

Brief Description

The SSC Modular Evaluation Kit provides hardware and software for a very simple and intuitive method of evaluating IDT's sensor signal conditioner (SSC) ICs. For the evaluation of different SSC ICs, only the IC-specific SSC Evaluation Board and software are needed; the other parts of the evaluation hardware (SSC Communication Board and SSC Sensor Replacement Board) are typically the same.

The SSC Communication Board (SSC CB) can provide the power supply for the evaluation hardware and handle the communication with a PC via a USB interface. To prevent malfunctioning or damage, a galvanic isolation to the PC's USB port is established on board via optocouplers for the information lines and an isolated DC/DC converter for the power line. It is also possible to supply the Evaluation Kit by an external 12 VDC power line via the KL1 screw terminal on the SSC CB. It is also possible to supply the SSC Evaluation Board or a user-specific application circuit via the KL2 screw terminal with a voltage of 2.7 to 5.5 VDC.

A USB-UART device transfers all signals to the standardized USB port of the user's PC. Its UART interface is connected via optocouplers with the UART of a microcontroller, which controls all functions of the Evaluation Kit and of the IDT SSC IC to be evaluated. Its software allows direct communication with the SSC IC via I²C™, SPI, or ZACwire™ or communication by LIN via a discrete level shifter depending on settings in the IC's configuration registers. The microcontroller also controls the power lines (12VDC, 5VDC, and VPP EEPROM programming voltage) by driving several electronic switches. The microcontroller displays the status of communication via LEDs.

An on-board dual header strip enables access to all signal and power lines. This allows a simple signal check; e.g., by a digital oscilloscope, a multimeter, or a connection with user-specific hardware.

Important: Always ensure that there is no power when connecting SSC Evaluation Kit boards.

Features

- Interface fully compatible with USB 2.0
- “Plug & play” capability
- Power for the Evaluation Kit provided by USB port or an external power supply as selected with jumper setting
- Internal generation of all required voltage levels: 5 VDC and 12 VDC
- On-board galvanic isolation between PC and evaluation hardware
- Access to all digital communication lines of the IDT SSC IC being evaluated

Benefits

- PC-controlled configuration and calibration via USB interface—simple, low cost
- Standard communication board for all IC types in IDT's SSC product family
- USB port driver included in the Evaluation Kit setup software—simple installation



^{*} I²C™ is a trademark of NXP.

Important Note

Restrictions in Use

The ZSC31xxx / ZSSC3xxx USB SSC Evaluation Kit hardware and ZSC31xxx / ZSSC3xxx USB SSC Evaluation Kit software are designed for IC evaluation, laboratory setup and module development only.

The ZSC31xxx / ZSSC3xxx USB Evaluation Kit hardware and software must not be used for module production or production test setups.

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Contents

1	Electrical Specifications.....	4
2	SSC Communication Board Connections	5
3	Software Installation	6
3.1.	System Requirements	6
3.2.	USB Driver Installation	6
3.3.	ZSC31xxx/ZSSC3xxx Software Installation	6
4	Circuit Description	6
4.1.	USB Power and the Communication Interface.....	6
5	Special Functions of the SSC Communication Board.....	8
5.1.	Trigger	8
5.2.	Pull-up.....	8
5.3.	ADC Channel ADC0 to ADC4	8
5.4.	Digital Channel D2 to D7	8
5.5.	RX/TX	8
5.6.	LIN Channel.....	8
5.7.	I ² C™ Channel.....	9
5.8.	SPI Channel.....	9
5.9.	OWI Channel (ZACwire™)	9
5.10.	Vpp Pulse Generation	9
5.11.	5V Channel.....	9
5.12.	12V Channel	9
6	SSC Communication Board Schematics.....	10
7	SSC Evaluation Kit Controller Language	12

8	Related Documents.....	14
9	Glossary	14
10	Document Revision History	15

List of Figures

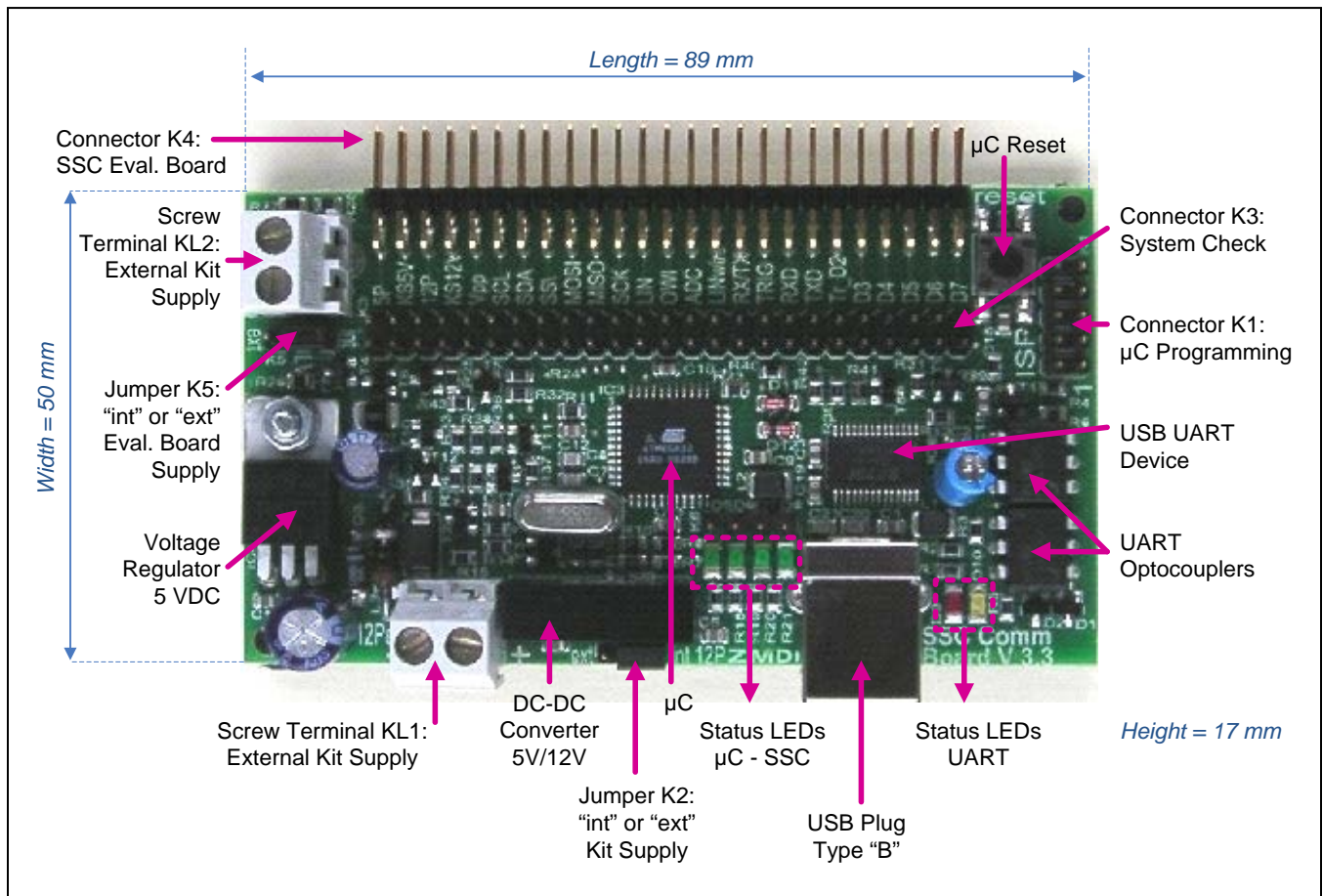
Figure 2.1	SSC Communication Board with Dimensions	5
Figure 6.1	Communication Board Schematic Part 1: USB-Interface Circuit.....	10
Figure 6.2	Communication Board Schematic Part 2: Control Circuit.....	11
Figure 7.1	Start Sequence with Trigger Configuration.....	13

1 Electrical Specifications

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
External Voltage Supply Input on KL1	$V_{\text{SUPPLY_EXT}}$		8		16	V DC
USB Current	I_{USB}		40		500	mA
Current Capability of 12V Supply via DC/DC ¹⁾	$I_{12\text{V_DC/DC}}$				78	mA
Current at 12P pin on K4	$I_{12\text{P}}$	With external voltage supply via KL1			150	mA
Current at KS12V pin on K4	I_{KS12V}	With external voltage supply via KL1			40	mA
Current at 5P pin on K4	$I_{5\text{P}}$	With external voltage supply via KL1			150	mA
Current at KS5V pin on K4	I_{KS5V}	With external voltage supply via KL1			150	mA
Current at 5P pin on K4	$I_{5\text{P}}$	With internal supply ²⁾			40	mA
Current at KS5V pin on K4	I_{KS5V}	With internal supply ²⁾			40	mA
Current at 12P pin on K4	$I_{12\text{P}}$	With internal supply ²⁾			40	mA
Current at KS12V pin on K4	I_{KS12V}	With internal supply ²⁾			40	mA
1. Total, including SSC Communication Board power supply. 2. Complete power supply via USB.						

2 SSC Communication Board Connections

Figure 2.1 SSC Communication Board with Dimensions



3 Software Installation

Note: To install the ZSC31xxx/ZSSC3xxx SSC Evaluation Software, administrator rights are required on the user's PC.

3.1. System Requirements

- 5x86 compatible PC
- 32MB RAM
- Hard drive with 20MB free space
- Free USB port
- Microsoft Windows® ME/2000/XP/Vista/Windows®7

3.2. USB Driver Installation

Refer to the IDT document *SSC_AN_CommunicationBoard_Driver_Installation_rev_X_xy.pdf* for instructions for installing the two USB drivers required by the ZSC31xxx/ZSSC3xxx SSC Evaluation Software. These drivers will make the PC's USB port appear as a virtual COM port (typically COM3 or COM4 on most computers). The SSC Evaluation Kit software accesses the SSC Evaluation Board through the SSC CB as if it were a COM (RS232) port. These drivers will not affect the operation of any other USB peripherals.

The two required driver files can be downloaded from www.IDT.com/SSC-COMM-BD. Click on the link titled "SSC CB USB Driver Rev. X" (where X is the current revision) and follow the dialog instructions as needed to download the zip file for the drivers and extract the files.

3.3. ZSC31xxx/ZSSC3xxx Software Installation

The ZSC31xxx/ZSSC3xxx Evaluation Kits do not include the software, which must be downloaded from the product page on the IDT website (www.IDT.com) to ensure receiving the latest release.

On the product page, click on the link for the Evaluation Software and follow the dialog instructions as needed to download the zip file for the software.

Open the zip file and extract the executable file.

To install the software on the user's PC hard drive, double-click on the downloaded *extracted* file. Respond to the dialog box to select the installation directory, and the software will complete the installation, which results in a program shortcut on the desktop of the PC.

4 Circuit Description

4.1. USB Power and the Communication Interface

SSC Evaluation Kits are interfaced to the user's PC via a Universal Serial Bus (USB Rev. 2.0). The USB communication is handled by an FT232R USB UART configured with a special IDT-specific product ID to simplify the system installation process and provide "plug & play" functionality. The communication to the on-board microcontroller is handled by a common UART line via optocouplers to provide galvanic isolation.

The USB power line supplies this interface circuit via a galvanic isolated 5-to-12V DC/DC converter circuit. Therefore no additional power supply is required. To fulfill the USB specification for devices with more than 100mA power consumption, the supply input of the subsequent circuit is switched by a MOS transistor, which is controlled by the USB-UART-interface IC. As a result, the power supply of the connected microcontroller and SSC Evaluation Board will be switched on after successful PC USB driver initialization. The maximum load current of the DC-DC converter's 12VDC output line is 78mA, which is sufficient for supplying the SSC Evaluation Board hardware and some additional external electronic devices. Alternately, it is possible to supply the SSC Evaluation Kit by an external 12VDC power line; e.g., to prevent additional noise caused by the DC-DC converter or to allow more than a 78mA load current at the 12VDC line.

The 5VDC supply line is generated by a common LDO linear regulator supplied by the 12VDC line. The microcontroller (type ATmega32) handles the communication with the IDT SSC IC by using its specific Evaluation Software running on the user's PC. All serial protocols are implemented in the microcontroller's software (I^2C^{TM} / SPI / LIN / LINwireTM / OneWireTM / ZACwireTM), except that for LIN, a discrete LIN level shifter is used. The communication status of the microcontroller is displayed by four LEDs. The microcontroller controls both power lines by electronic switches, so a defined power ON/OFF procedure is practicable. The EEPROM programming voltage V_{pp} is also provided by the SSC Communication Board and controlled by the microcontroller via a discrete transistor circuit. To use this function, a 12VDC power supply is needed.

The IDT SSC Evaluation Board can be connected to the SCC Communication Board via the 50-pin connector. Additionally, all system signals can be checked via the 50-pin header on board. This can also be used for connecting external electronics.

5 Special Functions of the SSC Communication Board

5.1. Trigger

Each SSC IC needs a special start procedure to switch into the Command Mode. Therefore a special timing and communication procedure after power-on is required. On board this function will be provided by the corresponding supply channels (KS5V: 2.7 to 5.5 V; KS12V: 8 to 16 V). Both channels are controlled via electronic switches.

To connect user-specified hardware, a separate trigger signal can be provided at the TRIG pin. This trigger signal will be activated by the trigger command (For details, refer to section 7 and the IDT command syntax spreadsheet *SSC_CB_Command_Syntax_Version_y_xx.xls*, where *y_xx* refers to the current silicon revision).

5.2. Pull-up

Some interfaces (ZACwire™, OneWire™, and LINwire™) need an additional pull-up resistor to support reliable data communication. To eliminate any parasitics caused by this pull-up resistor on the power supply of the SSC IC and data output pin for the selected SSC IC interface, the pull up resistor must be disconnected from the circuit during the start-up phase. This function will be supported by the switchable pin *Tr_D2*. The ZACwire™, OneWire™, and LINwire™ protocol manipulate the signal *Tr_D2* automatically. Connect the pull-up resistor or an external pull-up source to *Tr_D2*.

5.3. ADC Channel ADC0 to ADC4

The SSC Communication Board provides five ADC channels: ADC0 to ADC4. The ADC0 channel is labeled “OWI” (ZACwire™); in OWI mode, the ADC0 is not available. The ADC channels have a resolution of 10-bits. To use these channels, refer to the SSC Communication Board command descriptions that are given in *SSC_CB_Command_Syntax_Version_y_xx.xls*.

5.4. Digital Channel D2 to D7

The SSC Communication Board provides six bidirectional digital channels D2 to D7. The D2 channel is not available during ZACwire™, OneWire™, and LINwire™ communication (reserved for pull-up switching). The output channels have tri-state functionality. To use these channels, refer to the SSC Communication Board command descriptions in *SSC_CB_Command_Syntax_Version_y_xx.xls*.

5.5. RX/TX

The RX/TX connector provides the serial protocol that is used for communication between the USB serial bridge and the microcontroller.

5.6. LIN Channel

The LIN channel provides a 12V LIN-complaint signal to connect LIN-compliant devices. A discrete circuitry converts the 5V microcontroller signal to the 12V LIN level and vice versa. To use this channel, refer to the SSC Communication Board command descriptions in *SSC_CB_Command_Syntax_Version_y_xx.xls*.

5.7. I²C™ Channel

The I²C communication protocol is provided at the SCL (clock) and SDA (serial data) pins. To use this channel, refer to the SSC Communication Board command descriptions in *SSC_CB_Command_Syntax_Version_y_xx.xls*. On the board, there are pull-up resistors of 4.7kΩ each, which are connected to the switched KS5V power line.

5.8. SPI Channel

The SPI communication protocol is provided at the MOSI (Master Out Slave In), MISO (Master In Slave Out), and SCK (Clock) pins. To use this channel, refer to the SSC Communication Board command descriptions in *SSC_CB_Command_Syntax_Version_y_xx.xls*.

5.9. OWI Channel (ZACwire™)

At the OWI (One Wire Interface) pin, the OneWire™ and ZACwire™ communication protocol is provided. To use this channel, refer to the SSC Communication Board command descriptions that are given in *SSC_CB_Command_Syntax_Version_y_xx.xls*.

5.10. Vpp Pulse Generation

At the Vpp pin, a special EEPROM programming pulse can be provided. To use this pulse, refer to the SSC Communication Board command descriptions in *SSC_CB_Command_Syntax_Version_y_xx.xls*. Important: The kit must be supplied via USB or by an external 12VDC supply via screw terminal KL1.

5.11. 5V Channel

At the 5P pin, a stabilized voltage of 5VDC is available to supply external circuits. The KS5V channel provides the same voltage, controlled by the microcontroller via an electronic switch to provide special IC start-up scenarios. The SSC Evaluation Board can be supplied via the KL2 screw terminal and KS5V by an external 2.7 to 5.5 VDC supply by setting the K5 jumper from “int” to “ext.” To use this channel, refer to SSC Communication Board command descriptions in *SSC_CB_Command_Syntax_Version_y_xx.xls* regarding trigger pulse generation.

5.12. 12V Channel

At the 12P pin, a stabilized voltage of 12VDC is available to supply external circuits if the kit is supplied via USB. When supplying the kit with an 8 to 16 VDC by an external power supply via screw terminal KL1, this voltage is available at the 12P pin. The KS12V channel provides the same voltage, as controlled by the microcontroller via an electronic switch to provide special IC start-up scenarios. To use this channel, refer to the SSC Communication Board command descriptions in *SSC_CB_Command_Syntax_Version_y_xx.xls*.

6 SSC Communication Board Schematics

Figure 6.1 Communication Board Schematic Part 1: USB-Interface Circuit

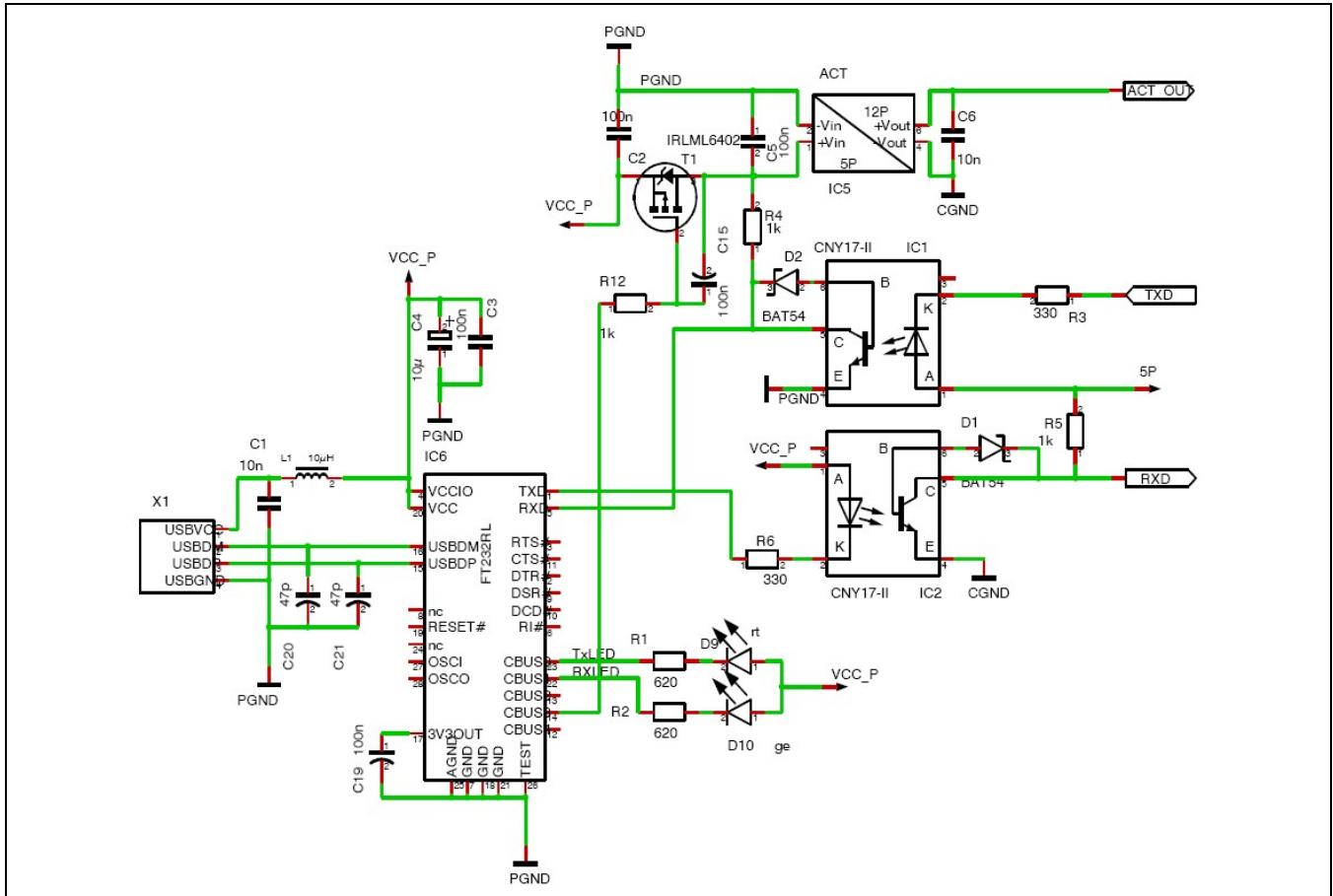
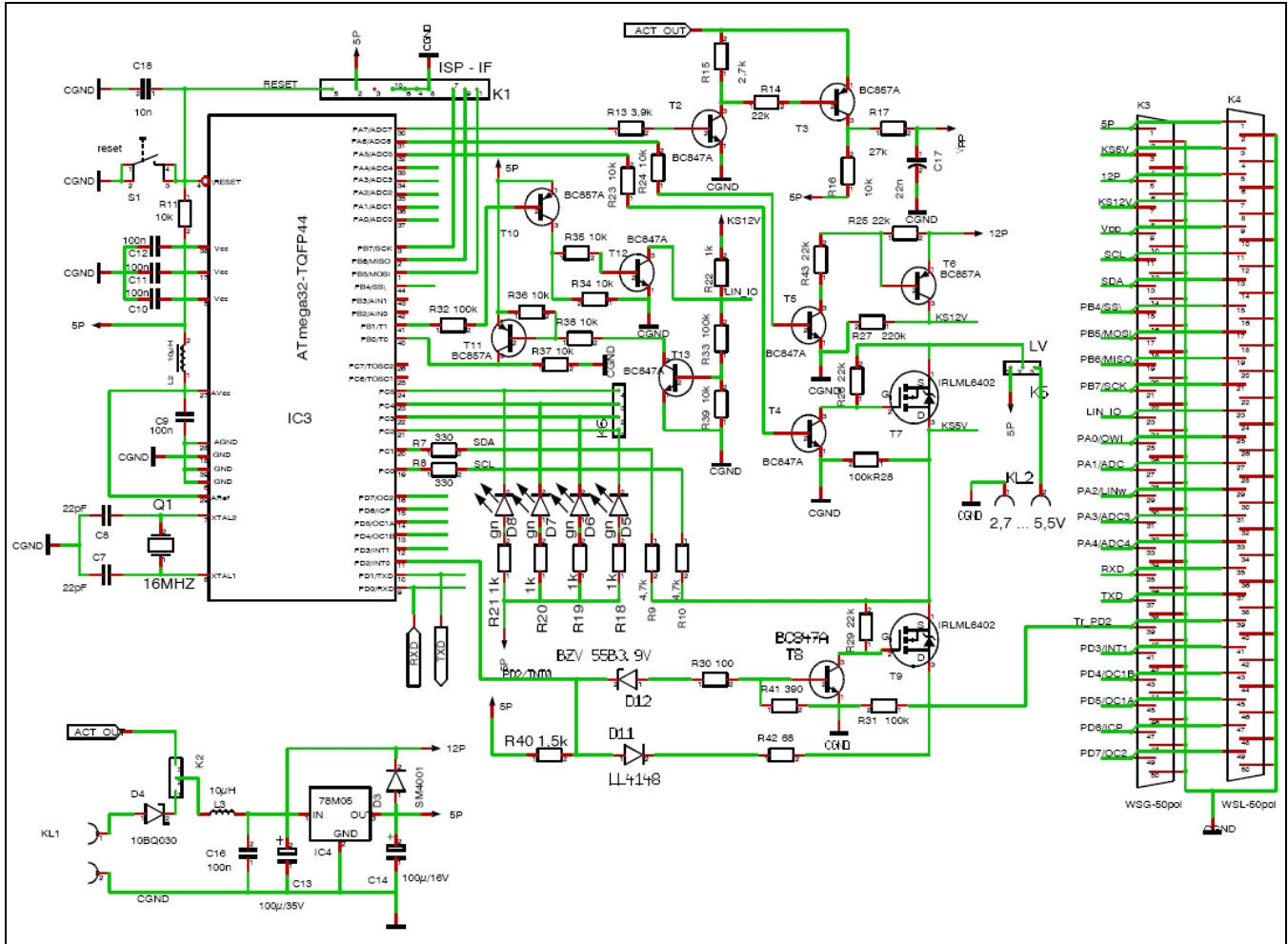


Figure 6.2 Communication Board Schematic Part 2: Control Circuit



7 SSC Evaluation Kit Controller Language

The SSC Communication Board contains a modern microcontroller with an 8-bit wide internal RISC processor. The communication between this microcontroller and the higher level unit is addressed by a serial protocol. The USB-to-serial converter transforms this signal into a USB-complaint data stream. To control the SSC Communication Board with a PC, the USB data will be forwarded to a virtual serial interface (virtual COM port). This communication is implemented by the USB2COMM driver (see section 3.2).

To control the SSC Communication Board, a software interface is necessary. For the simplest case, a terminal program (such as Hyper Terminal) can communicate using the corresponding virtual COM port via defined commands with the SSC Communication Board hardware. The configuration for this method and for all user software is

- Baud rate: 19200
- Data bits: 8
- Stop bits: 1
- Parity: none

A basic terminal program adapted to the communication parameters of the SSC Communication Board is available on the IDT web site. The communication procedure for the different software modules is based on this model. To access the program, a free customer login account for the IDT website is required. Visit www.IDT.com/SSC-COMM-BD. Click on the link titled “SSC Terminal Program Rev. X” (where X is the current revision) and follow the dialog instructions as needed to download the zip file for the program and extract the file. Click on the extracted file to activate the program.

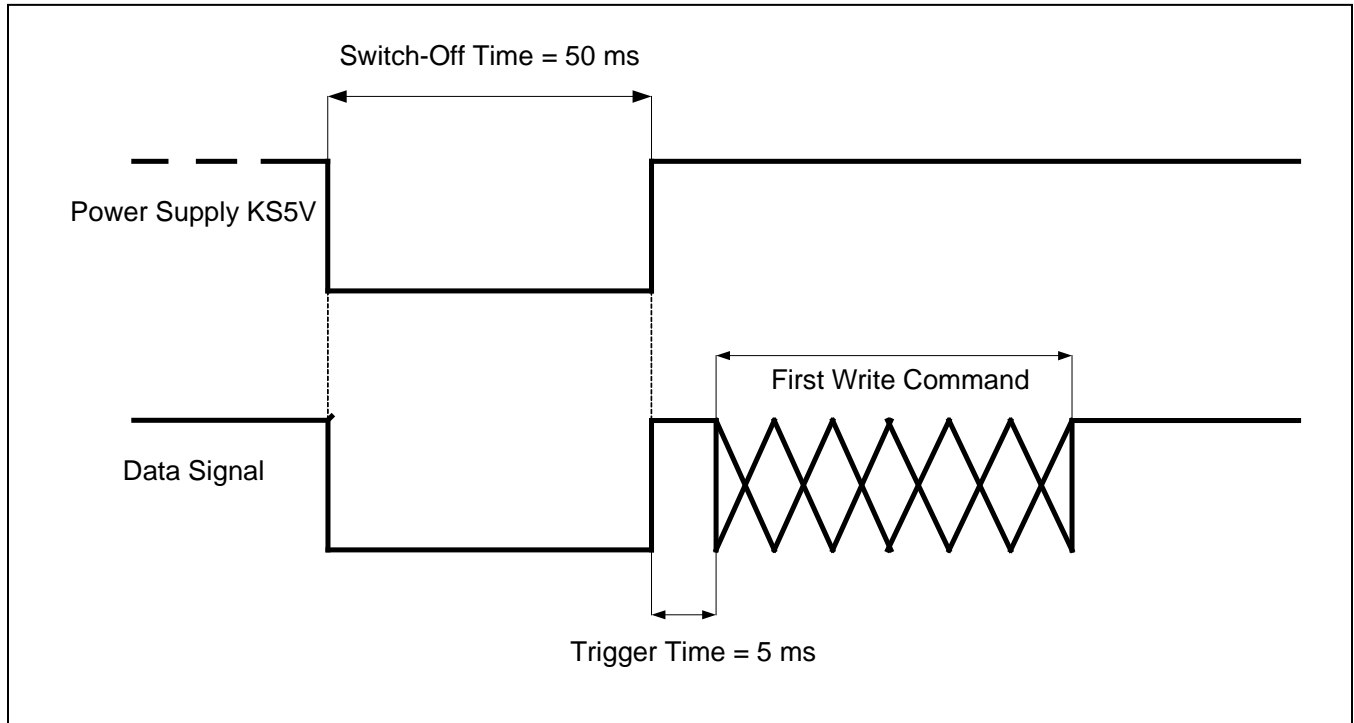
The possible commands can be classified as READ, WRITE and SPECIAL commands. Every command that is sent to the hardware is answered by an acknowledge plus “value” or a not-acknowledge plus corresponding error code. For the typical IC data structure, refer to the corresponding SSC IC data sheet and/or functional description.

Depending on the type of sensor signal conditioner, a special start-up sequence is necessary to switch the IC to the digital communication mode. To handle this sequence, a special trigger command is provided. The trigger values can be selected with a special preparation call. This call configures the channel, which must switch off and on before the first data packet will be sent. The execution of this trigger command can be selected within a subsequent read/write procedure. The switch-off time before a trigger event is executed can also be programmed. The default value is 300ms.

Example:

Command description:	command
Set the switch off time to 50ms:	T_050
Select trigger channel KS5V with a trigger time 10ms:	T01010
Write to the I ² C™ channel with trigger:	lwt7800101
Read a 4 byte value via the I ² C™ port without trigger:	lr_78004

Figure 7.1 Start Sequence with Trigger Configuration



For a complete command list, refer to the current version of *SSC_CB_Command_Syntax_Version_y_xx.xls*.

8 Related Documents

Document
SSC Communication Board Command Syntax Spreadsheet [†]
SSC Application Note – SSC Evaluation Kit Firmware Update [‡]
SSC Sensor Replacement Board Datasheet
SSC Evaluation Kit Feature Sheet

Visit IDT's website www.IDT.com or contact your nearest sales office for the latest version of these documents.

9 Glossary

Term	Description
ADC	Analog-to-digital converter
I ² C™	A common two-wire-serial bus system
LDO	Low drop-out
LIN	A common one-wire-serial bus system
LINwire™	A one-wire-serial bus system using LIN protocol at a voltage level of 5VDC
RX	Receive
SPI	A common three-wire-serial bus system
SSC	Sensor signal conditioner
TX	Transmit
ZACwire™	A IDT-specific one-wire-serial bus system on a 5V level.

[†] This document is included in the terminal program zip file that can be downloaded from the IDT website. See section 7 for instructions for accessing the zip file. This spreadsheet is also available upon request.

[‡] Available on IDT's web page (<http://www.idt.com>). A customer login is required (see section 7).

10 Document Revision History

Revision	Date	Description
1.06	August 16, 2011	<p>Moved instructions for driver installation to the separate document <i>SSC_AN_CommunicationBoard_Driver_Installation_rev_X_xy.pdf</i>.</p> <p>Updated specifications in section 1.</p> <p>Updated system requirements to include Windows® 7.</p> <p>General text edits for clarity.</p> <p>Updated references to hardware.</p> <p>Updated references to documents.</p> <p>Updated related documents.</p> <p>New document format implemented.</p>
1.07	July 31, 2013	<p>Update for downloading software and documentation from the web.</p> <p>Update for contact information and imagery for cover and headers.</p>
	April 13, 2016	<p>Changed to IDT branding.</p>

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(Rev.1.0 Mar 2020)

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