
PULSE IV SYSTEM

AM3242



www.amcad-mw.com

SYSTEM CATEGORY: HIGH VOLTAGE

- Compact and efficient design
- SMU (Source Measure Unit)
- Compatible with AM3200 system
- Unrivalled measurement resolution and accuracy
- High reliability pulse generators
- Plug and Play using IVCAD (a Dassault Systèmes software)



MAIN FEATURES :

- Reliable pulser head with long lasting performances.
- Unique solution with **-50V to 1500V , +150A** specifications.
- Static and **Dynamic Rds ON** measurement up to 1500V saturation level.
- Select between two pulse rise/fall times
- Current leakage measurement up to 1500V in DC and Pulsed modes.
- Transistors body diode measurement down to -150A
- High accuracy voltage measurements thanks to remote sense connections.
- High accuracy voltage and current measurements using multiple ranges.
- High precision for low level DC bias current (**100 nA resolution**).
- Safe over-current and over-power protection circuitry operating independently of the connection mismatch event.
- Internal or external synchronization.



System description

The AM3242 is a high voltage probe designed for the AM3200 system.

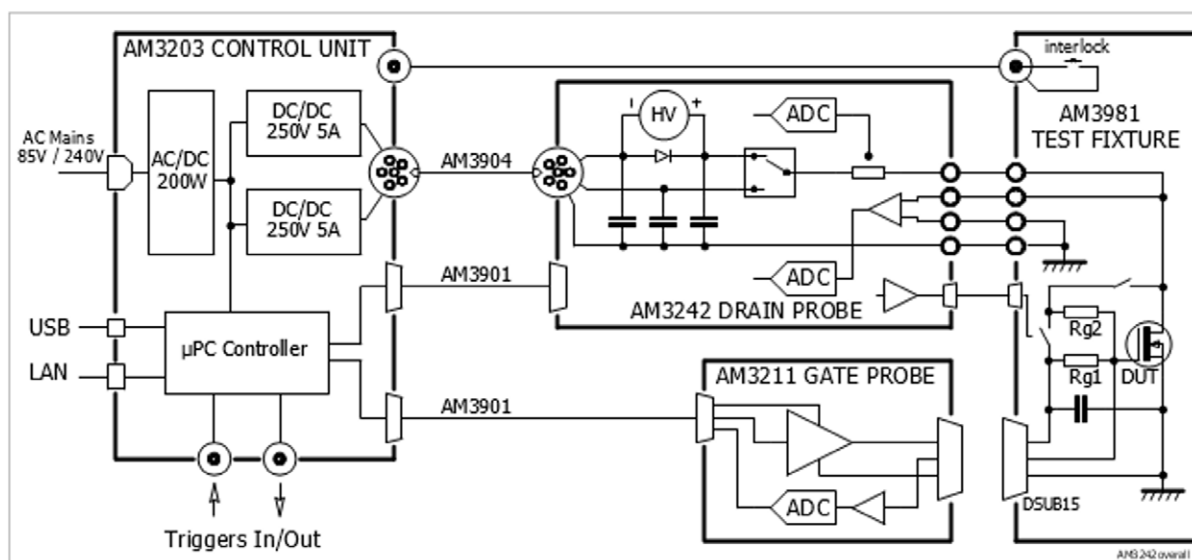
It comes with test fixture enabling the measurements on TO220, TO247, D2PACK, POWERPACK SO-8 and custom packages. The AM3242 along with the AM3203 Control Unit and AM3211 Input pulse head is a complete system for high-power transistor characterization.



Pulser Safe Operating Area

Emergency stop when the operating point exceeds design limits: I_p (pulsed current), V_{dc} (pulser output voltage, drain pulser only), P_{max} (pulsed power), F_{max} (switching frequency), Temperature

Programmable thresholds: 3 thresholds for quiescent, pulsed and transient current, and 2 thresholds for pulsed and quiescent power.



Measurement Sampling Time

Programmable thresholds: pulse current and power, quiescent current and power, transient current.

Operating Area

The operating area is divided in 3 parts:

1. High voltage, from 100V up to 1500V

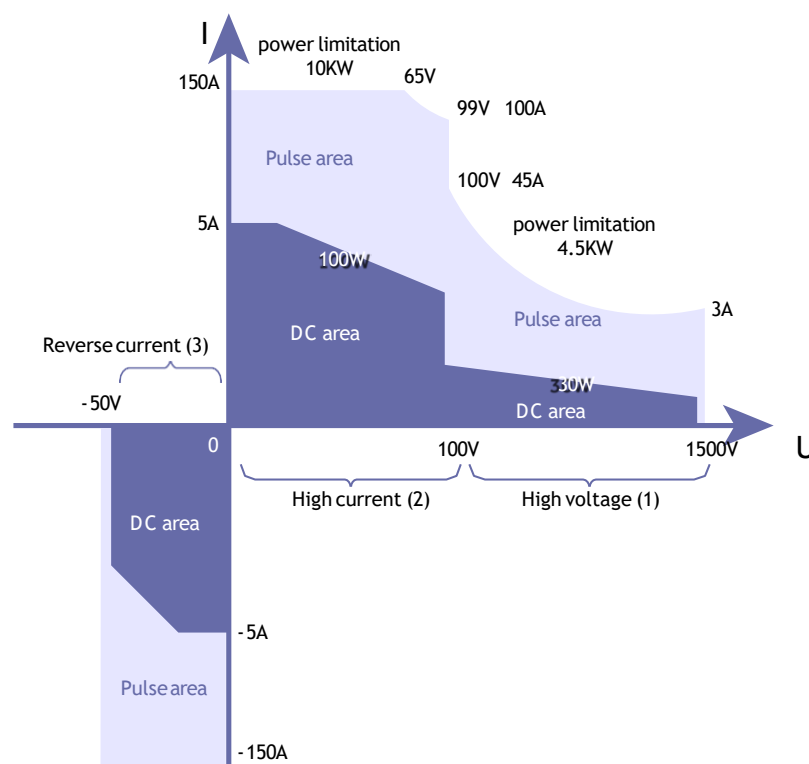
High Voltage is not available at the same time for Quiescent and Pulsed level

2. Low voltage, from 0V up to 100V

Low voltage and High current area

3. Reverse voltage, from 0V down to -50V

Reverse voltage cannot be used together with a positive level. When using a Pulsed reverse level, the Quiescent level is forced to 0V.



Operating area specifications

Parameter	Conditions	High Voltage (1) (Max)	Low Voltage (2) (Max)	Reverse Voltage (3) (Max)
Voltage Range		+1500V	+100V	-50V
Pulsed current	According to AC power limitation	+45A	+150A	-150A
Pulsed Power	0.1% Duty cycle 100µs Pulse Width max Calculated without the voltage drop of the internal resistance	4.5KW	10KW	7.5KW
DC Current	According to DC power limitation	+300mA	+5A	-5A
DC Power		30W	100W	100W
Voltage programming resolution		6mV	1mV	1mV
Voltage programming accuracy		1V	250mV	250mV
Voltage output ripple	DC, no load	200mV	20mV	20mV
Voltage settling time (pulse or quiescent level change)	Full step	3s	50ms	50ms
	1% step	100ms	10ms	10ms

Timing Specifications

Parameter	Conditions	High Voltage (1) (Max)	Low Voltage (2) (Max)	Reverse Voltage (3) (Max)
Pulse frequency		1KHz@1500V 5KHz@600V	5KHz	
Duty Cycle		0.1%		
Pulse width	High current level (150A)	n.a	100μs	
Rise Time (10% - 90%)	Fast mode (Vq=0V), no Load	230ns @Vp=1500V	65ns @Vp=50V	75ns @Vp=-50V
	Slow mode (Vq=0V), no Load Pulse width > 10μS	550ns @Vp=1500V	130ns @Vp=50V	n.a
Fall Time (10% - 90%)	Fast mode (Vq=0V), no Load	215ns @Vp=1500V	75ns @Vp=50V	75ns @Vp=-50V
	Slow mode (Vq=0V), no Load Pulse width > 10μS	340ns @Vp=1500V	170ns @Vp=50V	n.a
Pulse settling time	150A @ Load=50mΩ Fast mode	n.a	9μs	10μs
	150A @ Load=50mΩ Slow mode	n.a	20μs	n.a

Current Measurement Specifications

Range		+150A	-150A (Reverse)	1.5A*	15mA	150µA	1.5µA
Resolution	16 bit	2.8mA		28µA	0.27µA	2.7nA	27pA
Noise floor, no load, 1 sample**	C-C	40mA		0.6mA	4µA	100nA	1nA
ENOB, no load, 1 sample	LSB	11.5 bit		11 bit	11.5 bit	10.5 bit	10.5 bit
Maximum Gain error	(% of value)	0.2%		0.2%	0.2%	0.2%	0.2%
Maximum offset error		200mA		2mA	20µA	200nA	100nA
Self-cut-off level, back to 150A range		-	-	2A	2A	2A	2A
Minimum over-range measurement	-6.5%	-10A	+10A	-100mA	-1mA	-10µA	-100nA
Maximum over-range measurement	110%	165A	-165A	1.65A	16.5mA	165µA	1.65µA
Settling time	99%	0.5µs		0.5µs	5µs	50µs	1.5s

* while using 1.5A range: di/dt higher than 260A/µs combined with a current going above 2A may cause damage to the 1.5A range (if the current pulse started under 2A) ** averaging with 10 points removes the noise

Voltage Measurement Specifications

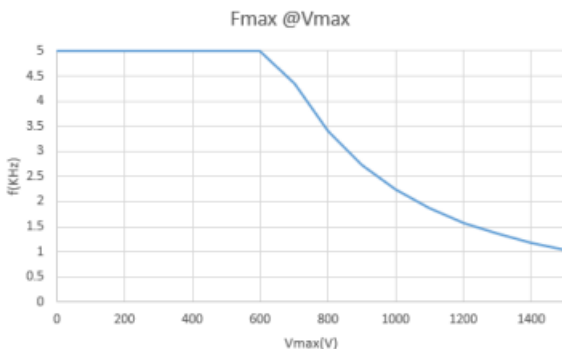
Range		1500V	100V	±12V
Resolution	16 bit	26mV	2,2mV	0,43mV
Noise floor, no load, 1 sample**	C - C	200mV	15mV	6mV
ENOB, no load, 1 sample	LSB	13 bit	13 bit	12 bit
Maximum gain error	(% of value)	0.2%	0.2%	0.2%
Maximum offset error		250mV	20mV	2mV
Self-cut-off level, back to 1500V range		-	117V	117V
Maximum negative over-range measurement		-100V	-30V	-14.4V
Maximum positive over-range measurement		1600V	110V	14.9V
Settling time / full range step	99.9%	0.5µs	0.5µs	0.5µs
Recovery delay / after 1500V falling edge		na	1,5µs	2µs

** averaging with 10 points removes the noise

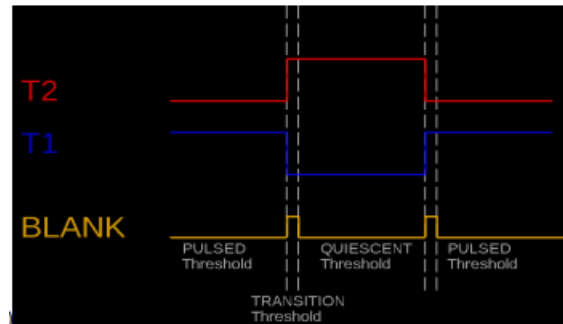
Protections - Current breaker & Real time thresholds

Parameter	Conditions	High Voltage (1) (Max)	Low Voltage (2) (Max)	Reverse Voltage (3) (Max)
Frequency limitation (*)		1KHz @ 1500V	5KHz	5KHz
Current breaker programming range thresholds (**)	Pulsed, Quiescent and Transition	+3A to 160A	+3A to 160A	-3A to -160A
Pulsed power limitation (***)	High voltage area	4KW to 4.5KW	4KW to 10KW	4KW to 10KW
Sense voltage drop ($R_{in} + R_{cable}$)	GND Sense to GND	+/-10V	+/-10V	+/-10V
	OUT Sense to OUT	+/-10V	+/-10V	+/-10V
Common mode output voltage	GND to Earth	+/-10V	+/-10V	+/-10V

(*)The maximum switching frequency is voltage dependent. The SOA controller measures the average frequency of the Ptrig signal for a 1s duration window. The Fmax limit is 5KHz for any voltage < 600V, then decreases to $1/V^2$ (see graph below).



(**) An internal signal BLANK defines the transition period.



(***)The Power limitation is achieved by tuning the current breaker threshold and monitoring the internal Power supply.

Example: If pulsed voltage is monitored at 80V (=> Low voltage zone) and pulsed level threshold is set by user at 10A and the power limiter for Low voltage level at 5KW, the current threshold remains the same as the one the user set. But if the user changes the pulsed level threshold from 10A to 100A, the pulser will internally change it from 100A to $5KW/80V = 62.5A$.

NB: Since the minimum current level is 3A, 4KW protection IS NOT assured above 1,3KV (4KW/3A)

There is NO protection for breaker for the DC current under +/-3A. It is the user responsibility to limit the DC current. (Unless the DC current is above +/-3A and then can be limited by the current breaker if set correctly). **There is NO protection for the DC powers specified. It is the user responsibility to limit it.**

Internal RCL elements specifications

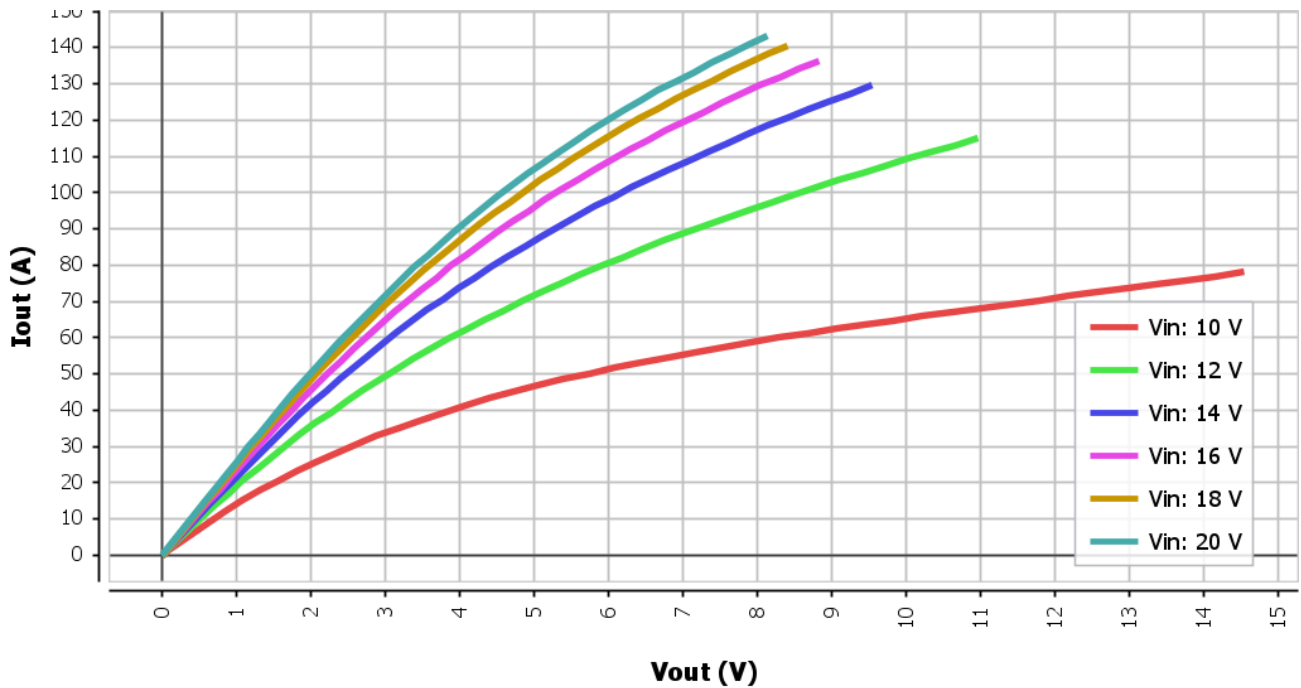
Parameter	Conditions	Value
Internal Resistance (R_{in})	Current range 150A	0.2Ω
$V_{out} = V_{programmed} - R_{in} * I_{out}$	Current range < 150A	1.2Ω
GUARD terminal Resistance		0.2Ω
Resistance between GND and Earth		10Ω
Sense input impedance	GND sense to GND OUT sense to OUT	10KΩ 10KΩ
Internal storage capacitor (C_{stor})	High current & Reverse area ($V_{out} < 100V$)	4mF 0,75V drop @ 150A @ Width=20μs
$V_{drop} = (I_{out} * width) / C_{stor}$	High voltage area ($V_{out} > 100V$)	13.5μF 0,75V drop @ 0.5A @ Width=20μs
Internal serial inductance		200nH

Connections

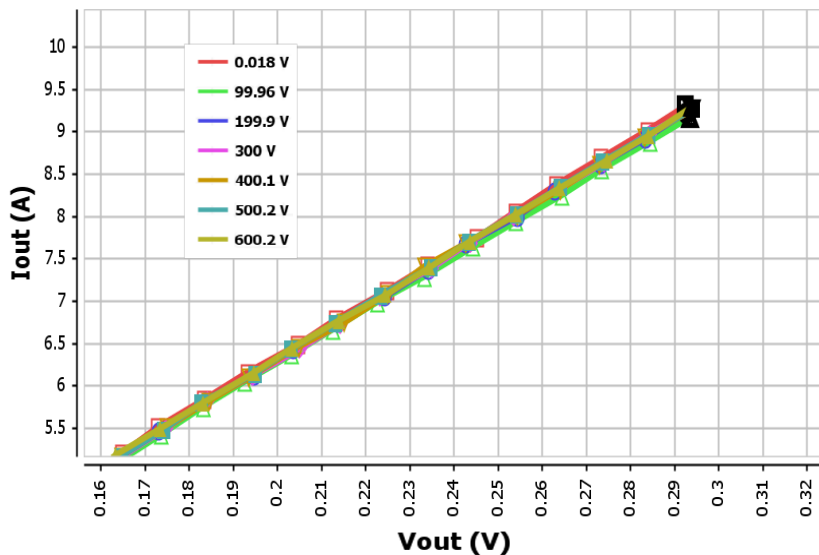
Panel Side	Connection	Name
Front panel Force	4mm banana plug - red	Force +
	4mm banana plug - black	Force -
Front panel Sense	4mm banana plug - red	Sense +
	4mm banana plug - black	Sense -
Front panel Jumper	Jumper 2.54mm pitch	Internal connection sense
Rear panel	Power & control	To AM3203 main frame Pulse SMU 2 side

Typical measurement

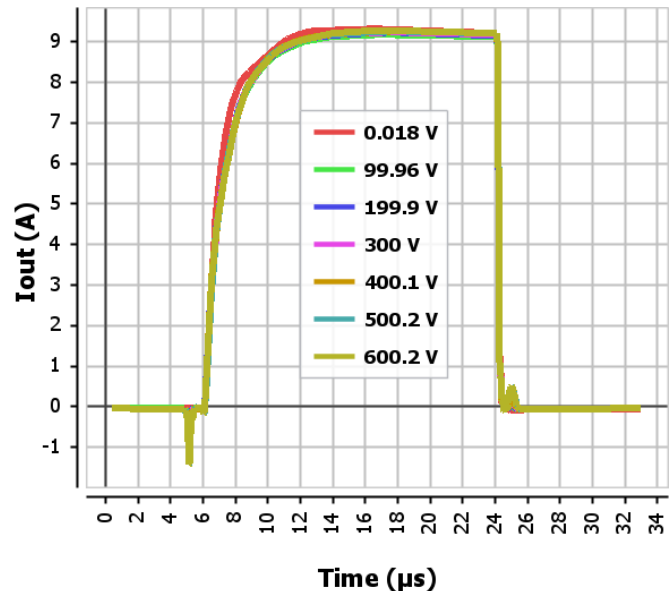
IV Network at a given quiescent bias point (0;0)



IV at high power for different quiescent bias points and different V_{ds}

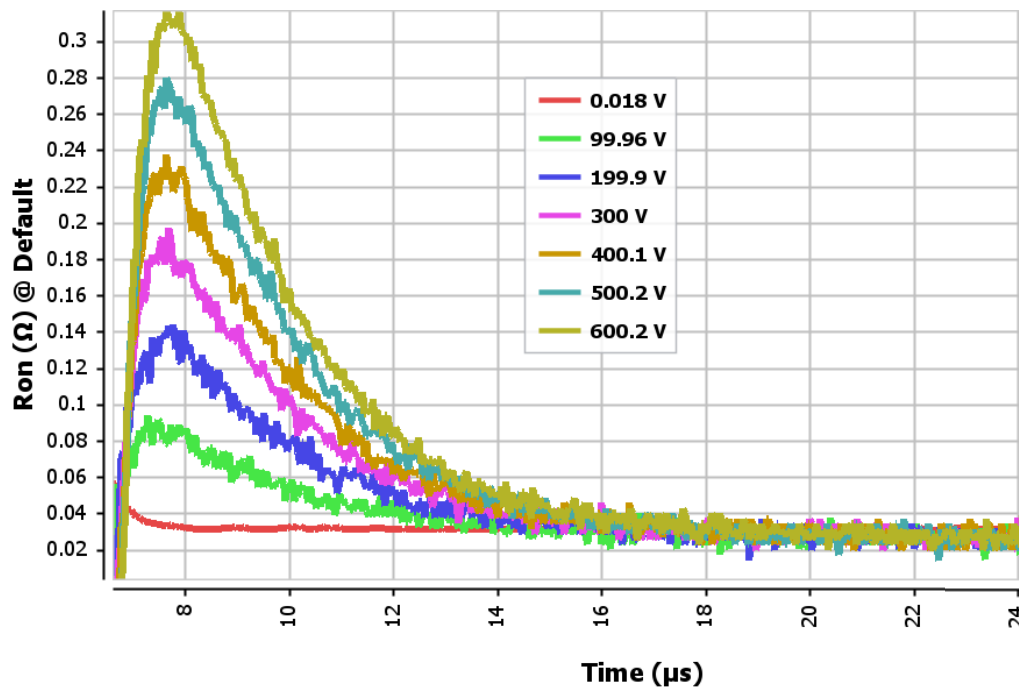


time domain at high power for different quiescent bias points at $V_{ds}=0.3\text{V}$

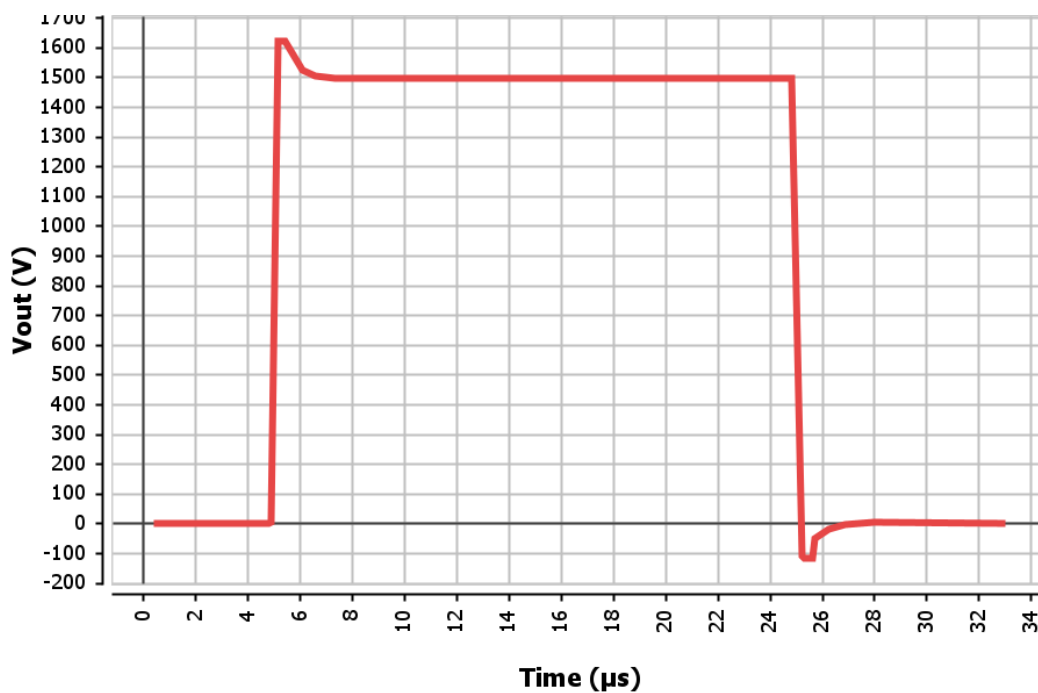


Typical measurement

Dynamic R_{dson} for different quiescent bias points

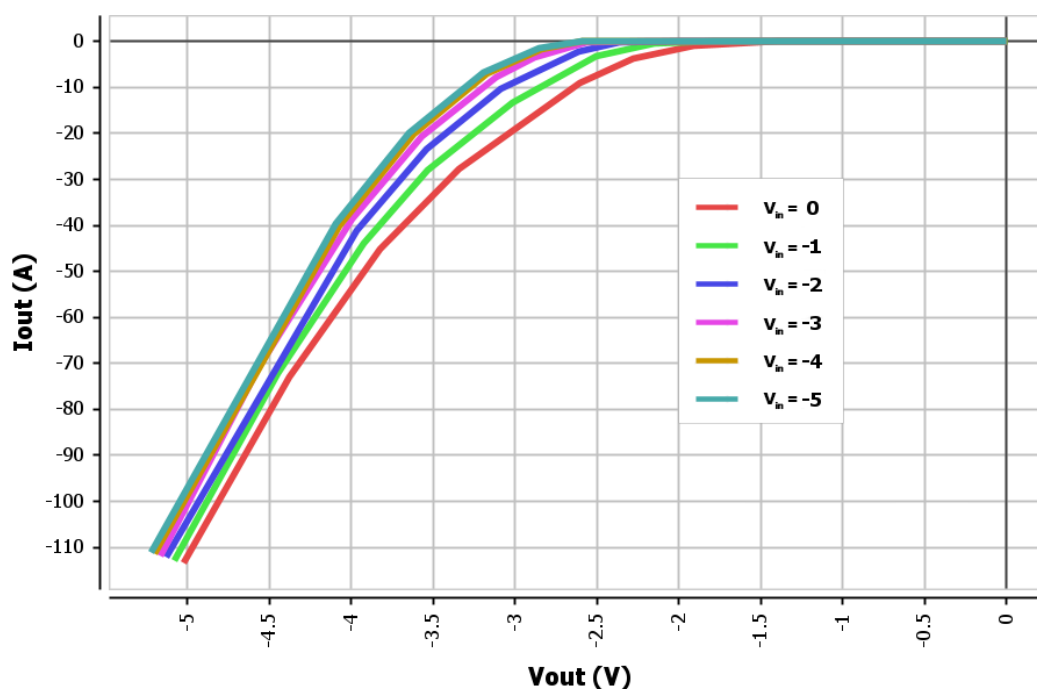


Pulse shape at a maximum voltage of 1500V on open conditions

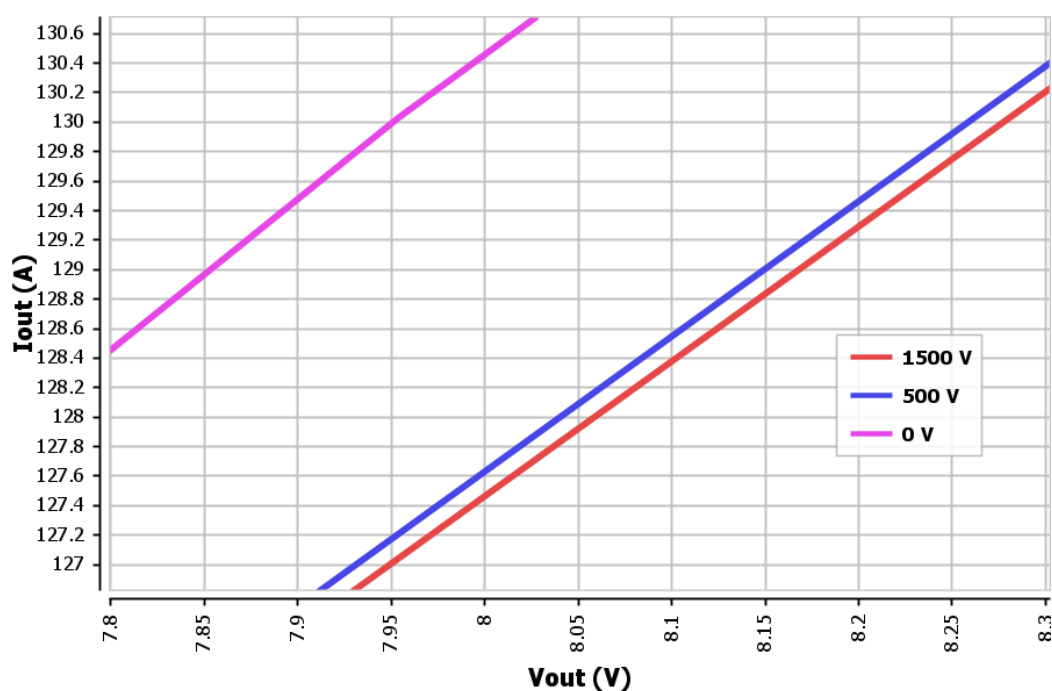


Typical measurement

Body diode characteristics down to -110A for different V_{gs} conditions

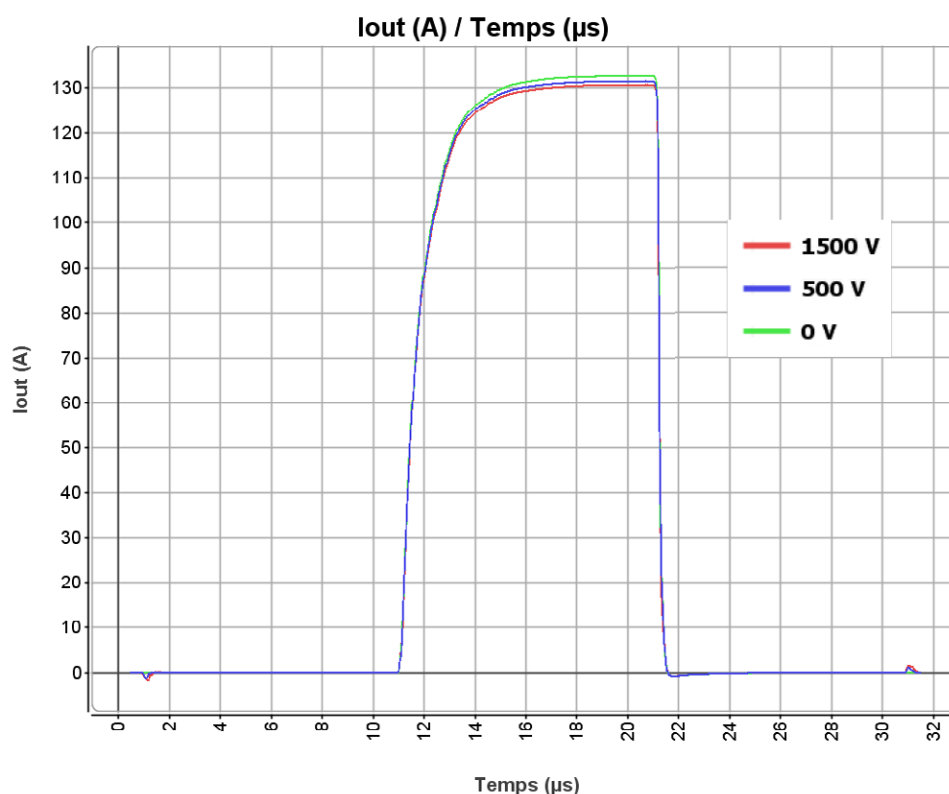


IV Network plotted for 3 different quiescent bias conditions

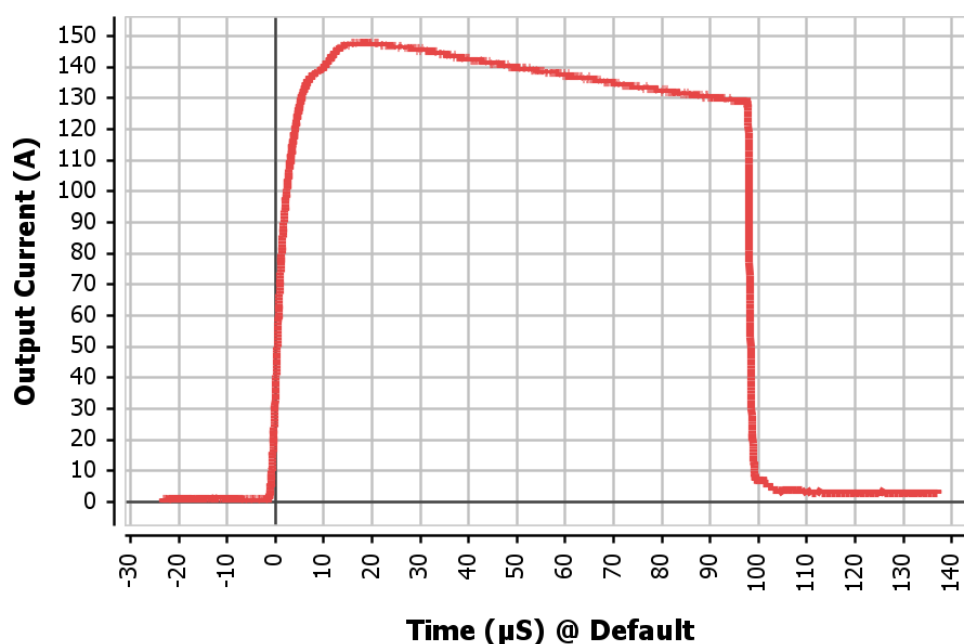


Typical measurement

Pulse shape at high current around 130A on 50 mΩ load at a fixed Vds for different quiescent bias conditions



Pulse shape at high current around 150A on 50 mΩ load at a fixed Vds



Warranty

Any AMCAD product comes with a two-year parts and labor warranty, when returned to our workshops. A phone support service is also available for the same period.

At the end of the initial two-year period, a further contract can be subscribed, including:

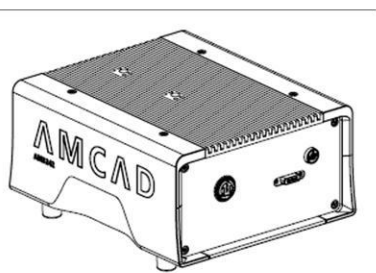
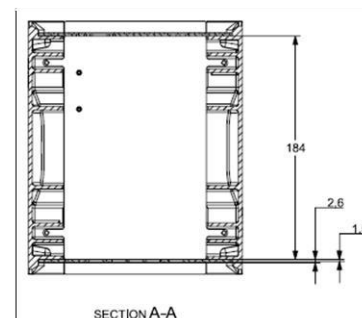
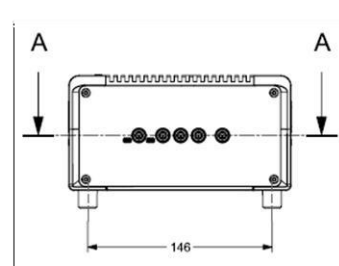
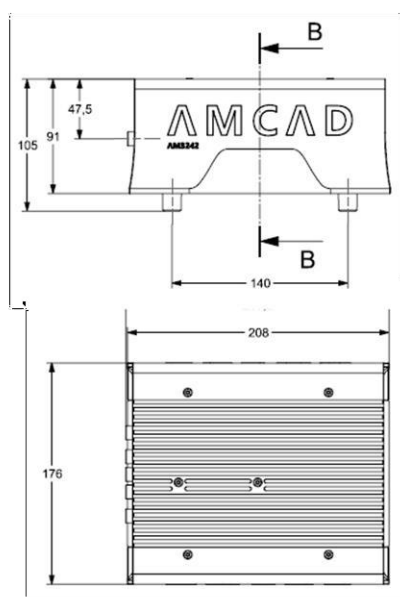
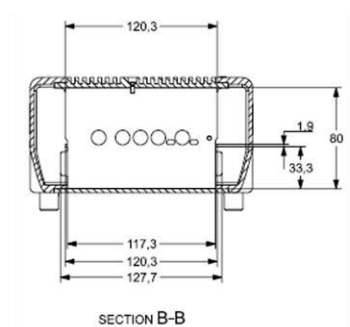
- a preventive functional check and calibration of the modules (on-site or in our workshop)
- a further two-year warranty period

Quality Regulations & Environment

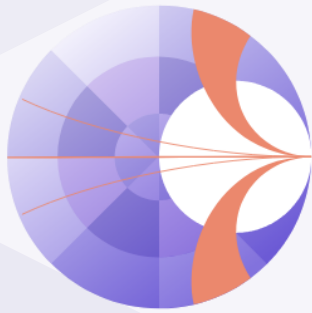
The PIV System and all modules are compliant to the applicable European directive and hold the CE mark.

- ISO/CEI 17025 compliant calibration for any DC source or measurement module, calibration certificate provided.
- Serial number based life cycle management
- All products are 100% tested (test reports provided)
- AMCAD only uses RoHS compliant components and does not use substances banned by the COSHH regulation.
- AMCAD complies with the relevant national regulations related to the safety and health of its employees against hazardous substances.
- The protection degree of the PIV system is IP20 according to CEI 60529.

Probe dimensions (mm)



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