

**Display Elektronik GmbH**

# DATA SHEET

**LCD MODULE**

## **DEM 240320D TMH-PW-N (A-TOUCH)**

**2,8" TFT with Touch-Panel**

*Product Specification*

*Ver.: 0*

16.02.2011

Revise Records

Rev.	Date	Contents	Written	Approved
0	16.01.2011	Preliminary Specification	CL	MH

Special Notes

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**2. GENERAL DESCRIPTION**

MAIN TECHNICS :	COG
DISPLAY CONTENT :	240(RGB) *320 DOTS
DISPLAY TYPE :	262K-COLORS-TFT-NEGATIVE-TRANSMISSIVE
DRIVER METHOD :	1/320 DUTY
VIEWING DIRECTION :	6:00
CONTROLLER:	HX8347D (HIMAX)
BACKLIGHT :	LED WHITE
OPEATING TEMPERATURE:	-20°C-+70°C
STORAGE TEMPERATURE:	-30°C-+80°C
INTERFACE:	3-wire serial interface

**3. MECHANICAL SPECIFICATIONS**

ITEM	CONTENT	UNIT
PIXEL'S NUMBER	240 x RGB x 320	PIXEL
MODULE DIMENSION	50.00 x 118.6 x 4.15	mm
ACTIVE AREA	43.20 x 7.6	mm
PIXEL SIZE	0.18 x 0.18	mm

**4. ELECTRO-OPTICAL CHARACTERISTICS**

Item	Symbol	Conditions	Specifications			Unit	Note	
			Min.	Typ.	Max.			
Transmittance	T%	Viewing normal angle $\theta_x = \theta_y = 0^\circ$	NA	5.8	NA	%	All left side data are based on CMO's following condition --  NTSC: 61% LC: 5066 <b>Light : C Light</b> (Machine:DMS) Polarizer without DBEF <b>Reference Only</b>	
Contrast Ratio	CR		150	250	NA	--		
Response Time	T <sub>R</sub>		NA	15	20	ms		
	T <sub>F</sub>		NA	20	30	ms		
Chromaticity	Red		X <sub>R</sub>	0.602	0.632	0.662		
			Y <sub>R</sub>	0.298	0.328	0.358		
	Green		X <sub>G</sub>	0.266	0.296	0.326		
			Y <sub>G</sub>	0.546	0.576	0.606		
	Blue		X <sub>B</sub>	0.103	0.133	0.163		
			Y <sub>B</sub>	0.092	0.122	0.152		
White	X <sub>W</sub>	0.274	0.304	0.334				
	Y <sub>W</sub>	0.304	0.334	0.364				
Viewing Angle	Hor.	$\theta_{x+}$	-	45	-	deg.		
		$\theta_{x-}$	-	45	-			
	Ver.	$\theta_{y+}$	-	35	-			
		$\theta_{y-}$	-	15	-			

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

The contrast ratio can be calculated by the following expression.

$$\text{Contrast Ratio (CR)} = L_{63} / L_0$$

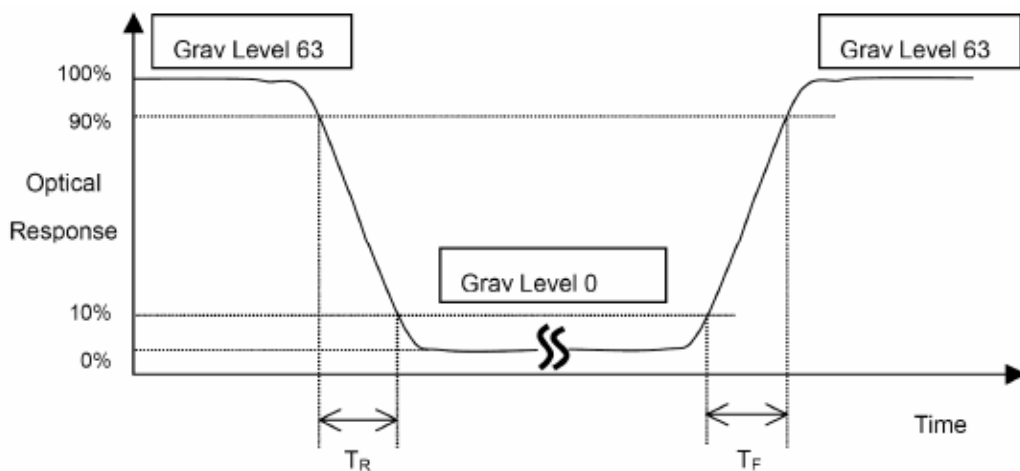
L63: Luminance of gray level 63

L0: Luminance of gray level 0

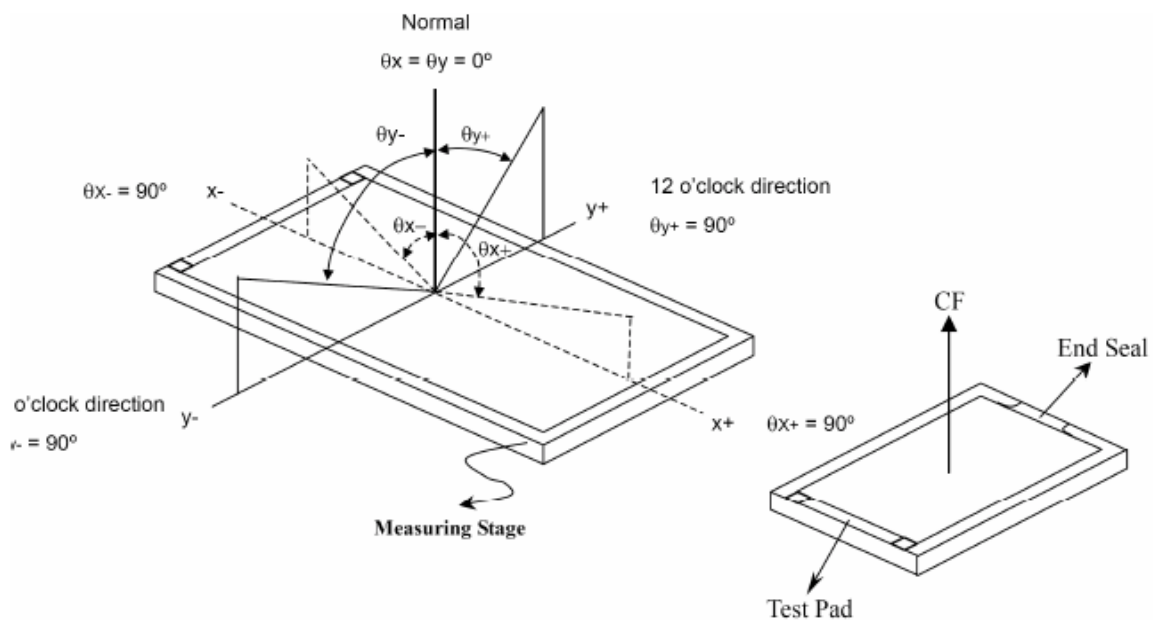
$$\text{CR} = \text{CR} (10)$$

CR (X) is corresponding to the Contrast Ratio of the point X at Figure in Note (6).

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



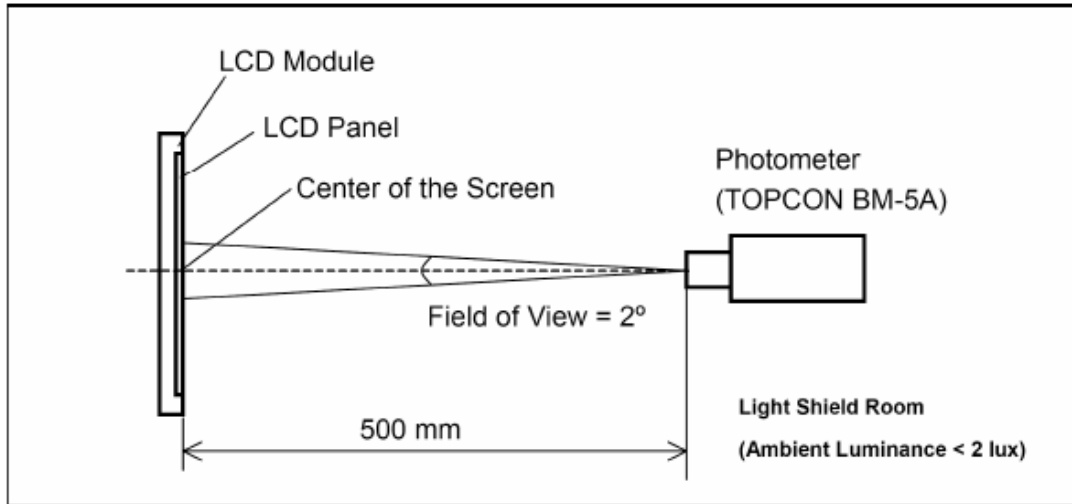
\*Note(3) Definition of Viewing Angle



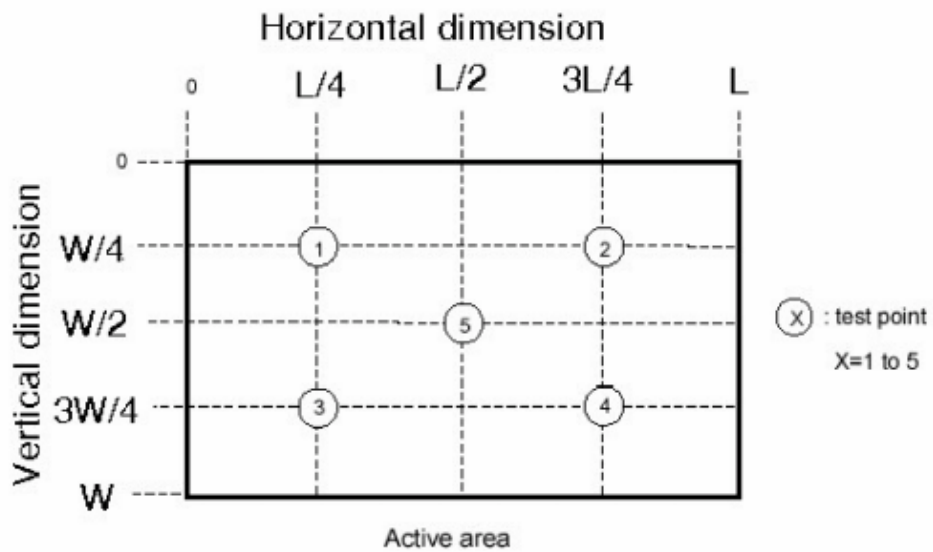
\*\*\* The above "Viewing Angle" is the measuring position with Largest Contrast Ratio; not for good image quality. View Direction for good image quality is 6 O'clock. Module maker can increase the "Viewing Angle" by applying Wide View Film.

\*Note (4) Measurement Set-Up:

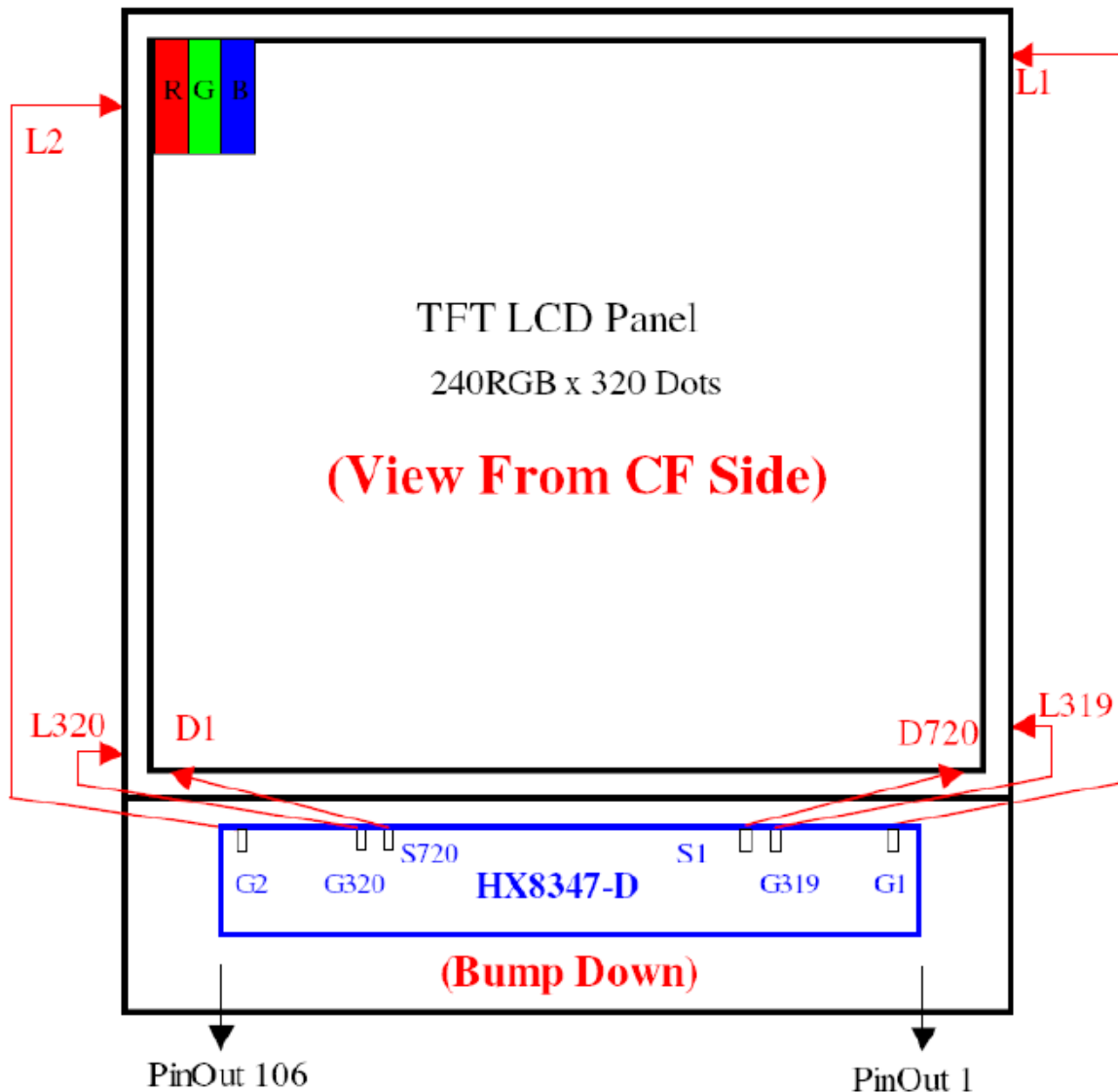
The LCD module should be stabilized at a given temperature for 20 minutes to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting Backlight for 20 minutes in a windless room.



\*Note (5)



### 5. BLOCK DIAGRAM



### 6. ELECTRONIC CHARACTERISTICS

#### 6.1 MAXIMUM VALUES

ITEM	SYMBOL	STANDARD VALUE		UNIT
		MIN	MAX	
Logic supply voltage	V <sub>DD</sub>	-0.3	+4.6	V
Operating Temperature	Top	-20	+70	°C
Storage Temperature	Tst	-30	+80	°C



## 6.2 DC CHARACTERISTICS

Parameter	Symbol	Conditions	Spec.			Unit
			Min.	Typ.	Max.	
<b>Power &amp; Operating Voltages</b>						
IO Operating voltage	IOVCC	I/O supply voltage	1.65	1.8	3.3	V
Driver Operating voltage	VCI	Operation voltage	2.3	2.8	3.3	
Source Drive Voltage	VREG1	Triple Pump	3.3	4.65	4.8	
	VREG1	Dual Pump	3.3	4.65	5.8	
Gate Drive High Voltage	VGH	IVGH=100 $\mu$ A (Typ:BT=001) VCI=2.8 Dual Pump	9.5	14.25	-	
		IVGH=100 $\mu$ A (Typ:BT=001) VCI=2.8 Triple Pump	11.6	17.39	-	
Gate Drive Low Voltage	VGL	IVGL=100 $\mu$ A (Typ:BT=001) VCI=2.8 Dual Pump	-6.85	-9.5	-	
		IVGL=100 $\mu$ A (Typ:BT=001) VCI=2.8 Triple Pump	-8.46	-11.59	-	
Drive Supply Voltage	VGH-VGL	-	-	-	30	
<b>Input / Output</b>						
High level input voltage	VIH	-	0.7IOVCC	-	IOVCC	V
Low level input voltage	VIL	-	VSSD	-	0.3IOVCC	
High level output voltage	VOH	IOH=-1.0mA	0.8IOVCC	-	IOVCC	
Low level output voltage	VOL	IOL=+1.0mA	VSSD	-	0.2IOVCC	
Input leakage current	IIL	-	-1	-	1	$\mu$ A
Oscillator frequency	fOSC	Frame rate at 65hz, default Vs and Hs setting T <sub>A</sub> =25 $^{\circ}$ C	2.76	2.85	2.94	MHz
<b>Booster(VCI=2.8V)</b>						
DDVDH boost voltage1	DDVDH	Dual Pump IDDVDH=1mA	4.8	5.0	5.2	V
		Triple Pump IDDVDH=1mA	5.9	6.1	6.3	
VCL boost voltage	VCL	ICL=-300 $\mu$ A	-2.5	-2.65	2.75	
<b>VCOM Generator(VCI=2.8V)</b>						
VCOM amplitude	VCOM	No load, Dual Pump	2.5	4.4	7.3	V
		No load Triple Pump	2.5	4.4	8.3	V
VCOM high level	VCOMH	No load Dual Pump	2.5	3.205	4.8	V
		No load Triple Pump	2.5	3.205	5.8	V
VCOM low level	VCOML	No load	-2.5	-1.195	VSSD	V
<b>Source Driver(Typ:T<sub>A</sub>=25<math>^{\circ}</math>C VCI=2.8v)</b>						
Output voltage deviation (mean value)	DVOS	VSSD+1.0 ~ VREG1-1.0	-	+/-10	+/-20	mV
		VSSD+0.1V ~ VSSD+1.0 VREG1-1.0 ~ VREG1-0.1V	-	+/-30	+/-50	mV
Output voltage range	VOS	-	0.1	-	DDVDH-0.1	V
Output offset voltage	Voff	-	-	+/-30	+/-50	mV

## 6.3 TIMING CHARACTERISTICS

## Serial Interface Characteristics

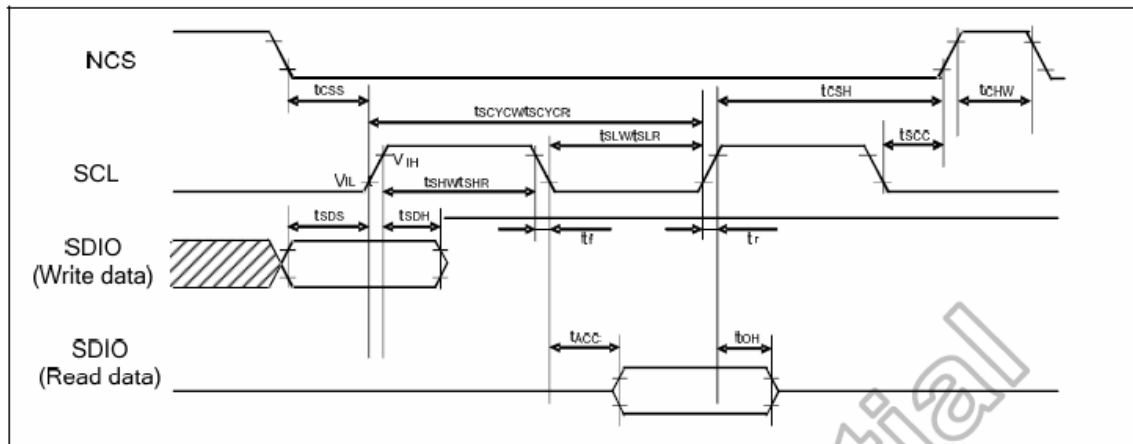


Figure 11.4 Serial interface characteristics

(VSSA=0V, IOVCC=1.65V to 3.3V, VCI=2.3V to 3.3V, T<sub>A</sub>=-30 to 70° C)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Serial clock cycle (Write)	tSCYCW		20	-	-	
SCL "H" pulse width (Write)	tSHW	SCL	8	-	-	ns
SCL "L" pulse width (Write)	tSLW	SCL	8	-	-	ns
Data setup time (Write)	tSDS	SDIO	10	-	-	ns
Data hold time (Write)	tSDH	SDIO	10	-	-	ns
Serial clock cycle (Read)	tSCYCR		150	-	-	
SCL "H" pulse width (Read)	tSHR	SCL	60	-	-	ns
SCL "L" pulse width (Read)	tSLR	SCL	60	-	-	ns
Access Time	tACC	SDI for maximum CL=30pF For minimum CL=8pF	10	-	50	ns
Output disable time	tOH	SDO For maximum CL=30pF For minimum CL=8pF	15	-	50	ns
SCL to Chip select	tSCC	SCL, NCS	20	-	-	ns
NCS "H" pulse width	tCHW	NCS	40	-	-	ns
Chip select setup time	tCSS	NCS	15	-	-	ns
Chip select hold time	tCSH	NCS	15	-	-	ns

**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.

**7. PINS DESCRIPTION**

Pin No.	Symbol	Description
1	/RESET	L: initialization is executed
2	VSYNC	Vertical synchronizing signal in RGB interface.
3	HSYNC	Horizontal synchronizing signal in RGB interface.
4	DOTCLK	Data enable signal in RGB interface.
5	DE	A data ENABLE signal in RGB I/F mode.
6-23	DB17-DB0	Data Bus
24	NC	No connect
25	SDA	Serial data input pin and output pin
26	/WR(SCL)	server as serial data clock in serial bus system interface
27	DNC	Command / parameter or display data selection pin.
28	/CS	L:Chip Selected H:Chip Unselected
29	NC	No connect
30	VCC	Power supply
31	GND	Ground
32	X+	touch panel output pin.(Touch screen X corrdinate right)
33	Y+	touch panel output pin.(Touch screen Y corrdinate down)
34	X-	touch panel output pin.(Touch screen X corrdinate left)
35	Y-	touch panel output pin.(Touch screen Y corrdinate up)
36	LEDA	Backlight LED anode
37	LEDK1	Backlight LED cathode(K1)
38	LEDK2	Backlight LED cathode(K2)
39	LEDK3	Backlight LED cathode(K3)
40	LEDK4	Backlight LED cathode(K4)

**8. INSTRUCTION DESCRIPTION**

(Hex)	Operation Code	W/R	Upper Code	Lower Code								Comment
			D[17:8]	D7	D6	D5	D4	D3	D2	D1	D0	
00	Himax ID	R	-	0	1	0	0	0	1	1	1	-
01	Display Mode control	W/R	-	DP_STB(0)	DP_STB_S(0)	-	-	SCROL(0)	IDMON(0)	INVON(0)	PTLON(0)	-
02	Column address start 2	W/R	-	SC[15:8] (8'b0000_0000)								-
03	Column address start 1	W/R	-	SC[7:0] (8'b0000_0000)								-
04	Column address end 2	W/R	-	EC[15:8] (8'b0000_0000)								-
05	Column address end 1	W/R	-	EC[7:0] (8'b1110_1111)								-
06	Row address start 2	W/R	-	SP[15:8] (8'b0000_0000)								-
07	Row address start 1	W/R	-	SP[7:0] (8'b0000_0000)								-
08	Row address end 2	W/R	-	EP[15:8] (8'b0000_0001)								-
09	Row address end 1	W/R	-	EP[7:0] (8'b0011_1111)								-
0A	Partial area start row 2	W/R	-	PSL[15:8] (8'b0000_0000)								-
0B	Partial area start row 1	W/R	-	PSL[7:0] (8'b0000_0000)								-
0C	Partial area end row 2	W/R	-	PEL[15:8] (8'b0000_0001)								-
0D	Partial area end row 1	W/R	-	PEL[7:0] (8'b0011_1111)								-
0E	Vertical Scroll Top fixed area 2	W/R	-	TFA[15:8] (8'b0000_0000)								-
0F	Vertical Scroll Top fixed area 1	W/R	-	TFA[7:0] (8'b0000_0000)								-
10	Vertical Scroll height area 2	W/R	-	VSA[15:8] (8'b0000_0001)								-
11	Vertical Scroll height area 1	W/R	-	VSA[7:0] (8'b0100_0000)								-
12	Vertical Scroll Button area 2	W/R	-	BFA[15:8] (8'b0000_0000)								-
13	Vertical Scroll Button area 1	W/R	-	BFA[7:0] (8'b0000_0000)								-
14	Vertical Scroll Start address 2	W/R	-	VSP [15:8] (8'b0000_0000)								-
15	Vertical Scroll Start address 1	W/R	-	VSP [7:0] (8'b0000_0000)								-
16	Memory Access control	W/R	-	MY(0)	MX(0)	MV(0)	ML(0)	BGR(0)	-	-	-	-
17	COLMOD	W/R	-	CSEL[3:0] (4b'0110)				-	IFPF[2:0] (3b'110)			-
18	OSC Control 2	W/R	-	I/PI_RADJ1[3:0] (3b'0011)				N/P_RADJ0[3:0] (4b'0100)				-
19	OSC Control 1	W/R	-	-	-	-	-	-	-	-	OSC_EN(0)	-
1A	Power Control 1	W/R	-	-	-	-	-	-	BT[2:0] (001)			-
1B	Power Control 2	W/R	-	-	-	-	-	VRH[5:0] (01_1011)_4.8V				-
1C	Power Control 3	W/R	-	-	-	-	-	AP[2:0] (011)				-
1D	Power Control 4	W/R	-	I/PI_FS0[2:0] (100)			-	N/P_FS0[2:0] (100)				-
1E	Power Control 5	W/R	-	I/PI_FS1[2:0] (100)			-	N/P_FS1[2:0] (100)				-
1F	Power Control 6	W/R	-	GASEN(1)	VCOMG(0)	-	PON(0)	DK(1)	XDK(0)	DDVDH_TR(0)	STB(1)	-
22	SRAM Write Control	W/R	-	SRAM Write								-
23	VCOM Control 1	W/R	-	VMF[7:0] (1000_0000)								-
24	VCOM Control 2	W/R	-	VMH[7:0] (0111_0001)								-
25	VCOM Control 3	W/R	-	VML[7:0] (0010_1111)								-
26	Display Control 1	W/R	-	-	-	-	-	ISC[3:0] (0001)				-
27	Display Control 2	W/R	-	PT[1:0] (10)		PTV[1:0] (10)		-	-	PTG(1)	REF(1)	-
28	Display Control 3	W/R	-	-	-	GON(1)	DTE(0)	D[1:0] (00)		-	-	-

(Hex)	Operation Code	W/R	Upper Code	Lower Code								Comment
			D[17:8]	D7	D6	D5	D4	D3	D2	D1	D0	
29	Frame Rate control 1	W/R	-	I/PI_RTN[3:0](0010)				N/P_RTN[3:0](0010)				-
2A	Frame Rate Control 2	W/R	-	-	-	I/PI_DIV[1:0](00)		-	-	N/P_DIV[1:0](00)		-
2B	Frame Rate Control 3	W/R	-	N/P_DUM[7:0] (8b'0001_1100)								-
2C	Frame Rate Control 4	W/R	-	I/PI_DUM[7:0] (8b'0001_1100)								-
2D	Cycle Control 1	W/R	-	GDON[7:0] (8'b0000_1101)								-
2E	Cycle Control 2	W/R	-	GDOF[7:0] (8'b0111_0000)								-
2F	Display inversion	W/R	-	-	I/PI_NW[2:0](3b'001)			-	N/P_NW[2:0] (3b'001)			-
31	RGB interface control 1	W/R	-	-	-	-	-	-	RCM[1:0](00)			-
32	RGB interface control 2	W/R	-	-	-	-	DPL (0)	HSPL (0)	VSPL (0)	EPL (0)	-	
33	RGB interface control 3	W/R	-	HBP[7:0]								-
34	RGB interface control 4	W/R	-	HBP[9:8]				VBP[5:0]				-
36	Panel Characteristic	W/R	-	-	-	-	SS_P anel	GS_Pan el	REV_Pa nel	BGR_P anel	-	
38	OTP Control 1	W/R	-	OTP_PTM[1:0]		OTP_VARDJ[1:0]		OTP_P POR	OTP_O TPEN	OTP_PP ROG	OTP_P WE	-
39	OTP Control 2	W/R	-	-	-	-	-	OTP_Y A2	OTP_YA1	OTP_Y A0	-	
3A	OTP Control 3	W/R	-	-	-	-	OTP_X A4	OTP_X A3	OTP_X A2	OTP_XA1	OTP_XA0	-
3C	CABC Control 1	W/R	-	DBV[7:0](8'h00)								-
3D	CABC Control 2	W/R	-	-	-	BCTRL (0)	-	DD (0)	BL (0)	-	-	
3E	CABC Control 3	W/R	-	-	-	-	-	-	C1 (0)	C0 (0)	-	
3F	CABC Control 4	W/R	-	CMB[7:0](8'h00)								-
40	r1 Control (1)	W/R	-	-	-	-	VRP0[5:0] (6'b00_0001)				-	
41	r1 Control (2)	W/R	-	-	-	-	VRP1[5:0] (6'b00_1110)				-	
42	r1 Control (3)	W/R	-	-	-	-	VRP2[5:0] (6'b01_0001)				-	
43	r1 Control (4)	W/R	-	-	-	-	VRP3[5:0] (6'b01_1010)				-	
44	r1 Control (5)	W/R	-	-	-	-	VRP4[5:0] (6'b01_1000)				-	
45	r1 Control (6)	W/R	-	-	-	-	VRP5[5:0] (6'b10_0100)				-	
46	r1 Control (7)	W/R	-	PRP0[6:0] (7'b001_0101)								-
47	r1 Control (8)	W/R	-	PRP1[6:0] (7'b110_0101)								-
48	r1 Control (9)	W/R	-	-	-	-	PKP0[4:0] (5'b0_1011)				-	
49	r1 Control (10)	W/R	-	-	-	-	PKP1[4:0] (5'b1_100)				-	
4A	r1 Control (11)	W/R	-	-	-	-	PKP2[4:0] (5'b1_1001)				-	
4B	r1 Control (12)	W/R	-	-	-	-	PKP3[4:0] (5'b1_1010)				-	
4C	r1 Control (13)	W/R	-	-	-	-	PKP4[4:0] (5'b1_1000)				-	
50	r1 Control (14)	W/R	-	-	-	-	VRN0[5:0] (6'b01_1011)				-	
51	r1 Control (15)	W/R	-	-	-	-	VRN1[5:0] (6'b10_0111)				-	
52	r1 Control (16)	W/R	-	-	-	-	VRN2[5:0] (6'b10_0101)				-	
53	r1 Control (17)	W/R	-	-	-	-	VRN3[5:0] (6'b10_1110)				-	
54	r1 Control (18)	W/R	-	-	-	-	VRN4[5:0] (6'b11_0001)				-	
55	r1 Control (19)	W/R	-	-	-	-	VRN5[5:0] (6'b11_1110)				-	
56	r1 Control (20)	W/R	-	PRN0[6:0] (7'b001_1010)								-
57	r1 Control (21)	W/R	-	PRN1[6:0] (7'b110_1010)								-
58	r1 Control (22)	W/R	-	-	-	-	PKN0[4:0] (5'b0_0111)				-	
59	r1 Control (23)	W/R	-	-	-	-	PKN1[4:0] (5'b0_0101)				-	
5A	r1 Control (24)	W/R	-	-	-	-	PKN2[4:0] (5'b0_0110)				-	
5B	r1 Control (25)	W/R	-	-	-	-	PKN3[4:0] (5'b0_1011)				-	
5C	r1 Control (26)	W/R	-	-	-	-	PKN4[4:0] (5'b1_0100)				-	
5D	r1 Control (27)	W/R	-	CGMN1[1:0] (11)		CGMN0[1:0](00)		CGMP1[1:0](11)		CGMP0[1:0](00)		-
60	TE Control	W/R	-	-	-	TE_mod e(0)	TEOE(0)		-	-	-	
E4	Power saving 1	W/R	-	EQ_S1[7:0]								-
E5	Power saving 2	W/R	-	EQ_S2[7:0]								-
E6	Power saving 3	W/R	-	EQ_S3[7:0]								-
E7	Power saving 4	W/R	-	EQ_S4[7:0]								-
E8	Source OP control Normal	W/R	-	OPON_N[7:0]								-

(Hex)	Operation Code	W/R	Upper Code	Lower Code								Comment
			D[17:8]	D7	D6	D5	D4	D3	D2	D1	D0	
E9	Source OP control_IDLE	W/R	-	OPON_ <sub>[7:0]</sub>								-
EA	Power control internal use (1)	W/R	-	STBA <sub>[15:8]</sub>								-
EB	Power control internal use (2)	W/R	-	STBA <sub>[7:0]</sub>								-
EC	Source control internal use (1)	W/R	-	PTBA <sub>[15:8]</sub>								-
ED	Source control internal use (2)	W/R	-	PTBA <sub>[7:0]</sub>								-
FF	Page select	W/R	-	-	-	-	-	-	-	-	PAGE_SEL <sub>[1:0]</sub> (00)	-

## 9. BACKLIGHT PARAMETERS

### 9.1 ABSOLUTE MAXIMUM RATINGS

(Unless specified, The Ambient temperature Ta=25°C)

Item	Symbol	Condition	Rating	Unit
Operating temperature range	Topr		-20~+70	°C
Storage temperature range	Tst		-30~+80	°C

### 9.2 ELECTRICAL/OPTICAL CHARACTERISTICS

(Unless specified, The Ambient temperature Ta=25°C)

Item	Symbol	min	typ	max	Unit	Condition
Forward Voltage	Vf	3.1	3.3	3.5	V	If=60mA
Luminance	Lv	2500			cd/m <sup>2</sup>	If=60mA
color coordinate	X	0.283		0.32		If=60 mA,
	Y	0.276		0.32		

## 10. Product Quality & Reliability

### 10.1 Standard for Quality Test

#### 10.1.1 Inspection :

Before delivering, the supplier should take the following tests, and affirm the quality of product.

#### 10.1.2 Electro-Optical Characteristics:

According to the individual specification to test the product.

#### 10.1.3 Test of Appearance Characteristics:

According to the individual specification to test the product.

#### 10.1.4 Test of Reliability Characteristics:

According to the definition of reliability on the specification for testing products.

#### 10.1.5 Delivery Test:

Before delivering, the supplier should take the delivery test.

A. Test method: According to GB/2828, General Inspection Level take a single time.

B. The defects classify of AQL as following:

Major defect: AQL=0.25

Minor defect: AQL=1.0

Total defects: AQL=1.0

### 10.2 Standard for inspection

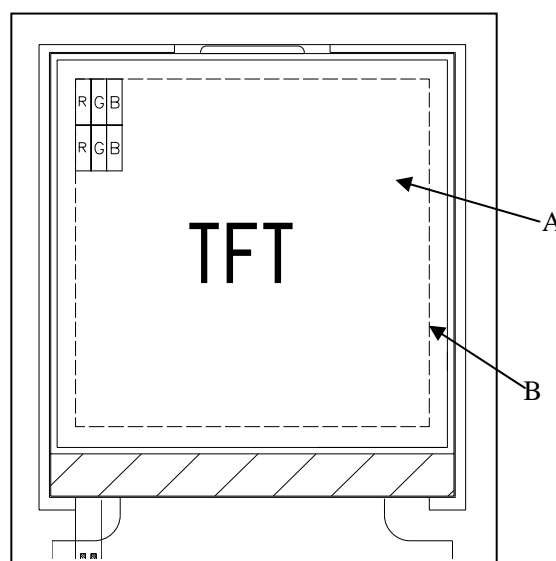
#### 10.2.1 Manner of appearance test:

- The test must be under a 40W fluorescent light, and the distance of view must be at 30~35 cm.
- When test the model of transmissive product must add the reflective plate.
- The test direction is base on about around 45° of vertical line.

#### 10.2.2 Definition of area: A B

A Area : Viewing area.

B Area : Out of viewing area.(Outside viewing area)

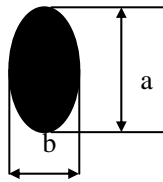


10.2.3 Basic principle:

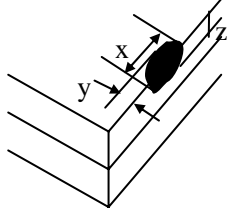
- A. In principle the defect out of Area A should be acceptable if the defect does not affect assemblage and the quality of productions.
- B. If defects that can not describe clearly, acceptable samples will be the standard.
- C. The sample of the lowest acceptable quality level must be discussed by both supplier and customer when any dispute happened.
- D. Must add new item on time when it is necessary.

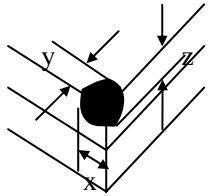
10.2.4 Standard of inspection

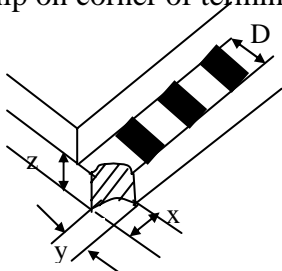
Defect	Inspect item	Criteria
1 Minor	Scratch and fold on polarizer. Scratch on glass. Glass fiber etc. ( by bare eyes , defect outside A area is acceptable )	1) width ≤ 0.02 mm length ignore acceptable 2) 0.02 mm < width ≤ 0.05 mm length ≤ 3 mm two are acceptable 3) width > 0.05 mm reject

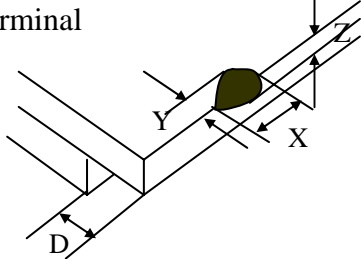
Defect	Inspect item	Criteria
2 Minor	Chip on glass(round type) Chip on polarizer(round type) Air bubble between polarizer and glass  $\Phi = (a + b) / 2$	$\Phi \leq 0.1\text{mm}$ acceptable $0.1 < \Phi \leq 0.2\text{mm}$ two are acceptable 1.The distance between any two dots should be more than 5mm. 2.Defect outside A area is acceptable. 3.If the air bubble is black, it can be judged as black spot.

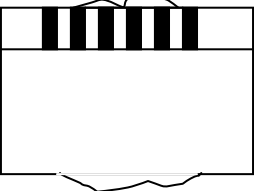


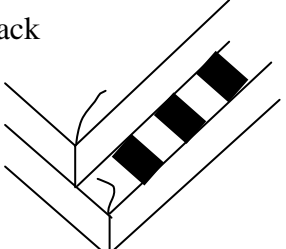
Defect	Inspect item	Criteria
3 Minor	<p>Chip out</p>  <p>x: length y: width z: thickness</p>	<p><math>x \leq 3 \text{ mm}</math> <math>z \leq t</math> <math>y \leq 1/3 s</math> reject</p> <p>t: glass thickness. S: distance between glass edge and inside of edge sealing</p>

Defect	Inspect item	Criteria
4 Minor	<p>Chip on corner of neat edge</p>  <p>X: length Y: width S: width of edge sealing</p>	<p><math>x \leq 3 \text{ mm}</math> <math>y \leq 3 \text{ mm}</math> <math>z \leq t</math></p> <p>any chip exposes the silver dot</p> <p>acceptable reject</p>

Defect	Inspect item	Criteria
5 Minor	<p>Chip on corner of terminal edge</p>  <p>D: terminal length</p>	<p><math>x &lt; 0.3 \text{ mm}</math> or <math>y &lt; 0.3 \text{ mm}</math> ignore</p> <p><math>x \leq 3 \text{ mm}</math> <math>y &lt; D</math> two are acceptable</p>

Defect	Inspect item	Criteria
6 Minor	Chip on opposite side of terminal 	$a \geq 80\text{mm}$ , $x \geq 7\text{mm}$ reject $a < 80\text{mm}$ , $x > 5\text{mm}$ reject $y > 1/2D$ reject $z > 1/2t$ , $y > 1/4D$ reject D: terminal length

Defect	Inspect item	Criteria
7 Minor	Cutting/breaking defect (flare) 	According to the dimension of drawing

Defect	Inspect item	Criteria
8 Minor	Crack 	Any crack trend to extend      reject

Defect	Inspect item	Criteria
9 Major	Liquid leakage, open sealant	reject

Defect	Inspect item	Criteria
10 Minor	Rainbow	According to samples

Defect	Inspect item	Criteria
11 Major	FPC, TCP, FLEX are broken or not connected firmly	reject

Defect	Inspect item	Criteria
12 Minor	The component on PCB or FPC is missing ,soldered unfirmly or bridged	reject

Defect	Inspect item	Criteria
13 Minor	The soldering tin is not enough	The height that soldering tin covers the bump of component is 1/2 less than the height of bump reject

Defect	Inspect item	Criteria
14 Minor	The soldering tin overflows	The soldering tin covers whole bump reject

Defect	Inspect item	Criteria
15 Minor	The component is broken	reject

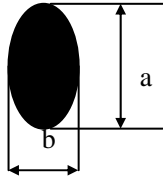
Defect	Inspect item	Criteria
16 Minor	The shape of pinouts is not the same as that in the criterion	It makes the LCM work badly reject

Defect	Inspect item	Criteria
17 Minor	The pinout is broken	reject

Defect	Inspect item	Criteria
18 Minor	The frame is scratched visibly	Length ignore Width >0.5mm reject

Defect	Inspect item	Criteria
19 Minor	The frame is rusted (accumulation)	When the shape is as dot,reference to defect 23 When the shape is as line,reference to defect 24

Defect	Inspect item	Criteria
20 Minor	Scratch and fold on touchpanel. ( by bare eyes ,defect outside A area is acceptable )	1) width≤0.02 mm acceptable 2) 0.02 mm<width≤0.05 mm length≤5 mm two are acceptable 3) width>0.05 mm reject

Defect	Inspect item	Criteria
21 Minor	Black & white dots on touchpanel (round type) Air bubble on touchpanel  $\Phi=(a + b)/2$	1) $\Phi \leq 0.1$ mm acceptable 2) $0.1 < \Phi \leq 0.3$ mm three are acceptable 3) $\Phi > 0.3$ mm reject 1.The distance between any two dots should be more than 5mm. 2.Defect outside A area is acceptable. 3.If the air bubble is black, it can be judged as black spot.

Defect	Inspect item	Criteria
22 Minor	Touchpanel warps	According to the dimension of drawing.

Defect	Inspect item	Criteria
23 Minor	Dirty on rear of touchpanel	It's visible at condition of $30 \pm 5$ cm, $45^\circ$

**10.3 RELIABILITY**

<b>Item</b>	<b>Condition</b>	<b>Criterion</b>
<b>High temperature operation</b>	<b>70°C , 96 hrs</b>	<b>-Cosmetic defects are not allowed after the test(Polarizer change is exceptional) -Contrast ratio change over 50% of initial value should not be happened -The current consumption should be below double of initial value -Brightness decrease should be lower than 50% of initial value</b>
<b>Low temperature operation</b>	<b>-20°C , 96 hrs</b>	
<b>Moisture storage</b>	<b>60°C , 90%RH, 96 hrs</b>	
<b>High temperature storage</b>	<b>80°C , 96 hrs</b>	
<b>Low temperature storage</b>	<b>-30°C , 96 hrs</b>	
<b>Thermal shock</b>	<b>-30°C (30 minute) 25°C (5 minute) 80°C (30 minute) CYCLES: 10</b>	
<b>LIFE TIME</b>	<b>50,000 hours, 25±10°C, 45±20% RH</b>	

## **11. PRECAUTIONS IN USING**

### **11.1 Liquid crystal display (LCD)**

The LCD panel is made up of glass, organic fluid and polarizer. When handling, please pay attention to the following items:

- 1) Keep the operation and storage temperature of the LCD within the range specified in the LCD specification. Otherwise, excessive temperature and humidity would cause polarization degradation, bubble generation or polarizer peel-off.
- 2) Prevent it from mechanical shock by dropping it from a high place, etc.
- 3) Don't contact, push or rub the exposed polarizers with anything harder than HB pencil lead.
- 4) Avoid using chemicals such as acetone, toluene, ethanol and isoropylalcohol to clean the front/rear polarizers and reflectors, which will cause damage to them.
- 5) Wipe off saliva or water drops immediately. Contact with water over a long period of time may cause deformation or color fading. The LCM is assembled and adjusted with a high degree of precision.
- 6) Do not put or attach anything on the display area. Avoid touching the display area with bare hand.

### **11.2 Precaution for handling LCD modules**

The LCM is assembled and adjusted with a high degree of precision, do not applying excessive shocks to it or making any alterations or modifications to it, the following precautions should be taken when handing.

- 1) Do not drop, bend or twist the module.
- 2) Do not alter or making any modification on the shape of the metal frame.
- 3) Do not change the shape, the pattern wiring or add any extra hole on the PCB.
- 4) Do not modify or touch the zebra rubber strip(conductive rubber) with another object.
- 5) Do not change the positions of components on the PCB.

### **11.3 Eletro-static discharge control**

Careful attention should be paid to control the electrostatic discharge of the modules, since the modules contain no. of CMOS LSI.

- 1) Make sure you are grounded properly when remove the module from its antistatic bag. Be sure that the module and have the same electric potential.
- 2) Only properly grounded soldering iron should be used.
- 3) Modules should be stored in antistatic bag or other containers resistant to static after remove from its original package.
- 4) When using the electric screw-driver is used, make sure the screw driver had been ground potentiality to minimize the transmission of EM wave produced by commutator sparks.
- 5) In order to reduce the generation of static electricity, a relative humidity of 50-60% is recommended.

**11.4 Precaution for soldering**

- 1) Soldering should apply to I/O terminals only.
- 2) Soldering temperature is  $280^{\circ}\text{C}+(-)10^{\circ}\text{C}$ .
- 3) Soldering time 3-4 seconds.
- 4) Eutectic solder (rosin flux filled) should be used.
- 5) If soldering flux is used, be sure to remove any remaining flux after finishing the soldering operation and LCD surface should be covered during soldering to prevent any damage to flux spatters.
- 6) When remove the lead wires from the I/O terminals, use proper de-soldering methods, e.g. suction type de-soldering irons. Do not repeat wiring by soldering more than three times at the pads and plated though holes may be damaged.

**11.5 Precaution for operation**

- 1) Adjust liquid crystal driving voltage ( $V_o$ ) to varies viewing angle and obtain the contrast.
- 2)  $V_o$  should be kept in proper range stated in the specification. Excess voltage will shorten the LCD life.
- 3) Response time is greatly delayed at low temperature. It will recover when go back to normal temperature.
- 4) Condensation on terminals can cause an electrochemical reaction disrupting the terminal circuit. Therefore it should be used under the relative condition of 50% RH.

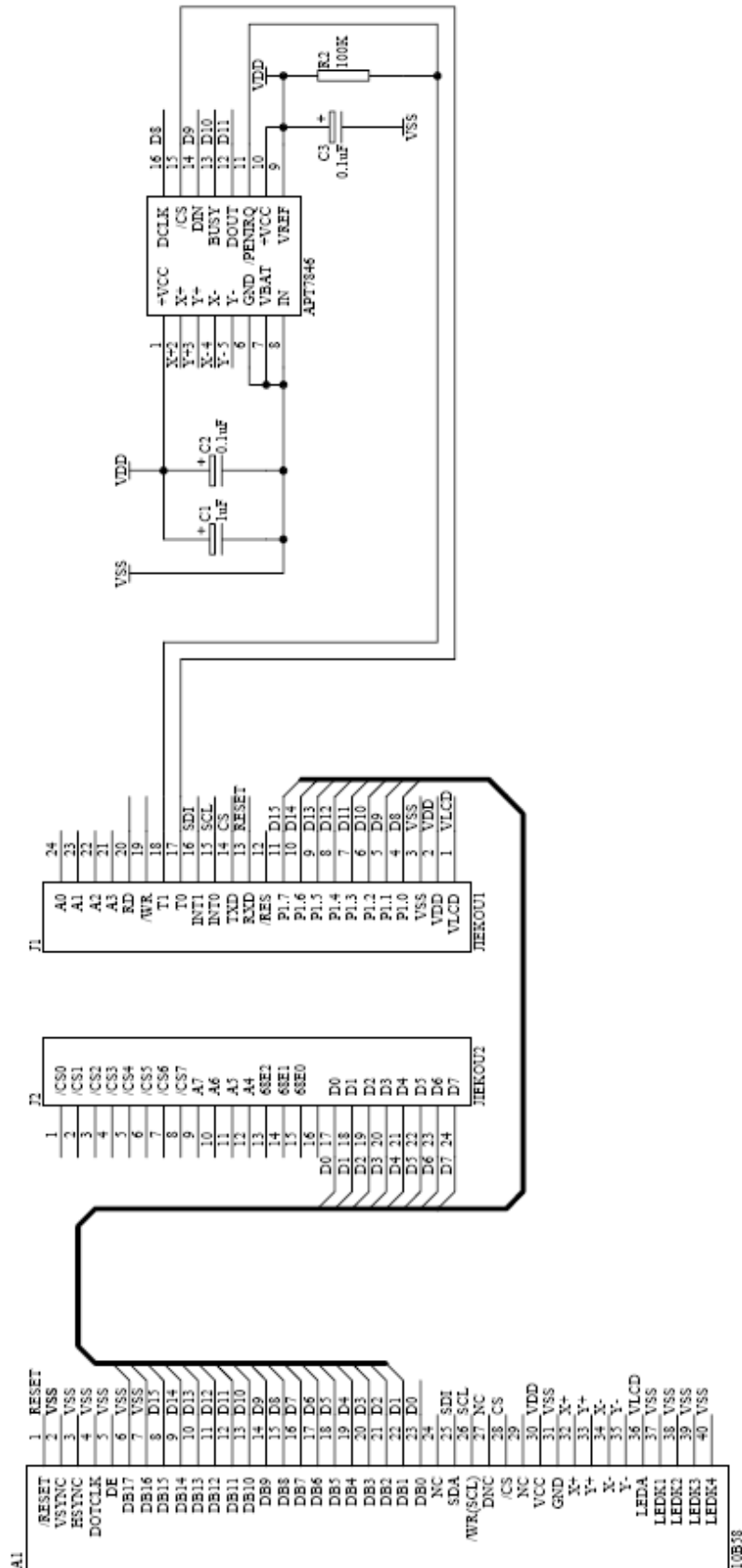
**11.6 Storage**

When long term storage is required, following precautions are necessary:

- 1) Storage them in a sealed polyethylene bag (antistatic), seal the opening, and store it where it is not subjected to direct sunshine, or to the light of fluorescent lamp. If properly sealed, there is no need for desiccant.
- 2) Store them in the temperature range of  $-30^{\circ}\text{C}\sim 80^{\circ}\text{C}$  and at low humidity is recommended.

## 12. APPLICATION

### 12.1 REFERENCE CIRCUIT





**12.2 APPENDIX****INITIALIZATION FOR REFERENCE**

```
BINITIAL:  
MOV REG,#02EH  
LCALL BWRCTRL  
MOV CMD,#079H  
LCALL BWRCMD ;  
MOV REG,#0EEH  
LCALL BWRCTRL  
MOV CMD,#00CH  
LCALL BWRCMD ;  
;Driving ability Setting  
MOV REG,#0EAH  
LCALL BWRCTRL  
MOV CMD,#000H  
LCALL BWRCMD ;PTBA[15:8]  
MOV REG,#0EBH  
LCALL BWRCTRL  
MOV CMD,#020H  
LCALL BWRCMD ;PTBA[7:0]  
MOV REG,#0ECH  
LCALL BWRCTRL  
MOV CMD,#008H  
LCALL BWRCMD ;STBA[15:8]  
MOV REG,#0EDH  
LCALL BWRCTRL  
MOV CMD,#0C4H  
LCALL BWRCMD ;STBA[7:0]  
MOV REG,#0E8H  
LCALL BWRCTRL  
MOV CMD,#040H  
LCALL BWRCMD ;OPON[7:0]  
MOV REG,#0E9H  
LCALL BWRCTRL  
MOV CMD,#038H  
LCALL BWRCMD ;OPON1[7:0]  
MOV REG,#0F1H  
LCALL BWRCTRL  
MOV CMD,#001H  
LCALL BWRCMD ;OTPS1B  
MOV REG,#0F2H  
LCALL BWRCTRL  
MOV CMD,#010H  
LCALL BWRCMD ;GEN  
MOV REG,#027H  
LCALL BWRCTRL  
MOV CMD,#0A3H  
LCALL BWRCMD ;  
;Gamma 2.2 Setting  
MOV REG,#040H  
LCALL BWRCTRL  
MOV CMD,#000H  
LCALL BWRCMD ;  
MOV REG,#041H  
LCALL BWRCTRL  
MOV CMD,#000H  
LCALL BWRCMD ;  
MOV REG,#042H  
LCALL BWRCTRL
```

MOV CMD,#001H  
LCALL BWR CMD ;  
MOV REG,#043H  
LCALL BWR CTRL  
MOV CMD,#013H  
LCALL BWR CMD ;  
MOV REG,#044H  
LCALL BWR CTRL  
MOV CMD,#010H  
LCALL BWR CMD ;  
MOV REG,#045H  
LCALL BWR CTRL  
MOV CMD,#026H  
LCALL BWR CMD ;  
MOV REG,#046H  
LCALL BWR CTRL  
MOV CMD,#008H  
LCALL BWR CMD ;  
MOV REG,#047H  
LCALL BWR CTRL  
MOV CMD,#051H  
LCALL BWR CMD ;  
MOV REG,#048H  
LCALL BWR CTRL  
MOV CMD,#002H  
LCALL BWR CMD ;  
MOV REG,#049H  
LCALL BWR CTRL  
MOV CMD,#012H  
LCALL BWR CMD ;  
MOV REG,#04AH  
LCALL BWR CTRL  
MOV CMD,#018H  
LCALL BWR CMD ;  
MOV REG,#04BH  
LCALL BWR CTRL  
MOV CMD,#019H  
LCALL BWR CMD ;  
MOV REG,#04CH  
LCALL BWR CTRL  
MOV CMD,#014H  
LCALL BWR CMD ;  
MOV REG,#050H  
LCALL BWR CTRL  
MOV CMD,#019H  
LCALL BWR CMD ;  
MOV REG,#051H  
LCALL BWR CTRL  
MOV CMD,#02FH  
LCALL BWR CMD ;  
MOV REG,#052H  
LCALL BWR CTRL  
MOV CMD,#02CH  
LCALL BWR CMD ;  
MOV REG,#053H  
LCALL BWR CTRL  
MOV CMD,#03EH  
LCALL BWR CMD ;  
MOV REG,#054H  
LCALL BWR CTRL  
MOV CMD,#03FH  
LCALL BWR CMD ;

```
MOV REG,#055H
LCALL BWRCTRL
MOV CMD,#03FH
LCALL BWRCMD ;
MOV REG,#056H
LCALL BWRCTRL
MOV CMD,#02EH
LCALL BWRCMD ;
MOV REG,#057H
LCALL BWRCTRL
MOV CMD,#077H
LCALL BWRCMD ;
MOV REG,#058H
LCALL BWRCTRL
MOV CMD,#00BH
LCALL BWRCMD ;
MOV REG,#059H
LCALL BWRCTRL
MOV CMD,#006H
LCALL BWRCMD ;
MOV REG,#05AH
LCALL BWRCTRL
MOV CMD,#007H
LCALL BWRCMD ;
MOV REG,#05BH
LCALL BWRCTRL
MOV CMD,#00DH
LCALL BWRCMD ;
MOV REG,#05CH
LCALL BWRCTRL
MOV CMD,#01DH
LCALL BWRCMD ;
MOV REG,#05DH
LCALL BWRCTRL
MOV CMD,#0CCH
LCALL BWRCMD ;
```

**;Power Voltage Setting**

```
MOV REG,#01BH
LCALL BWRCTRL
MOV CMD,#01BH
LCALL BWRCMD ;VRH=4.65V
MOV REG,#01AH
LCALL BWRCTRL
MOV CMD,#001H
LCALL BWRCMD ;BT (VGH~15V,VGL~-10V,DDVDH~5V)
MOV REG,#024H
LCALL BWRCTRL
MOV CMD,#02FH
LCALL BWRCMD ;VMH(VCOM High voltage ~3.2V)
MOV REG,#025H
LCALL BWRCTRL
MOV CMD,#057H
LCALL BWRCMD ;VML(VCOM Low voltage -1.2V)
;****VCOM offset**;/
MOV REG,#023H
LCALL BWRCTRL
MOV CMD,#086H
LCALL BWRCMD ;for Flicker adjust ;can reload from OTP
;Power on Setting
MOV REG,#018H
LCALL BWRCTRL
```

```
MOV CMD,#036H
LCALL BWR CMD ;I/P_RADJ,N/P_RADJ, Normal mode 75Hz
MOV REG,#019H
LCALL BWR CTRL
MOV CMD,#001H
LCALL BWR CMD ;OSC_EN='1', start Osc
MOV REG,#001H
LCALL BWR CTRL
MOV CMD,#000H
LCALL BWR CMD ;DP_STB='0', out deep sleep
MOV REG,#01FH
LCALL BWR CTRL
MOV CMD,#088H
LCALL BWR CMD; GAS=1, VOMG=00, PON=0, DK=1, XDK=0, DVDH_TRI=0,
STB=0

MOV REG,#01FH
LCALL BWR CTRL
MOV CMD,#080H
LCALL BWR CMD; GAS=1, VOMG=00, PON=0, DK=0, XDK=0, DVDH_TRI=0,
STB=0
MOV REG,#01FH
LCALL BWR CTRL
MOV CMD,#090H
LCALL BWR CMD; GAS=1, VOMG=00, PON=1, DK=0, XDK=0, DVDH_TRI=0,
STB=0
MOV REG,#01FH
LCALL BWR CTRL
MOV CMD,#0D0H
LCALL BWR CMD; GAS=1, VOMG=10, PON=1, DK=0, XDK=0, DDVDH_TRI=0,
STB=0

MOV REG,#016H
LCALL BWR CTRL
MOV CMD,#040H
LCALL BWR CMD

;262k/65k color selection
MOV REG,#017H
LCALL BWR CTRL
MOV CMD,#005H
LCALL BWR CMD ;default 0x06 262k color ; 0x05 65k color
;SET PANEL
MOV REG,#036H
LCALL BWR CTRL
MOV CMD,#000H
LCALL BWR CMD ;SS_P, GS_P,REV_P,BGR_P
;Display ON Setting
MOV REG,#028H
LCALL BWR CTRL
MOV CMD,#038H
LCALL BWR CMD ;GON=1, DTE=1, D=1000

MOV REG,#028H
LCALL BWR CTRL
MOV CMD,#03CH
LCALL BWR CMD ;GON=1, DTE=1, D=1100
;Set GRAM Area
MOV REG,#002H
LCALL BWR CTRL
MOV CMD,#000H
```

**LCALL BWR CMD  
MOV REG,#003H  
LCALL BWR CTRL  
MOV CMD,#000H  
LCALL BWR CMD ;Column Start  
MOV REG,#004H  
LCALL BWR CTRL  
MOV CMD,#000H  
LCALL BWR CMD  
MOV REG,#005H  
LCALL BWR CTRL  
MOV CMD,#0EFH  
LCALL BWR CMD ;Column End  
MOV REG,#006H  
LCALL BWR CTRL  
MOV CMD,#000H  
LCALL BWR CMD  
MOV REG,#007H  
LCALL BWR CTRL  
MOV CMD,#000H  
LCALL BWR CMD ;Row Start  
MOV REG,#008H  
LCALL BWR CTRL  
MOV CMD,#001H  
LCALL BWR CMD  
MOV REG,#009H  
LCALL BWR CTRL  
MOV CMD,#03FH  
LCALL BWR CMD ;Row End  
;Display ON**

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