Displaytech Ltd.

Website: www.displaytech-us.com

LCD Module

Product Specification

Product: 2.2” TFT Display Module (240RGBx320DOTS)

6 November 2008.

REVISION RECORD

VERSION	CHANGES	DATE
1.0	Initial revision	9 January 2008
2.0	Data updated on: General specifications, Interface description, Electrical characteristics, Optical characteristics, and Backlight spec	11 April 2008
2.1	Corrected the lifetime info on page 4	6 November 2008

Table of Content

1. Introduction

SDT022TFT is a display module that contains a TFT display with a 320 * 240 RGB resolution. The driver used for this project is the Samsung **S6D0139 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.

2. General Specifications

Item	Specification	Unit
LCD mode	Transmissive	---
Resolution	240(RGB)	Line
	320	Line
Viewing area	36.04	mm
	46.72	mm
Active area	33.84	mm
	45.12	mm
Driver IC	S6D0139X11	---
Interface type	System parallel interface	---
Colours	262K	---
Operation temperature range	-20~70	°C
Storage temperature range	-30~80	°C

Remarks:

1) Recommended mating connector: Hirose FH19SC-45S-0.5SH, FH12S-45S-0.5SH; or Molex 0512964593, 0512964594; or equivalent
2) Orientation: both Portrait and Landscape mode are available (controlled by software, refer to IC spec)

Component Life Cycle

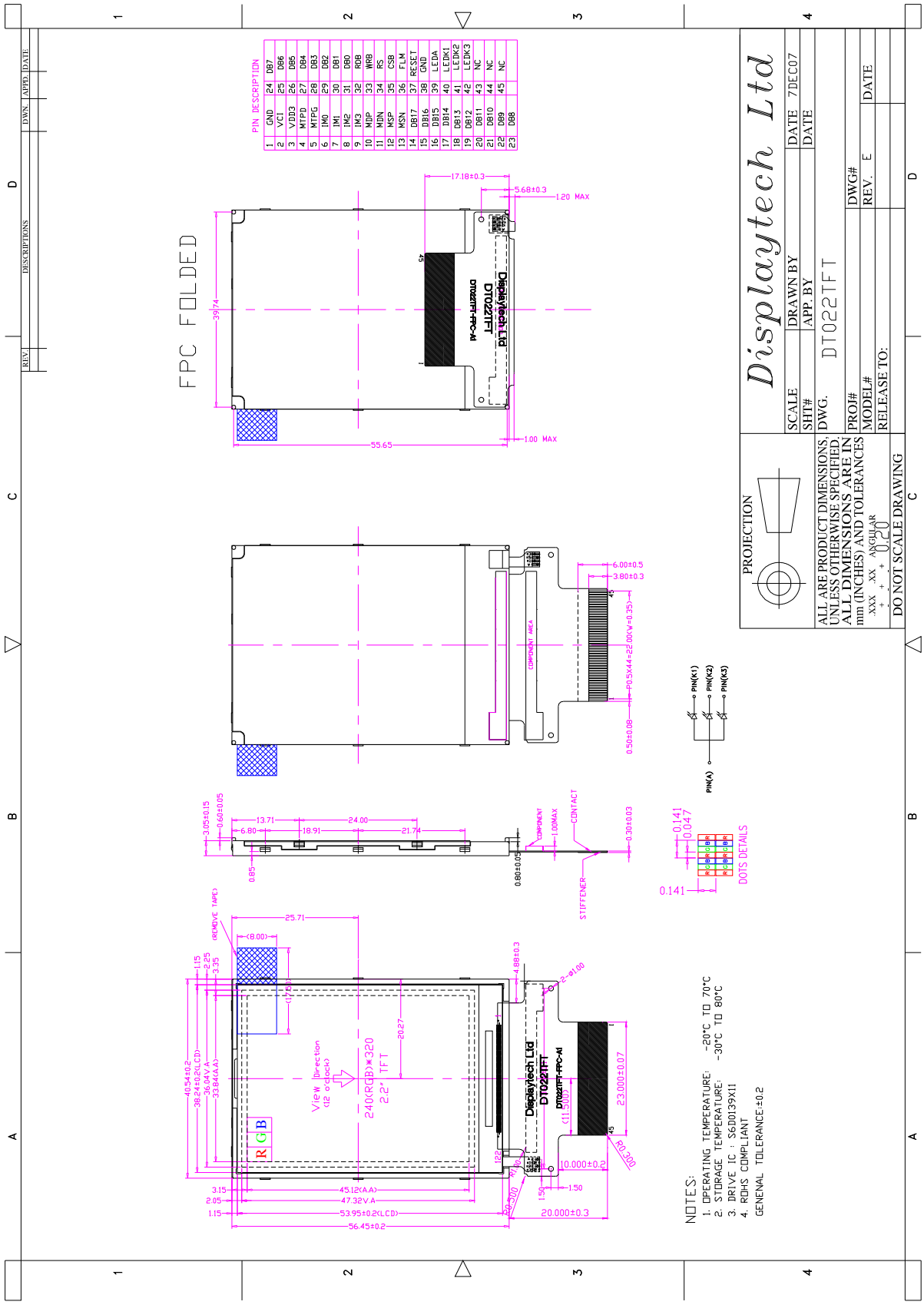
1) Storage Life: min. 1 Year
2) Operation Life (*1): min. 43 x 10^3 h (24h per day x 7 days per week x 52 weeks / year x 5 years) (Not include backlight)
3) Storage and Operation Life Times are defined for a temperature of +25°C

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

3. Mechanical Drawing



4. Interface Description

Pin no	Symbol	Level	Description
1	GND	0V	Ground
2	VCI	2.8V	Liquid crystal analog circuit power supply.
3	VDD3	2.8V	Power Supply
4	MTPD	---	Power supply for Non-volatile Memory (17.5V +/-0.5V) If MTP is not used, this pad should be floated.
5	MTPG	---	Power supply for Non-volatile Memory. (21.5V +/-0.5V) If MTP is not used, this pad should be floated.
6~9	IM0~IM3	H/L	
10	MDP	---	Should be floating. No use in MPU mode.
11	MDN	---	Should be floating. No use in MPU mode.
12	MSP	---	Should be floating. No use in MPU mode.
13	MSN	---	Should be floating. No use in MPU mode.
14~31	DB17~DB0	H/L	Data Bus
32	RDB	H/L	Read Signal
33	WRB	H/L	Write Signal
34	RS	H/L	Register Select Signal (Low: Index status, High : Control)
35	CSB	H/L	Chip Select Input (Low: Enable)
36	FLM	H/L	Frame head to synchronize RAM data write operation with the frame head position.
37	RESET	H/L	Reset Pin, initialises IC when Low
38	GND	0V	Ground
39	LEDA	-	LED Backlight Anode
40	LEDK1	-	LED Backlight Cathode
41	KEDK2	-	LED Backlight Cathode
42	LEDK3	-	LED Backlight Cathode
43~45	NC	-	No connection

IM3	IM2	IM1	IM0	Interface mode	DB Pin
VSS3	VSS3	VDD3	VSS3	80-system, 16 bit	DB[17:10], DB[8:1]
VSS3	VSS3	VDD3	VDD3	80-system, 8 bit	DB[17:10]
VDD3	VSS3	VDD3	VSS3	80-system, 18 bit	DB[17:0]
VDD3	VSS3	VDD3	VDD3	80-system, 9 bit	DB[17:9]

5. Absolute Maximum Ratings

Item	Symbol	Rating	Unit
Supply voltage range	V_{DD3}/V_{C1}	-0.3 to +5.0	V
Input voltage range	Vin	-0.3 to V_{DD3} +0.3	V
Operating Ambient Temperature	T_{OP}	-20 ~ +70	°C
Operating Ambient Humidity	H_{OP}	10 ~ 90 (Max 60°C)	% RH
Storage Temperature	T_{STG}	-30 ~ +80	°C
Storage Humidity	H_{STG}	10 ~ 90 (Max 60°C)	% RH

6. Electrical Characteristics

DC Characteristics

Item	Symbol	Rating	Unit
Power supply to I/O	V_{DD3}	2.7 to 2.9	V
Power supply to internal reference	V_{C1}	2.7 to 2.9	V
Input current	I_{DD}	20.4 max	mA
Input voltage “H”	V_{IH}	$0.8V_{DD3}$ to V_{DD3}	V
Input voltage “L”	V_{IL}	0 to $0.2V_{DD3}$	V
Output voltage “H”	V_{OH}	$0.7V_{DD3}$ to V_{DD3}	V
Output voltage “L”	V_{OL}	0 to $0.3V_{DD3}$	V

7. Display Controller /Power Supply Timing

See Display Controller Specification: **SAMSUNG S6D0139**

8. 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.

9. Optical Characteristics

Item		Symbol	Condition	Min	Typ	Max	Unit	Remark	Note
Response Time		Tr + Tf	θ=0º Ø=0º Ta=25ºC	---	36.2	54.3	ms	Fig 2	4
Contrast ratio		Cr		252	505	---	---		1
Luminance Uniformity		δ White		83	93	---	%		3
Surface Luminance		Lv		179	224	---	cd/m²		2
Viewing Angle range		θ	Ø=90º	70	80	---	deg	Fig 1	6
			Ø=270º	58	68	---			
			Ø=0º	70	80	---			
			Ø=180º	70	80	---			
CIE (x,y) Chromaticity	Red	x	θ=0º Ø=0º Ta=25ºC	0.560	0.610	0.660			5
		y		0.292	0.342	0.392			
	Green	x		0.278	0.328	0.378			
		y		0.525	0.575	0.625			
	Blue	x		0.097	0.147	0.197			
		y		0.032	0.082	0.132			
	White	x		0.241	0.301	0.361			
		y		0.246	0.306	0.366			

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.
Lv = 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, Tr) and from black to white (Decay Time, Tf). 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)

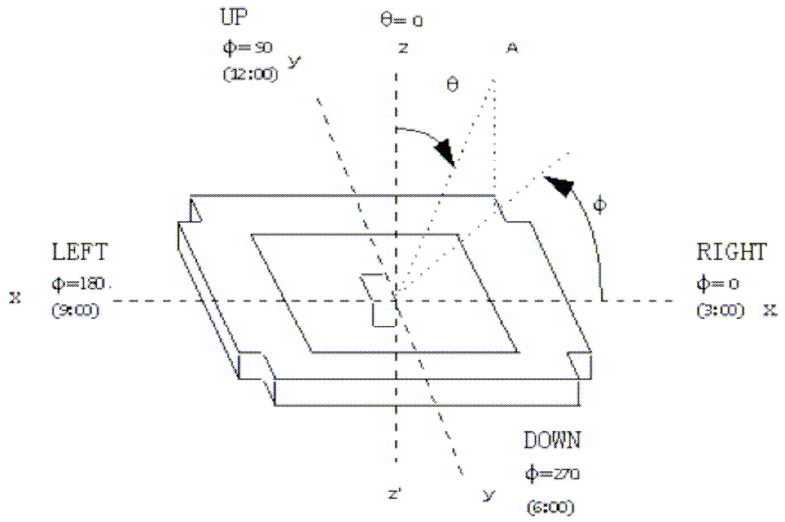
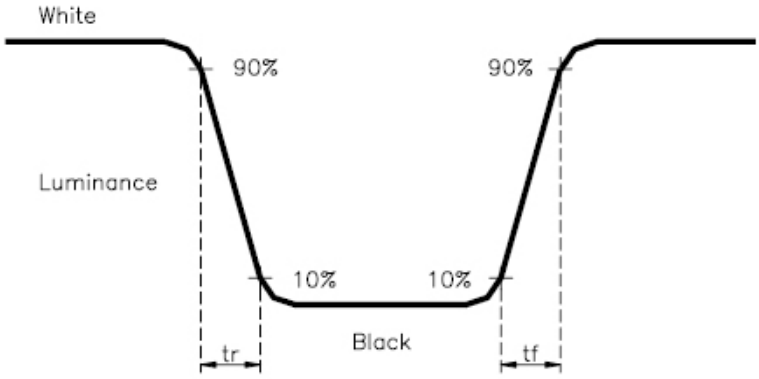


Fig. 2 (The response time is defined as the time interval between the 10% and 90% amplitudes. Refer to figure below.)



10.Backlight Specification

ITEM	PARAMETER		UNIT
COLOR	WHITE		
CHROMATICITY COORDINATE	X=0.283-0.330	Y=0.276-0.339	
AVERAGE LUMINOUS INTENSITY (LV)	2800 to 3800 (If 45mA)		cd/m^2
NO.OF LED SMT	3		---
FORWARD VOLTAGE (VF)	3.0 to 3.4 (If 45mA)		V

11.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