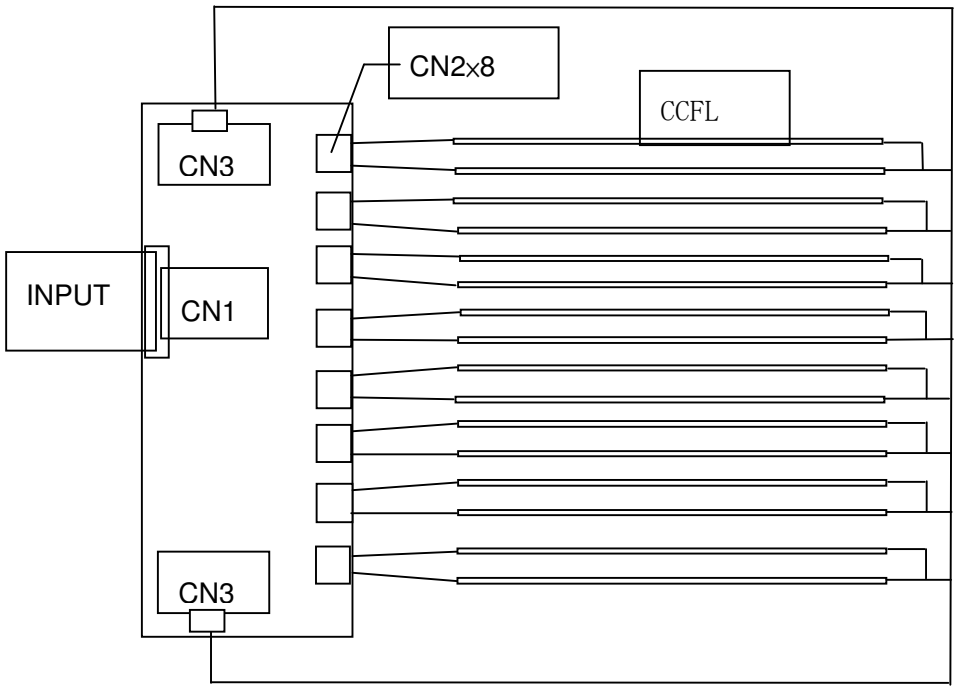
The backlight system is a direct-lighting type with 16 CCFT (Cold Cathode Fluorescent Tube).

The characteristics of the lamp are shown in the following table.

Parameter	Symbol	Min.	Typ.	Max.	Unit	Remark
Inverter						
Power Supply Input Voltage	V_{DDB}	**22.8**	**24.0**	**26.2**	**Vdc**	
Power Supply Input Current	I_{DDB}		**3.8**		**A**	
Power Consumption	P_B		**91.2**		**W**	
LAMP						
Lamp current	I_L		**5.0**		**mA**	
Lamp voltage	V_L	**(1089)**	**(1210)**	**(1331)**	**Vrms**	
Lamp power consumption	P_L		**(6.05)**		**W**	**【Note2】IL=5mA**
Lamp frequency	F_L		**(52)**		**kHz**	**【Note3】**
Established starting voltage	**Vs**		**(1360)**	**(1630)**	**Vrms**	**Ta=25℃**

			(1700)	(2040)	Vrms	Ta=0℃	【Note4】
Lamp life time	L_L	50000			hour	【Note5】	

【Note1】 Lamp current is measured with current meter for high frequency as shown below.



【Note2】 Calculated Value for reference ($I_L \times V_L$)

【Note3】 Lamp frequency may produce interference with horizontal synchronous frequency, and this may cause beat on the display. Therefore lamp frequency shall be detached as much as possible from the horizontal synchronous frequency and from the harmonics of horizontal synchronous to avoid interference.

【Note4】 The voltage above this value should be applied to the lamp for more than 1 second to start-up. Otherwise the lamp may not be turned on.

【Note5】 The life is determined as the time at which luminance of the lamp is 50% compared to that of initial value at the typical lamp current on condition of continuous operating at 25 ± 2°C.

【Note6】 The performance of the backlight, for example life time or brightness, is much influenced by the characteristics of the DC-AC inverter for the lamp. When you design or order the inverter, please make sure that a poor lighting caused by the mismatch of the backlight and the inverter (miss-lighting, flicker, etc.) never occur. When you confirm it, the module should be operated in the same condition as it is installed in your instrument.

【Note7】 Protection function : if one lamp cannot light on well, the inverter will shut down all lamps.

【Note8】 The value with "()" is the temporary spec that will be defined at the final spec

7. Timing characteristics of LCD module input signals

7-1. Timing characteristics

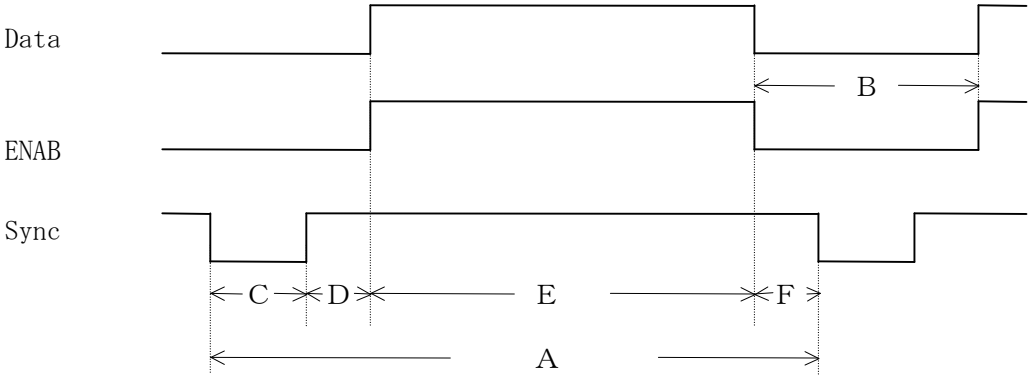
7-1. Timing characteristics

ITIME	Symbol		Min	Typ	Max	Unit	Notes
DCLK	Frequency	F_{CLK}	-	80	82	MHz	
	Period	t_{CLK}	12.2	12.5	-	ns	
Hsync	Period	t_{HA}	1512	1648	1780	t_{CLK}	
	Width-Active	t_{HC}	8	16	-		
	Frequency	fH	44	48.54	52	kHz	
Vsync	Frequency	fv	47	60	63	Hz	
	Period	t_{VA}	774	810	-	t_{HA}	
	Width-Active	t_{VC}	2	6	-		
Data Enable	Horizontal back porch	t_{HD}	8	80	-	t_{CLK}	
	Horizontal front porch	t_{HF}	16	186	-	t_{CLK}	
	Horizontal active	t_{HE}	1366	1366	1366	t_{CLK}	
	Horizontal blanking	t_{HB}	146	282		t_{CLK}	
	Vertical back porch	t_{VD}	2	20	-	t_{HA}	
	Vertical front porch	t_{VF}	2	16	-	t_{HA}	
	Vertical active	t_{VE}	768	768	768	t_{HA}	
	Vertical blanking	t_{VB}	6	42		t_{HA}	

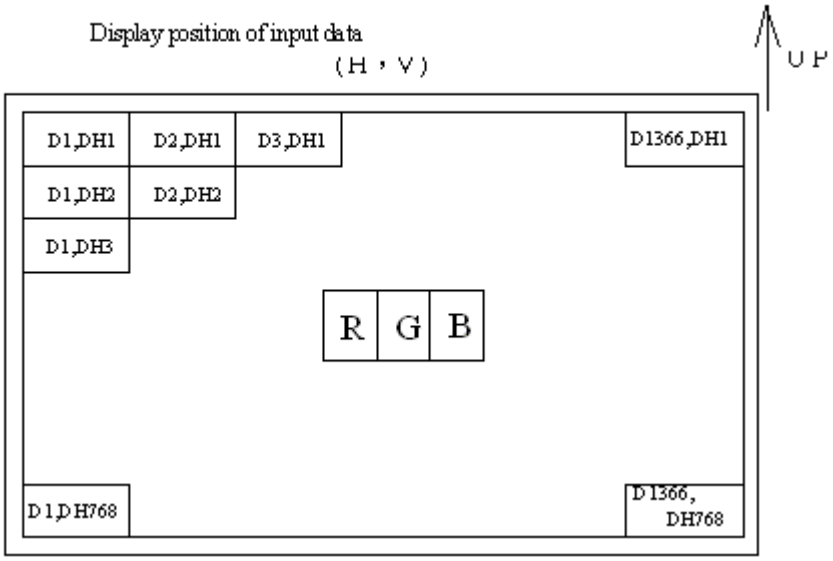
Notes: 1. The performance of electro-optical characteristics may be influenced by variance of the vertical refresh rates.

2.Hsync period shall be a double number of chraracter (8).

7-2 Signal Timing Waveform



7-3. Input Data Signals and Display Position on the screen



8. Input Signals, Basic Display Colors and Gray Scale of Each Color

	Colors & Gray scale	Gray Scale	Data signal																							
			R0	R1	R2	R3	R4	R5	R6	R7	G0	G1	G2	G3	G4	G5	G6	G7	B0	B1	B2	B3	B4	B5	B6	B7
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
	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
	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
	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	Black	GS0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	⇧	GS1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Darker	GS2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	⇧	↓					↓							↓									↓			
	⇩	↓					↓							↓									↓			
	Brighter	GS253	1	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	⇩	GS254	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red	GS255	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	Black	GS0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	⇧	GS1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Darker	GS2	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	⇧	↓																								
	⇩	↓																								
	Brighter	GS253	0	0	0	0	0	0	0	0	1	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	⇩	GS254	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	Green	GS255	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	Black	GS0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	⇧	GS1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
	Darker	GS2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
	⇧	↓																								
	⇩	↓																								
	Brighter	GS253	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	1	1	1
	⇩	GS254	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1
	Blue	GS255	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1

0 : Low level voltage, 1 : High level voltage

Each basic color can be displayed in 256 gray scales from 8 bit data signals. According to the combination of

total 24 bit data signals, the 16,777,216-color display can be achieved on the screen.

9. Optical Characteristics **Ta=25℃, V_{CC}=+12V**

Parameter		Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Viewing angle range	L/R	θ 21, θ 22	CR>10	80	85		Deg.	【Note1,4】
	U	θ 11		80	85		Deg.	
	D	θ 12		80	85		Deg.	
Contrast ratio		CRn	θ =0°	600	800	—		【Note2,4】
Response time(on/off)		τ		—	25		ms	【Note3,4】
Rise time	τ r				21		ms	
Fall time	τ d				4		ms	
Response time(gray to gray)		τ			8	16		
Chromaticity of White (CIE 1931)		Wx		0.246	0.276	0.306		【Note4】
		Wy		0.236	0.266	0.296		
Chromaticity of Red (CIE 1931)		Rx		0.613	0.643	0.673		
		Ry		0.305	0.335	0.365		
Chromaticity of Green (CIE 1931)		Gx		0.252	0.282	0.312		
		Gy		0.571	0.601	0.631		
Chromaticity of Blue (CIE 1931)		Bx		0.116	0.146	0.176		
		By		0.039	0.069	0.099		
Luminance of white 【Note4】		Y_L		400	500		Cd/m^2	
White Uniformity		$\delta_{W(5P)}$		—	-	1.3		【Note5】
Black Uniformity		$\delta_{B(5P)}$				1.3		【Note5】

※ **The measurement shall be executed 30 minutes after lighting at rating. (typical condition : I_L = 5.0 mArms)**

The optical characteristics shall be measured in a dark room or equivalent state with the method shown in Fig.3 below.

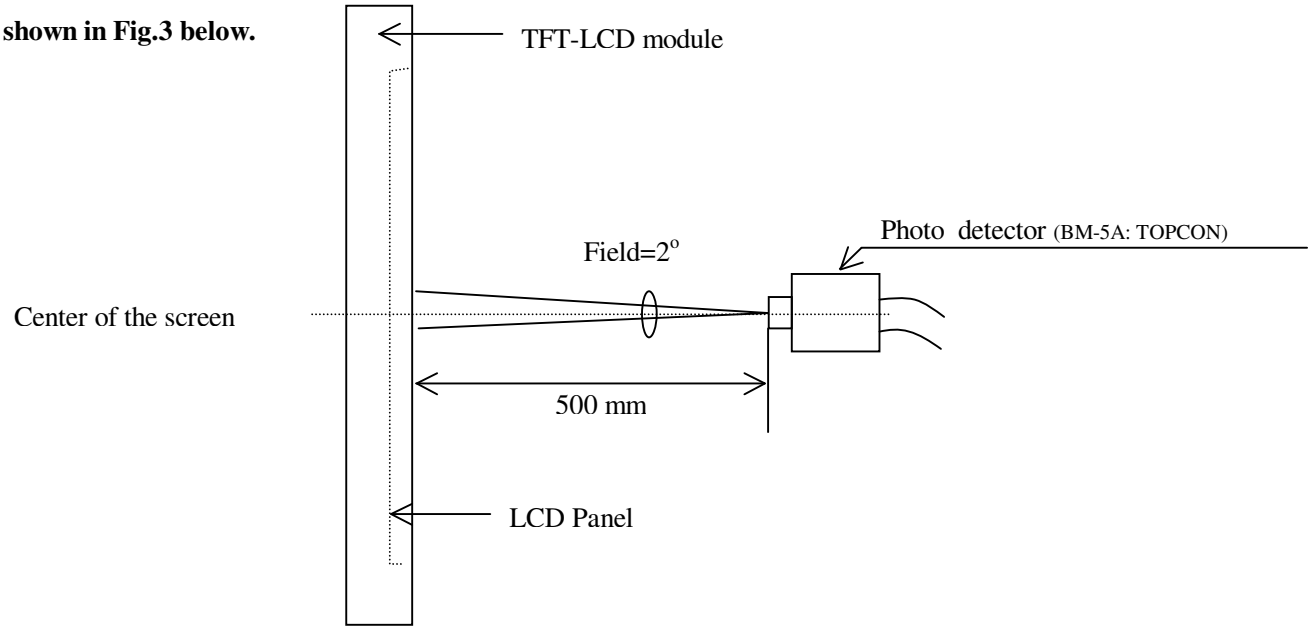
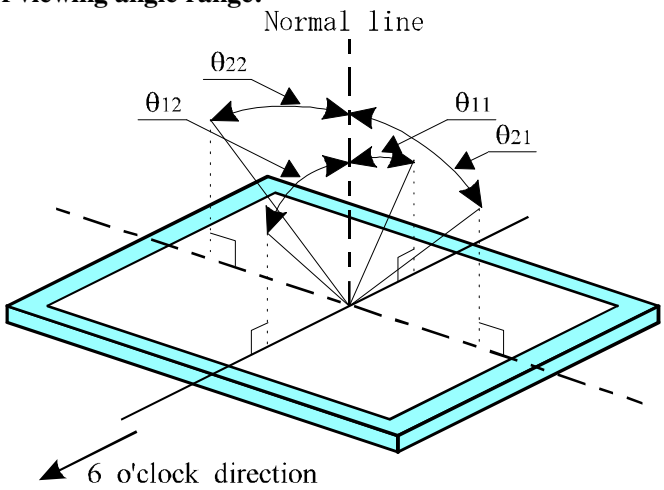


Fig 1. Optical characteristics measurement method

【Note1】 Definitions of viewing angle range:



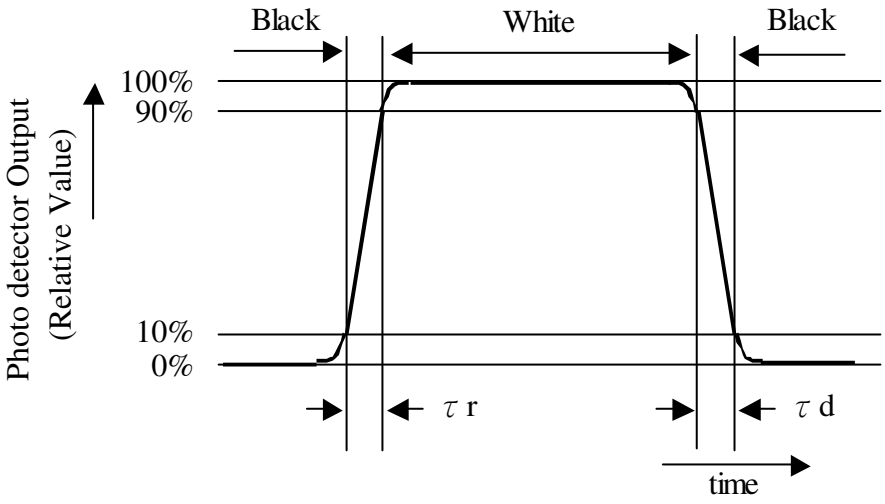
【Note2】 Definition of contrast ratio:

The contrast ratio is defined as the following.

$$\text{Contrast Ratio (CR)} = \frac{\text{Luminance (brightness) with all pixels white}}{\text{Luminance (brightness) with all pixels black}}$$

【Note3】 Definition of response time:

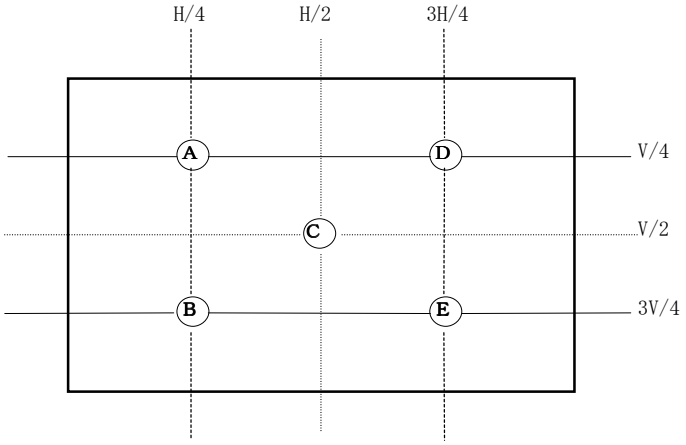
The response time is defined as the following figure and shall be measured by switching the input signal for "black" and "white" .



【Note4】 This shall be measured at center of the screen.

【Note5】Definition of white uniformity:

White uniformity is defined as the following the number of measurement points within active area, formula are δw(5)(A～E). HxV : active area



$$\delta_{W,B} = \frac{\text{Maximum Luminance (of 5 points measurement)}}{\text{Minnum Luminance (of 5 points measurement)}}$$

10. Display Quality

The display quality of the color TFT-LCD module shall be in compliance with the Incoming Inspection Standard.

11. Handling Precautions

a) Be sure to turn off the power supply when inserting or disconnecting the cable.

b) Be sure to design the cabinet so that the module can be installed without any extra stress such as warp or twist.

c) Since the front polarizer is easily damaged, pay attention not to scratch it.

d) Wipe off water drop immediately. Long contact with water may cause discoloration or spots.

e) When the panel surface is soiled, wipe it with absorbent cotton or other soft cloth.

f) Since the panel is made of glass, it may break or crack if dropped or bumped on hard surface. Handle with care.

g) Since CMOS LSI is used in this module, take care of static electricity and injure the human earth when handling.

h) Observe all other precautionary requirements in handling components.

i) This module has its circuitry PCBs on the rear side and should be handled carefully in order not to be stressed.

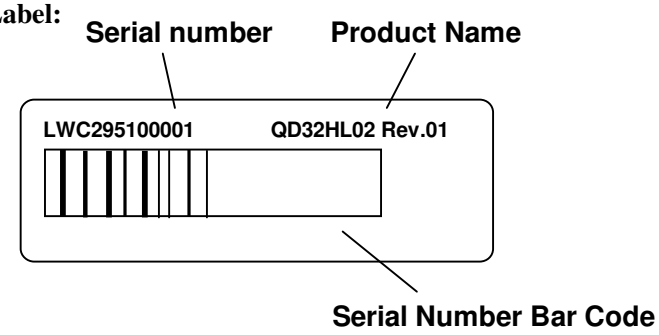
j) Laminated film is attached to the module surface to prevent it from being scratched . Peel the film off slowly just before the use with strict attention to electrostatic charges. Ionized air shall be blown over during the action. Blow off the 'dust' on the polarizer by using an ionized nitrogen gun, etc..

12.Reliability test items

No.	Test item	Conditions
1	High temperature storage test	Ta = 60℃ 240h
2	Low temperature storage test	Ta = -20℃ 240h
3	High temperature & high humidity operation test	Ta = 40℃ ; 95%RH 240h (No condensation)
4	High temperature operation test	Ta = 50℃ 240h
5	Low temperature operation test	Ta = 0℃ 240h
6	Vibration test (non- operating)	Frequency: 10～500Hz, 1.0G , 1Hr/each axis
7	Shock test (non- operating)	Gravity : 100G Pulse width : 2 ms, half sine wave Direction : ±X,±Y,±Z Once for each direction.
8	ESD	Contact-op:+-8kv, Contact-nop: +-10kv, Air-op:+-15kv, Air-nop: +-20kv, (contact area is limited on metal bezel)

13. Others

1) Lot No. Label:



LWC295100001 **Digital code 4, 5 is Date code.**

Digital 4 (Year) 1: 2001, 2: 2002, 3:2003,….

Digital 5 (Month) 1: Jan, 2: Feb,… , A:Oct, B:Nov., C: Dec.

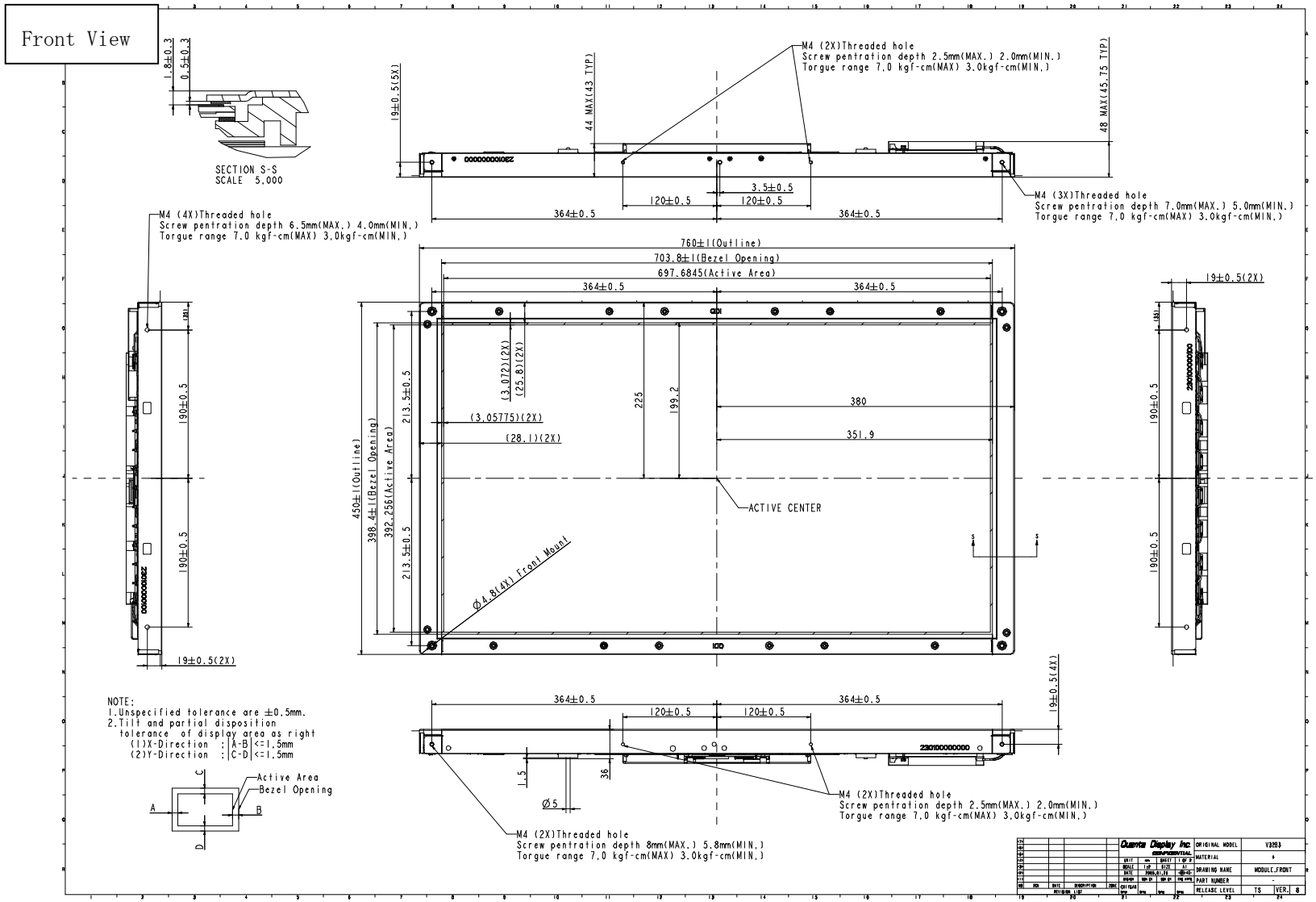
2) Adjusting volume has been set optimally before shipment, so do not change any adjusted value. If adjusted value is changed, the specification may not be satisfied.

3) Disassembling the module can cause permanent damage and should be strictly avoided.

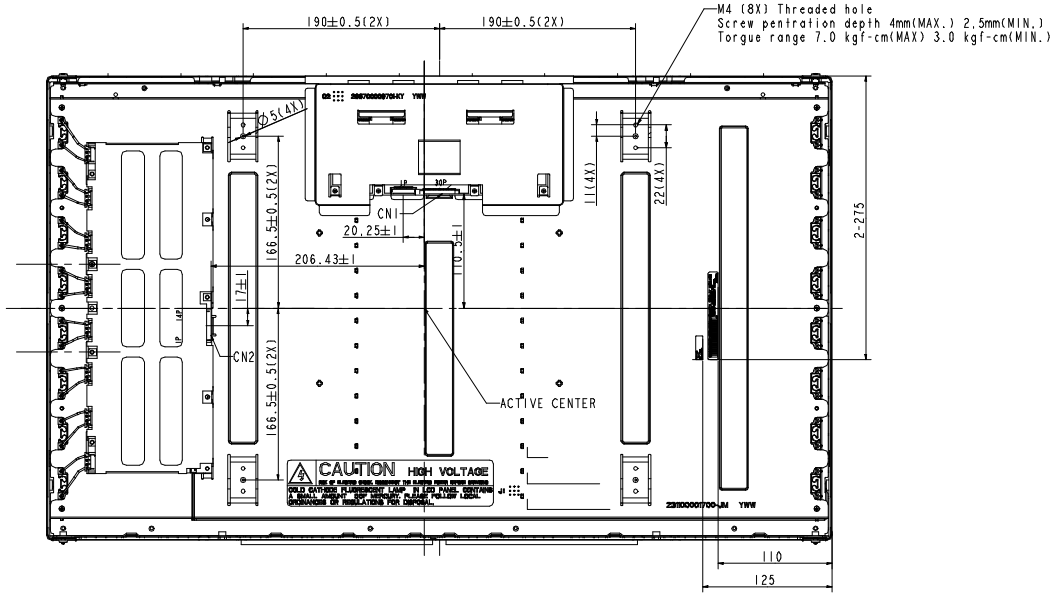
4) Please be careful since image retention may occur when a fixed pattern is displayed for a long time.

5) If any problem occurs in relation to the description of this specification, it shall be resolved through discussion with spirit of cooperation.

14. Drawing


Front View
SECTION S-S
SCALE 5.000
M4 (2X)Threaded hole
Screw pentration depth 2.5mm(MAX.) 2.0mm(MIN.)
Torgue range 7.0 kgf-cm(MAX) 3.0kgf-cm(MIN.)
M4 (3X)Threaded hole
Screw pentration depth 7.0mm(MAX.) 5.0mm(MIN.)
Torgue range 7.0 kgf-cm(MAX) 3.0kgf-cm(MIN.)
M4 (4X)Threaded hole
Screw pentration depth 6.5mm(MAX.) 4.0mm(MIN.)
Torgue range 7.0 kgf-cm(MAX) 3.0kgf-cm(MIN.)
760±1(Outline)
703.8±1(Bezel Opening)
697.6845(Active Area)
364±0.5
120±0.5
3.5±0.5
ACTIVE CENTER
Ø4.8(4X) Front Mount
M4 (2X)Threaded hole
Screw pentration depth 8mm(MAX.) 5.8mm(MIN.)
Torgue range 7.0 kgf-cm(MAX) 3.0kgf-cm(MIN.)
NOTE:
1.Unspecified tolerance are ±0.5mm.
2.Tilt and partial disposition
tolerance of display area as right
(1)X-Direction : |A-B|<=1.5mm
(2)Y-Direction : |C-D|<=1.5mm
Active Area
Bezel Opening
Quanta Display Inc
ORIGINAL MODEL V32H3
MATERIAL
DRAWING NAME MODULE_FRONT
PART NUMBER
RELEASE LEVEL TS VER. 8

Back View



NOTE:
1. CN1: The Interface Connector is FI-E30S (JAE)
2. CN2:The Connector of Inverter is SI4B-PH-SM3(JST)

Quanta Display Inc. CONFIDENTIAL	
ORIGINAL MODEL	V32C3
MATERIAL	-
DRAWING NAME	OUTLINE_V32C3(REAR)
PART NUMBER	-
REVISION	T00 VER. 11*