INDEPENDENTLY ADDRESSABLE MICROBAND ELECTRODES

MICROBAND DEVICES	Line and Space, Digit Length	Designs	Conductor
IAIME 0505.3 SERIES	5 microns, 3 mm long	10 bands	Au, Pt, ITO
IAME 2004.3 SERIES	20 microns, 3 mm long	4 bands	Au, Pt, ITO
IAME 1504.3 SERIES	15 microns, 3 mm long	4 bands	Au, Pt, ITO
IAME 1004.3 SERIES	10 microns, 3 mm long	4 bands	Au, Pt, ITO
IAME 0504.3 SERIES	5 microns, 3 mm long	4 bands	Au, Pt, ITO

ABTECH -- Chemical and biological sensor devices, instruments, and sensor systems.

■ **Independently Addressable Microband Electrodes (IAIMEs and IAMEs)** are inert, array microelectrodes formed from patterned noble metals sputter-deposited onto an insulating substrate chip. Microfabricated from magnetron sputter-deposited gold, e-gun vapor-deposited platinum or indium tin oxide, they are designed for: i) Electrical cell impedance and cell mobility studies, ii) Characterization of the electrical and optical properties of thin polymeric films and coatings, iii) Electrochemical applications in microelectrochemistry, iv) Electrical / electrochemical impedance spectroscopy, and v) Chemical and biological sensor development. ■ **IAIMEs** are designed with a total of ten (10) independently addressable microbands with five alternating bands and each interdigitated from opposing sides. ■ **Microbands** of IAIME chips are 5 microns wide and 3 mm long with a band spacing of 5 microns wide. IAIME chips are available in gold, platinum and indium tin oxide. ■ **IAMEs** are designed with a total of four (4) independently addressable microband electrodes. ■ **Microbands** and spacings of IAME chips are available in 5, 10, 15, and 20 μm wide and 3 mm long. IAME chips are available in gold, platinum and indium tin oxide. ■ **Investigate** the four-point electrical conductivity and chemoresistive responses of transducer-active, polymeric films in the same electrode configuration, the same test environment, and on the same sample film. ■ **In research and product development**, these devices are widely used for conductimetric, chemoresistive chemical and biological sensors using electrically conducting (electroconductive) polymers, for impedance sensors based on Langmuir-Blodgett or adsorbed polyelectrolyte thin films, for studying the environmental effects on polymer thin films, and in modern micro-electrochemistry. ■ **Develop** these devices into products where the application requires a compact, durable and versatile chemical or biological chemoresistive sensor of low cost.

■ Introduction

Independently Addressable Microband Electrodes (IAMEs) is the registered trade name for a family of devices developed by ABTECH. Also available in an interdigitated array, IAIMEs, these devices are microfabricated (using microelectronics fabrication techniques) from patterns of noble metals deposited on an insulating substrate chip. They are designed for cell motility studies, the simultaneous interrogation of the electrical, electrochemical, and optical properties of thin polymeric films and coatings, for applications in microelectrochemistry, and for electrical/electrochemical impedance spectroscopy.

■ Applications

Applications of IAMEs in research and product development include:

✓ Cell mobility testing: Study the chemotactic response of cells as they migrate across an interdigitated pattern of independently addressable electrodes.[1]

✓ Electro-chromatography: Voltage induced separation of biomolecules as they flow over the electrodes.

✓ Electrical and Electrochemical Impedance Spectroscopy of organic thin films and coatings[3].

✓ Capacitance probes and humidity sensors, e.g. based on Langmuir-Blodgett films[4].

✓ Modern microelectrochemistry: Generator-collector electrochemistry[5].

✓ Four-point electrical conductimetry: Determine the conductivity of thin films cast onto the four parallel microbands.

Coatings

Films or coatings may be applied to the IAME device may be achieved by dip coating, spin casting, spray painting, air-brushing, brush painting, by Langmuir-Blodgett thin film deposition, by electropolymerization, and by molecular self assembly.

Application Notes

For further information, request Application Notes:

IAME1 – *Independently Addressable Microband Electrodes: Applications and References.*

Technical Specifications

Substrate:	Schott D263 Borosilicate Glass				
	Dielectric Constant, ε_r, at 1 MHz	6.7			
	Dielectric Loss Angle, tan δ, at 1 MHz	61×10^{-4}			
	Electrical Resistivity (50 Hz) (250 °C)	1.6×10^{8} Ω cm			
	Coefficient of Linear Thermal Expansion α, 20-300 °C	7.2×10^{-6} K^{-1}			
	Refractive Index at 20°C, n_e ($\lambda = 546.1$ nm)	1.5249			
Metallization:	100 Å Ti /W | 1,000 Å Au or Pt				
IAIME 0505.3					
	Digit length, d, (µm):	2,995 µm			
	No. of digit pairs, N	5			
	Digit Width, a, (µm):	05 µm			
	Interdigit Space, a, (µm):	05 µm			
	Spatial Periodicity, λ, (µm)	20 µm			
	Zaretsky[6,7] Meander Length, M, (cm)	1.50			
	Center Line or Serpentine Length[9] (cm)	2.70			
IAME XX04.3		**2004.3**	**1504.3**	**1004.3**	**0504.3**
	Digit length, d, (µm):	2,980 µm	2,985 µm	2,990 µm	2,995 µm
	Digit Width, a, (µm):	20 µm	15 µm	10 µm	05 µm
	Interdigit Space, a, (µm):	20 µm	15 µm	10 µm	05 µm
	Spatial Periodicity, λ, (µm)	80 µm	60 µm	40 µm	20 µm

IME Chip Dimensions	Un-packaged Die *(l x w x t)*	Packaged Electrode* *(l x w x t)*
IAIME 0505.3	1.50 x 3.00 x 0.05 cm	13.2 x 1.38 x 0.7 cm
IAME XX04.3	1.00 x 2.00 x 0.05 cm	13.2 x 1.38 x 0.7 cm

*Electrode Body:	PVC–jacketed printed circuit board
*Encapsulant:	Epoxy header. Polyimide packaged chip.
*Leadwires:	Color coded, 30AWG stranded copper, shielded, and PVC jacketed.

References and Notes

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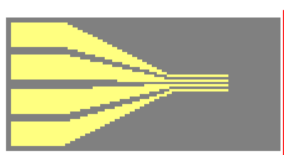
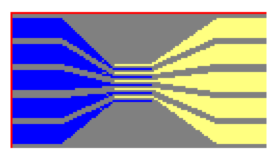
6. Zaretsky, M. C.; Mouyad, L.; Melcher, J. R. *IEEE Trans. Electr. Insul.* **1988**, *23*, 897.
7. The Zaretsky convention defines the meander length; M = N•d
8. Serpentine length is defined as: S = (2a + d) (2N-1)

General Ordering Information





INDEPENDENTLY ADDRESSABLE AND INTERDIGITATED MICROBAND ELECTRODES (IAMEs AND IAIMEs)

IAIME 0505.3- C *where* C = Au, Pt or ITO *and* µm
IAME XX04.3- C *where* C = Au, Pt or ITO *and* XX = 5, 10, 15 or 20 µm

IAME SERIES ***Independently Addressable***	**GOLD (Au)**	**PLATINUM (Pt)**	**INDIUM TIN OXIDE (ITO)**
IAME 05 µm lines and spaces	IAME 0504.3-Au	IAME 0504.3-Pt	IAME 0504.3-ITO
IAME 10 µm lines and spaces	IAME 1004.3-Au	IAME 1004.3-Pt	IAME 1004.3-ITO
IAME 15 µm lines and spaces	IAME 1504.3-Au	IAME 1504.3-Pt	IAME 1504.3-ITO
IAME 20 µm lines and spaces	IAME 2004.3-Au	IAME 2004.3-Pt	IAME 2004.3-ITO
IAIME SERIES ***Independently Addressable Interdigitated***	**GOLD(Au)**	**PLATINUM (Pt)**	**INDIUM TIN OXIDE (ITO)**
IAIME 05 µm lines and spaces	IAIME 0505.3-Au	IAIME 0505.3-Pt	IAIME 0505.3-ITO

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For Further Information
Customer Service and Support
Tel.: +1 804.783 7829
Fax.: +1 804 783 7830

Advanced Biosensor Technology

911 East Leigh Street, G24, Richmond, Virginia 23219, U.S.