

Agilent 4279A 1 MHz C-V Meter

Technical Overview



- Measurement time: 10 ms/20 ms/30 ms
- Measurement accuracy: 0.1% (20 ms)
- Internal dc bias: 0 V to ± 38 V, 0.1% programmable sweep
- Measurement range : 0.00001 pF to 1280 pF

High Test Throughput and Reliability for Semiconductor C-V Testing

The Agilent 4279A 1 MHz C-V meter offers the optimum solution for increasing quality and throughput when measuring the capacitance vs. bias voltage characteristics of semiconductors. The 4279A measures capacitance over a range of 0.00001 pF to 1280.00 pF with a basic accuracy of 0.1% and a 6 digit display resolution while sweeping the dc bias voltage. An internal, programmable dc bias sweep source with a 0.1% voltage accuracy throughout the ± 38 V range assures very low measurement error due to bias voltage uncertainty. It makes the 4279A ideal for the precise characterization and testing of varactor diodes, MOS diodes, etc. Measurement time can be selected from three modes of 10 ms, 20 ms and 30 ms/meas. to maximize productivity. The 4279A's very fast ranging and high speed GPIB data transfer capabilities

reduce test time. The automatic bias polarity control feature allows quick selection of the correct polarity bias voltage for the device under test. This new function eases manual testing of samples in incoming/outgoing inspection and provides a simple method of polarity control for automatic test systems.

Applications

- C-V measurement for performing doping profile of wafers.
- C-V characterization and sorting of varactor diodes.
- Capacitance testing of rf mixer and switching diodes.
- Testing capacitors with an applied dc bias for incoming inspection.

Agilent 4279A key specifications

Measurement parameters	C, DF, Q, ESR, G		
Test frequency	1 MHz		
Test signal level	20 mV, 50 mV, 100 mV, 200 mV, 500 mV, and 1 Vrms		
Measurement range	C	0.00001 ~ 1280.00 pF	
	DF	0.00001 ~ 9.99999 (Q displays 1/DF)	
Measurement accuracy¹	0.1%		
Measurement time²	10 ms (short) /20 ms (medium) /30 ms (long)		
Test cable length	0m, 1m, 2m		
Internal DC bias³	Voltage	Resolution	Basic accuracy
	0 to ± 38 V	1 mV	$\pm (0.1\% + 1 \text{ mV})$
Bias sweep	51 points max, GPIB programmable		
Interface	GPIB		

1. Accuracy specified at ambient temperature of $23 \text{ C}^\circ \pm 5 \text{ C}^\circ$

2. Measurement time is supplemental performance data(not specified)

3. Resolution and accuracy apply to bias voltage below 4V

Measurement display output

Basic measurement accuracy of 0.1% and 6 digit display resolution.

Softkeys

Softkeys for user friendly, fast and convenient instrument setup

Large LCD display

For easy viewing of instrument settings and measurement results.

GPIB interface

For high speed data acquisition and instrument control



Monitor display and system messages

Allows verification of measurement setup and instrument operation.

Internal dc bias sweep source

Precise bias voltage sweep with a voltage setting accuracy of 0.1% is obtained by downloading an GPIB sweep program. Auto polarity bias eliminates the need of checking the polarity of the DUTs.

0 m/1 m/2 m test cables, and error compensation

Enables accurate measurements even on the low capacitance ranges when using test cables. Open/short and standard compensation eliminates measurement errors due to test cabling and fixturing.



High speed measurement

Three measurement time modes (10 ms/20 ms/30 ms) allow you to optimize test throughput and accuracy.

Specifications

Measurement function

Parameters measured: C-DF, C-Q, C-ESR, C-G

Measurement circuit modes: series  and parallel 

Ranging modes: Auto, manual and program

Measurement terminals: Four-terminal pair

Test cable length: 0, 1, and 2 meters

Integration time: Short, medium and long (refer to supplemental performance data for measurement time)

Trigger: Internal, external and manual

Trigger delay: programmable delay from the trigger command to the start of the measurement, 0 to 1000 ms in 1 ms steps.

Averaging: 1, 2, 4,..., 128, and 256, programmable

Error-correction: Zero open and short adjustments, offset compensation, and STD compensation (which improves measurement accuracy by using a standard capacitor as a reference.)

• Test signal

Test frequency and accuracy: 1 MHz, $\pm 0.02\%$

Signal level (unknown terminal open): 20 mV, 50 mV, 100 mV, 200 mV, 500 mV, and 1 Vrms, selectable.

• Display

LCD Dot-matrix display. Capable of displaying measured values, control settings, self test messages, and annunciations.

Display digits: 4, 5, 6 digits, selectable, maximum display 999999

• GPIB interface

Remote control and ASCII or binary data output. Packed data output when the swept bias measurements are made.

Measurement range

C	0.00001 pf to 1280.00 pf
DF	0.00001 to 9.99999
Q	0.1 to 9.99999
ESR	0.001 Ω to 999.999 k Ω
G	0.0001 μ S to 9.99999 mS

Notes:

1. C ranges 2 pF to 1024 pF full scale. 25% overranging on all ranges, when $DF \leq 0.2$.
2. Q displays 1/DF
3. ESR and G ranges depend on the capacitance value.

Measurement accuracy

Specified at the UNKNOWN terminals and at the end of the standard 1m or 2m test leads under the following conditions:

1. Warm-up time: ≥ 10 minutes
2. Ambient temperature is $23\text{ }^{\circ}\text{C} \pm 5\text{ }^{\circ}\text{C}$ and short term drift is less than $0.2\text{ }^{\circ}\text{C}/\text{minute}$.
3. Test cable length is 0 or 2 meters (Agilent 16048A/B/D).
4. Zero open/short compensation has been performed.
5. $\text{DF} \leq 0.2$

Error tolerances double when ambient temperature is within the $5\text{ }^{\circ}\text{C}$ to $18\text{ }^{\circ}\text{C}$, or $28\text{ }^{\circ}\text{C}$ to $45\text{ }^{\circ}\text{C}$ range.

Accuracies are relative to the calibration standards.

• C-DF measurement accuracy

C range (Cf)	Test signal level	
	20 mV	500 mV, 1V
1024 pF	0.15% + 0.05%	
512 pF	0.07% + 0.03%	
128 pF	0.07% + 0.03%	
	0.0004 + 0.0003/a*	
32 pF	0.15% + 0.08%	0.1% + 0.05%
	0.06% + 0.04%	0.07% + 0.03%
	0.07% + 0.03%	0.07% + 0.03%
	0.0004 + 0.0003/a	0.0004 + 0.0003/a*
8 pF	0.15% + 0.15%	
	0.06% + 0.08%	
	0.06% + 0.05%	
	0.0004 + 0.0007/a	
2 pF	0% + 0.5%	0.1% + 0.05%
	0% + 0.3%	0.06% + 0.04%
	0% + 0.2%	0.06% + 0.04%
	0.003/a	0.0005 + 0.0005/a

Notes:

1. The above accuracy table provides short, medium and long integration accuracy equations.

C	Accuracy in short
C	Accuracy in medium
C	Accuracy in long
DF	Accuracy in long

2. Accuracy equations are read as follows:
C: \pm (% of reading + % of full scale)
DF: \pm (absolute DF value)

$$3. \alpha = \frac{C_x}{C_f}$$

where, C_x is the capacitance reading and C_f is the full scale value of selected capacitance range.

4. DF accuracy at 1024 pF range is $0.0007 + 0.0003/\alpha$ (contact the nearest Agilent sales office for more detailed accuracy specifications.)

• Multi channel error correction

Zero open/short adjustments and STD compensation for each measurement path (max. 16 channels).

Dc bias

Internal bias: 0 V to ± 38 V

Bias voltage range	Resolution	Accuracy ($23\text{ }^{\circ}\text{C} \pm 5\text{ }^{\circ}\text{C}$)
$\pm (0.000 \sim 4.000)$ V	1 mV	$\pm(0.1\%$ of setting + 1 mV)
$\pm (4.002 \sim 8.000)$ V	2 mV	$\pm(0.1\%$ of setting + 2 mV)
$\pm (8.005 \sim 20.000)$ V	5 mV	$\pm(0.1\%$ of setting + 3 mV)
$\pm (20.01 \sim 38.00)$ V	10 mV	$\pm(0.1\%$ of setting + 10 mV)

Bias voltage sweep: max. 51 sweep points can be programmed via GPIB.

Step delay: programmable delay from the step (up or down) in bias voltage to the start of the measurement, 3 to 1000 ms in 1 ms steps.

External bias: 0 V to ± 100 V

• General

Operating temperature and humidity: $5\text{ }^{\circ}\text{C}$ to $45\text{ }^{\circ}\text{C}$, $\leq 95\%$ RH at $40\text{ }^{\circ}\text{C}$

Power requirements: 100/120/220 V $\pm 10\%$, 240 V + 5% - 10%; 48 Hz to 66 Hz; 200 VA maximum

Size: 177(H) x 426(W) x 498(D) mm

Weight: approximately 15 kg

• Option

Option 4279A-003: 1% test frequency shift. Prevents possible test signal interface from other 1 MHz signal sources.

Supplemental Performance Characteristics

Measurement time: programmable bias sweep measurement time is given by the following equations when the trigger delay and step delay times are set to the minimum values and the display is set to the BLANK mode.

Short: approx. $(3+7.5xN)$ ms

Medium: approx. $(3+16xN)$ ms

Long: approx. $(3+28xN)$ ms

Where, N is the number of bias sweep points.
Includes bias setting time and ranging time.
Measurement display adds 5 ms per bias sweep points.

Ranging time: ≤ 3 ms in program mode,
 ≤ 20 ms/range in auto ranging mode.

Internal bias voltage setting time: ≤ 3 ms to reach
99.9% of bias voltage setting.

Auto bias polarity switching time: ≤ 4 ms after triggered.

Ordering Information

= Choose ONE and ONLY one

= Choose any combination

Agilent 4279A 1 MHz C-V meter

Furnished accessories: None

Test frequency shift options

Option 4279A-800 no test frequency shift

Option 4279A-003 1% test frequency shift

Documentation options

Option 4279A-ABA add specified quantities of English manual

Option 4279A-ABJ add specified quantities of Japanese manual

Note: Manual is not furnished with the 4279A.

Cabinet options

Option 4279A-907 front handle kit

Option 4279A-908 rack mount kit

Option 4279A-909 rack mount & front handle kit

Certification option

Option 4279A-UK6 commercial calibration certificate with test data

Accessories

16048A BNC test leads (1 m)

16048B BNC to SMC test leads (1 m)

16048D BNC test leads (2 m)

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