YOUR DISCRETE TEST SOURCE
SCIENTIFIC TEST, INC.

CURVE TRACER SERIES 5000
SEMICONDUCTOR TESTER

CONTENTS

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CURVE TRACER SERIES 5000

FUNCTION

The Curve Tracer Series 5000 provides all of the functions of the 5000E and 5300HX with the ability to create digital curves for storage and intuitive manipulation.

Curves are generated using high speed ATE test steps to build the curve point by point. Precision data points are generated quickly and accurately using an STI 5000C or 5300C Test System. Data increments are programmable in linear or logarithmic steps. Curves are generated rapidly. Typical test time per step is 6 to 20MS. A two hundred data point curve will typically take only a few seconds to generate. Captured curve data points can be loaded into Excel® to create curve trace presentations.

- PC Based
- Wide Selection of Available Curves
- Programmable Data Point Increments
- Increments can be Linear or Logarithmic
- Programmable Off-Time to Minimize Heating
- Save and Recall Curve Entry Programs
- Save and Recall Previously Captured Curve Image
- Load Curve Data Directly to Excel
- Run up to 10 Curve Programs in Sequence with data loaded to Excel Automatically
- Program Maximum Current/Voltage Limits to Prevent Damage or Heating
- Store/Recall Test Programs
- Multiple Sequential Curves
- Multiple Devices
- Current Limit in Test Program
- Logarithmic Curves
- Automatically Load Curve Data to Excel
- Large Selection of Curves
- Easy to Use
  - Select Curve
  - Enter Range
  - Press Start
- Full Range of Current (not limited to 20A)
- Graph Features - Tools
  - Scales Axes
  - Change Log/Linear
  - View Data Points on Curve
  - Zoom
  - Print Graph
  - Set cursors for new sweep
  - Save Graph
- No Patch Cords
- No SMU Set-Up-Selection; Completely Automatic

Optional tests can be created for connection to external test equipment.
For Curve Tracer specifications refer to Discrete Semiconductor Tester 5000E & 5300HX brochure.

PROGRAMMING

Programming a curve is simple and straightforward. Select desired curve on the menu and fill in the blanks.

Model 5300C

RANGES

VOLTAGE

- 1KV Standard, 2KV Optional
- .20V Gate/Base; 80V Optional

CURRENT

- 2NA to 50A, 100A Optional
- Optional: 20PA

OPTIONAL

- 100/500/1000/1200A

RESOLUTION

- 1MV
- 0.1NA
- 0.1 Milliohm RDSON
- Test Fixtures

PERFORMANCE

The Series 5000 Curve Tracer provides quick creation of digital curves for storage and inuitive manipulation. Curves are generated using a high speed ATE system.

Model 5000C

High resolution assures tests like RDSON to an accuracy of ± 0.5 milliohm at 1 A test current.

STANDARD CURVES

Additional curves can be added using any test available. These include but are not limited to transistor, triac, SCR, MOSFET, IGBT, OVP, gated device, diode, zener, opto-coupler, regulator, MOV, J-FET, opto-switch, diac, opto-logic, Quadrac®, sidac, STS, SBS, and relay.

CURVE TRACER CURVES AVAILABLE

MOSFET N-Channel
- ID vs. VDS (at range of VGS)
- ID vs. VGS (at range of VDS)
- IS vs. VSD
- RDS vs. VGS (at fixed ID)
- RDS vs. ID (at several VGS)
- IDSS vs. VDS (Reverse Bias Selectable)
- VGSTH vs. ID

MOSFET P-Channel
- ID vs. VDS (at range of VGS)
- ID vs. VGS (at range of VDS)
- IS vs. VSD
- RDS vs. VGS (at fixed ID)
- RDS vs. ID (at range of VGS)
- IDSS vs. VDS (Reverse Bias Selectable)
- VGSTH vs. ID

Transistor NPN
- HFE vs. IC
- BVCE (O, S, R, V) vs. IC
- ICBO vs. VCBO
- VCE (SAT) vs. IV (at fixed IC/IB ratio)
- VCE (SAT) vs. IB (at range of IC)
- VBE (SAT) vs. IC (at fixed VCE)
- IC vs. VCE (at range of IB) (Curve Tracer Only)
- IEBO vs. VEB
- ICEO vs. VCE

Transistor PNP
- HFE vs. IC
- BVCE (O, S, R, V) vs. IC
- BVEBO vs. IE
- ICBO vs. VCBO
- VCE (SAT) vs. IC (at fixed IC/IB ratio)
- VCE (SAT) vs. IB (at range of IC)
- VBE (SAT) vs. IB (at fixed IC/IB ratio)
- VBE (ON) vs. IC (at fixed VCE)
- IC vs. VCE (at range of IB) (Curve Tracer only)
- IEBO vs. VEB
- ICEO vs. VCE

IGBT N-Channel
- IC vs. VCE (at range of VGE)
- IC vs. VGE (at range of VCE)
- ICES vs. VCE
- IF vs. VF
- VCE vs. VGE

IGBT P-Channel
- IC vs. VCE (at range of VGE)
- IC vs. VGE (at range of VCE)
- ICES vs. VCE
- IF vs. VF
- VCE vs. VGE

Diode
- IF vs. VF
- IR vs. VR

Zener
- IF vs. VF
- IZ vs. BVZ

Triac
- IT vs. VT+ (at fixed IG and RGK open)
- IT vs. VT- (at fixed IG and RGK open)

SCR
- IT vs. VTM (at fixed IG and RGK open)

SSOVP
- IT vs. VT+ (at fixed IBO)
- IT vs. VT- (at fixed IBO)

SIDAC
- IT vs. VT+ (at fixed IBO)
- IT vs. VT- (at fixed IBO)

DIAC
- ID vs. VF+
- ID vs. VF-

Regulator Positive
- Electronic Load vs. VOUT (at fixed IMAX)

Regulator Negative
- Electronic Load vs. VOUT (at fixed IMAX)

JFET N-Channel
- ID (OFF) vs. VDS (at range of VGS)
- ID (OFF vs. VGS (Reverse Bias) (at fixed VDS)
- ID (ON) vs. VDS (at range of VGS)
- ID (ON) vs. VGS (Reverse Bias) (at fixed VDS)

JFET P-Channel
- ID (OFF) vs. VDS (at range of VGS)
- ID (OFF vs. VGS (Reverse Bias) (at fixed VDS)
- ID (ON) vs. VDS (at range of VGS)
- ID (ON) vs. VGS (Reverse Bias) (at fixed VDS)

Other Curves
- Negative V vs. I (on state negative resistance devices, requires Load Box)
- Positive V vs. I (on state negative resistance devices, requires Load Box)
- V vs. I Quadrants I and III

PROGRAMMING

Programming the data points on the curve tracer is simple and direct. Fig. 1 shows an IDON vs VDS program screen for an N-Channel MOSFET. The maximum limit for the measured variable, IDON, is the top line entry. When the maximum limit is reached, data capture terminates and the curve is complete. The horizontal axis is VDS and is programmable in increments. Two different increment sizes can be programmed. This allows the user to program finer data points in the area of interest in the curve. In the example shown, the first increment size is 400 MV; the second increment size is 4V. The increment size changes at VDS of 4V. VDS range is programmed from 10MV to 40V. VGS data points can be programmed similarly. The curve is run by sweeping the VDS data points at each VGS bias voltage and continues until the maximum ID is obtained at each VGS or until all data points have been reported.

Additional tabs provide user selectable features. Tabs can be selected by clicking on a function near the top of the Curve Tracer screen: Load/Save for recall and saving programs, Sweep Type to select linear or logarithmic axes where appropriate, Ext. Relays to set relay drivers to connect external components, ADP-401A to set pin connections when the curve tracer is used with an ADP401A 8 or 16 pin programmable scanner, and Misc. Controls to load a completed curve and data points directly to Excel with the graph automatically included. The data points can also be graphed in other formats provided by Excel.

A number of graphing features are also included. The mouse can be used to zoom in on a specific area of the curve. Cursors can be moved on a completed curve to re-set start and stop limits to re-generate the curve in greater detail in an area of interest. Clicking on an axis will change the scale from linear to logarithmic. Clicking on a curve will show all data points on the curve.

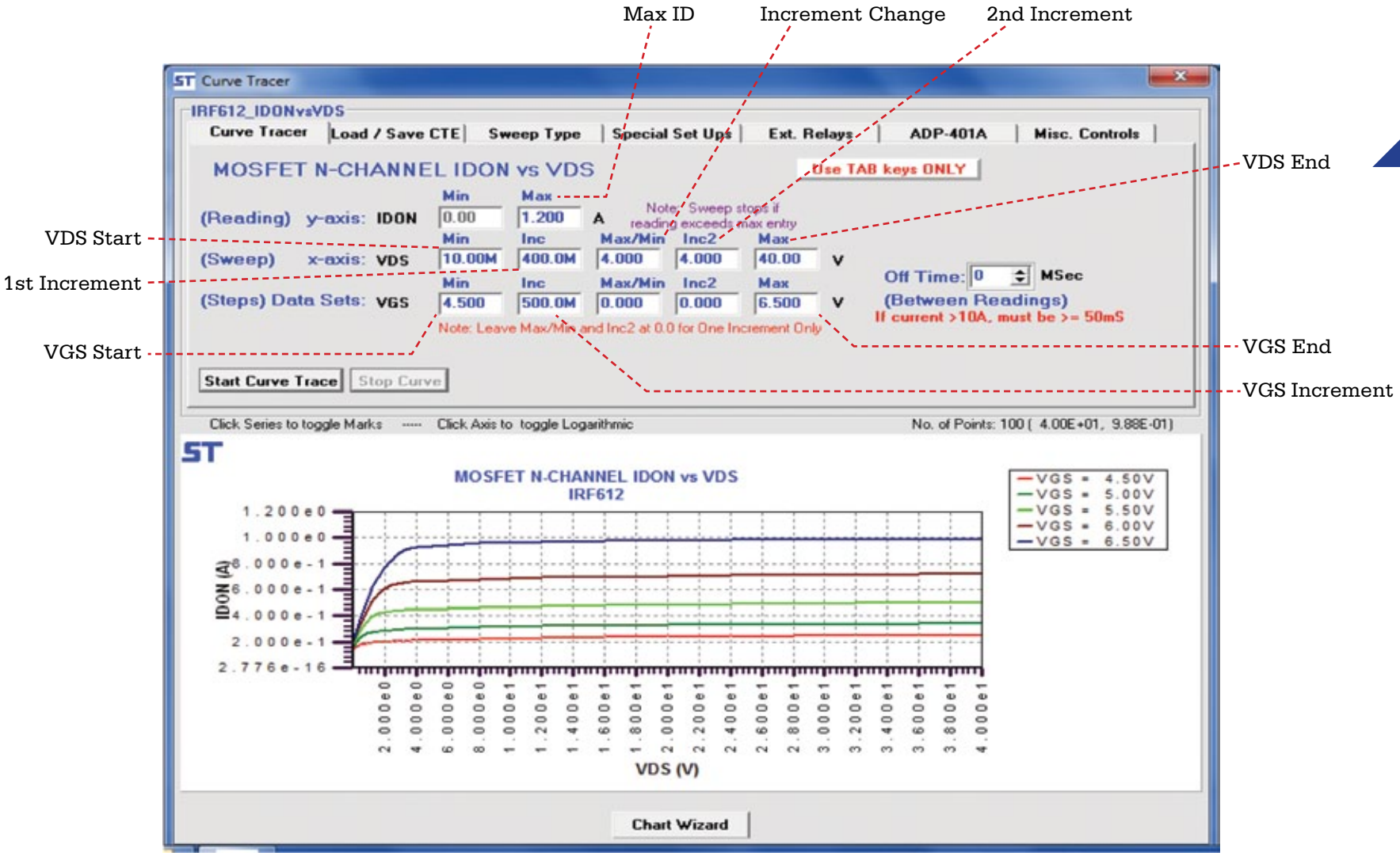
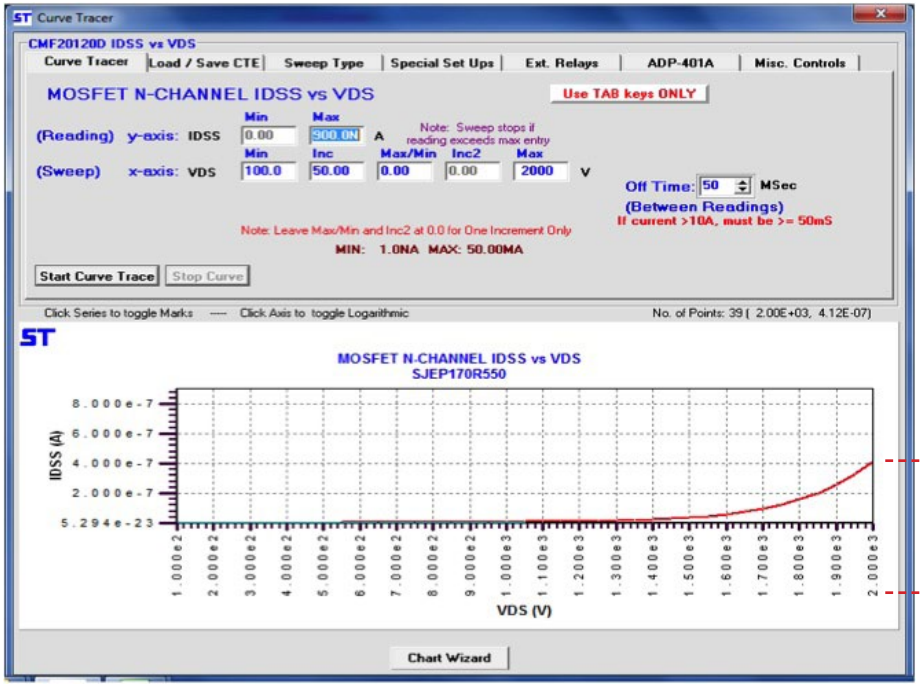


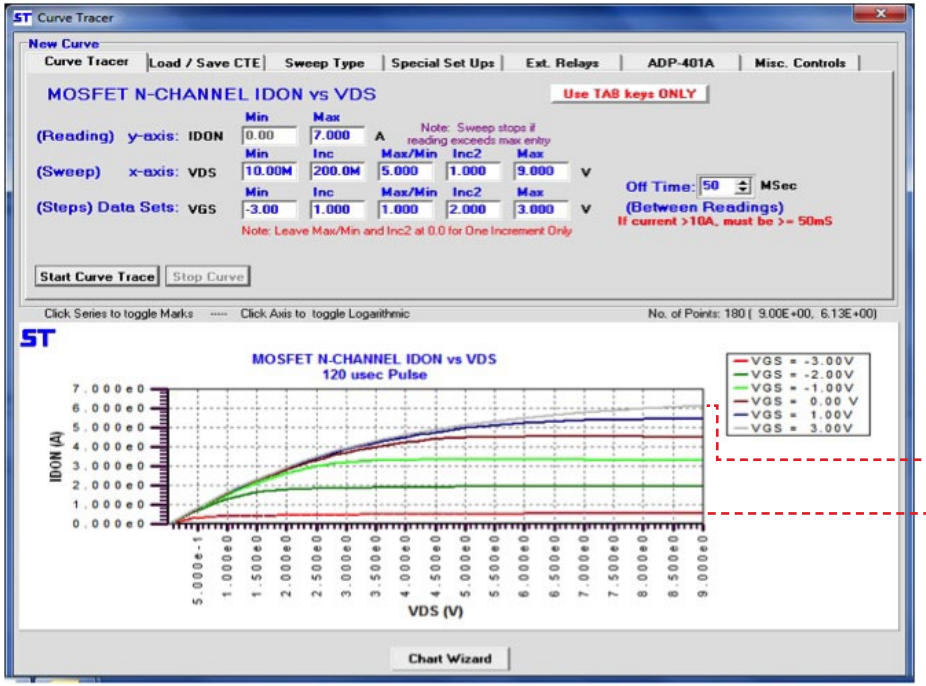
Figure 1

Other curves are similarly programmed. See examples that follow in Figures 2 thru 9.

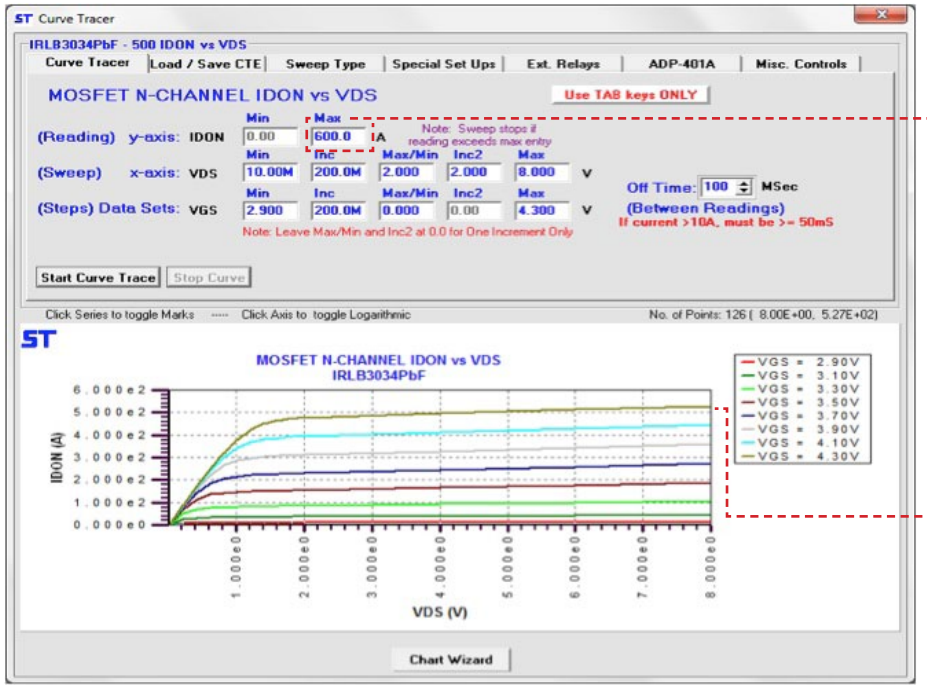
EXAMPLES



SiC IDSS vs VDS (Figure 2)



GaN FET, Bipolar Gate, IDON vs VDS (Figure 3)



Hi-Deck Required

500A+

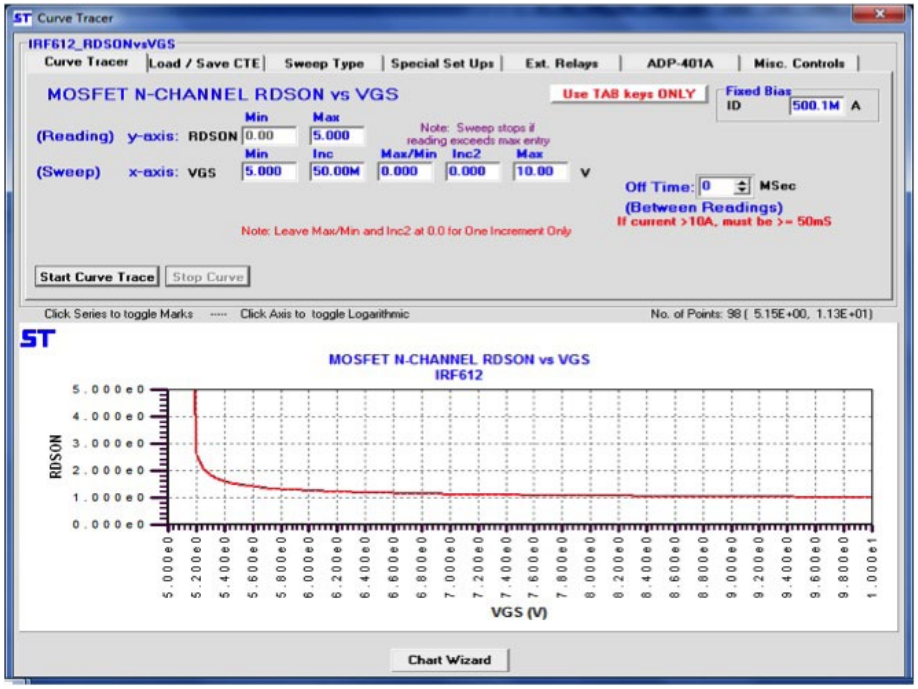
HI Current MOSFET, ID vs VDS (Figure 4)

Hi-Deck Required

700A+

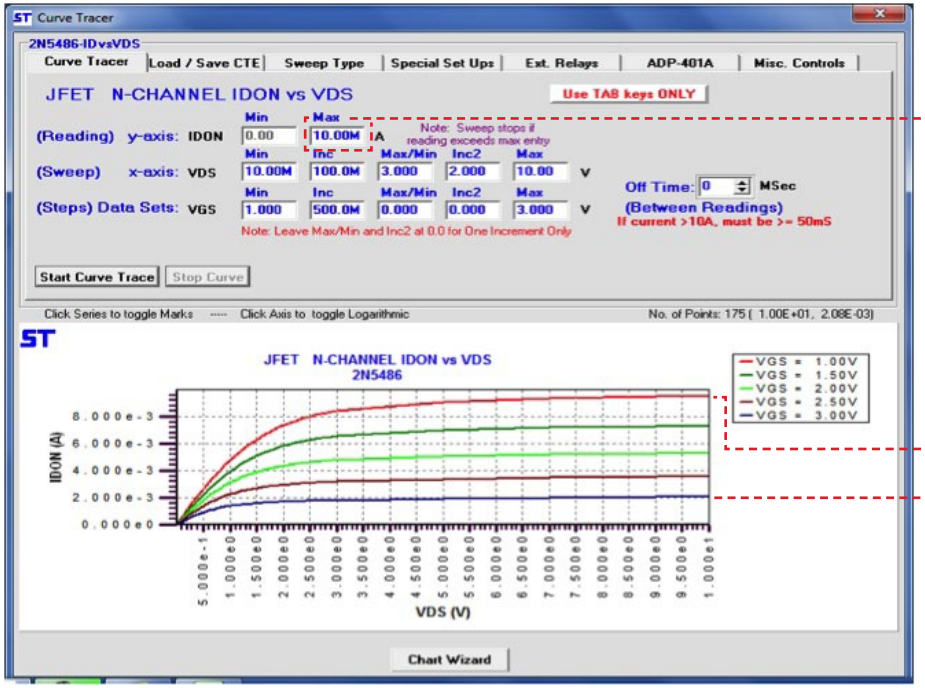
HI Current IGBT, IC vs VCE (Figure 5)

EXAMPLES



NMOS RDSON vs VGS (Figure 6)

NPN hFE vs IC (Figure 7)



Hi-Deck Required

VGS -1V

VGS -3V

N JFET, IDON vs VDS (Figure 8)

NPN IC vs VCE (Figure 9)

CURVE SUITE

A suite of curves can be generated using a group of previously saved curve programs. The curves are run in sequence automatically without the intervention of an operator other than to start the curve sequence. See Figures 10 thru 15. Individual graphs are displayed on the screen as the curves are generated; curve data points are automatically loaded into Excel along with the captured graph. Graphs can be viewed in order by clicking the “View Next” button.

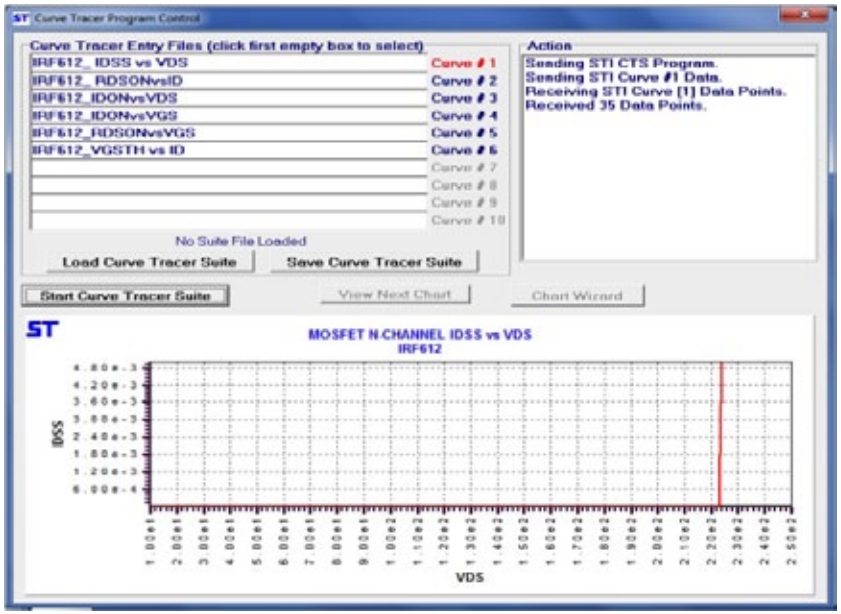


Figure 10

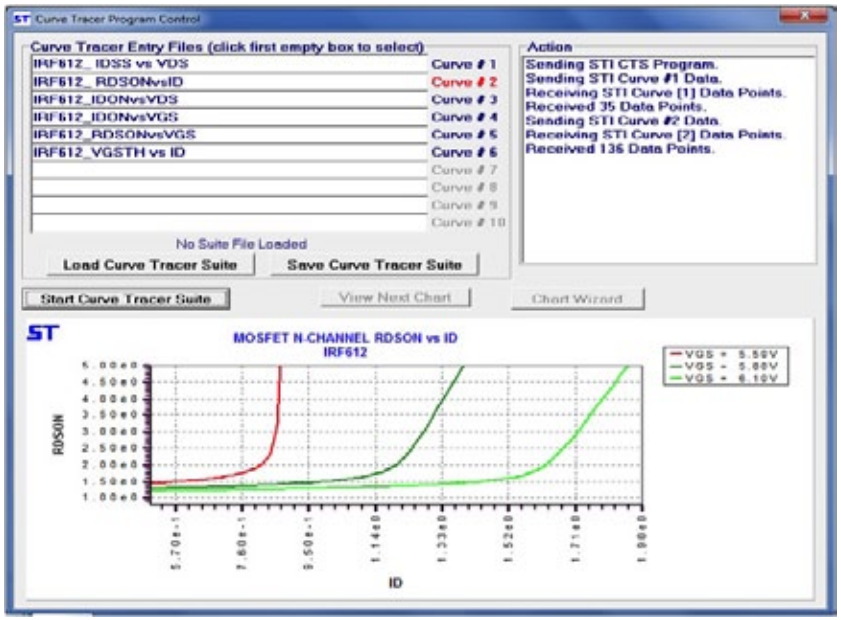


Figure 11

Figure 12

Figure 13

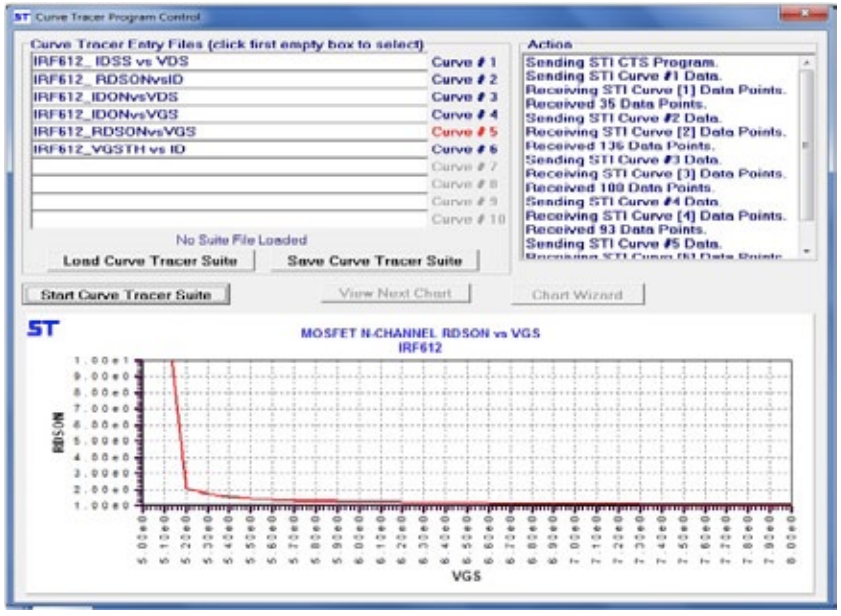


Figure 14

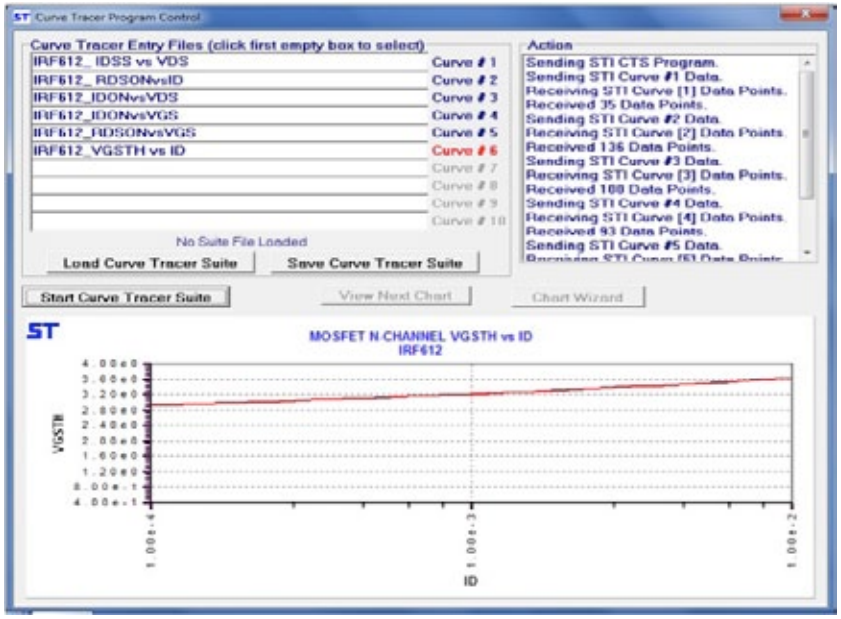
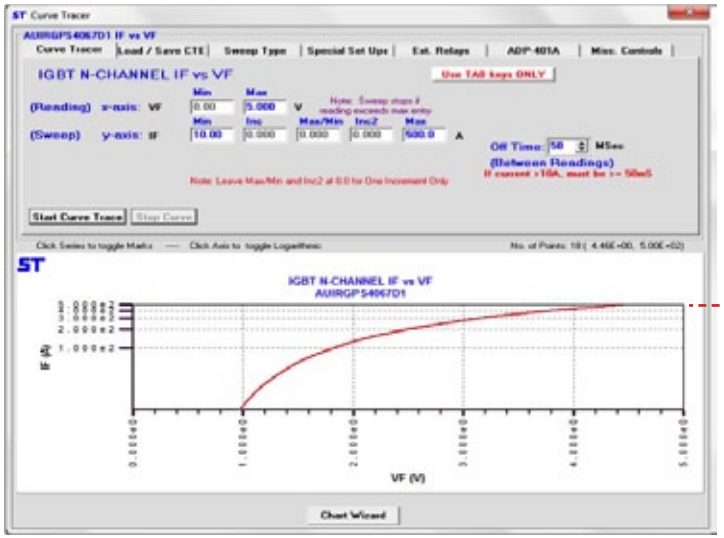


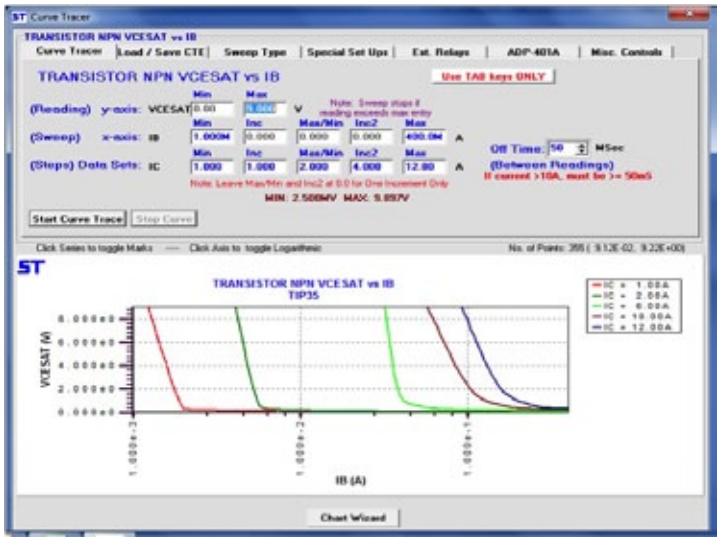
Figure 15

CURVE EXAMPLES

500A



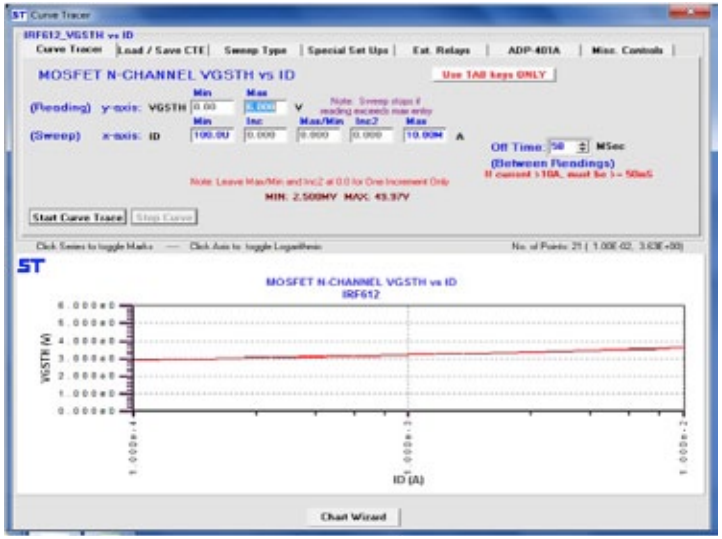
IGBT Diode IF vs VF



NPN VCE vs IB

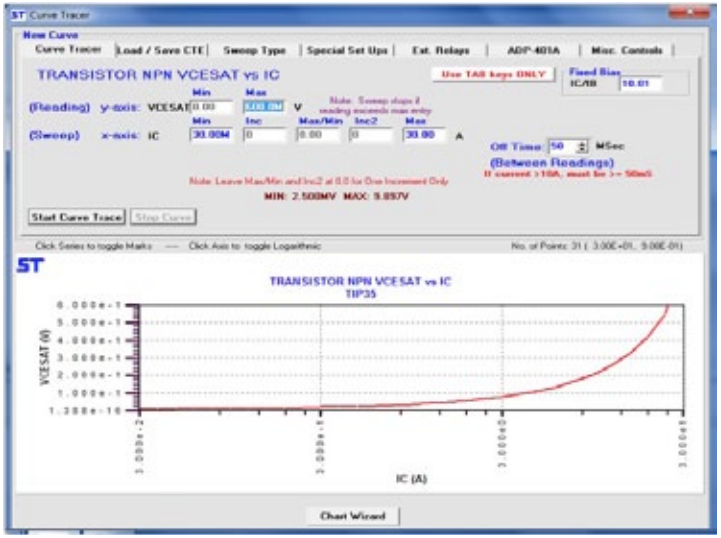
IGBT IC vs VCE, 100A Option

NPN IC vs VCE

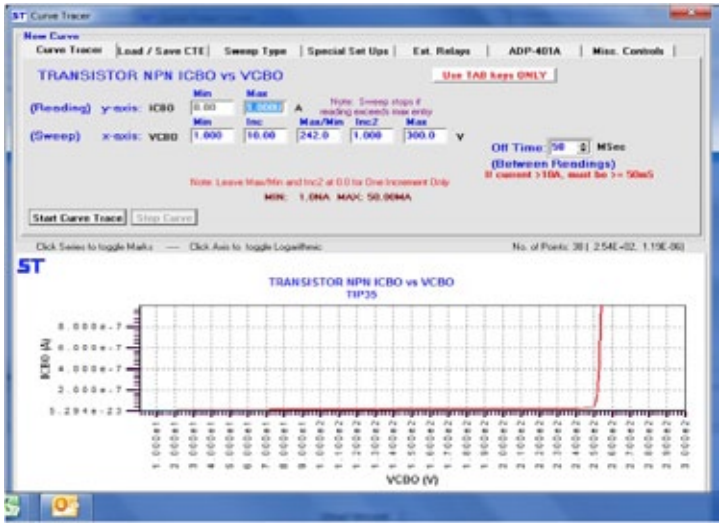


VGSTH vs ID

IGBT ICES vs VCE

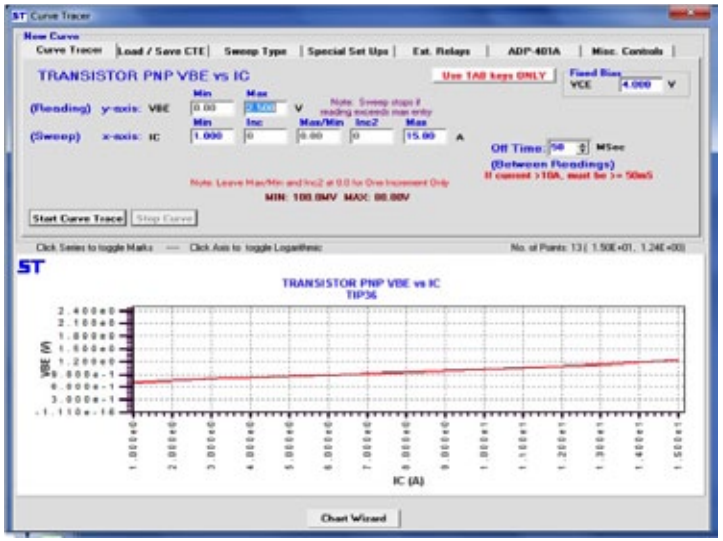


NPN VCESAT vs IC, IC/IB Fixed Ratio

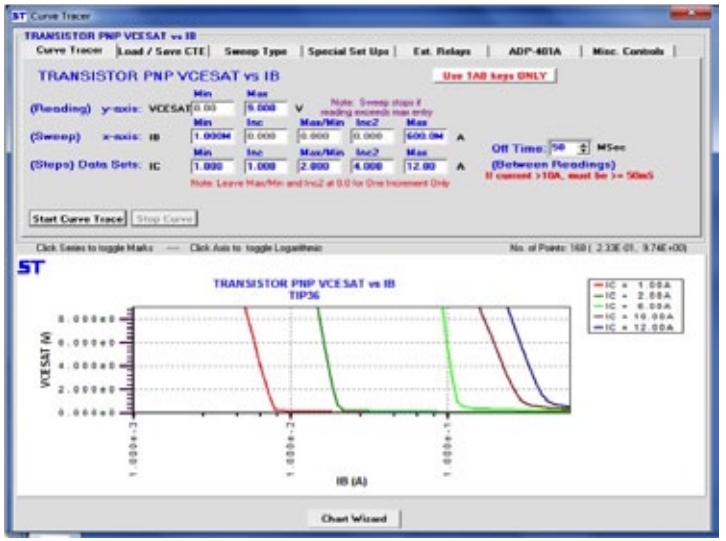


NPN ICBO vs VCB

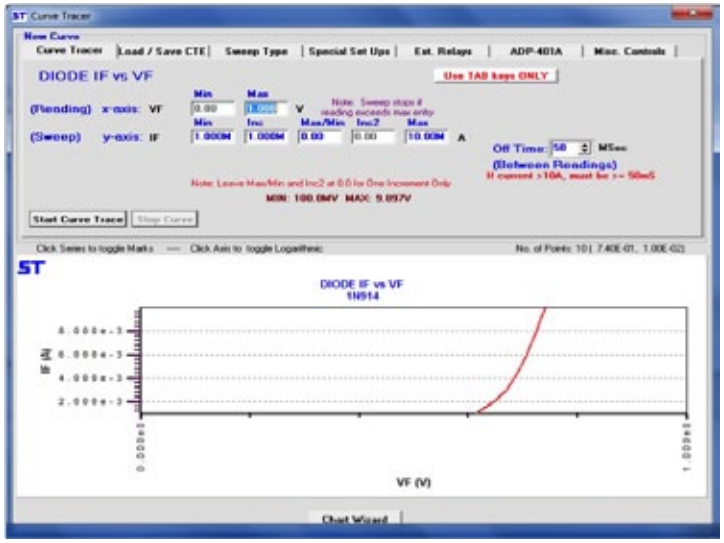
CURVE EXAMPLES



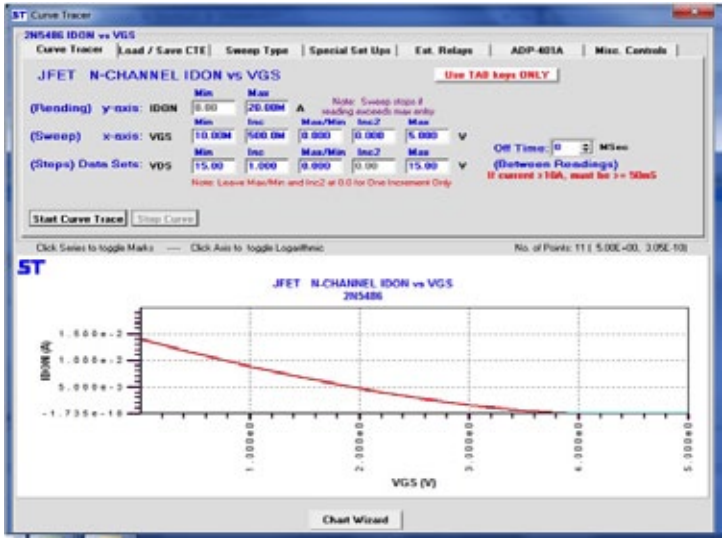
PNP VBE vs IC, fixed VCE



PNP VCE vs IB



Diode IF vs VF



JFET IDON vs VGS

WEIGHT AND DIMENSIONS

MODEL	DIMENSIONS (mm)	WEIGHT (kg)	POWER
MODEL 5000 SERIES Tester Mainframe	17" (432) x 20" (508) x 10.5" (267)	55 lbs (25)	120/240 VAC (+5%, -15%) 50/61 Hz, Fused 2A/1A
MODEL LC-1000 Lo Current Deck	16.5" (419) x 10.5" (267) x 8" (203)	11 lbs (5)	Powered from 5000 Series Tester
MODEL HC-500 Hi Current Deck	17" (432) x 20" (508) x 10.5" (267)	35 lbs (15.9)	Powered from 5000 Series Tester

RACK MOUNT AVAILABLE

SELECTING A TESTER

QUESTIONS TO ASK

- Is programming easy? Will vendor give you software to evaluate?
- Are current and voltage ranges sufficient?
- Can current/voltage ranges be extended later?
- Are a wide selection of fixtures available?
- Is test/datalog speed adequate?
- Will vendor benchmark your samples for speed and correlation?
- Is the test method "single measure"?
- Does it include self-test with convenient troubleshooting guide?
- Is auto-calibrate included?
- Is vendor experienced? How many systems have they installed?
- Is tester limited to single device type/family? (latent cost)
- Is curve trace available?

TEST SPECIFICATIONS

SCIENTIFIC TEST, INC. TEST SPECIFICATIONS 5000C/5300C

	TEST		SPECIFICATION		
	PARAMETER	V RANGE	I RANGE	MAX RES.	ACCURACY
LEAKAGE	I_R, I_{CBO}, $I_{CEO/R/S/X}$, $I_{DSS/X}$, I_{DOFF}, I_{DRM}, I_{RRM}	.10V to 999V (2000V)[1]	2NA (20PA)[2] to 50MA	1 NA (1PA)[2]	1% + 2NA + 20PA/V[8] (1% + 200PA + 2PA/V)[2,8]
	I_{EBO}, I_{GSSF}, I_{GSSR}, I_{GSS}, I_{GKO}, I_R (OPTO)	.10V to 20V (80V)[3]	2NA (20PA)[2] to 3A	1 NA (1PA)[2]	1% + 2NA + 20PA/V[8] (1% + 200PA + 2PA/V)[2,8]
BREAKDOWN	BV_{CEO}, BV_{CES} (IGBT) (300µS Pulse above 10mA)	.10V to 450V (900V)[1] to 700V (1400V)[1] to 800V (1600V)[1]	100µA to 200MA to 100MA to 50MA	1 MV	1% + 100MV
	BV_{DSS}, V_D, BV_{CBO}, V_{DRM}, V_{RRM}, V_{BB}	.10V to 999V (2000V)[1]	100NA to 50MA	1 MV	1% + 100MV
	BV_R, BV_Z	.10V to 5.00V to 9.999V to 50.00V to 700V (1400V)[1] to 999V (2000V)[1] BVZ Soak - 50V (100V) 0-50 ms to 99 secs	10µA to 49.9A (500A)[4] to 25A (250A)[4] to 9.99A to 100 MA to 50MA to 400mA to 80mA	1 MV	0.4% + 2 LSB
	BV_{EBO}, BV_{GSS}, BV_{GKO}	.10V to 20V (80V)[3]	100NA to 3A	1 MV	1% + 10MV
VCESUS	V_{CEOSUS}, V_{CERSUS}, V_{CEVSUS}	V_{CE}: TO 1500V Inductive Kickback, 35mH choke	I_C: to 4A	0.5V	2% + 0.5V
IMPEDANCE	ZZ (1 kHZ) 0.1Ω to 20 KΩ	0.1V to 200V DC (measure 50µV to 300mV rms)	100µA to 300mA DC	0.001 Ω 1µV	1% + 1% Range
GAIN	h_{FE} (1 to 99,999) CTR (.01 to 99,999)	V_{CE}: .10V to 5.00V[5] to 9.99V to 49.9V	I_E: 10µA to 49.9A (500A)[4] derate to 25A (250)[4] derate to 9.99A I_F, I_B: 100NA to 10A	.01 hFE .0001 CTR	V_{CE}: 1% + 10MV I_C: 1% + 100NA I_F, I_B: 1% +5NA

1. 2000V Hi Voltage (Anode/Collector) Option
2. Lo Current Deck Option — Also adds programmable soak time from 1 mS to 99 secs. for current under 1µA. (Not available on 5000E)
3. 80V Lo Source (Gate/Base) Option
4. 500 Amp Hi Current Deck Option. (Not available on 5000E)
5. Voltage @ front panel terminals; allow for drop in cables
6. Optional 100V Hi Source
7. 40A Lo Soure Option
8. Hi Deck or Adaptor: 1% + 2NA + 40PA/V

	TEST		SPECIFICATION		
	PARAMETER	V RANGE	I RANGE	MAX RES.	ACCURACY
ON STATE	V_{CESAT}, V_{BESAT}, V_{BEON} V_F, V_T V_{DSON}, I_{DON}, V_{GSON} V_{GEON} V_F (Opto-Diode)	V_{CE}, V_D, V_F, V_T: .10V to 5.00V to 9.99V V_{GS}, V_{GE}, V_{BE}, V_F: .10V to 9.99V	I_E, V_T, I_F, I_D: 10µA to 49.9A (500A)[4] derate to 25A (250A)[4] I_B, I_F, I_{GT}: 100NA to 10A (40A)[7]	1MV	V: 1% + 10MV I_E, I_F, I_D, I_T: 1% + 100NA I_B, I_{GT}: 1% + 5NA
	V_{GSTH}, V_{GETH}	.10V to 49.9V	I_D: 100µA to 3A	1MV	1% + 10MV
	V_O (Regulator)	V_O: .10V to 20V (50V)[3] V_{IN}: .10V to 49.9V Load: Resistive or Electronic	I_O: 1MA to 5A	1MV	1% + 10MV
	I_{IN} (Regulator)	V_{IN}: .10V to 20V (80V)[3] Load: R_{GK}, 1K, 10K, EXT, OPEN, SHORT	I_{IN}: 1MA to 3A	10NA	1% + 5NA
	V_C	.10V to 49.9V	10MA to 10A	1MV	1% + 10MV
OFF	V_{GSOFF}	V_O: .10V to 20V (80V)[3]	I_D: 100NA (20PA)[2] to 3A V_{DS}: .10V to 50V	1MV	1% + 10MV
TRIGGER	I_{GT} V_{GT} V_{OPER} (Relay)	V_D: 5V to 49.9V V_{GT}: .10V to 20V (80V)3 .10V to 50V	I_{AK}: to 3A I_{GT}: 100NA to 3A R_L: 12, 30, 100Ω, EXT	10NA 1MV .10V	1% + 5NA 1% + 10MV 1% + .10V
HOLD	I_H $V_{RELEASE}$ (Relay)	V_D: 5V to 49.9V .10V to 50V	I_H: 1.5A I_{GT}: 100NA to 3A R_L: 12, 30, 100Ω, EXT (Initial I_{AK} set by R_L)	1µA .10V	1% + 2µA 1% + .10V
LATCH	I_L (Tested indirectly, no exact value)	V_D: 5V to 49.9V	I_L: 100µA to 3A I_{GT}: 100NA to 3A R_L: 12, 30, 100Ω, EXT	N/A	N/A
BREAKOVER	V_{BO}, I_{BO} (SSOVP) V_{BO}, I_{BO} (STS, DIAC) V_{BO}, I_{BO} (SIDAC) V_S, I_S (SBS, STS)	0.10 to 400V[1] 0.10 to 20V (80V)[3] 0.10 to 400V[1] 0.10 to 20V (80V)[3]	10mA to 900mA 1µA to 200µA 1µA to 1mA 1µA to 200µA	1mV	1% + 100mV 1% + 10mV 1% + 100mV

Accuracy specifications are in addition to ± 1 digit in readout.

CLIENT LIST

* Indicates that customer has multiple installations.

Our curve tracers and semiconductor testers are in use worldwide for high volume production, quality control and final testing of semiconductor devices. Over 38% of our customers have two or more of our semiconductor test systems. Many have three or more of our automated semiconductor test equipment - one has 30 of our test systems. For referrals to individual customer references, please contact us.

A.T.E. (IR) India *
ABB Automation Sweden
ABB Hafo, Inc. Sweden
Acme Electric U.S.A. *
Advanced Scientific Taiwan
AeRa Corporation U.S.A.
Allen Bradley U.S.A. *
Allied Signal Aerospace U.S.A.
Altronic, Inc. U.S.A. *
Alltest
Anpec
American Reliability Labs U.S.A.
Analytical Solutions
AP Microelectroincs USA
Artesyn North America, Inc.
Arche Taiwan
Astec America U.S.A.*
Astec Pekan - Malaysia
Aurra Industries U.S.A.
AVCO Systems Div. U.S.A.
Avionic Instrument U.S.A. *
AVX Corporation U.S.A. *
Avaya Communications U.S.A. *
Base 10 Systems U.S.A.
Barber Colman U.S.A.
Beacon Light Products U.S.A.
B.F. Goodrich Aerospace U.S.A.
Black & Decker U.S.A.
Boeing Electronics U.S.A. *
Bourns Ltd UK
Bourns Xiamen China Ltd
Bridgepoint U.S.A.
Brown Boveri & Cie Switzerland
California Instruments U.S.A.
Canaan Korea Co.
Cardiac Pacemakers / Guidant U.S.A.
Carlin Combustion U.S.A.
Cirrus Logic, Inc.
China Electronics China *
Clarostat U.S.A. *
Comdial U.S.A.
Concord Semiconductor Wuxi Co. Ltd.
Concurrent Computer Corp. U.S.A.
Control Concepts U.S.A. *
Copam Electronics Taiwan
Corning Cable Systems U.S.A. *
Cox & Company, Inc. U.S.A.
Crown International U.S.A.
Cree, Inc.
Cree Microwave U.S.A. *
Crown International
Custom Analytical U.S.A.
CSIST Taiwan *
Cyntec Co. Ltd. Taiwan
Daewoo Corporation, South Korea R.O.K.
Delphi (Delco) U.S.A. *
Delphi Automotive Indiana
Delta Electronic Ind. Ltd. Taiwan
Delta Products Corp. Mexico
Digital Equipment Corp. U.S.A. *
DII Taiwan
Diodes, Inc. U.S.A. *
Diodes Shanghai Co., Ltd.
DPA Labs U.S.A. *
Dovatron International U.S.A.
Dynamic Controls Corp. U.S.A.
Eaton Cutler - Hammer U.S.A. *
Eastn Elequip U.S.A. *
EG&G Power Systems U.S.A.
Emerson Industrial Controls U.S.A. *
Epic Technologies U.S.A.
Ericsson Components U.S.A. *
ERSO / ITRI Taiwan
E-Systems U.S.A.
Ferguson Enerprises
Fireye, Inc. U.S.A.
Fisher - Rosemount Singapore
Formosa Silicon Semiconductor Taiwan *
G.E.C. Marconi U.S.A.
General Electric U.S.A. *
General Electric Energy Louisville
General Electric Global Research
General Electric India
GHZ Technology, Inc. U.S.A. *
Goldstar - South Korea R.O.K.
GPU Nuclear Corporation U.S.A.
Gull Inc. U.S.A.
Hang Zhou Reliability Instrument China *
Hayes Instrument U.S.A.
Hazeltine Corporation U.S.A.
Heath Company (Zenith) U.S.A.
Hipro Electronics China
Hipro - Thailand
Hitachi - Malaysia
Howard Industries U.S.A. *
Honeywell, Inc. U.S.A.
HTV GmbH
Boeing EDD U.S.A.
Hutson Industries U.S.A. *
ICL U.S.A.
ICE France
Integra Technologies Inc. U.S.A.
IEC U.S.A.
International Rectifier Czech Rep. *
International Rectifier England *
International Rectifier Italy *
International Rectifier Mexico *
International Rectifier U.S.A. *

Interpoint U.S.A
ITI Indian Telephone India
IXYS U.S.A.
Johnson Controls, Inc. U.S.A.
Jung Jin - South Korea R.O.K.
Kidde Fenwal, Inc. U.S.A.
Kimpsion Corporation
Kodenshi - South Korea R.O.K.
Kollsman Instrument U.S.A. *
L-3 Communications ETI
L-3 Communications U.S.A. *
LaMarche U.S.A.
Lead Year - Taiwan
Littelfuse
Lear Corporation U.S.A. *
LiteOn - Taiwan *
Litton Systems Canada *
Lockheed Martin U.S.A.
Loras Industries, Inc.
Lucas SEI Electronics U.S.A.
Loras Industries U.S.A. *
Maida Development U.S.A. *
Lucerne Products, Inc. U.S.A.
Medtronic, Inc. U.S.A.
Mars Electronics U.S.A.
Micro Energy U.S.A.
MIC - Taiwan
Micro Networks Co. U.S.A. *
Microsemi Lawrence U.S.A. *
Micronova Technology U.S.A.
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OMC Trade Winds U.S.A.
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On Semiconductor
Opto Tech - Taiwan
Phihong Enterprise Co. Ltd. Taiwan
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Photron - Taiwan *
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Power-One
Powerrex, Inc.
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PSE & G U.S.A.
Protek Devices U.S.A. *
PSG Industries U.S.A.
PSI Technologies Philippines *
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QPL U.S.A.
R.S.M. Electron Power U.S.A. *
RGA Labs U.S.A. *
Raytheon U.S.A. *
Ray International U.S.A. *
R.E. Phelon PR/DR
Richardson Electronics U.S.A. *
Rainbird Corporation U.S.A.
Rockwell International U.S.A.
Rinehart Motion Systems U.S.A.
Samwha - South Korea R.O.K. *
Rohm Electronics U.S.A.
Samsung Aerospace - South Korea R.O.K.
Samyang - South Korea R.O.K.
Sensormatic U.S.A. *
Seefull Electronics Shanghai *
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System Sensor (Pittway Group) Italy
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