



VL-FS-MDLS161612D-02 REV. A  
(MDLS161612D-LV-G-LED04G-IC-NT3881DH-01A1)

JULY/2002

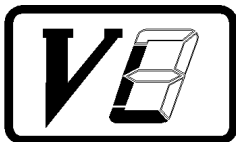
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DOCUMENT NUMBER AND REVISION  
**VL-FS-MDLS161612D-02 REV. A**  
**(MDLS161612D-LV-G-LED04G-IC-NT3881DH-01A1)**

DOCUMENT TITLE:  
**SPECIFICATION**  
**OF**  
**LCD MODULE TYPE**  
**ITEM NO.: MDLS161612D-02**

| DEPARTMENT  | NAME         | SIGNATURE                                                                             | DATE      |
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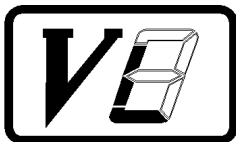
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## VARITRONIX LIMITED

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### Specification of LCD Module Type Item No.: MDLS161612D-02

#### 1. General Description

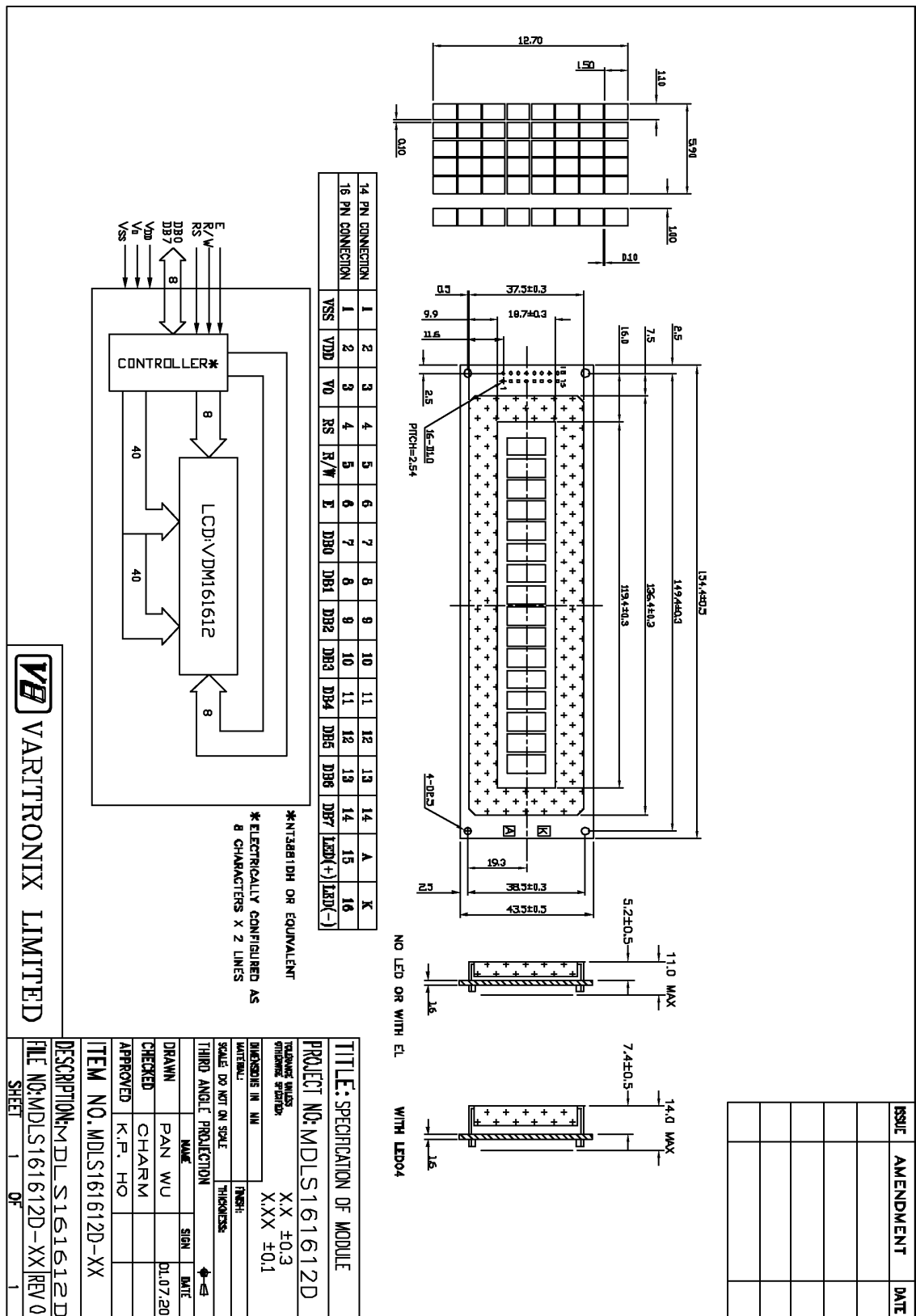
- 16 characters (5 x 8 dots) x 1 line STN Positive Yellow Transflective Dot Matrix LCD module.
- Viewing Angle: 6 O'clock direction.
- Driving duty: 1/16 Duty, 1/5 bias.
- 'NOVATEK' NT3881DH-01/AI (die form) LCD Controller and Driver or equivalent
- Yellow-green LED04 backlight.

#### 2. Mechanical Specifications

The mechanical detail is shown in Fig. 1 and summarized in Table 1 below.

Table 1

| Parameter              | Specifications                    | Unit  |
|------------------------|-----------------------------------|-------|
| Outline dimensions     | 154.4(W) x 43.5(H) x 14.0 MAX.(D) | mm    |
| Effective viewing area | 119.4(W) x 18.7(H)                | mm    |
| Display format         | 16 characters x 1 line            | -     |
| Character size         | 5.90(W) x 12.70(H) (5 x 8 dots)   | mm    |
| Character spacing      | 1.00(W)                           | mm    |
| Character pitch        | 6.90(W)                           | mm    |
| Dot size               | 1.10(W) x 1.50(H)                 | mm    |
| Dot spacing            | 0.10(W) x 0.10(H)                 | mm    |
| Dot pitch              | 1.20(W) x 1.60(H)                 | mm    |
| Weight                 | TBD                               | grams |



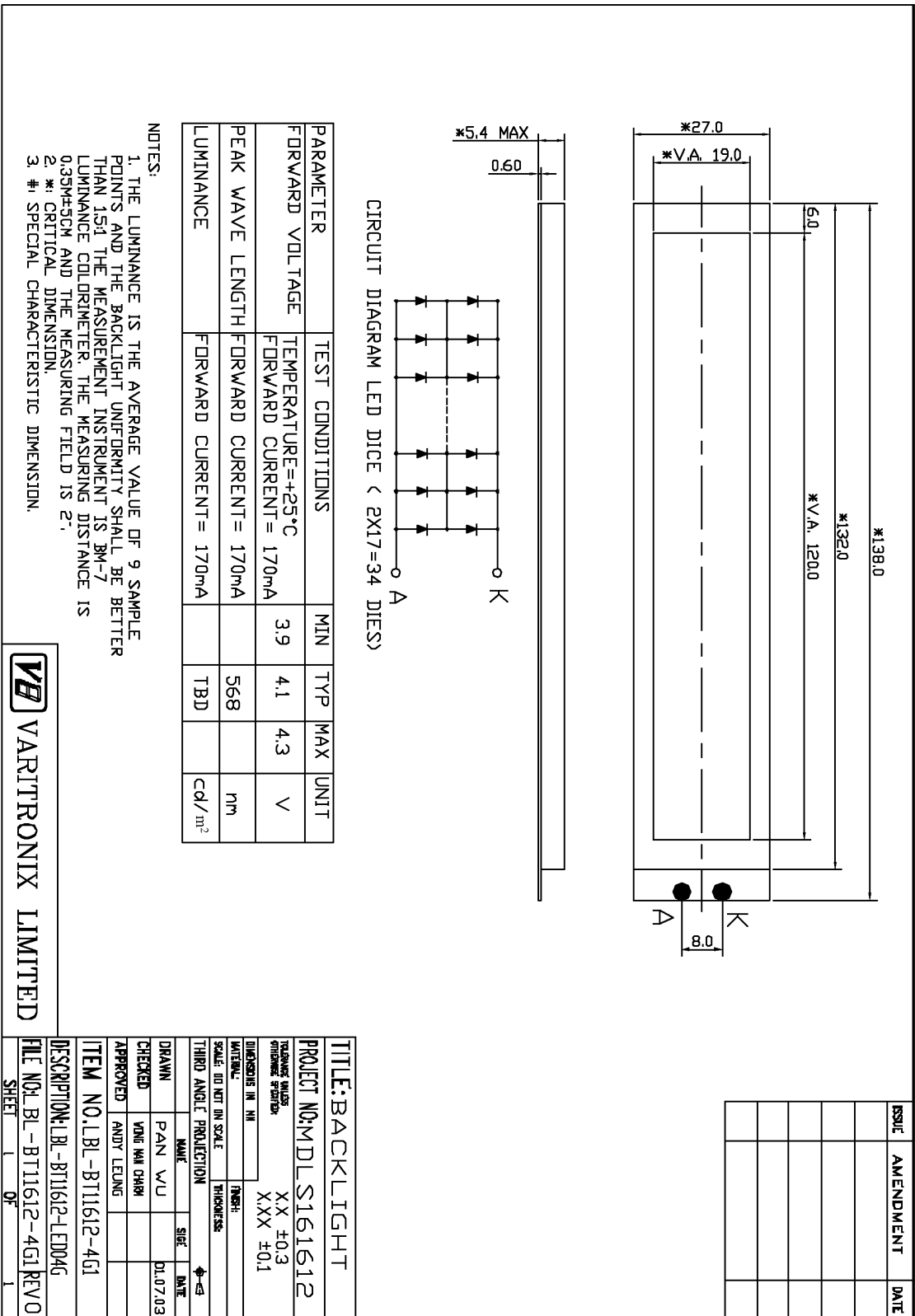


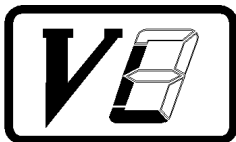
Figure 2: Backlight Drawing



### 3. Interface signals

Table 2

| Pin No. | Symbol | Description                                                                                                                                                      |
|---------|--------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1       | VSS    | Ground(0V).                                                                                                                                                      |
| 2       | VDD    | Power supply for logic (+5V).                                                                                                                                    |
| 3       | V0     | Power supply for LCD driver.                                                                                                                                     |
| 4       | RS     | Register Select Input:<br>"High" for Data register (for read and write)<br>"Low" for Instruction register (for write),<br>Busy flag, address counter (for read). |
| 5       | R/W    | Read/Write signal:<br>"High" for Read mode.<br>"Low" for Write mode.                                                                                             |
| 6       | E      | Enable.<br>Start signal for data read /write.                                                                                                                    |
| 7       | DB0    | Data input/output (LSB).                                                                                                                                         |
| 8       | DB1    | Data input/output.                                                                                                                                               |
| 9       | DB2    | Data input/output.                                                                                                                                               |
| 10      | DB3    | Data input/output.                                                                                                                                               |
| 11      | DB4    | Data input/output.                                                                                                                                               |
| 12      | DB5    | Data input/output.                                                                                                                                               |
| 13      | DB6    | Data input/output.                                                                                                                                               |
| 14      | DB7    | Data input/output (MSB).                                                                                                                                         |
| 15 or A | LED(+) | Anode of LED backlight.                                                                                                                                          |
| 16 or K | LED(-) | Cathode of LED backlight.                                                                                                                                        |



#### 4. Absolute Maximum Ratings

##### 4.1 Electrical Maximum Ratings(Ta = 25 °C)

Table 3

| Parameter                        | Symbol        | Min. | Max.     | Unit |
|----------------------------------|---------------|------|----------|------|
| Power Supply voltage (Logic)     | VDD – VSS     | -0.3 | +7.0     | V    |
| Power Supply voltage (LCD drive) | VLCD=VDD – V0 | -0.3 | +13.5    | V    |
| Input voltage                    | Vin           | -0.3 | VDD +0.3 | V    |

Note:

The modules may be destroyed if they are used beyond the absolute maximum ratings.

All voltage values are referenced to VSS = 0V.

##### 4.2 Environmental Condition

Table 4

| Item                                                                       | Operating Temperature (Topr)                                                                                                                 |       | Storage Temperature (Tstg) |       | Remark          |
|----------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------|-------|----------------------------|-------|-----------------|
|                                                                            | Min.                                                                                                                                         | Max.  | Min.                       | Max.  |                 |
| Ambient Temperature                                                        | 0°C                                                                                                                                          | +50°C | -10°C                      | +60°C | Dry             |
| Humidity                                                                   | 95% max. RH for Ta ≤ 40°C<br>< 95% RH for Ta > 40°C                                                                                          |       |                            |       | no condensation |
| Vibration (IEC 68-2-6)<br>cells must be mounted<br>on a suitable connector | Frequency: 10 ~ 55 Hz<br>Amplitude: 0.75 mm<br>Duration: 20 cycles in each direction.                                                        |       |                            |       | 3 directions    |
| Shock (IEC 68-2-27)<br>Half-sine pulse shape                               | Pulse duration : 11 ms<br>Peak acceleration: 981 m/s <sup>2</sup> = 100g<br>Number of shocks : 3 shocks in 3<br>mutually perpendicular axes. |       |                            |       | 3 directions    |





## 5. Electrical Specifications

### 5.1 Typical Electrical Characteristics

At  $T_a = 25\text{ }^{\circ}\text{C}$ ,  $V_{DD} = 5V \pm 5\%$ ,  $V_{SS} = 0V$ .

Table 5

| Parameter                                            | Symbol                     | Conditions                                                                                | Min. | Typ. | Max.     | Unit |
|------------------------------------------------------|----------------------------|-------------------------------------------------------------------------------------------|------|------|----------|------|
| Supply voltage (Logic)                               | $V_{DD}-V_{SS}$            |                                                                                           | 4.75 | 5.00 | 5.25     | V    |
| Supply voltage (LCD)                                 | $V_{LCD}$<br>$=V_{DD}-V_0$ | $V_{DD} = 5.0V$ ,<br>Note1.                                                               | 4.1  | 4.5  | 4.9      | V    |
| Input signal voltage<br>for E,DB0-DB7,R/W,RS.        | $V_{IH}$                   | "H" level                                                                                 | 2.2  | -    | $V_{DD}$ | V    |
|                                                      | $V_{IL}$                   | "L" level                                                                                 | -0.3 | -    | 0.8      | V    |
| Supply Current<br>(Logic & LCD)                      | $I_{DD}$                   | Character mode,<br>Note 1                                                                 | -    | 1.4  | 2.1      | mA   |
| Supply Current (LCD)                                 | $I_0$                      | Character mode,<br>Note 1                                                                 | -    | 1.0  | 1.5      | mA   |
| Supply Voltage of<br>yellow-green LED04<br>backlight | $V_{LED04}$                | Forward current<br>$=170\text{ mA}$<br><br>No. of LED<br>chips<br>$=2 \times 17$<br>$=34$ | 3.9  | 4.1  | 4.3      | V    |

Note (1) : There is tolerance in optimum LCD driving voltage during production and it will be within the specified range.



## 5.2 Timing Specifications

At  $T_a = 0\text{ }^{\circ}\text{C}$  To  $+50\text{ }^{\circ}\text{C}$  ,  $V_{DD} = +5V \pm 5\%$ ,  $V_{SS} = 0V$ .

Refer to Fig. 3, the bus timing diagram for write mode.

Table 6

| Parameter                       | Symbol     | Min. | Max. | Unit | Remarks              |
|---------------------------------|------------|------|------|------|----------------------|
| Enable cycle time               | $t_{CYCE}$ | 500  | -    | ns   |                      |
| Enable "High" level pulse width | $t_{WHE}$  | 300  | -    | ns   |                      |
| Enable rise time                | $t_{RE}$   | -    | 25   | ns   |                      |
| Enable fall time                | $t_{FE}$   | -    | 25   | ns   |                      |
| RS, R/W set-up time             | $t_{AS}$   | 60   | -    | ns   | 8-bit operation mode |
|                                 |            | 100  |      |      | 4-bit operation mode |
| RS, R/W address hold time       | $t_{AH}$   | 10   | -    | ns   |                      |
| Data output delay               | $t_{DS}$   | 100  | -    | ns   |                      |
| Data hold time                  | $t_{DHR}$  | 10   | -    | ns   |                      |

Refer to Fig. 4, the bus timing diagram for read mode .

Table 7

| Parameter                       | Symbol     | Min. | Max. | Unit | Remarks              |
|---------------------------------|------------|------|------|------|----------------------|
| Enable cycle time               | $t_{CYCE}$ | 500  | -    | ns   |                      |
| Enable "High" level pulse width | $t_{WHE}$  | 300  | -    | ns   |                      |
| Enable rise time                | $t_{RE}$   | -    | 25   | ns   |                      |
| Enable fall time                | $t_{FE}$   | -    | 25   | ns   |                      |
| RS, R/W set-up time             | $t_{AS}$   | 60   | -    | ns   | 8-bit operation mode |
|                                 |            | 100  |      |      | 4-bit operation mode |
| RS, R/W address hold time       | $t_{AH}$   | 10   | -    | ns   |                      |
| Read data output delay          | $t_{RD}$   | -    | 190  | ns   |                      |
| Read data hold time             | $t_{DHR}$  | 20   | -    | ns   |                      |

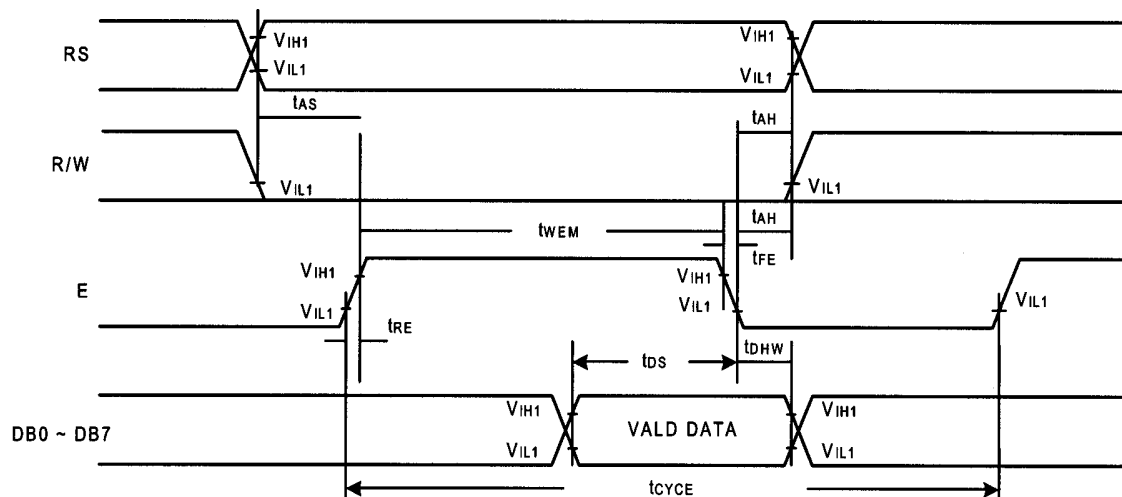
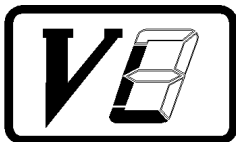


Figure 3: Bus write operation sequence (Writing data from MPU to NT3881).

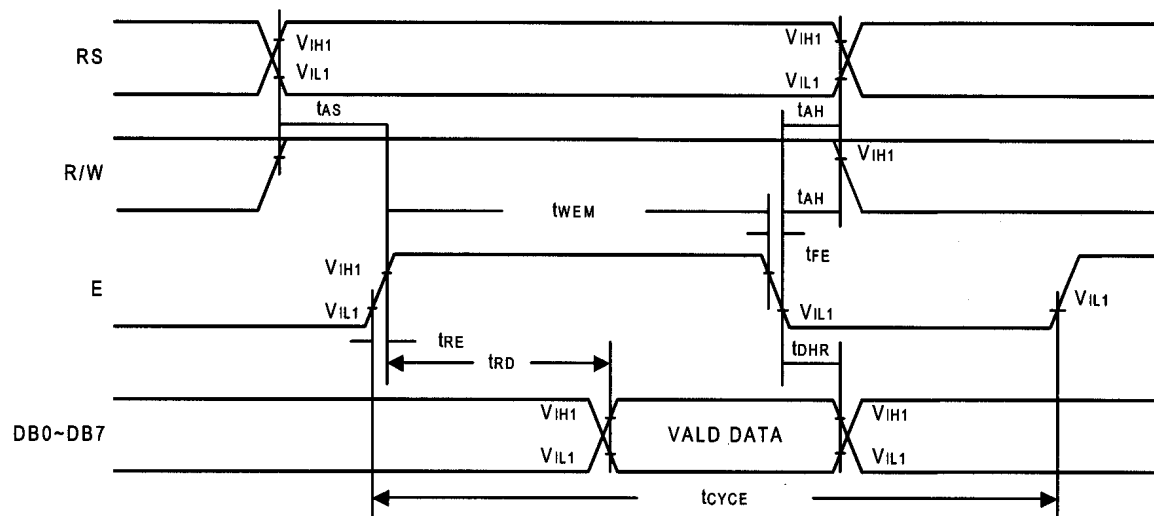
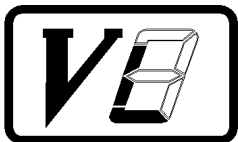


Figure 4: Bus read operation sequence (Reading out data from NT3881 to MPU).



### 5.3 Timing Diagram of VDD against V0.

Power on sequence shall meet the requirement of Figure 5, the timing diagram of VDD against V0.

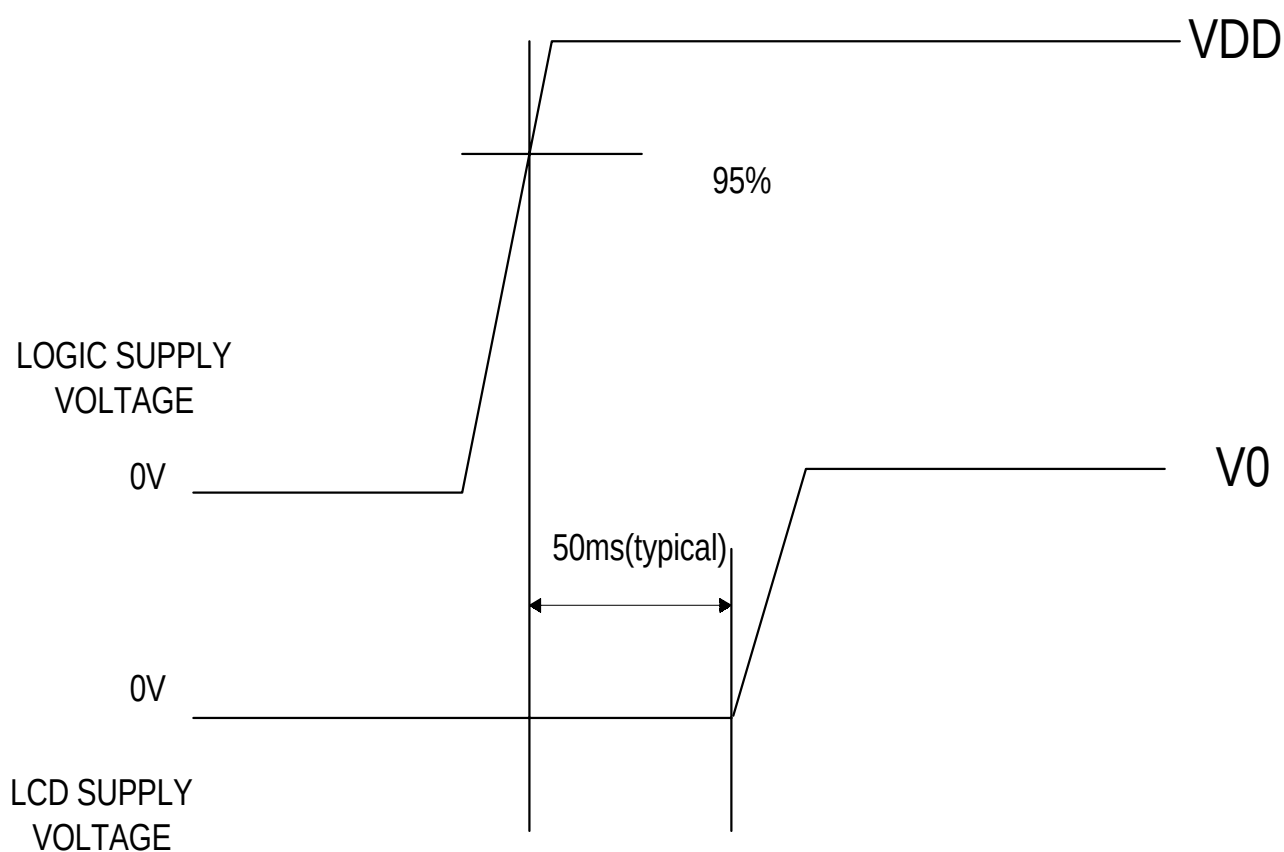
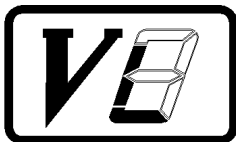


Figure 5: Timing diagram of VDD against V0.



#### 5.4 Correspondence between Character Codes and Character Patterns (NOVATEK Standard NT3881D-01)

|                                                        |   | Higher 4-bit (D4 to D7) of Character Code (Hexadecimal) |   |    |   |   |   |   |   |   |   |   |   |   |   |   |   |
|--------------------------------------------------------|---|---------------------------------------------------------|---|----|---|---|---|---|---|---|---|---|---|---|---|---|---|
|                                                        |   | 0                                                       | 1 | 2  | 3 | 4 | 5 | 6 | 7 | 8 | 9 | A | B | C | D | E | F |
| Lower 4-bit (D0 to D3) of Character Code (Hexadecimal) | 0 | CG<br>RAM<br>(1)                                        |   |    | 0 | 1 | P | ` | P |   |   |   | 一 | 夕 | ミ | α | ρ |
|                                                        | 1 | CG<br>RAM<br>(2)                                        |   | !  | 1 | A | Q | a | q |   |   | 。 | ア | チ | △ | Δ | q |
|                                                        | 2 | CG<br>RAM<br>(3)                                        |   | "  | 2 | B | R | b | r |   |   | 「 | イ | ウ | × | β | θ |
|                                                        | 3 | CG<br>RAM<br>(4)                                        |   | #  | 3 | C | S | c | s |   |   | 」 | ウ | テ | モ | ε | ω |
|                                                        | 4 | CG<br>RAM<br>(5)                                        |   | \$ | 4 | D | T | d | t |   |   | 、 | エ | ト | ヤ | μ | Ω |
|                                                        | 5 | CG<br>RAM<br>(6)                                        |   | %  | 5 | E | U | e | u |   |   | 。 | オ | ナ | 1 | δ | ü |
|                                                        | 6 | CG<br>RAM<br>(7)                                        |   | &  | 6 | F | V | f | v |   |   | ヲ | カ | ニ | ヨ | ρ | Σ |
|                                                        | 7 | CG<br>RAM<br>(8)                                        |   | '  | 7 | G | W | g | w |   |   | フ | キ | ヌ | ラ | g | π |
|                                                        | 8 | CG<br>RAM<br>(1)                                        |   | (  | 8 | H | X | h | x |   |   | イ | ク | ネ | リ | フ | Σ |
|                                                        | 9 | CG<br>RAM<br>(2)                                        |   | )  | 9 | I | Y | i | y |   |   | ウ | ケ | リ | ル | 一 | Y |
|                                                        | A | CG<br>RAM<br>(3)                                        |   | *  | : | J | Z | j | z |   |   | エ | コ | ハ | レ | j | 〒 |
|                                                        | B | CG<br>RAM<br>(4)                                        |   | +  | ; | K | [ | k | [ |   |   | オ | サ | ヒ | ロ | * | 斤 |
|                                                        | C | CG<br>RAM<br>(5)                                        |   | ,  | < | L | ¥ | l | l |   |   | ヤ | シ | フ | ワ | ¢ | 円 |
|                                                        | D | CG<br>RAM<br>(6)                                        |   | -  | = | M | ] | m | ] |   |   | ユ | ズ | へ | ン | も | ÷ |
|                                                        | E | CG<br>RAM<br>(7)                                        |   | .  | > | N | ^ | n | → |   |   | ヨ | セ | ホ | ゝ | ん |   |
|                                                        | F | CG<br>RAM<br>(8)                                        |   | /  | ? | O | _ | o | + |   |   | ッ | リ | マ | ° | ö | ■ |

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