

Reference Design High Power

Title	RDHP-2250Q Adapter Board			
Application	Electrical Interface for "SCALE EV"			
Author System Engineering Automotive				
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Revision	1.4			

Feature Set

- Compatible for operation of "SCALE EV" boards
- On-board bit stream reader for bit stream analysis
- 4-bit LED counter for SO fault event
- Accessible oscilloscope probe point, input and output interface for signal measurement
- Available BNC sockets for PWM signal IN and ASC_AD
- Alternate fiber optic connection for PWM signal IN and SO fault trigger
- Input Common Mode Choke provision and LED indicator for power supply input

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No responsibility is accepted for the accuracy or sufficiency of any of the statements, technical information, recommendations, or opinions communicated and any liability for any direct, indirect or consequential loss or damage suffered by any person arising therefrom is expressly disclaimed.



1 **Scope**

This document provides a detailed information about RHDP-2250Q (may be referred as adapter board in this document). This will cover the circuit schematic, PCB layout, board assembly, bill of materials, input / output pin details and bit stream reader user manual.

2 Introduction

The adapter board is designed to aid in interfacing the SCALE EV boards (e.g. 2SP02152FQC0-FF900R12ME7W_B11) to an electrical and measurement set-up.

It provides the input and output ports for both low and high voltage tests. Accessible oscilloscope probing points are provided for ease of analyzing signals. The board also includes common mode chokes, line drivers, pull-up / down resistors and alternate fiber optic connection to enhance its noise immunity. On-board bit stream readers and SO fault counters are available for bit stream analysis.



Figure 1 – RDHP-2250Q Adapter Board.



Circuit Schematic 3



Figure 2 – Schematic Diagram (Bottom Channel).





Figure 3 – Schematic Diagram (Top Channel).







Figure 4 – Schematic Diagram (SO Fault Counter).



4 PCB Layout



Figure 5 – PCB Layout (Top Layer).



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Figure 6 – PCB Layout (Middle Layer 1).





Figure 7 – PCB Layout (Middle Layer 2).





Figure 8 – PCB Layout (Bottom Layer).



5 Board Assembly



Figure 9 – Board Assembly.



6 Bill of Materials

#	Qty	Designator	Value	Part Description	Parameters	Manufacturer
1	12	C100, C102, C104, C109, C113, C200, C203, C204, C208, C211, C300, C301	100n / 0805	Ceramic Chip Capacitor	X7R / 100V / 10%	
2	6	C101, C112, C114, C202, C210, C212	330p / 0603	Ceramic Chip Capacitor	NP0,C0G / 100V / 5%	
3	2	C103, C201	47p / 0603	Ceramic Chip Capacitor	NP0,C0G / 100V / 5%	
4	6	C105, C110, C111, C115, C209, C213	100n / 0603	Ceramic Chip Capacitor	X7R / 50V / 10%	
5	2	C106, C205	470n / 1206	Ceramic Chip Capacitor	X7R / 100V / 10%	
6	4	C107, C108, C206, C207	22u / 1206	Ceramic Chip Capacitor	X7R / 10V / 10%	
7	2	C116, C214	100p / 0603	Ceramic Chip Capacitor	NP0,C0G / 50V / 2%	
8	10	D100, D101, D102, D103, D104, D200, D201, D202, D203, D204	SZ1SMA24AT3G	TVS DIODE 24VWM 38.9VC SMA	24V / 10.3A Ipp	Diodes Incorporated
9	2	D106, D207	BAV99	High-speed switching diodes	100V / 215mA / 250mW	Nexpiria
10	2	D109, D209	AFBR-1539Z	Fiber Optic Transmitter	650nm / Vertical / 10MBd	Avago
11	2	D300, D301	BAV21WS	High Voltage Diode	150V / 250mA / 200mW / 1.0V @ If = 100mA	Diodes
12	2	IC100, IC200	74LVC2G34W6-7	Buffers & Line Drivers LVC 2 Gates LOGIC	1.65V to 5.5V	DIODE
13	2	IC101, IC201	74LVC244APW	Buffers & Line Drivers Octal w / Tri-St Out	1.65V to 3.6V	Nexperia
14	1	IC102	74HCT2G14GV-Q100	Dual inverting Schmitt trigger	4.5V to 5.5V	Nexperia
15	2	IC103, IC204	HFBR-2531ETZ	Fiber Optic Receiver	600nm / Vertical / 1MBd	Avago
16	1	IC104	MC74HC73ADR2G	Single Negative-Edge- Triggered JK-Type Flip- Flop	2.0V to 6.0V / 25mA	ON Semiconductor
17	2	IC105, IC202	74LVC1G17QW5-7	Buffers & Line Drivers Logic LVC 1 Gate SOT25 T&R 3K	1.65V to 5.5V	DIODE
18	1	IC300	SN74HC393PW	Counter ICs Dual 4-Bit Binary Counters	2V to 6V	Texas Instruments
19	2	L100, L200	880uH / CE1755-AL	Input Common Mode Choke		Coilcraft
20	2	L101, L201	12uH / 0603	Shielded Multilayer Inductor		TDK Corporation
21	12	D108, D110, D208, D210, D302, D303, D304, D305, D306, D307, D308, D309	HSMQ-C170-T0000	D000 Standard LEDs - SMD GREEN Top Mt Green		Broadcom Limited
22	2	Q100, Q200	2N7002H	60 V, N-channel Trench MOSFET	60V 300mA (Tc) 830mW (Tc)	Nexperia



23	12	R100, R140, R200, R239, R304, R305, R306, R307, R308, R309, R310, R311	10k / 0805	Thick Film Chip Resistor	1% / 0.125W / 150V	
24	12	R104, R105, R106, R118, R128, R153, R202, R206, R207, R218, R230, R254	5k1 / 0603	Thick Film Chip Resistor	1% / 0.1W / 75V	
25	18	R107, R108, R109, R112, R113, R121, R136, R151, R205, R208, R209, R212, R213, R221, R222, R236, R302, R303	0R / 0603	Thick Film Chip Resistor	1% / 0.1W / 75V	
26	24	R114, R116, R130, R132, R133, R134, R135, R137, R139, R141, R152, R154, R215, R220, R231, R232, R233, R234, R235, R241, R242, R244, R252, R253	100k / 0603	Thick Film Chip Resistor	1% / 0.1W / 75V	
27	18	R123, R127, R129, R144, R145, R147, R148, R149, R150, R224, R227, R228, R246, R247, R248, R249, R250, R251	3k3 / 0603	Thick Film Chip Resistor	1% / 0.1W / 75V	
28	2	R125, R223	220R / 0603	Thick Film Chip Resistor	1% / 0.1W / 150V	
29	2	R131, R237	4k7 / 0603	Thick Film Chip Resistor	1% / 0.1W / 75V	
30	6	R138, R238, R300, R301, R313, R315	10k / 0603	Thick Film Chip Resistor	1% / 0.1W / 75V	
31	2	R142, R240	33R / 0603	Thick Film Chip Resistor	1% / 0.1W / 75V	
32	2	R146, R245	560R / 1206	Thick Film Chip Resistor	1% / 0.25W / 200V	
33	2	R157, R256	3k / 0603	Thick Film Chip Resistor	1% / 0.1W / 150V	
34	2	R159, R259	2k / 0603	Thick Film Chip Resistor	1% / 0.1W / 75V	
35	2	R312, R314	200k / 0603	Thick Film Chip Resistor	1% / 0.1W / 75V	
36	4	S100, S200, S300, S301	Push button Switch	PCB Push switch	12VDC / 50mA	C&K
37	4	S101, S102, S201, S202	Toggle Switch	Switch on-on 1pol		Nikkai
38	4 S101, S102, S201, S202 TP100, TP101, TP102, TP103, TP104, TP105, TP106, TP107, TP108, TP109, TP110, TP111, TP112, TP113, TP114, TP115, TP116, TP117, TP118, TP119, TP120, TP121, TP122, TP200, TP201, TP202, TP203, TP204, TP205, TP206, TP207, TP208, TP209, TP210, TP211, TP212, TP213, TP214, TP215, TP216, TP217, TP218, TP219, TP220, TP221,		PCB testpoint	PCB testpoint	Grid 3.2mm / PCB Hole 1.32mm	Vero Technologies Ltd.



RDHP-2250Q User Guide

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39	2	U100, U200	NUCLEO-F042K6	Development Boards & Kits - ARM STM32 Nucleo-32 development board STM32F042K6 MCU, supports Arduino nano connect		ST Microelectronics
40	2	X100, X200	7Pin Header Molex	Conn Header SMD 7Pos 3MM	125V / 3A / 7Pin / 3.0mm / 180°	Molex
41	2	X101, X201	1X07 POS VERT TIN	Headers & Wire Housings 1X07 POS VERT TIN		TE Connectivity
42	8	X102, X103, X106, X107, X202, X203, X205, X206	Coaxial Connector	Ultra Small Surface Mount Coaxial Connector	100V / 10mA / 2Pin / 180°	Hirose Electric
43	2	X104, X204	2X07 POS VERT TIN	Headers & Wire Housings 2X07 POS VERT TIN		TE Connectivity
44	6	X105, X111, X113, X208, X212, X214	Header 3Pin Wuerth	3Pin Header Wuerth- 180°	250V / 3A / 3Pin / 2.54mm / 180°	WE Würth Elektronik
45	4	X108, X109, X210, X211	Socket for banana plug	Socket for banana plug with insulating sleeve	1000V / 24A / 1Pin / 90°	Multi-Contact
46	4	X114, X115, X215, X216	BNC Socket 180°	BNC Socket 180°, 50Ohm	500hm / 180°	Rosenberger
47	2	X116, X217	1X4Pin, Pitch 2.54	Headers & Wire Housings 1X04 POS VERT TIN		TE Connectivity
48	1	X207	SCREW Terminal	SCREW Terminal M4	1Pin / 180°	Ninigi
49	4	X300, X301, X400, X401	1X15Pin, Pitch 2.54	Pin Header Receptacle for Nucleo Board		Samtec

Table 1 – Bill of Materials.



7 **3D Image**



Figure 10 – Unit 3D Render (Top).





Figure 11 – Unit 3D Render (Bottom).



8 I / O Connector Details

8.1 Bottom Channel Connectors

	Bottom Channel Gate Driver Connectors					
Connector	Pin #	Symbol	Function			
	1	GND				
	2	B_OUT1				
	3	IN1				
X100	4	SO1	Interface Connector to Gate Driver Board Mates with Molex 0436450700			
	5	ASC_AD_EN1				
	6	ASC_AD1				
	7	VCC_1				
	1	GND				
	2	B_OUT1				
	3	IN1				
X101	4	SO1	Alternate Interface Connector to Gate Driver Board			
	5	ASC_AD_EN1				
	6	ASC_AD1				
	7	VCC_1				
X102	COAX	B_OUT1	Input micro-coaxial port for B_OUT1 Mates with Hirose UFL-2HF6-068N1T-AC-200			
X103	COAX	SO1	Input micro-coaxial port for SO1 Mates with Hirose UFL-2HF6-068N1T-AC-200			
	1	GND				
	2	GND				
	3	B_OUT1				
	4	GND				
	5	ASC_AD1				
	6	GND				
V104	7	SO1	Additional Din Haadars for Conoral Burnosos			
7104	8	GND	Additional Fill fleaders for General Fulposes			
	9	ASC_AD_EN1				
	10	GND				
	11	IN1				
	12	GND				
	13	VCC1				
	14	GND				



	1	SO1	
X105	2	GND	Additional Pin Headers for Bit stream signals
	3	B_OUT1	
X106	COAX	SO1	Output micro-coaxial port for B_OUT1 Mates with Hirose UFL-2HF6-068N1T-AC-200
X107	COAX	B_OUT1	Output micro-coaxial port for SO1 Mates with Hirose UFL-2HF6-068N1T-AC-200
X108	BANANA	VCC_1	5V Supply Line
X109	BANANA	GND	Ground
	1	VCC1	
X111	2	ASC_AD_EN1	ASC_AD_EN1 mode selection pins
	3	GND	
	1	VCC2	
X113	2	ASC_AD1	ASC_AD1 mode selection pins
	3	GND	
X114	BNC	ASC_AD1	Input BNC port for ASC_AD1
X115	BNC	IN1	Input BNC port for IN1
	1	TR2	
V116	2	TR1	Pit stroom Dooder Trigger Outputs
XIIO	3	TR0	bit stream keader migger Outputs
	4	GND	
	1	IN1_OPT	
S101	2	IN1	IN1 source selection switch (fiber ontic or BNC)
	3	IN1_BNC	
	1	SO1_OPT	
S102	2	SO1	SO1 fiber optic output enable switch
	3	GND	

 Table 2 – Connector Details (Bottom Channel).



8.2 Top Channel Connectors

	Top Channel Gate Driver Connectors					
Connector	Pin #	Symbol	Function			
	1	GND				
	2	B_OUT2				
	3	IN2	Interface Connector to Gate Driver Board			
X200	4	SO2	Mates with Molex 0436450700			
	5	ASC_AD_EN2				
	6	ASC_AD2				
	7	VCC_2				
	1	GND				
	2	B_OUT2				
	3	IN2				
X201	4	SO2	Alternate Interface Connector to Gate Driver Board			
	5	ASC_AD_EN2				
	6	ASC_AD2				
	7	VCC_2				
X202	COAX	SO2	Input micro-coaxial port for SO2 Mates with Hirose UFL-2HF6-068N1T-AC-200			
X203	COAX	B_OUT2	Input micro-coaxial port for B_OUT2 Mates with Hirose UFL-2HF6-068N1T-AC-200			
	1	GND				
	2	GND				
	3	B_OUT2				
	4	GND				
	5	ASC_AD2				
	6	GND				
V204	7	SO2	Additional Din Haadars for Constal Durnassa			
7204	8	GND	Auditional Pill neaders for General Purposes			
	9	ASC_AD_EN2				
	10	GND				
	11	IN2				
	12	GND				
	13	VCC2				
	14	GND				
X205	COAX	SO2	Output micro-coaxial port for SO2 Mates with Hirose UFL-2HF6-068N1T-AC-200			
X206	COAX	B_OUT2	Output micro-coaxial port for B_OUT2 Mates with Hirose UFL-2HF6-068N1T-AC-200			
X207	X207 SCREW GND M4 Screw Terminal for Earth Connection		M4 Screw Terminal for Earth Connection			
	1	SO2				
X208	2	GND	Additional Pin Headers for Bit stream signals			
	3	B_OUT2				
X210	BANANA	VCC_2 5V Supply Line				
X211	BANANA	GND	Ground			



	1	VCC2		
X212	2	ASC_AD_EN2	ASC_AD_EN2 mode selection pins	
	3	GND		
	1	VCC2		
X214	2	ASC_AD2	ASC_AD2 mode selection pins	
	3	GND		
X215	BNC	ASC_AD2	Input BNC port for ASC_AD2	
X216	BNC	IN2	Input BNC port for IN2	
	1	TR2		
V217	2	TR1	Bit stroom Booder Trigger Outputs	
×217	3	TR0	bit stream Reader migger Outputs	
	4	GND		
	1	IN2_OPT	IND source colortion switch	
S201	2	IN2	(fiber optic or BNC)	
	3	IN2_BNC		
	1	SO2_OPT		
S202	2	SO2	SO2 fiber optic output enable switch	
	3	GND		

 Table 3 – Connector Details (Top Channel).



9 Interface Connector to Gate Driver Board

It is highly recommended to use X100 / X200 and X101 / X201 as the interface connector to a gate driver board especially during high voltage tests. These connectors have TVS diodes in parallel (Figure 12) as a protection of the adapter board for sudden high voltage transient.



Figure 12 – Interface Connectors.

$10\,$ ASC_AD and ASC_AD_EN Mode Selection Pins

Mode selection pins are provided for both ASC_AD (X214 / X113) and ASC_AD_EN (X212 / X111) lines. This is a standard three pin header (Figure 13) where the middle pin can either be shorted to VCC or GND using a 2-pin jumper (Figure 14).



Figure 13 – ASC_AD and ASC_AD_EN Mode Selection Pins.





Figure 14 – 2-Pin Jumper.

11 Fiber Optic Interface

The adapter board includes fiber optic interface for PWM IN and SO signals (Figure 15). This can be utilized using fiber optic cable HFBR-RNS001Z (Figure 16).



Figure 15 – Fiber Optic Interface.





Figure 16 – Fiber Optic Cable: HFBR-RNS001Z.



12 PWM Signal IN Source Select

The adapter board provides two options (via Fiber Optic or BNC) for the PWM signal IN. This can be selected using switch S101 / S201 as shown in Figure 17.



Figure 17 – Fiber Optic Selection Switch.

13 SO Output Select

The adapter board also provides an additional fiber optic output for the SO signal. This can be selected using switch S102 / S202 as shown in Figure 17. Make sure that the LED indicators D110 / D210 (Figure 18) are OFF prior to each test. This can be done using the reset buttons S100 / S200 (Figure 18). When an SO fault is detected, the circuit latches the LED indicator HIGH (fiber optic line LOW). As such, the circuit is a single fault event. A SO fault counter is also included in this board to provide the number of SO fault event.



Figure 18 – SO Single Fault Trigger.



14 Earth Grounding Connection

An M4 screw terminal is provided for earth ground connection of the adapter board as shown in Figure 19.



Figure 19 – M4 Screw Terminal for Earth Grounding.



15 SO Fault Counter

The adapter board features a 4-bit SO fault counter for each channel. D302-305 for the top channel and D306-309 for the bottom channel with D305 and D309 as its respective LSB (Figure 20). Each LED represents a bit with its ON state as logic '1'. Given the number of bits, the counter has a maximum count of 16. Switch S300 and S301 are reset buttons for the respective counter (Figure 20).



Figure 20 – SO Fault Counter Circuit Schematic.



Figure 21 – SO Fault Counter.



16 Bit Stream User Manual

16.1 Failure and Status Monitoring of SCALE-iDriver2 IC

The gate driver IC used on SCALE EV boards features failure and status monitoring via a bit stream (B_OUT), containing status and measurement data, plus a dedicated fault pin (SO). This configuration allows an interrupt to be generated, via the SO pin on a fault, ensuring the status is read and immediately addressed by the system.

The information of the B_OUT frame consists of a Start Bit Logic High, 27 Payload bits and 1 Stop bit. Prior to the Start Bit a series of Logic Low bits (B_OUT[idle]) are sent. The number of idle bits is not fixed and is defined by the asynchronous frame time t_{B_OUT} minus the time required for the transmission of the Start Bit, Pay Load bits and the Stop Bit.

	B_OUT Frame					
Idlo Bitc		Pa				
Tule Dits	Start Bit	A / D Temperature	Diagnostic and Monitoring	Stop Bit		
		Signal	Information			
B_OUT[idle] B_OUT[1] B_OUT[2:13]		B_OUT[14:28]	B_OUT[29]			

The definition of a logic low or high condition of B_OUT bits is determined by the pulse width as shown.



Figure 22 – Logic High and Low of B_OUT bits.

Refer to the SCALE EV Family data sheet for details of status feedback and temperature measurement.



16.2 Installation Guide

Below are the steps for installing the software (Note: Administrator permission may be required):

1. Download the SIC2192_Reader.msi file, then right-click to Install



Figure 23 – Bit Stream Software Installer.

2. A setup wizard will open, click Next



Figure 24 – Installer Setup Wizard: Welcome Screen.



3. Select installation directory, then click **Next**

🕼 PI SIC2192 Reader	-		×
Select Installation Folder			
The installer will install PI SIC2192 Reader to the following folder.			
To install in this folder, click "Next". To install to a different folder, enter it b	elow or c	lick "Browse	".
_ <u>F</u> older:	K		
C:\Program Files\Power Integrations\PI SIC2192 Reader\		Browse	
		Disk Cost	
Install PI SIC2192 Reader for yourself, or for anyone who uses this com	puter:		
Everyone			
⊖ Just me		M	2
< Back Next	>	Cance	el

Figure 25 – Installer Setup Wizard: Select Installation Folder.

4. Click **Next** to start the installation

🛃 PI SIC2192 Reader	-		×
Confirm Installation			5
The installer is ready to install PI SIC2192 Reader on your computer. Click "Next" to start the installation.			
		~	2
< Back	lext >	Can	cel



5. Wait for the installation to complete



6. A confirmation will appear upon successful installation, click Close to finish

🛃 PI SIC2192 Reader	_		\times
Installation Complete			-
PI SIC2192 Reader has been successfully installed.			
Click "Close" to exit.			
Please use Windows Update to check for any critical updates to the .NET F	ramew	ork.	
		~	1
	_	5	
< Back Close		Cai	ncel

Figure 27 – Installer Setup Wizard: Installation Complete.

7. Bit Stream Reader software installation is done.

6											
	P SIC	2192 Toolbox									×
0		DOWOR		Port	~	0	pen	Close	Resc	an Device	1 v
				Saue To	C:\Users\cdong\	Documents\	SIC219	2 log.csv			
				Save IV							
		integrations		LogMsg	Device identificat Replace this text	t will be writ	ten to t	he			
10	Maging	incogracionio			trace log to identi	y your devic	e.				
	B-	Description	Real-Time	Data Tin	nel Hilev	al 50	Con	Real-Time	Data Time?	Hilevel	SO Con
	OUT	Description	Content1	Cold In	Conter	t1 1	1	Content2	Cond Thirds	Content2	2 2
	01	Start Bit					\square				
Biel	02-13	Temperature Sensor (Ohm)					1				
	14	Vviso UnderVoltage UVWVISO					1				
	15	Vviso OverVoltage OVWVISO									
	16	Gate Monitor									
	17	Overtemperature OT2gp									
	18	Overtemperature OT1co					11				
	10	Secondary Side Fluxlink Out Of Service 10us					11				
-	19	Secondary Side Fluxlink Out Of Service >= 20us					[
$\langle \neg$	20	DESAT Detection					[
	21	CRC									
	22	Primary Side Fluxlink Out Of Service 10us					[
	22	Primary Side Fluxlink Out Of Service >= 20us					[
	23	Overtemperature OT1 _{DCDC}					[
	24	Overtemperature OT2 pcpc		0.0							
	25	Primary Side DC/DC Controller Overcurrent									
	26	Unused					[
	27	Dead-Time Insertion					[
	28	Interlock	1								
	29	Stop Bit									
	1 A A	Sync1 (Sampled @ Start Bit)				-					
		Reader Status	No Connection			Re	eset	No Connection			Reset

Figure 28 – Bit Stream Reader Software.



16.3 Bit Stream Reader Hardware

16.3.1 Microcontroller Module

The reader uses an STM32 Nucleo-32 development board with STM32L432KC μ C as its data processing unit. Since the reader may be susceptible to certain interference / power supply drops, the on board RESET button (B1) allows to re-start the firmware at any time. Additional required modification from the standard Nucleo-32 development board is to short SB17 as shown below.



Figure 29 – Required Modification: Short SB17.

16.3.2 Trigger Output Signals

The reader has 3 trigger outputs with the following functionalities:

- TR0 is high during a B_OUT frame reception.
- TR1 is briefly high when a fault / warning is active in the received B-OUT frame.
- TR2 is briefly high if a CRC error is detected in the received B-OUT frame.



Figure 30 – Bit Stream Reader Triggers.



These triggers can be utilized when analyzing a bit stream frame, fault / warning or CRC error event using an oscilloscope. This can be done by probing the desired trigger to an oscilloscope channel. The signal can then be set as the signal trigger source with a signal level of around 1.5 V and rising edge polarity. In addition, single acquisition mode can be used on TR1 and TR2 to detect an occurrence of a fault, warning or CRC error. Note that TR1 and TR2 will be high about 160ms after a frame is received. This is the time the microcontroller module needs to process the received data.

As an example, TR0 can be utilized to analyze a B_OUT frame as shown in the snapshot.



Figure 31 – Oscilloscope Snapshot of B_OUT and SO with TR0 as trigger source.



16.3.3 Hardware Usage

Below are the steps for setting up the bit stream reader connection:

1. Connect the reader to the PC via a **USB Cable Type A to Micro B**. Make sure that the USB cable has a data line and is not just a power cable.



Figure 32 – USB Cable Type A to Micro B.

When performing high voltage tests on the SCALE EV gate drive board, it is highly recommended to use a **USB Isolator** as an additional safety for the PC USB port. As an example, 62588 Delock USB Isolator with 5 kV Isolation¹ can be used for this application.



¹ https://www.delock.de/produkte/G_62588/merkmale.html?setLanguage=en





Figure 33 – Delock USB Isolator (Part Number: 62588).

 The respective SO and B_OUT signals are already connected to the reader once the interface connectors X100 / X200 and X101 / X201 are used (refer to section 9). An additional option for a micro coaxial input and output port is also provided on the adapter board. As an example, UFL-2HF6-068N1T-AC-200 Hirose micro coaxial cable² can be used for this application.



Figure 34 – Alternate Micro-coaxial Input and Output ports.



Figure 35 – U.FL Micro Coaxial Cable (Part Number: UFL-2HF6-068N1T-AC-200).

3. Hardware set-up is ready for use.

² https://www.hirose.com/product/p/CL0321-0573-0-18



16.4 Bit Stream Reader Software

16.4.1 Software Details

This section provides a detailed description for the functionality of each component of the reader software interface. Refer to Figure 36 for the item number.



Figure 36 – Bit Stream Reader Software User Interface.



Item	Name	Details
1	Port	List of all available COM port on the PC. This is used to choose the appropriate COM port assigned to the bit stream reader. A maximum of 2 readers can be simultaneously connected in the software
2	Open	Button to connect the software to the selected COM port of the reader. This will open the connection to the reader and start the data acquisition and logging.
3	Close	Button to disconnect the communication and stop the data acquisition and logging from the selected COM port of the reader.
4	Rescan	Button to refresh all available COM ports in the port list. This can be used if a desired COM port does not reflect in the list.
5	Device	Assigns the selected device number to the COM port to be opened. This device identification will be used in the data log. It will also determine which device panel to display the data in the software user interface.
6	Save Settings	This is used to select the target directory and set the filename for logging. By default, the filename is set to $SIC2192_log.csv$ and is saved in the local documents folder. Both devices can log in the same file. If a separate log file is needed for the 2 nd reader, the save settings should be set accordingly before connecting the 2 nd reader.
7	Screen Update	Slider to change the screen update time of the software user interface (slide to the left for faster refresh rate).
8	Log Message	Text box for additional information to be included at the beginning of the log file.
9	B_OUT	Bit number (1 to 29).
10	Description	Description of each B_OUT bit.
11	Real-Time Content	This column shows the latest received value of each bit. Note that the screen update time is much slower compared to the device's transmission rate. As such, the contents in this column may be delayed.
12	Data Time	 The Data Time column shows the following: The current NTC resistance value (temperature reading) Blank if no fault / warning is detected since the start or latest Reset Time elapsed since a fault / warning was detected under the following conditions: If the time indicator resets continuously this means that the fault / warning is still active.



		 If an increasing time ind warning was detected in the 	licator is shown this means that a fault / he past but is now resolved							
13	High Level Content	The High Level Content column sho - Minimum and maximum NTC re the connection was established - "Warning" or "Error", depending	ws: esistance value (temperature reading) since or the reset was pressed g on the type of fault detected							
14	SO Status	Virtual LED: Green \bigcirc indicates hi update. Red \bigcirc indicates low SO wa	gh SO were detected since the last screen as detected.							
15	Content	Virtual LED: Green $igodoldsymbol{\Theta}$ indicates nor Orange $igodoldsymbol{\Theta}$ indicates a recent warnii	LED: Green Indicates normal operation (no fault / warning detected). Indicates a recent warning and red for recent error.							
		Shows one of the following message	es:							
		No Connection	No open connection to a reader							
		Connected (Receiving Data)	Successful connection to a reader. Data is received							
16	Reader Status	Connected (No Data received since Start / Reset)	No B_OUT data received after opening connection or pressing reset.							
		<i>Connected (No Data available at this time)</i>	No new B_OUT data received							
		Connected (Record Out Of Sync)	No sync / start bit detected.							
17	Reset	Refreshes all contents (data and display. The received data and logg	efreshes all contents (data and timer) in the corresponding device's panel splay. The received data and logging is not affected by pressing this button.							



16.4.2 Software Usage

Below are the steps for using the bit stream reader software.

1. Open Device Manager to check the assigned COM port for the bit stream reader



Figure 37 – Device Manger.

2. **Open** the bit stream reader software.

9	P SIC2192 Toolbox							- 0	×
Second Contract of	OOWOr		Port	~	Open	Close	Resc	an Device 1	~
	DOWEI		Save To CA	Users\cdong\Docu	ments\SIC2	192_log.csv			
i angelik Talaya	• Integrations		Rep trac	place this text; it will be log to identify you	be written to r device.	the			
â1	B- OUT	Real-Time Content1	Data Time1	Hi Level Content1	SO Con 1 1	Real-Time Content2	Data Time2	Hi Level Content2	SO Con 2 2
*	01 Start Bit								
eyele Bio	02-13 Temperature Sensor (Ohm)								
	14 Vviso UnderVoltage UVWVISO								
	15 Vviso OverVoltage OVWVISO								
<u>u</u>	16 Gate Monitor								
	17 Overtemperature OT2 _{0D}								
tile X	18 Overtemperature OT1co								
	10 Secondary Side Fluxlink Out Of Service 10us								
	Secondary Side Fluxlink Out Of Service >= 20us								
	20 DESAT Detection								
	21 CRC								
	22 Primary Side Fluxlink Out Of Service 10us								
NO.	Primary Side Fluxlink Out Of Service >= 20us								
	23 Overtemperature OT1 _{DCDC}								
	24 Overtemperature OT2 pcpc								
	25 Primary Side DC/DC Controller Overcurrent								
	26 Unused								
	27 Dead-Time Insertion								
	28 Interlock								
	29 Stop Bit								
	 Sync1 (Sampled @ Start Bit) 								
	Reader Status	No Connection			Reset	No Connection			Reset

Figure 38 – Bit Stream Software.



3. Assign a Device Number

PISIC	192 Toolbox									- 0]	×
	ower		Port Save To	COM1 C:\Use	7 v	Op ments\	ien SIC21	Clos	Ret	Can Device	1	~
Version	integrations		LogMsg	Device Replac trace le	e identification: xo ce this text; it will og to identify you	oox be writt r device	en to e.	the	1	え		
B- OUT	Description	Real-Time Content1	Data Ti	me1	Hi Level Content1	S0 1	Con 1	Real-Time Content2	Data Time2	Hi Level Content2	S0 2	Con 2
02-13 14 15 16 17 18 19 20 21 22 23 24	Start Die Temperature Sensor (Ohm) Vviso UnderVoltage UVWVISO Gate Monitor Overtemperature 0T2 ₈₀ Overtemperature 0T1 ₈₀ Secondary Side Fluxlink Out 0f Service 10us Secondary Side Fluxlink Out 0f Service >= 20us DESAT Detection CRC Primary Side Fluxlink Out 0f Service 10us Primary Side Fluxlink Out 0f Service 10us Primary Side Fluxlink Out 0f Service >= 20us Overtemperature 0T1 _{DCDC} Overtemperature 0T1 _{DCDC}	DE		C	E-1			DE	VIC	E 2		
25 26	Primary Side DC/DC Controller Overcurrent Unused			-								
27 28 29	Dead-Time Insertion Interlock Stop Bit					_					_	
	Reader Status	No Connection				Re	set	No Connection			Re	set

Figure 39 – Bit Stream Software: Device Selection.

4. Click **Save To** to modify the filename and folder directory of the log file. By default, the filename is set to *SIC2192_log.csv* and is saved in the local documents folder.

10° SIC:	192 Toolbox								- 0		~
F 3102	132 1001004										
-			Port CC	0M17 ~	Ope	en	Close	Reso	can Device 1		~
			Save To	\Users\cdong\Docur	ments\S	IC21	92_log.csv				
			Save to							. 📍	
	integrations		LogMsg De	vice identification: xx	ox be writte	en to	the				
	incegrations		tra	ce log to identify you	device						
Version	: 1.6.1.3	Deal Time	Data Time	1 1511	00	Can	De el Time	Data Tima 0	LEI aver	00	Con
OUT	Description	Content1	Data Time	Content1	1	1	Content2	Data Timez	Content2	2	2
01	Start Bit	Contoniti			+ +	_	CONTONIL		Contonia	-	
02-13	Temperature Sensor (Ohm)				- 1						
14	Vviso UnderVoltage UVWVISO				- 1					1	
15	Vviso OverVoltage OVWVISO				- 1					1	
16	Gate Monitor				- 1					1	
17	Overtemperature OT2gp				1					1	
18	Overtemperature OT1gp				1					1	
10	Secondary Side Fluxlink Out Of Service 10us				7					1	
19	Secondary Side Fluxlink Out Of Service >= 20us				7					1	
20	DESAT Detection									1	
21	CRC									1	
22	Primary Side Fluxlink Out Of Service 10us									1	
22	Primary Side Fluxlink Out Of Service >= 20us]	
23	Overtemperature OT1 _{DCDC}										
24	Overtemperature OT2 DCDC										
25	Primary Side DC/DC Controller Overcurrent										
26	Unused										
27	Dead-Time Insertion										
28	Interlock										
29	Stop Bit										
-	Sync1 (Sampled @ Start Bit)					_					_
	Reader Status	No Connection			Res	et	No Connection			Re	set

Figure 40 – Bit Stream Software: Save Settings.



5. **Log Message / Information** that will be included at the beginning of the log file may be provided through this text box.

P SIC2	192 Toolbox									-	- 0		×
-	DOWOr -		Port	COM1	7 ~	Op	ben	Close	Re	scan	Device 1		~
Т		$ \ge $	Save To	C:\Use	ers/cdong/Docur	ments\	SIC2	192_log.csv				J	
Version	integrations [®]	$\boldsymbol{\nu}$	LogMsg	Device Replac trace le	e identification: xo ce this text; it will og to identify you	ox be writ r devic	ten to e.	the					
B- OUT	Description	Real-Time Content1	Data Tir	me1	Hi Level Content1	S0 1	Con 1	Real-Time Content2	Data Time2	P Hi Co	Level ntent2	S0 2	Con 2
01	Start Bit												
02-13	Temperature Sensor (Ohm)											1	
14	Vviso UnderVoltage UVWVISO											1	
15	V _{VISO} OverVoltage OVWVISO											1	
16	Gate Monitor					1						1	
17	Overtemperature OT2gp					1						1	
18	Overtemperature OT1gp					1						1	
10	Secondary Side Fluxlink Out Of Service 10us					1						1	
19	Secondary Side Fluxlink Out Of Service >= 20us					٦						1	
20	DESAT Detection					1						1	
21	CRC					1						1	
	Primary Side Fluxlink Out Of Service 10us					1						1	
22	Primary Side Fluxlink Out Of Service >= 20us					1						1	
23	Overtemperature OT1 _{DCDC}					1						1	
24	Overtemperature OT2 DCDC					1						1	
25	Primary Side DC/DC Controller Overcurrent					1						1	
26	Unused					1						1	
27	Dead-Time Insertion					1						1	
28	Interlock					1						1	
29	Stop Bit					1						1	
	Sync1 (Sampled @ Start Bit)											1	
-	Reader Status	No Connection				Re	set	No Connection				Re	set

Figure 41 – Bit Stream Software: Log Message.

6. Choose the COM **Port** assigned to the bit stream reader. If the COM port is not in the list, click **Rescan**.

P SIC2		7	Port Save To	COM17 V C:\Users\cdong\Doc	Op uments\S	en SIC2:	Close 22 log:sv	Resc	an Device 1	. •	×
Version			LogMsg	Device identification: Replace this text; it wi trace log to identify yo	ur device	en to	the				
B- OUT	Description	Real-Time Content1	Data Tim	Hi Level Content1	S0 1	Con 1	Real-Time Content2	Data Time2	Hi Level Content2	S0 2	Con 2
01	Start Bit										\square
02-13	Temperature Sensor (Ohm)									_	
14	V _{VISO} UnderVoltage UVWVISO									_	
15	V _{VISO} OverVoltage OVWVISO									_	
16	Gate Monitor										
17	Overtemperature OT2 _{GD}									_	
18	Overtemperature OT1gp										
10	Secondary Side Fluxlink Out Of Service 10us										
15	Secondary Side Fluxlink Out Of Service >= 20us										
20	DESAT Detection										
21	CRC										
22	Primary Side Fluxlink Out Of Service 10us										
22	Primary Side Fluxlink Out Of Service >= 20us									1	
23	Overtemperature OT1 _{DCDC}									1	
24	Overtemperature OT2 DCDC									1	
25	Primary Side DC/DC Controller Overcurrent									1	
26	Unused									1	
27	Dead-Time Insertion									1	
28	Interlock									1	
29	Stop Bit									1	
•	Sync1 (Sampled @ Start Bit)									1	
	Reader Status	No Connection			Re	set	No Connection			Re	eset

Figure 42 – Bit Stream Software: Port Selection.



7. Click **Open** to start connection.

P SIC2	2192 Toolbox								- 0		×
4	ower		Port COM	17 sers\cdong\Donu	Ope ments\S	en SIC21	Close 92 log.csv	Resc	an Device 1		~
Version	integrations ⁻		LogMsg Logk Hopk trace	indentification: x ace this text; it will log to identify you	oox be writte r device	en to	the			. •	1 1
B- OUT	Description	Real-Time Content1	Data Time1	Hi Level Content1	SO 1	Con 1	Real-Time Content2	Data Time2	Hi Level Content2	S0 2	Con 2
01	Start Bit Temperature Sensor (Ohm)				-					-	Т
14	Vviso UnderVoltage UVWVISO										
16	Gate Monitor										
18	Overtemperature OT1gp										
19	Secondary Side Fluxlink Out Of Service 10us Secondary Side Fluxlink Out Of Service >= 20us				-					-	
20	DESAT Detection										
21	Primary Side Fluxlink Out Of Service 10us										
23	Overtemperature OT1 _{DCDC}										
24 25	Overtemperature OT2 DCDC Primary Side DC/DC Controller Overcurrent				-						
26	Unused										
28	Interlock										
- 29	Stop Bit Sync1 (Sampled @ Start Bit)					_					
-	Reader Status	No Connection			Res	set	No Connection			Re	set

Figure 43 – Bit Stream Software: Open Connection.

8. An overwrite prompt may appear if the chosen log filename already exists. Click **Yes** to abort the connection or click **No** to overwrite the existing file and continue connection.

p sic2	192 Toolbox							-		-		×
-	DOMOR		Port	COM17	~	Op	en	Close	Res	can Device	1	
T	JUWEI		Save To	C:\Users\c	dong\Docu	ments	SIC219	02_log.csv				
Version	integrations		LogMsg	Device iden Replace the trace log to	ntification: x s text; it will identify you	oox be writt r device	en to t	he				
B- OUT	Description	Real-Time Content1	Data Ti	ime1 H	i Level ontent1	S0 1	Con 1	Real-Time Content2	Data Time2	Hi Level Content2	SO 0	000
01	Start Bit		-									
02-13	Temperature Sensor (Ohm)		Log	file exists				×				
14	Vviso UnderVoltage UVWVISO											
15	Vviso OverVoltage OVWVISO		The	log file alre	ady exists							
16	Gate Monitor		Do	you want to	abort and	chang	e the f	ile name?				
17	Overtemperature OT2gp			0> overwrite	is the exist	ing me						
18	Overtemperature OT1gp											
10	Secondary Side Fluxlink Out Of Service 10us					Yes		No				
19	Secondary Side Fluxlink Out Of Service >= 20us					_						
20	DESAT Detection											
21	CRC		V				[
22	Primary Side Fluxlink Out Of Service 10us						[
22	Primary Side Fluxlink Out Of Service >= 20us											
23	Overtemperature OT1 _{DCDC}											
24	Overtemperature OT2 pcpc											
25	Primary Side DC/DC Controller Overcurrent											
26	Unused						[
27	Dead-Time Insertion						[
28	Interlock						[
29	Stop Bit						[
1	Sync1 (Sampled @ Start Bit)						[
1.42	Reader Status	No Connection				Re	set	No Connection			Rese	et

Figure 44 – Bit Stream Software: Overwrite Prompt.



9. Reader status must show **Connected (Receiving Data)** upon successful connection. Data is now being logged to the CSV file.



Figure 45 – Bit Stream Software: Successful Connection.

10. A fault may be simulated (e.g. VISO Under Voltage Warning by setting $V_{VISO-COM} = 12$ V at IGBT Mode 1) to verify the connection.

P SIC2	192 Toolbox								- 0		×
	ower		Port Save To	COM17 ~ C:\Users\cdong\Docum	O; nents\	oen SIC21	Close 92_log.csv	Res	can Device 1		~
Version	integrations		LogMag	Device identification: xx Replace this text; it will b trace log to identify your	xx be writt devic	ten to e.	the			. •	
B- OUT	Description	Real-Time Content1	Data Ti	me1 Hi Level Content1	S0 1	Con 1	Real-Time Content2	Data Time2	Hi Level Content2	S0 2	Con 2
01	Start Bit	1									
02-13	Temperature Sensor (Ohm)	000001011101	5161	5161 to 5161						-	
14	V _{VISO} UnderVoltage UVWVISO	0	-406m	is Warning		0				_	
15	V _{VISO} OverVoltage OVWVISO	1				•				_	
16	Gate Monitor	1			_	•				_	
17	Overtemperature OT2gp	1				\circ					
18	Overtemperature OT1gp	1				\bullet				_	
19	Secondary Side Fluxlink Out Of Service 10us	1				\circ					
15	Secondary Side Fluxlink Out Of Service >= 20us										
20	DESAT Detection	1			\mathbf{O}	\circ					
21	CRC	0				\circ					
22	Primary Side Fluxlink Out Of Service 10us	0				\circ				1	
22	Primary Side Fluxlink Out Of Service >= 20us									1	
23	Overtemperature OT1 _{DCDC}	0				\circ				1	
24	Overtemperature OT2 DCDC	0				\circ				1	
25	Primary Side DC/DC Controller Overcurrent	0			1	\circ				1	
26	Unused	0								1	
27	Dead-Time Insertion	0			1	\circ				1	
28	Interlock	0			1	\bullet				1	
29	Stop Bit	1			1					1	
	Sync1 (Sampled @ Start Bit)	1		192 bytes unprocesse	d					1	
•	Reader Status	Connected (Receiv	ing Data)		Re	eset	No Connection			Re	eset

Figure 46 – Bit Stream Software: Fault Simulation.



11. Make sure to **Close** the connection every after test to avoid errors in logging.

P SIC2	192 Toolbox								_		×
	DOMOR		Port	COM17 ~	Ор	en	Close	Resc	an Device 1		~
			Save To	C:\Users\cdong\Docum	ents\.	SIC2	92_log.csv	K		J	
Version			LogMsg	Device identification: xxx Replace this text; it will be trace log to identify your of	x e writt device	en to e.	the				
B- OUT	Description	Real-Time Content1	Data Ti	me1 Hi Level Content1	S0 1	Con 1	Real-Time Content2	Data Time2	Hi Level Content2	SO 2	Con 2
01	Start Bit	1									
02-13	Temperature Sensor (Ohm)	000001011101	5161	5161 to 5161]						
14	V _{VISO} UnderVoltage UVWVISO	1]						
15	V _{VISO} OverVoltage OVWVISO	1]						
16	Gate Monitor	1]						
17	Overtemperature OT2gp	1									
18	Overtemperature OT1gp	1									
19	Secondary Side Fluxlink Out Of Service 10us	1									
13	Secondary Side Fluxlink Out Of Service >= 20us										
20	DESAT Detection	1			\mathbf{O}						
21	CRC	1									
22	Primary Side Fluxlink Out Of Service 10us	0]						
~~~	Primary Side Fluxlink Out Of Service >= 20us				]						
23	Overtemperature OT1 _{DCDC}	0			]						
24	Overtemperature OT2 DCDC	0			]						
25	Primary Side DC/DC Controller Overcurrent	0			]						
26	Unused	0			]						
27	Dead-Time Insertion	0			1					1	
28	Interlock	0			]	0					
29	Stop Bit	1			]						
-	Sync1 (Sampled @ Start Bit)	1		558 bytes unprocessed	<u> </u>						
	Reader Status	Connected (Receiv	ring Data)		Re	set	No Connection			Re	set

Figure 47 – Bit Stream Software: Close Connection

12. The same steps will apply when using the device 2 panel. Simply choose **Device 2** on step 3.

P SIC	2192 Toolbox							- 0		$\times$
-	DOMOR		Port	COM18 V	Open	Close	Res	can Device 2		~
Т			Save To	C:\Users\cdong\Docum	ents\SIC2	192_log.csv		シー	J	
Version	integrations [®]		LogMsg	Device identification: xx Replace this text; it will b trace log to identify your	ox e written t device.	o the				
B- OUT	Description	Real-Time Content1	Data Tir	me1 Hi Level Content1	SO Cor 1 1	Real-Time Content2	Data Time2	Hi Level Content2	S0 2	Con 2
01	Start Bit					1				
02-13	Temperature Sensor (Ohm)				1	000001011101	5161	5161 to 5161	1	
14	Vviso UnderVoltage UVWVISO				1	1			1	$\circ$
15	Vviso OverVoltage OVWVISO				1	1			1	$\circ$
16	Gate Monitor				1	1			1	$\circ$
17	Overtemperature OT2gp				1	1			1	
18	Overtemperature OT1gp				1	1			1	$\circ$
10	Secondary Side Fluxlink Out Of Service 10us				1	1			1	$\circ$
19	Secondary Side Fluxlink Out Of Service >= 20us				1				1	
20	DESAT Detection				1	1				$\circ$
21	CRC					1			1	$\circ$
22	Primary Side Fluxlink Out Of Service 10us					0			1	$\circ$
22	Primary Side Fluxlink Out Of Service >= 20us				1				1	
23	Overtemperature OT1 _{DCDC}				1	0			1	$\circ$
24	Overtemperature OT2 pcpc				1	0			1	$\circ$
25	Primary Side DC/DC Controller Overcurrent				1	0			1	$\circ$
26	Unused				1	0			1	
27	Dead-Time Insertion				1	0			1	$\circ$
28	Interlock				1	0			1	$\circ$
29	Stop Bit				1	1			1	
-	Sync1 (Sampled @ Start Bit)					1	12	bytes unprocessed	i	
-	Reader Status	No Connection			Reset	Connected (Receiv	ring Data)		Re	set

Figure 48 – Bit Stream Software: Device 2



### 16.5 Firmware Update

In case a firmware update becomes available, follow the steps below to re-flash the Bit Stream Reader hardware via ST-LINK Utility³:

1. Open ST-LINK Utility and connect the Bit Stream Reader to the PC via USB



Figure 49 – ST LINK Utility.

2. Click File -> **Open File** 



Figure 50 – ST LINK Utility: Open File.

³ Download and install at: https://www.st.com/en/development-tools/stsw-link004.html



3. Browse for the new FW file, then click **Open** 

🛃 Open				×
← → <b>*</b> ↑ 🖡 « 202	11212 > nucleo-firmware	✓ ひ <>> Se	arch nucleo-firmware	
Organize - New folder			•	0
- Quick accord	Name	Date modified	Туре	Siz
Quick access	L412KBnucleoSIC2192RDRE.bin	12/13/2021 3:31 PM	BIN File	
Microsoft Word	L412KBnucleoSIC2192RDRE.elf	12/13/2021 3:31 PM	ELF File	
OneDrive	L412KBnucleoSIC2192RDRE_FixedBitRate	12/13/2021 3:31 PM	BIN File	
	L412KBnucleoSIC2192RDRE_FixedBitRate	12/13/2021 3:31 PM	ELF File	
Intwork 🔮				
File name	:: L412KBnucleoSIC2192RDRE.bin	All Files		$\sim$
		Tools 🗸 Ope	n 🔻 Cancel	

Figure 51 – ST LINK Utility: File Selection.

4. Click  $\overset{[]}{\smile}$  for flash write operation.

412KBnucleoSIC2		SIC 210 2DDE	Data Wi	dth: 32 bits	Revision ID Flash size		
	192RDRE.bin], Fi	le size: 11304 B	/tes				_
Address	0	4	8	С	ASCII		
00000000x0	2000A000	08001551	080013E5	080013E7	Qåç		
x00000010	080013E9	080013EB	080013ED	00000000	éēí		
x00000020	00000000	00000000	00000000	080013EF	·····ī		
0x0000030	080013F1	00000000	080013F3	080013F5	ñóõ		
x00000040	080015A1	080015A1	080015A1	080015A1	1111		
x00000050	080015A1	080015A1	080015A1	080015A1	111		
x00000060	080015A1	080015A1	080015A1	080015A1	1		
x00000070	080015A1	080015A1	080015A1	080015A1	1111		
0x0000080	080015A1	080015A1	080015A1	00000000	1		
<							>
6:53:32 : [L412k 6:53:32 : [L412k	3nucleoSIC2192R 3nucleoSIC2192R	DRE.bin] opener DRE.bin] checks	I successfully. um : 0x00114E4E	E			

Figure 52 – ST LINK Utility: Flash Write Operation.



5. Click **Start** to begin re-flashing. Default settling will erase existing firmware, upload and verify the new one.

Download [ L4	12KBnucleoSIC2192RDRE.bin ]		×
Start address File path	0x08000000 C:\Develop\Sources\STM32_	CUBE\L412KBnucleoSIC21 Brows	e
Extra options	Skip Flash Erase	Skip Flash Protection verificati	on
Verification	• Verify while programming	○ Verify after programming	
Click "Start" to p	program target.		
After program	ning Reset after programming	Full Flash memory Checksum	
	Start	Cancel	

Figure 53 – ST LINK Utility: Start Flashing.

6. Re-flashing of new firmware is complete



#### 16.6 Data Log

### 16.6.1 Log file Details

This section provides a detailed description for each component of the log file created by the software. Refer to figure 13 for the item number.

	<del>ن</del> ک	⇔				SIC21	92_log - Ex	xcel		<b>—</b> ~		7)	T	- 0		×
File	Home	e Insert	Page Layou	t Formulas	Data	Review	View	ς	2 Tell me	e what you w	ant to do	C	hristian D	ave Ong	$\beta_{+}^{2}$ Sha	are
Paste	Cal	ibri •	11 - A		enment		General \$ - % 	• ,	Form 🖓 Cond	litional Form at as Table * Styles *	atting *	Delete	· Σ· · ↓·	AZT Sort & F Filter * Se	ind &	~
cipbou		Tone			giinen		Number			Styles		Cello		conting		
W1	Ŧ		$\sqrt{f_x}$													۷
	А	В		С	D		E		F	G	Н	1	J	К		L
1	H	lex-Value		Corresponding	Description											
2	0	x4000000 = (	01 Start													
3	0	$x_{3}FFC0000 = 0$	02-13 Tempe	rature bit range											_	
4	0	0x00020000 = 1	14 VVISO U	nder Voltage W	arning	_										_
5		x00010000 = :	15 VVISO C	ver Voltage Wa	rning											_
0		$0 \times 00008000 = 1$	16 Gate Mo	onitoring Warnin	g				-(1)						-	
2		x00004000 =	17 OTZGD	Over Temperatu Over Temperatu	re warning				Ť						-	
0		$0 \times 00002000 = 1$	10 Origo 19 Seconda	over remperatu	Out Of Sen	vice War	ning									
10		$x_{000001000} = 0$	DESAT D	etection Fault	Cout of Serv	nce wai	inng									
11		x00000400 = 3	20 DES/RE	ceccion ruur												
12	0	$0 \times 00000200 = 3$	22 Primary	Side FluxLink Ou	ut Of Service	Warnin	2									
13	0	x00000100 = 3	23 OT1DCD	C Over Tempera	ature Warnir	ng	>									
14	C	x00000080 = 2	24 OT2DCE	C Over Tempera	ature Warnir	ng										
15	0	x00000040 = 2	25 Primary	Side DC/DC Con	troller Over	Current	Warning									
16	0	x00000020 = 2	26 Unused													
17	0	x00000010 = 2	27 Dead tin	ne Insertion Wa	rning											
18	C	x0000008 = 2	28 Interlock	Warning												
19	0	0x0000004 = 2	29 Stop Bit													
20	0	x0000002 = 3	30 Reserve	d (at present alv	vays 0)											
21	C	x00000001 = 3	31 Reserve	d for internal us	e by Windov	vs App -	to be igno	red			-				_	
22	1	ick is the syst	em tick the r	ecord was receiv	/ed.						Ľ	·			_	_
23		Count is the an	nount of iden	tical records rec	eived										_	_
24		Note lines with	this with no	leading Device	Number / eq	ual to 0 a	are indicat	ive a	and shoul	d be ignored	while pro	ocessing dat	ta.			_
25		.og Message:	a ta coll ha	Device identific	ation: xxxx	-			6						_	_
20		replace this te	xt; it will be v	written to the					Ŷ							
28	L.	Tace log to lue	nuny your de	vice.												
29 Dev		)ate Time Cha	nge (5)	Tick 6	Count (7)	SIC219	2 Data	2	Commen	t - DebugDat						-
30		1/27/2022 2:3	9:08 PM	20959984	100	0 0x417	5F81D	9	SO Idle	S1 High						-
31	1	1/27/2022 2:3	9:08 PM	20960671	100	0 0x417	5F81D		S0 Idle	S1 High						-
32	1	1/27/2022 2:3	9:09 PM	20961406	10	4 0x417	5F81D		S0 Idle	S1 High						
33	1	1/27/2022 2:3	9:09 PM	20961484	100	0 0x417	5F805		SO Idle	S1 High						
34	1	1/27/2022 2:3	9:10 PM	20962171	66	8 0x417	5F805		SO Idle	S1 High						-
-	> S	IC2192_log	(+)							4						Þ
Ready													-	P	+ 8	18%

Figure 54 – Log File.



Item	Name	Details
1	<b>B_OUT</b> Information	a look up table with the description of each B_OUT bits
2	Log Notes	provides a short note about the log file
3	Log Message	information defined by the user from the Log Message text box in the software user interface
4	Device	'1' or '2' depending on the device number
5	Date Time Change	date and time record when the data was processed by the Windows PC
6	Tick	ms timer of the Windows PC. This is to provide more timing resolution to the date and time
7	Count	amount of times the frame repeats itself. A new line will be written if count reaches 1000
8	SIC2192 Data	actual data bits recorded from the IC. A new line will be written if the data changes
9	Comment — Debug Data	reflects the state of SYNC0, SYNC1 and INPUT



### 16.6.2 Example of Data Log Analysis

A sample data log is shown in Figure 55. The reader connection was opened with an inphase IN+ and IN- signal,  $V_{VISO-COM} = 12$  V at IGBT Mode 1. These conditions should trigger 3 warnings: under voltage VISO, dead-time insertion and interlock warning. Logged data shows that all of these warnings were successfully captured. Note that the first bit and last two bits of the logged data is not part of the B_OUT bit stream.

Warnings were eventually resolved by turning off the IN- signal and then setting  $V_{VISO-COM}$  = 25 V. These can be verified on the logged data. As shown, the dead-time insertion and interlock warnings were resolved initially followed by the resolution of the under voltage VISO.

Device	Da	te T	ime	Chan	ge		Tick	{		Cou	int	1	SIC2	192	Dat	ta	Cor	nme	ent -	Deb	ugD	ata											1		
1	1 1/	27/3	202	2 2:39	:08 F	M	20	0959	984		100	00	0x41	75	810	)	<b>SO</b> I	dle		51 H	igh	Simu	late	d U	nde	r Vol	Itage	e VIS	50,	-		_	<u> </u>	_	
t	1 1/	27/3	202	2 2:39	:08 F	M	20	0960	671		100	00	0x41	75F	810	)	SO I	dle		51 H	igh	Dead	d-tin	ne In	nser	tion	and	Inte	erlo	ck W	/arni	ings			
1	1 1/	27/3	202	2 2:39	:09 P	M	20	0961	406		10	)4	0x41	75	810	)	SO I	dle		S1 H	igh														
1	1 1/	27/3	202	2 2:39	:09 F	M	20	0961	484		100	)0	0x41	75	805	5	SO 1	dle		51 H	igh	Reso	lved	De	ad-t	ime	Inse	ertio	n	-		-		-	٦
1	1 1/	27/2	202	2 2:39	:10 F	M	20	0962	171		66	68	0x41	75	805	5	SO 1	dle		51 H	igh	and	Inte	rloc	k W	arnii	ngs						l l		
1	1 1/	27/3	202	2 2:39	:10 F	M	20	0962	609		100	0	0x41	77	C05	5	SO 1	dle		S1 H	igh	Reso	lved	l Un	der	Volt	age	VIS	0 W	arni	ng -	_		+	+
1	1 1/	27/3	202	2 2:39	:11 F	M	20	0963	359		100	00	0x41	77	C05	5	SO 1	dle		S1 H	igh											_	l l		
1	1 1/	27/2	202	2 2:39	:12 F	M	20	0964	093		100	00	0x41	77	C05	5	S0 I	dle		S1 H	igh														
1	1 1/	27/2	202	2 2:39	13 F	M	20	0964	796		100	00	0x41	77	C05	5	SO 1	dle		S1 H	igh											_			
1	1 1/	27/3	202	2 2:39	:13 F	M	20	0965	546	-	25	60	0x41	778	C05	5	SO 1	dle		S1 H	igh						_						l I		
B_OUT	X Not Bart on D. OIT Bits		1 2001	2 03	04	05	06	Temperature		09 1	10 1	1	12	13	VISO Under Voltage	12 VISO Over Voltage	11 Gate Monitoring	11 OT2GD Over Temperature	2 OTIGD Over Temperature	5 Secondary-side Flux Line Out-of-Service	8 DESAT Detection	CRC 21	8 Primary-side Flux Line Out-of-Service	<pre>2 OT1DCDC Over Temperature</pre>	Control Conternation Content Conten	2 Primary-side Flux Line Out-of-Service	Duused 26	2 Deadtime Insertion Warning	8 Interlock Warning	65 Stop	X Not Part on B_OUT Bits	X Not Part on B_OUT Bits			
Data Log	3		4			1				7				5	6			1	F			8	3			3	1			I	)		-	_	
Binary		0	1	0 0	0 0	0	0	1	0	1	1	1	0	1	0	1	1	1	1	1	1	0	0	0	0	0	0	1	1	1	0	1			
Data Los	,		4		1	1				7		Т		5					F			5	3			(	0				5		-		
Binary	1	0	1	0 0	0	0	0	1	0	1	1	1	0	1	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	1	0	1			
Unitary			-	0 0	10	0	0	+	0	-	-	-1	0	-	0	1	-	1	1	1 1	1	0	0	0	0	0	0	0	0	1	0	-			
Data			4		1					7				-					r		0						0	-			-	_	4		
Data Log	3		4						0	1			0	1								2	5	-	-				-	:					
Binary		0	1	0 0	0	0	0	1	0	1	1	1	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	1	0	1	1		

Figure 55 – Example of Data Log Analysis.



### 16.7 Troubleshooting

Issue	Details
COM Port not in the list	<ul> <li>Check if the USB connection is plugged in properly</li> <li>Check if the PC is able to detect the reader COM Port via Device Manager</li> <li>Click the Rescan Button to refresh the list</li> </ul>
No Log File Created	<ul> <li>Check if the filename and directory in the save settings is defined properly.</li> </ul>
Reader Status: No Connection	- Click the Open Button to start connection
Reader Status: <i>Connected (No Data received since Start / Reset)</i>	<ul> <li>Check if the B_OUT and SO signal is connected properly</li> <li>Check if the gate driver board is supplied with enough voltage (VCC = 5 V and V_{VISO-COM} = 15 V to 30 V)</li> </ul>
Reader Status: <i>Connected (No Data available at this time)</i>	<ul> <li>Check if the USB connection was unplugged</li> <li>Check if the B_OUT and SO signal was disconnected</li> </ul>
Reader Status: Connected (Record Out Of Sync)	<ul> <li>Check if the B_OUT signal is switching properly (low and high bits are observed)</li> </ul>



# 17 Revision History

Date	Author	Revision	Description and changes	Reviewed
05-May-22	CO	1.1	Initial Release.	MH
27-Jul-22	СО	1.2	Updated Schematic Diagram and Bill of Materials. Included Disclaimer Information.	MH, CD
28-Jul-22	PV	1.3	Minor Typo Corrections	MH
06-Feb-23	СО	1.4	Additional filter stage on Bit stream signal for better noise immunity during inverter test	MH



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