SHARP

No.	LD -16753
DATE	Aug.. 07 . 2004

TECHNICAL LITERATURE

FOR

TFT - LCD module

MODEL No. LQ197V3DZ69

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DEVELOPMENT ENGINEERING DEPT. II
TAKI DEVELOPMENT CENTER
AVC LIQUID CRYSTAL DISPLAY GROUP
SHARP CORPORATION

RECORDS OF REVISION

LQ197V3DZ69

SPEC No.	DATE	REVISED No.	PAGE	SUMMARY	NOTE
LD-16753	Aug.07.2004				1st Issue

1. Application

This technical literature applies to the color 19.7 ”VGA TFT-LCD module LQ197V3DZ69.

* The device listed in these technical literature sheets was designed and manufactured for use in AV equipment.

* In case of using the device for applications such as control and safety equipment for transportation (aircraft, trains, automobiles, and 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 technical literature 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, inverter circuit, back light system and etc. Graphics and texts can be displayed on a 640×RGB×480 dots panel with about 16 million colors by supplying date signal of 24 bit(8 bit x RGB), 3 kind of timing signal, +5V of DC supply voltages and supply voltage for back light.
Also, this module includes the DC/AC inverter to drive the CCFT lamps.

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3. Mechanical Specifications

Parameter	Specifications	Unit
Display size	50 (Diagonal)	cm
	19.7 (Diagonal)	inch
Active area	401.28 (H) x 298.8 (V)	mm
Pixel Format	640 (H) × 480 (V) (1pixel = R + G + B dot)	pixel
Pixel pitch	0.627 (H) × 0.6225 (V)	mm
Pixel configuration	B, G, R vertical stripe	
Display mode	Normally black	
Unit Outline Dimensions *1	462.6(W) ×338.45(H) × 45.2(D)	mm
Mass	3150±50	g
Surface treatment	Anti Glare, low reflection coating Hard Coating : 2H Haze :23 +/- 5%	

(*1)Outline dimensions are shown in Fig.1

4. Input Terminals

4-1. Control circuit driving

CN1 Using connector : 50FLZX-RSM1-A-TB (JST)

Pin No.	Symbol	Function	Remarks
1	GND		
2	CK	Clock signal(sampling each data)	
3	GND		
4	Hsync	Horizontal synchronized signal	【Note 1】
5	Vsync	Vertical synchronized signal	【Note 1】
6	GND		
7	GND		
8	R0	Red data signal (LSB)	
9	R1	Red data signal	
10	R2	Red data signal	
11	R3	Red data signal	
12	GND		
13	R4	Red data signal	
14	R5	Red data signal	
15	R6	Red data signal	
16	R7	Red data signal (MSB)	
17	GND		
18	G0	Green data signal (LSB)	
19	G1	Green data signal	
20	G2	Green data signal	
21	G3	Green data signal	
22	GND		
23	G4	Green data signal	
24	G5	Green data signal	
25	G6	Green data signal	
26	G7	Green data signal (MSB)	
27	GND		
28	B0	Blue data signal (LSB)	
29	B1	Blue data signal	
30	B2	Blue data signal	
31	B3	Blue data signal	
32	GND		
33	B4	Blue data signal	
34	B5	Blue data signal	
35	B6	Blue data signal	
36	B7	Blue data signal (MSB)	
37	GND		
38	GND		
39	NC	Reserved	
40	NC	Reserved	
41	NC	Reserved	
42	NC	Reserved	
43	NC	Reserved	
44	VDD	+5V Power Supply	
45	VDD	+5V Power Supply	
46	VDD	+5V Power Supply	
47	VDD	+5V Power Supply	
48	L/R	Reverse terminal of Right and Left	【Note 2】
49	U/D	Reverse terminal of Up and Down	【Note 2】
50	GND		

Shield case contacts GND(Grand) of LCD module.

Recommended dimensions of FPC/FFC are shown in Fig.2.

Fig.2 Recommended FPC/FFC dimensions

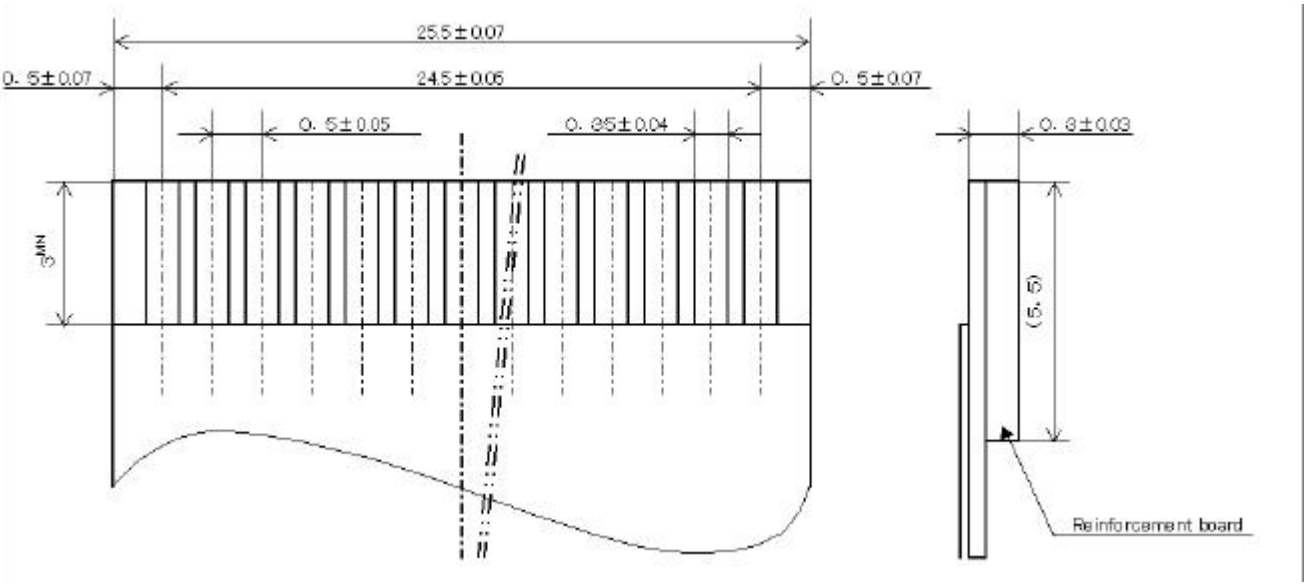
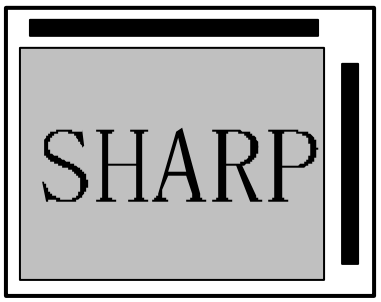


Fig.2 Recommended FPC/FFC dimensional diagram

【Note 1】The polarity combination of the Hsync.,Vsync.

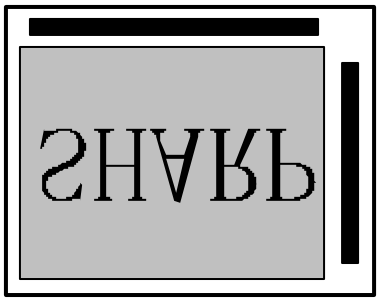
Hsync	Negative
Vsync	Negative

【Note 2】

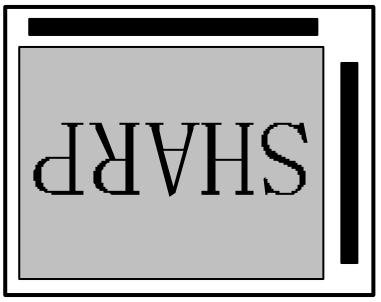


R/L : L
U/D : L

R/L : H
U/D : L



R/L : L
U/D : H



R/L : H
U/D : H

4-2. Inverter driving for back light

CN3 Suppling for Inverter Power Using connector : S12B-PH-SM3-TB(JST)
Matching connector : PHR-12(JST)

Terminal #	Signal	Functions	Remarks
1	V_{ON}	Back light ON／OFF	【Note 1】
2	$V_{BRT}0$	Setting of PWM light adjustment	【Note 2】
3	$V_{BRT}1$	PWM light adjustment pulse input	【Note 3】
4	$V_{BRT}2$	PWM light adjustment analogue input	【Note 4】
5	$V_{BRT}3$	Current light adjustment analogue input	【Note 5】
6	GND	GND	
7	VINV	+12V	
8	VINV		
9	VINV		
10	GND	GND	
11	GND		
12	GND		

* GND(Ground) of Inverter doesn't contact GND(Ground) of LCD module.

【Note 1】Inverter ON／OFF

Input Voltage	Functions
3V	Inverter in action
0V	Inverter at still

【Note 2】Setting of PWM light adjustment

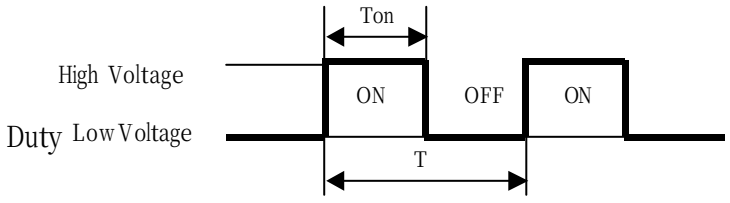
To control PWM, adjust outer input pulse signal according to a range of analogue input voltage shown below.

Input Voltage	Functions
5V	$V_{BRT}2$ select 【Note 4】
0V	$V_{BRT}1$ select 【Note 3】

【Note 3】PWM light adjustment pulse input

By 100 Hz~ 350 Hz input pulse signal, PWM DUTY is controlled.

Input signal			Functions	Remarks
MIN	TYP	MAX	DUTY (20%) :Dark :100% Bright (100Hz)	$V_{BRT}0$=0V
100Hz	-	350Hz		



Ton > 2ms

【Note 4】PWM light adjustment analogue input

By 0~ 5 V analogue input voltage, brightness control is adjusted.

Input Voltage	Functions	Remarks
5V	Brightness Control (20%): Dark	$V_{BRT}0$=5V
0V	Brightness Control (100%): Bright	

Note) 0~ 0.3 V: Duty is 100%.

Do not adjust the voltage between 0.3~ 0.7 V, as the range cannot be detected

【Note 5】Current light adjustment analogue input

By 0~ (5.0) V analogue input voltage, current light is adjusted.

	MIN	TYP	MAX	Functions
Input Voltage [V]	0	—	5.0	Light adjustment 4.0mA: Dark - 6.0mA: Bright
Lamp Current [mArms]	4.0mA	—	6.0mA	

4-3. Back light driving

The back light system is under-lighting type with 6 CCFTs(Cold Cathode Fluorescent Tube).

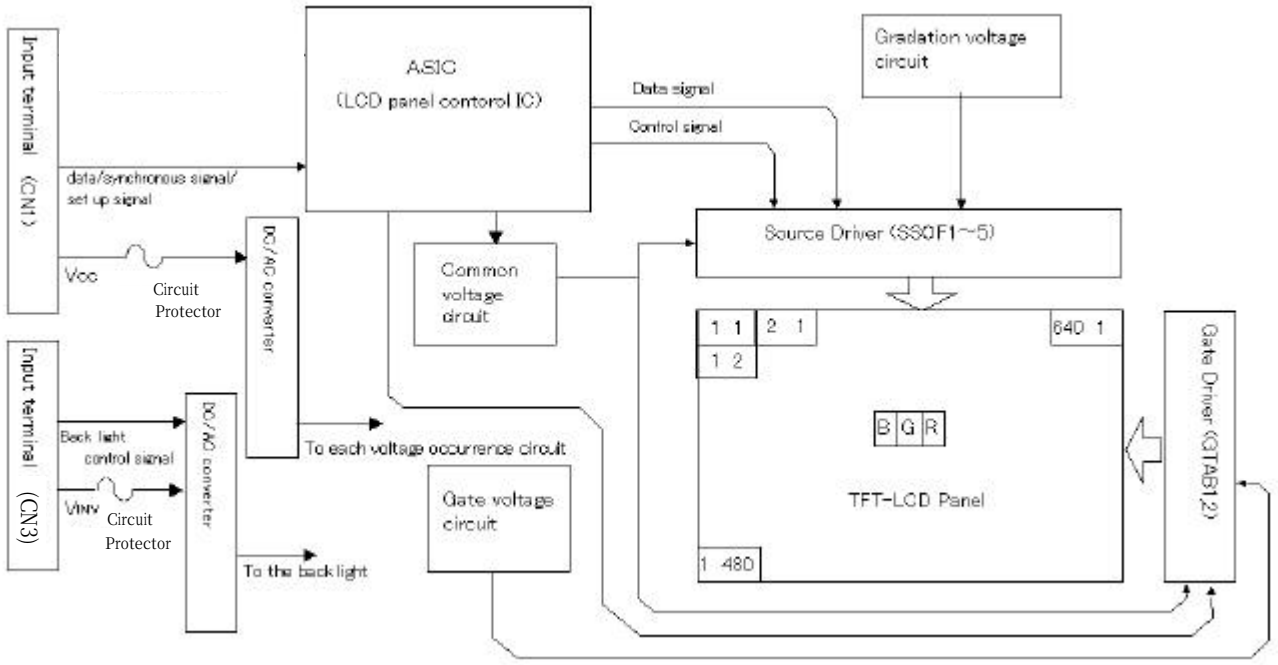
The characteristics of the lamp are shown in the following table. The value mentioned below is at the case of one CCFT.

Item	Symbol	Min.	Typ.	Max.	Unit	Remarks
Life time	T_L	50000	-	-	Hour	【Note 1】

【Note 1】Lamp life time is defined as below in the continuous operation under the condition of Ta=25°C and Brightness Control (100%)

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

4-4 LCD Module Block Diagram



5. Absolute Maximum Ratings

Parameter	Symbol	Condition	Ratings	Unit	Remark
Input voltage (for Control)	V_{IC}	Ta=25 °C	-0.3 ~ 3.6	V	【Note 1】
5V supply voltage (for Control)	Vcc	Ta=25 °C	0 ~ + 6	V	
Input voltage (for Inverter)	V_{I1}	Ta=25 °C	0 ~ + 6	V	【Note 2】
	V_{I2}	Ta=25 °C	0 ~ + 6	V	【Note 3】
12V supply voltage (for Inverter)	V_{INV}	Ta=25 °C	0 ~ +14	V	
Storage temperature	T_{stg}	-	-25 ~ +60	Degree	【Note 4】
Operation temperature (Ambient)	T_{opa}	-	0 ~ +50	Degree	

【Note 1】CK, R0～R7, G0～G7, B0～B7, Hsync, Vsync, R/L, U/D

【Note 2】V_{ON} , PWM_{SEL} , $V_{BRT2,3}$

【Note 3】V_{BRT1}

【Note 4】Humidity 95%RH Max.(Ta≦40 degree)

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

No condensation.

6. Electrical Characteristics

6-1. Control circuit driving Ta=25 degree

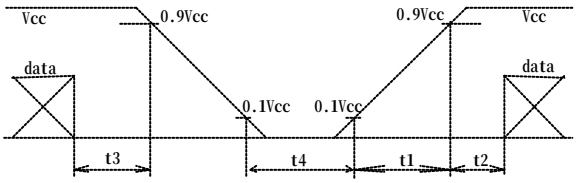
Parameter		Symbol	Min.	Typ.	Max.	Uniit	Remark
+5V supply voltage	Supply voltage	Vcc	+4.5	+5.0	+5.5	V	【Note 1】
	Current dissipation	Icc	-	460	800	mA	【Note 2】
Permissive input ripple voltage		V_{RP}	-	-	100	mVP-P	Vcc=+5.0V
Input Low voltage		V_{IL}	GND	-	0.9	V	【Note 3】
Input High voltage		V_{IH}	3.0	-	3.6	V	
Input leak current (Low)		I_{OL1}	-	-	1.0	μA	V_I =0V 【Note 3】
Input leak current (High)		I_{OH1}	-	-	1.0	μA	V_I =Vcc 【Note 3】

Note 1】

1) Input voltage sequences

0 < t1 ≦ 10ms, 0 < t2 ≦ 10ms

0 < t3 ≦ 1s, t4 ≧ 1s



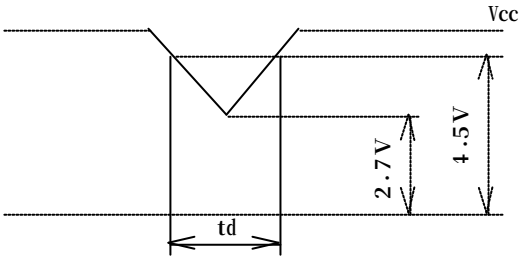
2) Dip conditions for supply voltage

a) 2.7V ≦ Vcc < 4.5V

td ≦ 10ms

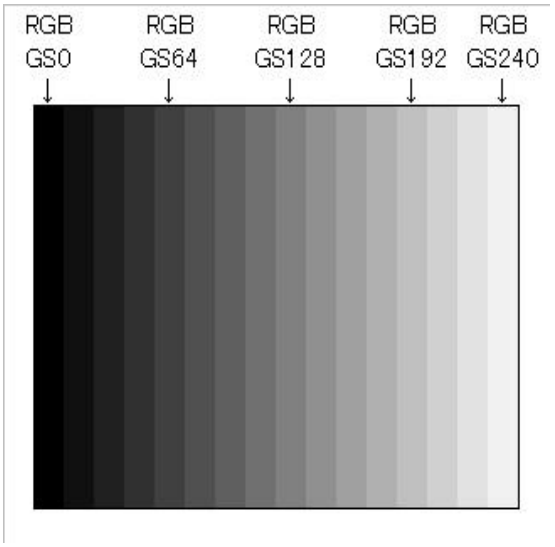
b) Vcc < 2.7V

Condition of Dip conditions for supply voltage is based on input voltage sequence.



【Note 2】Typical current situation : 16 gray-bar pattern(Vcc=+5.0V)

The explanation of RGB gray scale see section 16.



【Note 3】CK,R0～R7,G0～G7,B0～B7,Hsync,Vsync, L/R, U/D

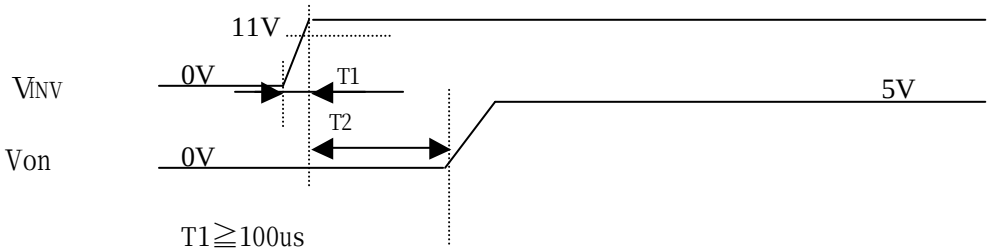
6-2. Inver driving for back light

The back light system is under-lighting type with 6 CCFTs (Cold Cathode Fluorescent Tube)

Ta=25℃

Parameter		Symbol	Min.	Typ.	Max.	Unit	Remark
+12V	Supply voltage	V_{INV}	11.0	12.0	13.0	V	【Note 1】
	Current dissipation	I_{INV}	-	4.6	5.5	A	Vinv=+12V Brightness =MAX V_{ON}=+5V
Lamp Current		I_L	-	6.0	6.5	mArms	Vinv=+12V Brightness =MAX V_{ON}=+5V
Permissive input ripple voltage		V_{INVRP}	-	-	200	mVP-P	V_{INV}=+12V
Brightness control analogue input	Input voltage (Low)	V_{ONL1}	0	-	0.5	V	【Note 2】 impedance =110kΩ
	Input voltage (High)	V_{ONH1}	3.3	-	5.0	V	
Brightness control PWM pulse inout (V_{BRT2})	Input voltage (Low)	V_{ONL2}	0	-	0.5	V	
	Input voltage (High)	V_{ONH2}	(3.3)	-	5.0	V	
		$1/B_I$	100	-	350	Hz	
Brightness control (V_{BRT3})	Max duty(100%)		0		0.3	V	【Note 3】
	Changeable Voltage		0.7		5.0	V	Impedance =335kΩ

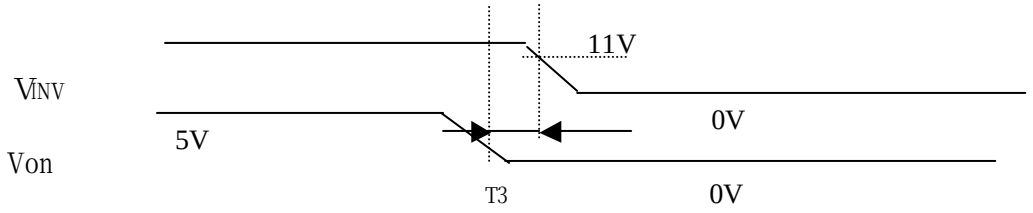
【Note 1】1)V_{INV}-turn-on condition



T1≧100us

T2≧0ms

2)V_{INV}-turn-off condition



T3≧0ms

【Note 2】impedance $V_{ON:}$:100kΩ ,PWM_{SEL}:1.1MΩ

【Note 3】Refrain from using the device under the condition V_{BRT3}=0.3 ~ 0.7 V) because of the possibility of flicker on display. In case of V_{BRT} > 5.0V, the protective circuit may stop driving the inverter.

7. Timing characteristics of input signals

Timing diagrams of input signal rare shown in Fig.3

7-1. Timing ch aracteristics

Parameter		Symbol	Min.	Typ.	Max.	Unit	Remark
Clock	Frequency	1/Tc	-	25.17	30.0	MHz	【Note 1】
	High time	Tch	5	-	-	ns	
	Low time	Tc1	5	-	-	ns	
Data	Set up time	Tds	5	-	-	ns	
	Hold time	Tdh	5	-	-	ns	
Horizontal synchronized signal	Cycle	TH	-	31.78	-	μs	【Note 2】
			650	800	1620	Clock	
	Pulse width	THp	2	-	10	Clock	
	First data timing	THe	10	10	10	Clock	
Vertical synchronized signal	Cycle	TV	492	525	1000	Line	【Note 2】
	Pulse width	TVp	2	-	12	Line	
Horizontal display area		THd	640	640	640	Clock	
Vertical display area		TVd	480	480	480	Line	
Hsync-Clock phase difference		THc	10	-	Tc-10	ns	
Hsync-Vsync phase difference		TVh	0	-	TH-THp	Clock	

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

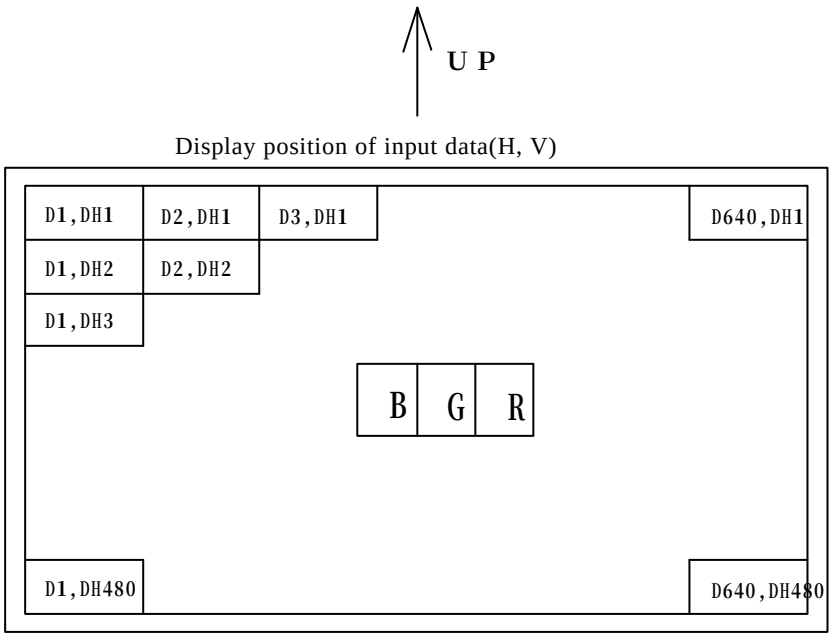
【Note 2】Horizontal cycle need not be stable during vertical blanking period. In addition, it is acceptable, if horizontal cycle is within the specifications against other factors, e.g. clock frequecies, 1H clock time (min., max.) and etc.. But, please note that the image quality may deteriorate at certain frequencies.

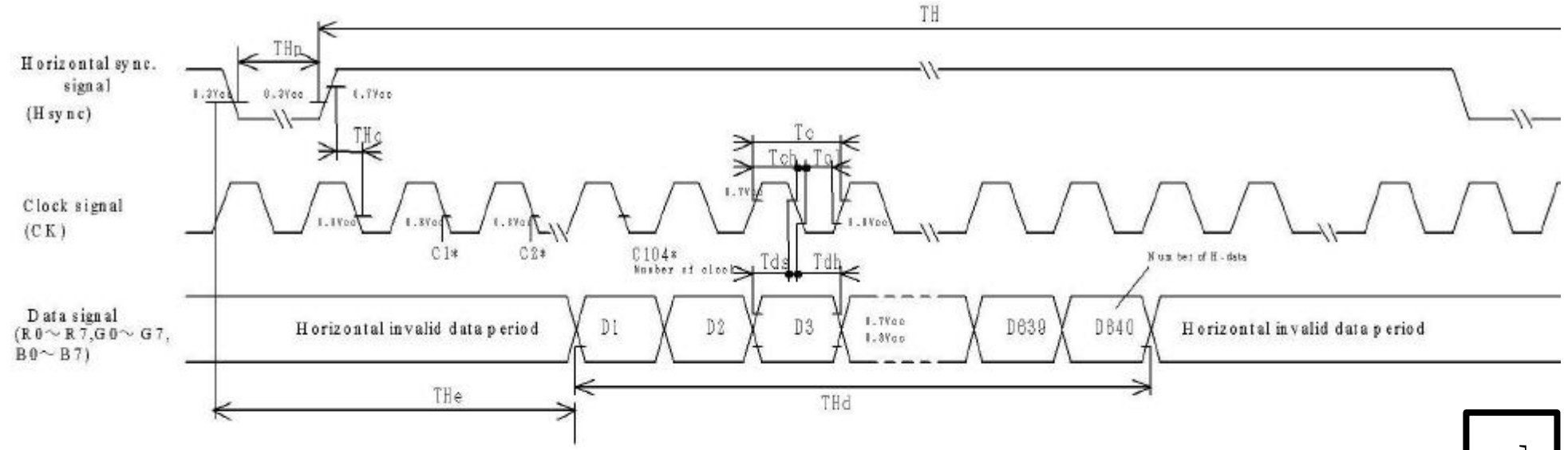
7-2. Vertical display position

The vertictal display position is determined by the falling edge of Vsync signal .

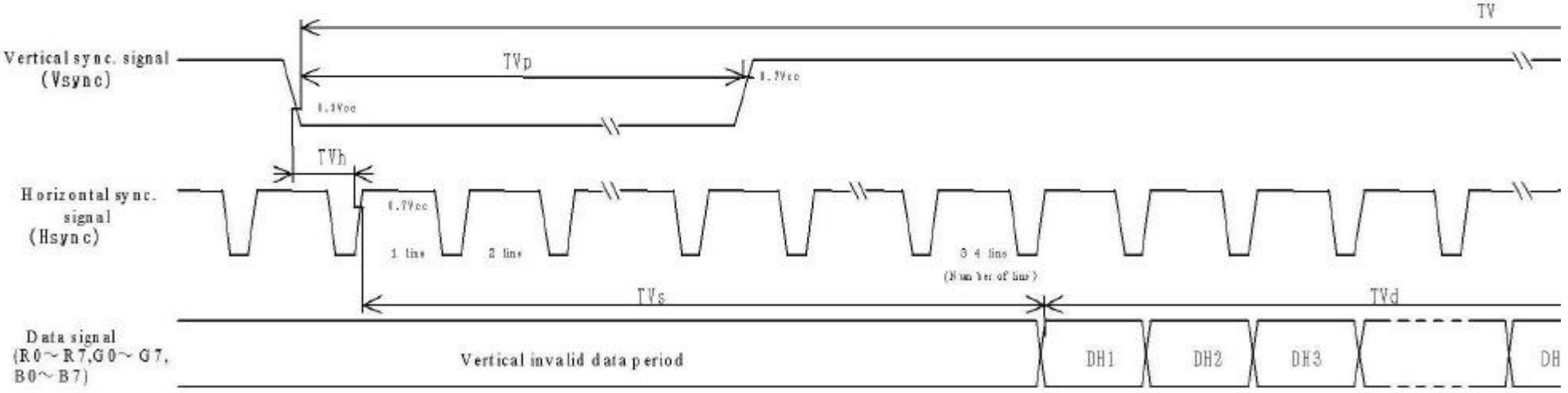
Parameter	Symbol	Min.	Typ.	Max.	Unit	Remark
Vertical data start position	TVs	12	12	12	Line	

7-3. Input data signal and display position on the screen




TH
THp
Horizontal sync. signal (Hsync)
0.3Vcc
0.3Vcc
0.7Vcc
THc
Tc
Tch
Tcl
0.7Vcc
Clock signal (CK)
0.8Vcc
0.8Vcc
0.8Vcc
0.8Vcc
C1*
C2*
C104*
Number of clock
Tds
Tdh
Number of H-data
Data signal (R0～R7,G0～G7, B0～B7)
Horizontal invalid data period
D1
D2
D3
0.7Vcc
0.8Vcc
D639
D640
Horizontal invalid data period
THe
THd

TBD


TV
Vertical sync. signal (Vsync)
TVp
0.7Vcc
0.3Vcc
TVh
Horizontal sync. signal (Hsync)
0.7Vcc
1 line
2 line
3 4 line
(Number of line)
TVs
TVd
Data signal (R0～R7,G0～G7, B0～B7)
Vertical invalid data period
DH1
DH2
DH3
DH

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

	Color & Gray scale	Data signal																								
		Gray Scale	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	X	X	1	1	1	1	1	1
	Green	—	0	0	0	0	0	0	0	0	X	X	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	Cyan	—	0	0	0	0	0	0	0	0	X	X	1	1	1	1	1	1	X	X	1	1	1	1	1	1
	Red	—	X	X	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Magenta	—	X	X	1	1	1	1	1	1	0	0	0	0	0	0	0	0	X	X	1	1	1	1	1	1
	Yellow	—	X	X	1	1	1	1	1	1	X	X	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	White	—	X	X	1	1	1	1	1	1	X	X	1	1	1	1	1	1	X	X	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	0	1	0	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	⇩	GS251	1	1	0	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red	GS252	X	X	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	0	1	0	1	1	1	1	1	0	0	0	0	0	0	0	0
	⇩	GS251	0	0	0	0	0	0	0	0	1	1	0	1	1	1	1	1	0	0	0	0	0	0	0	0
	Green	GS252	0	0	0	0	0	0	0	0	X	X	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	0	1	0	1	1	1	1	1
	⇩	GS251	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	1	1	1	1	1
	Blue	GS252	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	X	X	1	1	1	1	1	1

0 :Low level voltage, 1 :High level voltage,

Each basic color can be displayed in 253 gray scales with 8 bit data signals. According to the combination of total 24 bit data signals, the 16-million-color display can be achieved on the screen. (X: don 't care)

9. Optical characteristics

Ta=25 degree, Vcc=+5V , V_{INV}=－12V

Parameter		Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Viewing angle range	Horizontal	θ21, θ22	CR≧10	80	85	-	Deg.	【Note1,4】 Brightness=MAX
	Vertical	θ11 θ12		80	85	-	Deg.	
Contrast ratio		CRn	Best Viewing Angle	450	550	-		【Note2,4】 Brightness=MAX
Response time		τr+τd	θ=0 deg.	-	25	55	ms	【Note3,4,5】 Brightness=MAX
Chromaticity of white		X		0.242	0.272	0.302	-	【Note 4】 Brightness=MAX
		Y		0.248	0.278	0.308	-	
Luminance of white		YL1		400	500	-	cd/m^2	【Note 4】 Brightness=MAX
Luminance uniformity		δW		-	-	1.25		【Note 6】 Brightness=MAX

*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.

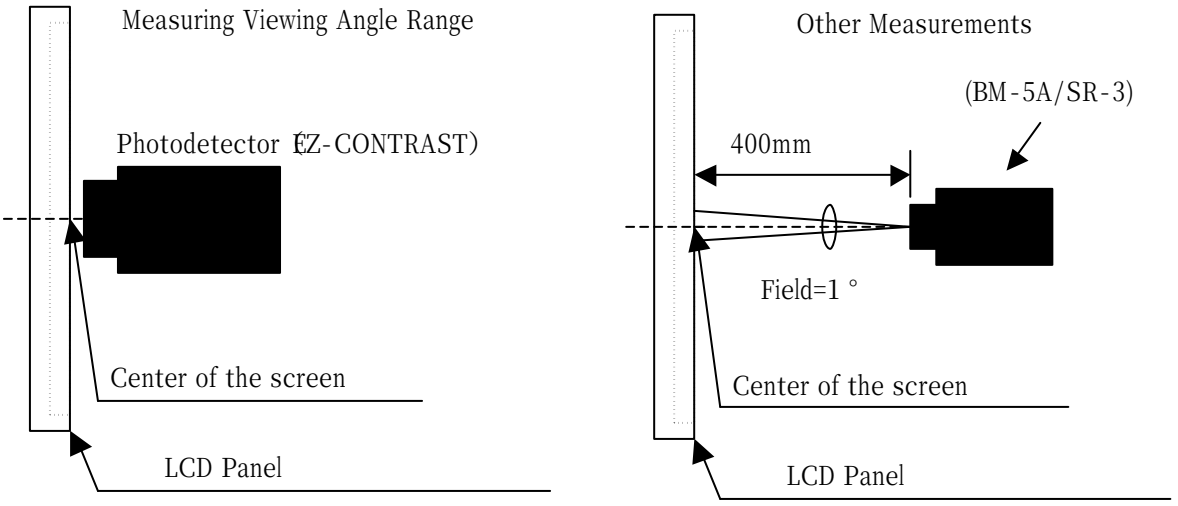
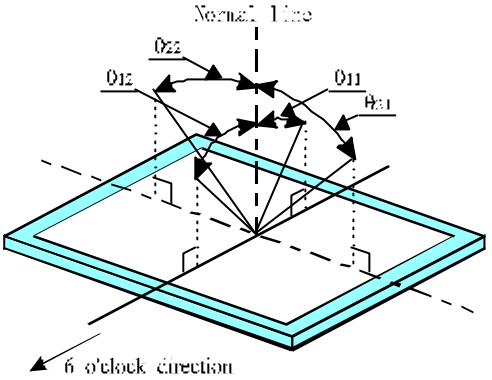


Fig.4 Optical characteristics measurement method

【Note 1】Definitions of viewing angle range :



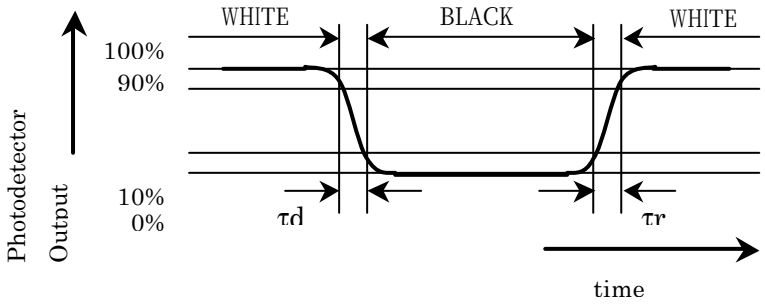
【Note 2】Definition of contrast ratio :

The contrast ratio is defined as the following.

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

【Note 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".



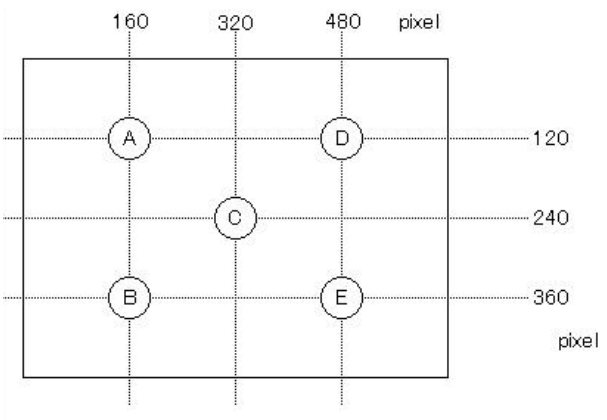
【Note 4】This shall be measured at center of the screen.

【Note 5】.Typical Value(15ms) is measured under default condition.(60Hz)

【Note 6】Definition of white uniformity ;

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

$$\delta W = \frac{\text{maximum Luminance of five points(brightness)}}{\text{minimum Luminace of five points(brightness)}}$$



10. Display Quantity

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

11.Warning

The module includes the inverter circuit, which generates high voltage. Do not touch the inverter cover DSand CCFT lamp terminals when inverter is turning on. Please alert "Don't touch it ",if someone may touch.

12 Handling Precautions of the module

a) Be sure to turn off the power supply when inserting disconnecting the cable.

b) This product is using the parts(inverter, CCFT etc) which generate the high voltage. Therefore, during operating, please don't touch these parts.

c) Brightness control voltage is switched for "ON" and "OFF", as shown in Fig.5. Voltage difference generated by this switching, ΔVINV, may affect a sound output, etc. when the power supply is shared between the inverter and its surrounding circuit. So, separate the power supply of the inverter circuit with the one of its surrounding circuit.

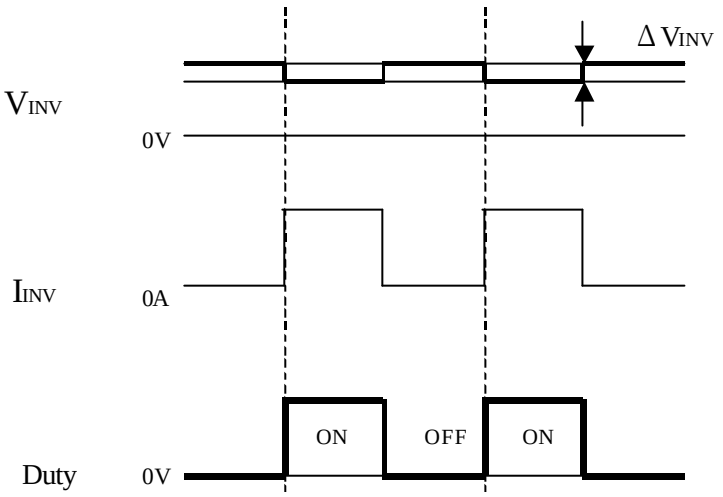


Fig.5 Brightness control voltage.

d) Be sure to fix the module in the same plane so that the module can be installed without any extra stress such as warp or twist.

e) Since the front polarizer is easily damaged, pay attention to treat it.

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

g) When the panel surface is soiled, wipe it with absorbent cotton or other soft cloth.

h) Since the panel is made of glass, it may break or crack if dropped or bumped on hard surface. Handle with care.

i) Since CMOS LSI is used in this module, take care of static electricity and consider wearing the earth personnel when handling.

j) Ground attachment to the LCD module should be considered, so that influences from EMI and outer noise is minimized.

k) 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.

l) Observe all other precautionary requirements in handling components.

m) 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

n) 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.

o) Blow off dust with N2 blower for which static electricity preventive measure has been taken. Ionized air gun is recommended.

p) Please connect from the product side to the inverter's power source ground line, as the PWB's ground for inverter is not connected to module's bezel.

12. Packing form

a) Piling number of cartons: 3(maximum)

b) Packing quantity in one carton : 5

c) Carton size : 537mm(W) × 400mm(D) × 528mm(H)

d) Total mass of one carton filled with full modules : 18.6Kg

13. Reliability test items

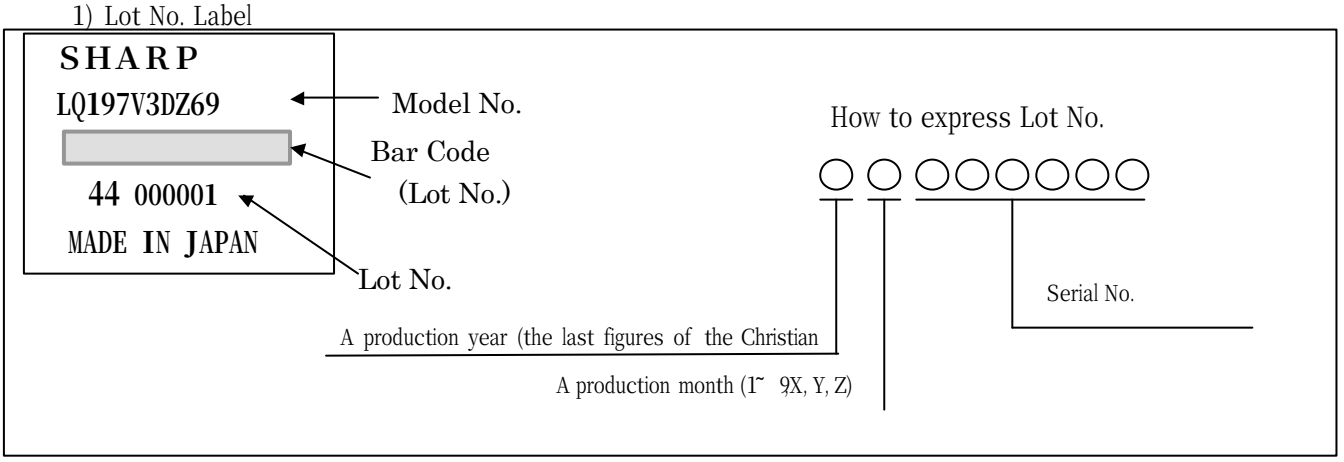
No	Test item	Conditions
1	High temperature storage test	Ta = 60°C 240h
2	Low temperature storage test	Ta = -25°C 240h
3	High temperature & high humidity operation test	Ta = 40°C ; 95%RH 240h (No condensation)
4	High temperature operation test	Ta = 50°C 240h (The panel temp. must be less than 60°C)
5	Low temperature operation test	Ta = 0°C 240H
6	Vibration test (non- operating)	Waveform : Sine wave 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.
8	Thermal shock test (Storage)	Ta=-25°C～60°C ; 5 cycles Test period : 10 hours (1 hour for each temperature)
9	Altitude	Ta=50°C,70kPa,3,048m(10,000ft), t=24h (Operating) Ta=70°C,12kPa,15,240m(50,000ft), t=24h (Storage)

【Result evaluation criteria】

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

14. Others

1) Lot No. 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) Turn off the inverter circuit for back light before turning off the power source for the controller.

6) Rust is out of considerations.

7) Regulation on usage of destructible chemical substances for the Ozone layer

Regulated substances：CFCS、Quadru Carbon Chloride、1,1,1-Tri chloro-ethylene (MethylChloroform)

a) above mentioned substances are not used in the product, and/or assembled unit and parts of this product

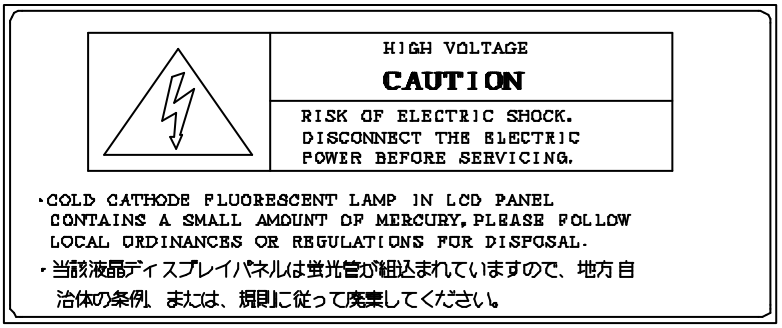
b) above mentioned substances are not used in the process of manufacturing the product and/or assembled unit and parts of this product.

8) Label of using material information

It is displaying the material of the optical parts with the label in the module back.

MATERIAL INFORMATION
DIFFUSER SHEET：>PMMA－X. PET<
DIFFUSER BOARD：>MMA／S<
REFLECTOR：>PET<

9) Cold cathode fluorescent lamp in LCD PANEL contains a small amount of mercury.
Please follow local ordinances or regulations for disposal.



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