

DMT050WVNTNT0-5A

PRODUCT SPECIFICATION

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TBD

<i>Customer's Approval</i>	
<u>Signature</u>	<u>Date</u>

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Revision History

VERSION	DATE	DESCRIPTION	AUTHOR
0.1	May 23, 2024	Preliminary	Yvette Hsieh

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1. General Description

1.1 Introduction

This is a 5.0" size colour active matrix TFT LCD module that uses amorphous silicon TFT as a switching device. The display is normally black mode, , transfective, 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 RGB interface.

1.2 Main Features

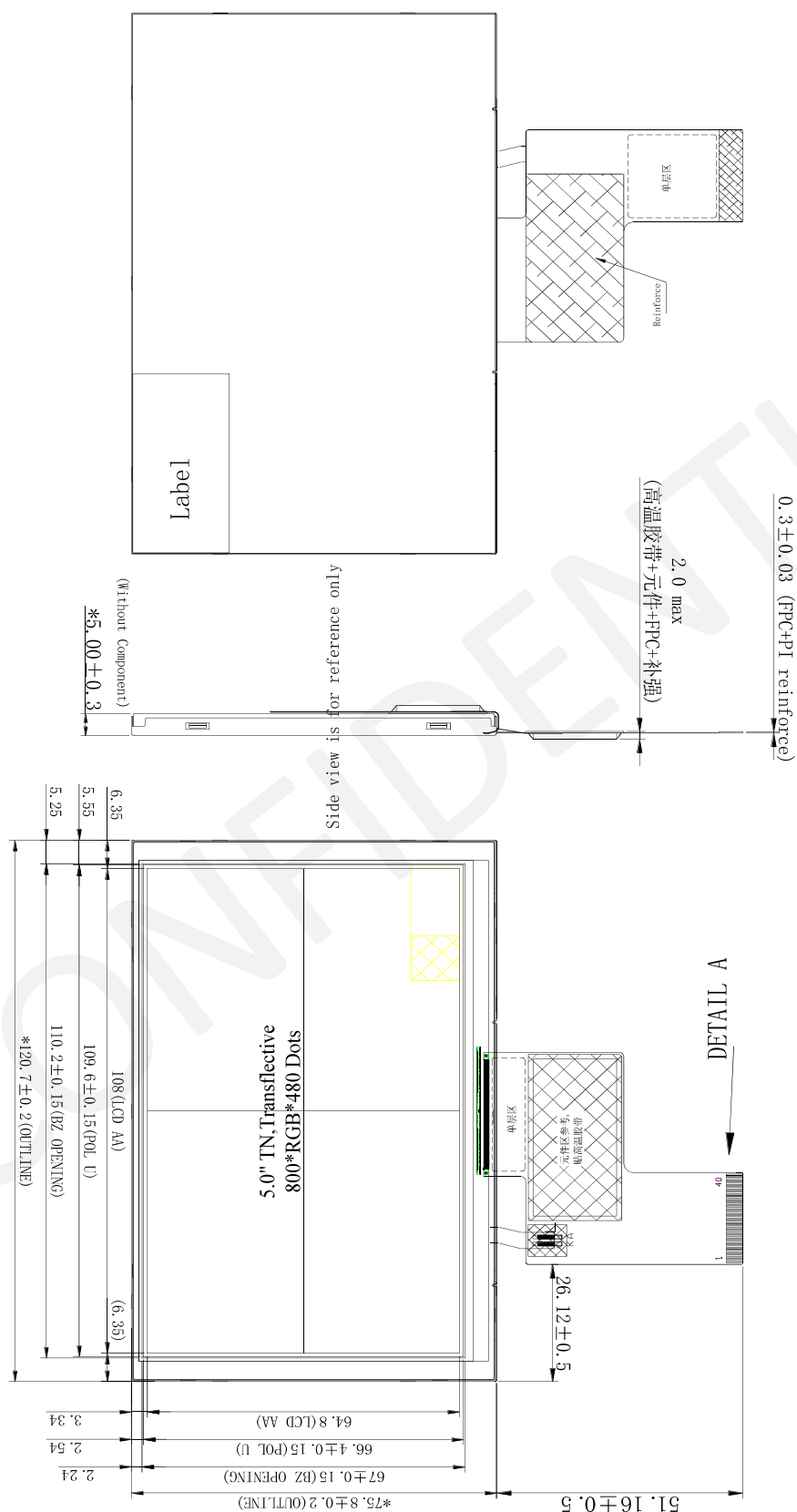
Item	Contents
Display Type	TFT LCD
Screen Size	5.0" Diagonal
Display Format	800 x RGB x 480 Dots
No. of Colour	16.7M
Overall Dimensions	120.7 (W) x 75.8 (H) x 5.0 (D) mm
Active Area	108.0 (W) x 64.8 (H) mm
Mode	Normally Black / Transfective / TN
Viewing Direction	12 o'clock
Interface	RGB
Driver IC	TBD
Backlight Type	LED, White, 12 chips
Operating Temperature	-30°C ~ 85°C
Storage Temperature	-30°C ~ 85°C
ROHS	RoHS Compliance

2. Mechanical Specification

2.1 Mechanical Characteristics

Item	Characteristic	Unit
Display Format	800 x RGB x 480	Dots
Overall Dimensions	120.7 (W) x 75.8 (H) x 5.0 (D)	mm
Active Area	108.0 (W) x 64.8 (H)	mm
Dot Pitch	0.135 x 0.135	mm
Weight	TBD	g
Driver IC	TBD	

2.2 Mechanical Drawing



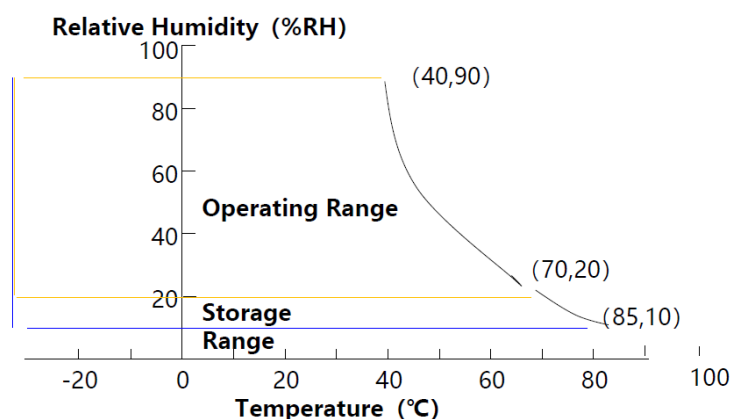
3. Electrical Specification

3.1 Absolute Maximum Ratings

(Ta=25°C)

Item		Symbol	Min	Max	Unit	Note
Power Supply	LCD Module	VCC	0	3.6	V	-
	BLU	V _{LED}	-	19.2	V	-
		I _{LED}	-	80	mA	-
Operating Temperature		T _{OPR}	-30	+85	°C	1
Storage Temperature		T _{STG}	-30	+85	°C	

Note 1: Temperature and relative humidity range are shown in the figure below.



Note 2: The absolute maximum rating values of this product are not allowed to be exceeded at any times. Should a module be used with any of the absolute maximum ratings exceeded, the characteristics of the module may not be recovered, or in an extreme case, the module may be permanently destroyed.

Note 3: Please refer to RELIABILITY.

3.2 DC Electrical Characteristics

Item	Symbol	Min	Typ.	Max	Unit	Note
Supply Power Voltage	VCC	3.0	3.3	3.6	V	TTL Mode
I/O Power Voltage	IOVCC	3.0	3.3	3.6	V	
Votp	VOTP	7.5	7.75	8	V	-

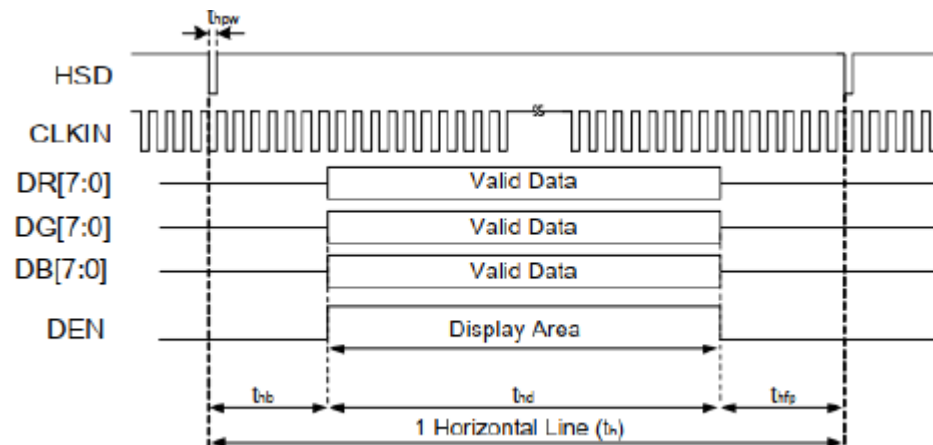
3.3 Interface Pin Assignment

No.	Symbol	Function
1	LEDK	Backlight LED cathode
2	LEDA	Backlight LED anode
3	GND	Ground
4	VCC	Supply voltage (3.3V)
5-12	R0-R7	Data bus
13-20	G0-G7	Data bus
21-28	B0-B7	Data bus
29	GND	Ground
30	CLK	Pixel clock signal
31	DISP	Display on/off control (H: on, L/NC: off)
32	HSYNC	Horizontal sync signal
33	VSYNC	Vertical sync signal
34	DEN	Data enable
35	NC	No connection
36	GND	Ground
37-40	NC	No connection

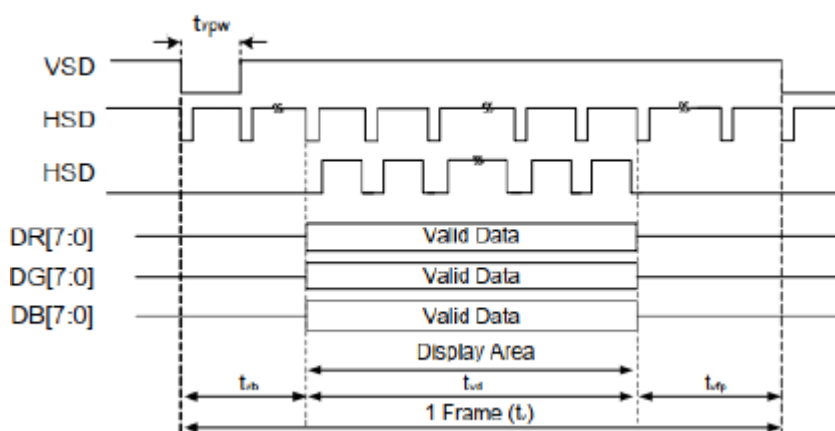
3.4 Timing Characteristics

3.4.1 TTL INPUT TIMING

Horizontal Timing



Vertical Timing



24-bit parallel RGB Input Timing	Symbol	Min	Typ	Max	Unit
DCLK Frequency	f_{xclk}	29	32.4	37.6	MHz
Horizontal Display Area	t_{hd}	-	800	-	DCLK
HS Pulse Width	t_{hpw}	4	24	HBP - 1	DCLK
HS Back Width	t_{hbp}	62	160	200	DCLK
HS Front Width	t_{hfp}	38	40	100	DCLK
1 Horizontal Line	t_h	9900	1000	1100	DCLK
Vertical Display Area	t_{vd}	-	480	-	THT

24-bit parallel RGB Input Timing	Symbol	Min	Typ	Max	Unit
VS Pulse Width	t_{vpw}	2	2	VBP – 1	THT
VS Back Width	t_{vbp}	12	23	35	THT
VS Front Width	t_{vfp}	12	37	55	THT
1 Vertical Line	t_v	504	540	570	THT
Frame Rate	-	-	60	-	Hz

3.4.2 Power Sequence

Power On Sequence

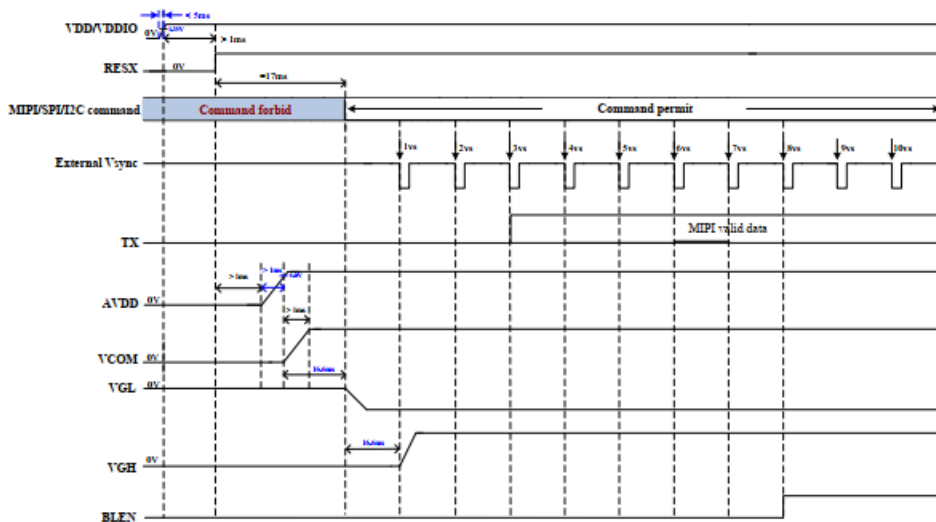


Figure : Power On timing chart

Power Off Sequence

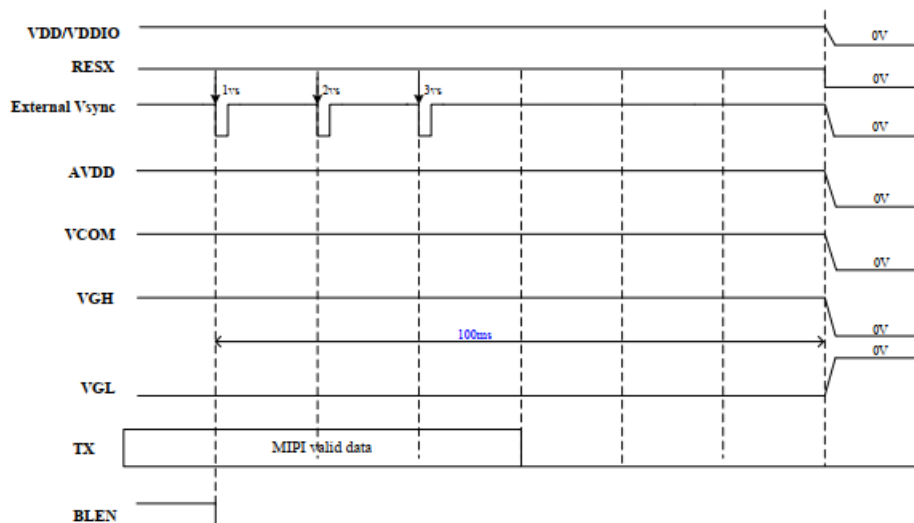


Figure : Power Off timing chart

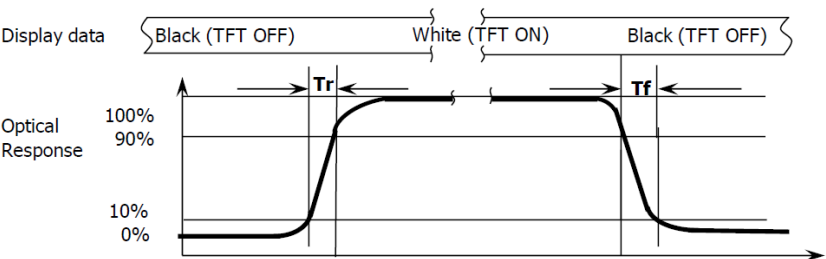
4. Optical Specification

4.1 Optical Characteristics

Transmissive

Characteristics		Symbol	Conditions	Min	Typ.	Max	Unit	Note
Contrast Ratio		CR	$\theta=0$ (Center) Normal Viewing Angle	-	60	-	-	Perpendicular
NTSC		%		-	40	-	%	-
Response time		TR + TF	25°C	-	20	25	ms	6
Viewing Angle	Left	θ_{x-}	CR > 2	-	50	-	Deg	1
	Right	θ_{x+}		-	60	-		
	Up	θ_{y+}		-	60	-		
	Down	θ_{y-}		-	60	-		
Colour Chromaticity	Red	Rx	$\theta=0$ (Center) Normal Viewing Angle	-0.03	0.581	+0.03	-	5
		Ry			0.347			
	Green	Gx			0.365			
		Gy			0.547			
	Blue	Bx			0.171			
		By			0.119			
	White	Wx			0.344			
		Wy			0.382			
Uniformity		ΔY	80	-	-	%	4	
Luminance		YL	$I_F = 60mA$	-	200	-	cd/m ²	-

(Reflective)							
Characteristics		Symbol	Conditions	Min	Typ.	Max	Note
Contrast Ratio		CR	$\theta=0$	-	7	-	Perpendicular
NTSC		%	(Center) Normal Viewing Angle	-	16.5	-	-
Viewing Angle	Left	θ_{x-}	CR > 2	-	60	-	1
	Right	θ_{x+}		-	70	-	
	Up	θ_{y+}		-	70	-	
	Down	θ_{y-}		-	60	-	
Colour Chromaticity	Red	Rx	$\theta=0$ (Center) Normal Viewing Angle	-0.03	0.456	+0.03	@D65 Light
		Ry			0.342		
	Green	Gx			0.304		
		Gy			0.479		
	Blue	Bx			0.192		
		By			0.220		
	White	Wx			0.314		
		Wy			0.362		

Note	Item	Test method
1	Definition of Viewing Angle	Viewing angle is the angle at which the contrast ratio is greater than 10. The viewing are determined for the horizontal or 3, 9 o'clock direction and the vertical or 6, 12 o'clock direction with respect to the optical axis which is normal to the LCD surface.
2	Definition of Contrast Ratio(CR)	Contrast measurements shall be made at viewing angle of $\theta = 0^\circ$ and at the center of the LCD surface. Luminance shall be measured with all pixels in the view field set first to white, then to the dark (black) state. $CR = \frac{\text{Luminance when displaying a white raster}}{\text{Luminance when displaying a black raster}}$
3	Definition of Luminance	Center trans of white is defined as the LCD surface. Luminance shall be measured with all pixels in the view field set first to white.
4	Definition of Uniformity	The White luminance uniformity on LCD surface is then expressed as : $\Delta Y = (\text{Minimum Luminance of 9points} / \text{Maximum Luminance of 9points}) * 100$
5	Definition of Color Chromaticity	The color chromaticity coordinates shall be calculated from the spectral data measured with all pixels first in red, green, blue and white. Measurement condition is C light source .
6	Definition of Response Time	The electro optical response time measurements shall be made by switching the "data" input signal ON and OFF. The times needed for the transmittance to change from 10% to 90% is T_r , and 90% to 10% is T_f 

Note	Item	Test method
7	Definition of Measure Setup	

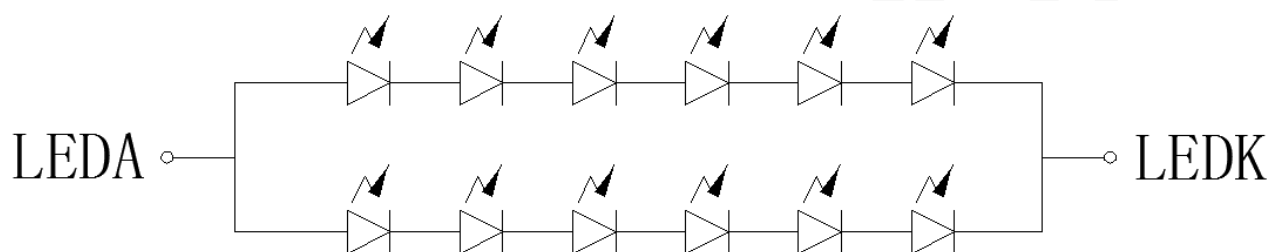
5. LED Backlight Specification

5.1 LED Backlight Characteristics

w	Symbol	Min	Typ.	Max	Unit
Forward Voltage	V_F	-	18.6	-	V
Forward Current	I_F	-	60	-	mA
LED Lifetime	W_{BL}	25000	-	-	Hrs

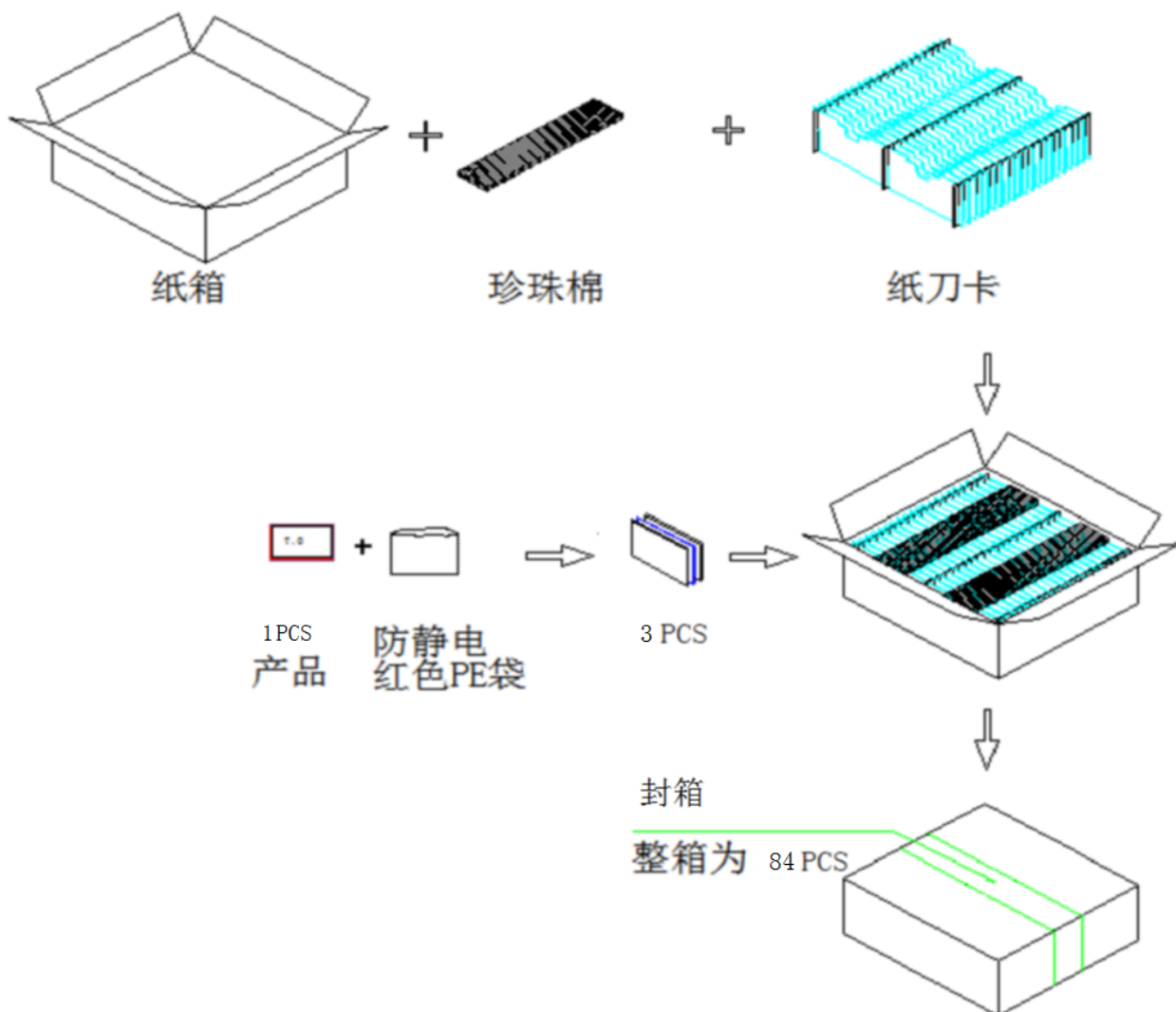
Note1: LED lifetime: brightness to be decreased to 50% of the initial value.

5.2 Internal Circuit Diagram



$$I_f = 30 \times 2 \text{mA}, V_f = 18.6 \text{V REF}$$

6. Packaging



7. Quality Assurance Specification

7.1 Conformity

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

7.2 Environment Required

7.3 Delivery Assurance

7.3.1 Delivery Inspection Standards

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

(TBD)

7.4 Dealing with Customer Complaints

7.4.1 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.

7.4.2 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.

8. Reliability Specification

8.1 Reliability Tests

Test Item	Test Condition
High Temperature Operation	85°C, 240 hours
Low Temperature Operation	-30°C, 240 hours
High Temperature Storage	85°C, 240 hours
Low Temperature Storage	-30°C, 240 hours
Thermal Shock (Non-operation)	-20°C,30 min ↔ 70°C,30 min, Change time:5min 100 Cycles.
High Temperature & High	60 °C, 90%RH, 240 hours
ESD Test	330Ω/150pF, Contact: ±4K, Air: ±8K, class B

Note 1: After the reliability test, the product only guarantee function normally without any fatal defect (non-display, line defect, abnormal display etc.). All the cosmetic specification is judged before the reliability test.

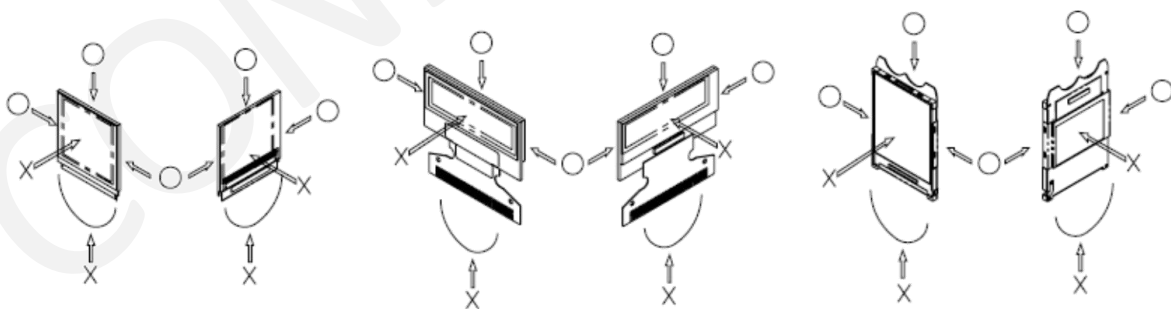
8.1.1 Inspection Check Standard.

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 25±5 °C, 65±5% RH.

9. Handling Precautions

9.1 Handling Precautions

- 1) Since the display panel is made of glass, do not apply mechanical impacts such as 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 handling 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.

9.2 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.

9.3 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.

9.4 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.

9.5 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

9.6 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.