

# 4 Digit I2C Display



The 4 Digit I2C Display is a display utilizing 4 seven segment pulse width modulated displays with a simple 2 wire IIC protocol interface. A rich command set enables users to control all digits together or individually, and all segments can be controlled individually which is useful for simple animations.

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## Features:

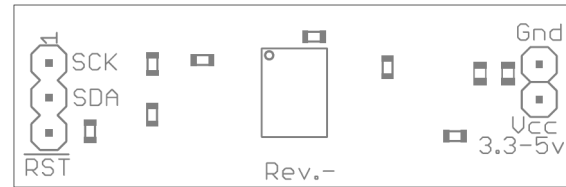
- Rich Command Set
- Hex Digit Display (0-9,A-F)
- Fully Customizable Segments
- Low Power Sleep Mode
- Programmable Address (0-7)
- Connect up to 8 Modules per Interface
- Only 5 Connections, One Optional
- 255 Level Brightness
- Small Form Factor
- Vcc from 3.3V – 5.0V

## Description:

The 4 Digit I2C Display is an easy to use, modular unit with power on display test, 400 KHz serial interface speed, and small form factor. Ideally suited for pin limited microcontrollers, the Display requires only 2 pins – Serial Clock, and Serial Data. An active low Reset is also available but not necessary for full functionality.

The 4 Digit I2C Display has a total of 10 commands and all Display modules ship with a default address of 0. To change the address issue the Change Address command and send the new address (described later in this document).

## Pinout:



SDA – Serial Data

SCK – Serial Clock

RST – Active Low Reset

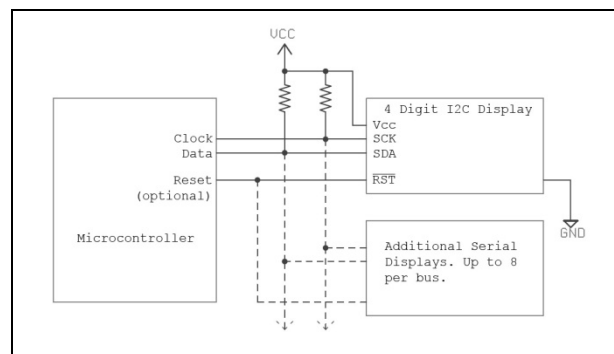
Gnd – Ground

Vcc – Positive Voltage

## Operation:

Upon power up, the display turns all digits and all segments on for approximately 2 seconds. The power on test is to show that the display is functioning and has a default brightness of 127. After the display goes blank, it is ready to accept commands. All commands follow the order: Start, Command, Argument/s, and Stop. It is not possible to send multiple commands in the same Start/Stop transaction.

## Typical Application Circuit:



## Command Explanation:

The 4 Digit I2C Display has a total of 10 commands. The command byte is 8 bits long and the upper nibble is the command to execute. The lower nibble contains the address of the module as well as the Read/Write bit at position 0.

## Command Byte Summary:

Bit 7

bit 0

c	c	c	c	a	a	a	r/ $\overline{w}$
---	---	---	---	---	---	---	-------------------

c = Command (0-F)

a = Address (0-7)

r/ $\overline{w}$  = Read/Write

### For example:

To set the brightness, send the command 10h, followed by the data of [00h-FFh]. 10h assumes that the address is 0.

## Command Summary:

The Value column has the 4 bit command to execute. The Args column details how many bytes are to be Read/Written, and the R/W column details which direction data is to flow.

Value	Command Name	Args	R/W
0	Reserved	n/a	n/a
1	Set Brightness	1	W
2	Set Digits	1	W
3	Set Segments	2	W
4	Set All Digits	2	W
5	Set Decimal Points	1	W
6	Suppress Leading Zero's	1	W
7	Blank Display	1	W
8	Sleep	1	W
9	Reserved	n/a	n/a
A	Reserved	n/a	n/a
B	Reserved	n/a	n/a
C	Reserved	n/a	n/a
D	Reserved	n/a	n/a
E	Get Firmware Version	1	R
F	Set Address of Module	1	W

NOTE: Ensure that you transmit the total required argument bytes. Failure to do so can generate unexpected results. All commands follow the same order: Start, Command, Argument/s, Stop. It is not possible to send multiple commands in the same Start/Stop transaction.

## Command Descriptions:

### Set Brightness

Command

Bit 7 bit 0

0	0	0	1	a	a	a	0
---	---	---	---	---	---	---	---

Argument

v	v	v	v	v	v	v	v
---	---	---	---	---	---	---	---

a = Address of the module (0h-7h).

v = Value to set (00h-FFh).

Set Brightness has 256 values from 00h-FFh. When the brightness is set to 0, the display will be extremely dim, but not completely off. This is due to the PWM being 10 bits in size. The 2 least significant bits are always 1. To completely blank the display for lowest current consumption, use Blank Display or send the unit into Sleep instead for the lowest possible current draw.

### Set Digits

Command

Bit 7 bit 0

0	0	1	0	a	a	a	0
---	---	---	---	---	---	---	---

Argument

x	x	d	d	v	v	v	v
---	---	---	---	---	---	---	---

a = Address of the module (0h-7h).

d = Digit to Set (0h-3h).

v = Value to Set (0h-Fh).

x = Don't Care.

Set Digit will set the specified digit to the value presented in the argument. Digit 0 is the left most digit of the display.

## Set Segments

Command

Bit 7

bit 0

0	0	1	1	a	a	a	0
---	---	---	---	---	---	---	---

Argument 1

x	x	x	x	x	X	d	d
---	---	---	---	---	---	---	---

Argument 2

a	b	c	d	e	f	g	Dp
---	---	---	---	---	---	---	----

a = Address of Module (0h-7h).

d= Digit to Set Segments (0h-3h).

Argument 2 corresponds to the segments of that digit (1=on, 0=off).

Set Segments will allow full control of which segments are on including the decimal point. This feature is useful for custom characters, or for simple animations. Digit 0 is the left most digit.

## Set All Digits

Command

Bit 7

bit 0

0	1	0	0	a	a	a	0
---	---	---	---	---	---	---	---

Argument 1

d0	d0	d0	d0	d1	d1	d1	d1
----	----	----	----	----	----	----	----

Argument 2

d2	d2	d2	d2	d3	d3	d3	d3
----	----	----	----	----	----	----	----

a= Address of Module (0h-7h).

d0 = Value to set digit 0 to (0h-Fh).

d1 = Value to set digit 1 to (0h-Fh).

d2 = Value to set digit 2 to (0h-Fh).

d3 = Value to set digit 3 to (0h-Fh).

The Set All Digits command allow for full refresh of the display with 3 bytes, one command and two arguments. Digit 0 is the left most digit.

## Set Decimal Points

Command

Bit 7 bit 0

0	1	0	1	a	a	a	0
---	---	---	---	---	---	---	---

Argument

x	x	x	x	Dp3	Dp2	Dp1	Dp0
---	---	---	---	-----	-----	-----	-----

a = Address of Module (0h-7h).

x = Don't Care.

Dp3 = Decimal point of Digit 3.

Dp2 = Decimal point of Digit 2.

Dp1 = Decimal point of Digit 1.

Dp0 = Decimal point of Digit 0.

The Set Decimal Points argument is a flag byte with one bit position for each digit. Multiple decimal points can be active at any time. For example if 0Fh is sent to the module, all decimal points will be 'ON'. Digit 0 is the left most digit.

## Suppress Leading Zero's

Command

Bit 7 bit 0

0	1	1	0	a	a	a	0
---	---	---	---	---	---	---	---

Argument

x	x	x	x	x	x	x	v
---	---	---	---	---	---	---	---

a = Address of Module (0h-7h).

x = Don't Care.

v = Value to Set (1=on, 0=off).

The Suppress Leading Zero's is a function that will turn off any digits with a value that start with 0. For example if the display currently holds '00Ab', then with Suppress on, the first 2 digits will be 'OFF'. The display will only show 'Ab'. If however, the second digit has its decimal point 'ON' then that digit will be 'ON' '00.Ab'. Only the first 0 will be 'OFF'. The display will show '0.Ab'. If the value is '0000', then the display will show the right most '0' digit.

## Blank Display

Command

Bit 7

bit 0

0	1	1	1	a	a	a	0
---	---	---	---	---	---	---	---

Argument

x	x	x	x	x	x	x	v
---	---	---	---	---	---	---	---

a = Address of Module (0h-7h).

x = Don't Care.

v = Value to Set (1=on, 0=off).

The Blank Display will turn off all digits and put the device into a reduced current consumption mode. This will keep the device 'alive' and able to respond to future commands immediately. This is preferable to setting the Brightness to 0, as the display will still be 'ON' very dimly. A brightness of 0 will always consume more current than Blanking will.

## Sleep

Command

Bit 7

bit 0

1	0	0	0	a	a	a	0
---	---	---	---	---	---	---	---

Argument

x	x	x	x	x	x	x	v
---	---	---	---	---	---	---	---

a = Address of Module (0h-7h).

x = Don't Care.

v = Value to Set (1=on, 0=off).

The Sleep command will send the display into the lowest current consumption mode. Set the value to '1' to put the display to Sleep. In this mode, the I2C interface is still active, the display is 'OFF', and the currently displayed value is retained. Any command with the read flag set will wake the device from sleep and respond with AAh. A write command will wake the device, but the display will not execute the command. It is not necessary to set the sleep value to '0' as it will be reset once the display is brought out of sleep. The display requires 150µS to wake from sleep. During this time, the module will not respond to any commands. Ensure that at least 150µS elapse after a wake command before sending any new commands.



## Get Firmware Version

Command

Bit 7 bit 0

1	1	1	0	a	a	a	1
---	---	---	---	---	---	---	---

Argument

m	m	m	m	n	n	n	n
---	---	---	---	---	---	---	---

a = Address of Module (0h-7h).

m = Major Revision Number (0h-Fh).

n = Minor Revision Number (0h-Fh).

The Get Firmware Version is the only read command. It will return the firmware version of the display. The argument will be read out of the display.

## Set Address

Command

Bit 7 bit 0

1	1	1	1	a	a	a	0
---	---	---	---	---	---	---	---

Argument

x	x	x	x	x	v	v	v
---	---	---	---	---	---	---	---

a = Current Address of Module (0h-7h).

x = Don't Care.

v = New Address to Set (0h-7h).

The Set Address command is essential for using multiple displays on the same bus. After sending this command, the module will display 'Addn'. Where 'n' is the new address set. If multiple displays are to be used on the same bus, each display must have a unique address set before installation into the group bus, or bus conflicts could occur. It is recommended that a display be the only load on the bus while the address is being set.

## Electrical Characteristics:

### Absolute Maximum Ratings

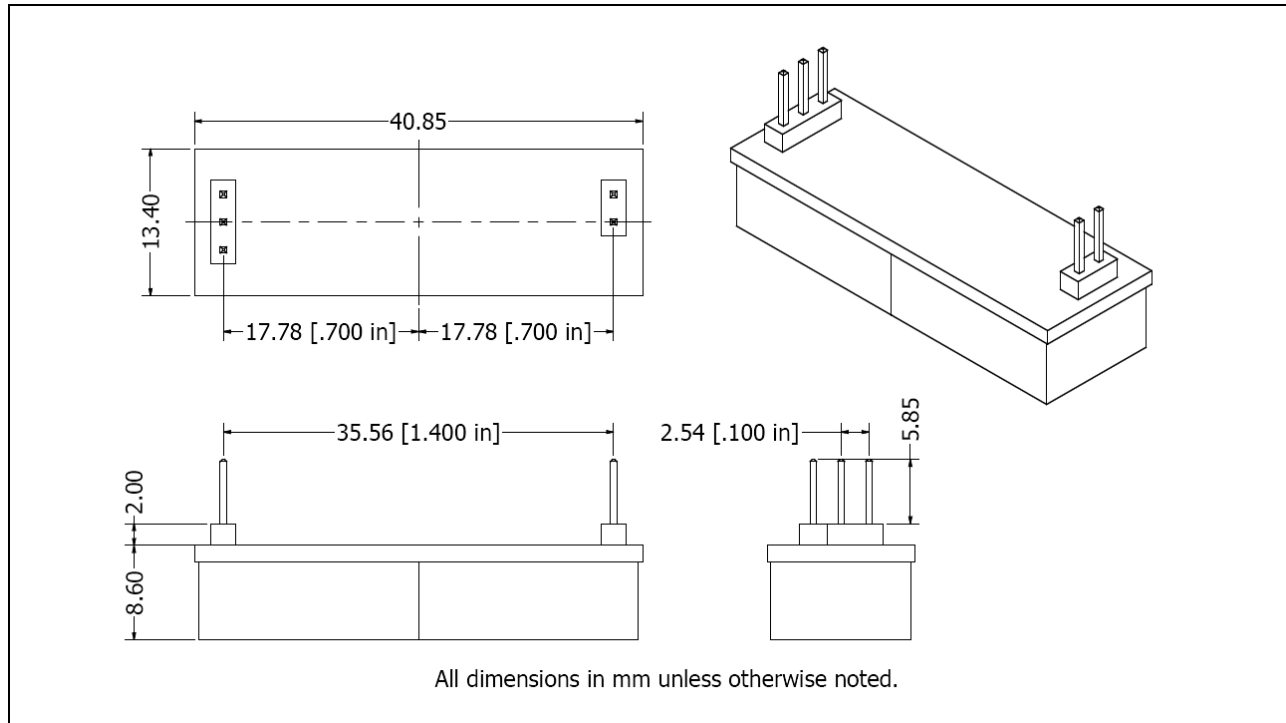
Voltage on Vcc with respect to Gnd	-0.3V to 6.5V
Voltage on I/O pins with respect to Gnd	-0.3V to (Vcc +0.3V)
Maximum current sunk by any I/O pin	25mA
Maximum current sourced out of any I/O pin	25mA

### Current Ratings

Vcc	Condition	Value	Units
3.3	All Digits On All Segments On Full Brightness	36	mA
3.3	All Digits On All Segments On Brightness 0x7F	20	mA
3.3	Blanking	4.50	mA
3.3	Sleeping	23	μA
5.0	All Digits On All Segments On Full Brightness	73	mA
5.0	All Digits On All Segments On Brightness 0x7F	39	mA
5.0	Blanking	4.50	mA
5.0	Sleeping	184	μA

Note: Values are typical.

## Packaging:



## Revision History:

V1.0	Initial Release	Nov 2011
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