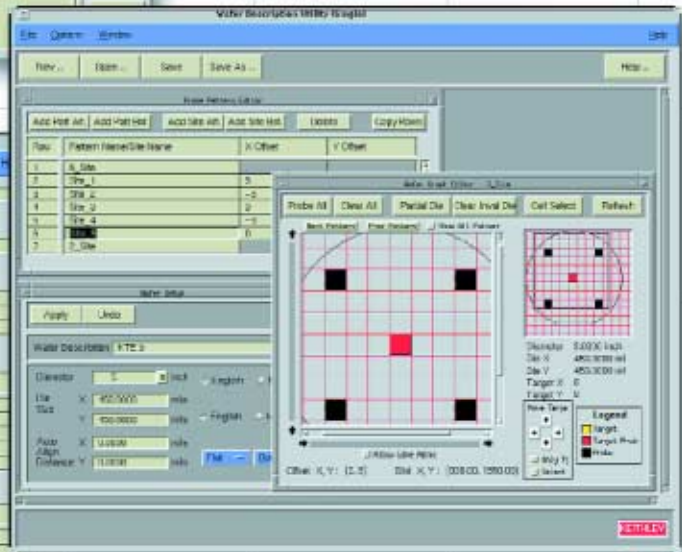
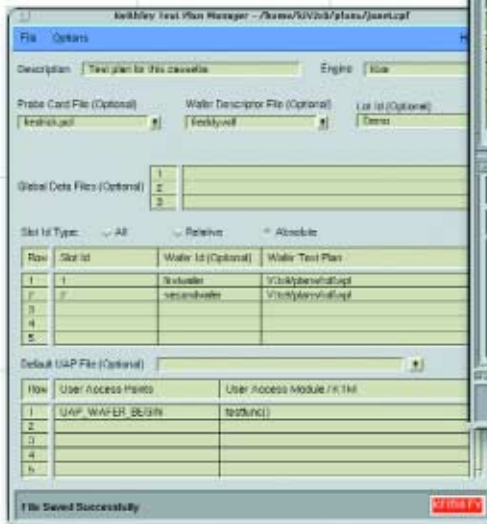




KTE 4

Parametric test software for Keithley APT systems



Easy to use—no programming required

Supports fast, efficient testing

Quick test system startup

Customizable test execution

Production test program management



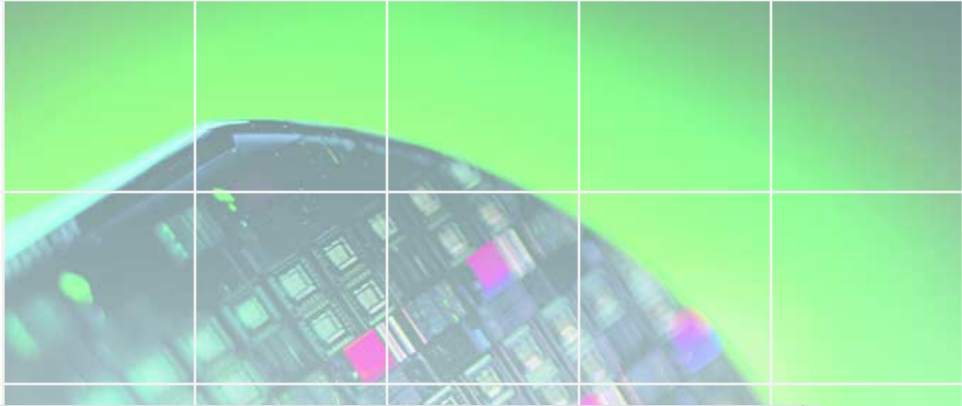
Parametric test software represents a constantly increasing financial investment that demands protection. To support migration to more powerful hardware, KTE software has been designed for upward compatibility with existing high performance testers, such as the S600 Series, S400UX, and S900NT, as well as those that will be developed in the future. This ensures that fabs won't have to sacrifice today's investments in test software to meet tomorrow's testing challenges.



The Challenge of Today's Parametric Testing Environment

As devices get smaller and wafers get larger, ensuring parametric test efficiency becomes more challenging each year. Today's parametric test managers and engineers recognize the enormous impact of test software on the productivity of their APT systems. Increasingly, they're demanding systems with point-and-click interfaces that let them generate and debug tests, assign tests to specific wafer locations, and create intelligent sampling plans quickly and easily. At the same time, they need to be able to customize the software to meet their fabs' specific requirements and to manage and control these programs easily. The latest release of the Keithley Test Environment (KTE) software addresses these needs by combining exceptional ease-of-use with customization flexibility in a single, integrated package.

Minimizing the time to first production is critical—a delay of a few weeks due to parametric test development problems that prevent line startup can easily cost millions. The time required to create new test plans for new products is also costly. KTE software is designed to help fabs bring parametric testing systems online faster and to create new test plans efficiently to meet new testing needs. Its modular structure allows program components to be re-used to create new test plans quickly.



Wafer Description Utility (Single) - DSP13.wdf [1.3_revised - Rw]

File Options Window Version Control Help

New ... Open ... Save Save As ... Help ...

Wafer Graph Editor - Base_Pattern

Probe All Clear All Partial Die Clear Inval Die Cell Select Refresh

Next Pattern Prev Pattern Show All Patterns

Row	Pattern Name/Site Name
1	Base_Pattern
2	Site_12
3	Site_14
4	Site_19
5	Site_22
6	Site_23
7	Retest_Pattern
8	Site_5
9	Site_6

Offset X, Y: (-1, 0) Dist X, Y: (-20.30, 0.00)

Diameter: 8.0000 inch
Die X: 20.3000 mm
Die Y: 20.5000 mm
Target X: 0
Targat Y: 0

Move Target:

Legend:
Target (Green square)
Target Probe (Blue square)
Probe (Black square)

Only Tgt Select

Site Optimization

Select site optimization style

Site Editor

Site Ref. Add Subsite Aft. Add Subsite Bef. Delete Copy Rows

Site Desc/Subsite Name	X mm	Y mm
hame	0	0
moda	-1.4	-6.4
modb	-1.4	0
modc	0	-6.4

Use the Right Mouse Button to Reset the Pattern/Site List

KTE

Create Basic Test Plans in Minutes

Only three basic components are required to build a test plan in KTE:

- One or more test macro files, which contain a list of tests and test parameters.
- A wafer description that defines the probing locations
- A wafer/cassette test plan that defines the wafers to test and the test to execute.

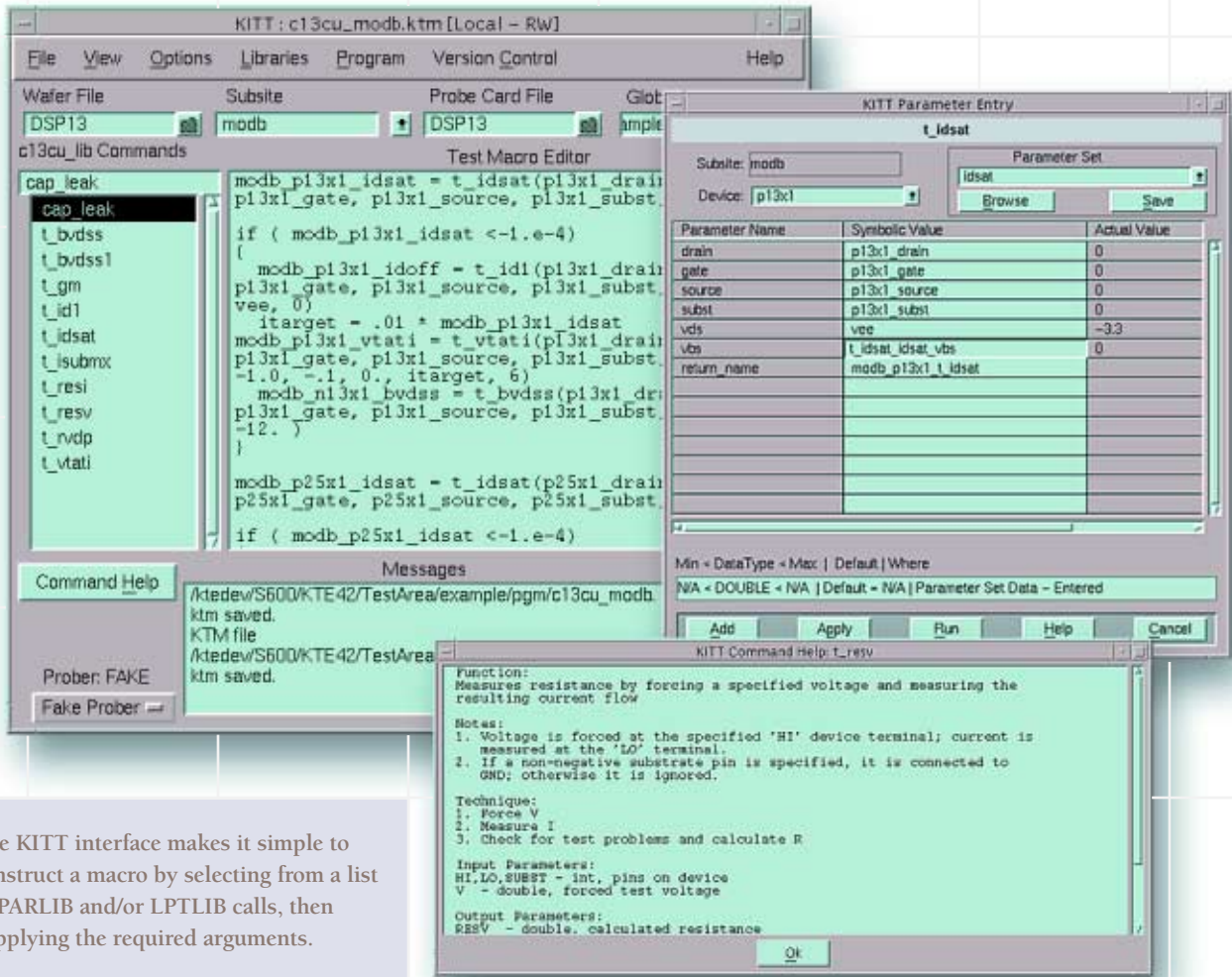
The Graphical User Interface (GUI) simplifies building powerful test plans interactively. No programming experience is required to build test plans using the standard test algorithms supplied. The data-driven test environment means there's no need to spend hours recompiling the execution engine before it's possible to determine the effect of an algorithm change on the test plan.

Simple Test Macro Development

The tests to be executed are defined using the Keithley Interactive Test Tool (KITT), combining them into logical groupings called macros. Each test macro lists all the test algorithms for a specific subsite or device, including input parameters and test conditions. Tests are debugged interactively using either individual macro calls or groups of them. KITT allows test algorithms from multiple libraries to be called, simplifying the management and distribution on new test routines. Low-level instrument and prober calls can also be used when developing new tests.

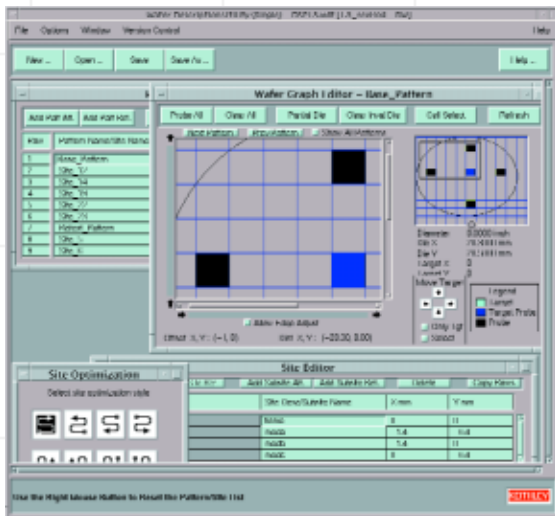
KTE 4 offers a variety of new capabilities, including the ability to perform conditional testing within the KITT macro language. This allows the user to perform adaptive testing by using the result of one measurement to determine which measurements are made subsequently. The ability to perform calculations on input, output and passed values is also new to this release, which provides greater flexibility in creating test macros.

The parameter entry screen used to build the test macros allows users to predefine default values for the parameters and provides validation limits for the test parameters. This screen also allows users to employ set-up conditions from predefined test parameter sets and to incorporate device-specific information (pin numbers, geometry, etc.) from a test structure file. The KITT tool includes an on-line help facility to speed development of new tests.



The KITT interface makes it simple to construct a macro by selecting from a list of PARLIB and/or LPTLIB calls, then supplying the required arguments.

Specify Wafer Geometry and Probing Patterns Quickly



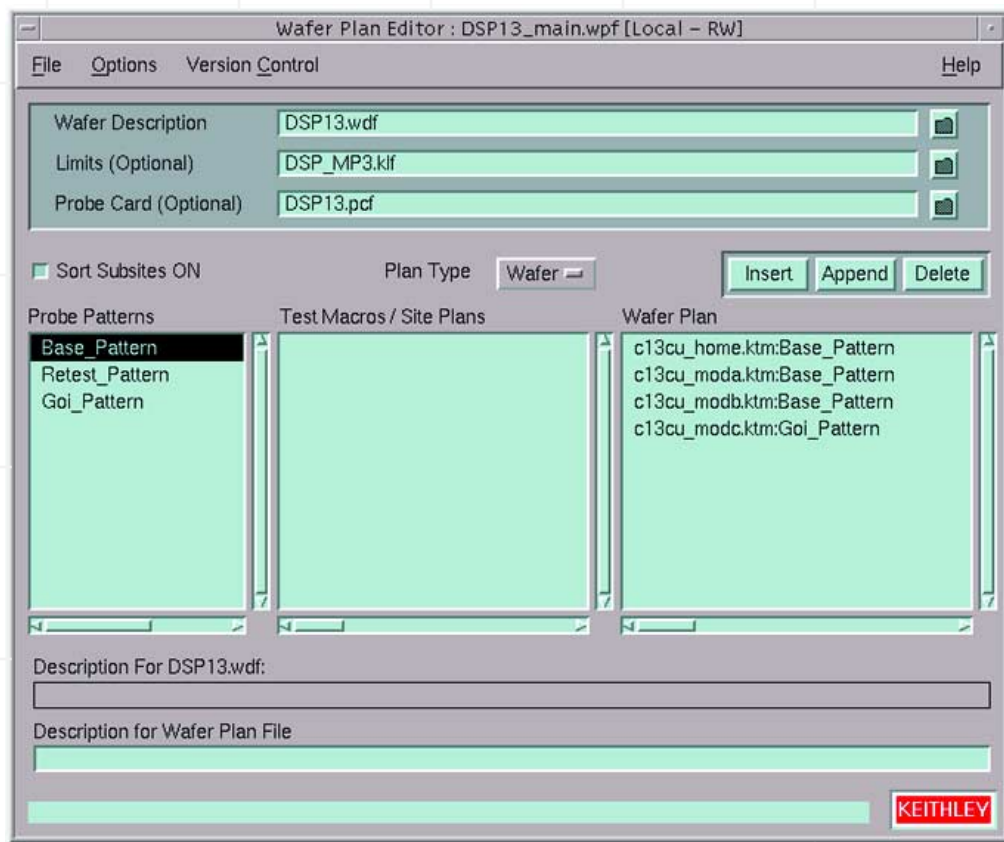
The Wafer Description Utility simplifies defining specific sites to test.

Once the device test algorithms and macros are complete, it's time to define the location of the devices on the wafer using the Wafer Description Utility (WDU). Simply enter the wafer size and die size and a wafer graphic is displayed immediately. WDU supports wafer sizes up to 300mm for leading-edge facilities. Next, just point and click to create as many site or die probe patterns as desired or enter the site coordinates directly in a spreadsheet view. Then, define the subsites or pin touchdown locations within each site location. Once a wafer description has been created, it can be used with any algorithm, macro or test sampling plan. The WDU provides nine different ways to optimize the prober movement pattern to speed testing.

Create Wafer Test Plans by Linking Probe Patterns and Tests

A few point-and-clicks are all it takes to create a wafer test plan with the Wafer Plan Editor, which ensures high test coverage flexibility. Simply choose the appropriate wafer description, then match the test macros with any probe pattern—the KTE software creates the specified test plan automatically. The Wafer Plan Editor also allows specifying the limits file and probe card file, if required. There's no limit on the number of wafer test plans that can be created and stored, so engineers are free to design plans for testing scenarios, including quick screenings, normal testing, rework, or thorough analysis.

The Wafer Plan Editor generates test plans automatically.



Combine any Group of Wafer Test Plans into Cassette Test Plans

When the wafer test plans are complete, they're ready to integrate into an automated cassette test plan. Using the Cassette Test Plan Manager, select the right wafer test plan to apply to each wafer in the cassette or apply the same plan to all wafers in the cassette. For instance, choose a more thorough screening on the first wafer in the boat in order to assess the initial quality of the lot as early as possible. More time-consuming breakdown or Wafer Level Reliability tests may be

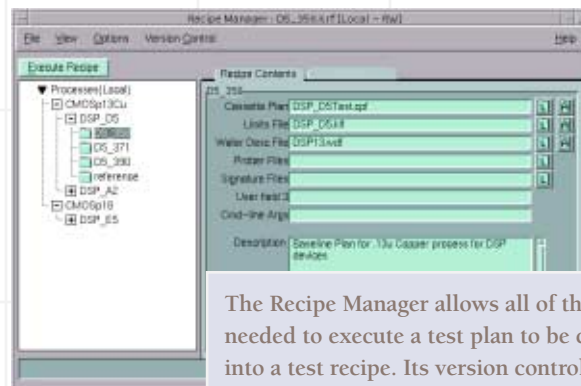


The Test Plan Manager simplifies combining individual wafer test plans, wafer descriptions, and UAPs into a single, comprehensive Cassette Test Plan.

executed on a limited number of sites on a few wafers. If necessary, choose the appropriate probe card file and wafer description. If data is to be shared between test algorithms or if the program is to be customized at run-time, specify the appropriate global data files.

Optional Test Recipe Manager

Foundries and fabs that manufacture a variety of customized products face the daunting task of managing hundreds of different test plans. If these products are used in critical applications or are supplied under a foundry agreement, changes must be controlled and tracked to ensure traceability of the test results. The Recipe Manager (KRM) and Version Control Option allow all of the component parts of a test plan to be collected into a test recipe, which can be managed as a single entity. A source code control system is used to provide revision control of the recipe, as well as control of all the individual files that make up the recipe. This allows any changes to be controlled and documented and helps to ensure consistency in the test results.

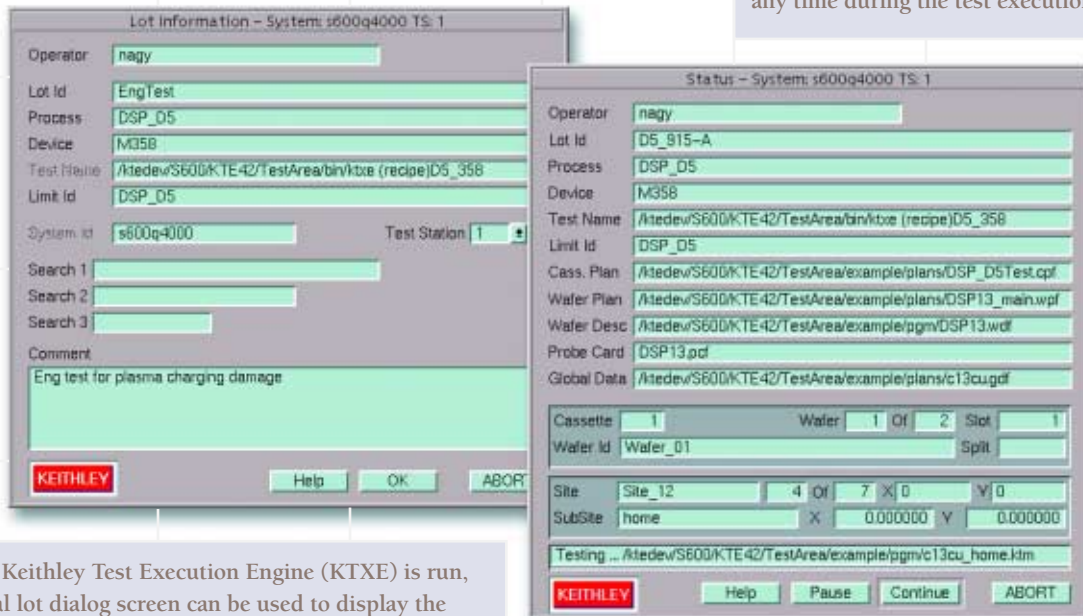


The Recipe Manager allows all of the files needed to execute a test plan to be collected into a test recipe. Its version control capabilities ensure all changes are controlled and tracked.

The modular architecture of KTE, combined with the Recipe Manager, makes it easy to create derivative programs quickly. For example, a new product that has the same test structures but a different wafer stepping can be created by copying an existing recipe and substituting a new wafer description file with the updated wafer stepping pattern. A test log file facility can be used to document the specific version of all the files used to test a specific lot of wafers for traceability of the test conditions.

High Throughput Production Wafer Test Execution

The status dialog box opens automatically to display all relevant information on the current test plan, including an update on the status of the test process. If the operator notices a problem, he can pause or abort the test plan at any time during the test execution.



When the Keithley Test Execution Engine (KTXE) is run, an optional lot dialog screen can be used to display the tests selected and to allow optional operator input. Testing begins as soon as the operator clicks the “OK” button.

Once a cassette test plan is complete, it's ready to be put into production. The test execution engine (KTXE) has been optimized to provide very high speed execution, comparable to a stand alone compiled test program, while still maintaining the flexibility of a data-driven environment that is customizable at run-time. KTE's execution engine can be started in a variety of ways, including using a custom GUI created with the Keithley Operator Program Editor (KOPED). The engine can also be started at the command line or be launched by another program. Command line arguments are available for selecting the test plan, overriding the default wafer description, forcing values normally entered by the operator, specifying error logging behavior, specifying the test data report to be generated, and disabling specific functions of the test execution engine. All of these arguments can be used to tailor test execution to the fab's specific requirements.

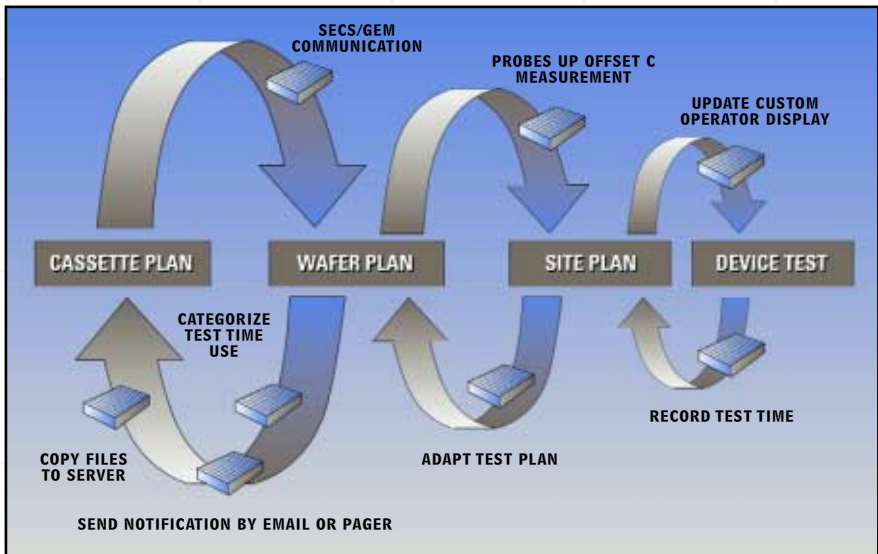
KTXE Command Line Arguments

Command line arguments are available to specify the following (partial list):

- Cassette plan file name
- Wafer description file name
- Lot ID, device, and process field
- Lot limit file ID field
- Lot summary report options
- Disable test macro (KTM) execution
- Disable calling of User Access Point (UAP) modules
- Enable test plan documentation generator
- Set error report flag reporting mode
- Set the event reporting mode
- Select debug flag

The Flexibility of a Custom Solution Paired with the Reliability of a Standard Product

If non-standard or fab-specific processing will be required during test execution, the Keithley Test Plan Manager offers the option to insert software modules at User Access Points (UAPs) located at the lot level, wafer level, or macro level. These UAPs allow running specialized routines written in C at specified points during cassette plan processing. These routines can be designed to handle a variety of functions, including unique testing, data movement, adaptive testing, inter-process communication, or operator communication tasks. Keithley provides several routines that can be used “as-is” or as examples of how to enhance the execution environment.



Common Uses of User Access Points.



Automatic Test Documentation

The Test Documentation Tool actually simulates the test plan, documenting all the important occurrences in a report that outlines the exact probe movement and test macros that will be run at each location on each wafer. This provides invaluable information for troubleshooting and debugging test plans, as well as documentation for reference purposes.

On-line Help

All KTE tools feature on-line electronic versions of the manuals. This simplifies using these tools, particularly in cleanroom environments.

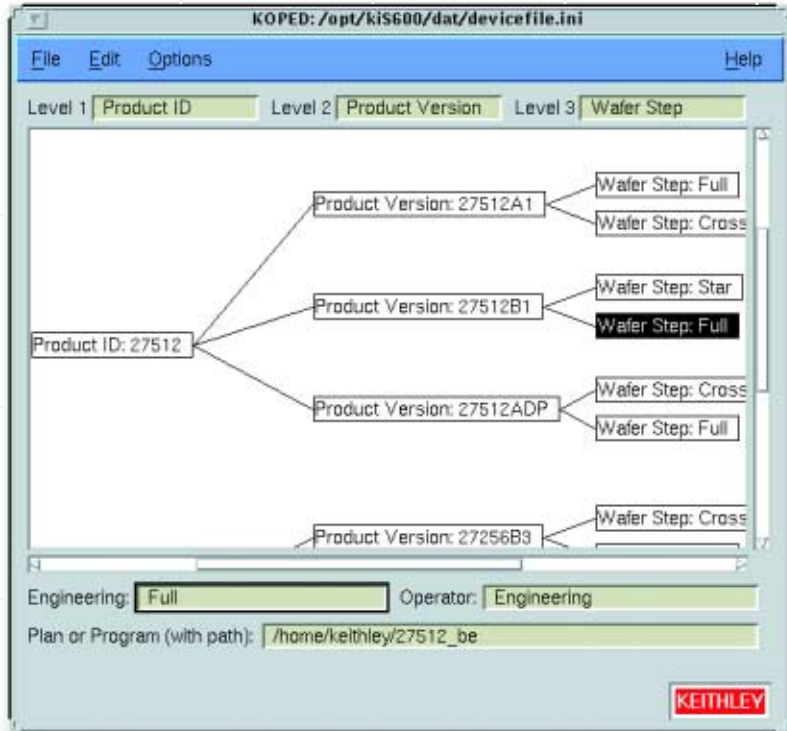
Once all the pieces have been assembled into a Cassette Test Plan, KTE makes it easy to generate test documentation automatically.

Customizable User Interface

Build Operator Screens Automatically

Most fabs test wafers created using a variety of processes, containing different versions of different products. The Keithley Operator Program Editor (KOPED) simplifies creating an operator screen to launch the appropriate test plan for the wafer to be tested.

KOPED can be used to construct a screen that allows the operator to select from a list of available product IDs, choose a product version from all the possibilities with that product ID, then select the specific wafer test from a list of tests applicable to that version. Screen labels can be easily customized to match the fab's unique vocabulary.



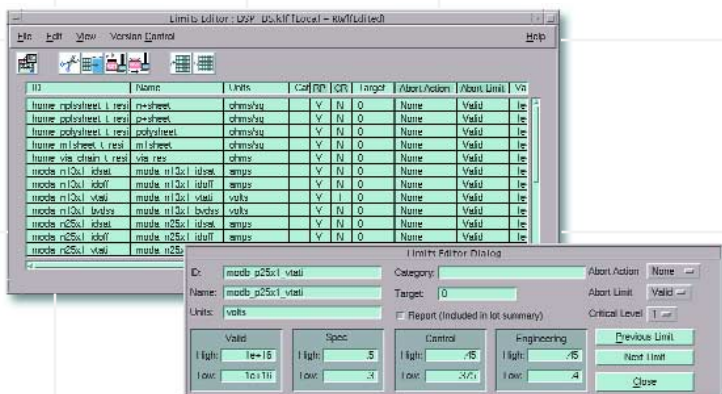
KTE software supports creating custom operator screens for operator data entry and program status monitoring using either the Keithley User Interface Library or the Tcl/Tk scripting language.

Test Result Summary Report Generator

The Keithley Summary Tool (KSU) automates generating PostScript or ASCII text reports summarizing production test data. KSU combines information from test result data files with user-configured bin limits to create reports, complete with summary statistics that detail the means, standard deviations, and ranges of the results. These reports may be exported in standard comma-delimited ASCII files for easy importing into databases and spreadsheets. KSU includes a utility for performing a quick search of lots, based on a series of search rules.

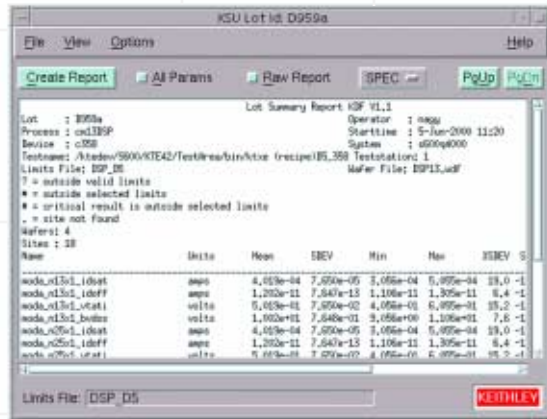
Powerful Limits Files Support Conditional Test

By assigning values to fields in the Limits File Editor, engineers can easily specify important information about each measured parameter, such as measurement units or the range of expected results. For example, the "ID" field can be used to assign a unique key to a parameter, while the "Name" field allows adding a more descriptive name to make the parameter easier to recognize. A fab-specific category can be assigned. With a click of the mouse, a report flag can be set to include the parameter in the lot summary report. A target value and four different levels of High/Low limit pairs may be used to characterize the expected results.

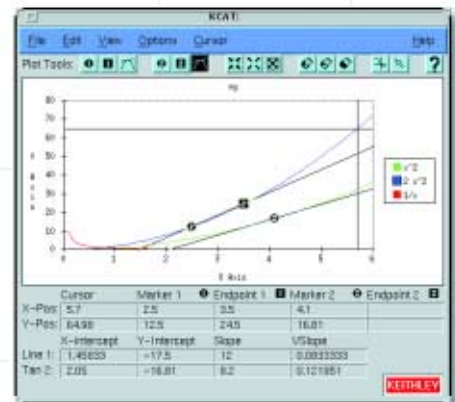


KTE's Limits File Editor simplifies assigning information to each measured parameter.

The Keithley Summary Tool provides a simple means of transferring test data in text format.



A "critical level" value indicates how crucial a particular parameter is to the test plan. This field can be used to disposition wafers automatically or to determine where test results are sent. The abort action and abort limit fields allow test plans to be terminated early if the results of a specific measurement fall outside the acceptable limits. The limit files can also be used to support adaptive test by allowing real comparison of test results to limits values. Based on this comparison, additional sites or tests can be added to the test plan.



The Keithley Curve Analysis Tool (KCAT) translates arrays of test data collected in KITT into curves and calculates slopes, intercepts, and tangents that are useful for device characterization.

Powerful C-Based Algorithm Development

KTE software provides a comprehensive set of sample parametric test algorithms (PARLIBS) as C language libraries. Engineers can use these algorithms “straight out of the box” or as the starting point when it’s necessary to create custom algorithms using C.

To modify these routines or create new ones, the Keithley User Library Toolkit (KULT) allows the user to edit the algorithm source code interactively and then quickly create a test library. In addition to isolating the users from many of the details, KULT allows them to define parameter limits, default values, data entry forms, and help text.

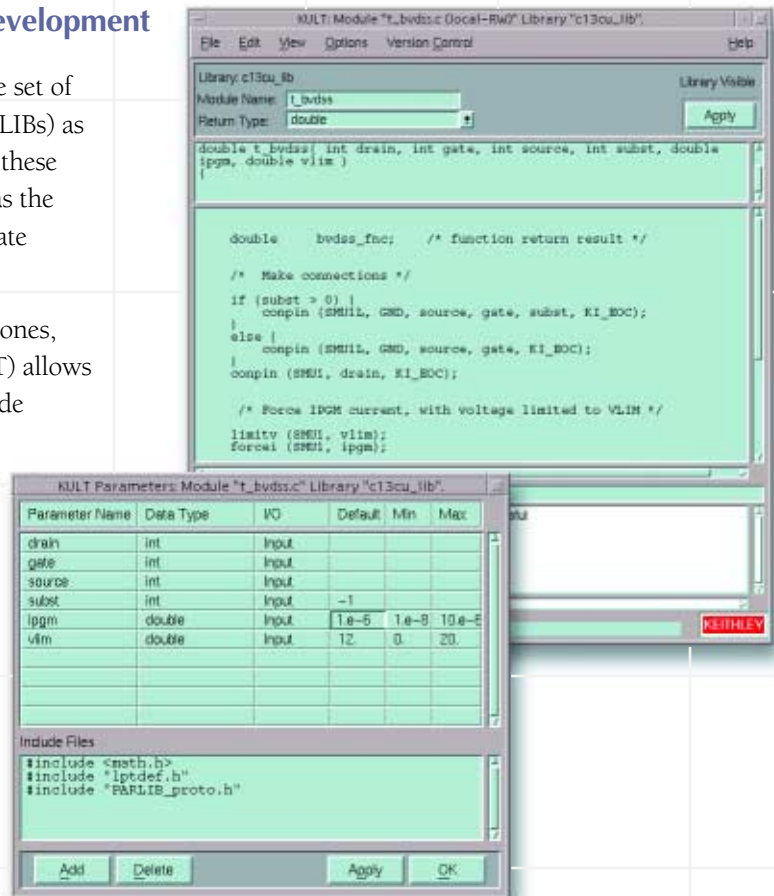
The Keithley User Library Tool (KULT) is an interactive utility designed to speed test algorithm development and modification, taking care of most of the common C code development details.

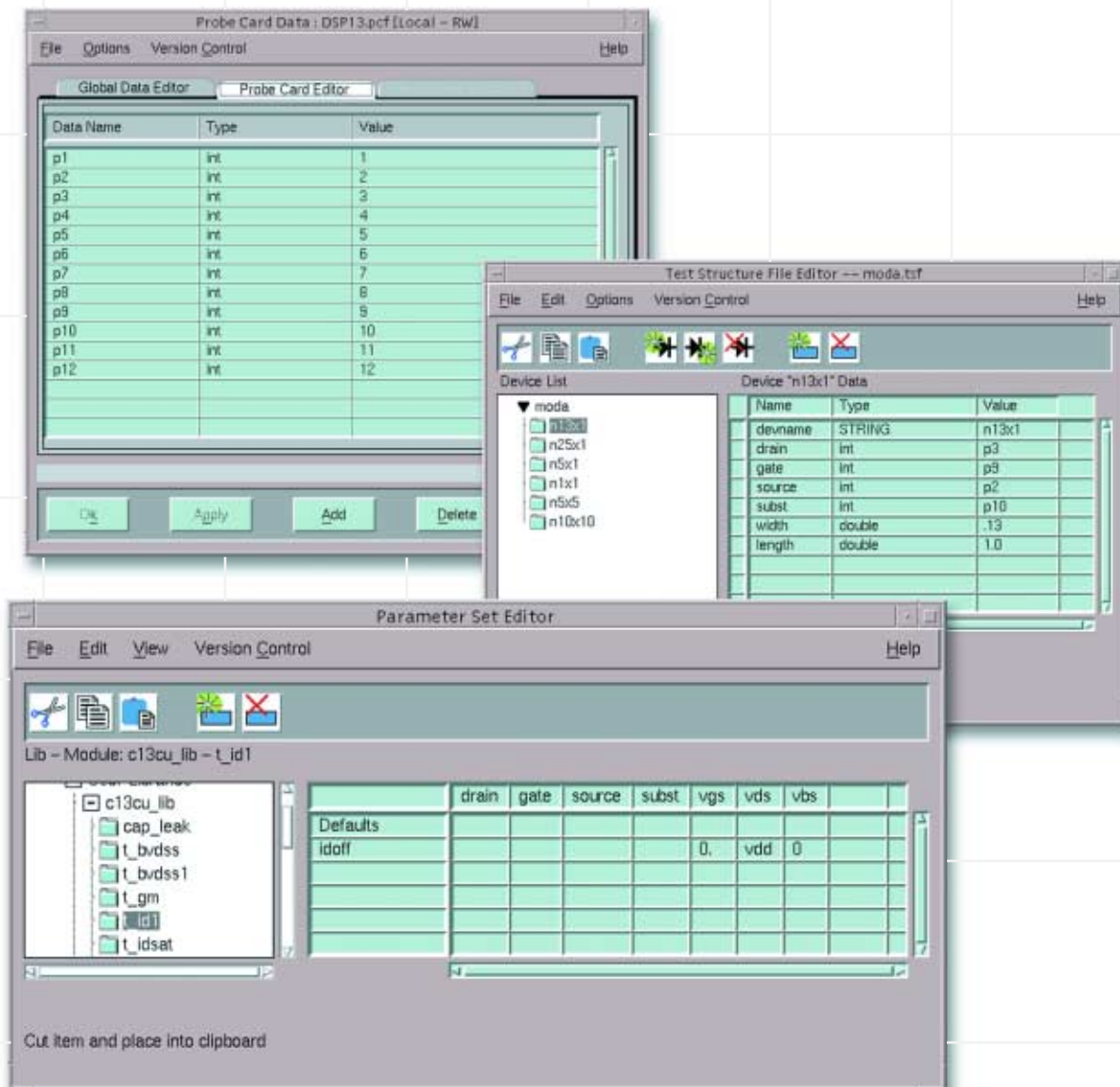
Global Data

KTE software uses global data files to support sharing variables between algorithms or to pass values between them. For instance, a sheet resistance measurement made with one algorithm can be used in any subsequent algorithm. Similarly, symbolic names can be used in test algorithms rather than hard-coded pin numbers. The symbolic-name-to-pin-number scramble table can be modified or replaced at any time. One table can be used for development while another one is used for production. This simplifies changing probers or probe cards because there’s no need to make any code changes in the test algorithms.

Commonly used groups of test conditions can be collected in test parameter sets to simplify repetitive testing. These parameter sets also allow the user to make changes and apply them across the entire test program by making a single change in the data file.

Information about the device being tested, including pad names and geometry information, can be defined in a test structure file. This file can be created manually or can be imported from another tool, such as the TestChip Technologies Device Definition file. Using an ASCII file to hold data used in multiple tests greatly simplifies making global test changes.





GUI editors are provided to simplify creating and modifying global data sets.

System Diagnostics and Calibration

In production, the need for accurate data is critical—no engineer has time to waste on searching for suspected process problems that are actually the result of faulty data. KTE software includes a comprehensive set of system diagnostic and calibration tools to ensure the accuracy of results over time.

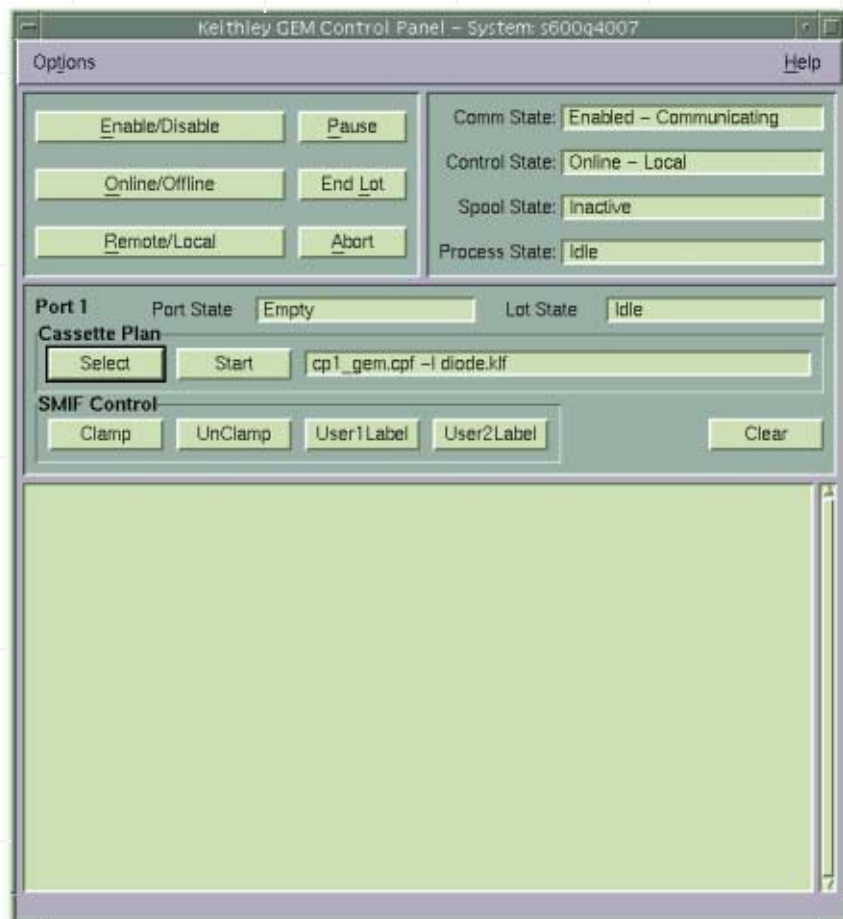
System verification and calibration are essential to ensure accurate data is being collected. Although KTE software provides a common platform to support multiple Keithley parametric testers, the exact procedure for verifying and calibrating the instrumentation for each tester is instrument-dependent. Therefore, refer to the specific tester's documentation for details on the system diagnostics and calibration support provided.

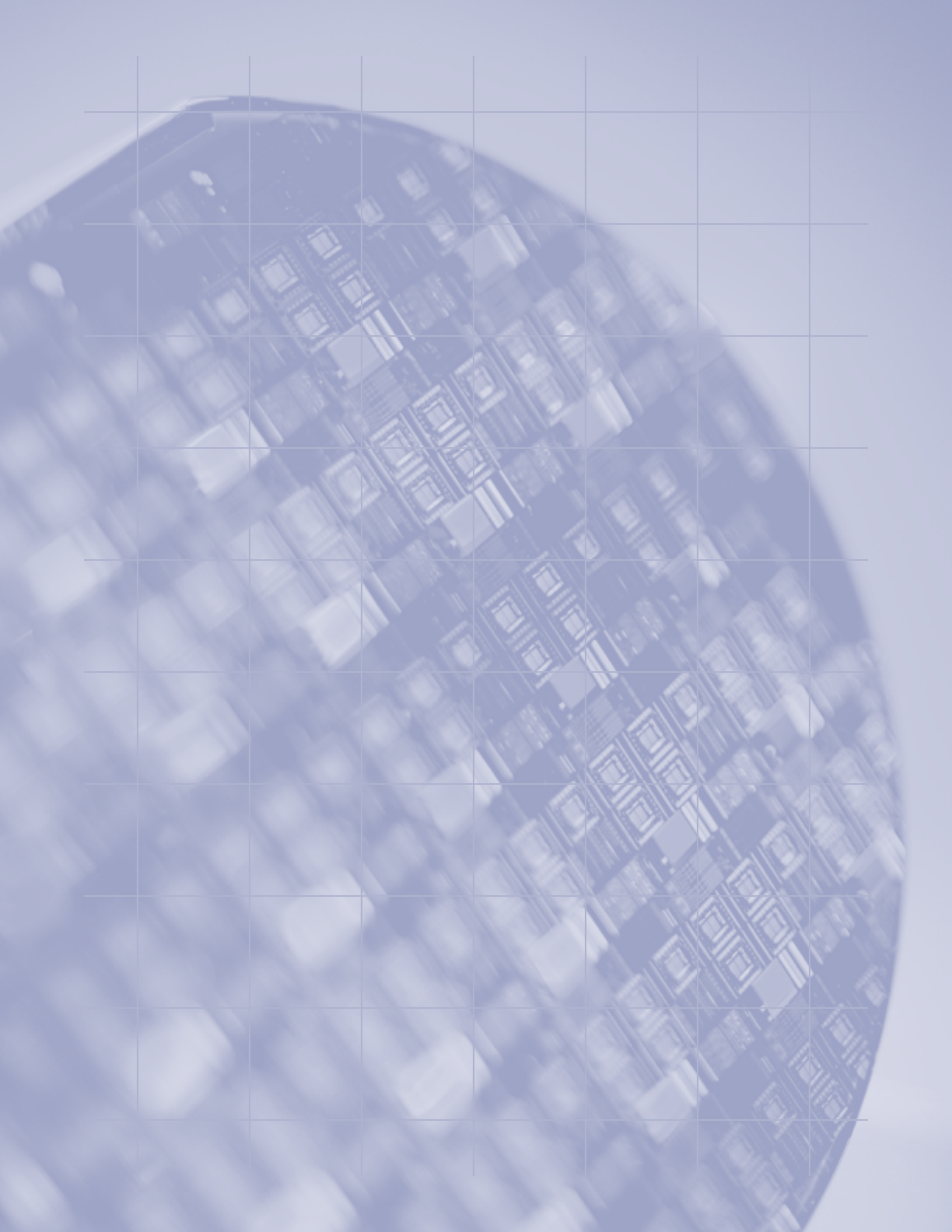
Merges Seamlessly into Any Fab Environment

As existing fabs are updated and new ones come online, fab managers have become increasingly concerned with automation issues. Today's processing and testing tools must offer the flexibility to fit into the fab's Computer-Integrated Manufacturing (CIM) environment. KTE software provides this fab integration flexibility through an optional fully-compliant

SECS/GEM interface. Custom software can be created in C to run at User Access Points in the cassette test plan, an approach that allows fabs that use older versions of SECS software or custom communication interfaces to integrate KTE software into their systems. Consult a Keithley sales representative for more information on the SECS/GEM interface.

The GEMCP control panel allows the user to monitor and control the SECS/GEM interface on the tester.





System Requirements

KTE software is sold as part of Keithley's S400UX and S600 Series parametric test stations. It requires:

- Sun Ultra 5 or 10
- Sun Solaris v2.7 UNIX Operating System
- SPARCWorks C V5.0 Compiler
- Minimum 64MB memory recommended
- 2GB hard drive recommended (While KTE software requires less than 50MB, additional space is recommended for storing test results.)

Keithley Instruments provides a greater measure of confidence to customers around the world by designing solutions for their emerging test and measurement needs. Building from our strength in low level electrical measurement solutions and working with industry experts, we have become the technology leader in semiconductor device testing and characterization. We also provide accurate data on electrical, physical and periodic phenomena in fields as diverse as global communications and component manufacturing.

Keithley solutions leverage off standard easy-to-use platforms, like Microsoft Windows, to slash training and start-up time. Whether the application demands a PC plug-in board, a bench-top instrument, or a fully integrated test system, Keithley products are designed to improve the quality, throughput, and yield of complex components and products.

Keithley is committed to providing worldwide expert technical and applications support for our APT products. For more information on how KTE can improve your parametric test productivity or for the name of the Keithley APT specialist near you, phone 1-800-552-1115.

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