# Dot Graphic VFD Module   GU256x8F-K660A7

- ❑ **256 x 8 High Brightness Dot Graphic Display**
- ❑ **Single 5V DC Supply**
- ❑ **5x7 ASCII & European Font**
- ❑ **Asynchronous and SPI Serial Interfaces**
- ❑ **Transformerless Low Profile PSU**
- ❑ **Integrated IR Keyboard Receiver**
- ❑ **Terminal Mode with User Definable Edit Fields**
- ❑ **Multi-Address Daisy / Star Point Communication**
- ❑ **Semi-custom IR Codes, Character Fonts and Firmware**

The module includes the VFD glass, VF drivers and microcontroller with refresh RAM, character generation, interface logic and patented transformerless DC/DC converter. The module features a unique low profile compact design. Key codes from the integrated IR receiver can be sent to the host. The module can operate in terminal mode where the host sends text with user editable fields. When editing is complete the user presses ENTER to transmit the display content to the host.
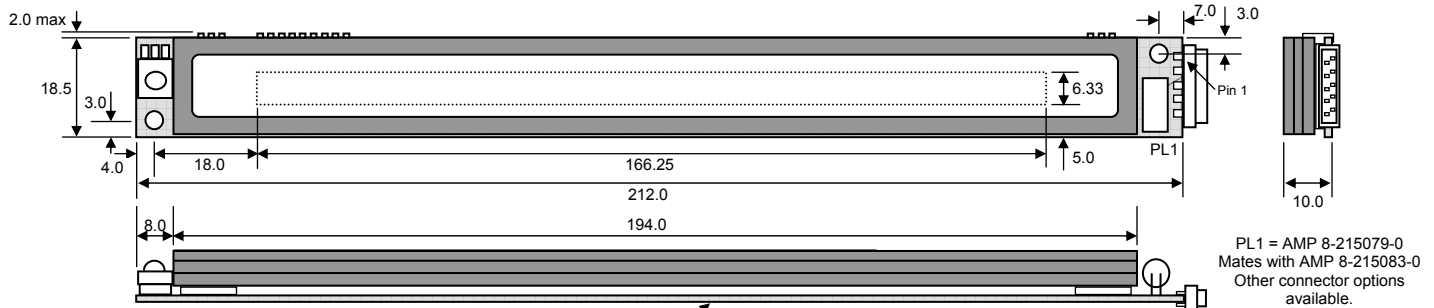
PL1 = AMP 8-215079-0
Mates with AMP 8-215083-0
Other connector options available.

Dimensions in mm subject to tolerances.
Mounting holes 3.0mm dia.

ELECTRICAL SPECIFICATION

Parameter	Sym	Min	Typ	Max	Units	Condition
Supply Voltage	V_{DD}	4.5	5.0	5.5	V	G_{ND}=0V
Supply Current	I_{DD}	-	250	-	mA	VDD=5V(Disp on)
Supply Current	I_{DD}	-	30	-	mA	VDD=5V(Disp off)
Logic High Input	V_{IH}	3.0	-	V_{DD}	V	VDD=5V
Logic Low Input	V_{IL}	-0.5	-	1.5	V	VDD=5V
Logic High Output	V_{OH}	4.2	-	-	V	VDD=5V
Logic Low Output	V_{OL}	-	-	0.6	V	VDD=5V

OPTICAL & ENVIRONMENTAL SPECIFICATION

Parameter	Value
Display Area (XxYmm)	166.25 x 6.0
Dot Size/Pitch (XxY mm)	0.5 x 0.6 / 0.66 x 0.77
Luminance	700 cd/m² Typical
Colour of Illumination	Blue-Green (505nm)
Operating Temperature	-40°C to +85°C
Storage Temperature	-40°C to +85°C
Operating Humidity	20 to 85% RH @ 25°C

Optical filters can provide violet, red, yellow, blue & green output.
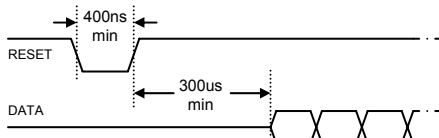
PL1 (Asynchronous interface)

Pin	Signal	Description
1	VDD	5V Supply
2	-	Do not used
3	RXD	Serial input
4	-	Do not used
5	0V	0V supply
6	-	Do not used
7	TXD	Serial output
8	RESET	Reset input
9	MB	Module busy
10	HB	Host busy

PL1 (Synchronous interface)

Pin	Signal	Description
1	VDD	5V Supply
2	SCK	Serial clock
3	/SS	Select
4	MOSI	Serial data in
5	0V	0V supply
6	MISO	Serial data out
7	-	Do not used
8	RESET	Reset input
9	MB	Module busy
10	HB	Host busy

CHARACTER TABLE

RESET TIMING

The module is reset when a low-level signal is applied to the RESET line which is pulled high with a 10K resistor.

Detailed specification, software commands and interface timing are available on request.
Subject to change without notice.
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15 May 09

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SOFTWARE COMMANDS (command execution time = 5us unless otherwise stated)

Instruction	Hex	Description
Dummy Read (SPI) Set Address (Async)	00H + xx	00H is used in SPI mode to allow a read operation. In asynchronous mode this command either enables the module with the specified address or initiates an auto addressing sequence. xx = 00H – 7FH set module address to receive data (00H enables all modules) xx = 80H – FFH start auto addressing sequence (1st module adopts address xx+1)
Software Reset Execution time = 50uS	01H	Resets the VFD module. Text mode is enabled, the display is cleared, the write position is set to 00H, all flashing and edit areas are cleared and the display is turned on.
Set Character Mode	02H	Data is converted to 5x7 dot characters in the character table.
Set Graphic Mode	03H	Data is directly written to the dots on the display.
Set Start of Edit Area	04H	Defines the start of a user edit area in character mode.
Set End of Edit Area	05H	Defines the end of a user edit area in character mode.
Set Start of Flash Area	06H	All subsequent characters received will flash in character mode.
Set End of Flash Area	07H	All subsequent characters received will be static in character mode.
Enable / Disable User Edit	08H + xx	In user edit mode the underline cursor will be visible and the KBC56A IR keyboard can be used to enter data into the editing areas previously defined xx = 00H – disable, 01H – enable (IR ASCII echo OFF), 02H – enable (IR ASCII echo ON)
Read User Edit Data	09H	In user edit mode this command will send the current character contents of the display
Cancel All Flashing	0AH	Cancels any flashing characters
Display ON	0BH	Turn display PSU ON (default)
Display OFF	0CH	Turn display PSU OFF (power save mode)
Set Write Position	0DH + xx	Sets the write position to xx. (00H – 29H in text mode, 00H – 7FH in graphic mode)
Graphic Write	0EH + len + data	Writes graphical data to the display at the current write position. The graphical data length is sent followed by the actual data which should be in a vertical orientation, with bit 7 uppermost. The writing position advances to the right after each data byte
Character Write Execution time = 85ms when scrolling	20H - FFH	Writes character data to the display. The character write position is automatically advanced to the right. When the right end of the display is reached new characters are scrolled in

INTERFACE SELECTION

Interface type is selected using option links J5 (1-2). The function of the remaining links depend on the interface selected.
O = open, L = linked. J12 links can be used to specify the module address (addresses 1-15).

Interface selection (J5)

1-2	Interface
Open	Synchronous (SPI)
Link	Asynchronous

Synchronous mode settings (J5)

| 5-6	3-4	Mode
Open	Open	Mode 0 (idle low, rising clock)
Open	Link	Mode 1 (idle low, falling clock)
Link	Open	Mode 2 (idle high, falling clock)
Link	Link	Mode 3 (idle high, rising clock)

Asynchronous baud rate (J5)

5-6	3-4	Baud
Open	Open	38400
Open	Link	9600
Link	Open	19200
Link	Link	115200

SYNCHRONOUS SERIAL COMMUNICATION (SPI)

With synchronous communications selected, data can be clocked into the VFD module using the rising or falling edge of SCK selectable using the J5 option link 3-4. The SCK idle state can be set low or high using the J5 options link 5-6. By default data is clocked in on the rising edge, clock idle low. The most significant bit is always sent first. Data is stored in a 256 byte buffer. To ensure no loss of data when sending a large amount of continuous data the host can monitor the MB (Module Busy) line. MB will be set high if the number of bytes in the buffer waiting to be processed exceeds 224. Command execution times are specified in the software command section.
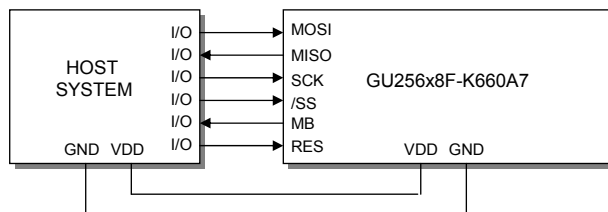

The /SS pin must be low when clocking data into the module. It can be permanently pulled low but this is not recommended since low – high transitions on the /SS pin ensures re-synchronisation of the SPI bus. 00H can be sent as a dummy byte in order to read data out of MISO.
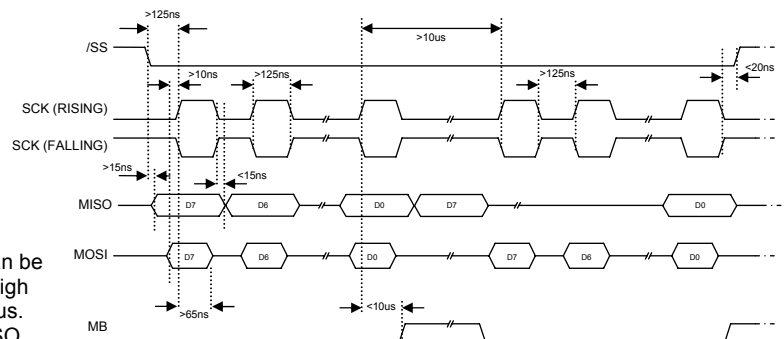
ASYNCHRONOUS SERIAL COMMUNICATION

The asynchronous communication baud rate can be set using the J5 option links. The default setting is 38400 baud. Multiple modules can be operated using star point or daisy chain connection with fixed addressing using jumper J12. Automatic addressing is available in daisy chain mode to allow communication with up to 127 modules.

CMOS Asynchronous serial communication from host system to VFD module.

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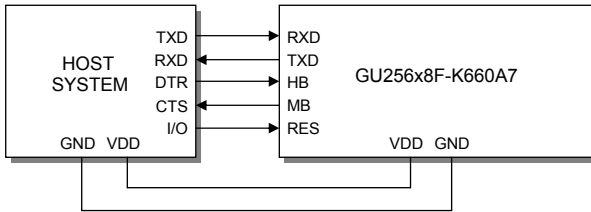
The host busy line (HB), when high, stops the module from sending data to the host until the line goes low. The use of HB and MB is optional, and they can be connected together if not required.
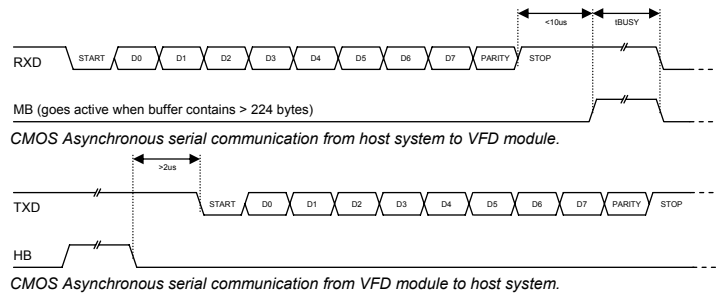
Daisy Chain Connection

More than one display module can be connected to a host system. The host transmit line is connected to the RXD of the first module. TXD of the first module is connected to RXD of the next module, and so on. TXD of the last module is connected to the receive line of the host. It is possible to auto allocate addresses to all modules in the system. This method allows control of up to 127 modules. To auto allocate addresses the host must send 00H followed by a value with the MSB set (ie 80H). This will assign address 01H to the first module, 02H to the second module, and so on. The host must wait for the auto address allocation sequence to complete before sending more data. This can take up to 2ms x number of modules connected. The host can determine the number of modules in the system by reading the two bytes sent at the end of the auto address sequence. For instance a host with 4 displays connected will receive the values 00H + 84H (if 80H was sent as the base address).

After daisy mode has been enabled all command / data bytes are processed by all modules. To send commands / data to a specific module use the Set Address command in the range 00H – 7FH.

In daisy mode, data sent from the module to the host (ie IR key data) is sent as 3 bytes in the form 0FH, address, data.

Linking any J12 links will enable manual daisy mode and the module address will relate to the J12 links as in the adjacent table. Up to 15 modules can be connected using this scheme.

Fixed module addressing (J12)

7-8	5-6	3-4	1-2	Address
Open	Open	Open	Open	Daisy off
Open	Open	Open	Link	1
Open	Open	Link	Open	2
Open	Open	Link	Link	3
Open	Link	Open	Open	4
Open	Link	Open	Link	5
Open	Link	Link	Open	6
Open	Link	Link	Link	7
Link	Open	Open	Open	8
Link	Open	Open	Link	9
Link	Open	Link	Open	10
Link	Open	Link	Link	11
Link	Link	Open	Open	12
Link	Link	Open	Link	13
Link	Link	Link	Open	14
Link	Link	Link	Link	15

Example system using 4 modules in daisy chain mode
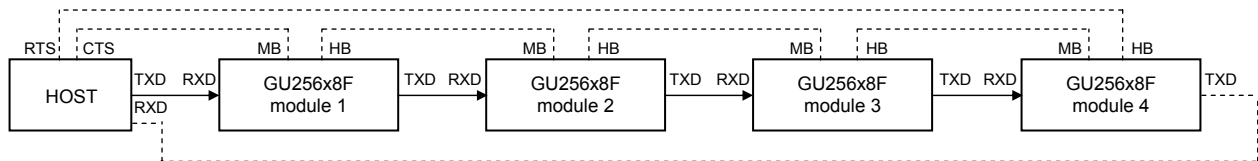
Miniumum connections are shown using solid lines – dashed connections are optional.

Host sends 00H + 80H to start auto addressing sequence and receives 00H + 84H from the last module when complete (if TXD from the last module is connected to RXD of the host). Alternatively the host can wait a period of time equal to the number of modules in the system x 2ms.

Module 1 is assigned address 01H, module 2 is address 02H, module 3 is address 03H and module 4 is address 04H.

Global addressing (broadcast mode) where all modules respond to data is set initially. The host must send 00H + 01H to address module 1, 00H + 02H to address module 2, and so on. Sending 00H + 00H sets broadcast mode.

Star Point Connection

When multiple modules are all directly connected to the host, fixed addressing needs to be set using jumpers on J12. Only RXD on each module is used – TXD, MB and HB should not be connected.
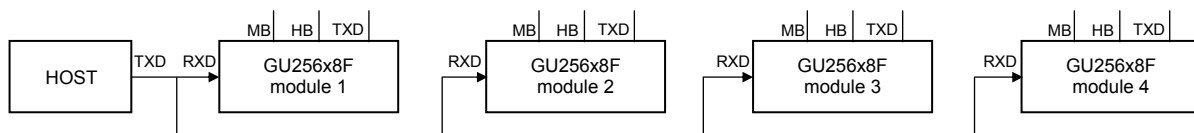
IR DATA TRANSMISSION (using KBC56A keyboard)

Data received by the IR receiver from the remote keyboard KBC56A is stored in an internal 16 byte buffer. In asynchronous mode the value is sent on TXD immediately, unless HB (host busy) is high. If the IR buffer is full, further data received is discarded. CTRL then ALT or CTRL then SHIFT enable ALT or SHIFT Lock which is cancelled using CTRL. When lock is on, ALT or SHIFT can be used to input a related alternate character. When the IR buffer is empty the data read is 00H.

| Key	Normal	Shift	Lock	ALT	CTRL		Key	Normal	Shift	Lock	ALT	CTRL
ESC	1B	01	1B	02	80		f F	66	46	46	Hex	9B
TAB	03	04	03	05	81		g G	67	47	47	1C	9C
INS	06	0E	06	0F	83		h H	68	48	48	1D	9D
DEL	1A	10	1A	11	82		i I	69	49	49	1E	9F
▲ PUp	0B	12	0B	13	84		j J	6A	4A	4A	1F	A0
◄HME	08	14	08	15	85		k K	6B	4B	4B	E0	A1
► END	09	16	09	17	86		l L	6C	4C	4C	E1	A2
▼ PDn	0A	18	0A	19	87		m M	6D	4D	4D	E2	A3
? ¥ /	3F	9C	3F	2F	88		n N	6E	4E	4E	E3	A4
* € \	2A	9D	2A	5C	89		o O	6F	4F	4F	E4	A5
(£ [	28	9B	28	5B	8A		p P	70	50	50	E5	A6
) $]	29	24	29	5D	8B		q Q	71	51	51	E6	A7
1 @	31	40	31	Hex	8C		r R	72	52	52	E7	A8
2 &	32	26	32	Hex	8D		s S	73	53	53	F0	A9
3 <	33	3C	33	Hex	8E		t T	74	54	54	F1	AA
4 >	34	3E	34	Hex	8F		u U	75	55	55	F2	AB
5 %	35	25	35	Hex	90		v V	76	56	56	F3	AC
6 +	36	2B	36	Hex	91		w W	77	57	57	F4	AD
7 -	37	2D	37	Hex	92		x X	78	58	58	F5	AE
8 =	38	3D	38	Hex	93		y Y	79	59	59	F6	AF
9 ~	39	7E	39	Hex	94		z Z	7A	5A	5A	F7	B0
0 #	30	23	30	Hex	95		' ! "	27	21	27	22	B1
a A	61	41	41	Hex	96		, ; |	2C	3B	2C	B2	B2
b B	62	42	42	Hex	97		. : °	2E	3A	2E	F8	B3
c C	63	43	43	Hex	98		Space	20	5F	20	07	B4
d D	64	44	44	Hex	99		Enter	0D	0D	0C	00	B8
e E	65	45	45	Hex	9A							

USER EDIT MODE

The host can capture user information entered using the KBC56A infrared keyboard. The host sends a message which contains editing fields. Subsequent user keyboard entry is then restricted to the editing fields. The user then enters data using the keyboard. When complete the user presses either ENTER or ESC. The host can then send a command to retrieve this data. A typical sequence of events using user edit mode :-

- Host sends prompt screen text and defines user edit area(s) using start and end markers (04H / 05H)
- Host sends User Edit Enable command (08H + 01H or 08H + 02H if the ASCII echo to host is required)
- Cursor is automatically enabled and user can edit text within edit markers using the KBC56A
- User presses ESC or ENTER on KBC56A and display sends 1BH or 0DH respectively to host
- Host can then send the read command (09H) and display sends entire screen contents (42 characters) to host
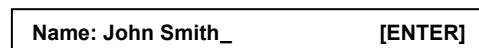- Host disables User Edit Mode (08H + 00H) – cursor is automatically disabled

When user edit mode is enabled with echo enabled (08H + 02H) all ASCII codes received via the IR keyboard are sent to the host. When echo is disabled only the ENTER and ESC keys send data to the host. When entering ASCII data into the edit fields characters are overwritten and the cursor moves to the right. The cursor automatically moves from one edit field to the next. The LEFT and RIGHT keys can be used to move the cursor position within the field(s).

Example :-

Host sends text - The data sent (shown in HEX) to show this message with the edit field is :-
4E 61 6D 65 3A **04** 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 **05** 20 5B 45 4E 54 45 52 5D

04H ... 05H
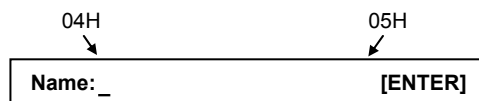
Name:_   [ENTER]

User enters text - Using the KBC56A the user enters their name and then presses ENTER.

Name: John Smith_   [ENTER]

Host reads text - The entire display content is returned :-

User entered data

4E 61 6D 65 3A **4A 6F 68 6E 20 53 6D 69 74 68 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20** 20 5B 45 4E 54 45 52 5D