Display Elektronik GmbH

DATA SHEET

TFT MODULE

DEM 240320B TMH-PW-N (A-TOUCH)

2,4” TFT with Touch-Panel

Product Specification ***Ver.: 2.1.0***

22.05.2013

Revise Records

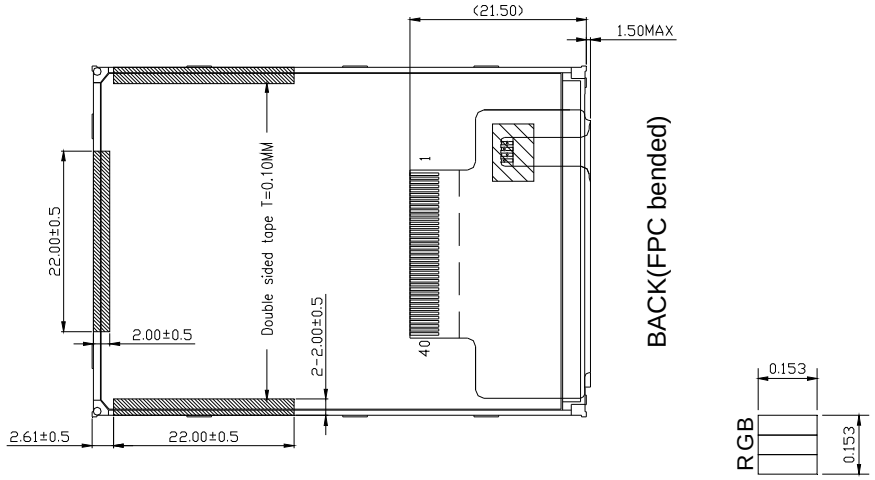
Rev.	Date	Contents	Written	Approved
0	17.05.2012	Preliminary Specification	WL	MH
1	22.05..2012	Update LED current and luminance	WL	MH
2.1.0	22.05.2013	Change TFT-Panel	MH	MH

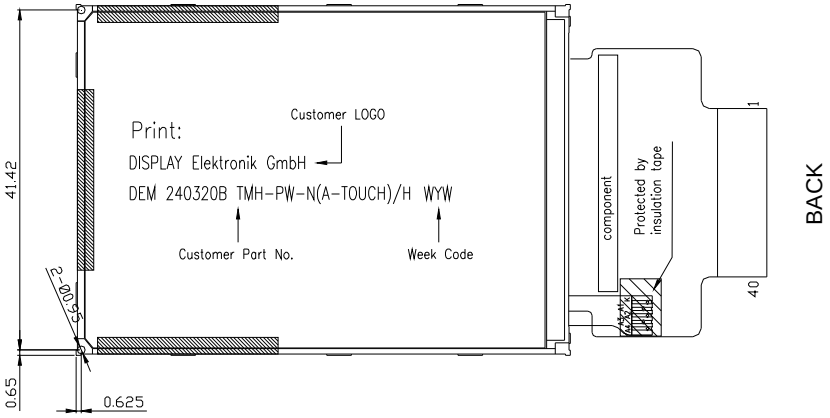
Special Notes

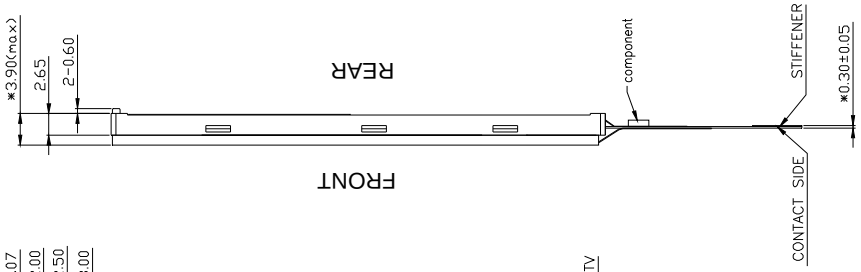
Note1.	
Note2.	
Note3.	
Note4.	
Note5.	

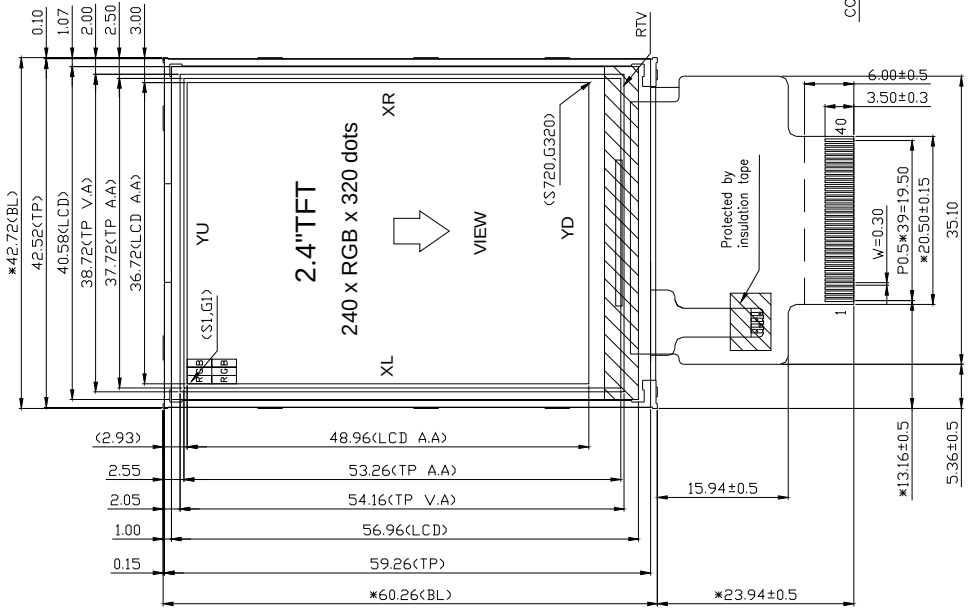
CONTENT

1. LCM DRAWING









2. GENERAL DESCRIPTION

MAIN TECHNICS：	COG
DISPLAY CONTENT:	GRAPHIC
DISPLAY TYPE:	262K COLORS-TFT-NEGATIVE-TRANSMISSIVE
DRIVER METHOD:	1/320 DUTY
VIEWING DIRECTION:	12:00
CONTROLLER:	ILI9325C (ILITEK)
BACKLIGHT:	LED WHITE
OPEATING TEMPERATURE:	-20°C to +70°C
STORAGE TEMPERATURE:	-30°C to +80°C
INTERFACE:	SPI and 8080 Series MPU(8/16-bit)
TOUCH-PANEL:	Integrated 4-Wire-Resistive-Touch-Panel

3. MECHANICAL SPECIFICATIONS

ITEM	CONTENT	UNIT
PIXEL'S NUMBER	**240 x RGB x 320**	**DOTS**
MODULE DIMENSION	**42.72 x 60.26 x 2.65**	**mm**
ACTIVE AREA	**36.72 x 48.96**	**mm**
PIXEL SIZE	**0.153 x 0.153**	**mm**

4. ELECTRO-OPTICAL CHARACTERISTICS

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Transmittance (without Polarizer)		T(%)	–	–	13.5	–	–	
Contrast Ratio		CR	Θ=0 Normal viewing angle	400	500	–	–	(1)(2)
Response time	Rising	T_R		–	2	4	msec	(1)(3)
	Falling	T_F		–	6	12		
Color gamut		S(%)			60		%	
Color chromaticity (CIE1931)	White	W_x		TBD	0.308	TBD		(1)(4) CF glass (C-light)
		Wy		TBD	0.325	TBD		
	Red	Rx		TBD	0.630	TBD		
		Ry		TBD	0.337	TBD		
	Green	Gx		TBD	0.284	TBD		
		Gy		TBD	0.543	TBD		
	Blue	Bx		TBD	0.143	TBD		
		By		TBD	0.120	TBD		
Viewing angle	Hor.	Θ_L	CR>10	TBD	45	–		
		Θ_R		TBD	45	–		
	Ver.	Θ_U		TBD	45	–		
		Θ_D		TBD	20	–		
Optima View Direction		12 O'clock						(5)

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

The contrast ratio can be calculated by the following expression.

Contrast Ratio (CR) = L63 / L0

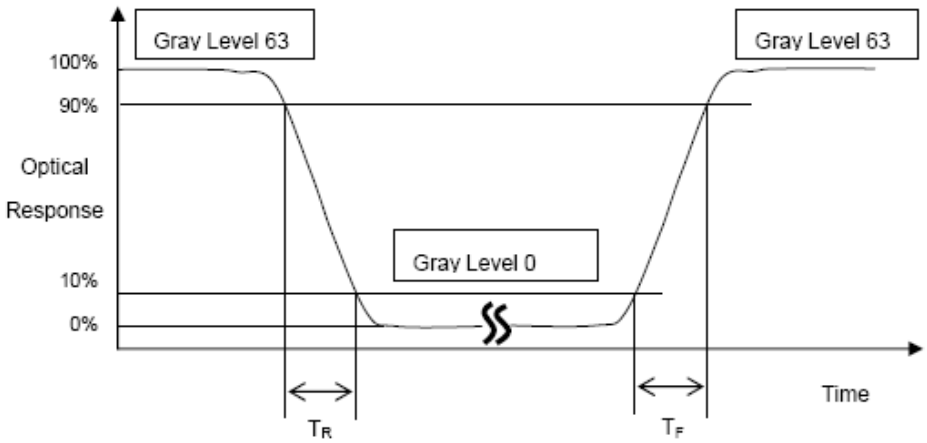
L63: Luminance of gray level 63

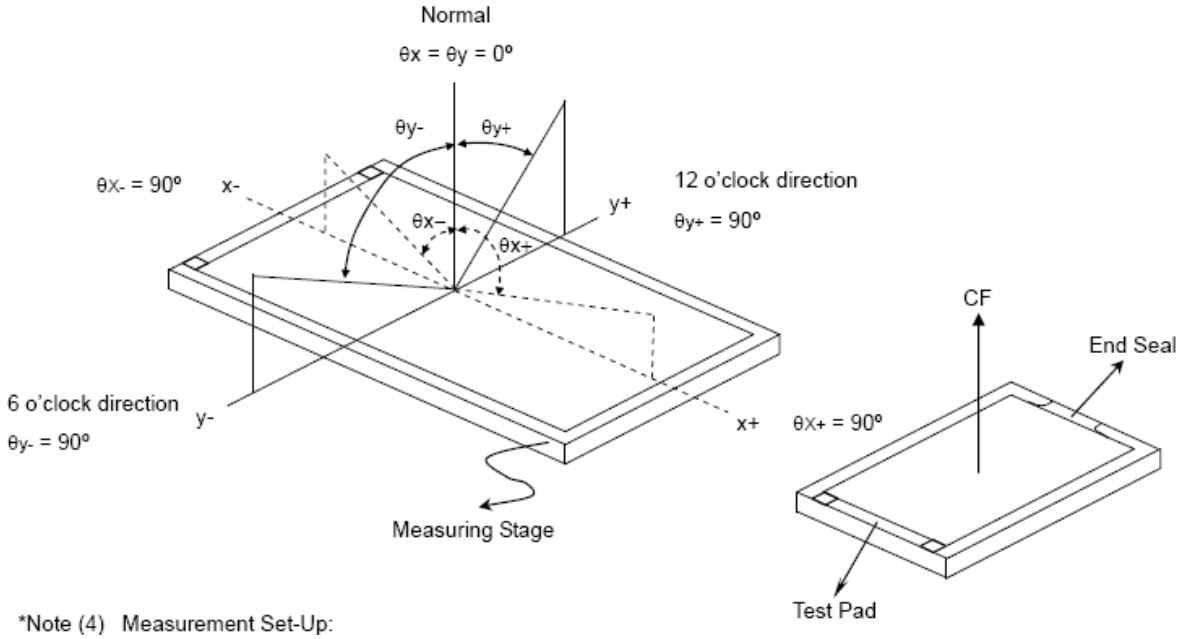
L 0: Luminance of gray level 0

CR = CR (5)

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

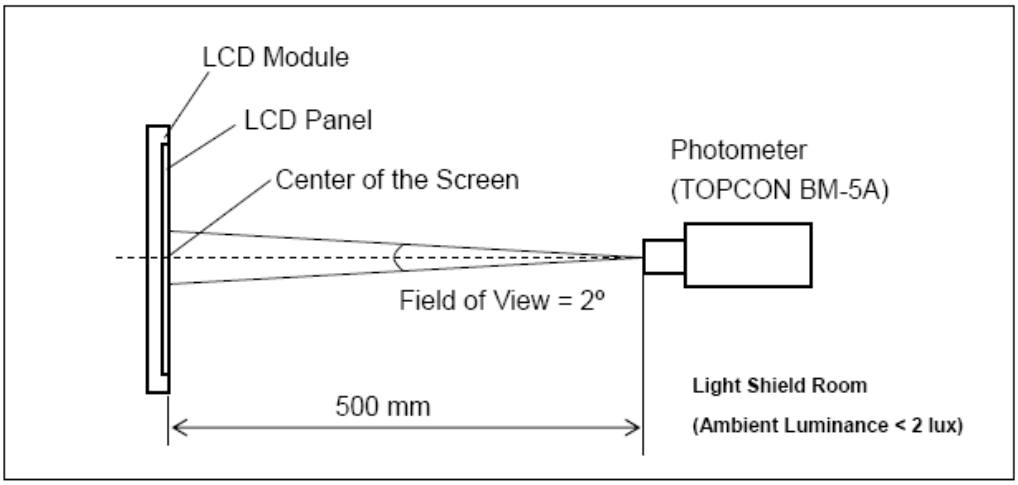
*Note (2) Definition of Response Time (T_R, T_F):

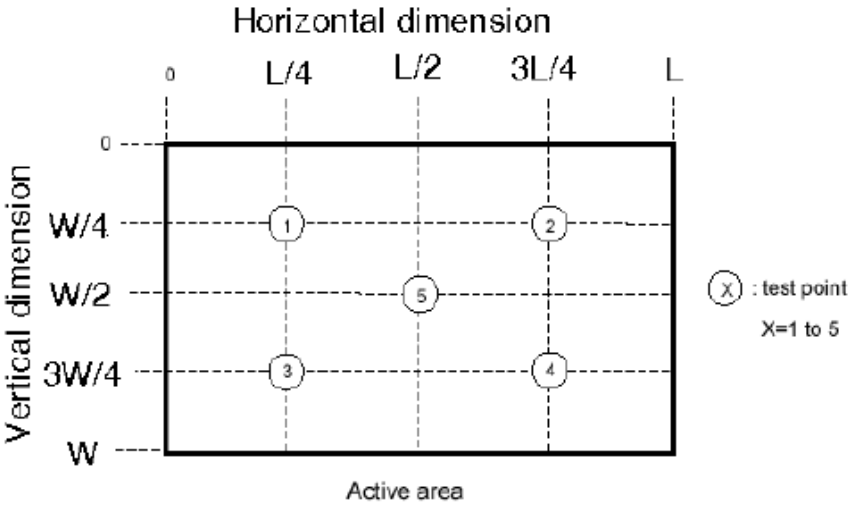




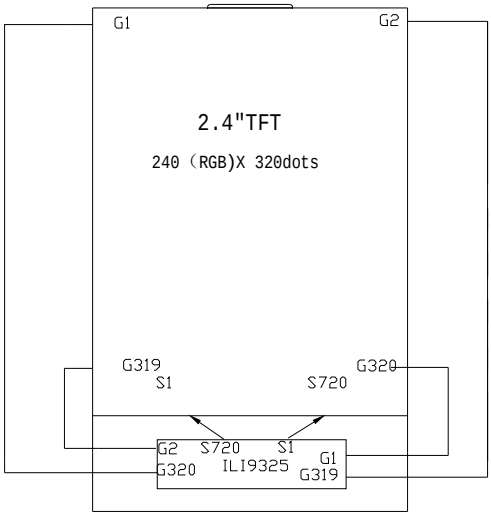
*Note (4) Measurement Set-Up:

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.





5. BLOCK DIAGRAM



6. ELECTRONIC CHARACTERISTICS

6.1 MAXIMUM VALUES

ITEM	SYMBOL	STANDARD VALUE		UNIT
		MIN	MAX	
Logic supply voltage	**V_{DD}**	**-0.3**	**+4.6**	**V**
Operating Temperature	**Top**	**-20**	**+70**	**°C**
Storage Temperature	**Tst**	**-30**	**+80**	**°C**

6.2. DC CHARACTERISTICS

(VCC = VCI=2.50 ~ 3.3V, IOVCC = 1.65 ~ 3.30V, Ta= -40 ~ 85 °C)

Item	Symbol	Unit	Test Condition	Min.	Typ.	Max.	Note
Input high voltage	V_{IH}	V	IOVCC= 1.65 ~ 3.3V	0.8*IOVCC	-	IOVCC	-
Input low voltage	V_{IL}	V	IOVCC= 1.65 ~ 3.3V	-0.3	-	0.2*IOVCC	-
Output high voltage(1) (DB0-17 Pins)	V_{OH1}	V	IOH = -0.1 mA	0.8*IOVCC	-	-	-
Output low voltage (DB0-17 Pins)	V_{OL1}	V	IOVCC=1.65~3.3V	-	-	0.2*IOVCC	-
I/O leakage current	I_{LI}	µA	Vin = 0 ~ VCC	-0.1	-	0.1	-
Current consumption during normal operation (VCC - GND)+ (VCI - GND)	I_{OP}	µA	VCC=IOVCC=2.8V , Ta=25°C , fOSC = 512KHz (Line) GRAM data = 0000h	-	TBD	-	-
Current consumption during standby mode (VCC - GND)+ (VCI - GND)	I_{ST}	µA	VCC=IOVCC=2.8V , Ta=25 °C	-	TBD	TBD	-
LCD Drive Power Supply Current (DDVDH-GND)	ILCD	mA	VCI=2.8V , VREG1OUT =4.8V DDVDH=5.2V , Frame Rate: 70Hz, line-inversion, Ta=25 °C, GRAM data = 0000h,	-	5.5	-	-
LCD Driving Voltage (DDVDH-GND)	DDVDH	V	-	4.5	-	6	-
Output deviation voltage	V_{DEV}	mV	-	-	-	TBD	-
Output offset voltage	V_{OFFSET}	mV	Note1	-	-	TBD	-

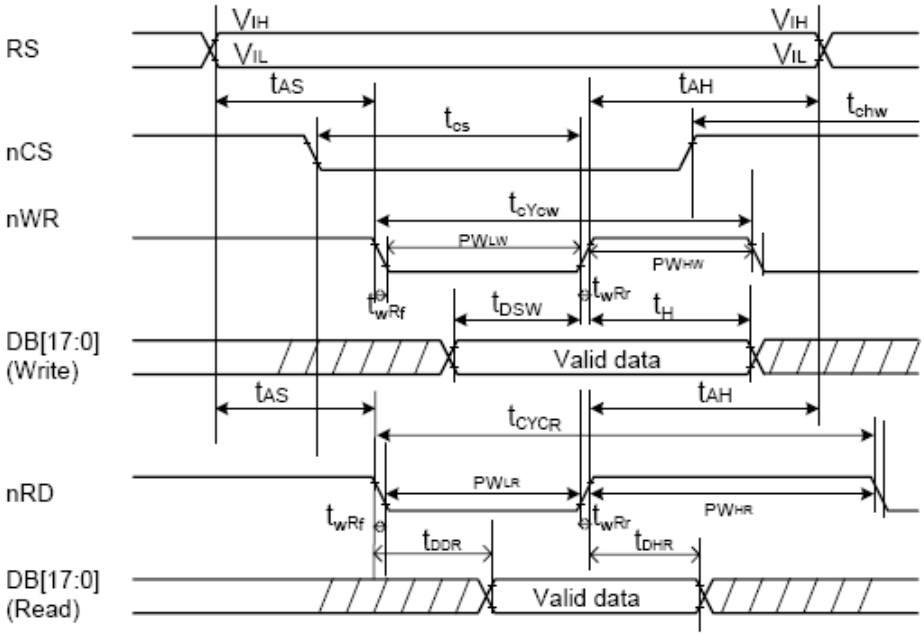
Note1: The Max. value is between with measure point and Gamma setting value.

6.3 TIMING CHARACTERISTICS

i80-System Interface Timing Characteristics

Normal Write Mode (IOVCC = 1.65~3.3V)

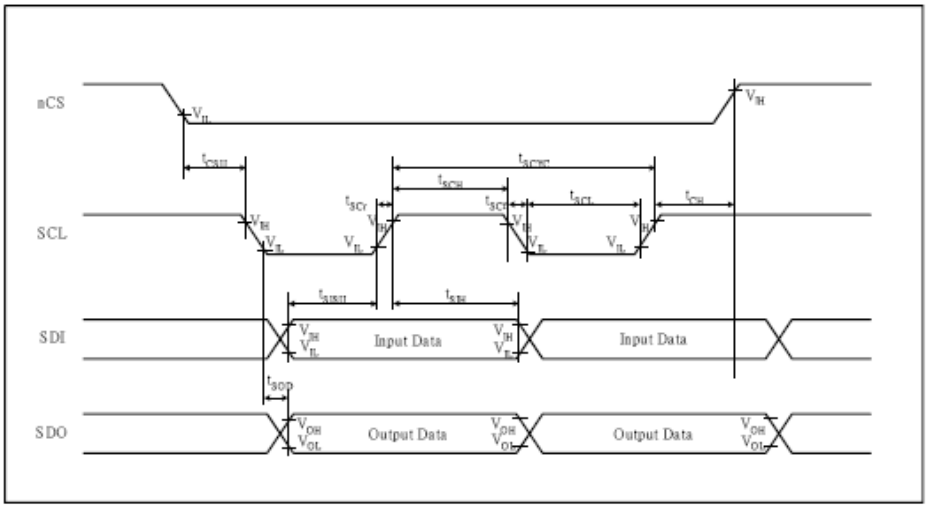
Item		Symbol	Unit	Min.	Typ.	Max.	Test Condition
Bus cycle time	Write	t_{CYCW}	ns	TBD	-		-
	Read	t_{CYCR}	ns	300	-	-	-
Write low-level pulse width		PW_{LW}	ns	TBD	-	500	-
Write high-level pulse width		PW_{HW}	ns	TBD	-	-	-
Read low-level pulse width		PW_{LR}	ns	150	-	-	-
Read high-level pulse width		PW_{HR}	ns	150	-	-	
Write / Read rise / fall time		t_{WRr}/t_{WRf}	ns	-	-	25	
Setup time	Write (RS to nCS, E/nWR)	t_{AS}	ns	10	-	-	
	Read (RS to nCS, RW/nRD)			5	-	-	
Address hold time		t_{AH}	ns	5	-	-	
Write data set up time		t_{DSW}	ns	10	-	-	
Write data hold time		t_H	ns	15	-	-	
Read data delay time		t_{DDR}	ns	-	-	100	
Read data hold time		t_{DHR}	ns	5	-	-	



Serial Data Transfer Interface Timing Characteristics

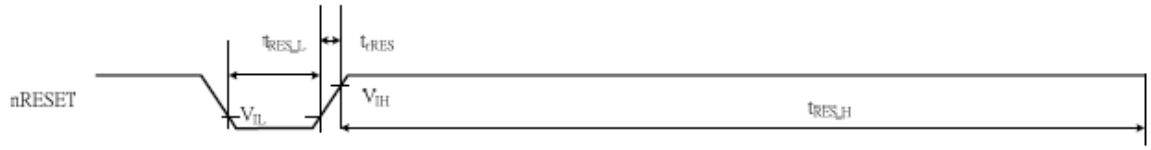
(IOVCC= 1.65 ~ 3.3V)

Item		Symbol	Unit	Min.	Typ.	Max.	Test Condition
Serial clock cycle time	Write (received)	t_{SCYC}	μs	TBD	-	-	
	Read (transmitted)	t_{SCYC}	μs	200	-	-	
Serial clock high – level pulse width	Write (received)	t_{SCH}	ns	40	-	-	
	Read (transmitted)	t_{SCH}	ns	100	-	-	
Serial clock low – level pulse width	Write (received)	t_{SCL}	ns	40	-	-	
	Read (transmitted)	t_{SCL}	ns	100	-	-	
Serial clock rise / fall time		t_{SCr}, t_{SCf}	ns	-	-	5	
Chip select set up time		t_{CSU}	ns	10	-	-	
Chip select hold time		t_{CH}	ns	50	-	-	
Serial input data set up time		t_{SISU}	ns	20	-	-	
Serial input data hold time		t_{SIH}	ns	20	-	-	
Serial output data set up time		t_{SOD}	ns	-	-	100	
Serial output data hold time		t_{SOH}	ns	5	-	-	



Reset Timing Characteristics (IOVCC = 1.65 ~ 3.3 V)

Item	Symbol	Unit	Min.	Typ.	Max.
Reset low-level width	t_{RES_L}	ms	1	-	-
Reset rise time	t_{rRES}	μs	-	-	10
Reset high-level width	t_{RES_H}	ms	50	-	-



7. PINS DESCRIPTION

PIN DESCRIPTION:

<table>
<tr><th>Pin No.</th><th>Symbol</th><th>Description</th></tr>
<tr><td>1–4</td><td>DB8–DB11</td><td>Data Bus</td></tr>
<tr><td>5</td><td>GND</td><td>Ground</td></tr>
<tr><td>6</td><td>VCC</td><td>Power supply: +2.8V</td></tr>
<tr><td>7</td><td>/CS</td><td>L: Chip Selected; H: Chip Unselected</td></tr>
<tr><td>8</td><td>RS</td><td>L:Command; H:display data</td></tr>
<tr><td>9</td><td>/WR</td><td>A write strobe signal and enables an operation to write data when the signal is low.</td></tr>
<tr><td>10</td><td>/RD</td><td>A read strobe signal and enables an operation to read out data when the signal is low.</td></tr>
<tr><td>11</td><td>IM0</td><td rowspan="3">Select the MPU system interface mode
<table><tr><td></td><td>8bit</td><td>16bit</td><td>SPI</td></tr><tr><td>IM0</td><td>1</td><td>0</td><td>ID</td></tr><tr><td>IM1</td><td>1</td><td>1</td><td>0</td></tr><tr><td>IM2</td><td>0</td><td>0</td><td>1</td></tr></table></td></tr>
<tr><td>12</td><td>IM1</td></tr>
<tr><td>13</td><td>IM2</td></tr>
<tr><td>14</td><td>SDI</td><td>SPI interface input pin</td></tr>
<tr><td>15</td><td>SDO</td><td>SPI interface output pin</td></tr>
<tr><td>16</td><td>YU</td><td>touch panel output pin.(Touch screen Y corrdinate up YU)</td></tr>
<tr><td>17</td><td>XL</td><td>touch panel output pin.(Touch screen X corrdinate left XL)</td></tr>
<tr><td>18</td><td>YD</td><td>touch panel output pin.(Touch screen Y corrdinate down YD)</td></tr>
<tr><td>19</td><td>XR</td><td>touch panel output pin.(Touch screen X corrdinate right XR)</td></tr>
<tr><td>20</td><td>LEDK</td><td>Backlight LED cathode</td></tr>
<tr><td>21</td><td>LEDA1</td><td>Backlight LED anode(A1)</td></tr>
<tr><td>22</td><td>LEDA2</td><td>Backlight LED anode(A2)</td></tr>
<tr><td>23</td><td>LEDA3</td><td>Backlight LED anode(A3)</td></tr>
<tr><td>24</td><td>LEDA4</td><td>Backlight LED anode(A4)</td></tr>
<tr><td>25</td><td>DB12</td><td>Data bus</td></tr>
<tr><td>26–33</td><td>DB0–DB7</td><td>Data bus</td></tr>
<tr><td>34</td><td>/RESET</td><td>L: initialization is executed</td></tr>
<tr><td>35</td><td>VCI</td><td>A Power supply for step-up circuit and power supply circuit.(+2.8v)</td></tr>
<tr><td>36</td><td>VCC</td><td>Power supply:+2.8V</td></tr>
<tr><td>37</td><td>GND</td><td>Ground</td></tr>
<tr><td>38–40</td><td>DB13–DB15</td><td>Data bus</td></tr>
</table>

8. INSTRUCTION DESCRIPTION

No.	Registers Name	R/W	RS	D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0
IR	Index Register	W	0	-	-	-	-	-	-	-	-	ID7	ID6	ID5	ID4	ID3	ID2	ID1	ID0
00h	Driver Code Read	RO	1	1	0	0	1	0	0	1	1	0	0	1	0	0	1	0	1
01h	Driver Output Control 1	W	1	0	0	0	0	0	SM	0	SS	0	0	0	0	0	0	0	0
02h	LCD Driving Control	W	1	0	0	0	0	0	0	B/C	0	0	0	0	0	0	0	0	0
03h	Entry Mode	W	1	TRI	DFM	0	BGR	0	0	0	0	ORG	0	I/D1	I/D0	AM	0	0	0
05h	16 bits data format control	W	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	EPF1	EPF0
07h	Display Control 1	W	1	0	0	PTDE1	PTDE0	0	0	0	BASEE	0	0	GON	DTE	CL	0	D1	D0
08h	Display Control 2	W	1	0	0	0	0	FP3	FP2	FP1	FP0	0	0	0	0	BP3	BP2	BP1	BP0
09h	Display Control 3	W	1	0	0	0	0	0	0	PTS1	PTS0	0	0	PTG1	PTG0	ISC3	ISC2	ISC1	ISC0
0Ah	Display Control 4	W	1	0	0	0	0	0	0	0	0	0	0	0	0	FMARKOE	FMI2	FMI1	FMI0
0Ch	RGB Display Interface Control 1	W	1	0	ENC2	ENC1	ENC0	0	0	0	RM	0	0	DM1	DM0	0	0	RIM1	RIM0
0Dh	Frame Maker Position	W	1	0	0	0	0	0	0	0	FMP8	FMP7	FMP6	FMP5	FMP4	FMP3	FMP2	FMP1	FMP0
0Fh	RGB Display Interface Control 2	W	1	0	0	0	0	0	0	0	0	0	0	0	VSPL	HSPL	0	EPL	DPL
10h	Power Control 1	W	1	0	0	0	SAP	0	BT2	BT1	BT0	APE	AP2	AP1	AP0	0	0	SLP	STB
11h	Power Control 2	W	1	0	0	0	0	0	DC12	DC11	DC10	0	DC02	DC01	DC00	0	VC2	VC1	VC0
12h	Power Control 3	W	1	0	0	0	0	0	0	0	0	VCIRE	0	0	0	VRH3	VRH2	VRH1	VRH0
13h	Power Control 4	W	1	0	0	0	VDV4	VDV3	VDV2	VDV1	VDV0	0	0	0	0	0	0	0	0
20h	Horizontal GRAM Address Set	W	1	0	0	0	0	0	0	0	0	AD7	AD6	AD5	AD4	AD3	AD2	AD1	AD0
21h	Vertical GRAM Address Set	W	1	0	0	0	0	0	0	0	AD16	AD15	AD14	AD13	AD12	AD11	AD10	AD9	AD8
22h	Write Data to GRAM	W	1	RAM write data (WD17-0) / read data (RD17-0) bits are transferred via different data bus lines according to the selected interfaces.															
29h	Power Control 7	W	1	0	0	0	0	0	0	0	0	0	0	VCM5	VCM4	VCM3	VCM2	VCM1	VCM0
2Bh	Frame Rate and Color Control	W	1	0	0	0	0	0	0	0	0	0	0	0	0	FRS[3]	FRS[2]	FRS[1]	FRS[0]
30h	Gamma Control 1	W	1	0	0	0	0	0	KP1[2]	KP1[1]	KP1[0]	0	0	0	0	0	KP0[2]	KP0[1]	KP0[0]
31h	Gamma Control 2	W	1	0	0	0	0	0	KP3[2]	KP3[1]	KP3[0]	0	0	0	0	0	KP2[2]	KP2[1]	KP2[0]
32h	Gamma Control 3	W	1	0	0	0	0	0	KP5[2]	KP5[1]	KP5[0]	0	0	0	0	0	KP4[2]	KP4[1]	KP4[0]
35h	Gamma Control 4	W	1	0	0	0	0	0	RP1[2]	RP1[1]	RP1[0]	0	0	0	0	0	RP0[2]	RP0[1]	RP0[0]
36h	Gamma Control 5	W	1	0	0	0	VRP1[4]	VRP1[3]	VRP1[2]	VRP1[1]	VRP1[0]	0	0	0	0	VRP0[3]	VRP0[2]	VRP0[1]	VRP0[0]
37h	Gamma Control 6	W	1	0	0	0	0	0	KN1[2]	KN1[1]	KN1[0]	0	0	0	0	0	KN0[2]	KN0[1]	KN0[0]
38h	Gamma Control 7	W	1	0	0	0	0	0	KN3[2]	KN3[1]	KN3[0]	0	0	0	0	0	KN2[2]	KN2[1]	KN2[0]
39h	Gamma Control 8	W	1	0	0	0	0	0	KN5[2]	KN5[1]	KN5[0]	0	0	0	0	0	KN4[2]	KN4[1]	KN4[0]
3Ch	Gamma Control 9	W	1	0	0	0	0	0	RN1[2]	RN1[1]	RN1[0]	0	0	0	0	0	RN0[2]	RN0[1]	RN0[0]
3Dh	Gamma Control 10	W	1	0	0	0	VRN1[4]	VRN1[3]	VRN1[2]	VRN1[1]	VRN1[0]	0	0	0	0	VRN0[3]	VRN0[2]	VRN0[1]	VRN0[0]
50h	Horizontal Address Start	W	1	0	0	0	0	0	0	0	0	HSA7	HSA6	HSA5	HSA4	HSA3	HSA2	HSA1	HSA0

No	Registers Name	R/W	RS	D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0
	Position																		
51h	Horizontal Address End Position	W	1	0	0	0	0	0	0	0	0	HEA7	HEA6	HEA5	HEA4	HEA3	HEA2	HEA1	HEA0
52h	Vertical Address Start Position	W	1	0	0	0	0	0	0	0	VSA8	VSA7	VSA6	VSA5	VSA4	VSA3	VSA2	VSA1	VSA0
53h	Vertical Address End Position	W	1	0	0	0	0	0	0	0	VEA8	VEA7	VEA6	VEA5	VEA4	VEA3	VEA2	VEA1	VEA0
60h	Driver Output Control 2	W	1	GS	0	NL5	NL4	NL3	NL2	NL1	NL0	0	0	SCN5	SCN4	SCN3	SCN2	SCN1	SCN0
61h	Base Image Display Control	W	1	0	0	0	0	0	0	0	0	0	0	0	0	0	NDL	VLE	REV
66h	SPI Read/Write Control	W	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	WRX (0)
6Ah	Vertical Scroll Control	W	1	0	0	0	0	0	0	0	VL8	VL7	VL6	VL5	VL4	VL3	VL2	VL1	VL0
80h	Partial Image 1 Display Position	W	1	0	0	0	0	0	0	0	PTDP08	PTDP07	PTDP06	PTDP05	PTDP04	PTDP03	PTDP02	PTDP01	PTDP00
81h	Partial Image 1 Area (Start Line)	W	1	0	0	0	0	0	0	0	PTSA08	PTSA07	PTSA06	PTSA05	PTSA04	PTSA03	PTSA02	PTSA01	PTSA00
82h	Partial Image 1 Area (End Line)	W	1	0	0	0	0	0	0	0	PTEA08	PTEA07	PTEA06	PTEA05	PTEA04	PTEA03	PTEA02	PTEA01	PTEA00
83h	Partial Image 2 Display Position	W	1	0	0	0	0	0	0	0	PTDP18	PTDP17	PTDP16	PTDP15	PTDP14	PTDP13	PTDP12	PTDP11	PTDP10
84h	Partial Image 2 Area (Start Line)	W	1	0	0	0	0	0	0	0	PTSA18	PTSA17	PTSA16	PTSA15	PTSA14	PTSA13	PTSA12	PTSA11	PTSA10
85h	Partial Image 2 Area (End Line)	W	1	0	0	0	0	0	0	0	PTEA18	PTEA17	PTEA16	PTEA15	PTEA14	PTEA13	PTEA12	PTEA11	PTEA10
90h	Panel Interface Control 1	W	1	0	0	0	0	0	0	DIVI1	DIVI0	0	0	0	RTNI4	RTNI3	RTNI2	RTNI1	RTNI0
92h	Panel Interface Control 2	W	1	0	0	0	0	0	NOWI2	NOWI1	NOWI0	0	0	0	0	0	0	0	0
95h	Panel Interface Control 4	W	1	0	0	0	0	0	0	DIVE1	DIVE0	0	0	0	0	0	0	0	0
97h	Panel Interface Control 5	W	1	0	0	0	0	NOWE3	NOWE2	NOWE1	NOWE0	0	0	0	0	0	0	0	0
A1h	OTP VCM Programming Control	W	1	0	0	0	0	OTP_ PGM_EN	0	0	0	0	0	VCM_ OTP5	VCM_ OTP4	VCM_ OTP3	VCM_ OTP2	VCM_ OTP1	VCM_ OTP0
A2h	OTP VCM Status and Enable	W	1	PCM_ CNT1	PCM_ CNT0	VCM_ D5	VCM_ D4	VCM_ D3	VCM_ D2	VCM_ D1	VCM_ D0	0	0	0	0	0	0	0	VCM_ EN
A5h	OTP Programming ID Key	W	1	KEY 15	KEY 14	KEY 13	KEY 12	KEY 11	KEY 10	KEY 9	KEY 8	KEY 7	KEY 6	KEY 5	KEY 4	KEY 3	KEY 2	KEY 1	KEY 0
B1h	Write Display Brightness	W	1	X	X	X	X	X	X	X	X	DBV7	DBV6	DBV5	DBV4	DBV3	DBV2	DBV1	DBV0
B2h	Read Display Brightness	R	1	X	X	X	X	X	X	X	X	DBV7	DBV6	DBV5	DBV4	DBV3	DBV2	DBV1	DBV0
B3h	Write CTRL Display value	W	1	X	X	X	X	X	X	X	X	X	X	BCTRL	X	DD	BL	X	X
B4h	Read CTRL Display value	R	1	X	X	X	X	X	X	X	X	X	X	BCTRL	X	DD	BL	X	X
B5h	Write Content Adaptive Brightness Control value	W	1	X	X	X	X	X	X	X	X	X	X	X	X	X	X	C[1:0]	
B6h	Read Content Adaptive Brightness Control value	R	1	X	X	X	X	X	X	X	X	X	X	X	X	X	X	C[1:0]	
BEh	Write CABC Minimum Brightness	W	1	X	X	X	X	X	X	X	X	CME[7:0]							
BFh	Read CABC Minimum Brightness	R	1	X	X	X	X	X	X	X	X	CME[7:0]							

No.	Registers Name	R/W	RS	D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0
C8h	CABC Control 1	W	1	X	X	X	X	X	X	X	X	PWM_DIV[7:0]							
C9h	CABC Control 2	W	1	X	X	X	X	X	X	X	X	THRES_MOV[3:0]				THRES_STILL[3:0]			
CAh	CABC Control 3	W	1	X	X	X	X	X	X	X	X	0	0	0	0	THRES_UI[3:0]			
CBh	CABC Control 4	W	1	X	X	X	X	X	X	X	X	DTH_MOV[3:0]				DTH_STILL[3:0]			
CCh	CABC Control 5	W	1	X	X	X	X	X	X	X	X	0	0	0	0	DTH_UI[3:0]			
CDh	CABC Control 6	W	1	X	X	X	X	X	X	X	X	DIM_OPT2[3:0]				0	DIM_OPT1[2:0]		
CEh	CABC Control 7	W	1	X	X	X	X	X	X	X	X	SCD_VLINE[9:0]							

9. BACKLIGHT PARAMETERS

9.1 ABSOLUTE MAXIMUM RATINGS

(Unless specified, The Ambient temperature Ta=25℃)

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

9.2 ELECTRICAL/OPTLCAL CHARACTERISTICS

(Unless specified, The Ambient temperature Ta=25℃)

Item	Symbol	min	typ	max	Unit	Condition
Forward Voltage	Vf	2.9	3.2	3.5	V	If=60mA
Luminance	Lv	3500			cd/m^2	If=60mA
color coordinate	X	0.26		0.30		If=60mA
	Y	0.26		0.30		

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:

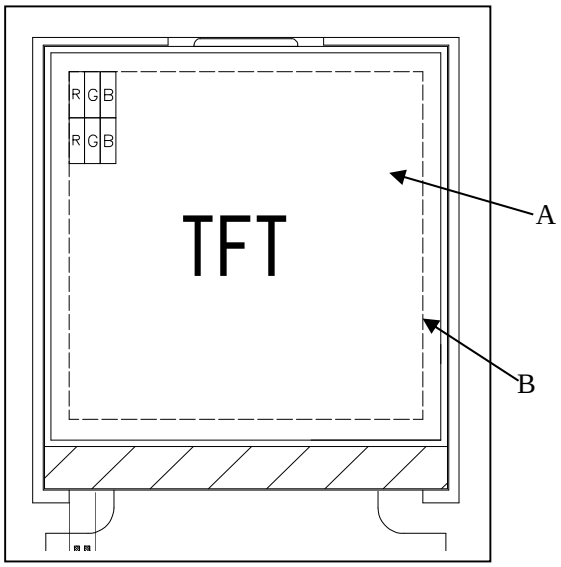
a. The test must be under a 40W fluorescent light, and the distance of view must be at 30~35 cm.

b. When test the model of transmissive product must add the reflective plate.

c. 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)

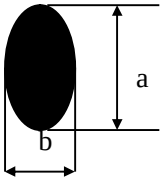


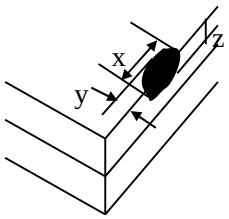
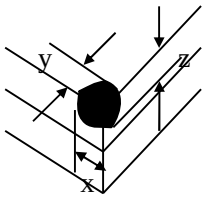
10.2.3 Basic principle:

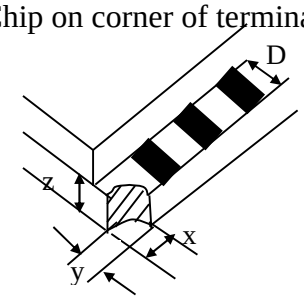
A. In principle the defect out of Area A should be acceptable if the defect does not affect assemblage and the quality of productions.
B. If defects that can not describe clearly, acceptable samples will be the standard.
C. The sample of the lowest acceptable quality level must be discussed by both supplier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

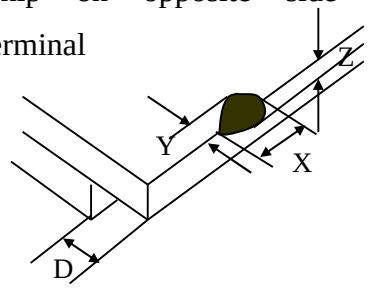
10.2.4 Standard of inspection

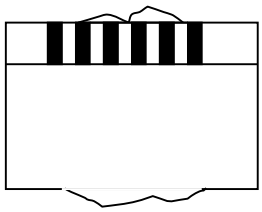
Defect	Inspect item		Criteria
1 Minor	Scratch and fold on polarizer. Scratch on glass. Glass fiber etc. （by bare eyes，defect outside A area is acceptable）		1) width ≤ 0.02 mm length ignore acceptable 2) 0.02 mm<width≤0.05 mm length≤3 mm two are acceptable 3) width>0.05 mm reject

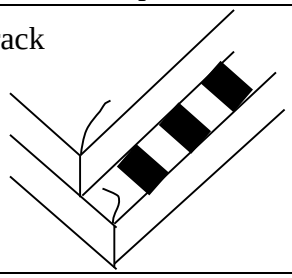
Defect	Inspect item		Criteria
2 Minor	Chip on glass(round type) Chip on polarizer(round type) Air bubble between polarizer and glass  Φ=(a + b)/2		Φ≤0.1mm acceptable 0.1<Φ≤0.2mm two are acceptable 1.The distance between any two dots should be more than 5mm. 2.Defect outside A area is acceptable. 3.If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

Defect	Inspect item		Criteria
3 Minor	Chip out  x: length y: width z: thickness		x≤3 mm z≤t y≤1/3 s reject t: glass thickness. S: distance between glass edge and inside of edge sealing
Defect	Inspect item		Criteria
4 Minor	Chip on corner of neat edge  X: length Y: width S: width of edge sealing		x≤3 mm y≤3 mm z≤t acceptable any chip exposes the silver dot reject

Defect	Inspect item		Criteria
5 Minor	Chip on corner of terminal edge  D: terminal length		x<0.3 mm or y<0.3 mm ignore x≤3 mm y<D two are acceptable

Defect	Inspect item		Criteria
6 Minor	Chip on opposite side of terminal 		a≥80mm，x≥7mm reject a<80mm， x>5mm 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

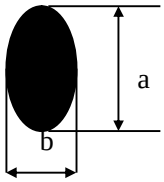
Defect	Inspect item		Criteria
16 Minor	The shape of pinouts is not the same as that in the criterion		It makes the LCM work badly reject

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 Φ=(a + b)/2 		1) Φ≤0.1 mm acceptable 2) 0.1<Φ≤0.3 mm three are acceptable 3) Φ>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 of30 ± 5 cm, 45 °

Defect	Inspect item		Criteria
24 Minor	Dirty on rear of touchpanel		It’s visible at condition of30 ± 5 cm, 45 °

10.3 RELIABILITY

Item	Condition	Criterion
High temperature operation	**70℃， 96 hrs**	**-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**
Low temperature operation	**-20℃， 96 hrs**	
Moisture storage	**60℃，90%RH, 96 hrs**	
High temperature storage	**80℃， 96 hrs**	
Low temperature storage	**-30℃， 96 hrs**	
Thermal shock	**-30℃ (30 minute)** **25℃ (5 minute)** **80℃ (30 minute)** **CYCLES: 10**	
LIFE TIME	**50,000 hours, 25±10℃, 45±20% RH**	

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 Electro-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℃+(-)10℃.
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 (Vo) to varies viewing angle and obtain the contrast.
2) Vo 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.

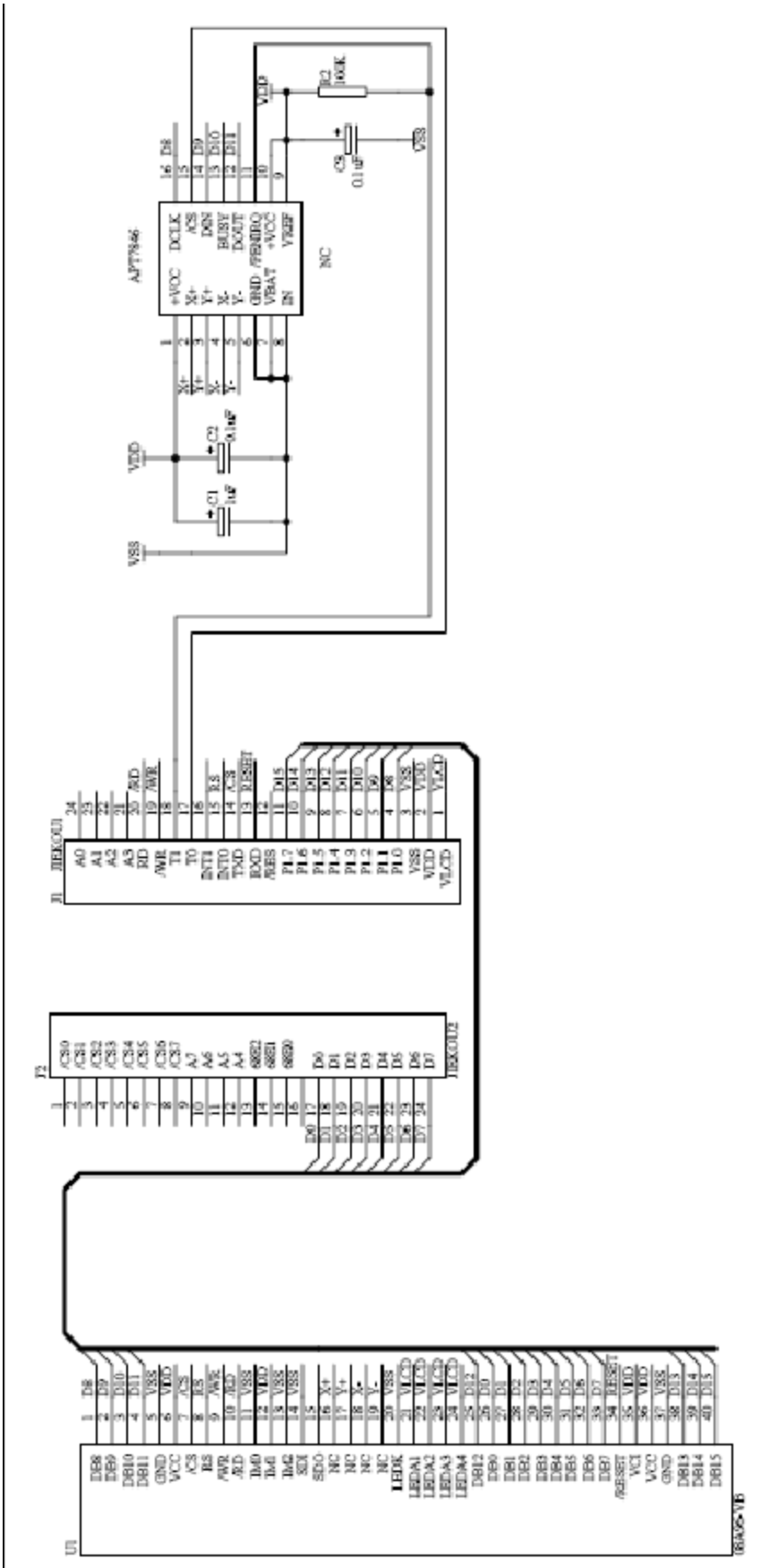
11.6 Storage

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℃~80℃ and at low humidity is recommended.

12. APPLICATION

12.1 REFERENCE CIRCUIT



12.2 APPENDIX

INITIALIZATION FOR REFERENCE (MPU: AT89C512):

```
//************* Start Initial Sequence **********
      LCD_CtrlWrite(0x00E3);LCD_DataWrite(0x3008);//Set internal timing
      delay(200);
      LCD_CtrlWrite(0x00E7);LCD_DataWrite(0x0012);//Set internal timing
      delay(200);
      LCD_CtrlWrite(0x00EF);LCD_DataWrite(0x1231);//Set internal timing
      delay(200);
     LCD_CtrlWrite(0x0001);LCD_DataWrite(0x0000);//Set SS and SM bit
      LCD_CtrlWrite(0x0002);LCD_DataWrite(0x0200);//LCD Driving Wave
        Control
      LCD_CtrlWrite(0x0003);LCD_DataWrite(0x0030);//set GRAM write direction
        and BGR
      LCD_CtrlWrite(0x0005);LCD_DataWrite(0x0000);//16bits Data Format
      Selection
      LCD_CtrlWrite(0x0008);LCD_DataWrite(0x0207);//set the back porch and
      front porch
      LCD_CtrlWrite(0x0009);LCD_DataWrite(0x0000);//set non-display area
      refresh cycle ISC[3:0]
      LCD_CtrlWrite(0x000A);LCD_DataWrite(0x0000);//FMARK function
      LCD_CtrlWrite(0x000C);LCD_DataWrite(0x0000);//RGB interface setting
      LCD_CtrlWrite(0x000D);LCD_DataWrite(0x0000);//Frame marker Position
      LCD_CtrlWrite(0x000F);LCD_DataWrite(0x0000);//RGB interface polarity

//*************Power On sequence ****************//
      LCD_CtrlWrite(0x0010);LCD_DataWrite(0x0000);//SAP, BT[3:0], AP, DSTB,
      SLP, STB
      LCD_CtrlWrite(0x0011);LCD_DataWrite(0x0007);//DC1[2:0], DC0[2:0],
      VC[2:0]
      LCD_CtrlWrite(0x0012);LCD_DataWrite(0x0000);//VREG1OUT voltage
      LCD_CtrlWrite(0x0013);LCD_DataWrite(0x0000);//VDV[4:0] for VCOM
      amplitude
      delay(400);
      LCD_CtrlWrite(0x0010);LCD_DataWrite(0x1290);//SAP, BT[3:0], AP, DSTB,
      SLP, STB
      delay(400);
      LCD_CtrlWrite(0x0011);LCD_DataWrite(0x0227);//DC1[2:0], DC0[2:0],
      VC[2:0]
      delay(400);
      LCD_CtrlWrite(0x0012);LCD_DataWrite(0x001B);//VREG1OUT voltage
      delay(400);
      LCD_CtrlWrite(0x0013);LCD_DataWrite(0x1700);//VDV[4:0] for VCOM
```

```
        amplitude
        LCD_CtrlWrite(0x0029);LCD_DataWrite(0x001E);//VCM[4:0] for VCOMH
       LCD_CtrlWrite(0x002B);LCD_DataWrite(0x000D);//Set Frame Rate
        delay(400);

//************************************************************************
******
        LCD_CtrlWrite(0x0020);LCD_DataWrite(0x0000);//GRAM horizontal Address
        LCD_CtrlWrite(0x0021);LCD_DataWrite(0x0000);//GRAM Vertical Address

// ----------- Adjust the Gamma Curve ----------//
        LCD_CtrlWrite(0x0030);LCD_DataWrite(0x0004);
        LCD_CtrlWrite(0x0031);LCD_DataWrite(0x0007);
        LCD_CtrlWrite(0x0032);LCD_DataWrite(0x0006);
        LCD_CtrlWrite(0x0035);LCD_DataWrite(0x0206);
        LCD_CtrlWrite(0x0036);LCD_DataWrite(0x0408);
        LCD_CtrlWrite(0x0037);LCD_DataWrite(0x0507);
        LCD_CtrlWrite(0x0038);LCD_DataWrite(0x0200);
        LCD_CtrlWrite(0x0039);LCD_DataWrite(0x0707);
        LCD_CtrlWrite(0x003C);LCD_DataWrite(0x0504);
        LCD_CtrlWrite(0x003D);LCD_DataWrite(0x0F02);

//------------------ Set GRAM area ---------------//
        LCD_CtrlWrite(0x0050);LCD_DataWrite(0x0000);//Horizontal GRAM Start
Address
        LCD_CtrlWrite(0x0051);LCD_DataWrite(0x00EF);//Horizontal GRAM End
Address
        LCD_CtrlWrite(0x0052);LCD_DataWrite(0x0000);//Vertical GRAM Start
Address
        LCD_CtrlWrite(0x0053);LCD_DataWrite(0x013F);//Vertical GRAM End
Address
        LCD_CtrlWrite(0x0060);LCD_DataWrite(0xA700);//Gate Scan Line
        LCD_CtrlWrite(0x0061);LCD_DataWrite(0x0001);//NDL,VLE,REV
        LCD_CtrlWrite(0x006A);LCD_DataWrite(0x0000);//Set scrolling line
        LCD_CtrlWrite(0x0066);LCD_DataWrite(0x0000);//SPI Read/Write Control

//--------------- Partial Display Control ---------//
        LCD_CtrlWrite(0x0080);LCD_DataWrite(0x0000);
        LCD_CtrlWrite(0x0081);LCD_DataWrite(0x0000);
        LCD_CtrlWrite(0x0082);LCD_DataWrite(0x0000);
        LCD_CtrlWrite(0x0083);LCD_DataWrite(0x0000);
        LCD_CtrlWrite(0x0084);LCD_DataWrite(0x0000);
        LCD_CtrlWrite(0x0085);LCD_DataWrite(0x0000);
```

```
//--------------- Panel Control --------------------//
        LCD_CtrlWrite(0x0090);LCD_DataWrite(0x0010);
        LCD_CtrlWrite(0x0092);LCD_DataWrite(0x0600);

        LCD_CtrlWrite(0x0007);LCD_DataWrite(0x0133);//Display ON
        delay(400);

}
```