AUO Display+

CUSTOMER APPROVAL SHEET

Company Name	
MODEL	A029SAT01.0
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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Product Specification

2.9" TFT-LCD MODULE

Model Name： **A029SAT01.0**

Planned Lifetime:

Phase-out Control:

EOL Schedule:

< □ >Preliminary Specification

< >Final Specification

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

Version	Revise Date	Page	Content
0.0	2021/09/22		First Draft

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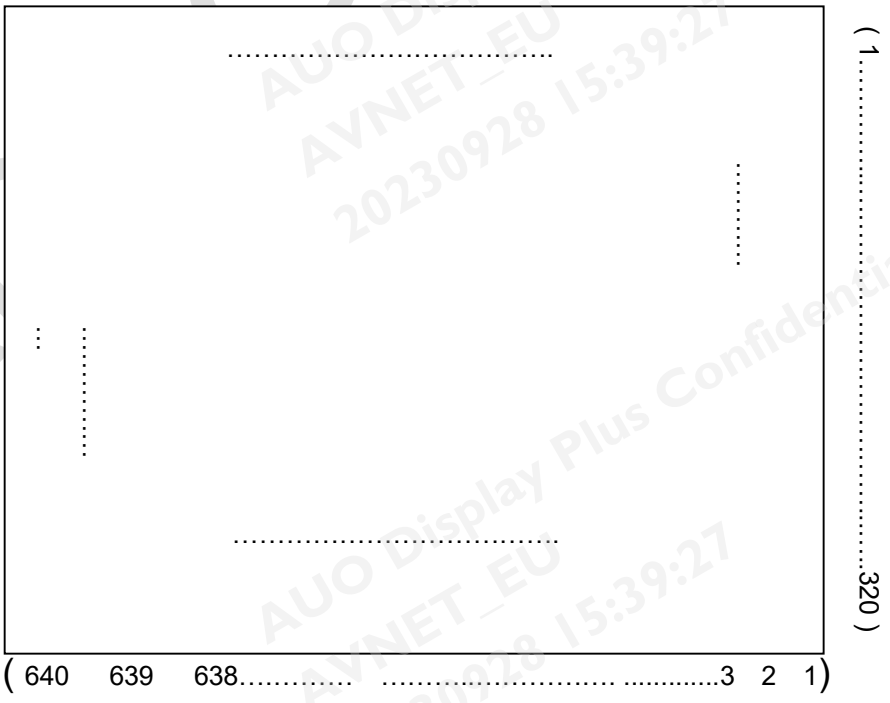
A. General Information

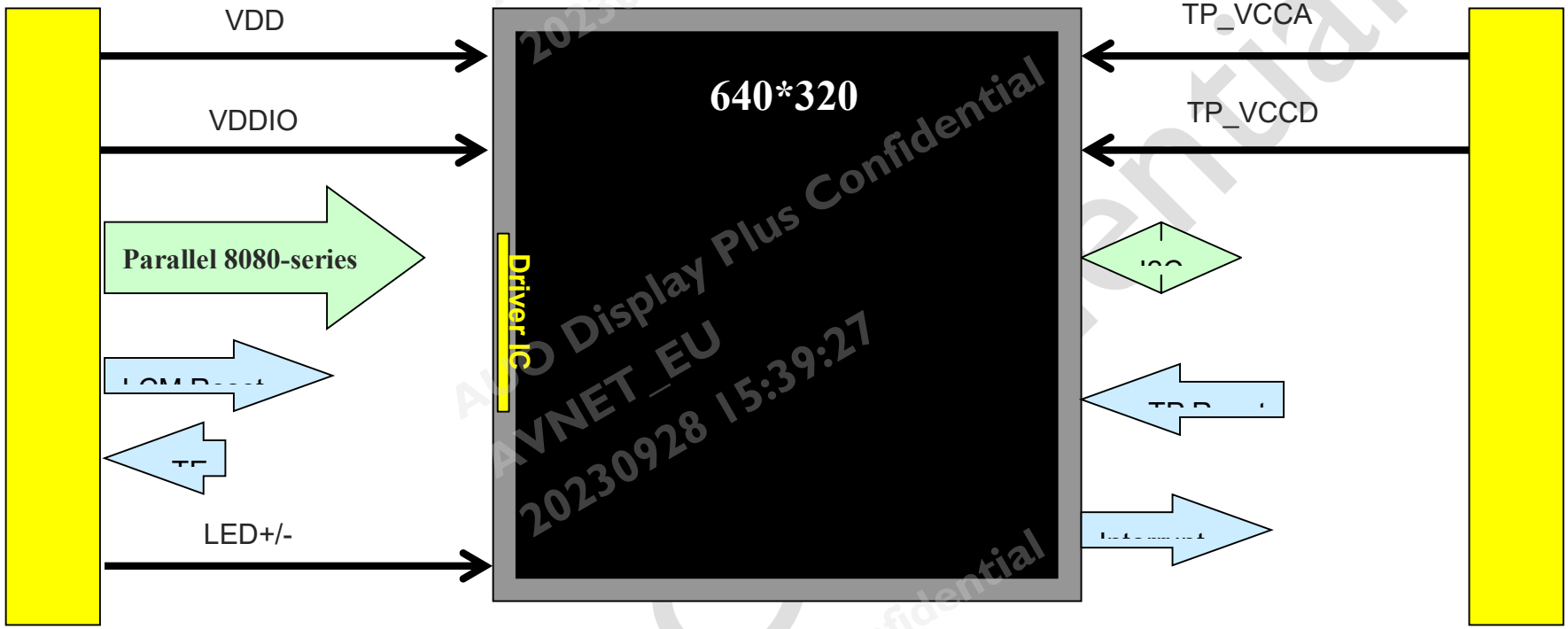
NO.	Item	Unit	Specification	Remark
1	Screen Size	inch	2.9(Diagonal)	
2	Display Resolution	dot	640 (mono) x 320	
3	Overall Dimension	mm	79.9(H)×79.9(V)x3.38(Max)(T)	Note 1
4	Active Area	mm	64.96(H) x 32.48(V)	
5	Pixel Pitch	mm	0.1015(H)x0.1015(V)	
6	Color Configuration	--	Mono	NA
7	Color Depth	--	Parallel 8080-series MCU Interface (8-bit)	
8	NTSC Ratio	%	NA	
9	Display Mode	--	Normally Black	
10	Panel surface Treatment	--	AF	
11	Weight	g	27.5(typ.)	
12	Panel Power Consumption	mW	24.55(typ.)	
13	Backlight Power Consumption	W	0.223(typ.)	
14	Touch Sensor Type		Projected Capacitive Touch Panel	
15	Touch Structure		GFF	
16	Coverlens Thickness/Materials		1.1mm DT Glass	
17	Touch Channel(X*Y)		11Rx , 11Tx	

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

Note 2: Below figure shows dot stripe arrangement.

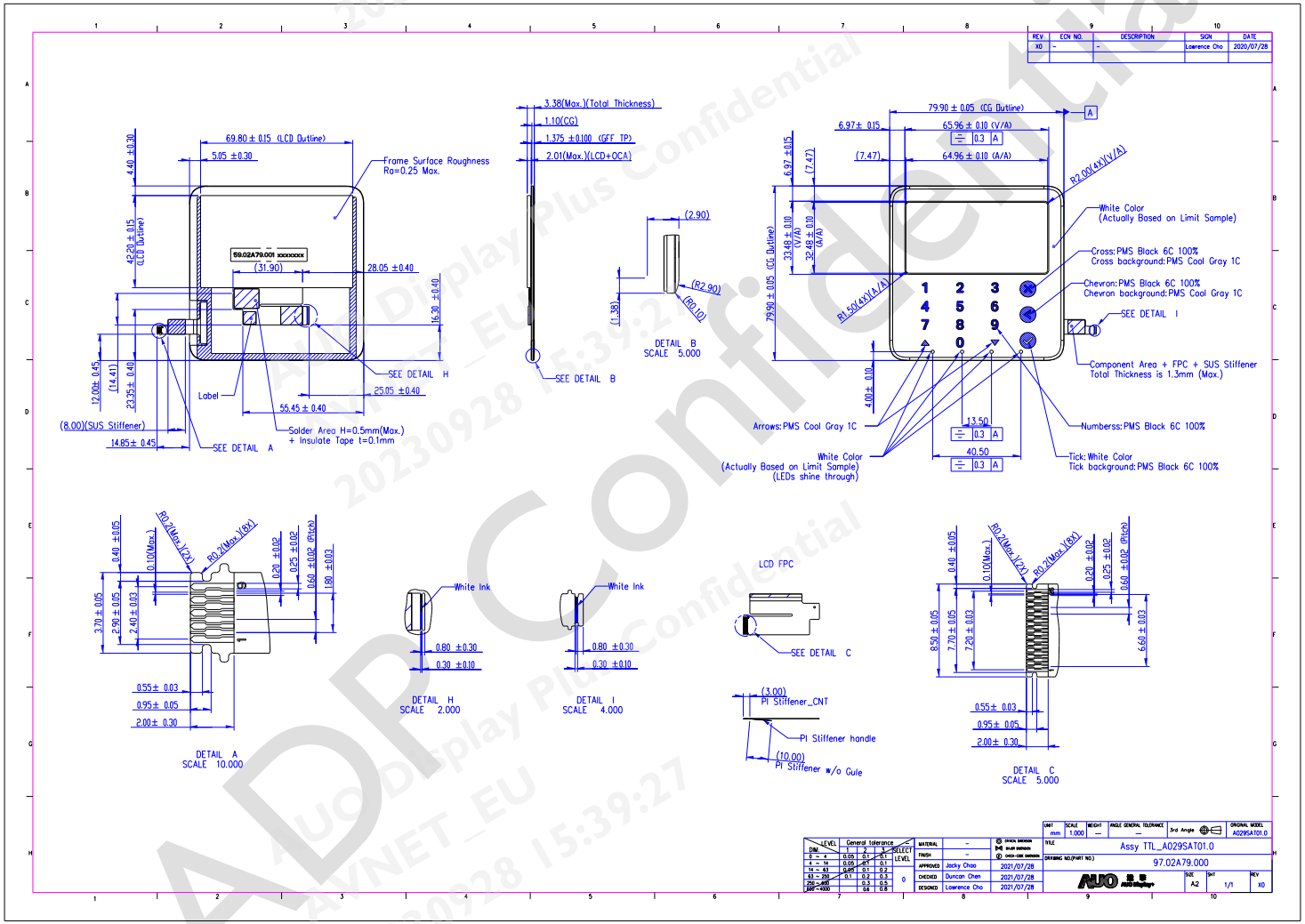


B. Block Diagram



C. Outline Dimension

1. TFT-LCD Module – Front View/ Rear View (preliminary)



D. Electrical Specifications

1. TFT LCD Panel Pin Assignment

Connector Name / Designation	LCM Connector
Manufacturer	Molex
Mating Connector Model Number	504754-2500

NO.	Symbol	Description
1	GND	Ground
2	BKL_ANODE	Backlight power supply (+)
3	BKL_CATHODE1	Backlight power supply (-)
4	BKL_CATHODE2	Backlight power supply (-)
5	GND	Ground
6	VDD	Analog power supply
7	VDDIO	Digital logic and I/O power supply
8	GND	Ground
9	LCD_RST#	Display reset
10	SMC_CE0#	8080-I Chip Select (CS#)
11	SMC_A0	8080-I Data/Command Select (D/C#)
12	SMC_WE#	8080-I Write Operation Indication (WR#)
13	SMC_OE#	8080-I Read Operation Indication (RD#)
14	GND	Ground
15	SMC_D0	8080-I Data[0]
16	SMC_D1	8080-I Data[1]
17	SMC_D2	8080-I Data[2]
18	SMC_D3	8080-I Data[3]
19	SMC_D4	8080-I Data[4]
20	SMC_D5	8080-I Data[5]
21	SMC_D6	8080-I Data[6]
22	SMC_D7	8080-I Data[7]
23	GND	Ground
24	FMARK	Tearing effect signal
25	NC	No connect (for AUO test use)

2. TP Pin Assignment

Connector Name / Designation	LCM Connector
Manufacturer	Molex
Mating Connector Model Number	504754-0900

NO.	Symbol	Description
1	TP_EN	Reset
2	TAMPER3_N	
3	TP_IRQ#	Touch screen interrupt
4	I2CSecure_SDA	Data line
5	GND	Ground
6	TAMPER3_P	
7	I2CSecure_SCL	Serial clock line
8	VCCD	Digital Power
9	VCCA	Analog Power

3. Absolute Maximum Ratings

Item	Symbol	Min.	Max.	Unit
Power Voltage	VDD	-0.3	4	V
	VDDIO	-0.3	4	V
	VCCD	-0.3	4	V
	VCCA	-0.3	4	V

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

Item	Symbol	Min.	Typ.	Max.	Unit
Power supply	VDD	2.4	2.75	3.3	V
	VDDIO	1.65	1.8	3.3	V
	VCCD	1.65	3.3	3.6	V
	VCCA	2.7	3.3	3.6	V
LCM Input voltage	VIH	VDDIOx0.7	-	VDDIO	V
	VIL	0	-	VDDIOx0.3	V
TP Input voltage	VTIH	VCCDx0.75	-	VCCD	V
	VTIL	0	-	VCCD x0.25	V

b. Power Consumption

Parameter	Symbol	Typ.	Max.	Unit	Remark
Normal mode	$I_{VDD}+I_{VDDIO}$	7.44	8.93	mA	Note 1
Sleep mode	$I_{VDD}+I_{VDDIO}$	5.1	6.1	mA	
TP	$I_{TP\_3V3}+I_{TP\_1V8}$	12	14.4	mA	

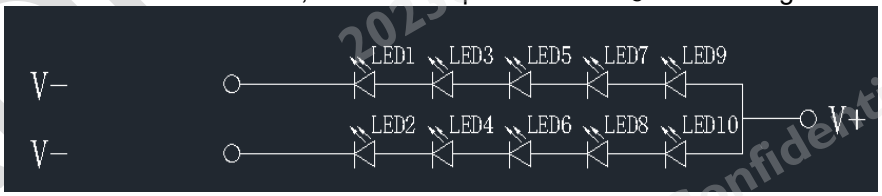
Note 1: Test condition: black Pattern, 25℃

c. Backlight Driving Conditions

Parameter	Symbol	Min.	Typ.	Max.	Unit	Remark
LED Lightbar current	I_L	-	14.6	-	mA	Note 1, 2
LED Lightbar Voltage	V_L		15.25	16.5	V	
Power consumption	P		0.223	0.241	W	
LED Lightbar life time		20,000	-	-	Hr	Note 1, 2, 3, 4

Note 1: LED backlight is LED lightbar type(10 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= 14.6mA

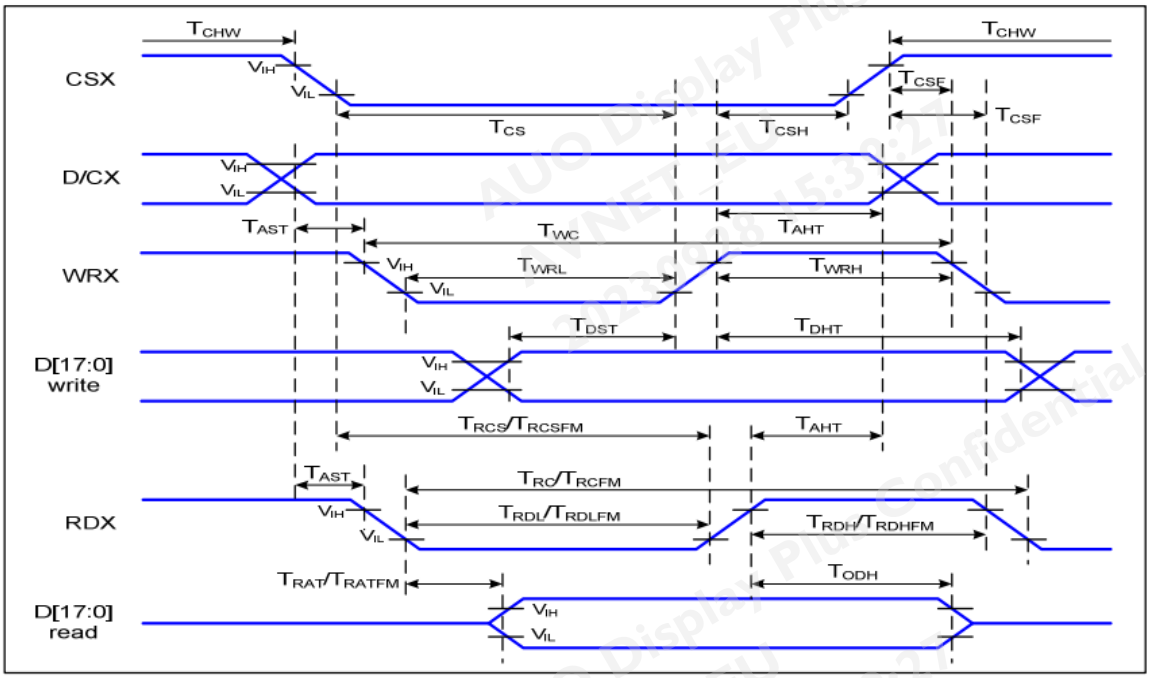


Note 3: The value is only for reference.

Note 4: If it operates with LED lightbar voltage more than 14.6mA, it maybe decreases LED lifetime.

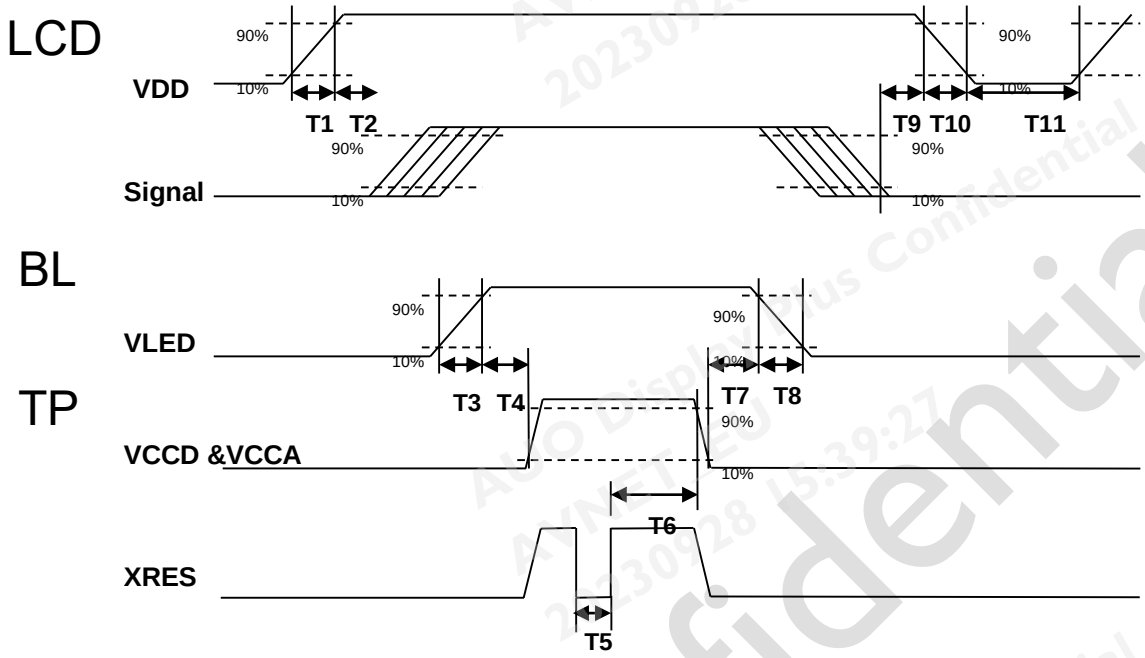
5. Input Timing

Signal	Symbol	Parameter	Min	Max	Unit	Description
D/CX	T_{AST}	Address setup time	0		ns	-
	T_{AHT}	Address hold time (Write/Read)	10		ns	
CSX	T_{CHW}	Chip select "H" pulse width	0		ns	-
	T_{CS}	Chip select setup time (Write)	15		ns	
	T_{RCS}	Chip select setup time (Read ID)	45		ns	
	T_{RCSFM}	Chip select setup time (Read FM)	355		ns	
	T_{CSF}	Chip select wait time (Write/Read)	10		ns	
	T_{CSH}	Chip select hold time	10		ns	
WRX	T_{WC}	Write cycle	66		ns	
	T_{WRH}	Control pulse "H" duration	15		ns	
	T_{WRL}	Control pulse "L" duration	15		ns	
RDX (ID)	T_{RC}	Read cycle (ID)	160		ns	When read ID data
	T_{RDH}	Control pulse "H" duration (ID)	90		ns	
	T_{RDL}	Control pulse "L" duration (ID)	45		ns	
RDX (FM)	T_{RCFM}	Read cycle (FM)	450		ns	When read from frame memory
	T_{RDHFM}	Control pulse "H" duration (FM)	90		ns	
	T_{RDLFM}	Control pulse "L" duration (FM)	355		ns	
D[17:0]	T_{DST}	Data setup time	10		ns	For CL=30pF
	T_{DHT}	Data hold time	10		ns	
	T_{RAT}	Read access time (ID)		40	ns	
	T_{RATFM}	Read access time (FM)		340	ns	
	T_{ODH}	Output disable time	20	80	ns	



6. Recommended Power ON/OFF Sequence

VDD power, backlight and touch on/off sequence is as below. Interface signals are also shown in the chart.
Signals from any system shall be Hi-Z state or low level when VDD is off.



Power ON/OFF Sequence Timing

Parameter	Value			Unit
	Min.	Typ.	Max.	
T1	0.5	-	10	[ms]
T2	30	40	50	[ms]
T3	0.5	-	10	[ms]
T4	10	-	-	[ms]
T5	20	-	-	[ms]
T6	20	-	-	[ms]
T7	10	-	-	[ms]
T8	-	-	10	[ms]
T9	0	16	50	[ms]
T10	-	-	10	[ms]
T11	1000	-	-	[ms]

The detailed LCD power on/off sequence is shown in the figure below

VDDI and VDD can be applied in any order. VDD and VDDI can be power down in any order.

During power off, if LCD is in the Sleep Out mode, VDD and VDDI must be powered down minimum 120msec after RESX has been released. During power off, if LCD is in the Sleep In mode, VDDI or VDD can be powered down minimum 0msec after RESX has been released.

CSX can be applied at any timing or can be permanently grounded. RESX has priority over CSX.

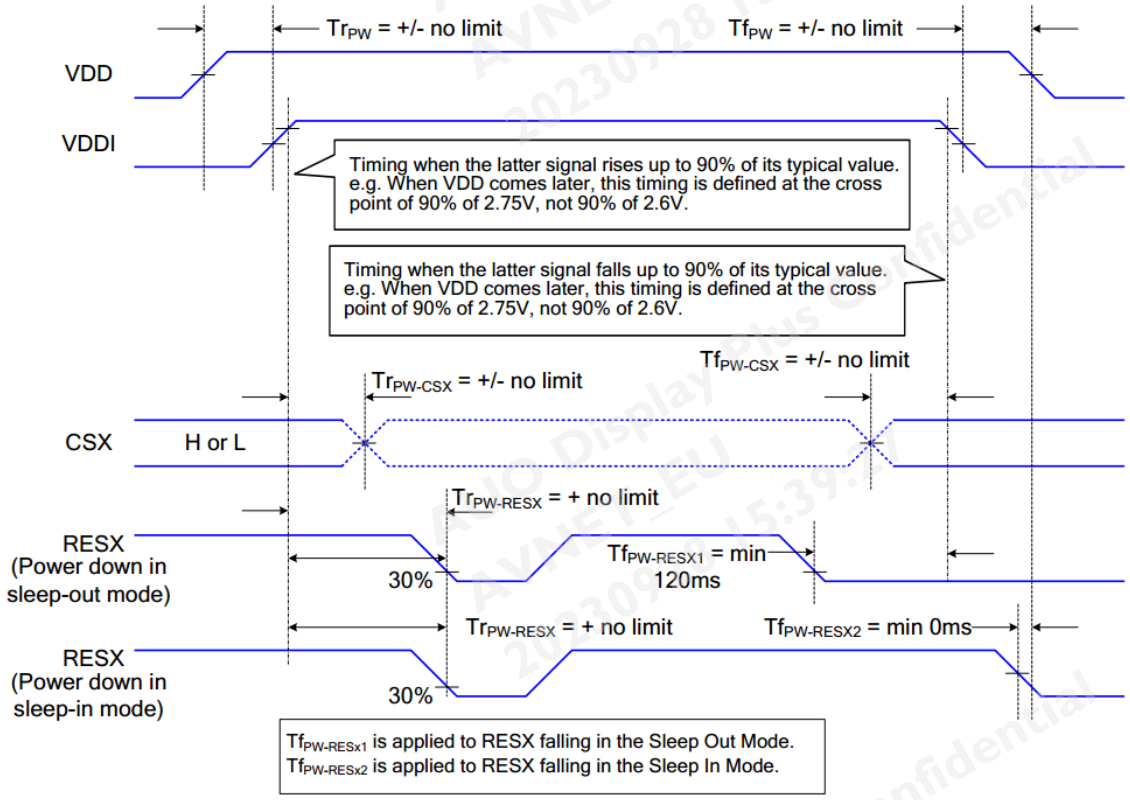
Note 1: There will be no damage to the display module if the power sequences are not met.

Note 2: There will be no abnormal visible effects on the display panel during the Power On/Off Sequences.

Note 3: There will be no abnormal visible effects on the display between end of Power On Sequence and before receiving Sleep Out command. Also between receiving Sleep In command and Power Off Sequence.

Note 4: If RESX line is not held stable by host during Power On Sequence as defined in the sequence below, then it will be necessary to apply a Hardware Reset (RESX) after Host Power On Sequence is complete to ensure correct operation. Otherwise function is not guaranteed.

The power on/off sequence is illustrated below



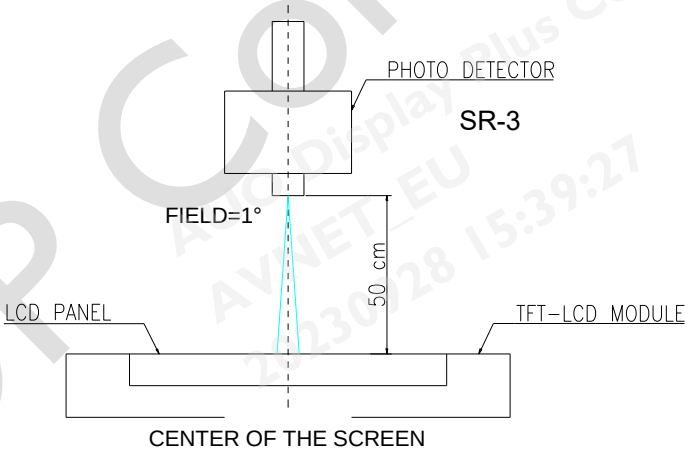
E. Optical Specification

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°	--	--	35	ms	Note 3
Contrast ratio	CR	At optimized viewing angle	700	1000	--		Note 4
Viewing Angle Top Bottom Left Right		CR≧ 10	80	85	--	deg.	Note 5
Brightness	Y_L	VL = 12V	--	450	--	cd/m^2	Note 6
Chromaticity White	X	θ=0°	0.285	0.315	0.345		
	Y	θ=0°	0.290	0.320	0.350		
Uniformity	ΔY_L	%	75	80			Note 7

Note 1 : To be measured in the dark room. Ambient temperature =25□, and LED lightbar current I_L = 40mA.

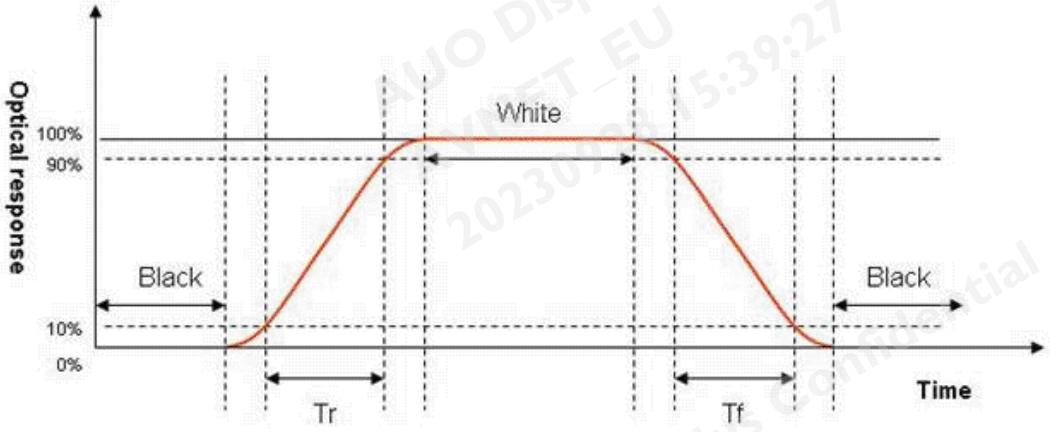
Note 2 :To be measured on the center area of panel with a viewing cone of 1°by Topcon luminance meter SR-3, after 10 minutes operation.



Note 3: Definition of response time:

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

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

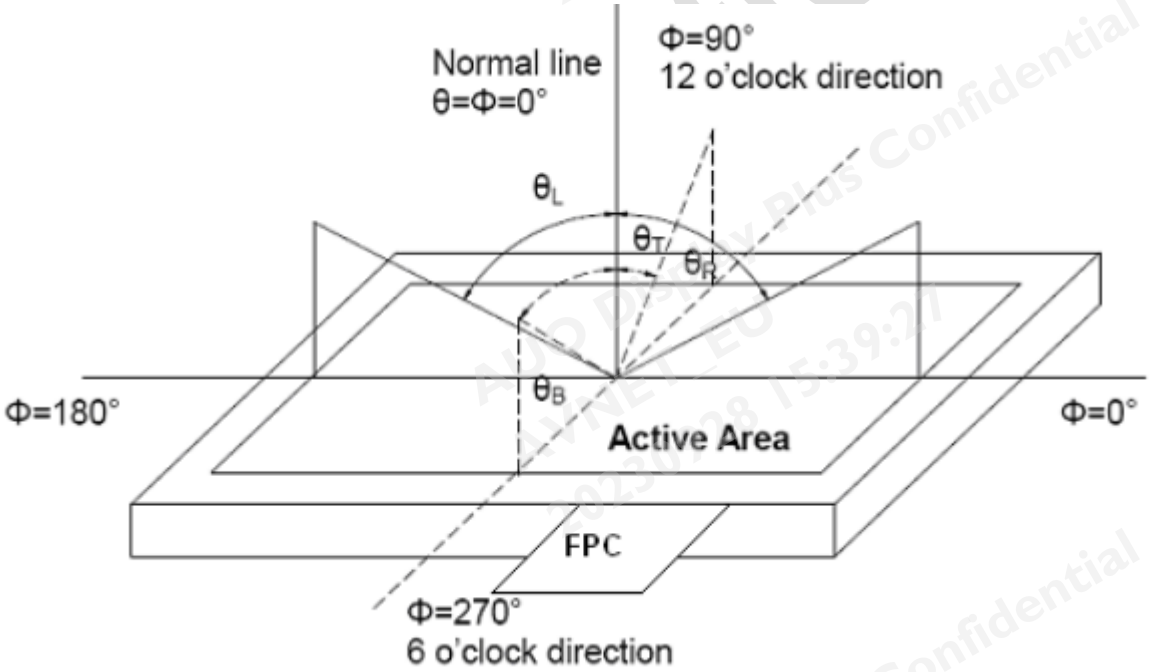


Note 4.Definition of contrast ratio:

Contrast ratio is calculated with the following formula.

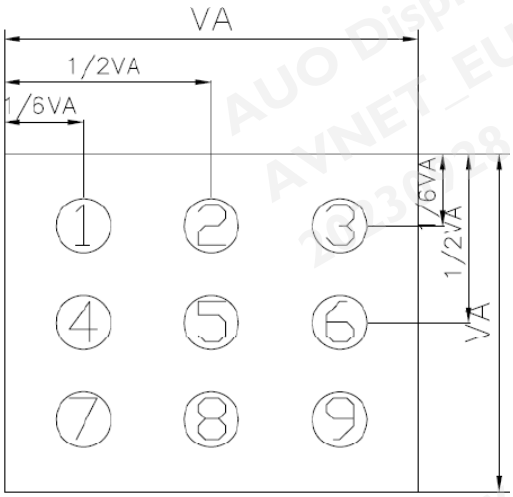
$$\text{Contrast ratio (CR)} = \frac{\text{Photo detector output when LCD is at "White" status}}{\text{Photo detector output when LCD is at "Black" status}}$$

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 9 points is defined as below:



$$\text{Uniformity} = \frac{\text{minimum luminance in 9 points (1-9)}}{\text{maximum luminance in 9 points (1-9)}}$$

F. Reliability Test Items

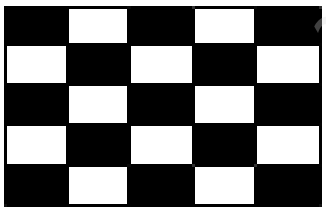
No.	Test items	Conditions	Remark
1	High Temperature Storage	Ta= 80℃ 240Hrs	Note 1 & Note 2
2	Low Temperature Storage	Ta= -30℃ 240Hrs	Note 1 & Note 2
3	High Ttemperature Operation	Tp= 70℃ 240Hrs	Note 1 & Note 2
4	Low Temperature Operation	Ta= -20℃ 240Hrs	Note 1 & Note 2
5	High Temperature & High Humidity	Tp= 60℃. 90% RH 240Hrs	Note 1 & Note 2
6	Image Sticking	25℃, 1hrs	Note 5
7	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
8	Mechanical Shock	100G . 6ms, ±X,±Y,±Z 3 times for each direction	Non-operation JIS C7021, A-7 condition C

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.

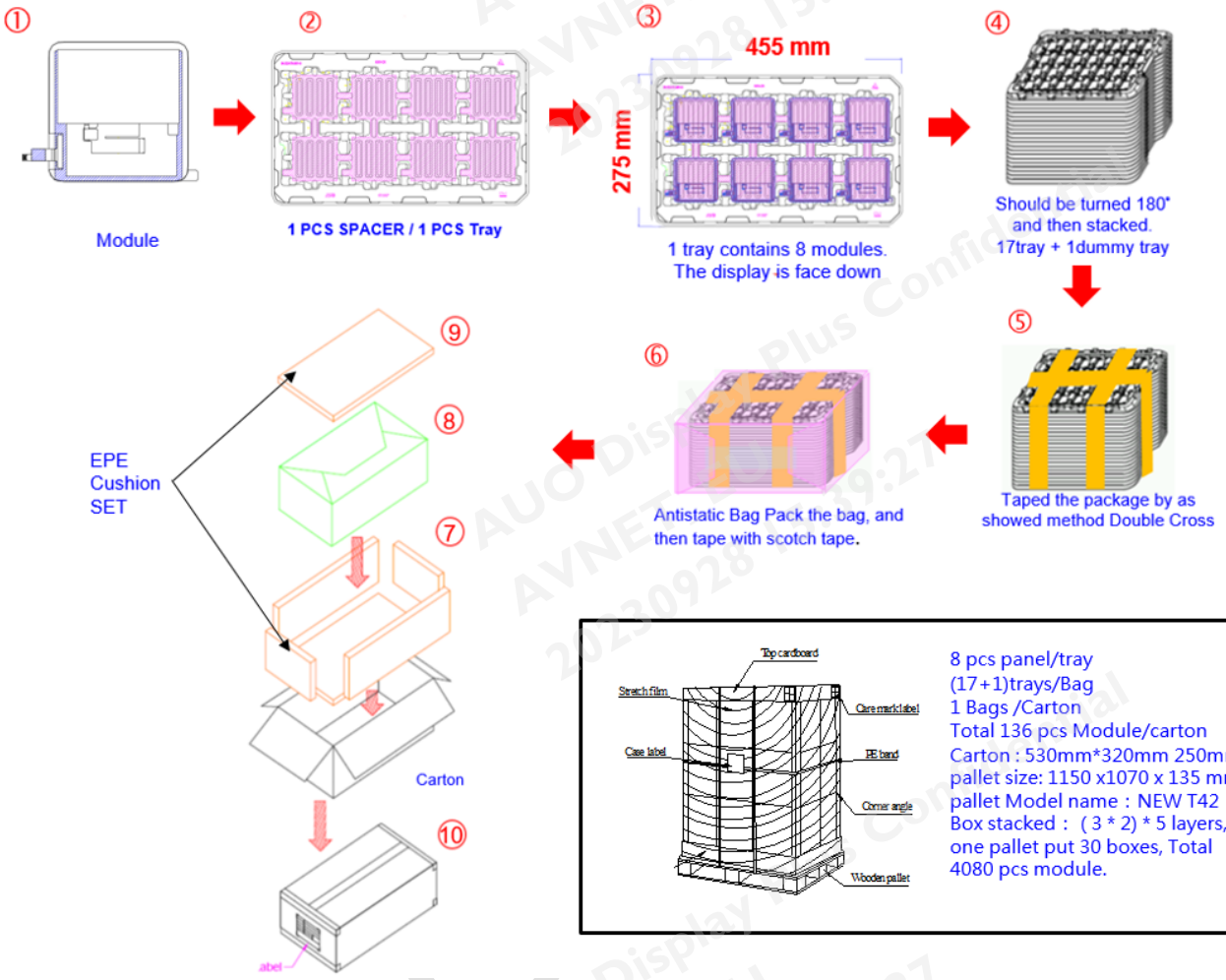
Note 3: All the cosmetic specification is judged before the reliability stress.

Note 5: Operate with 5×5 chess board pattern as figure and lasting time and temperature as the conditions. Then judge with 50% gray level after waiting 5 seconds , the mura must disappear.



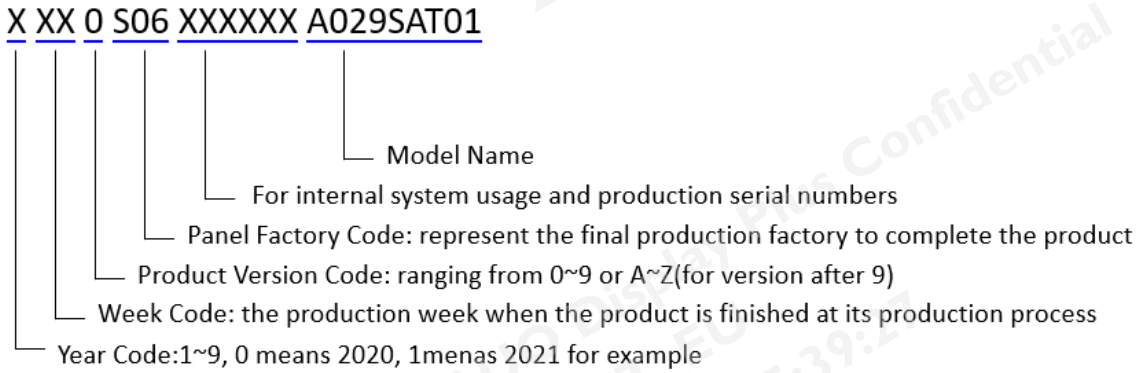
G. Packing and Marking

1. Packing Form (136pcs/Carton)



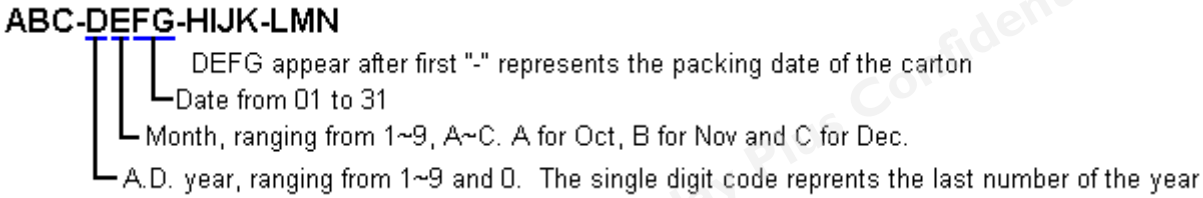
2. Module/Panel Label Information

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.

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.