

|                   |            |                      |            |
|-------------------|------------|----------------------|------------|
| MC21603A6W-SPR-V2 | 2 x 16     | 3mm Character Height | LCD Module |
| Specification     |            |                      |            |
| Version: 1        |            | Date: 28/10/2020     |            |
| Revision          |            |                      |            |
| 1                 | 26/10/2020 | First Issue          |            |

| Display Features      |                        |  |                  |
|-----------------------|------------------------|--------------------------------------------------------------------------------------|------------------|
| Character Count       | 2 x 16                 |                                                                                      |                  |
| Appearance            | Black on Yellow/Green  |                                                                                      |                  |
| Logic Voltage         | 5V                     |                                                                                      |                  |
| Interface             | Parallel               |                                                                                      |                  |
| Font Set              | English / Japanese     |                                                                                      |                  |
| Display Mode          | Reflective             |                                                                                      |                  |
| Character Height      | 3.15mm                 |                                                                                      |                  |
| LC Type               | STN                    |                                                                                      |                  |
| Module Size           | 53.00 x 20.00 x 8.00mm |                                                                                      |                  |
| Operating Temperature | -20°C ~ +70°C          |                                                                                      |                  |
| Construction          | COB                    |                                                                                      |                  |
| LED Backlight         | ---                    |                                                                                      |                  |
|                       |                        | Box Quantity                                                                         | Weight / Display |
|                       |                        | ---                                                                                  | ---              |

\* - For full design functionality, please use this specification in conjunction with the ST7066U specification. (Provided Separately)

| Display Accessories |                                  |
|---------------------|----------------------------------|
| Part Number         | Description                      |
| MDC16-1-BC          | 16 way connector with 1mm pitch. |
|                     |                                  |
|                     |                                  |

| Optional Variants |             |         |
|-------------------|-------------|---------|
| Fonts             | Appearances | Voltage |
|                   |             |         |
|                   |             |         |
|                   |             |         |



## 1. FUNCTIONS & FEATURES

- MC21603A6W-SPR-V2 Series LCD type :
- Viewing Direction : 6 O'clock
- Driving Scheme : 1/16 Duty, 1/5 Bias
- Power Supply Voltage : 5.0V
- LCD Operation Voltage : 4.6V
- Display contents : 16 Characters x 2 line
- Internal Memory : CGROM (13200bits )  
: CGRAM (64 x 8bits)  
: DDRAM (80 x 8 bits for Digits)  
: CGROM of the ST7066U-0A
- CGROM
- 8-Bit Parallel
- RoHS Compliant

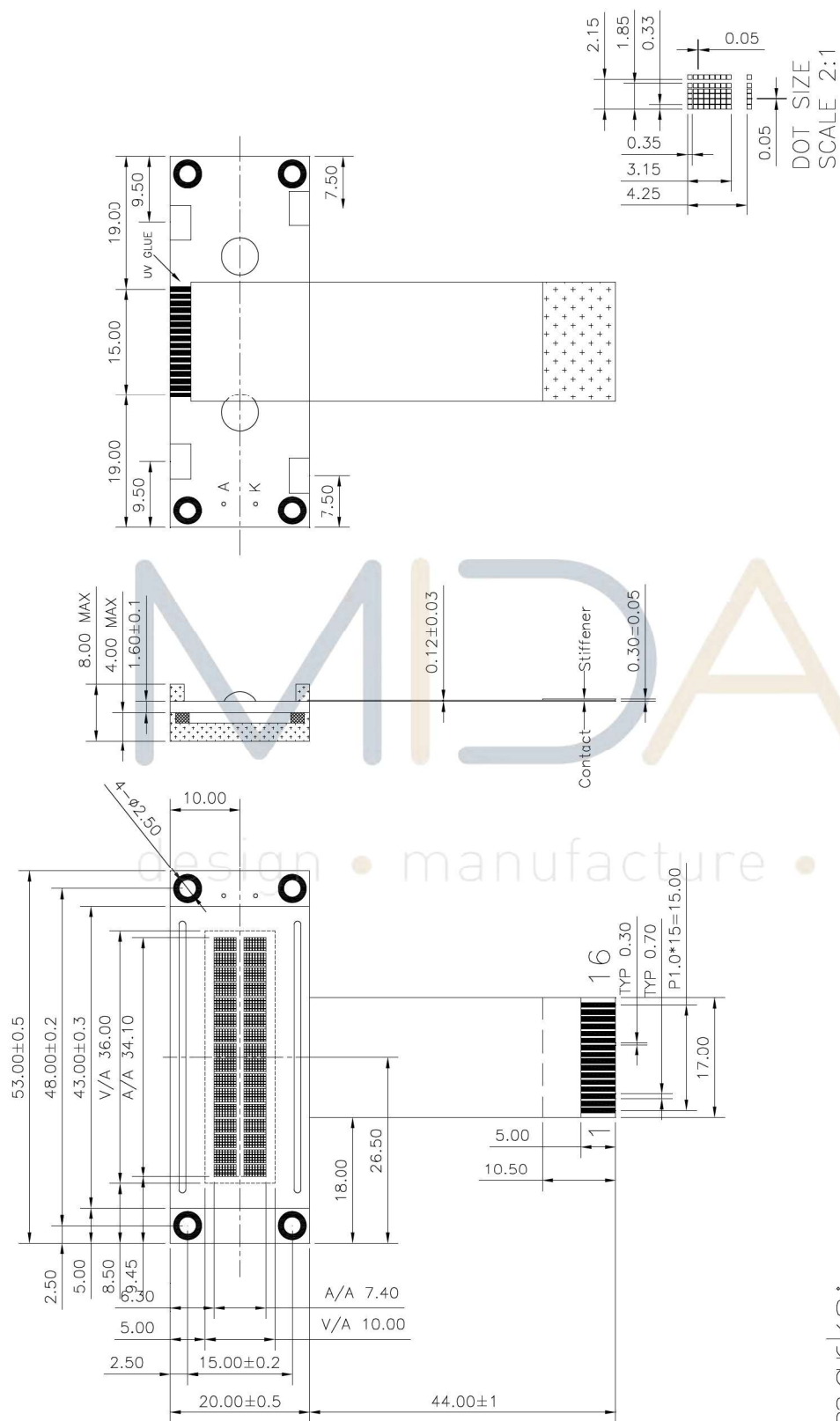
## 2. MECHANICAL SPECIFICATIONS

- Module Size : 53.00(L) x 20.00(W) x 8.00(H)mm
- Viewing area : 36.00(L) x 10.00 (W) mm
- Active area : 34.10(L) x 7.40(W) mm
- Dot Size : 0.33 (L) x 0.35 (W) mm
- Dot Gap : 0.05mm

design • manufacture • supply



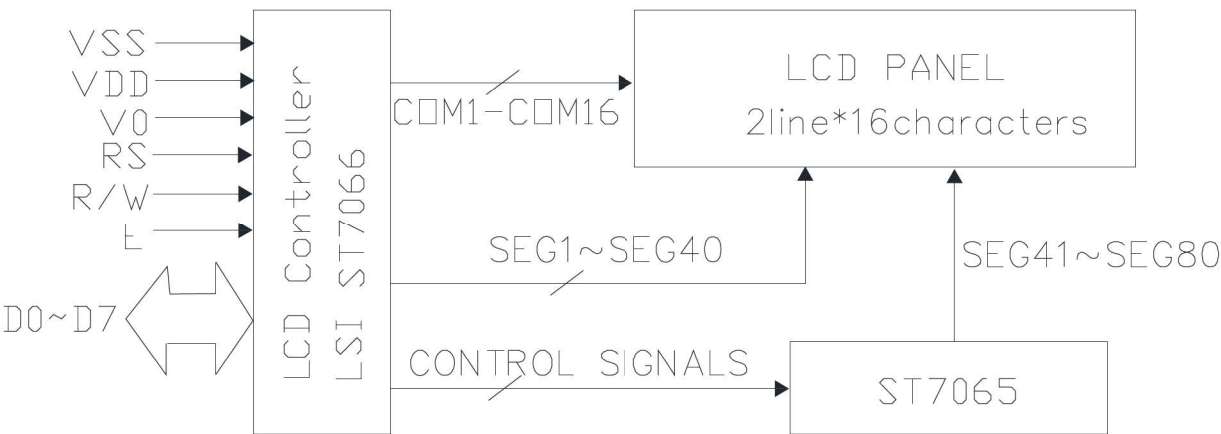
## EXTERNAL DIMENSIONS



Remarks:

1. Unmarked tolerance is  $\pm 0.3$
2. All materials comply with RoHs
3.  ...:critical dimension.

BLOCK DIAGRAM



PIN ASSIGNMENT

| Pin No. | Symbol | Function                           |
|---------|--------|------------------------------------|
| 1       | VSS    | Ground                             |
| 2       | VDD    | Supply Voltage for logic           |
| 3       | V0     | Operating voltage for LCD          |
| 4       | RS     | H:DATA,L:instruction code          |
| 5       | R/W    | H:Read(Module→MPU) L: (MPU→Module) |
| 6       | E      | Chip enable signal                 |
| 7       | DB0    | Date bus line                      |
| 8       | DB1    |                                    |
| 9       | DB2    |                                    |
| 10      | DB3    |                                    |
| 11      | DB4    |                                    |
| 12      | DB5    |                                    |
| 13      | DB6    |                                    |
| 14      | DB7    |                                    |
| 15      | A      | NC                                 |
| 16      | K      | NC                                 |

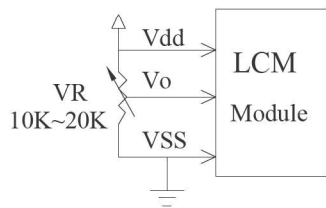
### MAXIMUM ABSOLUTE POWER RATINGS

| Item                     | Symbol    | Standard value       | Unit |
|--------------------------|-----------|----------------------|------|
| Supply voltage for logic | $V_{DD}$  | -0.3~+7.0            | V    |
| Supply voltage for LCD   | $V_{LCD}$ | -0.3~10 $V_{CC}+0.3$ | V    |
| Input voltage            | $V_{IN}$  | 0.3~ $V_{CC}+0.3$    | V    |
| Operating temperature    | $T_{opr}$ | -20~+70              | °C   |
| Storage temperature      | $T_{stg}$ | -30~+80              | °C   |

### DC CHARACTERISTICS

| Item                            | Symbol          | Standard Value |     |          | Test Condition | Unit |
|---------------------------------|-----------------|----------------|-----|----------|----------------|------|
|                                 |                 | MIN            | TYP | MAX      |                |      |
| Supply Voltage For Logic        | $V_{DD}-V_{SS}$ | —              | 5.0 | —        | —              | V    |
| Supply Voltage For LCD<br>*Note | $V_{DD}-V_0$    | —              | —   | —        | —              | V    |
|                                 |                 | —              | 4.6 | —        |                | V    |
|                                 |                 | —              | —   | —        |                | V    |
| Input High Volt.                | $V_{IH}$        | 0.7 $V_{DD}$   | —   | $V_{DD}$ | —              | V    |
| Input Low Volt.                 | $V_{IL}$        | -0.3           | —   | 0.6      | —              | V    |
| Output High Volt.               | $V_{OH}$        | 3.9            | —   | $V_{DD}$ | —              | V    |
| Output Low Volt.                | $V_{OL}$        | 0              | —   | 0.4      | —              | V    |
| Supply Current                  | $I_{DD}$        | 1.0            | 1.2 | 1.5      | $V_{DD}=5.0V$  | mA   |

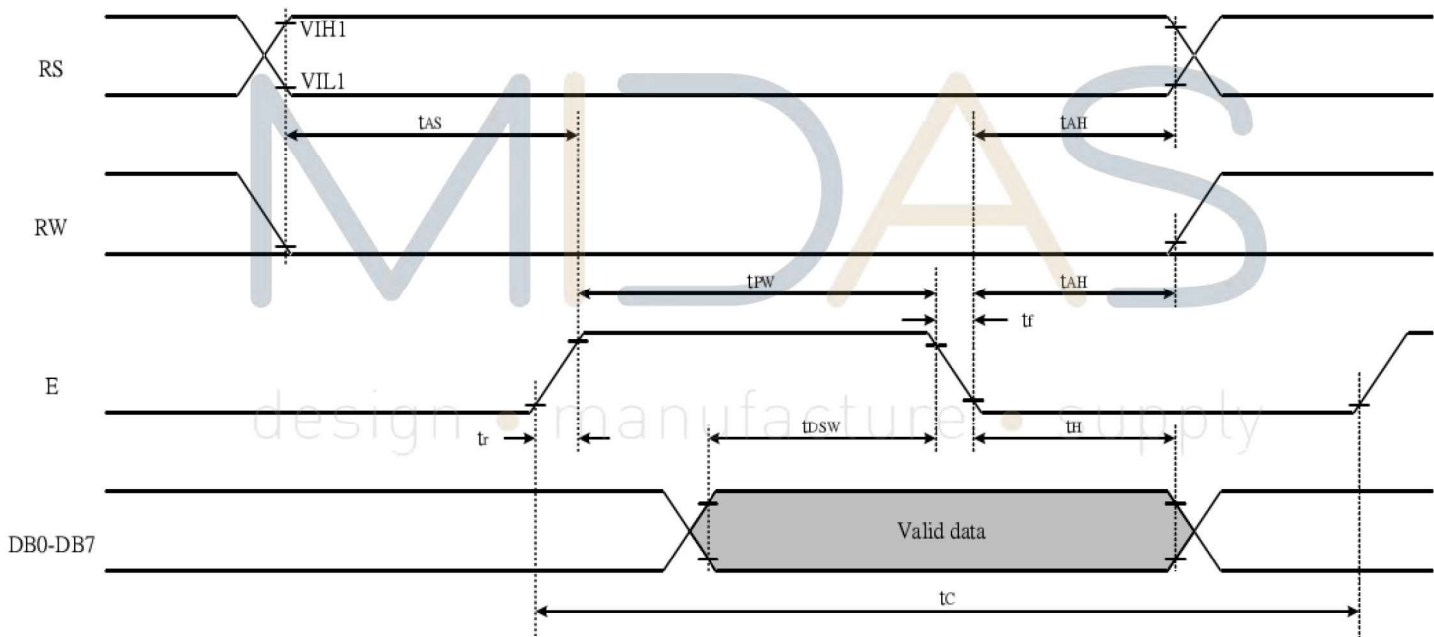
\* Note: Please design the VOP adjustment circuit on customer's main board



# AC CHARACTERISTICS

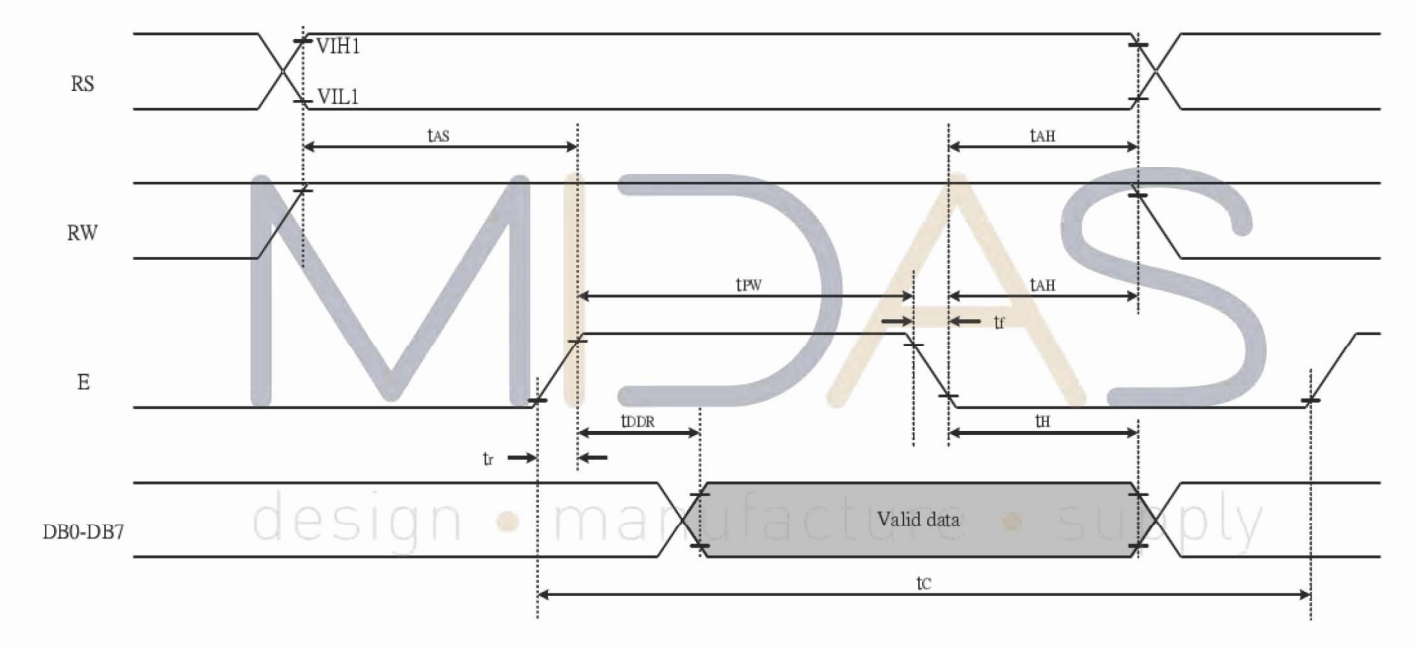
## 1. Write mode

| Characteristic        | Symbol     | Min  | Type | Max | Unit | Test PIN |
|-----------------------|------------|------|------|-----|------|----------|
| Enable Cycle Time     | $t_C$      | 1200 | ---  | --- | ns   | E        |
| Enable Pulse Time     | $T_{PW}$   | 140  | ---  | --- | ns   | E        |
| Enable Rise/Fall Time | $T_R, T_F$ | ---  | ---  | 25  | ns   | E        |
| Address Set-up Time   | $T_{AS}$   | 0    | ---  | --- | ns   | RW,RS,E  |
| Address Hold Time     | $T_{AH}$   | 10   | ---  | --- | ns   | RW,RS,E  |
| Data Set-up Time      | $T_{DSW}$  | 40   | ---  | --- | ns   | DB0~DB7  |
| Data Hold Time        | $T_H$      | 10   | ---  | --- | ns   | DB0~DB7  |



2. Read Mode

| Characteristic        | Symbol     | Min  | Type | Max | Unit | Test PIN |
|-----------------------|------------|------|------|-----|------|----------|
| Enable Cycle Time     | $t_C$      | 1200 | ---  | --- | ns   | E        |
| Enable Pulse Time     | $T_{PW}$   | 140  | ---  | --- | ns   | E        |
| Enable Rise/Fall Time | $T_R, T_F$ | ---  | ---  | 25  | ns   | E        |
| Address Set-up Time   | $T_{AS}$   | 0    | ---  | --- | ns   | RW,RS,E  |
| Address Hold Time     | $T_{AH}$   | 10   | ---  | --- | ns   | RW,RS,E  |
| Data Set-up Time      | $T_{DDR}$  | ---  | ---  | 100 | ns   | DB0~DB7  |
| Data Hold Time        | $T_H$      | 10   | ---  | --- | ns   | DB0~DB7  |



# STANDARD CHARACTER PATTERN (ST7066U-0A)

NO.7066-0A

| b7-b4<br>b3-b0 |                  | 0000 | 0001 | 0010 | 0011 | 0100 | 0101 | 0110 | 0111 | 1000 | 1001 | 1010 | 1011 | 1100 | 1101 | 1110 | 1111 |
|----------------|------------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| 0000           | CG<br>RAM<br>(1) |      |      |      | 0    | a    | P    | ^    | P    |      |      |      | -    | 9    | 3    | 0    | P    |
| 0001           | (2)              |      |      | !    | 1    | A    | Q    | a    | 4    |      |      | .    | 7    | 7    | 4    | 3    | q    |
| 0010           | (3)              |      |      | "    | 2    | B    | R    | b    | r    |      |      | "    | 4    | W    | X    | P    | @    |
| 0011           | (4)              |      |      | #    | 3    | C    | S    | c    | s    |      |      | 1    | 0    | 7    | E    | 0    | *    |
| 0100           | (5)              |      |      | \$   | 4    | D    | T    | d    | t    |      |      | \    | I    | t    | P    | μ    | 0    |
| 0101           | (6)              |      |      | %    | 5    | E    | U    | e    | u    |      |      | *    | 7    | 7    | 7    | 7    | 0    |
| 0110           | (7)              |      |      | &    | 6    | F    | V    | f    | v    |      |      | 9    | 0    | =    | 9    | 0    | Σ    |
| 0111           | (8)              |      |      | *    | 7    | G    | W    | g    | w    |      |      | 7    | 7    | X    | 9    | g    | π    |
| 1000           | (1)              |      |      | <    | 8    | H    | X    | h    | x    |      |      | 4    | 0    | *    | U    | r    | X    |
| 1001           | (2)              |      |      | >    | 9    | I    | Y    | i    | y    |      |      | 0    | 7    | 7    | U    | 7    | y    |
| 1010           | (3)              |      |      | *    | *    | J    | Z    | j    | z    |      |      | =    | 0    | 0    | U    | j    | *    |
| 1011           | (4)              |      |      | +    | *    | K    | L    | k    | l    |      |      | *    | 9    | E    | 0    | *    | π    |
| 1100           | (5)              |      |      | ,    | <    | L    | *    | 1    | 1    |      |      | 7    | 9    | 7    | 7    | 0    | π    |
| 1101           | (6)              |      |      | -    | =    | N    | I    | n    | 7    |      |      | u    | Σ    | 7    | U    | 7    | ÷    |
| 1110           | (7)              |      |      | .    | >    | N    | ^    | n    | *    |      |      | 0    | E    | 0    | 7    | π    |      |
| 1111           | (8)              |      |      | /    | ?    | 0    | L    | 0    | 0    |      |      | 0    | U    | 7    | 7    | 0    | ■    |

## INSTRUCTION TABLE

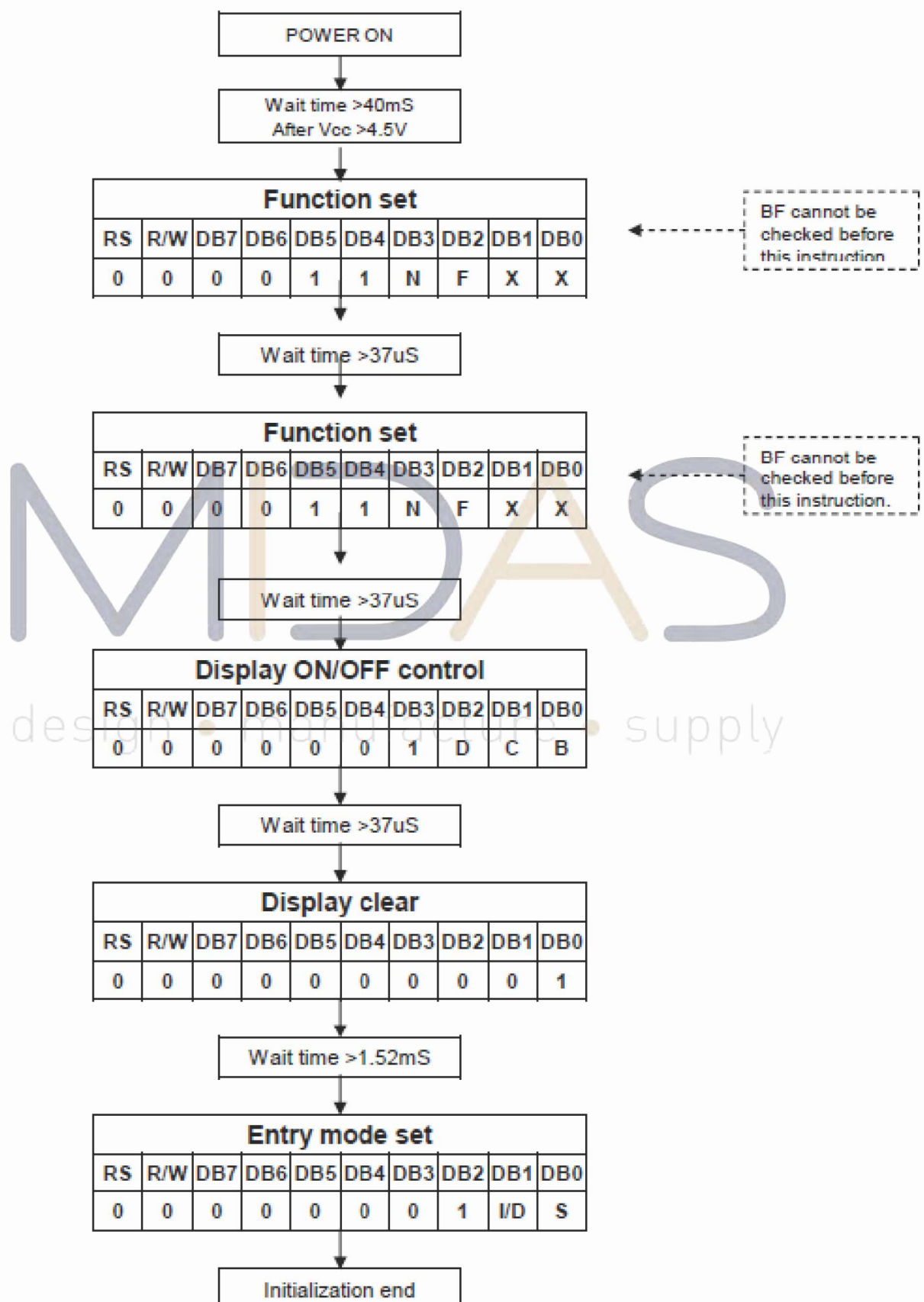
| Command                 | RS | R/W | DB7 | DB6 | DB5 | DB4 | DB3 | DB2 | DB1 | DB0 | Execution time<br>(fosc=270KHz) | Remark                                                                                                                           |
|-------------------------|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|---------------------------------|----------------------------------------------------------------------------------------------------------------------------------|
| Clear Display           | 0  | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 1   | 1.52ms                          | Write "20H" to DDRAM. And set DDRAM address to "00H" from AC                                                                     |
| Return home             | 0  | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 1   | x   | 1.52ms                          | Set DDRAM address to "00H" from AC and return cursor to its original position if shifted. The contents of DDRAM are not changed. |
| Entry mode Set          | 0  | 0   | 0   | 0   | 0   | 0   | 0   | 1   | I/D | S   | 37us                            | Sets cursor move direction and specifies display shift. These operations are performed during data write and read.               |
| Display on/off control  | 0  | 0   | 0   | 0   | 0   | 0   | 1   | D   | C   | B   | 37us                            | D=1: entire display on<br>C=1: cursor on<br>B=1: cursor position on                                                              |
| Cursor or Display Shift | 0  | 0   | 0   | 0   | 0   | 1   | S/C | R/L | x   | x   | 37us                            | Set cursor moving and display shift control bit, and the direction, without changing DDRAM data.                                 |
| function Set            | 0  | 0   | 0   | 0   | 1   | DL  | N   | F   | x   | x   | 37us                            | DL: interface data is 8/4 bits<br>N: number of line is 2/1<br>F: font size is 5x11/5x8                                           |
| Set CGRAM address       | 0  | 0   | 0   | 1   | AC5 | AC4 | AC3 | AC2 | AC1 | AC0 | 37us                            | Set CGRAM address in address counter                                                                                             |
| Set DDRAM address       | 0  | 0   | 1   | AC6 | AC5 | AC4 | AC3 | AC2 | AC1 | AC0 | 37us                            | Set DDRAM address in address counter                                                                                             |
| Read busy flag& address | 0  | 1   | BF  | AC6 | AC5 | AC4 | AC3 | AC2 | AC1 | AC0 | 0us                             | Whether during internal operation or not can be known by reading BF. The contents of address counter can also be read.           |
| Write data to RAM       | 1  | 0   | D7  | D6  | D5  | D4  | D3  | D2  | D1  | D0  | 37us                            | Write data into internal RAM (DDRAM/CGRAM)                                                                                       |
| Read data from RAM      | 1  | 1   | D7  | D6  | D5  | D4  | D3  | D2  | D1  | D0  | 37us                            | Read data from internal RAM (DDRAM / CGRAM)                                                                                      |

### Note:

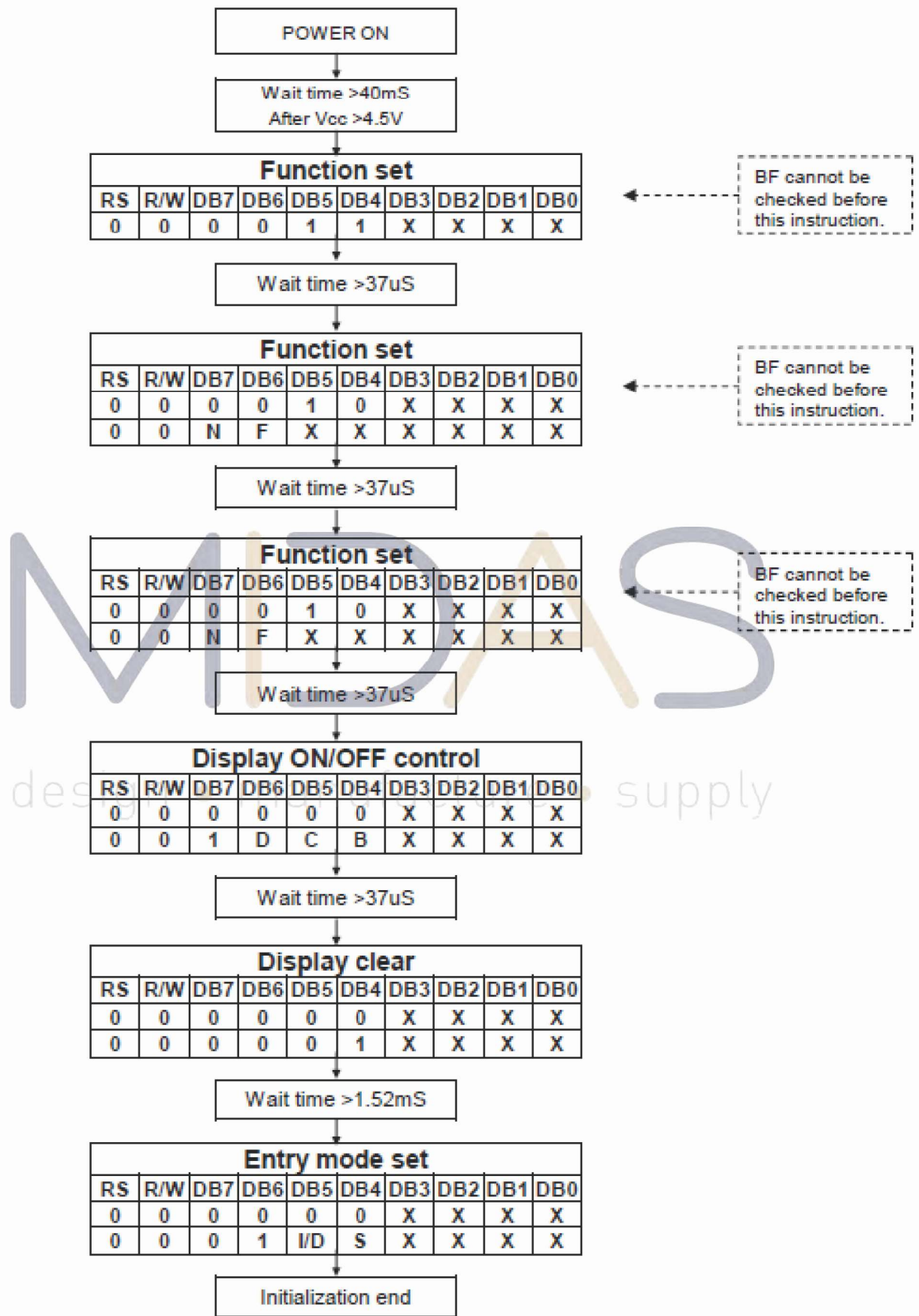
Be sure the ST7066U is not in the busy state (BF=00) before sending an instruction from the MPU to the ST7066U. If an instruction is sent without checking the busy flag, the time between the first instruction and next instruction will take much longer than the instruction time itself. Refer to instruction table for the list of each instruction execution time.

## RESET FUNCTION

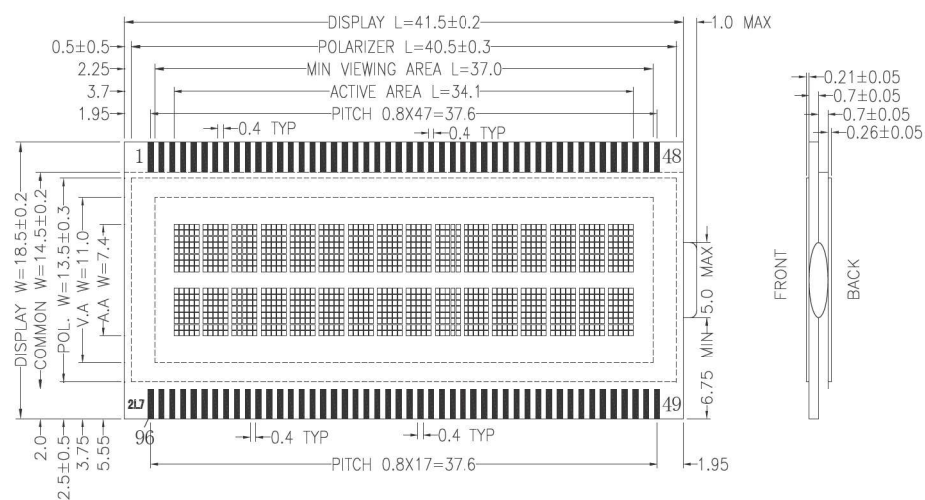
8-bit Interface ( $f_{osc}=270\text{KHz}$ )



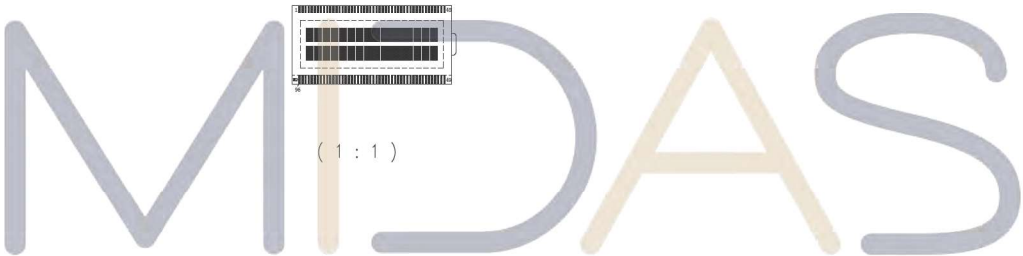
#### 4-bit Interface (fosc=270KHz)



LCD ARTWORK

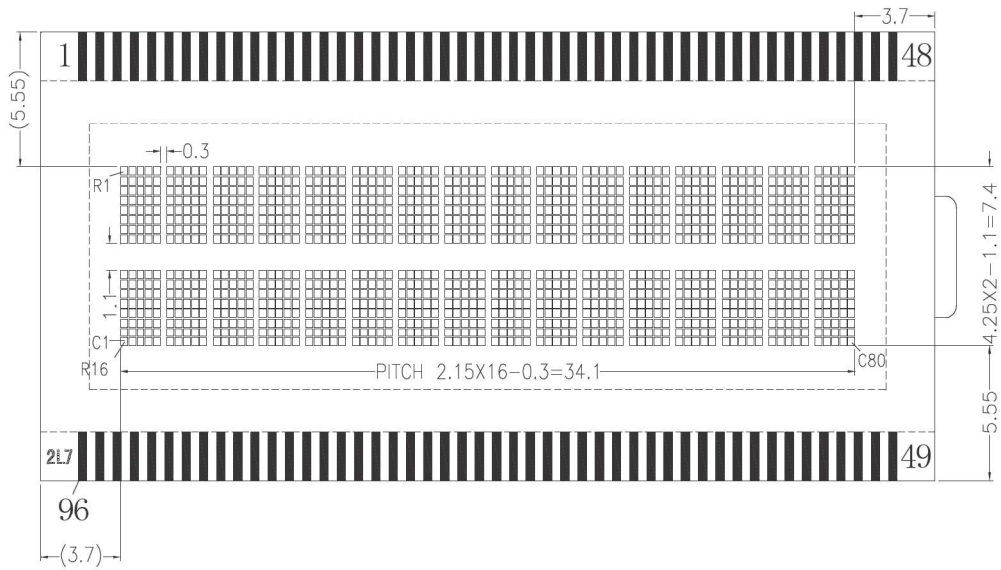


UNLESS OTHERWISE SPECIFIED  
DIMENSIONS ARE IN MM  
TOLERANCES:±0.2MM



LABELLING

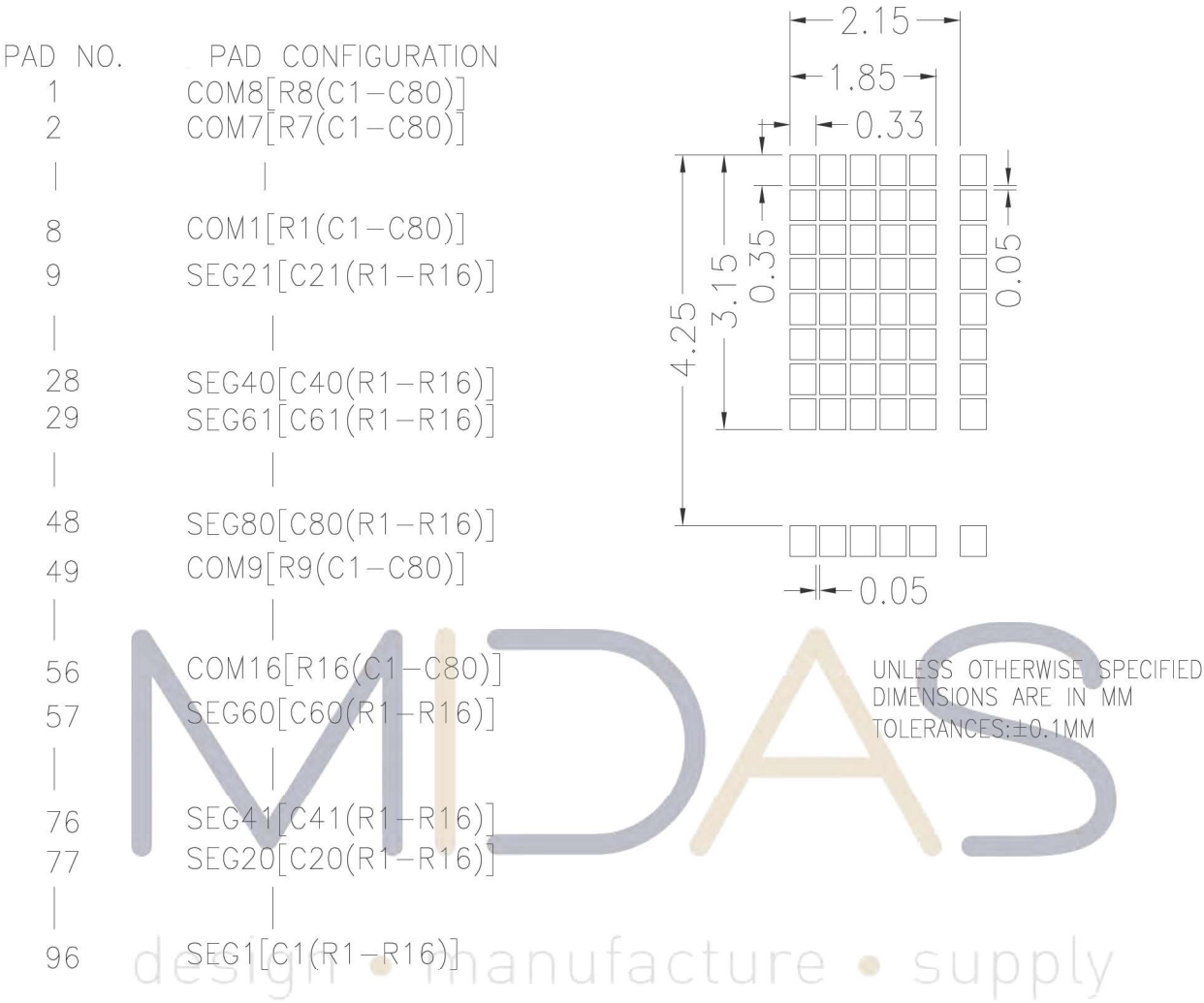
design • manufacture • supply



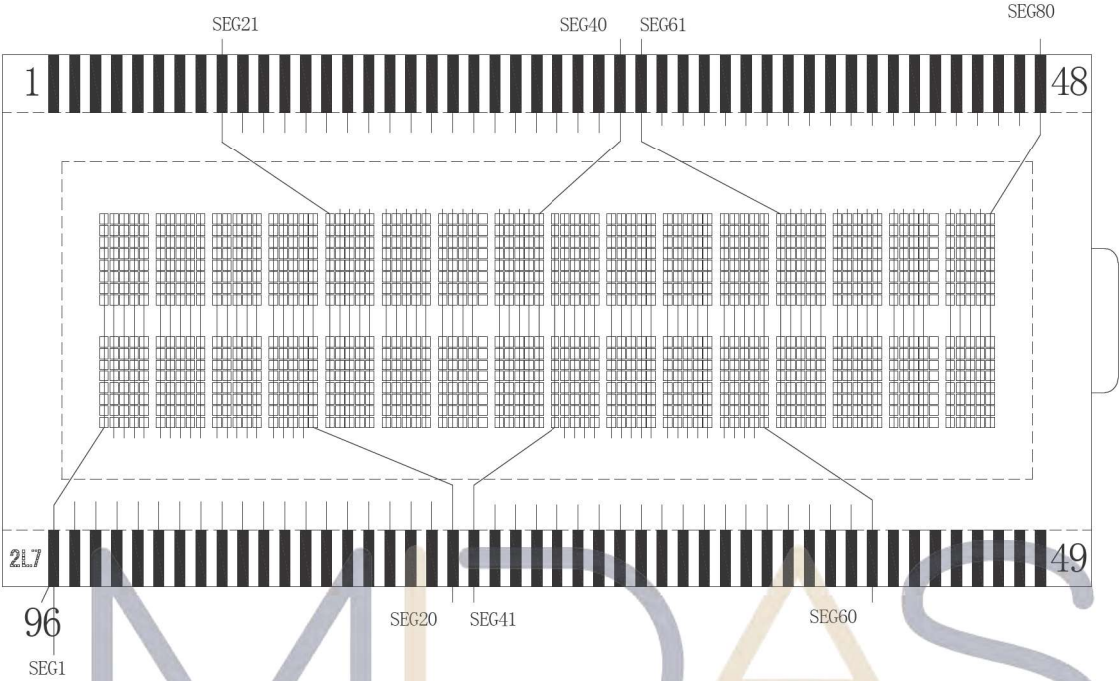
UNLESS OTHERWISE SPECIFIED  
DIMENSIONS ARE IN MM  
TOLERANCES:±0.2MM



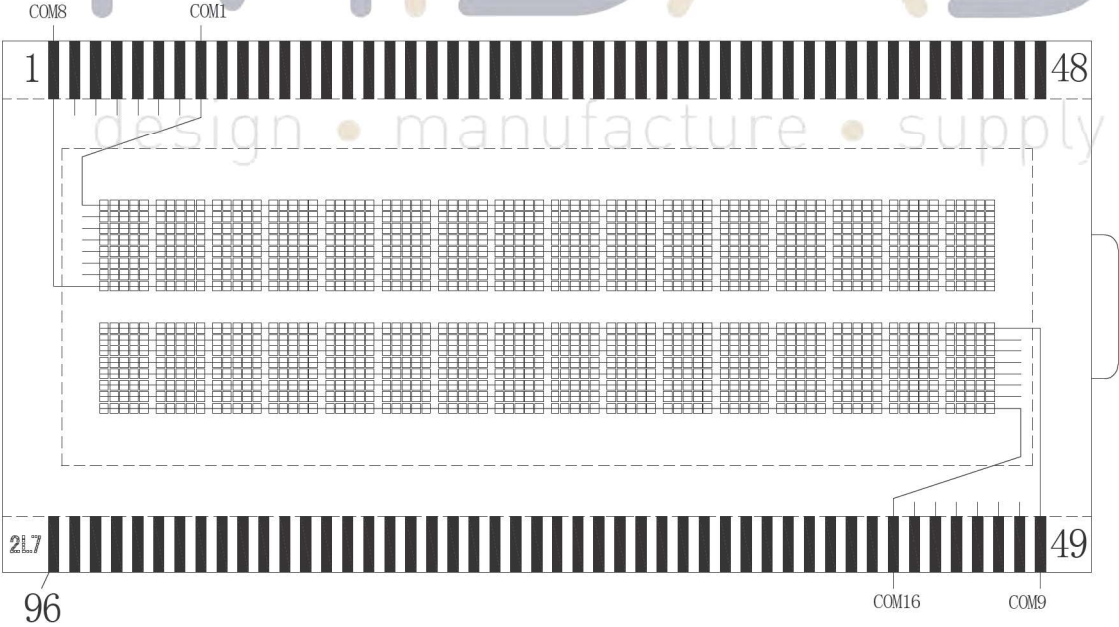
PAD CONFIGURATION & GRAPHIC DIMENSION



SEG & COM LAYOUT



SEG LAYOUT



COM LAYOUT



## THE MODULE ACCEPT QUALITY LEVEL (AQL)

1. Inspection Standard: ANSI Z-1.4 Table Normal Inspection Single Sampling Level II.

### RELIABILITY TEST

Operating life time: 50,000 hours

(at room temperature without direct irradiation of sunlight)

Reliability characteristics shall meet following requirements.

| Tests Item                      | Condition                                                 |
|---------------------------------|-----------------------------------------------------------|
| High temperature storage        | +80°C x 96HRS                                             |
| Low temperature storage         | -30°C x 4HRS                                              |
| High temperature operation      | +70°C x 96HRS                                             |
| Low temperature operation       | -20°C x 4HRS                                              |
| High temperature, High humidity | +60°C x 95%RH x 96HRS                                     |
| Thermal shock                   | -20°C x 30min → 25°C x 10s → +70°C x 30 min<br>x 5 cycles |
| Vibration test                  | Frequency x Swing x Time<br>40Hz x 4mm x 4hrs             |
| Drop test                       | Drop height*Times<br>1.0m * 6times                        |

### QUALITY DESCRIPTION & APPLICATION NOTE • supply

Please refer to “General Inspection Criteria” document

