



WANXIN IMAGE
INCORPORATION

Product Specifications

1.77" TFT-LCD Module
Model No. : WXCAT17-MS3#001

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Records of Version

Version	Revise Date	Page	Content
1.0	2007-03-01	all	New released



1 General Description

WXCAT17-MS3#001 is a transmissive type a-Si TFT-LCD (amorphous silicon thin film transistor liquid crystal display) module which is composed of a TFT-LCD panel, a driver circuit and a backlight unit. The panel size is 1.77 inch and the resolution is 128×160. The panel can display up to 65K colors and is suitable for cell phone application.

1.1 Features

- ◆ High image quality a-Si TFT LCD module.
- ◆ 65,536 color number.
- ◆ 80-system 8-bit bus CPU Interface.
- ◆ High-speed RAM write function is available.
- ◆ Partial-screen display function is available.
- ◆ Sleep and Stand-by modes are available for power saving.
- ◆ High contrast, high brightness.
- ◆ Light weight, slim design.
- ◆ Low power consumption.

1.2 Application

- ◆ Mobile phone
- ◆ MP3, MP4 player



1.3 General Specification

No	Item	Specification	Remark
1	Type	Transmissive	
2	Display Mode	Normally White	
3	Pixel Element	a-Si TFT	
4	Screen Size	1.77 inch (diagonal)	
5	Resolution	128(RGB)×160	
6	Color Number	65536	
7	Active Area	28.032×35.04 (mm)	
8	Dot Pitch	73×219 (μm)	
9	Color Arrangement	RGB-stripe	
10	Assembly Type	COG	
11	Back Light	LED	
12	Viewing Direction	12 o'clock	
13	Module Dimension	34.0mm×45.83mm×2.6mm	Including double-side tape
14	Power Supply	2.5~3.3 V	
15	Interface	80-system 8-bit	
16	Surface Treatment	UV Cut	



2 Absolute Maximum Ratings

2.1 Electrical Absolute Maximum Ratings

2.1.1 TFT-LCD Panel Absolute Maximum Ratings

Ta=25°C GND=0V

Item	Symbol	Condition	Standard Value		Unit	Remark
			Min	Max		
Input power supply voltage	Vcc	GND=0V	-0.3	4.6	V	Logic
	Vci	GND=0V	-0.3	4.6	V	Analog

- If the LSI is used above these absolute maximum ratings, it may become permanently damaged. Using the LSI within the following electrical characteristics limit is strongly recommended for normal operation. If these electrical characteristic conditions are also exceeded, the LSI will malfunction and cause poor reliability.

2.1.2 Back-Light Unit

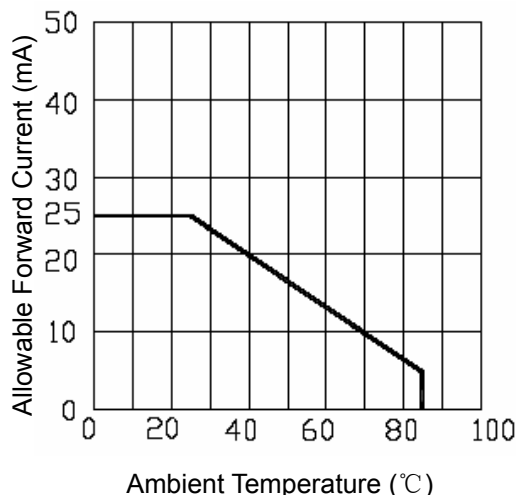
Ta=25°C

Item	Symbol	Min	Max	Unit	Remark
Forward current	I _B	--	25	mA	--
Reverse voltage	V _R	--	5	V	

2.2 Environment Absolute Maximum Ratings

Item	Symbol	Min	Max	Unit	Remark
Operation temperature range	Top	-20	70	°C	Ambient
Storage temperature range	Tst	-30	80	°C	Ambient

- Corrosive gas environment is not acceptable.
- TFT-LCD color will change slightly depending on environment temperature. This phenomenon is reversible. Current reduction rate of LED backlight is according to the graph indicated below:





3 Electrical Characteristics

3.1 TFT-LCD Module

Ta=25°C

Item	Symbol	Min.	Typ.	Max.	Unit	Remark
Power Supply	V _{CC}	2.4	2.8	3.3	V	
	V _{ci}	2.5	2.8	3.3	V	

3.2 Back-Light Unit

Item	Symbol	Min.	Typ.	Max.	Unit	Remark
Current	I _B	--	20	25	mA	
Forward voltage	V _F	6.0	6.4	7.2	V	I _B =20mA
Power Consumption	P _{BL}	--	128	180	mW	

- Two LEDs are in serial type
- The luminous intensity of LED is strongly dependent on the driving current.
- It is recommended the input of backlight to be constant current rather than constant voltage.



4 Optical Specification

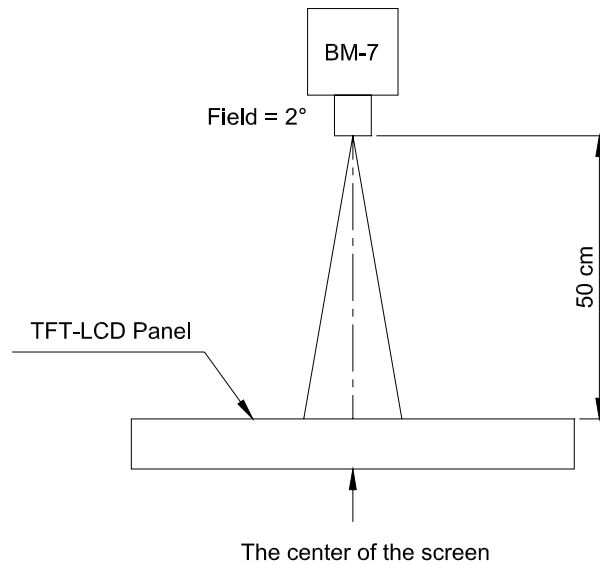
$T_a=25^{\circ}\text{C}$, $V_{cc}=V_{ci}=3.3\text{V}$, $I_B=20\text{mA}$

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Brightness		B	$\theta=0^{\circ}$ Normal viewing angle	(150)	(200)	--	cd/m^2	Note 1
Contrast Ratio		CR		(150)	(200)	--	--	Note 2
Response Time		Rising : T_r		--	(25)	(40)	ms	Note 3
		Falling : T_f						
Color Chromaticity (CIE 1931)	White	X	At the center of panel	(0.207)	(0.307)	(0.407)	--	
		Y		(0.223)	(0.323)	(0.423)		
	Red	X	Backlight On	(0.531)	(0.631)	(0.731)		
		Y		(0.258)	(0.358)	(0.458)		
	Green	X	Equipment: BM7 Field=2°	(0.222)	(0.322)	(0.422)		
		Y		(0.475)	(0.575)	(0.675)		
	Blue	X		(0.040)	(0.140)	(0.240)		
		Y		(0.008)	(0.108)	(0.208)		
Viewing Angle	Top	θ_U	$CR \geq 10$ Backlight On Equipment: BM7 Field=2°	(50)	--	--	Degrees	Note 4
	Bottom	θ_D		(15)	--	--		
	Left	θ_L		(40)	--	--		
	Right	θ_R		(40)	--	--		
Uniformity		Un	$\theta=0^{\circ}$ Normal viewing angle Backlight On Equipment: BM7 Field=2°	(70)	(80)	--	%	Note 5



Note 1: The brightness test equipment setup

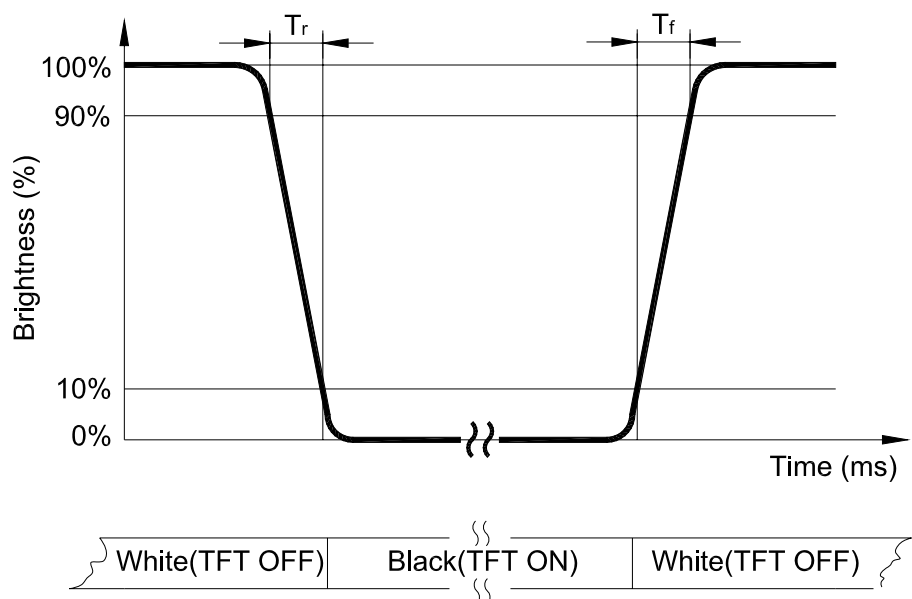
$I_B=20\text{mA}$, Field= 2° (As measuring "black" image, field= 2° is the best testing condition)



Note 2: Definition of contrast ratio (C.R)

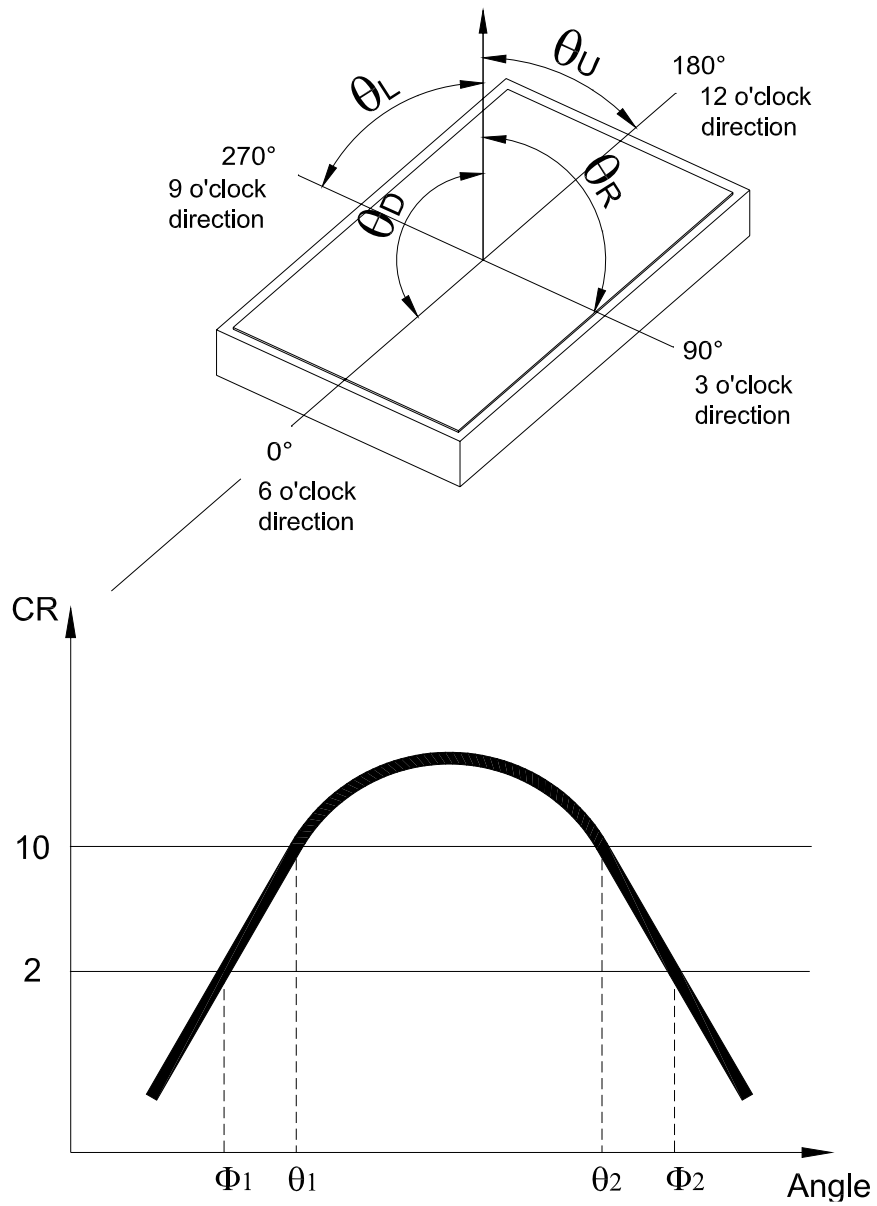
$$\text{C.R} = \frac{\text{Brightness When LCD is at "White" State}}{\text{Brightness When LCD is at "Black" State}}$$

Note 3: Definition of response time



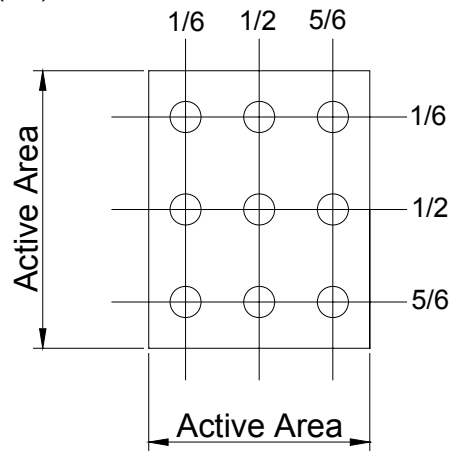


Note 4: Definition of viewing angle





Note 5: Definition of uniformity (U_n)

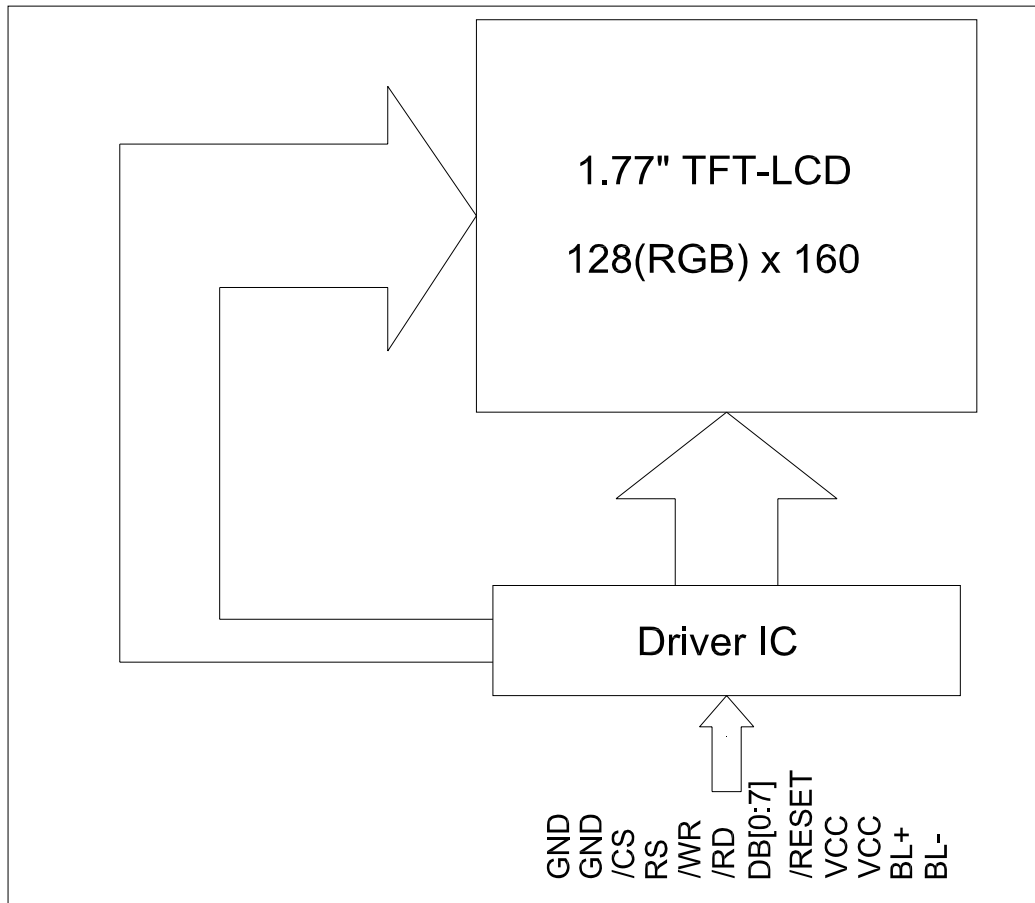


$$U_n = \frac{B_{\min}}{B_{\max}} \times 100\%$$

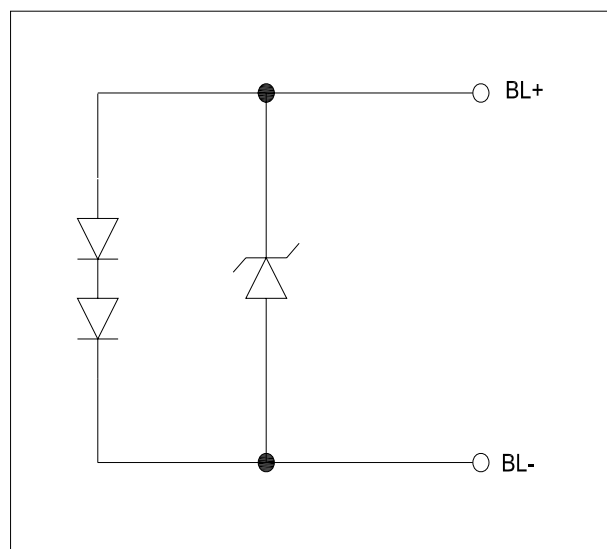


5 Block Diagram

5.1 TFT-LCD Module



5.2 Back-Light Unit





6 Interface Specification

6.1 Pin Assignment

Pin No	Symbol	Description	Input/Output	Note
1	LED-	Backlight Cathode	Input	
2	LED+	Backlight Anode	Input	
3	GND	Power Ground	Input	
4	VCC	Power Supply	Input	
5	NC	No Connection	--	
6	NC	No Connection	--	
7	/CS	Chip Select	Input	-
8	/RESET	System Reset	Input	-
9	RS	Register Select Signal	Input	-
10	/WR	Write Signal Strobe	Input	-
11	/RD	Read Signal Strobe	Input	-
12	DB7	Data 8	Input/Output	-
13	DB6	Data 7	Input/Output	-
14	DB5	Data 6	Input/Output	-
15	DB4	Data 5	Input/Output	-
16	DB3	Data 4	Input/Output	-
17	DB2	Data 3	Input/Output	-
18	DB1	Data 2	Input/Output	-
19	DB0	Data 1	Input/Output	-
20	GND	Power Ground	Input	-



7 Interface Description

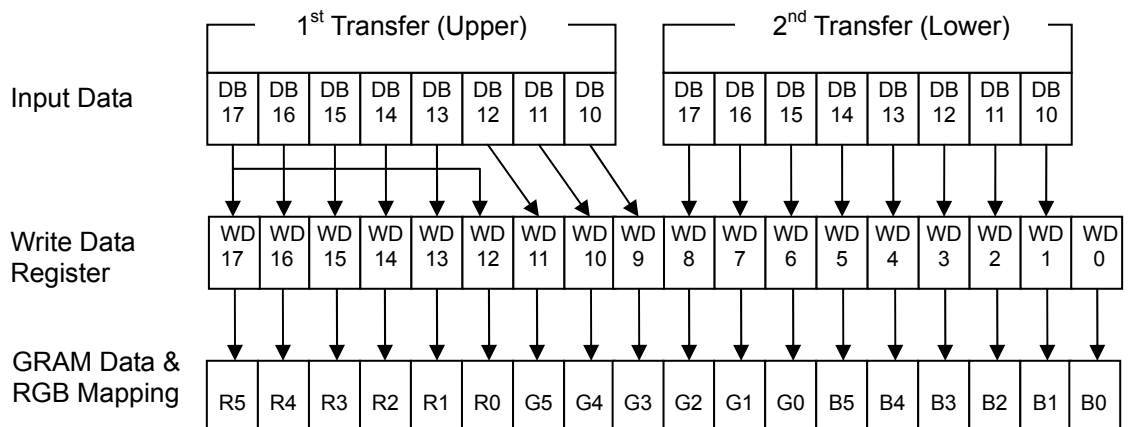
The **WXCAT17-MS3#001** has a high-speed system interface : an 80-system 8-bit bus.

The **WXCAT17-MS3#001** includes an index register (IR), which is stored the index data of internal control register and GRAM. There are 8-bit bus control registers, which are used to temporarily store the data written to or read from the GRAM. When the data is written into the GRAM from the MPU, it is first written into the write-data latch and then automatically written into the GRAM by internal operation. Data is read through the read-data latch when reading from the GRAM. Therefore, the first read data operation is invalid and the second read data operation is valid.

7.1 Register Selection

/WR	/RD	RS	Operations
0	1	0	Writes Indexes into IR
1	0	0	Reads internal status
0	1	1	Writes data into control register or GRAM
1	0	1	Reads control register or GRAM data

7.2 8-bit CPU Interface



(2 transfers/pixel) 65,536 colors



7.3 DC Characteristics

(VCC=2.40~3.30V, IOVCC=1.65~3.30V, Ta=-40~85°C)

Item	Symbol	CONDITION	Min	Typ	Max	Unit	Note
Input high voltage	V _{IH}	VCC=1.8~3.3V	0.8*IOVCC	--	IOVCC	V	--
Input low voltage(1) (DB0-17 Pins)	V _{IL}	VCC=1.8~3.3V	-0.3	--	0.2*IOVCC	V	--
Output high voltage (DB0-17 Pins)	V _{OH1}	IOH=-0.1mA	0.8*IOVCC	--	--	V	--
Output low voltage	V _{OL1}	IOVCC=1.65~3.3V VCC=2.4~3.3V IOL=0.1mA	--	--	0.2*IOVCC	V	--
I/O leakage current	I _{IL}	Vin=0 ~VCC	-0.1	--	0.1	μA	--
Current consumption During normal operation (Vcc-VSS)	I _{OP}	VCC=3V, TA=25°C, fOCS=177KHZ (176 line) GRAM data=0000h	--	100 (VCC)	--	μA	--
Current consumption During standby mode (Vcc-VSS)	I _{ST}	VCC=3V, Ta=25°C	--	5	10	μA	--
LCD Drive Power Supply Current (DDVDH-VSS)	ILCD	VCC=3V, VGAM1OUT=5.0V DDVDH=5.5V, Fosc=177khz(160 line), TA=25°C, GRAM data=0000h, REV="0", SAP="001", ON4-0="0", OP4-0="0", MP52-00="0", MN52-00="0", CP12-00="0", CN12-00="0"	--	3.0	--	mA	--
LCD Driving Voltage(DDVD-VSS)	DDVDH	--	4.5	--	6	V	--
Output voltage deviation		--	--	5	--	mV	--
Dispersion of the Average	V	--	-10	--	10	mV	--

7.4 CLOCK Characteristics

(VCC=2.40~3.30V, IOVCC=1.65~3.30V)

Item	Symbol	Condition	Min	Typ	Max	Unit
RC oscillation	f _{osc}	Rf=200KΩ, VCC=3.0V	--	220	--	KHz

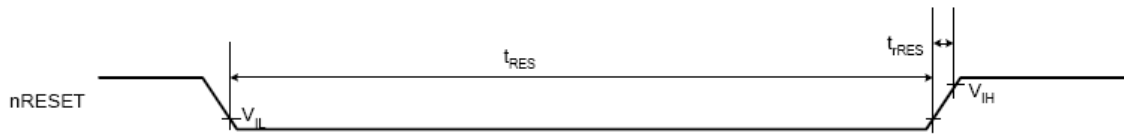
7.5 Reset Timing Characteristics

(VCC=1.8~3.3V, IOVCC=1.65~3.3V)

Item	Symbol	Min	Typ	Max	Unit
Reset low-level width	t _{RES}	1	--	--	ms
Reset rise time	t _{rRES}	--	--	10	μs



Note 1: Reset Timing

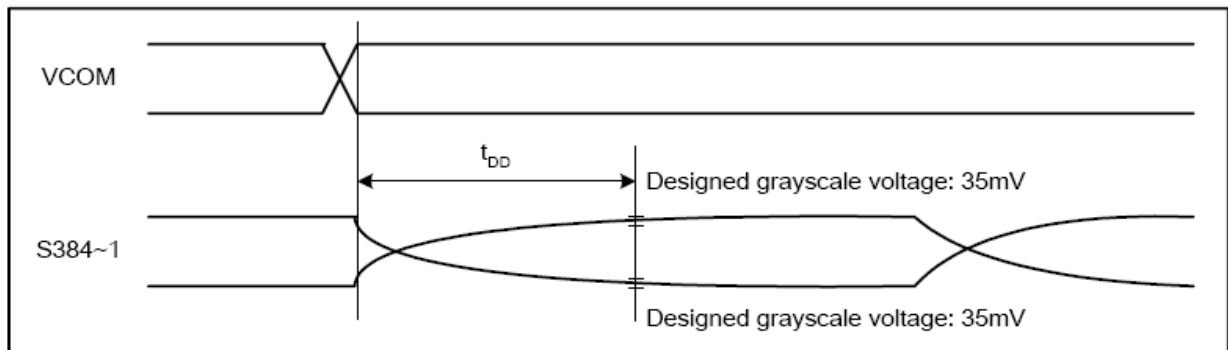


7.6 LCD driver outputs Characteristics

(VCC=2.40~3.30V,IOVCC=1.65~3.30V)

Item	Symbol	Timing diagram	Min	Typ	Max	Unit	note
Driver output delay time	t_{DD}	VCC=3V,DDVDH=5.5V,VGAM1OUT=5.0, RC oscillation: fosc=220KHZ(160Lines) TA=25℃,RVE=0,SAP=010,AP=010,0N14-00=0, 0P14-00=0,MP52-00=0,NM52-00=0,CP12-00=0, CN12-00=0,Load resistance R=10kΩ, Load capacitance C=20Pf . when the level changes from a same grayscale level on all pins .Time to reach +/-35Mv when VCOM polarity inverts	--	35	--	μs	*1

Note 1: LCD Driver Output

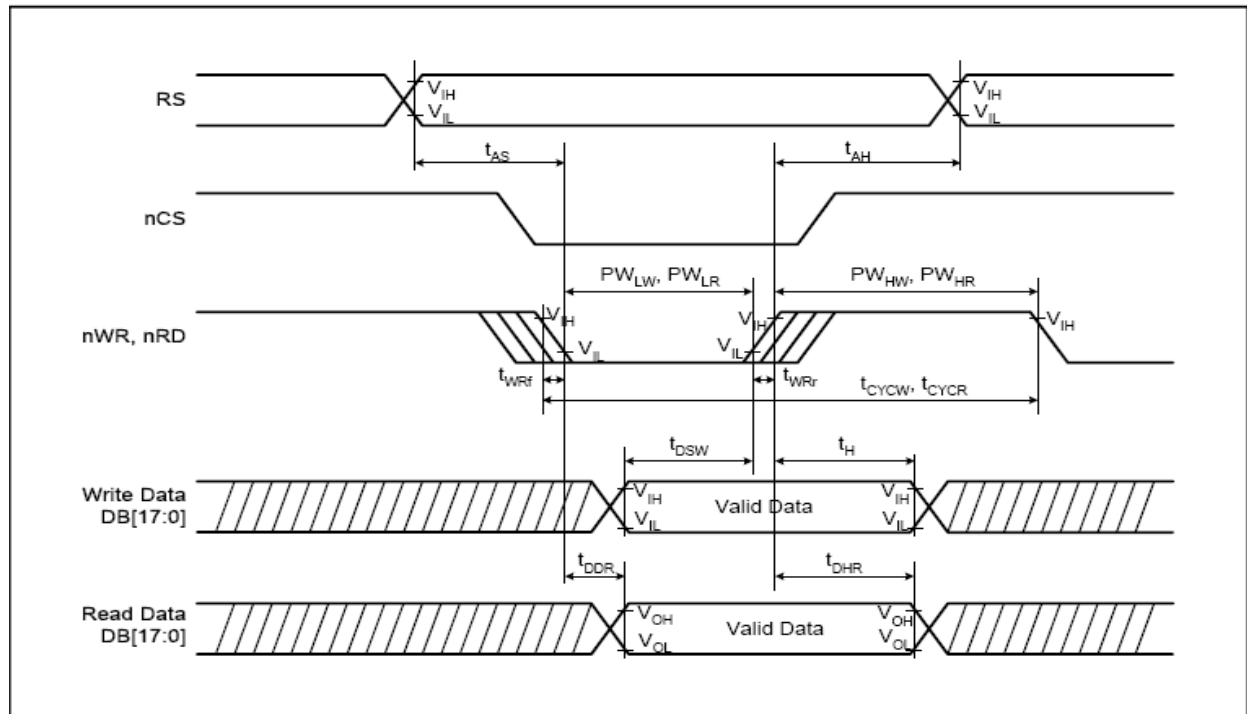




7.7 AC Characteristics

Item		Symbol	Min.	Typ.	Max.	Unit	Test Condition
Bus cycle time	Write	t_{CYCW}	100	--	--	--	--
	Read	t_{CYCR}	300	--	--	--	--
Write low-level pulse width		PW_{LW}	50	--	--	ns	--
Write high-level pulse width		PW_{HW}	50	--	--	ns	--
Read low-level pulse width		PW_{LR}	150	--	--	ns	--
Read high-level pulse width		PW_{HR}	150	--	--	ns	--
Write/Read rise/fall time		t_{WRr}/t_{WRf}	--	--	25	ns	--
Setup time	Write(RS to nCS,E/nWR)	t_{AS}	10	--	--	ns	
	Read((RS to nCS,RW/Nrd)		5	--	--		
Address hold time		t_{AH}	5	--	--	ns	
Write data set up time		t_{DSW}	10	--	--	ns	
Write data hole time		t_H	15	--	--	ns	
Read data delay time		t_{DDR}	--	--	100	ns	
Read data hold time		t_{DHR}	5	--	--	ns	

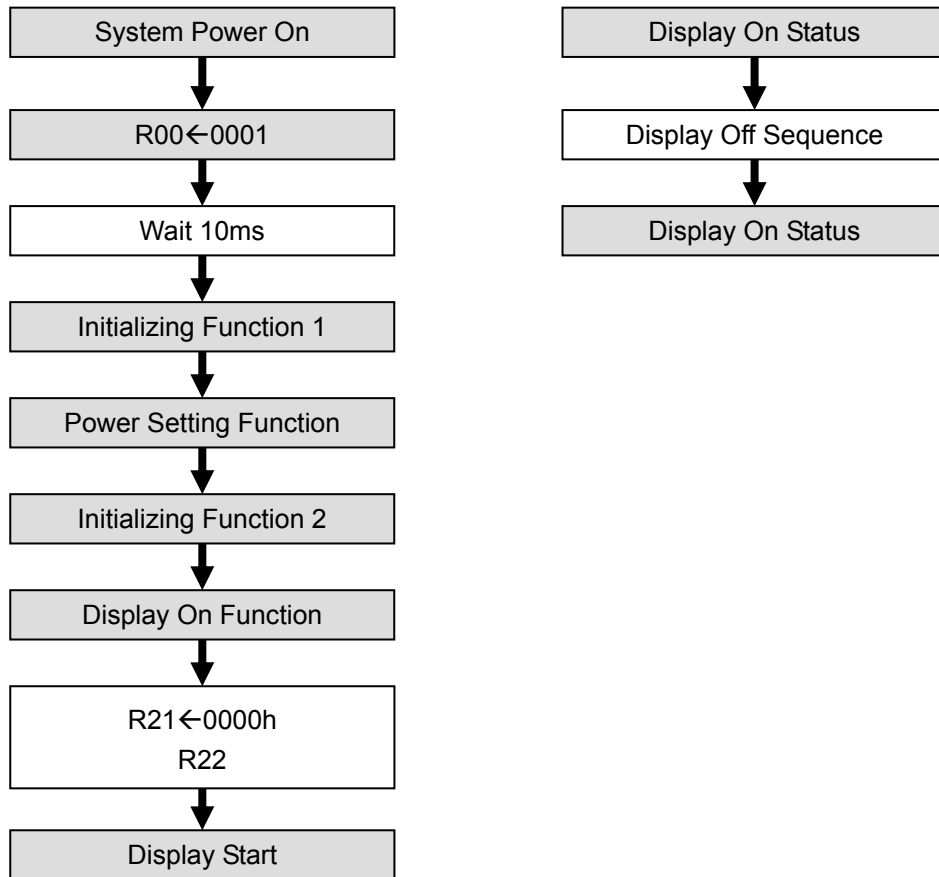
Note 1: 80-system Interface Timing





8 Driver IC Control Algorithms

8.1 Power On/Off Sequence





8.2 Initializing & Power Setting Sequence

<Initializing 1 Sequence>

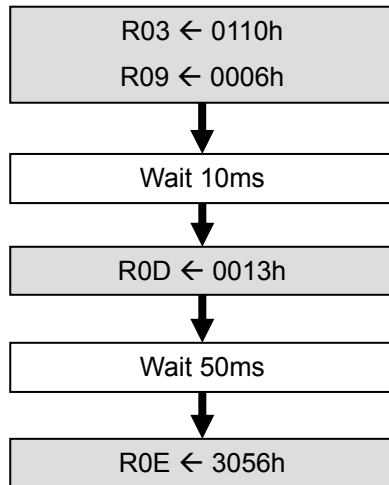
R02 ← 0700h
R05 ← 0030h
R25 ← 0000h
R26 ← 0000h
R08 ← 0202h
R0A ← 0000h
R0B ← 0000h
R0C ← 0000h
R0F ← 0000h
R21 ← 0000h
R14 ← 9F00h
R16 ← 7F00h
R17 ← 9F00h
R03 ← 0000h
R09 ← 0000h
R0D ← 0000h
R0E ← 0000h

<Initializing 2 Sequence>

R30 ← 0000h
R31 ← 0707h
R32 ← 0707h
R33 ← 0305h
R34 ← 0007h
R35 ← 0000h
R36 ← 0007h
R37 ← 0502h
R3A ← 1F00h
R3B ← 050Eh

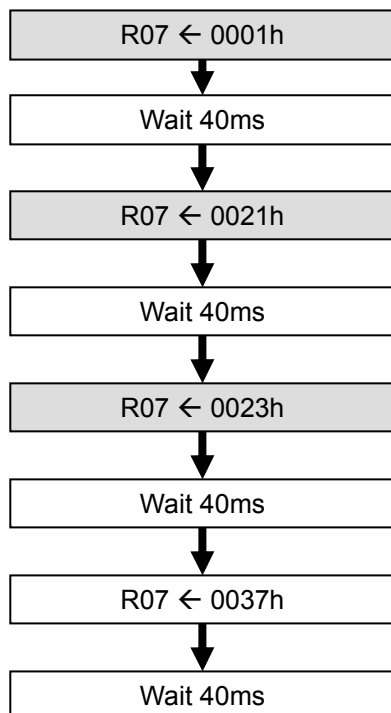


8.3 Power Setting Sequence

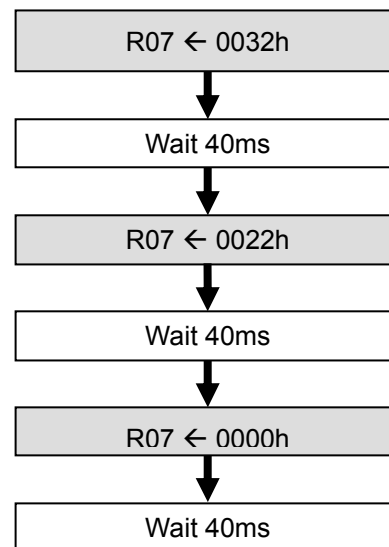


8.4 Display On/Off Sequence

Display On Function

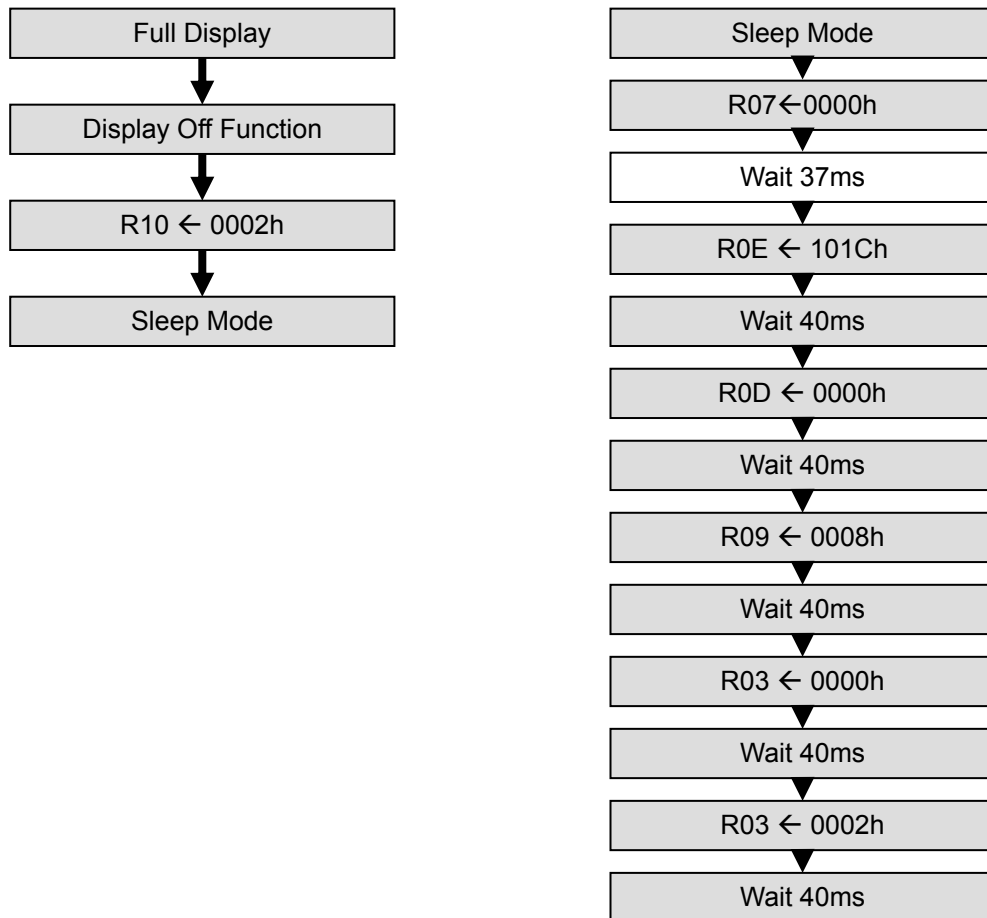


Display Off Function



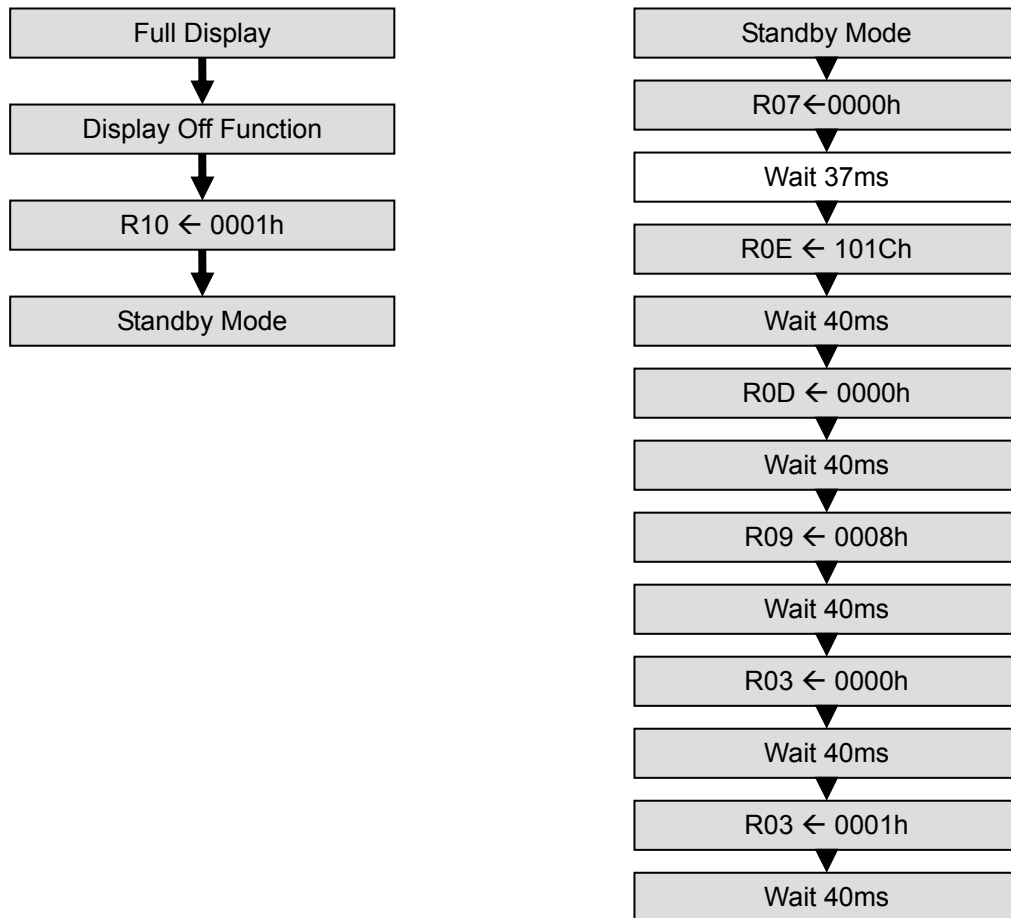


8.5 Sleep / Wake up Sequence





8.6 Standby / Wakeup Sequence





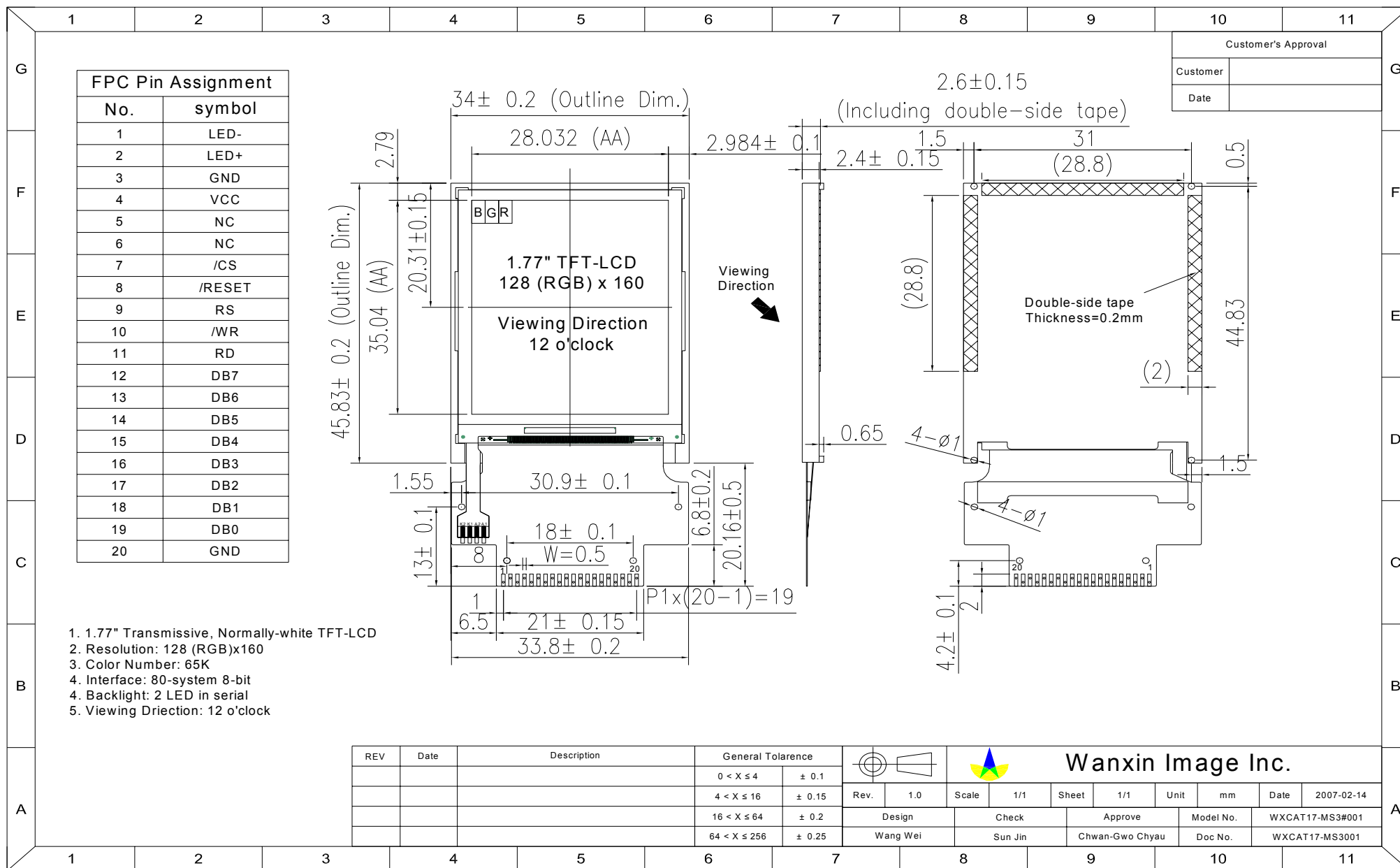
9 Reliability Test Items

Item	Test Condition	
High Temperature Storage	80 °C, 240 hrs	
Low Temperature Storage	-30 °C, 240 hrs	
High Temp. & High Humidity Storage	60 °C, 90% RH, 240 hrs	
Vibration Test (Non-operating)	Freq.:10~55~10 Hz, Amp.:1.5mm 1 hr for each direction of X, Y, Z	
Electrostatic Discharge Test (Non-operating)	Terminals	150 pF, 0 Ω, ±300 V, Contact
	Panel	150 pF, 330 Ω, ±8 KV, Air
Thermal Shock (Static)	-30℃, 30 min /80℃, 30 min, 20 cycles	
High Temperature Operation	70 °C, 240 hrs	
Low temperature Operation	-20 °C, 240 hrs	
High Temperature & High Humidity (Operating)	50 °C, 90%RH, 240 hrs	
FPC Peeling Strength Test	Pull speed: 50 mm/min, +90°, Criterion > 400gf/cm	
Criterion: There should be no change which might affect the practical display function when the display quality test is conducted under normal operating condition.		



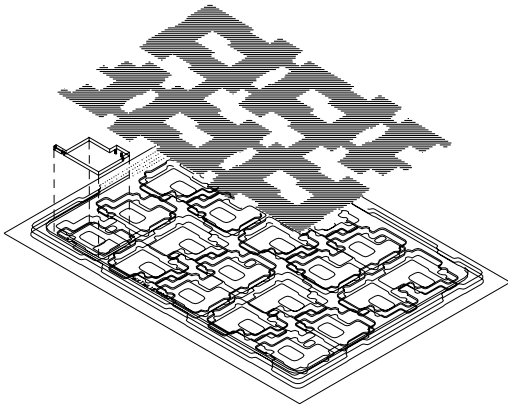
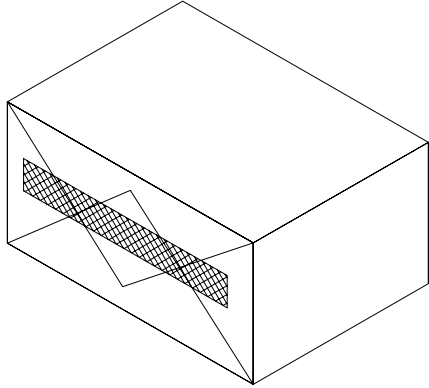
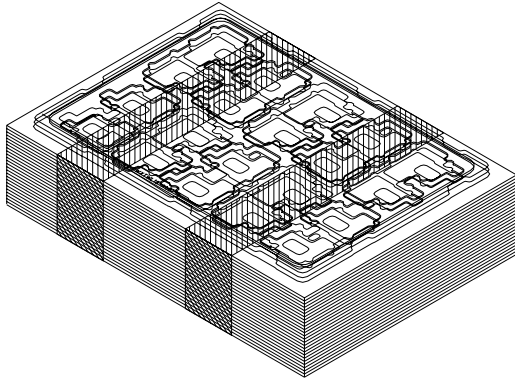
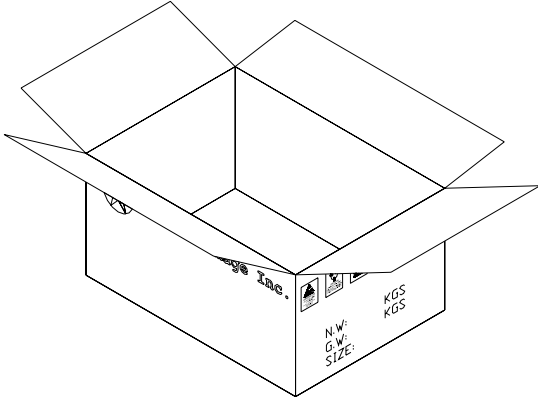
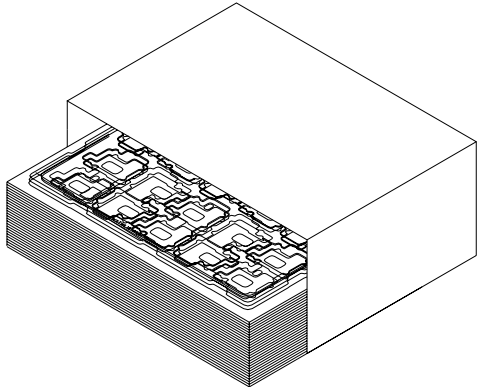
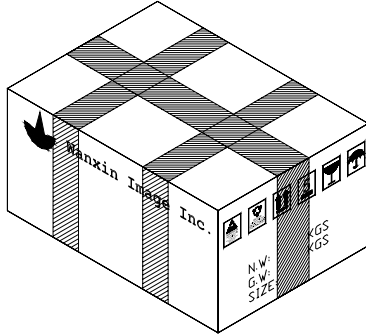
10 Outline Dimension

See next page.





11 Package

<p>1</p>  <p>16 pcs per tray + 1 cover (EPE)</p>	<p>4</p>  <p>Packing bag</p>
<p>2</p>  <p>25 trays + 1 dummy tray = 400 pcs Packing 26 trays with sealing tape</p>	<p>5</p>  <p>Putting bag into carton Protected by 6 pieces of cushion EPE sheet</p>
<p>3</p>  <p>Putting trays into anti-electrostatic bag</p>	<p>6</p>  <p>Packing carton with sealing tape Carton outline size: 417×310×262 (mm)</p>



12 Precautions

Please pay attentions to the followings as using the LCD module.

12.1 Handling

- (a) Do not apply strong mechanical stress like drop, shock or any force to LCD module. It may cause improper operation, even damage.
- (b) Because the polarizer is very fragile and easy to be damaged, do not hit, press or rub the display surface with hard materials.
- (c) Do not put heavy or hard material on the display surface, and do not stack LCD modules.
- (d) If the display surface is dirty, please wipe the surface softly with cotton swab or clean cloth.
- (e) Avoid using Ketone type materials (e.g. Acetone), Toluene, Ethyl acid or Methyl chloride to clean the display surface. It might damage the polarizer permanently. The recommended solvents are water and Isopropyl alcohol.
- (f) Wipe off water droplets or oil immediately.
- (g) Protect the LCD module from ESD. It will damage the LSI and the electronic circuit.
- (h) Do not touch the output pins directly with bare hands.
- (i) Do not disassemble the LCD module.

12.2 Storage

- (a) Do not leave the LCD modules in high temperature, especially in high humidity for a long time.
- (b) Do not expose the LCD modules to sunlight directly.
- (c) The liquid crystal is deteriorated by ultraviolet. Do not leave it in strong ultraviolet ray for a long time.
- (d) Avoid condensation of water. It may cause improper operation.
- (e) Please stack only up to the number stated on carton box for storage and transportation. Excessive weight will cause deformation and damage of carton box.

12.3 Operation

- (a) When mounting or dismounting the LCD modules, turn the power off.
- (b) Protect the LCD modules from electric shock.



- (c) The Driver IC control algorithms stated in chapter 8 should always be obeyed to avoid damaging the LSI and electronic circuit.
- (d) Be careful to avoid mixing up the polarity of power supply for backlight.
- (e) Absolute maximum rating specified above has to be always kept in any case. Exceeding it may cause non-recoverable damage of electronic components or, nevertheless, burning.
- (f) When a static image is displayed for a long time, remnant image is likely to occur.
- (g) Be sure to avoid bending the FPC to an acute shape, it might break FPC.

12.4 Others

- (a) If the liquid crystal leaks from the panel, it should be kept away from the eyes or mouth.
- (b) For the fragility of polarizer, it is recommended to attach a transparent protective plate over the display surface.
- (c) It is recommended to peel off the protection film on the polarizer slowly so that the electrostatic charge can be minimized.