



## TFT GRAPHIC DISPLAY MODULE DATASHEET



Datasheet Release Date 2019-06-12  
for  
**CFAF128128B1-0145T**

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## 1. General Information

### Datasheet Revision History

Datasheet Release: **2017-10-30**  
Datasheet for the CFAF128128B1-0145T TFT graphic display module.  
Datasheet Release: **2019-06-12**  
Better drawing, better block diagram, revised handling.

### Product Change Notifications

You can check for or subscribe to [Part Change Notices](#) for this display module on our website.

### Variations

Slight variations between lots are normal (e.g., contrast, color, or intensity).

### Volatility

This display module has volatile memory.

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## 2. Module Description

This is a full color TFT graphic display module with a white LED backlight, TFT panel, integrated controller/driver, and a FPC tail. This display requires only a single source for both power supply and logic. This display module has a built-in Sitronix ST7735S, 262K Color Single-Chip TFT Controller.

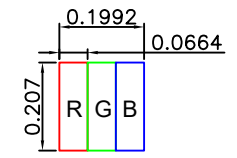
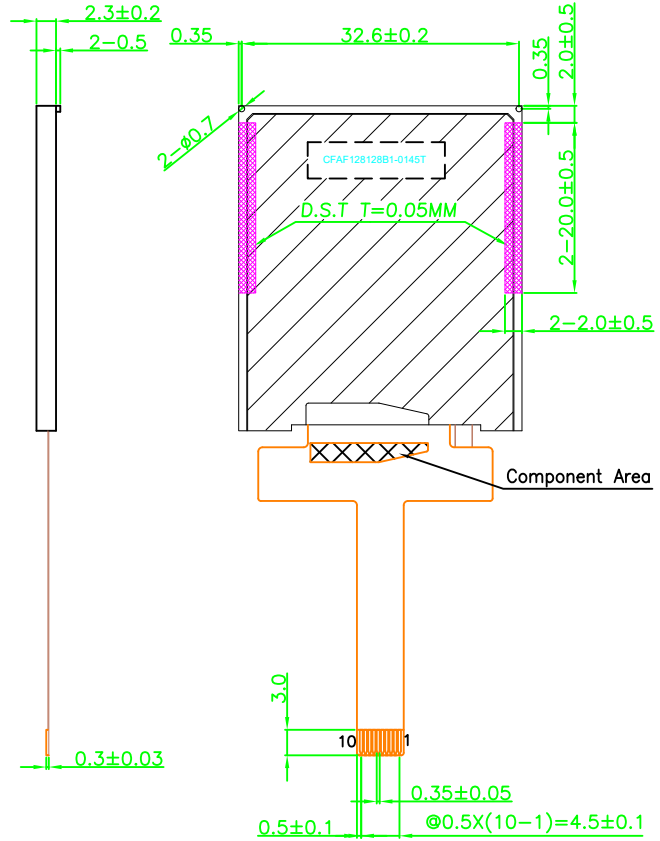
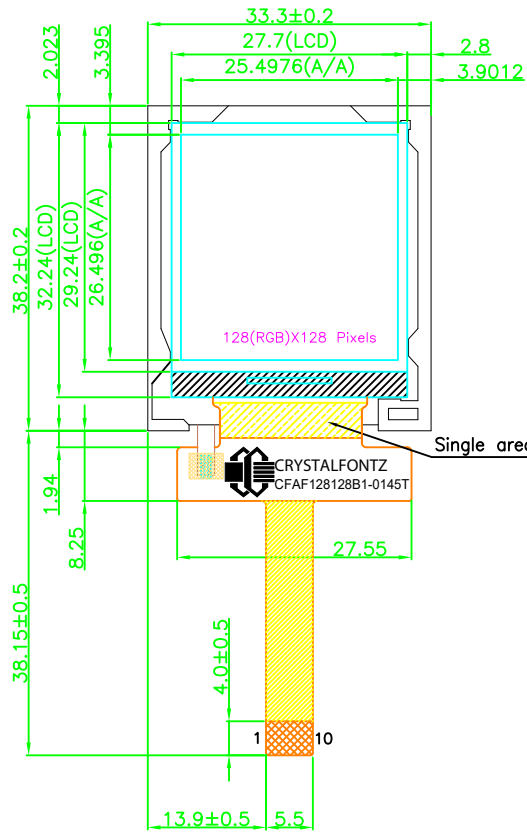
Please see [Sitronix ST7735S LCD Controller Datasheet](#) for further reference.

## 3. Features

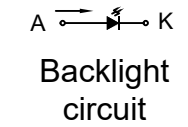
- 128\*128 Dot Matrix
- +3V Power Supply
- Viewing Direction: 6 o'clock
- Built-in Controller: Sitronix ST7735S (or equivalent)
- Operating Temperature: -10°C to +60°C
- Storage Temperature: -20°C to +60°C
- Interface: SPI

## 4. Mechanical Data

Item	Specification (mm)	Specification (inch, reference)
Overall Module Dimension (without FPC)	33.3 (W) x 38.2 (H) x 2.3 (D)	1.311 (W) x 1.504 (H) x 0.091 (D)
Overall Module Dimension (with FPC)	33.3 (W) x 76.35 (H) x 2.8 (D)	1.311 (W) x 3.006 (H) x 0.110 (D)
Active Area	25.498 (W) x 26.496 (H)	1.004 (W) x 1.043 (H)
Dot Pitch	0.199 (W) x 0.207 (H)	0.007 (W) x 0.008 (H)
Weight (Typical)	4.4 grams	0.16 ounces



Pixel Detail  
(50x)



Pin	Function
1	A (LED+)
2	K (LED-)
3	SPI4 / nSPI3
4	Vcc
5	Ground
6	nCS
7	nRST
8	MOSI
9	SCK
10	D / nC

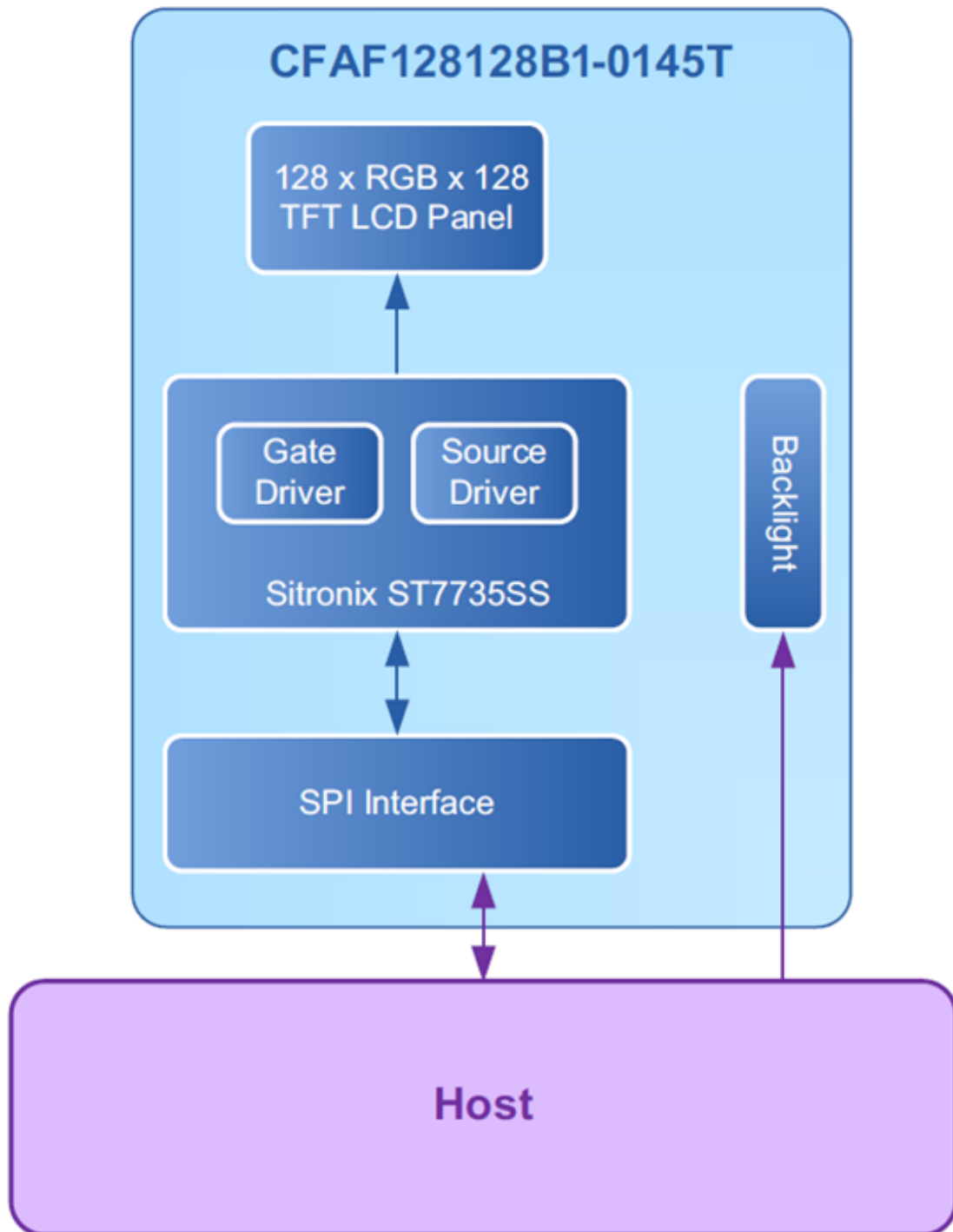
Diagonal size: 1.44" or 1.45" (actual is ~1.4477)  
 Viewing direction: 6 O'clock (12 O'clock inverts)  
 Operating temperature: -10°C to +60°C  
 Storage temperature: -10°C to +60°C  
 Controller: ST7735S

Tolerance: ±0.3 mm unless otherwise specified.

Mating connector:  
 10-position, 0.5mm  
 Gold contact area  
 Top or bottom contact side as required by your application  
 Possible candidates:  
 Top: Amphenol ICC (FCI) SFV10R-2STBE1HLF  
 Bottom: TE Connectivity AMP Connectors 1-1734592-0



## 6. System Block Diagram



## 7. Interface Pin Function

Pin	Symbol	Function	
1	A (LED+)	Common supply pin for LED. "A" (anode) or "+" for LED backlight.	
2	K (LED-)	Individual supply pin for LED. "K" (cathode for German or original Greek spelling) or "-" of LED backlight.	
3	SPI4W / $\overline{\text{SPI3W}}$	$\overline{\text{SPI4W}} / \overline{\text{SPI3W}}$	
		0	3-wire, 9-bit SPI mode. The $\overline{\text{D/C}}$ pin is not used. The 9th SPI bit selects the data or command register.
		1	4-wire, 8-bit SPI mode. The $\overline{\text{D/C}}$ pin is used to select the data or command register.
4	V <sub>LOGIC I/O</sub>	Digital Logic Supply and Input/Output Supply (3.0-3.6)	
5	GND	Ground. Must be connected to an external ground.	
6	$\overline{\text{CS}}$	Chip Select Input. Low: Controller chip is selected. Communications with host is possible. High: Controller chip is not selected. Host interface signals are ignored by the controller.	
7	$\overline{\text{RST}}$	Controller hardware reset pin, active low. On power on, drive $\overline{\text{RST}}$ low for at least 10 $\mu$ S. After $\overline{\text{RST}}$ is returned to high, wait 120mS for the internal reset operation to complete. Keep $\overline{\text{RST}}$ driven high for normal operation.	
8	SDA	Serial data, in or out (bi-directional)	
9	SCK	Serial Clock – rising edge.	
10	$\overline{\text{D/C}}$	In 4-wire, 8-bit SPI mode, the $\overline{\text{D/C}}$ pin is used to select the data or command register. 1 – High: Addresses the data register. 0 – Low: Addresses the command register. In 3-wire, 9-bit SPI mode, the $\overline{\text{D/C}}$ pin is not used. Please connect it to V <sub>LOGIC I/O</sub> .	

## 8. Absolute Maximum Ratings

Parameter	Symbol	Min	Typ	Max	Unit	Notes
Supply Voltage for Logic	V <sub>DD</sub>	-0.3	-	+4.6	V	(1)(2)(3)
Operating Temperature	T <sub>OPR</sub>	-10	-	+60	°C	-
Storage Temperature	T <sub>STG</sub>	-20	-	+60	°C	-

**Notes:**

- (1) These are stress ratings only. Extended exposure to the absolute maximum ratings listed above may affect device reliability or cause permanent damage.
- (2) T<sub>A</sub>=25°C, V<sub>SS</sub>=0V
- (3) Functional operation should be restricted to the limits in the DC Characteristics table below.

## 9. Electrical Characteristics

$T_A=25^{\circ}\text{C}, V_{SS}=0\text{V}$						
Item	Symbol	Condition	Min	Typ	Max	Unit
Supply Voltage for Logic	$V_{DD}$	$T_A=25^{\circ}\text{C}$	3.0	3.3	3.6	V
Supply Voltage for LCM	$I_{DD}$	$V_{DD}=3.3\text{v}$	-	1.7	2.55	mA
Input High Voltage	$V_{IH}$	-	$0.7 \times V_{DD}$	-	$V_{DD}$	V
Input Low Voltage	$V_{IL}$	-	$V_{SS}$	-	$0.3 \times V_{DD}$	V

## 10. Optical Characteristics

Item	Symbol	Condition	Min	Typ	Max	Unit	Notes	
Transmittance	T	-	-	6.0	-	%	-	
Contrast Ratio	CR	$\Theta=0$ Normal Viewing Angle	-	350	-	-	(1)(2)	
Response Time	T rise	-	-	25	-	ms	(1)(3)	
	T fall							
Red Chromaticity	x	$\Theta=\Phi=0^{\circ}$ LED Backlight	0.5304	0.5804	0.6304	ms	-	
	y		0.2934	0.3434	0.3934	ms	-	
Green Chromaticity	x		0.2418	0.2918	0.3418	ms	-	
	y		0.5265	0.5765	0.6265	ms	-	
Blue Chromaticity	x		0.0918	0.1418	0.1918	ms	-	
	y		0.0316	0.0816	0.1316	ms	-	
White Chromaticity	x		0.1881	0.2381	0.2881	ms	-	
	y		0.2293	0.2693	0.3293	ms	-	
Viewing Angle (Horizontal)	$\theta_{x+}$		$CR \geq 10$	-	45	-	deg	-
	$\theta_{y-}$			-	45	-	deg	-
Viewing Angle (Vertical)	$\theta_{x+}$	-		35	-	deg	-	
	$\theta_{y-}$	-		15	-	deg	-	
Viewing Direction	6 o'clock							

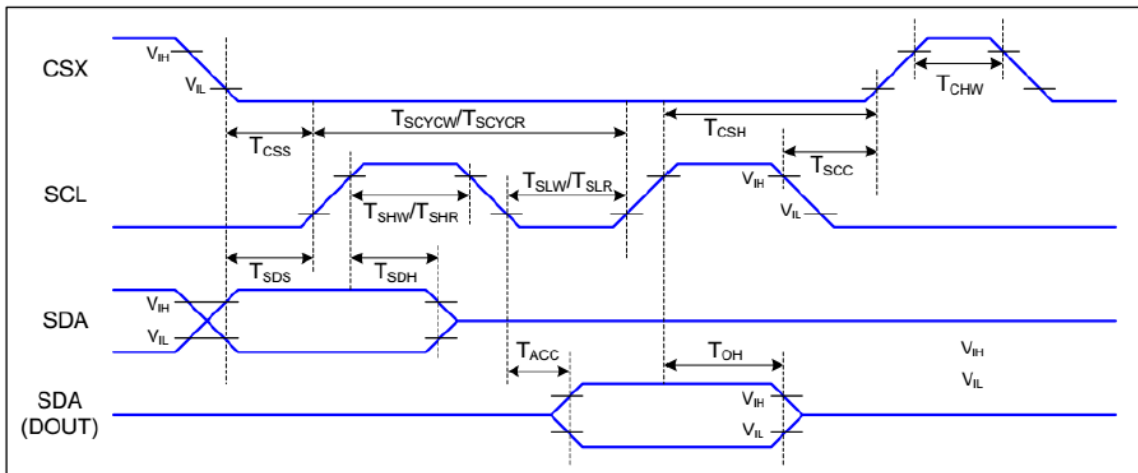
Notes:

- (1) Measuring Surrounding: Dark Room
- (2) Ambient Temperature:  $25 \pm 2^{\circ}\text{C}$
- (3) Warm Up Time: 30-Minutes



## 11. Timing Characteristics

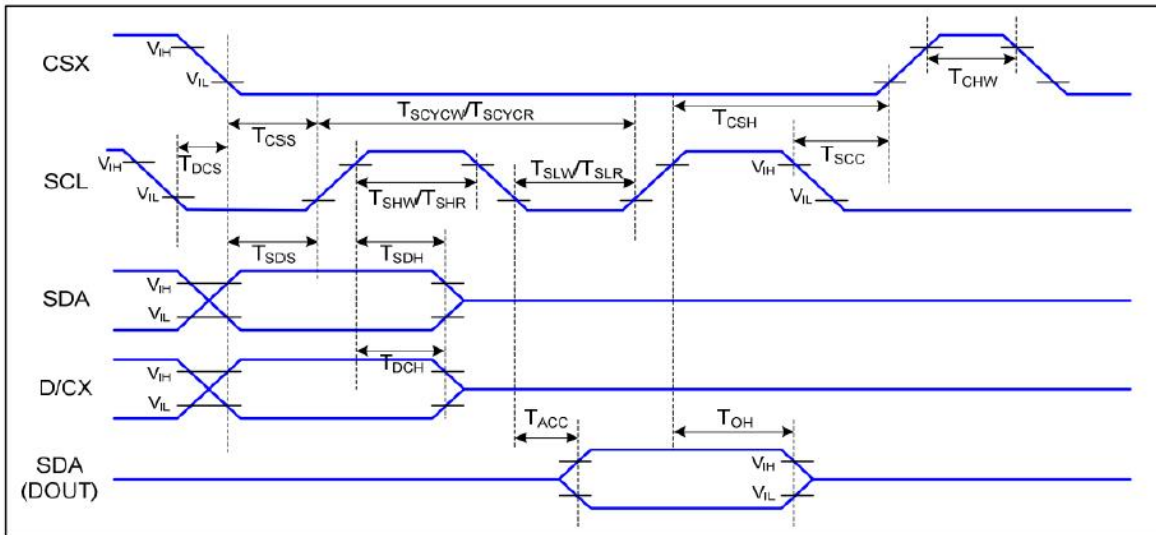
### 11.1. Serial Interface Characteristics (3-line serial)



Ta=25 °C, VDDI=1.65~3.7V, VDD=2.5~4.8V

Signal	Symbol	Parameter	Min	Max	Unit	Description
CSX	TCSS	Chip Select Setup Time (Write)	15		ns	
	TCSH	Chip Select Hold Time (Write)	15		ns	
	TCSS	Chip Select Setup Time (Read)	60		ns	
	TSCC	Chip Select Hold Time (Read)	65		ns	
	TCHW	Chip Select "H" pulse width	40		ns	
SCL	TSCYCW	Serial Clock Cycle (Write)	66		ns	
	TSHW	SCL "H" Pulse Width (Write)	15		ns	
	TSLW	SCL "L" Pulse Width (Write)	15		ns	
	TSCYCR	Serial Clock Cycle (Read)	150		ns	
	TSHR	SCL "H" Pulse Width (Read)	60		ns	
	TSLR	SCL "L" Pulse Width (Read)	60		ns	
SDA (DIN) (DOUT)	TSDS	Data Setup Time	10		ns	For Maximum CL=30pF For Minimum CL=8pF
	TSDH	Data Hold Time	10		ns	
	TACC	Access Time	10	50	ns	
	TOH	Output Disable Time	15	50	ns	

## 11.2. Serial Interface Characteristics (4-line serial)



T<sub>a</sub>=25 °C, V<sub>DDI</sub>=1.65~3.7V, V<sub>DD</sub>=2.5~4.8V

Signal	Symbol	Parameter	MIN	MAX	Unit	Description
CSX	TCSS	Chip Select Setup Time (Write)	45		ns	
	TCSH	Chip Select Hold Time (Write)	45		ns	
	TCSS	Chip Select Setup Time (Read)	60		ns	
	TSCC	Chip Select Hold Time (Read)	65		ns	
	TCHW	Chip Select "H" Pulse Width	40		ns	
SCL	TSCYW	Serial Clock Cycle (Write)	66		ns	-Write Command & Data Ram
	TSHW	SCL "H" Pulse Width (Write)	15		ns	
	TSLW	SCL "L" Pulse Width (Write)	15		ns	
	TSCYCR	Serial Clock Cycle (Read)	150		ns	-Read Command & Data Ram
	TSHR	SCL "H" Pulse Width (Read)	60		ns	
TSLR	SCL "L" Pulse Width (Read)	60		ns		
D/CX	TDCS	D/CX Setup Time	10		ns	
	TDCH	D/CX Hold Time	10		ns	
SDA (DIN) (DOUT)	TSDS	Data Setup Time	10		ns	For Maximum CL=30pF For Minimum CL=8pF
	TSDH	Data Hold Time	10		ns	
	TACC	Access Time	10	50	ns	
	TOH	Output Disable Time	15	50	ns	

## 12. Backlight Characteristics

Item	Condition	Symbol	Min	Typ	Max	Unit
Supply Current	V=3.2v	I	-	20	-	mA
Supply Voltage	I <sub>F</sub> =20mA	V	2.7	3.0	3.3	V
Luminous Intensity for LCM		I <sub>v</sub>	120	180	-	cd/m <sup>2</sup>
Uniformity for LCM		-	70	-	-	%
LED Lifetime		-	20K	-	-	Hr.
Color	White					

**Notes:**

- (1) Supply current minimum value is only for reference since the LED brightness efficiency keeps enhancing. Current consumption becomes less and less to achieve the same luminance.
- (2) Lifetime is defined as the amount of time when the luminance has decayed to <50% of the initial value (20K hours is an estimate for reference only).

## 13. LCD Module Precautions

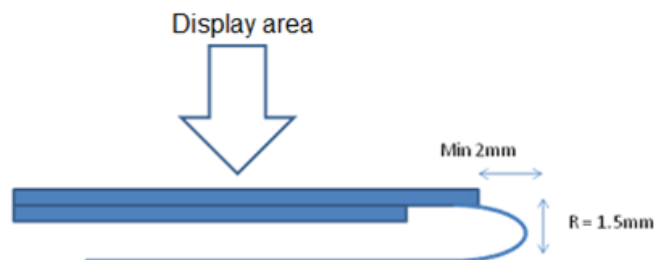
The precautions below should be followed when using LCD modules to help ensure personal safety, module performance, and compliance of environmental regulations.

### 13.1. Modules

- Avoid applying excessive shocks to module or making any alterations or modifications to it.
- Do not make extra holes on the printed circuit board, modify its shape or change the components of LCD display module.
- Do not disassemble the LCD display module.
- Do not operate the LCD display module above the absolute maximum rating.
- Do not drop, bend or twist the LCD display module.
- Do not solder. Use only an appropriate ZIF connector designed for FPC.
- ZIF connector should have gold flash contacts to maximize reliability/
- Store in an anti-static electricity container and clean environment.
- Crystalfontz may change passive components -- resistors, capacitors and other passive components may have different appearance and color due to different suppliers.
- Crystalfontz may change the flex PCB revision. An appropriate PCN will be issued if there is change to the form, fit or function. You can subscribe to PCNs on the module's web page.

### 13.2. Handling Precautions

- Since the display panel is made of glass, do not apply mechanical impacts or drop it.
- If the display panel is accidentally broken, and the internal organic substance leaks out, be careful not to inhale or touch the organic substance.
- If pressure is applied to the display surface or its neighborhood of the LCD display module, the cell structure may be damaged, so be careful not to apply pressure to these sections.
- The polarizer covering the surface of the LCD display module is soft and can be easily scratched. Please be careful when handling the LCD display module.
- Do not use any solvents (even water) to clean the LCD's polarizer. Using a cloth to rub the polarizer can cause small scratches that may reduce performance.
- If you need to clean the LCD's front surface, you can carefully apply and remove normal office tape. The contaminates will adhere to the tape and be removed from the LCD's polarizer.
- Ensure that your mounting secures the LCD and protects it from mechanical stresses
- The LCD module is sensitive to ESD. Treat the LCD module as you would a bare IC. Use appropriate ESD precautions when handling.
- Observe humidity limits. Do not operate the LCD if there is condensation.
- Do not make sharp bends in the FPC (Flexible Printed Circuit). Observe the following diagram:



- Dispose of this module -- and any electronics -- properly. Do not place in the normal trash. Check with your local disposal company for procedures to recycle or dispose of electronics.