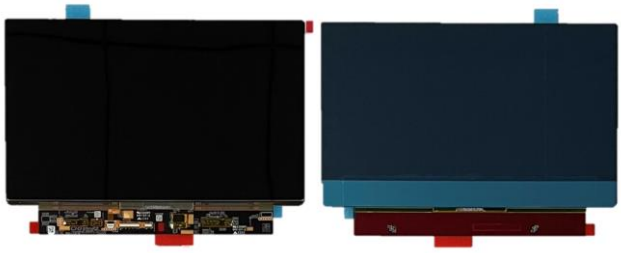
DMA112F5NMOMI-2A
PRODUCT SPECIFICATION

Version 0.1
Jun 12, 2024



Customer's Approval	
Signature	*Date*

Prepared *by Yvette Hsieh*
Approved by *Eric Wan*

Revision History

VERSION	DATE	DESCRIPTION	AUTHOR
0.1	Jun 12, 2024	Preliminary	Yvette Hsieh

Legal Notice

Table Of Contents

1. GENERAL DESCRIPTION 4
1.1 Introduction 4
1.2 Main Features 4
2. MECHANICAL SPECIFICATION 5
2.1 Mechanical Characteristics 5
2.2 Mechanical Drawing 6
3. ELECTRICAL SPECIFICATION OLED 7
3.1 Absolute Maximum Ratings 7
3.2 DC Characteristics 7
3.3 Interface Pin Assignment 9
3.4 Block Diagram 11
3.5 Timing Characteristics 12
4. OPTICAL SPECIFICATION OLED 16
4.1 Optical Characteristics 16
5. PACKAGING 21
6. QUALITY ASSURANCE SPECIFICATION 22
6.1 Conformity 22
6.2 Environment Required 22
6.3 Delivery Assurance 23
6.4 Dealing with Customer Complaints 29
7. RELIABILITY SPECIFICATION 30
7.1 Reliability Tests 30
8. HANDLING PRECAUTIONS 31
8.1 Handling Precautions 31
8.2 Storage Precautions 32
8.3 Designing Precautions 32
8.4 Operation Precautions 33
8.5 Other Precautions 33

1. General Description

1.1 Introduction

This is a 11.2” size colour AMOLED display module. The display is 1.07B colour, has a resolution of 2560 x 1536 and supports MIPI 2-Port D-PHY interface and with TBD bonding touch panel.

1.2 Main Features

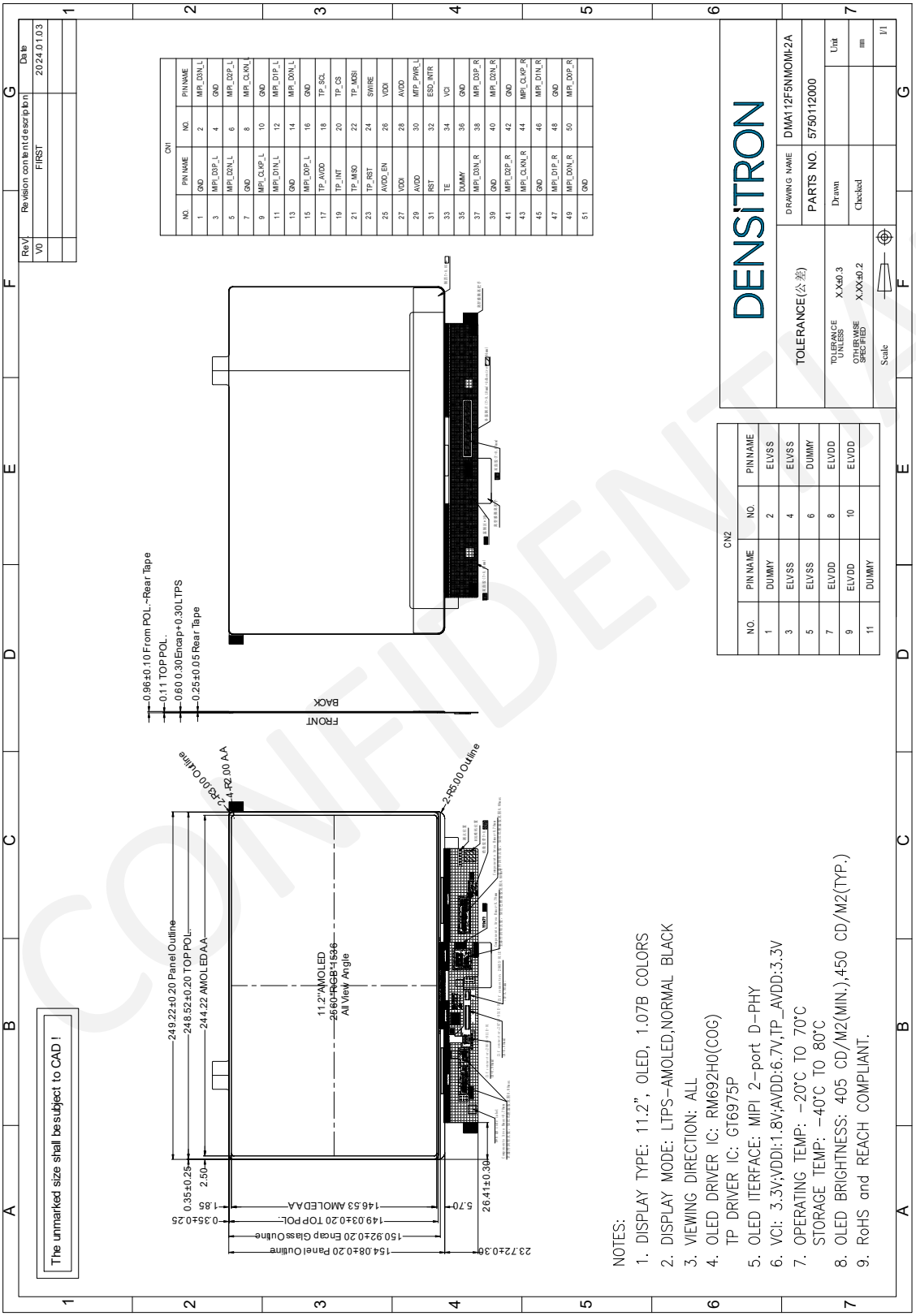
Item	Contents
Display Type	AMOLED
Screen Size	11.2” Diagonal
Display Format	2560 x RGB x 1536 Dots
No. of Colour	1.07B
Mode	Normally Black / Transmissive
Overall Dimensions	249.22 (W) x 154.08 (H) x 0.96 (D) mm
Active Area	244.22 (W) x 146.53 (H) mm
Surface Treatment	Glare (6H)
Viewing Direction	All round
Interface	MIPI 2-Port D-PHY
Display Driver IC	RM692H0
Touch Interface	I^2C
Touch Controller	GT6975P
Operating Temperature	-20°C ~ +70°C
Storage Temperature	-40°C ~ +80°C
ROHS	RoHS Compliance

2. Mechanical Specification

2.1 Mechanical Characteristics

Item	Characteristic	Unit
Display Format	2560 x RGB x 1536	Dots
Overall Dimensions	249.22 (W) x 154.08 (H) x 0.96 (D)	mm
Active Area	244.22 (W) x 146.53 (H) mm	mm
Dot Pitch	0.0954 (W) x 0.0954 (H)	mm
Weight	TBD	g
IC Controller/Driver	RM692H0	

2.2 Mechanical Drawing



3. Electrical Specification OLED

3.1 Absolute Maximum Ratings

(Ta=25°C, VSS=0V)

Item	Symbol	Min	Max	Unit
Digital Supply Voltage	VCI	-0.3	5.5	V
Digital Interface Supply Voltage	VDDI	-0.3	5.5	V
Power Supply for Source Driver	ELVDD	-0.3	7.7	V
	ELVSS	-7.7	0.3	V
Operating Temperature	T_{OP}	-20	+70	°C
Storage Temperature	T_{ST}	-40	+80	°C

Note 1: When this module is used beyond the above absolute maximum ratings, permanent breakage of the module may occur. Also, for normal operations, it is desirable to use this module under the conditions according to Section 3.2 "DC Electrical Characteristics OLED" and Section 4 "Optical Characteristics OLED." If this module is used beyond these conditions, malfunctioning of the module can occur and the reliability of the module may deteriorate.

3.2 DC Characteristics

Item	Symbol	Min	Typ	Max	Unit	Note
AMOLED Power Positive	ELVDD	4.55	4.6	4.65	V	-
AMOLED Power Negative	ELVSS	-3.55	-3.50	-3.45	V	Ref
Digital Power Supply	VDDI	1.75	1.80	1.85	V	Measurement from ZIF connector pin
Analog Power Supply	VCI	2.6	3.3	3.6	V	Ref
	AVDD	6.65	6.70	6.75	V	Ref
TP Power Supply Voltage	TP_AVDD	2.7	3.3	3.4	V	-
TP_AVDD Ripple	-	-	-	100	mV	-
TP_IC Operating temperature range	-	-20	25	85	°C	-

3.2.1 Normal Mode

Power supply: VDDI = 1.8V, VCI = 3.3V, Frame Frequency: F_{frame}: 120Hz@25°C, brightness 450 nits, Command Mode.

Display Condition	Symbol	Min	Typ	Max	Unit	Note
100% Pixel on 450 nits, VELVDD = 4.6V, VELVSS = -3.5V	IELVDD/ELVSS	-	650	800	mA	Ref
	IVCI	-	15	20	mA	Ref
	IVDDI	-	261	290	mA	Ref
	IAVDD	-	75	90	mA	Ref

3.2.2 HBM Mode

Power supply: VDDI = 1.8V, VCI = 3.3V, Frame Frequency: F_{frame}: 120Hz@25°C, brightness 600 nits, Command Mode.

Display Condition	Symbol	Min	Typ	Max	Unit	Note
100% Pixel on 600 nits, VELVDD = 4.6V, VELVSS = -3.5V	IELVDD/ELVSS	-	850	1000	mA	Ref
	IVCI	-	15	20	mA	Ref
	IVDDI	-	261	290	mA	Ref
	IAVDD	-	75	90	mA	Ref

3.3 Interface Pin Assignment

3.3.1 CN1(Connector:20718-051E-01)

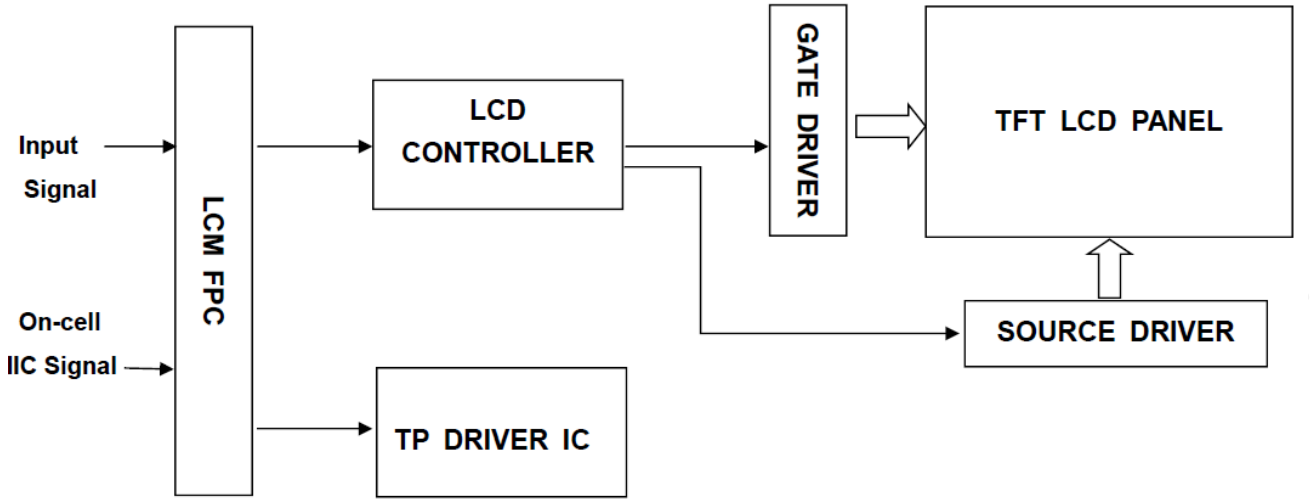
No.	Symbol	I/O	Function
1	GND	P	Ground
2	MIPI_D3N_L	I	L-Port MIPI DSI data 3 for Master IC
3	MIPI_D3P_L	I	
4	GND	P	Ground
5	MIPI_D2N_L	I	L-Port MIPI DSI data 2 for Master IC
6	MIPI_D2P_L	I	
7	GND	P	Ground
8	MIPI_CLKN_L	I	L-Port MIPI DSI clock for Master IC
9	MIPI_CLKP_L	I	
10	GND	P	Ground
11	MIPI_D1N_L	I	L-Port MIPI DSI data 1 for Master IC
12	MIPI_D1P_L	I	
13	GND	P	Ground
14	MIPI_D0N_L	I	L-Port MIPI DSI data 0 for Master IC
15	MIPI_D0P_L	I	
16	GND	P	Ground
17	TP_AVDD	P	Analog power supply (Typ3.3V)
18	TP_SCL	I	TP Slave clock for SPI (Serial Peripheral Interface) (1.8V)
19	TP_INT	I	TP INT for AP (1.8V)
20	TP_CS	I	TP Slave select for SPI (Serial Peripheral Interface) (1.8V)
21	TP_MISO	I	TP Master input, slave output for SPI (Serial Peripheral Interface) (1.8V)
22	I2C_MOSI	I	TP Master output, slave input for SPI (Serial Peripheral Interface) (1.8V)
23	I2C_RST	I	TP Reset (1.8V)
24	SWIRE	I	Enable ELVDD and ELVSS output of DC/DC IC
25	AVDD_EN	I	Enable ELVDD and ELVSS output of DC/DC IC
26-27	VDDI	P	Digital power for drive IC
28-29	AVDD	P	Charge pumping power for driver IC
30	MTP_PWR_L	I	Power supply for OTP. Float it for normal operation
31	RST	I	Reset pin for DDIC, active low
32	ESD_INTR	I	MIPI_error detection pin
33	TE	I	Feedback from driver IC for synchronism

No.	Symbol	I/O	Function
34	VCI	P	Anolog power for driver IC
35	DUMMY	-	No connection
36	GND	P	Ground
37	MIPI_D3N_R	I	R-Port MIPI DSI data 3 for Master IC
38	MIPI_D3P_R	I	
39	GND	P	Ground
40	MIPI_D2N_R	I	R-Port MIPI DSI data 2 for Master IC
41	MIPI_D2P_R	I	
42	GND	P	Ground
43	MIPI_CLKN_R	I	R-Port MIPI DSI clock for Master IC
44	MIPI_CLKN_R	I	
45	GND	P	Ground
46	MIPI_ D1N _R	I	R-Port MIPI DSI data 1 for Master IC
47	MIPI_ D1P _R	I	
48	GND	P	Ground
49	MIPI_ D0N _R	I	R-Port MIPI DSI data 0 for Master IC
50	MIPI_ D0P _R	I	
51	GND	P	Ground

3.3.2 CN2(Connector:20655-011E-01)

No.	Symbol	I/O	Function
1	DUMMY	-	No connection
2-5	ELVSS	P	ELVSS for OLED
6	DUMMY	-	No connection
7-10	ELVDD	P	ELVDD for OLED
11	DUMMY	-	No connection

3.4 Block Diagram



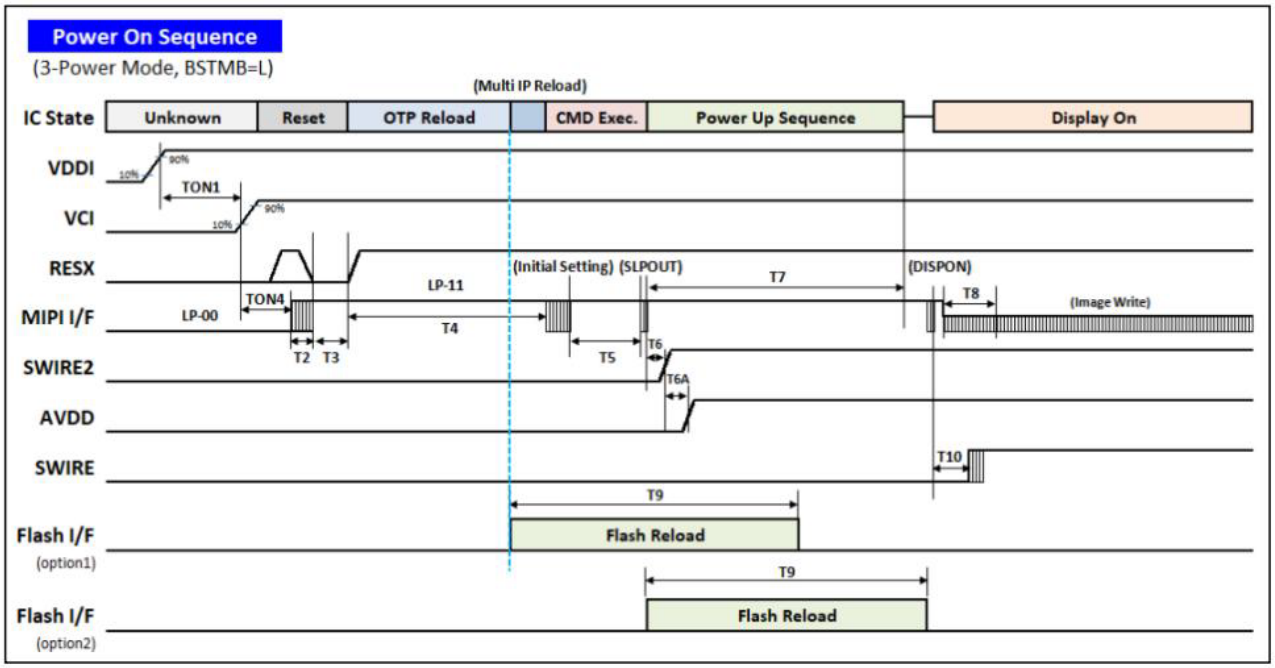
3.5 Timing Characteristics

3.5.1 Recommended Operating Sequence

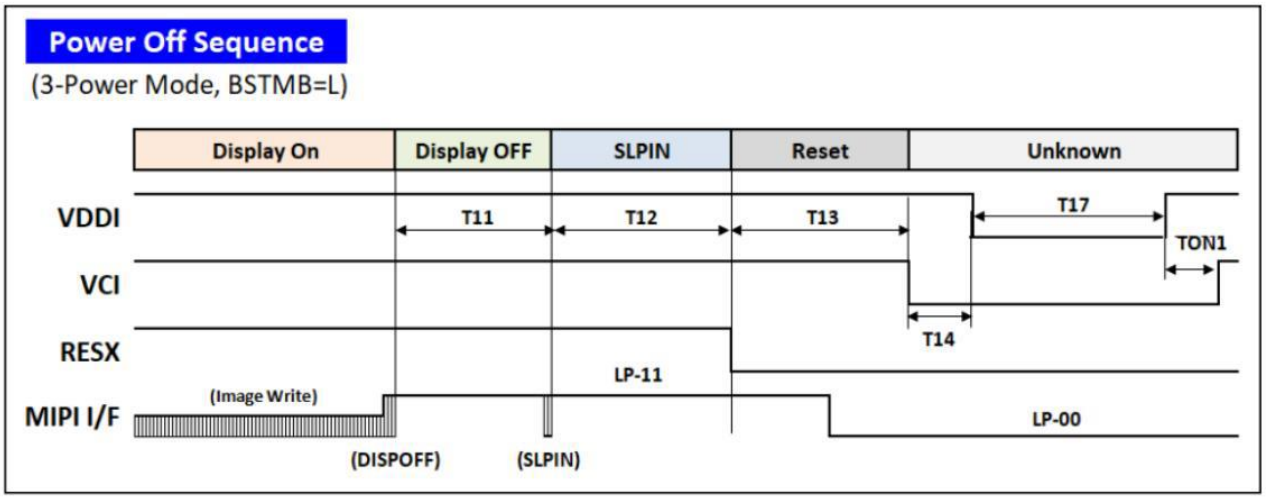
Timing Characteristics of Power On/Off Sequence

Symbol	Min	Typ	Max	Unit	Note
TON1	2	-	-	ms	VDDI to VDDI power ready timing (for 3-power mode)
TON2	0	-	-	ms	VDDI to DVDD power ready timing (for 4-power mode)
TON3	2	-	-	ms	VDDI to VCI power ready timing (for 3-power mode)
TON4	0	-	-	ms	VCI to MIPI LP11 timing
T2	1	-	-	ms	MIPI stabilization time
T3	1	-	-	ms	Effective hardware reset period
T4	32	-	-	ms	Initial code input starts to RESX goes H
T5	0	-	-	ms	Initial code input finish to SLPOUT command input
T6	0	-	16	ms	SWIRE2 goes H after SLPOUT cmd
T6A	0	-	16	ms	AVDD starts after SWIRE2 goes H
T7	6	6	6	VS	Normal power-up sequence
T8	2	-	14	VS	Display-on blanking region
T9	0	80	-	ms	16Mb Quad-SPI flash reload time
T10	1	-	7	VS	SWIRE enable after receiving DISPON cmd
T11	1	-	14	VS	Display off blanking region
T12	1	-	-	VS	Power off blanking region
T13	2	-	-	ms	Effective hardware reset period
T14	2	-	-	ms	Power off period (for 3-Power mode)
T15	2	-	-	ms	Power off period (for 4-Power mode)
T16	0	-	-	ms	Power off period (for 4-Power mode)
T17	5	-	-	ms	Power down period

3.5.2 Power On Sequence



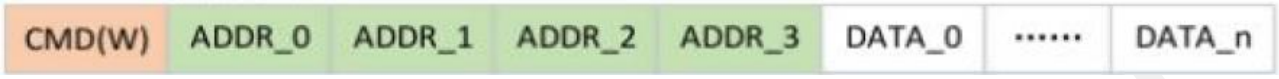
3.5.3 Power Off Sequence



3.5.4 SPI

GT6975P provides SPI interface, only support CPOL=0, CPHA=0 mode. Communicating with master control from SPI_MOSI (Slave input). SPI_MISO (Slave out), SPI_CLK (Serial clock), SPI_CS (Chip select). GT6975P always serves as slave device in the system with all communication being initialized by the host.

SPI write protocol



CMD (W): Write command, fixed to 0xF0

ADDR_0~ADDR_3: 32-bit address of register to be written (big-endian mode: high byte first, low byte last)

DATA_0~DATA_n: Data to be writen

SPI read protocol

1. One byte Mode

CMD (R): Read command, fixed to 0xF1

ADDR_0~ADDR_3: 32-bit address of register to be read (big-endian mode: high byte first, low byte last)

DATA_0~DATA_n: Data to be read

The data for each communication must be word-aligned data, and the register address is incremented automatically to send the subsequent data in sequence.

2. Two-Byte Mode

CMD (R): Read command, fixed to 0xF0

ADDR_0~ADDR_3: 32-bit address of register to be read (big-endian mode: high byte first, low byte last)

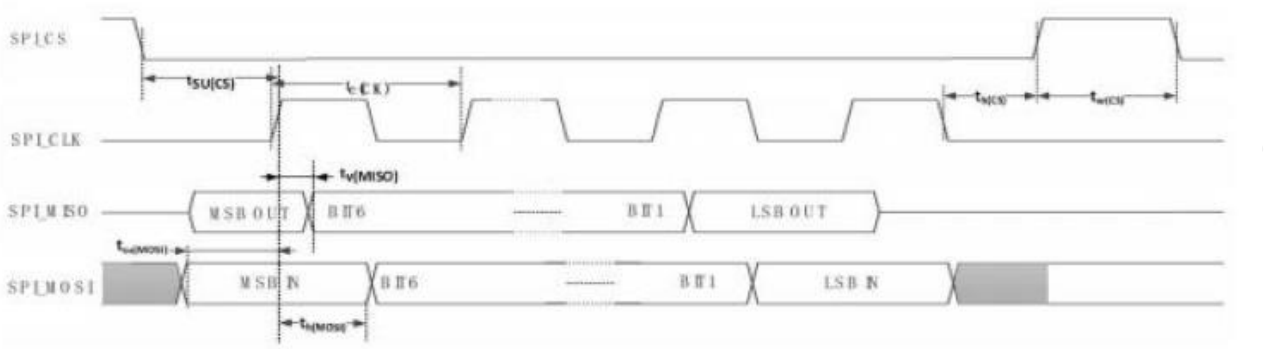
CMD(R): Read command, fixed to 0xF1

DATA_0~DATA_n: Data to be read

The data for each communication must be word-aligned data, and the register address is incremented automatically to send the subsequent data in sequence.

Symbol	Description	Min	Typ	Max	Unit	Condition
1/tc (CK)	SPI Clock Frequency	-	20	25	MHz	-
DuCy (SPI_CLK)	SPI Duty Ratio	-	50	-	%	-
tsu (CS)	SPI_CS Setup Time	25	-	-	ns	-

Symbol	Description	Min	Typ	Max	Unit	Condition
th (CS)	SPI_CS Hold time	6.25	-	-	ns	-
tw (CS)	SPI_CS Wait Time	6.25	-	-	ns	-
tsu (MOSI)	Data Input Setup Time	10	-	-	ns	-
th (MOSI)	Data Input Hold Time	1	-	-	ns	-
tv (MISO)	Data Output Period Time	TBD	-	TBD	ns	C = 20pF



4. Optical Specification OLED

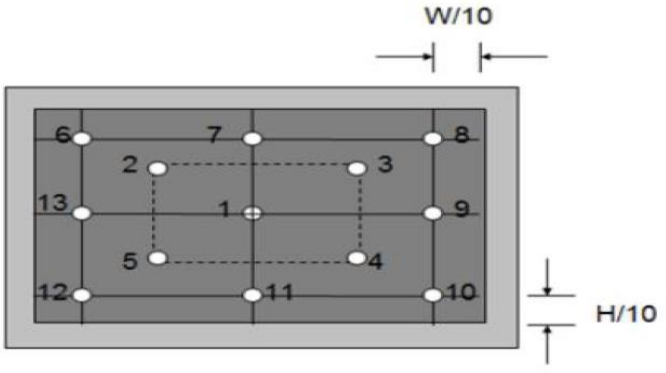
4.1 Optical Characteristics

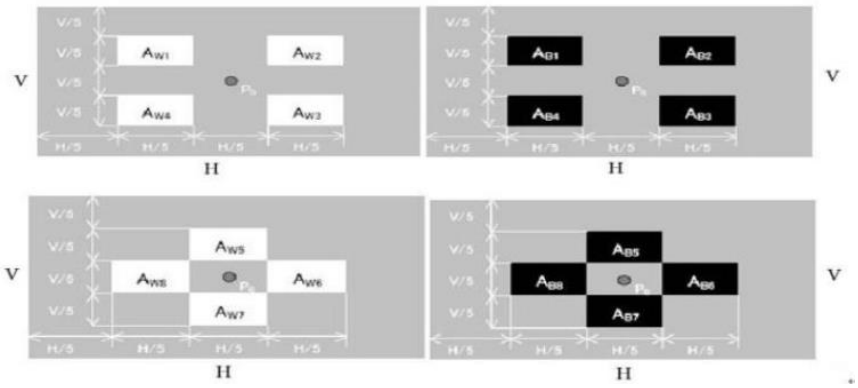
Characteristics		Symbol	Conditions		Min	Typ.	Max	Unit	Note
Brightness		-	Full Whitem Center		405	450	495	cd/m^2	-
HBM		-	-		540	600	660	cd/m^2	-
Minimum Brightness		-	No flicker		-	4	5	cd/m^2	-
Brightness Uniformity		-	Full White		80	-	-	%	1
Contrast Ratio		CR	Normal to surface		100000	1000000	-	-	2
Viewing Angle	Left	ΘL	CR ratio ≥ 10		80	-	-	-	-
	Right	ΘR							
	Top	ΘU							
	Bottom	ΘD							
Color Chromaticity	Red	Rx	Normal to surface		-0.02	0.682	+0.02	-	-
		Ry				0.3148			
	Green	Gx				0.230			
		Gy				0.732			
	Blue	Bx				0.138			
		By				0.043			
	White	Wx				0.295			
		Wy				0.315			
Color Gamut		-	vs. NTSC		98	108	-	%	-
			vs DCI-P3		99	100	-	%	-
CCT		-	-		7000	7800	8600	K	-
CCT Range		-	-		-	-	900	K	-
Colour Shift		-	@45 Degree		-	-	4.5	JNCD	3
Cross-talk		-	4% black or white window, 127 gray scale		-	-	2	%	4
Gamma (120Hz)		-	9 Gray ~ 15 Gray		1.9	2.2	2.5	-	-
		-	16 Gray ~ 240 Gray		2.0	2.2	2.4	-	-
Gamma (60Hz)		-	Normal ~HBM	16 ~ 240 Gray	2.0	2.2	2.4	-	-
				9 ~ 15 Gray	1.9	2.2	2.5	-	-

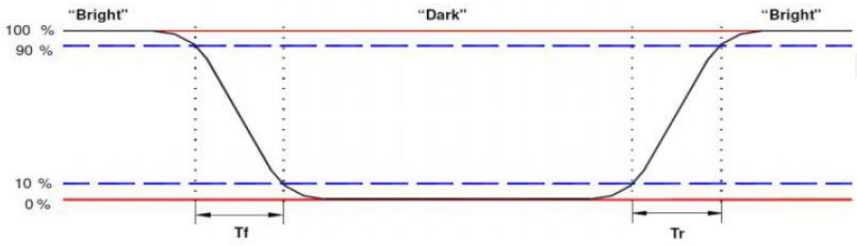
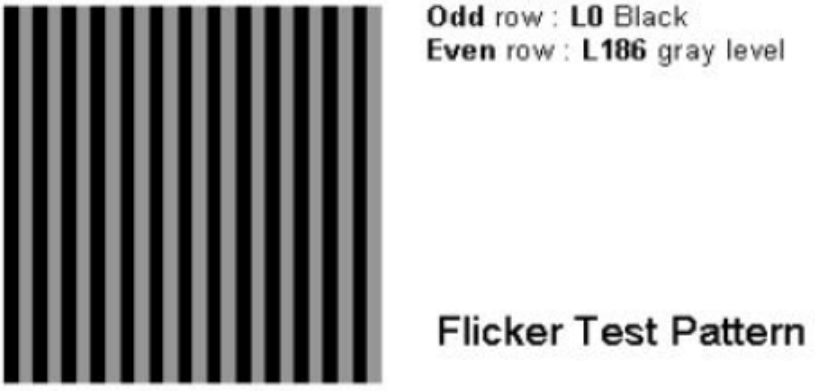
Characteristics	Symbol	Conditions		Min	Typ.	Max	Unit	Note
		30 ~ 100 nits	64 ~ 240 Gray	2.0	2.2	2.4	-	-
			32 ~ 63 Gray	1.9	2.2	2.5	-	-
		4 ~ 20 nits	80 ~ -240 Gray	1.9	2.2	2.5	-	-
Response Time	Tr + Tf	-		-	-	2	ms	5
Flicker	-	Normal Θ = θ = 0°		-	-	-40	dB	6
Short-burn in	-	-		Case 1: @240hr ≥ B10 93%@25°C Case 2: @72hr ≥ B10 93%@50°C			-	7
Image Retention	-	-		-	-	TBD	sec	8
Upper Pol Compensation film	-	BenQ 110um		HC/3H			-	-

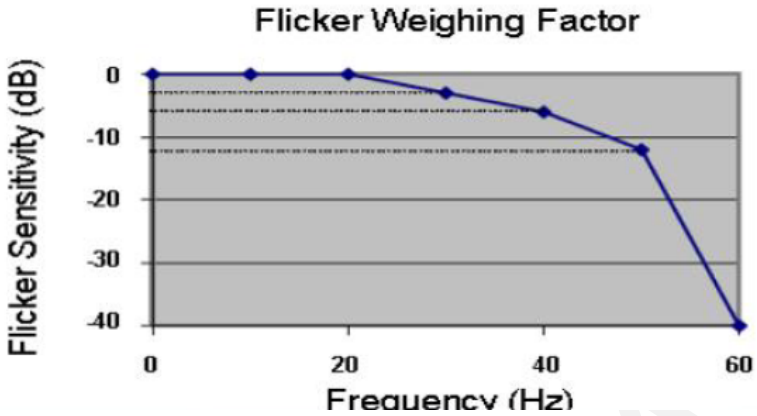
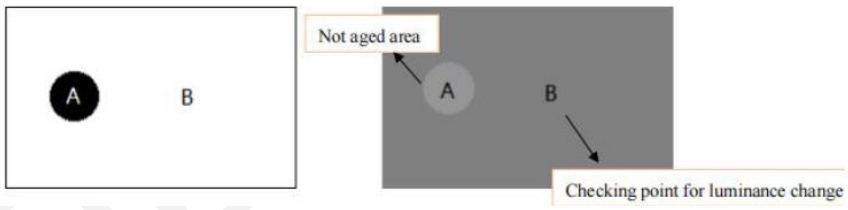
Note: Measuring Condition = in dark room, at ambient temperature 25±3°C, 65±20%RH for 15 min warm-up time.

Distance of OLED display center to measuring machine is 50cm.

Note	Item	Test method
1	Definition of Brightness Uniformity	Measure 13 point of Display Brightness Brightness Uniformity = L_{min} / L_{MAX} x100% 

Note	Item	Test method
2	Definition of Contrast Ratio	Dark Room C.R = LW/LB LW: full white brightness of display center P0. LB: full black brightness of display center P0.
3	Definition of Color Shift	Out-spec panel (4.5~5.5JNCD) should be less than 5%
4	Definition of Cross-talk	4% black or white window, 127 gray background  $L_{W\_OFF} = \frac{L_{w1} + L_{w2} + L_{w3} + L_{w4}}{4}$ $L_{B\_OFF} = \frac{L_{B1} + L_{B2} + L_{B3} + L_{B4}}{4}$ $CT = \frac{\lvert L_{Wi\_ON} - L_{W\_OFF} \rvert}{L_{W\_OFF}} \times 100\% (i = 5\ to\ 8)$ for white windows AWi (I = 5 to 8), and

Note	Item	Test method
		$CT = \frac{\lvert L_{Bi\_ON} - L_{B\_OFF} \rvert}{L_{B\_OFF}} \times 100\% (i = 5 \text{ to } 8)$ for black windows ABi (i = 5 to 8). The maximum cross-talk value shall be noted in the measurement report.
5	Definition of Response Time	Response time = Pixel turn on and turn off time (White -> Black). It is measuring transition time from 10% to 90% of luminance. 
6	Flicker	Suggested Instrument: Konica Minolta CA-310 or Klein Intruments K-8  The flicke level is defined by Fast Fourier Transformation (FTT) as follows: $Flicker = 20\log_{10}\left(2\frac{f_{FFTC}(n)}{f_{FFTC}(0)}\right) + FS(Hz)$ (dB) $f_{FFTC}(n)$ is the n-th FFT coefficient $f_{FFTC}(0)$ is the 0-th FFT coefficient which is DC component FS(Hz) is the flicker sensitivity as a function of frequency. The peak flicker level shall be reported based on the calculation using above formula in which FS(Hz) is determined by the flicker weighing factor shown below:

Note	Item	Test method
		
7	Definition of Short burn In	To measured the burn-in, a test pattern with full white background (area B) and a black circle (area A) is applied to the AMOLED display at 420 nits setting with ACL off. The area of the black circle should not exceed the 20% of the whole displayed area and is big enough for brightness measurement.  After the minimum time specied below (e.g. 200 hours), a fill white image is applied on the display, and the luminance in area A and B are measured at 25°C and compared accoring to the change rate defined as: 1- {A_200hrs/A_0hr-B_200hr/B_0hr} 5 display samples should be measured (all of samples have better luminance than this value)
8	Definition of Image Retention	Light on a 128 gray pattern, capture the luminance of A and B (LA/LB), change to a black and white pattern,

5. Packaging

TBD

6. Quality Assurance Specification

6.1 Conformity

The performance, function and reliability of the shipped products conform to the Product Specification.

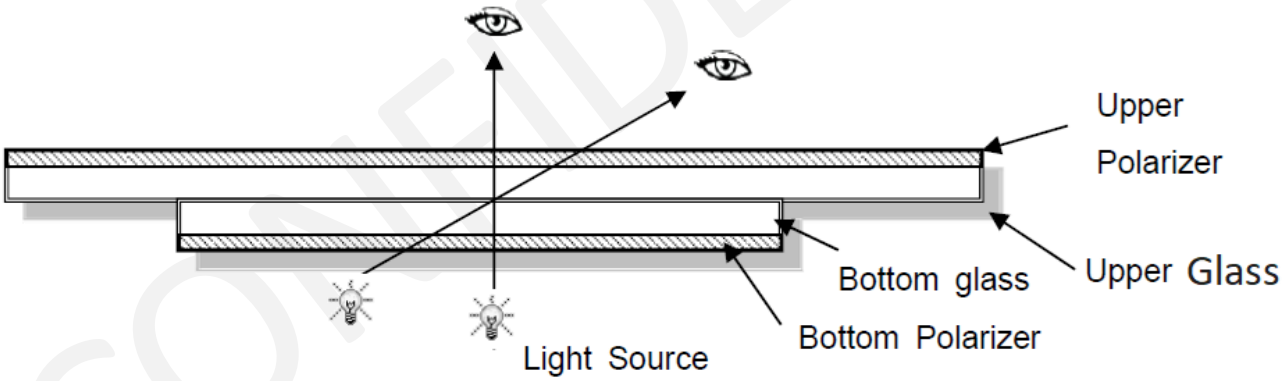
6.2 Environment Required

Customer's test & measurement are required to be conducted under the following conditions:

Temperature:	25±5℃
Humidity:	65% ± 10% RH
Viewing Angle:	Normal Viewing Angle
Illumination:	Single fluorescent lamp (300 to 700 Lux)
Viewing distance:	30 - 50cm

Finger glove (or finger cover) must be worn by the inspector.

Inspection table or jig must be anti-electrostatic.

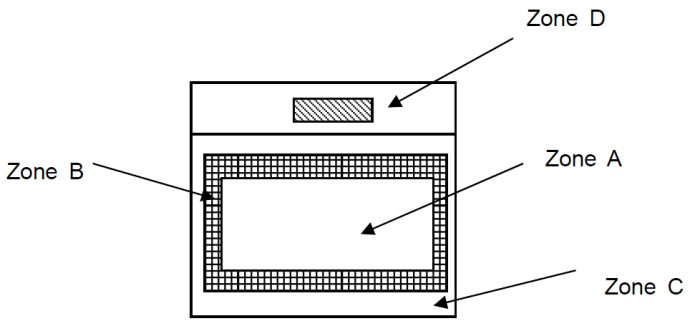


6.3 Delivery Assurance

6.3.1 Delivery Inspection Standards

Class II, Normal Inspection, MIL-STD-105E

6.3.2 Zone Definition



Zone A: Effective Viewing Area (Character or Digit can be seen)

Zone B: Viewing Area except Zone A

Zone C: Outside (Zone A + Zone B) Area which cannot be seen after assembly by customer.

Zone D: IC Bonding Area

Note: Generally, visual defects in Zone C can be ignored when it doesn't affect product function or appearance after assembly by customer

6.3.3 Criteria & Acceptable Quality Level

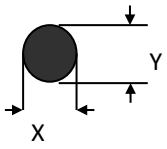
Partition	AQL
Major	0.65
Minor	1.5

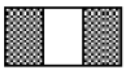
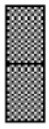
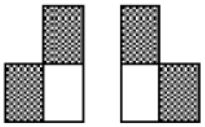
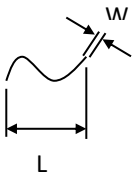
LCD: Liquid Crystal Display, LCM: Liquid Crystal Module, CTP: Capacitive Touch Panel

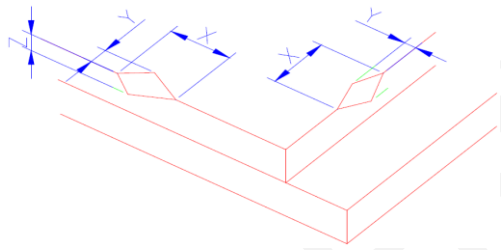
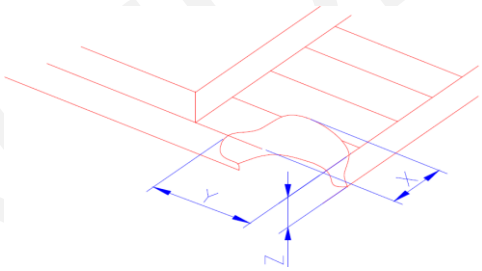
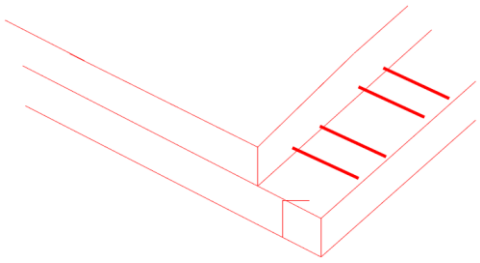
No.	Items	Criteria	Classification of defects
1	Functional defects	1) No display, Open or miss line 2) Display abnormally, Short 3) Backlight no lighting, abnormal lighting. 4) TP no function.	Major
2	Missing	Missing components, etc.	
3	Outline Dimension	Overall outline dimension beyond the drawing or deformation is not allowed.	
4	Color Tone	To judge color unevenness, please refer to limit sample	Minor
5	Spot/ Line Defect	Light dot, Dim spot, Polarizer Air Bubble Polarizer accidented spot, etc.	
6	Soldering Appearance	Good soldering, peeling off is not allowed.	
7	LCD/Polarizer/TP	Black/White spot/line, scratch, crack, etc.	

6.3.4 Criteria & Classification

Units: mm

<table>
<tr><th>Class</th><th>Item</th><th colspan="4">Criteria</th></tr>
<tr><td rowspan="25">Minor</td><td rowspan="25">Spot & Pixel Defect</td><td colspan="4">Round type: as per following drawing, ∅ = (X+Y)/2  </td></tr>
<tr><td colspan="4">1) Light Dot（LCD/Polarizer black/white spot, light dot, pinhole, dent, stain, etc.）</td></tr>
<tr><td rowspan="2">Size\Zone</td><td colspan="3">Acceptable Quantity</td></tr>
<tr><td>A</td><td>B</td><td>C</td></tr>
<tr><td>∅≤0.15</td><td>Ignore</td><td rowspan="4" colspan="2">Ignore</td></tr>
<tr><td>0.15<∅≤0.25</td><td>3 (distance ≧ 10mm)</td></tr>
<tr><td>0.25<∅≤0.4</td><td>2 (distance ≧ 10mm)</td></tr>
<tr><td>0.4<∅</td><td>0</td></tr>
<tr><td colspan="4">2) Dim Spot (LCD/Polarizer dim dot, light leakage, dark spot, etc.)</td></tr>
<tr><td rowspan="2">Size\Zone</td><td colspan="3">Acceptable Quantity</td></tr>
<tr><td>A</td><td>B</td><td>C</td></tr>
<tr><td>∅≤0.15</td><td>Ignore</td><td rowspan="4" colspan="2">Ignore</td></tr>
<tr><td>0.15<∅≤0.25</td><td>3 (distance ≧ 10mm)</td></tr>
<tr><td>0.25<∅≤0.4</td><td>2 (distance ≧ 10mm)</td></tr>
<tr><td>0.4<∅</td><td>0</td></tr>
<tr><td colspan="4">3) Polarizer Accidented Spot</td></tr>
<tr><td rowspan="2">Size\Zone</td><td colspan="3">Acceptable Quantity</td></tr>
<tr><td>A</td><td>B</td><td>C</td></tr>
<tr><td>∅≤0.2</td><td colspan="2">Ignore</td><td rowspan="3">Ignore</td></tr>
<tr><td>0.2<∅≤0.5</td><td colspan="2">2 (distance ≧ 10mm)</td></tr>
<tr><td>0.5<∅</td><td colspan="2">0</td></tr>
<tr><td colspan="4">4) Pixel Bad Points</td></tr>
<tr><td>Item</td><td>Zone A</td><td colspan="2">Acceptable Quantity</td></tr>
<tr><td rowspan="3">Bright Dot</td><td>Random</td><td colspan="2">N≦2</td></tr>
<tr><td>2 dots adjacent</td><td colspan="2">N≦0</td></tr>
<tr><td>3 dots adjacent</td><td colspan="2">N≦0</td></tr>
<tr><td rowspan="2">Dark Dot</td><td>Random</td><td colspan="2">N≦3</td></tr>
<tr><td>2 dots adjacent</td><td colspan="2">N≦0</td></tr>
</table>

<table>
<tr><th>Class</th><th>Item</th><th colspan="4">Criteria</th></tr>
<tr><td rowspan="11"></td><td rowspan="11"></td><td></td><td>3 dots adjacent</td><td colspan="2">N≦0</td></tr>
<tr><td>Distance</td><td>1. Minimum Distance Between Bright dots.
2. Minimum Distance Between dark dots
3. Minimum Distance Between dark and bright dots.</td><td colspan="2">5mm</td></tr>
<tr><td colspan="2">Total Q’ty of bright and dark dots</td><td colspan="2">N≦4</td></tr>
<tr><td colspan="5">Note:
A) Bright dot: Dots appearing bright and unchanged in size in which LCD panel is displaying under black pattern.
B) Dark dot: Dots appearing dark and unchanged in size in which LCD panel is displaying under pure red, green, blue picture.
C) 2 dot adjacent = 1 pair = 2 dots
Picture:
 
2 dot adjacent
 
2 dot adjacent
 
2 dot adjacent (vertical)
 
2 dot adjacent (slant)</td></tr>
<tr><td colspan="5">5) Polarizer Bubble</td></tr>
<tr><td rowspan="2">Size\Zone</td><td colspan="3">Acceptable Quantity</td></tr>
<tr><td>A</td><td>B</td><td>C</td></tr>
<tr><td>∅≤0.2</td><td colspan="2">Ignore</td><td rowspan="3">Ignore</td></tr>
<tr><td>0.2<∅≤0.4</td><td colspan="2">2 (distance ≧ 10mm)</td></tr>
<tr><td>0.4<∅</td><td colspan="2">0</td></tr>
<tr><td>Minor</td><td>Line Defect (LCD/ Polarizer backlight black/white line,</td><td colspan="4">Line type: as per following drawing
 
</td></tr>
</table>

<table>
<tr><th>Class</th><th>Item</th><th colspan="5">Criteria</th></tr>
<tr><td rowspan="5"></td><td rowspan="5">scratch, stain)</td><td rowspan="2">Width (mm)</td><td rowspan="2">Length (mm)</td><td colspan="3">Acceptable quantity</td></tr>
<tr><td>A</td><td>B</td><td>C</td></tr>
<tr><td>W≤0.05</td><td>Ignore</td><td colspan="2">Ignore</td><td rowspan="3">Ignore</td></tr>
<tr><td>0.05<W≤0.06</td><td>L ≤ 5.0</td><td colspan="2">N ≤ 3</td></tr>
<tr><td>0.06<W≤0.08</td><td>L ≤ 4.0</td><td colspan="2">N ≤ 2</td></tr>
<tr><td>0.08<W</td><td colspan="5">Define as spot defect</td></tr>
<tr><td>Minor</td><td>LCD
Crack/Broken</td><td colspan="6">Symbols:
N: Count, X: Length, Y: Width, Z: Height, L: Length of ITO, T: Height of LCD
1) The edge of LCD broken: X≦3.0mm; Y<Inner border line of the seal; Z≦T
 
2) LCD corner broken: X≦3.0mm; Y≦L; Z≦T
  </td></tr>
<tr><td>Major</td><td>LCD Crack</td><td colspan="6">The LCD with extensive crack is not acceptable.
  </td></tr>
<tr><td>Major</td><td>Electronic Components SMT</td><td colspan="6">Missing parts, solderless connection, cold solder joint, mismatch, or the positive and negative polarity opposite, is not allowed.</td></tr>
<tr><td>Minor</td><td>Display Color & Brightness</td><td colspan="6">1) Color: Measuring the colour coordinates in accordance with the datasheet or samples.</td></tr>
</table>

Class	Item	Criteria
		2) Brightness: Measuring the brightness of white screen in accordance with the datasheet or samples.
Minor	LCD Mura/ Waving/ Hot spot	Not visible through 5% ND filter in 50% gray or judged by limit sample if necessary.

Criteria (functional items)

No.	Item	Criteria
1	No display	Not allowed
2	Missing segment	
3	Short circuit	
4	Backlight no lighting	
5	CTP no function	

6.4 Dealing with Customer Complaints

6.4.1 Non-conforming Analysis

Purchaser should supply Densitron with detailed data of non-conforming sample.

After accepting it, Densitron should complete the analysis in reasonable time and update the status to the purchaser.

6.4.2 Handling of Non-conforming Displays

If any non-conforming displays are found during customer acceptance inspection which Densitron is clearly responsible for, return them to Densitron.

Both Densitron and customer should analyse the reason and discuss the handling of non-conforming displays when the reason is not clear.

Equally, both sides should discuss and come to agreement for issues pertaining to modification of Densitron quality assurance standard.

7. Reliability Specification

7.1 Reliability Tests

Test Item	Test Condition	Inspection After Test
High Temperature Operating	70°C, 96 hrs	Inspection after 2 hours storage at room temperature, The sample shall be free from defects: 1. Remarkable deterioration of no clearly visible defects or display quality. However, any polarizer's deteriorations by the high temperature/ High humidity Storage test and the High temperature/ High humidity Operation test are permitted. 2. No function-related abnormalities. 3. Optical criteria:. White △u'v' ≤0.02 4. No visible defects. (optical /mechanical).
Low Temperature Operating	-20°C, 96 hrs	
High Temperature Storage	80°C, 96 hrs	
Low Temperature Storage	-40°C, 96 hrs	
High Temperature & High Operating	60°C, 90% RH, 96 hours.	
Thermal Shock (Non-operation)	-20°C, 30 min ↔ 70°C, 30 min, Change time:5min 20CYC.	
ESD Test	C=150pF, R=330,5points/panel Air: ±8~15KV, 5times Contact: ± 6~8KV, 5 times; (Environment: 15°C~35°C, 30%~60%).	
Vibration (Non-operation)	Frequency：10Hz~55Hz~10Hz Amplitude: 1.5mm, X, Y, Z direction for total 3hours (Packing condition)	
Box Drop Test	Drop to the ground from 75cm height, one time, every side of carton. (Packing condition)	

Note 1: The test samples should be applied to only one test item.

Note 2: Sample size for each test item is 5~10pcs.

Note 3: For Damp Proof Test, Pure water(Resistance＞10MΩ) should be used.

Note 4: In case of malfunction defect caused by ESD damage, if it would be recovered to normal state after resetting, it would be judged as a good part.

Note 5: Failure Judgment Criterion: Basic Specification, Electrical Characteristic, Mechanical Characteristic, Optical Characteristic.

Note 6: The color fading mura of polarizing filter should not care.

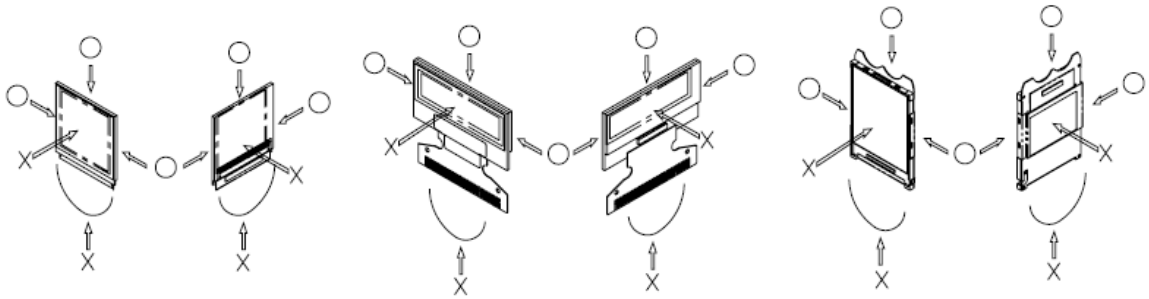
7.1.1 Failure Check Standard

After the completion of the described reliability test, the samples were left at room temperature for 2 hrs prior to conducting the failure teat at 23±5 °C；55±15% RH.

8. Handling Precautions

8.1 Handling Precautions

1) Since the display panel is being made of glass, do not apply mechanical impacts such us dropping from a high position.
2) If the display panel is broken by some accident and the internal organic substance leaks out, be careful not to inhale nor lick the organic substance.
3) If pressure is applied to the display surface or its neighborhood of the OEL display module, the cell structure may be damaged and be careful not to apply pressure to these sections.
4) The polarizer covering the surface of the OEL display module is soft and easily scratched. Please be careful when handling the OEL display module.
5) When the surface of the polarizer of the OEL display module has soil, clean the surface. It takes advantage of by using following adhesion tape.
   a. Scotch Mending Tape No. 810 or an equivalent
   b. Never try to breathe upon the soiled surface nor wipe the surface using cloth containing solvent such as ethyl alcohol, since the surface of the polarizer will become cloudy.
   c. Also, pay attention that the following liquid and solvent may spoil the polarizer:
      - Water
      - Ketone
      - Aromatic Solvents
6) Hold OEL display module very carefully when placing OEL display module into the system housing. Do not apply excessive stress or pressure to OEL display module. And, do not over bend the film with electrode pattern layouts. These stresses will influence the display performance. Also, secure sufficient



rigidity for the outer cases.
7) Do not apply stress to the LSI chips and the surrounding molded sections.
8) Do not disassemble nor modify the OEL display module.
9) Do not apply input signals while the logic power is off.
10) Pay sufficient attention to the working environments when handing OEL display modules to prevent occurrence of element breakage accidents by static electricity.

- Be sure to make human body grounding when handling OEL display modules.
- Be sure to ground tools to use or assembly such as soldering irons.
- To suppress generation of static electricity, avoid carrying out assembly work under dry environments.
- Protective film is being applied to the surface of the display panel of the OEL display module. Be careful since static electricity may be generated when exfoliating the protective film.

11) Protection film is being applied to the surface of the display panel and removes the protection film before assembling it. At this time, if the OEL display module has been stored for a long period of time, residue adhesive material of the protection film may remain on the surface of the display panel after removed of the film. In such case, remove the residue material by the method introduced in the above Section 5).
12) If electric current is applied when the OEL display module is being dewed or when it is placed under high humidity environments, the electrodes may be corroded and be careful to avoid the above.

8.2 Storage Precautions

1) When storing OEL display modules, put them in static electricity preventive bags avoiding exposure to direct sun light nor to lights of fluorescent lamps, etc. and, also, avoiding high temperature and high humidity environments or low temperature (less than 0°C) environments. (We recommend you to store these modules in the packaged state when they were shipped from Densitron Technologies Plc.) At that time, be careful not to let water drops adhere to the packages or bags nor let dewing occur with them.
2) If electric current is applied when water drops are adhering to the surface of the OEL display module, when the OEL display module is being dewed or when it is placed under high humidity environments, the electrodes may be corroded and be careful about the above.

8.3 Designing Precautions

1) The absolute maximum ratings are the ratings which cannot be exceeded for OEL display module, and if these values are exceeded, panel damage may be happen.
2) To prevent occurrence of malfunctioning by noise, pay attention to satisfy the VIL and VIH specifications and, at the same time, to make the signal line cable as short as possible.
3) We recommend you to install excess current preventive unit (fuses, etc.) to the power circuit (VDD). (Recommend value: 0.5A)
4) Pay sufficient attention to avoid occurrence of mutual noise interference with the neighboring devices.
5) As for EMI, take necessary measures on the equipment side basically.
6) When fastening the OEL display module, fasten the external plastic housing section.

7) If power supply to the OEL display module is forcibly shut down by such errors as taking out the main battery while the OEL display panel is in operation, we cannot guarantee the quality of this OEL display module.
8) The electric potential to be connected to the rear face of the IC chip should be as follows: US2066

*Connection (contact) to any other potential than the above may lead to rupture of the IC.

8.4 Operation Precautions

1) When an OEL display module is operated for a long of time with fixed pattern may remain as an after image or slight contrast deviation may occur. Nonetheless, if the operation is interrupted and left unused for a while, normal state can be restored. Also, there will be no problem in the reliability of the module.
2) To protect OEL display modules from performance drops by static electricity rapture, etc., do not touch the following sections whenever possible while handling the OEL display modules.
   a. Pins and electrodes
   b. Pattern layouts such as the FPC
3) With this OEL display module, the OEL driver is being exposed. Generally speaking, semiconductor elements change their characteristics when light is radiated according to the principle of the solar battery. Consequently, if this OEL driver is exposed to light, malfunctioning may occur.
   a. Design the product and installation method so that the OEL driver may be shielded from light in actual usage.
   b. Design the product and installation method so that the OEL driver may be shielded from light during the inspection processes.
4) Although this OEL display module stores the operation state data by the commands and the indication data, when excessive external noise, etc. enters into the module, the internal status may be changed. It therefore is necessary to take appropriate measures to suppress noise generation or to protect from influences of noise on the system design.
5) We recommend you to construct its software to make periodical refreshment of the operation statuses (re-setting of the commands and re-transference of the display data) to cope with catastrophic noise.

8.5 Other Precautions

1) Request the qualified companies to handle industrial wastes when disposing of the OEL display modules. Or, when burning them, be sure to observe the environmental and hygienic laws and regulations.