

## User's Guide

# NHD-320240WG-**ATMI-NZ**

# LCM

(Liquid Crystal Display Graphic Module)

**RoHS Compliant**

|                |                                                        |
|----------------|--------------------------------------------------------|
| <b>NHD-</b>    | Newhaven Display                                       |
| <b>320240-</b> | 320 x 240 pixels                                       |
| <b>WG-</b>     | W= Factory Line G= Display Type: Graphic               |
| <b>A-</b>      | Model / Serial number: A                               |
| <b>T-</b>      | White LED B/L                                          |
| <b>M-</b>      | STN-(negative)Blue                                     |
| <b>I-</b>      | Transmissive, 6:00 View, Wide Temperature (-20 ~ +70c) |
| <b>NZ-</b>     | Without Negative Voltage; RoHS                         |

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For product support, contact

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November 19, 2008

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# 1. Module Classification Information

NHD   320240   W   G — ATMI - NZ  
 ①   ②   ③   ④   ⑤ ⑥ ⑦ ⑧   9

① Brand : Newhaven Display

② Display Font : 320 x 240 Dots

③ Factory Line: W

④ Display Type : H→Character Type, G→Graphic Type, C→ Color

⑤ Model / Serial number: **A**

⑥ Backlight Type :    N→Without backlight                      **T**- LED, White  
                                          B→EL, Blue green                      A→LED, Amber  
                                          D→EL, Green                              R→LED, Red  
                                          W→EL, White                              O→LED, Orange  
                                          F→CCFL, White                            G→LED, Green  
                                          Y→LED, Yellow Green

⑦ LCD Mode :            B→TN Positive, Gray                      T→FSTN Negative  
                                          N→TN Negative,                            C→STN Color  
                                          G→STN Positive, Gray  
                                          Y→STN Positive, Yellow Green  
                                          **M**→STN Negative, Blue  
                                          F→FSTN Positive

⑧ LCD Polarize Type/    A→Reflective, N.T, 6:00                      H→Transflective, W.T,6:00  
   Temperature range/    D→Reflective, N.T, 12:00                      K→Transflective,  
   View direction            G→Reflective, W. T, 6:00                      W.T,12:00  
                                          J→Reflective, W. T, 12:00                      C→Transmissive, N.T,6:00  
                                          B→Transflective, N.T,6:00                      F→Transmissive, N.T,12:00  
                                          E→Transflective, N.T.12:00                      **I**→Transmissive, W. T, 6:00  
                                          L→Transmissive, W.T,12:00

9 Special Code:            **NZ**: Without Negative Voltage

## 2. Precautions in Use of LCD Module

- (1) Avoid applying excessive shocks to the 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 LCD Module.
- (3) Don't disassemble the LCM.
- (4) Don't operate it above the absolute maximum rating.
- (5) Don't drop, bend or twist LCM.
- (6) Soldering: only to the I/O terminals.
- (7) Storage: please storage in anti-static electricity container and clean environment.

## 3. General Specification for **NHD-320240WG-ATMI-NZ**

| ITEM              | STANDARD VALUE                    | UNIT |
|-------------------|-----------------------------------|------|
| Number of dots    | 320 x 240                         | dots |
| Outline dimension | 166.8(W) x 109.0(H) x 11.0max(T)  | mm   |
| View area         | 122.0(W) x 92.0(H)                | mm   |
| Active area       | 115.18(W) x 86.38(H)              | mm   |
| Dot size          | 0.34(W) x 0.34(H)                 | mm   |
| Dot pitch         | 0.36(W) x 0.36(H)                 | mm   |
| LCD type          | STN- BLUE, Negative, Transmissive |      |
| View direction    | 6 o'clock                         |      |
| Backlight         | LED, White                        |      |

#### 4. Absolute Maximum Ratings

| ITEM                     | SYMBOL          | MIN. | TYP. | MAX.     | UNIT |
|--------------------------|-----------------|------|------|----------|------|
| Operating Temperature    | $T_{OP}$        | -20  | —    | +70      | °C   |
| Storage Temperature      | $T_{ST}$        | -30  | —    | +80      | °C   |
| Input Voltage            | $V_I$           | 0    | —    | $V_{DD}$ | V    |
| Supply Voltage For Logic | $V_{DD}$        | 0    | —    | 6.5      | V    |
| Supply Voltage For LCD   | $V_{DD}-V_{EE}$ | 0    | —    | 32       | V    |

#### 5. Electrical Characteristics

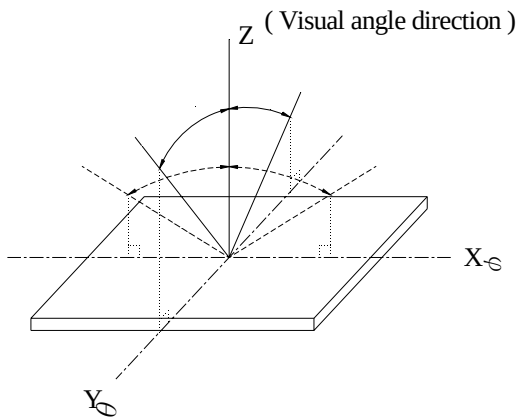
| ITEM                   | SYMBOL          | CONDITION                 | MIN.         | TYP. | MAX.        | UNIT |
|------------------------|-----------------|---------------------------|--------------|------|-------------|------|
| Logic Voltage          | $V_{DD}-V_{SS}$ | —                         | —            | 5.0  | 5.5         | V    |
| Supply Voltage For LCD | $V_{DD}-V_{EE}$ | $T_a=-20^{\circ}\text{C}$ | —            | —    | 25.0        | V    |
|                        |                 | $T_a=25^{\circ}\text{C}$  | —            | 24.0 | —           | V    |
|                        |                 | $T_a=+70^{\circ}\text{C}$ | 23.0         | —    | —           | V    |
| Input High Volt.       | $V_{IH}$        | —                         | $0.8V_{DD}$  | —    | $V_{DD}$    | V    |
| Input Low Volt.        | $V_{IL}$        | —                         | 0            | —    | $0.2V_{DD}$ | V    |
| Output High Volt.      | $V_{OH}$        | —                         | $V_{DD}-0.4$ | —    | —           | V    |
| Output Low Volt.       | $V_{OL}$        | —                         | —            | —    | 0.4         | V    |
| Supply Current         | $I_{DD}$        | —                         | 70.0         | 75.0 | 80.0        | mA   |

#### 6. Optical Characteristics

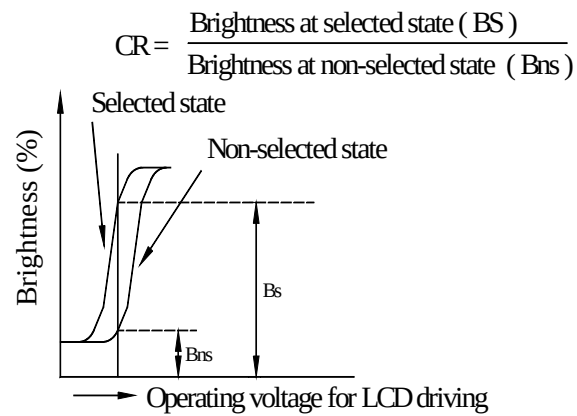
| ITEM           | SYMBAL        | CONDITION   | MIN | TYP | MAX | UNIT |
|----------------|---------------|-------------|-----|-----|-----|------|
| View Angle     | (V) $\theta$  | $CR \geq 2$ | 10  | —   | 105 | deg. |
|                | (H) $\varphi$ | $CR \geq 2$ | -30 | —   | 30  | deg. |
| Contrast Ratio | CR            | —           | —   | 3   | —   | —    |
| Response Time  | T rise        | —           | —   | 200 | 300 | ms   |
|                | T fall        | —           | —   | 150 | 200 | ms   |

## 6.1 Definitions

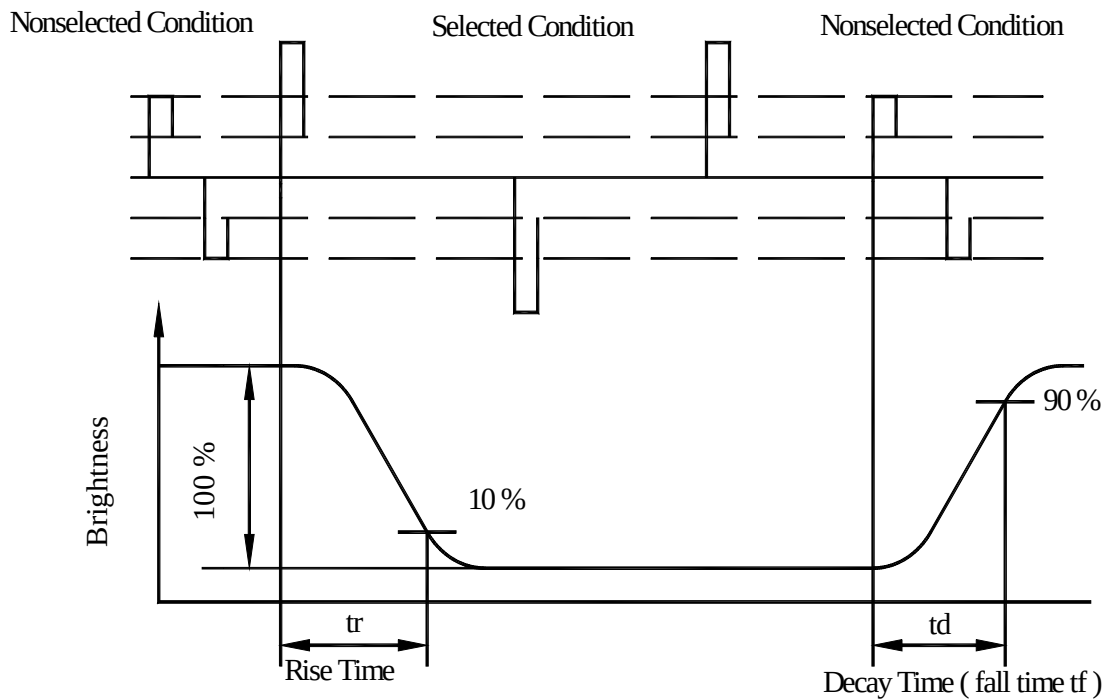
### ■ View Angles



### ■ Contrast Ratio



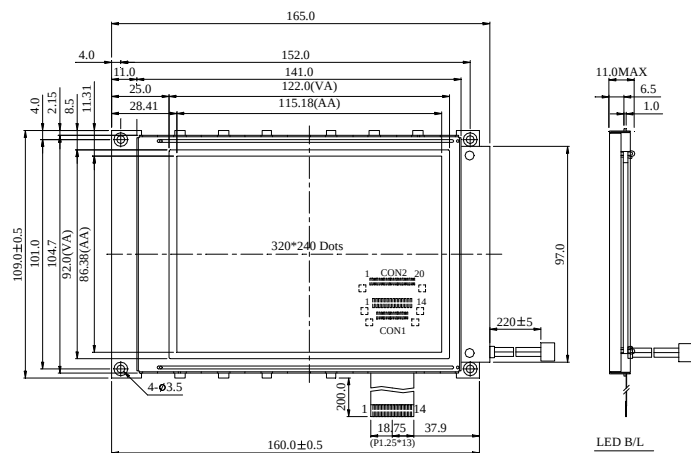
### ■ Response time



## 7. Interface Description

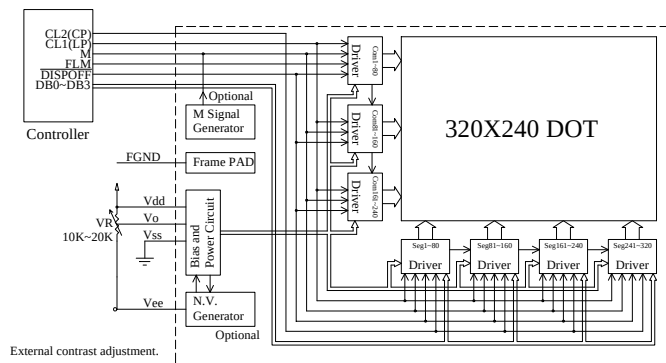
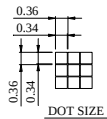
| Pin No. | Symbol                      | Level      | Description                             |
|---------|-----------------------------|------------|-----------------------------------------|
| 1       | D0                          | H/L        | Display data, bit0                      |
| 2       | D1                          | H/L        | Display data, bit1                      |
| 3       | D2                          | H/L        | Display data, bit2                      |
| 4       | D3                          | H/L        | Display data, bit3                      |
| 5       | $\overline{\text{DISPOFF}}$ | H/L        | H: Display ON, L: Display OFF           |
| 6       | FLM                         | H/L        | Scan start-up signal                    |
| 7       | M (N.C.)                    | H/L        | Frame reverse signal (alternate signal) |
| 8       | CL1 (LP)                    | H to L     | Data latch pulse                        |
| 9       | CL2 (CP)                    | H to L     | Data shift pulse                        |
| 10      | V <sub>DD</sub>             | 5.0V       | Power supply for Logic                  |
| 11      | V <sub>SS</sub>             | 0V         | Ground                                  |
| 12      | V <sub>EE</sub>             | -25v       | Negative voltage output (Built-in)      |
| 13      | V <sub>O</sub>              | (Variable) | Driving voltage for LCD                 |
| 14      | FGND                        |            | Frame Ground                            |

8. Contour Drawing & Block diagram

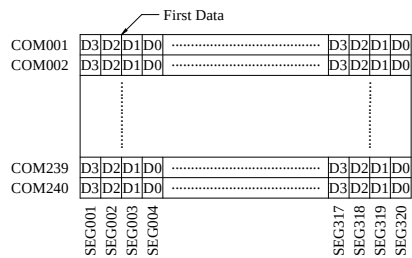
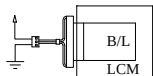


| FINNO. | SYMBOL  |
|--------|---------|
| 1      | DB0     |
| 2      | DB1     |
| 3      | DB2     |
| 4      | DB3     |
| 5      | DISPOFF |
| 6      | FLM     |
| 7      | M       |
| 8      | LP      |
| 9      | CP      |
| 10     | Vdd     |
| 11     | Vss     |
| 12     | Vee     |
| 13     | Vo      |
| 14     | FGND    |

The non-specified tolerance of dimension is ±0.3mm.



LED B/L drive directly from connector .

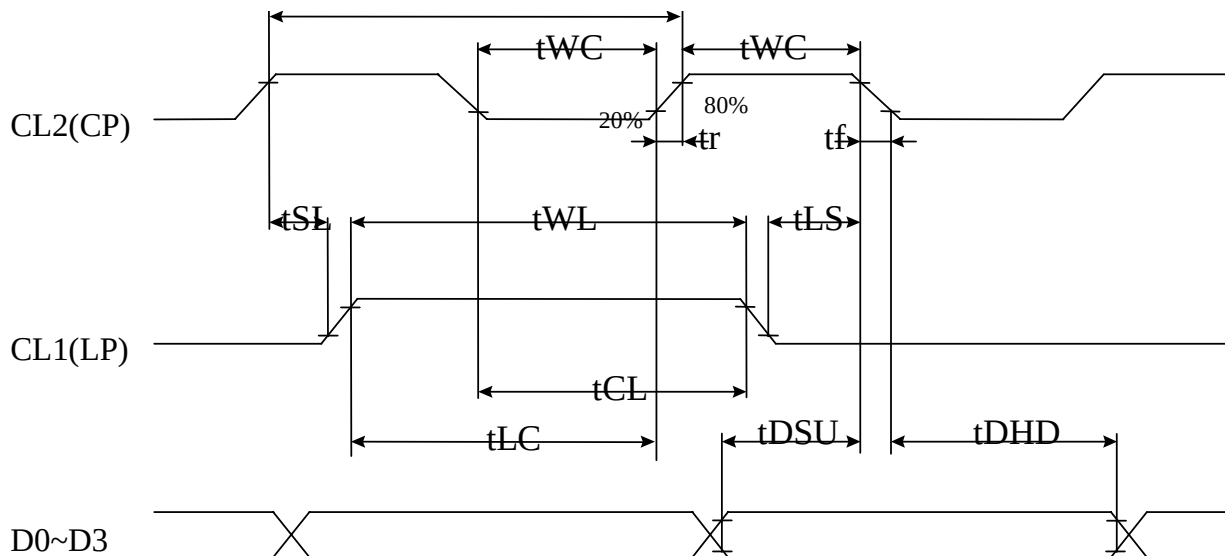




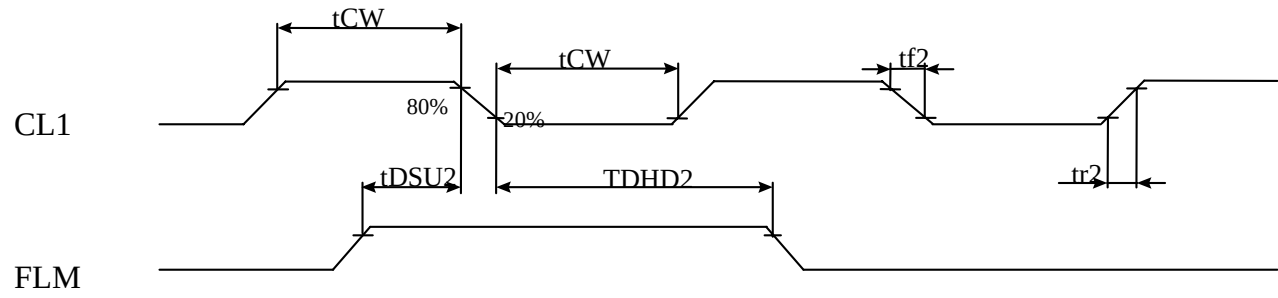
## 9. Timing Characteristics

### 9.1. Common & Segment interface timing:

| ITEM               | symbol  | Test Condition | Min. | Typ. | Max. | Units |
|--------------------|---------|----------------|------|------|------|-------|
| Clock Cycle        | tC      | Fig.1          | 100  | —    | —    | ns    |
| CP Pulse Width     | tWC     | Fig.1          | 50   | —    | —    | ns    |
| LP Pulse Width     | tWL     | Fig.1          | 50   | —    | —    | ns    |
| Data Set Up Time   | tDSU    | Fig.1          | 30   | —    | —    | ns    |
| Data Hold Time     | tDHD    | Fig.1          | 30   | —    | —    | ns    |
| CP Rise/Fall Time  | tr,tf   | Fig.1          | —    | —    | 50   | ns    |
| CP to LOAD         | tCL     | Fig.1          | 80   | —    | —    | ns    |
| LOAD to CP         | tLC     | Fig.1          | 110  | —    | —    | ns    |
| LP Pulse Width     | tLW     | Fig.1          | 50   | —    | —    | ns    |
| CL1 Pulse Width    | tCW     | Fig.2          | 63   | —    | —    | ns    |
| Data Set Up Time   | tDSU2   | Fig.2          | 100  | —    | —    | ns    |
| Data Hold Time     | tDHD2   | Fig.2          | 100  | —    | —    | ns    |
| CL1 Rise/Fall Time | tr2,tf2 | Fig.2          | —    | —    | 50   | ns    |

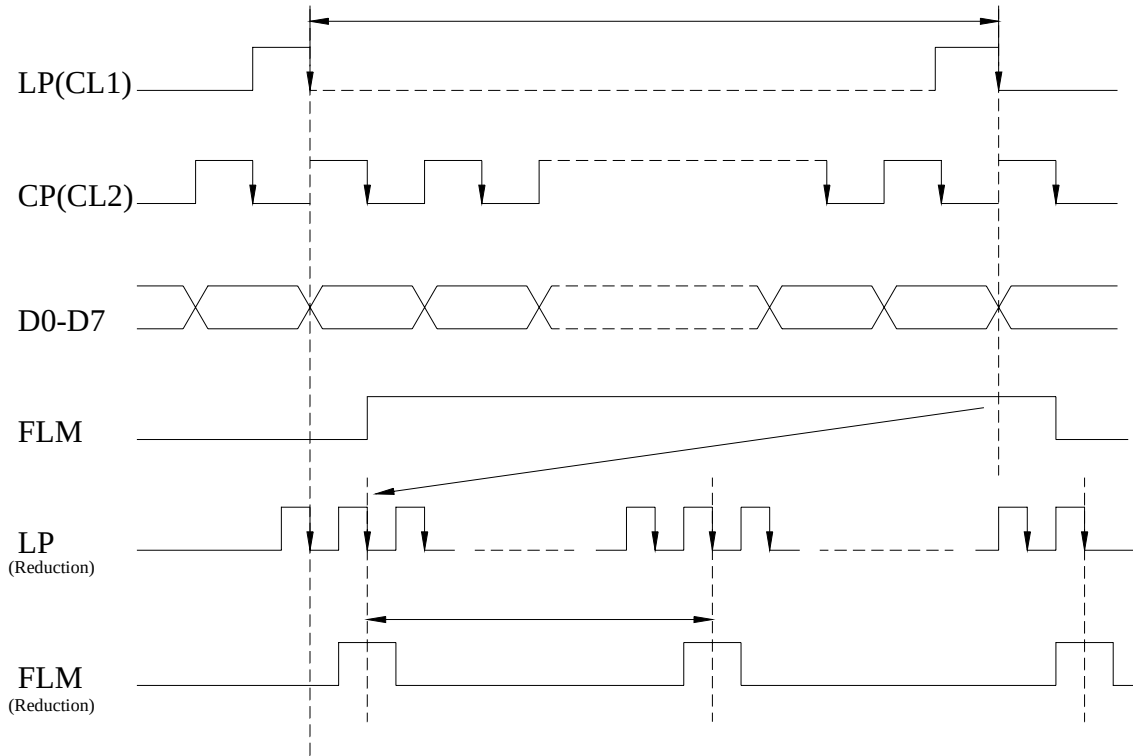


**Fig 1. SEGMENT TIMING**

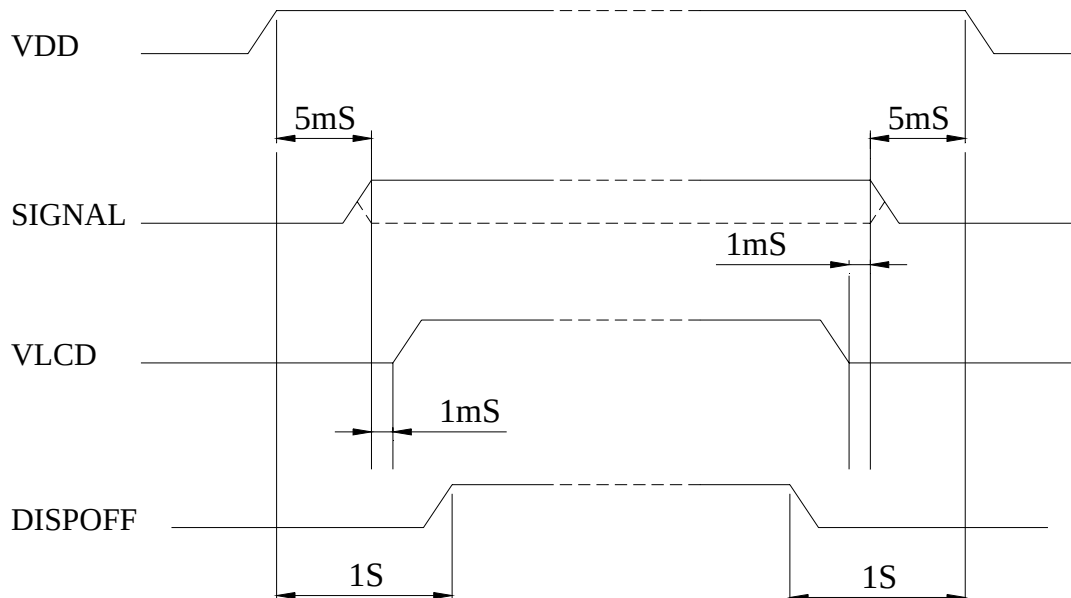


**Fig 2 COMMON TIMING**

### TIMING CHART OF INPUT SIGNAL



### POWER ON/OFF TIMING



## 10. Quality Assurance

### ◆ Screen Cosmetic Criteria

| No.        | Defect                        | Judgement Criteria                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Partition  |                               |        |           |           |   |           |   |       |   |            |                               |        |           |           |   |           |   |       |   |       |
|------------|-------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|-------------------------------|--------|-----------|-----------|---|-----------|---|-------|---|------------|-------------------------------|--------|-----------|-----------|---|-----------|---|-------|---|-------|
| 1          | Spots                         | A) Clear<br><table><tr><th>Size: d mm</th><th>Acceptable Qty in active area</th></tr><tr><td>d ≤0.1</td><td>Disregard</td></tr><tr><td>0.1&lt;d≤0.2</td><td>6</td></tr><tr><td>0.2&lt;d≤0.3</td><td>2</td></tr><tr><td>0.3&lt;d</td><td>0</td></tr></table> <p>Note: Including pin holes and defective dots which must be within one pixel size.</p> <p>B) Unclear<br/><table><tr><th>Size: d mm</th><th>Acceptable Qty in active area</th></tr><tr><td>d ≤0.2</td><td>Disregard</td></tr><tr><td>0.2&lt;d≤0.5</td><td>6</td></tr><tr><td>0.5&lt;d≤0.7</td><td>2</td></tr><tr><td>0.7&lt;d</td><td>0</td></tr></table></p> | Size: d mm | Acceptable Qty in active area | d ≤0.1 | Disregard | 0.1<d≤0.2 | 6 | 0.2<d≤0.3 | 2 | 0.3<d | 0 | Size: d mm | Acceptable Qty in active area | d ≤0.2 | Disregard | 0.2<d≤0.5 | 6 | 0.5<d≤0.7 | 2 | 0.7<d | 0 | Minor |
| Size: d mm | Acceptable Qty in active area |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |            |                               |        |           |           |   |           |   |       |   |            |                               |        |           |           |   |           |   |       |   |       |
| d ≤0.1     | Disregard                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |            |                               |        |           |           |   |           |   |       |   |            |                               |        |           |           |   |           |   |       |   |       |
| 0.1<d≤0.2  | 6                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |            |                               |        |           |           |   |           |   |       |   |            |                               |        |           |           |   |           |   |       |   |       |
| 0.2<d≤0.3  | 2                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |            |                               |        |           |           |   |           |   |       |   |            |                               |        |           |           |   |           |   |       |   |       |
| 0.3<d      | 0                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |            |                               |        |           |           |   |           |   |       |   |            |                               |        |           |           |   |           |   |       |   |       |
| Size: d mm | Acceptable Qty in active area |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |            |                               |        |           |           |   |           |   |       |   |            |                               |        |           |           |   |           |   |       |   |       |
| d ≤0.2     | Disregard                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |            |                               |        |           |           |   |           |   |       |   |            |                               |        |           |           |   |           |   |       |   |       |
| 0.2<d≤0.5  | 6                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |            |                               |        |           |           |   |           |   |       |   |            |                               |        |           |           |   |           |   |       |   |       |
| 0.5<d≤0.7  | 2                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |            |                               |        |           |           |   |           |   |       |   |            |                               |        |           |           |   |           |   |       |   |       |
| 0.7<d      | 0                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |            |                               |        |           |           |   |           |   |       |   |            |                               |        |           |           |   |           |   |       |   |       |
| 2          | Bubbles in Polarize           | <table><tr><th>Size: d mm</th><th>Acceptable Qty in active area</th></tr><tr><td>d≤0.3</td><td>Disregard</td></tr><tr><td>0.3&lt;d≤1.0</td><td>3</td></tr><tr><td>1.0&lt;d≤1.5</td><td>1</td></tr><tr><td>1.5&lt;d</td><td>0</td></tr></table>                                                                                                                                                                                                                                                                                                                                                                             | Size: d mm | Acceptable Qty in active area | d≤0.3  | Disregard | 0.3<d≤1.0 | 3 | 1.0<d≤1.5 | 1 | 1.5<d | 0 | Minor      |                               |        |           |           |   |           |   |       |   |       |
| Size: d mm | Acceptable Qty in active area |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |            |                               |        |           |           |   |           |   |       |   |            |                               |        |           |           |   |           |   |       |   |       |
| d≤0.3      | Disregard                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |            |                               |        |           |           |   |           |   |       |   |            |                               |        |           |           |   |           |   |       |   |       |
| 0.3<d≤1.0  | 3                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |            |                               |        |           |           |   |           |   |       |   |            |                               |        |           |           |   |           |   |       |   |       |
| 1.0<d≤1.5  | 1                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |            |                               |        |           |           |   |           |   |       |   |            |                               |        |           |           |   |           |   |       |   |       |
| 1.5<d      | 0                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |            |                               |        |           |           |   |           |   |       |   |            |                               |        |           |           |   |           |   |       |   |       |
| 3          | Scratch                       | In accordance with spots cosmetic criteria. When the light reflects on the panel surface, the scratches are not to be remarkable.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Minor      |                               |        |           |           |   |           |   |       |   |            |                               |        |           |           |   |           |   |       |   |       |
| 4          | Allowable Density             | Above defects should be separated more than 30mm each other.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Minor      |                               |        |           |           |   |           |   |       |   |            |                               |        |           |           |   |           |   |       |   |       |
| 5          | Coloration                    | Not to be noticeable coloration in the viewing area of the LCD panels.<br>Back-light type should be judged with back-light on state only.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Minor      |                               |        |           |           |   |           |   |       |   |            |                               |        |           |           |   |           |   |       |   |       |

## 11. RELIABILITY

## Content of Reliability Test

| Environmental Test |                                      |                                                                                                                                                                                                                                                                                                                                                                                                |                                                         |                     |
|--------------------|--------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------|---------------------|
| No.                | Test Item                            | Content of Test                                                                                                                                                                                                                                                                                                                                                                                | Test Condition                                          | Applicable Standard |
| 1                  | High Temperature storage             | Endurance test applying the high storage temperature for a long time.                                                                                                                                                                                                                                                                                                                          | 80℃<br>200hrs                                           | —                   |
| 2                  | Low Temperature storage              | Endurance test applying the high storage temperature for a long time.                                                                                                                                                                                                                                                                                                                          | -30℃<br>200hrs                                          | —                   |
| 3                  | High Temperature Operation           | Endurance test applying the electric stress (Voltage & Current) and the thermal stress to the element for a long time.                                                                                                                                                                                                                                                                         | 70℃<br>200hrs                                           | —                   |
| 4                  | Low Temperature Operation            | Endurance test applying the electric stress under low temperature for a long time.                                                                                                                                                                                                                                                                                                             | -20℃<br>200hrs                                          | —                   |
| 5                  | High Temperature/ Humidity Storage   | Endurance test applying the high temperature and high humidity storage for a long time.                                                                                                                                                                                                                                                                                                        | 80℃,90%RH<br>96hrs                                      | —                   |
| 6                  | High Temperature/ Humidity Operation | Endurance test applying the electric stress (Voltage & Current) and temperature / humidity stress to the element for a long time.                                                                                                                                                                                                                                                              | 70℃,90%RH<br>96hrs                                      | —                   |
| 7                  | Temperature Cycle                    | Endurance test applying the low and high temperature cycle.<br><div style="text-align: center;"> <math display="block">  \begin{array}{ccccc}  -30^{\circ}\text{C} &amp; 25^{\circ}\text{C} &amp; 80^{\circ}\text{C} \\  \longleftarrow &amp; \longrightarrow &amp; \\  30\text{min} &amp; 5\text{min} &amp; 30\text{min} \\  \hline  &amp; 1\text{ cycle} &amp;   \end{array}  </math> </div> | -30℃/80℃<br>10 cycles                                   | —                   |
| Mechanical Test    |                                      |                                                                                                                                                                                                                                                                                                                                                                                                |                                                         |                     |
| 8                  | Vibration test                       | Endurance test applying the vibration during transportation and using.                                                                                                                                                                                                                                                                                                                         | 10~22Hz→1.5mmp-p<br>22~500Hz→1.5G<br>Total 0.5hrs       | —                   |
| 9                  | Shock test                           | Constructional and mechanical endurance test applying the shock during transportation.                                                                                                                                                                                                                                                                                                         | 50G Half sign wave 11 msdc<br>3 times of each direction | —                   |
| 10                 | Atmospheric pressure test            | Endurance test applying the atmospheric pressure during transportation by air.                                                                                                                                                                                                                                                                                                                 | 115mbar<br>40hrs                                        | —                   |
| Others             |                                      |                                                                                                                                                                                                                                                                                                                                                                                                |                                                         |                     |
| 11                 | Static electricity test              | Endurance test applying the electric stress to the terminal.                                                                                                                                                                                                                                                                                                                                   | VS=800V,RS=1.5kΩ<br>CS=100pF<br>1 time                  | —                   |

\*\*\*Supply voltage for logic system=5V. Supply voltage for LCD system =Operating voltage at 25℃

## 12. Backlight Information

(Ta=25°C)

| PARAMETER          | SYMBOL           | MIN | TYP | MAX | UNIT              | TEST CONDITION          |
|--------------------|------------------|-----|-----|-----|-------------------|-------------------------|
| Supply Current     | I <sub>LED</sub> | -   | 150 | 180 | mA                | V=3.7V                  |
| Supply Voltage     | V                | -   | 3.5 | 3.6 | V                 | -                       |
| Reverse Voltage    | V <sub>R</sub>   | -   | -   | 10  | V                 | -                       |
| Luminous Intensity | I <sub>V</sub>   | -   | 30  | -   | CD/M <sup>2</sup> | I <sub>LED</sub> =160mA |
| Wave Length        | λ <sub>p</sub>   | —   | -   | -   | nm                | I <sub>LED</sub> =160mA |
| Life Time          | -                | -   | 50K | -   | Hr.               | V≤3.6mA                 |
| Color              | White            |     |     |     |                   |                         |

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# Mouser Electronics

Authorized Distributor

Click to View Pricing, Inventory, Delivery & Lifecycle Information:

Newhaven Display:

[NHD-320240WG-ATMI-NZ](#)