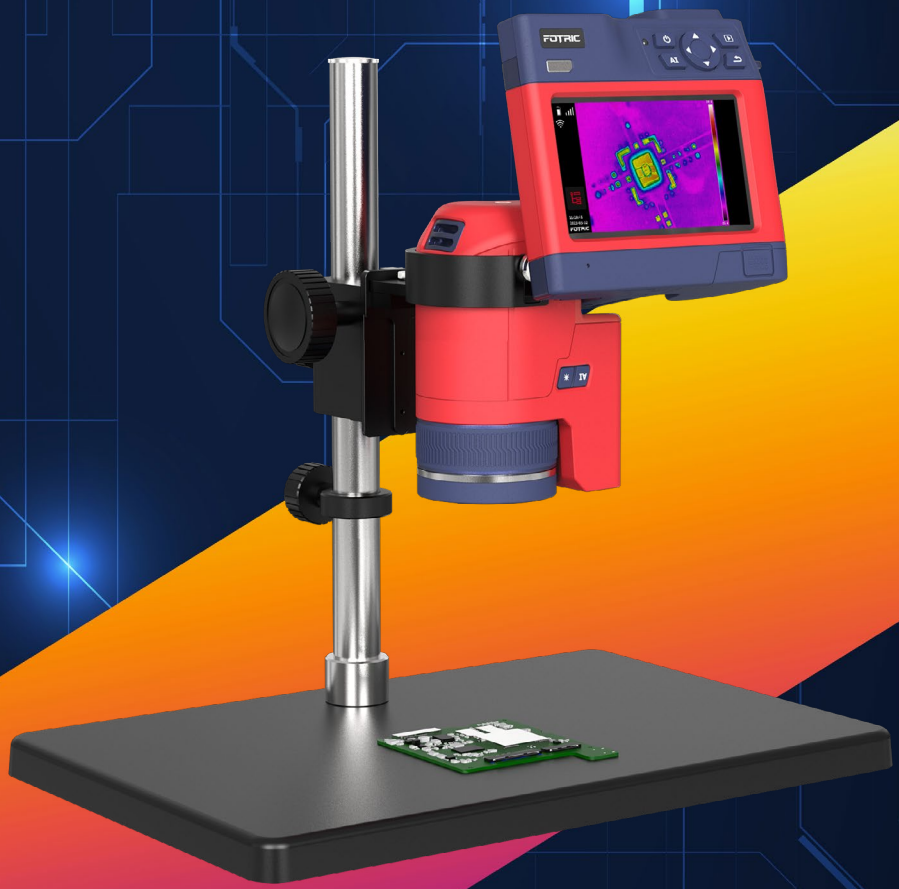
# FOTRIC 220 Pro

Professional Handheld R&D Camera

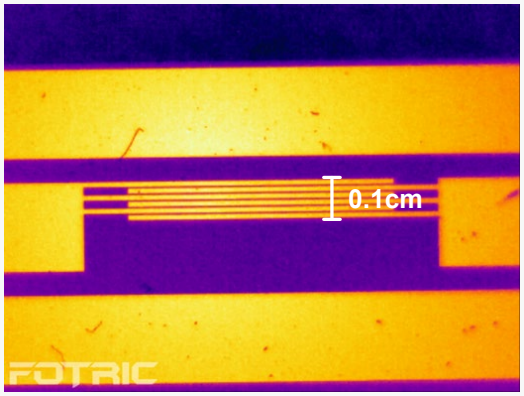
> **R&D in Universities and Research Institutes**
> **Industrial Labs**



# Unlock Discovery with **Unprecedent Clarity**

## > Up to 20μm Macro Lens

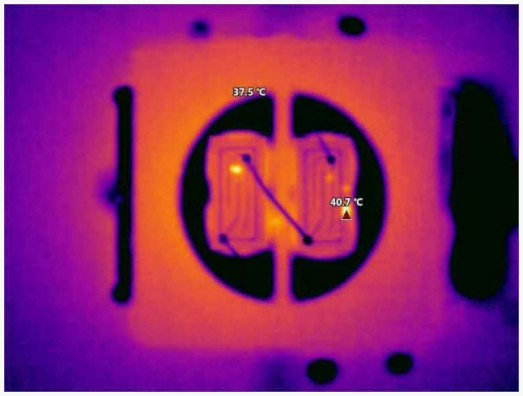
The FOTRIC macro lens boasts outstanding optical performance, effortlessly capturing clear images of extremely fine details and providing precise temperature distribution data.





Electrode etching

**Note:**
Laser-etched electrical circuits are essential tools in MEMS. Thermal imaging simplifies the inspection of installation integrity across different substrate materials. When equipped with a macro lens, it also allows for a more detailed evaluation of circuit performance.




LED chip

**Note:**
In microelectronics, thermal cameras play a crucial role in optimizing performance and design while ensuring product quality. By identifying heat generation points during operation, researchers can better understand thermal behavior and make necessary adjustments to improve efficiency and prevent overheating. This detailed thermal analysis aids in refining designs and addressing potential issues during the development process.

# Unleash Your Video Data's **Full Potential**

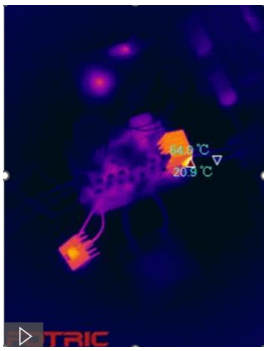
## > Radiometric Mastery

The AnalyzIR software supports dissecting your video data from every aspect.

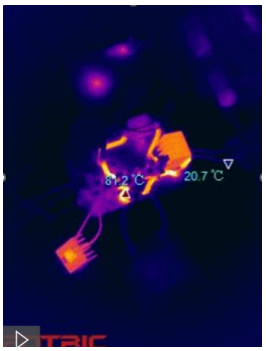
- Time-temperature curve
- Distribution histogram
- 3D diagram

## > Frame by Frame Analysis

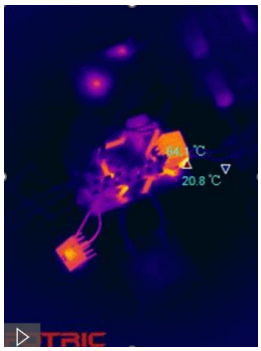
The fleeting moment when the rectifier bridge is pierced by the current.



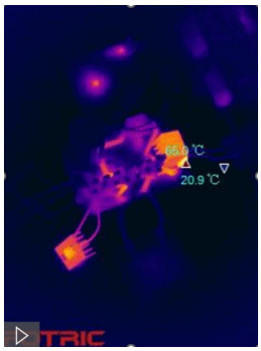
2min 2sec 291ms



2min 2sec 385ms



2min 2sec 525ms



2min 2sec 666ms

After analyzing frame by frame with AnalyzIR, it became evident that the sudden rise in temperature was caused by the current piercing the rectifier bridge, initially suspected to be an issue with the DSP (digital signal processor).

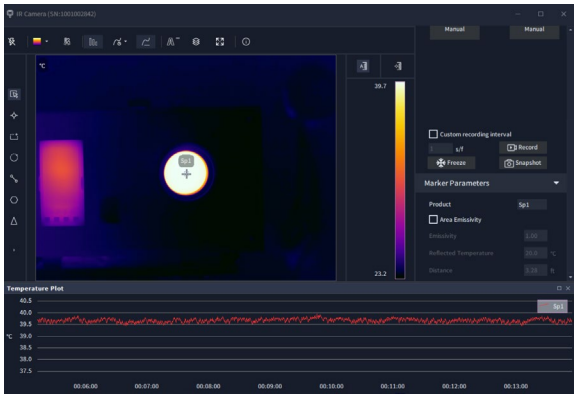
# Unwaivering Commitment for **Accuracy**

Up to
**1280x1024**
IR Resolution

Up to
**30mK**
Thermal Sensitivity

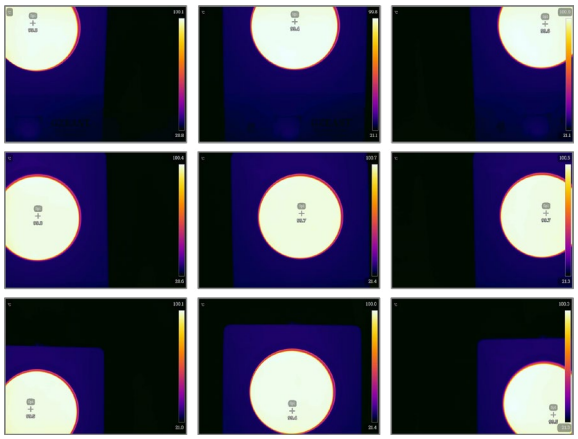
Up to
**±1℃ /1%**
Accuracy

## > Exceptional Thermal Stability




After reaching thermal equilibrium, the camera's temperature fluctuation is less than 0.5°C.

## > Extraordinary Temperature Uniformity



**±0.4℃**

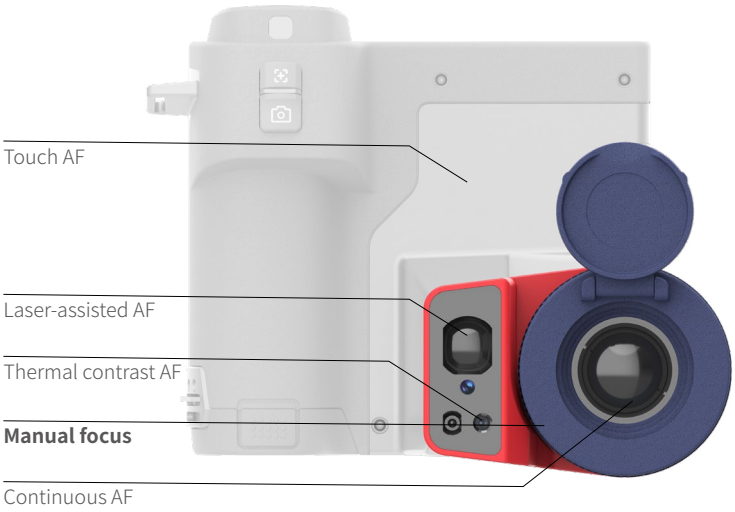
Margin of error against the center region

**Note:**

The thermal camera was aimed at a 100°C black body, measuring temperatures at the center, four corners, and along the edges of the screen. All nine points showed nearly identical results, demonstrating exceptional measurement uniformity.

# Designed for **User Experience**

## > TurboFocus® Intelligent Focus System




### Instant Autofocus

Deliver fast and silent focus at mid and long range.

### Precise Manual Focus

Enables fined-tuned observation at close distance.

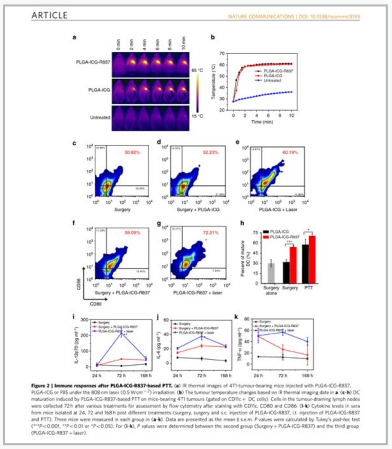
## > Professional Test Bench

**Precision Meets Versatility**

Elevate your testing with our advanced test bench, designed for precise adjustments and effortless maneuverability. Perfect for demanding R&D, industrial, or educational applications, it ensures seamless, accurate results every time.

# Trusted by Researchers Across the **Globe**

## > Publication List


ARTICLE

**Article:**《Photothermal therapy with immune-adjuvant nanoparticles together with checkpoint blockade for effective cancer immunotherapy》

**Publication:**《Nature》

**Model:** FOTRIC 225

mouse sera after found that mice vels of IL-12p70, those in sera of ementary Fig. 4). effect of PLGA- stained release of

tem activation. riment results,

Such results suggest that R837-containing nanoparticles could potentially act as an adjuvant to promote immunological responses of tumour-associate antigens in cell residues.

In our further *in vivo* experiment, BALB/c mice-bearing subcutaneous 4T1 tumours were intratumourally (i.t.) injected with PLGA-ICG or PLGA-ICG-R837 and then irradiated by an 808 nm laser at the power density of 0.5 W cm$^{-2}$ for 10 min. As monitored by an infrared thermal camera (Fotric 225), the tumour temperature of mice injected with PLGA-ICG or PLGA-ICG-R837 under laser irradiation quickly rose to ~60 °C, which was high enough to effectively ablate tumours

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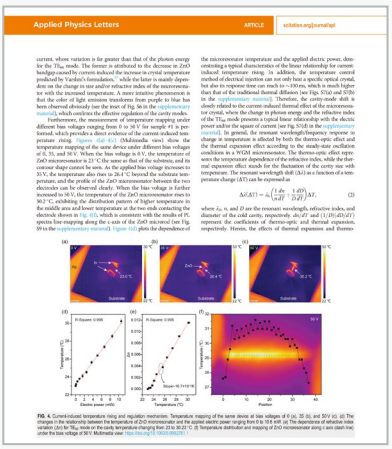

Applied Physics Letters ARTICLE scitation.org/journal/apl

**Article:**《Dynamic regulating of lasing mode in a whispering-gallery micro-resonator by thermo-optic effect》

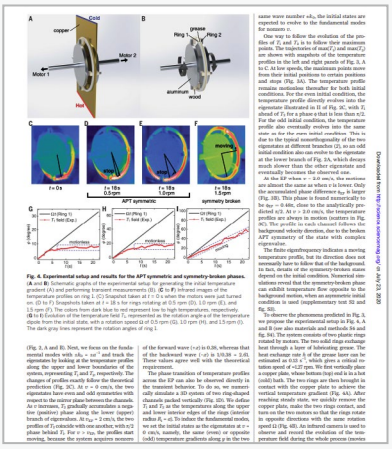
**Publication:**《Applied Physics Letters》

**Model:** FOTRIC 228S

ration of the nt to develop of the cavity ve photonic

nto the ZnO nductivity to rial) without ee Fig. S1 in by electrical lasing mode ffect and the

0.03 nm) equipped with a CCD detector and the optically triggered streak camera (Optronis, Optoscope sc-10). The absorption spectrum is measured by a UV-Vis-NIR spectrophotometer (UV-3600 Plus, Shimadzu). The bias voltage is applied through a low-noise power supply equipment (Keysight, 2961A). The temperature mapping is presented by a thermal imager (FOTRIC, 228S-M20) equipped with an infrared magnifying lens with a resolution of 20 $\mu$m. The finite difference time domain (FDTD) method is performed to simulate the electric-field distribution of the fundamental mode confined in the optical microresonator with a resonant wavelength of 400 nm shown in Fig. S2. The structure model of microresonator has a diameter of 5 $\mu$m and a refractive index of 2.3.


**Article:**《Anti–parity-time symmetry in diffusive systems》

**Publication:**《Science》

**Model:** FOTRIC 233S

nd thickness around $d$ = 0.5 mm. According to the derivation following Eq. (S. 1

ange rate is $h = \kappa_\parallel (\rho c)^{-1} (bd)^{-1} = 0.13\ s^{-1}$. Therefore, the critical rotation speed sh

$/(k_0 R_1) = h = 1.27$ rpm. To generate temperature gradient, the bottom of the copp

ersed in 70 °C hot water, while the top was covered by an ice bag. The temperatur

evolutions were measured with a Fotric 233s infrared camera, whose imaging res

urement precision are 160 × 120 pixel and 0.1 °C, respectively.

# Trusted by Researchers Across the **Globe**

## > Publication List

| Publication | Article | Model |
|---|---|---|
| **Applied Thermal Engineering** | Investigation on the microwave drying kinetics and pumping phenomenon of lignite spheres | FOTRIC 226 |
| **CARBON** | Spray-freezing Induced Multidimensional Morphology Tuning of Assembled Spherical Carbon for Solar-driven Steam Generation | FOTRIC 260 |
| **Carbon** | Fabrication of core-shell nanostructured poly(3,4-ethylenedioxythiophene)/carbon nanotube composites with enhanced thermoelectric power factor | FOTRIC 226 |
| **Science** | Anti-Parity-Time Symmetry in Diffusive Systems | FOTRIC 224S |
| **Journal of Food Engineering** | Continuous flow microwave system with helical tubes for liquid food heating | FOTRIC 285 |
| **ACS Applied Nano Materials** | Plasma Cleaning and Self-Limited Welding of Silver Nanowire Films for Flexible Transparent Conductors | FOTRIC 322Pro |
| **Nano Today** | Edge confined covalent organic framework with efficient biocompatibility and photothermic conversion | FOTRIC 345 |
| **Carbon** | A structure evolution mechanism for the modulus loss in electromechanical response of carbon nanotube fiber | FOTRIC 615C |
| **Applied Physics Letters** | Dynamic regulating of lasing mode in a whispering-gallery microresonator by thermo-optic effect | FOTRIC 228S |
| **Nature** | Non-Hermitian topological whispering gallery | FOTRIC 228S |
| **Foods** | Efficient Solar-Driven Water Purification Based on Biochar with Multi-Level Pore Bundle Structure for Preparation of Drinking Water | FOTRIC 226S |
| **Applied Materials Today** | Stiffness tunable implanted electrode enabled by magnetic liquid metal forwireless hyperthermia | FOTRIC 228S |
| **Nanomaterials** | Design and Analysis of a Hollow Metallic Microlattice Active Cooling System for Microsatellites | FOTRIC 618C |
| **Applied Thermal Engneering** | Thermal management of 3D chip with non-uniform hotspots by integrated gradient distribution annular-cavity micro-pin fins | FOTRIC 226S |
| **Advanced Optical Materials** | Elucidating Orbital Delocalization Effects on Boosting Electrochemiluminescence Efficiency of Carbon Nitrides | FOTRIC 285 |
| **Advanced Materials** | Geometric Phase and Localized Heat Diffusion | FOTRIC 347 |
| **Advanced Therapeutics** | Regulation of ID4 In Vivo for Efficient Magnetothermal Therapy of Breast Cancer | FOTRIC 228S |
| **ACS Nano** | Graphene Oxide-Grafted Magnetic Nanorings Mediated Magnetothermodynamic Therapy Favoring Reactive Oxygen Species-Related Immune Response for Enhanced Antitumor Efficacy | FOTRIC 228S |
| **ACS Nano** | Ferrimagnetic Vortex Nanoring-Mediated Mild Magnetic Hyperthermia Imparts Potent Immunological Effect for Treating Cancer Metastasis | FOTRIC 228S |
| **Nature** | Brown-fat-mediated tumour suppression by cold-altered global metabolism | FOTRIC 285 |

# Specifications

| Model | 229Pro | 228Pro | 226Pro |
|---|---|---|---|
| **Thermal Imaging Parameters** | | | |
| Infrared Resolution | 1280 x 1024 | 640 x 480 | 384 x 288 |
| Super Resolution(SR) | Support | | |
| Detector Type | Uncooled FPA infrared detector | | |
| Thermal Sensitivity (NETD) | 30mk@30° C(86 °F ) | | 40mk@30° C(86 °F ) |
| Detector Pitch | 12μm | 17μm | 17μm |
| Spectral Range | 8~14μm | | |
| Image Frame Rate | 30Hz | | |
| Field of View (FOV) | 25° x 20° | 25° x 19° | |
| Spatial Resolution (IFOV) | 0.34mrad | 0.68mrad | 1.14mrad |
| Minimum Imaging Distance | 0.4 m | 0.25 m | 0.1 m |
| Focal length | 35mm | 25mm | 15mm |
| Focus Mode | TurboFocus ™ system for continuous, laser-assisted, thermal contrast, and touch AF; Manual focus | | |
| Lens Recognition | Automatic | | |
| Optional Interchangeable Lens | 46° Wide-angle Lens; 50μm Macro Lens | 46° Wide-angle Lens; 20μm Macro Lens; 50μm Macro Lens | 46° Wide-angle Lens; 50μm Macro Lens; 100μm Macro Lens |
| Digital Zoom | 1-32x continuous zoom | 1-16x continuous zoom | 1-6x continuous zoom |
| **Temperature Analysis** | | | |
| Complete Temperature Range | -20~650°C (-4~1202 °F ) | | |
| Temperature Range | -20~120°C (-4~248 °F )，0~650°C (32~1202 °F )，Intelligent range | | |
| Temperature Extension | Support extension: lowest to -40°C / °F (Not applicable to macro lenses, measurement accuracy may exceed 2%), highest to 2000°C /3632 °F | | |
| Accuracy | ± 1°C /3.6 °F or ± 1 %, whichever is greater (ambient temp at 25°C /77 °F , temperature range 0° C-100° C/32 °F -212 °F ), ± 2°C /3.6 °F or ± 2 % for other temperature range. Note: Macro lens can also achieve ±2°C /3.6 °F or ±2% measurement accuracy between -20° C(-4 °F )~400° C(752 °F ) | | ± 2°C /3.6 °F or ± 2 %, whichever is greater (ambient temp at 25°C /77 °F ). Note: Macro lens can also achieve ±2°C /3.6 °F or ±2% measurement accuracy between -20° C (-4 °F )~400° C(752 °F ) |
| Measurement Tools | Spot：18<br>Line：6<br>Area：18<br>AnalyzIR: Unlimited ROIs | Spot：15<br>Line：6<br>Area：15<br>AnalyzIR: Unlimited ROIs | Spot：9<br>Line：3<br>Area：9<br>AnalyzIR: Unlimited ROIs |

# Specifications

| | | |
|---|---|---|
| Line Temperature Distribution | Support | |
| Measurement Parameters | Emissivity, Reflected temperature, Ambient temperature, Humidity, Distance and IR window compensation. | |
| Local Parameters | Support | |
| Area Alarms | High temperature alarm and low temperature alarm | |
| Temperature Rise Feature | Yes | |
| On-Device Analysis | Support Radiometric Video and Image Analysis | |
| PC Software | AnalyzIR Professional Analysis Software | |
| **Image Display** | | |
| Display Screen | 5inch (landscape)1280 x 720 resolution | |
| Image Mode | Thermal\Digital\Picture-in-Picture\T-DEF® Blend | |
| Palette | 16 standard + 16 inverted | |
| Minimum Temperature Span | Auto (Minimum Temp Span 3°C ), Manual (Minimum Temp Span 2°C ), Touch-screen(Minimum Temp Span 2°C | |
| Color Alarm | High temperature, low temperature, and interval isotherms | |
| Hot and Cold Spot Tracing | Yes | |
| **Capture Features** | | |
| Digital Camera | 2 Cameras: 5-mega pixel and 13-mega pixel | |
| Storage Card | SD card of 256GB memory, support expansion to 2TB | SD card of 128GB memory, support expansion to 2TB |
| Capture Mode | Single frame and Time-lapse | |
| Image Format | JPEG(Radiometric)，JPEG(Non-radiometric) | |
| Video Format | IRS(Radiometric), MP4(Non-Radiometric) | |
| Radiometric Video Recording | Support | |
| Non-Radiometric Video Recording | Support | |
| Gallery | Support viewing, editing and deleting image and video files | |
| **Remote Access** | | |
| PC | Remote Control Via AnalyzIR | |
| Mobile Device | Through IRExplorer | |
| **Power System** | | |
| Battery Type | 3.6V，10000mAh lithium | |
| Battery Life | Over 4 hours per battery | |
| Battery Charging System | Battery charger, DC 13V charging, USB charging | |
| Battery Charging Time | 2.5 hours to 90% full charge | |
| Energy Management | User-selectable screen-off modes | |

# Specifications

| | |
|---|---|
| **Physical Parameters** | |
| Operating Temperature | -20° C ~ 50° C(-4 °F ~122 °F ) |
| Storage Temperature | -40° C ~ 70° C(-40 °F ~158 °F ) without batteries |
| **Language** | |
| Languages | English, Spanish, French, German, Italian, Korean, Portuguese, Traditional Chinese, Thai |
| **Configuration** | |
| Packaging | Thermal imaging camera, lens, lens cap, 3 rechargeable lithium batteries, battery charger, power adapter,B5 R&D Bench, USB Type-C to USB interface cable, Micro HDMI interface to HDMI interface cable, SD card, SD card reader, accessory bag (wrist strap), information bag (packing list, calibration certificate, user manual), hard carrying case |

FOTRIC

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Dec. 2024

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