Crystal Clear Technology

Product Specification

T3224C11VR01 （without Touch Panel）

Crystal Clear Technology sdn. bhd.
16Jalan TP5—Taman Perindustrian Sime UEP
47600 Subang Jaya—Selangor DE
Malaysia. T: +603 80247099 F: +603 80247098

1.0 Record of revision

Rev	Date	Item	Page	Comment	Originator	Checked By
	15/03/10			Preliminary	CF Liew	Azhar

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3.0 General specification

Display format : 240 (W) x RGB x 320 (H) dots
Screen size : 2.2 inch
Surface treatment : Glare
Active area : 33.48mm x 44.64mm
General dimensions : 39.84mm x 56.90mm x 3.00mm
Pixel pitch : 0.1395mm x 0.1395mm
Controller : HIMAX, HX8347D

LCD type : ☐ CSTN ☒ TFT ☐ OLED

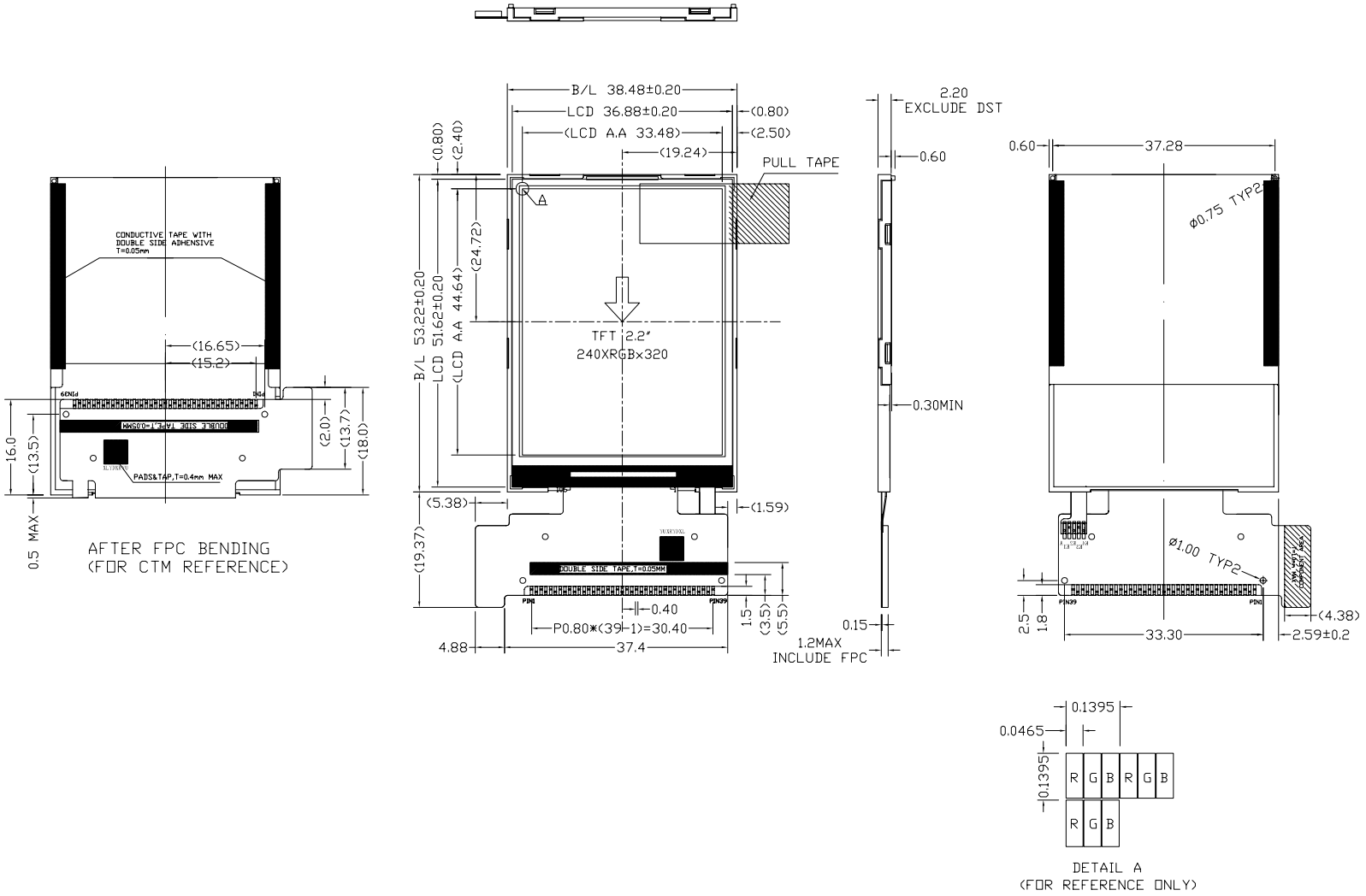
Polarizer mode : ☐ Reflective ☐ Transflective
☒ Transmissive

View angle : ☐ 6 O' clock ☒ 12 O'clock
☐ 9 O'clock ☐ 3 O'clock

Backlight : ☐ NONE ☒ LED ☐ CCFL

Backlight color : ☐ Yellow Green ☐ Amber ☒ White
☐ Blue Green ☐ Others

Temperature range : ☐ Normal temperature ☒ Wide temperature
Operating 0 to 50 C Operating –20 to 70 C
Storage –20 to 70 C Storage –30 to 80 C



Pin Assignment

1	2	3	4	5	6	7	8	9	10
IM0	IM3	YU/Y+	XR/X+	YD/Y-	XL/X-	GND	2.8V	1.8V/2.8V	FMARK
11	12	13	14	15	16	17	18	19	20
CS	RS	WR	RD	DB0	DB1	DB2	DB3	DB4	DB5
21	22	23	24	25	26	27	28	29	30
DB6	DB7	DB8	DB9	DB10	DB11	DB12	DB13	DB14	DB15
31	32	33	34	35	36	37	38	39	
RESET	ID/GND	LED A	LED K1	LED K2	LED K3	LED K4	DB16	DB17	

MODEL NAME	NO	MATERIAL	REMARKS
	1		

CRYSTAL CLEAR TECHNOLOGY SDN BHD
16, JLN TP5, TMN PERINDUSTRIAN SIME UEP,
47500 SUBANG JAYA, SELANGOR DARUL EHSAN.

PART NAME: T3224C11VR00

APPROVED	CHECKED	DRAWN	UNIT : MM / NTS	DRAWING NUMBER	SHEET	REV.
	Khairiah	Khairiah			1/1	

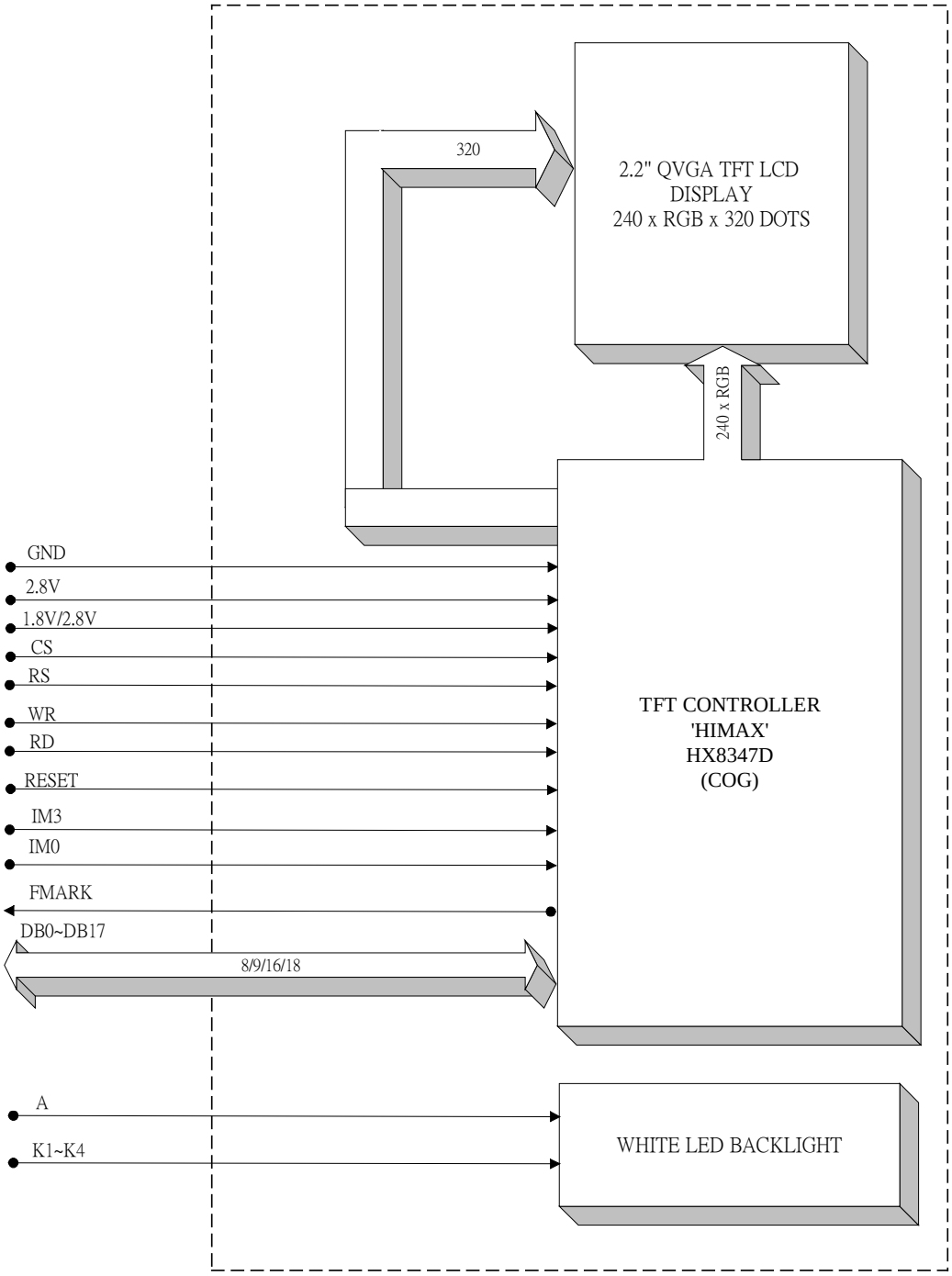


Figure 2: Block Diagram

3. Interface signals

Table 2: Pin assignment

<table>
<tr><th>Pin No.</th><th>Symbol</th><th>Description</th></tr>
<tr><td>1</td><td>IM0</td><td rowspan="2">System interface select.
<table>
<tr><th>IM3</th><th>IM0</th><th>Interface</th></tr>
<tr><td>0</td><td>0</td><td>8080 MCU 16-bits Parallel</td></tr>
<tr><td>0</td><td>1</td><td>8080 MCU 8-bits Parallel</td></tr>
<tr><td>1</td><td>0</td><td>8080 MCU 18-bits Parallel</td></tr>
<tr><td>1</td><td>1</td><td>8080 MCU 9-bits Parallel</td></tr>
</table></td></tr>
<tr><td>2</td><td>IM3</td></tr>
<tr><td>3</td><td>YU/Y+</td><td>No connection.</td></tr>
<tr><td>4</td><td>XR/X+</td><td>No connection.</td></tr>
<tr><td>5</td><td>YD/Y-</td><td>No connection.</td></tr>
<tr><td>6</td><td>XL/X-</td><td>No connection.</td></tr>
<tr><td>7</td><td>GND</td><td>Ground.</td></tr>
<tr><td>8</td><td>2.8V</td><td>Power supply.</td></tr>
<tr><td>9</td><td>1.8V/2.8V</td><td>Power supply.</td></tr>
<tr><td>10</td><td>FMARK</td><td>Output a frame head pulse signal is used as synchronies MCU to frame rate.</td></tr>
<tr><td>11</td><td>CS</td><td>Chip select signal.
Low: chip can be accessed; High: chip cannot be accessed.</td></tr>
<tr><td>12</td><td>RS</td><td>The signal for command or parameter select under parallel mode:
Low: command. High: parameter.</td></tr>
<tr><td>13</td><td>WR</td><td>I80 system:
Serves as a write signal and writes data at the rising edge.</td></tr>
<tr><td>14</td><td>RD</td><td>I80 system:
Serves as a read signal and read data at the low level.</td></tr>
<tr><td>15~30</td><td>DB0~DB15</td><td>8/9/16/18-bit bi-directional data bus.
The unused pins let to open.</td></tr>
<tr><td>31</td><td>RESET</td><td>Reset pin. Setting either pin low initializes the LSI.
Must be reset the chip after power being supplied.</td></tr>
<tr><td>32</td><td>ID/GND</td><td>Ground.</td></tr>
<tr><td>33</td><td>A</td><td>Anode of LED backlight.</td></tr>
<tr><td>34</td><td>K1</td><td>Cathode of LED backlight.</td></tr>
<tr><td>35</td><td>K2</td><td>Cathode of LED backlight.</td></tr>
<tr><td>36</td><td>K3</td><td>Cathode of LED backlight.</td></tr>
<tr><td>37</td><td>K4</td><td>Cathode of LED backlight.</td></tr>
<tr><td>38~39</td><td>DB16~DB17</td><td>8/9/16/18-bit bi-directional data bus.
The unused pins let to open.</td></tr>
</table>

4. Absolute Maximum Ratings

4.1 Electrical Maximum Ratings – for IC Only

Table 3

Parameter	Symbol	Min.	Max.	Unit
Power supply voltage (VCC)	IOVCC	-0.3	+4.6	V
Power supply voltage (VCI)	VCI	-0.3	+4.6	V

Note: The modules may be destroyed if they are used beyond the absolute maximum ratings.
GND=0V.

4.2 Environmental Condition

Table 4

Item	Operating temperature (Topr)		Storage temperature (Tstg) (Note 1)		Remark
	Min.	Max.	Min.	Max.	
Ambient temperature(Ta)	-20°C	+70°C	-30°C	+80°C	Dry
Humidity (note 1)	90% max. RH for Ta ≤ 40°C < 50% RH for 40°C < Ta ≤ Maximum operating temperature.				No condensation
Vibration (IEC 68-2-6) cells must be mounted on a suitable connector	Frequency: 10 ~ 55 Hz Amplitude: 0.75 mm Duration: 20 cycles in each direction.				3 directions
Shock (IEC 68-2-27) Half-sine pulse shape	Pulse duration: 11 ms Peak acceleration: 981 m/s^2 = 100g Number of shocks: 3 shocks in 3 mutually perpendicular axes.				3 directions

Note 1: Product cannot sustain at extreme storage conditions for long time.

5. Electrical Specifications

5.1 Typical Electrical Characteristics

At Ta = 25 °C, VDD= 2.8V ±0.1V, GND=0V.

Table 5

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Power supply voltage	VDD		2.7	2.8	2.9	V
TFT gate ON voltage	VGH	Note 1	12	-	18	V
TFT gate OFF voltage	VGL	Note 2	-12	-	-7	V
TFT common electrode voltage	Vcom	Note 3	-2	-	5	V
Input signal voltage	V_{IH}	"H" level	0.8VDD	-	VDD	V
	V_{IL}	" L" level	-0.3	-	0.2VDD	V
Supply current (Logic)	IDD	VDD=2.8V	-	TBD	-	mA
Supply voltage of white LED backlight	VLED	Forward current =60mA	-	3.0	-	V
Luminance (on the backlight surface)		Number of LED dies = 3	-	3500	-	cd/m^2

Note 1: VGH is TFT Gate operating voltage.

Note 2: VGL is TFT Gate operating voltage.

Note 3: Vcom must be adjusted to optimize display quality.

5.2 Timing Characteristics

5.2.1 Reset Input Timing

At Ta = 25°C, GND=0V, VDD=2.8V±0.1V.

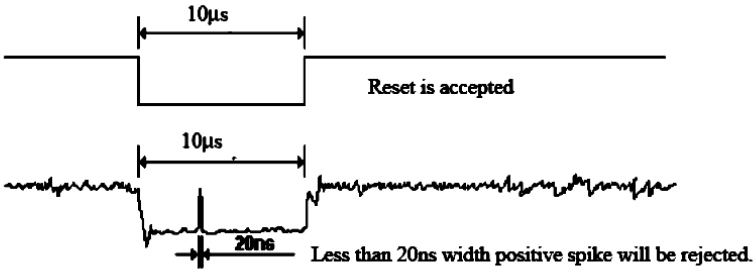
Table 6

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 STB mode	ms
		-		-	120	When reset applied during STB mode	ms
tPRES	Reset goes high level after Power on time	NRESET & IOVCC	1	-	-	Reset goes high level after Power on	ms

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

NRESET Pulse	Action
Shorter than 5 µ	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 STB Out –mode. The display remains the blank state in STB –mode) and then return to Default condition for H/W reset.
(3) During Reset Complete Time, VMF 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 below:



(5) It is necessary to wait 5msec after releasing !RES before sending commands. Also STB Out

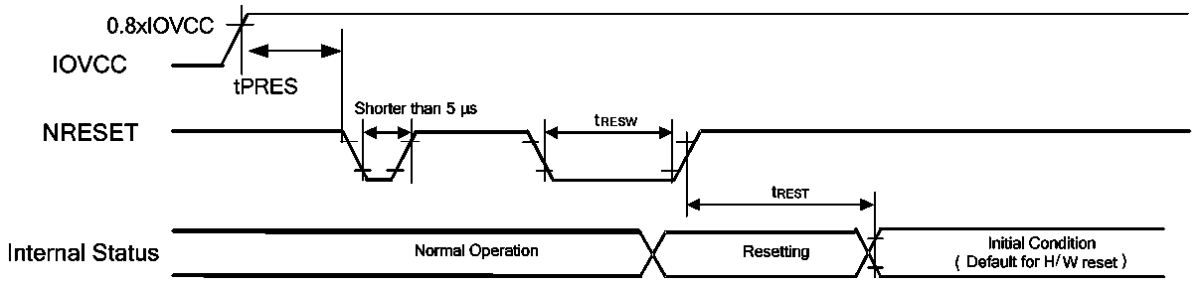


Figure 4: Reset Input Timing

5.2.2 Parallel Interface Characteristics (I80-system interface)

At Ta = 25°C, GND=0V, VDD=2.8V ±0.1V.

Table 7

Signal	Symbol	Parameter	Min.	Max.	Unit	Description
DNC_SCL	t_{AST}	Address setup time	0	-	ns	-
	t_{AHT}	Address hold time (Write/Read)	10	-		
NCS	t_{CHW}	Chip select "H" pulse width	0	-	ns	-
	t_{CS}	Chip select setup time (Write)	15	-		
	t_{RCS}	Chip select setup time (Read ID)	45	-		
	t_{RCSFM}	Chip select setup time (Read FM)	355	-		
	t_{CSF}	Chip select wait time (Write/Read)	10	-		
	t_{CSH}	Chip select hold time	10	-		
NWR_SCL	t_{WC}	Write cycle	66	-	ns	-
	t_{WRH}	Control pulse "H" duration	15	-		
	t_{WRL}	Control pulse "L" duration	15	-		
NRD(ID)	t_{RC}	Read cycle (ID)	160	-	ns	When read ID data
	t_{RDH}	Control pulse "H" duration (ID)	90	-		
	t_{RDL}	Control pulse "L" duration (ID)	45	-		
DB17~DB0	t_{RCFM}	Read cycle (FM)	450	-	ns	When read from frame memory
	t_{RDHFM}	Control pulse "H" duration (FM)	90	-		
	t_{RDLFM}	Control pulse "L" duration (FM)	355	-		
DB17~DB0	t_{DST}	Data setup time	10	-	ns	For maximum C_L=30pF For minimum C_L=8pF
	t_{DHT}	Data hold time	10	-		
	t_{RAT}	Read access time (ID)	-	40		
	t_{RATFM}	Read access time (FM)	-	340		
	t_{ODH}	Output disable time	20	80		

Note: The input signal rise time and fall time (tr, tf) is specified at 15 ns or less.
Logic high and low levels are specified as 30% and 70% of IOVCC for Input signals.

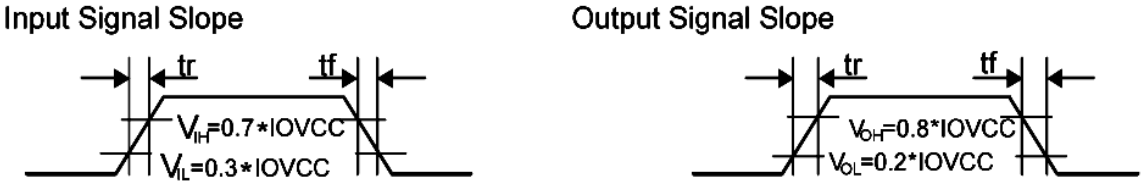


Figure 5

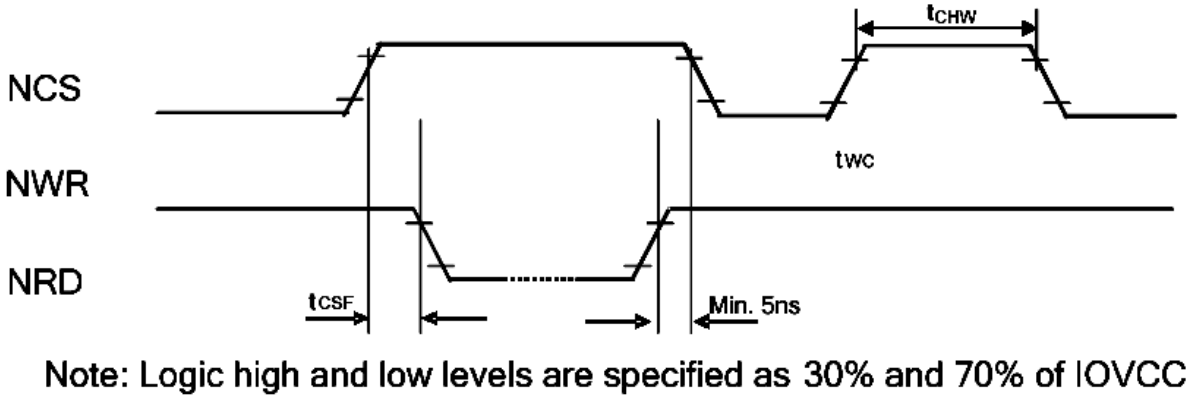
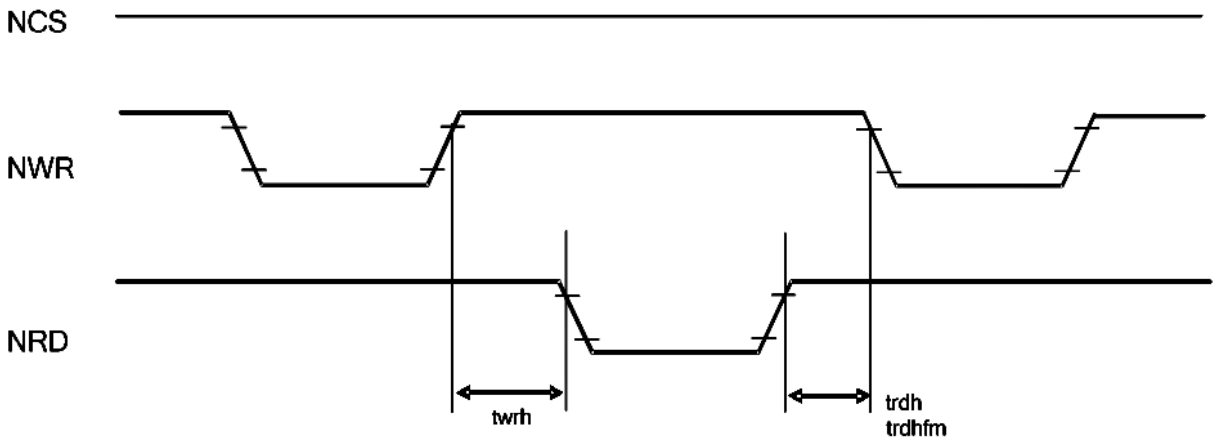


Figure 6: Chip Select Timing



Note: Logic high and low levels are specified as 30% and 70% of IOVCC

Figure 7: Write to Read and Read to Write Timing

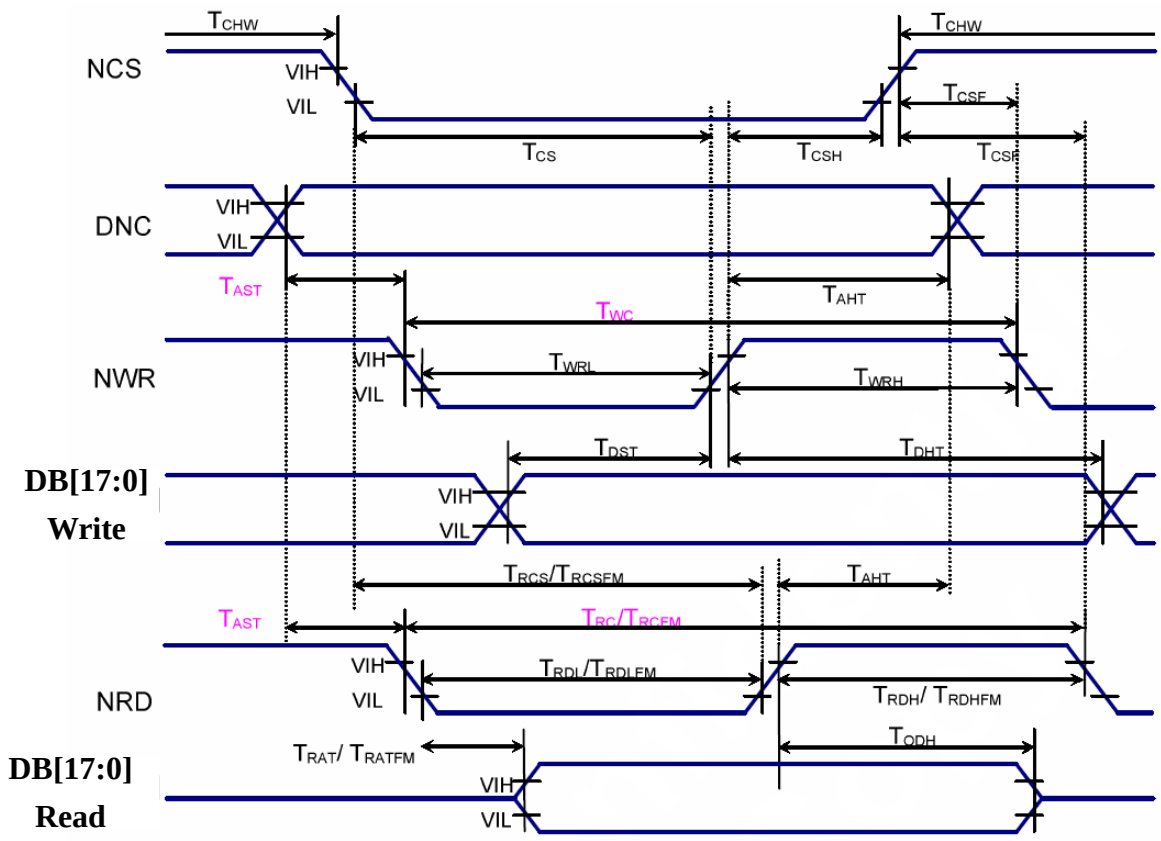


Figure 8: Parallel Interface Characteristics (I80-system interface)

5.3 Referential Instruction Setup Flow

5.3.1 Power Supply Setting Flow

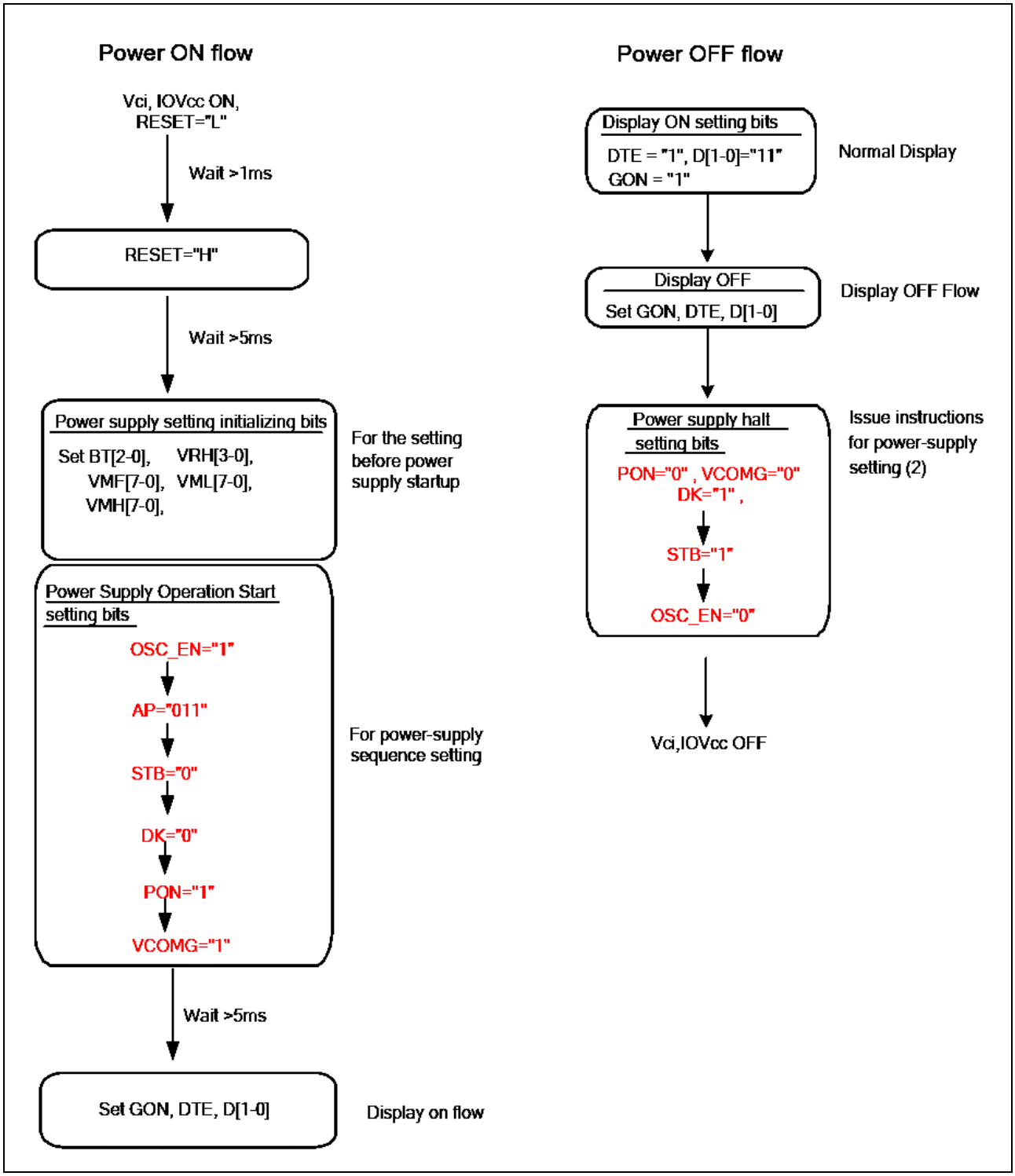


Figure 9: Power Supply Setting Flow

5.3.2 Display On/Off Setting Flow

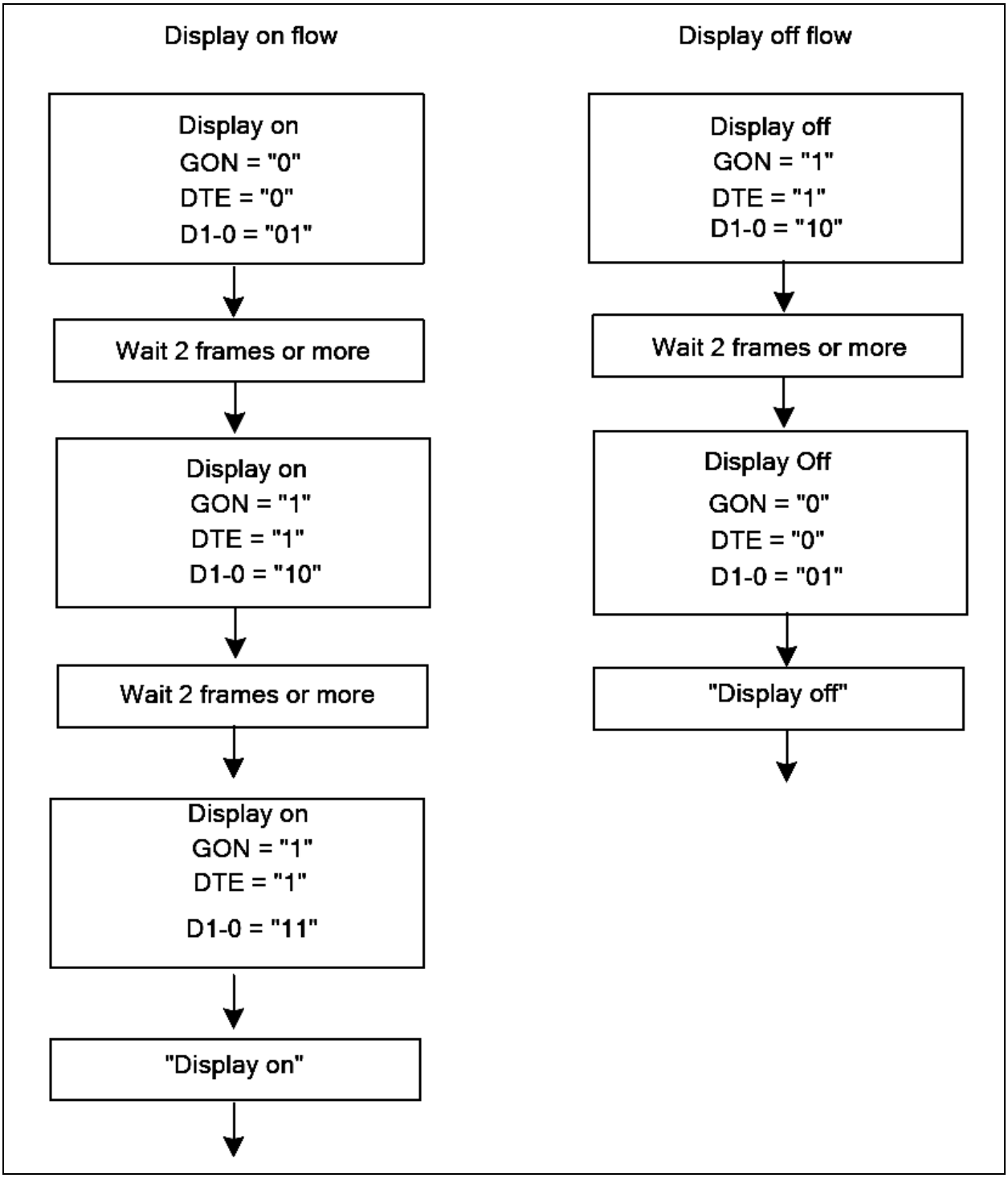


Figure 10: Display On/Off Setting Flow

5.3.3 Standby Mode Setting Flow

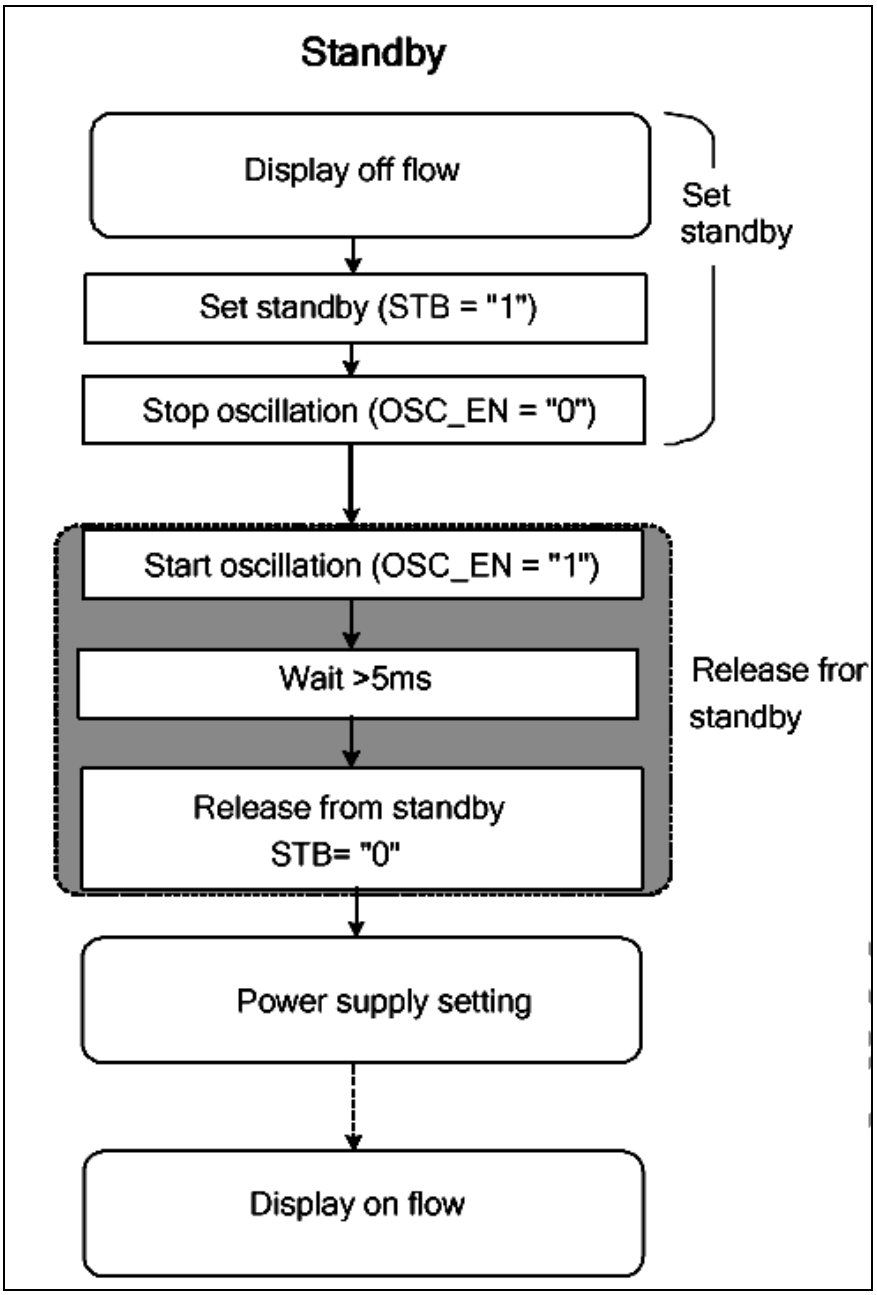


Figure 11: Standby Mode Setting Flow

5.3.4 Deep Standby Mode Set up Flow

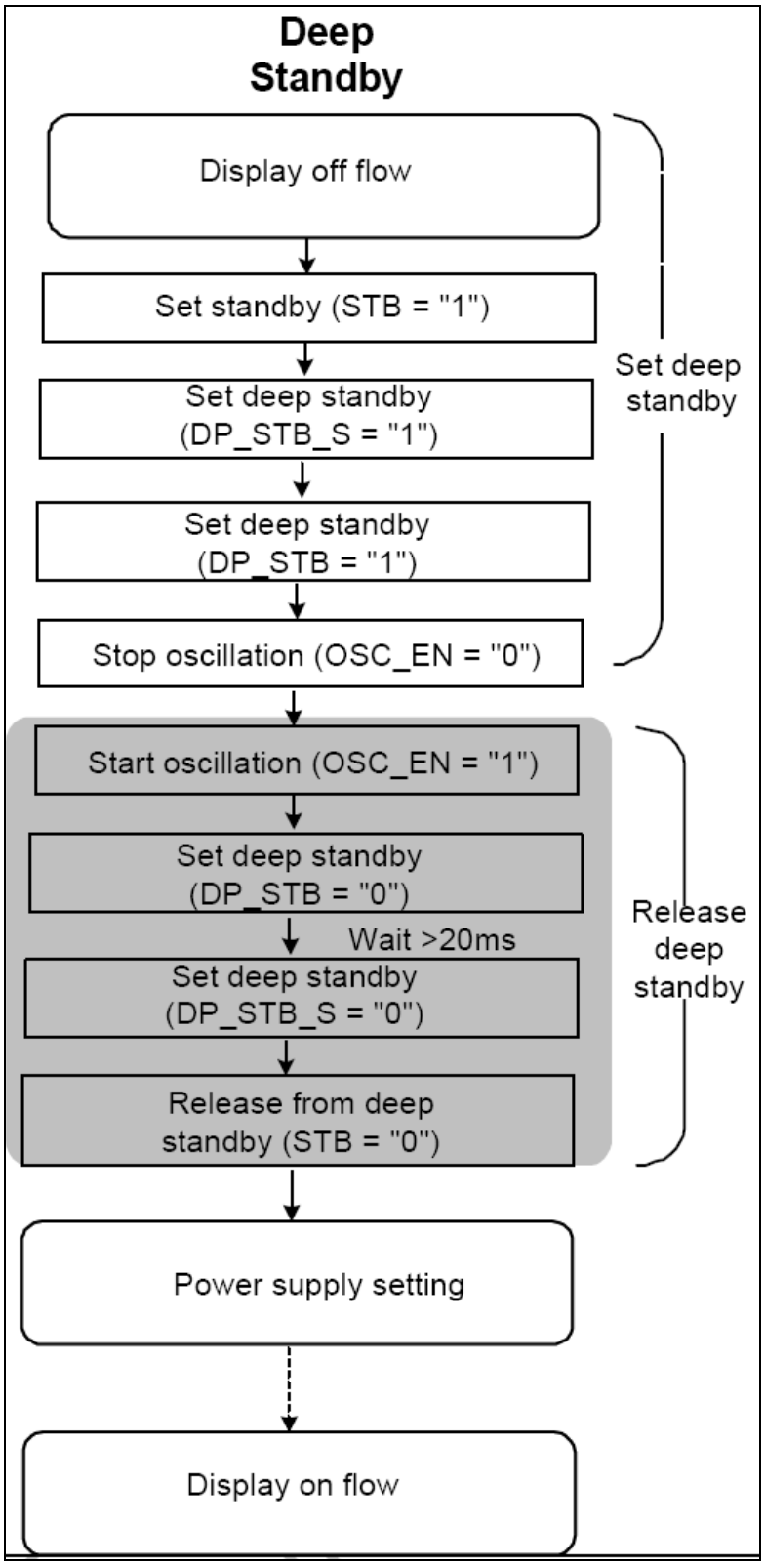


Figure 12: Deep Standby Mode Setting flow

6. Optical Characteristics

Table 8

Items		Symbol	Condition	specifications			Unit	Remark
				Min.	Typ.	Max.		
Threshold voltage		Vsat		2.9	3.2	3.5	V	Fig. 13
		Vth		1.2	1.5	1.8	V	
Viewing angle range	Horizontal	ϕ1 (3 o'clock)	CR＞10	-	45	-	Deg.	Note 1
		ϕ2 (9 o'clock)		-	45	-	Deg.	
	Vertical	θ2 (12 o'clock)		-	35	-	Deg.	
		θ1 (6 o'clock)		-	15	-	Det.	
Contrast ratio		CR	θ = 0°	-	300	-	-	Note 2
Transmittance		T (%)	θ = 0°	-	5.6	-	-	Note 3
White chromaticity		Xw	θ = 0°	0.270	0.300	0.330	-	Note 4 Color filter glass
		Yw		0.304	0.334	0.364	-	
Reproduction of color	Red	X_R	θ = 0°	0.616	0.646	0.676	-	
		Y_R		0.291	0.321	0.351	-	
	Green	X_G		0.268	0.298	0.328	-	
		Y_G		0.543	0.573	0.603	-	
	Blue	X_B		0.104	0.134	0.164	-	
		Y_B		0.103	0.133	0.163	-	
Response time		Tr + Tf	θ = 0°	-	40	-	msec	Note 5

Note (1) Definition of Contrast Ratio (CR):

The contrast ratio can be calculated by the following expression.

Contrast Ratio (CR) = L63 / L0

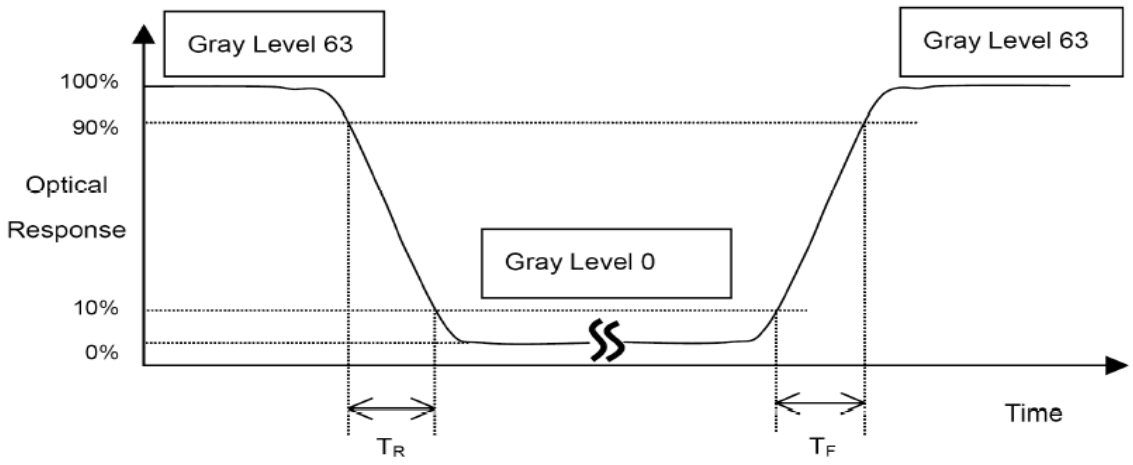
L63: Luminance of gray level 63

L0: Luminance of gray level 0

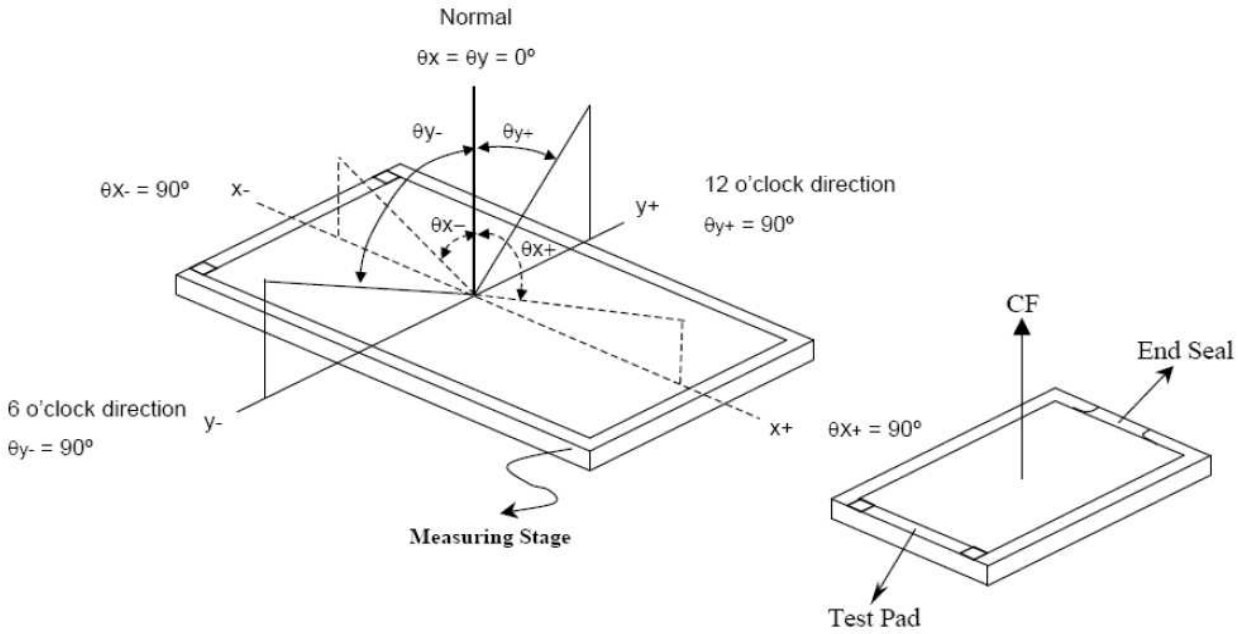
CR = CR (5)

CR (X) is corresponding to the Contrast Ratio of the point X at Figure in Note (5).

Note (2) Definition of Response Time (TR, TF):



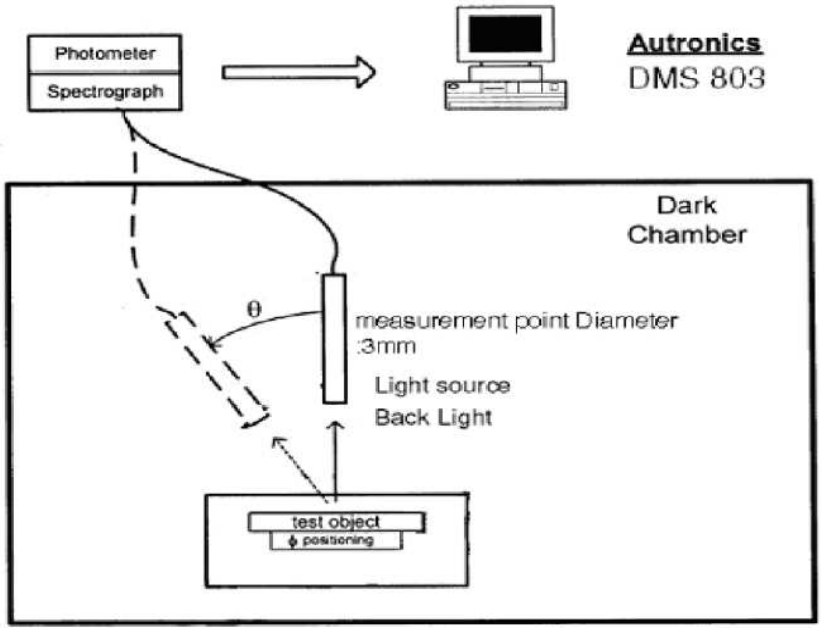
*Note(3) Definition of Viewing Angle



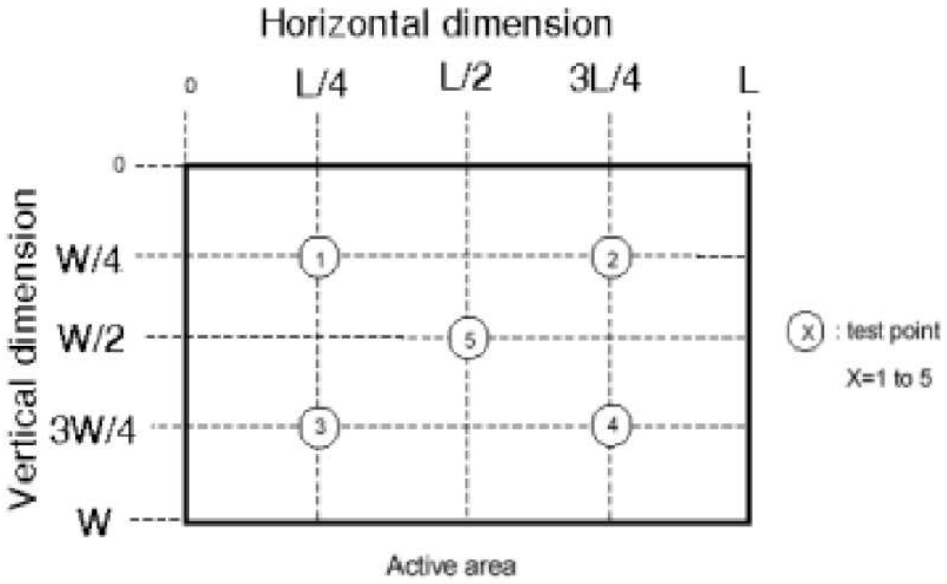
*** The above "Viewing Angle" is the measuring position with Largest Contrast Ratio; not for good image quality. View Direction for good image quality is 6 O'clock. Module maker can increase the "Viewing Angle" by applying Wide View Film.

*Note (4) Measurement Set-Up:

The LCD module should be stabilized at a given temperature for 20 minutes to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting Backlight for 20 minutes in a windless room.

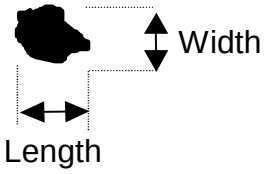
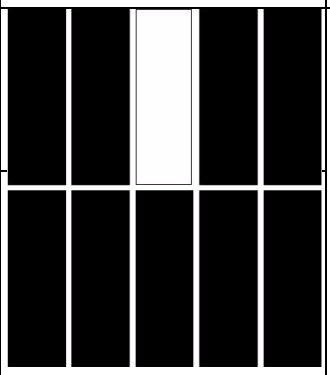


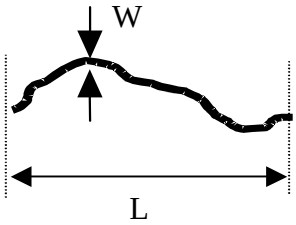
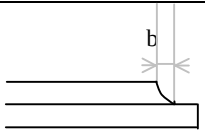
*Note (5)

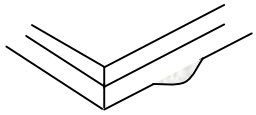
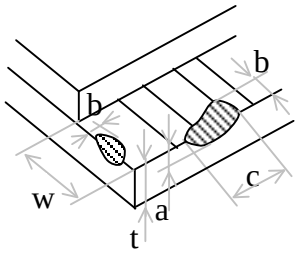
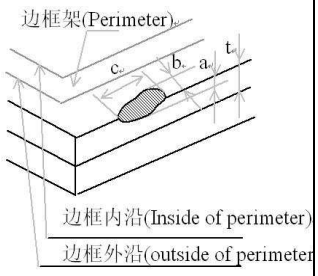
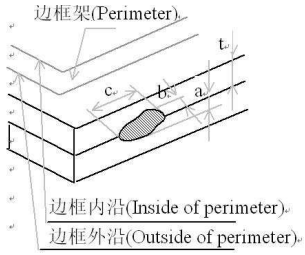
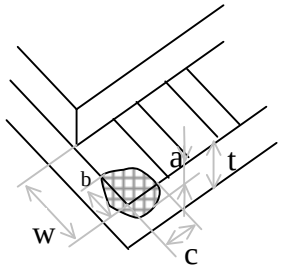

Horizontal dimension
0
L/4
L/2
3L/4
L
Vertical dimension
0
W/4
W/2
3W/4
W
1
2
3
4
5
X : test point
X=1 to 5
Active area

7. TFT Panel Inspection Specifications

<table>
<tr><td rowspan="2">Failure mode</td><td rowspan="2">Illustration</td><td colspan="2" rowspan="2">Category (Unit: mm)</td><td colspan="2">Acceptable count</td></tr>
<tr><td>Viewing area</td><td>non-Viewing area</td></tr>
<tr><td rowspan="4">Black spot

White spot</td><td rowspan="4"> 
Φ= (Length+width)/2</td><td>A</td><td>Φ≦0.10</td><td>Not count</td><td rowspan="4">Not count</td></tr>
<tr><td>B</td><td>0.10<Φ≦0.15</td><td>The gap between the two spots should be 5 mm and above.</td></tr>
<tr><td>C</td><td>0.15<Φ≦0.20</td><td>1</td></tr>
<tr><td>D</td><td>0.20<Φ</td><td>0</td></tr>
<tr><td>Bright spot(Red spot,green spot and blue spot caused by damaged colour filter)</td><td>  </td><td>A</td><td>Area≦1 sub-pixel</td><td>0</td><td>N/A</td></tr>
<tr><td rowspan="3">Black line

White line</td><td rowspan="3">  </td><td>A</td><td>W≦0.03</td><td>Not count</td><td>Not count</td></tr>
<tr><td>B</td><td>0. 03<W≦0.05, L≦3.0</td><td>2</td><td></td></tr>
<tr><td>C</td><td>0.05<W</td><td>Judged by spot spec</td><td></td></tr>
<tr><td colspan="6">(Below are cosmetic inspection specifications)</td></tr>
<tr><td>Excess glass</td><td>  </td><td colspan="4">b≦1.0, this defect shall not affect the outline dimension or assembly process.(Remarks: For COG process, the defect size is decided by the dimension of LCD panel.)</td></tr>
</table>

<table>
<tr><td></td><td>  </td><td colspan="2">This defect shall not affect the outline dimension or assembly process.</td></tr>
<tr><td rowspan="5">Glass defect (scratch, damage)</td><td rowspan="4">LCD ledge damage
  </td><td colspan="2">Category</td></tr>
<tr><td>A</td><td>The defect shall not affect the outline dimension or assembly process at non ITO zone.</td></tr>
<tr><td>B</td><td>b≦1/4w, a & c not count (at ITO zone)</td></tr>
<tr><td>C</td><td>Alignment mark on LCD ledge shall not be damaged.</td></tr>
<tr><td>Outside of perimeter damage
  </td><td colspan="2">b can’t reach inside of perimeter.</td></tr>
<tr><td>Joint glass damage
  </td><td colspan="2">b can’t reach outside of perimeter or ITO layout.</td></tr>
<tr><td rowspan="2">(Corner damage)
  </td><td>A</td><td>a ≦ t， b ≦ 3.0， c ≦ 3.0</td></tr>
<tr><td colspan="2">B. Alignment mark on LCD ledge shall not be damaged.</td></tr>
<tr><td colspan="4">Remark: a stands for thickness of damage, b for width, c for length and t for glass thickness. (Unit: mm)</td></tr>
</table>

8.0 USING LCD MODULES

8-1. Liquid Crystal Display Modules

LCD is composed of glass and polarizer. Pay attention to the following items when handling.

1. Please keep the temperature within specified range for use and storage. Polarization degradation, bubble generation or polarizer peel-off may occur with high temperature and high humidity.
2. Do not touch, push or rub the exposed polarizers with anything harder than an HB pencil lead (glass, tweezers, etc).
3. N-hexane is recommended for cleaning the adhesive used to attach front/rear polarizers and reflectors made of organic substances which will be damaged by chemicals such as acetone, toluene, ethanol and isopropylalcohol.
4. When the display surface becomes dusty, wipe gently with absorbent cotton or other soft material like chamois soaked in petroleum benzin. Do not scrub hard to avoid damaging the display surface.
5. Wipe off saliva or water drops immediately, contact with water over a long period of time may cause deformation or color fading.
6. Avoid contacting oil and fats.
7. Condensation on the surface and contact with terminals due to cold will damage, stain or dirty the polarizers. After products are tested at low temperature they must be warmed up in a container before coming is contacting with room temperature air.
8. Do not put or attach anything on the display area to avoid leaving marks on.
9. Do not touch the display with bare hands .This will stain the display area and degradate insulation between terminals (some cosmetics are determinated to the polarizers).
10. As glass is fragile. It tends to become or chipped during handling especially on the edges. Please avoid dropping or jarring.

8-2. Precaution for Handling LCD Modules

Since LCM has been assembled and adjusted with a high degree of precision, avoid applying excessive shocks to the module or making any alterations or modifications to it.

1. Do not alter, modify or change the shape of the tab on the metal frame.
2. Do not make extra holes on the printed circuit board, modify its shape or change the positions of components to be attached.
3. Do not damage or modify the pattern writing on the printed circuit board.
4. Absolutely do no modify the zebra rubber strip (conductive rubber) or heat seal connector.
5. Except for soldering the interface, do not make any alterations or modifications with a soldering iron.
6. Do not drop, bend or twist LCM.

8-3. Electro-Static Discharge Control

Since this module uses a CMOS LSI, the same careful attention should be paid to electrostatic discharge as for an ordinary CMOS IC.

1. Make certain that you are grounded when handing LCM.
2. Before remove LCM from its packing case or incorporating it into a set, be sure the module and your body have the same electric potential.
3. When soldering the terminal of LCM, make certain the AC power source for the soldering iron does not leak.
4. When using an electric screwdriver to attach LCM, the screwdriver should be of ground potentiality to minimize as much as possible any transmission of electromagnetic waves produced sparks coming from the commutator of the motor.
5. As far as possible make the electric potential of your work clothes and that of the work bench the ground potential.
6. To reduce the generation of static electricity be careful that the air in the work is not too dried. A relative humidity of 50%~60% is recommended.

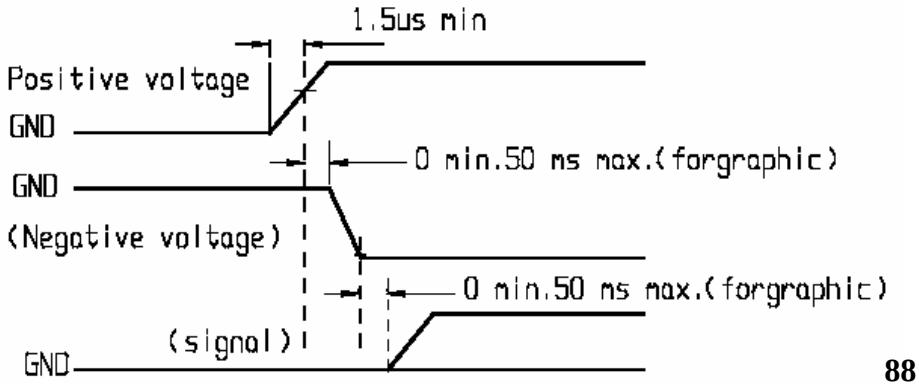
8-4. Precaution for soldering to the LCM

1. Observe the following when soldering lead wire, connector cable and etc. to the LCM.
   - Soldering iron temperature: 280℃±10℃
   - Soldering time: 3-4 sec.
   - Solder: eutectic solder.

   If soldering flux is used, be sure to remove any remaining flux after finishing to soldering operation. (This does not apply in the case of a non- halogen type of flux.) It is recommended that you protect the LCD surface with a cover during soldering to prevent any damage dug to flux spatters.
2. When soldering the electroluminescent panel and PC board, the panel and board should not be detached more than three times. This maximum number is determined by the temperature of the soldering iron.
3. When remove the electroluminescent panel form the PC board, be sure the solder has completely melted, the soldered pad on the PC board could be damaged

8-5. Precaution for Operation

1. Viewing angle varies with the change of liquid crystal driving voltage (Vo). Adjust Vo to show the best contrast.
2. Driving the LCD in the voltage above the limit shortens its life.
3. Response time is greatly at temperature below the operating temperature range. However, this does not mean the LCM will be out of the order. It will recover when it returns to the specified temperature range.
4. If the display area is pushed hard during operation, the display will become abnormal. However, it will return to normal if it is turned off and then back on.
5. Condensation of terminals can cause an electrochemical reaction disrupting the terminal circuit. Therefore, it must be used under the relative condition of 40℃, 50%RH.
6. When turning the power on, input each signal after the positive/negative voltage becomes stable.



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8-6. Storage

When storing LCD as spares for some years, the following precaution are necessary.

1. Store them in a sealed polyethylene bag. If properly sealed, there is no need for desiccant.
2. Store them in a dark place. Do not expose to sunlight or fluorescent light, keep the temperature between 0℃ and 35℃.
3. The polarizer surface should not come in contact with any other objects. (We advise you to store them in the container in which they were shipped.)
4. Environmental conditions:
   - Do not leave them for more than 168hrs. at 60℃.
   - Should not be left for more than 48hrs. at -20℃.

8-7. Safety

1. It is recommended to crush damaged or unnecessary LCD into pieces and wash off with solvents such as acetone and ethanol, which should later be burned.
2. If any liquid leak out of a damaged glass cell and comes in contact with the hands, wash off thoroughly with soap and water.

8-8. Limited Warranty

Unless agreed between CCT and customer, CCT will replace or repair any of its LCD modules which are found to be functionally defective when inspected in accordance with CCT LCD acceptance standards (copies available upon request) for a period of one year from date of shipments. Cosmetic/ visual defects must be returned to CCT within 90 days of shipment. Confirmation of such date shall be based on freight documents. The warranty liability of CCT limited to repair and/or replacement on the terms set forth above. CCT will not be responsible for any subsequent or consequential events.

8-9. Return LCM under warranty

No warranty can be granted if the precautions stated above have been disregarded. The typical examples of violations are:

- Broken LCD glass.
- PCB eyelet's damaged.
- PCB conductors damaged.
-Circuit modified in any way, including addition of components.
- PCB tampered with by grinding, engraving or painting varnish.
-Soldering to or modifying the bezel in any manner.

Module repairs will be invoiced to the customer upon mutual agreement. Modules must be returned with sufficient description of the failures or defects. Any connectors or cable installed by the customer must be removed completely without damaging the PCB eyelet's conductors and terminals.

Crystal Clear Technology
16 Jalan TP5—Taman Perindustrian Sime UEP
47600 Subang Jaya—Selangor DE
Malaysia