

PHEMOS-1000

THEMOS-1000

iPHEMOS-MP

TriPHEMOS

# Electro Optical Probing Unit

Localize failure points through transistor frequency mapping and waveform characterization

## EOP

Electro Optical Probing

Instant capture of operating waveforms



### Features

- Wide range of operating frequency 10 kHz - 1 GHz
- Maximum 500 000 sampling points for a long test loop
- Capture EOP waveforms in 2 seconds

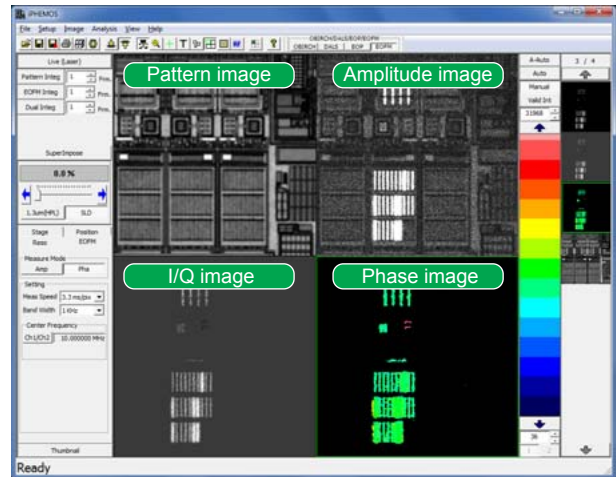
### Applications

- Measurement of transistors' operating waveforms
- Characterization and debug of active circuit

## EOFM

Electro Optical Frequency Mapping

Visualization of transistors out of targeted frequency



### Features

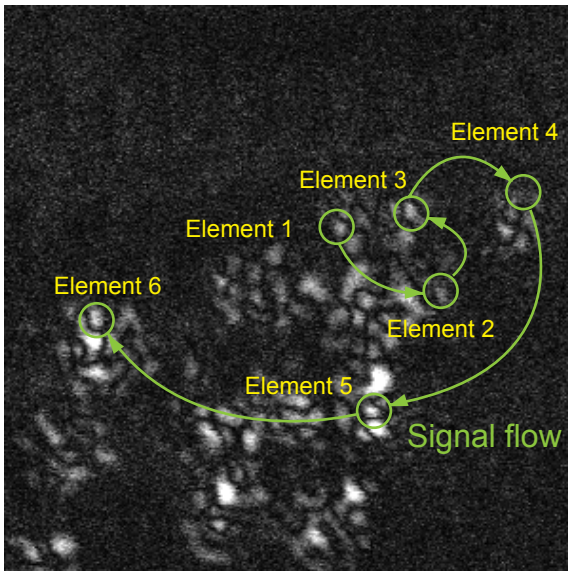
- Save EOP target identification time by acquiring multiple images simultaneously
- Quick detection of timing delay using phase animation images
- High quality pattern image with no interference fringes

### Applications

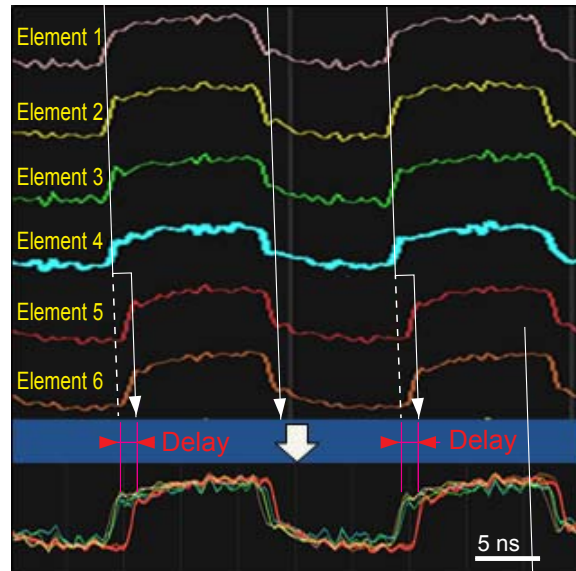
- Observation on structural failure of scan chain
- Identification of a probing point from EOFM images
- Validation of digital and analog circuits
  - Oscillating circuit
  - Timing defect check of IO circuit

## Case study

- Purpose** Check the delay in paths on a 28 nm TEG operated at 400 MHz. To identify the delay points, the measurement positions of the target paths were defined with the EOFM function and the delay was measured by EOP.
- Method** Operated the device at a 400 MHz clock rate. Acquired EOFM images at 50 MHz data rate to define positions of suspect elements in a defective circuit. Checked operating waveform of suspect elements (1 to 6) by EOP.
- Results**



EOFM image



EOP waveform

Results showed an error in the duty ratio at elements 5 and 6. Examining the waveforms in detail confirmed a delay in the pulse rising edge between elements 4 and 5. However, no delay was found in the pulse falling edge.

- Conclusion** Since a large delay only occurs between elements 4 and 5 in the pulse rising edge, the result indicates there are high resistance defects in the wiring or in the via hole.

- ★ PHEMOS is a registered trademark of Hamamatsu Photonics K.K. (France, Germany, Japan, Korea, Taiwan, UK., U.S.A.)
- ★ THEMOS is a registered trademark of Hamamatsu Photonics K.K. (France, Germany, Japan, U.S.A.)
- ★ Product and software package names noted in this documentation are trademarks or registered trademarks of their respective manufacturers.
  - Subject to local technical requirements and regulations. Availability of products included in this promotional material may vary. Please consult with your local sales representative.
  - Information furnished by HAMAMATSU is believed to be reliable. However, no responsibility is assumed for possible inaccuracies or omissions.
  - Specifications and external appearance are subject to change without notice.

© 2015 Hamamatsu Photonics K.K.

**HAMAMATSU PHOTONICS K.K.** [www.hamamatsu.com](http://www.hamamatsu.com)

**HAMAMATSU PHOTONICS K.K., Systems Division**

812 Joko-cho, Higashi-ku, Hamamatsu City, 431-3196, Japan, Telephone: (81)53-431-0124, Fax: (81)53-435-1574, E-mail: [export@sys.hpk.co.jp](mailto:export@sys.hpk.co.jp)

U.S.A.: Hamamatsu Corporation: 360 Foothill Road, Bridgewater, N.J 08807, U.S.A., Telephone: (1)908-231-0960, Fax: (1)908-231-1218 E-mail: [usa@hamamatsu.com](mailto:usa@hamamatsu.com)

Germany: Hamamatsu Photonics Deutschland GmbH.: Arzbergerstr. 10, D-82211 Herrsching am Ammersee, Germany, Telephone: (49)8152-375-0, Fax: (49)8152-265-8 E-mail: [info@hamamatsu.de](mailto:info@hamamatsu.de)

France: Hamamatsu Photonics France S.A.R.L.: 19, Rue du Saule Trapu, Parc du Moulin de Massy, 91882 Massy Cedex, France, Telephone: (33)1 69 53 71 00, Fax: (33)1 69 53 71 10 E-mail: [infos@hamamatsu.fr](mailto:infos@hamamatsu.fr)

United Kingdom: Hamamatsu Photonics UK Limited: 2 Howard Court, 10 Tewin Road, Welwyn Garden City, Hertfordshire AL7 1BW, UK, Telephone: (44)1707-294888, Fax: (44)1707-325777 E-mail: [info@hamamatsu.co.uk](mailto:info@hamamatsu.co.uk)

North Europe: Hamamatsu Photonics Norden AB: Torshamnsgatan 35 16440 Kista, Sweden, Telephone: (46)8-509-031-00, Fax: (46)8-509-031-01 E-mail: [info@hamamatsu.se](mailto:info@hamamatsu.se)

Italy: Hamamatsu Photonics Italia S.r.l.: Strada della Moia, 1 int. 6 20020 Arese (Milano), Italy, Telephone: (39)02-93581733, Fax: (39)02-93581741 E-mail: [info@hamamatsu.it](mailto:info@hamamatsu.it)

China: Hamamatsu Photonics (China) Co., Ltd.: B1201 Jiaming Center, No.27 Dongsanhuan Beilu, Chaoyang District, Beijing 100020, China, Telephone: (86)10-6586-6006, Fax: (86)10-6586-2866 E-mail: [hpc@hamamatsu.com.cn](mailto:hpc@hamamatsu.com.cn)