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Specification for
TFT LCD Module
Model No.
QD15XL02 Rev. 02

☐ 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
00	11/06/2003	N/A	Preliminary specification Initiate
01	12/16/2003	N/A	~~Dot defect : 3,6,6 update to 3,5,5~~ separate IIS spec
02	01/05/2003	N/A	Update the lamp life time(typ.) , view angle(CR>5) and Lum.(min)

1. Application

This specification applies to a color TFT-LCD module, QD15XL02.

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 1024×3×768 dots panel with 262,144 colors by using LVDS (Low Voltage Differential Signaling) to interface and supplying +3.3V DC supply voltage for TFT-LCD panel driving and supply voltage for backlight.

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 multimedia use, can be obtained by using this module.

Optimum viewing direction is 6 o'clock.

[Features]

1) High aperture panel; high-brightness or low power consumption.
2) Brilliant and high contrast image.
3) Small footprint and thin shape.
4) Light weight.

3. Mechanical Specifications

Parameter	Specifications	Unit
Display size	15” Diagonal	inch
Active area	304.1X228.1	mm
Pixel format	1024 (H)×768 (V)	Pixel
	(1 pixel = R+G+B dots)	
Pixel pitch	0.297 (H) × 0.297 (V)	mm
Pixel configuration	R,G,B vertical stripe	
Display mode	Normally white	
Unit outline dimensions (typ.)*1	321(W)×249 (H)×10.5(D)	mm
Mass	Max. 900	g
Surface treatment	Anti-glare and hard-coating 3H	

*1.Note : excluding backlight cables. Outline dimensions is shown in this specification

4. Input Terminals

4-1. TFT-LCD panel driving

CN1 (1 channel, LVDS signals – NSC/Ti standard and +3.3V DC power supply)

Using connector: DF19K-20P-1H (Hirose)

Interface Cable Pin Assignments

PIN NO	. SYMBOL	FUNCTION
1	VDD	Power Supply, 3.3 V (typical)
2	VDD	Power Supply, 3.3 V (typical)
3	GND	Ground
4	GND	Ground
5	RxIN0-	LVDS Receiver IN0- Signal
6	RxIN0+	LVDS Receiver IN0+ Signal
7	GND	Ground
8	RxIN1-	LVDS Receiver IN1- Signal
9	RxIN1+	LVDS Receiver IN1+ Signal
10	GND	Ground
11	RxIN2-	LVDS Receiver IN2- Signal
12	RxIN2+	LVDS Receiver IN2+ Signal
13	GND	Ground
14	RxCLKIN-	LVDS CLOCK - Signal
15	RxCLKIN+	LVDS CLOCK + Signal
16	GND	Ground
17	NC	
18	NC	
19	NC	
20	GND	Ground

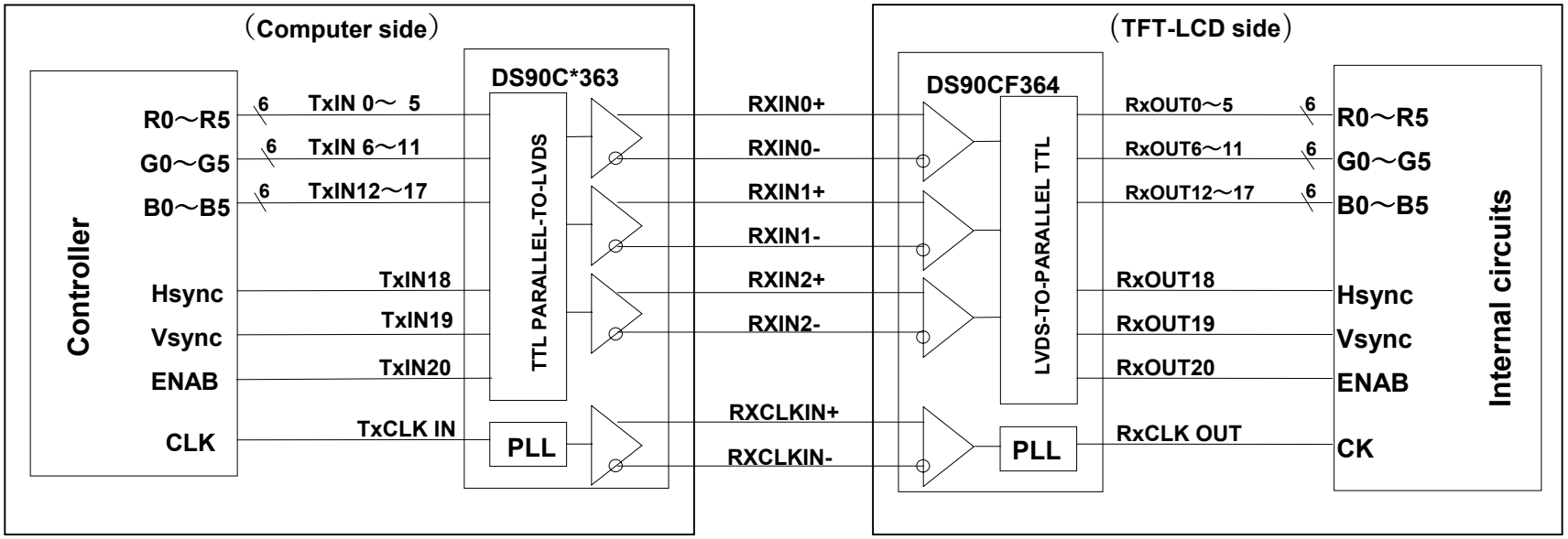
【Note 1】Relation between LVDS signals and actual data shows below section (4-2).

【Note 2】The shielding case is connected with signal GND.

【Note 3】 Let Pin 17,18,19 NC if not used.

4-2 Interface block diagram

Using receiver：DS90CF364(National semiconductor) Corresponding Transmitter：DS90C363,DS90C383(National semiconductor)



4-3. Backlight driving

CN2 (connector): BHR-03VS-1(JST)

Mating connector:SM02(8.0) B-BHS-1(JST)

Pin No.	Symbol	Function
1	V_{HIGH}	Power supply for lamp (High voltage side)
2		NC
3	V_{LOW}	Power supply for lamp (Low voltage side)

5. Absolute Maximum Ratings

5-1 LCD module

Parameter	Symbol	Condition	Ratings	Unit	Remark
Input voltage	V_I	Ta=25℃	−0.3 ～ Vcc+0.3	V	【Note1】
+3.3V supply voltage	Vcc	Ta=25℃	0 ～ ＋ 4	V	
Storage temperature	Tstg	—	−25 ～ ＋60	℃	【Note2】
Operating temperature (Ambient)	Topa	—	0 ～ ＋50	℃	

【Note1】LVDS signals

【Note2】Humidity：95%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
VDD	Supply voltage		VDD	+3.0	+3.3	+3.6	V	【Note2】
	Current dissipation		IDD	—	*616*	*666*	mA	【Note3】
Permissive input ripple voltage			V_{RP}	—	—	100	mV p-p	VDD=+3.3V
Differential input Threshold voltage		High	V_{TH}	—	—	+100	mV	V_{CM}=+1.2V 【Note1】
		Low	V_{TL}	–100	—	—	mV	
Terminal resistor			R_T	—	100	—	Ω	Differential input
Rush current			I_{RUSH}			1.5	A	Rise time 470uS

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

【Note2】

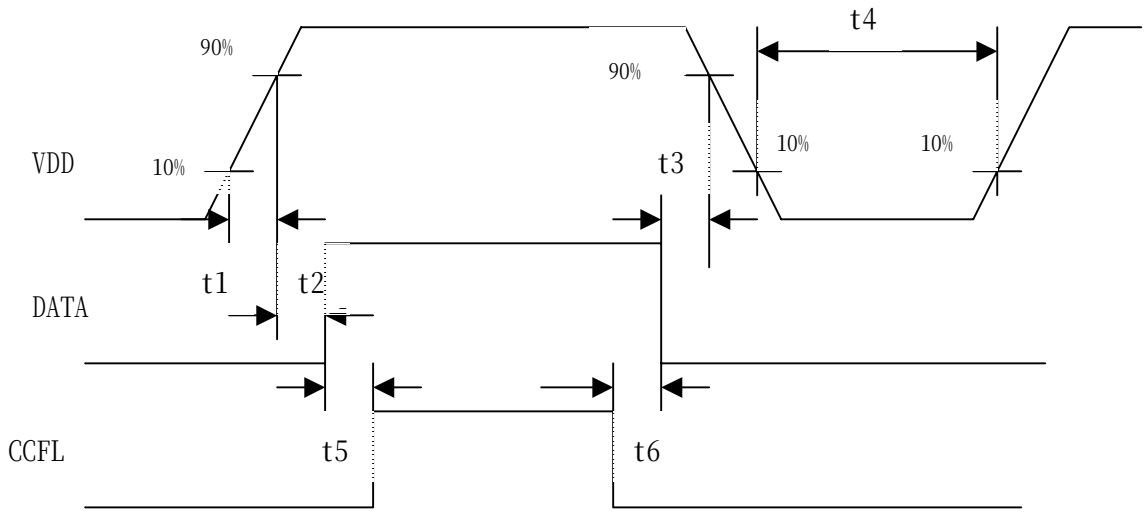
On-off conditions for supply voltage

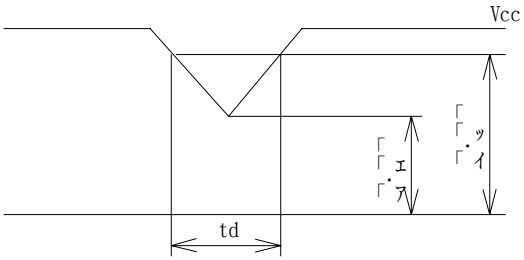
0＜t1≦10 ms

0＜t2≦50 ms

0＜t3≦50 ms

400 ms≦t4 ; 200 ms≦t5 ; 200 ms≦t6





VDD-dip conditions

1) **2.5 V≦VDD＜3.0 V**
   td≦10 ms
2) **VDD＜2.5 V**
   VDD-dip conditions should also follow the On-off conditions for supply voltage

【Note3】 Typical current situation : black pattern.
VDD=+3.3V

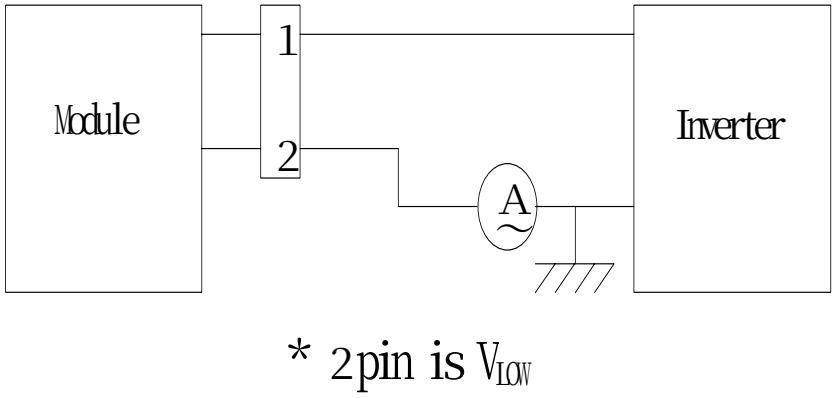
6-2. Backlight driving

The backlight system is an edge-lighting type with single CCFT (Cold Cathode Fluorescent Tube).

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

Parameter	Symbol	Min.	Typ.	Max.	Unit	Remark
Lamp current range	I_L	2.5	8.0	8.5	mArms	【Note1】
Lamp voltage	V_L	*503*	*585*	*644*	Vrms	
Lamp power consumption	P_L	*4.02*	*4.68*	*5.12*	W	【Note2】
Lamp frequency	F_L	*30*		*80*	kHz	【Note3】
Kick-off voltage	Vs	—	—	*920*	Vrms	Ta=25℃
		—	—	*1400*	Vrms	Ta=0℃ 【Note4】
Lamp life time	L_L	*30000*	*50000*	—	hour	【Note5】

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



below.

【Note2】 Calculated Value for reference ($I_L \times V_L$) IL=8.0mA

【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 = 8.0 mArms.

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

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

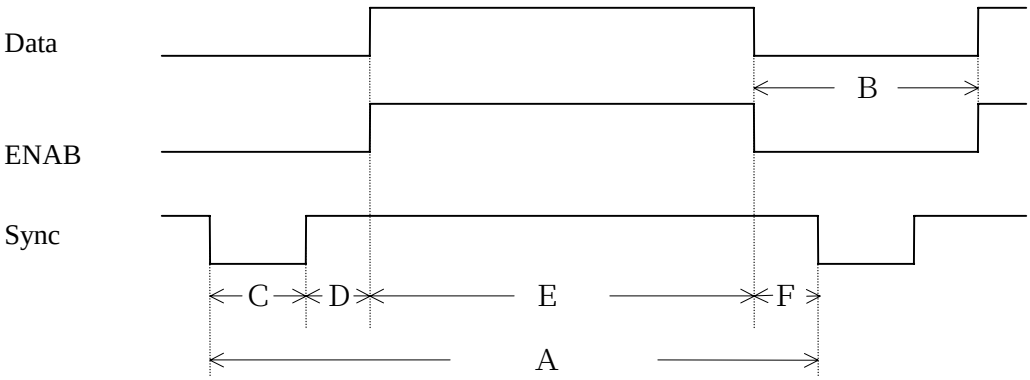
Note) The performance of the backlight, for example life time or brightness, is much influenced by the characteristics of the DC-AC inverter for the lamp. When you design or order the inverter, please make sure that a poor lighting caused by the mismatch of the backlight and the inverter (miss-lighting, flicker, etc.) never occur. When you confirm it, the

module should be operated in the same condition as it is installed in your instrument.

7. Timing characteristics of LCD module input signals

7-1. Timing characteristics

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



(Vertical)

Item (symbol)	Min.	Typ.	Max.	Unit	Remark
Vsync cycle (T_{VA})	—	16.667	—	ms	Negative
	803	806	967	line	
Blanking period(T_{VB})	35	38	99	line	
Sync pulse width (T_{VC})	2	6	—	line	
Back porch (T_{VD})	0	29	32	line	
Sync pulse width + Back porch (T_{VC}+T_{VD})	2	35	-	line	
Active display area (T_{VE})	768	768	768	line	
Front porch (T_{VF})	0	3	—	line	

(Horizontal)

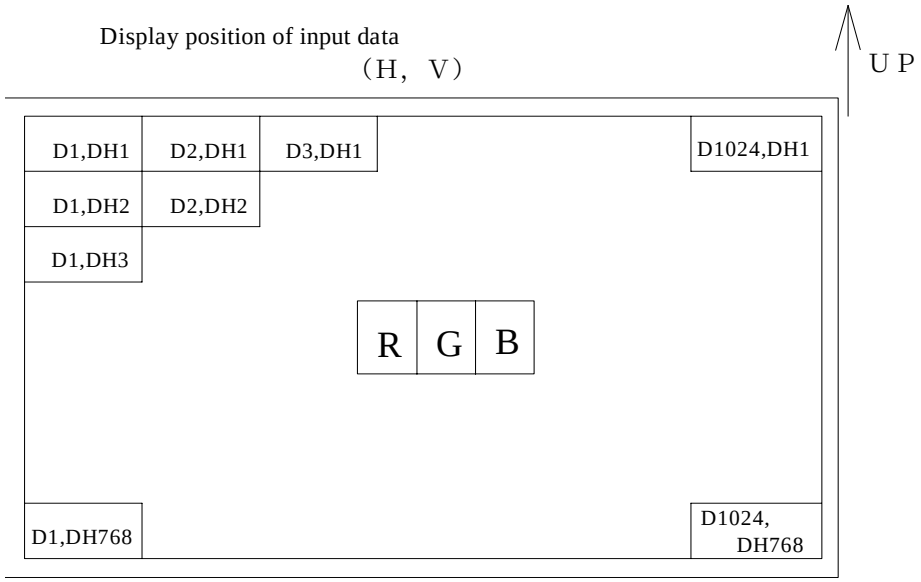
Item (symbol)	Min.	Typ.	Max.	Unit	Remark
Hsync cycle (T_{HA})		20.677	—	μs	Negative
	1320	1344	1600	clock	
Blanking period (T_{HB})	296	320	576	clock	
Sync pulse width (T_{HC})	8	136	-	clock	
Back porch (T_{HD})	0	160	-	clock	
Sync pulse width + Back porch (T_{HC} +T_{HD})	8	296	-	clock	
Active display area (T_{HE})	1024	1024	1024	clock	
Front porch (T_{HF})	0	24	—	clock	

(Clock)

Item	Min.	Typ.	Max.	Unit	Remark
Frequency	40	65.0	80	MHz	【Note1】

Note) In case of lower frequency, the deterioration of display quality, flicker etc., may occur.

7-2. 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	G0	G1	G2	G3	G4	G5	B0	B1	B2	B3	B4	B5
Basic Color	Black	—	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	1	1	1	1	1	1
	Green	—	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
	Cyan	—	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1
	Red	—	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	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	Black	GS0	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
	Darker	GS2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	⇧	↓				↓						↓						↓		
	⇩	↓				↓						↓						↓		
	Brighter	GS61	1	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	⇩	GS62	0	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	Red	GS63	1	1	1	1	1	1	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
	⇧	GS1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
	Darker	GS2	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
	⇧	↓				↓						↓						↓		
	⇩	↓				↓						↓						↓		
	Brighter	GS61	0	0	0	0	0	0	1	0	1	1	1	1	0	0	0	0	0	0
	⇩	GS62	0	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0
	Green	GS63	0	0	0	0	0	0	1	1	1	1	1	1	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
	⇧	GS1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
	Darker	GS2	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
	⇧	↓				↓						↓						↓		
	⇩	↓				↓						↓						↓		
	Brighter	GS61	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	1
	⇩	GS62	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1
	Blue	GS63	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1

0 : Low level voltage, 1 : High level voltage

Each basic color can be displayed in 64 gray scales from 6 bit data signals. According to the combination of total 18 bit data signals, the 262,144-color display can be achieved on the screen.

9. Optical Characteristics

Ta=25℃, Vcc=+3.3V

Parameter		Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Viewing Angle Range	Horizontal	θ21, θ22	CR>10	50	60	—	Deg.	【Note1,4】
	Vertical	θ11		35	45	—	Deg.	
		θ12		35	45	—	Deg.	
	Horizontal	θ21, θ22	CR>5	60	70		Deg	
	Vertical	θ11		45	55		Deg	
		θ12		45	55		Deg	
Contrast ratio		CRn	θ=0°	300	400	—		【Note2,4】
Response Time	Rise	τr	θ=0°	—	5	10	ms	【Note3,4】
	Decay	τd		—	20	25	ms	
Chromaticity of White		Wx		0.283	0.313	0.343		【Note4】
		Wy		0.299	0.329	0.359		
Chromaticity of Red		Rx		0.607	0.637	0.667		
		Ry		0.311	0.341	0.371		
Chromaticity of Green		Gx		0.272	0.302	0.342		
		Gy		0.553	0.583	0.613		
Chromaticity of Blue		Bx		0.115	0.145	0.175		
		By		0.069	0.099	0.129		
Luminance of white 【Note4】								
		Y_{L2}	Center	200	250	—	Cd/m^2	I_L = 8.0mArms
White Uniformity		δw	5 Points	—	—	1.3		【Note5】

※ The measurement shall be executed 30 minutes after lighting at rating.

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

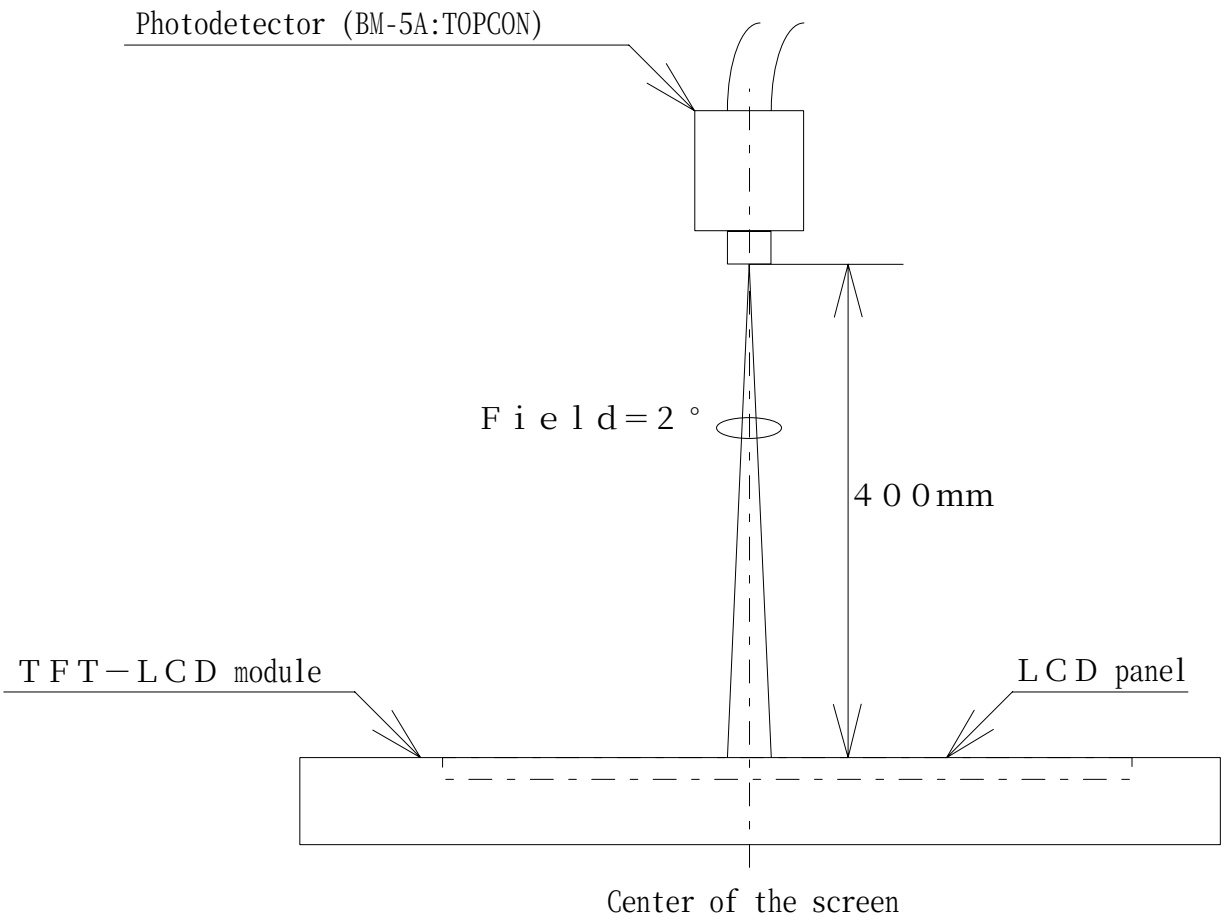
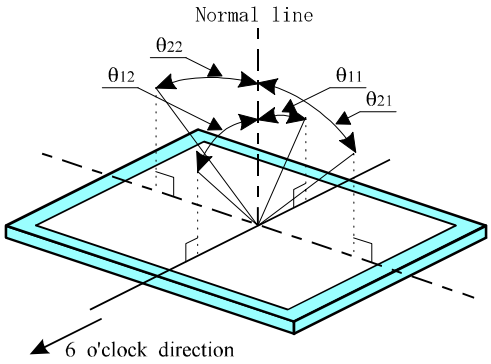


Fig.3 Optical characteristics measurement method

【Note1】Definitions of viewing angle range:



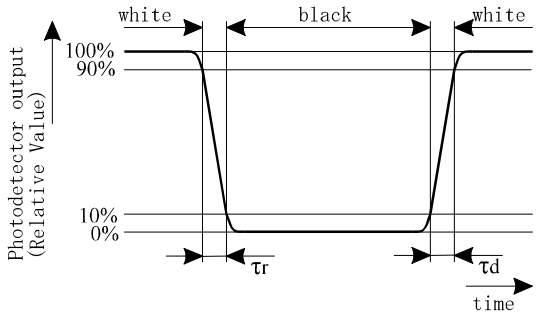
【Note2】Definition of contrast ratio:

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" .

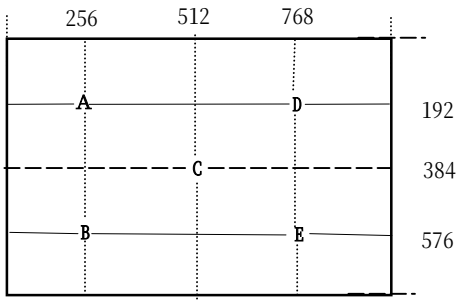


【Note4】This shall be measured at center of the screen.

【Note5】Definition of white uniformity:

$$\delta w = \frac{\text{Maximun Luminance of 5 points}}{\text{Minimum Luminance of 5 points}}$$

(5 Points A,B,C,D,E)



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..

k) Mounting screw hole can stand torque 1.3~1.5 Kgf-cm.

12. Reliability test items

No.	Test item	Conditions
1	High temperature storage test	Ta = 60℃ 240h
2	Low temperature storage test	Ta = -25℃ 240h
3	High temperature & high humidity operation test	Ta = 40℃ ; 90 %RH 240h ; (As remark 3) (No condensation)
4	High temperature operation test	Ta = 50℃ 240h (The panel temp. must be less than 60℃)
5	Low temperature operation test	Ta = 0℃ 240h
6	Vibration test (non- operating)	Frequency: 10～500Hz, 1G, Test period : 3 hours (1 hour for each direction of X,Y,Z)
7	Shock test (non- operating)	Max. gravity : 150G Pulse width : 4 ms, Half sine wave Direction : ±X,±Y,±Z once for each direction.

Remark:

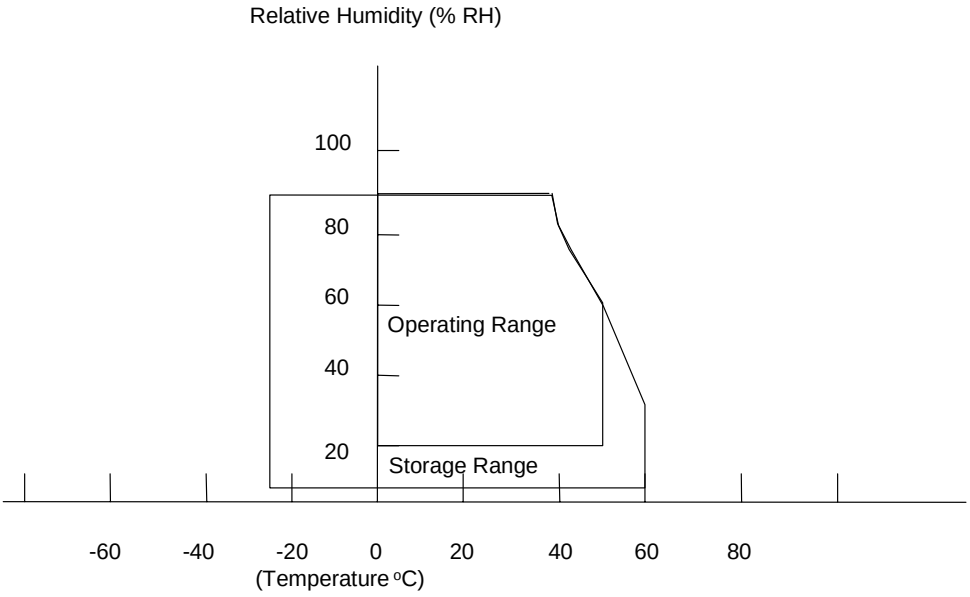
(1) A failure is defined as the appearance of pixel failured on any color layer or the appearance of horizontal or vertical lines, bars etc.

(2) Low temperature storage " Panel must return to operating temperature range prior to activation."

(3) Hi temperature / Humidity test

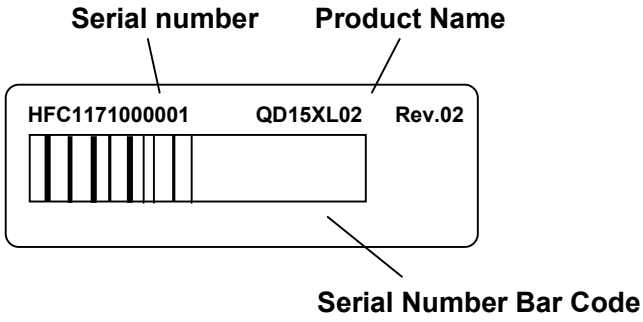
Max. wet-bulb temperature is less than 39°C ; At glass temperature high than 40 °C.

Temperature and relative humidity range is shown in the figure below.


Relative Humidity (% RH)
100
80
60
40
20
Operating Range
Storage Range
-60
-40
-20
0
20
40
60
80
(Temperature °C)

13. Others

1) Lot No. Label:



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.