SHARP

TENTATIVE

No.	LD-S140734E
DATE	Apr. 28, 2015

TECHNICAL LITERATURE

FOR

TFT - LCD module

MODEL No. LQ315D1JG93

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So, please contact SHARP or its representative before designing your product based on this literature.

Development Department
Large Liquid Crystal Display Business Unit
Display Device Business Divison Ⅱ
SHARP CORPORATION

RECORDS OF REVISION

LQ315D1JG93

SPEC No.	DATE	REVISED No.	PAGE	SUMMARY	NOTE
LD-S140734	Jul. 31, 2014	-	-	-	1st. Issue
	Oct. 2, 2014	A	7	added the model number of "Using connector" and "Mating connector"	2nd. Issue
			7	Modified Table of Backlight electrical characteristic (the value of LED Voltage) "(120)" ⇒ "(130)"	
			7	Modified Table of Backlight electrical characteristic (Remark of LED Current) "total 2line" ⇒ "total 4line"	
			8	Modified Table of Control circuit driving (the typ. value of Current dissipation) "(1.0)" ⇒ "(2.0)"	
	Oct. 24, 2014	B	10	Modified Figure of eDP Interface Power Sequence	3th. Issue
			10	Modified Table of eDP Power Sequence Timing Parameters (the Min. and Max. values of t10, t11 and t12)	
			19	Changed the location of LED cable outlet from right side to left side	
	Dec. 16, 2014	C	1	Modified the mass of LCD module	4th. Issue
			8	Modified Table of Control circuit driving (Typ. value of Current dissipation) Typ value : "(1.0)" ⇒ "(2.0)"	
			10	Modified Table of eDP Power Sequence Timing Parameters t3 (Min) : "(60)" ⇒ "(170)" t3 (Max) : "(150)" ⇒ "(200)" t10 (Min) : "(20)" ⇒ "(50)" t10 (Max) : "N/A" ⇒ "(500)"	
	Mar. 12, 2015	D		Modified module name "LQ315D1JGxx" -> "LQ315D1JG93"	5th. Issue
			1	Modified the mass of LCD Module "5.7" -> "5.8"	
			2	Modified the function of Pin No. 11 of CN1 Added O/S switching function	

				Deleted the pull up resistor (3kΩ) for the equivalent circuit figrure of [Note1]	
			3	Deleted the equivalent circuit figure of the terminal for HTPDN of [Note2]	
				Added the internal circuit figure of O/S SET	
				Modified LED Voltage of Absolute Maximum Ratings	
			7	Modified LED Current of Absolute Maximum Ratings	
				Modified the Min. value and Typ. value of LED Life Time Min. value : ”(30000)” ⇒ “ - “ Max. value : ”(50000)” ⇒ ”(30000)”	
			10	Modified the value of Min. and Max of t3 t3 (Min.) : ”(170)” ⇒ ”TBD” t3 (Max.) : ”(200)” ⇒ ”TBD”	
			14	Modified the Typ. value of O/S driving ON “(6)”ms ⇒ “(8)”ms	
				Modified the Typ. value of O/S driving OFF “(12)”ms ⇒ TBD	
			17	Fixed Packing Form	
			18	Modified 1) Lot No. Label	
				Modified 2) Packing Label	
			20	Deleted User Label	
	Apr. 28, 2015	E		Modified section 4-1., 6-1., 7-1. and 7-2. for changing interface from eDP to V by One	6th. Issue

1. Application

This technical literature applies to the color 31.5" TFT-LCD module LQ315D1JG93.

* 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 that 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 ▲E

This module is a color active matrix LCD module. It is composed of a color TFT-LCD panel, driver ICs, control circuit, power supply circuit, and back light system etc. Graphics and texts can be displayed on a 3840 x RGB x 2160 (QFHD) dots panel with about one billion colors by using V by One to interface, +12V of DC supply voltages.

And in order to improve the response time of LCD, this module applies the Over Shoot driving (O/S 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 ▲C

Parameter	Specifications	Unit
Display size（Diagonal）	800.757	mm
	31.526	inch
Active area	697.92 (H) x 392.58 (V)	mm
Pixel Format	3840 (H) x 2160 (V) （1pixel = R + G + B dot）	pixel
Pixel pitch	0.18175(H) x 0.18175 (V)	mm
Pixel configuration	R, G, B horizontal stripe	
Color gamut	(Adobe100%)	
Display mode	Normally black	
Unit Outline Dimensions (*2)	734.8[W] x 430.0 [H] x 26.5[D]	mm
Mass ▲D	5.8	kg
Surface treatment	Anti glare Hard coating: 3H	

(*2) Outline dimensions are shown in Fig.5.

4. Input Terminals

4-1. TFT panel driving ▲D ▲E

CN1 (Interface signals)

Using connector: FI-RNE51SZ-HF (Japan Aviation Electronics Industry, Ltd.)

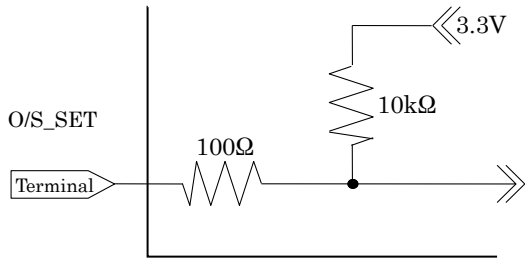
Mating connector: JF08R0R051***MA,FI-RE51HL, FI-RE51CL (Japan Aviation Electronics Industry, Ltd.)

CN1

Pin No.	Symbol	Function	Remark
1	VCC	+12V Power Supply	
2	VCC	+12V Power Supply	
3	VCC	+12V Power Supply	
4	VCC	+12V Power Supply	
5	NC	NC(OPEN)	
6	GND		
7	GND		
8	GND		
9	Reserved	It is required to set non-connection (OPEN)	
10	Reserved	It is required to set non-connection (OPEN)	
11	O/S_SET	O/S operation setting H: O/S driving ON, L: O/S driving OFF	O/S_SET pin is pulled up 3.3V (by 10kΩ). [Note1]
12	Reserved	It is required to set non-connection (OPEN)	
13	NC	NC(OPEN)	
14	GND		
15	Reserved	It is required to set non-connection (OPEN)	
16	Reserved	It is required to set non-connection (OPEN)	
17	GND		
18	Reserved	It is required to set non-connection (OPEN)	
19	Reserved	It is required to set non-connection (OPEN)	
20	GND		
21	NC	NC(OPEN)	
22	Reserved	It is required to set non-connection (OPEN)	
23	Reserved	It is required to set non-connection (OPEN)	
24	Reserved	It is required to set non-connection (OPEN)	
25	HTPDN	Hot plug detect	Output(Open Drain)
26	LOCKN	Lock detect (L:Lock,H:Unlock)	Output(Open Drain)
27	GND		
28	Rx0n	V-by-One HS Data Lane0	
29	Rx0p	V-by-One HS Data Lane0	
30	GND		
31	Rx1n	V-by-One HS Data Lane1	
32	Rx1p	V-by-One HS Data Lane1	
33	GND		
34	Rx2n	V-by-One HS Data Lane2	
35	Rx2p	V-by-One HS Data Lane2	
36	GND		
37	Rx3n	V-by-One HS Data Lane3	
38	Rx3p	V-by-One HS Data Lane3	
39	GND		
40	Rx4n	V-by-One HS Data Lane4	
41	Rx4p	V-by-One HS Data Lane4	
42	GND		
43	Rx5n	V-by-One HS Data Lane5	
44	Rx5p	V-by-One HS Data Lane5	
45	GND		

46	Rx6n	V-by-One HS Data Lane6	
47	Rx6p	V-by-One HS Data Lane6	
48	GND		
49	Rx7n	V-by-One HS Data Lane7	
50	Rx7p	V-by-One HS Data Lane7	
51	GND		

[Note1] The internal circuit figure of the terminal



[Note 2] V-by-One® HS Color Data mapping

Packer input & Unpacker output		Data
Byte0	D[0]	R2
	D[1]	R3
	D[2]	R4
	D[3]	R5
	D[4]	R6
	D[5]	R7
	D[6]	R8
	D[7]	R9(MSB)
Byte1	D[8]	G2
	D[9]	G3
	D[10]	G4
	D[11]	G5
	D[12]	G6
	D[13]	G7
	D[14]	G8
	D[15]	G9(MSB)
Byte2	D[16]	B2
	D[17]	B3
	D[18]	B4
	D[19]	B5
	D[20]	B6
	D[21]	B7
	D[22]	B8
	D[23]	B9(MSB)
Byte3	D[24]	-
	D[25]	-
	D[26]	B0(LSB)
	D[27]	B1
	D[28]	G0(LSB)
	D[29]	G1
	D[30]	R0(LSB)
	D[31]	R1

Block Diagram (LCD Module) ▲E

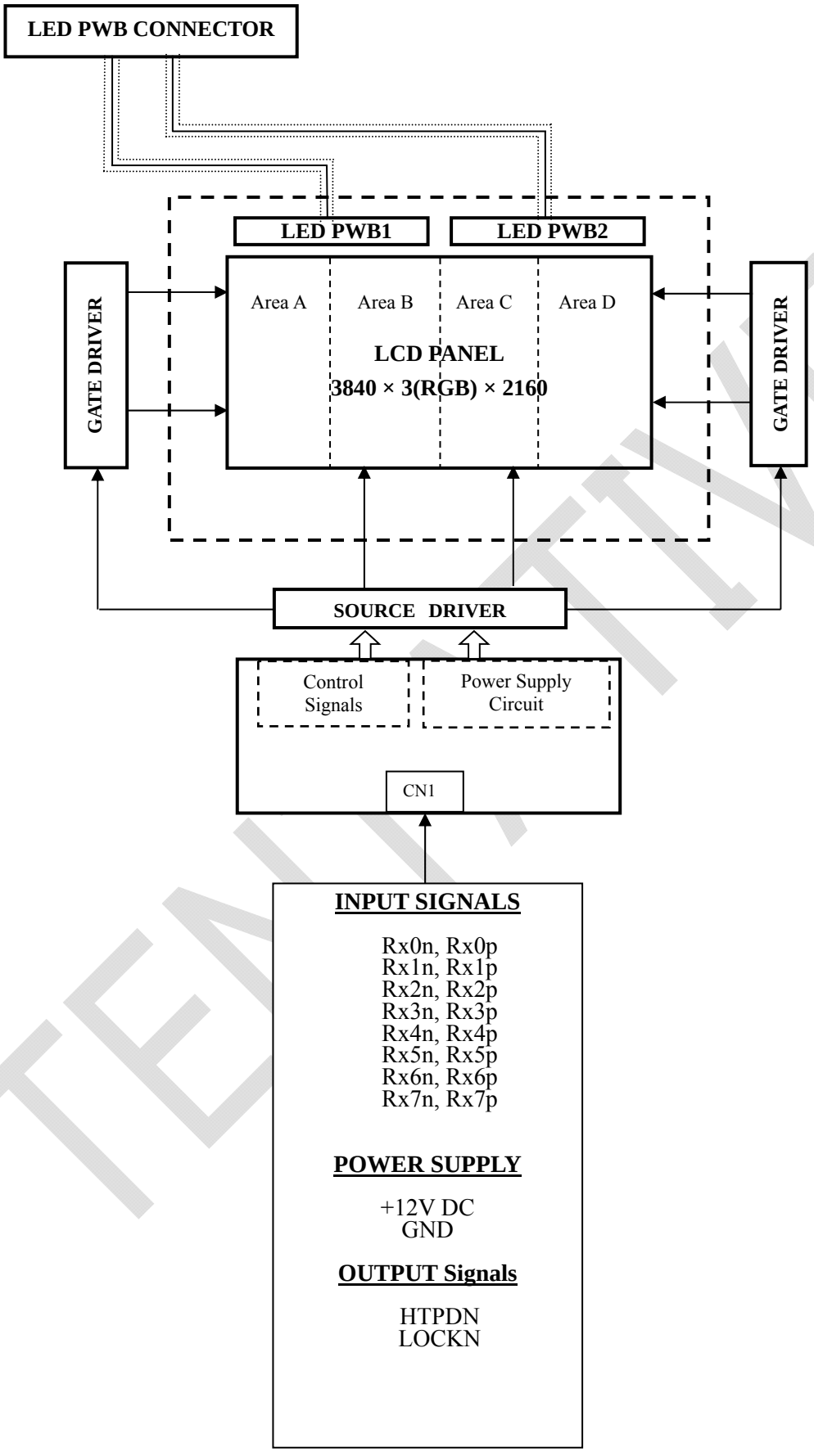


Fig.1 Block Diagram (LCD Module)

4-4. Backlight driving

DC power supply of LED PWB CONNECTOR ▲A

Using connector: H401K-D06N-12B(E&T)

Mating connector : 4530 Series(E&T)

Pin No.	Symbol	Function	Remark
1	V_{LED}−	Cathode(1st. line of LED PWB1)	
2	V_{LED}+	Anode(LED PWB1 Common)	
3	V_{LED}−	Cathode(2nd. line of LED PWB1)	
4	V_{LED}−	Cathode(1st. line of LED PWB2)	
5	V_{LED}+	Anode(LED PWB2 Common)	
6	V_{LED}−	Cathode(2nd. line of LED PWB2)	

4.5. Backlight electrical characteristic ▲A ▲D

Parameter	Symbol	Min.	Typ.	Max.	Unit	Remark
LED Current	I_{LED}	-	(60)	-	mA	the value of each line. (total 4line) [Note 1]
LED Voltage	V_{LED}		(130)		V	

[Note1] LED PWB is required current control. LED current (I_F) is the value of each line.

[Note 2]The characteristics of the LED are shown in the following table. The value mentioned below is at the case of one LED.

Item	Symbol	Min.	Typ.	Max.	Unit.
Life Time	T_L	-	(30000)	-	hour

LED life time is defined as the time when brightness becomes 50% of the original value in the continuous operation under the Ta = 25°C

[Note 3]Overcurrent and overvoltage may cause LED chip damage. Therefore we ask for design consideration to implement error detective function such as open, overcurrent and overvoltage on LED driver board.

5. Absolute Maximum Ratings

Parameter	Symbol	Ratings	Unit	Remark
12V supply voltage (for Control)	VCC	0 ~ + 14	V	
LED Voltage ▲D	V_{LED}	135.3	V	
LED Current ▲D	I_{LED}	65	mA	Applied to 1 LED line only.
Storage temperature	Tstg	-25~ +60	°C	[Note 1] [Note 2]
Operation temperature (Ambient)	Ta	0 ~ +40	°C	

[Note 1] Humidity 95%RH Max. (Ta≦40°C)

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

[Note 2]Glass surface temperature: 60 °C Max.

6. Electrical Characteristics

6-1.Control circuit driving ▲A ▲C ▲E

Control circuit driving Ta=25 °C

Parameter		Symbol	Min.	Typ.	Max.	Unit	Remark
+12V supply voltage	Supply voltage	Vcc	11.6	12	12.6	V	[Note 1]
	Current dissipation	Icc	-	1.25	2.5	A	[Note 2]
	Inrush current	IRUSH1	-	TBD	-	A	
		IRUSH2	-	TBD	-	A	
Permissible input ripple voltage		VRP	-	-	100	mVP-P	Vcc = +13.0V
Unit Interval		UI	266		1667	ps	[Note 5]
Differential input Allowable Intra-pair Skew		tRISK_INTRA	0.3			UI	[Note 4]
Differential input Allowable Inter-pair Skew		tRISK_INTER	5			UI	[Note 4]

[Note 1]

Input voltage sequences

2.0ms < t1 ≦ 20ms

200ms < t2

10ms < t3 < 1s

t4 > 50ms

t5> 10ms

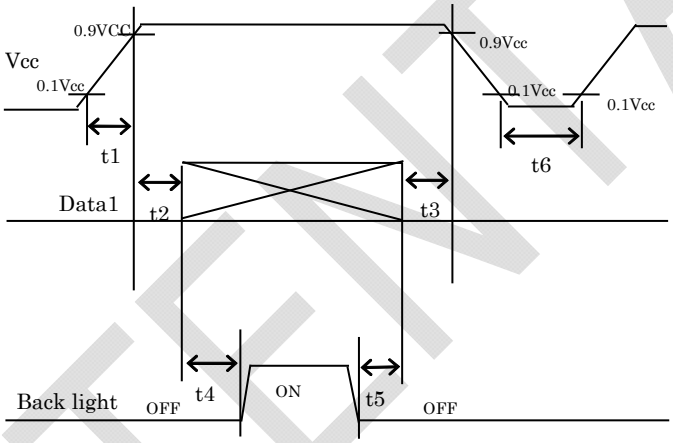
t6 > 1s

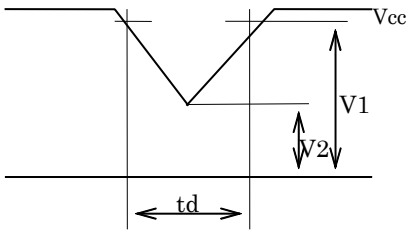
Dip conditions for supply voltage

6.5V ≦ Vcc < 10.8V

td < 10ms

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





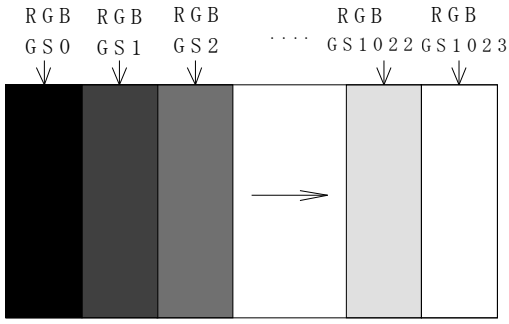
V1: 10.8V

V2: 6.5V

Data1: Rx0n, Rx0p, Rx1n, Rx1p, Rx2n, Rx2p, Rx3n, Rx3p, Rx4n, Rx4p, Rx5n, Rx5p, Rx6n, Rx6p, Rx7n, Rx7p, Rx8n, Rx8p,

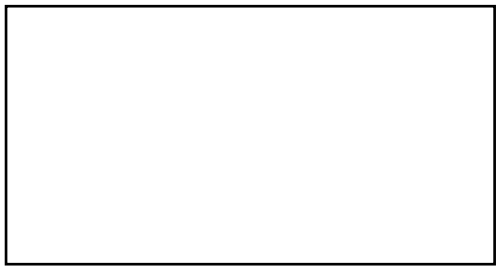
[Note]About the relation between data input and back light lighting, please base on the above-mentioned input sequence. When back light is switched on before panel operation or after a panel operation stop, it may not display normally. But this phenomenon is not based on change of an incoming signal,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

[Note 2] Typical current situation: 1024 gray-bar patterns. (Vcc = +12.0V)
The explanation of RGB gray scale is seen in section 8.



Vcc＝+12.0V
CK＝T.B.D MHz
Th＝T.B.D μs

Maximum current condition: Full White pattern.

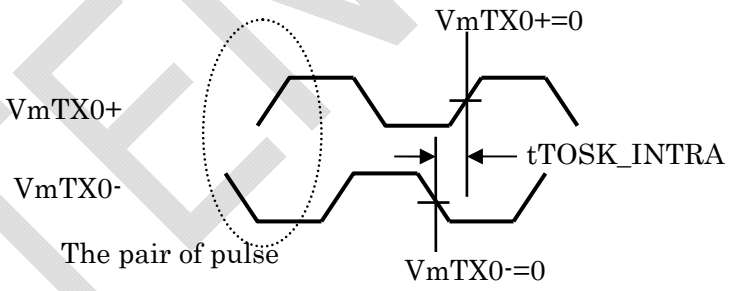


Vcc＝+12.0V
CK＝T.B.D MHz
Th＝T.B.D μs

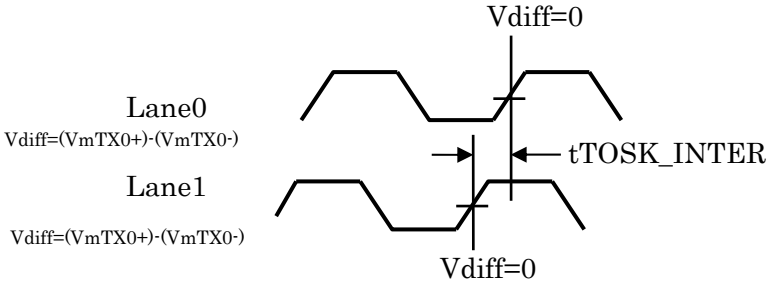
[Note 3] Vcc12V inrush current waveform

T.B.D

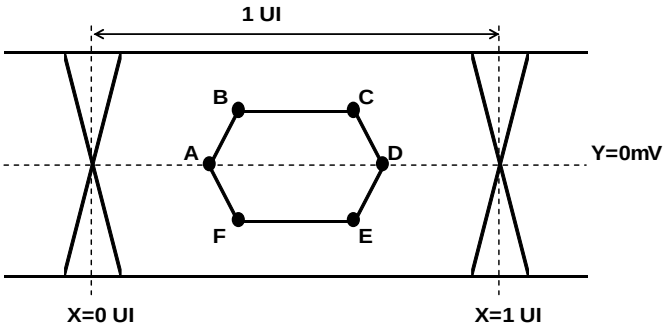
[Note 4] Differential input Allowable Intra-pair Skew



Differential input Allowable Inter-pair Skew



[Note 5] Eye diagram (Eye mask)



	X[UI]	Y[mV]
A	0.25	0
B	0.3	50
C	0.7	50
D	0.75	0
E	0.7	−50
F	0.3	−50

7. Timing characteristics of input signals ▲E

7-1. Timing characteristics

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

Parameter		Symbol	Min.	Typ.	Max.	Unit	Remark
Clock	Frequency	1/Tc	69	74.25	76	MHz	
Data enable signal	Horizontal total	TH	542	550	600	clock	
			7.3	7.41	8.05	µs	
	Horizontal period	TP		11	-	clock	
	Horizontal Back poach	TS		37	-	clock	
	Horizontal period (High)	THd	480	480	480	clock	
	Vertical period	TV	2218	2250	3000	line	
			47	60	63	Hz	
	Vertical period (High)	TVd	2160	2160	2160	line	

[Note]-When vertical period is very long, flicker and etc. may occur.

-Please turn off the module after it shows the black screen.

-Please make sure that length of vertical period should become of an integral multiple of horizontal length of period. Otherwise, the screen may not display properly.

-As for your final setting of driving timing, we will conduct operation check test at our side, please inform your final setting.

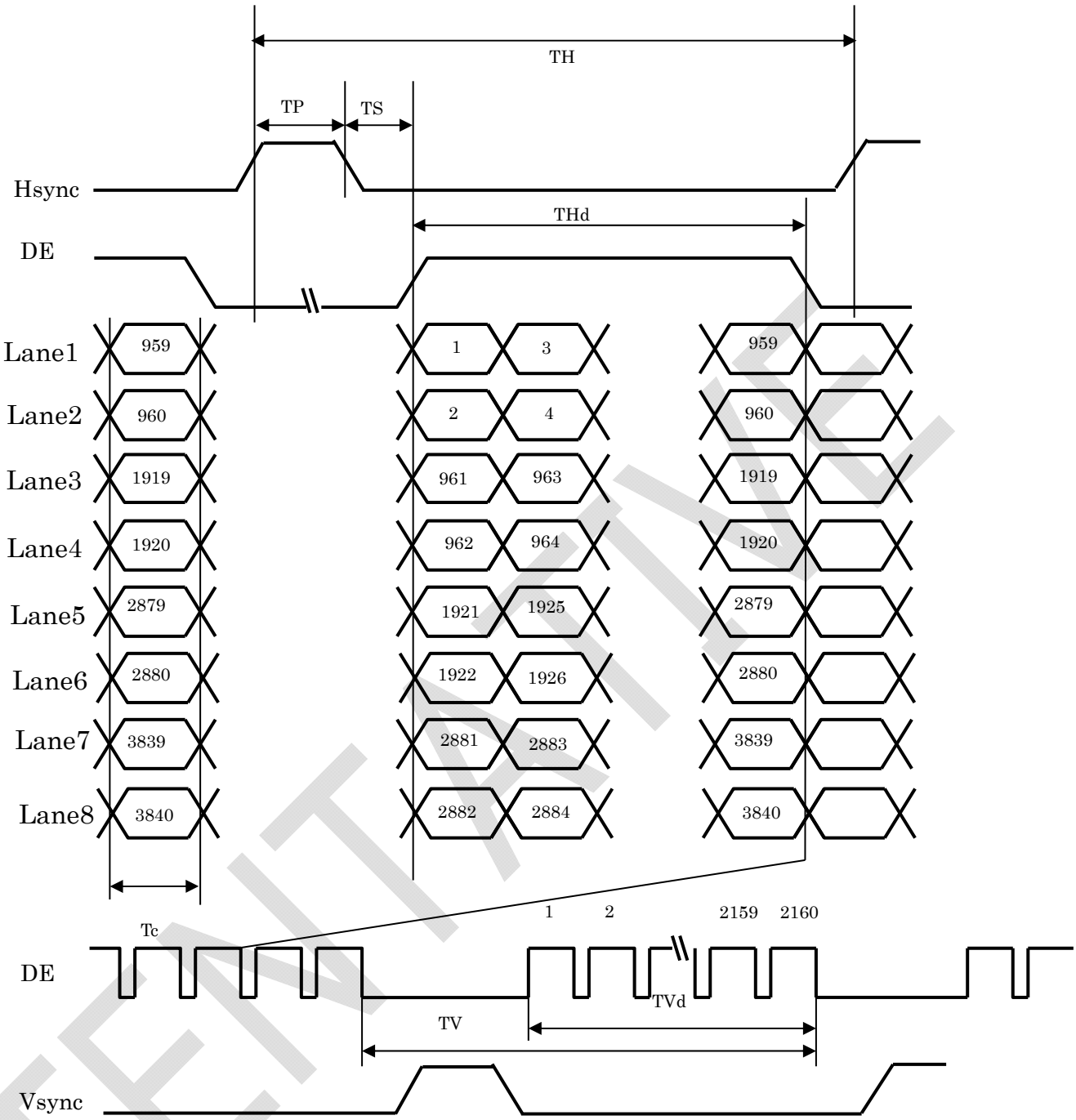
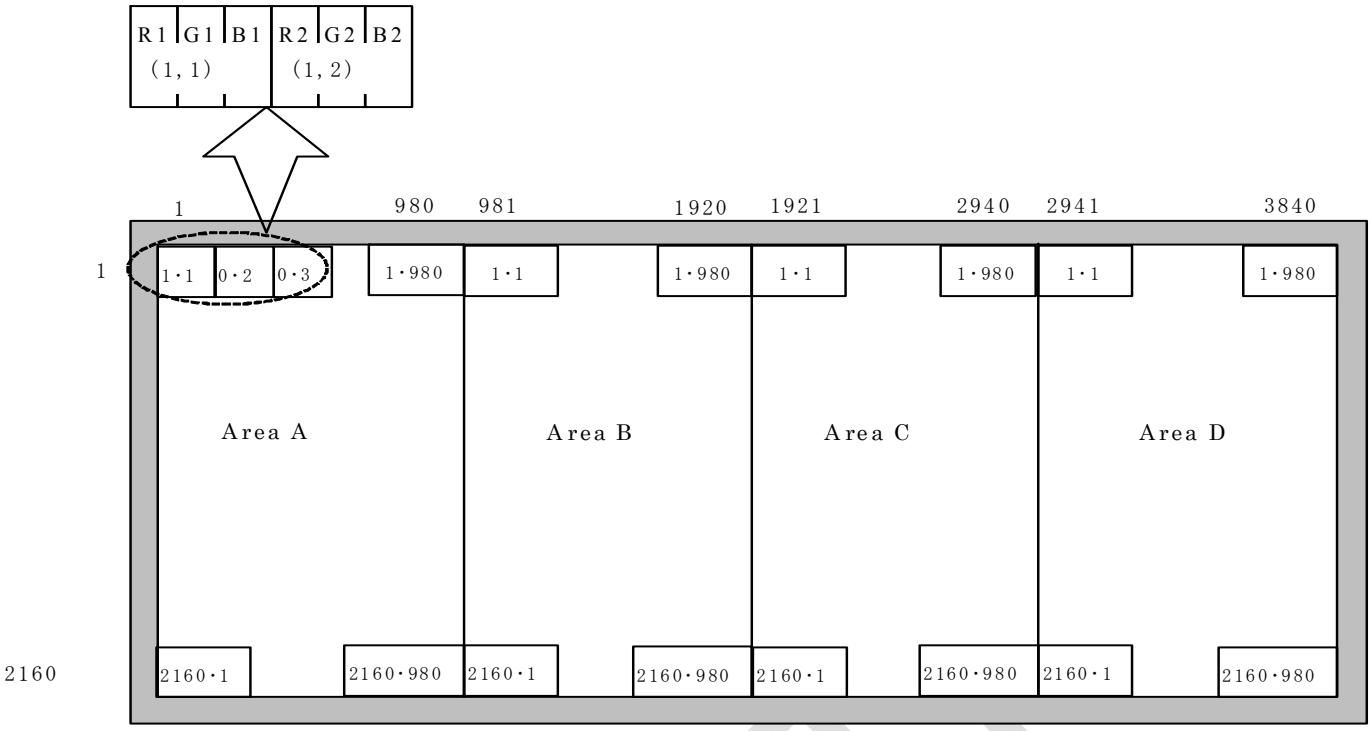


Fig.2 Timing characteristics of input signal

7-2. Input data signal and display position on the screen



Display position of Dat (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	R8	R9	G0	G1	G2	G3	G4	G5	G6	G7	G8	G9	B0	B1	B2	B3	B4	B5	B6	B7	B8	B9
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	0	0	0	0	0	0
	Blue	–	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1
	Green	–	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0
	Cyan	–	0	0	0	0	0	0	0	0	0	0	1	1	1	1	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	1	1	0	0	0	0	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	1	1	0	0	0	0	0	0	0	0	0	0	1	1	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	1	1	1	1	0	0	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	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	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	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	0	0	0	0	0	0
	⇧	↓					↓										↓										↓					
	⇩	↓					↓										↓										↓					
	Brighter	GS1021	1	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	⇩	GS1022	0	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red	GS1023	1	1	1	1	1	1	1	1	1	1	0	0	0	0	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	0	0	0	0	0	0
	⇧	GS1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	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	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	⇧	↓					↓										↓										↓					
	⇩	↓					↓										↓										↓					
	Brighter	GS1021	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0
	⇩	GS1022	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0
	Green	GS1023	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	0	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	0	0	0	0	0	0
	⇧	GS1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	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	0	0	0	0	1	0	0	0	0	0	0	0	0
	⇧	↓					↓										↓										↓					
	⇩	↓					↓										↓										↓					
	Brighter	GS1021	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	1	1	1	1	1
	⇩	GS1022	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1
	Blue	GS1023	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1

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

Each basic color can be displayed in 1024gray scales from 10 bit data signals. According to the combination of total 30 bit data signals, the about one billion-color display can be achieved on the screen.

9. Optical characteristics ▲D

Test conditions:Vcc = 12.0V, I_{LED}= (60) mA, Timing=60Hz, Ta=25°C

Parameter		Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Viewing angle range	Horizontal	θ21 θ22	CR≧10	(70)	(89)	-	Deg.	[Note1][Note4]
	Vertical	θ11 θ12		(70)	(89)	-	Deg.	
Contrast ratio		CRn		(750)	(1,000)	-		[Note2][Note4]
Response time	O/S driving ON	τDRV		-	(8)	-	ms	[Note3][Note4] [Note5]
	O/S driving OFF			-	TBD	-	ms	
Chromaticity of white		x			(0.313)		-	[Note 4]
		y			(0.329)		-	
Chromaticity of red		x			(0.64)		-	
		y			(0.33)		-	
Chromaticity of green		x			(0.21)		-	
		y			(0.71)		-	
Chromaticity of blue		x			(0.15)		-	
		y			(0.06)		-	
Luminance of white		Y_{L1}		(240)	(350)	-	cd/m^2	[Note 4]
Luminance uniformity		δ_W			-	(1.33)		[Note 6]

Measurement condition: Set the value of duty to maximum luminance of white.

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

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

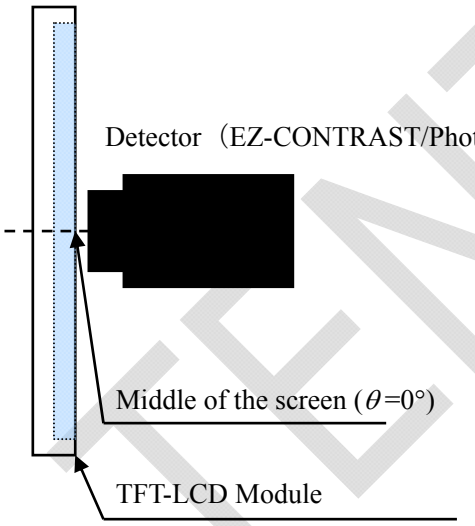


Fig.3-1 Measurement of viewing angle range and response time.

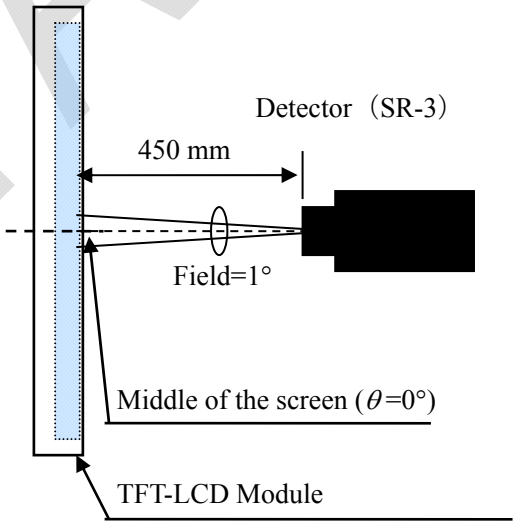
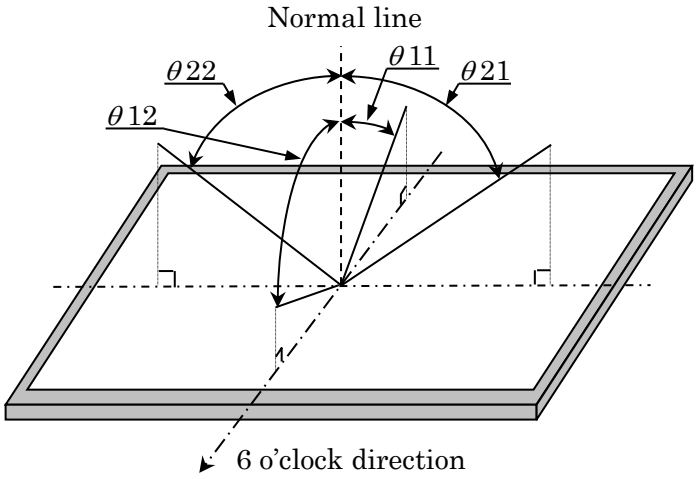


Fig.3-2 Measurement of Contrast, Luminance, Chromaticity.

Viewing angle range: EZ-CONTRAST

Response time : Photo Diode

[Note 1]Definitions of viewing angle range:



[Note 2]Definition of contrast ratio:

The contrast ratio is defined as the following.

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

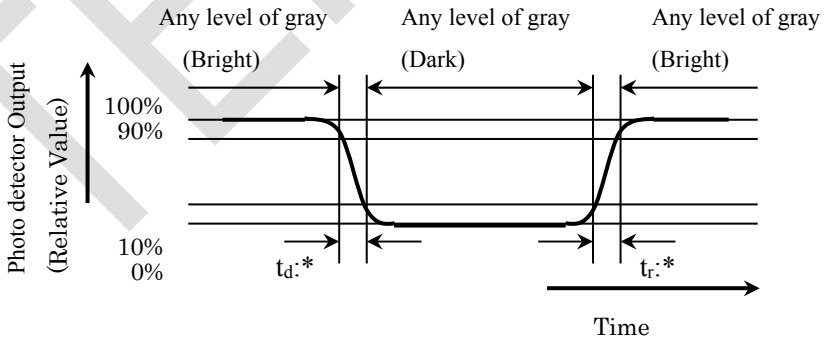
[Note 3]Definition of response time

The response time (τ_{Drv}) is defined as the following figure and shall be measured by switching the input signal for "five luminance ratio (0%, 25%, 50%, 75%, and 100%)" and "five luminance ratio (0%, 25%, 50%, 75%, and 100%)".

	0%	25%	50%	75%	100%
0%		tr: 0%-25%	tr: 0%-50%	tr: 0%-75%	tr: 0%-100%
25%	td: 25%-0%		tr: 25%-50%	tr: 25%-75%	tr: 25%-100%
50%	td: 50%-0%	td: 50%-25%		tr: 50%-75%	tr: 50%-100%
75%	td: 75%-0%	td: 75%-25%	td: 75%-50%		tr: 75%-100%
100%	td: 100%-0%	td: 100%-25%	td: 100%-50%	td: 100%-75%	

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

τ_{Drv} = □ (t*: x-y)/20



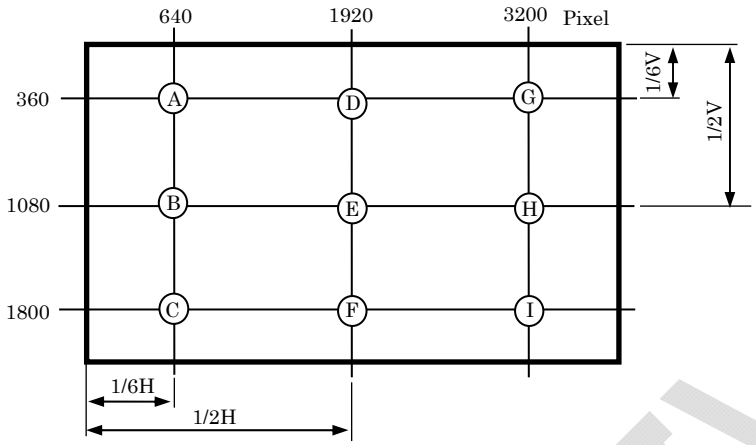
[Note 4]This shall be measured at center of the screen.

[Note 5] Response time is the value when O/S driving is used at typical input time value.

[Note 6]Definition of white uniformity

White uniformity is defined as the following with 9 points measurement.

$$\delta W = \frac{\text{Maximum Luminance of 9 points (Brightness)}}{\text{Minimum Luminance of 9 points (Brightness)}}$$



10. Handling Precautions of the module

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

b) Voltage difference generated by this switching, ΔV_{LED}, may affect a sound output, etc. when the power supply is shared between the LED PWB and its surrounding circuit. So, separate the power supply of the LED PWB with the one of its surrounding circuit.

c) Be sure to design the cabinet so that the module can be installed without any extra stress such as warp or twist.

d) Since the front polarizer is easily damaged, pay attention not to scratch it.

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

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

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

h) Since CMOS LSI is used in this module, take care of static electricity and take the human earth into consideration when handling.

i) The module has some printed circuit boards (PCBs) on the back side, take care to keep them from 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 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.

m) 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.

n) This LCD module is designed to prevent dust from entering into it. However, there would be a possibility to have a bad effect on display performance in case of having dust inside of LCD module. Therefore, please ensure to design your product to keep dust away around LCD module.

o) Make sure that the LCD module is operated within specified temperature and humidity.
Measures against dust, water, condensation, vibration, and heat dissipation structure, etc. are required at the

cabinet or equipment side. Avoid combination of background and image with large different luminance.
Please consider the design and operating environment.

p) Ultra-violet ray filter is necessary in outdoor environment.

q) Operation for 24 hours a day is NOT recommended.

r) When the module is turned on, you might hear cracking noises coming from the module until it warms up. Similarly, this phenomenon might occur when the module is turned off until it cools down.
This phenomenon occurs by a large amount of heat generation due to a big module.
Therefore, it is not a defect.

s) Image retention may occur if same fixed pattern is displayed for a long time.
In some cases, it may not disappear. It is recommended to use moving picture periodically.
After long-term static display, periodical power-off or screen saver is needed. For screen saver, moving picture or black pattern is strongly recommended.

t) Do not put a laminate film on LCD module, after peeling of the original one. If you put on it, it may cause discoloration or spots because of the occurrence of air gaps between the polarizer and the film.

u) Ground module bezel to stabilize against EMI and external noise.

11. Packing form ▲D

a) Piling number of pallets: 2 Maximum

b) Packing quantity in 1 pallet : 36pcs (18pcs ×2carton)

c) Carton size: 850 (W) × 1,110 (D) × 1,138 (H)

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

e) Packing Form is shown in Fig.4.

12. Reliability test item

*only as for the module.

No.	Test item	Condition
1	High temperature storage test	Ta=60°C t=240h
2	Low temperature storage test	Ta=-25°C t=240h
3	High temperature and high humidity operation test	Ta=40°C ; 95%RH t=240h (No condensation)
4	High temperature operation test	Ta=40°C t=240h
5	Low temperature operation test	Ta= 0°C t=240h
6	Vibration test* (non-operation)	Frequency: 10~57Hz/Vibration width (one side): 0.075mm : 58~500Hz/Acceleration: 9.8 m/s^2 Sweep time: 11 minutes Test period: 3 hours (1h for each direction of X, Y, Z)
7	Shock test* (non-operation)	Maximum acceleration: 294m/s^2 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

【Note】these items apply to the single module.

【Result evaluation criteria】

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

13. Others

1) Lot No. Label ▲D

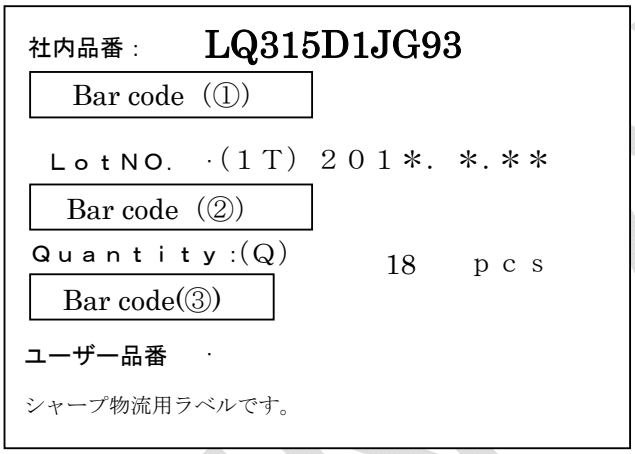
The label that displays SHARP, product model (LQ315D1JG93), a product number is stuck on the back of the module.

How to express Lot No.

○ ○ N ○ ○ ○ ○ ○ ○

- A production year (the last figures of the Christian era)
- A production month (1-9, X, Y, Z)
- Identification Code
- Serial number
- Management number

2) Packing Label ▲D



① Management No.

② Lot No. (Date)

③ Quantity

3) Adjusting volume has been set optimally before shipment, so do not change any adjusted value. If adjusted value is changed, the technical literature may not be satisfied.

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

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

6) The chemical compound, which causes the destruction of ozone layer, is not being used.

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

8) This module is corresponded to RoHS.

9) Rust on the module is not taken up a problem.

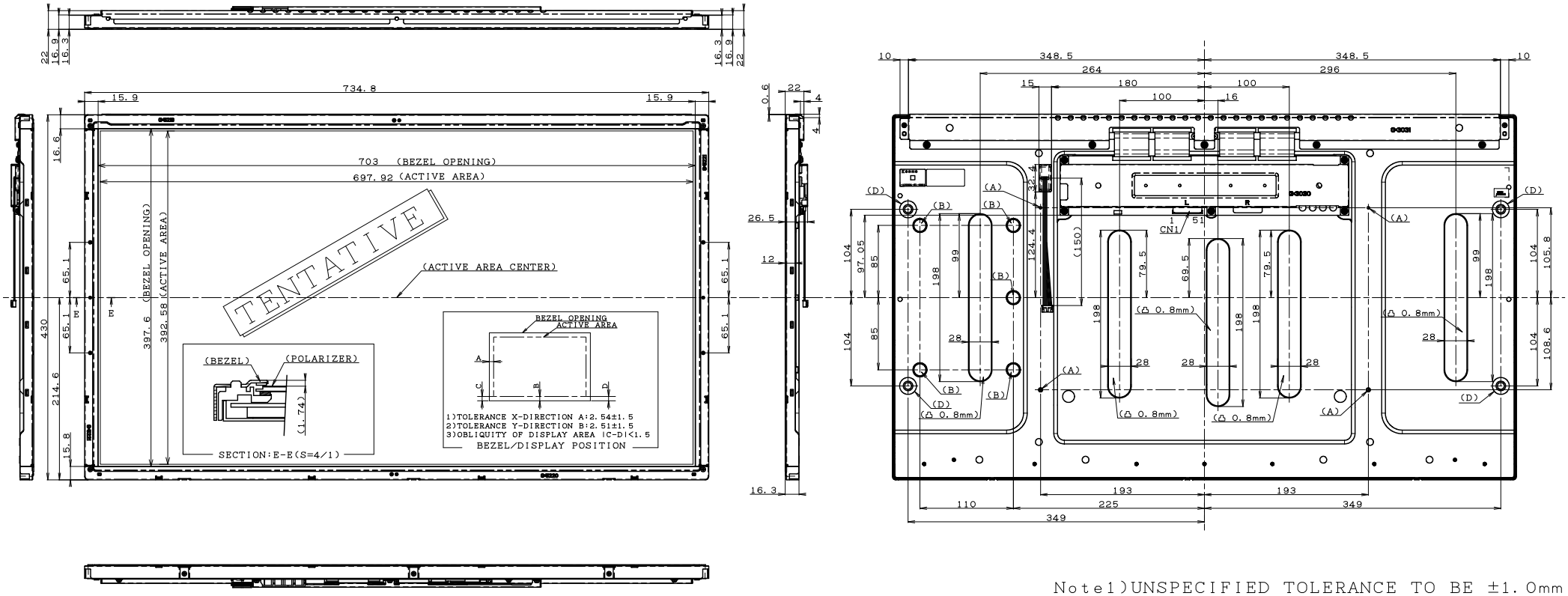
10) Appearance quality and standard are referred to the outgoing incoming inspections.

11) This LCD is appropriate to UL. Below figure shows the UL label.

Factory code

14. Carton storage condition

Temperature	0°C to 40°C
Humidity	90%RH or less
Reference condition	: 20°C to 35°C, 85%RH or less (summer) : 5°C to 15°C, 85%RH or less (winter) ・the total storage time (40°C,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 life	1 year



Note1)UNSPECIFIED TOLERANCE TO BE ±1.0mm