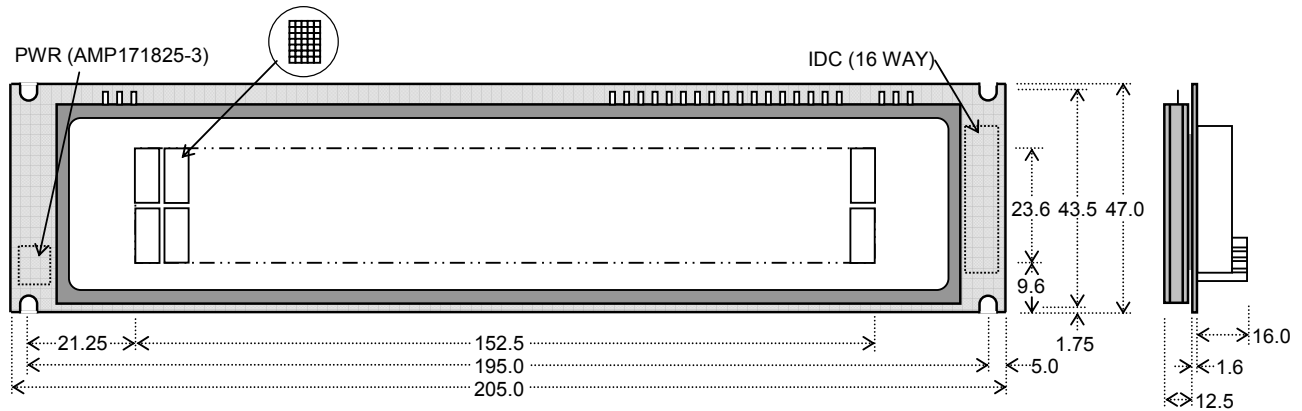


# Dot Graphic VFD Module

# CU20029-KTW220A

- 2 Line of 20 Characters 9mm High
- High Speed Parallel/TTL Serial Interface
- Operating Temp -40°C to +85°C
- Single 5V Supply
- High Brightness Blue Green Display
- ASCII, Katakana & Extended Character Font
- 16 User Definable Character RAM

The module includes the Vacuum Fluorescent Display glass, driver and micro-controller ICs with refresh RAM, character generator and interface logic. The high speed 8 bit parallel interface is 5V CMOS compatible suitable for connection to a host CPU bus. The asynchronous serial interface accepts baud rates up to 19,200 with or without parity. Two character font tables can be hardware or software selected. User defined characters and many control commands are available.



Dimensions in mm & subject to tolerances. Mounting slots 3.5mm dia.

## ELECTRICAL SPECIFICATION

Parameter	Symbol	Value	Condition
Power Supply Voltage	VCC	5.0VDC +/- 5%	GND=0V
Absolute Max Vcc	VCC (max)	7.0VDC	GND=0V
Power Supply Current	ICC	600mADC typ.	Vcc=5V
Logic High Input	VIH	3.5VDC min.	Vcc=5V
Logic Low Input	VIL	1.5VDC max.	Vcc=5V
Absolute Max Logic I/P	VI	0.3V to Vcc+0.3V	-
Logic High Output	VOH	4.5VDC min.	IOH = -2.0mA
Logic Low Output	VOL	0.33VDC max.	IOL =2.0mA

The power on rise time should be less than 100ms. The inrush current at power on can be 2 x Icc.

## OPTICAL and ENVIRONMENTAL SPECIFICATIONS

Parameter	Value
Character Size/Pitch (XxY mm)	6.2 x 9.5 / 7.7 x 14.1
Dot Size/Pitch (XxY mm)	1.0 x 1.1 / 1.3 x 1.4
Luminance	350 cd/m <sup>2</sup> Min. 900 cd/m <sup>2</sup> Typ.
Colour of Illumination	Blue-Green (Filter for colours)
Operating Temperature	-40°C to +85°C
Storage Temperature	-50°C to +85°C
Operating Humidity (non condensing)	20 to 80% RH @ 25°C

## SOFTWARE COMMANDS

Instruction	D0-D7	Instruction	D0-D7
Back Space	08H	International Font	18H
Horizontal Tab	09H	Katakana Font	19H
Line Feed	0AH	Euro Currency Mark	1AH
Form Feed	0CH	Escape	1BH
Carriage Return	0DH	> Send User Font	+43H
Clear Display	0EH	> Position cursor	+48H
Increment Write Mode	11H	> Software Reset	+49H
Over-Write Mode	12H	> Luminance	+4CH
Horizontal Scroll Mode	13H	> Flickerless Write	+53H
Cursor Off	14H	> Cursor Blink Speed	+54H
Blinking Block Cursor On	15H	Character Data	20H-FFH
Cursor Off	16H	User Character Data	00H-FFH
Cursor Off	17H		

## TIMING PARAMETERS (min)

Data Set Up To Write	100ns	Subject to change without notice. IUK Doc Ref: 61536 Iss:3 28 Feb 11
Write Pulse Width	160ns	
Hold After Write	10ns	

## CHARACTER FONTS

		International Font																Additional Katakana Font															
00	10	20	30	40	50	60	70	80	90	00	10	20	30	40	50	60	70	80	90	00	10	20	30	40	50	60	70	80	90				
01		!	1	A	Q	a	q	°	DI	H	A	N	Q	A	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q				
02		"	2	B	R	b	r	°	E	I	H	A	N	Q	A	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q			
03		#	3	C	S	c	s	°	F	J	H	A	N	Q	A	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q			
04		\$	4	D	T	d	t	°	L	H	A	N	Q	A	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q			
05		%	5	E	V	e	v	°	O	P	H	A	N	Q	A	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q			
06		&	6	F	V	f	v	°	I	H	A	N	Q	A	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q			
07		'	7	G	U	g	u	°	E	S	-	F	X	F	+	0	0	7	†	‡	§	¶	‡	§	¶	‡	§	¶	‡	§			
08		(	8	H	X	h	x	°	€	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°			
09		)	9	I	V	i	v	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°			
0A		*	1	J	Z	j	z	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°			
0B		+	2	K	L	k	l	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°			
0C		,	3	L	N	l	n	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°			
0D		-	4	M	O	m	o	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°			
0E		.	5	N	O	n	o	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°			
0F		/	?	0	o	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°			

International font location ADH (when Euro currency mark is enabled)

## PCB JUMPERS (OPEN (L)INK)

Baud	J3	J2	J1
19200	O	O	O
9600	O	O	L
4800	O	L	O
2400	O	L	L
1200	L	O	O
Parity	J5	J4	
EVEN	O	O	
ODD	O	L	
NONE	L	L / O	
Font	J6		
International	O		
Katakana	L		

## 3 PIN POWER CONNECTOR

Pin	Sig
1	Vcc (5V)
2	SIN/TEST
3	GND (0V)

## IDC DATA CONNECTOR

Pin	Sig	Pin	Sig
1	D7	9	/WR
2	D6	10	/CS
3	D5	11	SIN/TEST
4	D4	12	BUSY
5	D3	13	GND (0V)
6	D2	14	GND (0V)
7	D1	15	Vcc (5V)
8	D0	16	Vcc (5V)

Defaults: 19200, Even parity, International Font.

## CONTACT

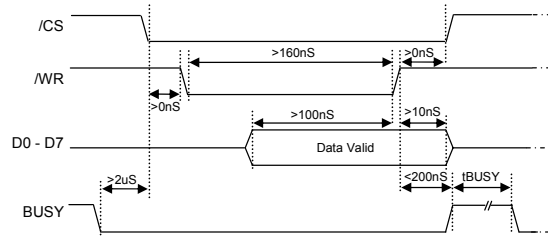
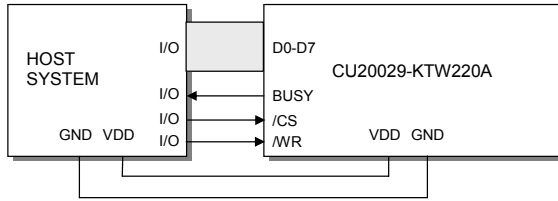
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## SOFTWARE COMMANDS

Instruction +busy time	Data Format	Description																																																																																														
Backspace 6us	08H	Moves the cursor left by one character. If the cursor is at the left end of the display no cursor movement is made.																																																																																														
Horizontal Tab 6us (20us on scroll)	09H	Moves the cursor right by one character. If the cursor is at the right end of the display the action depends on the write mode currently selected. In DC1 and DC2 mode no cursor movement is made. In DC3 mode the entire contents of the display is scrolled left by one character, the right end character position is cleared. No cursor movement is made.																																																																																														
Line Feed 6us (20us on scroll)	0AH	The display is cleared. No cursor movement is made.																																																																																														
Form Feed 6us	0CH	Moves the cursor to the left end.																																																																																														
Carriage Return 6us	0DH	Moves the cursor to the left end.																																																																																														
Clear 65us	0EH	Clear all displayed characters. No cursor movement is made.																																																																																														
Cancel 65us	0FH	Clear all displayed characters. No cursor movement is made.																																																																																														
Auto CR Mode (DC1) 6us	11H	Specifies automatic carriage return mode. (default)																																																																																														
Overwrite Mode (DC2) 6us	12H	Specifies character overwrite mode.																																																																																														
Horizontal Scroll Mode (DC3) 6us	13H	Specifies horizontal scroll mode.																																																																																														
Cursor Off (DC4) 6us	14H	The cursor is turned off																																																																																														
Cursor On (DC5) 6us	15H	The cursor is displayed as a blinking full block. The blink rate can be specified using the Blink Speed Control command.																																																																																														
Cursor Off (DC6) 6us	16H	The cursor is turned off																																																																																														
Cursor Off (DC7) 6us	17H	The cursor is turned off																																																																																														
International Font 6us	18H	All subsequent characters displayed will be from the International font. This font can also be selected as the default by using the J6 hardware jumper link (OPEN).																																																																																														
KATAKANA Font 6us	19H	All subsequent character displayed will be from the KATAKANA font. This font can also be selected as the default by using the J6 hardware jumper link (LINKED).																																																																																														
Euro Currency Mark 6us	1AH	This command enables the Euro currency mark at location ADH in the International font. Sending the International Font command (or after a reset) restores the character at location ADH to a blank (this is the default condition). This will affect any existing ADH characters already on the display.																																																																																														
User Defined Font 6us (1BH) 4us (43H) + character code + data byte 1 + data byte 2 + data byte 3 + data byte 4 15us (byte 5)	1BH + 43H + character code + data byte 1 + data byte 2 + data byte 3 + data byte 4 + data byte 5	<p>Define a user character. Up to 16 user characters can be defined and stored by the module. The specified character code can be 00H – FFH. Command codes can be overwritten with a UDF so be aware that doing so will disable that command. All UDF's are lost on power off or reset. If more than 16 UDF's are defined the older definitions are overwritten.</p> <p style="text-align: center;">Bit / Byte assignment</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td></td> <td>7</td> <td>6</td> <td>5</td> <td>4</td> <td>3</td> <td>2</td> <td>1</td> <td>0</td> </tr> <tr> <td>Byte 1</td> <td>P8</td> <td>P7</td> <td>P6</td> <td>P5</td> <td>P4</td> <td>P3</td> <td>P2</td> <td>P1</td> </tr> <tr> <td>Byte 2</td> <td>P16</td> <td>P15</td> <td>P14</td> <td>P13</td> <td>P12</td> <td>P11</td> <td>P10</td> <td>P9</td> </tr> <tr> <td>Byte 3</td> <td>P24</td> <td>P23</td> <td>P22</td> <td>P21</td> <td>P20</td> <td>P19</td> <td>P18</td> <td>P17</td> </tr> <tr> <td>Byte 4</td> <td>P32</td> <td>P31</td> <td>P30</td> <td>P29</td> <td>P28</td> <td>P27</td> <td>P26</td> <td>P25</td> </tr> <tr> <td>Byte 5</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>UL</td> <td>P35</td> <td>P34</td> <td>P33</td> </tr> </table> <p style="text-align: right;">Dot assignment</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td>P1</td> <td>P2</td> <td>P3</td> <td>P4</td> <td>P5</td> </tr> <tr> <td>P6</td> <td>P7</td> <td>P8</td> <td>P9</td> <td>P10</td> </tr> <tr> <td>P11</td> <td>P12</td> <td>P13</td> <td>P14</td> <td>P15</td> </tr> <tr> <td>P16</td> <td>P17</td> <td>P18</td> <td>P19</td> <td>P20</td> </tr> <tr> <td>P21</td> <td>P22</td> <td>P23</td> <td>P24</td> <td>P25</td> </tr> <tr> <td>P26</td> <td>P27</td> <td>P28</td> <td>P29</td> <td>P30</td> </tr> <tr> <td>P31</td> <td>P32</td> <td>P33</td> <td>P34</td> <td>P35</td> </tr> <tr> <td colspan="5" style="text-align: center;">UL</td> </tr> </table>		7	6	5	4	3	2	1	0	Byte 1	P8	P7	P6	P5	P4	P3	P2	P1	Byte 2	P16	P15	P14	P13	P12	P11	P10	P9	Byte 3	P24	P23	P22	P21	P20	P19	P18	P17	Byte 4	P32	P31	P30	P29	P28	P27	P26	P25	Byte 5	-	-	-	-	UL	P35	P34	P33	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13	P14	P15	P16	P17	P18	P19	P20	P21	P22	P23	P24	P25	P26	P27	P28	P29	P30	P31	P32	P33	P34	P35	UL				
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Cursor Moving 6us (1BH) 4us (48H) 4us (position)	1BH + 48H + position	<p>The cursor is moved to the specified position. The relationship between the position value and the display is as follows:-</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td></td> <td>Left end</td> <td>2<sup>nd</sup> col</td> <td>3<sup>rd</sup> col</td> <td>-</td> <td>Right end</td> </tr> <tr> <td>Top</td> <td>00H</td> <td>01H</td> <td>02H</td> <td>-</td> <td>13H</td> </tr> <tr> <td>Bottom</td> <td>14H</td> <td>15H</td> <td>16H</td> <td></td> <td>27H</td> </tr> </table>		Left end	2 <sup>nd</sup> col	3 <sup>rd</sup> col	-	Right end	Top	00H	01H	02H	-	13H	Bottom	14H	15H	16H		27H																																																																												
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Top	00H	01H	02H	-	13H																																																																																											
Bottom	14H	15H	16H		27H																																																																																											
Luminance 6us (1BH) 4us (4CH) 4us (luminance)	1BH + 4CH + luminance	<p>The display luminance can be set to one of 4 levels.</p> <p>luminance = 00H – 3FH specifies 25%</p> <p>luminance = 40H – 7FH specifies 50%</p> <p>luminance = 80H – BFH specifies 75%</p> <p>luminance = C0H – FFH specifies 100% (default)</p>																																																																																														
Flickerless Writing Mode 6us (1BH) 6us (53H)	1BH + 53H	Set flickerless write mode. By default, priority is given to data communication and display flicker can occur if data is sent to the display continuously. If flickerless writing mode is specified, priority is given to display refresh to avoid possible flicker. Command and data busy times will be up to 200us longer when this mode is set.																																																																																														
Blink Speed Control 6us (1BH) 4us (54H) 6us (speed)	1BH + 54H + speed	The blink rate of the cursor can be specified. Rate = speed x 30ms. (default=14H)																																																																																														
Initialise 6us (1BH) 40us (49H)	1BH + 49H	Clear the display, erase any defined characters, set the cursor position to the top left of the display and reset all settings to defaults.																																																																																														
Character Write 7us (20us on scroll)	20H – FFH	Display the specified character from the currently selected font (or UDF is defined) at the current cursor position. After the character is written to the display a horizontal tab automatically follows.																																																																																														

## PARALLEL COMMUNICATION

Data on D0-D7 is clocked into the module when /CS is low and a rising edge is detected on /WR. The host must keep the data stable for the time period indicated in the timing diagram. The module busy line can be used to give a sufficient delay between commands.



Parallel Interface Timing.

The input lines D0-D7 are internally pulled up.