Name: **4-Digit Serial LED Display**
Code: **MR400-012.1**

7-segment LED displays are used in many projects to visualize informations; their use is simple as lighting a LED, but it should be complicated because of the need to manage a lot of interface signals to organize more than a digit at the same time, especially when the control device used doesn't provide enough I/O lines.

Our board have a built-in 4-digit 7-segment LED display and it requires a minimum of only one I/O line to control it. It is possible to control the display through two different communication interfaces: Serial TTL or I2C.

In addition to standard hexadecimal characters, other special characters can be visualized; it is also available an indipendent control of decimal points, apostrophe and colon.

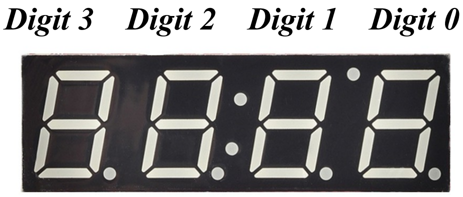
Communication protocol is very simple and all the informations are sent in a single byte. The most significant two bits represent the character set to be used, further two bits indicate wich one of the 4 digits is having a change and the last significant 4 bits specify the character to visualize.

(MSB)| S1 S0 | P1 P0 | C3 C2 C1 C0 |**(LSB)**

DIGIT POSITION

P1 P0	Modified digit
0 0	Digit 0 (unit)
0 1	Digit 1 (tens)
1 0	Digit 2 (hundreds)
1 1	Digit 3 (thousands)

Tab.1 – Digit position



CHARACTERS SET

S1 S0	Characters set
0 0	Hexadecimal standard set
0 1	Special characters
1 0	Decimal points, apostrophe and colon
1 1	RESERVED

Tab.2 – Characters set

HEXADECIMAL STANDARD SET

C3 C2 C1 C0	Character
0x0	0
0x1	1
0x2	2
0x3	3
0x4	4
0x5	5
0x6	6
0x7	7
0x8	8
0x9	9
0xA	a
0xB	b
0xC	C
0xD	d
0xE	E
0xF	F

Tab.3 – Hexadecimal standard set

Therefore, for example, to visualize standard exadecimal characters (0x00 to 0x0F), it will be enough to send the specific value to be displayed and add to it an offset value to transfer it on the digit choosen. If you send a value in the range 0x00 – 0x0F, the character will be displayed on digit 0; if you send a value in the range 0x10 – 0x1F, the character will be visualized on digit 1; sending a value from 0x20 to 0x2F, it will be visualized on digit 2 and sending a value from 0x30 to 0x3F, it will be visualized on digit 3.

In addition to standard hexadecimal characters, others special characters can be visualized. These characters are listed in the related table (ref. Tab.4); it is possible to recall them with the same method as for standard characters with only one difference: you have to add to the requested value an offset of 0x40 (S1=0, S0=1). Therefore, for example, to visualize “S” character on digit 2 it is necessary to send the value 0x63, that is the value 0x03 for “S” character, adding to it the value 0x20 in order to display it on digit 2 and finally adding to it the value 0x40 to use the special characters set (ref. Tab.2).

For a more flexible use of this item, it has been made possible switching on independently every single decimal point, apostrophe and colon.

Switching on or switching off state of each one of these elements is managed through the six less signifacnt bits of the byte 0b10xxxxxx byte.

Essentially, sending the value 0x80, you will set the OFF state to all these elements; to switch on the decimal point of digit 0, it is necessary to add to 0x80 the value 0x08; to switch on the decimal point of digit 1, it is necessary to add 0x04; to switch on the decimal point of digit 2, it is necessary to add 0x02; to switch on the decimal point of digit 3, it is necessary to add 0x01. Finally, to switch on the apostrophe or the colon you must add respectively 0x20 or 0x10.

Therefore, for example, if you want to display “-3.14”, you should send the following sequence of bytes (not necessarily in the same order listed below):

0x79(-) 0x23(3) 0x82(.) 0x11(1) 0x04(4)

The characters set correspondant to the S1 = 1, S0 = 1 bits (offset 0xc0) is not available and it is reserved for future implementations. All the bytes received with these values will be ignored.

SPECIAL CHARACTERS

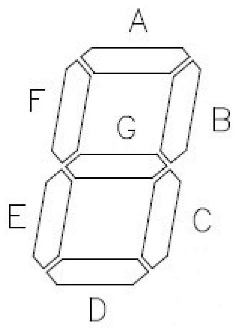
C3 C2 C1 C0	Carattere
0x0	H
0x1	L
0x2	P
0x3	S
0x4	U
0x5	h
0x6	c
0x7	o
0x8	
0x9	G segment
0xA	D segment
0xB	A segment
0xC	B segment B
0xD	C segment
0xE	E segment
0xF	F segment

Tab.4 – Special characters

DECIMAL POINTS, APOSTROPHE, COLON

P1 P0 C3 C2 C1 C0	Character
P1 = 1	Apostrophe = ON
P1 = 0	Apostrophe = OFF
P0 = 1	Colon = ON
P0 = 0	Colon = OFF
C3 = 1	Decimal point of digit 0 = ON
C3 = 0	Decimal point of digit 0 = OFF
C2 = 1	Decimal point of digit 1 = ON
C2 = 0	Decimal point of digit 1 = OFF
C1 = 1	Decimal point of digit 2 = ON
C1 = 0	Decimal point of digit 2 = OFF
C0 = 1	Decimal point of digit 3 = ON
C0 = 0	Decimal point of digit 3 = OFF

Tab.5 – Decimal points, apostrophe, colon



CONNECTIONS

SDI	Bidirectional serial data
SCK	Clock serial input (prodeced by host controller)
RX	TTL serial data input
GND	Ground wire
+5V	Power supply (+5V)

Tab.6 – Connections

FEATURES

Operating voltage	+5V
Power current	1.2mA typ. (with all LEDs off) 80mA (with all LEDs on)
Interface	I2C, Serial TTL
I2C address	0x0C
Operating temperature	-25 / +85°C
Dimensions	43.2 x 22.9 mm (1.7" x 0.9")
Weight	7.4g (0.26 oz)

Tab.7 – Features