Shanghai AVIC OPTOELECTRONICS Co. Ltd.

TFT COLOR LCD MODULE

(COMMON)

TMS236FH1-01TB

60cm (23.6W Type)

FHD

LVDS Interface (2port)

DATA SHEET

(Version 2.0)

Published by

Product Technology Department

Shanghai AVIC OPTOELECTRONICS Co. Ltd.

Approved by	***Date***
Checked by	***Date***
Prepared by	***Date***

Signature of customer

Confirmed by	***Date***

INTRODUCTION

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3) Any other causes attributable to customer

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Any question arising out of, or in connection with, this SPECIFICATION or any matter not stipulated herein will be settled each time upon consultation between both parties.

CONTENTS

Record of Revision

Rev	Issued Date	Description	Editor
1.0	2010-9-14	Preliminary Release	Richard Yu
2.0	2010-10-25	Add “Weight” Add “Power consumption” Add” Power supply current”	Richard Yu

1. OUTLINE

1.1 STRUCTURE AND PRINCIPLE

TMS236FH1-01TB module is composed of the amorphous silicon thin film transistor liquid crystal display (a-Si TFT LCD) panel structure with driver LSIs for driving the TFT (Thin Film Transistor) array and a backlight. The a-Si TFT LCD panel structure is injected liquid crystal material into a narrow gap between the TFT array glass substrate and a color-filter glass substrate.

Color (Red, Green, Blue) data signals from a host system (e.g. PC, signal generator, etc.) are modulated into best form for active matrix system by a signal processing board, and sent to the driver LSIs which drive the individual TFT arrays. The TFT array as an electro-optical switch regulates the amount of transmitted light from the backlight assembly, when it is controlled by data signals. Color images are created by regulating the amount of transmitted light through the TFT array of red, green and blue dots.

1.2 APPLICATIONS

• Monitor for PC

1.3 FEATURES

• a-Si TFT active matrix
• LVDS interface
• R.G..B input 8bit, 16.7 millions colors (6bit+Hi-FRC)
• Resolution FHD(1,920× 1,080pixels)
• Wide viewing angle 85°/85° (L/R); 80°/80° (U/D)
• High contrast ratio 1000: 1
• Module size 544.8(H) ×320.5 (V) ×18.7 (D) mm
• Fast response time (Ton+ Toff= 5 ms）
• High gamut (against NTSC 72% typ.)
• Edge light type backlight (4 CCFL lamps)
• Inverter less
• RoHS compliance

2. GENERAL SPECIFICATIONS

Display area	521.28 (H) × 293.22 (V) mm (typ.)
Diagonal size of display	60cm (23.6 inches)
Drive system	a-Si TFT active matrix
Display color	16.7 M colors (6bit+ Hi-FRC)
Pixel	1,920 (H) × 1,080(V) pixels
Pixel arrangement	RGB vertical stripe
Dot pitch	271.5 (H) × 271.5(V) μm
Pixel pitch	90.5 (H) ×271.5 (V) μm
Module size	544.8 (H) ×320.5(V) ×18.7 (D) mm
Weight	3200g
Contrast ratio	1000: 1 (typ.)
Viewing angle	170°/ 160° (typ.)
Color gamut	72% (typ.)
Response time	5 ms (typ.)
Luminance	300 cd/m^2 (typ.)
Transmissive Mode	Normally White
Surface Treatment	AG Type
Signal system	LVDS 2port
Power supply voltage	LCD panel signal processing board: 5.0V
Backlight	4 cold cathode fluorescent lamps
Power consumption	30W

3. ABSOLUTE MAXIMUM RATINGS

Parameter		Symbol	Rating	Unit	Remarks
Power supply voltage	Power voltage	VDD	-0.3 ~ +6.0	V	Ta = 25°C
	Lamp voltage	VBLH	846~ 1034	Vrms	Ta = 25°C
Input voltage for signals		Vi	-0.3 ~ +3.3	V	Ta = 25°C
Lamp current		IBL	3.0~ 8.0	mArms	Ta = 25°C, for each lamp
Lamp Oscillation frequency		FO	40~ 80	kHz	Ta = 25°C
Storage temperature		Tst	-20 ~ +60	°C	Note 3
Operating temperature		Top	0 ~ +50	°C	Note 3, 4
Absolute humidity		AH	≤ 70	g/m^3	Ta > 50°C
Operating altitude		-	≤ 4,850	m	0°C≤ Ta≤ 50°C
Storage altitude		-	≤ 13,600	m	-20°C≤ Ta≤ 60°C

Note1: Display signals are DA0+/-, DA1+/-, DA2+/-, DA3+/-, CKA+/-, DB0+/-, DB1+/-, DB2+/-, DB3+/-, and CKB+/-.

Note2: Function signal is MSL.

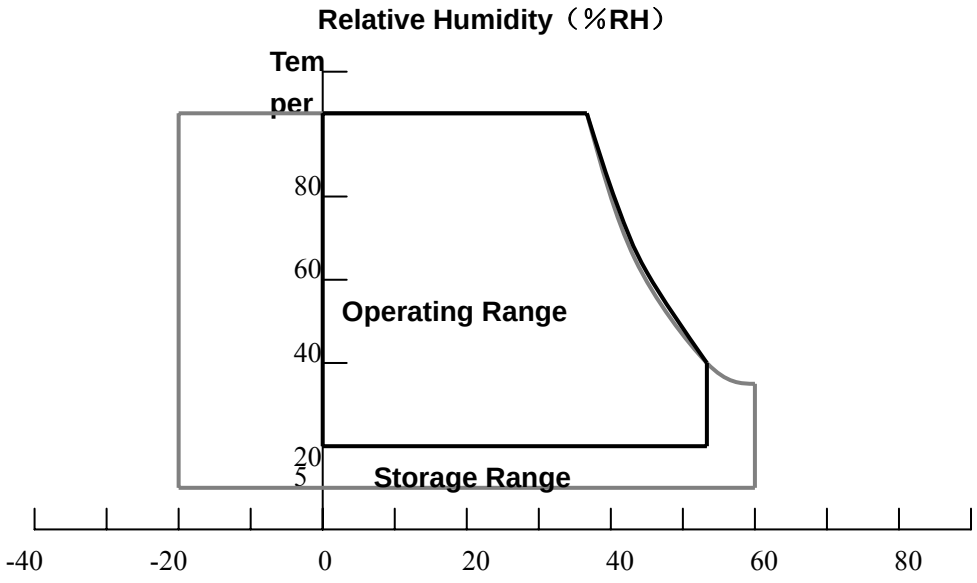
Note3: Temperature and relative humidity range is shown in the figure below.

(a) 90%RH Max. (Ta≤ 40°C)

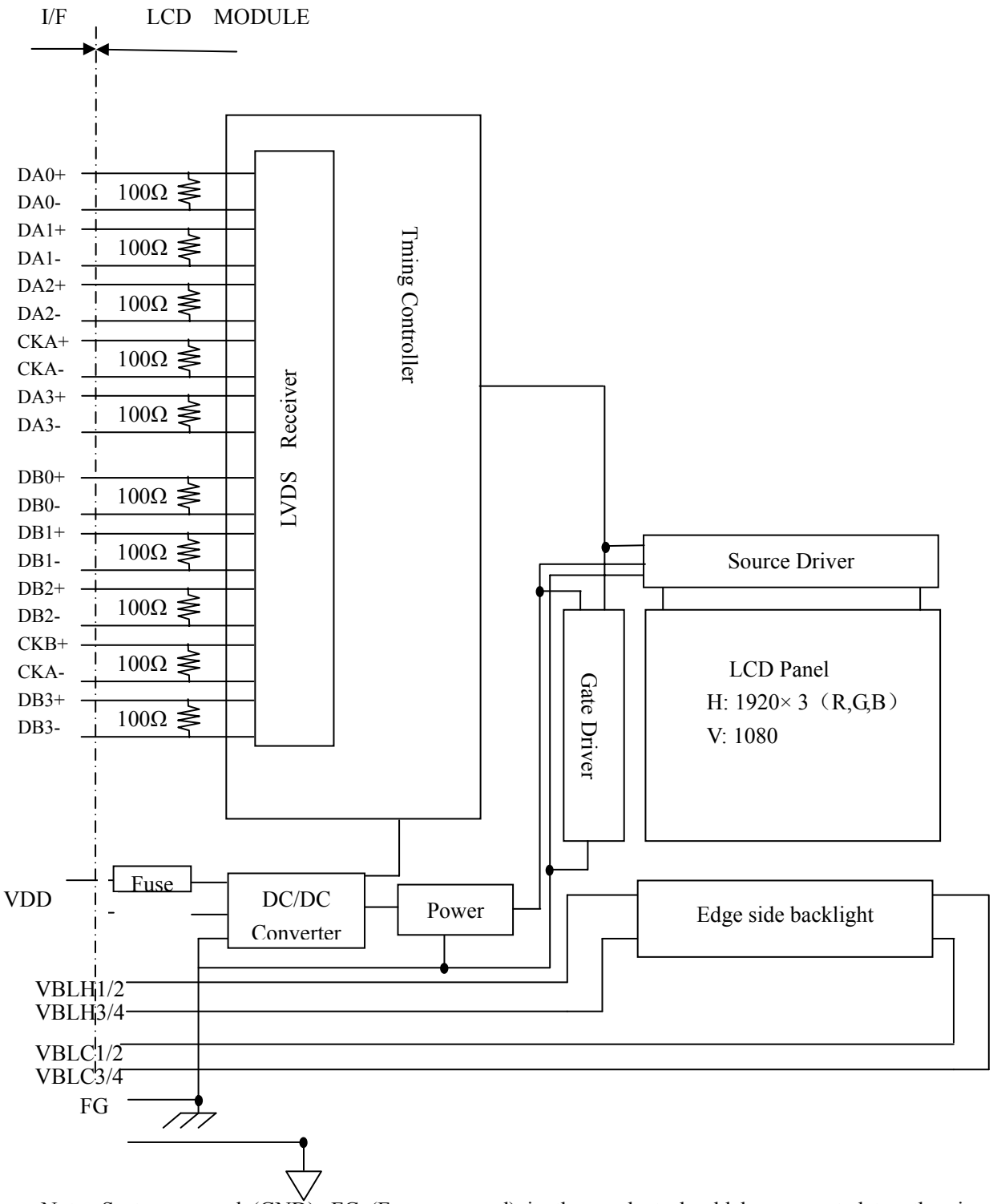
(b)Web-bulb temperature should be39°C Max. (Ta> 40°C)

(c) No condensation.

Note4: The temperature of panel display surface area should be 0°C Min and 60°C Max.



4. BLOCK DIAGRAM



Note: System ground (GND), FG (Frame ground) in the product should be connected together in customer equipment.

5. MECHANICAL SPECIFICATIONS

Parameter	Specification	Unit
Module size	544.8± 0.5 (W) × 320.5 ± 0.5 (H) × 18.7 (D)	mm
Display area	521.28(H) × 293.22(V) mm (typ.), [60cm (23.6 inches)]	mm
Weight	3200	g

6. ELECTRICAL CHARACTERISTICS

6.1 Driving for LCD panel signal processing board

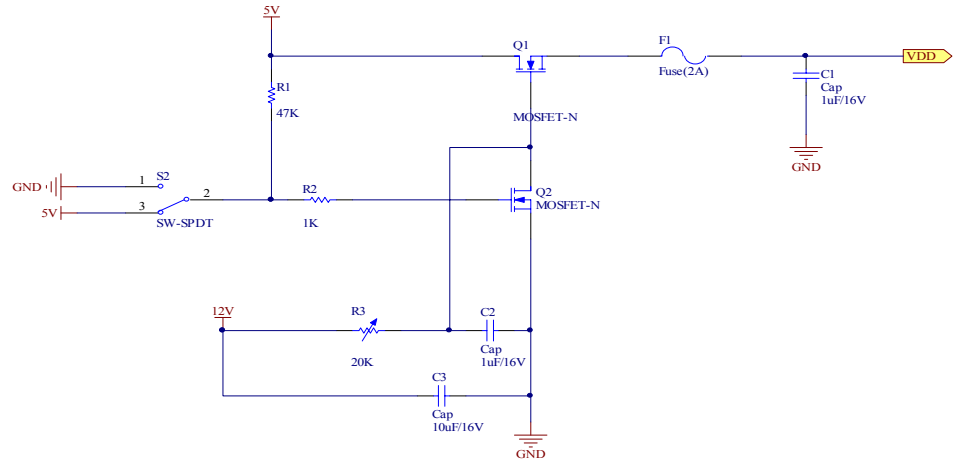
Parameter		Symbol	Min.	typ.	max.	Unit	Remarks
Power supply voltage		V_{IN}	4.5	5.0	5.5	V	25±2°C
Power supply current		IDD	-	0.9	1.08	A	at VDD = 5.0V
Permissible ripple voltage		V_{RPL}	-	-	300	mV	25±2°C,Vp-p
Differential input voltage		| Vid |	100	-	600	mV	
Differential input threshold voltage for LVDS receiver	Low	VTL	-100	-	-	mV	at VCM = 1.2V Note3
	High	VTH	-	-	100	mV	
Input voltage width for LVDS receiver		Vi	0	-	3.3	V	-
Terminating resistor		RT	-	100	-	Ω	-
Rush current		I_{rush}	-	-	2.5	A	25±2°C ,Note4

Note 1: Checkered flag pattern (EIAJ ED-2522)

Note 2: 2H1V dot inverse pattern

Note 3: Common mode voltage for LVDS receiver

Note4 : Measurement Conditions:



6.2 Driving for backlight lamp

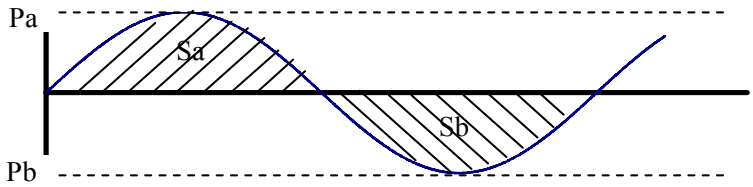
(Ta=25°C) Note1

Parameter	Symbol	min.	typ.	max.	Unit	Remarks
Lamp voltage	VBLH	846	940	1034	Vrms	IBL=7mArms
Lamp current	IBL	3.0	7.0	8.0	mArms	at L = 300cd/ m^2 (typ.)
Lamp starting voltage Note1	VS	-	-	1900	Vrms	Ta = 0°C Note2 Note3
		-	-	1500		Ta =25°C Note2 Note3
Lamp operating lifetime	Hr	50000	-	-	Hour	IBL=7mArms Note5
Oscillation frequency	FO	40	50	80	kHz	Note4

Note1: The backlight of this product is made up of 4 lamps. The specification above is only for one lamp.

Note2: The voltage timing cycle of each lamp should be set as the same phase. [Vs] and [VBLH] is the voltage between the high port and low port, the value is the characteristic of lamp. The starting voltage of inverter should be higher than the value. The possibility of not lighting exists by the lower voltage, so the suitable voltage should considered by the test.

Note3: The asymmetric ratio of working waveform for lamps (Lamp voltage peak ratio, Lamp current peak ratio and waveform area ratio) should be less than 5% (See the following figure). If the waveform is asymmetric, DC (Direct current) element applies into the lamp. In this case, a lamp lifetime may be shortened, because a distribution of a lamp enclosure substance inclines toward one side between low voltage terminal (Cold terminal) and high voltage terminal (Hot terminal).



$|Pa - Pb| / Pb \times 100 \leqslant 5\%$
$|Sa - Sb| / Sb \times 100 \leqslant 5\%$

Pa: Supply voltage/current peak for positive, Pb: Supply voltage/current peak for negative
Sa: Waveform space for positive part, Sb: Waveform space for negative part

Note4: In case "FO" is not the recommended value, beat noise may display on the screen, because of interference between "FO" and "1/th". Recommended value of "FO" is as following.

$FO = 1/4 \times 1/th \times (2n-1)$

Th: Horizontal signal period(See **"9.0Timing characteristics".)**

n: Natural number (1, 2, 3 ……)

Note5: Lamp operating lifetime is mean time to half-luminance. In case the product works under room temperature environment.

7. CONNECTIONS AND FUNCTIONS FOR INTERFACE PINS

CN1: MSBKT2407P30HD (Produced by STM) or equivalent.

Pin	Name	Description
1	ORX0N	Negative LVDS differential data input. Channel O0 (odd)
2	ORX0P	Positive LVDS differential data input. Channel O0 (odd)
3	ORX1N	Negative LVDS differential data input. Channel O1 (odd)
4	ORX1P	Positive LVDS differential data input. Channel O1 (odd)
5	ORX2N	Negative LVDS differential data input. Channel O2 (odd)
6	ORX2P	Positive LVDS differential data input. Channel O2 (odd)
7	GND	Power Ground
8	ORXCLKN	Negative LVDS differential clock input. (odd)
9	ORXCLKP	Positive LVDS differential clock input. (odd)
10	ORX3N	Negative LVDS differential data input. Channel O3(odd)
11	ORX3P	Positive LVDS differential data input. Channel O3 (odd)
12	ERX0N	Negative LVDS differential data input. Channel E0 (even)
13	ERX0P	Positive LVDS differential data input. Channel E0 (even)
14	GND	Power Ground
15	ERX1N	Negative LVDS differential data input. Channel E1 (even)
16	ERX1P	Positive LVDS differential data input. Channel E1 (even)
17	GND	Power Ground
18	ERX2N	Negative LVDS differential data input. Channel E2 (even)
19	ERX2P	Positive LVDS differential data input. Channel E2 (even)
20	ERXCLKN	Negative LVDS differential clock input. (even)
21	ERXCLKP	Positive LVDS differential clock input. (even)
22	ERX3N	Negative LVDS differential data input. Channel E3 (even)
23	ERX3P	Positive LVDS differential data input. Channel E3 (even)
24	GND	Power Ground
25	NC	Not connection.
26	NC	Not connection.
27	NC	Not connection.
28	VIN	+5.0V power supply
29	VIN	+5.0V power supply
30	VIN	+5.0V power supply

7.2 Backlight lamp

CN201, CN203: BHSR-02VS-1/Locking

Adaptable connector: SM02B-BHSS-1-TB

Pin No.	Signal name	Function
1	VH1	High voltage input terminal for upper lamp (Cable color: Blue)
2	VL1	Low voltage input terminal for upper lamp (Cable color: Black)

CN202, CN204: BHSR-02VS-1 /Locking

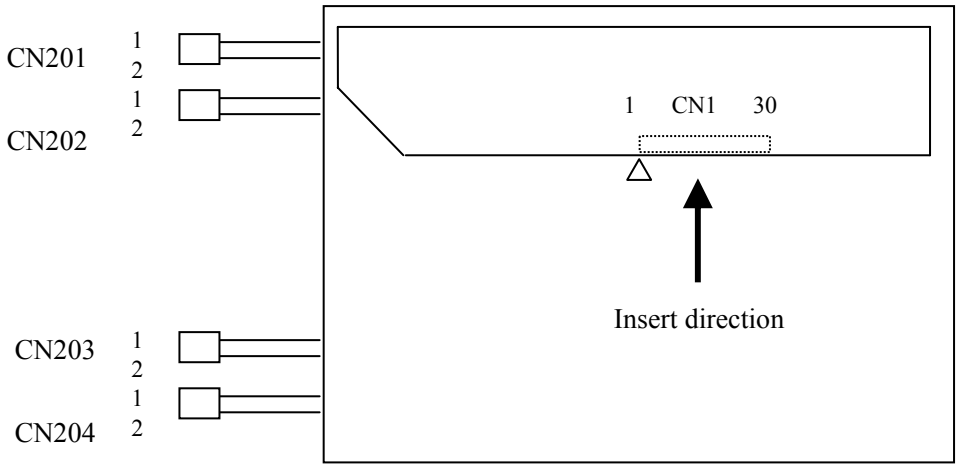
Adaptable connector: SM02B-BHSS-1-TB

Pin No.	Signal name	Function
1	VH2	High voltage input terminal for upper lamp (Cable color: Pink)
2	VL2	Low voltage input terminal for upper lamp (Cable color: White)

Note1: The ports of VDD and GND should be all used. As for the input of LVDS, please use the twisted pair wire of the transmission impedance 100Ω.

Note2: System ground (GND), FG (Frame ground) and VBLC (Lamp low voltage terminal) in the product should be connected together in customer equipment.

7.3 Position of plugs and a socket



7.4 Connection between receiver and transmitter for LVDS

Input DATA			Transmitter pin	Transmitter DS90CF383,C385 or equivalent			CN1 pin	CN1 Symbol
Odd pixel data and control signals	RA0	→	51	TXIN0				
	RA1	→	52	TXIN1		TA1-	→ 1	DA0-
	RA2	→	54	TXIN2		TA1+	→ 2	DA0+
	RA3	→	55	TXIN3				
	RA4	→	56	TXIN4		TB1-	→ 3	DA1-
	RA5	→	3	TXIN6		TB1+	→ 4	DA1+
	GA0	→	4	TXIN7				
	GA1	→	6	TXIN8		TC1-	→ 5	DA2-
	GA2	→	7	TXIN9		TC1+	→ 6	DA2+
	GA3	→	11	TXIN12			7	GND
	GA4	→	12	TXIN13		TCLK1-	→ 8	CKA-
	GA5	→	14	TXIN14		TCLK1+	→ 9	CKA+
	BA0	→	15	TXIN15				
	BA1	→	19	TXIN18		TD1-	→ 10	DA3-
	BA2	→	20	TXIN19	1'ST	TD1+	→ 11	DA3+
	BA3	→	22	TXIN20				
	BA4	→	23	TXIN21				
	BA5	→	24	TXIN22				
	RSVD	→	27	TXIN24				
	RSVD	→	28	TXIN25				
	DE	→	30	TXIN26				
	RA6	→	50	TXIN27				
	RA7	→	2	TXIN5				
	GA6	→	8	TXIN10				
	GA7	→	10	TXIN11				
	BA6	→	16	TXIN16				
	BA7	→	18	TXIN17				
	RSVD	→	25	TXIN23				
	CLK	→	31	CLKIN				
Even pixel data	RB0	→	51	TXIN0				
	RB1	→	52	TXIN1		TA2-	→ 12	DB0-
	RB2	→	54	TXIN2		TA2+	→ 13	DB0+
	RB3	→	55	TXIN3			14	GND
	RB4	→	56	TXIN4		TB2-	→ 15	DB1-
	RB5	→	3	TXIN6		TB2+	→ 16	DB1+
	GB0	→	4	TXIN7			17	GND
	GB1	→	6	TXIN8		TC2-	→ 18	DB2-
	GB2	→	7	TXIN9		TC2+	→ 19	DB2+
	GB3	→	11	TXIN12				
	GB4	→	12	TXIN13		TCLK2-	→ 20	CKB-
	GB5	→	14	TXIN14		TCLK2+	→ 21	CKB+
	BB0	→	15	TXIN15				
	BB1	→	19	TXIN18		TD2-	→ 22	DB3-
	BB2	→	20	TXIN19	2'nd	TD2+	→ 23	DB3+
	BB3	→	22	TXIN20			24	GND
	BB4	→	23	TXIN21			25	GND
	BB5	→	24	TXIN22			26	NC
	RSVD	→	27	TXIN24			27	GND
	RSVD	→	28	TXIN25			28	VDD
	RSVD	→	30	TXIN26			29	VDD
	RB6	→	50	TXIN27			30	VDD
	RB7	→	2	TXIN5				
	GB6	→	8	TXIN10				
	GB7	→	10	TXIN11				
	BB6	→	16	TXIN16				
	BB7	→	18	TXIN17				
	RSVD	→	25	TXIN23				
	CLK	→	31	CLKIN				

Note1 :The lowest bit (RA0, GA0, BA0, RB0, GB0, BB0), the most upper bit (RA7, GA7, BA7, RB7, GB7, BB7)

Note2 :Connecting cable between LCD panel's connector and transmitter should use 100Ω twisted line.

Note3 :If only Hsync and Vsync, the product don't work. Make sure DE signal has been input.

8. DISPLAY COLORS AND INPUT DATA SIGNALS

This product can display in equivalent to 16,777,216 colors in 256 scales. Also the relation between display colors and input data signals is as the following table.

Display colors		Data signal （0:Low level，1:High Level）																							
		R7	R6	R5	R4	R3	R2	R1	R0	G7	G6	G5	G4	G3	G2	G1	G0	B7	B6	B5	B4	B3	B2	B1	B0
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
	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
	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
	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
Red grayscale	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	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Dark ↑	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
					:								:								:				
	↓				:								:								:				
	Bright	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	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
Green grayscale	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	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
	Dark ↑	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
					:								:								:				
	↓				:								:								:				
	Bright	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0
	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
Blue grayscale	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Dark ↑	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
					:								:								:				
	↓				:								:								:				
	Bright	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	1
		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	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

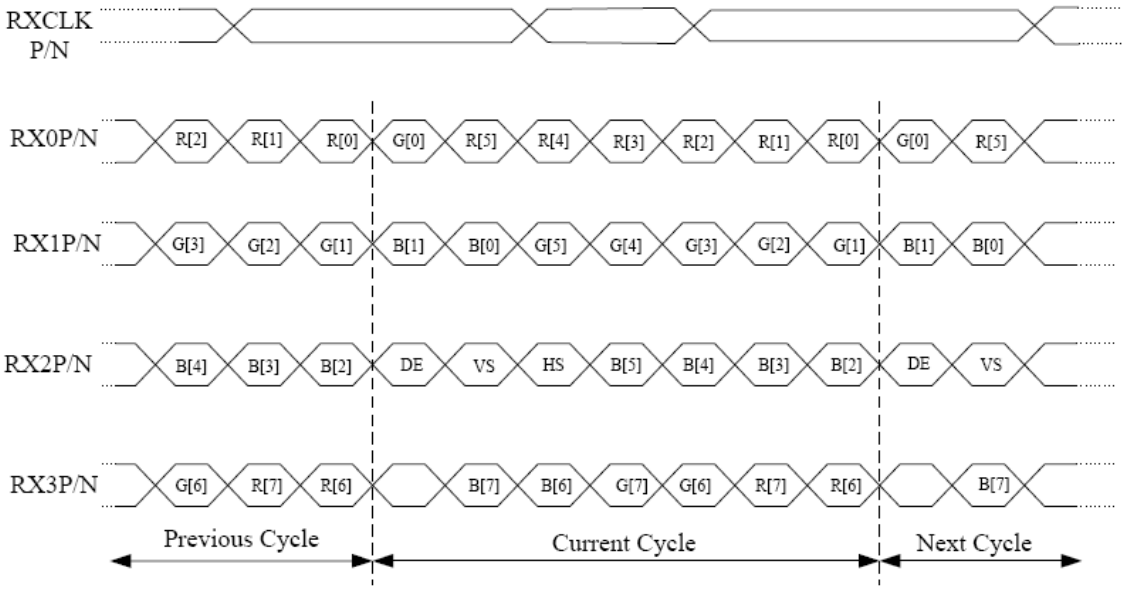
9. INTERFACE TIMING

9.1 Timing characteristics

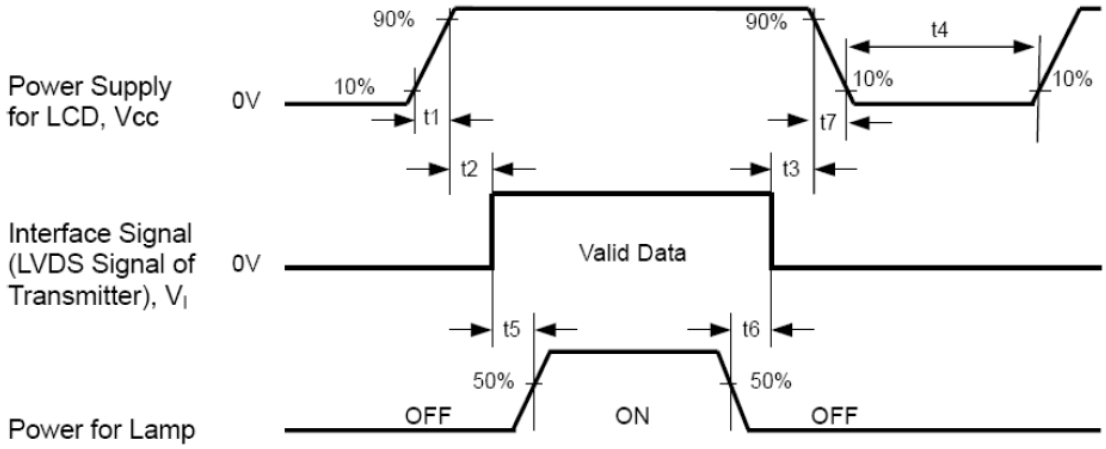
Parameter		Symbol	min.	typ.	max.	Unit	Remarks
Clock	Frequency<dual>	f_{dck}	69.30	73.26	77.35	MHz	LVDS transmitter input
		tc	14.43	13.65	12.93	ns	
	Rise time, Fall time	-	Refer to the timing characteristics of LVDS transmitter			ns	Note 1
	Duty	-				-	
Horizontal signals	Cycle	T_{hp}	14.8	18.0	26.5	μs	67.5kHz(typ.)
			1050	1100	1150	CLK	
	Display period	HA	960			CLK	-
Vertical signals	Cycle	T_{vp}	13.3	16.67	20	ms	60.0Hz(typ.)
			1100	1110	1121	lines	
	Display period	VA	1080			lines	-
DE/Data	Setup time	-	Refer to the timing characteristics of LVDS transmitter			ns	Note 1
	Hold time	-				ns	
	Rise time, Fall time	-				ns	

Note1: See the data sheet of LVDS transmitter.

9.2 Input signal timing mapping



9.3 Power On/Off Sequence



Parameter	Symbol	Unit	min	typ	max
VDD Rise Time	T1	ms	0.47	TBD	10
VDD Good to Signal Valid	T2	ms	0.5	TBD	50
Signal Disable to Power Down	T3	ms	0	TBD	50
Power Off	T4	ms	1000	TBD	TBD
Signal Valid to Backlight On	T5	ms	200	TBD	TBD
Backlight Off to Signal Disable	T6	ms	200	TBD	TBD
VDD Fall Time	T7	ms	0	TBD	100

Note1： When VDD is on, but the value is lower than 4.5V, a protection circuit may work, then the module may not display.

Note2：The signal line is not connected with the module, at the end of cable the terminal resistor of 100Ω should be added.

Note3: Display signals (D0+/-, D1+/-, D2+/-, D3+/- and CK+/-) must be “0” voltage, exclude the VALID period (See above sequence diagram). If these signals are higher than 0.3 V, the internal circuit is damaged.

If some of display signals of this product are cut while this product is working, even if the signal input to it once again, it might not work normally. If customer stops the display signals, they should cut VDD.

Note4: When VDD is on, it should be set above 4.0V.

Note5: The backlight power supply voltage should be inputted within the valid period of display and function signals, in order to avoid unstable data display.

9.4 Power supply voltage ripple

When the power supply is designed, the next form can give the reference. If the voltage ripple is over the value in next form, the noise should be seen in display area.

Ripple (Measured at input terminal of power supply)

	VDD (5V to drive the panel)
Ripple voltage	≤300mVP-P（Including spike noise）

9.5 Fuse

Parameter	Fuse		Rating	Fusing current	Remarks
	Type	Supplier			
VDD	F0603FA2000V032T	AEM	2A 32V	-	

Note1: There are different power supply systems from the power input terminal. The power supply capacity should be less than the fusing current. If the power supply capacity is above the fusing current, the fuse may blow in a short time, and then nasty smell, smoking and so on may occur.

10. OPTICS

10.1 Optical characteristics

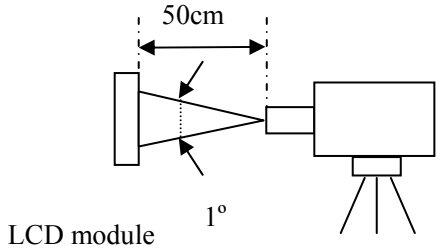
Note1 ,Note2

Parameter Note1		Condition	Symbol	min.	typ.	max.	Unit	Remarks
Luminance		White at center θR=0°, θL=0°, θU=0°, θD=0°	L	300	-	-	cd/ m^2	-
Contrast ratio		White/Black at center θR=0°, θL=0°, θU=0°, θD=0°	CR	700	1000	-	-	Note3
Luminance uniformity		White θR=0°, θL=0°, θU=0°, θD=0	LU	-	1.25	1.33	-	Note4
Chromaticity	White	X coordinate	Wx	0.298	0.313	0.328	-	Note5
		Y coordinate	Wy	0.314	0.329	0.344	-	
	Red	X coordinate	Rx	0.632	0.647	0.662	-	
		Y coordinate	Ry	0.319	0.334	0.349	-	
	Green	X coordinate	Gx	0.269	0.284	0.299	-	
		Y coordinate	Gy	0.592	0.607	0.622	-	
	Blue	X coordinate	Bx	0.136	0.151	0.166	-	
		Y coordinate	By	0.056	0.071	0.086	-	
Color gamut		θR=0°, θL=0°, θU=0°, θD=0 At center,against NTSC	C	69	72	-	%	
Response time		White to black	Ton	-	1.5	3.5	ms	Note6 Note7
		Black to white	Toff	-	3.5	5.5	ms	
		Ton+ Toff	-	-	5	8	ms	
Viewing angle	Right	θU=0°, θD=0°, CR≥10	θR	75	85	-	°	Note8
	Left	θU=0°, θD=0°, CR≥10	θL	75	85	-	°	
	Up	θR=0°, θL=0°, CR≥10	θU	70	80	-	°	
	Down	θR=0°, θL=0°, CR≥10	θD	70	80	-	°	

Note1: The values in upper table are only initial characteristics.

Note2: Measurement conditions are as follows.

Ta= 25°C, VDD= 5.0V, IBL= 7mArms/lamp, Display mode: FHD,
Horizontal cycle=67.5 KHz, Vertical cycle=60.0Hz
Optical characteristics are measured at luminance saturation after 30minutes from working the product in the dark room. Also measurement method for luminance is as follows.



Luminance Meter (TOPCON BM-5A)
Spectroradiometer(TOPCON SR-3)

Note 3: See**"10.2 Definition of contrast ratio".**

Note 4: See**"10.3 Definition of luminance uniformity".**

Note 5: CIE 1931 Chromaticity Diagram Standard.

Note 6: Product surface temperature: TopF = 33.0 °C

Note 7: See **"10.4 Definition of response time".**

Note 8: See **"10.5 Definition of viewing angle".**

10.2 Definition of contrast ratio

The contrast ratio is calculated by using the following formula.

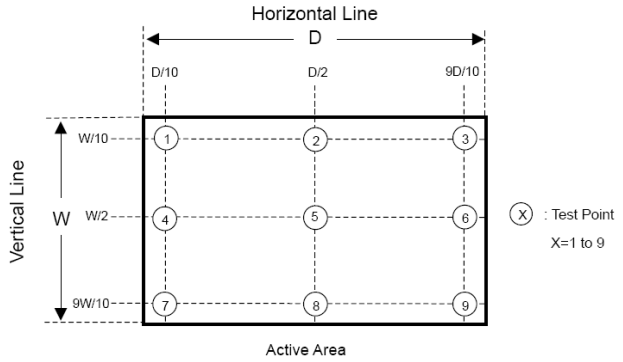
$$\text{Contrast ratio (CR)} = \frac{\text{Luminance of white screen}}{\text{Luminance of black screen}}$$

10.3 Definition of luminance uniformity

The luminance uniformity is calculated by using the following formula.

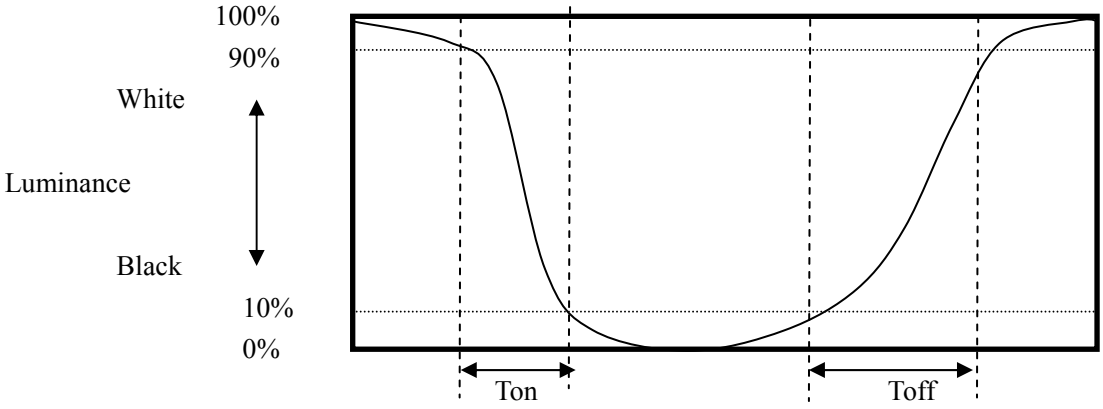
$$\text{Luminance uniformity (LU)} = \frac{\text{Maximum luminance from ① to ⑨}}{\text{Minimum luminance from ① to ⑨}}$$

The luminance is measured at near the 9 points shown below.

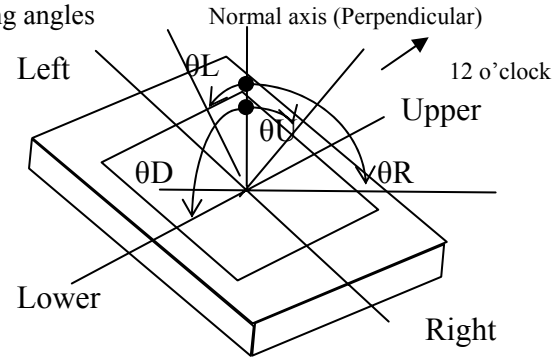


10.4 Definition of response times

Response time is measured, the luminance changes from "white" to "black", or "black" to "white" on the same screen point, by photo-detector. Ton is the time it takes the luminance change from 90% down to 10%. Also Toff is the time it takes the luminance change from 10% up to 90%. (See the following diagram.)



10.5 Definition of viewing angles



11. MARKINGS

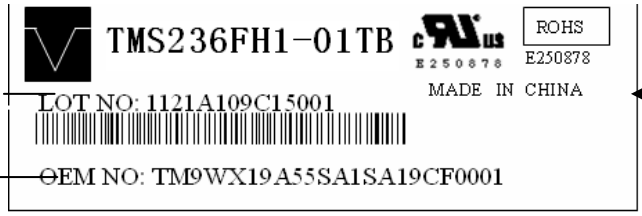
The various markings are attached to this product. See "11.3 INDECATION LOCATIONS" for attachment positions.

11.1 PRODUCT LABEL

Product label

UL MARK

ROHS Mark



Lot number Note 1

Country of manufacture

OEM number

Note2

Note1: The meaning of OEM number

- Example: TM9WX19A55SA1SA19CF0001

TM9WX19A	55	SA1SA1	9CF	0001
Module Number	**Source & Gate Driver IC Code**	**Location Line#**	**Date code**	**Serial Number**

Date code:

1st Character Year Codes

Month	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	So on
Code	6	7	8	9	0	1	2	3	4	5	6	

2nd Character Month Codes

Month	January	February	March	April	May	June	July	August	September	October	November	December
Code	1	2	3	4	5	6	7	8	9	A	B	C

3rd Character Day Codes

Day	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11st	12nd
Code	1	2	3	4	5	6	7	8	9	A	B	C

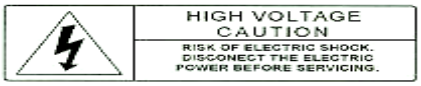
13rd	14th	15th	16th	17th	18th	19th	20th	21st	22nd	23rd	24th
D	E	F	G	H	J	K	L	M	N	P	Q

25th	26th	27th	28th	29th	30th	31st
R	S	T	U	V	W	X

Note2: Do not attach anything such as label and so on, on the product label! In case repair the product, AVIC needs the contents of product label such as the lot number, inspection date and so on, to identify the warranty period with individual product. If AVIC cannot decipher the contents of product label, such repair shall be entitled to charge. Also AVIC may give a new lot number to reconditioned products.

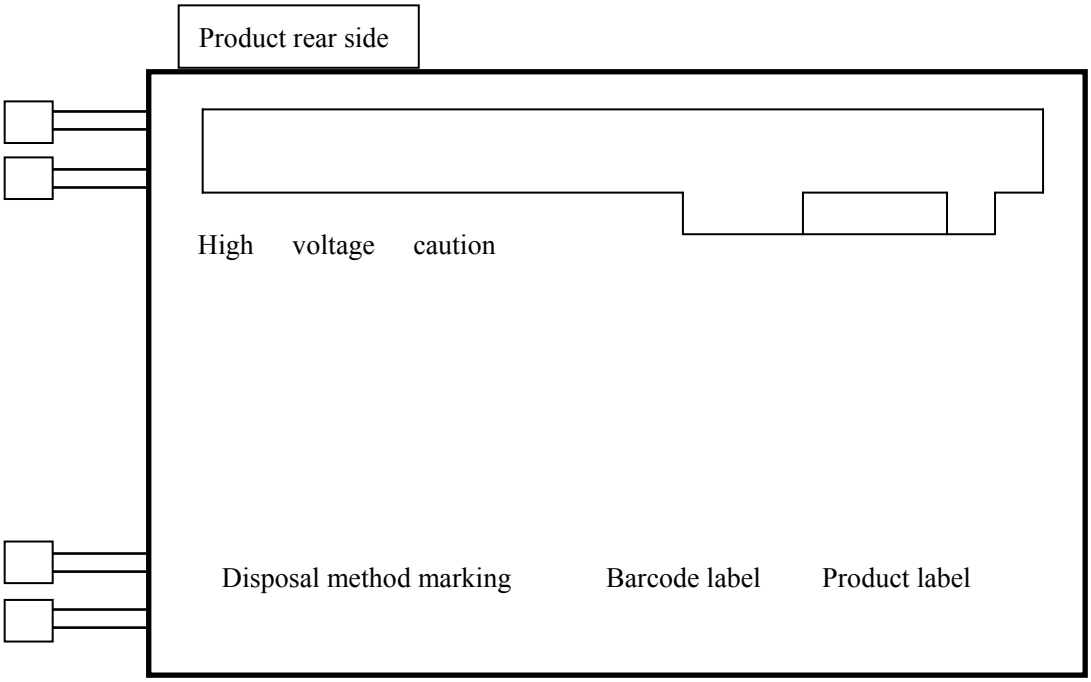
11.2 OTHER MARKINGS

High voltage caution marking



Disposal method marking for lamp

11.3 INDICATION LOCATIONS



12. PACKING, TRANSPORTATION AND DELIVERY

AVIC will pack products to deliver to customer in accordance with AVIC packing specifications, and will deliver products to customer in such a state that products will not suffer from a damage during transportation .The delivery conditions are as follows.

12.1 PACKING

(1) Packing box

8 products are packed up with the maximum in a packing box(See "**12.5 OUTLINE FIGURE FOR PACKING** ").

Products are put into a plastic bag for prevention of moisture with cushion, and then the bag is sealed up with heat sealing.

The type name and quality are shown on outside of the packing box, either labeling or printing.

(2) Pallet Packing (See"**12.5 OUTLINE FIGURE FOR PACKING** ")

① Packing boxes are tired on a cardboard pallet.(8 boxes×4 tiers maximum)

② Cardboard sleeve and top cap are attached to the packing boxes, then they are fixed by a band.

12.2 INSPECTION RECORD SHEET

Inspection record sheets are included in the packing box with delivery products to customer. It is summarized to a number of products for pass/fail assessment.

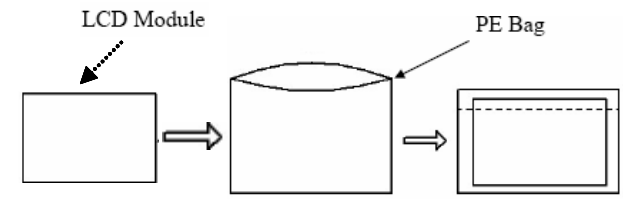
12.3 TRANSPORTATION

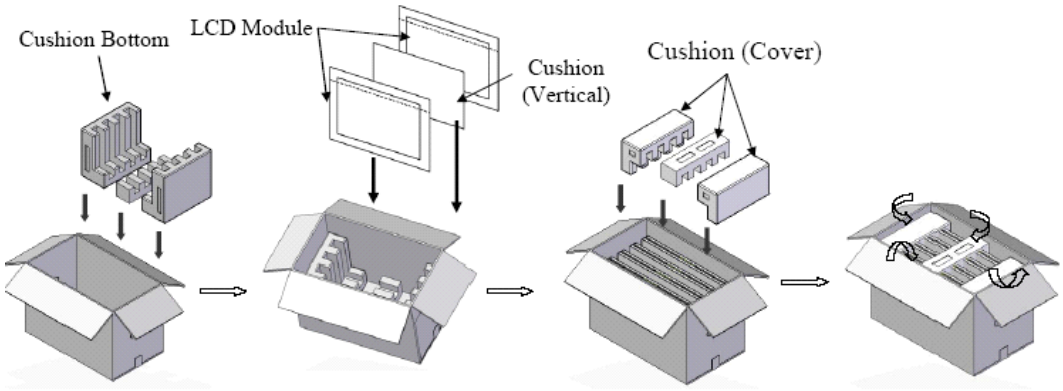
The product is transported by vehicle, aircraft or shipment in the state of pallet packing.

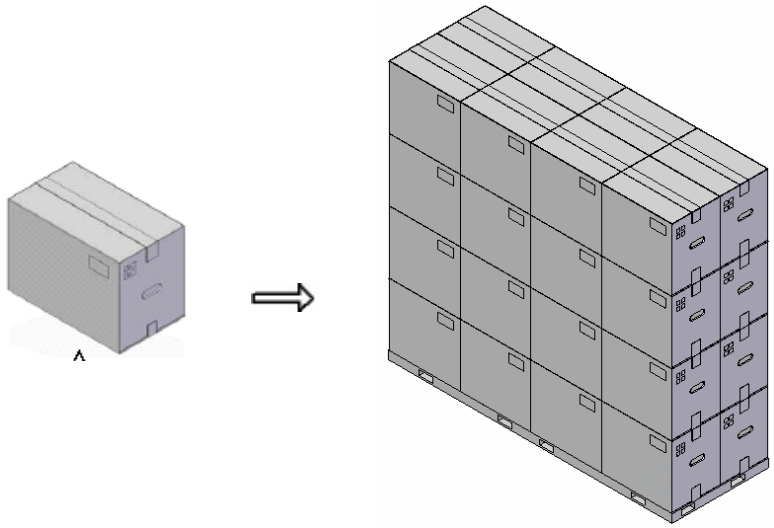
12.4 SIZE AND WEIGHT FOR PACKING BOX

Parameter	Packing box	Unit
Size	604（L）× 274（W）× 417（H）(typ.)	mm
Weight	3.2	kg
Total weight	TBD (with 6 products)	kg

12.5 OUTLINE FIGURE FOR PACKING







13. PRECAUTIONS

13.1 MEANING OF CUTION SIGNS

The following caution signs have very important meaning .**Be sure to read "9.2 CAUTIONS" and "9.3 ATTENTIONS", after understanding these contents!**

	This sign have the meaning that customer will be injured by himself or the product will sustain a damage, if customer has wrong operations.
	This sign has the meaning that customer will get an electrical shock, if customer has wrong operations.
	This sign has the meaning that customer will be injured by himself, if customer has wrong operations.

13.2 CAUTIONS

*** Do not touch lamp cables while turn on .Customers will be in danger of an electric shock**

*** Do not touch the working backlight and IC. Customers will be in danger of burn injury.**
*** Do not shock and press the LCD panel and the backlight! There is a danger of breaking, because they are made of glass.(shock :To be not greater 294m/s^2 and to be not greater 11ms, Pressure: To be not greater 19.6N)**

13.3 ATTENTIONS 

13.3.1 Handling of the product

① Take hold of both ends without touch the circuit board when customer pulls out products (LCD modules) from inner packing box. If customer touches it, products may be broken down or out of adjustment, because of stress to mounting parts.

② Do not hook cables nor pull connection cables such as flexible cable and so on , for fear of damage.

③ If customer puts down the product temporarily, the product puts on flat subsoil as a display side turns down.

④ Take the measures of electrostatic discharge such as earth band, ionic shower and so on, when customer deal with the product, because products may be damaged by electrostatic.

⑤ The torque for mounting screws must never exceed 0.34N-m. Higher torque values might result in distortion of the bezel.

⑥ The product must be installed using mounting holes without undue stress such as bends or twist (See outline drawings).And do not add undue stress to any portion (such as bezel flat area) except mounting hole portion.
Bends or twist described above and undue stress to any portion except mounting hole portion may cause display

un-uniformity.

⑦ Do not press or rub on the sensitive display surface .If customer clean on the panel surface, AVIC recommends using the cloth with ethanolic liquid such as screen cleaner for LCD.

⑧ Do not push-pull the interface connectors while the product is working, because wrong power sequence may break down the product.

⑨ Do not bend or unbend the lamp cable at the near part of the lamp holding rubber, to avoid the damage for high voltage side of the lamp. This damage may cause a lamp breaking and abnormal operation of high voltage circuit.

13.3.2 Environment

① Do not operate or store in high temperature, high humidity, dewdrop atmosphere or corrosive gases. Keep the product in antistatic pouch in room temperature, because of avoidance for dusts and sunlight, if customer stores the product.

② In order to prevent dew condensation occurring by temperature difference, the product packing box must be opened after leave under the environment of an unpacking room temperature enough. Because a situation of dew condensation occurring is changed by the environment temperature and humidity, evaluate the leaving time sufficiently. (Recommendation leaving time: 6 hour or more with packing state)

③ Do not operate in a high magnetic field .Circuit boards may be broken down by it.

④ This product is not designed as radiation hardened.

⑤ Use an original protection sheet on the product surface (polarizer). Adhesive type protection sheet should be avoided, because it may change color or properties of the polarizer.

13.3.3 Characteristics

The following items are neither defects nor failures.

① Response time, luminance and color may be changed by ambient temperature.

② The LCD may be seemed luminance non-uniformity, flicker, vertical seam or small spot by display patterns.

③ Optical characteristics (e.g. luminance, display uniformity, etc.) gradually is going to change depending on operating time ,and especially low temperature, because the LCD has cold cathode fluorescent lamps.

④ Do not display the fixed pattern for a long time because it may cause image sticking .Use a screen saver, if the fixed pattern is displayed on the screen.

⑤ The display color may be changed by viewing angle because of the use of condenser sheet in the backlight.

⑥ Optical characteristics may be changed by input signal timings.

⑦ The interference noise of input signal frequency for this product and luminance control frequency of customer's backlight inverter may appear on a display. Set up luminance control frequency of backlight inverter so that the interference noise doses not appear.

13.4 Other

① All GND and VCC terminals should be used without a non-connected line.

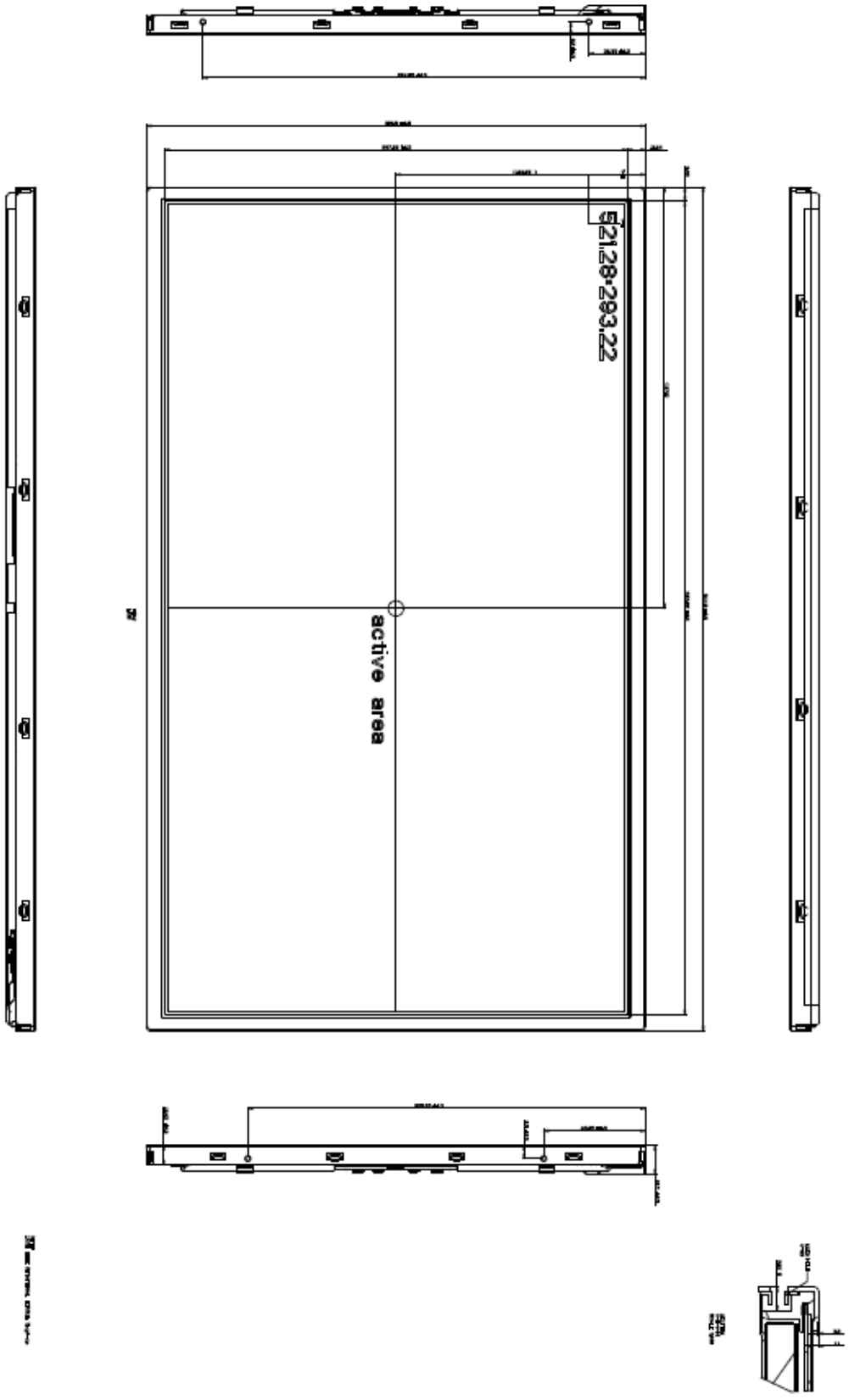
② Do not disassemble a product or adjust volume without permission of AVIC.

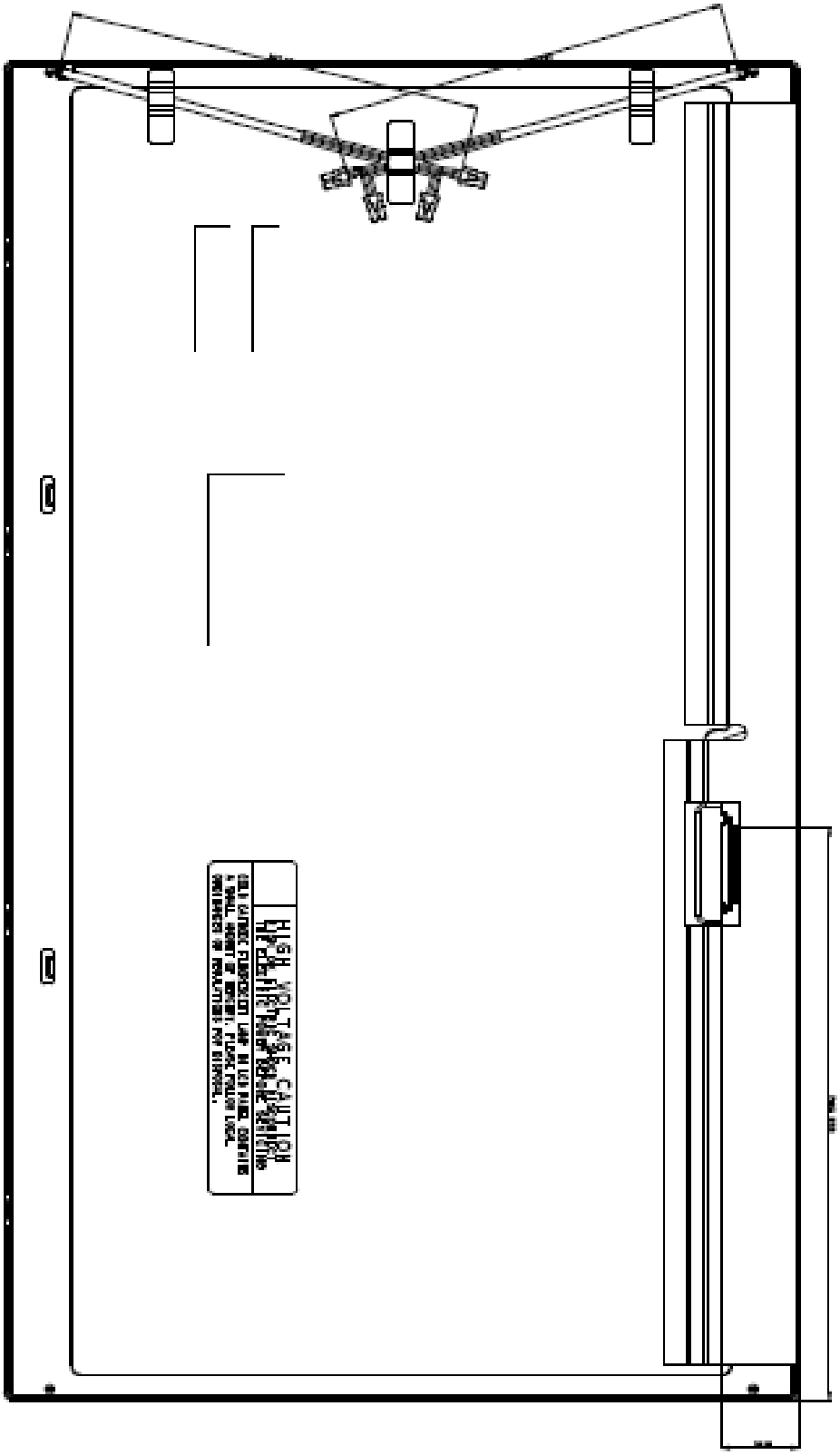
③ Pay attention not to insert waste materials inside of products, if customer uses screw nails.

④ Pack the product with original shipping package, because of avoidance of some damages during transportation, when customer returns it to AVIC for repair and so on .

⑤ Not only the module but also the equipment should be packed and transported as the module. becomes vertical .Otherwise, there is the fear that a display dignity decreases by an impact or vibrations.

14.OUTDRAWING





Rev	Revised date	Main Revision item and sign	Approved by	Checked by	Prepared by	Published date
1.0	2010-9-14	Sign: 质量 / 营业				2010-9-14