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

DEVICE SPECIFICATION FOR

TFT - LCD module

MODEL No. LK460D3LA12

CUSTOMER'S APPROVAL

DATE _____

BY _____

PRESENTED

BY Makoto Takeda

M. TAKEDA
GENERAL MANAGER
LCD DEVELOPMENT CENTER
AVC LIQUID CRYSTAL DISPLAY GROUP
SHARP CORPORATION

RECORDS OF REVISION

MODEL No. : LK460D3LA12

SPEC No. : LD-19Z11

DATE	NO.	REVISED No.	PAGE	SUMMARY	NOTE
LD-19Z11	2008. 3.24	—	—	—	1st Issue

1. Application

This specification applies to the color 46.0" TFT-LCD module LK460D3LA12.

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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 1920×RGB×1080 dots panel with about 16,772,216 colors by using LVDS (Low Voltage Differential Signaling) to interface, +12V of DC supply voltages.

This module also includes the DC/AC inverter to drive the CCFT. (+60V/+12V of DC supply voltage)

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.

With this technology, image signals can be set so that liquid crystal response completes within one frame. As a result, motion blur reduces and clearer display performance can be realized.

3. Mechanical Technical literatures

Parameter	Technical literatures	Unit
Display size	116.809 (Diagonal)	cm
	46.00 (Diagonal)	inch
Active area	1018.08 (H) x 572.67 (V)	mm
Pixel Format	1920(H) x 1080(V) (1pixel = R + G + B dot)	pixel
Pixel pitch	0.53025(H) x 0.53025 (V)	mm
Pixel configuration	R, G, B vertical stripe	
Display mode	Normally black	
Unit Outline Dimensions (*1)	1075.1 (W) x 631.0 (H) x 63.0 (D) *Excluding lug parts	mm
Mass	11.6 ± 1.0	kg
Surface treatment	Anti glare Hard coating: 2H	

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

4. Input Terminals

4.1. TFT panel driving

CN1 (Interface signals) (Shown in Fig.1)

Using connector : FI-RE41S-VF (Japan Aviation Electronics Ind., Ltd.)
Mating connector : FI-RE41H(L), FI-R41C2(L) (Japan Aviation Electronics Ind. , Ltd.)
Mating LVDS transmitter: THC63LVDM83R or equivalent device

Pin No.	Symbol	Function	Remark
1	GND		
2	AIN0–	Aport (–)LVDS CH0 differential data input	LVDS
3	AIN0+	Aport (+)LVDS CH0 differential data input	LVDS
4	AIN1–	Aport (–)LVDS CH1 differential data input	LVDS
5	AIN1+	Aport (+)LVDS CH1 differential data input	LVDS
6	AIN2–	Aport (–)LVDS CH2 differential data input	LVDS
7	AIN2+	Aport (+)LVDS CH2 differential data input	LVDS
8	GND		
9	ACK–	Aport LVDS Clock signal(–)	LVDS
10	ACK+	Aport LVDS Clock signal(+)	LVDS
11	AIN3–	Aport (–)LVDS CH3 differential data input	LVDS
12	AIN3+	Aport (+)LVDS CH3 differential data input	LVDS
13	AIN4–	NC	LVDS
14	AIN4+	NC	LVDS
15	GND		
16	BIN0–	Bport (–)LVDS CH0 differential data input	LVDS
17	BIN0+	Bport (+)LVDS CH0 differential data input	LVDS
18	BIN1–	Bport (–)LVDS CH1 differential data input	LVDS
19	BIN1+	Bport (+)LVDS CH1 differential data input	LVDS
20	BIN2–	Bport (–)LVDS CH2 differential data input	LVDS
21	BIN2+	Bport (+)LVDS CH2 differential data input	LVDS
22	GND		
23	BCK–	Bport LVDS Clock signal(–)	LVDS
24	BCK+	Bport LVDS Clock signal(+)	LVDS
25	BIN3–	Bport (–)LVDS CH3 differential data input	LVDS
26	BIN3+	Bport (+)LVDS CH3 differential data input	LVDS
27	BIN4–	NC	LVDS
28	BIN4+	NC	LVDS
29	GND		
30	SELLVDS	Select LVDS Data order[Note 1]	Pull up: 3.3V
31	Reserved	It is required to set non-connection(OPEN)	Pull down: GND
32	Reserved	It is required to set non-connection(OPEN)	Pull down: GND
33	Reserved	It is required to set non-connection(OPEN)	Pull up: 3.3V
34	FRAME	Frame frequency setting 1:60Hz, 0:50Hz	Pull down: GND
35	Reserved	It is required to set non-connection(OPEN)	Pull down: GND
36	Reserved	It is required to set non-connection(OPEN)	Pull up: 3.3V
37	Reserved	It is required to set non-connection(OPEN)	Pull up: 3.3V
38	Reserved	It is required to set non-connection(OPEN)	Pull up: 3.3V
39	Reserved	OPEN or Fix to GND	Pull down: GND
40	O/S_set	O/S operation setting 1:O/S ON, 0:O/S OFF	Pull up: 3.3V
41	GND		

*0: Low level voltage (GND) 1: High level voltage (3.3V)
[Note]-GND of a liquid crystal panel drive part has connected with a module chassis.

CN2 (Shown in Fig.1)

Using connector : SM15B-GHS-TB (J.S.T. Mfg. Co., Ltd.)
Mating connector : GHR-15V-S (connector) (J.S.T Mfg. Co., Ltd.)
: SSHL-002T-P0.2 (Terminal) (J.S.T. Mfg. Co., Ltd.)

Pin No.	Symbol	Function	Remark
1	Vcc	+12V	
2	Vcc	+12V	
3	Vcc	+12V	
4	Vcc	+12V	
5	GND		
6	GND		
7	GND		
8	GND		
9	Reserved		[Note 3]
10	Reserved		[Note 3]
11	Reserved		[Note 3]
12	Reserved		[Note 3]
13	Reserved		[Note 3]
14	Reserved		[Note 3]
15	Reserved		[Note 3]

*0: Low level voltage (GND) 1: High level voltage (3.3V)

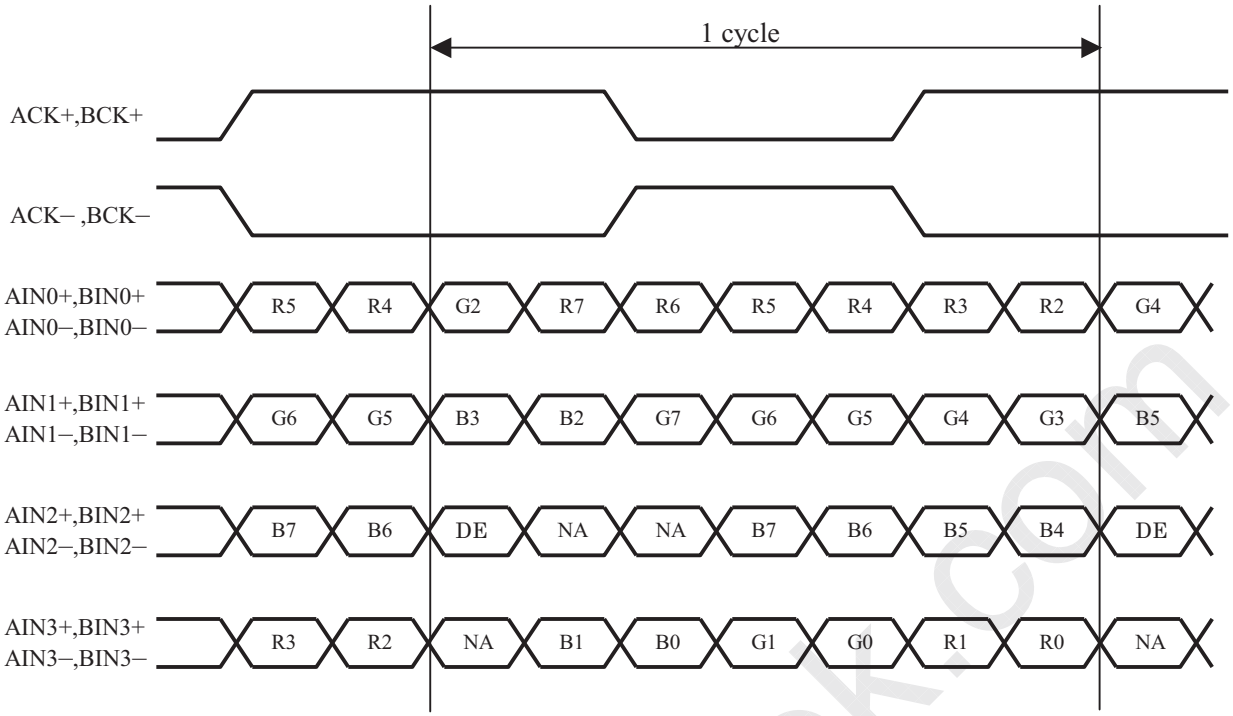
[Note 1] LVDS Data order

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	NA	NA
28	TC5	NA	NA
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

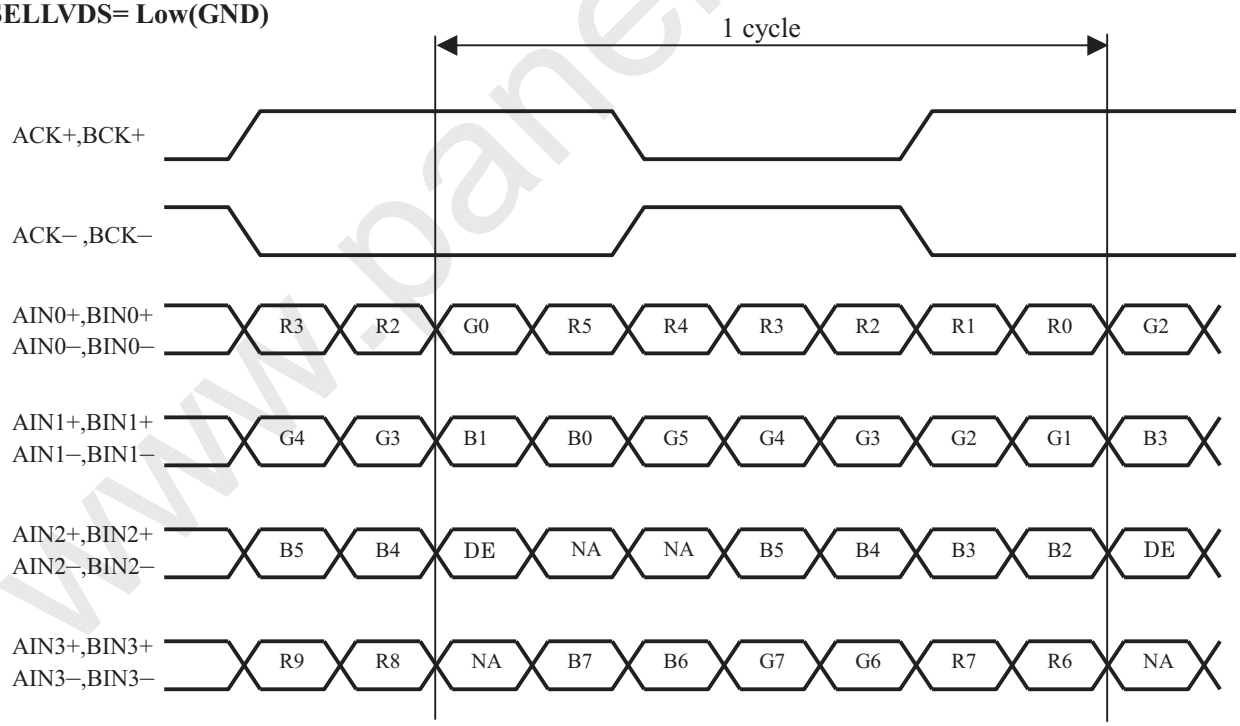
NA: Not Available

(*) Since the display position is prescribed by the rise of DE (Display Enable) signal, please do not fix DE signal during operation at "High."

SELLVDS= High (3.3V) or Open

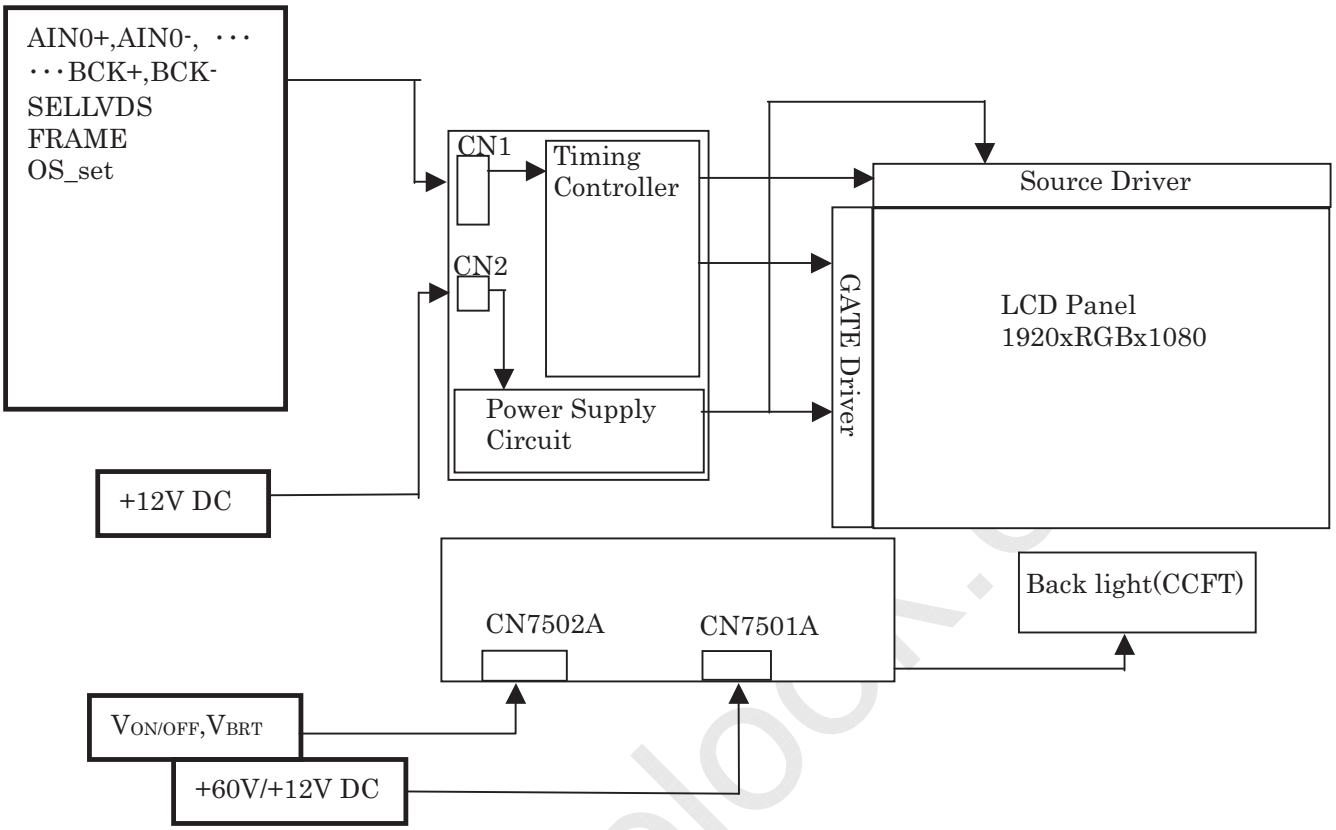


SELLVDS= Low(GND)



DE: Display Enable
NA: Not Available (Fixed Low)

4.2. Block Diagram (LCD Module)



4.3. Backlight driving

CN7501A (+60/12V DC power supply)

Using connector: S3P-VH(LF)(SN) (JST)

Mating connector: VHR-3 (JST)

Pin No.	Symbol	Function	Default(open)	remark
1	V_{INV1}	+60V Power supply		
2	GND	GND		
3	V_{INV2}	+12V Power supply		

[Note] GND for power supply of inverter needs to connect to B/L chassis.

CN7502A (Control Signal)

Using connector: S09B-PASK-2(LF)(SN) (JST)

Mating connector: PAP-09V-S (JST)

Pin No.	Symbol	Function	Default(open)	remark
1	SGND	Signal GND		
2	$V_{ON/OFF}$	Inverter ON/OFF		[Note 1]
3	Reserved	It is required to set non-connection(OPEN)		
4	Reserved	It is required to set non-connection(OPEN)		
5	Reserved	It is required to set non-connection(OPEN)		
6	Reserved	It is required to set non-connection(OPEN)		
7	Reserved	It is required to set non-connection(OPEN)		
8	V_{BRT}	Brightness Control	Pull up:3.3V	[Note 2]
9	NC	-		

[Note] Shield case does not connect to GND inside the inverter board.

[Note 1]Inverter ON/OFF

Pin No.2 is used for the control of the Inverter ON / OFF.

Input voltage	Function
0V	Inverter : OFF
3.3V	Inverter : ON

[Note 2] Brightness Control

PWM Brightness Control is regulated by analog input voltage (0V to 3.3V)

	Min.	Typ.	Max.	Function
Input voltage	0	<—>	3.3	0V : Dark - 3.3V : Bright
Reference Brightness ratio[%]	14	<—>	100	

4.4. The back light system characteristics

The back light system is direct type with 20 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	–	60000	–	Hour	[Note]

[Note]

- 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 °C and brightness control(V_{BRT}=3.3V).
- Above value is applicable when the long side of LCD module is placed horizontally.(Landscape position). (Lamp lifetime may vary if LCD module is in portrait position due to the change of mercury density inside the lamp.)

5. Absolute Maximum Ratings

Parameter	Symbol	Condition	Ratings	Unit	Remark
Input voltage (for Control)	V_I	Ta=25 °C	-0.3 ~ 3.6	V	[Note 1]
+12V supply voltage (for Control)	Vcc	Ta=25 °C	0 ~ + 14	V	
Input voltage (for Inverter)	$V_{ON/OFF}$ V_{BRT}	Ta=25 °C	0 ~ + 5	V	
+60V supply voltage (for Inverter)	V_{INV1}	Ta=25 °C	0 ~ +72	V	
+12V supply voltage (for Inverter)	V_{INV2}	Ta=25 °C	0 ~ +13.2	V	
Storage temperature	Tstg	–	-25 ~ +60	°C	[Note 2]
Operation temperature (Ambient)	Topa	–	0 ~ +50	°C	

[Note 1]SELLVDS, FRAME, O/S_set

[Note 2]Humidity 95%RH Max. (Ta≦40°C)

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

No condensation.

6. Electrical Characteristics

6.1 Control circuit driving

Ta=25°C

Parameter		Symbol	Min.	Typ.	Max.	Unit	Remark
+12V supply voltage	Supply voltage	Vcc	11.4	12	12.6	V	[Note 1]
	Current dissipation	Icc	—	0.8	1.5	A	[Note 2]
	Inrush current	I_{RUSH}	-	0.9	-	A	[Note 7]
		T_{RUSH}	-	4.4	-	ms	[Note 7]
Permissible input ripple voltage		V_{RP}	–	–	100	mV_{P-P}	Vcc = +12.0V
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	V	
Input leak current (Low)		I_{IL1}	–	–	400	µA	V_I = 0V[Note 4]
		I_{IL2}	–	–	40	µA	V_I = 0V[Note 5]
Input leak current (High)		I_{IH1}	–	–	40	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

$0 < t1 \leqq 20ms$

$10 < t2 \leqq 20ms$

$10 < t3 \leqq 50ms$

$0 < t4 \leqq 1s$

$t5 \geqq 850ms$

$t6 \geqq 0$

$t7 \geqq 300ms$

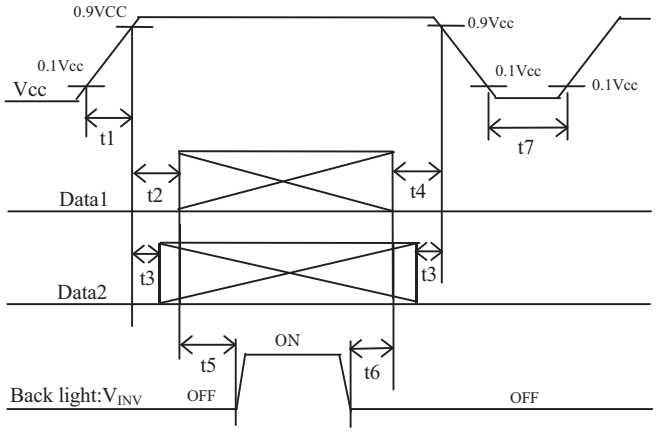
Dip conditions for supply voltage

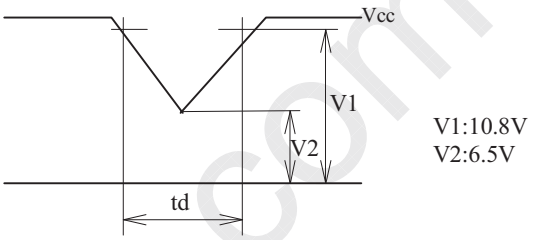
a) $6.5V \leqq Vcc < 10.8V$

$td \leqq 10ms$

b) $Vcc < 6.5V$

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



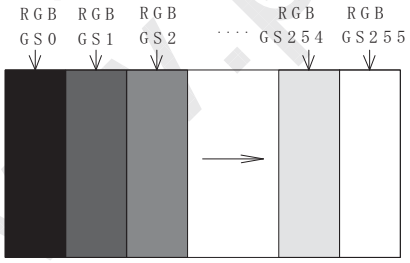


※ Data1: ACK±, AIN0±, AIN1±, AIN2±, AIN3±,BCK±, BIN0±, BIN1±, BIN2±, BIN3±
*V_{CM} voltage pursues the sequence mentioned above

※ Data2: SELLVDS, FRAME, O/S_set

[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.

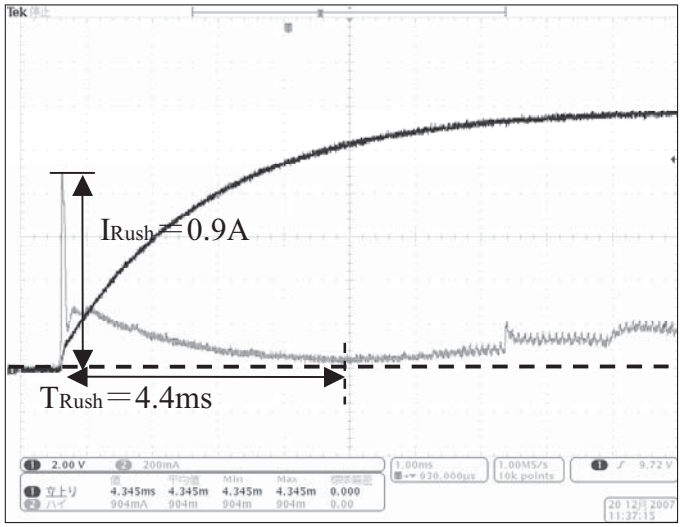
[Note 2] Maximum current situation: white (RGB GS256)
Typical current situation: 256 gray-bar pattern (Vcc = +12.0V)
The explanation of RGB gray scale is seen in section 8.



Vcc＝12.0V
CK＝74.25MHz

[Note 3] SELLVDS, FRAME, O/S_set
[Note 4] SELLVD, O/S_set
[Note 5] FRAME
[Note 6] ACK±, AIN0±, AIN1±, AIN2±, AIN3±, BCK±, BIN0±, BIN1±, BIN2±, BIN3±

[Note 7]The Rush current corrugation at the time of power on (reference)

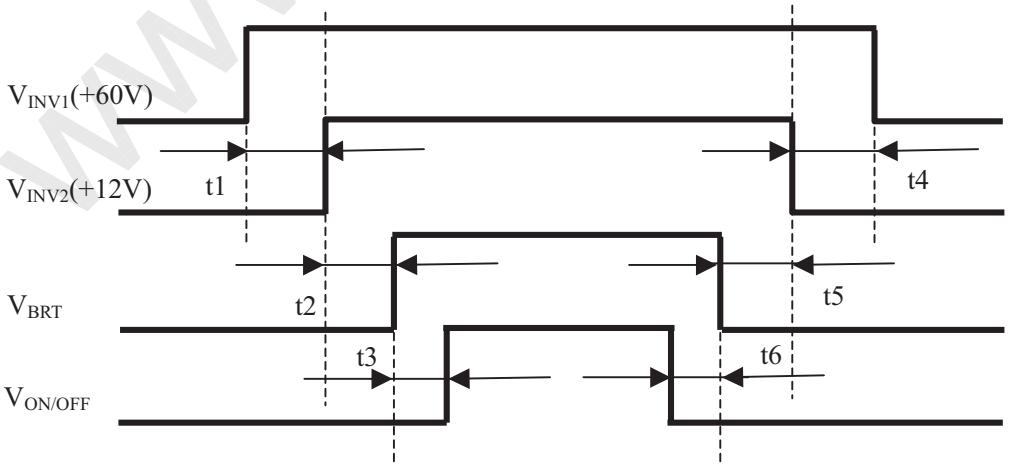


6.2. Inverter driving for back light

The back light system is direct type with 20 CCFTs (Cold Cathode Fluorescent Tube). Ta=25°C

Parameter		Symbol	Min.	Typ.	Max.	Unit	Remark
+60V /+12V	Current dissipation1	$I_{INV\,1}$	–	–	4.5	A	V_{INV1} = 60V V_{INV2} = 12V V_{BRT}=3.3V [Note 1,2]
	Current dissipation2	$I_{INV\,2}$	–	3.3	4.0	A	
	Supply voltage	V_{INV1}	54	60	66	V	
	Supply voltage	V_{INV2}	10.9	12	13.1	V	
Permissible input ripple voltage		V_{RF}	–	–	500	mV_{p-p}	V_{INV} = +12V
Input voltage (Low)		V_{ONL}	0	–	0.4	V	
Input voltage (High)		V_{ONH}	3.0	3.3	3.6	V	
Brightness control voltage vs Brightness level (Reference value)		–	0	→	3.3	V	
			14	→	100	%	

[Note 1] V_{INV}-turn-on and turn-off condition



t1,t2＞0
t3＞100 μ s
t4,t5＞0
t6＞100 μ s

[Note 2]

Current Dissipation 1 : Definition within 60 minutes after turn on.(Rush current is excluded.)

Current Dissipation 2 : Definition more than 60 minutes after turn on.

[Note]

In case of using around min. brightness control voltage, luminance uniformity is changed for the worse. So, it should be set up min. brightness control voltage, under the confirmation by TV set.

Note: The inverter unit is driving at the following drive frequency.

Lamp driving frequency: 33.9kHz (Typ.)

Burst dimmer frequency:317 Hz (Typ.)

There is possibility that the display problem of the backlights such as flicker, blinking, etc by the interference of the above inverter driving frequency and the LCD driving frequency will occur.

In setting of a LCD driving frequency, we recommend to set for the no interference with the above frequency to occur.

6. Timing characteristics of input signals

6.1. 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 period	TH	1084	1100	1200	clock	
			14.6	14.8	16.1	µs	
	Horizontal period (High)	THd	960	960	960	clock	
	Vertical period	TV	1109	1125	1400	line	
	Vertical period (High)	TVd	1080	1080	1080	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.

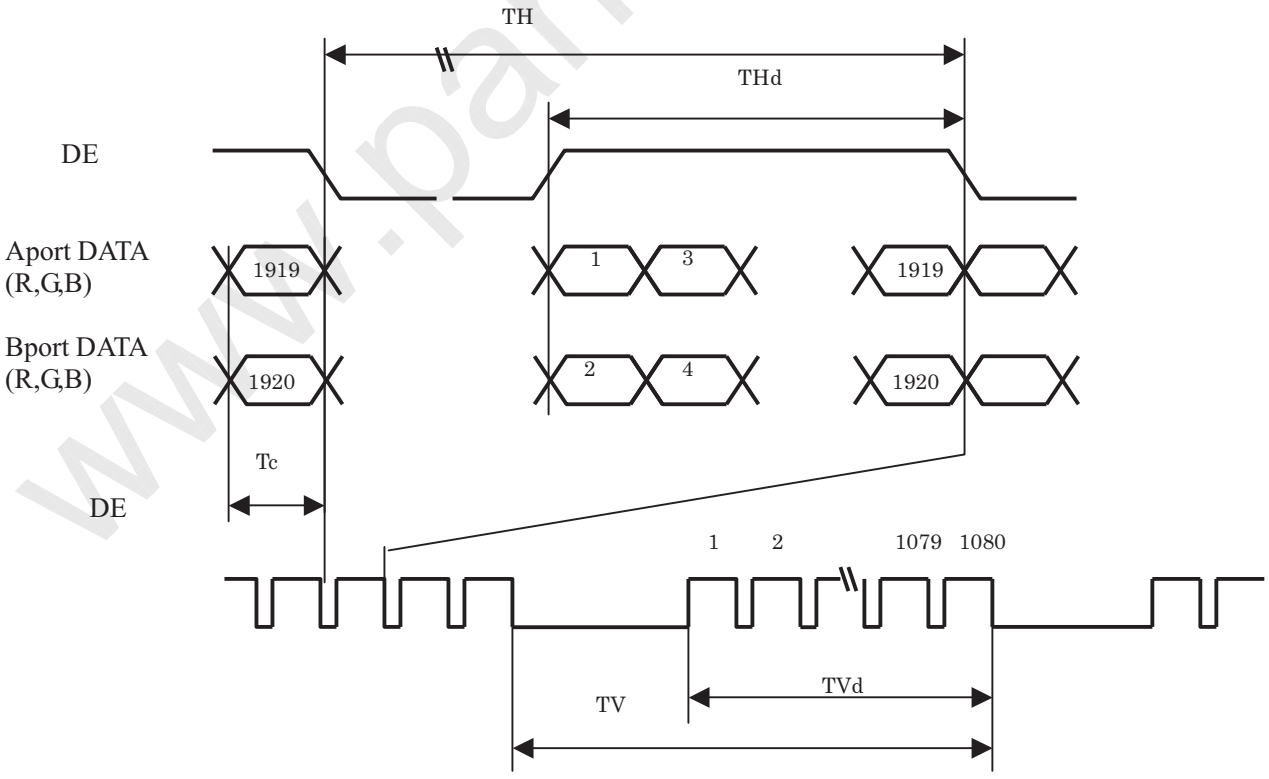
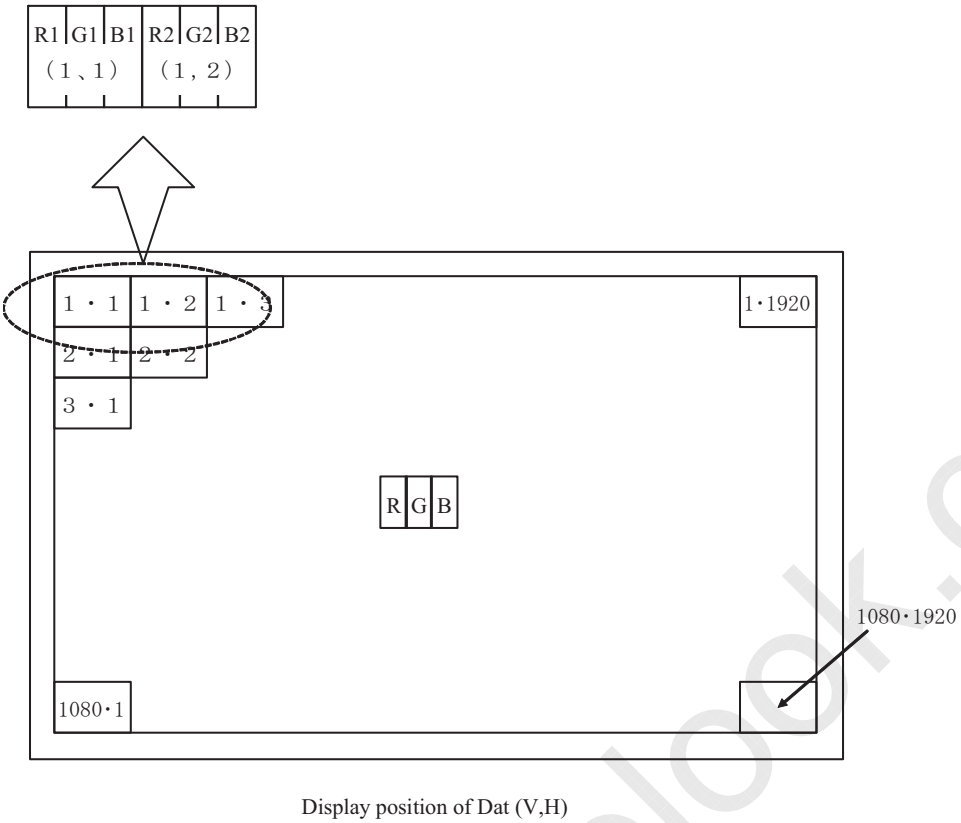


Fig.2 Timing characteristics of input signals

6.2. Input data signal and display position on the screen



Display position of Dat (V,H)

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

	Colors & 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	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	GS254	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 bits data signals. According to the combination of total 24 bits data signals, the 16-million-color display can be achieved on the screen.

8. Optical characteristics

Ta=25°C, Vcc=12V, V_{INV1} =60V, V_{INV2} =12V, V_{BRT}=3.3V, Timing :60Hz(typ.value)

Parameter		Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Viewing angle range	Horizontal	θ21 θ22	CR≧10	80	88	–	Deg.	[Note1,4]
	Vertical	θ11 θ12		80	88	–	Deg.	
Contrast ratio		CRn	θ =0 deg.	1300	1500	–		[Note2,4]
Response time		T_{DRV}		–	6	–	ms	[Note3,4,5]
Chromaticity of white		x		0.253	0.283	0.313	–	[Note 4]
		y		0.263	0.293	0.323	–	
Chromaticity of red		x		0.575	0.605	0.635	–	
		y		0.302	0.332	0.362	–	
Chromaticity of green		x		0.261	0.291	0.321	–	
		y		0.546	0.576	0.606	–	
Chromaticity of blue		x		0.116	0.146	0.176	–	
		y		0.058	0.088	0.118	–	
Luminance of white		Y_L		320	400	–	cd/m^2	
Luminance uniformity		δ_W		–	–	1.25	–	[Note 6]

Measurement condition: Set the value of V_{BRT} 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.

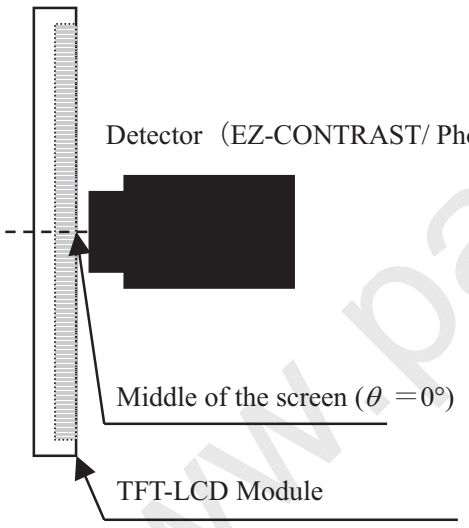


Fig.3-1 Measurement of viewing angle range and Response time.
(Viewing angle range: EZ-CONTRAST, Response time: Photodiode)

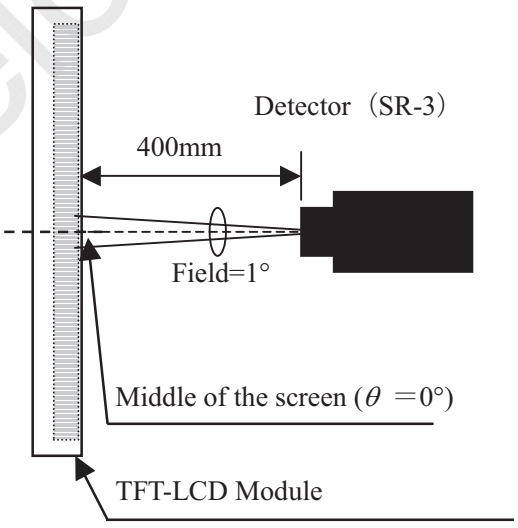
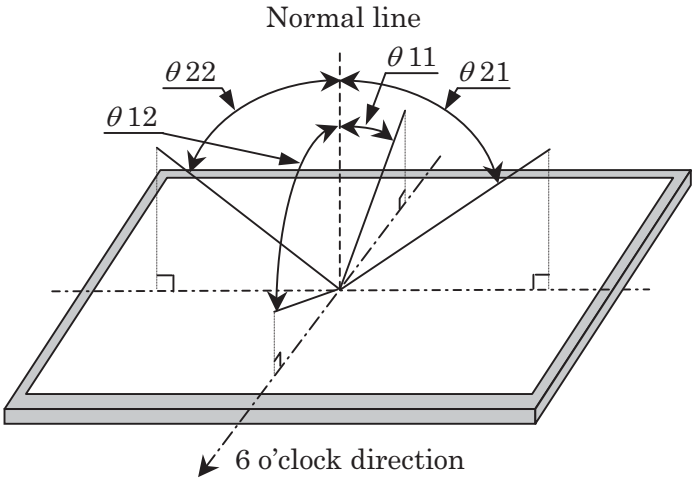


Fig.3-2 Measurement of Contrast, Luminance, Chromaticity and Response time.

[Note 1]Definitions of viewing angle range:



[Note 2]Definition of contrast ratio:

The contrast ratio is defined as the following.

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

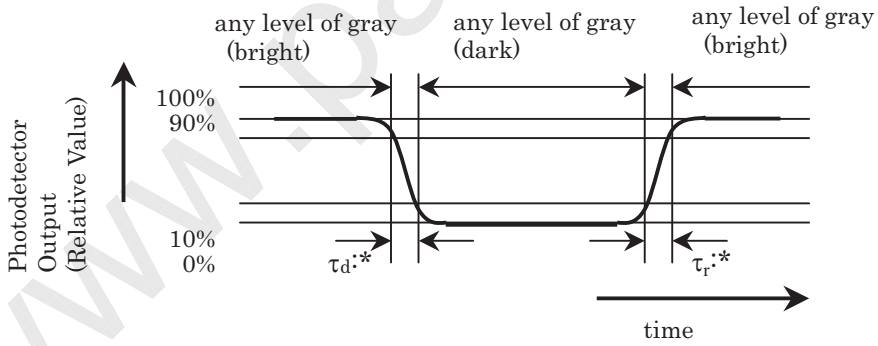
[Note 3]Definition of response time

The response time (T_{DRV}) is defined as the following figure and shall be measured by switching the input signal for "any level of gray (0%, 25%, 50%, 75% and 100%)" and "any level of gray (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)

$T_{DRV} = \Sigma(t*:x-y)/20$



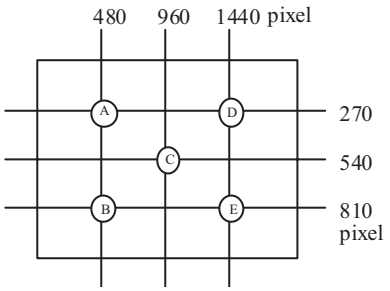
[Note 4]This shall be measured at center of the screen.

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

[Note 6]Definition of white uniformity;

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

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



9. 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.

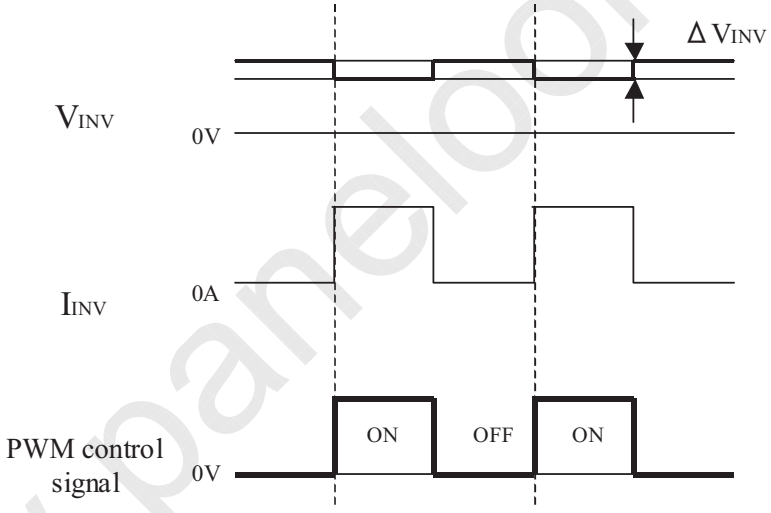


Fig.4 Brightness control voltage.

*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 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) 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 TV set to keep dust away around LCD module.

10. Packing form

a) Piling number of cartons: 2 maximum
b) Packing quantity in one carton: 8pcs
c) Carton size: 1190(W) × 1010(D) × 856(H)
d) Total mass of one carton filled with full modules: 112kg(typ.)

11. Reliability test item

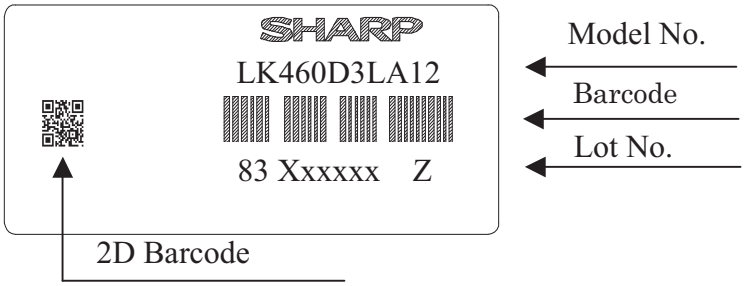
No.	Test item	Condition
1	High temperature storage test	Ta= 60°C 240h
2	Low temperature storage test	Ta=-25°C 240h
3	High temperature and high humidity operation test	Ta= 40°C ; 95%RH 240h (No condensation)
4	High temperature operation test	Ta= 50°C 240h
5	Low temperature operation test	Ta= 0°C 240h
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: 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

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

12. Others

1)Lot No. Label ;

The label that displays SHARP, product model (LK460D3LA12), a product number is stuck on the back of the module.



How to express Lot No.

○ ○ ○ ○ ○ ○ ○ ○ — —

A production year(the last figures of the Christian Era)

A production month (1-9,X,Y,Z)

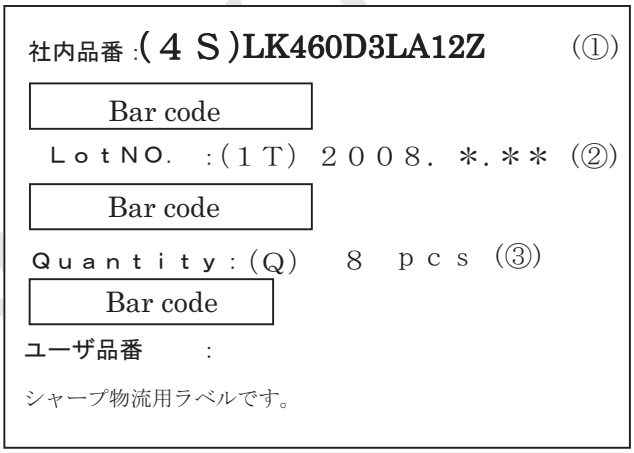
Serial No.

Management No.

Identification Code

K:Kameyama Plant.
L:Kameyama Tec. Kameyama Fab.
J:Kameyama Tec. Yaita Fab.
S:SHM
N:NSEC
P:SMPL
X:SEMEX
A or B:JABIL

2) Packing Label

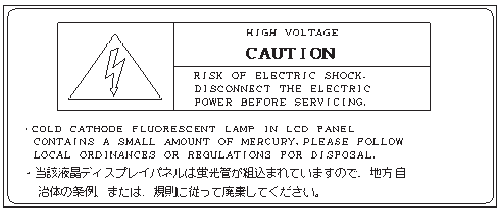


① Management No.

② Lot No. (Date)

③ Quantity

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) The chemical compound, which causes the destruction of ozone layer, is not being used.
6) Cold cathode fluorescent lamp in LCD PANEL contains a small amount of mercury. Please follow local ordinances or regulations for disposal. The below figure shows the label.



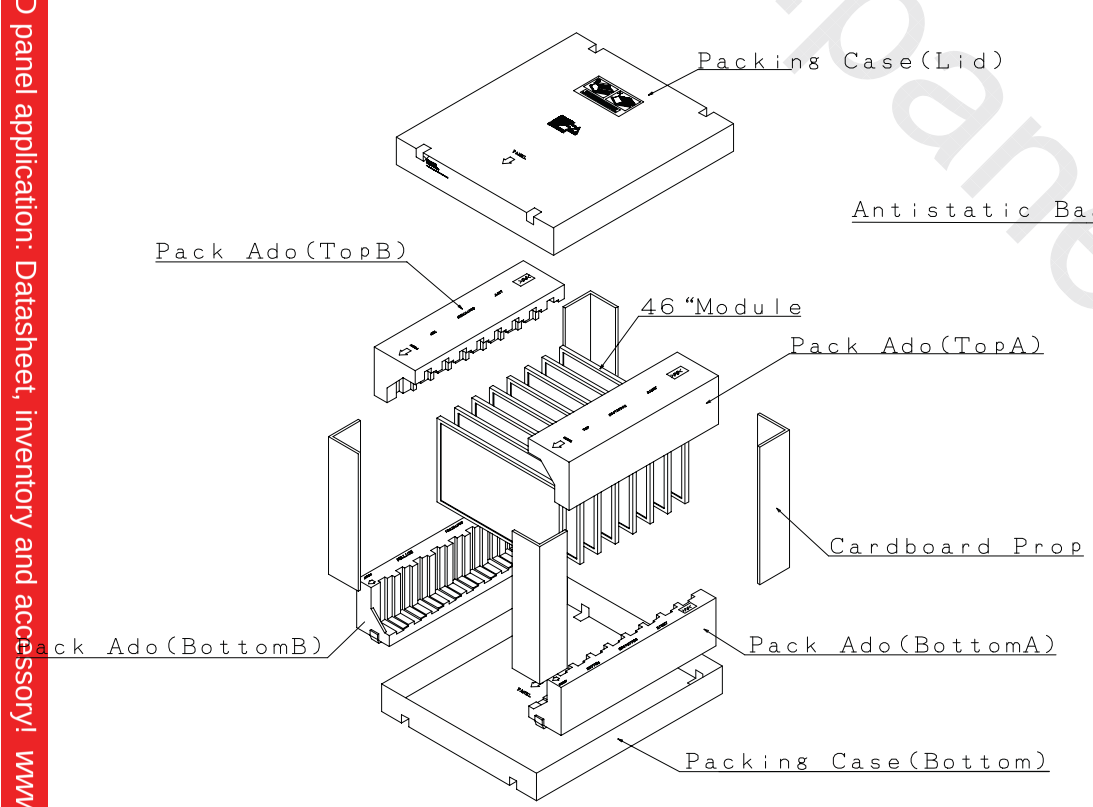
7) When any question or issue occurs, it shall be solved by mutual discussion.

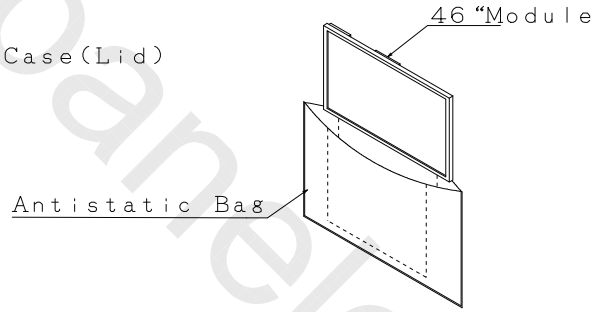
15. Carton storage condition

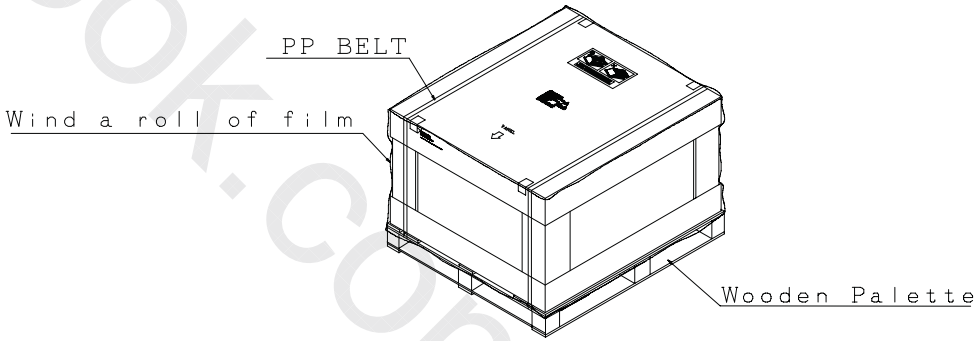
Temperature	0°C to 40°C
Humidity	95%RH or less
Reference condition:	20°C to 35°C, 85%RH or less (summer)
:	5°C to 15°C, 85%RH or less (winter)
	・the total storage time (40°C, 95%RH) : 240H or less
Sunlight	Be sure to shelter a product from the direct sunlight.
Atmosphere	Harmful gas, such as acid and 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

LD-19Z11-20

Parts Name	Material
Packing Case(Bottom)	Cardboard
Packing Case(Lid)	Cardboard
Pack Ado(BottomA)	PS
Pack Ado(BottomB)	PS
Pack Ado(TopA)	PS
Pack Ado(TopB)	PS
Cardboard Prop	Cardboard
Wooden Palette	Fumigation woods
Antistatic Bag	PE







《Architect's Conception》

LD-19Z11-21

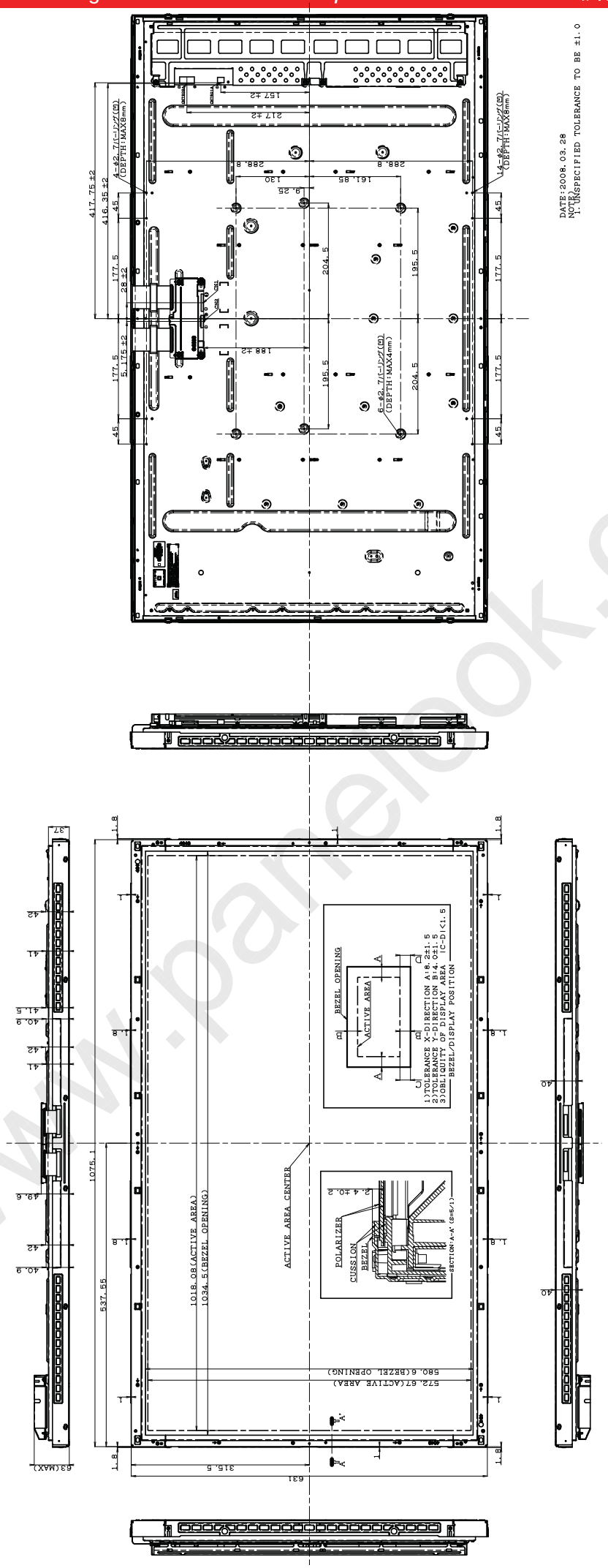


Fig 1 LK460D3LA12 OUTLINE DIMENSIONS