SerialStore™

20-Byte ROM for EUI/MAC Addresses, Serial Numbers and Configuration Data

Summary

SerialStore is a low cost read-only memory which may be used to store up to 20 bytes of data. The host processor reads the data via an SPI interface. It is extremely low power, consuming nanoWatts when not in use.

SerialStore provides a secure repository for configuration information, serial numbers, MAC addresses, etc. A MAC/EUI allocation service is available.

SerialStore is firmware for the PIC10F200 microcontroller and is available as a firmware download from *www.hexwax.com*. Individual devices are programmed in-circuit using the TEAclipper programming clip.

Applications

- Serial number storage
- MAC / EUI address storage
- Random number seeds
- Configuration data storage
- Calibration data storage

Features

- MAC/EUI address allocation service
- GUID allocation service
- SOT-23 package smaller than 3mm x 2mm
- Ultra low cost, low component count
- SPI communication with host
- Based on the PIC10F200 processor
- Available in SOT-23 and DIL packages
- Industrial and extended temperature ranges
- Can be programmed in-circuit
- 2.0V to 5.5V supply
- nanoWatt power during sleep

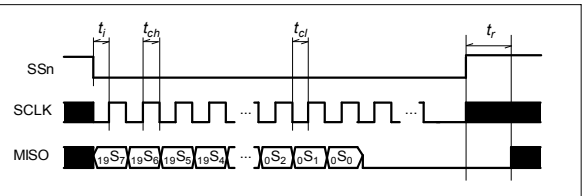
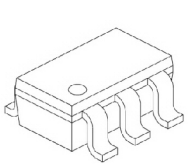
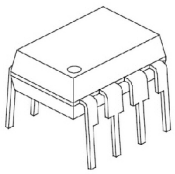


Figure 1. SPI Timing Diagram

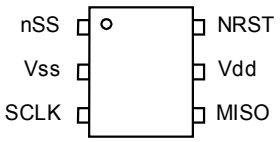
Mechanical Specifications



SOT-23



DIL



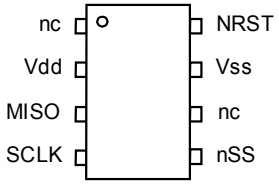


Table 1. Pinout Table	
Name	***Description***
SSn	Slave select (chip select), active low TEAclipper programming pin 2
SCLK	SPI clock input TEAclipper programming pin 3
NRST	Reset, active low, 22K pullup recommended TEAclipper programming pin 4
MISO	SPI data master in / slave out
Vdd	2.0V – 5.5V supply
Vss	Power supply ground

Electrical Specifications

Table 2. Electrical Specifications	
Voltage on *Vdd* (Normal use)	*2.0 – 5.5* VDC
Voltage on *Vdd* during programming	*4.5 – 5.5* VDC
Typical supply current, active	175µA Vdd = 2V 630µA Vdd = 5V
Maximum supply current, active	275µA Vdd = 2V 1100µA Vdd = 5V
Typical supply current, sleep	100nA Vdd = 2V 350nA Vdd = 5V
Maximum supply current, sleep	1200nA Vdd = 2V 2400nA Vdd = 5V
Operating Temperature, Industrial	–40°C to 85°C
Operating Temperature, Extended	–40°C to 125°C*
*Higher maximum current figures may apply.	

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Data Options

The 20 bytes of data consist of a 16-byte section followed by a 4-byte section. Various data types are supported as shown in table 1.

Table 3. Data Options	
Code	***Description***
F	***Fixed*** – The same value is programmed into the section in all SerialStore devices, can be used for configuration and calibration data
R	***Random*** – A random value is programmed into the section [1]
I	***Increment*** – An incrementing value is programmed into the section [1]
M	***MAC-6*** – A unique 6-byte MAC address is programmed into the section, e.g. for Bluetooth addresses [2,3]
E	***EUI-8*** – A unique 8-byte EUI address is programmed into the section, e.g. for ZigBee addresses [2,3]
[1] 4-byte section only [2] 16-byte section only [3] Stored in most significant bytes; ignore other bytes	

The values are set at the time the TEAclipper programming clip is charged with SerialStore licenses. Refer to the Firmware Delivery section for details.

Operational Description

The SerialStore device is selected by transitioning *SSn* from high to low. At that time, *SCLK* should be low (*CPOL=0*). On the rising edge of *SCLK*, one bit of data may be read on *MISO* (*CHPA=0*). On the falling edge of *SCLK*, the data on *MISO* may change. (This is also known as *Mode D* operation.)

Referring to figure 1, *SSn* transitions from high to low and then the host may clock in up to twenty bytes of data on MISO. The 16-byte section is transmitted first, followed by the 4-byte section. Data are transmitted most significant bit, most significant byte first.

The *NRST* input is an active low reset. During normal operation and programming it should be connected to Vdd via a 22K pull-up. As with all microcontroller circuits, a 100nF decoupling capacitor is recommended across, and as close as possible to, the *Vss* and *Vdd* pins.

The SPI interface on SerialStore is implemented in firmware rather than hardware, placing strict limitations on the speed of communications. Refer to table 4 for timing details.

Table 4. SPI Timings		
Name	***Value***	***Description***
f_{clk}	40kHz	Maximum clock frequency [$=1/(t_{cl}+t_{ch})$]
t_{ch}	12.5µs	Minimum clock high time
t_{cl}	12.5µs	Minimum clock low time
t_i	12.5µs	Minimum initialization time
t_r	12.5µs	Maximum MISO release time
Refer to figure 1 for interpretation of these values		

Slave Select / Sleep

SSn must be held low continuously for an entire transaction to complete successfully. It may, however, be taken high at any time.

When *SSn* is high, SerialStore will enter a low power sleep state. *MISO* will enter a high impedance state within a time t_r. For minimum power consumption, SCLK, MOSI *and* MISO should be biased high or low when not in use to avoid unnecessary waking.

Firmware Delivery

The SerialStore firmware is available as an encrypted firmware download from *www.hexwax.com*. To download it you will need a TEAclipper/PIC HV and a TEAclipper/USB adapter.

To load the firmware onto the TEAclipper, start the HexWax Explorer firmware and log in. Then download the SerialStore firmware pack from the *hexwax.com* products section. When download completes, a SerialStore folder will appear in the Local Files section of HexWax Explorer. In this folder are the *SerialStore-XY.wax* files which contain the firmware. There is one *wax* file for every permitted combination of data options, where *X* is the code of the option for the 16-byte section, and *Y* for the 4-byte section.

You will need SerialStore license credits in order to decrypt the *SerialStore-XY.wax* files. Contact *hexwax.com* for details of payment options and how to obtain free samples.

Once you have license credits, select a *SerialStore-XY.wax* file and insert a TEAclipper/PIC HV into the TEAclipper/USB adapter. Press the *Charge Now…* button. Referring to figure 2, select how many licenses you wish to load onto the TEAclipper. Additionally, you may be asked to specify *Fixed* or *Increment From* values if these data options were selected. Finally press OK to obtain a decryption key and to charge the TEAclipper with the decrypted firmware.

If Unique MAC-6 or EUI-8 data options were selected, addresses are assigned by *www.hexwax.com*.

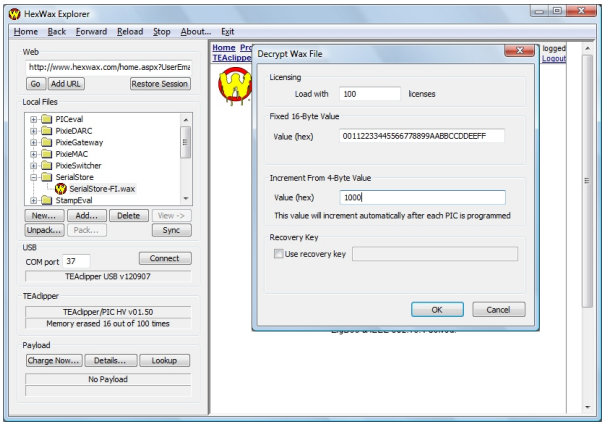

Figure 2: *Decrypting the SerialStore-XY.wax file*

Programming SerialStore

SerialStore may be programmed in-circuit provided the programming signals are protected against contention. In particular, note that the *NRST* line is subject to a voltage of 13V during programming. The recommended circuit is shown in figure 3.

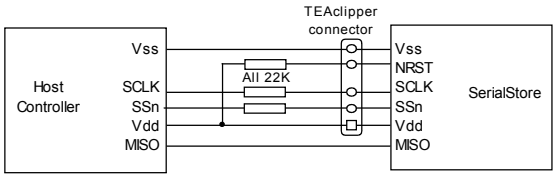

Figure 3. Recommended connection to permit in-circuit programming

Pranng is programmed into the microcontroller simply by inserting the TEAclipper into its connector. The circuit must be powered and the TEAclipper must be held in place until the LEDs stop flashing and the green LED glows steadily. Since the programming time is very fast, no programming socket is required for the TEAclipper. It may be leaned against five plate-through holes as depicted in figure 4.

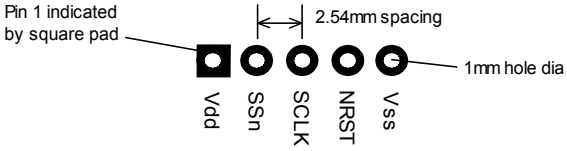

Figure 4. Recommended plate-through connector design

The TEAclipper requires a minimum supply to the SerialStore of 4.5V during programming. If the target board cannot tolerate a Vdd of 5V, then a supply of 5V may be temporarily applied in an isolated fashion as shown in figure 5. (The host *Vdd* should be powered as normal during programming.)

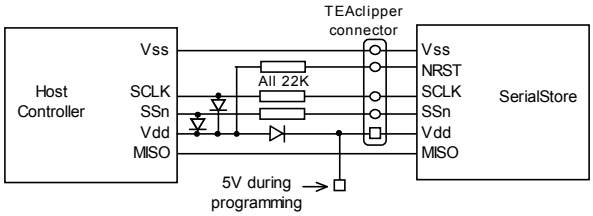

Figure 5. Recommended connection to permit in-circuit 5V programming host controller cannot tolerate Vdd of 5V.

Evaluation Guide

The circuit in figure 6 was used during development and testing of this product and is recommended for evaluation. The test Host Controller firmware *SerialStoreHost* is provided in the firmware pack in both compiled hex format and in C.

Note that the NRST input is connected to an I/O pin on the host. This allows the evaluator to experiment with its use; doing so does, however, require the use of a protection diode. Note also that the circuit is not quite identical to the TEAleaf evaluation circuit: pin 5 on the SerialStore connects to pin 25 on the host, not pin 24.

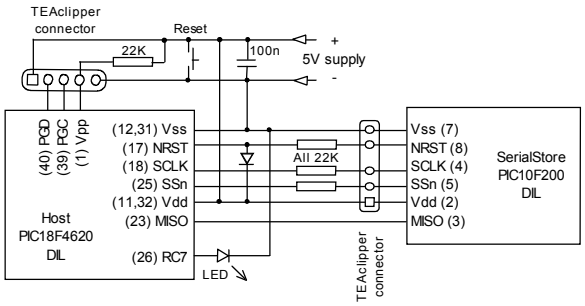

Figure 6. Recommended evaluation circuit

The TEAclipper Evaluation Board contains a PIC10F202 microcontroller originally intended for TEAleaf evaluation. PIC10F202 devices are compatible except for the location of the oscillator calibration bit. So long as you don't mind de-calibrating the oscillator, it may also be used for evaluating SerialStore. (See Table 5 for a labeling key.) There is also a ZIF socket to allow you to implement the host controller on a variety of processors, including the 18F4620 shown in figure 6.

Table 5. Evaluation Board Labeling Guide		
SerialStore Pin Name	***Evaluation Board Label***	***TEAclipper Connection***
MOSI	PGD	PGD
SCLK	PGC	PGC
NRST	nRST	Vpp
SSn	Dat	-
Vdd	Vdd	Vdd
Vss	Vss	Vss

Program the 18F4620 with the *SerialStoreHost.hex* firmware and the PIC10F200 with the *SerialStore.wax* firmware. The host firmware *SerialStoreHost.hex* reads the SerialStore and then reads out the 20-byte value as flashes on the LED. Each hex digit from the most significant is flashed as shown in table 6.

Table 6. Evaluation Host LED Flash Interpretation			
# of flashes	***Hex Digit***	***# of flashes***	***Hex Digit***
16	0	8	8
1	1	9	9
2	2	10	A
3	3	11	B
4	4	12	C
5	5	13	D
6	6	14	E
7	7	15	F

If the SPI signals interfere with the programming process, press the Reset button to hold the host in the reset state while programming the SerialStore.

Contact Information

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