LEADER TIME SRL

PRODUCT SPECIFICATION

240*160 Graphic COG LCD MODULE
MODEL: LT-240160A-901 Ver:1.2

< ◇ > Finally Specification

CUSTOMER'S APPROVAL	
CUSTOMER :	
SIGNATURE:	DATE:

APPROVED BY	PM REVIEWD	PD REVIEWD	PREPARED By

Prepared By:

LEADER TIME SRL

VIA MONS. PROSDOCIMI, 27

36042 BREGANZE (VI)

- This specification is subject to change without notice. Please contact LT or it's representative before designing your product based on this specification.

Revision Status

Version	Revise Date	Page	Content	Modified By
Ver. 1.0	2008.09.24		First Issued	
Ver. 1.1	2009.03.12	5	Modify BLU , backlight circuit and LCD drive voltage	
Ver. 1.2	2009.08.07	5	Modify LCD drive voltage	

Table of Contents

1. Features

The features of LCD are as follows

* Display mode : FSTN ,Negative , transmissive
* IC : UC1611S
* Interface Input Data : I^2C
* Driving Method : 1/160 Duty, 1/12 Bias
* Viewing Direction : 12 O'clock
* Backlight : LED Unit(RGB)
*Sample NO : EY2416A4FVE7G-1.2/090724

2. MECHANICAL SPECIFICATIONS

Item	Specification	Unit
Module Size	105.8(W) x 80.68(H) x 13.3max(T)	mm
Viewing Area	98.8 (W) x 65.68 (H)	mm
Activity Area	94.78(W) x63.18(H)	mm
Number of Dots	240 X 160 Dots	-
Dot Size	0.375(W) x 0.375(H)	mm
Dot Pitch	0.395(W) x 0.395H)	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	-	4	V
Supply Voltage For LCD Drive	$V_{OP}= V_0 – V_{SS}$	-0.3	-	19.8	V
Input Voltage	Vin	-0.4	-	V_{DD}+0.5	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 -20℃, and the back ground will become darker at high temperature operating.

3-2 ELECTICAL CHARACTERISTICS

Item		Symbol	Test Condition	Min.	Typ.	Max.	Unit
Logic supply Voltage		$V_{DD} - V_{SS}$	Ta = 25 °C	3.1	3.3	3.5	V
LCD Drive		$V_{OP}=V_0-V_{SS}$		16.2	16.5	16.8	V
Input Voltage	"H" Level	V_{IH}	V_{DD}=3V ± 10%	0.85V_{DD}	-	-	V
	"L" Level	V_{IL}		-	-	0.2V_{DD}	V
Current Consumption		I_{DD}	V_{DD} = 3V	-	1.9	-	mA

3-3. BACKLIGHT

3-3-1. Absolute Maximum Ratings

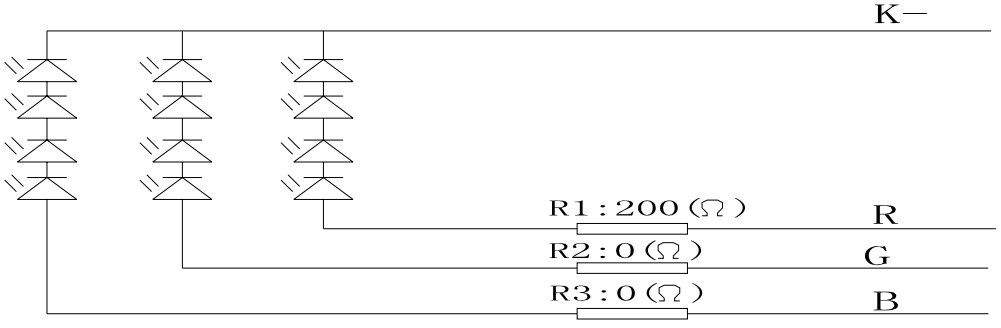
Item	Symbol	Condition	Min.			Typ.			Max.			Unit
			R	G	B	R	G	B	R	G	B	
Forward Current	IF	Ta = 25℃	-	-	-	-	-	-	20	20	20	mA
Reverse Voltage	VR		-	-	-	-	-	-	-	-	-	V
Power Dissipation	PD		-	-	-	-	-	-	240	240	240	mW

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

Item	Symbol	Condition	Min.			Typ.			Max.			Unit
			R	G	B	R	G	B	R	G	B	-
Forward Voltage	VF	IF(R)=15mA IF(G)=15mA IF(B)=15mA	-	-	-	12	12	12	-	-	-	V
Forward Current	IF	VF(RGB)=12V				15	15	15				mA
Emission wavelength	λP	-	625	520	465	-	-	-	630	525	470	nm
Average Luminous Intensity	Lv	-	-	-	-	20	70	25	-	-	-	cd/m^2

The brightness is measured without LCD panel

3-3-3. Backlight circuit

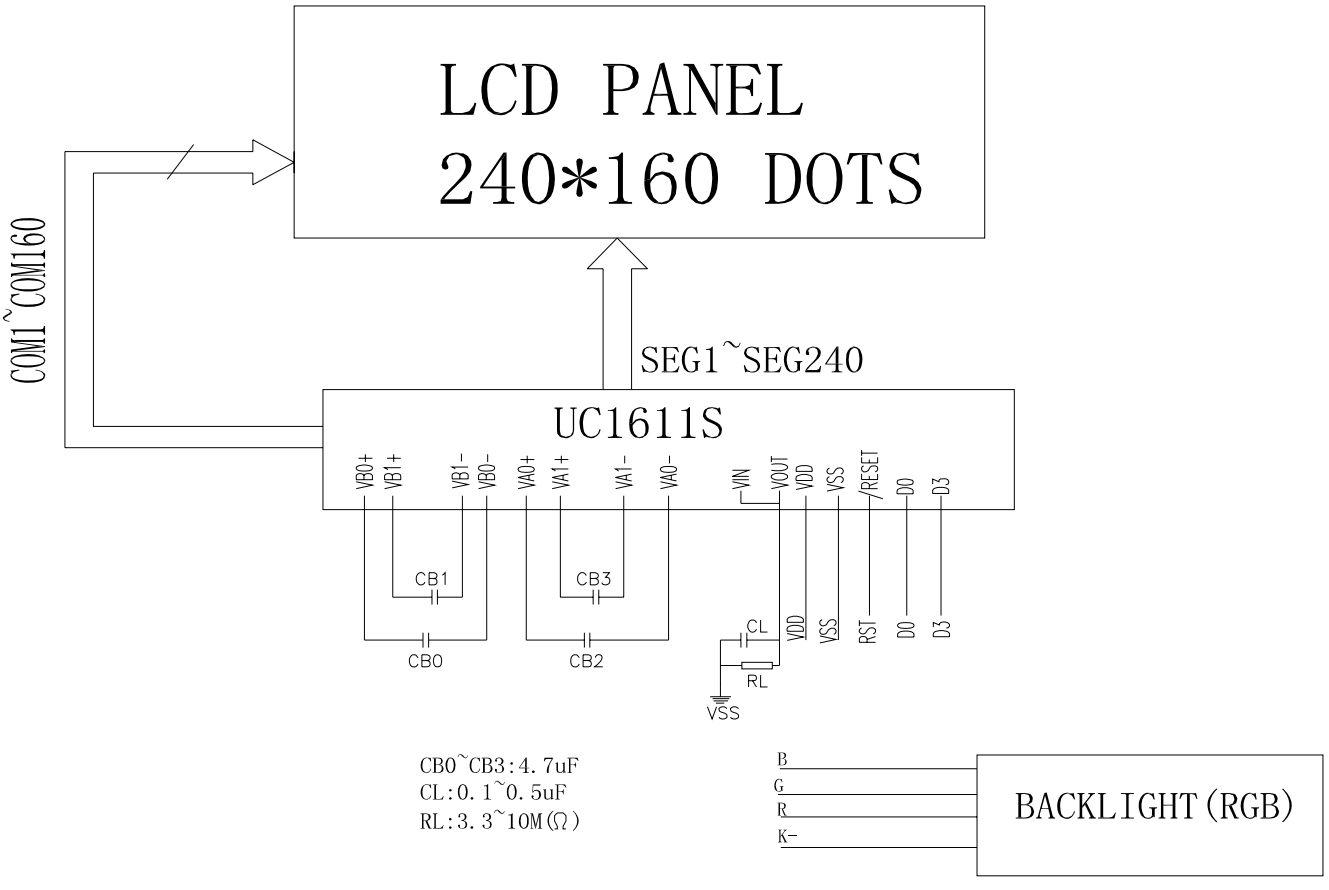


4. TERMINAL FUNCTIONS AND BLOCK DIAGRAM

4-1. INTERFACE PIN FUNCTION DESCRIPTION

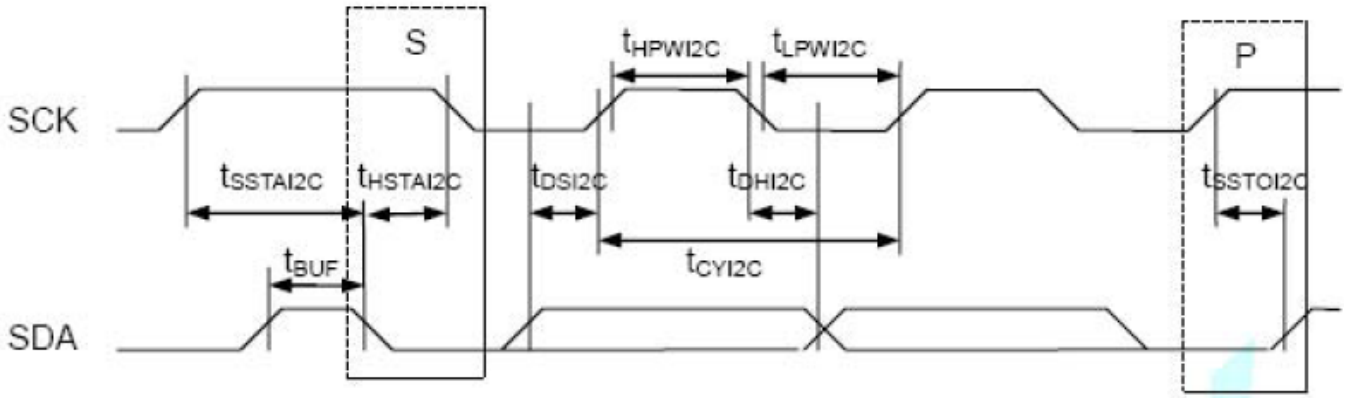
Pin No.	Pin Name	Function
1~8	VB0+, VB1+, VB1-, VB0-, VA0+, VA0-, VA1+-, VA1-	LCD Bias voltage
9	VLCD	High voltage LCD power supply
10	VDD	Power supply
11	VSS	Ground
12	RST	Reset pin
13~14	D0, D3	Data bus
15~18	DUMMY	Float pin
	K	Cathode of Backlight
	R(red)	Anode of Backlight
	G(green)	Anode of Backlight
	B(blue)	Anode of Backlight

4-2. BLOCK DIAGRAM



5.TIMING CHARACTERISTICS

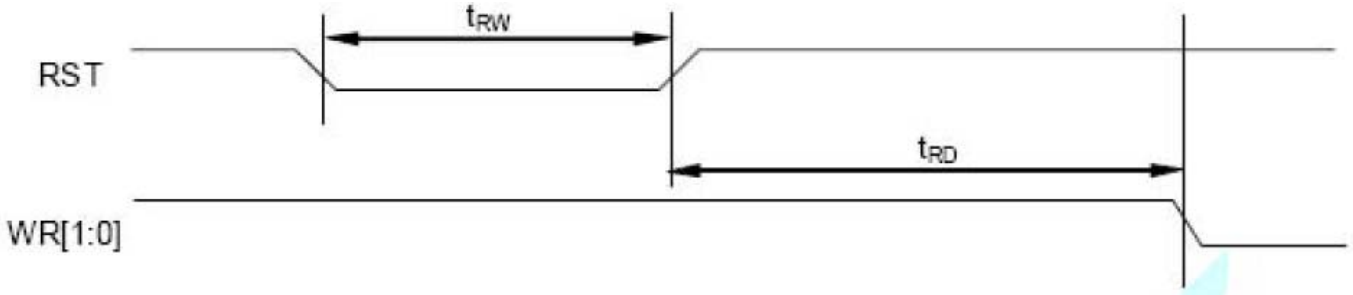
5-1.Serial bus timing characteristic



(2.5V ≤ V_{DD} < 3.3V, Ta= –30 to +85°C)

Symbol	Signal	Description	Condition	Min.	Max.	Units
t_{CYI2C}	SCK	SCK cycle time (read) (write)	tr+tf ≤ 100nS	580 275	–	nS
t_{LPWI2C}		Low pulse width (read) (write)		290 165	–	nS
t_{HPWI2C}		High pulse width (read) (write)		290 110	–	nS
t_{DSI2C}	SCK SDA	Data setup time		28	–	nS
t_{DHI2C}		Data hold time		11	–	nS
$t_{SSTAI2C}$		START Setup time		28	–	nS
$t_{HSTAI2C}$		START Hold time		50	–	nS
$t_{SSTOI2C}$		STOP setup time		28	–	nS
T_{BUF}		Bus Free time between STOP and START condition		165	–	nS

5-2. Reset timing



(1.65V ≤ V_{DD} < 3.3V, Ta= –30 to +85°C)

Symbol	Signal	Description	Condition	Min.	Max.	Units
t_{RW}	RST	Reset low pulse width		3	–	μS
t_{RD}	RST, WR	Reset to WR pulse delay		10	–	mS

6. INSTRUCTION SET

Type	C/D	W/R	D7	D6	D5	D4	D3	D2	D1	D0	Chip Action	Comments
R	–	–	–	–	–	–	–	–	–	–	Set RST pin Low	Wait 1mS after RST is Low
R	–	–	–	–	–	–	–	–	–	–	Set RST pin High	
R	–	–	–	–	–	–	–	–	–	–	Automatic Power-ON Reset.	Wait ~150mS
R	0	0	1	0	1	0	0	0	1	1	Set Line Rate	Set LC[5:4]=11b
R	0	0	1	1	1	1	0	1	0	0	Set V_{MTP1} Potentiometer	Set MTP V_{LCD}
R	0	0	0	1	1	0	1	1	1	1		MTP2: 6Fh(6V)
R	0	0	1	1	1	1	0	1	0	1	Set V_{MTP2} Potentiometer	Set MTP V_{LCD}
R	0	0	0	0	1	0	1	0	0	0		MTP3: 28h(12V)
R	0	0	1	1	1	1	0	1	1	0	Set MTP Write Timer	Set MTP Timer
R	0	0	0	0	1	0	0	1	0	1		MTP4:25h(100mS)
R	0	0	1	1	1	1	0	1	1	1	Set MTP Read Timer	Set MTP Timer
R	0	0	0	0	0	0	0	1	0	1		MTP5:05h(10mS)
R	0	0	1	0	1	1	1	0	0	1	Set MTP Write Mask	Set MTP Bit Mask
C	0	0	0	0	0	0	0	0	0	1	MTPM	Ex: To program PMO[5:0], set MTPM *
R	-	-	-	-	-	-	-	-	-	-		Apply TST4 voltage Program: 10V
R	0	0	1	0	1	1	1	0	0	0	Set MTP Control	Set MTPC[3]=1
R	0	0	-	-	0	0	1	0	1	1		Set MTPC[2:0]=011
R	0	1	-	-	-	-	-	ws	-	MS	Get Status & PM	Check MTP Status until MS=0 and WS=1
R												Remove TST4 voltage
R											V_{DD}=0V	Power OFF

Type	C/D	W/R	D7	D6	D5	D4	D3	D2	D1	D0	Chip action	Comments
R	–	–	–	–	–	–	–	–	–	–	Set RST pin Low	Wait 1mS after RST is Low
R	–	–	–	–	–	–	–	–	–	–	Set RST pin High	
R	–	–	–	–	–	–	–	–	–	–	Automatic Power-ON Reset.	Wait ~150mS
R	0	0	1	0	1	0	0	0	1	1	Set Line Rate	Set LC[5:4]=11b
R	0	0	1	1	1	1	0	1	0	0	Set V_{MTP1} Potentiometer	Set MTP V_{LCD}
R	0	0	0	1	1	0	1	1	1	1		MTP2: 6Fh(6V)
R	0	0	1	1	1	1	0	1	0	1	Set V_{MTP2} Potentiometer	Set MTP V_{LCD}
R	0	0	0	0	1	0	1	0	0	0		MTP3: 28h(12V)
R	0	0	1	1	1	1	0	1	1	0	Set MTP Write Timer	Set MTP Timer
R	0	0	0	0	1	0	0	1	0	1		MTP4:25h(100mS)
R	0	0	1	1	1	1	0	1	1	1	Set MTP Read Timer	Set MTP Timer
R	0	0	0	0	0	0	0	1	0	1		MTP5:05h(10mS)
R	0	0	1	0	1	1	1	0	0	1	Set MTP Write Mask	Set MTP Bit Mask
C	0	0	0	1	1	1	1	1	1	1	MTPM	Ex: To erase PMO[5:0] , set MTPM
R	0	0	1	0	1	1	1	0	0	0	Set MTP Control	Set MTPC[3]=1
R	0	0	-	-	0	0	1	0	1	0		Set MTPC[2:0]=010
R	0	1	-	-	-	-	-	ws	-	MS	Get Status & PM	Check MTP Status
												until MS=0 WS=1
R											V_{DD}=0V	Power OFF

* It is recommended that users clear all the bits to be programmed.

Type	C/D	W/R	D7	D6	D5	D4	D3	D2	D1	D0	Chip action	Comments
R	–	–	–	–	–	–	–	–	–	–	Turn on V_{DD} and $V_{DD2/3}$	Wait until V_{DD} and $V_{DD2/3}$ are stable
R	–	–	–	–	–	–	–	–	–	–	Set RST pin Low	Wait 1mS after RST is Low
R	–	–	–	–	–	–	–	–	–	–	Set RST pin High	
R	–	–	–	–	–	–	–	–	–	–	Automatic Power-ON Reset.	Wait ~150mS
C	0	0	0	0	1	0	0	1	#	#	Set Temp. Compensation	Set up LCD format specific parameters, MX, MY, etc.
C	0	0	1	1	0	0	0	0	0	0	Set LCD Mapping Control	
C	0	0	0	0	0	0	#	#	#	#		
A	0	0	1	0	1	0	0	0	#	#	Set Line Rate	Fine tune for power, flicker, contrast, and shading.
C	0	0	1	1	1	0	1	0	#	#	Set LCD Bias Ratio	LCD specific operating voltage setting
R	0 0	0 0	1 #	0 #	0 #	0 #	0 #	0 #	0 #	1 #	Set Gain and PM	
O	1 . . 1	0 . . 0	# . . #	# . . #	# . . #	# . . #	# . . #	# . . #	# . . #	# . . #	Write display RAM	Set up display image
R	0	0	1	0	1	0	1	1	1	1	Set Display Enable	

POWER-DOWN

Type	C/D	W/R	D7	D6	D5	D4	D3	D2	D1	D0	Chip action	Comments
R	0	0	1	1	1	0	0	0	1	0	System Reset	
R	–	–	–	–	–	–	–	–	–	–	Draining capacitor	Wait ~1mS before V_{DD} OFF

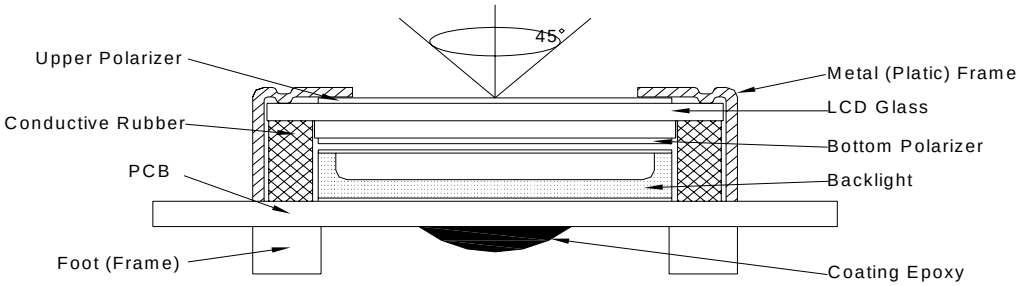
DISPLAY-OFF

Type	C/D	W/R	D7	D6	D5	D4	D3	D2	D1	D0	Chip action	Comments
R	0	0	1	0	1	0	1	0	0	0	Set Display Disable	
O	1 . . 1	0 . . 0	# . . #	# . . #	# . . #	# . . #	# . . #	# . . #	# . . #	# . . #	Write display RAM	Set up display image. (Image update is optional. Data in the RAM is retained through the SLEEP state.)
R	0	0	1	0	1	0	1	1	1	1	Set Display Enable	

7. QUALITY SPECIFICATIONS

7 - 1. LCM Appearance and Electric inspection Condition

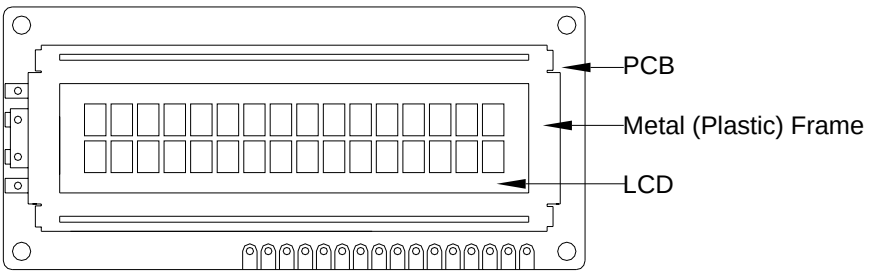
1. Inspection will be done by placing LCM 30cm away from inspector's eyeballs under normal illumination.



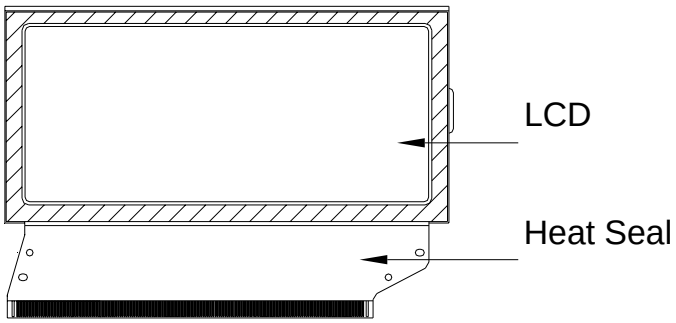
2. View Angle: with in 45˚around perpendicular line.

7 - 2. Definition

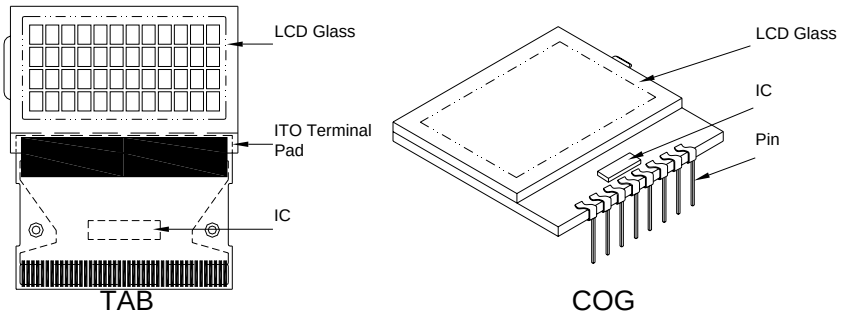
1. COB



2. Heat Seal



3. TAB and COG



7-3. Sampling Plan and Acceptance

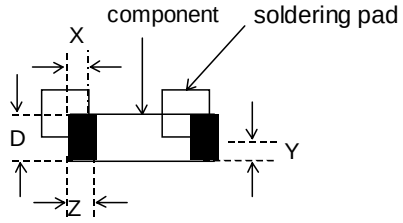
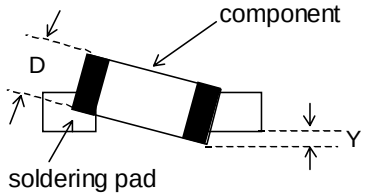
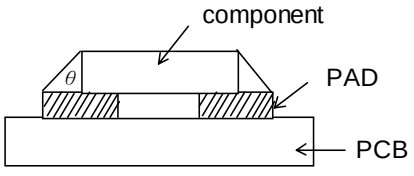
1. Sampling Plan
   MIL - STD - 105E (||) ordinary single inspection is used.
2. Acceptance
   Major defect: AQL = 0.25%
   Minor defect: AQL = 0.65%

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

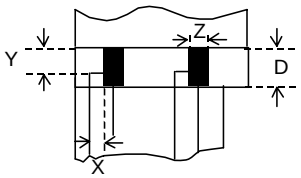
2. SMT

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 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<0.1mm	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
		$\Phi \leq 1.0$mm		2
		$1.0 < \Phi \leq 1.5$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		

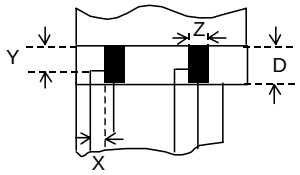
4. Flexible Film Connector (FFC)

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
		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 $\Phi = \frac{L+W}{2}$	Φ> 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

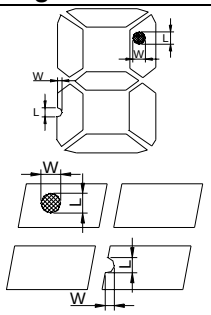
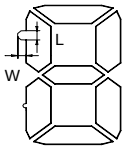
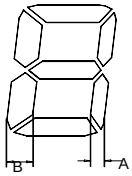
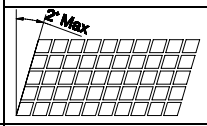
7. LED 、 Backing Protective Film and Others

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
		Φ>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 / 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	∗ Unobvious transparant 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 / 100mm^2		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 / 100mm^2	2	1	0
			Note	W is more than 1/2 segment width			Reject
				$\Phi = \frac{L + W}{2}$ Distance between two defect is 10mm			
Minor	Protuberant Segment	 Φ = (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 / 100mm^2	2	1	0
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	60℃, 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 ~ 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 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 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
- Trichloro trifloro 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
- 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.
- 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 reequired.

(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