PRODUCT SPECIFICATIONS

SHARP

AVC Liquid Crystal Displays Group

LK460D3LZ19

TFT-LCD Module

Spec. Issue Date: December 28, 2006

No: LD-18Z32

PREPARED BY : DATE	SHARP	SPEC No. LD-18Z32
		FILE No.
		ISSUE : Dec.28.2006
APPROVED BY : DATE	AVC Liquid Crystal Display GROUP SHARP CORPORATION	PAGE : 26 pages
	SPECIFICATION	APPLICABLE GROUP AVC Liquid Crystal Display Group

DEVICE SPECIFICATION FOR

TFT-LCD Module

MODEL No.

LK460D3LZ19

☐ CUSTOMER'S APPROVAL

DATE ________________

BY ________________

PRESENTED

BY *Makoto Takeda*

M. TAKEDA
DIVISION GENERAL MANAGER
DEVELOPMENT CENTER
AVC Liquid Crystal Display Group
SHARP CORPORATION

SHARP

RECORDS OF REVISION

MODEL No. : LK460D3LZ19

SPEC No. : LD-18Z32

SPEC No.	DATE	REVISED No.	SUMMARY		NOTE
			PAGE		
LD-18Z32	Dec. 28. 2006	-	-	-	1st Issue

1. Application

This specification applies to the color 46.0” TFT-LCD module LK460D3LZ19.

* This module is not designed to use in dusty environment and to prevent image retention caused by long-term display of fixed pattern. So please consider items mentioned above before use and design equipment.

* 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 specification sheets.

* Contact and consult with a SHARP sales representative for any questions about this device.

2. Overview

This module is a color active matrix LCD module incorporating amorphous silicon TFT (Thin Film Transistor). It is composed of a color TFT-LCD panel, driver ICs, control circuit, power supply circuit, inverter circuit and back light system etc. Graphics and texts can be displayed on a 1920×RGB×1080 dots panel with 16,777,216 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. (+24V 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 these technologies, 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.

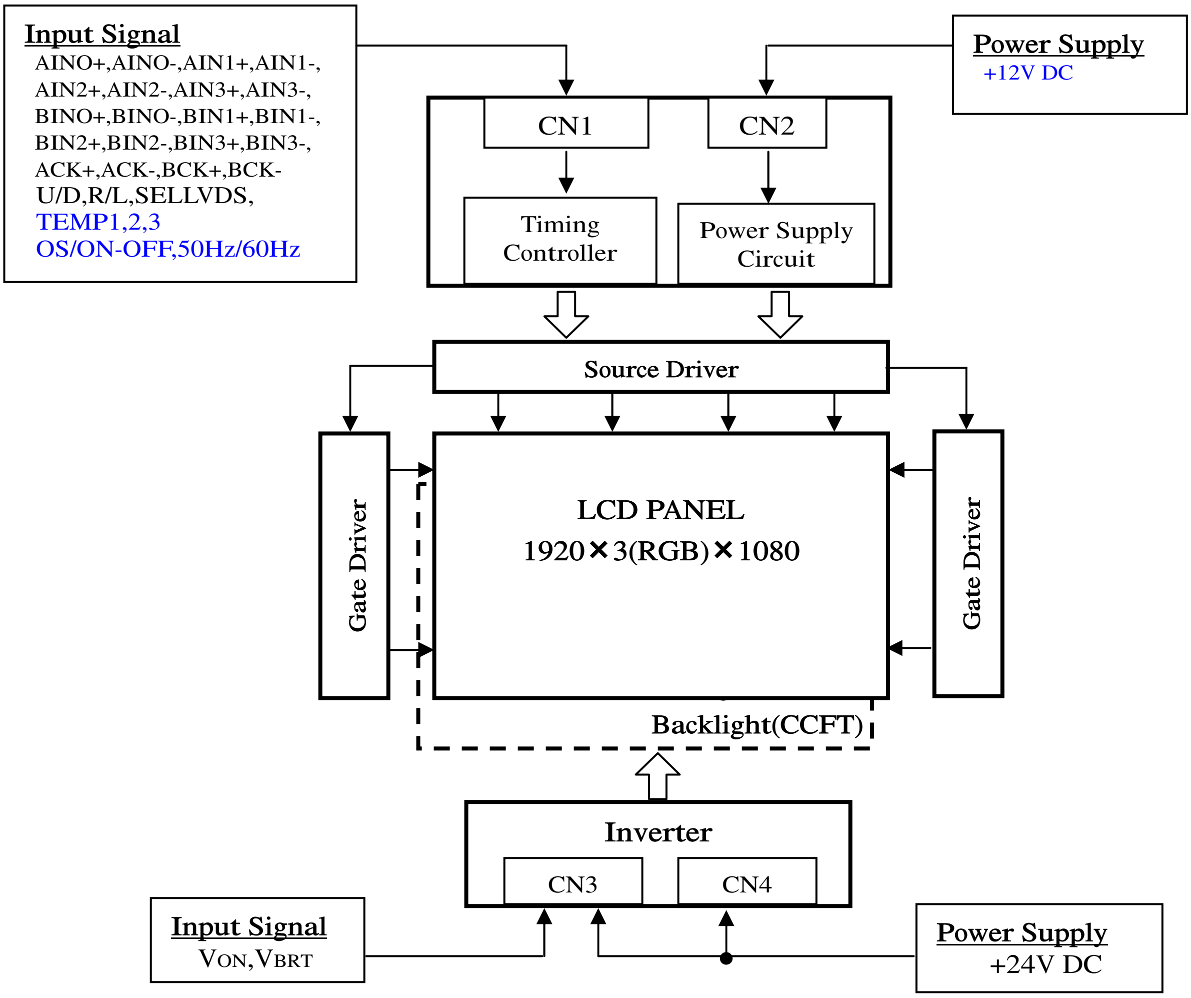
3. Mechanical Specifications

Parameter	Specifications	Unit
Display size	116.809 （Diagonal）	cm
	46.0 （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)	1083.0(W) x 627.0(H) x 65.7(D)	mm
Mass	17.1 ± 0.5	kg
Surface treatment	Anti glare, low reflection coating Hard coating: 2H	

(*1) Outline dimensions are shown in Fig.1-1, Fig.1-2. (excluding protruding portion)

4. Input Terminals

4-1. Block Diagram



4-2. TFT panel driving

CN1 (Shown in Fig.1 : Outline dimensions)

Using connector : FI-RE41S-VF (Japan Aviation Electronics Ind. , Ltd.)

Mating connector : FI-RE41HL (Japan Aviation Electronics Ind. , Ltd.)

Mating LVDS transmitter : THC63LVDM83R(THine) 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	GND		
14	GND		
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	GND		
28	GND		
29	GND		
30	SELLVDS	Select LVDS data order [Note1]	PULL UP
31	R/L	Horizontal shift direction [Note2]	PULL DOWN
32	U/D	Vertical shift direction [Note2]	PULL DOWN
33	NC	It is required to set non-connection(OPEN)	
34	50Hz/60Hz	Frame frequency setting H:60Hz, L:50Hz [Note3]	PULL DOWN
35	NC	It is required to set non-connection(OPEN)	
36	TEMP3	Date3 of panel surface temperature [Note4]	PULL UP
37	TEMP2	Date2 of panel surface temperature [Note4]	PULL UP
38	TEMP1	Date1 of panel surface temperature [Note4]	PULL UP
39	NC	It is required to set non-connection(OPEN)	
40	O/Sset	O/S operation setting H:O/S_ON, L:O/S_OFF [Note4]	PULL UP
41	NC	It is required to set non-connection(OPEN)	

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

CN2 (Shown in Fig.1 Outline dimensions)

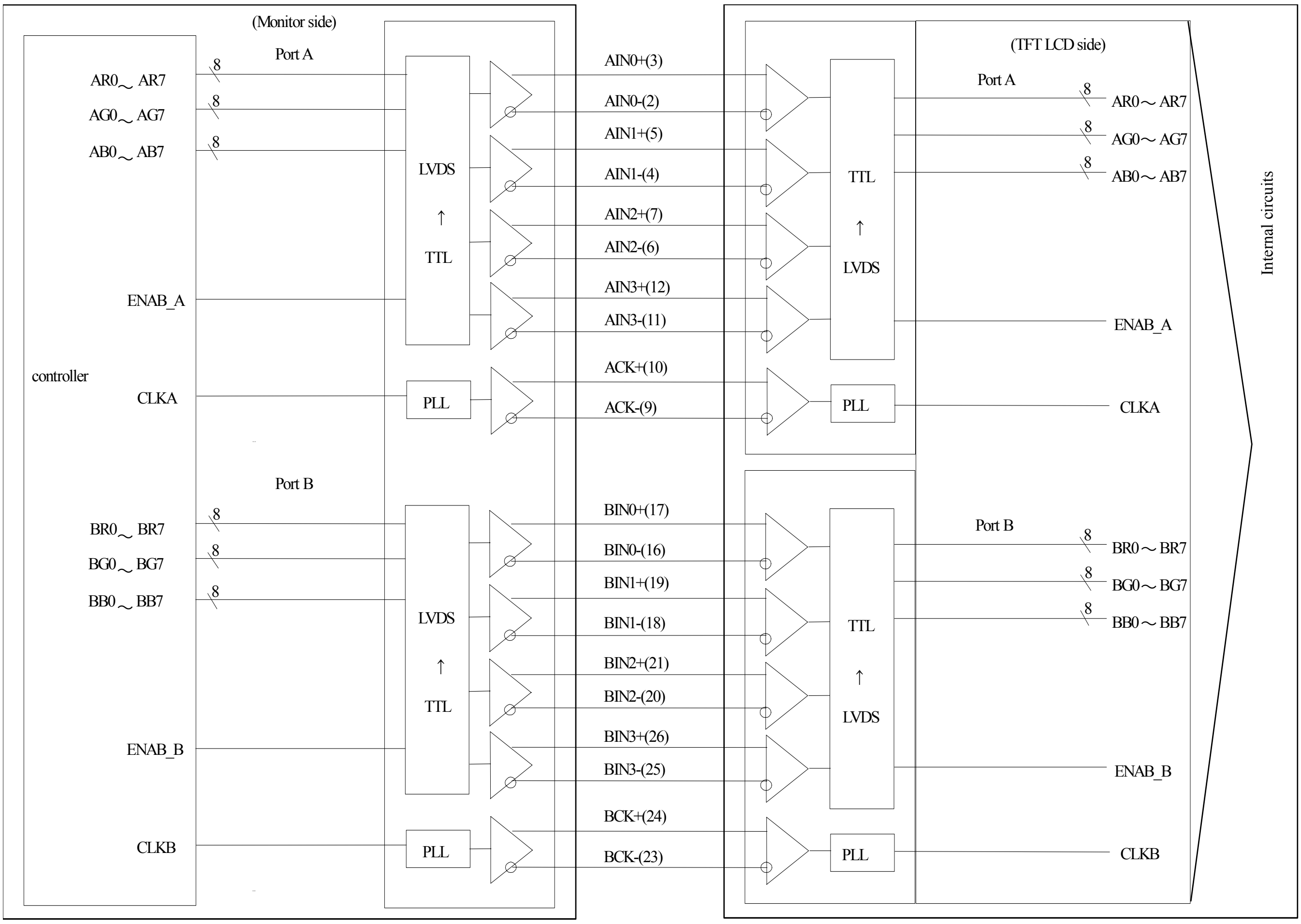
Using connector : BM20B-SHLDS-G-TFT (J.S.T. Mfg Co.,Ltd.)

Mating connector : SHLDP-20V-S-1(J.S.T. Mfg Co.,Ltd.)

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	Vcc	+12V Power Supply	
6	GND	GND	
7	GND	GND	
8	GND	GND	
9	GND	GND	
10	GND	GND	
11	NC	It is required to set non-connection(OPEN)	
12	NC	It is required to set non-connection(OPEN)	
13	NC	It is required to set non-connection(OPEN)	
14	NC	It is required to set non-connection(OPEN)	
15	NC	It is required to set non-connection(OPEN)	
16	NC	It is required to set non-connection(OPEN)	
17	NC	It is required to set non-connection(OPEN)	
18	NC	It is required to set non-connection(OPEN)	
19	NC	It is required to set non-connection(OPEN)	
20	NC	It is required to set non-connection(OPEN)	

・Interface block diagram

Corresponding Transmitter: THC63LVDM83R (THine)



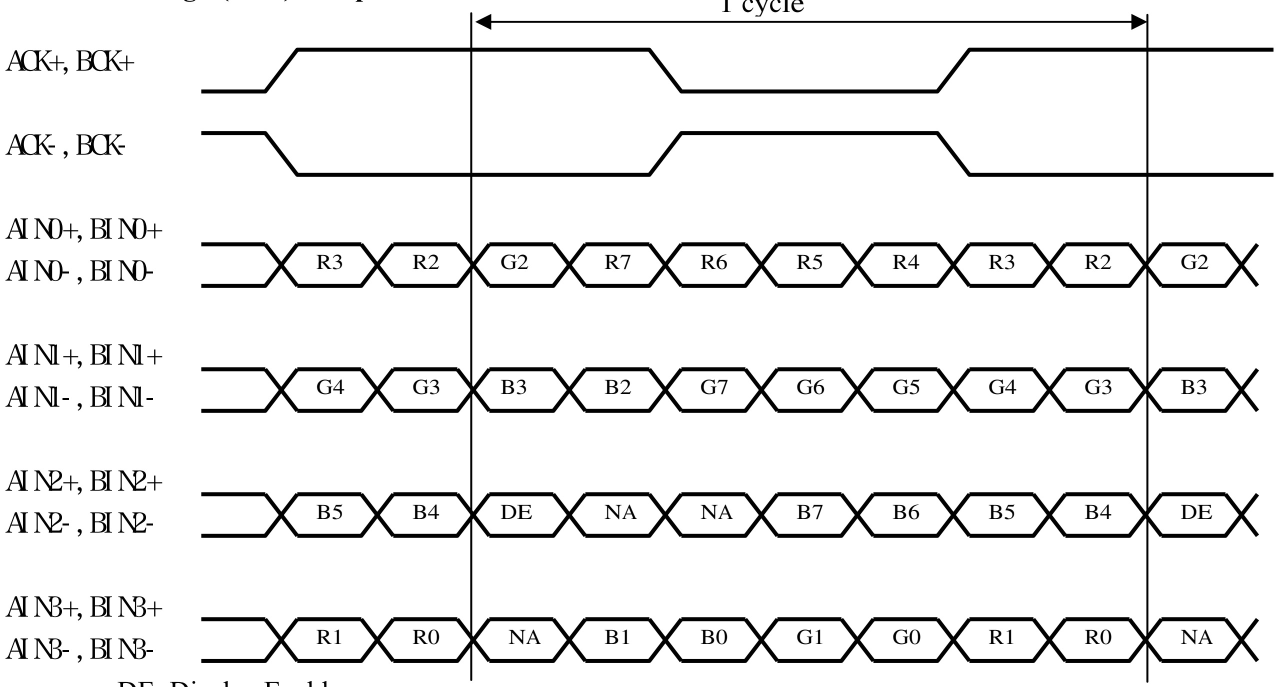
[Note 1]SELLVDS

Transmitter		SELLVDS	
Pin No	Data	=L(GND)	=H(3.3V) or Open
51	TA0	R0(LSB)	R2
52	TA1	R1	R3
54	TA2	R2	R4
55	TA3	R3	R5
56	TA4	R4	R6
3	TA5	R5	R7(MSB)
4	TA6	G0(LSB)	G2
6	TB0	G1	G3
7	TB1	G2	G4
11	TB2	G3	G5
12	TB3	G4	G6
14	TB4	G5	G7(MSB)
15	TB5	B0(LSB)	B2
19	TB6	B1	B3
20	TC0	B2	B4
22	TC1	B3	B5
23	TC2	B4	B6
24	TC3	B5	B7(MSB)
27	TC4	N A	N A
28	TC5	N A	N A
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	N A	N A

NA: Not Available
DE: Display Enable

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

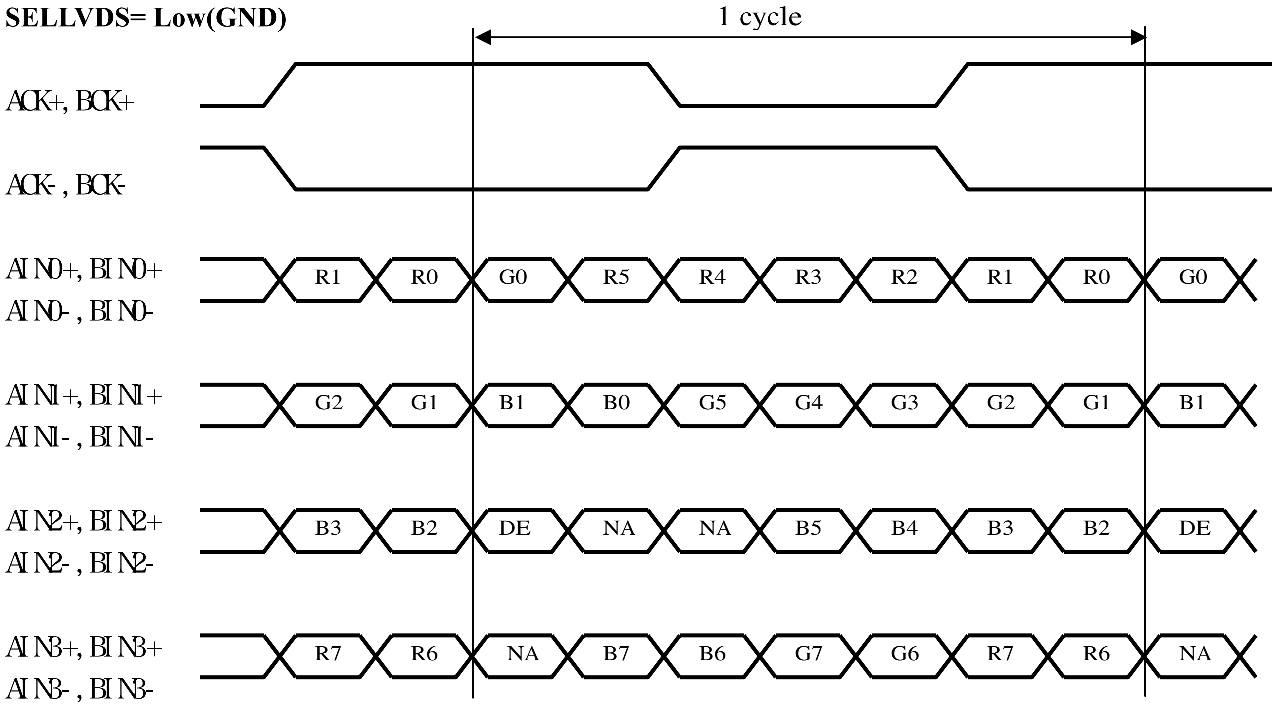
SELLVDS= High (3.3V) or Open



DE: Display Enable

NA: Not Available (Fixed Low)

SELLVDS= Low(GND)



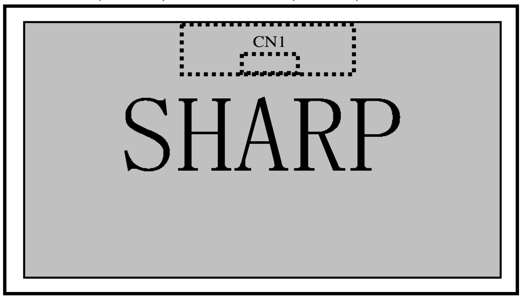
DE: Display Enable

NA: Not Available (Fixed Low)

[Note 2] Display reversal function

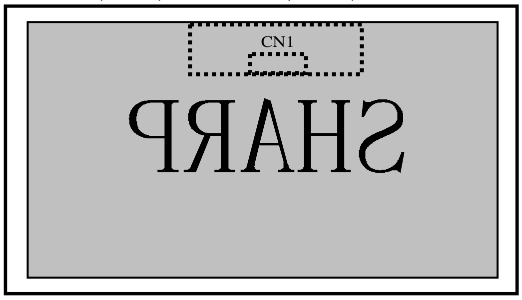
Normal (Default)

R/L : L (GND)   U/D: L (GND)



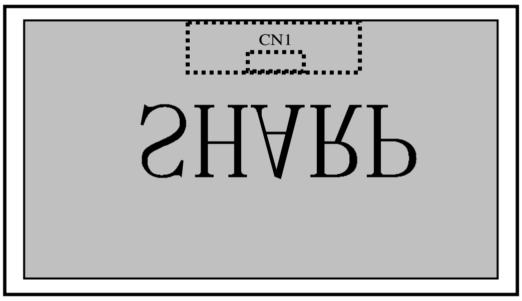
Horizontal reverse image

R/L : H (3.3V)   U/D: L (GND)



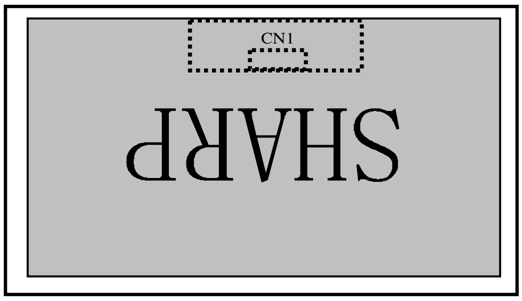
Vertical reverse image

R/L : L (GND)   U/D: H (3.3V)



Horizontal and vertical reverse image

R/L : H(3.3V)   U/D: H (3.3V)



[Note 3] Frame frequency setting   *L: Low level voltage (GND)   H: High level voltage(3.3V)

Symbol	Function	Remark
50Hz/60Hz	Frame frequency setting H:60Hz, L:50Hz	Pull down 10kΩ: (GND)

[Note 4] O/S control   *L: Low level voltage (GND)   H: High level voltage(3.3V)

Symbol	Function	Remark
OS/ON-OFF	O/S operating setting H:OS_ON, L:OS_OFF	Pull up 10kΩ: (3.3V) (*)
TEMP3	Data3 of panel surface temperature	Pull up 10kΩ: (3.3V) (*)
TEMP2	Data2 of panel surface temperature	Pull up 10kΩ: (3.3V) (*)
TEMP1	Data1 of panel surface temperature	Pull up 10kΩ: (3.3V) (*)

(*) In case of OS/ON-OFF setting ”L”(OS_OFF), it should be set the TEMP1~3 to “L”.

According as the surface temperature of the panel, enter the optimum 3 bit signal into pin No.4,5,6. Measuring the correlation between detected temperature by the sensor on PWB in users side and actual surface temperature of panel at center, convert the temperature detected by the sensor to the surface temperature of panel to enter the 3 bit temperature data.
For overlapping temperatures (such as 5°C,10°C,15°C,20°C,25°C, 30°C,35°C) select the optimum parameter, judging from the actual picture image.

Pin no.	Surface temperature of panel (assembled to the set)							
	0-5°C	5-10°C	10-15°C	15-20°C	20-25°C	25-30°C	30-35°C	35°C and above
TEMP3	0	0	0	0	1	1	1	1
TEMP2	0	0	1	1	0	0	1	1
TEMP1	0	1	0	1	0	1	0	1

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

4-3. Backlight driving

CN3 (Inverter control and +24V DC power supply) (Shown in Fig.1 : Outline dimensions)

Using connector: S14B-PH-K-S (LF) (J.S.T. Mfg Co.,Ltd.)

Mating connector: PHR-14 (J.S.T. Mfg Co.,Ltd.)

Pin No.	Symbol	Function	Remark
1	V_{INV}	24V	
2	V_{INV}	24V	
3	V_{INV}	24V	
4	V_{INV}	24V	
5	V_{INV}	24V	
6	GND	GND	
7	GND	GND	
8	GND	GND	
9	GND	GND	
10	GND	GND	
11	Reserved	For LCD module internal usage, should be open	
12	V_{ON}	Inverter ON/OFF	【Note 1】
13	V_{BRT}	Brightness Control	【Note 2】
14	Reserved	For LCD module internal usage, should be open	

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

CN4 (+24V DC power supply) (Shown in Fig.1 : Outline dimensions)

Using connector: S14B-PH-K-S (LF) (J.S.T. Mfg Co.,Ltd.)

Mating connector: PHR-14 (J.S.T. Mfg Co.,Ltd.)

Pin No.	Symbol	Function	Remark
1	V_{INV}	24V	
2	V_{INV}	24V	
3	V_{INV}	24V	
4	V_{INV}	24V	
5	V_{INV}	24V	
6	GND	GND	
7	GND	GND	
8	GND	GND	
9	GND	GND	
10	GND	GND	
11	Reserved	For LCD module internal usage, should be open	
12	Reserved	For LCD module internal usage, should be open	
13	Reserved	For LCD module internal usage, should be open	
14	Reserved	For LCD module internal usage, should be open	

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

【Note 1】 Inverter ON/OFF

Pin No.12 is used for the control of the Inverter ON / OFF.

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

【Note 2】Brightness control

PWM brightness control is regulated by analog input voltage (0V to 3.3V).

Input voltage	Function
3.3V	Brightness Maximum (Bright 100%)
0V	Brightness Minimum (Dark 20%)

4-4. The back light system characteristics

The back light system is direct type with 22 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.

CCFC model : CFL3331A (Stanley Electric Co.,Ltd)

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℃.

・Above value is applicable when the long side of LCD module is placed horizontally (Landscape position).

5. Absolute Maximum Ratings

Parameter	Symbol	Condition	Ratings	Unit	Remark
Input voltage (for Control)	V_I	Ta=25 ℃	-0.3 ~ 3.6	V	[Note 1]
12V supply voltage (for Control)	VCC	Ta=25 ℃	0 ~ +14	V	
Input voltage (for Inverter)	V_{BRT} V_{ON}	Ta=25 ℃	0 ~ +6	V	
24V supply voltage (for Inverter)	V_{INV}	Ta=25 ℃	0 ~ +29	V	
Storage temperature	Tstg	-	-25 ~ +60	℃	[Note 2]
Operation temperature (Ambient)	Topa	-	0 ~ +50	℃	

[Note 1] SELLVDS, R/L, U/D, 50Hz/60Hz, OS/ON-OFF, TEMP3,2,1

[Note 2]Humidity 95%RH Max.(Ta≦40℃)

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

No condensation.

6. Electrical Characteristics

6-1. Control circuit driving Ta=25 ℃

Parameter		Symbol	Min.	Typ.	Max.	Uniit	Remark
+12V supply voltage	Supply voltage	Vcc	11.4	12.0	12.6	V	[Note 1]
	Current	Icc	-	0.85	1.8	A	[Note 2]
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}	-	-	0.8	V	[Note 3]
Input High voltage		V_{IH}	2.0	-	3.3	V	
Input leak current (Low)		I_{IL}	-	-	400	μA	V_I = 0V [Note 4]
Input leak current (High)		I_{IH}	-	-	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

$0 < t1 \leqq 10ms$

$10ms \leqq t2\text{-}1 \leqq 20ms$ Clock signal

$10ms \leqq t2\text{-}2 \leqq 1s$ Enable signal

$0 < t3 \leqq 1s$

$t4 \geqq 300ms$

$500ms \leqq t5$

*Please input data signals after clock confirmed.

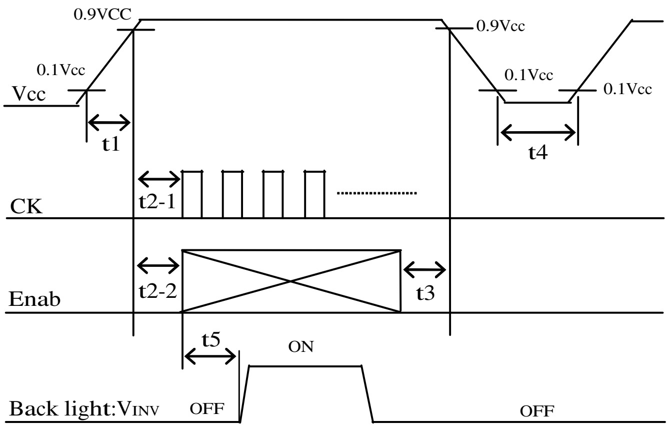
Dip conditions for supply voltage

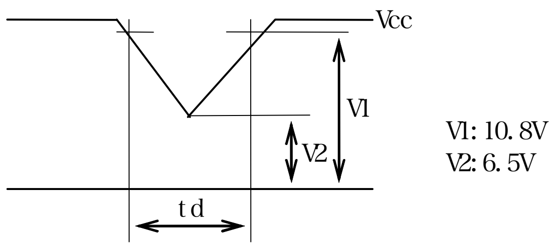
a) $6.5V \leqq Vcc < 10.8V$

$td \leqq 10ms$

b) $Vcc < 6.5V$

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



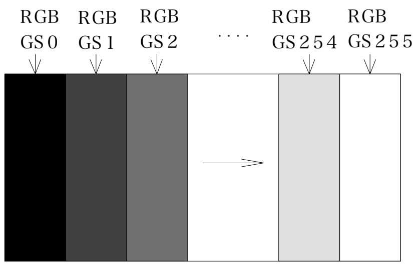


About the relation between data input and back light lighting, please base on the above-mentioned input sequence. When backlight is switched on before panel operation or after a panel operation stop, it may not display normally. But this phenomenon is not based on change of an incoming signal, and does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

[Note 2] Maximum current situation: white (RGB GSS255)

Typical current situation: 256 gray-bar pattern

The explanation of RGB gray scale is seen in section 8.



Vcc＝12.0V

CK＝74.25MHz

Th＝14.8μs

[Note 3] R/L, U/D, SELLVDS, 50Hz/60Hz, OS/ON-OFF, TEMP3,2,1

[Note 4] SELLVDS,

[Note 5] R/L,U/D, 50Hz/60Hz, OS/ON-OFF, TEMP3,2,1

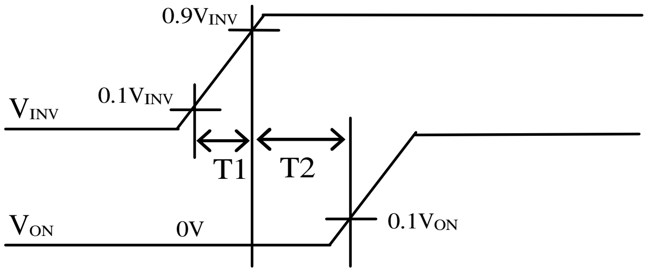
[Note 6] ACK±, BCK±, AIN0±, AIN1±, AIN2±, AIN3±, BIN0±, BIN1±, BIN2±, BIN3±

6-2. Inverter driving for back light

The back light system is direct type with 22 CCFTs (Cold Cathode Fluorescent Tube). Ta=25℃

Parameter		Symbol	Min.	Typ.	Max.	Unit	Remark
+24V	Current 1	I_{INV1}	-	10.0	11.9	A	V_{INV} = 24V V_{BRT} = 3.3V, V_{ON}= 3.3V 【Note 4】
	Current 2	I_{INV2}	-	8.0	9.2	A	
	Supply voltage	V_{INV}	22.8	24.0	25.2	V	【Note 1】
Permissible input ripple voltage		V_{RF}	-	-	200	mV	V_{INV} = +24V
Input voltage (Low)		V_{ONL}	0	-	1.0	V	【Note 2】 impedance=2kΩ (Min.)
Input voltage (High)		V_{ONH}	3.0	3.3	5.0	V	
Input voltage		V_{BRT}	0	-	3.3	V	【Note 3】 impedance=950kΩ (Min.)

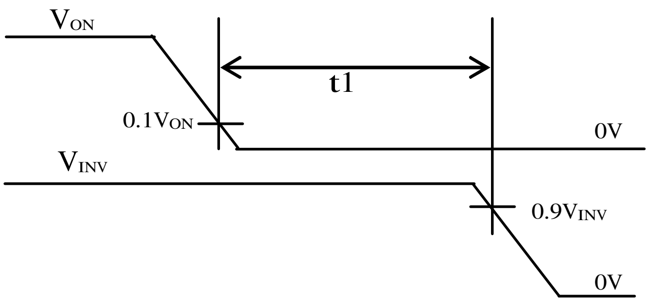
【Note 1】 1)V_{INV}(+24V) turn-on condition



T1 > 100μs

T2 ≧ 1ms

2) V_{INV}(+24V) turn-off condition



t1≧1ms

【Note 2】 V_{ON}

【Note 3】 V_{BRT}

【Note 4】 Current1) Definition within 60 minutes after turn on. (Rush current is excluded.)

Current2) Definition more than 60 minutes after turn on.

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

*The lamp drive frequency: 59kHz ± 2kHz

*The burst Brightness control drive frequency: 275Hz ± 5Hz

The above drive frequency and the module drive frequency are cause and there is possibility Backlight display problem occurs. When setting the drive frequency of the module, The interference with the above frequency make not occur.

7. Timing characteristics of input signals

7-1. Timing characteristics

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

Item		Symbol	Min	Typ	Max	Unit
DCLK	Frequency	1/Tc	55	74.25	80	MHz
DE (Data Enable)	Horizontal total	TH	1030	1100	1650	CLOCK
			14.8	14.8	-	μs
	Horizontal valid	THd	960	960	960	CLOCK
	Horizontal retrace period	TH-THd	1.80	1.87	-	μs
	Vertical total	TV	1111	1125	1360	LINE
	Vertical valid	TVd	1080	1080	1080	LINE

【Note 1】 When vertical period is very long, flicker and etc. may occur.

【Note 2】 Please turn off the module after it shows the black screen.

【Note 3】 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.

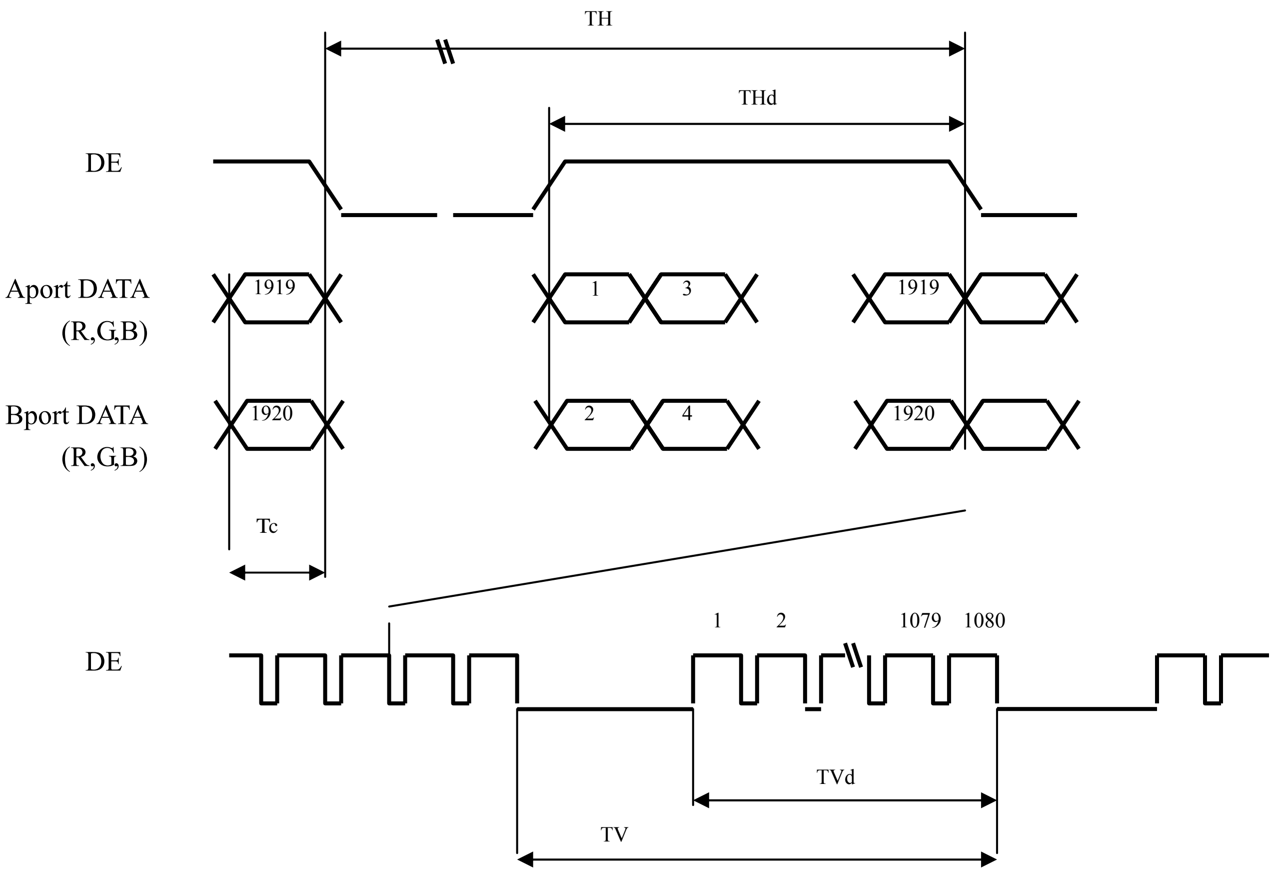
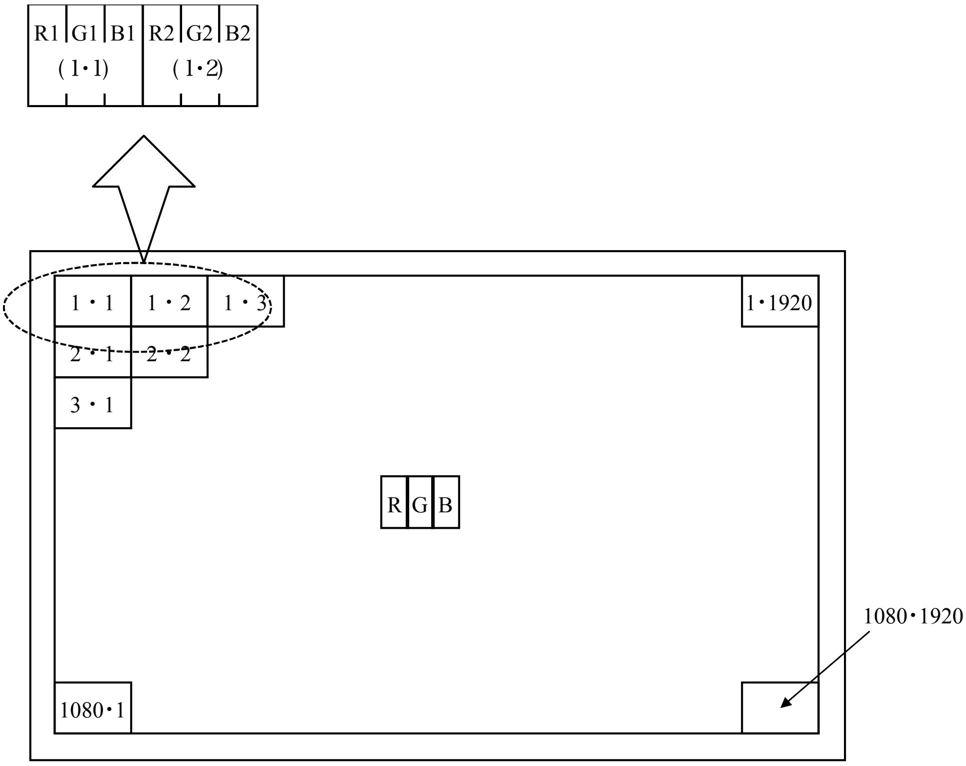


Fig.2 Timing characteristics of input signals

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



Display position of Data (V,H)

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

	Colors & Gray scale	Gray Scale	R0	R1	R2	R3	R4	R5	R6	R7	G0	G1	G2	G3	G4	G5	G6	G7	B0	B1	B2	B3	B4	B5	B6	B7
			Data signal																							
Basic Color	Black	–	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Blue	–	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	Green	–	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	Cyan	–	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Red	–	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Magenta	–	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	Yellow	–	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	White	–	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Gray Scale of Red	Black	GS0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	⇧	GS1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Darker	GS2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	⇧	↓				↓								↓								↓				
	⇩	↓				↓								↓								↓				
	Brighter	GS253	1	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	⇩	GS254	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red	GS255	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gray Scale of Green	Black	GS0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	⇧	GS1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Darker	GS2	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	⇧	↓				↓								↓								↓				
	⇩	↓				↓								↓								↓				
	Brighter	GS253	0	0	0	0	0	0	0	0	1	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	⇩	GS254	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	Green	GS255	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
Gray Scale of Blue	Black	GS0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	⇧	GS1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
	Darker	GS2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
	⇧	↓				↓								↓								↓				
	⇩	↓				↓								↓								↓				
	Brighter	GS253	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	1	1	1
	⇩	GS254	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1
	Blue	GS255	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1

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

Each basic color can be displayed in 256 gray scales from 8 bit data signals. According to the combination of total 24 bit data signals, the 16-million-color display can be achieved on the screen.

9. Optical characteristics

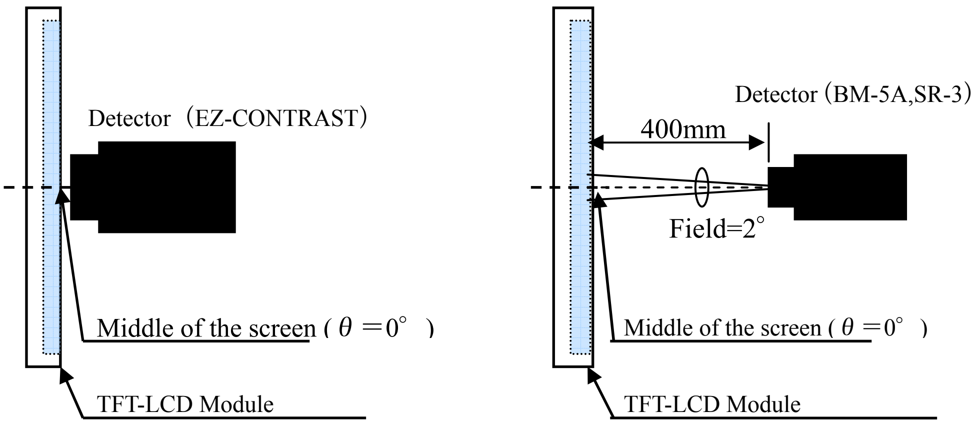
Ta=25°C, Vcc = 12.0V, V_{INV} = 24.0V, V_{BRT} = 3.3V

Parameter		Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Viewing angle range	Vertical	θ 11,12	CR≧10	80	88	-	Deg.	[Note1,4]
	Horizontal	θ 21,22		80	88	-	Deg.	
Contrast ratio		CR	θ =0 deg.	900	1800	-		[Note2,4] V_{BRT}=3.3V
Response time		τ d	θ =0 deg.	-	6	-	ms	[Note3,4,5] V_{BRT}=3.3V
		τ r		-	6	-	ms	
Chromaticity	White	Wx	θ =0 deg.	0.255	0.285	0.315	-	[Note 4] V_{BRT}=3.3V
		Wy		0.266	0.296	0.326	-	
	Red	Rx	θ =0 deg.	0.617	0.647	0.677	-	
		Ry		0.296	0.326	0.356	-	
	Green	Gx	θ =0 deg.	0.238	0.268	0.298	-	
		Gy		0.589	0.619	0.649	-	
	Blue	Bx	θ =0 deg.	0.110	0.140	0.170	-	
		By		0.051	0.081	0.111	-	
Luminance of white		Y_L	θ =0 deg.	360	450	-	cd/m^2	[Note 4] V_{BRT}=3.3V
Luminance uniformity		δ_W	θ =0 deg.	-	-	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.



Photodetector

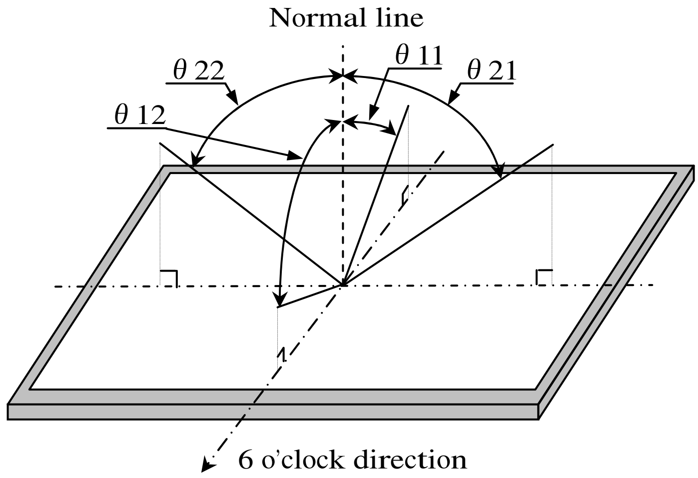
Response time: BM-5A

Viewing angle range: EZ-CONTRAST

Contrast, Luminance and Chromaticity : SR-3

Fig3 Optical characteristics measurement

[Note 1]Definitions of viewing angle range :



[Note 2]Definition of contrast ratio :

The contrast ratio is defined as the following.

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

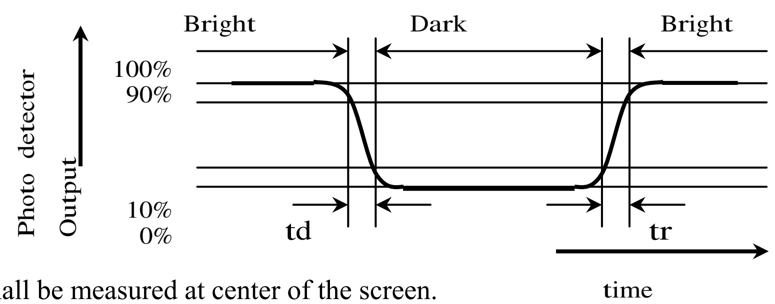
[Note 3]Definition of response time

The response time (τd and τr) 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:10 0%-75%	

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

$\tau r = \Sigma(tr{:}x\text{-}y)/10$, $\tau d = \Sigma(td{:}x\text{-}y)/10$



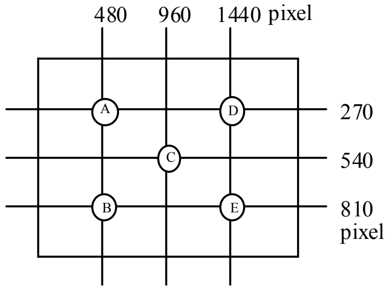
[Note 4] This shall be measured at center of the screen.

[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)

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

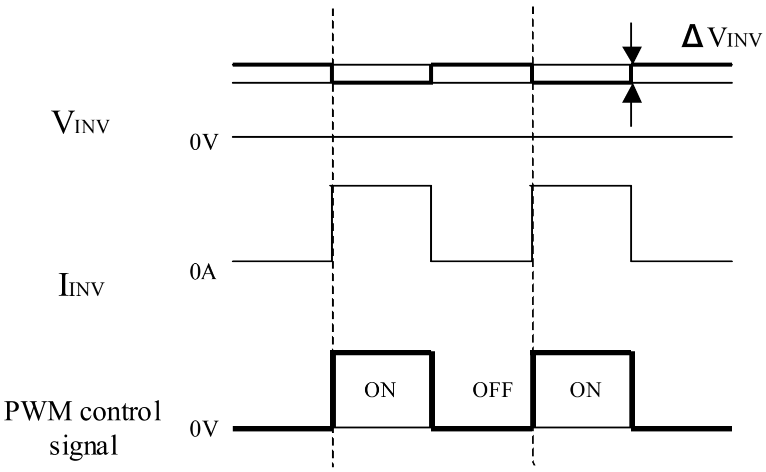


10. Handling Precautions of the module

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.



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) Please consider to minimize the influence of EMI and the exogenous noise before designing the grounding of LCD module.

k) The module has some printed circuit boards (PCBs) and lamp cables on the back side, take care to keep them form any stress or pressure when handling or installing the module; otherwise some of electronic parts on the PCBs may be damaged.

l) Observe all other precautionary requirements in handling components.

m) When some pressure is added onto the module from rear side constantly, it causes display non-uniformity issue, functional defect, etc.. So, please avoid such design.

n) When handling LCD modules and assembling them into cabinets, please be noted that long-term storage in the environment of oxidization or deoxidization gas and the use of such materials as reagent, solvent, adhesive, resin, etc. which generate these gasses, may cause corrosion and discoloration of the LCD modules.

o) Lamps of the backlight are placed horizontally to the long side of LCD module. So make sure that the LCD module are placed horizontally (landscape position), as lifetime of backlight becomes shorter if placed at a tilt.

p) Make sure that the LCD module is operated within specified temperature and humidity.
Measures against dust, water, vibration, and heat radiation, etc. are required at the cabinet or equipment side. And image retention may occur if same fixed pattern is displayed for a long time. In some cases, it may not disappear. Please consider the design and operating environment.

11. Packing form

a) Piling number of cartons : 2 maximum
b) Packing quantity in one carton : 5 pcs.
c) Carton size : 1186(W) × 572 (D) × 822 (H)
d) Total mass of one carton filled with full modules : 100 kg (typ)
e) Packing Form are shown in Fig.4

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 (Panel surface temperature is below 60°C)	
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/ s^2 Sweep time: 11 minutes Test period: 3 hours (1h for each direction of X, Y, Z)	【Note】
7	Shock test (non-operation)	Maximum acceleration: 490m/s^2 Pulse width: 11ms, sinusoidal half wave Direction: ±X, ±Y, ±Z, once for each direction.	【Note】
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】 LCD panel misalignment is within tolerance levels after vibration and shock tests.
LCD module is supposed to be installed at the right position mentioned in the outline dimensions during vibration and shock tests.

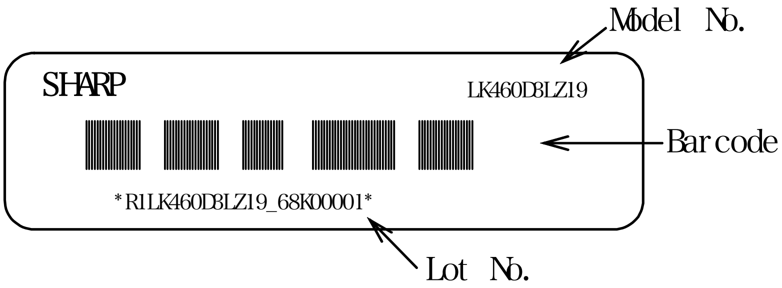
【Result evaluation criteria】

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

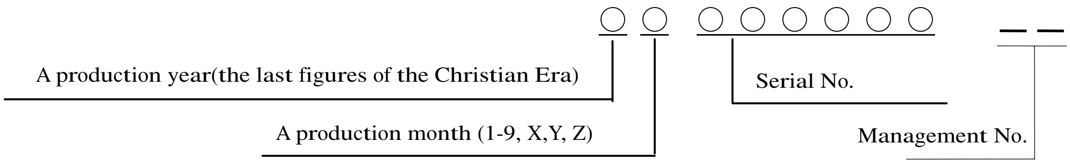
13. Others

1)Lot No. Label:

The label that displays SHARP,product model(LK460D3LZ19),a product number is stuck on the back of the module.



How to express Lot No.



2) Packing Label

社内品番：（４Ｓ）LK460D3LZ19

Barcode

ＬｏｔNO.　：（１Ｔ）2006. *. ** (②)

Barcode

Ｑｕａｎｔｉｔｙ：(Q)　5 ｐｃｓ (③)

Barcode

ユーザ品番　：

＊＊＊＊＊

シャープ物流用ラベルです。

① Management No. (LK460D3LZ19)

② Lot No. (Date)

③ Quantity

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

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) Cold cathode fluorescent lamp in LCD PANEL contains a small amount of mercury. Please follow local ordinances or regulations for disposal. It is displaying the label in the module back.

COLD CATHODE FLUORESCENT LAMP IN LCD PANEL
CONTAINS A SMALL AMOUNT OF MERCURY, PLEASE FOLLOW
LOCAL ORDINANCES OR REGULATION FOR DISPOSAL
当該液晶ディスプレイパネルは蛍光管が組み込まれていますので、地方自
治体の条例、または、規則に従って廃棄ください。

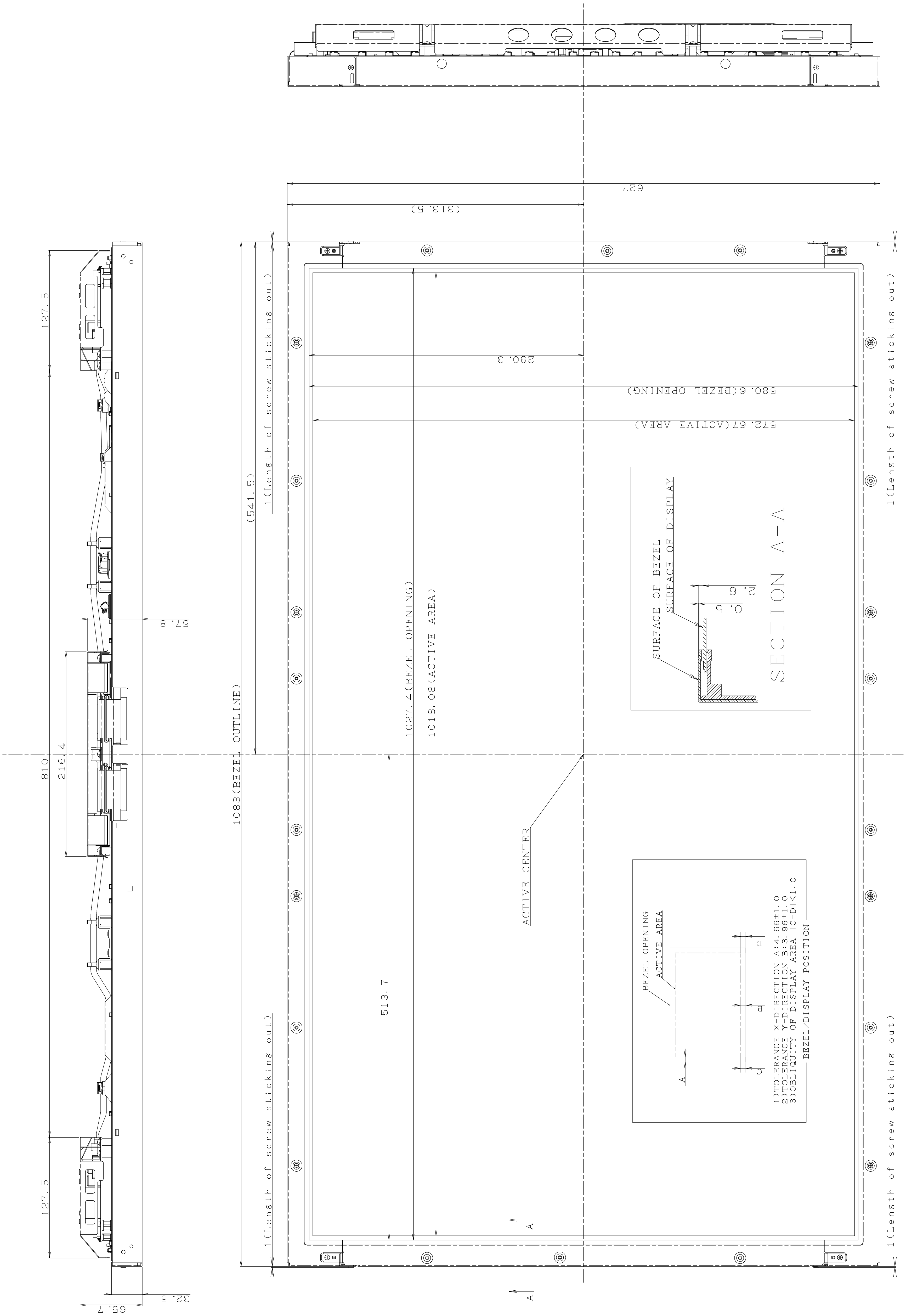
7) Lead-free soldering is applied.

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

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

14. Carton storage condition

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



UNSPECIFIED TOLERANCE TO BE ±1.0
UNIT:mm

Fig 1-1. LK460D3LZ19 Outline dimensions (1/2)

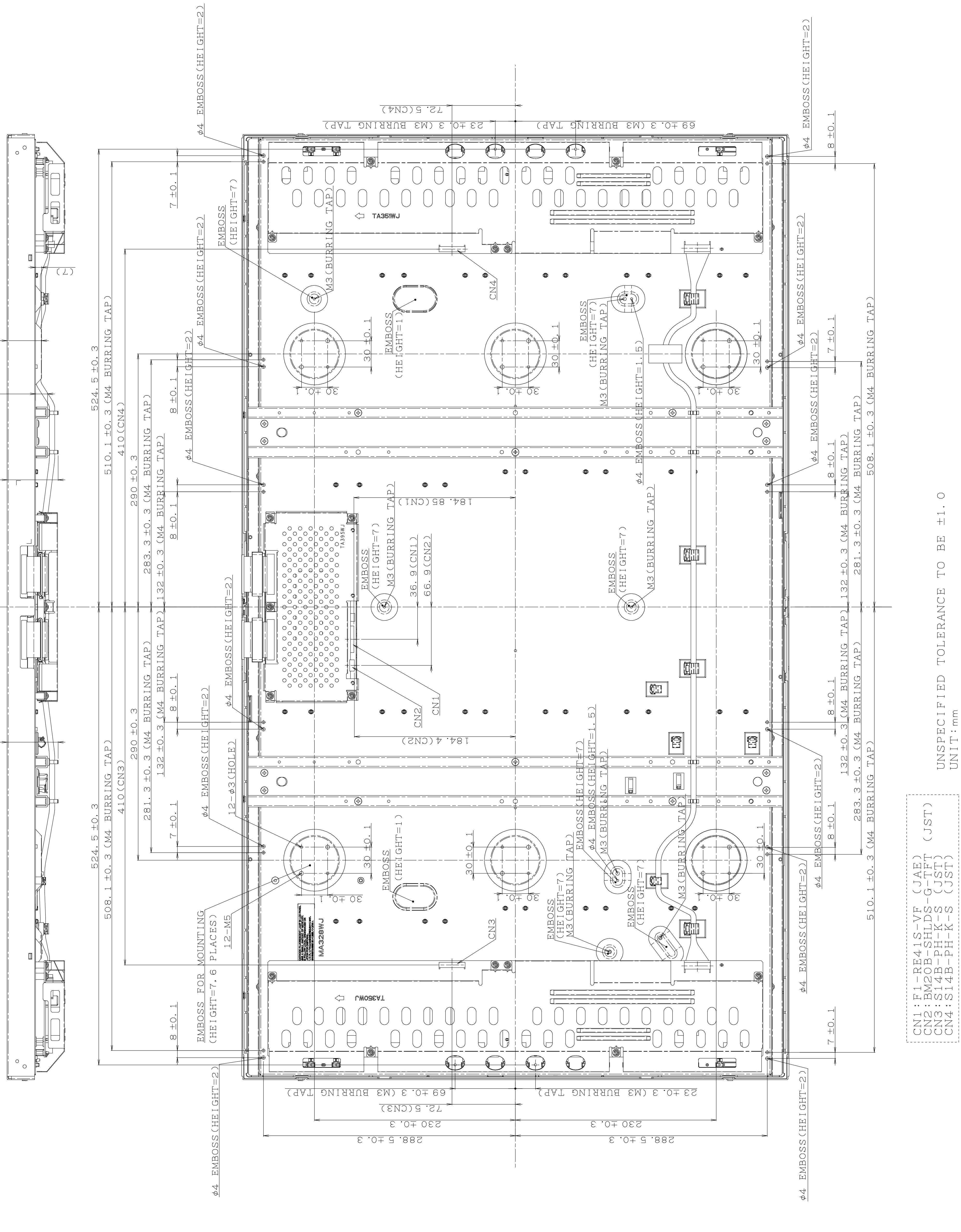


Fig 1-2. LK460D3LZ19 Outline dimensions (2/2)

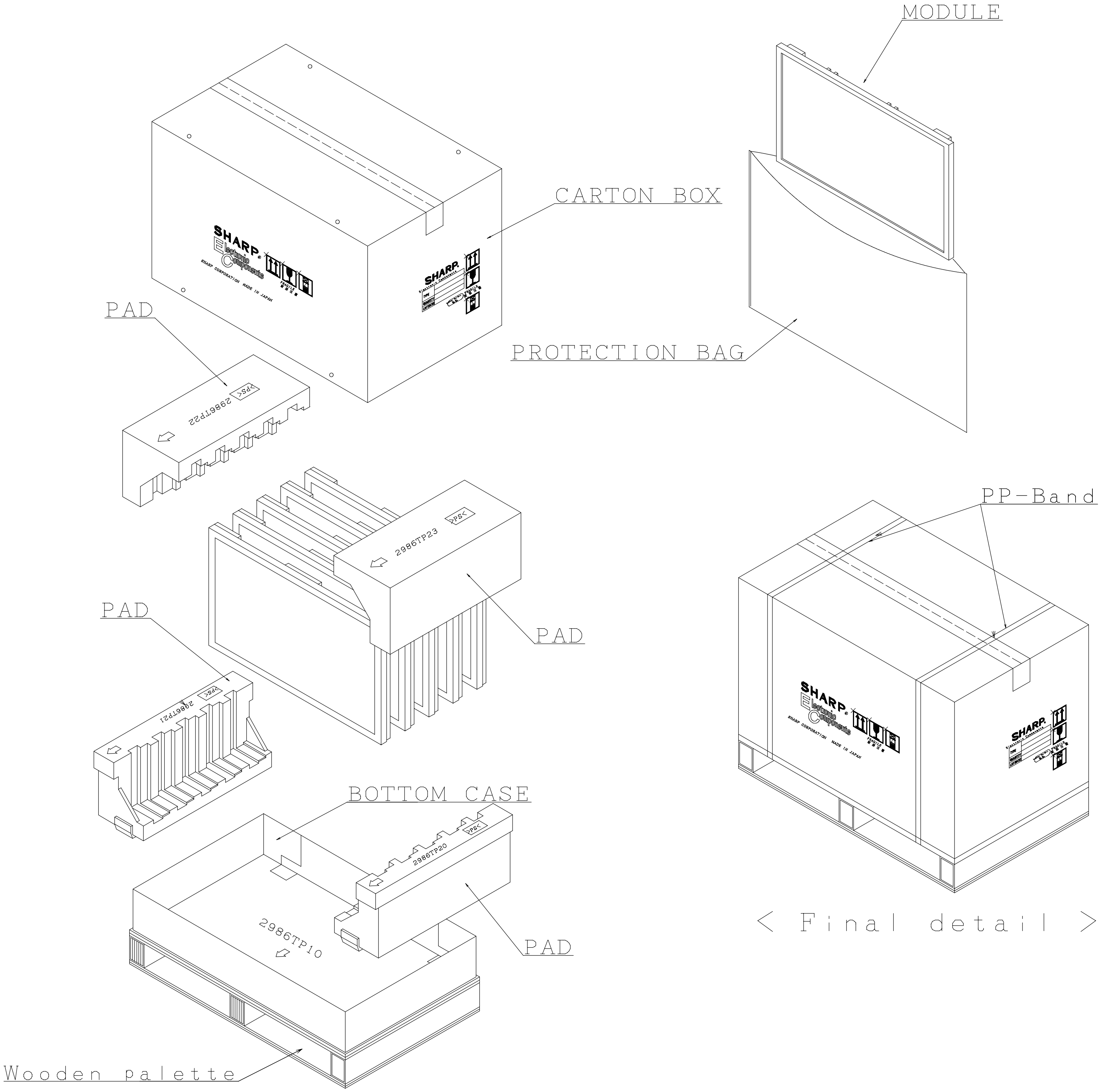


Fig 4. Module packing form

SPECIFICATIONS ARE SUBJECT TO CHANGE WITHOUT NOTICE.

SHARP®

NORTH AMERICA

SHARP Microelectronics of the Americas
5700 NW Pacific Rim Blvd.
Camas, WA 98607, U.S.A.
Phone: (1) 360-834-2500
Fax: (1) 360-834-8903
Fast Info: (1) 800-833-9437
www.sharpsma.com

EUROPE

SHARP Microelectronics Europe
Division of Sharp Electronics (Europe) GmbH
Sonninstrasse 3
20097 Hamburg, Germany
Phone: (49) 40-2376-2286
Fax: (49) 40-2376-2232
www.sharpsme.com

JAPAN

SHARP Corporation
Electronic Components & Devices
22-22 Nagaike-cho, Abeno-Ku
Osaka 545-8522, Japan
Phone: (81) 6-6621-1221
Fax: (81) 6117-725300/6117-725301
www.sharp-world.com

TAIWAN

SHARP Electronic Components
(Taiwan) Corporation
8F-A, No. 16, Sec. 4, Nanking E. Rd.
Taipei, Taiwan, Republic of China
Phone: (886) 2-2577-7341
Fax: (886) 2-2577-7326/2-2577-7328

SINGAPORE

SHARP Electronics (Singapore) PTE., Ltd.
438A, Alexandra Road, #05-01/02
Alexandra Technopark,
Singapore 119967
Phone: (65) 271-3566
Fax: (65) 271-3855

KOREA

SHARP Electronic Components
(Korea) Corporation
RM 501 Geosung B/D, 541
Dohwa-dong, Mapo-ku
Seoul 121-701, Korea
Phone: (82) 2-711-5813 ~ 8
Fax: (82) 2-711-5819

CHINA

SHARP Microelectronics of China
(Shanghai) Co., Ltd.
28 Xin Jin Qiao Road King Tower 16F
Pudong Shanghai, 201206 P.R. China
Phone: (86) 21-5854-7710/21-5834-6056
Fax: (86) 21-5854-4340/21-5834-6057
Head Office:
No. 360, Bashen Road,
Xin Development Bldg. 22
Waigaoqiao Free Trade Zone Shanghai
200131 P.R. China
Email: smc@china.global.sharp.co.jp

HONG KONG

SHARP-ROXY (Hong Kong) Ltd.
3rd Business Division,
17/F, Admiralty Centre, Tower 1
18 Harcourt Road, Hong Kong
Phone: (852) 28229311
Fax: (852) 28660779
www.sharp.com.hk
Shenzhen Representative Office:
Room 13B1, Tower C,
Electronics Science & Technology Building
Shen Nan Zhong Road
Shenzhen, P.R. China
Phone: (86) 755-3273731
Fax: (86) 755-3273735