

# Getting Started with the Teensy Circuits and Programming

# Solderless Breadboards

mbus.net

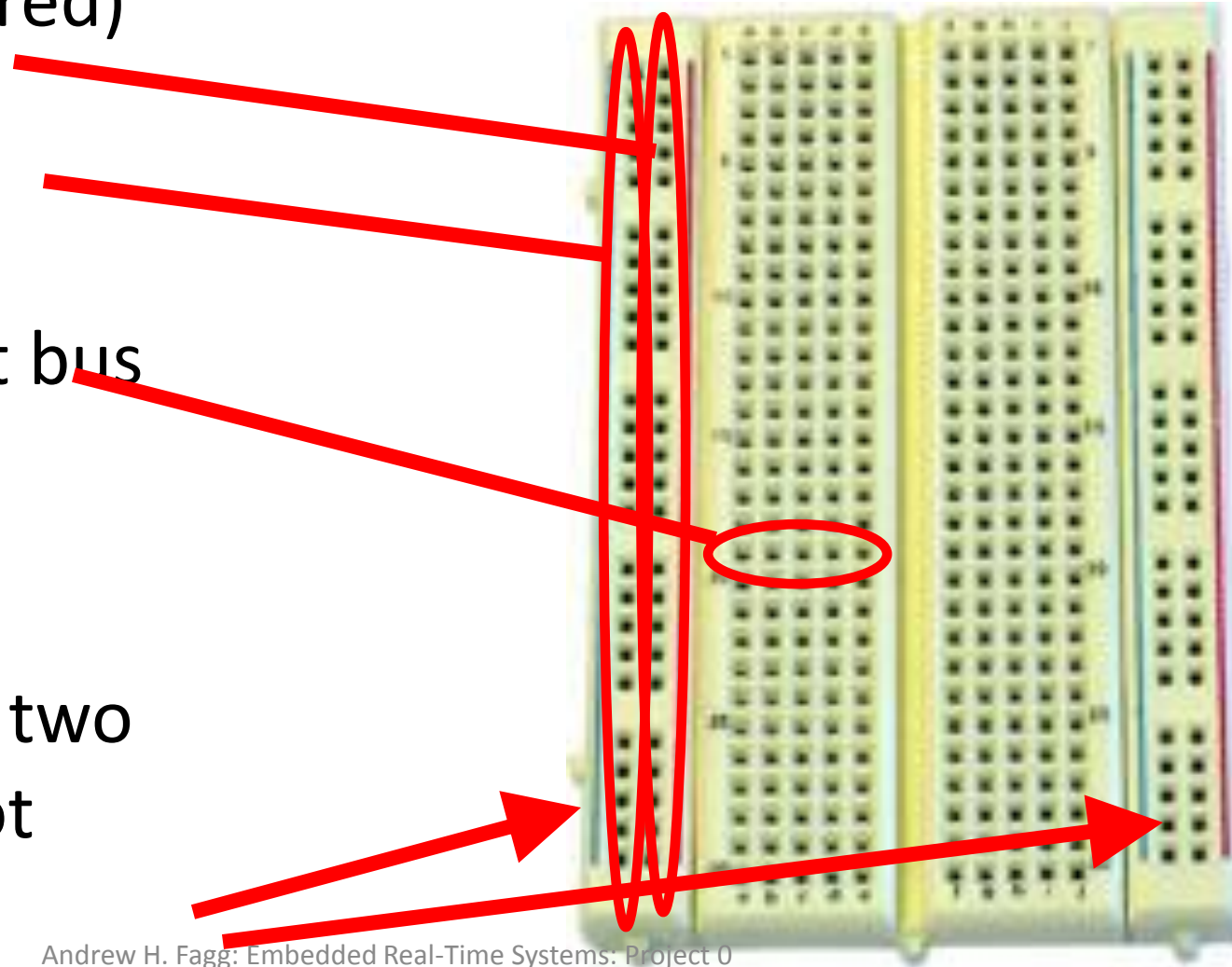
Power bus (red)

Ground bus

(blue)

Component bus

Note that the two  
sides are not  
connected



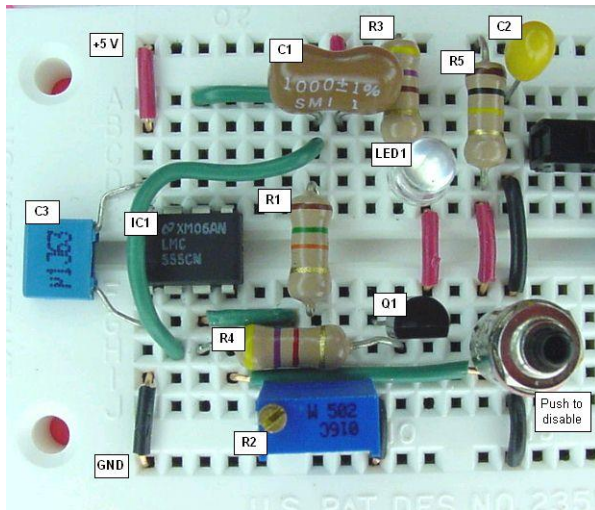
# Wiring Standards

When possible, use wire colors for different types of signals. The common color assignments are:

- Black: ground
- Red: power
- Other: various signals

# Clean Wiring

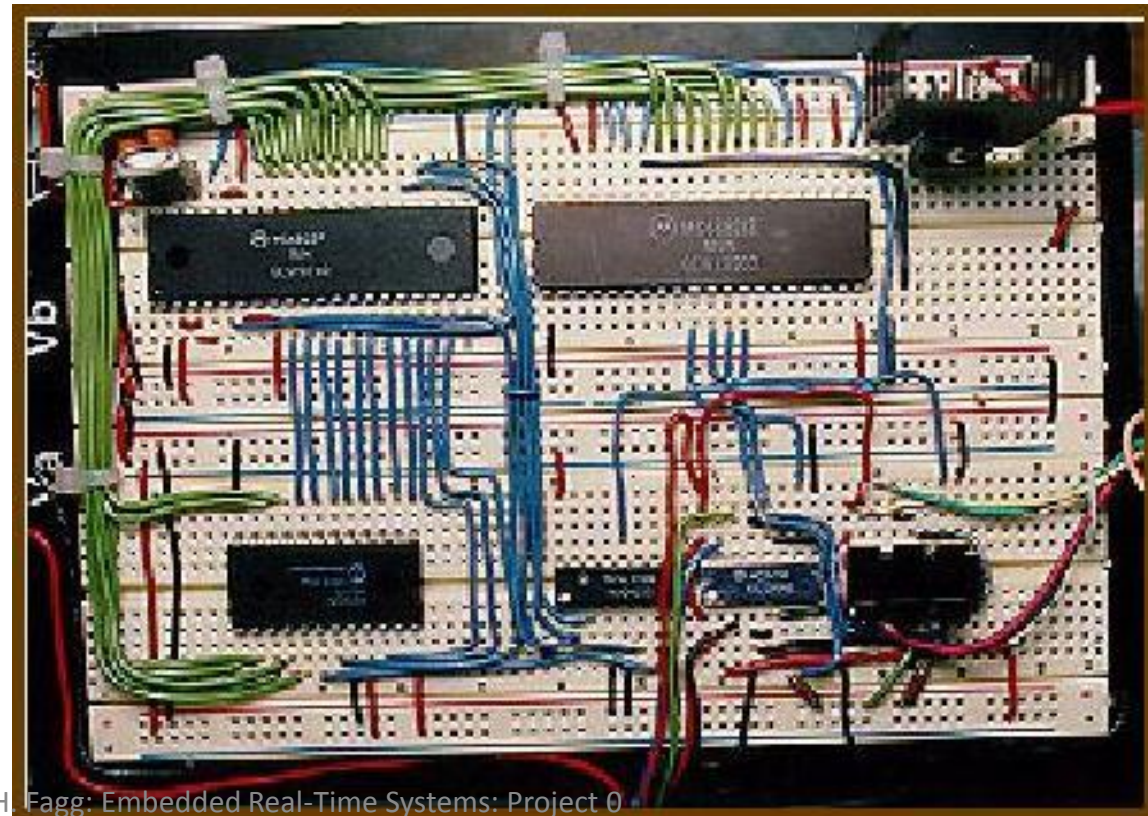
A clean breadboard will make debugging easier – and it makes circuits more robust



[www.linefollowing.com](http://www.linefollowing.com)

[tangentsoft.net](http://tangentsoft.net)

Andrew H. Fagg: Embedded Real-Time Systems: Project 0



# Care with Power

- Only insert components and wires into the breadboard when power is disconnected
- “Wire, check-twice, then power”
  - Never reverse power and ground (this is a very common mistake)

# Care with Power

We are using a mixture of 3.3V and 5V components

- Be careful: we can't always mix and match
- The teensy can be powered by USB or via a connection to the Vin pin
- The teensy can provide 3.3V supply (up to 250mA)
- Even though the teensy uses 3.3V as its base voltage, it is 5V tolerant (but not all 3.3V components will be)

# Suggested Wiring Procedure

- Power supply
- Power/ground buses
- Insert primary components
- Wire power/ground for components
- Add signals and remaining components

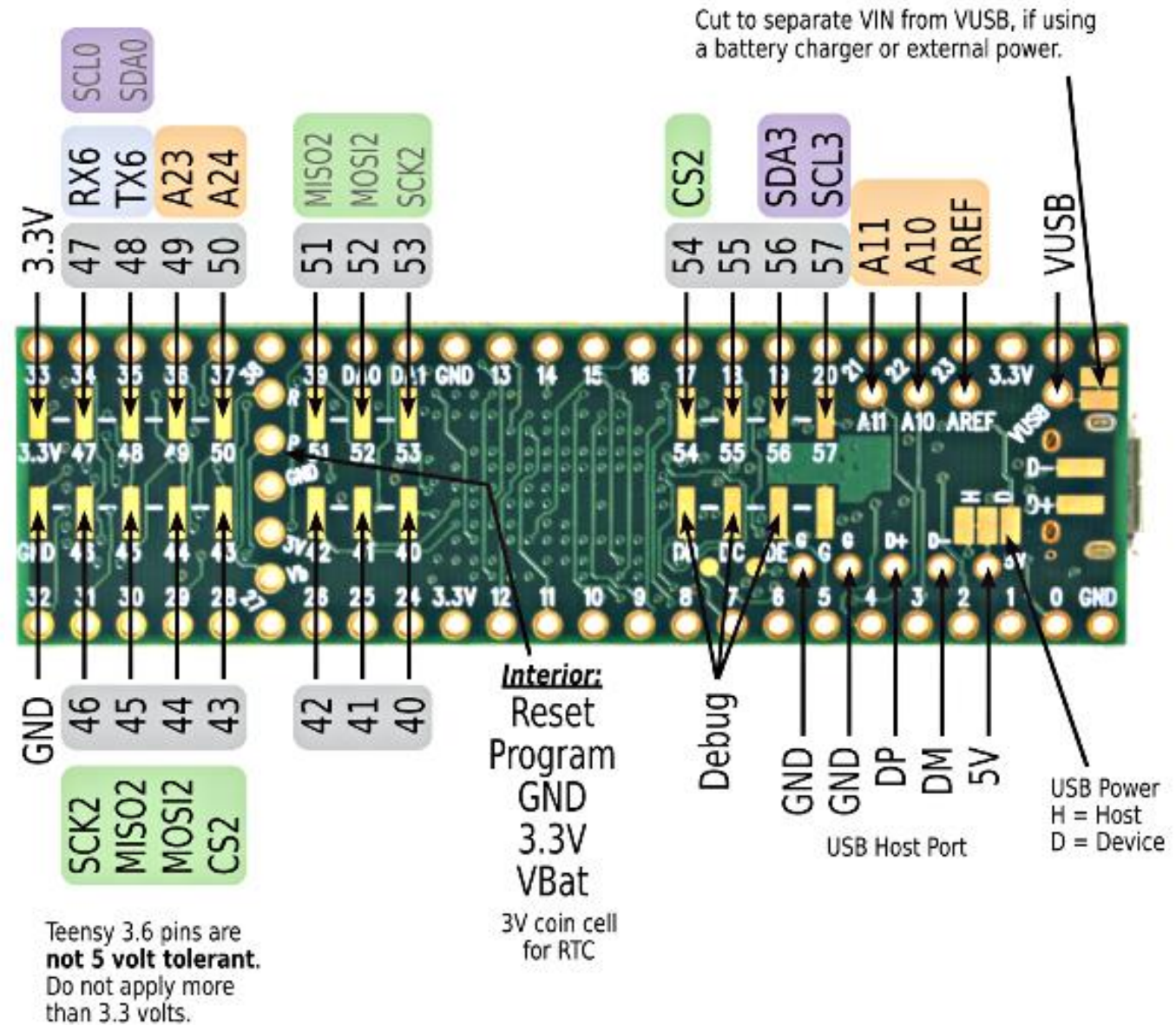
# Debugging Techniques

- Test incrementally
- Test intermediate sub-circuits

# Teensy 3.5

|       |        |     |      |    |                        |        |            |
|-------|--------|-----|------|----|------------------------|--------|------------|
|       |        |     | GND  |    | Vin (3.6 to 6.0 volts) |        |            |
| Touch | MOSI1  | RX1 | 0    |    | Analog GND             |        |            |
| Touch | MISO1  | TX1 | 1    |    | 3.3V (250 mA max)      |        |            |
|       |        |     | PWM  | 2  | 23 A9                  | PWM    | Touch      |
| SCL2  | CAN0TX |     | PWM  | 3  | 22 A8                  | PWM    | Touch      |
| SDA2  | CAN0RX |     | PWM  | 4  | 21 A7                  | PWM    | CS0 mosi1  |
|       | miso1  | tx1 | PWM  | 5  | 20 A6                  | PWM    | CS0 sck1   |
|       |        |     | PWM  | 6  | 19 A5                  |        | SCL0 Touch |
| scl0  | mosi0  | RX3 | PWM  | 7  | 18 A4                  |        | SDA0 Touch |
| sda0  | miso0  | TX3 | PWM  | 8  | 17 A3                  |        | sda0 Touch |
|       | CS0    | RX2 | PWM  | 9  | 16 A2                  |        | scl0 Touch |
|       | CS0    | TX2 | PWM  | 10 | 15 A1                  |        | CS0 Touch  |
|       | MOSI0  |     |      | 11 | 14 A0                  | PWM    | sck0       |
|       | MISO0  |     |      | 12 | 13 (LED)               | SCK0   |            |
|       |        |     | 3.3V |    | GND                    |        |            |
|       |        |     | 24   |    | A22                    | DAC1   |            |
|       |        |     | 25   |    | A21                    | DAC0   |            |
|       |        | tx1 | 26   |    | 39 A20                 |        |            |
|       |        | rx1 | 27   |    | 38 A19                 | PWM    | SDA1       |
|       |        |     | 28   |    | 37 A18                 | PWM    | SCL1       |
| Touch | can0tx |     | PWM  | 29 | 36 A17                 | PWM    |            |
| Touch | can0rx |     | PWM  | 30 | 35 A16                 | PWM    |            |
|       | CS1    | RX4 | A12  | 31 | 34 A15                 | CAN1RX | sda0       |
|       | SCK1   | TX4 | A13  | 32 | 33 A14                 | CAN1TX | scl0       |

# Teensy 3.5 Reverse Side



# Teensy 3.1 vs Teensy 3.5



# Teensy Programming Interface

As simple as connecting the Teensy to your laptop via a USB cable

- Be careful not to torque the USB connection on the Teensy

# Demonstration...

# General Program Hints

- Use LEDs to show status information (e.g., to indicate what part of your code is being executed)
- Remember: on the Teensy boards, there is a LED connected to port C, bit 5
- Have one LED blink in some unique way at the beginning of your program
- Go slow:
  - Implement and test incrementally
  - Insert plenty of pauses into your code (e.g., with `delay ()`)

# Project 0

- Summary:
  - Connect 4 LEDs and a switch to your Teensy board
  - Write a program that: waits for the switch to be pressed, then displays an interesting LED flashing pattern
- Details are on the class web page

# Project Completion

See me or the TA for a code review

- Every member of the group must be present
- Every member of the group must demonstrate their own program and downloading to the Teensy
- Deadline: Thursday, February 8 @1:30pm

Future projects: we will have more formal coding, documentation and hand-in procedures