



ARM® Cortex®-A8 with Spartan®-6 FPGA Hosts Thermal Imaging SBC1656



Features

- ✓ ARM Cortex-A8 processor, 800MHz
- ✓ Xilinx Spartan-6 FPGA expands vision processing capabilities
- ✓ Stack-on FLIR Lepton® Infrared Sensor
- ✓ Program using OpenCV and GStreamer
- ✓ TFT/LVDS 24-bit display interface with backlight and touchscreen
- ✓ 512MB SDRAM, 4GB Flash, 2 SD/MMC
- ✓ Dual CAN bus interface
- ✓ Up to 64 differential DIO from FPGA
- ✓ Dual 10/100 Ethernet / Web Server

The SBC1656 is ideal for mid-range embedded vision applications deployed in harsh, rugged, environment with limited access to power. Freescale's i.MX515 ARM Cortex-A8 CPU provides a NEON™ GPU which processes video input from the stack-on Lepton Infrared sensor, while the Xilinx Spartan-6 FPGA is available for additional video processing computations for this multimedia-rich board.

The SBC1656 ships with a factory-installed Linux image in NAND flash plus an SD card with a full build of Linux, including a broad suite of development tools. There is a vision development layer included with the Development Kit that provides access to OpenCV and GStreamer. Users can use Eclipse for development and program directly from the command line.

The SBC1656 includes the features listed above plus dual CAN, real-time clock, watchdog timer, audio, SATA HDD, and 1-Wire interface. Industrial I/O includes up to 64 differential DIO, two PWM, DAC and/or ADC available through StackableUSB™. The SBC1656 uses minimal power and operates at extended temperatures (-40 to +85) on a 3.5" x 3.5" (PC/104) footprint.

Software Support

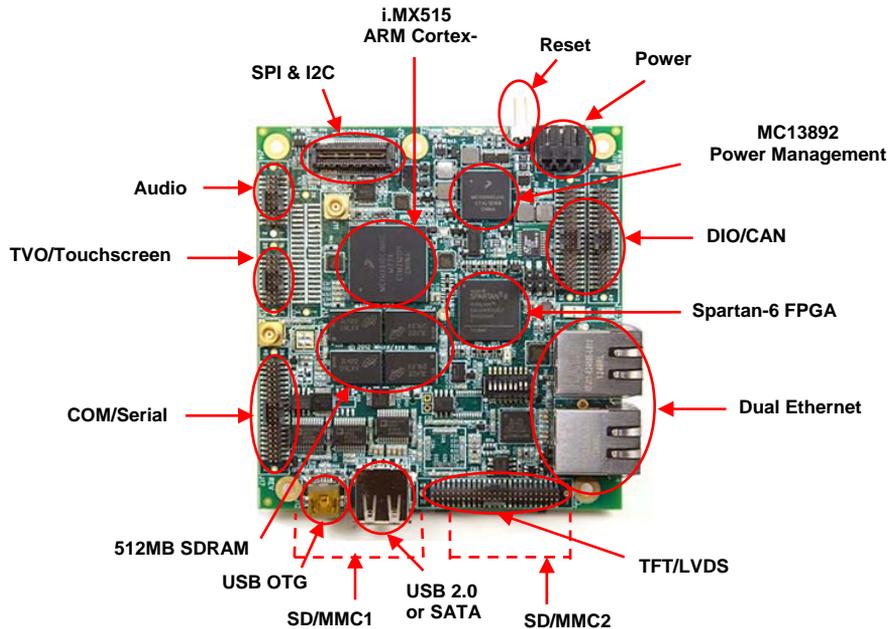


Features & Standards



Compatible Hardware





Technical Details:

At the heart of the SBC1656 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 enhanced by a floating-point coprocessor, ARM's NEON SIMD media accelerator, AGP Video with 64MB Video memory, and OpenGL ES 2.0 and OpenVG 1.1 hardware accelerators for fast, power-efficient graphics operations.

The heart of vision processing for the SBC1656 is a Xilinx Spartan-6 FPGA that can be programmed using Xilinx ISE tools. Developers can use Xilinx IP cores, Micro/sys cores, third party cores or the user's own cores. The FPGA supports the i.MX515 by offloading repetitive computational tasks, leaving the i.MX515 free for system level functions such as networking, application programs and

general housekeeping. Other applications such as digital I/O, serial ports, and SPI ports can be implemented in the FPGA.

The FPGA communicates to the i.MX515 via a memory bus configuration using the Freescale-defined WEIM bus. The SBC1656 ships with the FPGA 95% available for the users' IP. When optional digital I/O, SPI and COM ports are ordered, 80% of the FPGA remains available for the user.

The stack-on FLIR Lepton, a highly compact 8 μ m to 14 μ m longwave infrared (LWIR) sensor, is automatically detected by Linux. Thermal sensitivity is <50mK and images are produced with 80 x 60 pixel resolution.

The SBC1656 memory subsystem provides 512MB of DDR2 SDRAM for application data. The 4MB SPI NOR flash memory holds the bootloader and operating system. Up to 4GB NAND flash is also available for

operating system and non-volatile user storage.

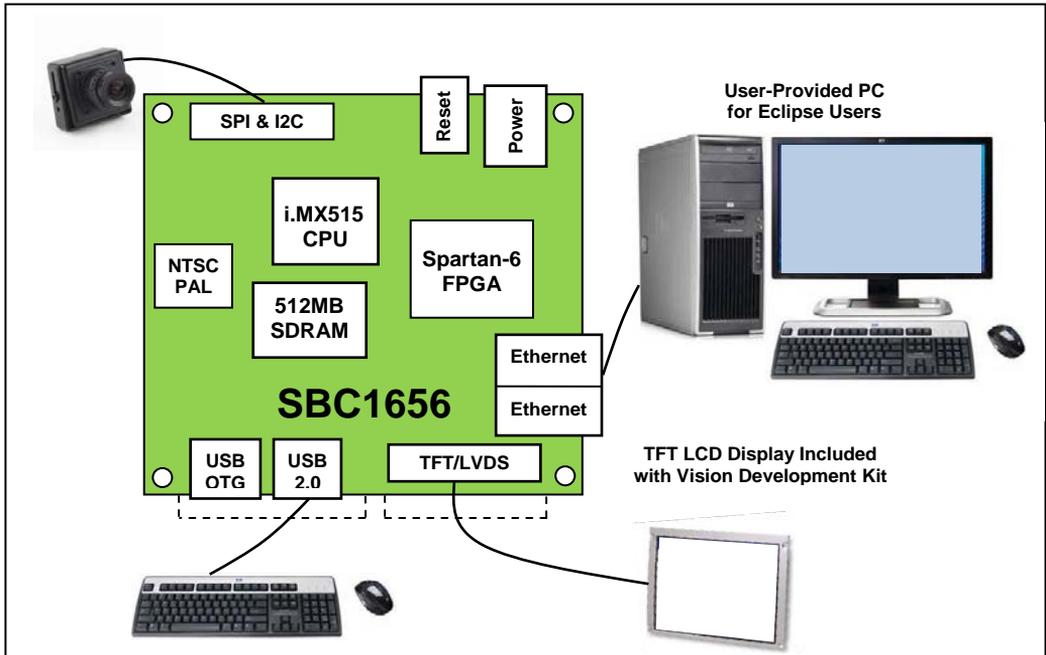
The SBC1656 integrates many additional features including an interrupt controller, watchdog timer, SDRAM and flash memory controllers, three High-Speed USB ports, one Full-Speed On-The-Go USB port, a 10/100 Ethernet MAC, three 16C550 UARTs, 1-Wire interface, 24-bit flat panel display output, 4-wire resistive touchscreen interface, an audio port, and two PWM. Additional peripherals include a second 10/100 Ethernet port and dual Controller Area Network controllers (CAN).

Large application programs, data storage and/or portability of either of these items is available via one of two SD card slots or connecting to the SATA HDD connector to attach an external hard drive.

The SBC1656 becomes a powerful front-end processor for control applications when mated with a StackableUSB I/O board offering DAC and ACD via an easily programmable PIC32 microcontroller.

The SBC1656 has both a Linux and a WindowsCE BSP. The SBC1656 comes standard with a factory installed Linux runtime image. The Linux BSP (included with the Development Kit) is supplied on SD card and includes integrated Linux support layers, including OpenCV and GStreamer.

Micro/sys can provide OEMs with customized versions of the SBC1656 and a single part number for ordering.



Specifications:

Mechanical:

- ❑ PC/104 footprint
- ❑ 3.55" (plus I/O region) x 3.775" x .6"
- ❑ Installed Secure Digital (SD) card extends past edge of board
- ❑ Max height .535" (Ethernet connector)

Environmental:

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

Power Requirements:

- ❑ +5v ±5% at 500mA typical, 850mA max

Power Connector	
Pin	Signal
1	+5V
2	Reserved
3	GND

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)
- ❑ JTAG (IEEE 1149.1) debug interface

On-board Memory

- ❑ 512MB DDR2 Synchronous DRAM
- ❑ 4MB SPI NOR flash
- ❑ 4GB NAND flash (option)

Memory Expansion

- ❑ Two SD/MMC card slots
- ❑ SATA HDD connector (option)

Thermal Imaging:

- ❑ FLIR Lepton Infrared sensor
- ❑ Longwave infrared (LWIR) 8µm to 14µm
- ❑ Thermal sensitivity <50mK
- ❑ Data via SPI and command via I2C

Thermal Imaging (cont'd):

- ❑ 9 frames per second

User Programmable FPGA

- ❑ Xilinx Spartan-6 XC6SLX16
- ❑ Configurable with Micro/sys FPGA options (see Ordering Info)
- ❑ Program apps with Development Kit

Watchdog Timer:

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

Serial Interfaces:

- ❑ Three RS232 asynchronous serial ports
- ❑ Four optional serial ports in FPGA
- ❑ 16C550-compatible
- ❑ RTS and CTS modem controls
- ❑ Four RS485 half-duplex ports (option)
- ❑ SPI
- ❑ I2C

Ethernet Ports:

- ❑ Two 10/100BASE-T Ethernet ports
- ❑ Standard RJ45 connectors

USB:

- ❑ One Full-Speed USB 2.0 On-The-Go port providing device and limited Host functions, Mini-AB connector
- ❑ Two High-Speed USB 2.0 Host ports
- ❑ StackableUSB connector (option)
- ❑ High-Speed transfers at 480Mbit/sec, Full-Speed at 12Mbit/sec, or 1.5Mbit/sec

Real Time Clock:

- ❑ RTC with onboard battery, 10 year life

Controller Area Network:

- ❑ Dual CAN 2.0B, 1Mbit/sec (option)
- ❑ Standard and extended data and remote frames
- ❑ Two receive buffers and three transmit buffers with prioritized message storage

Digital I/O:

- ❑ Up to 64 TTL programmable bi-directional signals from FPGA
- ❑ 1-Wire interface

Digital I/O (cont'd):

- ❑ Two PWM outputs

Audio/Video I/O:

- ❑ Microphone/headphone, line in/line out (option)
- ❑ 24-bit LVDS (option) /TFT LCD interface
- ❑ 4-wire resistive touchscreen interface

External Connections:

- ❑ Three 40-pin headers for COM1-COM7, RS485, DIO, and CAN
- ❑ One 50-pin header for LVDS/TFT
- ❑ Two 20-pin headers for Audio and TVOut/Touchscreen
- ❑ Two 8-pin modular RJ45 Ethernet jacks

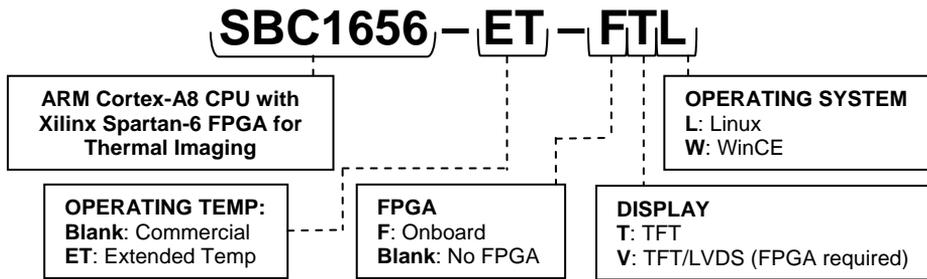
External Connections (cont'd):

- ❑ Two SD/MMC card slots
- ❑ SATA HDD connector (option)
- ❑ StackableUSB connector (option)
- ❑ USB 2.0, Type A (option)
- ❑ USB On-The-Go, Mini-AB
- ❑ 2-pin locking header for reset
- ❑ 3-pin removable terminal strip for power input

Development Kits Available:

- ❑ DK1656 with complete cable set
- ❑ DKV1656 for vision development
- ❑ DKF1656 for FPGA development
- ❑ DKC1656 for both vision & FPGA development

Ordering Information:



SBC1656 Options:

1656OPT7*	Upgrade to 4GB flash
1656OPT8-2	Configurable RS485
1656OPT8-4	Configurable RS485
1656OPT22	CAN Bus Interface
1656OPT22-1	Dual CAN Bus Interface
1656OPT24*	SATA Interface
1656OPT45	Audio Interface
1656OPT60	StackableUSB Host
1656OPT63**	Type A USB Header
* Add "-ET" to 1656OPTxx for Extended Temp	
* Not available in Extended Temp.	
** 1656OPT24 & 1656OPT63 not available together	

Related Products:

CS1656**	Complete Cable Set
BA2020	20-pin high density to 20-pin screw terminal
BA4040	40-pin high density to 40-pin screw terminal
BA4052	50-pin high density to 50-pin screw terminal
CA4133	RJ45 Ethernet Cable
CA4136	Mini B to Type A USB
DKV1656	Vision Development Kit
DKF1656	FPGA Development Kit
DKC1656	Vision & FPGA Dev Kit
** Cables nominally 15"	