



# SPECIFICATIONS

**CUSTOMER** : \_\_\_\_\_




**MODEL NO.** : **GFE122032E-YPAE-01**

**VERSION** : **B**

**DATE** : **2017.03.23**

**CERTIFICATION** : **ROHS**

**CUSTOMER SIGN** : \_\_\_\_\_

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## 1. SCOPE

This specification covers the engineering requirements for the GFE122032E-YPAE-01 liquid crystal module.

## 2. PRODUCT SPECIFICATIONS

### 2.1 General

- 122 × 32 dot matrix LCD
- **STN (Yellow-Green), Positive** mode LCD panel
- **Transflective** Wide temperature type
- 6 o'clock
- Multiplexing driving : 1/32duty, 1/6bias
- Controller IC : **SBN1661G\*2** or Compatible
- Backlight: **Yellow-Green (EDGE)**

### 2.2 Mechanical Characteristics

| Item             | Value                      | Unit |
|------------------|----------------------------|------|
| Number of dots   | 122X32                     | Dot  |
| Dot size         | 0.36 X0.41                 | mm   |
| Dot pitch        | 0.4X0.45                   | mm   |
| Module dimension | 65.4(W) X 28.2(H) X 5.5(T) | mm   |
| Viewing Area     | 54.8 (W) X 19 (H)          | mm   |
| Active Area      | 48.76 (W) X 15.32(H)       | mm   |
| Module           | FFC L=19.4mm               |      |



### 2.3 Absolute Maximum Ratings (Without LED back-light)

| Characteristic            | Symbol   | Unit | Value                |
|---------------------------|----------|------|----------------------|
| Operating Voltage (logic) | $V_{DD}$ | V    | -0.3 to +5.5         |
| Input Voltage             | $V_{IN}$ | V    | -0.3 to $V_{DD}+0.3$ |

Note 1: Referenced to  $V_{SS}=0V$

### 2.4 Electrical Characteristics (Without LED back-light)

| Characteristic           | Symbol          | Condition       | Min.        | Typ. | Max.        | Unit |
|--------------------------|-----------------|-----------------|-------------|------|-------------|------|
| Operating Voltage(logic) | $V_{DD}-V_{SS}$ | --              | 4.7         | 5.0  | 5.3         | V    |
| Input Voltage            | $V_{IH}$        | --              | $0.8V_{DD}$ | --   | $V_{DD}$    | V    |
|                          | $V_{IL}$        | --              | $V_{SS}$    | --   | $0.2V_{DD}$ |      |
| Output Voltage           | $V_{OH}$        | $I_{OH}=-0.1mA$ | $0.8V_{DD}$ | --   | $V_{DD}$    | V    |
|                          | $V_{HL}$        | $I_{OL}=0.1mA$  | $V_{SS}$    | --   | $0.2V_{DD}$ |      |

### 2.5 Optical Characteristics Absolute maximum ratings

| Item                        | Symbol | Rating | Unit |
|-----------------------------|--------|--------|------|
| Operating temperature range | Top    | -20~70 | °C   |
| Storage temperature range   | Tst    | -30~80 | °C   |

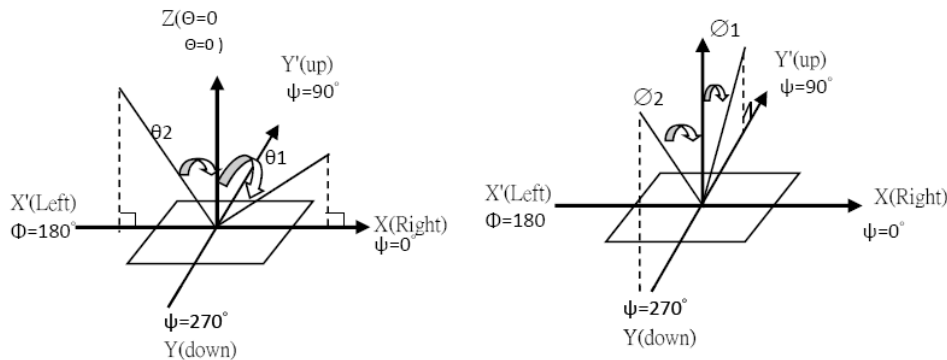


## 2.6. Optical Characteristics

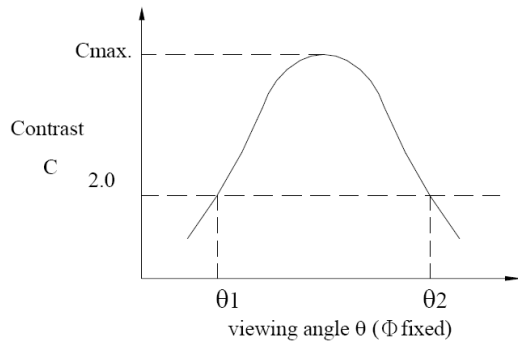
1/32 duty, 1/6 bias, Vop=9 V, Ta=25°C

| Item                | Symbol                  | Conditions                                | Min. | Typ. | Max   | Reference   |
|---------------------|-------------------------|---|------|------|-------|-------------|
| Driving voltage     | Vop                     |   | --   | 9    | --    |             |
| Viewing angle       | $\theta_1$ 、 $\theta_2$ | $C \geq 2.0, \varnothing = 0^\circ$<br>C  | 30°  | -    | -     | Notes 1 & 2 |
| Contrast            | C                       | $\theta = 5^\circ, \varnothing = 0^\circ$ | 2.0  | -    | -     | Note 3      |
| Response time(rise) | ton                     | $\theta = 5^\circ, \varnothing = 0^\circ$ | -    | -    | 260ms | Note 4      |
| Response time(fall) | toff                    | $\theta = 5^\circ, \varnothing = 0^\circ$ | -    | -    | 380ms | Note 4      |

Note 1: Definition of angles  $\theta$  and  $\varnothing$

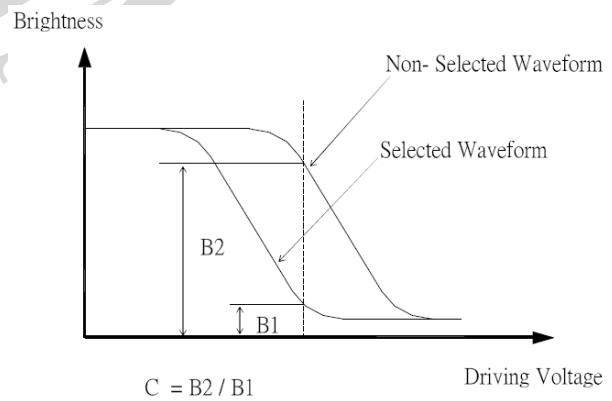


Note 2: Definition of viewing angles  $\theta_1$  and  $\theta_2$

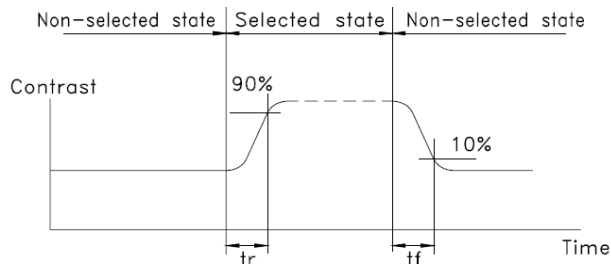


Note : Optimum viewing angle with the naked eye and viewing angle  $\theta$  at Cmax. Above are not always the same

Note 3: Definition of contrast C



Note 4: Definition of response time



Note: Measured with a transmissive LCD panel which is displayed 1 cm<sup>2</sup>

V<sub>OPR</sub> : Operating voltage      f<sub>FRM</sub> : Frame frequency  
t<sub>ON</sub> : Response time (rise)    t<sub>OFF</sub> : Response time (fall)



## 2.7 LED Back-light Characteristics

### 2.7.1 Electrical / optical specifications

Ta = 25°C

| Item                         | Symbol          | Condition                 | Min. | Typ. | Max. | Unit              |
|------------------------------|-----------------|---------------------------|------|------|------|-------------------|
| Forward voltage              | V <sub>f</sub>  | If=100mA,<br>Yellow Green | 1.9  | 2.0  | 2.1  | V                 |
| *Luminous Intensity          | I <sub>v</sub>  | If=100mA,<br>Yellow Green | 80   | 120  | --   | cd/m <sup>2</sup> |
| Peak Emission Wavelength     | λ <sub>P</sub>  | If=100mA,<br>Yellow Green | --   | 570  | --   | nm                |
| Spectrum Radiation Bandwidth | Δλ              | If=100mA,<br>Yellow Green | --   | 20   | --   | nm                |
| Reverse Current              | I <sub>R</sub>  | VR=8V,<br>Yellow Green    | --   | --   | 0.2  | mA                |
| Luminous Uniformity          | ΔL <sub>v</sub> | If=100mA,<br>Yellow Green | 70   |      |      | %                 |

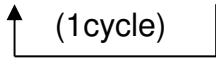
Note: \* Please refer to CIE 1931 Chromaticity diagram.

### 2.7.2 LED Maximum Operating Range

| Item              | Symbol          | Yellow-Green | Unit |
|-------------------|-----------------|--------------|------|
| Power Dissipation | P <sub>AD</sub> | 210          | mW   |
| Forward Current   | I <sub>F</sub>  | 100          | mA   |
| Reverse Voltage   | V <sub>R</sub>  | 5            | V    |



### 3. RELIABILITY

| NO. | ITEM                            | CONDITION   |         | STANDARD                     | NOTE      |
|-----|---------------------------------|---|---------|------------------------------|-----------|
| 1   | High Temp. Storage              | 80°C  | 120 hrs | Appearance<br>Without defect |           |
| 2   | Low Temp. Storage               | -30°C   | 120 hrs | Appearance<br>Without defect |           |
| 3   | High Temp. & High Humi. Storage | 40°C<br>90% RH  | 120 hrs | Appearance<br>Without defect |           |
| 4   | High Temp. Operating Display    | 70°C  | 120 hrs | Appearance<br>Without defect |           |
| 5   | Low Temp. Operating Display     | -20°C   | 120 hrs | Appearance<br>Without defect |           |
| 6   | Thermal Shock                   | -20°C, 30min. → 70°C, 30min.<br><br>(1cycle) |         | Appearance<br>Without defect | 10 cycles |

\*\* Dissipation current, contrast and display functions

\*\* Polarizing filter deterioration, other appearance defects

\*\* The function test shall be conducted after 4hours storage at the normal temperature and humidity after remove from the test chamber.



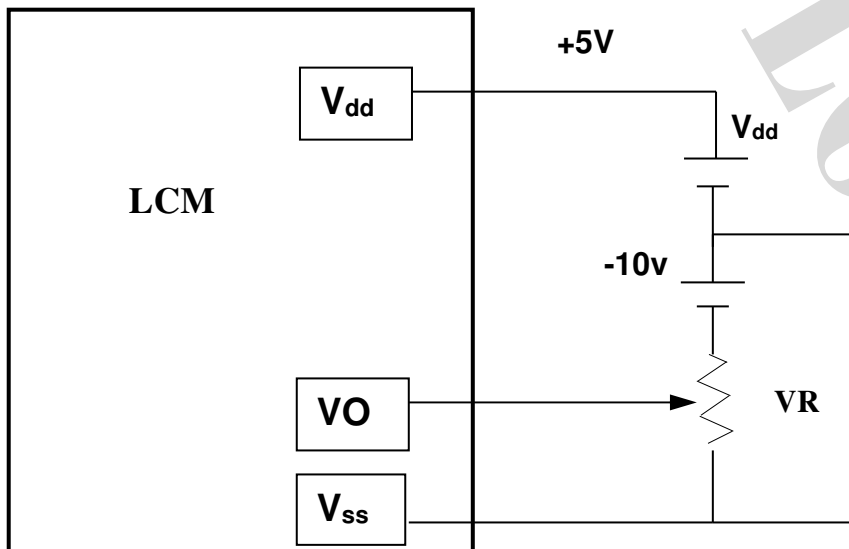


## 4. OPERATING INSTRUCTIONS

### 4.1 Input signal Function

| Pin No | Symbol  | Function  |
|--------|---------|---|
| 1      | Vdd     | Power supply for logic (+5V)  |
| 2      | Vss     | Signal ground (GND)   |
| 3      | Vo      | Operating voltage for LCD (variable)  |
| 4      | RES     | Reset signal  |
| 5      | E1      | Chip1 enable (segment 1 to segment 64),Active high  |
| 6      | E2      | Chip2 enable (segment 65 to segment 128),Active high  |
| 7      | R/W     | Data read & write   |
| 8      | A0      | Start enable signal to read or write the data   |
| 9-12   | DB0~DB3 | Four low order bi-directional three-state data bus lines. Used for data transfer between the MPU and the LCD module.                                  |
| 13-16  | DB4~DB7 | Four high order bi-directional three-state data bus lines. Used for data transfer between the MPU and the LCD module. DB7 can be used as a busy flag. |
| 17     | A       | LED backlight drive voltage V+  |
| 18     | K       | LED backlight drive voltage ground  |

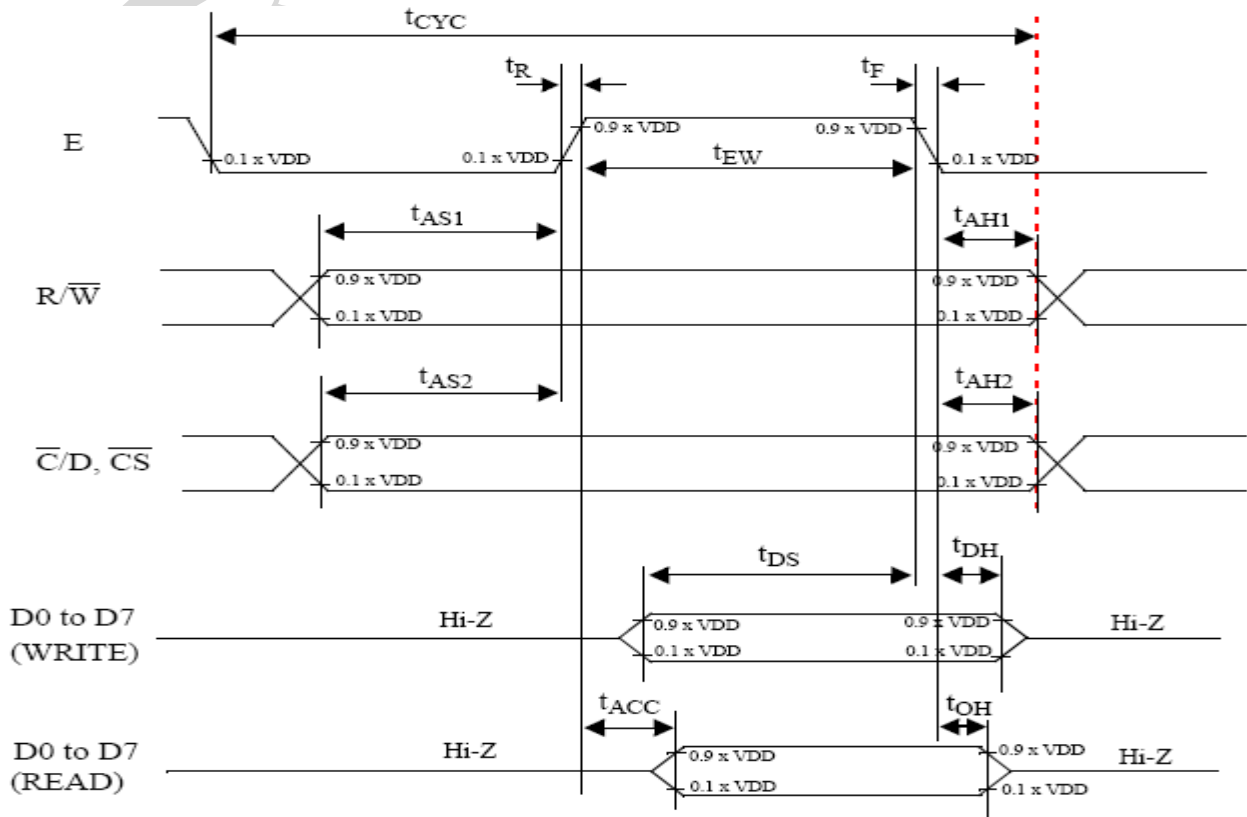
### 4.2 Voltage Generator Circuit



**VR : 10K~20K**



### 4.3 Timing Diagram



| symbol     | parameter                                   | min. | max. | test conditons    | unit |
|------------|---|------|------|-------------------|------|
| $t_{AS1}$  | Address set-up time with respect to R/W     | 20   |      |                   | ns   |
| $t_{AS2}$  | Address set-up time with respect to C/D, CS | 20   |      |                   | ns   |
| $t_{AH1}$  | Address hold time with respect to R/W       | 10   |      |                   | ns   |
| $t_{AH2}$  | Address hold time respect with to C/D, CS   | 10   |      |                   | ns   |
| $t_F, t_R$ | Enable (E) pulse falling/rising time        |      | 15   |                   | ns   |
| $t_{CYC}$  | System cycle time                           | 1000 |      | Note 1            | ns   |
| $t_{EWR}$  | Enable pulse width for READ                 | 100  |      |                   | ns   |
| $t_{EWW}$  | Enable pulse width for WRITE                | 80   |      |                   | ns   |
| $t_{DS}$   | Data setup time                             | 80   |      |                   | ns   |
| $t_{DH}$   | Data hold time                              | 10   |      |                   | ns   |
| $t_{ACC}$  | Data access time                            |      | 90   | CL= 100 pF.       | ns   |
| $t_{OH}$   | Data output hold time                       | 10   | 60   | Refer to Fig. 23. | ns   |
| $t_{AS1}$  | Address set-up time with respect to R/W     | 40   |      |                   | ns   |
| $t_{AS2}$  | Address set-up time with respect to C/D, CS | 40   |      |                   | ns   |
| $t_{AH1}$  | Address hold time with respect to R/W       | 20   |      |                   | ns   |
| $t_{AH2}$  | Address hold time respect with to C/D, CS   | 20   |      |                   | ns   |
| $t_F, t_R$ | Enable (E) pulse falling/rising time        |      | 15   |                   | ns   |
| $t_{CYC}$  | System cycle time                           | 2000 |      | Note 1            | ns   |
| $t_{EWR}$  | Enable pulse width for READ                 | 200  |      |                   | ns   |
| $t_{EWW}$  | Enable pulse width for WRITE                | 160  |      |                   | ns   |
| $t_{DS}$   | Data setup time                             | 160  |      |                   | ns   |
| $t_{DH}$   | Data hold time                              | 20   |      |                   | ns   |
| $t_{ACC}$  | Data access time                            |      | 180  | CL= 100 pF.       | ns   |
| $t_{OH}$   | Data output hold time                       | 20   | 120  | Refer to Fig. 23. | ns   |



#### 4.4.Display Command

| COMMAN<br>D                        | Code   |        |        |                  |                          |                            |                                    |        |        |                  |        | FUNCTION  |   |
|------------------------------------|--------|--------|--------|------------------|--------------------------|----------------------------|------------------------------------|--------|--------|------------------|--------|---|---|
|                                    | A<br>0 | R<br>1 | W<br>0 | D<br>7           | D<br>6                   | D<br>5                     | D<br>4                             | D<br>3 | D<br>2 | D<br>1           | D<br>0 |   |   |
| Display<br>On/Off                  | 0      | 1      | 0      | 1                | 0                        | 1                          | 0                                  | 1      | 1      | 1                | 0/1    | Turns display on or off<br>1:ON,0:OFF   |   |
| Display<br>start line              | 0      | 1      | 0      | 1                | 1                        | 0                          | Display start address<br>(0 to 31) |        |        |                  | 0/1    | Specifies RAM line<br>corresponding to top line of<br>display.  |   |
| Set page<br>address                | 0      | 1      | 0      | 1                | 0                        | 1                          | 1                                  | 1      | 0      | Page(<br>0 to 3) |        | Sets display RAM page in page<br>address register.  |   |
| Set column<br>(Segment)a<br>ddress | 0      | 1      | 0      | 0                | Column address (0 to 79) |                            |                                    |        |        |                  |        | 0/1   | Sets display RAM column<br>address in column address<br>register. |
| Read status                        | 0      | 0      | 1      | B<br>U<br>S<br>y | A<br>D<br>C              | O<br>N<br>/<br>O<br>F<br>F | R<br>E<br>S<br>E<br>t              | 0      | 0      | 0                | 0      | Reads the following status:<br>BUSY 1:Busy 0:Ready<br>ADC 1:CW output<br>0:CCW output<br>ON/OFF 1: Display off<br>0:Display on<br>RESET 1:Being reset<br>0:Normal |   |
| Write<br>display<br>data           | 1      | 1      | 0      | Write date       |                          |                            |                                    |        |        |                  |        | 0/1   | Writes data from data bus into<br>display RAM.                    |
| Read<br>display<br>data            | 1      | 0      | 1      | Read data        |                          |                            |                                    |        |        |                  |        | 0/1   | Reads data from display RAM<br>onto data bus.                     |
| Select<br>ADC                      | 0      | 1      | 0      | 1                | 0                        | 1                          | 0                                  | 0      | 0      | 0                | 0/1    | 0:CCW output,1:CCW output   |   |
| Stats drive<br>ON/OFF              | 0      | 1      | 0      | 1                | 0                        | 1                          | 0                                  | 0      | 1      | 0                | 0/1    | Selects static driving operation<br>1:Static drive,0:Normal driving   |   |
| Select duty                        | 0      | 1      | 0      | 1                | 0                        | 1                          | 0                                  | 1      | 0      | 0                | 0/1    | Selects LCD duty cycle<br>1:1/32,0:1/16   |   |
| Read-Modi<br>fy-Write              | 0      | 1      | 0      | 1                | 1                        | 1                          | 0                                  | 0      | 0      | 0                | 0      | Read-modify-write ON  |   |
| End                                | 0      | 1      | 0      | 1                | 1                        | 1                          | 0                                  | 1      | 1      | 1                | 0      | Read-Modify-Write OFF   |   |
| Reset                              | 0      | 1      | 0      | 1                | 1                        | 1                          | 0                                  | 0      | 0      | 1                | 0      | Software reset  |   |



## 5. NOTES

### ▪ Safety

- If the LCD panel breaks, be careful not to get the liquid crystal in your mouth. If the liquid crystal touches your skin or clothes, wash it off immediately using soap and plenty of water.

### Handling

- Avoid static electricity as this can damage the CMOS LSI.
- The LCD panel is plate glass; do not hit or crush it.
- Do not remove the panel or frame from the module.
- The polarizing plate of the display is very fragile; handle it very carefully

### Mounting and Design

- Mount the module by using the specified mounting part and holes.
- To protect the module from external pressure, leave a small gap by placing transparent plates (e.g. acrylic or glass ) on the display surface, frame, and polarizing plate
- Design the system so that no input signal is given unless the power-supply voltage is applied.
- Keep the module dry. Avoid condensation, otherwise the transparent electrodes may break.

### Storage

- Store the module in a dark place where the temperature is  $25^{\circ}\text{C}\pm 10^{\circ}\text{C}$  and the humidity below 65% RH.
- Do not store the module near organic solvents or corrosive gases.
- Do not crush, shake, or jolt the module (including accessories).

### Cleaning

- Do not wipe the polarizing plate with a dry cloth, as it may scratch the surface.
- Wipe the module gently with soft cloth soaked with a petroleum benzine.
- Do not use ketonic solvents (ketone and acetone) or aromatic solvents (toluene and xylene), as they may damage the polarizing plate.

## 6. OPERATION PRECAUTIONS

Any changes that need to be made in this specification or any problems arising from it will be dealt with quickly by discussion between both companies.

