

LIQUID CRYSTAL DISPLAY MODULE

**4.3" WVGA (800 x RGB x 480) TFT**

**Product Code: 43WVF0H-0**

**Product Specification**

APPROVAL



**Seiko Instruments Inc.**

Mobile Display Division

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## History of Revision

Revision	Contents	Date	In Charge
a	First publication	Oct. 09, 2007	K.Hayashi
b	P.4: Change description "Viewing direction"    "Viewing angle" P.11: Change description "Range of viewing angle" P.11: Modify Figure "Definition of   ,   ", "Definition of contrast C" P.13: Add description "7-2 Criteria"	Nov. 12, 2007	K.Hayashi
c	P.4: Error corection Module size "3.35mm(t)"    "3.27mm(t)" P.4: Changed Weight: "(TBD)g"    "(50.6)g" P.7: Changed Current consumption: IDVDD: "(TBD)max."    "(9.1)max." IAVDD: "(41)typ./ (TBD)max."    "(36.5)typ./ (52.8)max." P.8: Changed Parallel RGB Input Timing Characteristics Clock frequency: "10 min"    "- min." P.11: Changed Contrast ratio: "(TBD)min."    "(300)min." P.11: Changed Color: White x: "(0.28)min./ (0.33)typ./ (0.38)max" White y: "(0.30)min./ (0.35)typ./ (0.40)max" Red x: "(0.55)min./ (0.60)typ./ (0.65)max" Red y: "(0.30)min./ (0.35)typ./ (0.40)max" Green x: "(0.29)min./ (0.34)typ./ (0.39)max" Green y: "(0.52)min./ (0.57)typ./ (0.62)max" Blue x: "(0.10)min./ (0.15)typ./ (0.20)max" Blue y: "(0.07)min./ (0.12)typ./ (0.17)max" P.11: Changed NTSC ratio: "(TBD)min."    "(45)min." P.12: Changed Brightness: "(TBD)min./ (TBD)typ."    "(250)min./ (350)typ." P.12: Changed Uniformity: "(TBD)min."    "(70)min." P.15: Added "9. Packing Specifications"	May. 15, 2008	Y.Fujino
d	P.4: Changed model number of SII: "RA158Z"    "RA158Z20" P.4: Changed drawing No: "RA158Z 1A"    "RA158Z20 1A" P.7: Deleted product name of LED P.15: Changed "9-4 Packing process"	Oct. 2, 2008	Y.Fujino
1.0	P.4: Changed model number of SII: "RA158Z20"    "43WVF0H-0" P.4: Changed drawing No: "RA158Z20 1A"    "43WVF0H-0 1A" P.14: Modify "8-5 Storage". P.--: Deleted "( )", "TBD", "preliminary"	Apr. 21, 2009	A.Uehata

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## 1. General

### SPECIFICATIONS ARE SUBJECT TO CHANGE WITHOUT ANY NOTICE.

#### 1-1 Application

This specification applies to the LCD module designated 43WVF0H-0 LCD to be delivered from Seiko Instruments Inc. (hereinafter "SII").

#### 1-2 Name of product, model number

Name of product: LCD module

Model number of SII: 43WVF0H-0

#### 1-3 Mechanical Dimensions

Please refer to drawing No "43WVF0H-0 1A".

#### 1-4 Quality Assurance Standard

Quality assurance standard should be based on the Delivery Inspection Standard.

#### Note:

( ): Target value for sample production. Might be modified after evaluation of sample.

TBD: To Be Determined after evaluation of sample.

## 2. Product specifications

This product is LCD module with 4.3inch WVGA (800RGB x 480 dots) LCD module.

### 2-1 Basic Specifications

Module size:	106mm(W)x69.8mm(H)x3.27mm(t) (except FPC length)
Active area:	93.6mm(W)x56.16mm(H)
Dot pitch:	0.039mmx0.117mm, 217dpi
Weight:	50.6 g typ.
Display size:	4.3 inch
Number of pixels:	800RGBx480 dots
Dot layout:	Vertical stripes
Interface:	24bit Parallel RGB
Number of colors:	16,777,216 colors
Display mode:	FFS Mode, Transmissive Mode, Normally Black
Viewing angle(U/D/R/L):	80/80/80/80 (@CR≥10)
Drive method:	Line inversion
Back Light Unit:	Bottom edge type, 10-LEDs, Serial
Operating temperature:	From -20 to +60 °C (dry)
Storage temperature:	From -30 to +70 °C (dry)

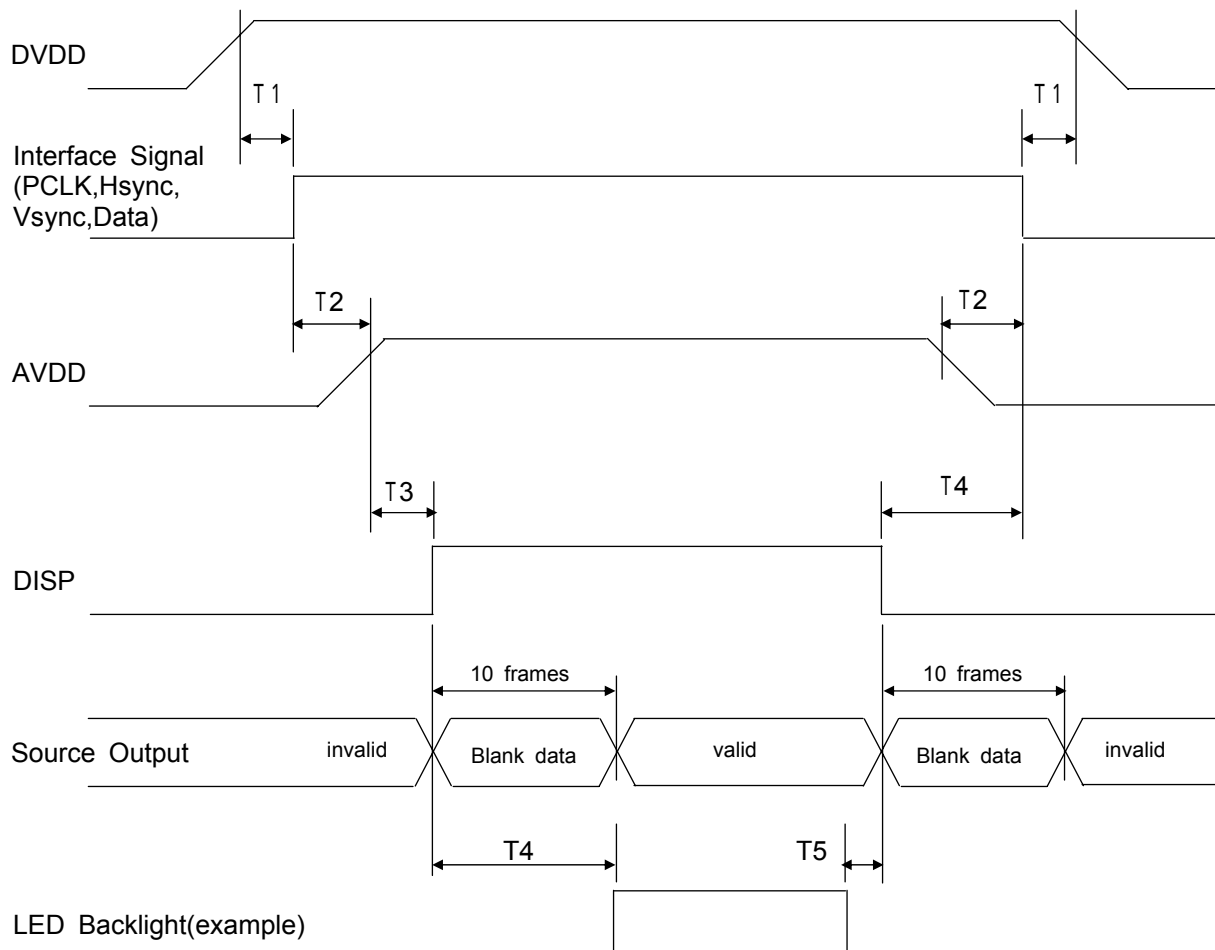
## 2-2 Interface

No.	Symbol	Description
1	VSS	Ground: 0V
2	VSS	Ground: 0V
3	DVDD	Digital power supply: 3.3V(Typ.)
4	DVDD	Digital power supply: 3.3V(Typ.)
5	R0	Red data(LSB)
6	R1	Red data
7	R2	Red data
8	R3	Red data
9	R4	Red data
10	R5	Red data
11	R6	Red data
12	R7	Red data(MSB)
13	G0	Green data(LSB)
14	G1	Green data
15	G2	Green data
16	G3	Green data
17	G4	Green data
18	G5	Green data
19	G6	Green data
20	G7	Green data(MSB)
21	B0	Blue data(LSB)
22	B1	Blue data
23	B2	Blue data
24	B3	Blue data
25	B4	Blue data
26	B5	Blue data
27	B6	Blue data
28	B7	Blue data(MSB)
29	VSS	Ground: 0V
30	PCLK	Dot clock: Data sampling at the PCLK falling edge
31	DISP	Display On/Off: Low active
32	HSYNC	Horizontal sync input with negative polarity
33	VSYNC	Vertical sync input with negative polarity
34	DE	Data enable input with positive polarity
35	AVDD	Analog power supply: 5.0V(Typ.)
36	AVDD	Analog power supply: 5.0V(Typ.)
37	VSS	Ground:0V
38	VSS	Ground:0V
39	VLED-	LED backlight power supply: cathode
40	VLED+	LED backlight power supply: anode

### 3. Recommended Power ON/OFF Sequence

#### 3-1 Power ON/OFF Sequence

To prevent the device damage from latch up or DC operation, the Power ON/OFF Sequence shall be as shown in below.



Parameter	Specification	unit
T1	$0 < T1 < 50$	ms
T2	$0 < T2 < 50$	ms
T3	$0 < T3 < 50$	ms
T4	$170 (10 \text{ frames}) < T4$	ms
T5	$0 < T5$	ms

#### NOTE:

When DISP pin is pulled "H", blank data is output for 10 frames first, from the falling edge of the following VSYNC signal. Similarly, when DISP is pulled "L", 10 frames of blank data will be output from the falling edge of the following VSYNC, too.

## 4. Electrical Characteristics

### 4-1 Absolute Maximum Rating

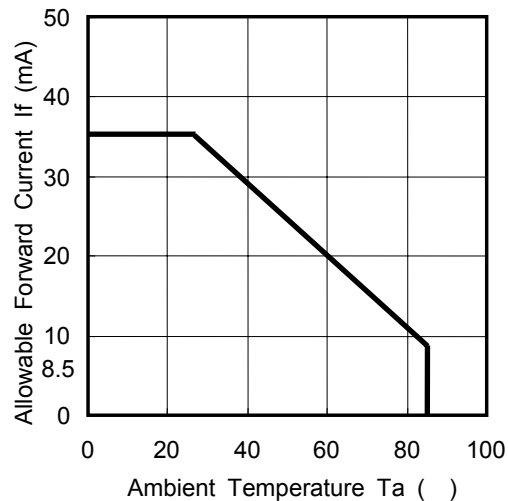
VSS=0V

Item		Symbol	Standard	Unit	Remark
Supply Voltage		DVDD	-0.3 to +5.0	V	
		AVDD	-0.3 to +5.5		
Backlight LED	DC forward current	If	35	mA	*1,2
	Reverse voltage	Vr	5	V	*2
	Power dissipation	Pd	123	mW	*2
Storage temperature range		Tstg	-30 to +70	°C	Dry
Operating temperature range		Top	-20 to +60	°C	Dry

Note: Use over the absolute maximum rating might affect reliability and might cause malfunction.

\*1: Ambient Temperature vs. Allowable Forward Current

\*2: Apply to 1 LED. Backlight consists of 10 LEDs.



### 4-2 Electrical Characteristics

VSS=0V, Ta=25 degree C

Item	Symbol	Min.	Typ.	Max.	Unit	Remark
Power supply voltage	DVDD	2.25	3.3	3.6	V	
	AVDD	4.8	5.0	5.2	V	
Current consumption	IDVDD	-	6.3	9.1	mA	*1
	IAVDD	-	36.5	52.8	mA	
Input high voltage	VIH	0.7DVDD	-	DVDD	V	
Input low voltage	VIL	0	-	0.3DVDD	V	
LED forward voltage	Vf	-	3.2	3.5	V	*2
LED current	IF	-	20	-	mA	

\*1: DVDD=3.3V, AVDD=5.0V, fclk=33.5MHz, 1/tv=60Hz, All white pattern.

\*2: IF=20mA. Apply to 1 LED.

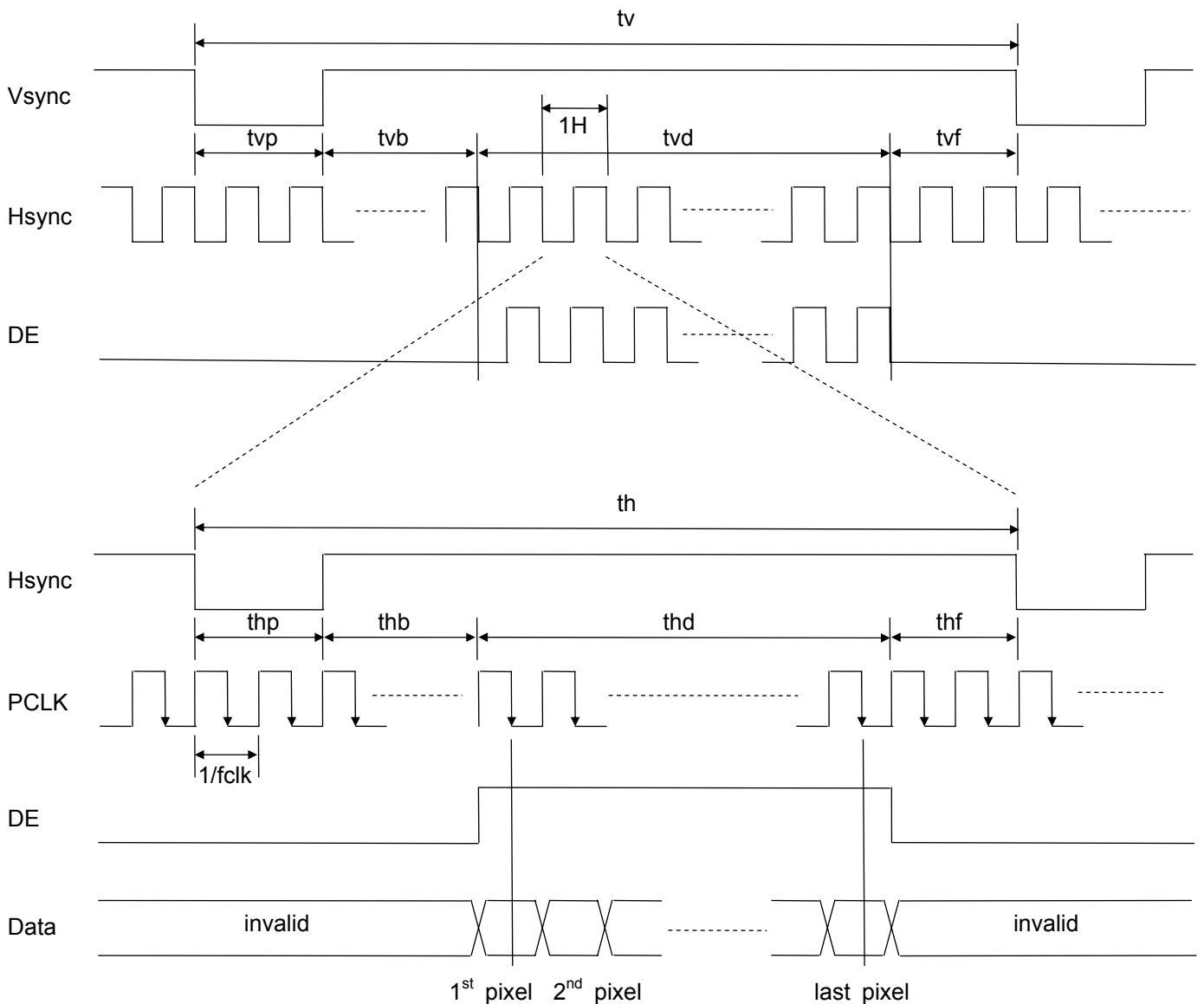
4-3 Parallel RGB Input Timing Characteristics

VSS=0V, DVDD=3.3V, AVDD=5.0V, Ta=25 degree C

Item	Symbol	Min.	Typ.	Max.	Unit	Remarks
Clock frequency	fclk	-	33.5	50	MHz	*1
Hsync cycle	1/th	-	31.5	-	KHz	*1
Vsync cycle	1/tv	-	60	-	Hz	*1
Horizontal cycle	th	-	1063	-	CLK	*1
Horizontal display period	thd	-	800	-	CLK	
Horizontal front porch	thf	-	164	-	CLK	*1
Horizontal pulse width	thp	-	10	-	CLK	*1
Horizontal back porch	thb	-	89	-	CLK	*1
Vertical cycle	tv	-	523	-	H	*1
Vertical display period	tvd	-	480	-	H	
Vertical front porch	tvf	-	10	-	H	*1
Vertical pulse width	tvp	-	10	-	H	*1
Vertical back porch	tvb	-	23	-	H	*1

Note: Unit CLK=1/fclk, H=th

\*1: Please change the value to fit on your system.



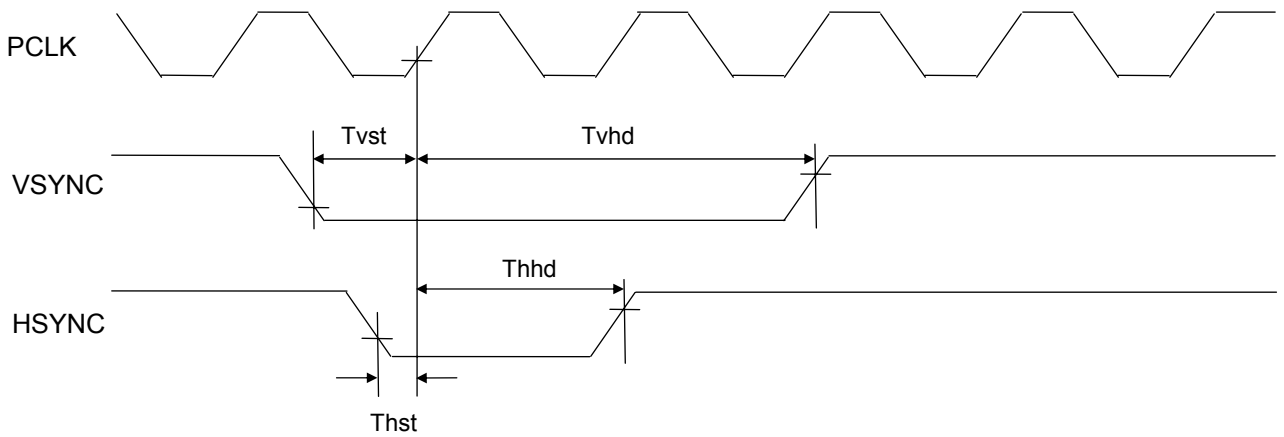
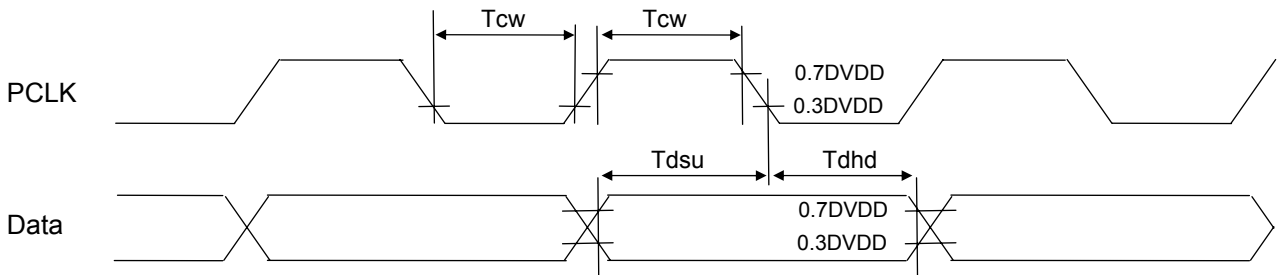
NOTE: Data sampling at the PCLK falling edge.



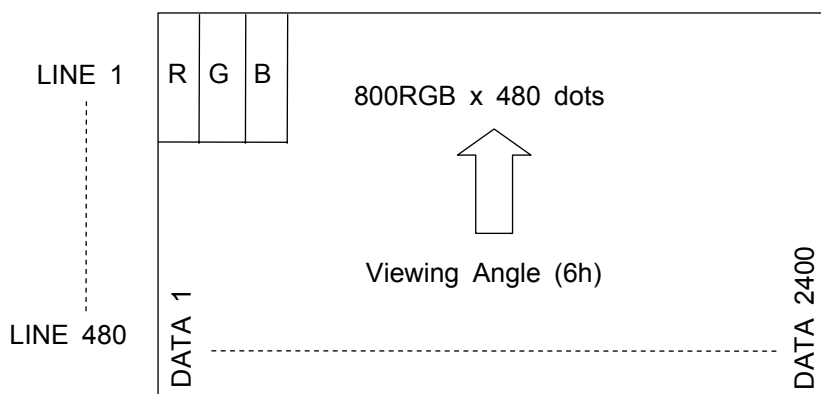
4-4 AC Timing Characteristics

VSS=0V, DVDD=3.3V, AVDD=5.0V, Ta=25 degree C

Item	Symbol	Min.	Typ.	Max.	Unit
PCLK pulse width	Tcw	8	-	-	ns
Vsync setup time	Tvst	12	-	-	ns
Vsync hold time	Tvhd	12	-	-	ns
Hsync setup time	Thst	12	-	-	ns
Hsync hold time	Thhd	12	-	-	ns
Data setup time	Tdsu	4	-	-	ns
Data hold time	Tdhd	2	-	15	ns



4-5 Pixel Data Format



4-6 Input Data Signal and Each Colors

DISPLAY		INPUT DATA SIGNAL																							
		R7	R6	R5	R4	R3	R2	R1	R0	G7	G6	G5	G4	G3	G2	G1	G0	B7	B6	B5	B4	B3	B2	B1	B0
BASIC COLOR	BLACK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	BLUE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	GREEN	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	CYAN	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	RED	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	MAGENTA	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	YELLOW	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
WHITE	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
GRAY SCALE OF RED	BLACK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	↑	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	dark	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	↑																								
	↓																								
	light	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
↓	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
RED	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
GRAY SCALE OF GREEN	BLACK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	↑	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	
	dark	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	
	↑																								
	↓																								
	light	0	0	0	0	0	0	0	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0	
↓	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0		
GREEN	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0		
GRAY SCALE OF BLUE	BLACK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	↑	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	
	dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	
	↑																								
	↓																								
	light	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	1	
↓	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0		
BLUE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1		
GRAY SCALE OF WHITE	BLACK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	↑	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	
	dark	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	
	↑																								
	↓																								
	light	1	1	1	1	1	1	0	1	1	1	1	1	1	0	1	1	1	1	1	1	1	0	1	
↓	1	1	1	1	1	1	1	0	1	1	1	1	1	1	0	1	1	1	1	1	1	1	0		
WHITE	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1		

NOTE: 0 = Low level voltage, 1 = High level voltage

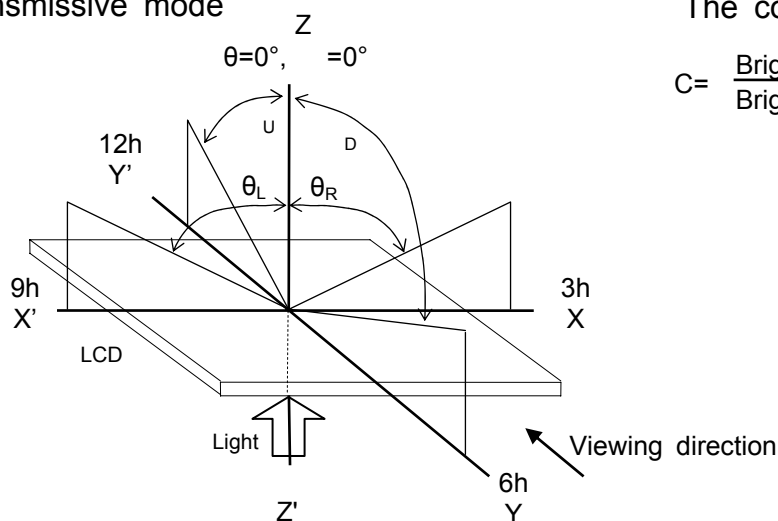
### 5. LCD Optical Characteristics

VSS=0V, DVDD=3.3V, AVDD=5.0V, fclk=33.5MHz, 1/tv=60Hz, IF=20mA, Ta=25 degreeC

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Contrast ratio	C	$\theta=0^\circ, \phi=0^\circ$	300	400	-	-
Range of viewing angle ( $\phi:6h-12h$ )	U	C $\geq$ 10	-	80	-	degree
	D		-	80	-	
Range of viewing angle ( $\theta:3h-9h$ )	$\theta_R$		-	80	-	
	$\theta_L$		-	80	-	
Color	White	x	0.28	0.33	0.38	-
		y	0.30	0.35	0.40	-
	Red	x	0.55	0.60	0.65	-
		y	0.30	0.35	0.40	-
	Green	x	0.29	0.34	0.39	-
		y	0.52	0.57	0.62	-
	Blue	x	0.10	0.15	0.20	-
		y	0.07	0.12	0.17	-
NTSC ratio		↑	45	50	-	%
B/W Response time	Ton+ Toff	$\theta=0^\circ, \phi=0^\circ$	-	35	50	msec

#### \*Definition of $\theta, \phi$

Transmissive mode



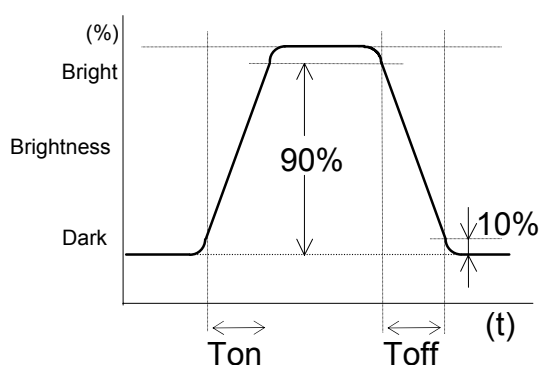
#### \*Definition of contrast C

The contrast ratio is defined as follows:

$$C = \frac{\text{Brightness of selected position(white)}}{\text{Brightness of unselected position(black)}}$$

#### \*Definition of response time (Ton, Toff)

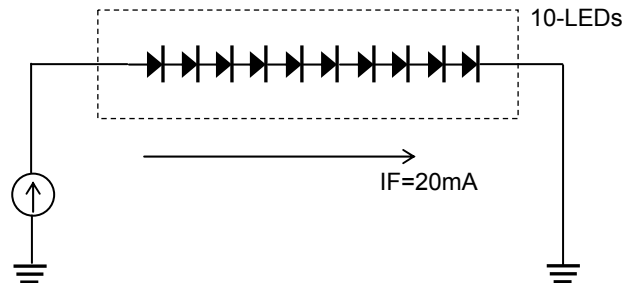
The response time is defined as the following figure.



## 6. LED Backlight Characteristics

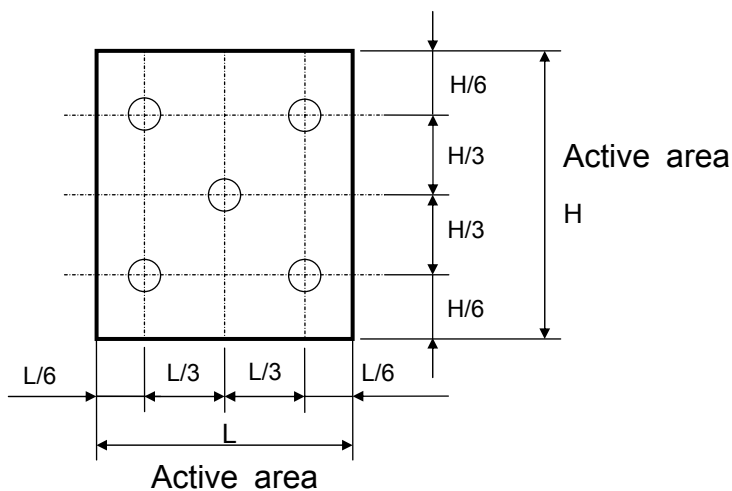
Item	Symbol	Condition	Min.	Typ.	Max.	unit
Brightness *1 *2 *3	$B_p$	$T_a=25^{\circ}\text{C}\pm 3^{\circ}\text{C}$	250	350	-	$\text{cd}/\text{m}^2$
Uniformity *1 *2 *4	$\Delta B_p$	30-80%RH	70	-	-	%

Note: Due to the dispersion of  $V_f$ , the fixed voltage supply can not control the brightness of LED. Therefore, SII strongly recommends using the constant current power supply.



- \*1 The data is measured after LEDs are turned on for 5 minutes.
- \*2 Tester: BM-7 ( TOPCON ) ; spot size= $1^{\circ}$ field ; Distance= $500\text{mm}$   
Conditions  
LED backlight power supply :  $20\text{mA}$   
LCD: White color
- \*3 Brightness in the center of the LCD panel.
- \*4 Definition of Uniformity ( $\Delta B_p$ )  
 $\Delta B_p = B_p (\text{Min.}) / B_p (\text{Max.}) \times 100[\%]$   
 $B_p (\text{max.}) =$  Maximum brightness in 5 measurement spots (refer to below chart).  
 $B_p (\text{Min.}) =$  Minimum brightness in 5 measurement spots (refer to below chart).

Measurement spots ( 5 spots )



## 7. Reliability

SII will develop engineering samples that meet the reliability level in mass production.

### 7-1 Reliability levels

Test Items	Condition
High temperature storage	+70°C±3°C, for 240 hours *Measure after 12hours left at normal temperature and humidity.
Low temperature storage	-30°C±3°C for 240 hours *Measure after 12hours left at normal temperature and humidity.
Operation at high temperature	+60°C±3°C, 30%RH max for 240 hours *Measure after 12hours left at normal temperature and humidity.
Operation at low temperature	-20°C±3°C, for 240 hours *Measure after 12hours left at normal temperature and humidity.
Operation at high temperature and high humidity	+40°C±3°C, 90%RH max. (no condensation) for 240 hours *Measure after 12hours left at normal temperature and humidity.
Temperature cycle storage	<p>70°C±3°C</p> <p>-30°C±3°C</p> <p>t1=30min t2=5min</p> <p>First cycle      Second cycle</p> <p>Repeat 5 cycles *Measure after 12hours left at normal temperature and humidity</p>
Vibration	Sweep at 10Hz to 50Hz, amplitude 1.5mm for 2 hours each in X, Y, and Z directions. Apply shipping package to this test.
Mechanical shock	Drop onto the tiled floor from 60 centi meter heights, 6 faces. Apply shipping package to this test.
ESD	<p>1) 200V max. under below condition. (EIA Standard: MM) 2) 1000V max. under below condition. (EIA Standard: HBM) ( Each terminal on I/F.)</p> <p>R=0 C=200pF</p> <p>R=1500 C=100pF</p> <p>LCD MODULE</p> <p>VDD or VSS</p>

### 7-2 Criteria

- |                                 |  |
|---------------------------------|--|
| (1) Functional characteristics: | No abnormalities.  |
| (2) Display characteristics:    | Satisfy the original standard.<br>No uneven contrast, No bubble, No blur, etc. |
| (3) Electrical characteristics: | Satisfy the original standard.   |
| (4) Appearance:                 | No relief, etc at joint.   |

## 8. Handling Precautions

### 8-1 Operation

Burn-in sometimes happens when the same character was displayed at along time. Therefore, to prevent Burn-in, SII recommended to set up a Screen-saver function.

### 8-2 Safety

**DO NOT** put it in your mouth in case LCD panel has broken. If the liquid crystal touches your skin or clothes, wash it off immediately using soap and water.

### 8-3 Handling

- (1) The LCD panel is plate glass. **DO NOT** subject the panel to mechanical shock or to excessive force on its surface.
- (2) The polarizer attached to the display is very easy to damage, handle it with care to avoid scratching.
- (3) To avoid contamination on the display surface, **DO NOT** touch the display surface with bare hands.
- (4) Provide a space so that the LCD panel does not come into contact with other components.
- (5) To protect the LCD panel from external pressure, put covering glass (acrylic board or similar board) to keep appropriate space between them.
- (6) Transparent electrodes may be disconnected if you use the LCD panel under environmental conditions where dew condensation occurs.
- (7) Property of semiconductor devices may be affected when they are exposed to light possibly resulting in malfunctioning of the ICs.  
To prevent such malfunctioning of the ICs, your design and mounting layout done are so that the IC is not exposed to light in actual use.

### 8-4 Static Electricity

- (1) Ground soldering iron tips, tools and testers when they operate.
- (2) Ground your body when handling the products.
- (3) **DO NOT** apply voltage to the input terminal without applying power supply.
- (4) **DO NOT** apply voltage that exceeds the absolute maximum rating.
- (5) Store the products in an anti-electrostatic container.

### 8-5 Storage

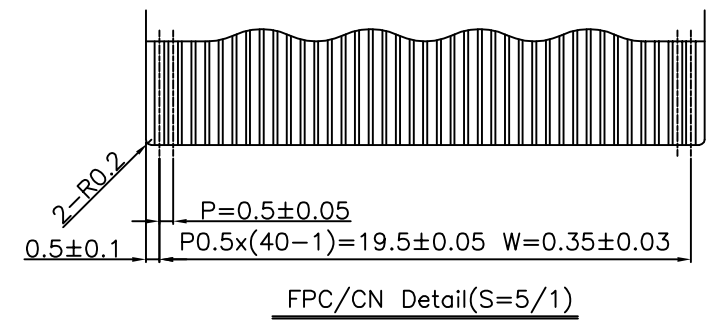
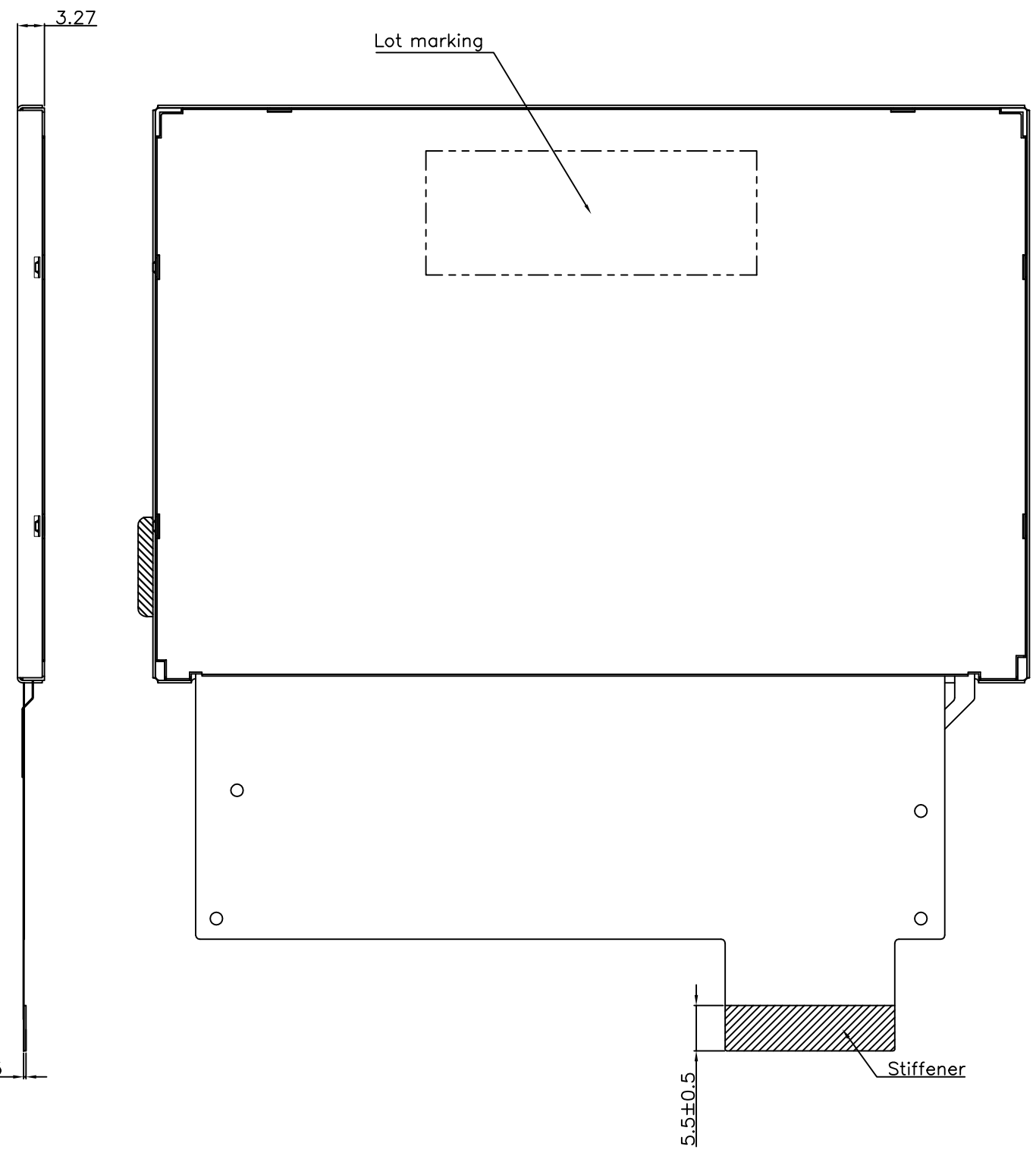
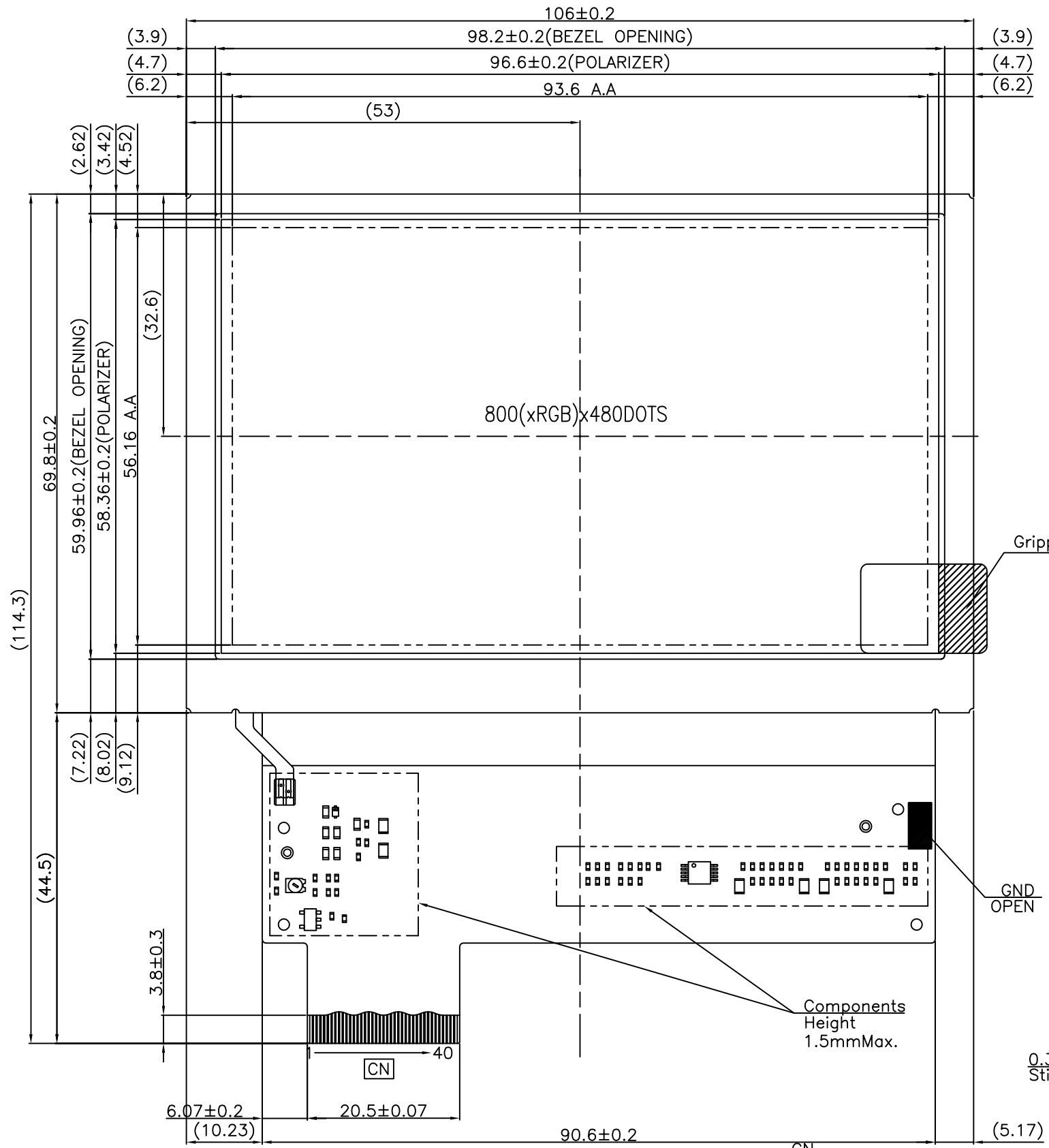
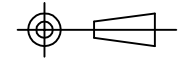
Store the products in a dark place at  $25\pm 10$  degree C, low humidity (65%RH or less). **DO NOT** store the products in an atmosphere containing organic solvents or corrosive gases.

### 8-6 Cleaning

- (1) **DO NOT** wipe the polarizer with dry cloth, as it might cause scratch.
- (2) Wipe the polarizer with a soft cloth soaked with petroleum IPA, other chemical might damage.

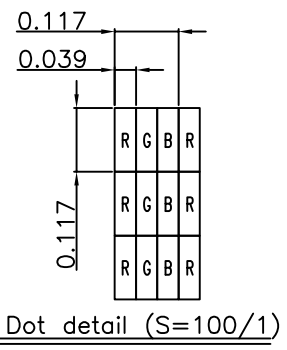
### 8-7 Waste

When dispose of LCD module, manage it as the production waste.



Note: Connector recommendation HIROSE FH12A-40S-0.5S

No.	Signal	No.	Signal
1	VSS	21	B0
2	VSS	22	B1
3	DVDD	23	B2
4	DVDD	24	B3
5	R0	25	B4
6	R1	26	B5
7	R2	27	B6
8	R3	28	B7
9	R4	29	VSS
10	R5	30	PCLK
11	R6	31	DISP
12	R7	32	HSYNC
13	G0	33	VSYNC
14	G1	34	DE
15	G2	35	AVDD
16	G3	36	AVDD
17	G4	37	VSS
18	G5	38	VSS
19	G6	39	VLED-
20	G7	40	VLED+



					MATERIAL			
					TREATMENT			
					PART NUMBER	SCALE(A2)	UNIT	DATE
					(1)	2/1	1=1mm	23.Feb,2009
					CAL. 43WVFOH-0			
					TITLE		REV. 1	
					Assembly drawing			
					DRAWING		PAGE 1	
					No. 43WVFOH-0 1A			
					Seiko Instruments Inc.			
ST09-080	1	Set up for mass production						
CHIEF	LEADER	DESIGNED	DRAWN	CHECKED				
K.Takahashi	M.Suzuki	M.Suzuki	M.Suzuki	A.Takenezawa				