Pre-Compliance Load Dump Simulator

1 Introduction

The TBLDS1 is a Load Dump Simulator for Pre-Compliance applications.
Load dump pulses, according to the standards ISO 7637-2, ISO 16750-2 and J2139 are among the most demanding transients that automotive electronic systems must survive without damage.
The TBLDS1 is an affordable device aimed at design engineers who do not want to spend in standard compliance load dump simulators but still require a tool to ensure that their circuits are ready for submission to the test house.



Picture 1: TBLDS1 front view

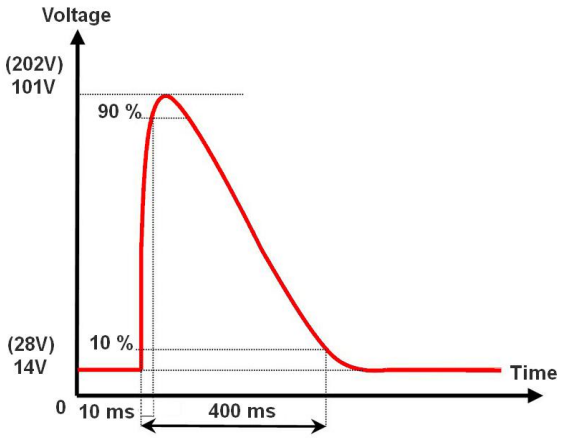
2 Specification

Rise time:	adjustable; typ. 100 µs – 10 ms
Fall time:	adjustable; typ. 700 ms – 1s
Pulse:	single pulse or five pulses at 10-second intervals
Ri:	2 Ohm
EUT current:	3 A max. in a 12 V system; 1.5 A max. in a 24 V system
EUT voltage:	external power supply required; +14 V or +28 V
Transient supply:	external power supply required; +230 V max.
TBLDS1 supply:	internal galvanically isolated supply, powered via USB-C port note: USB-C supply not included
Dimensions:	L x W x H 19 cm x 22 cm x 8 cm
Weight:	900 g

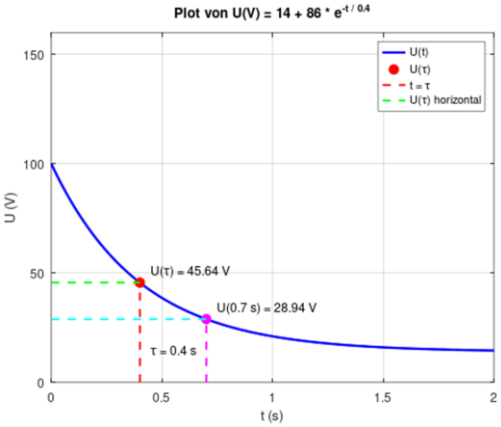
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3 Pulse form

ISO 7637-2 pulse form:

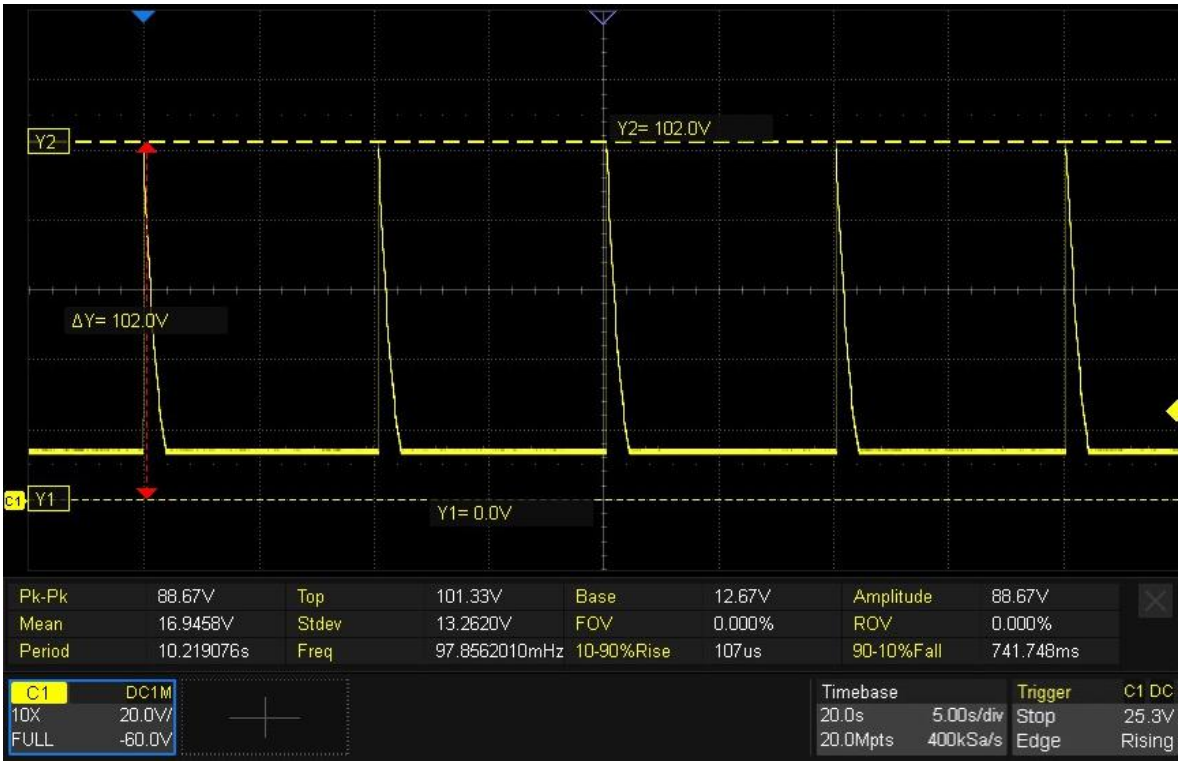


J2139 pulse form; 12 V system:
Rise time: 100µs



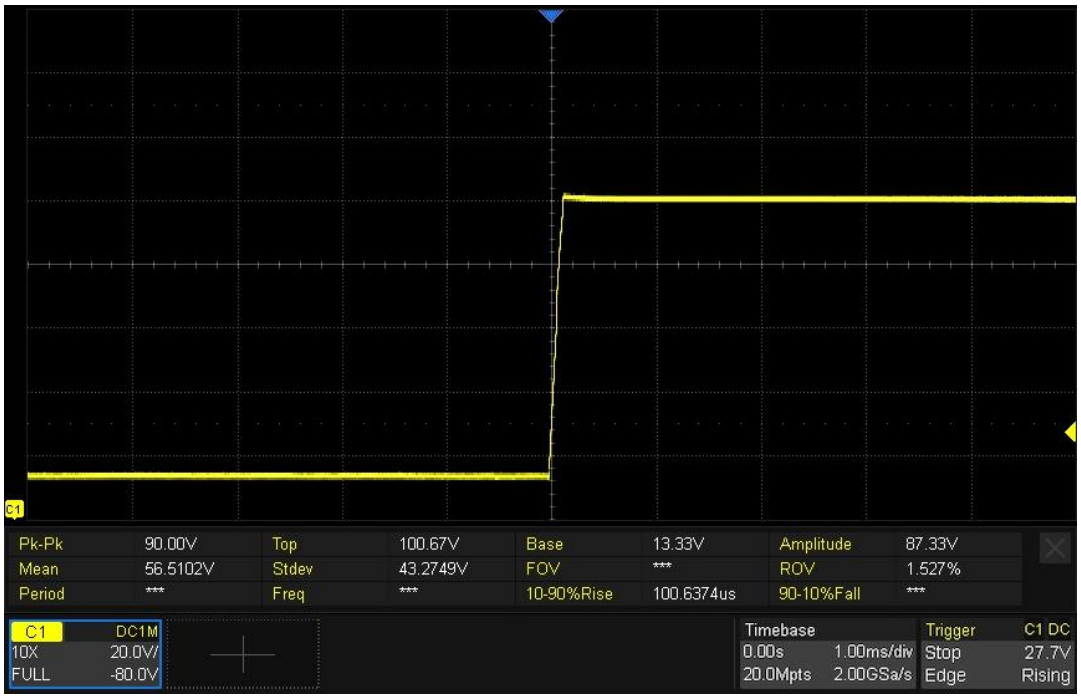
<u>J2139 transient characteristics:</u>
Rise time: 100 µs
Repetition: 5 pulses at 10 second intervals

Equation 12 V system: $14+86e^{(-t/0,4)}$
Equation 24 V system: $28+122e^{(-t/0,4)}$

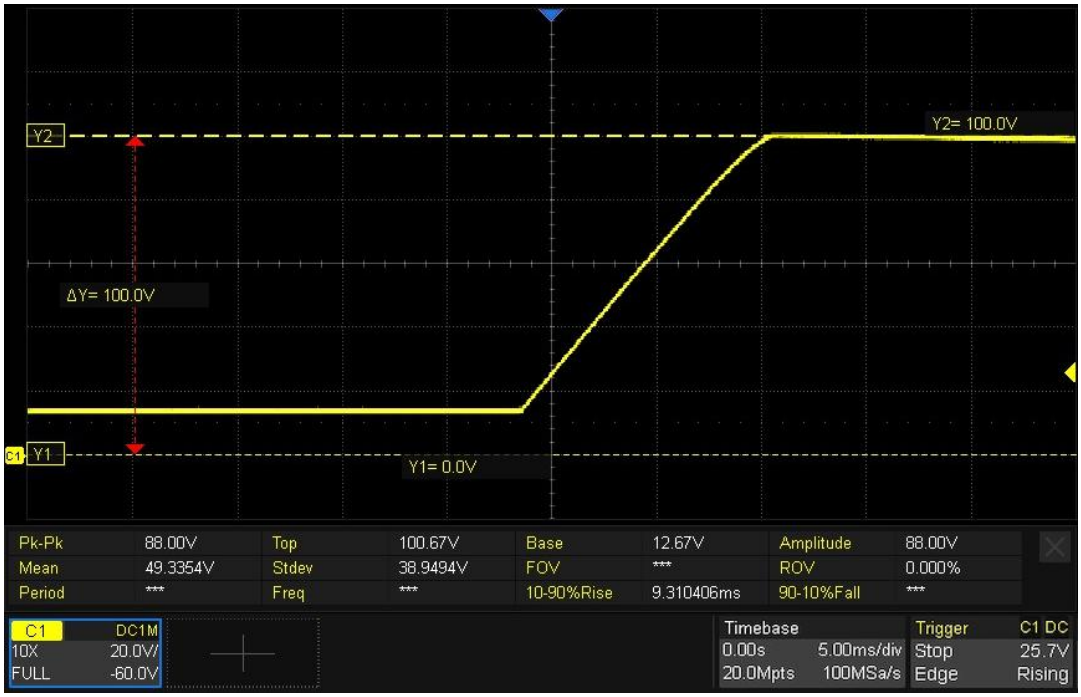


TBLDS1, Pulse train, 5 s / DIV

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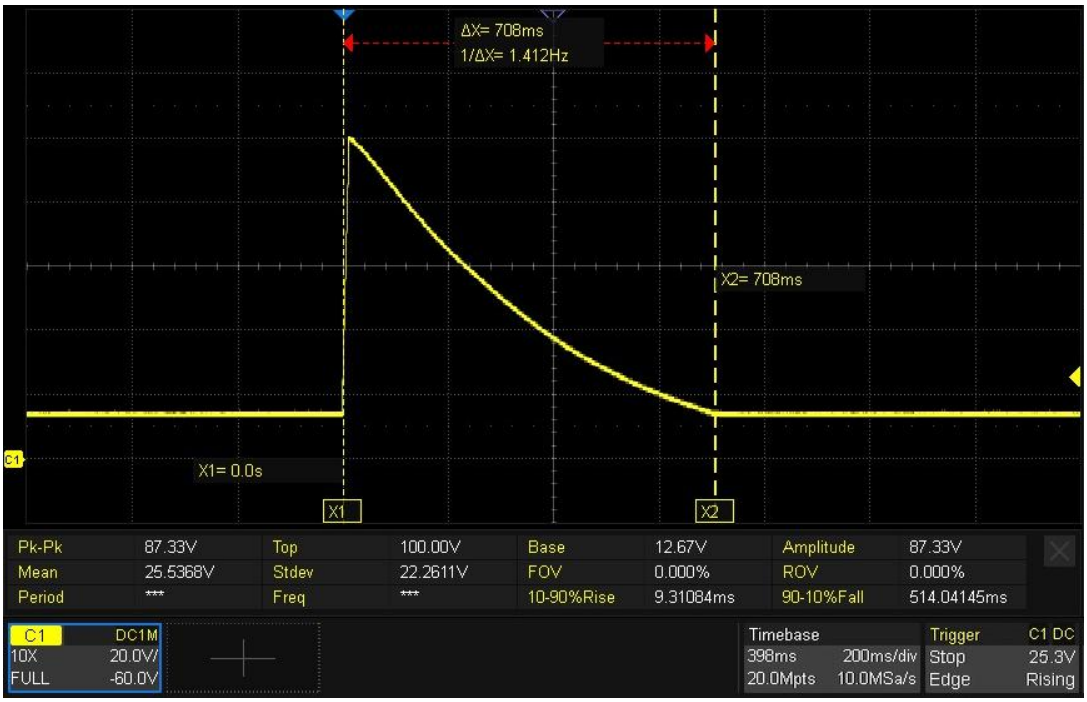


TBLDS1 minimum rise time, 1 ms / DIV

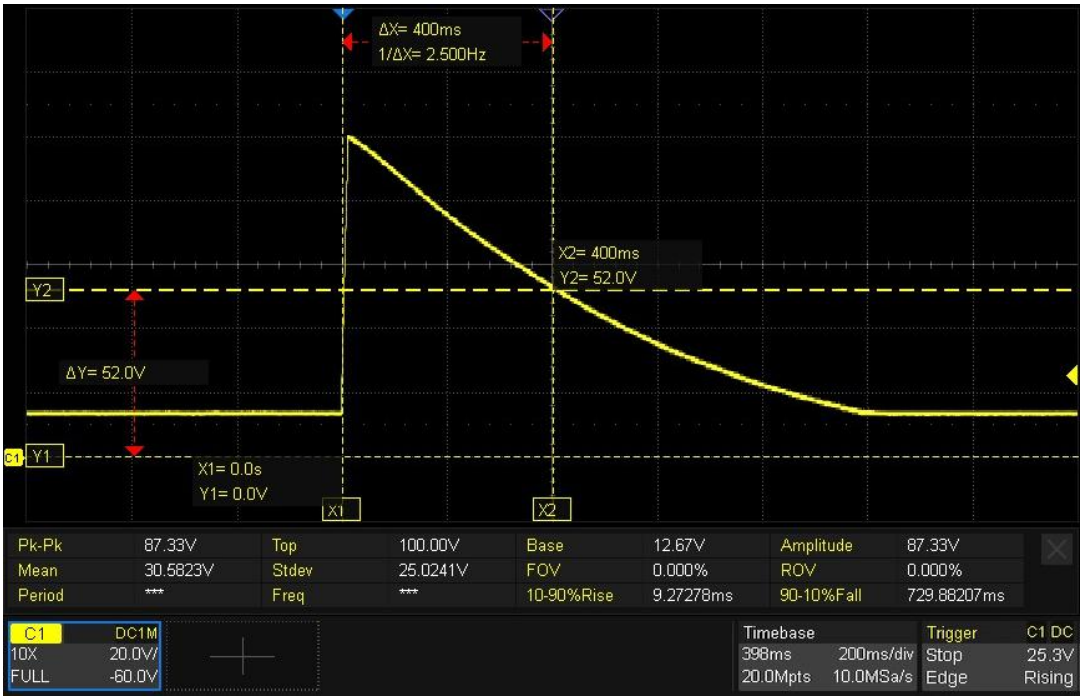


TBLDS1, Maximum rise time, 5 ms / DIV

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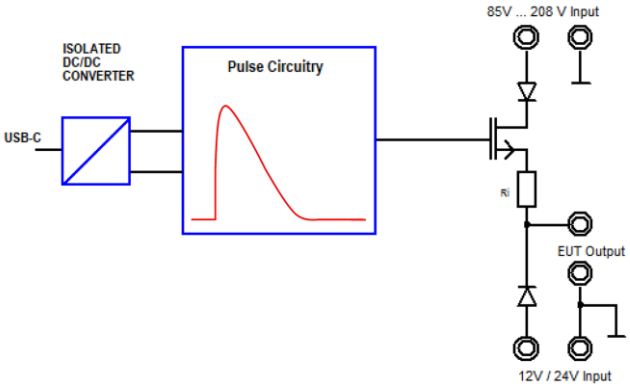


TBLDS1 Minimum fall time, 200 ms / DIV

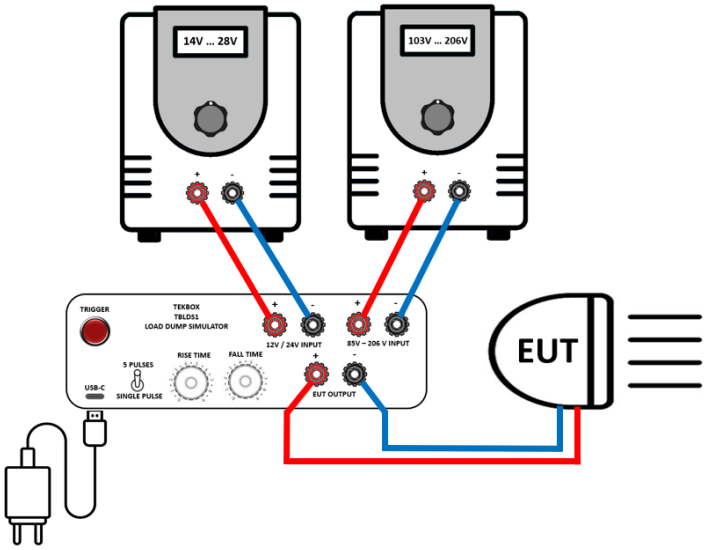


TBLDS1, Maximum fall time, 200 ms / DIV

4 Operation



Simplified schematic



Test setup

Apply power in the following order: USB supply, low voltage supply, and high voltage supply.

To validate the waveform, connect a load resistor and an oscilloscope to the EUT terminals. The load resistor must be not only rated for the desired load current, but also capable of withstanding the pulse energy.

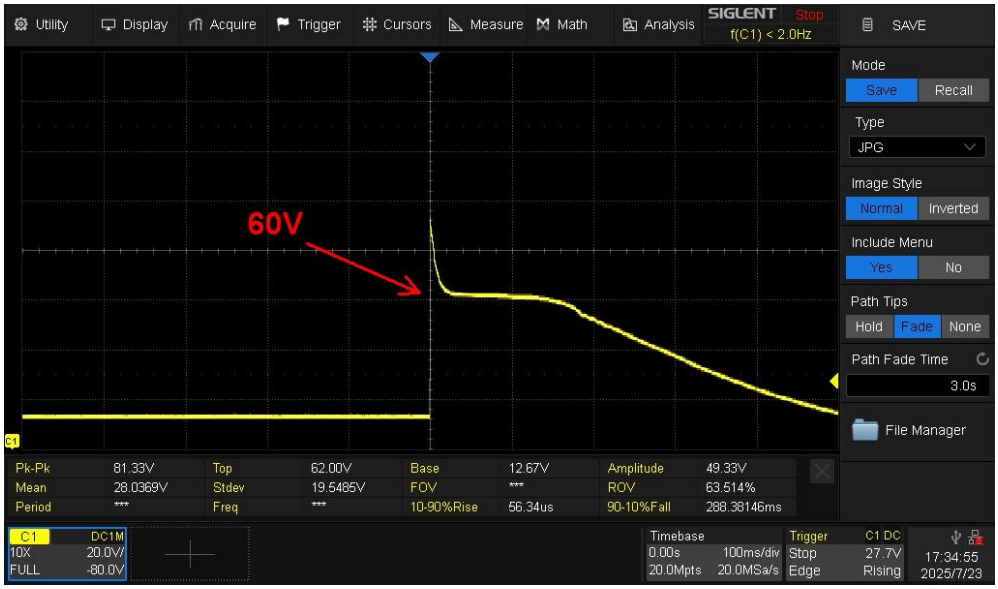
Example: use a 24 Ohm resistor to set up a load current of 0,5A at 12V. The dissipation at 12V is 6 W, however, the maximum current during the pulse is 100V / 24Ω = 4,2 A. The resistor must be rated to withstand at least 5A pulse current and 420 W pulse power.

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To set the minimum rise time and maximum fall time, turn the rise time potentiometer full counterclockwise, the fall time potentiometer full clockwise, and push the trigger button.

Be aware of the current requirements for the high voltage supply. If you connect two common type lab supplies with a 60V / 5A rating in series, you may only test resistive loads with current consumption of up to 0,5A.

For a resistive load with 1A current consumption and a 12V system, the corresponding load resistance is 12Ω.
At the peak of the pulse, the high voltage supply must provide 100V/12 Ω = 8,3A.
If the high voltage power supply is unable to generate the required peak current, it will enter current limiting mode and clip the load dump pulse:



Load dump pulse, 5A power supply, 1 A load current

The output capacitors supply the peak on the left side of the pulse. Adding more bypass capacitors may overcome the restrictions of the power supply, if there is no power supply with suitable current rating at hands.

Warnings:

Letal electric shocks could be caused by the voltages present during load dump testing. Do not open the TBLDS1, while connected to power. Only trained laboratory personnel are permitted to use the TBLDS1 load dump simulator.

Do not connect loads consuming more than 3A in 12V systems or 1,5A in 24V systems to stay within the safe operating area of the FETs.

When working with lead acid batteries, insert a fuse into the supply line. If the EUT shorts upon a load dump pulse, the battery gets shorted and the series diode in the low voltage supply path will be damaged.

5 Ordering Information

Part Number	Description
TBLDS1	Pre-compliance load dump simulator, USB C-cable

6 History

Version	Date	Author	Changes
V 1.0	24.7.2025	Mayerhofer	Creation
V 1.1	28.8.2025	Mayerhofer	Warnings updated