PRODUCT SPECIFICATIONS

■:APPROVAL FOR SPECIFICATION
■:APPROVAL FOR SAMPLE

For Customer: _____

Module No. : **MT18G10M**

Date:2006/09/08
Version : 6

Table of Contents

For Customer's Acceptance

Accepted by	Comment
Date:	

This specification is proposed by Arima Display Corporation.

Presented by	Checked by	Organized by
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2. History of Specification Revision

Date	Rev.	Page	Contents
2006/06/21	1		new
2006/07/18	2	15	IC-HX8310 be changed to IC-ILI9160
2006/08/07	3	16,17	Add Appearance Specification and Display Specification
2006/09/07	4	17,18	Modify Appearance Specification and Display Specification
2006/09/08	5	17,18	Modify Appearance Specification and Display Specification
2006/09/08	6	17	Modify Appearance Specification and Display Specification

1. General Description

∗ Description

MT18G10M is a transmittance 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 1.79 inch and the resolution is 128×160. The panel can display up to 262K colors and is suitable for cell phone application.

∗ Features

- High image quality a-Si TFT LCD module.
- 262K color number.
- M68/i80-system 16/8 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.

∗ Applications

- Mobile phone.
- Handheld Device

∗ General information

No	Item	Specification	Remark
1	Type	Transmissive	
2	Display Mode	Normally White	
3	Pixel Element	a-Si TFT	
4	Screen Size	1.79 inch (diagonal)	
5	Resolution	128(RGB) x160	
6	Color Number	262K	
7	Active Area	28.416 x35.52 (mm)	
8	Dot Pitch	74 x 222 (μ m)	
9	Color Arrangement	RGB-stripe	
10	Assembly Type	COG	
11	Back Light	LED * 3	
12	Viewing Direction	12 o'clock	
13	Weight	6.7g	
14	Module Dimension	34.0mm x 56.8mm x3.70mm	
15	Power Supply	1.8 ~3.3 V	
16	Interface	CPU I/F	
17	Surface Treatment	glare type	

2. Absolute Maximum Ratings

2.1 Electrical Absolute Maximum Ratings

(1) TFT-LCD Panel Absolute Maximum Ratings

Ta=25℃ GND=0V

Item	Symbol	Condition	Standard Value		Unit	Remark
			Min.	Max.		
Input power supply voltage	V_{cc}	Vss=0V	-0.5	5.0	V	Logic
	Vci	Vss =0V	-0.5	5.0	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) Back-Light Unit

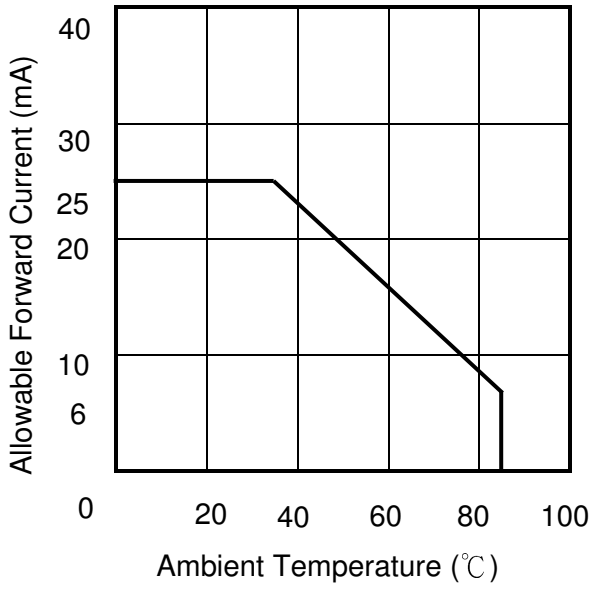
Ta=25℃

Item	Symbol	Min.	Max.	Unit	Remark
Current	I_B	--	25	mA	--

2.2 Environment Absolute Maximum Ratings

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

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



3. Electrical Characteristics

(1) TFT-LCD Module

Ta =25℃

Item	Symbol	Min.	Typ.	Max.	Unit	Remark
Power supply	V_{CC}	2.5	(2.8)	3.3	V	
	V_{CI}	2.5	(2.8)	3.3	V	

(2) Back-Light Unit

Item	Symbol	Min.	Typ.	Max.	Unit	Remark
current	I_B	--	20	25	mA	
Power Consumption	P_{BL}	--	(210)	--	mW	

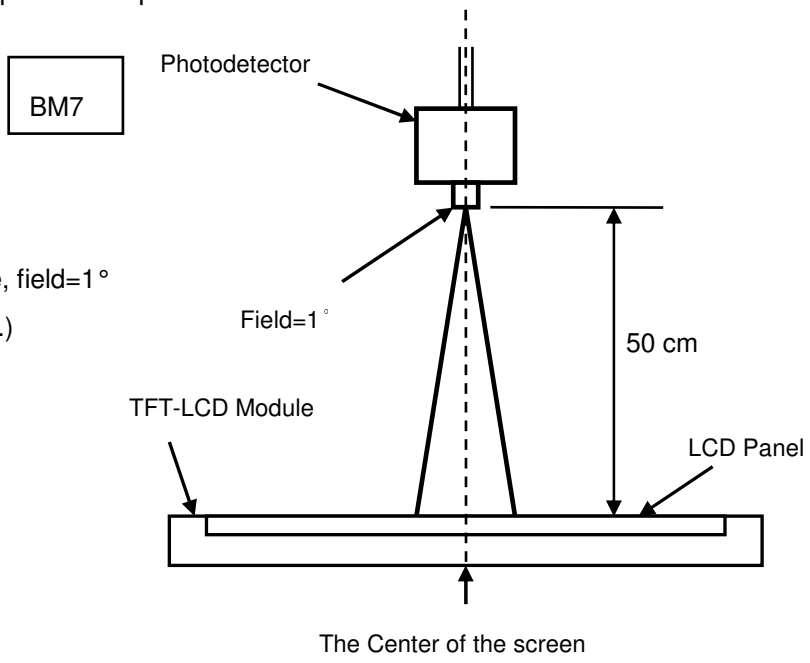
* Three LEDs serial type

4. Optical Specification

Ta=25℃, Vcc=Vci=2.8V, I_B=20mA

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Brightness(AVG of nine point)		B	θ=0° Normal viewing angle At the center of panel 。	(200)	(230)	--	cd/m^2	(1)
Contrast Ratio		C/R		(150)	(200)	--	--	(2)
Response Time		Rising: Tr		--	15	30	ms	(3)
		Falling: Tf		--	35	50		
Color chromaticity (CIE 1931)	White	Wx		(0.256)	(0.306)	(0.356)	--	
		Wy		(0.279)	(0.329)	(0.379)		
	Red	Rx		(0.587)	(0.637)	(0.687)		
		Ry		(0.295)	(0.345)	(0.395)		
	Green	Gx		(0.276)	(0.326)	(0.376)		
		Gy		(0.548)	(0.598)	(0.648)		
	Blue	Bx		(0.092)	(0.142)	(0.192)		
		By		(0.067)	(0.117)	(0.167)		
Viewing Angle	Top	θx-	CR≧10 Backlight On	--	(45)	--	Degrees	(4)
	Bottom	θx+		--	(40)	--		
	Left	θy-		--	(50)	--		
	Right	θy+		--	(50)	--		
Uniformity		Un	θ=0° Normal viewing angle	80	--	--	%	(5)

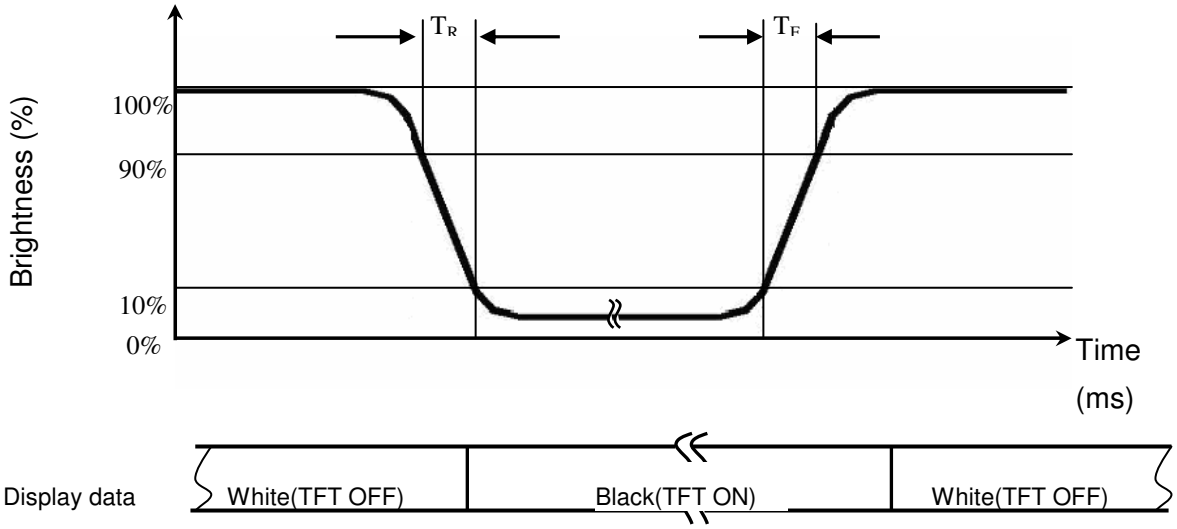
Note 1: The brightness test equipment setup



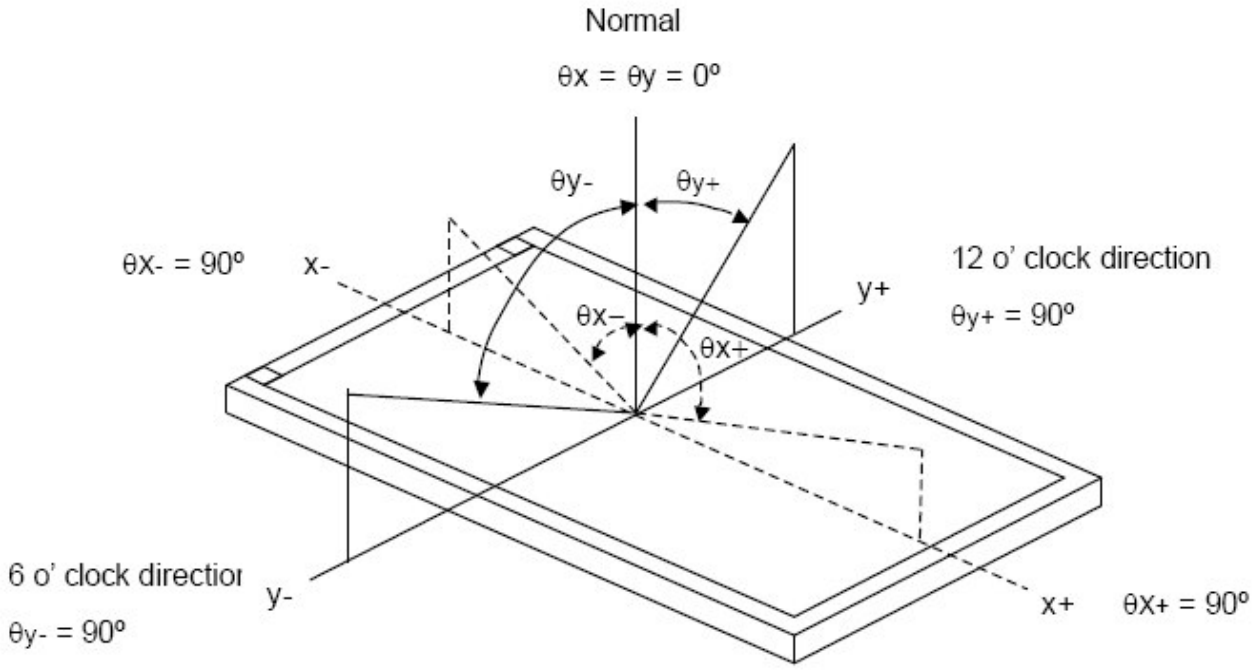
Note 2: Definition of contrast Ratio (C.R)

$$C.R = \frac{\textbf{Brightness When LCD is at “White” State}}{\textbf{Brightness When LCD is at “Black” State}}$$

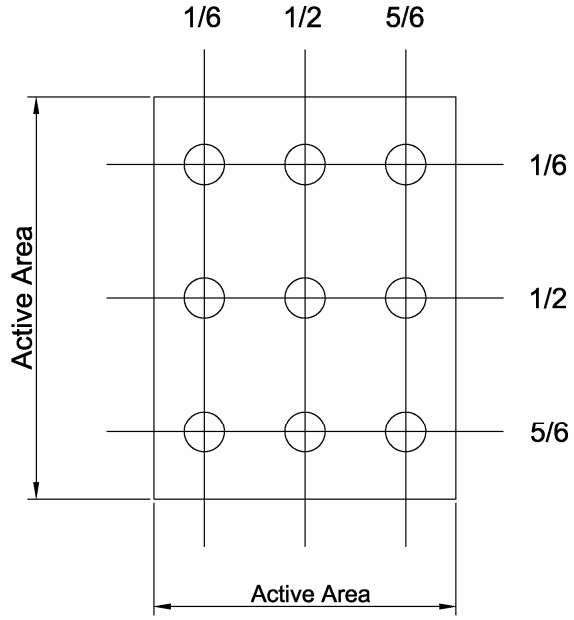
Note 3: Definition of response time



Note 4: Definition of viewing angle



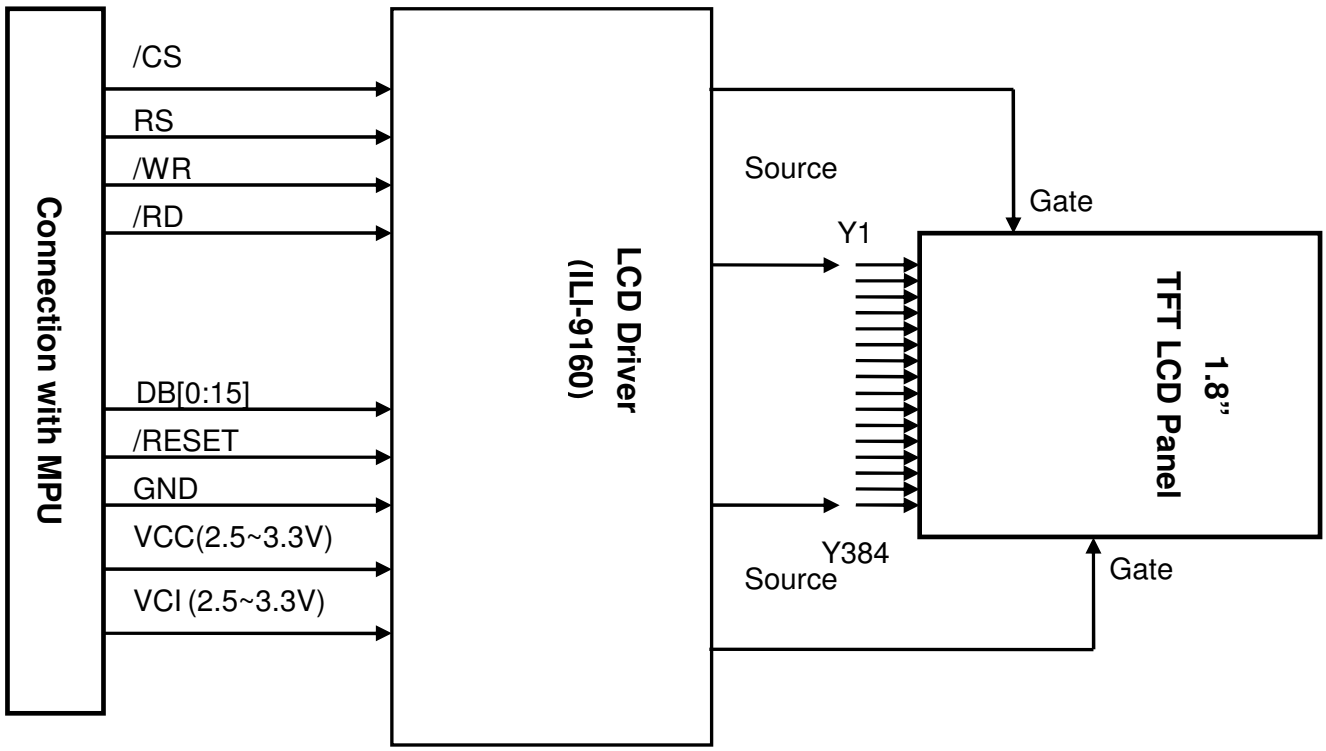
Note 5: Definition of uniformity (Un)



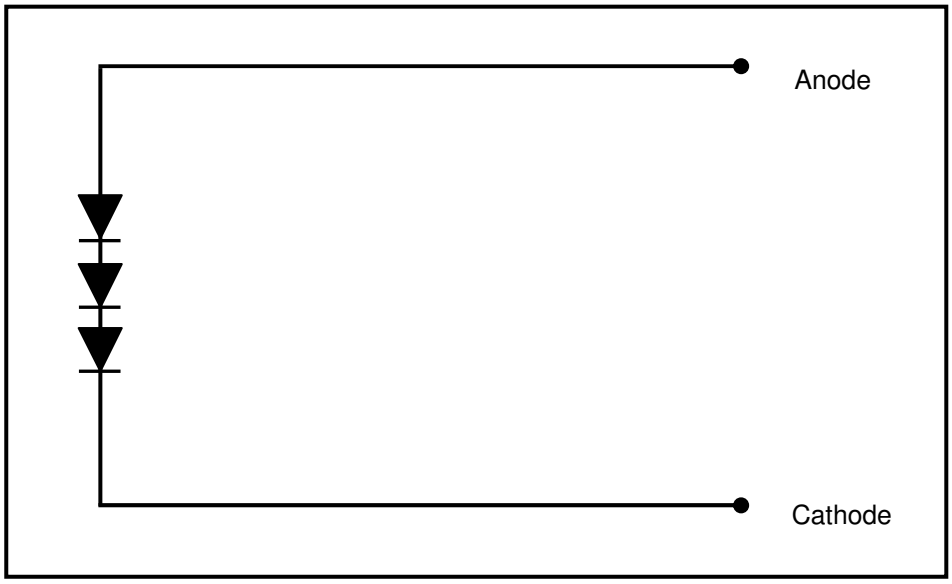
$$Un = \frac{Bmin}{Bmax} \times 100\%$$

5. Block Diagram

5.1 TFT-LCD Module (Interface System Structure)



5.2 Back-light Unit



6. Input Terminal Pin Assignment

1	VCC	Logic-Circuit Power Supply			Input
2	GND	Power Ground			Input
3	/CS	Chip Select			Input
4	RS	Register Select			Input
5	/WR	Write			Iutput
6	/RD	Read			Input
7	D0	Data 0			Input/Output
8	D1	Data 1			Input/Output
9	D2	Data 2			Input/Output
10	D3	Data 3			Input/Output
11	D4	Data 4			Input/Output
12	D5	Data 5			Input/Output
13	D6	Data 6			Input/Output
14	D7	Data 7			Input/Output
15	D8	Data 8			Input/Output
16	D9	Data 9			Input/Output
17	D10	Data 10			Input/Output
18	D11	Data 11			Input/Output
19	D12	Data 12			Input/Output
20	D13	Data 13			Input/Output
21	D14	Data 14			InputOutput
22	D15	Data 15			Input/Output
23	RESET	System Reset			Input
24	GND	Power Ground			Input
25	IM1	IM1	IM0/ID	Interface Mode	Input/Output
		0	0	M68-system 16-bit interface	
26	IM0	0	1	M68-system 8-bit interface	Input/Output
		1	0	i80-system 16-bit interface	
		1	1	i80-system 8-bit interface	
27	LEDA	Anode			Input
28	NC	NC			-
29	NC	NC			-
30	LEDK	Cathode			Input

7. Interface Specifications

7.1 DC Characteristics

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

Item	Symbol	Unit	Test Condition	Min.	Typ.	Max.	Note
Input high voltage	V_{IH}	V	VCC= 1.8 ~ 3.3V	0.8*IOVCC	-	IOVCC	-
Input low voltage	V_{IL}	V	VCC= 1.8 ~ 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 VCC= 2.4 ~ 3.3V IOL = 0.1mA	-	-	0.2*IOVCC	-
I/O leakage current	I_{LI}	µA	Vin = 0 ~ VCC	-0.1	-	0.1	-
Current consumption during normal operation (V_{CC} – VSSD)	I_{OP}	µA	VCC=3.0V , Ta=25°C , fOSC = 177KHz (176 Line) GRAM data = 0000h	-	100 (VCC)	-	-
Current consumption during standby mode (V_{CC} – VSSD)	I_{ST}	µA	VCC=3V , Ta=25 °C	-	5	10	-
LCD Drive Power Supply Current (VLCDC-VSSD)	ILCD	mA	VCC=3V , VGAM1OUT=5.0V VLCDC=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	-	-
LCD Driving Voltage (VLCDC-VSSD)	VLCDC	V	-	4.5	-	6	-
Output voltage deviation		mV	-	-	5	-	-
Dispersion of the Average Output Voltage	V	mV	-	-10	-	10	-

7.1.1 Clock Characteristics

Clock Characteristics (IOVCC=1.65 ~ 3.3V, VCC=2.4 ~ 3.3V)

Item	Symbol	Unit	Min.	Typ.	Max.	Testing condition
External clock frequency	fcp	KHz	100	176	600	
External clock duty ratio	duty	%	45	50	55	
External clock rise time	trcp	µs	-	-	0.2	
External clock fall time	tfcp	µs	-	-	0.2	
R-C oscillation clock	fosc.	KHz	210	220	230	Rf=200K ohm, VCC=3V

7.1.2 Reset Timing Characteristics

Reset Timing Characteristics (VCC = 1.8 ~ 3.3 V, IOVCC = 1.65 ~ 3.3 V)

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

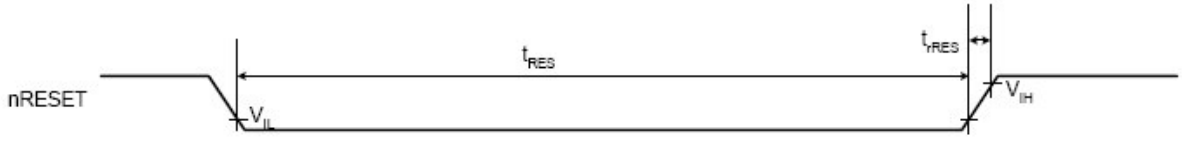


Figure76 Reset Timing

7.2 AC Characteristics

7.2.1 Clock Characteristics

Clock Characteristics (IOVCC=1.65 ~ 3.3V, VCC=2.4 ~ 3.3V)

Item	Symbol	Unit	Min.	Typ.	Max.	Testing condition
External clock frequency	fcp	KHz	100	176	600	
External clock duty ratio	duty	%	45	50	55	
External clock rise time	trcp	µs	-	-	0.2	
External clock fall time	tfcp	µs	-	-	0.2	
R-C oscillation clock	fosc.	KHz	210	220	230	Rf=200K ohm, VCC=3V

7.2.2 i80-System Interface Timing Characteristics

Normal Write Mode (IOVCC = 1.65~3.3V, VCC=2.4~3.3V)

Item		Symbol	Unit	Min.	Typ.	Max.	Test Condition
Bus cycle time	Write	t_{CYCW}	ns	100	-	-	-
	Read	t_{CYCR}	ns	300	-	-	-
Write low-level pulse width		PW_{LW}	ns	50	-	-	-
Write high-level pulse width		PW_{HW}	ns	50	-	-	-
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	-	-	

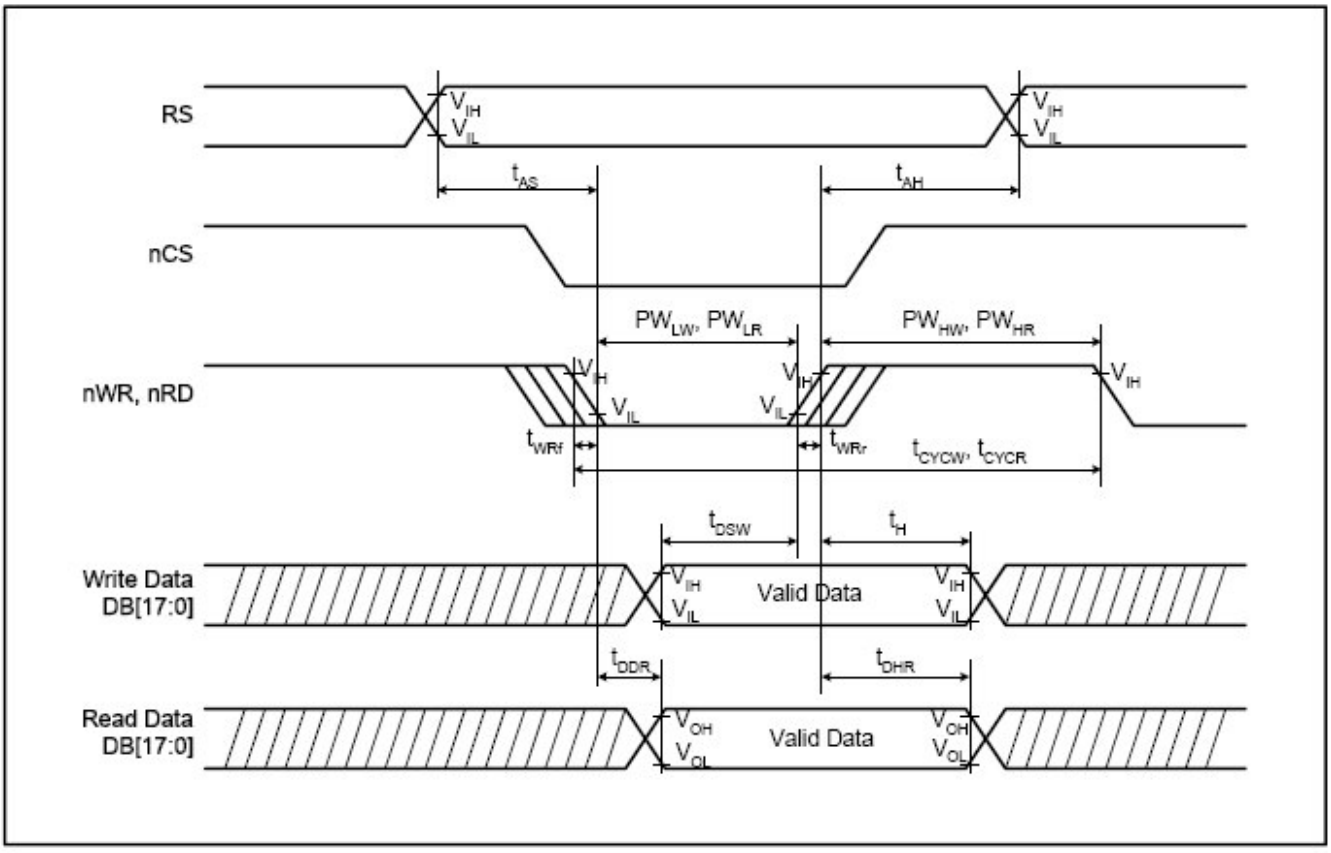


Figure78 i80-System Interface Timing

7.2.3 M68-System Interface Timing Characteristics

Normal Write Mode (IOVCC = 1.65~3.3V, VCC=2.4~3.3V)

Item		Symbol	Unit	Min.	Typ.	Max.	Test Condition
Bus cycle time	Write	t_{CYCEW}	ns	100	-	-	-
	Read	t_{CYCER}	ns	300	-	-	-
Write low-level pulse width		PW_{ELW}	ns	50	-	-	-
Write high-level pulse width		PW_{EHW}	ns	50	-	-	-
Read low-level pulse width		PW_{ELR}	ns	150	-	-	-
Read high-level pulse width		PW_{EHR}	ns	150	-	-	
Write / Read rise / fall time		t_{WRr}/t_{WRf}	ns	-	-	25	
Setup time	Write (RS to nCS, E/nWR)	t_{ASE}	ns	10	-	-	
	Read (RS to nCS, RW/nRD)			10	-	-	
Address hold time		t_{AHE}	ns	5	-	-	
Write data set up time		t_{DSWE}	ns	10	-	-	
Write data hold time		t_{HE}	ns	15	-	-	
Read data delay time		t_{DDRE}	ns	-	-	100	
Read data hold time		t_{DHRE}	ns	5	-	-	

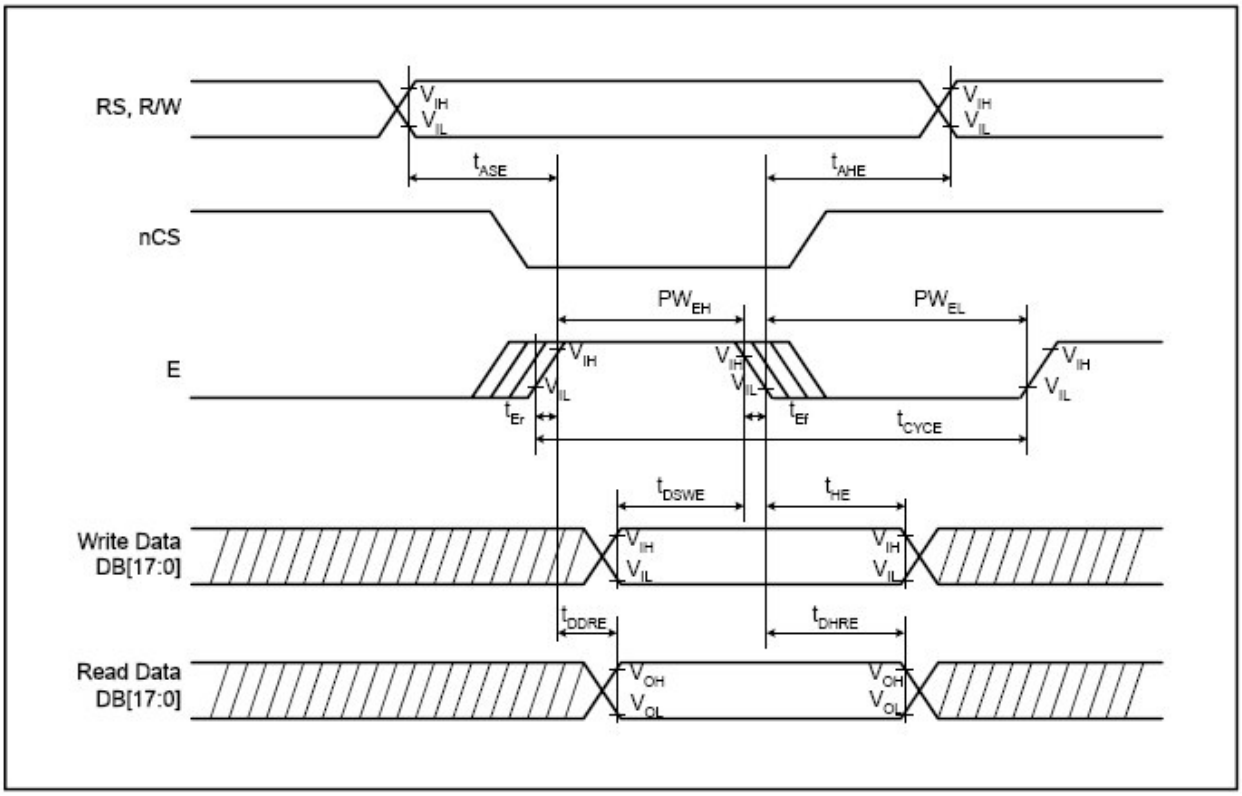


Figure79 M68-System Interface Timing

7.2.4 Serial Data Transfer Interface Timing Characteristics

(IOVCC = 1.65~3.3V, VCC=2.4~3.3V)

Item		Symbol	Unit	Min.	Typ.	Max.	Test Condition
Serial clock cycle time	Write (received)	t_{SCYC}	ns	70	-	-	-
	Read (transmitted)	t_{SCYC}	ns	150	-	-	-
Serial clock high – level pulse width	Write (received)	t_{SCH}	ns	30	-	-	-
	Read (transmitted)	t_{SCH}	ns	70	-	-	-
Serial clock low – level pulse width	Write (received)	t_{SCL}	ns	30	-	-	-
	Read (transmitted)	t_{SCL}	ns	70	-	-	-
Serial clock rise / fall time		t_{scr}/t_{scf}	ns	-	-	20	-
Chip select set up time		t_{CSU}	ns	20	-	-	-
Chip select hold time		t_{CH}	ns	60	-	-	-
Serial input data set up time		t_{SISU}	ns	30	-	-	-
Serial input data hold time		t_{SIH}	ns	30	-	-	-
Serial output data set up time		t_{SOD}	ns	-	-	100	-
Serial output data hold time		t_{SOH}	ns	10	-	-	-

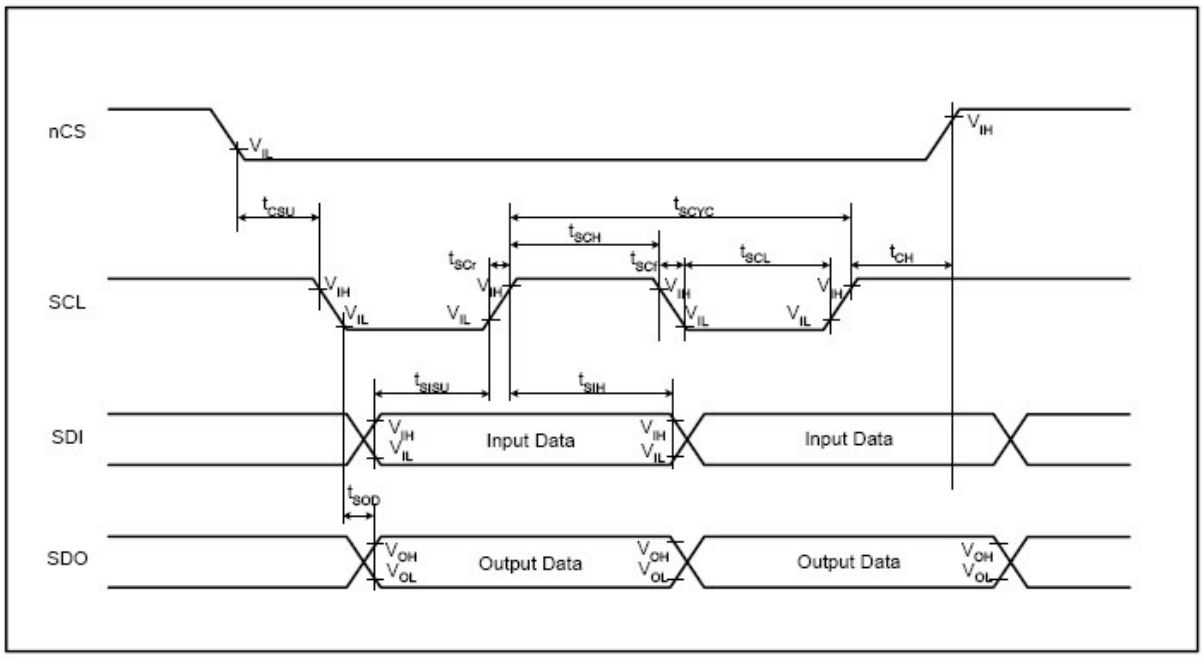


Figure80 SPI System Interface Timing

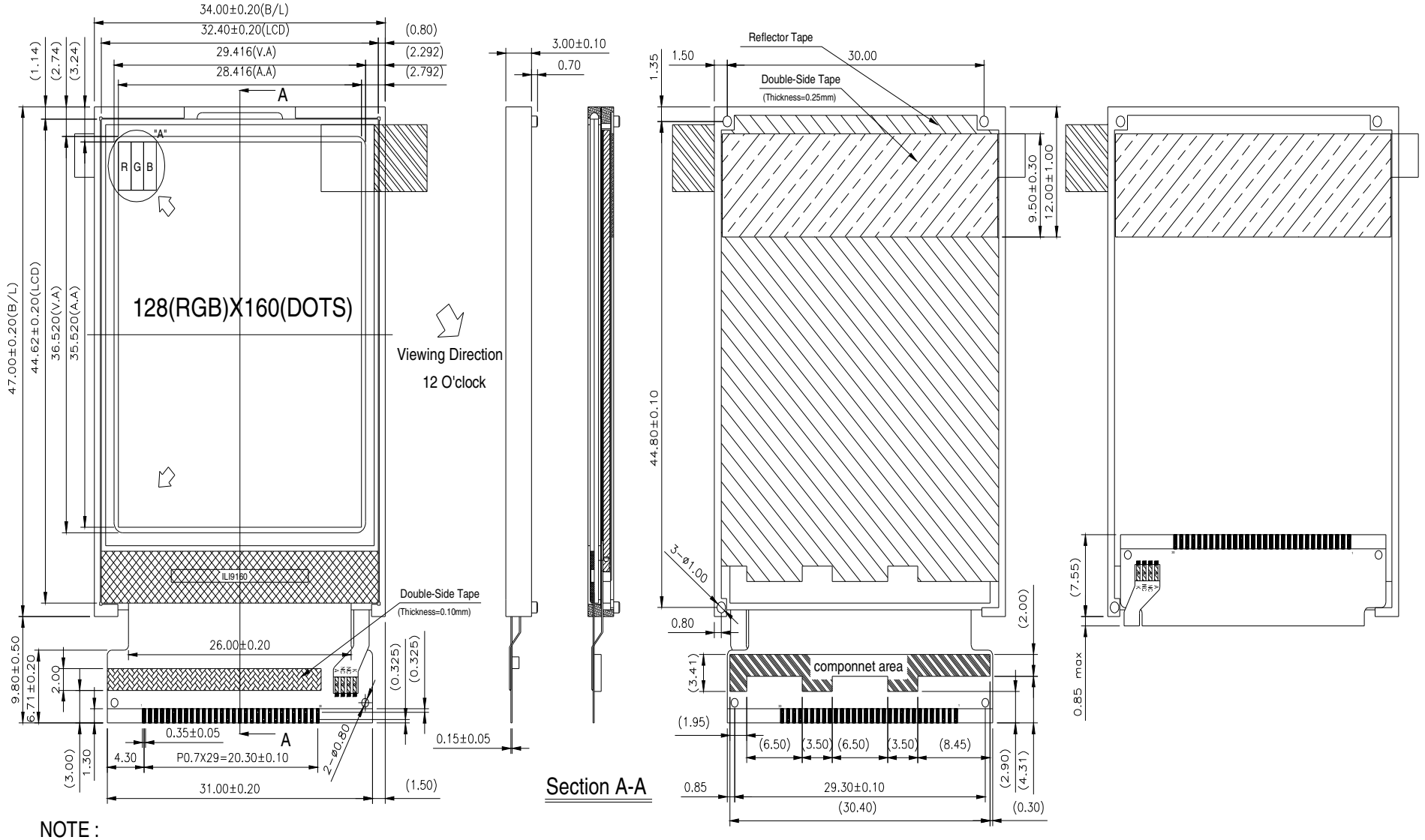
8. Driver IC Control Algorithms

Refer to the data Sheet of LCD Control IC ILI9160

9. Reliability Test Items

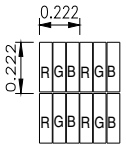
No.	Test items	Conditions	Remark
1	High temperature storage	80℃ 240H	
2	Low temperature storage	-30℃ 240H	
3	High temperature & high humidity storage	60℃. 90% RH, 240H	
4	Low temperature operation	-20℃ 240H	
5	Thermal Shock	-30℃ ,30 min /80℃ ,30 min , 20 cycles	Static
6	High temperature operation	70℃ 240H	
7	Low temperature operation	-20℃ 240H	
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.OutlineDimension



NOTE :

1. LCD SPEC.
   (1).LCD TYPE : 65K ,262K COLOR , a-Si TFT 1.8"QQVGA
   (2).DRIVE IC : HX-8310A
   (3).VIEWING DIRECTION :12 O'CLOCK
   (4).OPERATION TEMP. : -20° ~ 70°
   (5).STORAGE TEMP. : -30° ~ 80°
   (6).GENERAL TOLERANCE:±0.2mm
2. Backlight :
   (1).LED:3 white LED
   (2).VLED=10.5V(max.), I=20mA
   (3)B/L FPC Circuit : Serial



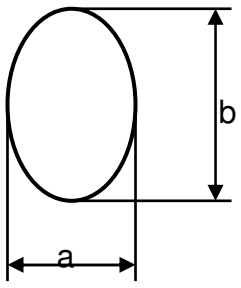
DETAIL "A"
SCALE= 20 : 1

11. Appearance Specification

No.	Item	Specification		ACC Q'TY	AQL	Remark
1	Scratch in display area	--	W≦0.02mm	Disregard	--	Note 1 (L≧W)
		L≦3.0mm	0.02mm＜W≦0.05mm	N≦1	1.0	
		L≦2.0mm	0.05mm＜W≦0.08mm	N≦1		
			0.08mm＜W	N≦0		
2	Bubbles in display area	D≦0.15mm		Disregard	1.0	Note 2
		0.15mm＜D≦0.3mm		N≦1	1.0	
		0.3mm＜D≦0.5mm		N≦1	1.0	
		0.5mm＜D		N≦0	1.0	
3	Spot (Dark/White dot)	D≦0.1mm		Disregard	1.0	Note 1 (L≧W) Note 2
		0.1mm＜D≦0.15mm		N≦1		
		0.15mm＜D≦0.20mm		N≦1		
		0.20mm＜D		N≦0		
4	Continuous defect	Distance between 2 defects stated≧ 8mm Total number ≦2		--	0.65	--
5	Bezel and plastic frame	Broken or become deformed		--	1.0	
6	FPC	Broken or become deformed		--	1.0	

Note 1: Definition of W and L

Note 2: D=average diameter D=(a+b)/2



12. Display Specification

No.	Item	Specification	ACC Q'TY	AQL	Remark
1	Line defect	--	N=0	0.65	--
2	Dot defect (Bright dot)	D≦0.1mm	Disregard	--	Note 1
		0.1mm＜D≦0.25mm	N≦2	0.65	
		0.25mm＜D	N≦0		
	Dot defect (Dark dot)	D≦0.1mm	Disregard		
		0.1mm＜D≦0.20mm	N≦3		
		0.2m＜D≦0.25m	N≦2		
		0.25mm＜D	N≦0		
3	Continuous defect	Distance between 2 bright of dark dot≧8mm Total number≦2	--	0.65	
4	Display function	No display malfunction	--	0.65	
5	Wrong viewing direction	Do not meet product specification	--	0.65	
6	Flickering	--	--	0.65	
7	Contrast ratio	Do not meet product specification	--	1.0	
8	Viewing Angle	Do not meet product specification	--	1.0	
9	Color Chromaticity	Do not meet product specification	--	1.0	
10	Brightness	Do not meet product specification	--	1.0	
11	Display Uniformity	Do not meet product specification	--	0.65	
12	Backlight unit	Do not light up or twinkling	--	0.65	--

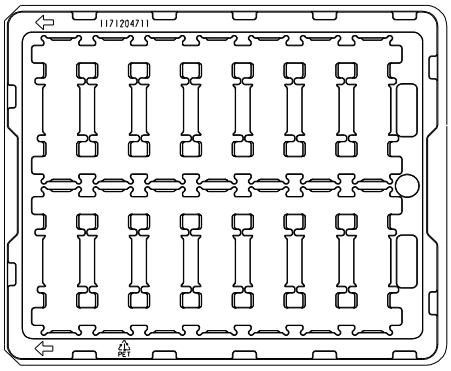
Note 1：Base on power on sequence in product specification.

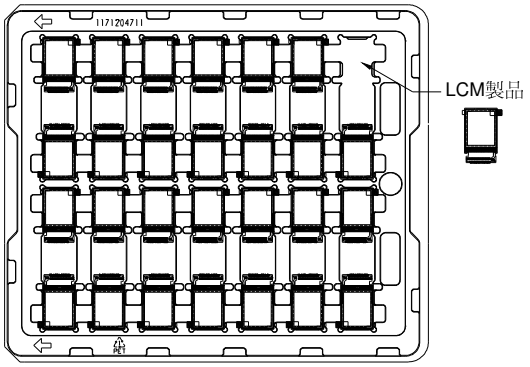
11. Package

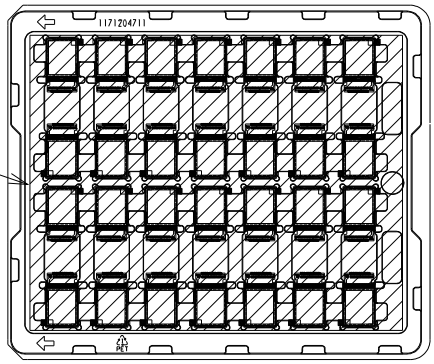
11.1 Method of the packaging

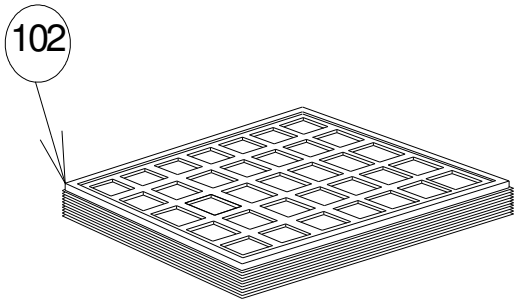
（1）Each Tray record load 28 PCS LCM products with, and each Tray record put 1 PCS buffer material in addition, 13 put Tray records of external the top add an empty Tray of sets in fact, it is one pile to amount to 14.

＊Notice that needs to pile pile alternately among each Tray plate.

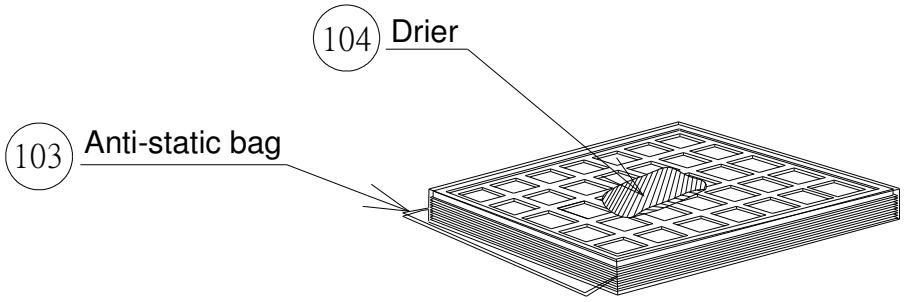




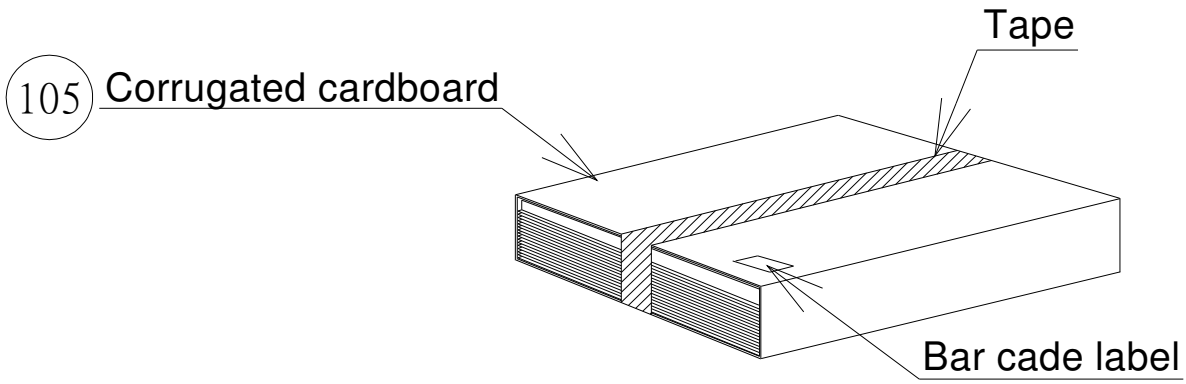




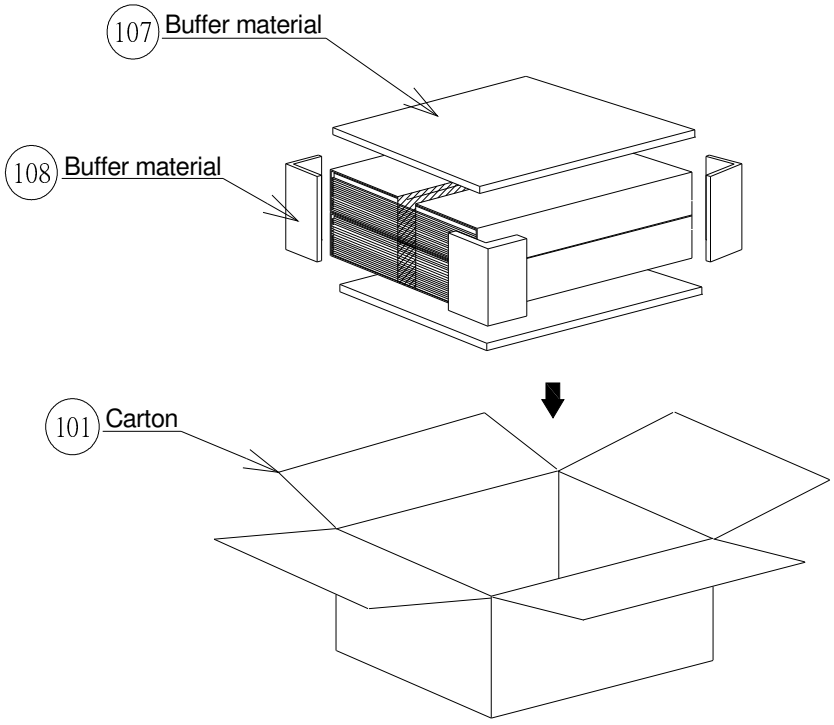
（2）Each pile is put with a pack of drier of an anti-static bag and sealed.



（3）Is it is it live in with a corrugated cardboard of frames regular and then to have each the more last to seal , and stick the bar code label at the corrugated cardboard .

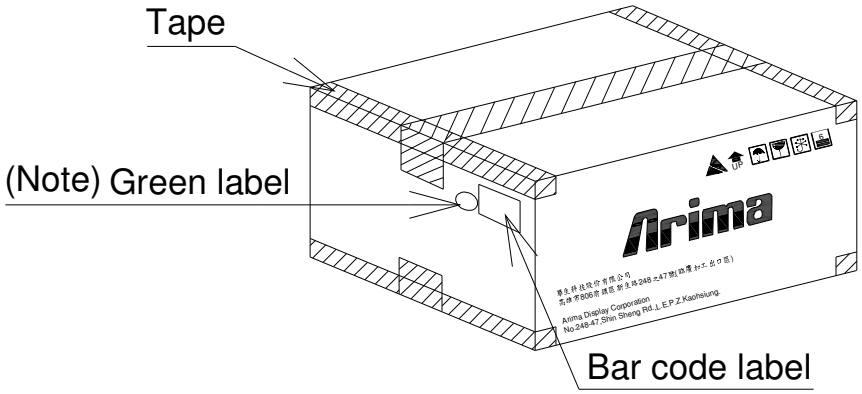


（4）Every two superposes and enters 4 angle posts and buffers material and 2 slices and buffers material, put into one more big packing box.



（5）Stick the sticky tape of a case, insert or stick the materials , such as name of the products , quantity and weight ,etc. and stick the bar code label in the blue frame in right on the case, confirm that all please stick Green label in the lower left corner of the blue frame above right for GP products in the packing boxes, namely finish the packaging.

Note: If in the packing box is not GP products, please don't stick Green label on the packing box .



（6）Before the packaging produces the goods, all products must be confirmed OK by QC department.

11.2 Design of the label

（1）Bar code label

The label content of the bar code includes in order

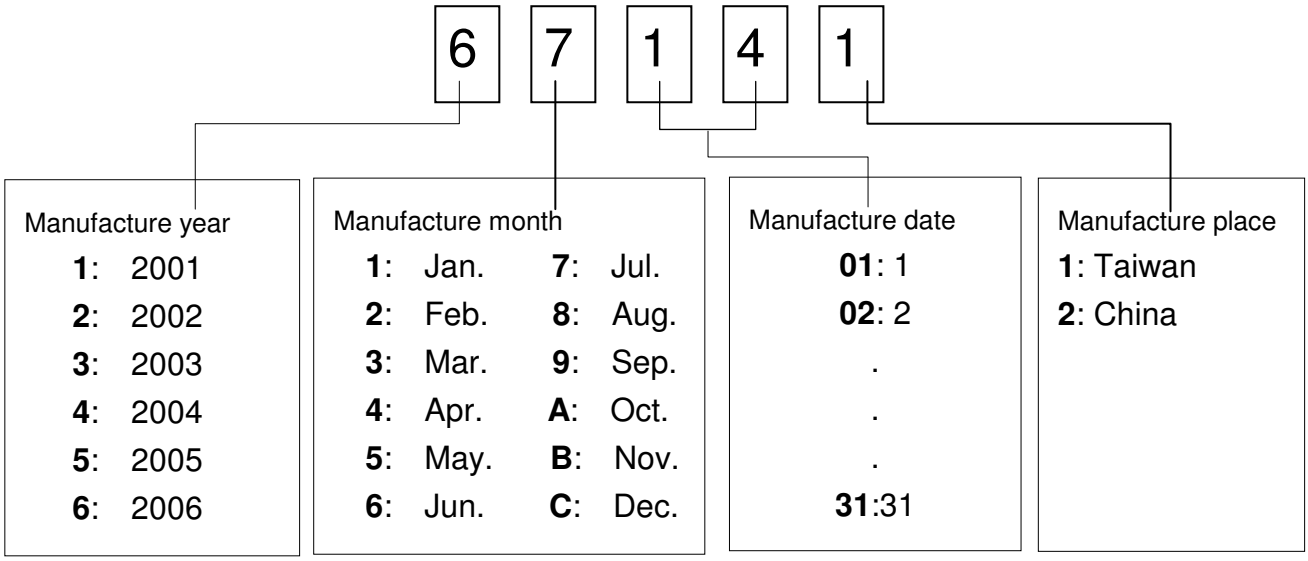
[1] P/N（Product No.）: MT18G10M

[2] Quantity : Qxxx

[3] Lot No. : LOTxxxxx

For example :

Lot No. Definition



（2）Green label

Green label pattern

11.3.Package Materials

No.	Item	Dimensions	Quantity	Unit Weight
101	Carton	540×430×250 mm	1 pcs	1.130 Kg
102	PET Tray	440×370×10.5 mm	28 pcs	0.130 Kg
103	Anti-static bag	600×480×0.05 mm	2 pcs	0.025 Kg
104	Drier	—	2 pcs	0.021 Kg
105	Corrugated cardboard	960×440×3 mm	2 pcs	0.290 Kg
106	緩衝材	390×310×1 mm	26 pcs	0.0033 Kg
107	Buffer material	390 x 230 x 10 mm	2 pcs	0.020 Kg
108	Buffer material	100 x 100 x 200 mm	4 pcs	0.026 Kg
Materials Total Weight		（5.68）Kg +/- 5%		

11.4.Package Weight

No.	Item	Quantity	Unit Weight
1	LCM Product	728 pcs	0.0071 Kg
2	Packaging Materials	1 set	5.68 Kg
Package Weight		（10.85）Kg +/- 5%	

12. General 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 should always 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