# LCD Module Product Specification

Product: 2.2" TFT Display Module (240RGBx320DOTS)

# **REVISION RECORD**

VERSION	CHANGES	DATE
1.0	Initial revision	9 January 2008

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#### 1. Introduction

**DT022TFT** 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	
Possibution	240(RGB)	Line
Resolution	320	Line
Viewing eree	35.44	mm
viewing area	46.72	mm
A ativa araa	33.84	mm
Active area	45.12	mm
Driver IC	S6D0139	
Interface type	System parallel	
Colours	262K	
Operation temperature range	-20~70	°C
Storage temperature range	-30~80	°C

#### **Component Life Cycle**

Storage Lifemin. 1 YearOperation Life \*1min. 40 x 103 h (22h per day x 7 days per week x 52 weeks / year x 5<br/>years)Backlight Operation Life \*2min. 5 x 103 h

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
- \*2. Backlight Operation Life ends when the backlight luminance is reduced to 0.7 of the original value

# 3. Mechanical Drawing



# 4. Interface Description

Pin no	Symbol	Level	Description					
1	GND	0V	Ground	Ground				
2	VCI	2.8V	Analogue	Analogue Power Supply				
3	VDD3	1.8V/2.8V	Power Su	pply to I/	O Block of	f IC		
4	MTPD		Power Su	pply for N	Non-volati	le Memory	(17.0V +/- 0.5V)	
5	MTPG		Power Su	pply for N	Non-volati	le Memory	(17.0V +/- 0.5V)	
6~9	IM0~IM3	H/L	IM3	IM2	IM1	IM0/ID	MPU interface	DB Pin assign
							mode	
			VSS3	VSS3	VDD3	VSS3	80 system, 16 bit	DB17-10,
								DB8-1
			VSS3	VSS3	VDD3	VDD3	80 system, 8 bit	DB17-10
			VDD3	VSS3	VDD3	VSS3	80 system, 18 bit	DB17-0
			VDD3	VSS3	VDD3	VDD3	80 system, 9 bit	DB17-9
10	MDP	H/L	Not used, leave floating					
11	MDN	H/L	Not used,	Not used, leave floating				
12	MSP	H/L	Not used,	Not used, leave floating				
13	MSN	H/L	Not used,	Not used, leave floating				
14~31	DB17~DB0	H/L	Data Bus	Data Bus				
32	RDB	H/L	Read Sign	nal				
33	WRB	H/L	Write Signal					
34	RS	H/L	Register S	Register Select (Low : Index status, High : Control)				
35	CSB	H/L	Chip Sele	Chip Select Input (Low : Enable)				
36	FLM	H/L	Output Pin for Test (when not used, leave floating)					
37	RESET	H/L	Reset Pin, initialises IC when Low					
38	GND	0V	Ground					
39	LEDA	-	LED Back	LED Backlight Anode				
40	LEDK1	-	LED Back	klight Cat	hode			
41	KEDK2	-	LED Back	klight Cat	hode			
42	LEDK3	-	LED Back	klight Cat	hode			
43~45	NC	-	No conne	No connection				

## 5. Absolute Maximum Ratings

Item	Symbol	Rating	Unit
Supply voltage range	Vdd3/Vc1	-0.3 to +5.0	V
Input voltage range	Vin	-0.3 to VDD3 +0.3	V
Operating Ambient Temperature	Тор	-20 ~ +70	°C
Operating Ambient Humidity	Нор	10 ~ 90 (Max 60 C)	% RH
Storage Temperature	Tstg	-30 ~ +80	°C
Storage Humidity	Нѕтд	10 ~ 90 (Max 60 C)	% RH

# 6. Electrical Characteristics

# **DC** Characteristics

Item	Symbol	Rating	Unit
Power supply to I/O	VDD3	2.7/1.7 to 2.9/1.9	V
Power supply to internal reference	Vcı	2.7 to 2.9	V
Input current	Idd	20.4 max	mA
Input voltage "H"	VIH	0.8Vdd3 to Vdd3	V
Input voltage "L"	VIL	0 to 0.2VDD3	V
Output voltage "H"	Vон	0.7VDD3 to VDD3	V
Output voltage "L"	Vol	0 to 0.3VDD3	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.

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	С
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	С
Conducted RF signals	IEC 61000-4-6	150kHz- 30MHz	1 V	1kHz sine, 80% AM	С
Radiated emission	IEC 61000-6-4	30 MHz- 1000MHz	47 dBuV	d = 10 m	n.a.

Table 1. EMC specification for operational modules

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

Ite	m	Symbol	Condition	Min	Тур	Max	Unit	Remark	Note
Response Time		Tr + Tf			60	80	ms	Fig 2	4
Contrast ratio		Cr	θ=0°	280	560				1
Luminance Uniformity		δ White	Ø=0°	78	87		%		3
Surface Lumir	nance	Lv	Ta=25°C	125	156		Cd/m <sup>2</sup>		2
			Ø=90°		>80				
Viewing Angle range		θ	Ø=270°		>80		deg	Fig 1	6
			Ø=0°		>80				
			Ø=180°		>80				
	Pad	Х		0.534	0.584	0.634			
	Keu	у		0.278	0.328	0.378			
CIE (x,y) Chromacity	Creen	x	0.08	0.293	0.343	0.393			
	Green	У	0=0 Ø=0°	0.495	0.545	0.595			5
	Plue	Х	y = 0 T <sub>2</sub> =25°C	0.095	0.145	0.195			5
	Diue	у	1a-25 C	0.024	0.074	0.124			
	White	х		0.250	0.300	0.350			
	white	у		0.254	0.304	0.354			

Note 1: Contrast Ratio = <u>Average Surface Luminance with all white pixels (P 1, P2, P 3, P4, P5)</u> Average Surface Luminance with all black pixels (P1, P2, P 3, P4, P5)

Note 2: Surface luminance is the LCD surface from the surface with all pixels displaying white. Lv = Average Surface Luminance with all white pixels (P1, P2, P 3, P4, P5)

Note 3: The uniformity in surface luminance,  $\delta$  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.

 $\delta$  WHITE = <u>Minimum Surface Luminance with all white pixels (P1, P2, P3, P4, P5)</u>

Maximum Surface Luminance with all white pixels (P1, P2, P 3, P4, P5)

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.) White



#### **10.Backlight Specification**

ITEM	PARA	UNIT	
COLOR	LOR WHITE		
CHROMATICITY COORDINATE	X=0.283-0.330 Y=0.276-0.339		
AVERAGE LUMINOUS INTENSITY (LV)	2800 to 34	cd/m <sup>2</sup>	
NO.OF LED SMT	3		
FORWARD VOLTAGE (VF)	3.0 to 3.2 (IF 45mA)		V

#### ABSOLUTE MAXIMUM RATING

ITEM	SYMBOL	PARAMETER
FORWARD CURRENT	If	42.5mA
REVERSE VOLTAGE	Vr	5V

#### **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