

PRODUCT SPECIFICATION**ROHS****MONO LCD MODULE**
MODEL: G1203E0FTM1G-A0 Ver: 1.0

< ◇ > Preliminary Specification

< ◆ > Finally Specification

CUSTOMER'S APPROVAL	
CUSTOMER :	
SIGNATURE:	DATE:

APPROVED BY	PM REVIEWED	PD REVIEWED	PREPARED BY

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1. FEATURES

The features of LCD are as follows

- * Display mode : FSTN /Transmissive/Positive
- * Drive IC : ST7567
- * Interface Input Data : 8080 series or 6800 series or 4-line
- * Driving Method : 1/33Duty, 1/6 Bias
- * Viewing Direction : 6 O'clock
- * Backlight : LED/Orange
- *Sample NO. : G1203E0FTM1G-A0_01/20110414

2. MECHANICAL SPECIFICATIONS

Item	Specification	Unit
Module Size	46.6(W) x 26.6(H) x 5(D)	mm
Number of Dots	128x32 Dots	
View display Area	41(W) x15(H)	mm
Activity Display Area	39.02(W) x 12.78 (H)	mm
Dot Size	0.285(W) x 0.38(H)	mm
Dot Pitch	0.305(W) x 0.4(H)	mm

3. ELECTRICAL SPECIFICATIONS

3-1. ABSOLUTR MAZIMUM RATINGS (Ta=25 °C)

Item	Symbol	Standard Value			Unit
		Min.	Typ.	Max.	
Supply Voltage For Logic	V _{DD} -V _{SS}	-0.3	-	3.6	V
Supply Voltage For LCD Drive	V ₀ -V _{SS}	-0.3	-	16	V
Input Voltage	V _{in}	-0.3	-	V _{DD} +0.3	V
Operating Temp.	Top	0	-	+50	°C
Storage Temp.	Tst	-10	-	+60	°C

*. NOTE: The response time will be extremely slow when the operating temperature is around -10°C, and the back ground will become darker at high temperature operating.

3-2. ELECTRICAL CHARACTERISTICS

Item	Symbol	Test Condition	Min.	Typ.	Max.	Unit	
Logic supply Voltage	$V_{DD}-V_{SS}$	$T_a=25\text{ }^\circ\text{C}$ $V_{DD}=3.0V\pm 10\%$	2.7	3	3.3	V	
LCD Drive	V_0-V_{SS}		6.2	6.5	6.8	V	
Input Voltage	"H" Level		V_{IH}	$0.7V_{DD}$	-	V_{DD}	V
	"L" Level		V_{IL}	V_{SS}	-	$0.3V_{DD}$	V
Frame Frequency	f_{FLM}		70	75	80	Hz	
Current Consumption	I_{DD}		-	0.13	-	mA	

3-3. BACKLIGHT**3-3-1. Absolute Maximum Ratings**

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Forward Current	IF	$T_a=25\text{ }^\circ\text{C}$	-	-	40	mA
Reverse Voltage	VR		-	-	5	V
Power Dissipation	PD		-	-	88	mW

3-3-2. Electrical-optical Characteristics ($T_a=25\text{ }^\circ\text{C}$)

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Forward Voltage	VF	$I_f=40\text{mA}$ $T_a=25\text{ }^\circ\text{C}$	1.8	2.0	2.2	V
Average Luminous Intensity	I_v		80	-	-	cd/m^2
Peak wave length	λ_p		584	592	594	nm

The brightness is measured without LCD panel

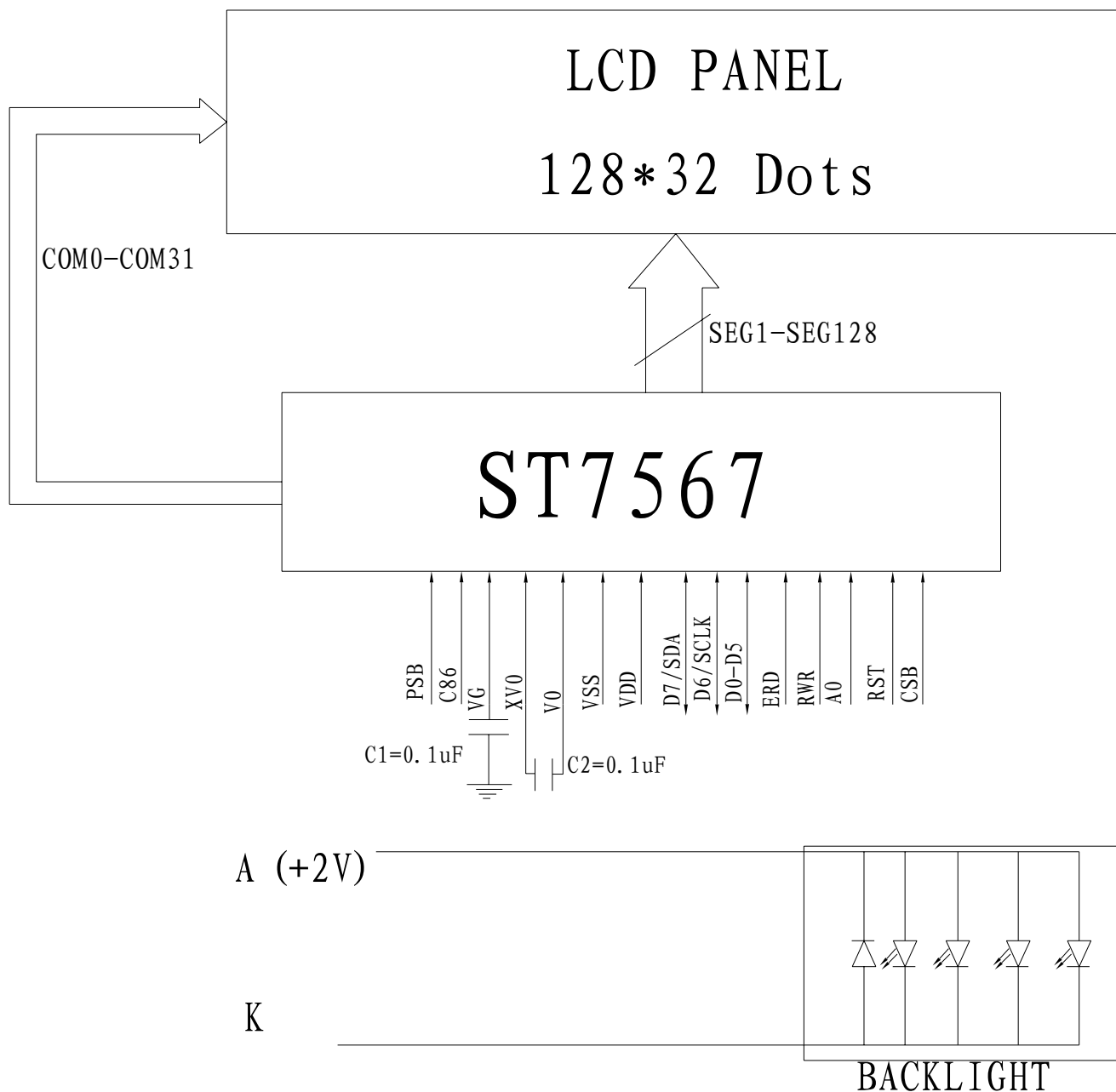
For operation above $25\text{ }^\circ\text{C}$, The I_{fm} & P_d must be derated, the current derating is $-0.36\text{mA}/^\circ\text{C}$ for DC drive and $-0.86\text{mA}/^\circ\text{C}$ for Pulse drive, the Power dissipation is $-0.75\text{mW}/^\circ\text{C}$. The product working current must not more than the 60% of the I_{fm} or I_{fp} according to the working temperature.

4. TERMINAL FUNCTIONS AND BLOCK DIAGRAM

4-1. INTERFACE PIN FUNCTION DESCRIPTION

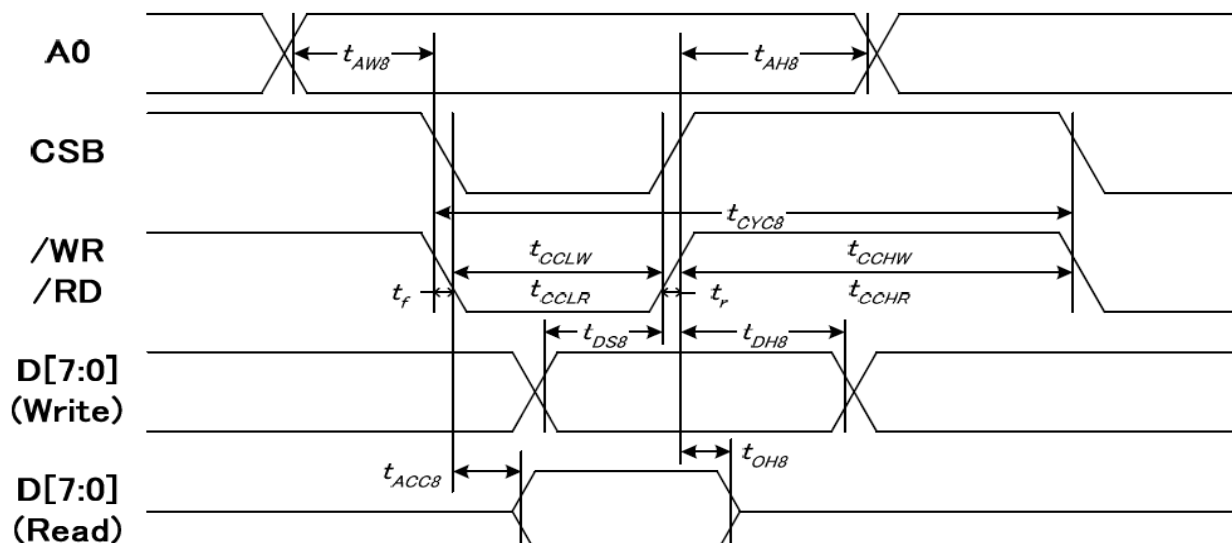
Pin No.	SYMBOL	Function												
1	CSB	Chip select signal.												
2	RST	Reset signal												
3	A0	Select register signal												
4	RWR	Read/Write execution control pin.												
5	ERD	Read/Write execution control pin.												
6-11	D0-D5	Date bus												
12	D6/SCLK	Serial clock input for serial mode												
13	D7/SDA	Data input for serial mode												
14	VDD	Power supply												
15	VSS	Ground												
16	V0	Supply voltage for LCD driving												
17	XV0	XV0 is the LCD driving voltage for common circuits at positive frame.												
18	VG	VG is the LCD driving voltage for segment circuits.												
19	C86	C86 selects the microprocessor type in parallel interface mode.												
		<table border="1"> <thead> <tr> <th>PSB</th> <th>C86</th> <th>Selected Interface</th> </tr> </thead> <tbody> <tr> <td>"H"</td> <td>"H"</td> <td>Parallel 6800 Series MPU Interface</td> </tr> <tr> <td>"H"</td> <td>"L"</td> <td>Parallel 8080 Series MPU Interface</td> </tr> <tr> <td>"L"</td> <td>"X"</td> <td>Serial 4-Line SPI Interface</td> </tr> </tbody> </table>	PSB	C86	Selected Interface	"H"	"H"	Parallel 6800 Series MPU Interface	"H"	"L"	Parallel 8080 Series MPU Interface	"L"	"X"	Serial 4-Line SPI Interface
		PSB	C86	Selected Interface										
		"H"	"H"	Parallel 6800 Series MPU Interface										
"H"	"L"	Parallel 8080 Series MPU Interface												
"L"	"X"	Serial 4-Line SPI Interface												
20	PSB	Select the interface type pin												
21	A	Backlight (+2V)												
22	K	Backlight (-)												

4-2. BLOCK DIAGRAM



5. TIMING CHARACTERISTICS

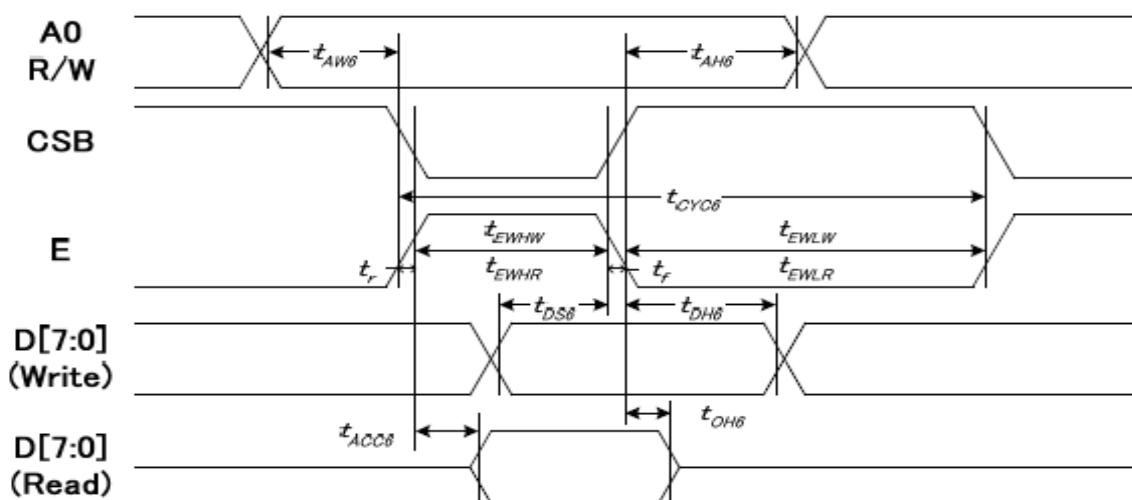
System Bus Timing for 8080 Series MPU



(VDD1 = 3.3V, Ta = 25°C)

Item	Signal	Symbol	Condition	Min.	Max.	Unit
Address setup time	A0	t_{AW8}		0	—	ns
Address hold time		t_{AH8}		10	—	
System cycle time	/WR	t_{CYC8}		240	—	
/WR L pulse width (WRITE)		t_{CCLW}		80	—	
/WR H pulse width (WRITE)		t_{CCHW}		80	—	
/RD L pulse width (READ)		RD	t_{CCLR}		140	
/RD H pulse width (READ)	t_{CCHR}			80	—	
WRITE Data setup time	D[7:0]	t_{DS8}		40	—	
WRITE Data hold time		t_{DH8}		20	—	
READ access time		t_{ACC8}	CL = 16 pF	—	70	
READ Output disable time		t_{OH8}	CL = 16 pF	5	50	

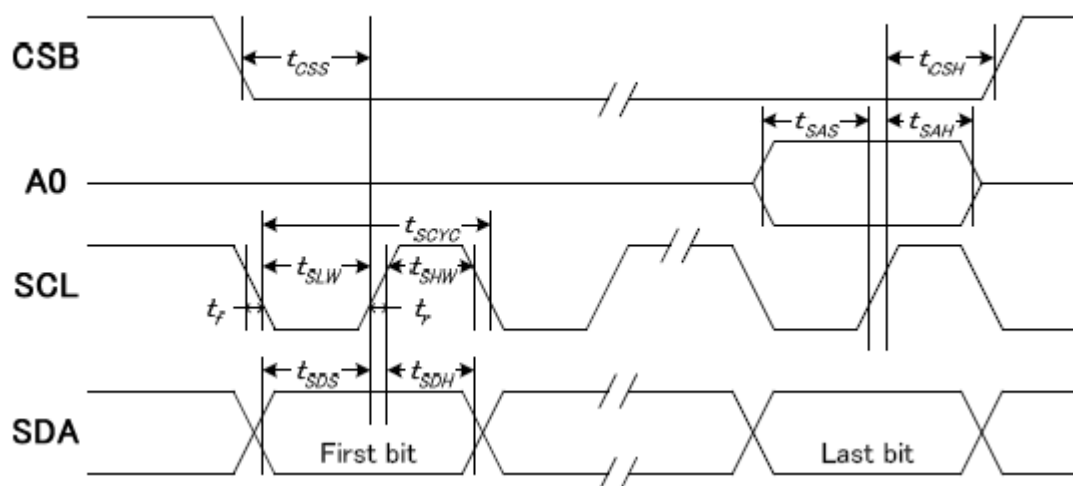
System Bus Timing for 6800 Series MPU



(VDD1 = 3.3V, Ta = 25°C)

Item	Signal	Symbol	Condition	Min.	Max.	Unit
Address setup time	A0	tAW6		0	—	ns
Address hold time		tAH6		10	—	
System cycle time	E	tCYC6		240	—	
Enable L pulse width (WRITE)		tEWLW		80	—	
Enable H pulse width (WRITE)		tEWHW		80	—	
Enable L pulse width (READ)		tEWLR		80	—	
Enable H pulse width (READ)	tEWHR		140	—		
Write data setup time	D[7:0]	tDS6		40	—	
Write data hold time		tDH6		10	—	
Read data access time		tACC6	CL = 16 pF	—	70	
Read data output disable time		tOH6	CL = 16 pF	5	50	

System Bus Timing for 4-Line Serial Interface



(VDD1 = 3.3V, Ta = 25°C)

Item	Signal	Symbol	Condition	Min.	Max.	Unit
Serial clock period	SCLK	tSCYC		50	—	ns
SCLK "H" pulse width		tSHW		25	—	
SCLK "L" pulse width		tSLW		25	—	
Address setup time	A0	tSAS		20	—	
Address hold time		tSAH		10	—	
Data setup time	SDA	tSDS		20	—	
Data hold time		tSDH		10	—	
CSB-SCLK time	CSB	tCSS		20	—	
CSB-SCLK time		tCSH		40	—	

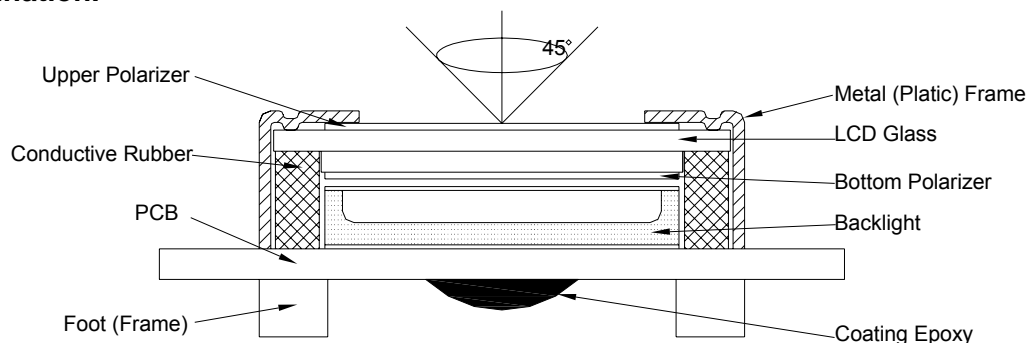
6. INSTRUCTION SET

INSTRUCTION	A0	R/W (RWR)	COMMAND BYTE								DESCRIPTION
			D7	D6	D5	D4	D3	D2	D1	D0	
(1) Display ON/OFF	0	0	1	0	1	0	1	1	1	D	D=1, display ON D=0, display OFF
(2) Set Start Line	0	0	0	1	S5	S4	S3	S2	S1	S0	Set display start line
(3) Set Page Address	0	0	1	0	1	1	Y3	Y2	Y1	Y0	Set page address
(4) Set Column Address	0	0	0	0	0	1	X7	X6	X5	X4	Set column address (MSB)
	0	0	0	0	0	0	X3	X2	X1	X0	Set column address (LSB)
(5) Read Status	0	1	0	MX	D	RST	0	0	0	0	Read IC Status
(6) Write Data	1	0	D7	D6	D5	D4	D3	D2	D1	D0	Write display data to RAM
(7) Read Data	1	1	D7	D6	D5	D4	D3	D2	D1	D0	Read display data from RAM
(8) SEG Direction	0	0	1	0	1	0	0	0	0	MX	Set scan direction of SEG MX=1, reverse direction MX=0, normal direction
(9) Inverse Display	0	0	1	0	1	0	0	1	1	INV	INV =1, inverse display INV =0, normal display
(10) All Pixel ON	0	0	1	0	1	0	0	1	0	AP	AP=1, set all pixel ON AP=0, normal display
(11) Bias Select	0	0	1	0	1	0	0	0	1	BS	Select bias setting 0=1/9; 1=1/7 (at 1/65 duty)
(12) Read-modify-Write	0	0	1	1	1	0	0	0	0	0	Column address increment: Read:+0 , Write:+1
(13) END	0	0	1	1	1	0	1	1	1	0	Exit Read-modify-Write mode
(14) RESET	0	0	1	1	1	0	0	0	1	0	Software reset
(15) COM Direction	0	0	1	1	0	0	MY	-	-	-	Set output direction of COM MY=1, reverse direction MY=0, normal direction
(16) Power Control	0	0	0	0	1	0	1	VB	VR	VF	Control built-in power circuit ON/OFF
(17) Regulation Ratio	0	0	0	0	1	0	0	RR2	RR1	RR0	Select regulation resistor ratio
(18) Set EV	0	0	1	0	0	0	0	0	0	1	Double command!! Set electronic volume (EV) level
	0	0	0	0	EV5	EV4	EV3	EV2	EV1	EV0	
(19) Set Booster	0	0	1	1	1	1	1	1	0	0	Double command!! Set booster level:
	0	0	0	0	0	0	0	0	0	0	BL=0: 4X BL=1: 5X
(20) Power Save	0	0	Compound Command								Display OFF + All Pixel ON
(21) NOP	0	0	1	1	1	0	0	0	1	1	No operation
(22) Test	0	0	1	1	1	1	1	1	1	-	Do NOT use. Reserved for testing.

7. QUALITY SPECIFICATIONS

7-1. LCM Appearance and Electric inspection Condition

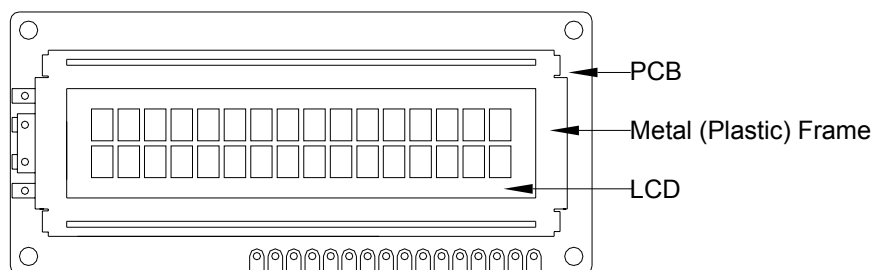
1. Inspection will be done by placing LCM 30cm away from inspector's eyeballs under normal illumination.



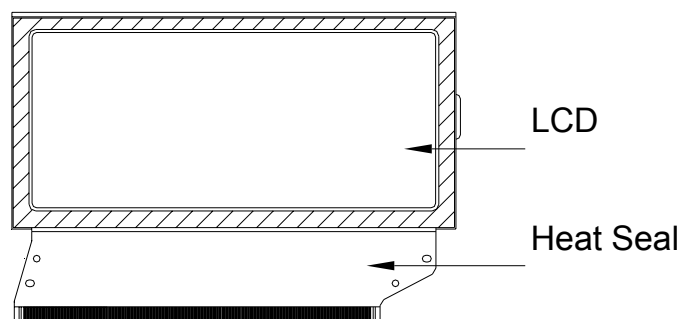
2. View Angle: with in 45° around perpendicular line.

7-2. Definition

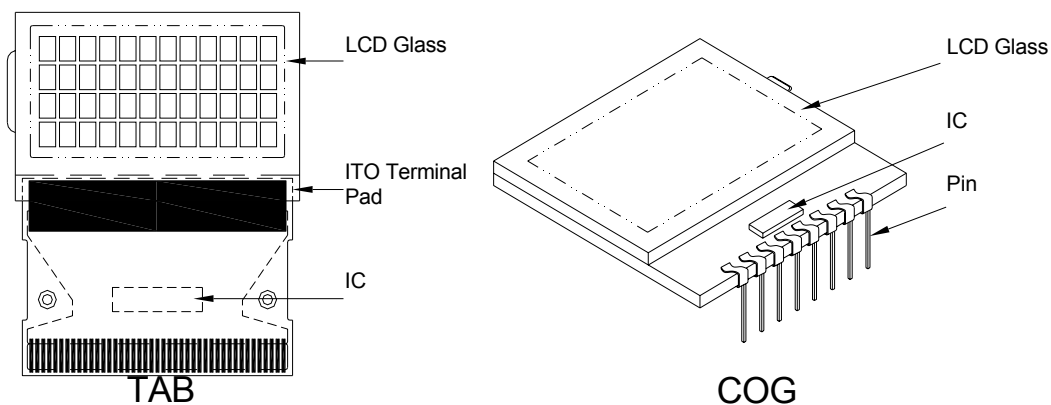
1. COB



2. Heat Seal



3. TAB and COG



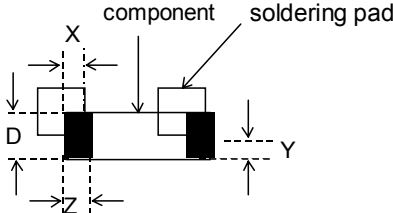
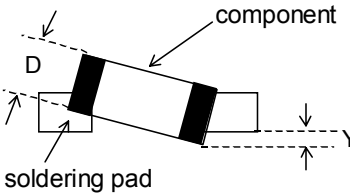
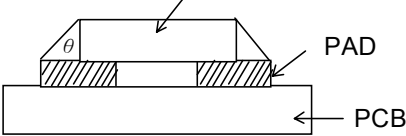
7-3. Sampling Plan and Acceptance

- Sampling Plan
MIL - STD - 105E (||) ordinary single inspection is used.
- Acceptance
Major defect: AQL = 0.65%
Minor defect: AQL = 1.5%

7-4. Criteria**1. COB**

Defect	Inspection Item	Inspection Standards	
Major	PCB copper flakes peeling off	Any copper flake in viewing Area should be greater than 1.0mm ²	Reject
Major	Height of coating epoxy	Exceed the dimension of drawing	Reject
Major	Void or hole of coating epoxy	Expose bonding wire or IC	Reject
Major	PCB cutting defect	Exceed the dimension of drawing	Reject

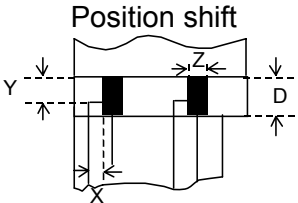
2. SMT

Defect	Inspection Item	Inspection Standards	
Minor	Component marking not readable		Reject
Minor	Component height	Exceed the dimension Of drawing	Reject
Major	Component solder defect (missing , extra, wrong component or wrong orientation)		Reject
Minor	Component position shift 	$X < 3/4Z$ $Y > 1/3D$	Reject
Minor	Component tilt 	$Y > 1/3D$	Reject
Minor	Insufficient solder 	$\theta \leq 20^\circ$	Reject

3. Metal (Plastic) Frame

Defect	Inspection Item	Inspection Standards		
Major	Crack / breakage	Anywhere		Reject
Minor	Frame Scratch	W	L	Acceptable of Scratch
		$w < 0.1\text{mm}$	Any	Ignore
		$0.1 \leq w < 0.2\text{mm}$	$L \leq 5.0\text{mm}$	2
		$0.2 \leq w < 0.3\text{mm}$	$L \leq 3.0\text{mm}$	1
		$w \geq 0.3\text{mm}$	Any	0
Note: 1. Above criteria applicable to scratch lines with distance greater than 5mm. 2. Scratch on the back side of frame (not visible) can be ignored.				
Minor	Frame Dent , Prick $\Phi = \frac{L + W}{2}$			Acceptable of Dents / Pricks
		$\Phi \leq 1.0\text{mm}$		2
		$1.0 < \Phi \leq 1.5\text{mm}$		1
		$1.5\text{mm} < \Phi$		0
Note : 1. Above criteria applicable to any two dents / pricks with distance greater than 5mm 2. Dent / prick on the back side of frame (not visible) can be ignored				
Minor	Frame Deformation	Exceed the dimension of drawing		
Minor	Metal Frame Oxidation	Any rust		

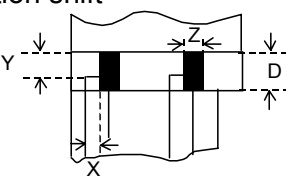
4. Flexible Film Connector (FFC)

Defect	Inspection Item	Inspection Standards	
Minor	Tilted soldering	Within the angle $+5^\circ$	Acceptable
Minor	Uneven solder joint /bump		Reject
Minor	Hole $\Phi = \frac{L + W}{2}$	Expose the conductive line	Reject
		$\Phi > 1.0\text{mm}$	Reject
Minor		$Y > 1/3D$	Reject
		$X > 1/2Z$	Reject

5. Screw

Defect	Inspection Item	Inspection Standards	
Major	Screw missing/loosen		Reject
Minor	Screw oxidation	Any rust	Reject
Minor	Screw deformation	Difficult to accept screw driver	Reject

6. Heatseal 、TCP 、FPC

Defect	Inspection Item	Inspection Standards	
Major	Scratch expose conductive layer		Reject
Minor	HS Hole $\Phi = \frac{L+W}{2}$	$\Phi > 0.5\text{mm}$	Reject
Major	Adhesion strength	Less than the specification	Reject
Minor	Position shift 	$Y > 1/3D$	Reject
		$X > 1/2Z$	Reject
Major	Conductive line break		Reject

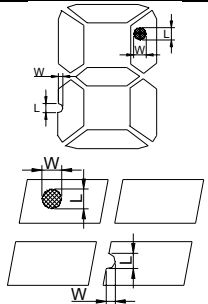
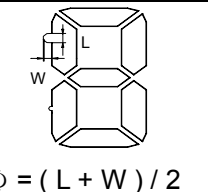
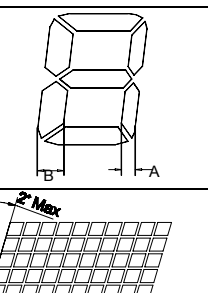
7. LED 、 Backing Protective Film and Others

Defect	Inspection Item	Inspection Standards	
Minor	LED dirty, prick	Acceptable number of units	
		$\Phi \leq 0.10\text{mm}$	ignore
		$0.10 < \Phi \leq 0.15\text{mm}$	2
		$0.15 < \Phi \leq 0.2\text{mm}$	1
		$\Phi > 0.2\text{mm}$	0
The distance between any two spots should be $\geq 5\text{mm}$ Any spot/dot/void outside of viewing area is acceptable			
Minor	Protective film tilt	Not fully cover LCD	Reject
Major	COG coating	Not fully cover ITO circuit	Reject

8. Electric Inspection

Defect	Inspection Item	Inspection Standards	
Major	Short		Reject
Major	Open		Reject

9. Inspection Specification of LCD

Defect	Inspect Item		Inspection Standards				
			W	W≤0.03	0.03<W≤0.05	W>0.05	
Minor	Linear Defect	* Glass Scratch * Polarizer Scratch * Fiber and Linear material	L	L<5	L<3	Any	
			ACC. NO.	1	1	Reject	
			Note	L is the length and W is the width of the defect			
			Φ	Φ≤0.1	0.1<Φ≤0.15	0.15<Φ≤0.2	Φ>0.2
Minor	Black Spot and Polarizer Pricked	* Foreign material between glass and polarizer or glass and glass * Polarizer hole or protuberance by external force	ACC. NO.	3EA / 100mm ²	2	1	0
			Note	Φ is the average diameter of the defect. Distance between two defects > 10mm.			
			Φ	Φ≤0.3	0.3<Φ≤0.5	0.5<Φ	
			ACC. NO.	3EA / 100mm ²	1	0	
Minor	White Spot and Bubble in polarizer	* Unobvious transparent foreign material between glass and glass or glass and polarizer * Air protuberance between polarizer and glass	ACC. NO.	3EA / 100mm ²	1	0	
			Note	Φ is the average diameter of the defect. Distance between two defects > 10mm.			
			Φ	Φ≤0.10	0.10<Φ≤0.20	0.20<Φ≤0.25	Φ>0.25
			ACC. NO.	3EA / 100mm ²	2	1	0
Minor	Segment Defect		ACC. NO.	3EA / 100mm ²	2	1	0
			Note	W is more than 1/2 segment width Distance between two defect is 10mm			
			Φ = $\frac{L+W}{2}$				
			Φ	Φ≤0.10	0.10<Φ≤0.20	0.20<Φ≤0.25	Φ>0.25
Minor	Protuberant Segment	 $\Phi = (L + W) / 2$	ACC. NO.	3EA / 100mm ²	2	1	0
			W	Glue	W≤1/2 Seg W≤0.2	W≤1/2 Seg W≤0.2	Ignore
			Φ	Φ≤0.10	0.10<Φ≤0.20	0.20<Φ≤0.25	Φ>0.25
			W	Glue	W≤1/2 Seg W≤0.2	W≤1/2 Seg W≤0.2	Ignore
Minor	Assembly Mis-alignment		1. Segment				
			B	B≤0.4mm	0.4<B≤1.0mm	B>1.0mm	
			B-A	B-A<1/2B	B-A<0.2	B-A<0.25	
			Judge	Acceptable	Acceptable	Acceptable	
			2. Dot Matrix				
			Deformation>2°				Reject
Minor	Stain on LCD Panel Surface		Accept when stains can be wiped lightly with a soft cloth or a similar one. Otherwise, judged according to the above items: "Black spot" and "White Spot"				

8. RELIABILITY

NO.	Item	Condition	Criterion
1	High Temperature Operating	50°C, 96Hrs	No defect in cosmetic and operational function allowable.
2	Low Temperature Operating	0°C, 96Hrs	
3	High Humidity	50°C, 90%RH, 96Hrs	
4	High Temperature Storage	60°C, 96Hrs	
5	Low Temperature Storage	-10°C, 96Hrs	
6	Vibration	Random wave 10 ~ 100Hz Acceleration: 2g 2 Hrs per direction(X,Y,Z)	Total current Consumption should be below double of initial value.
7	Thermal Shock	0°C to 25°C to 50°C (60Min) (5Min) (60Min) 16Cycles	
8	ESD Testing	Contract Discharge Voltage: +1 ~ 5kV and -1 ~ -5kV Air Discharge Voltage: +1 ~ 8kV and -1 ~ -8kV	There will be discharged ten times at every discharging voltage cycle. The voltage gap is 1kV.

Note: 1) Above conditions are suitable for our company standard products.

2) For restrict products, the test conditions listed as above must be revised.

9. HANDLING PRECAUTION

(1) Mounting Method

The panel of the LCD Module consists of two thin glass plates with polarizes, which easily get damaged. Since the Module is fixed by utilizing fitting holes in the printed circuit board.

Extreme care should be taken when handling the LCD Modules.

(2) Caution of LCD handling & cleaning

When cleaning the display surface, use soft cloth with solvent (recommended below) and wipe lightly.

- Isopropyl alcohol

- Ethyl alcohol

- Tricolors triflers' thane

Do not wipe the display surface with dry or hard materials that will damage the polarizer surface.

Do not use the following solvent:

- Water- Kenton- Aromatics

(3) Caution against static charge

The LCD Module use C-MOS LSI drivers, so we recommend that you connect any unused input terminal to VDD or VSS, do not input any signals before power is turned on. And ground your body, Work/assembly table. And assembly equipment to protect against static electricity.

(4) Packaging

- Modules use LCD elements, and must be treated as such. Avoid intense shock and falls from a height.

- To prevent modules from degradation. Do not operate or store them exposed directly to sunshine or high temperature/humidity.

(5) Caution for operation

- It is indispensable to drive LCD's within the specified voltage limit since the higher voltage than the limit shortens LCD life. An electrochemical reaction due to direct current causes LCD deterioration, Avoid the use of direct current drive.

- Response time will be extremely delayed at lower temperature than the operating temperature range and on the other hand at higher temperature LCD's show dark color in them. However those phenomena do not mean malfunction or out of order with LCD's, which will come back in the specified operating temperature range.

- If the display area is pushed hard during operation, some font will be abnormally displayed but it resumes normal condition after turning off once.

- A slight dew depositing on terminals is a cause for electro-chemical reaction resulting in terminal open circuit.

Usage under the relative condition of 40°C, 50%RH or less is required.

(6) Storage

In the case of storing for a long period of time (for instance.) For years) for the purpose or replacement use, the following ways are recommended.

- Storage in a polyethylene bag with sealed so as not to enter fresh air outside in it, And with no desiccant.

- Placing in a dark place where neither exposure to direct sunlight nor light is. Keeping temperature in the specified storage temperature range.

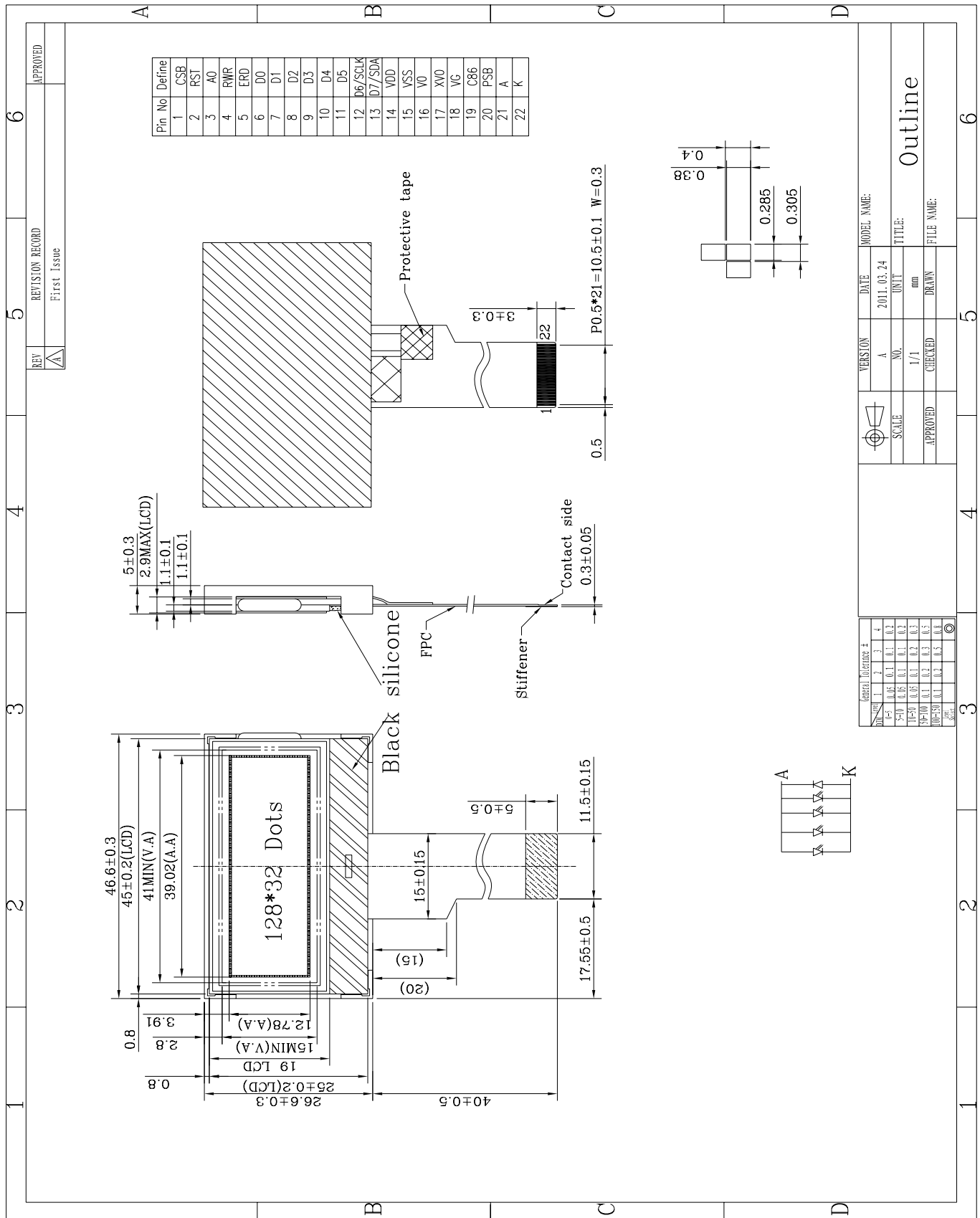
- Storing with no touch on polarizer surface by the anything else. (It is recommended to store them as they have been contained in the inner container at the time of delivery)

(7) Safety

- It is recommendable to crash damaged or unnecessary LCD into pieces and wash off liquid crystal by using solvents such as acetone and ethanol. Which should be burned up later.

- When any liquid crystal leaked out of a damaged glass cell comes in contact with your hands, please wash it off well with soap and water.

10. OUTLINE DIMENSION



REV	REVISION RECORD	APPROVED
A	First Issue	

DATE	2011.03.24	MODEL NAME:	
VERSION	A	UNIT	mm
NO.	1/1	TITLE:	Outline
SCALE	1/1	DRAWN	
APPROVED		CHECKED	
FILE NAME:			