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1 *Micropump driver ICs realized with 0.35  $\mu\text{m}$  high voltage process*

## MINIATURIZED HIGH-VOLTAGE PIEZOELECTRIC ACTUATOR DRIVER

### Fraunhofer Research Institution for Microsystems and Solid State Technologies EMFT

Hansastraße 27 d  
80686 München  
Phone: +49 89 54 75 90  
Fax: +49 89 54 75 95 50  
E-Mail: [contact@emft.fraunhofer.de](mailto:contact@emft.fraunhofer.de)

Project manager:  
Frank Vanselow  
[Frank.Vanselow@emft.fraunhofer.de](mailto:Frank.Vanselow@emft.fraunhofer.de)

[www.emft.fraunhofer.de](http://www.emft.fraunhofer.de)

### Applications

The Fraunhofer Research Institution for Microsystems and Solid State Technologies EMFT develops a current-mode piezoelectric actuator driver IC that combines the advantages of power efficiency, with miniaturization (QFN package) and smart driver control to compensate actuator degradation. Therefore the IC promises enhanced actuation precision over long-term operation.

Possible applications are:

- Piezoelectric Sensors
- High-Precision Actuator Drives
- Ultrasonic Transducers
- Micropumps

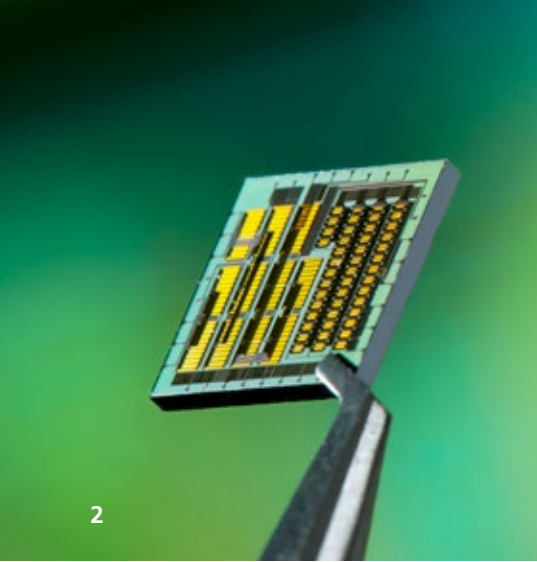
### Technical innovation

A novel concept combining a high-voltage DC-DC converter, high-voltage current sources, and a patent pending negative power

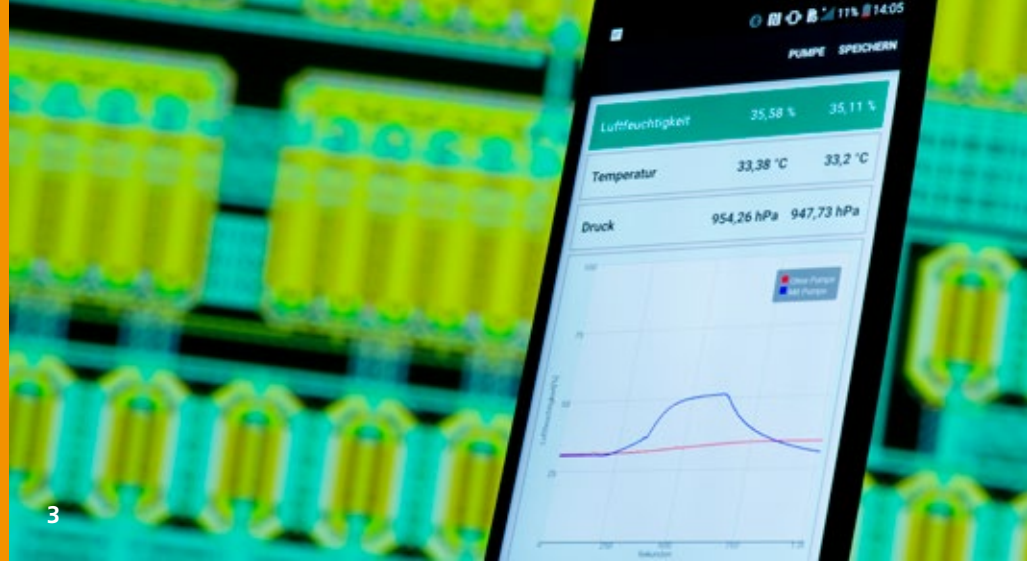
supply generator minimizes the number of external components. It provides an outstanding cost effective solution having a number of unique features:

- **Single-ended high-voltage driving** enables the use of MEMS (micro-electro-mechanical systems) micropumps in close-to-body applications, the silicon channel structure requires ground connection
- **Adjustable high voltage signal of positive and negative polarity** to achieve fast and accurate pumping/mechanical displacement
- **Programmable rising/ falling ramps** allow accurate mechanical displacement control
- **Miniaturized driver electronics** allow entering of new application fields

Fraunhofer EMFT is participant in the



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### Technical data

Engineering samples are fabricated and tested in a XFAB 0.35  $\mu\text{m}$  technology that is able to support voltage levels up to 700 V. Fraunhofer EMFT offers a modular, fully flexible driver solution including various IPs that are adaptable to customer needs. The driver topology can support smart health applications with high precision requirements as good as mobile applications with low power/ high efficiency requirements.

Fraunhofer EMFT Actuator Driver Portfolio:

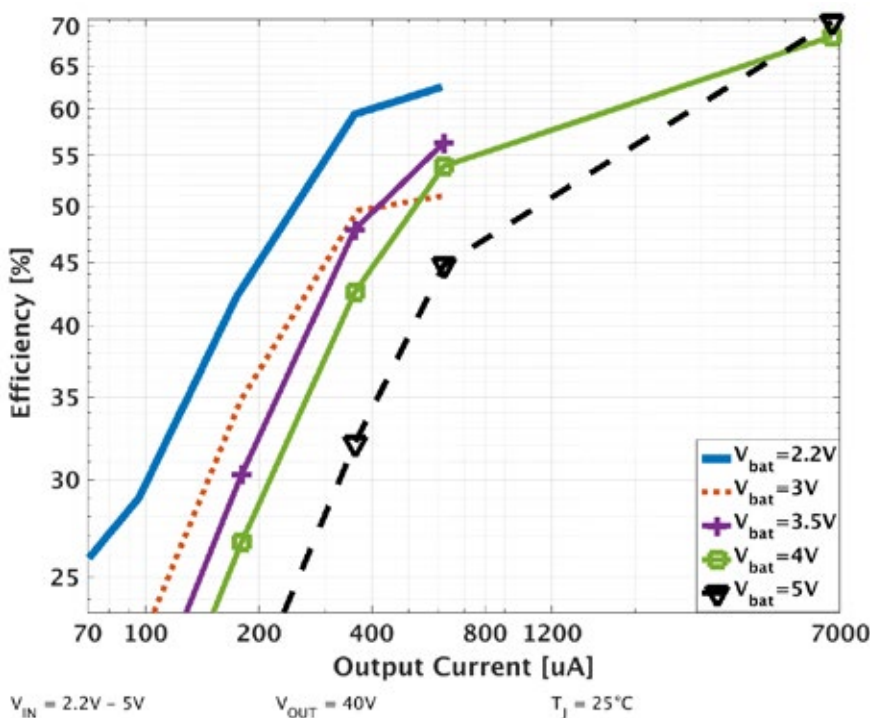
Driver IC Type	MAGNO01	SMP01
Area	7 mm x 7 mm	3 mm x 3 mm
Capacitive Load	2 nF- to 10 nF	2 nF- to 68 nF
High-Voltage Limits	+300 V / -100 V	+100 V / -50 V
Programmable Output Current	640 $\mu\text{A}$ - to 2.4 mA	640 $\mu\text{A}$ - to 2.4 mA
Maximum Signal Precision	<1 %	<1 %

### Outlook

The Fraunhofer EMFT is further working on IP for ongoing miniaturization and performance. We are aiming for fully capacitive solutions that do not require external coils. Furthermore, in the near future we will offer digital IP including digital interfaces for customer convenience.

### Funding

This work has been supported through European H2020 ADMONT project. EU JU grant agreement no. 661796.



4 Boost Converter power efficiency for input voltages 2.2V- to 5V and different load currents.

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3 Smartphone with integrated micropump driver