



We provide test & programming solutions for today's electronics

JTAG

TECHNOLOGIES[®]

Experience our story and discover our proven solutions based on boundary-scan. We were one of the primary architects of this standard, but after 25 years we are so much more than that.



DESIGN

Get new board and system designs up and running.



PRODUCTION

Complete your production line with JTAG.



SERVICE

Repair boards even when no design data is available.

www.jtag.com





25 years in the heart of electronics

How JTAG Technologies keeps our electronics-dominated world running

Electronics is everywhere – the world would no longer function without chips and circuit boards. Not that an average user of a mobile phone, a car or even a hospital bed will always be aware of this, but his life would look very different without all those miniature soldered components. And once it is clear how important they are, it also becomes clear how dependent we are on their correct functioning.

That's where the products of JTAG Technologies, a Philips spin-off from Eindhoven, come in. To put it simply – without JTAG testing there can be no guarantee of a working printed circuit board and without that, there would be no modern television, no medical equipment, no social media, no rocket to Mars, let alone a smart city or the internet of things. In short, the role that JTAG Technologies plays in keeping our society running is hard to underestimate.

All of those essential electronically powered devices would be full of faults without the test equipment made in Eindhoven.

JTAG Technologies has been developing test solutions for more than 25 years and throughout that time, the company has ensured that the method for verifying designs and testing printed circuit boards during and after production remained up to date.

How does it work?

Anyone who wants to test whether a circuit board works correctly has two main options: a functional test or a structural test. During functional test, it is only possible to determine whether or not the board is functioning as it should. If it is not, a costly and time-consuming detection process will be needed to determine the exact cause of the problem. A structural test on the other hand solves this because it is the individual components and the way they are assembled that is tested, relieving the developer or test engineer from a lot of searching after a problem has been found. Sounds good, but there are constraints – this method also requires all the individual parts of the board to be accessible – and that became a serious problem in the mid 80's due to the advancing chip packaging techniques.

Following the introduction of ultra-fine pitch (< 1 mm pin spacing) connectors, their placement on both sides of the boards and the arrival of Surface Mounted Devices (SMD), structural testing had become virtually impossible. JTAG, however, solved that problem using 'boundary-scan' technology. Boundary-scan ensures that the pins of the device or 'chip' are always accessible by adding extra logic to the border – or 'boundary' – of the chip.

The JTAG system can then isolate the pins from the functional electronics (the core of the chip) and control them separately. As a consequence, chip to chip (and chip to connector) tracks can be tested via the pins ensuring every error can not only be detected instantly but is also easily traceable.

Since it benefits the whole industry, the JTAG/boundary-scan method was officially accepted as the world standard (IEEE Std 1149.1) in 1990 and as a result, JTAG Technologies maintained a global perspective right from the start. While initially, the technology adoption was mainly within Europe, JTAG Technologies' sales and service channels in the USA and in Asia were soon established and continue to flourish.

Additional standards

The first boundary-scan standard was soon augmented by additional variants supporting analog testing, in-system programming and embedded instrument access etc. In fact due to the rapid advances in technology almost half of JTAG Technologies' employees are engaged in R&D while the remainder take care of sales, support and service.

Meanwhile educating the market about the new technology has always been at the forefront of JTAG Technologies' activities, a process that is also subject to strong regional differences in the way new technology is deployed. Thus, over the past 25 years, JTAG Technologies outlook has grown not only in line with the additional standards, but also with the market conditions and the ever-changing regulations.

For many onlookers, the advent of the USB or the ban on lead soldering may sound like small and logical developments, but for JTAG Technologies, they have presented challenges to their ingenuity and adaptability.

OUR MISSION

Our mission is to offer customers added value with a complete range of powerful hardware and software products allowing customers to optimize their applications and maximize the benefits they achieve from boundary-scan implementation.

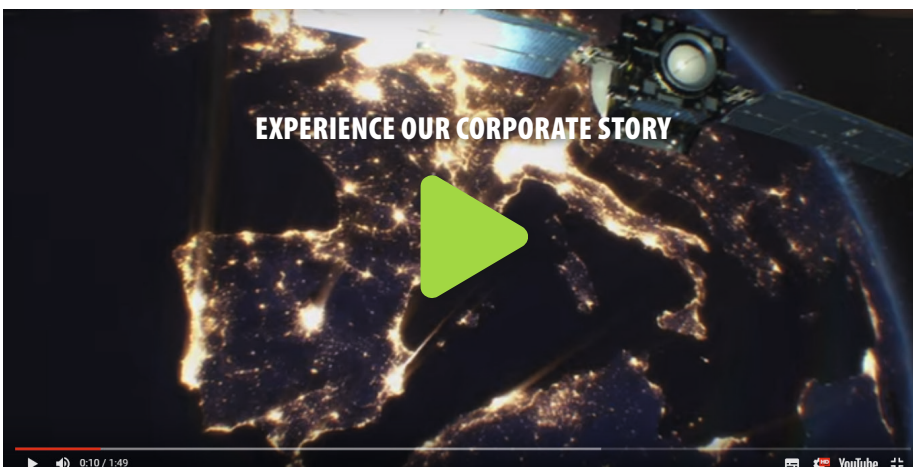
OUR VISION

We believe that boundary-scan is a superior technology to overcome the test and programming challenges in today's and tomorrow's modern electronic assemblies.

Success

The company's success is evident from its track record, with more than ten thousand test systems successfully installed via a network of representatives throughout the world, including countries with more complex trading arrangements such as China and Russia.

The consistent theme throughout all the years, however, is the essential role that the company plays within all sectors that work with electronics. From the medical world to defense, automotive, and more, JTAG Technologies remains a prime-mover in keeping our electronics-dominated society up and running.



<https://bit.do/jtagvideo>

Powerful and proven solutions

Forging the path to your product's success

Our boundary-scan solutions, used throughout your product life cycle, optimize your investment, get you to market quicker, and save you money.

Gain access to high-density PCBs

- Build testability and programmability into products.
- Access BGAs and other high density packages without in-circuit testers.
- Reduce functional test times to handle highly complex circuits.
- Obtain precise fault diagnosis and reduce repair time.

Reduce time-to-market

- Decrease debug time for hardware prototypes and expedite re-programming PLDs and flash memories during firmware debugging.
- Start test engineering earlier, based on pre-layout design information.
- Ready test programs at the start of production, complete with high-resolution diagnostics for repair.

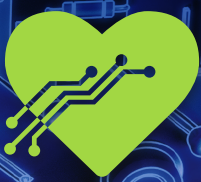
Increase quality on all fronts

- Know the testability of your designs; take corrective action prior to board layout.
- Verify correct PCB assembly at prototype stage and in production.
- Program flash memories and PLDs in-system at high throughput rates.
- Improve manufacturing operation with valuable process information reports.

Lower manufacturing costs

- Share test programs between design and production to increase accuracy and consistency of results.
- Cut fixturing costs by reducing or eliminating discrete test points.
- Reduce repair times with improved coverage and precise diagnostics.
- Maximize fault coverage.
- Eliminate stocking and logistics of pre-programmed parts.

At JTAG Technologies we are proud to say that we **are** boundary-scan. Since the early 1990s we have lived and breathed the technology that has revolutionized the manufacture and test of digital and mixed signal Printed Circuit Board Assemblies (PCBAs) the world over.



25+ years in the
heart of electronics



Customers in
50+ countries



10,000+
systems sold



2,500+
customers



Worldwide
support



Our global innovation alliances



TERADYNE



IPC

ARM



Improving test effectiveness throughout your product's life cycle

Boundary-scan's impact on the bottom line

JTAG/boundary-scan, based on IEEE Std 1149.1 and related standards, is now widely used in the electronics manufacturing industry to solve difficult test problems on complex Printed Circuit Board Assemblies (PCBAs).

By overcoming the access difficulties which often degrade the efficiency of conventional test methods, boundary-scan has become the pre-eminent structural test method in the 21st century.

This growth has been further helped by improvements in software application tools and increasingly versatile hardware from JTAG/boundary-scan tools providers. Besides test there are additional, derivative uses and application environments for boundary-scan. This can lead to benefits across a product's life-cycle, not just in manufacturing testing.

THE PRODUCT LIFE CYCLE

As an electronic product moves through its life cycle, from development through prototyping to manufacturing and finally to the service and support phase, responsibility for the product also migrates through the organization. However, at the handover from one department or discipline to the next delays and disruptions can occur, brought on by a variety of issues.

One of these issues is the use of different test methods and tools among the various departments or disciplines. This means failures of correlation can occur putting stress on inter-department communications and relations.

If problems are not rapidly understood and resolved, vital aspects such as time-to-market, repair turnaround time, and product quality and reliability can escalate beyond acceptable limits.

Symptoms and consequences of problematic handovers can include:

- Extra design cycles, caused by poor testability and/or manufacturability, often involving multiple layout spins and prototyping runs
- Long prototype debug intervals, caused in part by the presence of manufacturing faults obscuring design issues
- Problems in manufacturing fault ('bone-pile') clearing as a result of low test coverage, poor test diagnostics and/or wrong documentation
- Excessive reliance on functional test and time expended in PCB trouble-shooting, due to test 'slip' at structural testing
- Mystery failures in HASS or HALT environmental tests, e.g. failures at extended stress temperatures that disappear at room temperature
- Lengthy repair times due to poor diagnostics capability in the support facilities

BOUNDARY-SCAN IN THE PRODUCT LIFE CYCLE

By providing a consistent inter-departmental, inter-disciplinary, approach boundary-scan can help resolve the issues mentioned above. Furthermore, cost-savings and quality improvements invariably accompany these benefits. JTAG/boundary-scan technology has proven to be particularly effective when implemented 'corporately' throughout the life-cycle of the product.

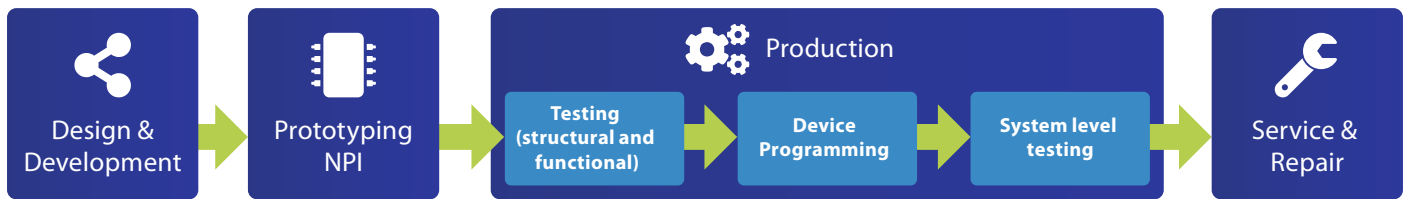
B) Role of JTAG/boundary-scan tools in prototyping

Once the 'paper' design is complete prototypes will be built that also require testing for manufacturing faults. Unlike structural test methods such as in-circuit testing, JTAG/boundary-scan testing requires minimal fixturing and can easily be applied on the designer's bench or to small prototype runs. Screening for structural faults at this stage enables the designer to properly focus on prototype design issues.

C) JTAG/boundary-scan throughout production

1) Structural Test

JTAG/boundary-scan improves production test efficiency in several important ways. Boundary-scan-based device inter-connections tests can run at high speed and are capable of producing pin-level diagnostics. As a result, fixturing for board test access can be dramatically simplified, if not eliminated entirely. Furthermore, the modular nature of JTAG/boundary-scan tools allow them to be combined with



A) Use JTAG/boundary-scan tools in the product development phase

Using boundary-scan coverage analysis tools early in the product cycle pays off in reduced time to market and improved product quality. The designer will know, prior to prototyping, the level of test coverage that will be attained with the product. If the coverage is deemed to be inadequate, the design can be modified and coverage re-examined, avoiding the delays that every subsequent process step would otherwise encounter. By adopting a policy in which the design phase must include DFT (Design for Test) analysis that meets coverage requirements, the organization will avoid wasted layout spins and prototype builds.

Using JTAG/boundary-scan fault coverage analysis tools early in the product cycle will result in reduced time to market and improved product quality. Coverage data can be presented as color-coded schematics and/or spreadsheet format for quick and easy analysis. The design engineer can then assess coverage at the pcb level and, if deemed to be inadequate, the design can be modified and coverage re-examined. Trapping DFT (Design For Test) and DFM (Design For Manufacturing) issues early on avoids delays caused by design and layout re-spins.

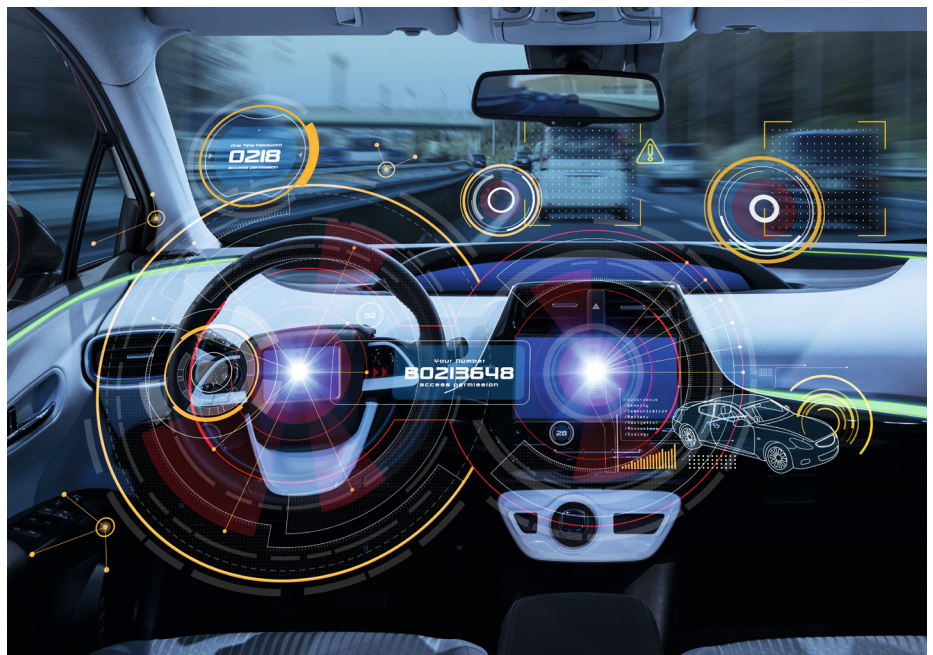
Specific JTAG/boundary-scan tools for debug allow easy access to device pins for electrical stimulus and sensing – allowing users to 'buzz out' connections or build functional style tests in Python. Furthermore these tools provide a convenient means of programming (and re-programming) flash and logic elements on the board during firmware verification.

The ease with which boundary-scan applications can be developed means that design revisions can be quickly incorporated in the test and programming routines.

other structural test methods, such as in-circuit testing or flying probe, which may already be in use in the factory.

2) Functional Test

Boards with faults that are not detected by structural testing are said to "escape" to the functional test stage. Structural test escape faults are readily detected in traditional functional testing, but are not so easily diagnosed and corrected. Adding JTAG/boundary-scan at the functional stage helps minimize the bone-pile by ensuring that no (or very few) manufacturing defects



remain unresolved at this stage. Because of the precise diagnostics from boundary-scan, board repair is usually swift and requires only one action rather than several trial and error attempts to locate the faulty device/pin.

This precision has a positive impact on product quality, and reduction of product-to-market times. Savings can also result from reduced product handling, fewer test stations, less floor space, a reduction in training requirements, and use of a familiar, unified GUI to the operator.

3) Production programming

In-system device programming is another important aspect of PCBA production. JTAG/boundary-scan offers the opportunity to use the same tools for both testing and the high-throughput in-system programming (ISP) of a range of device types (e.g. NOR, NAND and serial flash memories, programmable logic devices plus Micros and DSPs featuring embedded memory).

Programming is performed at an optimal point in the flow, and reprogramming (if required) can be performed easily without

having to remove devices from the board. Savings result from reducing the number of tools in use and simplifying the process flow.

4) Environmental stress testing

Environmental stress testing (HASS and HALT) can be significantly enhanced using JTAG/boundary-scan. Because the target interface is implemented using a compact low-pin count cable, largely immune to interference, the test set-up is simple.

Furthermore, boundary-scan testing can be set to run continuously so that environmentally-induced failures can be detected and time-stamped for later diagnosis. Thus, intermittent faults which might occur only at elevated temperatures, for example, are captured, avoiding no fault-found situations and preventing costly escapes to the field.

5) System-level

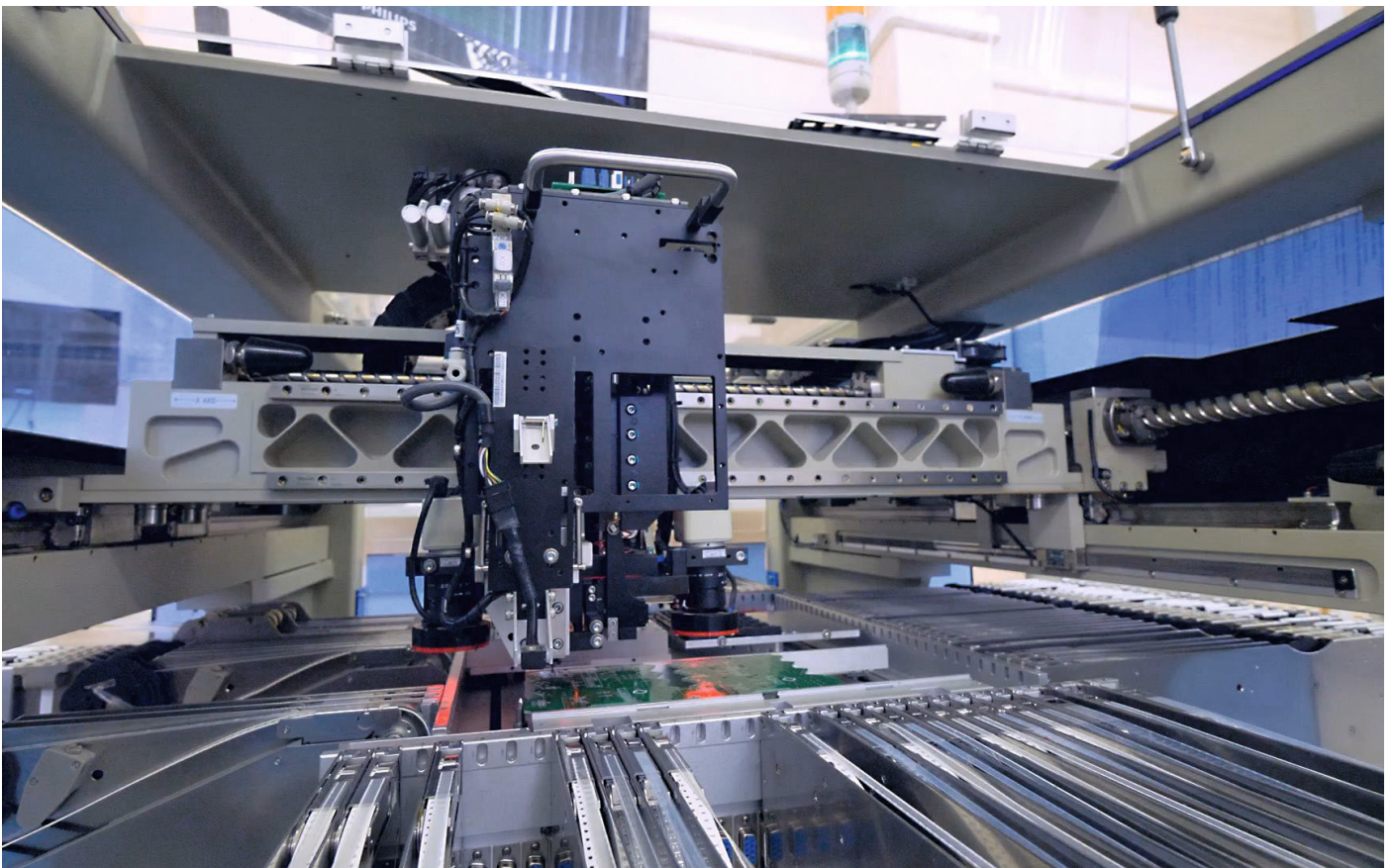
JTAG/boundary-scan technology can be applied at system level for both test and in-system programming. This can be performed using either an external tester or by using an embedded JTAG controller. Commercial ICs for embedded JTAG control and bus 'bridging' are available that enable

such boundary-scan control to be designed into the target system itself, which is then capable of 'self-test' application execution. This type of advanced architecture is advantageous in maintaining test and programming access to complex systems such as those found in datacoms and military/aerospace applications.

D) Use JTAG/boundary-scan in repair

Centralized as well as distributed repair facilities can use the same JTAG/boundary-scan-based tests as the factory, helping to avoid correlation problems when analyzing test results. Furthermore, because boundary-scan is simple to set-up and connect, the repair department can rapidly switch between target types and versions in high-mix situations.

In summary, if the product has been well planned, including observing the principles of design-for-testability, the enterprise will experience many, if not all, of the above benefits. Transitions of responsibility from one organization to the next are streamlined, inter-departmental communications are enhanced, and correlation problems are avoided by the use of a common test methodology.



BOUNDARY-SCAN BASED FUNCTIONAL TESTING – USING PYTHON, LABVIEW OR MS-.NET

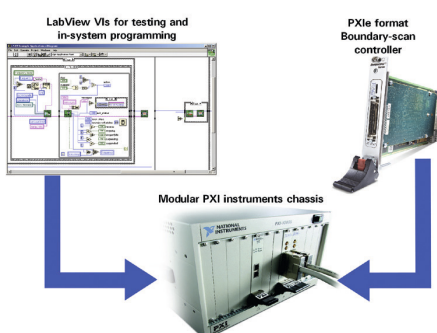
One important aspect of enhancing the product life-cycle with JTAG/boundary-scan test is its integration within functional test. Each test method adds quality assurance value for the anticipated fault spectrum as follows:

- Boundary-scan for manufacturing faults, typically caused by soldering problems
- Functional testing for at-speed problems, faults that occur at operating range limits, user-generated errors, in other words the types of faults anticipated in actual use

Though distinct in purpose and methodology, the two techniques, boundary-scan and functional testing, can be combined with great effectiveness over a number of tester hardware platforms, such as: USB, Ethernet, LXI or PXI(e) architectures.

What's more in recent times a hybrid tool has also been introduced known as JTAG Functional Test (JFT) whereby JTAG/boundary-scan access to digital and mixed signal circuit elements is scripted in a Python, LabVIEW or 'Dot.Net' program. Use of JFT enables a 'boundary-scan only' solution to test parts such as ADCs DACs or complex logic clusters that rely on limits checking and/or conditional branching decisions. The coded 'scripts' can be further enhanced by adding (processor) core emulation test capabilities with JTAG Technologies' CoreCommander functions. Supported cores include: AD BlackFin, ARM 7/9/11, Cortex-A/M/R, Infineon TriCore, NXP PowerPC, TI C2000.

For the production environment boundary-scan vectors for (structural) testing and JFT (functional) scripts plus ISP applications for PLDs and flash, developed for use in the prototyping phase, are often combined.



These can form part of a functional tester based around a JT 5705 MIOS controller and dedicated fixture or they can be added to a 'large format' functional tester e.g. built around a PXI chassis and rackmount solution. The boundary-scan operations can easily be integrated into various software 'executives' such as custom GUIs or industry standards TestStand, LabVIEW, ATEasy, etc.

Upon a JTAG/boundary-scan PASS the test executive software proceeds to the next steps in the sequence, for example a set of functional tests that utilize additional instruments for temperature profiling, parametric measurement, electro mechanical verification, etc. On the other hand, if the boundary-scan tests FAIL then scan diagnostics, layout visualization tools, direct the repair to the point(s) of failure. If in-system programming is also required, these steps can be performed after the structural test.

The advantages of combining the two methods within a test system are:

- Reduction in process steps and simplified product flow
- One-stop for structural and functional testing, and in-system programming
- Saving of factory floor space
- Reduced training requirements for test personnel with a uniform user interface

JTAG/boundary-scan offers a compact footprint, high performance, and broad availability of instrument types, including PXI(e)-based instrumentation.

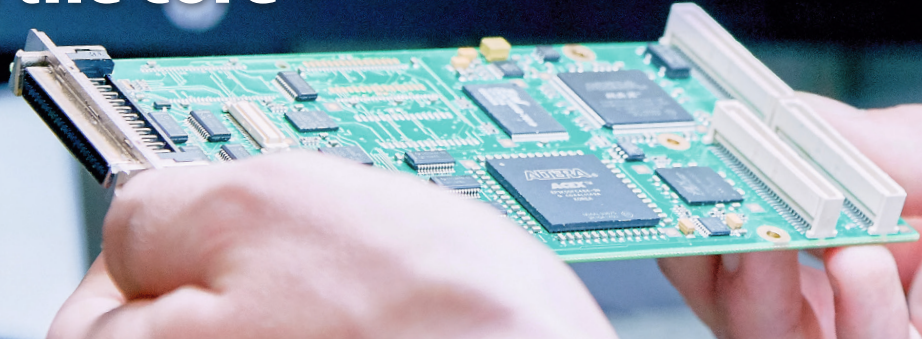
Typically the JTAG controllers allow up to four individual targets to be tested and programmed, but for high volume production requirements, multiple controllers can be deployed, all running from a common test/ programming source.

Conclusion: combined testing delivers economic benefits

Testing is too often considered as a 'no value-added' proposition. However, this viewpoint ignores the real and substantial savings that can be realized with a well-conceived test strategy.

If the test strategist considers the life-cycle issues described, measurable cost savings can be achieved by use of JTAG/boundary-scan, which can be enhanced by combination with functional test.

Our solutions support reliability and flexibility at the core



Throughout the life-cycle of your products JTAG/boundary-scan can be used for testing and device programming. Whether it's in automotive, healthcare, astronomy, mil-aero or other high-technology industry, JTAG Technologies helps you achieve the performance that matches your ambitions – and those of your customers. By providing tools for each event in your product's life (Design, Production and Service) we help you to succeed at every stage.

DESIGN SOLUTIONS

Time-to market is critical and any new product should be ready for production as soon as possible. To optimize the production yield, designs should also be well 'testable'. Design For Test (DFT) guidelines and analysis tools from JTAG Technologies assist the design engineer in creating highly testable designs without incurring extra engineering time. During prototype debugging and board 'bring-up' JTAG/ boundary-scan tools can help design engineers to focus on design problems and avoid losing valuable time by detecting 'trivial' connectivity problems that can be caused by poor soldering or other assembly errors.

Design debugging

When you see errors during board bring-up, hardware debug tools help you to determine if a design error, or a manufacturing fault, like an unsoldered

device pin, is causing the failure. JTAG Technologies debug tools achieve this using the boundary-scan capabilities of the JTAG devices in your design. JTAG Live Buzz and BuzzPlus let you observe the activity of signals and verify interactively the presence of a connection by 'buzzing-out' that connection.

Further tools such as Clip offer more options to drive and sense multiple inputs and outputs of non-JTAG 'cluster' devices connected to pins of a JTAG device. For more sophisticated testing, harness the power of Python with JTAG Live Script and compose your own re-useable test modules that contain branches, loops and compares. Advanced users can bolt-on CoreCommander software modules to take control of the microprocessor or microcontroller and test memory and I/O devices at speed – all without the need for embedded software or firmware.

Device programming

An essential part of modern product developments is device configuration or programming. With FPGAs and CPLDs often the hardware and software tools provided by the vendor of these devices are used. Flash memories and microcontrollers/DSPs with embedded flash are mostly programmed using the tools for developing embedded software. Our *In-system Device Programming Guide* provides valuable information to increase throughput and improve the convenience of programming during the manufacturing process.

Hardware

Sometimes the JTAG controller/cable from your device vendor for programming the FPGAs or CPLDs, can be used for debug purposes too since JTAG Technologies debug tools also support these.

Alternatively the single test access port (TAP) JTAG Live controller or the two TAP JT 3705/USB controller provide robust, low-cost solutions to access the JTAG chain(s) on your board for hardware debugging and device programming. Optionally Digital IO Scan (DIOS) modules can be added to the mix in order to extend boundary-scan access to connector pins.

Maximizing the testability of your design

In production the boundary-scan capabilities can be used to test the PCB Assemblies (PCBAs) for manufacturing defects. By applying the Design For Test (DFT) rules from our *Board DFT Guidelines* the boundary-scan capabilities of your boards can be fully utilised resulting in the optimum boundary-scan testability for your design.

Designers of 'multi-board' systems may wish to consult JTAG Technologies System DFT Guidelines too - here you can learn about scan bridge devices and built-in test techniques. Finally you can quickly assess the accessibility/testability of your design with JTAG Maps – a graphical display system that can highlight test access at the schematic level.

Testing small series

For small batch PCBA testing you can save time by using AutoBuzz- a product that is part of JTAG Live Studio. After learning the connectivity map between JTAG devices from a known-good board (or even your board's netlist), AutoBuzz can check and compare the connections of a faulty board automatically, revealing failing devices and connections. Add to the test coverage by combining the AutoBuzz test with other board tests in a single JTAG Live Script application. Since Studio also supports programming of the FPGAs via JAM, STAPL or SVF files you can further increase productivity in the Script environment.

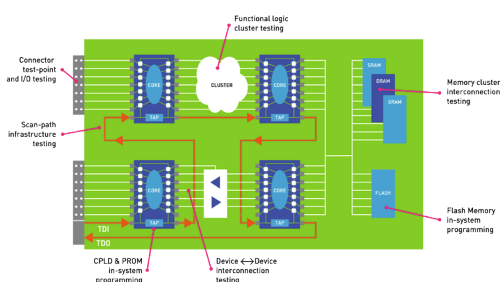


SERVICE SOLUTIONS

Nobody wants to wait a long time for the repair of a product. JTAG/boundary-scan can help to shorten repair times even if no, or only limited, design data is available and can be used to re-program parts for system upgrades.

Board repair

Repairing boards is a challenge especially if design data is missing or incomplete. When that happens you can benefit from JTAG devices on the board (PCB Assembly) you're working on.

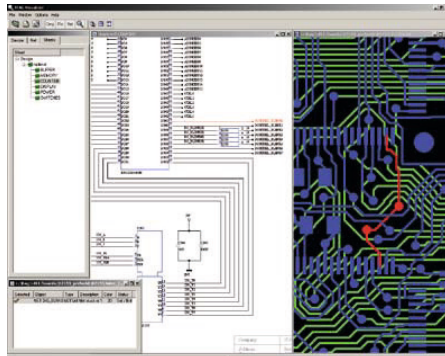


See what's wrong even without design data

Since AutoBuzz can automatically learn the connections between JTAG devices on a known-good board it is ideal for service applications where design data is scarce. A full connectivity compare by AutoBuzz between the results from a faulty board against those learned from a known-good board can then reveal failing devices and connections.

Enhanced fault search with design data

If design data is available use the simple Buzz tool to check pin to pin connections interactively – against the schematics. Or, use the Clip tool to set-up a sequence of test patterns/vectors making it easy to test non-scan device 'clusters'.



Checking processor-based boards without using firmware

In a processor-based design Core-Commander routines control the device's core. This allows you to set-up internal device ip blocks such as memory controllers allowing you to verify the connectivity between the microprocessor or microcontroller and memory and I/O devices 'at speed'. No embedded software/ firmware, emulators or debug tools for software are needed.

Re-use tests from design or manufacturing

If you have access to the boundary-scan tests used during the design of the product or used in manufacturing then you can often directly (re-)use these tests in service.

Device programming

In service, devices may be re-programmed after repair, or for system upgrades, using readily available programming files. Since any type of device can be present on a board, the complete range of devices and device types are supported by JTAG Technologies service equipment.

DESIGN & SERVICE TOOLS

The JTAG Live tools range is most often used in design and service. Please contact your local sales office or distributor to get a full assessment of your needs and a 'best-fit' solution.



JTAG Live®

www.jtaglive.com



PRODUCTION SOLUTIONS

Improvements in Design For Manufacturing (DFM) alongside the use of high quality assembly and inspection equipment today minimizes the chance for assembly errors. In spite of this, however, assembly errors do occur, and Printed Circuit Board Assemblies (PCBAs) must be tested to detect these errors in an effort to deliver PCBAs with zero defects. Modern designs rely on JTAG/boundary-scan for testing, which offers access to a device's pins to greatly enhance fault coverage at PCBA level. In addition, the build process frequently requires individual devices of all types to be programmed or configured for their eventual function – most often using JTAG/boundary-scan as the conduit. When choosing a JTAG/boundary-scan supplier therefore it makes sense to ensure hardware and software fit all the required testing and device programming needs for stand-alone or integrated operation with the required performance.

COMPLETE YOUR PRODUCTION LINE WITH JTAG TEST SOLUTIONS

Design For Test (DFT) rules serve to optimize the test process for detecting assembly errors. Modern designs rely on JTAG boundary-scan for testing. Boundary-scan in a device gives access to its pins irrespective of the device package and allows for a maximum fault coverage.

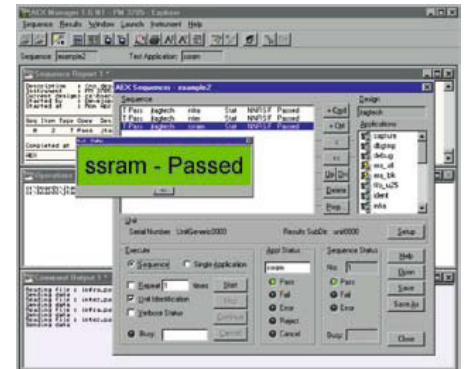
With our Testability analysis you can determine which percentage of a design can be tested with boundary-scan. Our booklet *Board DFT Guidelines* helps you to optimize the boundary-scan testability of your design.

Test application development

Various standard tests are developed to help achieve the maximum fault coverage. JTAG/boundary-scan tests such as interconnect test, pull-up, pull-down resistor tests, memory cluster tests and tests of logic devices can all be generated automatically with ProVision.

With the addition of powerful Python JFT scripts, tests can be added for those parts of the circuit where automatic generation

is not possible, for example sequential circuitry, ADCs and DACs. Whether your design consists of a single board or comprises of multiple boards any configuration can be handled within ProVision. Once a set of tests has been generated the fault coverage of this set can be calculated and compared against the testability of the design to see if additional tests are needed.



Run-time solutions

At run-time, on the factory floor, your JTAG/boundary-scan test and ISP (In-System-Programming) applications can be executed 'Stand Alone' using JTAG Technologies' AEX Manager or 'Integrated' as part of a larger multi-faceted test system.

For custom functional testers one of JTAG Technologies' Production Integration Packages can be selected, currently supporting LabVIEW, LabWindows, TestStand, C, C++, C#, .NET, Visual Basic and ATEasy. In addition certified packages (aka Symphony products) are available for third party in-circuit testers and flying probe testers from Agilent, Teradyne, Digitaltest, Seica, Spea, Takaya, etc.

Diagnostics

For production 'test and repair' stations optional diagnostics software analyzes the detected faults and reports the type of fault(s) and the nets and pins involved. Using Visualizer graphical display software the location of a fault can be highlighted on the layout and/or schematic diagram making it simple for factory repair technicians to locate the fault on the board.



DEVICE PROGRAMMING SOLUTIONS

Devices are often programmed as part of the board configuration process. Available programming solutions differ per device type:

- Flash memories (NOR, NAND, Serial)
- Microcontrollers and DSPs (embedded flash)
- FPGAs, CPLDs
- PMBus devices

Depending on the type of device the programming application files can either be generated automatically by ProVision or are provided as ready-to-run solutions for fixed device configurations. The application files for all device types can be executed with any JTAG Technologies' run-time package, either stand-alone or integrated with other (test) systems.

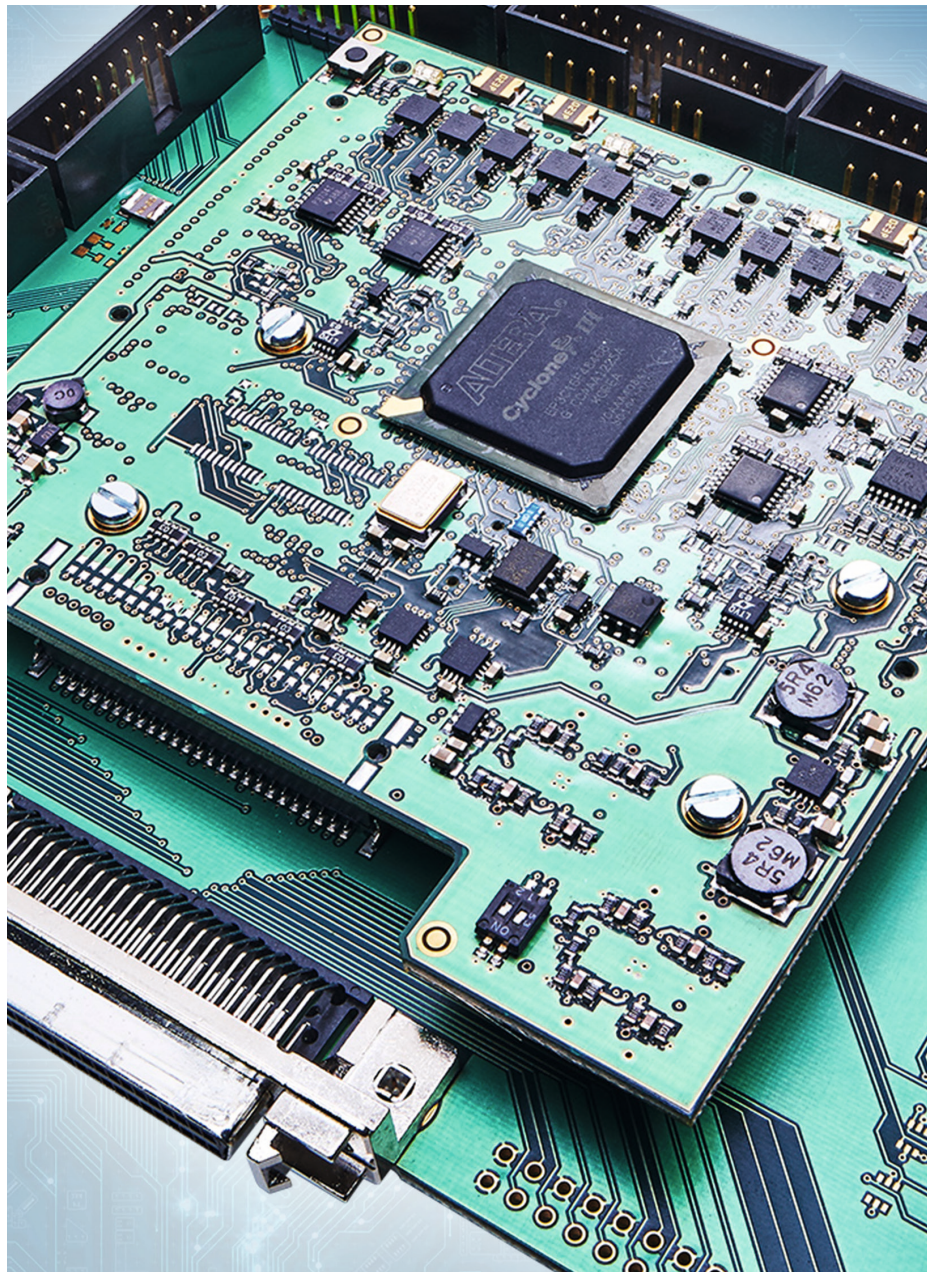
Discrete Flash memories (NOR, NAND, Serial)

Flash memories can be programmed via the boundary-scan enabled pins of JTAG devices they are connected to. In a boundary-scan based flash programming application the flash device pins are controlled via neighboring boundary-scan device(s) to deliver data and commands to the flash memory.

Application files that include Read-ID, Erase, Blank-check, Program and Verify are automatically generated with ProVision using information drawn from an extensive model library. Alternatively it is possible to use JTAG Technologies' CoreCommander to leverage the JTAG-enabled debug logic of a microprocessor and subsequently program flash memories connected to the processor bus.

Microcontrollers and DSPs (embedded flash)

Programming the embedded flash of a microcontroller usually requires a dedicated solution for that device type. JTAG Technologies has devised programming solutions for an extensive range of microcontrollers and DSPs as listed on www.jtag.com/product/micros-dsps-embedded. These solutions are



provided as ready-to-run programming application files for direct execution with a JTAG Technologies' run-time package.

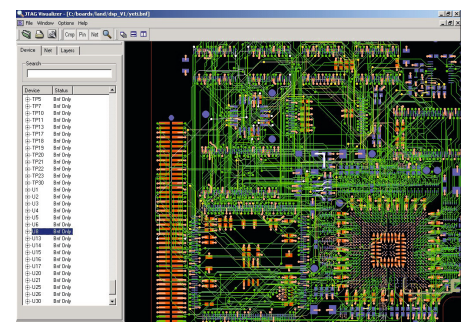
FPGAs and CPLDs

Different data formats are used for in-system programming of FPGAs and CPLDs such as SVF, JAM, STAPL and ISC IEEE 1532. PLD programming applications using the ISC IEEE 1532 format can be generated automatically with ProVision.

SVF, JAM and STAPL files exported for the device vendors design tool can directly be executed with a JTAG Technologies' run-time package.

PMBUS Devices

Power Management devices using the PMBus protocol can be programmed via the boundary-scan register of a connected device. In a boundary-scan PMBus programming application a boundary-scan device acts as PMBus master to deliver data and commands to the target device. The programming application files can automatically be generated with ProVision.



HARDWARE

To test a board (PCBA) and program devices you will need some or all of the following hardware:

- a JTAG/boundary-scan controller connecting your PC or workstation with the JTAG interface on the board,
- I/O modules (digital or mixed signal) allowing boundary-scan access to I/O connectors and/or test points on the board.

JTAG controllers

To reliably execute your test and programming applications JTAG Technologies offers a wide range of controllers available in a choice of form factors, TAP port counts and performance.

The high speed JT 37x7 DataBlaster tops the range and features scalable performance with bolt on DIOS and measurement options. The DataBlaster is available in a wide variety of different form factors.

The mid-range JT 5705 mixed signal controller features two TAPs and supports control and measurement of analog and digital signals in combination with boundary-scan.

The popular JT 3705/USB Explorer controller is the ideal choice when maximum performance is not the main driving factor.

I/O modules

Add auxiliary I/O modules to enhance scan-powered test and analog measurement to portions of your design that lack boundary-scan access. Select from digital I/O scan (DIOS) modules, mixed I/O scan (MIOS) modules, or Socket Test Modules (STM) to conveniently test sockets, connectors and sensors.

COMBINED INSTRUMENTS

Keep your boundary-scan controllers and I/O modules as separate elements, or combine them in a single slim-line unit. The Rack Mountable Instrument (RMIC) for example is a self-contained tester that can combine one or more boundary-scan controllers and a range of I/O modules. It is ideal for installation in a 19-inch test rack or as part of a bench-top set-up.



| INTEGRATION TABLE | |
|----------------------------|--|
| Vendor | In-circuit testers & Flying probe testers |
| Digitaltest | MTS30 Sparrow, 180 Eagle, 300 Sigma, 888 Omega, 505 Condor |
| Huntron | Access Prober |
| Keysight (Agilent) | 3070, i3070 |
| Seica | Pilot 4D, Pilot Next |
| SPEA | 3030, 4020, 4050, 4060, 4080 (4030, 4040) |
| Takaya | APT-1400, APT-9400 |
| Teradyne | TestStation (including GR228x and TS12x) |
| Viavi solutions (Aeroflex) | 42xx, 58xx, 45xx series |
| Vendor | Modules and Subsystems for Defense and Aerospace ATE |
| Teradyne | Di-050, HSSub |

HARDWARE INTEGRATION WITH OTHER SYSTEMS

The high-speed DataBlaster controllers are available in many popular PC-interface formats (e.g. PCI, PCIe, PXI, PXIe, USB, Ethernet, Firewire) for stand-alone use as well as test system integration. For a seamless integration with specialist In-Circuit Testers or Flying Probe Testers JTAG Technologies have developed dedicated hardware interfaces, matching directly with the format of your tester.

By combining your JTAG controller with an In-Circuit Tester, Flying Probe Tester, or your Functional Test System you can

also use the native test and measurement hardware of that system in place of DIOS modules to measure the I/O connectors and test points in combination with boundary-scan.

To execute JTAG/boundary-scan applications in remote locations use JTAG TapCommunicator. This truly unique product can overcome problems caused by lack of target accessibility. By utilizing the native communications protocol of the target (e.g. Ethernet, Bluetooth, SpaceWire etc.) boundary-scan tests and programming applications can be applied over virtually any distance.



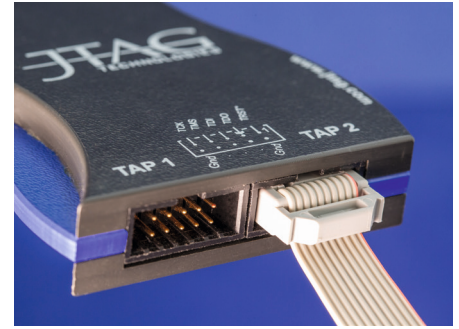
PROVIDING TOOLS FOR EACH DISCIPLINE

Design, Production and Service

Our products have been subject to a program of continuous development for over 25 years.

For design and service we offer interactive debugging tools matching with the interactive approach of fault finding.

For production software we distinguish between two categories: Test and Device programming. Depending on the modules that are purchased these packages can support either test applications, device programming applications, or both.



| JTAG Live Buzz | JTAG Live BuzzPlus | JTAG Live AutoBuzz | JTAG Live Clip | JTAG Live Script | JTAG Live Core-Commander | JTAG Live Studio | JTAG Maps (Visualizer) |
|----------------|--------------------|--------------------|----------------|------------------|--------------------------|------------------|------------------------|
|----------------|--------------------|--------------------|----------------|------------------|--------------------------|------------------|------------------------|



DESIGN SOLUTIONS

| | | | | | | | | |
|----------------------|---|---|---|---|---|---|---|---|
| Design debugging | ✓ | ✓ | | ✓ | | ✓ | | |
| Device programming | | | | | ✓ | | ✓ | |
| Design for test | | | | | | | | ✓ |
| Testing small series | | | ✓ | | ✓ | ✓ | ✓ | |



SERVICE SOLUTIONS

| | | | | | | | | |
|--------------------|---|---|---|---|---|---|---|--|
| Board repair | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ | |
| Device programming | | | | | ✓ | | ✓ | |

| JTAG ProVision | JTAG Visualizer | CTPG_M | JTAG ProVision Platform | Core-Commander | Production Integrated Packages | BSD (Test Diagnostics) | Device support option | ATE integration |
|----------------|-----------------|--------|-------------------------|----------------|--------------------------------|------------------------|-----------------------|-----------------|
|----------------|-----------------|--------|-------------------------|----------------|--------------------------------|------------------------|-----------------------|-----------------|



PRODUCTION SOLUTIONS

Test solutions

| | | | | | | | | |
|-------------------|---|---|---|---|---|---|---|---|
| Development | ✓ | ✓ | ✓ | | ✓ | | | |
| Run-time | | | | ✓ | ✓ | ✓ | | ✓ |
| Production repair | | ✓ | | ✓ | ✓ | | ✓ | |

Device programming solutions

| | | | | | | | | |
|--------------------|---|--|--|---|--|---|---|---|
| Development | ✓ | | | | | | | |
| Run-time solutions | | | | ✓ | | ✓ | ✓ | ✓ |

Note: JTAG Technologies' 'Classic' Production Stand-Alone package (PSA) has, for many years, been the standard execution system operated in production and several thousand PSA systems are still in use today. For new projects, however, ProVision Platform run-time system is usually recommended.

Choose your boundary-scan controller based on your desired performance:

| | JTAG Live Controller | JT 3705/USB Explorer | JT 5705 Mixed-Signal JTAG Tester | JT 37x7 Datablaster |
|----------------------|----------------------|----------------------|----------------------------------|---------------------|
| | 6 MHz | 6 MHz | 15 MHz | 40 MHz |
| Design Solutions | ✓ | ✓ | ✓ | |
| Service Solutions | ✓ | ✓ | ✓ | |
| Production Solutions | | ✓ | ✓ | ✓ |



Hardware & software

High quality products for reliable solutions



JTAG PROVISION

The JTAG ProVision software suite is used to generate boundary-scan tests and in-system programming applications for assembled PCBs and systems.

This professional development tool is fully automated and supports the import of design data from over 30 different EDA and CAD/CAM systems.

Other key data inputs are JTAG device BSDL (description) models and a large, well-maintained model library describing tens of thousands of non-JTAG devices which includes memories, bus logic, and other active and passive parts.

Features

- Easy to learn, requires minimal knowledge
- Simple to use with application wizards
- Creates board tests, system tests and programs devices

Benefits

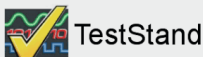
- Backwards compatible with other JTAG tools
- Seamless links to Visualizer and Boundary-Scan Diagnostics
- Built-in fault coverage examiner assessment tool
- Minimal training needed

ProVision and PIPs can be extended with the following options:

- JTAG Visualizer
- CPTg_M
- CoreCommander
- BSD (Test Diagnostics)

PRODUCTION INTEGRATION PACKAGES

Our Production Integration Packages (PIPs) allow users to execute the full range of JTAG board test and programming applications from a 'third party' environment. In addition to the test oriented front-ends such as National Instruments' LabView and TestStand, JTAG Technologies also provides support for a range of generic compilers for Microsoft and others. Each PIP package includes full capability to load and launch applications to test and program boards on our DataBlaster, Explorer or MIOS (mixed-signal) IEEE Std. 1149.x boundary-scan controllers.



Features

- Use PIPs to create bespoke JTAG sequences in your chosen language
- Support for 3rd party test executives (LabView, LabWindows, TestStand, ATEasy etc.)
- Options for most high-level languages (VB, C++, .NET)

Benefits

- Seamless integration of boundary-scan applications into bespoke test executives
- Multiple programming languages supported
- Additional integration options available upon request
- Works with your established test systems

BOUNDARY-SCAN CONTROLLERS

Our designers have been developing high-speed digital test equipment for well over 30 years. The current range of controllers ranges from the compact, stylish and reliable JTAG live controller and the JT 3705/USB to the rugged, dependable DataBlaster family and variants that have been developed for industrial use.

The latest addition, JT5705/USB adds analog measure and source capabilities to provide a true mixed-signal tester platform.

General Product Highlights:

- Wide range of highly reliable JTAG/ Boundary-scan IEEE Std.1149.x controllers
- Support Board (PCBA) Testing, System Testing and Device In-System Programming
- ETT (Enhanced Throughput Technology) and AutoWrite on selected models
- Choice of USB, PXI (e), Ethernet, PCI(e) or Firewire formats
- Mixed signal options feature Frequency, Digital and Analog IO channels
- Seamless integration with 3rd party vendor hardware through customized solutions



MAKING JTAG ACCESSIBLE

The JTAG Live family consists of several tool options that you can use separately or in combination.

JTAG Live Buzz

An easy and free starting solution for debugging boards.

JTAG Live BuzzPlus

BuzzPlus extends Buzz with a unique 'seek and discover' mode that effectively learns the network of nodes for a connection.

JTAG Live AutoBuzz

A totally unique tool that effectively learns a connectivity signature of all boundary-scan parts within a design from only the BSDL models of those parts.

JTAG Live Clip

Clip is the vector-based upgrade for creating and saving board-level tests. It features unlimited pattern depth and bit width.

JTAG Live Script

Script uses the open-source Python™ language to provide a powerful command and control structure to manipulate and sense cluster I/Os

JTAG Live CoreCommander

CoreCommander routines take control of key processor core functions using the built-in emulation/debug functions found in today's RISC and DSP cores.

JTAG Live Studio

Your complete JTAG/boundary-scan solution for testing, debugging and programming your boards.

JTAG Live Visualizer

JTAG Visualizer is a design data viewer that also integrates with JTAG Technologies' family of boundary-scan products and selected 3rd party systems.

JTAG Live Controller

6 MHz

USB connected and powered controller with a single test access port.

JT 3705/USB Explorer

6 MHz

Low-cost USB boundary-scan controller specifically suited for low volume testing and in-system programming of (C)PLDs.

JTAG



JT 5705 Mixed-Signal JTAG Tester

15 MHz

A unique combination of JTAG TAP controller (tester) interfaces plus digital and analog I/O in a compact package.



JT 37x7 Datablaster

40 MHz

The JT 37x7 DataBlasters are a family of high-performance, up to 40 MHz TCK, boundary-scan controllers.

Support World class, worldwide



Our mission

Our sole, dedicated mission is to develop boundary-scan solutions to meet the needs of the electronics industry. We are committed to your success helping you to realize the maximum benefits of the technology.

Getting started

To assist you in applying boundary-scan in the design phase, JTAG Technologies offers the industry's widest range of services and technical support.

- Boundary-scan tutorials and seminars, in-person or via the Internet
- Training for developers, engineers, and production personnel, including extensive hands-on sessions
- Testability reviews of your designs, prior to production
- In-system programmability reviews to maximize throughput
- Design and process consultation to optimize your test strategy
- Consultation for system level testing

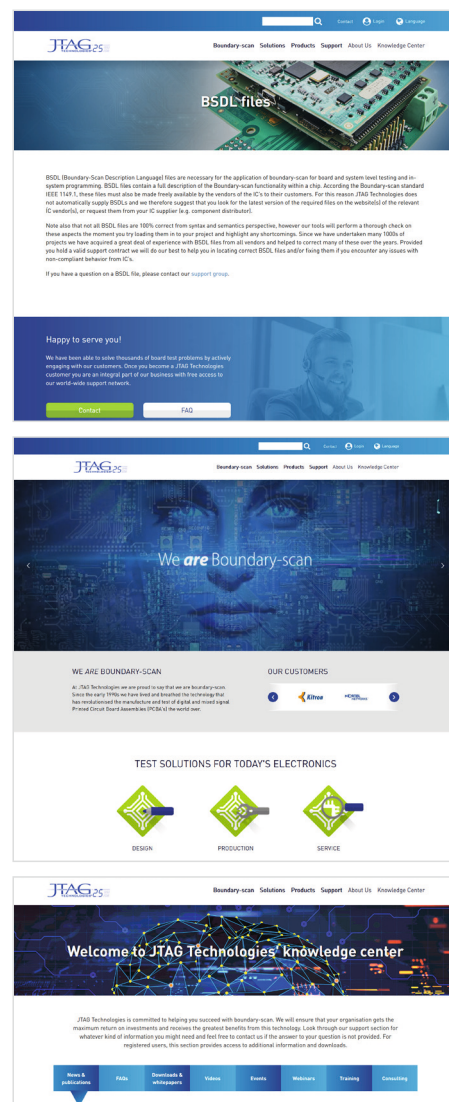
Your designs achieve the greatest possible testability and programmability; and your engineers and operators quickly become effective users of the tools and technology.

We are here to support you

We have sales and factory-trained technical support in virtually every part of the world where electronics products are manufactured. That means you'll receive consistent, knowledgeable, and personal service, whether you're in North America, Europe, Asia, South America or Australia. Let us know how we can help you. Our knowledgeable and professional sales and support teams are ready to help you maximize your results from boundary-scan. Our people distinguish our company. Our network of factory-trained field engineers is extensive and accessible, delivering world-class support when and how you need it – via email, phone or on-site.

360° support

- Training, on-site or remote, tailored to your needs
- On-line access to product updates, FAQs, application notes, and technical documentation
- Reasonably priced software maintenance agreements
- Flexible software licensing for LAN and WAN corporate networks
- Professional services, covering test strategy consulting, BSDL support and turn-key application development



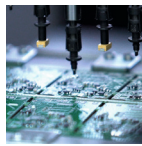
The JTAG.com website - a valuable resource

Powerful and proven solutions for all markets



AUTOMOTIVE

Smarter, safer and more serviceable solutions at lower costs



CM/EMS

Higher production quality and reliability without loss of productivity



AVIONICS

Increasing the operational deployability of aircraft



DATA PROCESSING

Improved safety of data processing without the loss of productivity



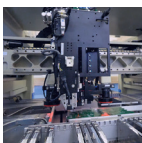
DEFENSE

Solutions for higher mission readiness



CONSUMER ELECTRONICS

Increased service capabilities of your consumer electronics



INDUSTRIAL AUTOMATION

Smart solutions to increase uptime in your industry



HEALTHCARE

Maintaining the reliability of ever smaller electronics



TELECOM & DATACOM

Supporting the increasing demand for safety and reliability



TRANSPORTATION

Increasing operational deployability through smarter service capabilities

Happy to serve you!

We have been able to solve thousands of board test problems by actively engaging with our customers.

Once you become a JTAG Technologies customer you are an integral part of our business with free access to our world-wide support network.

JTAG
TECHNOLOGIES®

www.jtag.com

Why use *boundary-scan*?

- ✓ Reduced Time to Market
- ✓ Faster ROI
- ✓ Reusable Test Vectors
- ✓ Reduced Test Time
- ✓ Reduced Design Iterations
- ✓ Increased Availability
- ✓ Efficient and Economical Production

Why choose *JTAG Technologies*?

- ✓ Testing and device programming solutions
- ✓ Solutions for Design, Production and Service
- ✓ One of the primary architects of boundary-scan
- ✓ Customers in more than 50 countries
- ✓ More than 10,000 systems sold
- ✓ The number one dedicated boundary-scan company
- ✓ World class, worldwide support

Global Representation

Want to know more about our technology, products and services?
Please contact us at one of our global offices.

Europe and ROW (*Headquarters*)

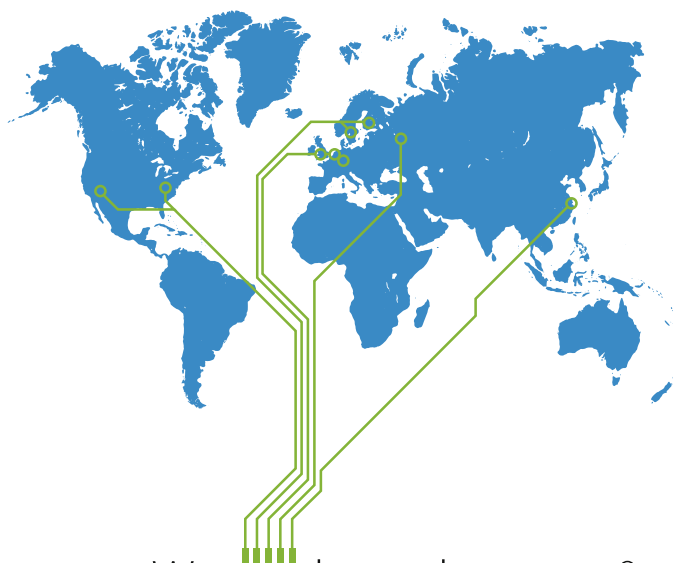
Boschdijk 50, 5612 AN Eindhoven
The Netherlands
T: +31 (0) 40 295 0870
E: info@jtag.com

United Kingdom and Ireland

T: +44 (0) 1234 831212
E: sales@jtag.co.uk

USA and Canada

T: +1 877 FOR JTAG (*Eastern US*)
T: +1 949 454 9040 (*Western US*)
E: info@jtag.com



Germany

T: +49 (0) 971 6991064
E: germany@jtag.com

Sweden

T: +46 (0) 76 393 7029
E: sweden@jtag.com

Finland

T: +358 (0) 9 4730 2670
E: finland@jtag.com

Russian Federation

T: +7 812 602 09 15
E: russia@jtag.com

China (Malaysia, Singapore, Taiwan, Thailand, South Korea)

T: +86 (021) 5831 1577
E: IEEE1149@JTAG.com.sg

www.jtag.com

www.jtaglive.com

We **are** boundary-scan.®