



*LOAD***SLAMMER**

LoadSlammer 1100 User Guide

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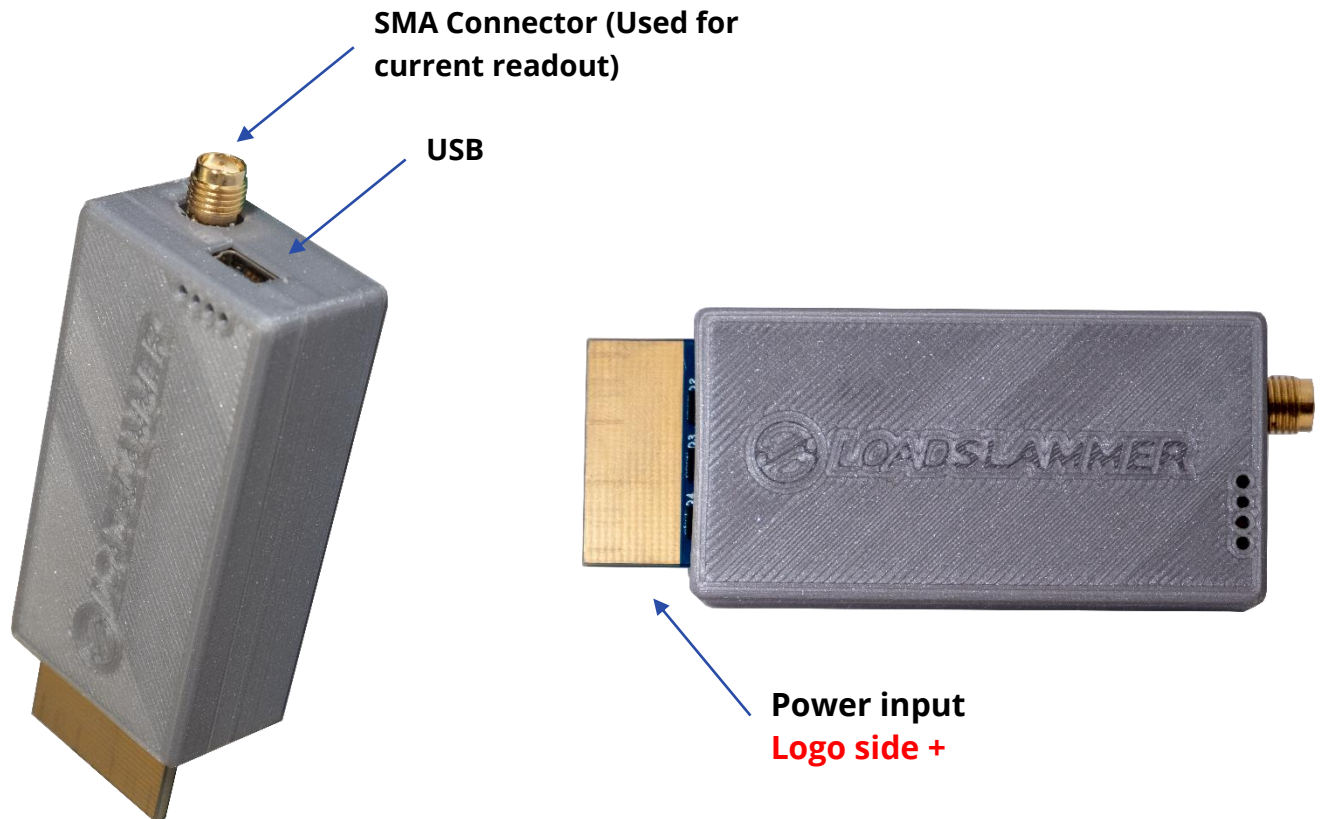
2 INTRODUCTION

2.1 OVERVIEW

The LoadSlammer™ is used to test high transient high current loads as seen in CPU, GPU, FPGA, and ASIC power profiles. It is designed to be easy to use with a GUI and current sense output. The Bootloader feature ensures your ability to obtain firmware updates.

Powerful 3D graphing tools with adjustable controls allows you to set the parameters you want. The LS1100 stores the results into onboard memory where it can be downloaded to your PC in a CSV format..

2.2 HARDWARE



2.3 SPECIFICATIONS LS1100

Slew Rate (11 selectable settings) <u>Soldered in</u> LoadSlammer 50 A/μS – 1000 A/μS ^{3,4}	1. 50-65 2. 100-185 3. 150-270 4. 200-370 5. 260-390 6. 335-470 7. 400-573 8. 500-640 9. 610-750 10. 650-850 11. 650-1000	A/μS	
Slew Rate (11 selectable settings) <u>Molex connector</u> in LoadSlammer 50 A/μS – 500A/μS ^{3,4}	1. 47-65 2. 100-170 3. 150-270 4. 200-360 5. 250-380 6. 335-470 7. 400-565 8. 480-605 9. 490-590 10. 500-650 11. 520-770	A/μS	
Current (5A increments)	30-120	A	
Frequency Range (100 Hz steps) ¹	100 – 2500	Hz	
Duty Cycle (0.25% steps) ²	Active window is divided into 16 steps Actual duration is based on frequency	%	
Input Voltage	0.70 – 2.5V	V	
Current Sense Output	Conversion Ratio	100	A/V
	Max Current	120	A
	Bandwidth	10	MHz
	Accuracy	10	%
Voltage Readout	Sample Rate	10	MSPS
	Accuracy	1	%
Current Readout	Sample Rate	10	MSPS
	Accuracy	10	%
Protection Thresholds	Over Voltage	2.7	V
	Over Current	130	A
	Over Temperature	80	°C
Average Power Dissipation	3	W	
Peak Power Dissipation (instantaneous)	300	W	
Connector (optional)	Molex 45719-0007		
GUI	The GUI was developed on Windows 10 with Chrome web browser version 61 and newer.		
Non-Isolated	LoadSlammer™ must be used with a regulator that has a ground earth reference and positive voltage.		
Frequency Sweep	20Khz – 1MHz		

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3.1 PHYSICAL CONNECTION TO DUT

3.1.1 Placement Location

Placement of the LoadSlammer™ on the DUT (Device Under Test) is crucial. For best results, place the LoadSlammer™ as close to the load as possible to include the parasitic impedance of the PCB traces. Placing the LoadSlammer™ right near the output of the regulator doesn't adequately test the output filtering due to the lack of parasitic impedance in the PCB from regulator to load.

Do not connect the LoadSlammer51™ using wires. This increases the impedance of the system which prevents high slew rates.

3.1.2 Connector vs Soldering

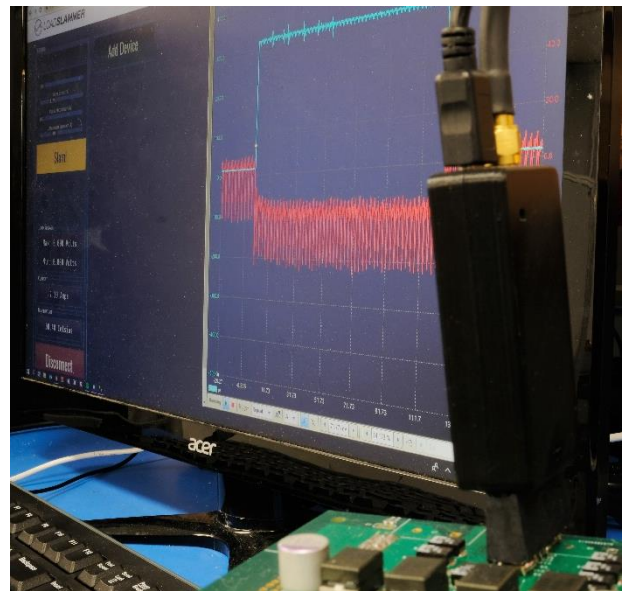
Using a connector provides ease of use and reduces wear on the PCB but adds inductance and resistance to the power path. These factors may limit your maximum slew rate.

Soldering directly to the PCB helps minimize inductance which can provide a cleaner signal and a faster slew rate

To solder a slammer to the DUT, find a large ground and power plane butting up to each other, scrape some solder mask off, then solder it down with copper braid. Alternatively, if your PCB has many ceramic capacitors in a row, it's possible to solder directly over them.

3.1.3 Thermal Considerations

While not strictly required, a fan moving air over the LoadSlammer™ will allow for higher duty cycles. The Over Temperature feature is set to 80° C, at which point it will automatically turn off and alert the user both through the GUI and a red LED on the LoadSlammer™ board. To reset the OTP (Over Temperature Protection), you need to disable the output then reenable it.



Note: For optimal performance when using a connector, ensure that the LoadSlammer™ is firmly seated and that the connector socket is clean. Failure to ensure a good connection can impact your test results.

3.2 LOADSLAMMER™ GUI

3.2.1 Connecting to your LoadSlammer™

First, make sure a USB cable is connecting the slammer to a PC/laptop and the computer has Google Chrome installed. No drivers are necessary. Simply load up <https://guipower.com/>, click connect, and choose the LoadSlammer model you are using.

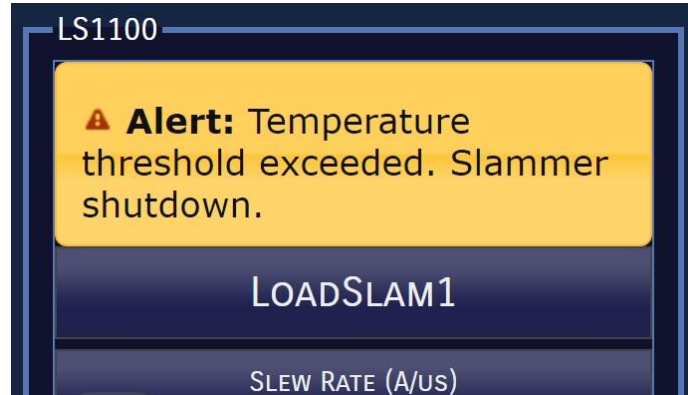
3.2.2 GUI Overview

The screenshot shows the LS1100 GUI interface. It features a dark blue background with white text and controls. At the top, it says 'LS1100'. Below that is a section for 'ENTER SLAMMER LABEL'. The main control area includes sliders for 'SLEW RATE (A/US)' (set to 50), 'DUTY CYCLE (%)' (set to 2), 'PULSE FREQUENCY (Hz)' (set to 1500), and 'MAXIMUM CURRENT (A)' (set to 120). There are three buttons: 'Slam!', 'Frequency Sweep: Off', and '3D Sweep'. Below these are readout sections for 'LOAD VOLTAGE' (Max: 0.987 Volts, Min: 0.977 Volts), 'CURRENT' (1.66 Amps), and 'TEMPERATURE' (34.39 Celsius). At the bottom is a large red 'Disconnect' button and the serial number 'SERIAL #:SL112C-DEVSLA1'. Blue arrows point from each of these elements to descriptive text on the right.

- Label your slammer to easily identify it
- Slamming controls**
Adjust slew rate, current, duty cycle, and frequency of slamming
- Output enable button
- Frequency Sweep Control
- 3D Sweep Control
- Status readout from slammer**
Voltage Overshoot & Undershoot
Current Readout
Temperature Readout
- Connection button & serial number

3.2.3 Protection Features

The LoadSlammer™ has built in protection to prevent over temperature, over voltage, and over current events. In the case of an overload event, the output is automatically turned off, and a warning is displayed. To re-enable the slammer, simply enable the output again.



3.2.4 Testing with multiple LoadSlammers™

It is possible to use the LS1100 and other slammers at the same time to test different voltage rails.

(Need to insert paragraph/ section number here) Frequency Sweep

A frequency Sweep test can identify changes in the frequency response of the circuit and approximate phase margin. Very fast slew rates can provide useful information regarding the regulator output decoupling solution.

To activate the function, simply set the current slider to the desired level, and press the "Frequency Sweep" button during testing.

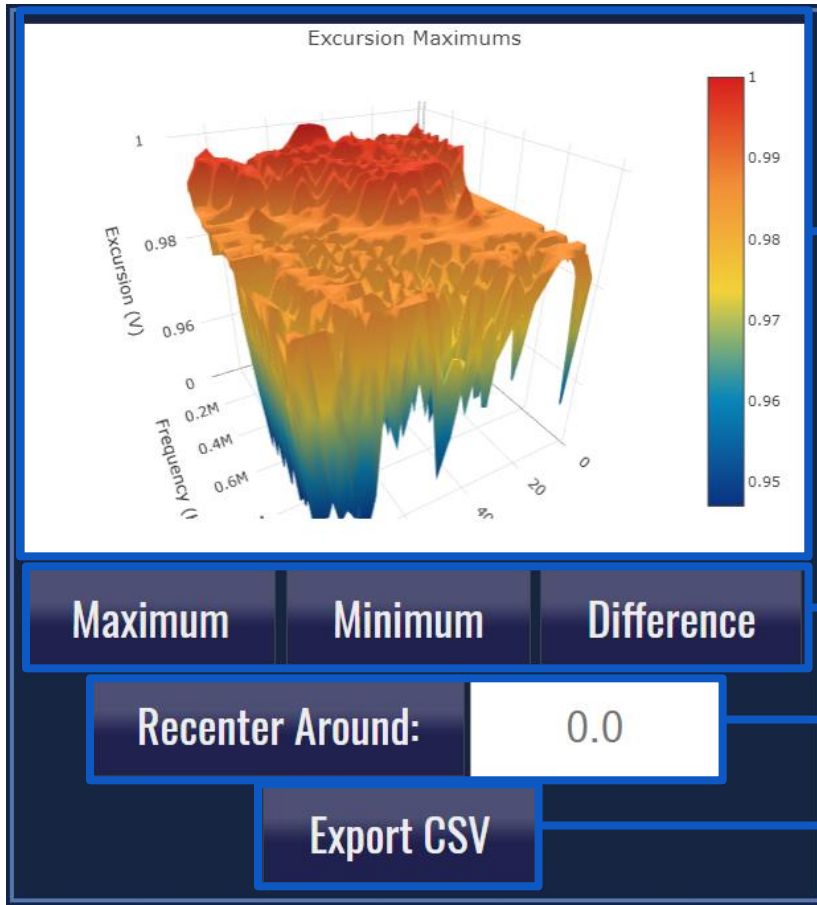
3.2.5 LoadSlammer™ 3D Sweep

The LoadSlammer™ 1100 can rapidly pulse through a variety of frequencies and duty cycles to give an in-depth picture of the frequency response of a circuit. Modern Switching regulators utilize control architectures that must be tested with exhaustive frequencies and duty cycles. To use, simply select the desired target current and click the "3D Sweep Button". In 5 seconds, pulses ranging from 1 MHz to 20 kHz at duty cycles between 1-90 % will be tested, and the data will be accumulated by the GUI and presented as an intuitive 3D surface plot with an option to export the raw data in an easy to import CSV file.

Frequencies tested are done in 20 kHz increments going from 20 kHz to 1 MHz Duty cycles begin at 1%, then test from 5% to 90% in 5 % increments. Each combination is tested for a full 526 microseconds.

If you need additional functionality or help with integration contact us.

3.2.6 3D Plot Controls



3D Data Plot

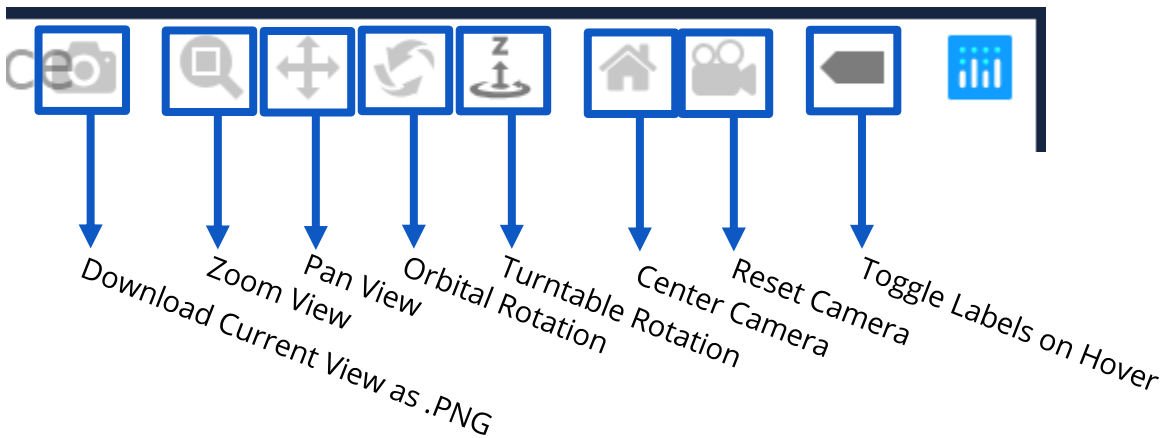
Mouse over to see the data at any point, click and drag to move viewpoint, mouse wheel to zoom.

View Controls

See data Maximums, Minimums, or the Difference of the two.

Recenter Data Control & User defined value field.

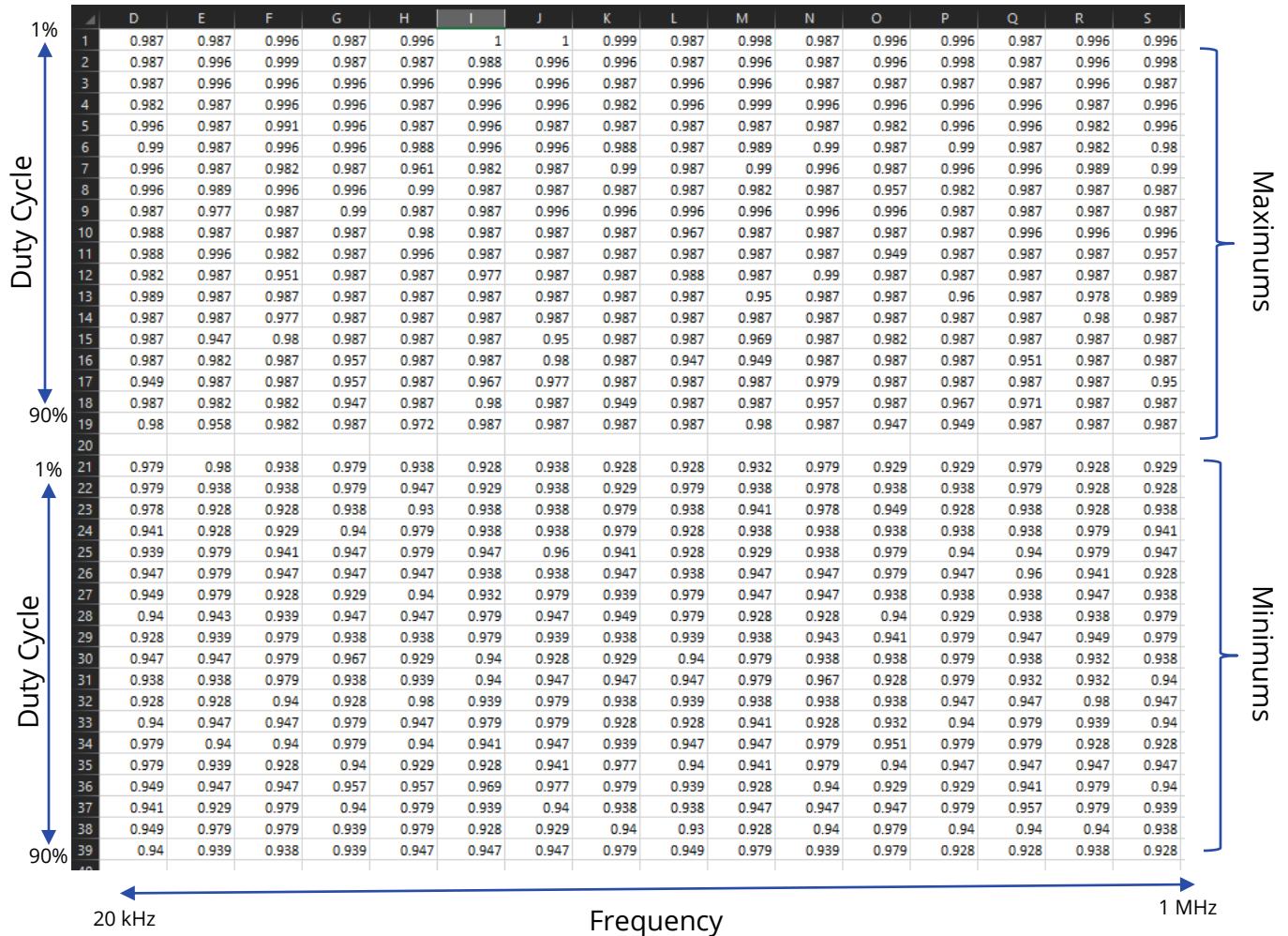
Export Data Control.



3.2.7 Data storage and CSV output

CSV Export capability allows for the easy importing of acquired data into a variety of other applications for analysis.

3.2.8 CSV Formatting



4 OPERATION

Use the following steps to get started with the LoadSlammer™:

1. Make sure system is powered off
2. Install LoadSlammer™ unit onto DUT (Device Under Test)
Note: Make sure you observe proper polarity. The case has polarity marked with + and GND
3. Connect USB cable from LoadSlammer™ to PC
4. Attach current output of LoadSlammer™ to an oscilloscope channel set to 1M Ω input impedance (optional)
5. Adjust the current output to rest at 0 V
6. Connect to LoadSlammer™ through the GUI
7. Turn on DUT and verify voltage read from GUI is correct
8. Adjust GUI parameters to desired values
9. Hit the “Slam!” button to start slamming
10. Use appropriate conversion ratio on current monitor output (see table).

4.1 TEST EQUIPMENT SETUP

4.1.1 Oscilloscope

The current output has an offset of a few mV, so it should be zeroed out before taking measurements. Also make sure the input impedance is set to 1M Ω .

4.1.2 External DC Load

An external DC load unit can be connected to the DUT to keep the VR from entering power saving modes. A DC load may also simulate a more real-world scenario. Load stepping from 20A – 70A will show how the converter responds with a light load already applied.

5 CHANGE HISTORY

Revision Number	Date	Reason for change
1.0	December, 2018	Initial Release
1.1		Not used
1.2	February 15, 2019	General update of text, pictures and explanations applicable to all sections.

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Офис по работе с юридическими лицами:

105318, г.Москва, ул.Щербаковская д.3, офис 1107, 1118, ДЦ «Щербаковский»

Телефон: +7 495 668-12-70 (многоканальный)

Факс: +7 495 668-12-70 (доб.304)

E-mail: info@moschip.ru

Skype отдела продаж:

moschip.ru

moschip.ru_4

moschip.ru_6

moschip.ru_9