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	AVC LIQUID CRYSTAL DISPLAY SHARP CORPORATION **SPECIFICATION**	APPLICABLE GROUP AVC LIQUID CRYSTAL DISPLAY GROUP

DEVICE SPECIFICATION FOR

TFT - LCD module

MODEL No. LQ315T3LZ23

CUSTOMER'S APPROVAL

DATE

BY

PRESENTED

BY K. Tanaka

K. TANAKA
Department General manager
Development Engineering Dept. 2, 3
DEVELOPMENT CENTER
AVC LIQUID CRYSTAL DISPLAY GROUP
SHARP CORPORATION

RECORDS OF REVISION

MODEL No : LQ315T3LZ23

SPEC No : LD-17408

Date	Revised No.	PAGE	SUMMARY	NOTE
2005.05.10		-	-	1st Issue
2005.05.17	A	P.10	Changed the sentence (Reliability and lifetime ~ -> Display works ~)	2nd Issue
		P.12	Deleted the sentence (When vertical period is very long, ~) Added the vertical frequency	

1. Application

This specification applies to the color TFT-LCD module LQ315T3LZ23.

* 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, inverter circuit and back light system etc. Graphics and texts can be displayed on a 1366×RGB×768 dots panel with 16,777,216 colors by using LVDS (Low Voltage Differential Signaling) to interface, +5V of DC supply voltages and supply voltage for back light.

This module also includes the DC/AC inverter to drive the CCFT . (+24V of DC supply voltage)

And in order to improve the response time of LCD, this module applies the O/S (over shoot) driving technology for the control circuit .In the O/S driving technology, signals are being applied to the liquid crystal according to a pre-fixed process as an image signal of the present frame when a difference is found between image signal of the previous frame and that of the current frame after comparing them.

By using the captioned process, the image signals of this LCD module are being set so that image response can be completed within one frame, as a result, image blur can be improved and clear image performance can be realized.

3. Mechanical Specifications

Parameter	Specifications	Unit
Display size	80.04 (Diagonal)	cm
	31.5 (Diagonal)	inch
Active area	697.69 (H) x 392.26 (V)	mm
Pixel Format	1366 (H) x 768 (V) (1pixel = R + G + B dot)	pixel
Pixel pitch	0.51075(H) x 0.51075 (V)	mm
Pixel configuration	R, G, B vertical stripe	
Display mode	Normally black	
Unit Outline Dimensions *1	780.0(W) x 450.0(H) x Max 48.0(D)	mm
Mass	6.4 +/- 0.3	kg
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. TFT panel driving

CN1 (Interface signals and +5V DC power supply) (Shown in Fig.1)

Using connector ：FI-X30SSL-HF (Japan Aviation Electronics Ind. , Ltd.) or SM30B-LDYGLS-01(Japan Solderless Terminals MGF. Co., Ltd)

Mating connector ：FI-X30H,FI-X30C or FI-X30M (Japan Aviation Electronics Ind. , Ltd.)

Mating LVDS transmitter：THC63LVDM83A or equivalent device

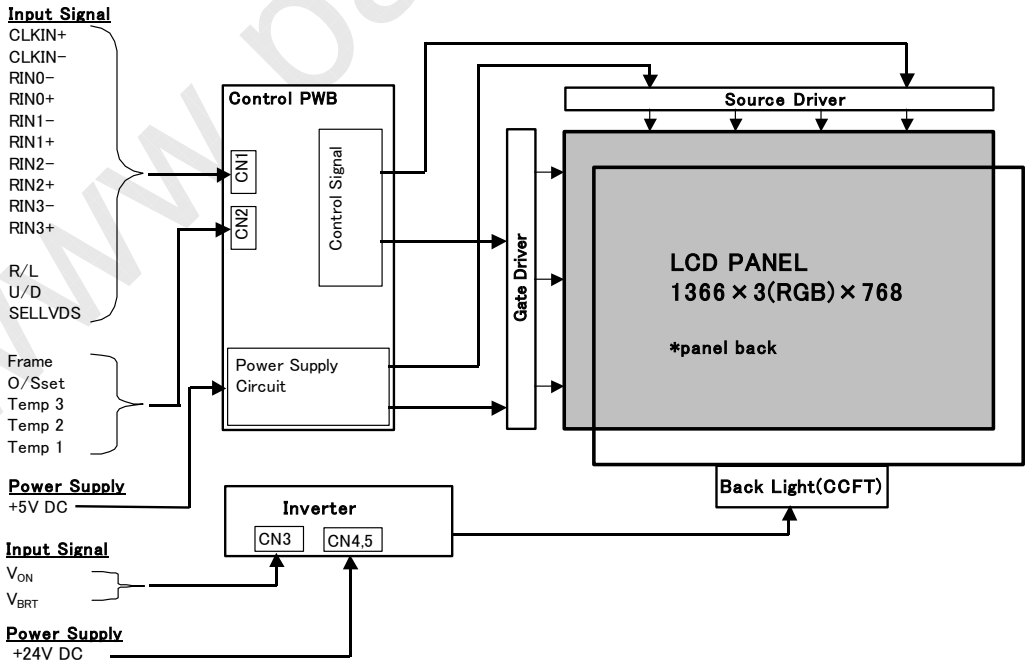
Pin No.	Symbol	Function	Remark
1	VCC	+5V Power Supply	
2	VCC	+5V Power Supply	
3	VCC	+5V Power Supply	
4	VCC	+5V Power Supply	
5	GND		
6	GND		
7	GND		
8	GND		
9	SELLVDS	Select LVDS data order 【Note1】	Pull up Default H:3.3V
10	NC		
11	GND		
12	RIN0-	Negative (-) LVDS differential data input	LVDS
13	RIN0+	Positive (+) LVDS differential data input	LVDS
14	GND		
15	RIN1-	Negative (-) LVDS differential data input	LVDS
16	RIN1+	Positive (+) LVDS differential data input	LVDS
17	GND		
18	RIN2-	Negative (-) LVDS differential data input	LVDS
19	RIN2+	Positive (+) LVDS differential data input	LVDS
20	GND		
21	CLKIN-	Clock Signal(-)	LVDS
22	CLKIN+	Clock Signal(+)	LVDS
23	GND		
24	RIN3-	Negative (-) LVDS differential data input	LVDS
25	RIN3+	Positive (+) LVDS differential data input	LVDS
26	GND		
27	R/L	Horizontal shift direction 【Note 2】	
28	U/D	Vertical shift direction 【Note 2】	
29	Reserved	Not Available	
30	Reserved	Not Available	

【Note】

1. Shield case on the module's back surface connects the GND of internal circuit.
2. It is recommend to connect all the GND terminals because of stable operation.

【Note1】SELLVDS

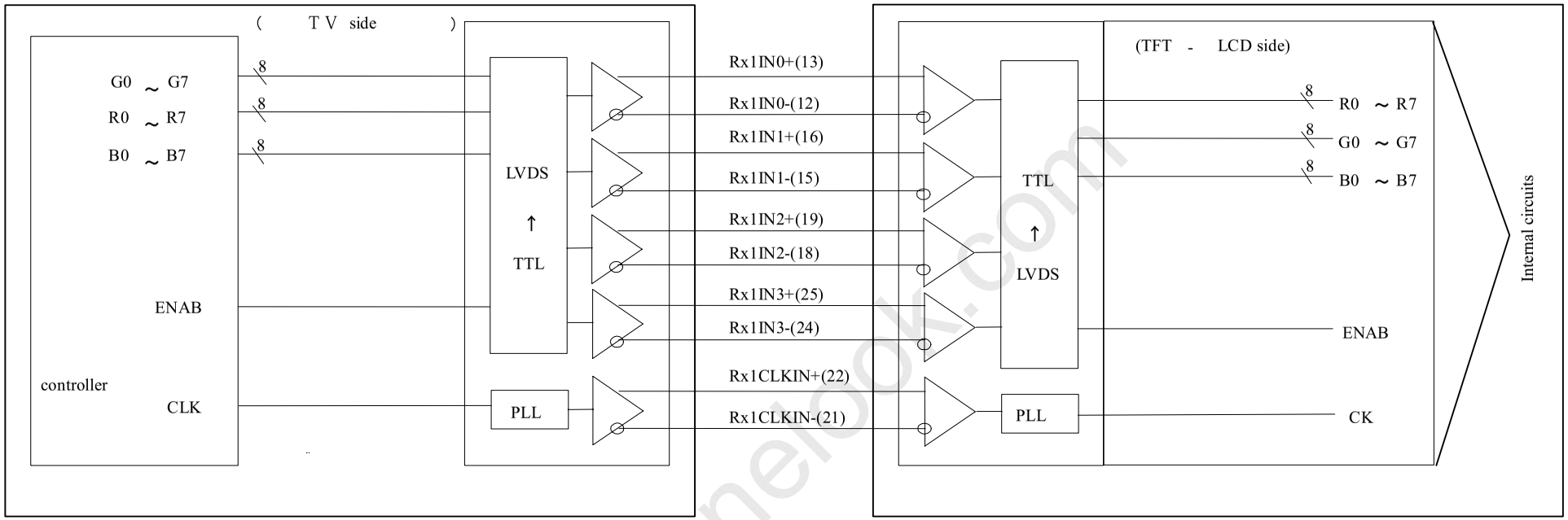
Transmitter		SELLVDS	
Pin No	Data	=L(GND)	=H(3.3V) or Open
51	TA0	R0(LSB)	R2
52	TA1	R1	R3
54	TA2	R2	R4
55	TA3	R3	R5
56	TA4	R4	R6
3	TA5	R5	R7(MSB)
4	TA6	G0(LSB)	G2
6	TB0	G1	G3
7	TB1	G2	G4
11	TB2	G3	G5
12	TB3	G4	G6
14	TB4	G5	G7(MSB)
15	TB5	B0(LSB)	B2
19	TB6	B1	B3
20	TC0	B2	B4
22	TC1	B3	B5
23	TC2	B4	B6
24	TC3	B5	B7(MSB)
27	TC4	NC	NC
28	TC5	(RSV1)	(RSV1)
30	TC6	DE	DE
50	TD0	R6	R0(LSB)
2	TD1	R7(MSB)	R1
8	TD2	G6	G0(LSB)
10	TD3	G7(MSB)	G1
16	TD4	B6	B0(LSB)
18	TD5	B7(MSB)	B1
25	TD6	(NA)	(NA)



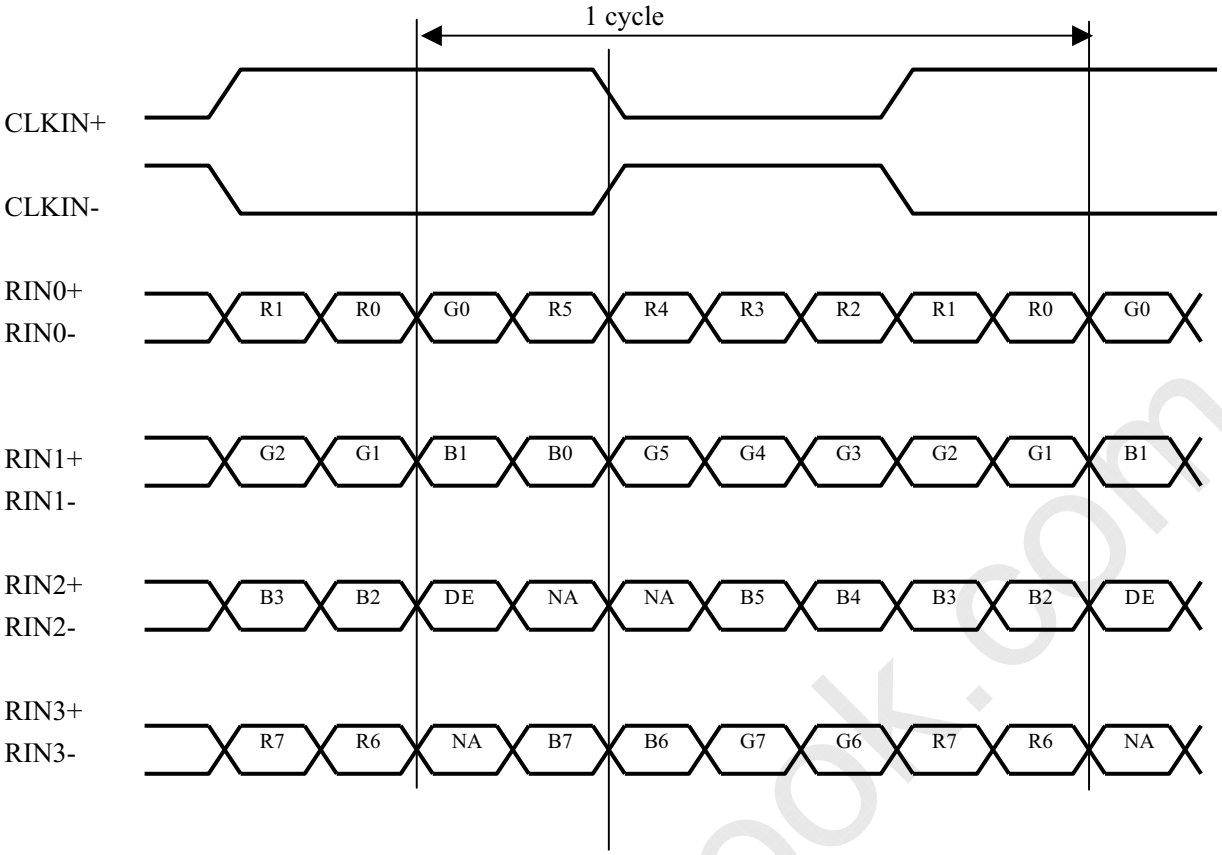
Block Diagram (LCD Module)

Interface block diagram

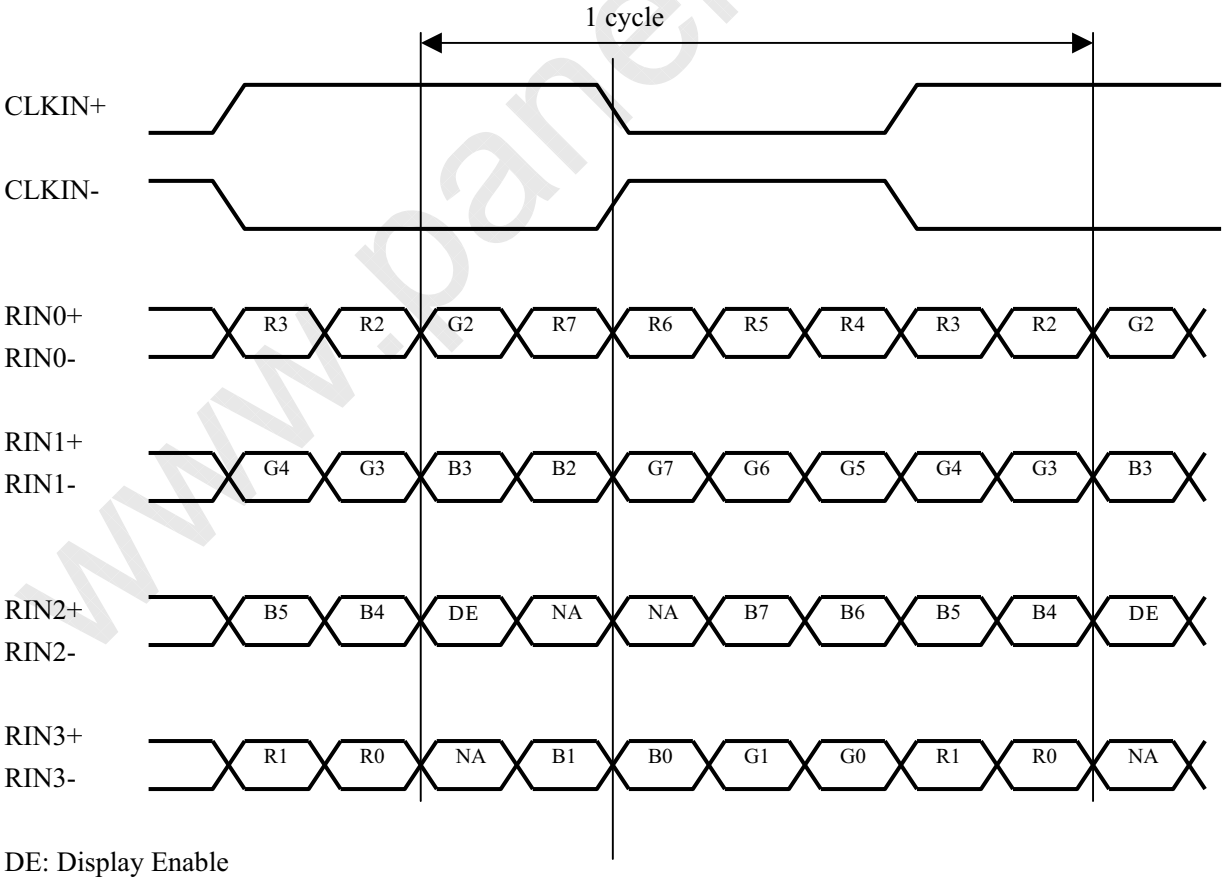
Corresponding Transmitter:THC63LVDM83R(THine) etc.



SELLVDS= Low(GND)



SELLVDS= High(3.3V) or Open



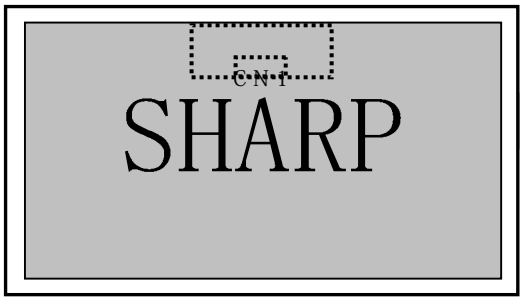
DE: Display Enable

NA: Not Available (Fixed Low)

【Note 2】

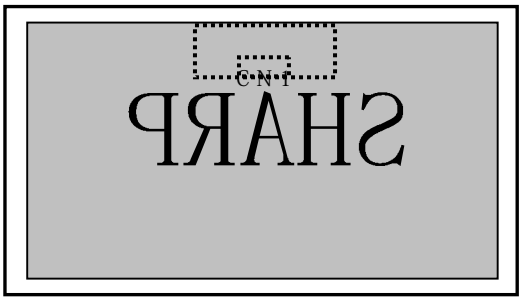
Normal (Default)

R／L：L（GND）U／D:L（GND）



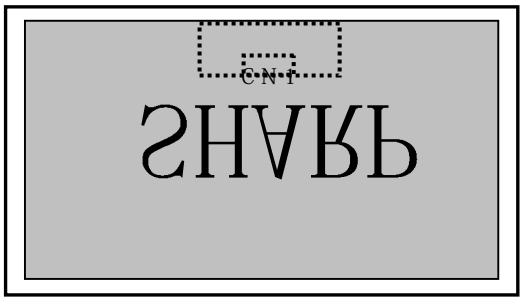
Horizontal reverse image

R／L：H（3．3V）U／D：L（GND）



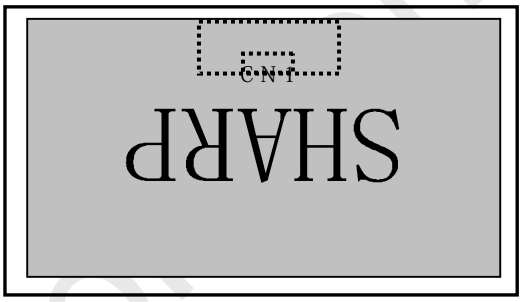
Vertical reverse image

R／L：L（GND）U／D:H（3．3V）



Horizontal and vertical reverse image

R／L：H（3．3V）U／D:H（3．3V）



CN2(O/S control) -(Shown in Fig 1)

OS Driving Pin No and function

Using connector : SM07B-SRSS-TB-A (JST)

Mating connector : SHR-07V-S or SHR-07V-S-B（JST）

Pin No.	Symbol	Function	Default
1	Frame	Frame frequency setting H:60Hz, L:50Hz	Pull down 0V : (GND)
2	O/S set	O/S operation setting H:O/S_ON, L:O/S_OFF	Pull down 0V : (GND)
3	TEST	Fix to Low level usually.	Pull down 0V : (GND)
4	Temp3	Data3 of panel surface temperature	Pull down 0V : (GND)
5	Temp2	Data2 of panel surface temperature	Pull down 0V : (GND)
6	Temp1	Data1 of panel surface temperature	Pull down 0V : (GND)
7	GND		

* L: Low level voltage (GND) H: High level voltage(3.3V)

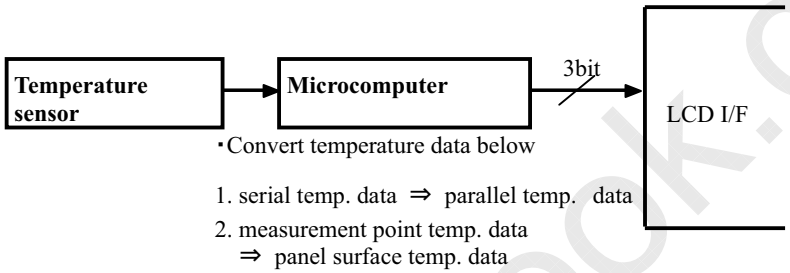
【Note】In case of O/S set setting ”L”(O/S_OFF), it should be set the “Temp1~3” and “Frame” to “L”.

According as the surface temperature of the panel, enter the optimum 3 bit signal into pin No.4,5,6. Measuring the correlation between detected temperature by the sensor on PWB in users side and actual surface temperature of panel at center , convert the temperature detected by the sensor to the surface temperature of panel to enter the 3 bit temperature data.

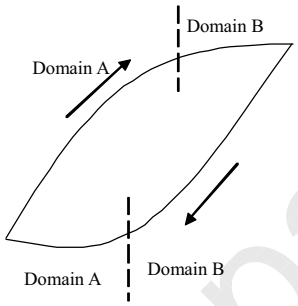
Pin no.	Surface temperature of panel							
	0-5℃	5-10℃	10-15℃	15-20℃	20-25℃	25-30℃	30-35℃	35℃ and above
4	L	L	L	L	H	H	H	H
5	L	L	H	H	L	L	H	H
6	L	H	L	H	L	H	L	H

* L: Low level voltage (GND) H: High level voltage(3.3V)

*For overlapping temperatures (such as 5℃,10℃,15℃,20℃,25℃, 30℃,35℃) select the optimum parameter, judging from the actual picture image.



OS Driving ref. circuit



There is a LM70(product by NS) etc. as a temperature sensor. Please perform temperature compensation between a measurement point and panel surface temperature with a microcomputer. Moreover, please give hysteresis about the change of setting temperature.

4-2. Backlight driving

CN3 (Inverter control) Using connector: S6B-PH-SM3-TB(JST) Mating connector: PHR-6 (JST)

Pin No.	Symbol	Function	Input Impedance	Remark
1	V_{ON}	Inverter ON/OFF	24k ohm	【Note 1】
2	Reserved	Not Available	-	
3	Reserved	Not Available	-	
4	V_{BRT}	Brightness Control	100k ohm	【Note 2】
5	Reserved	Not Available	-	
6	GND	GND		

* GND of an inverter board is not connected to GND of a module chassis and a liquid crystal panel drive part.

【Note 1】 Inverter ON/OFF

Input voltage	Function
3~5V	Inverter: ON
0~1V	Inverter: OFF

【Note 2】 Brightness Control

PWM Brightness is controlled by analog input voltage (0V to 5V) .

Input voltage	Function
5V	Brightness Control : Dark
0V	Brightness Control : Bright

【Reference】The characteristic of the V_{BRT} vs. dimming level

Input voltage (V_{BRT})	Dimming level (luminance)
0V	0%
0.5V	15%
1.0V	30%
1.5V	41%
2.0V	52%
2.5V	62%
3.0V	70%
3.5V	78%
4.0V	84%
4.5V	90%
5.0V	94%

* The measurement shall be executed more than 60 minutes after adjusting dimming voltage.

CN4,CN5 (Inverter Power input Pin layout) Using connector: B10B-PH-SM3-TB (JST)

Mating connector: PHR-10 (JST)

Pin No.	Symbol	Function
1	V_{INV}	+24V
2	V_{INV}	+24V
3	V_{INV}	+24V
4	V_{INV}	+24V
5	V_{INV}	+24V
6	GND	-
7	GND	-
8	GND	-
9	GND	-
10	GND	-

*GND of an inverter board is not connected to GND of a module chassis and a liquid crystal panel drive part.

4-3. Lamp characteristics

The back light system is direct type with 18 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.

CCFT type : CFL2753A/CFL(STANLEY ELECTRIC CO.,LTD)

CFL15E361Y728P5S30A (NEC Lighting, Ltd)

Item	Symbol	Min.	Typ.	Max.	Unit	Remarks
Life time	T_L	60000	-	-	Hour	【Note 1】

【Note 1】Lamp life time is defined as the time when brightness becomes 50% of the original value in the continuous operation under the condition of Ta=25 ℃ and brightness control(V_{BRT}=0V).

5. Absolute Maximum Ratings

Parameter	Symbol	Condition	Ratings	Unit	Remark
Input voltage (for Control)	V_I	Ta=25 ℃	-0.3 ~ 3.6	V	【Note 1】
5V supply voltage (for Control)	VCC	Ta=25 ℃	0 ~ + 6	V	
Input voltage (for Inverter)	V_{BRT} V_{ON}	Ta=25 ℃	0 ~ + 6	V	
24V supply voltage (for Inverter)	V_{INV}	Ta=25 ℃	0 ~ +29	V	
Storage temperature	Tstg	-	-25 ~ +60	℃	【Note 2】
Operation temperature (Ambient)	Topa	-	0 ~ +50	℃	

【Note 1】 SELLVDS, R/L, U/D, Frame, O/S set, TEST, Temp1, Temp2, Temp3

【Note 2】 Humidity 95%RH Max.(Ta≦40 ℃)

Maximum wet-bulb temperature at 39 ℃ or less.(Ta>40 ℃) No condensation.

【Note】 The management temperature of each part is shown in reference(page23,24)

6. Electrical Characteristics

6-1. Control circuit driving

Ta=25 ℃

Parameter		Symbol	Min.	Typ.	Max.	Unit	Remark
+5V supply voltage	Supply voltage	Vcc	+4.5	+5.0	+5.5	V	【Note 1】
	Current dissipation	Icc	-	0.8	1.8	A	【Note 2】
Permissible input ripple voltage		V_{RP}	-	-	100	mV_{P-P}	Vcc = +5.0V
Differential input threshold voltage	High	V_{TH}	-	-	100	mV	V_{CM} = +1.2V 【Note 6】
	Low	V_{TL}	-100	-	-	mV	
Input Low voltage		V_{IL}	0	-	1.0	V	【Note 3】
Input High voltage		V_{IH}	2.3	3.3	3.6	V	
Input leak current (Low)		I_{IL1}	-	-	100	μA	V_I = 0V 【Note 4】
		I_{IL2}	-	-	400	μA	V_I = 0V 【Note 5】
Input leak current (High)		I_{IH1}	-	-	100	μA	V_I =3.3V 【Note 4】
		I_{IH2}	-	-	400	μA	V_I =3.3V 【Note 5】
Terminal resistor		R_T	-	100	-	Ω	Differential input

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

【Note 1】

Input voltage sequences

0 < t1 ≦ 10ms

10ms ≦ t2-1 ≦ 20ms

t2-2 ≧ 10ms

0 < t3 ≦ 1s

t4 ≧ 1s

t5 ≧ 200ms

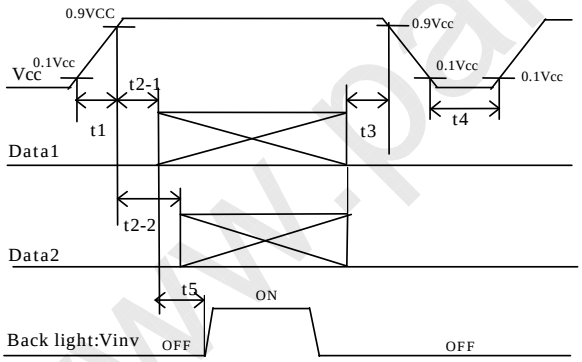
Dip conditions for supply voltage

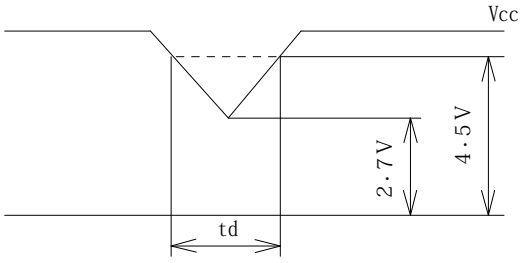
a) 2.7V ≦ Vcc < 4.5V

td ≦ 10ms

b) Vcc < 2.7V

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





※ Data1:CLKIN±,RIN0±,RIN1±, RIN2±, RIN3±

※ Data2:R/L,U/D,SELLVDS,Frame,O/Sset,Temp1,2,3

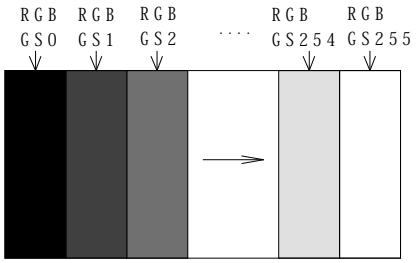
DATA2 sequence is recommended above figure.

However, even if the sequence is out of recommended timing, display works normally.

【Note】

About the relation between data input and back light lighting, it based on the above-mentioned input sequence. When back light is switched on before panel operation or after a panel operation stop, it may not display normally. But this phenomenon is not based on change of an incoming signal, and does not give a damage to a liquid crystal display.

【Note 2】Typical current situation: 256 gray-bar pattern (Vcc = +5.0V)
The explanation of RGB gray scale is seen in section 8.



Vcc＝5.0V
CK＝82.0MHz
Th＝20.67μs

【Note 3】R/L, U/D, SELLVDS, TEST, Frame, O/Sset, Temp1, Temp2, Temp3
【Note 4】R/L, U/D
【Note 5】SELLVDS, Frame, O/Sset, Temp1, Temp2, Temp3
【Note 6】CLKIN±, RIN0±,RIN1±, RIN2±, RIN3±

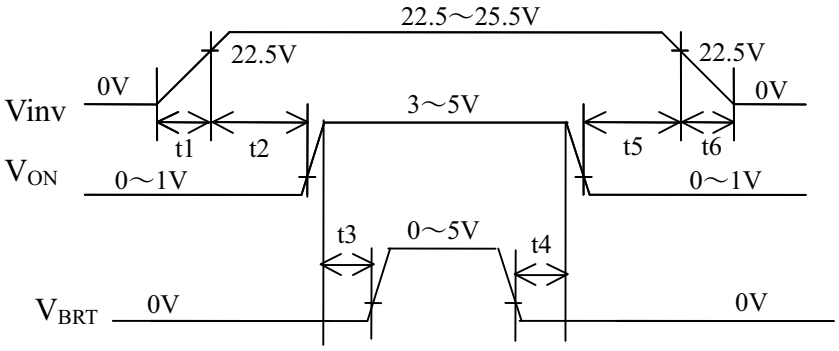
6-2. Inverter driving for back light

The back light system is direct type with 18 CCFTs .

Ta=25℃

Parameter		Symbol	Min.	Typ.	Max.	Unit	Remark
+24V	Current dissipation	I_{INV}	-	4.2	6.5	A	V_{INV} = 24.0V V_{BRT} = 0V, V_{ON}=5V
	Supply voltage1	$V_{INV}1$	22.5	24.0	25.5	V	V_{BRT} = 0V, V_{ON}=5V 【Note 1】
	Supply voltage2	$V_{INV}2$	22.5	24.0	27.0	V	V_{BRT} = 0V, V_{ON}=0V 【Note 1,2】
Permissible input ripple voltage		V_{RF}	-	-	200	mV_{p-p}	V_{INV} = 24V
Input voltage (Low)		V_{ONL}	0	-	1.0	V	
Input voltage (High)		V_{ONH}	3.0	-	5.0	V	
Brightness control voltage		V_{BRT}	0	->	5	V	

【Note 1】Inverter sequences



t1,t6≧100μs
t2,t3,t4,t5≧0

*For the reduction of rush current, t1 should be more than 100us.
*Regarding t1, please input the V_{BRT} signal after lighting the lamps.
*There is no problem whether the V_{ON} signal is "H"(turning on) or "L"(turning off) under the supplying Vinv condition.

【Note2】

The definition of Vin voltage(27V) is only available with the condition of Von=0V(Inverter off).
In case of Von=5V(Inverter on), Vin voltage is defined as equal or less than 25.5V.

7. Timing characteristics of input signals

7-1. Timing characteristics

Timing diagrams of input signal are shown in Fig.2,3

Parameter		Symbol	Min.	Typ.	Max.	Unit	Remark
Clock	Frequency	1/Tc	65	82	85	MHz	
Data enable signal	Horizontal period	TH	1560	1696	1940	clock	
			17.0	20.67	-	μs	
	Horizontal period (High)	THd	1366	1366	1366	clock	
	Vertical period	TV	778	806	972	line	
			47	50	63	Hz	
	Vertical period (High)	TVd	768	768	768	line	

【Note】

1. It is recommend making sure that length of vertical period is an integral multiple of horizontal length of period. Otherwise, the screen may not display properly.

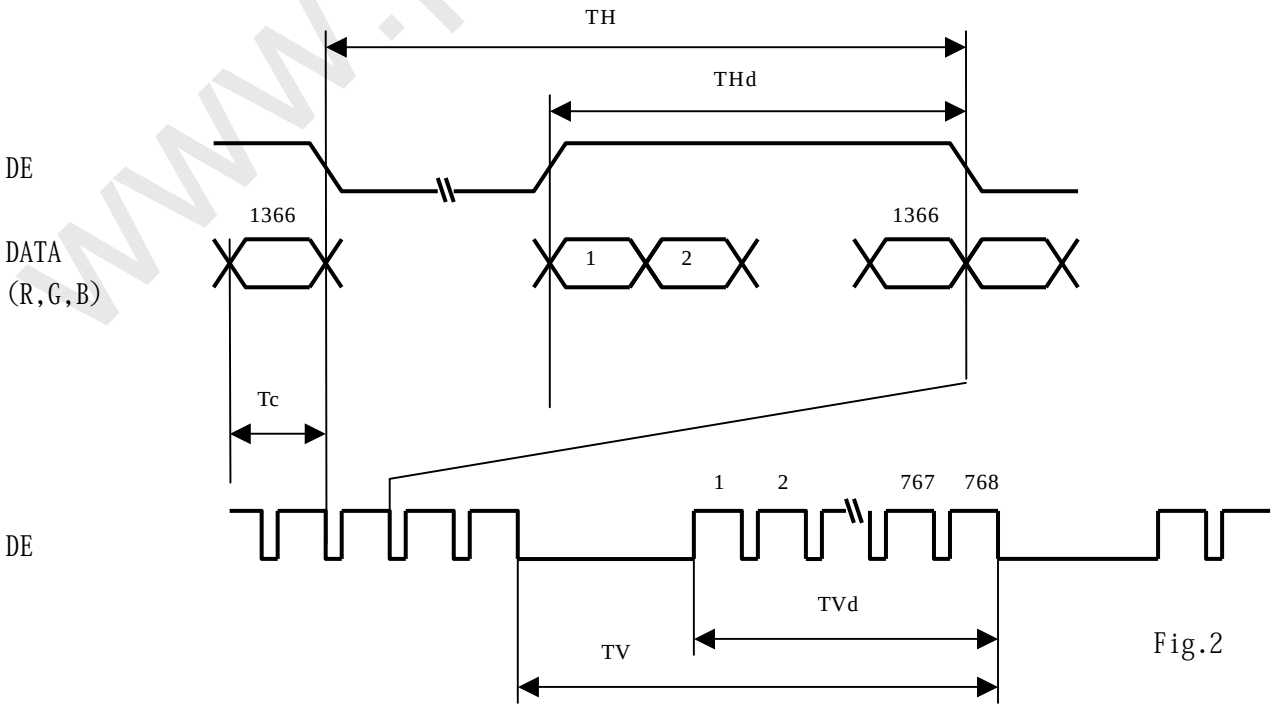
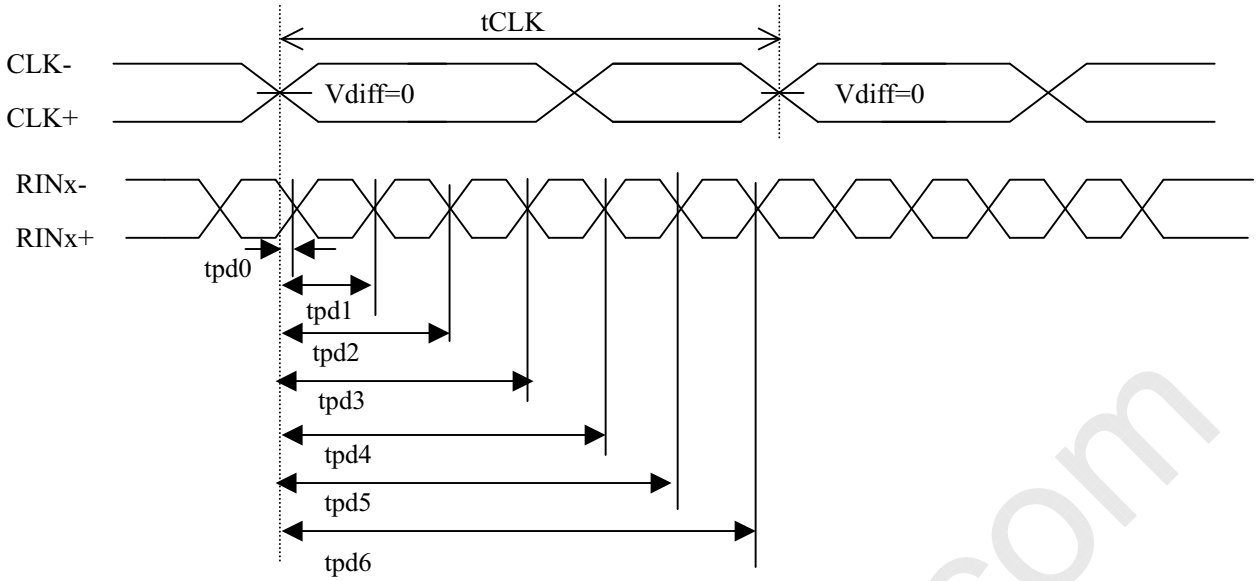


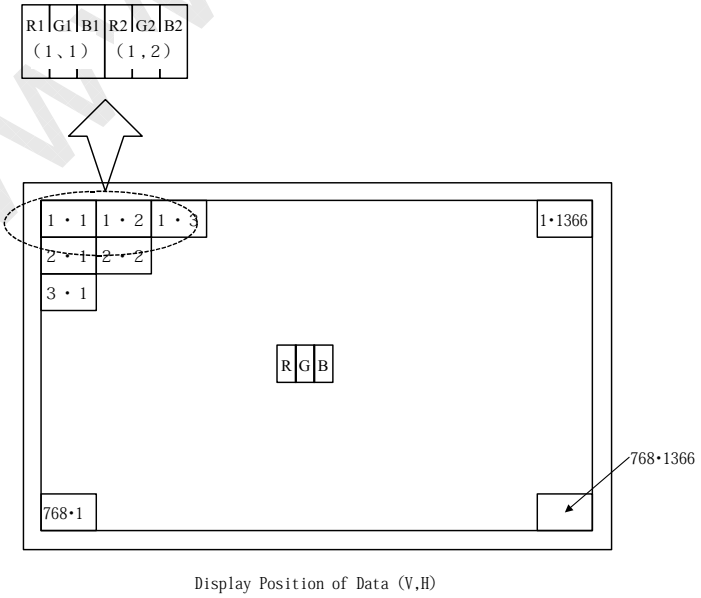
Fig.2

7-2 LVDS signal characteristics



The item		Symbol	min.	typ.	max.	unit
Clock	Frequency	1/tclk	65	82	85	MHz
Data position	Delay time, CLK rising edge to serial bit position 0	tpd0	-0.25	0	0.25	ns
	Delay time, CLK rising edge to serial bit position 1	tpd1	1* t clk/7-0.25	1* t clk/7	1* t clk/7+0.25	
	Delay time, CLK rising edge to serial bit position 2	tpd2	2* t clk/7-0.25	2* t clk/7	2* t clk/7+0.25	
	Delay time, CLK rising edge to serial bit position 3	tpd3	3* t clk/7-0.25	3* t clk/7	3* t clk/7+0.25	
	Delay time, CLK rising edge to serial bit position 4	tpd4	4* t clk/7-0.25	4* t clk/7	4* t clk/7+0.25	
	Delay time, CLK rising edge to serial bit position 5	tpd5	5* t clk/7-0.25	5* t clk/7	5* t clk/7+0.25	
	Delay time, CLK rising edge to serial bit position 6	tpd6	6* t clk/7-0.25	6* t clk/7	6* t clk/7+0.25	
	Delay time, CLK rising edge to serial bit position 7	tpd7	7* t clk/7-0.25	7* t clk/7	7* t clk/7+0.25	

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



Display Position of Data (V,H)

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

	Colors & Gray scale	Gray Scale	Data signal																							
			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	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	GS253	1	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	⇩	GS254	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	GS255	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	GS253	0	0	0	0	0	0	0	0	1	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	⇩	GS254	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	GS255	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	GS253	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	1	1	1
	⇩	GS254	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	GS255	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 24 bit data signals, the 16,777,216 colors display can be achieved on the screen.

9. Optical characteristics

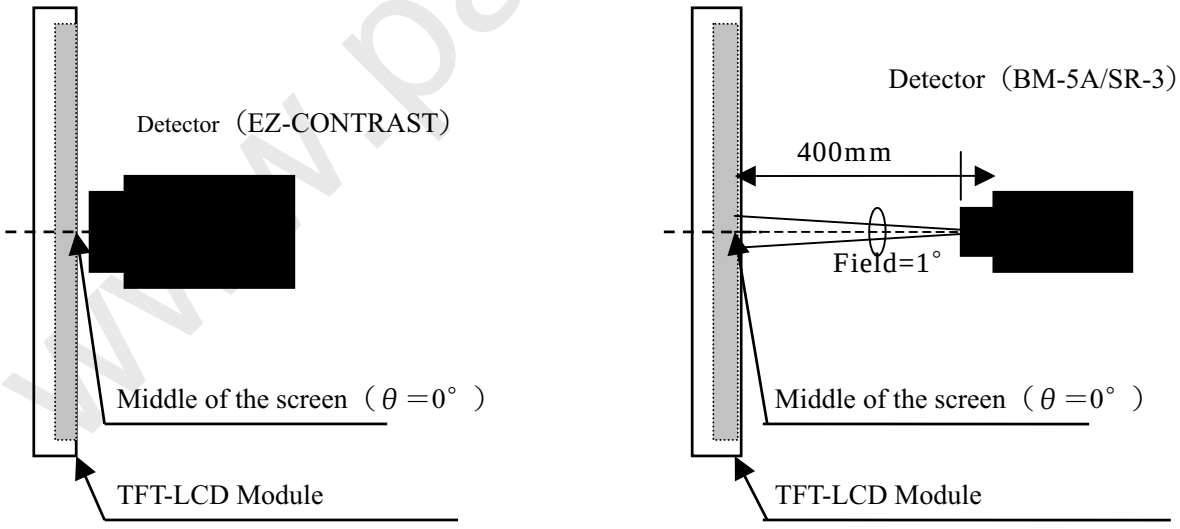
Ta=25℃, Vcc = +5.0V, V_{INV} = +24.0V, V_{BRT}=0V Timing characteristics of input signals: Typical value

Parameter		Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Viewing angle range	Horizontal	θ 21 θ 22	CR≧10	70	85	-	Deg.	【Note1,4】
	Vertical	θ 11 θ 12		70	85	-	Deg.	
Contrast ratio		CRn	θ =0 deg.	600	800	-		【Note2,4】
Response time (1)		τd1		-	6	-	ms	【Note3-1,4,5】
		τr1		-	6	-		
Response time (2)		τr2		-	12	20	ms	【Note3-2,4,5】
		τd2		-	12	20		
Chromaticity	white	x		0.242	0.272	0.302	-	【Note 4】
		y		0.247	0.277	0.307	-	
	black	x		-	0.300	-	-	
		y		-	0.280	-	-	
	red	x		0.610	0.640	0.670	-	
		y		0.300	0.330	0.360	-	
	green	x		0.250	0.280	0.310	-	
		y		0.570	0.600	0.630	-	
	blue	x		0.120	0.150	0.180	-	
		y		0.030	0.060	0.090	-	
Gamma		-		-	2.2	-	-	
Luminance	white	Y_{L1}		550	700	-	cd/m^2	
	black	Y_{L2}		-	0.9	1.35		
Luminance uniformity	white	δ W		-	-	1.25	-	【Note 6】
	black	δ B		-	-	1.6	-	

Measurement condition : Set the value of V_{BRT} to maximum luminance of white.

*The measurement shall be executed more than 60 minutes after lighting at rating.

【Note】The optical characteristics are measured using the following equipment.



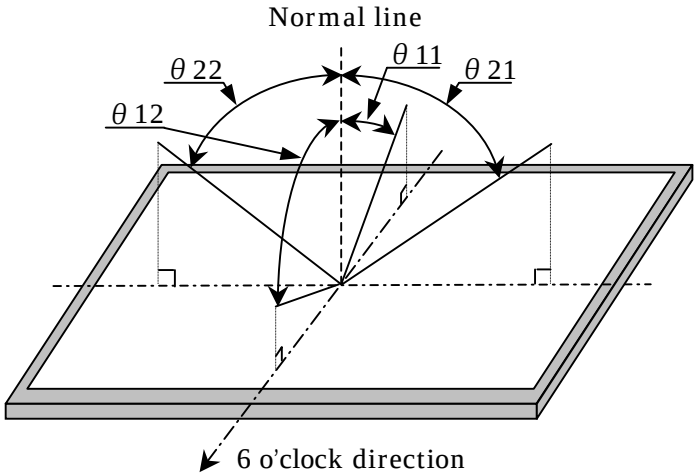
Response time : BM-5A

Viewing angle range : EZ-CONTRAST

Luminance, Chromaticity, Contrast : SR-3

Fig.3 Measurement method of optical characteristic

【Note 1】Definitions of viewing angle range :



【Note 2】Definition of contrast ratio :

The contrast ratio is defined as the following.

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

【Note 3】Definition of response time 1

3-1. Response time (1)

The response time (τd1 and τr1) is defined as the following figure and shall be measured by switching the input signal for "any level of gray (GS0, GS32, GS64, GS96, GS128, GS160, GS192, GS224 and GS255)" and "any level of gray (GS0, GS32, GS64, GS96, GS128, GS160, GS192, GS224 and GS255)".

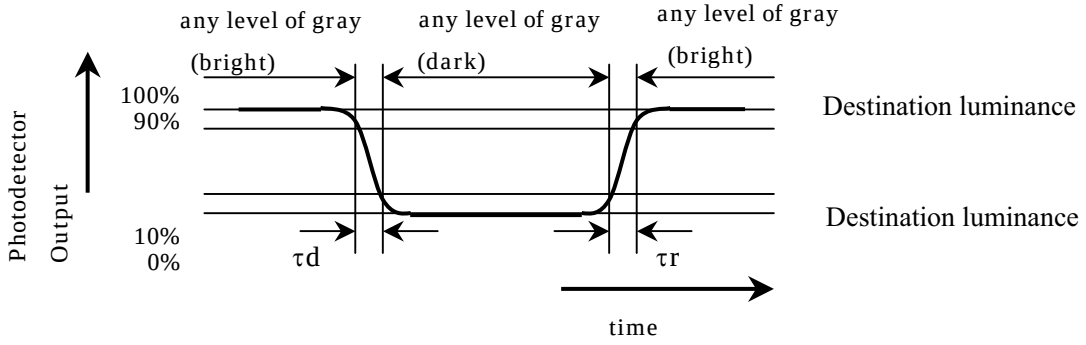
	GS0	GS32	GS64	GS96	GS128	GS160	GS192	GS224	GS255
GS0		tr:0-32	tr:0-64	tr:0-96	tr:0-128	tr:0-160	tr:0-192	tr:0-224	tr:0-255
GS32	td:32-0		tr:32-64	tr:32-96	tr:32-128	tr:32-160	tr:32-192	tr:32-224	tr:32-255
GS64	td:64-0	td:64-32		tr:64-96	tr:64-128	tr:64-160	tr:64-192	tr:64-224	tr:64-255
GS96	td:96-0	td:96-32	td:96-64		tr:96-128	tr:96-160	tr:96-192	tr:96-224	tr:96-225
GS128	td:128-0	td:128-32	Td:128-64	td:128-96		tr:128-160	tr:128-192	tr:128-224	tr:128-255
GS160	td:160-0	td:160-32	Td:160-64	td:160-96	td:160-128		tr:160-192	tr:160-224	tr:160-255
GS192	td:192-0	td:192-32	Td:192-64	td:192-96	td:192-128	td:192-160		tr:192-224	tr:192-255
GS224	td:224-0	td:224-32	Td:224-64	td:224-96	td:224-128	td:224-160	td:224-192		tr:224-255
GS255	td:255-0	td:255-32	Td:255-64	td:255-96	td:255-128	td:255-160	td:255-192	td:255-224	

t*:x-y...response time from level of gray(x) to level of gray(y)

τr1 = Σ(tr:x-y)/36 , τd1 = Σ(td:x-y)/36

3-2. Response time (2)

The response time (τd2 and τr2) is the maximum value defined as the following figure and shall be measured by switching the input signal for "any level of gray (bright)" and "any level of gray (dark)".



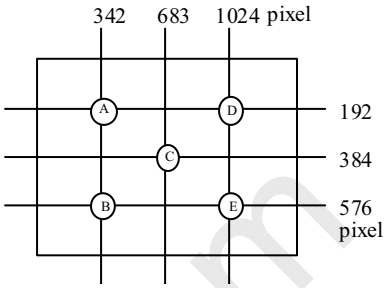
【Note 4】This shall be measured at center of the screen.

【Note 5】This value is valid when O/S driving is used at typical input time value.

【Note 6】Definition of luminance uniformity ;

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

$$\delta_{W}, \delta_{B} = \frac{\text{maximum luminance of five point(brightness)}}{\text{minimum luminance of five point(brightness)}}$$



10. Display Quality

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

11. Handling Precautions of the module

a) Be sure to turn off the power supply when inserting or 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.4. Voltage difference generated by this switching, ΔV_{INV}, 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.

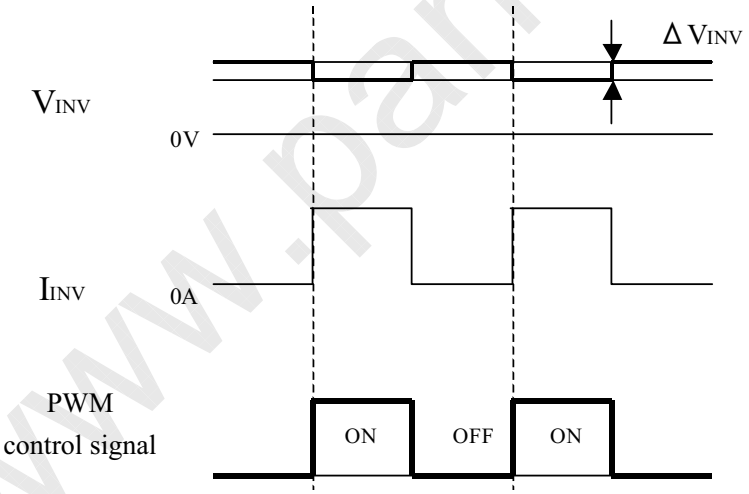


Fig.4 Brightness control voltage

Since inverter board’s GND is not connected to the frame of the LCD module, please connect it with the Customer’s GND of inverter power supply.

d) Be sure to design the cabinet 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 not to scratch 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 conventional Display cloth such as 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 take the human earth into consideration when handling.

j) 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.

k) Observe all other precautionary requirements in handling components.

l) 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.

m) When giving a touch to the panel at power on 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.

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) Do not rub or strike the screen with anything hard as this may scratch, mar, or damage the screen permanently. Dust the TV by wiping the screen and the cabinet with a soft, clean cloth. If the screen requires additional cleaning, use a clean, damp cloth ; DO NOT USE liquid cleaners or aerosol cleaners.

p) Because of seeing the light from the screw part in the bezel surface, please consider not to be a problem with cabinet design.

12. Packing form

a) Piling number of cartons: 3 maximum

b) Packing quantity in one carton: 5 pcs

c) Carton size: 820 mm(W) x 420 mm(D) x 730m(H)

d) Total mass of one carton filled with full modules: 50kg(Max)

Packing form figures are shown in Fig.4

13. Reliability test item

No.	Test item	Condition
1	High temperature storage test	Ta=60℃ 240h
2	Low temperature storage test	Ta=-25℃ 240h
3	High temperature and high humidity operation test	Ta=40℃ ; 95%RH 240h (No condensation)
4	High temperature operation test	Ta=50℃ 240h
5	Low temperature operation test	Ta=0℃ 240h
6	Vibration test (non-operation)	Frequency : 10~57Hz/Vibration width(one side) : 0.075mm : 58~500Hz/Acceleration : 9.8 m/s2 Sweep time: 11 minutes Test period : 3 hours(1h for each direction of X,Y,Z)
7	Shock test (non-operation)	Maximum acceleration : 490m/s2 Pulse width : 11ms,sinusoidal half wave Direction : +/-X,+/-Y,+/-Z,once for each direction.
8	ESD	* At the following conditions, it is a thing without incorrect operation and destruction. (1)Non-operation: Contact electric discharge ±10kV Non-contact electric discharge±20kV (2)Operation Contact electric discharge ±8kV Non-contact electric discharge ±15kV Conditions: 150pF、330ohm

【Result evaluation criteria】

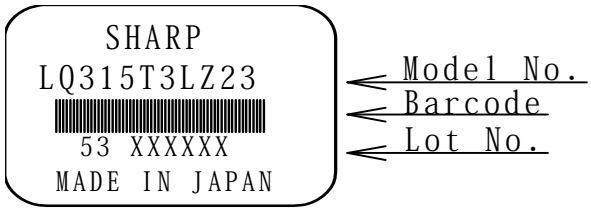
Under the display quality test condition with normal operation state, there shall be no change which may affect practical display function.

MTBF (Mean Time Between Failures)

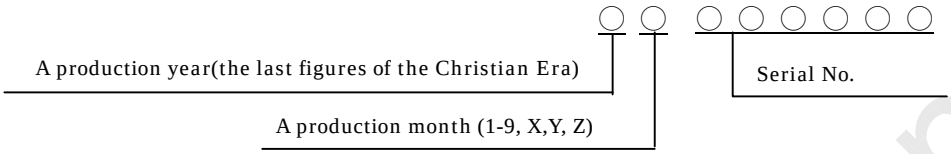
- Calculation of MTBF (Based on MIL-HDBK-217F)
  MTBF is calculated by using Parts Count Prediction Method with Sharp's market data.
  (Except MTBF of lamp)
  MTBF = Min 50,000 hours
- MTBF of lamp (based on supplier's data)
  MTBF =Min 10,288,065hours (Min 185,185,185hours/1 lamp)

14. Others

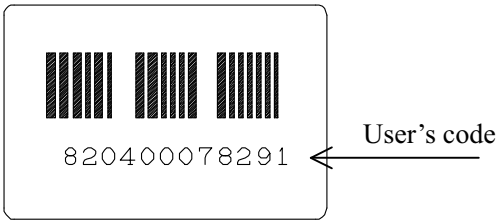
1) Lot No. Label ;



How to express Lot No.



2) Module Label



3) Packing Label

社内品番 : (4S) LQ315T3LZ23

Bar code (①)

LotNO. : (1T) 2005. x. xx

Bar code (②)

Quantity : (Q) 5 pcs

Bar code (③)

ユーザ品番 :

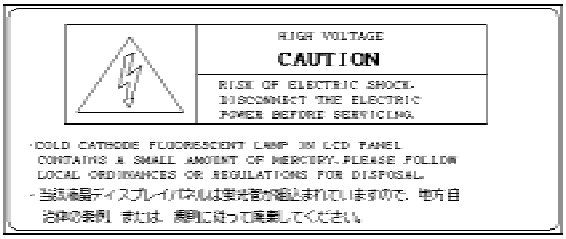
シャープ物流用ラベルです。

① Model No. (LQ315T3LZ23)

② Lot No. (Date)

③ Quantity

4) Cold cathode fluorescent lamp in LCD PANEL contains a small amount of mercury. Please follow local ordinances or regulations for disposal. This sentence is stamped on the backside of the module.



5) Label of using material information

It is displaying the material of the optical parts with the label on the backside of the module.

MATERIAL INFORMATION
OPTICAL FILM :> PC,PEST,AKUR-X,PC <
LENS FILM :> PET,AK-X <
DIFFUSER SHEET :> PMMA-X,PET <
DIFFUSER BOARD:> SMMA,PS <
REFLECTOR :> PAK-QD,PET+PMP <

6) 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.

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

8) Please be careful since image retention may occur when a fixed pattern is displayed for a long time.

9) Be sure to turn off the power supply of the inverter circuit before turning off the one of the control circuit.

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

11) This module is corresponded to RoHS.

15. Carton storage condition

Temperature	0℃ to 40℃
Humidity	95%RH or less
Reference condition :	20℃ to 35℃ , 85%RH or less (summer)
:	5℃ to 15℃ , 85%RH or less (winter)
	・the total storage time (40℃,95%RH) : 240H or less
Sunlight	Be sure to shelter a product from the direct sunlight.
Atmosphere	Harmful gas, such as acid and alkali which bites electronic components and/or wires must not be detected.
Notes	Be sure to put cartons on palette or base, don't put it on floor, and store them with removing from wall Please take care of ventilation in storehouse and around cartons, and control changing temperature is within limits of natural environment
Storage period	1 year

LD-17408-22

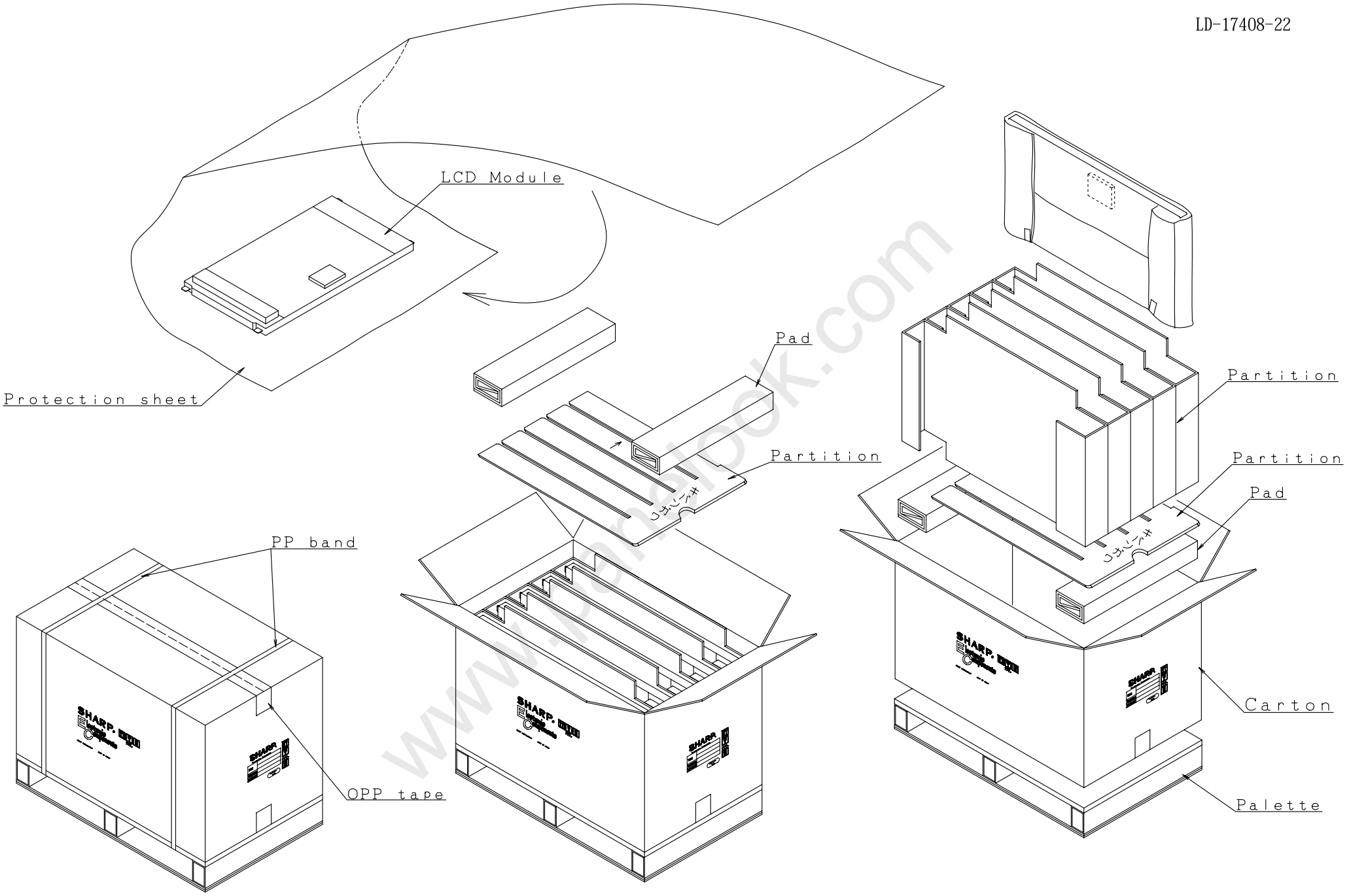
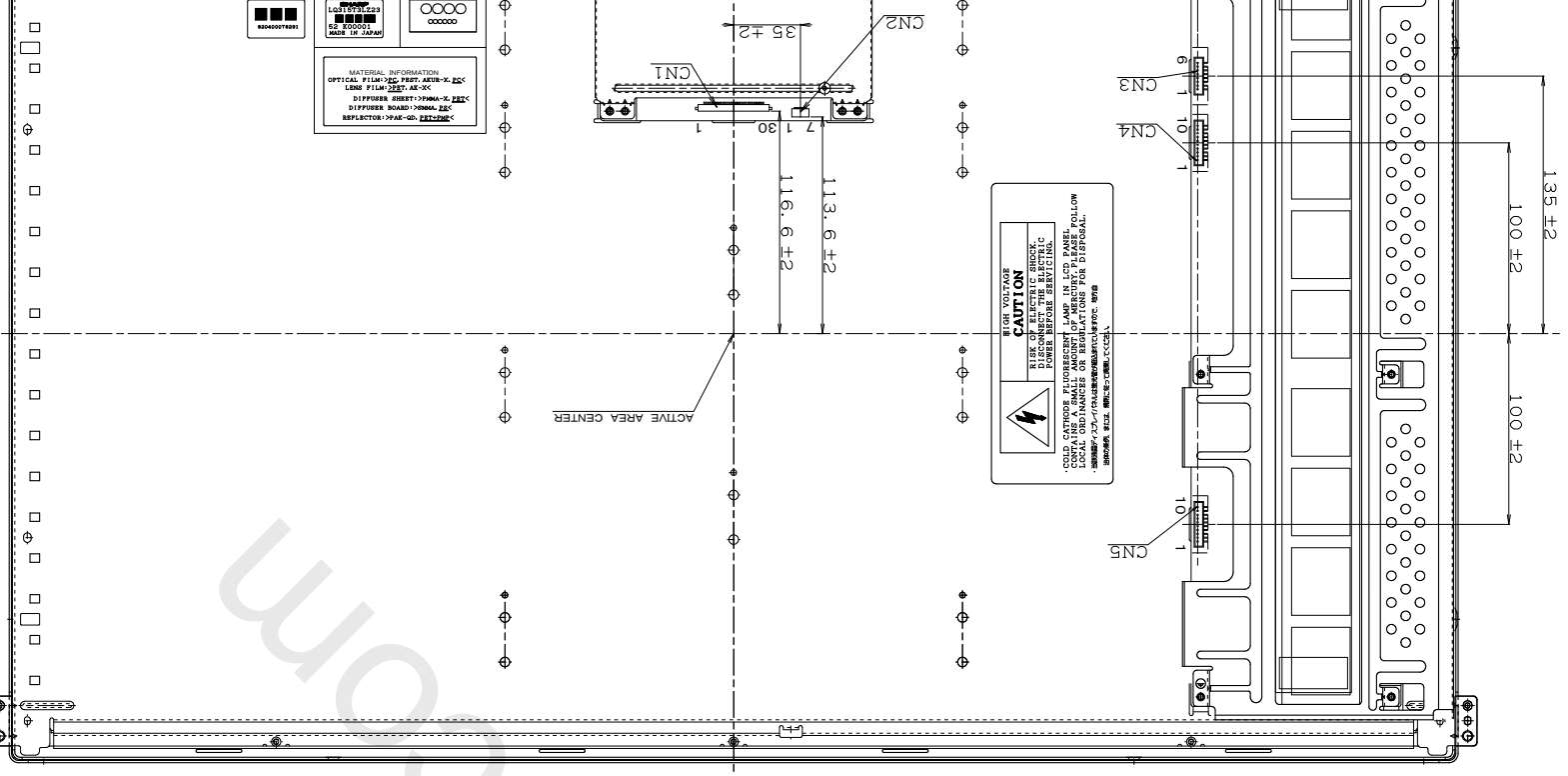
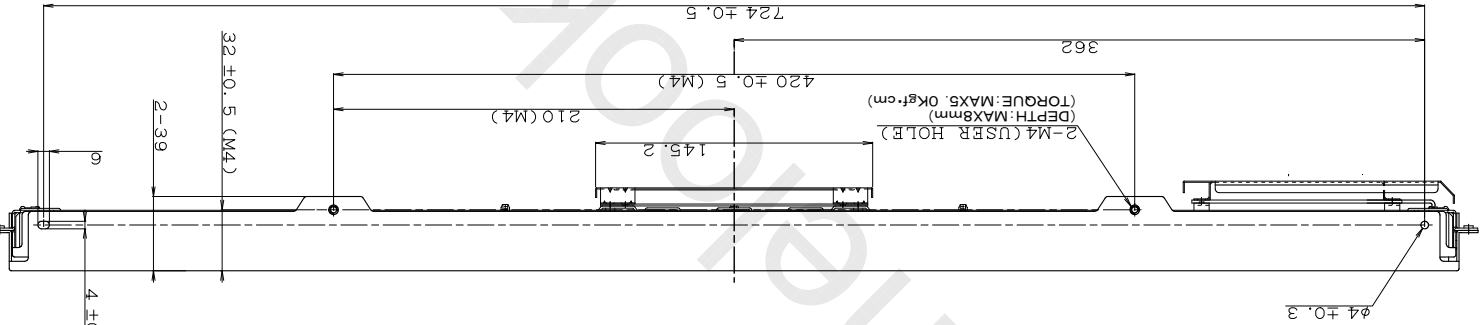
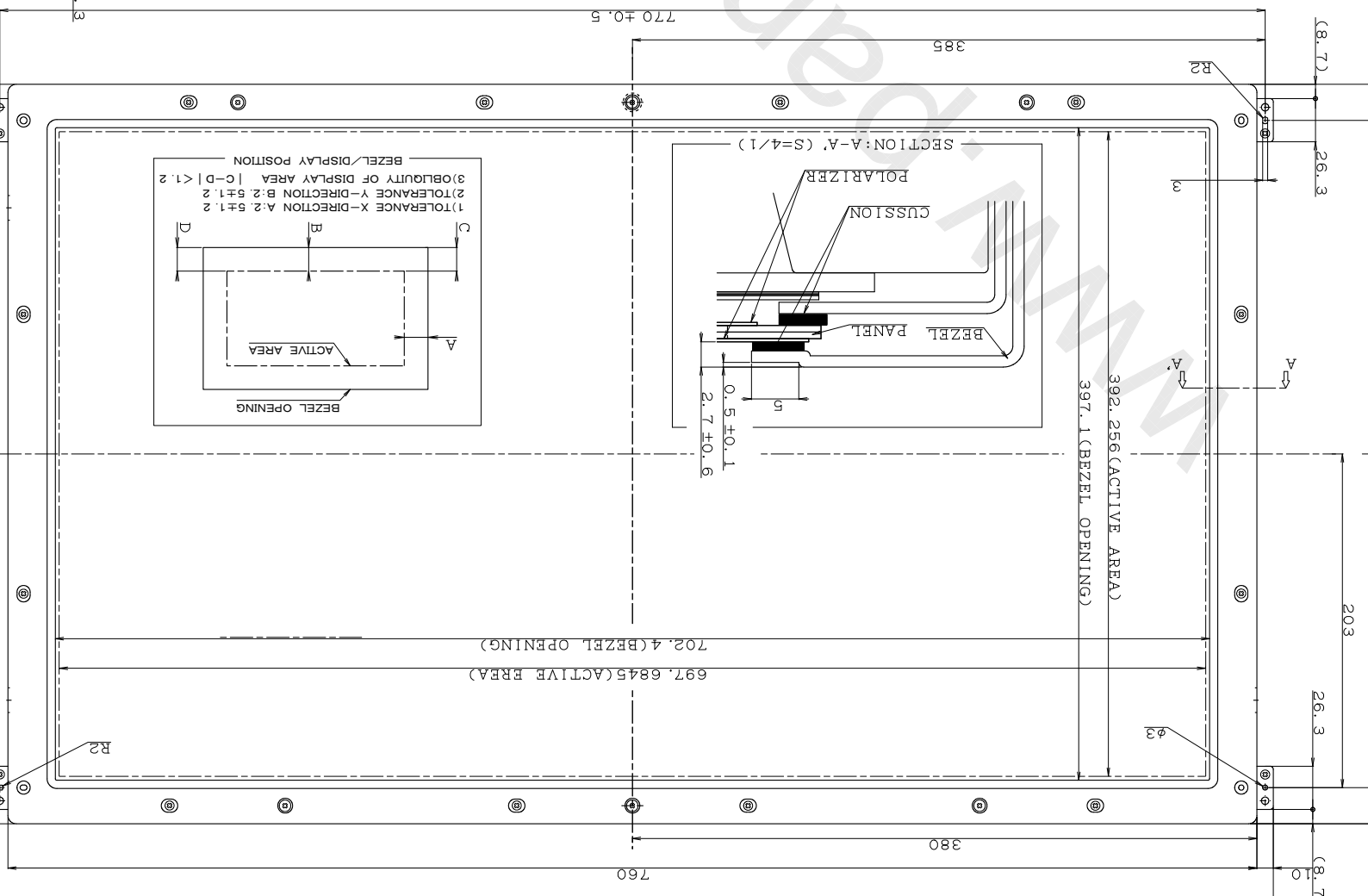


Fig 4 Packing form







Reference:

The management temperature of each part

The controlled temperature for critical parts is described as follows.

The following temperature is specified temperature to maintain the reliability as LCD module.

Therefore, it should be evaluated as TV set to confirm that no problem is found.

1） Specified temperature

The management temperature of each part

The management parts			The management temperature (degreeC)	Remark
LCD panel surface		Panel surface 1 to 9	65	Measurement point Reference 2-1
LCD unit backside	Inverter PWB	Transformer 1 to 18	104	Measurement point Reference 2-2
		Transistor 1 to 18	106	
		IC1	100	
		IC2	97	
	Control PWB	ASIC(IC1)	95	
		IC501	100	
		Coil 1, 2	100	
Lamp unit from inside		Diffuser Board 1 to 3	80	Measurement point Reference 2-3
		Reflector 1 to 3	80	
		Lamp1 to 18	120	

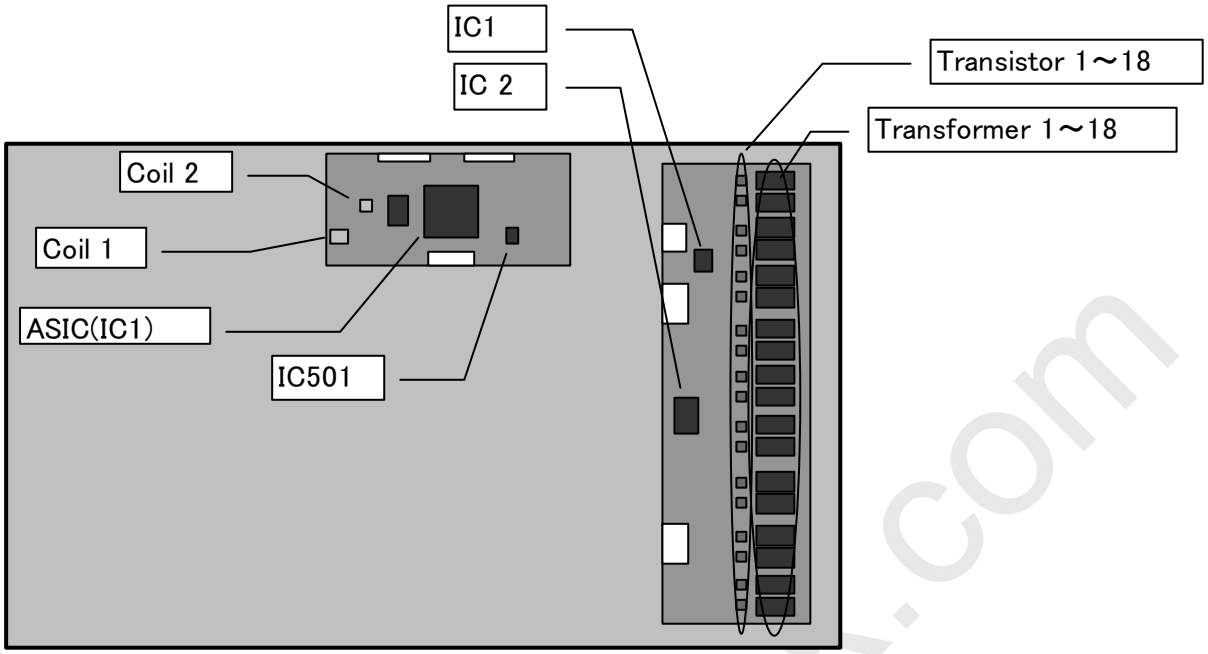
2） Measurement point

2-1. LCD panel surface (front view of panel)

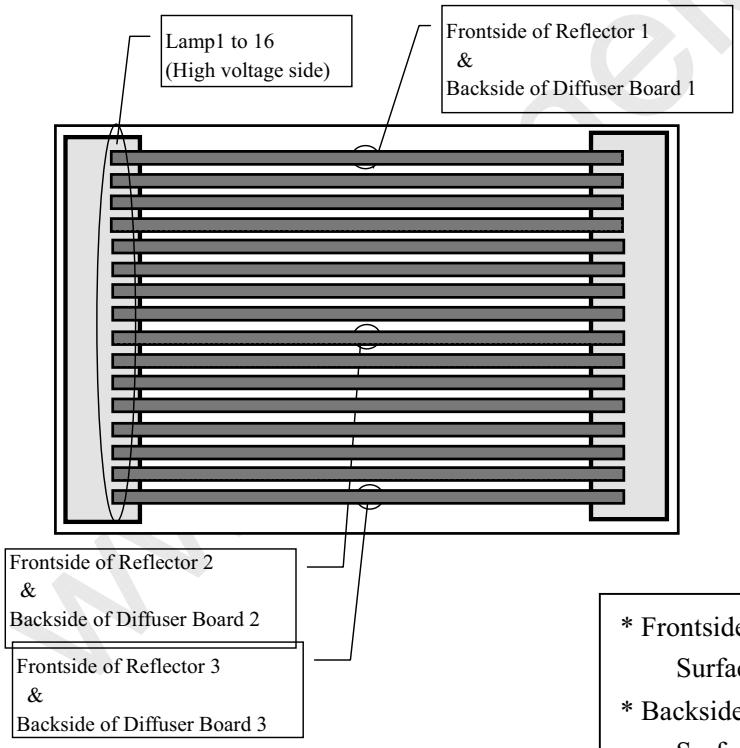
No.1 to 9 are measurement points of LCD panel

They are quartered each side and measured in each point of intersection

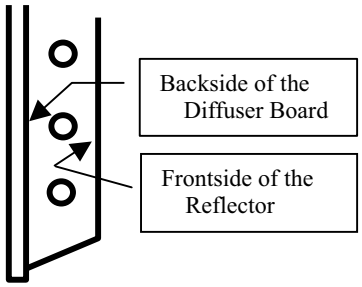
2-2. LCD panel backside



2-3. Lamp unit from inside *The front perspective view



The cross section



* Frontside of the Reflector :
Surface of Reflector at lamp side
* Backside of the Diffuser Board :
Surface of Diffuser Board at lamp side
[Representative point of resin temperature next to heat source]

Luminance maintenance rate curve (Estimated value)

All graphs : Lehmann's approximation formula

For reference