MULTI-INNO TECHNOLOGY CO., LTD.

LCD MODULE SPECIFICATION

Model : MI0230AT-1

Revision	2.0
Engineering	
Date	
Our Reference	

Table of Contents

Record of Revision

Rev	Issued Date	Description	Editor
1.0	2010-6-9	Preliminary Specification Release	
2.0	2010-10-14	Final Specification Release	

1 General Specifications

Feature		Spec
Display Spec.	Size	2.3 inch
	Resolution	320(RGB)×240
	Interface	CPU 16 bit
	Color Depth	65K/262K
	Technology Type	a-Si
	Pixel Pitch (mm)	0.1461×0.1461
	Pixel Configuration	R.G.B. Vertical Stripe
	Display Mode	Transmissive and Normally White
	Surface Treatment(Up Polarizer)	Clear Type
	Viewing Direction	12 o'clock
Mechanical Characteristics	LCM (W x H x D) (mm)	50.90×45.80×2.25
	Active Area(mm)	46.725×35.064
	With /Without TSP	Without TSP
	Weight (g)	8.4g
	LED Numbers	4 LEDs
Electronic	Driver IC	ILI9342

Note 1 : Requirements on Environmental Protection: Q/S0002

Note 2: LCM weight tolerance: ± 5%

2 Input/Output Terminals

2.1 TFT LCD Panel

No	Symbol	I/O	Description	Comment
1	LEDK	I	LED Cathode	
2	LEDA1	I	LED Anode	
3	LEDA2	I	LED Anode	
4	LEDA3	I	LED Anode	
5	LEDA4	I	LED Anode	
6	DB15	I/O	Data input/output	
7	DB14	I/O	Data input/output	
8	DB13	I/O	Data input/output	
9	DB12	I/O	Data input/output	
10	DB11	I/O	Data input/output	
11	DB10	I/O	Data input/output	
12	DB9	I/O	Data input/output	
13	DB8	I/O	Data input/output	
14	DB7	I/O	Data input/output	
15	DB6	I/O	Data input/output	
16	DB5	I/O	Data input/output	
17	DB4	I/O	Data input/output	
18	DB3	I/O	Data input/output	
19	DB2	I/O	Data input/output	
20	DB1	I/O	Data input/output	
21	DB0	I/O	Data input/output	
22	RESET	I	A reset signal	
23	RD	I	A read strobe signal and enables an operation to read out data when the signal is low.	
24	WR	I	A write strobe signal and enables an operation to write data when the signal is low.	
25	RS	I	A register select signal. RS=0,select command, RS=1,select data	
26	CS	P	A chip select signal	
27	IOVCC	P	Digital power supply	
28	VCI	P	Analog power supply	
29	GND	P	Power Ground	
30	GND	P	Power Ground	

Note 1: I/O definition：

I-----Input O---Output P----Power(Ground) NC---No connection

3 Absolute Maximum Ratings

3.1 Driving TFT LCD Panel

Ta = 25°C

Item	Symbol	Min.	Max.	Unit	Remark
Logic Power Supply	IOVCC	-0.3	3.3	V	
Analog Power Supply	VCI	-0.3	4.8	V	
Back Light Forward Current	I_{LED}	-	25	mA	For each LED
Operating Temperature	T_{OPR}	-20	70	℃	
Storage Temperature	T_{STG}	-30	80	℃	

4 Electrical Characteristics

4.1 Driving TFT LCD Panel

GND=0V, Ta=25℃

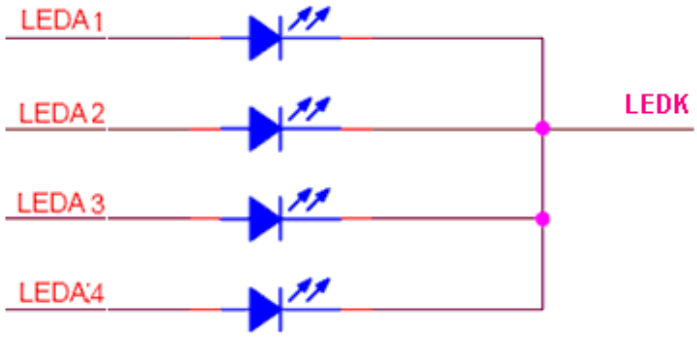
Item		Symbol	Min.	Typ.	Max.	Unit	Remark
Logic Power Supply		IOVCC	1.65	1.8/2.8	3.3	V	
Analog Power Supply		VCI	2.3	2.8	4.8	V	
Input Signal Voltage	Low Level	V_{IL}	0	---	0.2×IOVCC	V	
	High Level	V_{IH}	0.8×IOVCC	---	IOVCC	V	
(Panel+ LSI) Power Consumption		Black Mode (60Hz)	---	13.288	---	mW	
		8 color Mode	---	10.963	---	mW	
		Sleep Mode	---	0.03	---	mW	

4.2 Driving Backlight

Ta=25℃

Item	Symbol	Min.	Typ.	Max.	Unit	Remark
Forward Current	I_F	--	15	--	mA	
Forward Voltage	V_F	--	3.2	--	V	
Backlight Power Consumption	W_{BL}	--	192	--	mW	
Operating Life Time	--	10000	(20000)	--	Hrs	

Note1: Figure below shows the connection of backlight LED.



Note 2: One LED : I_F =15 mA, V_F =3.2V

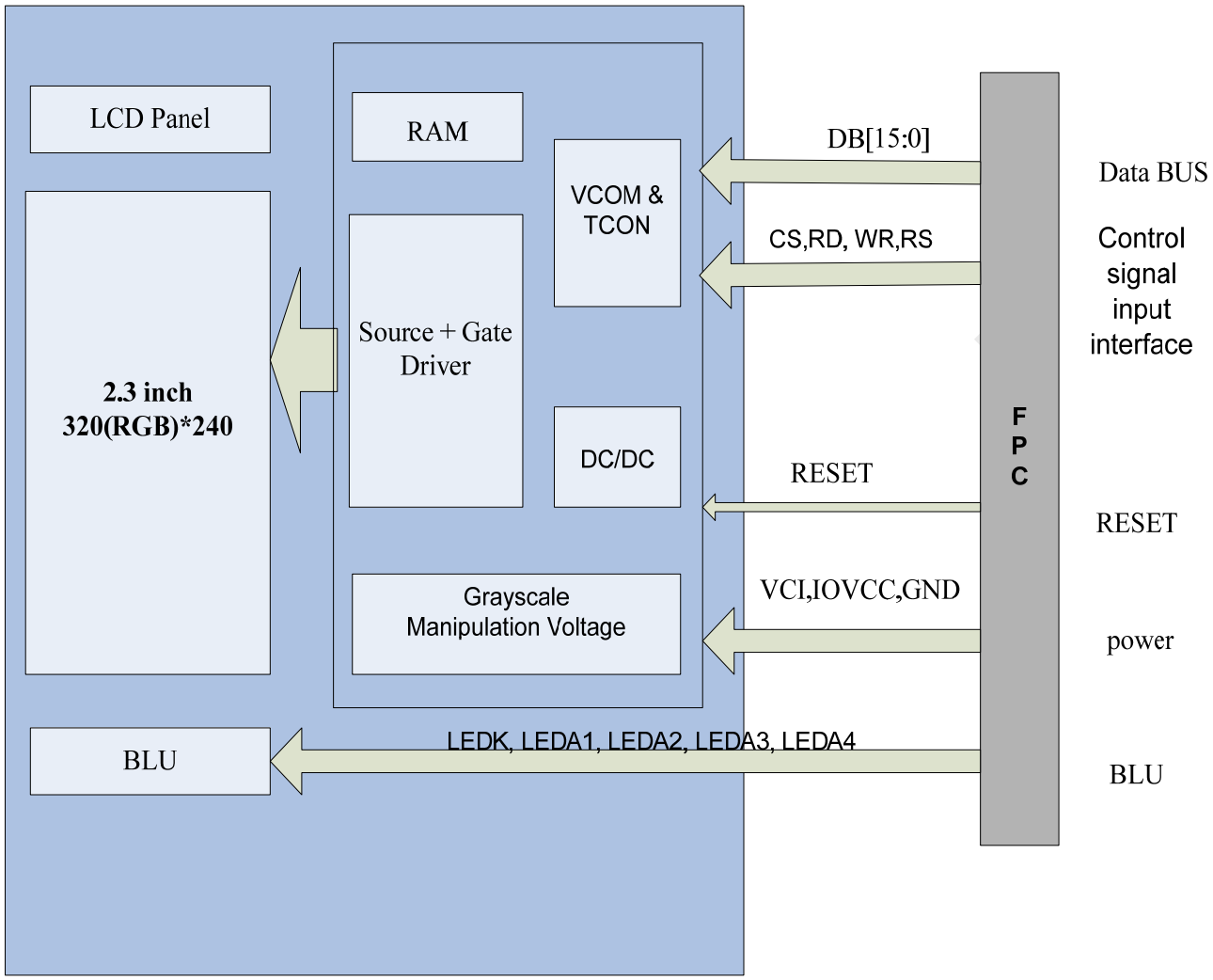
Note 3: I_F is defined for one channel LED.

Optical performance should be evaluated at Ta=25℃ only.

If LED is driven by high current, high ambient temperature & humidity condition. The life time of LED will be reduced.

Operating life means brightness goes down to 50% initial brightness. Typical operating life time is estimated data.

4.3 Block Diagram



5 Timing Chart

5.1 Interface Characteristics

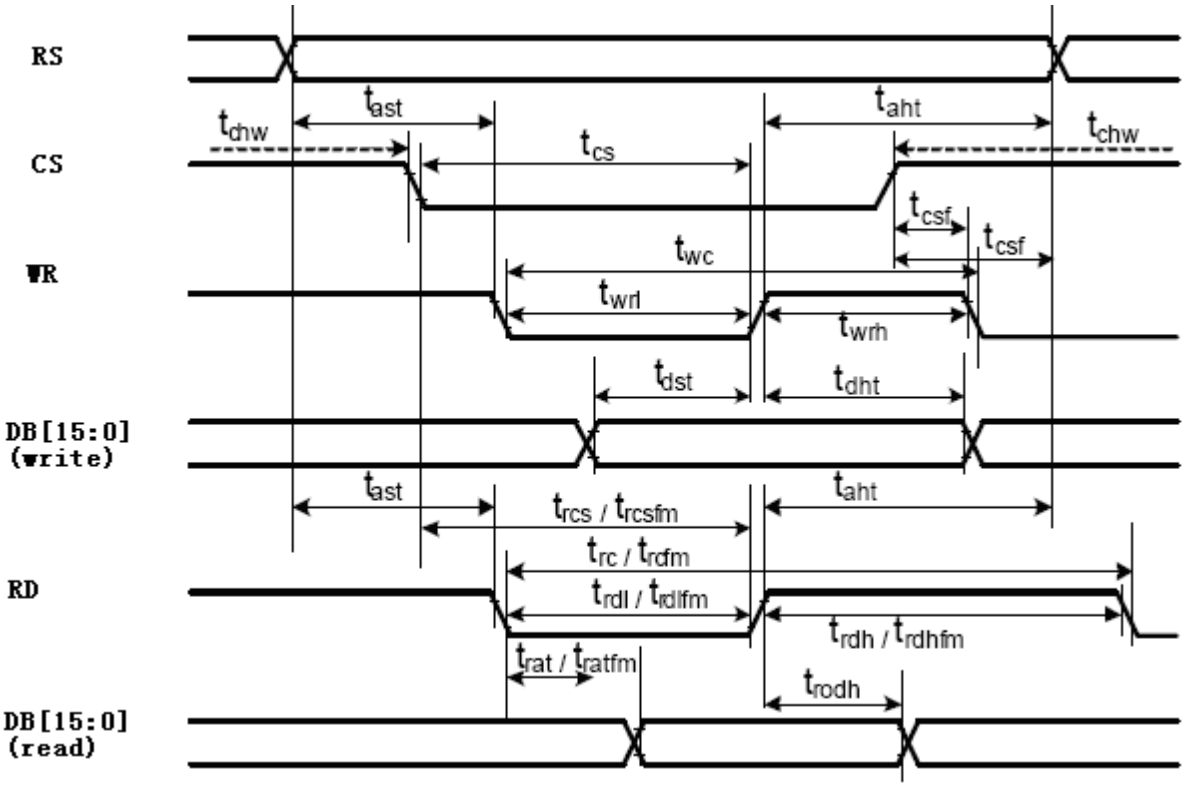


Figure 5.1 Interface Characteristics

5.2 Interface Timing Parameters

Normal Write Mode

Signal	Symbol	Parameter	Spec.			Description
			Min.	Max.	Unit	
RS	t_{AST} t_{AHT}	Address setup time Address hold time(Write/Read)	0 10	-	ns	-
CS	t_{CHW} t_{CS} t_{RCS} t_{RCSFM} t_{CSF}	Chip select “H” pulse width Chip select setup time (Write) Chip select setup time (Read ID) Chip select setup time (Read FM) Chip select wait time(Write/Read)	0 15 45 355 10	-	ns	-
WR	t_{WC} t_{WRH} t_{WRL}	Write cycle Control pulse “H” duration Control pulse “L” duration	66 33 33	-	ns	-
RD（ID）	t_{RC} t_{RDH} t_{RDL}	Read cycle (ID) Control pulse “H” duration (ID) Control pulse “L” duration (ID)	160 90 45	-	ns	When read ID data
RD(FM)	t_{RCFM} t_{RDHFM} t_{RDLFM}	Read cycle (FM) Control pulse “H” duration (FM) Control pulse “L” duration (FM)	450 90 355	-	ns	When read from frame memory
DB[15:0]	t_{DST} t_{DHT} t_{RAT} t_{RATFM} T_{ROD}	Data setup time Data hold time Read access time (ID) Read access time (FM) Output disable time	10 10 - - 20	- - 40 340 80	ns	For maximum C_L=30pF For minimum C_L=8pF

Table 5.2 CPU Interface Timing Parameters

5.3 Interface Register write/read timing

5.3.1 System Bus Interface Register or GRAM Write Timing

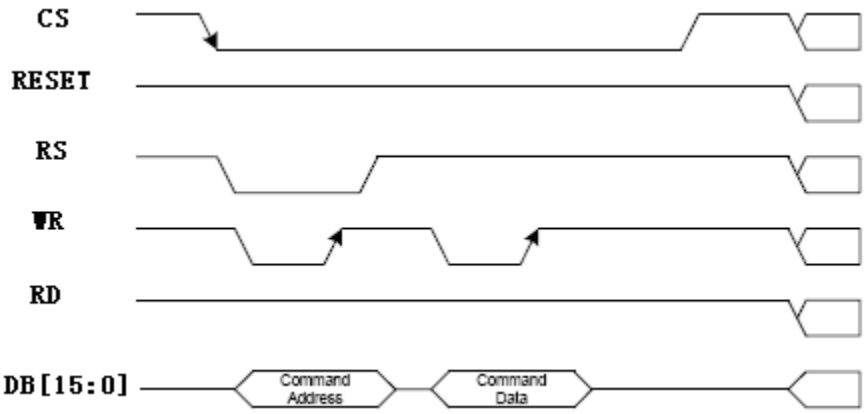


Figure 5.3.1 System Bus Interface Register or GRAM Write Timing

5.3.2 System Bus Interface Register or GRAM Read Timing

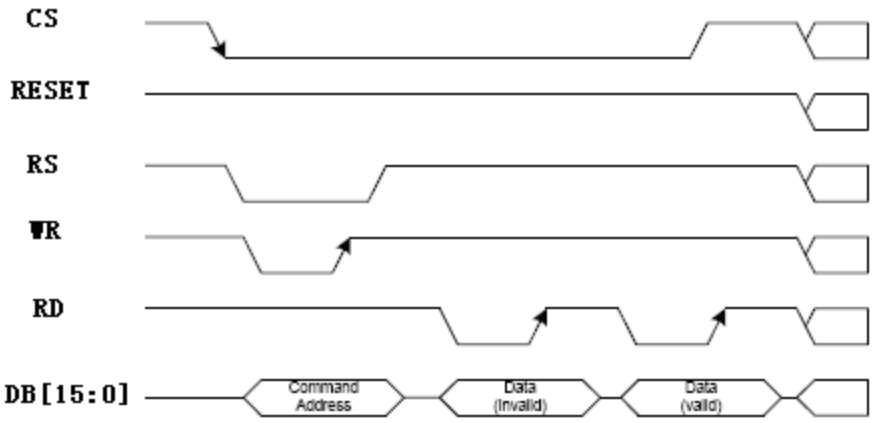


Figure 5.3.2 System Bus Interface Register or GRAM Read Timing

5.4 GRAM Write/Read Data Format

5.4.1 Write data for RGB 5-6-5 (65k colors) bits input in 16-bit parallel Interface

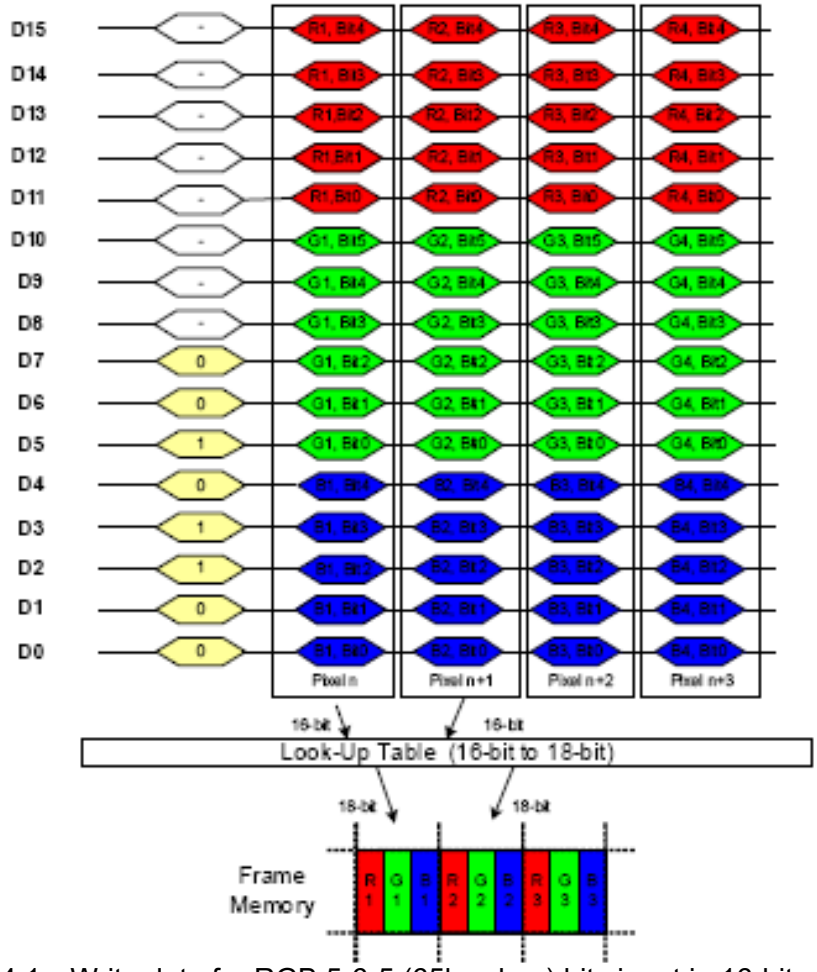


Figure 5.4.1 Write data for RGB 5-6-5 (65k colors) bits input in 16-bit parallel Interface

5.4.2 Write data for RGB 6-6-6 (262k colors) bits input in 16-bit parallel Interface

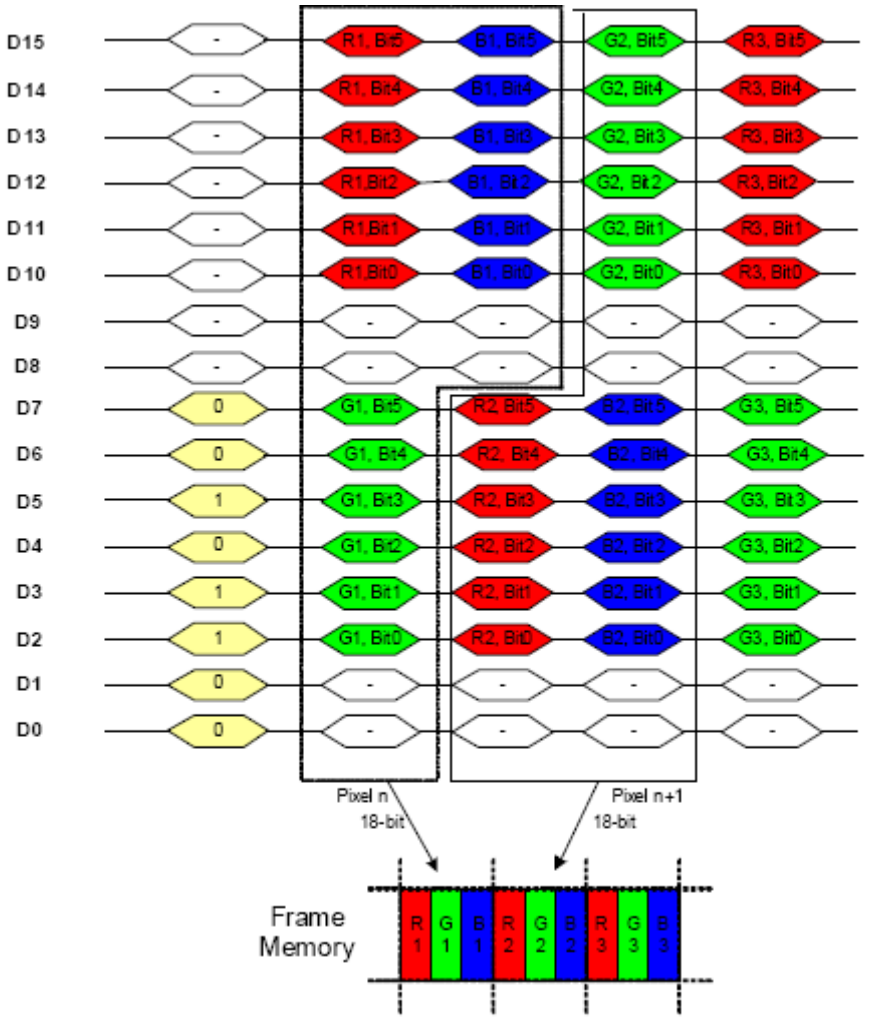


Figure 5.4.2 Write data for RGB 6-6-6 (262k colors) bits input in 16-bit parallel Interface

5.5 Reset Timing Characteristics

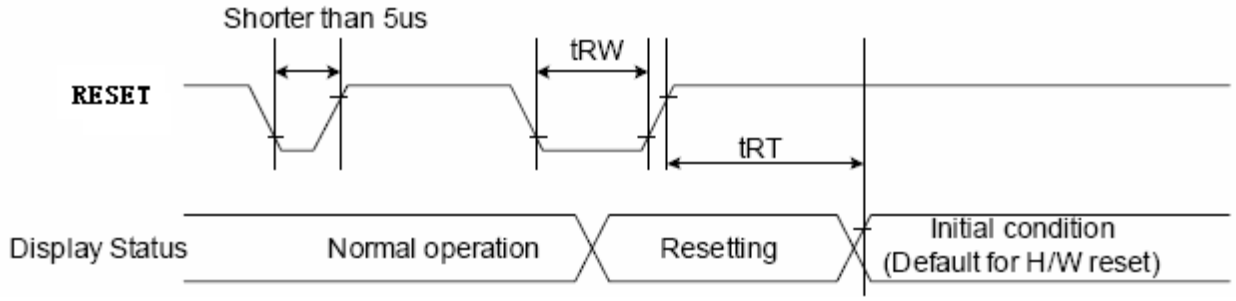


Figure 5.5.1 Reset Input Timing

Symbol	Parameter	Related Pins	Spec.			Note	Unit
			Min.	Typ.	Max.		
t_{RW}	Reset low pulse duaration	RESET	10	-	-	-	us
t_{RT}	Reset cancel	-	-	-	5	When reset applied during “Sleep In mode”	ms
		-		-	120	When reset applied during “Sleep Out mode”	ms

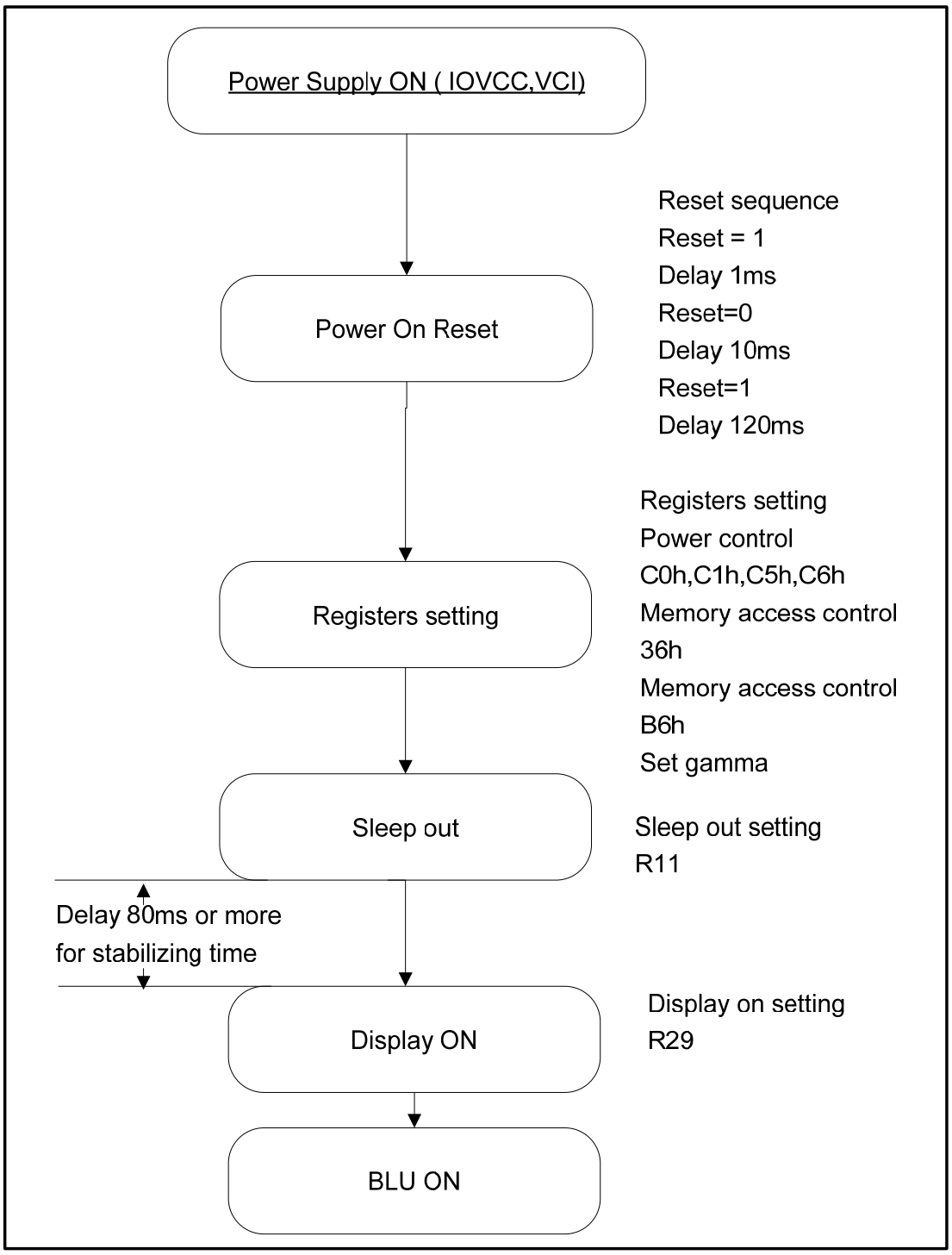
Table 5.5.1 Reset Timing Parameters

Note:

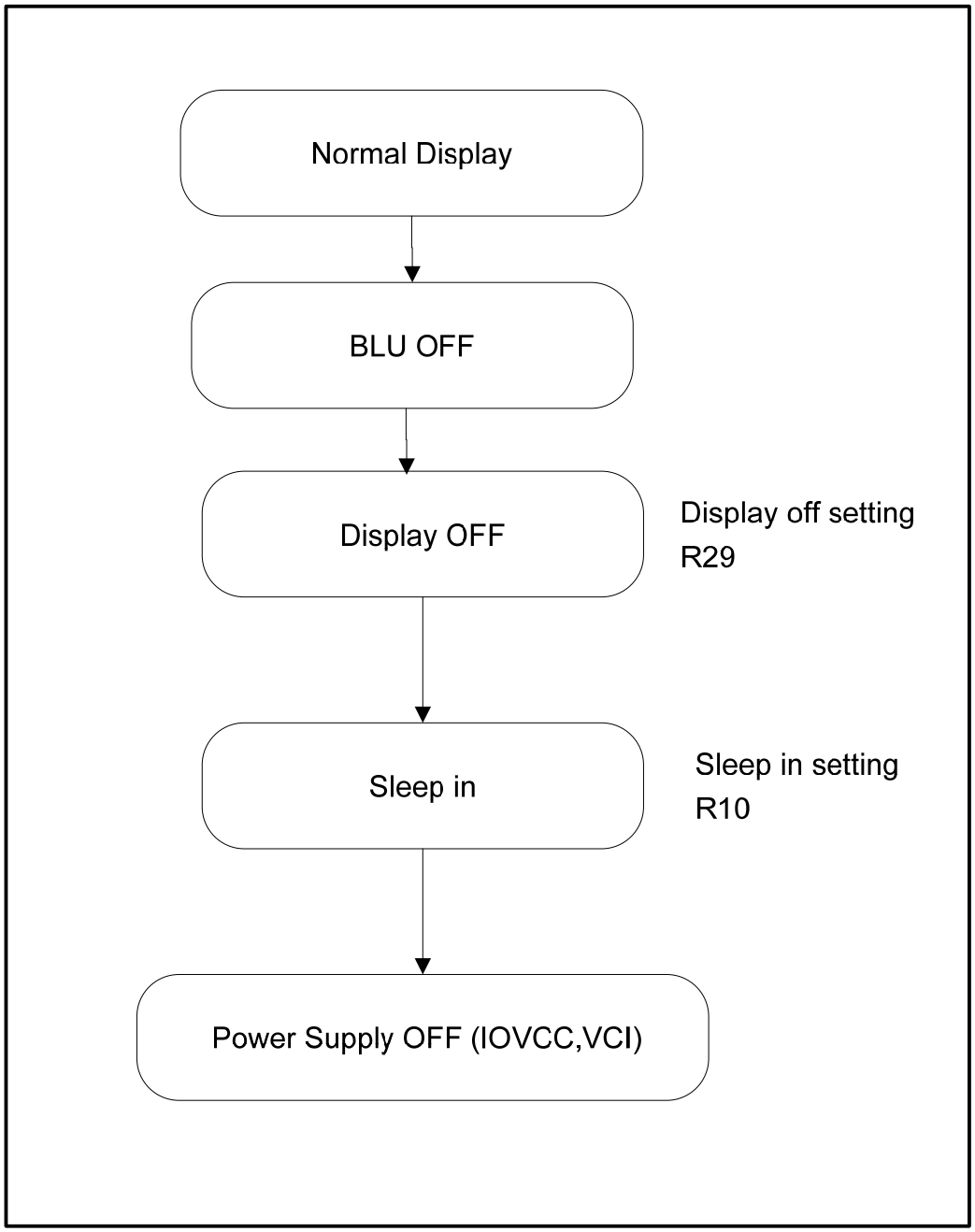
RESET Pulse	Action
Shorter than 5μs	Reset Rejected
Longer than 10μs	Reset
Between 5μs and 10μs	Reset Start

6 Power On/Off Sequence

6.1 Power on Sequence



6.2 Power off Sequence



7 Optical Characteristics

Ta=25℃

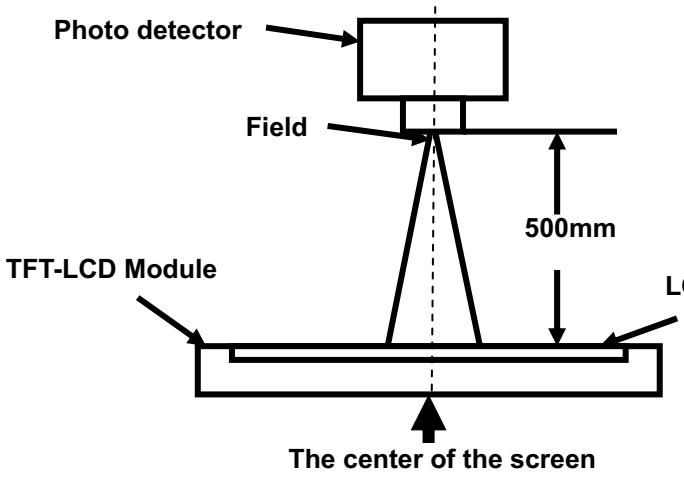
Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
View Angles		θT	CR≧10	60	70	-	Degree	Note 2
		θB		50	60	-		
		θL		60	70	-		
		θR		60	70	-		
Contrast Ratio		CR	θ=0°	400	500	-		Note1 Note3
Response Time		T_{ON}	25℃	-	20	30	ms	Note1 Note4
		T_{OFF}						
Chromaticity	White	x	Backlight is on	0.247	0.297	0.347		Note5, Note1
		y		0.263	0.313	0.363		
	Red	x		0.536	0.586	0.636		
		y		0.292	0.342	0.392		
	Green	x		0.288	0.338	0.388		
		y		0.518	0.568	0.618		
	Blue	x		0.098	0.148	0.198		
		y		0.032	0.082	0.132		
Uniformity		U		-	80	-	%	Note1 Note6
NTSC				-	50	-	%	Note 5
Luminance		L		200	250	-	cd/m^2	Note1 Note7

Test Conditions:

1. V_F =3.2V, I_F =15mA(Backlight current for each LED), the ambient temperature is 25℃.
2. The test systems refer to Note 1 and Note 2.

Note 1: Definition of optical measurement system.

The optical characteristics should be measured in dark room. After 5 minutes operation, the optical properties are measured at the center point of the LCD screen. All input terminals LCD panel must be ground when measuring the center area of the panel.



Item	Photo detector	Field
Contrast Ratio	SR-3A	1°
Luminance		
Chromaticity		
Lum Uniformity		
Response Time	BM-7A	2°

Note 2: Definition of viewing angle range and measurement system.

viewing angle is measured at the center point of the LCD by CONOSCOPE(ergo-80)。

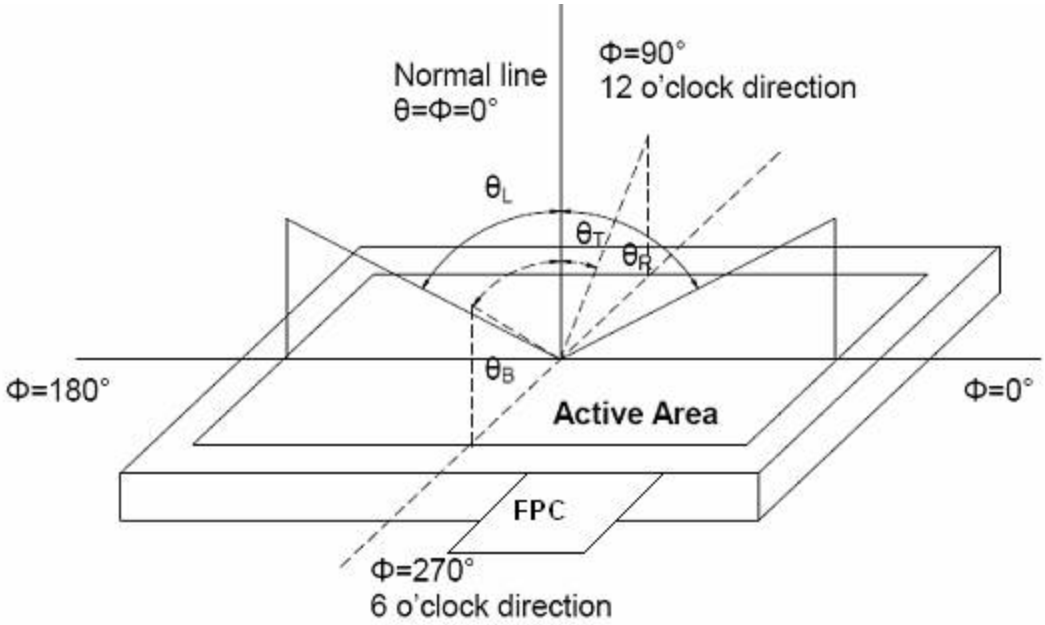


Fig. 1 Definition of viewing angle

Note 3: Definition of contrast ratio

$$\text{Contrast ratio (CR)} = \frac{\text{Luminance measured when LCD is on the "White" state}}{\text{Luminance measured when LCD is on the "Black" state}}$$

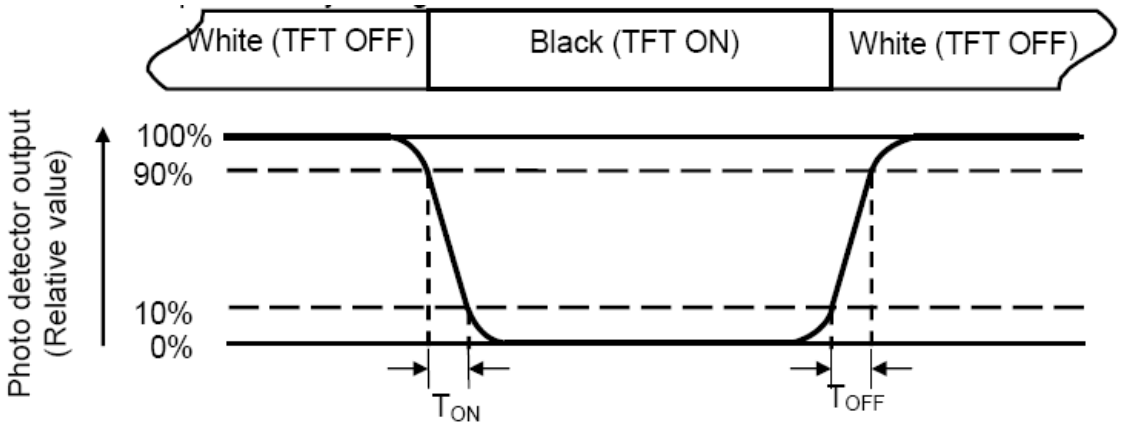
“White state “:The state is that the LCD should be driven by Vwhite.

“Black state”: The state is that the LCD should be driven by Vblack.

Vwhite: To be determined Vblack: To be determined.

Note 4: Definition of Response time

The response time is defined as the LCD optical switching time interval between “White” state and “Black” state. Rise time (T_{ON}) is the time between photo detector output intensity changed from 90% to 10%. And fall time (T_{OFF}) is the time between photo detector output intensity changed from 10% to 90%.



Note 5: Definition of color chromaticity (CIE1931)

Color coordinates measured at center point of LCD.

Note 6: Definition of Luminance Uniformity

Active area is divided into 9 measuring areas (Refer Fig. 2). Every measuring point is placed at the center of each measuring area.

Luminance Uniformity(U) = Lmin/ Lmax

L-------Active area length W----- Active area width

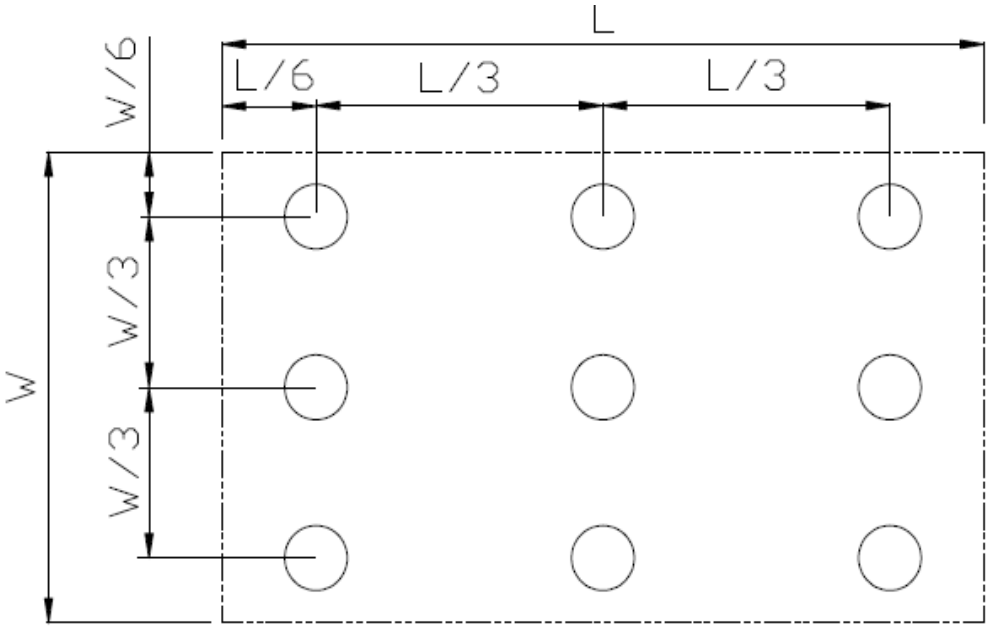


Fig. 2 Definition of uniformity

Lmax: The measured maximum luminance of all measurement position.

Lmin: The measured minimum luminance of all measurement position.

Note 7: Definition of Luminance:

Measure the luminance of white state at center point.

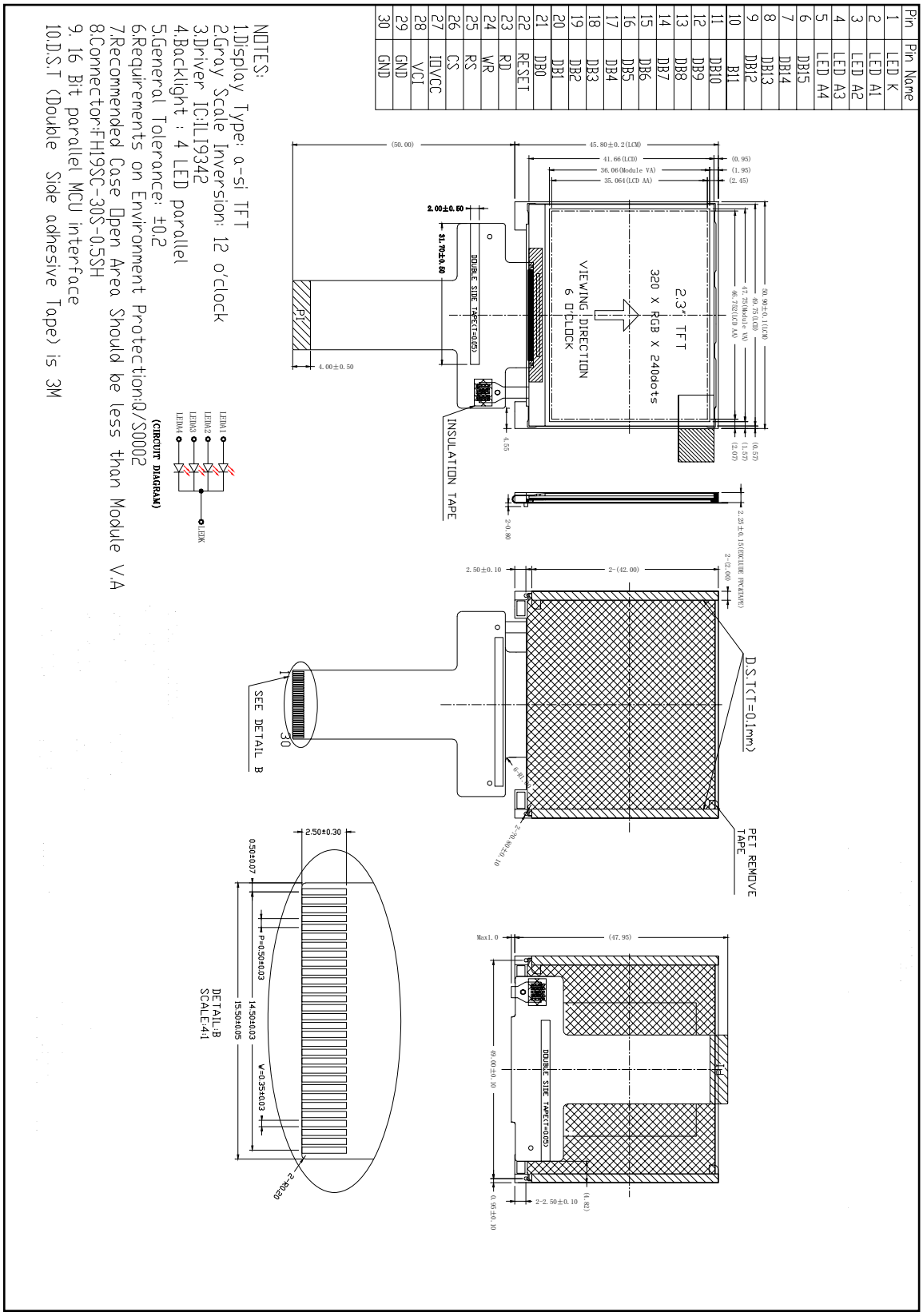
8 Environmental / Reliability Tests

No	Test Item	Condition	Remarks
1	High Temperature Operation	Ts=+70℃, 240hrs	Note1 IEC60068-2-1,GB2423.2
2	Low Temperature Operation	Ta=-20℃, 240hrs	IEC60068-2-1 GB2423.1
3	High Temperature Storage	Ta=+80℃, 240hrs	IEC60068-2-1 GB2423.2
4	Low Temperature Storage	Ta=-30℃, 240hrs	IEC60068-2-1 GB2423.1
5	High Temperature & High Humidity Storage	Ta=+60℃, 90% RH 240 hours	Note2 IEC60068-2-78 GB/T2423.3
6	Thermal Shock (Non-operation)	-30℃ 30 min~+70℃ 30 min, Change time:5min, 20 Cycles	Start with cold temperature, End with high temperature, IEC60068-2-14,GB2423.22
7	Electro Static Discharge (Operation)	C=150pF, R=330Ω，5points/panel Air:±8KV, 5times; Contact:±4KV, 5 times; （Environment: 15℃～35℃, 30%～60%, 86Kpa～106Kpa）	IEC61000-4-2 GB/T17626.2
8	Vibration (Non-operation)	Frequency range:10~55Hz, Stroke:1.5mm Sweep:10Hz~55Hz~10Hz 2 hours for each direction of X.Y.Z. (6 hours for total)(Package condition)	IEC60068-2-6 GB/T2423.10
9	Shock (Non-operation)	60G 6ms, ±X,±Y,±Z 3times, for each direction	IEC60068-2-27 GB/T2423.5
10	Package Drop Test	Height:80 cm, 1 corner, 3 edges, 6 surfaces	IEC60068-2-32 GB/T2423.8
11	Package Vibration Test	Random Vibration: 0.015GxG/Hz for 5-200Hz, -6dB/Octave from 200-500Hz 2 hours for each direction of X,Y,Z (6 hours for total)	IEC60068-2-34 GB/T2423.11

Note1: Ts is the temperature of panel's surface.

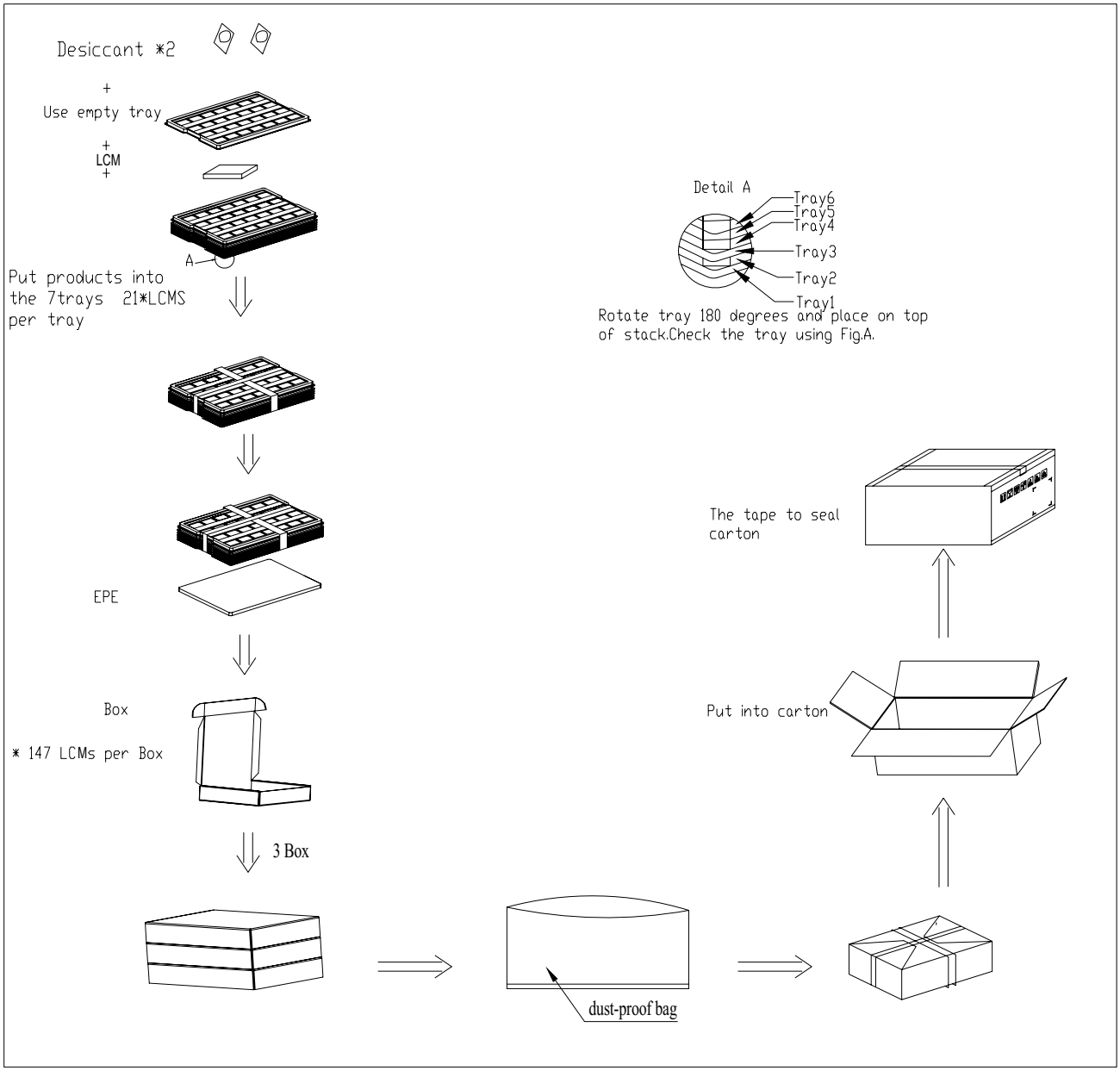
Note2: Ta is the ambient temperature of sample

9 Mechanical Drawing



10 Packing Drawing

No	Item	Model (Material)	Dimensions(mm)	Unit Weight(Kg)	Quantity (Pcs)	Remark
1	LCMmodule	MI0230AT-1	550.9×45.8×2.25	0.0084	441	
2	Tray	PET（Transmit）	485×330×13.8	0.1712	24	Anti-static
3	EPE	EPE	485X330X5	0.0183	3	
4	Dust-Proof bag	PE	700×545	0.046	1	
5	BOX	Corrugated Paper	520X345X74	0.3879	3	
6	Desiccant	Desiccant	45×50	0.002	6	
7	Carton	Corrugated Paper	544×365×250	1.01	1	
8	Total weight(Kg)	10.1				



11 Precautions for Use of LCD Modules

11.1 Handling Precautions

11.1.1 The display panel is made of glass. Do not subject it to a mechanical shock by dropping it from a high place, etc.

11.1.2 If the display panel is damaged and the liquid crystal substance inside it leaks out, be sure not to get any in your mouth, if the substance comes into contact with your skin or clothes, promptly wash it off using soap and water.

11.1.3 Do not apply excessive force to the display surface or the adjoining areas since this may cause the color tone to vary.

11.1.4 The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle this polarizer carefully.

11.1.5 If the display surface is contaminated, breathe on the surface and gently wipe it with a soft dry cloth. If still not completely clear, moisten cloth with one of the following solvents:

- Isopropyl alcohol
- Ethyl alcohol

Solvents other than those mentioned above may damage the polarizer. Especially, do not use the following:

- Water
- Ketone
- Aromatic solvents

11.1.6 Do not attempt to disassemble the LCD Module.

11.1.7 If the logic circuit power is off, do not apply the input signals.

11.1.8 To prevent destruction of the elements by static electricity, be careful to maintain an optimum work environment.

11.1.8.1 Be sure to ground the body when handling the LCD Modules.

11.1.8.2 Tools required for assembly, such as soldering irons, must be properly ground.

11.1.8.3 To reduce the amount of static electricity generated, do not conduct assembly and other work under dry conditions.

11.1.8.4 The LCD Module is coated with a film to protect the display surface. Be care when peeling off this protective film since static electricity may be generated.

11.2 Storage precautions

11.2.1 When storing the LCD modules, avoid exposure to direct sunlight or to the light of fluorescent lamps.

11.2.2 The LCD modules should be stored under the storage temperature range. If the LCD modules will be stored for a long time, the recommend condition is:

Temperature : 0℃ ～ 40℃ Relatively humidity: ≤80%

11.2.3 The LCD modules should be stored in the room without acid, alkali and harmful gas.

11.3 Transportation Precautions:

The LCD modules should be no falling and violent shocking during transportation, and also should avoid excessive press, water, damp and sunshine.

12 TFT-LCD Module Incoming Inspection Standard

12.1 Scope:

The incoming inspection standards shall be applied to TFT-LCD Modules (hereinafter called "Modules") that supplied by Multi-Inno Technology Co.,Ltd.

12.2 Incoming Inspection

The customer shall inspect the modules within twenty calendar days of the delivery date（the “inspection period）at its own cost. The result of the inspection（acceptance or rejection）shall be recorded in writing, and a copy of this writing will be promptly sent to the seller, If the results of the inspecting from buyer does not send to the seller within twenty calendar days of the delivery date. The modules shall be regards as acceptance.

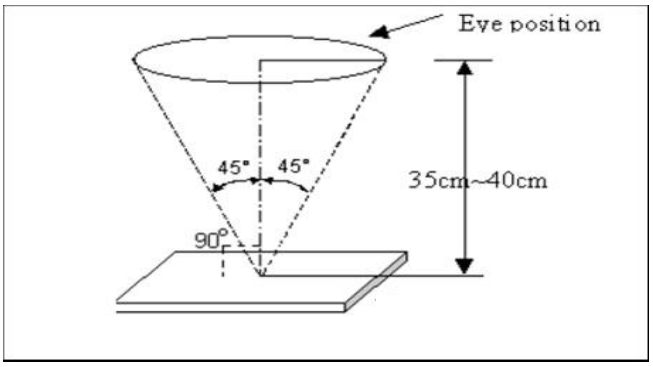
Should the customer fail to notify the seller within the inspection period, the buyers right to reject the modules. Shall be lapsed and the modules shall be deemed to have been accepted by the buyer.

12.3 Inspection Sampling Method

3.1. Lot size: Quantity per shipment lot per model
3.2. Sampling type: Normal inspection, Single sampling
3.3. Inspection level: II
3.4. Sampling table: MIL-STD-105D
3.5. Acceptable quality level （AQL）
Major defect: AQL=0.65
Minor defect: AQL=1.50

12.4 Inspection Conditions

12.4.1 Ambient conditions:
a. Temperature: Room temperature 25±5℃
b. Humidity: (60±10) ％RH
c. Illumination: Single fluorescent lamp non-directive (300 to 700 Lux)
12.4.2 Viewing distance
The distance between the LCD and the inspector’s eyes shall be at least 35±5 ㎝.
12.4.3 Viewing Angle
U/D: 45º/45º, L/R: 45º/45º



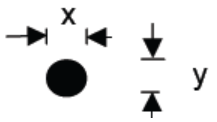
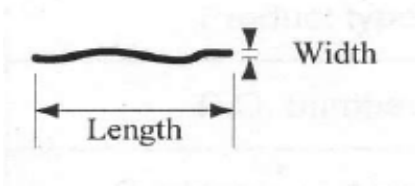
12.5 Inspection Criteria

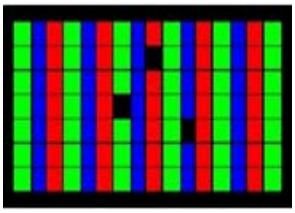
Defects are classified as major defects and minor defects according to the degree of defectiveness defined herein.

12.5.1 Major defect

Item No	Items to be inspected	Inspection Standard
5.1.1	All functional defects	1) No display 2) Display abnormally 3) line defect
5.1.2	missing	Missing function component
5.1.3	Crack	Glass Crack

12.5.2 Minor defect

<table>
<tr><th>Item No</th><th>Items to be inspected</th><th colspan="2">Inspection standard</th></tr>
<tr><td rowspan="5">5.2.1</td><td rowspan="5">Spot Defect
Including
Black spot
White spot</td><td colspan="2">For dark/white spot is defined
φ=(x+y)/2
  </td></tr>
<tr><td>Size φ(mm)</td><td>Acceptable Quantity</td></tr>
<tr><td>φ≤0.15</td><td>Ignore</td></tr>
<tr><td>0.15＜ φ≤0.30</td><td>3</td></tr>
<tr><td>0.30＜ φ</td><td>Not allowed</td></tr>
<tr><td rowspan="6">5.2.2</td><td rowspan="6">Line Defect
Including
Black line
White line
Scratch</td><td colspan="2">Define:
  </td></tr>
<tr><td>Width; Length(mm)</td><td>Acceptable Quantity</td></tr>
<tr><td>W≤0.03</td><td>Ignore</td></tr>
<tr><td>0.03＜ W≤0.05 L≤3.0</td><td>2</td></tr>
<tr><td>0.05＜ W≤0.1 L≤3.0</td><td>1</td></tr>
<tr><td>0.1＜ W; L>3.0</td><td>Not allowed</td></tr>
</table>

<table>
<tr><td rowspan="6">5.2.3</td><td rowspan="6">Polarizer Dent/Bubble</td><td>Size φ(mm)</td><td>Acceptable Quantity</td></tr>
<tr><td>φ≤0.2</td><td>Ignore</td></tr>
<tr><td>0.2＜ φ≤0.3</td><td>2</td></tr>
<tr><td>0.3＜ φ≤0.5</td><td>1</td></tr>
<tr><td>0.5＜ φ</td><td>Not allowed</td></tr>
<tr><td>Total QTY</td><td>3</td></tr>
<tr><td rowspan="6">5.2.4</td><td rowspan="6">Electrical Dot Defect</td><td colspan="2">Bright and Black dot define:
  and  </td></tr>
<tr><td colspan="2">Inspection pattern: Full white、Full black、Red、green and blue screens</td></tr>
<tr><td>Item</td><td>Acceptable Quantity</td></tr>
<tr><td>Black dot defect</td><td>3</td></tr>
<tr><td>Bright dot defect</td><td>0</td></tr>
<tr><td>Total Dot</td><td>3</td></tr>
</table>

Note: 1. Dot defect is defined as the defective area of the dot area is larger than 50% of the dot area.

2. The distance between black dot defects or black and bright dot defects should be more than 5mm apart.

3. Polarizer bubble is defined as the bubble appears on active display area. The defect of polarizer bubble shall be ignored if the polarizer bubble appears on the outside of active display area.

12.6 Mechanics specification

As for the outside dimension, weight of the modules, please refer to product specification for more details

12.7 Precaution

Please pay attention to the following items when you use the LCD Modules:

12.7-1 Do not twist or bend the module and prevent the unsuitable external force for display module during assembly.

12.7-2 Adopt measures for good heat radiation. Be sure to use the module with in the specified temperature.

12.7-3 Avoid dust or oil mist during assembly.
12.7-4 Following the correct power sequence while operating. Do not apply the invalid signal, otherwise, it will cause improper shut down and damage the module.
12.7-5 Less EMI: it will be more safety and less noise.
12.7-6 Please operate module in suitable temperature. The response time & brightness will drift by different temperature.
12.7-7 Avoid to display the fixed pattern (exclude the white pattern) in a long period, otherwise, it will cause image stains.
12.7-8 Be sure to turn off the power when connection of disconnecting the circuit.
12.7-9 Polarizer scratches easily, please handle it carefully.
12.7-10 Display surface never likes dirt of stains.
12.7-11 A dew drop may lead to destruction. Please wipe off and moisture before using module.
12.7-12 Sudden temperature changes cause condensation, and it will cause polarizer damaged.
12.7-13 High temperature and humidity may degrade performance. Please do not expose the module to the direct sunlight and so on.
12.7-14 Acetic acid or chlorine compounds are not friends with TFT display module.
12.7-15 Static electricity will damage the module; please do not touch the module without any grounded device.
12.7-16 Do not disassemble and reassemble the module by self.
12.7-17 Be careful do not touch the rear side directly.
12.7-18 Not strong vibration or shock. It will cause module broken.
12.7-19 Storage the modules in suitable environment with regular packing.
12.7-20 Be careful or injury from a broken display module.
12.7-21 Please avoid the pressure adding to the surface (front or rear side) of modules, because it will cause the display non-uniformity of other function issue.