SiliconBlue™

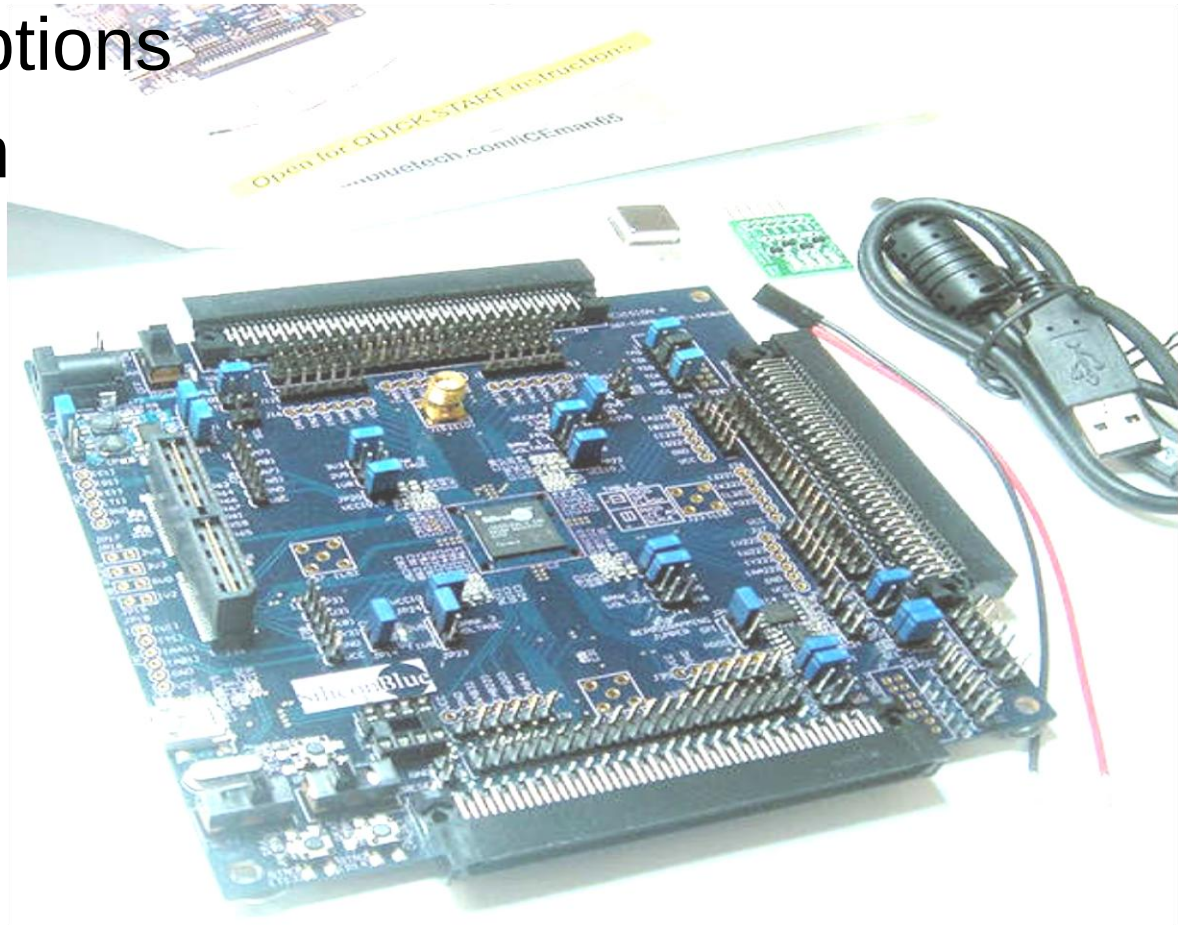
SiliconBlue Technologies
iCEman65 Board

Programmable Solutions for Consumer Handheld

7-MAY-2008 (v1.1)

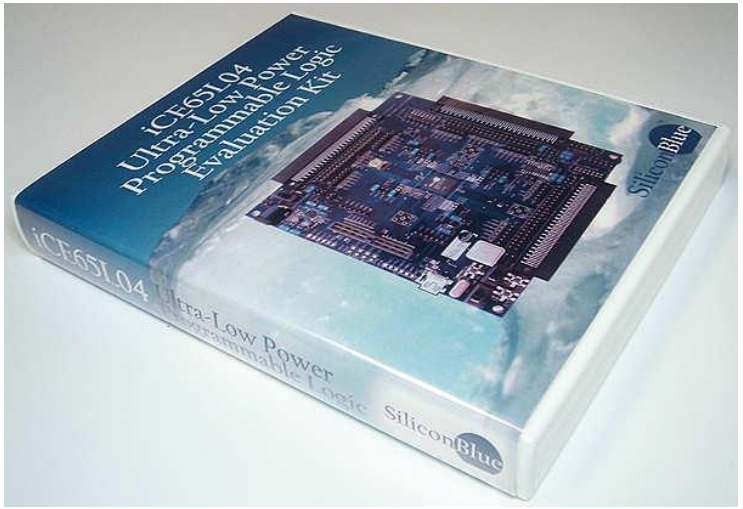
Agenda

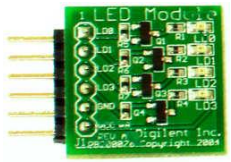
- iCEman65 Kit
- Programming Options
- More Information



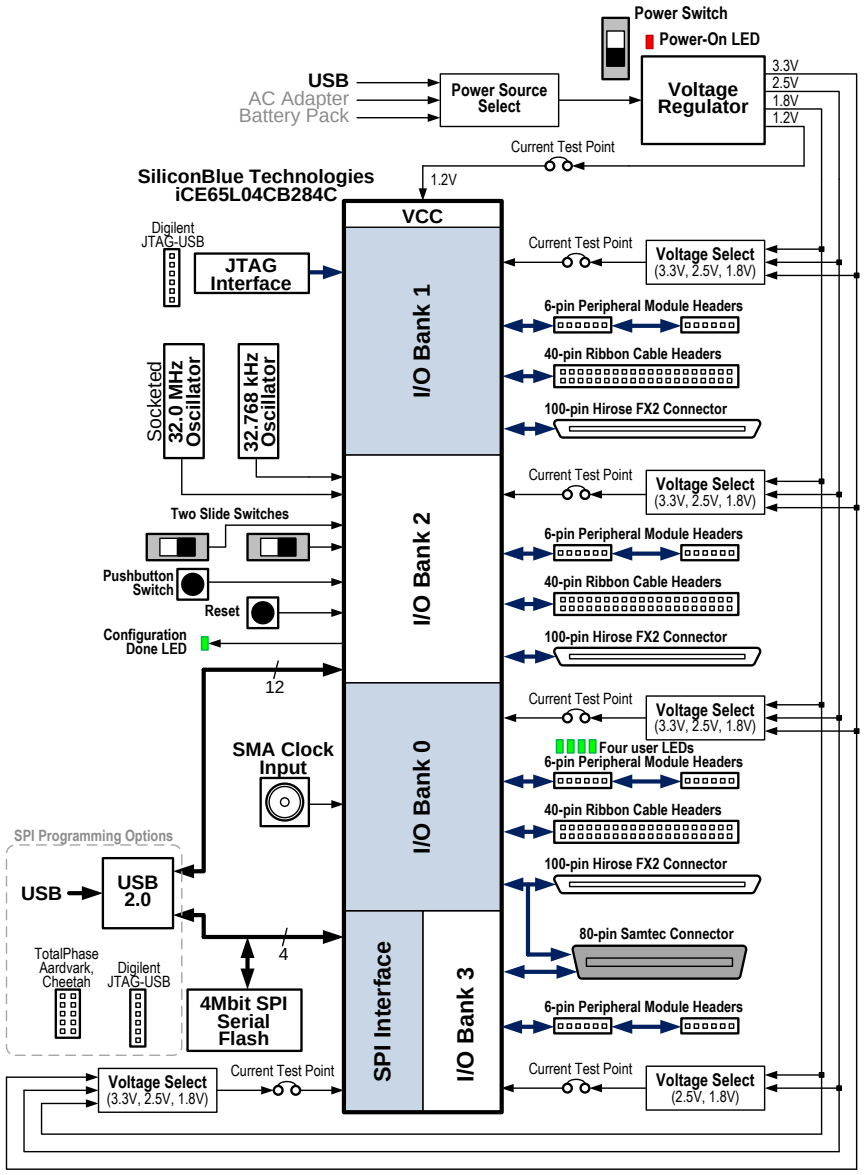
What's in the Box?

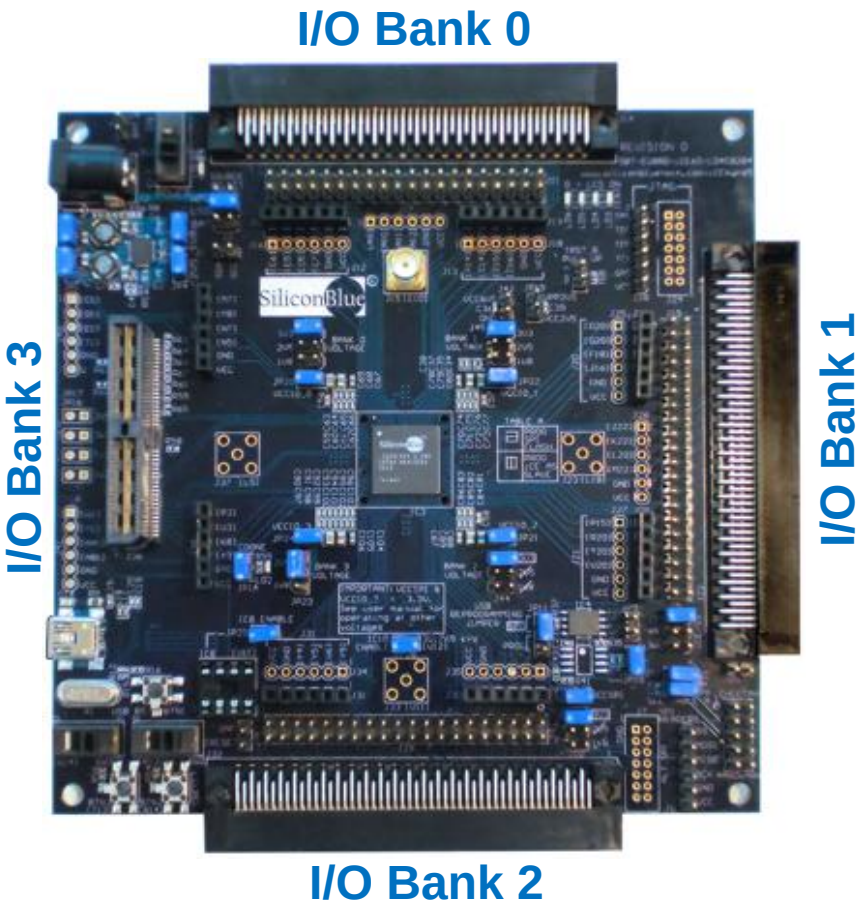
- iCEman65 board
- LED peripheral module
- 32.0 MHz oscillator can
- USB cable
- Two-pin power cable (for power measurements)
- Quick Start guide





iCEman65 Block Diagram



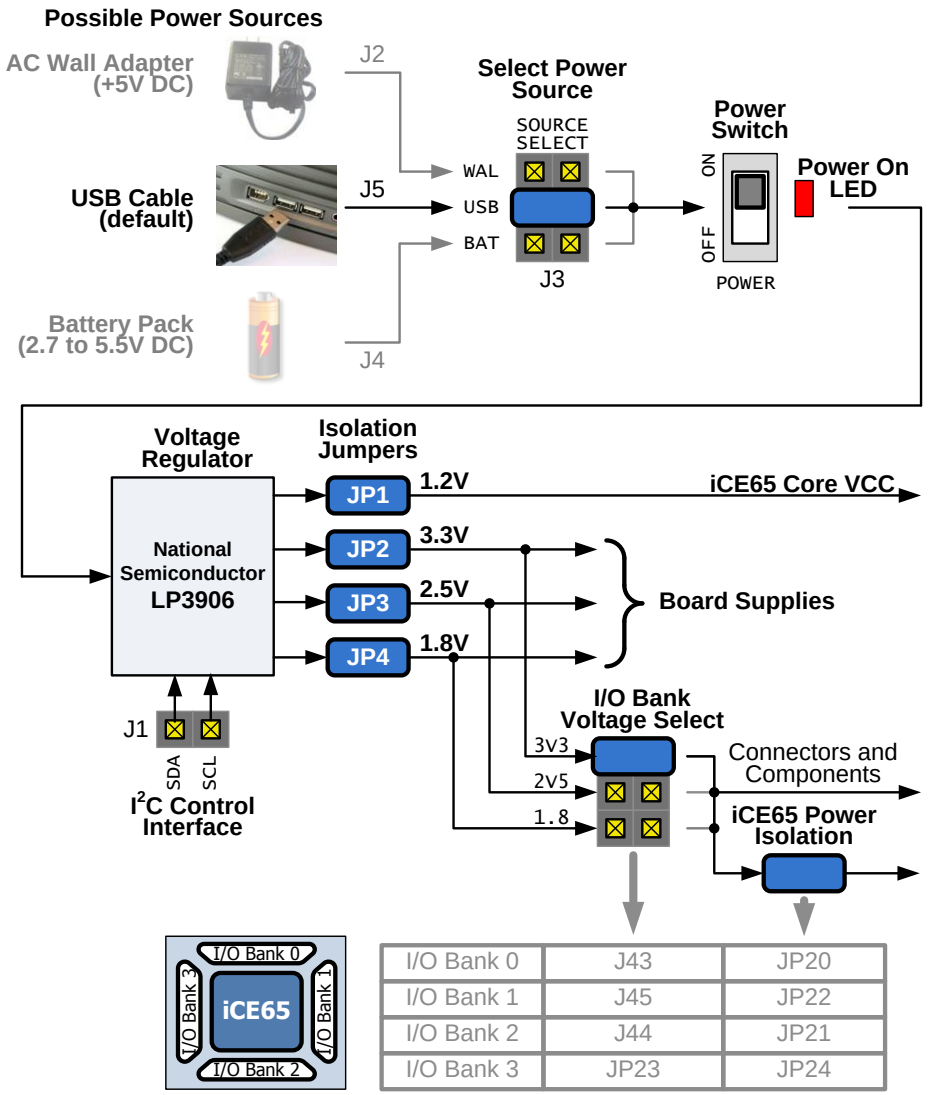


Design Philosophy

- **Deliver the Boards NOW!!!**
- Plentiful I/O : iCE65 Competitive Advantage
  - Expansion connectors and boards
  - Leverage off-the-shelf solutions where possible
- Flexible I/O Voltages : iCE65 Competitive Advantage
  - Separate voltages for each I/O bank supply
- Power Measurements : iCE65 Competitive Advantage
  - Jumpers for easy measurements
  - Each I/O bank, core isolated into power islands
- Programming Options
  - Onboard USB + third party options
- Options
  - Multiple power supply options
  - Board supports iCE65L02 through iCE65L16 in CB132, CB284 packages
  - CB284 socket (for testing on-board NVCM programming)

Power Options

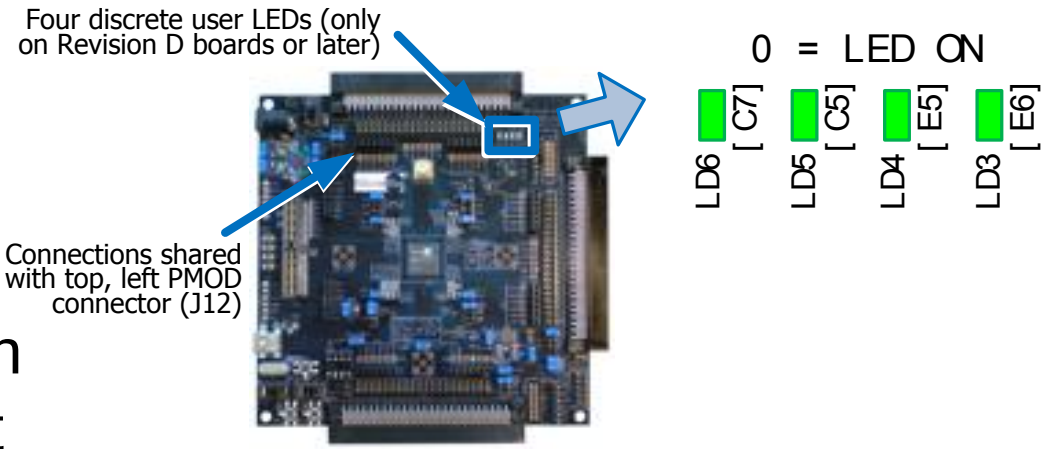
- Powered by USB by default
  - Also programming interface
- Optional power sources
  - AC adapter
  - Battery pack
- Each I/O bank has …
  - Independent voltage control
  - Isolation jumper

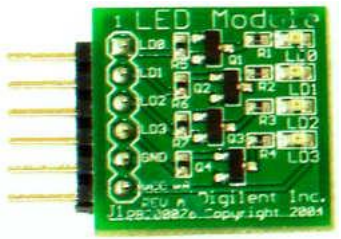


I/O Bank 0	J43	JP20
I/O Bank 1	J45	JP22
I/O Bank 2	J44	JP21
I/O Bank 3	JP23	JP24

LEDs

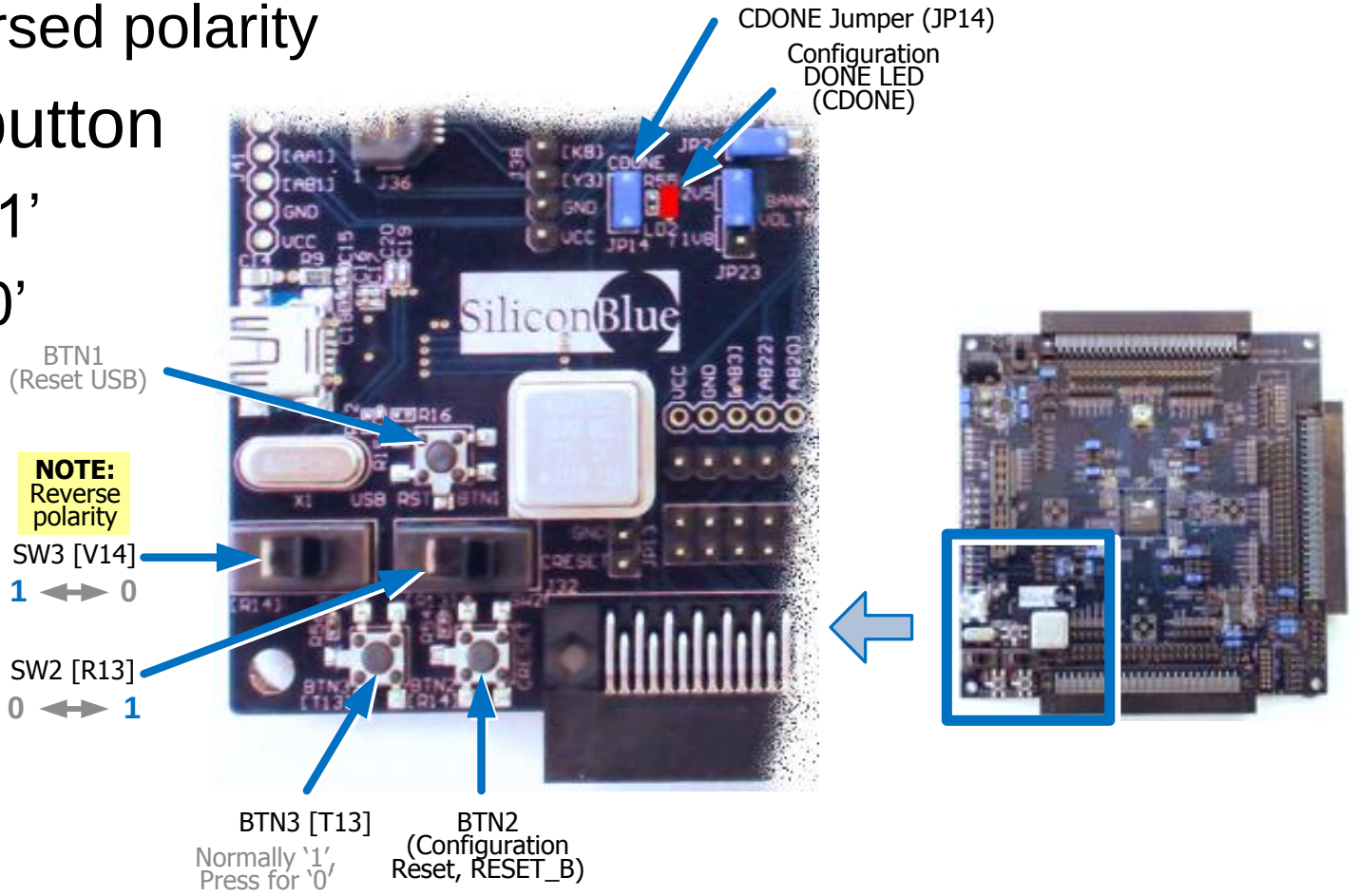
- Four general-purpose LEDs on the board
  - Not on Rev. B boards
  - Drive Low to light LED
  - Connections shared with upper-left PMOD socket
  - Pin numbers marked on board (Example “[C7]”)
- LED Peripheral Module
  - Included with kit
  - Plugs into any PMOD socket
  - Works at 1.8V to 3.3V



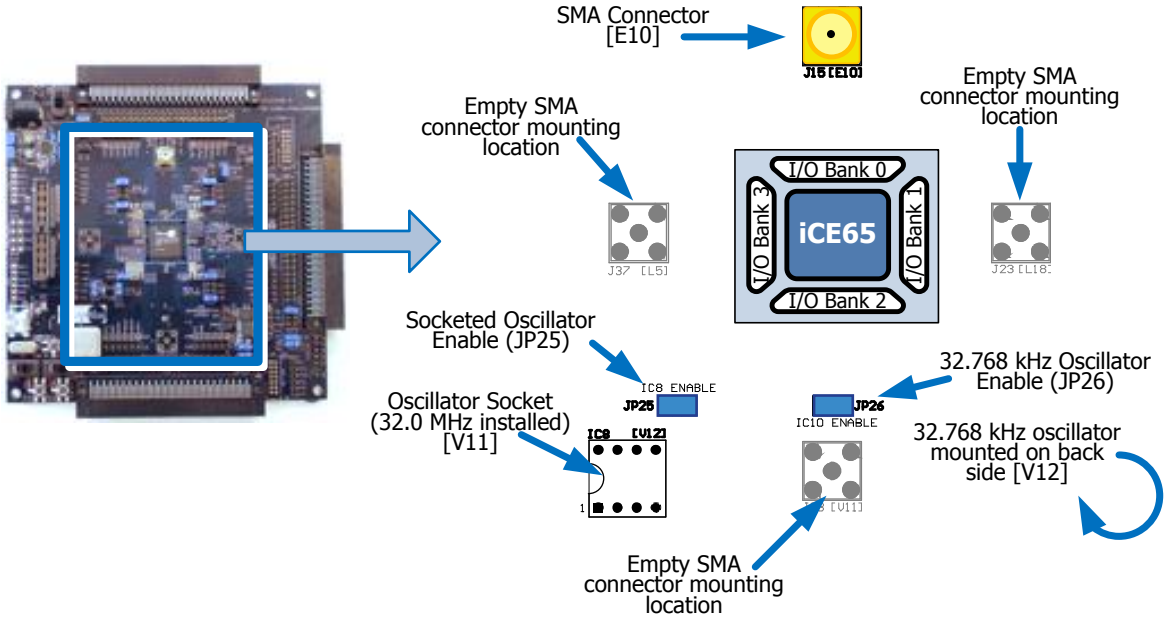


Switches

- CRESET_B pushbutton
- Two user slide switches
  - Note reversed polarity
- User pushbutton
  - Normally ‘1’
  - Push for ‘0’



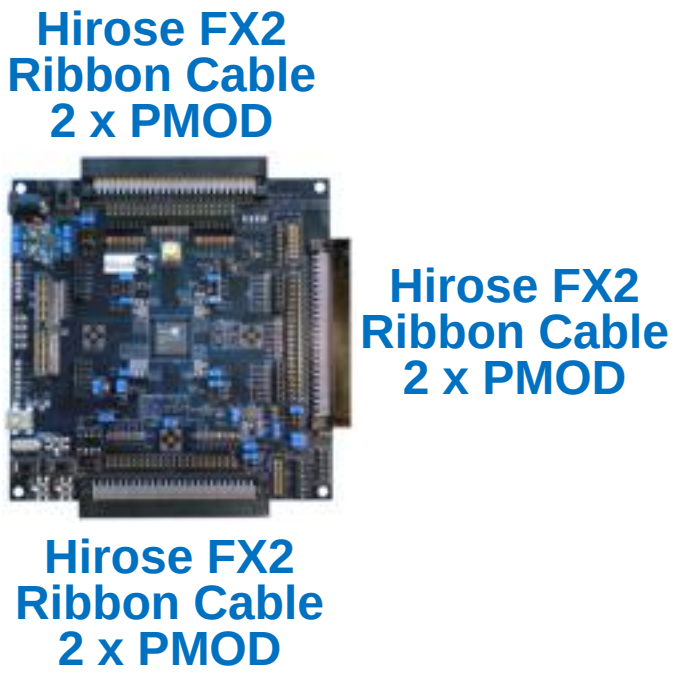
Clock Sources



- 32.768 kHz oscillator mounted on back side
- 32.0 MHz oscillator can shipped with board
  - Mount in 8-pin DIP socket
  - Can change to any half-size oscillator
- SMA Connector to drive from external clock source
  - Also available as an output

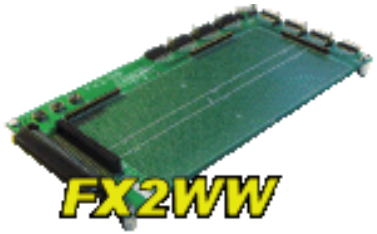
Expansion Connectors

- 100-pin Hirose FX2 Connectors
  - Banks 0, 1, and 2
  - Digilent FX2 boards
- 40-pin Ribbon Cable Connectors
  - Banks 0, 1, and 2
  - TerASIC camera and LCD panel
- 6-pin Peripheral Module (PMOD) Connectors
  - Eight total, two per I/O bank
  - Digilent PMOD modules
- 80-pin Samtec High-speed Connector
  - Bank 3 only



Hirose FX2 Expansion Boards

Breadboard Prototyping



Wirewrap Prototyping

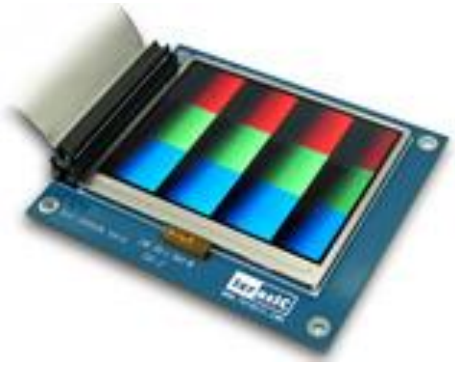
Video Decoder Board

www.digilentinc.com/Products/Catalog.cfm?Nav1=Products&Nav2=Accessory&Cat=Accessory

NOTE: Port Enhancement demo board plugs in to an FX2 connector.

40-Pin Ribbon Cable Boards

1.3MPixel CMOS Imager/Camera



3.6-inch 320 x 240 Color Display

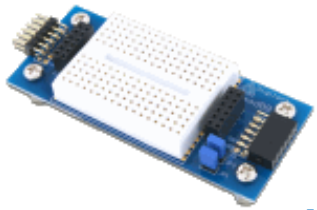
4.3-inch High-Resolution 800 x480 Color Display

www.terasic.com.tw

New board, not much information yet

5MPixel CMOS Imager/Camera

Peripheral Modules (PMOD)



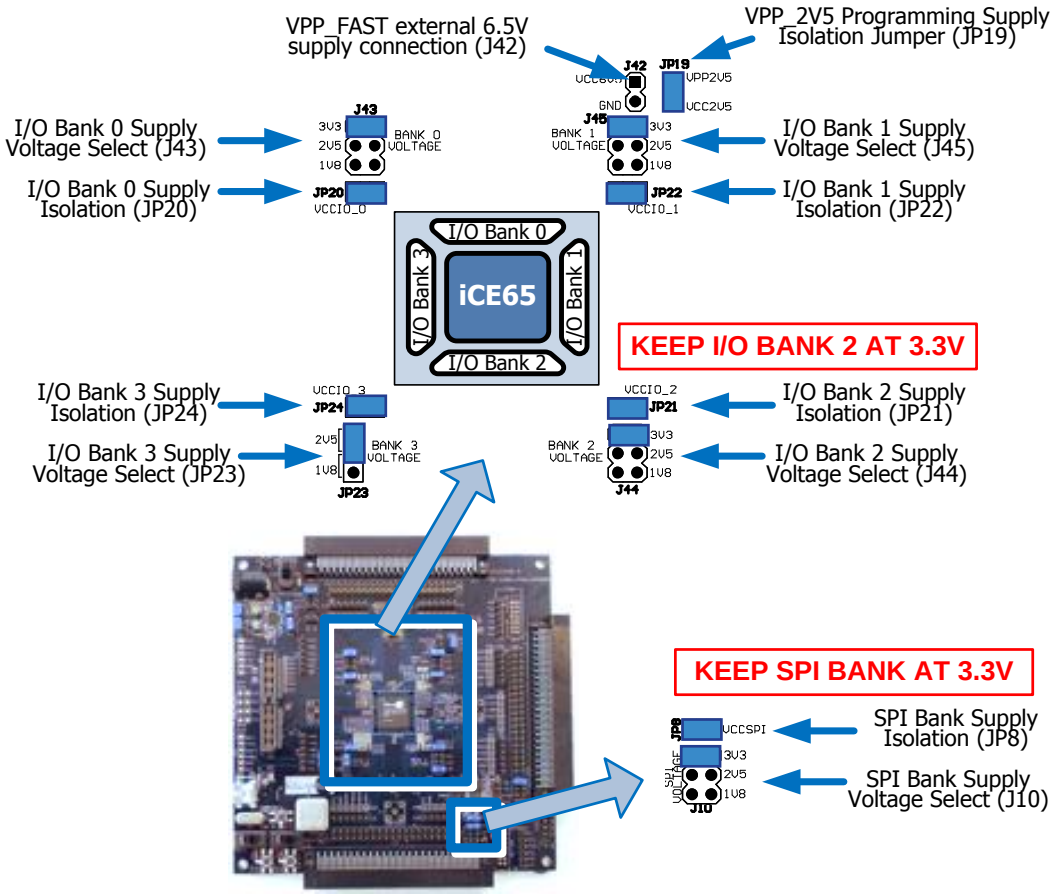
Prototype Module

- 6-pin connector
  - 4 signals
  - Power, Ground
- Easy interfaces
  - Analog
  - Interface
  - Memory
  - Display
  - Motor control

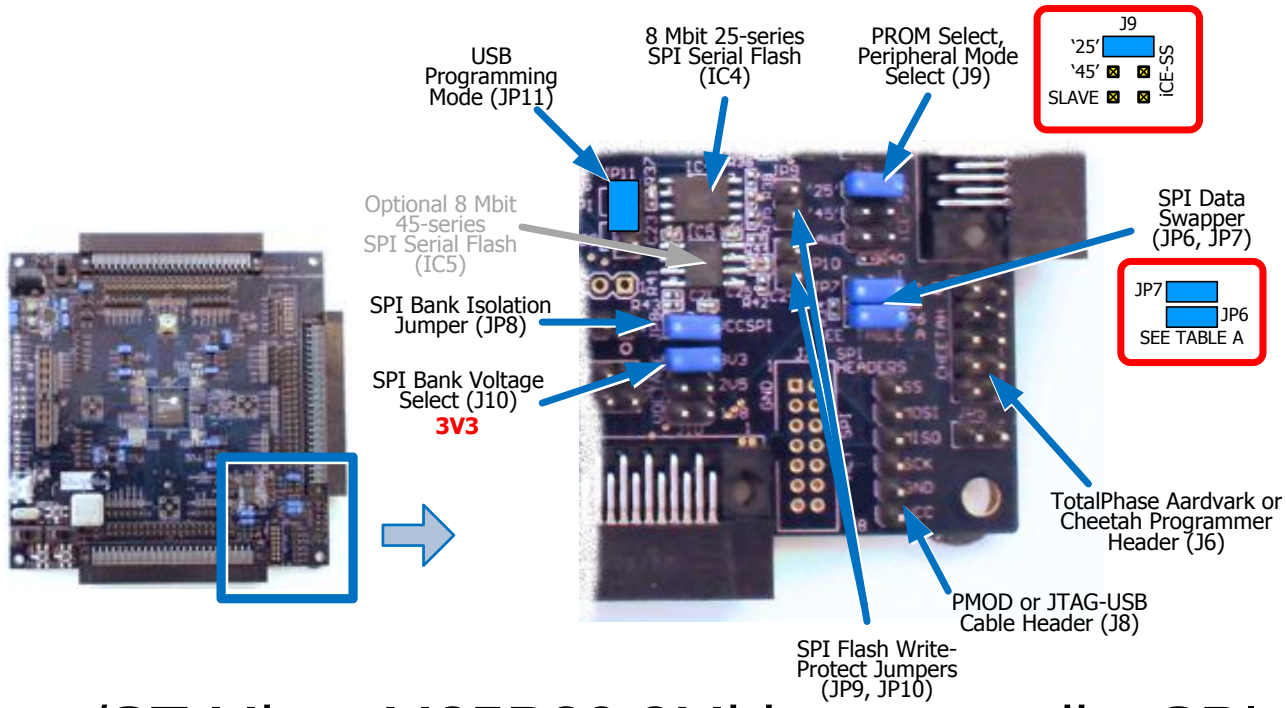
www.digilentinc.com/Products/Catalog.cfm?Nav1=Products&Nav2=Peripheral&Cat=Peripheral

I/O Bank Voltage Control

- Each I/O Bank has selectable input voltage
- Banks 0, 1, 2
  - 3.3V, 2.5V, 1.8V
  - Keep I/O Bank 2 at 3.3V unless you read the manual
- Bank 3
  - 2.5V or 1.8V
- SPI Mini Bank
  - 3.3V, 2.5V, 1.8V
  - Keep at 3.3V unless you read the manual



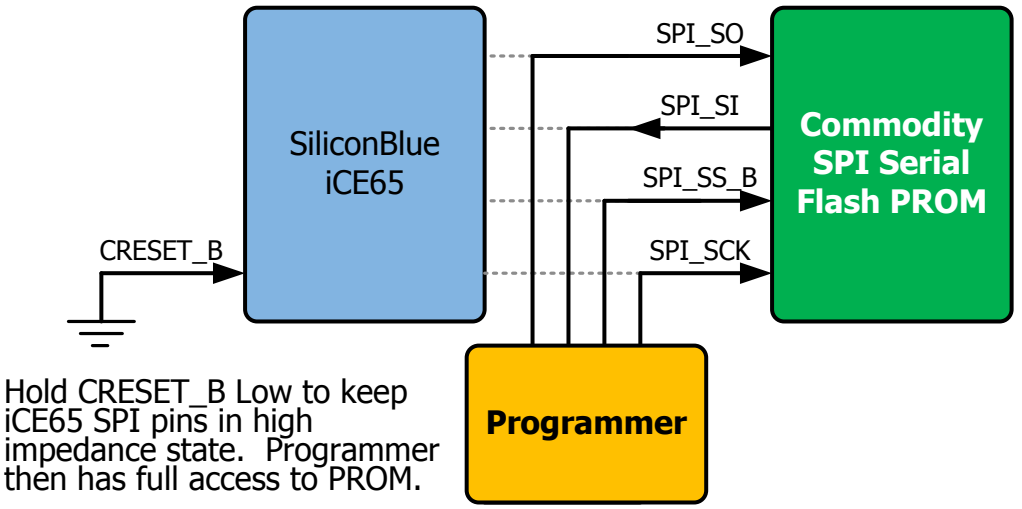
SPI Programming



- Numonyx/ST Micro M25P80 8Mbit, commodity SPI serial Flash PROM
  - Some boards also have Atmel AT45DB081D 8Mbit PROM (not default build)
- Programming support via onboard USB, TotalPhase box, or Digilent cable
- Set jumpers as required (including CRESET_B jumper)

Programming SPI Flash

- Hold CRESET_B Low
  - Tri-states all pins
  - Allows external programmer access to SPI Flash
- Built into iCEman65 board
- TotalPhase
  - Aardvark (lower-speed) www.totalphase.com/products/aardvark_i2cspi
  - Cheetah (high-speed) www.totalphase.com/products/cheetah_spi
  - Free Flash Center software www.totalphase.com/products/flash_center
- Digilent
  - JTAG-USB Cable www.digilentinc.com/Products/Detail.cfm?Prod=JTAG-USB&Nav1=Products&Nav2=Cables
  - Works with Adept/ICEUTIL

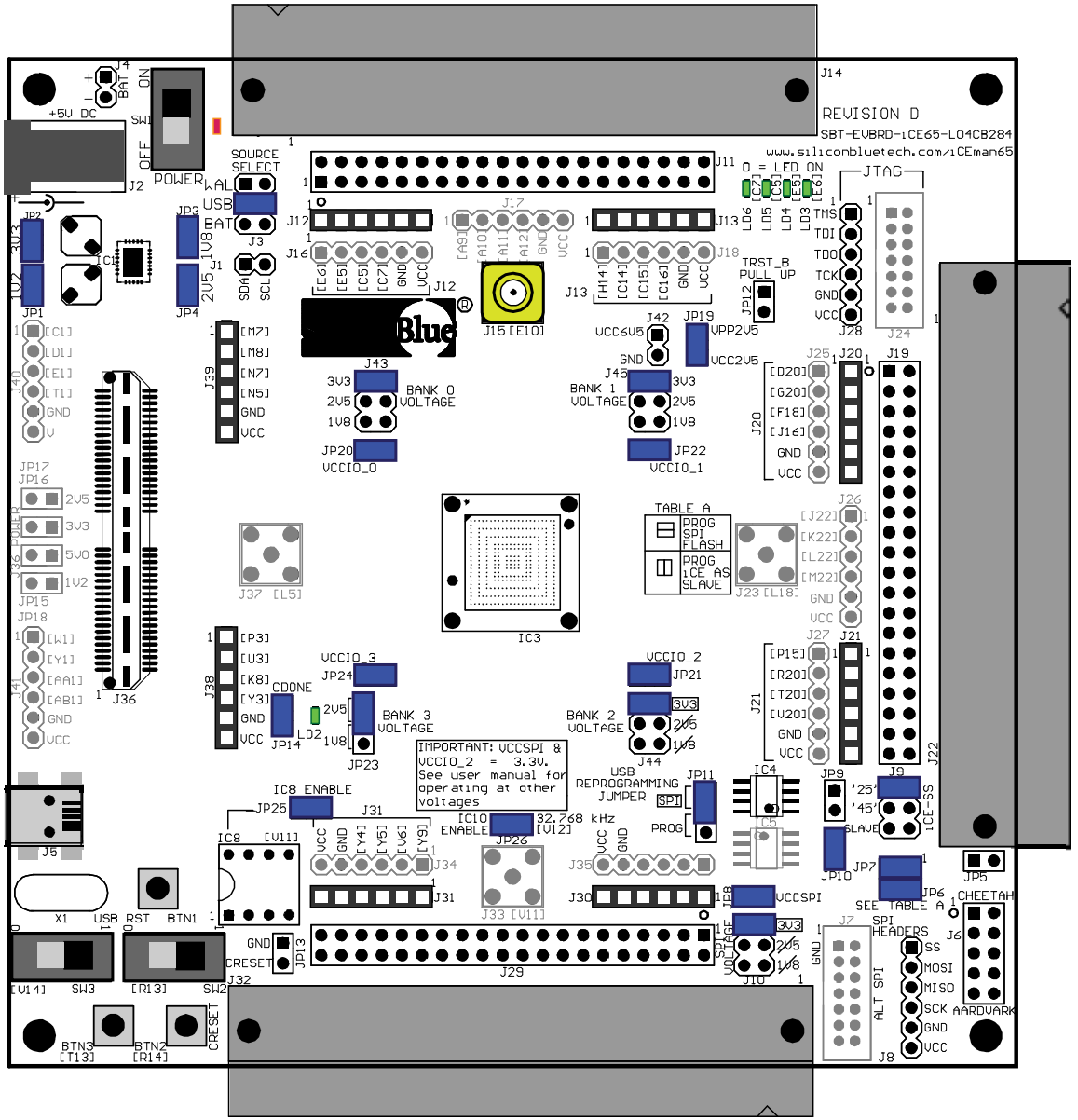


Hold CRESET_B Low to keep iCE65 SPI pins in high impedance state. Programmer then has full access to PROM.

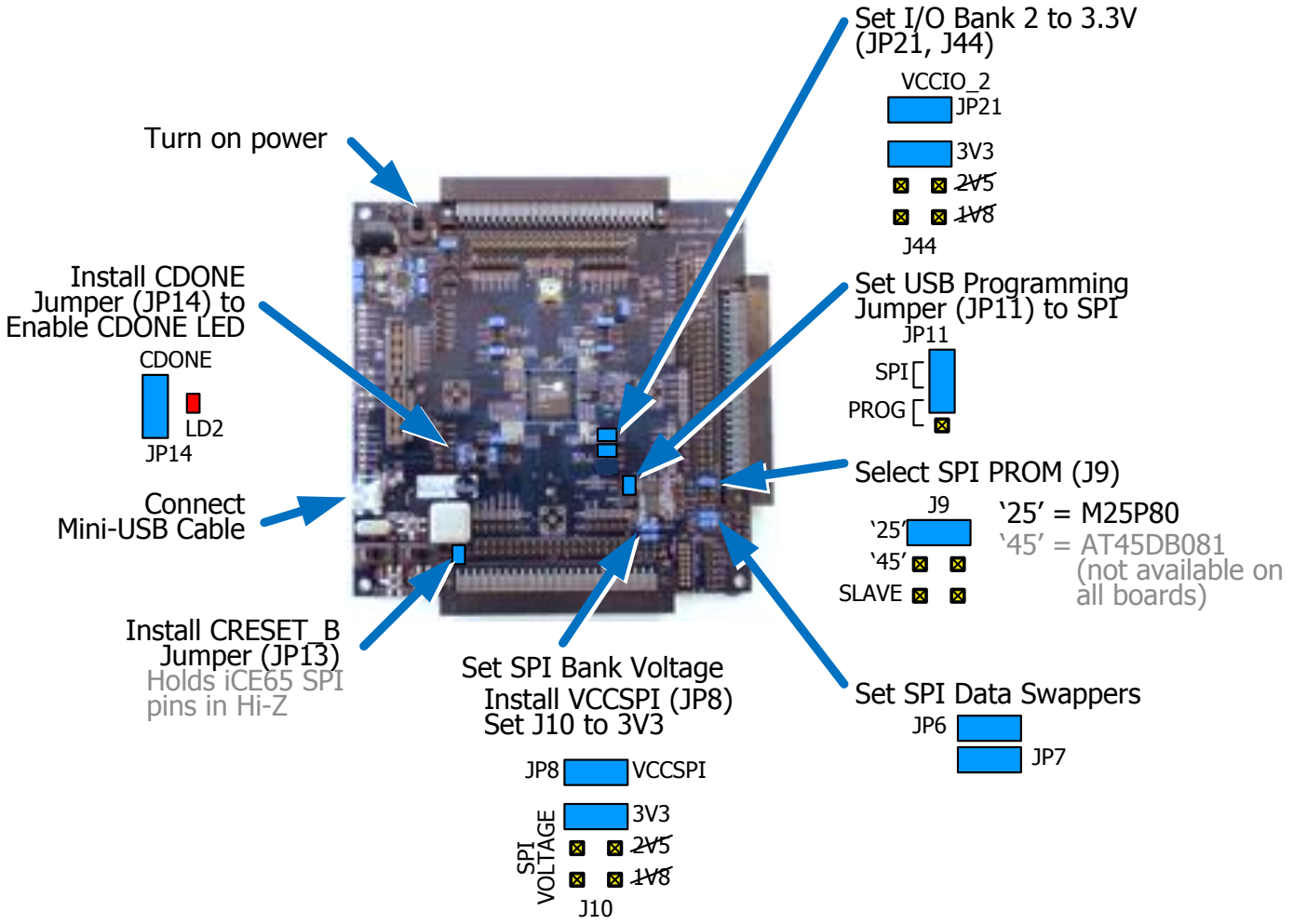
On-board USB Programmer

- Programming Software
  - Adept
    - USB device drivers
    - Available for download from iCEman65 web site www.siliconbluetech.com/iCEman65/downloads/Adept.msi
  - ICEUTIL
    - Command-line driven
    - Available for download from iCEman65 web site www.siliconbluetech.com/iCEman65/downloads/iceutil.exe
  - Installation Guide
    - Available for download from iCEman65 web site www.siliconbluetech.com/iCEman65/AdeptICEUTILInstallation.pdf

Default Jumper Settings



Programming Setup



- Be sure that jumper JP13 is installed to hold CRESET_B Low!

ICEUTIL Quick Reference

- Open DOS box, command window

```
iceutil [opt1] [otp2] [...]

 Options:
  -d <devname>  specify name of SPI interface device to use
  -m <memtype>  specify target device type
  -w <filename> write device with contents of specified file
  -r <filename> write specified file with contents read from flash
  -id           print the id code from the flash device
  -v            verify device contents after write
  -a <address>  specify starting address to write/read
  -l <length>   specify number of bytes to read
  -E            erase the flash memory device
  -NE           don't perform any erase before write
  -fb           read/write files in binary format
  -fi           read/write files in Intel hex format
  -fh           read/write files in raw hex format
  -s <freq>     set SPI clock speed
```

ICEUTIL Example

- Project creates two possible configuration images
  - `<project_name>_bitmap.hex` : raw hex file
  - `<project_name>_bitmap_int.hex:` Intel hex file
- Program M25P80 PROM with Raw Hex
  - `iceutil -d iCEman65 -m m25p80 -fh -w <project_name>_bitmap.hex -v`

Target iCEman65 board

Specify hex format

- Program M25P80 PROM with Intel Hex
  - `iceutil -d iCEman65 -m m25p80 -fi -w <project_name>_bitmap_int.hex -v`

Memory type

Write configuration image file

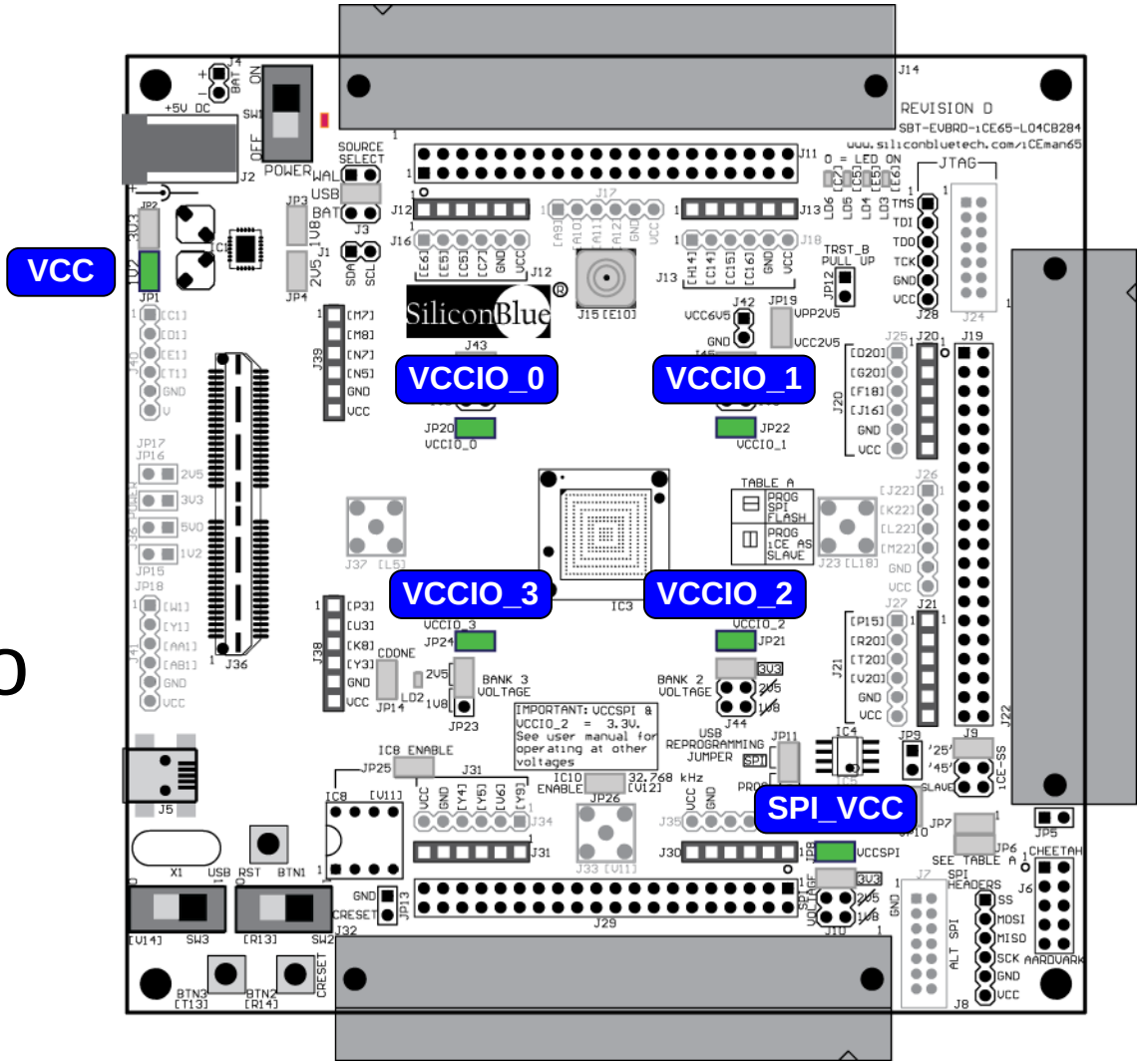
Verify after programming

Default Design

- Design pre-programmed on boards
- Shift registers toggle the LEDs in one direction
- I/O Banks 0, 1 controlled by 32.768 kHz oscillator on back of board
- I/O Banks 2, 3 controlled by 32.0 MHz socketed oscillator
- Slide switches SW2 and SW3 control the shift direction
- Pushbutton BTN3 resets the internal shift registers
- Pushbutton BTN2 reloads the configuration image

Measuring Power

- Each iCE65 voltage rail has an isolation jumper
  - VCC core
  - All four I/O banks
  - SPI mini bank
- Remove jumper to measure current



Techniques (1)

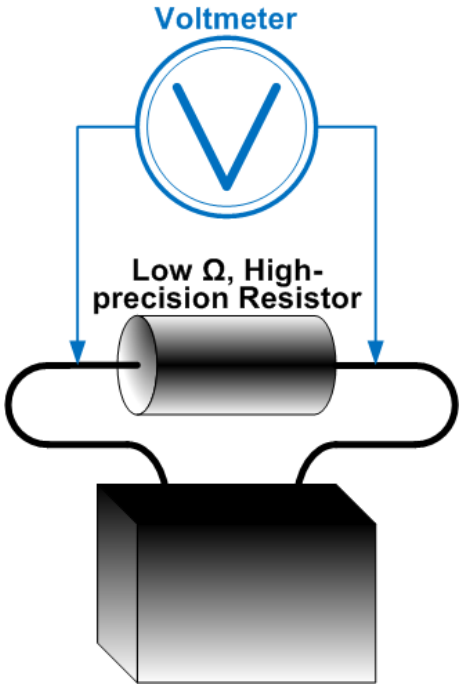
- Quick and Easy: Multimeter

  - Use a high-accuracy multimeter
  - Connect meter to jumper using included cable
  - Set meter to largest current setting (A, 100 mA) (can possibly damage meter if set too low)
  - Re-adjust to relevant range (mA, µA)
    - Too low of a setting results in too large a voltage drop across jumper
    - Potentially violates minimum voltage spec. for part
    - Possibly use a second voltage meter to measure voltage drop across first meter/jumper connection

Power = **Current** ● Voltage

Techniques (2)

- More Accurate:
  - Low Ω, high-precision (1%) resistor across jumper
  - Measure voltage drop across resistor
    - Better approach for measuring current draw over time
  - Resistor value is key
    - Too high: too large of a voltage drop
    - Too low: too small to measure



$$\text{Power} = \frac{(\ \textbf{Voltage}\ )^2}{\text{Resistor Value}}$$

More Information

- iCEman65 Evaluation Kit page
  www.siliconbluetech.com/iCEman65
- iCEman65 User Guide
  www.siliconbluetech.com/iCEman65/iCEmanBoardUserGuide.pdf
  - Frequent updates at the moment
- Adept/ICEUTIL Software and Installation Guide
- Schematics
- PC Board Layout Files (Gerbers)
- Reference designs (coming soon)