ROHS

# PRODUCT SPECIFICATION

## MONO LCD MODULE
## MODEL:  NCLMG10528

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# 1. Features

The features of LCD are as follows

* Display mode          : FSTN /Transmissive/Negative

* Controller IC         : RA6963C

   Driver    IC        :SDN8080G

* Interface Input Data  : 8-Bit

* Driving Method         : 1/64 Duty, 1/9 Bias

* Viewing Direction     : 6 O'clock

* Backlight             : 5 LED / Red

# 2. MECHANICAL SPECIFICATIONS

| Item | Specification | Unit |
|---|---|---|
| Module Size | 135.6(W) x51.2(H) x 10.9(Max) (T) | mm |
| Number of Dots | 240 x 64 Dots | |
| View display area | 111(W) x34(H) | mm |
| Activity Display Area | 105.56(W)×28.12(H) | mm |
| Dot Size | 0.4(W) x 0.4(H) | mm |
| Dot Pitch | 0.44(W) x 0.44(H) | mm |

# 3. ELECTRICAL SPECIFICATIONS

3-1 ABSOLUTR MAZIMUM RATINGS (Ta = 25 °C)

| Item | Symbol | Standard Value | | | Unit |
|---|---|---|---|---|---|
| | | Min. | Typ. | Max. | |
| Supply Voltage For Logic | $V_{DD} - V_{ss}$ | -0.3 | - | 7 | V |
| Supply Voltage For LCD Drive | $V_{OP} = V_{DD} - V_0$ | 6 | - | 28 | V |
| Input Voltage | Vin | -0.3 | - | $V_{DD}$+0.3 | V |
| Operating Temp. | Top | -20 | - | +70 | °C |
| Storage Temp. | Tst | -30 | - | +80 | °C |

*. NOTE: The response time will be extremely slow when the operating temperature is around -10℃, and the back ground will become darker at high temperature operating.

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3-2 ELECTICAL CHARACTERISTICS

| Item | | Symbol | Test Condition | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|---|
| Logic supply Voltage | | $V_{DD}$ - $V_{SS}$ | VDD=5V±5% Ta = 25 8C | 4.5 | 5 | 5.5 | V |
| LCD Drive | | $V_{OP}$= $V_{DD}$ –$V_0$ | | 12.9 | 13.2 | 13.5 | V |
| Input Voltage | "H" Level | $V_{IH}$ | | VDD-2.2 | - | $V_{DD}$ | V |
| | "L" Level | $V_{IL}$ | | 0 | - | 0.8 | V |
| Frame Frequency | | $f_{FLM}$ | | | 60 | | Hz |
| Current Consumption | | $I_{DD}$ | | - | 24 | - | mA |

3-3. BACKLIGHT
3-3-1. Absolute Maximum Ratings

| Item | Symbol | Condition | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| Forward Voltage | VF | Ta = 25 8C | 2.5 | 2.7 | 2.9 | V |
| Reverse Voltage | VR | | - | - | 4 | V |
| Power Dissipation | PD | | - | - | 400 | mW |

3-3-2. Electrical-optical Characteristics

| Item | Symbol | Condition | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| Forward Current | IF | Vf=2.7V Ta = 25 8C | - | 50 | - | mA |
| Average Luminous Intensity | Iv | | 140 | - | - | cd/m$_2$ |
| Peak Wave Length | $\lambda$ P | | 620 | 625 | 630 | nm |

The brightness is measured without LCD panel

For operation above 25 8C,The Ifm & Pd must be derated , the current derating is -0.36mA/ 8C for  DC  drive and -0.86mA/ 8C for Pulse drive ,the Power dissipation is -0.75mW/ 8C.The product working current must not more than the 60% of the Ifm or Ifp according to the working temperature.

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# 4. TERMINAL FUNCTIONS AND BLOCK DIAGRAM
## 4-1. INTERFACE PIN FUNCTION DESCRIPTION

| No. | Symbol | Function |
|-----|--------|----------|
| 1 | FG | Frame |
| 2 | VSS | Power GND |
| 3 | VDD | Power supply |
| 4 | VEE | Negative voltage of power supply |
| 5 | /WR | Data Write |
| 6 | /RD | Data Read |
| 7 | /CE | Chip enable |
| 8 | C/D | C/D:H  Command C/D:L Data |
| 9 | NC | No connection |
| 10 | /RESET | Reset pin |
| 11-18 | DB0~DB7 | Data I/O pin between MPU and RA6963C |
| 19 | FS | Pin for selection of font |
| 20 | V0 | Extemal bias voltage for LCD driver |
| 21 | LEDA | Backlight（+2.7v） |
| 22 | LEDK | Backlight（-） |

## 4-2. BLOCK DIAGRAM



**Model No.:** NCLMG10528
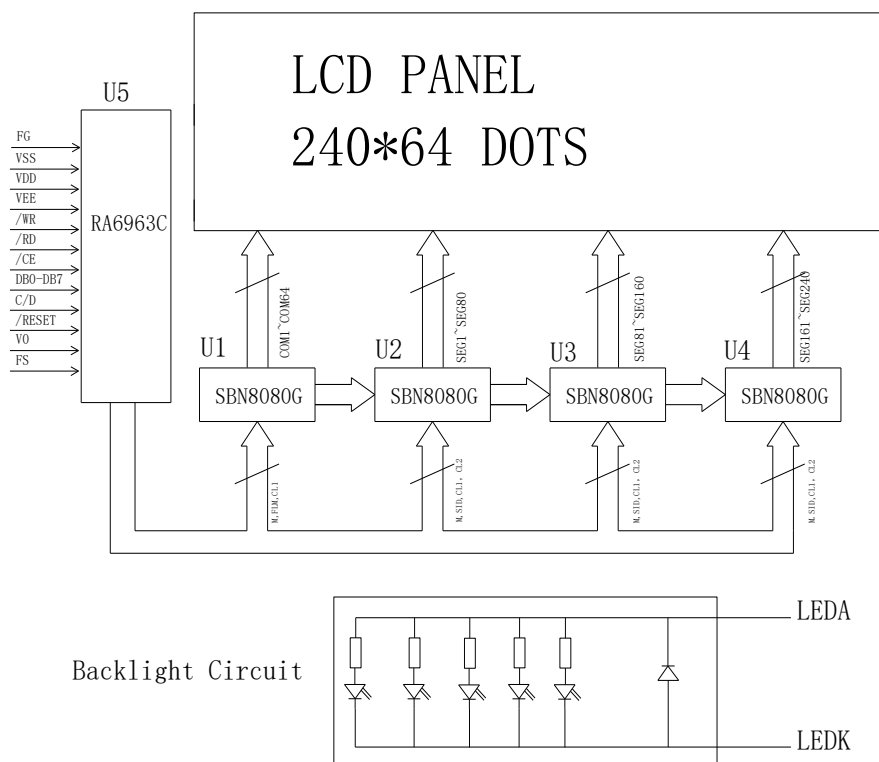
# 5. TIMING CHARACTERISTICS
## 5.1 MPU Interface Timing
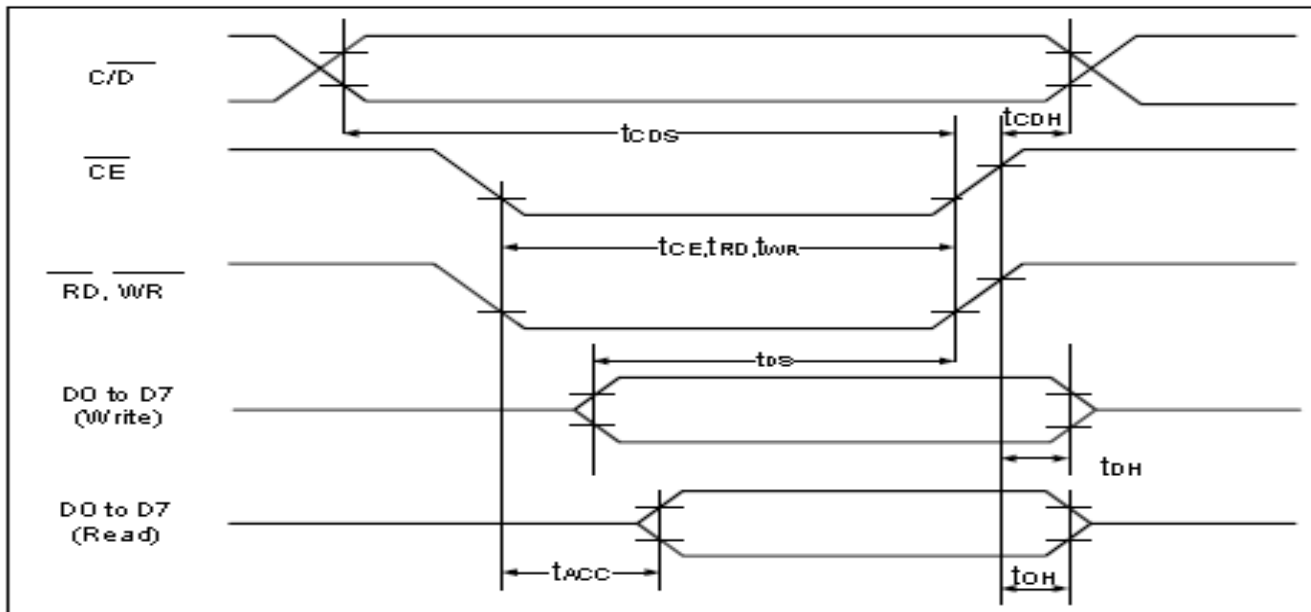


$(V_{DD}=+5V\pm5\%,GND=0V,Ta=-20\ to\ +70℃)$

| Item | Symbol | Test Conditions | Min. | Max. | Unit |
|------|--------|-----------------|------|------|------|
| C/$\overline{D}$ Set Up Time | $t_{CDS}$ | -- | 100 | -- | ns |
| C/$\overline{D}$ Hold Time | $t_{CDH}$ | -- | 10 | -- | ns |
| $\overline{CE}$, $\overline{RD}$, $\overline{WR}$ Pulse Width | $t_{CE}$, $t_{RD}$, $t_{WR}$ | -- | 80 | -- | ns |
| Data Set Up Time | $t_{DS}$ | -- | 80 | -- | ns |
| Data Hold Time | $t_{DH}$ | -- | 40 | -- | ns |
| Access Time | $t_{ACC}$ | -- | -- | 150 | ns |
| Output Hold Time | $t_{OH}$ | -- | 10 | 50 | ns |

## 5.2 Driver Interface Timing
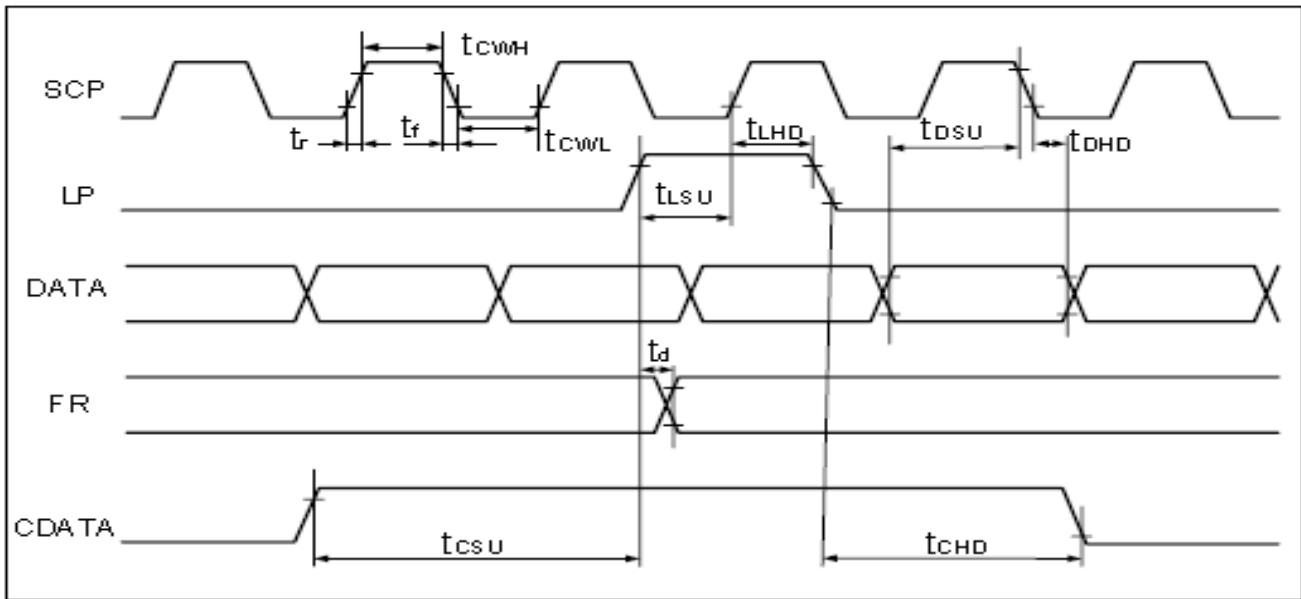
( $V_{DD}$=+5V±5%,GND=0V,Ta= -20 to +70℃ )

| Item | Symbol | Test Conditions | Min. | Max. | Unit |
|---|---|---|---|---|---|
| Operating Frequency | $f_{SCP}$ | Ta = -20~70℃ | — | 2.75 | MHz |
| SCP Pulse Width | $t_{CWH}$, $t_{CWL}$ | -- | 150 | — | ns |
| SCP Rise/Fall Time | $t_r, t_f$ | — | — | 30 | ns |
| LP Setup Time | $t_{LSU}$ | — | 150 | 290 | ns |
| LP Hold Time | $t_{LHD}$ | — | 5 | 40 | ns |
| Data Setup Time | $t_{DSU}$ | — | 170 | — | ns |
| Data Hold Time | $t_{DHD}$ | -- | 80 | — | ns |
| FR Delay Time | $t_d$ | -- | 0 | 90 | ns |
| CDATA Setup Time | $t_{CSU}$ | — | 450 | 850 | ns |
| CDATA Hold Time | $t_{CHD}$ | -- | 450 | 950 | ns |

## 5.3 External Memory Interface

External RAM Read
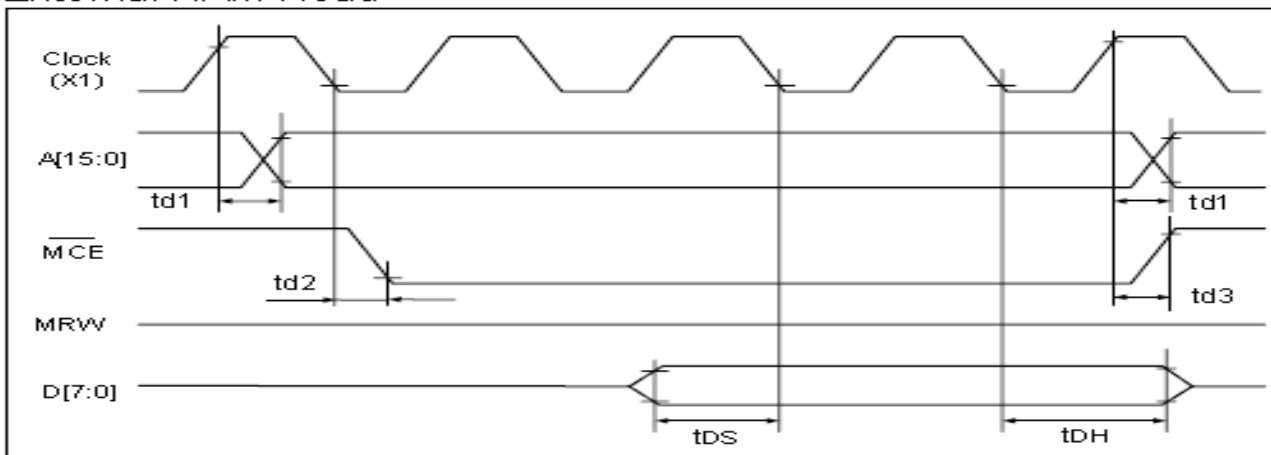
External RAM Write
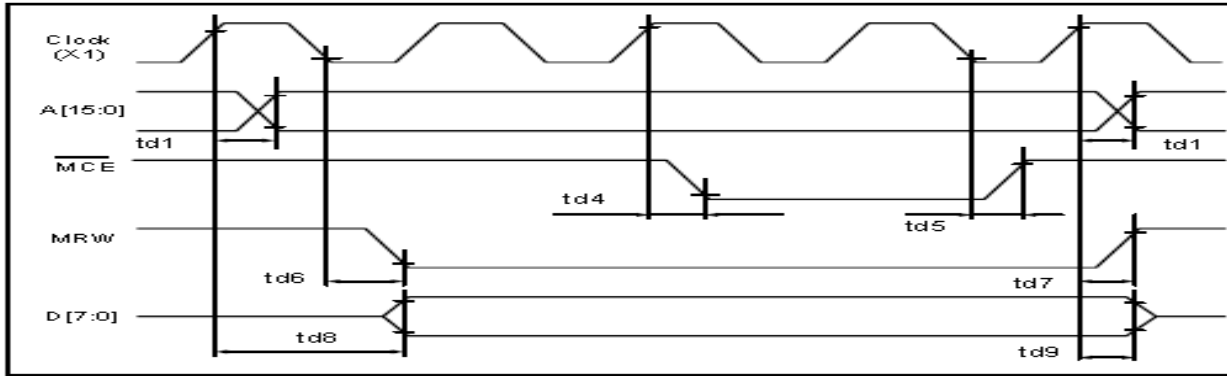


( $V_{DD}$=+5V±5%,GND=0V,Ta= -20 to +70℃ )

| Item | Symbol | Test Conditions | Min. | Max. | Unit |
|---|---|---|---|---|---|
| Address Delay Time | $t_{d1}$ | -- | -- | 250 | ns |
| $\overline{MCE}$ Fall Delay Time(Read) | $t_{d2}$ | -- | -- | 180 | ns |
| $\overline{MCE}$ Rise Delay Time(Read) | $t_{d3}$ | -- | -- | 180 | ns |
| Data Setup Time | $t_{DS}$ | -- | -- | -- | ns |
| Data Hold Time | $t_{DH}$ | -- | -- | -- | ns |
| $\overline{MCE}$ Fall Delay Time(Write) | $t_{d4}$ | -- | -- | 200 | ns |
| $\overline{MCE}$ Rise Delay Time(Write) | $t_{d5}$ | -- | -- | 200 | ns |
| MRW Fall Delay Time | $t_{d6}$ | -- | -- | 180 | ns |
| MRW Rise Delay Time | $t_{d7}$ | -- | -- | 180 | ns |
| Data Stable Time | $t_{d8}$ | -- | -- | 450 | ns |
| Data Hold Time | $t_{d9}$ | -- | -- | 200 | ns |

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# 6. INSTRUCTION SET

| COMMAND | CODE | D1 | D2 | FUNCTION |
|---|---|---|---|---|
| REGISTERS SETTING | 00100001 | X address | Y address | Set Cursor Pointer |
| | 00100010 | Data | 00H | Set Offset Register |
| | 00100100 | Low address | High address | Set Address Pointer |
| SET CONTROL WORD | 01000000 | Low address | High address | Set Text Home Address |
| | 01000001 | Columns | 00H | Set Text Area |
| | 01000010 | Low address | High address | Set Graphic Home Address |
| | 01000011 | Columns | 00H | Set Graphic Area |
| MODE SET | 1000X000 | — | — | OR mode |
| | 1000X001 | — | — | EXOR mode |
| | 1000X011 | — | — | AND mode |
| | 1000X100 | — | — | Text Attribute mode |
| | 10000XXX | — | — | Internal CG ROM mode |
| | 10001XXX | — | — | External CG RAM mode |
| DISPLAY MODE | 10010000 | — | — | Display off |
| | 1001XX10 | — | — | Cursor on, blink off |
| | 1001XX11 | — | — | Cursor on, blink on |
| | 100101XX | — | — | Text on, graphic off |
| | 100110XX | — | — | Text off, graphic on |
| | 100111XX | — | — | Text on, graphic on |
| CURSOR PATTERN SELECT | 10100000 | — | — | 1-line cursor |
| | 10100001 | — | — | 2-line cursor |
| | 10100010 | — | — | 3-line cursor |
| | 10100011 | — | — | 4-line cursor |
| | 10100100 | — | — | 5-line cursor |
| | 10100101 | — | — | 6-line cursor |
| | 10100110 | — | — | 7-line cursor |
| | 10100111 | — | — | 8-line cursor |
| DATA AUTO READ / WRITE | 10110000 | — | — | Set Data Auto Write |
| | 10110001 | — | — | Set Data Auto Read |
| | 10110010 | — | — | Auto Reset |
| DATA READ / WRITE | 11000000 | Data | — | Data Write and Increment ADP |
| | 11000001 | — | — | Data Read and Increment ADP |
| | 11000010 | Data | — | Data Write and Decrement ADP |
| | 11000011 | — | — | Data Read and Decrement ADP |
| | 11000100 | Data | — | Data Write and Nonvariable ADP |
| | 11000101 | — | — | Data Read and Nonvariable ADP |
| SCREEN PEEK | 11100000 | — | — | Screen Peek |
| SCREEN COPY | 11101000 | | | Screen Copy |

X : invalid

| COMMAND | CODE | D1 | D2 | FUNCTION |
|---|---|---|---|---|
| BIT SET / RESET | 11110XXX | — | — | Bit Reset |
| | 11111XXX | — | — | Bit Set |
| | 1111X000 | — | — | Bit 0 (LSB) |
| | 1111X001 | — | — | Bit 1 |
| | 1111X010 | — | — | Bit 2 |
| | 1111X011 | — | — | Bit 3 |
| | 1111X100 | — | — | Bit 4 |
| | 1111X101 | — | — | Bit 5 |
| | 1111X110 | — | — | Bit 6 |
| | 1111X111 | — | — | Bit 7 (MSB) |

X : invalid

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# 7. HANDLING PRECAUTION

(1) Mounting Method

The panel of the LCD Module consists of two thin glass plates with polarizers which easily get damaged since the Module is fixed by utilizing fitting holes in the printed circuit board. Extreme care should be taken when handling the LCD Modules.

(2) Caution of LCD handling & cleaning

When cleaning the display surface, use soft cloth with solvent (recommended below) and wipe lightly.
- Isopropyl alcohol
- Ethyl alcohol
- Trichloro trifloro thane

Do not wipe the display surface with dry or hard materials that will damage the polarizer surface.
Do not use the following solvent:
- Water
- Ketone
- Aromatics

(3) Caution against static charge

The LCD Module use C-MOS LSI drivers, so we recommend that you connect any unused input terminal to VDD or VSS, do not input any signals before power is turned on. And ground your body, Work/assembly table. And assembly equipment to protect against static electricity.

(4) Packaging

- Modules use LCD elements, and must be treated as such. Avoid intense shock and falls from a height.
- To prevent modules from degradation. Do not operate or store them exposed directly to sunshine or high temperature/humidity.

(5) Caution for operation

- It is indispensable to drive LCD's within the specified voltage limit since the higher voltage than the limit shorten LCD life. An electrochemical reaction due to direct current causes LCD deterioration, Avoid the use of direct current drive.
- Response time will be extremely delayed at lower temperature than the operating temperature range and on the other hand at higher temperature LCD's show dark color in them.However those phenomena do not mean malfunction or out of order with LCD's. Which will come back in the specified operating temperature range.
- If the display area is pushed hard during operation, some font will be abnormally displayed but it resumes normal condition after turning off once.
- A slight dew depositing on terminals is a cause for electro-chemical reaction resulting in terminal open circuit.

Usage under the relative condition of 40°C, 50%RH or less is reequired.

(6) Storage

In the case of storing for a long period of time (for instance.) For years) for the purpose or replacement use, The following ways are recommended.
- Storage in a polyethylene bag with sealed so as not to enter fresh air outside in it, And with no desiccant.
- Placing in a dark place where neither exposure to direct sunlight nor light is. Keeping temperature in the specified storage temperature range.
- Storing with no touch on polarizer surface by the anything else. (It is recommended to store them as they have been contained in the inner container at the time of delivery)
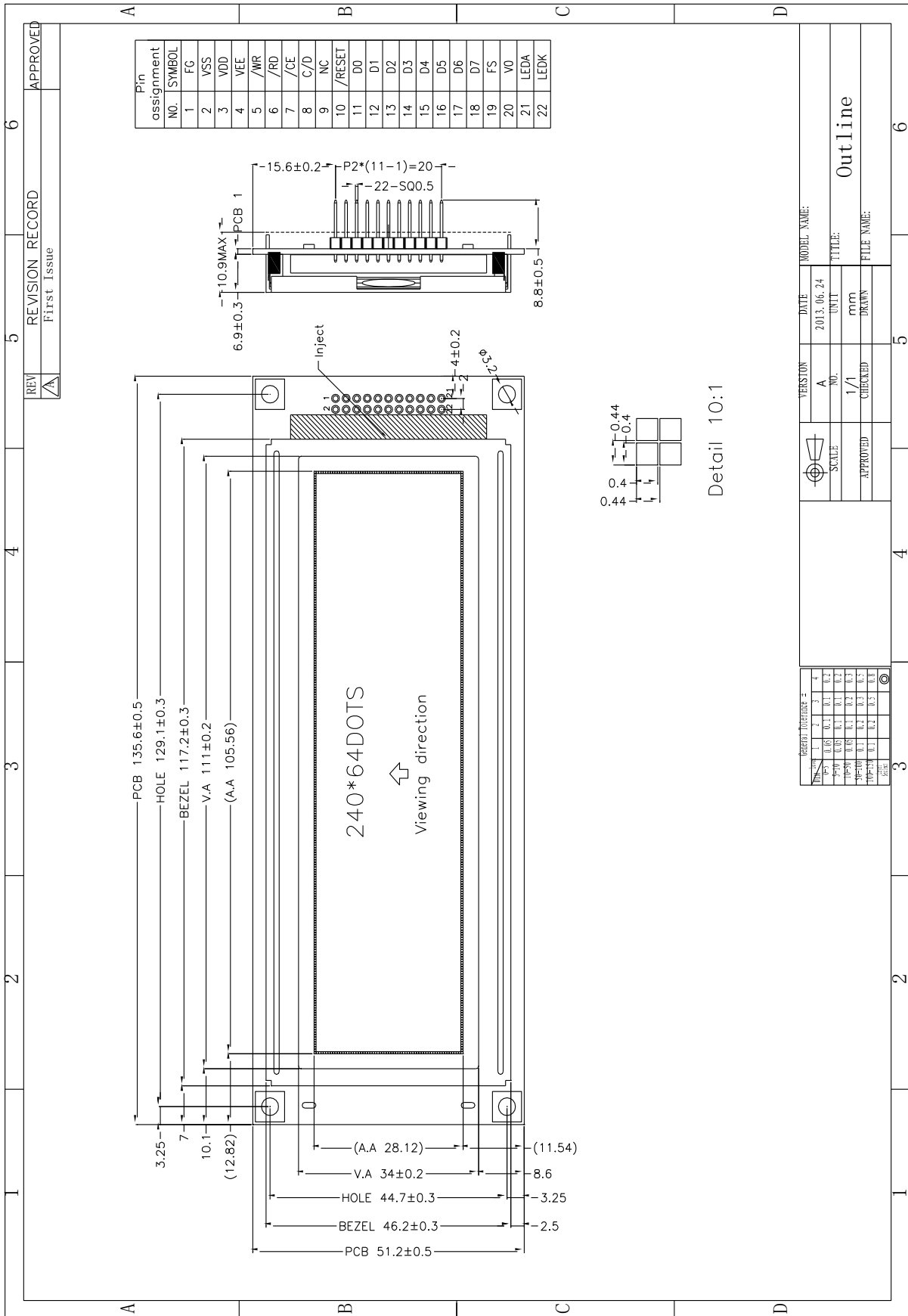
(7) Safety

- It is recommendable to crash damaged or unnecessary LCD into pieces and wash off liquid crystal by using solvents such as acetone and ethanol.

Which should be burned up later.

When any liquid crystal leaked out of a damaged glass cell comes in contact with your

hands, please wash it off well with soap and water.

# 8. OUTLINE DIMENSION



Pin assignment

| NO. | SYMBOL |
|---|---|
| 1 | FG |
| 2 | VSS |
| 3 | VDD |
| 4 | VEE |
| 5 | /WR |
| 6 | /RD |
| 7 | /CE |
| 8 | C/D |
| 9 | NC |
| 10 | /RESET |
| 11 | D0 |
| 12 | D1 |
| 13 | D2 |
| 14 | D3 |
| 15 | D4 |
| 16 | D5 |
| 17 | D6 |
| 18 | D7 |
| 19 | FS |
| 20 | V0 |
| 21 | LEDA |
| 22 | LEDK |

240*64DOTS

Viewing direction

PCB 135.6±0.5
HOLE 129.1±0.3
BEZEL 117.2±0.3
V.A 111±0.2
(A.A 105.56)

−15.6±0.2− P2*(11−1)=20
−22−SQ0.5
10.9MAX
6.9±0.3
8.8±0.5

Inject
4±0.2

Detail 10:1
0.44
0.4
0.4
0.44

3.25
7
10.1
(12.82)
(A.A 28.12)
V.A 34±0.2
HOLE 44.7±0.3
BEZEL 46.2±0.3
PCB 51.2±0.5
(11.54)
8.6
3.25
2.5

REVISION RECORD
REV
First Issue
APPROVED

MODEL NAME:
TITLE: Outline
FILE NAME:
DATE 2013.06.24
UNIT mm
DRAWN
CHECKED
APPROVED
VERSION A
NO. 1/1
SCALE

**Model No.:** NCLMG10528