

**Customer Name :RYOYO( Riken keiki)**

**Customer P/N : -**



**Unicorn P/N : UNC-MSGF014682-02**

**Customer Approval:**

- ☐ Approved for sample making.
- ☐ Approved for pilot production. Please specify minimum quantity (if any) \_\_\_\_\_ pcs
- ☐ Approved for mass production.

**Customer Signature and Date:**

**Unicorn Internal Approval:**

Written By (Electrical)	Written By (Mechanical)	Checked By (R&D)	Approved By	
			R&D	QA
GS.Xiang	SQ.Kuang	Zhang ZQ		

#### REVISION HISTORY:

Rev	Date	Description	Written By	Approved By
1.0	28-Apr.-2021	New Release(Change COMSCN to VSS based on MSGF014682-01)	XiangGS	LiShuangBing
Unicorn				

# **CONTENTS**

<b>1.0</b>	<b>GENERAL SPECIFICATION</b>
<b>2.0</b>	<b>PRODUCT NUMBERING SYSTEM</b>
<b>3.0</b>	<b>OUTLINE DRAWING</b>
<b>4.0</b>	<b>INTERFACE PIN DESCRIPTION</b>
<b>5.0</b>	<b>BLOCK DIAGRAM</b>
<b>6.0</b>	<b>OPERATING PRINCIPLE &amp; DRIVING METHOD</b>
<b>7.0</b>	<b>ABSOLUTE MAXIMUM RATINGS</b>
<b>8.0</b>	<b>ELECTRICAL CHARACTERISTICS</b>
<b>9.0</b>	<b>ELECTRO-OPTICAL CHARACTERISTICS</b>
<b>10.0</b>	<b>BACKLIGHT SPECIFICATION</b>
<b>11.0</b>	<b>RELIABILITY SPECIFICATION</b>
<b>12.0</b>	<b>QUALITY SPECIFICATION</b>
<b>13.0</b>	<b>ENVIRONMENTAL SPECIFICATION</b>
<b>14.0</b>	<b>PACKAGING SPECIFICATION</b>
<b>15.0</b>	<b>GENERAL PRECAUTIONS FOR USING LCD MODULES</b>
<b>16.0</b>	<b>MANUFACTURING DATECODING</b>
<b>17.0</b>	<b>PRODUCT CHANGE NOTIFICATION</b>
<b>18.0</b>	<b>LIMITED WARRANTY</b>
<b>19.0</b>	<b>MANUFACTURER CONTACT</b>
<b>20.0</b>	<b>APPENDIX</b>

## 1.0 GENERAL SPECIFICATION

Item	Contents	Unit
LCD type	FSTN Positive Transflective	-
Driving Scheme	1/144 Duty 1/12 Bias	-
LCD controller/ driver	ST75256i-G2	-
Module size (W×H×T)	80 × 54 × 7.0	mm
Viewing area (W×H)	70.7× 40.8	mm
Viewing angle	6	O'clock
Number of dots	240*144	dots
Dot size (W×H)	0.254 × 0.254	mm
Dot pitch (W×H)	0.264 × 0.264	mm
Backlight	LED	-
Backlight color	White	-
Operating temperature	-20 ~ 70	°C
Storage temperature	-40 ~ 80	°C

Remarks: Normal operating condition is temperature 15~35°C, humidity 45%~75%RH, atmospheric pressure 86~106kPa.

## 2.0 PRODUCT NUMBERING SYSTEM

**UNC - M S G F 014682- 02**

(1) (2) (3) (4) (5) (6) (7)

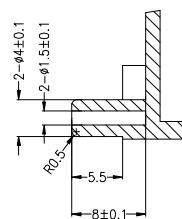
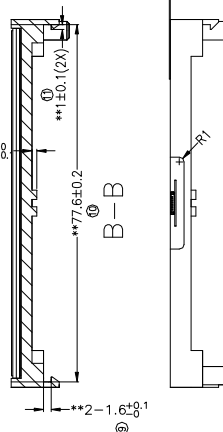
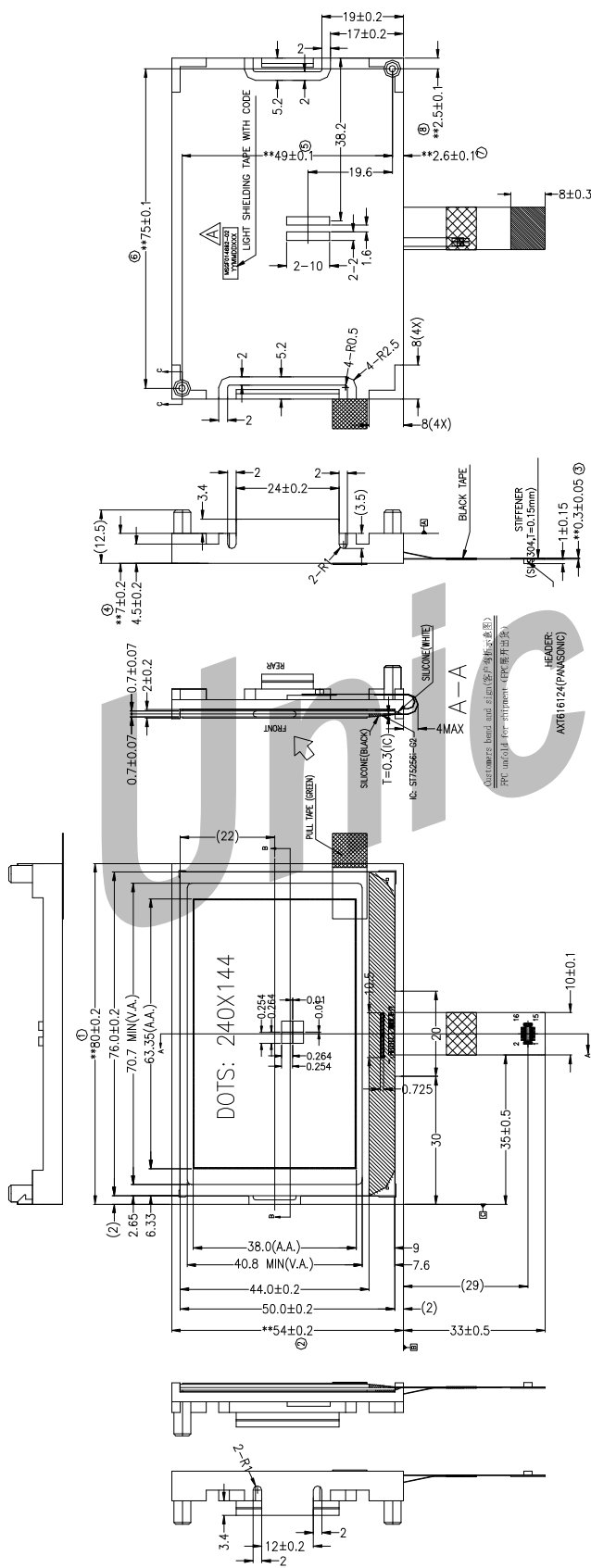
- (1) One of product brand name for Unicorn Electronic (Shenzhen) Co Ltd
- (2) Custom-made LCD module
- (3) Display type (T: TN, S: STN/FSTN/FFSTN/ASTN, H: HTN, V: PMVA, D: DSTN, C: CSTN, F: TFT, B: Bistable, P: Plastic LCD, R: Other)
- (4) Controller/driver package type (G: COG, T: TCP, F: COF, B: COB, N: Not applicable)
- (5) Interface connection type (F: FPC/COF, H: Heatseal, Z: Zebra connector, P: Pin, T: TAB, C: Connector, N: Not applicable)
- (6) Serial number
- (7) Product revision

### 3.0 OUTLINE DRAWING

Note: 1. "◇"Special Dimension (PPK/CPK Data Needed>1.67); "♦"Control Dimension; All Unmarked "◇" OR "♦"Dimensions are Reference Dimensions and No Measurement Needed.  
2. No Use of Prohibited Substances defined in SOP-E-QS-009 and Only purchase Designated Raw Materials from Green Partners. 3.  $\overline{A}$ ,  $\overline{B}$ ,  $\overline{C}$  are the datum reference. 4. Application opening window < LCD V.A.

### PIN ASSIGNMENT:

PIN	SYMBOL
1	SDA
2	SCL
3	RSTB
4	RSTB
5	VSS
6	VSS
7	VDD
8	VDD
9	XV0
10	XV0
11	V0
12	V0
13	LEDA
14	LEDA
15	LEDK
16	LEDK



CIRCUIT DESIGN (LED 1x4=4dies)

BACKLIGHT COLOR: WHITE

LED P/N: 01.JT. CBS206W-P

Forward Voltage:@IF=20mA

VF=2.2V(MIN)~2.8V(TYP)~3.2V(MAX)

LCM surface Luminance: 48cd/m<sup>2</sup>(MIN)

1000

MSGF014682-02  
YYMMDDXXX

"C-C" 2:1

For Customer Attention:

IC P/N and Version:	ST75266 V1.7a 2016/10/21
Interface Type:	Parallel(—)/Serial(—)/I2C(YES)
MPU Timing select:	6800(—)/8080(—)
Temperature Coefficient Select by software:	Soft setting
COM Scanning:	COM145~COM0
SEG Scanning:	SEG0~SEG239
Normal/High Power mode select:	High(—)/Normal(—)
D6(SAO)=0,D7(SA1)=0,COMSCN=0	

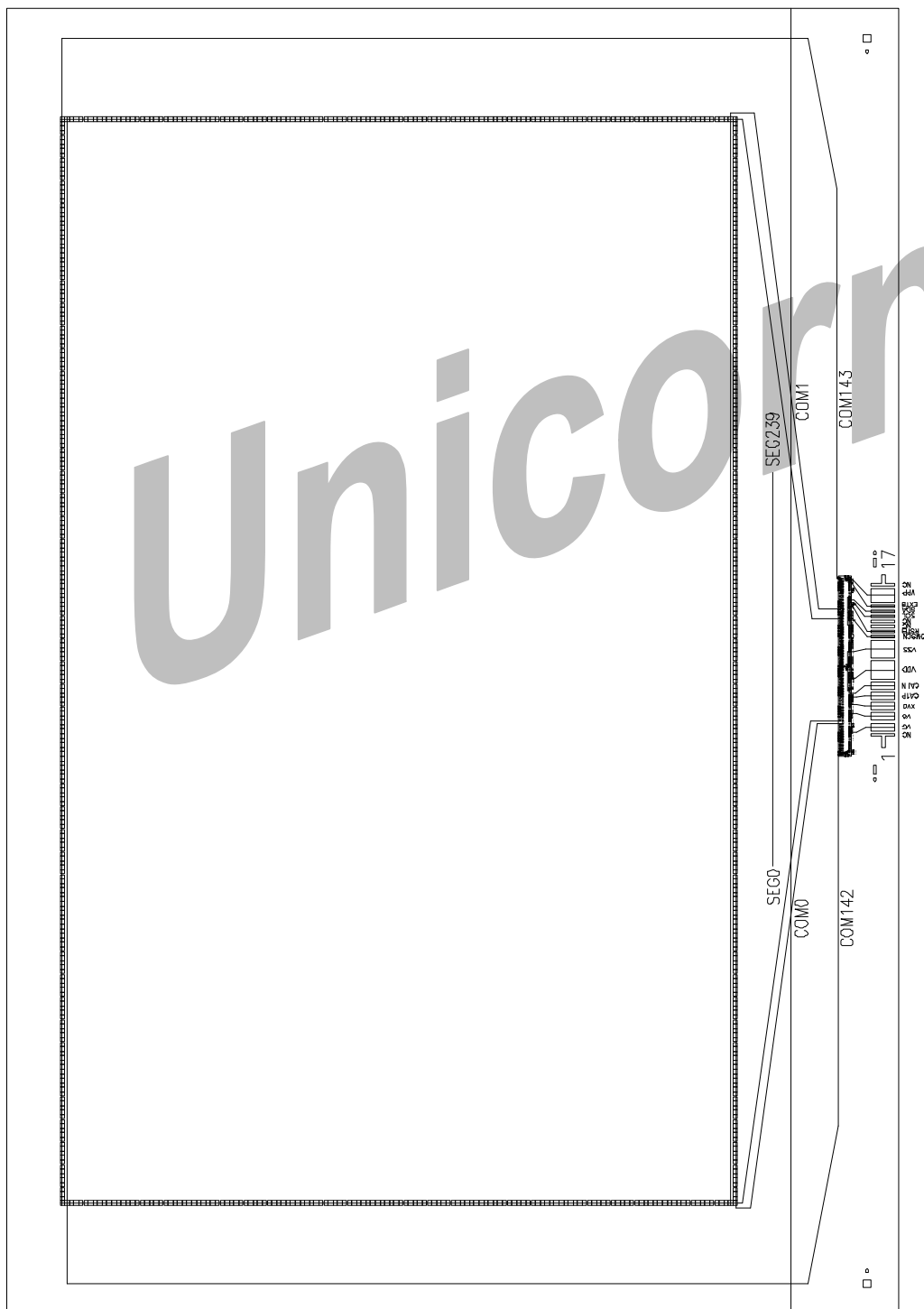
DD:Customer Designate(2.7 min)V,Only Unicorn internal

est(3.0)V (This Value Will Be Used For UNICORN

functional testing setting, Please Specify If It Is  
different From This Value)

INTERVIEW WITH THIS VIDEO

[illegible]



## SEGMENTS

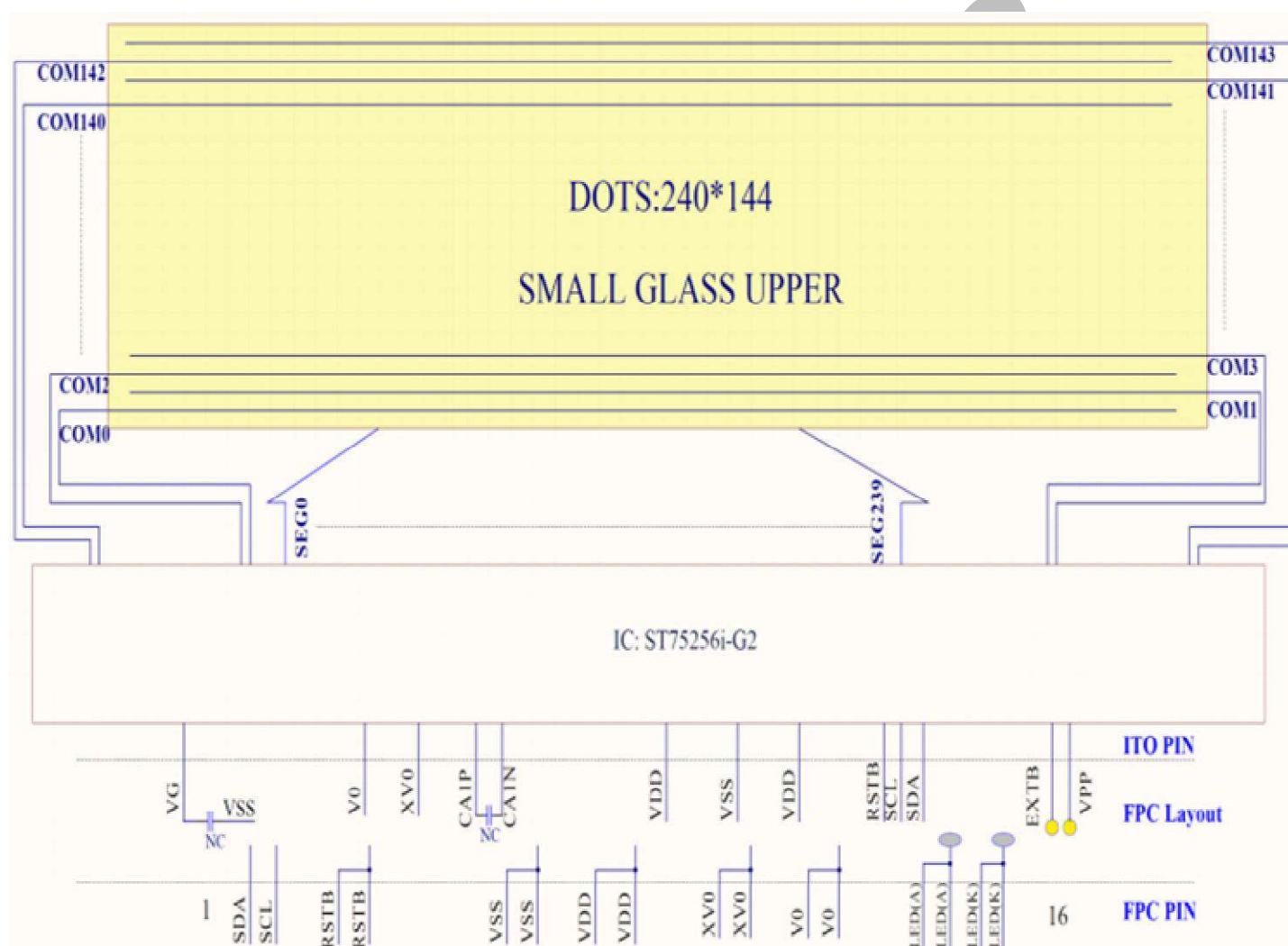
COMMONS

							CUSTOMER ORDERING NO. UNC-MSGF014682-02	<b>Unicorn</b> Unicorn Electronic(Shenzhen)Co Ltd.				
							MODULE P/N: UNC-MSGF014682-02					
							UNSPECIFIED TOLERANCE: ±0.2					
							VERSION A	DRAWING NO. UNC-UNC-MSGF014682-02-VerA				
	First released(used on -01 change version parameter )	LJ	200220				APPROD BY Binngao	DATE 200220	CHECK BY XIN	DATE 200220	DRAWING BY LJ	PAGE 2-2
		SYN	REVISION RECORD	REVISED by	DATE	UNIT: mm	Binnago	200220	SYG	200220		

## 4.0 INTERFACE PIN DESCRIPTION

Pin No.	Symbol	Pin Description
1	SDA	Serial data input terminal
2	SCL	Serial clock input terminal
3~4	RSTB	Reset input
5~6	VSS	Power ground
7~8	VDD	Power supply terminal
9~10	XV0	Negative operating voltage of COM-drivers.
11~12	V0	Positive operating voltage of COM-drivers.
13~14	LEDA	LED anode.
15~16	LEDK	LED cathode.

## 5.0 BLOCK DIAGRAM



## 6.0 OPERATING PRINCIPLE & DRIVING METHOD

- 6.1 Please refer to ST75256(V1.7a) IC data sheet
- 6.2 Instruction Description (based on IC spec ver as stated in 6.1 where the product is designed). This instruction description is for reference only. Customer is encouraged to always refer to the latest IC specification when developing application system platform.

### 9.1 INSTRUCTION TABLE

INSTRUCTION	A0	R/W	COMMAND BYTE								DESCRIPTION
			D7	D6	D5	D4	D3	D2	D1	D0	
1.Extension Command	0	0	0	0	1	1	EXT1	0	0	EXT0	Set extension instruction
Ext[1:0]=0,0 (Extension Command 1)											
2.Display ON/OFF	0	0	1	0	1	0	1	1	1	DSP	Set LCD display DSP=0: Display off DSP=1: Display on
3.Inverse Display	0	0	1	0	1	0	0	1	1	INV	Set inverse display INV=0: Normal display INV=1: Inverse display
4.All Pixel ON/OFF	0	0	0	0	1	0	0	0	1	AP	Set all pixel on mode, only for monochrome display AP=0: All pixel off mode AP=1: All pixel on mode
5.Display Control	0	0	1	1	0	0	1	0	1	0	Set display control CLD :Set CL dividing ratio DT[7:0] : Set the number of duty LF[4:0] : Set N-line inversion counter FI : Set the inversion type of frame at the end of common scan cycle
	1	0	0	0	0	0	0	CLD	0	0	
	1	0	DT7	DT6	DT5	DT4	DT3	DT2	DT1	DT0	
	1	0	0	0	LF4	FI	LF3	LF2	LF1	LF0	
6.Power Save	0	0	1	0	0	1	0	1	0	SLP	Set power save mode SLP=0: Sleep out mode SLP=1: Sleep in mode
7.Set Page Address	0	0	0	1	1	1	0	1	0	1	Set page address Starting page address: 00h ≤ YS ≤ 28h Ending page address: YS ≤ YE ≤ 28h
	1	0	YS7	YS6	YS5	YS4	YS3	YS2	YS1	YS0	
	1	0	YE7	YE6	YE5	YE4	YE3	YE2	YE1	YE0	
8.Set Column Address	0	0	0	0	0	1	0	1	0	1	Set column address Starting column address: 00h ≤ XS ≤ FFh Ending column address: XS ≤ XE ≤ FFh
	1	0	XS7	XS6	XS5	XS4	XS3	XS2	XS1	XS0	
	1	0	XE7	XE6	XE5	XE4	XE3	XE2	XE1	XE0	
9.Data Scan Direction	0	0	1	0	1	1	1	1	0	0	Set normal/ inverse display of address and address scan direction
	1	0	0	0	0	0	0	MV	MX	MY	
10.Write Data	0	0	0	1	0	1	1	1	0	0	Write data to DDRAM
	1	0	D7	D6	D5	D4	D3	D2	D1	D0	
11.Read Data	0	0	0	1	0	1	1	1	0	1	Read data from DDRAM (Only for parallel interface and I <sup>2</sup> C)
	1	1	D7	D6	D5	D4	D3	D2	D1	D0	
12.Partial In	0	0	1	0	1	0	1	0	0	0	Set partial area Starting partial display address: 00h ≤ PTS ≤ A1h Ending partial display address:
	1	0	PTS7	PTS6	PTS5	PTS4	PTS3	PTS2	PTS1	PTS0	



INSTRUCTION	A0	R/W	COMMAND BYTE								DESCRIPTION
			D7	D6	D5	D4	D3	D2	D1	D0	
	1	0	PTE7	PTE6	PTE5	PTE4	PTE3	PTE2	PTE1	PTE0	$00h \leq PTE \leq A1h$
13. Partial Out	0	0	1	0	1	0	1	0	0	1	Exit the partial mode
14. Read/Modify/Write In	0	0	1	1	1	0	0	0	0	0	Enable read modify write
15. Read/Modify/Write Out	0	0	1	1	1	0	1	1	1	0	Disable read modify write
16. Scroll Area	0	0	1	0	1	0	1	0	1	0	Set scroll area TL[7:0] : Set top line address BL[7:0] : Set bottom line address NSL[7:0] : Number of specified line SCM[1:0] : Area scroll mode
	1	0	TL7	TL6	TL5	TL4	TL3	TL2	TL1	TL0	
	1	0	BL7	BL6	BL5	BL4	BL3	BL2	BL1	BL0	
	1	0	NSL7	NSL6	NSL5	NSL4	NSL3	NSL2	NSL1	NSL0	
	1	0	0	0	0	0	0	0	SCM1	SCM0	
17. Set Start Line	0	0	1	0	1	0	1	0	1	1	Set scroll start address $00h \leq SL \leq A1h$
	1	0	SL7	SL6	SL5	SL4	SL3	SL2	SL1	SL0	
18. OSC ON	0	0	1	1	0	1	0	0	0	1	Turn on the internal oscillator
19. OSC OFF	0	0	1	1	0	1	0	0	1	0	Turn off the internal oscillator
20. Power Control	0	0	0	0	1	0	0	0	0	0	Power circuit operation VB=0: OFF, VB=1: ON VF=0: OFF, VF=1: ON VR=0: OFF, VR=1: ON
	1	0	0	0	0	0	VB	0	VF	VR	
21. Set Vop	0	0	1	0	0	0	0	0	0	1	Set Vop
	1	0	0	0	Vop5	Vop4	Vop3	Vop2	Vop1	Vop0	
	1	0	0	0	0	0	0	Vop8	Vop7	Vop6	
22. Vop Control	0	0	1	1	0	1	0	1	1	VOL	Control Vop VOL=0: Vop increase one step VOL=1: Vop decrease one step
23. Read Register Mode	0	0	0	1	1	1	1	1	0	REG	Set read register mode REG=0: read the register value of Vop[5:0] REG=1: read the register value of Vop[8:6]
24. Nop	0	0	0	0	1	0	0	1	0	1	No operation
25. Read Status (Parallel and I <sup>2</sup> C)	0	1	D7	D6	D5	D4	D3	D2	D1	D0	Read status byte (Parallel and I <sup>2</sup> C)
26. Read Status (4-Line and 3-Line SPI)	0	0	1	1	1	1	1	1	1	0	Read status byte (4-Line and 3-Line SPI)
	0	1	D7	D6	D5	D4	D3	D2	D1	D0	
27. Data Format Select	0	0	0	0	0	0	1	DO	0	0	DO=0: LSB on bottom (Default) DO=1: LSB on top
28. Display Mode	0	0	1	1	1	1	0	0	0	0	Set display mode DM=0 : Mono (Default) DM=1 : 4Gray Scale Mode
	1	0	0	0	0	1	0	0	0	DM	

**6.3 Recommended initial codes**

```
void Init_LCM()
{
    CS=0;
    RES=1;
    Delay(5);          // delay 5ms
    RES=0;
    Delay(10);
    RES=1;
    Delay(10);

    write_com(0x30); //Extension Command1
    write_com(0x6e); //Enable Master

    write_com(0x31); //Extension Command2
    write_com(0xd7); //Disable Auto Read
    write_data(0x9f); //Extension Command
    write_com(0xe0); //Enable OTP Read

    write_data(0x00); //Extension Command
    write_com(0xe3); //OTP Up-Load
    Delay(10);

    write_com(0xe1); //OTP Control Out
    Delay(20);
    write_com(0x30); //Extension Command1
    write_com(0x94); //Sleep Out
    write_com(0xae); //Display off
    Delay(30);

    write_com(0x20); //Power Control
    write_data(0x0b); //VB,VR,VF AllON

    write_com(0x81); //Set VOP
    write_data(0x04);
    write_data(0x04); //14.0V

    write_com(0x31); //Extension Command 2
    write_com(0x32); //Analog Circuit Set
    write_data(0x00); //
    write_data(0x01); //Booster Efficiency-6KHz
    write_data(0x02); //Bias=1/12

    write_com(0x51); //Booster Level
    write_data(0xfb); // *10

    write_com(0x30); //Extension Command1

    write_com(0xf0); //Display Mode
    write_data(0x10); //Mono Mode,Normal Mode

    write_com(0xca); //Display Control
    write_data(0x00); //CL Dividing Ratio---Not Divide
    write_data(0x8f); //Duty 1/144
    write_data(0x00); //Frame Inversion

    write_com(0x31); //Extension Command 2
```

```
write_com(0xf0); //Frame rate
write_data(0x0C);
write_data(0x0C);
write_data(0x0C);
write_data(0x0C);

write_com(0xf2); //Temperature Range
write_data(0x05); //TA
write_data(0x1e); //TB
write_data(0x32); //TC

write_com(0xf4); //Temperature Gradient Compensation
write_data(0x48);
write_data(0x12);
write_data(0x00);
write_data(0x00);
write_data(0x00);
write_data(0xFA);
write_data(0xA0);
write_data(0xff);

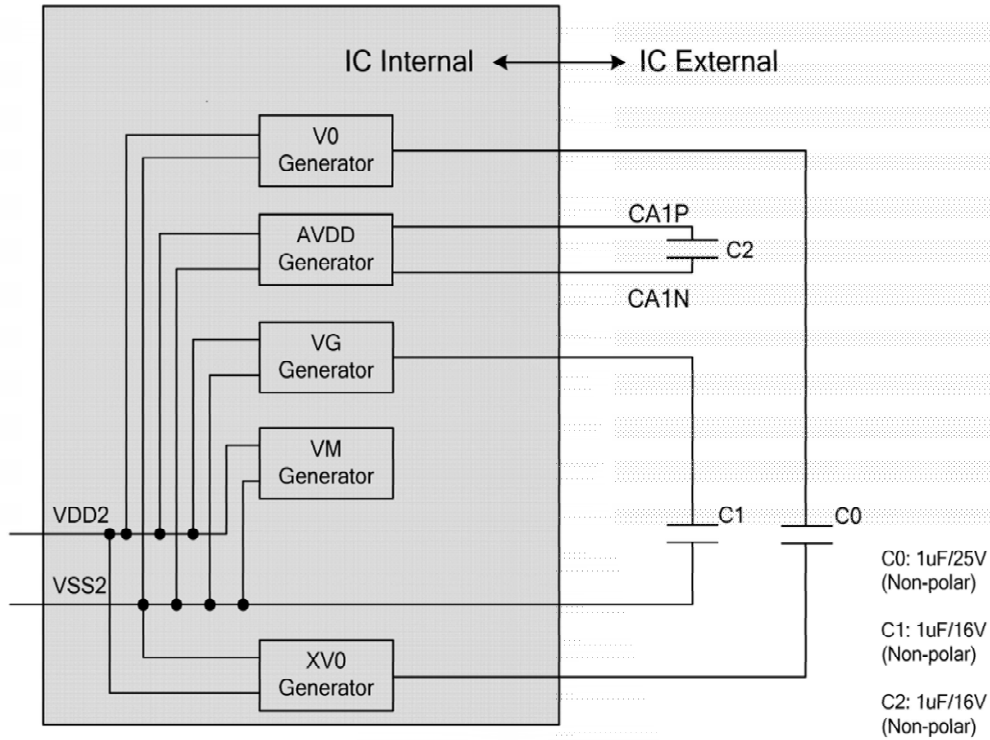
write_com(0x30); //Extension Command1
write_com(0xbc); //Data Scan Direction
write_data(0x01); //Address direction,COMSCN=L,write_data(0x01);
write_com(0xab); //Start line
write_com(0xa6); //Normal display
write_com(0x31); //Extension Command2
write_com(0x40); //Internal Power Supply
  Clealddram();
write_com(0xaf); //Display ON
  Delay(50);
}
```

**Notes:**

- 1) These initial codes are only for reference, Customer should optimize above setting according to the display pattern and application used.
- 2) Customer is advised to refer to "General Handling Precaution of LCD Modules" section in this product specification regarding the operating precaution of LCD modules, when optimizing the display initialization setting.
- 3) Unicorn will use above initial code for production testing by default. Customer is advised to highlight to Unicorn in case that initial code setting in customer application is different with above initial code. Reason is to ensure Unicorn testing is in-line with customer application as close as possible for good quality control.

## 6.4 Voltage generator circuit

The recommended external power components need only three capacitors. The detailed values of these three capacitors are determined by panel size and loading.



**Figure 37 Internal Power Supply Circuit**

Note:

1. C0: 1uF/25V~2.2uF/25V (Default 1uF/25V)
2. C1: 1uF/16V~2.2uF/16V (Default 1uF/16V)
3. C2: 1uF/16V~2.2uF/16V (Default 1uF/16V)

Note: R/C value stated above is for reference only. Customer is advised to fine tune the R/C setting according to actual application and highlight to Unicorn on the final setting used. Reason is to ensure Unicorn testing is in-line with customer application as close as possible for good quality control.

#### 6.5 Power on sequence

Referential Operation Flow	Operation Sequence
<p><b>Power ON Flow &lt;Start&gt;</b></p> <p>Wait Power Stable, <math>t &gt; 1\text{ms}</math> (Depends on system power)</p> <p>Keep RSTB=L ... *1 Wait reset start, <math>t &gt; 1\text{ms}</math> Set RSTB=H ... *1 Wait reset finished, <math>t &gt; 1\text{ms}</math></p> <p>Default State ... *2</p> <p>OTP Set (by user) (1) Auto Read Control (2) OTP WR/RD Control (3) OTP Read (4) OTP Control Out</p> <p>Function Set (by user) (1) Sleep Out Mode (2) Display OFF (3) Power Control (4) Set Vop (5) Analog Circuit Set (6) Booster Level (7) Display Mode (8) Display Control (9) Data Scan Direction (10) Inversion Display (11) Driving Select (12) Set ICON</p> <p>Clear ICON DDRAM by "0"</p> <p>Clear DDRAM by "0" (256 x 162 x 2)</p> <p>Function Set (by user) (1) Set Column Address (2) Set Page Address (3) Display ON</p> <p>External Power Supply*3 &lt;When "Driving Select" is external &gt;</p> <p><b>Power ON Flow &lt;End&gt;</b></p>	<p><b>Case-1: RSTB=L while Power ON</b></p> <p><b>Case-2: RSTB=H while Power ON</b></p>

#### Note

- Please refer to the specification of  $t_{RW}$  and  $t_R$ .
- Refer to the section of Reset circuit.
- The detail instruction functionality is described in section of INSTRUCTION DESCRIPTION.
- The power stable is defined as the time that the later power (VDDI or VDDA) reaches 90% of its rated voltage.
- VDDA include VDD2, VDD3, VDD4

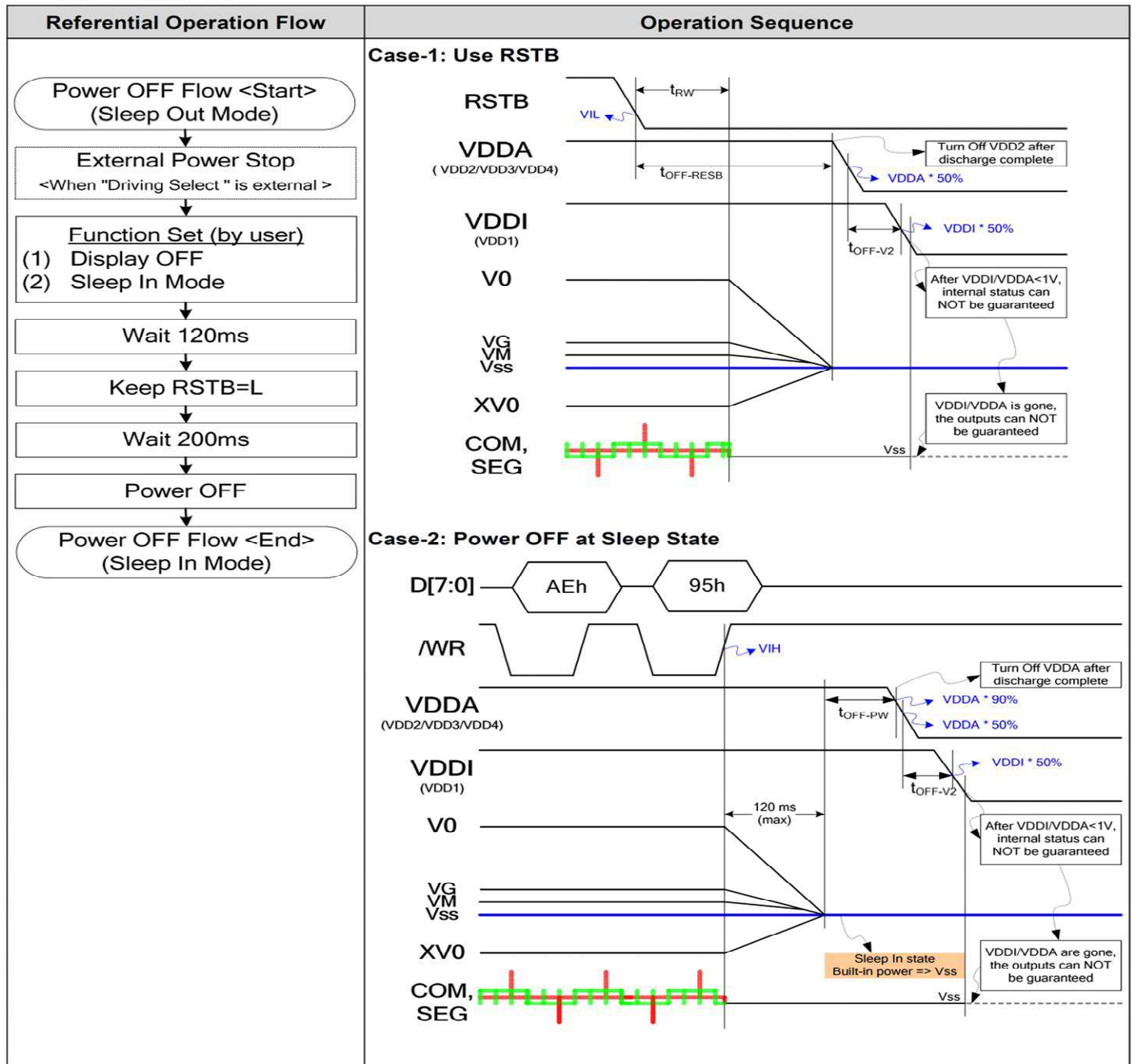
Item	Symbol	Requirement	Description
VDDA power ON delay	$t_{ON-V2}$	No Limitation	<ul style="list-style-type: none"> <li>VDDI and VDDA can be applied in any order. IC will NOT be damaged when one of VDDI and VDDA is ON but another is OFF.</li> <li>Power stable is defined as the time that the later power (VDDI or VDDA) reaches 90% of its rated voltage.</li> <li>Recommend Setting: <math>0ms \leq t_{ON-V2} \leq</math> No Limitation.</li> </ul>
RSTB input time	$t_{ON-RES}$	Case-1 $t_{RW} \leq t_{ON-RES}$ Case-2 No Limitation	<ul style="list-style-type: none"> <li>RSTB =L can be input at any time after power is stable.</li> <li><math>t_{RW}</math> &amp; <math>t_R</math> should match the timing specification of RSTB.</li> <li>RSTB has priority over CSB.</li> <li>Recommend Setting: <math>0 \leq t_{ON-RES} \leq 50</math> ms.</li> </ul>
CSB input time	$t_{ON-CS}$	No Limitation	<ul style="list-style-type: none"> <li>CSB can be input at any time after power is stable.</li> </ul>

Note : If RSTB is held high or unstable during power ON, a successful hardware reset by RSTB is required after VDDI and VDDA are both stable (as illustrated in Case-2). Otherwise, correct functionality can NOT be guaranteed.

Unicorn



#### 6.6 Power off sequence



Item		Symbol	Requirement	Description
Power OFF Time	Case-1	$t_{\text{OFF-RESB}}$	$200\text{ms} \leq t_{\text{OFF-RESB}}$	<ul style="list-style-type: none"> <li>Power can be turned OFF after built-in power becomes VSS.</li> </ul>
	Case-2	$t_{\text{OFF-PW}}$	$0 \leq t_{\text{OFF-PW}}$	
VDDA power ON delay		$t_{\text{OFF-V2}}$	No Limitation	<ul style="list-style-type: none"> <li>VDDI and VDDA can be powered down in any order. IC will NOT be damaged when one of VDDI and VDDA is ON but another is OFF.</li> <li>Recommend Setting: <math>0\text{ms} \leq t_{\text{OFF-V2}} \leq \text{No Limitation}</math>.</li> </ul>

Note: In Case-2, RSTB can fall to VSS at the same time as VDDI.

## 7.0 ABSOLUTE MAXIMUM RATINGS (Ta = 25°C, V<sub>SS</sub> = 0 V)

Parameter	Symbol	Min	Typ.	Max	Unit
Supply voltage for Logic	V <sub>DD</sub>	-0.3	-	4.0	V
Supply voltage for LCD	V <sub>0</sub> -XV <sub>0</sub>	-0.3	-	19	V
Input voltage	V <sub>IN</sub>	-0.3	-	V <sub>DD</sub> +0.3	V
Operating temperature	T <sub>OP</sub>	-20	25	70	°C
Storage temperature	T <sub>ST</sub>	-40	-	80	°C

Remarks: It is a normal characteristics that display may show some transitional optical imperfection when display is continuously running at extreme low and high temperature limit. Such transitional imperfection will disappear and resume back to normal characteristics within 24 hours when temperature returns back to room temperature. This transitional imperfection has no impact on display functionality and reliability for its nominal usage state as stated at item 1.0.

## 8.0 ELECTRICAL CHARACTERISTICS (Ta = 25°C, V<sub>SS</sub> = 0 V, V<sub>DD</sub>=3.0V)

Parameter	Symbol	Min	Typ.	Max	Unit
Supply voltage for LCD	V <sub>OP</sub>	13.9	14.0	14.1	V
Input voltage	V <sub>IH</sub>	0.7V <sub>DD</sub>	-	V <sub>DD</sub>	V
	V <sub>IL</sub>	V <sub>SS</sub>	-	0.3V <sub>DD</sub>	V
Logic supply current	I <sub>DD</sub>	-	800	1000	μA
LCM supply current	I <sub>LCM</sub>	-	1300	2000	μA
Frame Frequency	f	50	-	128	Hz

Remarks:

- 1) Please kindly set the supply voltage for LCD, V<sub>op</sub> (display driver IC output voltage to drive liquid crystal) within the recommended V<sub>op</sub> range. Min & max of this V<sub>op</sub> does not indicate the min & max acceptable contrast. Min & max acceptable contrast is controlled via limit sample as stated in "Quality Specification" in this specification.
- 2) For high duty ratio  $\geq 1/64$  duty or grayscale display (when applicable), small mismatch (even 1%) between the required supply voltage for LCD with the IC driving voltage (V<sub>op</sub>) can cause cross-talk or display dim issue. It is unlikely for LCD maker and IC maker to have such high precision (<1%) on the V<sub>op</sub> and V<sub>LCD</sub> respectively. Thus it is strongly recommended default-V<sub>op</sub> fine tuning is needed at customer side to ensure best LCD visual performance. Default-V<sub>op</sub> fine tuning can be done using software method (electronic volume setting adjustment, OTP/MTP/EEPROM) or hardware method (external resistor trim pot or voltage regulator).
- 3) For frame frequency, it is for reference only. Customer is recommended to use an appropriate value within the range stated in above table based on the actual application.



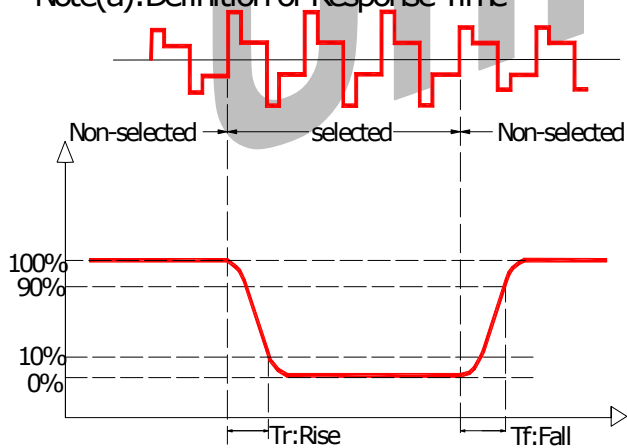
## 9.0 ELECTRO-OPTICAL CHARACTERISTICS

No	Item	Symbol	Measuring Conditions	Min.	Typ.	Max.	Unit	Remark
1	Response Time	Rise	Tr $\theta = 0^\circ$ $\phi = 0^\circ$	-20 °C	--	2500	ms	Note (a)
				25 °C	--	200		
				70 °C	--	100		
		Fall	Tf $\theta = 0^\circ$ $\phi = 0^\circ$	-20 °C	--	9200		
				25 °C	--	380		
				70 °C	--	150		
2	Viewing Angle (CR ≥ 2)	$\theta$	$\phi = 0^\circ$	25 °C	20	25	Deg	Note (b)
		$\theta$	$\phi = 180^\circ$	25 °C	35	40		
		$\theta$	$\phi = 90^\circ$	25 °C	25	30		
		$\theta$	$\phi = 270^\circ$	25 °C	20	35		
3	Contrast Ratio	CR	-	25 °C	2	3	-	Note (c)
4	Brightness on LCM	L <sub>LCM</sub>	$\theta = 0^\circ$ $\phi = 0^\circ$	25 °C	48	-	cd/m <sup>2</sup>	Note (d)

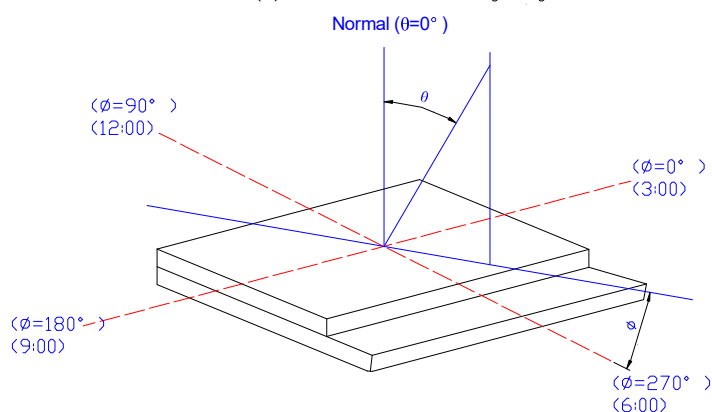
Remarks:

- EOC data above is measured using Otsuka Photol DMS-501 display measurement system.
- Brightness data is measured using photometer Topcon BM-7.

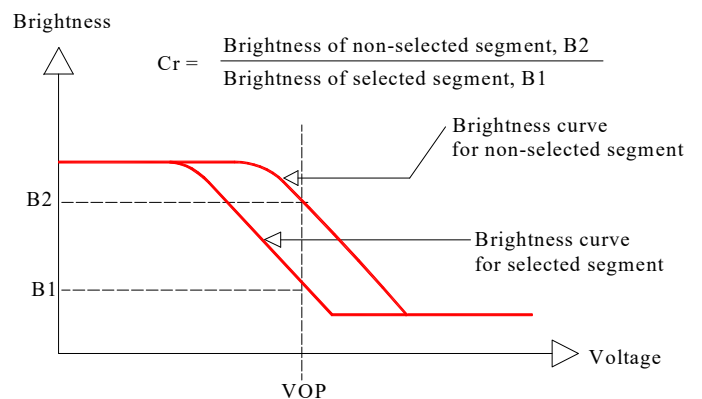
Note(a): Definition of Response Time



Note (b): Definition of Viewing Angle



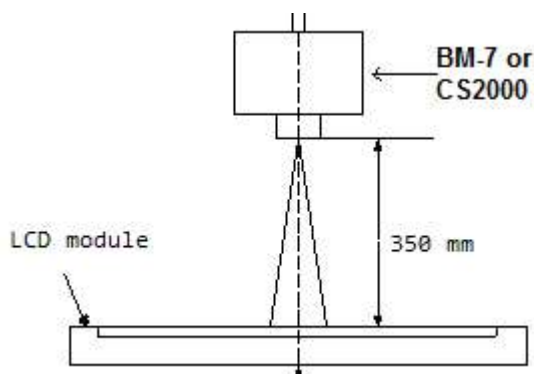
Note (c): Definition of Contrast Ratio



Note (d): backlight driving condition:  $I_f=20\text{mA}$

Luminance measuring point: Center of the dot matrix

measuring setup as below figure:



## 10.0 BACKLIGHT SPECIFICATION

### 10.1 LED Backlight Absolute Maximum Ratings ( $T_a=25^\circ\text{C}$ )

Item	Symbol	Conditions	Min	Max	Unit
Absolute maximum forward current	$I_{f_m}$	-	-	112	mA
Peak forward current	$I_{f_p}$	1 msec plus , 1/10 duty cycle	-	320	mA
Reverse voltage	$V_r$	-	-	5	V
Power dissipation	$P_d$	-	-	51.2	mW
Operating temperature range	$T_{opr}$	-	-20	70	$^\circ\text{C}$
Storage temperature range	$T_{stg}$	-	-40	80	$^\circ\text{C}$

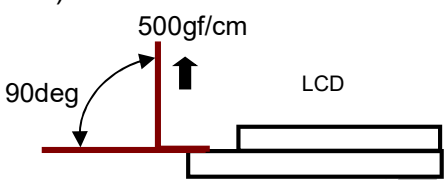
### 10.2 LED Backlight Electrical-optical characteristics

Item	Symbol	Min.	Typ.	Max.	Unit	Conditions
Forward voltage	$V_f$	2.2	2.8	3.2	mA	$I_f=20\text{mA}$ $T=25^\circ\text{C}$
Reverse current	$I_r$	-	-	4	$\mu\text{A}$	$V_r=4.5\text{v}$
Chromaticity coordinates	X	0.26	0.29	0.32	-	Note: 1,Aperture:1°,9 Point 2,Average=min/max* 100%
	Y	0.26	0.29	0.32	-	
Luminance	$L_v$	300	600	-	$\text{cd/m}^2$	
Uniformity	$\Delta$	80%	-	-	%	

Remarks: chromaticity and luminance data are measured using photometer Topcon BM-7A.

## 11.0 RELIABILITY SPECIFICATION

### 11.1 Reliability Test Conditions

No	Test Item	Test Conditions
1	High temperature storage	80°C, 240hrs
2	High temperature operation	70°C, 240hrs
3	Low temperature storage	-40°C, 240hrs
4	Low temperature operation	-20°C, 240hrs
5	High temperature humidity	40°C, 90%RH, 240hrs
6	Temperature cycling storage	80°C/30min, -40°C/30min(transition time:30min) :10 cycles
7	Drop test (on packaging)	Full packing, 100cm free fall (6 sides, 1 corner, 3 edges)
8	FPC peeling test	<p>Peeling Degree: 90 deg  Peeling force specification <math>\geq 500</math> gf/cm (without reinforcement silicone)</p>  <p>Peeling speed: 50mm/min  Qty: 3PCS</p>

#### Remarks:

- 1) For operation test, above specification is applicable when test pattern is changing during entire operation test.
- 2) Inspections after reliability tests are performed when the display temperature resumes back to room temperature.
- 3) It is a normal characteristic that some display abnormality can be seen during reliability test. If the display abnormality can recover as normal condition within 24 hours at room temperature, there is no permanent destruction over the display. The display still possesses its functionality and considered as acceptable after reliability tests.
- 4) For any life time simulation, normal use life time is defined as working in normal operating condition at 25°C and 60%RH. MTBF simulation is used for life time estimation. Acceleration at high temperature or high temperature high humidity (as stated above) is used in MTBF simulation with respect to normal use operating condition.

### 11.2 Failure Judgment Criteria

After the reliability tests above, test sample shall be let return to room temperature and humidity for at least 4 hours before final tests are carried out.

Item	Acceptance Criteria
Electrical characteristic	No electrical short and open. Increase in current consumption is less than 2 times of initial value.
Mechanical characteristic	Within mechanical and drawing specification
Optical characteristic	Within appearance standard as specified in this specification. Contrast ratio change & ON-transmission value shall not less than 50% of initial minimum value.

## 12.0 QUALITY SPECIFICATION

### 12.1 Acceptable Quality Level (AQL)

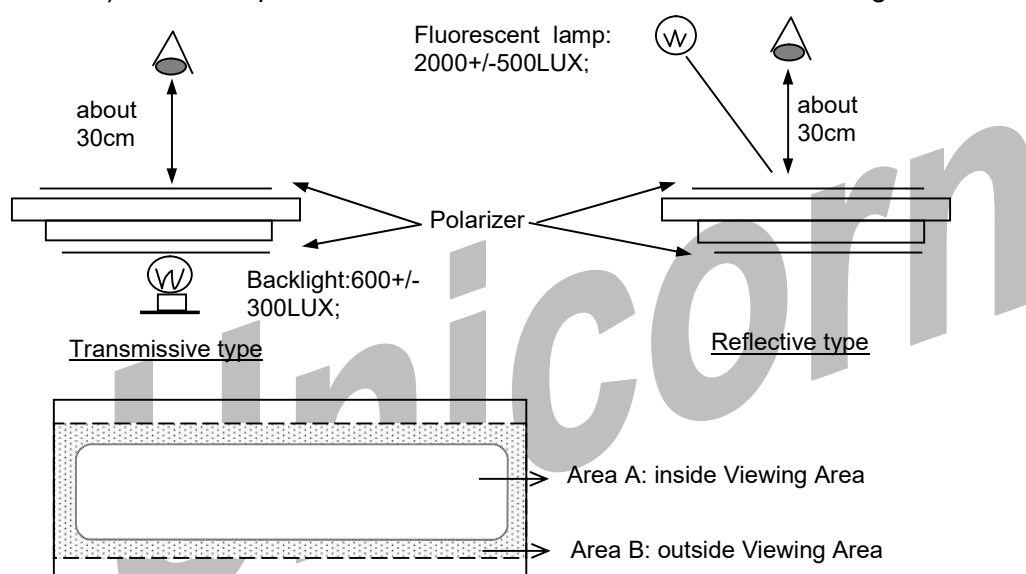
Each lot should satisfy the quality level defined as follows:

- Inspection method: MIL-STD-105E Level II normal one time sampling
- AQL level

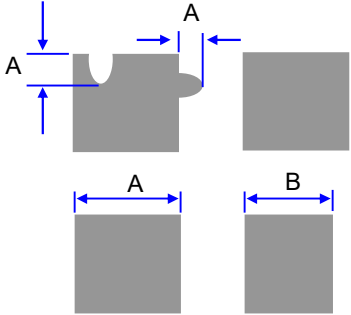
Category	AQL	Definition
Major	0.25%	Functional defective as product
Minor	0.25%	Satisfy all functions as product but not satisfy cosmetic standard

### 12.2 Conditions of Inspection

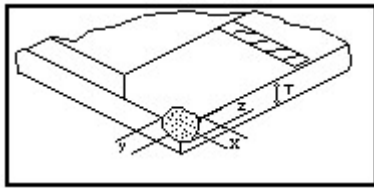
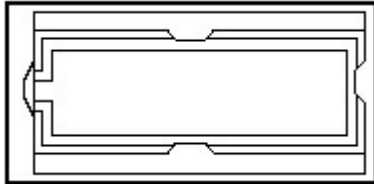
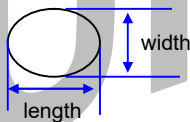
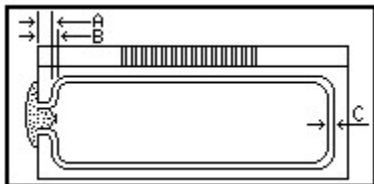
- Inspection equipments: inspection and testing equipment used by the company.
- Other inspection conditions are illustrated as the following:



### 12.3 Acceptance Criteria (Unicorn internal standard: JU-COG ver A0)

Defect	Acceptance Standard (unit in mm)	Category	Method	Zone
Full display	All segments must appear.	Major	Visual	A
Off display state	No pattern shall appear.	Major	Visual	A
Partial display state	Off pattern shall not appear during partial display state.	Major	Visual	A
Display condition	Dim display, extra pattern and short circuit are not acceptable	Major	Visual	A
Display pattern position	Display position shall conform to the tolerance specified on the drawing.	Major	Visual	A
Pixel Deformation	 <p>Pattern protrusion/indentation  <math>A \leq 0.15\text{mm}</math></p> <p>Width deformation:  <math>(A - B) \leq 0.10\text{mm}</math></p> <p>Note: Pixels shall not be bridged between each other.</p>	Minor	Visual Magnifier	A

Black or white spots (on pattern), pin hole	<div><div><div><div><div></div><div>length</div><div></div><div></div><div>width</div></div><div><div></div><div>length</div><div></div><div></div><div>width</div></div></div></div><div><math>d = (\text{length} + \text{width}) / 2</math></div><div>Note: Number of black/white spot acceptable shall not be more than 1 per each segment. The size of each pixel shall remain more than 1/2 of original pixel area. The distance between 2 defects must be &gt; 5mm.</div></div> <table><thead><tr><th>Size, d (mm)</th><th>Acceptable quantity</th></tr></thead><tbody><tr><td><math>d \leq 0.10</math></td><td>Unlimited</td></tr><tr><td><math>0.10 &lt; d \leq 0.20</math></td><td>3</td></tr><tr><td><math>d &gt; 0.20</math></td><td>0</td></tr></tbody></table>	Size, d (mm)	Acceptable quantity	$d \leq 0.10$	Unlimited	$0.10 < d \leq 0.20$	3	$d > 0.20$	0	Minor	Visual Magnifier	A				
Size, d (mm)	Acceptable quantity															
$d \leq 0.10$	Unlimited															
$0.10 < d \leq 0.20$	3															
$d > 0.20$	0															
Chip-out	<div>A: General chip-out on the glass edge</div> <div><div><div><div><div></div><div>X</div><div>Y</div><div>Z</div><div>T</div></div><div><div></div><div>X</div><div>Y</div><div>Z</div><div>T</div></div></div></div><div><div><div><div></div><div>X</div><div>Y</div><div>Z</div><div>T</div></div><div><div></div><div>X</div><div>Y</div><div>Z</div><div>T</div></div></div></div></div> <table><thead><tr><th>X (mm)</th><th>Y (mm)</th><th>Z (mm)</th></tr></thead><tbody><tr><td>Unlimited</td><td><math>\leq 0.3</math></td><td><math>\leq 1/2T</math></td></tr><tr><td><math>\leq 4.0</math></td><td><math>\leq 1.5</math></td><td><math>\leq 1/2T</math></td></tr><tr><td><math>\leq 3.0</math></td><td><math>\leq 1.0</math></td><td><math>\leq T</math></td></tr></tbody></table> <div>X = Length, Y = Width, Z = Height T = single glass thickness C = perimeter seal width All chip out shall not spread to viewing area.</div>	X (mm)	Y (mm)	Z (mm)	Unlimited	$\leq 0.3$	$\leq 1/2T$	$\leq 4.0$	$\leq 1.5$	$\leq 1/2T$	$\leq 3.0$	$\leq 1.0$	$\leq T$	Minor	Visual Magnifier	B
X (mm)	Y (mm)	Z (mm)														
Unlimited	$\leq 0.3$	$\leq 1/2T$														
$\leq 4.0$	$\leq 1.5$	$\leq 1/2T$														
$\leq 3.0$	$\leq 1.0$	$\leq T$														
	<div>B: Chip-out at terminal ledge or back of terminal ledge, but not exactly on terminal.</div> <div><div><div><div><div></div><div>X</div><div>Y</div><div>Z</div><div>T</div></div><div><div></div><div>X</div><div>Y</div><div>Z</div><div>T</div></div></div></div><div><div><div><div></div><div>X</div><div>Y</div><div>Z</div><div>T</div></div><div><div></div><div>X</div><div>Y</div><div>Z</div><div>T</div></div></div></div></div> <table><thead><tr><th>X (mm)</th><th>Y (mm)</th><th>Z (mm)</th></tr></thead><tbody><tr><td>Unlimited</td><td><math>\leq 0.3</math></td><td><math>\leq 1/2T</math></td></tr><tr><td><math>\leq 4.0</math></td><td><math>\leq 2.0</math></td><td><math>\leq 1/2T</math></td></tr><tr><td><math>\leq 3.0</math></td><td><math>\leq 1.0</math></td><td><math>\leq T</math></td></tr></tbody></table> <div>In the event that the distance between chip-out location and terminal is less than width of terminal, the acceptance criteria of chip-out on terminal shall apply.</div>	X (mm)	Y (mm)	Z (mm)	Unlimited	$\leq 0.3$	$\leq 1/2T$	$\leq 4.0$	$\leq 2.0$	$\leq 1/2T$	$\leq 3.0$	$\leq 1.0$	$\leq T$	Minor	Visual Magnifier	B
X (mm)	Y (mm)	Z (mm)														
Unlimited	$\leq 0.3$	$\leq 1/2T$														
$\leq 4.0$	$\leq 2.0$	$\leq 1/2T$														
$\leq 3.0$	$\leq 1.0$	$\leq T$														
	<div>C: Chip-out on terminal</div> <div><div><div><div><div></div><div>X</div><div>Y</div><div>Z</div><div>T</div><div>L</div></div><div><div></div><div>X</div><div>Y</div><div>Z</div><div>T</div><div>L</div></div></div></div></div> <table><thead><tr><th>X (mm)</th><th>Y (mm)</th><th>Z (mm)</th></tr></thead><tbody><tr><td>Unlimited</td><td><math>\leq 0.3</math></td><td><math>\leq 1/2T</math></td></tr><tr><td><math>\leq 2.0</math></td><td><math>\leq 0.8</math></td><td><math>\leq 1/2T</math></td></tr><tr><td><math>\leq 3.0</math></td><td><math>\leq 0.5</math></td><td><math>\leq T</math></td></tr></tbody></table> <div>Note: <math>Y \leq L</math></div>	X (mm)	Y (mm)	Z (mm)	Unlimited	$\leq 0.3$	$\leq 1/2T$	$\leq 2.0$	$\leq 0.8$	$\leq 1/2T$	$\leq 3.0$	$\leq 0.5$	$\leq T$	Minor	Visual Magnifier	B
X (mm)	Y (mm)	Z (mm)														
Unlimited	$\leq 0.3$	$\leq 1/2T$														
$\leq 2.0$	$\leq 0.8$	$\leq 1/2T$														
$\leq 3.0$	$\leq 0.5$	$\leq T$														

	<p>D: Chip-out on corner</p>  <table><tr><th>X (mm)</th><th>Y (mm)</th><th>Z (mm)</th></tr><tr><td>≤ 2.0</td><td>≤ 2.0</td><td>≤ T</td></tr></table> <p>Note: 1) In the event that the distance between chip-out location and terminal is less than the width of terminal, the acceptance criteria for chip-out on terminal shall apply. 2) In the event that the distance between chip-out location and corner is more than 0.2mm, the acceptance criteria for chip-out on glass edge shall apply.</p>	X (mm)	Y (mm)	Z (mm)	≤ 2.0	≤ 2.0	≤ T	Minor	Visual Magnifier	B									
X (mm)	Y (mm)	Z (mm)																	
≤ 2.0	≤ 2.0	≤ T																	
	<p>E: Chip-out on perimeter seal</p>  <p>Note: Any chip-out which reduces the perimeter seal width by more than 1/3 of the original width is not acceptable.</p>	Minor	Visual Magnifier	B															
Outer dimension	Outer dimension shall meet the dimension tolerance on the drawing.	Minor	Caliper	B															
Crack	Crack shall not exist	Minor	Visual	A B															
Black spot White spot Bubble Foreign Material Scratched spot	 <table><tr><th>Size, d (mm)</th><th>Acceptable quantity</th></tr><tr><td>d ≤ 0.15</td><td>Unlimited</td></tr><tr><td>0.15 &lt; d ≤ 0.20</td><td>3</td></tr><tr><td>d &gt; 0.20</td><td>0</td></tr></table> <p>d = (length + width) / 2 Distance between 2 defects must be &gt; 5mm</p>	Size, d (mm)	Acceptable quantity	d ≤ 0.15	Unlimited	0.15 < d ≤ 0.20	3	d > 0.20	0	Minor	Visual Magnifier	A							
Size, d (mm)	Acceptable quantity																		
d ≤ 0.15	Unlimited																		
0.15 < d ≤ 0.20	3																		
d > 0.20	0																		
Scratch Black line Dust	<table><tr><th>Length</th><th>Width</th><th>Acceptable quantity</th></tr><tr><td>Unlimited</td><td>T ≤ 0.02</td><td>Unlimited</td></tr><tr><td>L ≤ 1.0</td><td>T ≤ 0.03</td><td>Unlimited</td></tr><tr><td>L ≤ 2.0</td><td>T ≤ 0.05</td><td>3</td></tr><tr><td>-</td><td>T &gt; 0.05</td><td>0</td></tr></table> <p>In the event that T &gt; 0.05, the acceptance criteria for black/white spot shall apply. The distance between 2 defects must be &gt; 5mm.</p>	Length	Width	Acceptable quantity	Unlimited	T ≤ 0.02	Unlimited	L ≤ 1.0	T ≤ 0.03	Unlimited	L ≤ 2.0	T ≤ 0.05	3	-	T > 0.05	0	Minor	Visual Magnifier	A
Length	Width	Acceptable quantity																	
Unlimited	T ≤ 0.02	Unlimited																	
L ≤ 1.0	T ≤ 0.03	Unlimited																	
L ≤ 2.0	T ≤ 0.05	3																	
-	T > 0.05	0																	
Reverse twist	Reverse twist at non-viewing area: acceptable number is unlimited. Reverse twist within zone of viewing + 0.44mm: acceptable with condition that meet acceptance criteria for scratch/black line and do not over spread to AA zone.	Minor	Visual Magnifier	A B															
Endseal	 <p>A: End sealant length B: Sealing mouth length C: Perimeter seal width</p> <p>1) Minimum amount of end-sealant in the sealing mouth shall be A &gt; 1/3B; maximum amount of end-sealant shall not spread over to viewing area.</p>	Minor	Visual Magnifier	B															

	2) Dimension of end seal shall meet the dimension specified on the drawing. 3) Deformation of perimeter seal which result in perimeter seal less than 1/3C is not acceptable.			
Polarizer	Polarizer position must meet the tolerance indicated on the drawing.	Minor	Visual	A B
Discoloration	Obvious uneven discoloration (rainbow) shall not be seen.	Minor	Visual	A
FPC cosmetic defect	According to IPC-6013A.	-	Visual	-

Remarks (applicable to limit sample control):

- 1) LCD background color acceptance criteria shall base on customer's approved background color limit sample. This background color control is referring to the display appearance at OFF-state only.
- 2) Display contrast (ON-state) acceptance criteria shall base on customer's approved contrast limit sample when display is driven at the nominal driving conditions as stated in this specification at room temperature. Customer's approved contrast limit range should have at least 0.40V (of Vop equivalent) for manufacturing purpose.
- 3) In cases that such limit samples as stated in (1) and (2) above are not available, Unicorn shall control based on internal approved background color and contrast limit samples.

## 13.0 ENVIRONMENTAL SPECIFICATION

This product is designed, manufactured and compliant to below RoHS standard:

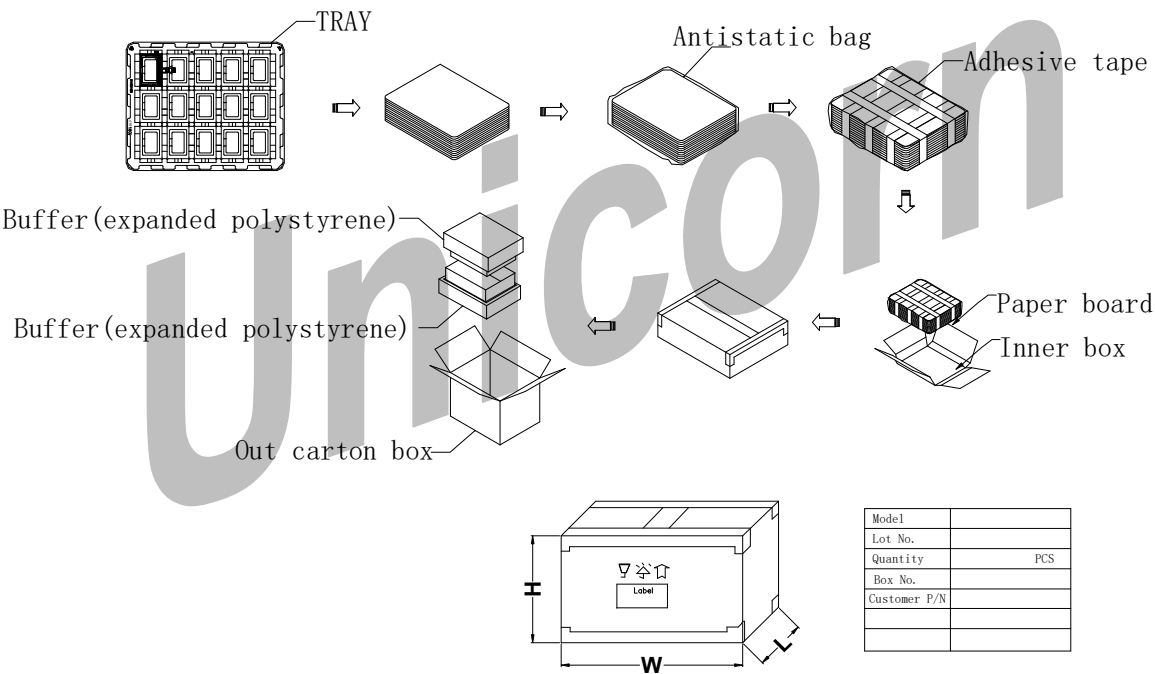
- |   |                   |
|---|-------------------|
| 1. Cadmium and Cadmium Compounds          | Less than 100ppm  |
| 2. Hexavalent Chromium Compounds          | Less than 1000ppm |
| 3. Lead and Lead Compounds                | Less than 1000ppm |
| 4. Mercury and Mercury Compounds          | Less than 1000ppm |
| 5. Polybrominated Biphenyls (PBBs)        | Less than 1000ppm |
| 6. Polybrominated Diphenyl ethers (PBDEs) | Less than 1000ppm |
| 7. Butyl benzyl phthalate (BBP)           | Less than 1000ppm |
| 8. Bis (2-ethylhexyl)phthalate (DEHP)     | Less than 1000ppm |
| 9. Dibutyl phthalate (DBP)                | Less than 1000ppm |
| 10. Diisobutyl phthalate(DIBP)            | Less than 1000ppm |

14.0 PACKAGING SPECIFICATION

Product No.	UNC-MSGF014682-02	Recycle	No
Product Name	LCD Module		
Quantity / each box	120 pcs	Box Material	Paper Carton
Outer carton Box size	46.5cm × 40.5cm × 30.5cm	Box Type	New
Quantity / inner box Quantity /outer box	12 × 5 × 2 = 120pcs	Weight	- kg

There are 12 pcs LCD per each anti-static plastic plate.  
There are 6 layer plastic plates per each inner carton box. Note(1)  
There are 2 inner carton boxes per each outer carton box.

Note(1): 5pcs trays put products and stacked + 1pcs trays as a cap.





## 15.0 GENERAL PRECAUTIONS FOR USING LCD MODULES

Handling Precaution	Operation Precautions
<ul style="list-style-type: none"> <li>No strong mechanical shock. LCD may be broken because it is made out of glass.</li> <li>Do not work on PCB. PCB may be cracked or damaged.</li> <li>Do not bend or process metal bezel positioning tab. LCD maybe shifted and LCD-PCB interconnection may be damaged,</li> <li>Do not scratch. Polarizer is soft material and can be easily scratched.</li> <li>Liquid crystal may leak when LCD/LCM is broken. Please wash your hands if you touch the liquid crystal.</li> <li>Wear gloves when handling LCD/LCM to avoid damage to LCD/LCM. Please do not touch electrodes with bare hands to avoid any contamination on connection.</li> </ul>	<ul style="list-style-type: none"> <li>Viewing angle can be adjusted by varying driving voltage, <math>V_0</math> or <math>V_{op}</math>.</li> <li>Display performance may vary or show abnormal electro-optical performance when viewed at angle beyond the specified viewing angle range.</li> <li>Display color may change under extreme temperature. This is not destructive symptom and display color will resume back to normal when temperature goes back to normal temperature.</li> <li>Driving voltage shall be kept within the specified range as stated in this product specification. Over-voltage may shorten the LCD/LCM lifetime.</li> <li>No DC voltage to LCD/LCM. Electrical characteristics and reliability of LCD/LCM will deteriorate under DC. Please control the DC content in application driving circuit.</li> <li>Avoid using the same display pattern for long time (continuous ON segment). It is a normal phenomena observed for passive driven display where image retention is observed when LCD is displayed with same pattern over 1 hour under temperature <math>&gt; 55^{\circ}\text{C}</math>. Customer is advised to design application software where display pattern will be changed from time to time, or using the N-line inversion function comes with the display driver IC.</li> <li>If the LCM is using master-slave configuration, customer is strongly recommended to use external <math>V_0</math>.</li> <li>If the LCM comes with MTP/OTP function, customer is recommended to use this MTP/OTP function for the best optical performance.</li> </ul>
Soldering Precaution on LCD/LCM	
<ul style="list-style-type: none"> <li>Use soldering iron with proper grounding and no AC leakage.</li> <li>Temperature at tip of soldering iron: <math>330 \pm 10^{\circ}\text{C}</math></li> <li>Type of solder: lead-free solder with resin flux fill.</li> <li>Soldering time: <math>&lt; 3\text{sec}</math>.</li> <li>Soldering on LCD/LCM I/O terminal only.</li> <li>Do not apply force on the LCD metal pin when soldering. Metal pin connection to LCD terminal will be damaged or loosen by this external force under soldering temperature.</li> <li>Do not solder and de-solder for more than 3 times because metal pin connection or soldering pads will be damaged.</li> </ul>	
Static Electricity	Long-term Storage Conditions
<ul style="list-style-type: none"> <li>Avoid static electricity. Please have proper ESD control and ground the human body and any electrical tools when assembling the LCD/LCM.</li> <li>Slowly peel off protective film. Static electricity will be generated when peeling the protective film. It is a normal behavior that LCD/LCM will response to the static charges generated and will resume back to normal condition slowly.</li> </ul>	<ul style="list-style-type: none"> <li>Store LCD/LCM in dark area and keep LCD/LCM away from direct sunlight and fluorescent light.</li> <li>Store LCD/LCM under temperature range of <math>0 \sim 35^{\circ}\text{C}</math> and room humidity of <math>50 \sim 60\% \text{RH}</math>.</li> <li>Possible <math>V_{op}</math> adjustment might be needed at customer side after prolong storage over 1 year from date of manufacturing.</li> </ul>
FPC cleanness	
<ul style="list-style-type: none"> <li>If ACF bonding is applied at customer side between FPC and PCB, cleaning on FPC and PCB bonding area (just before bonding) is a must to reduce risk of bonding reliability (eg bonding delamination/spring back phenomenon, low pull strength etc)</li> </ul>	

## 16.0 MANUFACTURING DATE CODING

All LCD/LCM will have an indication on lot number to show the manufacturing date of the LCD/LCM. Such indication can be a label stuck on the LCD/LCM or ink-injected code. Lot number is having below format:

<u>YYYYMMDD</u>	<u>XXX</u>
(1)	(2)

(1) YYYYMMDD- Year, month and day where the LCD/LCM is manufactured.

(2) XXX – unique serial number

## 17.0 PRODUCT CHANGE NOTIFICATION

- 17.1 Unicorn's LCD front-end manufacturing line is fully automated. Standardization is needed to run this automated line for higher efficiency and stability.
- 17.2 Thus, Unicorn reserves the right to make changes on materials and processes related to LCD front-end manufacturing line.
- 17.3 Change will be assessed, validated and qualified according to Unicorn's internal change management procedure to ensure agreed product and quality specification and application at customer side is not affected.
- 17.4 For other materials and processes not related to LCD front line, all changes shall be notified and approved by customer before any change is considered.

## 18.0 LIMITED WARRANTY

- 18.1 No warranty is granted if any of the precautions stated in handling LCD/LCM above being disregarded, or LCD/LCM is being operated beyond the specification as stated in this product specification. Broken glass, scratches on polarizer, mechanical damages as well as defects that are caused by accelerated environmental tests are excluded from this warranty.
- 18.2 Unless agreed between Unicorn and customer, Unicorn will replace or repair any of its LCD modules, which are found to be functionally defective when inspected in accordance with Unicorn's LCD acceptance standards (copies available upon request) for a period of 2 years from date of shipments.
- 18.3 Cosmetic/visual defects must be returned to Unicorn within 2 years of shipment. Confirmation of such date shall be based on freight documents. The warranty liability of Unicorn limited to repair and/or replacement on the terms set forth above. Unicorn will not be responsible for any subsequent or consequential events.

## 19.0 MANUFACTURER CONTACT:

### UNICORN ELECTRONIC (SHENZHEN) COMPANY LIMITED

No.214 of AnLan Road, Zhang Keng Jing Village, GuanLan Street,  
Bao'an District, ShenZhen, Guangdong, People's Republic of China.

Postal Code 518110.

Telephone No : 86-755-2782 7222

Fax No : 86-755-2782 5120

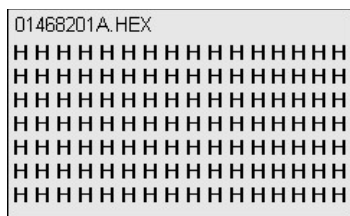
## 20.0 APPENDIX

### 20.1 Functional testing pattern

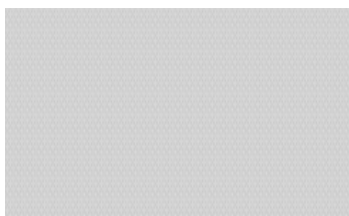
Below test patterns will be used at all LCM functional tests at mass production stage. Acceptance of a product during inspection will be judged based on these test patterns only. Customer should notify Unicorn if different test patterns being used at customer side to ensure same testing platform between Customer and Unicorn, especially on those defects (flickering, image sticking, cross-talk, black/white line) which are pattern-dependent. These test patterns

are by default agreed by both Customer and Unicorn, unless notified by Customer to revise such test patterns. If the defect listed in above description is seen in below pattern, LCD module should be judged as NG and vice versa.

1) Character pattern:



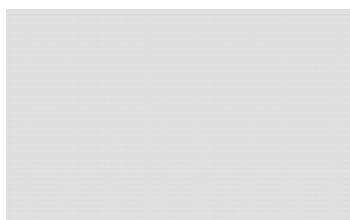
2) Full-off pattern::



3) Full-ON Pattern :



4) Sleep mode:



5) Checker Board Pattern 1:



6) Checker Board Pattern 2:

