

6TH INTERNATIONAL WORKSHOP ON THERMAL INVESTIGATIONS OF ICs AND SYSTEMS

plus a special
HALF-DAY ON COMPACT MODELS

Budapest
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Sponsored by



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in cooperation with



THERM 2000

6th International Workshop on

THERMal INvestigations of ICs and Systems

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a special half-day on compact models

Sponsored by the IEEE Computer Society Test Technology Technical Council and TIMA Laboratory in cooperation with the IEEE Components, Packaging, and Manufacturing Technology Society and with the DETERMIN Project supported by the European Commission.

Monday 25 September 2000

8:00	Registration	
9:30	Welcome address: B. Courtois, General Chair, TIMA Laboratory, Grenoble, France	
9:40	Invited talk: W. Claeys, U. Bordeaux 1, Talence, France Chair: V. Székely, BUTE, Budapest, Hungary	Characterisation of the thermal behaviour of microelectronic components by laser probing
10:20	Session 1 Chair: C. Villa, STMicroelectronics, Agrate Brianza, Italy	Measurement techniques
10:20	V. Székely¹, G. Farkas¹, E. Nikodémusz¹, M. Rencz¹, S. Ress², S. Török² ¹ MicReD Ltd, Budapest, Hungary ² BUTE, Budapest, Hungary	New procedures for thermal transient testing
10:40	G. Storti Gajani, A. Brambilla, A. Premoli DEI - Politecnico di Milano, Italy	Exploiting Electro-Thermal Oscillations for identifying MOSFET Thermal Parameters
11:00	V. Székely¹, M. Rencz², S. Török¹, S. Ress¹, B. Vizi¹ ¹ BUTE, Budapest, Hungary ² MicReD Ltd, Budapest, Hungary	Experiments on Effective board thermal conductivity measurements
11:20	R.C. Campbell, S.E. Smith Holometrix Micromet,	Laser Flash Measurements of Adhesive Bondline Effective Thermal Conductivity and Contact Resistance Using Multilayer

	Bedford, USA	Methods
11:40	Break	
12:00	Session 2 Chair: D. de Cogan, U. of East Anglia, Norwich, UK	Temperature mapping
12:00	S. Dilhaire¹, S. Jorez¹, L-D. Patino Lopez¹, W. Claeys¹, E. Schaub² ¹ U. Bordeaux 1, Talence, France ² National Research Laboratory of Metrology, Ibaraki, Japan	Measurement of Laser Diode Light Efficiency by Thermoreflectance Microscopy
12:20	S. Holé, G. Tessier, S. Grauby, D. Fournier ESPCI, Paris, France	Quantitative thermal imaging by thermoreflectance using a CCD array
12:40	A. Trigg Institute of Microelectronics, Singapore	Temperature mapping of ICs and MEMs devices using an Infrared Microscope
13:00	Lunch	
14:30	Vendor's session: B. Courtois, TIMA Laboratory, Grenoble, France	
15:30	Session 3 Chair: M. Baelmans, K.U.Leuven, Heverlee, Belgium	Thermal simulation
15:30	D. de Cogan¹, A. Kos² ¹ U. of East Anglia, Norwich, UK ² U. of Mining and Metallurgy, Krakow, Poland	TLM Solutions for Static Thermal Problems
15:50	Y.C. Gerstenmaier¹, G. Wachutka² ¹ Siemens, München, Germany ² München U. of Techn., München, Germany	Time dependent temperature fields calculated using eigenfunctions and eigenvalues of the heat conduction equation
16:10	M. Zubert, A. Napieralski TU of Łódź, Poland	The New General Method for Thermal and Electro-Thermal Model Reduction
16:30	Break	
17:00	Posters session <i>Posters are introduced by one slide in 3 minutes each</i>	

	Chair: M. Rencz, BUTE, Budapest, Hungary	
	S. Tzanova, V. Videkov TU of Sofia, Bulgaria	A New Undergraduate Course on Thermal Design of MCMs
	M. Pesare, A. Giorgio, A.G. Perri Politecnico di Bari, Italy	Analytical Solution to the Non-linear 3-D Heat Flow Equation for the Optimized Electrothermal Design of Integrated Devices
	M. Janicki, W. Tylman, T. Pozniak, A. Napieralski TU of Łódź, Poland	Influence of Power Device Placement on Integrated Circuit Temperature
	O. Vanék, M. Držík, B. Hucko, A. Kromka, M. Remis Slovak U. of Techn., Bratislava, Slovakia	Stresses in Diamond and SiO ₂ Films Deposited on Silicon Substrates
	F. Charlet, V. Gehanno, S. Putot, A. Fargeix LETI, Grenoble, France	An efficient numerical method to calculate the thermal distribution in multilayer media: application to optical recording
	A. Ebongue^{1,2}, F. Brachelet^{1,3}, F. Polet^{1,4}, B. Bêche^{4,5}, E. Gaviot^{4,5} ¹ IEMN, Villeneuve d'Ascq, France ² Jay Electronique, Montbonnot Saint Martin, France ³ S.A.R.L Captec, Villeneuve d'Ascq, France ⁴ ENSIM, Le Mans, France ⁵ LAUM, Le Mans, France	Rugged Infrared Sensors for Use in Safety-Related Industrial Environment
	M. Malinski¹, L. Bychto¹, S. Legowski², J. Szatkowski², J. Zakrzewski² ¹ TU of Koszalin, Poland ² Nicolaus Copernicus U., Torun, Poland	Photoacoustic Spectroscopy Studies of Zn _{1-x} Be _x Se Mixed Crystals
	P. Dziurdzia, A. Kos U. of Mining and Metallurgy, Kraków, Poland	Electro-thermal Simulations of Power Feedback in Active Cooling of Microstructures
	P.G. Tucker, Z. Pan The U. of Warwick, Coventry, UK	Turbulence Modelling for Unsteady Flow Complex Systems
	B. Wiecek TU of Łódź, Poland	Heat transfer modelling and IR measurements of electronic devices in enclosures
	P. Miribel-Català, E. Montané, S.A. Bota, M.	Mosfet-only temperature sensor for standard BCD smart power technology

	Puig-Vidal, J. Samitier U. of Barcelona, Spain	
	W. Szczesniak TU of Gdansk, Poland	Influence of Tasks Scheduling on Average and Peak Temperatures of CMOS Circuits
	Z. Huszka Austria Mikro Systeme Intl, Budapest, Hungary	Self-heating at the Parameter Extraction of SiGe HBTs
	M. Zubert, A. Napieralski TU of Łódź, Poland	Application of RESCUER software for Smart Power Circuits Design
	Z. Suszynski TU of Koszalin, Poland	Photoacoustic Amplitude Method of Determination of Thermal Diffusivity of Non-Opaque Materials
	S. Ress, E. Kollar BUTE, Budapest, Hungary	Comparison of various thermal transient measurement methods on a benchmark package
19:00	Bus to dinner	
Tuesday 26 September 2000		
8:30	Session 4 Chair: M-N. Sabry, Mansoura U., Egypt	Electro-thermal simulation
8:30	W. Batty¹, C. E. Christoffersen², S. David¹, R. G. Johnson¹, A. J. Panks³, C. M. Snowden^{1,3} ¹ U. of Leeds, UK ² NCSU, Raleigh, USA ³ Filtronic plc., Shipley, UK	Steady_state and transient electro_thermal simulation of power devices and circuits based on a fully physical thermal model
8:50	L. Codecasa, D. D'Amore, P. Maffezzoni Politecnico di Milano, Italy	Electro thermal networks for the analysis of power devices
9:10	M-N. Sabry¹, W. Fikry², Kh. Abdel Salam³, M.M. Awad¹, A.I. Nasser³ ¹ Mansoura U., Egypt ² Ain Shams U., Egypt ³ 10 th of Ramadan Techn. Inst., Egypt	Lumped Compact Transient Thermal Model of Self-Heating in MOSFETs
9:30	G. Breglio, N. Rinaldi, P. Spirito U. di Napoli "Federico II", Italy	3D dynamic electro-thermal simulator applied to a new cellular power MOS affected by Electro-Thermal instability
9:50	D.D.L. Wijngaards, E. Cretu, S.H. Kong, R.F. Wolffenbuttel	Modelling of integrated polySiGe Peltier elements

	Delft U. of Techn. / DIMES, The Netherlands	
10:10	Break	
10:40	Session 5 Chair: G. De Mey, U. Gent, Belgium	Thermal management I
10:40	P. Tadayon Intel Corporation, USA	Thermal Challenges During Microprocessor Testing
11:00	F. Blanc, F. Clermidy, T. Collette DEIN-CEA, Gif-sur-Yvette, France	Thermal Management impact in a fault-tolerant architecture
11:20	D. Copeland Showa Aluminum Corp., USA	Fundamental Performance Limits of Heatsinks
11:40	O. Karim¹, C. Gillot¹, C. Schaeffer¹, E. Gimet², S. Derou² ¹ LEGrenoble, Saint-Martin d'Hères, France ² PSA, Peugeot Citroën, Paris, France	Heat Sink Exchanger Dimensioning for Hybrid Vehicle Inverter
12:00	Lunch	
14:30	Session 6 Chair: D. Agonafer, IBM Corp., Poughkeepsie, USA	Thermal management II
14:30	M-N. Sabry Mansoura U., Egypt	Transverse Temperature Gradient Effect on Fin Efficiency for Micro-Channel Design
14:50	K. Nevelsteen, T. Persoons, M. Baelmans K.U.Leuven, Heverlee, Belgium	Heat transfer coefficients of forced convection cooled Printed Circuit Boards
15:10	J. Legierski, B. Wiecek TU of Łódź, Poland	Heat Pipes for Cooling Electronic Circuits
15:30	H. Chiueh, J. Draper, J. Choma Jr. U. of Southern California, USA	A Programmable Thermal Management Interface Circuit for PowerPC Systems
15:50	Break	
16:10	C.J.M. Lasance Philips Research Laboratories, Eindhoven, The Netherlands	The PROFIT project. On 1 January 2000, a new European project, nicknamed PROFIT, commenced as a successor to the successfully finished EC-funded projects DELPHI, SEED and THERMINIC. PROFIT is aimed at creating methods and tools that

	Chair: T. Reibe, European Commission, Brussels, Belgium	enable a sufficiently accurate measurement and prediction of temperature gradients in time and space, which is required for a more accurate and timely assessment of cost, performance, safety and reliability of electronic products in all stages of the product realisation process. This presentation will discuss its motivation, scope, objectives, advances over the state-of-the-art and the results achieved and expected in 2000.
17:00	Panel Moderator: <u>Y. Joshi</u>, U. of Maryland, USA Panelists: T. Baelmans, KU Leven, Belgium <u>D. Copeland</u> , Showa Aluminum, Japan <u>J. Parry</u> , Flomerics, UK <u>J. Rantala</u> , Nokia, Finland <u>C.J.M. Lasance</u> , Philips Research Laboratories, The Netherlands	The Status and Challenges in System Level Thermal Fluidic Modelling
19:00	Bus to dinner	
Wednesday 27 September 2000		
9:00	Half-day on compact models	
9:00	Chair: C.J.M. Lasance, Philips Research Laboratories, Eindhoven, The Netherlands Introduction: <u>J. Rantala</u>, Nokia, Helsinki, Finland This half-day is organized by the partners of the PROFIT European Project to discuss various issues dealing with compact models. A discussion time will follow the presentations of papers and demos.	
9:10	T. Franke Siemens, München, Germany	Thermal modelling of semiconductor packages
9:30	K. Van Damme¹, M. Baelmans¹, F. Christiaens², W. Nelemans² ¹ K.U. Leuven, Heverlee, Belgium ² Alcatel-Bell, Antwerp, Belgium	On the use of compact models for board level thermal simulations
9:50	E. Driessens¹, S. Van Dooren¹, B. Vandavelde¹, E. Beyne¹, M. Hereman², J. Van Puymbroeck² ¹ IMEC, Heverlee, Belgium ² Siemens, Oostkamp, Belgium	Parametric compact models for Polymer Stud Grid Array Assemblies

10:10	K. Van Damme, M. Baelmans K.U. Leuven, Heverlee, Belgium	Thermal modelling of welding power supplies with High Power Density in a CAE-environment
10:30	Break	
10:45	S. Djadoenath, P. Stehouwer Centre for Quantitative Methods, Eindhoven, The Netherlands	Creation and Validation of BCI Compact Thermal Models
10:55	J. Janssen¹, H. Pape², C.J.M. Lasance³ ¹ Philips Semiconductors, Nijmegen, The Netherlands ² Infineon, München, Germany ³ Philips Research Laboratories, Eindhoven, The Netherlands	Demonstration of the use of compact models
11:05	S. Van Dooren¹, E. Driessens¹, B. Vandeveld¹, E. Beyne¹, M. Hereman², J. Van Puymbroeck² ¹ IMEC, Heverlee, Belgium ² Siemens, Oostkamp, Belgium	Transient Thermal Characterization of the PSGA or Polymer Stud Grid Array
11:25	T. Hauck, T. Bohm Motorola, München, Germany	Thermal RC-Network Approach For Multichip Power Packages
11:45	Break	
12:00	C.J.M. Lasance Philips Research Laboratories, Eindhoven, The Netherlands	Two Benchmarks for the Study of Compact Thermal Modelling Phenomena
12:10	M. Rencz, V. Székely, E. Kollar BUTE, Budapest, Hungary	Measuring dynamic thermal multiport parameters of IC packages
12:30	Discussion	
13:00	Lunch	
14:30	Session 7 Chair: U. Dillner, IPHT, Jena Germany	Mems and sensors

14:30	Z. Vizváry¹, P. Fürjes², I. Bársony² ¹ BUTE, Budapest, Hungary ² Res. Inst. for Techn. Physics and Mat. Science, Budapest, Hungary	Three-Dimensional Finite Element Model For Thermomechanical Analysis Of Hotplates
14:50	V. Milanovi¹, M. Hopcroft², C.A. Zincke³, M. Zaghoul³, K.S.J. Pister¹ ¹ U. of California at Berkeley, USA ² Analog, Incorporated, of Sunnyvale, USA ³ The Washington U., USA	Modelling of Thermoelectric Effects in Planar Micromachined Structures Using SPICE
15:10	M. Kimura, Y. Gotoh Tohoku-Gakuin U., Tagajo, Miyagi, Japan	Transistor-Thermistor Made of a MOSFET
15:30	P. Fürjes¹, Z. Vizváry², M. Rácz¹, I. Barsony¹ ¹ Res. Inst. for Techn. Physics and Mat. Science, Budapest, Hungary ² BUTE, Budapest, Hungary	Temperature measurement in micro-filament heater
15:50	A. Poppe^{1,2}, G. Farkas¹, M. Rencz^{1,2}, Z. Benedek², L. Pohl², V. Székely², K. Torki³, S. Mir³, B. Courtois³ ¹ BUTE, Budapest, Hungary ² MicReD Ltd, Budapest, Hungary ³ TIMA Laboratory, Grenoble, France	Design of a scalable multi-functional thermal test die with direct and boundary scan access for programmed excitation and measurement data acquisition
16:10	Closing remarks	

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