

*Displaytech Ltd.*

Website: [www.displaytech.com.hk](http://www.displaytech.com.hk)

# LCD Module

## Product Specification

**Product: 3.2" TFT Display Module (240RGBx320DOTS)**

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.

6 November 2008.

**REVISION RECORD**

<b>VERSION</b>	<b>CHANGES</b>	<b>DATE</b>
1.0	Initial revision	9 January 2008
1.1	Corrected the resolution in Introduction section	14 March 2008
2.0	Data updated on: General specifications, Interface description, Electrical characteristics, Optical characteristics, and Backlight spec	11 April 2008
3.0	Corrected the lifetime info on page 4. Added DT032TFT-TS mechanical drawing (P. 6) and touch screen pinout connection (P.7)	6 November 2008

## Table of Content

<b>1. INTRODUCTION</b> -----	<b>Page 4</b>
<b>2. GENERAL SPECIFICATIONS</b> -----	<b>Page 4</b>
<b>3. MECHANICAL DRAWING</b> -----	<b>Page 5</b>
<b>4. INTERFACE DESCRIPTION</b> -----	<b>Page 7</b>
<b>5. ABSOLUTE MAXIMUM RATINGS</b> -----	<b>Page 8</b>
<b>6. ELECTRICAL CHARACTERISTICS</b> -----	<b>Page 8</b>
<b>7. DISPLAY CONTROLLER/POWER SUPPLY TIMING</b> -----	<b>Page 8</b>
<b>8. OPERATIONAL EMC REQUIREMENTS</b> -----	<b>Page 9</b>
<b>9. OPTICAL CHARACTERISTICS</b> -----	<b>Page 9</b>
<b>10. BACKLIGHT SPECIFICATION</b> -----	<b>Page 11</b>
<b>11. SAFETY PRECAUTION</b> -----	<b>Page 11</b>

## 1. Introduction

*DT032TFT* or *DT032TFT-TS* is a display module that contains a TFT display with a 320 \* 240 RGB resolution. The driver used for this project is the Solomon **SSD1289 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	50.60	mm
	66.80	mm
Active area	48.60	mm
	64.80	mm
Driver IC	SSD1289	---
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)

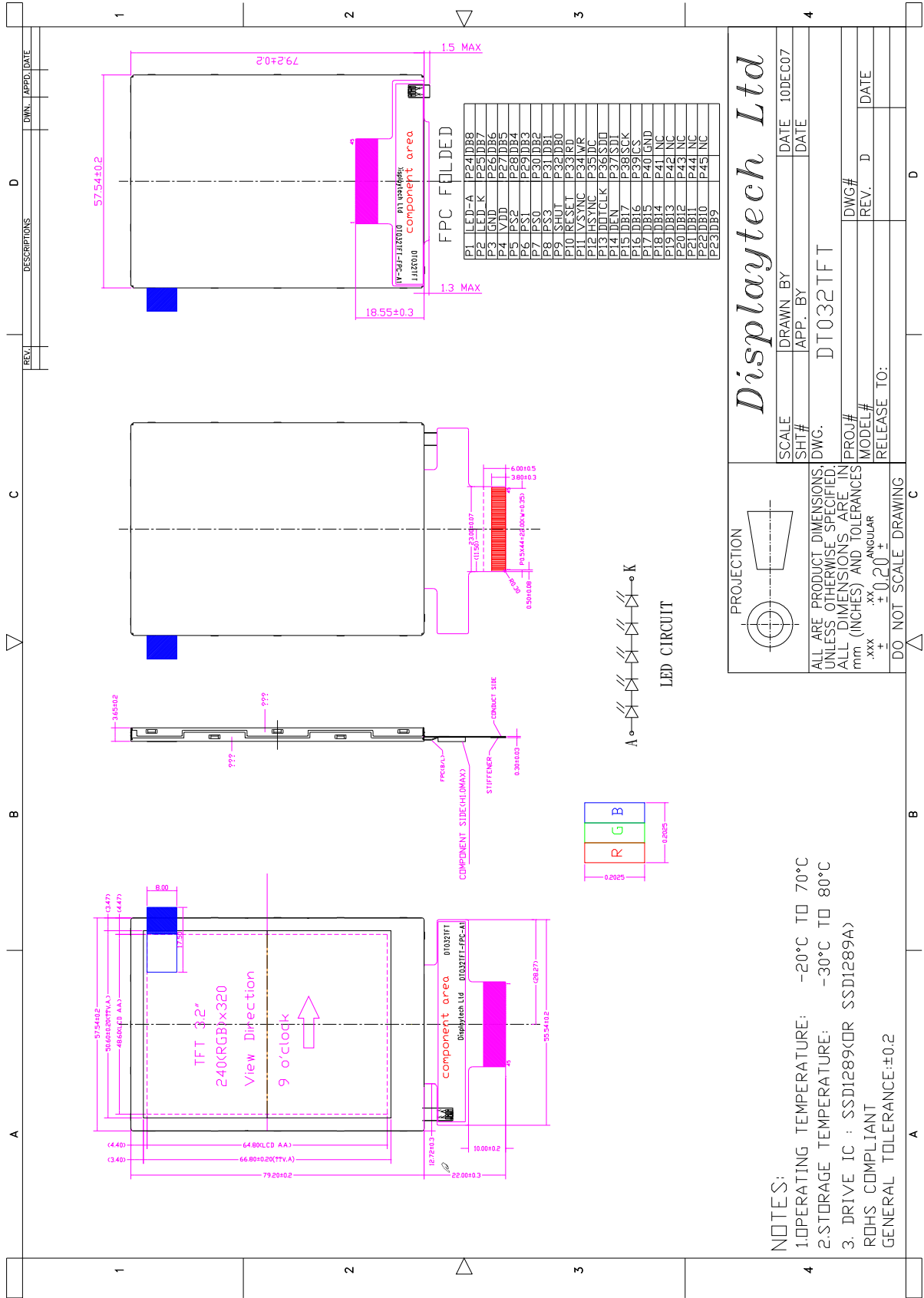
### Component Life Cycle

- 1) Storage Life: min. 1 Year
- 2) Operation Life (\*1): min. 43 x 10<sup>3</sup> 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 – DT032TFT

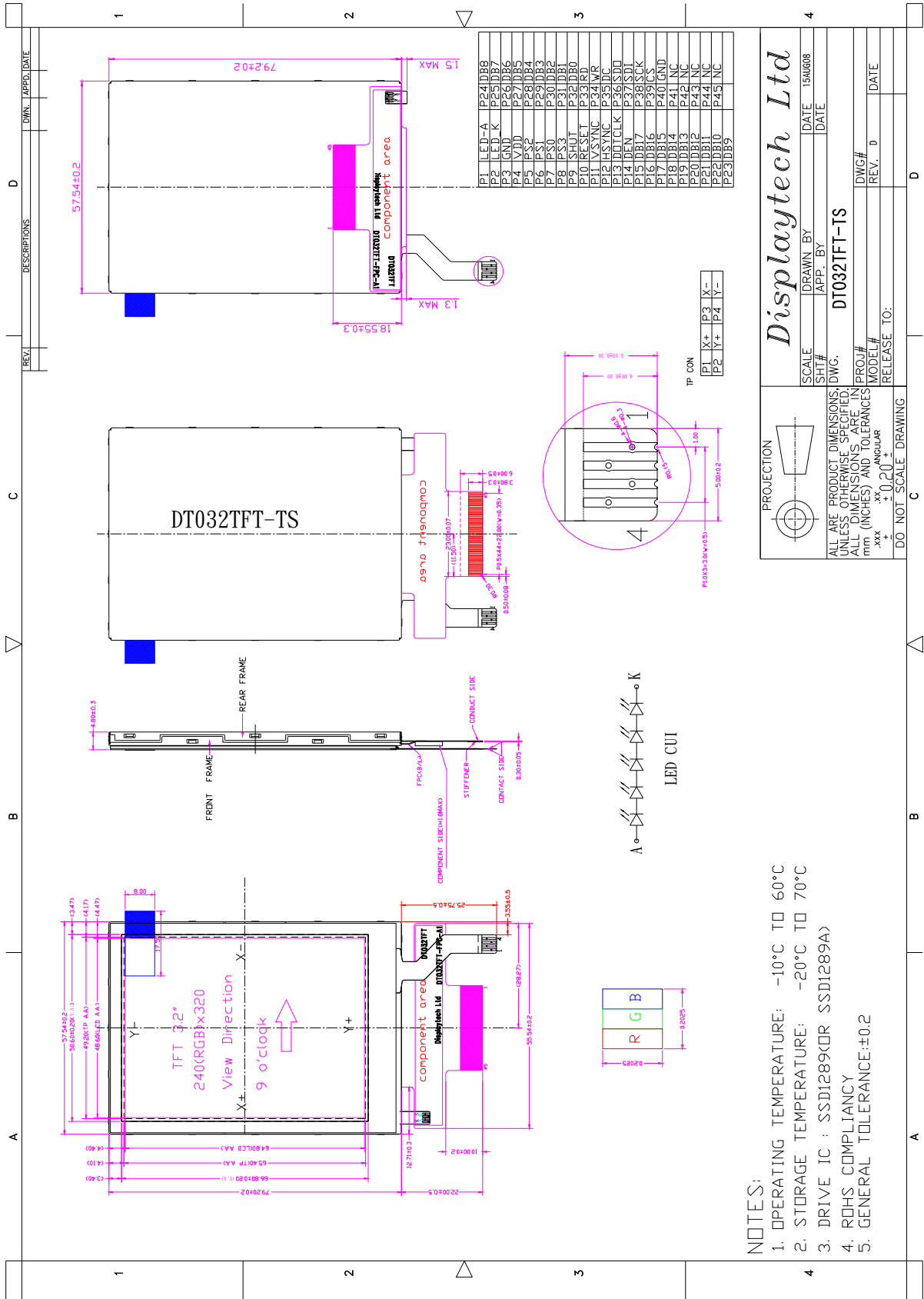


Displaytech Ltd

SCALE	DRAWN BY	DATE
SHT#	APP. BY	DATE
DWG. DT032TFT		
PROJ#	DWG#	DATE
MODEL#	REV.	D
RELEASE TO:		

- NOTES:
1. OPERATING TEMPERATURE: -20°C TO 70°C
  2. STORAGE TEMPERATURE: -30°C TO 80°C
  3. DRIVE IC : SSD1289 (OR SSD1289A)
- ROHS COMPLIANT  
GENERAL TOLERANCE: ±0.2

Mechanical Drawing – DT032TFT-TS



**Displaytech Ltd**

SCALE: \_\_\_\_\_ DRAWN BY: \_\_\_\_\_ DATE: 15/06/08

SHT#: \_\_\_\_\_ APP. BY: \_\_\_\_\_ DATE: \_\_\_\_\_

PROJ#: DT032TFT-TS

MODEL#: \_\_\_\_\_ DWG#: \_\_\_\_\_

RELEASE TO: \_\_\_\_\_ REV. D \_\_\_\_\_ DATE: \_\_\_\_\_

DO NOT SCALE DRAWING

PROJECTION:

ALL ARE PRODUCT DIMENSIONS UNLESS OTHERWISE SPECIFIED. ALL DIMENSIONS AND TOLERANCES IN INCHES AND DECIMALS. ANGULAR TOLERANCES: ±0.20°

- NOTES:
1. OPERATING TEMPERATURE: -10°C TO 60°C
  2. STORAGE TEMPERATURE: -20°C TO 70°C
  3. DRIVE IC : SSD1289(KOR SSD1289A)
  4. ROHS COMPLIANT
  5. GENERAL TOLERANCE:±0.2

**4. Interface Description**

Pin no	Symbol	Level	Description																				
1	LEDA	---	LED Backlight Anode																				
2	LEDK	---	LED Backlight Cathode																				
3	GND	0V	Ground																				
4	VDD	2.8V	Power supply																				
5	PS2	H/L	<table border="1"> <thead> <tr> <th>PS3</th> <th>PS2</th> <th>PS1</th> <th>PS0</th> <th>Interface Mode</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>1</td> <td>1</td> <td>1</td> <td>3 wire SPI</td> </tr> <tr> <td>1</td> <td>1</td> <td>1</td> <td>0</td> <td>4 wire SPI</td> </tr> <tr> <td>1</td> <td>0</td> <td>1</td> <td>1</td> <td>6800 parallel, 16 bit</td> </tr> </tbody> </table>	PS3	PS2	PS1	PS0	Interface Mode	1	1	1	1	3 wire SPI	1	1	1	0	4 wire SPI	1	0	1	1	6800 parallel, 16 bit
			PS3	PS2	PS1	PS0	Interface Mode																
			1	1	1	1	3 wire SPI																
1	1	1	0	4 wire SPI																			
1	0	1	1	6800 parallel, 16 bit																			
6	PS1	H/L	<table border="1"> <tbody> <tr> <td>1</td> <td>0</td> <td>1</td> <td>0</td> <td>6800 parallel, 8 bit</td> </tr> <tr> <td>1</td> <td>0</td> <td>0</td> <td>1</td> <td>8080 parallel, 16 bit</td> </tr> <tr> <td>1</td> <td>0</td> <td>0</td> <td>0</td> <td>8080 parallel, 8 bit</td> </tr> </tbody> </table>	1	0	1	0	6800 parallel, 8 bit	1	0	0	1	8080 parallel, 16 bit	1	0	0	0	8080 parallel, 8 bit					
			1	0	1	0	6800 parallel, 8 bit																
			1	0	0	1	8080 parallel, 16 bit																
1	0	0	0	8080 parallel, 8 bit																			
7	PS0	H/L	<table border="1"> <tbody> <tr> <td>0</td> <td>1</td> <td>1</td> <td>1</td> <td>6800 parallel, 18 bit</td> </tr> <tr> <td>0</td> <td>1</td> <td>1</td> <td>0</td> <td>6800 parallel, 9 bit</td> </tr> <tr> <td>0</td> <td>1</td> <td>0</td> <td>1</td> <td>8080 parallel, 18 bit</td> </tr> </tbody> </table>	0	1	1	1	6800 parallel, 18 bit	0	1	1	0	6800 parallel, 9 bit	0	1	0	1	8080 parallel, 18 bit					
			0	1	1	1	6800 parallel, 18 bit																
			0	1	1	0	6800 parallel, 9 bit																
0	1	0	1	8080 parallel, 18 bit																			
8	PS3	H/L	<table border="1"> <tbody> <tr> <td>0</td> <td>0</td> <td>1</td> <td>1</td> <td>8080 parallel, 9 bit</td> </tr> <tr> <td>0</td> <td>0</td> <td>1</td> <td>1</td> <td>Reserved</td> </tr> <tr> <td>0</td> <td>0</td> <td>1</td> <td>0</td> <td>16 bit RGB + 4 wire SPI</td> </tr> </tbody> </table>	0	0	1	1	8080 parallel, 9 bit	0	0	1	1	Reserved	0	0	1	0	16 bit RGB + 4 wire SPI					
			0	0	1	1	8080 parallel, 9 bit																
			0	0	1	1	Reserved																
0	0	1	0	16 bit RGB + 4 wire SPI																			
9	SHUT	---	<table border="1"> <tbody> <tr> <td>0</td> <td>0</td> <td>0</td> <td>1</td> <td>18 bit RGB + 4 wire SPI</td> </tr> </tbody> </table>	0	0	0	1	18 bit RGB + 4 wire SPI															
			0	0	0	1	18 bit RGB + 4 wire SPI																
			<p>When using the RGB interface, it is a input pin put the driver into sleep mode. A sharp falling edge must be provided to such pin when IC power on. Connect to VDDIO for sleep mode Connect to VSS for normal operating mode This pin has no effect in system interface and should be connected to VDDIO / VSS</p>																				
10	RESET	H/L	Reset signal pin																				
11	VSYNC	---	Frame synchronization signal. - Fixed to VDDIO or VSS if not used																				
12	HSYNC	---	Line synchronization signal. - Fixed to VDDIO or VSS if not used																				
13	DOTCLK	---	Dot-clock signal and oscillator source. A non-stop external clock must be provided to that pin even at front or black porch non-display period.																				
14	DEN	---	Display enable pin from controller. Data will be treated as dummy regardless the DEN status during front/back porch setting at registers R16 and R17.																				
15~32	DB17~DB0	H/L	Data bus																				
33	RD	H/L	68 system: Enable (E) 80 system: Read signal (/RD) Serial: Not used																				
34	WR	H/L	68 system: Read when high, Write when low (/WR) 80 system: Write signal (WR) Serial: Not used																				
35	DC	H/L	Register select signal																				
36	SDO	---	Data output pin in serial mode. - Leave it OPEN when not used																				
37	SDI	---	Data input pin in serial mode. Leave it OPEN when not used																				
38	SCK	---	Clock pin of serial interface. - Leave it OPEN when not used																				
39	CS	H/L	Chip select signal																				
40	GND	0V	Ground																				
41~45	NC	-	No connection																				

**Touch Screen FPC (only for DT032TFT-TS)**

Pin no	Symbol	Pin no	Symbol
1	X+	3	X-
2	Y+	4	Y-

## 5. Absolute Maximum Ratings

Item	Symbol	Rating	Unit
Supply voltage range	V <sub>DD</sub>	-0.3 to +4.0	V
Input voltage range	V <sub>in</sub>	-0.3 to V <sub>DD</sub> + 0.5	V
Operating Ambient Temperature	T <sub>OP</sub>	-20 ~ +70	°C
Operating Ambient Humidity	H <sub>OP</sub>	10 ~ 90 (Max 60°C)	% RH
Storage Temperature	T <sub>STG</sub>	-30 ~ +80	°C
Storage Humidity	H <sub>STG</sub>	10 ~ 90 (Max 60°C)	% RH

## 6. Electrical Characteristics

### DC Characteristics

Item	Symbol	Rating	Unit
Power supply for logic	V <sub>DD</sub> - V <sub>SS</sub>	2.7 to 2.9	V
Input current	I <sub>DD</sub>	16.74 max	mA
Input voltage “H”	V <sub>IH</sub>	0.9V <sub>DD</sub> to V <sub>DD</sub>	V
Input voltage “L”	V <sub>IL</sub>	0 to 0.1V <sub>DD</sub>	V
Output voltage “H”	V <sub>OH</sub>	0.8V <sub>DD</sub> to V <sub>DD</sub>	V
Output voltage “L”	V <sub>OL</sub>	0 to 0.2V <sub>DD</sub>	V

## 7. Display Controller /Power Supply Timing

See Display Controller Specification: SOLOMON SSD1289



### 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=0° Ø=0° Ta=25°C	---	25.5	35.25	ms	Fig 2	4
Contrast ratio	Cr		337	674	---	---		1
Luminance Uniformity	δ White		78	87	---	%		3
Surface Luminance	Lv		154	205	---	cd/m <sup>2</sup>		2
Viewing Angle range	θ	Ø=90°	70	80	---	deg	Fig 1	6
		Ø=270°	70	80	---			
		Ø=0°	59	69	---			
		Ø=180°	70	80	---			
CIE (x,y) Chromaticity	Red	x	0.590	0.640	0.690			5
		y	0.296	0.346	0.396			
	Green	x	0.289	0.339	0.389			
		y	0.537	0.587	0.637			
	Blue	x	0.095	0.145	0.195			
		y	0.004	0.054	0.104			
	White	x	0.250	0.310	0.370			
		y	0.253	0.313	0.373			

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

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)

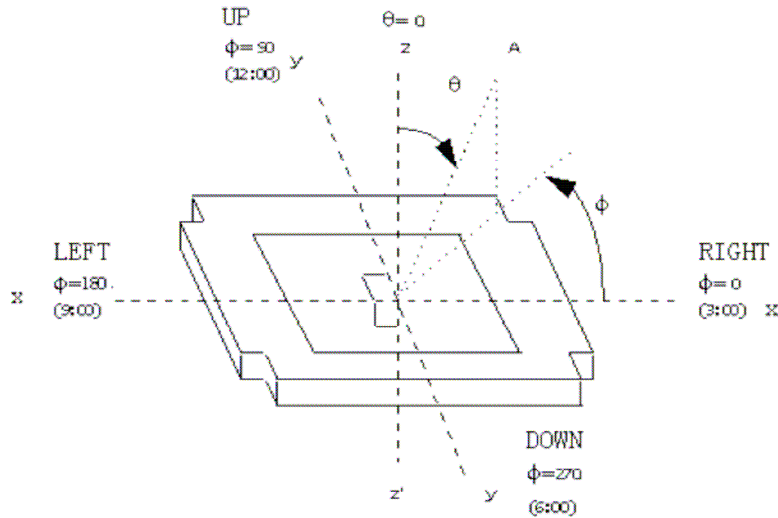
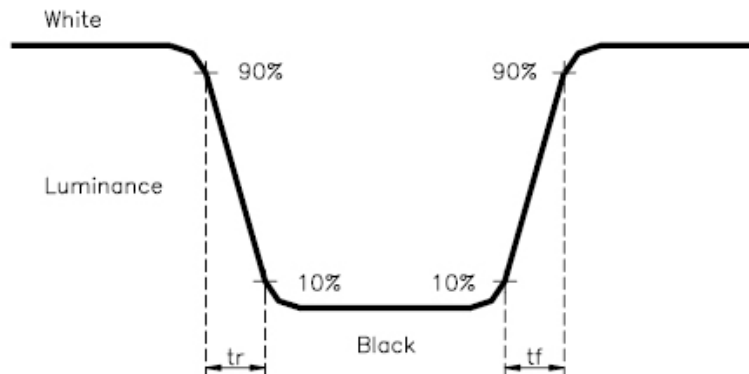


Fig. 2 (The response time is defined as the time interval between the 10% and 90% amplitudes. Refer to figure below.)



## 10.Backlight specification

ITEM	PARAMETER		UNIT
COLOR	WHITE		
CHROMATICITY COORDINATE	X=0.283-0.330	Y=0.276-0.339	
AVERAGE LUMINOUS INTENSITY (LV)	Min 2500 (IF 15mA)		cd/m <sup>2</sup>
NO.OF LED SMT	4		---
FORWARD VOLTAGE (VF)	14.5 to 17 (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