

HITACHI

FOR MESSRS: _____

DATE : Nov.10,2007

CUSTOMER'S ACCEPTANCE SPECIFICATIONS **TX18D56VM2FAA** CONTENTS

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*When product will be discontinued, customer will be informed by HITACHI with twelve months prior to discontinuation.

ACCEPTED BY; _____

PROPOSED BY; Elton Liu

RECORD OF REVISION

DATE	SHEET No.	SUMMARY

3. GENERAL DATA

The following specifications are applied to the following TFT .

Note : Inverter for Back-Light unit is not built in this module.

Product Name	TX18D56VM2FAA	
Effective Display Area	(H)153.4 x (V)86.4	[mm]
Display Dots	(H)(480x3) x (V)234	
Display Pixels	(H)480 x (V)234	[pixels]
Pixel Pitch	(H)0.3195 x (V)0.3690	[mm]
Color Pixel Arrangement	R+G+B Vertical Stripe	
Display Mode	Transmissive Mode, Normally White Mode	
Surface Polarizing Film	Anti-Glare Polarizer Film	
Number of Colors	262,144	[colors]
Interface	C-MOS (R + G + B 6 bit Digital)	
Color Saturation	60%(typ.) For NTSC	
Viewing Direction	12 O'clock	
Backlight	1pc . of CCFL (L shaped)	
Dimensions Outline	(H)167.0 x (V)102.0 x (t)11.1 typ.	[mm]
Weight	240	[g]

4. ABSOLUTE MAXIMUM RATINGS

4.1 ENVIRONMENTAL ABSOLUTE MAXIMUM RATINGS

Item		Operating		Storage		Unit	Note
		Min.	Max.	Min.	Max.		
Temperature	ambient	-30	85	-40	95	°C	1)
	surface	-30	85	-			
Humidity		2)		2)		%RH	1),2)
Vibration		-	4.9(0.5G)	-	19.6(2G)	m/s ²	3)
Shock		-	29.4(3G)	-	490(50G)	m/s ²	4)
Corrosive Gas		Not Acceptable		Not Acceptable		-	

Notes 1) The brightness of CCFL tends to degrade at low temperature and the life-time becomes shorter at low temperature.

2) $T_a \leq 40^\circ\text{C}$: Relative humidity should be less than 85%RH. Dew is prohibited.

$T_a > 40^\circ\text{C}$: Relative humidity should be less than the moisture of the 85%RH at 40°C .

3) Frequency of the vibration is between 20Hz and 100Hz. (Except the resonance point)

4) Pulse width of the shock is 10 ms.

4.2 ELECTRICAL ABSOLUTE MAXIMUM RATINGS

4.2.1 TFT MODULE

Item	Symbol	Min.	Max.	Unit	Note
Power Supply Voltage	VDD	0	5.5	V	
Input Voltage for logic	VI	-0.3	3.6	V	1)
Electrostatic Durability	VESD0	± 100		V	2),3)
	VESD1	± 8		kV	2),4)

Notes 1) It is applied to pixel data signal and clock signal.

2) Discharge coefficient : 200pF - 250 Ω , Environmental : 25°C - 70%RH

3) It is applied to I/F connector pins.

4) It is applied to the surface of a metallic bezel and a LCD panel.

4.2.2 BACK-LIGHT

Item	Symbol	Min.	Max.	Unit	Note
Input Current	IL	-	7.0	mA _{rms}	1)
Input Voltage	VL	-	1800	V _{rms}	2)

Notes 1) The specification is defined at ground line

2) The specification shall be applied at connector pins for a CCFL at start-up.

5. ELECTRICAL CHARACTERISTICS

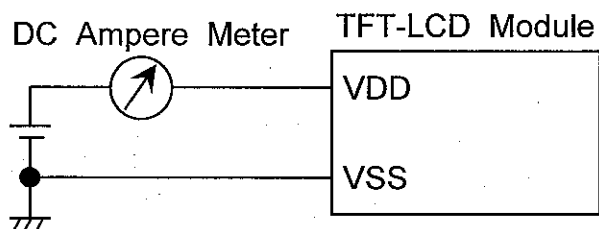
5.1 TFT-LCD MODULE

Ta=25°C, VSS=0V

Item		Symbol	Min.	Typ.	Max.	Unit	Note
Power Supply Voltage		VDD	4.5	5	5.5	V	
Input Voltage for Logic Circuits	Hi	VIH	2.0	-	3.6	V	1)
	Lo	VIL	VSS	-	0.8	V	1)
Power Supply Current		IDD	-	-	280	mA	2),3)
Vsync Frequency		fV	47	60	72	Hz	

Notes 1) The specification is applied to pixel data signal, timing signal and clock signal.

2) fV=60Hz, fCLK=9MHz, VDD=5.0V, DC Current.



Typical value is measured when displaying Black raster.

Maximum is measured when displaying Vertical-stripe pattern of 2 pixel pitch.

3) Current capacity for VDD power source should be larger than 2A.

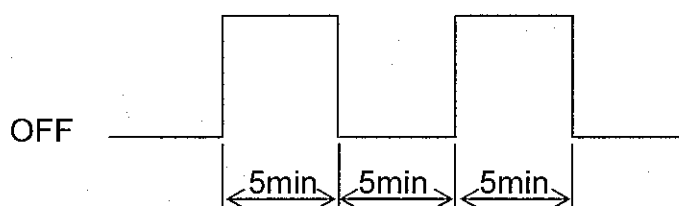
This TFT-LCD Module has a fuse (1A).

5.2 BACK-LIGHT

Item		Symbol	Min.	Typ.	Max.	Unit	Note
Input Voltage (IL=6mA)		VL	-	TBD.	1000	Vrms	3),4)
Input Current		IL	5.0	6.0	7.0	mA rms	1)
Established Starting Voltage	at 25°C	VS	-	-	(1450)	Vrms	3),7)
	at -30°C		-	-	(1500)		
Operating Frequency		fL	40	-	60	kHz	2)
CCFL Life Time (IL=6mA at 25°C)		-	15000	-	-	h	6)
CCFL Life Time intermittent		-	20000	-	-	cycle	6),10)
Start-up brightness		L _{LOW}	-	(70)	-	%	11)

Notes 1) The specification is defined at low voltage line.

- 2) Frequency of power supply for a CCFL may cause the interference with HSYNC frequency and causes beat or flicker on the display. Therefore, lamp frequency shall be as different as possible from HSYNC frequency in order to avoid the interference.
- 3) It is applied between each terminal in CCFL.
- 4) Operating voltage is measured at 25±2°C. The variance of the voltage is (±10%).
- 5) The lamp power consumption shown above does not include loss of external inverter.
- 6) Life time of a lamp is defined. The life is determined as the time at which brightness of the lamp is 50% compared to that of initial value at the typical lamp current on condition of continuous operating at 25±2°C.
- 7) Max frequency is 70kHz at starting time only.
- 8) The Voltage Vs should be applied to the lamps for more than 1.0 second for start up.
- 9) The burst frequency may produce interference with Vsync frequency and it may cause beat noise on the display. So please set the burst frequency to avoid the interference.
- 10) Intermission cycle (Ta=25°C)
High (7mA)



- 11) Starting temperature -20°C
 Lamp current boost current ILBOOST = 9mA rms
 Warm up time 1minute
 Reference brightness stable brightness at 100% PWM at 25°C

6. OPTICAL CHARACTERISTICS

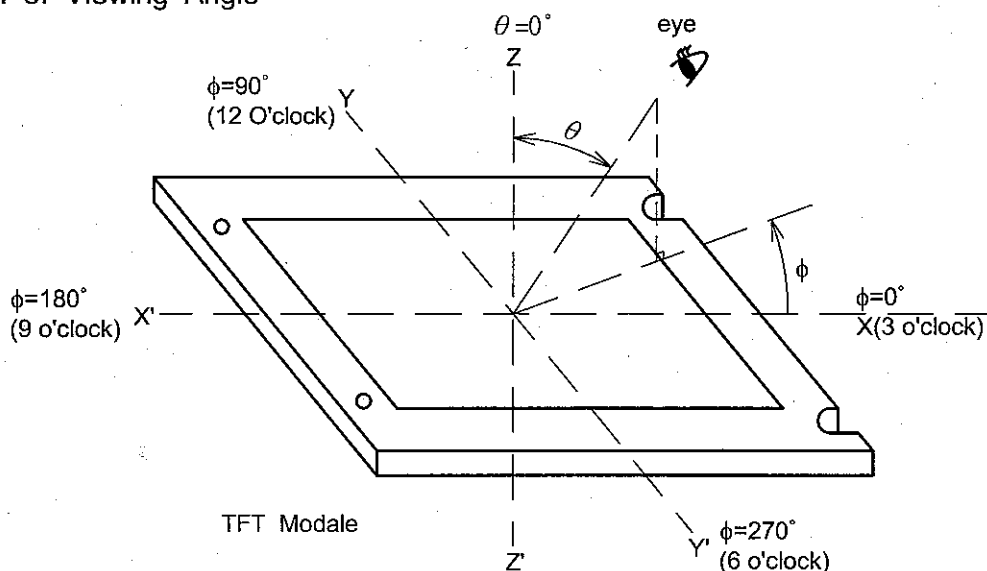
The following optical characteristics are measured under stable conditions. It takes about 15 minutes to reach stable conditions. The measuring point is the center of display area unless otherwise noted.

The optical characteristics should be measured in a dark room or equivalent state.

- Measuring equipment : KONICA MINOLTACS - 1000A, or equivalent
- Temperature = 25°C , VDD=5.0V , fV=60Hz , IL=6.0mA

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Contrast Ratio		CR	$\theta=0^\circ$ 1)	250	400	-	-	2)
Brightness of White		Bwh		400	TBD.	TBD.	cd/m ²	
Brightness Uniformity		Buni		80	TBD.	-	%	4)
Color Chromaticity (CIE)	Red	x		0.50	0.55	0.60	-	
		y		0.27	0.32	0.37		
	Green	x		0.25	0.30	0.35		
		y		0.45	0.50	0.55		
	Blue	x		0.11	0.16	0.21		
		y		0.09	0.14	0.19		
	White	x		0.30	0.33	0.36		
		y		0.30	0.33	0.36		
Response Time	Rise	ton	Ta = 25°C $\theta=0^\circ$ 1)	-	15	25	ms	3)
	Fall	toff		-	5	15		
	Rise	ton	Ta = -25°C $\theta=0^\circ$ 1)	-	270	500		
	Fall	toff		-	80	200		
	Rise	ton	Ta = -30°C $\theta=0^\circ$ 1)	-	390	750		
	Fall	toff		-	110	250		
Viewing Angle (CR ≥ 100)	x - x'	θ_x	$\Phi=0^\circ$	25	35	-	deg	1)
		$\theta_{x'}$	$\Phi=180^\circ$	25	35	-		
	y - y'	θ_y	$\Phi=90^\circ$	20	25	-		
		$\theta_{y'}$	$\Phi=270^\circ$	20	25	-		
Surface reflection	-			-	-	2.0	%	
Gamma	-			-	2.5	-		

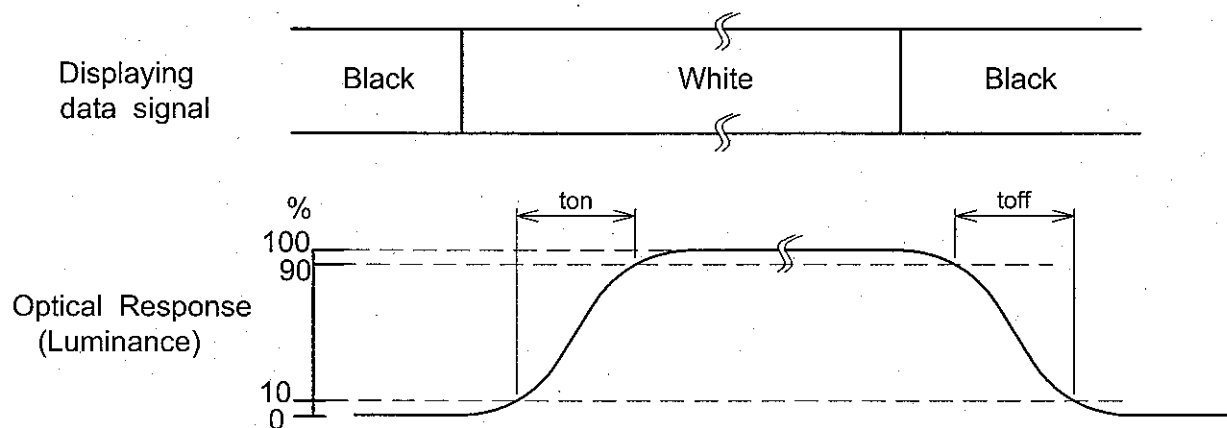
Note 1) Definition of Viewing Angle



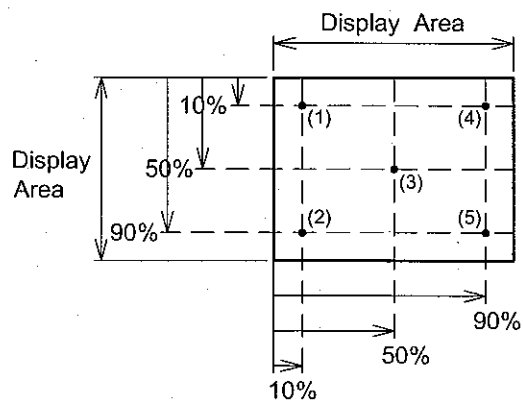
2) Definition of Contrast Ratio(CR):

$$CR = \frac{\text{(Luminance at displaying WHITE)}}{\text{(Luminance at displaying BLACK)}}$$

3) Definition of Response Time



4) Definition of Brightness Uniformity



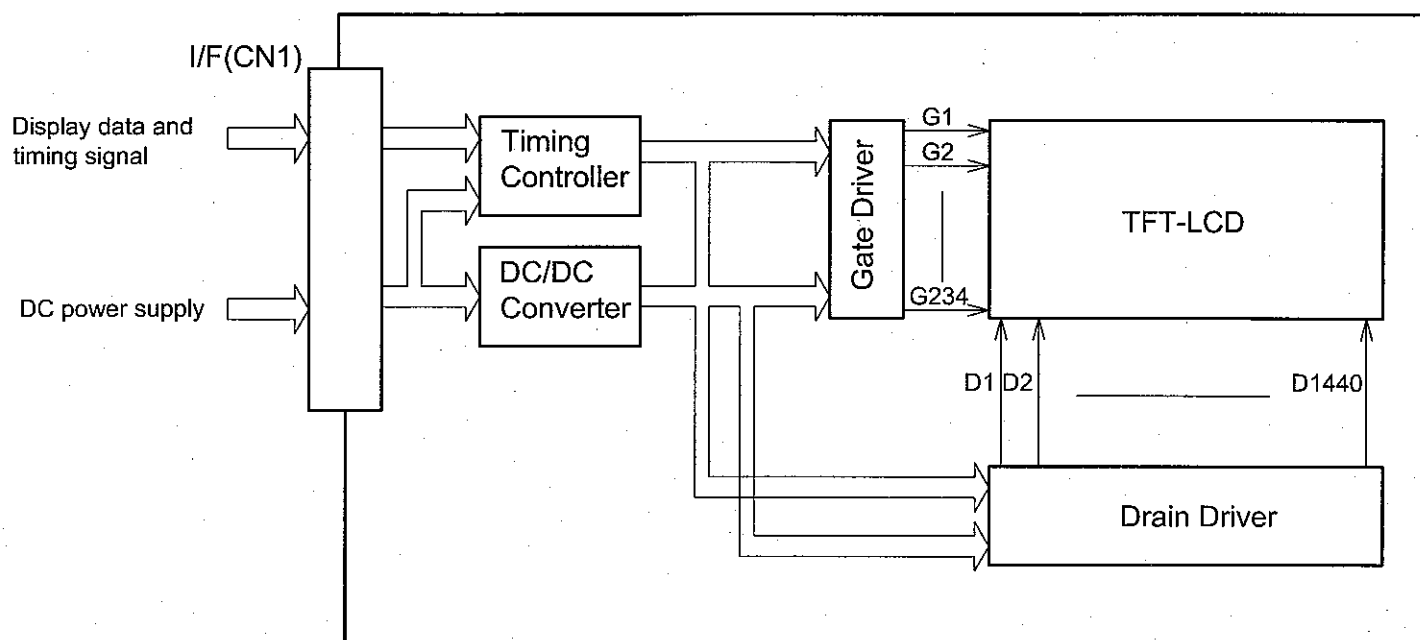
Display pattern is white (63 level). The brightness uniformity is defined as the following equation. Brightness at each point is measured, and maximum and minimum brightness is calculated.

$$Buni = \frac{Bmin}{Bmax} \times 100$$

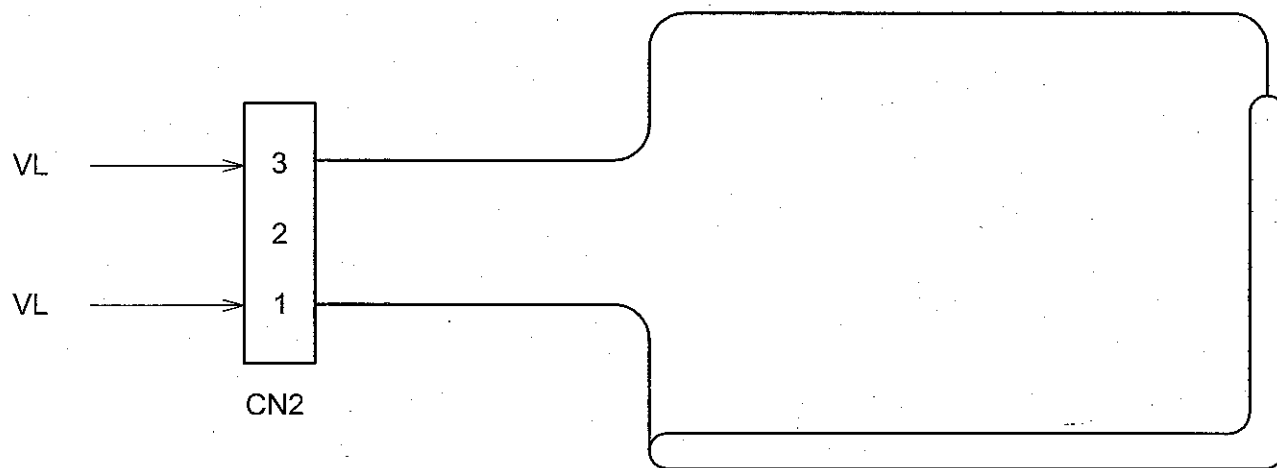
• : measuring points

7. BLOCK DIAGRAM

7.1 TFT MODULE



7.2 BACK-LIGHT UNIT



Color of Wires from CCFL to CN2

1 (VL) : Pink

3 (VL) : White

8. INTERFACE PIN CONNECTION

8.1 TFT-LCD MODULE

《Connector 1 : IRISO 9633S – 38A – T》

Pin No.	Symbol	Description	Note
1	VSS	Ground	2)
2	CLK	Clock	
3	VSS	Ground	
4	HSync	Horizontal Sync	
5	VSynC	Vertical Sync	
6	VSS	Ground	2)
7	R0	Red Data Signal 0 (LSB)	
8	R1	Red Data Signal 1	
9	R2	Red Data Signal 2	
10	R3	Red Data Signal 3	
11	R4	Red Data Signal 4	
12	R5	Red Data Signal 5 (MSB)	
13	VSS	Ground	2)
14	G0	Green Data Signal 0 (LSB)	
15	G1	Green Data Signal 1	
16	G2	Green Data Signal 2	
17	G3	Green Data Signal 3	
18	G4	Green Data Signal 4	
19	G5	Green Data Signal 5 (MSB)	
20	VSS	Ground	2)
21	B0	Blue Data Signal 0 (LSB)	
22	B1	Blue Data Signal 1	
23	B2	Blue Data Signal 2	
24	B3	Blue Data Signal 3	
25	B4	Blue Data Signal 4	
26	B5	Blue Data Signal 5 (MSB)	
27	VSS	Ground	2)
28	DTMG	Data Enable	
29	VDD	Power Supply	1)
30	VDD	Power Supply	1)
31	VSS	Ground	2)
32	VSS	Ground	2)
33	HR	Horizontally inverted	3)
34	VR	Vertically inverted	3)
35	NTC+	Temperature Sensor Pos	
36	NTC-	Temperature Sensor Neg	
37	BRT+	Brightness Sencor Pos	
38	BRT-	Brightness Sencor Neg	

Notes 1) All VDD pins shall be connected to +5.0V(Typ.).

2) All VSS pins shall be grounded. Metal bezel is internally connected to VSS.

3) HR , VR signal change isn't allowed during TFT Module power on.

8.2 BACK-LIGHT UNIT

《Connector 2 : JST BHR – 03VS – 1》

Pin No.	Symbol	Description
1	VL	Power Supply (High Voltage)
2	NC	No Connection
3	VL	Power Supply (Low Voltage)

8.3 RELATIONSHIP BETWEEN DISPLAY COLORS AND INPUT SIGNALS

color	Input	Red Data						Green Data						Blue Data					
		R5	R4	R3	R2	R1	R0	G5	G4	G3	G2	G1	G0	B5	B4	B3	B2	B1	B0
		MSB			LSB			MSB			LSB			MSB			LSB		
Basic Color	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(63)	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	Green(63)	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
	Blue(63)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
	Cyan	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1
	Magenta	1	1	1	1	1	1	0	0	0	0	0	0	1	1	1	1	1	1
	Yellow	1	1	1	1	1	1	1	1	1	1	1	1	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
Red	Red(0)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(1)	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
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	Red(62)	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(63)	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
Green	Green(0)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Green(1)	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
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	Green(62)	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0	0
	Green(63)	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
Blue	Blue(0)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Blue(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
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	Blue(62)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0
	Blue(63)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1

Notes 1) Definition of gray scale :

Color(n)---Number in parenthesis indicates gray scale level.

Larger n corresponds to brighter level.

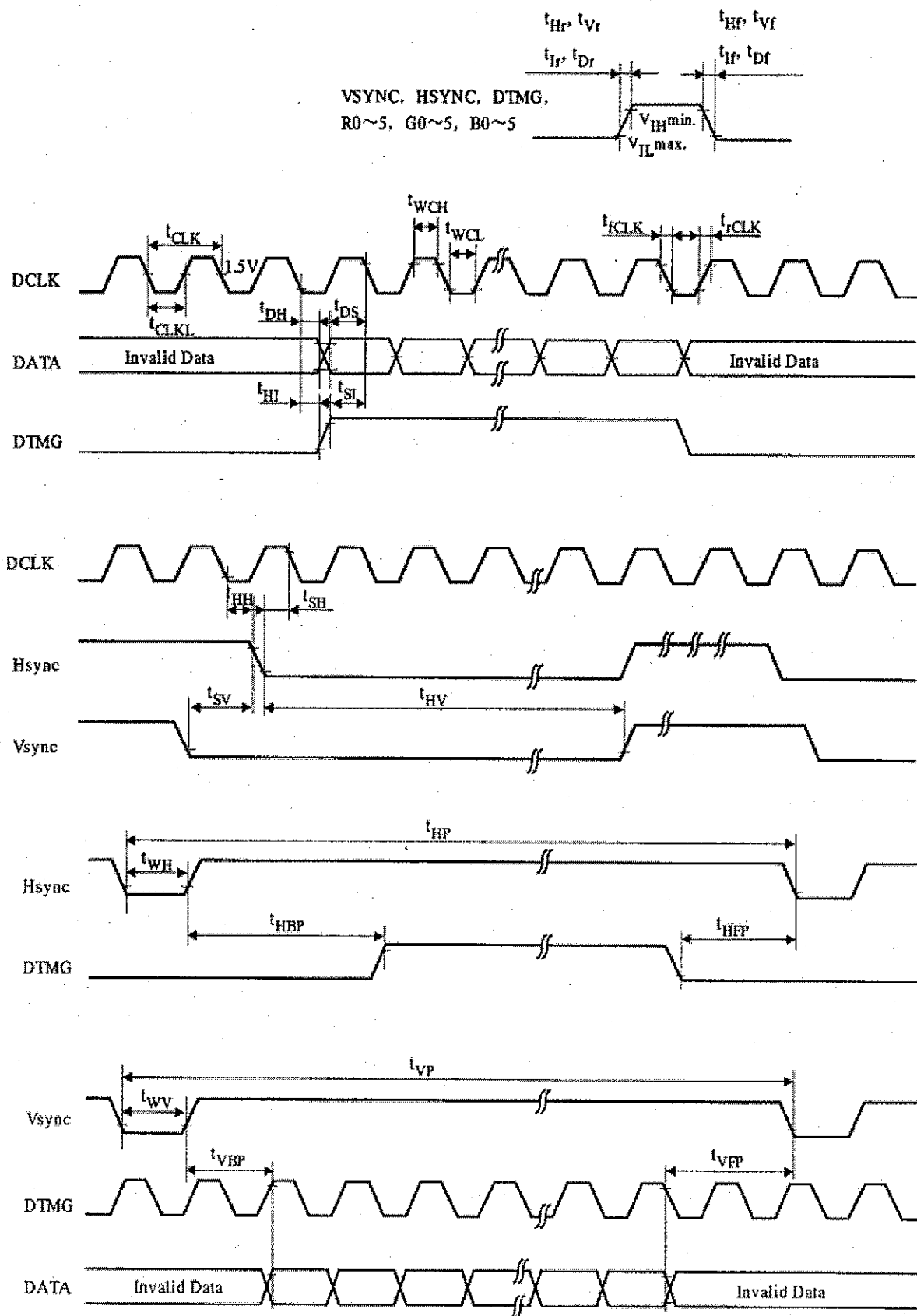
2) Data : 1 : High, 0 : Low

9. INTERFACE TIMING

9.1 TIMING CHART

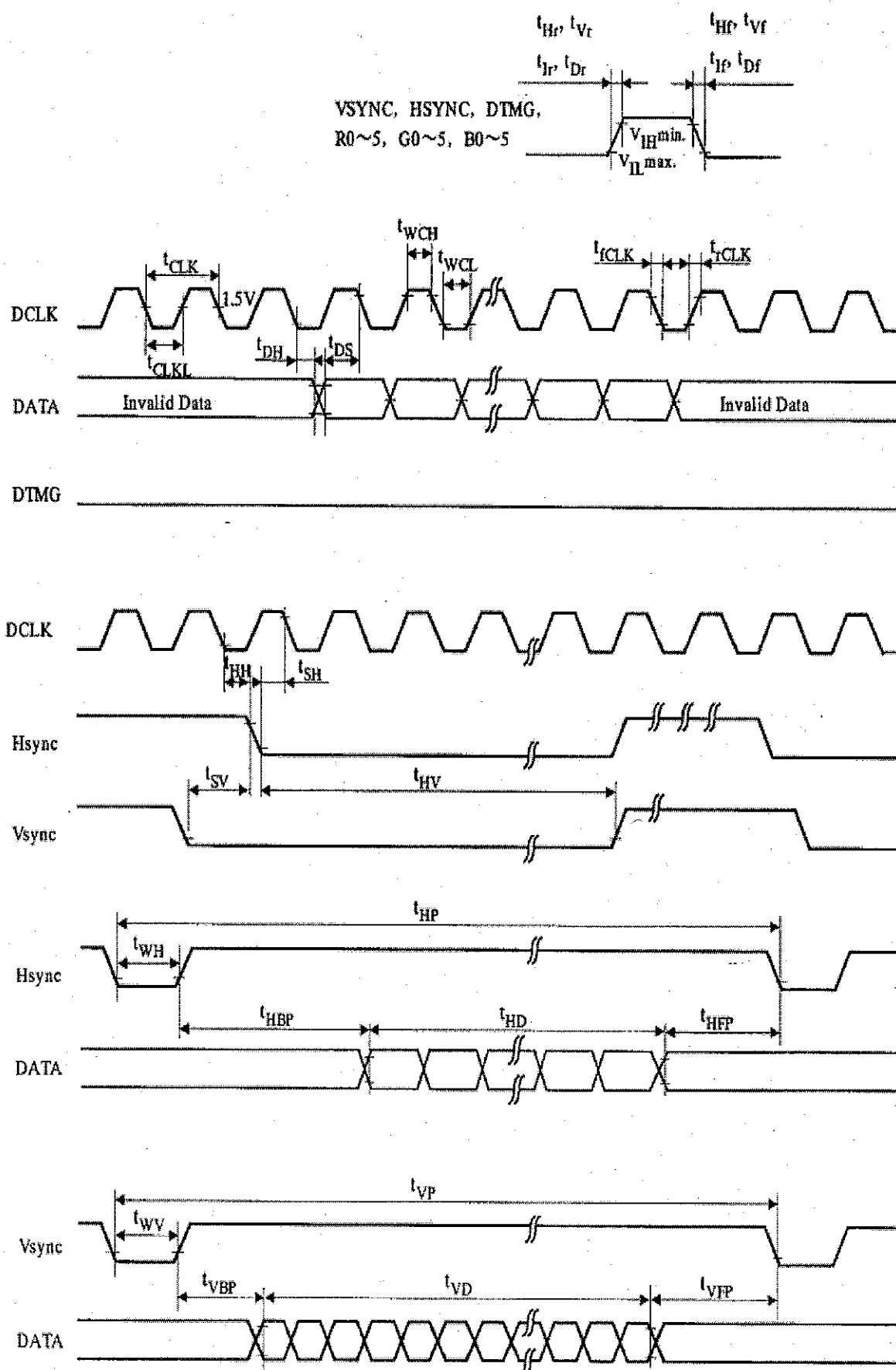
9.1.1 DTMG ACTIVE MODE

(Data : Latched at Fall edge of DCLK)



9.1.2 DTMG LOW MODE

(Data : Latched at Fall edge of DCLK)



9.2 INTERFACE TIMING SPECIFICATIONS

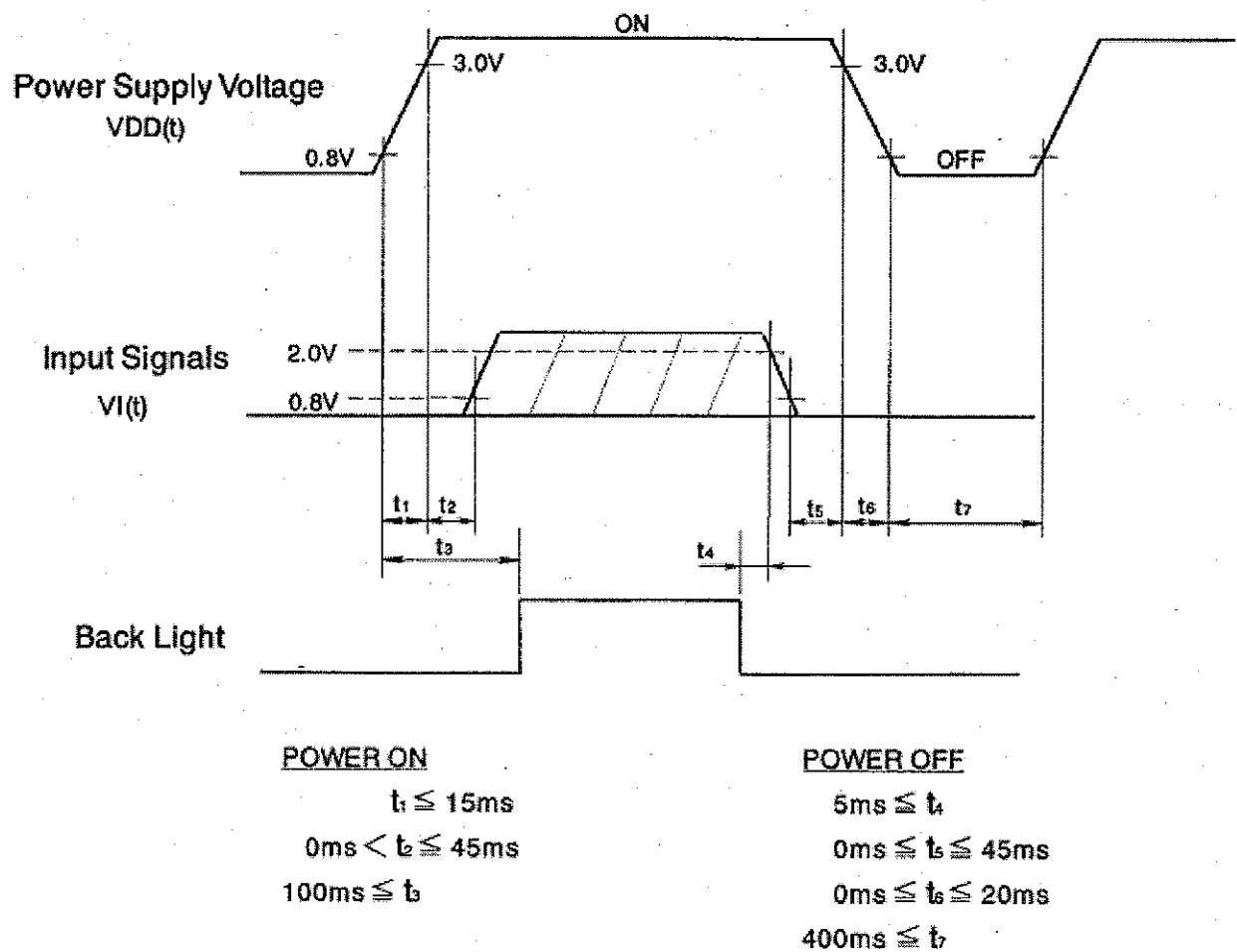
9.2.1 DTMG ACTIVE MODE

Item		Symbol	Min.	Typ.	Max.	Unit	Note
DCLK	Period	tCLK	7	11	25	MHz	
	Width-Low	tWC	12	-	-	ns	
	Width-Hi	tWCH	12	-	-		
	Rise time	trCLK	-	-	25		
	Fall time	tfCLK	-	-	25		
	Duty	D	0.45	0.5	0.55	-	
Hsync	Set up time	tSH	5	-	-	ns	for DCLK
	Hold time	tHH	10	-	-		
	Period	tHP	545	650	1300	tCLK	
	Width-Active	tWH	4	6	-		
	Rise/Fall time	tHr,tHf	-	-	30	ns	for DCLK
Vsync	Set up time	tSV	0	-	-	tCLK	for Hsync
	Hold time	tHV	2	-	-		
	Period	tVP	265	270	1023	tHP	
	Width-Active	tWV	3	3	3		
	Rise/Fall time	tVr,tVf	-	-	50	ns	for DCLK
DTMG	Set up time	tSI	5	-	-	ns	for DCLK
	Hold time	tHI	10	-	-		
	Rise/Fall time	tIr,tIf	-	-	30	ns	
	Horizontal Back porch	tHBP	7	48	-	tCLK	
	Horizontal Front porch	tHFP	-	116	-		
	Vertical Back porch	tVBP	18	18	18	tHP	
	Vertical Front porch	tVFP	-	15	-		
Data	Set up time	tDS	5	-	-	ns	for DCLK
	Hold time	tDH	10	-	-		
	Rise/Fall time	tDr,tDf	-	-	25	ns	

9.2.2 DTMG LOW MODE

Item		Symbol	Min.	Typ.	Max.	Unit	Note	
DCLK	Period	tCLK	7	11	25	MHz		
	Width-Low	tWC	12	-	-	ns		
	Width-Hi	twCH	12	-	-			
	Rise time	trCLK	-	-	25			
	Fall time	tfCLK	-	-	25			
	Duty	D	0.45	0.5	0.55	-		D= tCLKL/ tCLK
Hsync	Set up time	tSH	5	-	-	ns	for DCLK	
	Hold time	tHH	10	-	-			
	Period	tHP	545	650	1300	tCLK		
	Width-Active	tWH	6	6	6			
	Rise/Fall time	tHr,tHf	-	-	30	ns	for DCLK	
Vsync	Set up time	tsv	0	-	-	tCLK	for Hsync	
	Hold time	tHV	2	-	-			
	Period	tVP	265	270	1023	tHP		
	Width-Active	tWV	3	3	3			
	Rise/Fall time	tVr,tVf	-	-	50	ns	for DCLK	
DTMG	Set up time	tSI	-	-	-	ns	for DCLK	
	Hold time	tHI	-	-	-			
	Rise/Fall time	tIr,tIf	-	-	-	ns	for DCLK	
Data	Horizontal Back porch	tHBP	48	48	48	tCLK		
	Horizontal Display time	tHD	480	480	480			
	Horizontal Front porch	tHFP	66	116	766			
	Vertical Back porch	tVBP	18	18	18	tHP		
	Vertical Display time	tVD	234	234	234			
	Vertical Front porch	tVFp	10	15	768			
	Set up time	tDS	5	-	-	ns		for DCLK
	Hold time	tHD	10	-	-			
	Rise/Fall time	tDr,tDf	-	-	25			

9.3 TIMING BETWEEN INTERFACE SIGNAL AND POWER SUPPLY



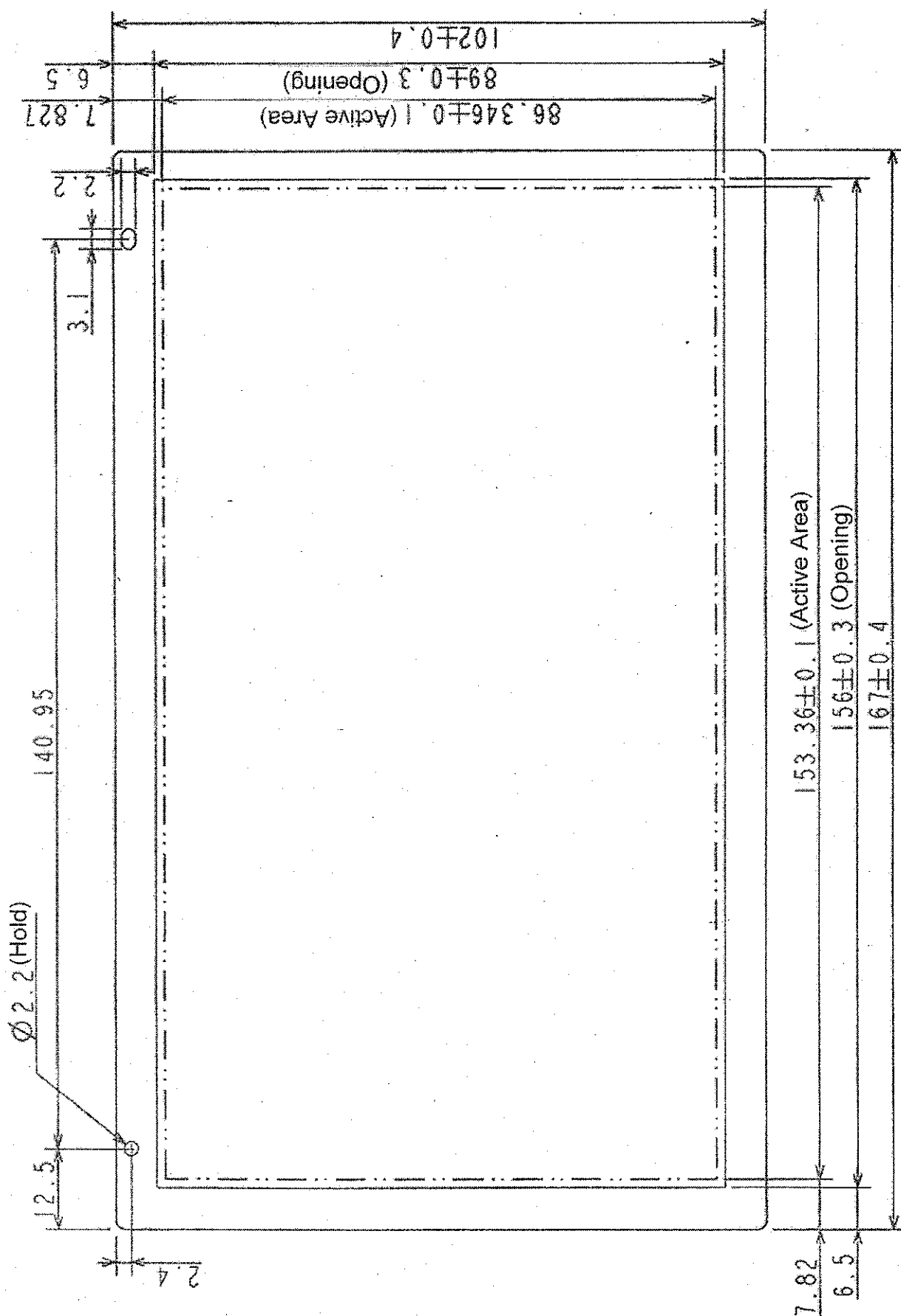
Note 1) Set $0V \leq V_I(t) \leq V_{DD}(t)$.

Here, $V_I(t)$, $V_{DD}(t)$ indicate the transitional state of V_I , V_{DD} when power supply is turned ON or OFF.

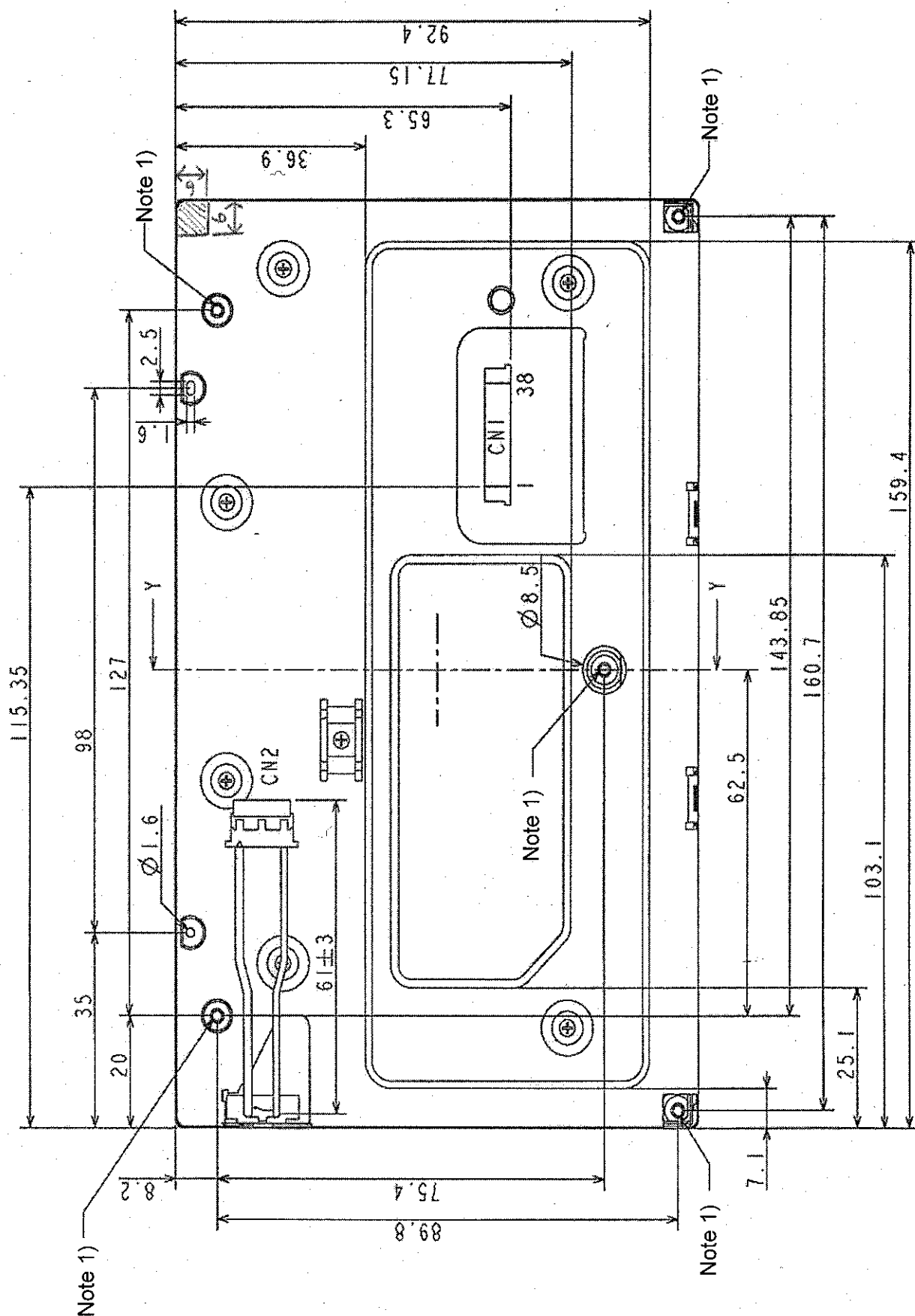
2) Do not keep interface signal high-impedance when power on.

10. DIMENSIONAL OUTLINE

10.1 SURFACE SIDE



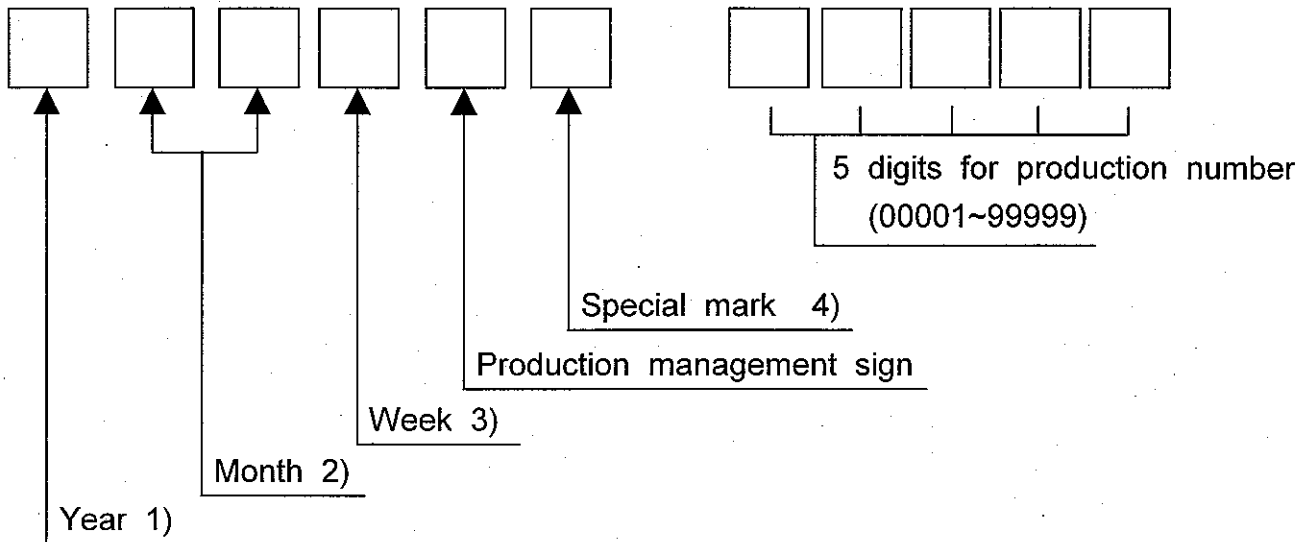
10.2 BACK SIDE



Note 1) : In the 4.5mm deep of the hold the diameter is 1.8mm.

11. DESIGNATION OF LOT MARK

11.1 LOT MARK



Notes

1)

Year	Mark
2007	7
2008	8
2009	9
2010	0
2011	1

2)

Month	Mark	Month	Mark
1	01	7	07
2	02	8	08
3	03	9	09
4	04	10	10
5	05	11	11
6	06	12	12

3)

Week (Days)	Mark
1~7	1
8~14	2
15~21	3
22~28	4
29~31	5

4) The special mark may be added by manufacturing accordingly to production number.

11.2 REVISION(REV.) CONTROL

REV. column is controlled by the manufacturing. A-Z except I and O is to be written on this column

11.3 LOCATION OF LOT MARK

Lot mark is printed on a label. The label is on rear side of module as shown in the drawing at Section 10.

The style of character may be changed without notice.



12. COSMETIC SPECIFICATIONS

12.1 CONDITION FOR COSMETIC INSPECTION

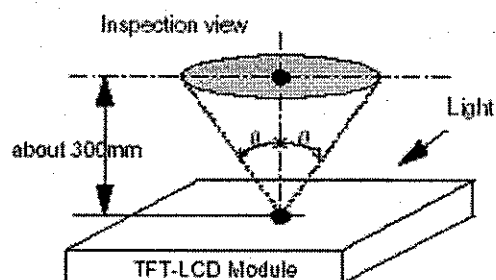
(1) Viewing zone

- a) The figure shows the correspondence between eyes (of inspector) and TFT-LCD module.

$\theta \leq 45^\circ$: when non-operating inspection

$\theta \leq 5^\circ$: when operating inspection

- b) Inspection should be executed only from front side and only A-zone.
Cosmetic of B-zone and C-zone are ignored.
(refer to 12.2 Definition of zone)



(2) Environmental

- a) Temperature : 25°C

The appearance inspection at Back-light on is done at 25°C on a TFT-LCD panel.

- b) Ambient light : More than 2000 [lx] and non-directive.

- c) Back-light : when non-operating inspection , Back-light should be off.

(3) Operating inspection

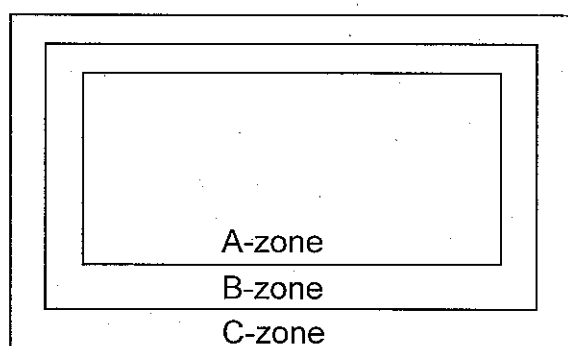
Operating inspection should be done with 8 color mode (without gray scale).

12.2 DEFINITION OF ZONE

A-zone : Display area (pixel area)

B-zone : Area between A-zone and C-zone

C-zone : Metallic bezel area (include I/F connector)



12.3 COSMETIC SPECIFICATIONS

When displaying conditions are not stable (ex. at turn on or off), the following specifications are not applied.

No	ITEM			Max. acceptable number	Unit	Note
				A-zone		
1	Dot defect	Sparkle mode	1-dot	4	pcs	1),2),4)
			2-dots	1	Units	1),2),5)
			3-dots	0		
			4-dots	0		
			Density	2	pcs/φ20mm	1),2),6)
			Total	5	pcs	1),2)
		Black mode	1-dot	5	pcs	1),3),4)
			2-dots	2	Units	1),3),5)
			3-dots	0		
			4-dots	0		
			Density	3	pcs/φ20mm	1),3),6)
			Total	5	pcs	1),3)
Total			10	pcs	1)	
2	Line defect			Serious one is not allowed	-	-
3	Uneven brightness					
4	Stains, Foreign Materials Line shape W : width (mm) L : length (mm)	W≤0.02	L : Ignore	Ignore	pcs	7)
		W≤0.03	L≤2.0	10		
			L>2.0	0		
		W≤0.06	L≤1.0	10		
			L>1.0	0		
W>0.06		-	(See dot shape)			
5	Stains, Foreign Materials Dot shape D : ave. dia (mm)	D≤0.22		Ignore	pcs	7)
		D≤0.33		5		
		D>0.33		0		
6	Scratch on polarizer Line shape W : width (mm) L : length (mm)	W≤0.01	L : Ignore	Ignore	pcs	8)
		W≤0.02	L≤40	10		
			L>40	0		
		W≤0.04	L≤20	10		
			L>20	0		
7	Scratch on polarizer Dot shape D : ave. dia (mm)	D≤0.2		Ignore	pcs	8)
		D≤0.4		10		
		D>0.4		0		

No	ITEM		Max. acceptable number	Unit	Note
			A-zone		
8	Bubbles, peeling In polarizer [D:ave.dia(mm)]	$D \leq 0.3$	Ignore	pcs	8)
		$D \leq 0.5$	10		
		$D \leq 1.0$	5		
		$D > 1.0$	0		
9	Not Acceptable Wrinkles on polarizer		Serious one is not allowed	-	-

Note 1) Dot defect : defect area > 1/2 dot

2) Sparkle mode : brightness of dot is more than 30% at black raster. (visible to eye)

3) Black mode : brightness of dot is less than 70% at white raster. (visible to eye)

4) 1 dot : defect dot is isolated, not attached to other defect dot.

5) N dots : N defect dots are consecutive. (N means the number of defects dots)

6) Density : number of defect dots inside 20mm ϕ .

7) Those stains which can be wiped out easily are not defects.

8) Polarizer area inside of B-zone is not applied.

13. PRECAUTION

Please pay attention to the followings when you use this TFT-LCD Module with Back-light unit.

Life support applications : HITACHI's products are not authorized for use in life support systems.

13.1 PRECAUTION TO HANDLING AND MOUNTING

- (1) You should consider the mouting structure so that uneven force (ex. twisted stress) is not applied to the module.
- (2) To improve the strength of module against the mechanical shock the space between the module and the case should be less than 1.0mm.
- (3) Protection material in front of LCD's screen surface is recommended to protect a polarizer , LCD-glass and metal bezel. Please be note that the protection material should not touch them directry.
- (4) Acetic acid type and chloline type materials for the cover case are not desiable because the former generate corrosive gas of attacking the polarizer at high temperature and the latter causes circuit break by electro-chemical reaction.
- (5) Do not touch, push or rub the exposed polarizers with glass, tweezers or anything harder than HB pencil lead. And please do not rub by dustclothes with chemical treatment. Do not touch the surface of polarizer with bare hand or greasy close. (Some cosmetics are detrimental to the polarizer.)
- (6) When the surface becomes dusty, please wipe gently with absorbent cotton or other soft materials chamois soaked Normal-Hexane. Normal-Hexane is recommended for clearning the adhesives used to attach front/rear polarizers. Do not use acetone, toluene and alcohol because they cause chemical damage to the polarizer.
- (7) Wipe off saliva or water drops as soon as possible. Their long time contact with polarizer cuses deformations and color fading.
- (8) The module should never be opened or modified.
It may cause not to operate properly.
- (9) Metallic bezel of a module should not be handled with bare hand or dirty gloves. Otherwise, color of a metallic frame may become dirty during its storage.
It is recommended to use clean soft gloves and clean finger stalls when a module is handled at incoming inspection process and production (assembly) process.
- (10) When you adopt a metallic shield board on backside of TFT-LCD Module, it should not be too close to TFT-LCD Module.
- (11) Do not pull or do not fold the CCFL cable.

13.2 PRECAUTION TO OPERATION

- (1) You should adopt radiation structure to satisfy the temperature specification.
- (2) Optical response time, luminance and chromaticity depend on the temperature of a TFT-LCD module. (At lower temperature it becomes longer.)
- (3) Response time and saturation time of CCFL luminance become longer at lower temperature operation.
- (4) Sudden temperature change may cause dew on and/or in the a module.
Dew males damage to a polarizer and/or electrical contacting portion.
Dew causes fading of displayed quality.
- (5) Fixed patterns displayed on a module for a long time may cause after-image.
It will be recovered soon.
- (6) Please connect the Back-light connector to the inverter circuit directly.
The long cable between CCFL and the inverter may cause the brightness drop of CCFL and may cause the rise of starting lamp voltage(Vs).
- (7) The module should not be connected or removed while a main system works.
- (8) Inserting or pulling I/F connectors causes any truble when power supply and signal datas are on-state. I/F connectors should be inserted and pulled after power supply and signal datas are turned off.

13.3 ELECTROSTATIC DISCHARGE CONTROL

- (1) Since a module consists of a TFT cell and electronic circuits with CMOS-ICs, which are very weak to electrostatic discharge, persons who are handling a module should be grounded through adequate methods such as a list band.
I/F connector pins should not be touched directly with bare hands.
- (2) Protection film for a polarizer on a module should be slowly peeled off so that the electrostatic charge can be minimized.

13.4 PRECAUTION TO STRONG LIGHT EXPOSURE

A module should not be exposed under strong light. Otherwise, characteristics of a polarizer and color filter in a module may be degraded.

13.5 PRECAUTION TO STORAGE

When TFT-LCD Modules are stored for long time, following precautions should be taken care of :

- (1) Modules should be stored in a dark place. It is prohibited to apply sunlight or fluorescent light during storage. Modules should be stored at 0 to 35°C at normal humidity (60%RH or less).
- (2) The surface of polarizers should not come in contact with any other object. It is recommended that modules should be stored in the HITACHI's shipping box.

13.6 PRECAUTION TO HANDLE PROTECTIVE FILM

- (1) When the protective film is peeled off, static electricity is generated between the film and the polarizer. This film should be peeled off slowly and carefully by people who are electrically grounded and with well ion-blown equipment or in such a condition, etc.
- (2) The protective film is attached to the polarizer with a small amount of glue. If some stress is applied to rub the protective film against the polarizer during the time you peel off the film, the glue is apt to remain more on the polarizer. So please carefully peel off the protective film without rubbing it against the polarizer.
- (3) When the module with protective film attached is stored for long time, sometimes there remains a very small amount of glue, still on the polarizer after the protective film is peeled off. Please refrain from storing the module at the module at the high temperature and high humidity for glue is apt to remain in these condition.
- (4) The glue may be taken for the modules failure, but you can remove the glue easily. When the glue remains on the polarizer surface or its vestige is recognized, please wipe them off with absorbent cotton waste or other soft material like chamois soaked with Norm-Hexane.

13.7 SAFETY

- (1) If module is broken, be careful to handle not to injure.
(TFT-LCD and Lamp are made of glass.)
Please wash hands sufficiently when you touch the liquid crystal coming out from broken LCDs.
- (2) As Back-light unit has high voltage circuit internal, do not open the case and do not insert foreign materials in the case.
- (3) The CCFL inverter should be designed to include the function of output shutdown in case the output overcurrent happen due to any backlight trouble.
The shutdown function should be assured to work in abnormal condition at the actual systems.

13.8 ENVIROMENTAL PROTECTION

- (1) This TFT-LCD Module include Cold Cathode Fluorescent Lamp (CCFL). CCFL contains a small amount of mercury. Please follow local ordinance or regulations for disposal.
- (2) Flexible circuits board, printed circuits board and solder used in a module contain small amount of lead (Pb). Please follow local ordinance or regulations for its disposal.

13.9 USE RESTRICTIONS AND LIMITATIONS

- (1) This product is not authorized for use in life support devices or systems, military applications or other applications which pose a significant risk of personal injury.
- (2) In no event shall HITACHI, Ltd. , be liable for any incidental, indirect or consequential damages in connection with the installation or use of this product, even if informed of the possibility thereof in advance. These limitations apply to all causes of action in the aggregate, including without limitation breach of contract, breach of warranty, negligence, strict liability, misrepresentation and other torts.

13.10 OTHERS

- (1) Electrical components which may not affect electrical performance are subjective to change without notice because of their availability.