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RoHS 2002/95/EC

Vacuum Fluorescent Display
Module
Specification

Model: CU20029-TE200K

This specification is subject to change without prior notice.
This product complies with RoHS Directive 2002/95/EC

Contents

1 General Description

This specification covers the operation and operating requirements of the Vacuum Fluorescent Display (VFD) module CU20029-TE200K.

1.1 Features

- Power supply
    - DC 5V
- Interface
    - Serial Interface (RS-232-level, bi-directional, asynchronous)
- Functions
    - Character display
    - Control commands
    - FROM User Fonts, FROM User Table
    - International fonts

1.2 Configuration

This single-board display module consists of a 40-character (20 characters × 2 lines) VFD, refresh RAM, character generator, DC/DC converter, display controller and all necessary control logic.   It is driven by a single 5V DC power supply.

1.3 Built-in Fonts

1-byte character:	International font	(Font spec. DS-1585-0002)
2-byte character:	Japanese	(Font spec. DS-1585-0003)
	Korean	(Font spec. DS-1585-0004)
	Simplified Chinese	(Font spec. DS-1585-0005)
	Traditional Chinese	(Font spec. DS-1585-0006)

2 Electrical Specifications

2.1 Absolute Maximum Ratings

Parameter	Symbol	Min.	Typ.	Max.	Unit	Condition
Power Supply Voltage	VCC	−0.3	-	6.0	VDC	-
Input Voltage RXD, DSR	VI1	−25	-	+25	VDC	-
Input Voltage TEST	VI2	−0.3	-	3.5	VDC	-

2.2 Electrical Characteristics

Measuring Conditions: Ambient temperature = 25 ºC, V_{CC} = 5.0 V_{DC}

Parameter		Symbol	Min.	Typ.	Max.	Unit	Condition
Input voltage RXD,DSR	'H'	VIH1	3	-	15	VDC	-
	'L'	VIL1	−15	-	−3	VDC	-
Output voltage TXD,DTR	'H'	VOH1	5	-	-	VDC	RL=3kΩ
	'L'	VOL1	-	-	−5	VDC	
Signal input impedance RXD,DSR		RIN	3	-	7	kΩ	-
Input voltage TEST	'H'	VIH2	2.64	-	3.3	VDC	-
	'L'	VIL2	0	-	0.66	VDC	-
Power Supply Voltage		VCC	4.75	5.00	5.25	VDC	-
Power Supply Current		Icc1	-	625	800	mADC	All dots ON
		Icc2	-	510	660	mADC	All dots OFF
		Icc3		21	30	mADC	Disp. power off

Note:
Slow start power supply may cause erroneous operation. The rise time of supply voltage should not exceed 50 ms.
Inrush current at power-on may exceed twice normal current.

3 Optical Specifications

Luminance:	Minimum 350 cd/m^2, typically 1000 cd/m^2
Color of illumination:	Green (Blue Green)

4 Environmental Specifications

Operating temperature:	−40 to +85 ºC
Storage temperature:	−40 to +85 ºC
Operating humidity:	20 to 80 % R.H (non-condensing)
Storage humidity:	20 to 80 % R.H (non-condensing)
Vibration:	10-55-10Hz, all amplitude 1.0mm, 30 minutes, X-Y-Z (non-operating)
Shock:	392m/s^2 (40G) 9ms X-Y-Z, 3 times each direction (non-operating)

5 Physical Specifications

Number of characters:	40 (20 characters × 2 lines)
Character format:	15 × 16 dot matrix
Display area:	159.0 × 23.59 mm (X × Y)
Character size:	6.53 × 10.52 mm (X × Y)
Character pitch:	8.03 × 13.07 mm (X × Y)
Dot size:	0.30 × 0.52 mm (X × Y)
Dot pitch:	0.45 × 0.67 mm (X × Y)
Weight:	Approximately 118g

6 Applicable Specifications

Applicable reliability spec:	TT-99-3102
Applicable production spec:	TT-98-3413

7 Interface

7.1 Interface Specification

Communication specification

Parameter	Details
Communication type	Asynchronous serial
Signal level	RS-232 standard
Baud rate	9600bps, 19200bps, 38400bps, 115200bps (set by JP1, JP2)
Bit format	Start(1bit) + Data(8bit) + Stop(1bit / 2bit, set by JP3)
Handshaking	DTR, DSR

Buffer capacity

Receive buffer	128 bytes
Transmit buffer	64 bytes

DTR signal change timing

DTR change	1(READY)→0(BUSY)	0(BUSY)→1(READY)
Condition	Receive buffer remaining space is approximately 32 bytes or less	Receive buffer remaining space is approximately 64 bytes or more

Data receive

Received data is stored in the receive buffer and processed in order of receipt.

If data continues to be received when DTR is BUSY and there is no more remaining space in the receive buffer, received data is discarded.

Data transmit

Transmit data is initially stored in the transmit buffer, and transmitted in order when DSR signal is READY.

If DSR remains BUSY and there is no more remaining space in the transmit buffer, command processing stops until space becomes available.

7.2   Interface timing
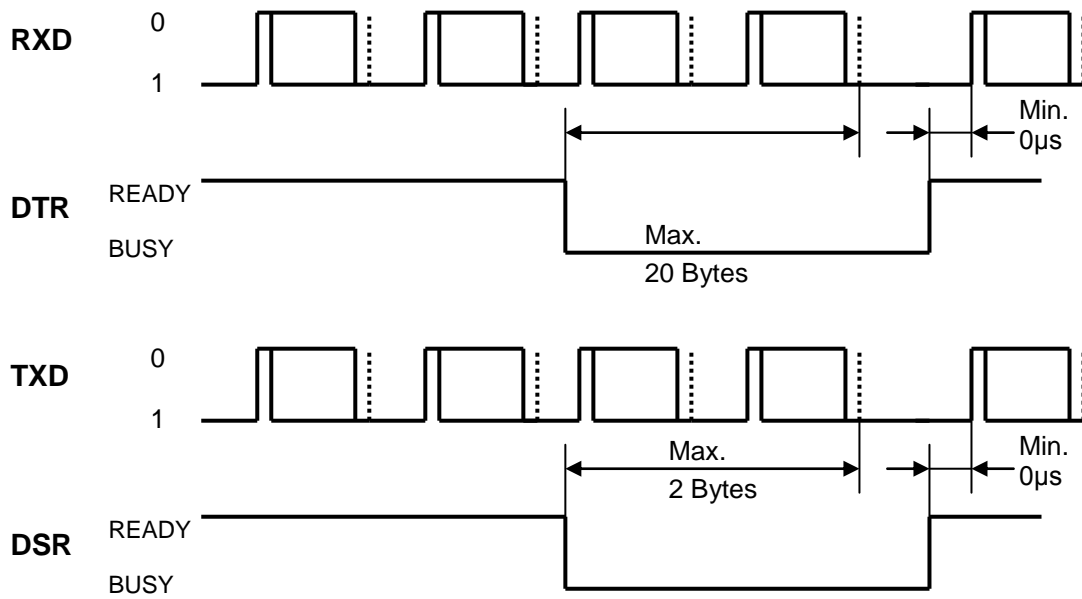
8   Jumper Settings

8.1   Jumper Location

Component side
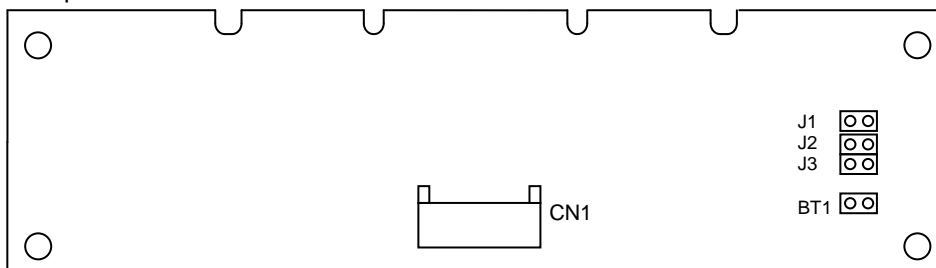
Note: BT1 is for factory use only – do not use.

8.2   Baud Rate setting

J1	J2	Setting
OPEN	OPEN	38400bps (factory default)
SHORT	OPEN	19200bps
OPEN	SHORT	9600bps
SHORT	SHORT	115200bps

8.3   Stop Bit setting

J3	Setting
OPEN	1 bit (factory default)
SHORT	2 bits

9 Operating mode

This display has the following operating modes. Mode is changed by command or jumper setting.

```
┌──────┐      ╱╲  NO    ┌──────────┐     ┌─────────────┐
│Power │────▶╱TEST╲────▶│ Initialize│───▶│ Normal Mode │
│ ON   │     ╲    ╱      └──────────┘     └─────────────┘
└──────┘      ╲╱                                  │
               │ YES                              ▼
               ▼                          ┌─────────────┐
         ┌──────────┐                     │User set up  │
         │Test Mode │                     │    mode     │
         └──────────┘                     └─────────────┘
```
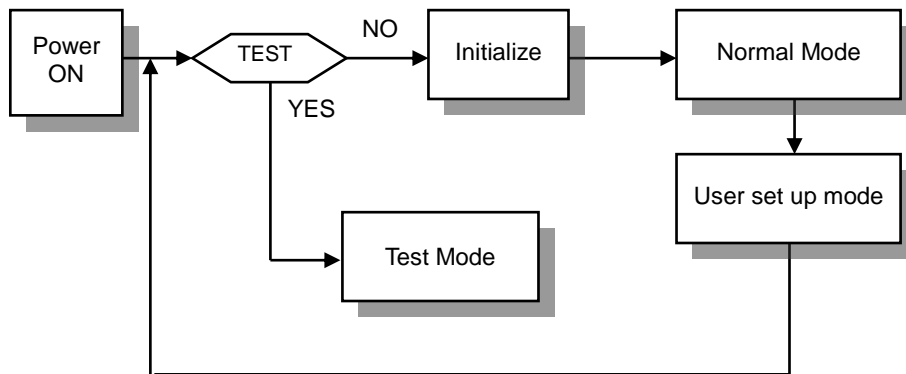
Note: If User set up mode -related commands are executed in Normal Mode, display may flicker.

10 Function

Data received is stored in the receive buffer and processed in order of receipt.

10.1 Command Configuration

The display module's commands are configured as follows.

08h–18h	Control command
1Bh ...	ESC command
1Fh ...	User Setup command
- 1Fh 28h 61h ...	- Display Power control command
- 1Fh 28h 65h ...	- User set up mode commands
- 1Fh 28h 67h ...	- Character setting command
20h–FFh	Character display

10.2 Command List

Command Name	Hex Code				
	Byte 1	Byte 2	Byte 3	Byte 4	Parameter
Back Space	08h	-	-	-	-
Horizontal Tab	09h	-	-	-	-
Line Feed	0Ah	-	-	-	-
Home Position	0Bh	-	-	-	-
Display Clear	0Ch	-	-	-	-
Carriage Return	0Dh	-	-	-	-
Line Clear	18h	-	-	-	-
FROM User Font	1Bh	25h	-	-	n
Initialize display		40h	-	-	-
International font set (character codes: 23h, 24h, 40h, 5Bh–5Eh, 60h, 7Bh–7Eh)		52h	-	-	n
Character table type (Character codes: 80h–FFh)		74h	-	-	n
Over-write mode	1Fh	01h	-	-	-
Vertical scroll mode		02h	-	-	-
Horizontal scroll mode		03h	-	-	-
Upper line		0Ah	-	-	-
Right end		0Dh	-	-	-
Cursor set		24h	-	-	x y
End position		42h	-	-	-
Cursor display		43h	-	-	n
Blink screen		45h	-	-	n
Brightness level setting		58h	-	-	n
Reverse display		72h	-	-	n
Display Power		28h	61h	40h	p
User set up mode start			65h	01h	d1 d2
User set up mode end				02h	d1 d2 d3
FROM User Font control Delete all characters / Register / Read 1 character (Character code: 20h–FFh)				30h	n m a - - -
FROM User Table control Delete / Register / Read all characters (Character code: 80h–FFh)				31h	n m - - -
Read Status information				40h	a [b c]
2-byte character			67h	02h	n
2-byte character type				03h or 0Fh	n
Character display (1-byte character)	20h–FFh	-	-	-	-
Character display (2-byte character)	c1	c2	-	-	-

Caution: FROM re-writing is limited (approximately 10,000 cycles).
Do not turn power off during FROM writing or deleting.

10.3 Command Descriptions

10.3.1 Character display

Code: **20h – FFh, or 2-byte character code c1 c2**

Function: Displays a character at the current cursor position, and moves the cursor position one character to the right.

Characters are displayed as follows.

Character		Code	Setting
1-byte character	Common (ASCII etc)	20h–7Fh (except International font set codes)	- - -
	International font set	23h,24h, 40h,5Bh–5Eh 60h,7Bh–7Eh	International font set n: 00h–0Dh
	Character table type	80h–FFh	Character table type n: 00h–05h,10h–13h
	FROM User Font	20h–FFh, applicable code	FROM User Font n: 01h FROM User Font Register
	FROM User Table	80h–FFh	Character table type n: FFh
2-byte character (See note)	Japanese JIS X0208(SHIFT-JIS)	c1: 81h–9Fh, E0h–EFh c2: 40h–7Eh, 80h–FCh	2-byte character n: 01h 2-byte character type n: 00h
	Korean KSC5601-87	c1: A1h–FEh c2: A1h–FEh	2-byte character n: 01h 2-byte character type n: 01h
	Simplified Chinese GB2312-80	c1: A1h–FEh c2: A1h–FEh	2-byte character n 01h 2-byte character type n: 02h
	Traditional Chinese Big-5	c1: A1h–FEh c2: 40h–7Eh, A1h–FEh	2-byte character n: 01h 2-byte character type n: 03h

Note: When 2-byte character is enabled, if c1 is outside the valid range, it is processed as a 1-byte character. If c1 is within the valid range, but c2 is outside the valid range, the 2-byte sequence is ignored, and nothing is displayed.

	2xh	3xh	4xh	5xh	6xh	7xh	8xh	9xh	Axh	Bxh	Cxh	Dxh	Exh	Fxh
x0h														
x1h														
x2h														
x3h														
x4h														
x5h														
x6h														
x7h														
x8h														
x9h														
xAh														
xBh														
xCh														
xDh														
xEh														
xFh														

International font set

Common

Character table

2-byte character

Cursor movement is as follows:

Overwrite mode

Cursor position		Operation
X(column)	Y(row)	
Not right end	-	Display character at cursor position. Cursor moves to the right by one character.
Right end	1st line	Display character at cursor position. Cursor moves to left end of 2nd line.
	2nd line	Display character at cursor position. Cursor moves to left end of 1st line.

Vertical scroll mode

Cursor position		Operation
X(column)	Y(row)	
Not right end	-	Display character at cursor position. Cursor moves to the right by one character.
Right end	1st line	Display character at cursor position. Cursor moves to left end of 2nd line.
	2nd line	Display character at cursor position. Display contents shift up by one line, 2nd line is cleared. Cursor moves to left end of 2nd line.

Horizontal scroll mode

Cursor position		Operation
X(column)	Y(row)	
Not right end	-	Display character at cursor position. Cursor moves to the right by one character.
Right end	-	Display character at cursor position. Transition to Scroll ON mode.
Scroll ON mode		Current line display contents shift left by one column. Display character at cursor position.

Scroll ON mode is cancelled by the commands Back Space, Line Feed, Upper Line, Home, End Position, Display Clear, Carriage Return, Right End, Line Clear, Cursor Set, Overwrite mode, Vertical scroll mode, Horizontal scroll mode, and Initialize, etc.

10.3.2 Back Space

Code: 08h

Function: The cursor moves to the left by one character.   The details of operation are as follows:

Overwrite mode

Cursor position		Operation
X(column)	Y(row)	
Not left end	-	Cursor moves to the left by one character.
Left end	1st line	Cursor moves to right end of 2nd line.
	2nd line	Cursor moves to right end of 1st line.

Vertical scroll mode

Cursor position		Operation
X(column)	Y(row)	
Not left end	-	Cursor moves to the left by one character.
Left end	1st line	Display contents shift down by one line and 1st line is cleared. Cursor moves to right end of 1st line.
	2nd line	Cursor moves to right end of 1st line.

Horizontal scroll mode

Cursor position		Operation
X(column)	Y(row)	
Not left end	-	Cursor moves to the left by one character.
Left end	-	Current line display contents shift right by one character and display is cleared at cursor position.

10.3.3 Horizontal Tab

Code: 09h

Function: The cursor moves to the right by one character.   The details of operation are as follows:

Overwrite mode

Cursor position		Operation
X(column)	Y(row)	
Not right end	-	Cursor moves to the right by one character.
Right end	1st line	Cursor moves to left end of 2nd line.
	2nd line	Cursor moves to left end of 1st line

Vertical scroll mode

Cursor position		Operation
X(column)	Y(row)	
Not right end	-	Cursor moves to the right by one character.
Right end	1st line	Cursor moves to left end of 2nd line.
	2nd line	Display contents shift up by one line, 2nd line is cleared. Cursor moves to left end of 2nd line.

Horizontal scroll mode

Cursor position		Operation
X(column)	Y(row)	
Not right end	-	Cursor moves to the right by one character.
Right end	-	Current line display contents shift left by one character and display is cleared at cursor position. Transition to Scroll ON mode.
Scroll ON mode		Current line display contents shift left by one character and display is cleared at cursor position.

Scroll ON mode is cancelled by the commands Back Space, Line Feed, Upper Line, Home, End Position, Display Clear, Carriage Return, Right End, Line Clear, Cursor Set, Overwrite mode, Vertical scroll mode, Horizontal scroll mode, and Initialize, etc.

10.3.4 Line Feed

Code: 0Ah

Function: The cursor moves to next lower line.   The details of operation are as follows:

Overwrite mode

Cursor position		Operation
X(column)	Y(row)	
-	1st line	Cursor moves to 2nd line.
	2nd line	Cursor moves to 1st line

Vertical scroll mode

Cursor position		Operation
X(column)	Y(row)	
-	1st line	Cursor moves to 2nd line.
	2nd line	Display contents shift up by one line, 2nd line is cleared. Cursor does not move.

Horizontal scroll mode

Cursor position		Operation
X(column)	Y(row)	
-	1st line	Cursor moves to 2nd line.
	2nd line	No operation

10.3.5 Home Position

Code: 0Bh

Function: Cursor moves to the home position (left end of 1st line).

10.3.6 Display Clear

Code: 0Ch

Function: Display is cleared and cursor moves to home position (left end of 1st line).

10.3.7 Carriage Return

Code: 0Dh

Function: Cursor moves to left end of current line.

10.3.8 Line Clear

Code: 18h

Function: Current line is cleared and cursor moves to left end of current line.

10.3.9 FROM User Font

Code: 1Bh   25h   n

Function: FROM User Font enable/disable.
n = 00h: Disable
n = 01h: Enable
Initial value: n = 00h
Characters already displayed are not affected.
For character codes for which a FROM User Font is not registered, normal built-in character is displayed.
See also 10.3.27 FROM User Font control.

10.3.10 Initialize display

Code: 1Bh   40h

Function: Clear display and return settings to initial state.
Refer to 10.4 Initial Settings.
Jumper settings are not re-loaded.

10.3.11 International font set

Code: **1Bh 52h n**

Function: Select international font set
Valid range: n: 0 (00h) – 13 (0Dh)
Default: n = 0 (00h)

Characters already displayed are not affected.

International font set

n	Font set
0(00h)	America
1(01h)	France
2(02h)	Germany
3(03h)	England
4(04h)	Denmark 1
5(05h)	Sweden
6(06h)	Italy
7(07h)	Spain 1
8(08h)	Japan
9(09h)	Norway
10(0Ah)	Denmark 2
11(0Bh)	Spain 2
12(0Ch)	Latin America
13(0Dh)	Korea

10.3.12 Character table type

Code: **1Bh 74h n**

Function: Select Character table type
Valid range: n = 0(00h), 1(01h), 2(02h), 3(03h), 4(04h), 5(05h),
16(10h), 17(11h), 18(12h), 19(13h), 255(FFh)
Default: n = 0 (00h)

Characters already displayed are not affected

Character table type

n	Character table type
0	PC437 (USA: Standard Europe)
1	Katakana
2	PC850 (Multilingual)
3	PC860 (Portuguese)
4	PC863 (Canadian-French)
5	PC865 (Nordic)
16	WPC1252
17	PC866 (Cyrillic #2)
18	PC852 (Latin 2)
19	PC858
255	FROM User Table

10.3.13 Over-write mode

Code: **1Fh 01h**

Function: Display mode set to Over-write mode.

10.3.14 Vertical scroll mode

Code: **1Fh 02h**

Function: Display mode set to Vertical scroll mode.

10.3.15 Horizontal scroll mode

Code: **1Fh 03h**

Function: Display mode set to Horizontal scroll mode.

10.3.16 Upper line

Code: **1Fh   0Ah**

Function: Move cursor up by one line.

Over-write mode

Cursor position		Operation
X(Column)	Y(Row)	
-	1st line	Cursor moves to 2nd line.
	2nd line	Cursor moves to 1st line.

Vertical scroll mode

Cursor position		Operation
X(Column)	Y(Row)	
-	1st line	Display contents shift down by one line, top line cleared. Cursor does not move.
	2nd line	Cursor moves to 1st line.

Horizontal scroll mode

Cursor position		Operation
X(Column)	Y(Row)	
-	1st line	Cursor does not move.
	2nd line	Cursor moves to 1st line.

10.3.17 Right end

Code: **1Fh   0Dh**

Function: Cursor moves to right end of current line.

10.3.18 Cursor set

Code: **1Fh   24h   x   y**

x: Cursor position x (1 char /unit)
y: Cursor position y (1 line /unit)
Definable area: x: 1 (01h) – 20h (14h)
                      y: 1 (01h) – 2 (02h)
Default: x = 1 (01h), y = 1 (01h)
Function: The cursor moves to the specified X, Y position.   If the specified X, Y position (X, Y, either or both) is outside the definable area, the command is ignored, and the cursor remains in the same position.

10.3.19 End position

Code: **1Fh   42h**

Function: Cursor moves to end position (left end of 2nd line).

10.3.20 Cursor display

Code: **1Fh   43h   n**

n: Cursor display setting
Definable area:
  n = 0 (00h): Cursor display off.
  n = 1 (01h): Cursor display on (block cursor).
Default: n = 0 (00h)
Function: Specifies cursor display ON/OFF.   Blink time for block cursor depends on time set in Blink screen command.

10.3.21 Blink screen

Code: **1Fh   45h   n**

n: Blink display time
Definable area: n = 0 (00h) Screen blink cancel.
                      n = 1 (01h) – 255 (FFh) Screen blink display.
Default: n = 0

Function: Screen blink control.
For n=0, screen blink is cancelled.
For n=1–255, screen blinks with the period:
Blink period = n×100ms

10.3.22 Brightness level setting

Code: **1Fh 58h n**

n: Brightness level setting

Definable area: n: 1 (01h) – 4 (04h)

Default: n = 4 (04h)

Function: Set display brightness level.

n	Brightness level
01h	25 %
02h	50 %
03h	75 %
04h	100 %

10.3.23 Reverse display

Code: **1Fh 72h n**

n: Reverse display setting

Definable area:

n = 0 (00h): Reverse display OFF.
n = 1 (01h): Reverse display ON.

Default: n = 0 (00h)

Function: Reverse character display setting ON/OFF.

10.3.24 Display Power

Code: **1Fh 28h 61h 40h n**

n: Display Power setting

Definable area:
n = 0 (00h): Display power OFF (power save mode)
n = 1 (01h): Display power ON

Default: n = 1 (01h)

Function: Display power ON/OFF.

10.3.25 User set up mode start

Code: **1Fh 28h 65h 01h d1 d2**

Definable area: d1 = 49h (Character 'I')
d2 = 4Eh (Character 'N')

Function: Start user set up mode.
Display screen is cleared and normal commands stop being accepted.
The following data is transmitted in response:

Transmitted data	Hex	Data length
(1) Header	28h	1 byte
(2) Identifier1	65h	1 byte
(3) Identifier 2	01h	1 byte
(4) Data	00h	1 byte

10.3.26 User set up mode end

Code: **1Fh 28h 65h 02h d1 d2 d3**

Definable area: d1 = 4Fh (Character 'O')
d2 = 55h (Character 'U')
d3 = 54h (Character 'T')

Function: End user set up mode, and software reset of display is executed.
After this command is executed, software reset is executed, the receiving buffer is cleared, and all settings and the display screen are reset to initial power-on state. Jumper settings are reloaded.

10.3.27 FROM User Font control

Code: **1Fh 28h 65h 30h n m a - - -**

n: Character select
m: Operation mode

m = 00h: Delete all characters

  1Fh 28h 65h 30h n m a b

 n: Character select
 m: Operation mode
 a: Fixed data 1
 b: Fixed data 2

m = 01h: Register single character

  1Fh 28h 65h 30h n m a p(1) p(2) --- p(30)

 n: Character select
 m: Operating mode
 a: Character code to register
 p(1)–p(30): Pattern data (refer to [10.5 Font Register data format](#))

m = 02h: Read data for single character

  1Fh 28h 65h 30h n m a

 n: Character select
 m: Operating mode
 a: Registered character code

Definable area:
 Delete all characters
 n = 02h, m = 00h,   a = 55h,   b = AAh

 Register single character
 n = 02h, m = 01h,   a: 20h–FFh, p(1)–p(30): 00h–FFh

 Read data for single character
 n = 02h, m = 02h,   a: 20h–FFh

Default: Deleted state
Function: Deletes all characters, registers a single character, or reads data for a single character for the FROM
                User Font.   If this command is executed in Normal Mode, display may flicker.   Deleted or
                re-registered font patterns are effective immediately (including any User Font characters already
                displayed), however changes to FROM User Font are not fully complete until next User setup mode
                end command, or power-on.   Refer also to 10.3.9 FROM User Font.

m = 00h   Delete all characters
This command deletes the User Font for all character codes, 20h–FFh.
Results of the operation are transmitted in the following format:

Transmitted data	Hex	Data length
(1) Header	28h	1 byte
(2) Identifier 1	65h	1 byte
(3) Identifier 2	30h	1 byte
(4) Data	00h,FFh	1 byte 00h: Normal FFh: Error

m = 01h: Register single character
This command registers the single character, given by character code a.
The registered font is displayed when User Font set is set ON.
A maximum of 224 characters, codes 20h–FFh, can be registered.
An already-registered character code cannot be re-registered unless Delete all characters is done.
Results of the operation are transmitted in the following format:

Transmitted data	Hex	Data length
(1) Header	28h	1 byte
(2) Identifier 1	65h	1 byte
(3) Identifier 2	30h	1 byte
(4) Data	00h,FFh	1 byte 00h: Normal FFh: Error (already registered)

m = 02h: Read data for one character
This command can be used to read the registered data for character code a.
Results of the operation are transmitted in the following format:

Transmitted data	Hex	Data length
(1) Header	28h	1 byte
(2) Identifier 1	65h	1 byte
(3) Identifier 2	30h	1 byte
(4) Registration status	00h,01h	1 byte 00h: unregistered 01h: registered
(5) Pattern	00h-FFh	30 bytes

10.3.28 FROM User Table control

Code: 1Fh   28h   65h   31h   n   m   - - -
n: Character select
m: Operation mode

m = 00h: Delete all characters

1Fh   28h   65h   31h   n   m   a   b
n: Character select
m: Operation mode
a: Fixed data 1
b: Fixed data 2

m = 01h: Register all characters

1Fh   28h   65h   31h   n   m   p(80h-1)   ---   p(80h-30)   p(81h-1)   ---   p(FFh-30)
n: Character select
m: Operating mode
p(80h-1) – p(FFh-30):
            30 bytes / character × 128 characters = 3840 bytes.
            Pattern data (refer to 10.5 Font Register data format)

m = 02h: Read data for all characters

1Fh   28h   65h   31h   n   m
n: Character select
m: Operating mode

Definable area:
 Delete all characters
  n = 02h, m = 00h,   a = 55h,   b = AAh

 Register all characters
  n = 02h, m = 01h,   p(80h-1) – p(FFh-30): 00h–FFh

 Read data for all characters
  n = 02h, m = 02h

Default: Deleted state

Function: Deletes, registers data, or reads data for all characters in the FROM User Table (80h–FFh).   If this
           command is executed in Normal Mode, display may flicker.   Deleted or registered data is effective
           immediately, including any User Table characters already displayed.

m = 00h   Delete all characters
This command deletes the User Font table for all character codes, 80h–FFh.
Results of the operation are transmitted in the following format:

Transmitted data	Hex	Data length
(1) Header	28h	1 byte
(2) Identifier 1	65h	1 byte
(3) Identifier 2	31h	1 byte
(4) Data	00h,FFh	1 byte 00h: Normal FFh: Error

m = 01h: Register all characters
This command registers all characters, 80h–FFh, for the User Font table.
The registered font is displayed when Character table type is set to FROM User Table.
128 characters, codes 80h–FFh, are registered.
Results of the operation are transmitted in the following format:

Transmitted data	Hex	Data length
(1) Header	28h	1 byte
(2) Identifier 1	65h	1 byte
(3) Identifier 2	31h	1 byte
(4) Data	00h,FFh	1 byte 00h: Normal FFh: Error

m = 02h: Read data for all characters
This command can be used to read the registered data for the all character codes 80h–FFh in the User Font
table.
Results of the operation are transmitted in the following format:

Transmitted data	Hex	Data length
(1) Header	28h	1 byte
(2) Identifier 1	65h	1 byte
(3) Identifier 2	31h	1 byte
(4) Pattern	00h–FFh	3840 bytes

10.3.29 Read Status information

Code: **1Fh   28h   65h   40h   a   [b   c]**

Definable area: a = 2 (02h), 3 (03h), 32 (20h), 48 (30h)

a= 02h: Firmware version information (b, c are not used)

a= 03h: Font data information (b, c are not used)

a= 20h: Memory checksum information

b: 00h–1Fh, 80h   Start address

c: 01h–20h   Data length

a= 30h: Product type information (b, c are not used)

Function: Respond with the requested display status information.   Response is formatted as follows:

Transmitted data	Hex	Data length
1: Header	28h	1 byte
2: Identifier 1	65h	1 byte
3: Identifier 2	40h	1 byte
4: Data	00h–FFh	a = 02h: 4 bytes a = 03h: 15 bytes a = 20h: 4 bytes a = 30h: 15 bytes

10.3.30 2-byte character

Code: **1Fh   28h   67h   02h   n**

n: 2-byte character setting
Valid range: n = 00h: 2-byte character OFF

n = 01h: 2-byte character ON

Default: n = 00h
Function: Sets 2-byte character ON/OFF.

10.3.31 2-byte character type

Code: **1Fh   28h   67h   03h   n**

1Fh   28h   67h   0Fh   n

n: 2-byte character type setting
Definable area: n = 00h: Japanese

n = 01h: Korean

n = 02h: Simplified Chinese

n = 03h: Traditional Chinese
Default: n = 00h
Function: Sets 2-byte character type.

10.4   Initial Settings

Item	Initial Setting	Note
Display screen	All characters space (blank)	
Cursor position	Left end of 1st line (x=01h, y=01h)	
Cursor display	OFF (n=00h)	
FROM User Font	Disabled (n=00h)	
International font set	America (n=00h)	
Character table type	PC437 (n=00h)	
Display Mode	Over-write mode	
Display Power	ON (n=01h)	
FROM User Font registration	Blank	See note
FROM User Table registration	Blank (All dots ON character)	See note
2-byte character	Disabled (n=00h)	
2-byte character type	Japanese (n=00h)	
Display Brightness	100% (n=04h)	
Reverse display	OFF (n=00h)	

Note: Data registered in FROM is not re-initialized on power-on or by Initialize command; it is retained until the next Delete or Register command.

10.5 Font Register data format (15×16 dot)

b7														
b6														
b5														
b4	p(1)	p(3)	p(5)	p(7)	p(9)	p(11)	p(13)	p(15)	p(17)	p(19)	p(21)	p(23)	p(25)	p(27)	p(29)
b3														
b2														
b1														
b0														

|														
b7														
b6														
b5														
b4	p(2)	p(4)	p(6)	p(8)	p(10)	p(12)	p(14)	p(16)	p(18)	p(20)	p(22)	p(24)	p(26)	p(28)	p(30)
b3														
b2														
b1														
b0														

11 Connector details

7-pin: S7B-XH-A (JST)

Pin No.	Signal	Function	Direction
1	RXD	Receive data	Input
2	DTR	Display READY	Output
3	DSR	Host READY	Input
4	TXD	Transmit data	Output
5	TEST*	TEST terminal	Input
6	VCC	Power (5V)	Input
7	GND	Ground	Input

* For factory use.   Please leave open (not connected).

12 Physical Dimensions

( ):REFERENCE ONLY
Unit : mm
Tolerance is 0.5mm unless stated otherwise.
*a Including extra frit glass

*a 37.7MAX
(36.0)
(9.5)
MAX7.0
MAX3.5
(5.0)
(50.0)
(5.0)

190.0
182.0
(159.0)
51.5
5.0
29.25
3.5
3.5
29.25
5.0
2-R1.0
40.0
(16.0)
4.0
5.0
(16.2)
(23.6)
47.0
4.0
55.0
4-φ3.5 Mounting Holes

9.7±1.0
*a 187.7MAX
(186.0)
1pin
S7B-XH-A
Mate Connector JST XHP-7
(95.0)
(2.0)
(1.6)
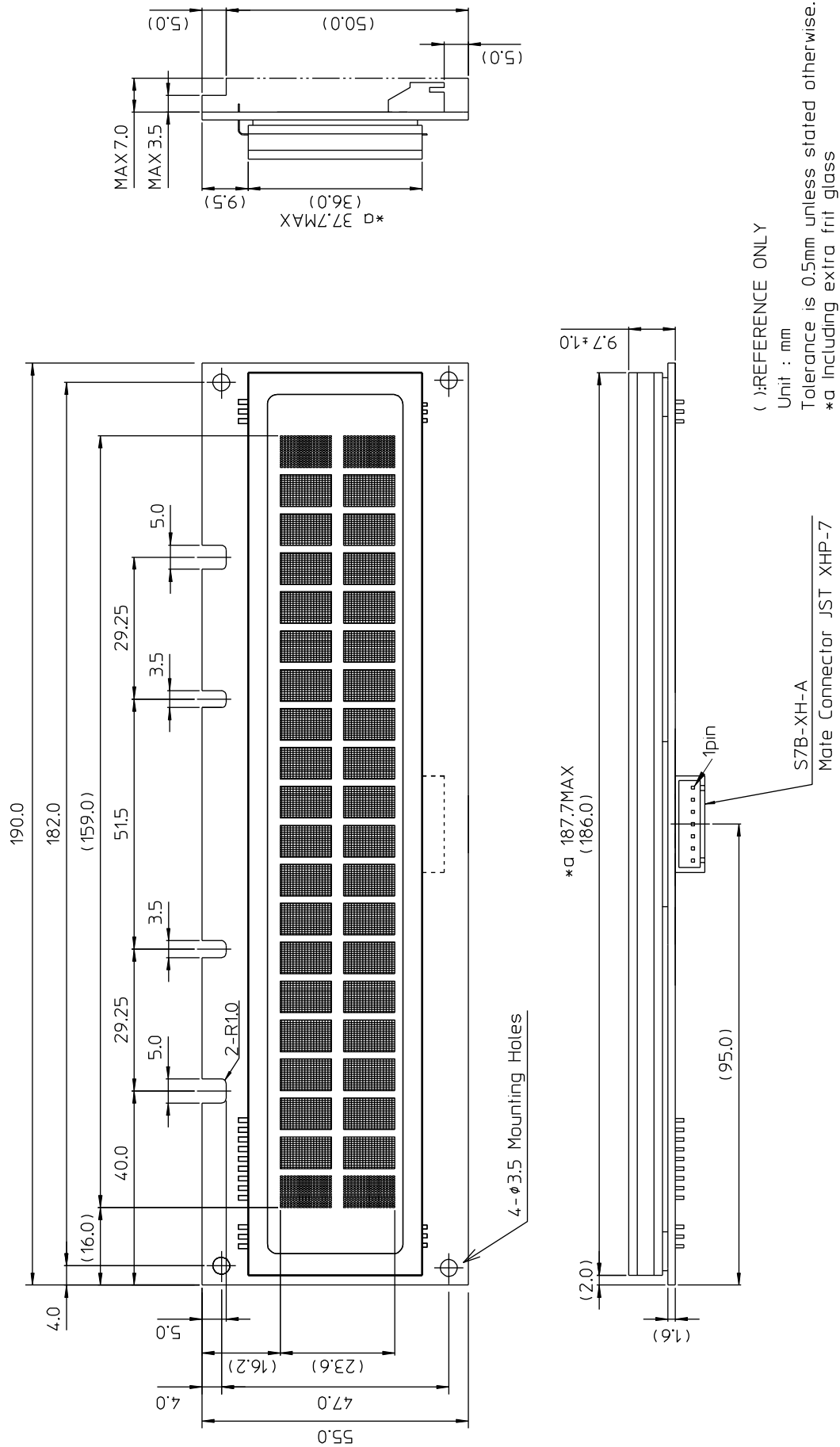
Notice for the Cautious Handling of VFD Modules

Handling and Usage Precautions:
Please carefully follow the appropriate product application notes and operation standards for proper usage, safe handling, and maximum performance.

[VFD tubes are made of glass]
- The edges of the VFD glass envelope are not smooth, so it is necessary to handle carefully to avoid injuries to hands.
- Use caution to avoid breaking the VFD glass envelope, to prevent injury from sharp glass particles.
- The tip of the exhaust pipe is fragile so avoid shock from impact.
- It is recommended to allow sufficient open space surrounding the exhaust pipe to avoid possible damage.
- Please design the PCB for the VFD module within 0.3 mm warping tolerance to avoid any forces that may damage the display due to PCB distortion causing a breakdown of the electrical circuit leading to VFD failure.

[High voltage]
- Avoid touching conductive electrical parts, because the VFD module uses high voltage exceeding 30 – 100 volts.
- Even when electric power is turned off, it may take more than one minute for the electrical current to discharge.

[Cable connection]
- Do not unplug the power and/or data cables of VFD modules during operation, because unrecoverable damage may result.
- Sending input signals to the VFD module when not powered can cause I/O port damage.
- It is recommended to use a 30cm or shorter signal cable to prevent functional failures.

[Electrostatic charge]
- VFD modules need electrostatic-free packaging and protection from electrostatic charges during handling and usage.

[Structure]
- During operation, VFD and VFD modules generate heat. Please consider sufficient heat radiation dissipation using heat sink solutions.
- Preferably, use UL-grade materials or components in conjunction with VFD modules.
- Warp and twist movement causes stress and may break VFDs and VFD modules. Please adhere to allowances within 0.3mm at the point of attachment.

[Power]
- Apply regulated power to the VFD module within specified voltages to protect from failures.
- VFD modules may draw in-rush current exceeding twice the typical current at power-on, so a power supply with sufficient capacity and quick starting of the power regulator is recommended.
- VFD module needs a specified voltage at the point of connection. Please use an adequate power cable to avoid a decrease in voltage. As a safety measure, a fuse or other over-current protection is recommended.

[Operating consideration]
- Illuminating phosphor will decrease in brightness during extended operation. If a fixed pattern illuminates for an extended period (several hours), the phosphor efficiency will decrease compared to the non-operating phosphor, causing non-uniform brightness. Please consider programming the display patterns to use all phosphor segments evenly. Scrolling may be a consideration for a period of time to refresh the phosphor condition and improve even illumination of the pixels.
- A signal cable 30cm or less is recommended to avoid possible disturbances to the signal.

[Storage and operating environment]
- Please use VFD modules under the recommended specified environmental conditions. Salty, sulfuric and dusty environments may damage the VFD module even during storage.

[Disposal]
- VFD uses lead-containing materials (RoHS directive exempts these lead compounds in the glass for electronic devices). When discarding VFDs or VFD modules, please adhere to applicable laws and regulations.

[Other cautions]
- Although the VFD module is designed to be protected from electrical noise, please plan your circuitry to exclude as much noise as possible.
- Do not reconstruct or repair the VFD module without our authorization. We cannot assure the quality or reliability of unauthorized reconstructed VFD modules.

Notice:
- We do not authorize the use of any patents that may be inherent in these specifications.
- Neither whole nor partial copying of these specifications is permitted without our approval. If necessary, please ask for assistance from our sales consultant.
- This product is not designed for military, aerospace, medical or other life-critical applications. If you choose to use this product for these applications, please ask us for prior consultation or we cannot accept responsibility for problems that may occur

MBBZ-009-S18A.

Revision history

Spec. number	Date	Revision
DS-1585-0001-00	Aug. 19, 2009	Initial version
DS-1585-0001-01	Sep. 4, 2009	6 Applicable production spec: corrected to TT-98-3413
DS-1585-0001-02	Oct. 20, 2010	The name of this product has been changed. CU20029-T307A -> CU20029-TE200K
DS-1585-0001-03	Jun. 30, 2011	1.3 Built-in Fonts DS number correction: 1584→1585 10.3.27 FROM User Font control 10.3.28 FROM User Table control Correction and clarification for when font pattern data changes are effective.
DS-1585-0001-04	Sep. 22, 2011	10.3.27 FROM User Font control 10.3.28 FROM User Table control Response data (Identifier 2) correction.