

**Display Elektronik GmbH**

# DATA SHEET

**LCD MODULE**

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

**2,6'' TFT with Touch-Panel**

*Product Specification*

*Ver.: 0*

**15.02.2011**

Revise Records

Rev.	Date	Contents	Written	Approved
0	15.02.2011	Preliminary Specification	CL	MH

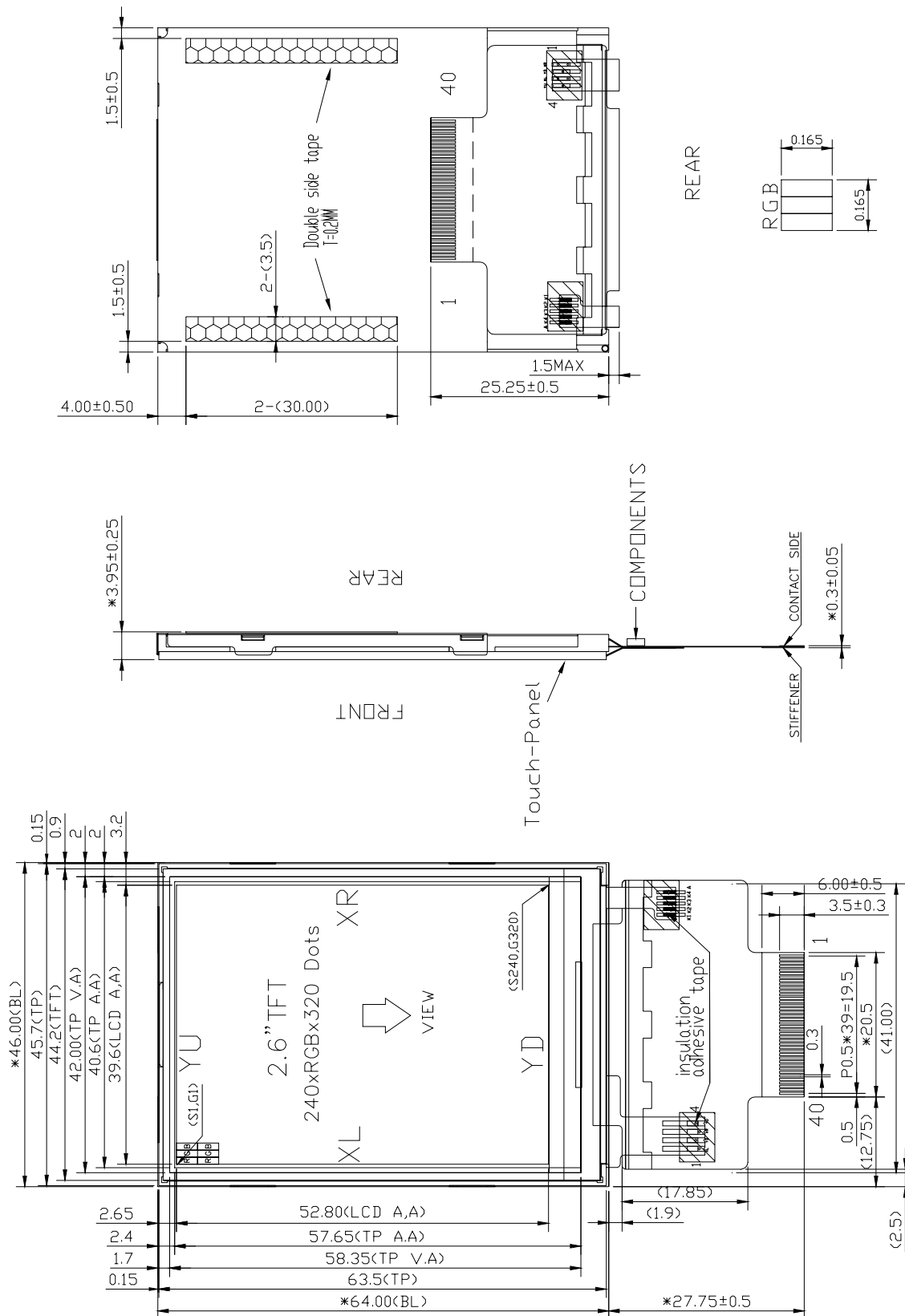
Special Notes

Note1.	
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## 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:	R61580 (RENESAS)
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

**3. MECHANICAL SPECIFICATIONS**

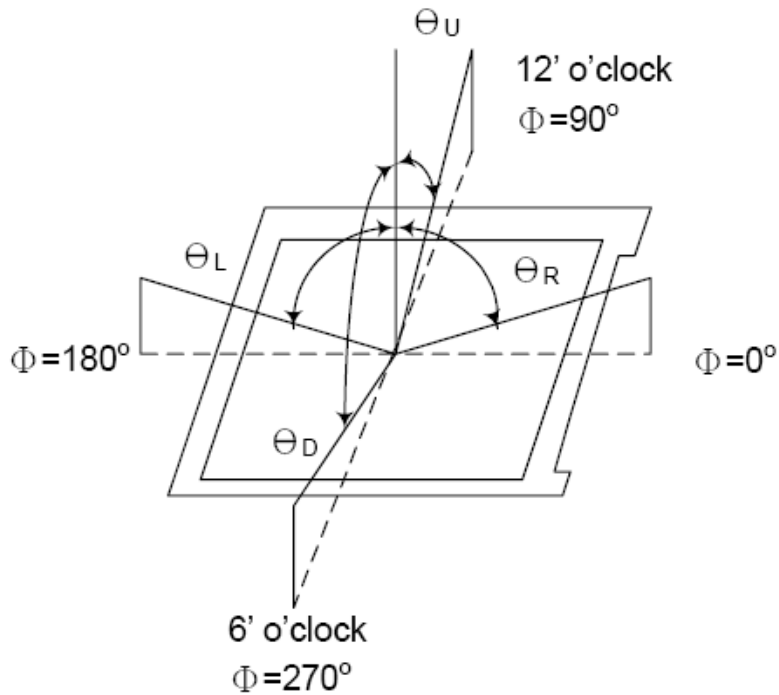
ITEM	CONTENT	UNIT
PIXEL'S NUMBER	240*320	PIXEL
MODULE DIMENSION	46.0(w)*91.75(h)*3.95(t)	mm
ACTIVE AREA	39.6(w)*52.8(h)	mm
PIXEL SIZE	0.165(w)*0.165(h)	mm

**4. ELECTRO-OPTICAL CHARACTERISTICS**

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Transmittance (without Polarizer)		T(%)	—	—	14.7	—	—	
Contrast Ratio		CR	$\Theta=0$ Normal viewing angle	400	500	—	—	(1)(2)
Response time	Rising	T <sub>R</sub>		—	2	4	msec	(1)(3)
	Falling	T <sub>F</sub>		—	6	12		
Color gamut		S(%)			60		%	
Color chromaticity (CIE1931)	White	W <sub>x</sub>		0.288	0.308	0.328		(1)(4) CF glass (C-light)
		W <sub>y</sub>		0.305	0.325	0.345		
	Red	R <sub>x</sub>		0.610	0.630	0.650		
		R <sub>y</sub>		0.317	0.337	0.357		
	Green	G <sub>x</sub>		0.264	0.284	0.304		
		G <sub>y</sub>		0.523	0.543	0.563		
	Blue	B <sub>x</sub>		0.123	0.143	0.163		
		B <sub>y</sub>		0.100	0.120	0.140		
Viewing angle	Hor.	$\Theta_L$	CR>10	35	45	—		
		$\Theta_R$		35	45	—		
	Ver.	$\Theta_U$		35	45	—		
		$\Theta_D$		10	20	—		
Optima View Direction		12 O'clock						(5)

## Measuring Equipment

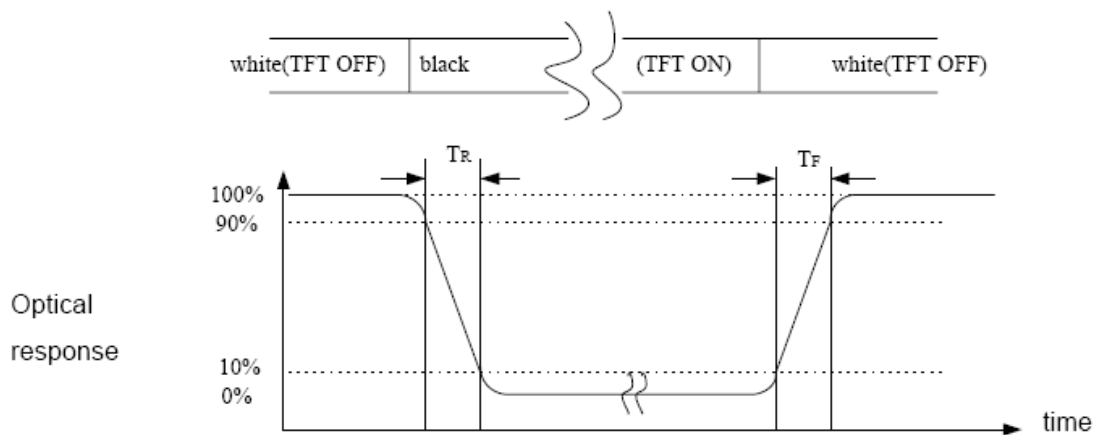
Note (1) Definition of Viewing Angle :

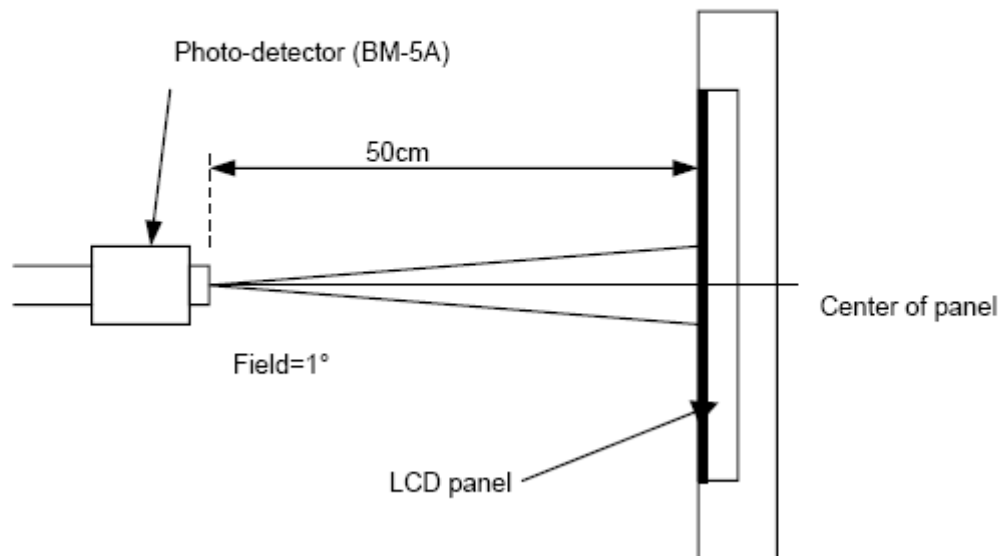


Note (2) Definition of Contrast Ratio(CR) :  
measured at the center point of panel

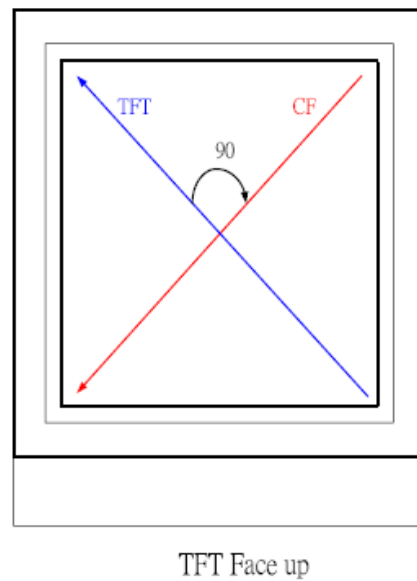
$$CR = \frac{\text{Luminance with all pixels white}}{\text{Luminance with all pixels black}}$$

Note (3) Definition of Response Time : Sum of  $T_R$  and  $T_F$



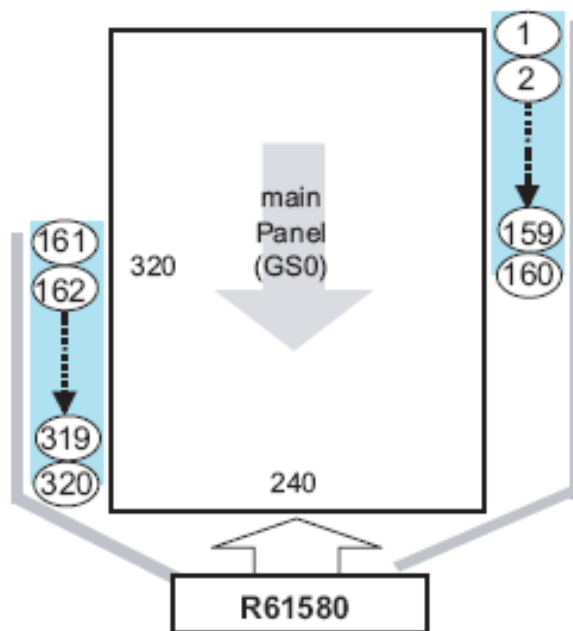
**Note (4) Definition of optical measurement setup**

**Note (5) Rubbing Direction** (The different Rubbing Direction will cause the different optima view direction).





## 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	$T_{op}$	-20	+70	°C
Storage Temperature	$T_{st}$	-30	+80	°C

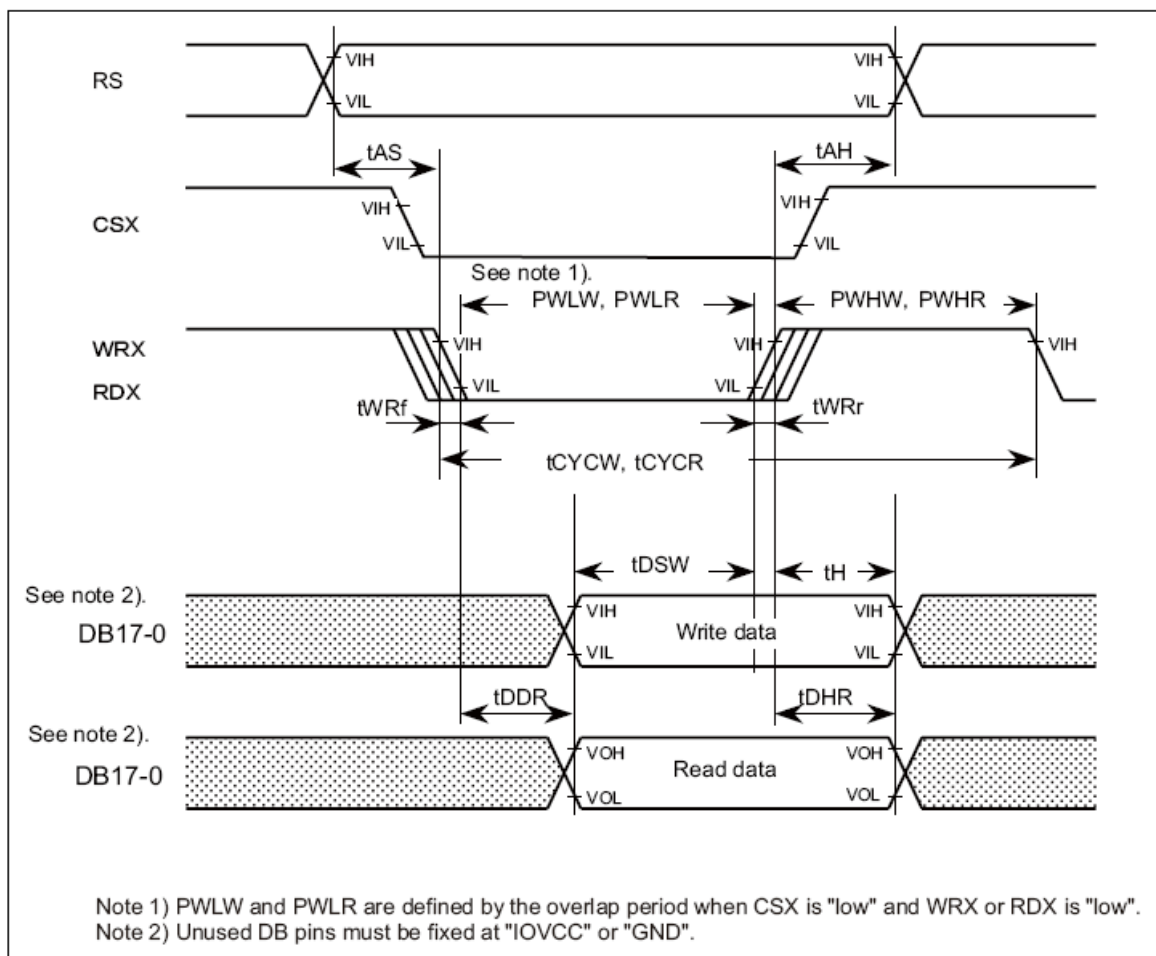
## 6.2. DC CHARACTERISTICS

DC Characteristics 1 (VCC= 2.50V~3.30V, IOVCC=1.65V~3.30V, Ta=-40C~+85C)

Item	Symbol	Unit	Test Condition	Min.	Typ.	Max.	Note
Input "High" level voltage 1 Except RESETX pin	V <sub>IH1</sub>	V	IOVCC=1.65V~3.30V	0.80 × IOVCC	—	IOVCC	2, 3
Input "Low" level voltage 1 Except RESETX pin	V <sub>IL1</sub>	V	IOVCC=1.65V~3.30V	-0.3	—	0.20 × IOVCC	2, 3
Input "High" level voltage 2 RESETX pin	V <sub>IH2</sub>	V	IOVCC=1.65V~3.30V	0.90 × IOVCC	—	IOVCC	2, 3
Input "Low" level voltage 2 RESETX pin	V <sub>IL2</sub>	V	IOVCC=1.65V~3.30V	-0.3	—	0.10 × IOVCC	2, 3
Output "High" level voltage 1 (DB0-17, FMARK)	V <sub>OH</sub>	V	IOVCC=1.65V~3.30V, IOH=-0.1mA	0.8 × IOVCC	—	—	2
Output "Low" level voltage 1 (DB0-17, FMARK)	V <sub>OL</sub>	V	IOVCC=1.65V~3.30V, IOL=0.1mA	—	—	0.20 × IOVCC	2
Input/Output leakage current	I <sub>LI</sub>	μA	Vin=0~IOVCC	-1	—	1	4
Current consumption ((IOVCC-GND) + (VCC-GND)) Normal operation (260-k color, display operation)	I <sub>OP1</sub>	mA	fosc=678kHz (320 line drive), IOVCC=VCC=3.00V, fFLM=70Hz, Ta=25°C, Frame memory data: 18'h000000, BLCON=0, See below for other information	—	0.6	TBD	5
Current consumption ((IOVCC-GND) + (VCC-GND)) Normal operation (260-k color, display operation), BLC ON	I <sub>OP1</sub>	mA	fosc=678kHz (320 line drive), IOVCC=VCC=3.00V, fFLM=70Hz, Ta=25°C, Frame memory data: 18'h000000, BLCON=1, See below for other information	—	0.8	TBD	5
Current consumption ((IOVCC-GND) + (VCC-GND)) 8-color mode (64 line partial display operation)	I <sub>OP2</sub>	μA	fosc=678kHz (64 line partial display operation), IOVCC=VCC=3.00V, fFLM=40Hz, Ta=25°C, Frame memory data: 18'h000000, BLCON=0, See below for other information	—	140	—	5
Current consumption ((IOVCC-GND) + (VCC-GND)) Deep standby mode	I <sub>DST</sub>	μA	IOVCC=VCC=3.00V, Ta=25°C	—	0.1	TBD	5

**DC Characteristics 2: Step-up circuit characteristics**

Item		Unit	Test condition	Min.	Typ.	Max.	Note
Step-up output voltage	DDVDH	V	IOVCC=VCC=2.8V, VCI=2.8V, Ta=25°C, VC=3'h1, BT=3'h4, AP=2'h3, DC0=3'h3, DC1=3'h2, C11=C12=C13=C21=C22=1[uF]/B characteristics, DDVDH=VGH=VGL=VCL=1[uF]/B characteristics, No load on the panel, Iload1=-3 [mA]	4.8	5.1	-	
	VGH	V	IOVCC=VCC=2.8V, VCI=2.8V, Ta=25°C, VC=3'h1, BT=3'h4, AP=2'h3, DC0=3'h3, DC1=3'h2, C11=C12=C13=C21=C22=1[uF]/B characteristics, DDVDH=VGH=VGL=VCL=1[uF]/B characteristics, Iload2=-100[uA], No load on the panel	14.4	15.1	-	
	VGL	V	IOVCC=VCC=2.8V, VCI=2.8V, Ta=25°C, VC=3'h1, BT=3'h4, AP=2'h3, DC0=3'h3, DC1=3'h2, C11=C12=C13=C21=C22=1[uF]/B characteristics, DDVDH=VGH=VGL=VCL=1[uF]/B characteristics, Iload3=+100[uA], No load on the panel	-	-10.0	-9.6	
	VCL	V	IOVCC=VCC=2.8V, VCI=2.8V, Ta=25°C, VC=3'h1, BT=3'h4, AP=2'h3, DC0=3'h3, DC1=3'h2, C11=C12=C13=C21=C22=1[uF]/B characteristics, DDVDH=VGH=VGL=VCL=1[uF]/B characteristics, Iload4=+200[uA], No load on the panel	-	-2.55	-2.4	

**6.3 TIMING CHARACTERISTICS****80-System Bus Interface**

## 80-System Bus Interface Timing Characteristics (9-/8-bit Interface)

Table 104 (IOVCC=1.65V ~ 3.30V) (T.B.D.)

Item		Symbol	Unit	Timing Diagram	Min.	Typ.	Max.
Bus cycle time	Write	tcycw	ns	Figure A	70	—	—
	Read	tcycr	ns	Figure A	450	—	—
Write low-level pulse width		PWLW	ns	Figure A	30	—	—
Read low-level pulse width		PWLR	ns	Figure A	170	—	—
Write high-level pulse width		PWHW	ns	Figure A	25	—	—
Read high-level pulse width		PWHR	ns	Figure A	250	—	—
Write / Read rise/ fall time		tWRr, WRf	ns	Figure A	—	—	25
Setup time	Write (RS to CSX, WRX)	tAS	ns	Figure A	0	—	—
	Read (RS to CSX, RDX)		ns	Figure A	10	—	—
Address hold time		tAH	ns	Figure A	2	—	—
Write data setup time		tDSW	ns	Figure A	25	—	—
Write data hold time		tH	ns	Figure A	10	—	—
Read data delay time		tDDR	ns	Figure A	—	—	150
Read data hold time		tDHR	ns	Figure A	5	—	—

Note: The above values are target values. They are subject to change.

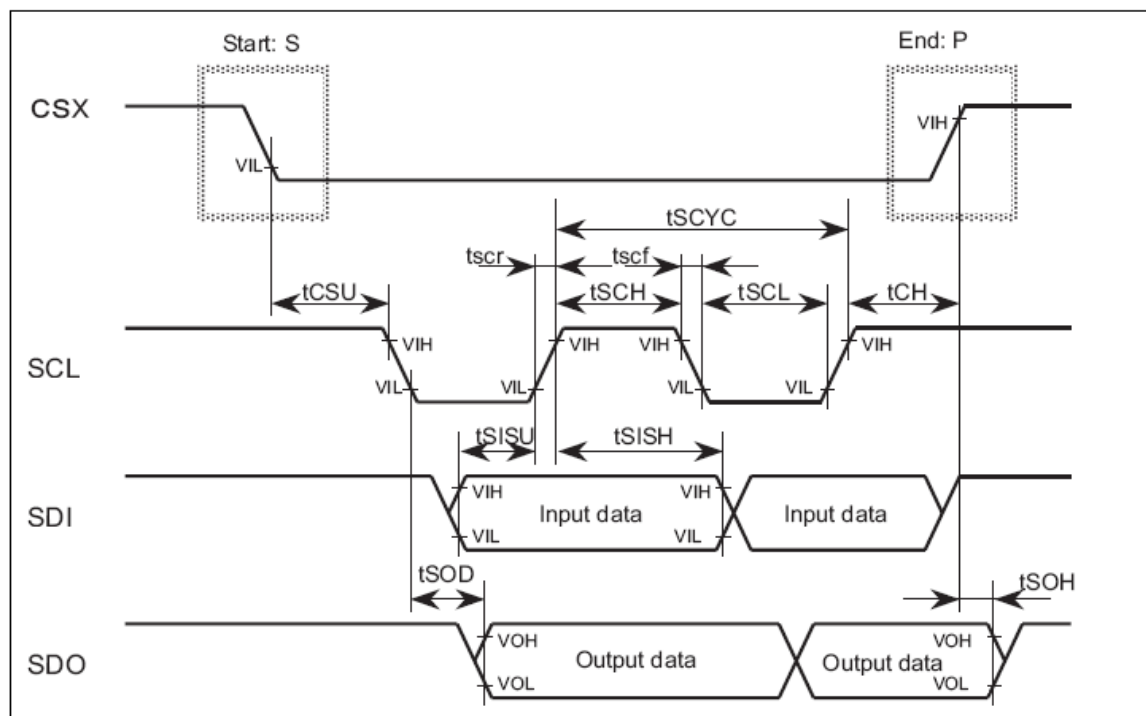
## 80-System Bus Interface Timing Characteristics (18-/16-bit Interface)

Table 103 (IOVCC=1.65V ~ 3.30V) (T.B.D.)

Item		Symbol	Unit	Timing Diagram	Min.	Typ.	Max.
Bus cycle time	Write	tcycw	ns	Figure A	75	-	-
	Read	tcycr	ns	Figure A	450	-	-
Write low-level pulse width		PWLW	ns	Figure A	40	-	-
Read low-level pulse width		PWLR	ns	Figure A	170	-	-
Write high-level pulse width		PWHW	ns	Figure A	25	-	-
Read high-level pulse width		PWHR	ns	Figure A	250	-	-
Write / Read rise/ fall time		tWRr, WRf	ns	Figure A	-	-	25
Setup time	Write (RS to CSX, WRX)	tAS	ns	Figure A	0	-	-
	Read (RS to CSX, RDX)		ns	Figure A	10	-	-
Address hold time		tAH	ns	Figure A	2	-	-
Write data setup time		tDSW	ns	Figure A	25	-	-
Write data hold time		tH	ns	Figure A	10	-	-
Read data delay time		tDDR	ns	Figure A	-	-	150
Read data hold time		tDHR	ns	Figure A	5	-	-

Note: The above values are target values. They are subject to change.

## Clock Synchronous Serial Interface



### Clock Synchronous Serial Interface Timing Characteristics

Table 105 (IOVCC=1.65V ~ 3.30V) (T.B.D.)

Item		Symbol	Unit	Timing Diagram	Min.	Typ.	Max.
Serial clock cycle time	Write (receive)	tscyc	ns	Figure B	100	—	20,000
	Read (transmit)	tscyc	ns	Figure B	350	—	20,000
Serial clock high-level width	Write (receive)	tsch	ns	Figure B	40	—	—
	Read (transmit)	tsch	ns	Figure B	150	—	—
Serial clock low-level width	Write (receive)	tscl	ns	Figure B	40	—	—
	Read (transmit)	tscl	ns	Figure B	150	—	—
Serial clock rise/fall time		tscr, tscf	ns	Figure B	—	—	20
Chip select setup time		tcsu	ns	Figure B	20	—	—
Chip select hold time		tch	ns	Figure B	60	—	—
Serial input data setup time		tsisu	ns	Figure B	30	—	—
Serial input data hold time		tsish	ns	Figure B	30	—	—
Serial output data delay time		tsod	ns	Figure B	—	—	130
Serial output data hold time		tsoh	ns	Figure B	5	—	—

Note: The above values are target values. They are subject to change.

**7. PIN DESCRIPTION**

Pin No.	Symbol	Description																				
1	NC	NC																				
2	LEDA	Backlight LED anode																				
3	LEDK1	Backlight LED cathode(K1)																				
4	LEDK2	Backlight LED cathode(K2)																				
5	LEDK3	Backlight LED cathode(K3)																				
6	LEDK4	Backlight LED cathode(K4)																				
7	IMO	<table><tr><th colspan="4">Select the MPU system interface mode</th></tr><tr><th></th><th>8bit DB[17:10]</th><th>16bit DB[17:10],DB[8:1]</th><th>SPI</th></tr><tr><td>IM0</td><td>1</td><td>0</td><td>0</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>	Select the MPU system interface mode					8bit DB[17:10]	16bit DB[17:10],DB[8:1]	SPI	IM0	1	0	0	IM1	1	1	0	IM2	0	0	1
Select the MPU system interface mode																						
	8bit DB[17:10]		16bit DB[17:10],DB[8:1]	SPI																		
IM0	1		0	0																		
IM1	1	1	0																			
IM2	0	0	1																			
8	IM1																					
9	IM2																					
10	/RESET	L: initialization is executed																				
11-18	DB[17:10]	Data bus																				
19-26	DB[8:1]	Data bus																				
27	SDO	SPI interface output pin																				
28	SDI	SPI interface input pin																				
29	/RD	180 system:Serves as a read signal and reads data at the low level																				
30	/WR/SCL	180 system:Serves as a write signal and writes data at the rising edge SPI Mode:Synchronizing clock signal in SPI mode																				
31	RS	L: Command;H: display data																				
32	/CS	L: Chip Selected H: Chip Unselected																				
33	VCC	I/O interface supply voltage																				
34	GND	Ground																				
35	VCI	Analog power supply voltage																				
36	XR	touch panel output pin.(Touch screen X coordinate right XR)																				
37	YD	touch panel output pin.(Touch screen Y coordinate down YD)																				
38	XL	touch panel output pin.(Touch screen X coordinate left XL)																				
39	YU	touch panel output pin.(Touch screen Y coordinate up YU)																				
40	NC	NC																				

## 8. INSTRUCTION DESCRIPTION

● R61580 Instruction List

Major category	Minor category	Index	IB15	IB14	IB13	IB12	IB11	IB10	IB9	IB8	Lower Code							Note
			ALMB10	ALMB10	ALMB10	ALMB10	ALMB10	ALMB10	ALMB10	ALMB10	IB7	IB6	IB5	IB4	IB3	IB2	IB1	IB0
1*	Display Control	00h	Device Code Read (Default)	0	0	0	0	0	0	0	ALMB10	ALMB10	ALMB10	ALMB10	ALMB10	ALMB10	ALMB10	0
		01h	Driver Output Control (Default)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		02h	LCD Driver Write Control (Default)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		03h	Entry Mode (Default)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		07h	Display Control 1 (Default)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		08h	Display Control 2 (Default)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		09h	Display Control 3 (Default)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0Ah	Display Control 4 (Default)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0Ch	External Display Interface Control 1 (Default)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0Dh	Frame Marker Position (Default)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2*	Frame Memory Access Control	0Eh	VCOM Low Power Control (Default)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0Fh	External Display Interface Control 2 (Default)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		10h	Power Control 1 (Default)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		11h	Power Control 2 (Default)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		12h	Power Control 3 (Default)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		13h	Power Control 4 (Default)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		20h	Frame Memory Address Set (Increment Address) (Default)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		21h	Frame Memory Address Set (Vector Address) (Default)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		22h	Frame Memory Data Write/Read (Default)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3*	Gamma Control	28h	NVM Data Read 1 (Default)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		29h	NVM Data Read 2 (Default)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		2Ah	NVM Data Read 3 (Default)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		30h	Gamma Control 1 (Default)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		31h	Gamma Control 2 (Default)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		32h	Gamma Control 3 (Default)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		33h	Gamma Control 4 (Default)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		34h	Gamma Control 5 (Default)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		35h	Gamma Control 6 (Default)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		36h	Gamma Control 7 (Default)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5*	Window Address Control	37h	Gamma Control 8 (Default)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		38h	Gamma Control 9 (Default)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		39h	Gamma Control 10 (Default)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		50h	Window Address Control (Default)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		51h	Window Address Control (Default)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		52h	Window Address Control (Default)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		53h	Window Address Control (Default)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		54h	Window Address Control (Default)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		55h	Window Address Control (Default)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		56h	Window Address Control (Default)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6*	Base Image Display Control	60h	Base Image Display Control (Default)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		61h	Base Image Display Control (Default)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		62h	Base Image Display Control (Default)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		63h	Base Image Display Control (Default)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		64h	Base Image Display Control (Default)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		65h	Base Image Display Control (Default)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		66h	Base Image Display Control (Default)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		67h	Base Image Display Control (Default)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		68h	Base Image Display Control (Default)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		69h	Base Image Display Control (Default)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8*	Partial Display Control	80h	Partial Display Control (Default)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		81h	Partial Display Control (Default)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		82h	Partial Display Control (Default)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		83h	Partial Display Control (Default)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		84h	Partial Display Control (Default)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		85h	Partial Display Control (Default)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		86h	Partial Display Control (Default)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		87h	Partial Display Control (Default)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		88h	Partial Display Control (Default)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		89h	Partial Display Control (Default)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0



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## **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	3.0	3.2	3.4	V	If=60mA
Luminance	Lv	3000			cd/m <sup>2</sup>	If=60mA
color coordinate	X	0.26		0.30		If=60 mA
	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

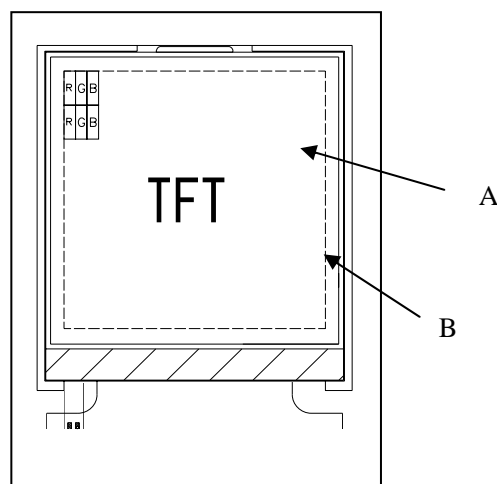
#### 10.2.1 Manner of appearance test:

- 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 VA)

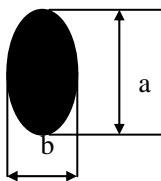


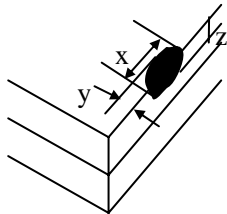
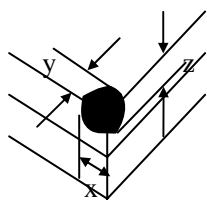
#### 10.2.3 Basic principle:

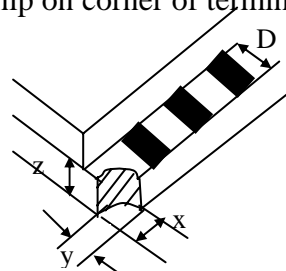
- In principle the defect out of Area A should be acceptable if the defect does not affect assemblage and the quality of productions.
- If defects that can not describe clearly, acceptable samples will be the standard.
- The sample of the lowest acceptable quality level must be discussed by both supplier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

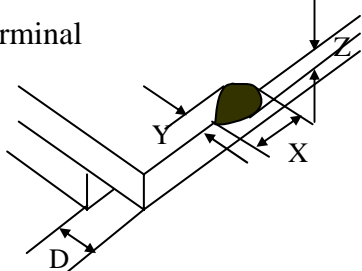
**10.2.4 Standard of inspection**

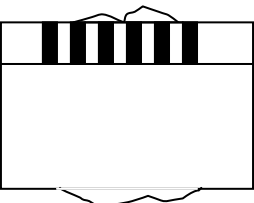
Defect	Inspect item	Criteria
1 Minor	Scratch and fold on polarizer. Scratch on glass. Glass fiber etc. ( by bare eyes , defect outside A area is acceptable )	1) width $\leq$ 0.02 mm length ignore acceptable 2) 0.02 mm<width $\leq$ 0.05 mm length $\leq$ 3 mm two are acceptable 3) width>0.05 mm reject

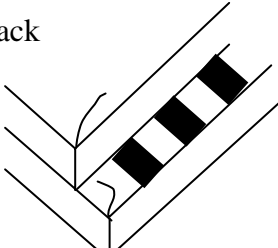
Defect	Inspect item	Criteria
2 Minor	Chip on glass(round type) Chip on polarizer(round type) Air bubble between polarizer and glass  $\Phi=(a + b)/2$	$\Phi\leq 0.1\text{mm}$ acceptable $0.1<\Phi\leq 0.2\text{mm}$ two are acceptable 1.The distance between any two dots should be more than 5mm. 2.Defect 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	Chip out  x: length y: width z: thickness	$x \leq 3 \text{ mm}$ $z \leq t$ $y \leq 1/3 s$ reject t: glass thickness. S: distance between glass edge and inside of edge sealing
Minor	Chip on corner of neat edge  X: length      Y: width S: width of edge sealing	$x \leq 3 \text{ mm}$ $y \leq 3 \text{ mm}$ $z \leq t$  acceptable any chip exposes the silver dot   reject

Defect	Inspect item	Criteria
5 Minor	Chip on corner of terminal edge  D: terminal length	$x < 0.3 \text{ mm}$ or $y < 0.3 \text{ mm}$ ignore $x \leq 3 \text{ mm}$ $y < D$ two are acceptable

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

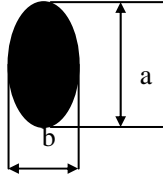
Defect	Inspect item	Criteria
16 Minor	The shape of pinouts is not the same as that in the criterion	It makes the LCM work badly reject

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 $\leq$ 0.02 mm                      acceptable 2) 0.02 mm<width $\leq$ 0.05 mm length $\leq$ 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, $45^\circ$

Defect	Inspect item	Criteria
24 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)</b> <b>-Contrast ratio change over 50% of initial value should not be happened</b> <b>-The current consumption should be below double of initial value</b> <b>-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)</b> <b>25°C (5 minute)</b> <b>80°C (30 minute)</b> <b>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 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  $280^{\circ}\text{C}+(-)10^{\circ}\text{C}$ .
- 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 through 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.

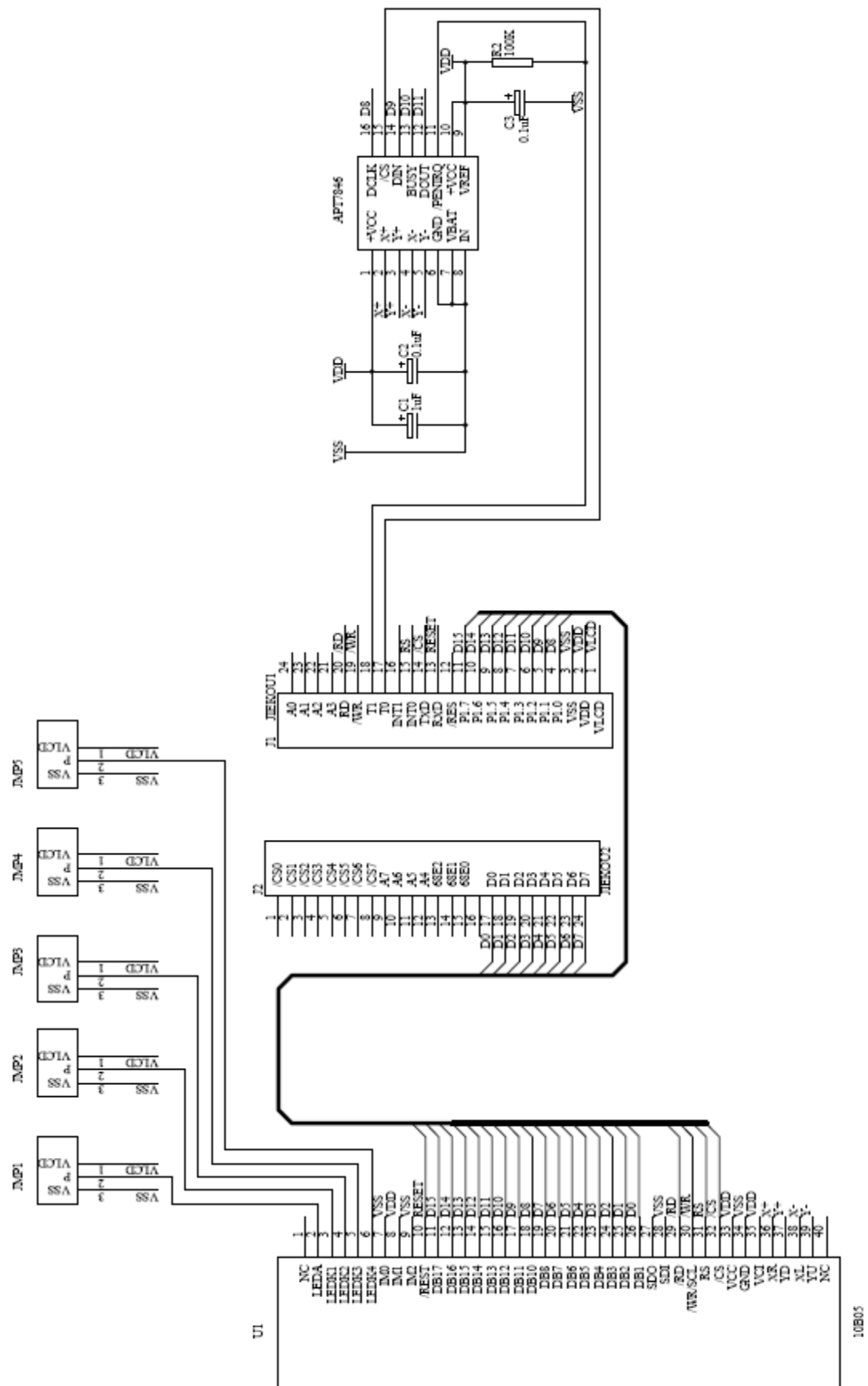
**11.6 Storage**

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 (MPU: AT89C512):

```
void LCD_Init()
{
LCD_CtrlWrite(0x00);LCD_DataWrite(0x0000);
LCD_CtrlWrite(0x00);LCD_DataWrite(0x0000);
delay(100);
LCD_CtrlWrite(0x00);LCD_DataWrite(0x0000);
LCD_CtrlWrite(0x00);LCD_DataWrite(0x0000);
LCD_CtrlWrite(0x00);LCD_DataWrite(0x0000);
LCD_CtrlWrite(0x00);LCD_DataWrite(0x0000);
LCD_CtrlWrite(0xA4);LCD_DataWrite(0x0001);
delay(100);
LCD_CtrlWrite(0x60);LCD_DataWrite(0xA700);
LCD_CtrlWrite(0x08);LCD_DataWrite(0x0808);
/*****/
//Gamma Setting:
LCD_CtrlWrite(0x30);LCD_DataWrite(0x0203);
LCD_CtrlWrite(0x31);LCD_DataWrite(0x080F);
LCD_CtrlWrite(0x32);LCD_DataWrite(0x0401);
LCD_CtrlWrite(0x33);LCD_DataWrite(0x050B);
LCD_CtrlWrite(0x34);LCD_DataWrite(0x3330);
LCD_CtrlWrite(0x35);LCD_DataWrite(0x0B05);
LCD_CtrlWrite(0x36);LCD_DataWrite(0x0005);
LCD_CtrlWrite(0x37);LCD_DataWrite(0x0F08);
LCD_CtrlWrite(0x38);LCD_DataWrite(0x0302);
LCD_CtrlWrite(0x39);LCD_DataWrite(0x3033);
/*****/
//Power Setting:
LCD_CtrlWrite(0x90);LCD_DataWrite(0x0018);//80Hz
LCD_CtrlWrite(0x10);LCD_DataWrite(0x0530);//BT,AP
LCD_CtrlWrite(0x11);LCD_DataWrite(0x0237);//DC1,DC0,VC
LCD_CtrlWrite(0x12);LCD_DataWrite(0x01BF);
LCD_CtrlWrite(0x13);LCD_DataWrite(0x1000);//VCOM
delay(200);
/*****/
LCD_CtrlWrite(0x01);LCD_DataWrite(0x0100);
LCD_CtrlWrite(0x02);LCD_DataWrite(0x0200);
LCD_CtrlWrite(0x03);LCD_DataWrite(0x1030);
LCD_CtrlWrite(0x09);LCD_DataWrite(0x0001);
LCD_CtrlWrite(0x0A);LCD_DataWrite(0x0008);
LCD_CtrlWrite(0x0C);LCD_DataWrite(0x0000);
LCD_CtrlWrite(0x0D);LCD_DataWrite(0xD000);
```

```
LCD_CtrlWrite(0x0E);LCD_DataWrite(0x0030);
LCD_CtrlWrite(0x0F);LCD_DataWrite(0x0000);
LCD_CtrlWrite(0x20);LCD_DataWrite(0x0000);//H Start
LCD_CtrlWrite(0x21);LCD_DataWrite(0x0000);//V Start
LCD_CtrlWrite(0x29);LCD_DataWrite(0x002E);
LCD_CtrlWrite(0x50);LCD_DataWrite(0x0000);
LCD_CtrlWrite(0x51);LCD_DataWrite(0x00EF);
LCD_CtrlWrite(0x52);LCD_DataWrite(0x0000);
LCD_CtrlWrite(0x53);LCD_DataWrite(0x013F);
LCD_CtrlWrite(0x61);LCD_DataWrite(0x0001);
LCD_CtrlWrite(0x6A);LCD_DataWrite(0x0000);
LCD_CtrlWrite(0x80);LCD_DataWrite(0x0000);
LCD_CtrlWrite(0x81);LCD_DataWrite(0x0000);
LCD_CtrlWrite(0x82);LCD_DataWrite(0x005F);
LCD_CtrlWrite(0x93);LCD_DataWrite(0x0701);
/*****/
LCD_CtrlWrite(0x07);LCD_DataWrite(0x0100);
delay(100);
}
```