主　論　文　要　旨

論文題名　**Ultralow-power-consumption Power-management Circuit Scheme in Micro-scale Energy Harvesting**

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主論文要旨

This paper describes an ultralow-power-consumption power-management circuit scheme of a wireless sensor terminal that uses micro energy harvesting. In particular, this paper describes a power-supply circuit in a thermoelectrically powered wristwatch and a zero-standby-power photosensor switch powered by an LED. A thermoelectric generator, which generates power using the temperature difference between a human body and a room, is embedded in the thermoelectrically powered wristwatch. When we wear the wristwatch, there is no need for battery exchange because the thermoelectric generator constantly charges the power into a secondary battery. In this paper, we proposed a power-supply circuit that consists of a variable-stage switched-capacitor-type booster circuit and uses maximum power point tracking (MPPT) for the booster. We showed that the power-supply circuit operates the wristwatch for 12 hours by wearing the wristwatch for 1 hour. We also clarified that the MPPT technology enables to increase the amount of charge almost twice.

A zero-standby-power photosensor switch with an LED prolongs the battery life by reducing the standby-power dissipation of the wireless sensor terminal. We proposed two types of detectors that operate at a power dissipation of less than nW level and detect the variation of the LED power generation. One is a photosensor switch with a visible light LED and the detector operates at only nW power level. When we applied the prototype switch to a wireless mouse, the battery life is prolonged twice compared to conventional devices. The other is a photosensor switch with an infrared LED and the detector, which operates at a subthreshold region and detects the rising edge of a power line, detects infrared pulse-signals with the power dissipation of 40 pW. We applied the switch to infrared-controlled receivers and demonstrated that those receivers can be controlled from the distance of 6 m while it keeps the zero-standby-power dissipation.