

***Displaytech Ltd.***

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# **LCD Module Product Specification**

**Product: 2.8" TFT Display Module (240RGBx320DOTS)**

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**REVISION RECORD**

<b>VERSION</b>	<b>CHANGES</b>	<b>DATE</b>
1.0	Initial revision	3 August 2007
2.0	Whole data sheet was amended	12 Nov 2007
3.0	Complete new module	9 January 2008

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## 1. Introduction

**DT028TFT** 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	47.00	mm
	60.10	mm
Active area	43.20	mm
	67.60	mm
Driver IC	R61505U	---
Interface type	System parallel / Serial / 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 10<sup>3</sup> h (22h per day x 7 days per week x 52 weeks / year x 5 years)

Backlight Operation Life \*2 min. 5 x 10<sup>3</sup> 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

PIN DESCRIPTION			
1	IM0	25	DB2
2	IM1	26	DB1
3	IM2	27	DB0
4	IM3	28	SD0
5	RESET	29	SD1
6	VSYNC	30	RD
7	HSYNC	31	WR/SCL
8	DOTCLK	32	RS
9	ENABLE	33	CS
10	DB17	34	FMARK
11	DB16	35	IOWCC
12	DB15	36	VCC
13	DB14	37	VC1
14	DB13	38	GND
15	DB12	39	LEDA
16	DB11	40	LE1K1
17	DB10	41	LE1K2
18	DB9	42	LE1K3
19	DB8	43	LE1K4
20	DB7	44	NC
21	DB6	45	NC
22	DB5		
23	DB4		
24	DB3		

#### 4. Interface Description

Pin no	Symbol	Level	Description			
1	IM0	H/L	IM3	IM2	IM1	IM0/ID
			0	0	0	0
			0	0	0	1
			0	0	1	0
2	IM1	H/L	0	0	1	1
			0	1	0	(ID)
			0	1	1	0
			0	1	1	1
3	IM2	H/L	1	0	0	0
			1	0	0	1
			1	0	1	0
			1	0	1	1
4	IM3	H/L	1	1	0	0
			1	1	1	0
			1	1	1	1
			1	1	1	1
5	RESET	H/L	Reset Pin			
6	VSYNC	H/L	Frame synchronous signal for RGB interface			
7	HSYNC	H/L	Line synchronous signal for RGB interface			
8	DOTCLK	H/L	Dot clock signal for RGB interface			
9	ENABLE	H/L	Data enable signal for RGB interface			
10~27	DB17~DB0	H/L	Data bus			
28	SDO	H/L	Serial data output in SPI mode			
29	SDI	H/L	Serial data input in SPI mode			
30	RD	H/L	Read signal			
31	WR/SCL	H/L	Write signal in 80 system (write enabled when low) Synchronous clock signal (SCL) in serial interface mode			
32	RS	H/L	Command / data select			
33	CS	H/L	Chip select			
34	FMARK	H/L	Frame head pulse signal			
35	IOVCC	1.65~3.3V	Logic power supply			
36	VCC	2.5~3.3V	Logic power supply			
37	VC1	--	LCD power supply circuit, connect to external supply 2.5V~3.3V			
38	GND	0V	Ground			
39	LEDA	-	Backlight anode			
40	LEDK1	-	Backlight cathode			
41	LEDK2	-	Backlight cathode			
42	LEDK3	-	Backlight cathode			
43	LEDK4	-	Backlight cathode			
44~45	NC	-	No connection			

## 5. Absolute Maximum Ratings

Item	Symbol	Rating	Unit
Supply voltage range	$V_{CC} - IOV_{CC}$	-0.3 to + 4.6	V
Input voltage range	$V_{in}$	$V_{CC} + 0.3$	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
Power supply for I/O	$IOV_{CC}$	1.7 to 2.9	V
Input current	$I_{DD}$	24.1 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 $IOV_{CC}$	V
Output voltage “L”	$V_{OL}$	0 to 0.2 $IOV_{CC}$	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 -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			29.5	45	ms	Fig 2	4
Contrast ratio		Cr	$\theta=0^\circ$	253	506		---		1
Luminance Uniformity		$\delta$ White	$\varnothing=0^\circ$	85	94		%		3
Surface Luminance		Lv	Ta=25°C	220	275		Cd/m <sup>2</sup>		2
Viewing Angle range		$\theta$	$\varnothing=90^\circ$	70	80		deg	Fig 1	6
			$\varnothing=270^\circ$	70	80				
			$\varnothing=0^\circ$	70	80				
			$\varnothing=180^\circ$	70	80				
CIE (x,y) Chromacity	Red	x	$\theta=0^\circ$ $\varnothing=0^\circ$ Ta=25°C	0.545	0.595	0.645			5
		y		0.295	0.345	0.395			
	Green	x		0.280	0.330	0.380			
		y		0.535	0.585	0.635			
	Blue	x		0.098	0.148	0.198			
		y		0.034	0.084	0.134			
	White	x		0.238	0.298	0.358			
		y		0.265	0.325	0.385			



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

Note 2: Surface luminance is the LCD surface from the surface with all pixels displaying white.

$L_v$  = Average Surface Luminance with all white pixels ( $P_1, P_2, P_3, P_4, P_5$ )

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 =  $\frac{\text{Minimum Surface Luminance with all white pixels (P}_1, P_2, P_3, P_4, P_5\text{)}}{\text{Maximum Surface Luminance with all white pixels (P}_1, P_2, P_3, P_4, P_5\text{)}}$

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)

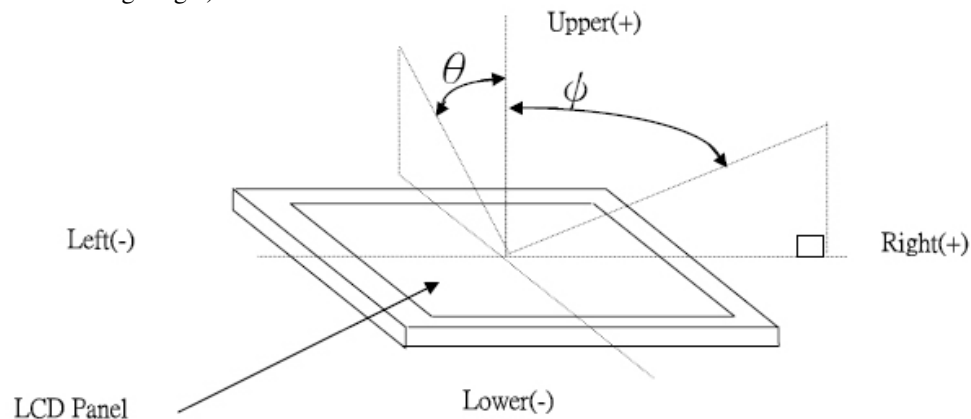
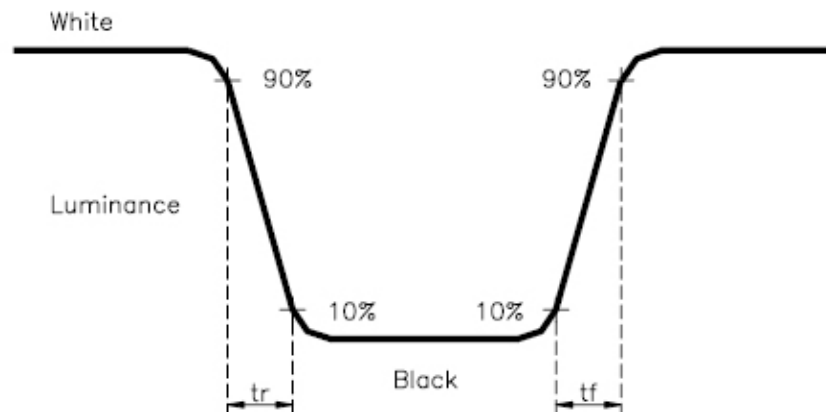


Fig. 2 (The response time is defined as the time interval between the 10% and 90% amplitudes. Refer to figure below.)



## 10.Backlight specification

ITEM	PARAMETER		UNIT
COLOR	WHITE		
CHROMATICITY COORDINATE	X=0.283-0.330	Y=0.276-0.339	
AVERAGE LUMINOUS INTENSITY (LV)	1800 to 2600 (IF 60mA)		cd/m <sup>2</sup>
NO.OF LED SMT	4		---
FORWARD VOLTAGE (VF)	3.0 to 3.4 (IF 60mA)		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