

Product Specification

(Preliminary)

Part Name: OEL Display Module
Part ID: LY069WG8-096016

Customer:
Approved by

CONFIDENTIAL

From: Li Yuan Electronics Co.,Ltd.
Approved by

Notes:

1. Please contact Li Yuan Electronics before assigning your product based on this module specification.
2. The information contained herein is presented merely to indicate the characteristics and performance of our products. No responsibility is assumed by Li Yuan Electronics for any intellectual property claims or other problems that may result from application based on the module described herein.

Revised History

Part Number	Revision	Revision Content	Revised on
LY069WG8-096016	A	New	January 6, 2011
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1. Basic Specifications

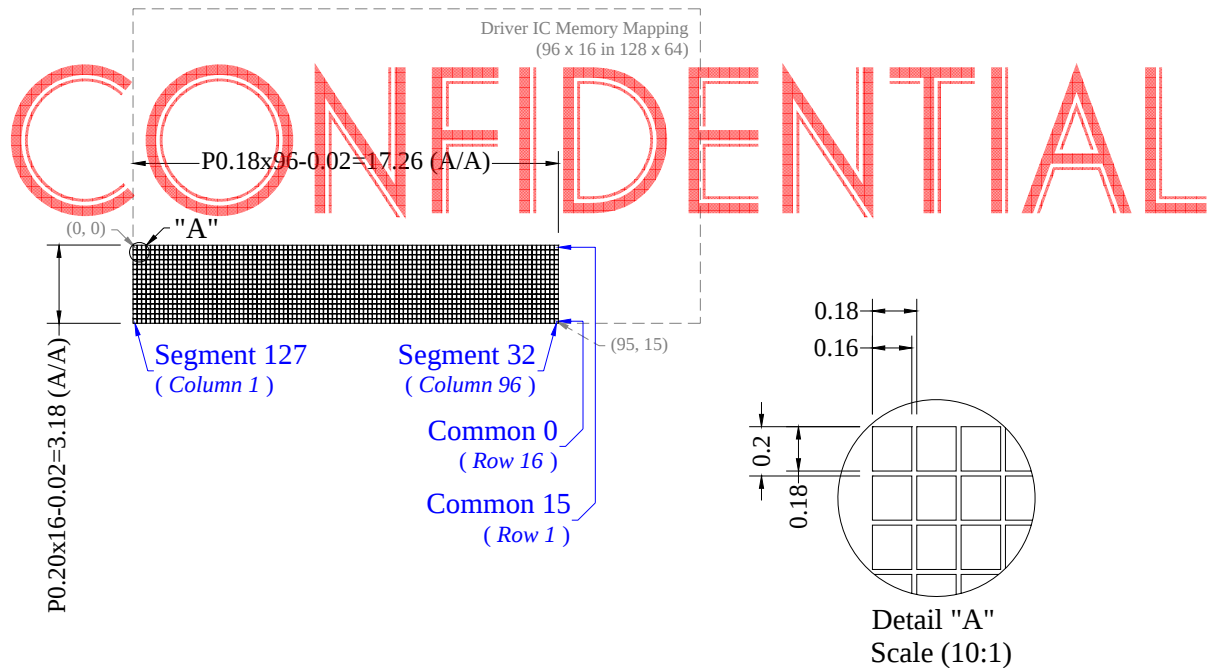
1.1 Display Specifications

- | | |
|-------------------|--------------------|
| 1) Display Mode: | Passive Matrix |
| 2) Display Color: | Monochrome (White) |
| 3) Drive Duty: | 1/16 Duty |

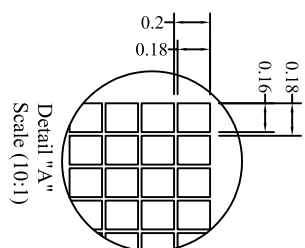
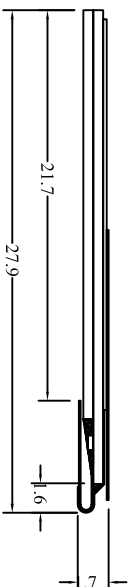
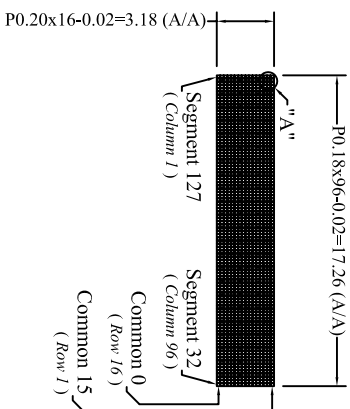
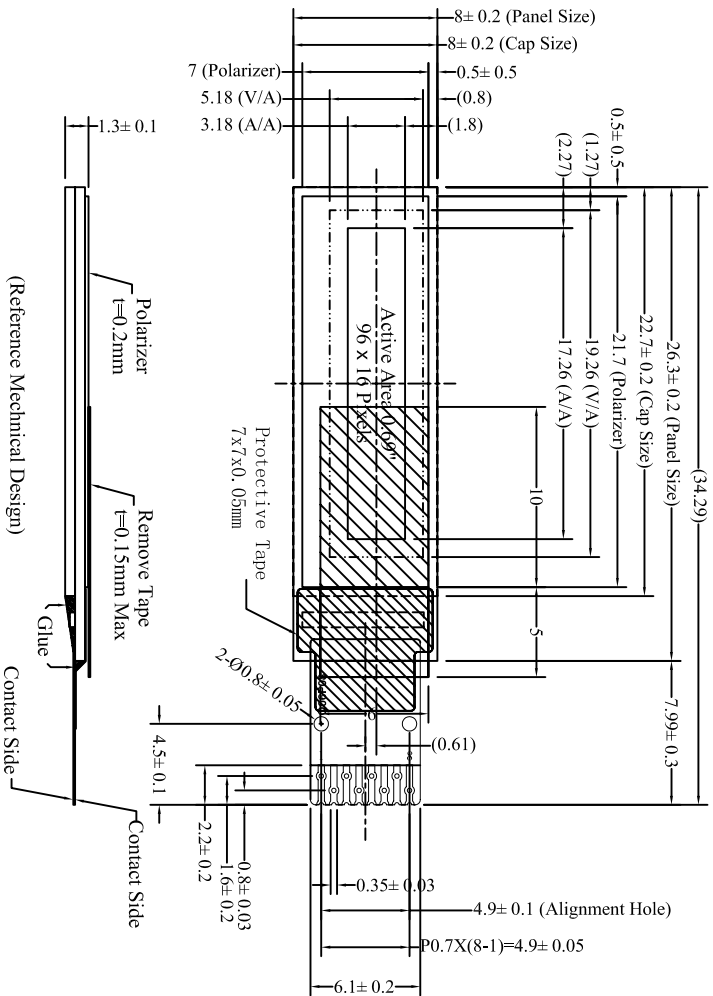
1.2 Mechanical Specifications

- | | |
|----------------------|--|
| 1) Outline Drawing: | According to the annexed outline drawing |
| 2) Number of Pixels: | 96 × 16 |
| 3) Panel Size: | 26.30 × 8.00 × 1.30 (mm) |
| 4) Active Area: | 17.26 × 3.18 (mm) |
| 5) Pixel Pitch: | 0.18 × 0.20 (mm) |
| 6) Pixel Size: | 0.16 × 0.18 (mm) |
| 7) Weight: | 0.57 (g) |

1.3 Active Area / Memory Mapping & Pixel Construction



Item	Date	Remark
A	20101228	Original Drawing



Pin	Symbol
1	VSS
2	RES#
3	SCL
4	SDA
5	IREF
6	VCOMH
7	VCC
8	VDD

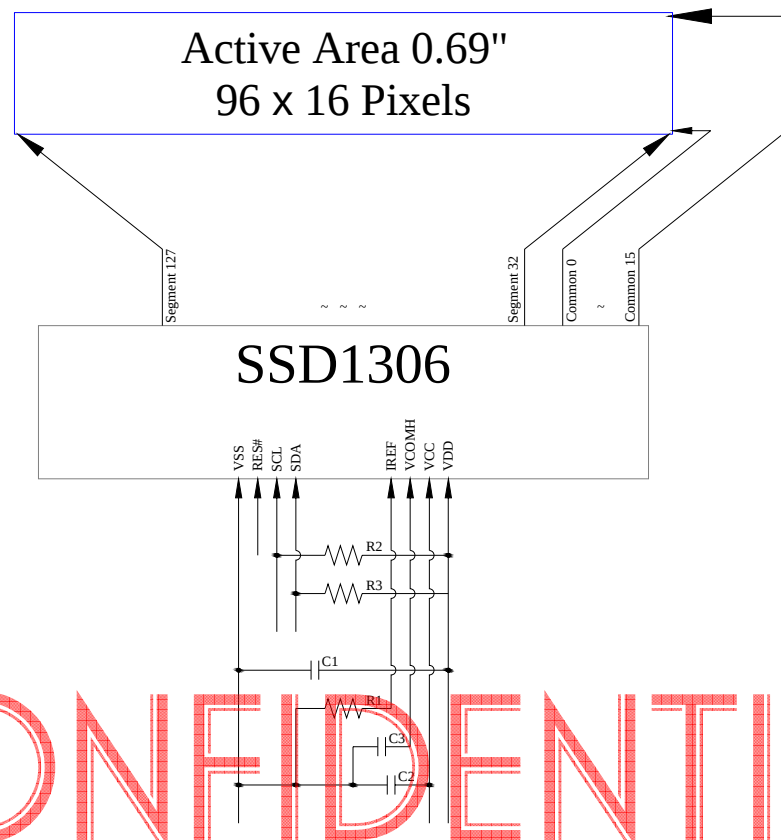
- Notes:
- Color: White
 - Driver IC: SSD1306
 - FPC Number: QUT0206F08
 - Interface: I² C
 - General Tolerance: ± 0.30
 - The total thickness (1.40 Max) is without polarizer protective film & remove tape. The actual assembled total thickness with above materials should be 1.65 Max.

Customer Approval			Signature		
Unless Otherwise Specified			Li Yuan Electronics Com., Ltd.		
Unit	mm	Title	LY069WG8-096016		
General Roughness	$\phi 0.3$	Pixel Number: 96 x 16, Monochrome, COG Package			
Tolerance	± 0.3	Drawn	Peter	E.E.	P.M.
Dimension	± 1	By			
Angle	± 1	Date	20101228		
Scale			1:1		
Sheet			1 of 1		
Size			A3		

1.5 Pin Definition

Pin Number	Symbol	I/O	Function
Power Supply			
8	VDD	P	Power Supply for Logic This is a voltage supply pin. It must be connected to external source.
1	VSS	P	Ground of OEL System This is a ground pin. It also acts as a reference for the logic pins, the OEL driving voltages, and the analog circuits. It must be connected to external ground.
7	VCC	P	Power Supply for OEL Panel This is the most positive voltage supply pin of the chip. It must be supplied externally.
Driver			
5	IREF	I	Current Reference for Brightness Adjustment This pin is segment current reference pin. A resistor should be connected between this pin and V _{SS} . Set the current at 12.5μA maximum.
6	VCOMH	O	Voltage Output High Level for COM Signal This pin is the input pin for the voltage output high level for COM signals. A capacitor should be connected between this pin and V _{SS} .
Interface			
2	RES#	I	Power Reset for Controller and Driver This pin is reset signal input. When the pin is low, initialization of the chip is executed.
3	SCL	I	I2C Bus Clock Signal The transmission of information in the I ² C bus is following a clock signal. Each transmission of data bit is taken place during a single clock period of this pin.
4	SDA	I/O	I2C Bus Data Signal This pin acts as a communication channel between the transmitter and the receiver.

1.6 Block Diagram



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Pins connected to MCU interface: RES#, SCL, and SDA

C1: 1 μ F
 C2, C3: 2.2 μ F / 16V X7R
 R1: 910k Ω , R1 = (Voltage at IREF - BGGND) / IREF
 R2, R3: 2k Ω

2. Absolute Maximum Ratings

Parameter	Symbol	Min	Max	Unit	Notes
Supply Voltage for Logic	V_{DD}	-0.3	4	V	1, 2
Supply Voltage for Display	V_{CC}	0	11	V	1, 2
Operating Temperature	T_{OP}	-40	70	°C	
Storage Temperature	T_{STG}	-40	80	°C	
Life Time (150 cd/m ²)		10,000	-	hour	3

Note 1: All the above voltages are on the basis of " $V_{SS} = 0V$ ".

Note 2: When this module is used beyond the above absolute maximum ratings, permanent breakage of the module may occur. Also, for normal operations, it is desirable to use this module under the conditions according to Section 3. "Optics & Electrical Characteristics". If this module is used beyond these conditions, malfunctioning of the module can occur and the reliability of the module may deteriorate.

Note 3: $V_{CC} = 10.0V$, $T_a = 25^{\circ}C$, 50% Checkerboard.

Software configuration follows Section 4.4 Initialization.

End of lifetime is specified as 50% of initial brightness reached. The average operating lifetime at room temperature is estimated by the accelerated operation at high temperature conditions.

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3. Optics & Electrical Characteristics

3.1 Optics Characteristics

Characteristics	Symbol	Conditions	Min	Typ	Max	Unit
Brightness	L_{br}	Note 4	120	150	-	cd/m ²
C.I.E. (White)	(x) (y)	C.I.E. 1931	0.25 0.27	0.29 0.31	0.33 0.35	
Dark Room Contrast	CR		-	>10,000:1	-	
Viewing Angle			-	Free	-	degree

* Optical measurement taken at $V_{DD} = 2.8V$, $V_{CC} = 10.0V$.
Software configuration follows Section 4.4 Initialization.

3.2 DC Characteristics

Characteristics	Symbol	Conditions	Min	Typ	Max	Unit
Supply Voltage for Logic	V_{DD}		1.65	2.8	3.3	V
Supply Voltage for Display	V_{CC}	Note 4	9.5	10.0	10.5	V
High Level Input	V_{IH}	$I_{OUT} = 100\mu A$, 3.3MHz	$0.8 \times V_{DD}$	-	V_{DD}	V
Low Level Input	V_{IL}	$I_{OUT} = 100\mu A$, 3.3MHz	0	-	$0.2 \times V_{DD}$	V
High Level Output	V_{OH}	$I_{OUT} = 100\mu A$, 3.3MHz	$0.9 \times V_{DD}$	-	V_{DD}	V
Low Level Output	V_{OL}	$I_{OUT} = 100\mu A$, 3.3MHz	0	-	$0.1 \times V_{DD}$	V
Operating Current for V_{DD}	I_{DD}		-	180	300	μA
Operating Current for V_{CC}	I_{CC}	Note 5	-	TBD	TBD	mA
		Note 6	-	TBD	TBD	mA
		Note 7	-	TBD	TBD	mA
Sleep Mode Current for V_{DD}	$I_{DD, SLEEP}$		-	1	5	μA
Sleep Mode Current for V_{CC}	$I_{CC, SLEEP}$		-	2	10	μA

Note 4: Brightness (L_{br}) and Supply Voltage for Display (V_{CC}) are subject to the change of the panel characteristics and the customer's request.

Note 5: $V_{DD} = 2.8V$, $V_{CC} = 10.0V$, 30% Display Area Turn on.

Note 6: $V_{DD} = 2.8V$, $V_{CC} = 10.0V$, 50% Display Area Turn on.

Note 7: $V_{DD} = 2.8V$, $V_{CC} = 10.0V$, 100% Display Area Turn on.

* Software configuration follows Section 4.4 Initialization.

3.3 AC Characteristics

Symbol	Description	Min	Max	Unit
t_{cycle}	Clock Cycle Time	2.5	-	μs
t_{HSTART}	Start Condition Hold Time	0.6	-	μs
t_{HD}	Data Hold Time (for "SDA _{OUT} " Pin)	0	-	ns
	Data Hold Time (for "SDA _{IN} " Pin)	300		
t_{SD}	Data Setup Time	100	-	ns
t_{SSTART}	Start Condition Setup Time (Only relevant for a repeated Start condition)	0.6	-	μs
t_{SSTOP}	Stop Condition Setup Time	0.6	-	μs
t_{R}	Rise Time for Data and Clock Pin		300	ns
t_{F}	Fall Time for Data and Clock Pin		300	ns
t_{IDLE}	Idle Time before a New Transmission can Start	1.3	-	μs

* ($V_{\text{DD}} - V_{\text{SS}} = 1.65\text{V to } 3.3\text{V}$, $T_{\text{a}} = 25^{\circ}\text{C}$)



4. Functional Specification

4.1 Commands

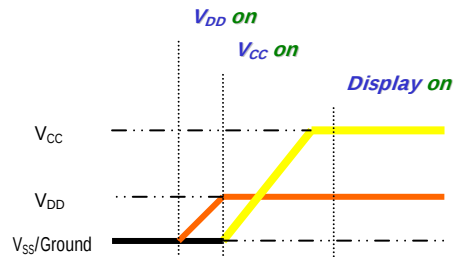
Refer to the Technical Manual for the SSD1306

4.2 Power down and Power up Sequence

To protect OEL panel and extend the panel life time, the driver IC power up/down routine should include a delay period between high voltage and low voltage power sources during turn on/off. It gives the OEL panel enough time to complete the action of charge and discharge before/after the operation.

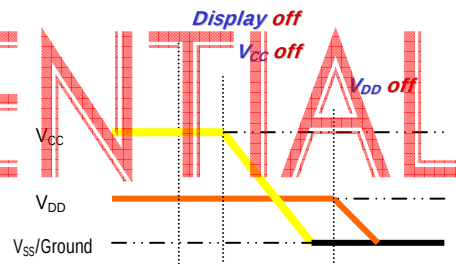
4.2.1 Power up Sequence:

1. Power up V_{DD}
2. Send Display off command
3. Initialization
4. Clear Screen
5. Power up V_{CC}
6. Delay 100ms
(When V_{CC} is stable)
7. Send Display on command



4.2.2 Power down Sequence:

1. Send Display off command
2. Power down V_{CC}
3. Delay 100ms
(When V_{CC} is reach 0 and panel is completely discharges)
4. Power down V_{DD}



Note 8:

- 1) Since an ESD protection circuit is connected between V_{DD} and V_{CC} inside the driver IC, V_{CC} becomes lower than V_{DD} whenever V_{DD} is ON and V_{CC} is OFF.
- 2) V_{CC} should be kept float (disable) when it is OFF.
- 3) Power Pins (V_{DD} , V_{CC}) can never be pulled to ground under any circumstance.
- 4) V_{DD} should not be power down before V_{CC} power down.

4.3 Reset Circuit

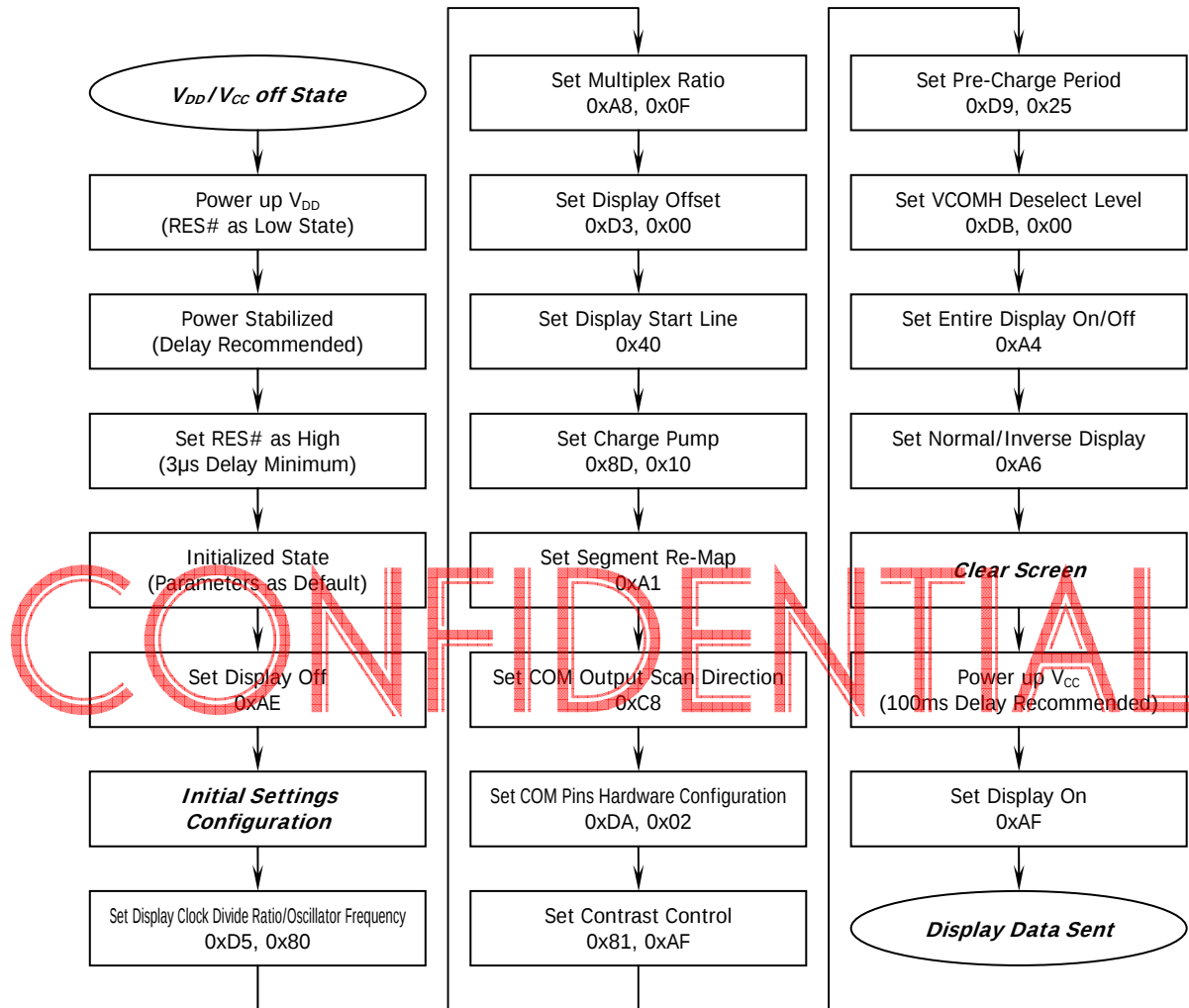
When RES# input is low, the chip is initialized with the following status:

1. Display is OFF
2. 128×64 Display Mode
3. Normal segment and display data column and row address mapping (SEG0 mapped to column address 00h and COM0 mapped to row address 00h)
4. Shift register data clear in serial interface
5. Display start line is set at display RAM address 0
6. Column address counter is set at 0
7. Normal scan direction of the COM outputs
8. Contrast control register is set at 7Fh
9. Normal display mode (Equivalent to A4h command)

4.4 Actual Application Example

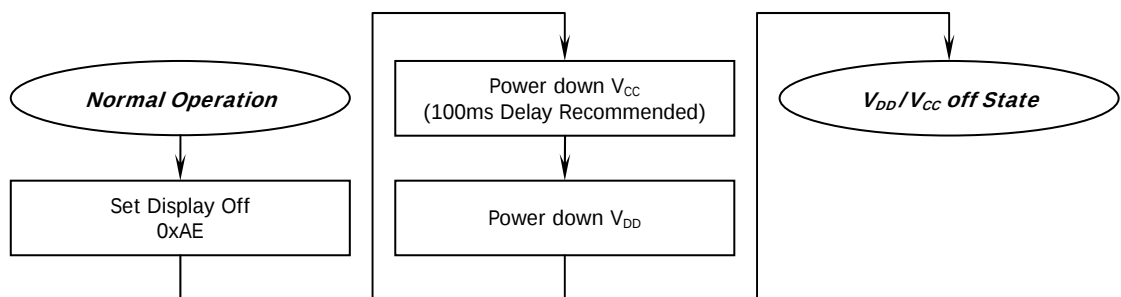
Command usage and explanation of an actual example

<Power up Sequence>

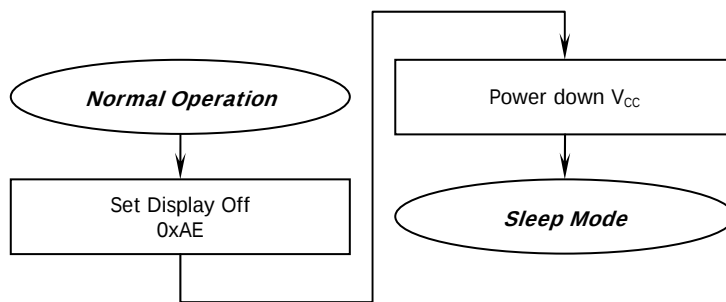


If the noise is accidentally occurred at the displaying window during the operation, please reset the display in order to recover the display function.

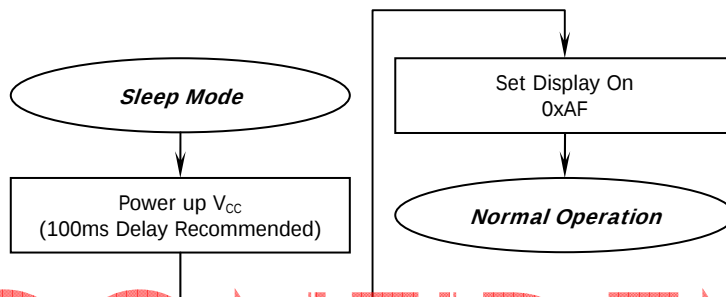
<Power down Sequence>



<Entering Sleep Mode>



<Exiting Sleep Mode>



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5. Reliability

5.1 Contents of Reliability Tests

Item	Conditions	Criteria
High Temperature Operation	70°C, 120 hrs	The operational functions work.
Low Temperature Operation	-40°C, 120 hrs	
High Temperature Storage	80°C, 120 hrs	
Low Temperature Storage	-40°C, 120 hrs	
High Temperature/Humidity Operation	60°C, 90% RH, 120 hrs	
Thermal Shock	-40°C $\leftrightarrow$ 80°C, 24 cycles 60 mins dwell	

* The samples used for the above tests do not include polarizer.

* No moisture condensation is observed during tests.

5.2 Failure Check Standard

After the completion of the described reliability test, the samples were left at room temperature for 2 hrs prior to conducting the failure test at 23 $\pm$ 5°C; 55 $\pm$ 15% RH.

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6. Outgoing Quality Control Specifications

6.1 Environment Required

Customer's test & measurement are required to be conducted under the following conditions:

Temperature:	$23 \pm 5^{\circ}\text{C}$
Humidity:	$55 \pm 15\% \text{ RH}$
Fluorescent Lamp:	30W
Distance between the Panel & Lamp:	$\geq 50\text{cm}$
Distance between the Panel & Eyes of the Inspector:	$\geq 30\text{cm}$
Finger glove (or finger cover) must be worn by the inspector.	
Inspection table or jig must be anti-electrostatic.	

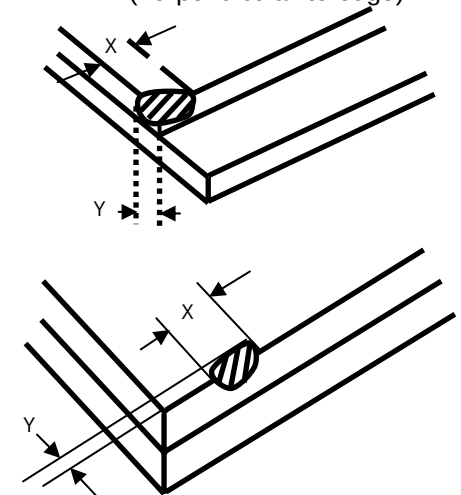
6.2 Sampling Plan

Level II, Normal Inspection, Single Sampling, MIL-STD-105E

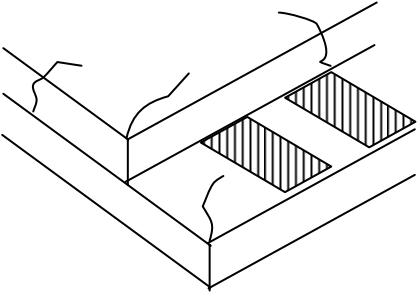
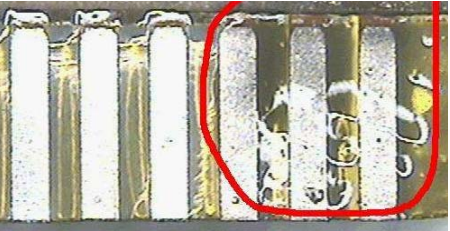
6.3 Criteria & Acceptable Quality Level

Partition	AQL	Definition
Major	0.65	Defects in Pattern Check (Display On)
Minor	1.0	Defects in Cosmetic Check (Display Off)

6.3.1 Cosmetic Check (Display Off) in Non-Active Area

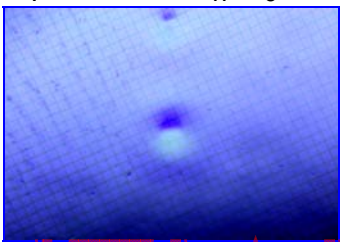
Check Item	Classification	Criteria
Panel General Chipping	Minor	$X > 6 \text{ mm}$ (Along with Edge) $Y > 1 \text{ mm}$ (Perpendicular to edge) 

6.3.1 Cosmetic Check (Display Off) in Non-Active Area (Continued)

Check Item	Classification	Criteria
Panel Crack	Minor	Any crack is not allowable. 
Copper Exposed (Even Pin or Film)	Minor	Not Allowable by Naked Eye Inspection
Film or Trace Damage	Minor	
Terminal Lead Prober Mark	Acceptable	
Glue or Contamination on Pin (Couldn't Be Removed by Alcohol)	Minor	
Ink Marking on Back Side of panel (Exclude on Film)	Acceptable	Ignore for Any

6.3.2 Cosmetic Check (Display Off) in Active Area

It is recommended to execute in clear room environment (class 10k) if actual in necessary.

Check Item	Classification	Criteria
Any Dirt & Scratch on Polarizer's Protective Film	Acceptable	Ignore for not Affect the Polarizer
Scratches, Fiber, Line-Shape Defect (On Polarizer)	Minor	$W \leq 0.1$ Ignore $W > 0.1, L \leq 2$ $n \leq 1$ $L > 2$ $n = 0$
Dirt, Black Spot, Foreign Material, (On Polarizer)	Minor	$\Phi \leq 0.1$ Ignore $0.1 < \Phi \leq 0.25$ $n \leq 1$ $0.25 < \Phi$ $n = 0$
Dent, Bubbles, White spot (Any Transparent Spot on Polarizer)	Minor	$\Phi \leq 0.5$ → Ignore if no Influence on Display $0.5 < \Phi$ $n = 0$ 
Fingerprint, Flow Mark (On Polarizer)	Minor	Not Allowable

* Protective film should not be tear off when cosmetic check.

** Definition of W & L & Φ (Unit: mm): $\Phi = (a + b) / 2$

