Using 1-Wire™ Devices On the Raspberry Pi

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March 21, 2015

What is 1-Wire Technology?

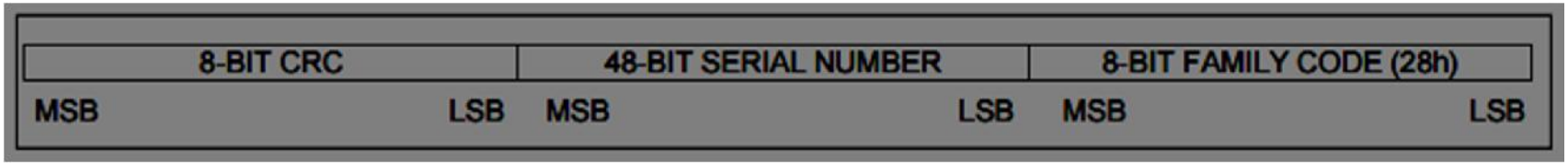
- A data bus
- Developed by Dallas Semiconductor (now Maxim Integrated)
- Low power
- Low speed
- Low connector

What is 1-Wire Technology?

- Serial protocol - Master/slave
  - 1. Parallel port
  - 2. GPIO
  - 3. Serial Adapter (DS9097U)
  - 4. I²C Adapter (DS2482)
  - 5. USB Adapter (DS2490)
  - 6. Ethernet

What is 1-Wire Technology?

- Each slave device has 64-bit ID
  - 1. Factory programmed (no user prgm)
  - 2. Unique ID (custom avail.)
  - 3. Unalterable



What is 1-Wire Technology?

- Operates from 2.8V to 5.25V
  - 1. Power can come from 1-Wire data line (parasitic supply).
  - 2. Separate power line.

What is 1-Wire Technology?

- Packages
  - 1. TO-92 (transistor-like)
  - 2. Small IC packaging (TSOC, SOIC, SOT23).
  - 3. iButtons - 16-mm, stainless steel case.
  - 4. Generally low pin count packages,

Applications

- Identification only
  - PCB Id and Authentication
  - Accessory/peripheral ID
  - Access control (ID badges)
  - Asset management

Applications

- Control
  - GPIO bits
  - A/D conversion
- Temperature
- Time
  - 32-bit counter - 136-yr period.
  - iButton has battery & crystal built-in.

Applications

- NV SRAM
  - With SHA-1 crypto, used as secure token for electronic cash
  - Validation of PCB and validation of EEPROMs
- OTP (one time programmable) EPROM
  - Network address (MAC)
  - PCB ID.
- EEPROM
  - PCB ID
  - Monitor medical consumables

Applications

- SHA-1 secure EEPROM
  - 1. Electronic cash
  - 2. Challenge and response security.
- Logging
  - Temperature
  - Hi-res temperature
  - Passwd protection
  - Temp & humidity
  - 2- & 8-K bytes of memory

Applications

- 1W devices emulated by small µC
  - Text LCD Controller (Louis Swart .ZA, and others)
- DalSemi used a combination of switches, temperature sensors, and other miscellaneous devices to produce a prototype weather station.

Wiring

- Pull up
  - Data line requires a pullup resistor.
  - 4.7K ohms to +V, less if long distance or large # 1W
  - Use MOSFET for strong pullup if processor can't handle current.
- One wire
- Two wires
- Three wire

Wiring

- Cables
  - Gray nylon telephone cable
  - CAT-5
- Connectors
  - RJ-12 (standard)
  - Screw block

APIs

- Python
- C
- Perl
- TCL
- PHP

“apt-cache search 1-wire” and see!

Using One Wire File System OWFS

- Easy to use, especially from shell.
  - Just use 'cat' to read.
  - Sudo apt-get install owfs owfs-doc
  - Optional web access to 1-wire devices
  - /etc/owfs.conf needs tweaking before use.
    - Comment out "server: FAKE"
    - Add FAHRENHEIT
    - Remove Localhost from "server : localhost:port = 4304

Using One Wire File System OWFS

- Two way to access your 1-Wire bus
  - 'sudo owfs -c /etc/owfs.conf -m /mnt/1wire -u -F"
    - Browse directories
    - Get data from device with simple 'cat'
  - 'Start owserver and companion servers
    - View 1-wire network using web browser.
    - Use 'ftp' client (?)

  - *<terminal session>*

Using GPIO

- A little trickier
  - Add "dtoverlay=w1-gpio,gpiopin=4" to /boot/config.txt and reboot.
  - Wire +3.3v, GND, and GPIO4 (pin 7) todevices.
  - "sudo modprobe w1-gpio”
  - "sudo modprobe w1-therm
  - *<terminal session>*

Toys

- Thermocrons (DS1921)
- LCD Display controller
- USB Master
- Reed switches and LEDs board
- DS9091K Demo & Development Kit
- TINI System

For More Information

- **Maxim Integrated**
  http://www.maximintegrated.com/en/app-notes
- **Hobby Boards**
  http://www.hobby-boards.com
- **One Wire File System**
  http://owfs.org
- **Family Code List**
  http://owfs.org/index.php?page=family-code-list
- **Just Google “one wire”!**