

AN-SL2002-01

400W Resistive Load Evaluation Board

Introduction

This Application Note contains the evaluation board description with specifications, board pictures, schematics and layout of the printed circuit board, bill-of-materials, and performance data for the SLE2002-R01, which is a 400W Resistor Load Evaluation Board using Silanna Semiconductor's SL2002 laser driver IC. The typical performance data is shown along with pictures from the SL200X GUI for Vin voltages varying from 2.8V up to 5V. For more specific information about the component placement and board layout guidelines, please refer to AN-SL2001-05.

Evaluation Board Description

This Application Note describes the capability of a 400W evaluation board with resistive load that includes a charge pump circuit which allows operation from a single cell battery (2.8V-6V), which is a valuable feature for portable range finder applications. The design uses SL2002 (Integrated Resonant Mode Laser Diode Drive System). The design shows the high peak current with very narrow laser FWHM pulse that can be achieved due to the high level of integration of the SL2002 controller.

Specifications

Table 1 shows the key specs for the 200W Resistive Load Evaluation Board for SL2002.

Parameter	Value	Unit
Input Voltage (min)	2.8	V
Input Voltage (max)	6	V
Peak Power (max)	400	W
Laser FWHM Pulse Width	5	ns
System No Load Power Consumption	< 5	mW
Rep Rate Switching Frequency	1	MHz

Table1: Key Specs

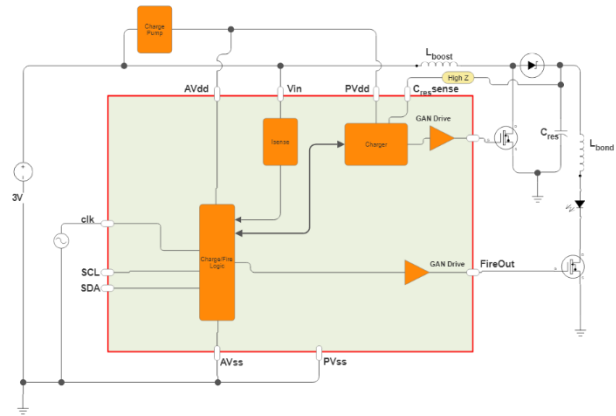


Figure1. Typical Application Diagram

SL2002 Key Features

- Flexible architecture can provide laser FWHM pulses less than 2ns
- High charging efficiency from a single 2.8V to 6V
- Integrates needed blocks for Charging and Firing Resonant-Mode Diode Lasers
- Inductor Current Control offers precise Resonant Capacitor Energy even with Input Voltage Fluctuations
- < 5 mW System No Load Power Consumption
- Up to 1 MHz Rep Rate limited by temperature rise in laser and other board components
- Minimal external components enable extremely integrated and efficient layout
- Integrated I2C interface and non-volatile memory for Output Power Control and Fault monitoring
- 1 mm x 3.5 mm WLCSP Package utilizing bumped die

Applications

- Laser TOF Measurement Systems
- LIDAR
- Range Finding
- 3D Mapping

Safety Warning

This device is capable of driving laser diodes to generate high power optical pulses. Such pulses are capable of causing PERMANENT VISION DAMAGE AND BLINDNESS as well as additional injury or property damage. Laser diodes emit light that may be outside of the users' visual range which can cause PERMANENT VISION DAMAGE AND BLINDNESS as well as additional injury or property damage. Users are fully responsible for following proper laser safety procedures to prevent injury or damage. We recommend the use of Laser Eye Safety Goggles for all testing.

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Board Pictures

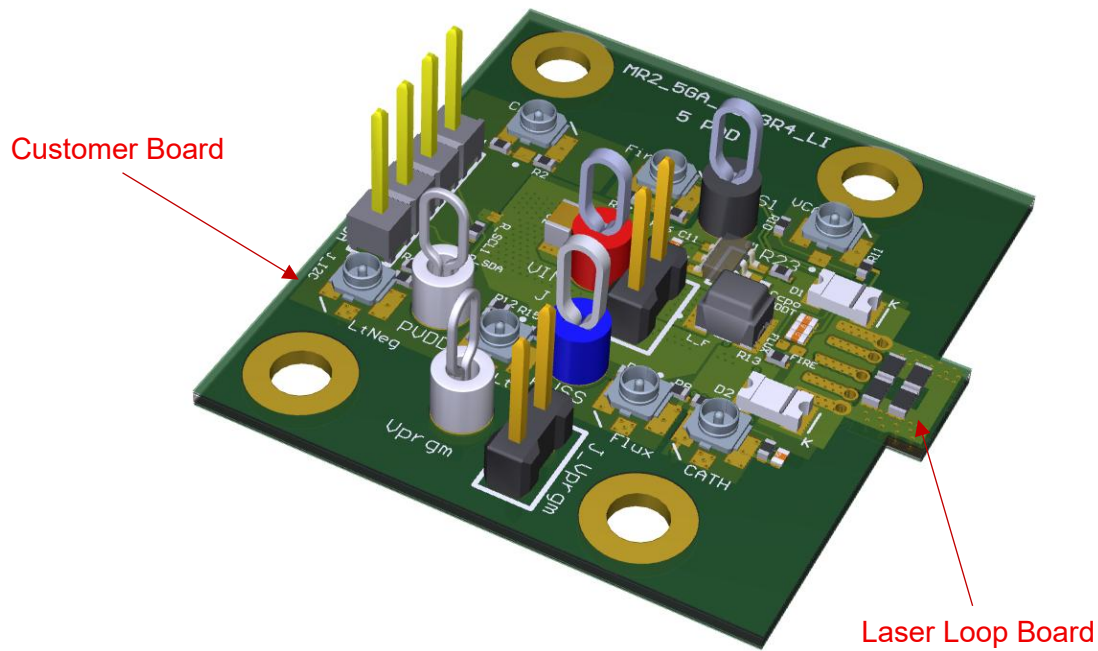


Figure 2. 3-D Picture of the Board

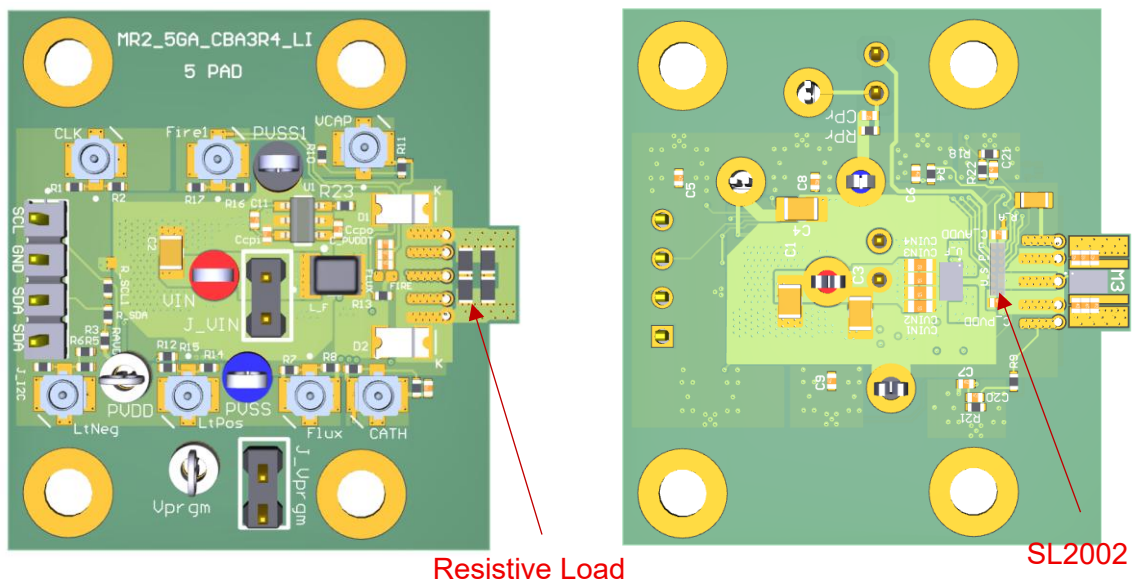


Figure 3. Top and Bottom View

Schematics and Layout

Figures 3 and 4 show the schematics of the Customer Evaluation board. There are two boards connected with the castellated vias. The larger board in Figure 3 is called Customer Board and the smaller board in Figure 4 is called Laser Loop Board

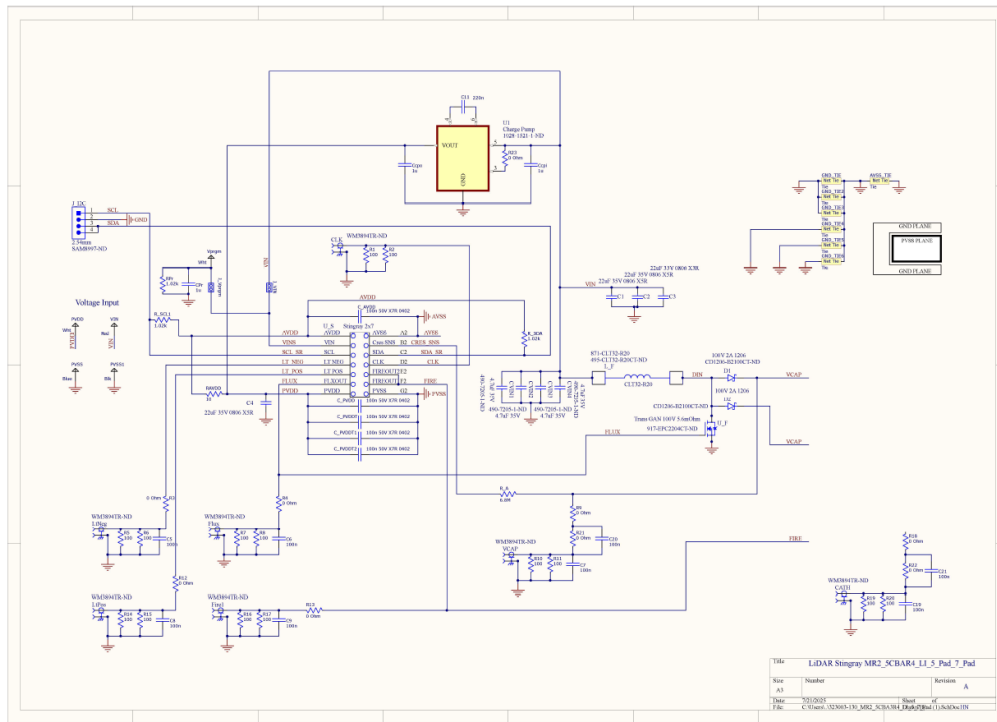


Figure 3: Schematics of the Customer Board

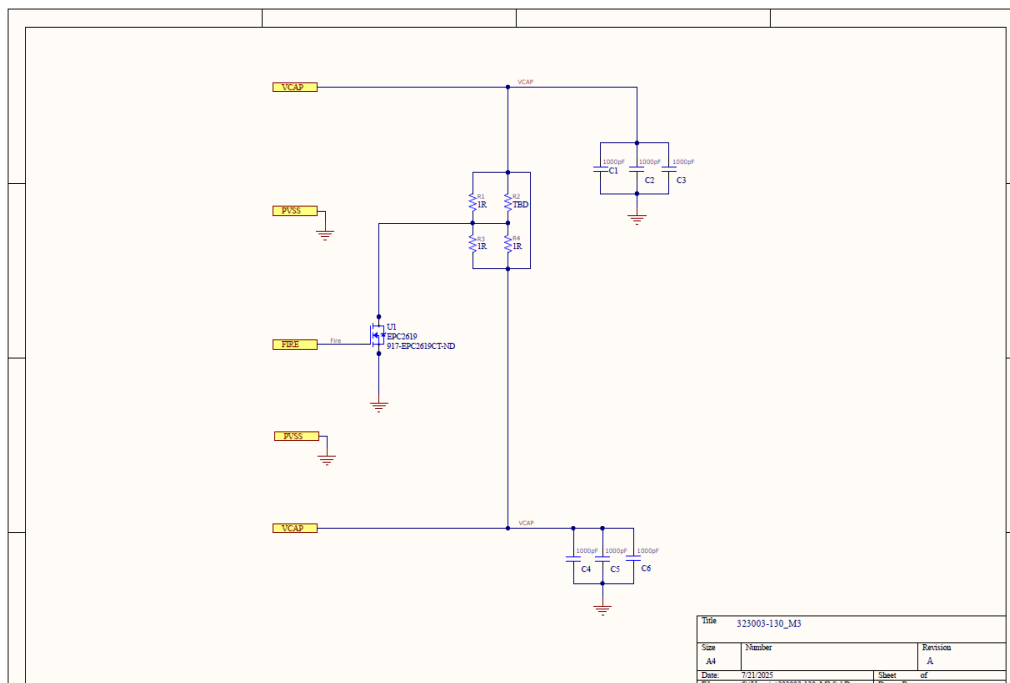


Figure 4: Schematic of the Laser Loop Board (M3)

Figures 5 and 6 show the layouts of the Customer Board (4 layers) and the Laser Loop Board (2-layers), respectively.

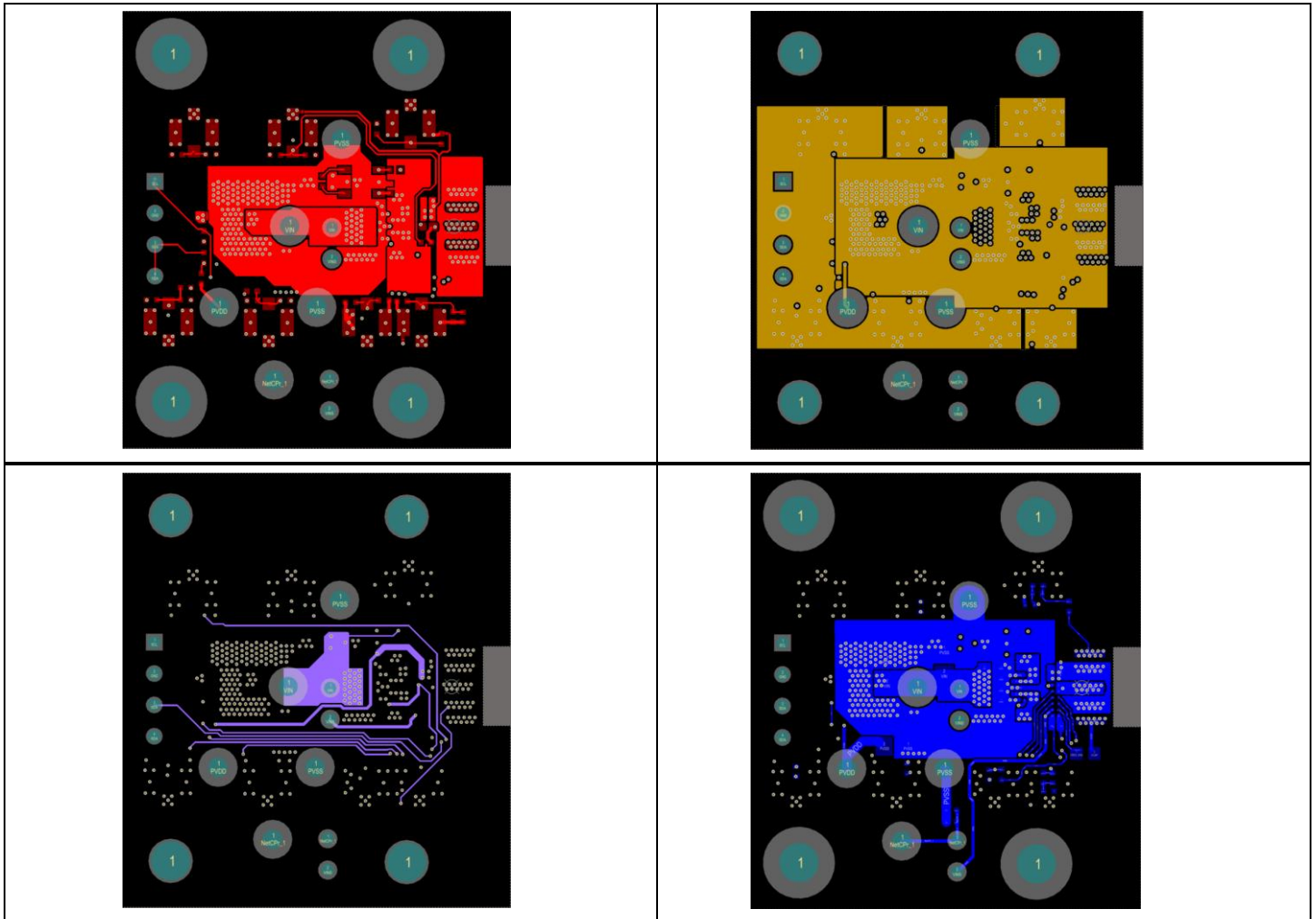


Figure 5: Layout of the Customer Board (4-layers)

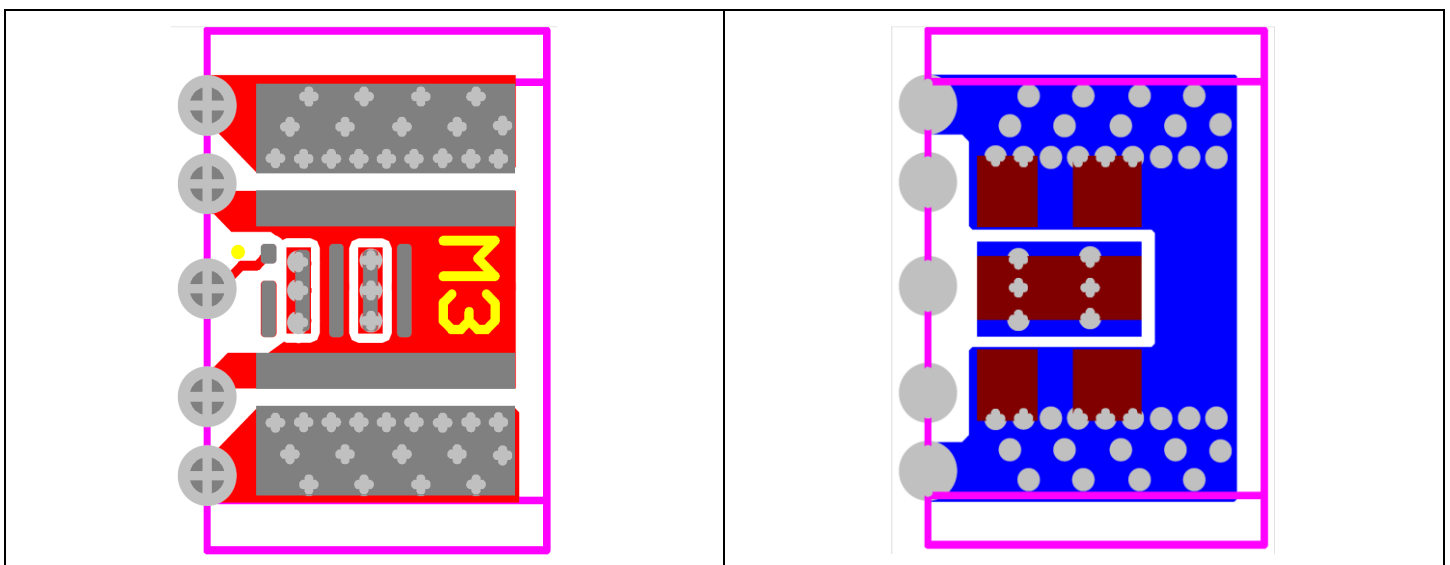


Figure 6: Layout of the Laser Loop Board (2-layers)

Bill of Materials (BOM)

MR2_5GA_CBA3R4_U_5_PAD BOM							
Designator	Description	MFR P/N	MFR Name	Distributor P/N	Distributor	Footprint	Quantity
C1, C2, C3, C4	CAP CER 22UF 35V X5R 0805	C2012X5R1V22M125AC	TDK Corporation	445-14428-1-ND	DigiKey	C0805	4
C5, C6, C7, C8, C9, C19, C20, C21		DNI				C0402 - HD	8
C11	CAP CER 220nF, 16V, X7R, 0402	C1005X7R1C224K050BC	TDK Corporation	445-5336-1-ND	DigiKey	C0402 - HD	1
C_AVDD, C_PVDD, C_PVDDT, C_PVDDT1, C_PVDDT2	CAP CER 0.1UF 50V X7R 0402	C1005X7R1H104K050BB	TDK Corporation	445-5332-1-ND	DigiKey	C0402 - HD	5
CATH, CLK, Fire1, Flux, LtNeg, LtPos, VCAP	CONN UMC RCPT STR 50 OHM SMD	0734120114	Molex	WM3894TR-ND	DigiKey	CONN UMC RCPT STR 50 OHM SMD	7
Ccp1, Ccpo, CPr	CAP CER 1uF, 35V, X5R, 0402	GRM155R6YA105KE11D	Murata Electronics	490-10019-1-ND	DigiKey	C0402 - HD	3
CVIN1, CVIN2, CVIN3, CVIN4	CAP CER 4.7UF 35V X5R 0603	GRM188R6YA475KE15D	Murata Electronics	490-7205-1-ND	DigiKey	C0603 - HD	4
D1, D2	DIODE SCHOTTKY 100V 2A 1206	CD1206-B2100	Bourns Inc.	CD1206-B2100CT-ND	DigiKey	D1206 - HD	2
J_12C	CONN HEADER VERT 4POS 2.54MM	TSW-104-07-F-S	Samtec Inc	SAM8997-ND	DigiKey	CONN HEADER VERT 4POS 2.54MM	1
J_VIN, J_Vprgm	CONN HEADER VERT 2POS 2.54MM	TSW-102-07-F-S	Samtec Inc	SAM10844-ND	DigiKey	Header - 1x2 - 100mil	2
L_F	440 nH Shielded Molded Inductor 10.1A 7.6mOhm 4-SMD	CLT32-R44	EPCOS-TDK Electronics	495-CLT32-R44CT-ND	DigiKey	IND_CLT32-R44	1
PVDD, Vprgm	PC TEST POINT MULTIPURPOSE WHITE	5012	Keystone Electronics	36-5012-ND	DigiKey	TP-WHT	2
PVSS	PC TEST POINT MULTIPURPOSE BLUE	5127	Keystone Electronics	36-5127-ND	DigiKey	TP-BLU	1
PVSS1	BLACK	5011	Keystone Electronics	36-5011-ND	DigiKey	TP-BLK	1
R1, R2, R5, R6, R7, R8, R10, R11, R14, R15, R16, R17, R19, R20		DNI				R0402 - HD	14
R3, R4, R9, R12, R13, R18, R21, R22, R23	RES 0 OHM JUMPER 1/16W 0402	RC0402JR-070RL	Yageo	311-0.0JRCT-ND	DigiKey	R0402 - HD	9
R_A	Thick Film Resistors - SMD 0603 6.8Mohm 1% Anti Surge AEC-Q200	ESR03EZPF6804	Rohm Semiconductor	755-ESR03EZPF6804	Mouser Electronics	C0603-HD	1
R_SCL1, R_SDA, RPr	RES 1K OHM 5% 1/16W 0402	RC0402JR-071KL	Yageo	311-10KJRCT-ND	DigiKey	R0402 - HD	3
RAVDD	RES 10 OHM 1% 1/16W 0402	RC0402FR-0710RL	Yageo	311-10.0.0LRCT-ND	DigiKey	R0402 - HD	1
U1	IC LED DRVR RGLTR PWM SOT23-6	RT9361AGE	Richtek USA Inc.	1028-1521-1-ND	DigiKey	SOT23-6	1
U_F	TRANS GAN 100V DIE 5.6MOHM	EPC2204	EPC	917-EPC2204CT-ND	DigiKey	EPC2204 GaN	1
U_S	Integrated Resonant Mode Laser Diode Drive System	SL2001	Silanna	SL2001	Silanna	Stingray_2x7	1
VIN	PC TEST POINT MULTIPURPOSE RED	5010	Keystone Electronics	36-5010-ND	DigiKey	TP-RED	1
M3 Laser Loop Board BOM							
Designator	Description	MFR P/N	MFR Name	Distributor P/N	Distributor	Footprint	Quantity
C1, C2, C3, C4, C5, C6	CAP CER 1000PF 100V COG/NP0 0402	GRM1555C2A102GE01D	Murata Electronics	490-GRM1555C2A102GE01DTR-ND	DigiKey	C0402	6
U1	TRANS GAN 100V .0042 OHM 6LGA	EPC2619	EPC	917-EPC2619CT-ND	DigiKey		1
R1, R2, R3, R4	RES 1 OHM 1% 1/10W 0603	MCT06030C1008FP500	Vishay Beyschlag	Toronto - 800W 905nm VCSEL	Osram	R0603	4

Table 2: Bill of Materials

Test Set-up

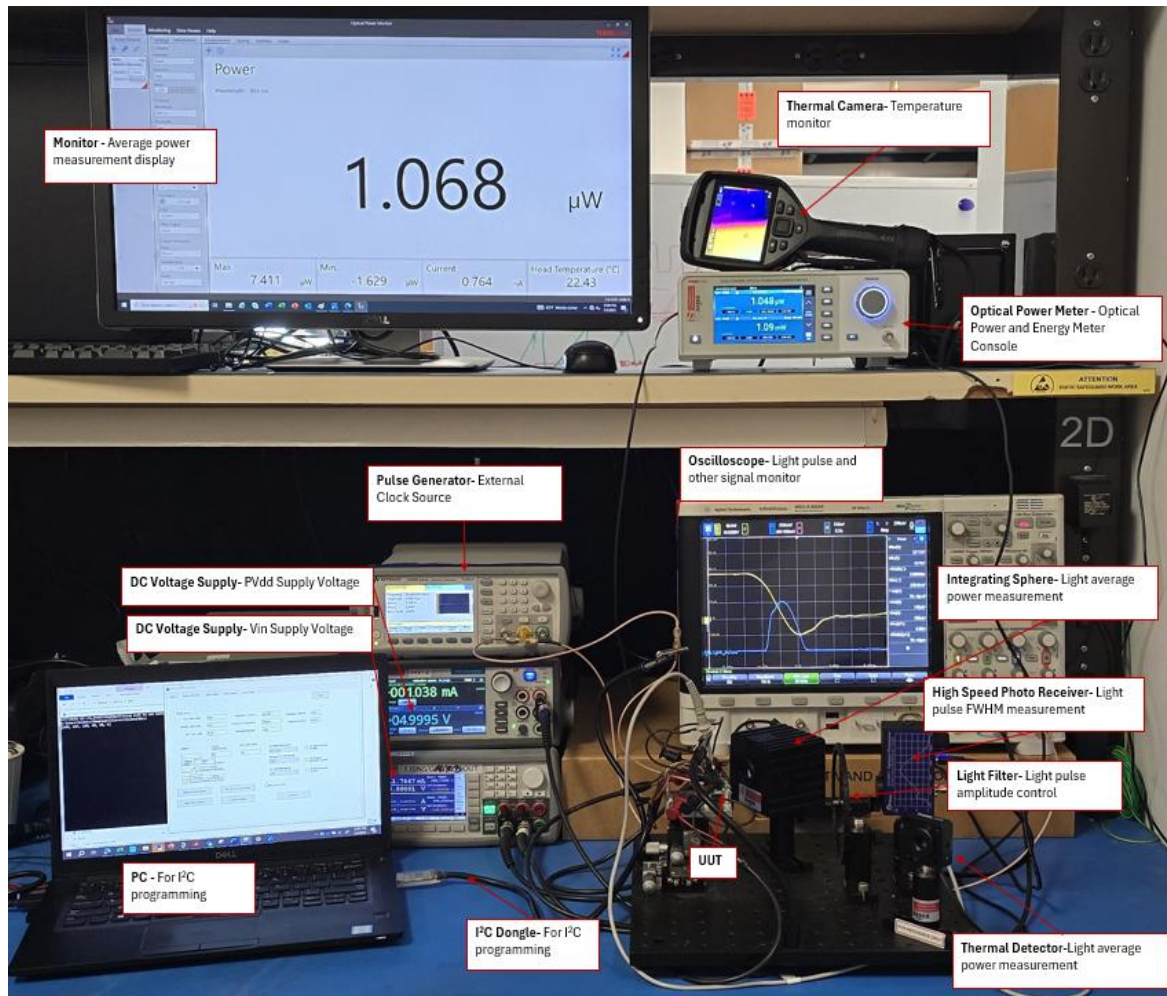


Figure 7. Standard Test Set-up

Equipment	Description/Model/Setting
Oscilloscope	Agilent Technologies MSO-x 6004 Data Acquisition Setting: Averaging 1024 ; 6GHz ; 10.0Gsa/s
Oscilloscope Probe	Agilent N2894A
Optical Power Meter	Thorlabs PM5020
Integrating Sphere	Thorlabs S142C
Optical Receiver	iCHaus iC212NST High-Speed Photo Receiver
Pulse Generator	Keysight 33500B Series Wave Generator
DC Voltage Supply, Vin	Keysight B2912A Precision Source/Measure Unit

Table 3: List of Equipment Used

Performance Data

This section provides details about the GUI settings and the corresponding Test Results from the evaluation board using the default settings. The SL2002 on this evaluation board is preprogrammed with MTP (multi-time programmable) memory that is common to all SL2002 evaluation boards. Below is the performance data of the board with the default Timing Setting at different input voltages.

Parameters	Test Data Summary			
Vin	5.00	3.00	2.80	V
Cres	75.92	46.86	43.76	V
Clock frequency	10.00	10.00	10.00	kHz
Vorload_Max	41.20	29.12	27.10	V
Peak Current	161.62	113.96	106.04	A
FWHM	3.54	3.34	3.33	ns

Table 4: Summary of Test Result (Default Timing Setting)

Below is the recommended Fault Config Setting in the GUI when evaluating this evaluation board.

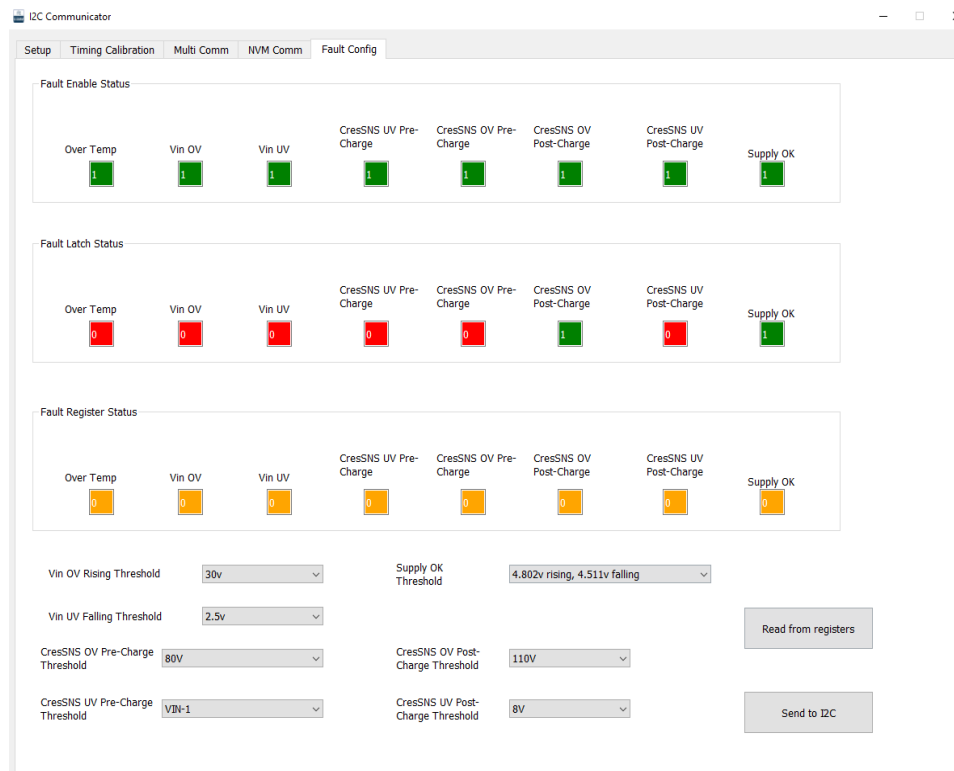


Figure 8: Fault Config Set-up

Vin = 5V

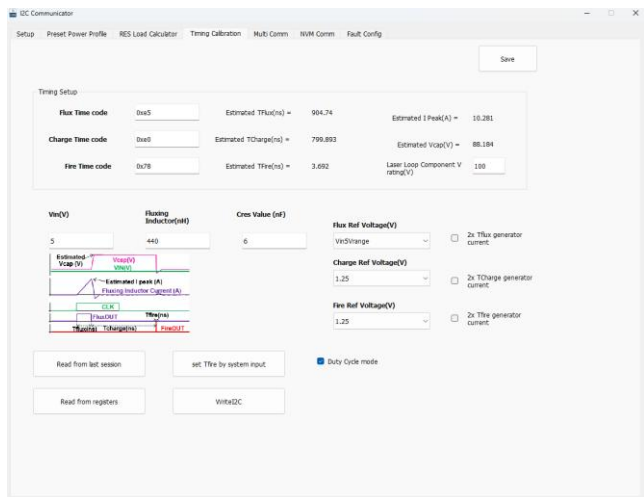


Figure 9: Timing Calibration Initial Readout

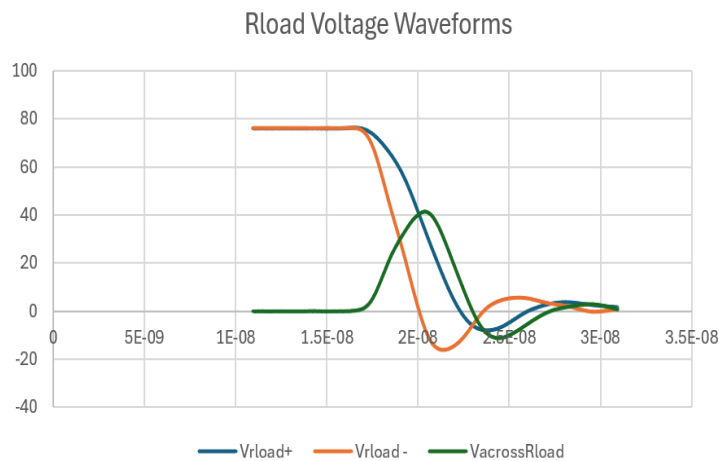


Figure 10: Rload Voltage

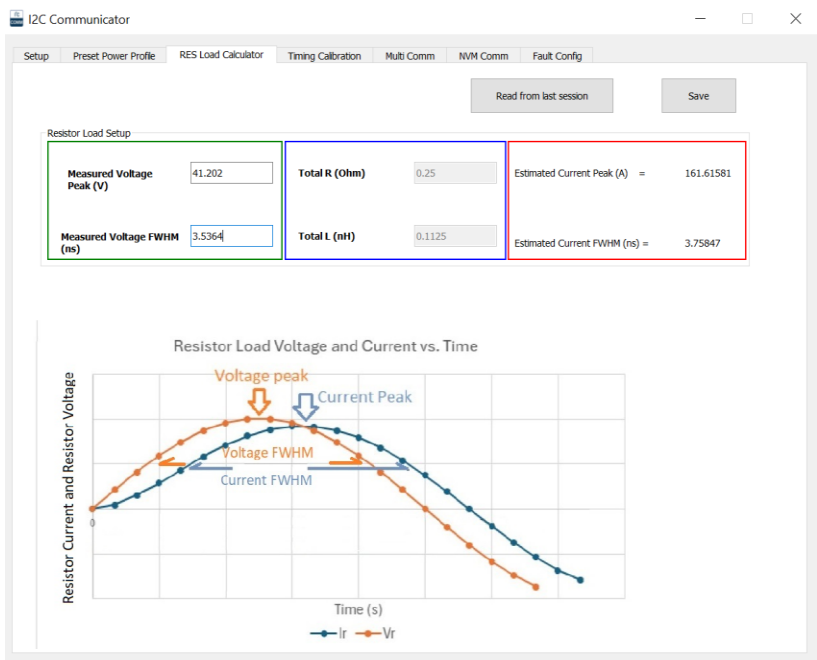


Figure 11: Estimated Current Peak (GUI image)

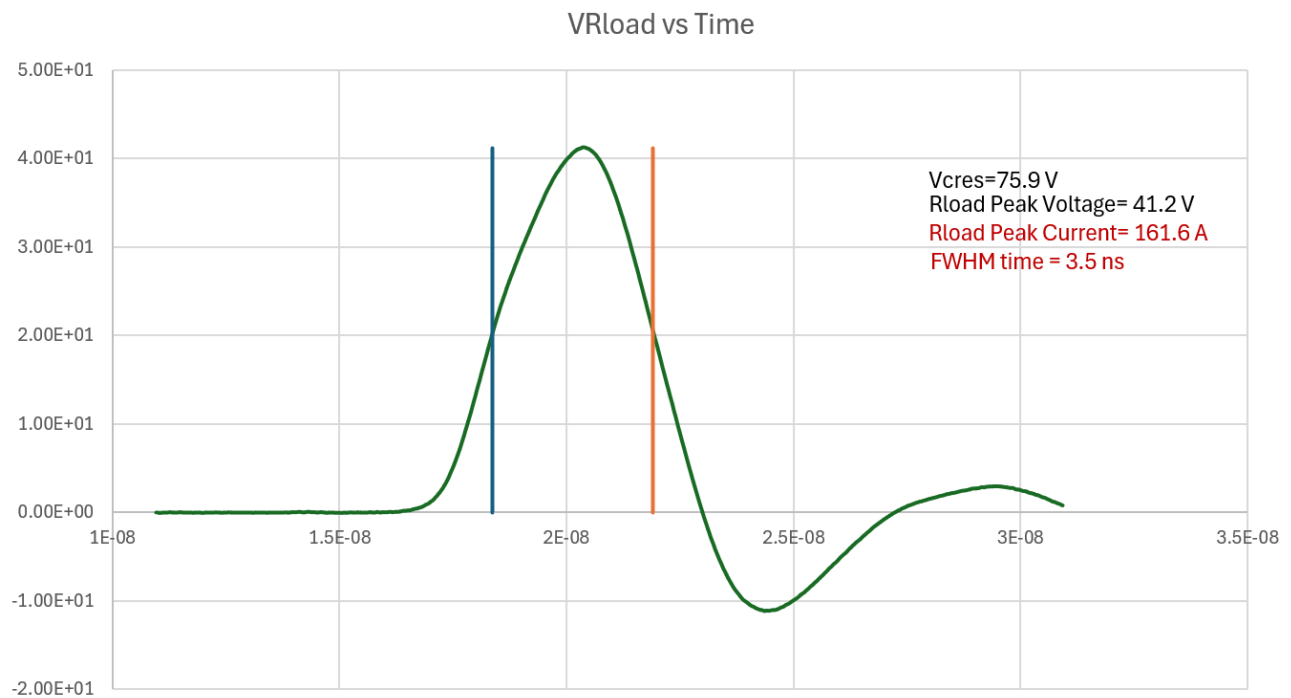


Figure 12: Voltage across Rload vs Time Curve (Default Timing)

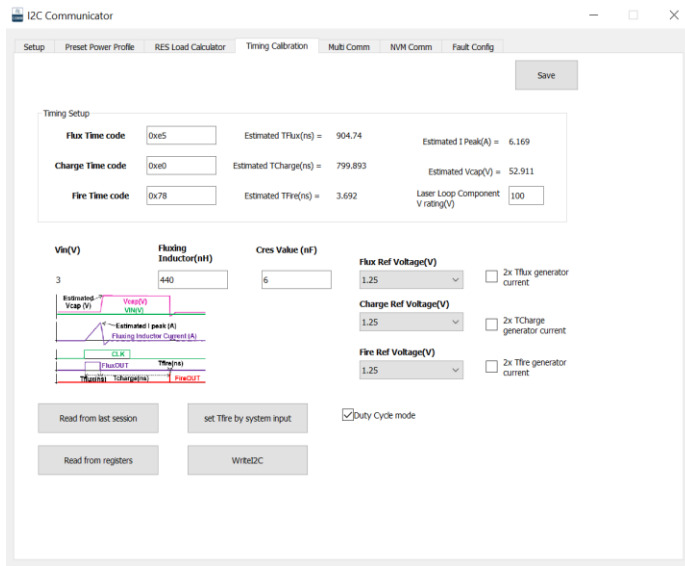
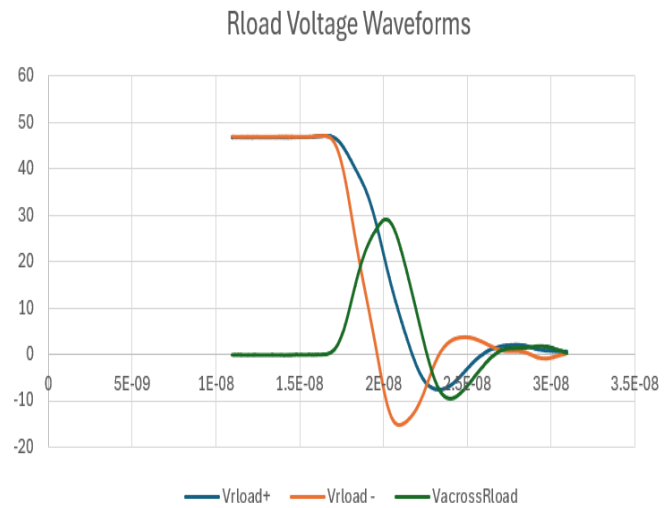
$V_{in} = 3.0V$ Figure 13: Timing Calib Setting 5V V_{in} and 30V V_{Cres} 

Figure 14: Rload Voltage

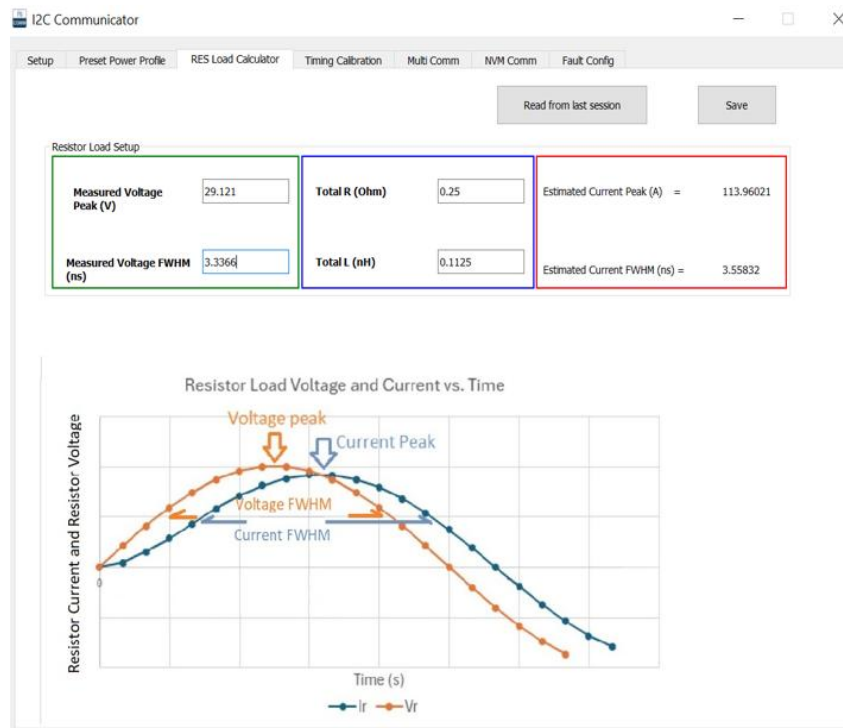


Figure 15: Estimated Current Peak (GUI image)

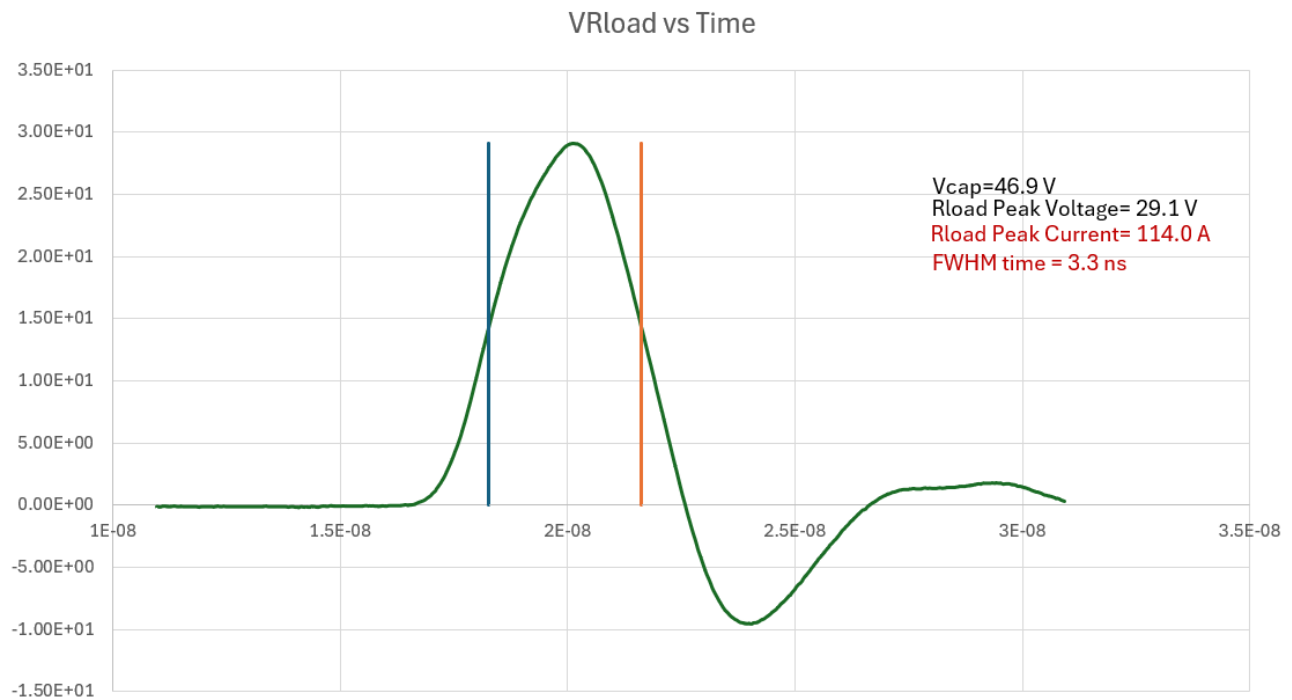


Figure 16: Voltage across Rload vs Time Curve

$V_{in} = 2.8V$

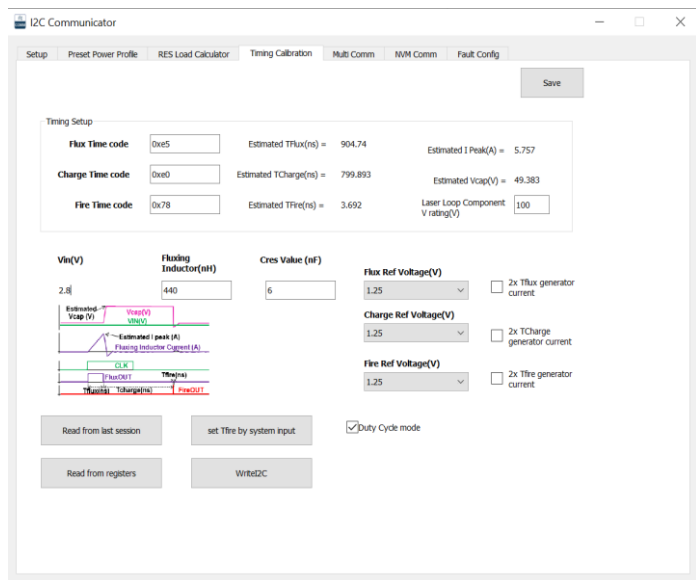


Figure 17: Timing Calib Setting 3V V_{in} and 30V V_{Cres}

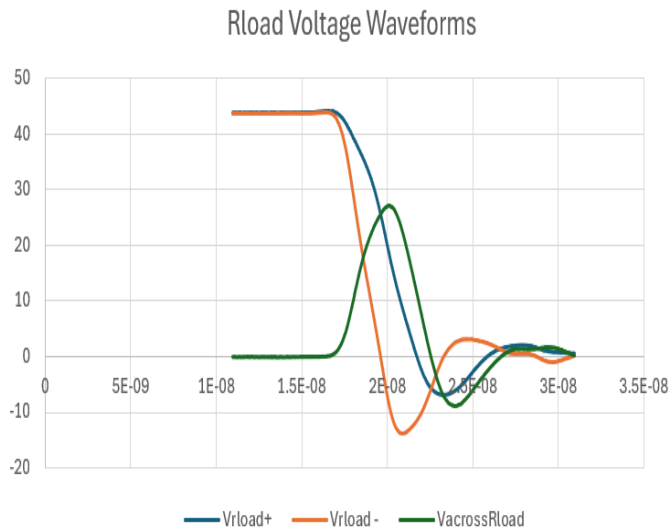


Figure 18: Rload Voltage

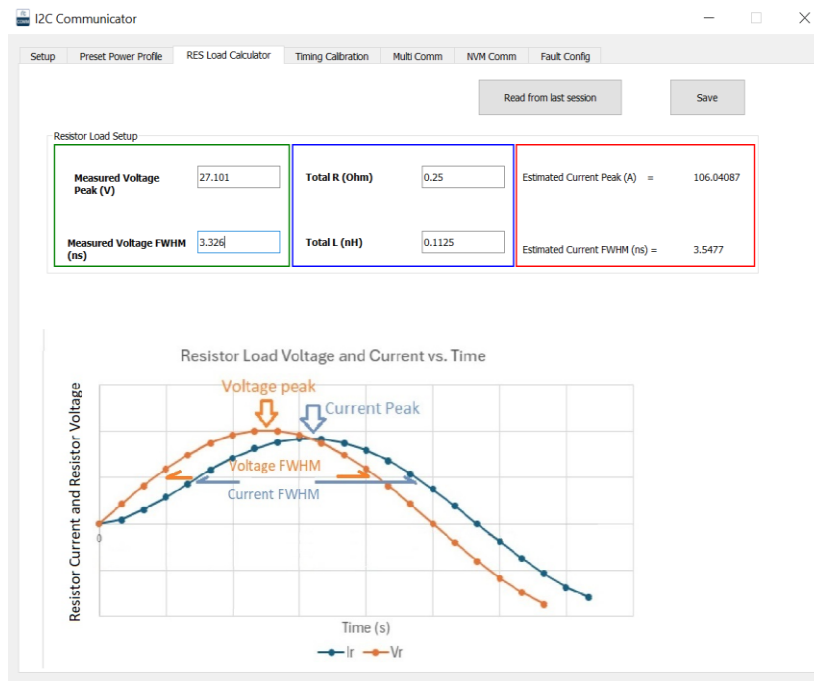


Figure 19: Estimated Current Peak (GUI image)

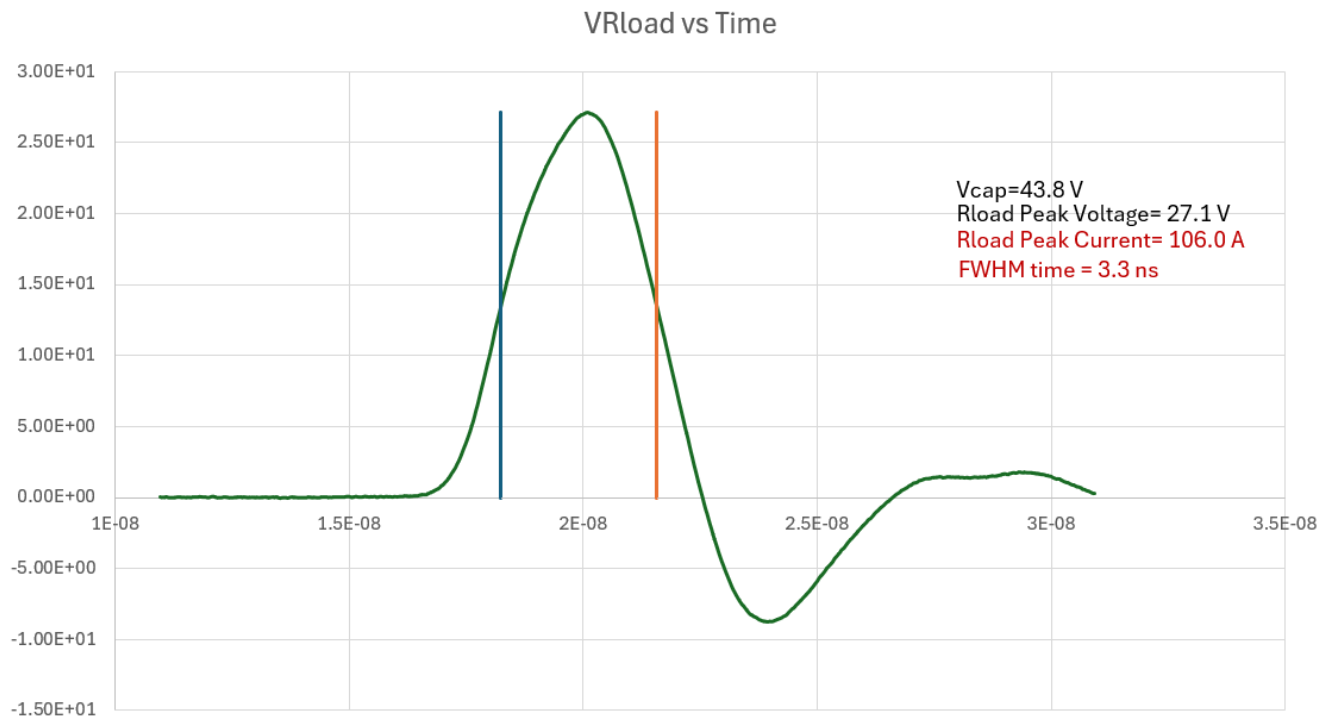


Figure 20: Voltage across Rload vs Time Curve

Summary and Conclusions

This application note provides detailed description of the 400W Resistor Load Evaluation Board using SL2002 including the test results for various GUI settings. Silanna's Application and Marketing team would encourage the customers to go through this Application Note and try duplicating at least some of the tests shown here, to ensure the board is functioning properly. This will also familiarize the user with the evaluation board hardware and the GUI software. In case of any questions or concerns, please contact Silanna Semiconductor's Application team (bcabico@silanna.com).

Revision History

Revision	Date	Author	Note
0.1	21 Jul 2025	BGC	Draft release.
0.2	25 Aug 2025	BGC	Revised
1.0	26 Aug 2025	BGC/ AZ	Document Control Release