

SHARP

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TECHNICAL LITERATURE
FOR
TFT - LCD module

MODEL No. L Q 0 5 7 Q 3 D G 0 2

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SHARP CORPORATION

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1. Application

This technical literature applies to color TFT-LCD module, LQ057Q3DG02.

2. Summary and Features

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 (PWB), FPC, front and back polarizer, sealed case, backlight unit. Graphics and texts can be displayed on a $320 \times \text{RGB} \times 240$ dots panel with 262,144 colors by suitable control supplying from the outside.

It isn't composed LED drive circuit for a backlight drive.

- Wide Viewing Angle technology is adopted.
(The most suitable viewing angle is in the 12 o'clock direction.)
- By adopting an active matrix drive, a picture with high contrast is realized.
- Reflection due to external light is minimized through the use of a low reflection black matrix .
- A thin, light and compact module is accomplished through the use of COG mounting technology.
- Through the use of high color purity color filter and TN-normally white mode excelled in color reproducibility, an image with highly natural color reproduction is realized.
- High viewing angle and high brightness.
- An inverted video display in the vertical / horizontal directions is possible.
- This module is adapted to RoHS compliance.

3. Mechanical specifications

table 3-1

Parameter	Specifications	Units
Screen size	14.4 (5.7 inch) diagonal	cm
Active area	115.2 (H) × 86.4 (V)	mm
Display format	320(H) × 240(V)	pixels
	(1 pixel = R + G + B dots)	
Dot pitch	0.360 (H) × 0.360 (V)	mm
Pixel configuration	R,G,B Stripe configuration	
Display mode	Normally white	
Outline dimension 【Note1-1】	144.0 (W) × 103.8 (H) × 12.3(D)	mm
Mass	190(typ)	g

【Note 1-1】

A FPC of LED and some projections are excluded.

A figure of outline dimension is shown in Fig. 1.

4. Input terminal

4-1. TFT-LCD panel driving part

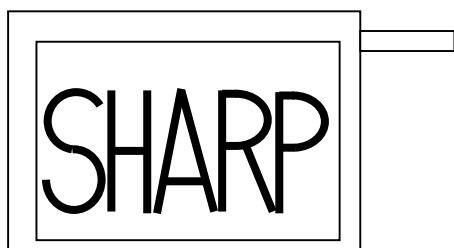
CN1 Used connector: IMSA-9637S-33Y902 (IRISO ELECTRONICS CO.,LTD.)

Table 4-1 Functional table of CN1 terminals

Pin No.	Symbol	Description	Polarity
1	GND	ground	
2	CK	Clock signal for sampling each data signal	
3	Hsync	Horizontal synchronous signal	Negative
4	Vsync	Vertical synchronous signal	Negative
5	GND	ground	
6	R0	RED data signal(LSB)	
7	R1	RED data signal	
8	R2	RED data signal	
9	R3	RED data signal	
10	R4	RED data signal	
11	R5	RED data signal(MSB)	
12	GND	ground	
13	G0	GREEN data signal(LSB)	
14	G1	GREEN data signal	
15	G2	GREEN data signal	
16	G3	GREEN data signal	
17	G4	GREEN data signal	
18	G5	GREEN data signal(MSB)	
19	GND	ground	
20	B0	BLUE data signal(LSB)	
21	B1	BLUE data signal	
22	B2	BLUE data signal	
23	B3	BLUE data signal	
24	B4	BLUE data signal	
25	B5	BLUE data signal(MSB)	
26	GND	ground	
27	ENAB	Signal to settle the horizontal display position 【Note4-1】	Positive
28	Vcc	+3.3V power supply	
29	Vcc	+3.3V power supply	
30	R/L	Selection signal for horizontal scanning direction 【Note4-2】 ("L": Normally, "H": Right-and-Left reversal)	
31	U/D	Selection signal for vertical scanning direction 【Note4-2】 ("H": Normally, "L": Up-and-Down reversal)	
32	GND	ground	
33	GND	ground	

【Note 4-1】 The horizontal display start timing is settled in accordance with a rising timing of ENAB signal. Don't keep ENAB "Low" during operation.

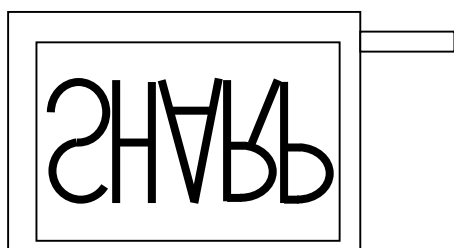
【Note 4-2】



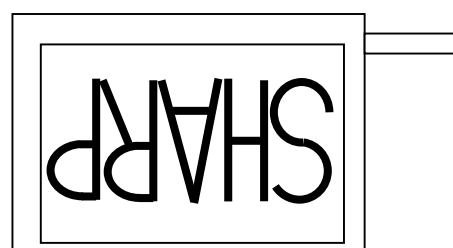
R/L = L, U/D = H



R/L = H, U/D = H



R/L = L, U/D = L



R/L = H, U/D = L

4-2. LED Backlight driving part (FPC1)

Table 4-2 Functional table of FPC terminals

Pin No.	Symbol	Description
1	LED-A1	Power Supply for LED (Anode)
2	LED-C1	Power Supply for LED (Cathode)
3	LED-A2	Power Supply for LED (Anode)
4	LED-C2	Power Supply for LED (Cathode)
5	LED-A3	Power Supply for LED (Anode)
6	LED-C3	Power Supply for LED (Cathode)
7	LED-A4	Power Supply for LED (Anode)
8	LED-C4	Power Supply for LED (Cathode)

Suitable connector : IMSA-9632S-08-AGF

5. Absolute maximum ratings

Table 5-1

Item	Symbol	Conditions	Rated value	Unit	Remarks
Input voltage	VI	Ta = 25°C	-0.3 ~ V _{CC} +0.3	V	【Note 5-1】
Power supply voltage	V _{CC}	Ta = 25°C	-0.3 ~ +4.0	V	
Temperature for storage	T _{stg}	-	-30 ~ +70	°C	【Note 5-2,3】
Temperature for operation	T _{opr}	-	-30 ~ +70	°C	【Note 5-2,3,4】

【Note 5-1】 CK, R0~R5, G0~G5, B0~B5, Hsync, Vsync, ENAB, R/L, U/D

【Note 5-2】 This rating applies to all parts of the module and should not be exceeded.

【Note 5-3】 Maximum wet-bulb temperature is less than 39°C. Condensation of dew must be avoided as electrical current leaks will occur, causing a degradation of performance specifications.

【Note 5-4】 The operating temperature only guarantees operation of the circuit. For contrast, speed response, and other factors related to display quality, judgment is done using the ambient temperature Ta = +25°C.

6. Electrical characteristics

6-1. TFT-LCD panel driving section

Table 6-1

Ta=25°C

Parameter		Symbol	MIN	TYP	MAX	Unit	Remarks
+3.3V power supply	Supply voltage	V _{CC}	+3.0	+3.3	+3.6	V	【Note 6-1】
	Current dissipation	I _{CC}	—	20	(30)	mA	【Note 6-2】
Permissible input ripple		V _{RF}	—	—	100	mVp-p	V _{CC} =+3.3V
Input Low voltage		V _{IL}	0	—	0.1V _{CC}	V	【Note 6-3】
Input High voltage		V _{IH}	0.9V _{CC}	—	V _{CC}	V	
Input leak current (Low)		I _{OL}	—	—	T.B.D	μA	V _I =0V 【Note 6-3】
Input leak current (High)		I _{OH}	—	—	T.B.D	μA	V _I =3.3~V _{CC} 【Note 6-3】

【Note 6-1】

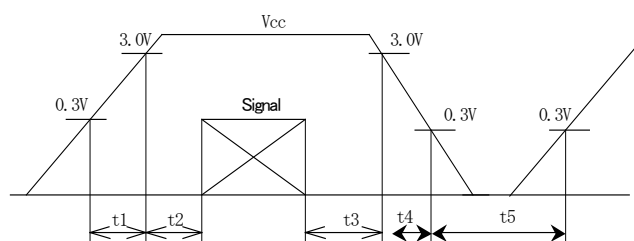
V_{CC} turn-on/off conditions.

$t_1 \leq \text{T.B.D}$

$0 < t_2 \leq \text{T.B.D}$

$0 < t_3 \leq \text{T.B.D}$

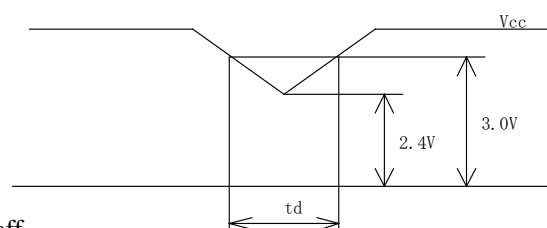
$1s < t_5$

V_{CC}-dip conditions

1) $2.4V < V_{CC} < 3.0V$

$t_d \leq \text{T.B.D}$

2) At $V_{CC} < \text{T.B.D}$

V_{CC}-dip conditions should also follow the V_{CC} turn-on/off conditions.【Note 6-2】 V_{CC} = 3.3V

Typical current situation : Timing ; Typical, Pattern ; T.B.D

Max current situation : Timing ; Typical, Pattern ; T.B.D

【Note 6-3】 CK,R0~R5,G0~G5,B0~B5,Hsync,Vsync,ENAB,R/L,U/D

6-2. Backlight driving section

The backlight system is edge-lighting type with 20 White-LED(White Light Emitting Diode).
The characteristics of White-LED are shown in the following table. (Ta = 25 deg.)

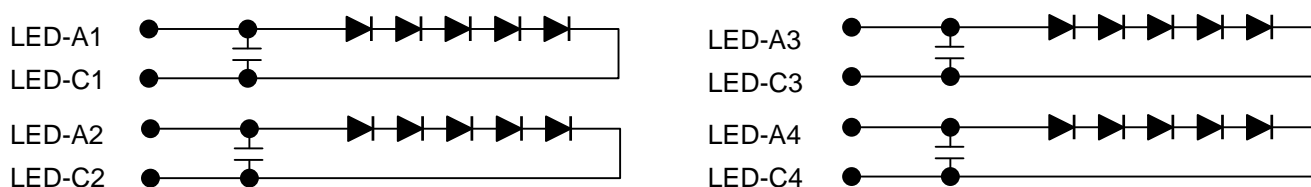
Table 6-2

Parameter	Min.	Typ.	Max.	Unit	Remark
LED voltage	-	16.0	T.B.D	V	LED current = 20mA
LED current range	T.B.D	20	T.B.D	mA	
Number of circuit strings	-	4	-		[Note 1]
LED power consumption	-	1.28	-	W	[Note 2]

[Note 1] The LED backlight is composed by 4 strings from which 5 LED is connected with the series.

The figure below shows the circuit chart.

In each string, there is a ceramic capacitor for the electrostatic protection.



[Note 2] Calculated value for reference ($I_L \times V_L$)

7. Timing Characteristics of input signals

Timing diagrams of input signal are shown in Fig.7

7-1. Timing characteristics

Table 7-1

Parameter		Symbol	MIN	TYP	MAX	Unit	Remarks
Clock	frequency	1/Tc	-	6.3	7.0	MHz	
	Duty ratio	TH/T	40	50	60	%	
Data	Setup time	Tds	10	-	-	ns	
	Hold time	Tdh	10	-	-	ns	
Horizontal sync. signal	Cycle	TH	50.0	63.6	-	μ s	
			360	400	450	clock	
	Pulse width	THp	1	-	6	clock	
Vertical sync. signal	Cycle	TV	251	262	280	line	
	frequency	1/TV	50	60	-	Hz	【Note7-1】
	Pulse width	TVp	1	-	6	line	
Horizontal display period		THd	320	320	320	clock	
Hsync-Clock phase difference		THc	5	-	-	ns	
Hsync-Vsync phase difference		TVh	0	-	320	clock	
Vertical display start position		TVs	7	7	7	line	

【Note7-1】 In case of lower frequency, the deterioration of display quality, flicker etc., may occur.

Please use this module in more than 50Hz.(1/Tv)

7-2. Horizontal display position

Table 7-2

Parameter		symbol	Min.	Typ.	Max.	Unit	Remark
Enable signal	Setup time	Tes	10	-	-	ns	
	Pulse width	Tep	320	-	-	clock	
Hsync-Enable signal phase difference		The	7	7	7	clock	

Please do not make ENAB fixation in "L".

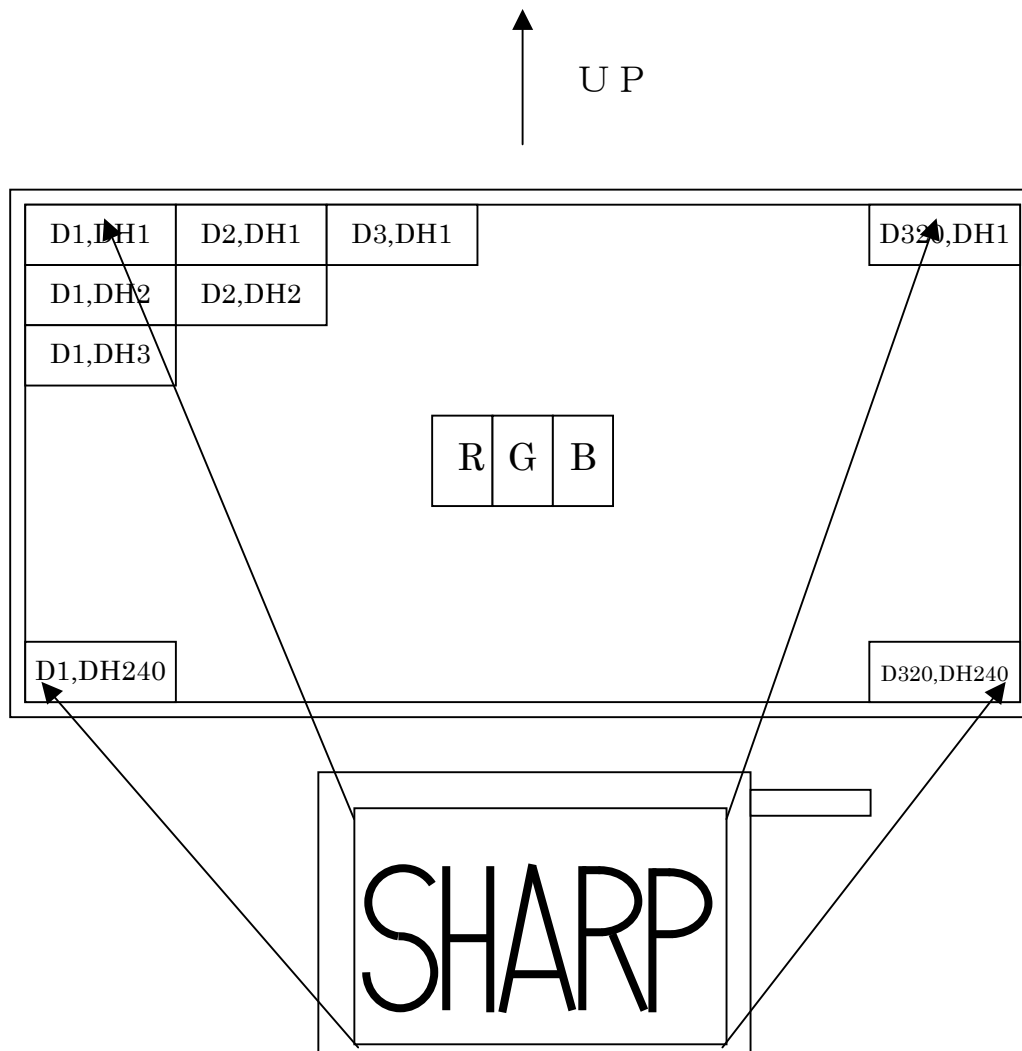
The Horizontal display start position (The) is fixed 7 clock.

7-3. Vertical display position

The Vertical display start position (TVs) is fixed 7 line.

ENAB signal has no relation to the vertical display position.

7-4. Input Data Signals and Display Position on the screen



Display position of input data (H,V)

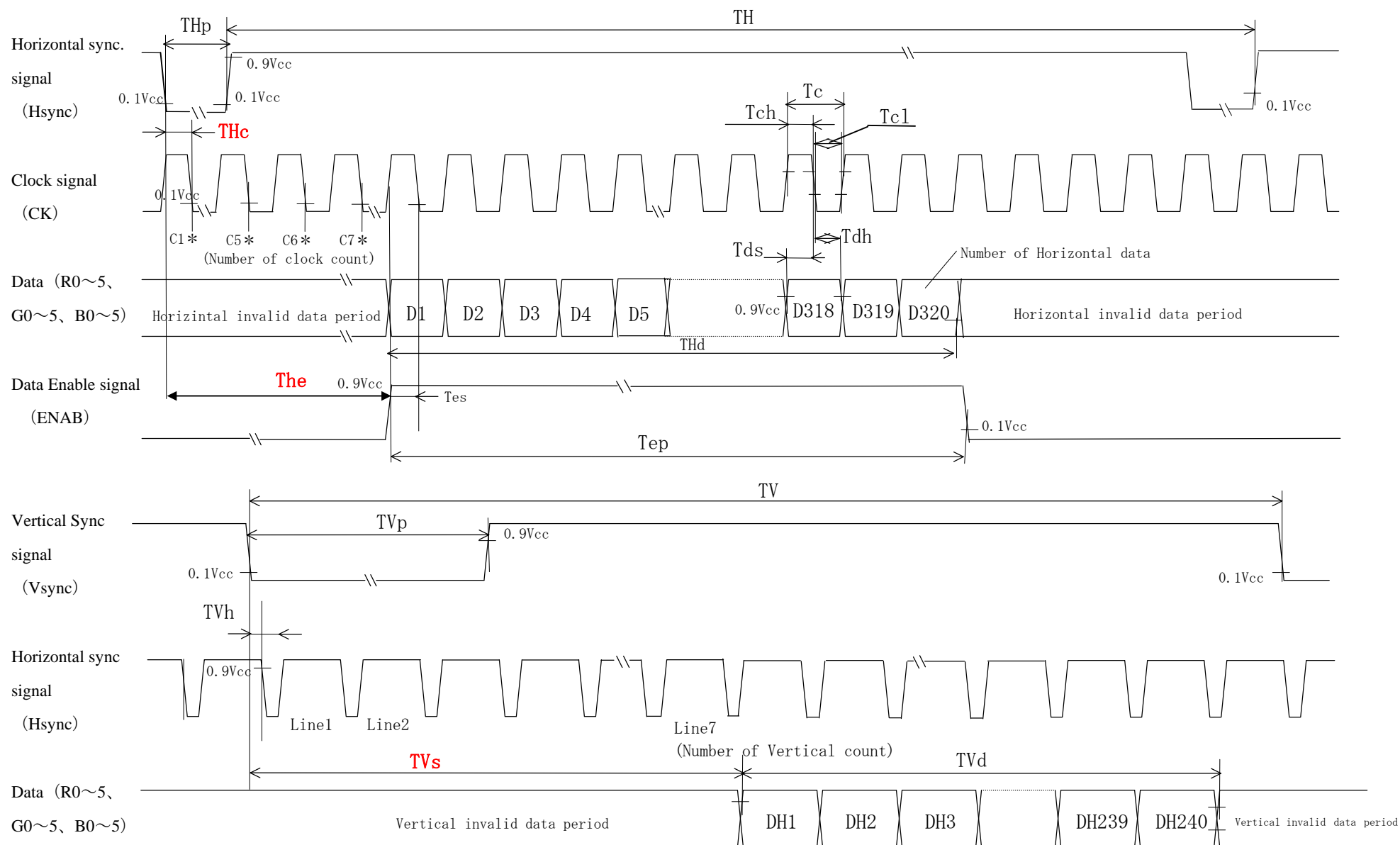


Fig 7. Input signal waveforms

(8) Input Signals, Basic Display Color and Gray Scale of Each Color

	Colors & Gray scale	Data signal																		
		Gray Scale	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
	Bleu	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

Table 9-1

Ta=25°C, VCC =+3.3V

Parameter	Symbol	Condition	Min	Typ	Max	Unit	Remarks
Viewing angle range	θ_{21}, θ_{22}	$CR \geq 5$	75	80	—	° (degree)	【Note 9-1】
	θ_{11}		75	80	—	° (degree)	
	θ_{12}		55	65	—	° (degree)	
Contrast ratio	CRmax	Optimal viewing angle	T.B.D	550	—		【Note 9-2】
Response time	Rise	$\theta = 0^\circ$	—	T.B.D	T.B.D	ms	【Note 9-3】
	Fall		—	T.B.D	T.B.D	ms	
White chromaticity	x		T.B.D	(0.313)	T.B.D		【Note 9-4】
	y		T.B.D	(0.329)	T.B.D		
Luminance	Y		(300)	400	—	cd/m ²	
LED life time	-	continuation	—	(30,000)	—	hour	【Note 9-5】

Remarks: The optical specifications are measured 30 minute after turning LED on and in a dark room or equivalent condition, according to the method shown in Fig.9-1 below.

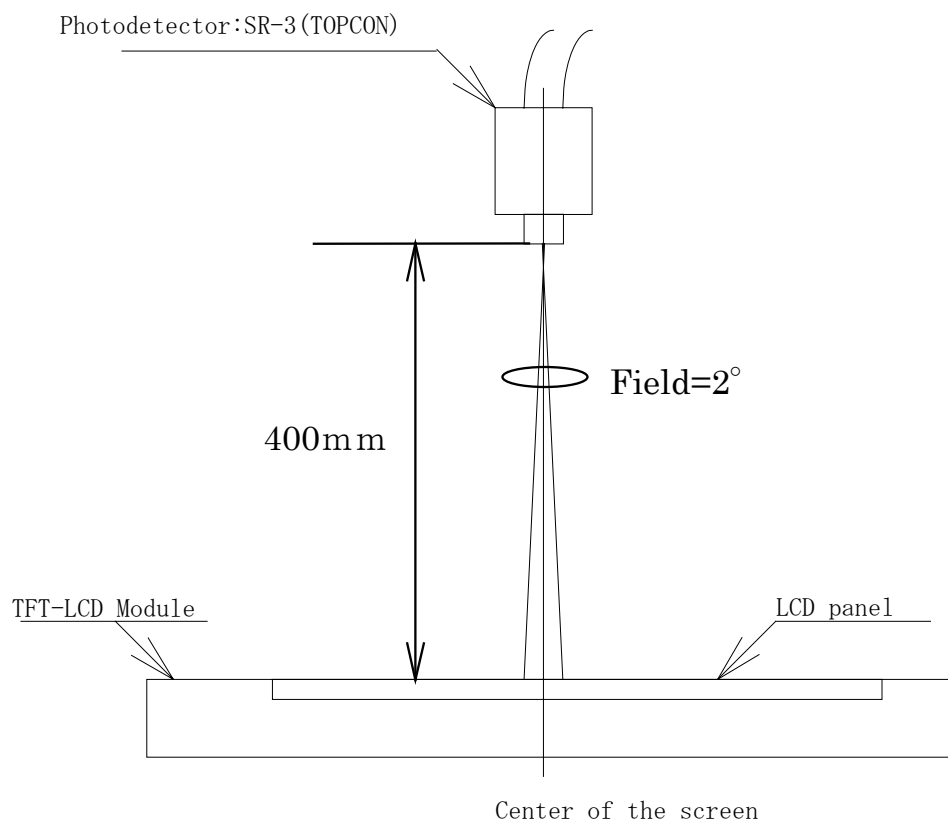
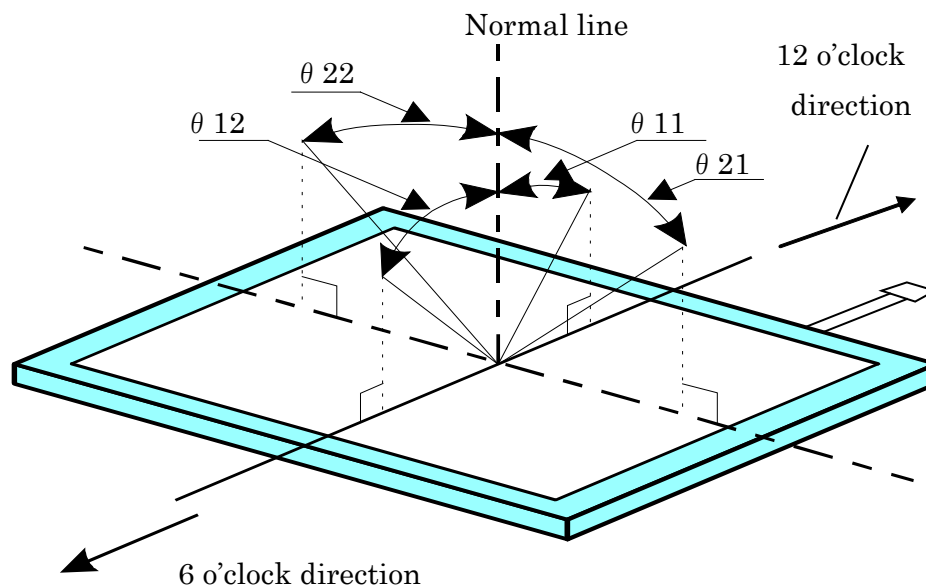


Fig.9-1 Optical characteristics measurement method

【Note 9-1】 Viewing angle range is defined as follows.



The best viewing angle of this module is slightly leaned to 12 o'clock from normal line.

Where $\theta_{11} > \theta_{\max}$, gray scale is reversed partially.

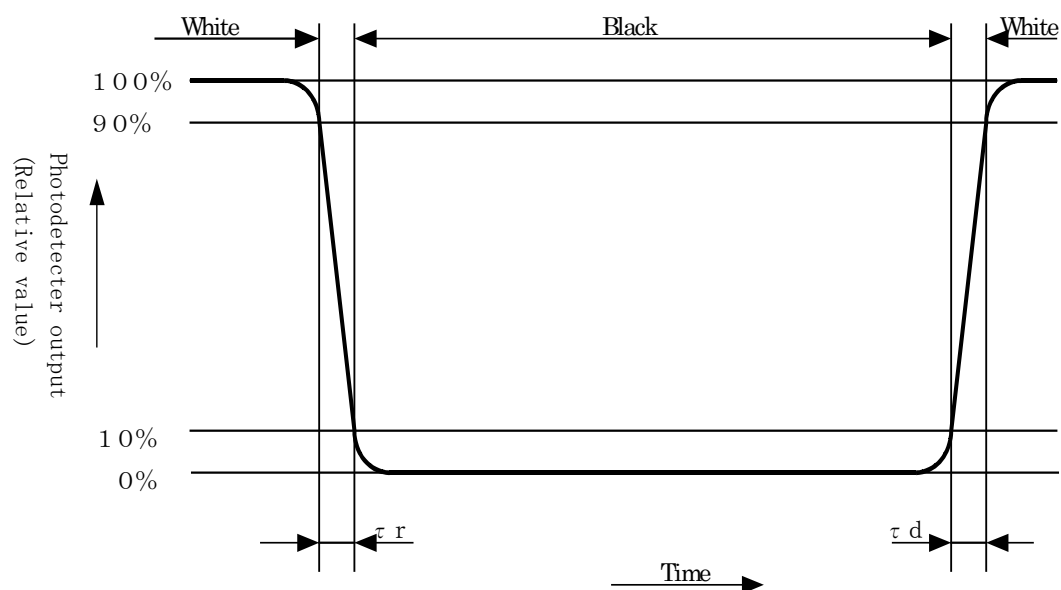
Where $\theta_{11} < \theta_{\max}$, or in θ_{12} direction, gray scale isn't reversed.

【Note 9-2】 Contrast ratio is defined as follows:

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

※ Measurement point : Center of the active area

【Note 9-3】 Response time is obtained by measuring the transition time of photo detector output, when input signals are applied so as to make the area "black" to and from "white".



【Note 9-4】 This parameter should be measured at the center of the screen and 30 minutes after turn-on.
The characteristics are measured when the driver circuit is not powered.

【Note 9-5】 The data for LED is for your reference, because LED is consumable component.
LED life time : When a brightness of lamp surface become 50% of the initial value under the Standard condition.

10. Handling Precautions

- a) Be sure to turn off the power supply when inserting or disconnecting the cable.
- b) Our TFT-LCD module is designed to be fixed to the hardware with mounting holes on 4-corners on the backside. Be sure to design the cabinet so that the module can be installed without any extra stress such as warp or twist.
- c) Wipe off water drop immediately. Long contact with water may cause discoloration or spots.
- d) When the panel surface is soiled, wipe it with absorbent cotton or other soft cloth.
- e) Since the panel is made of glass, it may break or crack if dropped or bumped on hard surface.
Handle with care.
- f) Since CMOS LSI is used in this module, take care of static electricity and ensure the human earth when handling. Observe all other precautionary requirements in handling components.
- g) Since there is a circuit board in the module back, stress shall not be impressed in designing and assembling. If stress is impressed, there arises a possibility that circuit parts may be damaged.
- h) Direct sunlight on LCD panel may cause degradation of panel quality. Do not expose the LCD panel to direct sunlight. Lightproof shade etc. should be attached when LCD panel is used under such environment.
- i) Connect GND to 4 place of mounting holes to get stable against EMI and external noise.
- j) When handling LCD modules and assembling them into cabinets, please be noted that long-term storage in the environment of oxidization or deoxidization gas and the use of such materials as reagent, solvent, adhesive, resin, etc. which generate these gasses, may cause corrosion and discoloration of the LCD modules.
- k) When installing LCD modules in the cabinet, we recommend to tighten screws with “torque=0.25~0.30N·m”.
Be sure to confirm it in the same condition as it is built in your instrument.
Inserting length to the module shall be within 5mm. Tapping screws shall be tighten only one time.
More than two time tightening is not assured. Please take care in the case of reworking.
- l) Liquid crystal contained in the panel may leak if the LCD is broken. Rinse it as soon as possible if it gets inside your eye or mouth by mistake.
- m) Notice: Never dismantle the module , because it will cause failure.
Please don't remove the fixed tape, insulating tape etc that was pasted on the original module.
(except for protection film of the panel and the crepe tape(yellow tape) temporarily adhered on the module.)
- n) Be careful when using it for long time with fixed pattern display as it may cause afterimage.
(Please use a screen saver etc., in order to avoid an afterimage.)
- o) Adjusting volume have been set optimally before shipment, so do not change any adjusted value.
If adjusted value is changed, the specification may not be satisfied.
- p) If a minute particle get into the module and adheres on an optical material, it may cause display irregularity issue, etc. Therefore, fine-pitch filters have to be built into cooling and inhalation hole if you intend to install a fan.
- q) Liquid crystal can be damaged by ultraviolet light. Be sure not to operate or storage under direct sunlight or strong ultraviolet light for a long time.
- r) Please storage modules in ambient temperature if possible. Below the storage temperature, liquid crystal can freeze and damage the LCD paenel. Above storage temperature, it can irreversibly turn into isotropic state which cannot work as display.

12. Reliability Test Items

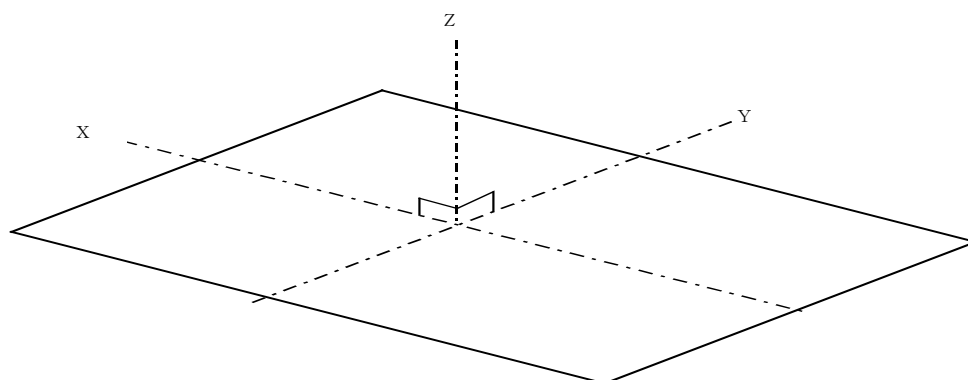
No.	Test items	Test conditions
1	High temperature storage test	Leaves the module at $T_a = +70^{\circ}\text{C}$ for 240h 【Note 1】
2	Low temperature storage test	Leaves the module at $T_a = -30^{\circ}\text{C}$ for 240h 【Note 1】
3	High temperature and high humidity operating test	Operates the module at $T_p = +40^{\circ}\text{C}$, 95%RH for 240h (No condensation) 【Note 1】
4	High temperature operating test	Operates the module at $T_p = +70^{\circ}\text{C}$ for 240h 【Note 1】
5	Low temperature operating test	Operates the module at $T_p = -30^{\circ}\text{C}$ for 240h 【Note 1】
6	Strength against ESD	$\pm 200\text{V} \cdot 200\text{pF}(0\Omega)$ 1 time for each terminals
7	Shock test (non-operating)	$490\text{m/s}^2 \cdot 11\text{ms}$, $\pm X$; $\pm Y$; $\pm Z$ once for each direction
8	Vibration test (non-operating)	Frequency : $5 \sim 57\text{Hz}$, One side : 0.076mm Frequency : $58 \sim 500\text{Hz}$, Acceleration : 9.8m/s^2 Sweep cycle : 11 minutes X,Y,Z 1 hours for each directions (total 3 hours) 【Note 2】
9	Thermal shock test	$T_a = -30^{\circ}\text{C} \sim +70^{\circ}\text{C}$, 50 cycles (0.5h) (0.5h)

【Result evaluation criteria】

Under the display quality test conditions with normal operation state, these shall be no change which may affect practical display function.

【Note 1】 T_a = Ambient temperature, T_p = Panel surface temperature

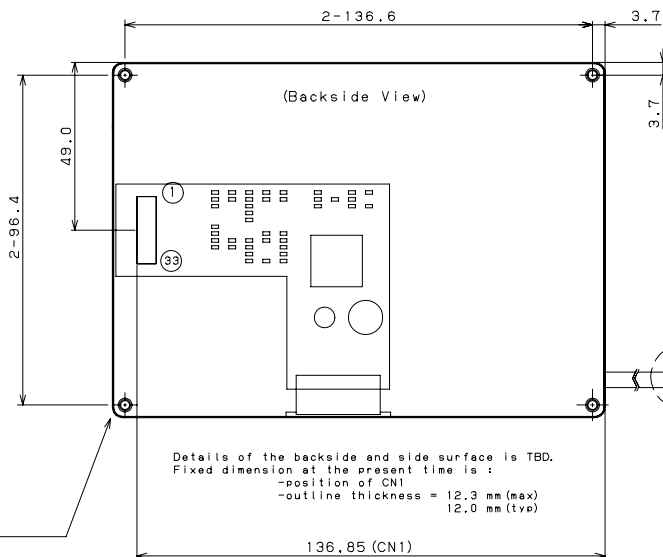
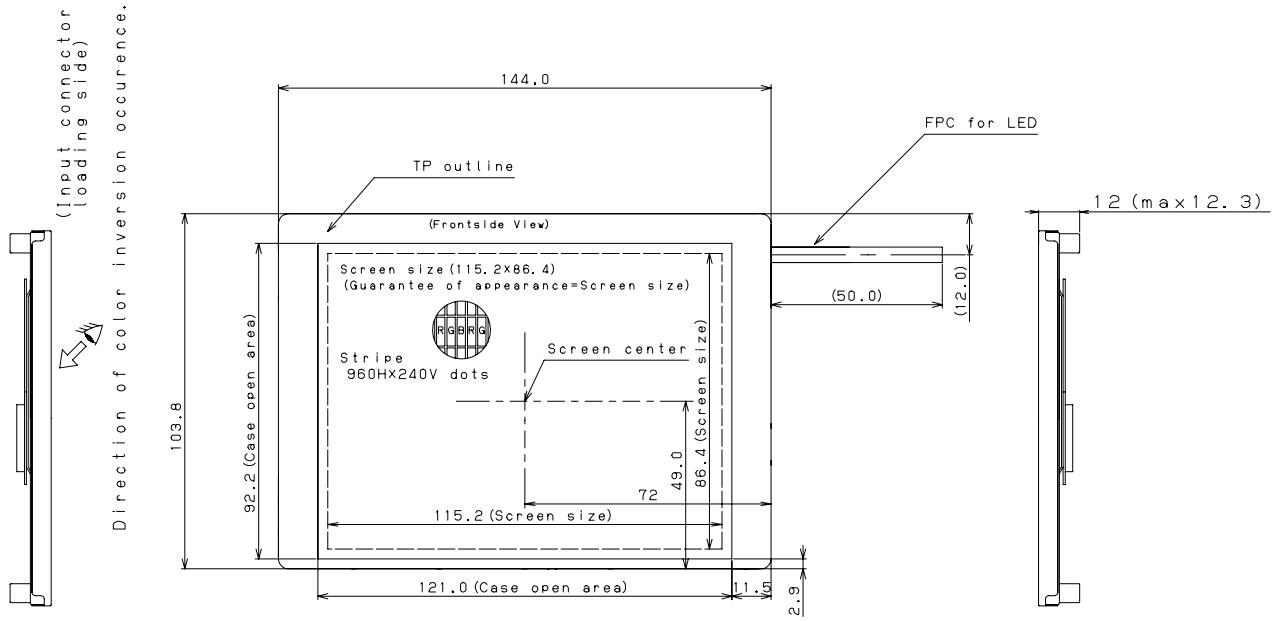
【Note 2】 X,Y,Z directions are shown as follows:



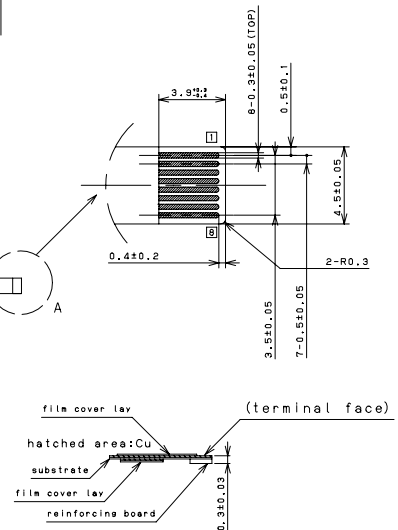
SHARP

TENTATIVE

Outline proposal



Detail for A (5:1)
Terminal is on the front side of this view.



Cross-section of LED FPC

depth 5.6 (4 point)
The hole for nominal size 3mm self-tapping screw attachment

- 1) CN1: I/O connector is IMS-9637S-33Y902 (IRISO ELECTRICS CO., LTD)
- 2) Recommendation screw is nominal size 3mm tapping amount of invasion 5mm.
- 3) General tolerance is ±0.5mm.

unit:mm	Please do not copy this material and do not disclose this to third party.		
DATE	2008.12.19		
MODEL	L:Q:0:5:7:Q:3:D:G:0:2:	free	
DRAWING NO	2:0:-:0:8:Z:-:0:3:2	size A2	
		SHARP CORPORATION	ENGINEERING DEPARTMENT MOBILE LIQUID CRYSTAL DIVISION ■ MOBILE LIQUID CRYSTAL DISPLAY GROUP
			Sign.

Fig. 1 OUTLINE DIMENSIONS