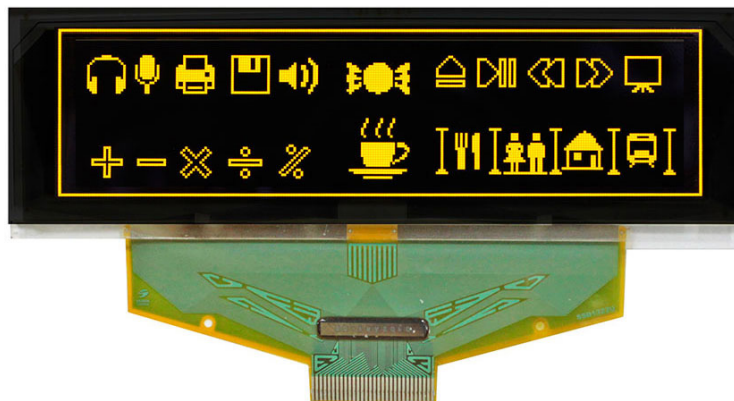


6.2021

OLED 3.12" - 256x64 dots

Incl. controller SSD1322



Outline 88.0 × 27.8 × 2.01mm

Features

- 3.12" Low-Power OLED
- -40..+80°C (T_{op.})
- 256x64 dots
- Yellow display
- Incl. controller SSD1322
- SPI, 8-Bit Interface
- Fast response time (10μs) even at -40°C
- FPC / ZIFF connection
- 88x28mm outline dimensions

Ordering code

OLED 3.12" - 256x64 dots, yellow

EA W256064-XALG

Accessories

ZIFF connector 30 pins, 0.5mm pitch, bottom contact
ZIFF connector 30 pins, 0.5mm pitch, top contact
USB Testboard

EA WF050-30S
EA WF050-30T
EA 9781-2USB

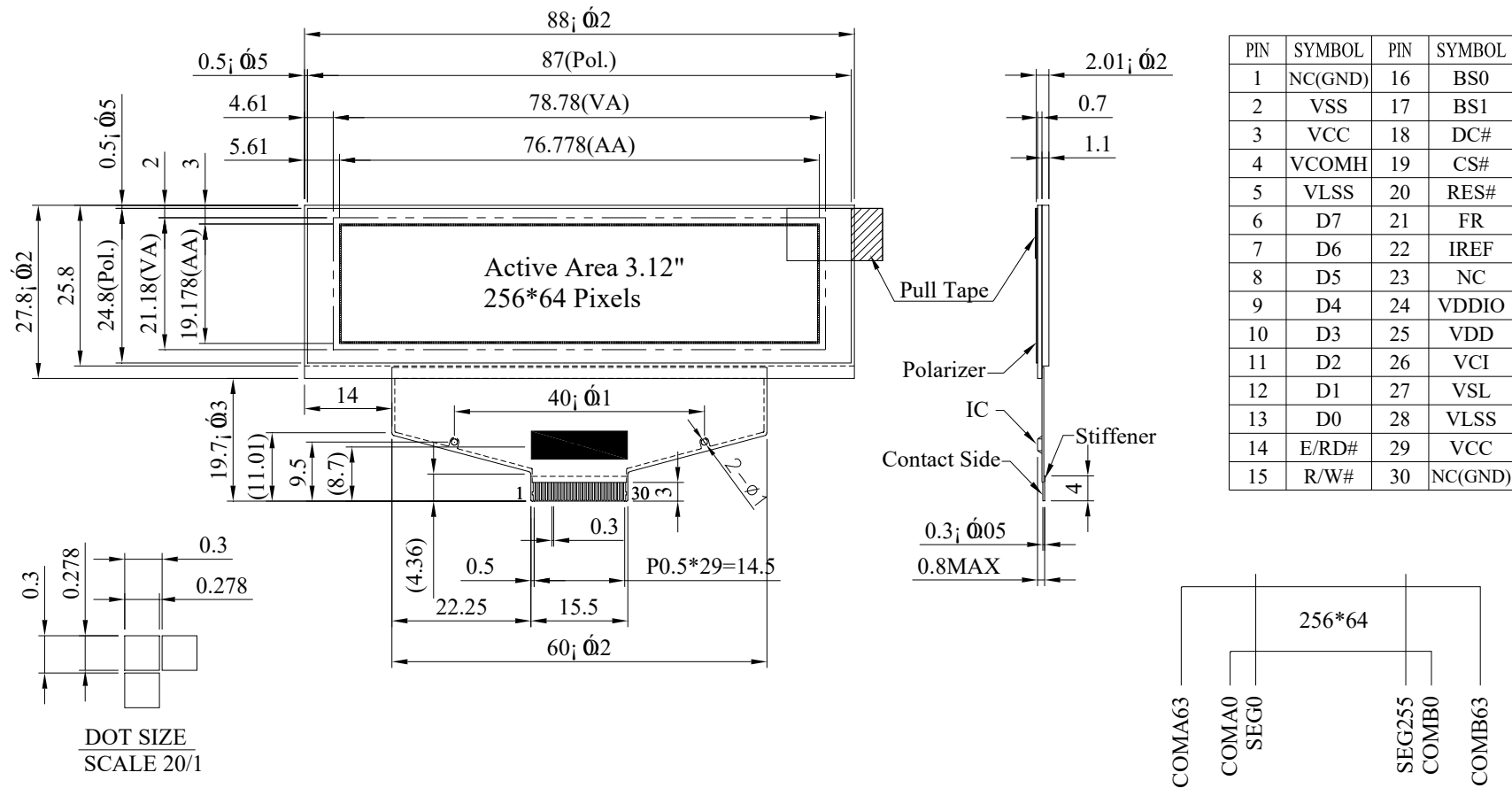
Content

1. General Specification
2. Contour Drawing & Block Diagram
3. Interface Pin Function
4. Absolute Maximum Ratings
5. Electrical Characteristics
6. Optical Characteristics
7. OLED Lifetime
8. Reliability
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10. Precautions in use of OLED Module
11. Initialization example
12. Application example

1. General Specification

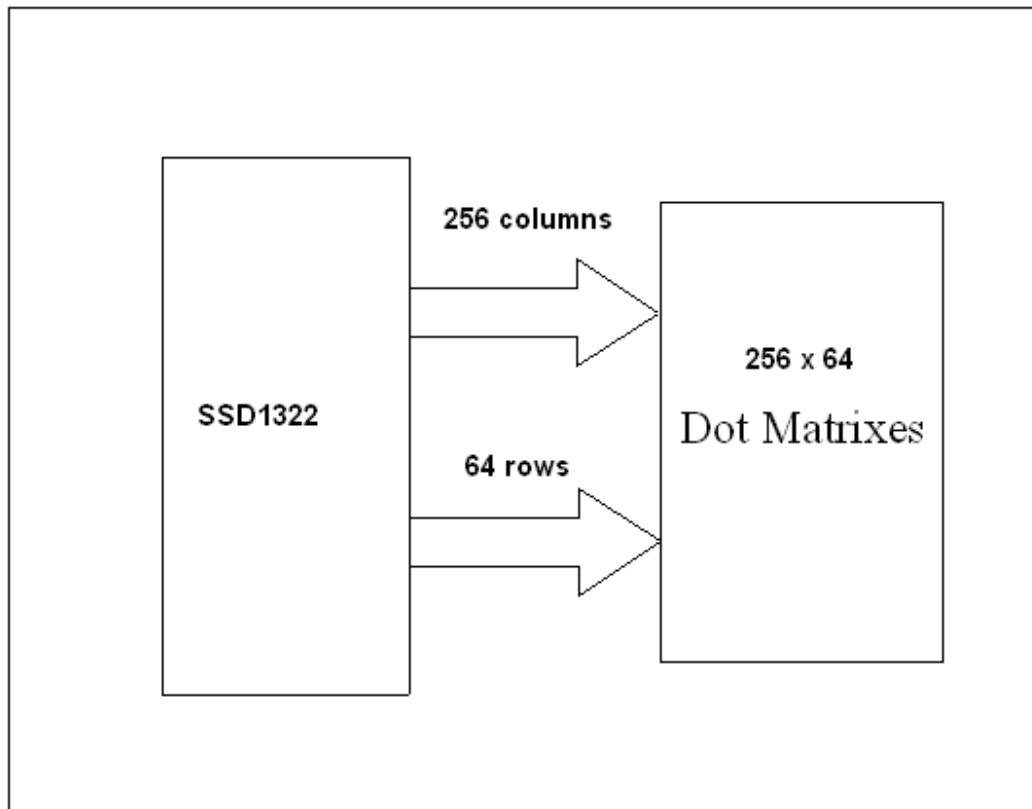
Item	Dimension	Unit
Dot Matrix	256 x 64 Dots	—
Module dimension	88.0 × 27.8 × 2.01	mm
Active Area	76.778×19.178	mm
Pixel Size	0.278×0.278	mm
Pixel Pitch	0.3×0.3	mm
Display Mode	Passive Matrix	
Display Color	Yellow	
Drive Duty	1/64 Duty	
Controller	SSD1322	
Interface	6800, 8080, SPI	
Size	3.12"	

2. Counter Drawing & Block Diagram



The non-specified tolerance of dimension is $\pm 0.3\text{mm}$.

FUNCTION BLOCK DIAGRAM



3. Interface Pin Function

Pin Number	Symbol	I/O	Function										
1	N.C. (GND)	P	Ground										
2	VSS	P	Ground.										
3	VCC	P	Power supply for panel driving voltage. This is also the most positive power voltage supply pin.										
4	VCOMH	P	COM signal deselected voltage level. A capacitor should be connected between this pin and VSS.										
5	VLSS	P	Analog system ground pin.										
6~13	D7~D0	I/O	Host Data Input/Output Bus These pins are 8-bit bi-directional data bus to be connected to the microprocessor's data bus. When serial mode is selected, D1 will be the serial data input SDIN and D0 will be the serial clock input SCLK.										
14	E/RD#	I	Read/Write Enable or Read This pin is MCU interface input. When interfacing to a 68XX-series microprocessor, this pin will be used as the Enable (E) signal. Read/write operation is initiated when this pin is pulled high and the CS# is pulled low. When connecting to an 80XX-microprocessor, this pin receives the Read (RD#) signal. Data read operation is initiated when this pin is pulled low and CS# is pulled low. When serial mode is selected, this pin must be connected to VSS.										
15	R/W#	I	Read/Write Select or Write This pin is MCU interface input. When interfacing to a 68XX-series, this pin will be used as Read/Write (R/W#) selection input. Pull this pin to "High" for read mode and pull it to "Low" for write mode. When 80XX interface mode is selected, this pin will be the Write (WR#) input. Data write operation is initiated when this pin is pulled low and the CS# is pulled low. When serial mode is selected, this pin must be connected to VSS.										
16	BS0	I	Communicating Protocol Select. Set MCU interface selection. <table border="1" data-bbox="545 1720 1171 1906"> <thead> <tr> <th>BS[1:0]</th> <th>Bus Interface Selection</th> </tr> </thead> <tbody> <tr> <td>00</td> <td>4 line SPI</td> </tr> <tr> <td>01</td> <td>3 line SPI</td> </tr> <tr> <td>10</td> <td>8-bit 8080 parallel</td> </tr> <tr> <td>11</td> <td>8-bit 6800 parallel</td> </tr> </tbody> </table>	BS[1:0]	Bus Interface Selection	00	4 line SPI	01	3 line SPI	10	8-bit 8080 parallel	11	8-bit 6800 parallel
BS[1:0]	Bus Interface Selection												
00	4 line SPI												
01	3 line SPI												
10	8-bit 8080 parallel												
11	8-bit 6800 parallel												
17	BS1	Note (1) 0 is connected to VSS (2) 1 is connected to VDDIO											

18	D/C#	I	<p>Data/Command Control This pin is Data/Command control pin connecting to the MCU. When the pin is pulled HIGH, the content at D[7:0] will be interpreted as data. When the pin is pulled LOW, the content at D[7:0] will be interpreted as command.</p>
19	CS#	I	<p>Data/Command Control This pin is the chip select input connecting to the MCU. The chip is enabled for MCU communication only when CS# is pulled LOW.</p>
20	RES#	I	<p>This pin is reset signal input. When the pin is pulled LOW, initialization of the chip is executed. Keep this pin pull HIGH during normal operation.</p>
21	FR	O	<p>This pin is No Connection pins. Nothing should be connected to this pin. This pin should be left open individually.</p>
22	IREF	I	<p>Current Reference for Brightness Adjustment This pin is segment current reference pin. A resistor should be connected between this pin and VSS. Set the current lower than 10uA.</p>
23	N.C.	-	<p>Reserved Pin The N.C. pin between function pins are reserved for compatible and flexible design.</p>
24	VDDIO	P	<p>Power Supply for I/O Pin It should be matched with the MCU interface voltage level.</p>
25	VDD	P	<p>Power Supply for Core Logic Circuit Power supply pin for core logic operation. A capacitor is required to connect between this pin and VSS</p>
26	VCI	P	<p>Power Supply for Operation VCI must always be equal to or higher than VDD and VDDIO.</p>
27	VSL	P	<p>Voltage Output Low Level for SEG Signal This is segment voltage reference pin. When external VSL is not used, this pin should be left open. When external VSL is used, this pin should connect with resistor and diode to ground.</p>
28	VLSS	P	<p>Ground of Analog Circuit These are the analog ground pins. They should be connected to VSS externally.</p>
29	VCC	P	<p>Power Supply for OLED Panel These are the most positive voltage supply pin of the chip. They must be connected to external source.</p>
30	N.C. (GND)	P	<p>Ground</p>

4. Absolute Maximum Ratings

Parameter	Symbol	Min	Max	Unit	Notes
Supply Voltage for Logic	VDD	-0.5	2.75	V	1, 2
Low voltage power supply	VCI	-0.3	4.0	V	1, 2
Power supply for I/O pins	VDDIO	-0.5	VCI	V	1, 2
Supply Voltage for Display	VCC	-0.5	20.0	V	1, 2
Operating Temperature	TOP	-40	+80	°C	-
Storage Temperature	TSTG	-40	+85	°C	-

Note 1: All the above voltages are on the basis of “VSS = 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 6 ‘Electrical Characteristics’. If this module is used beyond these conditions, malfunctioning of the module can occur and the reliability of the module may deteriorate

5. Electrical Characteristics

Item	Symbol	Condition	Min	Typ	Max	Unit
Supply Voltage for Logic	VDD	—	2.4	2.5	2.6	V
Power Supply for I/O pins	VDDIO	—	1.65	3.0	VCI	V
Low voltage power supply	VCI	—	2.4	3.0	3.5	V
Supply Voltage for Display	VCC	—	10	14.5	15	V
High Level Input	VIH	—	0.8×VDDIO	—	VDDIO	V
Low Level Input	VIL	—	0	—	0.2×VDDIO	V
High Level Output	VOH	—	0.9×VDDIO	—	VDDIO	V
Low Level Output	VOL	—	0	—	0.1×VDDIO	V
50% Check Board operating Current	ICC	VCC =12V	—	24	32	mA
		VCC =14.5V	—	32	42.5	mA

Note 1: Supply Voltage for Logic = VDD core power supply can be regulated from VCI.

Note 2: VCI must be larger than or equal to VDD

Notes 3: The VCC value can be adjusted according to the demand brightness. When VCC is lowered, the brightness decreases or when VCC is increased, the brightness increases. The VCC value is set within the recommended range. The life time of OLED is directly related to the set brightness, and lower brightness helps to improve the life time.

6. Optical Characteristics

Item	Symbol	Condition	Min	Typ	Max	Unit
View Angle	(V) θ	—	160	—	—	deg
	(H) ϕ	—	160	—	—	deg
Contrast Ratio	CR	Dark	10,000:1	—	—	—
Response Time	T rise	—	—	10	—	μ s
	T fall	—	—	10	—	μ s
Display with 50% check Board Brightness		VCC=12V	100	120	—	cd/m ²
		VCC=14.5V	120	140	—	
CIE _x (Yellow)		(CIE1931)	0.45	0.47	0.49	—
CIE _y (Yellow)		(CIE1931)	0.48	0.50	0.52	—

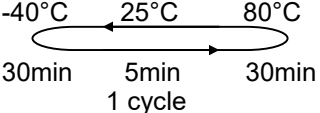
7. OLED Lifetime

ITEM	Conditions	Min	Typ	Remark
Operating Lifetime	T _a =25°C / Initial 50% check board brightness 100cd/m ²	50,000 Hrs	—	Note

Notes:

1. Life time is defined the amount of time when the luminance has decayed to <50% of the initial value.
2. This analysis method uses life data obtained under accelerated conditions to extrapolate an estimated probability density function (*pdf*) for the product under normal use conditions.
3. Screen saving mode will extend OLED lifetime.

8. Reliability

Environmental Test			
Test Item	Content of Test	Test Condition	Applicable Standard
High Temperature storage	Endurance test applying the high storage temperature for a long time.	85°C 240hrs	—
Low Temperature storage	Endurance test applying the low storage temperature for a long time.	-40°C 240hrs	—
High Temperature Operation	Endurance test applying the electric stress (Voltage & Current) and the thermal stress to the element for a long time.	80°C 240hrs	—
Low Temperature Operation	Endurance test applying the electric stress under low temperature for a long time.	-40°C 240hrs	—
High Temperature/ Humidity Storage	Endurance test applying the high temperature and high humidity storage for a long time.	60°C,90%RH 240hrs	—
High Temperature/ Humidity Operation	Endurance test applying the high temperature and high humidity Operation for a long time.	60°C,90%RH 120hrs	—
Temperature Cycle	Endurance test applying the low and high temperature cycle. 	-40°C /80°C 30 cycles	—
Mechanical Test			
Vibration test	Endurance test applying the vibration during transportation and using.	Frequency:10~55Hz amplitude:1.5mm Time:0.5hrs/axis Test axis:X,Y,Z	—
Others			
Static electricity test	Endurance test applying the electric stress to the finished product housing.	Air Discharge model ±4kv,10 times	—

*** Supply voltage for OLED system =Operating voltage at 25°C

Test and measurement conditions

1. All measurements shall not be started until the specimens attain to temperature stability. 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 $23\pm 5^{\circ}\text{C}$; $55\pm 15\%$ RH.
2. All-pixels-on is used as operation test pattern.
3. The degradation of Polarizer are ignored for High Temperature storage, High Temperature/ Humidity Storage, Temperature Cycle

Evaluation criteria

1. The function test is OK.
2. No observable defects.
3. Luminance: $> 50\%$ of initial value.
4. Current consumption: within $\pm 50\%$ of initial value.

APPENDIX:

RESIDUE IMAGE

Because the pixels are lighted in different time, the luminance of active pixels may reduce or differ from inactive pixels. Therefore, the residue image will occur. To avoid the residue image, every pixel needs to be lighted up uniformly.

9. Inspection specification

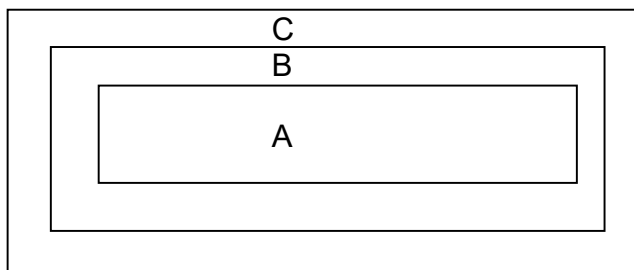
Inspection Standard:

MIL-STD-105E table normal inspection single sample level II.

Definition

- 1 Major defect : The defect that greatly affect the usability of product.
- 2 Minor defect : The other defects, such as cosmetic defects, etc.

Definition of inspection zone:



Zone A: Active Area

Zone B: Viewing Area except Zone A

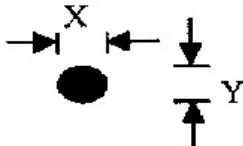
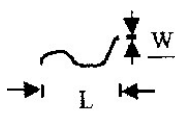
Zone C: Outside Viewing Area

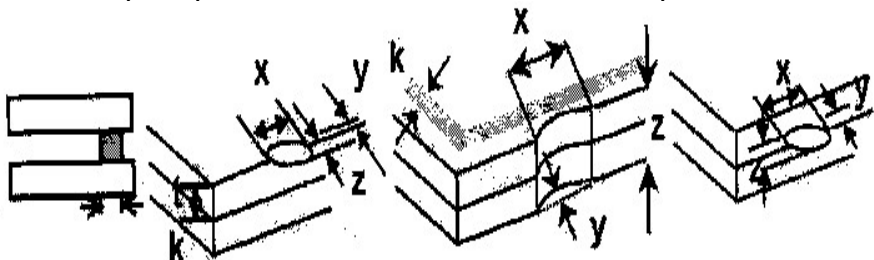
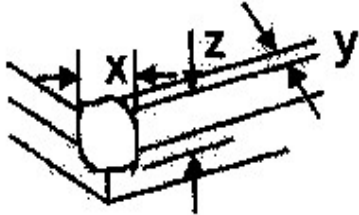
Note: As a general rule, visual defects in Zone C are permissible, when it is no trouble of quality and assembly to customer`s product.

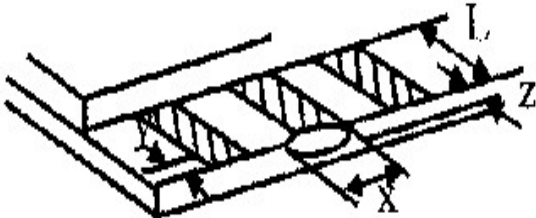
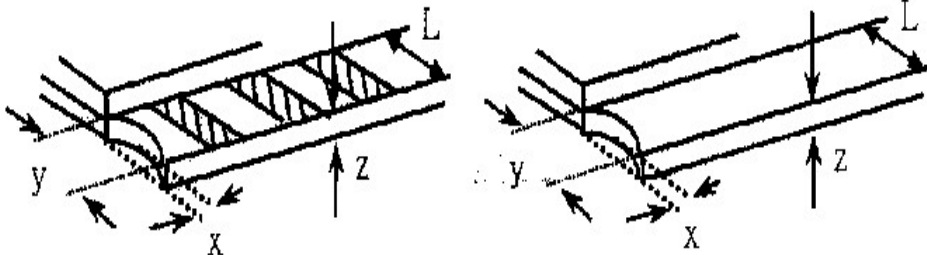
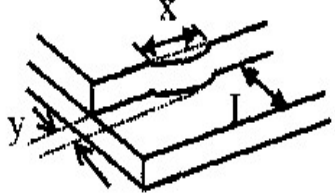
Inspection Methods

- 1 The general inspection : Under fluorescent light illumination: 750~1500 Lux, about 30cm viewing distance, within 45° viewing angle, under 25±5°C.
- 2 The luminance and color coordinate inspection : By SR-3 or BM-7 or the equal equipments, in the dark room, under 25±5°C.

NO	Item	Criterion	AQL
01	Electrical Testing	1.1 Missing vertical, horizontal segment, segment defect. 1.2 Missing character , dot or icon. 1.3 Display malfunction. 1.4 No function or no display. 1.5 Current consumption exceeds product specifications. 1.6 OLED viewing angle defect. 1.7 Mixed product types. 1.8 Contrast defect.	0.65
02	Black or white spots on OLED	2.1 White and black spots on display $\leq 0.25\text{mm}$, no more than three white or black spots present. 2.2 Densely spaced: No more than two spots or lines within 3mm.	2.5

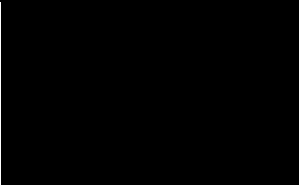
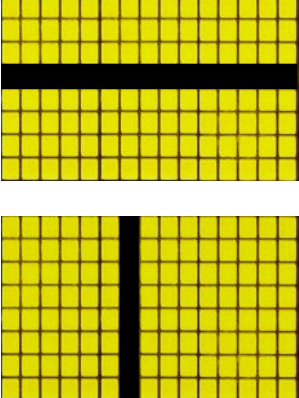
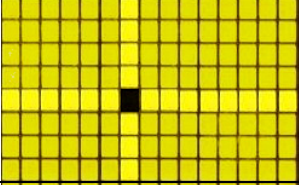
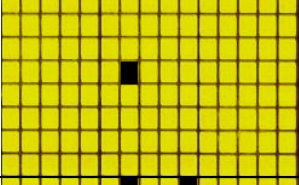
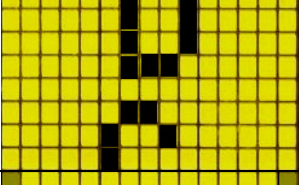
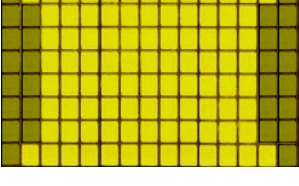
03	OLED black spots, white spots, contamination (non-display)	<p>3.1 Round type : As following drawing $\Phi = (x + y) / 2$</p> 	SIZE	Acceptable Q TY	2.5	
			$\Phi \leq 0.10$	Accept no dense		
			$0.10 < \Phi \leq 0.20$	2		
			$0.20 < \Phi \leq 0.25$	1		
			$0.25 < \Phi$	0		
		<p>3.2 Line type : (As following drawing)</p> 	Length	Width	Acceptable Q TY	2.5
			---	$W \leq 0.02$	Accept no dense	
			$L \leq 3.0$	$0.02 < W \leq 0.03$	2	
			$L \leq 2.5$	$0.03 < W \leq 0.05$		
			---	$0.05 < W$	As round type	
04	Polarizer bubbles	<p>If bubbles are visible, judge using black spot specifications, not easy to find, must check in specify direction.</p>	Size Φ	Acceptable Q TY	2.5	
			$\Phi \leq 0.20$	Accept no dense		
			$0.20 < \Phi \leq 0.50$	3		
			$0.50 < \Phi \leq 1.00$	2		
			$1.00 < \Phi$	0		
			Total Q TY	3		

NO	Item	Criterion	AQL																		
05	Scratches	Follow NO.3 OLED black spots, white spots, contamination																			
06	Chipped glass	<p>Symbols Define: x: Chip length y: Chip width z: Chip thickness k: Seal width t: Glass thickness a: OLED side length L: Electrode pad length:</p> <p>6.1 General glass chip : 6.1.1 Chip on panel surface and crack between panels:</p>  <table border="1"> <tr> <td>z: Chip thickness</td> <td>y: Chip width</td> <td>x: Chip length</td> </tr> <tr> <td>$Z \leq 1/2t$</td> <td>Not over viewing area</td> <td>$x \leq 1/8a$</td> </tr> <tr> <td>$1/2t < z \leq 2t$</td> <td>Not exceed 1/3k</td> <td>$x \leq 1/8a$</td> </tr> </table> <p>⊙ If there are 2 or more chips, x is total length of each chip.</p> <p>6.1.2 Corner crack:</p>  <table border="1"> <tr> <td>z: Chip thickness</td> <td>y: Chip width</td> <td>x: Chip length</td> </tr> <tr> <td>$Z \leq 1/2t$</td> <td>Not over viewing area</td> <td>$x \leq 1/8a$</td> </tr> <tr> <td>$1/2t < z \leq 2t$</td> <td>Not exceed 1/3k</td> <td>$x \leq 1/8a$</td> </tr> </table> <p>⊙ If there are 2 or more chips, x is the total length of each chip.</p>	z: Chip thickness	y: Chip width	x: Chip length	$Z \leq 1/2t$	Not over viewing area	$x \leq 1/8a$	$1/2t < z \leq 2t$	Not exceed 1/3k	$x \leq 1/8a$	z: Chip thickness	y: Chip width	x: Chip length	$Z \leq 1/2t$	Not over viewing area	$x \leq 1/8a$	$1/2t < z \leq 2t$	Not exceed 1/3k	$x \leq 1/8a$	2.5
z: Chip thickness	y: Chip width	x: Chip length																			
$Z \leq 1/2t$	Not over viewing area	$x \leq 1/8a$																			
$1/2t < z \leq 2t$	Not exceed 1/3k	$x \leq 1/8a$																			
z: Chip thickness	y: Chip width	x: Chip length																			
$Z \leq 1/2t$	Not over viewing area	$x \leq 1/8a$																			
$1/2t < z \leq 2t$	Not exceed 1/3k	$x \leq 1/8a$																			

NO	Item	Criterion	AQL																
06	Glass crack	<p>Symbols :</p> <p>x: Chip length y: Chip width z: Chip thickness k: Seal width t: Glass thickness a: OLED side length L: Electrode pad length</p> <p>6.2 Protrusion over terminal :</p> <p>6.2.1 Chip on electrode pad :</p>  <table border="1" data-bbox="331 1003 1216 1086"> <tr> <td>y: Chip width</td> <td>x: Chip length</td> <td>z: Chip thickness</td> </tr> <tr> <td>$y \leq 0.5\text{mm}$</td> <td>$x \leq 1/8a$</td> <td>$0 < z \leq t$</td> </tr> </table> <p>6.2.2 Non-conductive portion:</p>  <table border="1" data-bbox="395 1400 1216 1518"> <tr> <td>y: Chip width</td> <td>x: Chip length</td> <td>z: Chip thickness</td> </tr> <tr> <td>$y \leq L$</td> <td>$x \leq 1/8a$</td> <td>$0 < z \leq t$</td> </tr> </table> <p>⊙ If the chipped area touches the ITO terminal, over 2/3 of the ITO must remain and be inspected according to electrode terminal specifications.</p> <p>⊙ If the product will be heat sealed by the customer, the alignment mark not be damaged.</p> <p>6.2.3 Substrate protuberance and internal crack.</p>  <table border="1" data-bbox="726 1758 1220 1832"> <tr> <td>y: width</td> <td>x: length</td> </tr> <tr> <td>$y \leq 1/3L$</td> <td>$x \leq a$</td> </tr> </table>	y: Chip width	x: Chip length	z: Chip thickness	$y \leq 0.5\text{mm}$	$x \leq 1/8a$	$0 < z \leq t$	y: Chip width	x: Chip length	z: Chip thickness	$y \leq L$	$x \leq 1/8a$	$0 < z \leq t$	y: width	x: length	$y \leq 1/3L$	$x \leq a$	2.5
y: Chip width	x: Chip length	z: Chip thickness																	
$y \leq 0.5\text{mm}$	$x \leq 1/8a$	$0 < z \leq t$																	
y: Chip width	x: Chip length	z: Chip thickness																	
$y \leq L$	$x \leq 1/8a$	$0 < z \leq t$																	
y: width	x: length																		
$y \leq 1/3L$	$x \leq a$																		

NO	Item	Criterion	AQL
07	Cracked glass	The OLED with extensive crack is not acceptable.	2.5
08	Backlight elements	8.1 Illumination source flickers when lit. 8.2 Spots or scratched that appear when lit must be judged. Using OLED spot, lines and contamination standards. 8.3 Backlight doesn't light or color wrong.	0.65 2.5 0.65
09	Bezel	9.1 Bezel may not have rust, be deformed or have fingerprints, stains or other contamination. 9.2 Bezel must comply with job specifications.	2.5 0.65
10	PCB、COB	10.1 COB seal may not have pinholes larger than 0.2mm or contamination. 10.2 COB seal surface may not have pinholes through to the IC. 10.3 The height of the COB should not exceed the height indicated in the assembly diagram. 10.4 There may not be more than 2mm of sealant outside the seal area on the PCB. And there should be no more than three places. 10.5 No oxidation or contamination PCB terminals. 10.6 Parts on PCB must be the same as on the production characteristic chart. There should be no wrong parts, missing parts or excess parts. 10.7 The jumper on the PCB should conform to the product characteristic chart. 10.8 If solder gets on bezel tab pads, OLED pad, zebra pad or screw hold pad, make sure it is smoothed down.	2.5 2.5 0.65 2.5 2.5 0.65 0.65 2.5
11	Soldering	11.1 No un-melted solder paste may be present on the PCB. 11.2 No cold solder joints, missing solder connections, oxidation or icicle. 11.3 No residue or solder balls on PCB. 11.4 No short circuits in components on PCB.	2.5 2.5 2.5 0.65

NO	Item	Criterion	AQL
12	General appearance	12.1 No oxidation, contamination, curves or, bends on interface Pin (OLB) of TCP.	2.5
		12.2 No cracks on interface pin (OLB) of TCP.	0.65
		12.3 No contamination, solder residue or solder balls on product.	2.5
		12.4 The IC on the TCP may not be damaged, circuits.	2.5
		12.5 The uppermost edge of the protective strip on the interface pin must be present or look as if it cause the interface pin to sever.	2.5
		12.6 The residual rosin or tin oil of soldering (component or chip component) is not burned into brown or black color.	2.5
		12.7 Sealant on top of the ITO circuit has not hardened.	0.65
		12.8 Pin type must match type in specification sheet.	0.65
		12.9 OLED pin loose or missing pins.	0.65
		12.10 Product packaging must the same as specified on packaging specification sheet.	0.65
		12.11 Product dimension and structure must conform to product specification sheet.	0.65

Check Item	Classification	Criteria
No Display	Major	
Missing Line	Major	
Pixel Short	Major	
Darker Short	Major	
Wrong Display	Major	
Un-uniform B/A x 100% < 70% A/C x 100% < 70%	Major	

		 <p> A Normal B Dark Pixel C Light Pixel </p>
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10. Precautions in use of OLED Modules

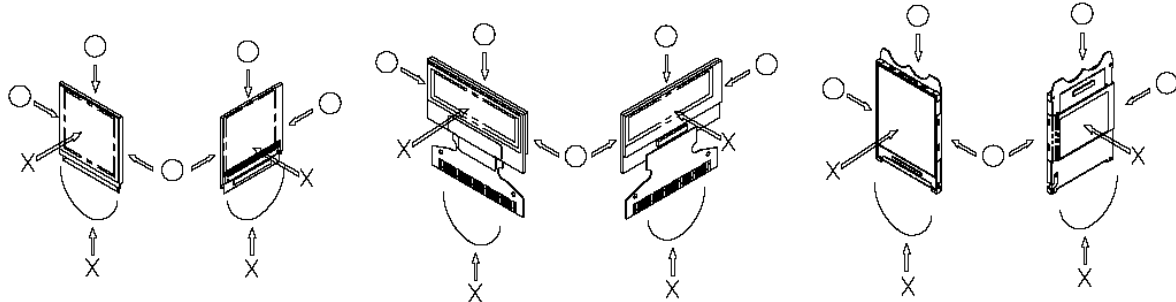
Modules

- (1) Avoid applying excessive shocks to module or making any alterations or modifications to it.
- (2) Don't make extra holes on the printed circuit board, modify its shape or change the components of OLED display module.
- (3) Don't disassemble the OLED display module.
- (4) Don't operate it above the absolute maximum rating.
- (5) Don't drop, bend or twist OLED display module.
- (6) Soldering: only to the I/O terminals.
- (7) Storage: please storage in anti-static electricity container and clean environment.
- (8) It's pretty common to use "Screen Saver" to extend the lifetime and Don't use fix information for long time in real application.
- (9) Don't use fixed information in OLED panel for long time, that will extend "screen burn" effect time..
- (10) ELECTRONIC ASSEMBLY has the right to change the passive components, including R2 and R3 adjust resistors. (Resistors, capacitors and other passive components will have different appearance and color caused by the different supplier.)
- (11) ELECTRONIC ASSEMBLY have the right to change the PCB Rev. (In order to satisfy the supplying stability, management optimization and the best product performance...etc, under the premise of not affecting the electrical characteristics and external dimensions, ELECTRONIC ASSEMBLY have the right to modify the version.)

10.1. Handling Precautions

- (1) Since the display panel is being made of glass, do not apply mechanical impacts such as dropping from a high position.
- (2) If the display panel is broken by some accident and the internal organic substance leaks out, be careful not to inhale nor lick the organic substance.
- (3) If pressure is applied to the display surface or its neighborhood of the OLED display module, the cell structure may be damaged and be careful not to apply pressure to these sections.
- (4) The polarizer covering the surface of the OLED display module is soft and easily scratched. Please be careful when handling the OLED display module.
- (5) When the surface of the polarizer of the OLED display module has soil, clean the surface. It takes advantage of by using following adhesion tape.
 - * Scotch Mending Tape No. 810 or an equivalentNever try to breathe upon the soiled surface nor wipe the surface using cloth containing solvent such as ethyl alcohol, since the surface of the polarizer will become cloudy. Also, pay attention that the following liquid and solvent may spoil the polarizer:
 - * Water
 - * Ketone
 - * Aromatic Solvents
- (6) Hold OLED display module very carefully when placing OLED display module into the

System housing. Do not apply excessive stress or pressure to OLED display module. And, do not over bend the film with electrode pattern layouts. These stresses will influence the display performance. Also, secure sufficient rigidity for the outer cases.



(7) Do not apply stress to the LSI chips and the surrounding molded sections.

(8) Do not disassemble nor modify the OLED display module.

(9) Do not apply input signals while the logic power is off.

(10) Pay sufficient attention to the working environments when handing OLED display modules to prevent occurrence of element breakage accidents by static electricity.

* Be sure to make human body grounding when handling OLED display modules.

* Be sure to ground tools to use or assembly such as soldering irons.

* To suppress generation of static electricity, avoid carrying out assembly work under dry environments.

* Protective film is being applied to the surface of the display panel of the OLED display module. Be careful since static electricity may be generated when exfoliating the protective film.

(11) Protection film is being applied to the surface of the display panel and removes the protection film before assembling it. At this time, if the OLED display module has been stored for a long period of time, residue adhesive material of the protection film may remain on the surface of the display panel after removed of the film. In such case, remove the residue material by the method introduced in the above Section 5.

(12) If electric current is applied when the OLED display module is being dewed or when it is placed under high humidity environments, the electrodes may be corroded and be careful to avoid the above.

10.2. Storage Precautions

(1) When storing OLED display modules, put them in static electricity preventive bags avoiding exposure to direct sun light nor to lights of fluorescent lamps. and, also, avoiding high temperature and high humidity environment or low temperature (less than 0°C) environments.

(We recommend you to store these modules in the packaged state when they were shipped from ELECTRONIC ASSEMBLY Technology Inc.

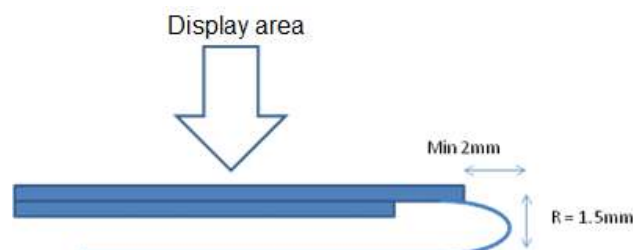
At that time, be careful not to let water drops adhere to the packages or bags nor let dewing occur with them.

(2) If electric current is applied when water drops are adhering to the surface of the OLED

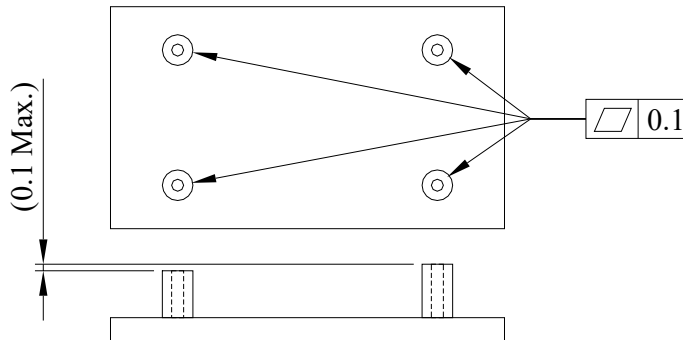
display module, when the OLED display module is being dewed or when it is placed under high humidity environments, the electrodes may be corroded and be careful about the above.

10.3. Designing Precautions

- (1) The absolute maximum ratings are the ratings which cannot be exceeded for OLED display module, and if these values are exceeded, OLED display module may be damaged.
- (2) To prevent occurrence of malfunctioning by noise, pay attention to satisfy the VIL and VIH specification and to make the signal line cable as short as possible.
- (3) We recommend you to install excess current preventive unit (fuses, etc.) to the power circuit (VDD / VCC). (Recommend value: 0.5A)
- (4) Pay sufficient attention to avoid occurrence of mutual noise interference with the nearby devices.
- (5) As for EMI, take necessary measures on the equipment side basically.
- (6) If the power supplied to the OLED display module is forcibly shut down by such errors as taking out the main battery while the OLED display panel is in operation, we cannot guarantee the quality of this OLED display module.
* Connection (contact) to any other potential than the above may lead to rupture of the IC.
- (7) If this OLED driver is exposed to light, malfunctioning may occur and semiconductor elements may change their characteristics.
- (8) The internal status may be changed, if excessive external noise enters into the module. Therefore, it is necessary to take appropriate measures to suppress noise generation or to protect module from influences of noise on the system design.
- (9) We recommend you to make periodical refreshment of the operation statuses (re-setting of the commands and re-transference of the display data) to cope with catastrophic noise.
- (10) It's pretty common to use "Screen Saver" to extend the lifetime and Don't use the same image for long time in real application. When an OLED display module is operated for a long of time with fixed pattern, an afterimage or slight contrast deviation may occur.
- (11) The limitation of FPC and Film bending.



- (12) The module should be fixed balanced into the housing, or the module may be twisted.



- (13) Please heat up a little the tape sticking on the components when removing it; otherwise the components might be damaged.

10.4. Precautions when disposing of the OLED display modules

- (1) Request the qualified companies to handle industrial wastes when disposing of the OLED display modules. Or, when burning them, be sure to observe the environmental and hygienic laws and regulations.

10.5. Other Precautions

- (1) When an OLED display module is operated for a long of time with fixed pattern may remain as an after image or slight contrast deviation may occur. Nonetheless, if the operation is interrupted and left unused for a while, normal state can be restored. Also, there will be no problem in the reliability of the module.
- (2) To protect OLED display modules from performance drops by static electricity rapture, etc., do not touch the following sections whenever possible while handling the OLED display modules.
- * Pins and electrodes
 - * Pattern layouts such as the TCP & FPC
- (3) With this OLED display module, the OLED driver is being exposed. Generally speaking, semiconductor elements change their characteristics when light is radiated according to the principle of the solar battery. Consequently, if this OLED driver is exposed to light, malfunctioning may occur.
- * Design the product and installation method so that the OLED driver may be shielded from light in actual usage.
 - * Design the product and installation method so that the OLED driver may be shielded from light during the inspection processes.
- (4) Although this OLED display module stores the operation state data by the commands and the indication data, when excessive external noise, etc. enters into the module, the internal status may be changed. It therefore is necessary to take appropriate measures to suppress noise generation or to protect from influences of noise on the system design.
- (5) We recommend you to construct its software to make periodical refreshment of the operation

statuses (re-setting of the commands and re-transference of the display data) to cope with catastrophic noise.

- (6) Resistors, capacitors and other passive components will have different appearance and color caused by the different supplier.
- (7) Our company will have the right to upgrade and modify the product function.

11. Initialization example

```

/*****
Global variables
*****/

uint8_t buf[20];           //SPI command buffer
uint8_t buffer[128];      //SPI data buffer
const uint8_t lookupval[4] = {0x0,0xF,0xF0,0xFF}; //lookup table

/*****
Function name: command
Description: send command via SPI
*****/

void command(uint8_t command){
    waitforemptybuffer(); //waits until SPI buffer is empty
    buf[0] = command;
    PORT5.PODR.BIT.B4 = 0; //set D/C# pin low
    R_RSPI0_Send(buf,1); //send buffer via SPI
}

/*****
Function name: data
Description: send data via SPI
*****/

void data(uint8_t data){
    waitforemptybuffer(); //waits until SPI buffer is empty
    buf[0] = data;
    PORT5.PODR.BIT.B4 = 1; //set D/C# pin high
    R_RSPI0_Send(buf,1); //send buffer via SPI
}

/*****
Function name: initW256064
Description: Initialization of the display
*****/

void initW256064 (void){
    PORT5.PODR.BIT.B5 = 0; //Reset pin low
    ms_delay(100); //100ms delay
    PORT5.PODR.BIT.B5 = 1; //Reset pin high
    ms_delay(100); //100ms delay

    command(0xFD); //set Command unlock
    data(0x12);

    command(0xAE); //set display off

```

```

command(0xB3); //set display clock divide ratio...
data(0x91); //...to 135 Frames/sec

command(0xCA); //set multiplex ratio...
data(0x3F); //...to 64-1

command(0xA2); //set display offset
data(0x00); //...to 0

command(0xA1); //start display start line
data(0x00); //...to 0

command(0xA0); //set Re-Map & Dual COM Line Mode
data(0x14);
data(0x11);

command(0xB5); //disable IO input
data(0x00);

command(0xAB); //function select
data(0x01);

command(0xB4); //enable VSL extern
data(0xA0);
data(0xFD);

command(0xC1); //set contrast current
data(0xFF);

command(0xC7); //set master contrast current
data(0x0F);

    command(0xB8); //set gray scale table
data(0x00);
data(0x00);
data(0x00);
data(0x03);
data(0x06);
data(0x10);
data(0x1D);
data(0x2A);
data(0x37);
data(0x46);
data(0x58);
data(0x6A);
data(0x7F);
data(0x96);
data(0xB4);

command(0xB1); //set phase length
data(0xE8);

```

```

    command(0xD1);    //enhance driving scheme capability
    data(0x82);
    data(0x20);

    command(0xBB);   //first pre charge voltage
    data(0x1F);

    command(0xB6);   //second pre charge voltage
    data(0x08);

    command(0xBE);   //VCOMH
    data(0x07);

    command(0xA9);   //no partial mode

    command(0xA6);   //set normal display mode

    ms_delay(1);     //stabilize VDD

    command(0xAF);   //display on

    ms_delay(200);   //stabilize VDD
}

/*****
Function name: initWindow
Description: Initialization of the window in horizontal addressing mode
*****/

void initWindow(uint8_t startcol, uint8_t stopcol, uint8_t startrow, uint8_t stoprow){
    command(0x15);
    data(28+startcol);
    data(28+stopcol);

    command(0x75);
    data(startrow);
    data(stoprow);

    command(0x5C);
    ms_delay(50);
}

```

```

/*****
Function name: sendDataW256064
Description: Sends data to the display (Initialization of the window before sending data to
the display -> initWindow())
Display controller provides 4Bit grayscale -> function only use monochrome data
*****/

void sendDataW256064 (const uint8_t *tx_buf, uint16_t tx_num){
    uint16_t i,j,w;
    uint16_t count, totcount;
    uint8_t byte;
    count = 0;
    totcount = 2;

    //convert monochrome pixel data to 4Bit grayscale 0->0000; 1->1111
    for (j=0;j<64;j++){           //all 64 rows
        waitforemptybuffer(); //Waits until SPI buffer is empty

        for(i=0;i<32;i++){
            byte = tx_buf[totcount];           //store actual byte
            totcount++;

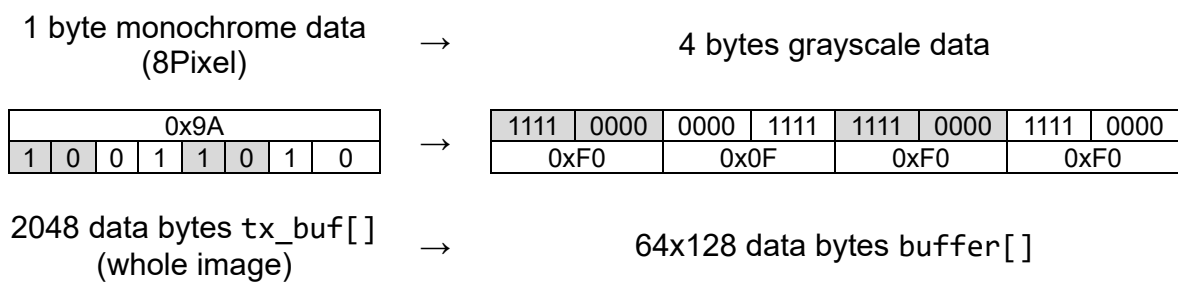
            for(w=0;w<4;w++){
                buffer[count] = lookupval[(byte & 0xC0)>>6];
                byte = byte << 2;
                count++;
            }
        }

        PORT5.PODR.BIT.B4 = 1;           //D/C# pin high
        R_RSPI0_Send(&buffer,128); //send data buffer via SPI (one row)

        count = 0;
    }
}

```

Conversion example of one monochrome data byte (8 pixel) to 4Bit grayscale data:



12. Application example

