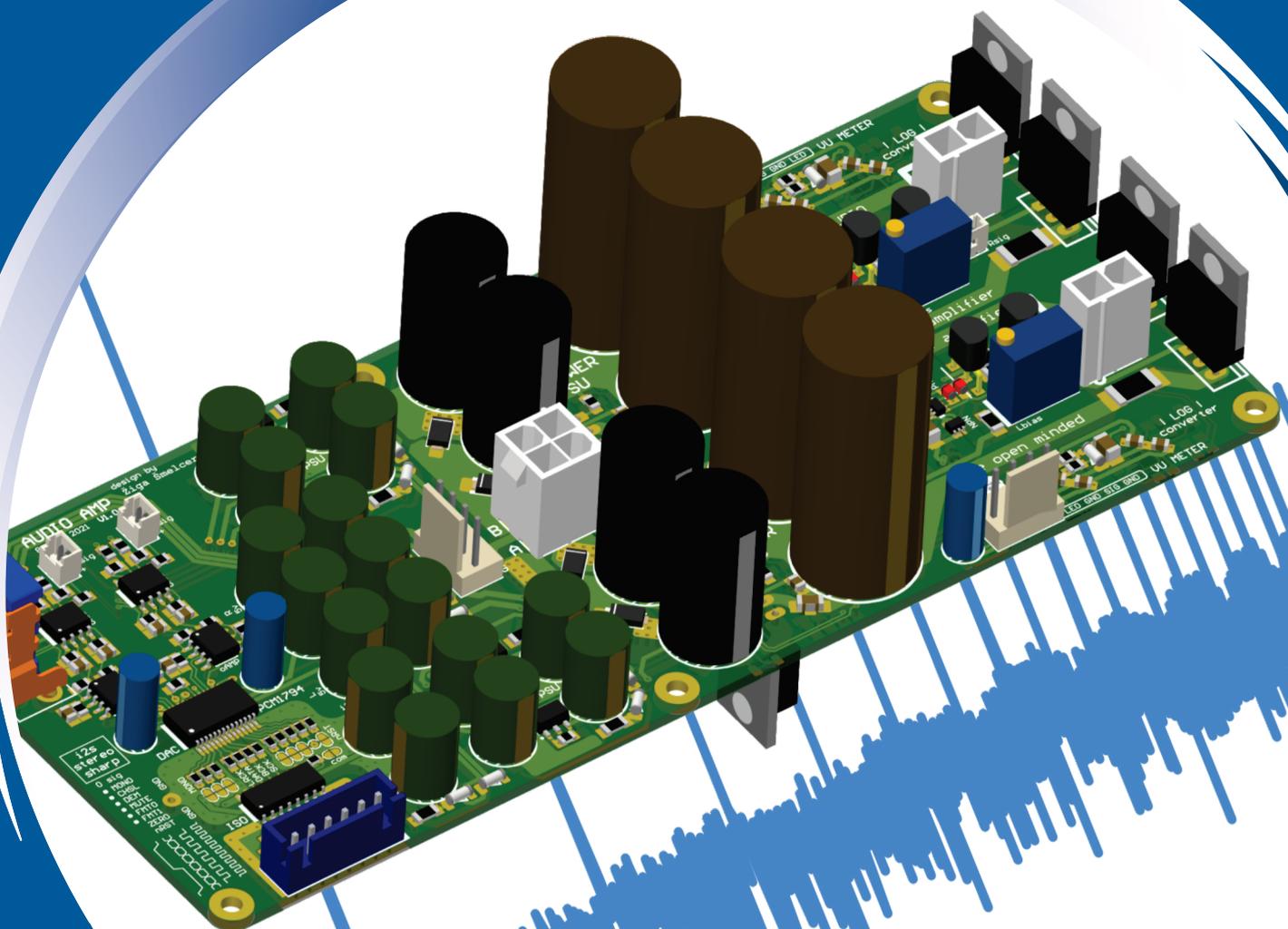


ISSN 0352-9045

Informacije MIDEM

*Journal of Microelectronics,
Electronic Components and Materials*
Vol. 52, No. 2(2022), June 2022

*Revija za mikroelektroniko,
elektronske sestavne dele in materiale*
letnik 52, številka 2(2022), Junij 2022



Informacije MIDEM 2-2022

Journal of Microelectronics, Electronic Components and Materials

VOLUME 52, NO. 2(182), LJUBLJANA, JUNE 2022 | LETNIK 52, NO. 2(182), LJUBLJANA, JUNIJ 2022

Published quarterly (March, June, September, December) by Society for Microelectronics, Electronic Components and Materials - MIDEM.
Copyright © 2022. All rights reserved. | Revija izhaja trimesečno (marec, junij, september, december). Izdaja Strokovno društvo za mikroelektroniko, elektronske sestavne dele in materiale – Društvo MIDEM. Copyright © 2022. Vse pravice pridržane.

Editor in Chief | Glavni in odgovorni urednik

Marko Topič, University of Ljubljana (UL), Faculty of Electrical Engineering, Slovenia

Editor of Electronic Edition | Urednik elektronske izdaje

Kristijan Brecl, UL, Faculty of Electrical Engineering, Slovenia

Associate Editors | Odgovorni področni uredniki

Vanja Ambrožič, UL, Faculty of Electrical Engineering, Slovenia

Arpad Bürmen, UL, Faculty of Electrical Engineering, Slovenia

Danjela Kuščer Hrovatin, Jožef Stefan Institute, Slovenia

Matija Pirc, UL, Faculty of Electrical Engineering, Slovenia

Franc Smole, UL, Faculty of Electrical Engineering, Slovenia

Matjaž Vidmar, UL, Faculty of Electrical Engineering, Slovenia

Editorial Board | Uredniški odbor

Mohamed Akil, ESIEE PARIS, France

Giuseppe Buja, University of Padova, Italy

Gian-Franco Dalla Betta, University of Trento, Italy

Martyn Fice, University College London, United Kingdom

Ciprian Iliescu, Institute of Bioengineering and Nanotechnology, A*STAR, Singapore

Marc Lethiecq, University of Tours, France

Teresa Orłowska-Kowalska, Wrocław University of Technology, Poland

Luca Palmieri, University of Padova, Italy

Goran Stojanović, University of Novi Sad, Serbia

International Advisory Board | Časopisni svet

Janez Trontelj, UL, Faculty of Electrical Engineering, Slovenia - Chairman

Cor Claeys, IMEC, Leuven, Belgium

Denis Donlagić, University of Maribor, Faculty of Elec. Eng. and Computer Science, Slovenia

Zvonko Fazarinc, CIS, Stanford University, Stanford, USA

Leszek J. Golonka, Technical University Wrocław, Wrocław, Poland

Jean-Marie Haussonne, EIC-LUSAC, Octeville, France

Barbara Malič, Jožef Stefan Institute, Slovenia

Miran Mozetič, Jožef Stefan Institute, Slovenia

Stane Pejovnik, UL, Faculty of Chemistry and Chemical Technology, Slovenia

Giorgio Pignatelli, University of Perugia, Italy

Giovanni Soncini, University of Trento, Trento, Italy

Iztok Šorli, MIKROIKS d.o.o., Ljubljana, Slovenia

Hong Wang, Xi'an Jiaotong University, China

Headquarters | Naslov uredništva

Uredništvo Informacije MIDEM

MIDEM pri MIKROIKS

Stegne 11, 1521 Ljubljana, Slovenia

T. +386 (0)1 513 37 68

F. + 386 (0)1 513 37 71

E. info@midem-drustvo.si

www.midem-drustvo.si

Annual subscription rate is 160 EUR, separate issue is 40 EUR. MIDEM members and Society sponsors receive current issues for free. Scientific Council for Technical Sciences of Slovenian Research Agency has recognized Informacije MIDEM as scientific Journal for microelectronics, electronic components and materials. Publishing of the Journal is cofinanced by Slovenian Research Agency and by Society sponsors. Scientific and professional papers published in the journal are indexed and abstracted in COBISS and INSPEC databases. The Journal is indexed by ISI® for Sci Search®, Research Alert® and Material Science Citation Index™.

Letna naročnina je 160 EUR, cena posamezne številke pa 40 EUR. Člani in sponzorji MIDEM prejema posamezne številke brezplačno. Znanstveni svet za tehnične vede je podal pozitivno mnenje o reviji kot znanstveno-strokovni reviji za mikroelektroniko, elektronske sestavne dele in materiale. Izdajo revije sofinancirajo ARRS in sponzorji društva. Znanstveno-strokovne prispevke objavljene v Informacijah MIDEM zajemamo v podatkovne baze COBISS in INSPEC. Prispevke iz revije zajema ISI® v naslednje svoje produkte: Sci Search®, Research Alert® in Materials Science Citation Index™.

Design | Oblikovanje: Snežana Madič Lešnik; Printed by | tisk: Biro M, Ljubljana; Circulation | Naklada: 1000 issues | izvodov; Slovenia Taxe Percue | Poštnina plačana pri pošti 1102 Ljubljana

Content | Vsebina

Original scientific papers

Izvirni znanstveni članki

G. N. Pandurengan, V. Krishnasamy, J. S. M. Ali, D. Almakhlles: Five-Level Transformerless Common Ground Type Inverter with Reduced Device Count	71	G. N. Pandurengan, V. Krishnasamy, J. S. M. Ali, D. Almakhlles: Petstopenjski pretvornik brez transformatorja s skupno ozemljitvijo in manjšim številom naprav
Y. Wang, X. Su, X. Jin, H. Yang, Z. Zhou: Design, Fabrication and Measurement of LDNMOS- SCR Devices with Appropriate ESD Protection Window for 18V HV CDMOS Process	83	Y. Wang, X. Su, X. Jin, H. Yang, Z. Zhou: Načrtovanje, izdelava in merjenje naprav LDNMOS- SCR z ustreznim zaščitnim oknom ESD za 18V HV proces CDMOSI
K. Arunachalam, M. Perumalsamy: Programmable implementation of time- area-efficient Elliptic Curve Cryptography for entity authentication	89	K. Arunachalam, M. Perumalsamy: Programirljivo izvajanje časovno učinkovite kriptografije eliptičnih krivulj za avtentikacijo entitet
R. Mishra, G. R. Mishra, S. O. Mishra , M. Faseehuddin: Electronically Tunable Mixed Mode Universal Filter Employing Grounded Passive Components	105	R. Mishra, G. R. Mishra, S. O. Mishra , M. Faseehuddin: Elektronsko nastavljen univerzalni filter mešanega načina z ozemljenimi pasivnimi komponentami
Ž. Šmelcer, A. Sešek: A Low Distortion Audio Amplifier	117	Ž. Šmelcer, A. Sešek: Avdio ojačevalnik z nizkim popačenjem
J. Balent, F. Smole, M. Topič, J. Krč: Analysis of effects of dangling-bond defects in doped a-Si:H layers in heterojunction silicon solar cells with different electron affinities of ITO contacts	129	J. Balent, F. Smole, M. Topič, J. Krč: Numerična analiza učinkov defektov bingljajočih vezi v dopiranih plasteh iz a-Si:H v heterospojnih silicijevih sončnih celicah s kontakti ITO z različnimi elektronskimi afinitetami
Announcement and Call for Papers: 57 th International Conference on Microelectronics, Devices and Materials With the Workshop on Energy Harvesting: Materials and Applications	143	Napoved in vabilo k udeležbi: 57. mednarodna konferenca o mikroelektroniki, napravah in materialih z delavnico o zbiranju energije: materiali in uporaba
Front page: Physical realization of a low distortion audio amplifier (Ž. Šmelcer et al.)		Naslovnica: Fizična izvedba avdio ojačevalnika z nizkim popačenjem (Ž. Šmelcer et al.)

MIDEM 2022

57th INTERNATIONAL CONFERENCE ON MICROELECTRONICS, DEVICES AND MATERIALS WITH THE WORKSHOP ON ENERGY HARVESTING: MATERIALS AND APPLICATIONS

September 14th – September 16th, 2022
Hotel City, Maribor, Slovenia

Announcement and Call for Papers

Chairs:

Prof. Dr. Tadej Rojac
Assist. Prof. Dr. Mojca Otoničar

IMPORTANT DATES

Abstract submission deadline:

May 1, 2022

Acceptance notification:

June 15, 2022

Full paper submission deadline:

July 31, 2022

Invited and accepted papers will be published in the Conference Proceedings.

Detailed and updated information about the MIDEM Conferences, as well as for paper preparation can be found on

<http://www.midem-drustvo.si//>

GENERAL INFORMATION

The 57th International Conference on Microelectronics, Devices and Materials with the Workshop on Energy harvesting: materials and applications continues a successful tradition of the annual international conferences organised by the MIDEM Society, the Society for Microelectronics, Electronic Components and Materials. The conference will be held in **Hotel City, Maribor, Slovenia** from **SEPTEMBER 14th – 16th, 2022**.

Topics of interest include but are not limited to:

- Energy harvesting: modelling, materials, devices,
- Novel monolithic and hybrid circuit processing techniques,
- New device and circuit design,
- Process and device modelling,
- Semiconductor physics,
- Sensors and actuators,
- Electromechanical devices, microsystems and nanosystems,
- Nanoelectronics,
- Optoelectronics,
- Photovoltaic devices,
- Electronic materials science and technology,
- New electronic materials and applications,
- Materials characterization techniques,
- Reliability and failure analysis,
- Education in microelectronics, devices and materials.

ORGANIZER:

MIDEM Society - Society for Microelectronics, Electronic Components and Materials, Slovenia

CO-ORGANIZER:

Republic of Slovenia, Ministry of Economic Development and Technology
European Union, European Regional Development fund

CONFERENCE SPONSORS: UL FE, UL FS, IJS, IMAPS, Slovenia Chapter;
IEEE, Slovenia Section



Boards of MIDEM Society | Organi društva MIDEM

MIDEM Executive Board | Izvršilni odbor MIDEM

President of the MIDEM Society | Predsednik društva MIDEM

Prof. Dr. Barbara Malič, Jožef Stefan Institute, Ljubljana, Slovenia

Vice-presidents | Podpredsednika

Prof. Dr. Janez Krč, UL, Faculty of Electrical Engineering, Ljubljana, Slovenia

Dr. Iztok Šorli, Mikroiks d.o.o., Ljubljana, Slovenia

Secretary | Tajnik

Olga Zakrajšek, UL, Faculty of Electrical Engineering, Ljubljana, Slovenia

MIDEM Executive Board Members | Člani izvršilnega odbora MIDEM

Prof. Dr. Slavko Bernik, Jožef Stefan Institute, Slovenia

Assoc. Prof. Dr. Miha Čekada, Jožef Stefan Institute, Ljubljana, Slovenia

Prof. DDr. Denis Donlagić, UM, Faculty of Electrical Engineering and Computer Science, Maribor, Slovenia

Prof. Dr. Leszek J. Golonka, Technical University, Wroclaw, Poljska

Prof. Dr. Vera Gradišnik, Tehnički fakultet Sveučilišta u Rijeci, Rijeka, Croatia

Mag. Leopold Knez, Iskra TELA, d.d., Ljubljana, Slovenia

Mag. Mitja Koprivšek, ETI Elektroelementi, Izlake, Slovenia

Asst. Prof. Dr. Gregor Primc, Jožef Stefan Institute, Ljubljana, Slovenia

Prof. Dr. Janez Trontelj, UL, Faculty of Electrical Engineering, Ljubljana, Slovenia

Asst. Prof. Dr. Hana Uršič Nemevšek, Jožef Stefan Institute, Ljubljana, Slovenia

Dr. Danilo Vrtačnik, UL, Faculty of Electrical Engineering, Ljubljana, Slovenia

Supervisory Board | Nadzorni odbor

Prof. Dr. Franc Smole, UL, Faculty of Electrical Engineering, Ljubljana, Slovenia

Prof. Dr. Drago Strle, UL, Faculty of Electrical Engineering, Ljubljana, Slovenia

Igor Pompe, retired

Court of honour | Častno razsodišče

Darko Belavič, Jožef Stefan Institute, Ljubljana, Slovenia

Dr. Miloš Komac, retired

Dr. Hana Uršič Nemevšek, Jožef Stefan Institute, Ljubljana, Slovenia

Informacije MIDE

Journal of Microelectronics, Electronic Components and Materials

ISSN 0352-9045

Publisher / Založnik:

MIDEM Society / Društvo MIDE

Society for Microelectronics, Electronic Components and Materials, Ljubljana, Slovenia

Strokovno društvo za mikroelektroniko, elektronske sestavne dele in materiale, Ljubljana, Slovenija

www.midem-drustvo.si