

PROGRAM

1999 IEEE Workshop on Charge-Coupled Devices and Advanced Image Sensors

Thursday, June 10

8:30 am	Opening Remarks	N. Teranishi J. Nakamura	
Session 1.	CCD Image Sensors (I)	Chairman N. Teranishi (NEC)	
8:45 am	A 2/3-in. 2,200k-pixel FIT-CCD for DTV 1080i		1
R1	S. Suzuki, T. Yamaguchi, T. Torikai, N. Iwawaki, M. Yamanaka, K. Hirata, H. Tanaka, K. Yokozawa, M. Tamura and T. Imanishi CCD Division, Matsushita Electronics Corporation, Japan		
9:10	BCD-A New High Performance Nondestructive Charge Detection Concept for		5
R2	CCD Image Sensors J. Hyneczek and H. Shibuya* ISETEX Inc, U.S.A. *Texas Instruments Japan Limited, Japan		
9:35	Influence of Sensor Settings and Doping Profile on Dark Current in FT-CCD's		9
R3	H. O. Folkerts, A. Heringa, H. Peek, D. Verbugt and L. Korthout Philips Semiconductors Image Sensors, The Netherlands		
10:00	Dynamic Range Improvement by Narrow-Channel Effect Suppression and		13
R4	Smear Reduction Technologies in Small Pixel IT-CCD Image Sensors A. Tanabe, Y. Kudoh, Y. Kawakami, K. Masubuchi, S. Kawai, T. Yamada, M. Morimoto*, K. Arai, K. Hatano**, M. Furumiya**, Y. Nakashiba**, N. Mutoh, K. Orihara and N. Teranishi Silicon Systems Research Labs., NEC, Japan *System Micro Division, NEC, Japan **ULSI Device Development Labs. NEC, Japan		
10:25	COFFEE BREAK		

Session 2. CMOS Image Sensors (I)		
Chairman J. Nakamura (Olympus)		
10:55 am	256 x 256 Pixel CMOS Imager with Linear Readout and 120dB Dynamic Range	17
R5	M. Schanz, C. Nitta, T. Eckart, B. J. Hosticka and R. Wertheimer* Fraunhofer Institute of Microelectronic Circuits and Systems, Germany *Center of Research and Engineering, BMW, Germany	
11:20	692 x 504 CMOS APS Imager with Extended Dynamic Range and On-Chip 12-bit ADC	WITHDRAWN
R6	G. W. Hughes, N. J. McCaffrey, D. S. Sauer*, F-L. Hsueh, P. A. Levine, and F. S. Pantuso Sarnoff Corporation, U.S.A.	
11:45	A 1/3" VGA CMOS Imaging System on a Chip	21
R7	S. Agwani, R. Cichomski, M. Gorder, A. Niederkorn, M. Skow and K. Wanda Digital DNA Systems Architecture Laboratory, Motorola Inc., U.S.A.	
12:10	Low Dark Current Pinned Photo-Diode for CMOS Image Sensor	25
R8	I. Inoue, H. Ihara, H. Yamashita, T. Yamaguchi, H. Nozaki and R. Miyagawa Microelectronics Eng. Lab., Toshiba Corp., Semiconductor Company, Japan	
12:10	LUNCH	
Session 3. CMOS Image Sensors (II)		
Chairman B. Dierickx (IMEC)		
1:50 pm	A Smart CMOS Imager with On-Chip High-Speed Windowed Centroiding Capability	29
R9	C. Sun, G. Yang, C. Wrigley, O. Y. Pecht* and B. Pain Center for Space Microelectronics Technology, JPL, U.S.A. *Electrical and Computer Eng. Dept., Ben-Gurion University, Israel	
2:15	Time-Domain Correlation Image Sensor: First CMOS Realization of Demodulator Pixels Array	33
R10	S. Ando and A. Kimachi Dept. Mathematical Eng. and Information Physics, Univ. of Tokyo, Japan	

2:40	Spatially Variant Flexible Sampling Control Integrated on a Sensor Focal Plane	37
R11	Y. Ohtsuka, T. Hamamoto and K. Aizawa Dept. Electrical Engineering, University of Tokyo, Japan	
3:05	Image Transmission with a Retina-Like CMOS Camera	41
R12	G. Sandini, P. Questa*, A. Mannucci*, F. Ciciani*, D. Scheffer**, and B. Dierickx** LIRA-Lab, DIST, University of Genova, Italy *Unitek Consortium, Italy **IMEC-Leuven, Belgium	
3:30	COFFEE BREAK	
Session 4.	Poster Session	
	Chairman J. Hynecek (ISETEX) K. Orihara (NEC)	
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P1	F. Andoh, M. Nakayama, H. Shimamoto and Y. Fujita* Science & Technical Research Laboratories, NHK, Japan *Engineering Administration Department, NHK, Japan	
4:05	A 128 x 128 Photo-Gate CMOS-APS with 10-bit Successive Approximation ADC	52
P2	J. Solhusvik, J. Bjornsen* and S. Eikedal* Electronic Systems Dept., ABB, Norway *Physical Electronics Dept., NTNU, Norway	WITHDRAWN
4:10	CMOS APS with Autoscaling and Customized Wide Dynamic Range	48
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P4	M. Sasaki, S. Kawahito* and Y. Tadokoro* Sendai National College of Technology, Japan *Toyohashi University of Technology, Japan	

4:20 P5	<p>An a-Se HARP Layer for a Solid-State Image Sensor</p> <p>W. D. Park, Y. Takiguchi*, M. Kosugi*, M. Kubota*, Y. Ohkawa*, K. Miyakawa*, S. Suzuki*, K. Shidara*, K. Tanioka*, A. Kobayashi**, and T. Hirai**</p> <p>Dongyang University, Korea</p> <p>*Science and Technical Research Laboratories, NHK, Japan</p> <p>**Hamamatsu Photonics K.K., Japan</p>	56
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4:30 P7	<p>A Vertically Integrated High Resolution Active Pixel Image Sensor for Deep Submicron CMOS Processes</p> <p>S. Benthien*, M. Wagner*, M. Verhoeven*, M. Bohm* **, B. Schneider**, B. van. Uffel*** and F. Librecht***</p> <p>*Silicon Vision GmbH, Germany</p> <p>**IHE, Universitat-GH Siegen, Germany</p> <p>***AGFA Gevaert N.V., Belgium</p>	64
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4:40 P9	<p>128 x 64 Pixels Adaptive-Integration-Time Image Sensor</p> <p>T. Hamamoto, Y. Ino and K. Aizawa*</p> <p>Dept. of Elec. Eng., Science University of Tokyo, Japan</p> <p>*Dept. of Elec. Eng., University of Tokyo, Japan</p>	72
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4:50 P11	<p>Design and Simulation of a CMOS Sensor Array</p> <p>Z. J. Wang and H. L. Kwok</p> <p>Dept. of Electrical and Computer Engineering, University of Victoria, Canada</p>	80

4:55	A Passive Photodiode Pixel with Memory	84
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P19	K. Sawada, S. Mimura*, K. Tomita*, T. Nakanishi*, H. Tanabe*, M. Ishida, and T. Ando** Dept. of Electrical and Electronic Eng., Toyohashi Univ. of Technology, Japan *HORIBA, Ltd., Japan **Research Institute of Electronics, Japan	

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6:00 P25	A Family of High Performance TDI Image Sensors G. Weale, C. Flood, M. Ledgerwood, J. G. Mihaychuk, S. Kamasz, H. Siefken, D. Deering and G. Ingram DALSA Inc., Canada	134
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6:10 pm -9:00 pm **POSTER VIEWING, RECEPTION**

Friday, June 11

Session 5. CMOS Image Sensors (III)

Chairman P. Wong (IBM)

8:15 am **Analysis and Enhancement of Low-Light-Level Performance of Photodiode-** 140
R13 **type CMOS Active Pixel Imagers Operated with Sub-Threshold Reset**
B. Pain, G. Yang, M. Ortiz, C. Wrigley, B. Hancock and T. Cunningham
Jet Propulsion Laboratory, California Institute of Technology, U.S.A.

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R14 O. B. Kwon*, K. N. Park*, D. Y. Lee*, K. J. Lee*, S. C. Jun*, C. K. Kim*, J. W.
Eom*, A. S. Choi*, Y. B. Lee* and W. Yang* **
*Image Sensor Dev. System I-C R&D, Hyundai Electronics Inc, Korea
**Harvard University, U.S.A.

9:05 **A Low-Light to Sunlight, 60 Frames/s, 80k Pixel CMOS APS Camera-on-a-** 148
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S. L. Barna, L. P. Ang, B. Mansoorian and E. R. Fossum
Photobit Corp., U.S.A.

9:30 **A Linear-Response, High-Dynamic Range CMOS Imager Suitable for** 151
R16 **Spectroscopic Applications**
D. Qian and W. Yang
Division of Engineering and Applied Sciences, Harvard University, U.S.A.

9:55 COFFEE BREAK

Session 6. Non-Visible Image Sensors

Chairman D. McGrath (MIT)

10:25 am **Current Skimming-Based CMOS Readout Architectures for Quantum Well** 155
R17 **Infrared Photodetectors**
C. Friedman, A. Arbel and R. Ginosar
VLSI Systems Research Center, Israel Institute of Technology, Israel

10:50 R18	A Stacked CMOS APS for Charge Particle Detection and its Noise Performance I. Takayanagi, J. Nakamura, H. Yurimoto*, T. Kunihiro*, K. Nagashima*, and K. Kosaka** Olympus Optical Co., Ltd., Japan *Tokyo Institute of Technology, Japan **Tokyo Technology, Inc., Japan	159
11:15 R19	Charge Loss in the Channel Stop Regions of the X-ray CCD G. Prigozhin, M. Pivovarov, S.Kissel, M. Bautz and G. Ricker Center for Space Research, MIT, U.S.A.	163
11:40 R20	A Partially Overlapped X-ray Imaging Pixel with Low Leakage and High Sensitivity B. Park and A. Nathan Electrical and Computer Engineering Dept., University of Waterloo, Canada	167
12:05 R21	A Model for Object Detectability Close to Defective Columns in X-Ray Imaging Arrays R. Dyck and M. Sayag Lockheed Martin Fairchild Systems, U.S.A.	WITHDRAWN
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Session 7.	Large Format Image Sensors Chairman R. Bredthauer (Semiconductor Tech. Associates) T. Kuroda (MEC)	
1:45 pm R22	Performance Characteristics of a 9216 x 9216 Pixel CCD D. Wen, R. Bredthauer, P. Bates, P. Vu and R. Potter Lockheed Martin Fairchild Systems, U.S.A.	171
2:10 R23	An 8M-CCD for an Ultra High Definition TV Camera C. Smith, M. Farrier, K. Mitani*, Q. Tang and G. Ingram DALSA Inc., Canada *NHK, Japan	175

2:35	Large Format CCD Image Sensors Fabricated on High Resistivity Silicon	179
R24	S. E.Holland, D. E. Groom, M. E. Levi, N. P. Palaio, S. Perlmutter, R. J. Stover* and M. Wei* Lawrence Berkeley National Laboratory, University of California, U.S.A. *Lick Observatory, University of California Observatories, U.S.A.	
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R25	J. Tandon Xerox Corporation, U.S.A	
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	Chairman O. Yadid-Pecht (Ben-Gurion Univ. of Negav) T. Tanioka (NHK)	
3:55 pm	First Multispectral Diode Color Imager with Three Color Recognition and	187
R26	Color Memory in Each Pixel M. Sommer*, P. Rieve*, M. Verhoeven*, M. Bohm* **, B. Schneider**, B. van. Uffel*** and F. Librecht*** *Silicon Vision GmbH, Germany **IHE, Universitat-GH Siegen, Germany ***Agfa-Gevaert N.V., Belgium	
4:20	Self-Calibrating Logarithmic CMOS Image Sensor with Single Chip Camera	191
R27	Functionality M. Loose, K. Meier and J. Schemmel IHEP, Heidelberg University, Germany	
4:45	A Novel CMOS-APS Configuration with an Extremely Low Fixed Pattern	195
R28	Noise T. I. Watanabe Corporate Research Labs., Fuji Xerox Co., Ltd., Japan	
5:10	CCD Requirements for Digital Photography	199
R29	R. L. Baer Hewlett-Packard Laboratories, U.S.A.	

5:35 **Test Methodologies for Digital CMOS Camera-on-a-Chip Image Sensors** 239
R30 G. Waligorski, M. B. Kaplinsky, V. Berezin and E. R. Fossum
 Photobit Corporation, U.S.A.

Session 9. Discussion Session

Chairman E. Fossum (Photobit)

6:10 pm -7:20 pm

7:20 pm -9:30 pm DINNER

Saturday, June 12

Session 10. Walter Kosonocky Award

Chairman Albert Theuwissen (Philips)

8:15 am -8:45 am **Walter Kosonocky Award Presentation**

Session 11. CMOS Image Sensors (V)

Chairman P. Denyer (VVL)

8:45 am **Area Auto Focus CMOS Sensor** 203
R31 H. Takahashi, T. Ezaki, M. Shinohara, S. Furudate, H. Nakamura, T. Ichise,
 and S. Sugawa
 Device Development Center, Canon Inc., Japan

9:10 **On Chip Focal Plane Filtering for CMOS Imagers** 207
R32 J. Huppertz, T. Kneip, M. Schwarz and B. J. Hosticka
 Fraunhofer Institute of Microelectronic Circuits and Systems, Germany

9:35 **CMOS Image Sensor Overlaid with a HARP Photoconversion Layer** 211
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 Y. Ishiguro, T. Hayashida M. Kosugi, H. Kokubun, T. Watanabe and M. Abe
 NHK Science and Technical Research Laboratories, Japan

10:00	LARS II -A High Dynamic Range Image Sensor with a-Si:H Photo Conversion Layer	215
R34	T. Lule*, H. Keller*, M. Wagner* and M. Bohm* ** *Silicon Vision GmbH, Germany **IHE, Universitat-GH Siegen, Germany	
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Session 12.	CCD Image Sensors (II)	
	Chairman K. Yonemoto (Sony) N. Mutoh (NEC)	
10:55 am	Performance of FT-CCD Image Sensor with Single Layer Poly-Silicon Electrode	219
R35	Y. Okada, Y. Ohtsuru, S. Izawa, N. Taino and M. Hamada CCD Development Dept., MOS-LSI Division, SANYO Electric Corp., Japan	
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R37	H. Peek, D. Verbugt, H. Stoldt and A. D. Veirman Philips Semiconductors Image Sensors, The Netherlands	
12:10	1/2" 2Mpixel Full Frame CCD Sensor for Digital Photography	231
R38	Z. Pektas, J. Toker and S. Bencuya Image Sensor Technology Division, Polaroid Corporation, U.S.A.	
12:35	A 1/4-inch 630k-pixel IT-CCD Image Sensor with High-Speed Capture Capability	235
R39	M. Kimura, H. Yoshida, I. Hirota, A. Yamamoto, K. Ezoe, Y. Okazaki, Y. Takamura, H. Mori* and Y. Fujita* Semiconductor Company, SONY Corporation, Japan *SONY Kokubu Corporation, Japan	
13:00	CLOSING REMARKS	