PRODUCT SPECIFICATION

MONO LCD MODULE
MODEL: G1206J7FSW6G-A1 Ver: 1.0

< ◇ > Preliminary Specification

< ◆ > Finally Specification

CUSTOMER'S APPROVAL	
CUSTOMER :	
SIGNATURE:	**DATE:**

APPROVED BY	PM REVIEWED	PD REVIEWED	PREPARED BY

Revision Status

Version	Revise Date	Page	Content	Modified By
Ver. 1.0	2013-8-29		First Issued	

Table of Contents

1. FEATURES

The features of LCD are as follows

  * Display mode   : FSTN /Transflective/Positive
  * Drive IC   : ST7565R
  * Interface Input Data   : SPI-4/6800/8080
  * Driving Method   : 1/65Duty, 1/9 Bias
  * Viewing Direction   : 6 O'clock
  * Backlight   : LED/White
  *Sample NO.   :

2．MECHANICAL SPECIFICATIONS

Item	Specification	Unit
Module Size	77.4(W) x 52.4(H) x 6.5(D)	mm
Number of Dots	128x64 Dots	
View display area	70(W) x 40(H)	mm
Activity Display Area	66.52(W) x 33.24 (H)	mm
Dot Size	0.48(W) x 0.48(H)	mm
Dot Pitch	0.52(W) x 0.52(H)	

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}	-0.3		3.6	V
Supply Voltage For LCD Drive	V_{LCD}	-0.3	-	13.5	V
Operating Temp.	Top	-20	-	+70	°C
Storage Temp.	Tst	-30	-	+80	°C

*. NOTE: The response time will be extremely slow when the operating temperature is around -10℃, 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}	Ta=25 °C VDD=3.0V ± 10%	2.7	3.0	3.3	V
LCD Drive		V_{LCD}		8.7	9.0	9.3	V
Input Voltage	"H" Level	V_{IH}		0.8V_{DD}		V_{DD}	V
	"L" Level	V_{IL}		Vss		0.2V_{DD}	V
Current Consumption		I_{DD}		-	0.7	-	mA

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

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Forward Current	IF	Ta=25 °C	-	-	100	mA
Power Dissipation	PD		-	-	320	mW
Reverse Current	Ir	VR=5V			15	uA

3-3-2. Electrical-optical Characteristics (Ta=25°C)

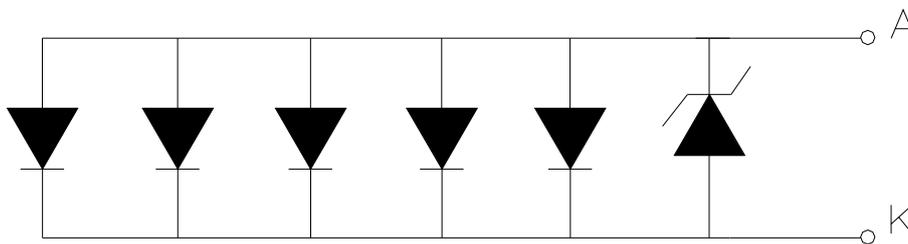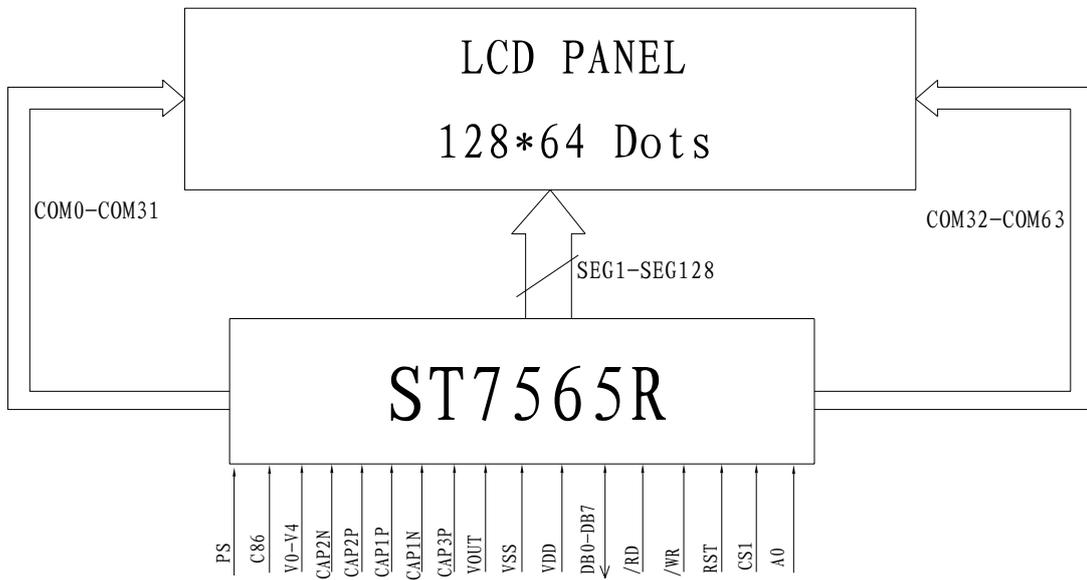| Item	Symbol	Condition	Min.		Typ.		Max.		Unit
Forward Voltage	VF	If=75mA Ta=25°C	2.8		3.1		3.4		V
Average Luminous Intensity (measured without LCD panel)	Iv		140		200		-		cd/m2
Color coordinates			X	Y	X	Y	X	Y	
			0.24	0.24	0.27	0.27	0.30	0.30	

The brightness is measured without LCD panel

For operation above 25 °C,The Ifm & Pd must be derated , the current derating is -0.36mA/ °C for DC drive and -0.86mA/ °C for Pulse drive ,the Power dissipation is -0.75mW/ °C.The product working current must not more than the 60% of the Ifm or Ifp according to the working temperature.

4. TERMINAL FUNCTIONS AND BLOCK DIAGRAM

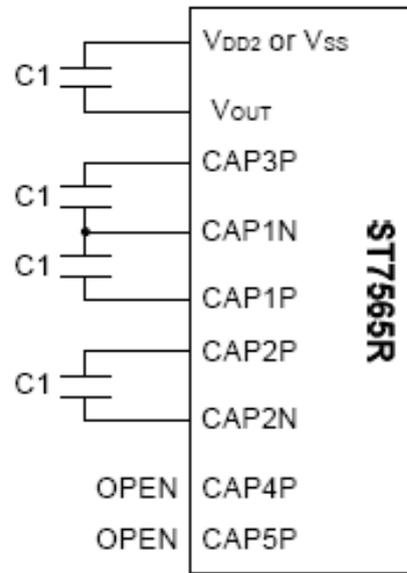## 4-1. INTERFACE PIN FUNCTION DESCRIPTION

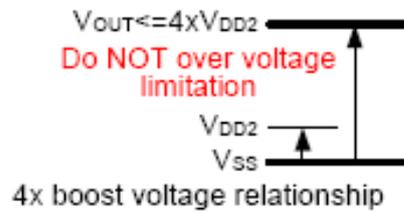| Pin No.	Pin Name	Function
1	PS	This pin configures the interface to be parallel mode or serial mode. P/S = "H": Parallel data input/output. P/S = "L": Serial data input.
2	C86	This is the MPU interface selection pin. C86 = "H": 6800 Series MPU interface. C86 = "L": 8080 Series MPU interface.
3-7	V0-V4	Supply voltage for LCD driving
8	CAP2N	Voltage booster circuit capacitor connection PIN
9	CAP2P	
10	CAP1P	
11	CAP1N	
12	CAP3P	
13	VOUT	Supply voltage converter input
14	VSS	Ground
15	VDD	Power supply
16-23	DB7-DB0	Data bus
24	/RD	When connected to 8080 series MPU, this pin is treated as the "/RD" signal of the 8080 MPU and is LOW-active. The data bus is in an output status when this signal is "L". • When connected to 6800 series MPU, this pin is treated as the "E" signal of the 6800 MPU and is HIGH-active. This is the enable clock input terminal of the 6800 Series MPU.
25	/WR	• When connected to 8080 series MPU, this pin is treated as the "/WR" signal of the 8080 MPU and is LOW-active. The signals on the data bus are latched at the rising edge of the /WR signal. • When connected to 6800 series MPU, this pin is treated as the "R/W" signal of the 6800 MPU and decides the access type : When R/W = "H": Read. When R/W = "L": Write.
26	A0	Select register signal
27	RST	Reset signal
28	CS1B	Chip selection signal

4-2. BLOCK DIAGRAM

LCD PANEL

128*64 Dots

COM0−COM31

COM32−COM63

SEG1−SEG128

ST7565R

PS
C86
V0−V4
CAP2N
CAP2P
CAP1P
CAP1N
CAP3P
VOUT
VSS
VDD
DB0−DB7
/RD
/WR
RST
CS1
A0

A

K

Backlight

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C1

V_DD2 or V_SS

V_OUT

CAP3P

C1

CAP1N

C1

CAP1P

CAP2P

C1

CAP2N

OPEN CAP4P

OPEN CAP5P

ST7565R

4x voltage booster circuit

V_OUT<=4xV_DD2

Do NOT over voltage limitation

V_DD2

V_SS

4x boost voltage relationship

ST7565R
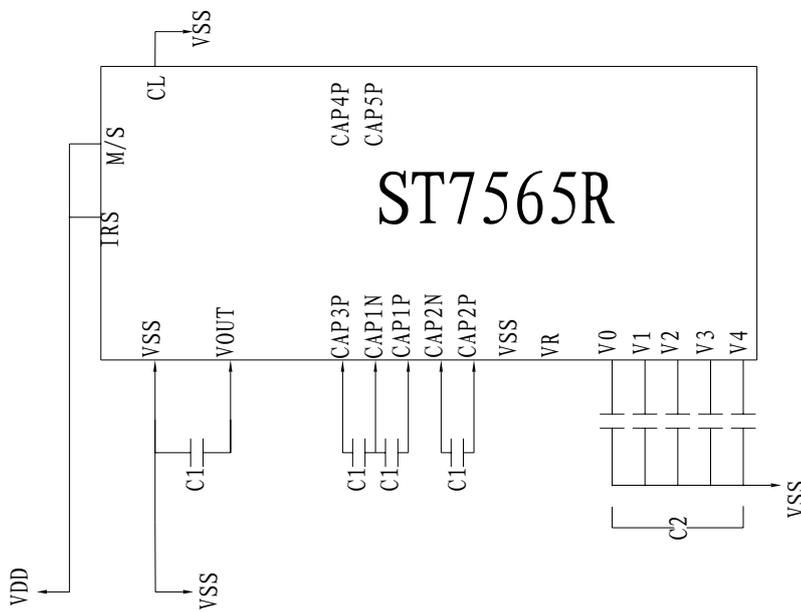
Item	Set value	unit
C1	1 ~ 2.2	uF
C2	0.1 ~ 1	uF

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5. TIMING CHARACTERISTICS

5.1 8080 seriel read/write mode timing characteristics

(VDD = 3.3V, Ta = –30 to 85°C)

Item	Signal	Symbol	Condition	Rating Min.	Rating Max.	Units
Address hold time	A0	t_{AH8}		0	—	
Address setup time		t_{AW8}		0	—	
System cycle time		t_{CYC8}		240	—	
Enable L pulse width (WRITE)	WR	t_{CCLW}		80	—	
Enable H pulse width (WRITE)		t_{CCHW}		80	—	
Enable L pulse width (READ)	RD	t_{CCLR}		140	—	Ns
Enable H pulse width (READ)		t_{CCHR}		80		
WRITE Data setup time	D0 to D7	t_{DS8}		40	—	
WRITE Address hold time		t_{DH8}		0	—	
READ access time		t_{ACC8}	CL = 100 pF	—	70	
READ Output disable time		t_{OH8}	CL = 100 pF	5	50	
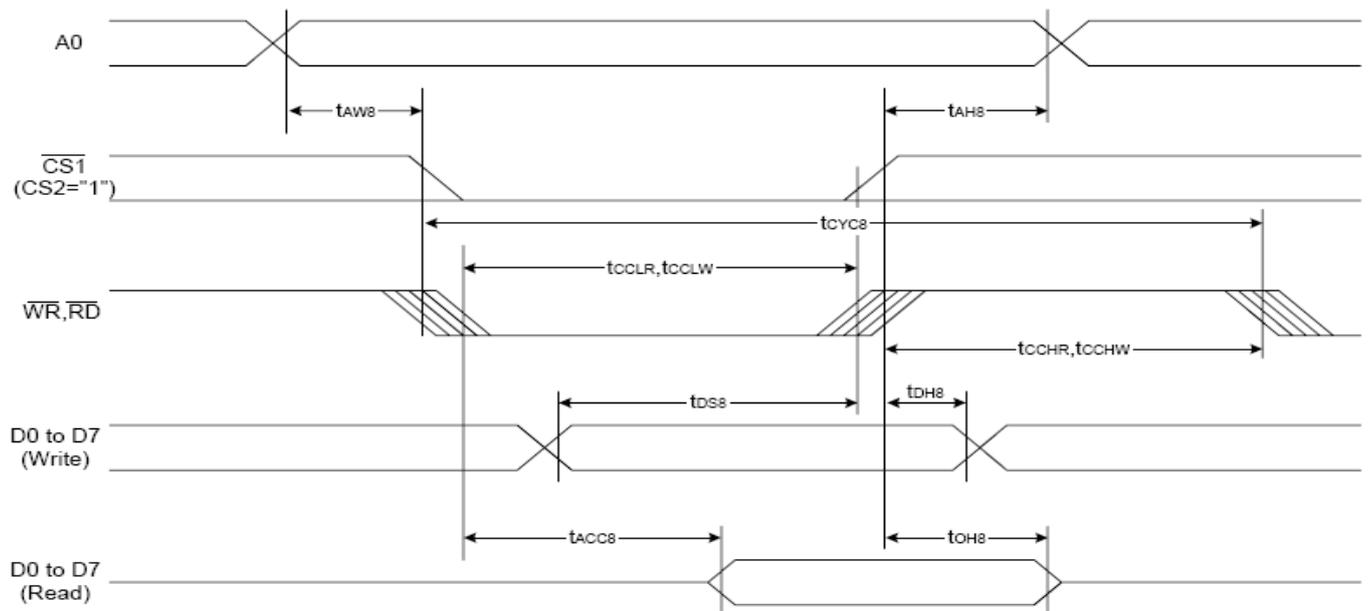
5.2 6800 series read/write mode timing characteristics

Item	Signal	Symbol	Condition	Rating Min.	Rating Max.	Units
Address hold time	A0	t_{AH6}		0	—	ns
Address setup time		t_{AW6}		0	—	
System cycle time		t_{CYC6}		240	—	
Enable L pulse width (WRITE)	WR	t_{EWLW}		80	—	
Enable H pulse width (WRITE)		t_{EWHW}		80	—	
Enable L pulse width (READ)	RD	t_{EWLR}		80	—	
Enable H pulse width (READ)		t_{EWHR}		140		
WRITE Data setup time	D0 to D7	t_{DS6}		40	—	
WRITE Address hold time		t_{DH6}		0	—	
READ access time		t_{ACC6}	$C_L = 100\ pF$	—	70	
READ Output disable time		t_{OH6}	$C_L = 100\ pF$	5	50	
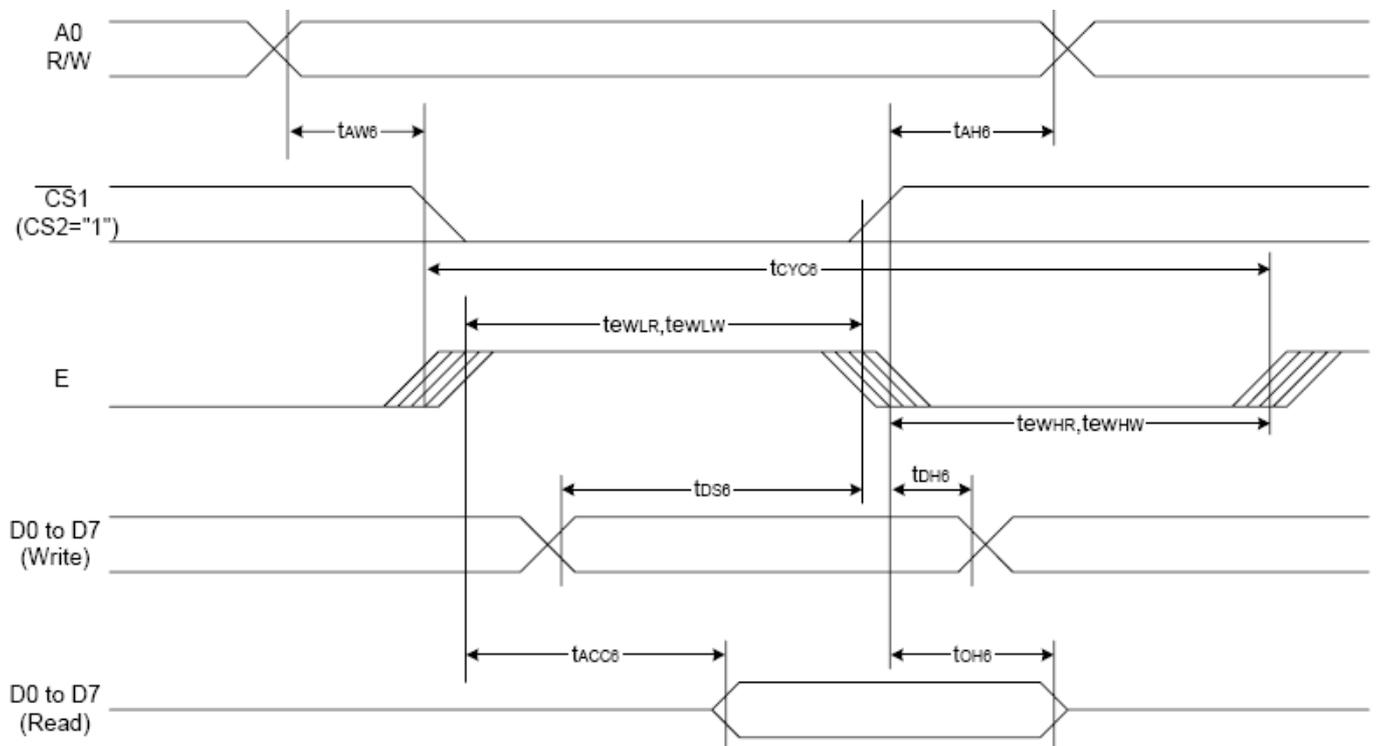
5.3 The 4-line SPI Interface

Item	Signal	Symbol	Condition	Rating Min.	Rating Max.	Units
4-line SPI Clock Period	SCL	T_{scyc}		50	—	ns
SCL "H" pulse width		T_{shw}		25	—	
SCL "L" pulse width		T_{SLW}		25	—	
Address setup time	A0	T_{SAS}		20	—	
Address hold time		T_{sah}		10	—	
Data setup time	SI	T_{sds}		20	—	
Data hold time		T_{SDH}		10	—	
CS-SCL time	CS	T_{css}		20	—	
CS-SCL time		T_{csh}		40	—	
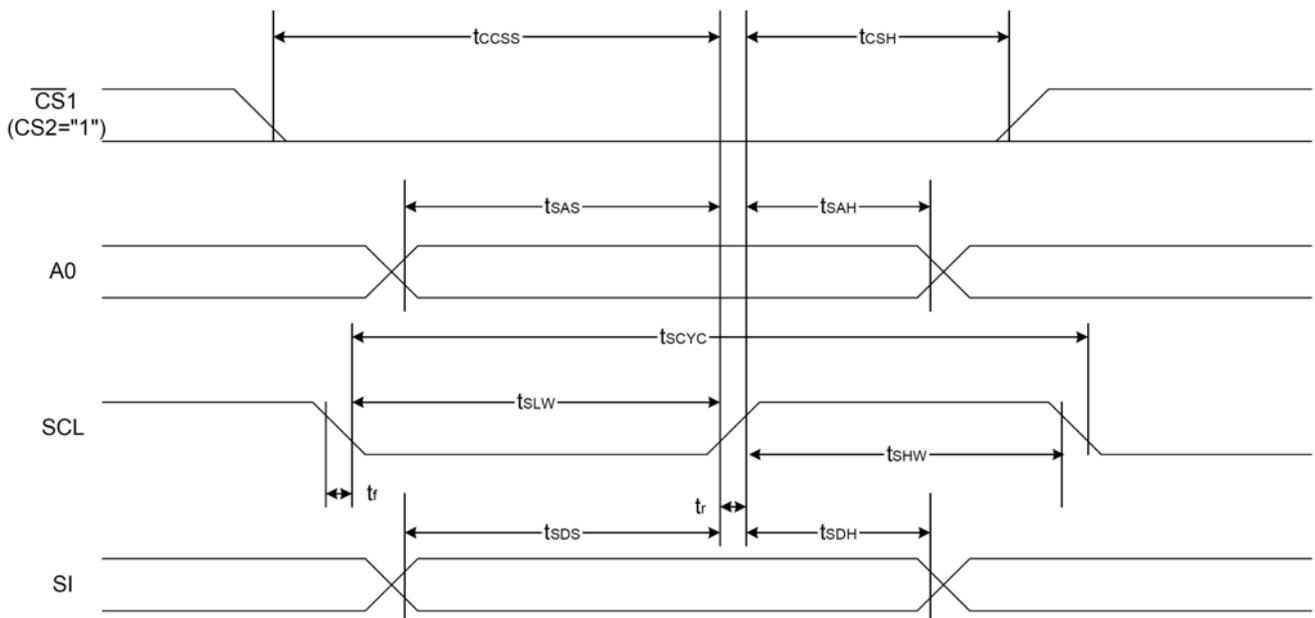
6. INSTRUCTION SET

Command	Command Code												Function
	A0	/RD	/WR	D7	D6	D5	D4	D3	D2	D1	D0		
(1) Display ON/OFF	0	1	0	1	0	1	0	1	1	1	0 / 1		LCD display ON/OFF 0: OFF, 1: ON
(2) Display start line set	0	1	0	0	1	Display start address							Sets the display RAM display start line address
(3) Page address set	0	1	0	1	0	1	1	Page address					Sets the display RAM page address
(4) Column address set upper bit	0	1	0	0	0	0	1	Most significant column address					Sets the most significant 4 bits of the display RAM column address.
Column address set lower bit	0	1	0	0	0	0	0	Least significant column address					Sets the least significant 4 bits of the display RAM column address.
(5) Status read	0	0	1	Status				0	0	0	0		Reads the status data
(6) Display data write	1	1	0	Write data									Writes to the display RAM
(7) Display data read	1	0	1	Read data									Reads from the display RAM
(8) ADC select	0	1	0	1	0	1	0	0	0	0	0 / 1		Sets the display RAM address SEG output correspondence 0: normal, 1: reverse
(9) Display normal/ reverse	0	1	0	1	0	1	0	0	1	1	0 / 1		Sets the LCD display normal/ reverse 0: normal, 1: reverse
(10) Display all points ON/OFF	0	1	0	1	0	1	0	0	1	0	0 / 1		Display all points 0: normal display 1: all points ON
(11) LCD bias set	0	1	0	1	0	1	0	0	0	1	0 / 1		Sets the LCD drive voltage bias ratio 0: 1/9 bias, 1: 1/7 bias (ST7565R)
(12) Read/modify/write	0	1	0	1	1	1	0	0	0	0	0		Column address increment At write: +1 At read: 0
(13) End	0	1	0	1	1	1	0	1	1	1	0		Clear read/modify/write
(14) Reset	0	1	0	1	1	1	0	0	0	1	0		Internal reset
(15) Common output mode select	0	1	0	1	1	0	0	0 / 1	*	*	*		Select COM output scan direction 0: normal direction 1: reverse direction
(16) Power control set	0	1	0	0	0	1	0	1	Operating mode				Select internal power supply operating mode
(17) V0 voltage regulator internal resistor ratio set	0	1	0	0	0	1	0	0	Resistor ratio				Select internal resistor ratio(Rb/Ra) mode
(18) Electronic volume mode set	0	1	0	1	0	0	0	0	0	0	1		Set the V0 output voltage electronic volume register
Electronic volume register set				0	0	Electronic volume value							
(19) Static indicator ON/OFF	0	1	0	1	0	1	0	1	1	0	0 / 1		0: OFF, 1: ON
Static indicator register set				0	0	0	0	0	0	0	Mode		Set the flashing mode
(20) Booster ratio set	0	1	0	1	1	1	1	1	0	0	0		select booster ratio 00: 2x,3x,4x 01: 5x 11: 6x
				0	0	0	0	0	0	step-up value			
(21) Power saver													Display OFF and display all points ON compound command
(22) NOP	0	1	0	1	1	1	0	0	0	1	1		Command for non-operation
(23) Test	0	1	0	1	1	1	1	*	*	*	*		Command for IC test. Do not use this command

7. QUALITY SPECIFICATIONS
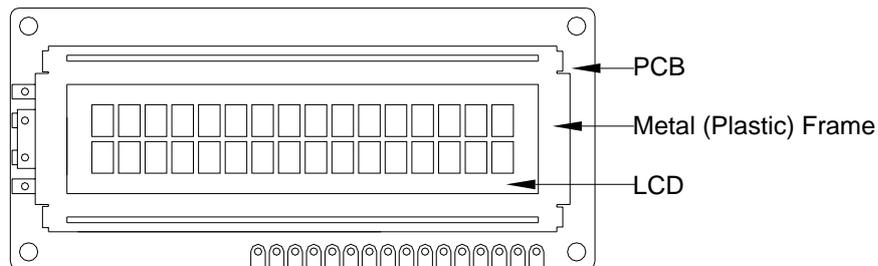
7-1. LCM Appearance and Electric inspection Condition

1. Inspection will be done by placing LCM 30cm away from inspector's eyeballs under normal illumination.
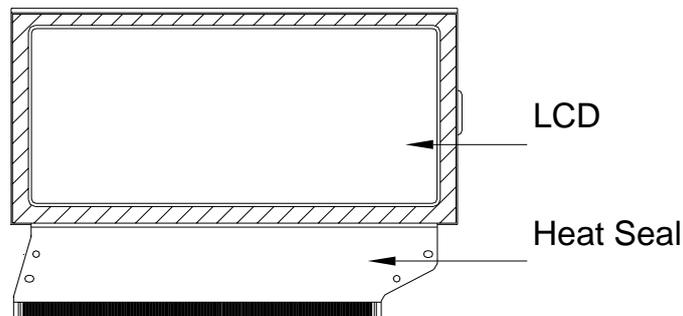
Upper Polarizer — | 45° | — Metal (Platic) Frame
Conductive Rubber — | — LCD Glass
PCB — | — Bottom Polarizer
| — Backlight
Foot (Frame) — | — Coating Epoxy
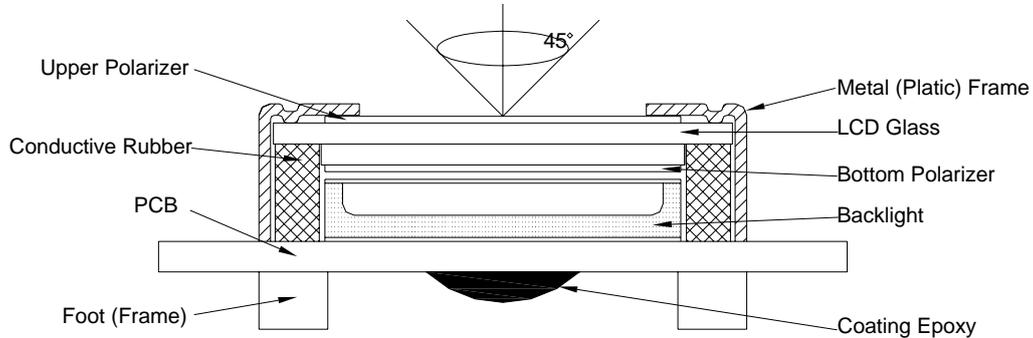
2. View Angle: with in 45° around perpendicular line.

7-2. Definition

1. COB

— PCB
— Metal (Plastic) Frame
— LCD

2. Heat Seal

LCD

Heat Seal

3. TAB and COG

LCD Glass
ITO Terminal Pad
IC

LCD Glass
IC
Pin

TAB   COG
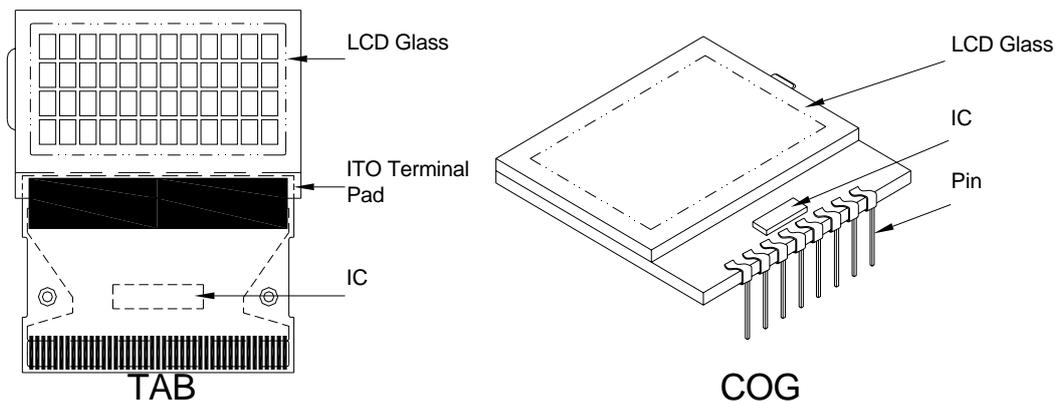
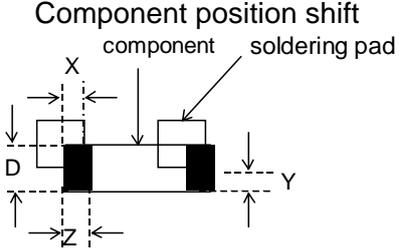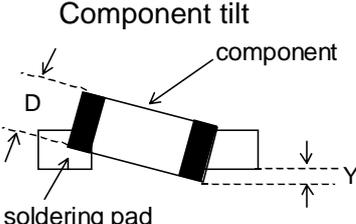## 7-3. Sampling Plan and Acceptance
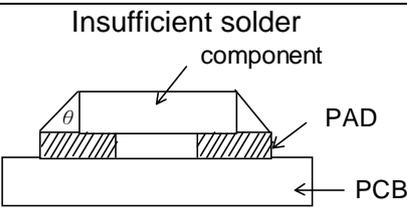
- Sampling Plan
  MIL - STD - 105E (‖) ordinary single inspection is used.

- Acceptance
  Major defect: AQL = 0.65%
  Minor defect: AQL = 1.5%

7-4. Criteria

1. COB

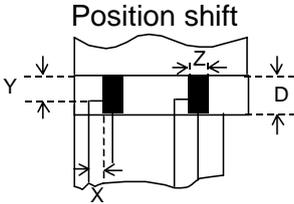| Defect	Inspection Item	Inspection Standards	
Major	PCB copper flakes peeling off	Any copper flake in viewing Area should be greater than $1.0mm^2$	Reject
Major	Height of coating epoxy	Exceed the dimension of drawing	Reject
Major	Void or hole of coating epoxy	Expose bonding wire or IC	Reject
Major	PCB 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	$\theta \leq 20°$	Reject

3. Metal (Plastic) Frame

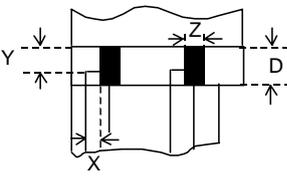| Defect	Inspection Item	Inspection Standards		
Major	Crack / breakage	Anywhere		Reject
Minor	Frame Scratch	W	L	Acceptable of Scratch
		w<0.1mm	Any	Ignore
		0.1$\leq$w<0.2mm	L$\leq$5.0mm	2
		0.2$\leq$w<0.3mm	L$\leq$3.0mm	1
		w$\geq$0.3mm	Any	0
		Note: 1. Above criteria applicable to scratch lines with distance greater than 5mm. 2. Scratch on the back side of frame (not visible) can be ignored.		
Minor	Frame Dent , Prick $\Phi = \dfrac{L + W}{2}$			Acceptable of Dents / Pricks
		$\Phi\leq$1.0mm		2
		1.0<$\Phi\leq$1.5mm		1
		1.5mm<Φ		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°	Acceptable
Minor	Uneven solder joint /bump		Reject
Minor	Hole $\Phi = \dfrac{L + W}{2}$	Expose the conductive line	Reject
		Φ > 1.0mm	Reject
Minor	Position shift	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 $\Phi = \dfrac{L + W}{2}$	$\Phi > 0.5mm$	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	
		$\Phi \leq 0.10mm$	ignore
		$0.10 < \Phi \leq 0.15mm$	2
		$0.15 < \Phi \leq 0.2mm$	1
		$\Phi > 0.2mm$	0
		The distance between any two spots should be $\geq 5mm$ 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			
Minor	**Linear Defect**	∗ **Glass Scratch** ∗ **Polarizer Scratch** ∗ **Fiber and Linear material**	**W**	**W≤0.03**	**0.03<W≤0.05**	**W>0.05**
			L	**L<5**	**L<3**	**Any**
			ACC. NO.	**1**	**1**	**Reject**
			Note	**L is the length and W is the width of the defect**		
Minor	**Black Spot and Polarizer Pricked**	∗ **Foreign material between glass and polarizer or glass and glass** ∗ **Polarizer hole or protuberance by external force**	**Φ**	**Φ≤0.1**	**0.1<Φ≤0.15 / 0.15<Φ≤0.2**	**Φ>0.2**
			ACC. NO.	**3EA / 100mm²**	**2 / 1**	**0**
			Note	**Φ is the average diameter of the defect. Distance between two defects > 10mm.**		
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**	**Φ**	**Φ≤0.3**	**0.3<Φ≤0.5**	**0.5<Φ**
			ACC. NO.	**3EA / 100mm²**	**1**	**0**
			Note	**Φ is the average diameter of the defect. Distance between two defects > 10mm.**		
Minor	**Segment Defect**		**Φ**	**Φ≤0.10**	**0.10<Φ≤0.20 / 0.20<Φ≤0.25**	**Φ>0.25**
			ACC. NO.	**3EA / 100mm²**	**2 / 1**	**0**
				W is more than 1/2 segment width		**Reject**
			Note	$\Phi = \dfrac{L + W}{2}$ **Distance between two defect is 10mm**		
Minor	**Protuberant Segment**	$\Phi = (L + W) / 2$	**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**
			ACC. NO.	**3EA / 100mm²**	**2 / 1**	**0**
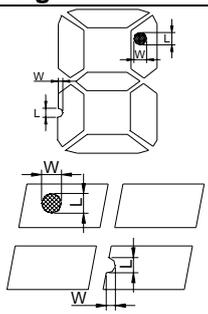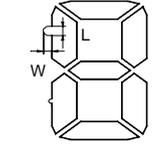
Defect	Inspect Item		Inspection Standards			
Minor	**Assembly Mis-alignment**		**1. Segment**			
			B	**B≤0.4mm**	**0.4<B≤1.0mm**	**B>1.0mm**
			B-A	**B-A<1/2B**	**B-A<0.2**	**B-A<0.25**
			Judge	**Acceptable**	**Acceptable**	**Acceptable**
			2. Dot Matrix			
			Deformation>2°			**Reject**
Minor	**Stain 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	70℃, 96Hrs	No defect in cosmetic and operational function allowable. Total current Consumption should be below double of initial value.
2	Low Temperature Operating	-20℃, 96Hrs	
3	High Humidity	40℃, 90%RH, 96Hrs	
4	High Temperature Storage	80℃, 96Hrs	
5	Low Temperature Storage	-30℃, 96Hrs	
6	Vibration	Random wave 10 ~ 100Hz Acceleration: 2g 2 Hrs per direction(X,Y,Z)	
7	Thermal Shock	-20℃ to 25℃ to 70℃ (60Min) (5Min) (60Min) 16Cycles	
8	ESD Testing	Contract Discharge Voltage: +1 ~ 4kV and −1 ~ −4kV	There will be discharged ten times at every discharging voltage cycle. The voltage gap is 1kV.
		Air Discharge Voltage: +1 ~ 6kV and −1 ~ −6kV	

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.
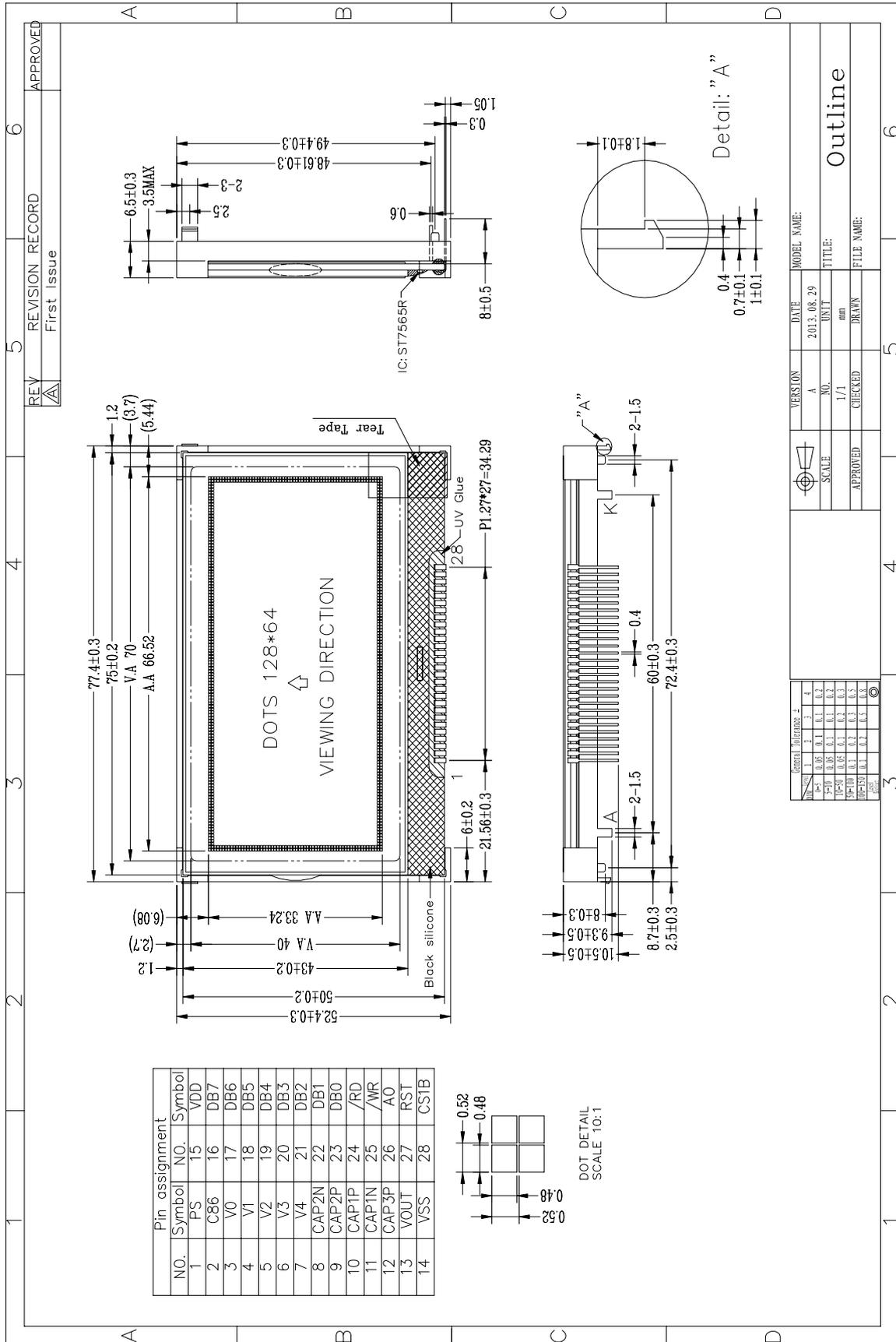
(6) Storage

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.

Model No.: G1206J7FSW6G−A1 **Ver:**1.0

10. OUTLINE DIMENSION

Detail: "A"

Outline

IC: ST7565R

Tear Tape

UV Glue

DOTS 128*64

VIEWING DIRECTION

Black silicone

P1.27*27=34.29

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Pin assignment			
NO.	Symbol	NO.	Symbol
1	PS	15	VDD
2	C86	16	DB7
3	V0	17	DB6
4	V1	18	DB5
5	V2	19	DB4
6	V3	20	DB3
7	V4	21	DB2
8	CAP2N	22	DB1
9	CAP2P	23	DB0
10	CAP1P	24	/RD
11	CAP1N	25	/WR
12	CAP3P	26	A0
13	VOUT	27	RST
14	VSS	28	CS1B

DOT DETAIL
SCALE 10:1

REV REVISION RECORD
First Issue
APPROVED

MODEL NAME:
VERSION A
DATE 2013.08.29
UNIT mm
NO. 1/1
TITLE:
FILE NAME:
SCALE
DRAWN
CHECKED
APPROVED

General Tolerance