5.0 inch TFT LCD
without Touch Panel
SPECIFICATION
MODEL NAME: LMCA4050ZXN1

Date: 2013/ 01 / 05

Customer Signature		
Customer		
Approved Date	**Approved By**	**Reviewed By**

Table of Contents

Record of Revision

Rev	Issued Date	Description	Editor
1.0	2013-1-05	Preliminary Specification Release	

1 General Specifications

Feature		Spec
Display Spec.	Size	4.99 inch
	Resolution	720(RGB) X1280
	Interface	MIPI
	Color Depth	16.7M
	Technology Type	a-si TFT
	Pixel Pitch (mm)	0.08625x0.08625
	Pixel Configuration	R.G.B. Vertical Stripe
	Display Mode	IPS NB
	Surface Treatment(Up Polarizer)	Clear
	Viewing Direction	--
	Gray Scale Inversion Direction	--
Mechanical Characteristics	LCM (W x H x D) (mm)	66.3*121.0*1.70
	Active Area(mm)	62.1*110.4
	With/Without TSP	Without TSP
	Weight (g)	TBD
	LED Numbers	10 LED
Electronic	Driver IC	HX8394A

2 Input/Output Terminals

2.1 TFT LCD Panel

No	Symbol	I/O	Description	Comment
1	VDD(IOVCC)	P	IO Power	
2	VCI	P	Analog Power	
3	ID(IOVCC)	P	LCM_ID Pin, Connected to IOVCC	
4	LED_A1	P	LED ANODE1	
5	LED_A2	P	LED ANODE2	
6	MTP	P	LCM MTP Power Pin, Please Let It Open on System Board	
7	LED_C1	P	LED CATHODE1	
8	LED_C2	P	LED CATHODE2	
9	NRES	P	Reset Pin	
10	TE	O	Output a Frame Head Pulse Signal	
11	PWM	O	Backlight On/Off Control Pin.	
12	GND	P	Ground	
13	DATA0-	I/O	MIPI DSI 0 Lane(0-)	
14	DATA0+	I/O	MIPI DSI 0 Lane(0+)	
15	GND	P	Ground	
16	GND	P	Ground	
17	DATA1-	I	MIPI DSI 1 Lane(1-)	
18	DATA1+	I	MIPI DSI 1 Lane(1+)	
19	GND	P	Ground	
20	CLK-	I	MIPI DSI CLK(+)	
21	CLK+	I	MIPI DSI CLK(-)	
22	GND	P	Ground	
23	DATA2-	I	MIPI DSI 2 Lane(2-)	
24	DATA2+	I	MIPI DSI 2 Lane(2+)	
25	GND	P	Ground	

26	DATA3-	I	MIPI DSI 3 Lane(3-)	
27	DATA3+	I	MIPI DSI 3 Lane(3+)	
28	GND	P	Ground	
29	GND	P	Ground	
30	GND	P	Ground	

Note1: I/O definition: I-----Input O---Output P----Power/Ground

Note2: No used I/O pin please fix to GND level

3 Absolute Maximum Ratings

3.1 Driving TFT LCD Panel

GND=0V, Ta = 25℃

Item	Symbol	MIN	MAX	Unit	Remark
Logic Supply Voltage	IOVCC	-0.3	5.5	V	
Power Supply Voltage	VCC	-0.3	5.5	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 Supply Voltage		IOVCC	1.65	1.8/2.8	3.3	V	
Power Supply Voltage		VCC	2.3	2.8	3.3	V	
Input Signal Voltage	Low Level	VIL	0	--	0.3*IOVCC	V	
	High Level	VIH	0.7*IOVCC	--	IOVCC	V	
Output Signal Voltage	Low Level	VOL	0	--	0.2*IOVCC	V	
	High Level	VOH	0.8*IOVCC	--	IOVCC	V	
(Panel+LSI) Power Consumption		Black Mode (60Hz)	--	TBD	--	mW	
		Sleeping Mode	--	TBD	--	uW	
		Standby Mode	--	TBD	--	uW	

4.2 Driving Backlight

Ta=25℃

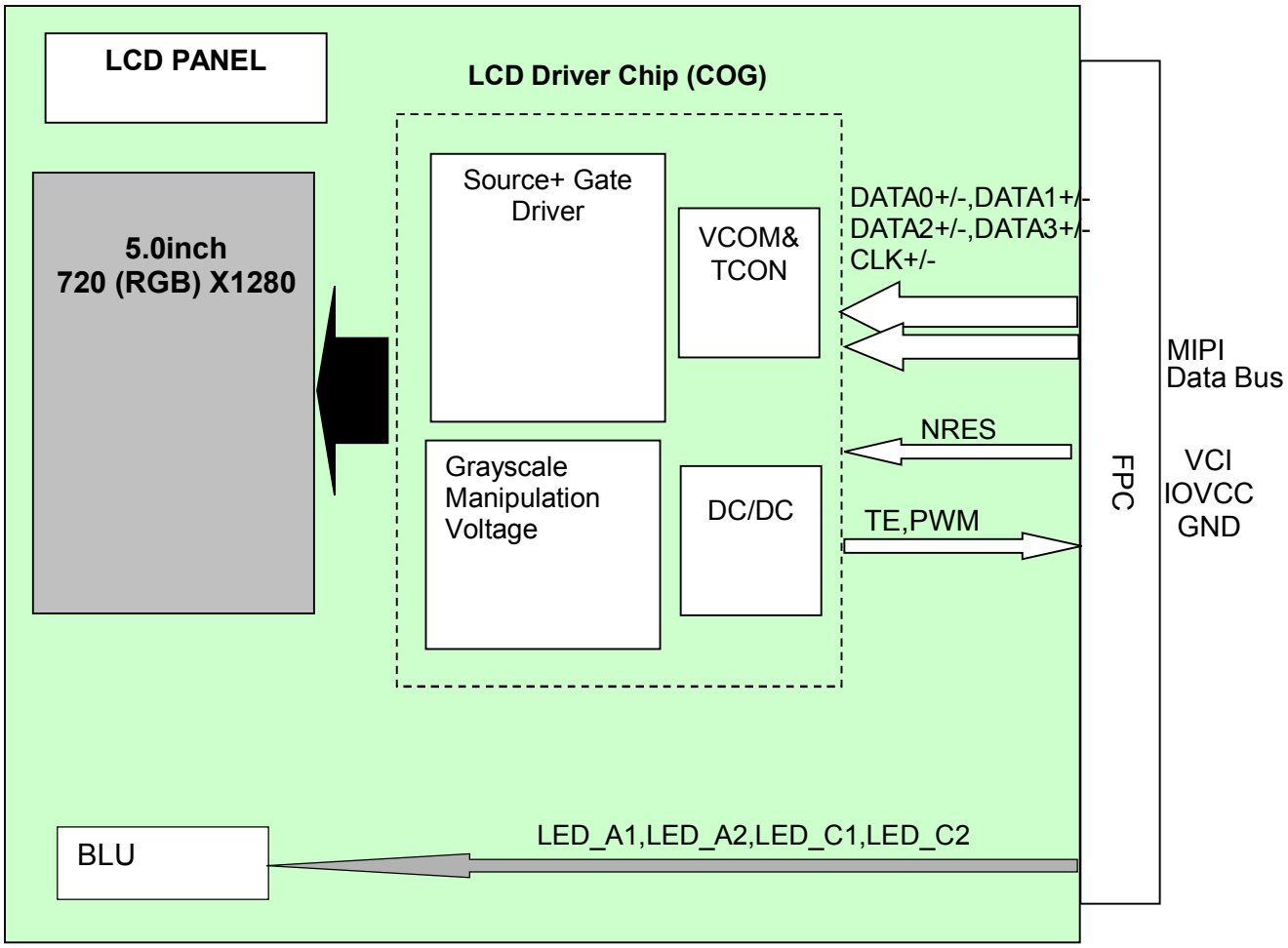
Item	Symbol	Min	Typ	Max	Unit	Remark
Forward Current	I_F	--	20	--	mA	1 LED
Forward Current Voltage	V_F	--	3.2	--	V	
Backlight Power Consumption	W_{BL}	--	64	--	mW	

Note 1: The figure below shows the connection of backlight LED.

Note 2: One LED : I_F =20 mA, V_F =3.2V

4.3 Block Diagram

LCD module diagram



5 INTERFACE TIMING

5.1 The Electrical Characteristics of Low-Power Transmitter

The Low-Power transmitter shall be a slew-rate controlled push-pull driver. It is used for driving the Lines in all Low-Power operating modes It is therefore important that the static power consumption of a LP transmitter be as low as possible. Under tables list DC and AC characteristic for LP-TX

Parameter	Description	Min.	Typ.	Max.	Unit	Note
V_{OL}	Thevenin output low level	-50	-	50	mV	-
V_{OH}	Thevenin output high level	1.1	1.2	1.3	V	-
Z_{OLP}	Output impedance of LP-TX	110	-	-	Ω	(1)

Note: (1)Though no maximum value for Z_{OLP} is specified, the LP transmitter output impedance shall ensure the t_{RLP}/t_{FLP} specification is met.

Table 8.8: LP Transmitter DC Specifications

Parameter	Description	Min.	Typ.	Max.	Unit	Note
$t_{RLP}/_{tFLP}$	15%-85% rise time and fall time	-	-	25	ns	(1)
$\delta V/\delta t_{SR}$	Slew rate @ C_{LOAD} = 0pF	-	-	500	mV/ns	(1),(3),(5),(6)
	Slew rate @ C_{LOAD} = 5pF	-	-	300	mV/ns	(1),(3),(5),(6)
	Slew rate @ C_{LOAD} = 20pF	-	-	250	mV/ns	(1),(3),(5),(6)
	Slew rate @ C_{LOAD} = 70pF	-	-	150	mV/ns	(1),(3),(5),(6)
	Slew rate @ C_{LOAD} = 0 to 70pF (Falling Edge Only)	30	-	-	mV/ns	(1),(2),(3)
	Slew rate @ C_{LOAD} = 0 to 70pF (Rising Edge Only)	30	-	-	mV/ns	(1),(3),(7)
	Slew rate @ C_{LOAD} = 0 to 70pF (Rising Edge Only)	30 – 0.075 * (VO,INST- 700)	-	-	mV/ns	(1),(8),(9)
C_{LOAD}	Load capacitance	0	-	70	pF	-

Note: (1) C_{LOAD} includes the low-frequency equivalent transmission line capacitance. The capacitance of TX and RX are assumed to always be <10pF. The distributed line capacitance can be up to 50pF for a transmission line with 2ns delay.

(2) When the output voltage is between 400 mV and 930 mV.

(3) Measured as average across any 50 mV segment of the output signal transition.

(4) This parameter value can be lower than TLPX due to differences in rise vs. fall signal slopes and trip levels and mismatches between Dp and Dn LP transmitters.

(5) This value represents a corner point in a piecewise linear curve.

(6) When the output voltage is in the range specified by VPIN(absmax).

(7) When the output voltage is between 400 mV and 700 mV.

(8) Where VO,INST is the instantaneous output voltage, VDP or VDN, in millivolts.

(9) When the output voltage is between 700 mV and 930 mV.

(LP Transmitter AC Specifications)

5.2 High-Speed Receiver

The HS receiver is a differential line receiver. It contains a switch-able parallel input termination, ZID, between the positive input pin Dp and the negative input pin Dn. Under Tables list DC and AC characteristic for HS-RX.

Parameter	Description	Min.	Typ.	Max.	Unit	Note
V_{IDTH}	Differential input high threshold	-	-	70	mV	-
V_{IDTL}	Differential input low threshold	-70	-	-	mV	-
V_{ILHS}	Single-ended input low voltage	-40	-	-	mV	(1)
V_{IHHS}	Single-ended input high voltage	-	-	460	mV	(1)
V_{CMRXDC}	Common-mode voltage HS receive mode	70	-	330	mV	(1),(2)
Z_{ID}	Differential input impedance	80	100	125	Ω	-

Note: (1) Excluding possible additional RF interference of 100mV peak sine wave beyond 450MHz.
(2) This table value includes a ground difference of 50mV between the transmitter and the receiver, the static common-mode level tolerance and variations below 450MHz

(HS Receiver DC Specifications)

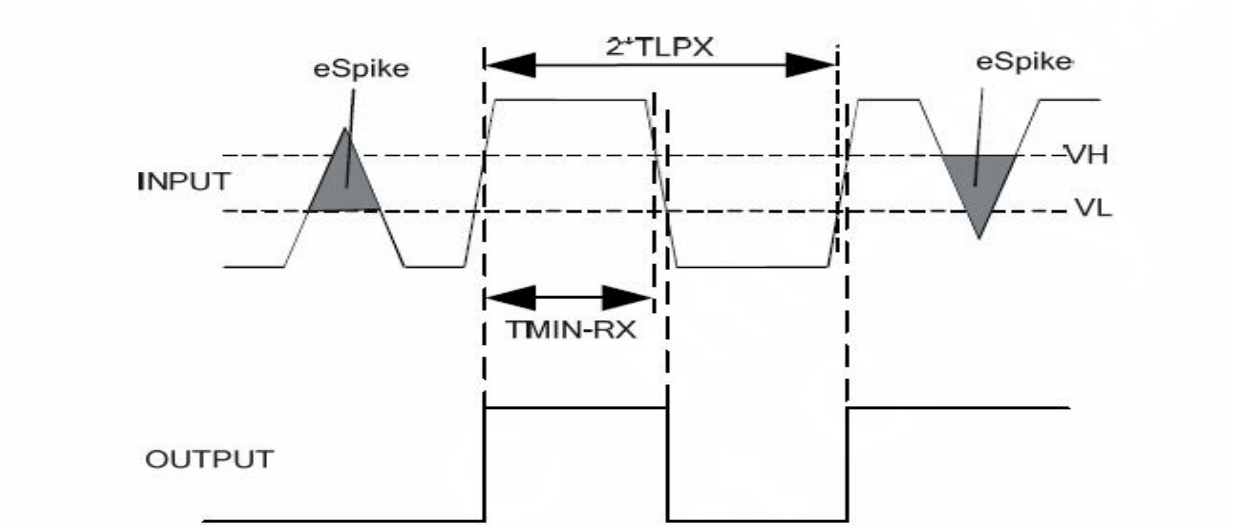
Parameter	Description	Min.	Typ.	Max.	Unit	Note
$\Delta V_{CMRX(HF)}$	Common mode interference beyond 450 MHz	-	-	100	mV_{PP}	(1)
C_{CM}	Common mode termination	-	-	60	pF	(2)

Note: (1) $\Delta V_{CMRX(HF)}$ is the peak amplitude of a sine wave superimposed on the receiver inputs.
(2) For higher bit rates a 14pF capacitor will be needed to meet the common-mode return loss specification.

(HS Receiver AC Specifications)

5.3 Low-Power Receiver

The low power receiver is an un-terminated, single-ended receiver circuit. The LP receiver is used to detect the Low-Power state on each pin. For high robustness, the LP receiver shall filter out noise pulses and RF interference. It is recommended the implementer optimize the LP receiver design for low power. The LP receiver shall reject any input glitch when the glitch is smaller than eSpike. The filter shall allow pulses wider than TMIN to propagate through the LP receiver. The related diagram shows as Figure 8.4 Input Glitch Rejection of Low-Power Receivers. Besides, under tables list DC and AC characteristic for LP-RX.



(Input Glitch Rejections of Low-Power Receivers)

Parameter	Description	Min.	Typ.	Max.	Unit	Note
V_{IL}	Logic 0 input threshold	-	-	550	mV	-
V_{IH}	Logic 1 input threshold	880	-	-	mV	-

(LP Receiver DC Specifications)

Parameter	Description	Min.	Typ.	Max.	Unit	Note
e_{SPIKE}	Input pulse rejection	-	-	300	V.ps	1, 2, 3
T_{MIN-RX}	Minimum pulse width response	20	-	-	ns	4
V_{INT}	Peak-to-peak interference voltage	-	-	200	mV	-
f_{INT}	Interference frequency	450	-	-	MHz	-

Note: (1) Time-voltage integration of a spike above VIL when being in LP-0 state or below VIH when being in LP-1 state
(2) An impulse less than this will not change the receiver state.
(3) In addition to the required glitch rejection, implementers shall ensure rejection of known RF-interferers.
(4) An input pulse greater than this shall toggle the output.

(LP Receiver AC Specifications)

5.4 Reset Timing Characteristics

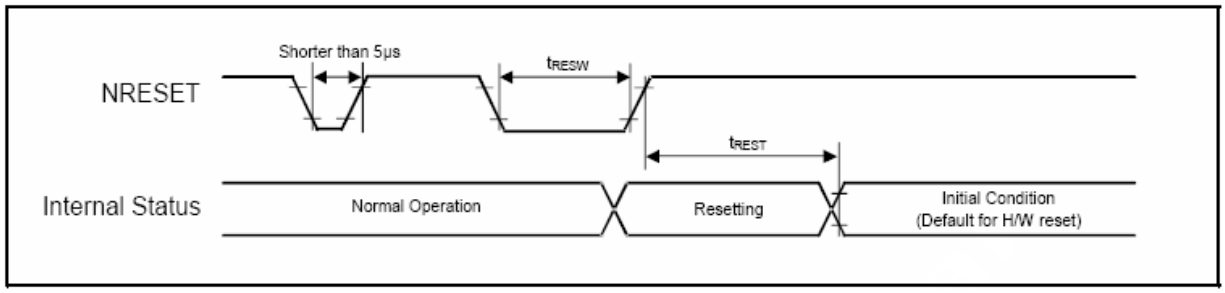


Figure5.5.1 Reset input timing

Symbol	Parameter	Related Pins	Spec.			Note	Unit
			Min.	Typ.	Max.		
tRESW	Reset low pulse width(1)	NRESET	10	-	-	-	µs
tREST	Reset complete time(2)	-	5	-	-	When reset applied during SLPIN mode	ms
		-	120	-	-	When reset applied during SLPOUT mode	ms

Table 5.5.1 Reset input timing SPEC

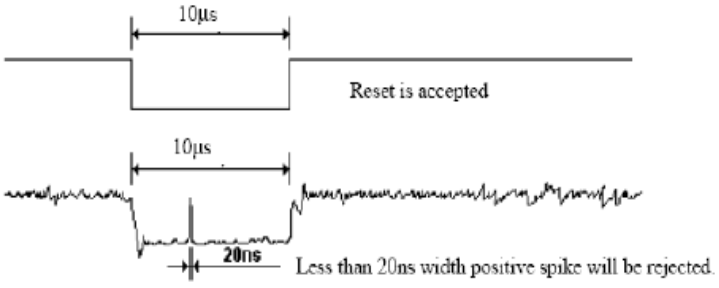
Note: (1) Spike due to an electrostatic discharge on NRESET line does not cause irregular system reset according to the following table.

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

(2) During the resetting period, the display will be blanked (The display is entering blanking sequence, which Maximum time is 120 ms, when Reset Starts in Sleep Out –mode. The display remains the blank state in Sleep In –mode) and then return to Default condition for H/W reset.

(3) During Reset Complete Time, ID and VCOM value in OTP will be latched to internal register during this period. This loading is done every time when there is H/W reset complete time (tREST) within 5ms after a rising edge of NRESET.

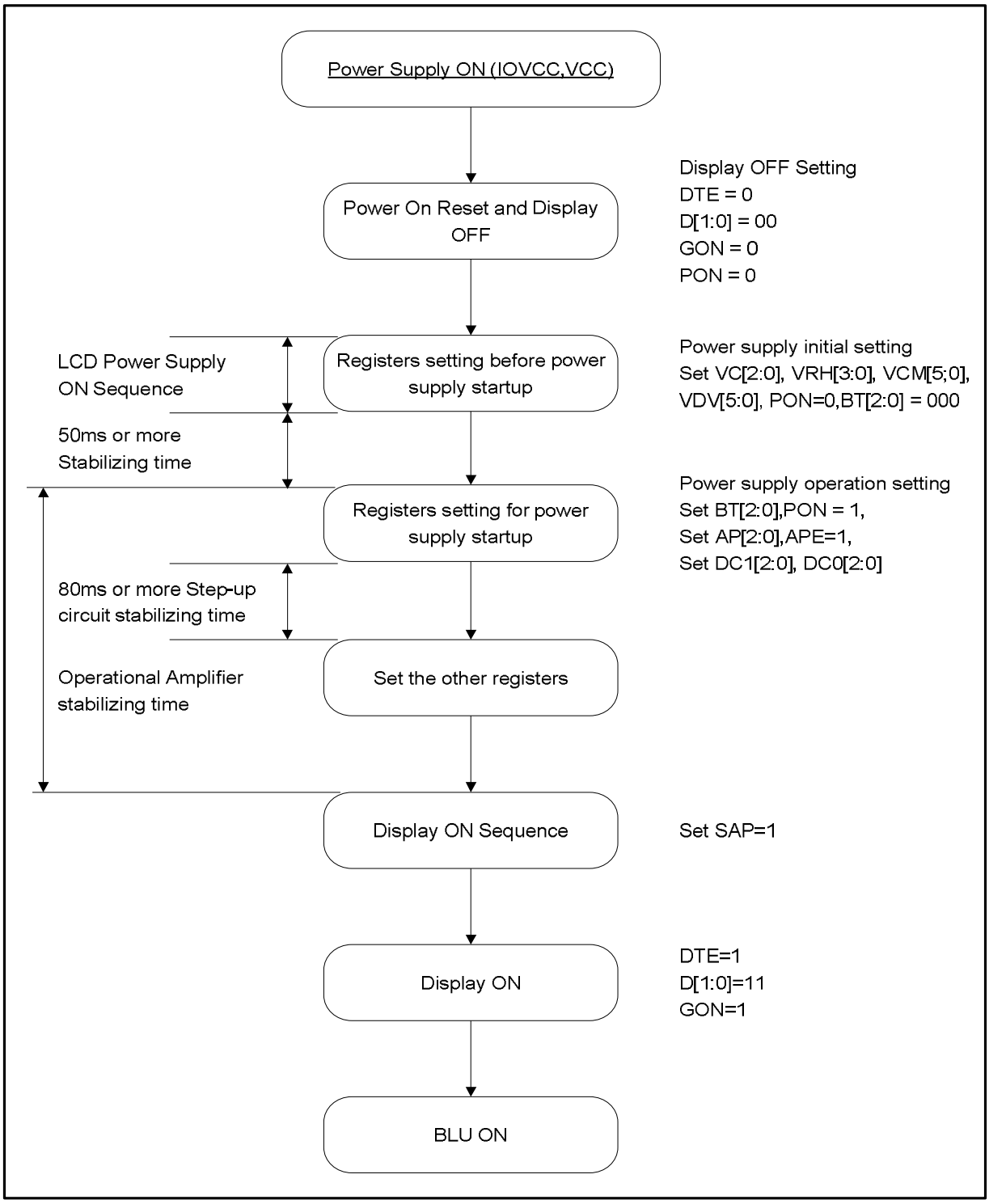
(4) Spike Rejection also applies during a valid reset pulse as shown as below:



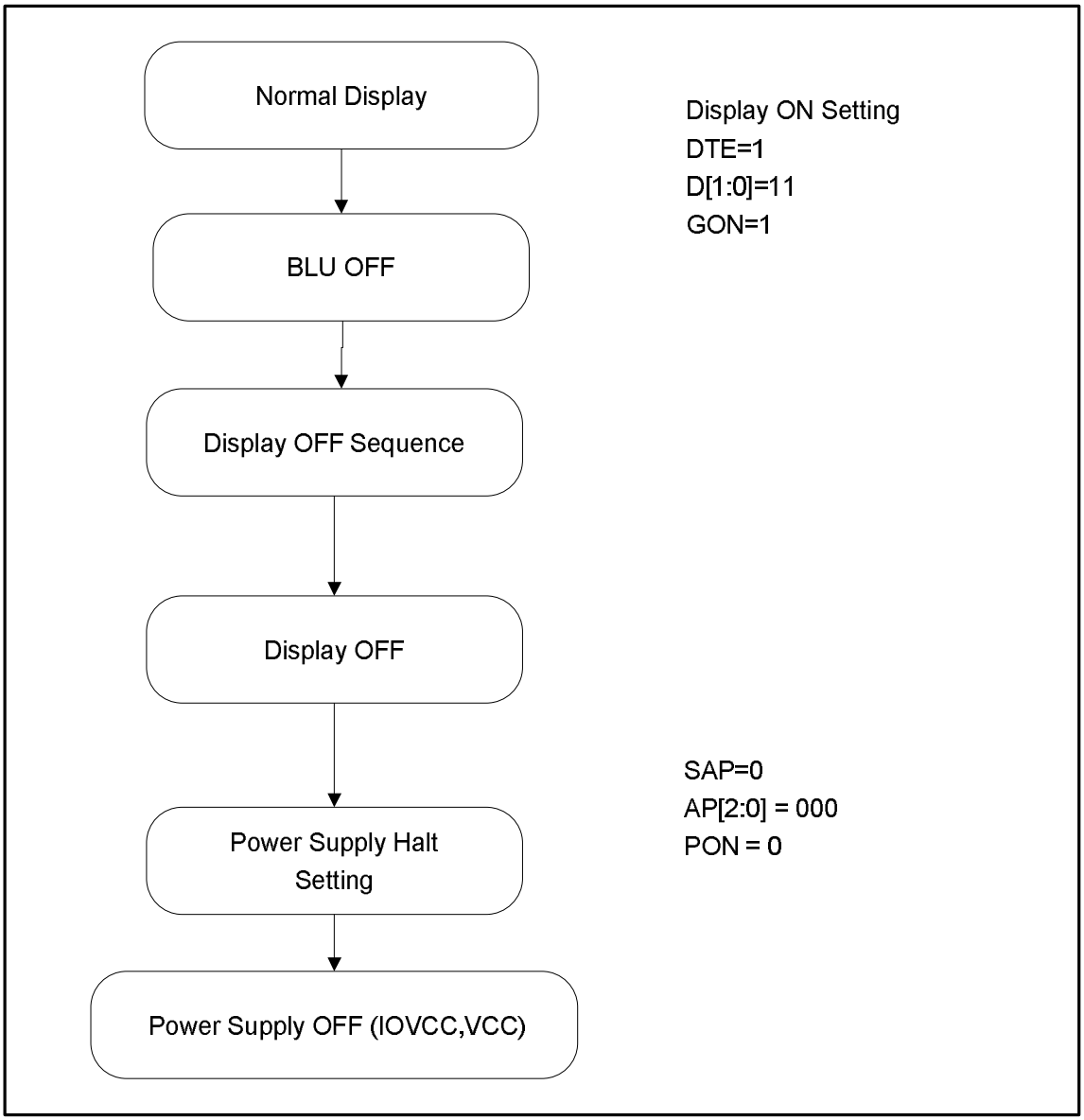
(5) It is necessary to wait 5msec after releasing NRESET before sending commands. Also Sleep Out command cannot be sent for 120msec.

5.5. POWER ON/OFF SEQUENCE

5.5.1 Power on Sequence



5.5.2 Power off Sequence



6 Optical Characteristics

Ta=25℃

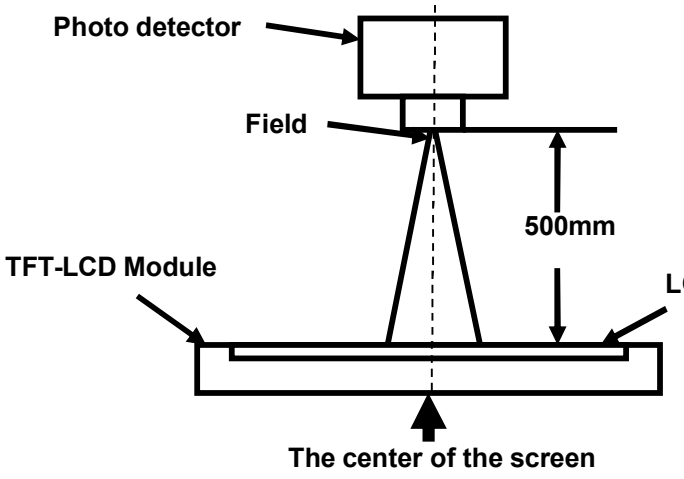
Item		Symbol	Condition	Min	Typ	Max	Unit	Remark
View Angles		θT	CR≧10	70	80	-	Degree	Note 2
		θB		70	80	-		
		θL		70	80	-		
		θR		70	80	-		
Contrast Ratio		CR	θ=0°	700	900	-	-	Note1 Note3
Response Time		T_{ON}	25℃	-	25	35	ms	Note1 Note4
		T_{OFF}						
Chromaticity	White	x	Backlight is on	0.27	0.30	0.33	-	Note5 Note1
		y		0.295	0.325	0.355		
	Red	x		0.606	0.636	0.666		
		y		0.297	0.327	0.357		
	Green	x		0.291	0.321	0.351		
		y		0.589	0.619	0.649		
	Blue	x		0.122	0.152	0.182		
		y		0.024	0.054	0.084		
Uniformity		U	-	80	-	-	%	Note1 Note6
NTSC		-	-	65	71	-	%	Note 5
Luminance		L		380	420	-	cd/m^2	Note1 Note7

Test Conditions:

1. V_F=3.2V, I_F=20mA(One LED current), 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)。

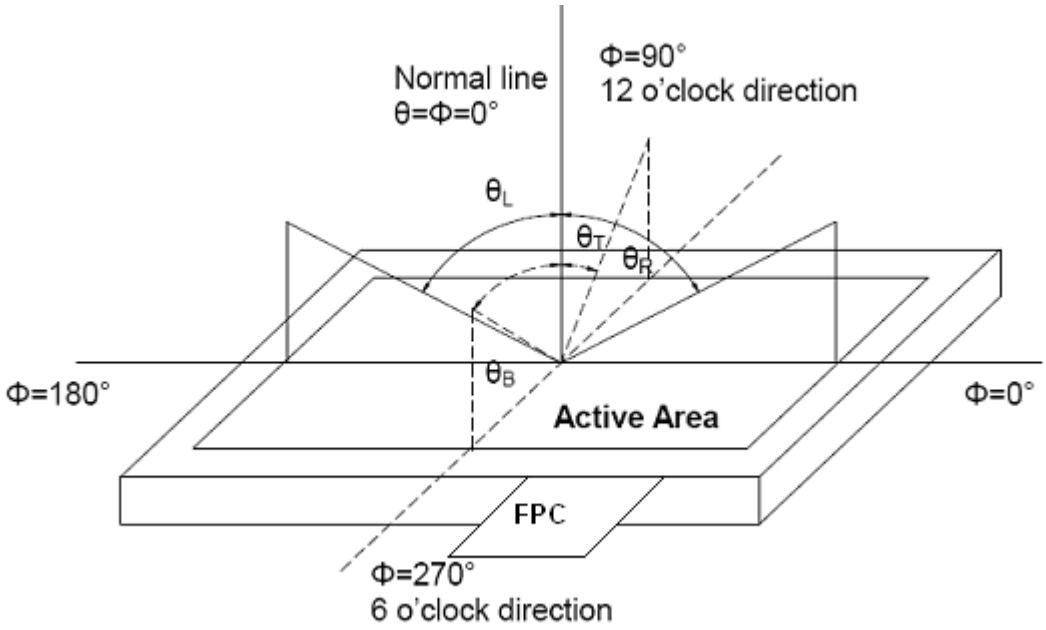


Fig. 1 Definition of viewing angle

Note 3: Definition of contrast ratio

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

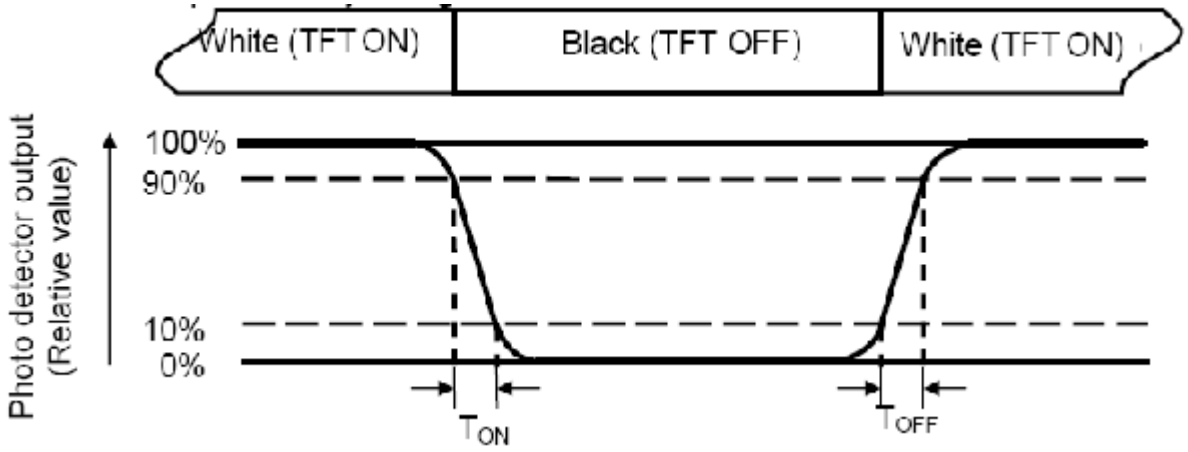
“White state “:The state is that the LCD should driven by Vwhite.

“Black state”: The state is that the LCD should 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 (TON) is the time between photo detector output intensity changed from 90% to 10%. And fall time (TOFF) 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

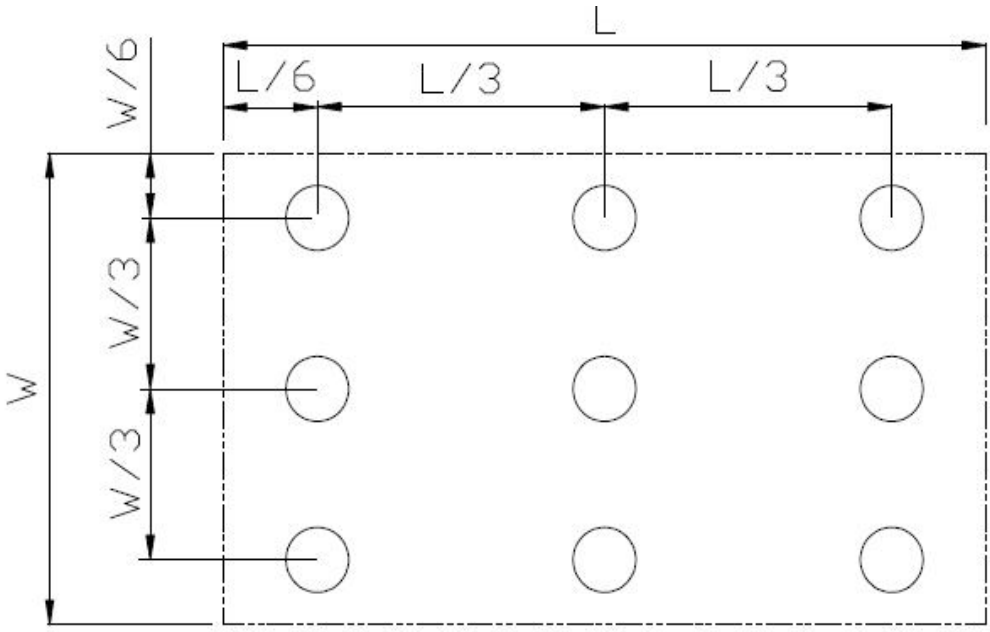


Fig. 2 Definition of uniformity

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.

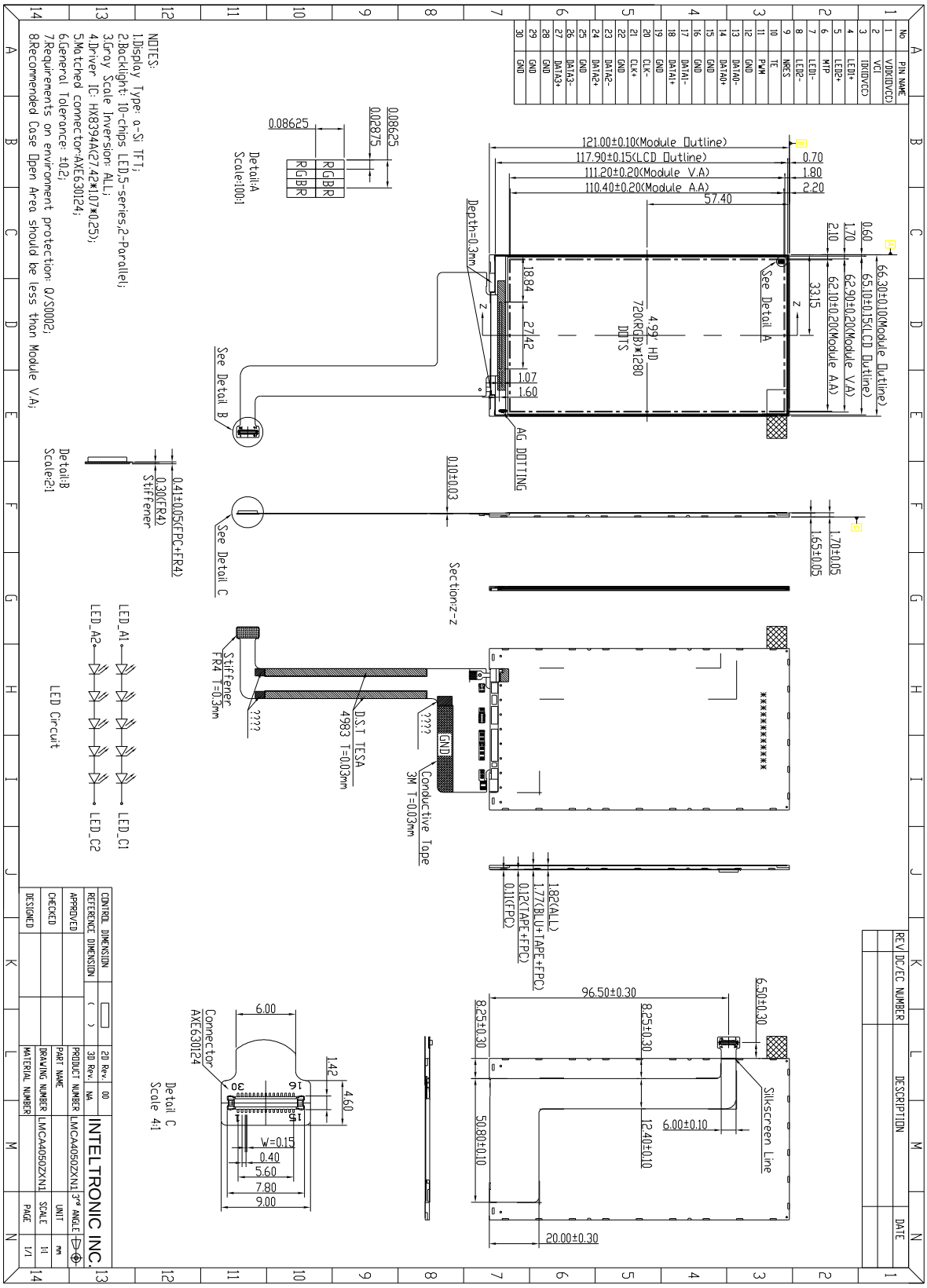
7 Environmental / Reliability Test

No	Test Item	Condition	Remark
1	High Temperature Operation	Ts=+70℃, 120hrs	Note1 IEC60068-2-1:2007,GB2423.2-2008
2	Low Temperature Operation	Ta=-20℃,120hrs	IEC60068-2-1:2007 GB2423.1-2008
3	High Temperature Storage	Ta=+80℃, 120hrs	IEC60068-2-1:2007 GB2423.2-2008
4	Low Temperature Storage	Ta=-30℃, 120hrs	IEC60068-2-1:2007 GB2423.1-2008
5	High Temperature & High Humidity Storage	Ta=+60℃, 90% RH 120 hours	Note2 IEC60068-2-78 :2001 GB/T2423.3—2006
6	Thermal Shock (Non-operation)	-30℃ 30 min~+70℃ 30 min, Change time:5min, 20 Cycles	Start with cold temperature, End with high temperature, IEC60068-2-14:1984,GB2423.22-2002
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）	IEC61000-4-2:2001 GB/T17626.2-2006
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)	IEC60068-2-6:1982 GB/T2423.10—1995
9	Shock (Non-operation)	60G 6ms, ± X,± Y,± Z 3times, for each direction	IEC60068-2-27:1987 GB/T2423.5—1995
10	Package Drop Test	Height:80 cm, 1 corner, 3 edges, 6 surfaces	IEC60068-2-32:1990 GB/T2423.8—1995

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

Note2: Ta is the ambient temperature of sample.

8 Mechanical Drawing



9 Precautions For Use of LCD Modules

9.1 Handling Precautions

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

9.1.2 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.

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

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

9.1.5 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

9.1.6 Do not attempt to disassemble the LCD Module.

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

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

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

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

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

9.1.8.4 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.

9.2 Storage precautions

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

10.2.2 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%

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

9.3 Transportation Precautions

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

10 .Inspection Specifications

The buyer (customer) shall inspect the modules within twenty calendar days since the delivery date (the "inspection period") at its own cost. The results of the inspection (acceptance or rejection) shall be recorded in writing, and a copy of this writing will be promptly sent to the seller.

The buyer may, under commercially reasonable reject procedures, reject an entire lot in the delivery involved if, within the inspection period, such samples of modules within such lot show an unacceptable number of defects in accordance with this incoming inspection standards, provided however that the buyer must notify the seller in writing of any such rejection promptly, and not later than within three business days of the end of the inspection period.

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

11. Warranty

Inteltronic Inc. warrants to you, the original purchaser, that each of its products will be free from defects in materials and workmanship for one year from the date of purchase.

Inteltronic Inc. will be limited to replace or repair any of its module which is found and confirmed defective electrically or visually when inspected in accordance with Inteltronic Inc. general module inspection standard.

This warranty does not apply to any products which have been on customer’s production line, repaired or altered by persons other than repair personnel authorized by Inteltronic Inc., or which have been subject to misuse, abuse, accident or improper installation. Inteltronic Inc. assumes no liability under the terms of this warranty as a consequence of such events.

If an Inteltronic Inc. product is defective, it will be repaired or replaced at no charge during the warranty period. For out-of-warranty repairs, you will be billed according to the cost of replacement materials, service time and freight. In returning the modules, they must be properly packaged with original package; there should be detailed description of the failures or defect.

12. RMA

Products purchased through Inteltronic Inc. and under warranty may be returned for replacement. Contact support@inteltronicinc.com for RMA number and procedures

Office Locations

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