SHARP

No.	LD – 12Y56
DATE	Nov. 13. 2000

TECHNICAL LITERATURE

FOR

TFT - LCD module

MODEL No. LQ181E1LW31

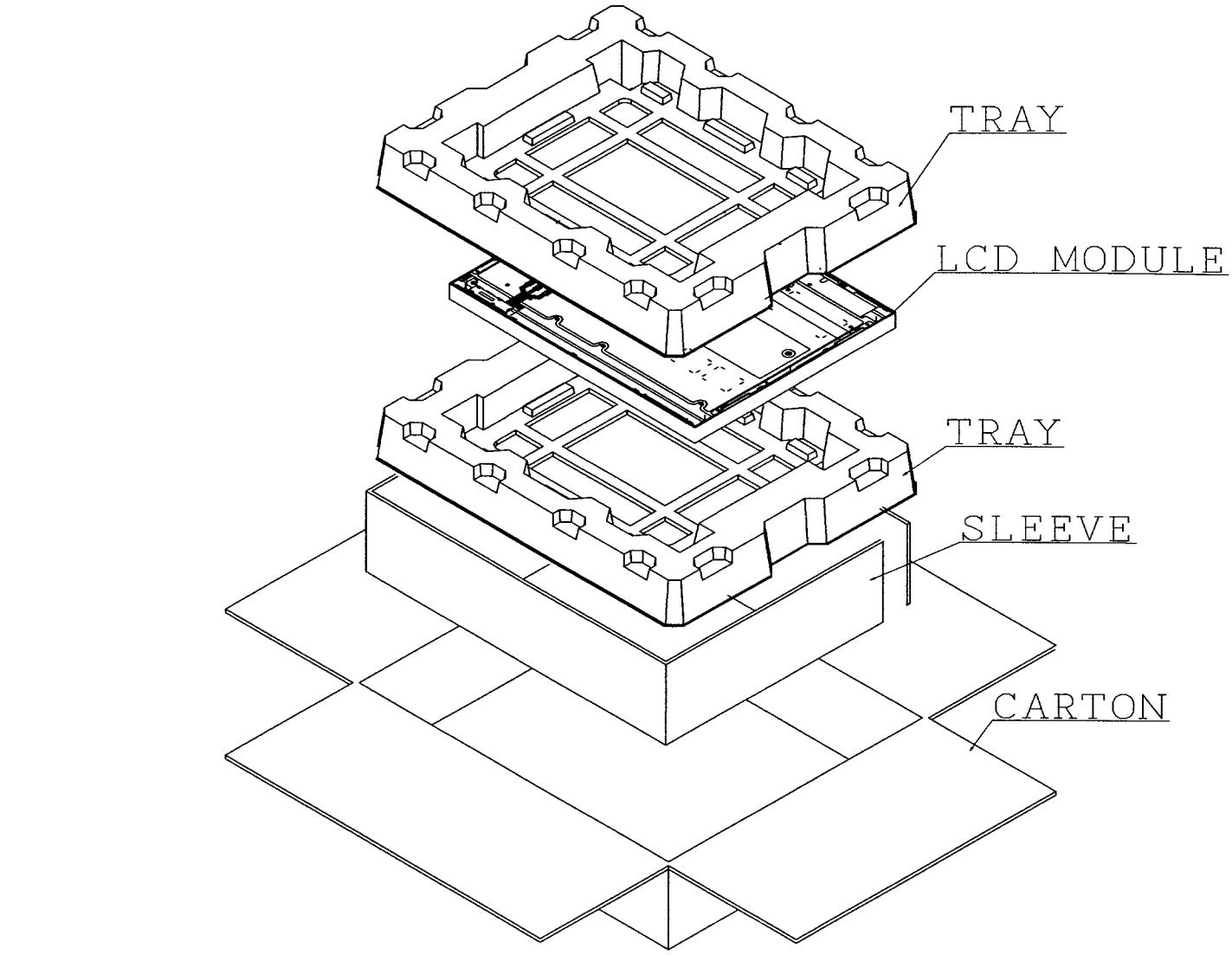
The technical literature is subject to change without notice. So, please contact Sharp or its representative before designing your product based on this literature.

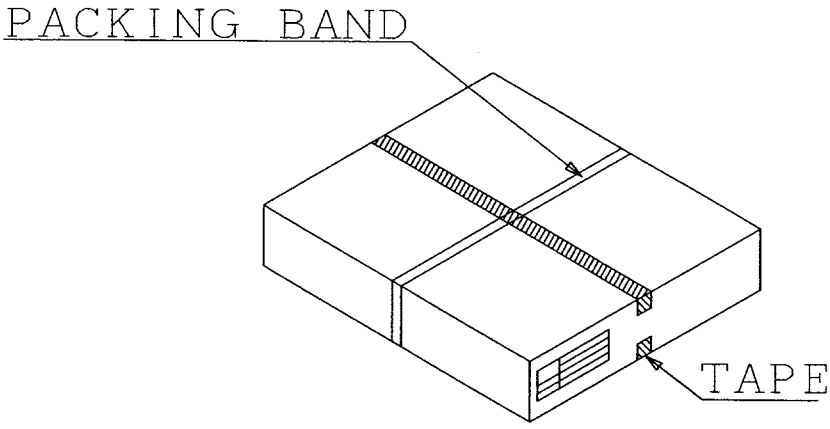
DEVELOPMENT ENGINEERING DEPARTMENT 3
TFT DIVISION 2
TFT LIQUID CRYSTAL GROUP
SHARP CORPORATION

RECORDS OF REVISION

LQ181E1LW31

SPEC No.	DATE	REVISED No.	PAGE	SUMMARY	NOTE
LD-12Y56	Nov. 13. 2000	-	-	-	1 st Issue





PACKING FORM

1. Application

This specification applies to the color 18.1 SXGA TFT-LCD module LQ181E1LW31.

◎The device listed in these specification 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.

◎SHARP 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.

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

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, power supply circuit and a back light unit. Graphics and texts can be displayed on a 1280×3×1024 dots panel with about 16 million colors (8 bit) by supplying 48 bit data signals(8bit×2pixel×RGB), two display enable signals, two dot clock signals, +12V DC supply voltages for TFT-LCD panel driving and supply voltage for back light.

3. Mechanical Specifications

Parameter	Specifications	Unit
Display size	46 (Diagonal)	cm
	18.1 (Diagonal)	Inch
Active area	359.0 (H)×287.2 (V)	Mm
Pixel format	1280 (H)×1024 (V)	Pixel
	(1 pixel=R+G+B dots)	
Pixel pitch	0.2805 (H)×0.2805 (V)	Mm
Pixel configuration	R,G,B vertical stripe	
Display mode	Normally Black	
Unit outline dimensions *1	389 (W)×317.2 (H)×27.5(D)	Mm
Mass	MAX 3.5	kg
Surface treatment	Anti-glare and hard-coating 2H	

*1.Note: excluding back light cables.

The thickness of module (D) doesn't contain the projection.

Outline dimensions are shown in Fig.1.

4. Input Terminals

4-1. TFT-LCD panel driving

CN1 (Interface signals and +12VDC power supply)

Using connector : FI-SE30P-HF (Japan Aviation Electronics Ind.,Ltd.)

Mating connector : FI-S30S (Japan Aviation Electronics Ind.,Ltd.)

Pin No.	Symbol	Function	Remark
1	Vcc	＋１２Ｖ　電源	
2	Vcc	＋１２Ｖ　電源	
3	Vcc	＋１２Ｖ　電源	
4	GND	ＧＮＤ	
5	GND	ＧＮＤ	
6	GND	ＧＮＤ	
7	NC	ＮＣ	
8	NC	ＮＣ	
9	GND	ＧＮＤ	
10	RxBIN3＋	Positive (＋) LVDS differential data input (B port)	
11	RxBIN3－	Negative (－) LVDS differential data input (B port)	
12	RxBCLKIN＋	Positive (＋) LVDS differential clock input (B port)	
13	RxBCLKIN－	Negative (－) LVDS differential clock input (B port)	
14	RxBIN2＋	Positive (＋) LVDS differential data input (B port)	
15	RxBIN2－	Negative (－) LVDS differential data input (B port)	
16	RxBIN1＋	Positive (＋) LVDS differential data input (B port)	
17	RxBIN1－	Negative (－) LVDS differential data input (B port)	
18	RxBIN0＋	Positive (＋) LVDS differential data input (B port)	
19	RxBIN0－	Negative (－) LVDS differential data input (B port)	
20	RxAIN3＋	Positive (＋) LVDS differential data input (A port)	
21	RxAIN3－	Negative (－) LVDS differential data input (A port)	
22	RxACLKIN＋	Positive (＋) LVDS differential clock input (A port)	
23	RxACLKIN－	Negative (－) LVDS differential clock input (A port)	
24	RxAIN2+	Positive (＋) LVDS differential data input (A port)	
25	RxAIN2－	Negative (－) LVDS differential data input (A port)	
26	RxAIN1＋	Positive (＋) LVDS differential data input (A port)	
27	RxAIN1－	Negative (－) LVDS differential data input (A port)	
28	RxAIN0＋	Positive (＋) LVDS differential data input (A port)	
29	RxAIN0－	Negative (－) LVDS differential data input (A port)	
30	GND	ＧＮＤ	

Data Mapping (Thine : THC63LVDM83A)

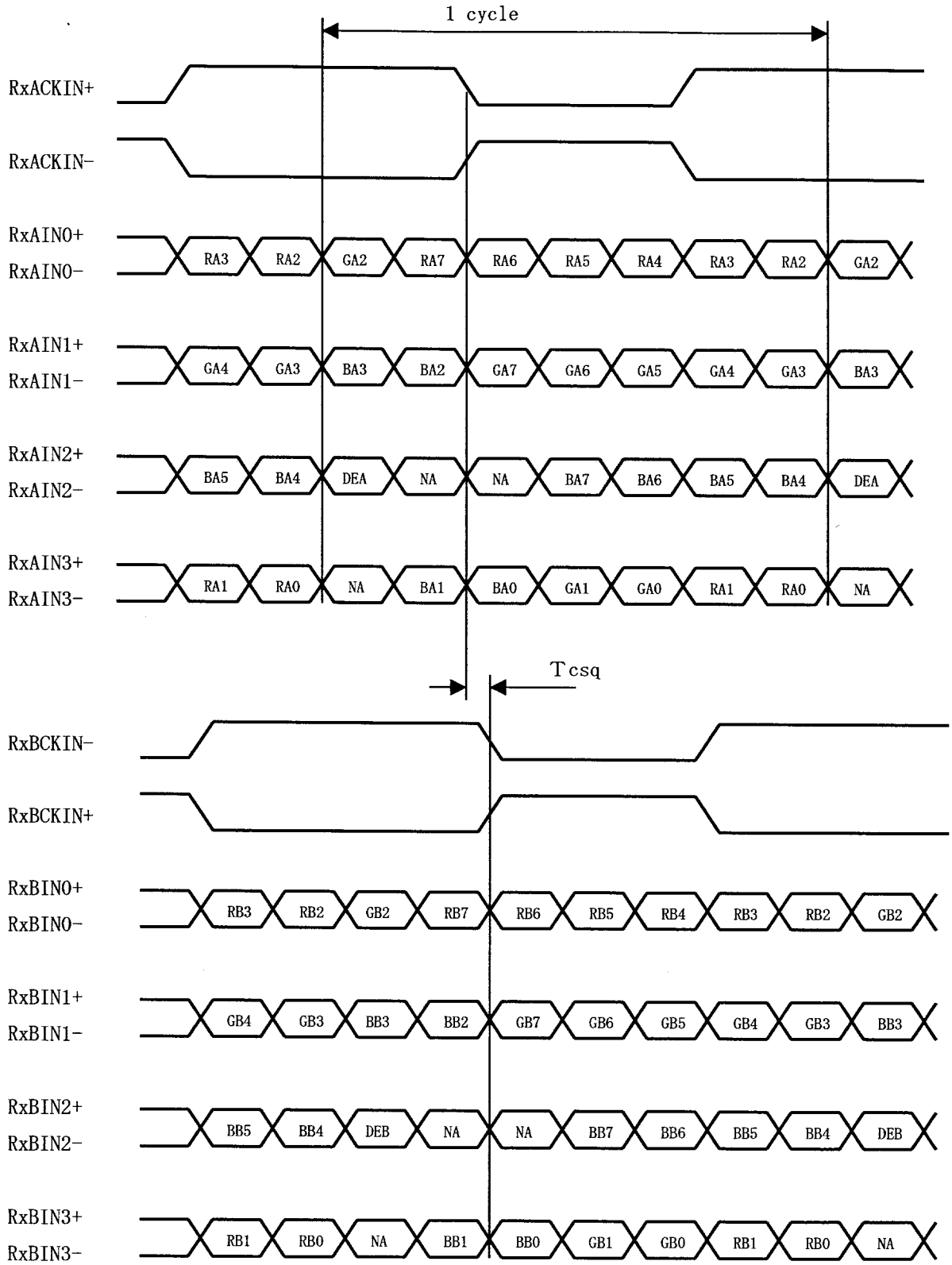
A port Data

Input Signal	Transmitter		Connector
	Pin	Data	
RA2	51	TA0	RxAIN0±
RA3	52	TA1	
RA4	54	TA2	
RA5	55	TA3	
RA6	56	TA4	
RA7	3	TA5	
GA2	4	TA6	
GA3	6	TB0	RxAIN1±
GA4	7	TB1	
GA5	11	TB2	
GA6	12	TB3	
GA7	14	TB4	
BA2	15	TB5	
BA3	19	TB6	
BA4	20	TC0	RxAIN2±
BA5	22	TC1	
BA6	23	TC2	
BA7	24	TC3	
RSVD(NA)	27	TC4	
RSVD(NA)	28	TC5	
DEA	30	TC6	
RA0	50	TD0	RxAIN3±
RA1	2	TD1	
GA0	8	TD2	
GA1	10	TD3	
BA0	16	TD4	
BA1	18	TD5	
RSVD(NA)	25	TD6	
DCLK	31	CLKIN	RxACLKIN±

B port Data

Input Signal	Transmitter		Connector
	Pin	Data	
RB2	51	TA0	RxBIN0±
RB3	52	TA1	
RB4	54	TA2	
RB5	55	TA3	
RB6	56	TA4	
RB7	3	TA5	
GB2	4	TA6	
GB3	6	TB0	RxOIN1±
GB4	7	TB1	
GB5	11	TB2	
GB6	12	TB3	
GB7	14	TB4	
BB2	15	TB5	
BB3	19	TB6	
BB4	20	TC0	RxBIN2±
BB5	22	TC1	
BB6	23	TC2	
BB7	24	TC3	
RSVD(NA)	27	TC4	
RSVD(NA)	28	TC5	
DEB	30	TC6	
RB0	50	TD0	RxBIN3±
RB1	2	TD1	
GB0	8	TD2	
GB1	10	TD3	
BB0	16	TD4	
BB1	18	TD5	
RSVD(NA)	25	TD6	
DCLK	31	CLKIN	RxBCLKIN±

RSVD : Non connect



DE: Display Enable

NA: Not Available

4-2. Back light driving

CN 2, 3

The module-side connector : BHSR-02VS-1 (JST)

The user-side connector : SM02B-BHSS-1-TB (JST)

Pin no.	Symbol	I／O	Function
1	V_{HIGH}	I	Power supply for lamp (High voltage side)
2	V_{LOW}	I	Power supply for lamp (Low voltage side)

5. Absolute Maximum Ratings

5-1. Module

Parameter	Symbol	Condition	Ratings	Unit	Remark
Storage temperature	Tstg	—	−25 ～ +60	℃	【Note1】
Operating temperature (Ambient)	Topa	—	0 ～ +50	℃	

【Note1】 Humidity : 95%RH Max. (Ta≦40℃)

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

No condensation.

5-2. TFT-LCD panel driving

Parameter	Symbol	Condition	Ratings	Unit	Remark
+12.0V supply voltage	Vcc	Ta=25℃	0 ～ + 14.0	V	

6. Electrical Characteristics

6-1. TFT-LCD panel driving

Ta=25℃

Parameter		Symbol	Min.	Typ.	Max.	Unit	Remark
Vcc	Supply voltage	Vcc	+11.4	+12.0	+12.6	V	【Note1】
	Current dissipation	Icc	—	500	1000	mA	【Note2】
Permissive input ripple voltage		V_{RF}	—	—	100	mVp-p	
Input current (Low)		I_{IL}	—	—	10	μA	V_I=GND
Input current (High)		I_{IH}	—	—	10	μA	V_I=Vcc
Output voltage (Low)		V_{OL}	—	—	0.4	V	I_{OL}=1mA
Output voltage (High)		V_{OH}	2.4	—	—	V	I_{OH}=−1mA

【Note1】

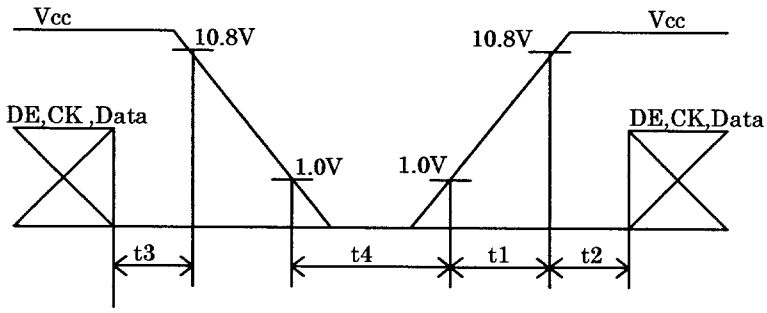
1) On-off sequences of Vcc and data

$0 < t1 \leqq 60ms$

$0 < t2 \leqq 10ms$

$0 \leqq t3 \leqq 1s$

$t4 \geqq 100ms$



2) Dip conditions for supply voltage

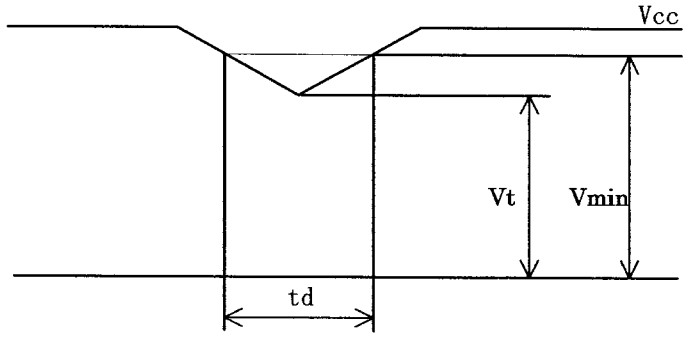
(Vmin,Vth) = (11.4V,9.6V)

i) $Vth \leqq Vcc < Vmin$

$td \leqq 20ms$

ii) $Vcc < Vth$

This case is described below *1.



*1 The LCD module shuts down when Vcc<Vth. It should also follow the 1) on-off sequence of Vcc and data.

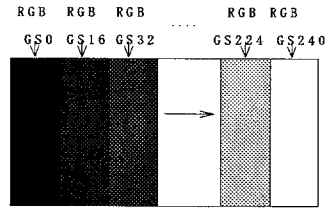
【Note2】

1) Typical current situation : 16-gray-bar pattern

Vcc=+5.0V, Vdd=+15.0V

Gray scale : GS(16N)

N=0～15



The explanation of each gray scale ,GS(16n), is described below section 8.

2） Maximum current situation :

The dots described the following figure(left) are displayed the gray scale described the following figure(right).

R, G, B, R, G, B
R, G, B, R, G, B
R, G, B, R, G, B
R, G, B, R, G, B
R, G, B, R, G, B

0, S, 0, S, 0, S
0, S, 0, S, 0, S
S, 0, S, 0, S, 0
S, 0, S, 0, S, 0
0, S, 0, S, 0, S

*1 0 =V0 gray scale
S =V255 gray scale

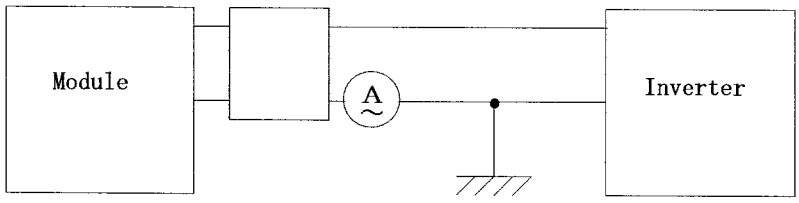
*1 The voltage correspond one of the 256 gray scale.

6-2. Back light driving

The back light system is an edge-lighting type with four CCFTs (Cold Cathode Fluorescent Tube). The characteristics of the lamp are shown in the following table. The value mentioned below is at the case of one CCFT.

Parameter	Symbol	Min.	Typ.	Max.	Unit	Remark
Lamp current range	I_L	2.5	6.0	7.0	mArms	【Note1】
Lamp voltage	V_L	—	720	—	Vrms	Ta=25℃
Lamp power consumption	P_L	—	4.32	—	W	【Note2】
Lamp frequency	F_L	35	60	70	KHz	【Note3】
Kick-off voltage	Vs	—	—	1300	Vrms	Ta=25℃ 【Note4】
		—	—	1600	Vrms	Ta=0℃ 【Note4】
Lamp life time	T_L	50000	—	—	hour	【Note5】

【Note1】 A lamp can be light in the range of lamp current shown above.
Maximum rating for current is measured by high frequency current measurement equipment connected to V_{LOW} at circuit showed below. (Note : To keep enough kick-off voltage and necessary steady voltage for CCFT.)
Lamp frequency : 35～70kHz
Ambient temperature : 0～50℃



【Note2】 Referential data per one CCFT by calculation ($I_L \times V_L$).
The data don't include loss at inverter.

【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 startup. 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=7.0 mArms.

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

② Kick-off voltage at Ta=0℃ exceeds maximum value, 1600 Vrms.

《Note》 The performance of the back light, 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 back light and the inverter (miss-lighting, flicker, etc.) never occurs. When you confirm it, the module should be operated in the same condition as it is installed in your instrument.

7. Timing characteristics of input signals

7-1. 2pixel mode timing characteristics

Timing diagrams of input signal are shown in Fig.2.

Parameter		Symbol	Min.	Typ.	Max.	Unit	Remark
Clock	Frequency	1/Tc	34	55	67.5	MHz	【Note1】
	Skew	Tcsq	−1	0	1	clock	
Data enable signal	Horizontal period	TH	800	848	928	clock	
			12.5	15	—	μs	
	Horizontal period (High)	THd	640	640	640	clock	
	Vertical period	TV	1026	1066	1080	line	【Note2】
	Vertical period (High)	TVd	1024	1024	1024	line	

【Note1】 Two pixel-data are sampled at the same time.

【Note2】 In case of using the long vertical period, the deterioration of display quality, flicker etc. may occur. There should be integral horizontal period per one vertical period.

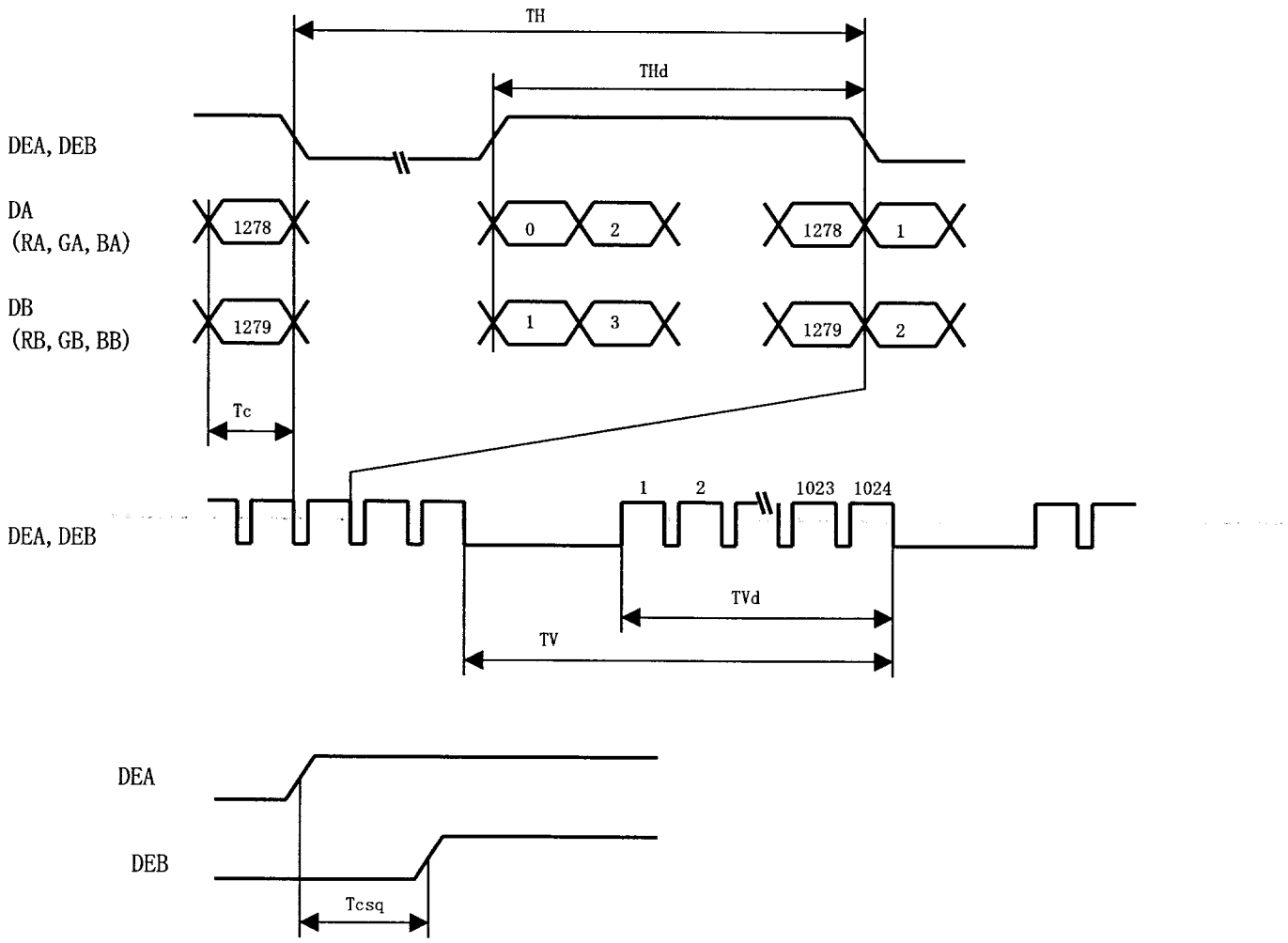
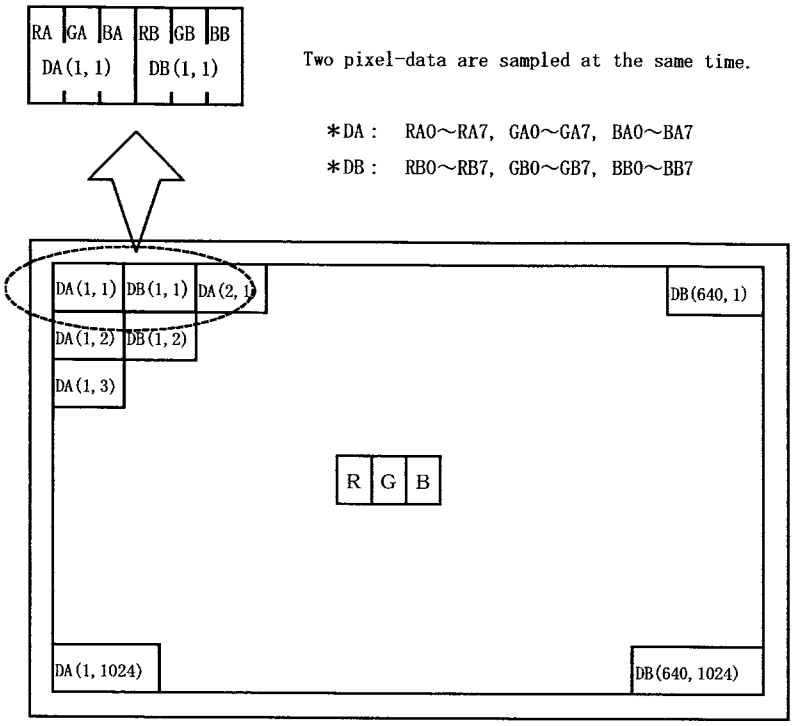


Fig. 2 Timing diagrams of input signal

7-2 Input Data Signals and Display Position on the screen

Graphics and texts can be displayed on a 1280 × 3× 1024 dots panel with 16M colors by supplying 48 bit data signal (8bit/color [256 gray scale] × 3 × 2 pixels).



Display position of input data (H, V)

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

	Colors & Gray scale	Gray Scale	Data signal																											
			RA0	RA1	RA2	RA3	RA4	RA5	RA6	RA7	GA0	GA1	GA2	GA3	GA4	GA5	GA6	GA7	BA0	BA1	BA2	BA3	BA4	BA5	BA6	BA7
			RB0	RB1	RB2	RB3	RB4	RB5	RB6	RB7	GB0	GB1	GB2	GB3	GB4	GB5	GB6	GB7	BB0	BB1	BB2	BB3	BB4	BB5	BB6	BB7
			RC0	RC1	RC2	RC3	RC4	RC5	RC6	RC7	GC0	GC1	GC2	GC3	GC4	GC5	GC6	GC7	BC0	BC1	BC2	BC3	BC4	BC5	BC6	BC7
			RD0	RD1	RD2	RD3	RD4	RD5	RD6	RD7	GD0	GD1	GD2	GD3	GD4	GD5	GD6	GD7	BD0	BD1	BD2	BD3	BD4	BD5	BD6	BD7
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	GS250	1	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	⇩	GS251	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	GS252	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	GS250	0	0	0	0	0	0	0	0	1	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	⇩	GS251	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	GS252	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	GS250	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	1	1	1
	⇩	GS251	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	GS252	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 48 bit data signals, the 16-million-color display can be achieved on the screen.

9. Optical Characteristics

Ta=25℃, Vcc=+12V

Parameter		Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Viewing Angle range	Vertical	θ 11	CR≧10	70	85	—	Deg.	【Note1,4】
		θ 12		70	85	—	Deg	
	Horizontal	θ 21, θ 22		70	85	—	Deg.	
Contrast ratio		C R	θ =0°	—	350	—		【Note2,4】
Response Time	Rise	τ r		—	5	—	m s	【Note3,4】
	Decay	τ d		—	20	—	m s	
Chromaticity of white		Wx		0.283	0.313	0.343	—	【Note4】
		Wy		0.299	0.329	0.359	—	
Chromaticity of red		Rx		0.60	0.63	0.66	—	
		Ry		0.31	0.34	0.37	—	
Chromaticity of green		Gx		0.24	0.27	0.30	—	
		Gy		0.56	0.59	0.62	—	
Chromaticity of blue		Bx		0.12	0.15	0.18	—	
		By		0.05	0.08	0.11	—	
Luminance of white		YL		—	235	—	cd/m^2	IL=6.0mA rms 【Note4】
White Uniformity		δ w		—	—	1.25	—	【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.4 below.

【Note1】 Definitions of viewing angle range:

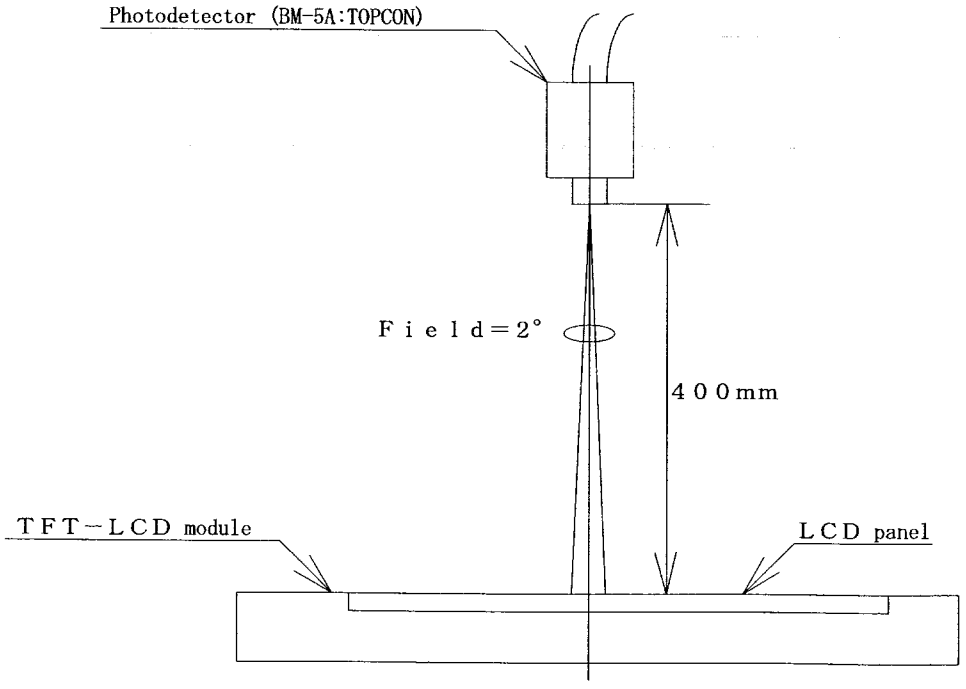
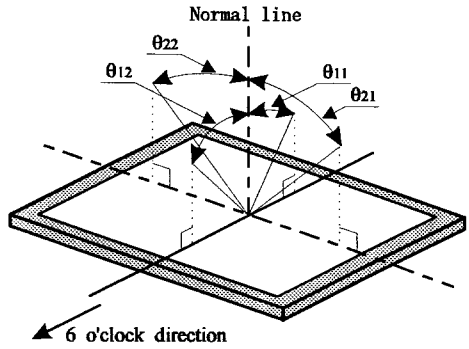


Fig. 4 Optical characteristics measurement method



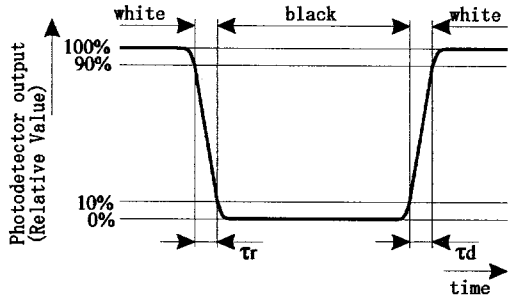
【Note2】 Definition of contrast ratio:

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:

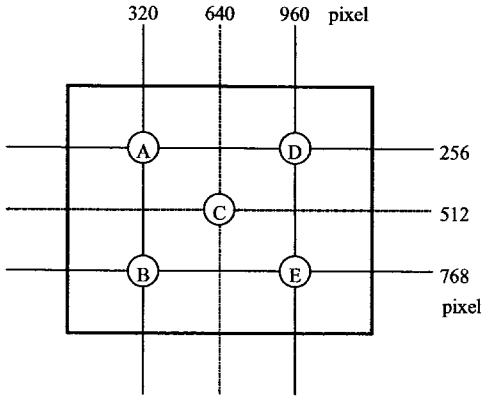
The response time is defined as the following figure and shall be measured by switching the input signal for "black" and "white".



【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).



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

10. 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 polarize is easily damaged, pay attention not to scratch it.

d) Since long contact with water may cause discoloration or spots, wipe off water drop immediately.

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 take the human earth into consideration when handling.

h) Make sure the four mounting holes of the module are grounded sufficiently. Take electro-magnetic interference (EMI) into consideration.

i) The module has some printed circuit boards (PCBs) on the back side. Take care to keep them form any stress or pressure when handling or installing the module; otherwise some of electronic parts on the PCBs may be damaged.

j) Observe all other precautionary requirements in handling components.

k) When some pressure is added onto the module from rear side constantly, it causes display non-uniformity issue , functional defect, etc. So, please avoid such design.

l) When giving a touch to the panel at power supply, it may cause some kinds of degradation. In that case, once turn off the power supply, and turn on after several seconds again, and that is disappear.

11. Packing form

a) Piling number of cartons : maximum 12 cartons

b) Packing quantity in one carton : 1 module

c) Carton size : TBD(W) × TBD(H)× TBD(D)

d) Total mass of one carton filled with full modules : 5kg

12. Reliability test items

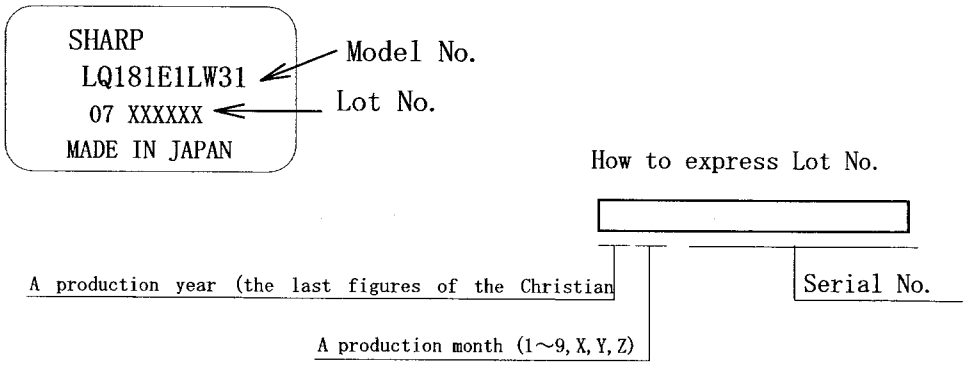
No.	Test item	Conditions
1	High temperature storage test	Ta=60℃ 240h
2	Low temperature storage test	Ta=-25℃ 240h
3	High temperature & high humidity operation test	Ta=40℃ ; 95%RH 240h (No condensation)
4	High temperature operation test	Ta=50℃ 240h (The panel temp. must be less than 60℃)
5	Low temperature operation test	Ta=0℃ 240H
6	Vibration test (non- operating)	Frequency : 10～57Hz/Vibration width (one side) : 0.075mm : 58～500Hz/Gravity : 9.8m/s^2 Sweep time : 11minutes 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 : 11ms, sine wave Direction : ±X, ±Y, ±Z, once for each direction.

【Result Evaluation Criteria】

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

13. Others

1) Lot No. and indication Label:

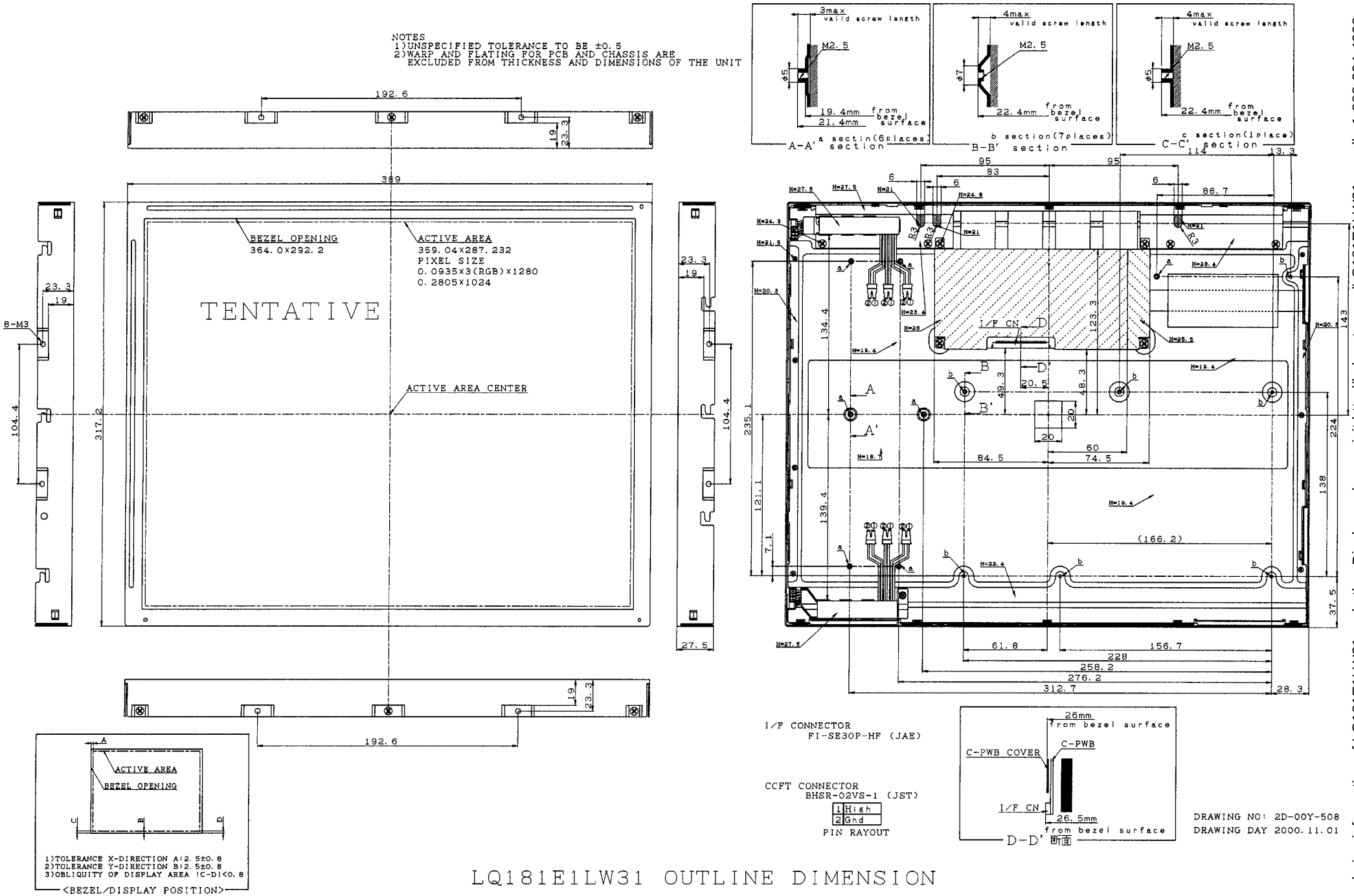


2) Adjusting volume have been set optimally before shipment, so do not change any adjusted value. If adjusted value is changed, the specification may not be satisfied.

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) When any question or issue occurs , it shall be solved by mutual discussion.



LQ181E1LW31 OUTLINE DIMENSION

DRAWING NO: 2D-00Y-508
DRAWING DAY 2000.11.01