SPECIFICATIONS FOR
LIQUID CRYSTAL DISPLAY MODULE

MODEL NO : AL2004AWWB-UA-WB-U01

CUSTOMER :

APPROVED SIGNATURE

DSGD :

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DATE : July.25.2017

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Revision Record

No.	Date	Model No.	Version	Remarks
1	July.25.2017	AL2004AWWB-UA-WB-U01	REV.0	Spec RoHs-Compliant

GENERAL SPECIFICATION

ITEM	DESCRIPTION				
Product No	AL2004AWWB-UA-WB-U01				
OLED Type	■ OLED White & Black				
Rear Polarizer	■ Reflective / Positive				
Backlight Type	■ OLED				
OLED Color	□ Yellow	□ Green	□ Amber	■ White	□
Temperature Range	■ Wide Temp., 5V, Single Supply Voltage				
Frame	■ Black				

TO BE VERY CAREFUL !

The OLED driver ICs are made by CMOS process, which are very easy to be damaged by static charge, make sure the user is grounded when handling the LCM.

※This parts comply with RoHs

OLED MODULE

AL2004A-UART-1

SCALE 4:1

UART CONNECTOR

ABSOLUTE MAXIMUM RATING

(1) Electrical Absolute Ratings

Item	Symbol	Min.	Max.	Unit	Note
Power Supply for Logic	V_{DD}-V_{SS}	-0.3	5.5	Volt	
Input Voltage	V_I	-0.3	V_{DD}	Volt	

(2) Environmental Absolute Maximum Ratings

Item	Wide Temperature			
	Operating		Storage	
	Min,	Max.	Min,	Max.
Ambient Temperature	-40℃	+70℃	-40℃	+85℃
Humidity(without condensation)	Note 4,5		Note 4,6	

Note 4   Background color changes slightly depending on ambient temperature. This phenomenon is reversible.

Note 5   Ta≦ 70℃: 75RH max

Ta>70℃: absolute humidity must be lower than the humidity of 75%RH at 70℃

Note 6   Ta at -30℃ will be <48hrs, at 80 ℃ will be <120hrs when humidity is higher than 70%.

ELECTRICAL CHARACTERISTICS

Item	Symbol	Condition	Min.	Typ	Max.	Unit	note
Power Supply for Logic	V_{DD}-V_{SS}	-	4.5	5.0	5.5	Volt	
Input Voltage	V_{IL}	L level	0	-	0.3 V_{DD}	Volt	
	V_{IH}	H level	0.7 V_{DD}	-	V_{DD}	Volt	
Onput Voltage	V_{OL}	L level	0	-	0.3 V_{DD}		
	V_{OH}	H level	0.7 V_{DD}	-	V_{DD}		
Power Supply Current for OLED	I_{DD}	V_{DD} =3.3V V_O-V_{SS} =10.0V	-	50.0	80.0	mA	

OPTICAL CHARACTERISTICS

Item	Symbol	Condition	Min.	Typ	Max.	Unit	note
Viewing angle range	Φ f(12 o'clock)	When Cr≧ 20	-	75	-	Degree	9,10
	Φ b(6 o'clock)		-	75	-		
	Φ l(9 o'clock)		-	65	-		
	Φ r(3 o'clock)		-	65	-		
Rise Time	Tr	V_O-V_{SS} =10.0V Ta=25℃	-	40		mS	
Fall Time	Tf		-	40			
Frame frequency	Frm		-	64	-	Hz	8,10
Contrast	Cr		-	10000	-		7
Brightness	L		100	120	-	cd/㎡	
Peak Emission Wavelength	C.I.E (White)		X=0.25 Y=0.27	X=0.29 Y=0.31	X=0.33 Y=0.35	nm	

MECHANICAL SPECIFICATION

| ITEM	DESCRIPTION
Product No.	AL2004AWWB-UA-WB-U01
Viewing Area	58.22(W)mm×13.52(H)mm
Module Size	98.0(W)×60.0(H)×9.7 max(D)
Dot Size	0.578(W)mm×0.57(H)mm
Dot Pitch	0.598(W)mm×0.60(H)mm
Display Format	20 characters (W)×4 lines (H)
Controller Interface	--
ROM Selection	English_Japanese Character Font Table
Built-in	With DC/DC Converter

INTERFACE PIN ASSIGNMENT

Pin No.	Pin Out	Level	Description
1	TX1	H/L	Serial Transmit Signal
2	RX1	H/L	Serial Receive Signal
3	+5V	+5V	Power Supply Voltage
4	VSS	0V	Power Supply Ground

[Note 7] Definition of Operation Voltage (Vop)

[positive type]   [Negative type]
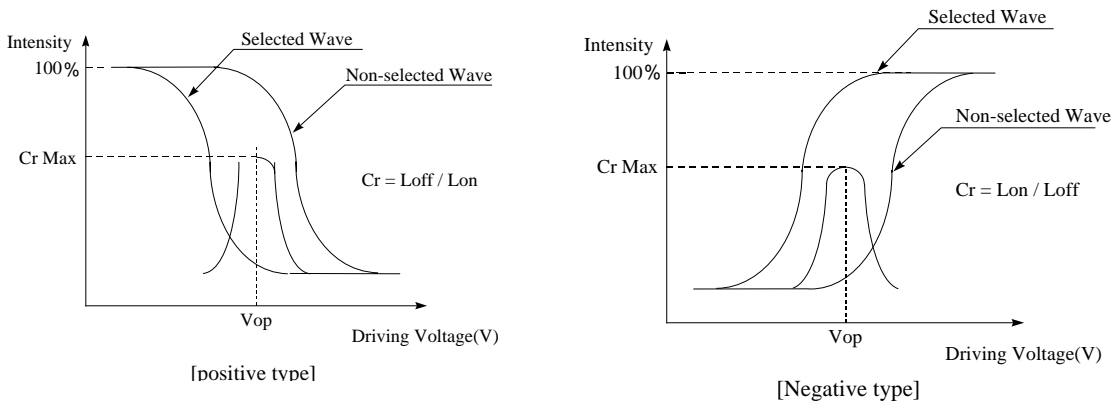
[Note 8] Definition of Response Time (Tr, Tf)

[positive type]   [Negative type]
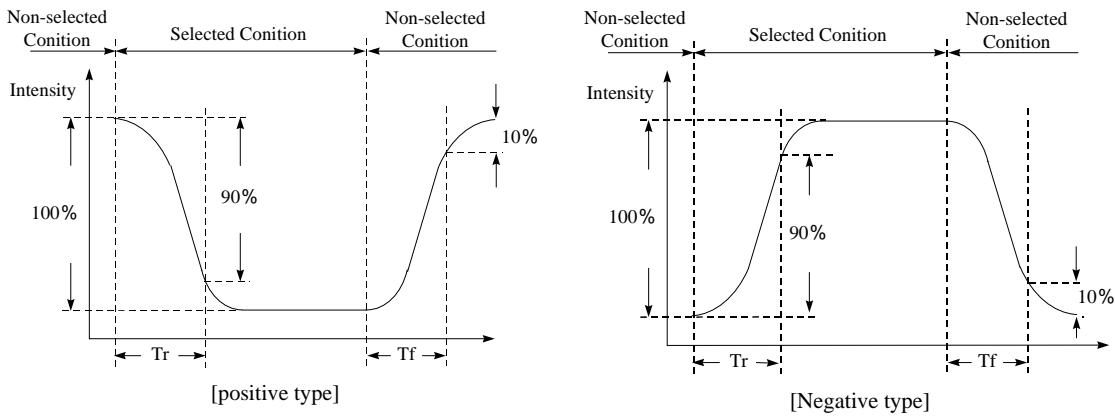
Conditions:

   Operating Voltage : Vop   **Viewing Angle(θ , φ): 0° , 0°**

Frame Frequency : 64 Hz   **Driving Wave form : 1/N duty, 1/a bias**

[Note 9] Definition of Viewing Direction
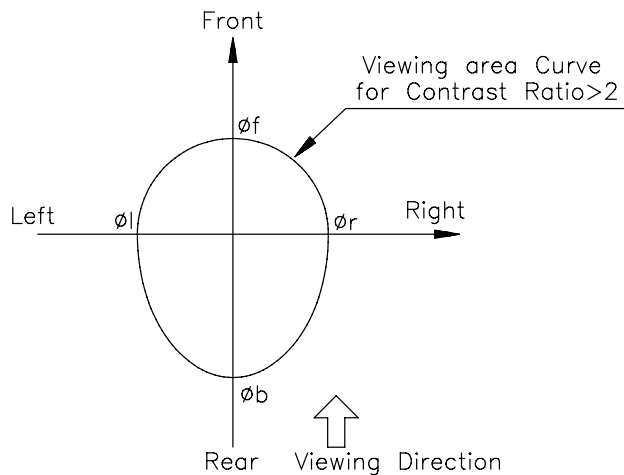
[Note 10] Definition of viewing angle
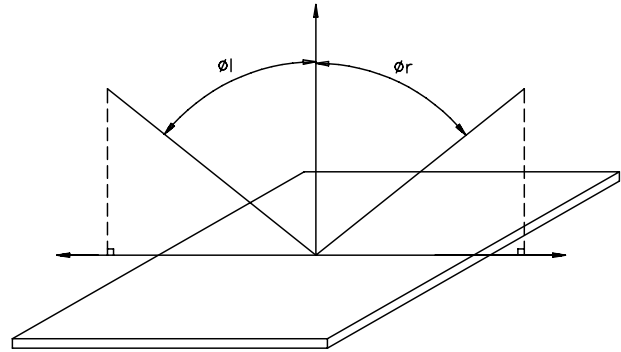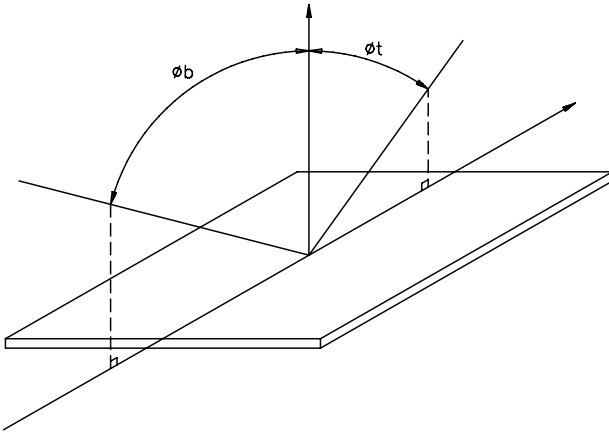
FUNCTIONAL SPECIFICATION

UART CONFIGURATION:

ITEM	SETTING VALUE
BAUD RATE	115200
DATA BIT	8
STOP BIT	1
PARITY BIT	NONE
FLOW CONTROL	NONE

COMMAND LIST:

Code	Function	Sequence of HEX command mode through UART	Instruction of ATcommand mode through UART
0x80	Write a 5X7 Character	1. Send 0x80 2. Send which line to put this character 3. Send which cloumn to put this character 4. Send character's ASCII code 5. Wait until receive a module available byte ('E') from OLED	1. AT80=(line,column,Character) 2. Wait until receive a module available byte ('E') from OLED delay 2ms
0x81	Write a 5X7 String	1. Send 0x81 2. Send which line to start the string 3. Send which cloumn to start the string 4. Send string 5. Wait until receive a module available byte('E') from OLED	1.AT81=(line,column,String) 2. Wait until receive a module available byte ('E') from OLED or delay 2ms
0xd0	Clear display	1. Send 0xd0 2.Wait until receive a module available byte ('E') from OLED	1. ATd0=() 2. Wait until receive a module available byte ('E') from OLED or delay 2ms
0xd4	Scroll the whole display leftward	1. Send 0xd4 2. Send the shift time (typical time is 70ms) 3.Wait until receive a module available byte ('E') from OLED	1. ATd4=(shif time in ms) 2. Wait until receive a module available byte ('E') from OLED or delay (shift time x20)
0xd5	Scroll the whole display rightward	1. Send 0xd5 2. Send the shift time (typical time is 70ms) 3.Wait until receive a module available byte ('E') from OLED	1. ATd5=(shif time in ms) 2. Wait until receive a module available byte ('E') from OLED or delay (shift time x20)
0xf0	Turn display Off	1. Send 0xf0 2.Wait until receive a module available byte ('E') from OLED or delay 2ms	1. ATf0=() 2. Wait until receive a module available byte ('E') from OLED or delay 2ms
0xf1	Turn display On	1. Send 0xf1 2.Wait until receive a module available byte ('E') from OLED or delay 2ms	1. ATf1=() 2. Wait until receive a module available byte ('E') from OLED or delay 2ms
0xf2	Turn Cursor Off	1. Send 0xf2 2.Wait until receive a module available byte ('E') from OLED or delay 2ms	1. ATf2=() 2. Wait until receive a module available byte ('E') from OLED or delay 2ms
0xf3	Turn Cursor On	1. Send 0xf3 2.Wait until receive a module available byte ('E') from OLED or delay 2ms	1. ATf3=() 2. Wait until receive a module available byte ('E') from OLED or delay 2ms
0xf4	Turn Cursor Blink Off	1. Send 0xf4 2.Wait until receive a module available	1. ATf4=() 2. Wait until receive a module available

		byte ('E') from OLED or delay 2ms	byte ('E') from OLED or delay 2ms
0xf5	Turn Cursor Blink On	1. Send 0xf5 2.Wait until receive a module available byte ('E') from OLED or delay 2ms	1. ATf5=() 2. Wait until receive a module available byte ('E') from OLED or delay 2ms
0xf6	Change Instruction mode (1 for AT command, 0 for Hex command)	1. Send 0xf6 2. Send instruction mode 1 3. Wait until receive a module available byte ('E') from OLED	1. ATf6=(instruction mode) 2. Wait until receive a module available byte ('E') from OLED or delay 2ms

ASCII CODE OF 5X7 FONTS(AT COMMAND MODE)

Hex	Symbol	Hex	Symbol	Hex	Symbol
0x20		0x40	@	0x60	`
0x21	!	0x41	A	0x61	a
0x22	"	0x42	B	0x62	b
0x23	#	0x43	C	0x63	c
0x24	$	0x44	D	0x64	d
0x25	%	0x45	E	0x65	e
0x26	&	0x46	F	0x66	f
0x27		0x47	G	0x67	g
0x28	(	0x48	H	0x68	h
0x29	)	0x49	I	0x69	i
0x2a	*	0x4a	J	0x6a	j
0x2b	+	0x4b	K	0x6b	k
0x2c	,	0x4c	L	0x6c	l
0x2d	-	0x4d	M	0x6d	m
0x2e	.	0x4e	N	0x6e	n
0x2f		0x4f	O	0x6f	o
0x30	0	0x50	P	0x70	p
0x31	1	0x51	Q	0x71	q
0x32	2	0x52	R	0x72	r
0x33	3	0x53	S	0x73	s
0x34	4	0x54	T	0x74	t
0x35	5	0x55	U	0x75	u
0x36	6	0x56	V	0x76	v
0x37	7	0x57	W	0x77	w
0x38	8	0x58	X	0x78	x
0x39	9	0x59	Y	0x79	y
0x3a	:	0x5a	Z	0x7a	z
0x3b	;	0x5b	]	0x7b	{
0x3c	<	0x5c	\	0x7c	|
0x3d	=	0x5d	[	0x7d	}
0x3e	>	0x5e	^	0x7e	~
0x3f	?	0x5f	_	0x7f	<-

ASCII CODE OF 5X7 FONTS(HEX COMMAND MODE)

Upper 4bit / Lower 4bit	0000	0001	0010	0011	0100	0101	0110	0111	1000	1001	1010	1011	1100	1101	1110	1111
0000	CG RAM (1)															
0001	CG RAM (2)															
0010	CG RAM (3)															
0011	CG RAM (4)															
0100	CG RAM (5)															
0101	CG RAM (6)															
0110	CG RAM (7)															
0111	CG RAM (8)															
1000	CG RAM (1)															
1001	CG RAM (2)															
1010	CG RAM (3)															
1011	CG RAM (4)															
1100	CG RAM (5)															
1101	CG RAM (6)															
1110	CG RAM (7)															
1111	CG RAM (8)															

HANDLING PRECAUTION

1. Mounting Method

The panel of the LCD Module consists of two thin glass plates with polarizes which easily get damaged since the Module is fixed by utilizing fitting holes in the printed circuit board. Extreme care should be taken when handling the LCD Modules.

2. Caution of LCD handling & cleaning

When cleaning the display surface, use soft cloth with solvent (recommended below) and Wipe lightly.

-Isopropyl alcohol

-Ethyl alcohol

-Trichlorotriflorothane

Do not wipe the display surface with dry or hard materials that will damage the polarize surface.

Do not use the following solvent：

-Water

-Kettle

-Aromatics

3. Caution against static charge

The LCD Module use C-MOSLSI drivers, so we recommend end that you connect any unused input terminal to VDD or VSS, do not input any signals before power is turned on. And ground your body, Work/assembly table. And assembly equipment to protect against static electricity.

4. Packaging

-Modules use LCD elements, and must be treated as such. Avoid in tense shock and falls from a height.

-To prevent modules from degradation. Do not operate or store them exposed directly to sunshine or high temperature/humidity.

5. Caution for operation

-It is indispensable to drive LCD's with in the specified voltage limit since the higher voltage than the limit shorten LCD life.

An electrochemical reaction due to direct current causes LCD deterioration, Avoid the use of direct current drive.

-Response time will be extremely delayed at lower temperature than the operating temperature range and on the other hand at higher temperature LCD's show dark color in them. However those phenomena do not mean malfunction or out of order with LCD's. Which will come back in the specified operating temperature range.

- If the display area is pushed hard during operation, some font will be abnormally displayed but it resumes normal condition after turning off once.

- A slight dew depositing on terminals is a cause for electro-chemical reaction resulting in terminal open circuit. Usage under the relative condition of 40 ℃, 50%RH or less is required.

6. Storage

In the case of storing for a long period of time (for instance. For years) for the purpose or replacement use, The following ways are recommended.

- Storage in a polyethylene bag with sealed so as not to enter fresh air outside in it, And with no desiccant.

- Placing in a dark place where neither exposure to direct sunlight nor light is. Keeping temperature in the specified storage temperature range.
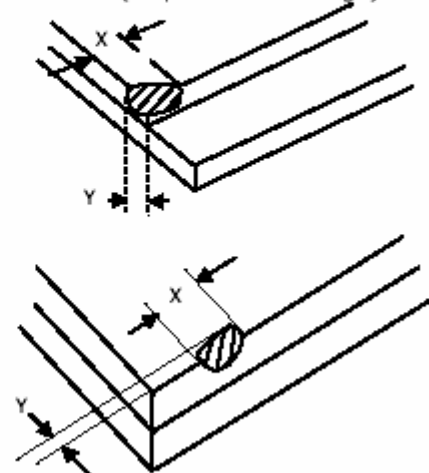
-Storing with no touch on polarizer surface by the anything else. (It is recommended to store them as they have been contained in the inner container at the time of delivery)
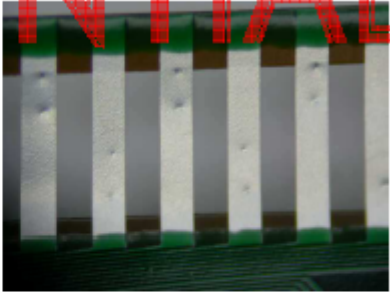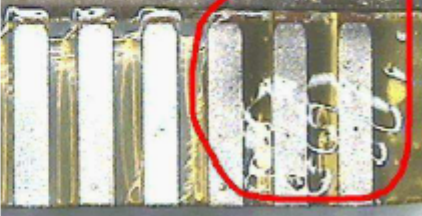
7. Safety
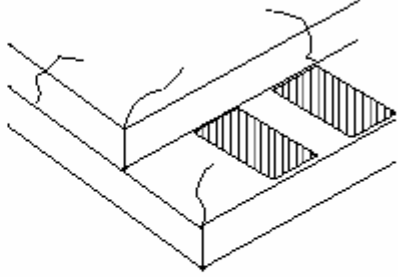
- It is recommendable to crash damaged or unnecessary LCD into pieces and wash off liquid crystal by using solvents such as acetone and ethanol. Which should be burned up later.

- When any liquid crystal leaked out of a damaged glass cell comes in contact with your hands, please wash it off well with soap and water.

Cosmetic Check (Display Off) in Non-Active Area

Check Item	Classification	Criteria
Panel General Chipping	Minor	X > 6 mm (Along with Edge) Y > 1 mm (Perpendicular to edge)
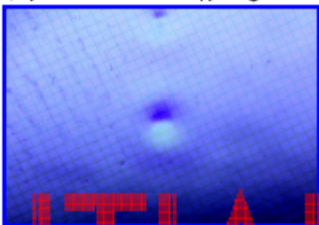
. Cosmetic Check (Display Off) in Non-Active Area (Continued)

Check Item	Classification	Criteria
Panel Crack	Minor	Any crack is not allowable.
Copper Exposed (Even Pin or Film)	Minor	Not Allowable by Naked Eye Inspection
Film or Trace Damage	Minor	
Terminal Lead Prober Mark	Acceptable	
Glue or Contamination on Pin (Couldn't Be Removed by Alcohol)	Minor	
Ink Marking on Back Side of panel (Exclude on Film)	Acceptable	Ignore for Any

Cosmetic Check (Display Off) in Active Area

It is recommended to execute in clear room environment (class 10k) if actual in necessary.

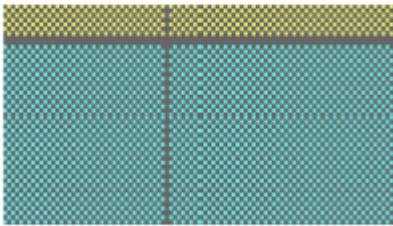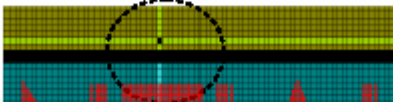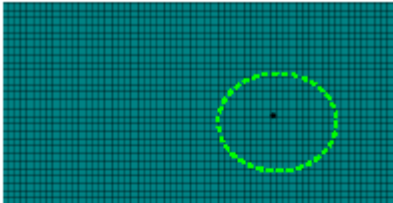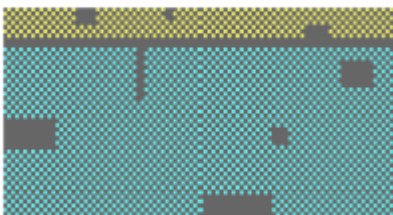| Check Item	Classification	Criteria	
Any Dirt & Scratch on Polarizer's Protective Film	Acceptable	Ignore for not Affect the Polarizer	
Scratches, Fiber, Line-Shape Defect (On Polarizer)	Minor	$W \leq 0.1$ $W > 0.1$ $\quad L \leq 2$ $\quad L > 2$	Ignore $n \leq 1$ $n = 0$
Dirt, Black Spot, Foreign Material, (On Polarizer)	Minor	$\Phi \leq 0.1$ $0.1 < \Phi \leq 0.25$ $0.25 < \Phi$	Ignore $n \leq 1$ $n = 0$
Dent, Bubbles, White spot (Any Transparent Spot on Polarizer)	Minor	$\Phi \leq 0.5$ ➔ Ignore if no Influence on Display $0.5 < \Phi \qquad n = 0$ 	
Fingerprint, Flow Mark (On Polarizer)	Minor	Not Allowable	

* Protective film should not be tear off when cosmetic check.
** Definition of W & L & Φ (Unit: mm): $\Phi = (a + b) / 2$

L

W

b: Minor Axis

a: Major Axis
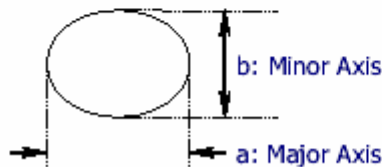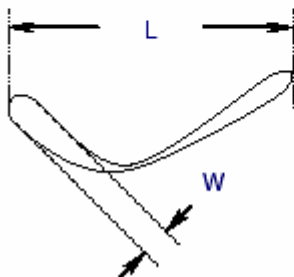
.Pattern Check (Display On) in Active Area

Check Item	Classification	Criteria
No Display	Major	
Missing Line	Major	
Pixel Short	Major	
Darker Pixel	Major	
Wrong Display	Major	
Un-uniform	Major	