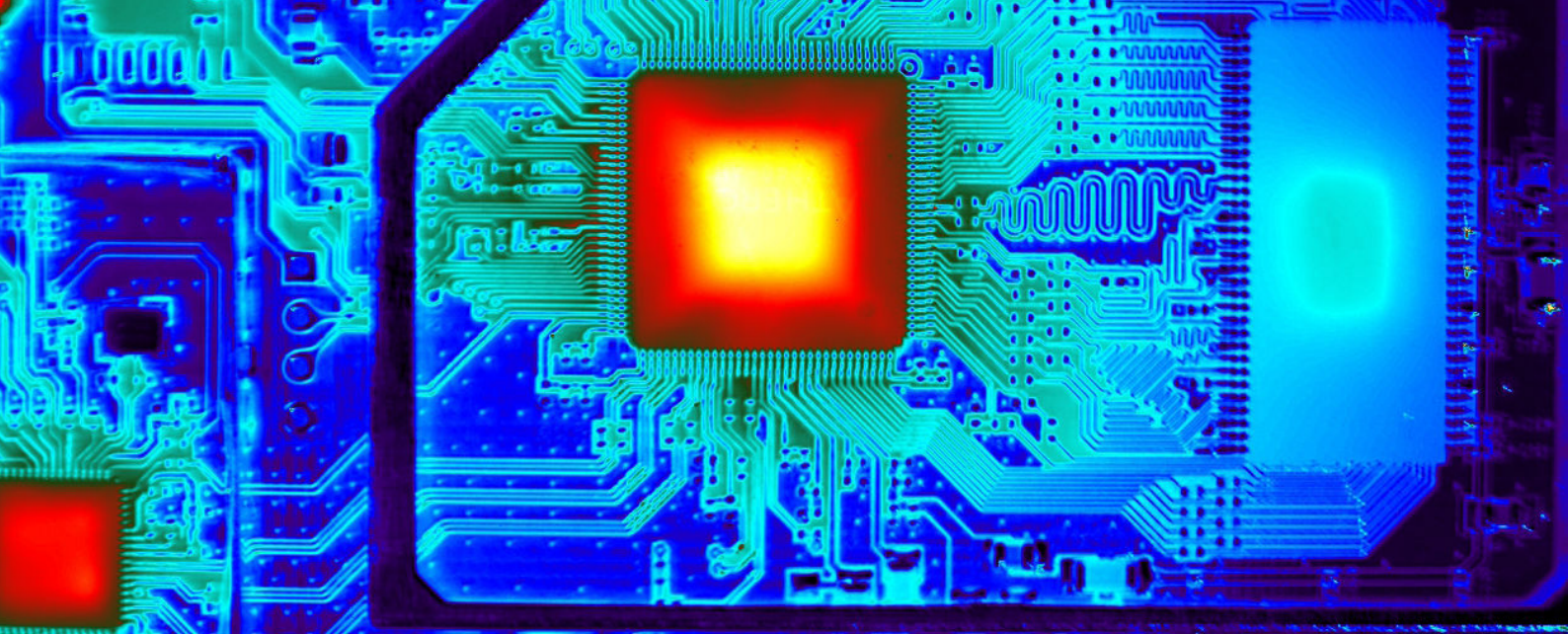




TAKE THE HEAT OFF YOUR ENGINEERING TEAMS, FROM LAB TO PRODUCTION

HOW IR IMAGING IS DRIVING **R&D IMPROVEMENTS**
IN ELECTRONICS DESIGN AND TESTING



INFRARED INSIGHT: speed up essential electronics design and testing

Product recalls do more than erode your bottom line profits; they can cause untold reputational damage to your business. With acute thermal imaging insights, you can short circuit quality concerns before they leave your benchtop.

Detect thousands of measurement points across entire electronic systems, with reliable data quantified in just seconds. The quality, conduction, and thermal emissions of every component in even the most complex systems can be revealed in mere moments—taking the guesswork out of quality control and ensuring that every element of your electronic systems meet the most robust standards.

Whether in the early rapid prototyping design phase, failure analysis and quality assurance phase, or troubleshooting on product returns, thermal measurement is a key tool for identifying problems and improving thermal management solutions.

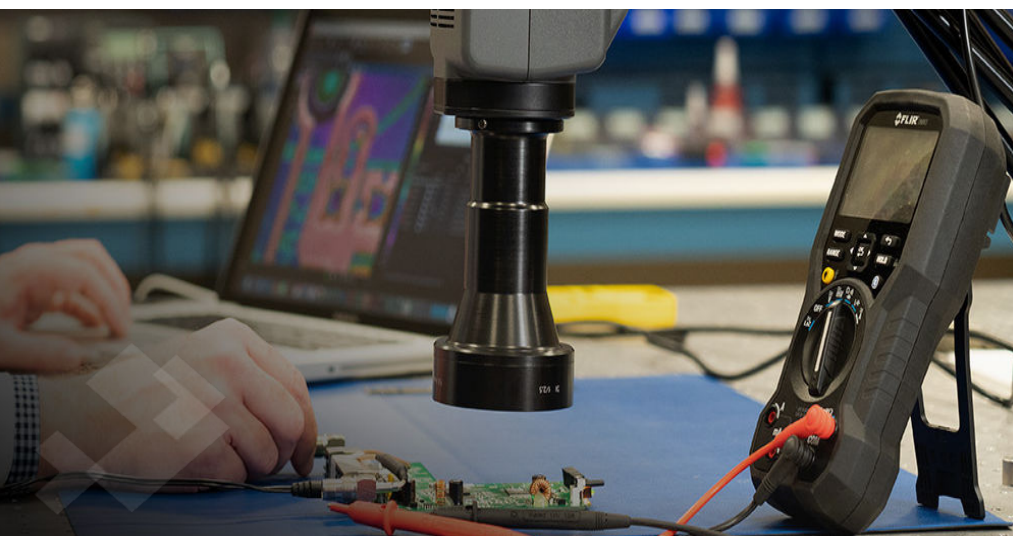
Over the next few pages, you'll learn how engineers in the fastest-growing electronics development fields of **commercial**, **automotive**, and **semiconductor** technologies are taking advantage of thermal camera systems to:

- Quickly discover hot spots and potential points of failure
- Visually identify overheating components BEFORE they fail
- Avoid overheated components on printed circuit boards
- Precisely pinpoint impending problems in everything from power electronics to discrete components
- Detect trace damage from power surges

WHAT IS IR THERMOGRAPHY?

An IR camera can visualize infrared radiation (IR) that is not detectable by the human eye, converting it to a clear image that details any small thermal variations. IR covers a portion of the electromagnetic spectrum from approximately 900 to 14,000 nanometers (0.9–14 μm), which is outside of the 400 to 700 nanometer range the human eye detects.

Unlike conventional video cameras or digital still cameras which use a charge coupled device, IR cameras utilize a focal plane array (FPA) system. This consists of micrometer size pixels made of materials sensitive to IR wavelengths. They work in conjunction with either embedded or third-party software to calculate the temperature of electronic components.

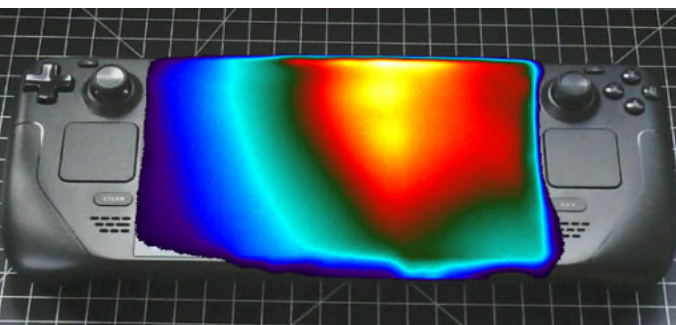




ELECTRONIC COMPONENT TESTING: from lab to production

With increased demand comes the need to expedite the production and testing of essential electronics components. Now more than ever, quality control must be as quick as it is comprehensive. Products must leave the production line in perfect working order, but the only way to ensure this is by checking each individual component for 100% quality control. In-circuit, contact test fixtures can be prohibitively expensive to produce and implement, slowing down production time and labor costs.

IR thermography circumvents this issue with ease, allowing for near instantaneous non-contact electronics testing of either entire systems or individual components and taking your quality control all the way from laboratory testing through to final production line checks.



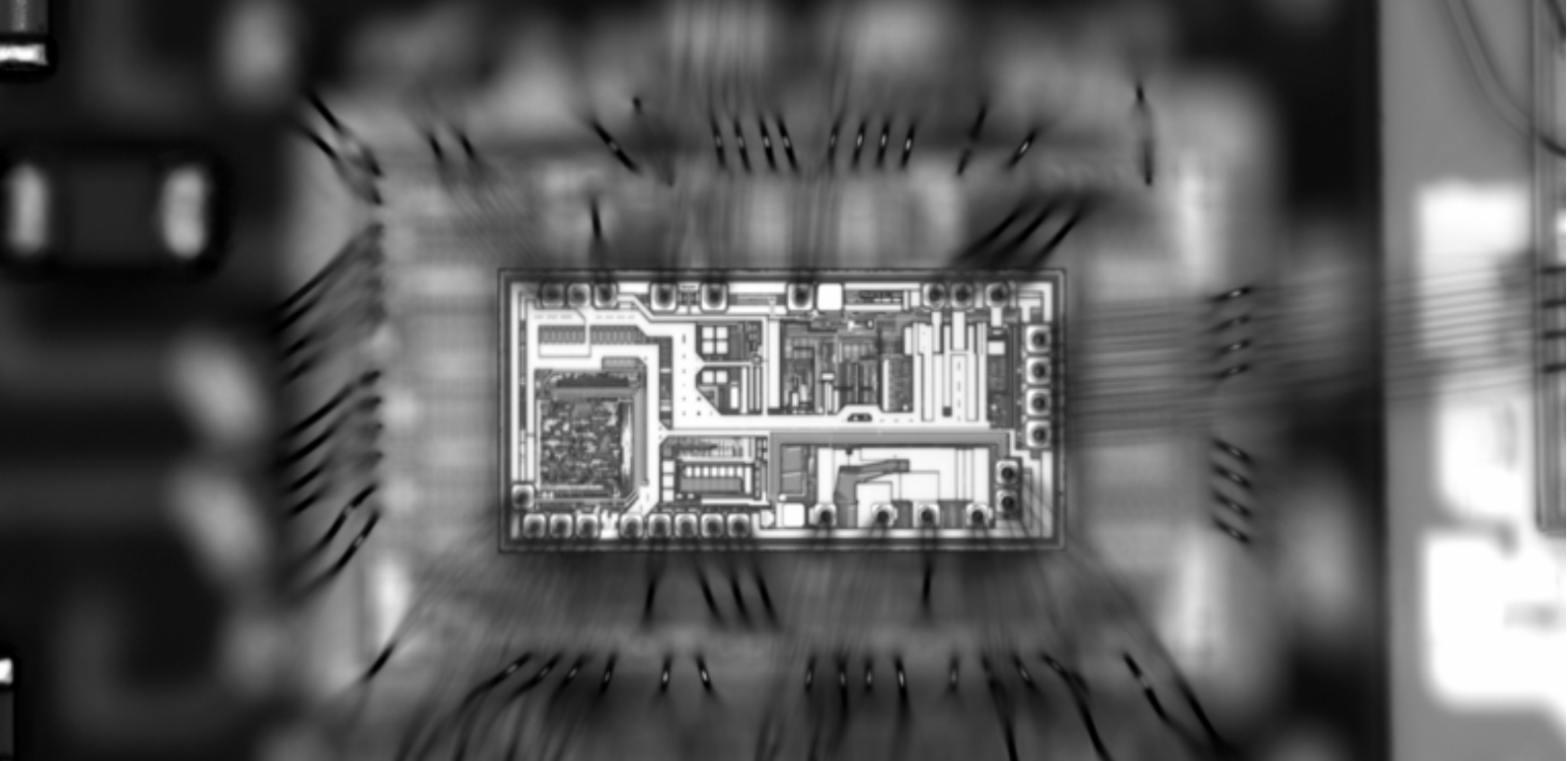
FLIR's range of high-performance thermal imaging cameras has a comprehensive range of temperature monitoring, allowing you to identify temperature differences as little as 20 mK.

Accelerate commercial technology development

Testing each component in situ on a circuit board is vital in the early stages of testing and product development, but the need to system test fully packaged electrical goods is more pressing than ever—especially when it comes to smart communication technology, such as smartphones, tablets and displays.

When a company issues a software or firmware update, it must be tested on a device already on the market to ensure that all components continue to operate. Heat is a key factor in determining how well such electronic devices work, so whether it's the latest iPhone, Android device, or SteamDeck (*shown above*), it's imperative to know that systems are working within accepted parameters.

This affects comfort as well as functionality. For example, OLEDs degrade at a higher temperature so prolonged exposure to faulty components will result in a visible loss in luminosity or even burn-in. It can also impact the accuracy of touch-screen elements and become unpleasant to handle for users. System level testing of commercial technology as new updates are rolled out is vital and it can be done up to ten times quicker with FLIR thermography.



KEY USES FOR IR IMAGING IN ELECTRONICS

From early R&D prototypes as goods prepare to roll off the production line, IR imaging is revolutionizing electronics testing. In fact, a recent TechValidate survey of 118 found that almost three quarters (71%) sped up testing time and expedited product development thermal imaging camera.

Easily record, analyze and share images

With the aid of cutting-edge FLIR thermal analysis software, you can effortlessly capture infrared data on electronic systems, analyze it, and share your results.

FLIR Research Studio offers a simplified workflow to help you quickly interpret the critical information needed for decision-making.

It features a wide range of thermal measurement tools and image filters, and allows you to share data in standard, image, or movie formats across multiple operating systems, in 22 different languages.



"WE NOW MONITOR OUR PRODUCTION 24 HOURS A DAY. AS WE NO LONGER NEED AN OPERATOR TO DO THIS, WE ARE SAVING MONEY."

OUR INITIAL INVESTMENT IN THE THERMAL IMAGING CAMERA REPAID ITSELF WITHIN AN EXTREMELY SHORT PERIOD OF TIME. WHAT IS MORE IMPORTANT EACH AND EVERY RESISTOR IS NOW CHECKED, ALLOWING US TO DELIVER A PERFECT PRODUCT TO OUR CUSTOMERS."

- Production Manager at **Isabellenhütte**.

HIGH STAKES,
HIGHER STANDARDS



“INFRARED THERMOGRAPHY, AND IN PARTICULAR THE FLIR SYSTEMS THERMAL IMAGING CAMERA, PROVED TO BE THE PERFECT WAY TO ENSURE THAT OUR QUALITY STANDARDS ARE EVEN HIGHER THAN BEFORE,”

says Mr. Eichman, Production Manager at **Isabellenhütte**.

NO RESISTANCE: agile, impactful electronics testing on production lines

One well known company from this non-contact electronics testing is **Isabellenhütte**—a manufacturer of resistance alloys for thermocouples, alloys for extension leads, and passive components used in the automotive industry.

Located in Dillenburg, Germany, Isabellenhütte's products are used by the automotive industry in fuel injection systems and other electronic control units. When it comes to electronics testing, the company relies on thermal imaging camera systems from FLIR across its production lines.

FLIR thermography allows the manufacturer to thoroughly inspect each component produced and identify possible defects in resistors in less than 1 second. The system renders an infrared image that allows operators to check for possible issues both with individual components and as part of a fully-functional electronic system. It does this by analyzing hot spots in the image which occur as a result of the higher surface temperature of any faulty device components. Within 20 milliseconds, the thermal imaging camera observes the thermal cycle of the component and displays a simple to understand temperature map of the system.



ACCELERATING AUTOMOTIVE INSIGHT: Exposing **worst-case scenarios**, safely

Part of the growing popularity of using IR imaging to thoroughly test electronic components is the volume of detailed data available. It takes testing to the extreme, allowing users to clearly quantify information from even the most unlikely outcome.

Abusive battery testing for car batteries

The Battery Innovation Center (BIC) in Newberry, Indiana, is a prime example. It focuses on the development, testing, validation, and commercialization of safe, reliable, and lightweight batteries for commercial and defense customers. Part of this process includes abusive testing, exposing batteries to the worst-case scenario to determine safety issues.

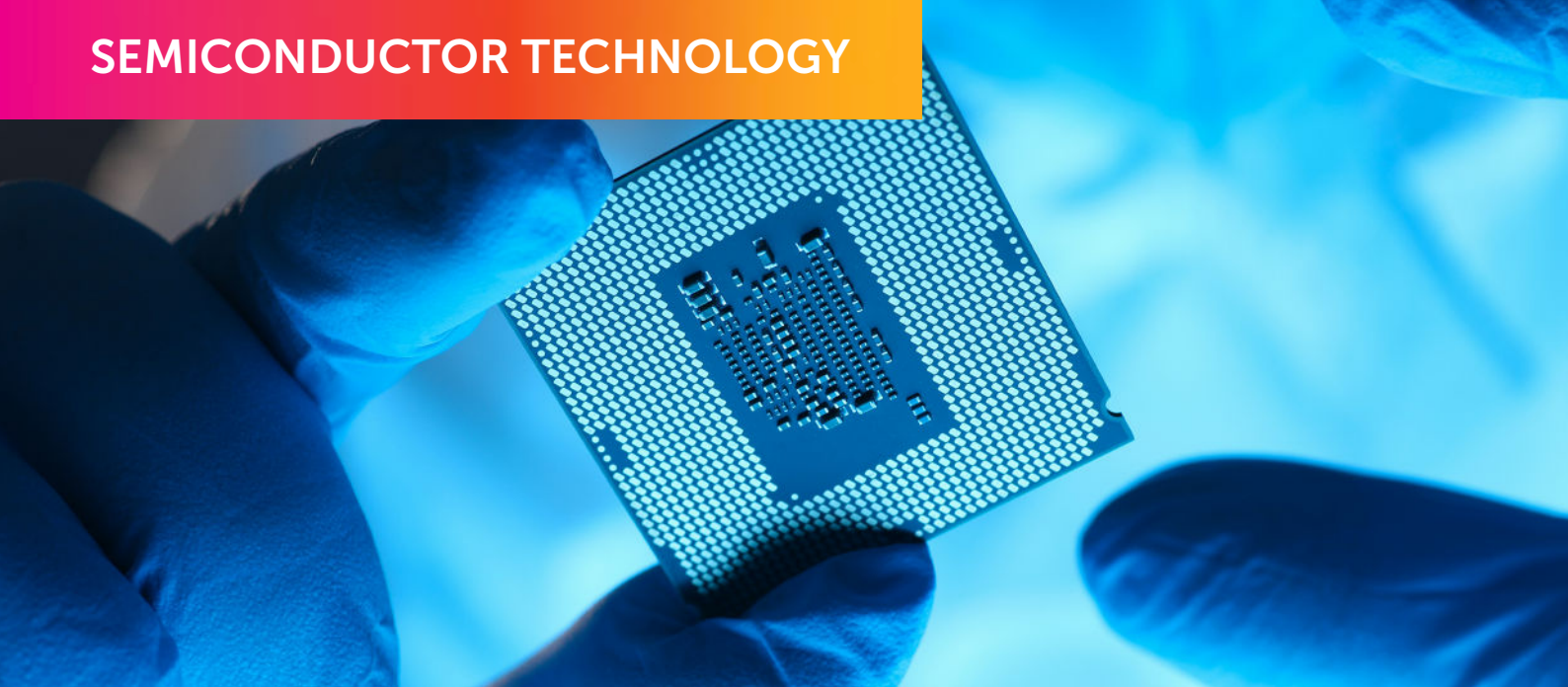
Replacing thermocouples with acute IR imaging

Highlight how individual electronic components respond to changing conditions as well as paint a picture of how the overall system reacts to this feedback.

NAILED IT: extreme testing captures all possibilities

One of the abusive tests that batteries are subjected to is nail penetration, which simulates short-circuiting and may cause the battery to overheat and catch fire or even explode. This is vital to understand how short circuits could lead to a build up of gases and where components are likely to be expelled from the unit once it reaches critical mass—which is all data that engineers can use when designing batteries to minimise fallout.

One high-speed IR thermal imaging camera can capture the entirety of the battery, negating the need for up to a thousand thermocouples required to yield similar data but with vastly more blind spots. FLIR's cutting edge IR imaging technology allows BIC engineers to slow down footage and capture materials in excess of 700°C. **The result?** Data that clearly exposes whether a thermal management system is working and how.

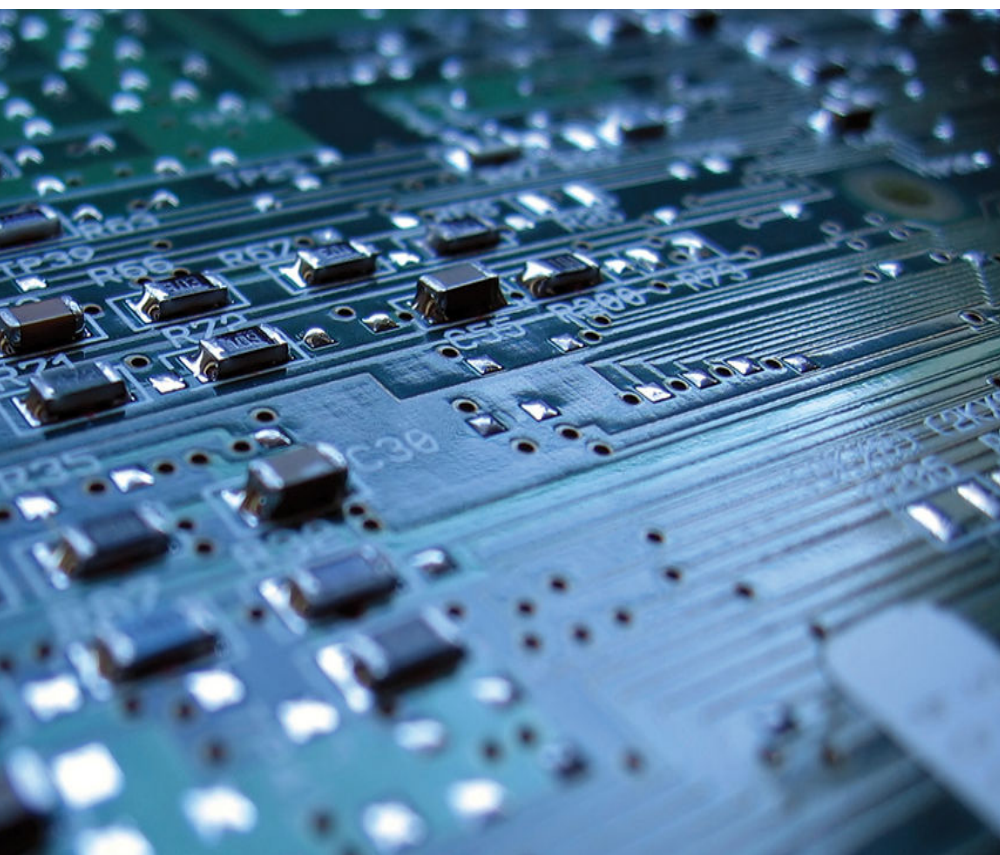


SAFEGUARD SEMICONDUCTOR EFFICIENCY: Improving reliability in **heat bonding**

Integrating FLIR thermal imaging cameras into the production of semiconductor packaging equipment leads to a dramatic increase in the reliability and productivity.

Protec, a manufacturer of semiconductor post-processing equipment such as dispensers, die bonders, and pneumatic cylinders, introduced FLIR thermal imaging cameras into the design of its Laser Assisted Bonding (LAB) equipment. The process uses lasers as a source of heat for bonding application, which dramatically increases productivity and reliability compared to existing reflow soldering technologies. With no need to heat rooms to excessive temperatures, this production method avoids deforming other components via thermal stress as the lasers irradiate the target element in milliseconds.

Such powerful equipment needs to be accurately monitored; FLIR IR thermal cameras are capable of measuring the exact temperature of the laser and the overall heat distribution.



Accurate, effective heat monitoring for **researchers** and **engineers**

FLIR A-Series Science Kits offer researchers and engineers a streamlined solution for accurate temperature measurement. Start testing quickly and easily view, acquire, and analyze data using included FLIR Research Studio software.

The Standard kit includes a FLIR A400, A500, or A700 Image Streaming camera, 24° lens with automatic/remote and manual focusing, as well as FLIR Macro Mode. The Professional kit has the added benefits of MSX® image enhancement, radiometric data transmission over Wi-Fi, and a close-up lens for accurate thermal measurements on small components.

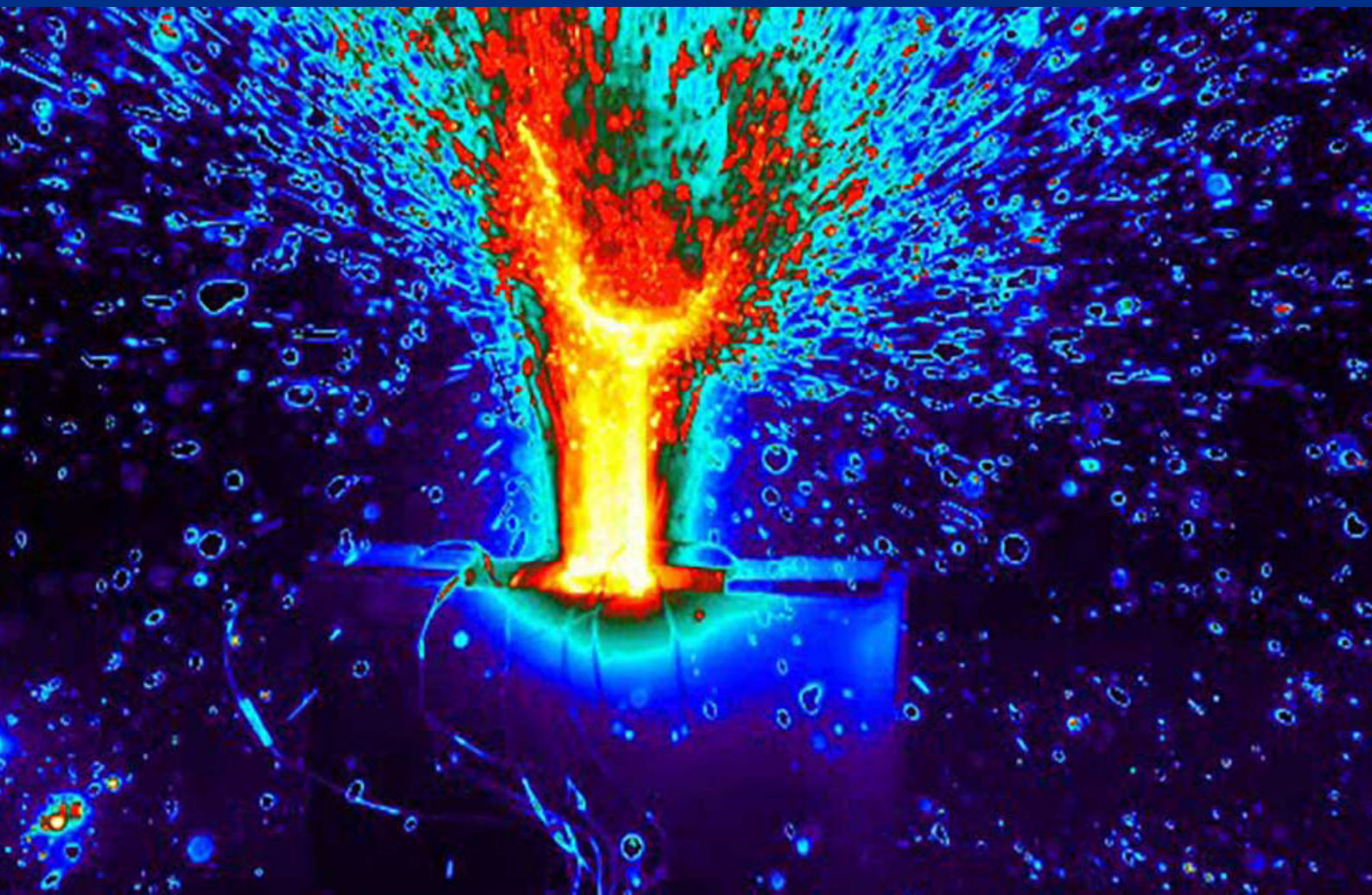
IMPROVE ROI AND DRIVE REDUCED DEVELOPMENT: Invest in IR imaging with the [world's most credible R&D partner](#)

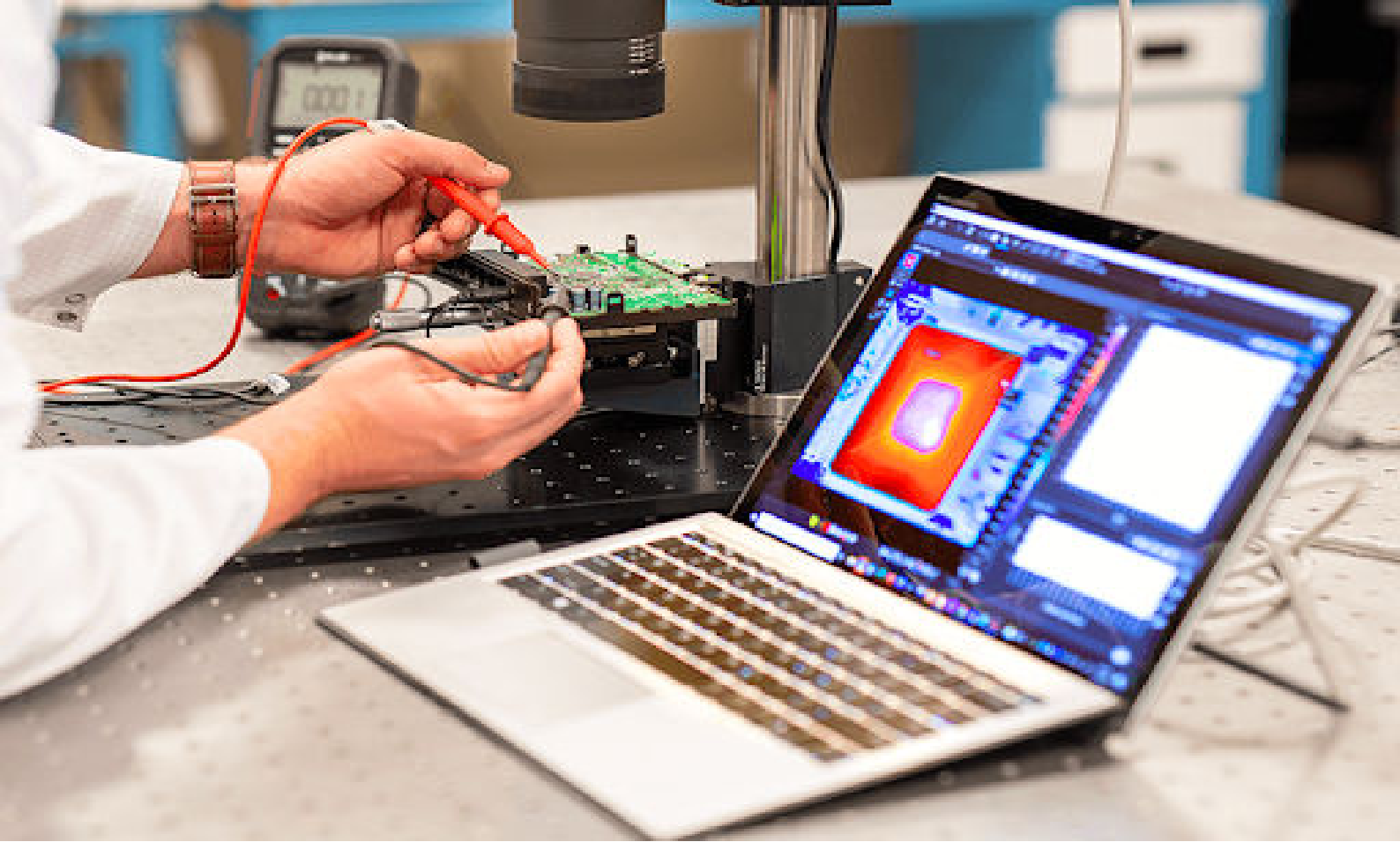
FLIR is the leading and most credible R&D partner for scientists and engineers globally, providing the essential data that drives critical decisions faster and unlocks innovation.

FLIR's powerful infrared imaging solutions can speed up the research and development process by optimizing product development and fast tracking available insights - ultimately improving your ROI and drastically reducing the time needed to get products on the market by enabling engineers to make critical decisions faster.

The key benefits of investing in FLIR IR imaging for electronics testing are:

- » **Reduced development time**
- » **Increased product efficiency**
- » **Increased product reliability**



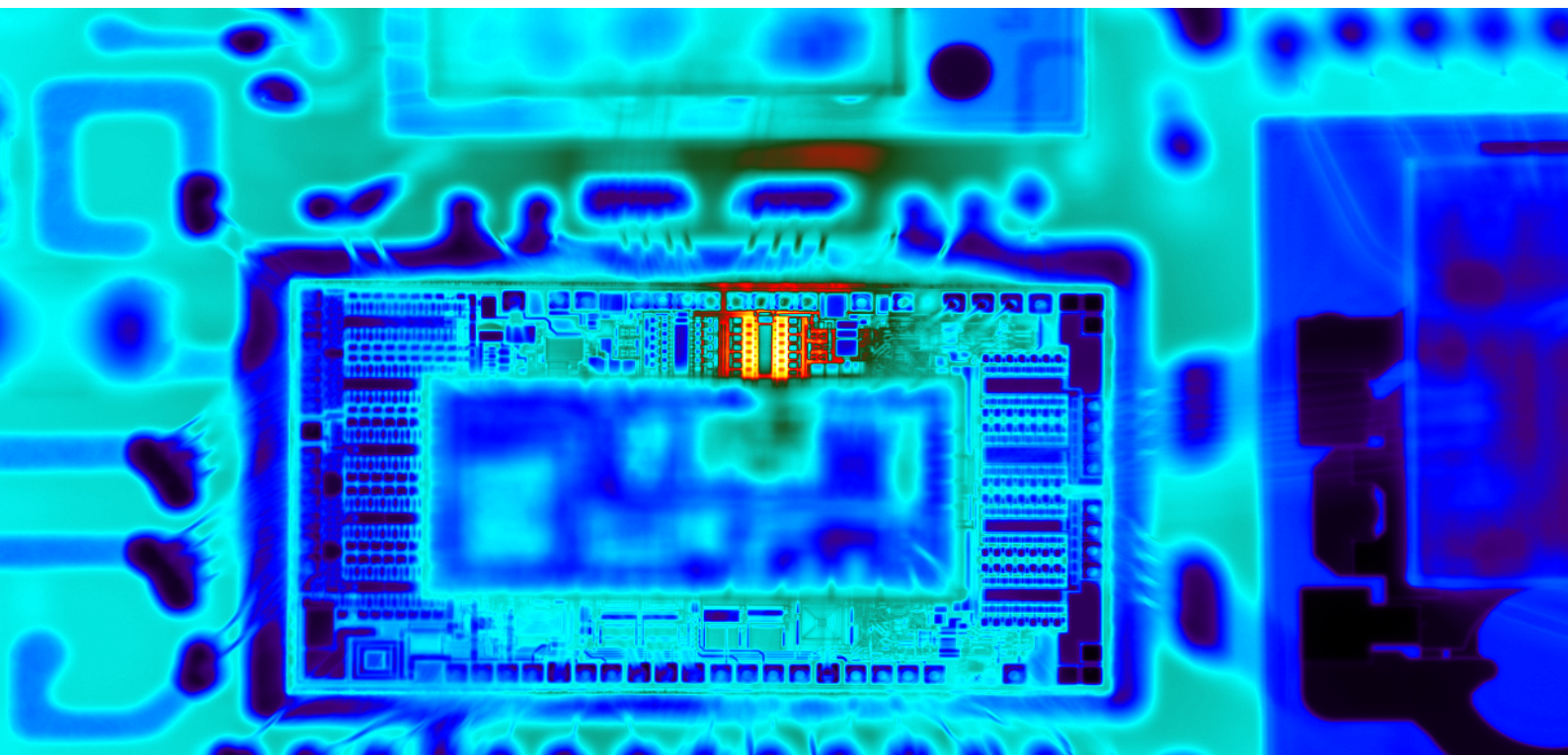


Defensible data differentiates FLIR from its competitors

FLIR's innovative IR thermal imaging solutions keep R&D teams running efficiently and effectively, all the way from laboratory testing through to production and final quality assurance.

A FLIR thermal imaging device doesn't simply deliver data; it gives engineers the confidence to make critical decisions faster, so that you can unlock innovation as it develops.

Made for experts, by experts, Teledyne FLIR is established as the world's most credible R&D partner for scientists and engineers around the globe—and for good reasons. We empower system specialists beyond borders, ensuring certainty and quality data underpins every decision throughout every step of a product's development.



About Teledyne FLIR

FLIR designs, develops, manufactures, markets, and distributes technologies that enhance perception and awareness. We bring innovative sensing solutions into daily life through our thermal imaging, visible-light imaging, video analytics, measurement and diagnostic, and advanced threat detection systems.

Teledyne FLIR offers a diversified portfolio that serves a number of applications in government & defense, industrial, and commercial markets. Our products help first responders and military personnel protect and save lives, promote efficiency within the trades, and innovate consumer-facing technologies. Teledyne FLIR strives to strengthen public safety and well-being, increase energy and time efficiency, and contribute to healthy and intelligent communities.

To learn more, visit flir.com/electronics.

