

# APEX

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## RG128646-3YFH DYB

### DATA SHEET

| ISSUE    | VERSION  | APPROVER     | CHECKER   | ENGINEER   |
|----------|----------|--------------|-----------|------------|
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## **1. SCOPE**

This specification covers the engineering requirements for the RG128646-3YFH DYB liquid crystal module.

## **2. PRODUCT SPECIFICATIONS**

### **2.1 General**

- 128 × 64 dot matrix LCD
- STN (Yellow-green) , Positive mode LCD panel
- Transflective , Wide temperature type
- 6 o'clock
- Back light: Edge LED (Yellow-green)
- Multiplexing driving : 1/64duty, 1/9bias
- COG SED1565

### **2.2 Mechanical Characteristics**

| <b>Item</b>                                               | <b>Characteristic</b>  |
|-----------------------------------------------------------|------------------------|
| Dot configuration                                         | 128 × 64               |
| Dot dimensions(mm)                                        | 0.48 × 0.48            |
| Dot spacing (mm)                                          | 0.04                   |
| Module dimensions (Horizontal × Vertical × Thickness, mm) | 86.2 × 53.0 × 5.5 max. |
| Viewing area (Horizontal × Vertical, mm)                  | 70.7 × 38.8            |
| Active area (Horizontal × Vertical, mm)                   | 66.52 × 33.24          |

**SPECIFICATIONS FOR LIQUID CRYSTAL DISPLAY MODULE**  
**MODEL NO: RG128646-3YFHDYB**

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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 $V_{DD}$ |

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) | $V_{DD}-V_{SS}$ | --              | 2.1         | 3.0  | 3.6         | 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    |
|                          | $V_{HL}$        | $I_{OL}=0.1mA$  | $V_{SS}$    | --   | $0.2V_{DD}$ |      |
| Current Consumption      | $I_{DD}$        | $V_{IN}=V_{DD}$ | --          | 0.05 | 1           | mA   |

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   |

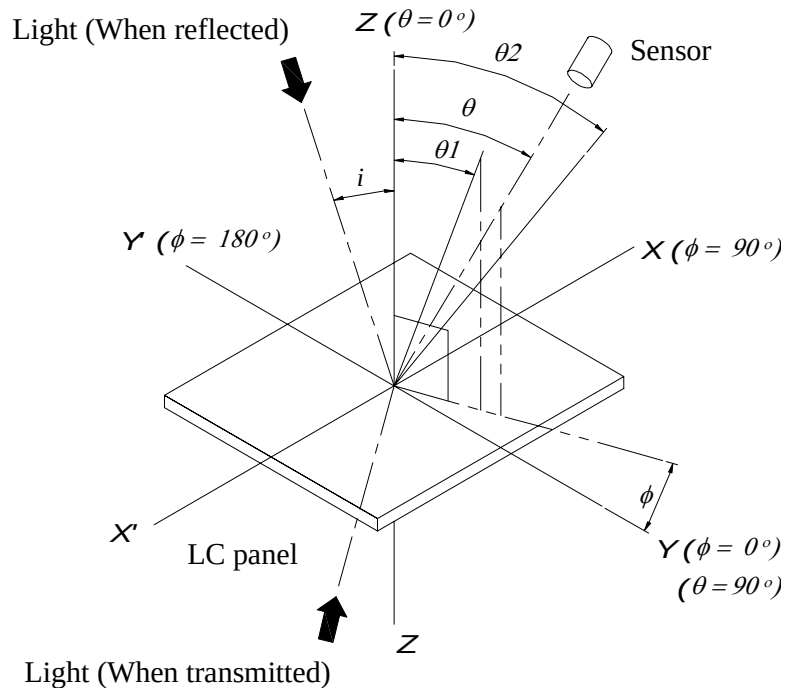
2.6 Optical Characteristics

1/64 duty, 1/9bias

| Item            | Symbol              | Temp.                              | Min. | Typ. | Max. | Unit |
|-----------------|---------------------|------------------------------------|------|------|------|------|
| Driving voltage | $V_{op}$            | 25 °C                              | 8.6  | 9.2  | 9.7  | V    |
| Contrast        | K                   | $\theta=0^\circ$<br>$\phi=0^\circ$ | 2    | 2.8  | 8.3  | --   |
| Frame freq.     | fF                  | --                                 | --   | 70   | --   | Hz   |
| Viewing angle*  | $\theta_2-\theta_1$ | 25 °C                              | 30   | 80   | --   | deg. |
|                 | $\phi$              |                                    | 60   | 75   | --   |      |
| Response time   | $t_{on}$            | 25 °C                              | --   | 47   | 250  | ms   |
|                 | $t_{off}$           |                                    | --   | 77   | 250  |      |

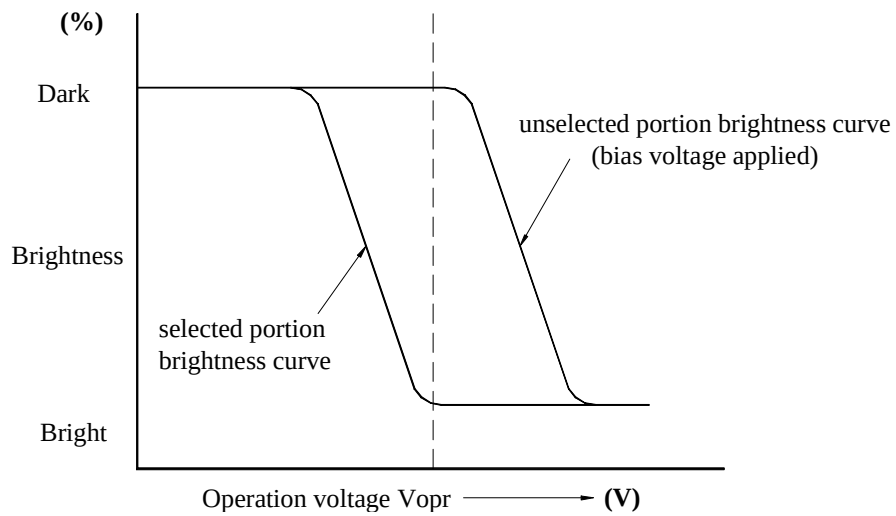
### 2.6.1 Definition of optical characteristics

\* Definition of angles  $\phi$  and  $\theta$



\*Definition of contrast C

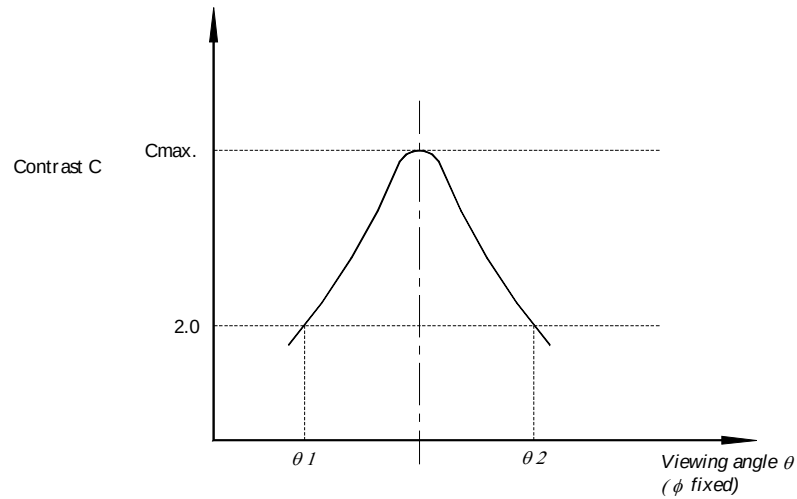
$$C = \frac{B1}{B2} = \frac{\text{Brightness of selected portion}}{\text{Brightness of unselected portion}}$$



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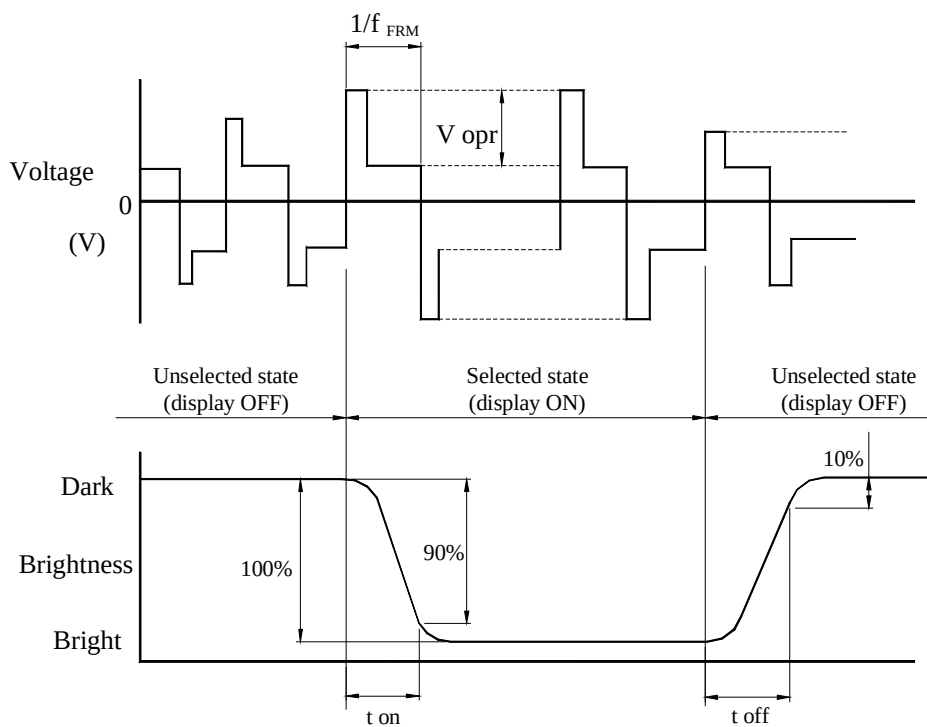
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\* Definition of viewing angles  $\theta_1$  and  $\theta_2$



Note : Optimum vision with the naked eye and viewing angle  $\theta$  at  $C_{max}$  above are not always the same.

\* Definition of response time



$V_{opr}$  : Operating voltage (V)

$t_{on}$  : Response time (rise) (ms)

$f_{FRM}$  : Frame frequency (Hz)

$t_{off}$  : Response time (fall) (ms)

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## 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 | --   | 4.2  | 4.4  | V                 |
| *Luminous Intensity             | I <sub>v</sub> | If=100mA,<br>Yellow Green | 25   | 32   | --   | cd/m <sup>2</sup> |
| Peak Emission<br>Wavelength     | λ <sub>P</sub> | If=100mA,<br>Yellow Green | --   | 570  | --   | nm                |
| Spectrum Radiation<br>Bandwidth | Δλ             | If=100mA,<br>Yellow Green | --   | 30   | --   | nm                |
| Reverse Current                 | I <sub>R</sub> | VR=8V,<br>Yellow Green    | --   | --   | 100  | μA                |

Note: \* Measured at the bare LED back-light unit.

### 2.7.2 LED Maximum Operating Range

| Item              | Symbol          | Yellow Green | Unit |
|-------------------|-----------------|--------------|------|
| Power Dissipation | P <sub>AD</sub> | 0.8          | W    |
| Forward Current   | I <sub>F</sub>  | 200          | mA   |
| Reverse Voltage   | V <sub>R</sub>  | 8            | V    |

### 3. RELIABILITY

#### 3.1 Reliability

| Test item                                  | Test condition                                                                               | Evaluation and assessment                       |
|--------------------------------------------|----------------------------------------------------------------------------------------------|-------------------------------------------------|
| Operation at high temperature and humidity | 40 °C±2 °C<br>90%RH for 500hours                                                             | No abnormalities in functions* and appearance** |
| Operation at high temperature              | 60 °C±2 °C for 500 hours                                                                     | No abnormalities in functions* and appearance** |
| Heat shock                                 | -20± ~ +60 °C Left for 1 hour at each temperature, transition time 5 min, repeated 10times   | No abnormalities in functions* and appearance** |
| Low temperature                            | -20±2 °C for 500 hours                                                                       | No abnormalities in functions* and appearance** |
| Vibration                                  | Sweep for 1 min at 10 Hz, 55Hz, 10Hz, amplitude 1.5mm 2 hrs each in the X,Y and Z directions | No abnormalities in functions* and appearance** |
| Drop shock                                 | Dropped onto a board from a height of 10cm                                                   | No abnormalities in functions* and appearance** |

\* Dissipation current, contrast and display functions

\*\* Polarizing filter deterioration, other appearance defects

#### 3.2 Liquid crystal panel service life

100,000 hours minimum at 25 °C±10 °C

#### 3.3 definition of panel service life

- Contrast becomes 30% of initial value
- Current consumption becomes three times higher than initial value
- Remarkable alignment deterioration occurs in LCD cell layer
- Unusual operation occurs in display functions



#### **4. OPERATING INSTRUCTIONS**

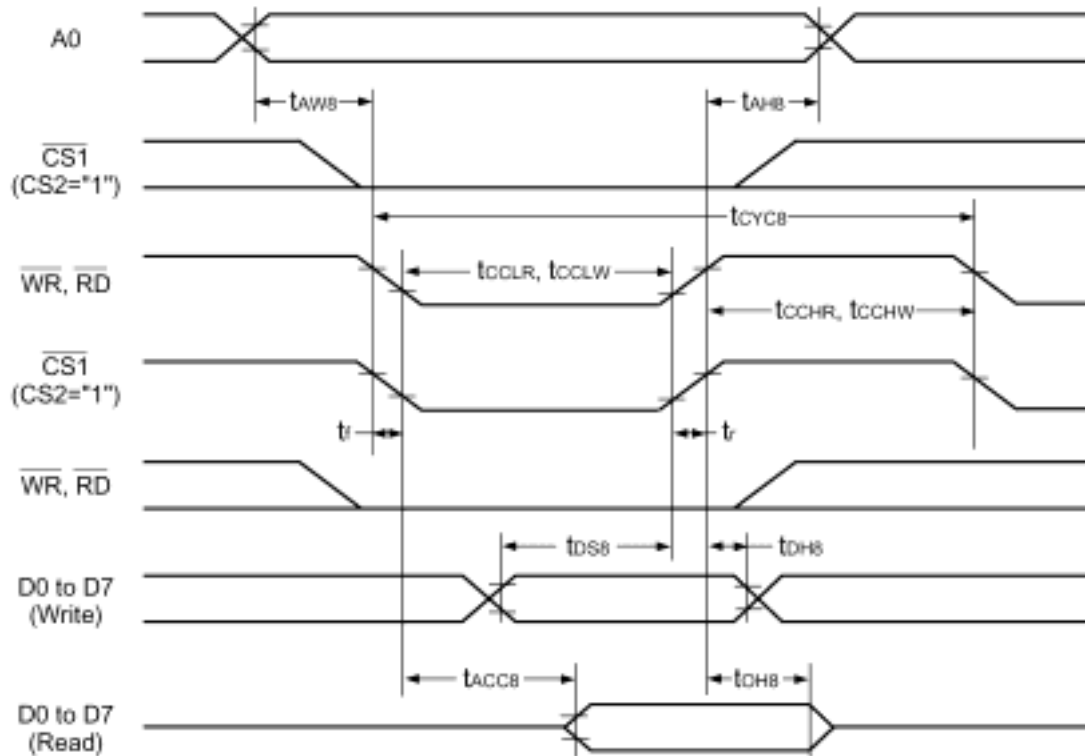
##### **4.1 Input signal Function**

| NO.   | Symbol | Function                                                                                                                                                                                                                                                   |
|-------|--------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1     | /CS1   | Chip select signal                                                                                                                                                                                                                                         |
| 2     | /RESET | RESET                                                                                                                                                                                                                                                      |
| 3     | A0     | H: display data, L: control data                                                                                                                                                                                                                           |
| 4     | W/R    | 8080 series MPU : Writes the display data.                                                                                                                                                                                                                 |
| 5     | R/D    | 8080 series MPU : Read the display data.                                                                                                                                                                                                                   |
| 6~13  | D0~D7  | This pins are the 8-bit bi-direction data bus to be connected to the microprocessor in parallel interface mode. D7 is the MSB while D0 is the LSB. When serial mode is selected, D7 is the serial data input (SDA) and D6 is the serial clock input (SCK). |
| 14    | VDD    | Power supply for logic (5V)                                                                                                                                                                                                                                |
| 15    | VSS    | Ground                                                                                                                                                                                                                                                     |
| 16    | VOUT   | Connect a capacitor between this terminal and the VSS                                                                                                                                                                                                      |
| 17    | CAP3-  | Connect a capacitor between this terminal and the CAP1+                                                                                                                                                                                                    |
| 18    | CAP1+  | Connect a capacitor between this terminal and the VSS                                                                                                                                                                                                      |
| 19    | CAP1-  | Connect a capacitor between this terminal and the VSS                                                                                                                                                                                                      |
| 20    | CAP2-  | Connect a capacitor between this terminal and the VSS                                                                                                                                                                                                      |
| 21    | CAP2+  | Connect a capacitor between this terminal and the VSS                                                                                                                                                                                                      |
| 22~26 | V1~V5  | This is a multi-level power supply for the liquid crystal drive. $VDD(=V0) \geq V1 \geq V2 \geq V3 \geq V4 \geq V5$                                                                                                                                        |

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## 4.2 Timing Diagram

System Bus Read/Write Characteristics for the 8080 series MPU



( $V_{DD}=2.7V$  to  $4.5V$ ,  $T_a=-40$  to  $85^{\circ}C$ )

| Item                                  | Signal   | Symbol     | Condition   | Rating |      | Units |
|---------------------------------------|----------|------------|-------------|--------|------|-------|
|                                       |          |            |             | Min    | Max. |       |
| Address hold time                     | A0       | $t_{AH8}$  | --          | 0      | --   | ns    |
| Address setup time                    |          | $t_{AW8}$  |             | 0      | --   | ns    |
| System cycle time                     | A0       | $t_{CYC8}$ | --          | 300    |      |       |
| Control L pulse width (WR)            | WR       | $t_{CCLW}$ | --          | 60     | --   | ns    |
| Control L pulse width (RD)            | RD       | $t_{CCLR}$ |             | 120    | --   | ns    |
| Control H pulse width (WR)            | WR       | $t_{CCHW}$ |             | 60     | --   | ns    |
| Control H pulse width (RD)            | RD       | $t_{CCHR}$ |             | 60     | --   | ns    |
| Data setup time                       | CS       | $t_{CSS}$  | --          | 100    | --   | ns    |
| Address hold time                     |          | $t_{CSH}$  |             | 100    | --   | ns    |
| RD access time<br>Output disable time | D0 to D7 | $t_{DS8}$  | --          | 40     | --   | ns    |
|                                       |          | $t_{DH8}$  |             | 15     | --   | ns    |
|                                       |          | $t_{ACC8}$ | $C_L=100pF$ | --     | 140  | ns    |
|                                       |          | $t_{OH8}$  |             | 10     | 100  | ns    |

## **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.

