Display Elektronik GmbH

15.12.2021

DATA SHEET

LCD MODULE

DEM 240064D FGH-PW

Product Specification   Ver.: 1

Revision Status

Version	Revise Date	Page	Content	Modified By
0	16.03.2011	-	First Issue	
0.1.0	20.11.2019	-	Change Production Line	
1	15.12.2021		Add Electrical Characteristics	

Table of Contents

1. FEATURES

The features of LCD are as follows

  * Display mode   : FSTN / Transflective / Positive

  * IC   : UC1608xGBE

  * Interface Input Data   : 8 bits/4 bits parallel bus

  * Driving Method   : 1/64 duty, 1/9 bias

  * Viewing Direction   : 6 O'clock

  * Backlight   : 6 LED / side white

  * Sample NO   : -

2. MECHANICAL SPECIFICATIONS

Item	Specification	Unit
Module Size	126.20 x 55.10 x 5.80	mm
Viewing Area	111.00 x 37.00	mm
Activity Area	105.57 x 31.97	mm
Number of Dots	240 x 64 Dots	-
Dot Size	0.41 x 0.47	mm
Dot Pitch	0.44 x 0.50	mm

3. ELECTRICAL SPECIFICATIONS

3-1 ABSOLUTE MAXIMUM RATINGS (Ta = 25 °C)

Item	Symbol	Standard Value			Unit
		Min.	Typ.	Max.	
Supply Voltage For Logic	$V_{DD}–V_{SS}$	-0.3	-	4.0	V
Supply Voltage For LCD Drive	$V_{OP} = V_{DD}-V_0$	-0.3	-	17	V
Input Voltage	Vin	-0.4	-	$V_{DD}+0.5$	V
Operating Temperature	Top	-10	-	+60	°C
Storage Temperature	Tst	-20	-	+70	°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 ELECTICAL CHARACTERISTICS

Item		Symbol	Test Condition	Min.	Typ.	Max.	Unit
Logic Supply Voltage		$V_{DD}–V_{ss}$		2.7	3.0	3.3	V
LCD Drive		$V_{OP}= V_{DD}-V_0$	Ta = 25°C	11.9	12.1	12.3-	V
Input Voltage	"H" Level	V_{IH}		$0.8V_{DD}$	-	-	V
	"L" Level	V_{IL}	$V_{DD}=3.0V$	-	-	$0.2V_{DD}$	V
Frame Frequency		f_{FLM}		-	75	-	Hz
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	Ifm		-	-	25*6	mA
Power Dissipation	Pd	Ta = 25 °C	-	-	75*6	mW
Reverse Voltage	Vr		-	-	5	V

3-3-2. Electrical-optical Characteristics

| Item	Symbol	Condition	Min.		Typ.		Max.		Unit
Forward Voltage	Vf		2.9		3.1		3.3		V
Luminance	Lv	Ta = 25 °C	150		-		-		cd/m^2
LED Lifetime	-	If = 90mA	20,000		30,000		-		hour
Colour Coordinates	-		X	Y	X	Y	X	Y	-
			0.25	0.25	0.28	0.28	0.32	0.32	

Note: The brightness is measured without LCD panel. For operation above 25°C, The Ifm Ifp & Pd must be derated, the current derating is -0.36mA/°C for DC drive and -0.86 mA/°C for Pulse drive, the Power dissipation is -1.5mW/°C.The produt 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

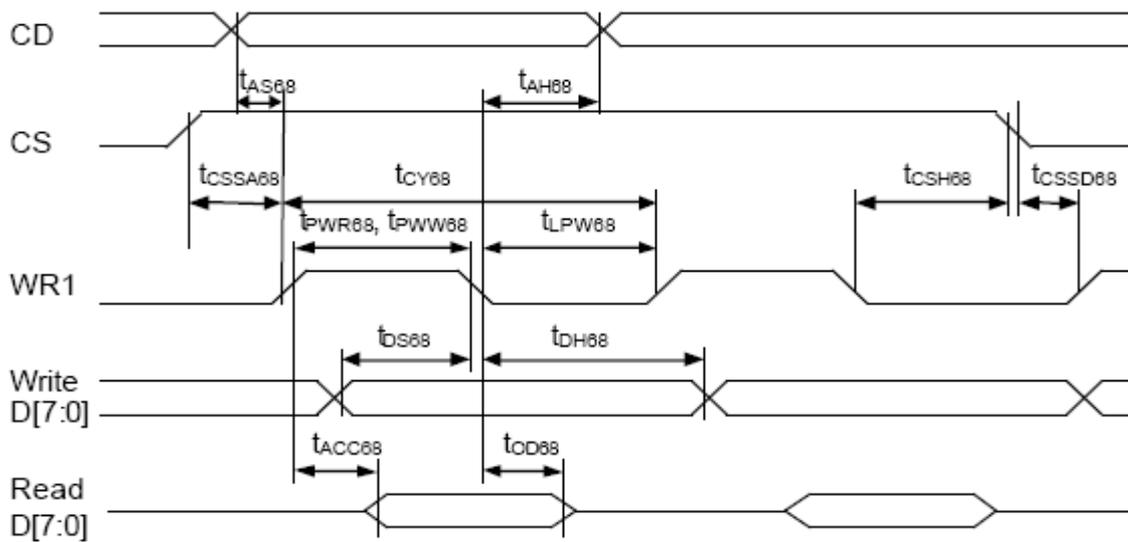| Pin No.	Pin Name	Function
1	NC	Not connect pin
2~5	VB1-,VB1+,VB0-,VB0+	LCD bias voltage
6	VLCD	LCD Power Supply
7	VBIAS	This is the reference voltage to generate the actual seg driving voltage
8	VSS	Ground
9	VDD	VDD is digital VDD
10~17	DB7~DB0	Command/data selection Data bus
18	RD	Read operation
19	WR	Write operation
20	CD	Control date/data selection
21	RST	Reset signal
22	CS	Chip selection
23~24	BM0,BM1	Bus mode selection

4-2. BLOCK DIAGRAM
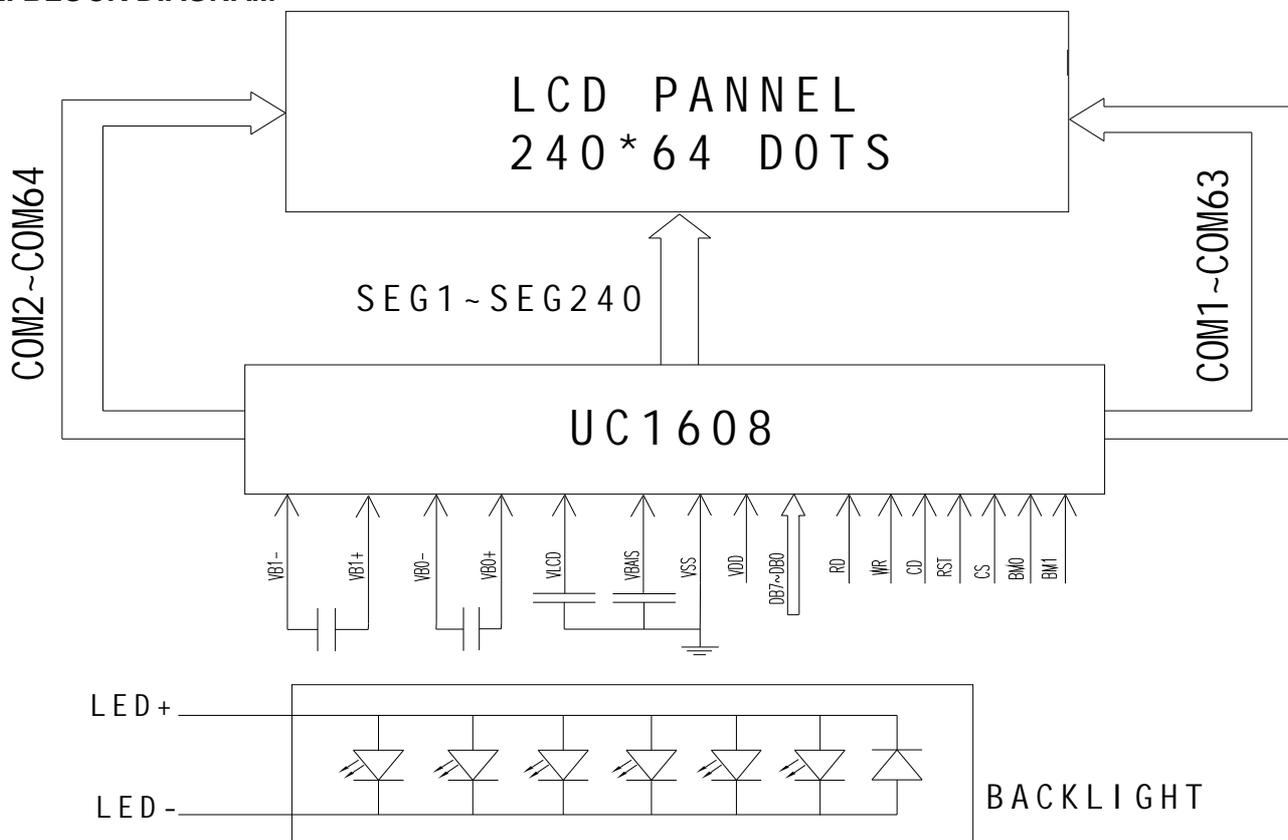
5. TIMING CHARACTERISTICS

Parallel Bus Timing Characteristics (for 8080 MCU)
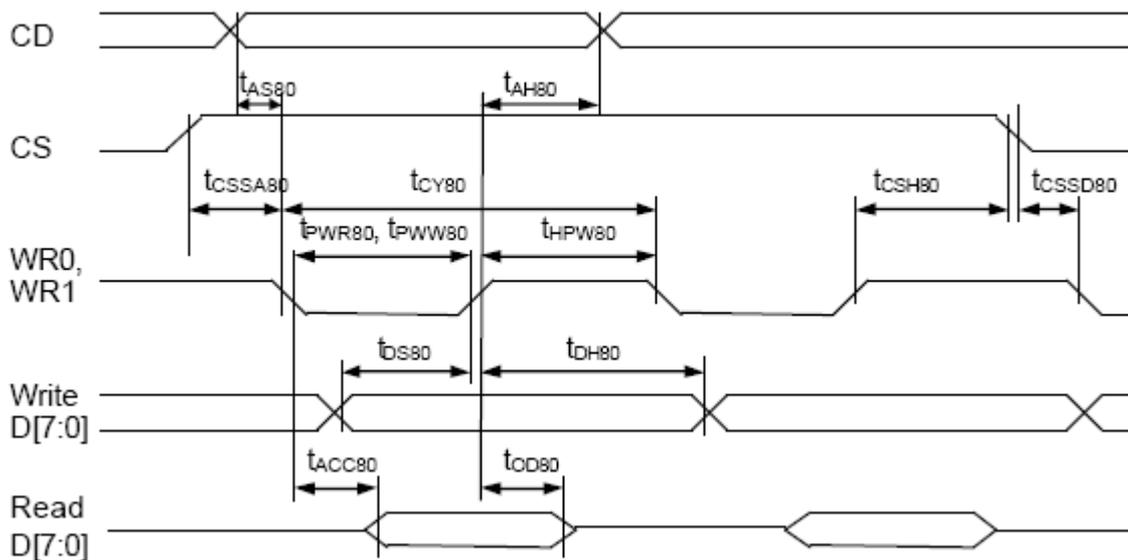
$(2.7V \leq V_{DD} < 3.3V, Ta= -30 \text{ to } +85^{\circ}C)$

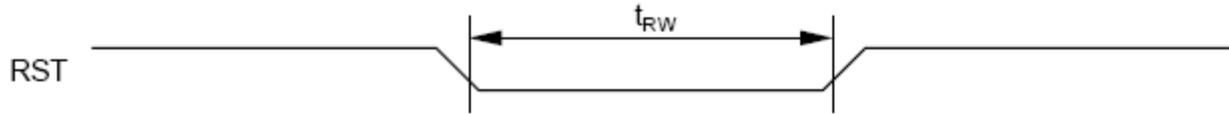| Symbol	Signal	Description		Condition	Min.	Max.	Units
t_{AS80} t_{AH80}	CD	Address setup time Address hold time			0 20	– 	nS
t_{CY80}		System cycle time 8 bits bus 4 bits bus	(read) (write) (read) (write)		 140 140 140 140	– 	nS
t_{PWR80}	WR1	Pulse width	8 bits (read) 4 bits		65 65	– 	nS
t_{PWW80}	WR0	Pulse width	8 bits (write) 4 bits		35 35	– 	nS
t_{HPW80}	WR0, WR1	High pulse width 8 bits bus 4 bits bus	(read) (write) (read) (write)		 65 35 65 35	– 	nS
t_{DS80} t_{DH80}	D0~D7	Data setup time Data hold time			30 20	– 	nS
t_{ACC80} t_{OD80}		Read access time Output disable time		$C_L = 100pF$	– 12	60 20	nS
t_{SSA80} t_{CSSD80} t_{CSH80}	CS1/CS0	Chip select setup time			10 10 20		nS

Parallel Bus Timing Characteristics (for 6800 MCU)

(2.7V ≤ V_{DD} < 3.3V, Ta= −30 to +85°C)

Symbol	Signal	Description	Condition	Min.	Max.	Units
t_{AS68} t_{AH68}	CD	Address setup time Address hold time		0 20	– 	nS

T_{CY68}		System cycle time
		8 bits bus (read)
		       (write)
		4 bits bus (read)
		       (write)
				
				140
				140
				140
				140
					–
					
						nS

t_{PWR68}	WR1	Pulse width 8 bits (read) 4 bits		65 65	– 	nS
t_{PWW68}		Pulse width 8 bits (write) 4 bits		35 35	– 	nS

t_{LPW68}		Low pulse width
		8 bits bus (read)
		           (write)
		4 bits bus (read)
		           (write)
				
				65
				35
				65
				35
					–
					
						nS

t_{DS68} t_{DH68}	D0~D7	Data setup time Data hold time		30 20	– 	nS
t_{ACC68} t_{OD68}		Read access time Output disable time	C_L = 100pF	– 12	60 20	nS
t_{CSSA68} t_{CSSD68} t_{CSH68}	CS1/CS0	Chip select setup time		10 10 20		nS

Reset timing

$(2.7V \leq V_{DD} < 3.3V, Ta= -30 \text{ to } +85^{\circ}C)$

Symbol	Signal	Description	Condition	Min.	Max.	Units
t_{RW}	RST	Reset low pulse width		1000	–	nS

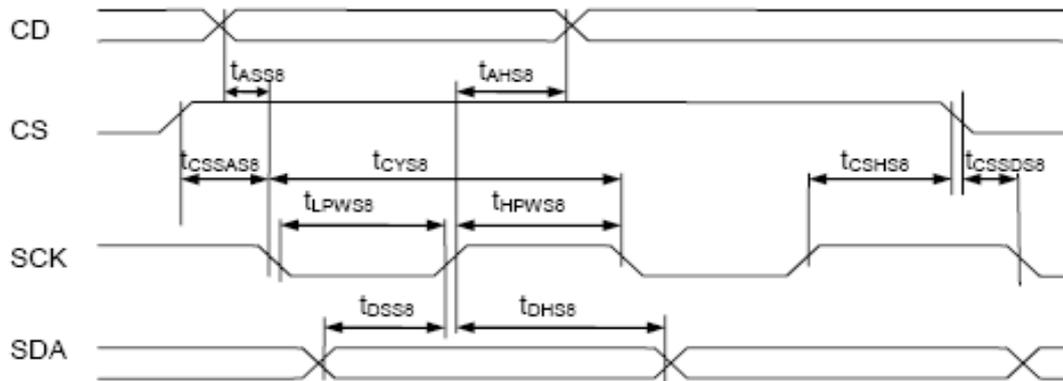FIGURE 17: Serial Bus Timing Characteristics (for S8)

$(2.7V \leq V_{DD} < 3.3V, Ta= -30 \text{ to } +85^{\circ}C)$

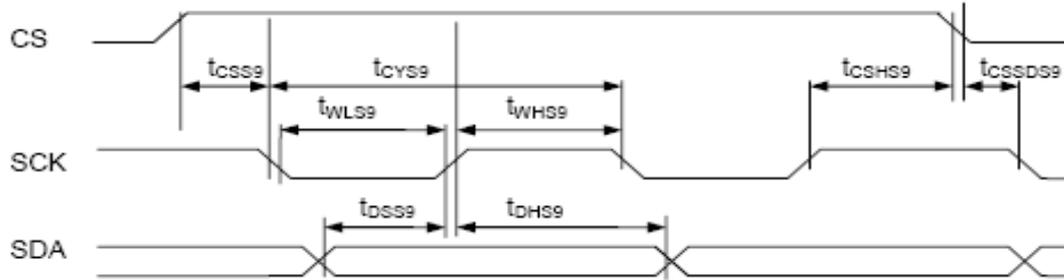| Symbol	Signal	Description	Condition	Min.	Max.	Units
t_{ASS8}	CD	Address setup time		0	–	nS
t_{AHS8}		Address hold time		20	–	nS
t_{CYS8}	SCK	System cycle time		140	–	nS
t_{LPWS8}		Low pulse width		65	–	nS
t_{HPWS8}		High pulse width		65	–	nS
t_{DSS8}	SDA	Data setup time		30	–	nS
t_{DHS8}		Data hold time		20		
t_{CSSAS8}	CS	Chip select setup time		10		nS
t_{CSSDS8}				20		
t_{CSHS8}				10		

FIGURE 18: Serial Bus Timing Characteristics (for S9)

$(2.7V \leq V_{DD} < 3.3V, Ta = -30 \text{ to } +85^{\circ}C)$

Symbol	Signal	Description	Condition	Min.	Max.	Units
t_{CYS9}	SCK	System cycle time		140	–	nS
t_{LPWS9}		Low pulse width		65	–	nS
t_{HPWS9}		High pulse width		65	–	nS
t_{DSS9} t_{DHS9}	SDA	Data setup time Data hold time		30 20	–	nS
t_{CSSAS9} t_{CSSDS9} t_{CSHS9}	CS	Chip select setup time		10 20 10		nS

6. INSTRUCTION SET

The following is a list of host commands supported by UC1608

C/D: 0: Control,   1: Data
W/R: 0: Write Cycle,   1: Read Cycle
Useful Data bits
–   Don't Care

	Command	C/D	W/R	D7	D6	D5	D4	D3	D2	D1	D0	Action	Default
1	Write Data Byte	1	0	#	#	#	#	#	#	#	#	Write 1 byte	N/A
2	Read Data Byte	1	1	#	#	#	#	#	#	#	#	Read 1 byte	N/A
3	Get Status	0	1	BZ	MX	DE	RS	WA	GN1	GN0	1	Get Status	N/A
4	Set Column Address LSB	0	0	0	0	0	0	#	#	#	#	Set CA[3:0]	0
	Set Column Address MSB	0	0	0	0	0	1	#	#	#	#	Set CA[7:4]	0
5	Set Mux Rate and temperature compensation.	0	0	0	0	1	0	0	#	#	#	Set {MR, TC[1:0]}	MR: 1b TC: 00b
6	Set Power Control	0	0	0	0	1	0	1	#	#	#	Set PC[2:0]	101b
7	Set Adv. Program Control. (double byte command)	0	0	0	0	1	1	0	0	0	R	For UltraChip only. Do not use.	N/A
		0	0	#	#	#	#	#	#	#	#		
8	Set Start Line	0	0	0	1	#	#	#	#	#	#	Set SL[5:0]	0
9	Set Gain and Potentiometer (double-byte command)	0	0	1	0	0	0	0	0	0	1	Set {GN[1:0], PM[5:0]}	GN=3 PM=0
		0	0	#	#	#	#	#	#	#	#		
10	Set RAM Address Control	0	0	1	0	0	0	1	#	#	#	Set AC[2:0]	001b
11	Set All-Pixel-ON	0	0	1	0	1	0	0	1	0	#	Set DC[1]	0=disable
12	Set Inverse Display	0	0	1	0	1	0	0	1	1	#	Set DC[0]	0=disable
13	Set Display Enable	0	0	1	0	1	0	1	1	1	#	Set DC[2]	0=disable
14	Set Fixed Lines	0	0	1	0	0	1	#	#	#	#	Set FL[3:0]	0
15	Set Page Address	0	0	1	0	1	1	#	#	#	#	Set PA[3:0]	0
16	Set LCD Mapping Control	0	0	1	1	0	0	#	#	#	#	Set LC[3:0]	0
17	System Reset	0	0	1	1	1	0	0	0	1	0	System Reset	N/A
18	NOP	0	0	1	1	1	0	0	0	1	1	No operation	N/A
19	Set LCD Bias Ratio	0	0	1	1	1	0	1	0	#	#	Set BR[1:0]	10b=12
20	Reset Cursor Mode	0	0	1	1	1	0	1	1	1	0	AC[3]=0, CA=CR	N/A
21	Set Cursor Mode	0	0	1	1	1	0	1	1	1	1	AC[3]=1, CR=CA	N/A
22	Set Test Control (double byte command)	0	0	1	1	1	0	0	1	TT		For UltraChip only. Do not use.	N/A
		0	0	#	#	#	#	#	#	#	#		

7. QUALITY SPECIFICATIONS

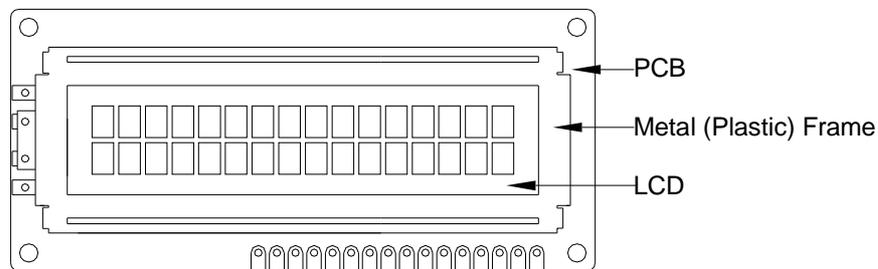### 7 - 1. LCM Appearance and Electric inspection Condition
1. Inspection will be done by placing LCM 30cm away from inspector's eyeballs under normal illumination.
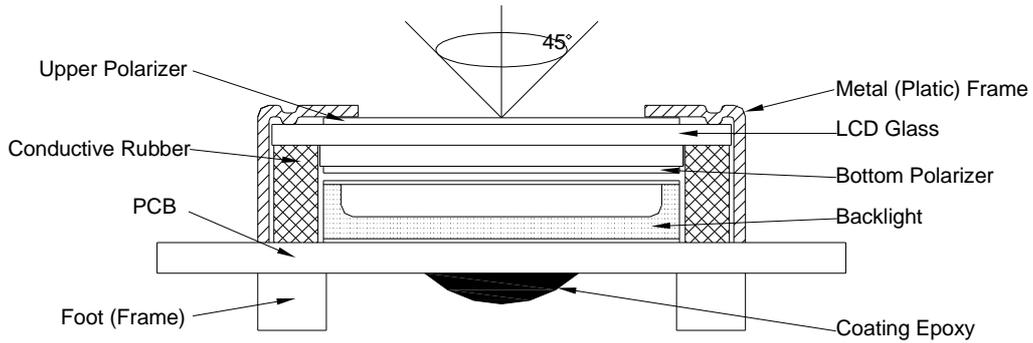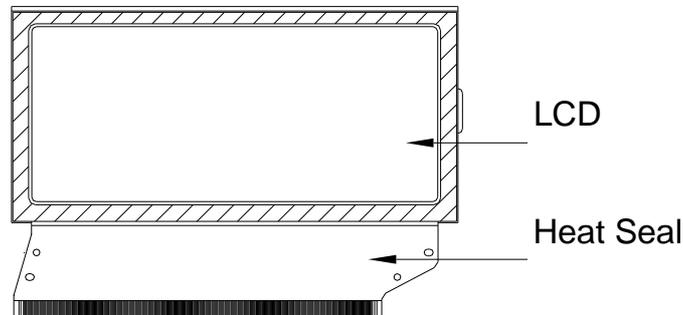

2. View Angle: with in 45°around perpendicular line.

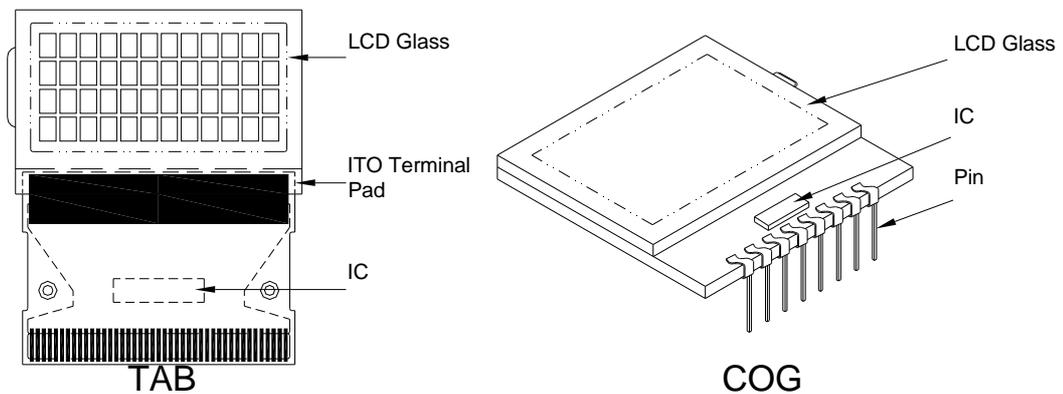### 7 - 2. Definition
1. COB

2. Heat Seal

3. TAB and COG

7-3. Sampling Plan and Acceptance

1. Sampling Plan

   MIL - STD - 105E (□) ordinary single inspection is used.
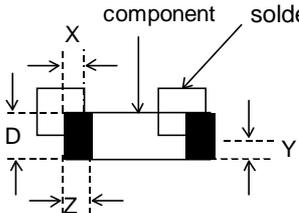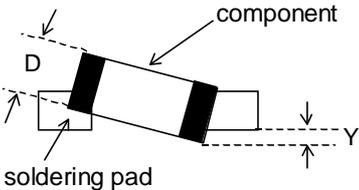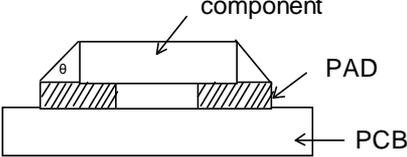
2. Acceptance

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

7-4. Criteria

1. COB

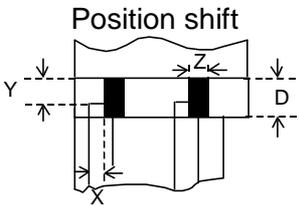| Defect	Inspection Item	Inspection Standards	
Major	PCB copper flakes peeling off	Any copper flake in viewing Area should be greater than $1.0mm^2$	Reject
Major	Height of coating epoxy	Exceed the dimension of drawing	Reject
Major	Void or hole of coating epoxy	Expose bonding wire or IC	Reject
Major	PCB 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 Reject
Minor	Component tilt 	$Y > 1/3D$	Reject
Minor	Insufficient solder 	$\theta \leq 20°$	Reject

3. Metal (Plastic) Frame

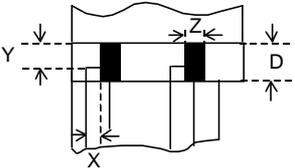| Defect	Inspection Item	Inspection Standards		
Major	Crack / breakage	Anywhere		Reject
Minor	Frame Scratch	W	L	Acceptable of Scratch
		w<0.1mm	Any	Ignore
		0.1$\leq$w<0.2mm	L$\leq$5.0mm	2
		0.2$\leq$w<0.3mm	L$\leq$3.0mm	1
		w$\geq$0.3mm	Any	0
		Note : 1. Above criteria applicable to scratch lines with distance greater than 5mm. 2. Scratch on the back side of frame (not visible) can be ignored .		
Minor	Frame Dent , Prick $$\Phi = \frac{L + W}{2}$$			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

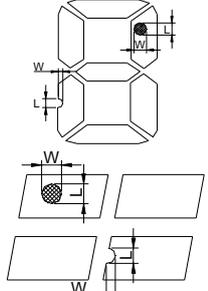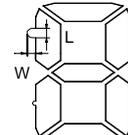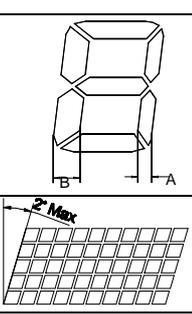| Defect	Inspection Item		Inspection Standards	
Major	Scratch expose conductive layer			Reject
Minor	HS Hole	$\Phi = \dfrac{L + W}{2}$	$\Phi > 0.5mm$	Reject
Major	Adhesion strength		Less than the specification	Reject
Minor	Position shift		Y > 1/3D	Reject
			X > 1/2Z	Reject
Major	Conductive line break			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$\leq$0.03	0.03<W$\leq$0.05	W>0.05
		L	L<5	L<3	Any
		ACC. NO.	1	1	Reject
		Note	L is the length and W is the width of the defect		
Minor	Black Spot and Polarizer Pricked * Foreign material between glass and polarizer or glass and glass * Polarizer hole or protuberance by external force	Φ	Φ$\leq$0.1	0.1<Φ$\leq$0.15 / 0.15<Φ$\leq$0.2	Φ>0.2
		ACC. NO.	3EA / 100mm^2	2 / 1	0
		Note	Φ is the average diameter of the defect. Distance between two defects > 10mm.		
Minor	White Spot and Bubble in polarizer * Unobvious transparant foreign material between glass and glass or glass and polarizer * Air protuberance between polarizer and glass	Φ	Φ$\leq$0.3	0.3<Φ$\leq$0.5	0.5<Φ
		ACC. NO.	3EA / 100mm^2	1	0
		Note	Φ is the average diameter of the defect. Distance between two defects > 10mm.		
Minor	Segment Defect	Φ	Φ$\leq$0.10	0.10<Φ$\leq$0.20 / 0.20<Φ$\leq$0.25	Φ>0.25
		ACC. NO.	3EA / 100mm^2	2 / 1	0
		Note	W is more than 1/2 segment width		Reject
			$\Phi = \dfrac{L + W}{2}$ Distance between two defect is 10mm		
Minor	Protuberant Segment $\Phi = (L + W) / 2$	Φ	Φ$\leq$0.10	0.10<Φ$\leq$0.20 / 0.20<Φ$\leq$0.25	Φ>0.25
		W	Glue	W$\leq$1/2 Seg W$\leq$0.2 / W$\leq$1/2 Seg W$\leq$0.2	Ignore
		ACC. NO.	3EA / 100mm^2	2 / 1	0
Minor	Assembly Mis-alignment	1. Segment			
		B	B$\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"			

8. RELIABILITY

No	Item	Condition	Quantity	Criteria
1	High Temperature Operating	60°C, 96Hrs	2	GB/T2423.2 -2008
2	Low Temperature Operating	-10°C, 96Hrs	2	GB/T2423.1 -2008
3	High Humidity	60°C, 90%RH, 96Hrs	2	GB/T2423.3 -2016
4	High Temperature Storage	70°C, 96Hrs	2	GB/T2423.2 -2008
5	Low Temperature Storage	-20°C, 96Hrs	2	GB/T2423.1 -2008
6	Thermal Cycling Test	-10°C, 60min~60°C, 60min, 20 cycles.	2	GB/T2423.22 -2012
7	Packing vibration	Frequency range:10Hz~50Hz Acceleration of gravity:5G X,Y,Z 30 min for each direction.	2	GB/T5170.14 -2009
8	Electrical Static Discharge	Air:±8kV 150pF/330Ω 5 times Contact:±4kV 150pF/330Ω 5 times	2	GB/T17626.2 -2018
9	Drop Test(Packaged)	Height:80 cm,1 corner, 3 edges, 6 surfaces.	2	GB/T2423.8 -1995

Note:1) Above conditions are suitable for 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 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 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.

  (8) Limited Warranty

        - Our warranty liability is limited to repair and/or replacement. We will not be responsible for any consequential loss.

        - If possible, we suggest customer to use up all modules in six months. If the module storage time over twelve months, we suggest that recheck it before the module be used

        - After the product shipped, any product quality issues must be feedback within three months, otherwise, we will not be responsible for the subsequent or consequential events.

10. OUTLINE DIMENSION

Pin connection table:
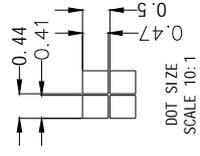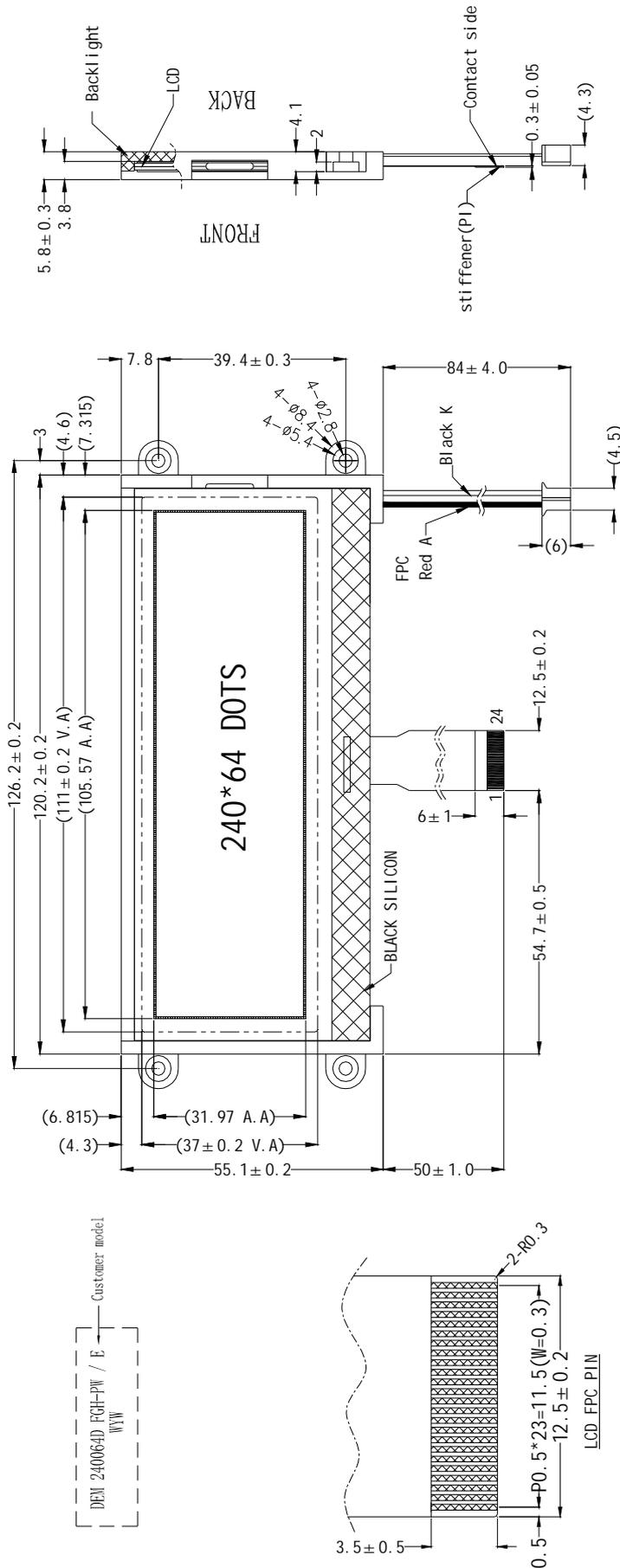
PIN	1	2	3	4	5	6	7	8	9	10	11	12
CONNECTION	NC	VB1−	VB1+	VB0−	VB0+	VLCD	VBAIS	VSS	VDD	DB7	DB6	DB5
PIN	13	14	15	16	17	18	19	20	21	22	23	24
CONNECTION	DB4	DB3	DB2	DB1	DB0	RD	WR	CD	RST	CS	BM0	BM1

NOTES:
1. Display type:FSTN
2. Viewing direction:6 O'CLOCK
3. Drive method:1/64DUTY 1/9BIAS
4. Polarizer mode:Transflective/Positive
5. LCD drive voltage:12V
6. Operation temperature:−10°C~+60°C
7. Storage temperature:−20°C~+70°C
8. Driver/Controller IC:UC1608
9. Logic power supply voltage:3.0V
10. Backlight : 6 LED/side White /If=90mA Vf=3.1±0.2V
    LED life time:20,000 Hrs(min.)~30,000 Hrs(typ.)
11. ROHS must be complied

Note: The dimension with"( )" is reference.