INNOLUX DISPLAY CORPORATION

LCD MODULE

SPECIFICATION

Model Name: **CT018TN01**

Version: 2.0

Date : Nov., 2003

The content of this technical information is subject to change without notice.
Please contact InnoLux or its agent for further information.

Customer Approval	Approved by

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Record of Revision

Version	Revise Date	Page	Content
0	05/27/03		Initial release
1	06/28/03	5/22	Correct gray scale table
		8/22	Add driver IC algorithms
		14/22	Update optical spec.
		18/22	Update quality assurance standards
		21/22	Update mechanical outline drawing
2	11/05/2003	7/22	Update Application circuit

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1. General specification

NO.	Item	Specification	Remark
1	LCD size	1.79 inch	
2	Driver element	α-Si TFT active matrix	
3	Resolution	128 X (RGB) X 160pixels	
4	Display mode	Normally white, Transmissive with LED Back-light	
5	Display number of colors	65K colors	
6	Optimal viewing direction	12 o`clock	
7	Dot pitch	0.074(W) X 0.222(V) mm	
8	Display area	28.416(W) X 35.52(V) mm	
9	Module size	34.0 X 46.7 X 3.3 mm	
10	Surface treatment	Glare Type 3H	
11	Weight	10.4g Typical	
12	Driver IC	HX8302A, HX8029A (Himax)	

2. Electrical specifications

(1). Absolute maximum ratings

Parameter		Symbol	Values		Unit	Remark
			Min.	Max.		
TFT Module	Logic Power	V_{DD}	-0.3	+4.6	V	
	DC/DC Power	V_{CI}	-0.3	+4.6	V	
Back- Light Unit	Current	I_B	-	25	mA	
Operating temperature		Top	-20	60	°C	
Storage temperature		T_{ST}	-30	70	°C	

(2). Pin assignment

(a). TFT LCD panel diving section (Connector:27-pin FPC hot bar type)

Pin no	Symbol	Function	Remark
1	NC	No Connection	-
2	GND	Power Ground	-
3	GND	Power Ground	-
4	/CS	Chip Select	Input
5	RS	Command (L) /Data (H)	Input
6	/WR	Write	Input
7	/RD	Read	Input

8	D0	Data 0	Input
9	D1	Data 1	Input
10	D2	Data 2	Input
11	D3	Data 3	Input
12	D4	Data 4	Input
13	D5	Data 5	Input
14	D6	Data 6	Input
15	D7	Data 7	Input
16	D8	Data 8	Input
17	D9	Data 9	Input
18	D10	Data 10	Input
19	D11	Data 11	Input
20	D12	Data 12	Input
21	D13	Data 13	input
22	D14	Data 14	Input
23	D15	Data 15	Input
24	/RESET	System Reset	Input
25	VCC	Logic Power	Input
26	VCI	DC/DC Converter Power	Input
27	NC	No Connection	-

(b). Backlight unit (Connector: 2-pin FPC solder type)

Pin no	Symbol	Function
1	Anode	LED Input Terminal
2	Cathode	GND

(3). Electrical characteristics

(a). TFT Module

Item		Symbol	Min.	Typ.	Max.	Unit	Remark
Logic Supply Power		V_{DD}	2.2	2.8	3.3	V	
DC/DC Supply Power		V_{CI}	2.5	2.8	3.3	V	
Current Consumption	Stand by	I_{SB}			0.05	mA	Note1
	Sleep	I_{SLP}			0.1	mA	Note1
	Still	I_{STL}			6	mA	Note2,4
	Full	I_F			10	mA	Note3,4
Vertical synchronous Frequency		Fvsync	55	85	115	Hz	

Note:

1: Still Picture is internal RAM

2: Power supply current value is still picture

3: Power supply current value of moving picture is high speed write mode

4: Disspiation current check pattern

0 gray black pattern

5: For the detail characteristics, refer to the specifications of gate/source driver

Himax: HX8609A, HX8302A

(b). Back light unit

The back-light system is an edge-lighting type with 3 white LED

Item	Symbol	Min.	Typ.	Max.	Unit	Remark
Current	I_B		15	20	mA	Note1
Power Consumption	P_{BL}		150		mW	Note2

Note:

1: 3 LEDs serial type

2: where I_B=15mA, V_B=P_{BL}/I_B

(c). 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	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	-
	Blue	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	-
	Green	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	-

	Cyan	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	-
	Red	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	-
	Magenta	1	1	1	1	1	0	0	0	0	0	0	1	1	1	1	1	-
Basic Color	Yellow	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	-
Gray Scale of RED	Black	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	R1
		0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	R2
		:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	R3~R28
		:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	
	↓ Light	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	R29
		0	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	R30
	Red	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	R31
Gray Scale of GREEN	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	G0
	Dark ↑	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	G1
		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	0	1	1	1	1	0	0	0	0	0	G61
		0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	G62
	Green	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	G63
Gray Scale of BLUE	Black	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	1	0	0	0	0	B1
		0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	B2
		:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	B3~B28
		:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	
	↓ Light	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	B29
		0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	B30
	Blue	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	B31

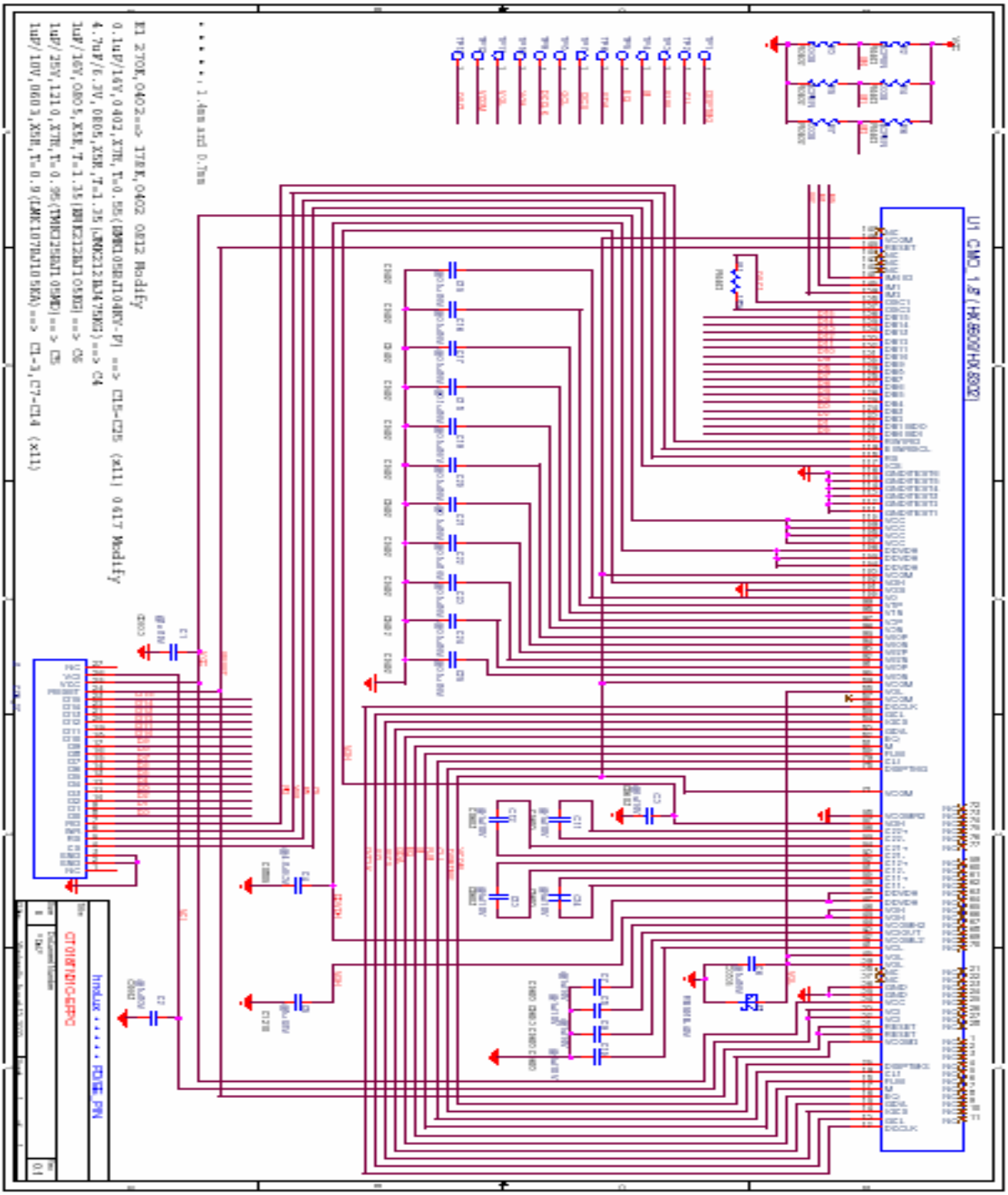
Note:

1. Definition of gray

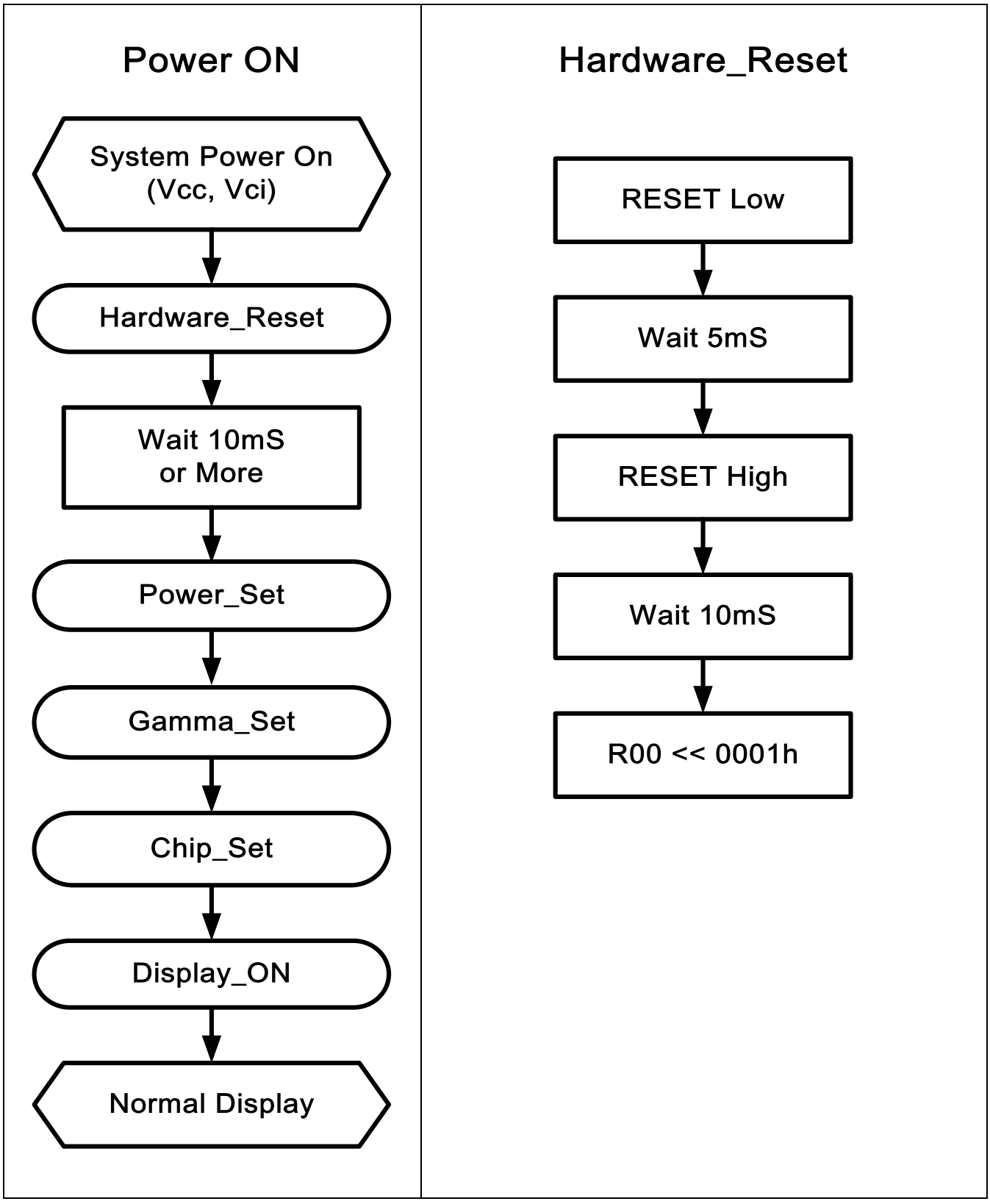
Rn=Red gray, Gn=Green gray, Bn=Blue gray, (n=gray level)

Input Signal: 0=low level voltage, 1=high level voltage

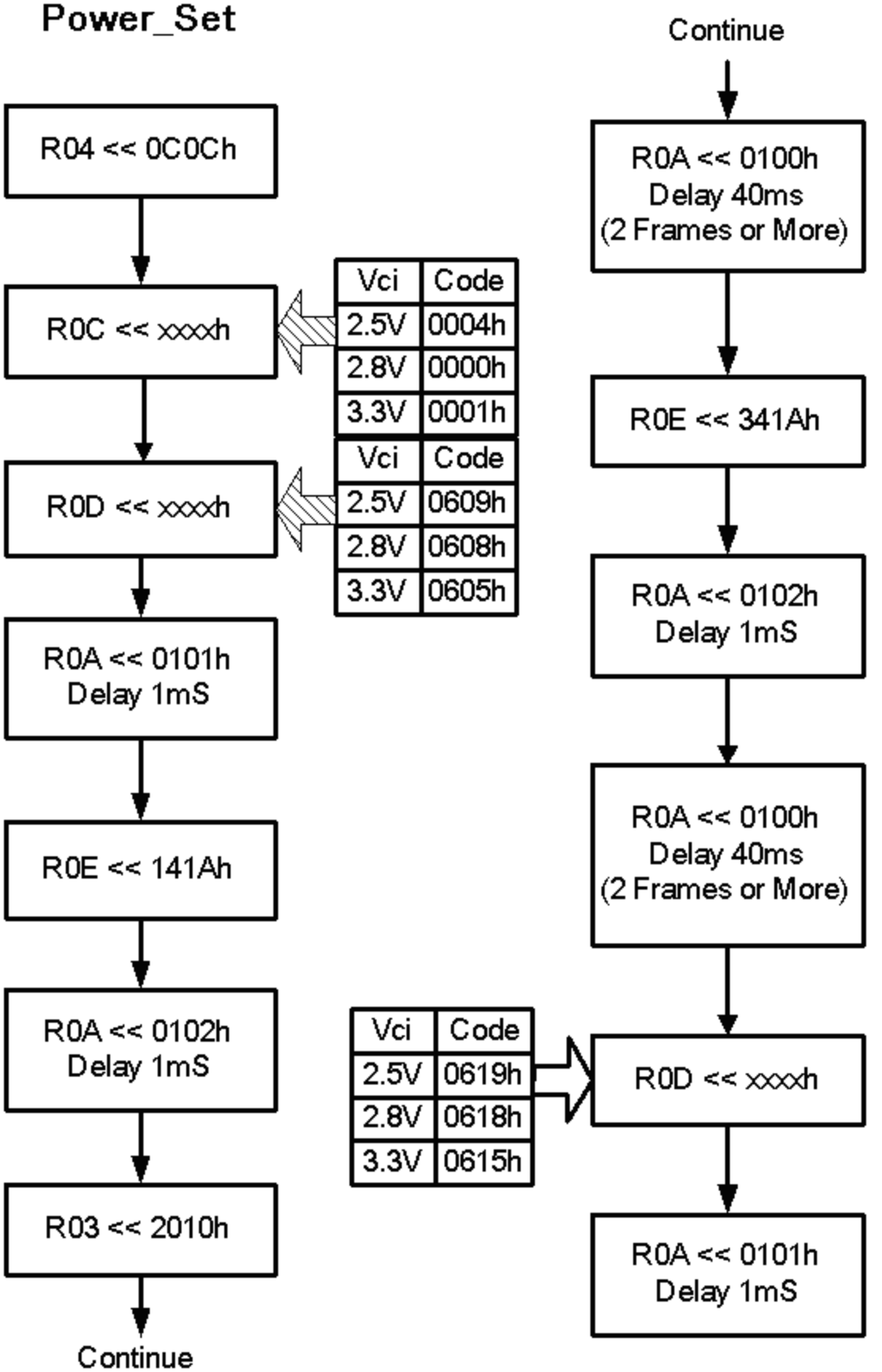
(d). Application circuit



3. Driver IC control algorithms



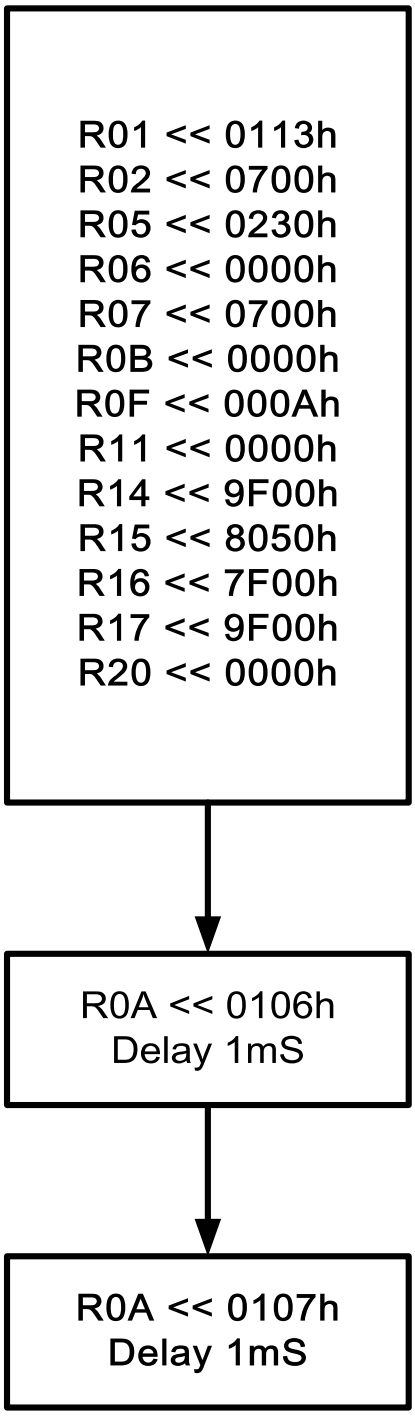
Power_Set


R04 << 0C0Ch
R0C << xxxxh
R0D << xxxxh
R0A << 0101h
Delay 1mS
R0E << 141Ah
R0A << 0102h
Delay 1mS
R03 << 2010h
Continue
Vci
Code
2.5V
0004h
2.8V
0000h
3.3V
0001h
Vci
Code
2.5V
0609h
2.8V
0608h
3.3V
0605h
Continue
R0A << 0100h
Delay 40ms
(2 Frames or More)
R0E << 341Ah
R0A << 0102h
Delay 1mS
R0A << 0100h
Delay 40ms
(2 Frames or More)
Vci
Code
2.5V
0619h
2.8V
0618h
3.3V
0615h
R0D << xxxxh
R0A << 0101h
Delay 1mS

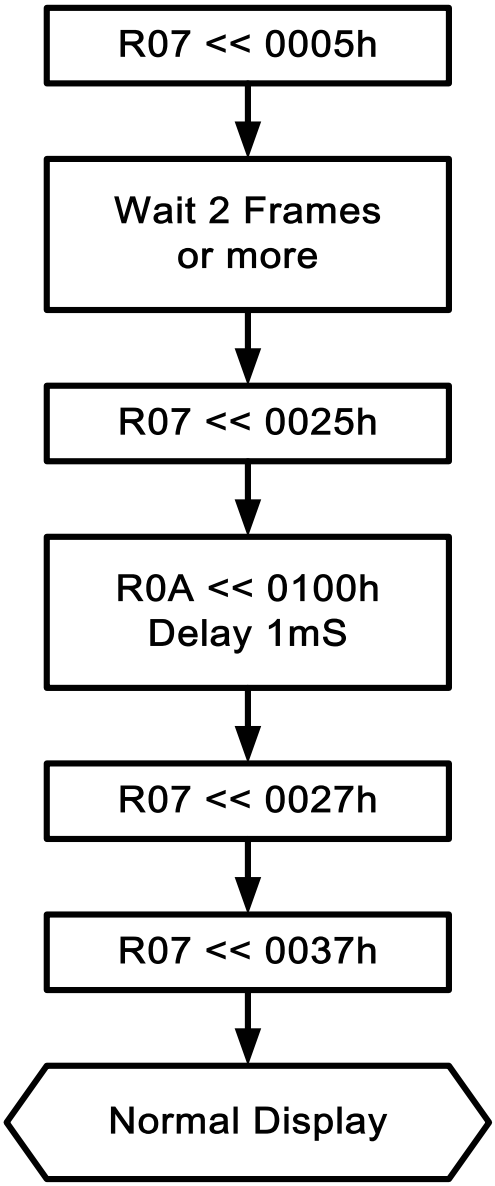
Gamma_set

R30 << 0604h
R31 << 0407h
R32 << 0107h
R33 << 0302h
R34 << 0006h
R35 << 0003h
R36 << 0301h
R37 << 0203h
R3F << 0000h

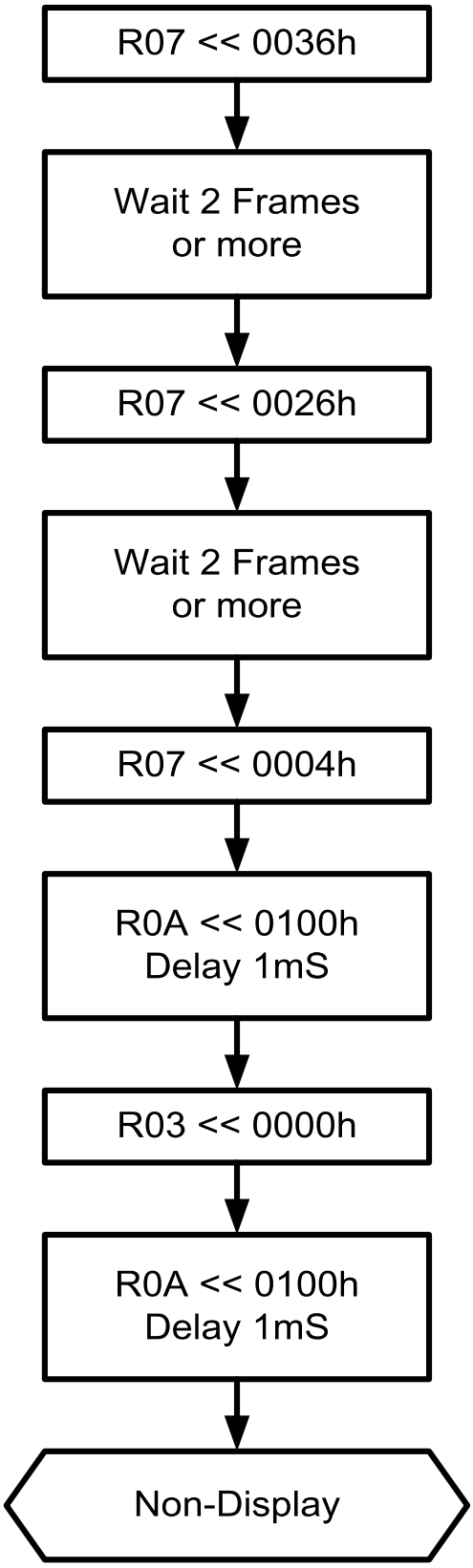
Chip_Set



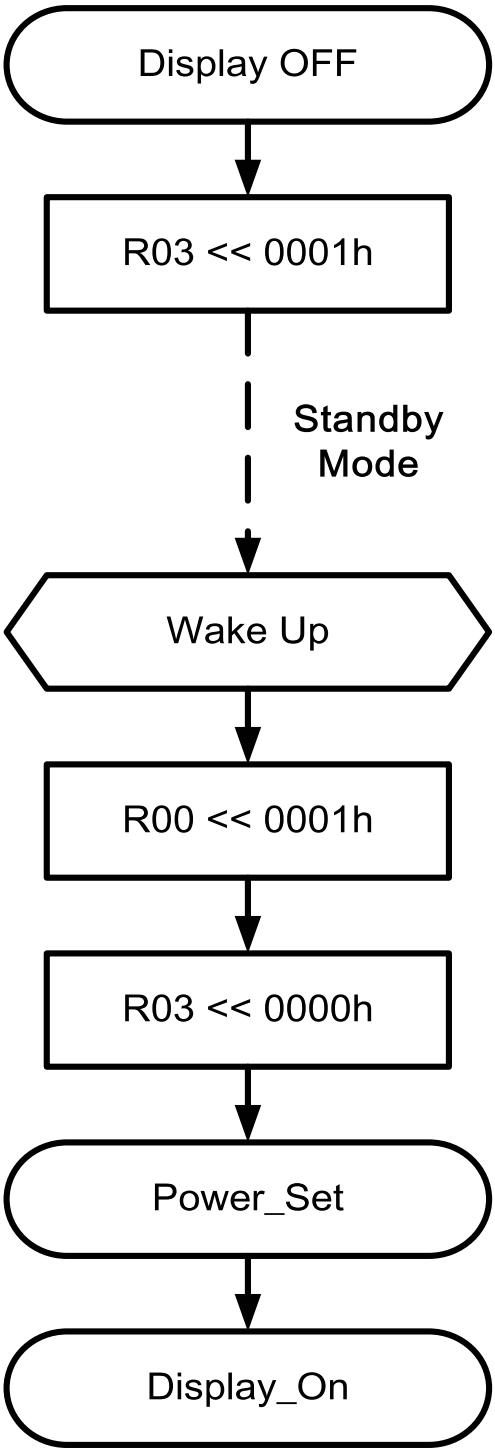
Display_ON



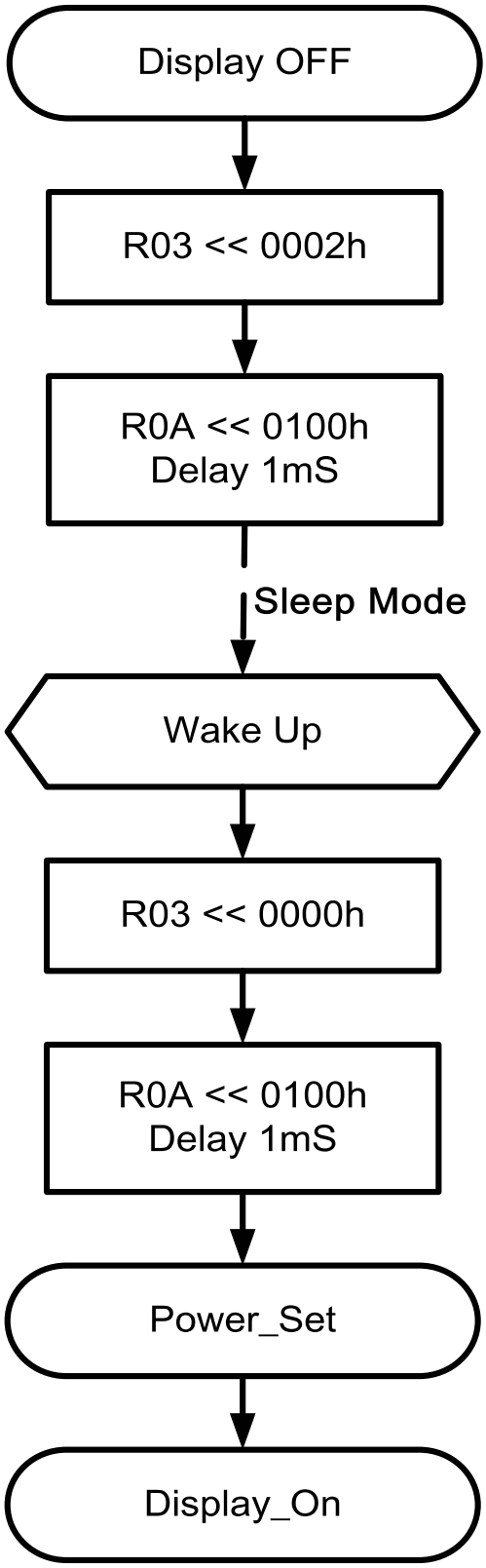
Display_OFF



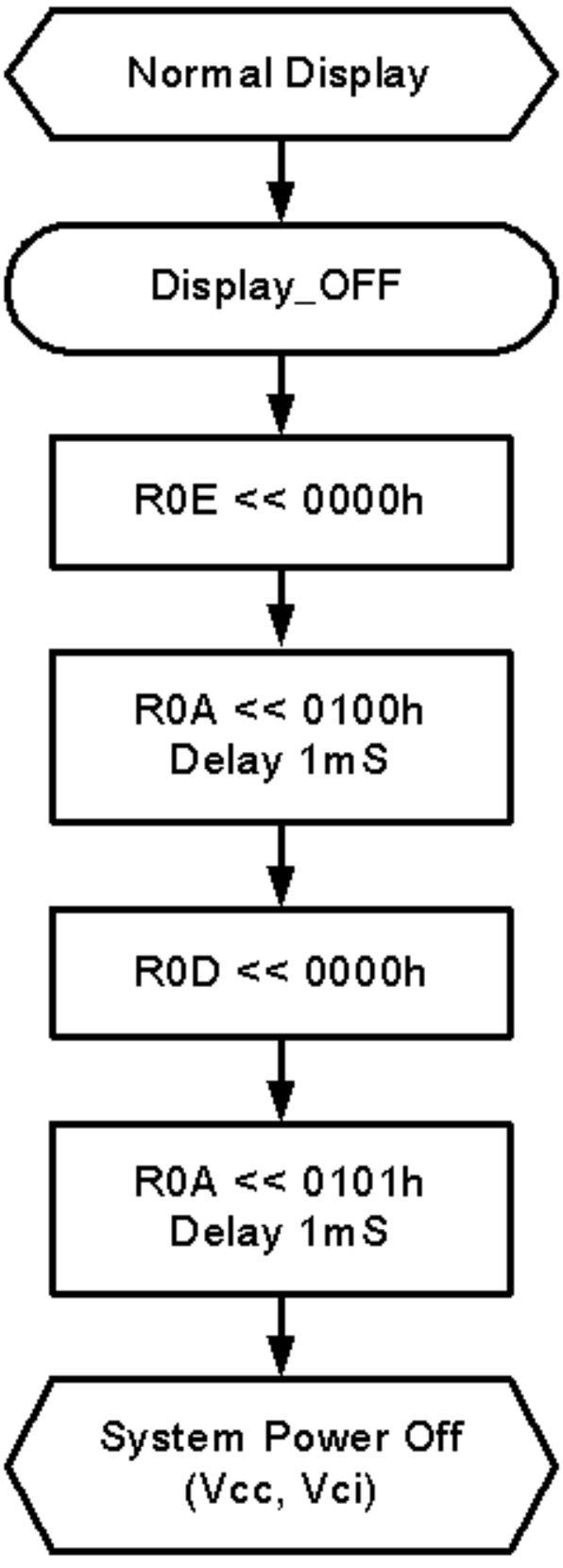
Standby



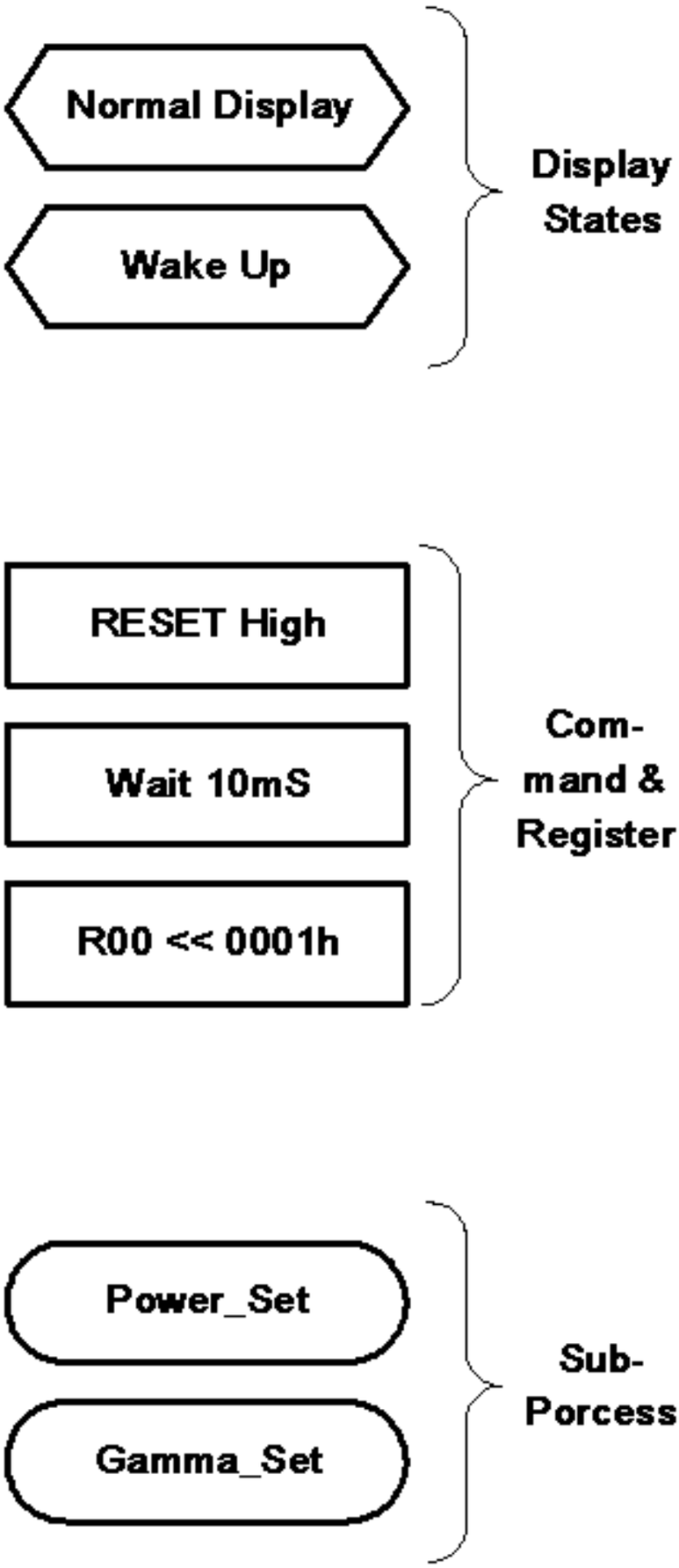
Sleep



Power OFF



Memo



4. Optical specifications

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

Ta=25±2℃.V_{CC}=V_{CI}=2.8V, I_B=15mA

Item		Symbol	Condition	Min	Typ	Max	Unit	Remark
Reflectance		R	BL off	0.5	1			Note2
Contrast ratio		CR	Note 1 Θ=Φ=0 Normal Viewing Angle B/L ON	150	200			Note3
Luminance of white		Y_L		100	150		Cd/m^2	Note4
Rise+Fall Time		$(T_r)+(T_f)$			30	50	mSec	Note5
Color Chromaticity	White	W_x		0.28	0.33	0.38		
		W_y		0.30	0.35	0.40		
	Red	R_x		0.51	0.56	0.61		
		R_y		0.30	0.35	0.40		
	Green	G_x		0.31	0.36	0.41		
		G_y		0.51	0.56	0.61		
	Blue	B_x		0.10	0.15	0.20		
		B_y		0.09	0.14	0.19		
Viewing Angle	Hor.	θ_L	CR≥2 B/L ON	50	TBD		Degree	Note6
		θ_R		50	TBD			
	Ver.	Φ_L		20	TBD			
		Φ_H		50	TBD			

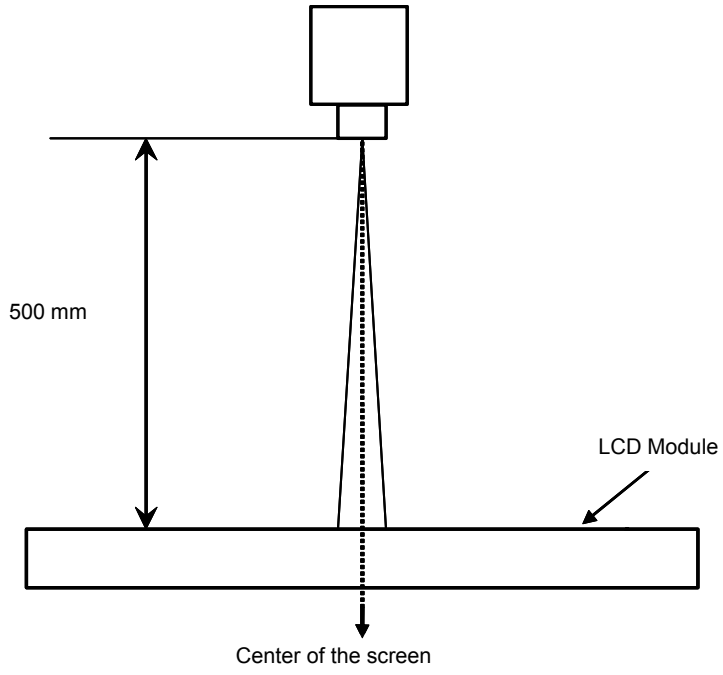
Note:

1. Test Equipment Setup

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

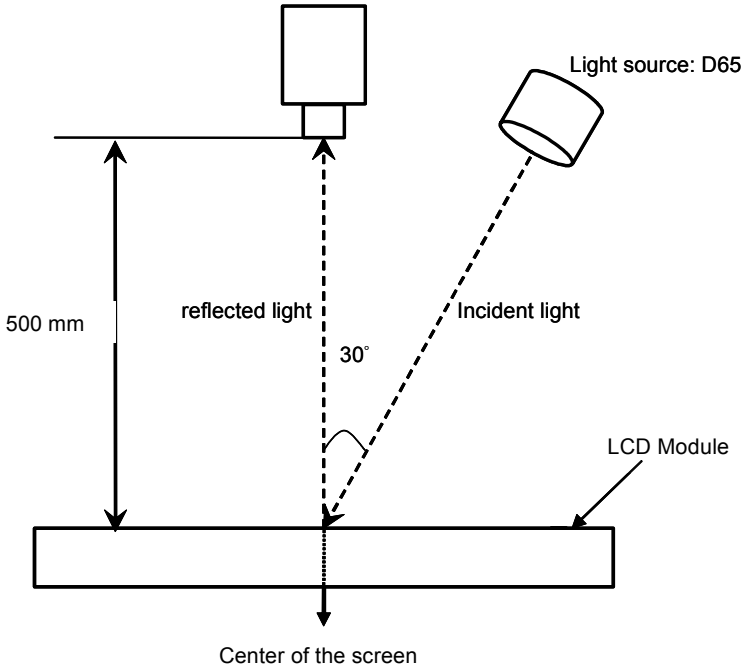
-Back-Light ON Condition

Measuring Instrument ： TOPCON BM-5A，BM-7
Field：1°



-Back-Light OFF Condition

Measuring Instrument ： LCD-5100
Field：1°



2. Definition of Reflectance: the reflectance is relative quantity to the standard white BaSO4 plate that the reflectance of the standard white plate is the 100%.

$$\text{Reflectance} = \frac{\text{Light intensity of the reflected light on LCD}}{\text{Output intensity of the reflected light on BaSO4 plate}} \times 100\%$$

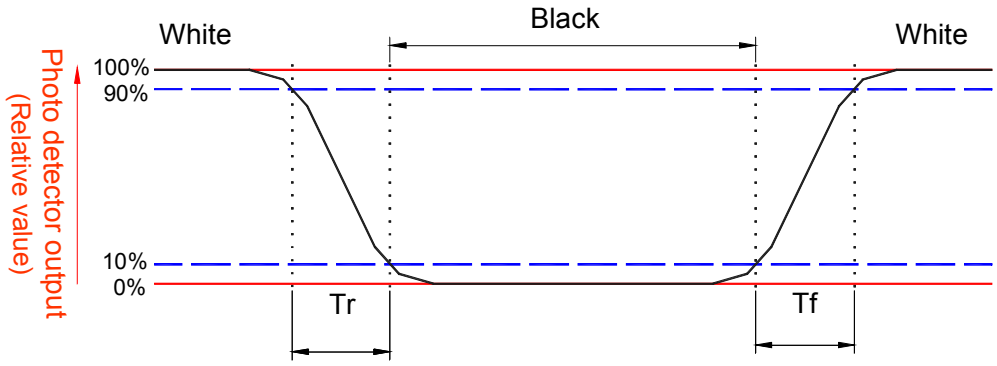
3. Definition of Contrast Ratio (CR): Ratio of gray max (Gmax) & gray min (Gmin) at the center point

$$CR = \frac{Gmax}{Gmin}$$

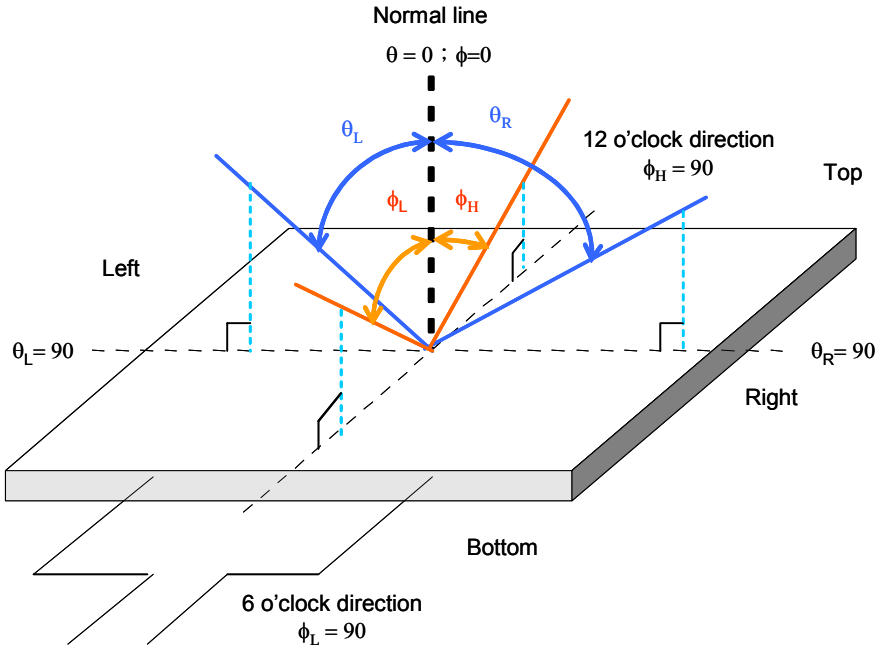
Gmax: Luminance with all pixels white

Gmin: Luminance with all pixels black

4. Definition of Luminance of white: Luminance of white at the center point
5. Definition of Response time: sum of Tr, Tf



6. Definition of Viewing Angle: Viewing angle range (CR≥2)



5. Reliability test items

Reliability levels in Mass production

Test Items	Test Conditions
High temperature storage	+70℃±3℃, Dry(30%RH max.) for 240 hours
Low temperature storage	-30℃±3℃ for 240 hours
High temperature operation	+60℃±3℃, Dry(30%RH max.) for 240 hours
Low temperature operation	-20℃±3℃ for 240 hours
Operation at high temperature and humidity	+40℃±3℃,90%±3%RH max. for 240 hours
Thermal shock	-30degree/0.5h ~ +70 degree/0.5h for a total 20 cycles
Package drop	Drop onto the tilted floor from 60cm heights, 1 corner, 3 edges, 6faces. Apply shipping package to this test
Package vibration test storage	Sweep at 10Hz to 55Hz to 10Hz, amplitude 0.75mm for 20cycles each in X,Y and Z directions. Apply shipping package to this test.
Electro-static discharge	Air / Contact ➔ ±2KV (Human body mode, contact connector, 150pF/330Ω)

Note1: High temp storage & High temp/High humidity Op the polarizer is out of subject

Note2: the test sample have recovery time 2 hours at room temp before function check

6. Quality assurance standards

(1). Sampling plan:

Unless there is other agreement , sampling plan for incoming inspection should follow MIL-STD-105E.

1.1 Lot size: Quantity per shipment as one lot (different model as different lot.)

1.2 Sampling type: Normal inspection, single sampling.

1.3 Sampling level: Level II.

1.4 AQL: Acceptable Quality Level

Major defect: AQL=0.65%

Minor defect: AQL=1.0%.

(2). Panel inspection condition:

2.1 Environment:

Room Temperature: 25±5 . ℃

Humidity: 65±5% RH.

Illumination: 300 ~ 700 Lux.

2.2 Inspection Distance: 35±5 cm

2.3 Inspection Angle: the vision of inspector should be perpendicular to the surface of the module.

(3). Display quality

3.1 Function Related: the function defects such as line defect, abnormal display, no display are considered the major defects.

3.2 Bright/dark dots

Defect Type	**Specification**	**Major**	**Minor**
Bright Dots	N ≤ 2		●
Dark Dots	N ≤ 4		●
Total Bright and Dark Dots	N ≤ 5		●
Distance between Bright and Bright dot	L ≥ 15 mm		●
Distance between Bright and Dark dot	L ≥ 5 mm		●
Distance between Dark dot	L ≥ 5 mm		●

Note 1: Dot defect is defined as the defective area is larger than 50% of the dot area.
Bright Dot is defined 5% transmission ND filter.

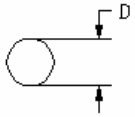
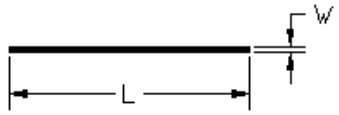
Note 2: Light Leakage: There shall not be visible light around the customer's bezel after assembly in normal View angle.

3.3 Pixel definition

R G B R G B R G B	Dot Defective
R G B R G B R G B	Defective Pixel
R G B R G B R G B	Defective Adjacent Sub-Pixels
	Defective Adjacent Pixels

Note: In cases where partial sub-pixel or pixel defects exceed 50% of the affected sub-pixel or pixel area, it will be counted as 1 defect.

3.4 Visual Inspection specification

Defect Type		**Specification Size**	**Count(N)**	**Major**	**Minor**
Dot Shape (Particle、Scratch and Bubbles in display area) 		D ≤ 0.25 mm	Ignored		
		0.25mm < D ≤ 0.5mm	N ≤ 3		●
		D > 0.5mm	N=0		
Line Shape (Particles、Scratch、Lint and Bubbles in display area) 		W ≤ 0.1 mm	Ignored		
		0.1< W ≤ 0.5mm and L ≤ 3mm	N ≤ 3		●
		W >0.5mm or L>3mm (Lint)	N=0		
		0.1< W≤ 0.5mm and L ≤ 10mm	N ≤ 3		
		W > 0.1 L > 10 mm	N=0		
Bubble in cell (active area)		It should be found by eyes			●
Bezel	Scratch	No harm			●
	Dirt				●
	Wrap	No harm			
	Sunken	No harm			
Label	No label	No			●
	Invert label				●
	Broken				●
	Dirt	Word can be read.			●
	Not clear				●
	Word out of shape				●
	Mistake	No			●
	Position	Be attached on right position			●
Screw	Not enough	No			
	Limp	No			
Connector	Connection status	No bend on pins and damage			
FPC/FFC	Broken	No			

Note:

Extraneous substance and scratch de not affect the display of image, for instance , the extraneous substance under polarizer film but outside the display area, scratch on metal bezel and backlight module or polarizer film. Outside of the display area are not counted.

7. Handling Precautions

1 Safety

The liquid crystal in the LCD is poisonous. **DO NOT** put it in your mouth. If the liquid crystal touches your skin or clothes, wash it off immediately using soap and water.

2 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 careful attention.
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) keeping appropriate gap 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.
8) 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.

3 Static electricity

1) Ground soldering iron tips, tools and testers when you 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 which exceeds the absolute maximum rating.
5) Store the products in an anti-electrostatic container.

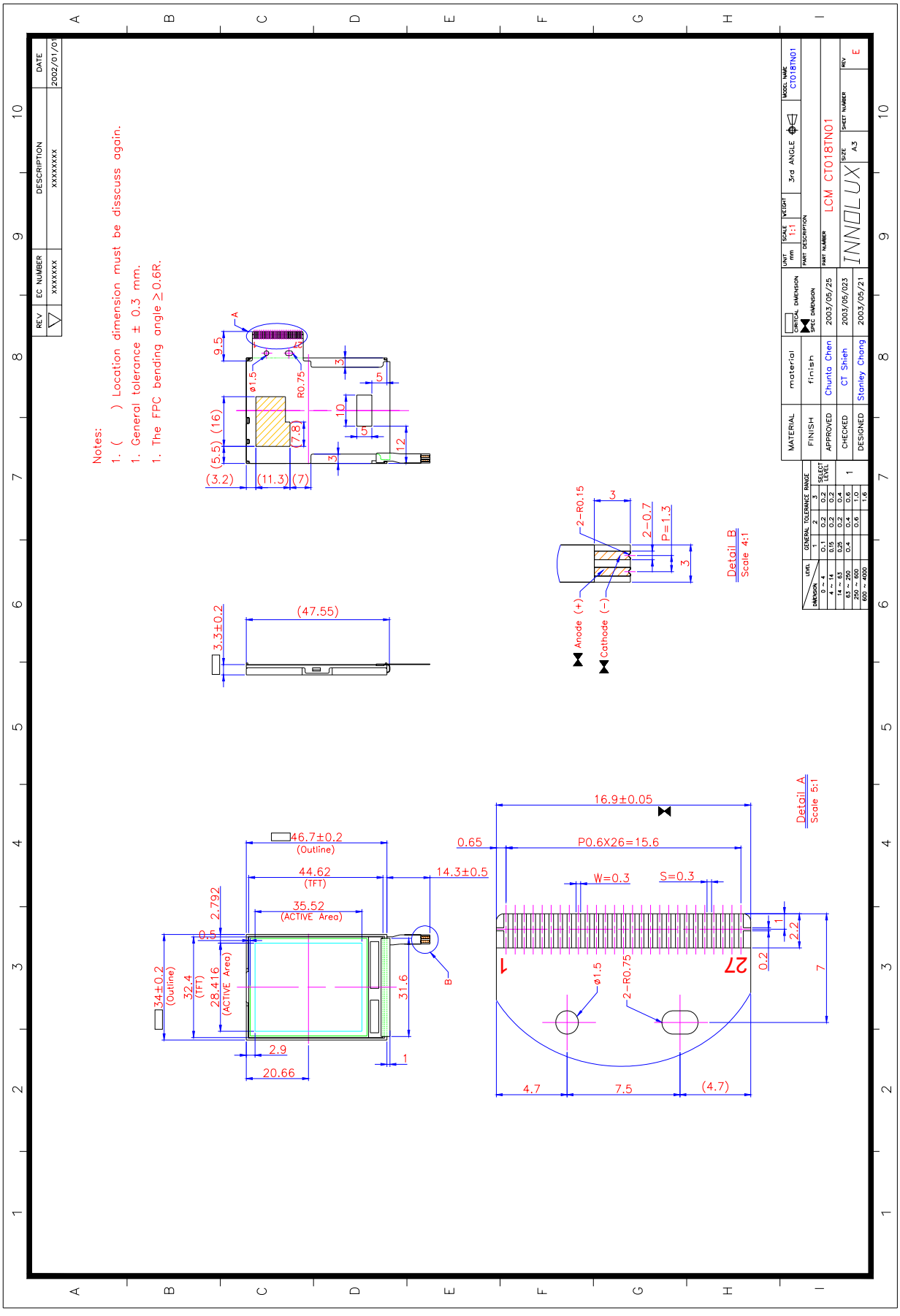
4 Storage

1) Store the products in a dark place at +25℃±10℃ , low humidity (65%RH or less).
2) **DO NOT** store the products in an atmosphere containing organic solvents or corrosive gases.

5 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. Mechanical dimensions



9. Package drawing