

## VACUUM FLUORESCENT DISPLAY MODULE

### ENGINEERING PROPOSAL

M204SD02KA

EVALUATION

- ACCEPTED WITHOUT ANY CHANGE
- THE FOLLOWING CHANGE IS REQUIRED

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VFD MODULE FACTORY

Electronic Components Division

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## Important Safety Notice

Please read this note carefully before using the product.

### Warning

- The module should be disconnected from the power supply before handling.
- The power supply should be switched off before connecting or disconnecting the power or interface cables.
- The module contains electronic components that generate high voltages which may cause an electrical shock when touched.
- Do not touch the electronic components of the module with any metal objects.
- The VFD used on the module is made of glass and should be handled with care. When handling the VFD, it is recommended that cotton gloves be used.
- The module is equipped with a circuit protection fuse.
- Under no circumstances should the module be modified or repaired. Any unauthorized modifications or repairs will invalidate the product warranty.
- The module should be abolished as the factory waste.

## 1. FEATURE

This vacuum fluorescent display (VFD) module consists of a 20 character by 4 line 5×8 dot matrix display, DC-DC/AC converter, and controller/driver circuitry.

The module can be configured for a Motorola M68 type parallel interface, an Intel I80-type parallel interface, or a synchronous serial interface.

A character generator ROM with 240 5×8 characters is provided along with RAM for the user to program an additional 8 characters. The luminance level of the VFD can be varied by setting two bits in the function set instruction.

Two hundred and thirty eight character fonts consisting of alphabets, katakanas, numerals and other symbols can be displayed.

This module has a dual-port RAM that allows data and instructions to be the module continuously. Thus, the busy flag is always 0 and the host never has to read the busy flag bit to determine if the module is busy.

Due to this feature, the execution times for each instruction are not specified.

## 2. SPECIFICATIONS

## 2-1. GENERAL SPECIFICATIONS

Table-1

Item	Value	
Number of characters	20 characters × 4 lines	
Character configuration	5×8 dot matrix	
Character Height	4.84 mm	
Character Width	2.35 mm	
Character Pitch	3.75 mm	
Peak Wavelength of Illumination	Green x=0.235, y=0.405	
Luminance	Minimum 350 cd/m <sup>2</sup> , 102 fL	Typical 500 cd/m <sup>2</sup> , 146 fL

## 2-2. ENVIRONMENTAL SPECIFICATIONS

Table-2

Item	Symbol	Min.	Max.	Unit	Comment
Operating Temperature	<i>T<sub>opr</sub></i>	-40	+85	°C	
Storage Temperature	<i>T<sub>stg</sub></i>	-40	+85	°C	
Operating Humidity	<i>H<sub>opr</sub></i>	20	85	%RH	Without condensation
Storage Humidity	<i>H<sub>stg</sub></i>	20	90	%RH	Without condensation
Vibration	-	-	4	G	Total amplitude: 1.5mm Freq: 10-55 Hz sine wave Sweep time: 1 min./cycle Duration: 2hrs./axis (X,Y,Z)
Shock	-	-	40	G	Duration: 11ms Wave form: half sine wave 3 times/axis (X,Y,Z,-X,-Y,-Z)

## 2-3. ABSOLUTE MAXIMUM SPECIFICATIONS

Table-3

Item	Symbol	Min.	Max.	Unit
Supply Voltage	$V_{CC}$	-0.3	6.5	V
Input signal Voltage	$V_{IN}$	-0.3	$V_{CC}+0.3$	V

## 2-4. DC ELECTRICAL SPECIFICATIONS

Table-4

Item	Symbol	Min.	Typ.	Max.	Unit
Supply Voltage	$V_{CC}$	4.5	5.0	5.5	V
Supply Current ( $V_{CC}=5.0V$ , All On)	$I_{CC}$	-	300	400	mA
Power Consumption ( $V_{CC}=5.0V$ , All On)	-	-	1.5	2.2	W
High-level input voltage (see Note) (E, R/W, RD/, SCK, RST/)	$V_{IH1}$	$0.8V_{CC}$	-	$V_{CC}$	V
Low-level input voltage (see Note) (E, R/W, RD/, SCK, RST/)	$V_{IL1}$	0.0	-	$0.2V_{CC}$	V
High - Level Input Voltage (see Note) (all input except E, R/W, RD/, SCK, RST/)	$V_{IH2}$	$0.7V_{CC}$	-	$V_{CC}$	V
Low - Level Input Voltage (see Note) (all input except E, R/W, RD/, SCK, RST/)	$V_{IL2}$	0	-	$0.3 V_{CC}$	V
High - Level Output Voltage ( $I_{OH} = -0.1mA$ )	$V_{OH}$	$V_{CC}-0.5$	-	-	V
Low - Level Output Voltage ( $I_{OL} = 0.1mA$ )	$V_{OL}$	-	-	0.5	V
Input Current (see Note)	$I_I$	-500	-	1.0	$\mu A$

Note: A 10k ohm pull-up resistor is included on each input line for TTL compatibility.

## 5. Interface Setting

## 5-1. Pin connection

Table-11

Pin No.	Serial	Parallel (Intel)	Parallel (Motorola)	Pin No.	Serial	Parallel (Intel)	Parallel (Motorola)
1	GND	GND	GND	2	Vcc	Vcc	Vcc
3	SI/SO	NC	NC	4	STB	RS	RS
5	NC	WR/	R/W	6	SCK	RD/	E
7	NC	DB0	DB0	8	NC	DB1	DB1
9	NC	DB2	DB2	10	NC	DB3	DB3
11	NC	DB4	DB4	12	NC	DB5	DB5
13	NC	DB6	DB6	14	NC	DB7	DB7

NC = No Connection

## 5-2. Jumper Setting

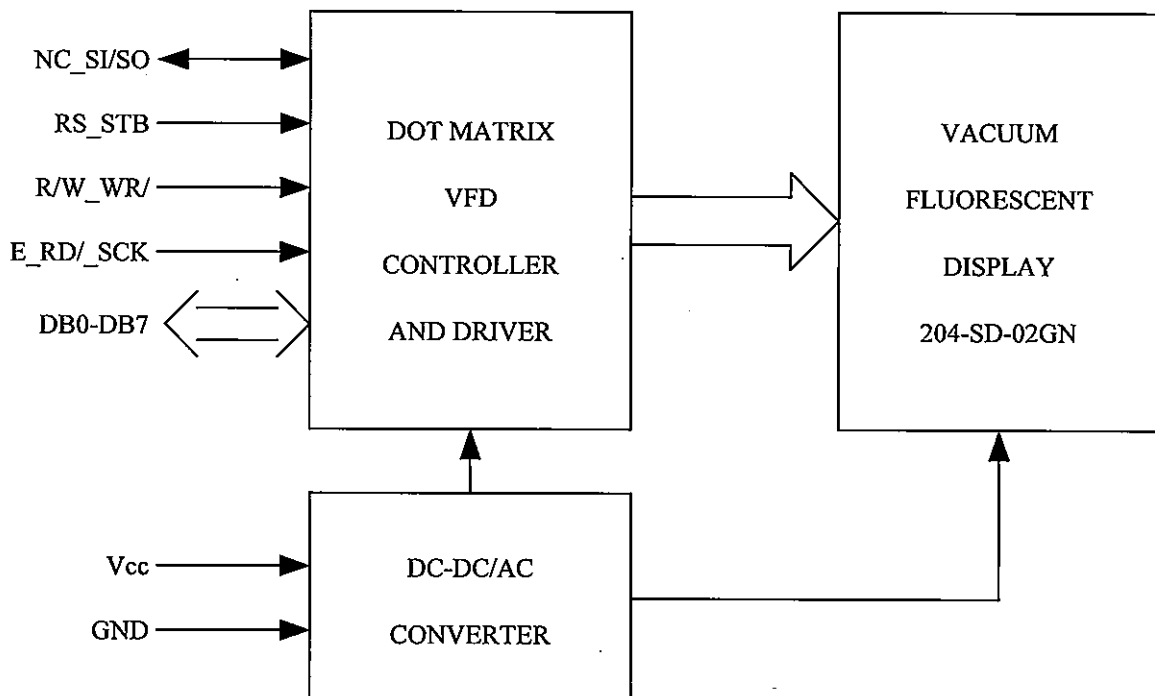
Table-12

Mode	J3	J4	J5	J6	J7
Parallel (Motorola)	open	shorted	open	shorted	open
Parallel (Intel)	open	shorted	open	open	shorted
Serial	shorted	open	shorted	shorted	open

Note : JP3-JP7 must be set as shown above for either one of the parallel modes or for the serial mode.

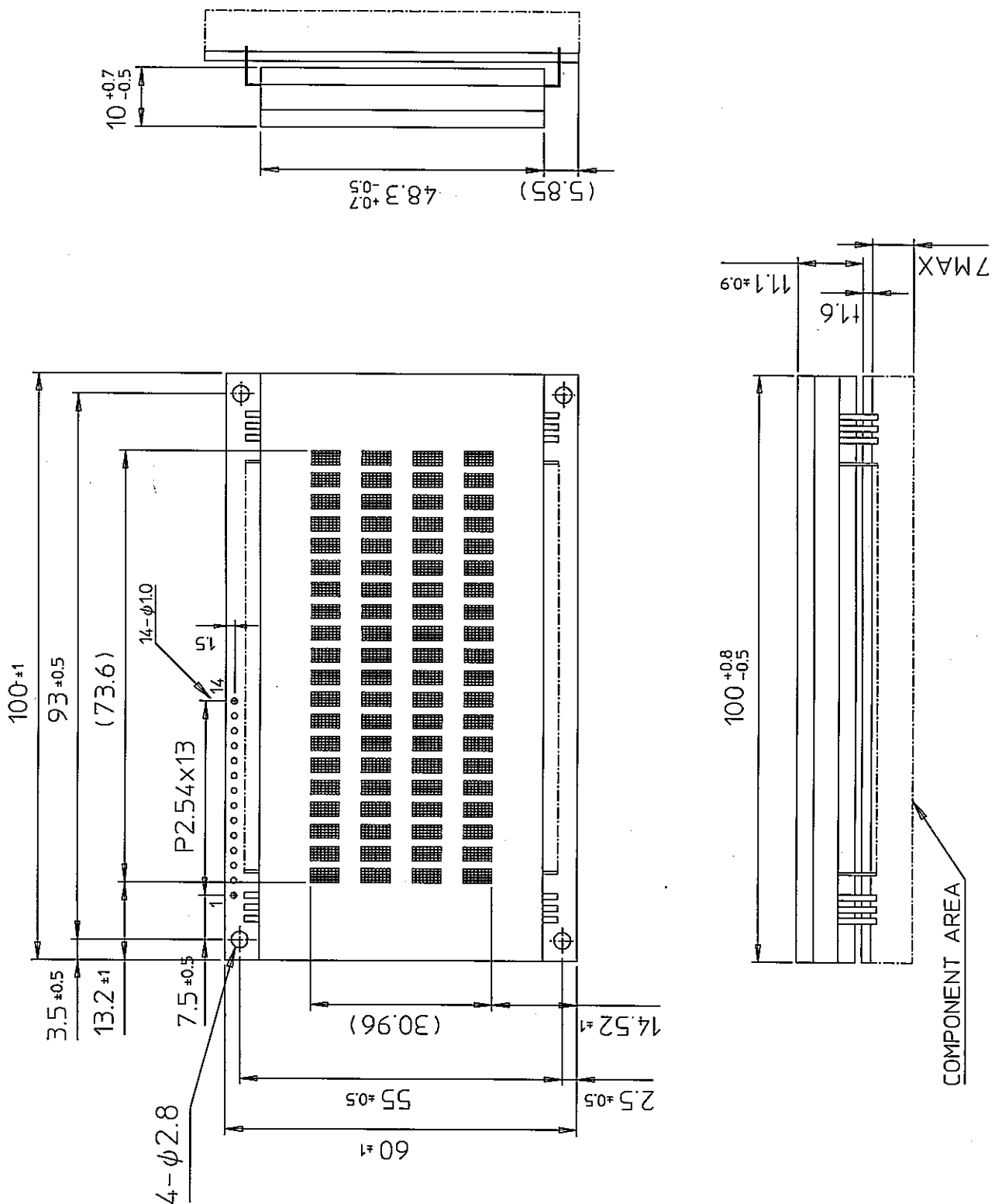
When the module is shipped , the parallel (Motorola) mode is set.

## 6 . CIRCUIT BLOCK DIAGRAM



M204SD02KA MECHANICAL DRAWING

FIGURE-13



M202SD16KA CHARACTER FONT TABLES (English/Japanese Font)

FIGURE-14

D3 D2 D1 D0	D7	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	
	D6	0	0	0	0	1	1	1	1	0	0	0	0	1	1	1	
	D5	0	0	1	1	0	0	1	1	0	0	1	1	0	0	1	
	D4	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	
		0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0 0 0 0	0		SP	0	0	0	0	0	0	1	1	1	1	1	1	1	
0 0 0 1	1		!	1	A	0	a	9	A	e	.	7	7	2	3	9	
0 0 1 0	2		"	2	B	R	b	r	A	E	'	7	7	x	B	0	
0 0 1 1	3		*	3	C	S	c	s	A	R	]	7	7	E	S	∞	
0 1 0 0	4		*	4	D	T	t	t	a	e	\	7	7	7	7	0	
0 1 0 1	5		%	5	E	U	e	u	E	O	.	*	*	1	0	0	
0 1 1 0	6		&	6	F	V	f	v	0	*	7	7	7	3	P	Σ	
0 1 1 1	7		'	7	G	W	g	w	0	0	7	7	7	7	9	π	
1 0 0 0	8		(	8	H	X	h	x	0	1	7	7	7	7	7	7	
1 0 0 1	9		)	9	I	Y	i	y	0	0	7	7	7	7	7	7	
1 0 1 0	A		z	*	;	J	Z	j	Z	U	Δ	7	7	7	7	7	
1 0 1 1	B		+	;	K	k	(	0	Δ	Δ	*	7	7	7	7	7	
1 1 0 0	C		,	<	L	Y	l	l	\	Δ	7	7	7	7	7	7	
1 1 0 1	D		-	=	M	m	)	*	Δ	Δ	7	7	7	7	7	7	
1 1 1 0	E		.	>	N	n	→	w	7	7	7	7	7	7	7	7	
1 1 1 1	F		/	?	O	o	←	S	↓	7	7	7	7	7	7	7	

SP : SPACE

## 8. WARRANTY

This display module is guaranteed for 1 year after a shipment from FUTABA.

## 9. OPERATING RECOMMENDATION

9-1. Since VFDs are made of glass material.

Avoid applying excessive shock or vibration beyond the specification for the module.  
Careful handling is essential.

9-2. Applying lower voltage than the specified may cause non activation for selected pixels.

Conversely, higher voltage may cause may non-selected pixel to be activated.  
If such a phenomenon is observed, check the voltage level of the power supply.

9-3. Avoid plugging or unplugging the interface connection with the power on.

9-4. 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.

9-5. 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 50cm (When the longer cable is required, please contact FUTABA engineering.).

9-6. When power supply is turned off, the capacitor does not discharge immediately.

The high voltage applied to the VFD must not contact the controller IC.

(The shorting of the mounted components within 30 seconds after power off may cause damage.)

9-7. The fuse is mounted on the module as circuit protection.

If the fuse blown, the problem shall be solved first and change the fuse.

9-8. When fixed pattern is displayed for long time, you may see uneven luminance.

It is recommended to change the display patterns sometimes in order to keep best display quality.

## REMARKS

This specification is subject to change without prior in order improve the design and quality.

Your consultation with FUTABA sales office is recommended for the use of this module.