

1.0	General description	p.4
2.0	Absolute maximum ratings	p.5
3.0	Optical characteristics	p.6
4.0	Block diagram	p.10
5.0	Input interface pin assignment	p.11
6.0	Electrical characteristics	p.12
7.0	Reliability test items.....	p.17
8.0	Outline dimension	p.18
9.0	Lot mark	p.22
10.0	Package specification	p.23
11.0	General precaution	p.24

1.0 GENERAL DESCRIPTION

1.1 Introduction

Startek Display model KD050C-1 is a color active matrix thin film transistor (TFT) liquid crystal display (LCD) that uses amorphous silicon TFT as a switching device. This model is composed of a TFT LCD panel, a driving circuit and a back light system. This TFT LCD has a 5.0 (15:9) inch diagonally measured active display area with WVGA (800 horizontal by 480 vertical pixel) resolution.

1.2 Features

- 5.0 (15:9 diagonal) inch configuration
- 6 bits + FRC driver with 1 channel TTL interface
- RoHS and Halogen-Free Compliance

1.3 Applications

- Personal Navigation Device
- Multimedia applications and Others AV system

1.4 General information

Item		Specification	Unit
Outline Dimension		121 x 76 x 3.4 (Typ.)	mm
Display area		110(H)x68(V)	mm
Number of Pixel		800 RGB (H) x 480(V)	pixels
Pixel pitch		0.135(H) x 0.135(V)	mm
Pixel arrangement		RGB Vertical stripe	
Display mode		Normally white	
Surface treatment		Antiglare, Hard-Coating (3H)	
Weight		66 (Typ.)	g
Back-light		LED Side-light type	
Power Consumption	Logic System	0.7 (Max.)	W
	B/L System	0.98 (Max.)	W

1.5 Mechanical Information

Item		Min.	Typ.	Max.	Unit
Module Size	Horizontal (H)	121	121	121.3	mm
	Vertical (V)	75.85	76	76.25	mm
	Depth (D)	-	3.4	3.7	mm
Weight (Without inverter)		-	66	-	g

2.1 Electrical Absolute Rating

2.1.1 TFT LCD Module

Item	Symbol	Min.	Max.	Unit	Note
Power supply voltage	V_{DD}	-0.5	5.0	V	GND=0
Logic Signal Input Level	V_i	-0.3	$V_{DD} + 0.3$	V	

2.1.2 Back-Light Unit

Item	Symbol	Typ.	Max.	Unit	Note
LED current	I_L	40	-	mA	(1)(2)(3)
LED voltage	V_L	23.1	-	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) $T_a = 25 \pm 2^\circ\text{C}$
- (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	$^\circ\text{C}$	
Storage Temperature	T_{stg}	-30	80	$^\circ\text{C}$	

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Contrast		CR	$\Theta=0$ Normal Viewing Angle	480	600	—		(1)(2)
Response time	Rising	T _R		—	2	4	msec	(1)(3)
	Falling	T _F		—	6	12		
White luminance (Center)		Y _L		320	400	—	cd/m ²	(1)(4)(7) (I _c =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	CR>10	65	75	—		
		Θ _R		65	75	—		
	Ver.	Θ _U		50	60	—		
		Θ _D		60	70	—		
Brightness uniformity		B _{UNI}	Θ=0	70	—	—	%	(5)(7)
Optima View Direction		6 O' clock						(6)

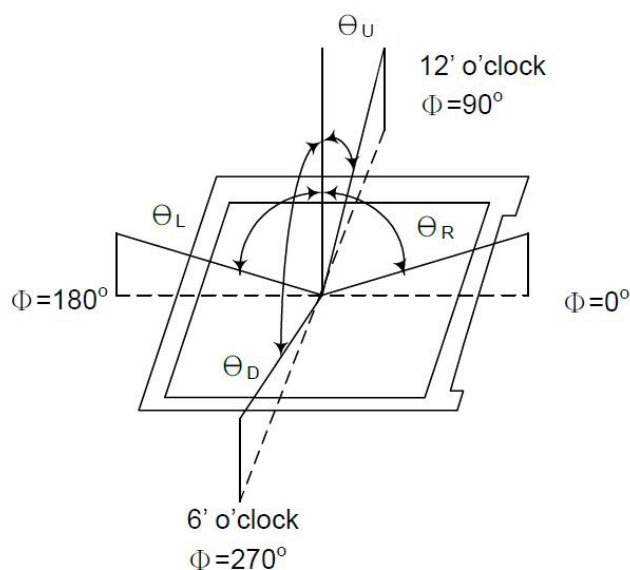
3.2 Measuring Condition

- Measuring surrounding: dark room
- LED current I_L : 40mA
- Ambient temperature: $25\pm 2^\circ\text{C}$
- 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 ~ 21m

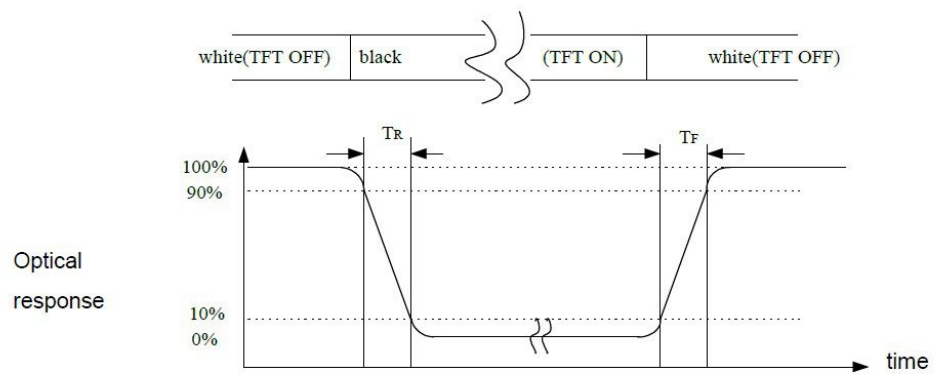
Note (1) Definition of Viewing Angle:



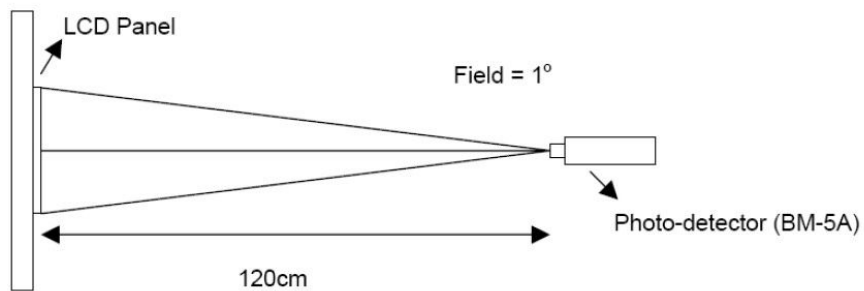
Note (2) Definition of Contrast Ratio (CR):
Measured at the center point of panel

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

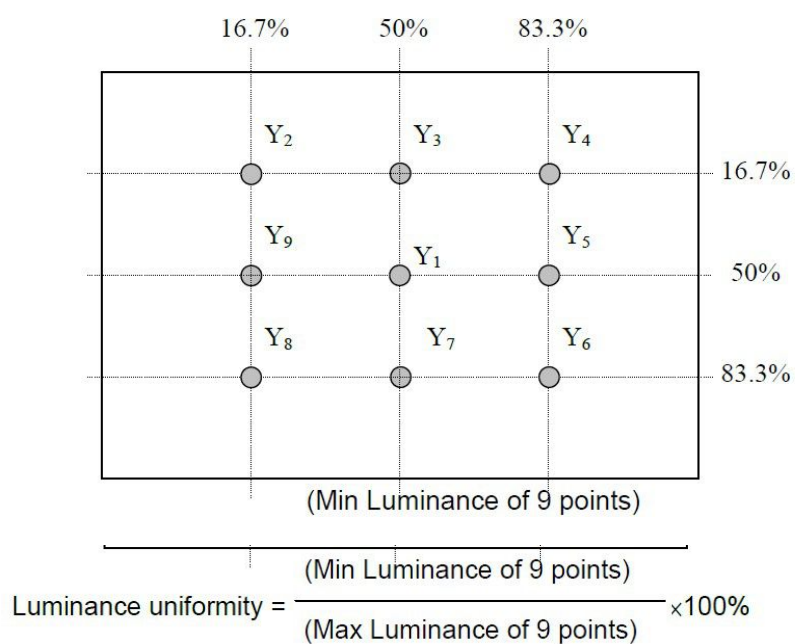
Note (3) Definition of Response Time: Sum of T_R and T_F



Note (4) Definition of optical measurement setup

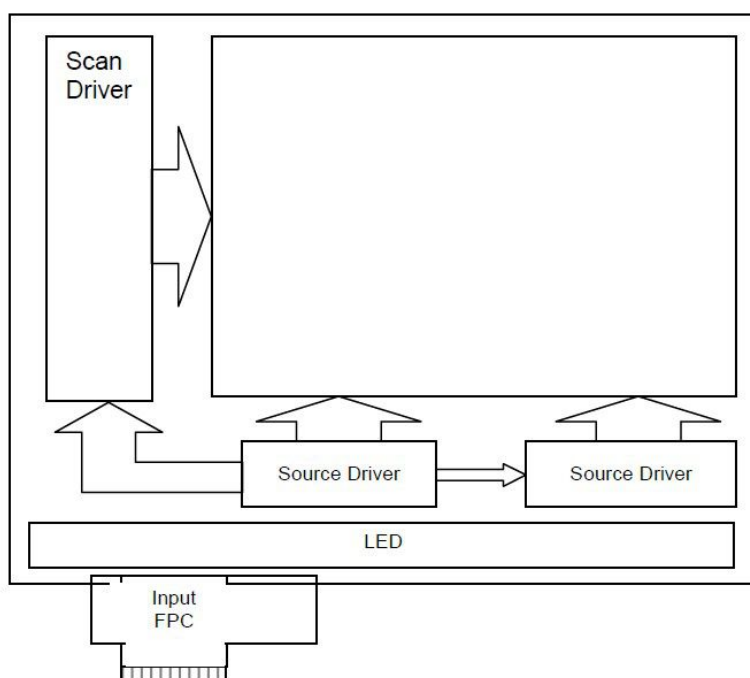


Note (5) Definition of brightness uniformity

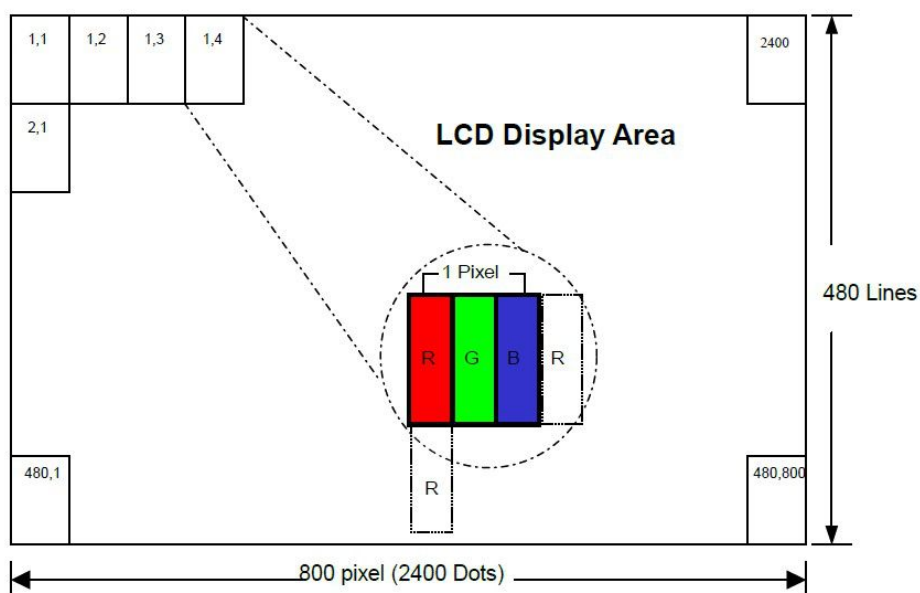


Note (6) Rubbing Direction (The different Rubbing Direction will cause the different optima view direction.

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



4.2 Pixel Format



5.0 INPUT INTERFACE PIN ASSIGNMENT

FPC connector is used for electronics interface.

The recommended model is FH19SC-40S-0.5SH (51) 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	DGND	I	Digital 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

6.0 ELECTRICAL CHARACTERISTICS

6.1 TFT LCD Module

Item	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}	-	-	220	mA	$V_{DD} = 3.3V$

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

Note (2): GND=0V

6.2 Back-Light Unit

The backlight system is an edge-lighting type with 14 LED.

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

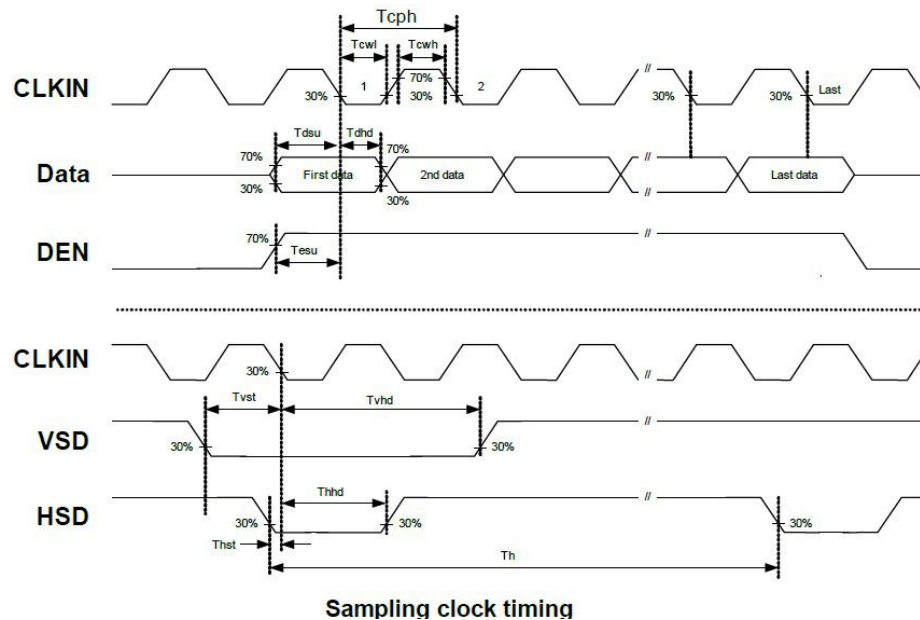
Item	Symbol	Min.	Typ.	Max.	Unit	Note
LED current	IL	-	40	-	mA	(2)
LED voltage	VL	-	23.1	-	V	
Operating LED life time	Hr	10000	-	-	Hour	(1)(2)

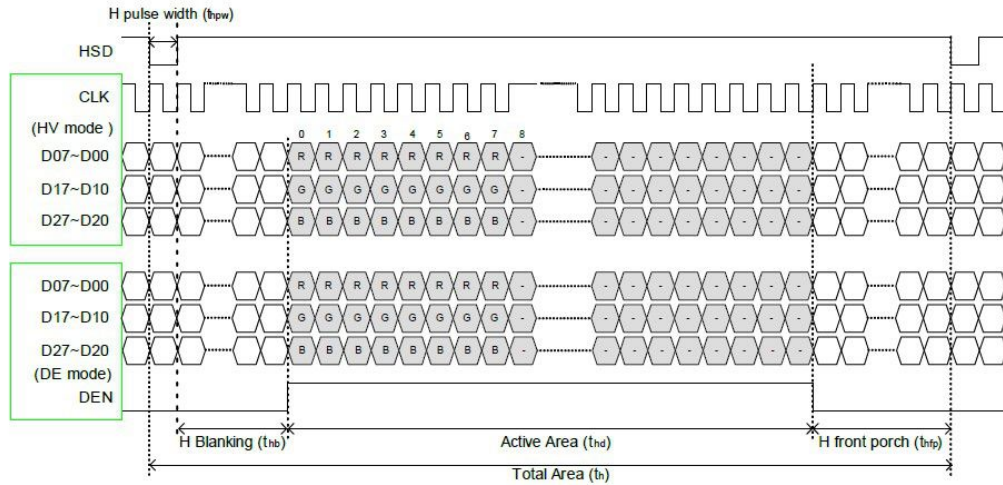
Note (1) LED life time (Hr) can be defined as the time in which it continues to operate under the condition: $T_a = 25 \pm 3^\circ C$, typical IL value indicated in the above table until the brightness becomes less than 50%.

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

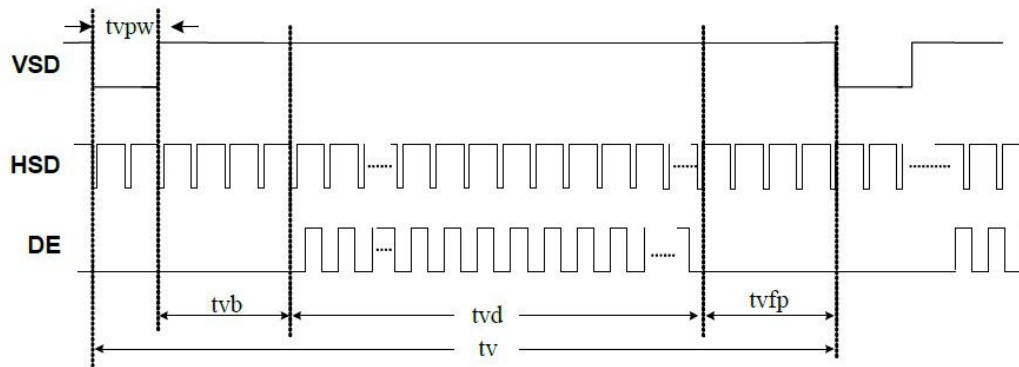
Item	Symbol	Min.	Typ.	Max.	Unit	Note
DCLK cycle time	Tclk	25			ns	
DCLK frequency	fclk		33	40	MHz	
DCLK pulse duty	Tcwh	40	50	60	%	
VSYNC setup time	Tvst	8			ns	
VSYNC hold time	Tvhd	8			ns	
HSYNC setup time	Thst	8			ns	
HSYNC hold time	Thhd	8			ns	
Data setup time	Tdasu	8			ns	
Data hold time	Tdahd	8			ns	
DE setup time	Tdesu	8			ns	
DE hold time	Tdehd	8			ns	
Horizontal display area	Thd		800		Tcph	
HSYNC period time	Th		928		Tcph	

HSYNC width	Thwh	1	48		Tcph	
HSYNC back porch	Thbp		40		Tcph	
HSYNC front porch	Thfp		40		Tcph	
Vertical display area	Tvd		480		th	
VSYNC period time	Tv		525		th	
VSYNC width	Tvwh		3		th	
VSYNC back porch	Tvbp		29		th	
VSYNC front porch	Tvfp		13		th	



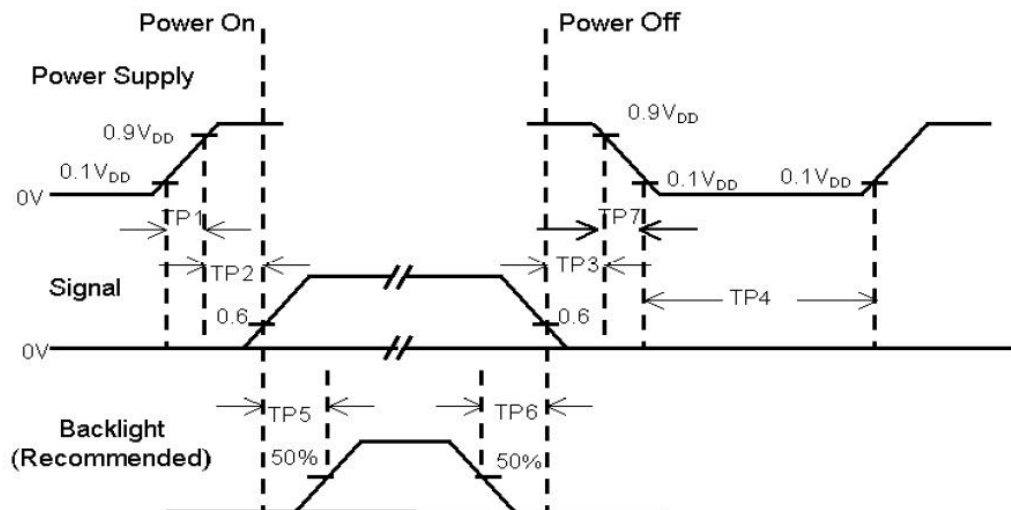


Horizontal display timing range



Vertical timing

6.5 Power Sequence



Item	Min.	Typ.	Max.	Unit	Remark
TP1	0.5	--	10	msec	
TP2	0	--	50	msec	
TP3	0	--	50	msec	
TP4	1000	--	--	msec	
TP5	200	--	--	msec	
TP6	200	--	--	msec	
TP7	0.5	--	10	msec	

Note : (1) The supply voltage of the external system for the module input should be the same as the definition of V_{DD} .

(2) Apply the lamp voltage within the LCD operation range. When the back-light turns on before the LCD operation or the LCD turns off before the back-light turns off, the display may momentarily become white.

(3) In case of V_{DD} = off level, please keep the level of input signal on the low or keep a high impedance.

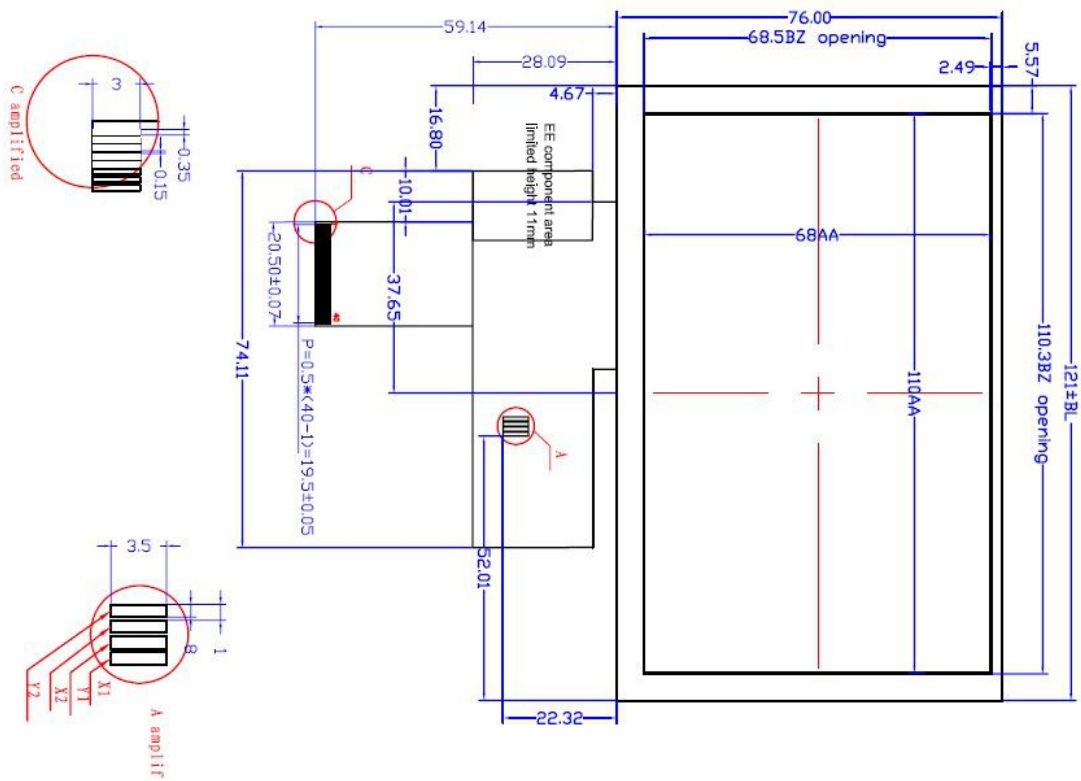
(4) TP4 should be measured after the module has been fully discharged between power off and on period.

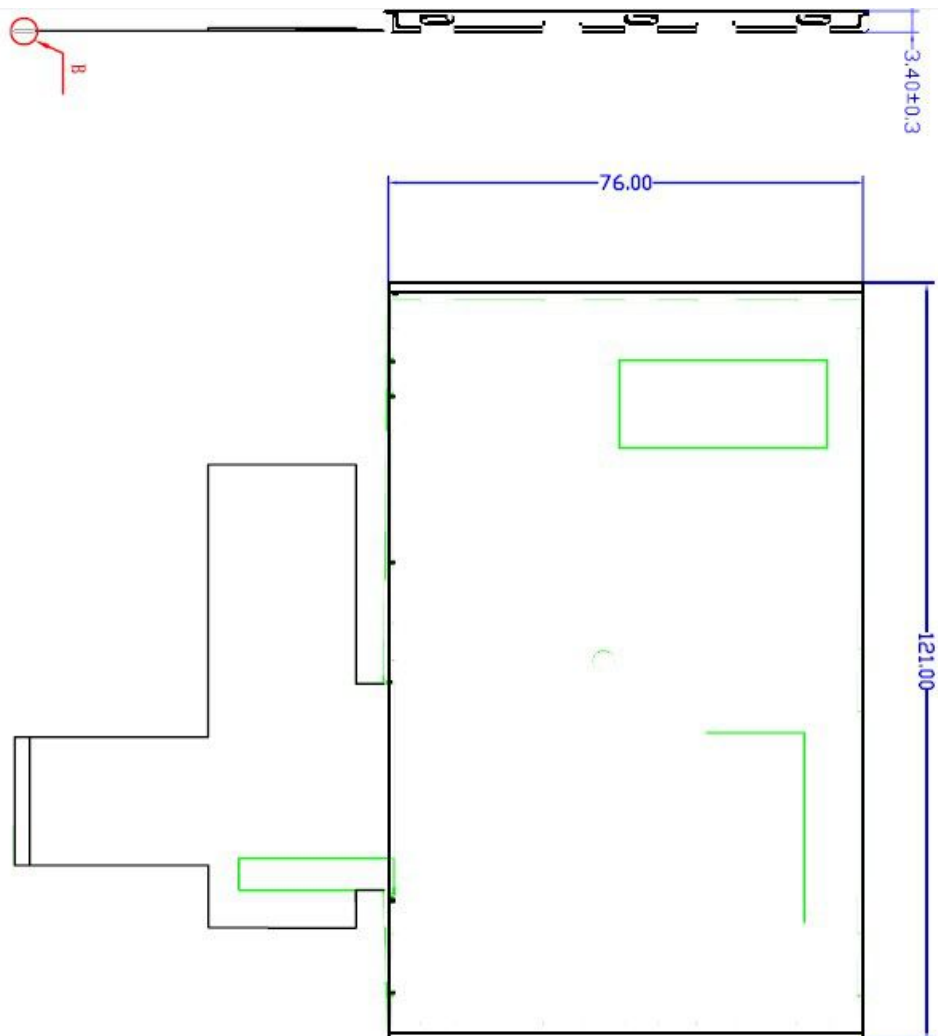
(5) Interface signal shall not be kept at high impedance when the power is on.

7.0 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 LOT MARK

9.1 Lot Mark

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
---	---	---	---	---	---	---	---	---	----	----	----	----	----	----

code 1,2,3,4,5,6: STARTEK internal flow control cde.

code 7: production location.

code 8: production year.

code 9: production month.

code 10,11,12,13,14,15: serial number.

Note (1) Production Year: Code 8 is defined by the last number of the year, for example

Year	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Mark	1	2	3	4	5	6	7	8	9	0

Note (2) Production Month

Month	Jan.	Feb.	Mar.	Apr.	May.	Jun.	Jul.	Aug.	Sep.	Oct	Nov.	Dec.
Mark	1	2	3	4	5	6	7	8	9	A	B	C

9.2 Location of Lot Mark

- (1) Location: The label is attached to the backside of the LCD module. See Section 8.0 OUTLINE DIMENSION).
- (2) Detail of the Mark: as attached below.
- (3) This is subject to change without prior notice.

10.0 PACKAGE SPECIFICATION

10.1 Packing form

LCM Model	LCM Qty. in the box	Inner Box Size (mm)	Notice
KD050C-1	200	466x242x304	

10.2 Packing assembly drawings

