



# Crystalfontz America, Incorporated

## GRAPHIC TFT MODULE SPECIFICATIONS

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PRELIMINARY

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## MAIN FEATURES

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### FEATURES/MODULE CLASSIFICATION INFORMATION

CFA F 480 272 C2 - 043 T - TS  
①      ②      ③      ④      ⑤      ⑥      ⑦

①	Brand	Crystalfontz America, Inc.
②	Display Type	F – TFT
③	Number of Pixels (Width)	480 pixels
④	Number of Pixels (Height)	272 pixels
⑤	Model Identifier	C2
⑥	diagonal size	4.3 inch
⑦	Backlight Type & Color	T – White LED Backlight
	Special Code	TS-touch panel



## ORDERING INFORMATION

PART NUMBER
CFAF480272C2-043T-TS

## 1.0 MECHANICAL SPECIFICATIONS

### PHYSICAL CHARACTERISTICS

Number of Pixels		
480 x272 pixels = 130560 pixels		
Pixel Detail	Horizontal	Vertical
Pixel Size	0.198	0.198
RGB Pixel		

Viewing Area		
	Width	Height
Millimeters	98.04	56.86
Inches	3.8598	2.2386

Module Excluding		
	Width	Height
Millimeters		
Inches		

Module Depth		
	Maximum	Nominal
Millimeters	4.05	4.35
Inches	0.1594	0.1713

Active Area		
Diagonal	Inches: 4.3"	
	Width	Height
Millimeters	95.04	53.856
Inches	3.7417	2.1203

Module Overall Including		
	Width	Height
Millimeters	105	67.2
Inches	4.1339	2.6457



## 2.0 ABSOLUTE MAXIMUM RATINGS

### 2.1 Electrical Absolute Rating

#### 2.1.1 TFT LCD Module

Item	Symbol	Min.	Max.	Unit	Note
Power supply voltage	VDD	-0.3	5.0	V	GND=0
Logic Signal Input Level	V <sub>i</sub>	-0.3	5.0	V	

#### 2.1.2 Back-Light Unit

Item	Symbol	Typ.	Max.	Unit	Note
LED current	I <sub>L</sub>	40	—	mA	(1)(2)(3)
LED voltage	V <sub>L</sub>	19.8	—	V	(1)(2)(3)

#### Note

- (1) Permanent damage may occur to the LCD module if beyond this specification. Functional operation should be restricted to the conditions described under normal operating conditions.
- (2) T<sub>a</sub> = 25±2°C
- (3) Test Condition: LED current 40 mA. The LED lifetime could be decreased if operating I<sub>L</sub> is larger than 40mA.

### 2.2 Environment Absolute Rating

Item	Symbol	Min.	Max.	Unit	Note
Operating Temperature	T <sub>opa</sub>	-20	70	°C	
Storage Temperature	T <sub>stg</sub>	-30	80	°C	



### 3.0 OPTICAL CHARACTERISTICS

#### 3.1 Optical specification

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	Note	
Contrast	CR	Normal viewing angle	480	600	—		(1)(2)	
Response time	Rising		$T_R$	—	3	6	msec	(1)(3)
	Falling		$T_F$	—	7	14		
White luminance (Center)	$Y_L$			(320)	(340)	—	cd/m <sup>2</sup>	(1)(4)(7) ( $I_L=40mA$ )
Color chromaticity (CIE1931)	White		$W_x$	0.260	0.310	0.360		(1)(4)
		$W_y$	0.280	0.330	0.380			
Viewing angle	Hor.	$\Theta_L$	65	75	—			
		$\Theta_R$	65	75	—			
	Ver.	$\Theta_U$	50	60	—			
		$\Theta_D$	60	70	—			
Brightness uniformity	$B_{UNI}$	$\Theta=0$	70	—	—	%	(5)(7)	
Optima View Direction	6 O' clock						(6)	

#### 3.2 Measuring Condition

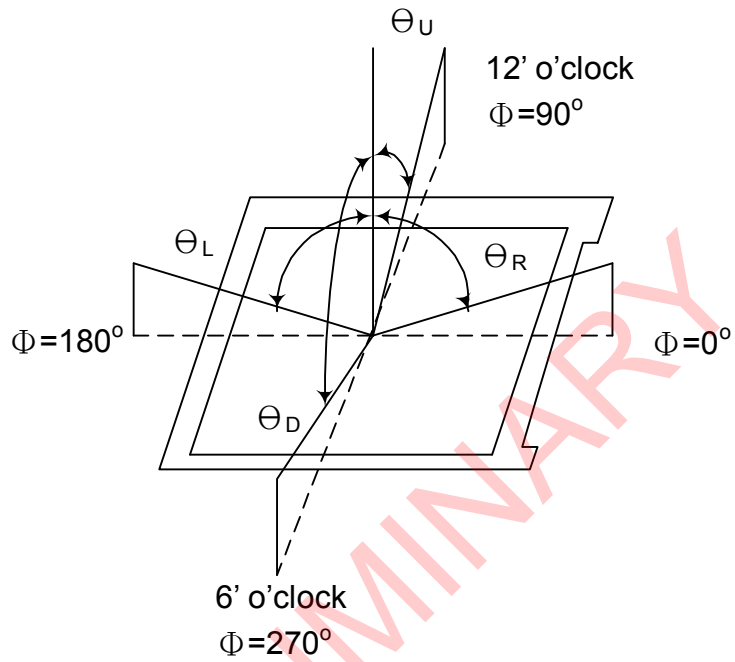
- Measuring surrounding: dark room
- LED current  $I_L$ : 40mA
- Ambient temperature: 25±2°C
- 15min. warm-up time.

#### 3.3 Measuring Equipment

- FPM520 of Westar Display technologies, INC., which utilized SR-3 for Chromaticity and BM-5A for other optical characteristics.
- Measuring spot size: 20 ~ 21 m



Note (1) Definition of Viewing Angle:

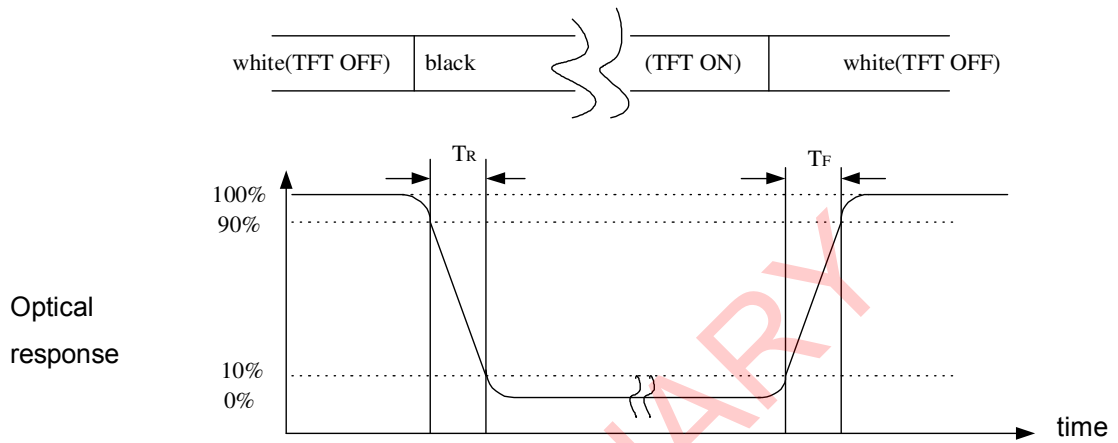


Note (2) Definition of Contrast Ratio (CR):  
measured at the center point of panel

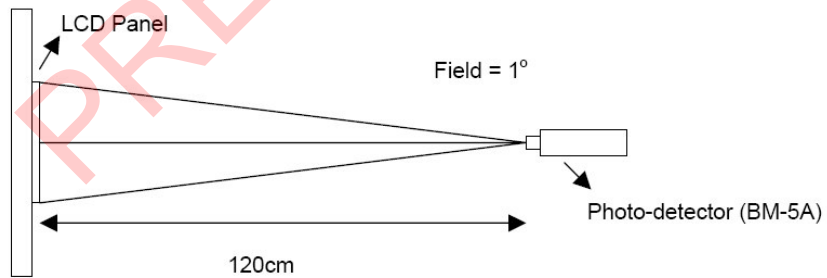
$$CR = \frac{\text{Luminance with all pixels white}}{\text{Luminance with all pixels black}}$$



Note (3) Definition of Response Time: Sum of  $T_R$  and  $T_F$



Note (4) Definition of optical measurement setup





Note (5) Definition of brightness uniformity



$$\text{Luminance uniformity} = \frac{(\text{Min Luminance of 9 points})}{(\text{Max Luminance of 9 points})} \times 100\%$$

Note (6) Rubbing Direction (The different Rubbing Direction will cause the different optima view direction.)

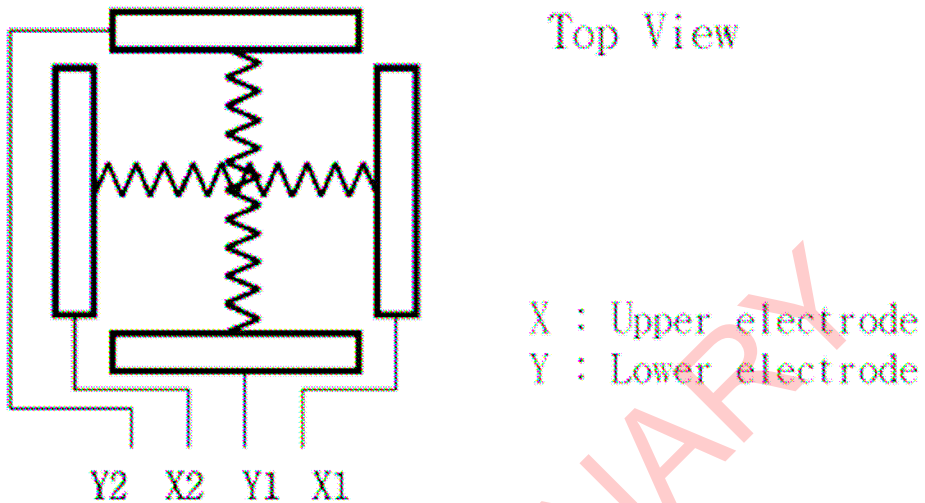
Note (7) Measured at the brightness of the panel when all terminals of LCD panel are electrically open.





## 4.0 Touch Screen Panel Specification

### 4.1 Block Diagram



Pin No.	Symbol	I/O	Function
1	X1	Right	Right electrode - differential analog
2	Y1	Bottom	Bottom electrode - differential analog
3	X2	Left	Left electrode - differential analog
4	Y2	Top	Top electrode - differential analog

### 4.2 Electrical Characteristics

Item	Min.	Typ.	Max.	Unit	Note
Terminal resistance	100	-	900	$\Omega$	X (Film Side)
	100	-	900	$\Omega$	Y (Glass Side)
Insulation resistance	20	-	-	M $\Omega$	DC 25V
Input voltage	-	5	7	V	
Chattering	-	-	10	ms	100K $\Omega$ pull-up
Transparency	-	80	-	%	JISK7105

Note: Avoid operating with hard or sharp material such as a ballpoint pen or a mechanical pencil except a polyacetal pen (tip R0.8mm or less) or a finger.

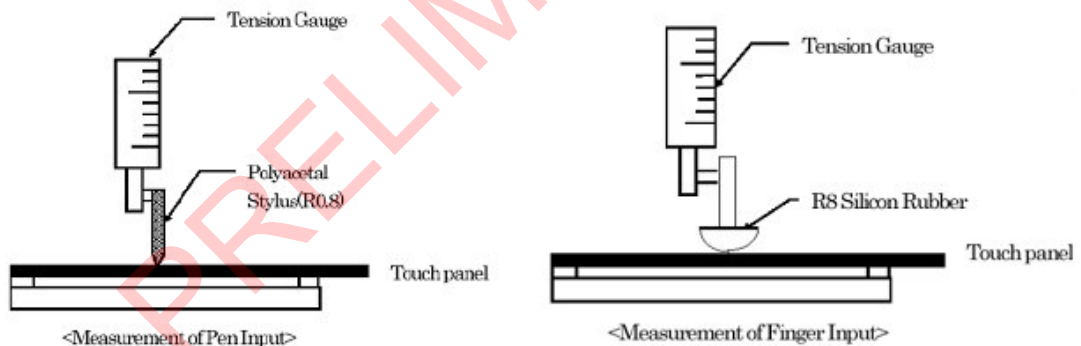


### 4.3 Mechanical & Reliability Characteristics

Item	Min.	Typ.	Max.	Unit	Note
Activation force	80	-	-	gf	(1)
Durability -surface scratching	Write 100,000	-	-	Characters	(2)
Durability -surface pitting	1,000,000	-	-	touches	(3)
Surface hardness	3	-	-	H	JIS K5400

#### Note (1) Activation Force Test Condition

1. Input DC 5V on X direction, drop off polyacetal stylus (R0.8), until output voltage stabilized.
2. R0.8mm silicon rubber for finger activation force test.
3. Test points: 9 points.



#### Note (2) Measurement for surface area (Scratching)

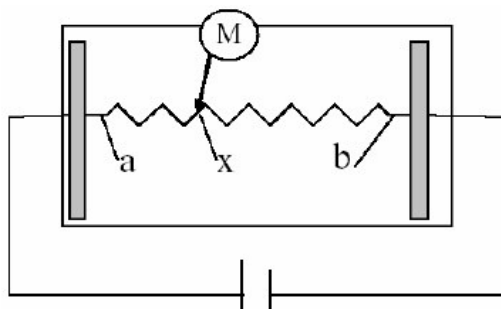
1. Scratch 100,000 times straight line on the film with a stylus change every 20,000 times.
2. Force: 250 gf.
3. Speed: 60 mm/sec.
4. Stylus: R0.8 polyacetal tip.

#### Note (3) Measurement for surface area (Pitting)

1. Pit 1,000,000 times on the film with a R8 silicon rubber.
2. Force: 250 gf.
3. Speed: 2 times/sec.



#### 4.4 Linearity Definition



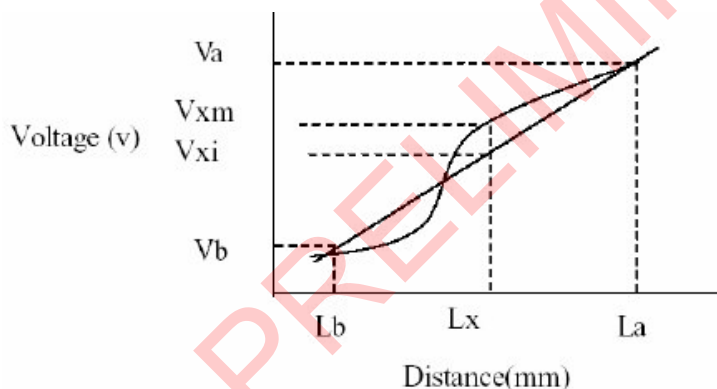
Va: maximum voltage in the active area of touch panel

Vb: minimum voltage in the active area of touch panel

X: random measuring point

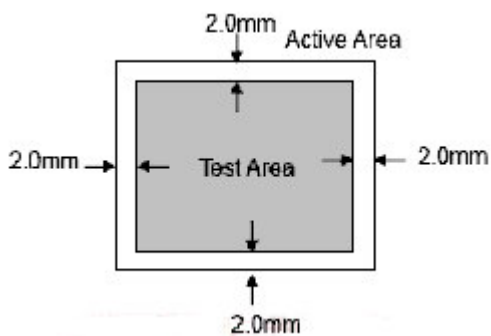
Vxm: actual voltage of Lx point

Vxi: theoretical voltage of Lx point



$$\text{Linearity} = \frac{|V_{xi} - V_{xm}|}{(V_a - V_b)} * 100\%$$

Note: Test area is as follows and operation force is 100gf.

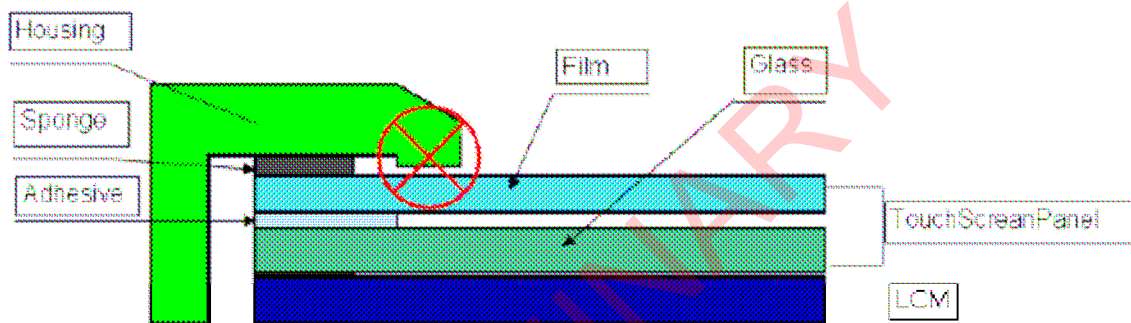




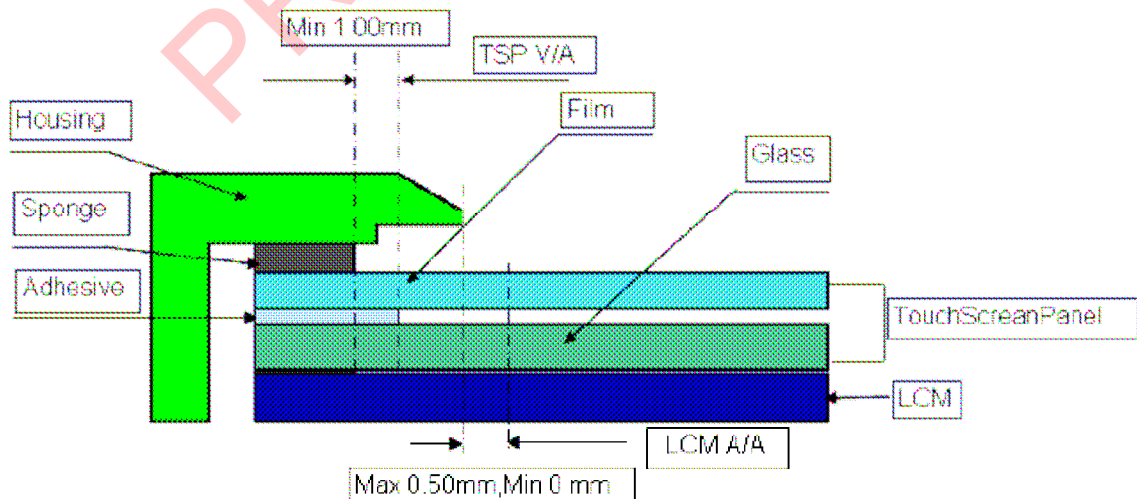
## 4.5 Housing Design Guide

Housing design follow as below

- (1) Avoid the design that housing overlap and press on the active area of the LCM.
- (2) Give enough gap (over 0.5mm at compressed) between the housing and TSP to protect wrong operating.



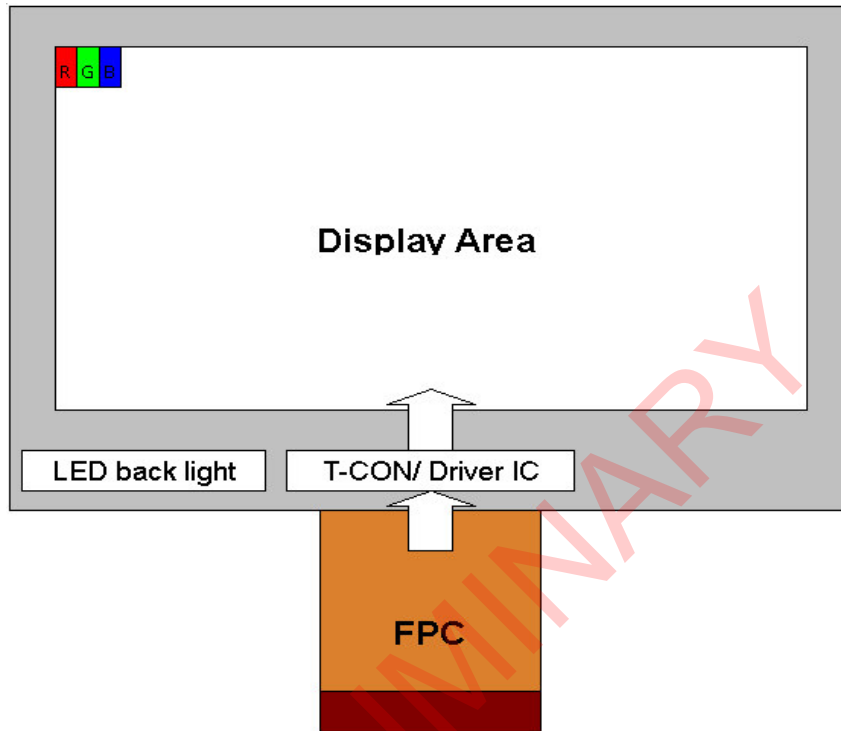
- (3) Use a buffer material (gasket) between the TSP and housing to protect damage and wrong operating.
- (4) Avoid the design that buffer material overlap and press on the inside of TSP view area.



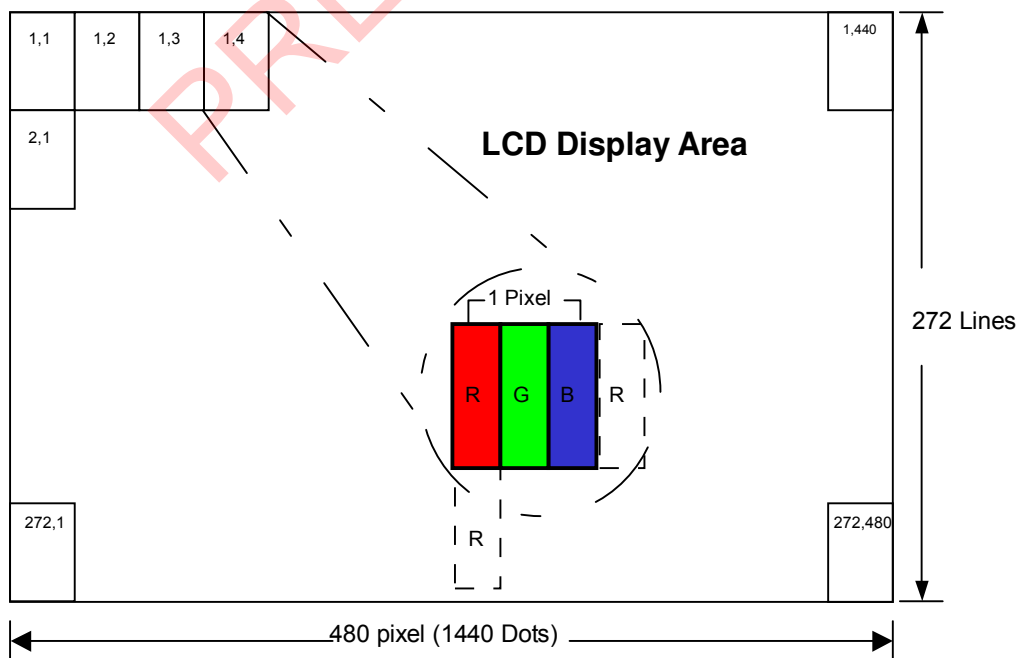


## 5.0 BLOCK DIAGRAM

### 5.1 TFT LCD Module



### 5.2 Pixel Format





## 6.0 INPUT INTERFACE PIN ASSIGNMENT

FPC connector is used for electronics interface. The recommended model is FH19SC-40S-0.5SH (05) manufactured by HIROSE.

Pin No	Symbol	I/O	Function
1	V <sub>LED-</sub>	P	Power for LED backlight cathode
2	V <sub>LED+</sub>	P	Power for LED backlight anode
3	GND	P	Power ground
4	V <sub>DD</sub>	P	Power voltage
5	R0	I	Red data (LSB)
6	R1	I	Red data
7	R2	I	Red data
8	R3	I	Red data
9	R4	I	Red data
10	R5	I	Red data
11	R6	I	Red data
12	R7	I	Red data (MSB)
13	G0	I	Green data (LSB)
14	G1	I	Green data
15	G2	I	Green data
16	G3	I	Green data
17	G4	I	Green data
18	G5	I	Green data
19	G6	I	Green data
20	G7	I	Green data (MSB)
21	B0	I	Blue data (LSB)
22	B1	I	Blue data
23	B2	I	Blue data
24	B3	I	Blue data
25	B4	I	Blue data
26	B5	I	Blue data
27	B6	I	Blue data
28	B7	I	Blue data (MSB)
29	GND	P	Power ground
30	DCLK	I	Pixel clock
31	DISP	I	Display on/ off
32	HSYNC	I	Horizontal sync signal
33	VSYNC	I	Vertical sync signal
34	DE	I	Data enable
35	NC	-	No connect
36	GND	P	Power ground
37	X <sub>R</sub>	I/O	Right electrode - differential analog
38	Y <sub>B</sub>	I/O	Bottom electrode - differential analog
39	X <sub>L</sub>	I/O	Left electrode - differential analog
40	Y <sub>T</sub>	I/O	Top electrode - differential analog

I/O: I: input, O: output, P: power



## 7.0 ELECTRICAL CHARACTERISTICS

### 7.1 DC Electrical Characteristics

Parameters	Symbol	Min.	Typ.	Max.	Unit	Note
Supply voltage	$V_{DD}$	3.0	3.3	3.6	V	
Input signal voltage	$V_{iH}$	$0.7 V_{DD}$	—	$V_{DD}$	V	Note (1)
	$V_{iL}$	GND	—	$0.3 V_{DD}$	V	Note (1)
Current of power supply	$I_{DD}$	—	TBD	—	mA	$V_{DD} = 3.3V$

Note (1): HSYNC, VSYNC, DE, R/G/B Data

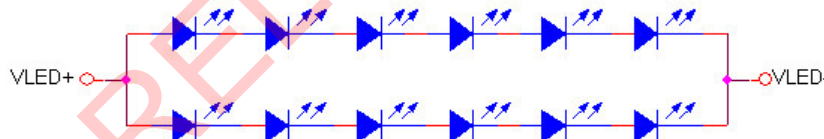
Note (2): GND = 0V

### 7.2 Back-Light Unit

The backlight system is an edge-lighting type with 12 LED.

The characteristics of the LED are shown in the following tables.

Parameters	Symbol	Min.	Typ.	Max.	Unit	Note
LED current	$I_L$	—	40	—	mA	(2)
LED voltage	$V_L$	—	19.8	—	V	
LED life time	Hr	10000	—	—	Hour	(1)(2)



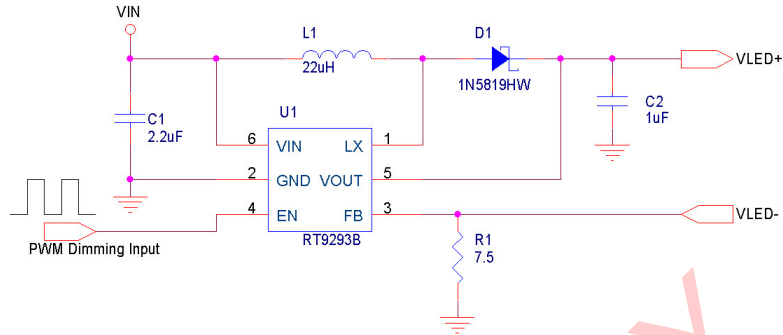
LED Light Bar Circuit

Note (1) LED life time (Hr) can be defined as the time in which it continues to operate under the condition:  $T_a=25\pm3\text{ }^\circ\text{C}$ , typical  $I_L$  value indicated in the above table until the brightness becomes less than 50%.

Note (2) The “LED life time” is defined as the module brightness decrease to 50% original brightness at  $T_a=25\text{ }^\circ\text{C}$  and  $I_L=40\text{mA}$ . The LED lifetime could be decreased if operating  $I_L$  is larger than 40mA. The constant current driving method is suggested.



Note (3) Suggested schematic of LED backlight driver.

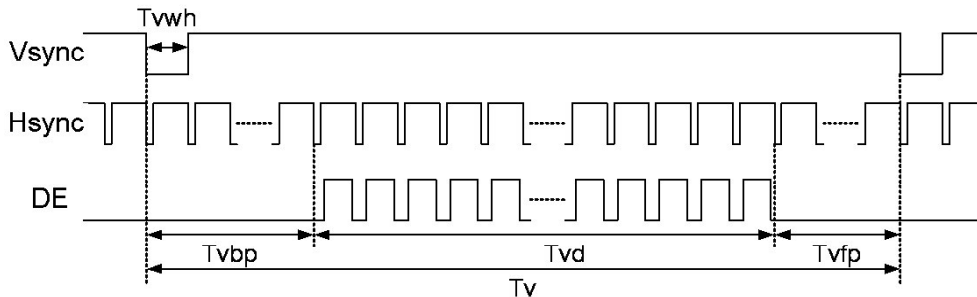


### 7.3 Data Input Format

Parallel 24-bit RGB Input Timing Table

Parameters	Symbol	Min.	Typ.	Max.	Unit	Conditions
DCLK frequency	fclk	5	9	12	MHz	
VSYNC period time	Tv	277	288	400	Th	
VSYNC display area	Tvd		272		Th	
VSYNC back porch	Tvbp	3	8	31	Th	
VSYNC front porch	Tvfp	2	8	93	Th	
HSYNC period time	Th	520	525	800	DCLK	
HSYNC display area	Thd		480		DCLK	
HSYNC back porch	Thbp	36	40	255	DCLK	
HSYNC front porch	Thfp	4	5	65	DCLK	

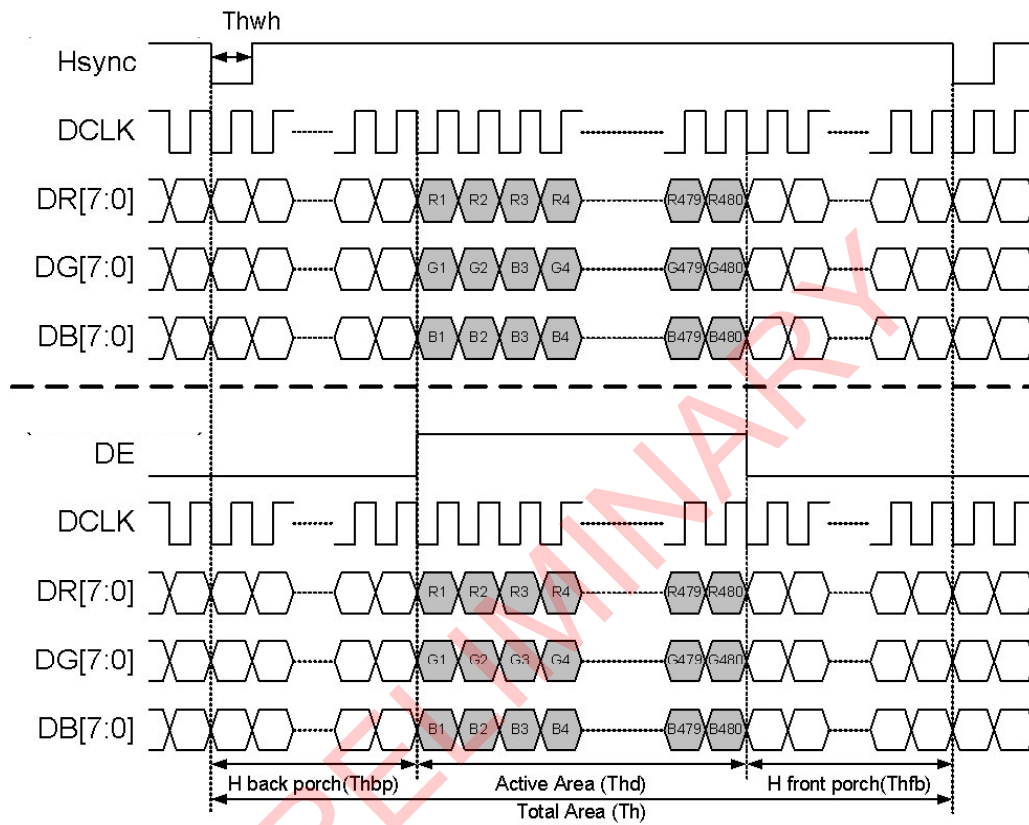
#### Vertical Input Timing







### Parallel 24-bit RGB Mode Data Format (DE Mode)

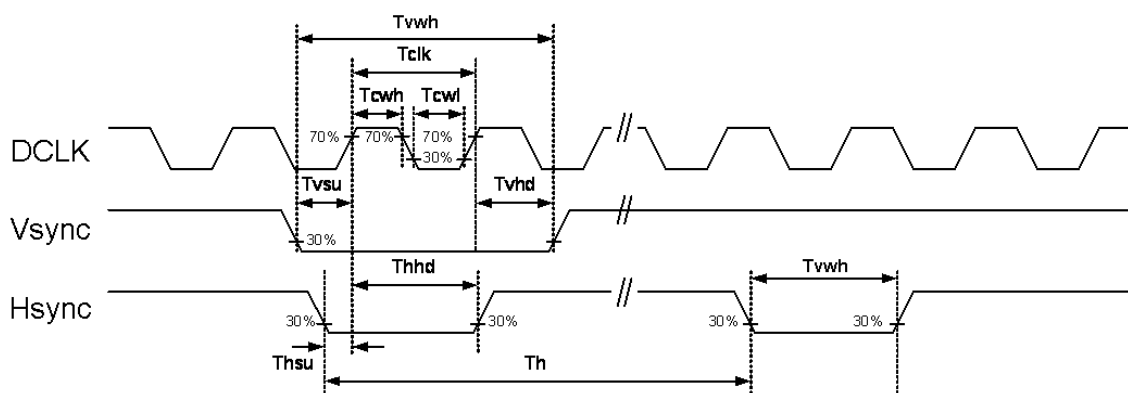
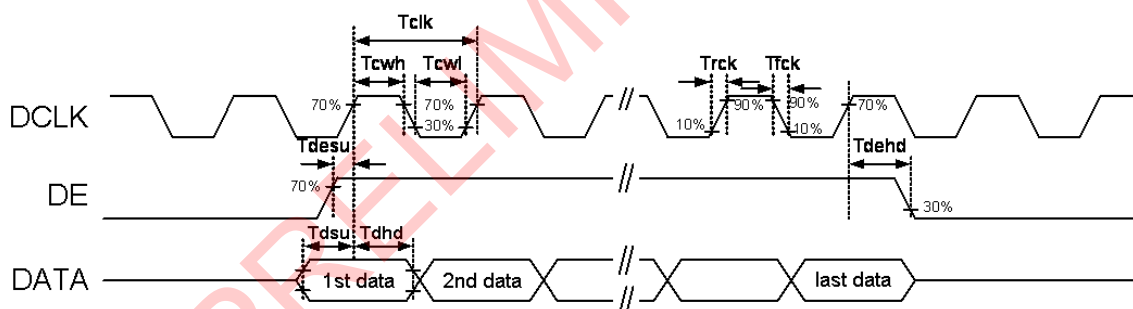




### 7.4 AC Electrical Characteristics

Parameters	Symbol	Min.	Typ.	Max.	Unit	Conditions
DCLK period time	Tclk	83.3	111.1	200	ns	Parallel 24-bit RGB mode
		33.3	37.0	41.7	ns	Serial 8-bit RGB mode
DCLK rising time	Trck	-	-	9	ns	
DCLK falling time	Tfck	-	-	9	ns	
DCLK pulse duty	Tcwh	40	50	60	%	
DE setup time	Tdesu	12	-	-	ns	
DE hold time	Tdehd	12	-	-	ns	
HSYNC pulse width	Thwh	1	-	-	DCLK	
HSYNC setup time	Thsu	12	-	-	ns	
HSYNC hold time	Thhd	12	-	-	ns	
VSYNC pulse width	Tvwh	1	-	-	Th	
VSYNC setup time	Tvsu	12	-	-	ns	
VSYNC hold time	Tvhd	12	-	-	ns	
Data setup time	Tdsu	12	-	-	ns	
Data hold time	Tdhd	12	-	-	ns	

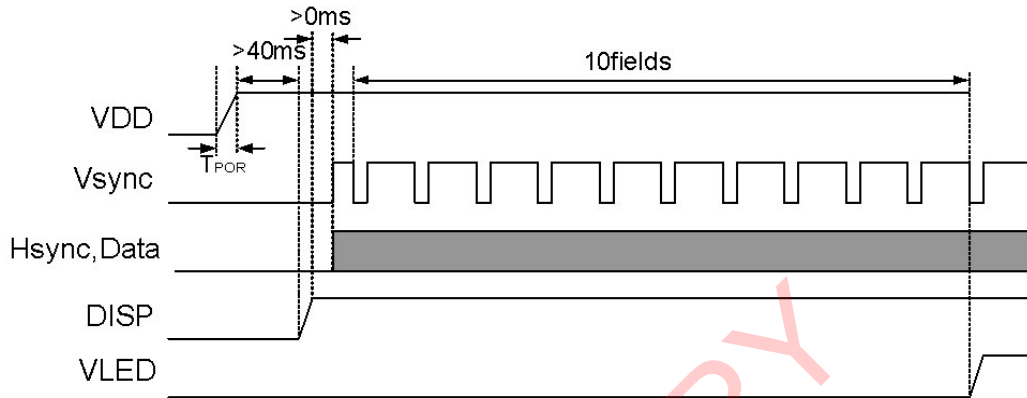
#### Clock and Data Input Timing Diagram



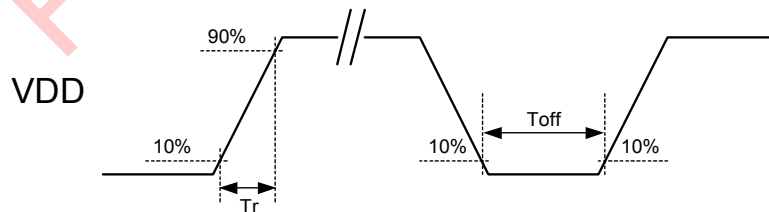
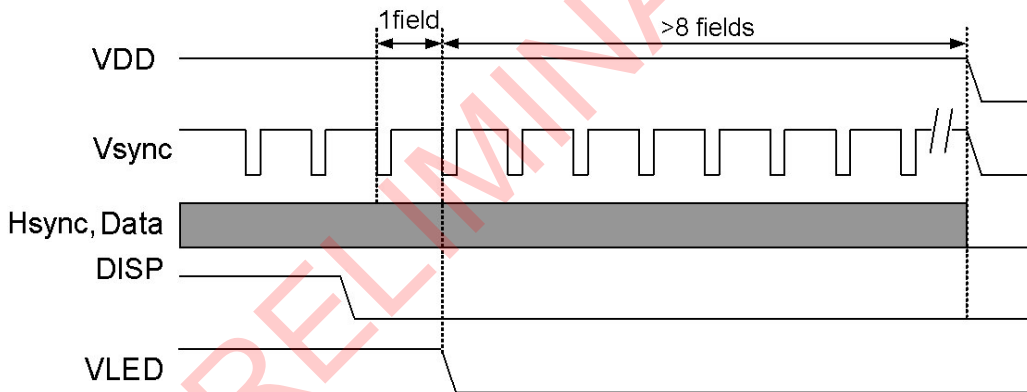


## 7.5 Power On/Off Sequence

### Power On Sequence



### Power Off Sequence



VDD power input timing

#### Notes:

- Data include R0~R7, G0~G7, B0~B7, HSD, VSD, DCLK, DE
- Power on sequence: VDD  $\rightarrow$  DISP  $\rightarrow$  Data  $\rightarrow$  V<sub>LED</sub>
- Power off sequence: DISP  $\rightarrow$  V<sub>LED</sub>  $\rightarrow$  Data  $\rightarrow$  VDD
- VDD power input timing:  $0.5\text{ms} < T_r < 10\text{ms}$ ;  $T_{off} > 500\text{ms}$



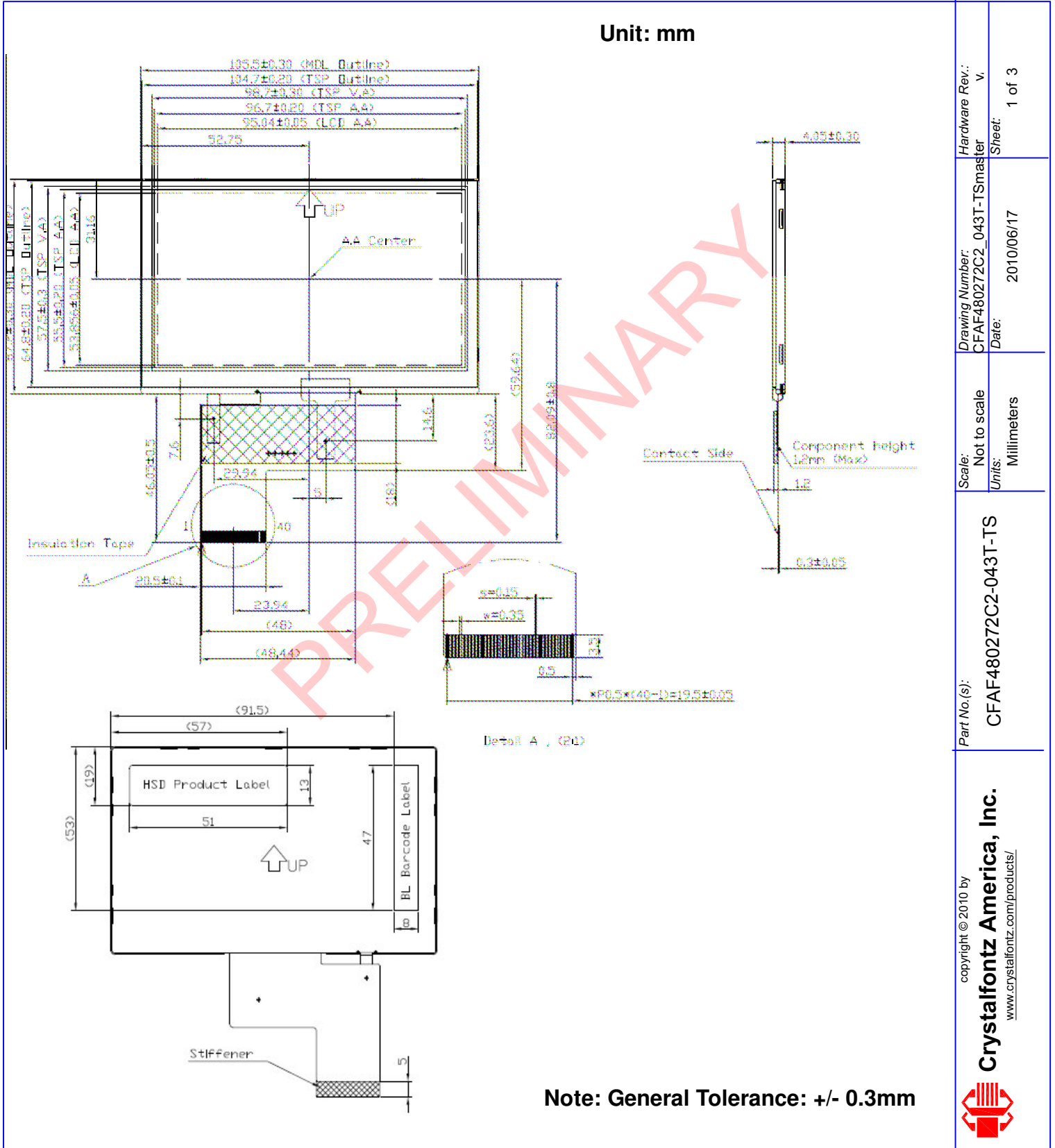
## 8.0 Reliability test items

No.	Item	Conditions	Remark
1	High Temperature Storage	Ta=+80°C, 240hrs	
2	Low Temperature Storage	Ta=-30°C, 240hrs	
3	High Temperature Operation	Ta=+70°C, 240hrs	
4	Low Temperature Operation	Ta=-20°C, 240hrs	
5	High Temperature and High Humidity (operation)	Ta=+60°C, 90%RH, 240hrs	
6	Thermal Cycling Test (non operation)	-30°C(30min) → +80°C(30min), 200cycles	
7	Electrostatic Discharge	±200V,200pF(0Ω) 1 time/each terminal	
8	Vibration	1.Random: 1.04Grms, 5~500Hz, X/Y/Z, 30min/each direction 2. Sine: Freq. Range: 8~33.3Hz Stoke: 1.3mm Sweep: 2.9G, 33.3~400Hz X/Z: 2hr, Y: 4hr, cyc: 15min	
9	Shock	100G, 6ms, ±X, ±Y, ±Z 3 time for each direction	JIS C7021, A-10 (Condition A)
10	Vibration (with carton)	Random: 0.015G <sup>2</sup> /Hz, 5~200Hz -6dB/Octave, 200~400Hz XYZ each direction: 2hr	
11	Drop (with carton)	Height: 60cm 1 corner, 3 edges, 6 surfaces	JIS Z0202

Note: There is no display function NG issue occurred, all the cosmetic specification is judged before the reliability stress.



### 9.0 MODULE OUTLINE DRAWINGS



Note: General Tolerance: +/- 0.3mm

Scale:	Not to scale	Drawing Number:	CFAF480272C2_043T-TSmaster	Hardware Rev.:	v.
Units:	Millimeters	Date:	2010/06/17	Sheet:	1 of 3
Part No.(s):	CFAF480272C2-043T-TS				
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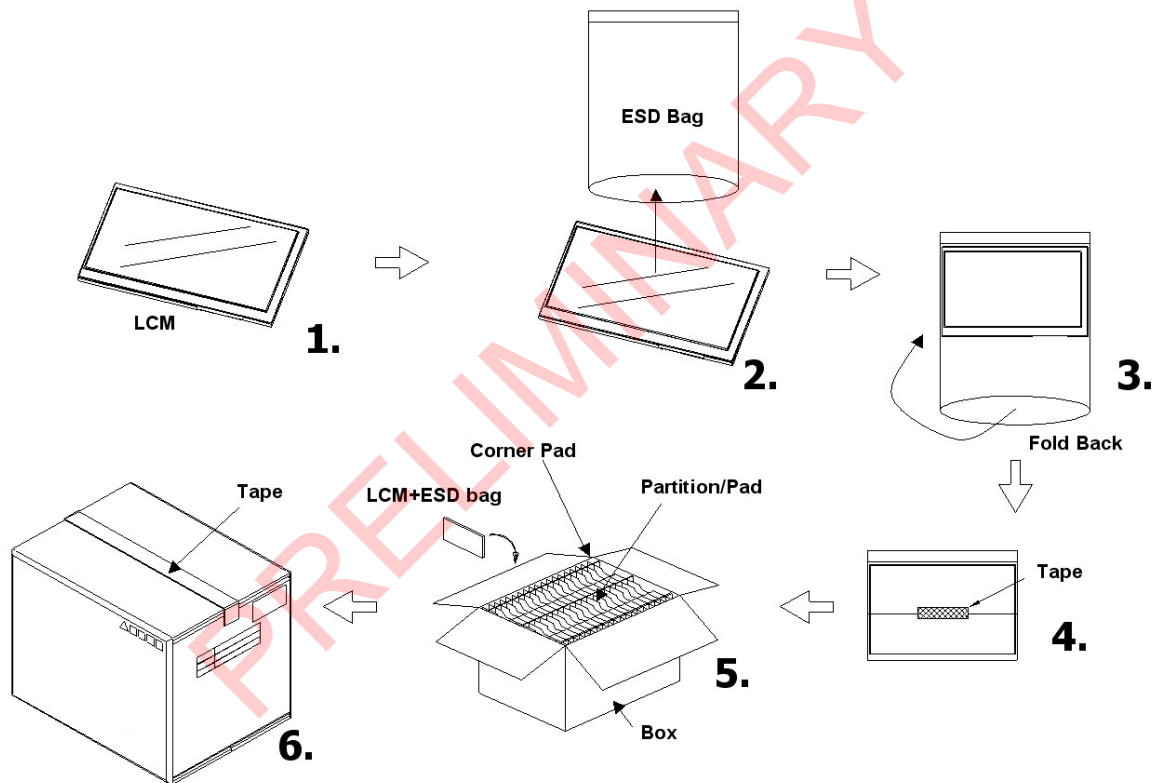


## 10.0 PACKAGE SPECIFICATION

### 10.1 Packing form

LCM Model	LCM Qty. in the box	Inner Box Size (mm)	Notice
CFAF480272C2-043T-TS	210	408 x 369 x 180	

### 10.2 Packing assembly drawings



Items	Material	Notice
Box	Corrugated Paperboard	
Partition/Pad	Corrugated Paperboard	
Corner Pad	Corrugated Paperboard	
ESD bag	Corrugated Paperboard	



## **11.0 GENERAL PRECAUTION**

### **11.1 Use Restriction**

This product is not authorized for use in life supporting systems, aircraft navigation control systems, military systems and any other application where performance failure could be life-threatening or otherwise catastrophic.

### **11.2 Disassembling or Modification**

Do not disassemble or modify the module. It may damage sensitive parts inside LCD module, and may cause scratches or dust on the display. Crystalfontz does not warrant the module, if customers disassemble or modify the module.

### **11.3 Breakage of LCD Panel**

11.3.1. If LCD panel is broken and liquid crystal spills out, do not ingest or inhale liquid crystal, and do not contact liquid crystal with skin.

11.3.2. If liquid crystal contacts mouth or eyes, rinse out with water immediately.

11.3.3. If liquid crystal contacts skin or cloths, wash it off immediately with alcohol and rinse thoroughly with water.

11.3.4. Handle carefully with chips of glass that may cause injury, when the glass is broken.

### **11.4 Electric Shock**

11.4.1. Disconnect power supply before handling LCD module.

11.4.2. Do not pull or fold the LED cable.

11.4.3. Do not touch the parts inside LCD modules and the fluorescent LED's connector or cables in order to prevent electric shock.

### **11.5 Absolute Maximum Ratings and Power Protection Circuit**

11.5.1. Do not exceed the absolute maximum rating values, such as the supply voltage variation, input voltage variation, variation in parts' parameters, environmental temperature, etc., otherwise LCD module may be damaged.

11.5.2. Please do not leave LCD module in the environment of high humidity and high temperature for a long time.

11.5.3. It's recommended to employ protection circuit for power supply.

### **11.6 Operation**

11.6.1 Do not touch, push or rub the polarizer with anything harder than HB pencil lead.

11.6.2 Use fingerstalls of soft gloves in order to keep clean display quality, when persons handle the LCD module for incoming inspection or assembly.

11.6.3 When the surface is dusty, please wipe gently with absorbent cotton or other soft material.



11.6.4 Wipe off saliva or water drops as soon as possible. If saliva or water drops contact with polarizer for a long time, they may causes deformation or color fading.

11.6.5 When cleaning the adhesives, please use absorbent cotton wetted with a little petroleum benzine or other adequate solvent.

### **11.7 Mechanism**

Please mount LCD module by using mounting holes arranged in four corners tightly.

### **11.8 Static Electricity**

11.8.1 Protection film must remove very slowly from the surface of LCD module to prevent from electrostatic occurrence.

11.8.2. Because LCD module use CMOS-IC on circuit board and TFT-LCD panel, it is very weak to electrostatic discharge. Please be careful with electrostatic discharge. Persons who handle the module should be grounded through adequate methods.

### **11.9 Strong Light Exposure**

The module shall not be exposed under strong light such as direct sunlight. Otherwise, display characteristics may be changed.

### **11.10 Disposal**

When disposing LCD module, obey the local environmental regulations.