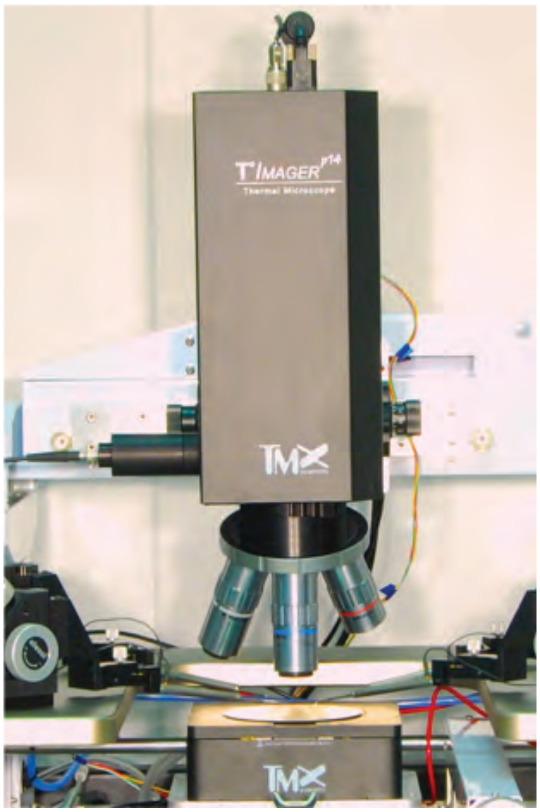
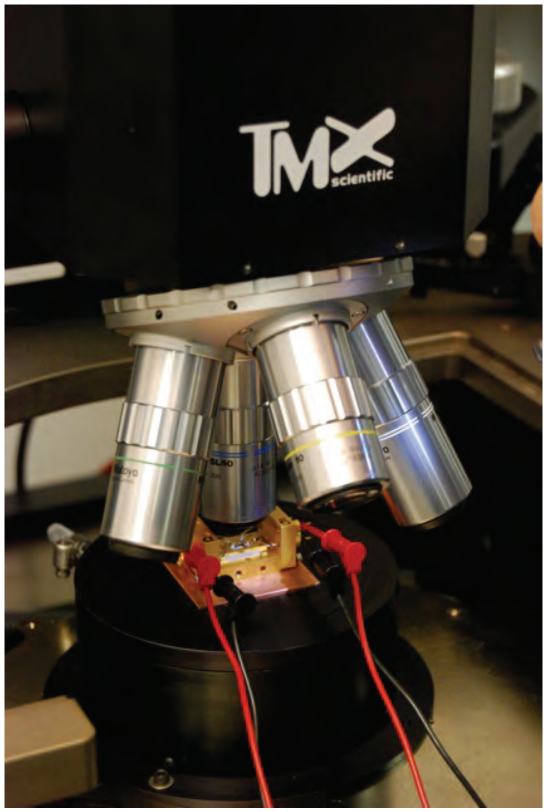
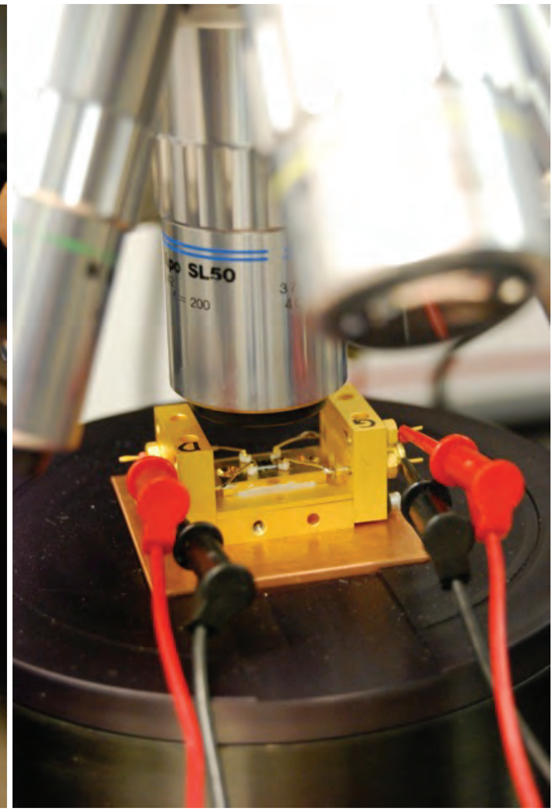
CERAMIC FORUM
お問い合わせ先
セラミックフォーラム株式会社
www.ceramicforum.co.jp
semi@ceramicforum.co.jp
03-5577-2947

T°IMAGER™

Submicron Thermoreflectance CCD Thermal Microscopy Systems



for in-situ non-invasive measurement of surface temperature fields of active microelectronic devices with deep submicron spatial resolution

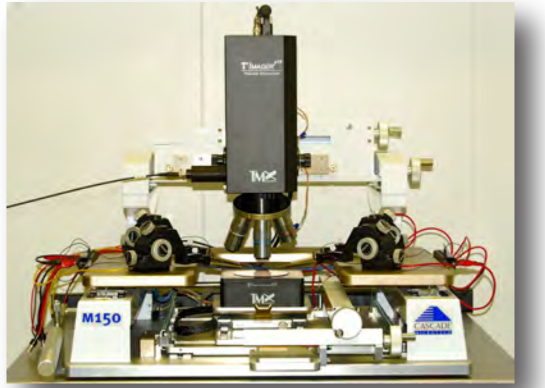
www.tmxscientific.com

TMX scientific™
Delivering Thermal Intelligence™

KEY FEATURES

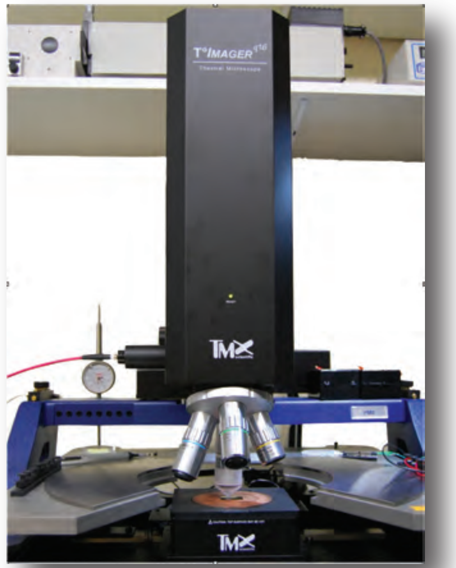
- Turn-key, full thermal image in seconds
- No surface treatment or painting required
- Map temperature fields up to 1000×1000 pixels
- Resolve temperature changes of 0.1°C of spots 0.3 μm* apart with excellent repeatability
- In-situ multi-material pixel-by-pixel calibration
- Large working distance for easy probe access
- Flexible triggering for pulsed device activation
- Intuitive interface & powerful image processing

Quiet compact design for non-invasive temperature mapping of device surfaces



T°IMAGER p14

For applications requiring higher dynamic range and electro-luminescence



T°IMAGER q16

THE FUTURE OF THERMAL MICROSCOPY

SPECIFICATIONS	T°IMAGER q16	T°IMAGER p14
Performance		
Temperature resolution:	0.05°C (Au micro-resistor; Light wavelength, λ = 485 nm)	0.2°C (Au micro-resistor, λ = 485 nm)
Accuracy (1000 frames‡):	<1% of measured response; <6% of absolute temperature	<2% of measured response; <7% of absolute temperature
Repeatability:	Better than 1% (3000 frames, Au micro-resistor, λ = 485 nm)	Better than 2% (3000 frames, Au micro-resistor, λ = 485 nm)
Measurement time, *s*:	4 – 120 (Function of frame rate and total number of frames acquired)	
Transient capability:	Temporal Resolution = 50 ns; Max Frequency = 1 MHz; Resolvable Thermal Rise Time = 250 ns	
Hardware		
CCD camera image, *pixels*:	512×512, 256×256, 128×128, and 64×64	1000×1000, 498×498, 248×248, 122×122
Data dynamic range, *bits*:	16	14 native, 16 pre-processing mode
Image pixel size, *μm*:	0.213 with 100X objective lens	0.098 with 100X objective lens
Field of view, *mm*:	5.5 (with 2X) to 0.11 (with 100X) for 512×512	5.0 (with 2X) to 0.10 (with 100X) for 1000×1000
Spatial resolution, *μm*:	0.28 for objective lens N.A. = 0.8 and λ = 450 nm	
Maximum magnification:	1400 with 100X objective lens	
Frame rate, *fps*:	1 – 30 (Function of image size, camera exposure time, and device activation time)	
Working distance:	≥ 13 mm (Function of objective lens)	
Objective lens mount:	Four-port Mitutoyo™ turret (C-type); Other options available	
Illumination sources:	(i) one or more LEDs (selectable in 365 – 780 nm range), or (ii) Tunable light source (350 – 1000 nm with Δλ = 5 nm)	
Illumination intensity:	Manual or Automatic adjustment for maximum signal-to-noise ratio	
Calibration:	Built-in automated *in-situ* multi-surface thermal calibration with unique *pixel-by-pixel* capability	
Activation of test device:	Dual use BNC trigger for (i) TTL synchronization with user-provided system, or (ii) Driving user-provided power amplifier	
Integration & customization:	Both hardware and software, upon request	
Software		
System control:	LabVIEW™-based intuitive interface for activation, acquisition, storage, and display	
Visualization:	Included T°Viewer™ application for data visualization and conversion to input formats of other visualization packages	
Electrical and Physical		
Mounting:	Integrated head attachable to probing station with adapter plate; Other options available	
Sample holder:	Optional temperature-stabilized thermal chuck (± 0.1°C) with vacuum holes (pump required, not included)	
Vibration isolation:	Isolation table required (not included)	
Operating environment:	5 – 30°C, 20 – 60% relative humidity, non-condensing	
Power requirements:	Low voltage 110 VAC, 60 Hz, 20 A (Total), with standard flexible cords and plugs	

	q16 Head	*p14 Head*	*PC-Controller*	*Calib. Chuck*	*Calib. Controller*	*LED Pulser*	*Device Pulser*
Weight, *lbs (kg)*:	20 (9)	12 (5.5)	35 (16)	1.4 (0.6)	25 (11)	29 (13)	29 (13)
Dimensions H×W×D, *in*: *(cm)*:	24×6×7.5 (61×15×19)	15×5×5 (38×13×13)	7×19×21 (18×48×53)	2.7×7×6 (7×18×15)	5.25×19×19 (13×48×48)	7×19×19 (18×48×48)	7×19×18 (18×48×46)

‡ Function of surface materials, surface quality, illumination light wavelength, and number of frames used for averaging.

LabVIEW™ is a trademark of National Instruments Corp. and Mitutoyo turret and lenses are products of Mitutoyo Corp.

www.tmxscientific.com

WHY T°IMAGER?

T°Imager™ is the leading thermal microscopy system that uses visible light to map a temperature field, thereby enabling a ten-fold better resolution than theoretically possible with state-of-the-art IR imaging. The 0.3 μm* spatial resolution is the best available on the market. The patented TMX CCD thermography system is based on thermo-reflectance physics, where the change in the surface temperature is measured by detecting the change in the sample's reflectivity.

HARDWARE

The T°Imager™ product line is highly modularized. The standard system requires a microscopy head, fiber delivered light source, and rack-mounted control PC. Optional modules include: in-situ calibration thermal chuck; single or multi-LED units; tunable wavelength light source; and transient device and LED modulation units. Illumination intensity is automatically adjusted to ensure optimal signal-to-noise ratio for a chosen light color and objective lens. The system provides an output trigger to modulate an active device under test and to synchronize image acquisition to the on- and off-states of the device. The temperature-induced change in the surface reflectivity between the two states is captured with a CCD camera to provide an accurate temperature rise map.

SOFTWARE

The LabVIEW™-based, intuitive user interface is used to view and position the device under test, control the data acquisition process, and display the resulting temperature field. The graphical interface is flexible and can be customized upon request to include device positioning and activation controls. Acquired temperature maps are stored on the PC controller in binary format readable by the sophisticated T°Viewer™ software for viewing and data analysis, or can be exported to popular data visualization formats. T°Viewer™ enables one tenth of a pixel image alignment for unsurpassed pixel-by-pixel calibration and temperature mapping accuracy.

*For N.A. = 0.8 and λ = 480 nm.

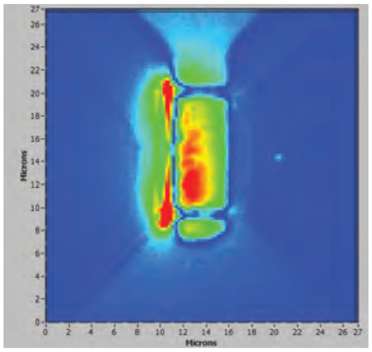
TMX scientific

Thermal Imaging ◂
Simulation ◂
Properties ◂

With speed, accuracy, and intuitive user control, TMX Scientific systems enable prototyping, diagnostics, and submicron hot-spot detection and failure localization, both on the surface and inside a device. The systems are compact, robust, flexible, mountable on standard probing stations, and available for OEM integration.

Detect Hot Spots

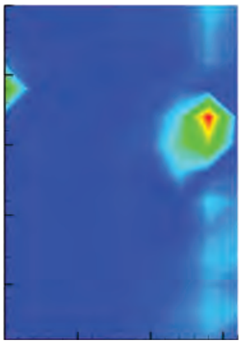
Identify location and severity of hot spots caused by non-uniform power dissipation to optimize device reliability and increase manufacturing yield.



Localizing hot spots on MOSFET (2 µm channel)

Localize Failure

Capture surface temperature map to detect local faults, such as oxide pinholes, ESD damage, latch-ups, and shorts between neighboring lines.



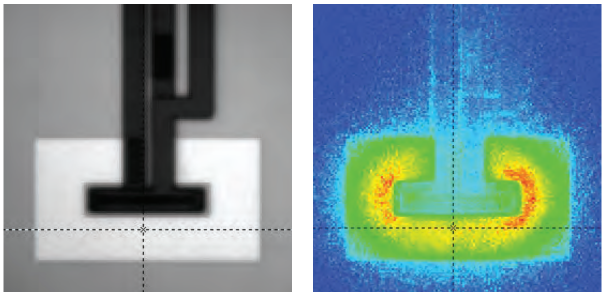
Thermal imprint due to break in oxide layer in MOSFET (15 µm channel)

Measure Electro-Luminescence

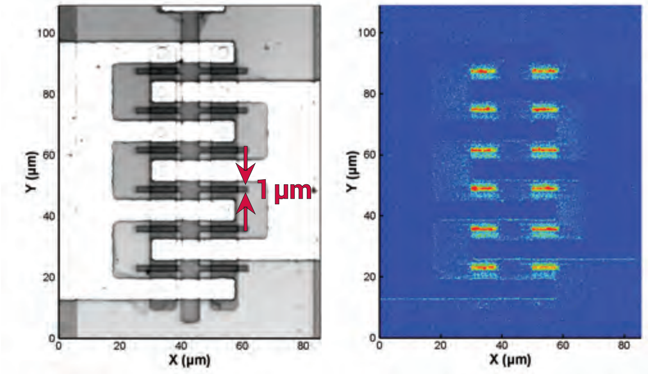
Acquire electro-luminescence emission map to localize failure and leakage points and to perform quality control of solar cells, surface-emitting lasers, optical amplifiers, and other microelectronic devices.

Diagnose Performance

Measure the device temperature at submicron scales to assess its thermal behavior throughout its life cycle — from prototype, to product, to operation or potential failure.



Thermal map of polysilicon resistor (30×44 µm)



Thermal map of multi-fingered MOSFET (1 µm channel)

Main: +1.214.884.8830
tmxinfo@tmxscientific.com
www.tmxscientific.com

TMX scientific™