Prepared by: Date 02/06/2004	**Quanta Display Inc. SPECIFICATION**	**Doc. No. QD17VL01-01**
		Doc. Rev. : 01
		Issue Date :02/06/2004
		Page: 21 pages (Include cover page, drawing)
Preliminary		

Specification for
TFT LCD Module

Model No. QD17VL01 REV:01

☐ **Customer's Approval**

Date _____

by _____

Approved By _____

These specification sheets are the proprietary product of Quanta Display Inc. ("QDI") and include materials protected under copyright of QDI. Do not reproduce or cause any third party to reproduce them in any form or by any means, electronic or mechanical, for any purpose, in whole or in part, without the express written permission of QDI.

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	05/27/2004	N/A	Preliminary specification Initiate

Content List

1. Application

This specification applies to a color TFT-LCD module, QD17VL01

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 640×3×480 dots panel with 16.7 million colors by using the LVDS (Low Voltage Differential Signaling) interface, 8-bit driving method and supplying +5V DC supply voltage for TFT-LCD panel driving.

The TFT-LCD panel used for this module has very high aperture ratio. 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 the LCD TV,HDTV and multimedia use, can be obtained by using this module.

[Features]

1) High aperture panel; high-brightness or low power consumption.
2) Brilliant and high contrast image.
3) 1 Channel LVDS (6-bit + FRC) interface compatible

3. General Specifications

Parameter	Specifications	Unit
Display size	430.8 (17") Diagonal	mm
Active area	344.64 (H)×258.48 (V)	mm
Pixel format	640 (H)×480 (V) (1 pixel = R+G+B dots)	Pixel
Pixel pitch	0.1795x3(H) × 0.5385(V)	mm
Pixel configuration	R,G,B vertical stripe	
Display mode	Normally White	
Unit outline dimensions	393(W)×286 (H)×41.8(T)	mm
Thickness	Max. 42. 8	mm
Weight	TBD	g
Surface treatment	Anti-glare & Hardness:3H	
Lamp Quantity	Direct 4 U-lamp	pcs

4. Input Terminals

4-1. TFT-LCD panel driving

CN1 (LVDS signals and +5V DC power supply)

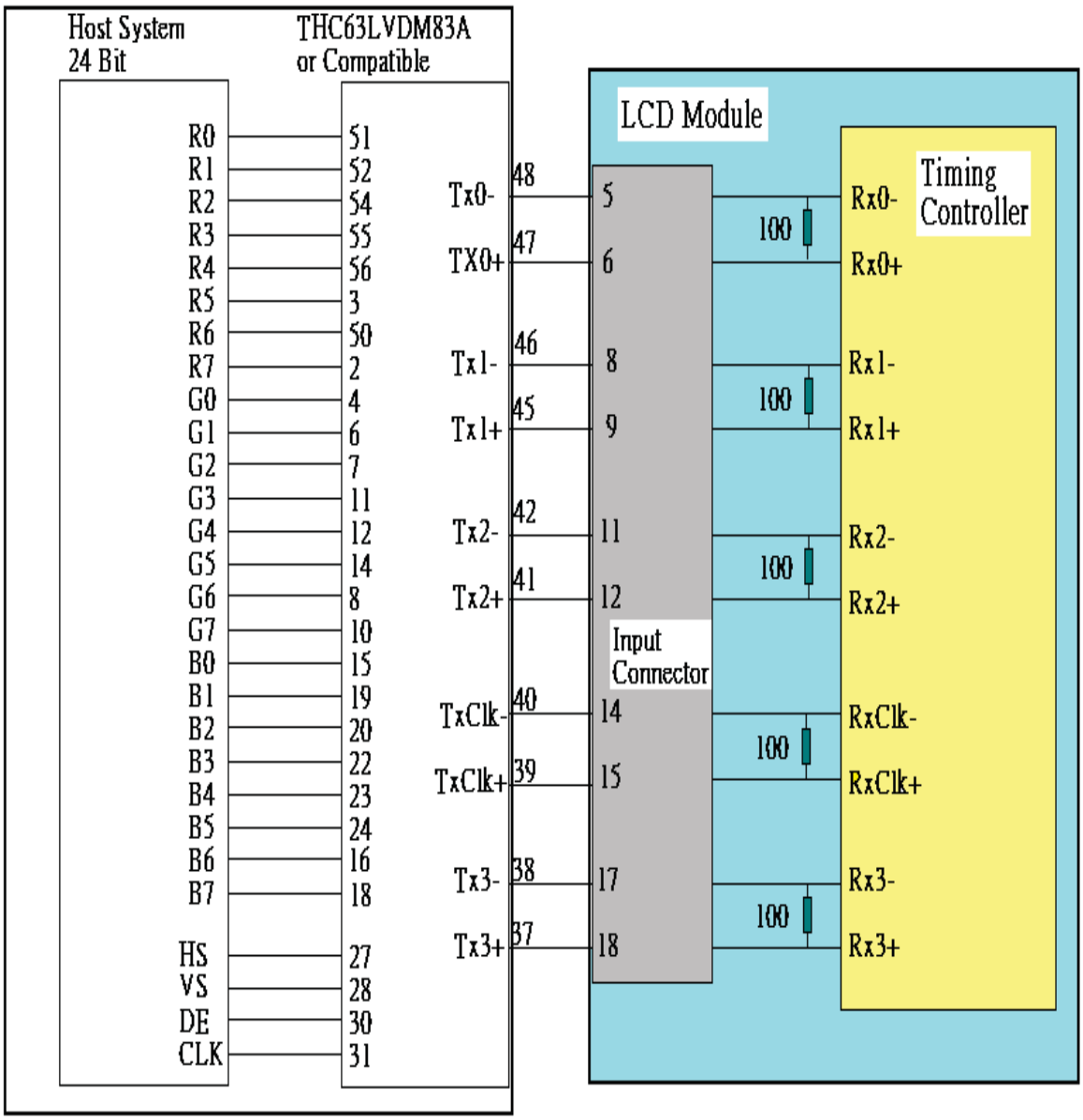
Using connector: DF14-20P-1.25H (Hirose) or Equivalent

Pin No.	Symbol	Function	Remark
1	VDD	+5V Input	
2	VDD	+5V Input	
3	GND	Power Ground	
4	GND	Power Ground	
5	RxIN0-	Receiver signal (-)	LVDS
6	RxIN0+	Receiver signal (+)	LVDS
7	GND	Ground	
8	RxIN1-	Receiver signal (-)	LVDS
9	RxIN1+	Receiver signal (+)	LVDS
10	GND	Ground	
11	RxIN2-	Receiver signal (-)	LVDS
12	RxIN2+	Receiver signal (+)	LVDS
13	GND	Ground	
14	CLKIN-	Clock signal (-)	LVDS
15	CLKIN+	Clock signal (+)	LVDS
16	GND	Ground	
17	RxIN3-	Receiver signal (-)	LVDS
18	RxIN3+	Receiver signal (+)	LVDS
19	GND	Ground	
20	GND	Ground	

【Note 1】 All GND(ground) pins should be connected together.

【Note 2】 All V_{DD} (power supply) pins should be connected together.

4-2 Interface block diagram



4-3. Backlight driving

Connector	Type	Manufactured
CN1	V_{High}	Power Supply for lamp (High Voltage Side)
CN2	N/A	N/A
CN3	V_{Low}	Power Supply for lamp (Low Voltage Side)

Connector	Type	Manufactured
CN1	S10B-PH-SM3-TB	JST

5.Absolute Maximum Ratings

LCD module

Parameter	Symbol	Condition	Ratings	Unit	Remark
+5V supply voltage	V_{DD}	Ta=25℃	-0.3 ~ 6.0	V	
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

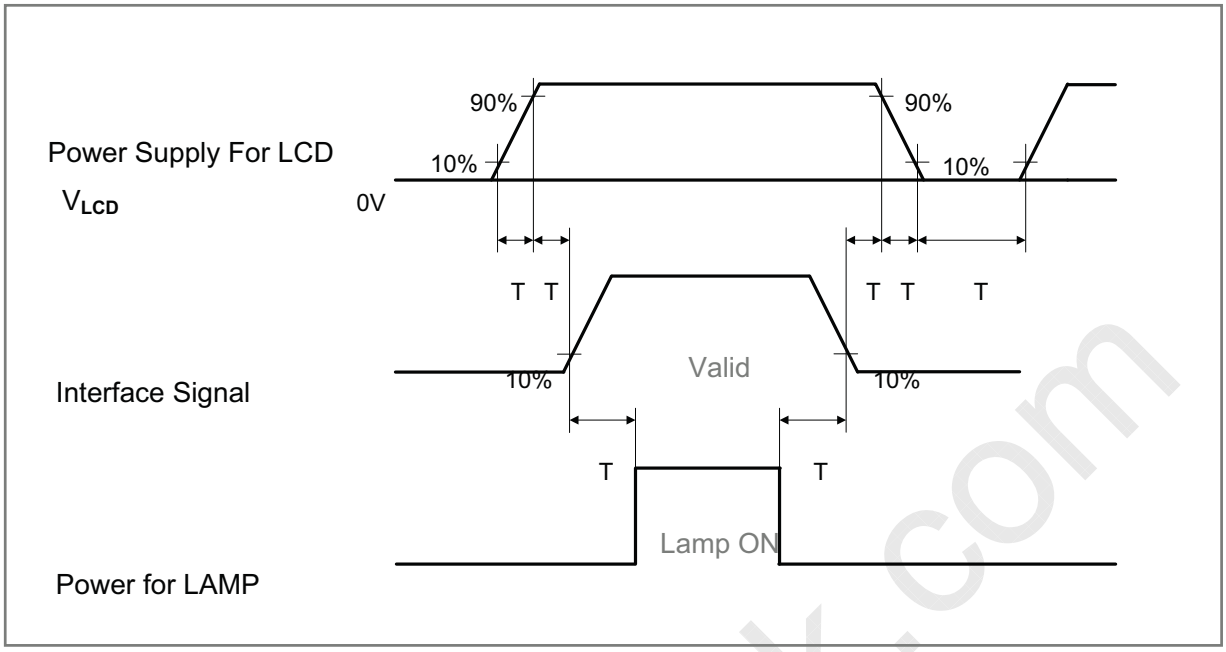
6-1.TFT-LCD panel driving Ta＝25℃

Parameter		Symbol	Min.	Typ.	Max.	Unit	Remark
V_{DD}	Supply voltage	V_{DD}	4.5	5.0	5.5	V	【Note2】
	Current dissipation	I_{DD}	-	230	300	mA	【Note3】
Permissive input ripple voltage		V_{RP}	-	-	100	mV p-p	V_{DD}=+5V
Differential input threshold voltage	High	V_{TH}	-	-	100	100	V_{CM}=+1.2V 【Note1】
	Low	V_{TL}	-100	-	-	mV	
Rush current		I_{RUSH}	-	-	3.0	A	Rise time 1mS

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

【Note2】

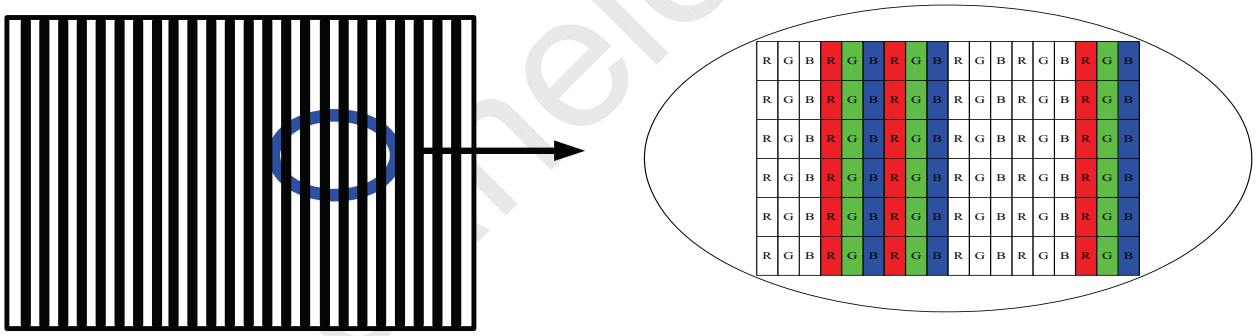
Power On-off sequence



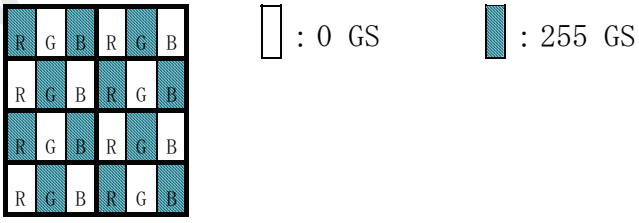
1ms＜T1≦10ms ; 0＜T2≦50ms ; 200ms≦T3 ; 200ms≦T4 ; 0＜T5≦50ms ; 0＜T6≦10ms ; 400ms≦T7

【Note3】

Typical current condition; 2-line vertical stripe pattern (0,255GS). V_{DD}=+5V



Maximum current condition; Change to 1x1 dot checkerboard pattern. V_{DD}=+5V



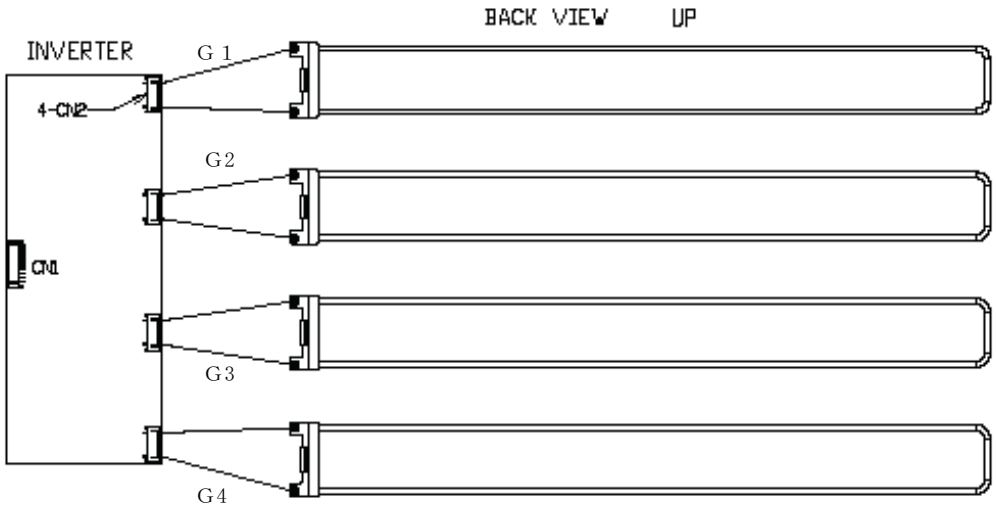
6-2. Backlight driving

The backlight system is a direct-lighting type with Direct 4 U-lamp.

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

Parameter	Symbol	Min.	Typ.	Max.	Unit	Remark
Lamp current range	I_L	-	(4. 7)	-	mArms	【Note1】
Lamp voltage	V_L	-	1,380	-	Vrms	
Lamp power consumption	P_L	-	6.5	-	W	【Note2】 IL=mA
Lamp frequency	F_L	-	42	-	kHz	【Note3】
Established starting voltage	Vs	-	-	2,470	Vrms	Ta=25℃
		-	-	2,660	Vrms	Ta=0℃ 【Note4】
Lamp life time	L_L	50,000	-	-	hour	【Note5】

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



【Note2】 Calculated Value for reference (I_L × 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】 Lamp life time is defined as the time when either ① or ② occurs in the continuous operation under the condition of Ta = 25℃ and I_L = mArms.

① Brightness becomes 50 % of the original value under standard condition.

② Kick-off voltage at Ta = 0℃ exceeds maximum value.

【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】The lamp wire length is +/- mm(from AL back cover surface to connector, not including connector length)

6-3 Backlight inverter

6-3-1 Backlight inverter connector and pin assignments

Inverter connector CN1 : S10B-PH-SM3-TB(JST) or Equivalent

Mating connector :PHR-10(JST) or Equivalent

CN1 : Inverter connector pin assignments

Pin No.	Symbol	Description	Remark
1	VDD	Power Input +12V	
2	VDD	Power Input +12V	
3	VDD	Power Input +12V	
4	GND	Ground	Connected to metal frame
5	GND	Ground	
6	GND	Ground	
7	NC	Not connection	
8	BRTC	Backlight On/OFF signal	High : On , Low: Off
9	BRTI	Luminance by voltage method	3-5V: 100%, 0V: 20%
10	SGND	Signal Ground	Connected to metal frame

6-3-2. Inverter Electrical Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit	Notes
Power Supply Input Voltage	V_{DDB}	10.8	12.0	13.2	Vdc	
Power Supply Input Current	I_{DDB}	-	(2,500)	-	mA	
Power Consumption	P_B	-	(30)	-	W	

7. Timing characteristics of LCD module input signals

7-1. Timing characteristics

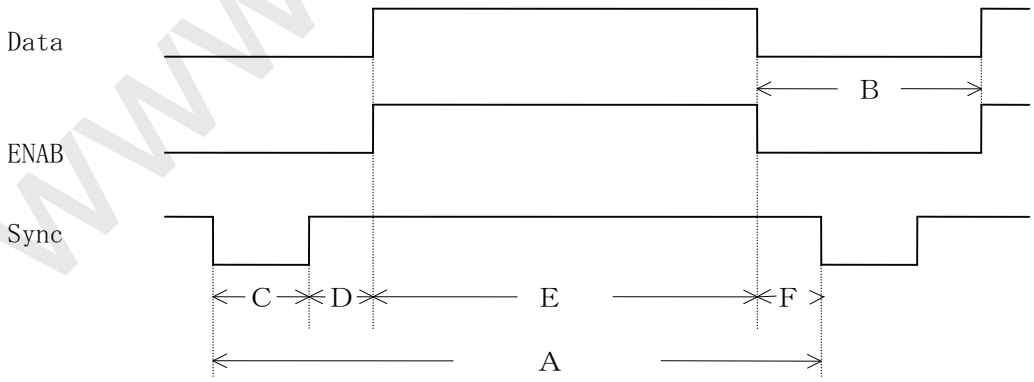
(This is specified at digital outputs of LVDS driver.)

Item	Symbol		Min	Typ	Max	Unit	Remark
Data Clock	Period	t_{CLK}	31.7	39.72	-	ns	
	Frequency	F_{CLK}	-	25.175	31.5	MHZ	
Hsync	Period	t_{HA}	-	800	-	tCLK	
	Frequency	fH	-	31.469	37.5	KHZ	
	Width	t_{HC}	10	96	-	tCLK	
Vsync	Period	t_{VA}	-	525	-	t_{HA}	NTSC: 57~63HZ
	Frequency	fv	47	60	75	HZ	PAL: 47~53HZ
	Width	t_{VC}	2	2	-	t_{HA}	
DE (Data Enable)	Horizontal Valid	t_{HE}	640	640	640	tCLK	
	Horizontal Back Porch	t_{HD}	8	48	-		
	Horizontal Front Porch	t_{HF}	16	16	-		
	Horizontal Blank	t_{HB}	34	160	-		
	Vertical valid	t_{VE}	480	480	480	t_{HA}	
	Vertical Back Porch	t_{VD}	2	33	-		
	Vertical Front Porch	t_{VF}	2	10	-		
	Vertical Blank	t_{VB}	6	45	-		

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

2. Hsync period will be a double number of character (8).

7-2 Signal Timing Waveform(The time "B" is t_{HB} on horizontal timing and t_{VB} on vertical timing)



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

	Colors & 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	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	0	0	0	0	0	0	0
	Darker	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	⇧				↑								↑								↑				
	⇩				↓								↓								↓				
	Bright	1	0	1	1	1	1	1	1	0	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
	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
Gray Scale of Green	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	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Darker	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	⇧				↑								↑								↑				
	⇩				↓								↓								↓				
	Bright	0	0	0	0	0	0	0	0	1	0	1	1	1	1	1	1	0	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
	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
Gray Scale of Blue	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	1	0	0	0	0	0	0	0
	Darker	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
	⇧				↑								↑								↑				
	⇩				↓								↓								↓				
	Bright	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	1	1	1
	⇩	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	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

9. Optical Characteristics

Ta=25℃, V_{DD}=+5V

Parameter		Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Viewing angle range	L/R	θ 21, θ 22	CR>10	65	75		Deg.	【Note1,4】
	U	θ 11		60	65		Deg.	
	D	θ 12		55	60		Deg.	
Contrast ratio		CRn	θ =0°		500	—		【Note2,4】
Response time		τ		—	16		ms	【Note3,4】
Rise time	τ r				TBD		ms	
Fall time	τ d				TBD		ms	
Chromaticity of White (CIE 1931)		Wx		0.255	0.285	0.315		【Note4】
		Wy		0.264	0.294	0.324		
Chromaticity of Red (CIE 1931)		Rx		TBD	TBD	TBD		
		Ry		TBD	TBD	TBD		
Chromaticity of Green (CIE 1931)		Gx		TBD	TBD	TBD		
		Gy		TBD	TBD	TBD		
Chromaticity of Blue (CIE 1931)		Bx		TBD	TBD	TBD		
		By		TBD	TBD	TBD		
Luminance of white 【Note4】		Y_L			450		Cd/m^2	
White Uniformity		δ w		—	-	1.25		【Note5】

※ The measurement shall be executed 30 minutes after lighting at rating. (typical condition : I_L = 4.7mA rms)

The optical characteristics shall be measured in a dark room or equivalent state with the method shown in Fig.1 below.

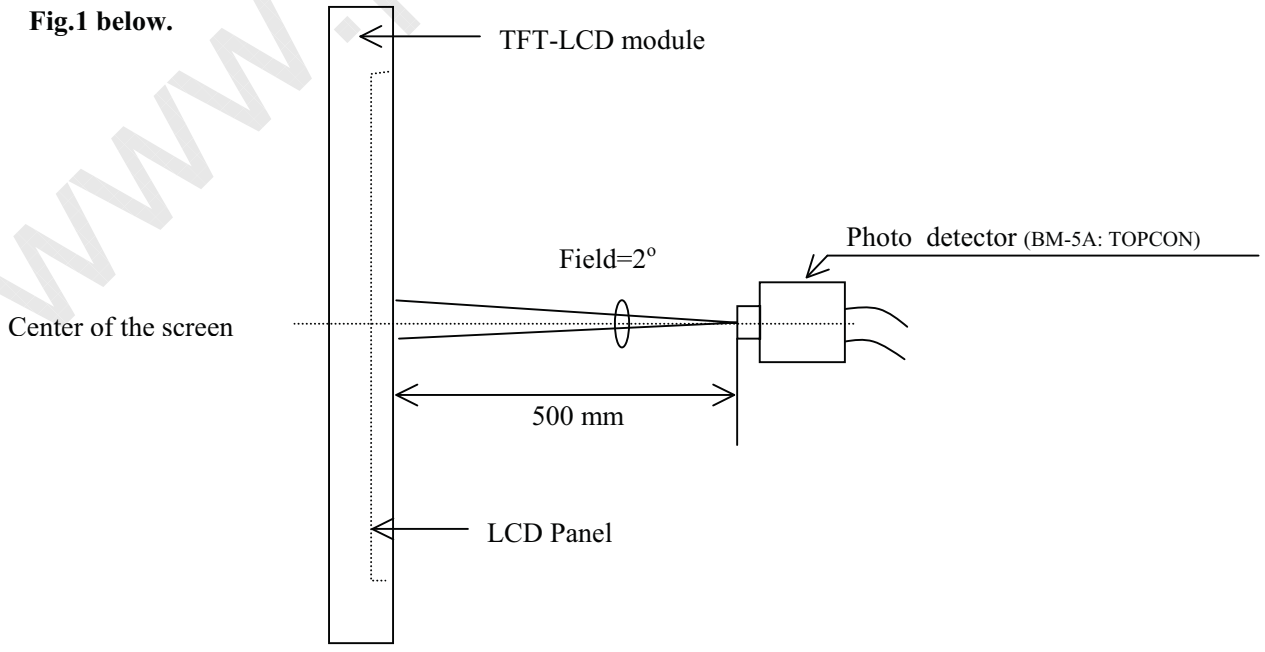
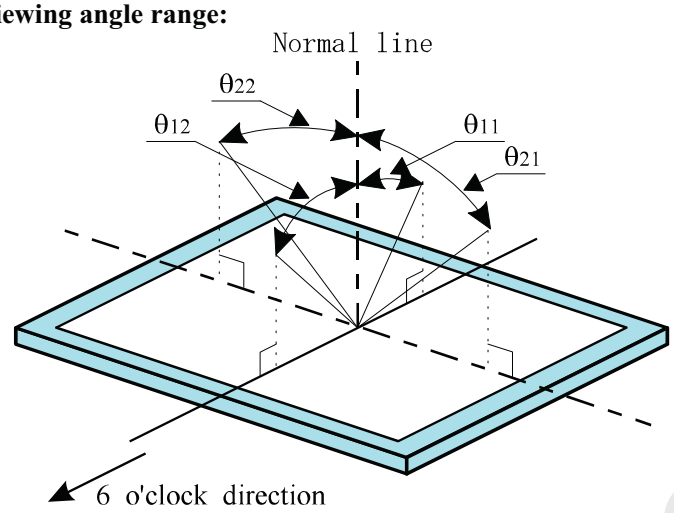


Fig 1. Optical characteristics measurement method

【Note1】 **Definitions of viewing angle range:**



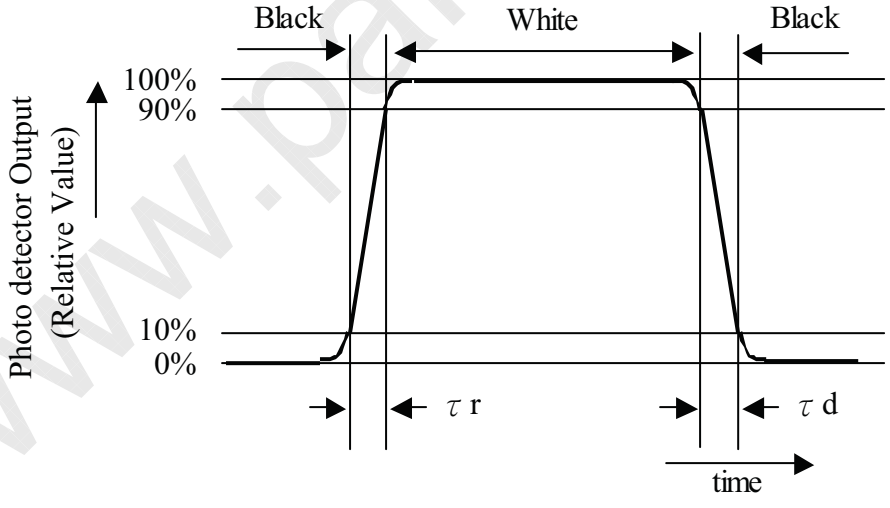
【Note2】 **Definition of contrast ratio:**

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:**

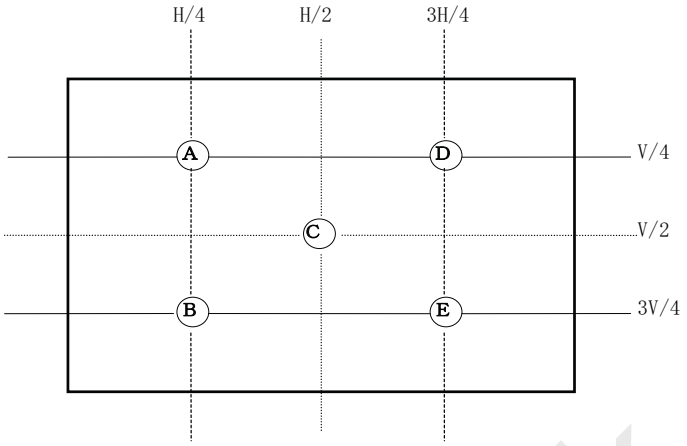
The response time is defined as the following figure and shall be measured by switching the input signal for "black" and "white" .



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

【Note5】Definition of white uniformity:

White uniformity is defined as the following with five measurements (A～E).HxV : active area



$$\delta_W = \frac{\text{Maximum Luminance (of 5 points measurement)}}{\text{Minnum Luminance (of 5 points measurement)}}$$

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

12.1 Reliability test items

No.	Test item	Conditions
1	High temperature storage test	Ta = 70℃ 500h
2	Low temperature storage test	Ta =-30℃ 500h
3	High temperature & high humidity operation test	Ta = 50℃ ; 95 %RH 500h
4	High temperature operation test	Ta = 60℃ 500h
5	Low temperature operation test	Ta = 0℃ 500h
6	Vibration test (non- operating)	Frequency: 10～500Hz, 1.2G , 1 Hr/each axis
7	Shock test (non- operating)	Gravity: 100G Pulse width: 2ms, half sine wave Direction : ±X,±Y,±Z Once for each direction.
		Gravity: 50G Pulse width: 11ms, 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)

12.2 消費電力/輝度/對比/色度在240Hrs測試後需符合

ITEM	測試前	240 hrs 測試後	remark
輝度			
五點均勻度			
色度			
消費電力			
對比			

12.3 環境測試注意事項

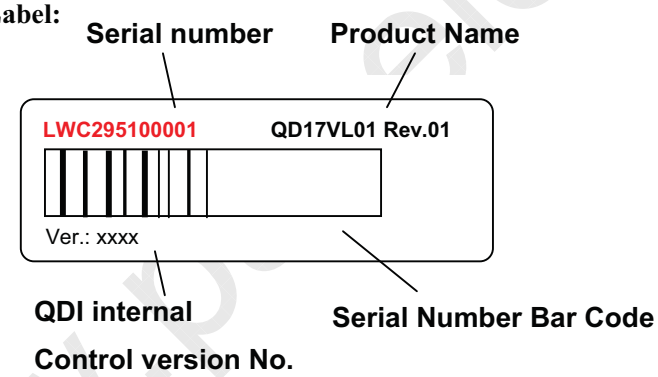
1. Module 回至室溫條件與操作方法
   (1)實驗結束後，LCD module 應置於 chamber 內以 20^0 C / hour 回温至常温(25±3 ^{0} C),才可取出 chamber，靜置 2~3 hours 後再行評價
   (2) 若初判有外觀 NG 問題產生，則放置 2 天後，再進行最終判定
2. Module 放置方法
   LCD module 應該垂直置放(+0,-30 度)於 chamber 內作環境測試，評價時亦然
3. 判定基準
   (1).沒有動作不良的發生。
   (2) 結構固定件無失效發生。
   (3). FPC cable 之connector 沒有脫落。
   (4) 消費電力/輝度/對比/色度在240Hrs測試後需符合內部仕樣書。
   (5) 光學品味在240Hrs測試後以5% ND filter與正常可視角度檢查無任何MURA。
   (6) 溫度低於0℃之信賴性檢查，燈管造成的暗區不列入判定
   (7) 溫度大於40℃以上之信賴性檢查,不將Edge Mura列入判定準則,因Polarizer使用SWV film 之故.

13. Module outline dimension

Parameters	Symbol	Min	Typ	Max	Unit	Remark
Module Outline Size	L				mm	
	W				mm	
	H				mm	
Center of Mounting Hole	H1				mm	
	H2				mm	
Bezel width	Bx				mm	
	By				mm	
Opening Size	Ox				mm	
	Oy				mm	
LVDS connector location	LCNx				mm	
	LCNy				mm	
Lamp wire location and lead length	Lpu				mm	
	LPl				mm	
BM width (all 4 sides)	BMu				mm	
	BMd				mm	
	BMl				mm	
	BMr				mm	
Weight					grams	

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.

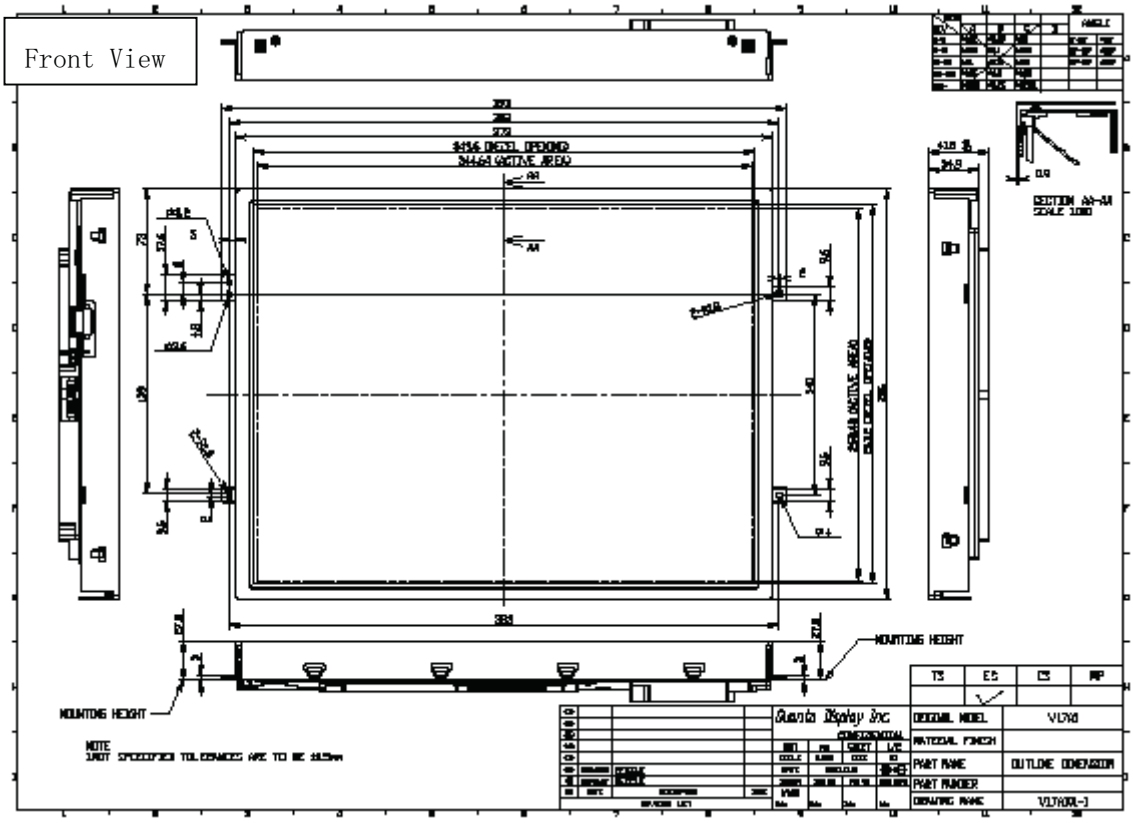
3) Disassembling the module can cause permanent damage and should be strictly avoided.

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.

Drawing

Front View



Back View