CUSTOMER APPROVAL SHEET

Company Name	
MODEL	**A090PAN01 V0**
CUSTOMER APPROVED	

☐ APPROVAL FOR SPECIFICATIONS ONLY (Spec. Ver. 0.0)

☐ APPROVAL FOR SPECIFICATIONS AND ES SAMPLE (Spec. Ver. 0.0)

☐ APPROVAL FOR SPECIFICATIONS AND CS SAMPLE (Spec. Ver. 0.0)

☐ CUSTOMER REMARK :

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Tentative

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Date :	2011/06/29

Product Specification

9.0" COLOR TFT-LCD MODULE

Model Name : **A090PAN01 V0**

Planned Lifetime:	From 2011/Aug To 2013/Jul
Phase-out Control:	From 2013/Jan To 2011/Jul
EOL Schedule:	2013/Jul

< ◆ >Preliminary Specification
< >Final Specification

Note: The content of this specification is subject to change.

Record of Revision

Version	Revise Date	Page	Content
0.0	2011/Jun/24	All	First Draft.
0.1	2011/Jun/29	10	Modify BLU LED input current 200mA->100mA. Add BLU LED forward voltage 18V.

Contents

A. General Information

This product is for CE Brand Tablet application.

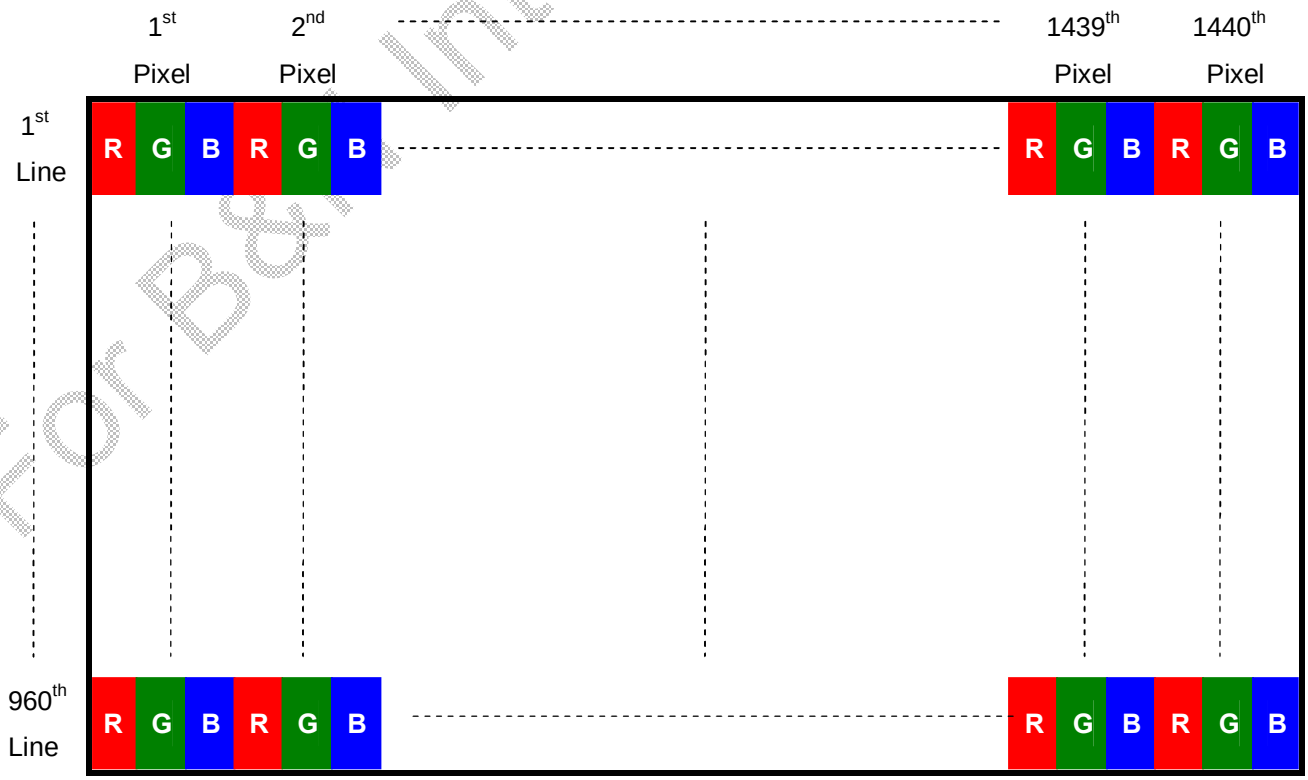
NO.	Item	Unit	Specification	Remark
1	Screen Size	inch	9(Diagonal)	
2	Display Resolution	dot	1440RGB(W)x960(H)	
3	Overall Dimension	mm	200.53(W) x140.04(H) x 2.54(D)	Note 1
4	Active Area	mm	190.08(W) x 126.72(H)	
5	Pixel Pitch	mm	0.132(W)x0.132(H)	
6	Color Configuration	--	R. G. B. Stripe	Note 2
7	Color Depth	--	16.7M Colors	Note 3
8	NTSC Ratio	%	50	
9	Display Mode	--	Normally Black	
10	Panel surface Treatment	--	Normal, 3H	
11	Weight	g	126	
12	Panel Power Consumption	**mW**	**800**	Note 4
13	Backlight Power Consumption	W	1.8	
14	Viewing direction		ASVA	

Note 1: Not include blacklight cable and FPC. Refer next page to get further information.

Note 2: Below figure shows dot stripe arrangement.

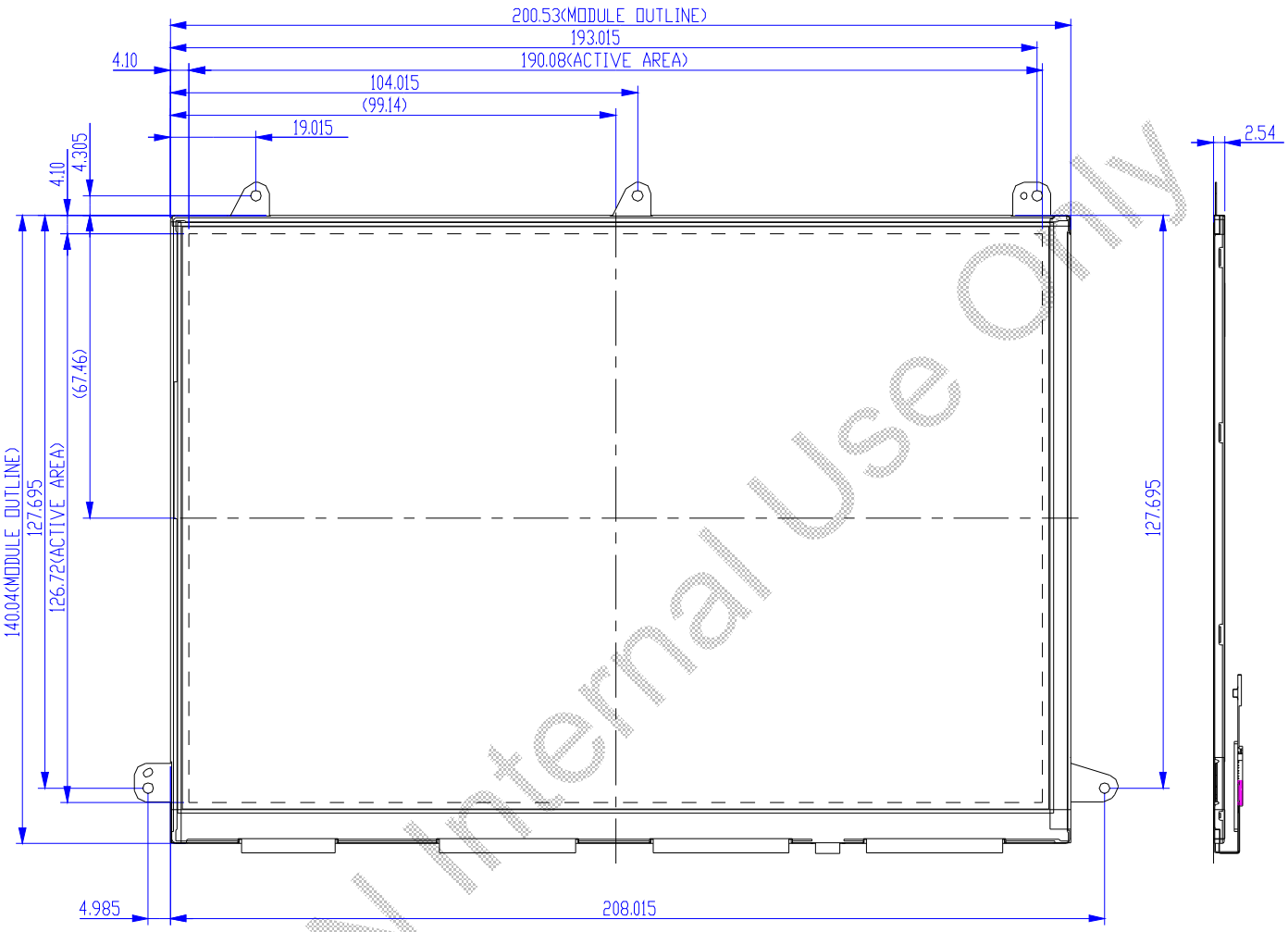
Note 3: Please refer to Electrical Characteristics chapter.

Note 4: Ref. Pattern at Page23

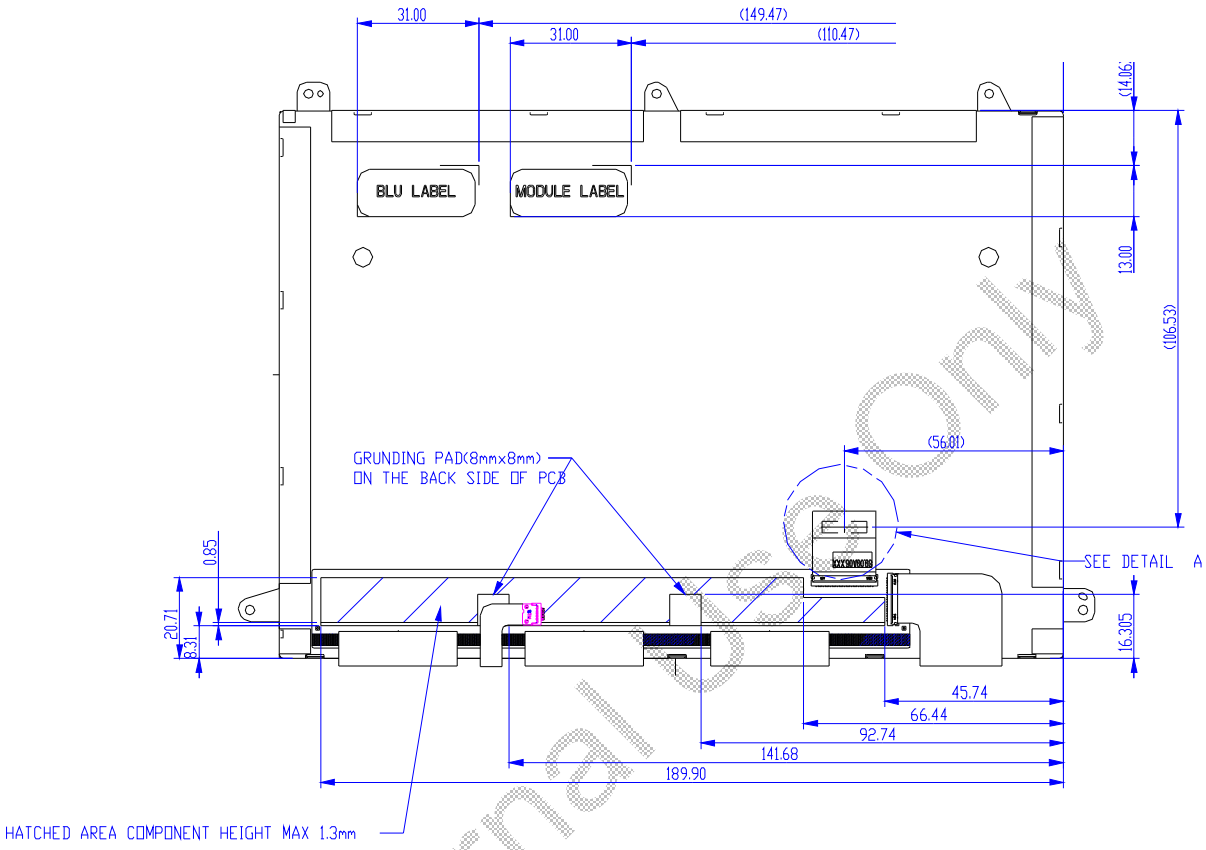


B. Outline Dimension

1. TFT-LCD Module-Front View



2. TFT-LCD Module-Rear View

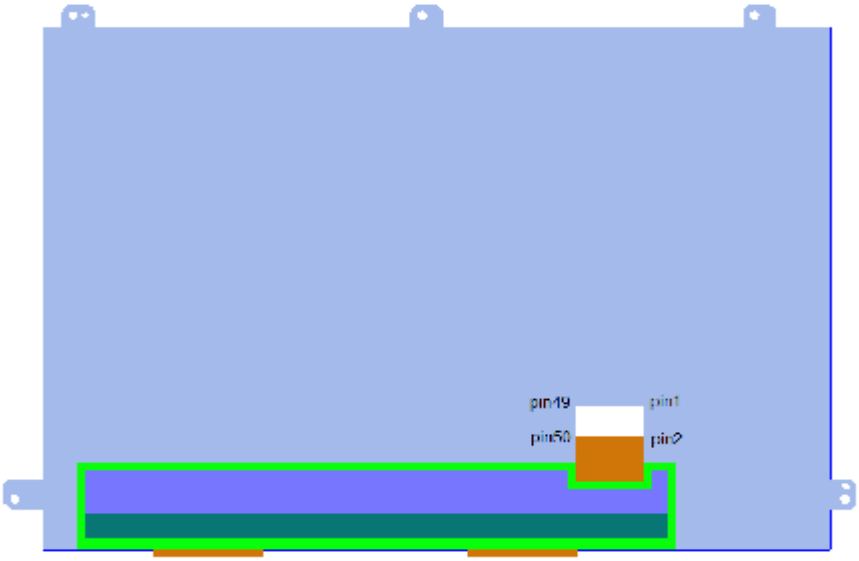


C. Electrical Specifications

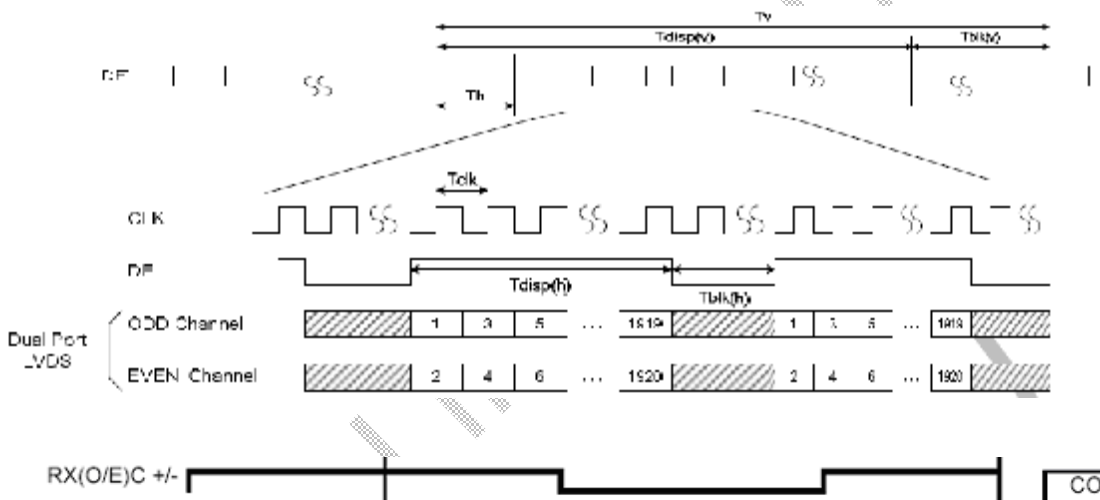
1. TFT LCD Panel Pin Assignment

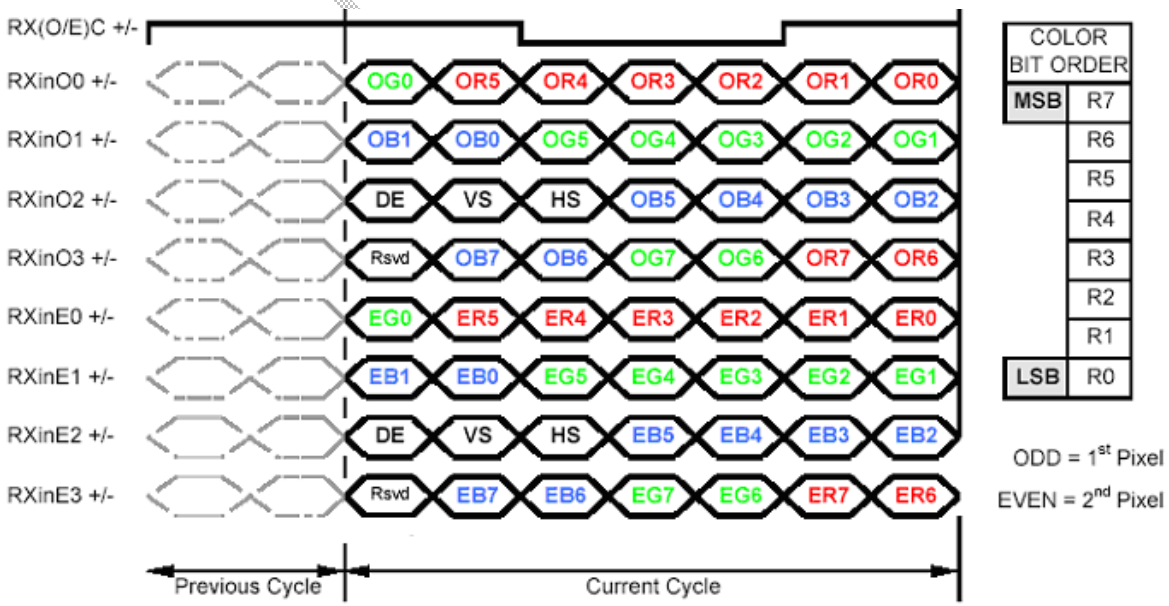
Recommended connector : **DF40C-50DS-0.4V(51)**

NO	Pin Definition	Pin Description	NO	Pin Definition	Pin Description
1	RXIN0OP	Odd Channel LVDS Positive Data0	2	RXIN0EP	Even Channel LVDS Positive Data0
3	RXIN0ON	Odd Channel LVDS Negative Data0	4	RXIN0EN	Even Channel LVDS Negative Data0
5	GND	Ground	6	GND	Ground
7	RXIN1OP	Odd Channel LVDS Positive Data1	8	RXIN1EP	Even Channel LVDS Positive Data1
9	RXIN1ON	Odd Channel LVDS Negative Data1	10	RXIN1EN	Even Channel LVDS Negative Data1
11	GND	Ground	12	GND	Ground
13	RXIN2OP	Odd Channel LVDS Positive Data2	14	RXIN2EP	Even Channel LVDS Positive Data2
15	RXIN2ON	Odd Channel LVDS Negative Data2	16	RXIN2EN	Even Channel LVDS Negative Data2
17	GND	Ground	18	GND	Ground
19	RXIN3OP	Odd Channel LVDS Positive Data3	20	RXIN3EP	Even Channel LVDS Positive Data3
21	RXIN3ON	Odd Channel LVDS Negative Data3	22	RXIN3EN	Even Channel LVDS Negative Data3
23	GND	Ground	24	GND	Ground
25	RXCLKOP	Odd Channel LVDS Positive Clock	26	RXCLKEP	Even Channel LVDS Positive Clock
27	RXCLKON	Odd Channel LVDS Negative Clock	28	RXCLKEN	Even Channel LVDS Negative Clock
29	GND	Ground	30	GND	Ground
31	VDD	PowerSupply,3.3V(typical)	32	PWM_IN	Back Light Dimming Signal Input
33	VDD	PowerSupply,3.3V(typical)	34	PWM_OUT	Back Light Dimming with DCR Signal Output
35	VDD	PowerSupply,3.3V(typical)	36	GND	Ground
37	GND	Ground	38	VLED	LED Power Supply, 18V(Typical)
39	GND	Ground	40	VLED	LED Power Supply, 18V(Typical)
41	NC	No Connection (Reserve; AUO Internal Use)	42	LED0	LED Feedback Channel 0
43	NC	No Connection (Reserve; AUO Internal Use)	44	LED1	LED Feedback Channel 1
45	SCL	DDC Clock	46	LED2	LED Feedback Channel 2
47	SDA	DDC Data	48	LED3	LED Feedback Channel 3
49	DCR_EN	H: Enable DCR(CABC); L:Disable	50	LED4	LED Feedback Channel 4



2. The Input Data Format





3. Absolute Maximum Ratings

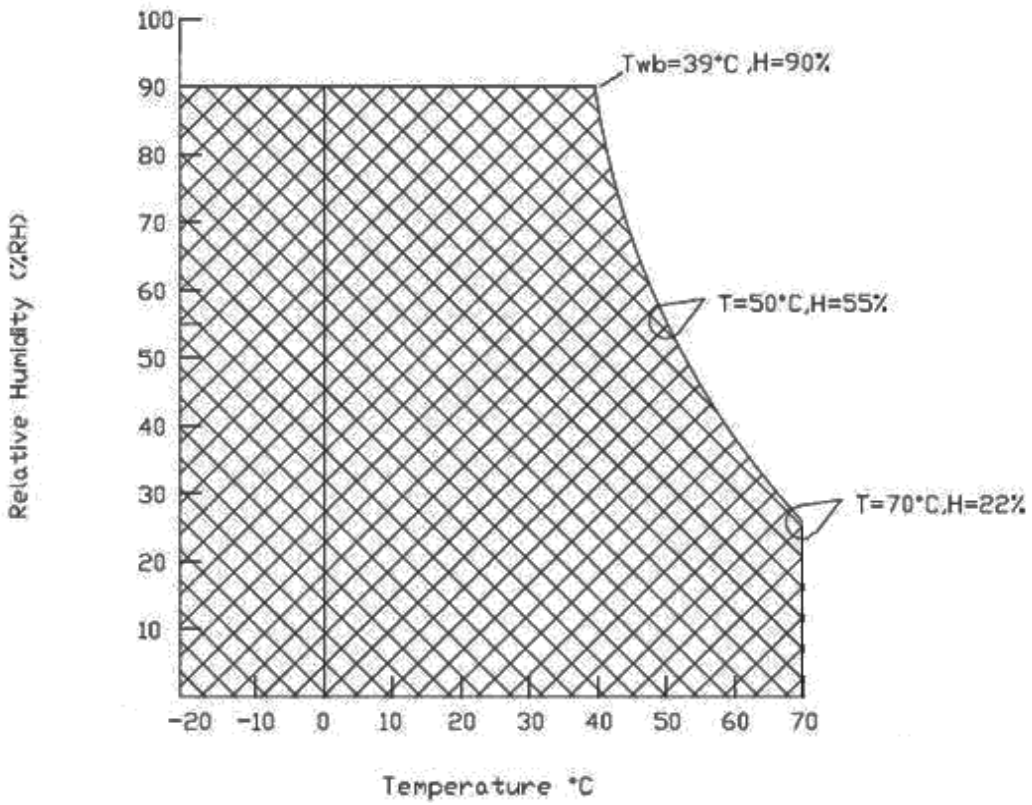
a. Absolute Ratings of TFT LCD Module

Item	Symbol	Min	Max	Unit
Logic/LCD drive Voltage	Vin	-0.3	+4.0	[Volt]

b. Absolute Ratings of Environment

Item	Symbol	Min	Max	Unit
Operating Temperature	TOP	-20	+70	[°C]
Operation Humidity	HOP	5	90	[%RH]
Storage Temperature	TST	-10	+60	[°C]
Storage Humidity	HST	5	90	[%RH]

Note: Maximum Wet-Bulb should be 39 °C and no condensation.



Note 1: Maximum ratings are those values beyond which damages to the device may occur. Functional operation should be restricted to the limits in the Electrical Characteristics chapter.

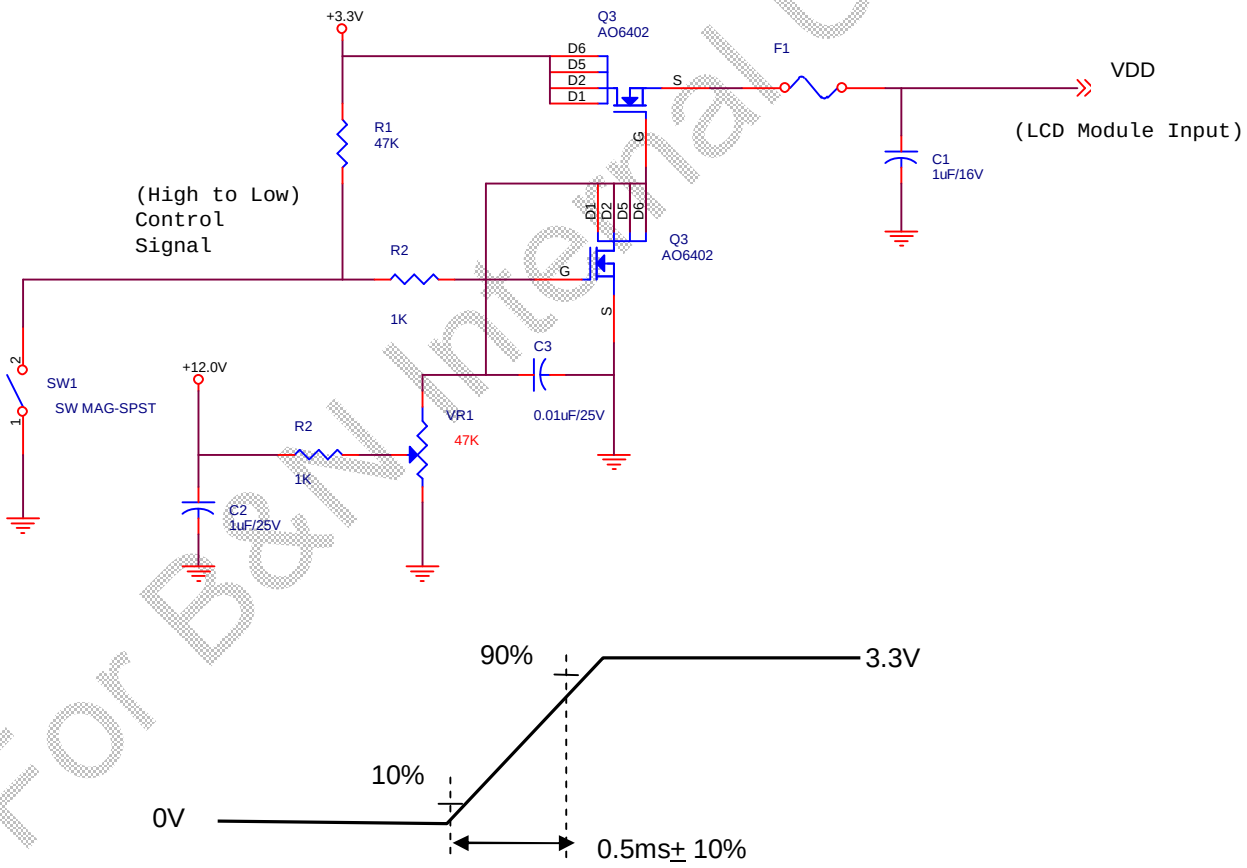
Note 2: Functional operation should be restricted under ambient temperature (25℃).

4. Electrical DC Characteristics

a. DC Charateristics

Symbol	Parameter	Min	Typ	Max	Units	Remark
VDD	Logic/LCD Drive Voltage	3.0	3.3	3.6	[Volt]	
IDD	VDD Current	-	240	-	[mA]	10x10 Chess Pattern (VDD=3.3V, at 60Hz)
Irush	LCD Inrush Current	-	-	1.5	[A]	Note 1
PDD	VDD Power	-	0.8	-	[Watt]	10x10 Chess Pattern (VDD=3.3V, at 60Hz)
VDDrp	Allowable Logic/LCD Drive Ripple Voltage	-	-	100	[mV] p-p	All white Pattern (VDD=3.3V, at 60Hz)

Note 1: Measurement condition:



VDD rising time

b. Backlight Driving Conditions

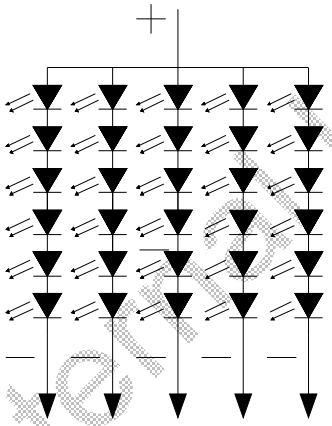
Parameter	Symbol	Min.	Typ.	Max.	Unit	Remark
LED Lightbar current	I_L	-	100	-	mA	Note 1, 2
LED Forward Voltage	Vf		18		V	
Power consumption	P		1.8	-	W	
LED Lightbar life time		TBD	-	-	Hr	Note 1, 2, 3, 4

Note 1: LED backlight is LED lightbar type(30 pcs of LED).

Note 2: Definition of "LED Lifetime": brightness is decreased to 50% of the initial value. LED Lifetime is restricted under normal condition, ambient temperature = 25℃ and LED lightbar current= 100mA

Note 3: The value is only for reference.

Note 4: If it operates with LED lightbar voltage more than 100mA, it maybe decreases LED lifetime.

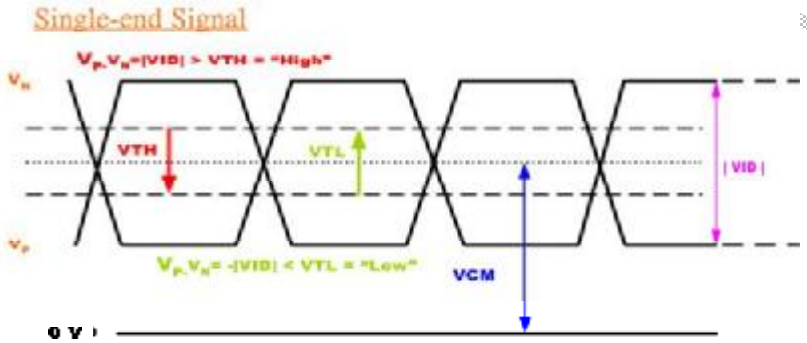


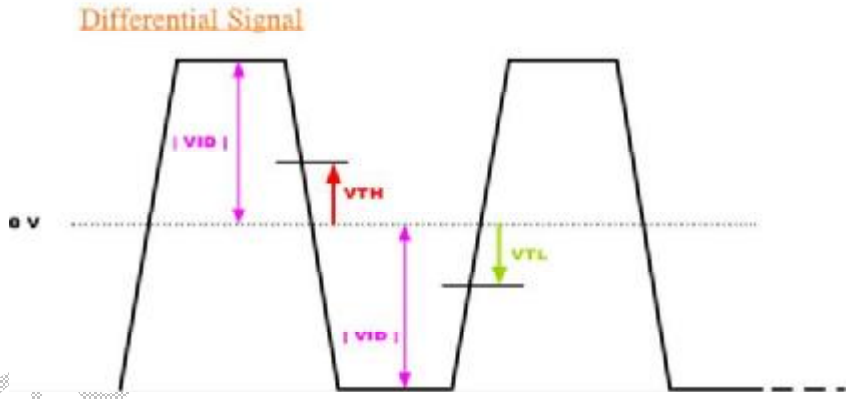
5. LVDS DC Characteristics

A. DC Characteristic

Symbol	Item	Min.	Typ.	Max.	Unit	Remark
VTH	Differential Input High Threshold	-	-	100	[mV]	VCM=1.25V
VTL	Differential Input Low Threshold	100	-	-	[mV]	VCM=1.25V
| VID |	Input Differential Voltage	100	350	600	[mV]	
VICM	Differential Input Common Mode Voltage	1.1	-	1.45	[V]	VTH/VTL=+-100mV

Input signals shall be low or Hi-Z state when VDD is off.



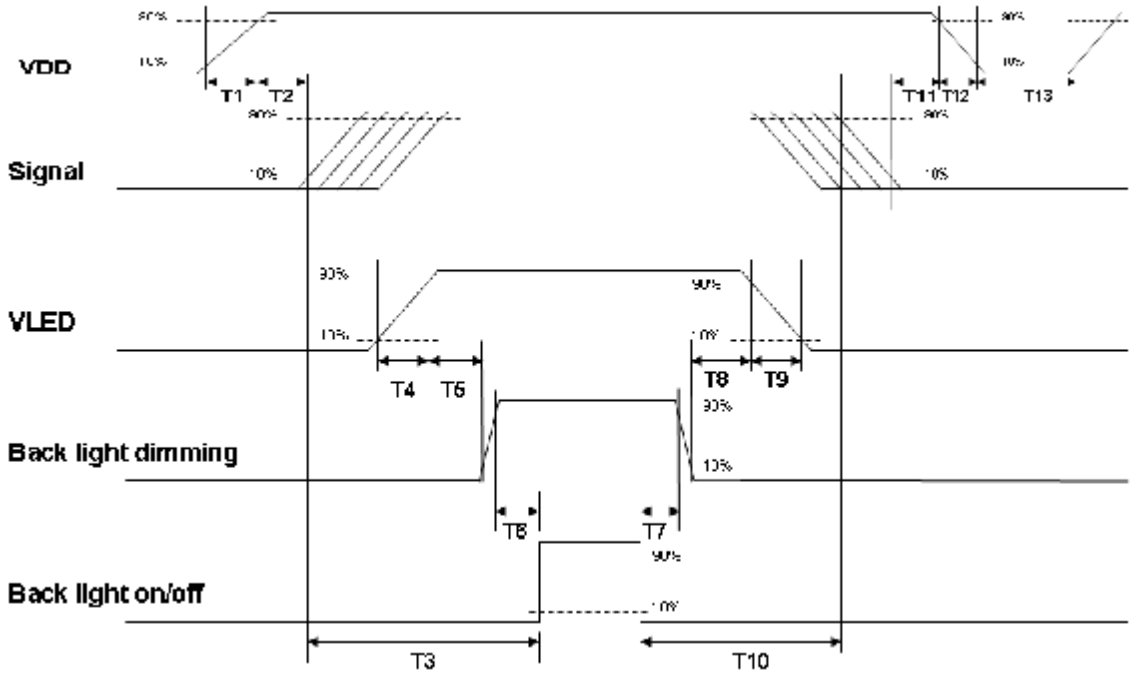


B. Input Timing Setting

Signal		Symbol	Min.	Typ.	Max.	Unit
Clock Frequency		1/ T_{Clock}	20	53	85	MHz
Vertical Section	Period	T_V	TBD	1024	TBD	T_{Line}
	Active	T_{VD}	--	960	--	
	Blanking	T_{VB}	TBD	64	TBD	
Horizontal Section	Period	T_H	TBD	864	TBD	T_{Clock}
	Active	T_{HD}	--	720	--	
	Blanking	T_{HB}	TBD	144	TBD	
Frame Rate		F	--	60	--	Hz

Note : DE mode.

c. Recommended Power On/OFF Sequence



Parameter	Value			Units
	Min.	Typ.	Max.	
T1	0.5	-	10	[ms]
T2	30	40	50	[ms]
T3	200	--	--	[ms]
T4	0.5	--	10	[ms]
T5	10	-	-	[ms]
T6	10	-	-	[ms]
T7	0	-	-	[ms]
T8	10	-	-	[ms]
T9	--	--	10	[ms]
T10	110	--	--	[ms]
T11	0	16	50	[ms]
T12	-	-	10	[ms]
T13	1000	-	-	[ms]

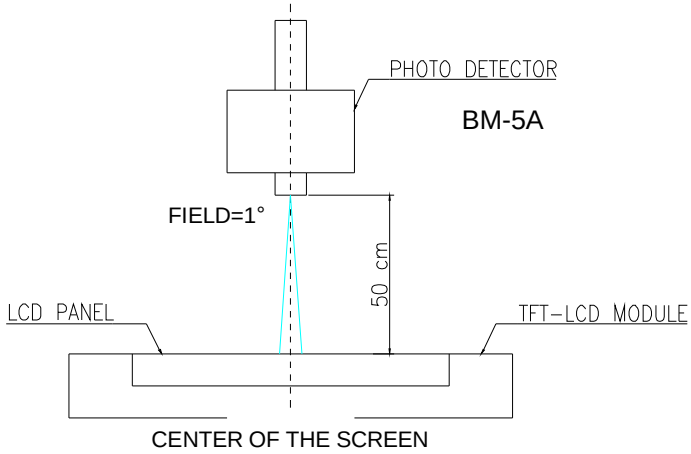
D. Optical Specification

All optical specification is measured under typical condition (Note 1, 2)

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Response Time Rise Fall		Tr Tf	θ=0°	-- --	12 18	20 30	ms ms	Note 3
Contrast ratio		CR	At optimized viewing angle	--	800	--		Note 4
Viewing Angle	Top Bottom Left Right		CR≧10	70 70 70 70	85 85 85 85		deg.	Note 5
Brightness		Y_L	V_L = 12V	320	400	--	cd/m^2	Note 6
Chromaticity	White	X	θ=0°	0.273	0.313	0.353		
		Y	θ=0°	0.297	0.337	0.377		
	Red	X	θ=0°	TBD	TBD	TBD		
		Y	θ=0°	TBD	TBD	TBD		
	Green	X	θ=0°	TBD	TBD	TBD		
		Y	θ=0°	TBD	TBD	TBD		
	Blue	X	θ=0°	TBD	TBD	TBD		
		Y	θ=0°	TBD	TBD	TBD		
Uniformity 5 Points		ΔY_L	%	80	--	--	%	Note 7
Uniformity 13 Points		ΔY_L	%	70	--	--	%	Note 8

Note 1 : To be measured in the dark room. Ambient temperature =25℃, and LED lightbar current I_L = 100mA.

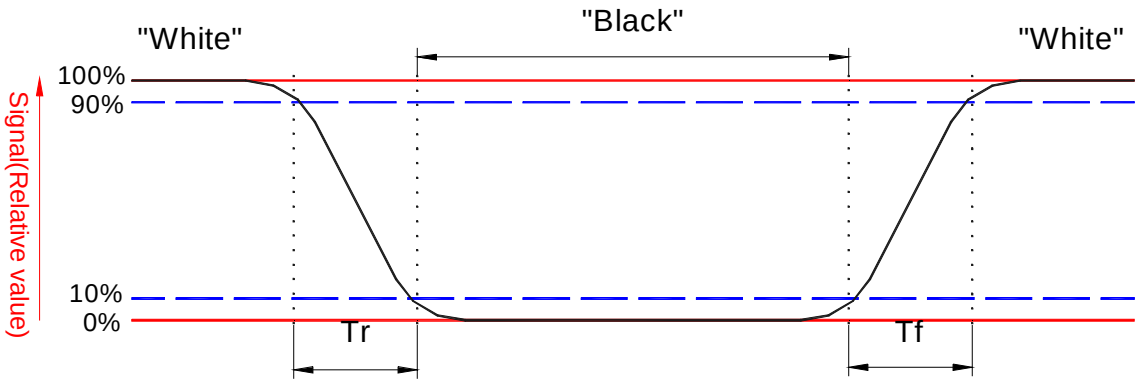
Note 2 :To be measured on the center area of panel with a viewing cone of 1°by Topcon luminance meter BM-5A, after 15 minutes operation.



Note 3: Definition of response time:

The output signals of photo detector are measured when the input signals are changed from "black" to "white"(falling time) and from "white" to "black"(rising time), respectively.

The response time is defined as the time interval between the 10% and 90% of amplitudes. Refer to figure as below.

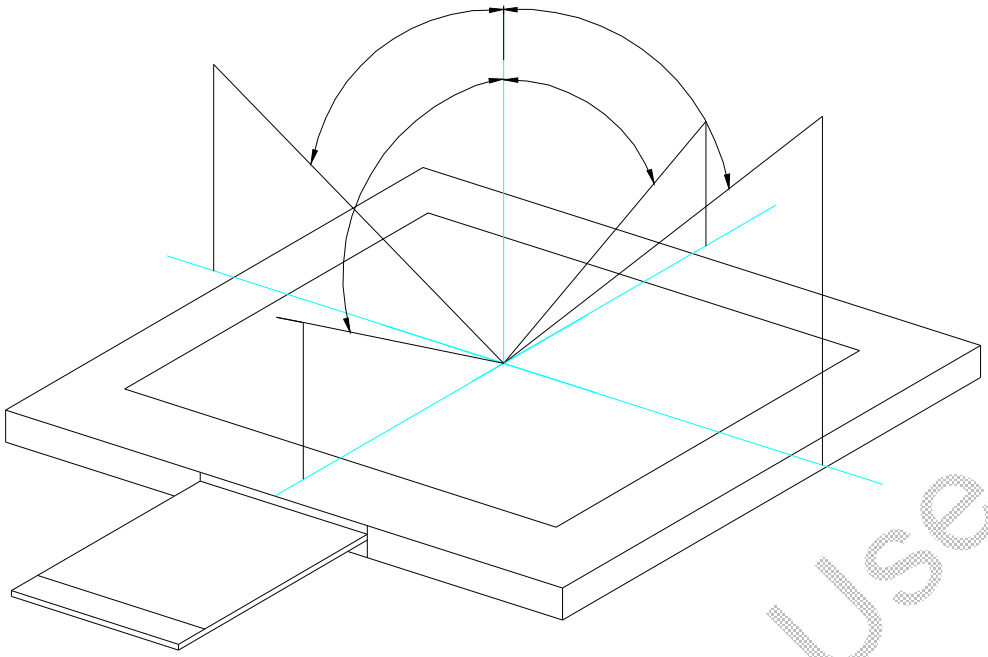


Note 4.Definition of contrast ratio:

Contrast ratio is calculated with the following formula.

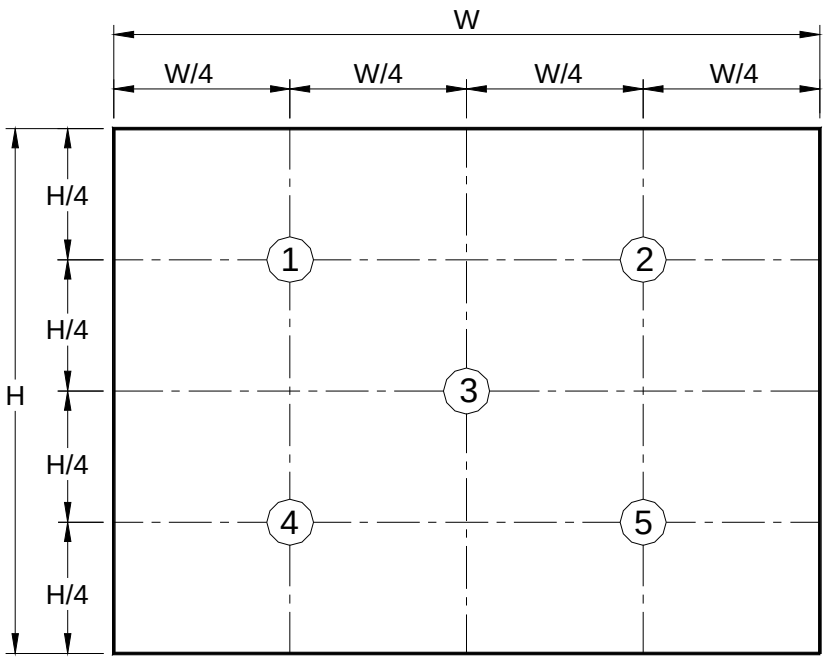
$$\text{Contrast ratio (CR)} = \frac{\text{Photo detector output when LCD is at "White" status}}{\text{Photo detector output when LCD is at "Black" status}}$$

Note 5. Definition of viewing angle, θ, Refer to figure as below.



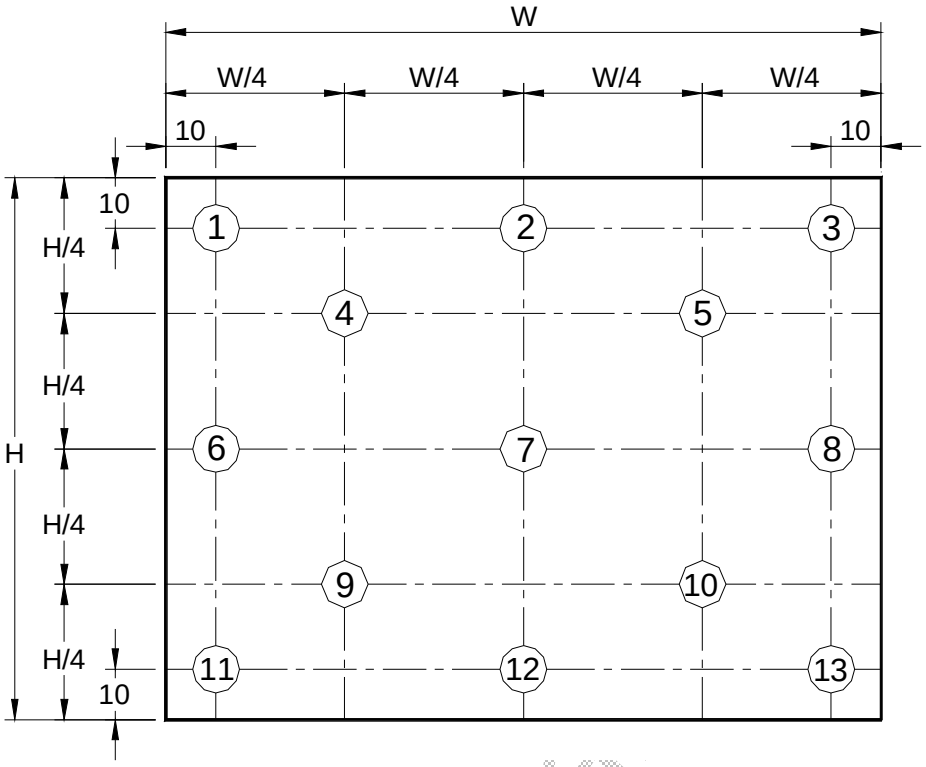
Note 6. Measured at the center area of the panel when all the input terminals of LCD panel are electrically opened.

Note 7: Luminance Uniformity of these 5 points is defined as below:



$$\text{Uniformity} = \frac{\text{minimum luminance in 5 points (1-5)}}{\text{maximum luminance in 5 points (1-5)}}$$

Note 8: Luminance Uniformity of these 13 points is defined as below:



$$\text{Uniformity} = \frac{\text{minimum luminance in 13 points (1-13)}}{\text{maximum luminance in 13 points (1-13)}}$$

E. Reliability Test Items

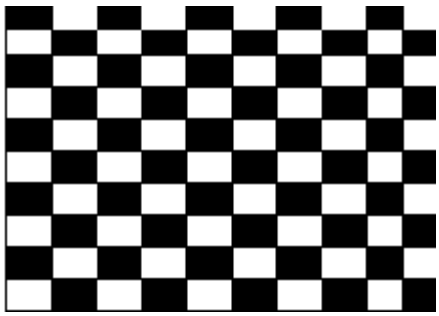
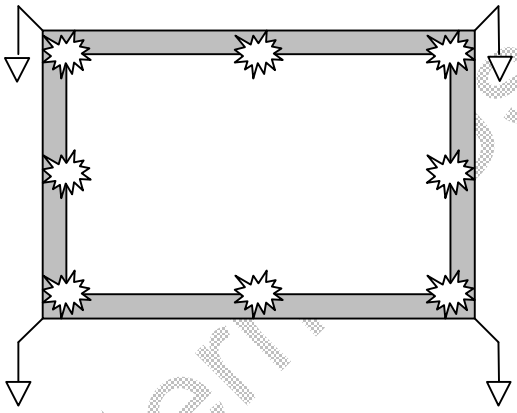
No.	Test items	Conditions	Remark
1	High Temperature Storage	Ta= 70℃ 240Hrs	
2	Low Temperature Storage	Ta= -20℃ 240Hrs	
3	High Ttemperature Operation	Tp= 60℃ 240Hrs	
4	Low Temperature Operation	Ta=-10℃ 240Hrs	
5	High Temperature & High Humidity	Tp= 60℃. 90% RH 240Hrs	Operation
6	Heat Shock	-20℃~70℃, 100 cycle, 1Hrs/cycle	Non-operation
7	Electrostatic Discharge	Contact = ± 4 kV, class B Air = ± 8kV, class B	Note 4
8	Image Sticking	25℃, 2hrs	Note 5
9	Vibration	Frequency range : 10~55Hz Stoke : 1.5mm Sweep : 10 ~ 55 ~ 10Hz 2 hours for each direction of X,Y,Z (6 hours for total)	Non-operation JIS C7021, A-10 condition A : 15 minutes
10	Mechanical Shock	100G . 6ms, ±X,±Y,±Z 3 times for each direction	Non-operation JIS C7021, A-7 condition C
11	Vibration (With Carton)	Random vibration: $0.015G^2$/Hz from 5~200Hz –6dB/Octave from 200~500Hz	IEC 68-34
12	Drop (With Carton)	Height: 60cm 1 corner, 3 edges, 6 surfaces	
13	Pressure	5kg, 5sec	Note 6

Note 1: Ta: Ambient Temperature. Tp: Panel Surface Temperature

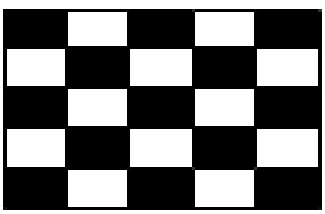
Note 2: In the standard conditions, there is not display function NG issue occurred. All the cosmetic specification is judged before the reliability stress.

Note 3: All the cosmetic specification is judged before the reliability stress.

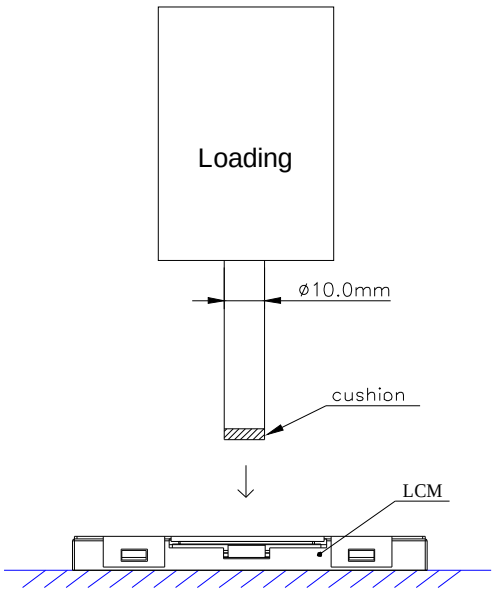
Note4 : All test techniques follow IEC6100-4-2 standard.

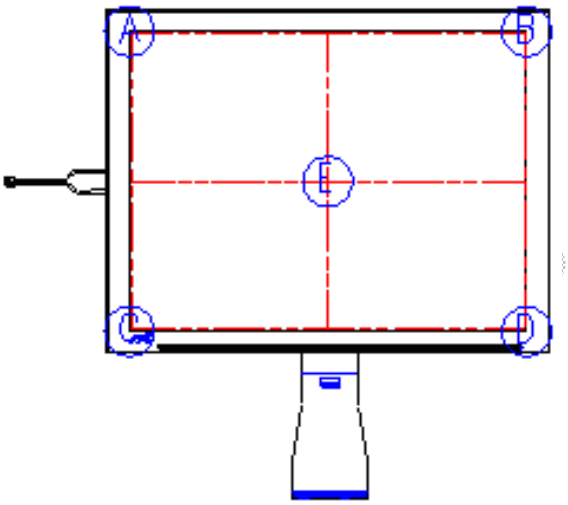
Test Condition		Note
Pattern	10x10 Chess Board 	
Procedure And Set-up	Contact Discharge：330Ω, 150pF, 1sec, 8 point, 10 times/point Air Discharge：330Ω, 150pF, 1sec, 8 point, 10 times/point 	
Criteria	B – Some performance degradation allowed. No data lost. Self-recoverable hardware failure.	
Others	1. Gun to Panel Distance 2. No SPI command, keep default register settings.	

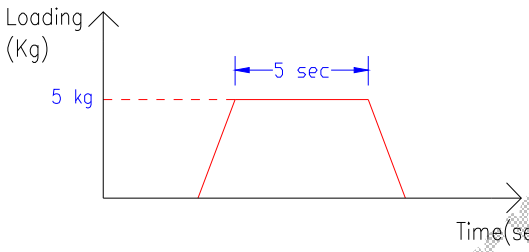
Note 5: Operate with 5×5 chess board pattern as figure and lasting time and temperature as the conditions. Then judge with 127 gray level after waiting 30 min, the mura is less than ND 5%.



Note 6: The panel is tested as figure. The jig is ϕ10 mm made by Cu with rubber and the loading speed is 3mm/min on position A~E. After the condition, no glass crack will be found and panel function check is OK.(no guarantee LC mura、LC bubble)







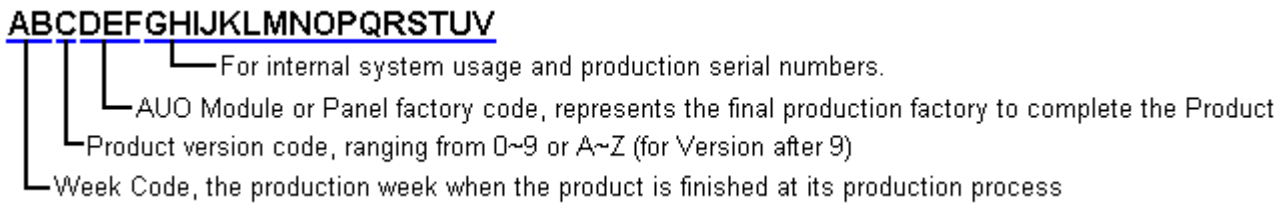
F. Packing and Marking

1. Packing Form

TBD

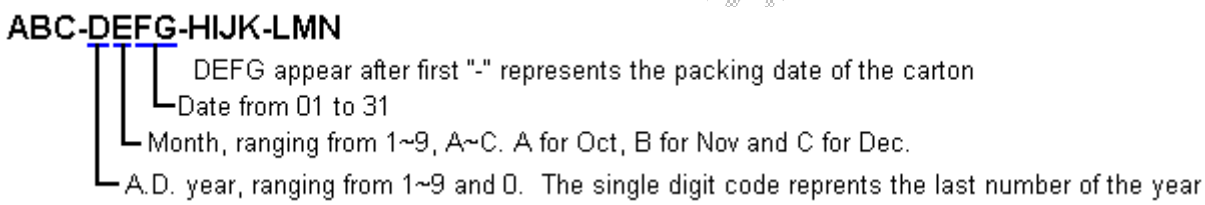
2. Module/Panel Label Information

The module/panel (collectively called as the “Product”) will be attached with a label of Shipping Number which represents the identification of the Product at a specific location. Refer to the Product outline drawing for detailed location and size of the label. The label is composed of a 22-digit serial number and printed with code 39/128 with the following definition:



3. Carton Label Information

The packing carton will be attached with a carton label where packing Q’ty, AUO Model Name, AUO Part Number, Customer Part Number (Optional) and a series of Carton Number in 13 or 14 digits are printed. The Carton Number is apparing in the following format:



Refer to the drawing of packing format for the location and size of the carton label.

G. Application Note

1. Application Circuit

TBD

2. CABC function block

TBD

H. Precautions

1. Do not twist or bend the module and prevent the unsuitable external force for display module during assembly.
2. Adopt measures for good heat radiation. Be sure to use the module with in the specified temperature.
3. Avoid dust or oil mist during assembly.
4. Follow the correct power sequence while operating. Do not apply the invalid signal, otherwise, it will cause improper shut down and damage the module.
5. Less EMI: it will be more safety and less noise.
6. Please operate module in suitable temperature. The response time & brightness will drift by different temperature.
7. Avoid to display the fixed pattern (exclude the white pattern) in a long period, otherwise, it will cause image sticking.
8. Be sure to turn off the power when connecting or disconnecting the circuit.
9. Polarizer scratches easily, please handle it carefully.
10. Display surface never likes dirt or stains.
11. A dewdrop may lead to destruction. Please wipe off any moisture before using module.
12. Sudden temperature changes cause condensation, and it will cause polarizer damaged.
13. High temperature and humidity may degrade performance. Please do not expose the module to the direct sunlight and so on.
14. Acetic acid or chlorine compounds are not friends with TFT display module.
15. Static electricity will damage the module, please do not touch the module without any grounded device.
16. Do not disassemble and reassemble the module by self.
17. Be careful do not touch the rear side directly.
18. No strong vibration or shock. It will cause module broken.
19. Storage the modules in suitable environment with regular packing.
20. Be careful of injury from a broken display module.
21. Please avoid the pressure adding to the surface (front or rear side) of modules, because it will cause the display non-uniformity or other function issue.