Basics of Keithley Interactive Test Environment

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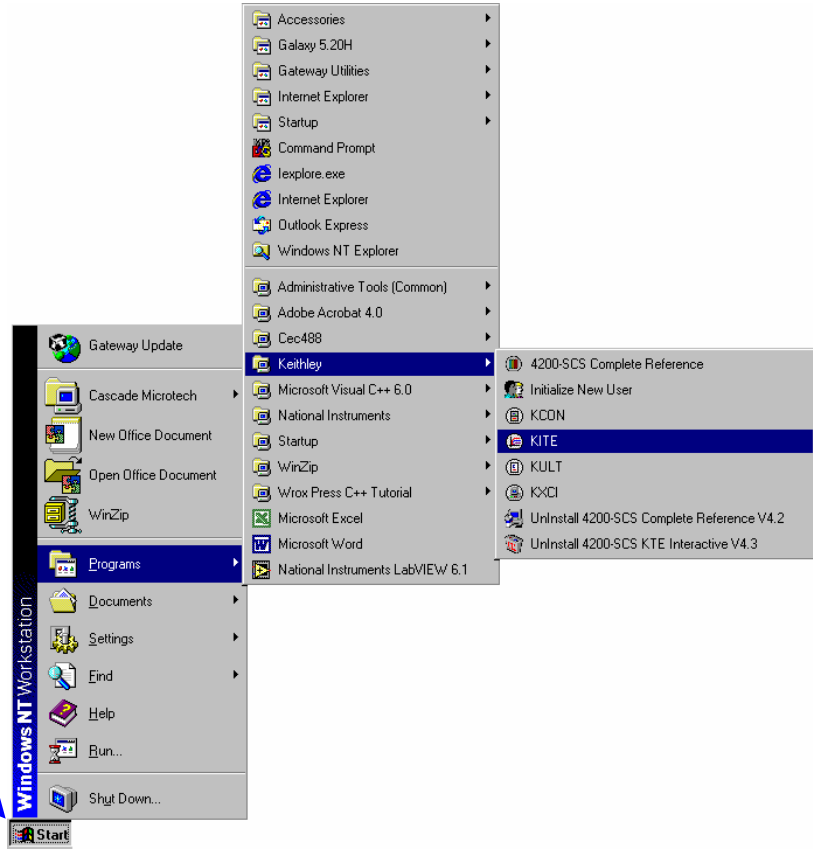
Launching KITE
Power Up and Log On

ACTION

1. From Power-up: disconnect DUTs, stay clear of SMU output connectors/probes
   - Log-on: KIUSER (no password) or KIADMIN (password: KIADMIN1)
   - If KITE doesn't load by default, use Windows Start > Programs > Keithley > KITE menu

OR

2) Click on KITE icon on 4200 desktop.



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KITE Overview

***KITE* interface consists of a variety of graphical user interfaces (GUIs) that allow you to do the following:**

- Build and edit tests.
- Configure tests
- Interactively or Automatically execute
- View test results, numerically and graphically.
- Analyze test results using built-in parameter extraction tools.
- View the analysis results, numerically, and graphically.

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Opening the Default Project

- **The 4200-SCS comes standard with several configured projects for a variety of applications including charge pumping, wafer level reliability, CV, and general device measurements.**
- **By factory default, when KITE launches the "default" project is opened.**
- **This project contains tests to run common devices such as a MOSFET, BJT, resistor, diode, and capacitor.**

Action

- ***Make sure the default project is opened. If not, go to File menu > Open Project. In the Projects folder, click on the default folder. Click on default.kpr to open the default project.***

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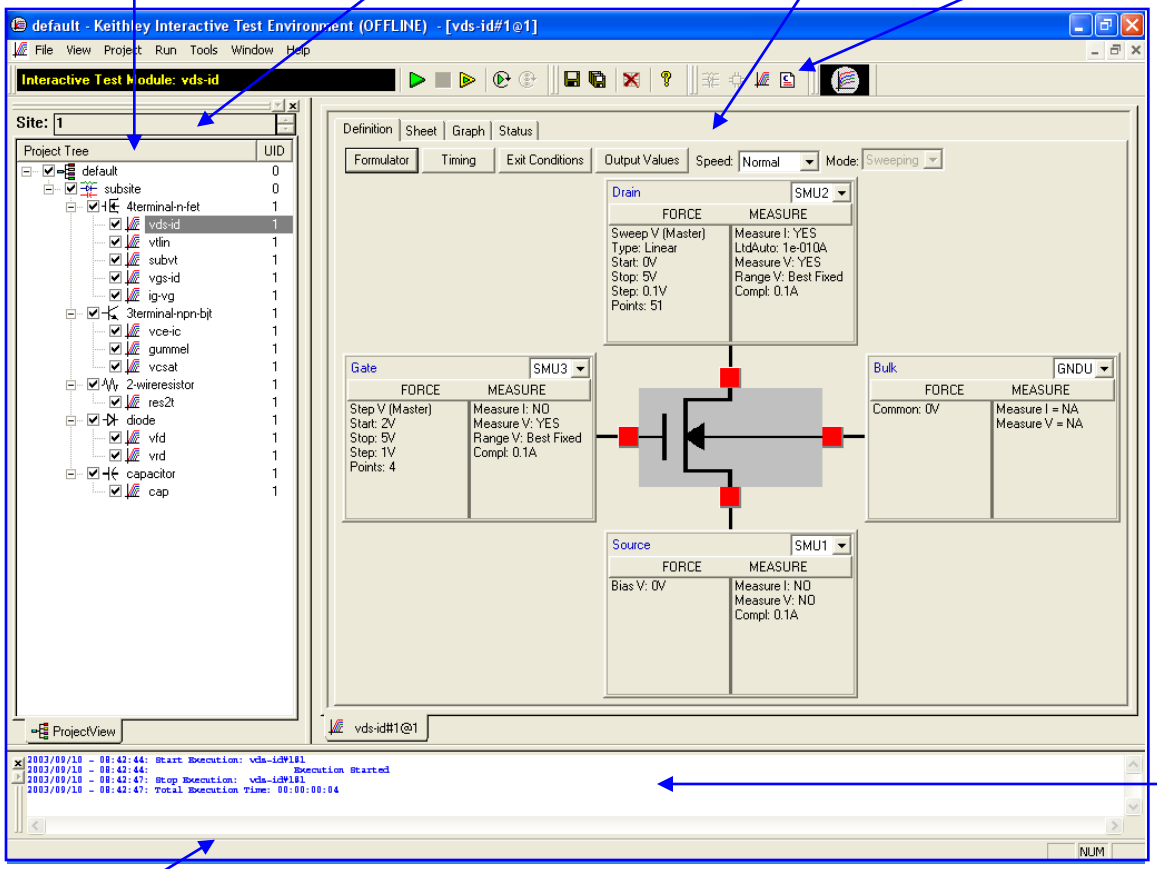
KITE Interface



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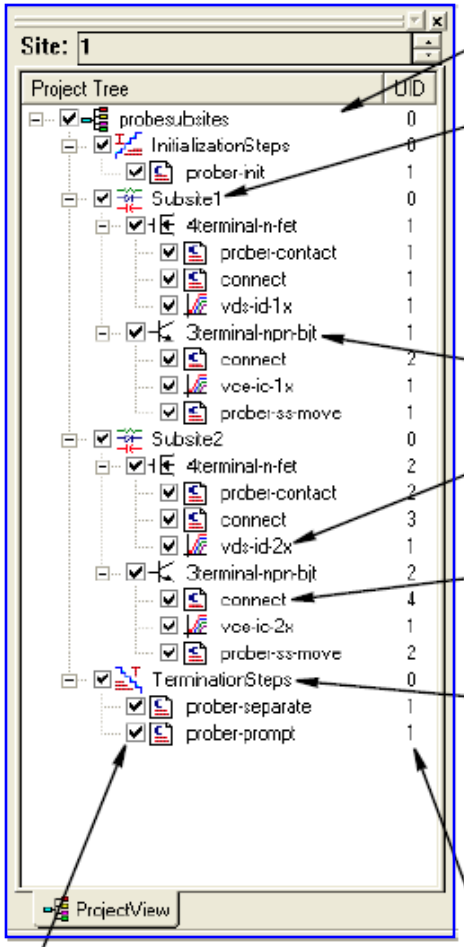
Understanding the Project Structure

Project Navigator



Project Plan

Subsite Plan

Device Plan

Interactive Test Module (ITM)

User Test Module (UTM)

Initialization Steps

Unique ID (UID) number

Test Enable Checkboxes

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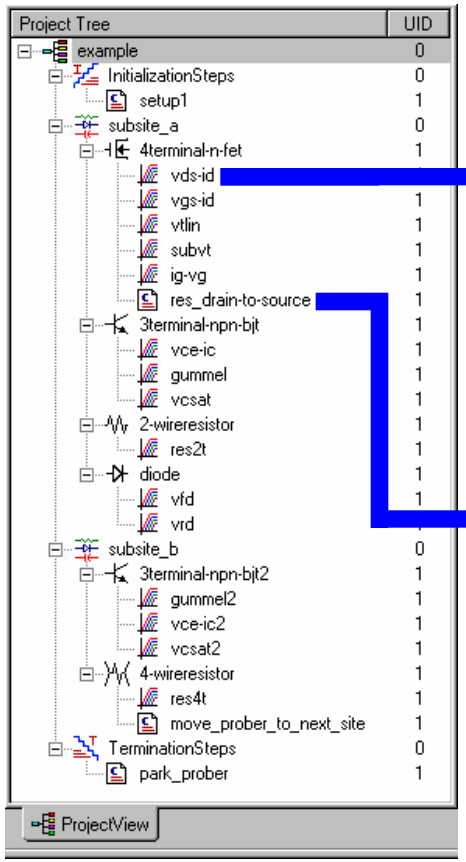
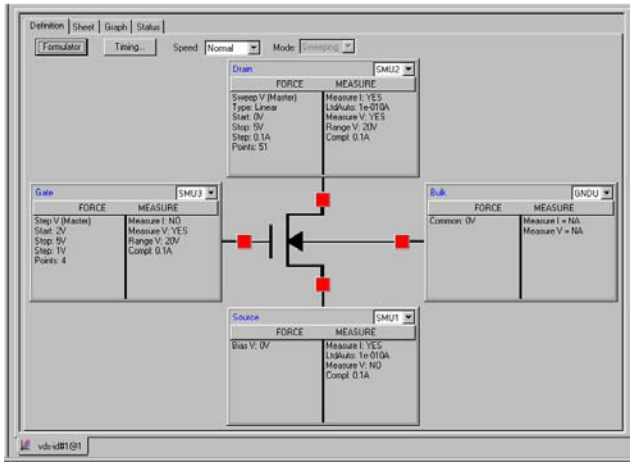
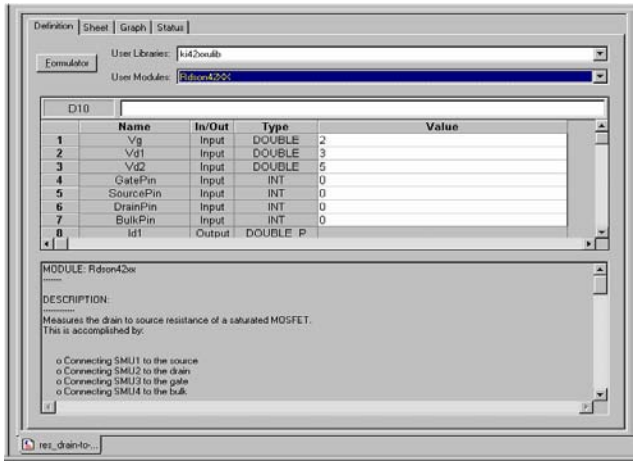
Two Types of Test Modules: ITMs and UTMs

Project Navigator





Interactive Test Module (ITM)



User Test Module (UTM)

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Both ITM and UTM Have 4 Tabs

Definition Tab – input fields for creating or modifying a test
Sheet Tab – spreadsheet for holding the test results
Graph Tab – report ready graph for visualizing the results
Status Tab – warns of errors in the test

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Primary Differences Between an ITM and a UTM

ITM Interactive Test Module	UTM User Test Module
Graphical User Interface, NO PROGRAMMING	Pre-programmed, modifiable code, fill in the blanks interface.
Is flexible. Several hundred standard tests provided, any can be easily modified or copied Easy to create any number of new tests.	**Is task-specific**. Programming language gives low level control of all instrumentation. Allows difficult tasks that cannot be done with the GUI ITM interface Source code provided as examples
Controls the SMUs, CVU and the PMUs. No control of external instruments Not able to “call” ITMs from programming or external interface.	Controls the SMUs, CVU and PMUs and O’scope. Full control of external instruments. Can write very sophisticated programs

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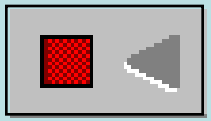
Selecting and Running an Existing ITM

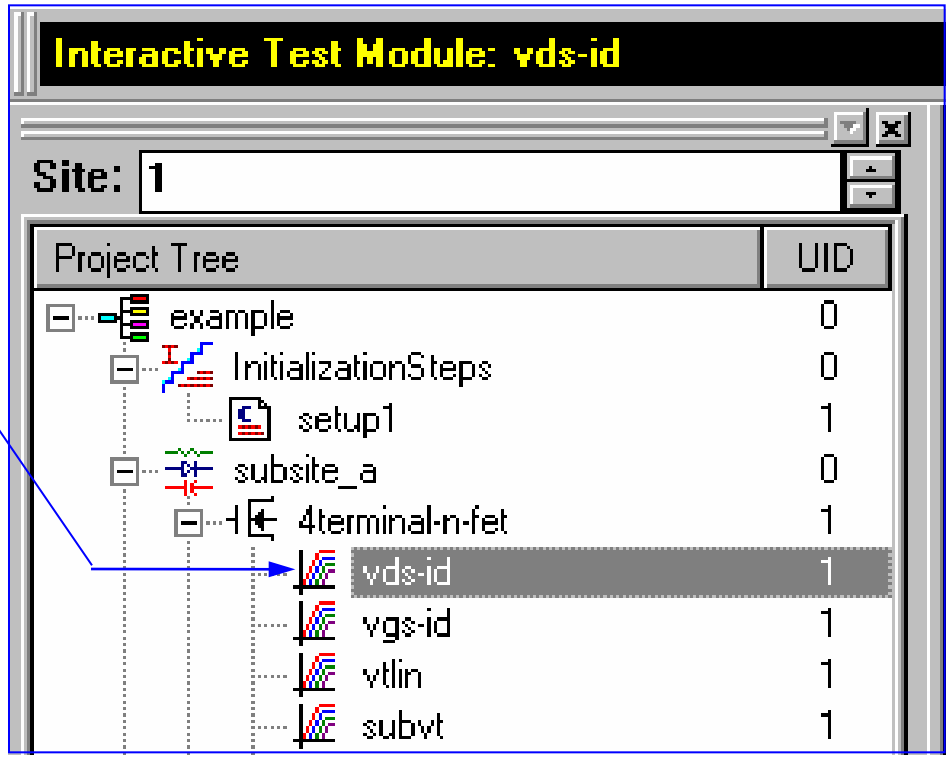
Action

1. Select vds-id ITM:
   Click to select ITM
2. Select the Graphs Tab to display the graph.
3. Run ITM:
   Click to run test

Click to abort test



Project Navigator



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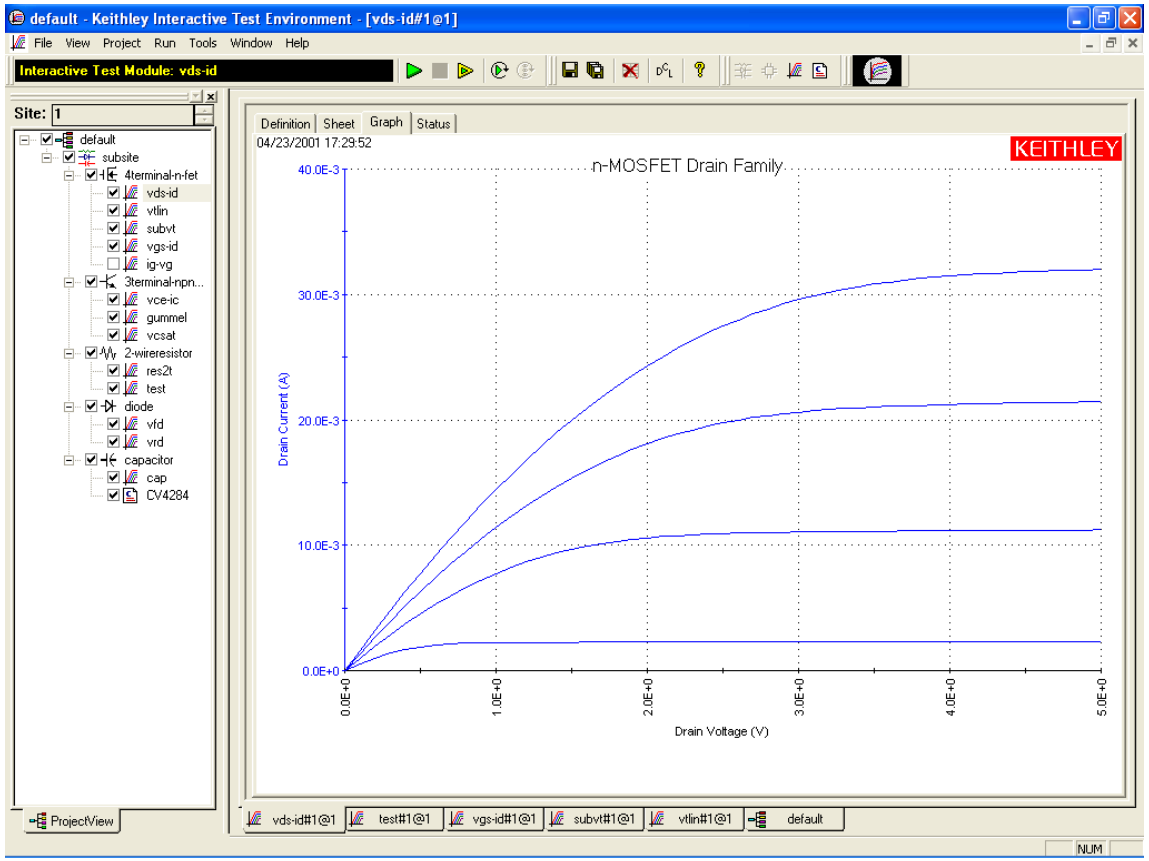
Graph Results – vds-id



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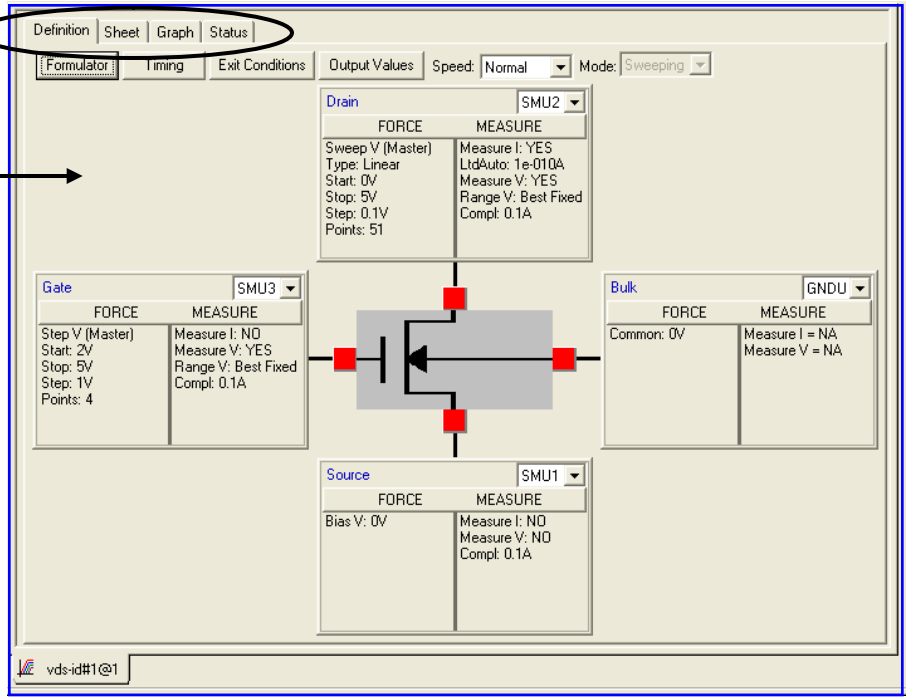
ITM Window

Each ITM has four Tabs:

- Definition – configures test including formulas, timing, SMU source and measure
- Sheet – displays test results in worksheet and make calculations
- Graph – creates and exports graphs
- Status – monitors status and provides resolution for problems



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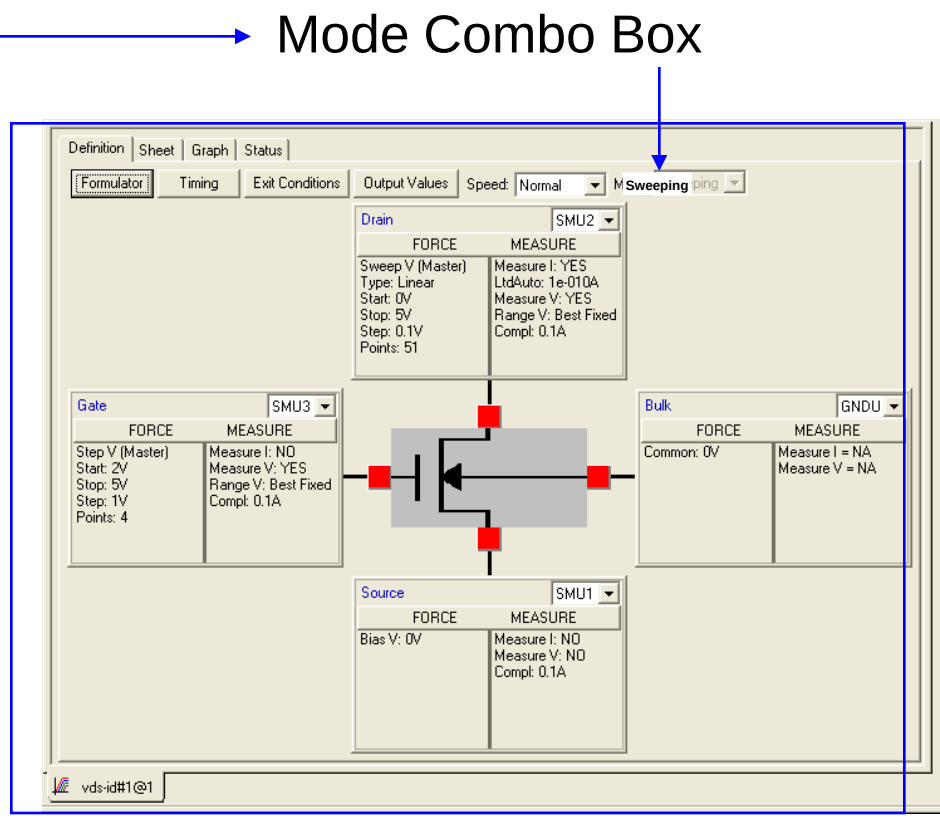
ITM Window
Definition Tab

- Displays the test device
- Displays instrument object (Force/Measure options) next to each terminal of DUT
- Provides access to the Formulator
- Selects Output Values to be exported to Subsite Data Sheet
- Configures Speed and Timing of the test
- Displays current test mode either Sweeping or Sampling



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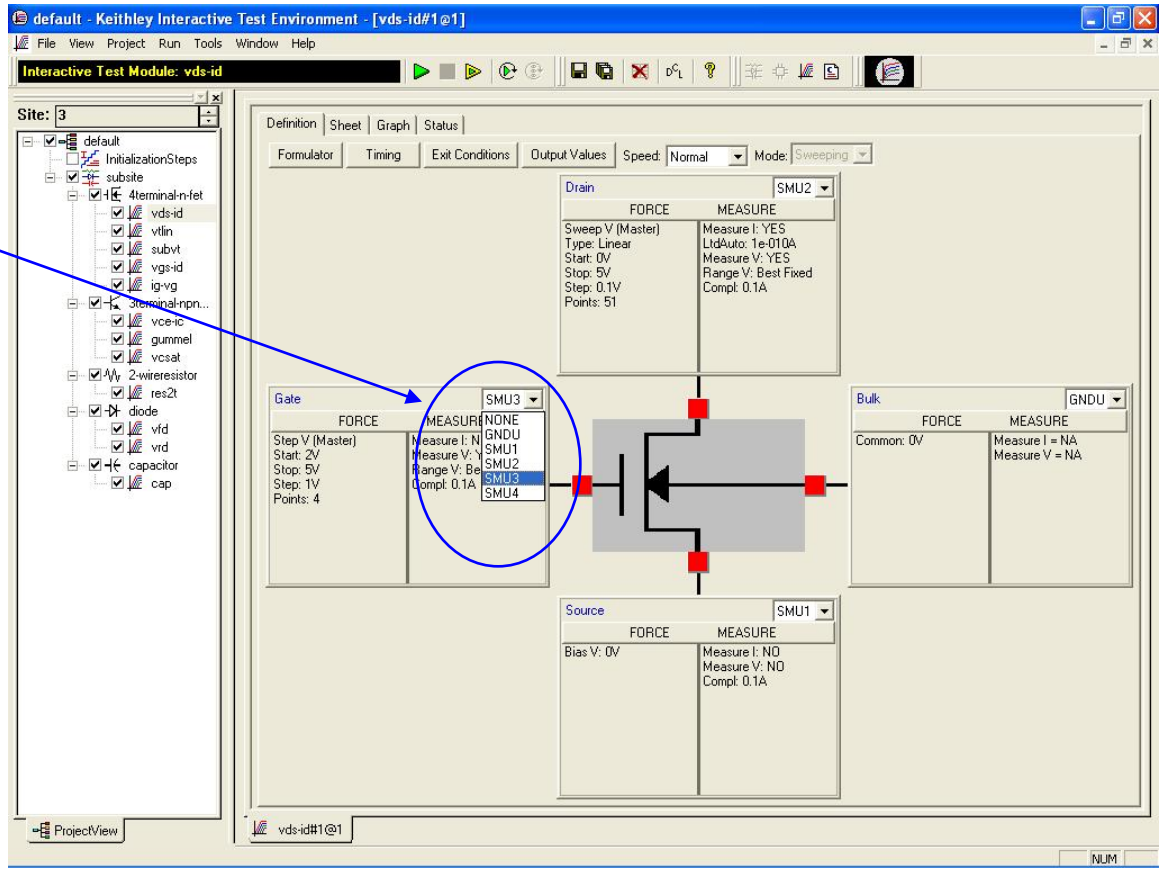
ITM Window
Instrument Selection

Assign a terminal connection from the Definition tab.

This software connection must accurately reflect the physical hardware connections at the time the ITM is executed.



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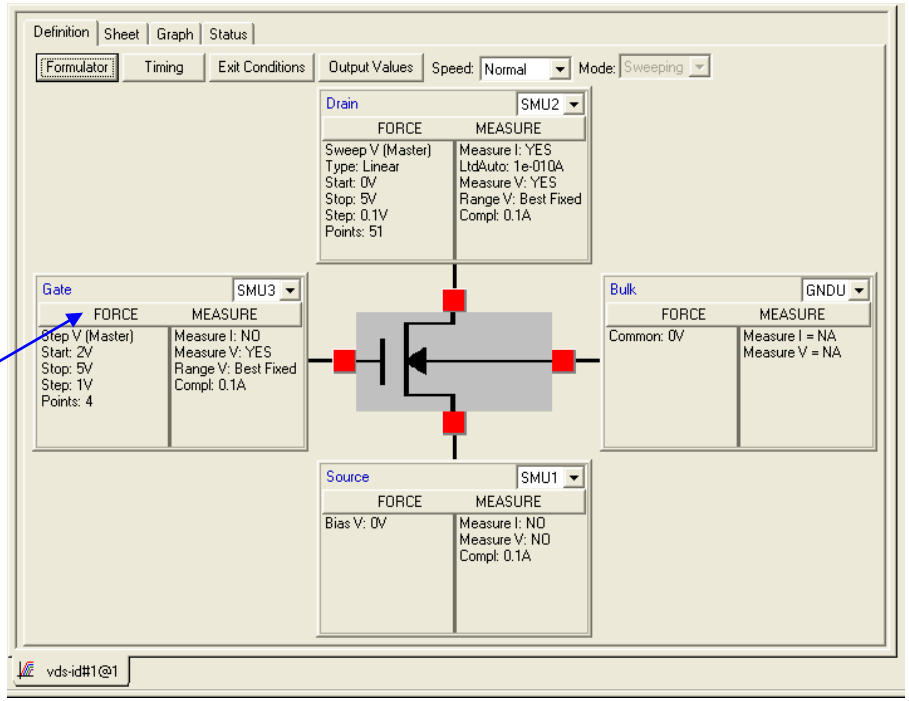
Definition Tab
Force/Measure Options Window

- **The Force and Measure functions of each SMU are configured in the Force/Measure Options Window.**

- **The Force/Measure Options Window is opened by clicking on it.**

Action **Click once on the Force Measure bar of the Gate, SMU 3 to open up the Window.**



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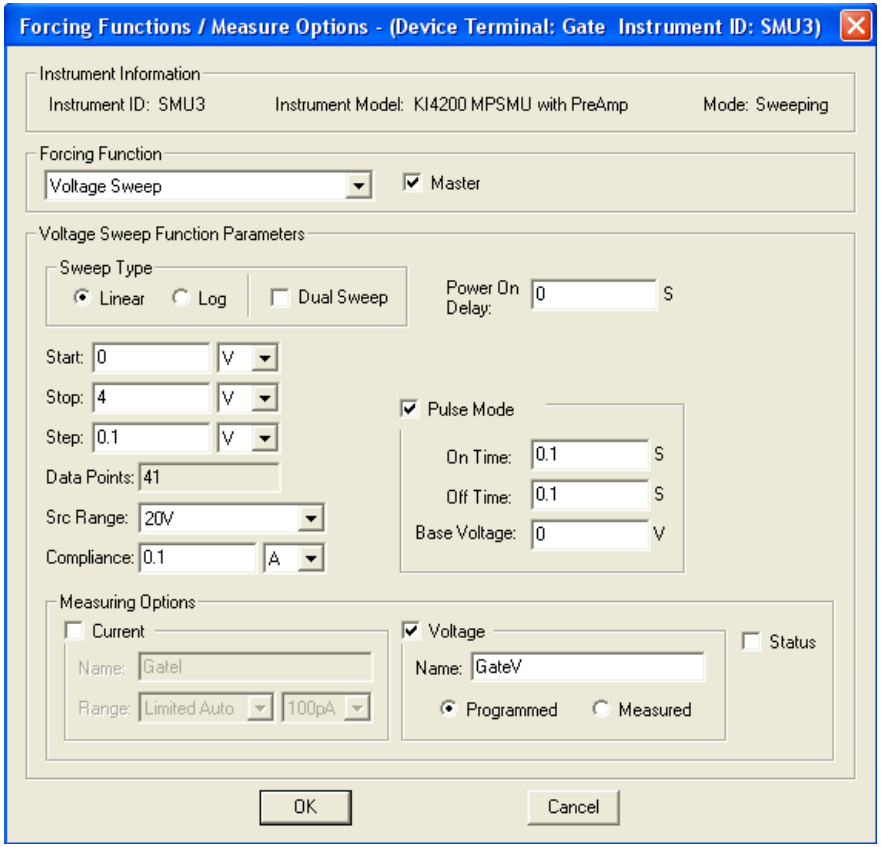
Definition Tab
Force/Measure Options Window

- A Forcing Functions/Measure Options window is associated with an instrument object that is assigned to a device terminal.
- The Forcing Functions/Measure Options window is used to configure the selected forcing function and measurements implemented by the instrument.



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Lab 2

Multiple Methods of Connecting a 2-terminal Device

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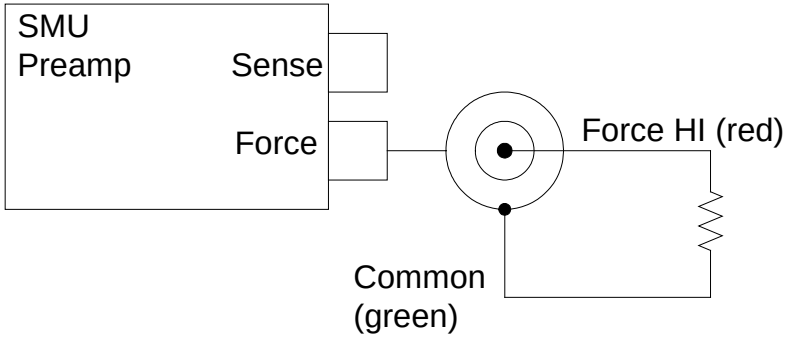
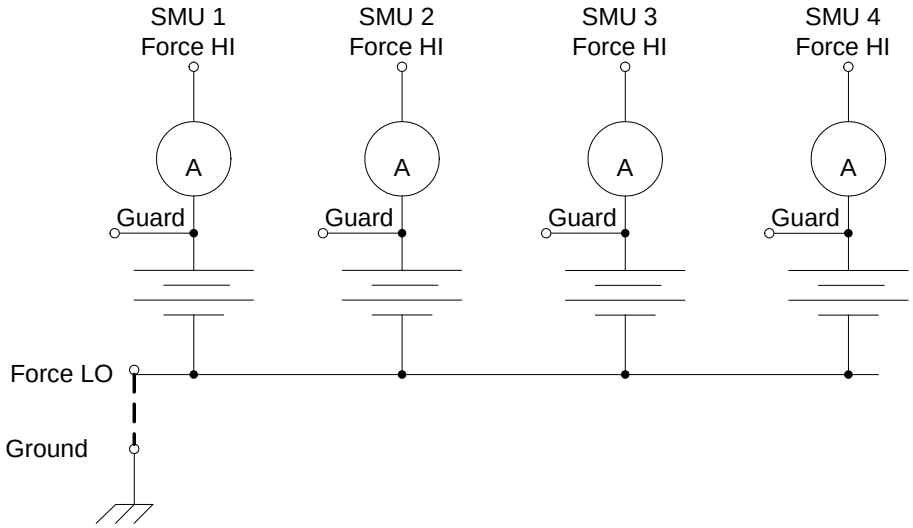
Lab 2 Review

Example 1 – Connecting a two-terminal device to a single SMU using a triax to alligator clip cable.



Recall that the outside shell of the Force HI terminal triax connectors are all connected together to Force LO or COMMON.



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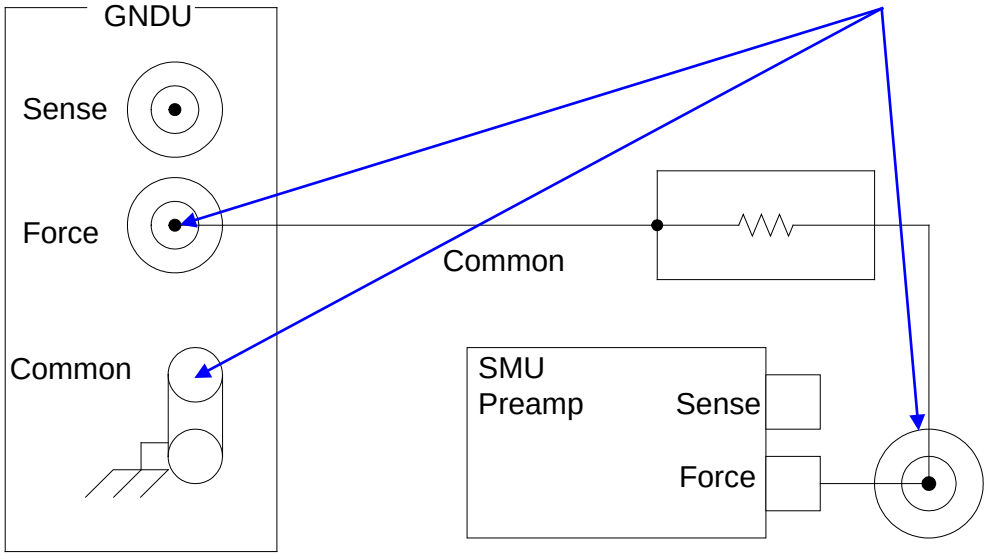
Lab 2 Review

Example 2 – Connecting a two-terminal device using a single SMU and the GNDU.

The outside shell of the SMU triax connector, the center pin of the GNDU Force connector, and the COMMON terminal binding post are all Force LO



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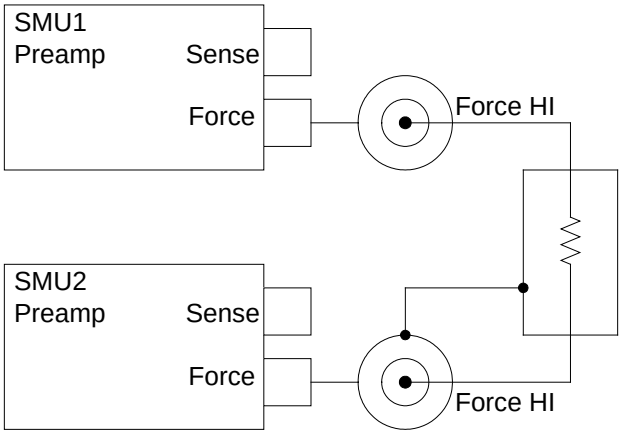
Lab 2 Review

Example 3 – Connecting a two-terminal device using two SMUs.



In this example, SMU2 was set up as the common terminal. This means that the SMU is set up to output 0 volts on the 100mA compliance range.

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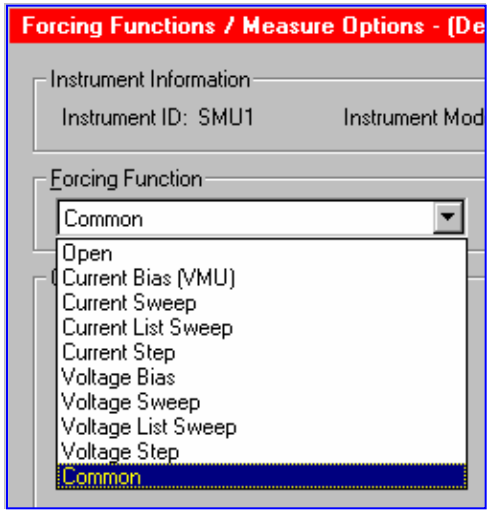
Definition Tab
Forcing Functions

Action

1) **Click on the Definition Tab.**
2) **Click on the Force Measure bar for an SMU.**
3) **Select either Sweeping Mode or Sampling Mode from the Mode Combo Box on the Definition Tab.**

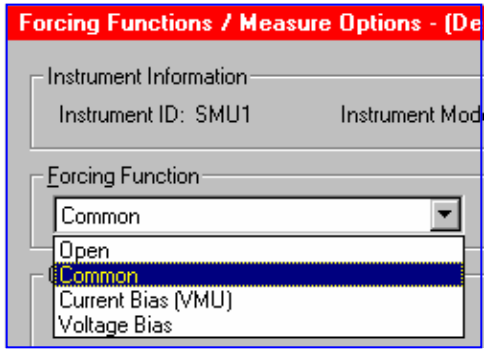
- Sweeping Mode applies to any ITM in which one or more forced voltages/current vary with time

Forcing Functions for Sweeping



- Sampling Mode applies to any ITM in which all forced voltages/currents are static, with measurements typically being made at timed intervals.

Forcing Functions for Sampling



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Definition Tab
Forcing Function Summary

Category	Name	Description	Availability		
			Sweeping	Sampling	Pulse Mode
Static	Open	Maintains zero-current at the terminal (subject to max V compliance).	•	•	
	Common	Maintains zero-voltage at the terminal (subject to max I compliance).	•	•	
	Current Bias	Maintains a set constant-current at the terminal (subject to set V compliance)..	•	•	•
	Voltage Bias	Maintains a set constant-voltage at the terminal (subject to set I compliance)..	•	•	•
Sweep	Current Sweep	Increments a series of current values at a rate determined by **Timng** and **Speed** settings. Generates parametric curve data that is recorded in the **Sheet** tab and can be plotted in the **Graph** tab.	•		•
	Voltage Sweep	Increments a series of voltage values at a rate determined by **Timng** and **Speed** settings. Generates parametric curve data that is recorded in the **Sheet** tab and can be plotted in the **Graph** tab.	•		•
List sweep	Current List Sweep	Same as a current sweep, but steps through a list of user-specified current values.	•		•
	Voltage List Sweep	Same as a voltage sweep, but steps through a list of user-specified voltage values.	•		•
Step	Current Step	Increments a current to two or more levels, each of which is held constant during the progress of a sweep or list sweep at another terminal. Like a sweep, curve data is recorded and can be plotted as a graph.	•		
	Voltage Step	Increments a voltage to two or more levels, each of which is held constant during the progress of a sweep or list sweep at another terminal. Like a sweep, curve data is recorded and can be plotted as a graph.	•		

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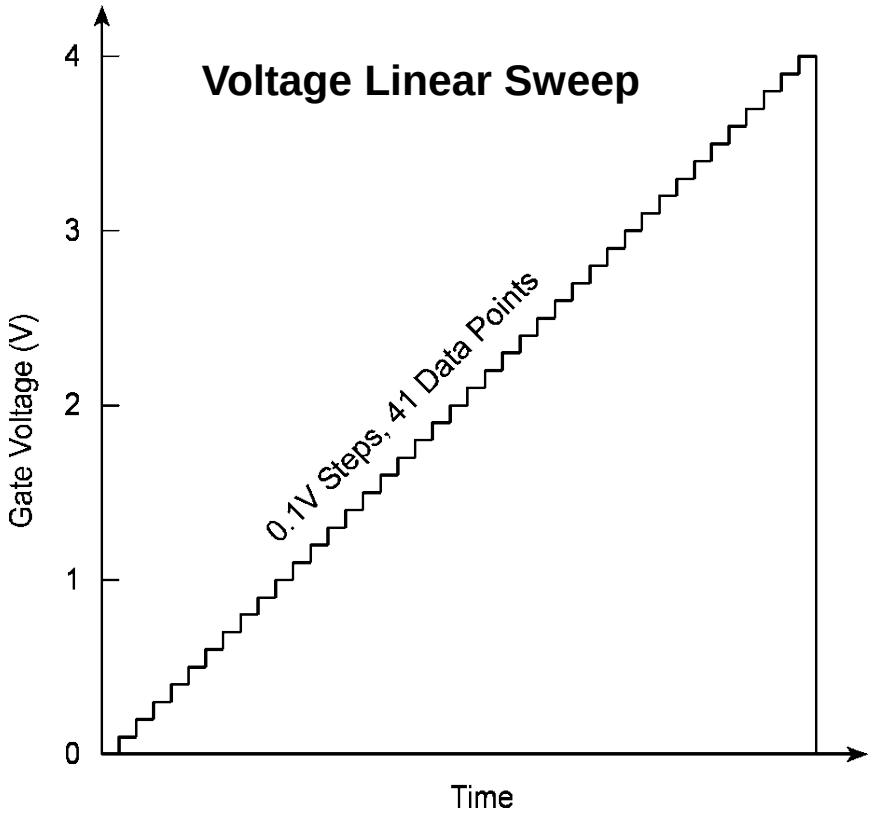
Definition Tab
Forcing Function – Linear Sweeps

- A linear sweep increments current or voltage in a series of uniform steps, at a speed that is determined by the Speed and Timing settings configured in the Timing window.
- The user enters the Start, Stop and Step voltages or currents.



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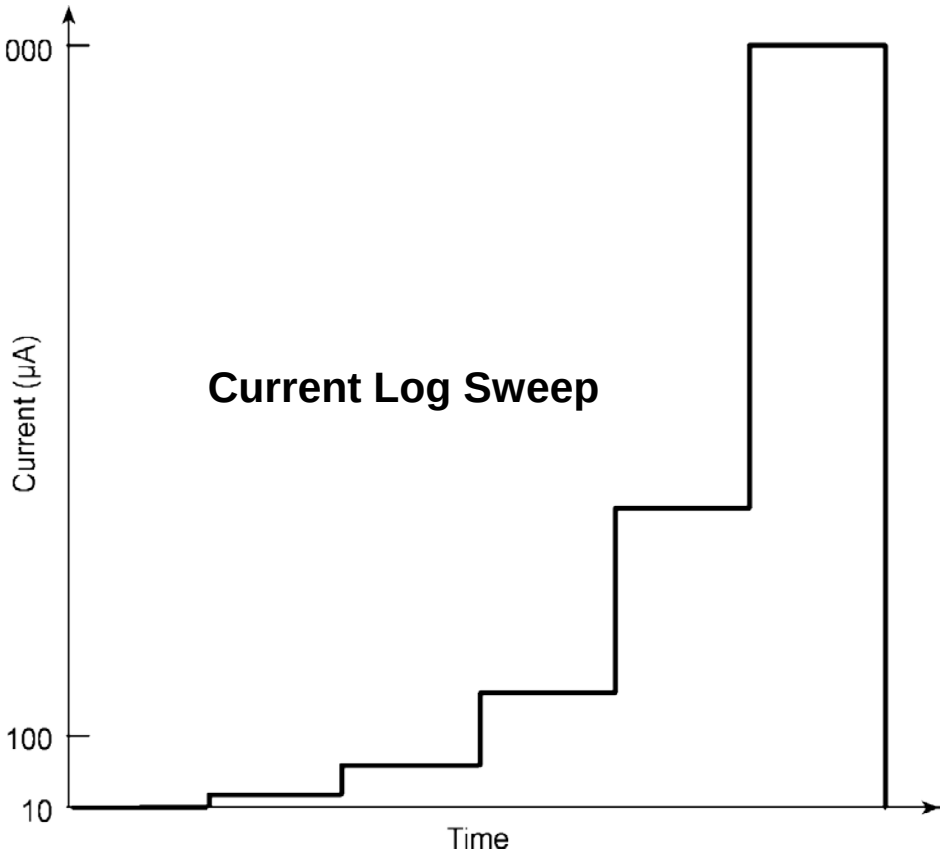
Definition Tab
Forcing Function – Log Sweeps

- A log sweep varies the step size logarithmically over the specified range, so that all decades are characterized uniformly.
- Each point is forced according to the equations shown below



Step size = (log10 |**Stop** value| - log10 |**Start** value| / **Data Points** value - 1)

SMU forcing value = 10 [log10 |**Start** value| + (n-1)(**Step** size)]
for data point n

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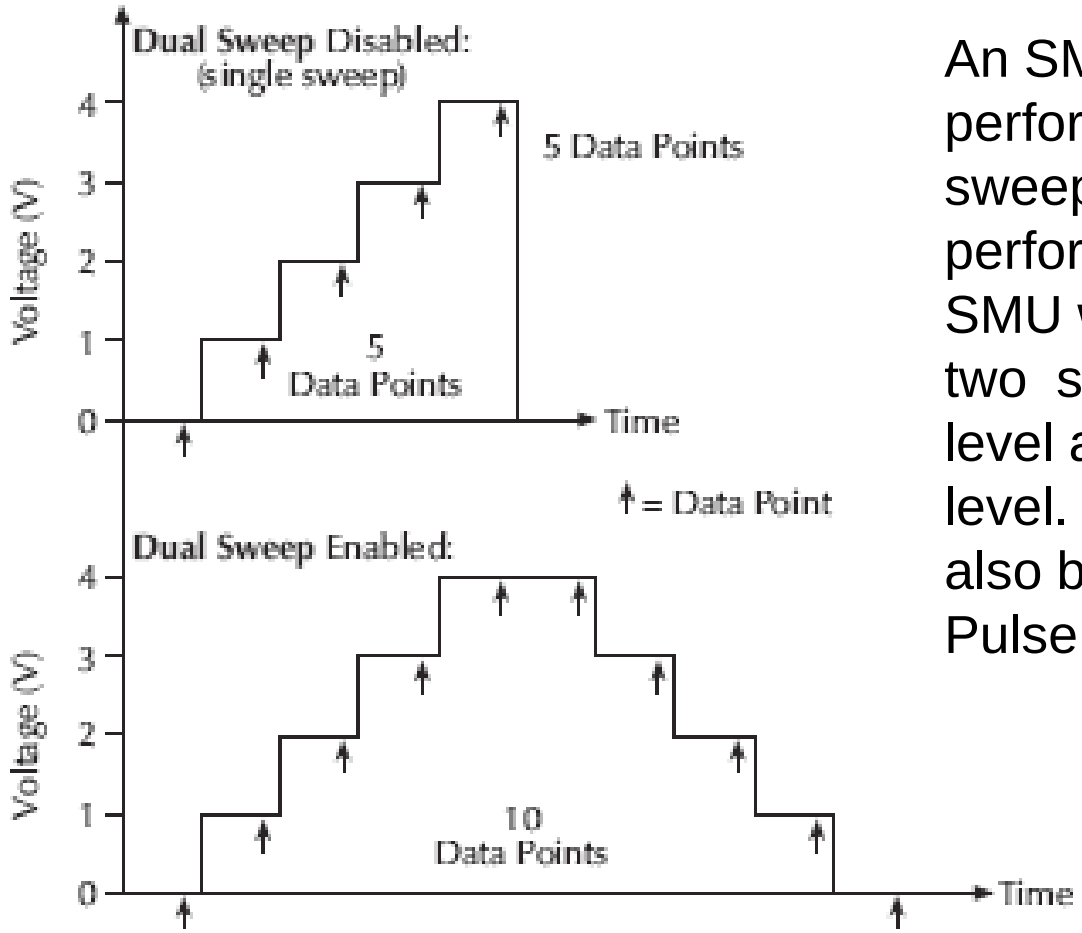
Definition Tab
Forcing Function – Dual Sweeps

Single and dual sweep examples (linear voltage sweep; 0 to 4V in 1V steps)



An SMU that is configured to perform a linear or log sweep, can also be set to perform a dual sweep. The SMU will essentially perform two sweeps: Start to Stop level and the Stop to Start level. A dual sweep can also be performed with the Pulse Mode selected.

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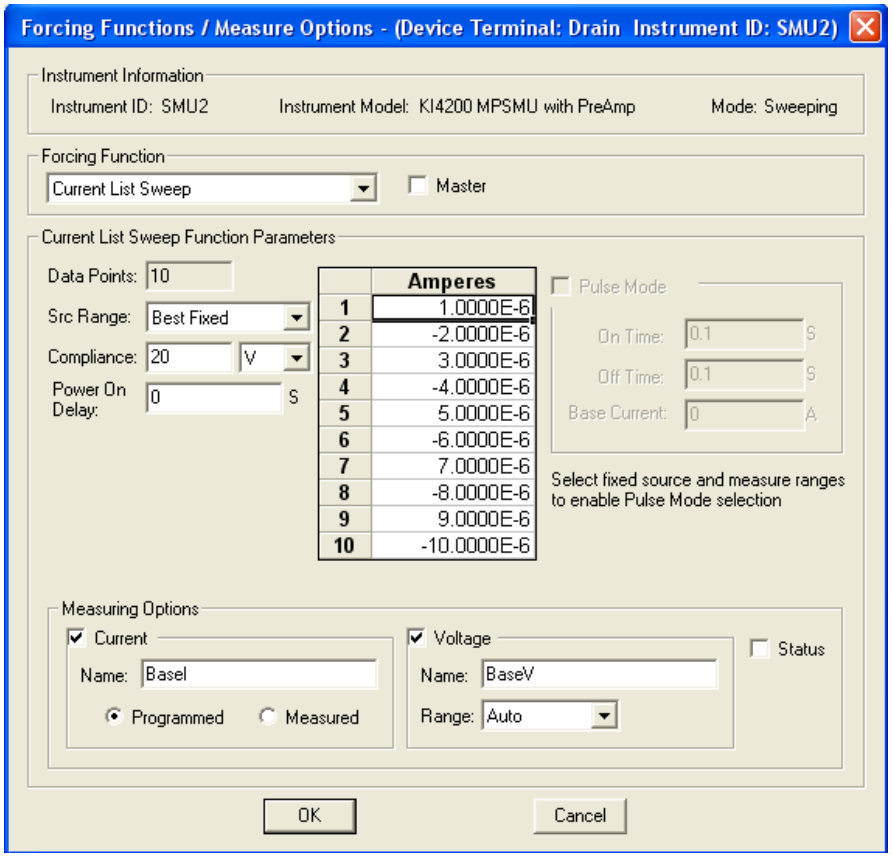
Definition Tab
Forcing Function – List Sweeps

- A **list sweep** forcing function steps a current or voltage through a list of user-specified values, at a rate that is determined by the Timing and Speed settings from the Timing Window.
- **Parameter List** – specifies the sequence and value of each value to be forced.
- **Data Points** – an integer between 0 and 4095, specifies the number of values in the parameter list.

Current List Sweep:



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Definition Tab
Forcing Function – Pulse Mode

- To avoid device overheating, voltages or currents can be applied to a device only for brief periods at widely spaced intervals. For Sweep (linear, log and list) and bias forcing functions, an SMU can be set to provide pulse output. Programmable parameters include On Time, Off Time and Base Voltage or Current:
  - Pulse Period = On Time + Off Time + cumulative measure time (if set to measure)
  - Pulse Width = On Time
  - Base Voltage/Current = Level the SMU goes to between sweep points.
- Pulse mode can only be selected if the source and measure ranges are set to FIXED (not AUTO).

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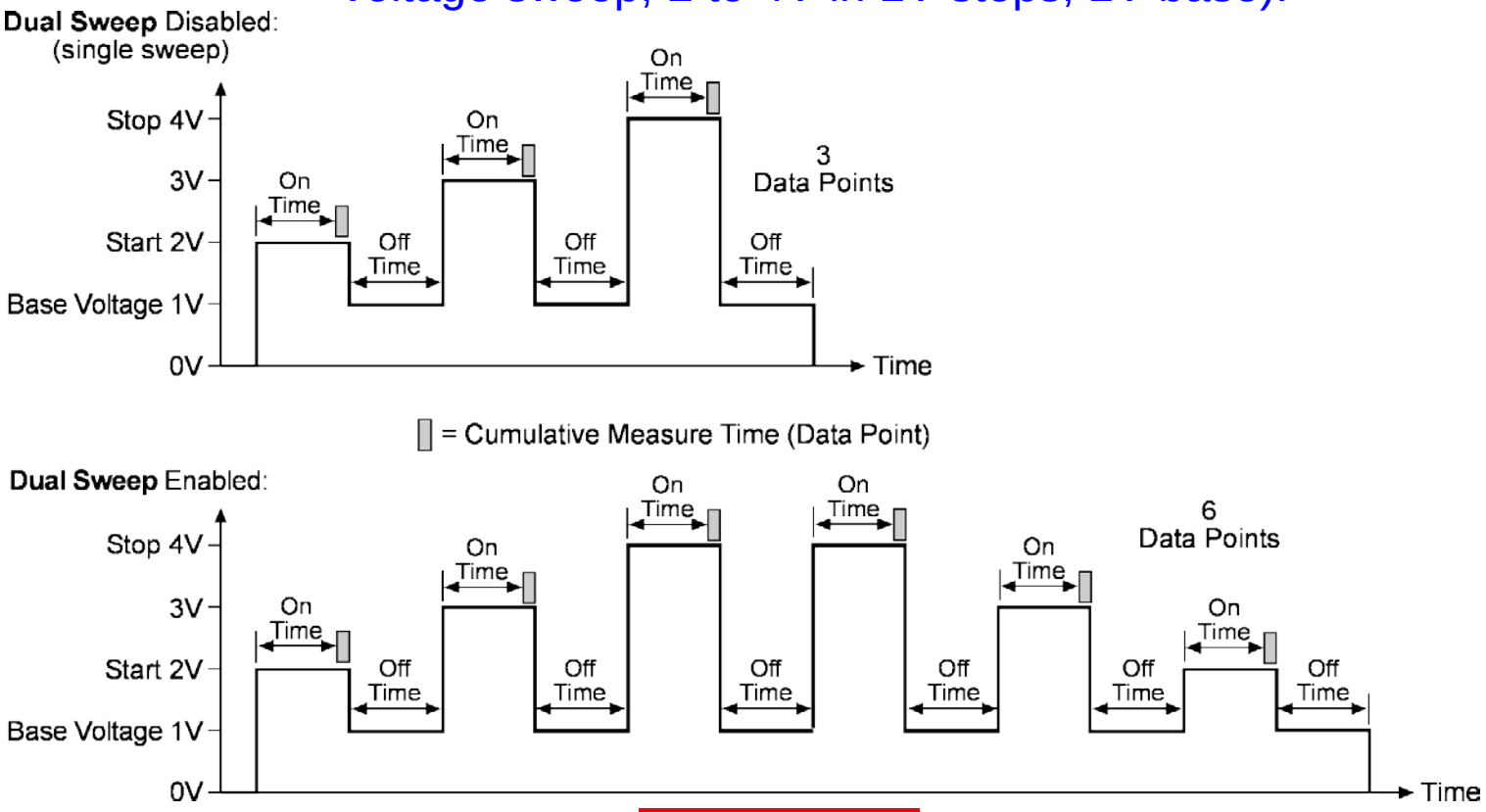
Definition Tab
Forcing Function – Pulse Mode

Pulse Mode examples – Single and dual sweep (linear voltage sweep; 2 to 4V in 1V steps, 1V base):



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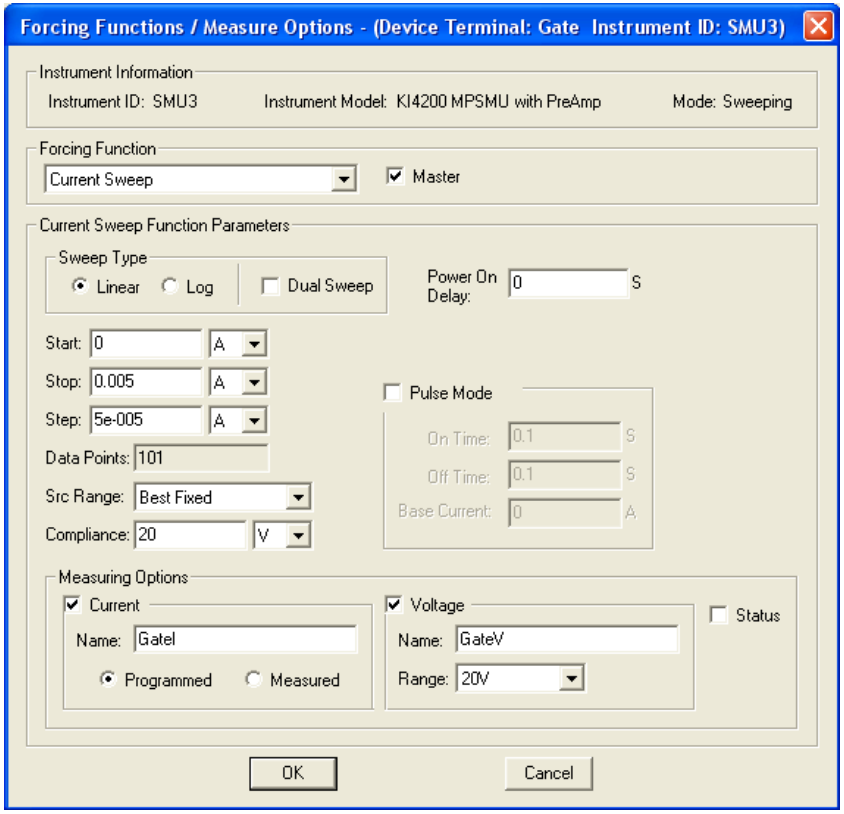
Definition Tab
Forcing Functions

Other parameters in the Forcing Functions/Measurements Options Window:

- Start, Stop, Step
- Data Points
- Src. Range
- Compliance
- Measuring Options
- Sweep Type: Linear, Log, and Dual Sweep

Current Sweep Forcing Functions/Measure Options window:



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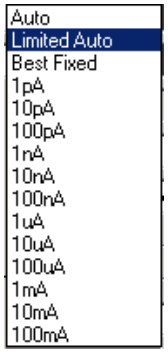
Definition Tab
Measuring Options

Check the Current or Voltage Measurement checkboxes if you desire the measured or sourced values to be recorded in the Worksheet or available to plot in the Graph.

Range Box

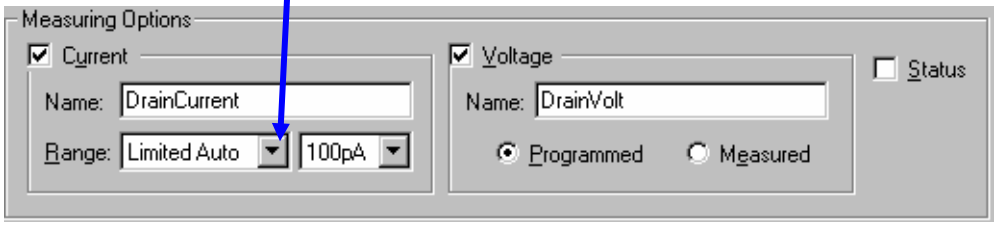


Action — **Click on Current Range arrow to Open Range Box**

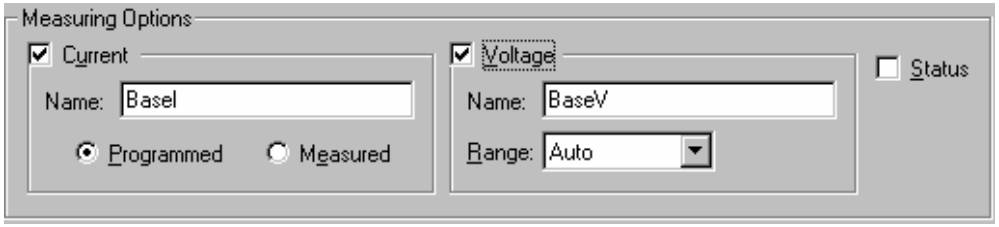
Range Options:

- **Auto** – Automatically finds the best measurement range. However, range-change time delays limit the measurement speed.
- **Limited Auto (current only)** – Auto ranges only to a minimum range that is user specified. Saves time when you don't need to maximize resolution at minimum currents.
- **Best Fixed** – Commands the SMU to automatically select a single measurement range.
- **Specific Numerical Range** – Enables manual selection of range. A single set range reduced measurement time.

Typical Measuring Options area for a voltage forcing function



Typical Measuring Options area for a current forcing function



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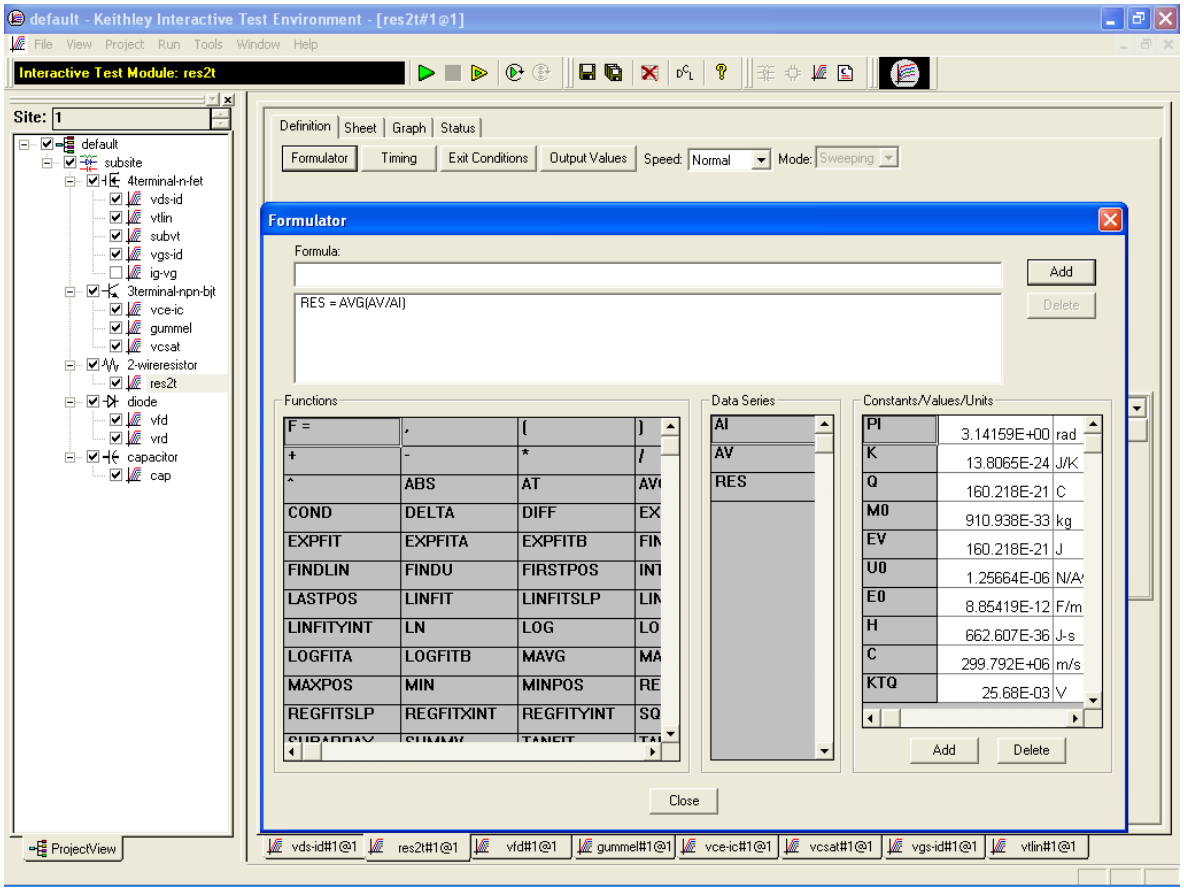
Definition Tab
Formulator

Action

1) **Click OK to exit Force/Meas Window.**
2) **Click Formulator button to open Formulator.**



The **Formulator** allows you to perform simple in-test calculations on ITM data and complex post-test data calculations:

- **Operators: +, -, *, /, ^**
- **Functions: ABS, DELTA, DIFF, EXP, INTEG, LN, LOG, SQRT, etc.**

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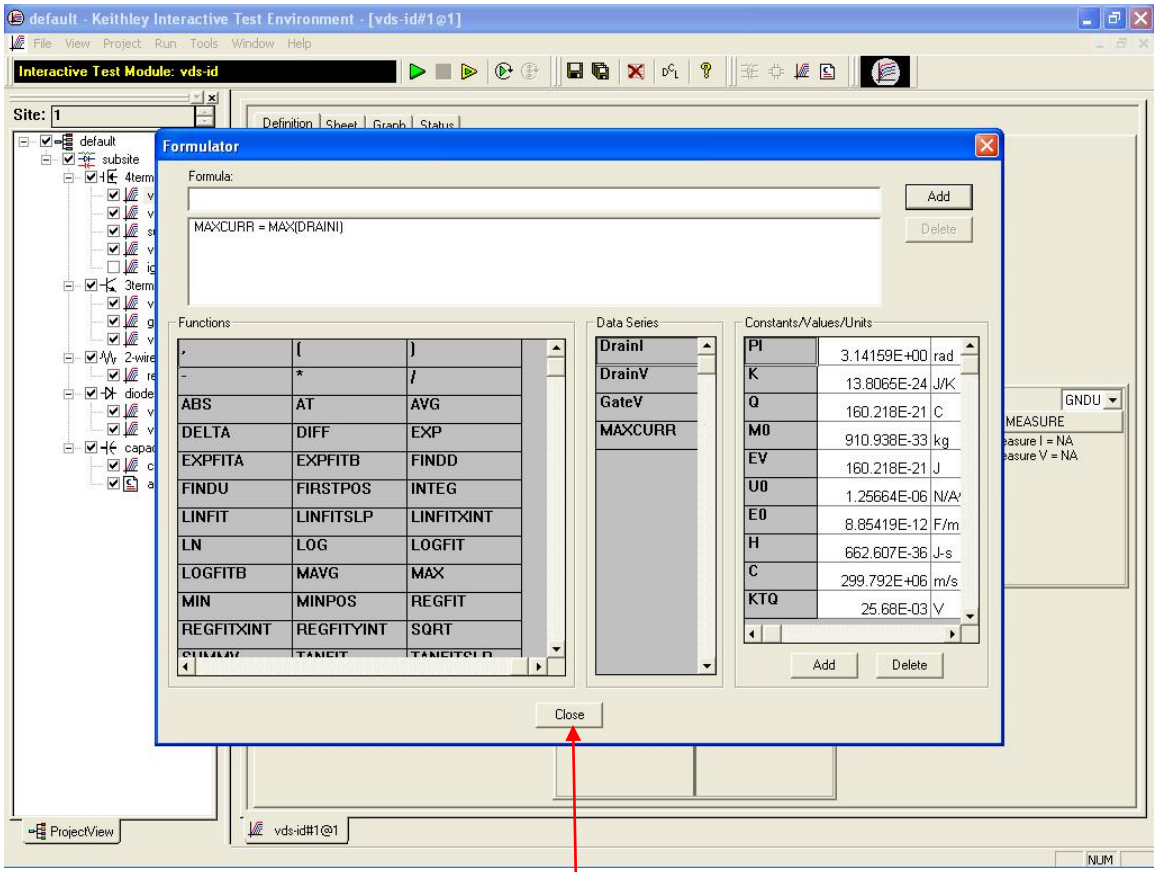
Definition Tab
Formulator: Adding a New Formula

Action

1) Add a new formula named, MAXCURR.
2) Start by typing MAXCURR= in the box directly under the word formula.
3) Next, using the mouse, click on the MAX formula from the list of formulas.
4) Highlight the V in MAXCURR=MAX(V) and click on DrainI in the Data Series.
5) Your formula should be: MAXCURR=MAX(DrainI)
6) Click on Add and notice the new formula appears in the Data Series.



Action Click on Close when finished in window.

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Lab 3

Measuring a Bipolar Junction Transistor Using the Default Project

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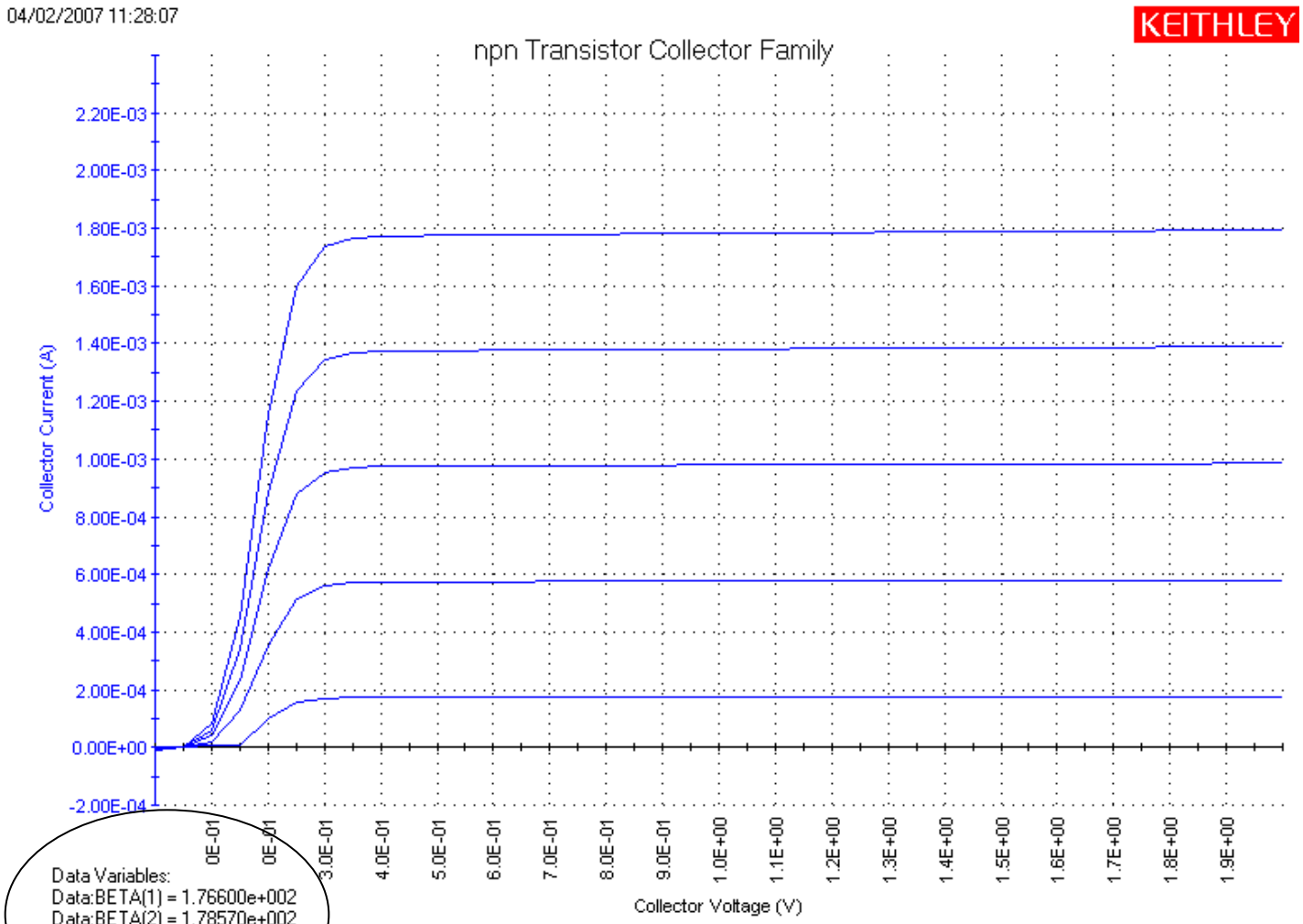
Lab 3 Results



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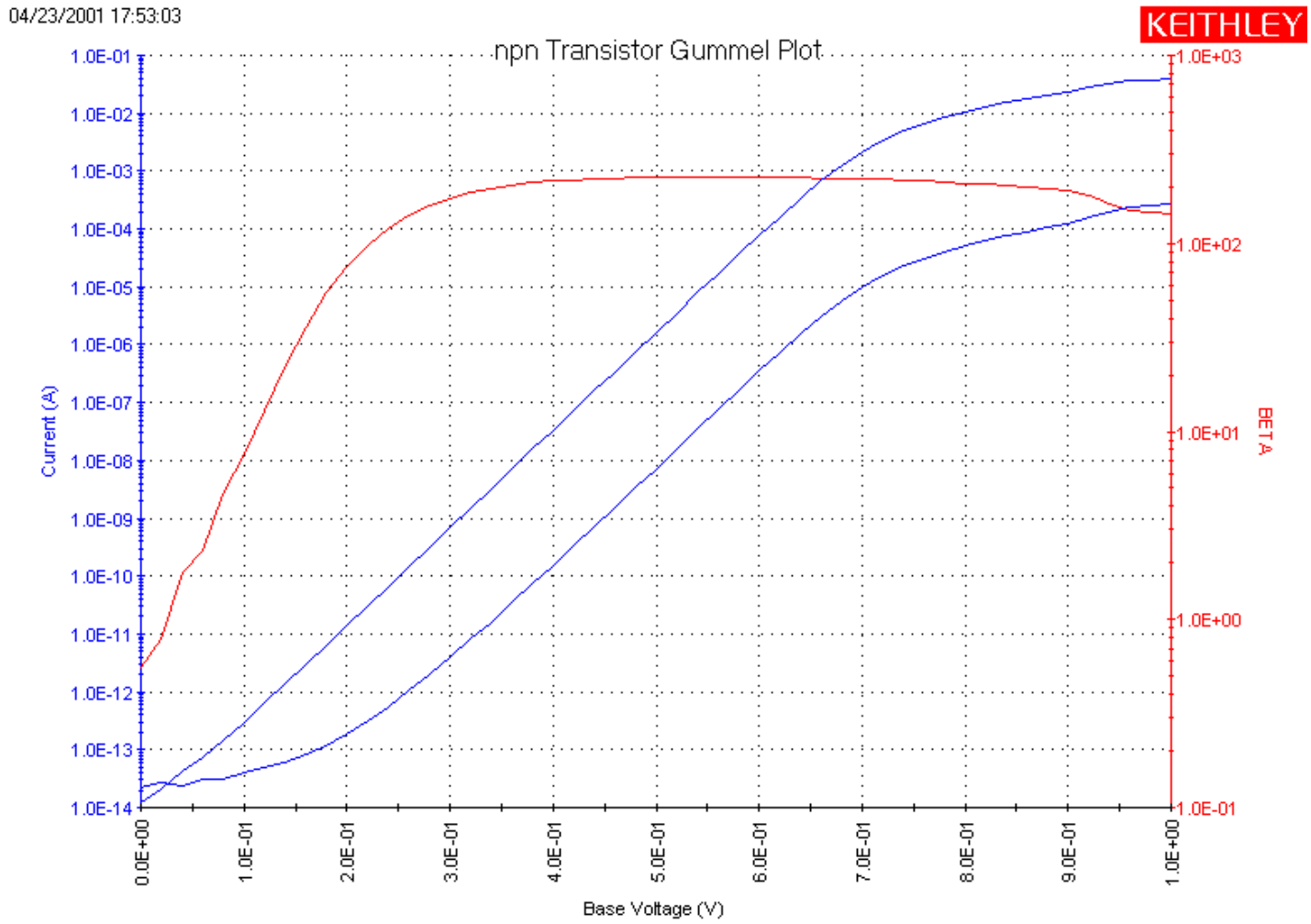
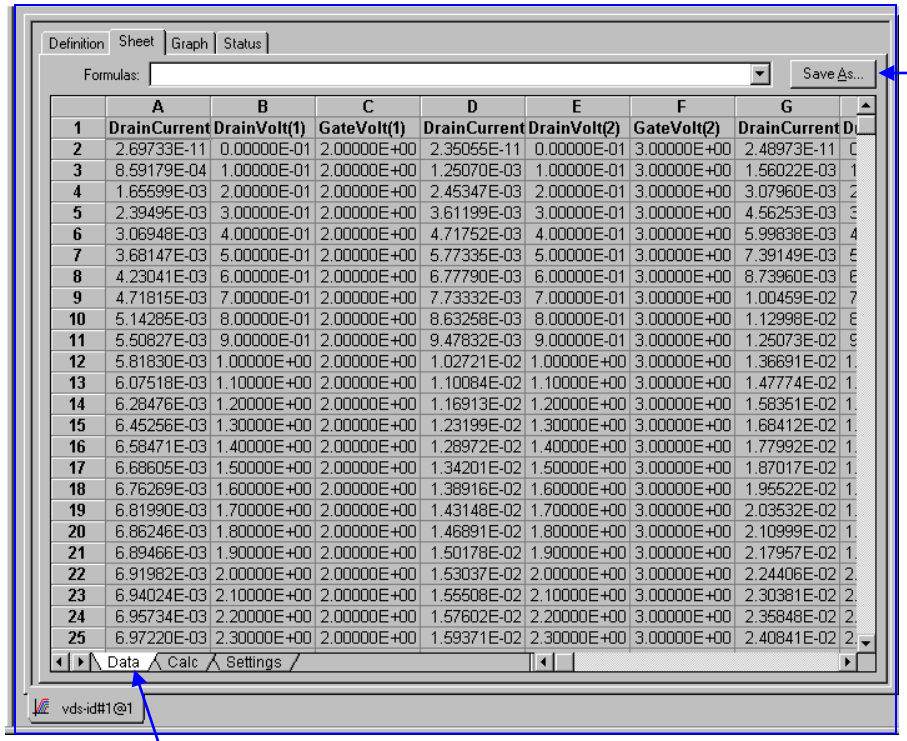
Lab 3 Results



ITM Window
Sheet Tab

Action **Click on Sheet tab**



	A	B	C	D	E	F	G
1	DrainCurrent	DrainVolt(1)	GateVolt(1)	DrainCurrent	DrainVolt(2)	GateVolt(2)	DrainCurrent
2	2.69733E-11	0.00000E-01	2.00000E+00	2.35055E-11	0.00000E-01	3.00000E+00	2.48973E-11
3	8.59179E-04	1.00000E-01	2.00000E+00	1.25070E-03	1.00000E-01	3.00000E+00	1.56022E-03
4	1.65599E-03	2.00000E-01	2.00000E+00	2.45347E-03	2.00000E-01	3.00000E+00	3.07960E-03
5	2.39495E-03	3.00000E-01	2.00000E+00	3.61199E-03	3.00000E-01	3.00000E+00	4.56253E-03
6	3.06948E-03	4.00000E-01	2.00000E+00	4.71752E-03	4.00000E-01	3.00000E+00	5.99838E-03
7	3.68147E-03	5.00000E-01	2.00000E+00	5.77335E-03	5.00000E-01	3.00000E+00	7.39149E-03
8	4.23041E-03	6.00000E-01	2.00000E+00	6.77790E-03	6.00000E-01	3.00000E+00	8.73960E-03
9	4.71815E-03	7.00000E-01	2.00000E+00	7.73332E-03	7.00000E-01	3.00000E+00	1.00459E-02
10	5.14285E-03	8.00000E-01	2.00000E+00	8.63258E-03	8.00000E-01	3.00000E+00	1.12998E-02
11	5.50827E-03	9.00000E-01	2.00000E+00	9.47832E-03	9.00000E-01	3.00000E+00	1.25073E-02
12	5.81830E-03	1.00000E+00	2.00000E+00	1.02721E-02	1.00000E+00	3.00000E+00	1.36691E-02
13	6.07518E-03	1.10000E+00	2.00000E+00	1.10084E-02	1.10000E+00	3.00000E+00	1.47774E-02
14	6.28476E-03	1.20000E+00	2.00000E+00	1.16913E-02	1.20000E+00	3.00000E+00	1.58351E-02
15	6.45256E-03	1.30000E+00	2.00000E+00	1.23199E-02	1.30000E+00	3.00000E+00	1.68412E-02
16	6.58471E-03	1.40000E+00	2.00000E+00	1.28972E-02	1.40000E+00	3.00000E+00	1.77992E-02
17	6.68605E-03	1.50000E+00	2.00000E+00	1.34201E-02	1.50000E+00	3.00000E+00	1.87017E-02
18	6.76269E-03	1.60000E+00	2.00000E+00	1.38916E-02	1.60000E+00	3.00000E+00	1.95522E-02
19	6.81990E-03	1.70000E+00	2.00000E+00	1.43148E-02	1.70000E+00	3.00000E+00	2.03532E-02
20	6.86246E-03	1.80000E+00	2.00000E+00	1.46891E-02	1.80000E+00	3.00000E+00	2.10999E-02
21	6.89466E-03	1.90000E+00	2.00000E+00	1.50178E-02	1.90000E+00	3.00000E+00	2.17957E-02
22	6.91982E-03	2.00000E+00	2.00000E+00	1.53037E-02	2.00000E+00	3.00000E+00	2.24406E-02
23	6.94024E-03	2.10000E+00	2.00000E+00	1.55508E-02	2.10000E+00	3.00000E+00	2.30381E-02
24	6.95734E-03	2.20000E+00	2.00000E+00	1.57602E-02	2.20000E+00	3.00000E+00	2.35848E-02
25	6.97220E-03	2.30000E+00	2.00000E+00	1.59371E-02	2.30000E+00	3.00000E+00	2.40841E-02

- Test data is recorded into the Sheet tab worksheet.
- All data in the **Sheet** tab for a test is in Microsoft Excel compatible format, with the .xls extension.
- Click **Save As** To save the contents of all **Sheet** tab worksheets to a designated folder.

Data tab for worksheet

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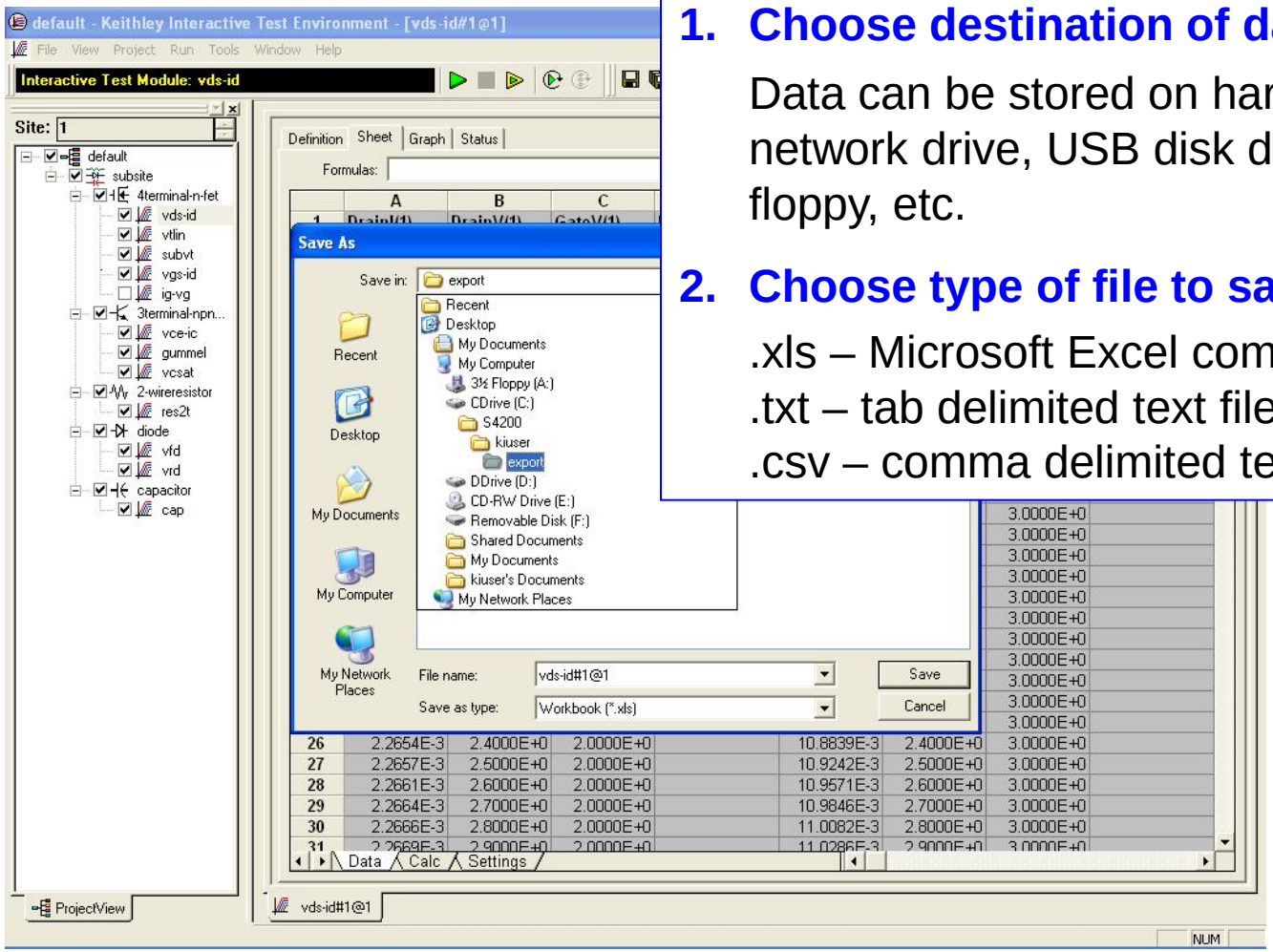
ITM Window
Sheet Tab: Saving Data

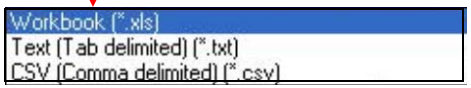


1. **Choose destination of data in worksheet:**

   Data can be stored on hard drive, external network drive, USB disk drive, CD ROM, floppy, etc.

2. **Choose type of file to save data as …**

   .xls – Microsoft Excel compatible format
   .txt – tab delimited text file
   .csv – comma delimited text file



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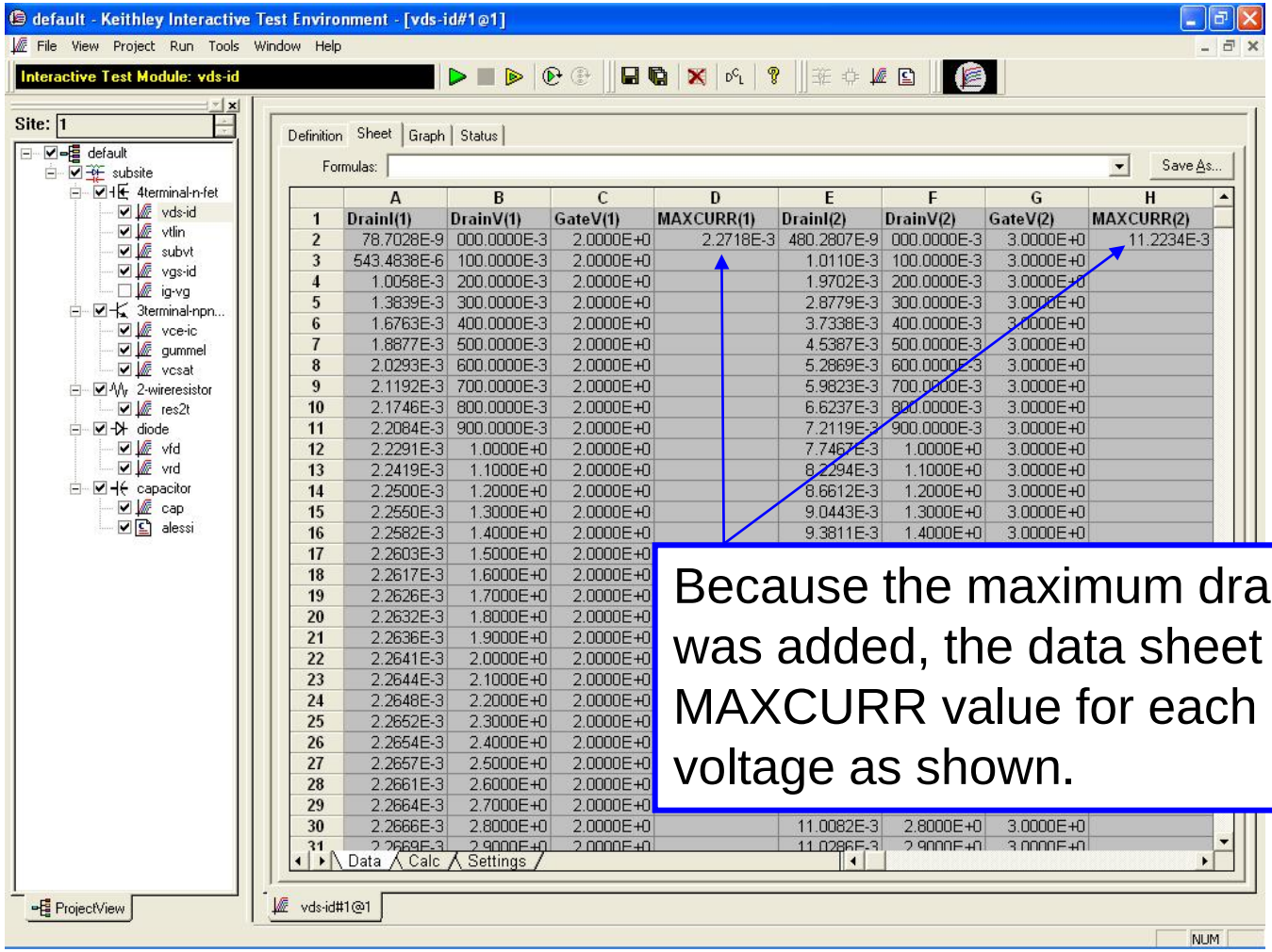
ITM Window
Sheet Tab



	A	B	C	D	E	F	G	H
1	DrainI(1)	DrainV(1)	GateV(1)	MAXCURR(1)	DrainI(2)	DrainV(2)	GateV(2)	MAXCURR(2)
2	78.7028E-9	000.0000E-3	2.0000E+0	2.2718E-3	480.2807E-9	000.0000E-3	3.0000E+0	11.2234E-3
3	543.4838E-6	100.0000E-3	2.0000E+0		1.0110E-3	100.0000E-3	3.0000E+0	
4	1.0058E-3	200.0000E-3	2.0000E+0		1.9702E-3	200.0000E-3	3.0000E+0	
5	1.3839E-3	300.0000E-3	2.0000E+0		2.8779E-3	300.0000E-3	3.0000E+0	
6	1.6763E-3	400.0000E-3	2.0000E+0		3.7338E-3	400.0000E-3	3.0000E+0	
7	1.8877E-3	500.0000E-3	2.0000E+0		4.5387E-3	500.0000E-3	3.0000E+0	
8	2.0293E-3	600.0000E-3	2.0000E+0		5.2869E-3	600.0000E-3	3.0000E+0	
9	2.1192E-3	700.0000E-3	2.0000E+0		5.9823E-3	700.0000E-3	3.0000E+0	
10	2.1746E-3	800.0000E-3	2.0000E+0		6.6237E-3	800.0000E-3	3.0000E+0	
11	2.2084E-3	900.0000E-3	2.0000E+0		7.2119E-3	900.0000E-3	3.0000E+0	
12	2.2291E-3	1.0000E+0	2.0000E+0		7.7467E-3	1.0000E+0	3.0000E+0	
13	2.2419E-3	1.1000E+0	2.0000E+0		8.2294E-3	1.1000E+0	3.0000E+0	
14	2.2500E-3	1.2000E+0	2.0000E+0		8.6612E-3	1.2000E+0	3.0000E+0	
15	2.2550E-3	1.3000E+0	2.0000E+0		9.0443E-3	1.3000E+0	3.0000E+0	
16	2.2582E-3	1.4000E+0	2.0000E+0		9.3811E-3	1.4000E+0	3.0000E+0	
17	2.2603E-3	1.5000E+0	2.0000E+0					
18	2.2617E-3	1.6000E+0	2.0000E+0					
19	2.2626E-3	1.7000E+0	2.0000E+0					
20	2.2632E-3	1.8000E+0	2.0000E+0					
21	2.2636E-3	1.9000E+0	2.0000E+0					
22	2.2641E-3	2.0000E+0	2.0000E+0					
23	2.2644E-3	2.1000E+0	2.0000E+0					
24	2.2648E-3	2.2000E+0	2.0000E+0					
25	2.2652E-3	2.3000E+0	2.0000E+0					
26	2.2654E-3	2.4000E+0	2.0000E+0					
27	2.2657E-3	2.5000E+0	2.0000E+0					
28	2.2661E-3	2.6000E+0	2.0000E+0					
29	2.2664E-3	2.7000E+0	2.0000E+0					
30	2.2666E-3	2.8000E+0	2.0000E+0		11.0082E-3	2.8000E+0	3.0000E+0	
31	2.2669E-3	2.9000E+0	2.0000E+0		11.0286E-3	2.9000E+0	3.0000E+0	

Because the maximum drain current formula was added, the data sheet should include a MAXCURR value for each step of the gate voltage as shown.

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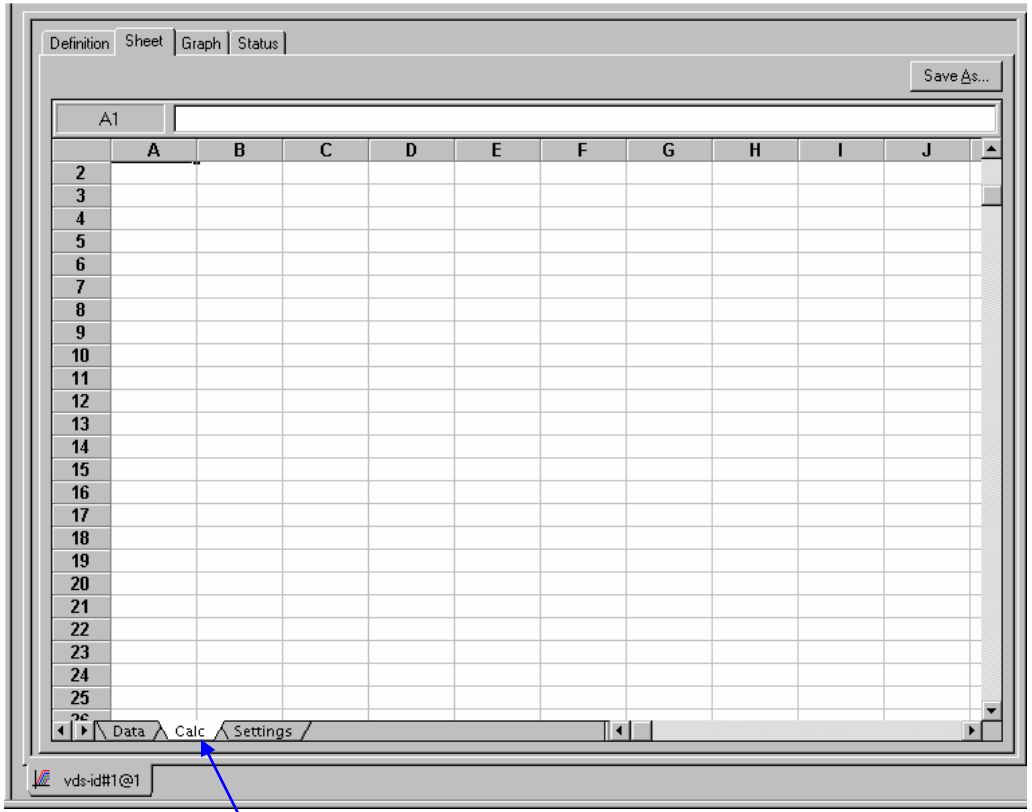
Sheet Tab
Calc Sheet

Action **Click on Calc tab**

The **Calc** worksheet is an Excel compatible spreadsheet, that allows you to:

- Hot-link and copy values and information from the Data and Settings worksheets.
- Perform additional data analysis.
- Values are updated real-time as ITM is executed.



Calc tab for worksheet

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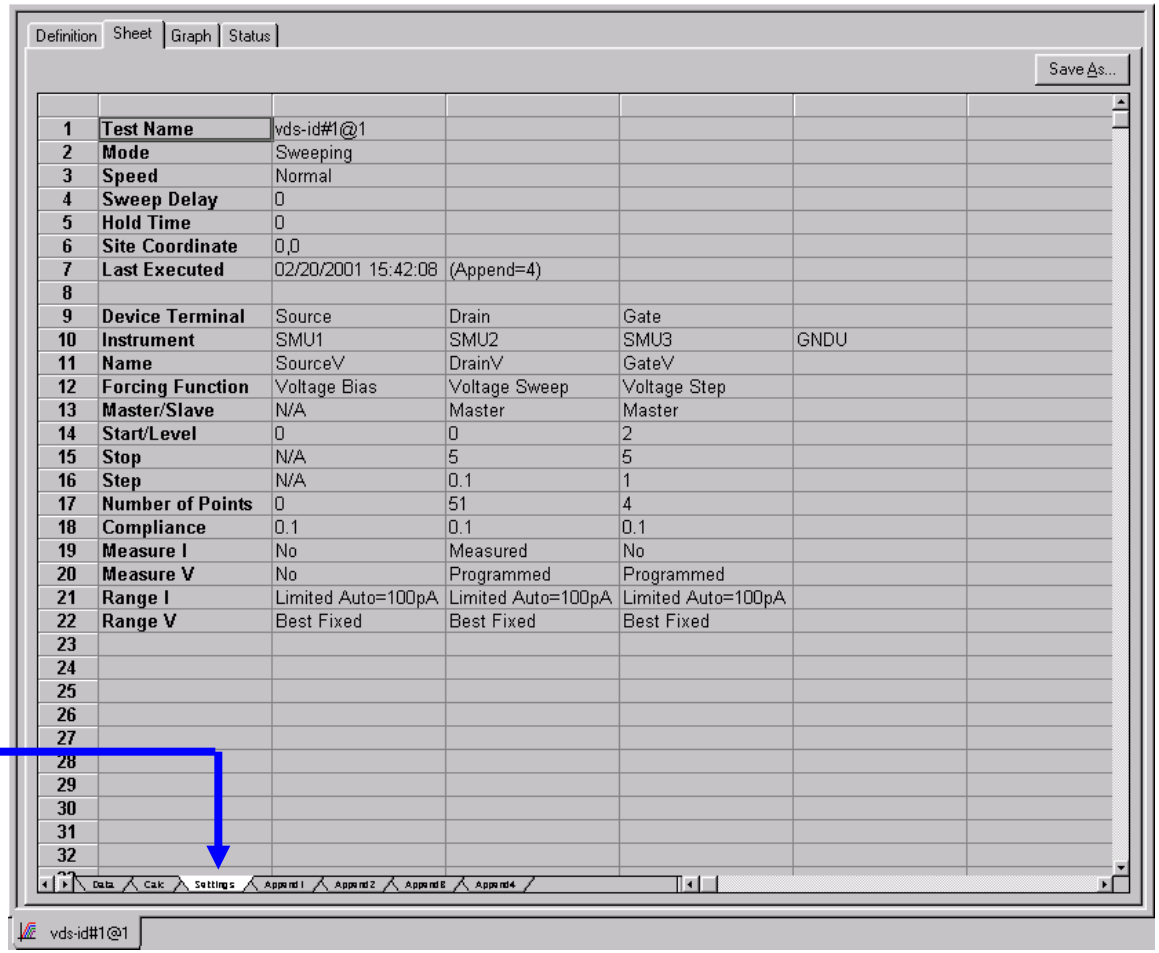
ITM Window
Sheet Tab: Settings Sheet

- The Settings worksheet records, for the last execution of a test, all test configuration information from the Definition tab.
- All settings recorded in Excel-compatible format.

Click on Settings tab → **Action**



1	Test Name	vds-id#1@1				
2	Mode	Sweeping				
3	Speed	Normal				
4	Sweep Delay	0				
5	Hold Time	0				
6	Site Coordinate	0,0				
7	Last Executed	02/20/2001 15:42:08	(Append=4)			
8						
9	Device Terminal	Source	Drain	Gate		
10	Instrument	SMU1	SMU2	SMU3	GNDU	
11	Name	SourceV	DrainV	GateV		
12	Forcing Function	Voltage Bias	Voltage Sweep	Voltage Step		
13	Master/Slave	N/A	Master	Master		
14	Start/Level	0	0	2		
15	Stop	N/A	5	5		
16	Step	N/A	0.1	1		
17	Number of Points	0	51	4		
18	Compliance	0.1	0.1	0.1		
19	Measure I	No	Measured	No		
20	Measure V	No	Programmed	Programmed		
21	Range I	Limited Auto=100pA	Limited Auto=100pA	Limited Auto=100pA		
22	Range V	Best Fixed	Best Fixed	Best Fixed		
23						
24						
25						
26						
27						
28						
29						
30						
31						
32						

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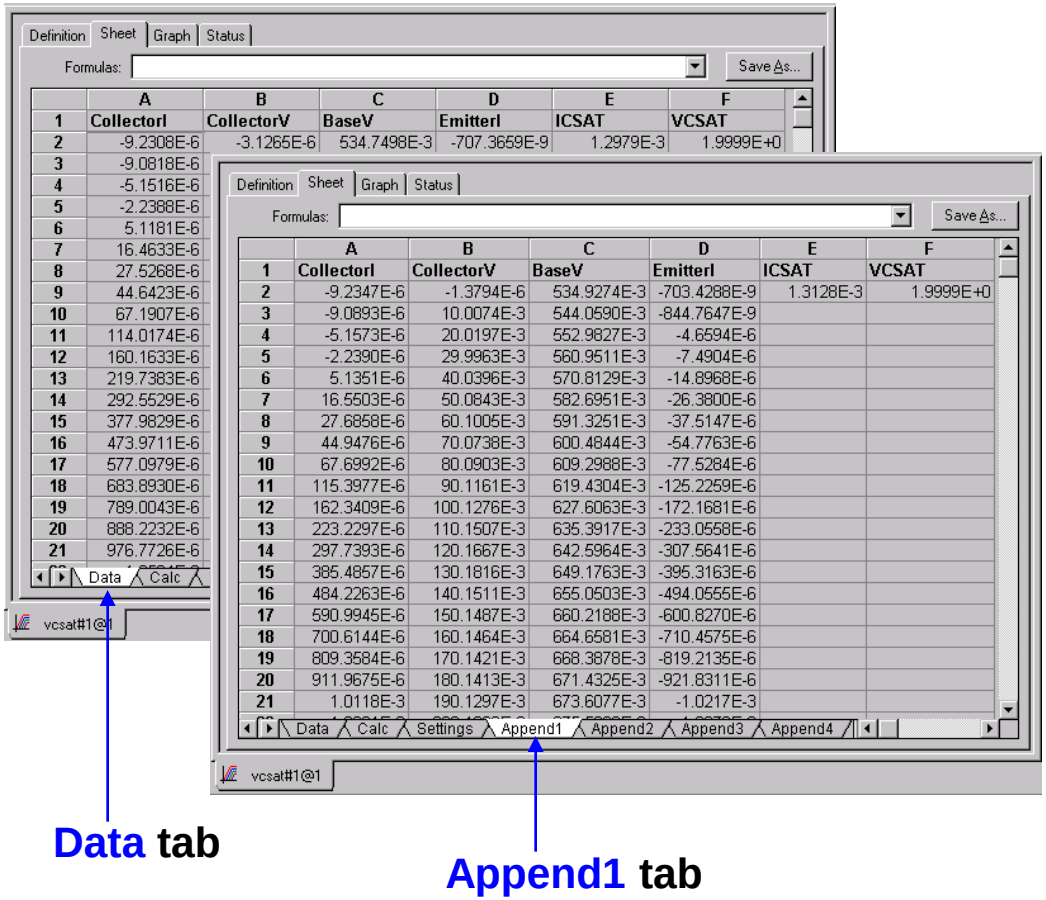
ITM Window
Sheet Tab: Append Worksheets



- The data generated for each Append execution of a test is located in an individual "Appendn" worksheet, where "n" designates the nth Append execution.
- Each Append worksheet contains the same columns and rows as the Data worksheet for the test.
- Each Append worksheet is labeled with a separate tab.

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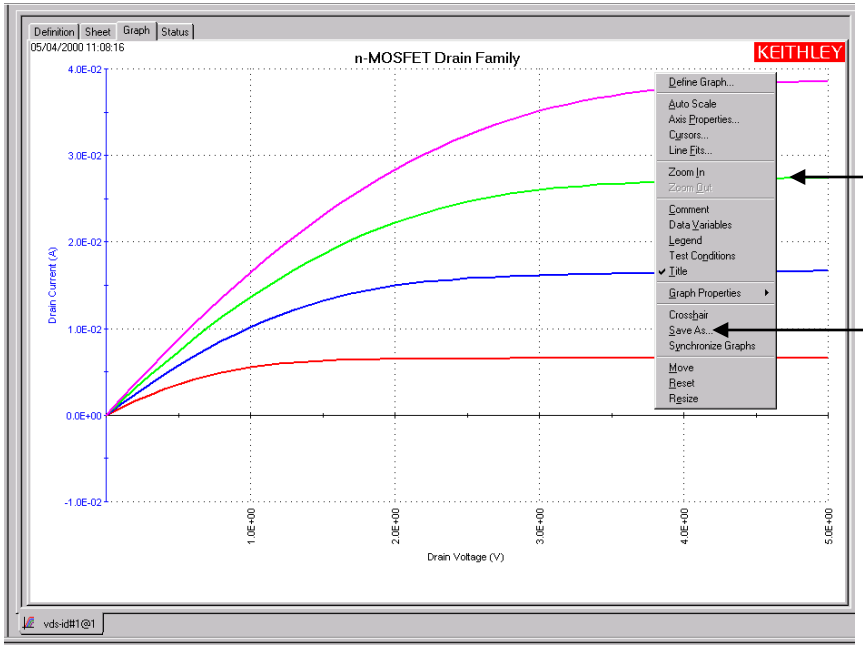
ITM Window
Graph Tab

Action

1) **Click on Graph tab**
2) **Right click on Graph**



The **Graph** tab allows you to create and export graphs of the test and test analysis results – which in some cases may be displayed in real time as the test executes:

- Displays user-specified data graphically in a user-specified format.
- Pop-up menu – Displayed when the **Graph** tab is displayed, by right-clicking on the **Graph** or selecting **Tools −> Graph Settings**. Use to configure parameters for the plot.
- Use **Save As** to save graph as a bitmap (.bmp) image.

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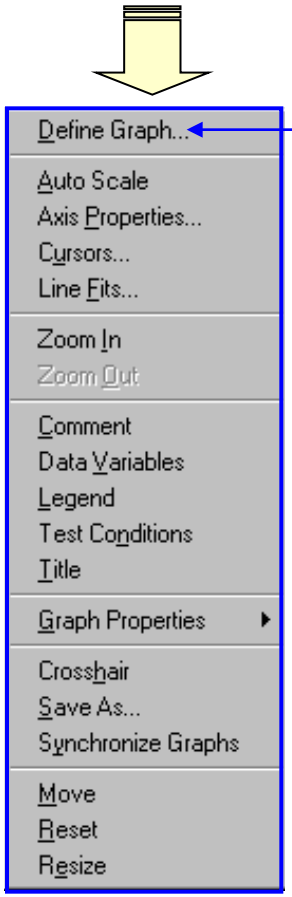
Graph Tab
Graph Settings Menu – Graph Settings

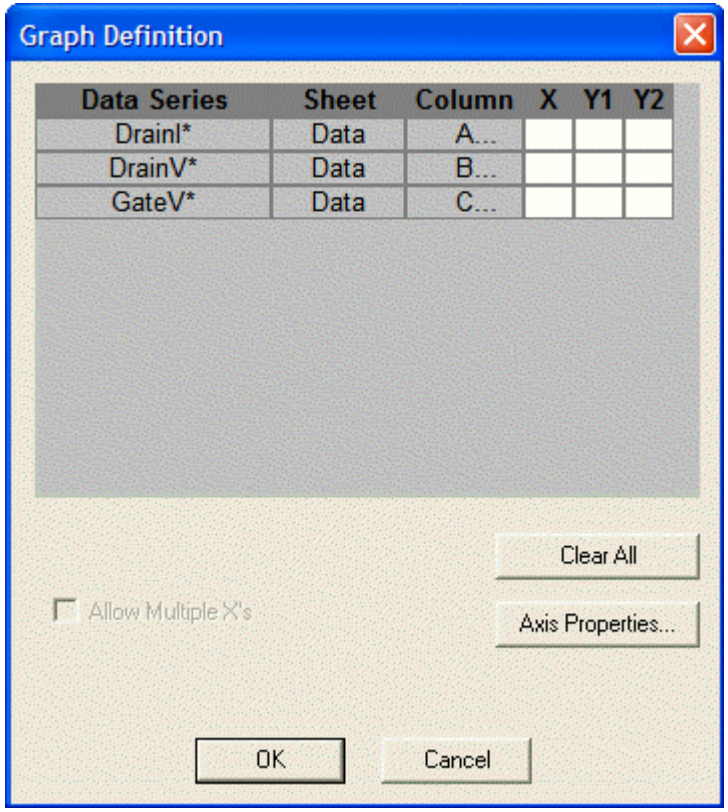
Right click on graph to open up the Graph Settings Menu:



Define Graph – Defines the parameters to be graphed and the axes on which these parameters are to be graphed.

Action

1) **Click on Define Graph.**
2) **Click OK when done.**



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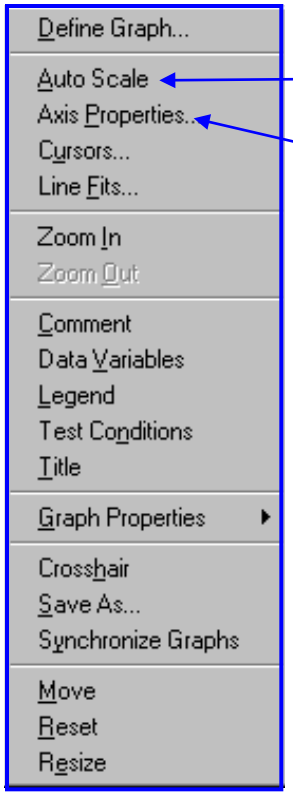
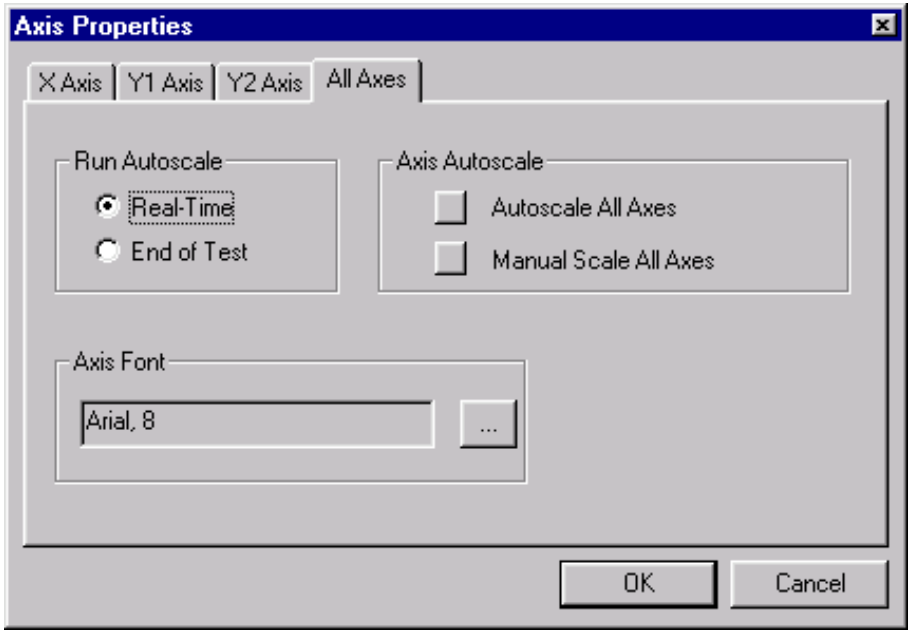
Graph Tab
Graph Settings Menu – Auto Scale & Axis Properties



Auto Scale – Automatically scales all axes.

Axis Properties – Opens the Axes properties window, which is the main access point for graph scaling and formatting.



Action

1) **Right click on Graph.**
2) **Click on Axis Properties.**
3) **Click OK when done.**

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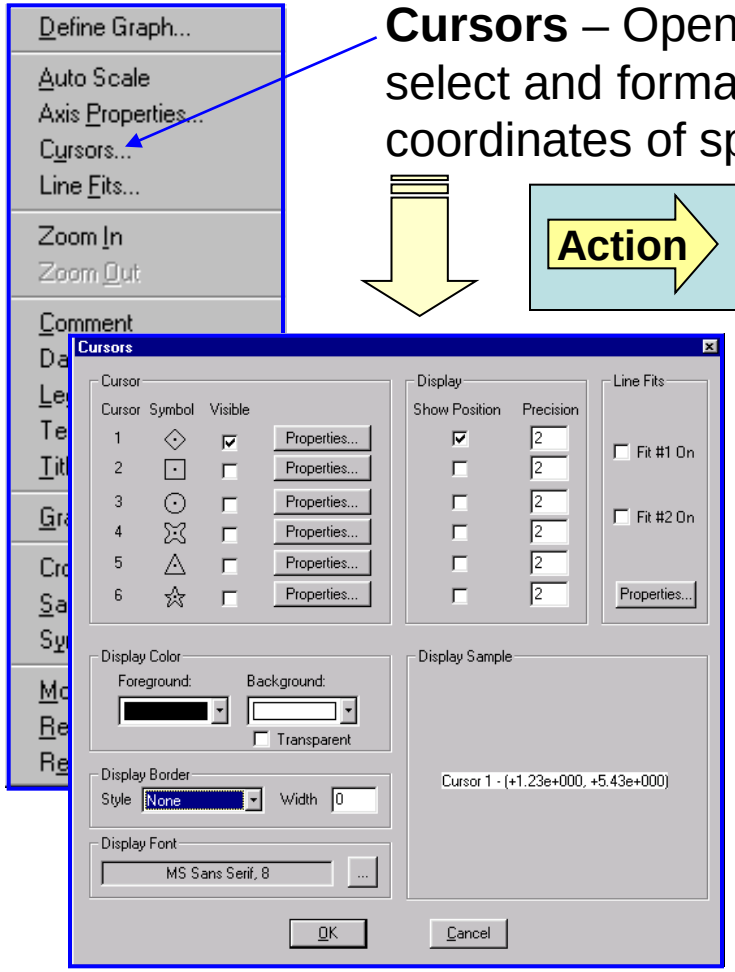
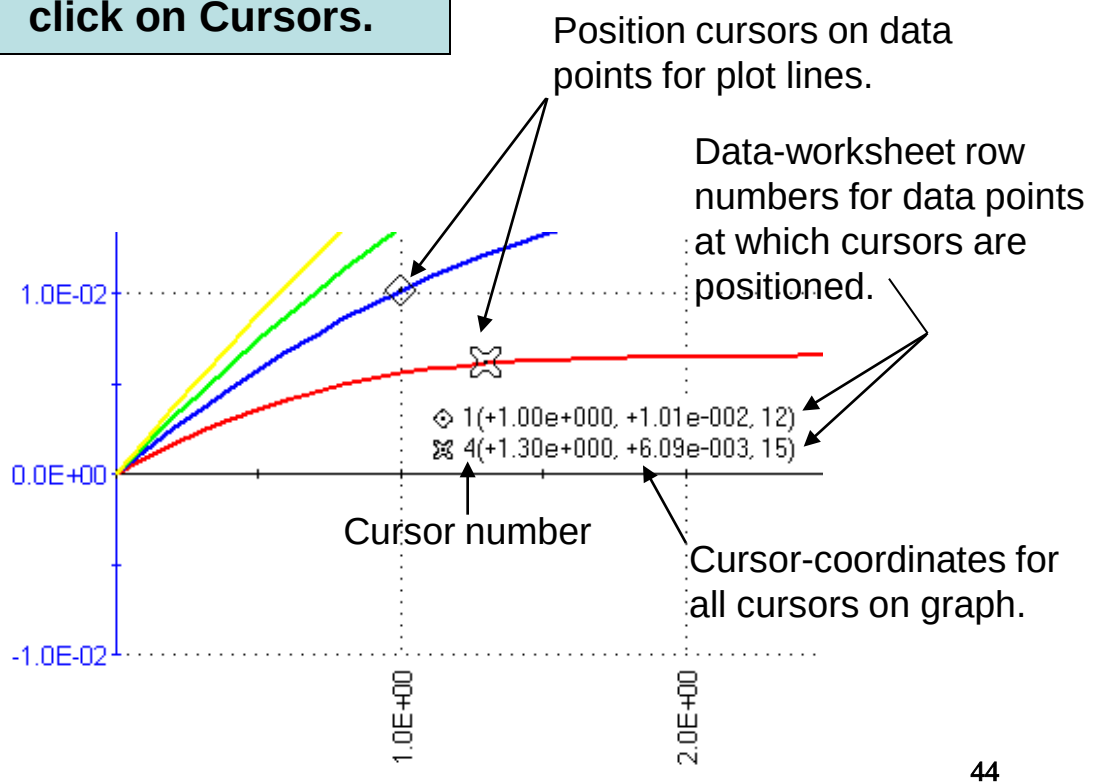
Graph Tab
Graph Settings Menu – Cursors



Cursors – Opens the Cursors window, from which you can select and format cursors that display the precise numerical coordinates of specific points on the plot lines.

Action **From Graph menu, click on Cursors.**



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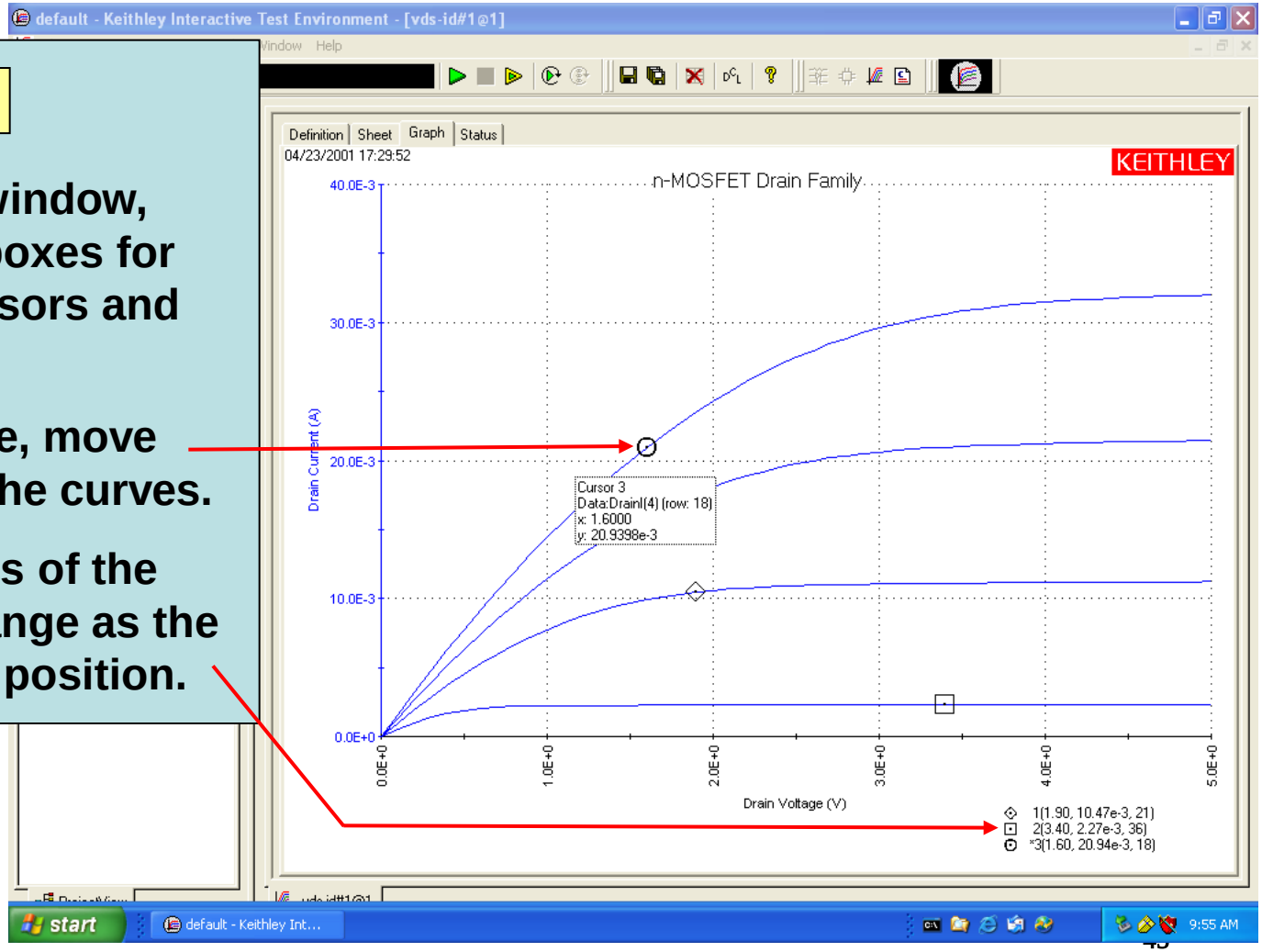
Graph Tab
Graph Settings Menu – Cursors

Action

- In the **Cursors** window, click the checkboxes for two or three cursors and click **OK**.
- Using the mouse, move the cursors on the curves.
- Notice the values of the coordinates change as the cursors change position.



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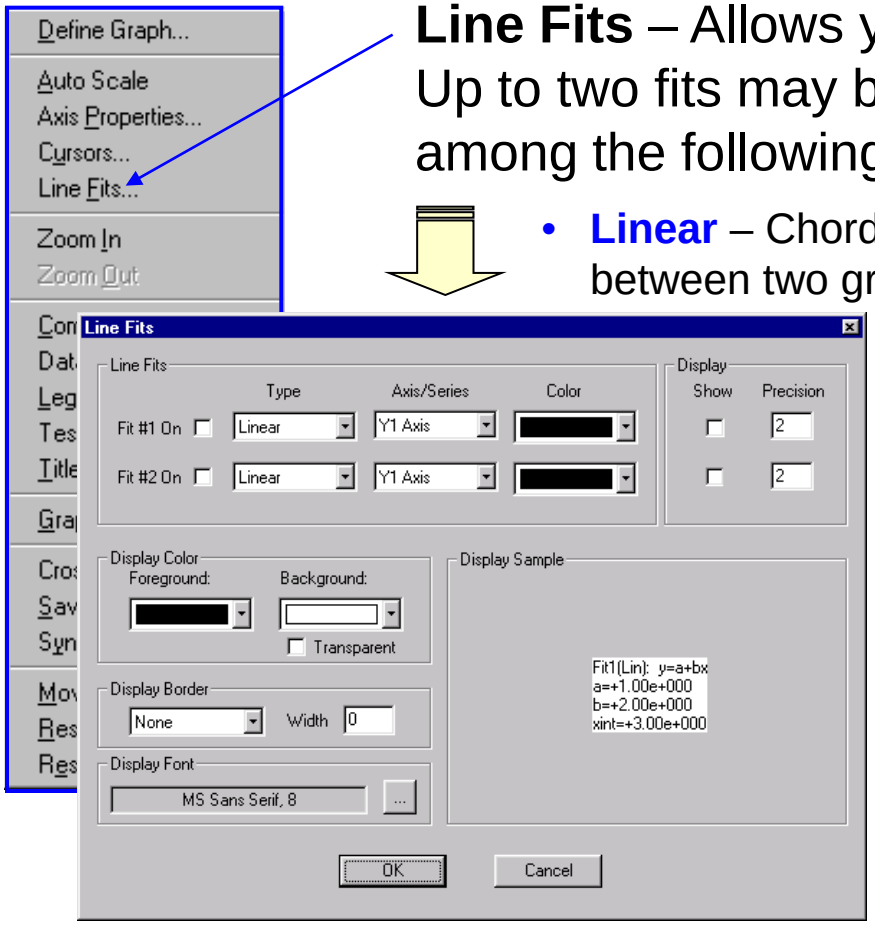
Graph Tab
Graph Settings Menu – Line Fits



Line Fits – Allows you to directly fit lines to **Graph** tab plots. Up to two fits may be performed on the graph, selected from among the following types:

- **Linear** – Chord line of the form $y = a + bx$, drawn between two graphically defined data points.
- **Regression** – Regression line of the form $y = a + bx$ for a graphically defined range of data points.
- **Exponential** – Regression line of the form $y = a \cdot e^{bx}$ for a graphically defined range of data points.
- **Log** – Regression line of the form $y = a + b \cdot log_{10}(x)$ for a graphically defined range of data points.
- **Tangent** – Tangent to the plot at a graphically defined data point. The tangent line has the form $y = a + bx$.

Action **From Graph Menu, click on Line Fits. Click OK when done.**

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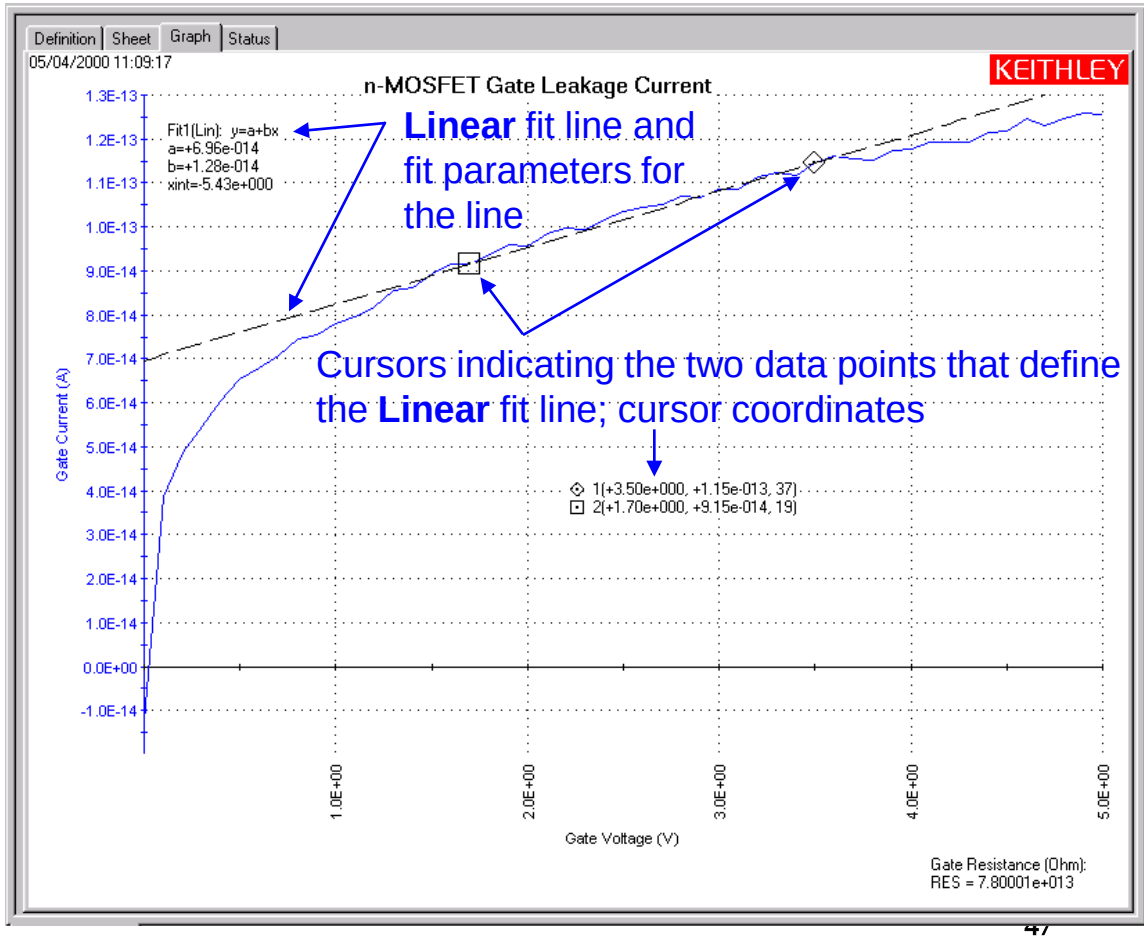
Graph Tab
Graph Settings Menu – Line Fits

The Graph displays the following:

- The fitted line
- The fit parameters
- The tangent data point or the starting and ending data points (data range)
- The data-point coordinates (Tangent or starting and ending data points are defined by cursors).

Linear Fit Example



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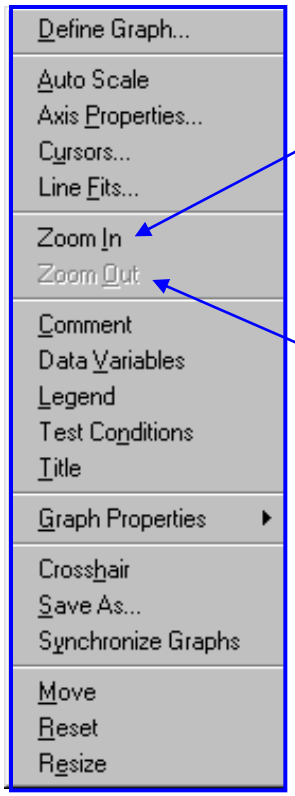
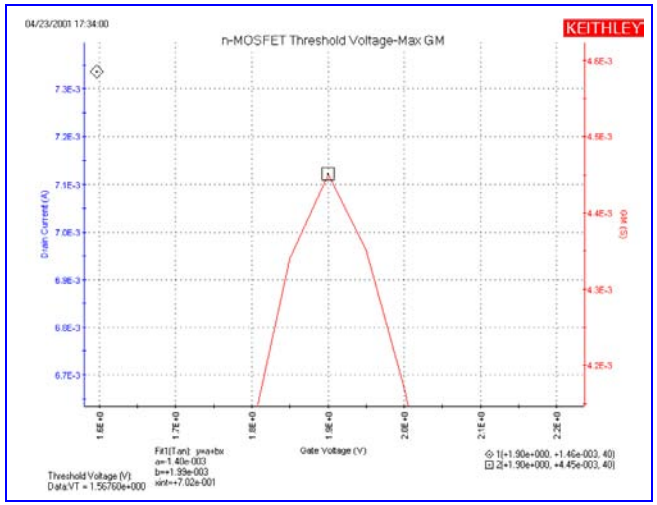
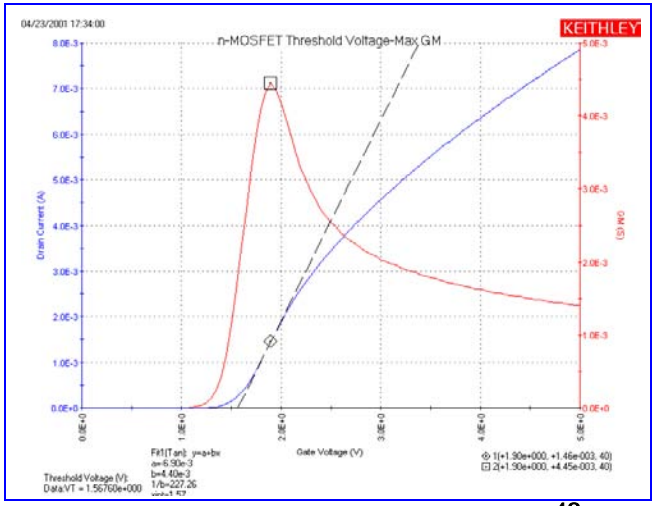
Graph Tab
Graph Settings Menu – Zoom In / Zoom Out



- **Zoom In** – Allows you to enlarge and examine a small, selected part of the graph.
- **Zoom Out** – Restores a graph to the original or previously zoom'ed size.





Action **From Graph Menu, click on Zoom In and draw an area to be enlarged. Then, Zoom Out.**

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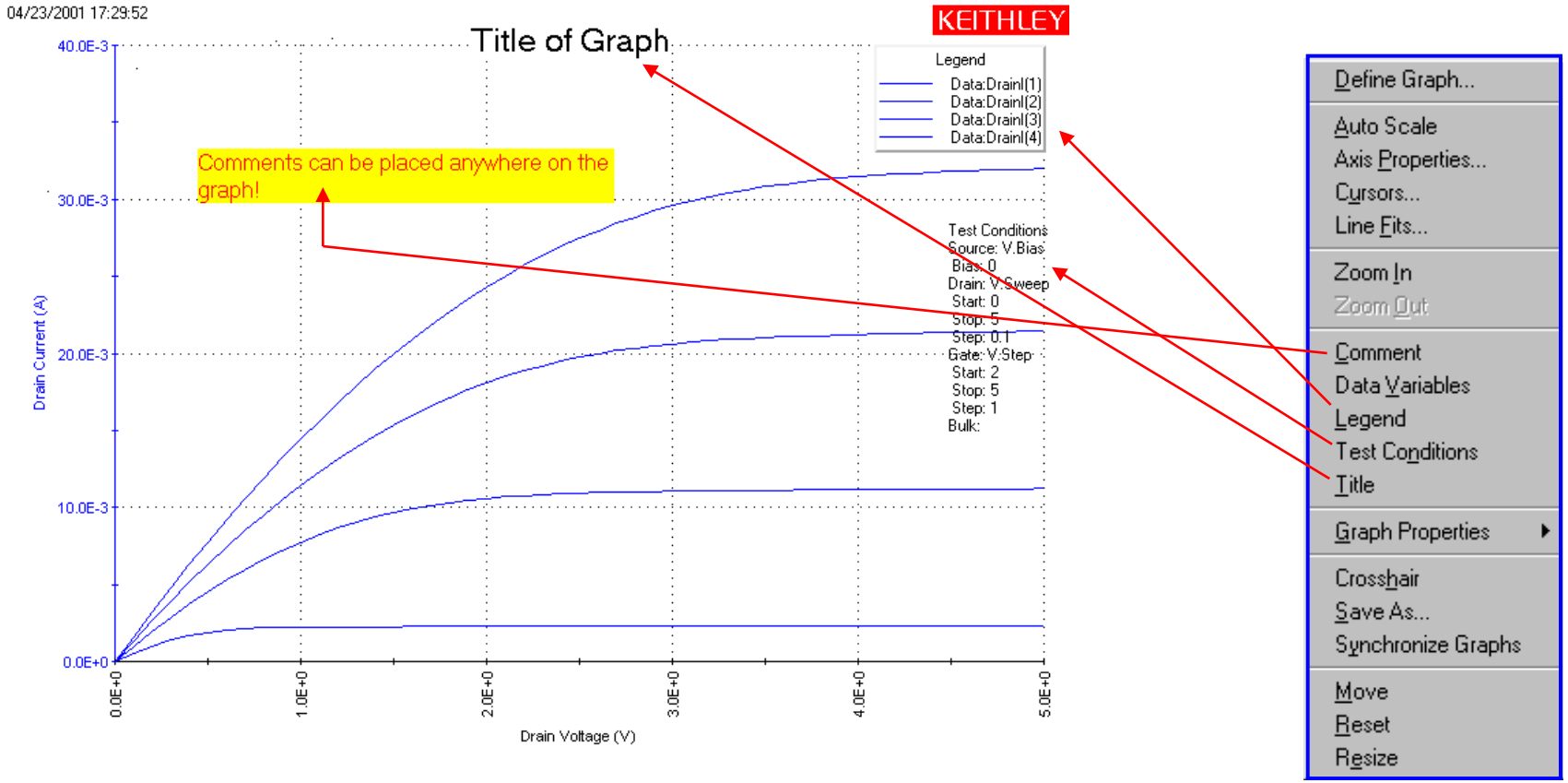
Graph Tab
Add Comments, Legend, Test Conditions, and Title to Graph

Clicking on **Comment**, **Legend**, **Test Conditions**, or **Title** in the menu opens up another menu to add these items to the graph. These items can be customized for such properties as color, borders, font, style, etc.



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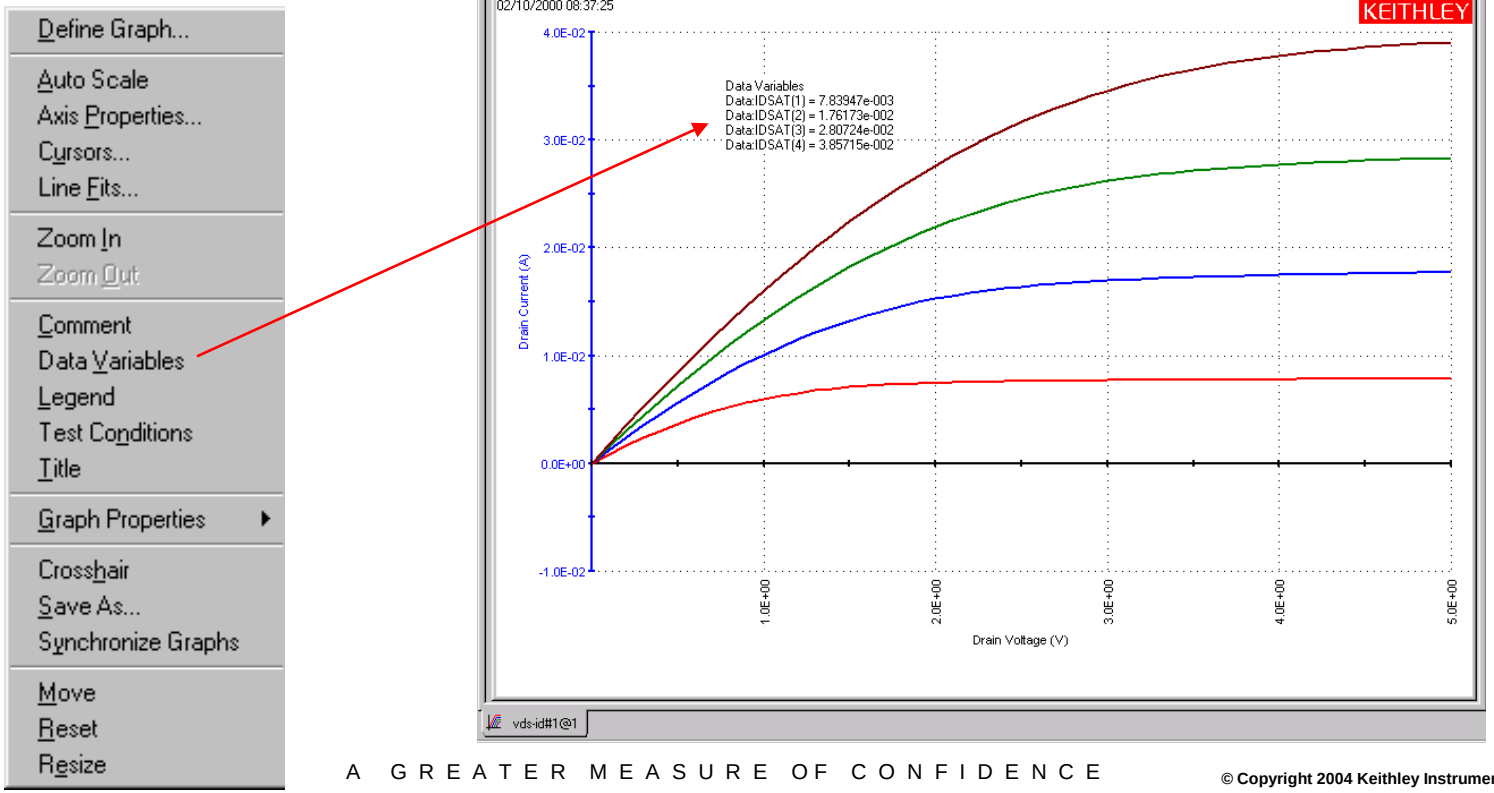
Graph Tab
Graph Settings Menu – Data Variables

On the graph, you can numerically display up to four extracted parameters, or **Data Variables**. The data variables are always taken from the second row of the worksheet. (The first row of the worksheet gives you the name of the data variable.) These can be derived values such as curve slopes, saturation values, etc.



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Graph Tab
Graph Settings Menu – Saving a Graph

Graphs can be saved in a project or in a file:

Saving the graph to the project:

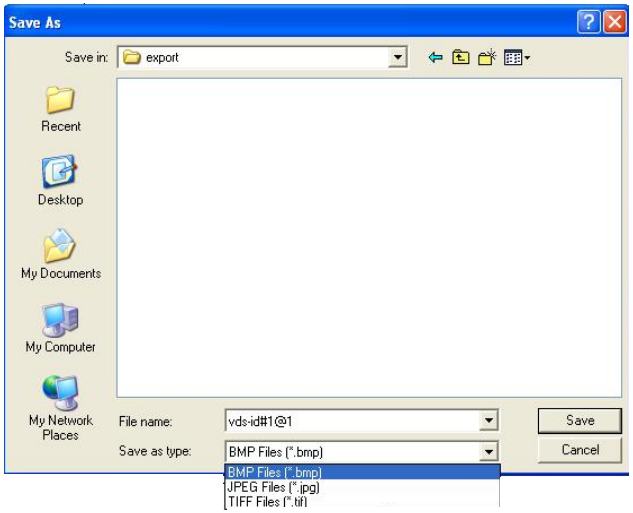
After you have finished configuring the graph, save it to the project by selecting **File** → **Save**, or by clicking the **Save** toolbar button.

Saving a graph as a bitmap file:

You can save a graph in bitmap (.bmp), JPEG (.jpg) or TIFF (.tif) format for use elsewhere, such as in a report, as follows:

1. In the Graph tab, display the Graph Settings menu by right-clicking on the graph, or by selecting **Tools** → **Graph Settings**.
2. In the Graph Settings menu, select Save As to open the **Save As** window.

Save As window



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