



Specifications for Approval

Customer : _____

Model name : GG0804A1FSN6G REV: A

Description : LCM (G0804A1FSN6-DB016-010820)

ISSUE	ENG	QA	APPROVAL

<p>Customer Approval</p>	<div style="margin-left: 20px;"> <input type="checkbox"/> Accept <input type="checkbox"/> Reject Comment: </div> <div style="text-align: right; margin-top: 20px;"> Approved by: _____ </div>
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REVISION RECORD (MODEL NO. : GG0804A1FSN6G)

Revision	Revision Date	Page	Contents
A	2001/8/27		Initial Release



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**1. FEATURES**

The features of LCD are as follows

- * Display mode : FSTN, Positive, Transflective
- * Color : Display dot : Black
Background: White
- * Display Format : 84(W) X 48(H) Dots
- * IC : PCD8544
- * Interface Input Data : Serial data interface form a MPU
- * Driving Method : 1/48 Duty, 1/7 Bias
- * Viewing Direction : 6 O'clock

2. MECHANICAL SPECIFICATIONS

Item	Specification	Unit
Module Size	38.36(W) x 33(H) x 2.0(T)	mm
Number of dots	84(W) x 48(H)	-
Viewing Area	34.96(W) x 23.4(H)	mm
Effective display area	28.95(W) x 19.41(H)	mm
Dot Size	0.315(W) x 0.375(H)	mm
Dot Pitch	0.345(W) x 0.405(H)	mm

3. ELECTRICAL SPECIFICATIONS

3-1. Absolute Maximum Ratings (Ta=25°C)

Item	Symbol	Standard Value			Unit
		Min.	Typ.	Max.	
Supply Voltage For Logic	V_{DD}	-0.5	-	7	V
Supply Voltage For LCD Drive	$V_0 - V_{SS}$	-0.5	-	10	V
Input Voltage	V_I	-0.5	-	$V_{DD}+0.5$	V
Ground supply current	I_{SS}	-0.5	-	50	mA
DC input or output current	$I_I I_O$	-10	-	10	mA
Total power dissipation	P_{TOT}	-	-	300	mA
Operating temperature	T_{op}	-20	-	70	°C
Storage temperature	T_{STG}	-30	-	80	°C

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**3. ELECTRICAL SPECIFICATIONS (Continued)**3-2. Electrical Characteristics (V_{SS}=0V)

Item	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Logic supply Voltage	V _{DD}	-	2.7	-	3.3	V
Input Voltage	"H" Level	V _{DD} =2.8V	0.7V _{DD}	-	V _{DD}	V
	"L" Level		V _{SS}	-	0.3V _{DD}	V
Current Consumption	I _{DD}	V _{DD} =2.85V test pattern = notel	-	6.20	7.4	mA
LCD Drive Voltage (Recommended Voltage)	V _{OUT}	Ta =25°C	7.3	7.6	7.9	V

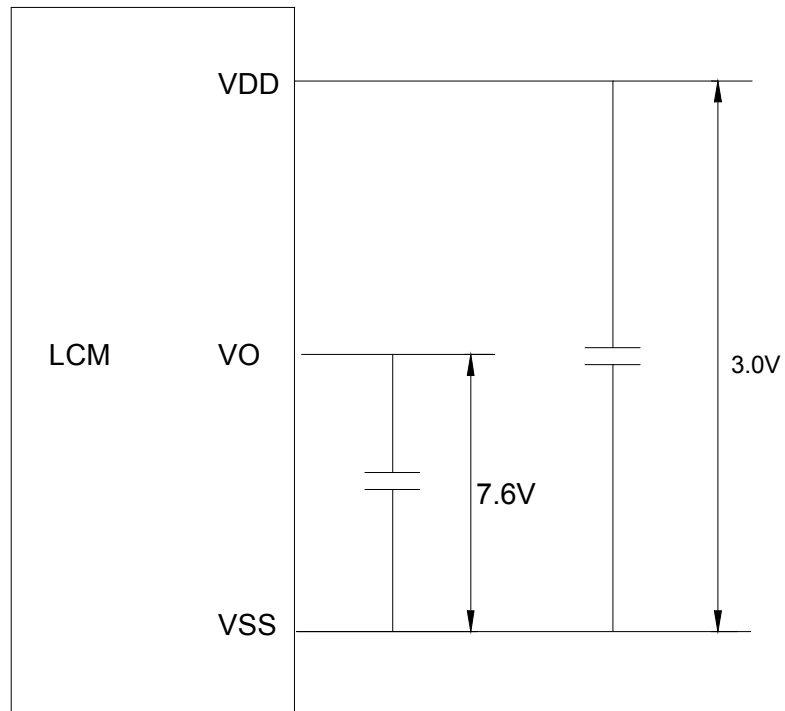
Note:

- 1) TEST PATTERN: ALL DOTS ON STATES .
 - 2) DUTY = 1/48
 - 3) ELECTRONIC VOLUME REGISTER (VOP 6:0)= 1000101B RECOMMANDABLE.
- * OPERATIONG VOLTAGE FLUCATUATE ABOT ± 0.3V BY EACHPANEL.

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4. POWER SUPPLY



VDD-VO: Operating Voltage for LCD

VR: 10K-20K

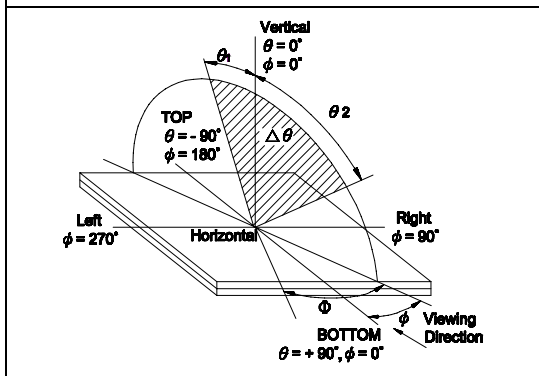
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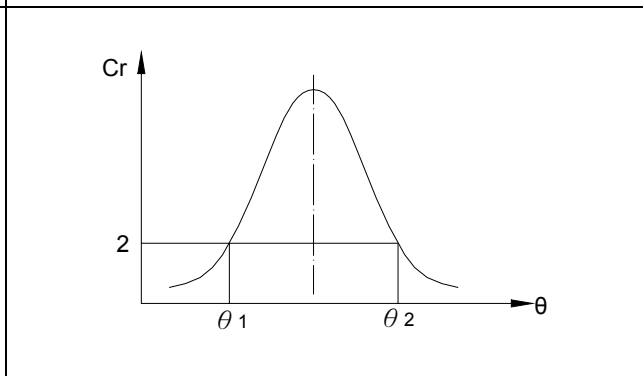
5. ELECTRO – OPTICAL CHARACTERISTICS

Item	Symbol	Temp.	Min.	Typ.	Max.	Unit	Conditions	Note
Viewing Angle	$\theta_2 - \theta_1$	25°C	30	-	-	Deg.	$Cr \geq 2$	1,2
	Φ		80	-	-			
Contrast Ratio	Cr	25°C	2	-	-	-	$\theta = 0^\circ$ $\Phi = 0^\circ$	3
Response Time(rise)	Tr	25°C	-	-	250	ms	$\theta = 0^\circ$ $\Phi = 0^\circ$	4
Response Time(fall)	Tf	25°C	-	-	250	ms	$\theta = 0^\circ$ $\Phi = 0^\circ$	4

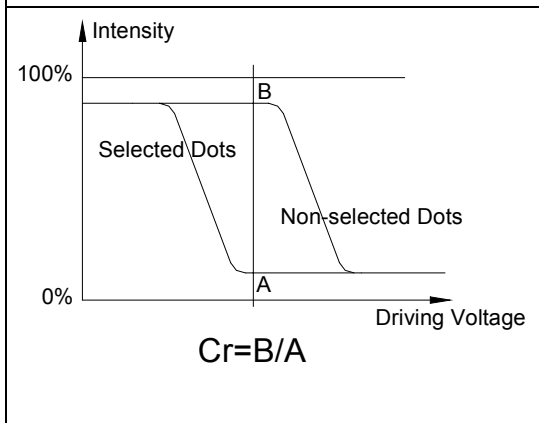
Note1 . Definition of Angle θ & Φ



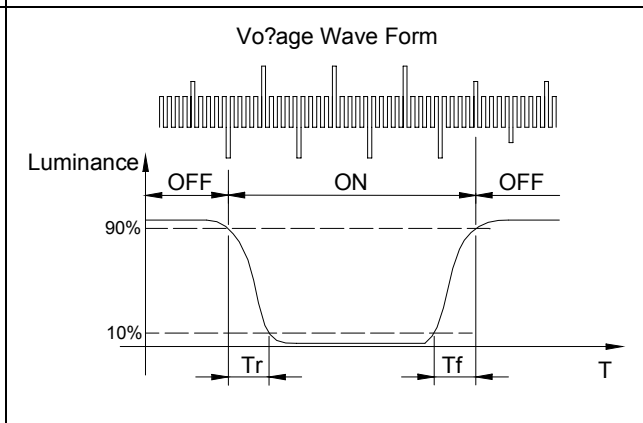
Note2. Definition of Viewing Angle θ_1 & θ_2



Note3 . Definition of Contrast Cr



Note4. Definition of Optical Response



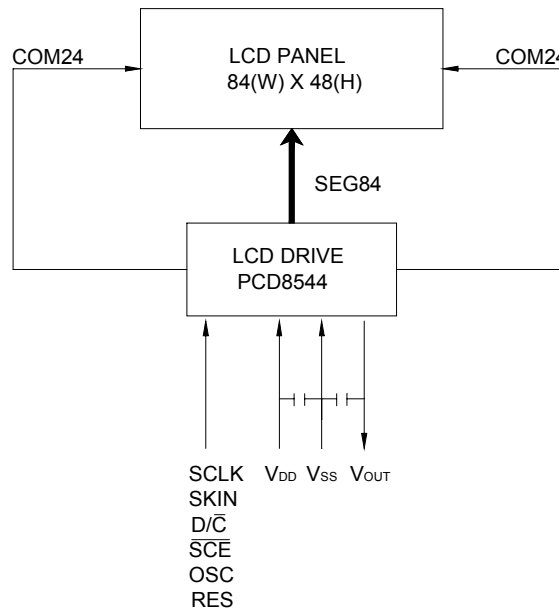


6. TERMINAL PIN FUNCTION AND BLOCK DIAGRAM

6-1. Interface Pin Function Description

Pin No.	Symbol	Functions
1	V _{DD}	Power for logic
2	SCLK	Serial clock
3	SDIN	Serial data
4	D/ \bar{C}	Select register (H = Data, L = Common)
5	\overline{SCE}	Chip select (L = Enable)
6	OSC	External clock (H = Internal clock)
7	V _{SS}	Ground
8	V _{OUT}	LCD output voltage
9	TST2	

6-2. Block Diagram



The required minimum value for the external capacitors in application with the PCD8544 are:

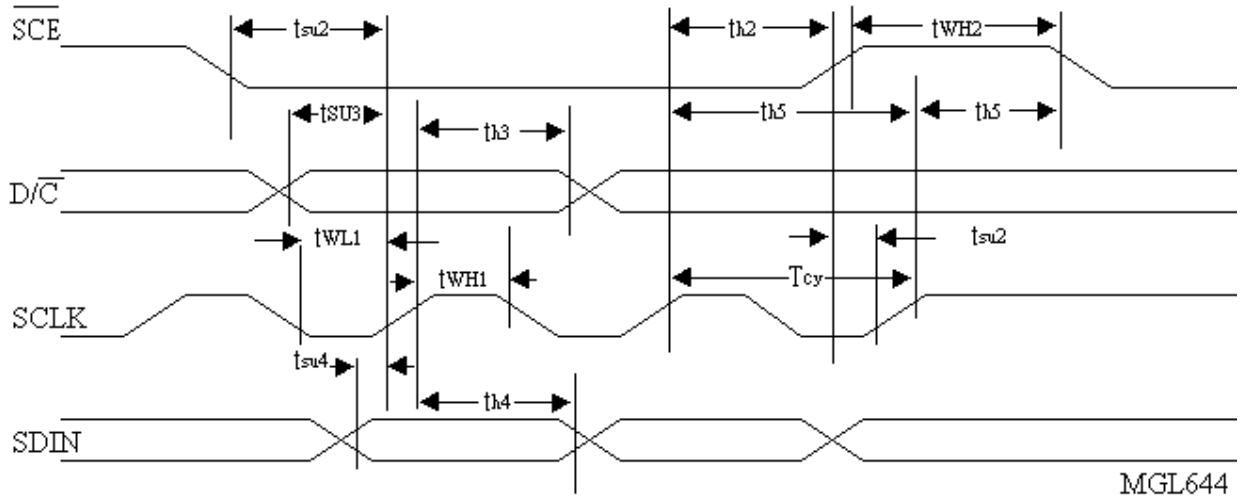
C_{ext} = min 1.0uF

Higher capacitor values are recommended for ripple reduction.



7.AC CHARACTERISTICS

7-1 Serial interface



MGL644

Fig. 15 Serial interface timing

7-2 Rest

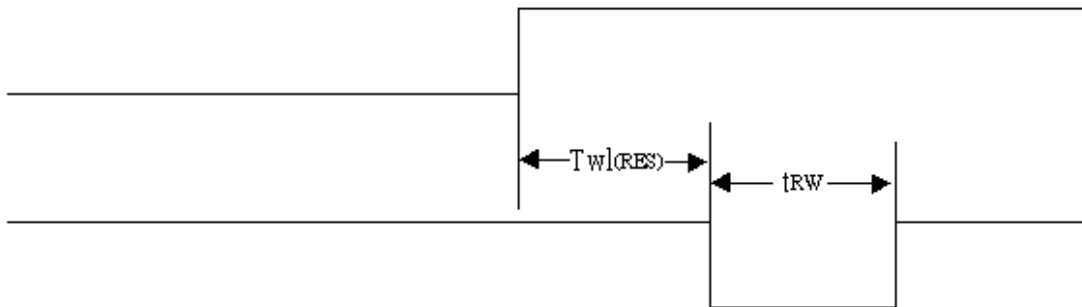


Fig. 16 Reset timing

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**7.AC CHARACTERISTICS (Continued)**

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
f _{OSC}	oscillator frequency		20	34	65	KHZ
f _{CLK(EXT)}	external clock frequency		10	32	100	KHZ
f _{frame}	frame frequency	f _{OSC} or f _{CLK(EXT)} =32kHz	—	67	—	Hz
t _{VHRL}	V _{DD} to $\overline{\text{RES}}$ LOW	Fig.16	0	—	30	ms
t _{wl(RES)}	$\overline{\text{RES}}$ LOW pulse width	Fig.16	100	—	—	ns

Serial bus timing characteristics

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
f _{SCLK}	clock frequency	V _{DD} =3.0V±10%	0	—	4	MHz
T _{cy}	clock cycle SCLK	ALL signal timing is based on 20% to 80% of V _{DD} and maximum rise and fall times of 10 ns	250	—	—	ns
t _{WH1}	SCLK pulse width HIGH		100	—	—	ns
t _{WL1}	SCLK pulse width LOW		100	—	—	ns
t _{SU2}	$\overline{\text{SCE}}$ set-up time		60	—	—	ns
t _{H2}	$\overline{\text{SCE}}$ hold time		100	—	—	ns
t _{WH2}	$\overline{\text{SCE}}$ min.HIGH time		100	—	—	ns
t _{H5}	$\overline{\text{SCE}}$ start hold time;note3		100	—	—	ns
t _{SU3}	D/ $\overline{\text{C}}$ set-up time		100	—	—	ns
t _{H3}	D/ $\overline{\text{C}}$ hold time		100	—	—	ns
t _{SU4}	SDIN set-up		100	—	—	ns
t _{H4}	SDIN hold time	100	—	—	ns	

NOTES:

1. T_{frame}=f_{CLK(EXT)}×480
2. $\overline{\text{RES}}$ may be LOW before V_{DD} goes HIGH.
3. Th5 is the time from the previous SCLK positive edge (irrespective of the state of $\overline{\text{SCE}}$) to the negative edge of $\overline{\text{SCE}}$ (see Fig. 15).



8.INSTRUCTION DESCRIPTION

8-1. **Table 1** Instruction set

INSTRUCTION	D/C	COMMAND BYTE								DESCRIPTION
		B7	B6	B5	B4	B3	B2	B1	B0	
(H = 0 or 1)										
NOP	0	0	0	0	0	0	0	0	0	No operation
Function set	0	0	0	1	0	0	PD	V	H	Power-down control; entry mode; extended instruction set control (H)
Write data	1	D ₇	D ₆	D ₅	D ₄	D ₃	D ₂	D ₁	D ₀	Writes data to RAM
(H =0)										
Reserved	0	0	0	0	0	0	1	X	X	Do not use
Display control	0	0	0	0	0	1	D	0	E	Sets display configuration
Reserved	0	0	0	0	1	X	X	X	X	Do not use
Set Y address of RAM	0	0	1	0	0	0	Y ₂	Y ₁	Y ₀	Sets Y- address of RAM: 0 ≤ Y ≤ 5
Set X address of RAM	0	1	X ₆	X ₅	X ₄	X ₃	X ₂	X ₁	X ₀	Sets X-address part of RAM: 0 ≤ X ≤ 83
(H =1)										
Reserved	0	0	0	0	0	0	0	0	1	Do not use
	0	0	0	0	0	0	0	1	X	Do not use
Temperature control	0	0	0	0	0	0	1	TC ₁	TC ₀	Set temperature coefficient (TC _x)
Reserved	0	0	0	0	0	1	X	X	X	Do not use
Bias system	0	0	0	0	1	0	BS ₂	BS ₁	BS ₀	Set bias system (BS _x)
Reserved	0	0	1	X	X	X	X	X	X	Do not use
Set V _{OP}	0	1	V _{OP6}	V _{OP5}	V _{OP4}	V _{OP3}	V _{OP2}	V _{OP1}	V _{OP0}	Write V _{OP} to register

8-2. **Table 2** Explanations of symbols in Table 1

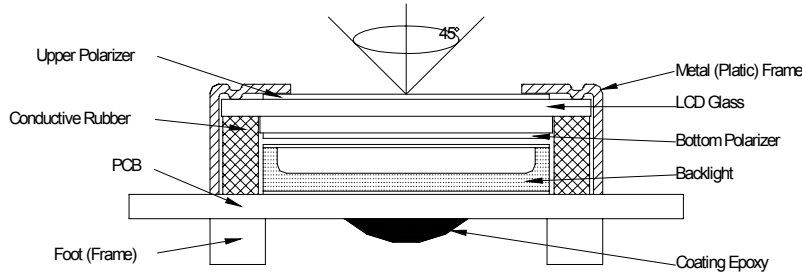
BIT	0	1
PD	Chip is active	Chip is in Power-down mode
V	Horizontal addressing	Vertical addressing
H	Use basic instruction set	Use extended instruction set
D and E 00 10 01 11	Display blank Normal mode All display segments on Inverse video mode	
TC ₁ and TC ₀ 00 01 10 11	V _{LCD} temperature coefficient 0 V _{LCD} temperature coefficient 1 V _{LCD} temperature coefficient 2 V _{LCD} temperature coefficient 3	



9. QUALITY SPECIFICATIONS

9 - 1. LCM Appearance and Electric inspection Condition

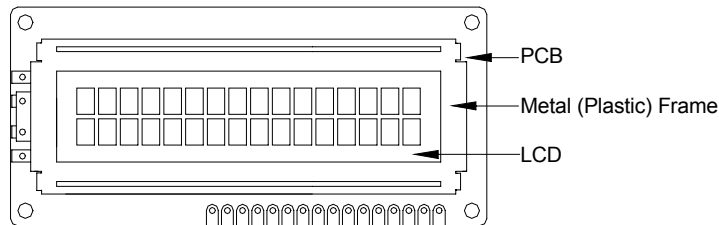
1. Inspection will be done by placing LCM 30cm away from inspector's eyeballs under normal illumination.



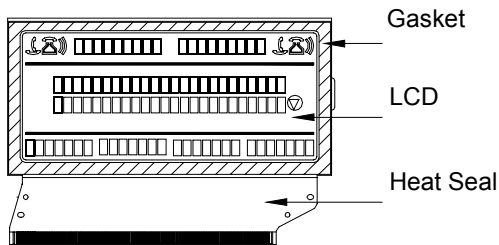
2. View Angle: with in 45° around perpendicular line.

9 - 2. Definition

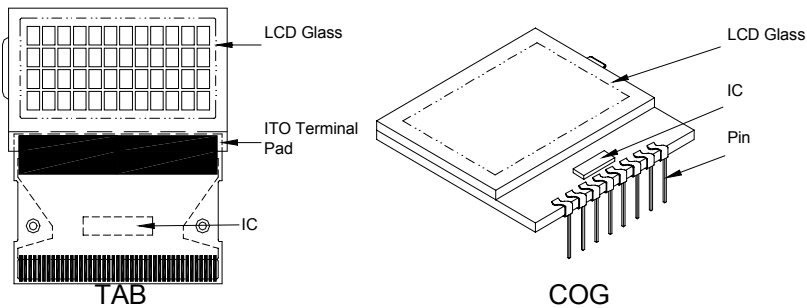
1. COB



2. Heat Seal



3. TAB and COG



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9. QUALITY SPECIFICATIONS (Continued)

9-3. Sampling Plan and Acceptance

1. Sampling Plan

MIL - STD - 105E (||) ordinary single inspection is used.

2. Acceptance

Major defect: AQL = 0.25%

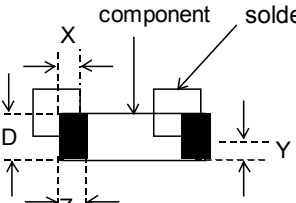
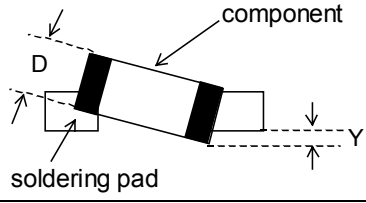
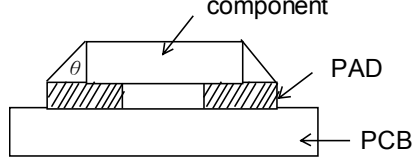
Minor defect: AQL = 0.65%

9-4. 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	<p>Component position shift</p> 	$X < 3/4Z$ $Y > 1/3D$	Reject Reject
Minor	<p>Component tilt</p> 	$Y > 1/3D$	Reject
Minor	<p>Insufficient solder</p> 	$\theta \leq 20^\circ$	Reject

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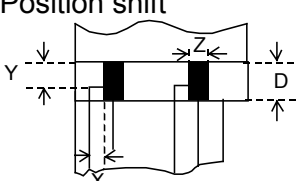
9. QUALITY SECIFICATIONS (Continued)

9-4. Criteria (Continued)

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≤w<0.2mm	L≤5.0mm	2
		0.2≤w<0.3mm	L≤3.0mm	1
		w≥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 $\Phi = \frac{L + W}{2}$			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°	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	Position shift 	$Y > 1/3D$	Reject
		$X > 1/2Z$	Reject



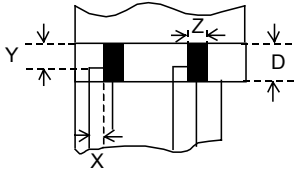
9. QUALITY SPECIFICATIONS (Continued)

9-4. Criteria (Continued)

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

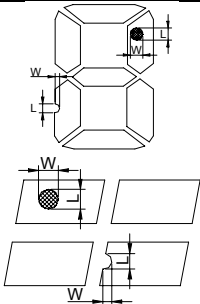
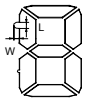
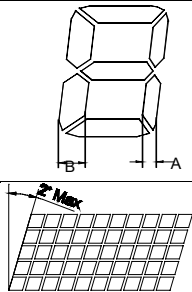
Defect	Inspection Item	Inspection Standards	
Major	Short		Reject
Major	Open		Reject



9. QUALITY SPECIFICATIONS (Continued)

9-4. Criteria (Continued)

9. Inspection Specification of LCD

Defect	Inspect Item		Inspection Standards				
			W	$W \leq 0.03$	$0.03 < W \leq 0.05$	$W > 0.05$	
Minor	Linear Defect	<ul style="list-style-type: none"> * 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			
Minor	Black Spot and Polarizer Pricked	<ul style="list-style-type: none"> * Foreign material between glass and polarizer or glass and glass * Polarizer hole or protuberance by external force 	Φ	$\Phi \leq 0.1$	$0.1 < \Phi \leq 0.15$	$0.15 < \Phi \leq 0.2$	$\Phi > 0.2$
			ACC. NO.	$3EA / 100mm^2$	2	1	0
			Note	Φ is the average diameter of the defect. Distance between two defects > 10mm.			
Minor	White Spot and Bubble in polarizer	<ul style="list-style-type: none"> * Unobvious transparent foreign material between glass and glass or glass and polarizer * Air protuberance between polarizer and glass 	Φ	$\Phi \leq 0.3$	$0.3 < \Phi \leq 0.5$	$0.5 < \Phi$	
			ACC. NO.	$3EA / 100mm^2$	1	0	
			Note	Φ is the average diameter of the defect. Distance between two defects > 10mm.			
Minor	Segment Defect		Φ	$\Phi \leq 0.10$	$0.10 < \Phi \leq 0.20$	$0.20 < \Phi \leq 0.25$	$\Phi > 0.25$
			ACC. NO.	$3EA / 100mm^2$	2	1	0
			Note	W is more than 1/2 segment width			
				$\Phi = \frac{L + W}{2}$ Distance between two defect is 10mm			
Minor	Protuberant Segment	 $\Phi = (L + W) / 2$	Φ	$\Phi \leq 0.10$	$0.10 < \Phi \leq 0.20$	$0.20 < \Phi \leq 0.25$	$\Phi > 0.25$
			W	Glue	$W \leq 1/2$ Seg $W < 0.2$	$W \leq 1/2$ Seg $W < 0.2$	Ignore
			ACC. NO.	$3EA / 100mm^2$	2	1	0
Minor	Assembly Mis-alignment		1. Segment				
			B	$B \leq 0.4mm$	$0.4 < B \leq 1.0mm$	$B > 1.0mm$	
			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"				

**10. RELIABILITY**

NO.	Item	Condition	Criterion
1	High Temperature Operating	70°C, 240Hrs	No defect in cosmetic and operational function allowable.
2	Low Temperature Operating	-10°C, 240Hrs	
3	High Humidity	80°C, 90%RH, 96Hrs	
4	High Temperature Storage	80°C, 240Hrs	
5	Low Temperature Storage	-30°C, 240Hrs	
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	-30°C to 25°C to 80°C (60Min) (5Min) (60Min) 10Cycles	
8	ESD Testing	Contract Discharge Voltage: +1 ~ 5kV and -1 ~ -5kV	There will be discharged ten times at every discharging voltage cycle. The voltage gap is 1kV.
		Air Discharge Voltage: +1 ~ 8kV and -1 ~ -8kV	

- Note:
- 1) Above conditions are suitable for GOLDENTEK standard products.
 - 2) For restrict products, the test conditions listed as above must be revised.

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11. HANDLING PRECAUTIONS

(1) Mounting Method

The panel of the LCD Module consists of two thin glass plates with polarizers 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
- Trichlorotrifluoroethane

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

Do not use the following solvent:

- Water
- Ketone
- 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 shorten LCD life. An electrochemical reaction due to direct current causes LCD deterioration, Avoid the use of direct current drive.

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11. HANDLING PRECAUTIONS (Continued)

- 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.

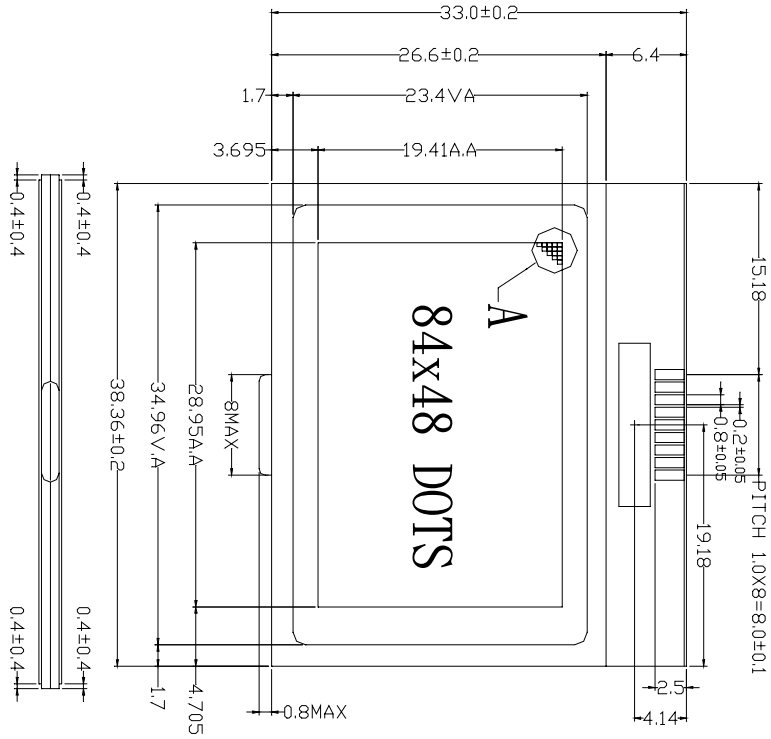
Which should be burned up later.

- 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.

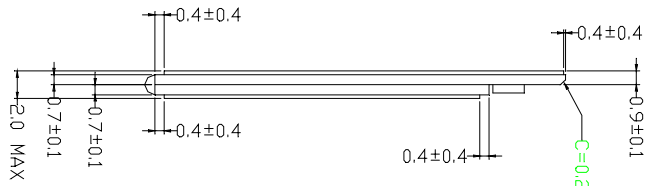
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12. OUTLINE DIMENSION

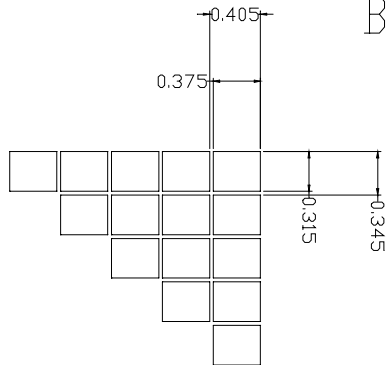


FRONT



BACK

DETAIL "A"



MODEL

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PRODUCT SPECIFICATIONS

REV: A