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## FOREWORD

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### Special Section on Analog Circuits and Their Application Technologies

The concept of IoT (Internet of Things) can be recognized as a technology to build a super smart society enabled with over 1 trillion sensors connected to the internet, and it becomes fundamental in the current and future information and communication systems along with AI. The total market of IoT is expected over 5 trillion dollars in 2035, and its economical ripple effect has strong impacts to IC industries especially in analog products for sensing, such as amplifiers, filters, and AD converters (ADC), and wireless/wireline communications. The productization of current systems including steps of PoC (proof of concept) and PoB (proof of Business) strongly demands the short TAT (turn-around-time) development for electronics systems, and consequently, design approach using off-the-shelf devices is becoming more important. By taking account of this technology trend, the editorial committee has changed the title of the special section from “Analog Circuits and Related SoC Integration” to “Analog Circuits and Their Application Technologies” to encourage submissions designed by various application-oriented approaches including the off-the-shelf designs.

Here, we are happy to publish this special section illustrating analog circuit innovations in the fields of IoT, medical/bioelectronics and high-speed wireless communications. This year’s special section includes two invited papers and ten submitted papers. The first invited paper, entitled “Transmission Line Coupler: High-Speed Interface for Non-contact Connector,” presents theoretical analysis and design guidelines of TLC with measurement results showing the contribution to each application, which are very helpful in the field of high-speed interface design. The second invited paper, entitled “Advances in Voltage-Controlled-Oscillator-Based  $\Delta\Sigma$  ADCs,” summarizes broad and informative review of VCO-based delta-sigma ADCs with very insightful view of thorough variety of VCO-based architecture and circuit topology of the ADC, and also covers usage of VCOs for other analog key blocks for future applications.

The ten submitted papers present various aspects in analog circuit design. The seven regular papers include subjects of a type-I digital ring-based PLL, an area-efficient physical random number generator, an integrated ambient light sensor system for LTPS TFT-LCDs, a digital frequency discriminator IC, a non-ideal issues analysis in a shaping SAR ADC, a design method of a standard-cell-based amplifier, and an impact of stacking on-chip inductor on power/ground network. Three brief papers present a ReRAM-based memory architecture for convolutional neural networks, both FSK transceiver and receiver for energy-budget-unbalanced application, and a supply modulated OOK transmitter for CGM contact lens.

On behalf of the editorial committee of this special section, I would like to express our sincere appreciation to all the authors of the submitted papers. I would also like to thank all the reviewers and all the committee members of this special section for their important contributions to the editorial work. Finally, I would like to thank professor Noriyuki Miura and Dr. Yasumoto Tomita for their extensive work as guest editors.

#### Guest Associate Editors:

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Masao Ito (Renesas Electronics), Guest Editor-in-Chief

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**Masao Ito** (*Member*) received his B.E. degree in electric and electronics engineering from Kobe University, Kobe, Japan, in 1989. He joined the LSI Laboratory, Mitsubishi Electric Corporation, Japan in 1989. He has been engaged in research and development of analog and mixed-signal circuits including Instrumental Amplifier, A/D, D/A and R/D converters, etc. at Mitsubishi Electric Corporation from 1989 to 2002, Advanced Analog Technology Division, Renesas Technology Corporation, Japan, from 2003 to 2009, Mixed Signal Core Development Division, Renesas Electronics Corporation, Japan, from 2010 to 2014, Elemental Technology Development Division, Renesas System Design Co.,Ltd., Japan, from 2015 to 2016, and Shared R&D Division, Renesas Electronics Corporation from 2017. He was a technical committee member of Symposium on VLSI Circuits from 2006 to 2017 and has been an editorial committee member of Special Section on Analog Circuits and their Application Technologies of IEICE Transactions on Electronics from 2003.

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