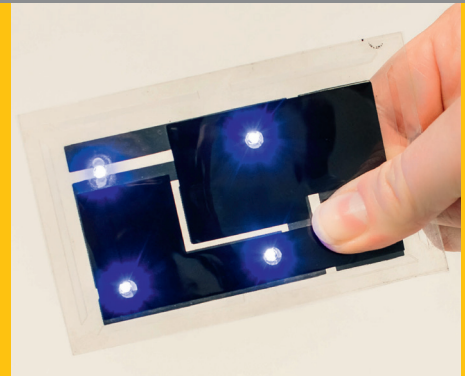




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## ENAS

FRAUNHOFER INSTITUTE FOR ELECTRONIC NANO SYSTEMS ENAS



## PRINTED THIN FILM BATTERY

Fraunhofer ENAS is part of



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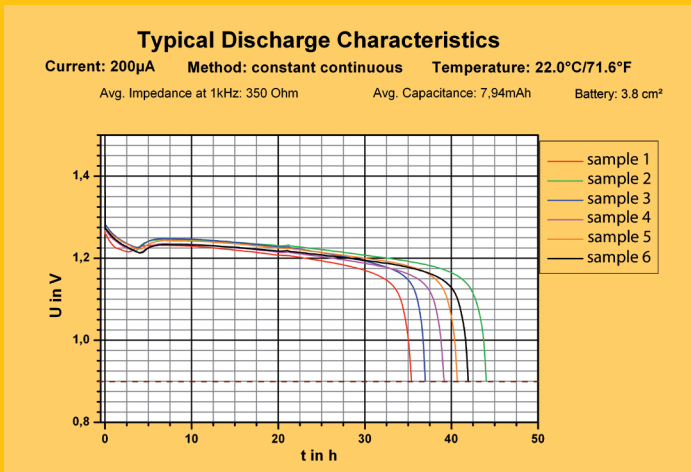
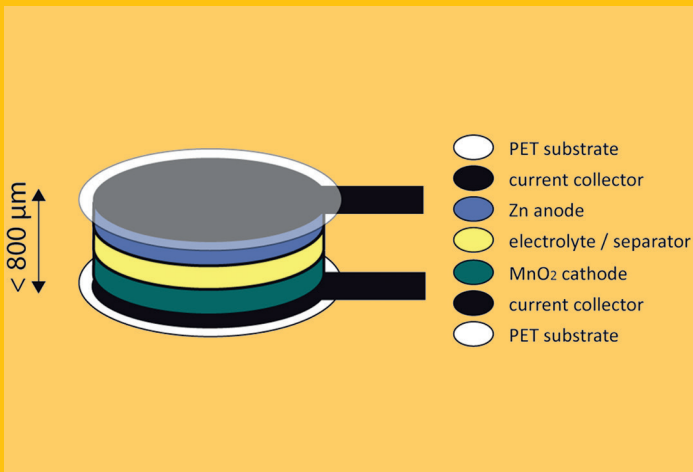
### General Description

Today electronic applications have become ubiquitous and can be found in all areas of our daily life. This requires matching energy sources with high flexibility in regard to thickness, geometrical shape, voltage, capacity and weight. Applying the appropriate functional materials to flexible substrates using mass printing technologies will open new opportunities to integrate batteries into ductile products.

The printed battery is based on a zinc manganese system that is free of mercury, widely used and is regarded as environmentally friendly. Even the plastic substrate can be substituted by compostable paper. The electrolyte is harmless. This battery will not burn or explode if damaged. By using high efficient printing technologies and well adapted materials / inks, the production

yield is > 90 percent when industrially manufactured. The batteries are fully charged after manufacturing and can be used instantaneously. Serial connections of batteries can be realized during print manufacturing, thus integer multiples of the nominal voltage of 1.5 V are demonstrated up to 15 V.

The printed batteries are especially suited for thin and flexible products in which they can be easily integrated. Appropriate products might be intelligent chip and sensor cards, medical patches and plasters for transdermal medication and vital signs monitoring or lab-on-chip analysis systems. Furthermore, the combination with other flexible electronic modules, e.g. flexible low-end displays, will open further and new fields of application. Demonstrators for different applications have been realized.



### Features/Benefits

- Low thickness
- High flexibility
- Low price
- High layout variability
- Environmentally friendly, can be designed as compostable
- Non-flammable, explosion proof
- Shelf lifetime > 3 yrs

### Suggested Applications

- Smart Systems
- Smart Cards
- Semi-active RFID-Label
- Medicine (“smart patches”)

### Characteristics primary Zn-MnO<sub>2</sub> battery

Parameter	Value				Unit
Nominal voltage	1.5	3.0	4.5	6.0	V
Nominal capacity	2	1	0.67	0.5	mAh/cm <sup>2</sup>
Energy content	3	3	3	3	mWh/cm <sup>2</sup>
Weight (standard cell approx. 4 cm <sup>2</sup> / 1.5 V)	< 1	< 2	< 3	< 4	g
Thickness	< 0.8	< 0.8	< 0.8	< 0.8	mm

Photo acknowledgments:  
 Fraunhofer ENAS  
 All information contained in this datasheet is preliminary and subject to change. Furthermore, the described system is not a commercial product.