<u>VACUUM FLUORESCENT DISPLAY MODULE</u>

<u>SPECIFICATION</u>

MODEL :CU40026SCPB-S20A

CUSTOMER

SPECIFICATION NO. :DS-31-0000-01
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JAPAN

1.0 General Description

1.1 Application: Readout of computer, microcomputer communication terminal and automatic instruments.

1.2 Construction: Single board display module consists of 80 character VFD, refresh memory, character generator, control circuit and DC/DC converter.

1.3 Display color: Blue-green.

1.4 Outline dimension : See attached drawings.

2.0 Absolute Maximum Ratings

Power Supply Voltage ----- V_{CC} : +7.0 Max, V_{DC}

Logic Input Voltage ------ V_{IN} : +7.0 Max. V_{DC}

3.0 Electrical Ratings

Parameter	Symbol	Min.	Typ.	Max	Unit
Power supply voltage	V_{CC}	4 75	5.00	5.25	V_{DC}

4 0 Electrical Characteristics

PARAMETER		SYMBOL	MIN	TYP	MAX	UNIT	CONDITION
INPUT VOLTAGE	H	V_{IH}	2.4	–	V_{CC}	Vdc	V_{CC} =5.0V
	L	V_{IL}	–	–	0.8	Vdc	V_{CC} =5.0V
OUTPUT VOLTAGE	H	V_{OH}	2.4	–	–	Vdc	I_{OH} = 400uA
		V_{OL}	–	–	0.4	Vdc	I_{OL} = 1.6 mA
Supply current		I_{cc}	–	0.75	0.85	A	VCC=5.0V Operate all dots in all chr positions

Note:

Power-on delay of V_{CC} shall be with 30 ms.

I_{CC} might be anticipated more than 2 times figure of above table at power on rush.

5.0 Optical Specifications

Number of characters :   80(2 line x 40 chrs)

Matrix format   :   5 x 7 dot character with cursor

Display area   :   188.55 mm x 16 mm(X x Y)

Character size   :   3.3 mm x 5.05 mm(X x Y)

Character pich   :   4.75 mm(center-to-center)

Dot size   :   0.5 mm x 0.55 mm(X x Y)

Dot pitch   :   0.7 mm x 0.7 mm(X x Y)

Luminance   :   700 Cd/m^2(Typ.) or 200fL

Color of illumination: Blue-green

6.0 Environmental Specifications

Operating temperature: -20 to +60°C

Storage temperature :   -40 to t70°C

Operating humidity   :   20 to 80% R.H

7.0 Mechanical Strength

Vibration Test   :Frequency   :10-55-10 HZ

Sweep time   :1 minute

Amplitude   :2 mm (Fixed 10G)

Direction   :X,Y & 2 (3 directions)

Times   :30 Min, for each direction

Shock Test   :Acceleration   :100G

Duration   :9.0 sec

Direction   :X,Y & 2 (3 directions)

Times   :Three (3) times for each direction

The test shall be done at no operating and no any mechanical and electrical failures should be found after the tests.

8.0 Functional Descriptions

The CU40026SCPB-S20A VFD Module will provide the functions of DATA WRITE, DATA READ, COMMAND WRITE, STATUS READ and DISPLAY RESET.

\WR	\RD	AD	\CS	FUNCTION	DIRECTION OF DATA BUS
0->1	1	0	0	DATA WRITE	HOST TO MODULE
0->1	1	1	0	COMMAND WRITE	HOST TO MODULE
1	0	0	0	DATA READ	MODULE TO HOST
1	0	1	0	STATUS READ	MODULE TO IOST

8.1 Data Write

8.1.1 Data write is executed at rising edge of \WR Pulse while \CS=AO="0" and \RD="1". This module accepts 158 characters and 16 control codes listed in Table 1.
Two desired fonts may be alternated into character code of 00H to FFH in Table I with ESC(18H) code. See (16) ESC.
Generally, the cursor automatically moves to right by one character position after execution of data write.
Control code are defined as follows:
The term of "CURSOR" means the writing position.

1) BS: Back Space

DC1 Mode: The cursor position is shifted to left by one character position. When the cursor is located at the left end of the bottom line, the cursor is shifted to the right most position of the top-line after execution. When the cursor is on the left most position of the top line, the cursor is shifted to the right most Position of the bottom line.

DC2 Mode: Same as DCl Mode.

2) HT: Horizontal Tab

DC1 Mode:The cursor Position is shifted to right by one character position. When the cursor is located at the right end of the top line, the cursor is shifted to the left most position of the bottom line. When the cursor is on the right most position of bottom line, the cursor is shifted to the left most position of the top line.

DC2 Mode: When the cursor is on the right most position of the bottom line, all characters on the bottom line are shifted to one line up, and the cursor is positioned to the left most position of the bottom line. At this time, all positions of the bottom line are cleared for a new line.

3) LF: Line Feed

DC1 Mode: When the cursor is shifted to the same column position of next line. When the cursor is on the bottom line, the cursor is shifted to the same column position of the top line.

DC2 Mode: When the cursor is on the bottom line, all characters on the bottom line are shifted to the upper line, and the cursor maintains the same position of the bottom line. At this time, all-positions of the bottom line are cleared for a new line. When the cursor is on the top line, same as DC1 Mode execution will he made.

4) CR: Carriage Return

DC1 Mode:The cursor is Positioned on the left most position of the same line.
DC2 Mode: Same as DC1 Mode.

5) DC1: Normal Mode (Default Mode)

   After a character is written, the position of the cursor is
   automatically shifted to the right by one character position. When the
   cursor is on the right most position of the top line, the cursor is
   shifted to the left most position of the bottom line. When the cursor is
   on the right most position of the bottom line, the cursor is shifted to
   the left most position of the top line.

6) DC2: Scroll Mode

   After all positions of the bottom line are written, the characters
   written on the bottom line are scrolled up to the top line, and the
   cursor is positioned at the left most position of the bottom line. At
   this time, all characters on the bottom line are cleared for a new line.
   The display module automatically selects the DC1 Mode above at initial
   power-on time. This selection will be maintained until another mode is
   selected.

7) DC3: Cursor On Mode (Default Mode)

   The Cursor position is displayed as an under-line.

8) DC4: Block Cursor Mode

   The character on cursor Position is alternatively flickering with full
   dots.

9) DC5: Cursor Off mode
   The under-line on cursor position is becoming invisible and DC4, DC6
   modes are cancelled.

10) DC6: Cursor Blink Mode
   The under-line on cursor position is flickering.

The following five control codes Select the font as follows:

11) SUB: English font (USA ASCII -7) (Default Code)

12) FS : Danish font (BCMA-7)

13) GS : General European font (ECMA-7)

14) RS : Swedish font (ECMA-7)

15) US : German font (ECMA-7)

Conversion Table from ASCII to ECMA is shown as follows:

HEX CODE	CONVERSION CODES				
	1A	1C	1D	1E	1F
23					
5B					
5C					
5D					
5E					
7B					
7C					
7D					
7E					
	ASCII	DANISH	GEN EUROPE	SWEDISH	GERMAN

SUB(1AH),English font, is automatically selected at the power-on reset. The selected mode is maintained unless other mode is selected.

16) ESC: the following ESC code assigns two iser desired fonts (UDF) into any character positions from 00H to FFH of table 1. RAM of the module reserves two-Character-size of memory for these new characters. Six-byte data succeeding this ESC code alternates present character font to new font desired.

1st byte: 1BHEX
2nd byte:Definition character code
Definable character codes are available from 00H to FFH of table 1. If the character code of control characters as BS,HT, CR, etc, is selected for a new character, the module displays new character instead of control action. Caution that definition of 1BH(ESC) character code kills ESC function thereafter.
3rd--7th byte : Formation of character font
Each dot data of 5 x 7 is defined with following Table.
Figures In the Table are corresponded to each dot position of 5 x 7. The dots to be lighted shall be specified as "1" (active high).

BYTE	D7	D6	D5	D4	D3	D2	D1	D0
3rd	23	15	22	16	21	17	20	18
4th	27	11	25	12	25	13	24	14
5th	31	9	30	*	29	*	28	10
6th	35	5	34	6	33	7	32	8
7th	*	8	*	2	19	1	UL	4

*="O" (low) UL:Under line

After execution of above sequence, the new character defined will be displayed by defined character code.

DISPLAY DOT

1	2	3	4	5
6	7	8	9	10
11	12	13	14	15
16	17	18	19	20
21	22	23	24	25
26	27	28	29	30
31	32	33	34	35

Definition of new character "!" to Character code AO Hex:

5 X 7 DOT
Dot pattern

		0		
		0		
		0		
		0		
		0		

5 X 7 Dot

Specify each dot

Byte/Bit	7	6	5	4	3	2	1	0	HEX
3rd Byte	0	0	0	0	0	0	0	1	01
4th Byte	0	0	0	0	0	1	0	0	04
5th Byte	0	0	0	0	0	0	0	0	00
6th Byte	0	0	0	0	1	0	0	1	09
7th Byte	0	1	0	0	0	0	0	0	40

Then Syntax should be written: 1B + A0 + C1 + 04 + 00 + 09 + 40 (Hex)

8.2   Command write is executed at rising edge of \WR pulse while \CS = "O" and
      A0=\RD="1". This module provides following commands:
      00XX XXXX: Set the cursor on 00XX XXYM(HEX) Position.
                  0000 0000 (00 Hex) : The left most of the top line.
                  0000 0001 (01 Hex) : The 2nd column of the top line.
                  0010 0111 (27 Hex) : The right most of the top line.
                  0010 1000 (28 Hex) : The left most of the bottom line.
                  0100 1111 (4F Hex) : The right most of the bottom line.
                  When more than the number of characters (80) is specified, the
                  cursor will not move.
      0101 0000: (50H) Software reset
                  The same execution as hardware reset of Part 8.4
      0101 0001: (51H) Read the cursor position.
                  Read data 00H means the left most cursor position.

8.3 Data Read

    After the data read command (51H) is written, data read is executed when
    \CS=A0=\RD="0" and \WR="1". After confirming that bit 0 of status data is
    "1"
    No confirming of status data, however, is needed, only when the data read
    is executed After 1.0 ms or more of command write.

8.4 Status Read

    The module outputs the status on bit 1 of data bus, when \CS=\RD="0" and
    A)=\WR="1"
    BIT 0: Status of data read: data read is valid when BIT 0="1"
    BIT 1: Status of data write: data write and command write are valid only
          when BIT 1="O".
    BIT 2 through 7: Do not care.
    No confirming of status bits, however, is needed, only when the period of
    write cycle is longer than 1.0 ms.

8.5 Hardware Reset

    RESET"1" makes the module initialized as follows:
    1. All character Positions are filled with SP(20H) characters.
    2. The cursor position is set on the left most position of the top line.
    3. DC1 and DC3 modes are selected.
    4. Alternated characters specified by ESC code are cancelled and standard
       characters in character generator are selected.

    Reset signal is active high and shall be maintained 50 ms or longer. No
    input is executed within 100 ms after reset pulse or reset command. (See
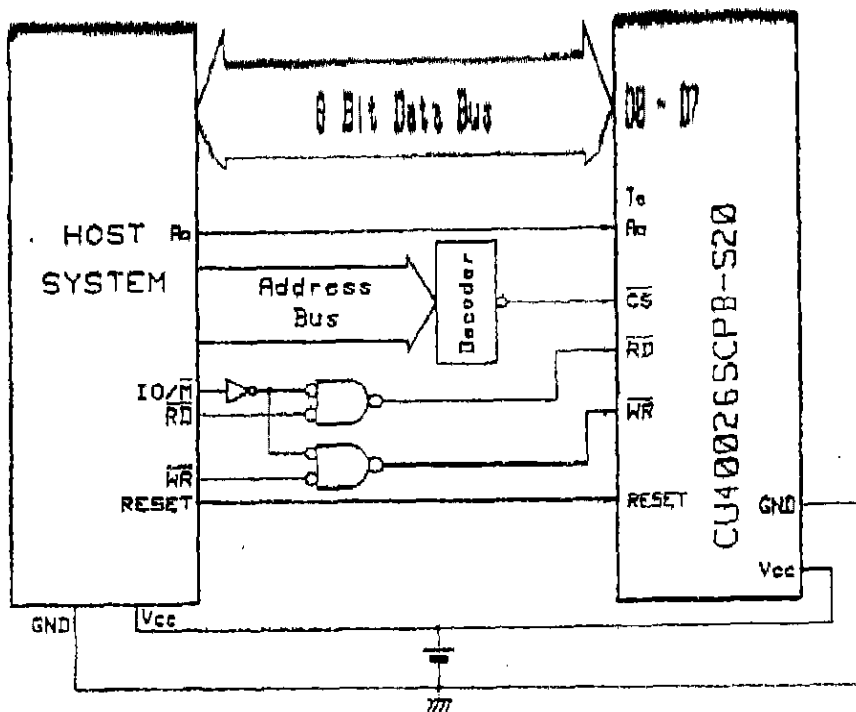   TIMING CHART)

8.6 Test Mode

    "0" more than 100msec to the T0 line at the power on or reset may intialize
    the test mode. During the test mode, no data/commands are acceptable. The
    test mode can be cancelled only power off or reset at open of T0 line.
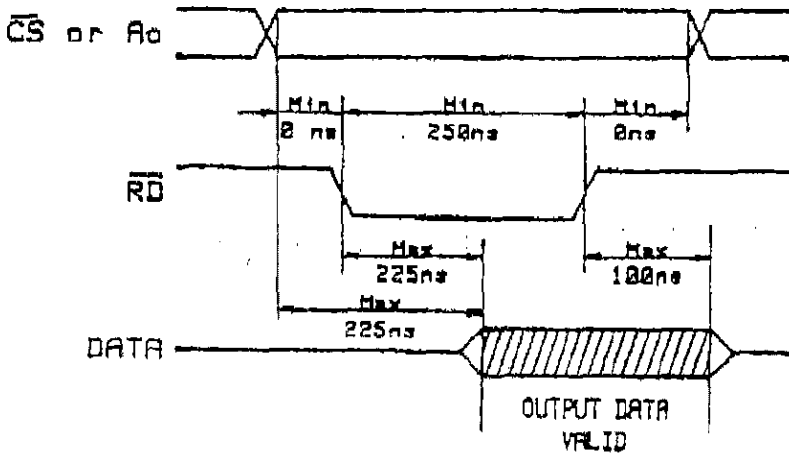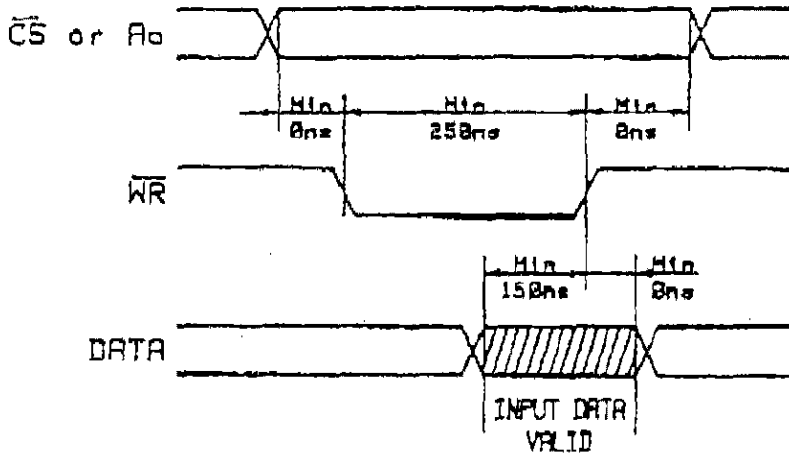   All stored ROM character fonts are displayed automatically at this mode.

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CHARRCTER FONTS

| D7 D6 D5 D4 → / D3 D2 D1 D0 ↓	0000 / 0	0000 / 1	0010 / 2	0011 / 3	0100 / 4	0101 / 5	0110 / 6	0111 / 7	1000 / 8	1001 / 9	1010 / A	1011 / B	1100 / C	1101 / D	1110 / E	1111 / F
0 0 0 0 — 0			SP			P	`	p								
0 0 0 1 — 1		DC1	!	1	A	Q	a	q								
0 0 1 0 — 2		DC2	"	2	B	R	b	r								
0 0 1 1 — 3		DC3	#	3	C	S	c	s								
0 1 0 0 — 4		DC4	$	4	D	T	d	t								
0 1 0 1 — 5		DC5	%	5	E	U	e	u								
0 1 1 0 — 6		DC6	&	6	F	V	f	v								
0 1 1 1 — 7			'	7	G	W	g	w								
1 0 0 0 — 8	BS		(	8	H	X	h	x								
1 0 0 1 — 9	HT		)	9	I	Y	i	y								
1 0 1 0 — A	LF	SUB	*	:	J	Z	j	z								
1 0 1 1 — B		ESC	+	;	K	[	k	{								
1 1 0 0 — C		FS	,	<	L	\	l										
1 1 0 1 — D	CR	GS	-	=	M	]	m	}								
1 1 1 0 — E		RS	.	>	N	^	n	~								
1 1 1 1 — F		US	/	?	O	_	o										

9.0 Interface Example

10.0 Data Write/Read Timing

11.0 Reset Timing
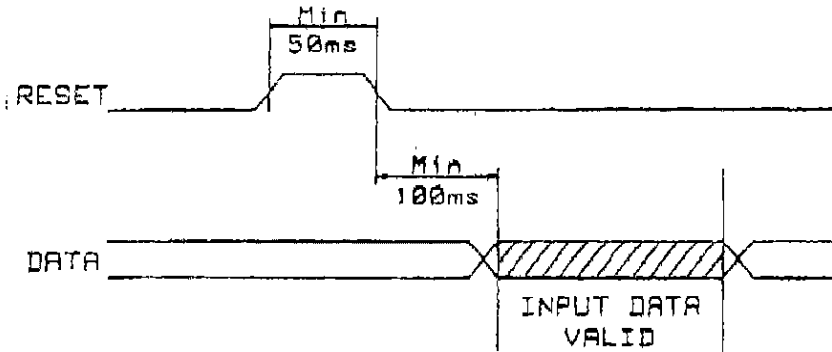
12.0 Pin Connection
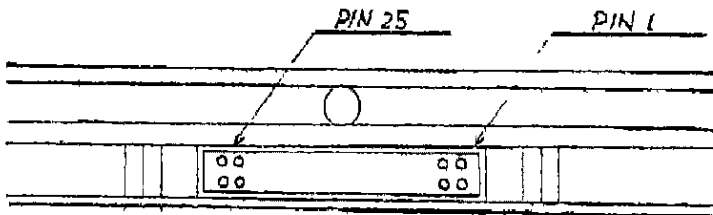
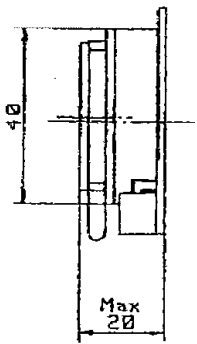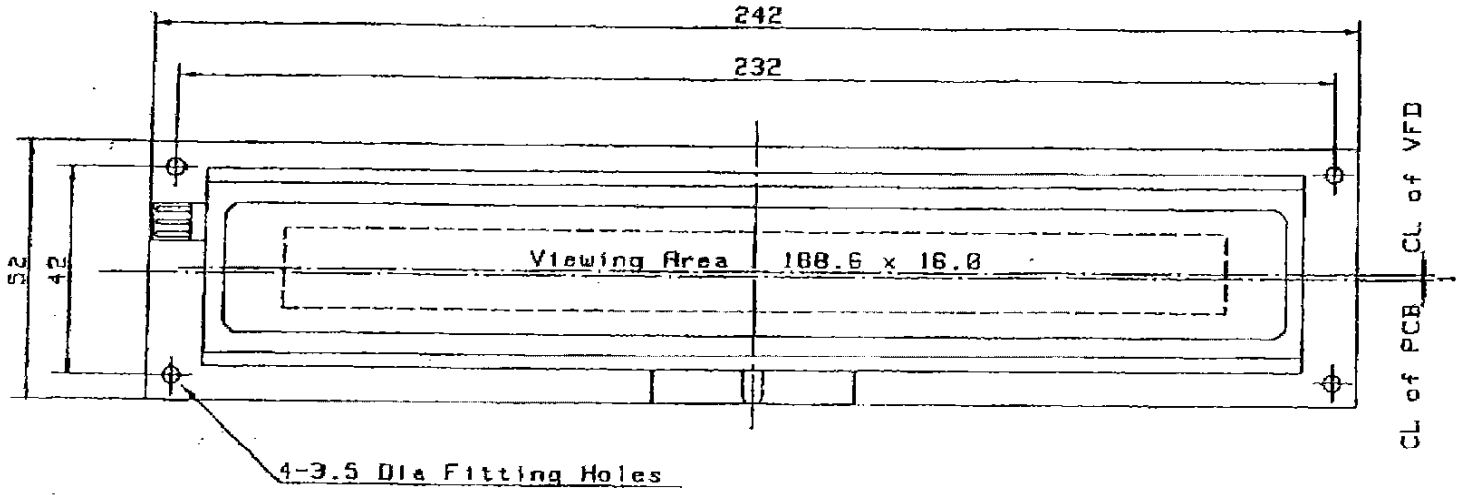| PIN NO	SIGNAL	PIN NO	SIGNAL
1	D2	2	GND
3	D6	4	GND
5	05	6	GND
7	D4	8	GND
9	D3	10	GND
11	D2	12	GND
13	D1	14	GND
15	D0	16	GND
17	\WR	18	GND
19	A0	20	RESET
21	\RD	22	GND
23	\CS	24	GND
25	T0	26	GND

CU40026SCPB-S20A

1 GND
2 NC
3 VCC

CU400265CPB-S20   OUTLINE DIMENSION

242

232

CL of VFD

CL of PCB

52

42

Viewing Area | 188.6 x 16.0

4-3.5 Dia Fitting Holes

40

220

Max 20

Power Connector AMP 171826-3

Data Connector IMSA-9030B-26C
Mates Connector:
STD-MIL Type 26P
Flat Cable Connector
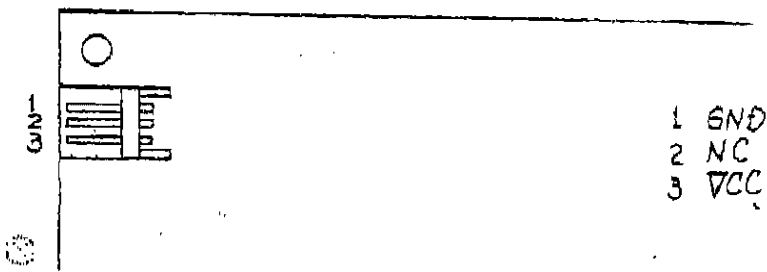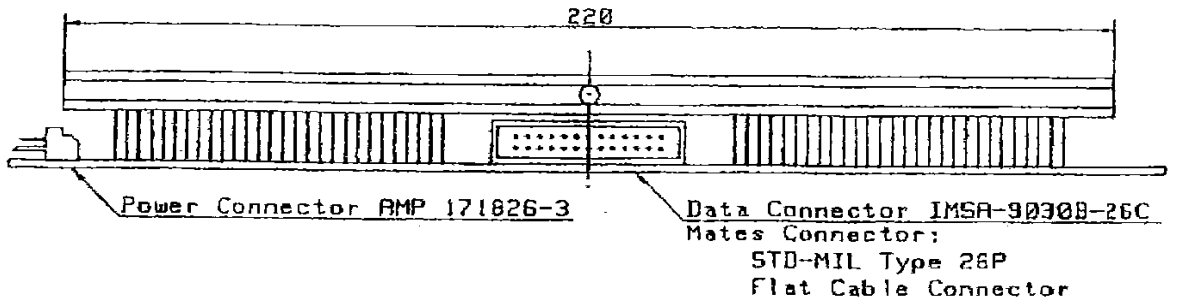
IMPORTANT PRECAUTIONS

* All VFD Modules contain MOS LSI's or IC's. Anti-Static handling procedures are always required.

* VF Display consists of Soda-lime glass. Heavy shock more than 100 G, thermal shock greater than 10°C/minute. Direct hit with hard material to the glass surface especially to the EXHAUST PIPE -- May CRACK the glass.

* Do not PUSH the display strongly. At mounting to the system frame, slight gap between display glass face and front panel is necessary to avoid a contact failure of lead pins of display. Twist or warp mounting will make the glass CRACK around the lead Pin of display.

* Neither DATA CONNECTOR or POWER CONNECTOR should be connect or disconnected while power is applied.
  As is often the case with most subsystems, caution should be exercised in selectively disconnecting power within a computer based system. The modules receive high logic on strobe lines as random signals on all data Ports. Removal Of Primary Power with logic signals applied may damage input circuitry.

* Stress more than specification listed under the Absolute Maximum Ratings may cause PARMANENT DAMAGE of the modules.

* +5 volts Power line must be regulated completely since all control logics are depended on this line.
  DO not apply slow-start power. Provide sufficient output current power source to avoid trouble of RUSH CURRENT at Power on. (At least output current of double figure of Icc. listed on the specification of each module, is required.)

* Data cable length between module and host system is recommended within 500 mm to free from a mis-operation caused by noise.

* Do not place the module on the conductive plate just after the power off. Due to big capacitors on the module, more than 1 min. of discharging time is required to avoid the failure caused by shorting of power line.