

Model 4200-SCS

Semiconductor Characterization System



The simple choice for complex characterization tasks

KEITHLEY

The Model 4200-SCS

IS THE BEST,
MOST COMPREHENSIVE AND
COST-EFFECTIVE SOLUTION
FOR A GROWING LIST OF
APPLICATIONS

- Semiconductor technology development
- Semiconductor process integration
- Incoming inspection
- Failure analysis
- Device reliability and lifetime testing
- Nanotechnology and MEMs research
- Mobile ion characterization
- Doping profile extractions
- High and low κ dielectric characterization
- Isothermal testing
- Flash memory testing
- Pulse testing of III-V devices
- Organic LED characterization
- Hall Effect and van der Pauw testing
- Semiconductor device modeling
- High power MOSFET/BJT characterization
- Interface charge trap characterization
- Solar cell/photovoltaic device characterization

DC I-V, C-V, and pulse testing in one environment

Expanded capabilities

Familiar Windows® Interface

No training, no floppies

Single-click test sequencing

No programming

Configurable, scalable, upgradable

Works now, grows later

Sub-femtoamp noise

See more, faster

Optional turnkey configurations

Start testing right out of the box



To learn more about C-V measurements, download a free copy of our application note, "Making I-V and C-V Measurements on Solar/Photovoltaic Cells Using the Model 4200-SCS Semiconductor Characterization System" from www.keithley.com.

A COMPLETE, INTEGRATED SOLUTION:

ALL FROM ONE VENDOR

Integrated industrial controller and additional RAM ensure high test throughput, plus system robustness, stability, and security.

Industry-standard Windows-based GUI minimizes set-up and integration time.

High speed, high precision ADC per DC channel eliminates performance tradeoffs.

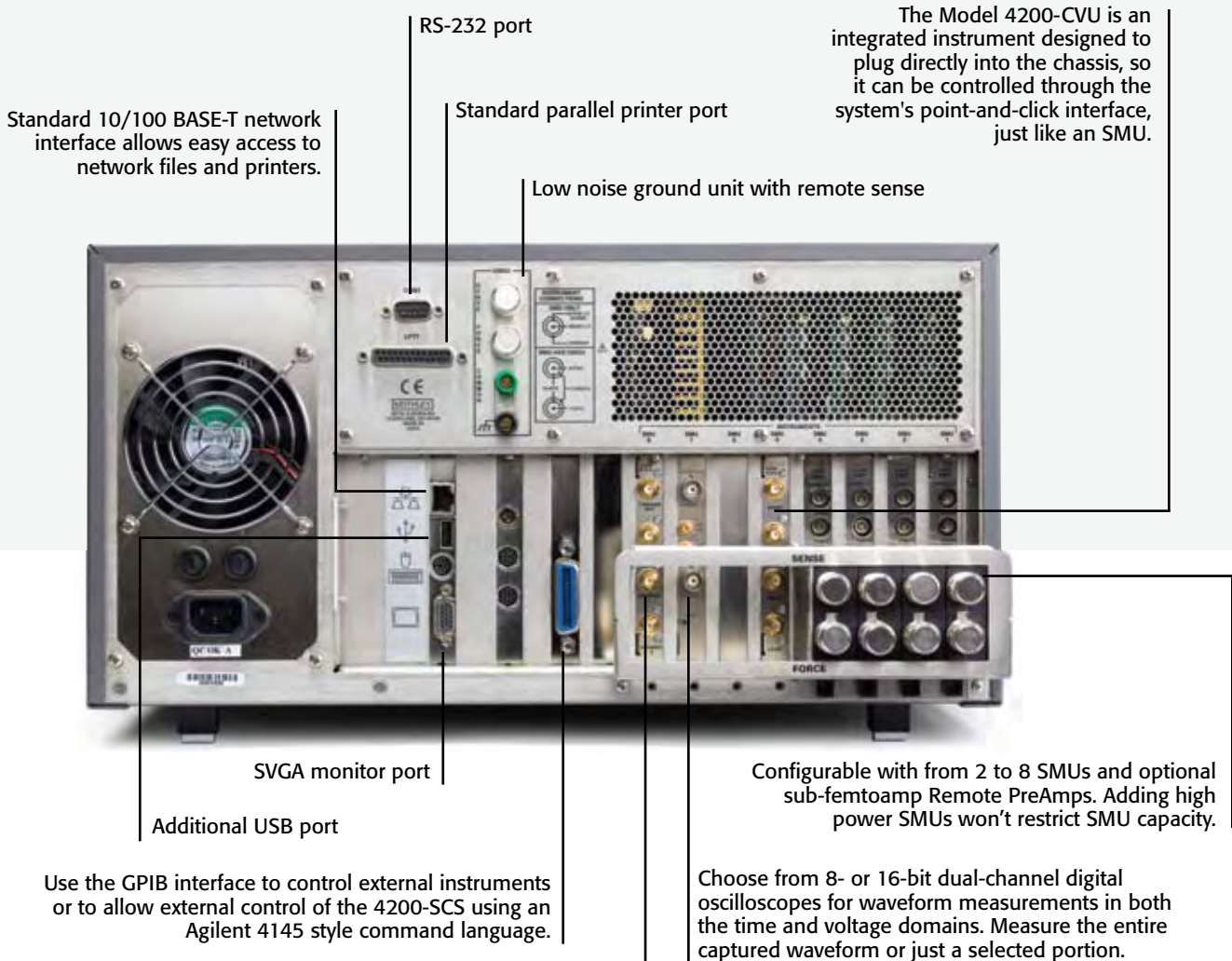
Store test setups and results right on the system with the high capacity fixed disk drive. No sorting through floppy disks to find the desired test.

The integrated CD-RW drive allows high capacity backup and data transfer.

Communicate quickly with a wide range of PC accessories with the built-in USB interface.

COMPLETE AND EASY-TO-USE CHARACTERIZATION ENVIRONMENT

- Even infrequent users can begin testing productively right away, without programming assistance, for a lower cost of test and faster ROI.
- The flexible user interface makes it easy to change parameters on the fly and test devices interactively with just a mouse click.
- KTEI software supports three different test applications packages to expand the Model 4200-SCS's pulsed testing capabilities dramatically: 4200-PIV-A for charge trapping and isothermal testing for leading-edge CMOS research, 4200-PIV-Q for higher power pulse testing in III-V and other higher frequency FET devices, and 4200-FLASH for testing FLASH and embedded memory devices.
- KTEI makes C-V tests as easy to set up and run as I-V tests. An extensive set of sample programs, test libraries, and built-in parameter extraction examples are included. The latest software enhancements add support for high power C-V, differential DC bias, and quasistatic C-V measurements.
- Export test settings, data, and plots to .xls, delimited text, .bmp, .jpg, or .tif file formats.
- Sample tests and projects for a variety of applications are included to simplify startup.
- Factory-supplied drivers for external capacitance meters, switch matrices, pulse generators, and a variety of probes simplify building configurations for specialized applications.
- Optional drivers for leading modeling software packages let the Model 4200-SCS fit into any lab's test environment.



Add up to 4 dual-channel pulse generators to configure the system for a growing range of pulse applications, from I-V pulse testing to stress/measure reliability testing using parallel AC stress on multiple channels.

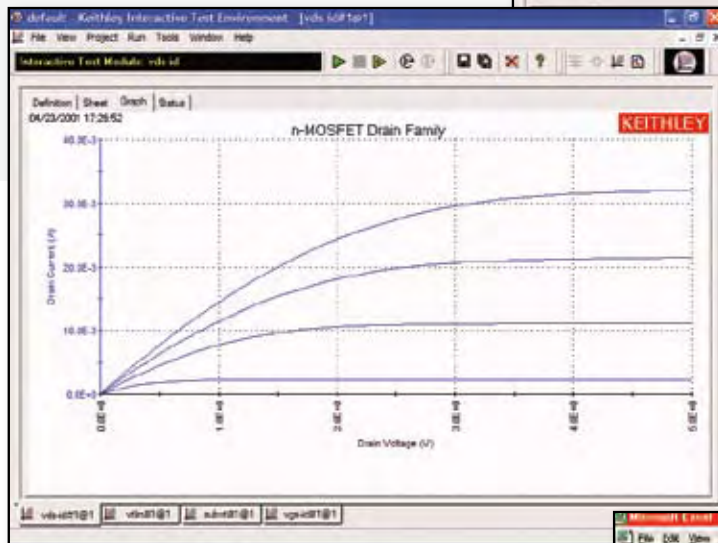
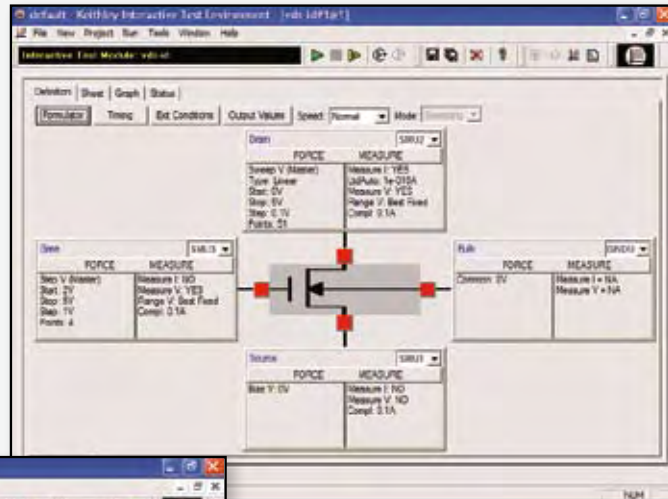
DC PreAmps can be either remotely or directly mounted on the probe station. By reducing the signal path between the DUT and the PreAmp from several feet to inches, the Model 4200-SCS can eliminate cable effects like parasitic capacitance and leakage currents, for more accurate low-level DC measurements.

INTUITIVE INTERFACE

SIMPLIFIES DEVICE AND MATERIAL CHARACTERIZATION AND ANALYSIS

1

Define a test starting from any of more than 400 supplied sample libraries, using the system's intuitive point-and-click interface.

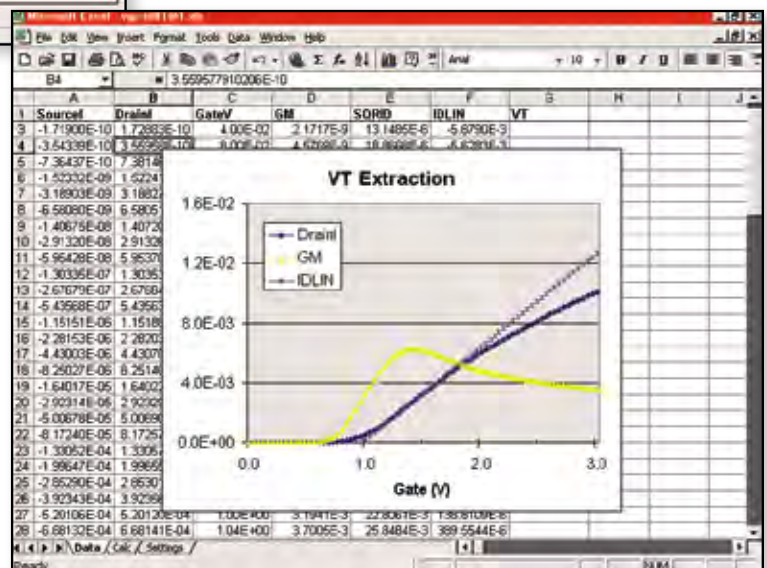


Click the on-screen Run button to start the test and view a real-time plot.

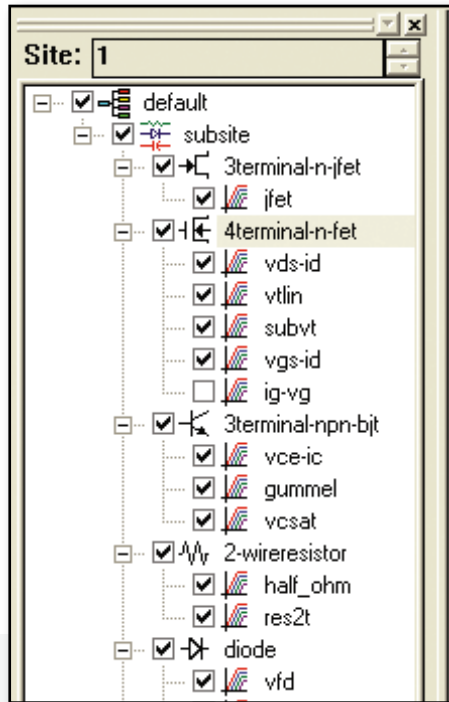
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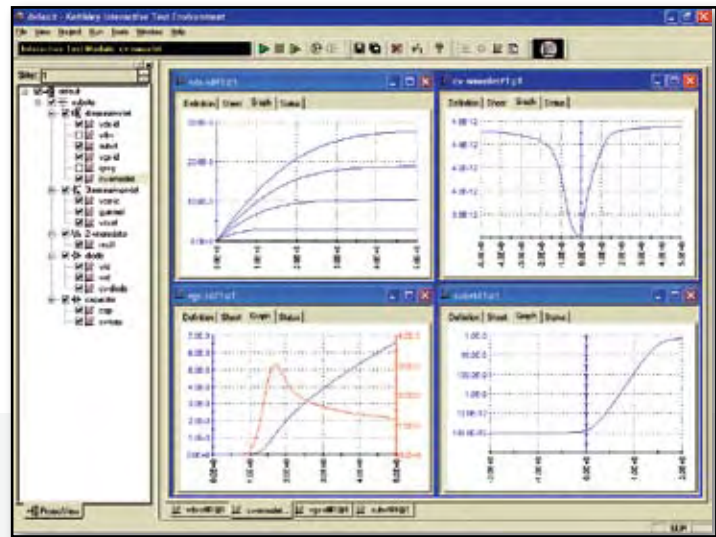
Export data in Excel workbook or ASCII formats and plots in .bmp, .jpg, or .tif formats for either online or offline analysis. Built-in Formulator, graphing, and calc sheet functions simplify complex analyses.



AUTOMATED TEST SEQUENCES WITHOUT WRITING CODE



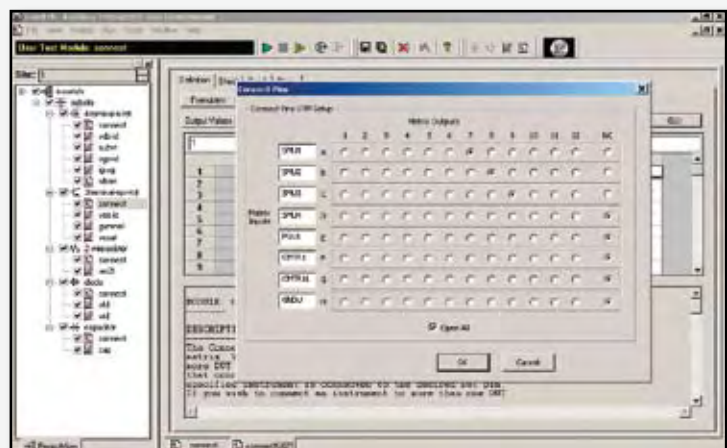
The Project Navigator organizes tests and controls test sequencing. Switching between different test setups and accessing test results is fast and simple. Sequence tests on a single device by clicking on the device in the Navigator, then clicking the Run button.



Keithley Interactive Test Environment (KITE) is designed to let users understand device behavior quickly. When running a test sequence, users can view results and plots for completed tests while the sequence is still running. As shown here, multiple plots can be viewed at the same time to get a complete picture of device performance.

Extend the 4200-SCS with C language test libraries

The User Test Module feature in KITE lets the 4200-SCS take on advanced test algorithm requirements with user-written C++ code. These modules give lab users a “fill in the blank” interface to C language subroutines. Everything needed to collect, analyze, and report results is integrated in one application. User Test Modules support viewing and graphing data in real time to monitor test progress. The Keithley User Library Tool (KULT), provided with the 4200-SCS, allows integrating these subroutines easily into a test sequence. Selected UTMs also have GUI interfaces to simplify test setups.



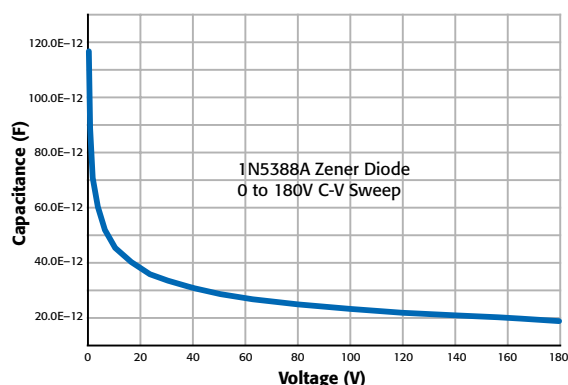
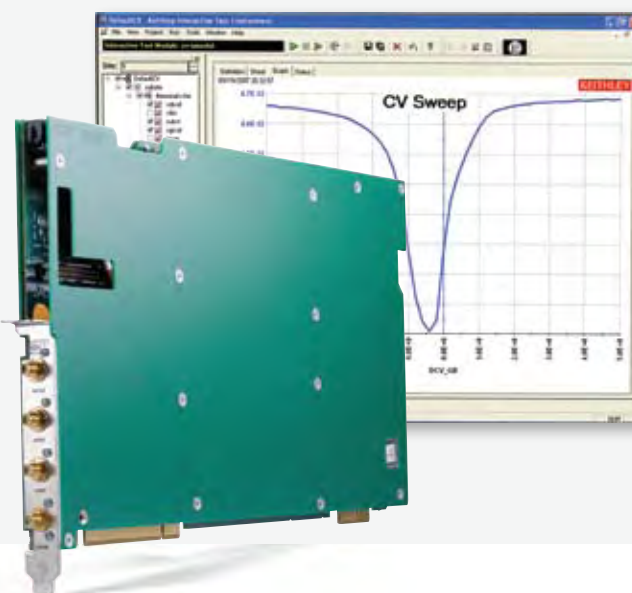
EXPAND YOUR CHARACTERIZATION OPTIONS:

C-V AS EASY AS I-V

When combined with the Model 4200-SCS's intuitive point-and-click interface and powerful Keithley Interactive Test Environment (KITE), the Model 4200-CVU and its supporting software make C-V tests as easy to set up and run as I-V tests. The system's flexible, powerful test execution engine makes it simple to combine I-V, C-V, and pulsed tests into the same test sequence, so the Model 4200-SCS can replace a variety of electrical test tools with a single, tightly integrated characterization solution.

The Model 4200-CVU is an integrated instrument designed to plug directly into the 4200-SCS chassis, so it can be controlled through KITE's point-and-click interface, just like an SMU, and allow users of any level of experience to perform C-V testing as if they were experts. A variety of sample tests, including tests for MOSCAPs, MOSFETs, and Mobile Ion characterization are bundled in, as well as common parameter extractions like oxide thickness, doping density, depletion depth, and flatband voltage. Operating specs like a frequency range of 10kHz to 10MHz and measured capacitance accuracy as low as 0.1% allow the Model 4200-CVU to outperform anything else in the market.

The 4200-CVU instrument integrates directly into one of the Model 4200-SCS's instrument slots.



The C-V Power Package can perform measurements up to 400V (180V in this zener diode example).

The new C-V Power Package hardware option works in tandem with the enhanced C-V software tools in KITE to make high power C-V measurements at up to 400V (200V per device terminal). A pair of Remote Bias Tees and cabling adapters route voltage from two of the Source-Measure Units installed in the system's chassis to bias either or both sides of a semiconductor device. This higher bias level makes the 4200-SCS ideal for testing higher power devices, such as MEMs, LDMOS devices, displays, automotive components, etc. The package also supports the use of DC currents up to 300mA, making it possible, for example, to measure capacitance when a transistor is turned on, a useful capability in device modeling.

To learn more, download a free copy of our new application note, **"Using the Model 4200-CVU-PWR C-V Power Package to Make High Voltage and High Current C-V Measurements with the Model 4200-SCS Semiconductor Characterization System"** at www.keithley.com.

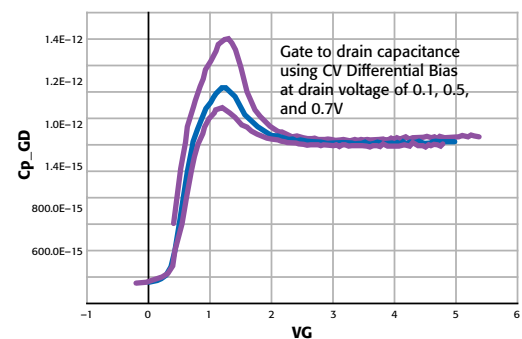


Much of the credit for the Model 4200-CVU's exceptional measurement accuracy, speed, and efficiency is due to the Model 4200-SCS's high speed digital measurement hardware and tight hardware and software integration, as well as Keithley's adherence to low-noise system design principles. This combination of strengths means the Model 4200-CVU can improve users' productivity significantly, whether the task is as simple as setting up a single measurement or running a preset test sequence with a single mouse-click or as sophisticated as triggering and plotting multiple C-V sweeps. The system's high speed digital architecture means the Model 4200-CVU can run and plot C-V sweeps in real time as fast as any competitive C-V meter. Keithley's modular system architecture means the Model 4200-CVU can be easily incorporated into any existing Model 4200 system ever manufactured, or configured into a new 4200-SCS system as an option.

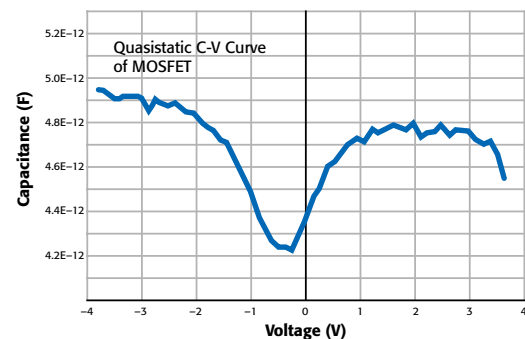
Powerful C-V test libraries and parameter extraction examples

There's much more to the Model 4200-CVU than hardware and interface software. By building on decades of experience in C-V test technology, Keithley is backing up the Model 4200-CVU with an extensive set of sample programs, test libraries, and built-in parameter extraction examples.

- Standard C-V sweeps for generic MOSFETs, diodes, and capacitors.
- MOSCap: Measures C-V on a MOS capacitor.
- MOSFET: Makes a C-V sweep on a MOSFET device.
- Lifetime: Determines generation velocity and lifetime testing (Zerbst plot) of MOS capacitors.
- Mobile Ion: Determines mobile charge using bias-temperature stress method.
- Capacitor: Performs both a C-V sweep and a C-f sweep on a Metal-Insulator-Metal (MIM) capacitor.
- PNjunction: Measures the capacitance of a p-n junction or Schottky diode as a function of the DC bias voltage across the device.
- Photo Voltaic cell: Measures both forward and reverse biased DC characteristics of an illuminated solar cell.
- BJT: Measures capacitance (at 0V bias) between terminals, including C_{be} , C_{bc} , and C_{ce} .
- I-V/C-V switch: Demonstrates using DC SMUs, CVU, and 707A/708A (switch matrix) in one project.
- Interconnect Capacitance: Measures C-V of small interconnect capacitance on wafer.
- Nanowire: Makes C-V sweep on a two-terminal nanowire device.
- Flash: Performs C-V measurements on a typical floating gate Flash memory device.



These test results show how the overlap capacitance of a device changes as the electric fields on the gate and drain are adjusted.



Results of a quasistatic C-V measurement on a MOSFET with 5pF of gate capacitance.

For more information, download "Using the Ramp Rate Method for Making Quasistatic C-V Measurements with the Model 4200-SCS Semiconductor Characterization System" at www.keithley.com.

EXPAND YOUR CHARACTERIZATION OPTIONS:

FAR BEYOND DC

Pulse generation and measurement flexibility

KTE Interactive provides software support for three instruments—a dual-channel pulse generator card (the Model 4205-PG2) that plugs into one of the Model 4200-SCS's slots, just like an SMU, and a choice of two dual-channel digital oscilloscopes for time- and voltage-domain measurements. Together, these instruments make it simple and cost-effective to integrate pulsing, waveform generation, and signal observation capabilities into the Model 4200-SCS's test environment.

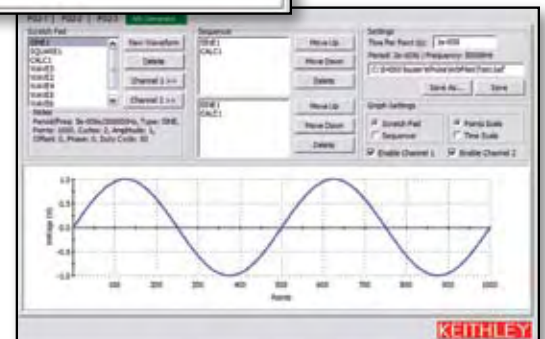
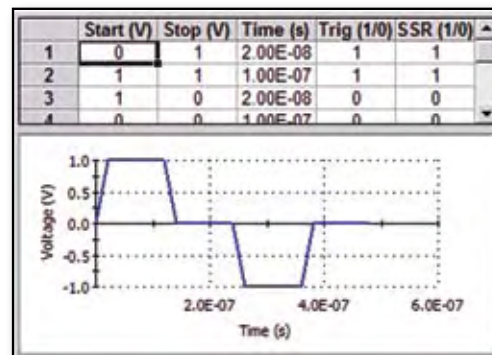
The 4205-PG2 supports two waveform generation modes in addition to our standard pulse capability. The Arbitrary Waveform Mode can generate complex waveforms made up of up to 256K data points at clock speeds up to 25MHz. The Segment ARB™ Mode (patent-pending) simplifies creating, storing, and generating waveforms made up of up to 1024 user-defined line segments. Each segment can have a different duration, allowing exceptional waveform generation flexibility.

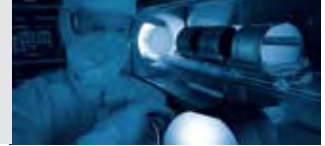


Dual-channel pulse generator

The Model 4205-PG2 Dual-Channel Pulse Generator provides voltage pulses as short as 10ns or up to $\pm 20V$ (into 50Ω).

Each Model 4200-SCS chassis can support four pulse generators, for up to eight pulse generation channels. This instrument expands the system's applications significantly, adding charge pumping (including tri-level charge pumping), parallel AC stress for stress/measure reliability testing, basic clock generation for test vectoring and failure analysis, and digital triggering for multi-pin device testing. A trigger-in capability simplifies synchronizing the operation of multiple pulse channels.





A choice of dual-channel digital oscilloscopes

The system supports two integrated digital oscilloscope options: the Model 4200-SCP2 offers 8-bit resolution with a sample rate up to 2.5 gigasamples/second, while the Model 4200-SCP2HR provides 16-bit resolution and a sample rate up to 400 megasamples/second. Both can be programmed for automated measurement and data acquisition or used with the stand-alone GUI application provided to perform traditional oscilloscope tasks. They provide measurements in both the time (frequency, rise/fall time) and voltage domains (amplitude, peak-peak, etc.).



Request a free copy of our white paper, ***Introducing Pulsing into Reliability Tests for Advanced CMOS Technologies***, at www.keithley.com.

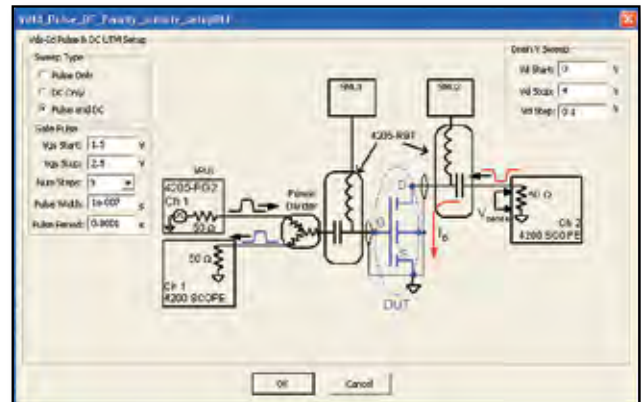
COMPLETE TURNKEY

APPLICATIONS PACKAGES

To help you tailor your Model 4200-SCS system cost-effectively, Keithley has designed three hardware/software packages for specific sets of pulse test applications.

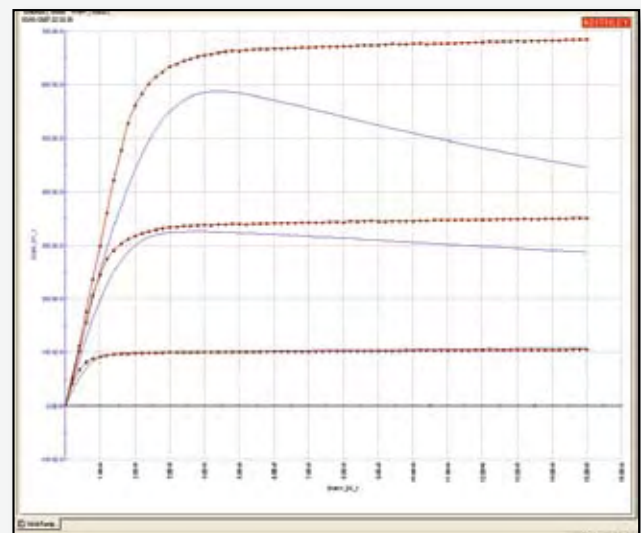
4200-PIV-A Pulse I-V Package

Our dual-channel pulse generator is combined with an integrated digital oscilloscope, specialized interconnect, and software that controls pulse generation and data acquisition to automate a variety of pulsed I-V tests. Patented cable compensation and load-line compensation functions are provided, producing DC-like I-V transistor curves, such as $V_{DS}-I_D$ and $V_{GS}-I_D$ families of curves for voltage threshold extraction. This package is ideal for pulsed I-V testing of devices with charge trapping or self-heating issues, such as high κ gate dielectric transistors and advanced CMOS technologies like SOI.



4200-PIV-Q Pulsed I-V, Q Point, Dual-Channel Pulsing Package

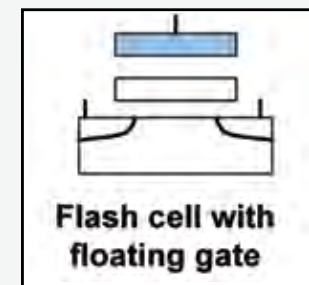
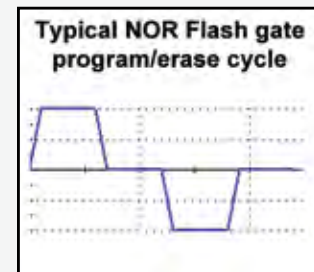
Choose the 4200-PIV-Q for quiescent point pulsing for RF transistors like HEMT and FET devices in III-V or LDMOS technologies. Combining multiple pulse generators and a digital oscilloscope offers a variety of new capabilities, including dual-channel pulsing (i.e., on both a device's gate and drain), higher power pulsing, and pulsing from a non-zero quiescent point. It's useful for investigating a variety of dispersion phenomena and looking at transient effects using a single pulse.





4200-FLASH Non-Volatile Memory Test Package

This package tests single flash memory cells or small arrays quickly and easily, providing four independent (but synchronized) multi-level pulse channels. It includes all the code and interconnect needed to perform a standard set of flash memory tests (characterization, endurance, and disturb tests) for NAND or NOR technologies (including MLC). It can generate program and/or erase cycles using the new Segment ARB™ wave generator, and tightly control the in-line High Endurance Output Relay, which can shorten lifetime testing times significantly.



Control external hardware via GPIB with our built-in drivers

Need to incorporate an external C-meter, switch matrix, probe, or external pulse generator into your semiconductor characterization system? Just set the GPIB address, install the GPIB cable, and the Model 4200-SCS is ready to start testing. The User Test Modules we supply load external instrument data directly into the system's analysis and graphing tools.

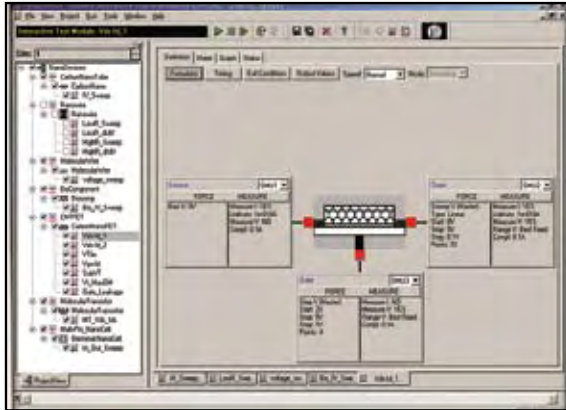
Automate testing and wafer stepping with prober control capabilities

- Control semi-automatic probers from Cascade, Suss, Micromanipulator, and Signatone with the drivers included.
- Use our single-click automation to step easily from die to die and sub-site to sub-site while running a test sequence and storing all the data.



COMPATIBLE WITH:

A VARIETY OF APPLICATIONS



Explore nanotechnology applications

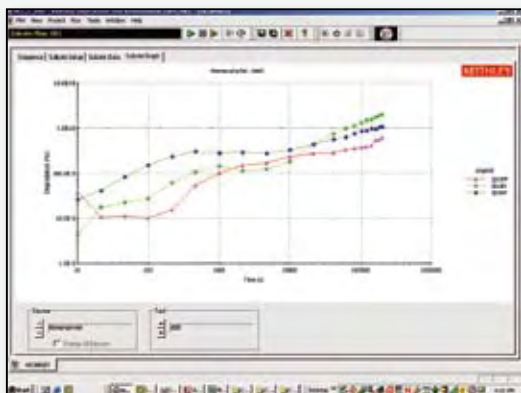
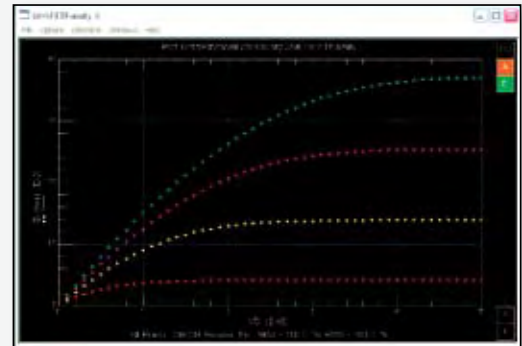
With 16 Interactive Test Modules (ITMs) for characterizing the seven most common nanodevice structures, the sample project and sample tests included in the Model 4200-SCS bring together the capabilities you need to create powerful nanotech R&D software applications. They can help you to focus on your research by slashing the time needed to develop new applications or to refine them as new test requirements emerge. The Model 4200-SCS conforms to and supports the new IEEE Standard P1650™-2005: IEEE Standard Test Methods for Measurement of Electrical Properties of Carbon Nanotubes.

Supported nanodevices:

- Carbon Nanotube
- Carbon Nanotube FET
- Molecular Transistor
- BioComponent
- Nanowire
- Multi-Pin Nanocell
- Molecular Wire

Data acquisition applications in the modeling lab

We've given the Model 4200-SCS the flexibility to interface with ProPlus Design Solutions' BSIMProPLUS™ package, Agilent's IC-CAP modeling application, or Silvaco's UTMOST III SPICE modeling software via the system's built-in GPIB interface. Instrument drivers allow these packages to control the Model 4200-SCS directly, just like any piece of instrumentation linked to the modeling station.



The pulse testing option (adding a 4205-PG2 pulse generator) supports AC stress testing of new materials, failure mechanisms, and clocked devices, and is controlled through the same point-and-click interface as DC stress.

Characterize device lifetimes accurately and economically

The stress-measure capabilities included make the Model 4200-SCS ideal for both packaged level and wafer level reliability testing applications. The system's sequencer controls the order of stress-measure steps, so any 4200-SCS test can be inserted into the measurement phase. Test sequences are completely user-programmable and can include both standard Interactive Test Modules, like Vt-lin, and custom User Test Modules. Multiple tests can be run during each measure step, and switch controls can isolate individual devices that were stressed in parallel. Several JEDEC-compliant sample projects are provided with the system, including projects for standard WLR tests like Hot Carrier Injection or Channel Hot Carrier, Negative Bias Temperature Instability, Charge to Breakdown, and Electromigration. All of these projects are easily customizable to adapt to specific WLR testing requirements.

COMPREHENSIVE SWITCHING SOLUTIONS

Integrated switching control

Three different standard switch configurations make it easy to find the best match for the application. Based on Keithley's six-slot Model 707A and single-slot Model 708A switch matrix mainframes, they include all the components, cabling, and instructions needed to assemble the switch matrix and incorporate it into the 4200-SCS test environment. Once the switch is installed, users can connect instrument terminals to output pins in minutes with a simple "fill-in-the-blank" interface in the Keithley Configuration Utility (KCON). No need to remember and program row and column closures—system applications and standard user libraries manage routing test signals from instruments to DUT pins. A new GUI simplifies configuring switch connections.



STANDARD SWITCH MATRIX CONFIGURATIONS

General Purpose

<100pA

Uses Model 7071 switch card



- Component ATE
- Best match to the 4200-SCS without optional PreAmps
- Excellent for remote sense applications
- Low cost, high density cables
- Expandable from 8×12 to 8×72

Low Current

<1pA

Uses Model 7072 switch card



- Basic device characterization
- Good match to the 4200-SCS with or without optional PreAmps
- Local sense, excellent for C-V meters and pulse generators
- Standard triax cables
- Expandable from 8×12 to 8×72

Ultra Low Current

<100fA

Uses Model 7174A switch card



- High performance device characterization
- Best match for the 4200-SCS when equipped with optional PreAmps
- Standard triax cables
- Expandable from 8×12 to 8×72

Request a **FREE** copy of our new Nanotechnology Measurement Handbook at www.keithley.com.

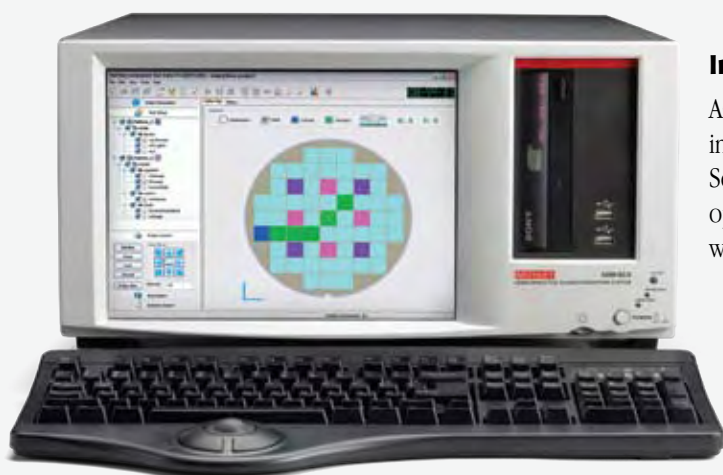


SUPERIOR MEASUREMENTS

Automate your characterization applications

Our new Automated Characterization Suite (ACS) option allows the Model 4200-SCS to interface easily with popular semi-automatic and fully automatic wafer probers. The ACS software simplifies a variety of complex system functions, including wafer description, test setup, interactive prober control, automation, and test summary report generation. It offers maximum operating flexibility by making it easy to switch between semi-automatic operation and fully automatic operation using the same test plan and environment.

ACS Integrated Test Systems are highly configurable, instrument-based systems for semiconductor characterization at the device, wafer, and cassette level.



Integration with a wide range of instrument options

ACS allows easy integration of a wide range of external instrumentation, including the Model 4200-SCS and Keithley's Series 2600 System SourceMeter® instruments. ACS uses an open architecture that gives you greater programming flexibility without compromising ease of use.

For more details on how our new **ACS Integrated Test Systems** can boost your testing productivity, contact your Keithley representative or download a copy of our new **ACS brochure** at www.keithley.com.



Additional device characterization solutions

Use Series 2600 System SourceMeter® instruments to configure applications that demand fast measurements and/or high channel counts. Their embedded Test Script Processors ensure unparalleled system automation and two to four times the test throughput of competitive products in I-V functional test applications. The TSP-Link™ master/slave connection seamlessly integrates multiple Series 2600 SourceMeter channels into a system that can be programmed and controlled as a single instrument. Add your choice of **Series 2400 SourceMeter instruments** for applications that also demand wide dynamic range: 10pA to 10A, 1μV to 1100V, 20W to 1000W.



For automated testing of electronic products and components, rely on **Series 3700 Switch Systems** with optional integrated DMMs for scalable, instrument-grade switching and multi-channel measurements. These LXI Class B-compliant solutions feature embedded Test Script Processors, so they offer unparalleled system automation, throughput, and flexibility.

Request our **FREE** white paper: **Pulsed Characterization of Charge-Trapping Behavior in High K Gate Stacks** at www.keithley.com.

CONDENSED SPECIFICATIONS

CURRENT SPECIFICATIONS

	Current Range ¹	Max. Voltage	Measure		Source	
			Resolution ³	Accuracy ±(% rdg + amps)	Resolution ³	Accuracy ±(% rdg + amps)
4210-SMU ² High Power SMU	1 A	21 V	1 μ A	0.100 % + 200 μ A	50 μ A	0.100 % + 350 μ A
	100 mA	210 V	100 nA	0.045 % + 3 μ A	5 μ A	0.050 % + 15 μ A
	100 mA	21 V	100 nA	0.045 % + 3 μ A	5 μ A	0.050 % + 15 μ A
	10 mA	210 V	10 nA	0.037 % + 300 nA	500 nA	0.042 % + 1.5 μ A
4200-SMU ² Medium Power SMU	1 mA	210 V	1 nA	0.035 % + 30 nA	50 nA	0.040 % + 150 nA
	100 μ A	210 V	100 pA	0.033 % + 3 nA	5 nA	0.038 % + 15 nA
	10 μ A	210 V	10 pA	0.050 % + 600 pA	500 pA	0.060 % + 1.5 nA
	1 μ A	210 V	1 pA	0.050 % + 100 pA	50 pA	0.060 % + 200 pA
4200-SMU and 4210-SMU with optional 4200-PA PreAmp	100 nA	210 V	100 fA	0.050 % + 30 pA	5 pA	0.060 % + 30 pA
	10 nA	210 V	10 fA	0.050 % + 1 pA	500 fA	0.060 % + 3 pA
	1 nA	210 V	3 fA	0.050 % + 100 fA	50 fA	0.060 % + 300 fA
	100 pA	210 V	1 fA	0.100 % + 30 fA	15 fA	0.100 % + 80 fA
	10 pA	210 V	0.3 fA	0.500 % + 15 fA	5 fA	0.500 % + 50 fA
	1 pA	210 V	100 aA	1.000 % + 10 fA	1.5 fA	1.000 % + 40 fA

VOLTAGE COMPLIANCE: Bipolar limits set with a single value between full scale and 10% of selected voltage range.

VOLTAGE SPECIFICATIONS

Voltage Range ¹	Max. Current		Measure		Source	
	4200-SMU	4210-SMU	Resolution ³	Accuracy ±(% rdg + volts)	Resolution ³	Accuracy ±(% rdg + volts)
200 V ⁴	10.5 mA	105 mA	200 μ V	0.015 % + 3 mV	5 mV	0.02 % + 15 mV
20 V	105 mA	1.05 A	20 μ V	0.01 % + 1 mV	500 μ V	0.02 % + 1.5 mV
2 V	105 mA	1.05 A	2 μ V	0.012 % + 150 μ V	50 μ V	0.02 % + 300 μ V
200 mV	105 mA	1.05 A	1 μ V	0.012 % + 100 μ V	5 μ V	0.02 % + 150 μ V

CURRENT COMPLIANCE: Bipolar limits set with a single value between full scale and 10% of selected current range.

Additional Specifications

MAX. OUTPUT POWER: 22 watts for 4210-SMU and 2.2 watts for 4200-SMU (both are four-quadrant source/sink operation).

DC FLOATING VOLTAGE: COMMON can be floated ± 32 volts from chassis ground.

VOLTAGE MONITOR (SMU in VMU mode):

Voltage Range	Measure Resolution	Measure Accuracy ±(%rdg + volts)
200 V	200 μ V	0.015 % + 3 mV
20 V	20 μ V	0.01 % + 1 mV
2 V	2 μ V	0.012 % + 110 μ V
200 mV	1 μ V	0.012 % + 80 μ V

INPUT IMPEDANCE: $>10^{13}\Omega$.

INPUT LEAKAGE CURRENT: <30 pA.

MEASUREMENT NOISE: 0.02% of measurement range (rms).

DIFFERENTIAL VOLTAGE MONITOR:

Differential Voltage Monitor is available by measuring with two SMUs in VMU mode, or by using the low sense terminal provided with each SMU.

GROUND UNIT

Voltage error when using the ground unit is included in the 4200-SMU, 4210-SMU, and 4200-PA specifications. No additional errors are introduced when using the ground unit.

OUTPUT TERMINAL CONNECTION: Dual triaxial, 5-way binding post.

MAXIMUM CURRENT: 2.6A using dual triaxial connection; 8.5A using 5-way binding posts.

LOAD CAPACITANCE: No limit.

CABLE RESISTANCE: FORCE $\leq 1\Omega$, SENSE $\leq 10\Omega$.

NOTES

- 1 All ranges extend to 105% of full scale.
- 2 Specifications apply on these ranges with or without a 4200-PA.
- 3 Specified resolution is limited by fundamental noise limits. Measured resolution is 6½ digits on each range. Source resolution is 4½ digits on each range.
- 4 Interlock must be engaged to use the 200V range.

CONDENSED AC SPECIFICATIONS

4205-PG2 PULSE GENERATOR SPECIFICATIONS

Standard pulse:	±20V into 50Ω ±40V into 1MΩ Period range: 20ns to 1s Programmable pulse width: 10ns to near DC
Arbitrary (ARB) waveform:	Depth: 256K points/channel Timebase: 20ns/point up to 1s/point, fixed timebase for entire waveform
Segment ARB™ waveform:	Depth: 1024 segments/channel Time per segment: 20ns to 1s, 10ns increments (each segment can have a different duration)

4200-PIV-A SPECIFICATIONS

Resolution:	100nA
Sample Rate:	1GS/s
DC Offset:	± 200V on drain
Pulse Source Voltage Range:	0 to ±5V into gate
Pulse Width:	40ns to 150ns

4200-CVU SPECIFICATIONS

Measurement Functions:	Measurement Parameters: Cp-G, Cp-D, Cs-Rs, Cs-D, R-jX, Z-theta.
Test Signal:	Frequency Range: 10kHz to 10MHz Minimum Resolution: 10kHz, 1MHz depending on frequency range. Source Frequency Accuracy: ±0.1%. Signal Output Level Range: 10mV rms to 100mV rms. Resolution: 1mV rms. Accuracy: ±(10.0% + 1mV rms) unloaded (at rear panel).
DC Bias Function:	DC Voltage Bias Range: ±30V Resolution: 1.0mV.
Sweep Characteristics:	Available Sweep Parameters: DC bias voltage, frequency.

KEY DIGITAL OSCILLOSCOPE SPECIFICATIONS

Bandwidth (50Ω):	DC to 750MHz
Channels:	2
Maximum sample rate:	1.25 giga-samples per second per channel 2.5 giga-samples per second one channel interleaved
On-board memory buffers:	Up to 1 mega-sample per channel

4200-PIV-Q TYPICAL SPECIFICATIONS

Gate and Drain Current Measure:	10μA resolution
Maximum Current Measure:	Gate: 100mA (into 50Ω) Drain: 760mA (into 50Ω)
Sample Rate:	200MS/s
Gate/Base Pulse Source:	-20V to +20V into 50Ω
Drain/Collector Voltage Range:	-38V to +38V into 50Ω
Pulse Width:	500ns to 999 ms

4200-FLASH SPECIFICATIONS

Pulse Source Voltage Range:	0 to ±20V into 50Ω 0 to ±40V into high impedance.
Pulse Width:	250ns to 1s
Switching time for DUT pin isolation:	100μs

C-V POWER PACKAGE TYPICAL PERFORMANCE

Measurement Parameters:	Cp-Gp, DCV, timestamp.
Ranging:	1pF to 1nF.
Test Signal:	100kHz to 10MHz, 10mV to 100mV.
DC Voltage Source:	±200V with 5mV resolution.
DC Current:	100mA or 300mA maximum.
Typical Cp Accuracy @ 1MHz:	1.0%.
DC Current Sensitivity:	10nA/V.
SMU Bias Terminals Supported:	4.

RAMP RATE QUASISTATIC C-V TYPICAL PERFORMANCE

Measurement Parameters:	Cp, DCV, timestamp.
Ranging:	1pF to 1nF.
Measurement Terminals:	Triaxial guarded.
Ramp Rate:	0.1V/s to 1V/s.
DC Voltage:	±200V.
Typical Cp Accuracy:	5% at 1V/s ramp rate.

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Ensure a faster return on your investment

System Development Services. Let us help you maximize your test productivity by integrating other hardware, such as a switch or C-V meter, into your Model 4200-SCS system.

Software Services. Short of in-house programmers? We can develop custom User Test Modules (UTMs) for your application or review and optimize other software you've already developed.

Implementation Services. We'll get your new system up and running quickly with services like installation, setup, configuration, and basic user training.

Consulting Services. Our Applications Engineers can help you develop test plans, optimize your test processes, or take on time-consuming measurements challenges.

Training Services. We'll deliver in-depth training on system operation, making and optimizing measurements, and system troubleshooting.

Services Contracts. We'll help you avoid unbudgeted maintenance expenses and ensure ongoing system accuracy and performance.



All the support you need

For applications assistance, call us on our toll-free hotline at 1-888- KEITHLEY (534-8453) from 8:00 am to 8:00 pm ET (U.S. only). For assistance beyond those hours, send our Applications Engineering Department a facsimile (440-248-6168) or an e-mail message (product_info@keithley.com). Our worldwide facilities and affiliates, which offer native language support services.

Ongoing system enhancements ensure ongoing ROI

Keithley has continually enhanced the Model 4200-SCS's hardware and software ever since its introduction. This ongoing commitment assures you of a cost-effective system upgrade path to address new testing needs as they arise, so you'll never have to buy a new parametric analyzer because your old one is obsolete. The Model 4200-SCS can keep up with the industry's changing test needs—making your capital investment stretch further and improving your ROI.

Download your FREE copies of this literature at www.keithley.com:

- C-V Characterization of MOS Capacitors Using the Model 4200-SCS Semiconductor Characterization System
- Making I-V and C-V Measurements on Solar/Photovoltaic Cells Using the Model 4200-SCS Semiconductor Characterization System
- Using the Model 4200-CVU-PWR C-V Power Package to Make High Voltage and High Current C-V Measurements with the Model 4200-SCS Semiconductor Characterization System
- Using the Ramp Rate Method for Making Quasistatic Measurements with the Model 4200-SCS Semiconductor C-V Characterization System

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