US Micro Products

Electronic Products for the OEM

TFT-LCD PRODUCT SPECIFICATION

PART NUMBER:	**USMP-TT022Q-01C**
DESCRIPTION:	2.2″ TFT LCD with 240 x 320 resolution, White LED B/L and 18 Bits&16 Bits Interface.

ISSUE DATE	APPROVED BY (Customer Use Only)	CHECKED BY	PREPARED BY
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History of Version

Date	Ver.	Edi.	Description	Page	Design by
5/21/2009	**01**	**001**	**New Drawing**	**-**	**Raymond**
7/1/2009	**01**	**002**	**New sample**	**-**	**Raymond**

Total: 24 Page

Contents

1. SPECIFICATIONS

1.1 Features

Main LCD Panel

Item	Standard Value
Display Type	240 *(R、G、B) * 320Dots
LCD Type	Active matrix TFT, Transmissive type
Screen size(inch)	2.2 (Diagonal)
Viewing Direction	12 O'clock
Color configuration	R. G. B. vertical stripe
Backlight	White LED B/L
Interface	18 Bits&16 Bits
Driver IC	R61580

1.2 Mechanical Specifications

Item	Standard Value	Unit
Outline Dimension	40.4(W) × 57.3(L) × 3.5max(H)	mm

LCD Panel

Item	Standard Value	Unit
Viewing Area (LCD)	35.08 (W) * 46.24 (L)	mm
Active Area (LCD)	33.48 (W) * 44.64 (L)	mm

Note : For detailed information please refer to LCM drawing

1.3 Absolute Maximum Ratings

Module

Item	Symbol	Condition	Min.	Max.	Unit
System Power Supply Voltage	VCC	-	-0.3	+4.6	V
	VGH-VGL	-	-0.3	+30	V
	GND-VGL	-	-0.3	+13	V
Input Voltage	VT	-	-0.3	VDD+0.3	V
Operating Temperature	T_{OP}	-	-20	+70	°C
Storage Temperature	T_{ST}	-	-30	+80	°C
Storage Humidity	H_D	Ta < 60 °C	20	90	%RH

1.4 DC Electrical Characteristics

Module GND = 0V, Ta = 25°C

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Power Supply Voltage	VDD	-	-	2.8	-	V
Input High Voltage	V_{IH}	-	0.8* VDD	-	VDD	V
Input Low Voltage	V_{IL}	-	-0.3	-	0.2* VDD	V
Output High Voltage	V_{OH}	I_{OH}=-0.1mA	0.8 * VDD	-	-	V
Output Low Voltage	V_{OL}	I_{OL}=0.1mA	-	-	0.2* VDD	V
Supply Current	ICC	VDD = 2.8 V Pattern=full display*1	-	7	11	mA

Note1:Maximum current display

1.5 Optical Characteristics

TFT LCD Panel VCC =2.8V, Ta=25°C

Item		Symbol	Condition	Min.	Typ.	Max.	unit	
Response time		Tr + Tf	Ta = 25°C θX, θY = 0°	-	40	60	ms	Note2
Viewing angle	Top	θY+	CR ≥ 10	-	50	-	Deg.	Note4
	Bottom	θY-		-	45	-		
	Left	θX-		-	50	-		
	Right	θX+		-	50	-		
Contrast ratio		CR	Ta = 25°C θX , θY = 0°	200	250	-	-	Note3
Color of CIE Coordinate (With B/L)	White	X		0.23	0.28	0.33	-	Note1
		Y		0.26	0.31	0.36		
	Red	X		0.59	0.64	0.69		
		Y		0.29	0.34	0.39		
	Green	X		0.29	0.34	0.39		
		Y		0.56	0.61	0.66		
	Blue	X		0.10	0.15	0.20		
		Y		0.04	0.09	0.14		
Average Brightness Pattern=white display (With B/L)		IV	IF= 60mA	190	210	-	cd/m^2	Note1
Uniformity (With B/L)		△B	IF= 60mA	80	-	-	%	Note1

Note1:

1：△B=B(min) / B(max) ×100%

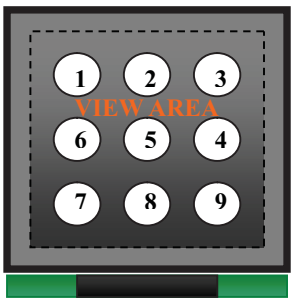
2：Measurement Condition for Optical Characteristics:

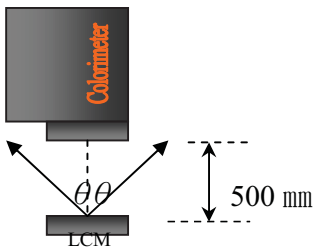
a：Environment: 25℃±5℃ / 60±20%R.H，no wind，dark room below 10 Lux at typical lamp current and typical operating frequency.

b：Measurement Distance: 500 ± 50 ㎜ ，(θ= 0°)

c：Equipment: TOPCON BM-7 fast，(field 1°)，after 10 minutes operation.

d：The uncertainty of the C.I.E coordinate measurement ±0.01，Average Brightness ± 4%





Colorimeter=BM-7 fast

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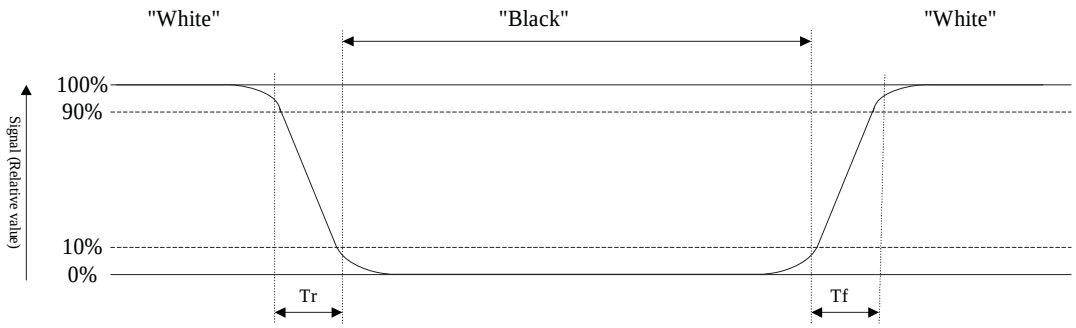
Note2: Definition of response time:

The output signals of photo detector are measured when the input signals are changed from “black” to “white”(falling time) and from “white” to “black”(rising time), respectively. The response time is defined as the time interval between the 10% and 90% of Amplitudes.

Refer to figure as below:



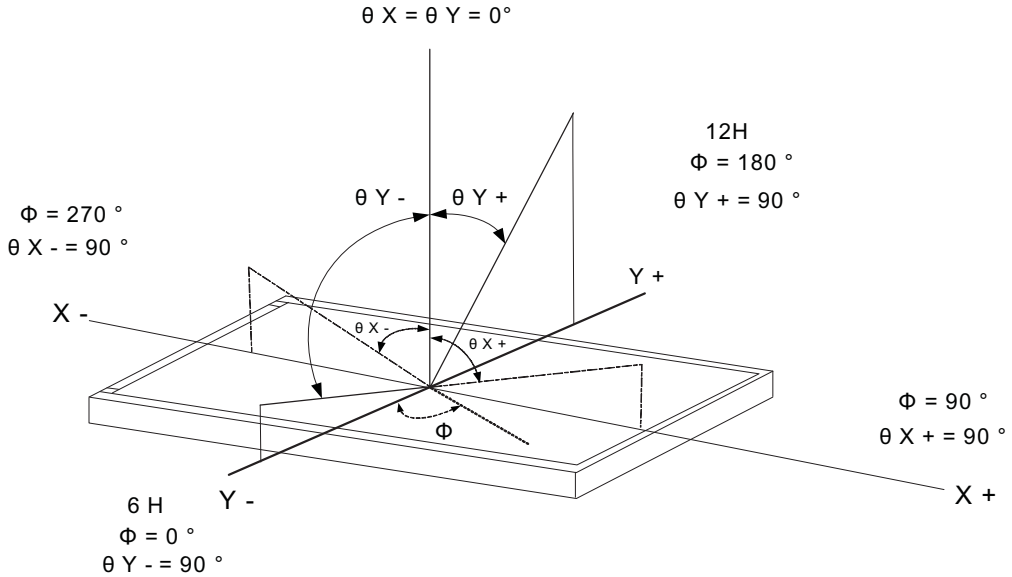
Note3: Definition of contrast ratio:

Contrast ratio is calculated with the following formula

$$\text{Contrast ratio (CR)} = \frac{\text{Photo detector output when LCD is at “White” state}}{\text{Photo detector output when LCD is at “Black” state}}$$

Note4: Definition of viewing angle:

Refer to figure as below:



1.6 Backlight & LED Characteristics

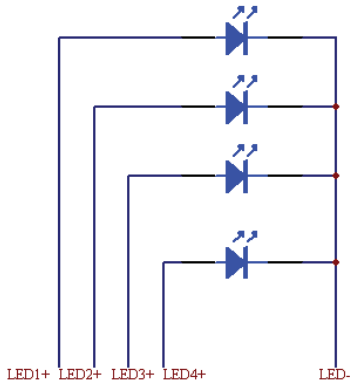
LCD Module with LED Backlight

Maximum Ratings

Item	Symbol	Conditions	Min.	Max.	Unit
Forward Current	IF	Ta =25℃	-	120	mA
Reverse Voltage	VR	Ta =25℃	-	5	V
Reverse Current	IR	Ta =25℃	-	60	μA
Power Dissipation	PD	Ta =25℃	-	360	mW

Electrical / Optical Characteristics

Item	Symbol	Conditions	Min.	Typ.	Max.	Unit
Forward Voltage	VF	IF= 60mA	-	3.3	3.6	V
Average Brightness (Without LCD)	IV		3800	4300	-	cd/m^2
Color of CIE Coordinate (Without LCD)	X		-	0.28	-	-
	Y		-	0.28	-	
Color	White					



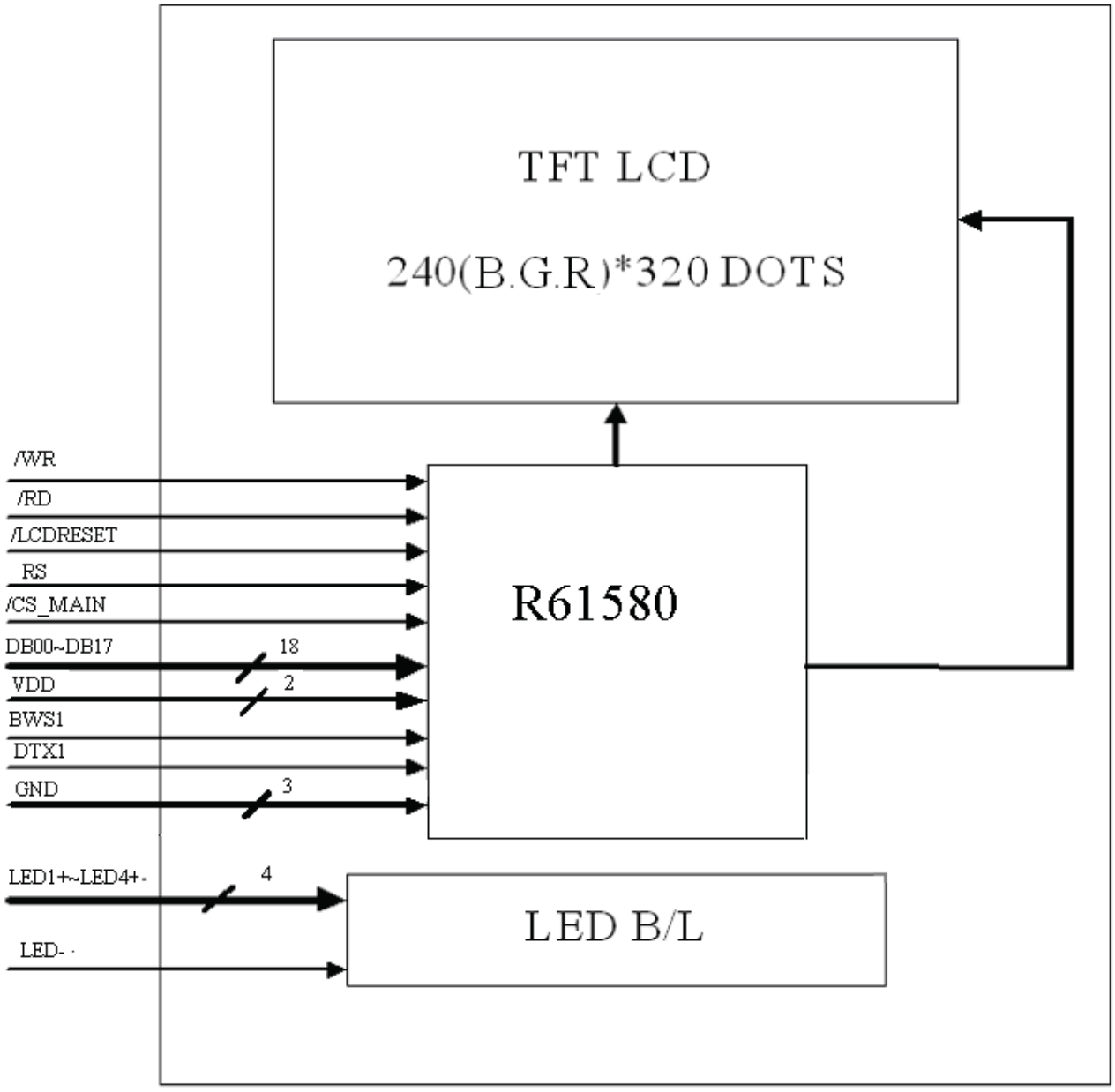
2. MODULE STRUCTURE

2.1 Counter Drawing

2.1.1 LCM Mechanical Diagram

* See Appendix

2.1.2 Block Diagram



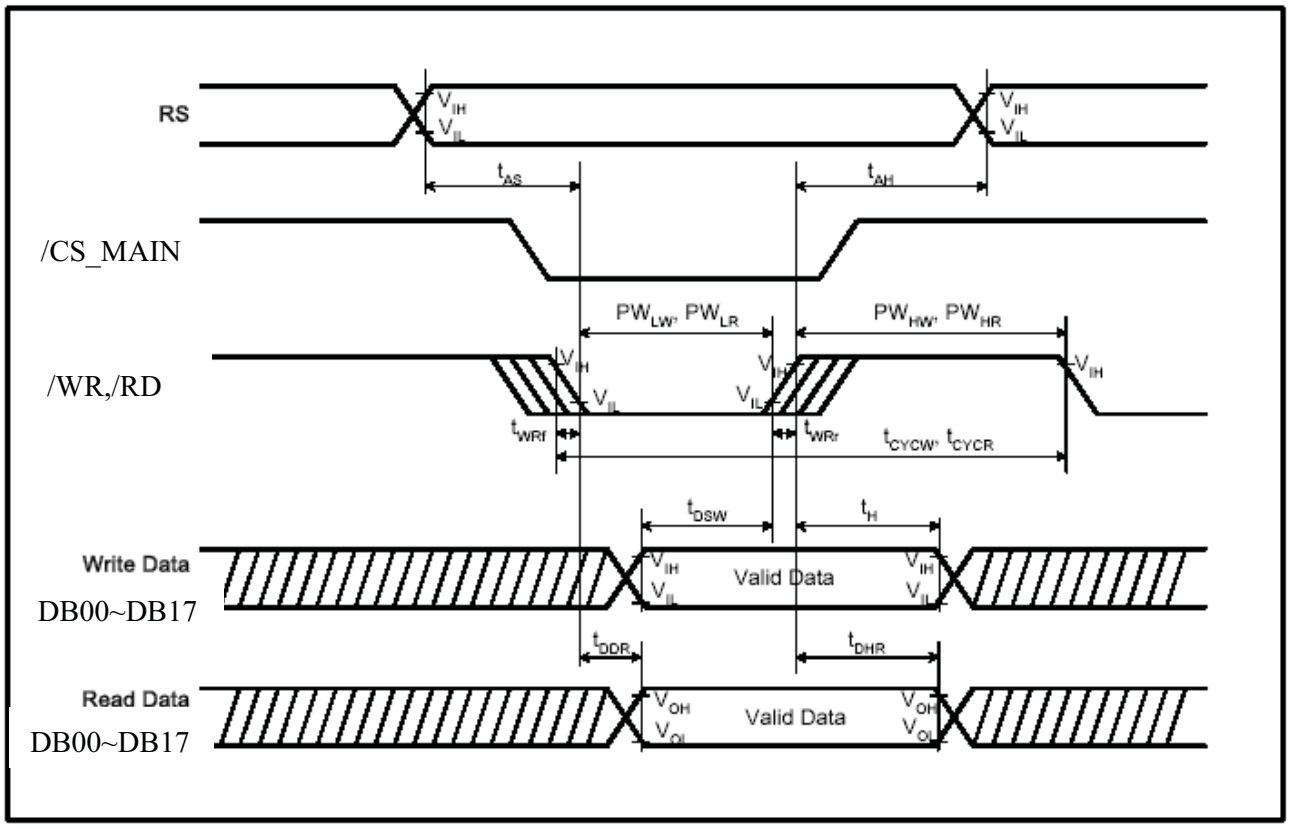
2.2 Interface Pin Description

Pin No.	Symbol	Function
1	GND	Ground
2	/CS_MAIN	Chip selection
3	RS	Command/date select
4	/WR	Write signal
5	/RD	Read signal
6	DB00	Data bus
7	DB01	
8	DB02	
9	DB03	
10	DB04	
11	DB05	
12	DB06	
13	DB07	
14	DB08	
15	DB09	
16	DB10	
17	DB11	
18	DB12	
19	DB13	
20	DB14	
21	DB15	
22	DB16	
23	DB17	
24	/LCDRESET	LCD reset signal
25	BWS1	BWS1（IM3） / MPU Interface type 0 / 16-bit 8080 parallel interface 1 / 18-bit 8080 parallel interface

Pin No.	Symbol	Function
26	DTX1	No connection
27	GND	Ground
28	X+	No connection
29	Y+	No connection
30	X-	No connection
31	Y-	No connection
32	GND	Ground
33	VDD	Power supply for LCD
34	VDD	Power supply for LCD
35	LED1+	LED light anode
36	LED2+	LED light anode
37	LED3+	LED light anode
38	LED4+	LED light anode
39	LED-	LED light cathode

2.3 Timing Characteristics

80-Sysyem Bus Operation

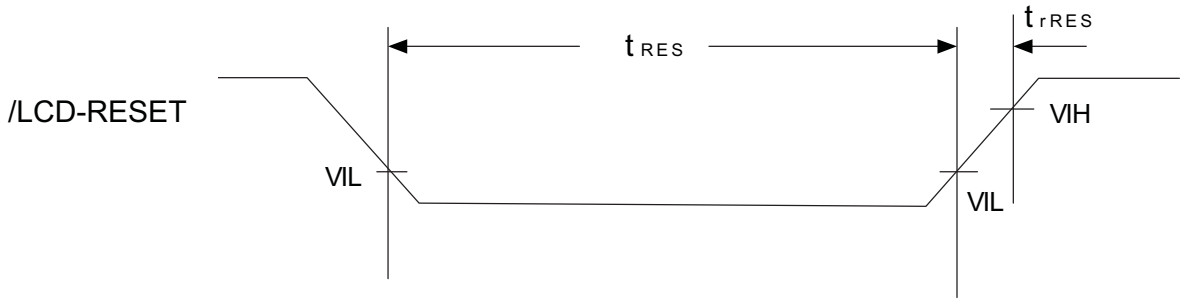


Normal write operation VCC= 2.8V, Ta=25℃

Symbol	Parameter		Min	Typ	Max	Unit
tcycw	Bus Cycle time	write cycle	100	-	-	ns
tcycr		read cycle	300	-	-	ns
tAS	setup time	Write(RS to /CS_MAIN,/WR)	10	-	-	ns
		Write(RS to /CS,/RD)	5			
tAH	Address Hold time		5	-	-	ns
tDSW	Write Data Setup time		10	-	-	ns
tH	Write Data Hold time		15	-	-	ns
tDDR	Read data delay time		-	-	100	ns
tDHR	Read data Hold Time		5	-	-	ns
PWLW	Write low-level pulse width		50	-	-	ns
PWLR	Read low-level pulse width		150	-	-	ns

PWHW	Write high-level pulse width	50	-	-	ns
PWHR	Read high-level pulse width	150	-	-	ns
tWRr WRf	Write / Read Rise time / Fall time	-	-	25	ns

LCD Reset

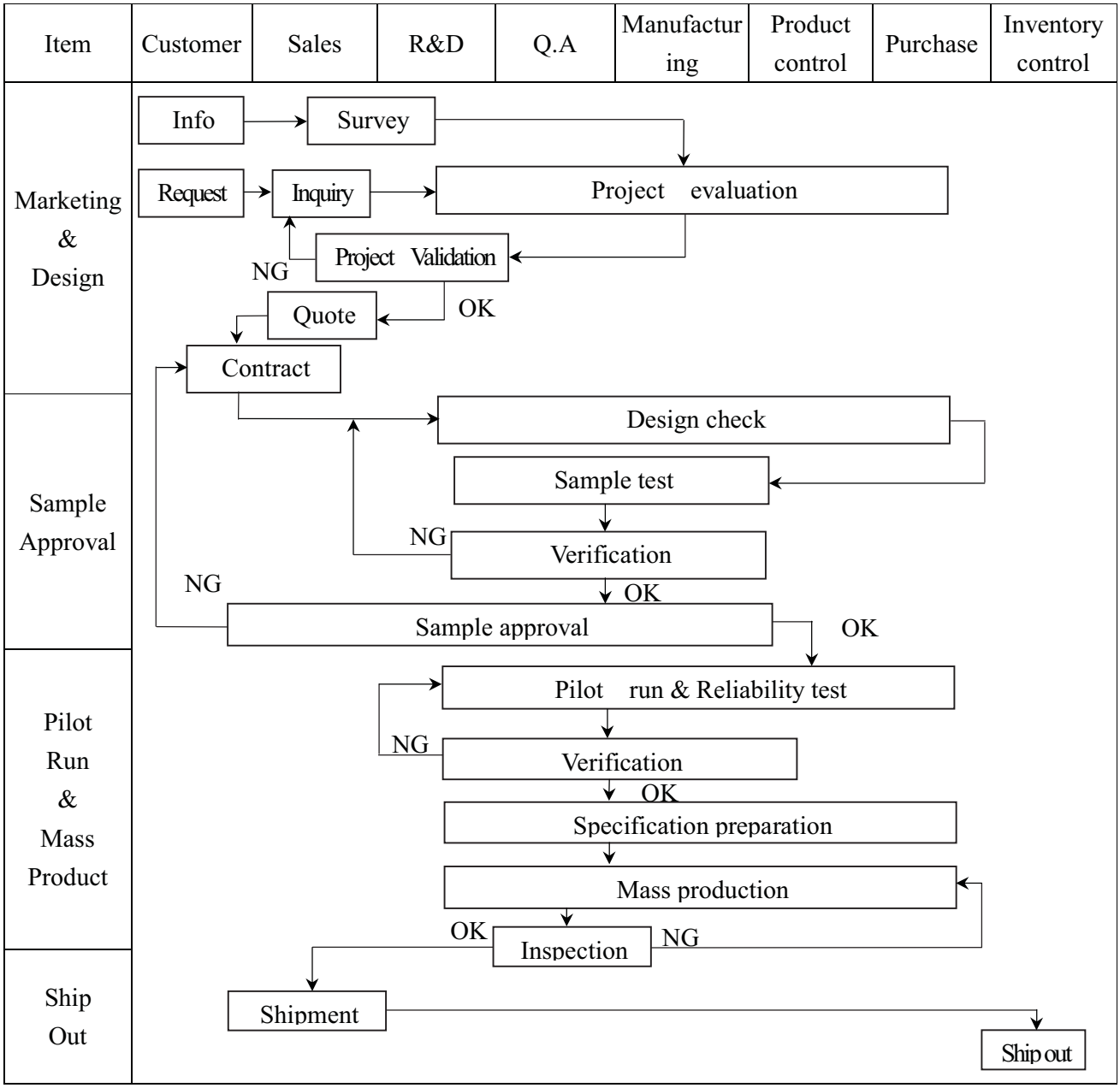


VCC = 2.8V, Ta=25℃

Item	Symbol	Condition	Min.	Max.	Unit
Reset low-level width	tRES	-	1	-	ms
Reset rise time	trRES		-	10	us

3. QUALITY ASSURANCE SYSTEM

3.1 Quality Assurance Flow Chart



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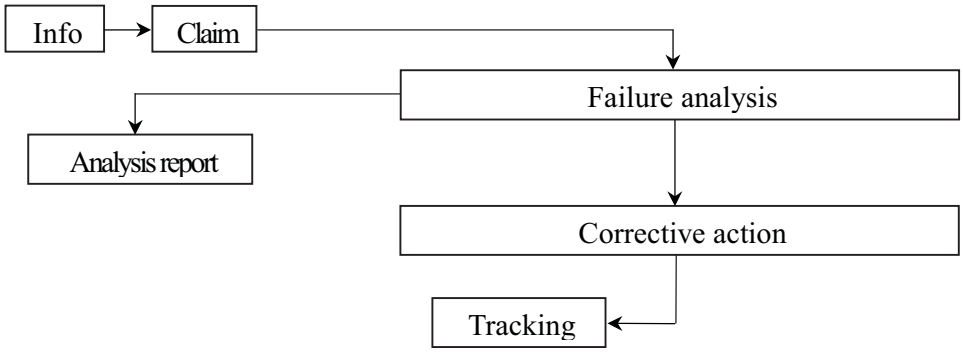
Item	Customer	Sales	R&D	Q.A	Manufactu ring	Product control	Purchase	Inventory control
Sales Service								
Q.A Activity	1. ISO 9001 Maintenance Activities 3. Equipment calibration 5. Standardization Management				2. Process improvement proposal 4. Education And Training Activities			

3.2.Inspection Specification

◆Scope ：The document shall be applied to TFT-LCD Module for less than 3.5″ (Ver.B01).

◆Inspection Standard：MIL-STD-105E Table Normal Inspection Single Sampling Level Ⅱ.

◆Equipment：Gauge、MIL-STD、Sample

◆Defect Level：Major Defect AQL： 0.4 ； Minor Defect AQL： 1.5

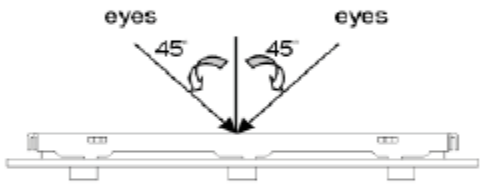
◆OUT Going Defect Level：Sampling.

◆Standard of the product appearance test：

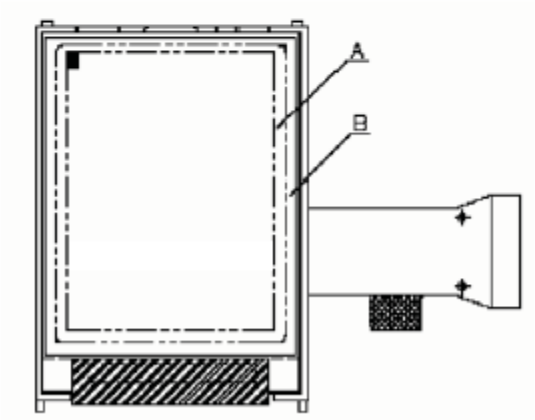
a. Manner of appearance test：

(1). The test best be under 20W×2 fluorescent light，and distance of view must be at 30 cm.

(2). The test direction is base on about around 45° of vertical line.



(3). Definition of area.



A area：viewing area

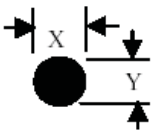
B area：Outside of viewing area

(4). Standard of inspection： (Unit：mm)

◆Specification For TFT-LCD Module Less Than 3.5″ : (Ver.02)

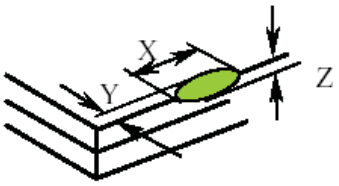
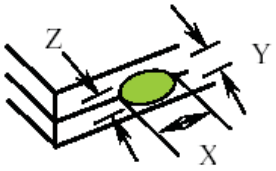
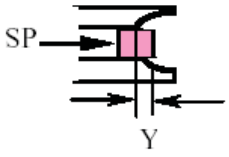
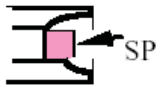
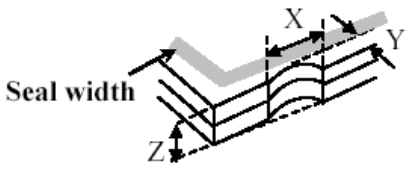
<table>
<tr><th>NO</th><th>Item</th><th>Criterion</th><th>Level</th></tr>
<tr><td rowspan="3">01</td><td rowspan="3">Product condition</td><td>1.1The part number is inconsistent with work order of production.</td><td>Major</td></tr>
<tr><td>1.2 Mixed product types.</td><td>Major</td></tr>
<tr><td>1.3 Assembled in inverse direction.</td><td>Major</td></tr>
<tr><td>02</td><td>Quantity</td><td>2.1The quantity is inconsistent with work order of production.</td><td>Major</td></tr>
<tr><td>03</td><td>Outline dimension</td><td>3.1 Product dimension and structure must conform to structure diagram.</td><td>Major</td></tr>
<tr><td rowspan="5">04</td><td rowspan="5">Electrical Testing</td><td>4.1 Missing line character and icon.</td><td>Major</td></tr>
<tr><td>4.2 No function or no display.</td><td>Major</td></tr>
<tr><td>4.3 Display malfunction.</td><td>Major</td></tr>
<tr><td>4.4 LCD viewing angle defect.</td><td>Major</td></tr>
<tr><td>4.5 Current consumption exceeds product specifications.</td><td>Major</td></tr>
<tr><td>05</td><td>Dot defect
(Bright dot、Dark dot)
On -display</td><td>
<table>
<tr><th colspan="2">Item</th><th>Acceptance (Q'ty)</th></tr>
<tr><td rowspan="4">Dot Defect</td><td>Bright Dot</td><td>≦ 2</td></tr>
<tr><td>Dark Dot</td><td>≦ 3</td></tr>
<tr><td>Joint Dot</td><td>≦ 2</td></tr>
<tr><td>Total</td><td>≦ 3</td></tr>
</table>
5.1 Inspection pattern：full white , full black , Red , Green and blue screens.
5.2 It is defined as dot defect if defect area ＞1/2 dot.
5.3 The distance between two dot defect ≧5 mm.
</td><td>Minor</td></tr>
</table>

◆Specification For TFT-LCD Module Less Than 3.5″ : (Ver.02)

<table>
<tr><th>NO</th><th>Item</th><th>Criterion</th><th>Level</th></tr>
<tr><td>06</td><td>Black or white dot、scratch、contamination
Round type
 

Φ=(x+y) / 2
Line type
 
</td><td>6.1 Round type (Non-display or display) :
<table><tr><th>Dimension (diameter : Φ)</th><th>Acceptance (Q'ty)</th></tr><tr><td>Φ ≦ 0.15</td><td>Ignore</td></tr><tr><td>0.15 < Φ ≦ 0.20</td><td>2</td></tr><tr><td>0.20 < Φ ≦ 0.30</td><td>2</td></tr><tr><td>Φ > 0.30</td><td>0</td></tr><tr><td>Total</td><td>3</td></tr></table>
6.2 Line type(Non-display or display) :
<table><tr><th>Length (L)</th><th>Width (W)</th><th>Acceptance (Q'ty)</th></tr><tr><td>---</td><td>W ≦ 0.03</td><td>Ignore</td></tr><tr><td>L ≦5.0</td><td>0.03 < W ≦ 0.05</td><td>3</td></tr><tr><td>---</td><td>W >0.05</td><td>As round type</td></tr><tr><td colspan="2">Total</td><td>3</td></tr></table></td><td>Minor</td></tr>
<tr><td>07</td><td>Polarizer Bubble</td><td><table><tr><th>Dimension (diameter : Φ)</th><th>Acceptance (Q'ty)</th></tr><tr><td>Φ ≦ 0.20</td><td>Ignore</td></tr><tr><td>0.20 < Φ ≦ 0.50</td><td>3</td></tr><tr><td>Φ > 0.50</td><td>0</td></tr><tr><td>Total</td><td>3</td></tr></table></td><td>Minor</td></tr>
</table>

◆Specification For TFT-LCD Module Less Than 3.5″ : (Ver.02)

NO	Item	Criterion	Level
08	The crack of glass	Symbols : X : The length of crack Y : The width of crack. Z : The thickness of crack W : terminal length t : The thickness of glass a : LCD side length 8.1 General glass chip : 8.1.1 Chip on panel surface and crack between panels:    【OK】  【NG】 	Minor

X	Y	Z
≦ a	Crack can't enter viewing area	≦1/2 t
≦ a	Crack can't exceed the half of SP width.	1/2 t < Z ≦2 t

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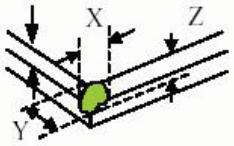
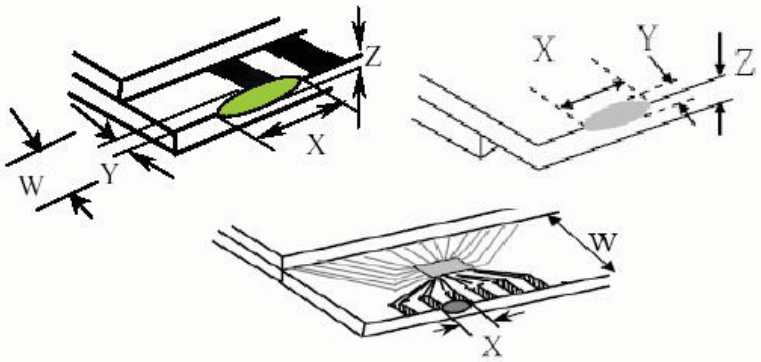
◆Specification For TFT-LCD Module Less Than 3.5″ : (Ver. 02)

<table>
<tr><th>NO</th><th>Item</th><th>Criterion</th><th>Level</th></tr>
<tr><td>08</td><td>The crack of glass</td><td>
Symbols :

X : The length of crack　　Y : The width of crack.
Z : The thickness of crack　　W : terminal length
t : The thickness of glass　　a : LCD side length

8.1.2 Corner crack :


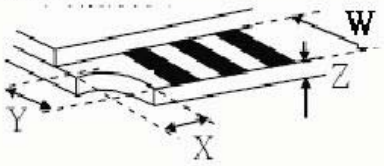
<table>
<tr><th>X</th><th>Y</th><th>Z</th></tr>
<tr><td>≦1/5 a</td><td>Crack can't enter viewing area</td><td>Z ≦ 1/2 t</td></tr>
<tr><td>≦1/5 a</td><td>Crack can't exceed the half of SP width.</td><td>1/2 t < Z ≦ 2 t</td></tr>
</table>
8.2 Protrusion over terminal :
8.2.1 Chip on electrode pad :


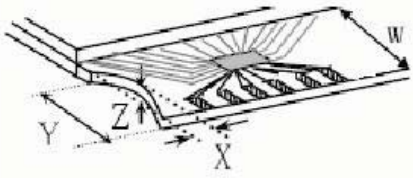
<table>
<tr><th></th><th>X</th><th>Y</th><th>Z</th></tr>
<tr><td>Front</td><td>≦ a</td><td>≦ 1/2 W</td><td>≦ t</td></tr>
<tr><td>Back</td><td>≦ a</td><td>≦ W</td><td>≦ 1/2 t</td></tr>
</table>
</td><td>Minor</td></tr>
</table>

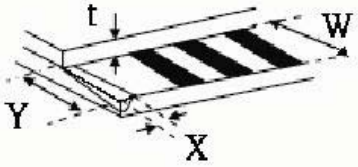
◆Specification For TFT-LCD Module Less Than 3.5″ : (Ver.02)

<table>
<tr><th>NO</th><th>Item</th><th>Criterion</th><th>Level</th></tr>
<tr><td>08</td><td>The crack of glass</td><td>
Symbols :

X : The length of crack　　Y : The width of crack.
Z : The thickness of crack　　W : terminal length
t : The thickness of glass　　a : LCD side length

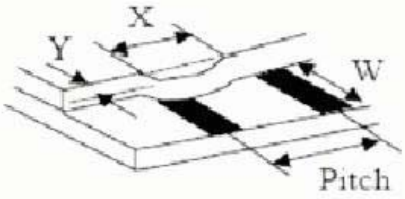
8.2.2 Non-conductive portion :






<table>
<tr><th>X</th><th>Y</th><th>Z</th></tr>
<tr><td>≦ 1/3 a</td><td>≦W</td><td>≦t</td></tr>
</table>
⊙ If the chipped area touches the ITO terminal, over 2/3 of the ITO must remain and be inspected according to electrode terminal specifications.

8.2.3 Glass remain :



<table>
<tr><th>X</th><th>Y</th><th>Z</th></tr>
<tr><td>≦ a</td><td>≦ 1/3 W</td><td>≦t</td></tr>
</table>
</td><td>Minor</td></tr>
</table>

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◆Specification For TFT-LCD Module Less Than 3.5″ : (Ver. 02)

NO	Item	Criterion	Level
09	Backlight elements	9.1 Backlight can't work normally.	Major
		9.2 Backlight doesn't light or color is wrong.	Major
		9.3 Illumination source flickers when lit.	Major
10	General appearance	10.1 Pin type、quantity、dimension must match type in structure diagram.	Major
		10.2 No short circuits in components on PCB or FPC .	Major
		10.3 Parts on PCB or FPC must be the same as on the production characteristic chart .There should be no wrong parts , missing parts or excess parts.	Major
		10.4 Product packaging must the same as specified on packaging specification sheet.	Minor
		10.5 The folding and peeled off in polarizer are not acceptable.	Minor
		10.6 The PCB or FPC between B/L assembled distance(PCB or FPC) is ≦1.5 mm.	Minor

4. RELIABILITY TEST

4.1 Reliability Test Condition

NO.	TEST ITEM	TEST CONDITION	
1	High Temperature Storage Test	Keep in 80 ±2℃ 96 hrs Surrounding temperature, then storage at normal condition 4hrs.	
2	Low Temperature Storage Test	Keep in -30 ±2℃ 96 hrs Surrounding temperature, then storage at normal condition 4hrs.	
3	High Temperature / High Humidity Storage Test	Keep in 60 ℃ / 90% R.H duration for 96 hrs Surrounding temperature, then storage at normal condition 4hrs. (Excluding the polarizer)	
4	ESD Test	Air Discharge: Apply 2 KV with 5 times Discharge for each polarity +/-	Contact Discharge: Apply 250 V with 5 times discharge for each polarity +/-
		1. Temperature ambiance : 15℃～35℃ 2. Humidity relative : 30%～60% 3. Energy Storage Capacitance(Cs+Cd) : 150pF±10% 4. Discharge Resistance(Rd) : 330Ω±10% 5. Discharge, mode of operation : Single Discharge (time between successive discharges at least 1 sec) (Tolerance if the output voltage indication : ±5%)	
5	Temperature Cycling Storage Test	-30℃ → +25℃ → 80℃ → +25℃ (30mins) (5mins) (30mins) (5mins) 10 Cycle Surrounding temperature, then storage at normal condition 4hrs.	
6	Vibration Test (Packaged)	1. Sine wave 10～55 Hz frequency (1 min) 2. The amplitude of vibration :1.5 mm 3. Each direction (X、Y、Z) duration for 2 Hrs	
7	Drop Test (Packaged)	Packing Weight (Kg) / Drop Height (cm) 0 ~ 45.4 / 122 45.4 ~ 90.8 / 76 90.8 ~ 454 / 61 Over 454 / 46 Drop direction :※1 corner / 3 edges / 6 sides each 1times	

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5. PRECAUTION RELATING PRODUCT HANDLING

5.1 SAFETY

5.1.1 If the LCD panel breaks , be careful not to get the liquid crystal to touch your skin.
5.1.2 If the liquid crystal touches your skin or clothes , please wash it off immediately by using soap and water.

5.2 HANDLING

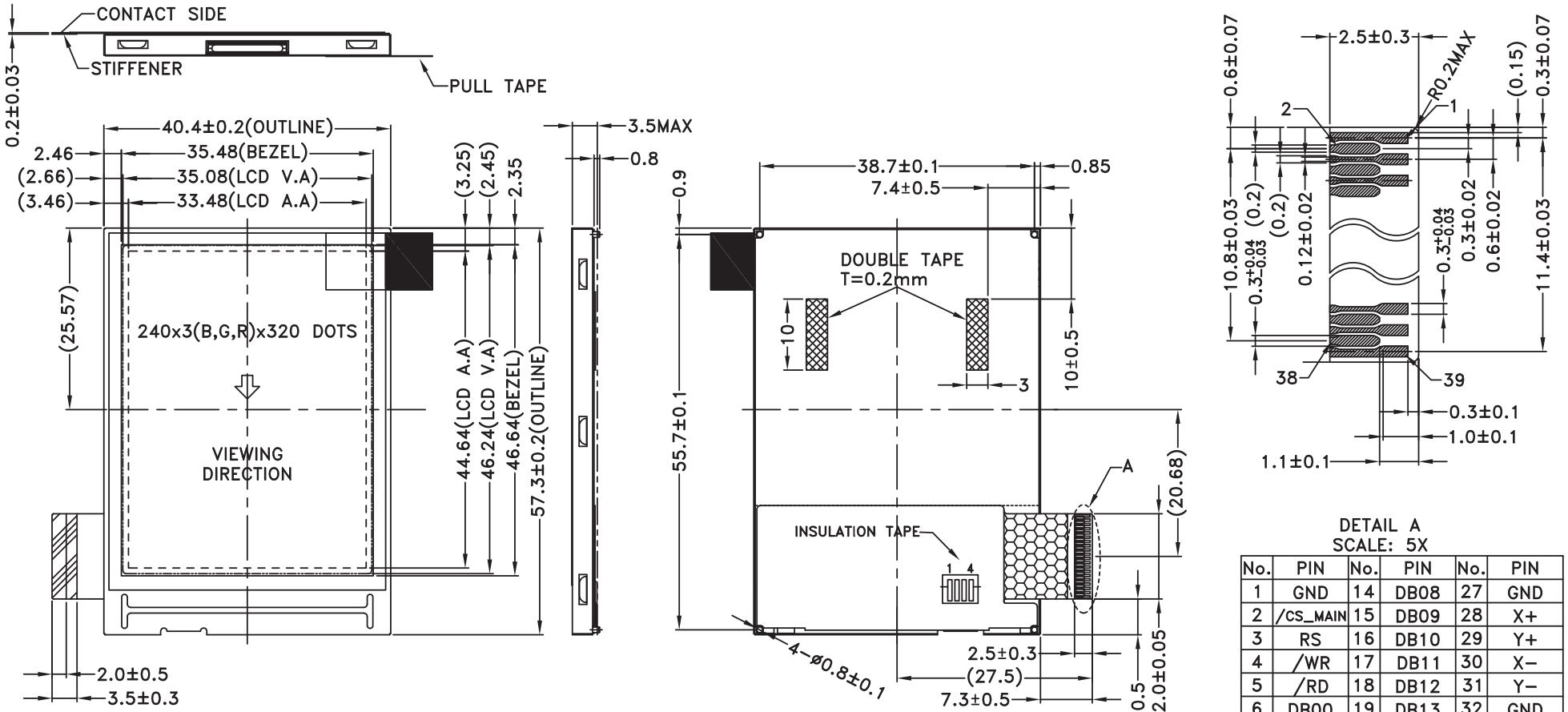
5.2.1 Avoid any strong mechanical shock which can break the glass.
5.2.2 Avoid static electricity which can damage the CMOS LSI—When working with the module , be sure to ground your body and any electrical equipment you may be using.
5.2.3 Do not remove the panel or frame from the module.
5.2.4 The polarizing plate of the display is very fragile. So , please handle it very carefully, do not touch , push or rub the exposed polarizing with anything harder than an HB pencil lead (glass , tweezers , etc.)
5.2.5 Do not wipe the polarizing plate with a dry cloth , as it may easily scratch the surface of plate.
5.2.6 Do not touch the display area with bare hands , this will stain the display area.
5.2.7 Do not use ketonics solvent & aromatic solvent. Use with a soft cloth soaked with a cleaning naphtha solvent.
5.2.8 To control temperature and time of soldering is 320 ± 10°C and 3-5 sec.
5.2.9 To avoid liquid (include organic solvent) stained on LCM

5.3 STORAGE

5.3.1 Store the panel or module in a dark place where the temperature is 25°C ± 5°C and the humidity is below 65% RH.
5.3.2 Do not place the module near organics solvents or corrosive gases.
5.3.3 Do not crush , shake , or jolt the module.

5.4 TERMS OF WARRANTY

5.4.1 Applicable warrant period
The period is within thirteen months since the date of shipping out under normal using and storage conditions.
5.4.2 Unaccepted responsibility
This product has been manufactured to your company's specification as a part for use in your company's general electronic products. It is guaranteed to perform according to delivery specifications. For any other use apart from general electronic equipment, we cannot take responsibility if the product is used in nuclear power control equipment, aerospace equipment , fire and security systems or any other applications in which there is a direct risk to human life and where extremely high levels of reliability are required.



DETAIL A
SCALE: 5X

No.	PIN	No.	PIN	No.	PIN
1	GND	14	DB08	27	GND
2	/CS_MAIN	15	DB09	28	X+
3	RS	16	DB10	29	Y+
4	/WR	17	DB11	30	X−
5	/RD	18	DB12	31	Y−
6	DB00	19	DB13	32	GND
7	DB01	20	DB14	33	VDD
8	DB02	21	DB15	34	VDD
9	DB03	22	DB16	35	LED1+
10	DB04	23	DB17	36	LED2+
11	DB05	24	/LCDRESET	37	LED3+
12	DB06	25	BWS1	38	LED4+
13	DB07	26	DTX1	39	LED−

NOTE:
1.DISPLAY TYPE:262k COLOR TFT−LCD,TRANSMISSIVE
2.OPERATING TEMP:−20°C~70°C
3.STORAGE TEMP:−30°C~80°C
4.LCD DRIVER:R61580
5.BACKLIGHT:4 CHIP−WHITE LED PARALLEL
6.FPC CONNECTOR:HIROSE FH26−39S−0.3SHW
7.GENERAL TOLORANCE:±0.2mm

REV	REV BY	REVISER	DATE
007			
006			
005			
004			
003			
002			
001	NEW DRAWING	Air	2009/05/20

PART NO: USMP-TT022Q-01C
DRAWING NAME :
TITLE: LCD Module Drawing

US Micro Products
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6207 Bee Caves Rd., Ste. 330; Austin, TX 78746 USA
Tel: (800) 741-7755, sales@usmicroproducts.com
www.usmicroproducts.com

Design	Air	(3)	Surface		
Check	Eddy	Unit	MM	Material	
Approve	Ryan	Scale	1:1	Thickness	
		Page	1/1	Quantity	

最小長度 (mm) \ 公差精度等級	精級
1 ~ 4	-
4 ~ 16	-
16 ~ 63	-
63 ~ 250	-
250 ~ 1000	-

PT-A-054-01

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