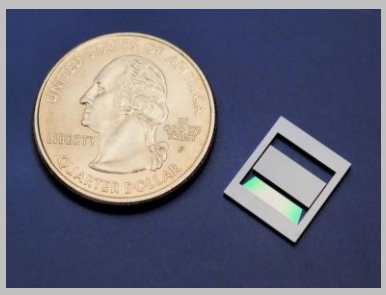
# BOLT™R0100

# EU Industrial, Building & Commercial

# Micro-Power Generator

## Scalable Renewable "Green" Energy



*BOLT™-R0100 without packaging (US quarter for size comparison)*

***Piezo-MEMS Vibration Energy Harvesting Micro-Power Generators (MPGs)***

MicroGen's *BOLT™* family products includes micro-power generators and modules (MPM or Power Cell). MPGs are fabricated using our proprietary piezoelectric MicroElectroMechanical Systems (piezo-MEMS) platform technology**. MPG devices convert mechanical vibration to electrical energy** (see videos http://www.youtube.com/watch?v=2QAYSfO9P6E and http://www.youtube.com/watch?v=9okGrLlGCDc for basic understanding of operation).

MicroGen's Power Cells are *'plug-n-play'* conventional battery replacement power sources. Power Cells contain MPG, electronics for rectification, impedance matching and voltage regulation, and a small capacitor for energy storage. Optional plug-in energy storage modules (ESM) include either an ultra-capacitor (see ESM-C datasheet), or rechargeable battery (see ESM-B data-sheet), and a battery management IC chip.

**Let MicroGen provide the energy harvesting 'building blocks' for powering your autonomous electronics, wireless sensor, and rechargeable battery application.**

FEATURES

- Piezo-MEMS vibration energy harvester or MPG patent-pending (patents issued and pending) technology
  - *Green* renewable energy product
  - Waste Electronic and Electrical Equipment (WEEE) compliant; CMOS compatible
  - European Union's (EU) Restrictions on Hazardous Substances (RoHS) compliant
- R0100 operational $f_1$ = 100 Hz targeted for EU/Asia industrial, building and commercial applications
  - Single vibrational axis; typical voltage *V* and power *P* full-width-half-maximum (FWHM) < 2.0 Hz
  - AC open-circuit voltage (OCV) >15 Volts, and optimal output power $P_{load}$ >50 μWatts @ $f_1$ and $G$ < 0.1 *g*

**Energy harvesting applications**

- *Industrial and building*
  - process automation
  - equipment monitoring
  - lighting control
- *Civil infrastructure monitoring*
  - bridge structural integrity
- *Automotive, aerospace and rail*
  - tire pressure sensors
- *Agriculture*
  - livestock management
- *Medical*
  - cardiac pacemaker
- *Mobile electronics*
  - health monitoring and gaming
- *Homeland security and defense*
  - asset tracking

microGen
*Energizing the Wireless World™*

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# *BOLT*™-R0100

EU/Asia – Industrial, Building & Commercial applications

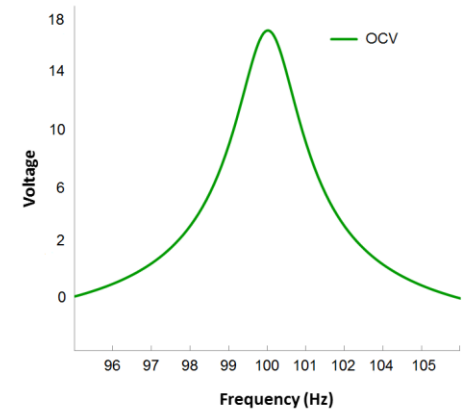
## *100 Hz Resonant Frequency Vibration Energy Harvesting MPG*

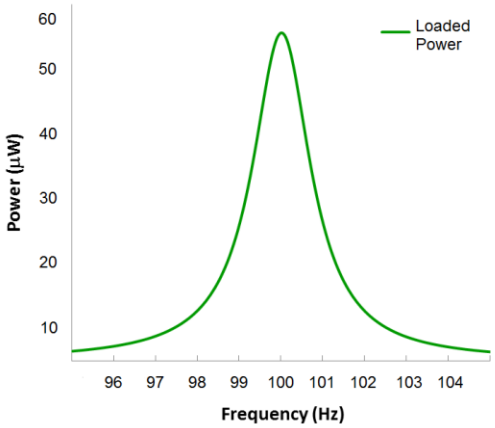
| Parameter | Specification |
|---|---|
| Resonant frequency ($f_1$) | 100 ± 1.0 Hz<br>(custom frequencies available, 100 to 1500 Hz) |
| Impedance $Z$ @ $f_1$ | 1.2 MΩ |
| Minimum external acceleration amplitude required for maximum power – $G_{operation}$ | ≤ 0.1 $g$<br>($g$ = 9.8 m/s$^2$) |
| Maximum operation acceleration $G_{max}$ | 3.0 $g$* |
| OCV (AC) @ $f_1$ and ≥ $G_{operation}$ | 17.0 Volts peak** |
| Output power @ $f_1$, ≥ $G_{operation}$, and $Z$ | 58 µWatts peak optimally loaded** |
| Temperature range | -40°C to +85°C |
| MPG materials | <100> Cz Si, poly-Si, $SiO_2$, AlN, Al, Mo, Ti |
| Wafer-level packaging (WLP) materials | borosilicate glass (BSG), glass frit |
| Environmental sealing and atmosphere | hermetic and partial vacuum |
| Dimensions, including WLP (L x W x H) | (15.0 x 15.0 x 5.8) mm$^3$ |
| Volume and overall weight | ~1.2 cm$^3$ and < 5 grams |
| Electrical connections | See below |

** Contact us for information on higher $G_{max}$ operation.* ** OCV and $V_{load} \propto$ external excitation acceleration amplitude $G$, and $P_{load} \propto G^2$

### BOLT-R0100 Output

$G_{operation} \leq G_{external} \leq G_{max}$




### BOLT-R0100 Mechanical Drawing and Pinout

(not to scale)