

Deterministic high-speed serial bus controller

SC4415 | Scout | Serial Bus Controller

Summary

Scout is the highest performing, best value serial controller on the market. Unlike any other serial bus implementations, Scout products were designed specifically for high-speed, high-performance control applications. Architected around an FPGA, the SC4415 ensures that all timing and control functions are deterministic. The product is targeted at high-volume production test applications and verification benches requiring reliable operation over millions of test sequences.



Scout – The standard in RFFE and I3C Bus Masters

Description

The Scout SC4415 represents the next generation in the Scout product line. It incorporates enhanced features as well as support for SPI, I2C, MIPI-RFFE and the MIPI-I3C protocols.

The DUT Interface incorporates serial bus, GPIO and triggering functions on a standard dual row header. This format provides flexibility, more interconnect options and helps minimize noise coupling. The interface voltage (V_{IO}) is software selectable. For non-standard interface voltages, Scout can be configured to accept an external reference source. Several triggered buffer modes provide scripting capability for high speed test and verification applications. Triggering modes include internal (software command) and 3 external options (via GPIO or the trigger input).

Scout instantiates itself as a standard COM port via USB. The unit supports manual operation using a terminal emulator or fully automated control in ATE environments via any programming language.

Common Applications

- Benchtop DVT (Designer Verification Testing)
- High Volume Production Test
- RF Design and Characterization

Serial Bus Modes and Features Supported

MIPI RFFE and I3C features are enabled via optional licenses. The SC4415 is field upgradeable, making it simple for customers to apply FW updates or upgrade with additional features.

SPI (included w/ base model)

- Standard SPI Read and Write Functions
- SPI Modes 0, 1, 2, and 3 (CPOL and CPHA)
- Positive and Negative Slave Select Polarity
- Configurable Word Widths for Command (0 to 16 bits), Address (0 to 16 bits), Write Data (0, 8, 16, and 32 bits) and Read Data (0, 8, 16, and 32 bits)
- Configurable Clock Frequency (50 kHz to 26 MHz)
- Commands Supported:

- Set SPI Clock Rate
- Set SPI interface Full Configuration
- Set Slave Select Line
- Set Slave Select Line Polarity
- Set SPI Protocol Mode
- Set Command/Address Width
- Set Read/Write Data Width
- Set Wait Cycles Before Read
- SPI Read/Write

MIPI-RFFE V3.0 (Option 02)

- Selectable Clock Frequency (100 kHz to 60 MHz)
- Commands Supported:

- Set RFFE SCLK rate
- Set RFFE half speed data response
- Register Read/Write
- Extended Register Read/Write
- Extended Register Read/Write Long
- Register Zero Write
- Masked Register Write
- Bus Clocked Condition

MIPI-I3C V1.0 (Option 03)

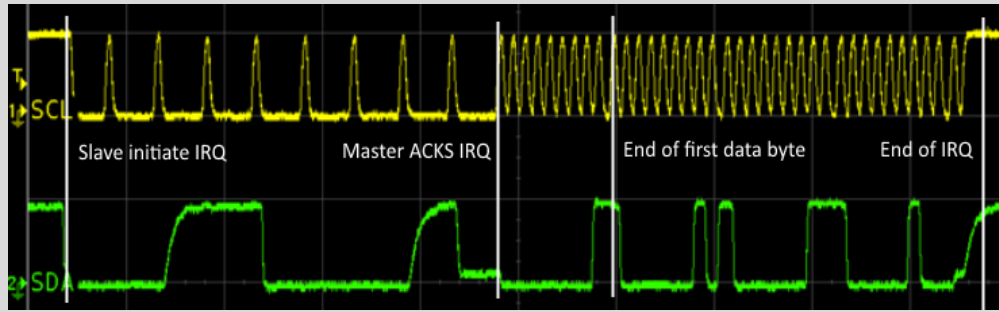
- Two Wire Serial Interface up to 12.5 MHz using Push-Pull and Open Drain with Pull-up
- Adjustable Bus Pull-Up Control
- Selectable I3C clock frequency (12.5 MHz, 6.25 MHz & 3.125 MHz)
- Dynamic Addressing while supporting Static addressing for legacy I2C Devices
- Automatic Bus Initialization & Device Priority management
- I3C Single Data Rate Messaging (SDR)
- High Data Rate messaging 25 Mb/s (HDR-DDR)
- In-Band Interrupts
- Hot Join
- Legacy I2C messaging (with restrictions as defined by MIPI I3C specification)
- Commands Supported:

- Set I3C and I2C SCLK Rates
- Set Internal Pull-Up Resistor Value
- Enable or Disable Bus Error reporting
- Initialize I3C Bus Definition
- View Bus Definition
- Add/Remove Device on Bus Definition
- Update I3C Device Dynamic Address
- Enable/Disable Hot-Join Requests
- Enable/Disable In-Band Interrupts
- CCC Read/Write
- Legacy I2C Read/Write
- I3C Read/Write
- I3C HDR-DDR Read/Write

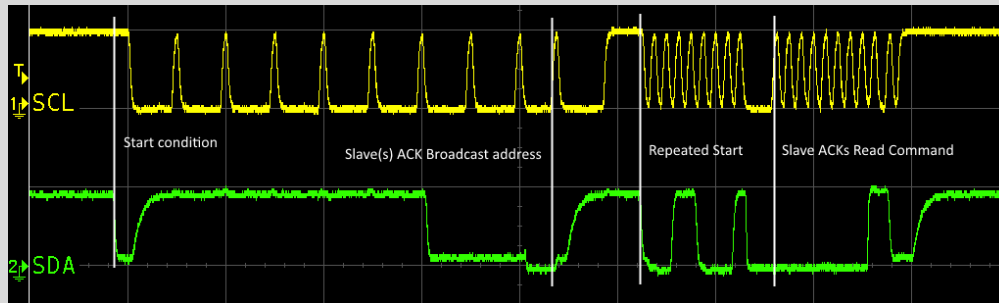
Legacy I2C (Option 03)

- Selectable I2C clock frequency (1 MHz, 400 kHz & 200 kHz)
- 7-Bit Slave Addressing
- Legacy I2C commands, as defined by the MIPI I3C specification

Typical Waveforms



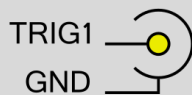
MIPI-I3C In Band Interrupt



MIPI-I3C SDR Read

Device Under Test (DUT) Connector Pin-Out

VIO	■	VIO
GND	■	GND
GPIO1	■	APIO1
GPIO2	■	APIO2
GND	■	GND
GPIO3	■	APIO3
GPIO4	■	APIO4
GND	■	GND
GPIO5	■	APIO5
GPIO6	■	APIO6
GND	■	GND
GPIO7	■	APIO7
GPIO8	■	APIO8
GND	■	GND
TRIG2	■	TRIG3



Type	Description
VIO	IO Voltage Reference. Can be internally generated or externally supplied to establish a common IO voltage between Scout and the connected devices.
APIO	Application Specific IO. These pins are dedicated for application specific purposes which are mode dependent and are not available for general purpose.
GPIO	General Purpose Input-Output. These pins are for general purpose use and are available in any application mode.
TRIG	Hardware Trigger. Used for triggering and synchronization.
GND	Signal ground reference.

Feature Overview

Serial Protocols Supported

- MIPI-I3C (Version 1.0 with legacy I2C)
- MIPI-RFFE (Version 3.0)
- SPI (Serial Peripheral Interface)
- Other protocols forthcoming

Sequencing and Timing

Scout was designed with determinism, low latency and fast execution in mind. Timing critical performance is achieved by using FPGA hardware and user configurable command cues. Users can define a command sequence and trigger multiple executions of the sequence using either software or hardware triggers.

GPIO

Eight General Purpose IO are available in all operating modes and each one can be configured as either an input or an output. The GPIO commands can be embedded in the command queue and executed alongside other serial protocol commands. GPIO timing is deterministic.

External Supply

The adaptor can be powered via USB, eliminating the need for an external power supply. For applications where the USB host may be current starved, an external 5Vdc power supply can be used to power the device.

Buffering and Trigger Modes

The SC4415 incorporates two instruction sequencers to accelerate high volume production test applications. These high capacity buffers can be recalled by activating one of several trigger modes. Both sequence buffers of 1024 instructions each can be filled and replayed in instruction sequencer style.

Specifications

USB Interface

- Type B Connector
- Supports USB 2.0 Full and High-Speed Modes
- Windows 7, 10, Linux and iOS

Power Requirements

- USB: +5 Vdc, <500 mA peak
- External (optional): +5 Vdc, <500 mA peak

IO Interface

- 2x30 pin, 100 mil pitch connector
 - 8x GPIO
 - 8x Dedicated IO (serial lines)
 - 2x Trigger Inputs
 - 1x Trigger Output
 - VIO (External input or output)
 - 10x Ground
- SMA(Female) Trigger Input
- Vio (Internally Generated):
 - +1.2, +1.8V, +2.5V and +3.3V
- Vio (Optional External Reference):
 - +0.8V min, +3.6V max
- Outputs:
 - Low 0 V to +0.8 V
 - High 0.7 Vio to Vio
 - +/- 12 mA max (@ 3.6 V)
- Inputs:
 - Low 0 V to +0.8 V
 - High 0.7 Vio to Vio
- Input Voltage (no damage):
 - -0.5 V min
 - +3.6 V max

Buffers

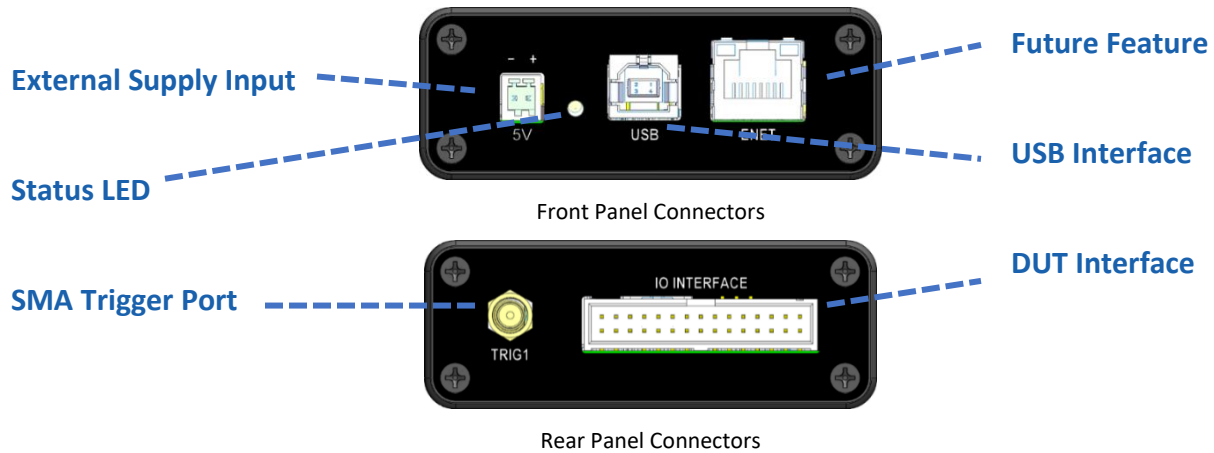
- Write Queues: 2 of 1024 commands each
- Data Queue: 1 of 4096 bytes

Triggers

- SW Trigger via command interface
- HW Trigger via external equipment sources
 - 1 SMA (Input)
 - 1 GPI via DUT Connector (Input)
 - 1 GPO via DUT Connector (Output)

Environmental/Regulatory

- FCC part 15.109, subpart B
- FCC part 15.107, subpart B
- Operating temperature: 0 to 70°C
- Storage temperature: -40 to +85°C
- Humidity: 5% to 85%, non-condensing
- ESD Protection
 - HBM JESD22-A114E Class 3B exceeds 8kV
- MM JESD22-A115-A
 - Exceeds 200 VCDM JESD22-C101C 1k V



Optional Features

Option 02 – MIPI-RFFE (Version 3.0)

Option 03 – MIPI-I3C (Version 1.0) / Legacy I2C

Option 21 – Extended warranty

Extends the standard software maintenance and warranty from 12 to 24 months.

- Options are not mutually exclusive



Support

Technical support is available through our website, www.signalcraft.com/support, or by contacting us at support@signalcraft.com.

Warranty

Full one-year parts and labor when used under normal installation and operation conditions. Repair services are available for products no longer covered under warranty.

Ordering Information

Send inquiries to info@signalcraft.com.