DMT070WVHTRS0-3A

PRODUCT SPECIFICATION

Version 0.1
Nov 21, 2023

TBD

Customer's Approval	
Signature	*Date*

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Approved by *Evan Huang*

Revision History

VERSION	DATE	DESCRIPTION	AUTHOR
0.1	Nov 21, 2023	Preliminary	Yvette Hsieh

Legal Notice

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1. General Description

1.1 Introduction

This is a 7.0" size colour active matrix TFT LCD module that uses amorphous silicon TFT as a switching device. The display is normally white mode, transmissive, and featuring high contrast and excellent colour saturation. The resolution of the TFT-LCD is 800 x 480 and can display up to 16.7M colours. The display module supports TTL (24-bit RGB) interface and tape bonding touch panel.

1.2 Main Features

Item	Contents
Display Type	TFT LCD
Screen Size	7.0" Diagonal
Display Format	800 x RGB x 480 Dots
No. of Colour	16.7M
Overall Dimensions	164.90 (W) x 100.00 (H) x 4.45 (D) mm
Active Area	153.84 (W) x 85.63(H) mm
Mode	Normally white / Transmissive / TN
Surface Treatment	Anti-glare
Viewing Direction	12 o'clock
Interface	TTL (24-bit RGB)
Controller IC	EK9716BD/BD3&EK73002ACGB
Backlight Type	LED, White, 30 chips
Touch Panel	Resistive Touch Panel (RTP)
Touch Interface	4-wire resistive
Bonding Type	Tape Bonding
Operating Temperature	-20°C ~ +70°C
Storage Temperature	-30°C ~ +80°C
ROHS	Compliant to RoHS 2.0

2. Mechanical Specification

2.1 Mechanical Characteristics

Item	Characteristic	Unit
Display Format	800 x RGB x 480	Dots
Overall Dimensions	164.90 (W) x 100.00 (H) x 4.45 (D)	mm
Active Area	153.84 (W) x 85.63(H)	mm
Dot Pitch	0.0641 (W) x 0.1784 (H)	mm
Weight	TBD ± 5%	g
Controller IC	EK9716BD/BD3&EK73002ACGB	

2.2 Mechanical Drawing
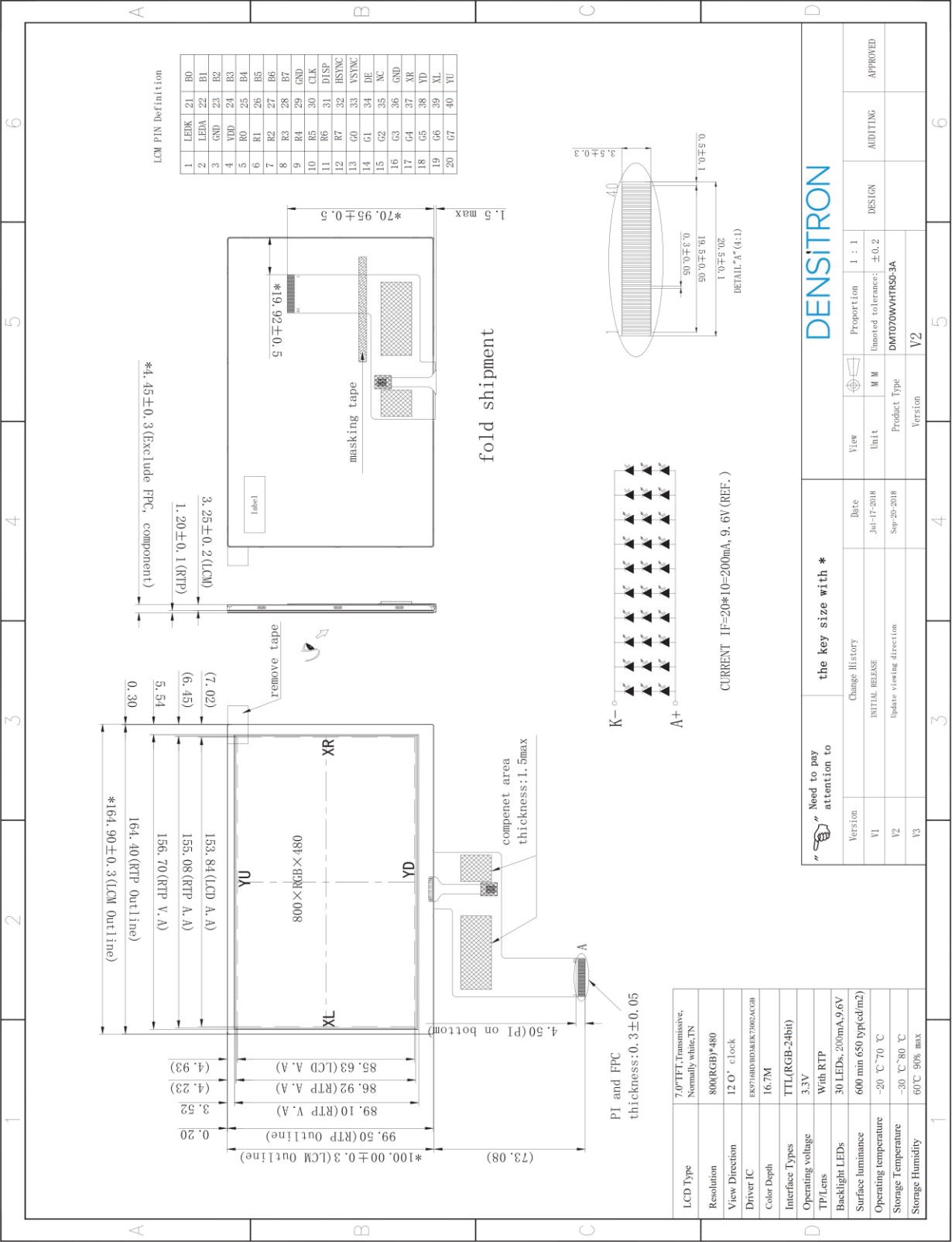
3. Electrical Specification

3.1 Absolute Maximum Ratings

Item	Symbol	Min	Max	Unit
Supply Voltage for Analog	V_{DD}	-0.5	5.0	V
Operating Temperature	T_{OP}	-20	+70	°C
Storage Temperature	T_{ST}	-30	+80	°C
Humidity	RH	-	90% (Max 60°C)	RH

Note 1: When this module is used beyond the above absolute maximum ratings, permanent breakage of the module may occur. For normal operations, it is desirable to use this module under the conditions according to Section 3.2 "Electrical Characteristics", to avoid malfunctioning.

Note 2: Please refer to item of RELIABILITY.

3.2 Electrical Characteristics

Item	Symbol	Min	Typ	Max	Unit
Analog Operating Voltage	VDD	3.0	3.3	3.6	V
Logic Operation Voltage	IOVDD	3.0	3.3	3.6	V
Input Current	IDD	-	TBD	-	mA
Input Voltage "H" Level	VIH	0.7 IOVCC	-	IOVCC	V
Input Voltage "L" Level	VIL	GND	-	0.3 IOVCC	V

3.3   Interface Pin Assignment

3.3.1   TFT-LCD Module

No.	Symbol	Function
1	LED-K	Backlight K Cathode input pin
2	LED-A	Backlight A Anode input pin
3	GND	System ground (0V)
4	VDD	Power supply +3.3V
5-12	R0-R7	Red data
13-20	G0-G7	Green data
21-28	B0-B7	Blue data
29	GND	System ground (0V)
30	DCLK	Clock fir input data. Data latched at rising/falling edge of this signal. Default is falling edge
31	DISP	Standby mode control. (Normally pull high) DISP = "L", enter standby mode for power saving, Timing controller and source driver will turn off, all outputs are Hi-Z DISP = "H", normal operation
32	HSYNC	Horizontal sync input in digital parallel RGB. Negative polarity
33	VSYNC	Vertical sync input in digital parallel RGB. Negative polarity
34	DEN	Input data control. When DE mode, active high to enable data input (Normally pull low)
35	NC	No connection
36	GND	System ground (0V)
37	XR/X+	The touch panel X Right pin
38	TD/Y-	The touch panel Y Down pin
39	YL/X-	The touch panel X Left pin
40	YU/Y+	The touch panel Y Up pin

DENSiTRON

3.4 Block Diagram

TBD

3.5 Timing Characteristics

3.5.1 RGB Input Timing

Vertical input timing
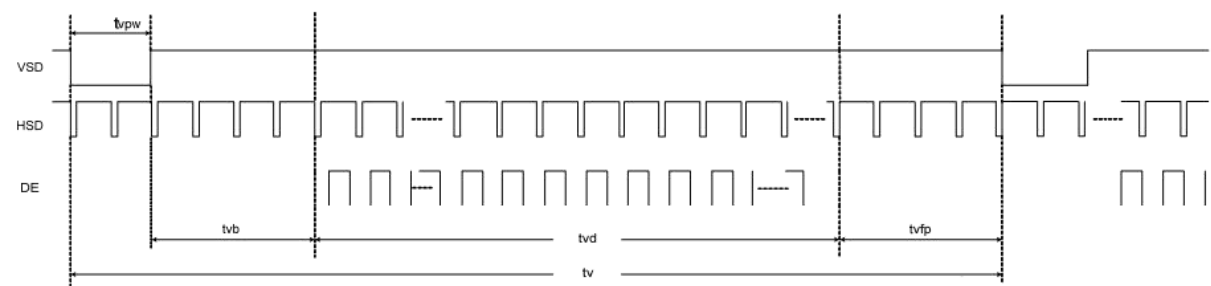
Parameter	Symbol	Min	Typ	Max	Unit	Note
Vertical Display Area	tvd		480		H	-
VSD period Time	tv	517	525	712	H	tvb + tvpw = 32H is fixed
VSD Pulse Width	tvpw	1	1	3	H	
VSD Back Porch (Blanking)	tvb	31	31	29	H	
VSD Front Porch	tvfp	5	13	200	H	-

Horizontal input timing
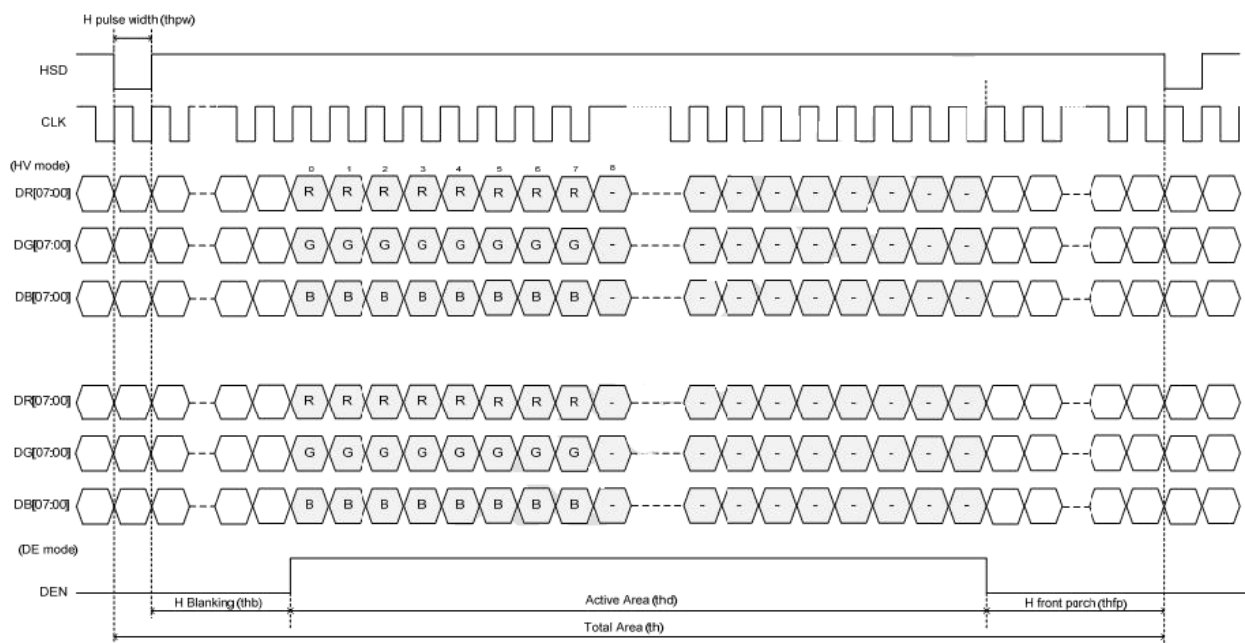
Parameter	Symbol	Min	Typ	Max	Unit	Note
Horizontal Display Area	thd		800		DCLK	-
DCLK Frequency	fclk	20	33.3	50	MHz	-
1 Horizontal Line	th	908	920	1088	DCLK	thb + thpw = 88DCLK is fixed
HSD Pulse Width	thpw	1	48	87	DCLK	
HSD Back Porch (Blanking)	thb	31	31	29	DCLK	
HSD Front Porch	thfp	20	40	200	DCLK	-

4. Electrical Specification Touch

Item	Min	Typ	Max	Unit	Note
Linearity	-	-	1.5	%	Analog X and Y direction
Terminal Resistance	350	-	950	Ω	x
	150	-	500		y
Insulation Resistance	20	-	-	MΩ	DC 25V
Voltage	-	5	-	V	DC
Transparency	78	-	-	%	-
Operation Force	70	-	120	g	-
Endurance	1000000	-	-	Touches	100g operation force
	-	-	30000	Slide	

5. Optical Specification

5.1 Optical Characteristics

Characteristics		Symbol	Conditions	Min	Typ	Max	Unit	Note
Contrast Ratio		CR	θ = 0°	400	500	-	-	1, 5
Response time (By quick)		$T_R + T_F$		-	25	-	msec	5
Viewing Angle	Left	θ_x-	CR ≥ 10	60	70	-	Deg	1, 6, 7
	Right	θ_x+		50	60	-		
	Up	θ_Y+		60	70	-		
	Down	θ_Y-		60	70	-		
Colour Chromaticity	Red	Rx	θ = 0°	0.562	0.592	0.622	-	-
		Ry		0.289	0.319	0.349		
	Green	Gx		0.279	0.309	0.339		
		Gy		0.537	0.567	0.597		
	Blue	Bx		0.117	0.147	0.177		
		By		0.12	0.15	0.18		
	White	Wx		0.269	0.299	0.329		
		Wy		0.308	0.338	0.368		
NTSC		-	-	-	50%	-	-	2
Luminance		Lv	-	600	650	-	cd/m^2	-
Uniformity		Avg	-	75	80	-	%	-
Transmittance		Trans	-	-	6.03%	-	-	3

Measuring Condition = Dark room, 25±2°C, 15min warm-up time.

Note 1: Measured with a viewing cone of 2° by Topcon luminance meter BM-5A.

Note 2: Measured with Otsuta chromaticity meter LCF-2100M, CF only measure under C light simulation.
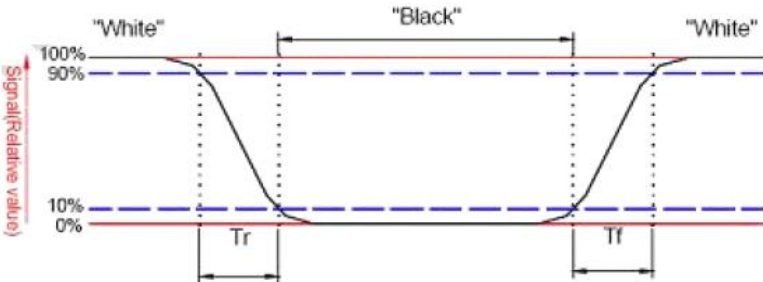
Note 3: BOE shipping status is cell without polarizer. Transmittance of Specification is cell with polarizer. The tolerance of Transmittance is ±10%.
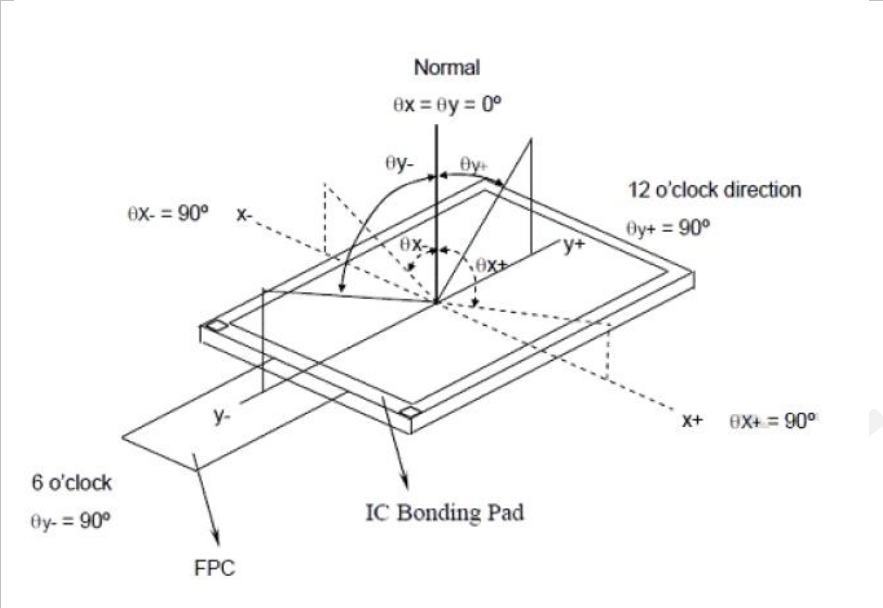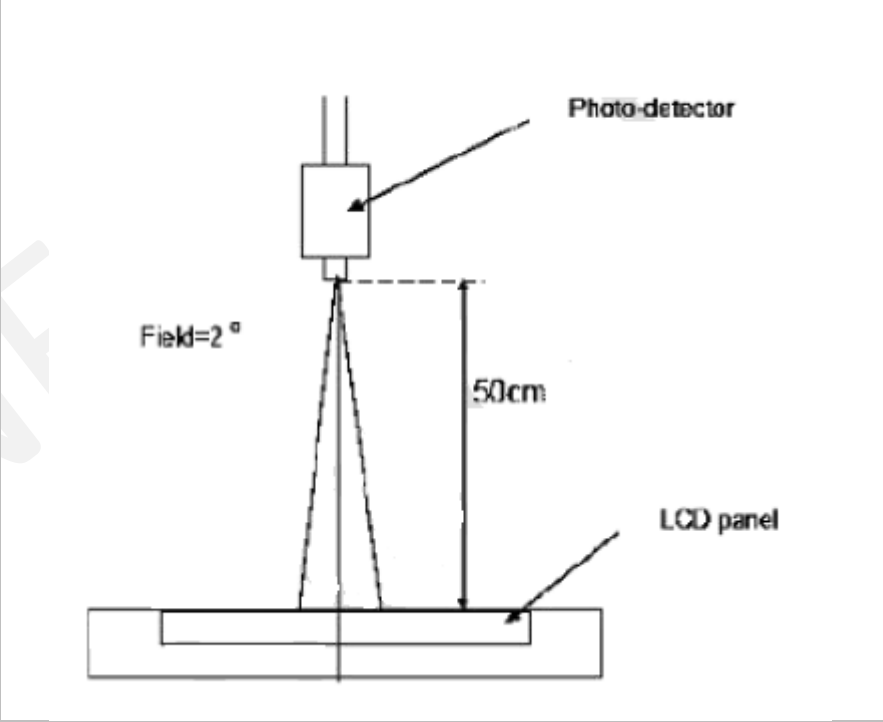
Note 4:
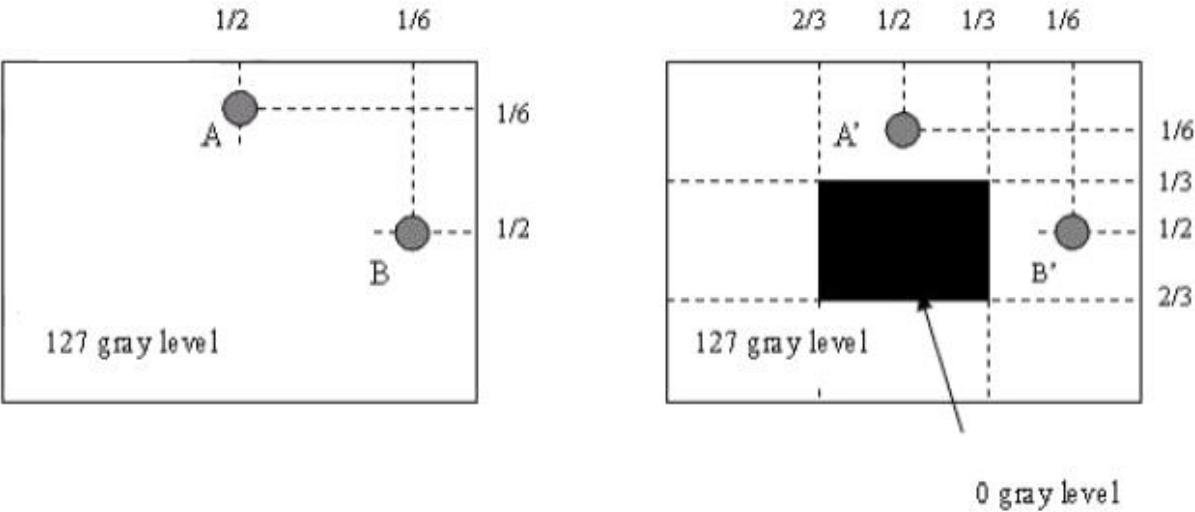
l LA-LA' l / LA x 100%= 2% max., LA and LA' are brightness at location A and A'.

l LB-LB' l / LB x 100%= 2% max., LB and LB' are brightness at location B and B'.

Note	Item	Test method
5	Definition of Response Time	The output signals of TRD-100 are measured when the input signals are changed to "White" (falling time) and from "White" to "Black" (rising time), respectively. The interval is between the 10% and 90% of amplitudes. Refer to figure as below.
6	Definition of Contrast Ratio (CR)	Contrast ratio is calculated by the following formula. $$Contrast\ ratio\ (CR) = \frac{Brightness\ on\ the\ "white"\ state}{Brightness\ on\ the\ "black"\ state}$$

Note	Item	Test method
7	Definition of Viewing Angle	
8	Definition of Optical Measurement Setup	

6. LED Backlight Specification

6.1 LED Backlight Electrical Characteristics

Item	Symbol	Min	Typ	Max	Unit
Voltage for LED Backlight	V_f	-	9.6	-	V
Current for LED Backlight	I_f	-	200	-	mA
Power Consumption	Wbl	-	1920	-	mW
LED Lifetime	-	30000	40000	-	Hrs

Note 1: The LED lifetime is defined as the module brightness decreased to 50% original brightness at Ta = 25°C, 60%RH ± 5%

Note 2: The life time of LED will be reduced if LED is driven by high current, high ambient temperature and humidity conditions.

Note 3: Typical operating lifetime is an estimated data.

Note 4: Permanent damage to the device may occur if maximum values are exceeded or reverse voltage is loaded. Functional operation should be restricted to the conditions describe under normal operating conditions.

6.2 Internal Circuit Diagram
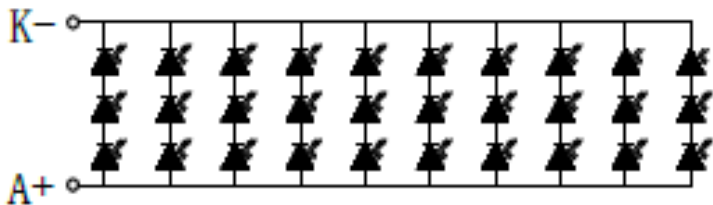
CURRENT IF=20*10=200mA, 9.6V(REF.)

7. Packaging

TBD

8. Quality Assurance Specification

8.1 Conformity

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

8.2 Environment Required

TBD

8.3 Delivery Assurance

8.3.1 Delivery Inspection Standards

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

8.3.2 Criteria & Acceptable Quality Level

TBD

8.3.3 Criteria & Classification

TBD

8.4 Dealing with Customer Complaints

8.4.1 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.

8.4.2 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.

9. Reliability Specification

9.1 Reliability Tests

| Test Item	Test Condition	Inspection after test
High Temperature Operation	70 ± 2°C, 96 hours	Inspection after 2~4hours storage at room temperature, the condensation is not accepted. The sample should be free from defects: 1.Air bubble in the LCD 2.Seal leak 3. Non-display 4. Missing segment 5. Glass crack
Low Temperature Operation	-20 ± 2°C, 96 hours	
High Temperature Storage	80 ± 2°C, 96 hours	
Low Temperature Storage	-30 ± 2°C, 96 hours	
Temperature Cycle	-30 ± 2°C (30min) ~ 80 ± 2°C (30min), 10 cycles	
High Temperature & High Humidity Storage	Ta = 60 ± 5°C, 90% RH ,96 hours.	
Vibration Test	Frequency: 10 ~ 55Hz, Stroke: 1.5mm Sweep: 10Hz ~ 55Hz ~ 10Hz 2 hours for each direction of X.Y.Z.	
Shock Test	Half-sine, wave, 300m/s	
Packaging Drop Test	Height: 80cm 1 corner, concrete floor	
Electro Static Discharge Test	C=150pF, R=330Ω Air: ±8KV, 150pF/330Ω, 30times; Contact: ±4KV, 20 times	

9.1.1 Inspection Check Standard

After the completion of the described reliability test, the samples are to be left at room temperature for 4 hrs prior to conducting the inspection check at 20±5 °C, 65±5% RH.

10. Handling Precautions

10.1 Handling Precautions

1) Since the display panel is made of glass, do not apply mechanical impacts such us dropping from a high position.

2) If the display panel is broken by accident and the internal organic substance leaks out, be careful not to inhale nor lick the organic substance.

3) If the liquid crystal touches your skin or clothes, wash it off immediately using soap and plenty of water

4) If pressure is applied to the display surface or its neighbourhood of the display module, the cell structure may be damaged and be careful not to apply pressure to these sections.

5) The polarizer covering the surface of the display module is soft and easily scratched. Please be careful when handling the display module.

6) When the surface of the polarizer of the 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

7) Hold the display module very carefully when placing it into the system housing. Do not apply excessive stress or pressure to display module. And, do not over bend the film with electrode pattern layouts. These stresses will
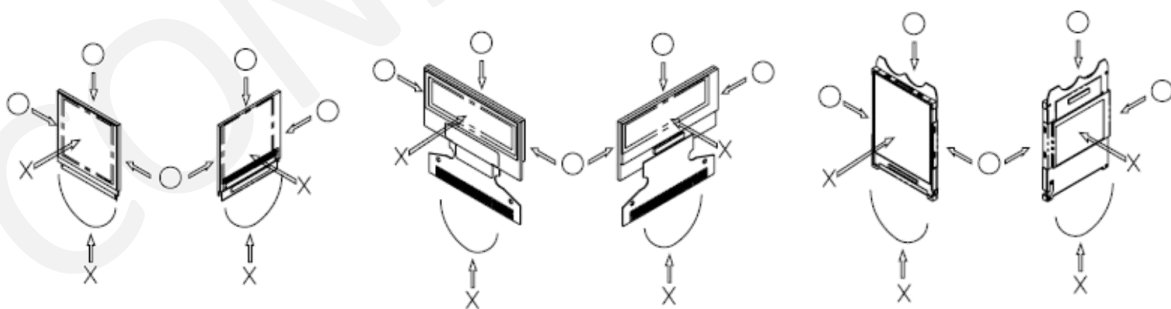
influence the display performance. Also, secure sufficient rigidity for the outer cases.

8) Do not apply stress to the LSI chips and the surrounding molded sections.

9) Do not disassemble nor modify the display module.

10) Do not apply input signals while the logic power is off.

11) Pay sufficient attention to the working environments when handing display modules to prevent occurrence of element breakage accidents by static electricity.

   a. Be sure to make human body grounding when handling display modules.

b. Be sure to ground tools to use or assembly such as soldering irons.

c. To suppress generation of static electricity, avoid carrying out assembly work under dry environments.

d. Protective film is being applied to the surface of the display panel of the display module. Be careful since static electricity may be generated when exfoliating the protective film.

12) A Protection film is being applied to the surface of the display panel and removes the protection film before assembling it. If the 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).

13) If electric current is applied when the 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.

10.2 Storage Precautions

1) When storing 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 store these modules in the packaged state when they are shipped from Densitron) 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 display module, when the 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.

10.3 Designing Precautions

1) The absolute maximum ratings are the ratings which cannot be exceeded for display module, and if these values are exceeded, panel damage may 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 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 neighbouring devices.

5) As for EMI, take necessary measures on the equipment side basically.

6) When fastening the display module, fasten the external plastic housing section.

7) If power supply to the display module is forcibly shut down by such errors as taking out the main battery while the display panel is in operation, we cannot guarantee the quality of this display module.

10.4 Operation Precautions

1) It is indispensable to drive the display within the specified voltage limit since excessive voltage shortens its life.

2) 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.

3) 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.

4) To protect display modules from performance drops by static electricity rapture, etc., do not touch the following sections whenever possible while handling the display modules.

   a. Pins and electrodes

   b. Pattern layouts such as the FPC

5) When the driver is being exposed (COG), semiconductor elements change their characteristics when light is radiated according to the principle of the solar battery. Consequently, if the driver is exposed to light, malfunctioning may occur.

   a. Design the product and installation method so that the driver may be shielded from light in actual usage.

   b. Design the product and installation method so that the driver may be shielded from light during the inspection processes.

6) Although the 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 the influences of noise on the system design.

7) We recommend you construct its software to make periodical refreshments of the operation statuses (re-setting of the commands and re-transference of the display data) to cope with catastrophic noise.

10.5 Cleaning Precautions

1) Keep TFT Scratch free: Avoid using abrasive materials like paper towels and newspaper in cleaning TFT LCD screens as they may scratch the surface. Instead, opt for a lint-free cloth. Don't spray the liquid directly on the monitor and remember to put gentle pressure when wiping the screen.

2) Avoid Vibration: During cleaning process, try to keep the TFT on shock proof platform to avoid strong shock and vibration. Do not apply pressure to the LCD screen of the LCD or bump or squeeze the LCD display back cover.

3) When the surface of the polarizer of the display module has soil, clean the surface. It takes advantage of using the following adhesion tape:

a) Scotch Mending Tape No. 810 or an equivalent.

b) Never try to breathe upon the soiled surface.

c) List of Safe and Unsafe solvents to clean TFT display:

Safe Solvents	Unsafe Solvents

Distilled Water	Ammonia
Isopropyl Alcohol	Acetone
Diluted White Vinegar = Water (Mix 1 part vinegar + 5 parts of Water)	Ethyl Alcohol
	Methyl Chloride
	Ethyl Acid

10.6 Other Precautions

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