

# 120 A TLP/HMM Test System TLP-12010A

Advanced TLP/HMM/HBM Solutions

## 1 Features

- High pulse output current up to  $\pm 120$  A (short circuit)
- Ultra-fast 50  $\Omega$  high voltage pulse output with typical 300 ps rise time
- Wafer, package and system level TLP and HMM testing
- Up to 180 kW peak output power into 50  $\Omega$  load
- Built-in HMM pulse up to  $\pm 32$  kV in 50  $\Omega$ -configuration
- High speed 50  $\Omega$  trigger output for oscilloscopes (synchronous to high voltage pulse output)
- 6 GPIB programmable pulse rise times: 300 ps to 50 ns (optional)
- 1 built-in pulse width: 100 ns
- Optional external pulse width extensions from 5 ns to 500 ns using the external pulse width extender TLP-12012A6
- Built-in pulse reflection suppression
- Fast measurement time, typically less than 0.2 s per pulse including one-point DC measurement between pulses
- Efficient software for system control and waveform data management
- The software can control automatic probers for fast measurements of complete wafers
- Integrated interlock safety shut-down

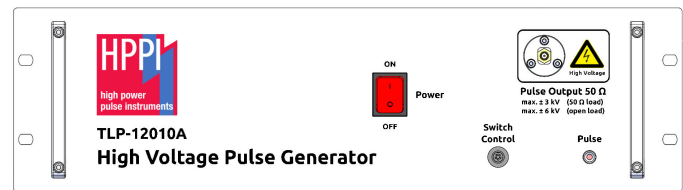
## 2 System Description

The high-current TLP/HMM test system TLP-12010A offers advanced features intended for the characterization of semiconductor devices, discrete components, such as TVS, varistors, capacitors, gas tubes, circuits and systems in the high power time domain. It includes high current I-V characteristics in pulsed operation mode, turn-on/off transient characteristics of the device, breakdown effects, charge recovery effects e.g. reverse recovery, Safe-Operating-Area (SOA) and ESD measurements in general.

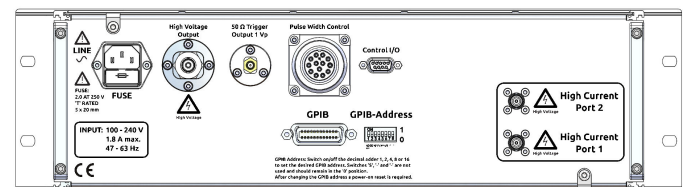
The TLP-12010A (Fig. 1) has 1 built-in 100 ns pulse width for currents up to 120 A.

Since the TLP-12010A is limited to just one single pulse width, the TLP-12012A6 pulse width extender may be considered. With this optional extender, additional pulse width of 5, 10, 50, 100, 200 and 500 ns for example can be generated. The selection of the pulse width is done manually on the rear panel of the TLP-12012A6.

The TLP-12010A is controlled by a highly flexible fast software including remote control.



(a) TLP-12010A high voltage pulse generator front side view



(b) TLP-12010A high voltage pulse generator rear side view



(c) 120 A, 50  $\Omega$  current sensor CS-0V5-A



(d) 18 GHz DUT switch

Figure 1: TLP-12010A overview

The DUT switch shown in Fig. 1(d) automatically connects the DUT to the pulse generator or to the source meter for DC measurements.

The advanced current sensor CS-0V5-A, with 150 ps rise-time, can be used up to e.g. 120 A at 580 ns pulse width or 100 A at 700 ns pulse width, according to its Amp x Second rating of 70 A  $\mu$ s, respectively.

The highly efficient TLP software offers best-in-class measurement speed with up to 5 pulses/s, depending on scope and SMU data transfer speed, with DC spot measurement after every pulse.

The software is based on the TLP-3010C/4010C platform and offers seamless control and enhanced features like 4 graphic plots with transient waveforms, DC and I-V data, as well as the I-V data in tabular form. Up to five different data sets can be loaded simultaneously for a direct comparison of devices.

Data plots can be copied to the Windows® clipboard and conveniently pasted into other applications. The software offers accurate TLP full system calibration using zener-diodes and resistors as reference.

For compliance with laboratory safety regulations an interlock shut-down function has been integrated according to [https://www.hppi.de/files/Interlock\\_Safety\\_Shutdown.pdf](https://www.hppi.de/files/Interlock_Safety_Shutdown.pdf)

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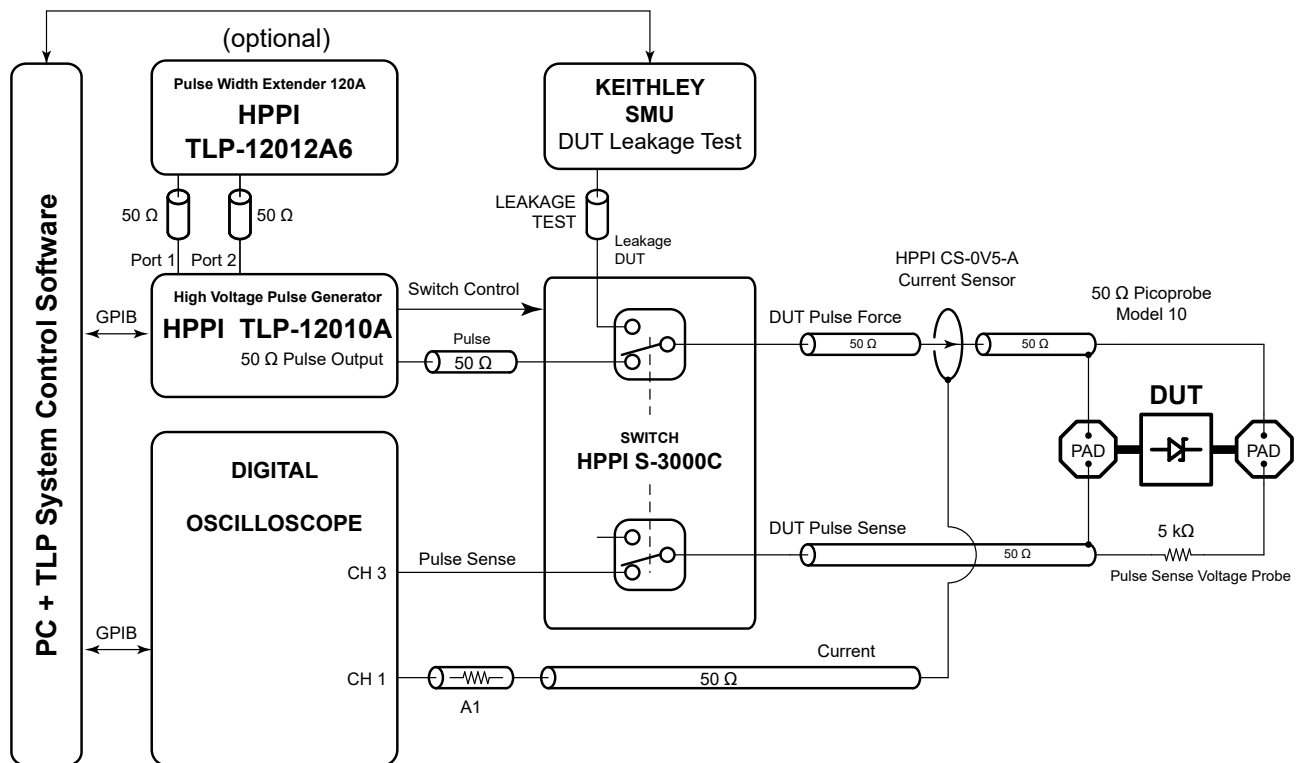


Figure 2: Typical TLP-12010A measurement setup

Fig. 2 shows a typical pulse force / pulse sense measurement configuration.

## 3 Specifications

| Parameter   | Symbol             | Limit Values |      |      | Unit | Remarks   |
|---|--------------------|--------------|------|------|------|---|
|   |                    | Min.         | Typ. | Max. |      |   |
| Output voltage (open load)                                    | $V_{out,\infty}$   | -6.0         |      | +6.0 | kV   | into open load <sup>1)</sup>  |
| Output voltage (50 Ω)   | $V_{out,50\Omega}$ | -3.0         |      | +3.0 | kV   | into 50 Ω <sup>2)</sup>   |
| Peak pulse output power (50 Ω)                                | $P_{out,50\Omega}$ |              | 180  |      | kW   | into 50 Ω <sup>3)</sup>   |
| Minimum output voltage step size                              | $V_{\Delta}$       |              | 0.1  |      | V    | into open load, GPIB progr.   |
| Maximum TLP output current                                    | $I_{tlp}$          | -120         |      | +120 | A    | into short circuit  |
| Maximum TLP output current                                    | $I_{tlp}$          | -60          |      | +60  | A    | into 50 Ω   |
| Maximum HMM first peak output current                         | $I_{peak}$         | -120         |      | +120 | A    | short circuit DUT, 50 Ω HMM   |
| Maximum HMM broad peak output current                         | $I_{30ns}$         | -64          |      | +64  | A    | short circuit DUT, 50 Ω HMM, equivalent to ±32 kV IEC 61000-4-2 (330 Ω, 150 pF) |
| Measurement pulse repetition time                             | $t_m$              | 200          | 500  |      | ms   | state dependent <sup>4)</sup>   |
| Pulse width   | $t_p$              |              | 100  |      | ns   | one internal charge line cable  |
| Pulse width using pulse width extender TLP-12012A6 (optional) | $t_p$              | 5            |      | 500  | ns   | 5/10/50/100/200/500 ns manual selectable with TLP-12012A6                       |
| Output pulse rise time  | $t_r$              | 0.3          |      | 50   | ns   | GPIB programmable 6 steps, out of: 0.3 / 0.6 / 1 / 2 / 5 / 10 / 20 / 50 ns      |

Table continued on next page ...

<sup>1)</sup> The maximum open load output voltage could reach 6.0 kV according the internal charge-line voltage setting. But in reality the output voltage it is limited by the breakdown voltage of the SMA connectors and other interconnection devices towards the DUT. Therefore, at open load condition the pulse voltage setting should not exceed the interconnection limits. This means that the TLP-12010A should not operated with maximum voltage at open load condition.

<sup>2)</sup> Limited by the breakdown voltage of the DUT connectors.

<sup>3)</sup> Limited by the breakdown voltage and the thermal capability (pulse width) of the DUT connectors.

<sup>4)</sup> Depending on the speed of the digital oscilloscope and SMU(s).

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|---|---|---------------------------|------|------|-----------------|-----------------------------------|
|   |   | Min.                      | Typ. | Max. |                 |                                   |
| AC line voltage range                     | V <sub>AC</sub>   | 100                       |      | 240  | V               | 47-63 Hz, max. 1.8 A              |
| Dimensions TLP-12010A (W x H x D)         | D <sub>12010A</sub>   | 428 (482.6) x 132.5 x 485 |      |      | mm <sup>3</sup> | 428 mm body, 482.6 mm rack flange |
| Weight TLP-12010A                         | W <sub>12010A</sub>   |                           | 18   |      | kg              | excluding accessories             |
| Software support of digital oscilloscopes | All models from Keysight, LeCroy, Tektronix. New models will be added on request.   |                           |      |      |                 |                                   |
| Software support of SMU source meters     | Keithley 24xx/26xx series SMU, Keithley 230 voltage source. Agilent B2900A. <b>5</b> SMUs can be controlled by the system: 1 leakage measurement SMU and <b>4</b> independent bias SMU. |                           |      |      |                 |                                   |
| Supported automatic probe stations        | all Suss <b>Cascade and Signatone</b> probe stations  |                           |      |      |                 |                                   |
| Integrated interlock safety shut-down     | <a href="https://www.hppei.de/files/Interlock_Safety_Shutdown.pdf">https://www.hppei.de/files/Interlock_Safety_Shutdown.pdf</a>   |                           |      |      |                 |                                   |

## 4 Ordering Information

| Pos. | Description  | Part No.    |
|------|--|-------------|
| 01   | High voltage pulse generator TLP-12010A including all required accessories such as PCB adapter, current sensor, pick-off tee, DUT switch, cables, software and manuals | TLP-12010A  |
| 02   | Optional 120 A manual pulse width extender TLP-12012A6 with 6 manual selectable built-in pulse width: 5/10/50/100/200/500 ns   | TLP-12012A6 |
| 03   | Precision Picoprobe <sup>®</sup> Micropositioner Probe Holder Kit, customizable for various micromanipulators  | PHD-3001A   |

### General

The product data contained in this data-sheet is exclusively intended for technically trained staff. You and your technical departments will have to evaluate the suitability of the product for the intended application and the completeness of the product data with respect to such application. Our products are solely intended to be commercially used internally and should not be sold to consumers. This data-sheet is describing the specifications of our products for which a warranty is being granted by HPPI GmbH. Any such warranty is granted exclusively pursuant the terms and conditions of the respective supply agreement. There will be no guarantee of any kind for the product and its specifications. For further information on technology, specific applications of our product, delivery terms, conditions and prices please contact HPPI:

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