




TFT DISPLAY MODULE

Product Specification

Customer	Standard		
Product Number	DMT043QQNTCSI-1A		
Customer Part Number	UReady-14300T		
Customer Approval		Date:	

Internal Approvals

Product Mgr	Doc. Control	Electr. Eng
Luo Luo	Luo Luo	David Hardman
Date: 19/03/18	Date: 19/03/18	Date: 19/03/18



Revision Record

Rev.	Date	Page	Chapt.	Comment	ECR no.
1.0	19-Mar-18	All	All	Initial Release	



Table of Contents

1.0	MAIN FEATURES	5
2.0	MECHANICAL SPECIFICATION	6
2.1	Mechanical Characteristics	6
2.2	Mechanical Drawing	7
3.0	ELECTRICAL SPECIFICATION	8
3.1	Absolute Maximum Ratings	8
3.1.1	TFT	8
3.1.2	PCT	8
3.2	Electrical Characteristics	9
3.2.1	Recommended Operating Conditions	9
3.2.2	Recommended Driving Condition for Backlight	9
3.3	Interface Pin Assignment	9
3.3.1	LCM Pin Assignment	9
3.4	Timing Characteristics	11
3.4.1	AC Electrical Characteristics	11
3.4.2	DC Electrical Characteristics	11
3.4.3	Timing	12
3.4.4	Data Input Format	12
		12
3.4.5	Input Clock and Data Timing Diagram	13
3.4.6	Power ON/OFF Sequence	13
4.0	OPTICAL SPECIFICATION	14
4.1	Optical Characteristics	14
4.1.1	Test Method	15
5.0	BACKLIGHT SPECIFICATION	16
5.1	LED Driving Conditions	16
5.2	LED Circuit	16
6.0	QUALITY ASSURANCE SPECIFICATION	17
6.1	Delivery Inspection Standards	17
6.1.1	Inspection Conditions	17
6.1.2	Environmental Conditions	17



6.1.3 Sampling Conditions	17
6.1.4 Definition of Area.....	18
6.1.5 Basic Principle	18
6.1.6 Inspection Criteria.....	19
6.1.7 Classification of Defects.....	22
6.1.8 Identification / marking criteria.....	22
6.2 Dealing with Customer Complaints	23
6.2.1 Non-conforming analysis	23
6.2.2 Handling of non-conforming displays	23
7.0 RELIABILITY SPECIFICATION.....	24
7.1 Reliability Tests	24
8.0 HANDLING PRECAUTIONS	25

1.0 Main Features

Item	Contents
Screen Size	4.3" Diagonal
Display Format	480 RGB * (110 min)
N° of Colour	16M
Active Area	95.04 (H) x 21.75 mm (V)
LCD Type	TFT
Mode	Transmissive / Normally Black
Viewing Direction	ALL
TFT Interface	24-bit RGB interface
PCT Interface	I2C
PCT Driver IC	FT5436
Simultaneous Touch Points	5
Backlight Type	LED
Operating Temperature	-20°C ~ +70°C
Storage Temperature	-30°C ~ +80°C
RoHS compliant	Yes

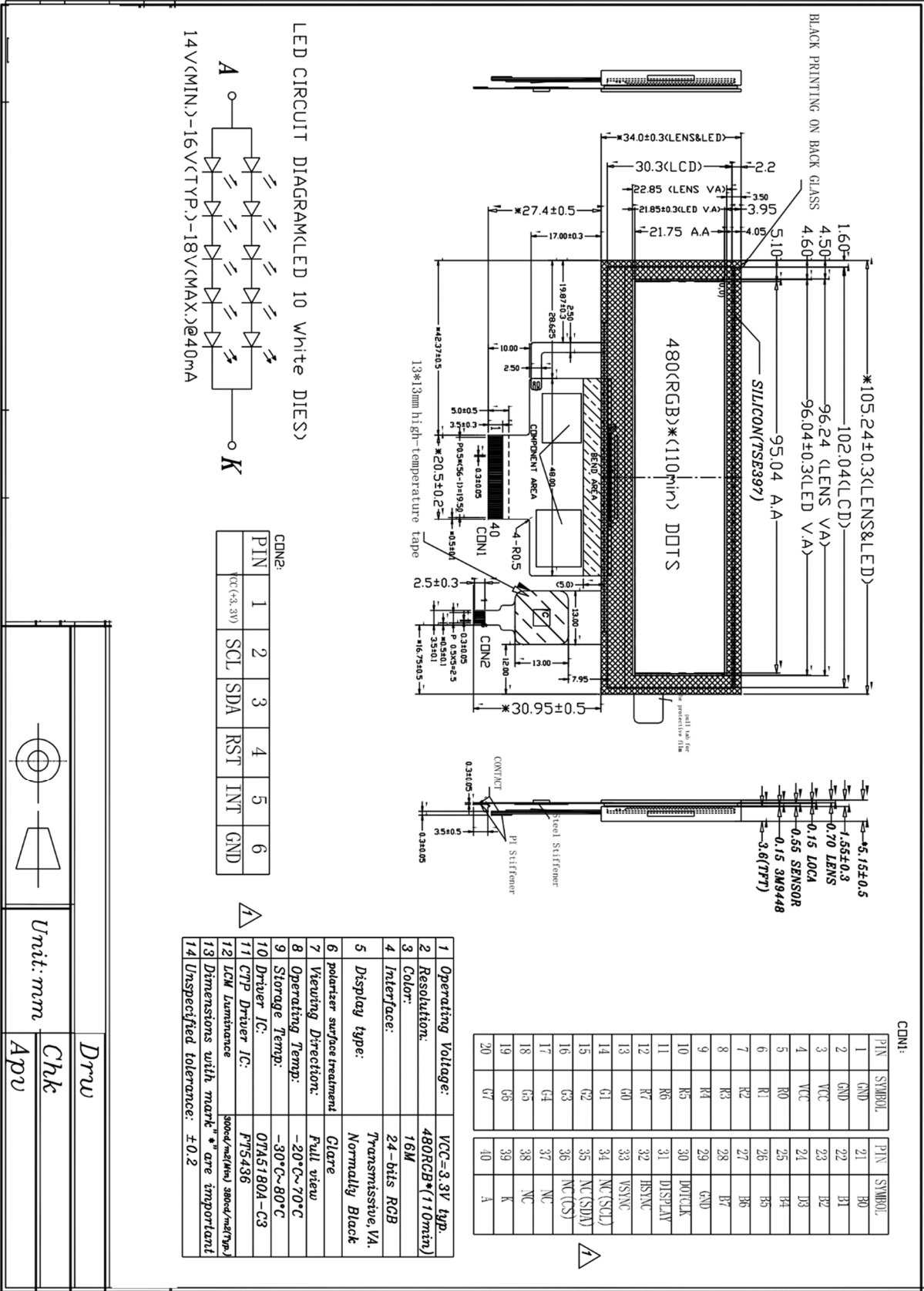


2.0 Mechanical Specification

2.1 Mechanical Characteristics

Item	Characteristic	Unit
Overall Dimensions	105.24 mm (H) x 34.00 mm (V) x 5.15 mm (D)	mm
Pixel Pitch	198 (H) x 198 (V)	μm
Weight	TBC	g

2.2 Mechanical Drawing



3.0 Electrical Specification

3.1 Absolute Maximum Ratings

3.1.1 TFT

Item	Symbol	Condition	Min	Max	Unit	Note
Power Supply Voltage LCM	VDD	-	-0.3	4.5	V	
Operating Temperature	TOP	-	-20	70	°C	1
Storage Temperature	TST	-	-30	80	°C	1,2,3

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.

3.1.2 PCT

Item	Symbol	Condition	Min	Max	Unit	Note
Power Supply Voltage	VBUS	-	-0.3	3.6	V	4
Operating Temperature	TOP	-	-20	70	°C	-
Storage Temperature	TST	-	-30	80	°C	-

Note 4. If used beyond the absolute maximum ratings, FT5436 may be permanently damaged. It is strongly recommended that the device be used within the electrical characteristics in normal operations. If exposed to the condition not within the electrical characteristics, it may affect the reliability of the device.



3.2 Electrical Characteristics

3.2.1 Recommended Operating Conditions

Item	Symbol	Min	Typ.	Max	Unit
Power Voltage	VCC	3.0	3.3	3.6	V
Input logic high voltage	VIH	0.7 VCC	-	VCC	V
Input logic low voltage	VIL	0	-	0.3VCC	V

3.2.2 Recommended Driving Condition for Backlight

Item	Symbol	Min	Typ.	Max	Unit
Forward Voltage	Vf	14	16	18	V
Forward Current	If	-	40	-	mA
Operating Life Time	-	20k	-	-	Hours

3.3 Interface Pin Assignment

3.3.1 LCM Pin Assignment

No.	Symbol	Function
1-2	GND	Ground
3-4	VCC	Logic regulator power supply
5-12	R0-R7	Data bit
13-20	G0-G7	Data bit
21-28	B0-B7	Data bit
29	GND	Ground
30	DOTCLK	Clock signal for data latching and internal counter of the timing controller.
31	DISPLAY	Display on/off mode control.
32	HSYNC	Horizontal sync input with negative polarity.
33	VSYNC	Vertical sync input with negative polarity.
34	NC(SCL)	No Connection
35	NC(SDA)	No Connection



No.	Symbol	Function
36	NC(CS)	No Connection
37-38	NC	No Connection
39	K	LED Backlight Cathode
40	A	LED Backlight anode



3.4 Timing Characteristics

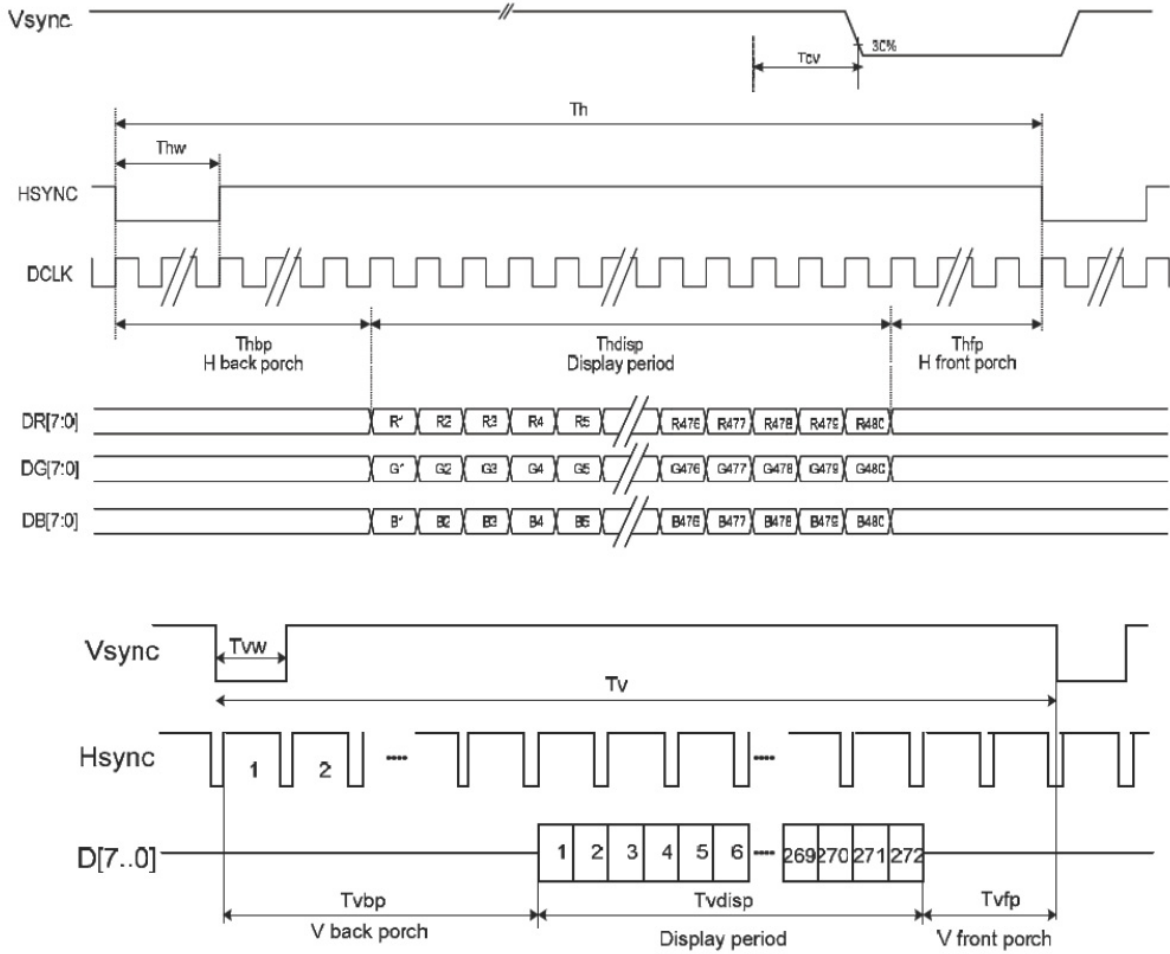
3.4.1 AC Electrical Characteristics

Item	Symbol	Min.	Typ.	Max.	Unit	Conditions
CLK pulse duty	Tcw	40	50	60	%	
Hsync width	Thw	1.0	-	-	DCLK	
Hsync period	Th	55	60	65	us	
Vsync setup time	Tvst	12	-	-	ns	
Vsync hold time	Tvhd	12	-	-	ns	
Hsync setup time	Thst	12	-	-	ns	
Hsync hold time	Thhd	12	-	-	ns	
Data set-up time	Tdsu	12	-	-	ns	
Data hold time	Tdhd	12	-	-	ns	
DE set-up time	Tdesu	12	-	-	ns	
DE hold time	Tdehd	12	-	-	ns	
SD output stable time	Tst	-	10	12	us	
GD output rise and fall time	Tgst	-	500	1000	ns	
Serial communication						
Delay between CSB and Vsync	Tcv	1			us	
CS input setup time	Ts0	50			ns	
Serial data input setup time	Ts1	50			ns	
CS input hold time	Th0	50			ns	
Serial data input hold time	Th1	50			ns	
SCL pulse high width	Twh1	50			ns	
SCL pulse low width	Twl1	50			ns	
CS pulse high width	Tw2	400			ns	

3.4.2 DC Electrical Characteristics

Item	Symbol	Min.	Typ.	Max.	Unit	Conditions
Low Level Input Voltage	Vil	GND	-	0.3xVDDIO	V	
High Level Input Voltage	Vih	0.7xVDDIO	-	VDDIO	uA	
High Level Output Voltage	Voh	VDDIO-0.4	-	VDDIO	ohm	
Low Level Output Voltage	Vol	GND	-	GND+0.4	uA	
Input Leakage Current	Iil			±1.0		
Pull High/Low Resistor	Rp	-	100K	-	ohm	
Digital Stand-by Current	Ist		5.0	20	uA	DCLK stopped, Output Hi-Z
Digital Operating Current	Icc	-	4	-	mA	DCLK = 9MHz

3.4.3 Timing

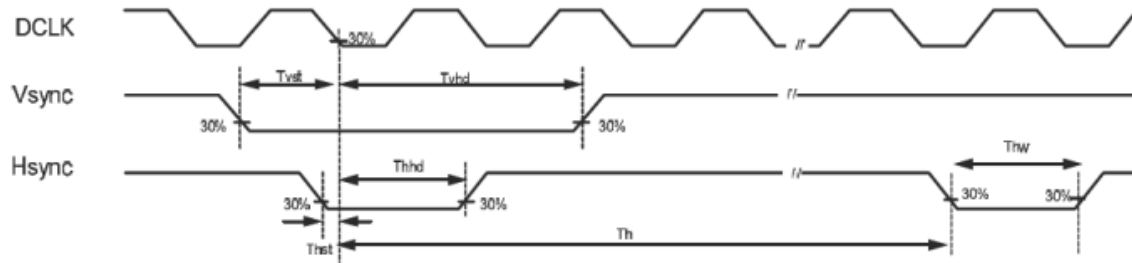


3.4.4 Data Input Format

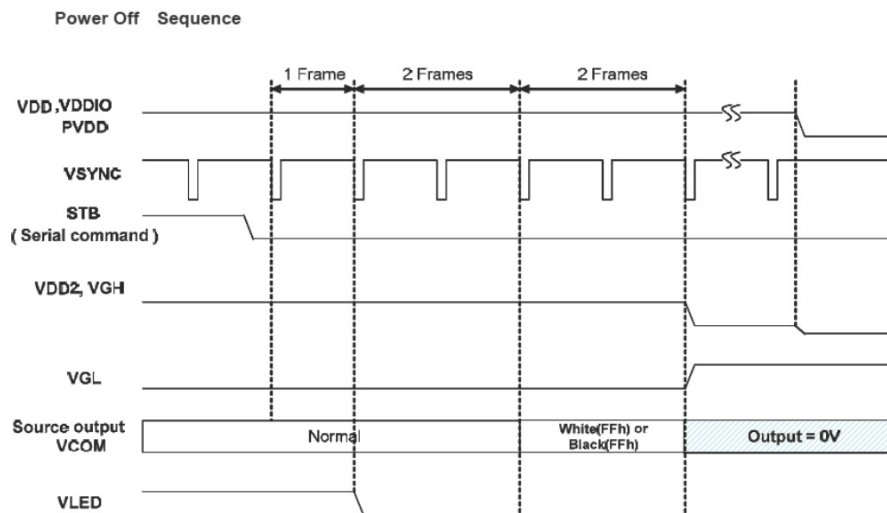
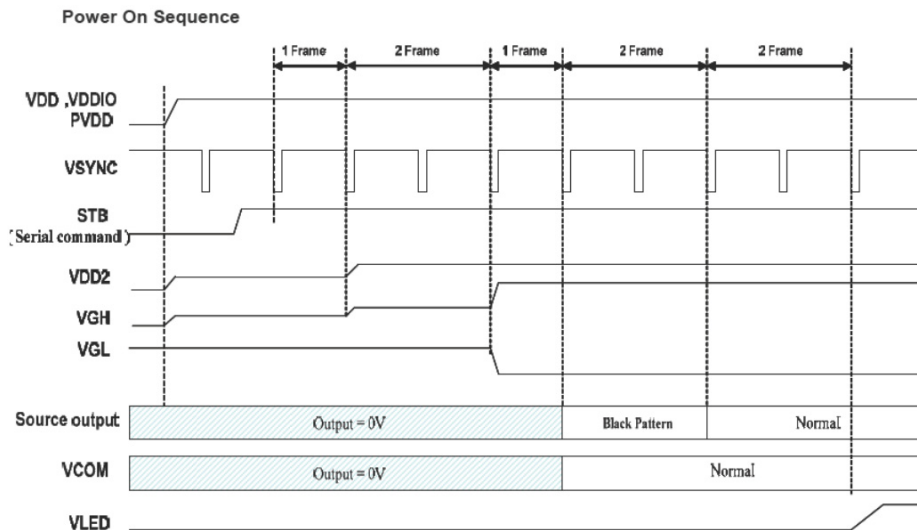
Item	Symbol	Min.	Typ.	Max.	Unit		
DCLK Frequency	Fclk	5	9	12	MHz		
DCLK Period	Tclk	83	110	200	ns		
Hsync	Period Time	Th	490	531	605	DCLK	
	Display Period	Thdisp		480		DCLK	
	Back Porch	Thbp	8	43		DCLK	By H_BLANKING setting
	Front Porch	Thfp	2	8		DCLK	
	Pulse Width	Thw	1			DCLK	
Vsync	Period Time	Tv	275	288	335	H	
	Display Period	Tvdisp		272		H	
	Back Porch	Tvbp	2	12		H	By V_BLANKING setting
	Front Porch	Tvfp	1	4		H	
	Pulse Width	Tvw	1	10		H	

3.4.5 Input Clock and Data Timing Diagram

6. 5. Input Clock and Data Timing Diagram



3.4.6 Power ON/OFF Sequence



Note:

- When normally-black LC is used, please send black pattern to discharge the panel.
- When normally-white LC is applied, please send white pattern to discharge the panel.

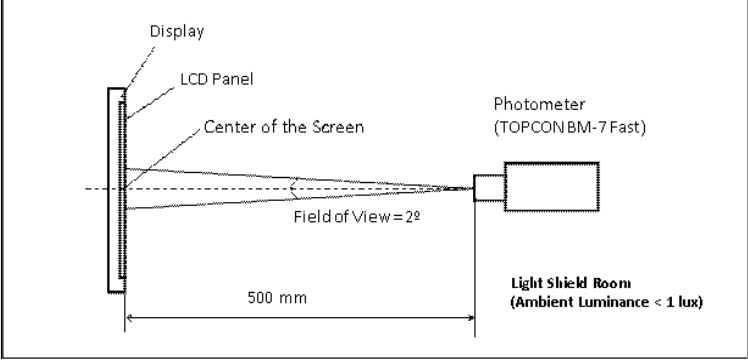
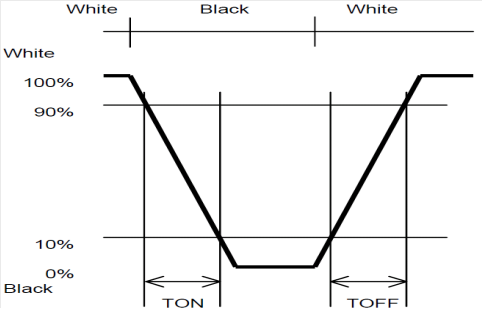
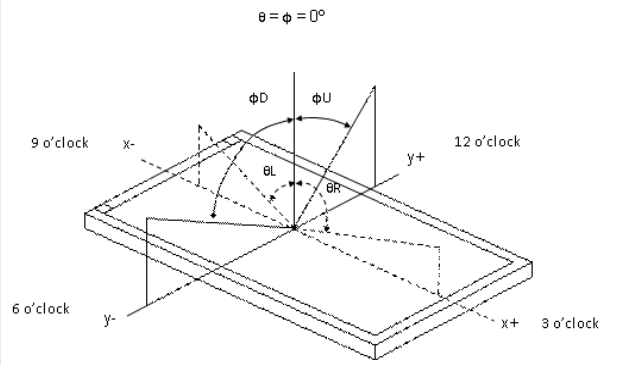
4.0 Optical Specification

4.1 Optical Characteristics

Measuring instruments : LCD-5100, Eldim, Topcon BM-7
 Driving condition: VDD = 3.3V, VSS = 0V
 Backlight: IF=40mA
 Measured temperature: Ta = 25 °C

Item	Symbol	Condition	Min	Typ	Max	Unit	Note
Response Time	TR+TF	$\theta=\phi=0^\circ$ Normal Viewing Angle	-	25	35	ms	2
Contrast Ratio	CR		-	500	-		3
Viewing Angle	Left	θ_L	CR \geq 10	70	-	deg	4
	Right	θ_R		70	-	deg	
	Up	ϕ_U		70	-	deg	
	Down	ϕ_D		70	-	deg	
Chromaticity	White	Wx	-	0.2999	-	-	5
		Wy	-	0.3318	-	-	
Centre Brightness			300	380	-	cd/m ²	6
Brightness Distribution			80	-	-	%	7

4.1.1 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 θ Vertical ϕ	<p>Move the luminance meter from right to left and up and down and determine 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) = $100 \times B/A \%$ A: max. brightness of the 9 points B: min. brightness of the 9 points</p>

5.0 Backlight Specification

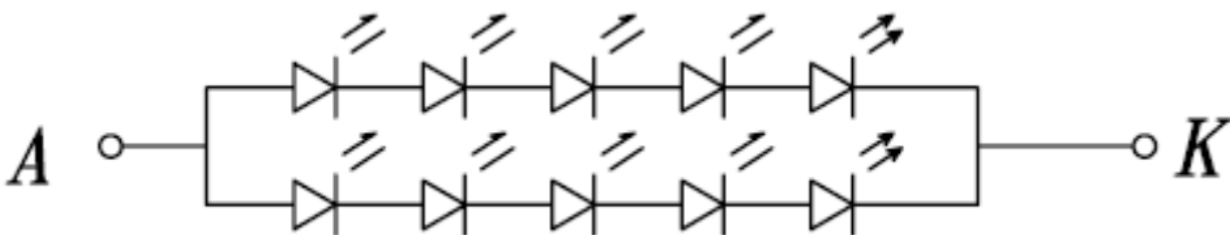
5.1 LED Driving Conditions

Item	Symbol	Condition	Min	Typ	Max	Unit
Forward Current	IF	Ta=25 °C	-	40	-	mA
Forward Voltage	VF	Ta= 25°C	14	16	18	V
LED life time	Hr	-	20k	-	-	hour

Note:

- The lifetime of the LED is defined as a period till the brightness of the LED decreases to the half of its initial value.
- This figure is given as a reference purpose only, and not a guarantee.
- This figure is estimated for an LED operating alone.
The performance of an LED may differ when assembled as a monitor together with a TFT panel due to different environmental temperature.
- Estimated lifetime could vary on a different temperature and usually higher temperature could reduce the life significantly.

5.2 LED Circuit



LED Circuit Drawing

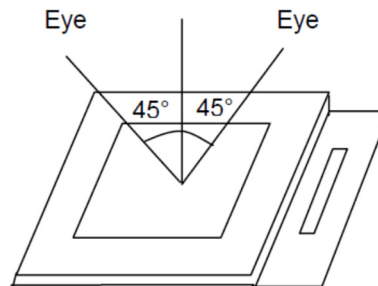
6.0 Quality Assurance Specification

6.1 Delivery Inspection Standards

6.1.1 Inspection Conditions

Inspection distance: 30 cm \pm 2 cm

Viewing angle: \pm 45°



6.1.2 Environmental Conditions

Ambient temperature: 25°C \pm 5°C

Ambient humidity: 65 \pm 10% RH

Ambient illumination: 300~700 lux

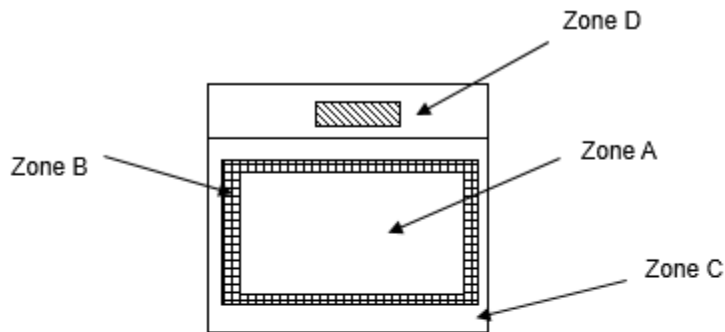
6.1.3 Sampling Conditions

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

Sampling Plan		GB/T 2828-2003
		Normal inspection, Class II
AQL	Major Defect	0.65%
	Minor Defect	1.5%

No	Items to be inspected	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 component	
3	Outline dimension	Overall outline dimension beyond the drawing is not allowed	
4	Color tone	Color unevenness, refer to limited sample	Minor
5	Spot Line defect	Light dot , Dim spot,Polarizer Bubble ; Polarizer accidented spot.	
6	Soldering appearance	Good soldering , Peeling off is not allowed.	

6.1.4 Definition of Area



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

Zone B : Viewing Area except Zone A

Zone C Cover (Zone A+Zone B) which can not be seen after assembly by customer .)

Zone D : IC Bonding Area

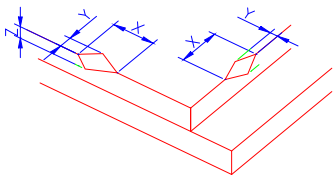
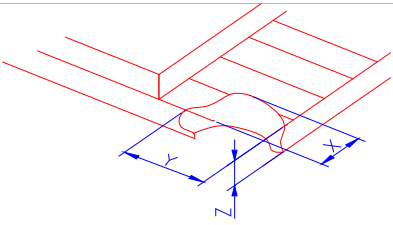
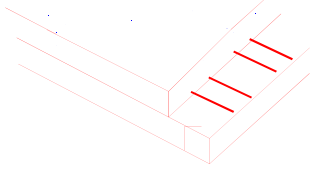
Note:

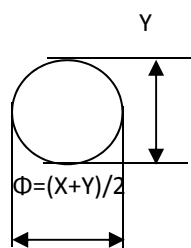
As a general rule ,visual defects in Zone C can be ignored when it doesn't effect product function or appearance after assembly by customer

6.1.5 Basic Principle

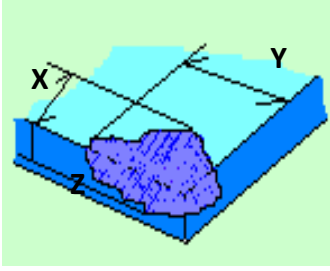
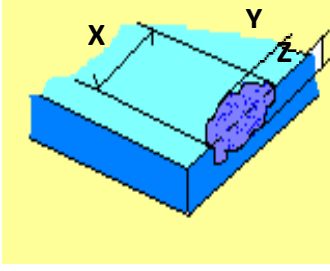
A set of sample to indicate the limit of acceptable quality level shall be discussed should a dispute occur.

6.1.6 Inspection Criteria

Number	Items	Criteria(mm)						
1.0 LCD Crack/Broken NOTE: X: Length Y: Width Z: Height L: Length of ITO T: Height of LCD	(1) The edge of LCD broken	<div style="text-align: center;">  </div> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th data-bbox="687 546 908 622">X</th> <th data-bbox="908 546 1291 622">Y</th> <th data-bbox="1291 546 1469 622">Z</th> </tr> </thead> <tbody> <tr> <td data-bbox="687 622 908 698">≤3.0mm</td> <td data-bbox="908 622 1291 698"><Inner border line of the seal</td> <td data-bbox="1291 622 1469 698">≤T</td> </tr> </tbody> </table>	X	Y	Z	≤3.0mm	<Inner border line of the seal	≤T
	X	Y	Z					
	≤3.0mm	<Inner border line of the seal	≤T					
(2)LCD corner broken	<div style="text-align: center;">  </div> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th data-bbox="687 1001 956 1077">X</th> <th data-bbox="956 1001 1190 1077">Y</th> <th data-bbox="1190 1001 1469 1077">Z</th> </tr> </thead> <tbody> <tr> <td data-bbox="687 1077 956 1153">≤3.0mm</td> <td data-bbox="956 1077 1190 1153">≤L</td> <td data-bbox="1190 1077 1469 1153">≤T</td> </tr> </tbody> </table>	X	Y	Z	≤3.0mm	≤L	≤T	
X	Y	Z						
≤3.0mm	≤L	≤T						
(3)LCD crack	<div style="text-align: center;">  <p>Crack Not allowed</p> </div>							

2.0 	Spot defect	① light dot (LCD/TP/Polarizer black/white spot , light dot, pinhole, dent, stain) <table border="1"> <thead> <tr> <th rowspan="2">Zone Size (mm)</th> <th colspan="3">Acceptable Qty</th> </tr> <tr> <th>A</th> <th>B</th> <th>C</th> </tr> </thead> <tbody> <tr> <td>$\Phi \leq 0.10$</td> <td colspan="3">Ignore</td> </tr> <tr> <td>$0.10 < \Phi \leq 0.25$</td> <td colspan="3">4(distance $\geq 10\text{mm}$)</td> </tr> <tr> <td>$0.25 < \Phi \leq 0.35$</td> <td colspan="3">3</td> </tr> <tr> <td>$\Phi > 0.4$</td> <td colspan="3">0</td> </tr> </tbody> </table>	Zone Size (mm)	Acceptable Qty			A	B	C	$\Phi \leq 0.10$	Ignore			$0.10 < \Phi \leq 0.25$	4(distance $\geq 10\text{mm}$)			$0.25 < \Phi \leq 0.35$	3			$\Phi > 0.4$	0		
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② Dim spot (LCD/TP/Polarizer dim dot, light leakage, dark spot) <table border="1"> <thead> <tr> <th rowspan="2">Zone Size (mm)</th> <th colspan="3">Acceptable Qty</th> </tr> <tr> <th>A</th> <th>B</th> <th>C</th> </tr> </thead> <tbody> <tr> <td>$\Phi \leq 0.1$</td> <td colspan="3">Ignore</td> </tr> <tr> <td>$0.10 < \Phi \leq 0.25$</td> <td colspan="3">4(distance $\geq 10\text{mm}$)</td> </tr> <tr> <td>$0.25 < \Phi \leq 0.35$</td> <td colspan="3">3</td> </tr> <tr> <td>$\Phi > 0.4$</td> <td colspan="3">0</td> </tr> </tbody> </table>	Zone Size (mm)	Acceptable Qty			A	B	C	$\Phi \leq 0.1$	Ignore			$0.10 < \Phi \leq 0.25$	4(distance $\geq 10\text{mm}$)			$0.25 < \Phi \leq 0.35$	3			$\Phi > 0.4$	0				
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③ Polarizer accidented spot <table border="1"> <thead> <tr> <th rowspan="2">Zone Size (mm)</th> <th colspan="3">Acceptable Qty</th> </tr> <tr> <th>A</th> <th>B</th> <th>C</th> </tr> </thead> <tbody> <tr> <td>$\Phi \leq 0.2$</td> <td colspan="3">Ignore</td> </tr> <tr> <td>$0.3 < \Phi \leq 0.5$</td> <td colspan="3">3(distance $\geq 10\text{mm}$)</td> </tr> <tr> <td>$\Phi > 0.5$</td> <td colspan="3">1</td> </tr> </tbody> </table>	Zone Size (mm)	Acceptable Qty			A	B	C	$\Phi \leq 0.2$	Ignore			$0.3 < \Phi \leq 0.5$	3(distance $\geq 10\text{mm}$)			$\Phi > 0.5$	1								
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④ Pixel bad points (light dot, Dim dot, color dot) <table border="1"> <thead> <tr> <th rowspan="2">Zone Size (mm)</th> <th colspan="3">Acceptable Qty</th> </tr> <tr> <th>A</th> <th>B</th> <th>C</th> </tr> </thead> <tbody> <tr> <td>$\Phi \leq 0.15$</td> <td>Ignore</td> <td colspan="2" rowspan="3">Ignore</td> </tr> <tr> <td>$0.2 < \Phi \leq 0.3$</td> <td>2(distance $\geq 10\text{mm}$)</td> </tr> <tr> <td>$\Phi > 0.4$</td> <td>1</td> </tr> </tbody> </table>	Zone Size (mm)	Acceptable Qty			A	B	C	$\Phi \leq 0.15$	Ignore	Ignore		$0.2 < \Phi \leq 0.3$	2(distance $\geq 10\text{mm}$)	$\Phi > 0.4$	1										
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⑤ Polarizer Bubble <table border="1"> <thead> <tr> <th rowspan="2">Zone Size (mm)</th> <th colspan="3">Acceptable Qty</th> </tr> <tr> <th>A</th> <th>B</th> <th>C</th> </tr> </thead> <tbody> <tr> <td>$\Phi \leq 0.2$</td> <td colspan="3">Ignore</td> </tr> <tr> <td>$0.3 < \Phi \leq 0.4$</td> <td colspan="3">4(distance $\geq 10\text{m}$)</td> </tr> <tr> <td>$0.4 < \Phi \leq 0.5$</td> <td colspan="3">3</td> </tr> <tr> <td>$\Phi > 0.5$</td> <td colspan="3">1</td> </tr> </tbody> </table>	Zone Size (mm)	Acceptable Qty			A	B	C	$\Phi \leq 0.2$	Ignore			$0.3 < \Phi \leq 0.4$	4(distance $\geq 10\text{m}$)			$0.4 < \Phi \leq 0.5$	3			$\Phi > 0.5$	1				
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Criteria (functional items)

Number	Items	Criteria (mm)
1	No display	Not allowed
2	Missing segment	Not allowed
3	Short	Not allowed
4	Backlight no lighting	Not allowed
5	TP no function	Not allowed

6.1.7 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.

6.1.8 Identification / marking criteria

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



6.2 Dealing with Customer Complaints

6.2.1 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.

6.2.2 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.

7.0 Reliability Specification

7.1 Reliability Tests

Test Item		Test Condition		Sample Size
Durability Test	High Temperature Operation	Ta= 70°C	96h	3pcs
	Low Temperature Operation	Ta=-20°C	96h	3pcs
	Temperature Cycle Operation	-30°C ↔ 80°C ON/OFF, 10 cycles. ON time over 10 seconds, OFF time over 10 seconds		3pcs
	High Temperature Storage	Tp= 80°C	96h	3pcs
	Low Temperature Storage	Tp= -30°C	96h	3pcs
	ESD Test	150pF, 330Ω, ±6KV (Contact)/±8KV (Air), 5 Points/panel, 10 times/point		3pcs
	Damp Test	40°C ± 5°C × 90%RH/240hours		3pcs
	Vibration Test	Frequency: 10Hz~55Hz~10Hz Amplitude: 1.5mm, X, Y, Z direction for total		3pcs
	Box Drop Test	1 Corner 3 Edges 6 faces, 66 cm (Medium Box)		1 box

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.



8.0 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 $25^{\circ}\text{C} \pm 10^{\circ}\text{C}$ 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).