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To:

Date: Mar, 10, 2009

## **HannStar Product Information** **(Formal)**

### **7" Color TFT-LCD Module**

Model: **HSD070I651-F\*\***

FPC & LED Cable Length (Option):

Option column	FPC & LED CABLE Length
	FPC 41.39 mm; LED CABLE 85mm
	FPC 72.30 mm; LED CABLE 120mm
	FPC 41.39 mm; LED CABLE 120mm

Please select FPC & LED CABLE Length at first column

- Note: 1.Please contact HannStar Display Corp. before designing your product based on this module specification.
- 2.The information contained herein is presented merely to indicate the characteristics and performance of our products. No responsibility is assumed by HannStar for any intellectual property claims or other problems that may result from application based on the module described herein.
- 3.The mark " \*\* " of Model means sub-model code.

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## Record of Revisions

Rev.	Date	Sub-Model	Description of change
1.0	Mar., 17, 2008	F00/ F01/ F10	Formal Product Specification was first issued.



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## 1.0 GENERAL DESCRIPTION

### 1.1 Introduction

HannStar Display model HSD070I651-F 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 7.0 (16:9) inch diagonally measured active display area with 1440 x 234 dot (480 horizontal by 234 vertical pixel) resolution.

### 1.2 Features

- 7 (16:9 diagonal) inch configuration
- Compatible with NTSC & PAL system
- Image Reversion: UP/DOWN and LEFT/RIGHT
- RoHS Compliance & Halogen-Free Compliance

### 1.3 Applications

- Digital Photo frame
- Portable DVD
- Multimedia applications and Others AV system

### 1.4 General information

Item		Specification	Unit
Outline Dimension		164.9 x 100 x 5.7 (Typ.)	mm
Display area		154.08(H) x 86.58(V)	mm
Number of Pixel		480 RGB (H) x234 (V)	pixels
Pixel pitch		0.321(H) x 0.370(V)	mm
Pixel arrangement		RGB Vertical stripe	
Display mode		Normally white	
Surface treatment		Antiglare, Hard-Coating (3H) with EWV film	
Weight		160 (Typ.)	g
Back-light		Side-Light type	
Power Consumption	Logic System	0.1(Max.)	W
	B/L System	1.2(Max.)	

### 1.5 Mechanical Information

Item		Min.	Typ.	Max.	Unit
Module Size	Horizontal (H)	164.6	164.9	165.2	mm
	Vertical (V)	99.7	100.0	100.3	mm
	Depth (D)	—	5.7	6.0	mm
Weight (Without inverter)		—	160	—	g

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## 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	DV <sub>DD</sub>	-0.3	6.0	V	GND=0
	AV <sub>DD</sub>	-0.3	6.0	V	AGND=0
Analog Signal Input Level V <sub>R</sub> , V <sub>G</sub> , V <sub>B</sub>		-0.2	AV <sub>DD</sub> +0.2	V	
Logic Signal Input Level V <sub>I</sub>		-0.3	DV <sub>DD</sub> +0.3	V	

Note: (1) Stresses above those listed under "Absolute Maximum Rating" may cause permanent damage to the device. These are stress ratings only. Functional operation of this device at indicated in the operational sections(6.1) of this specification.

#### 2.1.2 Back-Light Unit

Item	Symbol	Typ.	Max.	Unit	Note
LED current	I <sub>L</sub>	100	—	mA	(1) (2)(3)
LED voltage	V <sub>L</sub>	10.5	—	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℃

(3) Test Condition: LED current 100 mA. The LED lifetime could be decreased if operating I<sub>L</sub> is larger than 100mA.

### 2.2 Environment Absolute Rating

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

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### 3.0 OPTICAL CHARACTERISTICS

#### 3.1 Optical specification

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Contrast		CR	$\Theta=0$ Normal Viewing Angle	400	500	—		(1)(2)
Response time	Rising	T <sub>R</sub>		—	5	7	msec	(1)(3)
	Falling	T <sub>F</sub>		—	20	28		
White luminance (Center)		Y <sub>L</sub>		160	200	—	cd/m <sup>2</sup>	(1)(4) (I <sub>L</sub> =100mA)
Color chromaticity (CIE1931)	White	W <sub>x</sub>		0.260	0.310	0.360		(1)(4)
		W <sub>y</sub>		0.280	0.330	0.380		
Viewing angle	Hor.	Θ <sub>L</sub>	CR>10	60	70	—		
		Θ <sub>R</sub>		60	70	—		
	Ver.	Θ <sub>U</sub>		55	65	—		
		Θ <sub>D</sub>		55	65	—		
Brightness uniformity		B <sub>UNI</sub>	Θ=0	70	75	—	%	(5)
Optima View Direction		6 O' clock						(6)

#### 3.2 Measuring Condition

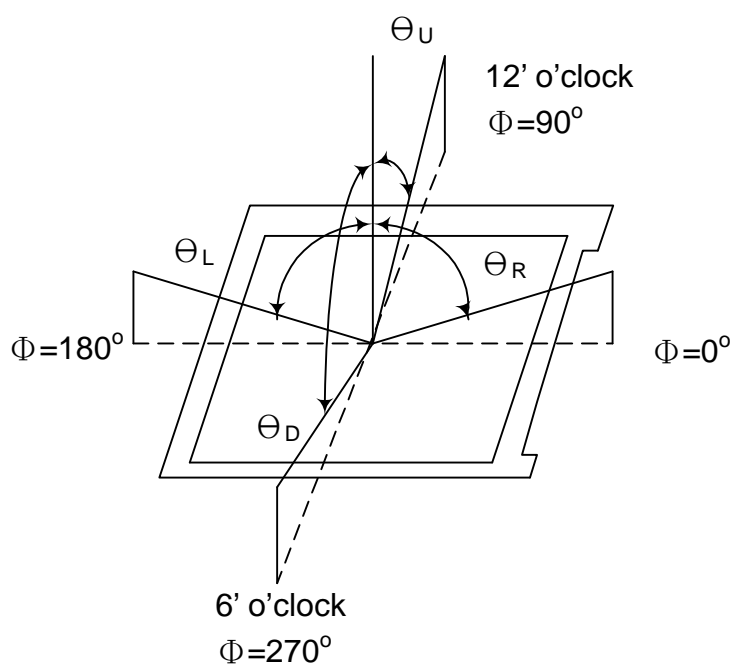
- Measuring surrounding: dark room
- LED current  $I_L$  : 100mA
- Ambient temperature: 25±2°C
- 15min. warm-up time.

#### 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 mm

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Note (1) Definition of Viewing Angle:



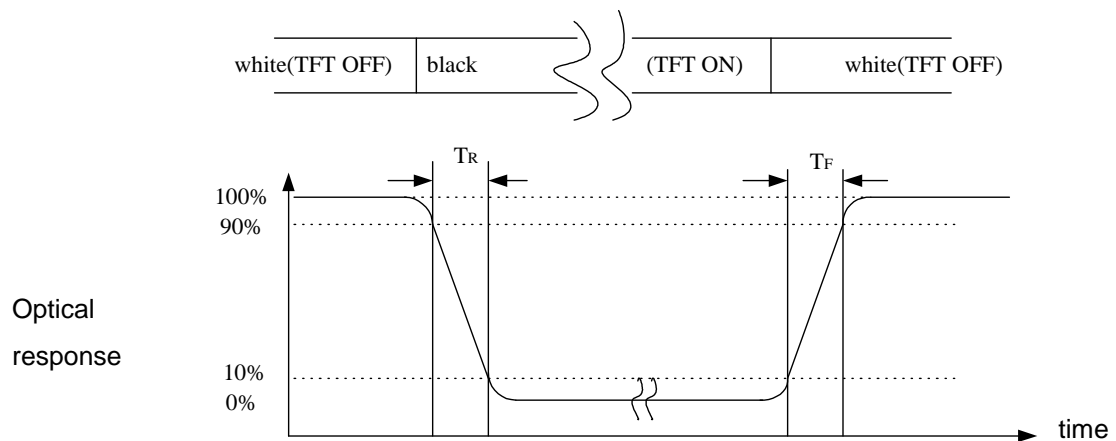
Note (2) Definition of Contrast Ratio (CR):

Measured at the center point of panel

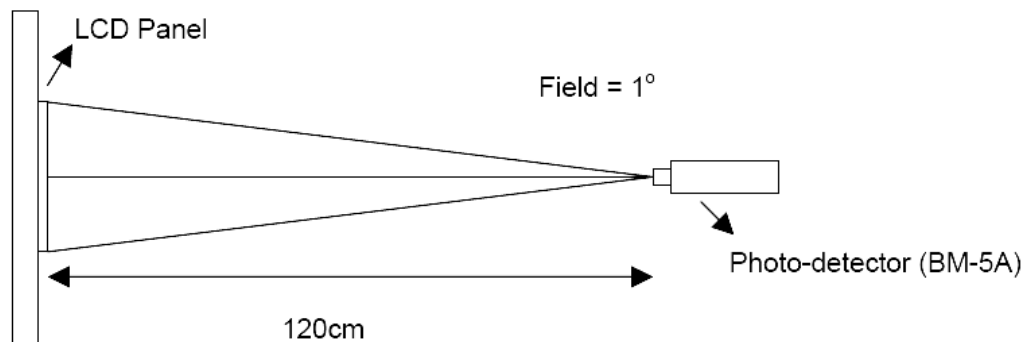
$$CR = \frac{\text{Luminance with all pixels white}}{\text{Luminance with all pixels black}}$$

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



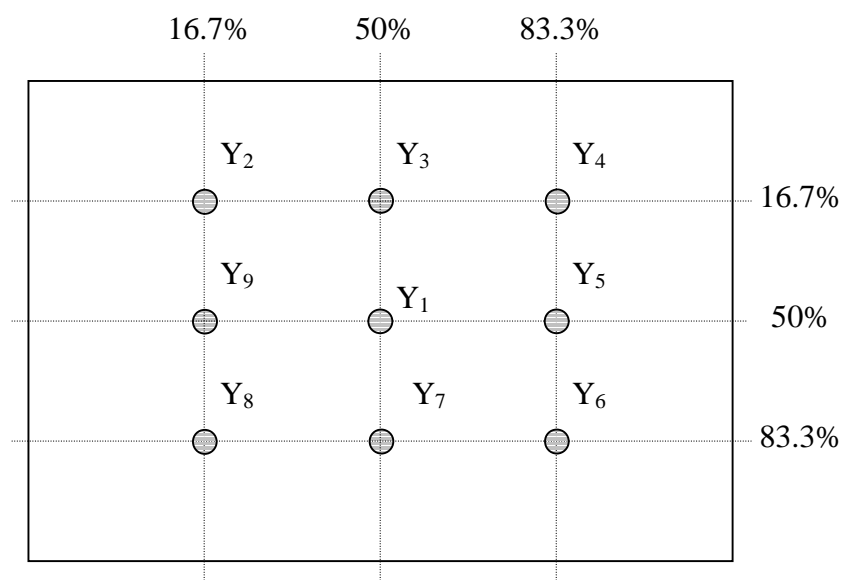
Note (4) Definition of optical measurement setup





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Note (5) Definition of brightness uniformity



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

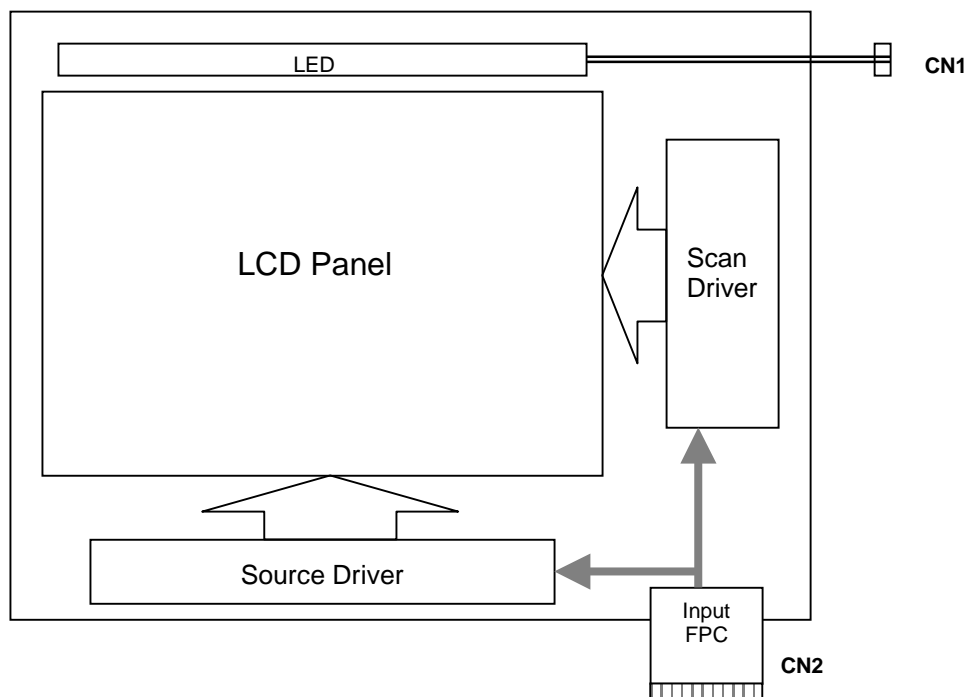
Note (6) Rubbing Direction (The different Rubbing Direction will cause the different optima view direction.)

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

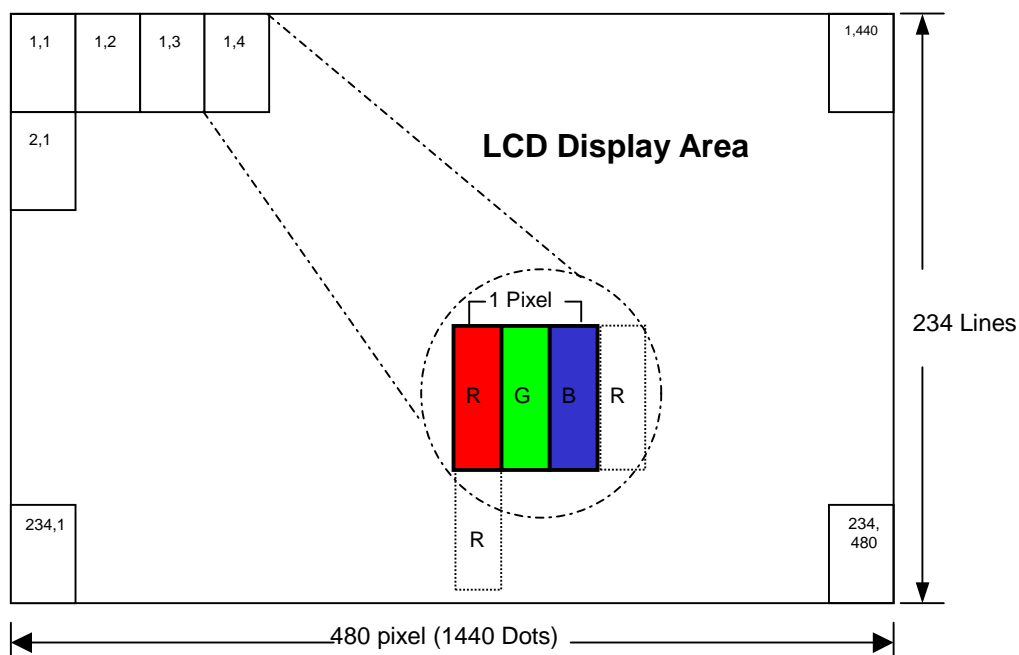
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## 4.0 BLOCK DIAGRAM

### 4.1 TFT LCD Module



### 4.2 Pixel Format



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## 5.0 INTERFACE PIN CONNECTION

### 5.1 TFT LCD Module

**CN2** (Input signal): FPC Down Connector, 26 pins, pitch: 0.5mm

Terminal no.	Symbol	I/O	Function	Note
1	DGND	-	Ground for logic circuit	
2	DV <sub>DD</sub>	I	Supply voltage of logic control circuit for scan (Gate) driver	
3	V <sub>GL</sub>	I	Negative power for scan (Gate) driver	
4	V <sub>GH</sub>	I	Positive power for scan (Gate) driver	
5	STVD	I/O	Vertical start pulse	(1)
6	STVU	I/O	Vertical start pulse	(1)
7	CKV	I	Shift clock input for scan (Gate) driver	
8	U/D	I	UP/DOWN scan control input	(1)
9	OE <sub>V</sub>	I	Output enable input for scan(Gate) driver	
10	V <sub>COM</sub>	I	Common electrode driving signal	
11	V <sub>COM</sub>	I	Common electrode driving signal	
12	L/R	I	LEFT/RIGHT scan control input	(1)
13	MOD	I	Sequential sampling and simultaneous sampling setting	(2)
14	OE <sub>H</sub>	I	Output enable input for data (Source) driver	
15	STHL	I/O	Start pulse for horizontal scan (Gate) line	(1)
16	STHR	I/O	Start pulse for horizontal scan (Gate) line	(1)
17	CPH3	I	Sampling and shifting clock pulse for data (Source) driver	(2)
18	CPH2	I	Sampling and shifting clock pulse for data (Source) driver	(2)
19	CPH1	I	Sampling and shifting clock pulse for data (Source) driver	
20	DV <sub>DD</sub>	I	Supply voltage of logic control circuit for data(Source) driver	
21	DGND	-	Ground for logic circuit	
22	V <sub>R</sub>	I	Alternated video signal input(Red)	
23	V <sub>G</sub>	I	Alternated video signal input(Green)	
24	V <sub>B</sub>	I	Alternated video signal input(blue)	
25	AV <sub>DD</sub>	I	Supply voltage for analog circuit	
26	AGND	-	Ground for analog circuit	

Note (1) Selection of scanning mode (please refer to the following table)

Setting of scan control input		IN/OUT state for start pulse				Scanning direction
U/D	L/R	STVD	STVU	STHR	STHL	
GND	DV <sub>DD</sub>	Output	Input	Output	Input	up to down, and from left to right.
DV <sub>DD</sub>	GND	Input	Output	Input	Output	down to up, and from right to left.
GND	GND	Output	Input	Input	Output	up to down, and from right to left.
DV <sub>DD</sub>	DV <sub>DD</sub>	Input	Output	Output	Input	down to up, and from left to right.

Note (2) MOD=H: Simultaneous sampling.(Please check CPH2 and CPH3 to GND when MOD=H)  
MOD=L: Sequential sampling.

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## 5.2 Back-Light Unit

**CN1** LED Power Source (BHSR-02VS-1) / JAPAN SOLDERLESS TERMINAL MFG CO., LTD.

Mating Connector: (SBHT-002T-P0.5) / JAPAN SOLDERLESS TERMINAL MFG CO., LTD.

Terminal no.	Symbol	Function
1	VL	LED power supply (high voltage)
2	GL	LED power supply (low voltage)

## 6.0 ELECTRICAL CHARACTERISTICS

### 6.1 TFT LCD Module (Operation Rating)

Item	Symbol	Min.	Typ.	Max.	Unit	Note
Supply Voltage	DV <sub>DD</sub>	2.7	3.3	5.5	V	
	V <sub>GH</sub>	14.3	15	15.7	V	
	V <sub>GL</sub>	-10.5	-10	-9.5	V	
	AV <sub>DD</sub>	3	-	5.5	V	
Video signal amplitude (VR, VG, VB)	V <sub>IA</sub>	0.4	-	AV <sub>DD</sub> -0.4	V	
	V <sub>iAC</sub>	-	4	-	V	AC component,
	V <sub>iDC</sub>	-	AV <sub>DD</sub> /2	-	V	DC component
VCOM	V <sub>CAC</sub>		5.5		Vp-p	AC component
	V <sub>CDC</sub>	1.6	1.8	2.0	V	DC component, (1)
Input signal voltage	V <sub>iH</sub>	0.7DV <sub>DD</sub>	-	DV <sub>DD</sub>	V	(2)
	V <sub>iL</sub>	0	-	0.3DV <sub>DD</sub>	V	(2)
Current of power supply	I <sub>DD</sub>	-	4.2	-	mA	DV <sub>DD</sub> =3.3V
	I <sub>ADD</sub>	-	3.7	-	mA	AV <sub>DD</sub> =5V(Black)
	I <sub>GH</sub>	-	60	-	uA	V <sub>GH</sub> =15V
	I <sub>GL</sub>	-	400	-	uA	V <sub>GL</sub> =-10V

Note (1): The brightness of LCD panel could be changed by adjusting the AC component of V<sub>COM</sub>.

Note (2): STHL, STHR, OEH, L/R, CPH1~CPH3, STVD, STVU, OEV, CKV, U/D

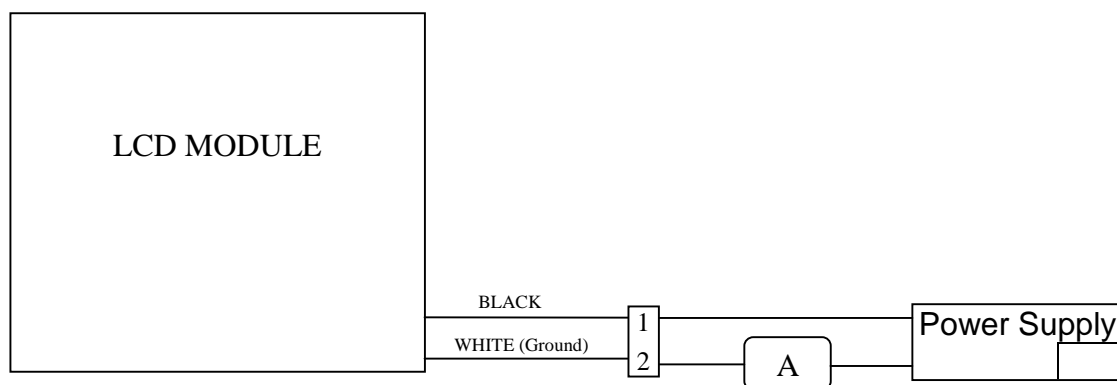
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## 6.2 Back-Light Unit

The back-light system is an edge-lighting type with 15 LED.

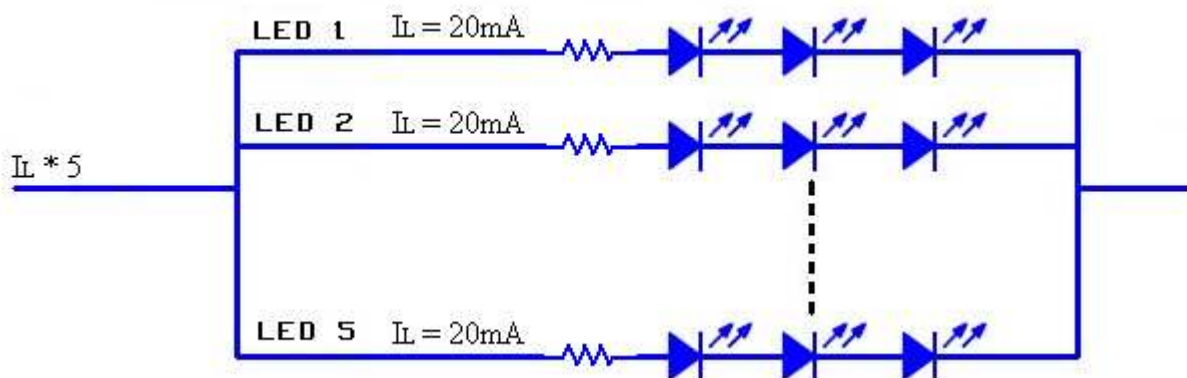
The characteristic of the LED is shown in the following tables.

Item	Symbol	Min.	Typ.	Max.	Unit	Note
LED current	IL	-	100	—	mA	(2)
LED voltage	VL	-	10.5	—	V	
Operating LED life time	Hr	20,000	-	—	Hour	(1)(2)



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

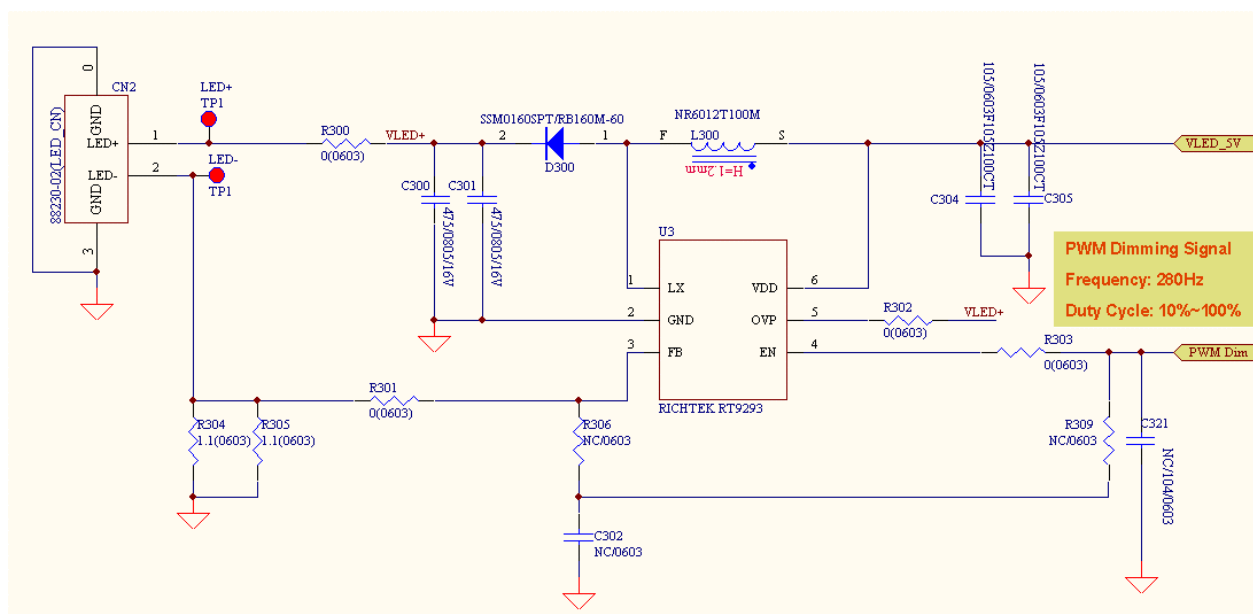
Note (2) The "LED life time" is defined as the module brightness decrease to 50% original brightness at  $T_a=25^\circ\text{C}$  and  $I_L=100\text{mA}$ . The LED lifetime could be decreased if operating IL is larger than 100mA. The constant current driving method is suggested.



LED Light Bar Circuit

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Note (3) Suggested Schematic of LED Back-Light Driver



### Suggested Schematic of LED Back-Light Driver

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### 6.3 AC Characteristics

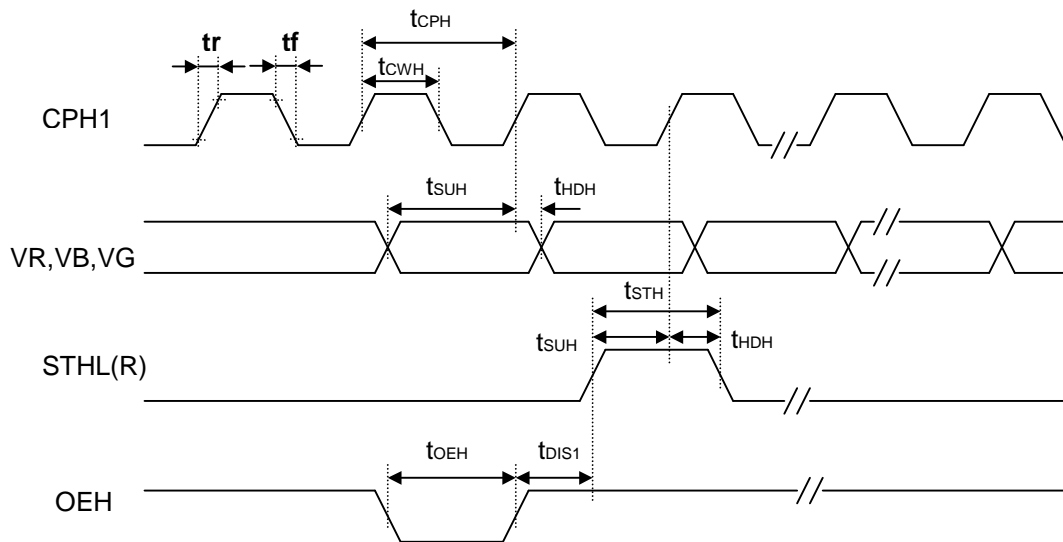
Item	Symbol	Min.	Typ.	Max.	Unit	Note
Rising time	t <sub>r</sub>	-	-	10	ns	(1)
Falling time	t <sub>f</sub>	-	-	10	ns	(1)
High and low level pulse duty	t <sub>CPH</sub>	100	103	-	ns	CPH1~CPH3
CPH pulse duty	t <sub>CWH</sub>	40	50	60	%	CPH1~CPH3
STH setup time	t <sub>SUH</sub>	20	-	-	ns	STHR,STHL
STH hold time	t <sub>HDH</sub>	10	-	-	ns	STHR,STHL
STH pulse width	t <sub>STH</sub>	-	1	-	t <sub>CPH</sub>	STHR,STHL
STH period	t <sub>H</sub>	61.5	63.5	65.5	μs	STHR,STHL
OEH pulse width	t <sub>OEH</sub>	-	1.23	-	μs	OEH
Sample and hold disable time	t <sub>DIS1</sub>	-	8.19	-	μs	
OEV pulse width	t <sub>OEV</sub>	-	4.77	-	μs	OEV
CKV pulse width	t <sub>CKV</sub>	-	3.91	-	μs	CKV
Clean enable time	t <sub>DIS2</sub>	-	3.90	-	μs	
Horizontal display timing range	t <sub>DH</sub>	-	1440	-	t <sub>CPH</sub> /3	
STV setup time	t <sub>SUV</sub>	200	-	-	ns	STVD,STVU
STV hold time	t <sub>HDV</sub>	300	-	-	ns	STVD,STVU
STV pulse width	t <sub>STV</sub>	-	1	-	t <sub>H</sub>	STVD,STVU
Horizontal line per field	t <sub>v</sub>	256	262	268	t <sub>H</sub>	(2)
Vertical display start	t <sub>SV</sub>		3	-	t <sub>H</sub>	
Vertical display timing range	t <sub>DV</sub>		234	-	t <sub>H</sub>	
VCOM Rising time	t <sub>COM</sub>		-	5	μs	
VCOM Falling time	t <sub>COM</sub>		-	5	μs	
VCOM delay time	t <sub>DCOM</sub>		-	3	μs	
RGB delay time	t <sub>DRGB</sub>		*	1	μs	

Note (1): For all of the logic signals.

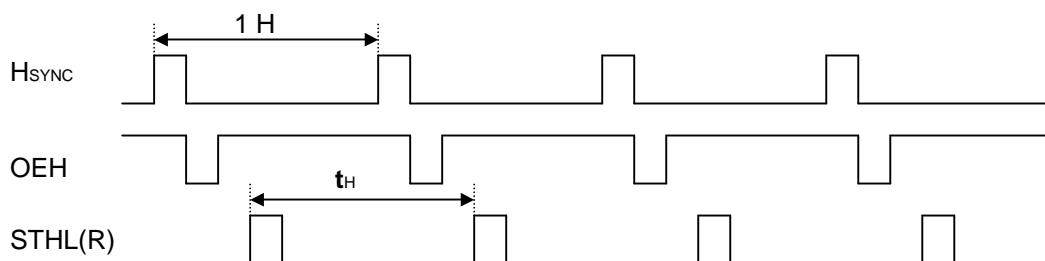
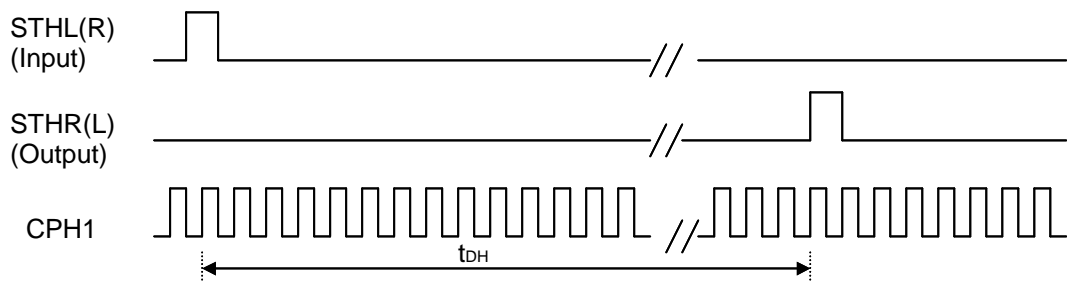
Note (2): Please don't use odd horizontal lines to drive LCD panel for both odd and even filed simultaneously.

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#### 6.4 Timing Diagram of Interface Signal



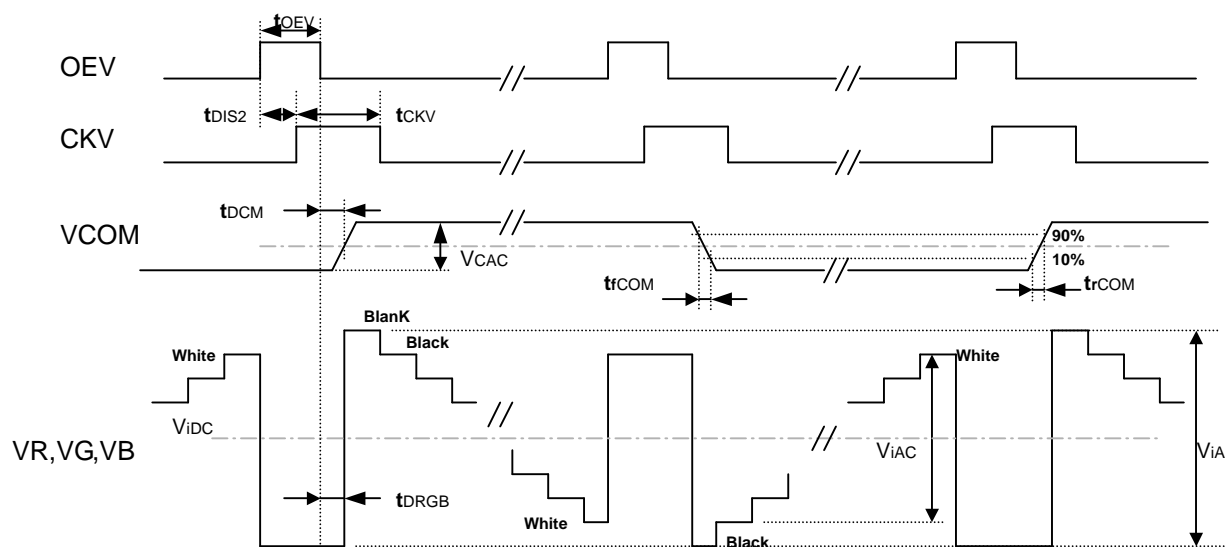
Sampling clock timing



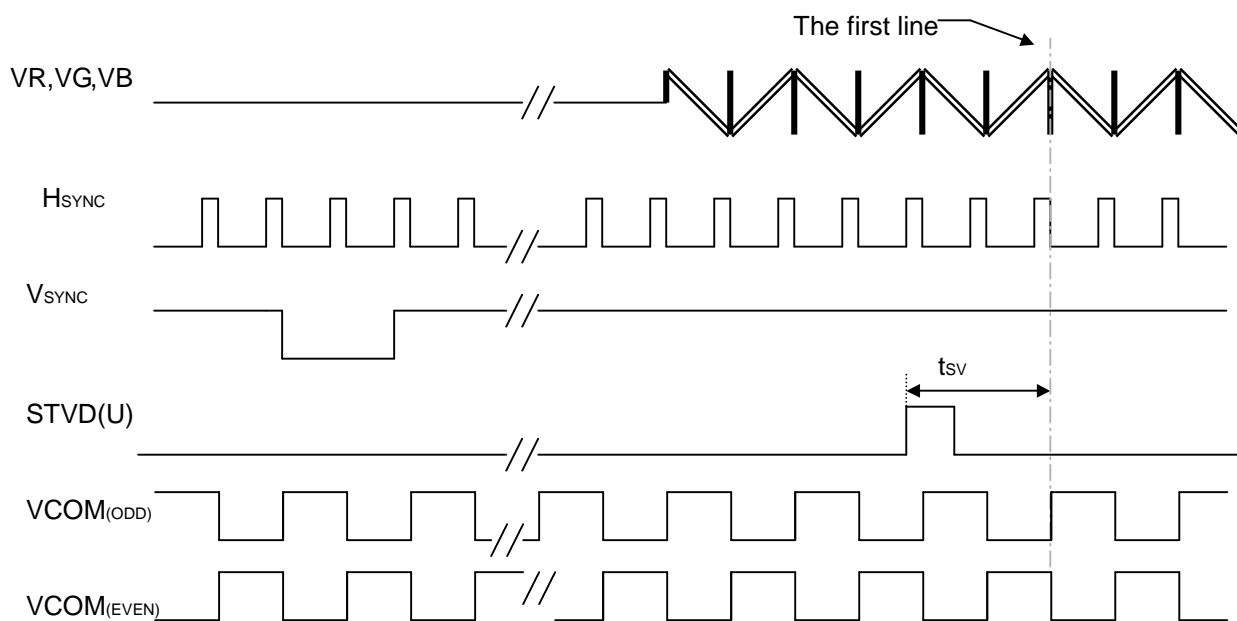
Horizontal display timing range



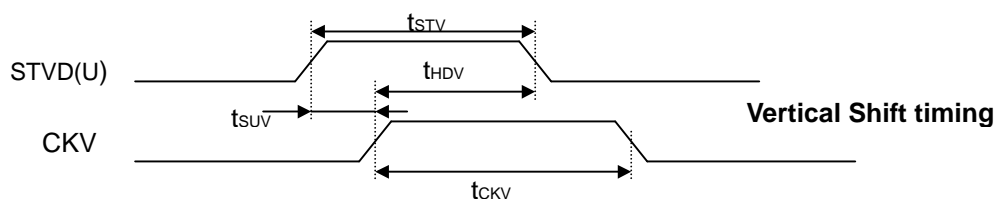
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### Detail Horizontal timing

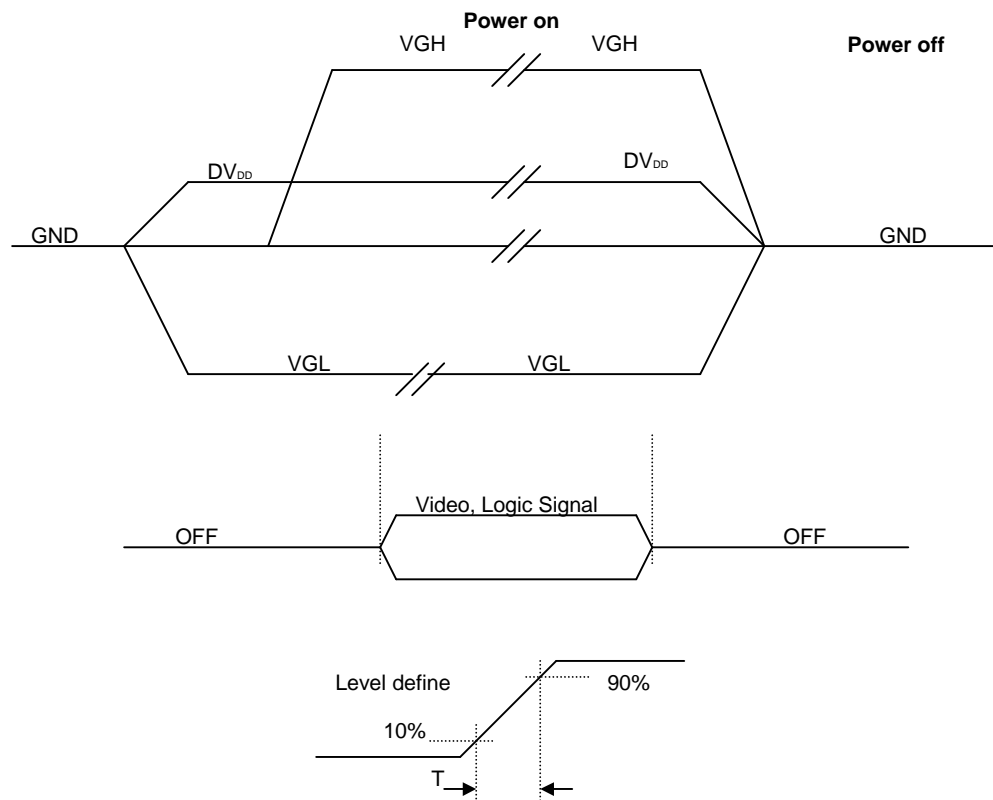


## Vertical timing



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## 6.5 Power Sequence



Power Sequence:  $DV_{DD} \rightarrow V_{GL} \rightarrow V_{GH}$

Note: Apply the LED 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.

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## 7.0 RELIABILITY TEST ITEMS

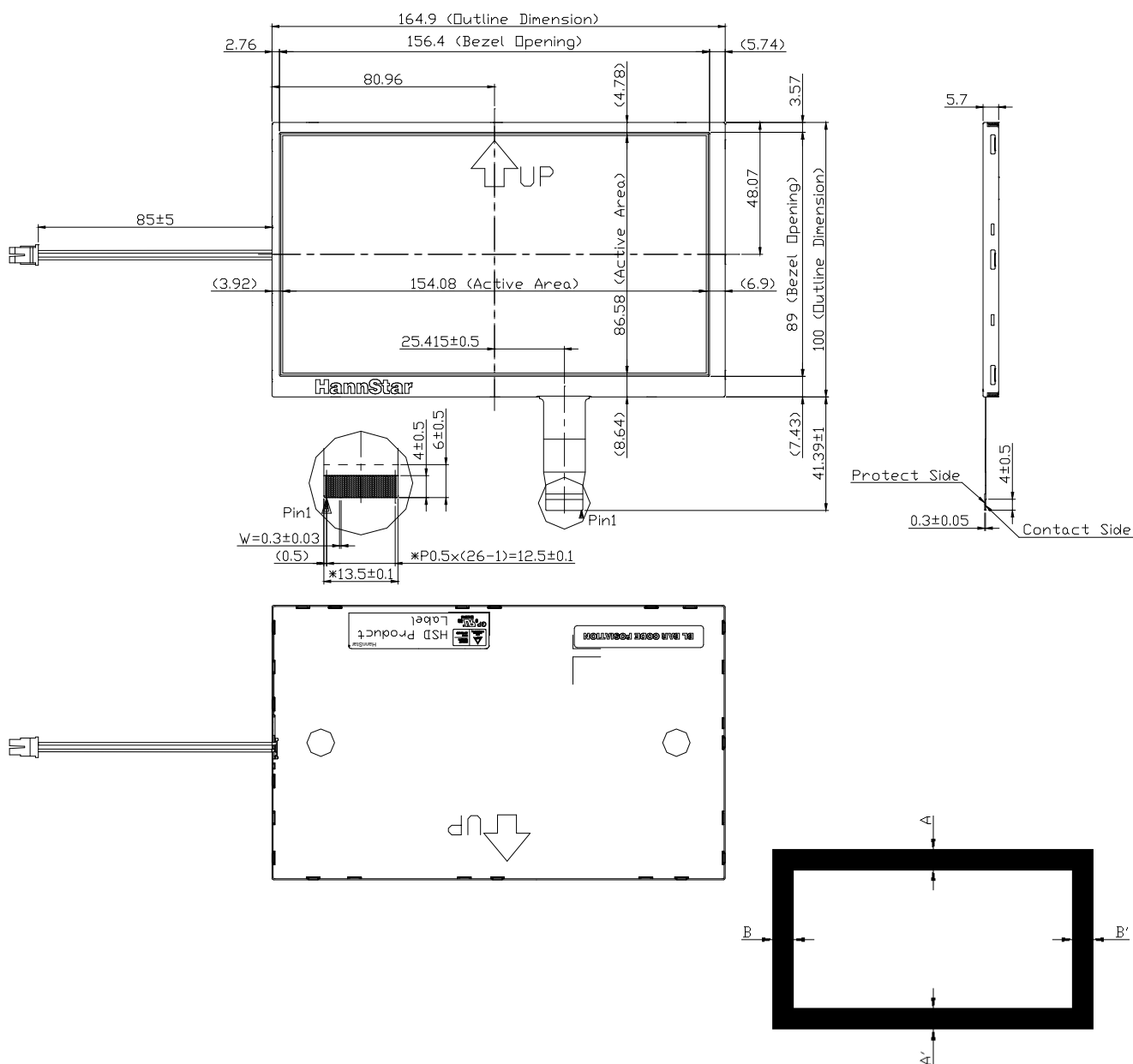
No.	Item	Conditions	Remark
1	High Temperature Storage	Ta=+80°C, 240hrs	
2	Low Temperature Storage	Ta=-30°C, 240hrs	
3	High Temperature Operation	Ta=+70°C, 240hrs	
4	Low Temperature Operation	Ta=-20°C, 240hrs	
5	High Temperature and High Humidity (operation)	Ta=+60°C, 90%RH, 240hrs	
6	Thermal Cycling 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, 10~500Hz, X/Y/Z, 30min/each direction 2.Sweep sine: 1.5G, 5~500Hz, X/Y/Z, 30min/each direction	
9	Shock	100G,6ms, ±X, ±Y, ±Z 3 time for each direction	JIS C7021, A-10 (Condition A)
10	Vibration (with carton)	Random: 1.04Grms, 10~500Hz, X/Y/Z 45min/each direction Fixed: 5Hz, 1.5Grms, X/Y/Z 45min/each direction	
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.

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## 8.0 OUTLINE DIMENSION

Unit: mm

**HSD070I65-F00\_ FPC length: 41.39 mm/ LED CABLE Length: 85mm**


BM Assembly Tolerance

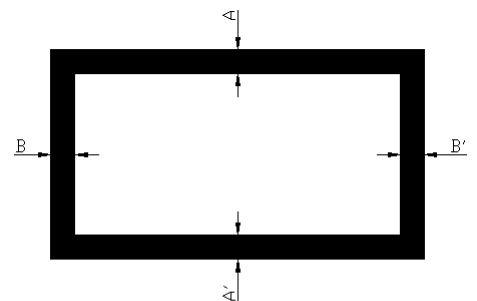
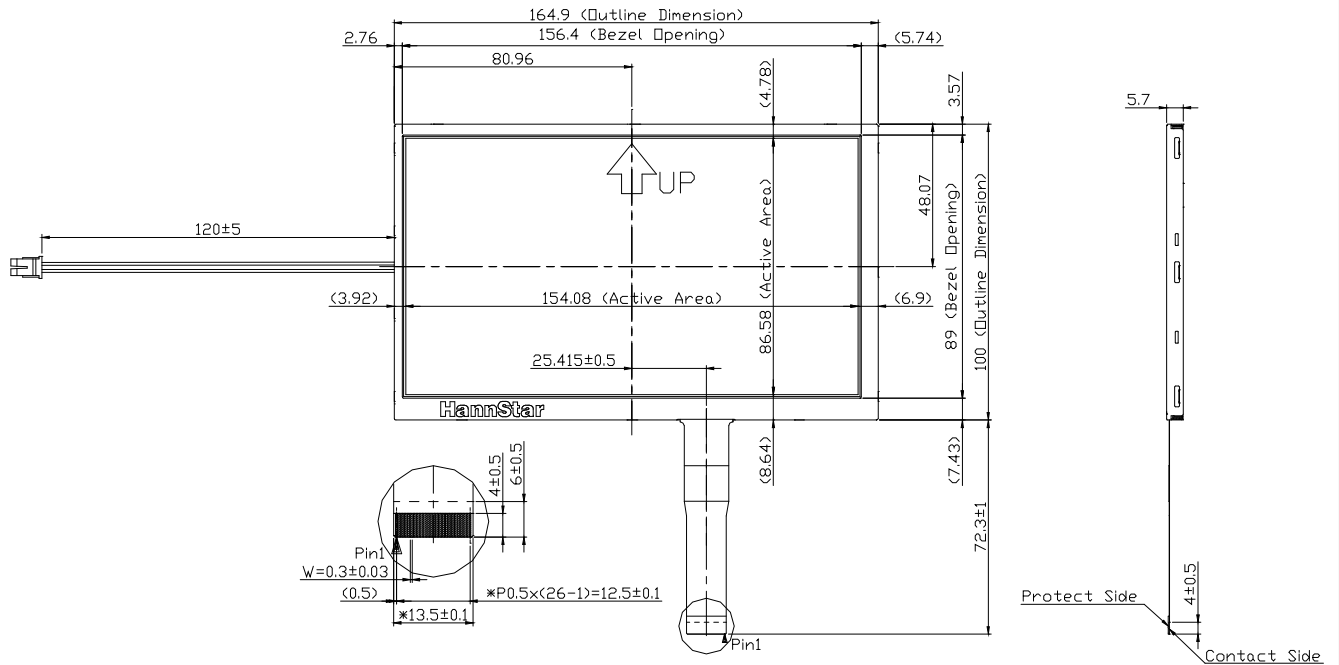
$$|A - A'| \leq 1 \text{ (mm)}$$

$$|B - B'| \leq 1 \text{ (mm)}$$

**Note: General Tolerance: +/- 0.3mm**

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## HSD070I65-F10\_ FPC length: 72.30 mm/ LED CABLE Length: 120mm



BM Assembly Tolerance

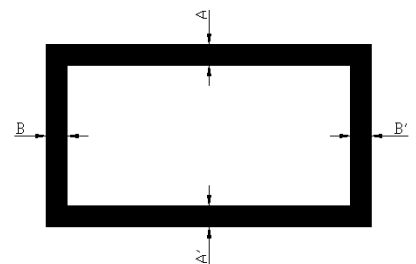
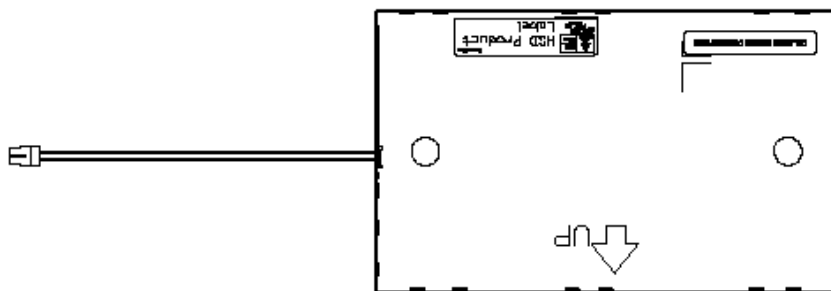
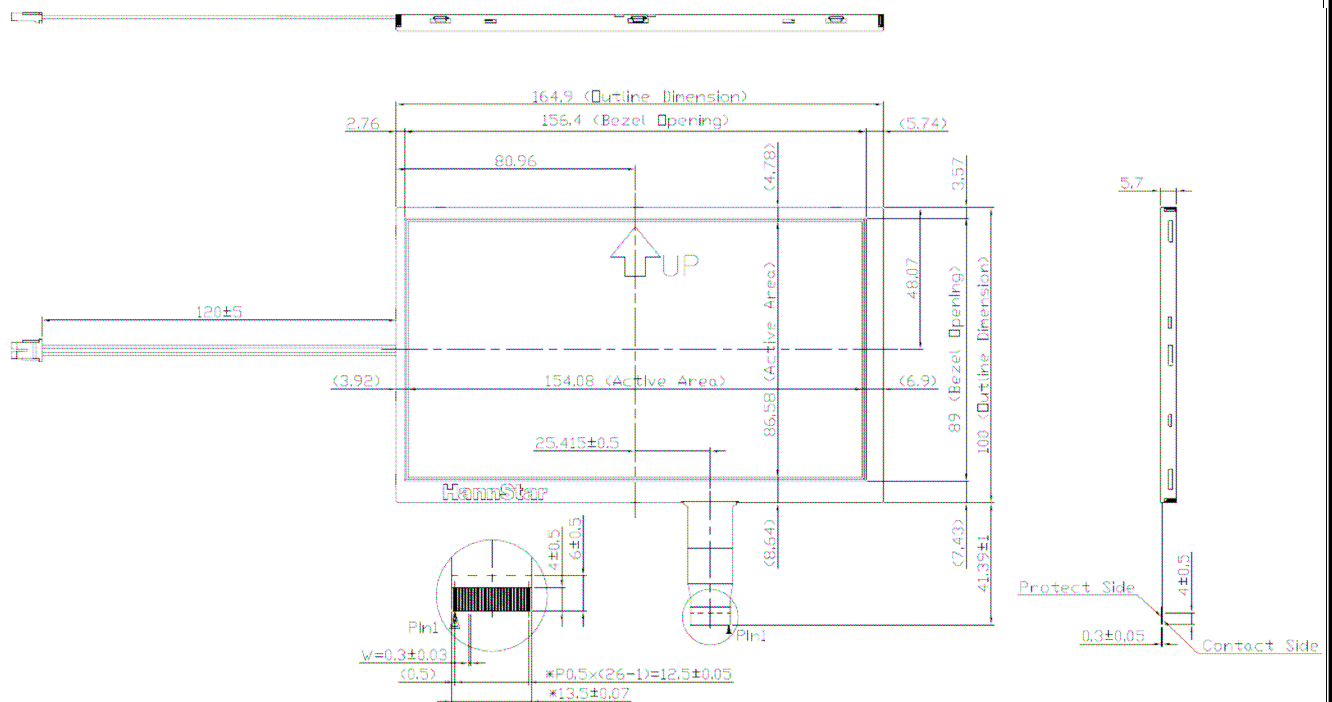
$$|A - A'| \leq 1 \text{ (mm)}$$

$$|B - B'| \leq 1 \text{ (mm)}$$

**Note: General Tolerance: +/- 0.3mm**

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**HSD070I65-F20\_ FPC length: 41.39 mm / LED CABLE Length: 120mm**



BM Assembly Tolerance,

$$|A - A'| \leq 1 \text{ (mm)},$$

$$|B - B'| \leq 1 \text{ (mm)},$$

**Note: General Tolerance: +/- 0.3mm**

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## 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: HannStar internal flow control code.

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

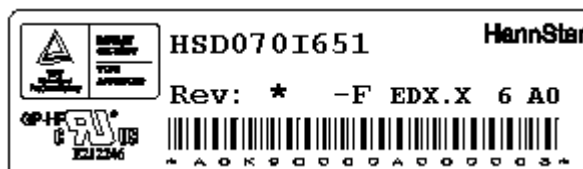
Year	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Mark	1	2	3	4	5	6	7	8	9	0

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 Detail of Lot Mark

- (1) Location: The label is attached on 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.



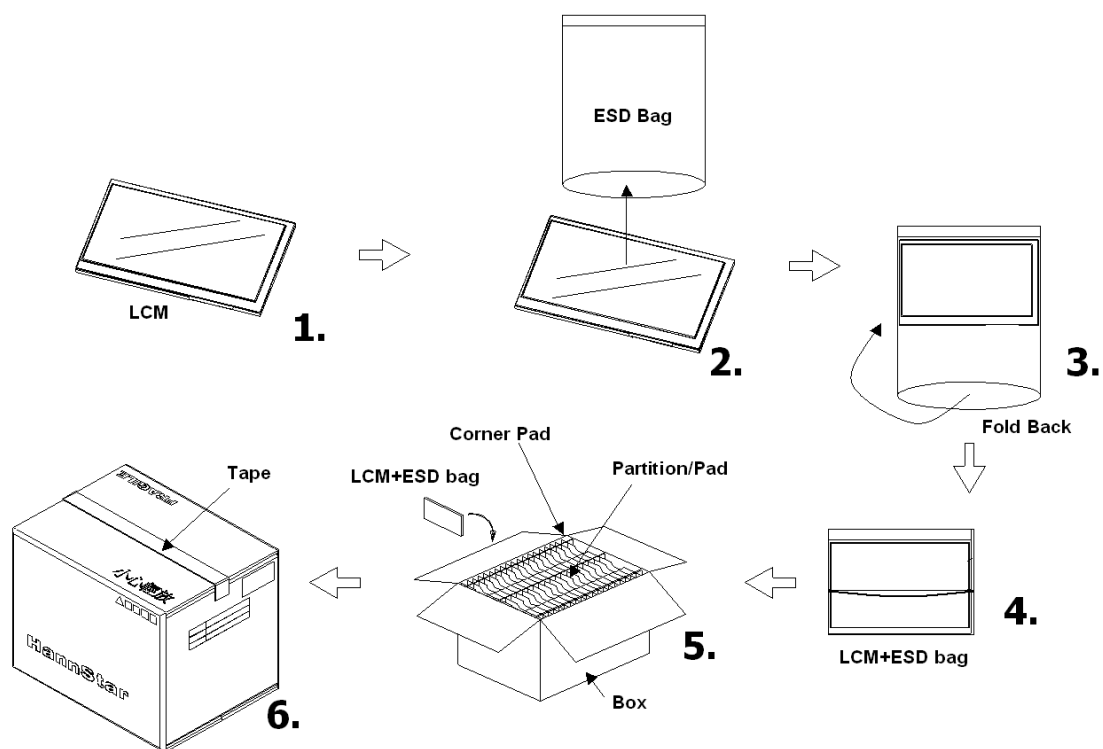
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## 10.0 PACKAGE SPECIFICATION

### 10.1 Packing form

LCM Model	LCM Qty. in the box	Inner Box Size (mm)	Notice
HSD070I651-F	80 pcs/box	451±5 x 375±5 x 284±5	

### 10.2 Packing assembly drawings



Items	Material	Notice
Box	Corrugated Paper Board	AB Flute
Partition/Pad	Corrugated Paper Board	A/B Flute
Corner Pad	Corrugated Paper Board	AB Flute
ESD bag	PE	



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## 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. HannStar 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.

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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 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.

#### **11.8 Strong Light Exposure**

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

#### **11.9 Disposal**

When disposing LCD module, obey the local environmental regulations.

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**Min. & Max. value of  $V_{RGB}$ ,  $V_{COM}$ : SPEC is for TCL only.**

## 6.0 ELECTRICAL CHARACTERISTICS

### 6.1 TFT LCD Module (Operation Rating)

Item	Symbol	Min.	Typ.	Max.	Unit	Note
Supply Voltage	$DV_{DD}$	2.7	3.3	5.5	V	
	$V_{GH}$	14.3	15	15.7	V	
	$V_{GL}$	-10.5	-10	-9.5	V	
	$AV_{DD}$	3	5	5.5	V	
Video signal amplitude (VR, VG, VB)	$V_{iA}$	0.4	-	$AV_{DD}-0.4$	V	
	$V_{iAC}$	3.5	4	4.5	V	AC component,
	$V_{iDC}$	-	$AV_{DD}/2$	-	V	DC component
VCOM	$V_{CAC}$	5.0	5.5	6.0	Vp-p	AC component
	$V_{CDC}$	1.6	1.8	2.0	V	DC component, (1)
Input signal voltage	$V_{iH}$	$0.7DV_{DD}$	-	$DV_{DD}$	V	(2)
	$V_{iL}$	0	-	$0.3DV_{DD}$	V	(2)
Current of power supply	$I_{DD}$	-	4.2	-	mA	$DV_{DD}=3.3V$
	$I_{ADD}$	-	3.7	-	mA	$AV_{DD}=5V(\text{Black})$
	$I_{GH}$	-	60	-	uA	$V_{GH}=15V$
	$I_{GL}$	-	400	-	uA	$V_{GL}=-10V$

Note (1): The brightness of LCD panel could be changed by adjusting the AC component of  $V_{COM}$ .

Note (2): STHL, STHR, OEH, L/R, CPH1~CPH3, STVD, STVU, OEV, CKV, U/D