Programing Microcontrollers

With the Microsoft .NET Micro Framework 4.0 Platform

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Introduction

Introduction

Workshop: .NET MF

Introduction

Workshop: .NET MF

Workshop: Zigbee

Microsoft .NET Micro Framework 4

Overview

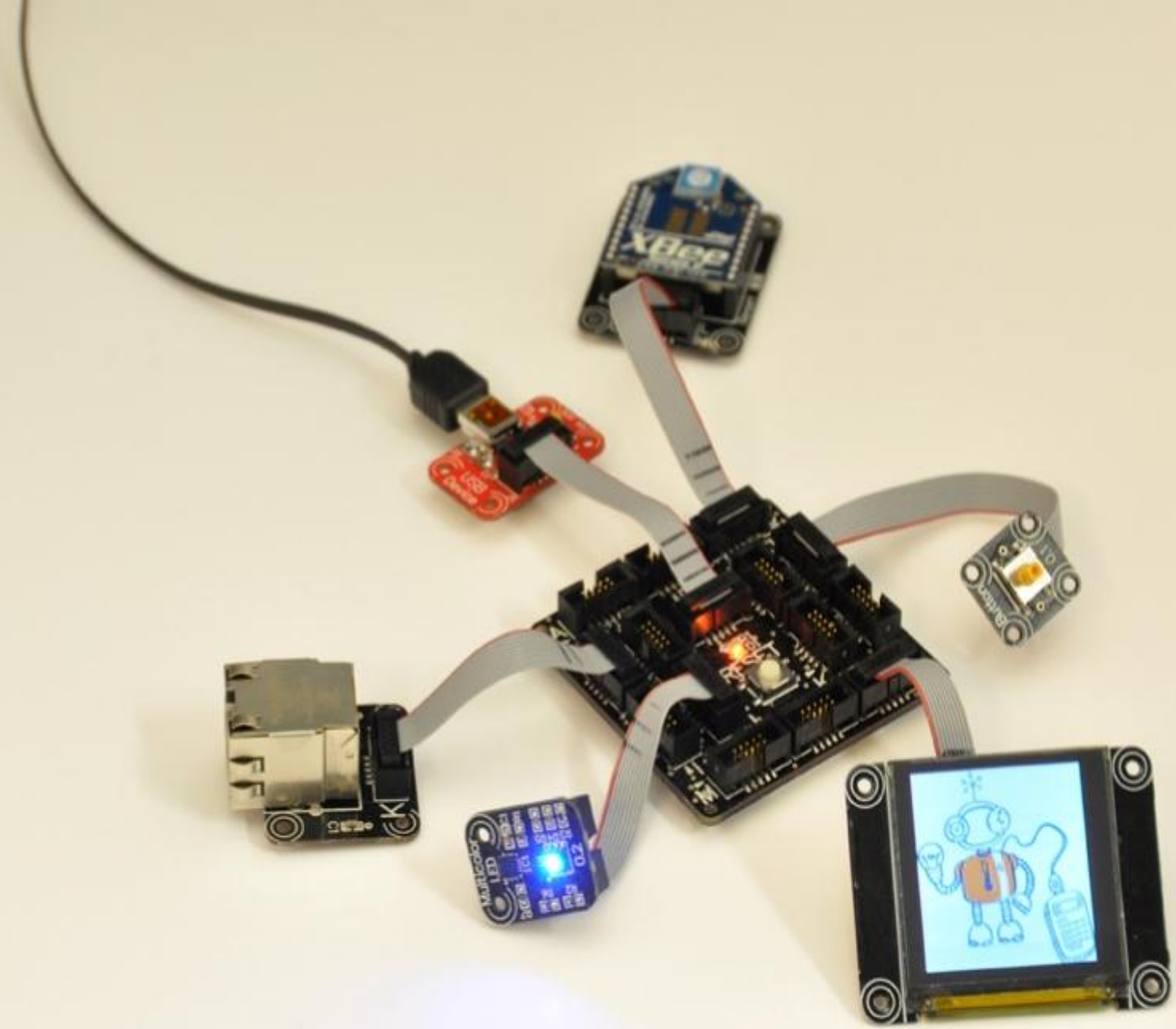
- Embedded devices, sensing, robotics
- Programming in C# / Visual Studio
- Subset of .NET
- Libraries for embedded programming
- Arduino pin-compatible boards
- Integrated emulator

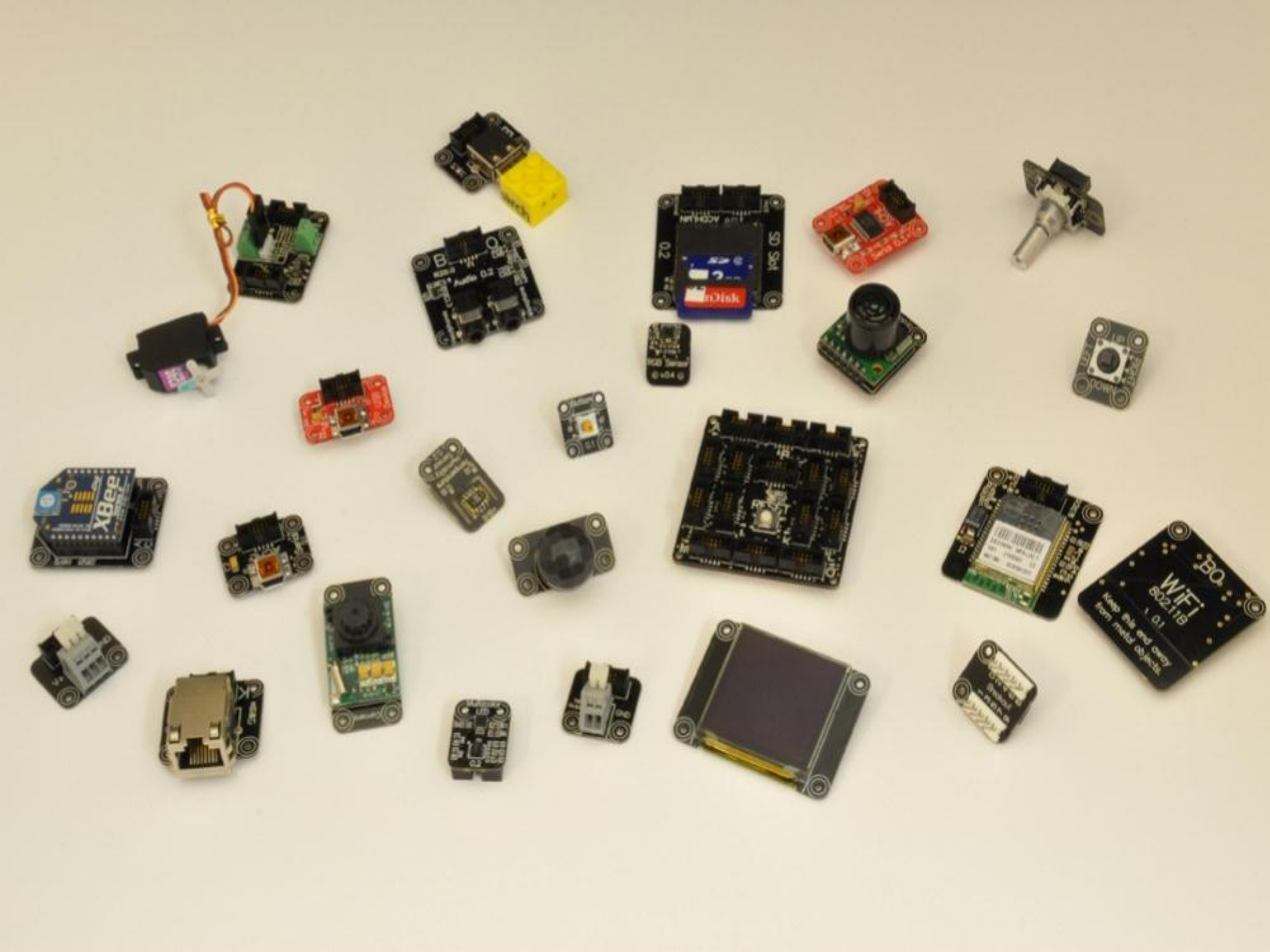
Differences to Arduino

- Supports run time debugging:
  breakpoints, variable inspection, stepping
- Advanced libraries:
  e.g., FAT and USB support
- Color displays, UI, graphics,
  WPF (not all of the boards)

Micro controllers

Microsoft Research Prototypes

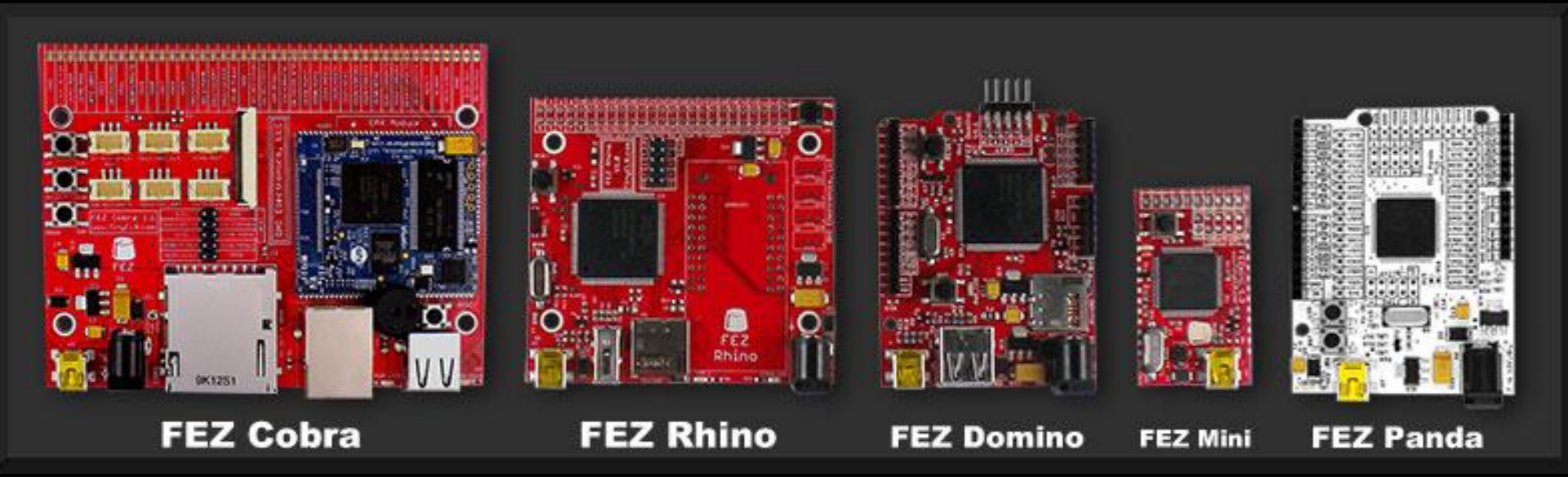

XBee
USB
LED


SD Slot
SanDisk
Audio 0.2
XBee
WiFi
802.11B
1.01
Keep this and every
from metal objects

GHI Electronics Boards

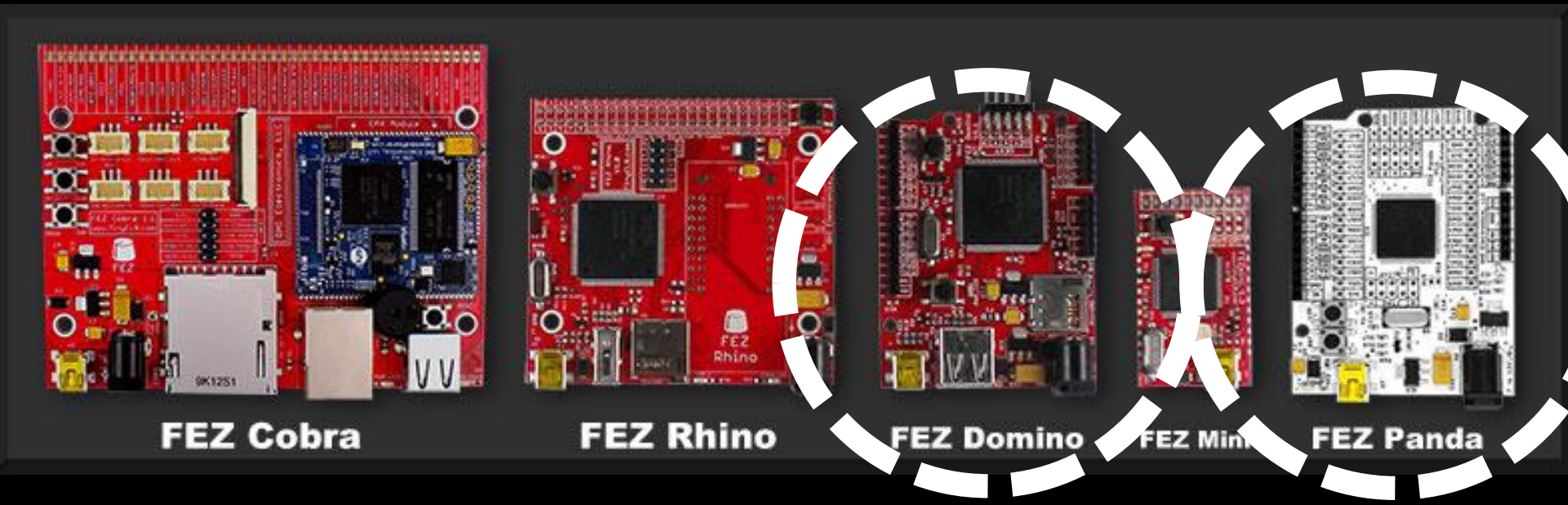
Overview

GHI Microcontrollers



Overview

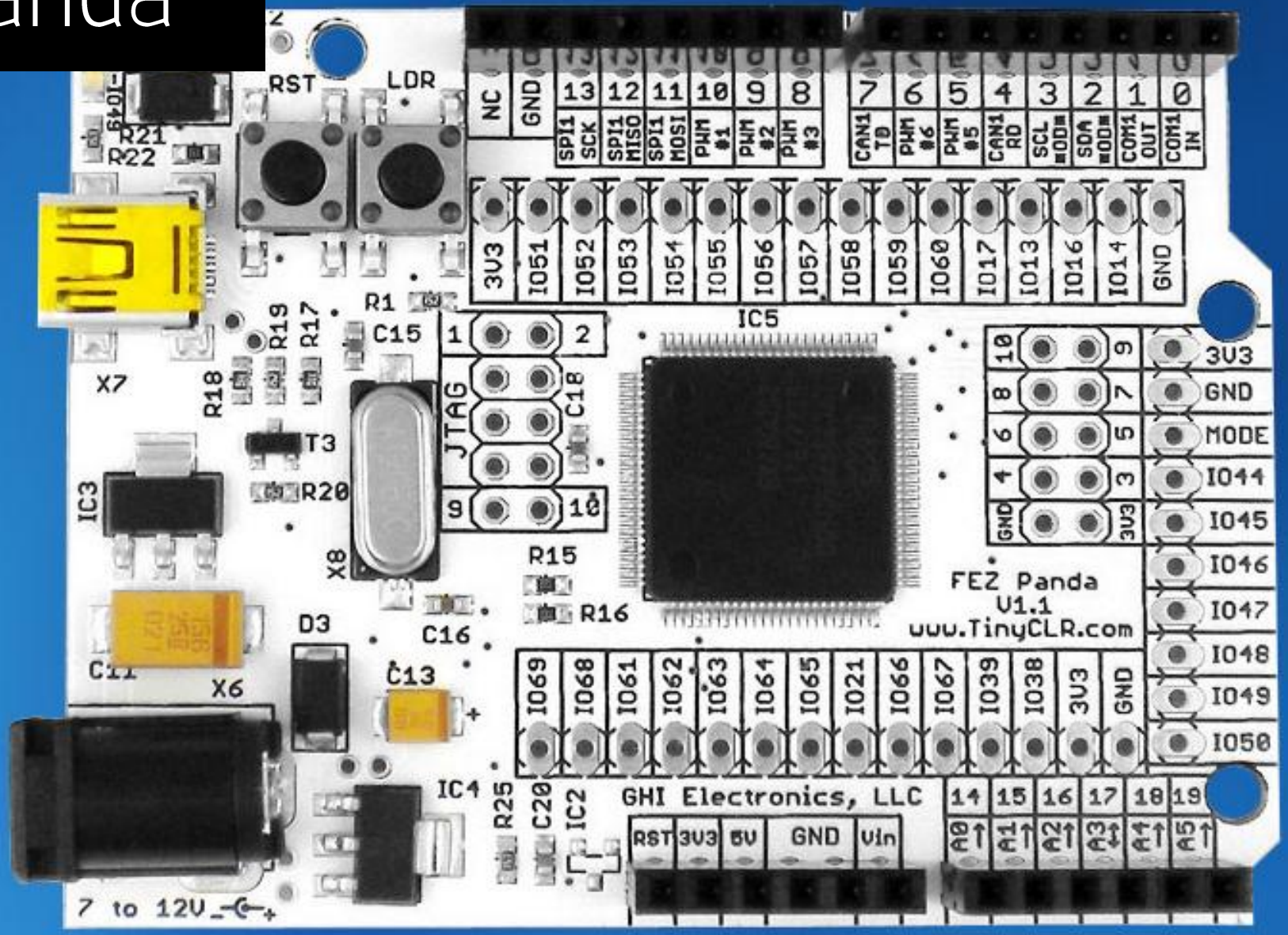
GHI Microcontrollers



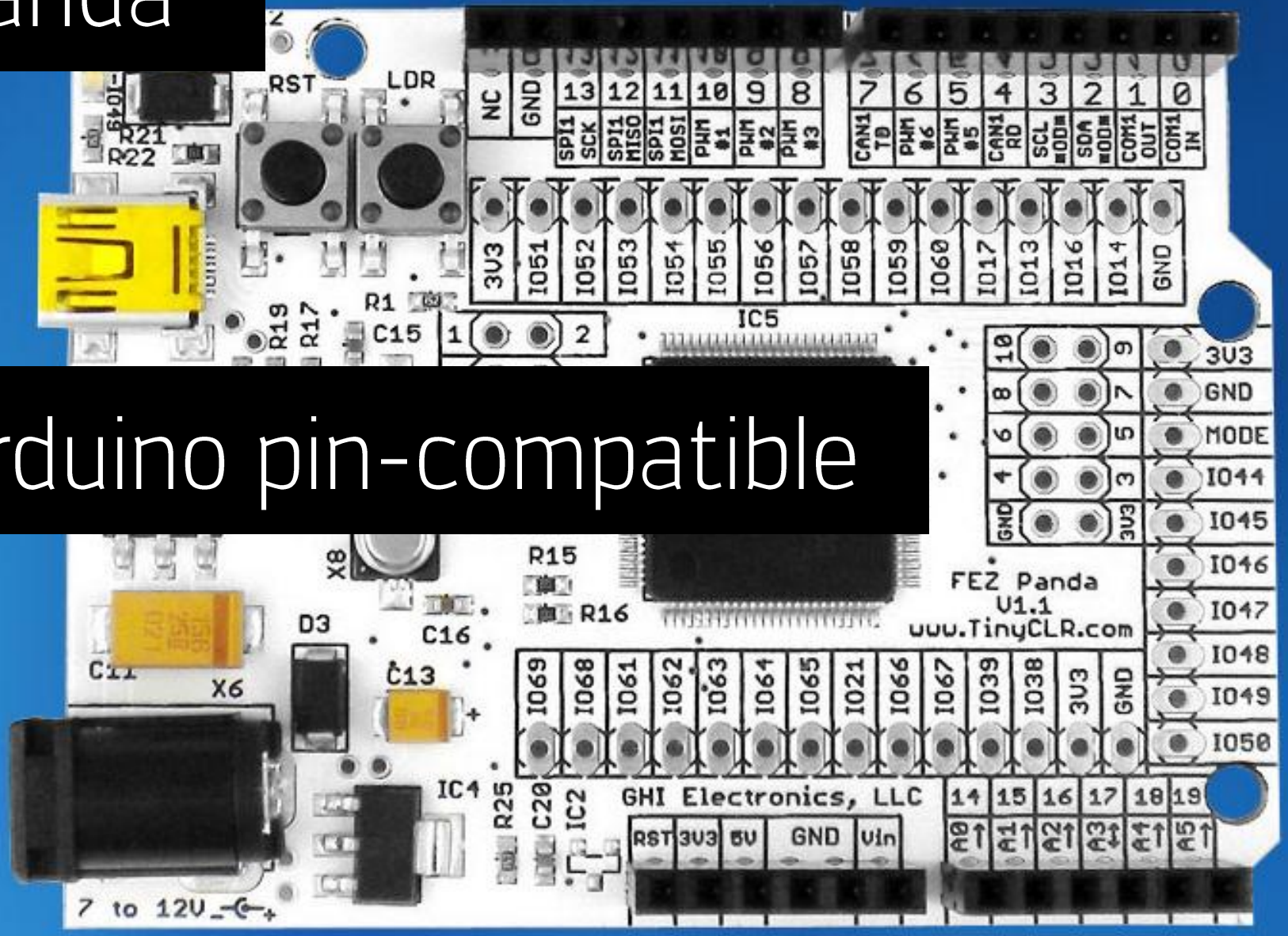
GHI Panda

(the boards you use)

Panda

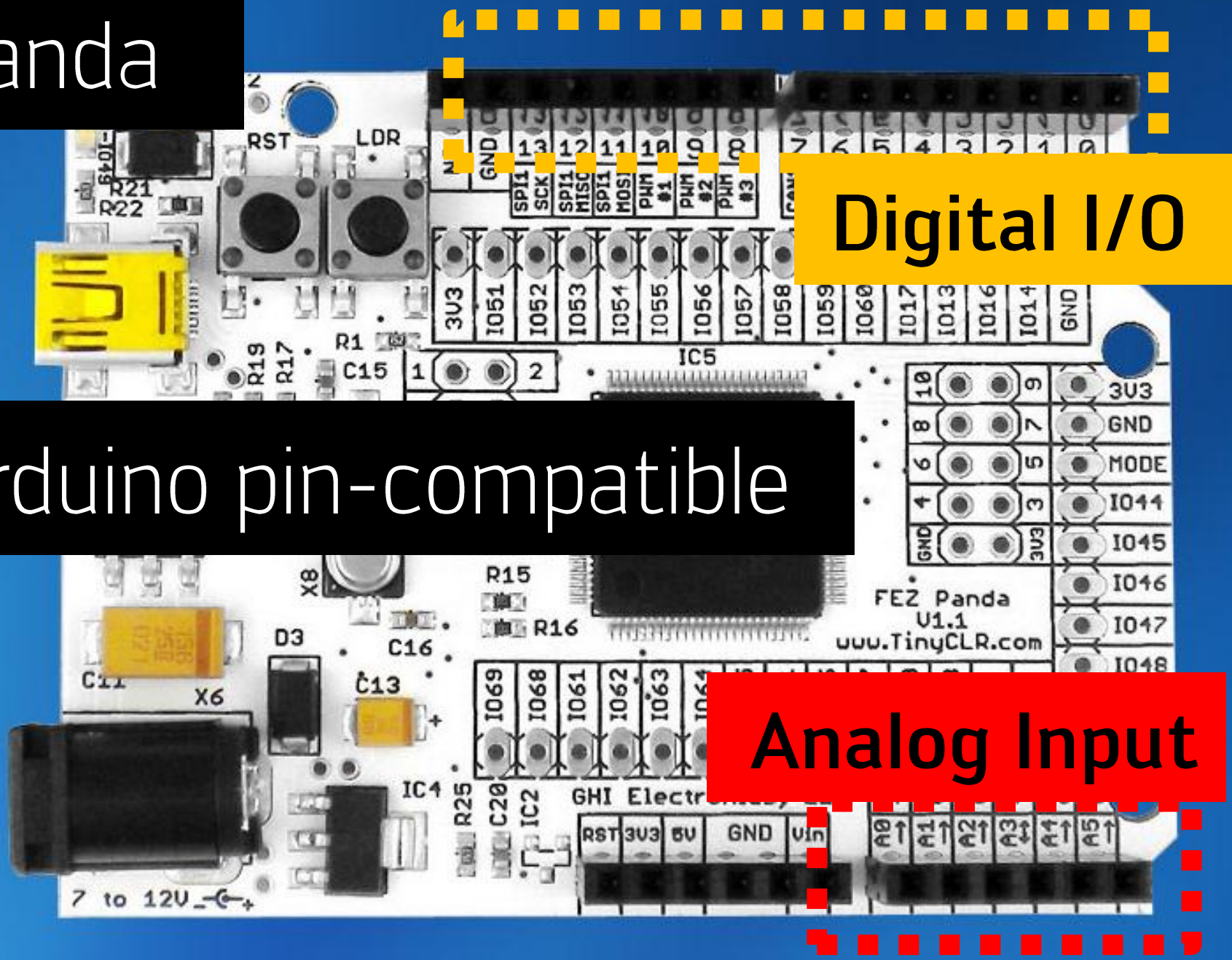

RST
LDR
NC
GND
13
12
11
10
9
8
7
6
5
4
3
2
1
0
SPI1 SCK
SPI1 MISO
SPI1 MOSI
PWM #1
PWM #2
PWM #3
CAN1 TD
PWM #6
PWM #5
CAN1 RD
SCL
SDA
COM1 OUT
COM1 IN
3V3
IO51
IO52
IO53
IO54
IO55
IO56
IO57
IO58
IO59
IO60
IO17
IO13
IO16
IO14
GND
R21
R22
R1
R19
R17
C15
IC5
X7
R18
C18
JTAG
T3
IC3
R20
X8
R15
R16
C16
D3
C11
X6
C13
IC4
R25
C20
IC2
3V3
GND
MODE
IO44
IO45
IO46
IO47
IO48
IO49
IO50
FEZ Panda
V1.1
www.TinyCLR.com
IO69
IO68
IO61
IO62
IO63
IO64
IO65
IO21
IO66
IO67
IO39
IO38
3V3
GND
GHI Electronics, LLC
RST
3V3
5V
GND
Vin
14
15
16
17
18
19
A0
A1
A2
A3
A4
A5
7 to 12V

Panda



Arduino pin-compatible

Panda



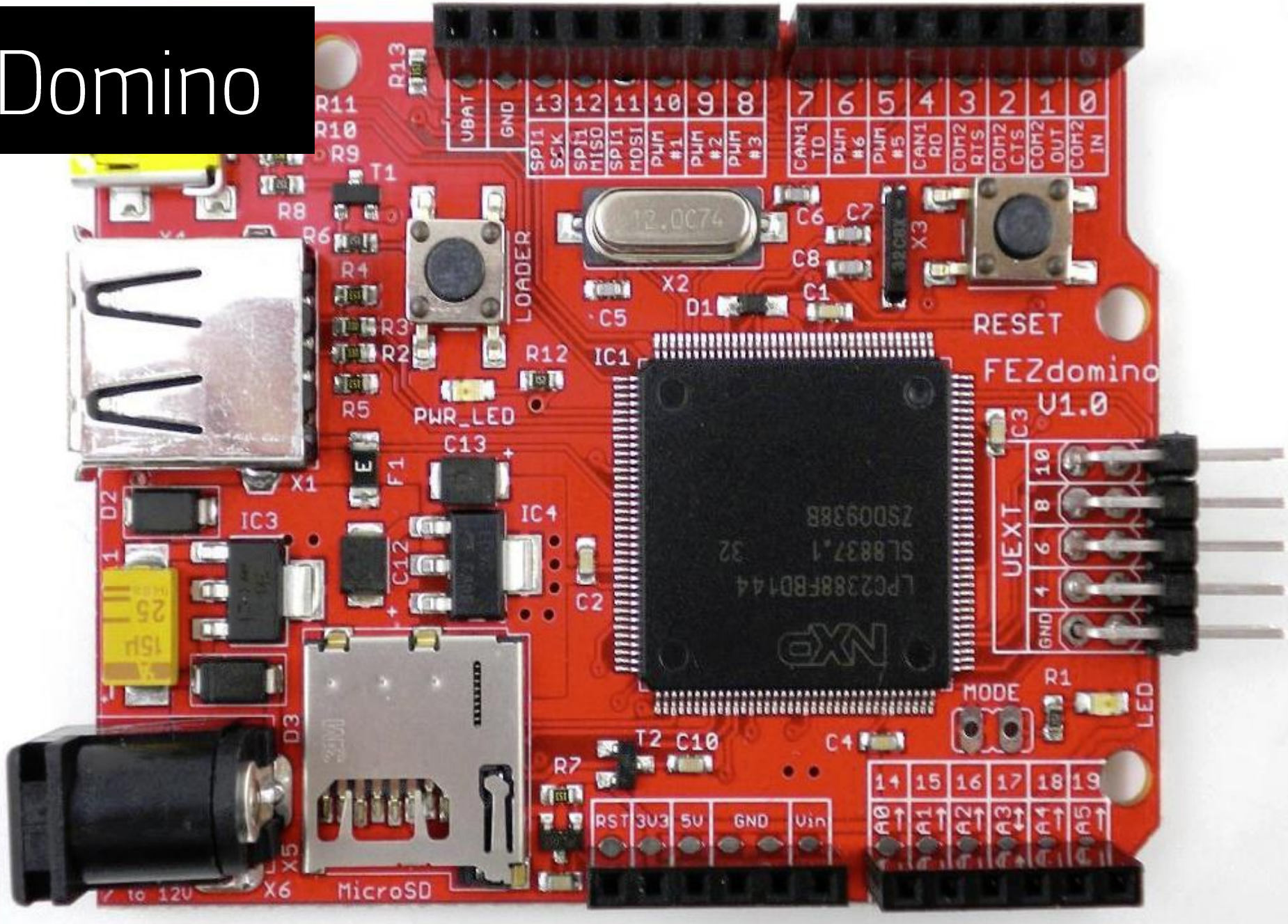
Digital I/O

Arduino pin-compatible

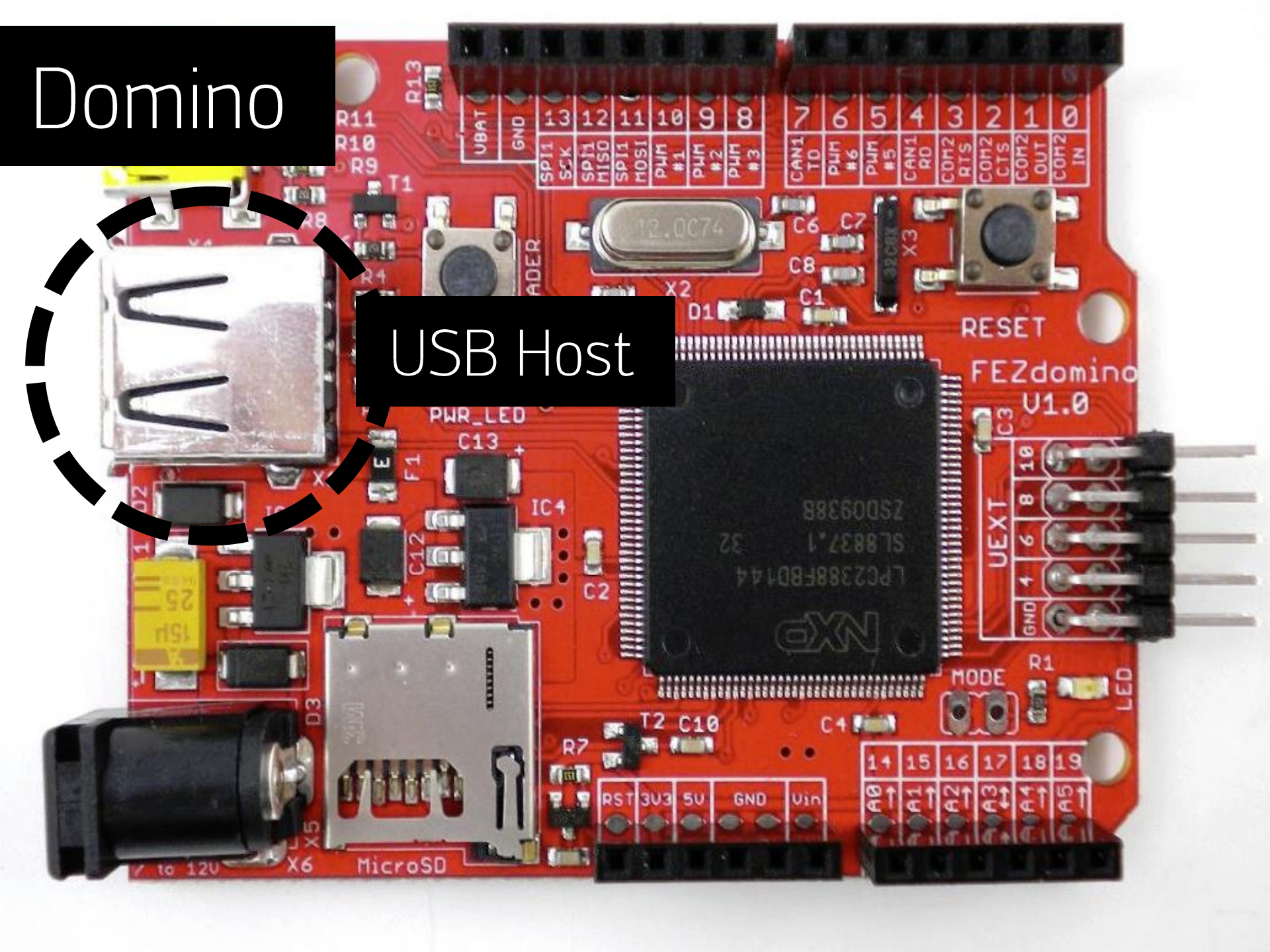
Analog Input

GHI Domino

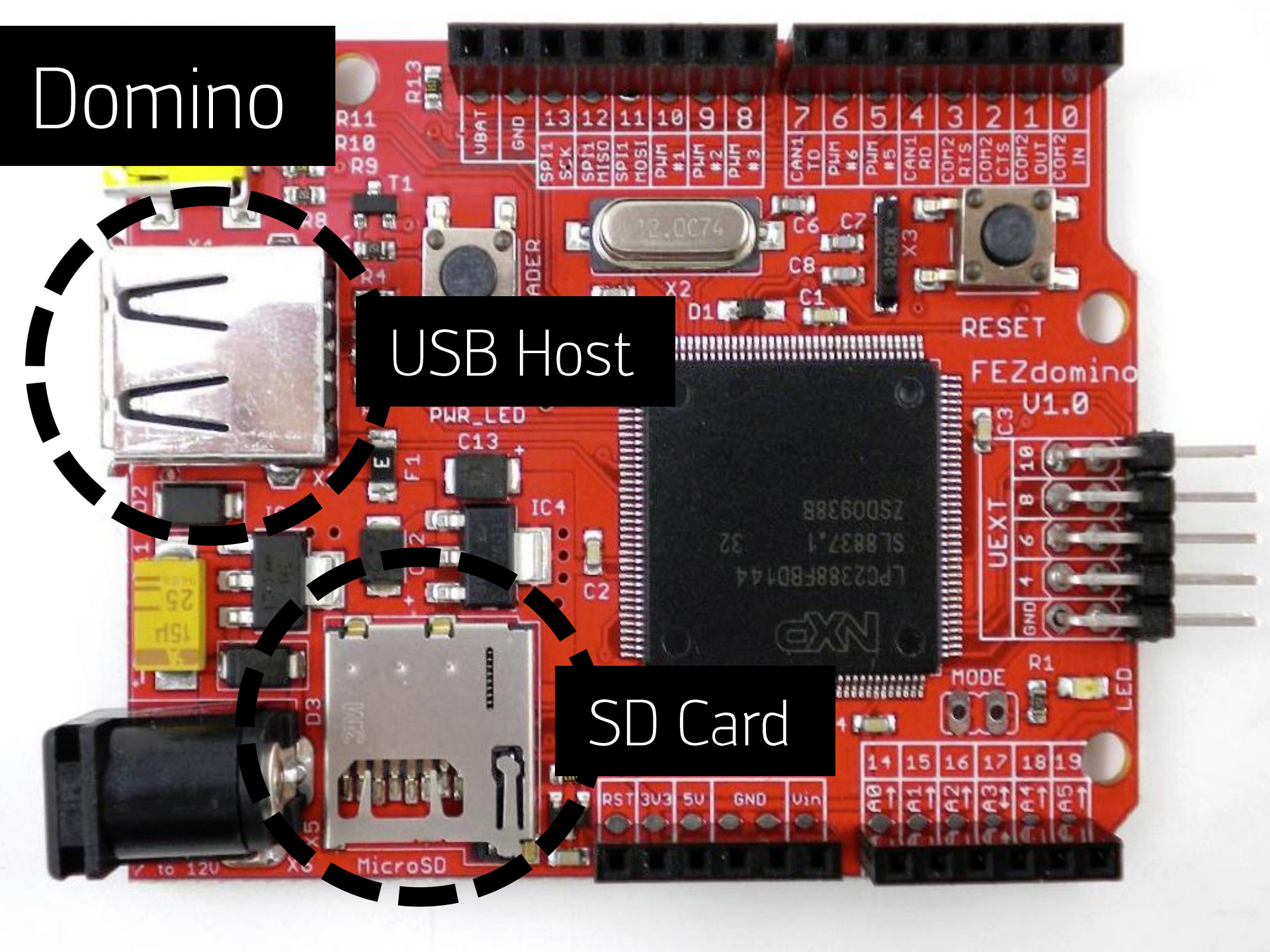
Domino


VBAT
GND
13 SPI1 SCK
12 SPI1 MISO
11 SPI1 MOSI
10 PWM #1
9 PWM #2
8 PWM #3
7 CAN1 TD
6 PWM #6
5 PWM #5
4 CAN1 RD
3 COM2 RTS
2 COM2 CTS
1 COM2 OUT
0 COM2 IN
LOADER
RESET
FEZdomino
V1.0
UEXT
10
8
6
4
GND
MODE
LED
R1
R13
R11
R10
R9
T1
R8
R6
R4
R3
R2
R5
X1
D2
IC3
F1
C13
IC4
C12
C2
R12
PWR_LED
IC1
C5
D1
X2
C6
C7
C8
C1
X3
C3
C4
T2
C10
R7
D3
X5
X6
MicroSD
to 12V
14 A0
15 A1
16 A2
17 A3
18 A4
19 A5
RST
3V3
5V
GND
Vin

Domino


USB Host
VBAT
GND
13 12 11 10 9 8
SPI1 SCK
SPI1 MISO
SPI1 MOSI
PWM #1
PWM #2
PWM #3
7 6 5 4 3 2 1 0
CAN1 TD
PWM #6
PWM #5
CAN1 RD
COM2 RTS
COM2 CTS
COM2 OUT
COM2 IN
RESET
FEZdomino
V1.0
PWR_LED
UEXT
MODE
LED
RST 3V3 5V GND Vin
14 15 16 17 18 19
A0 A1 A2 A3 A4 A5
MicroSD
X6
X5
to 12V

Domino

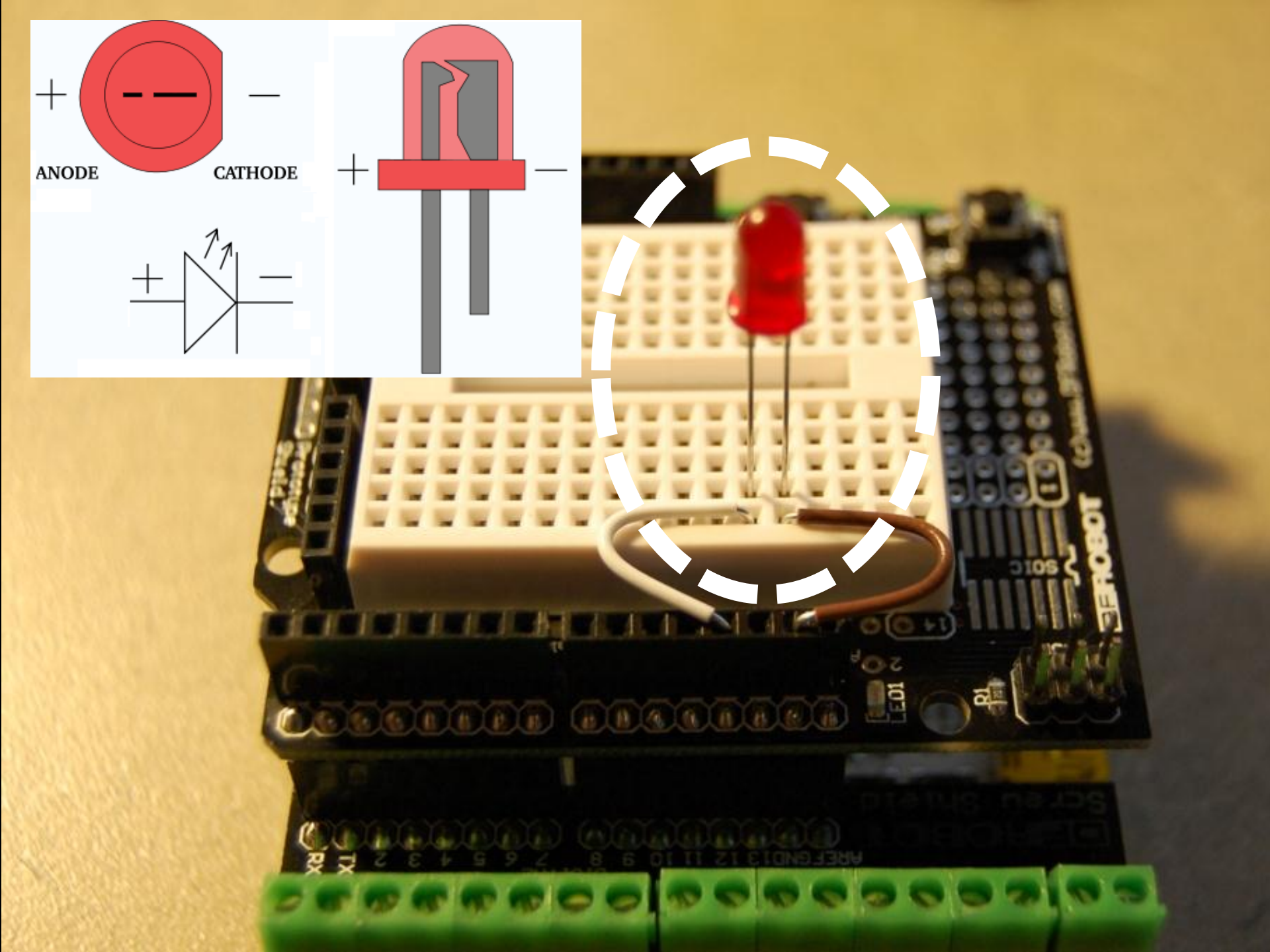

USB Host
SD Card
RESET
FEZdomino
V1.0
UEXT
MODE
LED
PWR_LED
MicroSD
VBAT
GND
SPI1 SCK
SPI1 MISO
SPI1 MOSI
PWM #1
PWM #2
PWM #3
CAN1 TD
PWM #6
PWM #5
CAN1 RD
COM2 RTS
COM2 CTS
COM2 OUT
COM2 IN
RST
3V3
5V
GND
Vin
A0
A1
A2
A3
A4
A5

“Hands on”

Installation and Setup

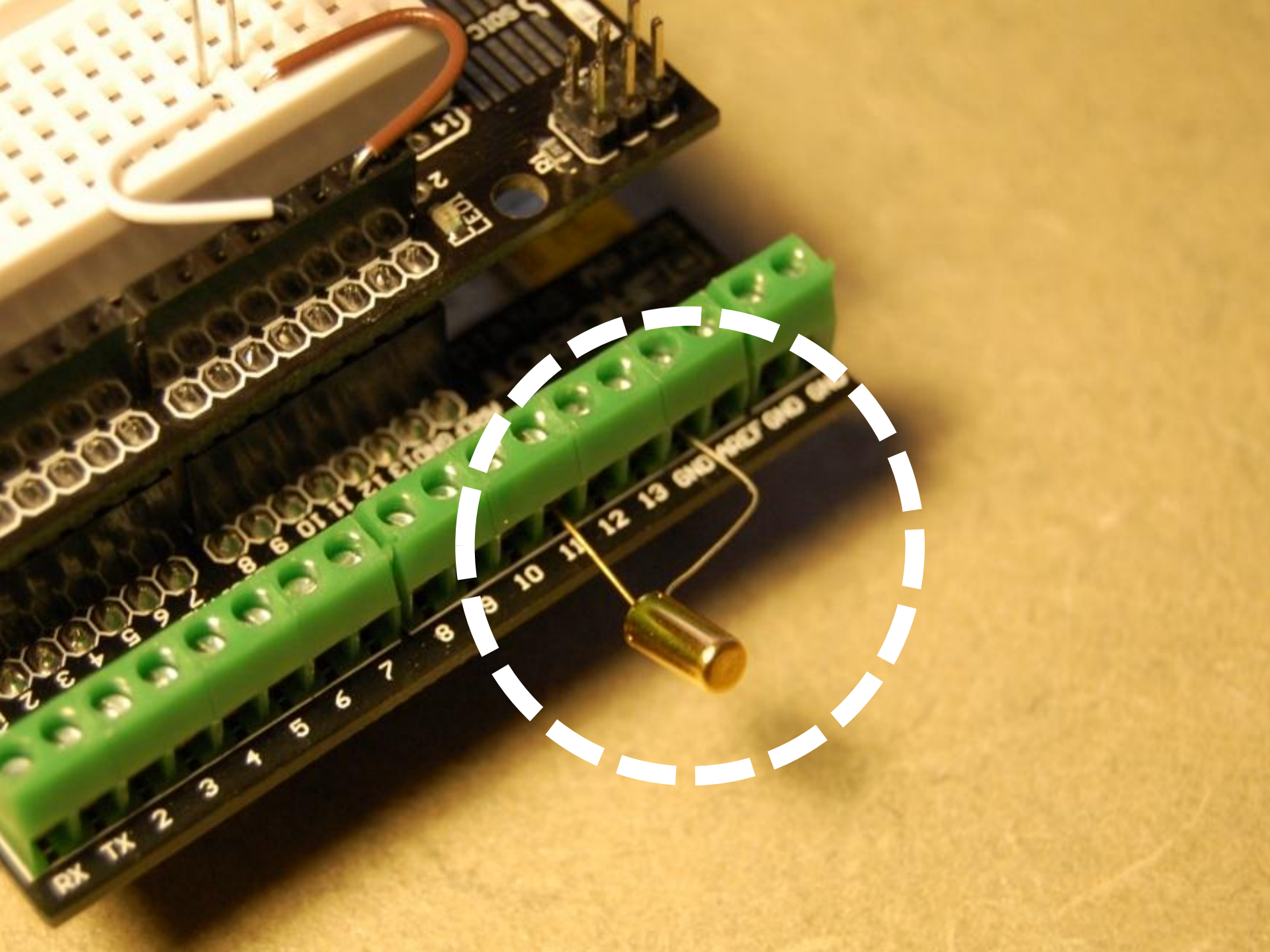
Example 1:

Hello World (LED)


+
−
ANODE
CATHODE
+
−
+
−

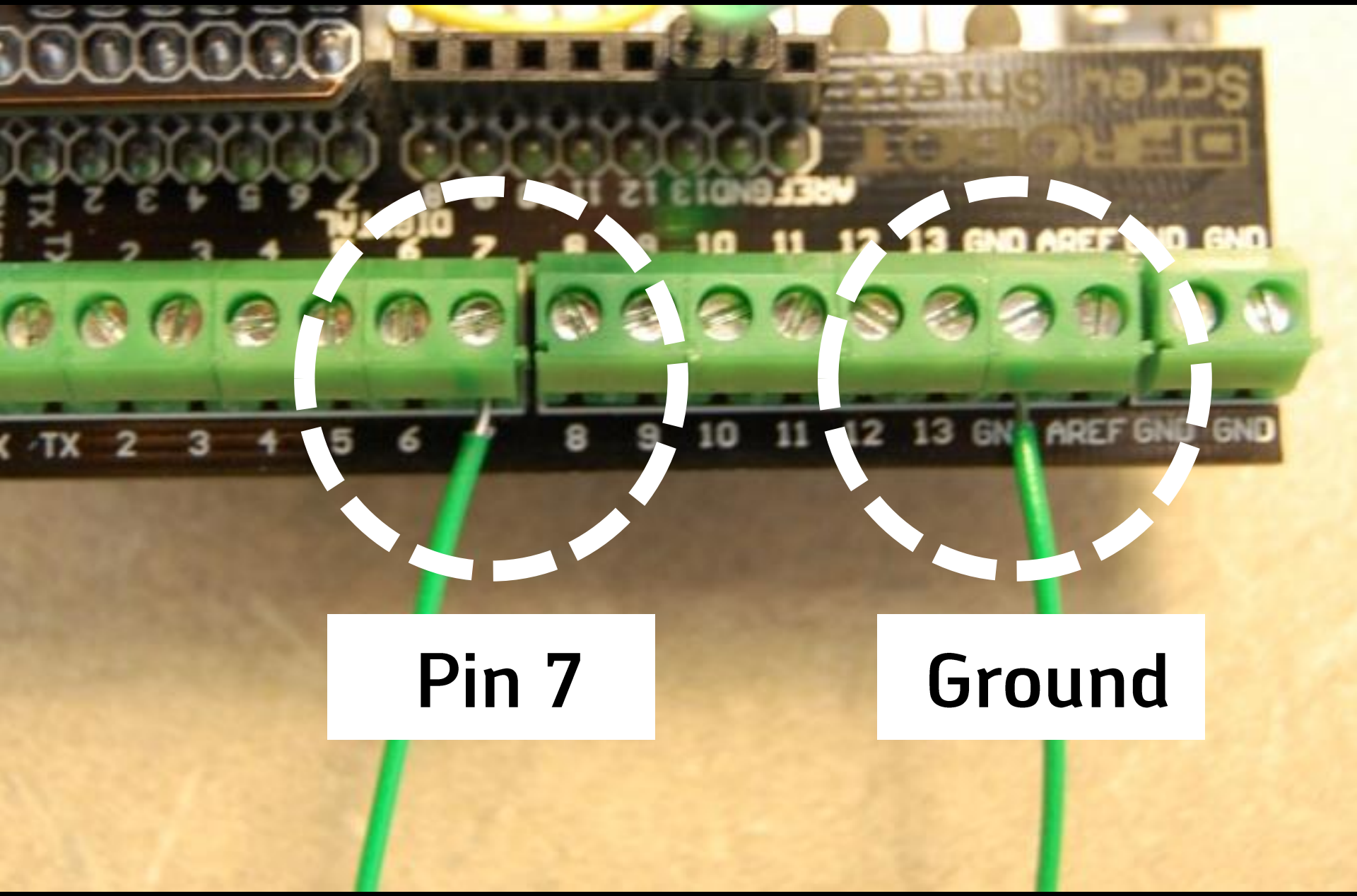
Example 2:

Tilt switch


RX TX 2 3 4 5 6 7 8 9 10 11 12 13 GND
LED

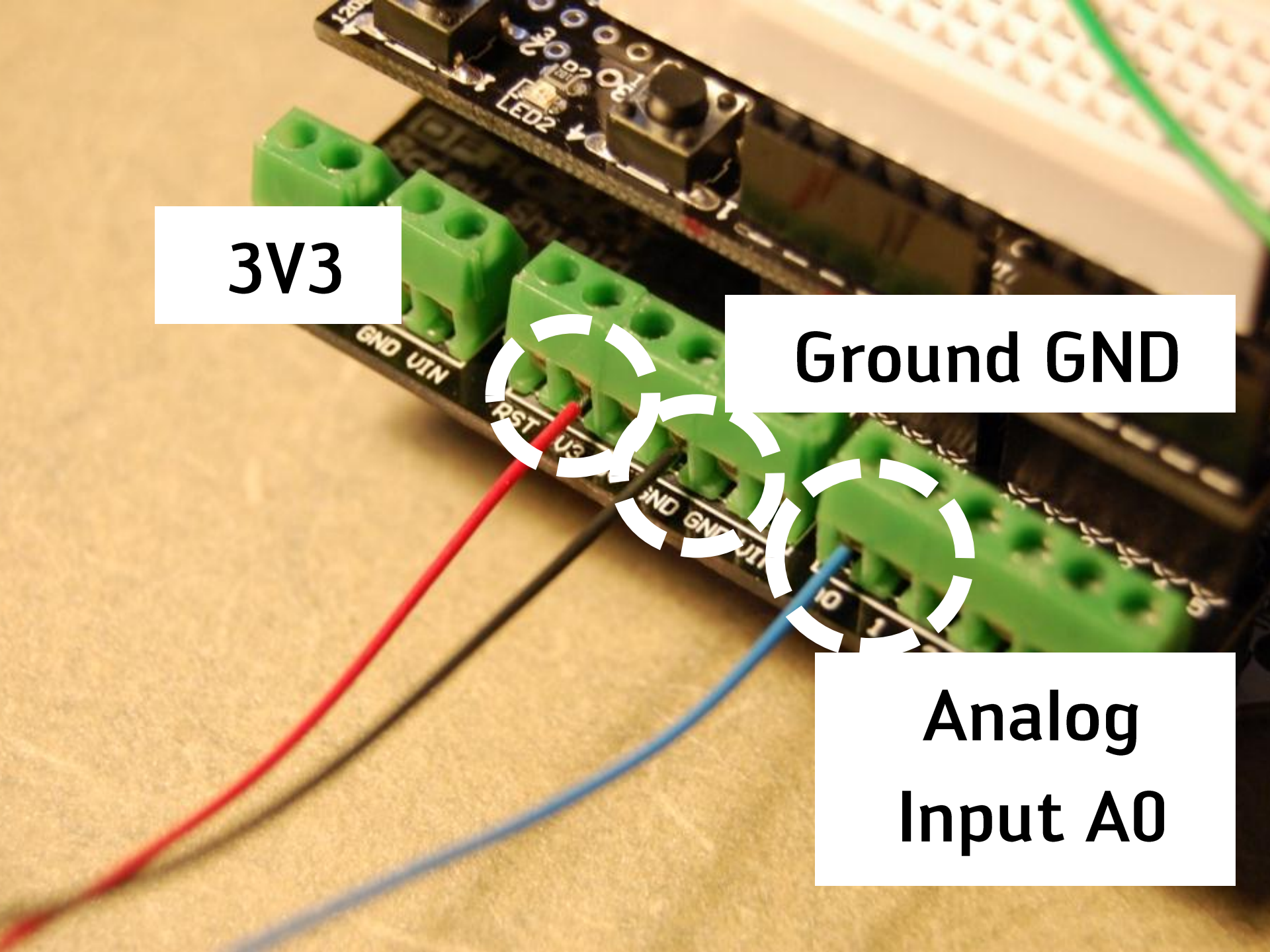
Example 3:

Button


Pin 7
Ground

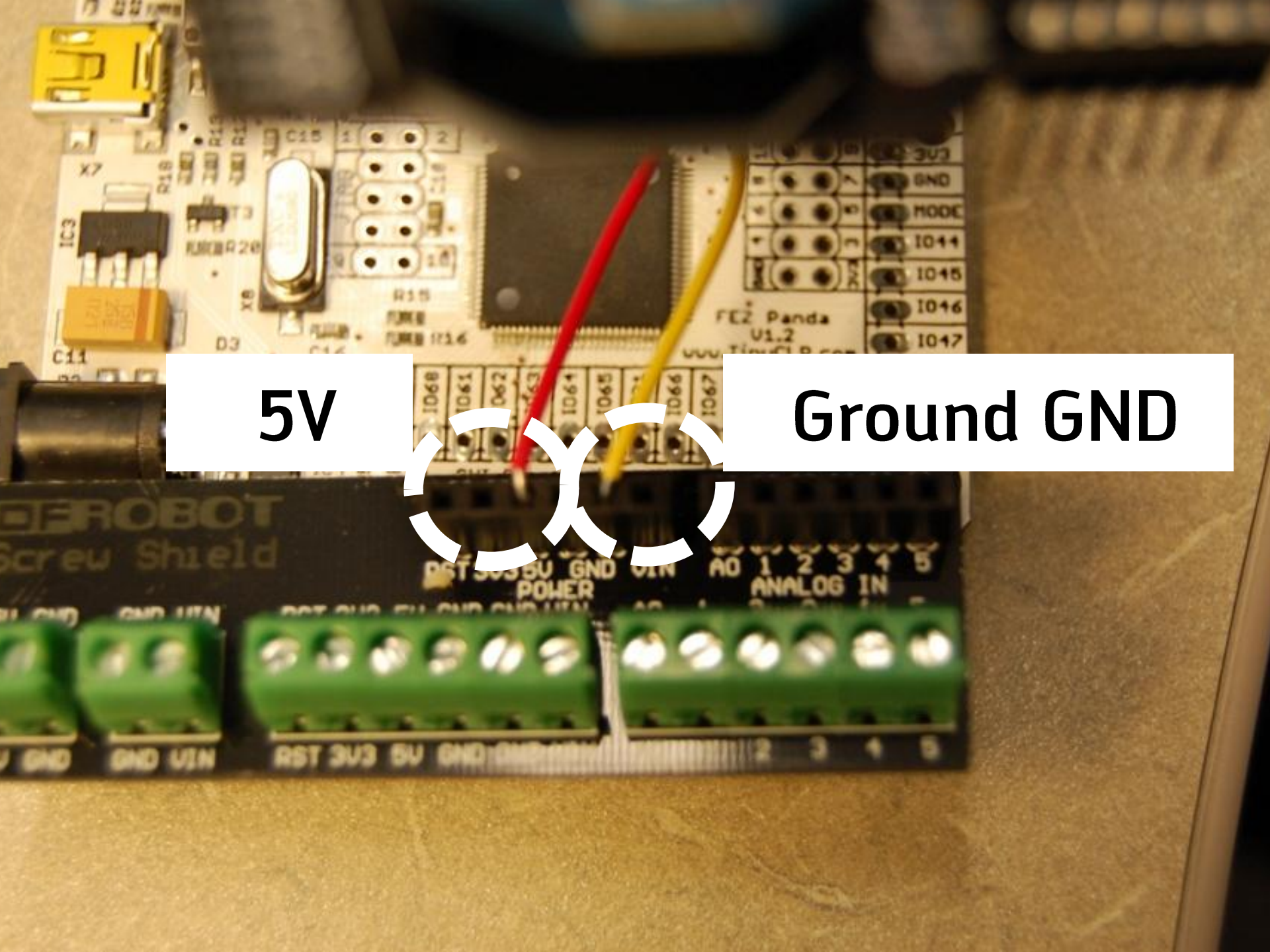
Example 4:

Distance Sensor


3V3
Ground GND
Analog
Input A0
GND VIN
RST
LED2

Example 5:

ZIGBEE


5V
Ground GND
FEZ Panda
V1.2
Screw Shield
POWER
ANALOG IN
RST 3V3 5V GND VIN
A0 1 2 3 4 5
GND VIN
RST 3V3 5V GND