



Crystalfontz America, Incorporated

GRAPHIC TFT MODULE SPECIFICATIONS

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MAIN FEATURES

FEATURESMODULE 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		

Module Depth		
	Maximum	Nominal
Millimeters	4.05	4.35
Inches	0.1594	0.1713

Viewing Area		
	Width	Height
Millimeters	98.04	56.86
Inches	3.8598	2.2386

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

Module Excluding		
	Width	Height
Millimeters		
Inches		

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 _i	-0.3	5.0	V	

2.1.2 Back-Light Unit

Item	Symbol	Typ.	Max.	Unit	Note
Forward current	I _L	30	40	mA	(1)(2)(3)
Forward voltage	V _L	19.8 (Typ)	—	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_a = 25±2°C
- (3) Test Condition: LED current 40 mA. The LED lifetime could be decreased if operating I_L is larger than 40mA.

2.2 Environment Absolute Rating

Item	Symbol	Min.	Max.	Unit	Note
Operating Temperature	T _{opa}	-20	70	°C	
Storage Temperature	T _{stg}	-30	80	°C	

CAUTION

Do not drive the LEDs at any current over their rated maximum of 20mA (15mA recommended for longer life). Be aware that the forward voltage of white LEDs can vary (LED to LED, batch to batch, and over time) by a significant amount. We recommend using a constant current LED power supply such as the AP3036, NCP5007, FAN5333, or similar to drive the LEDs. Do not use a constant voltage source to drive the LEDs.



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 ²	(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.	Θ_L	65	75	—			
		Θ_R	65	75	—			
	Ver.	Θ_U	50	60	—			
		Θ_D	60	70	—			
Brightness uniformity	B_{UNI}	$\Theta=0$	70	—	—	%	(5)(7)	
Optima View Direction	6 O' clock						(6)	

3.2 Measuring Condition

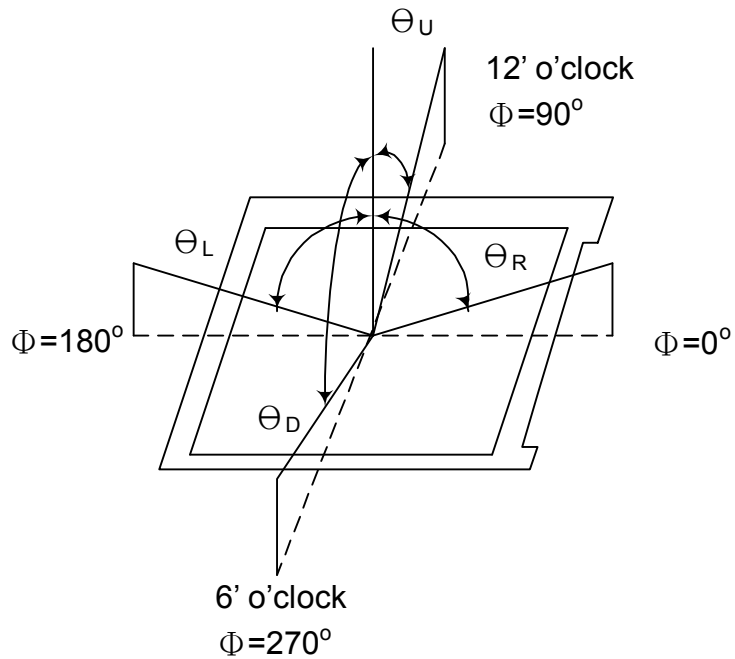
- Measuring surrounding: dark room
- LED current I_L : 40mA
- Ambient temperature: 25±2°C
- 15min. warm-up time.

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:

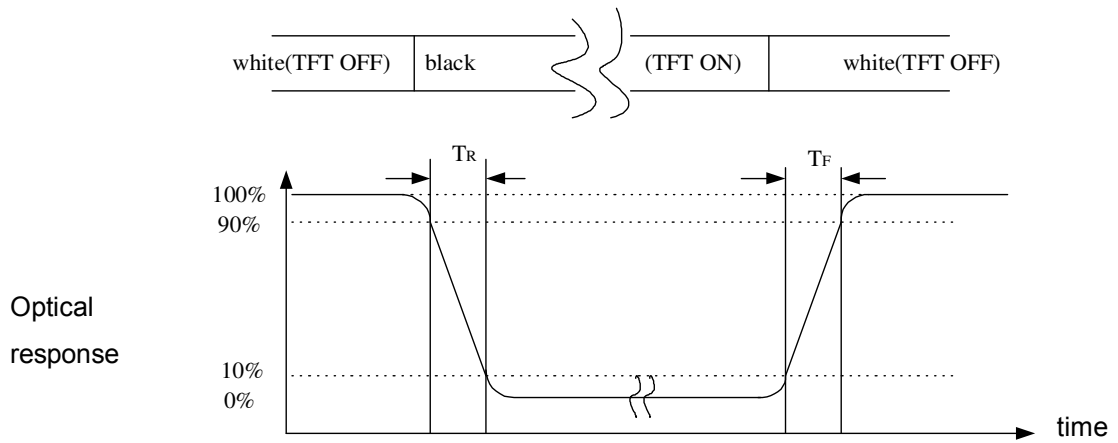


Note (2) Definition of Contrast Ratio (CR):
measured at the center point of panel

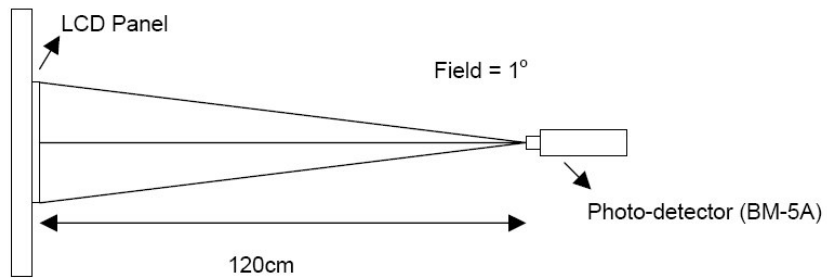
$$CR = \frac{\text{Luminance with all pixels white}}{\text{Luminance with all pixels black}}$$



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

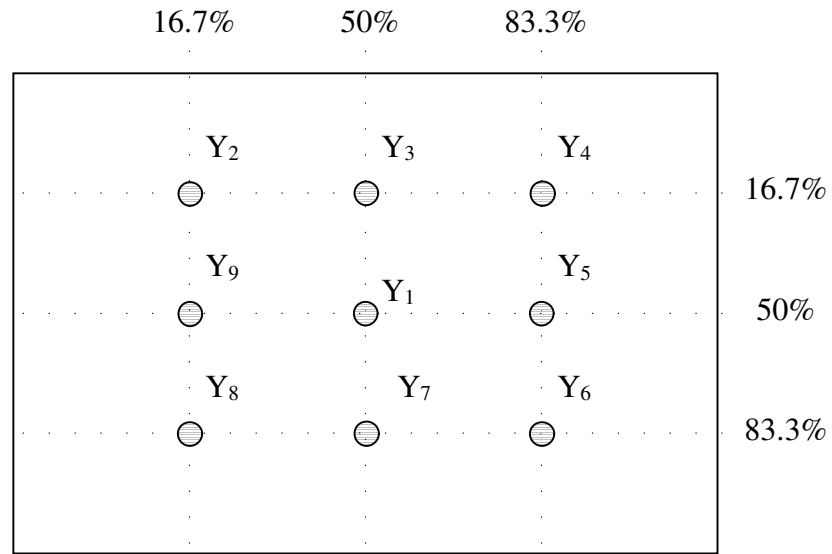


Note (4) Definition of optical measurement setup





Note (5) Definition of brightness uniformity



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

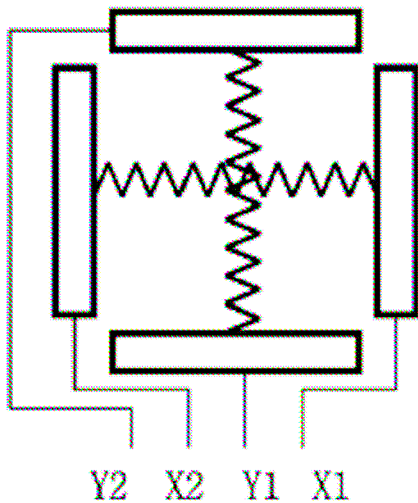
Note (6) Rubbing Direction (The different Rubbing Direction will cause the different optima view direction.)

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



Top View

X : Upper electrode
 Y : Lower electrode

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	Ω	X (Film Side)
	100	-	900	Ω	Y (Glass Side)
Insulation resistance	20	-	-	M Ω	DC 25V
Input voltage	-	5	7	V	
Chattering	-	-	10	ms	100K Ω 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.

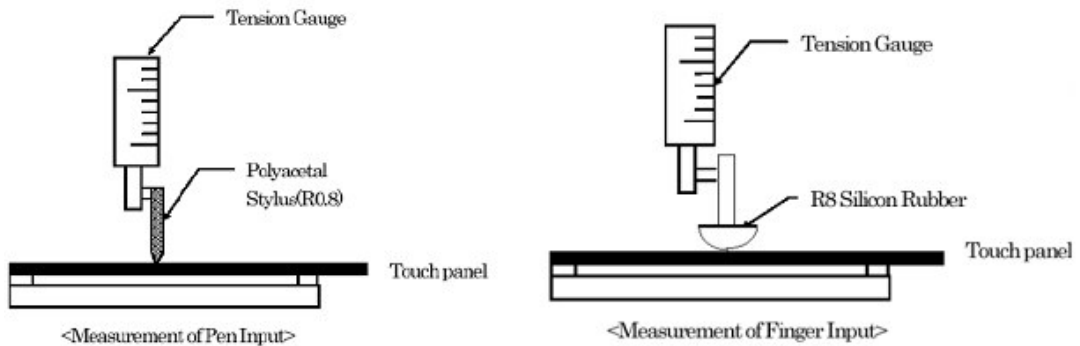


4.3 Mechanical & Reliability Characteristics

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)

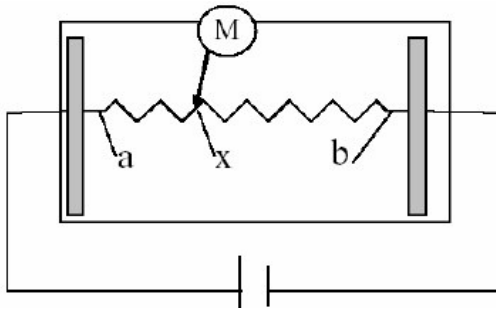
1. Scratch 100,000 times straight line on the film with a stylus change every 20,000 times.
2. Force: 250 gf.
3. Speed: 60 mm/sec.
4. Stylus: R0.8 polyacetal tip.

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



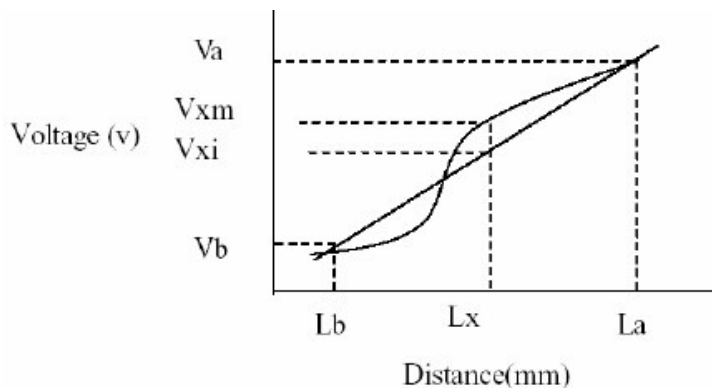
Va: maximum voltage in the active area of touch panel

Vb: minimum voltage in the active area of touch panel

X: random measuring point

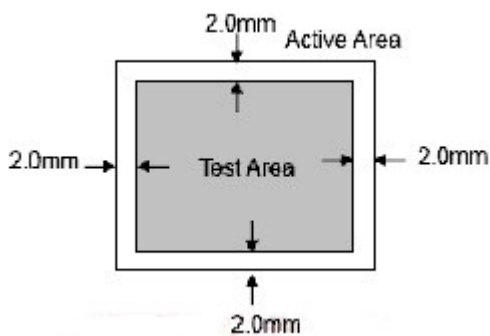
Vxm: actual voltage of Lx point

Vxi: theoretical voltage of Lx point



$$\text{Linearity} = \frac{|Vxi - Vxm|}{(Va - Vb)} * 100\%$$

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

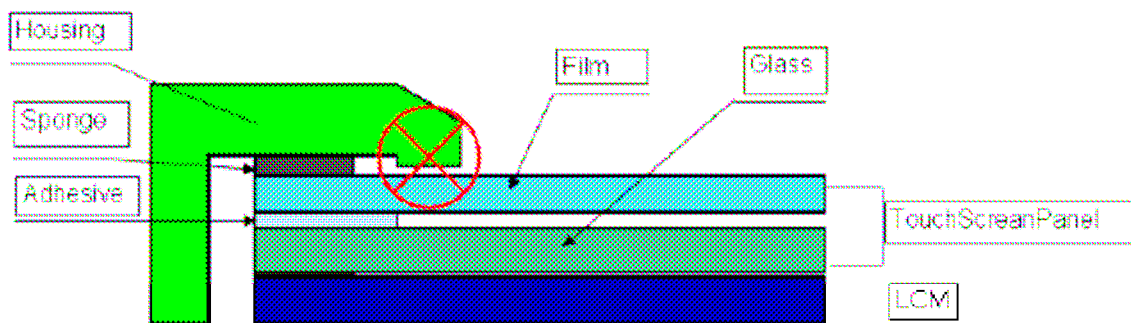




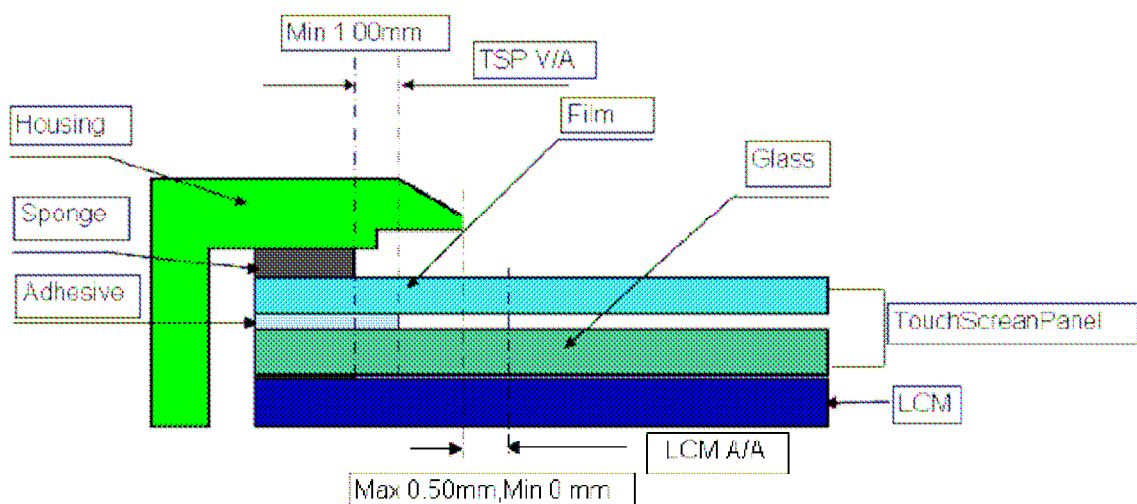
4.5 Housing Design Guide

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.



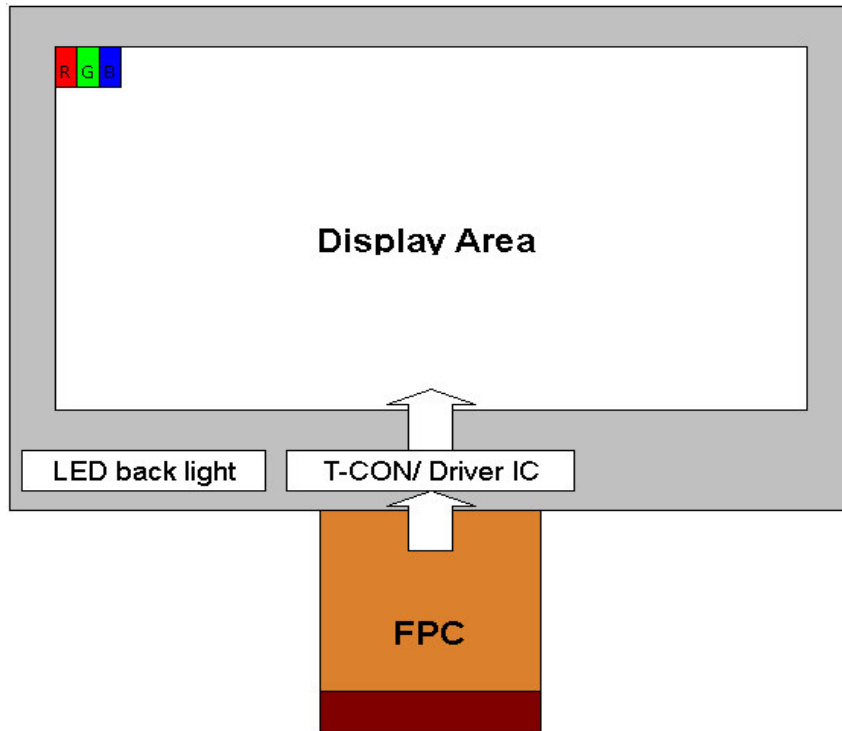
- (3) Use a buffer material (gasket) between the TSP and housing to protect damage and wrong operating.
- (4) Avoid the design that buffer material overlap and press on the inside of TSP view area.



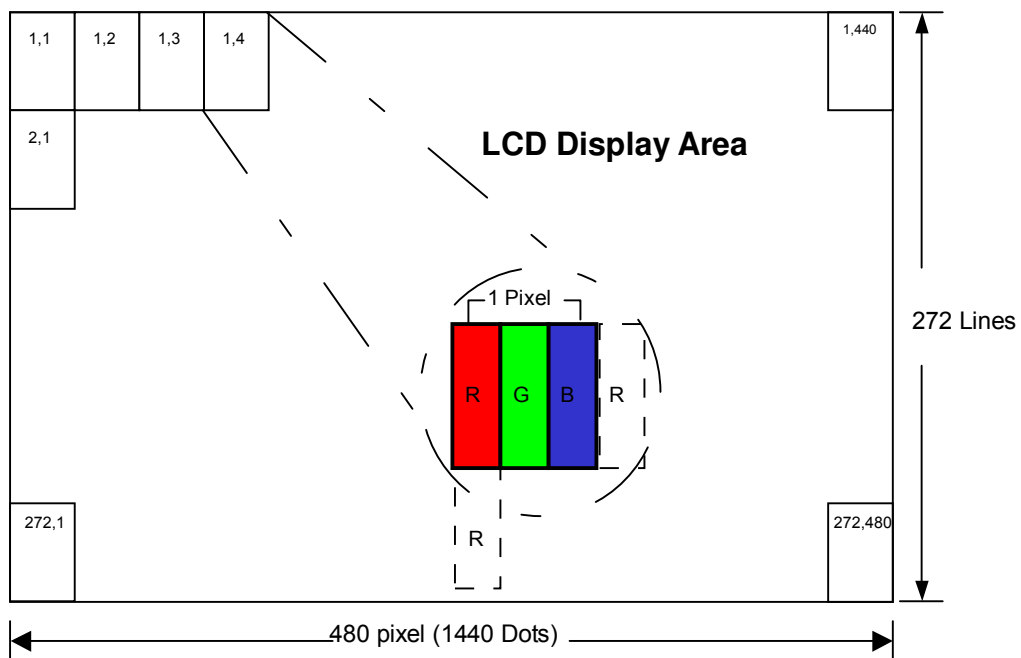


5.0 BLOCK DIAGRAM

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 _{LED-}	P	Power for LED backlight cathode
2	V _{LED+}	P	Power for LED backlight anode
3	GND	P	Power ground
4	V _{DD}	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 _R	I/O	Right electrode - differential analog
38	Y _B	I/O	Bottom electrode - differential analog
39	X _L	I/O	Left electrode - differential analog
40	Y _T	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

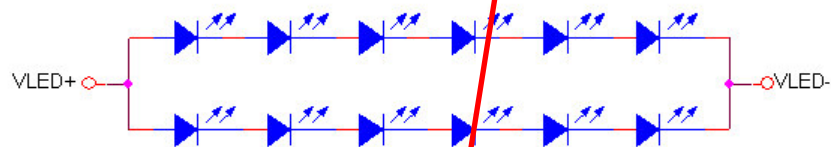
Note (2): GND = 0V

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
Forward current	IL	—	30	40	mA	(2)
Forward voltage	VL	—	19.8 (Typ)	—	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: $T_a=25\pm3^\circ\text{C}$, typical IL value indicated in the above table until the brightness becomes less than 50%.

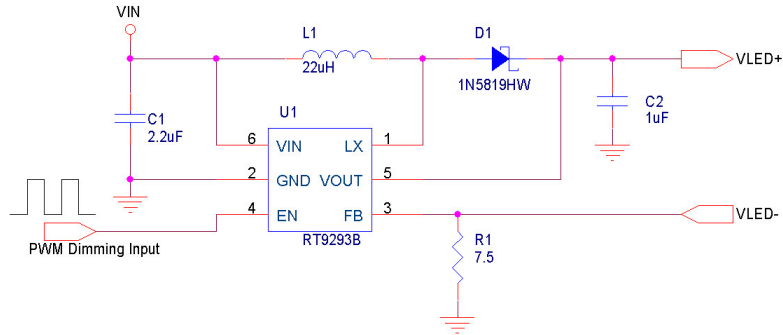
Note (2) The "LED life time" is defined as the module brightness decrease to 50% original brightness at $T_a=25^\circ\text{C}$ and $I_L=40\text{mA}$. The LED lifetime could be decreased if operating I_L is larger than 40mA. The constant current driving method is suggested.

CAUTION

Do not drive the LEDs at any current over their rated maximum of 20mA (15mA recommended for longer life). Be aware that the forward voltage of white LEDs can vary (LED to LED, batch to batch, and over time) by a significant amount. We recommend using a constant current LED power supply such as the AP3036, NCP5007, FAN5333, or similar to drive the LEDs. Do not use a constant voltage source to drive the LEDs.



Note (3) Suggested schematic of LED backlight driver.

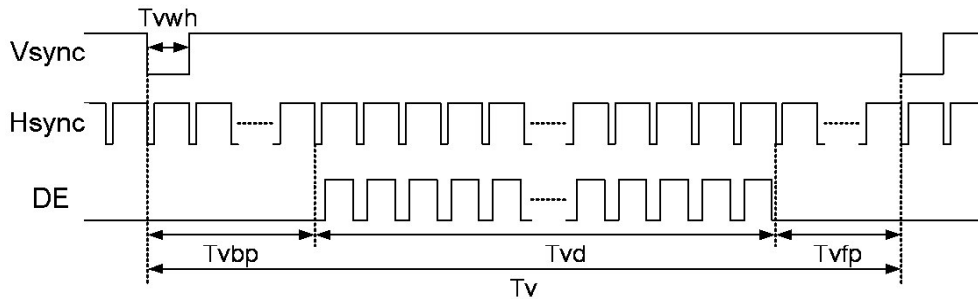


7.3 Data Input Format

Parallel 24-bit RGB Input Timing Table

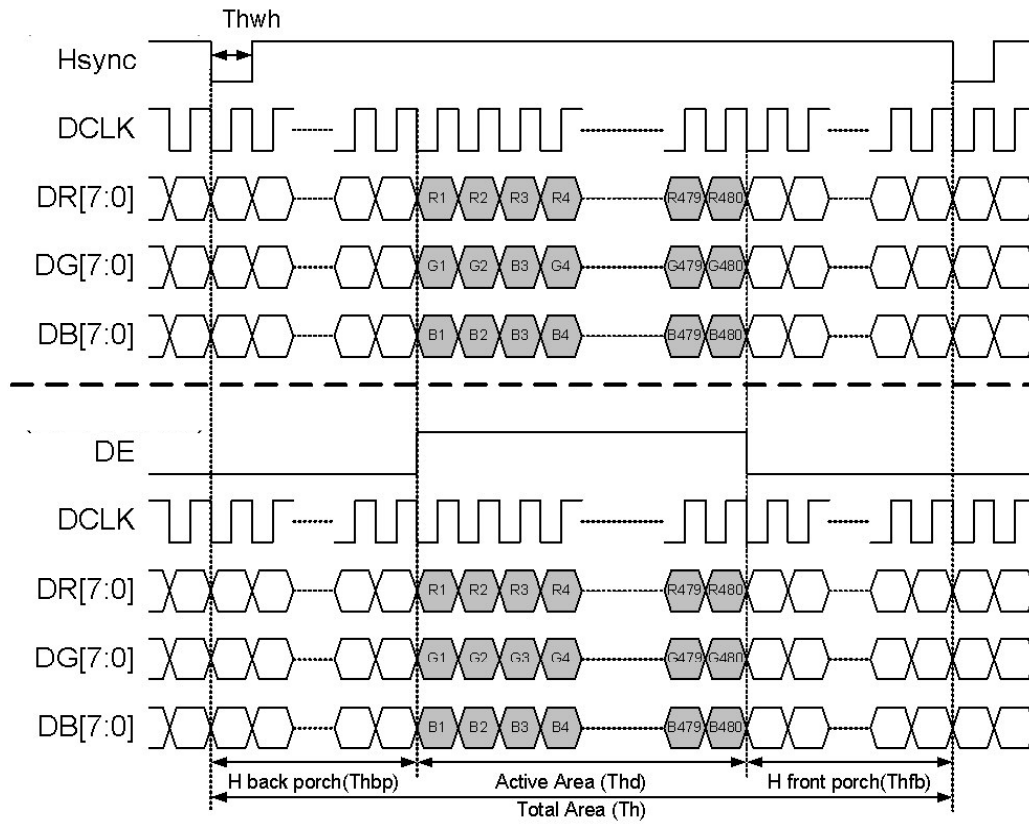
Parameters	Symbol	Min.	Typ.	Max.	Unit	Conditions
DCLK frequency	fclk	5	9	12	MHz	
VSYNC period time	Tv	277	288	400	Th	
VSYNC display area	Tvd	272			Th	
VSYNC back porch	Tvbp	3	8	31	Th	
VSYNC front porch	Tvfp	2	8	93	Th	
HSYNC period time	Th	520	525	800	DCLK	
HSYNC display area	Thd	480			DCLK	
HSYNC back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

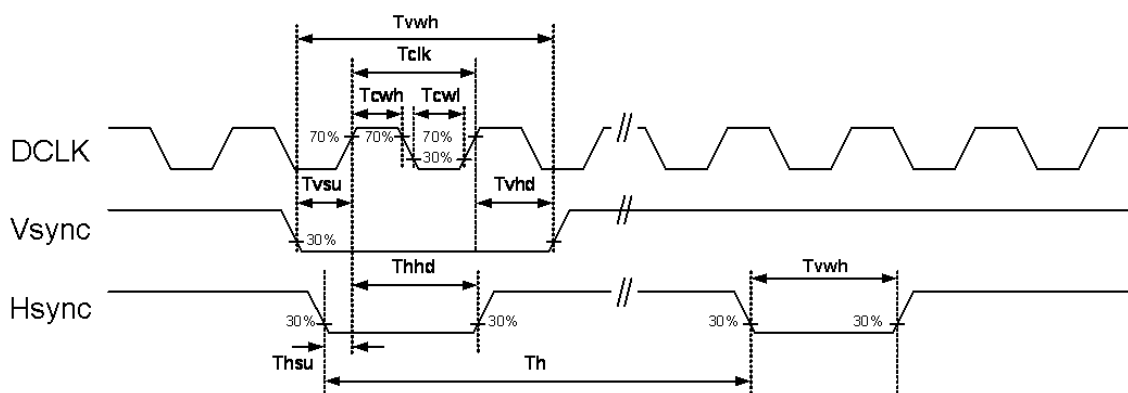
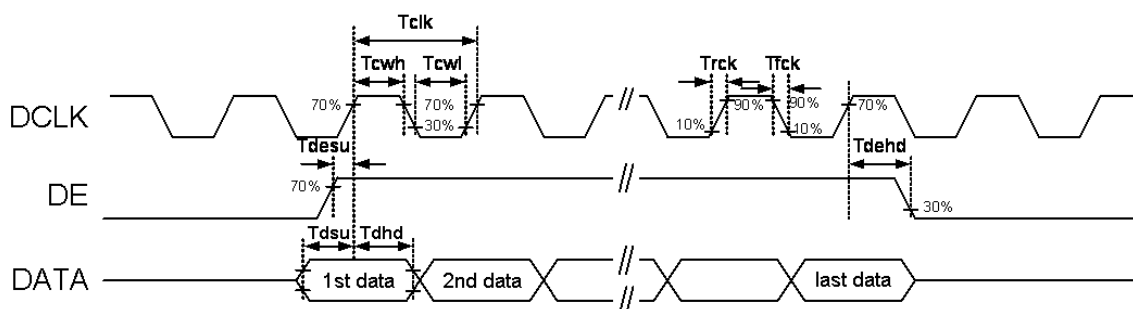




7.4 AC Electrical Characteristics

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	

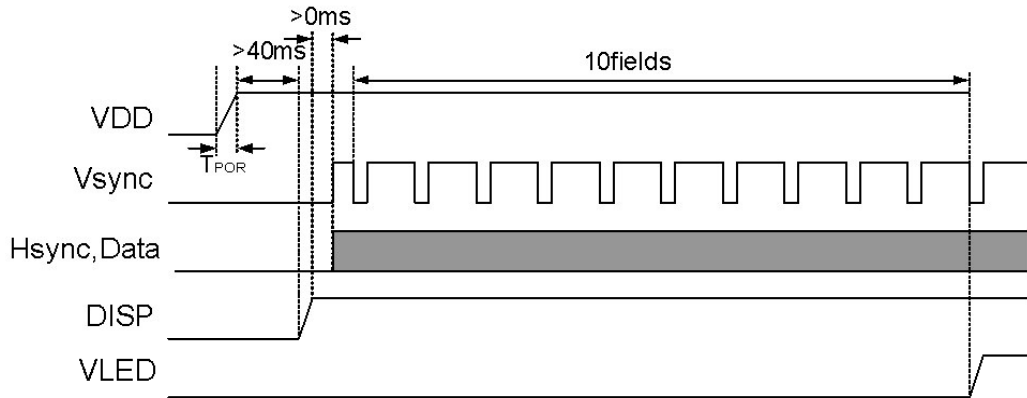
Clock and Data Input Timing Diagram



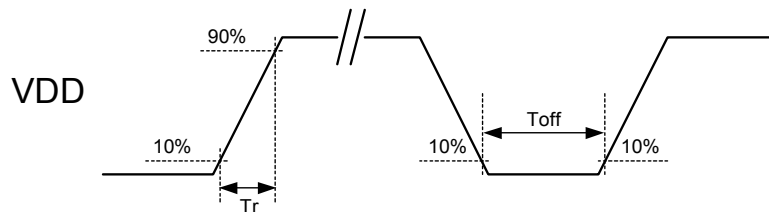
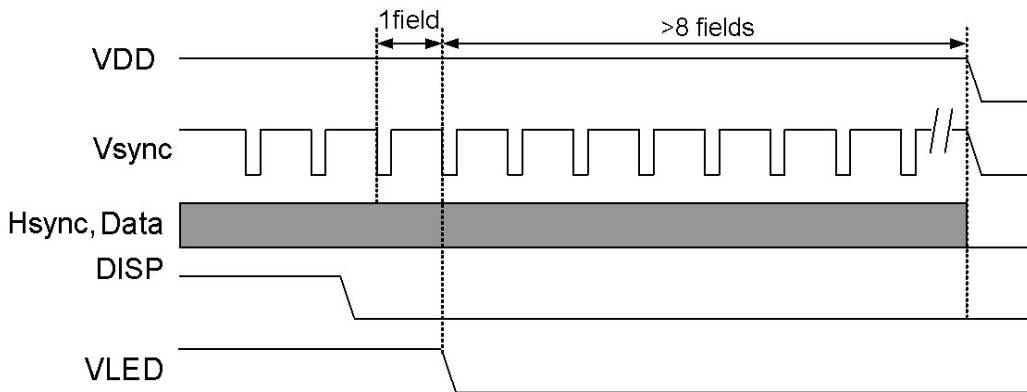


7.5 Power On/Off Sequence

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_{LED}
- Power off sequence: DISP \rightarrow V_{LED} \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

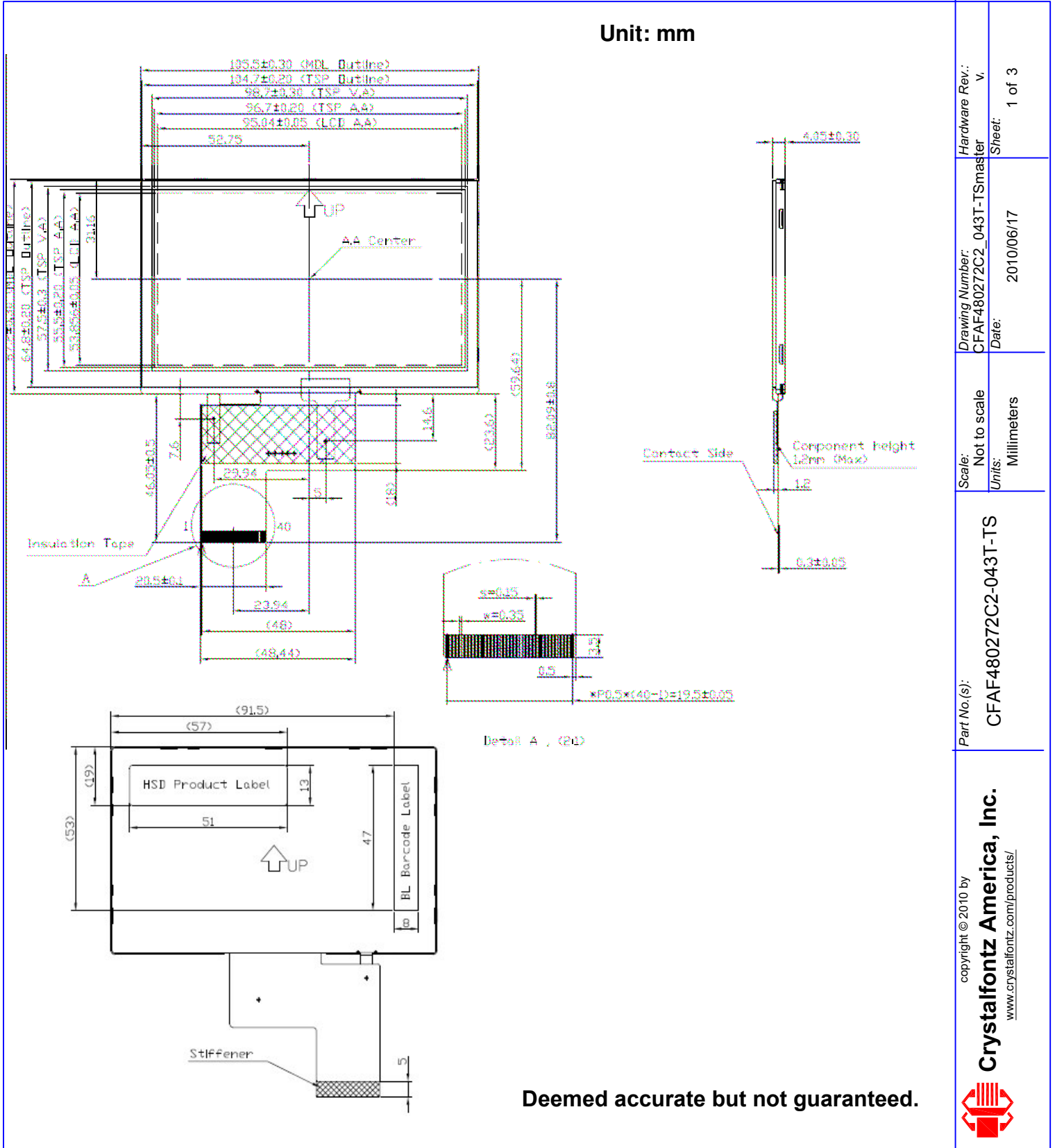
No.	Item	Conditions	Remark
1	High Temperature Storage	Ta=+80°C, 240hrs	
2	Low Temperature Storage	Ta=-30°C, 240hrs	
3	High Temperature Operation	Ta=+70°C, 240hrs	
4	Low Temperature Operation	Ta=-20°C, 240hrs	
5	High Temperature and High Humidity (operation)	Ta=+60°C, 90%RH, 240hrs	
6	Thermal Cycling 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 ² /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

Unit: mm



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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