

Displaytech Ltd.

Website: www.displaytech.com.hk

LCD Module Product Specification

Product: 3.3" TFT Display Module (320RGBx480DOTS)

Contents in this document are subject to change without notice. No part of this document may be reproduced or transmitted in any form or by any means, electronic or mechanical, for any purpose, without the express written permission of Displaytech Ltd.

2 March 2009.

1. REVISION RECORD

VERSION	CHANGES	DATE
1.0	Initial revision	2 March 2009

Table of Content

1. REVISION RECORD..... 1

2. Introduction 3

3. General Specifications 3

4. Mechanical Drawing..... 4

5. Interface Description..... 5

6. Absolute Maximum Ratings..... 7

7. Electrical Characteristics 7

8. Display Controller /Power Supply Timing 7

9. Operational EMC Requirements..... 8

10. Optical Characteristics..... 8

11. Backlight specification..... 10

12. Safety Precaution 10

2. Introduction

DT033TFT is a display module that contains a TFT display with a 480 * 320 RGB resolution. The driver used for this project is the MagnaChip **D51E5TA7601 or compatible** and can display 262K colors. The driver is mounted on the glass and the interconnection via FPC including components to drive the display module.

3. General Specifications

Item	Specification	Unit
LCD mode	Transmissive	---
Resolution	320(RGB)	Line
	480	Line
Viewing area	49.55	mm
	97.07	mm
Active area	47.952	mm
	95.472	mm
Driver IC	D51E5TA7601	---
Interface type	System parallel / RGB (1)	---
Colours	262K	---
Operation temperature range	-20~70	°C
Storage temperature range	-30~80	°C

Remarks:

- (1) Serial interface is available, but not recommendable, as the speed of it is very slow.
- (2) Recommended mating connector: Hirose FH19SC-45S-0.5SH, FH12S-45S-0.5SH; or Molex 0512964593, 0512964594; or equivalent
- (3) Orientation: both Portrait and Landscape mode are available (controlled by software, refer to IC spec)

Component Life Cycle

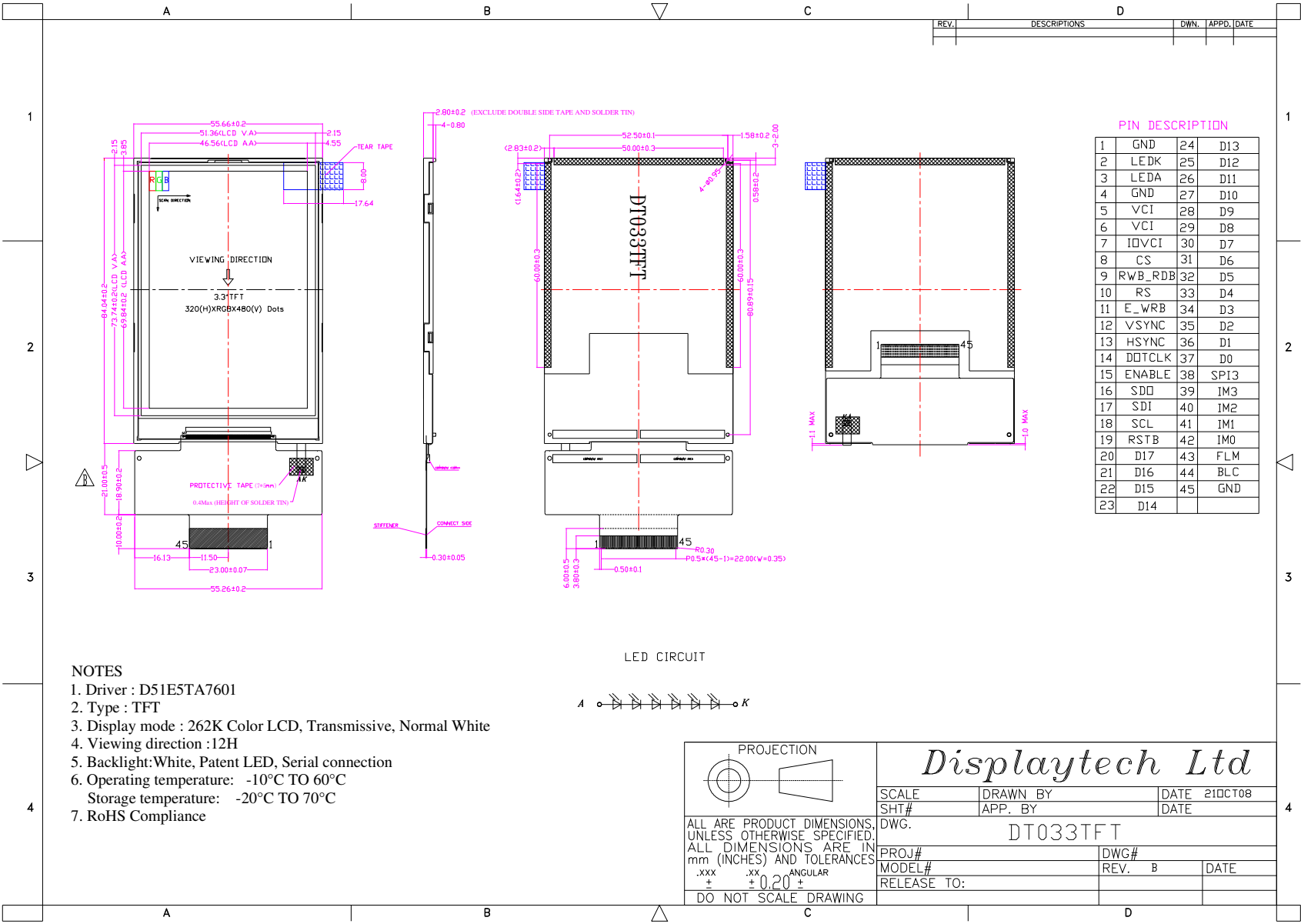
- 1) Storage Life: min. 1 Year
- 2) Operation Life (*1): min. 43 x 10³ h (24h per day x 7 days per week x 52 weeks / year x 5 years)
(Not include backlight)
- 3) Storage and Operation Life Times are defined for a temperature of +25°C

Notes:

*1. Operation life ends when one of the listed faults occurs:

- The on/off response-times reach 1.5 times of the max. value specified for a new display
- The contrast is reduced to 0.5 of the original contrast value
- Loss of function
- The number of cosmetic defects exceeds the maximum defined

4. Mechanical Drawing



5. Interface Description

Pin no	Symbol	Level	Description																																																																								
1	GND	0V	Ground																																																																								
2	LEDK	---	LED Backlight cathode																																																																								
3	LEDA	---	LED Backlight anode																																																																								
4	GND	0V	Ground																																																																								
5 ~ 6	VCI	2.5~3.3V	Analog power supply																																																																								
7	IOVCI	1.65~3.3V	I/O power supply for external interface.																																																																								
8	CS	H/L	Chip selection																																																																								
9	RWB_RDB	H/L	In M68 mode, this is used to select operation, read or write (RWB). In I80 mode, this serves as a read strobe signal (RDB).																																																																								
10	RS	H/L	The signal for register index or register command select. Low: Register index or internal status (in read operation) High: Register command.																																																																								
11	E_WRB	H/L	In M68 mode, this serves as a write/read enable strobe (E). In I80 mode, this serves as a write strobe signal (WRB).																																																																								
12	VSYNC	H/L	Frame synchronizing signal																																																																								
13	HSYNC	H/L	Horizontal Line synchronizing signal																																																																								
14	DOTCLK	H/L	Dot clock signal																																																																								
15	ENABLE	H/L	A data ENABLE signal in the RGB I/F mode																																																																								
16	SDO	H/L	Serial data transfer output in the serial data transfer interface mode																																																																								
17	SDI	H/L	Serial data transfer input/output in the serial data transfer interface mode																																																																								
18	SCL	H/L	In SPI mode, this serves as a synchronous clock (SCL)																																																																								
19	RSTB	H/L	Reset pin. Setting this pin to low initializes the LSI. Must be reset after power is supplied																																																																								
20 ~ 37	D17 ~ D0	H/L	<p>Data bus for SYSTEM I/F</p> <table border="1"> <thead> <tr> <th colspan="2">Interface Mode</th> <th colspan="2">Description</th> </tr> <tr> <th>IM[3:0]</th> <th>Description</th> <th>Index</th> <th>Data</th> </tr> </thead> <tbody> <tr> <td>4'b0000</td> <td>M68, 16-bit bus interface</td> <td>DB[8:1]</td> <td>DB[17:10],DB[8:1]</td> </tr> <tr> <td>4'b0001</td> <td>M68, 8-bit bus interface</td> <td>DB[17:10]</td> <td>DB[17:10]</td> </tr> <tr> <td>4'b0010</td> <td>I80, 16-bit bus interface</td> <td>DB[8:1]</td> <td>DB[17:10],DB[8:1]</td> </tr> <tr> <td>4'b0011</td> <td>I80, 8-bit bus interface</td> <td>DB[17:10]</td> <td>DB[17:10]</td> </tr> <tr> <td>4'b010x</td> <td>Serial peripheral interface</td> <td>-</td> <td>-</td> </tr> <tr> <td>4'b011x</td> <td>Serial peripheral interface</td> <td>-</td> <td>-</td> </tr> <tr> <td>4'b1000</td> <td>M68, 18-bit bus interface</td> <td>DB[8:1]</td> <td>DB[17:0]</td> </tr> <tr> <td>4'b1001</td> <td>M68, 9-bit bus interface</td> <td>DB[17:10]</td> <td>DB[17:9]</td> </tr> <tr> <td>4'b1010</td> <td>I80, 18-bit bus interface</td> <td>DB[8:1]</td> <td>DB[17:0]</td> </tr> <tr> <td>4'b1011</td> <td>I80, 9-bit bus interface</td> <td>DB[17:10]</td> <td>DB[17:9]</td> </tr> <tr> <td>4'b1100</td> <td>Reserved</td> <td>-</td> <td>-</td> </tr> <tr> <td>4'b1110</td> <td>Reserved</td> <td>-</td> <td>-</td> </tr> <tr> <td>4'b1101</td> <td>Reserved</td> <td>-</td> <td>-</td> </tr> <tr> <td>4'b1111</td> <td>Reserved</td> <td>-</td> <td>-</td> </tr> </tbody> </table> <p>Data bus for RGB I/F</p> <table border="1"> <thead> <tr> <th>Interface Mode</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>6-bit interface, 3-transfer</td> <td>DB[17:12]</td> </tr> <tr> <td>16-bit interface, 1-transfer</td> <td>DB[17:13],DB[11:1]</td> </tr> <tr> <td>18-bit interface, 1-transfer</td> <td>DB[17:0]</td> </tr> </tbody> </table> <p>Connected unused pins to the IOVCI or VSS level</p>	Interface Mode		Description		IM[3:0]	Description	Index	Data	4'b0000	M68, 16-bit bus interface	DB[8:1]	DB[17:10],DB[8:1]	4'b0001	M68, 8-bit bus interface	DB[17:10]	DB[17:10]	4'b0010	I80, 16-bit bus interface	DB[8:1]	DB[17:10],DB[8:1]	4'b0011	I80, 8-bit bus interface	DB[17:10]	DB[17:10]	4'b010x	Serial peripheral interface	-	-	4'b011x	Serial peripheral interface	-	-	4'b1000	M68, 18-bit bus interface	DB[8:1]	DB[17:0]	4'b1001	M68, 9-bit bus interface	DB[17:10]	DB[17:9]	4'b1010	I80, 18-bit bus interface	DB[8:1]	DB[17:0]	4'b1011	I80, 9-bit bus interface	DB[17:10]	DB[17:9]	4'b1100	Reserved	-	-	4'b1110	Reserved	-	-	4'b1101	Reserved	-	-	4'b1111	Reserved	-	-	Interface Mode	Description	6-bit interface, 3-transfer	DB[17:12]	16-bit interface, 1-transfer	DB[17:13],DB[11:1]	18-bit interface, 1-transfer	DB[17:0]
Interface Mode		Description																																																																									
IM[3:0]	Description	Index	Data																																																																								
4'b0000	M68, 16-bit bus interface	DB[8:1]	DB[17:10],DB[8:1]																																																																								
4'b0001	M68, 8-bit bus interface	DB[17:10]	DB[17:10]																																																																								
4'b0010	I80, 16-bit bus interface	DB[8:1]	DB[17:10],DB[8:1]																																																																								
4'b0011	I80, 8-bit bus interface	DB[17:10]	DB[17:10]																																																																								
4'b010x	Serial peripheral interface	-	-																																																																								
4'b011x	Serial peripheral interface	-	-																																																																								
4'b1000	M68, 18-bit bus interface	DB[8:1]	DB[17:0]																																																																								
4'b1001	M68, 9-bit bus interface	DB[17:10]	DB[17:9]																																																																								
4'b1010	I80, 18-bit bus interface	DB[8:1]	DB[17:0]																																																																								
4'b1011	I80, 9-bit bus interface	DB[17:10]	DB[17:9]																																																																								
4'b1100	Reserved	-	-																																																																								
4'b1110	Reserved	-	-																																																																								
4'b1101	Reserved	-	-																																																																								
4'b1111	Reserved	-	-																																																																								
Interface Mode	Description																																																																										
6-bit interface, 3-transfer	DB[17:12]																																																																										
16-bit interface, 1-transfer	DB[17:13],DB[11:1]																																																																										
18-bit interface, 1-transfer	DB[17:0]																																																																										
38	SPI3	H/L	Mode selection pin for Serial Peripheral Interface. If SPI3 = 0, 4-wire SPI mode If SPI3 = 1, 3-wire SPI mode. That is, SDI is bidirectional pin.																																																																								

39 ~ 42	IM3 ~ IM0	H/L	Select the MPU interface mode as listed below.	
			IM[3:0]	Description
			4'b0000	M68, 16-bit bus interface
			4'b0001	M68, 8-bit bus interface
			4'b0010	I80, 16-bit bus interface
			4'b0011	I80, 8-bit bus interface
			4'b010x	Serial peripheral interface, 16-bit stream IM[0] _ ID
			4'b011x	Serial peripheral interface, 18-bit stream IM[0] _ ID
			4'b1000	M68, 18-bit bus interface
			4'b1001	M68, 9-bit bus interface
			4'b1010	I80, 18-bit bus interface
			4'b1011	I80, 9-bit bus interface
			4'b1100	Reserved
			4'b1110	Reserved
			4'b1101	Reserved
4'b1111	Reserved			
Note: When the serial interface is selected, the IM0 pin is used as an ID bit of the device code.				
43	FLM	H/L	Output a frame head pulse signal	
44	BLC	H/L	PWM signal for back light control	
45	GND	0V	Ground	

6. Absolute Maximum Ratings

Item	Symbol	Rating	Unit
Supply voltage range	V _{CC} / IOV _{CC}	-0.3 to + 4.6	V
Input voltage range	V _{IN}	-0.3 to V _{CC} + 0.3	V
Operating Ambient Temperature	T _{OP}	-10 ~ +60	°C
Operating Ambient Humidity	H _{OP}	10 ~ 90 (Max 60°C)	% RH
Storage Temperature	T _{STG}	-20 ~ +70	°C
Storage Humidity	H _{STG}	10 ~ 90 (Max 60°C)	% RH

7. Electrical Characteristics

DC Characteristics

Item	Symbol	Rating	Unit
Power supply	V _{CC}	2.5 to 3.3	V
Input current	I _{DD}	19.83 typ; 39.66 max	mA
Input voltage “H”	V _{IH}	0.8 IOV _{CC} to IOV _{CC}	V
Input voltage “L”	V _{IL}	-0.3 to 0.2 IOV _{CC}	V
Output voltage “H”	V _{OH}	0.8 IOV _{CC} to IOV _{CC}	V
Output voltage “L”	V _{OL}	0 to 0.2 IOV _{CC}	V

8. Display Controller /Power Supply TimingSee Display Controller Specification: **MagnaChip D51E5TA7601**

9. Operational EMC Requirements

The operational EMC immunity requirements and emission limits for DISPLAYTECH modules are provided in table 1: EMC specification for operational modules.

Table 1. EMC specification for operational modules

EMC phenomena	REFERENCE standard	Frequency range	Level/ Limit	Test specification	Performance criteria
Electromagnetic field	IEC 61000-4-3	30MHz-1000MHz	3 V/m	1kHz sine, 80% AM	C
EFT/Burst	IEC 61000-4-4	n.a.	10 V	-8us/50us -10ns/100ns	C C
Electrostatic Discharge*	IEC61000-4-2	n.a.	4 kV/ 8 kV	Contact/ Air	C
Conducted RF signals	IEC 61000-4-6	150kHz-30MHz	1 V	1kHz sine, 80% AM	C
Radiated emission	IEC 61000-6-4	30 MHz-1000MHz	47 dBuV	d = 10 m	n.a.

After a charge of 4kV, the display module is allowed to go down for 2 seconds and need to comeback again. With 8kV the display module is allowed to go down and has to comeback after a reset.

10. Optical Characteristics

Item	Symbol	Condition	Min	Typ	Max	Unit	Remark	Note
Response Time	Tr + Tf	θ=0° Ø=0° Ta=25°C	---	35.5	53.25	ms	Fig 2	4
Contrast ratio	Cr		270	540	---	---		1
Luminance Uniformity	δ White		81	91	---	%		3
Surface Luminance	Lv		241	302	---	cd/m ²		2
Viewing Angle range	θ	Ø=90°	70	80	---	deg	Fig 1	6
		Ø=270°	63	73	---			
		Ø=0°	70	80	---			
		Ø=180°	70	80	---			
CIE (x,y) Chromaticity	Red	x	0.561	0.611	0.661			5
		y	0.296	0.346	0.396			
	Green	x	0.277	0.327	0.377			
		y	0.534	0.584	0.634			
	Blue	x	0.094	0.146	0.196			
		y	0.048	0.098	0.148			
	White	x	0.244	0.304	0.364			
		y	0.268	0.328	0.388			

Note 1: Contrast Ratio = $\frac{\text{Average Surface Luminance with all white pixels (P}_1, P_2, P_3, P_4, P_5)}{\text{Average Surface Luminance with all black pixels (P}_1, P_2, P_3, P_4, P_5)}$

Note 2: Surface luminance is the LCD surface from the surface with all pixels displaying white.
 $L_v = \text{Average Surface Luminance with all white pixels (P}_1, P_2, P_3, P_4, P_5)$

Note 3: The uniformity in surface luminance, δ WHITE is determined by measuring luminance at each test position 1 through 5, and then dividing the maximum luminance of 5 points luminance by minimum luminance of 5 points luminance.
 $\delta \text{ WHITE} = \frac{\text{Minimum Surface Luminance with all white pixels (P}_1, P_2, P_3, P_4, P_5)}{\text{Maximum Surface Luminance with all white pixels (P}_1, P_2, P_3, P_4, P_5)}$

Note 4: Response time is the time required for the display to transition from White to black (Rise Time, T_r) and from black to white (Decay Time, T_f). For additional information see FIG 2.

Note 5: CIE (x, y) chromaticity: The x,y value is determined by measuring luminance at each test position 1 through 5, and then taking average value

Note 6: Viewing angle is the angle at which the contrast ratio is greater than 2. For TFT module the contrast ratio is greater than 10. The angles are determined for the horizontal or x axis and the vertical or y axis with respect to the z axis which is normal to the LCD surface. For additional information see Fig 1.

Fig.1 (Definition of Viewing Angle)

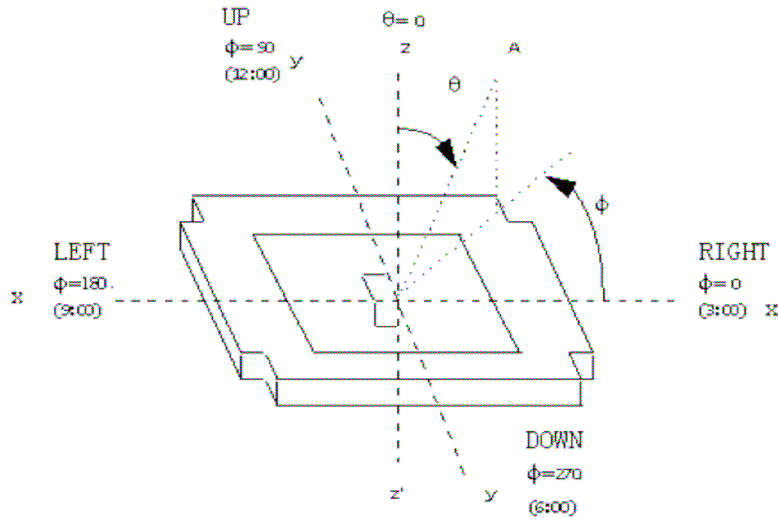
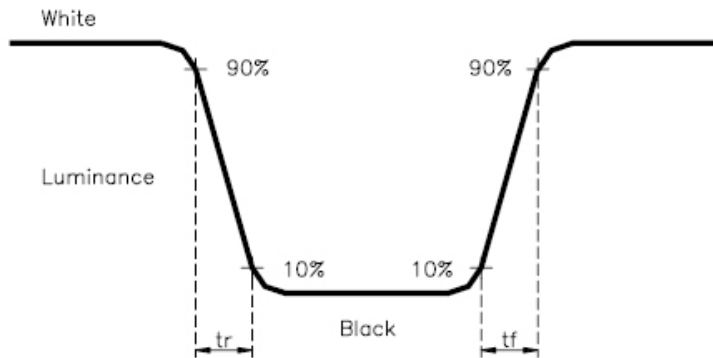


Fig. 2 (The response time is defined as the time interval between the 10% and 90% amplitudes. Refer to figure below.)



11.Backlight specification

ITEM	PARAMETER	UNIT
COLOR	WHITE	
NO.OF LED SMT	6	---
FORWARD VOLTAGE (VF)	19.2V typ. (IF 15mA)	V

12.Safety Precaution

Handling precautions:

- This device is susceptible to Electro-Static Discharge (ESD) damage. Observe Anti-Static precautions.

Power supply precautions:

- Identify and, at all times, observe absolute maximum ratings for both logic and LC drivers. Note that there is some variance between models.
- Prevent the application of reverse polarity to VCC and GND, however briefly.
- Use a clean power source free from transients. Power up conditions are occasionally “jolting” and may exceed the maximum ratings of the modules.
- The VCC power of the module should also supply the power to all devices that may access the display. Don’t allow the data bus to be driven when the logic supply to the module is turned off.

Operating precautions:

- DO NOT plug or unplug the module when the system is powered up.
- Minimize the cable length between the module and host MPU.
- Operate the module within the limits of the modules temperature specifications.

Mechanical/Environmental precautions:

- Improper soldering is the major cause of module difficulty. Use of flux cleaner is not recommended as they may seep under the elastomeric connection and cause display failure.
- Mount the module so that it is free from torque and mechanical stress.
- Surface of the LCD panel should not be touched or scratched. The display front surface is an easily scratched, plastic polarizer. Avoid contact and clean only when necessary with soft, absorbent cotton dampened with petroleum benzene.
- Always employ anti-static procedure while handling the module.
- Prevent moisture build-up upon the module and observe the environmental constraints for storage temperature and humidity.
- Do not store in direct sunlight
- If leakage of the liquid crystal material should occur, avoid contact with this material, particularly ingestion. If the body or clothing becomes contaminated by the liquid crystal material, wash thoroughly with water and soap