SHARP

No.	**LD-S11202**
DATE	Feb.24, 2011

TECHNICAL   LITERATURE

FOR

TFT - LCD   module

MODEL   No.   LK600D3LB14

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DEVELOPMENT DEPARTMENT 3
LIQUID CRYSTAL DISPLAY DIVISION 3
LIQUID CRYSTAL DISPLAY GROUP
 SHARP CORPORATION

RECORDS OF REVISION

LK600D3LB14

SPEC No.	DATE	REVISED No.	PAGE	SUMMARY	NOTE
LD-S10701	Feb.24, 2011	-	-	-	1st. Issue

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1. Application

This technical literature applies to the color 60.0" TFT-LCD module LK600D3LB14

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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 $1920 \times RGB \times 1080$ dots panel with one billion colors by using 8bit+FRC LVDS (Low Voltage Differential Signaling) to interface, +12V of DC supply voltages.

This module also includes the LED PWB and LED DRIVER PWB to drive the LED.

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.

This LCD module also adopts Double Frame Rate driving method including FRC (Frame Rate Control) function on the control circuit. Therefore the input signal to this LCD module is Single Frame Rate (50Hz or 60Hz),

But the output is Double-Frame Rate (100Hz or 120Hz) picture (inserting the intermediate image which is generated by the FRC).

With combination of these technologies, motion blur can be reduced and clearer display performance
can be realized.

3. Mechanical Specifications

Parameter	Specifications	Unit
Display size	152.496 　（Diagonal）	cm
	60.0 　（Diagonal）	inch
Active area	1329.12(H) x 747.63 (V)	mm
Pixel Format	1920(H) x 1080(V)　（1pixel = R + G + B dot）	pixel
Pixel pitch	0.69225(H) x 0.69225 (V)	mm
Pixel configuration	R, G, B vertical stripe	
Display mode	Normally black	
Unit Outline Dimensions (*1)	1380[W] x 790 [H] x (116.6) [D]	mm
Mass	(27)±1	kg
Surface treatment	Anti glare, low reflection coating　Hard coating: 3H	

(*1) Outline dimensions are shown in Fig.1 (excluding protruding portion)

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4. Input Terminals

4.1. TFT panel driving

CN1 (Interface signals and +12V DC power supply) (Shown in Fig.1)

Using connector　　　　　 : FI-RE51S-HF, or FI-REN51S2-HF (Japan Aviation Electronics Ind., Ltd.)

Mating connector　　　　　 : FI-RE51HL, FI-RE51CL (Japan Aviation Electronics Ind., Ltd.)

Mating LVDS transmitter: THC63LVD1023 or equivalent device

Pin No.	Symbol	Function	Remark
1	GND		
2	Reserved	It is required to set non-connection(OPEN)	Pull up 3.3V
3	Reserved	It is required to set non-connection(OPEN)	Pull up 3.3V
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	SELLVDS	Select LVDS data order [Note 2]	Pull up 3.3V [Note 1]
8	Reserved	It is required to set non-connection(OPEN)	
9	Reserved	It is required to set non-connection(OPEN)	
10	Reserved	It is required to set non-connection(OPEN)	
11	GND		
12	AIN0-	A port (-)LVDS CH0 differential data input	
13	AIN0+	A port (+)LVDS CH0 differential data input	
14	AIN1-	A port (-)LVDS CH1 differential data input	
15	AIN1+	A port (+)LVDS CH1 differential data input	
16	AIN2-	A port (-)LVDS CH2 differential data input	
17	AIN2+	A port (+)LVDS CH2 differential data input	
18	GND		
19	ACK-	A port LVDS Clock signal(-)	
20	ACK+	A port LVDS Clock signal(+)	
21	GND		
22	AIN3-	A port (-)LVDS CH3 differential data input	
23	AIN3+	A port (+)LVDS CH3 differential data input	
24	AIN4-	A port (-)LVDS CH4 differential data input	
25	AIN4+	A port (+)LVDS CH4 differential data input	
26	GND		
27	GND		
28	BIN0-	B port (-)LVDS CH0 differential data input	
29	BIN0+	B port (+)LVDS CH0 differential data input	
30	BIN1-	B port (-)LVDS CH1 differential data input	
31	BIN1+	B port (+)LVDS CH1 differential data input	
32	BIN2-	B port (-)LVDS CH2 differential data input	
33	BIN2+	B port (+)LVDS CH2 differential data input	
34	GND		
35	BCK-	B port LVDS Clock signal(-)	
36	BCK+	B port LVDS Clock signal(+)	
37	GND		
38	BIN3-	B port (-)LVDS CH3 differential data input	
39	BIN3+	B port (+)LVDS CH3 differential data input	
40	BIN4-	B port (-)LVDS CH4 differential data input	
41	BIN4+	B port (+)LVDS CH4 differential data input	
42	GND		
43	GND		
44	GRND		
45	GND		
46	GND		

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47	VCC	+12V Power Supply	
48	VCC	+12V Power Supply	
49	VCC	+12V Power Supply	
50	VCC	+12V Power Supply	
51	VCC	+12V Power Supply	

[Note] GND of a liquid crystal panel drive part has connected with a module chassis.

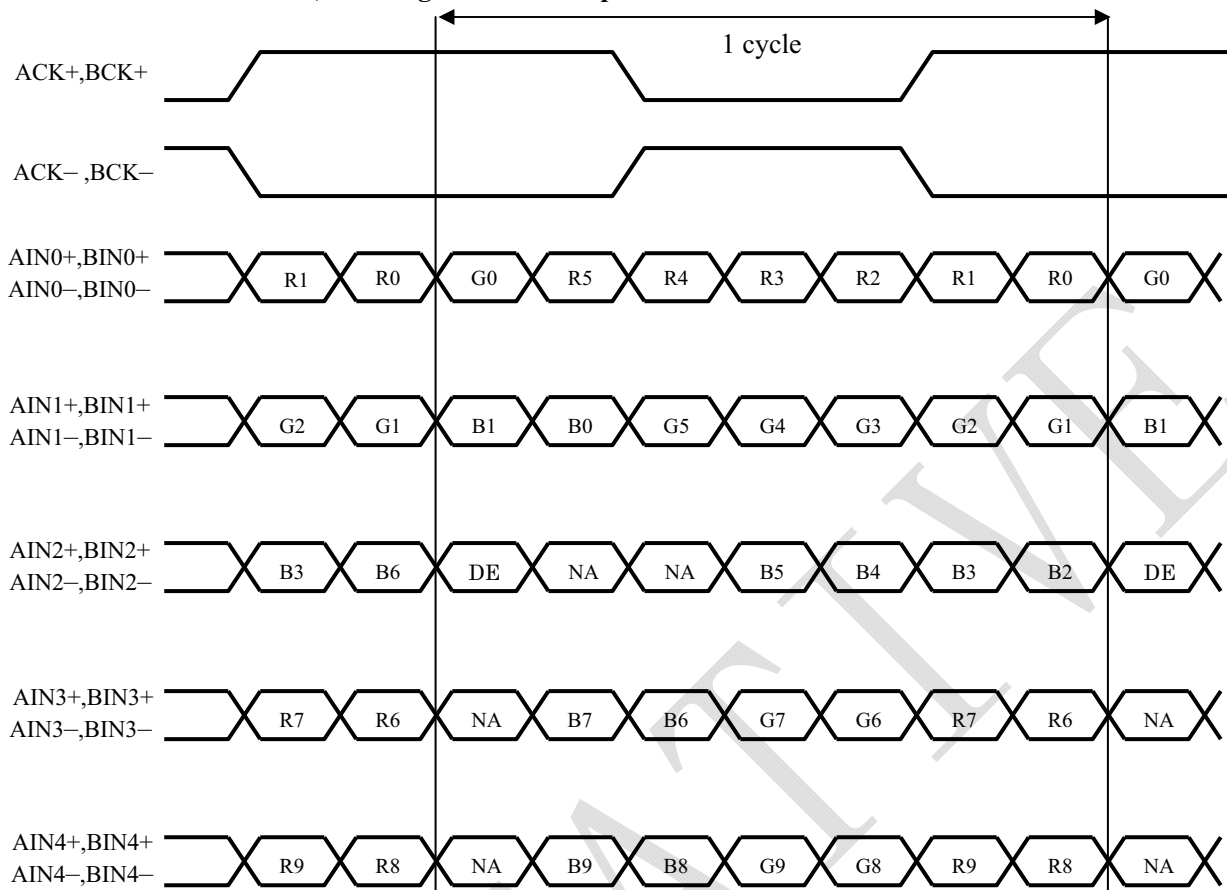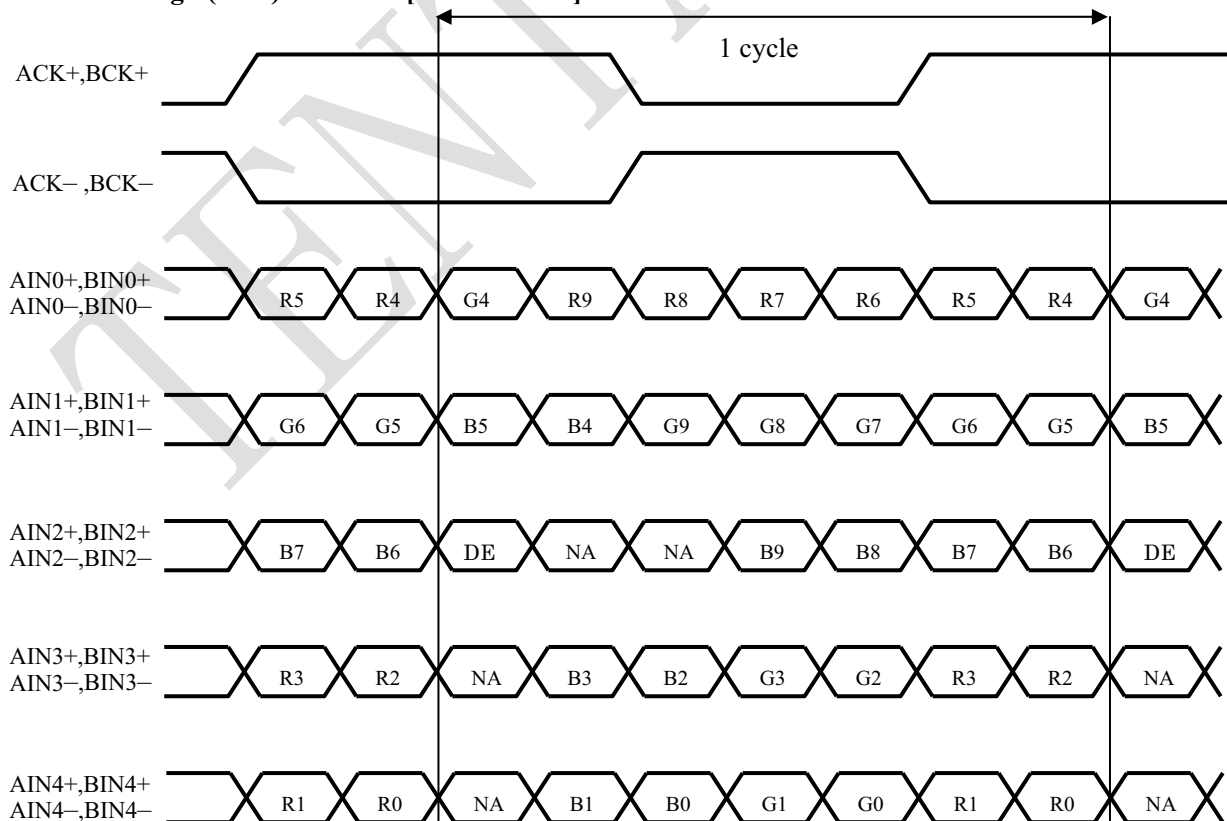[Note 1]The equivalent circuit figure of the terminal
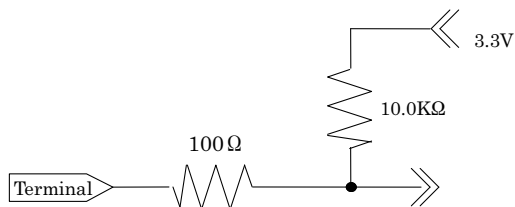
[Note 2] LVDS Data order

SELLVDS		
Data	L(GND) [VESA]	H(3.3V) or Open [JEIDA]
TA0	R0(LSB)	R4
TA1	R1	R5
TA2	R2	R6
TA3	R3	R7
TA4	R4	R8
TA5	R5	R9(MSB)
TA6	G0(LSB)	G4
TB0	G1	G5
TB1	G2	G6
TB2	G3	G7
TB3	G4	G8
TB4	G5	G9(MSB)
TB5	B0(LSB)	B4
TB6	B1	B5
TC0	B2	B6
TC1	B3	B7
TC2	B4	B8
TC3	B5	B9(MSB)
TC4	NA	NA
TC5	NA	NA
TC6	DE(*)	DE(*)
TD0	R6	R2
TD1	R7	R3
TD2	G6	G2
TD3	G7	G3
TD4	B6	B2
TD5	B7	B3
TD6	N/A	N/A
TE0	R8	R0(LSB)
TE1	R9(MSB)	R1
TE2	G8	G0(LSB)
TE3	G9(MSB)	G1
TE4	B8	B0(LSB)
TE5	B9(MSB)	B1
TE6	N/A	N/A

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".
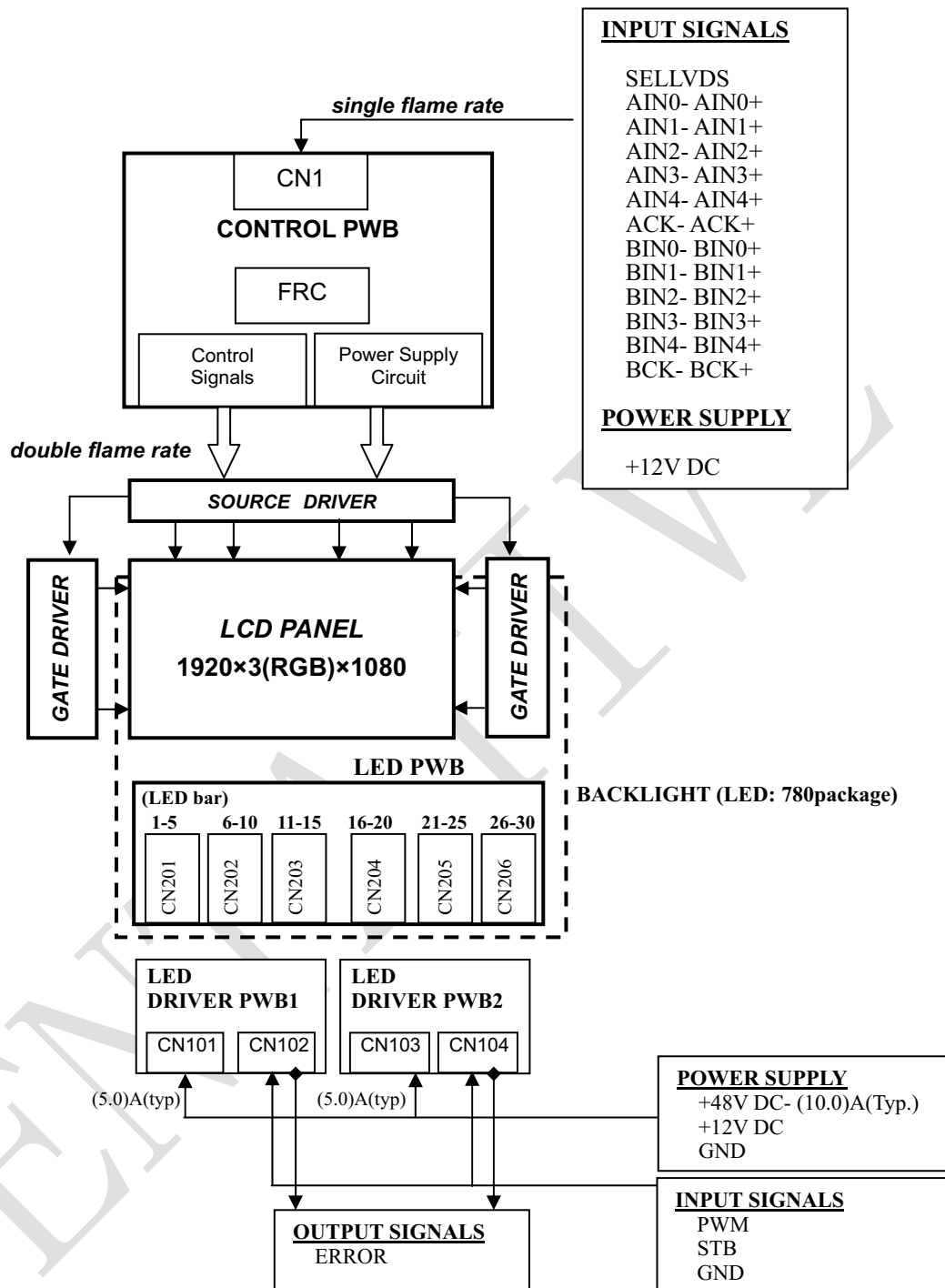
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SELLVDS= Low (GND) [VESA Mode]

　※**In case of VESA Mode,10-bit signal must be input**

	1 cycle

ACK+,BCK+

ACK−,BCK−

AIN0+,BIN0+ AIN0−,BIN0−	R1	R0	G0	R5	R4	R3	R2	R1	R0	G0
AIN1+,BIN1+ AIN1−,BIN1−	G2	G1	B1	B0	G5	G4	G3	G2	G1	B1
AIN2+,BIN2+ AIN2−,BIN2−	B3	B6	DE	NA	NA	B5	B4	B3	B2	DE
AIN3+,BIN3+ AIN3−,BIN3−	R7	R6	NA	B7	B6	G7	G6	R7	R6	NA
AIN4+,BIN4+ AIN4−,BIN4−	R9	R8	NA	B9	B8	G9	G8	R9	R8	NA

SELLVDS= High (3.3V) or OPEN [JEIDA Mode]

	1 cycle

ACK+,BCK+

ACK−,BCK−

AIN0+,BIN0+ AIN0−,BIN0−	R5	R4	G4	R9	R8	R7	R6	R5	R4	G4
AIN1+,BIN1+ AIN1−,BIN1−	G6	G5	B5	B4	G9	G8	G7	G6	G5	B5
AIN2+,BIN2+ AIN2−,BIN2−	B7	B6	DE	NA	NA	B9	B8	B7	B6	DE
AIN3+,BIN3+ AIN3−,BIN3−	R3	R2	NA	B3	B2	G3	G2	R3	R2	NA
AIN4+,BIN4+ AIN4−,BIN4−	R1	R0	NA	B1	B0	G1	G0	R1	R0	NA

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

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4.2.   Interface block diagram

INPUT SIGNALS
SELLVDS
AIN0- AIN0+
AIN1- AIN1+
AIN2- AIN2+
AIN3- AIN3+
AIN4- AIN4+
ACK- ACK+
BIN0- BIN0+
BIN1- BIN1+
BIN2- BIN2+
BIN3- BIN3+
BIN4- BIN4+
BCK- BCK+
POWER SUPPLY
+12V DC

single flame rate

CN1

CONTROL PWB

FRC

| Control Signals | Power Supply Circuit |

double flame rate

SOURCE DRIVER

GATE DRIVER

LCD PANEL
1920×3(RGB)×1080

GATE DRIVER

LED PWB

(LED bar)

1-5	6-10	11-15	16-20	21-25	26-30
CN201	CN202	CN203	CN204	CN205	CN206

BACKLIGHT (LED: 780package)

LED DRIVER PWB1

| CN101 | CN102 |

LED DRIVER PWB2

| CN103 | CN104 |

(5.0)A(typ)   (5.0)A(typ)

POWER SUPPLY
+48V DC- (10.0)A(Typ.)
+12V DC
GND

OUTPUT SIGNALS
ERROR

INPUT SIGNALS
PWM
STB
GND

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4-2. Backlight driving

CN101 (DC power supply of LED DRIVER PWB1)　※Shown in Fig.1

　　　Using connector: S16B-PASK-2　　(J.S.T. Mfg. co.,Ltd)

　　　Matching connector: PAP-16V-S　　　(J.S.T. Mfg. co.,Ltd)

Pin No.	Symbol	Function	Remark
1	V_{LED1}	+48V　　Power Supply	
2	V_{LED1}	+48V　　Power Supply	
3	V_{LED1}	+48V　　Power Supply	
4	V_{LED1}	+48V　　Power Supply	
5	V_{LED1}	+48V　　Power Supply	
6	V_{LED1}	+48V　　Power Supply	
7	V_{LED1}	+48V　　Power Supply	
8	GND		
9	V_{LED2}	+12V　　Power Supply	
10	GND		
11	GND		
12	GND		
13	GND		
14	GND		
15	GND		
16	GND		

*Current rating：3A (AWG#22)

CN102 (Control signal of LED DRIVER PWB1)

　　　Using connector: S09B-PASK-2　　(J.S.T. Mfg. co.,Ltd)

　　　Matching connector: PAP-09V-S　　　(J.S.T. Mfg. co.,Ltd)

Pin No.	Symbol	Function	Remark
1	Reserved	It is required to set non-connection (OPEN)	
2	Reserved	It is required to set non-connection (OPEN)	
3	GND		
4	Reserved	It is required to set non-connection (OPEN)	
5	Reserved	It is required to set non-connection (OPEN)	
6	ERROR	ERROR signal output　　Error: Low output	Pull up　3.3V (by 10kΩ)　【Note 1】
7	PWM	PWM dimming frequency	Pull up　3.3V (by 10kΩ)　(Duty: 100%)　【Note 2】
8	STB	LED backlight operation setting　　H: ON,　L: OFF	Pull up　3.3V (by 10kΩ)　【Note 2】
9	Reserved	It is required to set non-connection (OPEN)	

【Note 1】 ERROR: Open, Short, over current, over voltage, over heat

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CN103 (DC power supply of LED DRIVER PWB2) ※Shown in Fig.1

Using connector: S16B-PASK-2   (J.S.T. Mfg. co.,Ltd)

Matching connector: PAP-16V-S   (J.S.T. Mfg. co.,Ltd)

Pin No.	Symbol	Function	Remark
1	V_{LED1}	+48V Power Supply	
2	V_{LED1}	+48V Power Supply	
3	V_{LED1}	+48V Power Supply	
4	V_{LED1}	+48V Power Supply	
5	V_{LED1}	+48V Power Supply	
6	V_{LED1}	+48V Power Supply	
7	V_{LED1}	+48V Power Supply	
8	GND		
9	V_{LED2}	+12V Power Supply	
10	GND		
11	GND		
12	GND		
13	GND		
14	GND		
15	GND		
16	GND		

*Current rating：3A (AWG#22)

CN104 (Control signal of LED DRIVER PWB2)

Using connector: S09B-PASK-2   (J.S.T. Mfg. co.,Ltd)

Matching connector: PAP-09V-S   (J.S.T. Mfg. co.,Ltd)

Pin No.	Symbol	Function	Remark
1	Reserved	It is required to set non-connection (OPEN)	
2	Reserved	It is required to set non-connection (OPEN)	
3	GND		
4	Reserved	It is required to set non-connection (OPEN)	
5	Reserved	It is required to set non-connection (OPEN)	
6	ERROR	ERROR signal output * Error: Low output	Pull up 3.3V (by 10kΩ) 【Note 1】
7	PWM	PWM dimming frequency	Pull up 3.3V (by 10kΩ) (Duty: 100%) 【Note 2】
8	STB	LED backlight operation setting H: ON, L: OFF	Pull up 3.3V (by 10kΩ) 【Note 2】
9	Reserved	It is required to set non-connection (OPEN)	

*ERROR: Open, Short, over current, over voltage, over heat

【Note 1】 ERROR: Open, Short, over current, over voltage, over heat
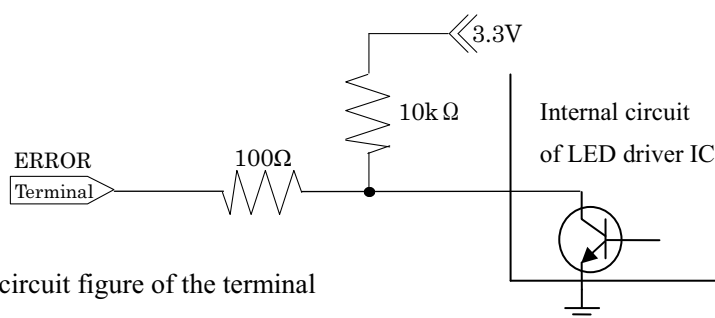
【Note 2】 The equivalent circuit figure of the terminal
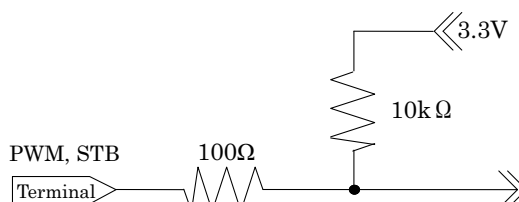
4-3. Backlight electrical characteristic

LED DRIVER PWB   ※value per unit

Parameter	Symbol	Min.	Typ.	Max.	Unit	Remark
Supply voltage	V_{LED1}	45.6	48	50.4	V	PWM duty=100%
	V_{LED2}	11.4	12	12.6	V	
Current dissipation	I_{LED1}	-	(5.0)	(TBD)	A	
	I_{LED2}	-	65	(200)	mA	
Inrush current	I_{RUSH1}	-	4.0	(20)	A	V_{LED1} PWM duty=100%
PWM dimming frequency	f_{PWM}	(463.86)	(488.28)	(512.70)	Hz	[Note]
PWM dimming on duty	D_{PWM}	5	-	100	%	
Input Low voltage	V_{IL}	0	-	0.7	V	
Input High voltage	V_{IH}	2.7	-	3.3	V	

[Note] The LED drives at blinking frequency 320Hz(Typ,)
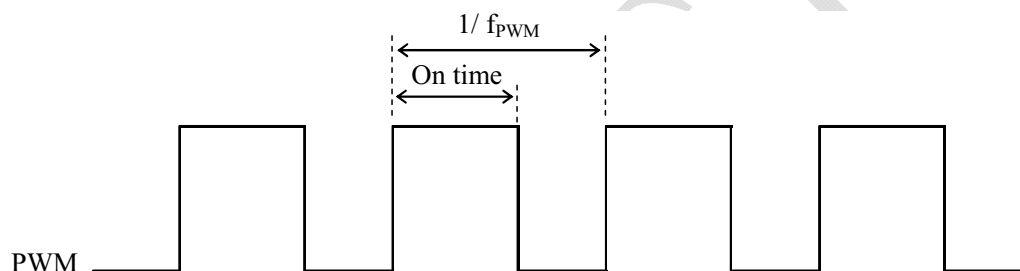
5. Absolute Maximum Ratings

Parameter	Symbol	Ratings	Unit	Remark
Input voltage	V_I	-0.3 ~ 3.6	V	[Note 1]
12V supply voltage (for Control)	VCC	0 ~ + 14	V	
Supply voltage (for LED driver)	V_{LED1}	0 ~ + 63	V	
	V_{LED2}	0 ~ + 14	V	
Storage temperature	Tstg	-25~ +60	°C	[Note 2] [Note 3]
Operation temperature (Ambient)	Ta	0 ~ +40	°C	

[Note 1] FRAME, SELLVDS, 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.

[Note 3]Glass surface temperature: 55 °C Max.

Backlight chassis surface temperature: 70 °C Max. （①～④）
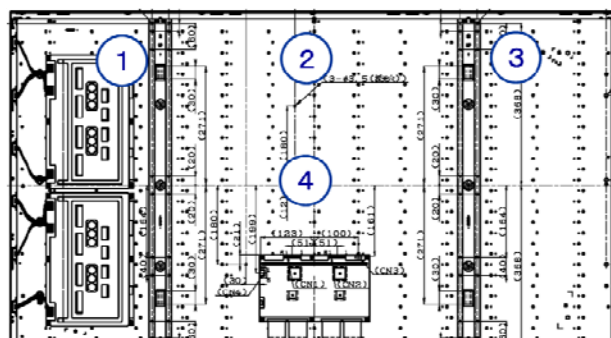
6. Electrical Characteristics

6.1. Control circuit driving   Ta=25 °C

Parameter		Symbol	Min.	Typ.	Max.	Unit	Remark
+12V supply voltage	Supply voltage	V_{cc}	11.4	12	12.6	V	[Note 1]
	Current dissipation	I_{cc}	-	1.4	3.5	A	[Note 2]
	Inrush current	$I_{RUSH}1$	-	8.2	-	A	t1=500us [Note 6]
		$I_{RUSH}2$	-	1.2	-	A	t1>5ms
Permissible input ripple voltage		V_{RP}	-	-	100	mV_{P-P}	Vcc = +12.0V
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	$V_I = 0V$
		I_{IL2}	-	-	100	μA	$V_I = 0V$ [Note 4]
Input leak current (High)		I_{IH1}	-	-	100	μA	$V_I = 3.3V$
		I_{IH2}	-	-	400	μA	$V_I = 3.3V$ [Note 4]
Terminal resistor		R_T	-	100	-	Ω	Differential input
Input Differential voltage		|VID|	200	400	600	mV	[Note 5]
Differential input common mode voltage		VCM	|VID|/2	1.2	2.4-|VID|/2	V	[Note 5]

[Note]V_{CM}: Common mode voltage of LVDS driver.

[Note 1]

Input voltage sequences   Dip conditions for supply voltage

0.5ms < t1 ≦ 20ms   a) (9.1)V ≦ Vcc < (10.8)V

20ms < t2 ≦ 50ms   td ≦ 10ms

20ms < t3 ≦ 50ms   b) Vcc < (9.1)V

0 < t4 ≦ 1s   Dip conditions for supply voltage is

t5 ≧ 950ms   based on input voltage sequence.

t6 ≧ 0

t7 ≧ 300ms
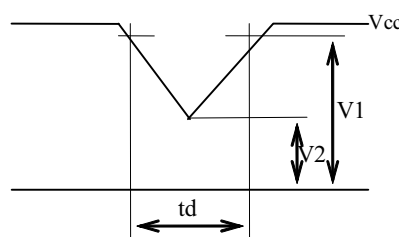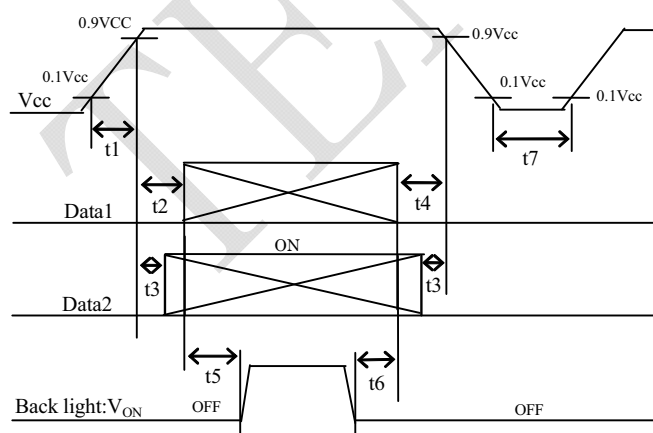
※ Data1: ACK±, AIN0±, AIN1±, AIN2±, AIN3±, AIN4±,BCK±, BIN0±, BIN1±, BIN2±, BIN3±, BIN4±

  *V_{CM} voltage pursues the sequence mentioned above

※ Data2: SELLVDS

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[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.

RGB GS0　RGB GS1　RGB GS2　…… RGB GS1022　RGB GS1023
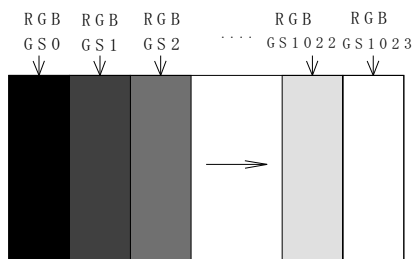
Vcc＝+12.0V
CK＝74.25MHz
Th＝14.8μs
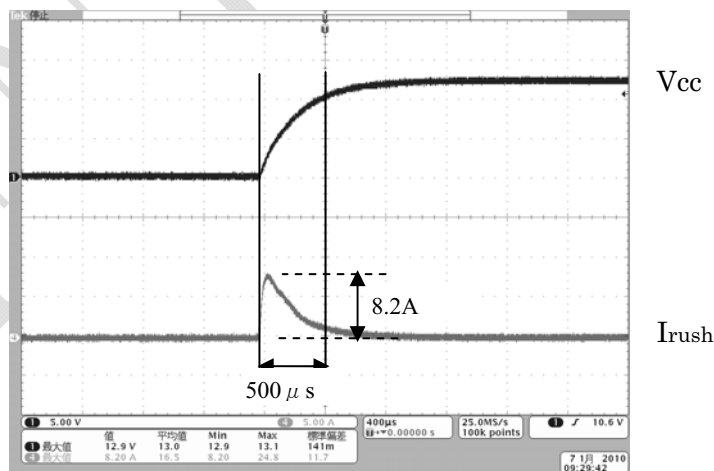
[Note 3] SELLVDS

[Note 4] SELLVDS

[Note 5] ACK±, AIN0±, AIN1±, AIN2±, AIN3±, AIN4±, BCK±, BIN0±, BIN1±, BIN2±, BIN3±, BIN4±

*CK-,*IN−

|VID|

*CK+,*IN+

|VID|

VCM

GND
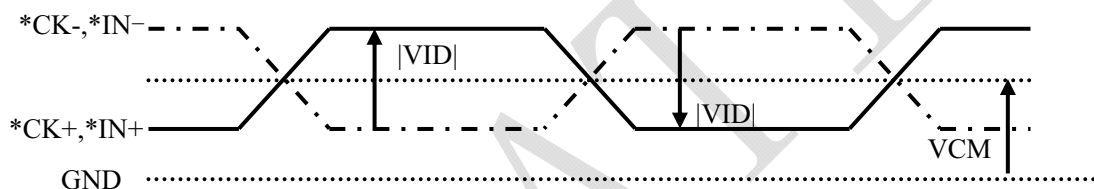
[Note 6] Vcc12V inrush current waveform

Vcc

8.2A

Irush

500 μ s

7. Timing characteristics of input signals

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	67	74.25	76	MHz	
Data enable signal	Horizontal period	TH	1050	1100	1300	clock	
			14.2	14.8	16.1	μs	
	Horizontal period (High)	THd	960	960	960	clock	
	Vertical period	TV	1109	1125	1400	line	
			47	60	61	Hz	
	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.
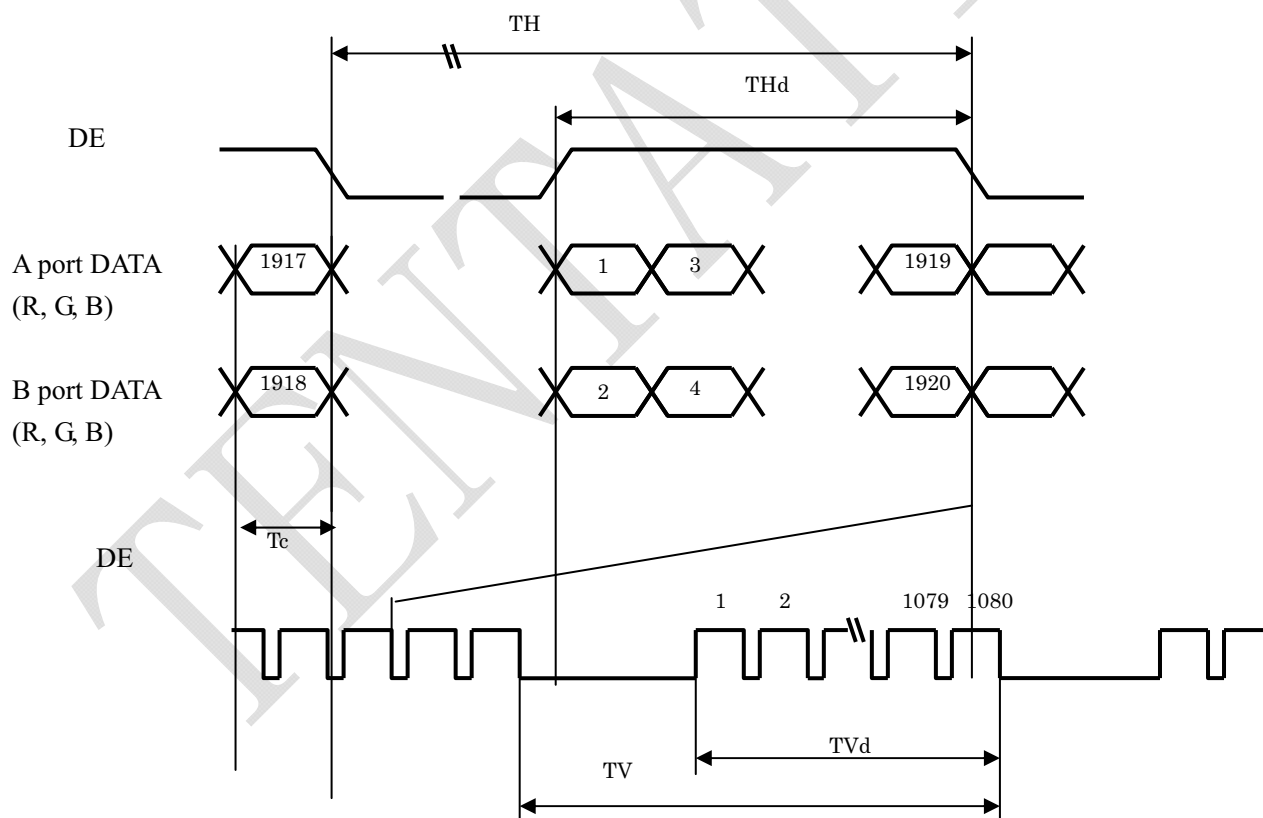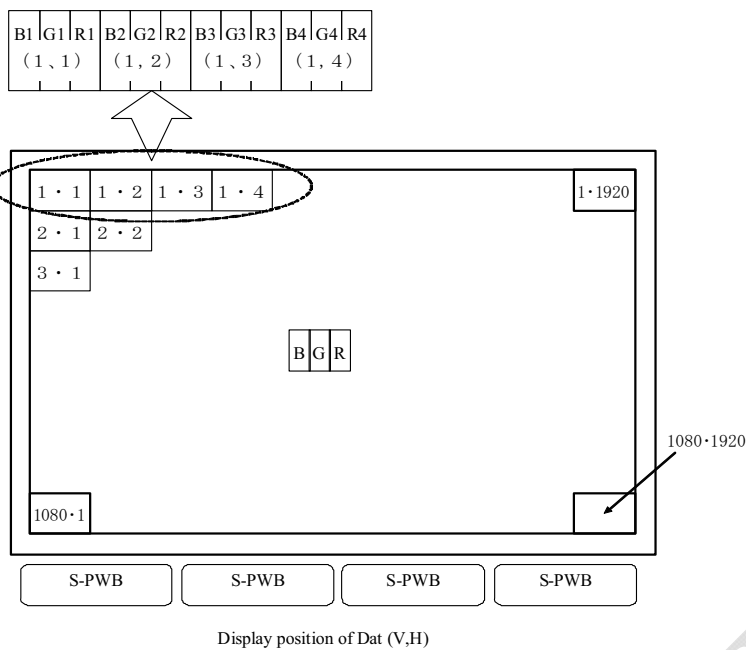

Fig.2 Timing characteristics of input signal

7.2. Input data signal and display position on the screen

| B1 G1 R1 | B2 G2 R2 | B3 G3 R3 | B4 G4 R4 |
| (1、1) | (1,2) | (1、3) | (1,4) |

1・1	1・2	1・3	1・4			1・1920
2・1	2・2				
3・1					

B G R

1080・1920

1080・1

| S-PWB | S-PWB | S-PWB | S-PWB |

Display position of Dat (V,H)

[Note] Scan direction is setting for using S-PWBs' side down.

7-3. LVDS signal characteristics

t_{CLK}

CLK-
CLK+
Vdiff=0   Vdiff=0

RINx-
RINx+

tpd0
tpd1
tpd2
tpd3
tpd4
tpd5
tpd6
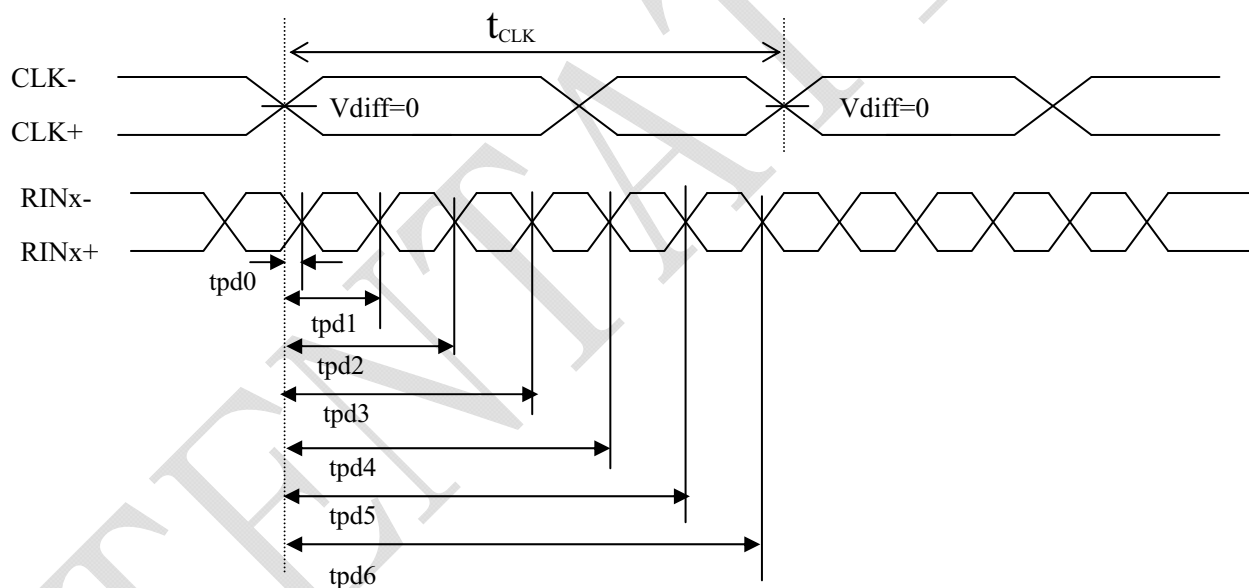
	The item	Symbol	min.	typ.	max.	unit
Data position	Delay time, CLK rising edge to serial bit position 0	tpd0	-0.25	0	0.25	ns
	Delay time, CLK rising edge to serial bit position 1	tpd1	$1*t_{CLK}/7-0.25$	$1*t_{CLK}/7$	$1*t_{CLK}/7+0.25$	
	Delay time, CLK rising edge to serial bit position 2	tpd2	$2*t_{CLK}/7-0.25$	$2*t_{CLK}/7$	$2*t_{CLK}/7+0.25$	
	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	$6*t_{CLK}7-0.25$	$6*t_{CLK}/7$	$6*t_{CLK}/7+0.25$	

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

Colors & Gray scale		Gray Scale	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	1	1	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	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 1021 gray scales from 10 bits data signals. According to the combination of total 30 bits data signals, one billion-color display can be achieved on the screen.

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9. Optical characteristics

Ta=25°C, Vcc=12.0V, V_{BRT}=100%, Timing:60Hz(typ. value)

Parameter		Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Viewing angle range	Horizontal	$\theta 21$ $\theta 22$	CR≧10	70	88	-	Deg.	[Note1,4]
	Vertical	$\theta 11$ $\theta 12$		70	88	-	Deg.	
Contrast ratio		CRn		(6,300)	(9,000)	-	-	[Note2,4]
Response time		τ_{DRV}			(4)		ms	[Note3,4,5]
Luminance	White	x	θ=0 deg.		(0.280)		-	[Note4]
		y			(0.285)		-	
	Red	x			(0.646)		-	
		y			(0.337)		-	
	Green	x			(0.281)		-	
		y			(0.607)		-	
	Blue	x			(0.143)		-	
		y			(0.071)		-	
Luminance	White	Y_L		(1,600)	(2,000)	-	cd/m^2	
Luminance uniformity	White	δw				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.

Detector（EZ-CONTRAST/ Photodiode）

Middle of the screen (θ=0°)

TFT-LCD Module

Detector（SR-3）

400mm

Field=1°

Middle of the screen (θ=0°)

TFT-LCD Module
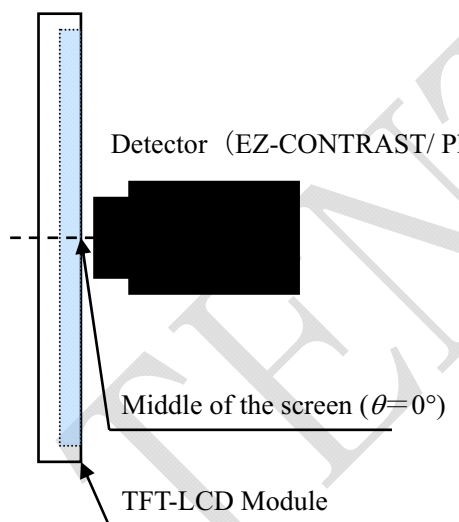
Fig.4-1 Measurement of viewing angle range and Response time.

　　Viewing angle range: EZ-CONTRAST
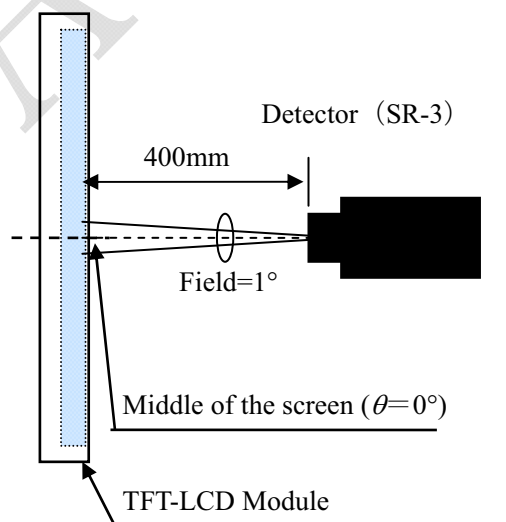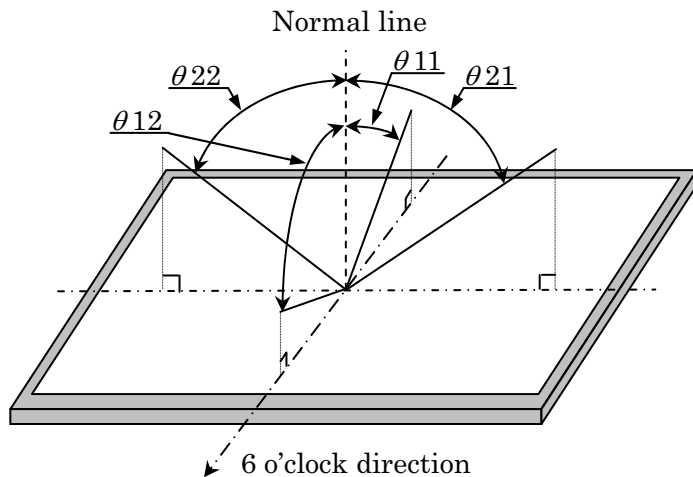　　Response time: Photodiode

Fig.4-2 Measurement of Contrast, Luminance, Chromaticity.

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[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_d and τ_r) 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%	tr25%-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)

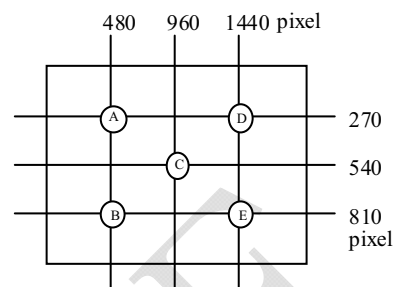$\tau_r = \Sigma(\text{tr:x-y})/10$, $\tau_d = \Sigma(\text{td:x-y})/10$
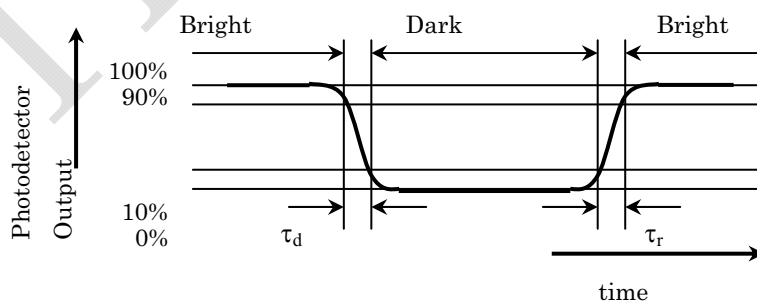
[Note 4]This shall be measured at center of the screen.

[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)

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

10. 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.
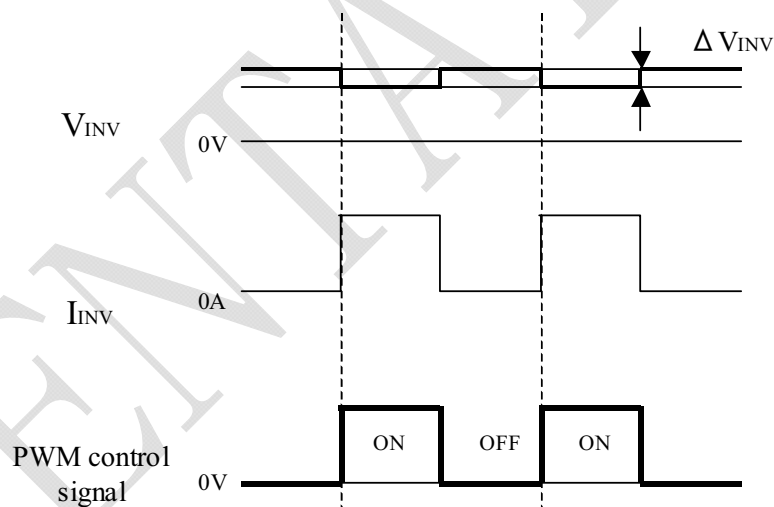
Fig.4 Brightness control voltage.

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 from 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.

11. Packing form

a) Piling number of cartons　　　　　　　　　: 2 Maximum

b) Packing quantity in one carton　　　　　　: 7pcs

c) Carton size　　　　　　　　　　　　　　: 1495 (W) × 1140 (D) × 1032 (H)

d) Total mass of one carton filled with full modules　: (235kg)

12. Reliability test item

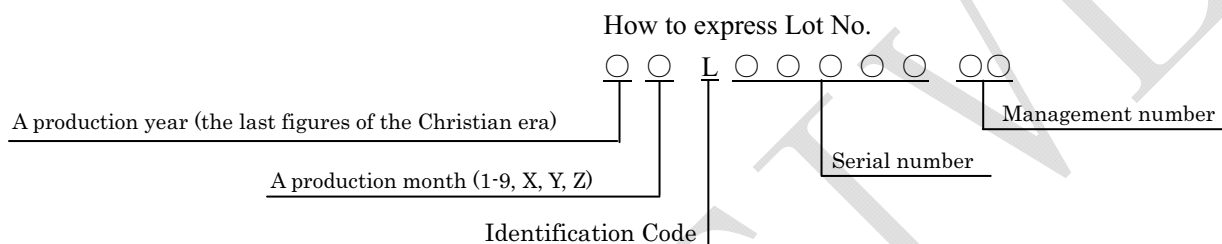| No.	Test item	Condition
1	High temperature storage test	Ta=60°C　　　240h
2	Low temperature storage test	Ta=-25°C　　　240h
3	High temperature and high humidity operation test	Ta=40°C ; 95%RH　　　　240h (No condensation)
4	High temperature operation test	Ta=50°C　　　240h
5	Low temperature operation test	Ta=0°C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

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13. Others

1) Lot No. Label;

　　The label that displays SHARP, product model (LK600D3LB14), a product number is stuck on the back of the module.

SHARP

LK600D3LB14 ← Module No.

← Barcode

← Lot No.

12 L50001

MADE IN JAPAN

How to express Lot No.

○ ○ L ○ ○ ○ ○ ○ ○○

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

Management number

Serial number

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

Identification Code

2) Packing Label

社内品番 : (4 S) LK600D3LB14

Bar code (①)

LotNO. (1 T) 200*. *.**

Bar code (②)

Quantity :(Q)　　　7　　p c s

Bar code (③)

ユーザ品番　　　　・

シャープ物流用ラベルです。

　　　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 specification 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.

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

Factory code
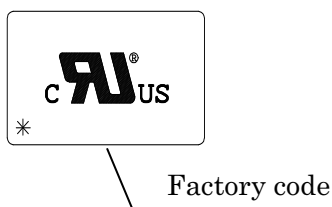
9) This module is corresponded to RoHS

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

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

14.　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

24-M4 depth 8mm
(USER HOLE)
(TORQUE:MAX9.0Kgf・cm)

60型(LK600D3LB14)
Note1)UNSPECIFIED TOLE

330.5
330.5
229.65
250
125
10
CN1
159
170
412
271
271
164
164
40
40
60
60
30
30
20
20
20
20
39
238
215
74
18
CN101
CN102
CN103
CN104
368
368
295.5
319.5

54.2
790
560
280
280
560
1380
1335.2 (ベゼル開口)
1329.12(アクティブエリア)

BEZEL OPENING
ACTIVE AREA
1)TOLERANCE X-DIRECTION A:TBD
2)TOLERANCE Y-DIRECTION B:TBD
3)OBLIQUITY OF DISPLAY AREA IC-D:TBD
BEZEL/DISPLAY POSITION
A-A

106.6
65
179.2
51.4
75
560
280
324.3
420.4
71
86.4
172.8
90
324.3
560
75

depth 5mm
HOLE)
:MAX6.0Kgf・cm)