

1. GENERAL SPECIFICATIONS

1-1. DIMENSIONS, WEIGHT (Refer FIGURE-1)

Table-1

Item	Specification	Unit
Outer Dimension	(L) 115.0±1	mm
	(W) 36.0±1	
	(T) 22.3Max.	
Weight	70	g

1-2. SPECIFICATIONS OF THE DISPLAY PANEL

Table-2

Item	Specification	Unit
Display Area (W×H)	88.6×13.5	mm
Dot Size (W×H)	0.45×0.56	mm
Dot Pitch (W×H)	0.73×0.86	mm
Number of Dot (W×H)	96×16 + Segment	mm
Color of Illumination	Green (x=0.24, y=0.41) Red (x=0.67, y=0.33)	—

Note) By using a filter, uniform color ranging from blue to orange (including white) can be obtained.

1-3. ENVIRONMENT CONDITIONS

Table-3

Item	Symbol	Min.	Max.	Unit
Operating Temperature	<i>T</i> _{opr}	0	+50	°C
Storage Temperature	<i>T</i> _{stg}	-20	+70	°C
Operating Humidity (note)	<i>H</i> _{opr}	20	85	%
Storage Humidity (note)	<i>H</i> _{stg}	20	90	%
Vibration (10 to 55Hz)	—	—	4	G
Shock	—	—	40	G

Note) Avoid operations and or storage in moist environmental conditions.

1-4. ABSOLUTE MAXIMUM RATINGS

Table-4

Item	Symbol	Min.	Max.	Unit
Supply Voltage	V_{cc1} (USB Power)	-0.3	5.5	V
	V_{cc2} (Floppy Power)	-0.3	5.5	V
Input signal voltage	V_{is}	-0.3	5.5	V

1-5. RECOMMENDED OPERATING CONDITIONS

Table-5

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Supply Voltage	V_{cc1} (USB Power) <small>note1)</small>	—	4.5	5.0	5.5	V
	V_{cc2} (Floppy Power)	—	4.5	5.0	5.5	V
H-Level Input Voltage	V_{IH}	$V_{cc1}=5.0V$	0.7V _{cc}	—	—	V
L-Level Input Voltage	V_{IL}	$V_{cc1}=5.0V$	—	—	0.3V _{cc}	V

Note1) According to USB standard

1-6. ELECTRICAL CHARACTERISTICS

Table-6

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Supply Current (note)	I_{cc1} <small>note2)</small>	$V_{cc}=5.0V$	—	350	450	mA
	I_{cc2} <small>note1)</small>	All on	—	350	450	mA
Power Consumption	—			1.75	2.25	W
Luminance	$L(\text{Green})$		350	700	—	cd/m ²
	$L(\text{red})$		70	140	—	
H-Level Input Current	I_{IH}	$V_{IH}=5V$	-1.0	—	1.0	μA
L-Level Input Current	I_{IL}	$V_{IL}=0V$	-0.6	—	0.1	mA

Note1) The surge current can be approx.5 times the specified supply current at power on.

Note2) According to USB standard

2. Interface

2-1. USB

This module can be communicated with the USB 2.0 interface (Full speed) if the USB cable is plugged. The communication with USB is based on HID class.

- USB Interface HID class (Standard) Conforming
- For Windows Xp multi language
- No additional driver for HID is needed

The module has interface of USB.

VFD Control Protocol uses HID report. HID report consists of the byte number of sending data and the sending data.

For HID, the report of data (IN or OUT) is fixed-length

The sum of data size and data is declared in HID Report Descriptor.

The data size means the size of sending or receiving data. Max is 63. So the report can send or receive 63bytes data max.

Following is type of report.

Data Size (8)	Data Size (8) [63]
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[Example]

Luminance adjustment (100%)

[illegible]

When the host needs the data (IN stage), more than 64bytes can be requested. If the length of response from VFD is over 63bytes, Data Size sets 64. If Data Size is 64, the host must read next data.

About interrupt in / Get report

The module replies 2 bytes "00H" to the request of the interrupt in / get report.

This data is not significant.

2-2. Descriptor Specifications

Standard Device Descriptor

Table-7

Offset	Field	Description	Size [byt]	Value	Comment
0	bLength	Size of descriptor in bytes	1	12H	
1	bDescriptorType	DEVICE Descriptor Type	1	01H	
2	bcdUSB	USB Release Number in BCD	2	0200H	Rev.2.0
4	bDeviceClass	Class code	1	00H	
5	bDeviceSubClass	Subclass code	1	00H	
6	bDeviceProtocol	Protocol code	1	00H	
7	bMaxPacketSize	Maximum packet size for endpoint zero	1	40H	
8	idVendor	Vendor ID	2	19C2H	
10	idProduct	Product ID	2	6A11H	
12	bcdDevice	Device release number in BCD	2	0100H	1.00
14	iManufacturer	Index of string descriptor describing manufacturer	1	01H	
15	iProduct	Index of string descriptor describing product	1	02H	
16	iSerialNumber	Index of string descriptor describing the device's serial number	1	00H	
17	bNumConfigurations	Number of possible configurations	1	01H	

Standard Configuration Descriptor

Table-8

Offset	Field	Description	Size [byte]	Value	Comment
0	bLength	Size of this descriptor in bytes	1	09H	
1	bDescriptorType	CONFIGURATION Descriptor Type	1	02H	
2	wTotalLength	Total length of data returned for this configuration	2	0022H	
4	bNumInterfaces	Number of interfaces supported by this configuration	1	01H	
5	bConfigurationValue	Value to use as an argument	1	01H	
6	iConfiguration	Index of string descriptor describing this configuration	1	00H	
7	bmAttributes	Set self powered or Bus powered, and remote wakeup	1	80H	
8	MaxPower	Maximum power consumption	1	FAH	500mA

Interface Descriptor (#1)

Table-9

Offset	Field	Description	Size [byte]	Value	Comment
0	bLength	Size of this descriptor in bytes	1	09H	
1	bDescriptorType	INTERFACE Descriptor Type	1	04H	
2	bInterfaceNumber	Number of this interface	1	00H	
3	bAlternateSetting	Value used to select this alternate setting	1	00H	
4	bNumEndpoints	Number of endpoints used by this interface	1	01H	
5	bInterfaceClass	Classs code	1	03H	HID
6	bInterfaceSubClass	Subclass code	1	00H	
7	bInterfaceProtocol	Protocol code	1	00H	
8	iInterface	Index of string descriptor describing this interface	1	00H	

HID Descriptor (#1)

Table-10

Offset	Field	Description	Size [byte]	Value	Comment
0	bLength	Size of HID descriptor	1	09H	
1	bDescriptorType	HID descriptor type	1	21H	HID Class descriptor
2	bcdHID	HID class specification	2	0111H	
4	bCountry	Country code of the localized hardware	1	00H	Not defined
5	bNumDescriptors	Number of class descriptors	1	01H	1 report descriptor
6	bReportType	Type of class descriptor	1	22H	REPORT descriptor
7	wReportLength	Descriptor length	2	0027H	39byte

Endpoint Descriptor (#1)

Table-11

Offset	Description	Size [byte]	Value	Comment
0	Size of this descriptor in bytes	1	07H	
1	ENDPOINT Descriptor Type	1	05H	
2	The address of the endpoint on the USB device described by this descriptor	1	83H	EP3 : IN
3	The endpoint's attributes	1	03H	Interrupt Transfer
4	Maximum packet size this endpoint	2	0040H	
6	Interval for polling endpoint for data transfers	1	FFH	255[ms]

HID Report Descriptor

Table-12

Part	Value (HEX)
Usage Page(Vendor-defined),	06 7F FF H
Usage (VFD_CONTROL),	09 04 H
Collection (Application),	A1 01 H
Usage (VFD_DATA_SIZE),	09 80 H
Logical Minimum (0),	15 00 H
Logical Maximum (255),	26 00 FF H
Report Size (8),	75 08 H
Report Count (1),	95 01 H
Input (Data, Variable, Absolute),	81 02 H
Usage (VFD_DATA_INPUT),	09 81 H
Report Count (01),	95 01 H
Input (Data, Variable, Absolute),	81 02 H
Usage (VFD_DATA_SIZE),	09 80 H
Report Count (1),	95 01 H
Output (Data, Variable, Absolute),	91 02 H
Usage (VFD_DATA_OUTPUT),	09 82 H
Report Count (63),	95 3F H
Output (Data, Variable, Absolute),	91 02 H
End Collection	C0 H

Description	Value(HEX)
VFD_CONTROL	04H
VFD_DATA_SIZE	80H
VFD_DATA_INPUT	81H
VFD_DATA_OUTPUT	82H

String diskripter

Part	Description	Value
bLength	Length	04H
bDescriptorType	Type=STRING	03H
bString	LangID(English US)	04 09 H
bLength	Length	34H
bDescriptorType	Type=STRING	03H
bString	Manufacturer	Targa GmbH
bLength	Length	5AH
bDescriptorType	Type=STRING	03H
bString	Product	Targa USB Graphic Vacuum Fluorescent Display

3. Functions

The module has write-in mode and control codes as per section 3-1.

If power is supplied through CN1 (USB Power) only, the VFD power supply will not start-up and data cannot be received. Only if power is supplied through CN1 (USB Power) and CN2 (Floppy Power) too the VFD power supply will start-up, the clock with running time (6x8 format) at the top row, and "POWER ON" at the bottom row will be displayed centred on the VFD.

If the clock data was not set prior to CN1 (USB Power) on and CN2 (Floppy Power) on and was off meanwhile, only "POWER ON" will be displayed centred at the bottom row, no clock will be displayed at all.

Now the VFD can receive data.

When CN2 (Floppy Power) is switched off, the module enters stand-by mode. It will display the information sent before entering stand-by mode.

If clock was displayed before entering stand-by mode it will be displayed centred with running time until CN2 (Floppy Power) is switched on again and new data has been sent.

Clock mode (3-1-1, 3-1-2, 3-1-3) and Dimming level (3-1-4) will be kept.

In upper row Clock mode the last data sent before entering stand-by mode will be displayed too at the lower row.

In 1 row Clock mode (8x16 format) only the running clock will be displayed, the rest of the VFD is blanked.

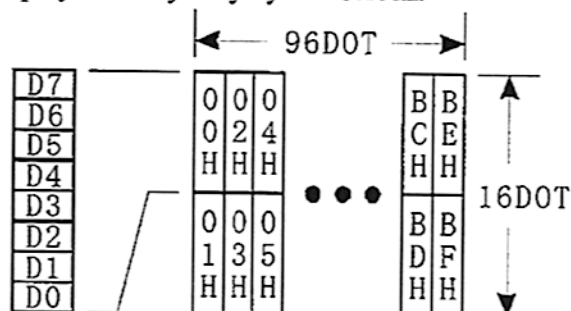
If CN2 (Floppy Power) is switched on again the clock with running time (6x8 format) at the top row and "POWER ON" at the bottom row will be displayed centred on the VFD until new data has been sent.

The module includes a power-on reset function.

5V (USB Power)	5V (Floppy Power)	clock data valid	top row	bottom row
OFF	OFF	-	nothing	
OFF > ON	OFF	no	nothing, because 5V Floppy missing for starting display	
ON	OFF > ON	no	nothing	"POWER ON" is displayed (6x8)
ON	OFF > ON	yes	clock is displayed in 6x8 in the mode which is set by the middleware acc. 3.1	"POWER ON" is displayed (6x8)
ON	ON	no / yes	display content is defined by middleware	
ON	ON > OFF	no	Keep previous data	"POWER ON" is displayed (6x8)
ON	ON > OFF	yes	clock is displayed in 6x8 in the mode which is set by the middleware acc. 3.1	Character or Graphic that middleware wrote. This text must be kept during Sleep state.
			clock is displayed in the mode which is set by the middleware acc. 3.1	

* Address map

* This module has the display memory only by one screen.



3-1 . Control Commands

Table-13

Code	Functions
1BH + 00H + 2bytes	Set Clock Data
1BH + 01H + 1byte	Clock is displayed on upper row (6x8 format)
1BH + 02H + 1byte	Clock is displayed (8x16 format)
1BH + 30H + 2bytes	Symbol Control
1BH + 40H + 1bytes	Dimming
1BH + 50H	Clear display RAM
1BH + 55H	All segments "ON"
1BH + 60H + 1byte	Set AC value
1BH + 70H + 1byte + 1~48byte	Write graphic data
1FH	RESET (Initialize the module)

3-1-1. Set Clock Data : 1BH + 00H + 2byte (clock data)

clock data : min(1byte) + hour (1byte)

* The clock shifts at the rate during 1 minute/day.

3-1-2. Clock is displayed on upper row (6 x 8 format) :

1BH + 01H + 1byte(12h/24h)

12h:00H (default) 24h:01H

* When clock data is not input, clock is not displayed.

* This mode (clock is displayed on upper row) is default.

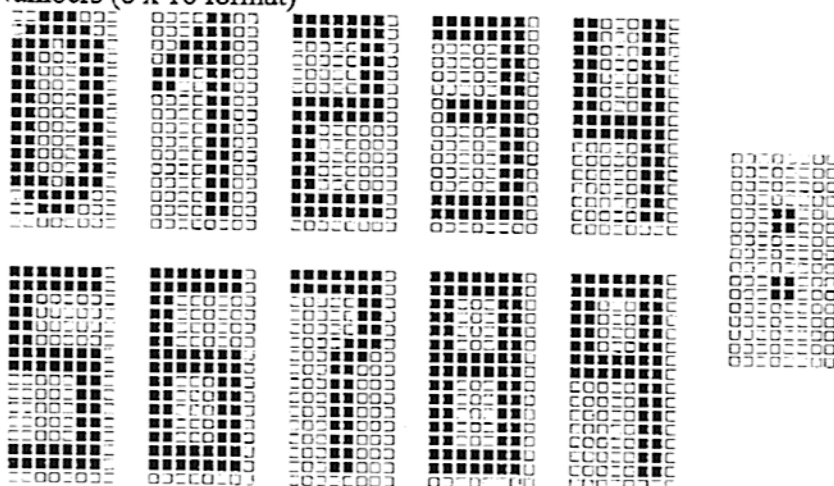
3-1-3. Clock is displayed on 1row (8 x 16 format)

1BH + 02H + 1byte(12h/24h)

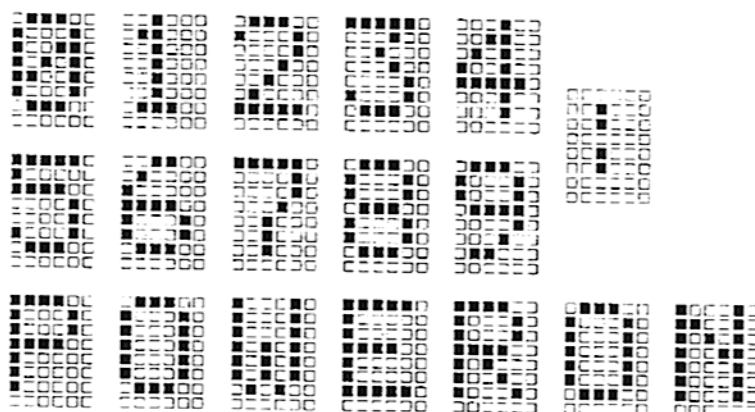
12h:00H 24h:01H

* When clock data is not input, clock is not displayed.

* Font of Numbers (8 x 16 format)



* Font of Numbers and alphabet (6 x 8 format)



3-1-4. Dimming : 1BH + 40H + 1 byte (Dimming level data)

The luminance can be controlled into 3 levels by using this function.

Dimming level data

0%	: 00 H
50 %	: 01 H (Default)
100%	: 02 H

3-1-5. Clear display RAM : 1BH + 50H

Whole display RAM areas including invisible area are filled with 00H data.

(Include the symbol)

3-1-6. Set address Counter(AC) value : 1BH + 60H + xxH

xxH : 00 ~ BFH

AC value represents the start address for graphic data.

There are 192 bytes as display RAM. It can be set on anywhere even if AC value is not visible area. The default value is 00H.

* Default : 00H

* When clock is displayed, AC value is set 00H.

3-1-7. Write graphic data :

1BH + 70H + 1 byte (Number of graphic data) + 1 ~ 48byte (Graphic data : xxH)

Number of graphic data : 01H ~ 30H

Graphic data : xxH : 00 ~ FFH

When a graphic data is written into the module, 8 bit pixel data would be displayed at AC position.

Graphic data can be sent at a time by 1 ~ 48 byte.

After this procedure, AC value will increment by one with the number of data sent before. In case the AC value is over BFH, it becomes 00H as next.

3-1-8. Symbols control

Segment On/Off and Grayscale

1BH + 30H + 2 bytes (Symbol address + Grayscale level data)

Symbol address

Table-14

00H	01H	02H	03H	04H	05H	06H	07H
A	B	C	D-1	D-2	E	F-1	F-2
08H	09H	0AH	0BH	0CH	0DH	0EH	0FH
F-3	F-4	G	H-1	H-2	H-3	H-4	H-5
10H	11H	12H	13H	14H	15H	16H	17H
H-6	H-7	H-8	H-9	H-10	H-11	H-12	H-13
18H							
H-14							

Grayscale level data

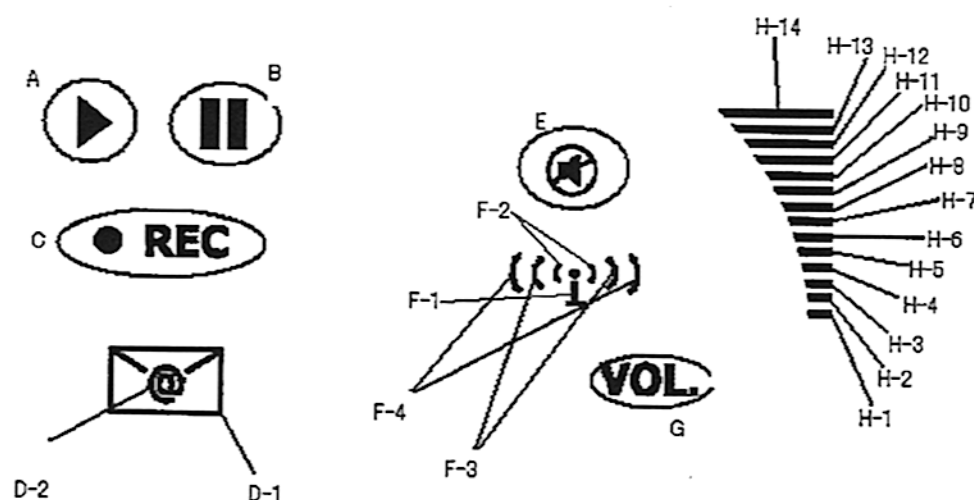
*The symbol in a capable grayscale : 0B H ~ 18 H.

The grayscale data of other symbols is ignored, and set to 100% level automatically.

0% : 00 H

50% : 01 H

100% : 02 H



3-1-9. All segment "ON" : 1BH + 55H

All segments are "ON". (Exclude the symbols)

3-1-10. RESET(Initialize the module) : 1FH

The status of the module becomes as below. Only the status of DC/DC converter will not be changed.

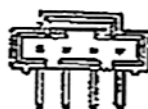
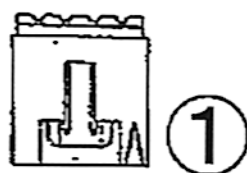
Display RAM : Whole RAM area is filled by 00H.
 AC : AC is set by 00H.
 Dimming : 50% (01H)

4. CONNECTOR PIN CONNECTION

Connector CN1 : 9553-04-9-S1 (White) (ALEX)

Table-15

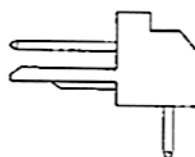
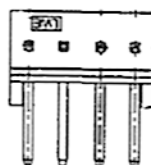
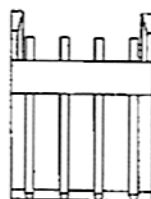
Pin No.	Signal
1	Vcc1 (USB Power)
2	USB GND
3	USB DATA +
4	USB DATA -



Connector CN2 : 6203P040BT (White) (LANDWIN)

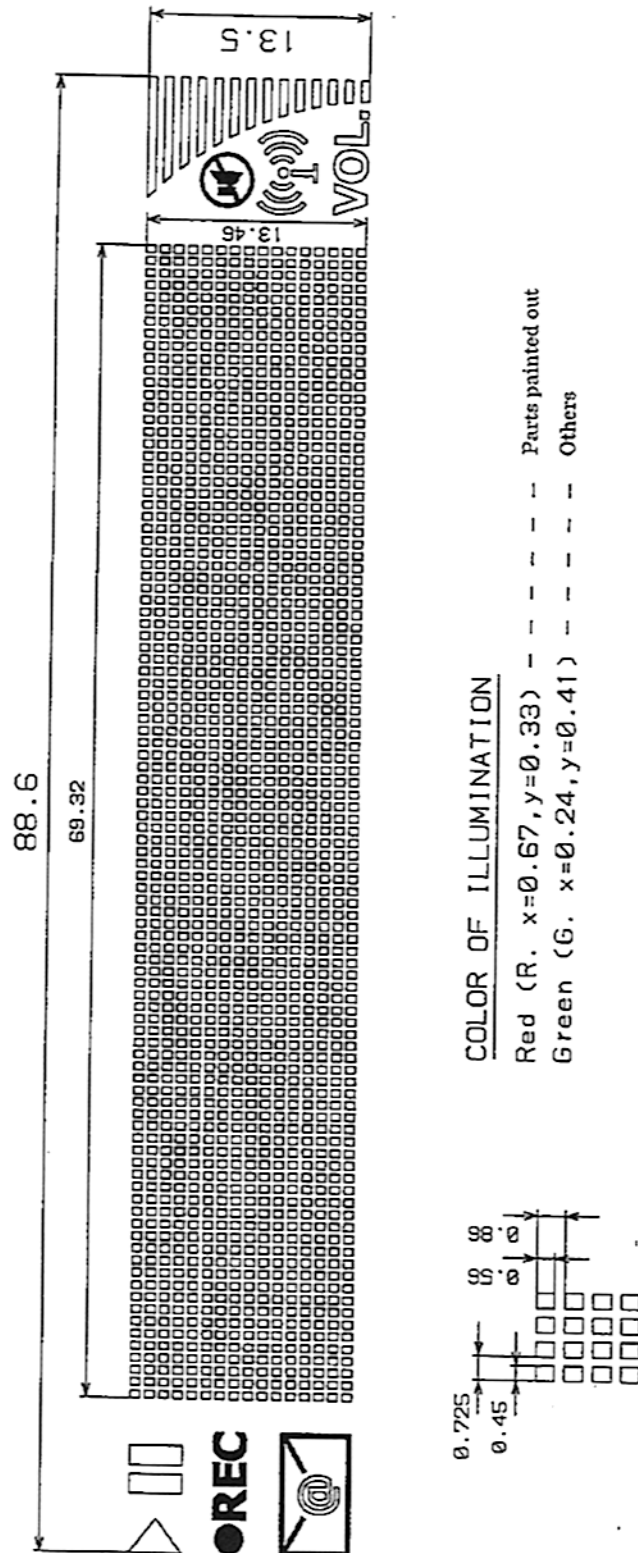
Table-16

Pin No.	Signal
1	Vcc1
2	GND
3	GND
4	NC (no pin)



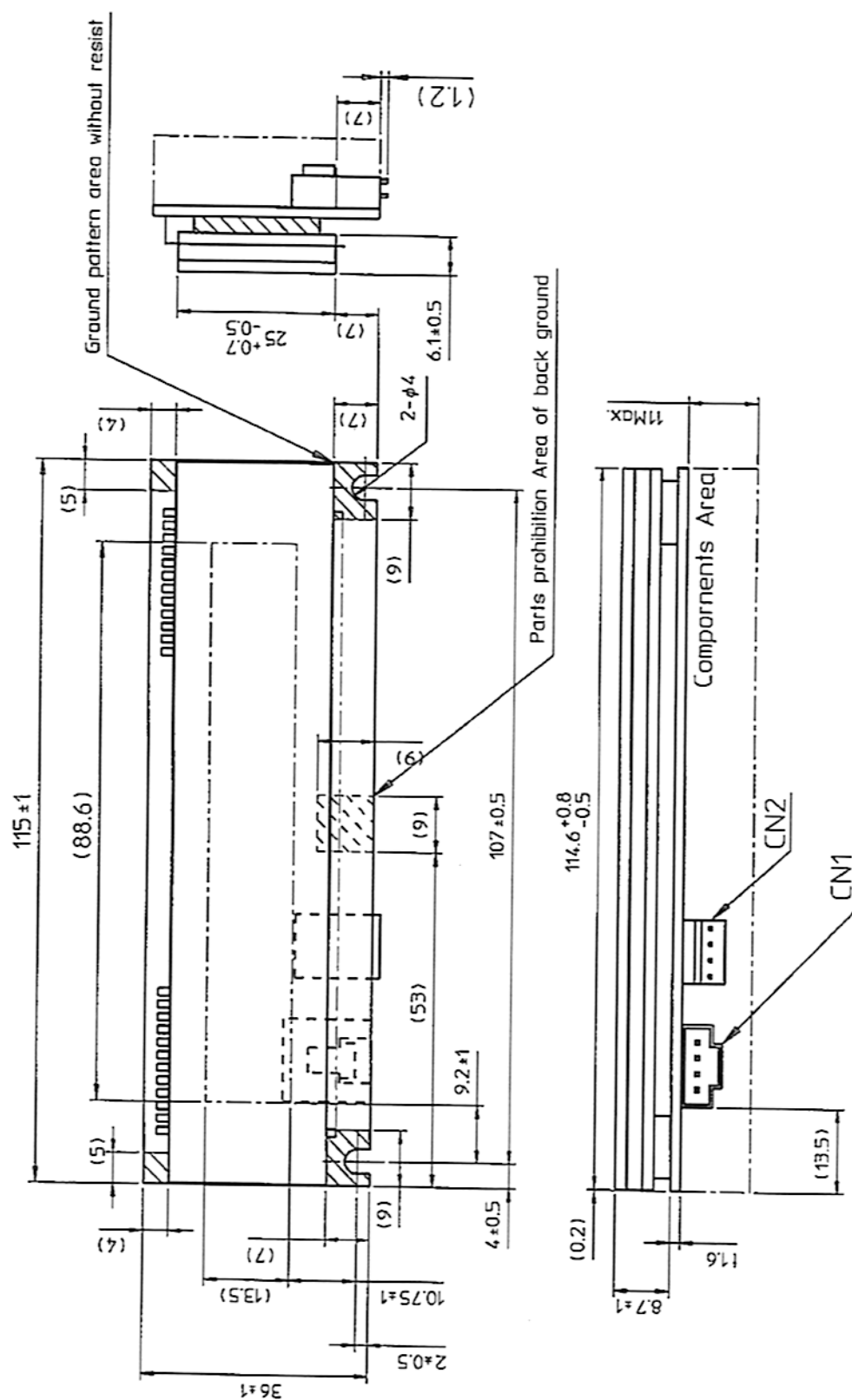
MDM166AA PATTERN DETAIL

FIGURE-1



MDM166AA MECHANICAL DRAWING

FIGURE-2



7. OPERATING RECOMMENDATION

- 7-1. Avoid applying excessive shock or vibration beyond the specification for this module.
- 7-2. Applying lower voltage than the specified may cause non activation for selected pixels.
Conversely, higher voltage may cause non-selected pixel to be activated.
If such a phenomenon is observed, check the voltage level of the power supply.
- 7-3. If the start up time of the supply voltage is slow, the controller may not be reset.
The supply voltage must be risen up to the specified voltage level within 30msec.
- 7-4. Avoid using the module where excessive noise interference is expected. Noise affects the interface signal and causes improper operation.
Keep the length of the interface cable less than 1.0m. (When the longer cable is required, please confirm there is no noise affection.)
USB standard cable is recommended.
- 7-5. The expected lifetime half to the brightness is 30 k hours.