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PART NO.: MC24021A-SERIES

FOR MESSRS.: \_\_\_\_\_

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ACCEPTED BY: \_\_\_\_\_

PROPOSED BY : \_\_\_\_\_

## RECORD OF REVISION

DATE	PAGE	SUMMARY

### 3. General specifications

#### 3.1 General specifications

PLEASE REFER TO:

“CUSTOMER ACCEPTANCE STANDARD SPECIFICATIONS (MS-10-0069)”

#### 3.2 This individual specification is prior to general specifications

#### 3.3 NUMBERING SYSTEM

MC24021A    

B	W
---	---

 -    

S	Y	M	L	O	U	N
---	---	---	---	---	---	---

(1)   (2)                      (3)   (4)   (5)   (6)   (7)   (8)   (9)

(1).CHARACTER FONTS :

PLEASE REFER TO

“CUSTOMER ACCEPTANCE STANDARD SPECIFICATIONS (MS-10-0069)”

(2).LCM TEMPERATURE :

“nil” : NORMAL TEMP

“W” : WIDE TEMP

(3).LCD TYPE :

“T” : TN TYPE                      “S” : STN TYPE

“H” : HTN TYPE                  “F” : FSTN TYPE

(4).LCD COLOR :

“Y” : YELLOW-GREEN    “B” : BLUE(STN/NEGATIVE)/BLACK(FSTN/NEGATIVE)

“G” : GRAY                      “W” : WHITE(FSTN/POSITIVE)

(5).LCD POLARIZE TYPE

“nil” : TRANSFLECTIVE

“M” : TRANSMISSIVE

(6).BACKLIGHT TYPE :

“L” : LED BACKLIGHT

“E” : EL BACKLIGHT

“R” : REFLECTIVE

(7).BACKLIGHT COLOR :

LED TYPE :

“nil” : YELLOW-GREEN    “A” : AMBER

“O” : ORANGE                  “R” : RED

EL TYPE :

“nil” : WHITE                  “B” : BLUE-GREEN

(8). VIEWING DIRECTION :

“nil” : 6 O’CLOCK                  “3” : 3 O’CLOCK

“U” : 12 O’CLOCK                  “9” : 9 O’CLOCK

(9).BACKLIGHT TYPE :

“nil” : LED(+),LED(-)---NORMAL                  “N” : LED(+),LED(-)---CHANGE

#### 4. Mechanical data

- (1) NUMBER OF CHARACTERS-----24 CH \* 2 LINE
- (2) MODULE SIZE -----118.0 W \* 36.0 H \* "C" T (Max) mm
- (3) EFFECTIVE AREA -----96.0 W \* 18.8 H mm
- (4) CHARACTER PATTERN -----5 \* 7 DOTS + CURSOR
- (5) CHARACTER SIZE-----3.20 W \* 4.85 H mm
- (6) CHARACTER PITCH -----3.70 mm
- (7) DOT SIZE-----0.60 W \* 0.65 H mm
- (8) DOT PITCH -----0.65 W \* 0.70 H mm

*NOTE : The dimension of "C" , please refer to Outline dimension on PAGE 8/10*

## 5. Absolute maximum ratings

### 5.1 Electrical absolute maximum ratings

<i>I T E M</i>	<i>SYMBOL</i>	<i>MIN.</i>	<i>MAX.</i>	<i>UNIT</i>	<i>COMMENT</i>
POWER SUPPLY FOR LOGIC	VDD-VSS	0	6.0	V	
INPUT VOLTAGE	VI	VSS	VDD	V	
STATIC ELECTRICITY	-----	-----	100	V	NOTE (1)
POWER SUPPLY FOR EL BLACKLIGHT	VEL	-----	AC200	Vrms	Fel=1.0KHz 60 SEC.MAX
	fEL	-----	2.0	KHz	ACC115 Vrms 60 SEC. MAX
POWER SUPPLY FOR LED	VLED	-----	6.0	V	-----

NOTE (1): ELECTRO-STATIC DISCHARGE RESISTANCE IS TESTED BY CHARGING A 200PF CAPACITOR AND DISCHARGING IT BY CONTACT WITH A INTERFACE CONNECTOR PIN.

### 5.2 Environmental absolute maximum ratings

<i>I T E M</i>	<i>CONDITION</i>	<i>OPERATION</i>		<i>STORAGE</i>		<i>COMMENT</i>
		<i>MIN.</i>	<i>MAX.</i>	<i>MIN.</i>	<i>MAX.</i>	
AMBIENT TEMPERATURE	NORMAL	0	50	-20	70	-----
	WIDE	-20	70			
HUMIDITY	-----	NOTE (2)		NOTE (2)		NO CONDENSATION
VIBRATION NOTE (2)	-----	-----	0.5G	-----	2G	10~300Hz XYZ DIRECTIONS 1 Hr EACH
SHOCK NOTE (3)	-----	-----	3G	-----	50G	10 msec XYZ DIRECTIONS 1 TIME EACH
CORROSIVE GAS	-----	NOT ACCEPTABLE		NOT ACCEPTABLE		-----

NOTE (2): Ta 50 : 90% RH MAX.

Ta > 50 : ABSOLUTE HUMIDITY MUST BE LOWER THAN THE  
HUMIDITY OF 90% RH AT 50 . (80%RH AT 60 )

NOTE (3): 1G=9.8m/s<sup>2</sup>

## 6. Electrical characteristics

$T_a = 25$

$V_{DD} = 5.0V \pm 0.25V$

ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	
INPUT VOLTAGE	$V_{IH}$	-----	2.2	-----	-----	V	
	$V_{IL}$	-----	-----	-----	0.6	V	
OUTPUT VOLTAGE	$V_{OH}$	$-I_{OH} = 0.2 \text{ mA}$	2.4	-----	-----	V	
	$V_{OL}$	$I_{OL} = 1.2 \text{ mA}$	-----	-----	0.4	V	
POWER SUPPLY CURRENT	$I_{DD}$	$V_{DD} = 5.0V$	-----	1.8	3.0	mA	
RECOMMENDED LCD DRIVING VOLTAGE, NOTE(1)	$V_{DD} - V_O$	STN/ FSTN DUTY =1/16 =10° NOTE(2)	Ta=-20°C	-----	4.8	-----	V
			Ta= 0°C	-----	4.7	-----	V
			Ta= 25°C	-----	4.5	-----	V
			Ta= 50°C	-----	4.3	-----	V
			Ta= 70°C	-----	4.2	-----	V
		TN DUTY =1/16 =25° NOTE(2)	Ta=-20°C	-----	4.5	-----	V
			Ta= 0°C	-----	4.4	-----	V
			Ta= 25°C	-----	4.2	-----	V
			Ta= 50°C	-----	4.0	-----	V
			Ta= 70°C	-----	3.9	-----	V
POWER SUPPLY CURRENT FOR B.L	NOTE(3)	NOTE(3)	-----	NOTE(3)	NOTE(3)	NOTE(3)	

NOTE (1): RECOMMENDED LCD DRIVING VOLTAGE MAY FLUCTUATE ABOUT  $\pm 0.5V$  BY EACH MODULE.

(2): = 0° : VIEWING DIRECTION AT 6 O'CLOCK  
= 180° : VIEWING DIRECTION AT 12 O'CLOCK

(3): LED CURRENT OF DIFFERENT BACKLIGHT TYPE

B.L TYPE	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT.	LED COLOR
ARRAY LED	$I_{LED}$	$V_{LED} = 5.0V$	-----	140	180	mA	YELLOW-GREEN, AMBER, ORANGE, RED
EL	$I_{EL}$	$V_{EL} = 115V_{rms}$ $f_{EL} = 400Hz$	-----	3.0	-----	mArms	-----

## 7. Optical characteristics

### TN TYPE LCD

$T_a = 25$   $V_{DD}-V_O = 4.2V$

<i>I T E M</i>	<i>SYMBOL</i>	<i>CONDITION</i>	<i>MIN.</i>	<i>TYP.</i>	<i>MAX.</i>	<i>UNIT</i>	<i>NOTE</i>
VIEWING ANGLE	2- 1	K = 1.4 NOTE(1)	20	30	----	deg.	NOTE(2)
CONTRAST RATIO	K	= 25° NOTE(1)	2.0	3.0	----	----	NOTE(2)
RESPONSE TIME	tr (rise)	= 25° NOTE(1)	----	150	250	ms	NOTE(2)
	tf (fall)	= 25° NOTE(1)	----	150	250	ms	NOTE(2)

### STN TYPE LCD

$T_a = 25$   $V_{DD}-V_O = 4.5V$

<i>I T E M</i>	<i>SYMBOL</i>	<i>CONDITION</i>	<i>MIN.</i>	<i>TYP.</i>	<i>MAX.</i>	<i>UNIT</i>	<i>NOTE</i>
VIEWING ANGLE	2- 1	K = 2.0 NOTE(1)	30	40	----	deg.	NOTE(2)
CONTRAST RATIO	K	= 10° NOTE(1)	3.0	4.0	----	----	NOTE(2)
RESPONSE TIME	tr (rise)	= 10° NOTE(1)	----	200	350	ms	NOTE(2)
	tf (fall)	= 10° NOTE(1)	----	300	400	ms	NOTE(2)

### FSTN, STN BLUE TYPE LCD

$T_a = 25$   $V_{DD}-V_O = 4.5V$

<i>I T E M</i>	<i>SYMBOL</i>	<i>CONDITION</i>	<i>MIN.</i>	<i>TYP.</i>	<i>MAX.</i>	<i>UNIT</i>	<i>NOTE</i>
VIEWING ANGLE	2- 1	K = 2.0 NOTE(1)	30	40	----	deg.	NOTE(2)
CONTRAST RATIO	K	= 10° NOTE(1)	4.0	5.0	----	----	NOTE(2)
RESPONSE TIME	tr (rise)	= 10° NOTE(1)	----	200	350	ms	NOTE(2)
	tf (fall)	= 10° NOTE(1)	----	300	400	ms	NOTE(2)

### Brightness for LCM

<i>SYMBOL</i>	<i>CONDITION</i>	<i>MIN.</i>	<i>TYP.</i>	<i>MAX.</i>	<i>UNIT</i>	<i>B.L TYPE</i>	<i>NOTE</i>
B	= 0°	4.0	----	----	cd/m <sup>2</sup>	EL	NOTE(2)
	= 0°	6.0	----	----		ARRAY LED	NOTE(3)

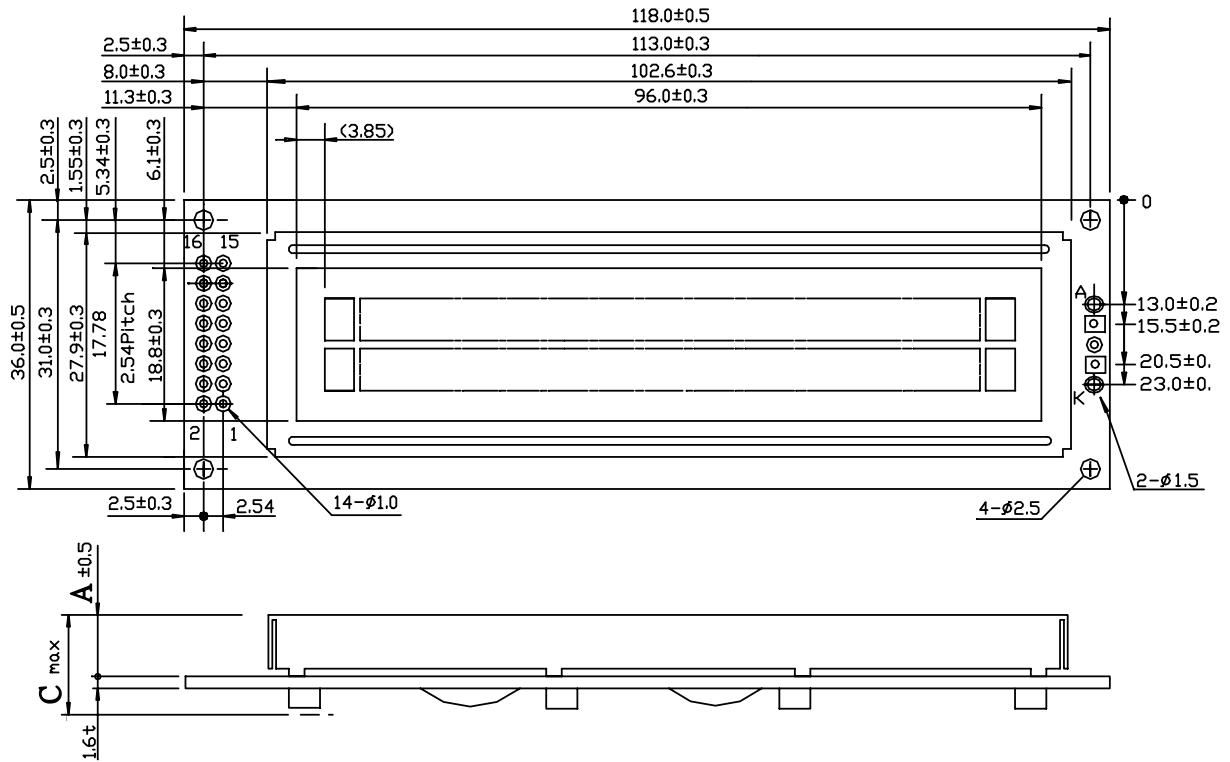
NOTE (1): = 0° : VIEWING DIRECTION AT 6 O'CLOCK

= 180° : VIEWING DIRECTION AT 12 O'CLOCK

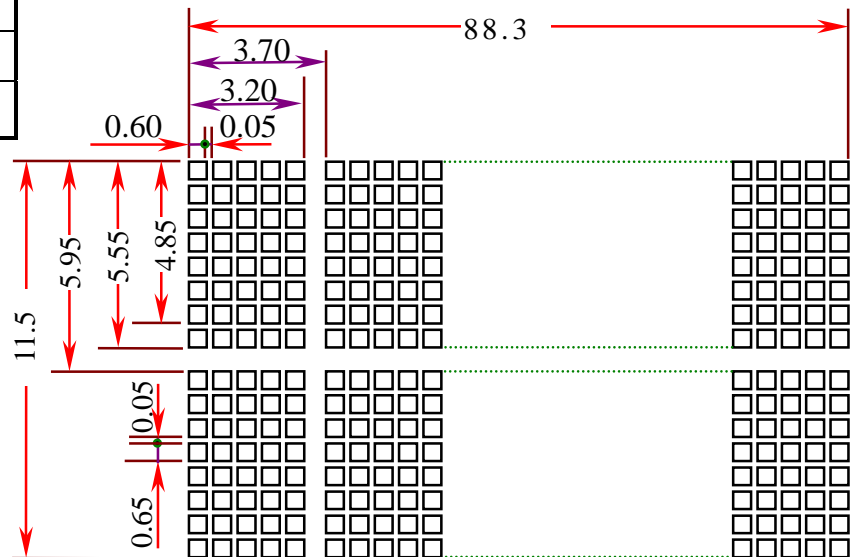
NOTE (2):SEE CUSTOMER ACCEPTANCE STANDARD SPECIFICATION FOR DEFINITION OF OPTICAL CHARACTERISTICS.

NOTE (3):UNDER NORMAL TEMPERATURE AND HUMIDITY IN A DARK ROOM.

## 8. Outline dimension



TYPE	A	C
LED B.L	9.5	15
EL& NO B.L	4.9	10



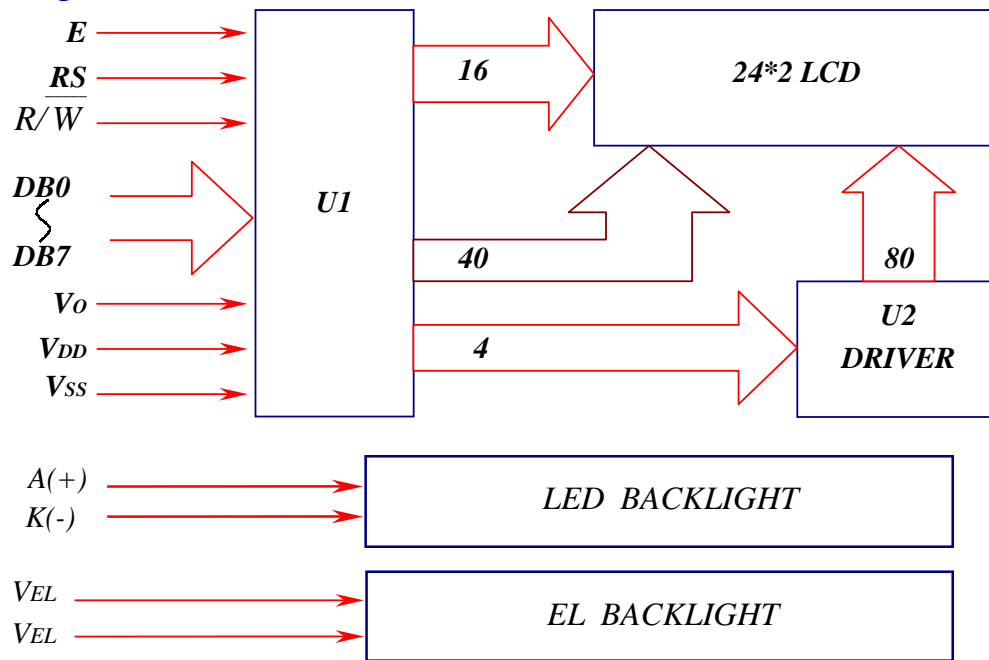
UNIT : mm  
SCALE : NTS

### Interface pin connection

<b>PIN NO.</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>	<b>9</b>
SYMBOL	VSS	VDD	Vo	RS	R/W	E	DB0	DB1	DB2
<b>PIN NO.</b>	<b>10</b>	<b>11</b>	<b>12</b>	<b>13</b>	<b>14</b>	<b>15</b>	<b>16</b>	<b>A</b>	<b>K</b>
SYMBOL	DB3	DB4	DB5	DB6	DB7	A(+)	K(-)	VEL	VEL



### 9. Block diagram



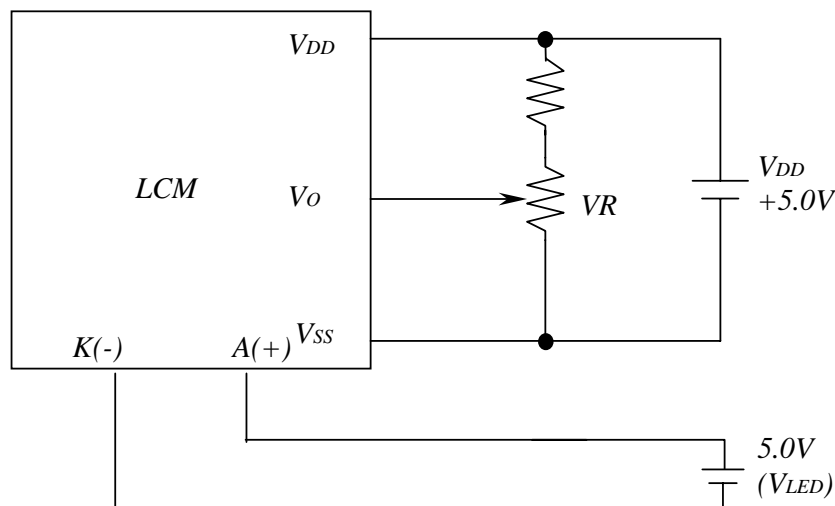
### Display data address charts

Character	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
LINE 1	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F	10	11	12	13
LINE 2	40	41	42	43	44	45	46	47	48	49	4A	4B	4C	4D	4E	4F	50	51	52	53

	21	22	23	24
LINE 1	14	15	16	17
LINE 2	54	55	56	57

### 10. Power supply for LCM



RECOMMENDED RESISTOR R:  $V_{DD}-V_o$  1.5V  
 $V_{DD}-V_o$ : LCD DRIVING VOLTAGE  
 VR: 10K ~20K

**10.1 Power supply for backlight**

