# ARM Cortex-A8 StackableUSB™ Pico-ITX Computer SBC5651

## Features

- ✓ ARM Cortex-A8 processor, 800MHz
- ✓ 512MB SDRAM, 4GB Flash, 4MB SPI NOR Flash
- ✓ Power Options:
  - Power-through-USB
  - Single cell Li-Ion battery
  - StackableUSB
  - Terminal block
- ✓ LCD touchscreen support
- ✓ Four USB ports, three serial ports
- ✓ One SD/MMC card slot
- ✓ 10/100 Ethernet
- ✓ Pico-ITX form factor

StackableUSB

RoHS COMPLIANT

The SBC5651 is for use in small, low-power handheld and portable devices typical to medical, gaming, ticketing, and test and measurement applications. With the Freescale i.MX515 ARM Cortex-A8 multimedia processor at its core, the SBC5651 can consume as little as 1W with user-programmable speeds up to 800MHz. The SBC5651 can be powered through the USB OTG connector, a standard terminal block, StackableUSB, or single cell Lithium Ion battery.

The SBC5651 on-board I/O feature set includes LCD touchscreen support (LVDS and TFT), LED back light control, keypad interface, SD card slot, 4G NAND flash, audio, Ethernet, USB On-The-Go, a real-time clock, watchdog timer, two PWM outputs, one SD/MMC card slot, 1-Wire interface, and three serial ports. For additional expansion, the StackableUSB interface allows for rugged, reliable board-to-board communication via USB, $I^2C$, and SPI.

All these features make the SBC5651 ideal for handheld, mobile devices or remote applications requiring rich connectivity and low power.

### Software Support

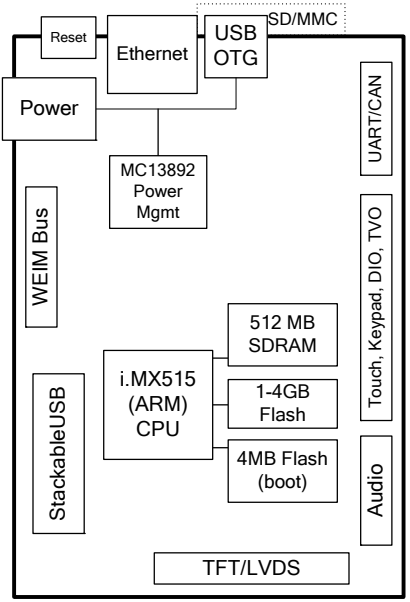
*Linux*
*Windows CE*
*VxWorks*
*Android*
*C, compilers*

### Compatible Hardware

*StackableUSB Client Devices*
*PC Hosts*
*TFT FP-Kits*
*LVDS FP-Kits*
*PSxxx, Power Supplies*
*Secure Digital Devices*
*RS232/RS485 Devices*
*CAN Devices*
*Ethernet Networks*

### Mounting/Packaging

*Standoffs, STDOFFUSB*
*ENC104*




## *Technical Details:*

At the heart of the SBC5651 is the Freescale i.MX515 multimedia applications processor, a System on Chip (SOC) offering high-performance processing optimized for the lowest power consumption. The core of i.MX515 is an 800MHz ARM Cortex-A8 CPU. The CPU is augmented by a floating-point coprocessor, ARM's NEON SIMD media accelerator, and OpenGL ES 2.0 and OpenVG 1.1 hardware accelerators for fast, power-efficient graphics operations.

The i.MX515 SOC integrates many peripherals, including an interrupt controller, watchdog timer, SDRAM and flash memory controllers, three (3) High-Speed USB ports, one (1) Full-Speed On-The-Go USB port, one (1) 10/100 Ethernet MAC, three (3) 16C550 UARTs, 1-Wire interface, resistive 24-bit flat panel display output, 4-wire resistive touchscreen interface, an 8-row x 6-column keypad controller, an audio port, and PWM and TV outputs.

In addition to the peripherals built into the i.MX515, the SBC5651 adds a Controller Area Network (CAN) controller and 16 bits of 82C55A-compatible programmable parallel I/O.

The SBC5651 offers three boot options: A dedicated 4MB SPI NOR flash memory, a partition of the NAND flash, and a bootable SD/MMC card slot.

The SBC5651 memory subsystem provides up to 512MB of DDR2 SDRAM for application data. The 4MB SPI NOR flash memory holds the bootloader and operating system. 1-4GB NAND flash is available for operating system and non-volatile user storage.

Three (3) 16C550-compatible RS232/RS485 serial ports allow communication with low-speed devices.

The SBC5651 can be powered from an external 5 VDC source, a single cell Li-Ion battery, through an on-board mini-AB USB

power connector, or through StackableUSB. If external power is supplied while a battery is plugged in, the battery will be recharged. Advanced power management is enabled by the new Freescale MC13892. Through user-programmable clock rates, the SBC5651 can attain sub 1W power requirements.

The SBC5651 becomes a powerful front-end processor for control applications with the standard StackableUSB expansion. This popular I/O channel accommodates multiple stacked I/O boards without use of a hub.

For true 32-bit application development, the SBC5651 supports 32-bit operating systems such as Linux, Windows CE, VxWorks, and Android. All have full tool suites available, including compilers and debuggers.

## *Specifications:*

**Mechanical**:
- ❑ Pico-ITX mounting holes
- ❑ 3.9" (plus I/O region) x 2.8" x .6"
- ❑ Installed Secure Digital (SD) card extends past edge of board
- ❑ Ethernet connector on top side has height of .535"

**Power Requirements:**

Option 1:
- ❑ +5v ±5% at 250mA typical, 350mA max at Pin1

Option 2:
- ❑ +4.8v single cell Li-Ion battery at Pin2

Option 3:
- ❑ Mini-AB USB OTG port

Option 4:
- ❑ +5v through StackableUSB connector

| Power Connector | |
|---|---|
| Pin | Signal |
| 1 | +5V |
| 2 | Battery Input |
| 3 | GND |

**Environmental:**
- ❑ Operating range 0° to +70°C, with 800MHz processor
- ❑ ET-version operating range -40° to +85°C, with 600MHz processor
- ❑ -40° to +85°C storage
- ❑ 5%-95% relative humidity, non-condensing

**Processor Core Section:**
- ❑ Freescale i.MX515 multimedia applications processor
- ❑ 800MHz or 600MHz clock rate
- ❑ ARM Cortex-A8 CPU core
- ❑ Hardware graphics accelerators (video, OpenGL ES 2.0 and OpenVG 1.1)

**On-board Memory:**
- ❑ 256-512MB DDR2 Synchronous DRAM
- ❑ 4MB SPI NOR flash
- ❑ 1-4GB NAND flash (option)

**Memory Expansion:**
- ❑ One (1) SD/MMC card slot

**Watchdog Timer:**
- ❑ Program must refresh watchdog timer periodically, or system will be reset
- ❑ Enabled through software

**COM1-COM3 Serial Ports:**
- ❑ Three (3) asynchronous serial ports
- ❑ 16C550-compatible
- ❑ RTS and CTS modem controls (on COM1)
- ❑ RS232 on all channels
- ❑ Optional RS485/RS232 configurations

**Ethernet Port:**
- ❑ 10/100BASE-T Ethernet port
- ❑ Standard RJ45 connector

**USB:**
- ❑ One (1) Full-Speed On-The-Go USB 2.0 port providing device and limited Host functions, Mini-AB connector
- ❑ Three (3) High-Speed USB 2.0 Host ports, StackableUSB connector
- ❑ Transfers at High-Speed 480Mbit/sec, Full-Speed 12Mbit/sec, or 1.5Mbit/sec

**Controller Area Network:**
- ❑ CAN version 2.0B, 1Mbit/sec
- ❑ Standard and extended data and remote frames
- ❑ Two (2) receive buffers and three (3) transmit buffers with prioritized message storage

**Real Time Clock:**
- ❑ RTC with rechargeable on-board battery

**Digital I/O:**
- ❑ 4-wire touchscreen interface
- ❑ $I^2C$ (on StackableUSB connector)
- ❑ SPI (on StackableUSB connector)
- ❑ 1-Wire interface
- ❑ Two (2) PWM outputs
- ❑ 8-row x 6-column keypad

**Audio/Video I/O:**
- ❑ Microphone input, stereo line in/line out, headphone out
- ❑ 24-bit TFT flat panel display output
- ❑ 24-bit LVDS flat panel display output option
- ❑ TV-out

**External Connections:**
- ❑ 50-pin header for TFT/LVDS LCD display out
- ❑ 50-pin header for touch, DIO, keypad, PWM, one-wire, and TVO
- ❑ 40-pin header for WEIM Bus
- ❑ 20-pin header for audio
- ❑ 20-pin header for CAN and Uart
- ❑ One (1) SD/MMC card slot
- ❑ One (1) USB Mini-AB USB connector
- ❑ 2-pin locking header for reset
- ❑ 2.1mm barrel power input
- ❑ One (1) RJ45 jack for Ethernet

**Development Kit:**
- ❑ Single Board Computer
- ❑ Industrial Enclosure
- ❑ Complete cable set and power supply
- ❑ Documentation, sample software

*Cables nominally 15", other lengths available*
*StackableUSB trademark Micro/sys, Inc.*
*VxWorks trademark Wind River*
*Android trademark Google, Inc.*

## *Ordering Information:*

**OEM Single Board Computers:**

| | |
|---|---|
| SBC5651 | i.MX515 ARM Cortex-A8 CPU, 800MHz, 256MB SDRAM, 4MB NOR Flash, Ethernet, Pico-ITX form factor |
| SBC5651-ET | i.MX515 ARM Cortex-A8 CPU, 600MHz, 256MB SDRAM, 4MB NOR Flash, Ethernet, Pico-ITX form factor, -40°C to +85°C |
| CS5651 | Complete Cable Set |
| 5651OPT1(ET) | Upgrade to 512MB SDRAM |
| 5651OPT5(ET) | Upgrade to 1GB flash |
| 5651OPT6(ET) | Upgrade to 2GB flash |
| 5651OPT7(ET) | Upgrade to 4GB flash |
| 5651OPT8-x (ET) | Configurable RS485 |
| 5651OPT22(ET) | CAN Bus Interface |
| 5651OPT28(ET) | LVDS Panel Support |
| 5651OPT45 (-ET) | Audio Interface |

**Related Products:**

| | |
|---|---|
| BA4052 | 50-pin high density to 50-pin screw terminal |
| BA4040 | 40-pin high density to 40-pin screw terminal |
| BA2020 | 20-pin high density to 20-pin screw terminal |
| CA4133 | RJ45 Ethernet Cable |
| CA4136 | Mini B to Type A USB Cable |

**Development Board Kits***

| | |
|---|---|
| DK5651-Linux | SBC5651 Linux-installed development kit |
| DK5651-WinCE | SBC5651 WinCE-ready development kit |
| DK5651-ET-Linux | SBC5651-ET Linux-installed development kit (emulating the ext temp clock speed for eval) |
| DK5651-ET-WinCE | SBC5651-ET WinCE-ready development kit (emulating the ext temp clock speed for eval) |

**See Development Kit Specifications*