

# LIQUID CRYSTAL DISPLAY MODULE

## Product Specification

<b>CUSTOMER</b>	<b>Standard</b>
<b>CUSTOMER PART NUMBER</b>	
<b>PRODUCT NUMBER</b>	<b>DET101WSNLNTOM-1A</b>

Product Mgr	Design Eng
<b>Bruno Recaldini</b>	<b>Sunny</b>
Date: 23-Dec-13	Date: 23-Dec-13

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**REVISION RECORD**

<b>Rev.</b>	<b>Date</b>	<b>Page</b>	<b>Chapt.</b>	<b>Comment</b>	<b>ECN no.</b>
1.0	23-Dec-13			Initial Release	

## 1 MAIN FEATURES

ITEM	CONTENTS
Screen Size	10.1" Diagonal
Display Format	1024 x RGB x 600 Dots
N° of Colour	16.7M
Overall Dimensions	235 mm (H) x 143 mm (V) x 7.54 mm (D)
Active Area	222.72 mm (H) x 125.28 mm (V)
LCD Type	TFT
Mode	MVA Transmissive / Normally White
Viewing Direction	Full view
Electrical Interface	LVDS
Backlight Type	LED
Operating Temperature	-20°C ~ +70°C
Storage Temperature	-30°C ~ +80°C
RoHS compliant	Yes

## 2 MECHANICAL SPECIFICATION

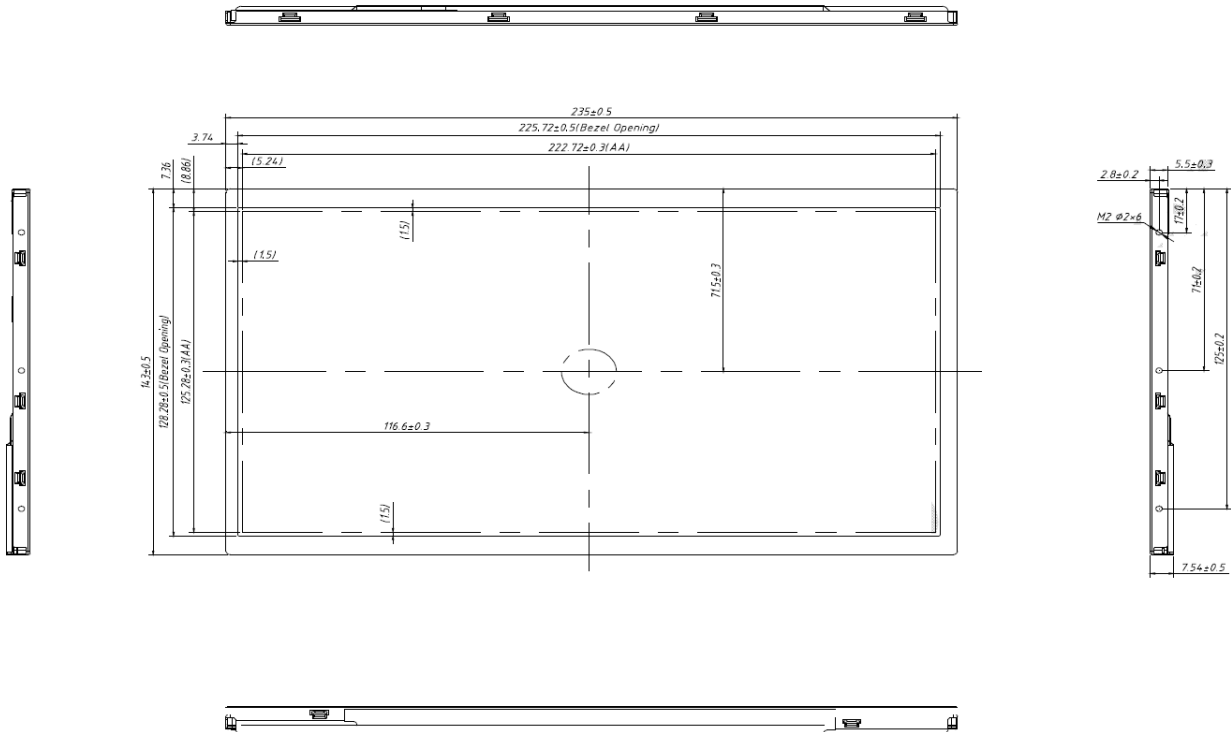
### 2.1 MECHANICAL CHARACTERISTICS

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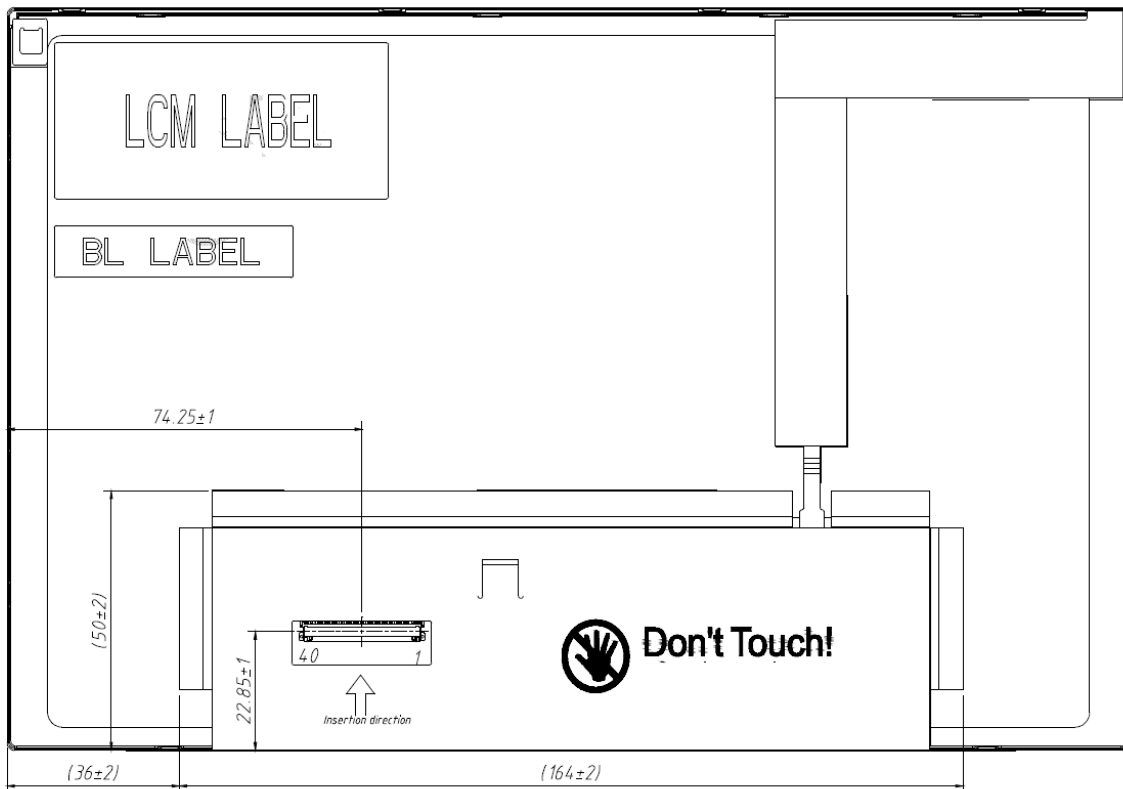
ITEM	CHARACTERISTIC	UNIT
Display Format	1024 x RGB x 600 Dots	Dots
Overall Dimensions	235 (H) x 143 (V) x 7.54 (D)	mm
Active Area	222.72 (H) x 125.28 (V)	mm
pixel Pitch	0.2175 (H) x 0.2088 (V)	mm
Weight	TBD	g

## 2.2 MECHANICAL DRAWING

Reference outline drawing: Front side



Reference outline drawing: Back side



### 3 ELECTRICAL SPECIFICATION

#### 3.1 ABSOLUTE MAXIMUM RATINGS

Item	Symbol	Condition	Min	Max	Unit	Note
Supply Voltage	VDD		-0.3	3.96	V	
Operating Temperature	TOP		-20	70	°C	1
Storage Temperature	TST		-30	80	°C	1,2,3
Operating Humidity	HOP		10	85	%RH	
Storage Humidity	HST		10	90	%RH	

Note 1. 90 % RH Max for Ta<50 °C, and 60% RH for Ta≥50°C.

Note 2. In case of below 0°C, the response time of liquid crystal (LC) becomes slower and the colour of panel becomes darker than normal one. Level of retardation depends on temperature, because of LC's characteristic.

Note 3. Only operation is guaranteed at operating temperature. Contrast, response time, another display quality are evaluated at +25°C.

### 3.2 ELECTRICAL CHARACTERISTICS

ITEM	SYMBOL	MIN.	TYP.	MAX.	UNIT	CONDITIONS
System Power Supply						
Input Power Supply Voltage	$V_{IN}$	3.0	3.3	3.6	V	
Input Power Supply Current	$I_{VIN}$	-	-	217	mA	Black pattern , 60Hz
Input Inrush Current	$I_{RUSH}$	-	-	1.5	A	0.5ms rise time (10%~90%)
Input Power Voltage Ripple	$V_{RPL}$	-	-	200	mV	Vp-p
LED Power Supply						
Input Power Supply Voltage	$V_{LED-IN}$	4.5	5	5.5	V	
Input Power Supply Current	$I_{IN}$	-	-	586	mA	$V_{LED}=4.5V, \eta=85\%$
EN/PWM	VH	2.0	-	5.0	V	
	VL	0	-	0.5	V	
LVDS Signals						
Differential Input High Threshold	$V_{th}$	-	-	+100	mV	$V_{cm}=+1.2V$
Differential Input Low Threshold	$V_{tl}$	-100	-	-	mV	$V_{cm}=+1.2V$
Magnitude Differential Input Voltage	$ V_{id} $	200	-	600	mV	
Common Mode Voltage	$V_{cm}$	1.0	1.2	1.4	V	$V_{th} - V_{tl} = 200mV$
Common Mode Voltage Offset	$\Delta V_{cm}$	-50	-	+50	mV	$V_{th} - V_{tl} = 200mV$
EDID Power Supply						
Input Power Supply Voltage	$V_{EDID}$	3.0		3.6	V	

Note: A. Input signals shall be low or Hi-Z state when VIN is off.

B. All electrical characteristics for LVDS signal are defined and shall be measured at the interface connector of LCD.

C. White Pattern at 3.3V driving voltage.



### 3.3 INTERFACE PIN ASSIGNMENT

#### SIGNAL PIN ASSIGNMENT

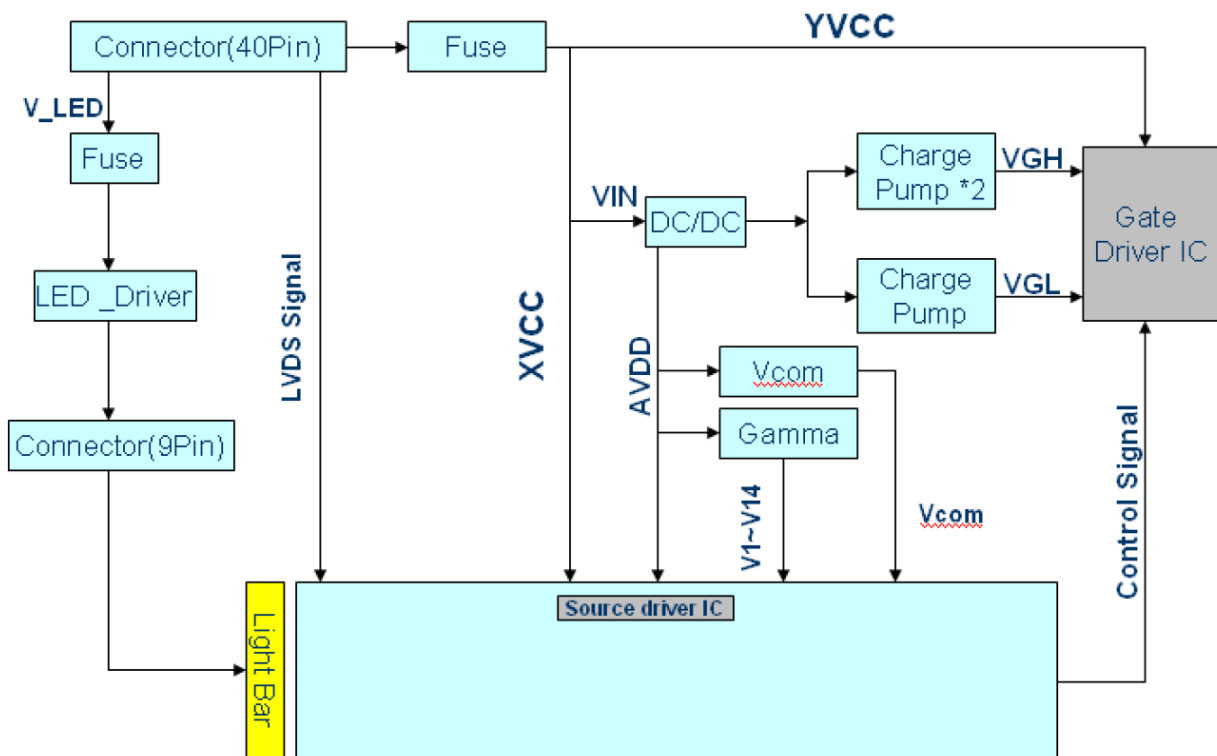
Type/Part number: 089H50-000000-G2-R

Pin #	Signal Name	Description	Remarks
1	BIST	BIST MODE SELECT(High Enable)	FOR INTERNAL TEST
2	VDD	LCD power supply (Typ. +3.3V)	
3	VDD	LCD power supply (Typ. +3.3V)	
4	V_EDID	EDID power supply	
5	NC	No connection	
6	CLK_EDID	EDID CLK signal	
7	Data_EDID	EDID Data signal	
8	LVDS input 0-	LVDS CH0 data signal(-) , R0 ~R5 , G0	
9	LVDS input 0+	LVDS CH0 data signal(+),R0 ~R5, G0	
10	GND	GND	
11	LVDS input 1-	LVDS CH1 data signal(-) G1 ~G5, B0 , B1	
12	LVDS input 1+	LVDS CH1 data signal(+) G1 ~G5, B0, B1	
13	GND	GND	
14	LVDS input 2-	LVDS CH2 data signal(-) B2 ~ B5, DE	
15	LVDS input 2+	LVDS CH0 data signal(+) B2 ~ B5, DE	
16	GND	GND	
17	LVDS CLK -	LVDS CLK data signal(-)	
18	LVDS CLK +	LVDS CLK data signal(+)	
19	GND	GND	
20	LVDS input 3-	LVDS CH3 data signal(-) R6~R7 G6~G7 B6~B7	
21	LVDS input 3+	LVDS CH3 data signal(+) R6~R7, G6~G7, B6~B7	
22	GND	GND	
23	NC	No connection	
24	NC	No connection	
25	GND	GND	
26	NC	No connection	
27	NC	No connection	
28	GND	GND	
29	NC	No connection	
30	NC	No connection	
31	GND	GND	
32	GND	GND	
33	GND	GND	
34	NC	No connection	
35	PWM	LED dimming signal	
36	LED_EN	LED Enable signal	
37	NC	No connection	
38	VLED	LED power supply (Typ. 5V)	
39	VLED	LED power supply (Typ. 5V)	
40	VLED	LED power supply (Typ. 5V)	

Note3: Selection of scanning mode

Setting of scan control input		Scanning Direction
SHLR	UPDN	
VDD	GND	Left to Right, Up to Down
GND	GND	Right to Left, Up to Down
VDD	VDD	Left to Right, Down to Up
GND	VDD	Right to Left, Down to Up

### 3.4 BLOCK DIAGRAM



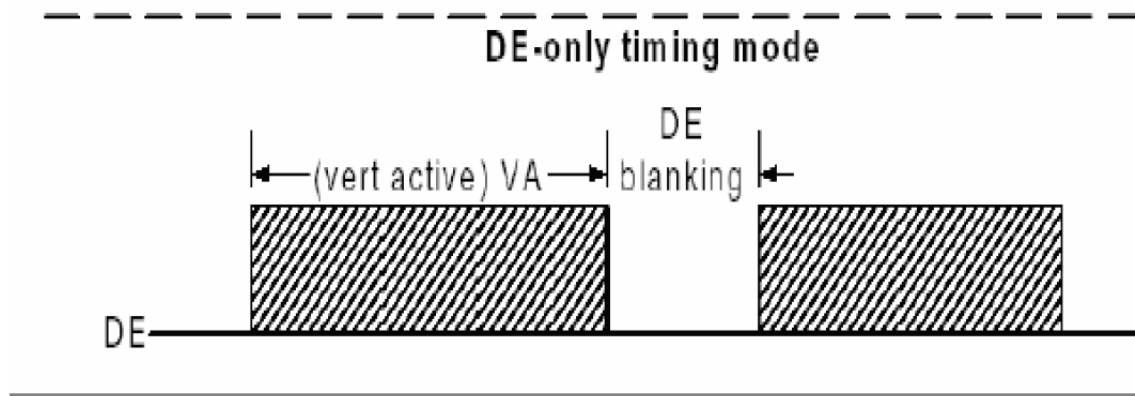
### 3.5 TIMING CHARACTERISTICS

#### Interface timings

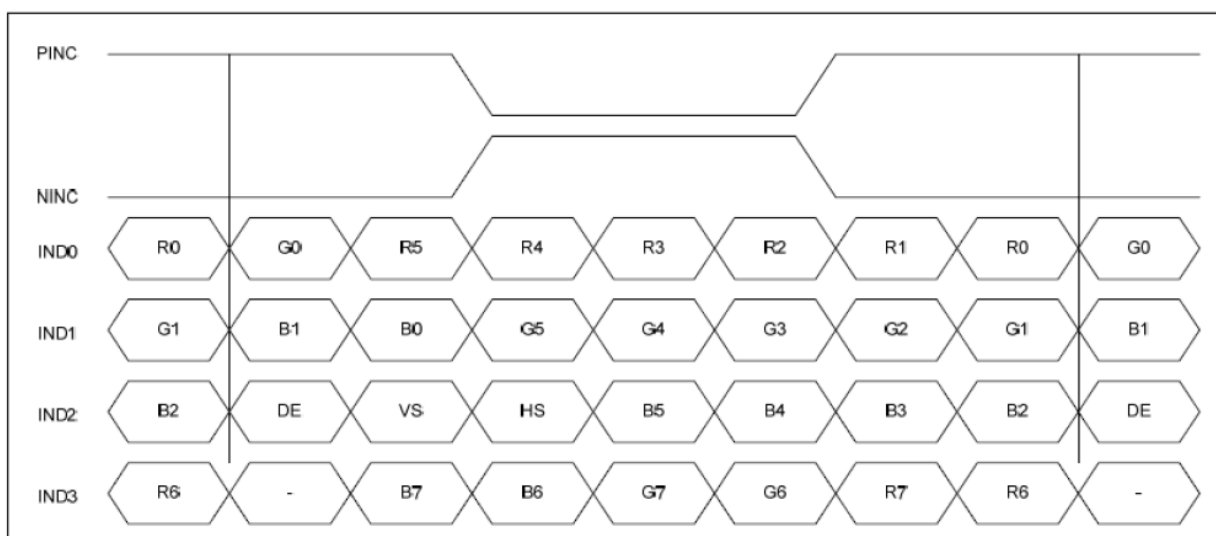
Synchronization Method : DE only

Parameter	Symbol	Unit	Min.	Typ.	Max.
LVDS Clock Frequency <single>	$f_{dck}$	MHz	45	51.2	65
H Total Time	$T_{hp}$	clocks	1,324	1,344	1,364
H Active Time	HA	clocks	1,024	1,024	1,024
H Blanking Time	$T_{HBLANK}$	clocks	300	320	340
V Total Time	$T_{vp}$	lines	615	635	645
V Active Time	VA	lines	600	600	600
V Blanking Time	$T_{VBLANK}$	lines	15	35	45
V Frequency	$f_v$	Hz	55	60	65

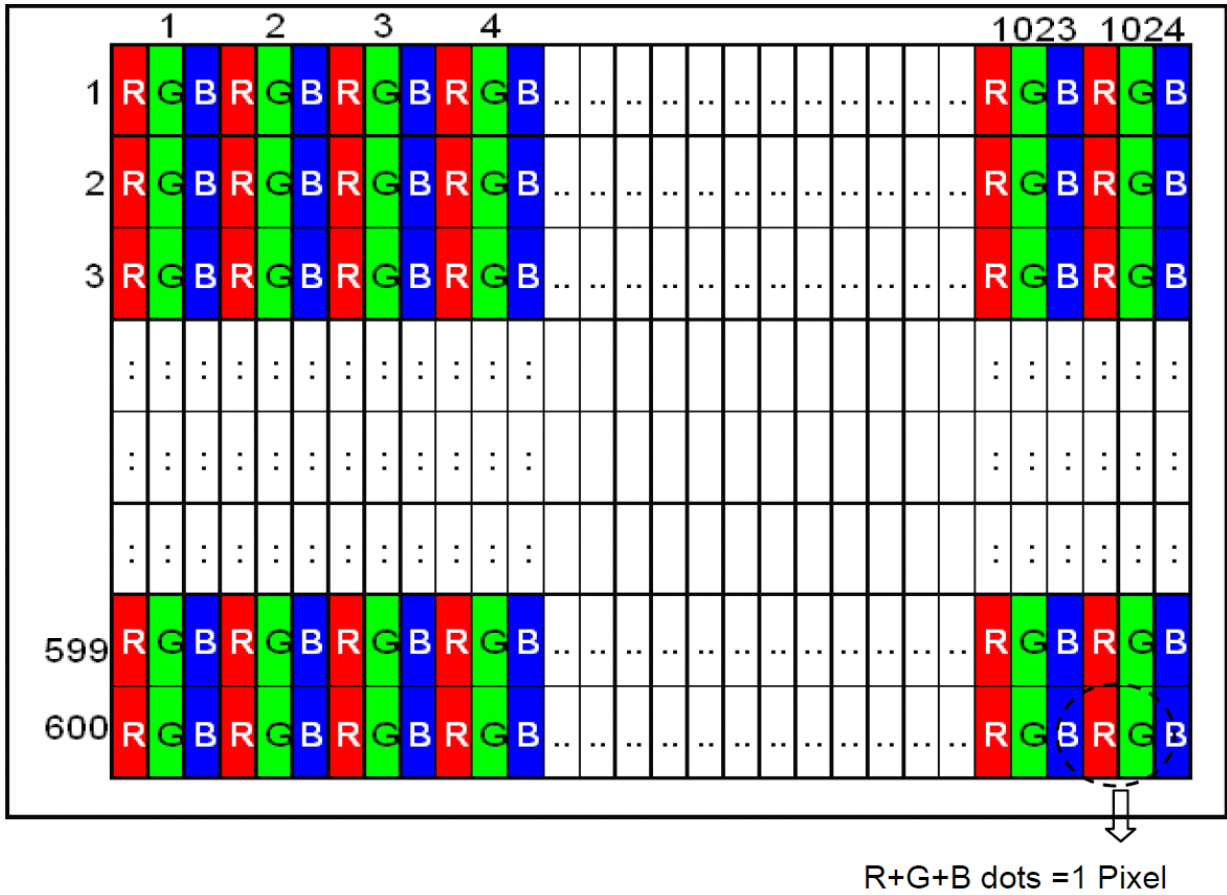
#### DE- only timing mode



#### LVDS Data Mapping



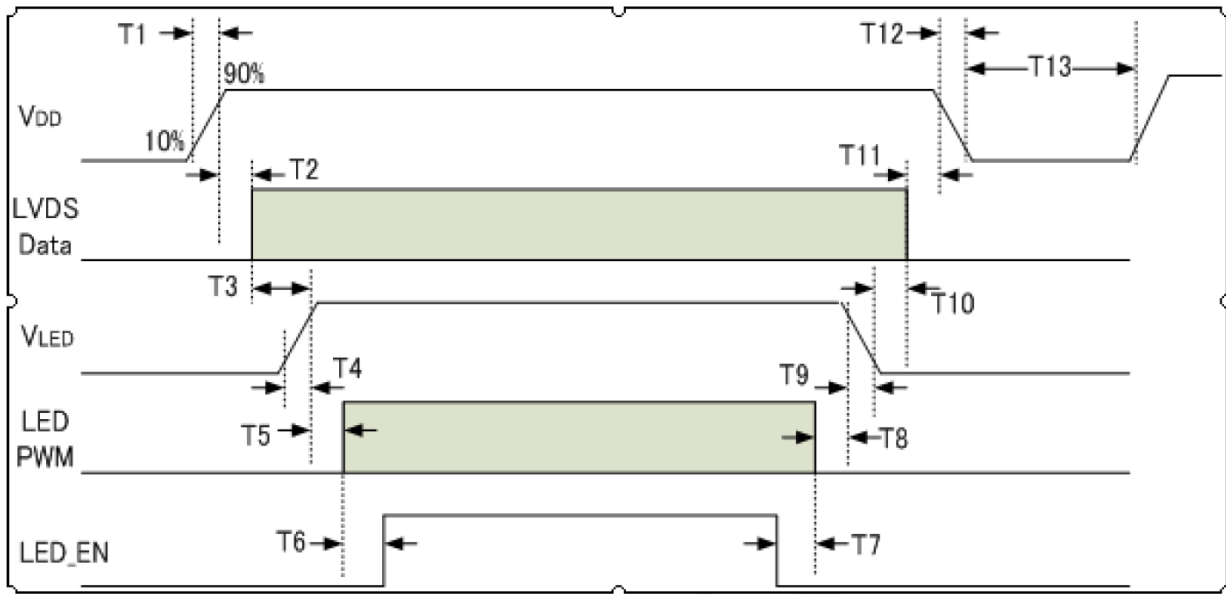
3.6 PIXEL DATA FORMAT



### 3.7 POWER SEQUENCE

#### Power ON/OFF Sequence

VDD power on/off sequence is as follows. Interface signals are also shown in the chart.



#### Power Sequencing Requirements

Parameter	Symbol	Unit	Min	Typ	Max
VDD Rise Time	T1	ms	0.5	--	10
VDD Good to Signal Valid	T2	ms	30	--	90
Signal Valid to Backlight On	T3	ms	200	--	--
Backlight Power On Time	T4	ms	0.5	--	--
Backlight Power Good to System PWM On	T5	ms	10	--	--
System PWM ON to Backlight Enable On	T6	ms	10	--	--
Backlight Enable Off to System PWM Off	T7	ms	0	--	--
System PWM Off to B/L Power Disable	T8	ms	10	--	--
Backlight Power Off Time	T9	ms	1	10	30
Backlight Off to Signal Disable	T10	ms	200	--	--
Signal Disable to VDD Down	T11	ms	0	--	50
VDD Fall Time	T12	ms	1	10	30
VDD Off Time	T13	ms	500	--	--

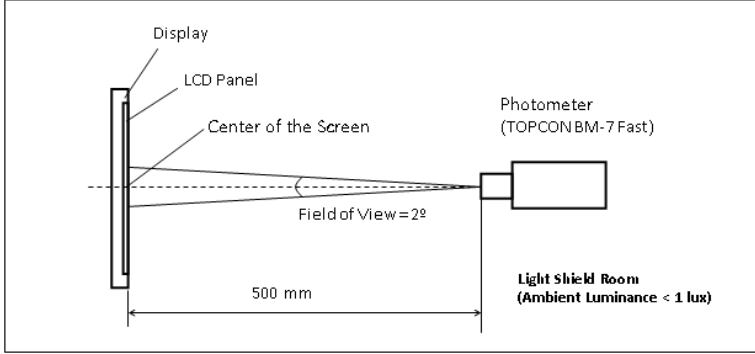
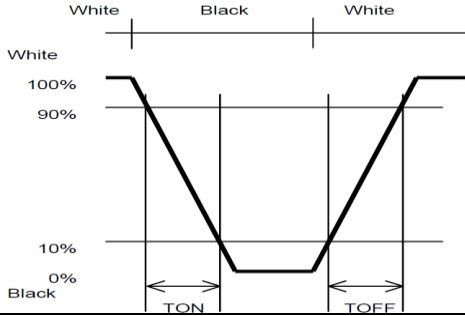
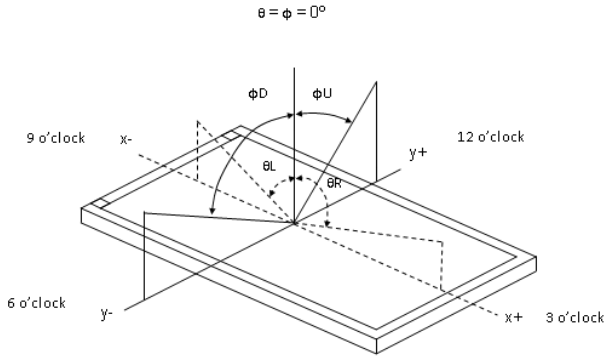
## 4 OPTICAL SPECIFICATION

### 4.1 OPTICAL CHARACTERISTICS

Measuring instruments: LCD-5100, Eldim, Topcon BM-7  
 Driving condition: IOVCC = VCI = 2.8V, VSS = 0V  
 Backlight: IF=20mA  
 Measured temperature: Ta = 25° C

Item	Symbol	Condition	MIN	TYP	MAX	Unit	Note			
Response Time	TR+TF	$\theta=\phi=0^\circ$ Normal Viewing Angle	-	16	-	ms	2			
Contrast Ratio	CR		-	500	-		3			
Viewing Angle	Left	CR ≥ 10	70	80	-	deg	4			
	Right		70	80	-	deg				
	Up		70	80	-	deg				
	Down		70	80	-	deg				
Colour Chromaticity	Red	Rx	CR ≥ 10	Typ.- 0.03	Typ.+0.0 3	-	5			
		Ry				-				
	Green	Gx				-				
		Gy				-				
	Blue	Bx				-				
		By				-				
	White	Wx				0.255		0.305	0.355	-
		Wy				0.275		0.325	0.375	-
Centre Brightness			-	300	-	cd/m <sup>2</sup>	6			
Brightness Distribution			75	85	-	%	7			

## Test Method

Note	Item	Test method
1	Setup	<p>The display should be stabilised at a given temperature for 30 minutes to avoid abrupt temperature change during measuring. In order to stabilise the luminance, measurements should be executed after lighting the backlight for 30 minutes in a windless room.</p> 
2	Response time	<p>Measure output signal waveform by the luminance meter when raster of window pattern is changed from white to black and from black to white.</p> 
3	Contrast ratio	<p>Measure maximum brightness and minimum brightness at the centre of the screen by displaying raster or window pattern. Then calculate the ratio between these two values.</p> $\text{Contrast Ratio (CR)} = \frac{\text{Brightness of unselected position (white)}}{\text{Brightness of selected position (black)}}$
4	Viewing angle Horizontal $\theta$ Vertical $\phi$	<p>Move the luminance meter from right to left and up and down and determinate the angles where contrast ratio is 10</p> 
5	Colour chromaticity	Measure chromaticity coordinates x and y of CIE1931 colorimetric system
6	Centre brightness	Measure the brightness at the centre of the screen
7	Brightness distribution	<p>(Brightness distribution)= 100 x B/A % A: max. brightness of the 9 points B: min. brightness of the 9 points</p>



## 5 BACKLIGHT SPECIFICATION

### 5.1 LED INTERFACE CONNNECTOR

#### LED DRIVER INPUT AND OUTPUT SPECIFICATIONS

ITEM	UNIT	MIN	TYP	MAX	CONDITION
V <sub>IN_LED</sub>	V	4.5	5	5.5	DUTY=100%
I <sub>VIN_LED</sub>	mA	-	-	586	V <sub>LED</sub> =4.5V , η=85%
F <sub>DIM</sub>	Hz	200	-	1K	-
DUTY	%	5	-	100	-
EN/PWM	VIH	V	2	5	-
	VIL	V	0	0.5	-
V <sub>out</sub>	V	11.6	13.2	14	-
I <sub>OUT</sub>	mA	-	159	-	-
L <sub>T</sub>	Hours	(30,000)	-	-	LED Life Time

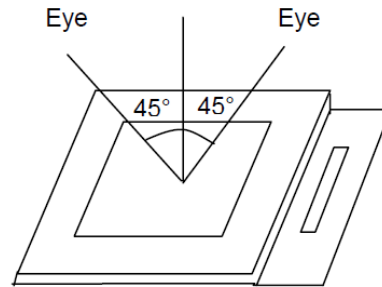
Note: The LED life time define as the estimated time to 50% degradation of initial luminous.

## 6 QUALITY ASSURANCE SPECIFICATION

### 6.1 DELIVERY INSPECTION STANDARDS

#### Inspection Conditions

Inspection distance: 30 cm ± 2 cm  
Viewing angle: ±45°



#### Environmental Conditions

Ambient temperature: 23°C ±5°C  
Ambient humidity: 55±10% RH  
Ambient illumination: 1000~1500 lux

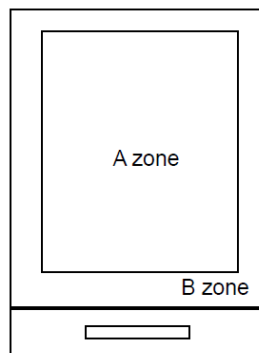
#### Sampling Conditions

1. Lot size: quantity of shipment lot per model
2. Sampling method:

Sampling Plan		ANSI / ASQC Z1.4-1993
		Normal inspection, Single Sampling
AQL	Major Defect	0.65%
	Minor Defect	1.5%

#### Definition of Area

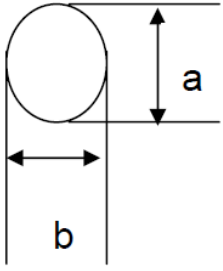
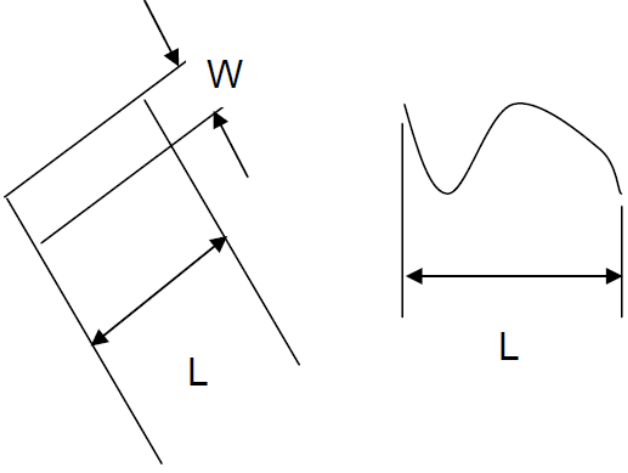
A zone: active area  
B zone: viewing area

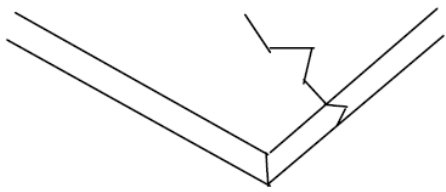
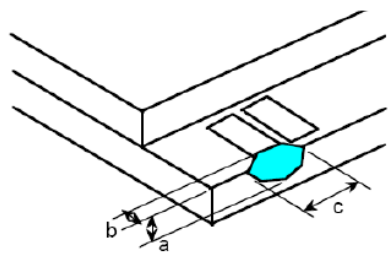


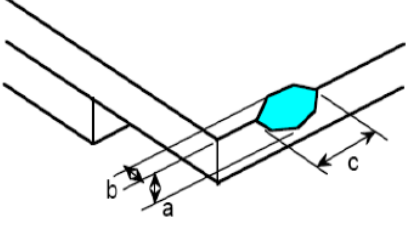
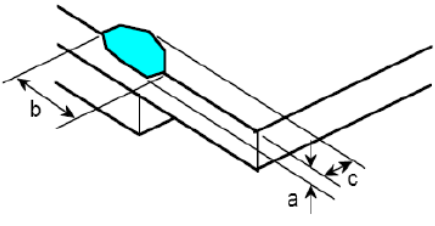
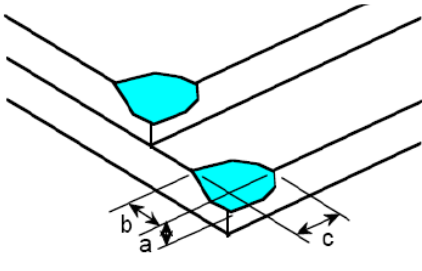
### Basic Principle

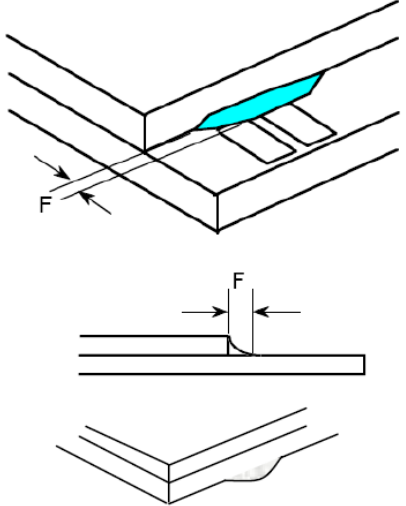
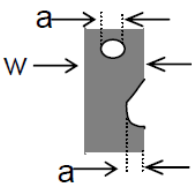
A set of sample to indicate the limit of acceptable quality level shall be discussed should a dispute occur.

**Inspection Criteria**

No.	Item	Criteria (Unit: mm)																		
01	Black / White spot Foreign material (Round type) Pinholes Stain Particles inside cell. (Minor defect)	 <table border="1" data-bbox="853 443 1380 801"> <thead> <tr> <th>Size</th> <th>Area</th> <th>Acc. Qty</th> </tr> </thead> <tbody> <tr> <td><math>\varphi \leq 0.10</math></td> <td></td> <td>Ignore</td> </tr> <tr> <td><math>0.10 &lt; \varphi \leq 0.15</math></td> <td></td> <td>2</td> </tr> <tr> <td><math>0.15 &lt; \varphi \leq 0.25</math></td> <td></td> <td>1</td> </tr> <tr> <td><math>0.25 &lt; \varphi</math></td> <td></td> <td>0</td> </tr> <tr> <td>Total</td> <td></td> <td>2 no include <math>\varphi \leq 0.10</math></td> </tr> </tbody> </table> <p><math>\varphi = (a + b) / 2</math></p> <p>Distance between 2 defects should more than 3mm apart.</p>	Size	Area	Acc. Qty	$\varphi \leq 0.10$		Ignore	$0.10 < \varphi \leq 0.15$		2	$0.15 < \varphi \leq 0.25$		1	$0.25 < \varphi$		0	Total		2 no include $\varphi \leq 0.10$
Size	Area	Acc. Qty																		
$\varphi \leq 0.10$		Ignore																		
$0.10 < \varphi \leq 0.15$		2																		
$0.15 < \varphi \leq 0.25$		1																		
$0.25 < \varphi$		0																		
Total		2 no include $\varphi \leq 0.10$																		
02	Black and White line Scratch Foreign material (Line type) (Minor defect)																			

		<table border="1"> <thead> <tr> <th>Length</th> <th>Width</th> <th>Acc. Qty</th> </tr> </thead> <tbody> <tr> <td>/</td> <td><math>W \leq 0.03</math></td> <td>Ignore</td> </tr> <tr> <td><math>L \leq 2.5</math></td> <td><math>0.03 &lt; W \leq 0.05</math></td> <td>3</td> </tr> <tr> <td><math>L \leq 2.5</math></td> <td><math>0.05 &lt; W \leq 0.10</math></td> <td>2</td> </tr> <tr> <td>/</td> <td><math>0.1 &lt; W</math></td> <td>0</td> </tr> <tr> <td colspan="2">Total</td> <td>3</td> </tr> </tbody> </table> <p>Distance between 2 defects should more than 3mm apart. Scratches not viewable through the back of the display are acceptable.</p>	Length	Width	Acc. Qty	/	$W \leq 0.03$	Ignore	$L \leq 2.5$	$0.03 < W \leq 0.05$	3	$L \leq 2.5$	$0.05 < W \leq 0.10$	2	/	$0.1 < W$	0	Total		3
Length	Width	Acc. Qty																		
/	$W \leq 0.03$	Ignore																		
$L \leq 2.5$	$0.03 < W \leq 0.05$	3																		
$L \leq 2.5$	$0.05 < W \leq 0.10$	2																		
/	$0.1 < W$	0																		
Total		3																		
03	Glass Crack (Minor defect)	 <p>Crack is potential to enlarge, any type is not allowed.</p>																		
04	Glass Chipping Pad Area: (Minor defect)	 <table border="1"> <thead> <tr> <th>Length and Width</th> <th>Acc. Qty</th> </tr> </thead> <tbody> <tr> <td><math>c &gt; 3.0, b &lt; 1.0</math></td> <td>1</td> </tr> <tr> <td><math>c &lt; 3.0, b &lt; 1.0</math></td> <td>3</td> </tr> <tr> <td colspan="2"><math>a &lt; \text{Glass Thickness}</math></td> </tr> </tbody> </table>	Length and Width	Acc. Qty	$c > 3.0, b < 1.0$	1	$c < 3.0, b < 1.0$	3	$a < \text{Glass Thickness}$											
Length and Width	Acc. Qty																			
$c > 3.0, b < 1.0$	1																			
$c < 3.0, b < 1.0$	3																			
$a < \text{Glass Thickness}$																				

<p>05</p>	<p>Glass Chipping Rear of Pad Area: (Minor defect)</p> 	<table border="1"> <thead> <tr> <th>Length and Width</th> <th>Acc. Qty</th> </tr> </thead> <tbody> <tr> <td><math>c &gt; 3.0, b &lt; 1.0</math></td> <td>1</td> </tr> <tr> <td><math>c &lt; 3.0, b &lt; 1.0</math></td> <td>2</td> </tr> <tr> <td><math>c &lt; 3.0, b &lt; 0.5</math></td> <td>4</td> </tr> <tr> <td colspan="2" style="text-align: center;"><math>a &lt; \text{Glass Thickness}</math></td> </tr> </tbody> </table>	Length and Width	Acc. Qty	$c > 3.0, b < 1.0$	1	$c < 3.0, b < 1.0$	2	$c < 3.0, b < 0.5$	4	$a < \text{Glass Thickness}$	
Length and Width	Acc. Qty											
$c > 3.0, b < 1.0$	1											
$c < 3.0, b < 1.0$	2											
$c < 3.0, b < 0.5$	4											
$a < \text{Glass Thickness}$												
<p>06</p>	<p>Glass Chipping Except Pad Area: (Minor defect)</p> 	<table border="1"> <thead> <tr> <th>Length and Width</th> <th>Acc. Qty</th> </tr> </thead> <tbody> <tr> <td><math>c &gt; 3.0, b &lt; 1.0</math></td> <td>1</td> </tr> <tr> <td><math>c &lt; 3.0, b &lt; 1.0</math></td> <td>2</td> </tr> <tr> <td><math>c &lt; 3.0, b &lt; 0.5</math></td> <td>4</td> </tr> <tr> <td colspan="2" style="text-align: center;"><math>a &lt; \text{Glass Thickness}</math></td> </tr> </tbody> </table>	Length and Width	Acc. Qty	$c > 3.0, b < 1.0$	1	$c < 3.0, b < 1.0$	2	$c < 3.0, b < 0.5$	4	$a < \text{Glass Thickness}$	
Length and Width	Acc. Qty											
$c > 3.0, b < 1.0$	1											
$c < 3.0, b < 1.0$	2											
$c < 3.0, b < 0.5$	4											
$a < \text{Glass Thickness}$												
<p>07</p>	<p>Glass Corner Chipping: (Minor defect)</p> 	<table border="1"> <thead> <tr> <th>Length and Width</th> <th>Acc. Qty</th> </tr> </thead> <tbody> <tr> <td><math>c &lt; 3.0, b &lt; 3.0</math></td> <td>Ignore</td> </tr> <tr> <td colspan="2" style="text-align: center;"><math>a &lt; \text{Glass Thickness}</math></td> </tr> </tbody> </table>	Length and Width	Acc. Qty	$c < 3.0, b < 3.0$	Ignore	$a < \text{Glass Thickness}$					
Length and Width	Acc. Qty											
$c < 3.0, b < 3.0$	Ignore											
$a < \text{Glass Thickness}$												

08	<p>Glass Burr: (Minor defect)</p> 	<table border="1" data-bbox="842 555 1305 645"> <thead> <tr> <th>Length</th> <th>Acc. Qty</th> </tr> </thead> <tbody> <tr> <td><math>F &lt; 1.0</math></td> <td>Ignore</td> </tr> </tbody> </table> <p>Glass burr don't affect assemble and module dimension.</p>	Length	Acc. Qty	$F < 1.0$	Ignore				
Length	Acc. Qty									
$F < 1.0$	Ignore									
09	<p>FPC Defect: (Minor defect)</p> 	<p>9.1 Dent, pinhole width <math>a &lt; w/3</math>. (w: circuitry width.)</p> <p>9.2 Open circuit is unacceptable.</p> <p>9.3 No oxidation, contamination and distortion.</p>								
10	<p>Bubble on Polarizer (Minor defect)</p>	<table border="1" data-bbox="715 1440 1181 1608"> <thead> <tr> <th>Diameter</th> <th>Acc. Qty</th> </tr> </thead> <tbody> <tr> <td><math>\varphi \leq 0.20</math></td> <td>Ignore</td> </tr> <tr> <td><math>0.20 &lt; \varphi \leq 0.30</math></td> <td>4</td> </tr> <tr> <td><math>0.30 &lt; \varphi</math></td> <td>None</td> </tr> </tbody> </table>	Diameter	Acc. Qty	$\varphi \leq 0.20$	Ignore	$0.20 < \varphi \leq 0.30$	4	$0.30 < \varphi$	None
Diameter	Acc. Qty									
$\varphi \leq 0.20$	Ignore									
$0.20 < \varphi \leq 0.30$	4									
$0.30 < \varphi$	None									
11	<p>Dent on Polarizer (Minor defect)</p>	<table border="1" data-bbox="715 1677 1181 1845"> <thead> <tr> <th>Diameter</th> <th>Acc. Qty</th> </tr> </thead> <tbody> <tr> <td><math>\varphi \leq 0.20</math></td> <td>Ignore</td> </tr> <tr> <td><math>0.20 &lt; \varphi \leq 0.30</math></td> <td>4</td> </tr> <tr> <td><math>0.30 &lt; \varphi</math></td> <td>None</td> </tr> </tbody> </table>	Diameter	Acc. Qty	$\varphi \leq 0.20$	Ignore	$0.20 < \varphi \leq 0.30$	4	$0.30 < \varphi$	None
Diameter	Acc. Qty									
$\varphi \leq 0.20$	Ignore									
$0.20 < \varphi \leq 0.30$	4									
$0.30 < \varphi$	None									
12	<p>Bezel</p>	<p>12.1 No rust, distortion on the Bezel.</p> <p>12.2 No visible fingerprints, stains or other contamination.</p>								

13	Touch Panel	<p>D: Diameter W: width L: length</p> <p>13.1 Spot: <math>D &lt; 0.25</math> is acceptable <math>0.25 \leq D \leq 0.4</math></p> <p>2dots are acceptable and the distance between defects should more than 10 mm. <math>D &gt; 0.4</math> is unacceptable</p> <p>13.2 Dent: <math>D &gt; 0.40</math> is unacceptable</p> <p>13.3 Scratch: <math>W \leq 0.03</math>, <math>L \leq 10</math> is acceptable, <math>0.03 &lt; W \leq 0.10</math>, <math>L \leq 10</math> is acceptable</p> <p>Distance between 2 defects should more than 10 mm. <math>W &gt; 0.10</math> is unacceptable.</p>
14	PCB	<p>14.1 No distortion or contamination on PCB terminals.</p> <p>14.2 All components on PCB must same as documented on the BOM/component layout.</p> <p>14.3 Follow IPC-A-600F.</p>
15	Soldering	Follow IPC-A-610C standard
16	Electrical Defect (Major defect)	<p>The below defects must be rejected.</p> <p>16.1 Missing vertical / horizontal segment,</p> <p>16.2 Abnormal Display.</p> <p>16.3 No function or no display.</p> <p>16.4 Current exceeds product specifications.</p> <p>16.5 LCD viewing angle defect.</p> <p>16.6 No Backlight.</p> <p>16.7 Dark Backlight.</p> <p>16.8 Touch Panel no function.</p> <p>16.9 Dark Dot –one Allowed.</p> <p>16.10 Bright Dot – one Allowed.</p> <p>Remark:</p> <p>1. A pixel defect is acceptable if one color is none functional and causes a bright dot. The display may have one case where one color is out and cause a dark dot.</p> <p>2. Bright dot caused by scratch and foreign object accords to item 1.</p>

Remark: LCD Panel Broken shall be rejected. Defect out of LCD viewing area is acceptable.



### **Classification of Defects**

Visual defects (except no or wrong label) are treated as minor defects, while electrical defects are treated as major defects.

Two minor defects are equal to one major defect in lot sampling inspection.

### **Identification / marking criteria**

Any unit with illegible / wrong / double or no marking / label shall be rejected.

## **6.2 DEALING WITH CUSTOMER COMPLAINTS**

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### **Non-conforming analysis**

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

After accepting it, Densitron should complete the analysis in two weeks from receiving the sample.

If the analysis cannot be completed on time, Densitron must inform the purchaser.

### **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
Durability Test	High Temperature Storage	Ta= 80°C 96h
	Low Temperature Storage	Ta=-30°C 96h
	Temperature Cycle Storage	-20°C for 30 min, then 70°C for 30 min, 20 cycles
	High Temperature Operation	Tp= 70°C 96h
	Low Temperature Operation	Tp= -20°C 96h
	High Temperature & Humidity Operation	Tp= 40°C RH= 90% 96h Non condensing
	Thermal Shock Resistance	The sample should be allowed to stand the following 5 cycles of operation: TSTL for 30 minutes -> normal temperature for 5 minutes -> TSTH for 30 minutes -> normal temperature for 5 minutes, as one cycle, then taking it out and drying it at normal temperature, and allowing it stand for 24 hours

Note: Ta=ambient temperature Tp= Panel temperature

Notes:

1. No dew condensation to be observed.
2. The function test shall be conducted after 4 hours storage at the normal temperature and humidity after removed from the test chamber.
3. No cosmetic or functional defects should be allowed.
4. Total current consumption should be less than twice the initial value.

## 8 HANDLING PRECAUTIONS

### **Safety**

If the LCD panel breaks, be careful not to get the liquid crystal fluid in your mouth or in your eyes. If the liquid crystal touches your skin or clothes, wash it off immediately using soap and plenty of water.

### **Mounting and Design**

Place a transparent plate (e.g. acrylic, polycarbonate or glass) on the display surface to protect the display from external pressure. Leave a small gap between the transparent plate and the display surface.

When assembling with a zebra connector, clean the surface of the pads with alcohol and keep the surrounding air very clean.

Design the system so that no input signal is given unless the power supply voltage is applied.

### **Caution during LCD cleaning**

Lightly wipe the display surface with a soft cloth soaked with Isopropyl alcohol, Ethyl alcohol or Trichlorotrifluoroethane.

Do not wipe the display surface with dry or hard materials that will damage the polariser surface. Do not use aromatic solvents (toluene and xylene), or ketonic solvents (ketone and acetone).

### **Caution against static charge**

As the display uses C-MOS LSI drivers, connect any unused input terminal to VDD or VSS. Do not input any signals before power is turned on. Also, ground your body, work/assembly table and assembly equipment to protect against static electricity.

### **Packaging**

Displays use LCD elements, and must be treated as such. Avoid strong shock and drop from a height. To prevent displays from degradation, do not operate or store them exposed directly to sunshine or high temperature/humidity.

### **Caution during operation**

It is indispensable to drive the display within the specified voltage limit since excessive voltage shortens its life. Direct current causes an electrochemical reaction with remarkable deterioration of the display quality. Give careful consideration to prevent direct current during ON/OFF timing and during operation. Response time is extremely delayed at temperatures lower than the operating temperature range while, at high temperatures, displays become dark. However, this phenomenon is reversible and does not mean a malfunction or a display that has been permanently damaged. If the display area is pushed on hard during operation, some graphics will be abnormally displayed but returns to a normal condition after turning off the display once. Even a small amount of condensation on the contact pads (terminals) can cause an electro-chemical reaction which causes missing rows and columns. Give careful attention to avoid condensation.

### **Storage**

Store the display in a dark place where the temperature is 25°C ± 10°C and the humidity below 50%RH. Store the display in a clean environment, free from dust, organic solvents and corrosive gases.

Do not crash, shake or jolt the display (including accessories).

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