



TO : General

DATE :

SAMSUNG TFT-LCD

MODEL NO. : LMS320HF0X-001

Note

Any Modification of Spec is not allowed without SEC's permission.

Approved by : J. O. Kwag

LCD BUSINESS

Samsung Electronics Co., LTD.



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Revision History*Preliminary*

Data	Rev. No.	Page	Summary
2007.07.25	00		1.Released V.00

General Description

* Description

LMS320HF0X-001 is a color active matrix Thin Film Transistor (TFT) liquid crystal display (LCD) that uses amorphous silicon TFT as a switching devices. This model is composed of a Transmissive with Micro Reflective (TMR) type Main TFT-LCD Panel.

The resolution of a 3.2" Main TFT-LCD contains 240 x 432 pixels can display up to 65K/260K colors.

* Features

- TMR type for Main TFT-LCD Panel.
- One back-light with 7 LEDs.
- 8/9/16/18bit CPU Interface, 6/16/18bit RGB Interface, 16/18bpp MDDI
- Full, Still, Stand-by & Deep Stand-by mode are available.
- mPVA(mobile Patterned Vertical Alignment) LC mode
- Driver IC : R61509(RENESAS[®])

* Applications

- Display terminals for cellular phone.

* General Information

Items	Specification	Unit
	Main Panel	
Display area(A/A)	39.6(H) × 71.25(V) (3.2 inch diagonal)	mm
Driver element	a-Si TFT Active matrix	-
Display colors	65K / 260K	color
Number of pixels	240×RGB×432	pixel
Pixel arrangement	RGB Vertical Stripe	-
Pixel pitch	0.165(H) × 0.165(V)	mm
Glass Thickness	0.4	mm
Display mode	Normally Black	-
Viewing direction	12	o'clock
Surface Treatment	2	H

* Mechanical Information

Item		Min.	Typ.	Max.	Unit	Note
Module size	Horizontal(H)	44.95	45.10	45.25	mm	(1)
	Vertical(V)	80.52	80.67	80.82	mm	(1)
	Depth(D)	2.15	2.30	2.45	mm	(1)
Weight		-	-	-	g	-

Note (1) Refer to the Outline Dimension in the page 28 for further information.

1. Absolute Maximum Ratings

1.1 Absolute Ratings of Environment

Item	Symbol	Min.	Max.	Unit	Note
Storage temperature	T _{STG}	-35	80	°C	(1)
Operating temperature (Ambient temperature)	T _{OPR}	-20	60	°C	(2)

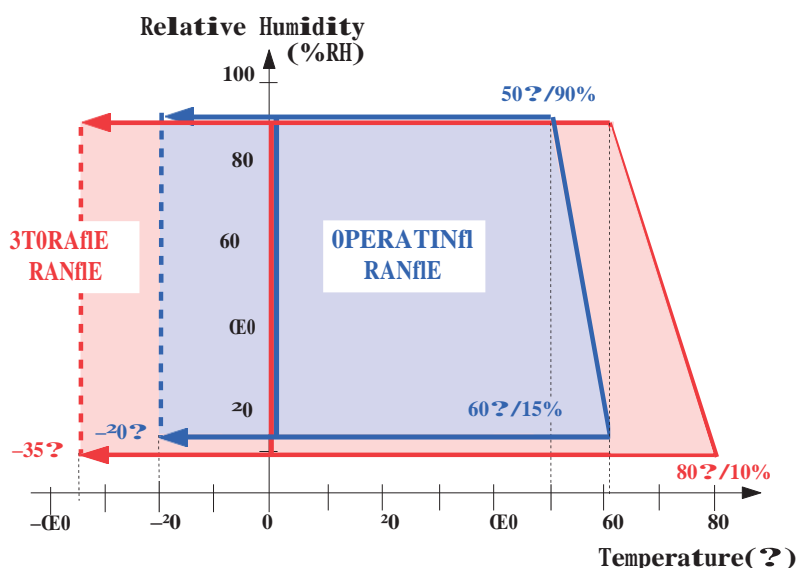
Note (1) 90% RH maximum humidity, 60°C maximum wet-bulb temperature

(2) When operated at a temperature lower than 0°C, the LCD worked slowly and the screen slowed appearing dim images due to the characteristics of LC(Liquid Crystal).

(3) If any fixed pattern is displayed in LCD for minutes, image-sticking phenomenon may occur.

(4) Degradation could occur to pixels' TFT when DC BIOS is input into its gate-signal under POWER OFF WAITING STAND-BY & SLEEP MODE. Therefore, LCD should be turn off then.

(5) Please operate a LCD module on the basis of the recommended S/W(Register DATA). If you want to change any part of the S/W, you must take Samsung's confirmation.



Temperature & Humidity Graph in Absolute Environment

1.2 Electrical Absolute Ratings、

(1) TFT-LCD Module

(Ta = 25 ± 2°C, Vss=GND=0)

Characteristics	Symbol	Min.	Max.	Unit	Note
Interface I/O voltage	IOVCC	1.65	3.1	V	-
DC/DC supply voltage	VCI	2.8	3.1	V	-

Item	Symbol	Min.	Max.	Unit.	Note
Current	I _B	-	20	mA	(1)

(2) Back-Light Unit (LED unit)

(Ta = 25 ± 2°C)

Note (1) Permanent damage to the device may occur if maximum values are exceeded or reverse voltage is loaded.

Functional operation should be restricted to the conditions described under normal operating conditions.

2. Optical Characteristics

The following items are measured under stable conditions. The optical characteristics should be measured in a dark room or equivalent state with the methods shown in Note (1).

Measuring equipment: LCD-7200, SR-3, BM-7, EZ-Contrast.

(Ta = 25 ± 2°C, IOVCC=2.6V, VCI = 3.0V, I_B = 20mA)

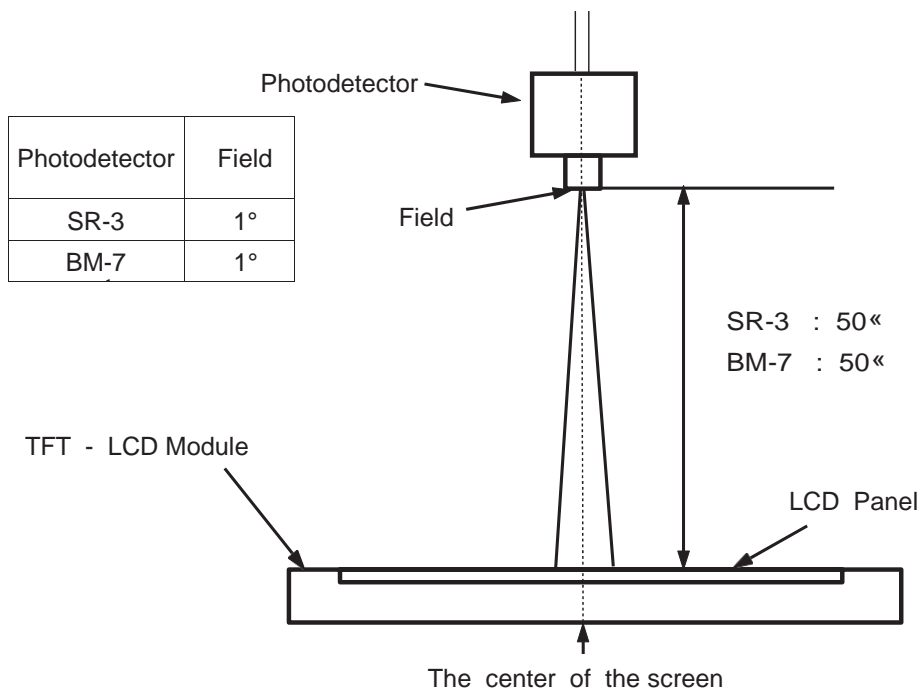
Item	Symbol	Condition	Min.	Typ.	Max.	Unit	Note	
Contrast ratio (Center point)	C/R	B/L On	300	350	-	-	(2) SR-3	
Luminance of white (Center point)	YL	B/L On	300	350	-5	cd/m2	(3) SR-3	
5-Point White Uniformity	U	B/L On	70	-	-	%	(4) SR-3	
NTSC Color Purity (CIE 1931)	Cp	B/L On	55	60	-	%	(5) SR-3	
Response time	Rising:Tr	Tr+Tf	-	25	-	msec	(6) BM-7	
	Falling:Tf							
Color chromaticity (CIE 1931)	White	Wx1	B/L On	0.269	0.319	0.369	-	(7) SR-3
		Wy1		0.310	0.360	0.410		
	Red	Rx		0.577	0.627	0.677		
		Ry		0.296	0.346	0.396		
	Green	Gx		0.296	0.346	0.396		
		Gy		0.555	0.605	0.655		
	Blue	Bx		0.097	0.147	0.197		
		By		0.051	0.101	0.151		
Viewing angle	Hor.	qL1	C/R ³ 10 B/L On	70	-	-	Degrees	(8) Ez-Contrast
		qR1		70	-	-		
	Ver.	fH1		70	-	-		
		fL1		70	-	-		

Note (1) Test Equipment Setup

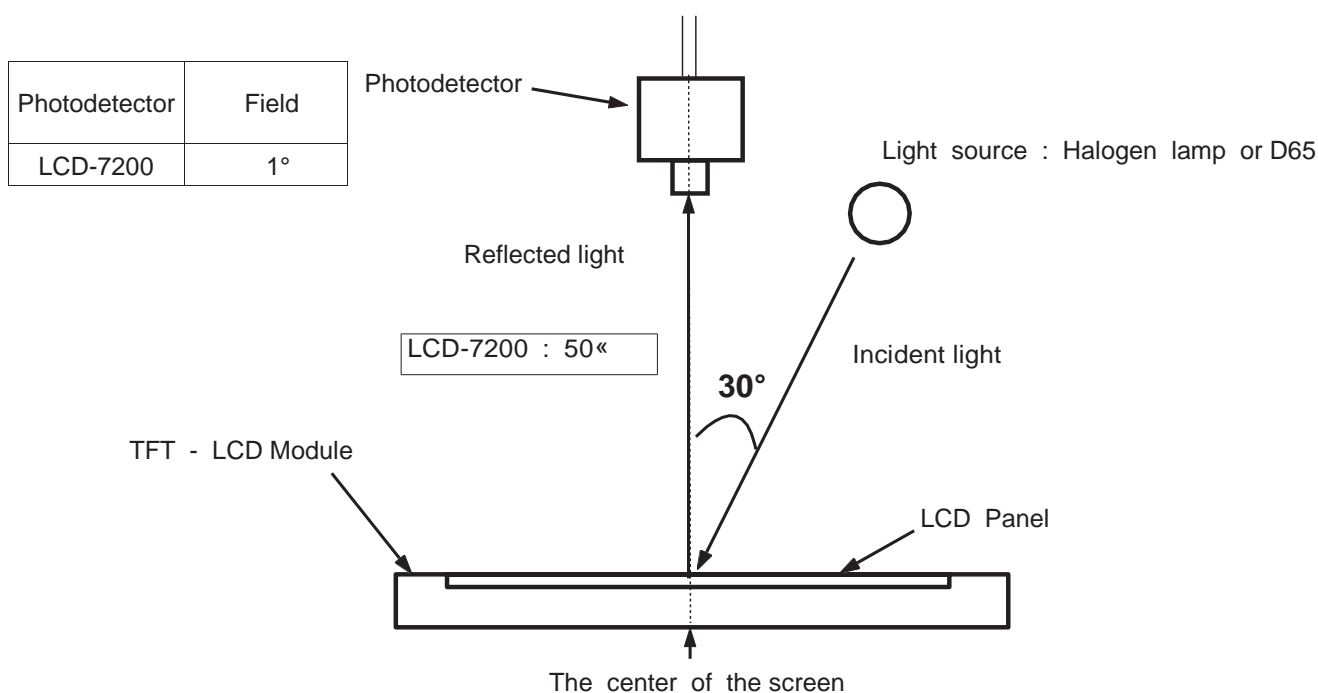
After stabilizing and leaving the panel alone at a given temperature for 30 min , the measurement should be executed. Measurement should be executed in a stable, windless, and dark room. 30 min after lighting the back-light. This should be measured in the center of screen.

Environment condition : $T_a = 25 \pm 2 \text{ }^\circ\text{C}$

- Back-Light On condition



- Back-Light Off condition



Note (2) Definition of Contrast Ratio (C/R) : Ratio of gray max (Gmax) & gray min (Gmin) at the center point

$$CR = \frac{G_{max}}{G_{min}}$$

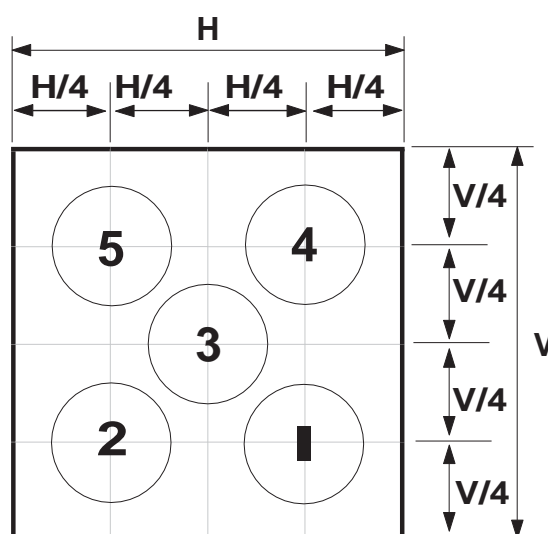
* Gmax : Luminance with all pixels white
 * Gmin : Luminance with all pixels black

Note (3) Definition of Luminance of White : Luminance of white at the center point

Light Source of Back-Light Unit	7-LED Parallel Type
LED Type & Maker	Chip Type White LED, SEM, KOREA
LED Product Code & Rank	SLSNNWH422US, Rank-K/L

Note (4) Definition of 5-Point Withe Uniformity

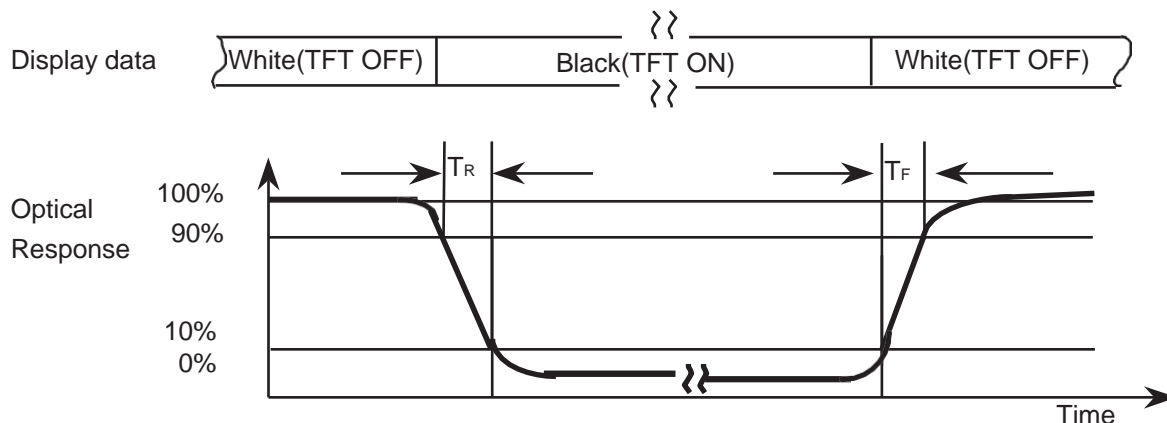
$$\text{5-Point Uniformity} = \frac{\text{Min luminance of white among 5-points}}{\text{Max luminance of white among 5-points}} \times 100\%$$



Note (5) NTSC Color Purity (CIE 1931)

$$\frac{\text{Triangle Area based on measured red, green, blue color coordinate}}{\text{Triangle Area based on NTSC standard red, green, blue color coordinate}} \times 100\%$$

Note (6) Definition of Response time : Sum of T_r , T_f

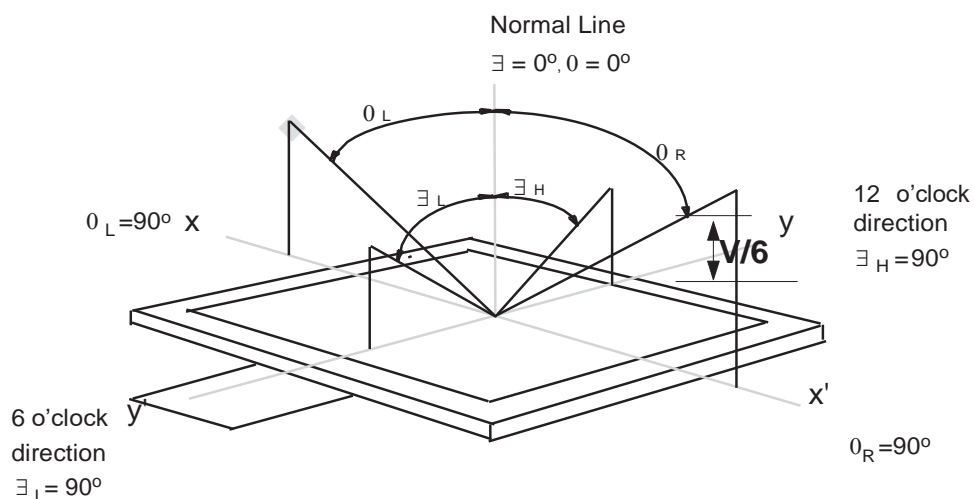


Note (7) Definition of Color Chromaticity (CIE 1931)

Color coordinate of white & red, green, blue at center point.

Light Source of Back-Light Unit	7-LED Parallel Type
LED Type & Maker	Chip Type White LED, SEM, KOREA
LED Product Code & Rank	SLSNNWH422US, Rank-K/L

Note (8) Definition of Viewing Angle



3. Electrical Characteristics

3.1 TFT-LCD Panel & Driver Circuit

(Ta = 25 ± 2°C)

Item	Symbol	Min.	Typ.	Max.	Unit	Note	
Interface I/O voltage	IOVCC	2.55	2.6	2.65	V		
DC/DC supply voltage	V _{CI}	2.95	3.0	3.05	V		
Dissipation Current	Stand-by	I _{STB}	-	-	100	^a	(1)
	Still	I _S	-	-	15	^a	(2),(4)
	Full	I _F	-	-	20		(3),(4)
Frame frequency	F _{freq}	60	70	90	Hz	-	

* To prevent a latch-up or DC operation of the LCD module, the power on/off sequence should be as the Chapter 8. Power On/Off Sequence.

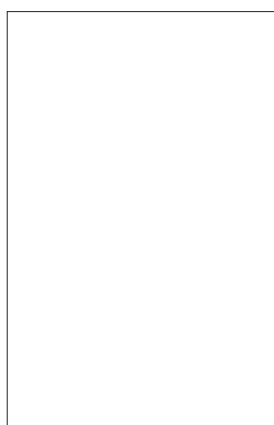
Note (1) IOVcc = 2.6 Vci = 3.0V, Deep Stand by Mode & No Input Signal

(2) IOVcc = 2.6 Vci = 3.0V, Internal Mode & No Input Signal

(3) IOVcc = 2.6 Vci = 3.0V, Moving Picture & Line Inversion

(4) IOVcc = 2.6 Vci = 3.0V, Dissipation Current Check Pattern (White Pattern)

€ 240 × 432 White Pattern



3.2 Back-Light Unit

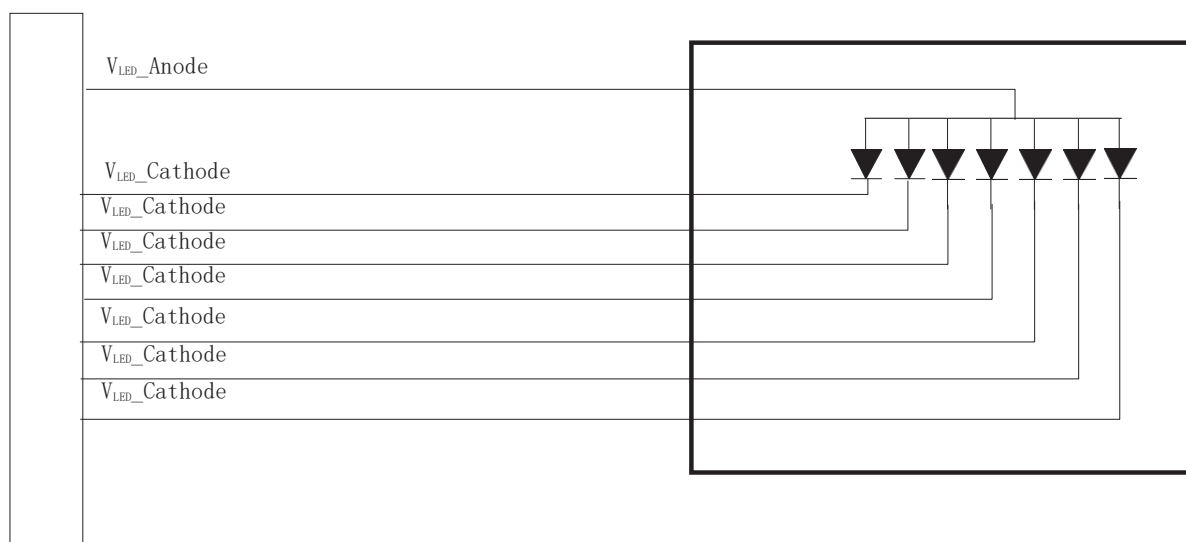
The back-light system is an edge-lighting type with seven white LEDs.

(Ta=25 ± 2°C)

Item	Symbol	Min.	Typ.	Max.	Unit	Note
Current	I _B	-	20	-	mA	(1)
Power Consumption	P _{BL}	-	450	-	mW	(2)

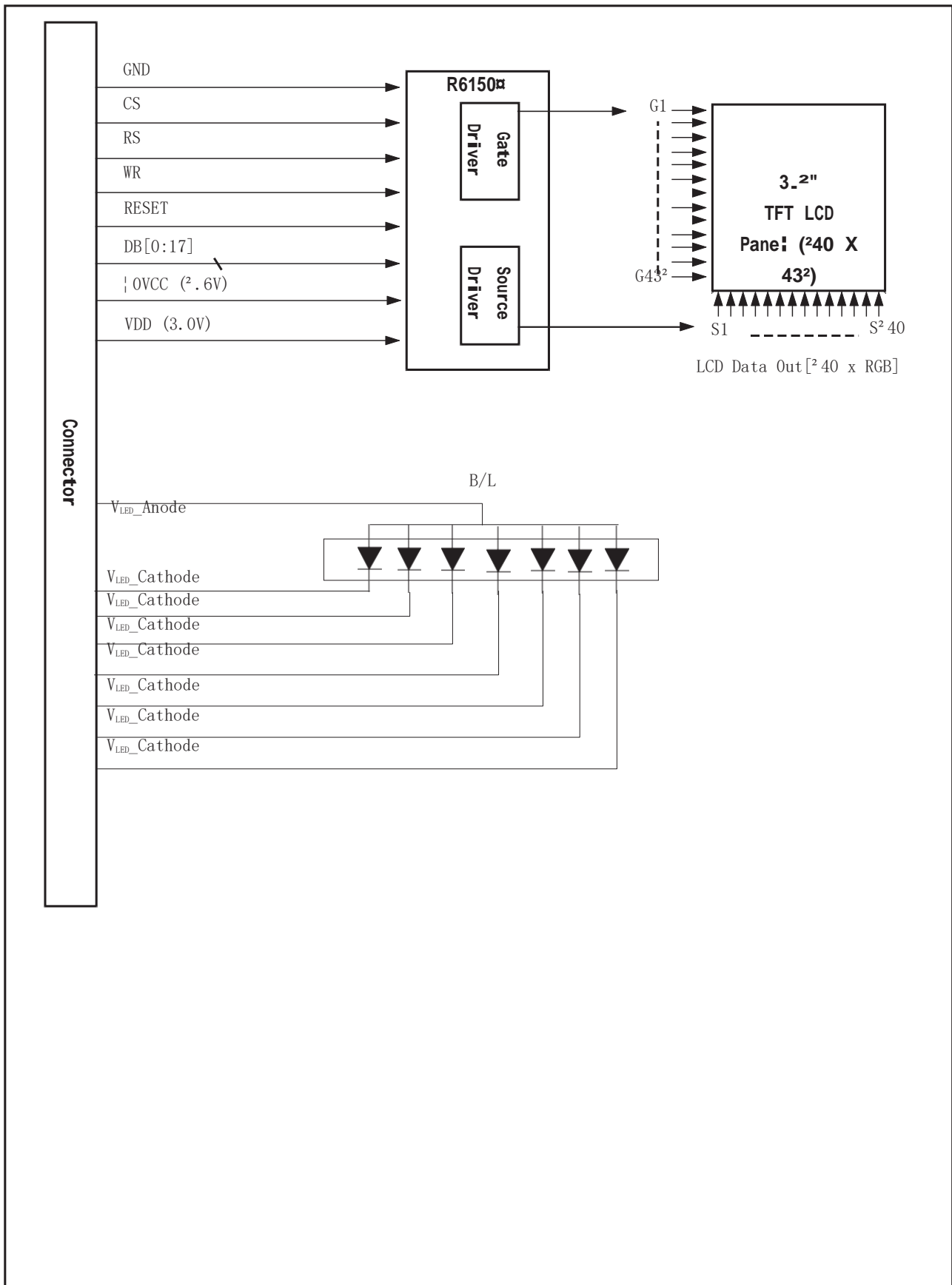
Note (1) 7LEDs parallel type

(2) Where I_B = 20mA, V_B = 3.2V (LED Forward Voltage), P_{BL} = V_B × I_B × [# of LED]



4. Block Diagram

4.1 TFT-LCD Module (CPU Interface System Structure)



5. Input Terminal Pin Assignment

5.1 Input Signal & Power (Example)

Pin Number	Pin Description	Pin Number	Pin Description
1	√ND	S	FLW
3	RESET	4	RD
†	CS	6	RS
F	WR	8	√ND
9	DB(◇)	1◇	DB(1)
11	DB(S)	1S	DB(3)
13	DB(4)	14	DB(†)
1†	DB(6)	16	DB(F)
1F	DB(8)	18	DB(9)
19	DB(1◇)	S◇	DB(11)
S1	DB(1S)	SS	DB(13)
S3	DB(14)	S4	DB(1†)
S†	DB(16)	S6	DB(1F)
SF	IOVCC	S8	IOVCC
S9	VCI	3◇	VCI
31	√ND	3S	LEDF
33	LED6	34	LED†
3†	LED4	36	LED3
3F	LEDS	38	LED1
39	LED+	4◇	√ND

5.2 Input Signal, Basic Display Colors and Gray Scale of Each Colors

COLOR	DISPLAY	Data Signal																GRAY SCALE LEVEL	
		RED					GREEN					BLUE							
		R0	R1	R2	R3	R4	R5	G0	G1	G2	G3	G4	G5	B0	B1	B2	B3		B4
BASIC COLOR	BLACK	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	1	1	1	1	1	-
	GREEN	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	-
	CYAN	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	-
	RED	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	-
	MAGENTA	1	1	1	1	1	1	0	0	0	0	0	0	1	1	1	1	1	-
	YELLOW	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	-
	WHITE	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	R0
	DARK ≠	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	R1
		0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	R2
		:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	R3~R60
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:		
	\$ LIGHT	1	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	R61
		0	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	R62
RED	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	R63	
GRAY SCALE OF GREEN	BLACK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	G0
	DARK ≠	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	G1
		0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	G2
		:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	G3~G60
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:		
	\$ LIGHT	0	0	0	0	0	1	1	0	1	1	1	1	0	0	0	0	1	G61
		0	0	0	0	0	1	0	1	1	1	1	1	0	0	0	0	1	G62
GREEN	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	1	G63	
GRAY SCALE OF BLUE	BLACK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	B0
	DARK ≠	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	B1
		0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	B2
		:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	B3~B60
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:		
	\$ LIGHT	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	B61
		0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	B62
BLUE	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	B63	

Note (1) Definition of Gray :

R_n : Red Gray, G_n : Green Gray, B_n : Blue Gray (n = Gray level)

Input Signal : 0 = Low level voltage, 1 = High level voltage

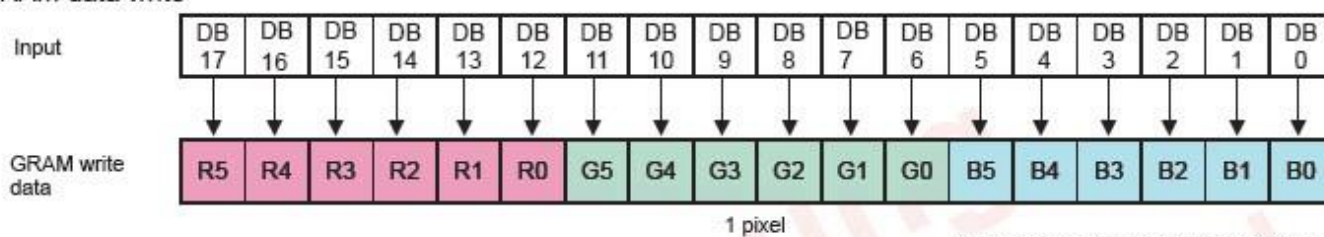
6. Interface Specifications

6.1 Register Selection

WR	RD	RS	Operation
0	1	0	Write index to IR (Index Register)
1	0	0	Setting disabled
0	1	1	Write to control register or internal GRAM
1	0	1	Read from the GRAM

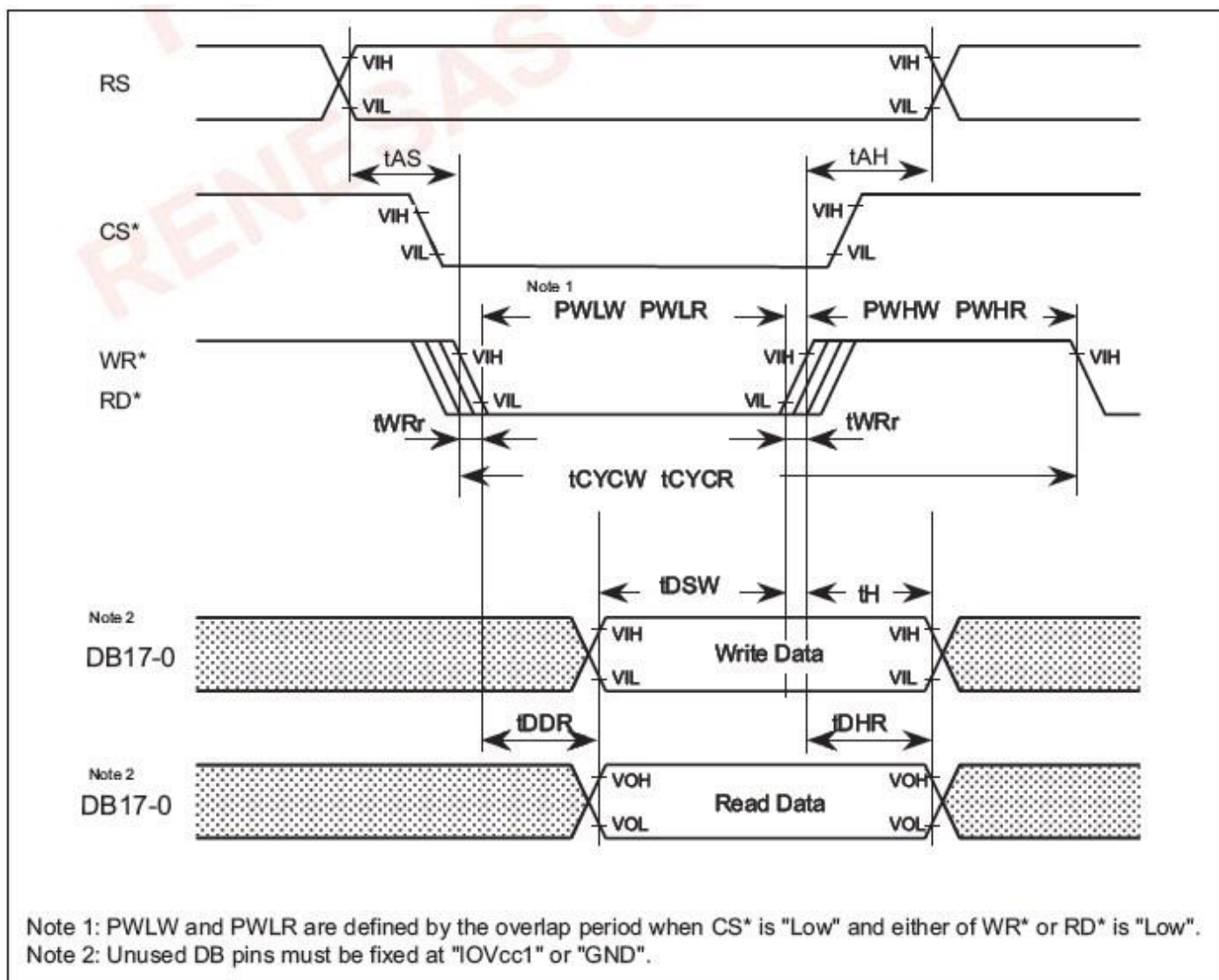
6.2 Data Format for 18bit CPU Interface

RAM data write



Note: Normal display in 262,144 colors.

6.3 18bit CPU Interface Timing - 80 System Write Case



6.4 DC Characteristics

(Ta = -40 to + 85°C, VCI = 2.8V ~ 3.1V, IOVCC = 1.65V ~ 3.1V)

Item	Symbol	Min.	Typ.	Max.	Unit
High level input voltage	V _{IH}	0.8×IOVCC	-	IOVCC	V
Low level input voltage	V _{IL}	0	-	0.2×IOVCC	

6.5 AC Characteristics

6.5.1 80-system bus interface timing characteristics (18 bit transfer modes)

(Ta = -40 to + 85°C, VCI = 2.8V ~ 3.1V, IOVCC = 1.65V ~ 3.1V)

Items		Symbol	Unit	Test condition	Min.	Typ.	Max.
Bus cycle time	Write	t _{CYCW}	ns	Figure 121	110	—	—
	Read	t _{CYCR}	ns	Figure 121	450	—	—
Write low- level pulse width		PWLW	ns	Figure 121	30	—	—
Read low-level pulse width		PWLR	ns	Figure 121	170	—	—
Write high-level pulse width		PWHW	ns	Figure 121	30	—	—
Read high-level pulse width		PWHR	ns	Figure 121	250	—	—
Write/ Read rise/fall time		t _{WRr} , t _{WRf}	ns	Figure 121	—	—	10
Setup time	Write (RS to CS*, WR*)	t _{AS}	ns	Figure 121	0	—	—
	Read (RS to CS*, RD*)		ns	Figure 121	10	—	—
Address hold time		t _{AH}	ns	Figure 121	2	—	—
Write data setup time		t _{DSW}	ns	Figure 121	20	—	—
Write data hold time		t _H	ns	Figure 121	10	—	—
Read data delay time		t _{DDR}	ns	Figure 121	—	—	150
Read data hold time		t _{DHR}	ns	Figure 121	5	—	—

7. Reset

If the /RESET input becomes L or the reset command is input, the each register to its default value. These default values are listed in the table below.

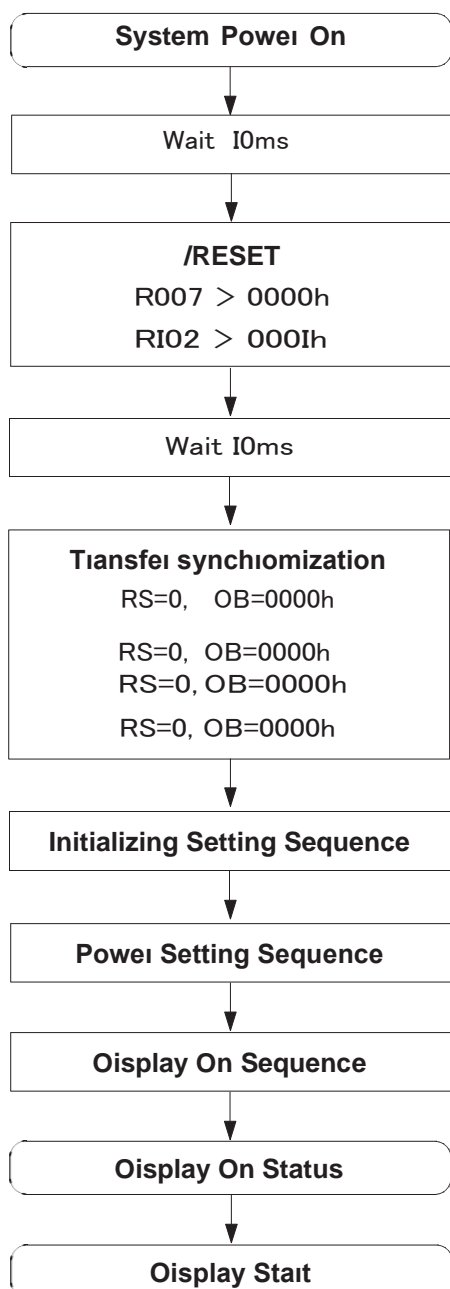
Register		Default	Note
Device code read	R000	1509H	-
Driver output control	R001	0000H	-
LCD-driving-wav control	R002	0000H	-
Entry Mode	R003	0030H	-
Outline sharpening control	R006	0000H	-
Display control 1	R007	0000H	-
Display control 2	R008	0808H	-
Display control 3	R009	0000H	-
Low power control	R00B	0000H	-
External Display Interface Control 1	R00C	0000H	-
External Display Interface Control 2	R00F	0000H	-
Panel interface control 1	R010	0017H	-
Panel interface control 2	R011	0000H	-
Panel interface control 3	R012	0000H	-
Panel interface control 4	R020	021EH	-
Panel interface control 5	R021	0000H	-
Panel interface control 6	R022	0000H	-
Frame marker control	R090	0000H	-
MDDI sub-display control	R092	0000H	-
Power control 1	R100	0000H	-
Power control 2	R101	0660H	-
Power control 3	R102	0000H	-
Power control 4	R103	0000H	-
Power control 5	R107	0000H	-
Power control 6	R110	0000H	-
RAM address set (horizontal)	R200	0000H	-
RAM address set (vertical)	R201	0000H	-
Write/read data from/to NVM	R280	0000H	-
Vcom high voltage 1	R281	0000H	-
Vcom high voltage 2	R282	0000H	-
Window horizontal RAM address start	R210	0000H	-
Window horizontal RAM address end	R211	00EFH	-
Window vertical RAM address start	R212	0000H	-
Window vertical RAM address end	R213	01AFH	-

Register		Default	Note
y Control 1	R300	0000H	-
y Control 2	R301	0000H	-
y Control 3	R302	0000H	-
y Control 4	R303	0000H	-
y Control 5	R304	0000H	-
y Control 6	R305	0000H	-
y Control 7	R306	0000H	-
y Control 8	R307	0000H	-
y Control 9	R308	0000H	-
y Control 10	R309	0000H	-
y Control 11	R30A	0000H	-
y Control 12	R30B	0000H	-
y Control 13	R30C	0000H	-
y Control 14	R30D	0000H	-
Base image number of line	R400h	3500H	-
Base image display control	R401H	0000H	-
Base image vertical scroll control	R404H	0000H	-

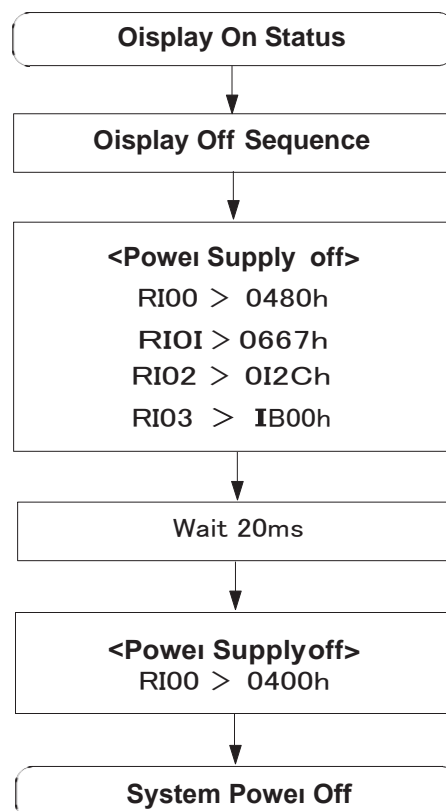
8. Operation Sequence

8.1 Power On/Off Sequence

< Power On Sequence >



< Power Off Sequence >



[^] Remark : VCI = 2.6V
IOVCC = 3.0V

8.2 Power Setting & Initializing Sequence

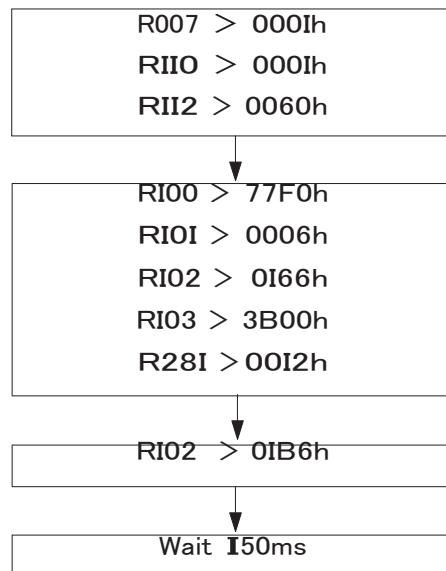
< Initializing Sequence >

R001 > 0I00h
 R002 > 0I00h
 R003 > I23Ih
 R006 > 0000h
 R008 > 0808h
 R006 > 000Ih
 R00B > 00I0h
 R00C > 000Ih
 R00F > 0000h
 R0I0 > 00I5h
 R0II > 0402h
 R0I2 > 0300h
 R020 > 0000h
 R02I > 0000h
 R022 > 0000h
 R060 > 0000h
 R062 > 0000h

R300 > 0307h
 R30I > 0604h
 R302 > 0000h
 R303 > 0303h
 R304 > 0I0Ih
 R305 > 0006h
 R306 > IFI0h
 R307 > 0005h
 R308 > 0000h
 R306 > 0707h
 R30A > 0300h
 R30B > 0303h
 R30C > 0506h
 R300 > IBIFh

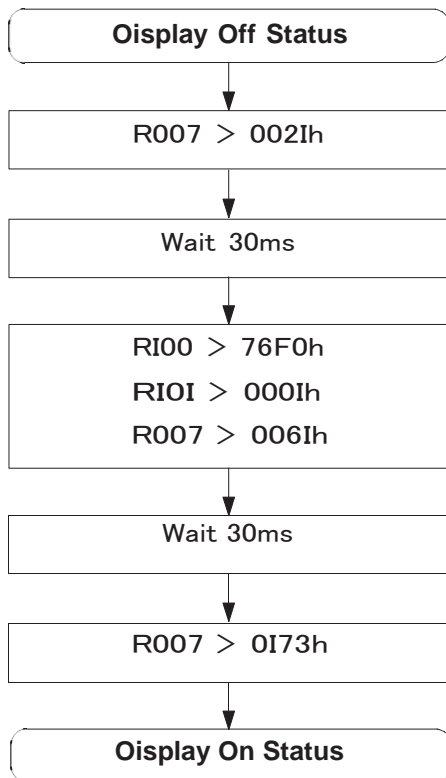
R400 > 3500h
 R40I > 0000h
 R404 > 0000h
 R2I0 > 0000h
 R2II > 00EFh
 R2I2 > 0000h
 R2I3 > 0IAFh

< Power Setting Sequence >

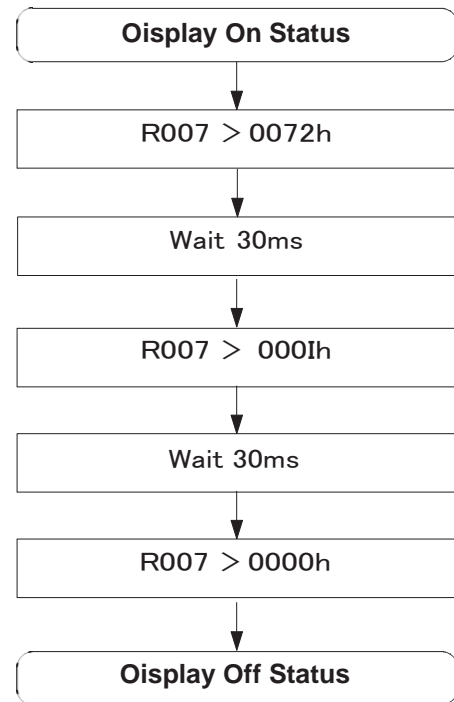


8.3 Display On/Off Sequence

< Display On Sequence >



< Display Off Sequence >



8.4 Stand-by / Standby-out Sequence

< Standby Sequence >

Display On Status

Display Off Sequence

Display Off Status

RI00 > 0004h

Standby Status

< Wake-up Sequence >

Standby Status

/RESET

RI07 > 0000h

RI02 > 0001h

Wait 10ms

Transfer synchronization

RS=0, OB=0000h

RS=0, OB=0000h

RS=0, OB=0000h

RS=0, OB=0000h

Initializing Setting Sequence

Power Setting Sequence

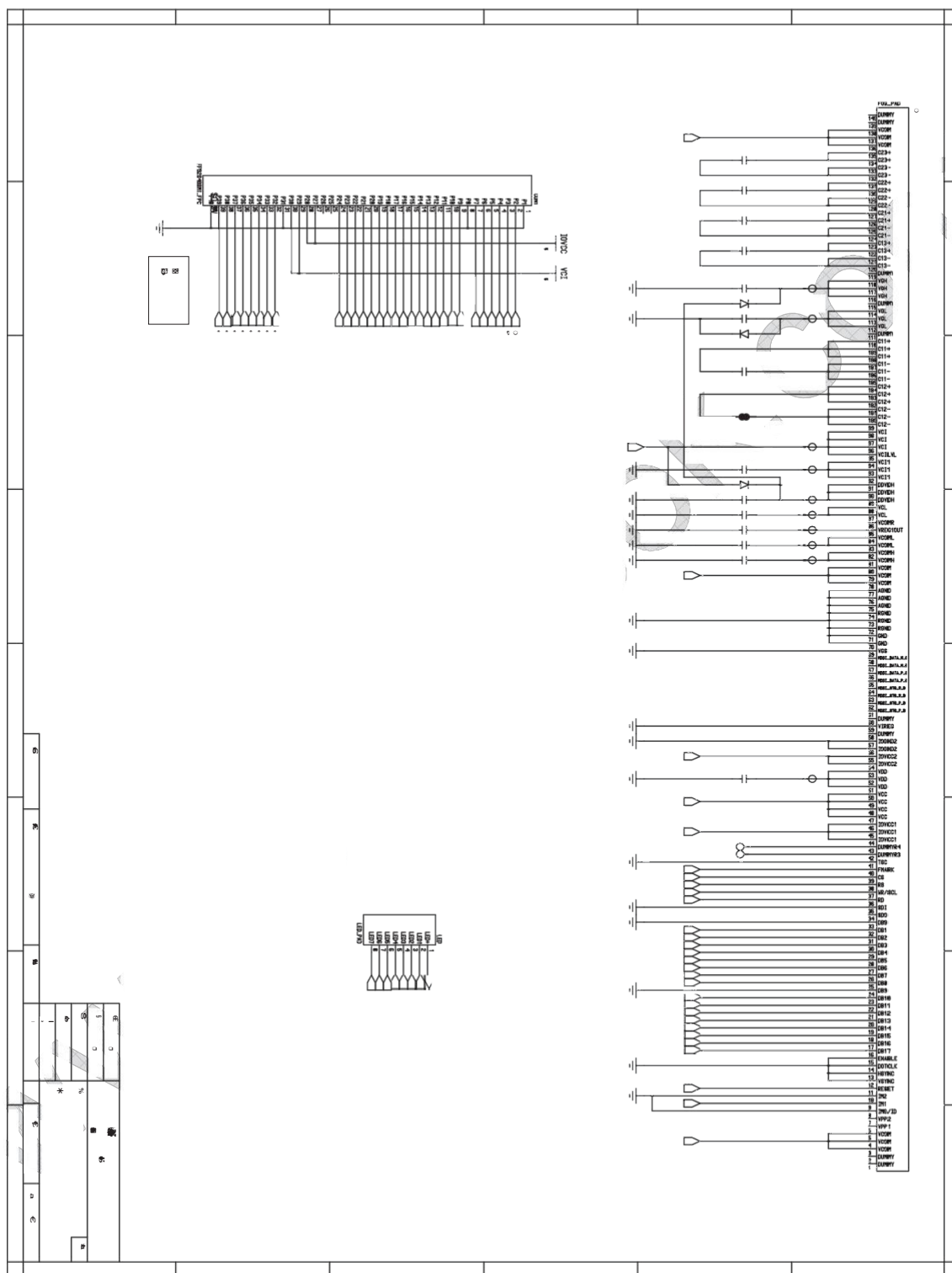
Display On Sequence

Display On Status

Display Start

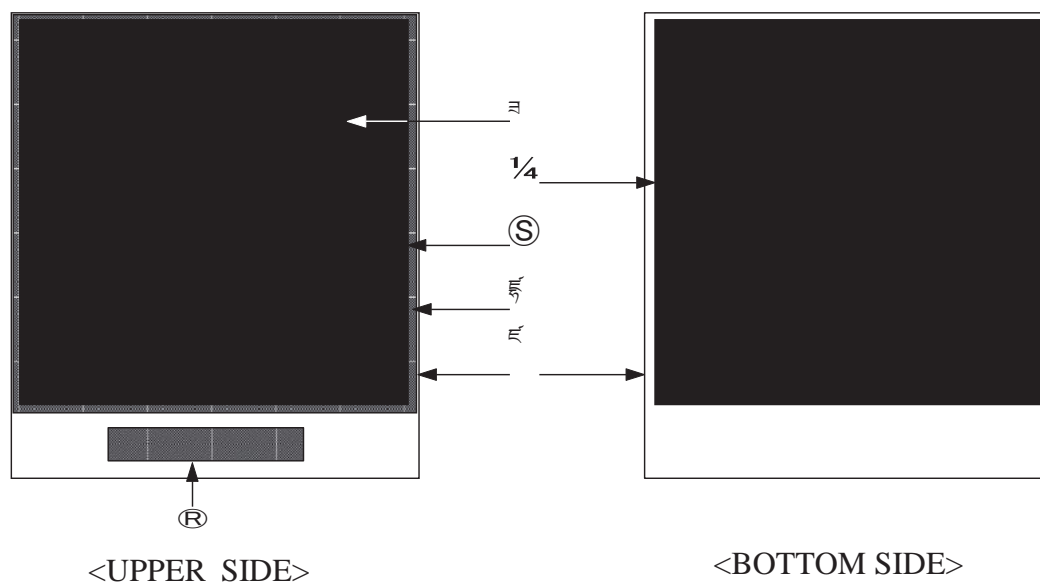
9. FPC Circuit

9.1 FPC Circuit



10. Partlist of components

10.1 Panel & Driver IC



No	Name	SPEC.	Maker	Amount	Remark
1	TFT GLASS	0.4T	SEC	1	④
2	COLOR FILTER GLASS	0.4T	SEC	1	④
3	UPPER POLARIZER	NAB-UFCATU-AG150G,	KORENO	1	Ⓢ
4	LOWER POLARIZER	NAB-UFCATU-AG150G	KORENO	1	¼
5	LIQUID CRYSTAL	MAT-03-877	MERCK	1	④
6	DRIVER IC	R61509, 0.225T	RENESAS	1	Ⓜ

10.2 Main FPC Partlist

TBD

10.3 B/L Partlist

TBD

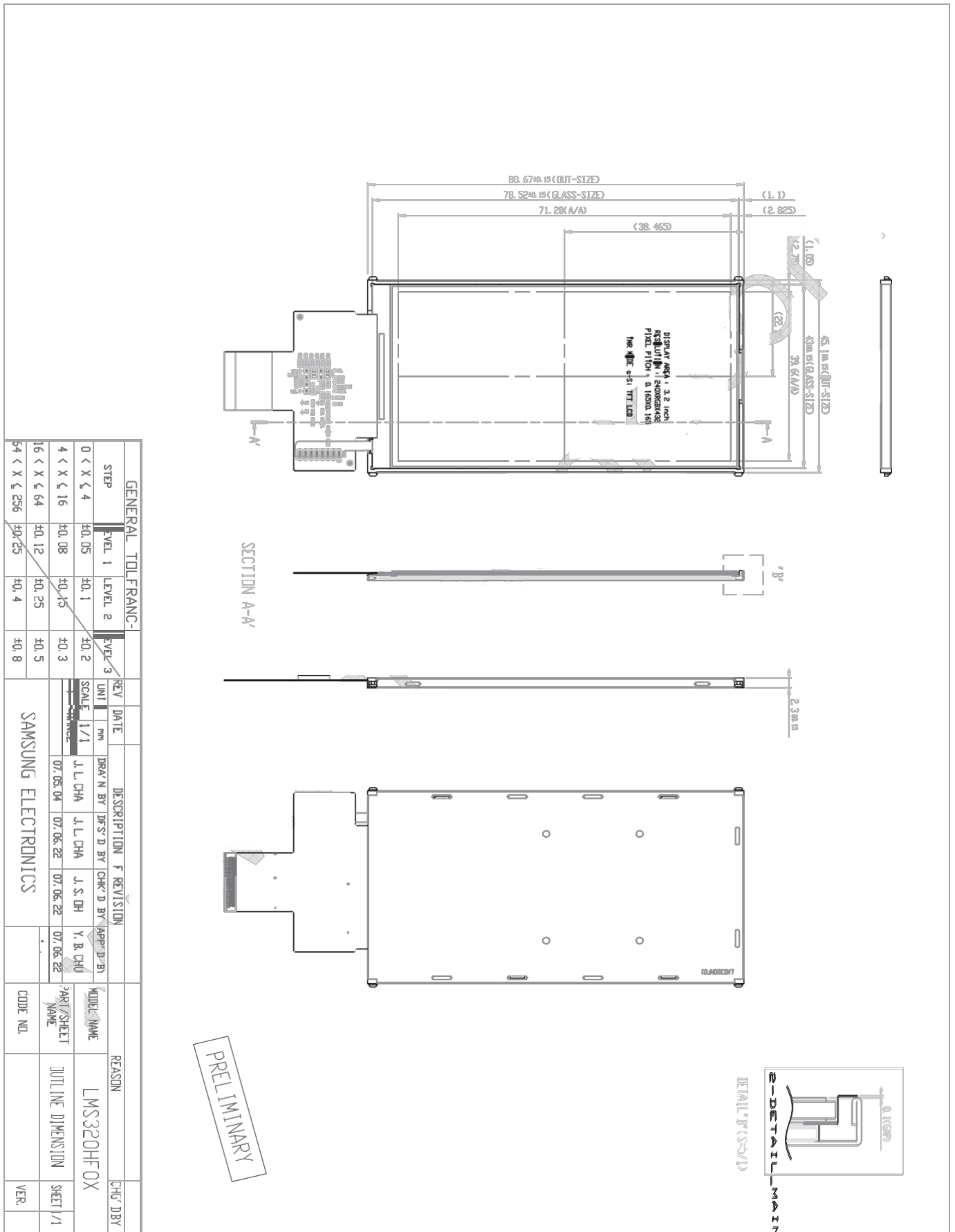
☒ Back Light Burr Control

- Burr Height : MAX 0.03mm
MAX 0.02mm (On FPC touch part)

- Burr direction : Inside

If the burr direction is outside, Add to chamfer or half impacting processing
On piercing area of FPC touch part

11. Module Outline Dimension



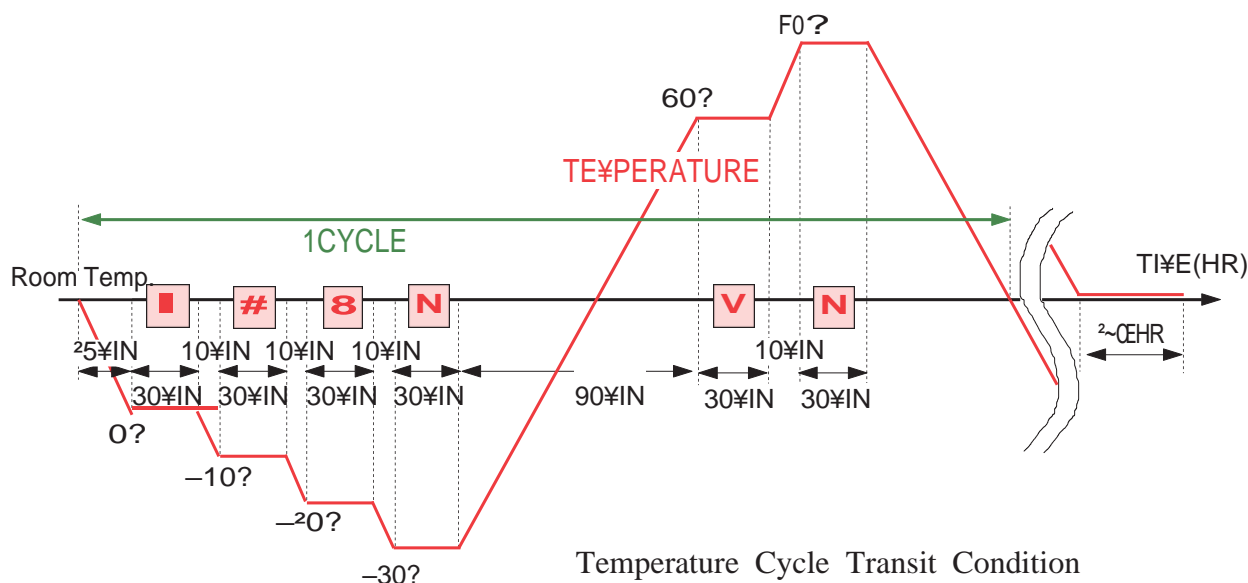
GENERAL TOLFRANC-			REV	DATE	DESCRIPTION / REVISION			MODEL NAME	REASON	CHK'D BY
STEP	LEVEL 1	LEVEL 2	LEVEL 3	UNI	DRW'N BY	DES'G'D BY	CHK'D BY	APP'D BY		
0 < X < 4	±0.05	±0.1	±0.2	mm	J. L. CHA	J. L. CHA	J. S. OH	Y. B. CHU	LMS320HF0X	
4 < X < 16	±0.08	±0.15	±0.3	mm	J. L. CHA	J. L. CHA	J. S. OH	Y. B. CHU		
16 < X < 64	±0.12	±0.25	±0.5	mm	J. L. CHA	J. L. CHA	J. S. OH	Y. B. CHU		
64 < X < 256	±0.25	±0.4	±0.8	mm	J. L. CHA	J. L. CHA	J. S. OH	Y. B. CHU		
SAMSUNG ELECTRONICS										
								PART / SHEET NAME	OUTLINE DIMENSION	SHEET 1/1
								CODE NO.		VER.

12. Reliability Test Result

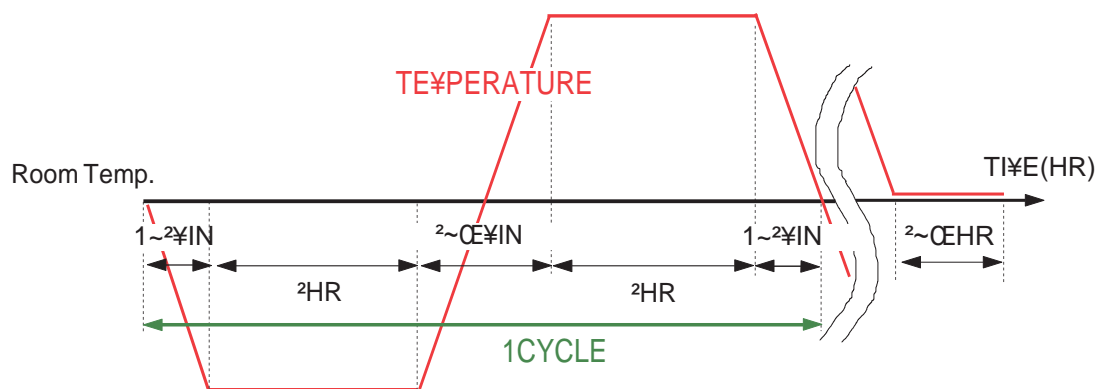
12.1 Condition

Item	Condition	Note
High Temperature Operating Life test	60?, 160HR	-
Low Temperature Operating Life test	-20?, 160HR	-
Thermal Humidity Bias test	60?, 90%RH, 160HR	-
Temperature Cycle ON/OFF test	-30? — 70?, ON/OFF, 12CYC	(1)
High Temperature Storage test	85?, 160HR	-
Low Temperature Storage test	-40?, 160HR	-
Thermal Shock test	(-40? ⇄ 85?) ^{30CYC}	(2)
Electro-Static Discharge test	Contact : ±4kV, 20times	(3)
	Air : ±8kV, 20times	
Box Vibration Test	RANDOM 0.74Grms, 1HR/Y axis (SMALL BOX)	(4)
Box Drop Test	1 Corner 3 Edges 6 faces, 66™(MEDIUM BOX)	-

Note (1) ON Time over 10 seconds, OFF Time under 10 seconds



Note (2) STORAGE



Thermal Shock Transit Condition

Note (3) Main-LCD, 5 times to every 4 corners of active area

Note (4) Basic transportation by common carrier environmental, 514.4 MIL-STD-810E

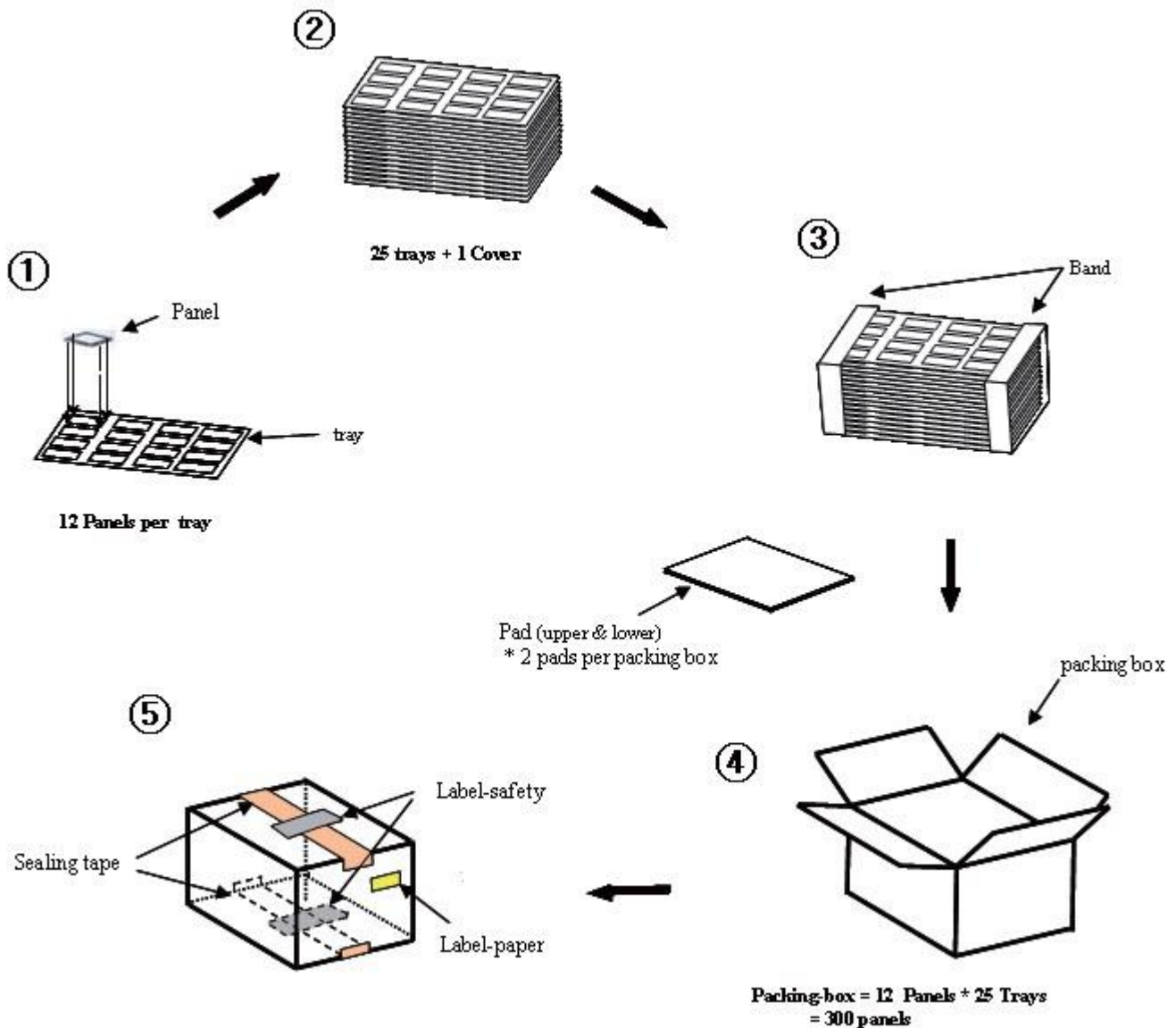
OVERALL L RMS LEVEL	BREAK POINT					
	FRQUENC Y	PSD VALUE	FRQUENC Y	PSD VALUE	FRQUENC Y	PSD VALUE
0.74G	10 TM	0.00650	121 TM	0.00300	340 TM	0.00003
	20 TM	0.00650	200 TM	0.00300	500 TM	0.00015
	120 TM	0.00020	240 TM	0.00150	-	-

11.2 Judgement

- (1) Main LCD should work under the normal condition.
- (2) After the temperature and humidity test, the luminance and CR(Contrast Ratio) should not be changed over 50% compared with those before the test.

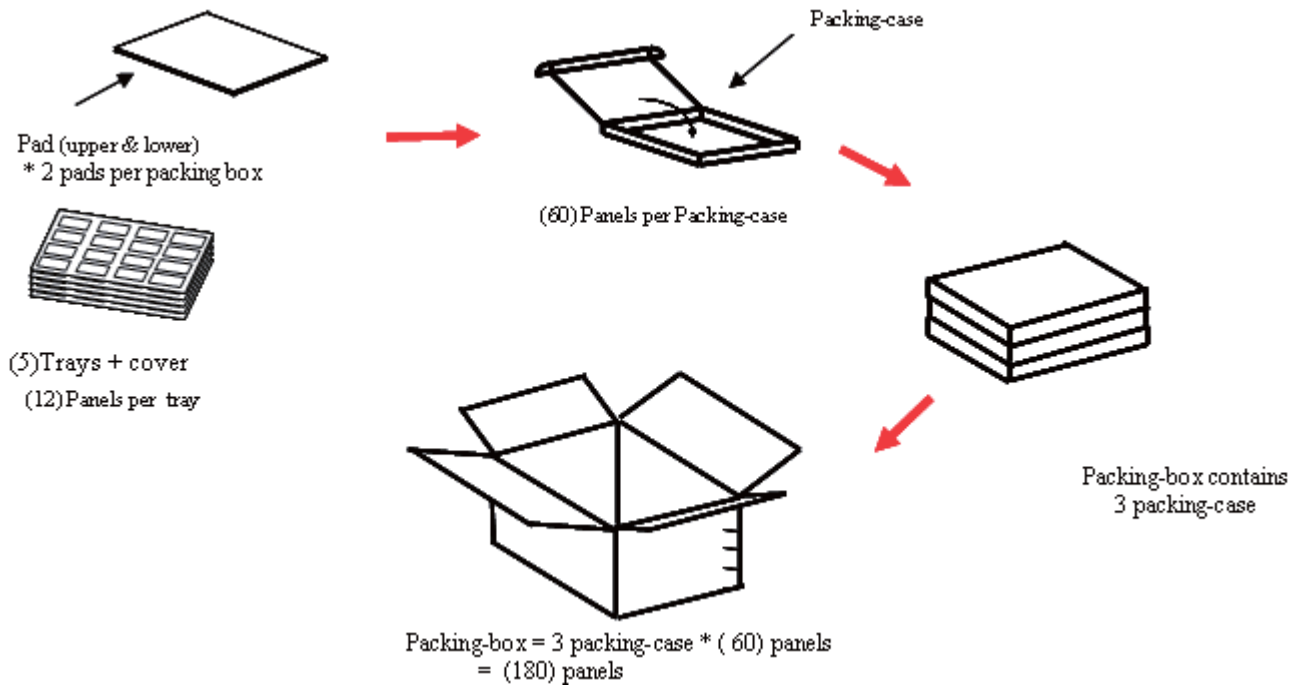
13. Packing

13.1 Case & Box

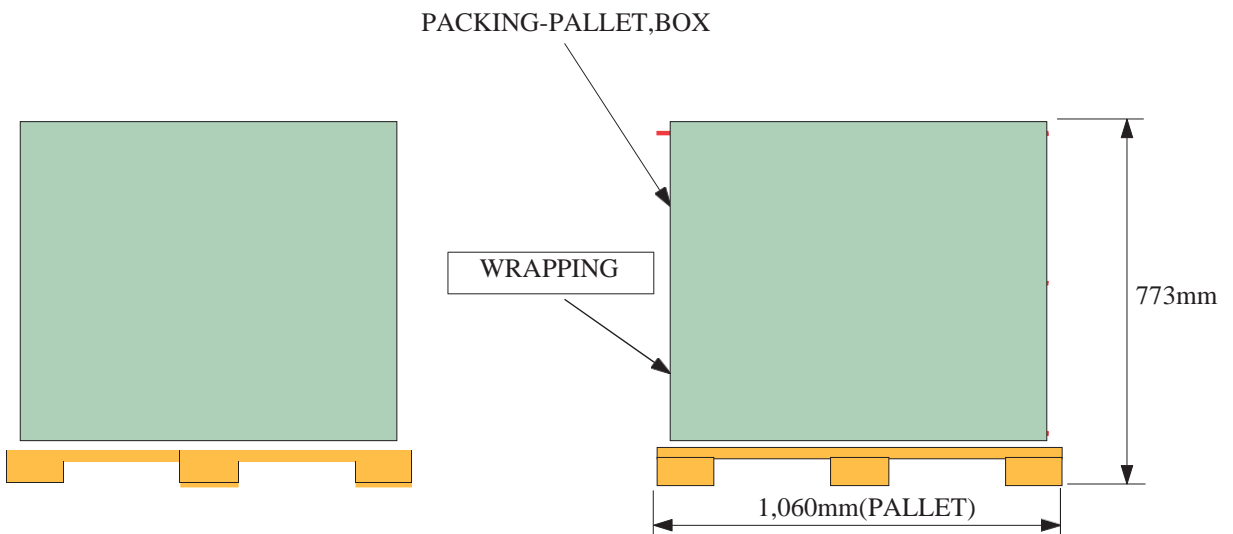
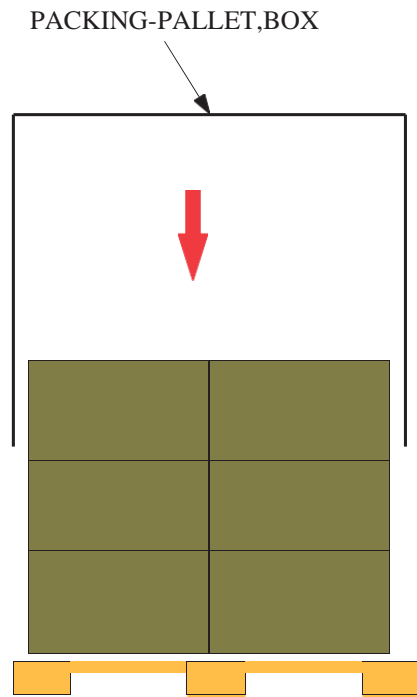
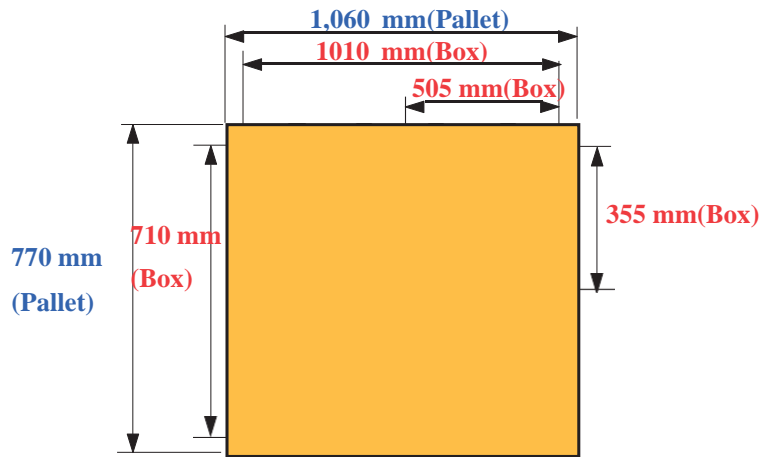
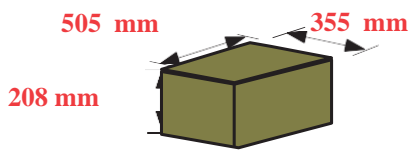


- Note
- (1) Total : Case : Approx. Kg
Box : Approx. Kg
 - (2) Size : Case : 490(W) x 342(D) x 58(H)
Box : 505(W) x 355(D) x 319(H)
 - (3) Pad Material : Polyethylene Foam T=3.0
 - (4) Resistance of tray surface : $10^3 \sim 10^6 \text{fi}$
 - (5) ESD of tray surface : 20~100V
 - (6) Place the panels in the tray facing the direction shown in the figure.
 - (7) Place 3 tray and cover(empty tray) and pads inside the packing-case.
 - (8) Place 5 packing-case inside the packing-box.(Affix the label)
 - (8) Seal the packing-box. Affix the label-safety.

☒ Packing spec. for small quantities



13.2 Over Pack



14. Marking & Others

A nameplate bearing followed by is affixed to a shipped product at the Specified location on each product.

14.1 Laser Printing on the back side of TFT-LCD Module

- 10 digits marking on the back side of TFT-LCD module

K	A	07	03	02	A	0
④	④	Ⓢ	¼	④	®	④

④ Module Site

< K (SEC), V (Voda), I (IDS), D (DTC), G (Digix), M (Samkyoung)
Y (Yoowon), T (Intelligent), E (E-Litecom)

④ Production Shift

Ⓢ Year : 06(2006), 07(2007)

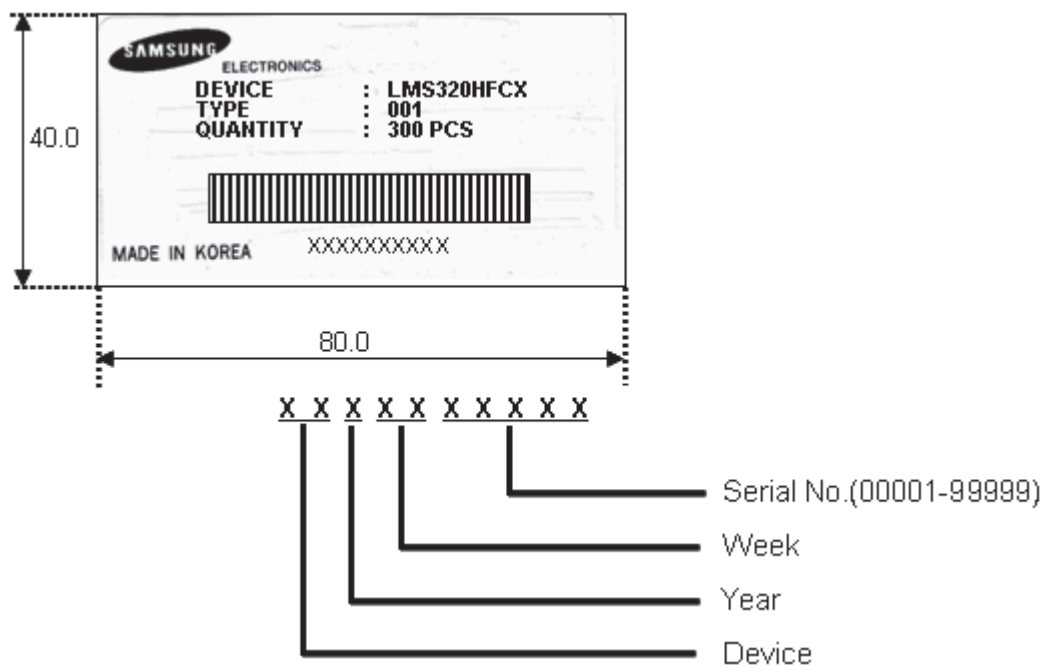
¼ Month : 01(January), 02(February), 03(March)

④ Day

® ASSY LINE

④ SAMPLE

14.2 Packing box attach



15. General Precautions

15.1 Handling

- (a) When the module is assembled, it should be attached to the system firmly. Be careful not to twist and bend the module.
- (b) Refrain from strong mechanical shock and / or any force to the module. In addition to damage, this may cause improper operation or damage to the module and back-light unit.
- (c) Note that polarizers are very fragile and could be easily damaged. Do not press or scratch the surface harder than a HB pencil lead.
- (d) Wipe off water droplets or oil immediately. If you leave the droplets for a long time, Staining and discoloration may occur.
- (e) If the surface of the polarizer is dirty, clean it using some absorbent cotton or soft cloth.
- (f) The desirable cleaners are water, IPA(Isopropyl Alcohol) or Hexane. Do not use Ketone type materials(ex. Acetone), Ethyl alcohol, Toluene, Ethyl acid or Methyl chloride. It might permanent damage to the polarizer due to chemical reaction.
- (g) If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth. In case of contact with hands, legs or clothes, it must be washed away thoroughly with soap.
- (h) Protect the module from static, it may cause damage to the CMOS Gate Array IC.
- (i) Use finger-stalls with soft gloves in order to keep display clean during the incoming inspection and assembly process.
- (j) Do not disassemble the module.
- (k) Protection film for polarizer on the module shall be slowly peeled off just before use so that the electrostatic charge can be minimized.
- (l) Pins of I/F connector shall not be touched directly with bare hands.

15.2 Storage

- (a) Do not leave the panel in high temperature, and high humidity for a long time. It is highly recommended to store the module with temperature from 0 to 23±2°C and relative humidity of less than 50%RH±10%RH.
- (b) Do not store the TFT-LCD module in direct sunlight.
- (c) The module shall be stored in a dark place. It is prohibited to apply sunlight or fluorescent light during the store.

15.3 Operation

- (a) Do not connect, disconnect the module in the "Power On" condition.
- (b) Power supply should always be turned on/off by the chapter 8 "Power On/Off sequence"

15.4 Others

- (a) The Liquid crystal is deteriorated by ultraviolet, do not leave it in direct sunlight and strong ultraviolet ray for many hours.
- (b) Avoid condensation of water. It may result in improper operation or disconnection of electrode.
- (c) Do not exceed the absolute maximum rating value. (the supply voltage variation, input voltage variation, variation in part contents and environmental temperature, and so on)
Otherwise the panel may be damaged.
- (d) If the panel displays the same pattern continuously for a long period of time, it can be the situation when the image "Sticks" to the screen.
- (e) This panel has its circuitry FPC on the bottom side and should be handled carefully in order not to be stressed.