Displaytech Ltd.

LCD Module
Product Specification

Product: 2.4'' TFT Display Module (240RGBx320DOTS)

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9 January 2008.

REVISION RECORD

VERSION	CHANGES	DATE
1.0	Initial revision	3 August 2007
2.0	Complete new module	9 January 2008

Table of Content

1. Introduction

DT024TFT is a display module that contains a TFT display with a 320 * 240 RGB resolution. The driver used for this project is the Renesas **R61505U 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	39.12	mm
	51.36	mm
Active area	36.72	mm
	48.96	mm
Driver IC	R61505U	---
Interface type	System parallel / RGB	---
Colours	262K	---
Operation temperature range	-20~70	°C
Storage temperature range	-30~80	°C

Component Life Cycle

Storage Life   min. 1 Year
Operation Life *1   min. 40 x 10³ h (22h per day x 7 days per week x 52 weeks / year x 5 years)
Backlight Operation Life *2 min. 5 x 10³ h
Storage and Operation Life Times are defined for a temperature of +25°C

Notes:
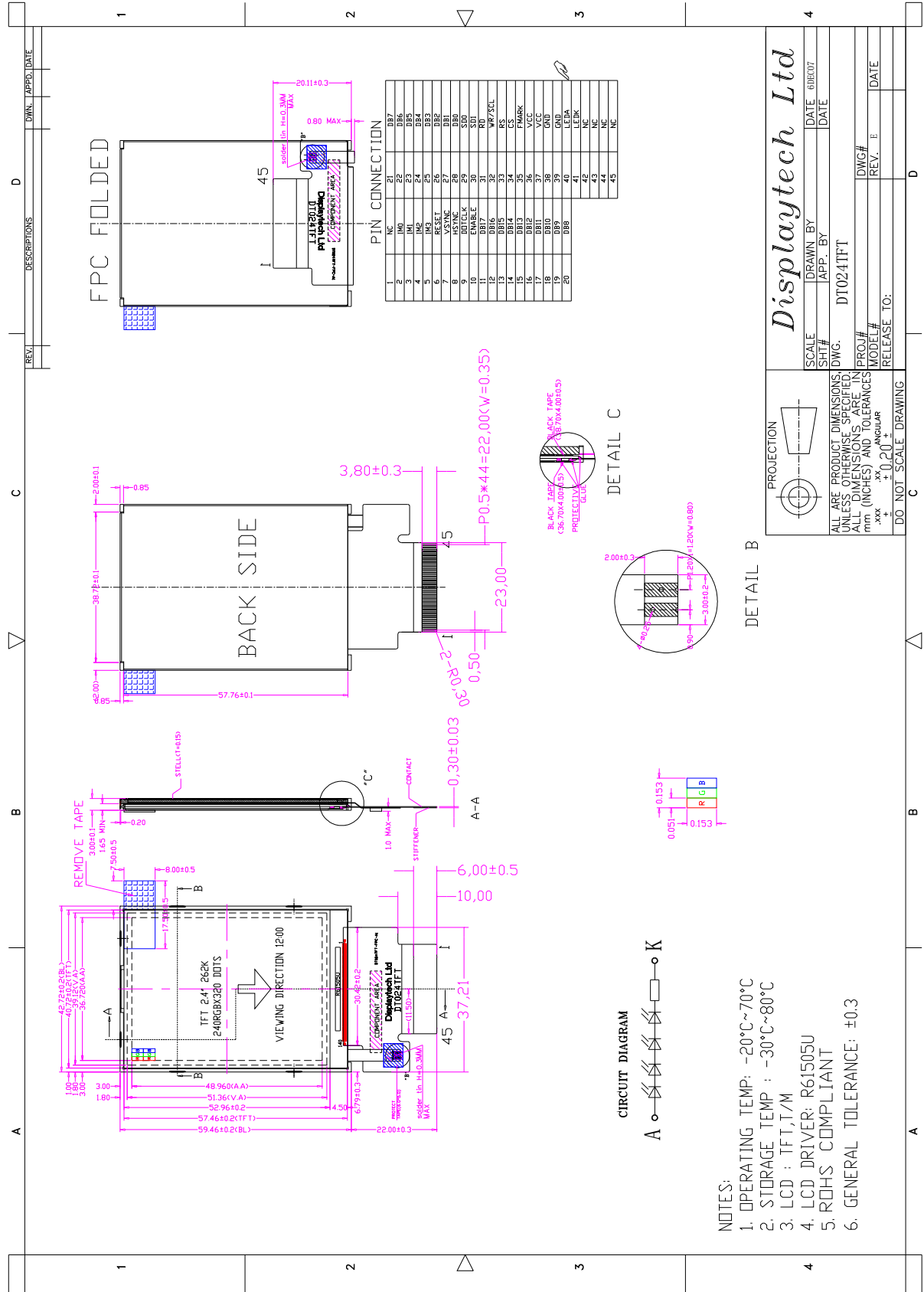*1. Operation life ends when one of the listed faults occurs:
- The on/off response-times reach 1.5 times of the max. value specified for a new display
- The contrast is reduced to 0.5 of the original contrast value
- Loss of function
- The number of cosmetic defects exceeds the maximum defined

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

3. Mechanical Drawing

PIN CONNECTION

No	Signal	No	Signal
1	NC	21	DB7
2	IM0	22	DB6
3	IM1	23	DB5
4	IM2	24	DB4
5	IM3	25	DB3
6	RESET	26	DB2
7	VSYNC	27	DB1
8	HSYNC	28	DB0
9	DOTCLK	29	SDO
10	ENABLE	30	SDI
11	DB17	31	RD
12	DB16	32	WR/SCL
13	DB15	33	RS
14	DB14	34	CS
15	DB13	35	FMARK
16	DB12	36	VCC
17	DB11	37	VCC
18	DB10	38	GND
19	DB9	39	GND
20	DB8	40	LEDA
		41	LEDK
		42	NC
		43	NC
		44	NC
		45	NC

NOTES:
1. OPERATING TEMP: -20°C~70°C
2. STORAGE TEMP : -30°C~80°C
3. LCD : TFT,T/M
4. LCD DRIVER: R61505U
5. ROHS COMPLIANT
6. GENERAL TOLERANCE: ±0.3

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DT024TFT

4. Interface Description

Pin no	Symbol	Level	Description					
1	NC		No connection					
2~5	IM0~IM3	H/L	IM3	IM2	IM1	IM0/ID	MPU interface mode	DB Pin assign
			0	0	0	0	Setting Disabled	-
			0	0	0	1	Setting Disabled	-
			0	0	1	0	80 system, 16 bit	DB17-10 DB8-1
			0	0	1	1	80 system, 8 bit	DB17-10
			0	1	0	(ID)	Clock synchronous serial	-
			0	1	1	0	Setting Disabled	-
			0	1	1	1	Setting Disabled	-
			1	0	0	0	Setting Disabled	
			1	0	0	1	Setting Disabled	
			1	0	1	0	80 system, 18 bit	DB17-0
			1	0	1	1	80 system, 9 bit	DB17-9
			1	1	0	0	Setting Disabled	
			1	1	0	1	Setting Disabled	
			1	1	1	0	Setting Disabled	
			1	1	1	1	Setting Disabled	
6	RESET	H/L	Reset Pin					
7	VSYNC	H/L	Frame synchronous signal for RGB interface					
8	HSYNC	H/L	Line synchronous signal for RGB interface					
9	DOTCLK	H/L	Dot clock signal for RGB interface					
10	ENABLE	H/L	Data enable signal for RGB interface					
11~28	DB17~DB0	H/L	Data bus					
29	SDO	H/L	Serial data output in SPI mode					
30	SDI	H/L	Serial data input in SPI mode					
31	RD	H/L	Read signal					
32	WR	H/L	Write signal in 80 system (write enabled when low) Synchronous clock signal (SCL) in serial interface mode					
33	RS	H/L	Command / data select					
34	CS	H/L	Chip select					
35	FMARK	H/L	Frame head pulse signal					
36	VCC	2.5~3.3V	Logic power supply					
37	VCC	2.5~3.3V	Logic power supply					
38	GND	0V	Ground					
39	GND	0V	Ground					
40	LEDA	-	LED Backlight Anode					
41	LEDK	-	LED Backlight Cathode					
42~45	NC	-	No connection					

5. Absolute Maximum Ratings

Item	Symbol	Rating	Unit
Supply voltage range	V_{CC} - GND	-0.3 to + 4.6	V
Input voltage range	Vin	Vcc + 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	V_{CC}	2.7 to 2.9	V
Input current	I_{DD}	19.8 max	mA
Input voltage "H"	V_{IH}	0.8V_{CC} to V_{CC}	V
Input voltage "L"	V_{IL}	-0.3 to 0.2V_{CC}	V
Output voltage "H"	V_{OH}	0.8V_{CC}	V
Output voltage "L"	V_{OL}	0 to 0.2V_{CC}	V

7. Display Controller /Power Supply Timing

See Display Controller Specification: **RENESAS R61505U**

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	C
				-10ns/100ns	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		---	31	46	ms	Fig 2	4
Contrast ratio		Cr	θ=0º	306	613	---	---		1
Luminance Uniformity		δ White	Ø=0º	79	88	---	%		3
Surface Luminance		Lv	Ta=25ºC	173	216	---	Cd/m²		2
Viewing Angle range		θ	Ø=90º	70	80		deg	Fig 1	6
			Ø=270º	53	63				
			Ø=0º	70	80				
			Ø=180º	70	80				
CIE (x,y) Chromacity	Red	x	θ=0º Ø=0º Ta=25ºC	0.538	0.585	0.635			5
		y		0.283	0.333	0.383			
	Green	x		0.287	0.337	0.387			
		y		0.508	0.558	0.608			
	Blue	x		0.099	0.149	0.199			
		y		0.054	0.104	0.154			
	White	x		0.250	0.300	0.350			
		y		0.270	0.320	0.370			

Note 1: Contrast Ratio = $\dfrac{\text{Average Surface Luminance with all white pixels } (P_1, P_2, P_3, P_4, P_5)}{\text{Average Surface Luminance with all black pixels } (P_1, P_2, P_3, P_4, P_5)}$

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.

δ WHITE = $\dfrac{\text{Minimum Surface Luminance with all white pixels } (P_1, P_2, P_3, P_4, P_5)}{\text{Maximum Surface Luminance with all white pixels } (P_1, P_2, P_3, P_4, P_5)}$

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.

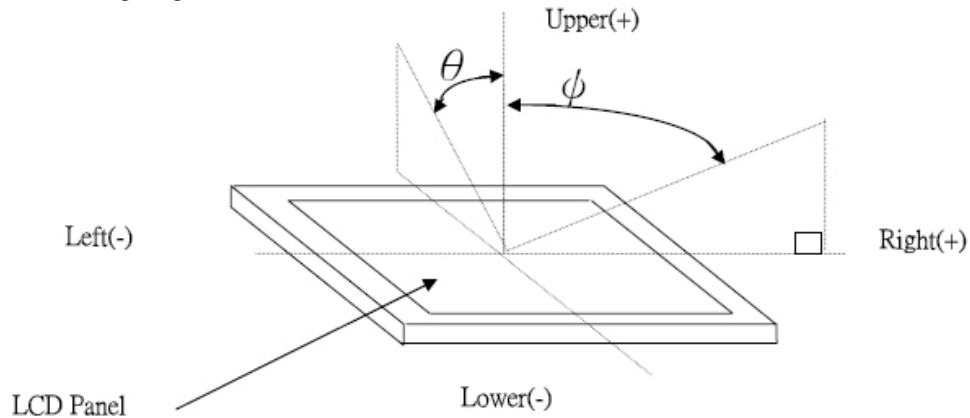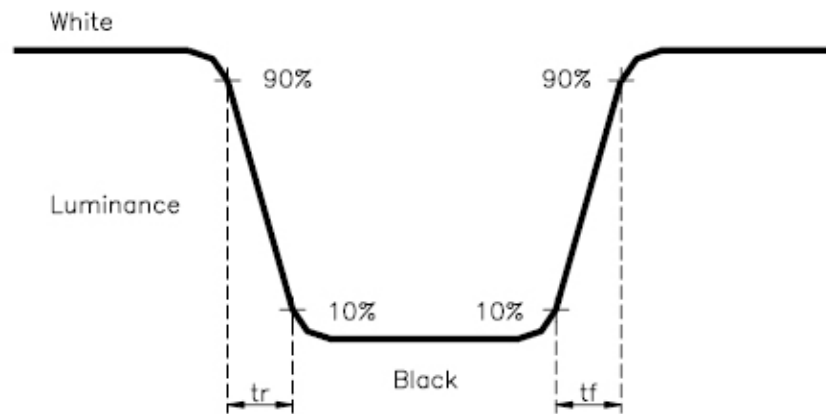Fig.1 (Definition of Viewing Angle)

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)	3300 to 4500 (IF 15mA)		cd/m^2
NO.OF LED SMT	4		---
FORWARD VOLTAGE (VF)	12.7 to 13.7 (IF 15mA)		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