ENH084V1-300/400 Color TFT-LCD Module Features

GENERAL DESCRIPTION

Panelview provides optically enhanced solutions to the standard Sharp LQ084V1DG21 color active matrix LCD module. The first enhancement is an index matching (IM) film lamination to the front surface of the display polarizer. The IM film is available in two surface treatments - IM/Clear and IM/110 (a 10% diffusion). The second enhancement is the incorporation of an enhanced light guide (ELG) providing for up to 30% increase in brightness.

This module is composed of a color TFT-LCD panel, driver ICs, control circuit and power supply circuit and a backlight unit. Graphics and text can be displayed on a 640x3x480 dots panel with 262,144 colors by supplying 18 bit data signals (6bit/color), four timing signals, +3.3V/+5V DC supply voltage for TFT-LCD panel driving and supply voltage for backlight.

The TFT-LCD panel used for this module is a low-reflection and higher-color-saturation type. Therefore, this module is also suitable for multimedia use. Optimum viewing direction is 12 o'clock.

This module is the type of wide viewing angle and high brightness (300cd/m^2). Backlight-driving DC/AC inverter is not built in this module.
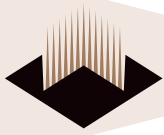
Panelview assumes no responsibility for any damage resulting from the use of the device which does not comply with the instructions and the precautions specified in these specification sheets. Panelview does assume the responsibility for the warranty of the enhanced product.

MECHANICAL SPECIFICATIONS

Parameter	Specifications	Units
Display size	21 (8.4") Diagonal	cm
Active area	170.9(H) x 129.6(V)	mm
Pixel format	640(H) x 480(V)	pixel
	(1 pixel R+G+B dots)	–
Pixel pitch	0.267(H) x 0.270(V)	mm
Pixel configuration	RGB vertical stripe	–
Display mode	Normally white	–
Unit outline dimensions (1)	216.0(W) x 152.4(H) x 12.0(D)	mm
Mass	410±20	g
Surface treatment	IM/Clear (glossy) or IM/110 and hardcoat 3H	–

Note:
1)   Excluding backlight cables and mounting tabs.

Original specifications created by Sharp.

Aug 2003 Rev. 0
ENH084V1-XXX
1
Panelview • (503) 690-2460 • www.whiteedc.com
Panelview is a subsidiary of White Electronic Designs Corporation

INPUT TERMINALS

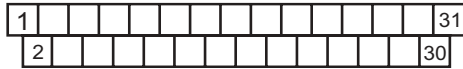CN1 Used connector: DF9BA-31P-1V (Hirose Electric Co., Ltd.)

Corresponding connector: DF9-31S-1V (Hirose Electric Co., Ltd.)
DF9A-31S-1V (Hirose Electric Co., Ltd.)
DF9B-31S-1V (Hirose Electric Co., Ltd.)
DF9M-31S-1V (Hirose Electric Co., Ltd.)

```
1  [ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ] 31
2  [ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ] 30
```

CN1 pin arrangement from module surface (Transparent view)

TFT-LCD PANEL DRIVING

Pin No.	Symbol	Function	Remark
1	GND	–	–
2	CK	Clock signal for sampling each data signal	–
3	Hsync	Horizontal synchronous signal	(1)
4	Vsync	Vertical synchronous signal	(1)
5	GND	–	–
6	R0	RED data signal (LSB)	–
7	RI	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	–	–
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	–	–
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	–	–
27	ENAB	Signal to settle the horizontal display position	(2)
28	Vcc	+3.3/+5.0V power supply	–
29	Vcc	+3.3/+5.0V power supply	–
30	R/L	Horizontal display mode select signal	(3)
31	U/D	Vertical display mode select signal	(4)

The shielding case is not connected with GND.

Notes:

1) *480 line, 400 line or 350 line mode is selected by the polarity combination of both synchronous signals.*
2) *The horizontal display start timing is settled in accordance with a rising timing of ENAB signal. In case ENAB is fixed "Low", the horizontal start timing is determined as described in "Horizontal Display Position", page 6. Do not keep ENAB "High" during operation.*

Mode	480 lines	400 lines	350 lines
Hsync	negative	negative	positive
Vsync	negative	positive	negative
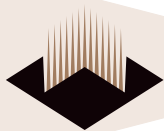
Original specifications created by Sharp.

3)

R/L=HIGH, U/D=LOW

WEDC

R/L=LOW, U/D=LOW

WEDC

4)

R/L=HIGH, U/D=HIGH

WEDC

R/L=LOW, U/D=HIGH

WEDC

BACKLIGHT DRIVING

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

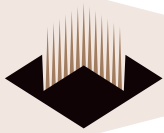Corresponding connector : SM02(8.0)B-BHS(JST)

CNA,CNB

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

ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Condition	Ratings	Unit	Remark
Input voltage	V_I	Ta=25°C	$-0.3{\sim}V_{CC}+0.3$	V	(1)
Supply voltage	V_{CC}	Ta=25°C	0~+6	V	–
Storage temperature	Tstg	–	−25~+70	°C	(2)
Operating temperature (Panel)	Topa	–	0~+63		
Operating temperature (Ambient)	Topp	–	0~+60	°C	

Notes:
1) CK, R0~R5, G0~G5, B0~B5, Hsync, Vsync, ENAB, R/L, U/L
2) Humidity: 95%RH Max. at Ta ≤ 40°C.
    Maximum wet-bulb temperature at 39°C or less at Ta > 40°C.
    No condensation

ELECTRICAL CHARACTERISTICS

TFT-LCD PANEL DRIVING

Ta=25°C

Parameter		Symbol	Min.	Typ.	Max.	Unit	Remark
3.3V	Supply voltage	V_{CC}	+3.0	+3.3	+3.6	V	(1)
5.0V	Supply voltage	V_{CC}	+4.5	+5.0	+5.5	V	
	Current dissipation	I_{CC}	–	410	460	mA	(2)
Permissive input ripple voltage		V_{RF}	–	–	100	mVp-p	V_{CC}=+3.3V
Input voltage (Low)		V_{IL}	–	–	$0.3V_{CC}$	V	(3)
Input voltage (High)		V_{IH}	$0.7V_{CC}$	–	–	V	
Input current (low)		I_{OL1}	–	–	1.0	μA	V_1=0V (4)
		I_{OL2}	–	–	60.0	μA	V_1=0V (5)
Input current (High)		I_{OH1}	–	–	1.0	μA	V_1=V_{CC} (6)
		I_{OH2}	–	–	60.0	μA	V_1=V_{CC} (7)

Notes:

1) Vcc-turn-on conditions

   $0 < T1 \leq 15ms$
   $0 < T2 \leq 20ms$
   $0 < T3 \leq 1s$
   $1s < T4$

Vcc-dip conditions

   a) $2.7V \leq V_{CC} < 3.0V$
       $td \leq 10ms$
   b) $V_{CC} < 2.7V$
       Vcc-dip conditions should also follow the Vcc-turn-on
   conditions.

2) Typical current situation: 16-gray-bar pattern
                   480 line mode
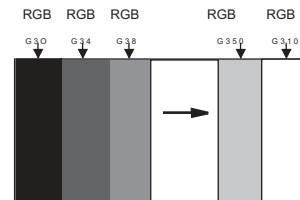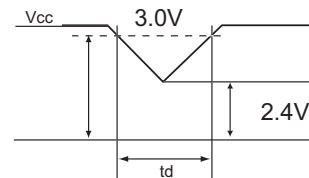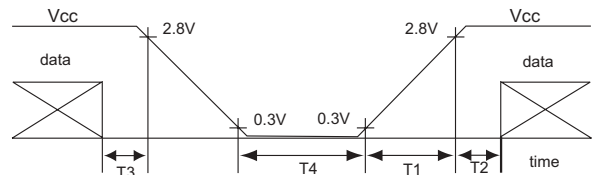 V_{CC}=+3.3V

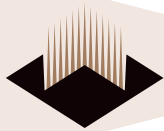3) CK, R0~R5, G0~G5, B0~B5, Hsync, Vsync, ENAB, R/L, U/D
4) CK, R0~R5, G0~G5, B0~B5, Hsync, Vsync, ENAB
5) R/L
6) CK, R0~R5, G0~G5, B0~B5, Hsync, Vsync
7) ENAB, U/D

*Original specifications created by Sharp.*

BACKLIGHT DRIVING

The backlight system is an edge-lighting type with single CCFT (Cold Cathode Fluorescent Tube). The Characteristics of a single lamp are shown in the following table.

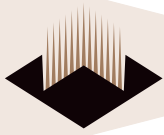| Parameter	Symbol	Min.	Typ.	Max.	Unit	Remark
Lamp current	I_L	2.0	6.0	6.5	mArms	(1)
Lamp power consumption	P_L	-	2.16	-	W	(2)
Lamp frequency	F_L	20	35	60	KHz	(3)
Kickoff voltage	V_S	-	-	800	Vrms	Ta=25°C
		-	-	1000	Vrms	Ta=0°C (4)
Lamp life time	L_L	-	25000	-	hour	(5)

* 3pin is V_{LOW}
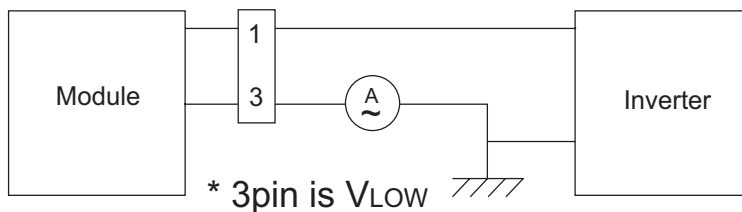
Notes:
1) Lamp current is measured with current meter for high frequency as shown above.
2) At the condition of Y_L=(300cd/m²)
3) Lamp frequency may produce interference with horizontal synchronous frequency, and this may cause horizontal beat on the display. Therefore, lamp frequency shall be detached as much as possible from the horizontal synchronous frequency and from the harmonics of horizontal synchronous to avoid interference.
4) The open output voltage of the inverter shall be maintained for more than 1 sec; otherwise the lamp may not be turned on.
5) Since the lamp is consumable, the life time written above is referential value and it is not guaranteed in this specification sheet by Panelview. Lamp life time is defined that it applied either (1) or (2) under this condition
(Continuous turning on at Ta=25°C, IL=6mArms)
   (1) Brightness becomes 50% of the original value under standard condition.
   (2) Kick-off voltage at Ta=0°C exceeds maximum value, 1500 Vrms.
      In case of operating under lower temp environments, the lamp exhaustion is accelerated and the brightness becomes lower.
      (Continuous operating for up to 1 month under lower temp conditions may reduce the brightness to 50%.)
      In case of such usage under lower temp environments, periodic lamp exchange by Panelview is recommended.

Note:
   The performance of the backlight, for example life time or brightness, is extremely influenced by the characteristics of the DC-AC inverter for lamp. When designing or ordering the inverter, make sure that poor lighting caused by the mismatch of the backlight and the inverter (miss-lighting, flicker, etc.), do not occur. Once this is confirmed, the module should be operated in the same condition as it is installed in the instrument. Recommended inverter is "CXA-L0612A-VJL(TDK corporation)".

Original specifications created by Sharp.

TIMING CHARACTERISTICS OF INPUT SIGNALS

Timing diagram of input signals are shown below.

<div align="center">Tɪᴍɪɴɢ Cʜᴀʀᴀᴄᴛᴇʀɪsᴛɪᴄs</div>

Parameter		Symbol	Mode	Min.	Typ.	Max.	Unit
Clock	Frequency	1/Tc	all	–	25.18	28.33	MHz
	High time	Tch	all	5	–	–	ns
	Low time	Tcl	all	10	–	–	ns
Data	Se-up time	Tds	all	5	–	–	ns
	Hold time	Tdh	all	10	–	–	ns
Horizontal sync. signal	Cycle	TH	all	30.00	31.78	–	μs
			all	750	800	900	clock
	Pulse width	THp	all	2	96	200	clock
Vertical sync. signal	Cycle	TV	480	515	525	560	line
			400	446	449	480	line
			350	447	449	510	line
	Pulse width	TVp	all	1	–	34	line
Horizontal display period		THd	all	640	640	640	clock
Hsync Clock phase difference		THc	all	10	–	Tc-10	ns
Hsync-Vsync phase difference		TVh	all	0	–	TH-THp	clock

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

HORIZONTAL DISPLAY POSITION

The horizontal display position is determined by the ENAB signal and the input data corresponding to the rising edge of ENAB signal is displayed at the left end of the active area.

Parameter		symbol	Min.	Typ.	Max.	Unit	Remark
Enable signal	Setup time	Tes	5	-	TC-10	ns	-
	Pulse width	Te	2	640	640	clock	-
Hsync-Enable signal phase difference		THe	44	-	TH-664	clock	-

Note:

When ENAB is fixed "Low", the display starts from the data of C104 (clock) as shown above. The module does not work when ENAB is fixed "High".
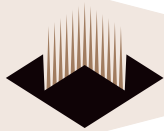
VERTICAL DISPLAY POSITION

The vertical display position is automatically centered in the active area at each mode of VGA, 480-, 400-, and 350-line mode. Each mode is selected depending on the polarity of the synchronous signals described on page 2, Input Terminals, Note 1.

In each mode, the data of TVn is displayed at the top line of the active area. The display position will be centered on the screen like the following figure when the period of vertical synchronous signal, TV is typical value.

In 400-, and 350-line mode, the data in the vertical data invalid period is also displayed. Inputting all data "()" is recommended during vertical data invalid period.

ENAB signal has no relation to the vertical display position.

Mode	V-data start (TVs)	V-data period (TVd)	V-display start (TVn)	V-display period	Unit
480	34	480	34	480	line
400	34	400	443-TV	480	line
350	61	350	445-TV	480	line

400 lines mode (TV=449)

350 lines mode (TV=449)
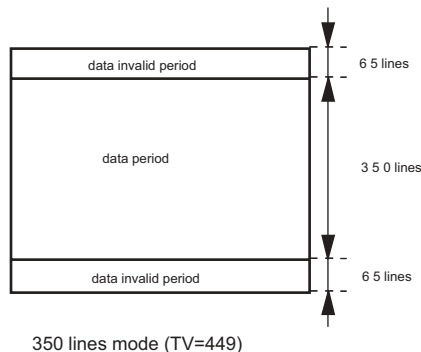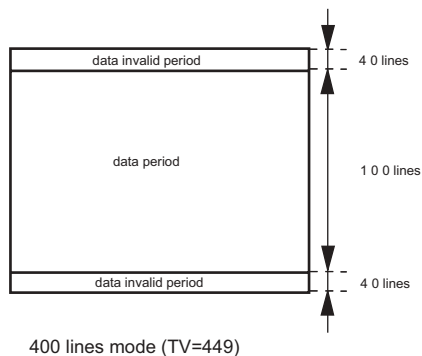
INPUT DATA SIGNALS AND DISPLAY POSITION ON THE SCREEN

Display position of input data (480 lines mode)

Original specifications created by Sharp.

Fig 2-1 Input signal waveforms (480 line mode)

Fig 2-2 Input signal waveforms (400 line mode)

Horizontal sync. signal (Hsync)

Clock signal (CK)

Data signal (R0~R5, G0~G5, B0~B5)

Data enable signal (ENAB)

Vertical sync. signal (Vsync)

Horizontal sync. signal (Hsync)

Data signal (R0~R5, G0~G5, B0~B5)

0.3Vcc
THp
0.3Vcc
THc
0.7Vcc
TH

0.8Vcc
0.8Vcc
C1*
0.3Vcc
C2*
Number of clock
*Only when enable terminal (ENAB) is fixed.
THe
Horizontal data invalid period

D1
C104*
0.7Vcc
Tes
0.7Vcc

D2
Tds
Tdh
Tc
Tch
Tcl

D3
0.3Vcc
0.7Vcc
0.3Vcc

THd
Tep

D639
D640
Number of H-data
0.3Vcc
Horizontal data invalid period

TVh
0.7Vcc
1
2
0.7Vcc

TVp
0.3Vcc

TVs
34
Number of line

DH1
DH2
DH3
TVd
DH399
DH400
Number of V-data line

TV

Vertical invalid data period

Vertical invalid data period

0.7Vcc

Fig. 2-3 Input signal waveforms (350 line mode)

INPUT SIGNALS, BASIC DISPLAY COLOR AND GRAY SCALE OF EACH COLOR

Colors & Gray scale		Gray Scale	RA0 RA0	RA1 R1	R2 R2	R3 R3	R4 R4	R5 R5	G0 G0	G1 G1	G2 G2	G3 G3	G4 G4	G5 G5	B0 B0	B1 B1	B2 B2	B3 B3	B4 B4	B5 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
	↑	GSI	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	GSG3	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1

Notes:

1) 0: Low level voltage 1: High level voltage

2) 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.
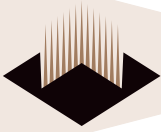
Original specifications created by Sharp.

OPTICAL CHARACTERISTICS

Ta=25°C, V_{CC}=+5V

Parameter		Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Viewing angle range	Horizontal	θ21	(CR≥10)	45	55	–	Deg.	(4)
		θ22		45	55	–	Deg.	
	Vertical	θ11		45	55	–	Deg.	
		θ12		30	40	–	Deg.	
Contrast ratio		CR	Best viewing angle	–	250	–	–	(2,4)
Response time	Rise	τr	θ = 0°	–	20	–	ms	(3,4)
	Decay	τd		–	40	–	ms	
Chromaticity of white		X		–	0.319	–	–	(4)
		Y		–	0.329	–	–	
Luminance of white		Y_L		240	300	–	cd/m²	
White Uniformity		δw		–	–	1.45	–	(5)
Viewing angle range as a brightness definition	Horizontal	θ21	50% of the maximum brightness	–	45	–	Deg.	(1)
		θ22		–	45	–	Deg.	
	Vertical	θ11		–	30	–	Deg.	
		θ12		–	35	–	Deg.	

The measurement shall be executed 30 minutes after lighting at rating. (typical condition: i_L=6mArms)
The optical characteristics shall be measured in a dark room or equivalent state with the method shown in Fig. 3 below.

Parameter	MIN.	TYP.	MAX.	UNIT
Luminance of white				
IM film	240	300	-	cd/m2
IM, ELG	300	400	-	
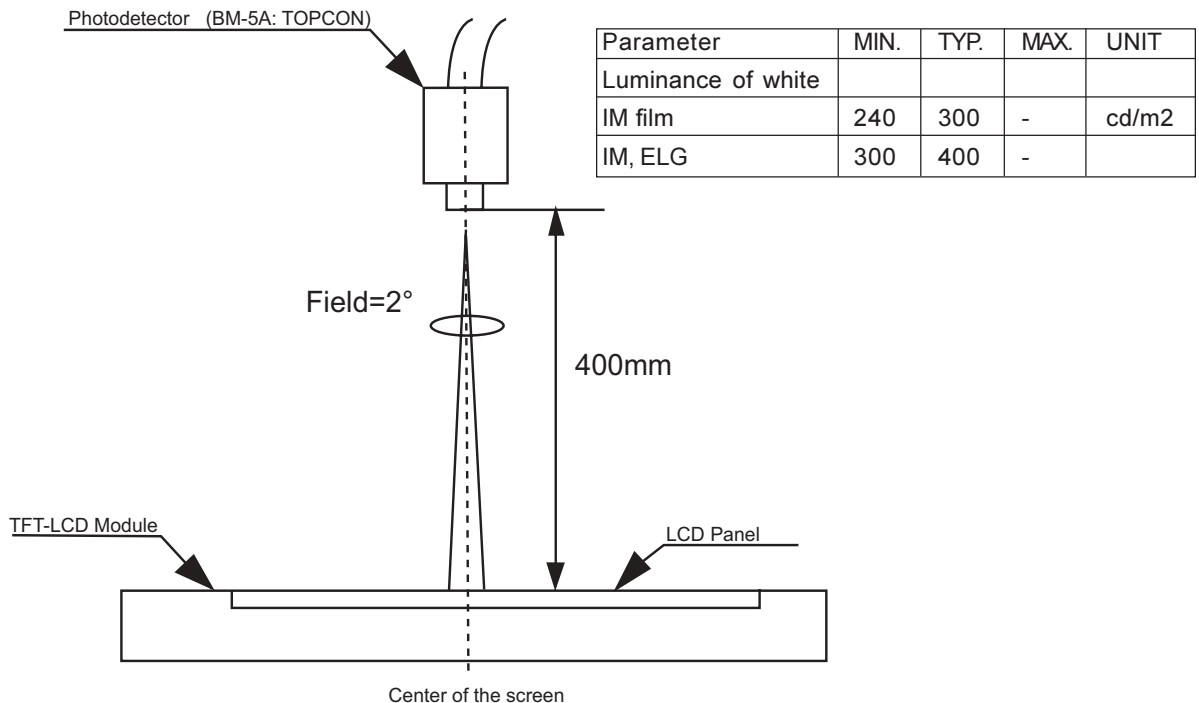
Optical characteristics measurement method

Original specifications created by Sharp.

Notes:

1) Definitions of viewing angle range:

2) Definition of contrast ratio:

$$\text{Contrast Ratio (CR)} = \frac{\text{Luminance (brightness) with all pixels white}}{\text{Luminance (brightness) with all pixels black}}$$
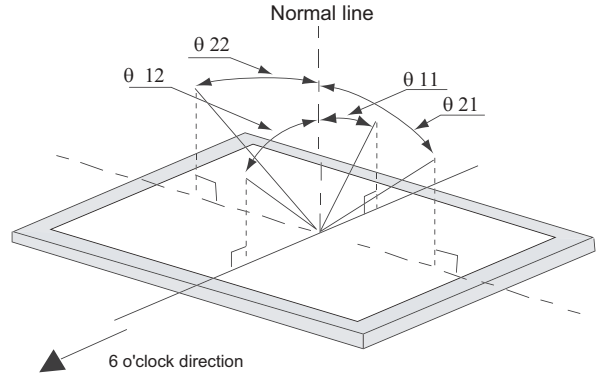
3) Definition of response time:
   The response time is defined as the following figure and shall be measured by switching the input signal for "black" and "white".
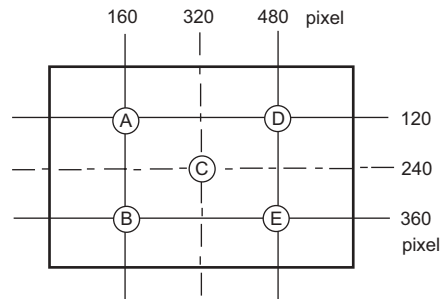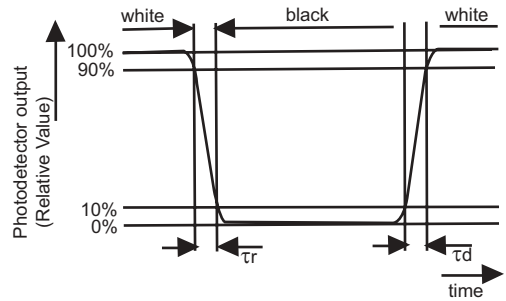
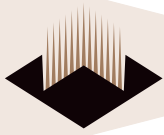4) This shall be measured at center of the screen.

5) Definition of white uniformity:
   White uniformity is defined as the following with live measurements (A~E).

$$\delta_W = \frac{\text{Maximum Luminance of five points (brightness)}}{\text{Minimum Luminance of five points (brightness)}}$$

Normal line

θ 22 θ 12 θ 11 θ 21

6 o'clock direction

white   black   white

Photodetector output
(Relative Value)

100%
90%

10%
0%

τ_r τ_d

time

160   320   480   pixel

A   D   120

C   240

B   E   360
pixel

Original specifications created by Sharp.

DISPLAY QUALITY

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

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 to avoid rubbing with something hard or sharp.

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.

t) Since the panel is made of glass and refined wires and components, it may break, crack or internal wire breaking 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 make certain one is grounded 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 carefully handled 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 'dust' on the polarizer by using an ionized nitrogen gun, etc.

k) Connect GND to 4 place of mounting holes to stabilize against EMI and external noise.

l) There are high voltage portions on the backlight and very dangerous. Careless handling may lead to electrical shock.

M) Be sure not to apply tensile stress to the lamp lead cable.

PACKING FORM

a) Piling number of cartons: MAX 8

b) Package quantity in one carton: 20 pcs

c) Carton size: 483 (W) x 275 (D) x 330 (H) mm

d) Total mass of 1 carton filled with full modules: 10.5 kg

OTHERS

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

b) Image retention may occur when a fixed pattern is displayed for a long period of time.

c) Do not use LCD module in the atmosphere of corrosive gases, such as sulfide gas or chlorine gases, which can damage the display.

RELIABILITY TEST ITEMS

No.	Test Item	Conditions	
1	High temperature storage test	Ta=70°C	240h
2	Low temperature storage test	Ta=25°C	240h
3	High temperature & high humidity operation test	Ta=40°C, 95%RH (No condensation)	240h
4	High temperature operation test	Ta=60°C	240h
5	Low temperature operation test	Ta=0°C	240h
6	Vibration test (non operating)	Frequency:	10~57Hz/Vibration width (one side):0.075mm 58~500Hz/Gravity:9.8m/s^2
		Sweep time:	11 minutes
		Test period:	3 hours (1 hour for each direction of X,Y,Z)
7	Shock test (non operating)	Max. gravity:	490m/s^2
		Pulse width:	11 ms, half sine wave
		Direction:	±X,±Y,±Z once for each direction.

Original specifications created by Sharp.

ENLARGED DETAIL (SCALE : 2)

(HEIGHT OF CONNECTOR TOP SURFACE)
5.6
2.2 (I/F PWB HEIGHT)
(33.5)
17.5
14
17.5

ENLARGED DETAIL (SCALE : 2)
3 +0.3/−0
3.5
(2)
R 2
2 - Full R
2.7 +0.2/−0
4
1.5

152.4
146.4
69.9
3.5
2.7
3
4

12
4.85
2.5

100
175.9
170.88
216
215
221
112.7

ACTIVE AREA CENTER
BEZEL OPENING (175.9X134.6)
ACTIVE AREA (170.88X129.6)

100.3

134.6
129.6

2.5
7
4.85

3.GND
1.HOT
(CNB)
(50)

12
28.5

43.2
109.3

Full - R
2 - R 1.5
2 - R 4
(2.5)
(2.5)
ENLARGED DETAIL (SCALE : 2)
(3)
3 ±0.2
45°
4

Original specifications created by Sharp.

CONNECTOR OF I/F AND
CIRCUMFERENCE DIAGRAM

CN1