Dual-Interface Memory Uses Energy Harvesting to Enable True Battery-Free System Design

STMicroelectronics is taking the first step to extending its family of RFID/NFC wireless memory ICs with a new 16-Kbit device that can also harvest enough energy to enable small electronic items using it to become completely battery-free electronic applications.

Energy harvesting converts energy captured from the surrounding environment into electrical energy to powering small systems. Ambient energy is available in a variety of forms, such as radio waves, waste heat, kinetic energy from movement by a user, or wind or solar energy, is freely available, and has no CO2 or other emissions. Utilizing this energy also saves designers relying on sources such as batteries or an external power supply, which can increase costs, impose size and weight restrictions, or complicate installation. Freeing equipment from power cables or any need to recharge or replace batteries, energy harvesting technology promises lower ownership costs and is gaining widespread consumer interest.

ST’s dual-interface memories, including the new 16-Kbit device, feature a low power I2C interface, as well as a 13.56-MHz ISO15693 contactless RF interface. This RF interface can harvest ambient radio waves emitted by RFID reader-writers and convert those waves into a voltage output that may be used to power other electronic components.

The energy harvesting capability of the EEPROM will enable new types of miniaturized electronics. ST has demonstrated the M24LR16E energy-harvesting wireless memory by illuminating indicator LEDs as well as by powering its battery-less STM8L-based Discovery kit. Other potential applications include e-paper devices such as electronic shelf labels, as well as industrial automation, sensing and monitoring systems, and personal healthcare products.

“The pioneering M24LR16E strengthens our Dual-Interface EEPROM portfolio by providing additional memory-density options and, by offering a means to harvest energy from its environment, to enable innovative applications for smart electronics,” said Benoit Rodrigues, General Manager of ST’s Memories Division. “This new device also strengthens ST’s portfolio of green-energy solutions for innovative high-tech products, helping to improve sustainability and quality of life.”

The M24LR16E features 16Kbits of non-volatile EEPROM storage, introducing a new lower-density option alongside ST’s established 64Kbit dual-interface wireless memory, the M24LR64. ST anticipates a broad user base for these RFID/NFC-compatible devices as RFID is now widely used in supply-chain and retail businesses, and NFC technology will be included in more than 500 million mobile phones sold annually by 2015, according to figures from ABI Research.

Main features of the M24LR16E:
• 16-Kbit EEPROM user memory
• 40 years data retention, 1 million write-erase cycles
• RF interface operating at 13.56MHz, compatible with
o RFID reader-writers
o ISO15693-capable NFC devices
• Low-power I2C interface operating at 400 kHz
• 1.8V to 5.5V supply-voltage range
• Vout analog output (energy harvesting)
• RF status digital output

The M24LR16E is in volume production now and available in SO8, TSSOP8 or MLP8 surface-mount packages. Prices are $0.6 in SO8 and TSSOP8 and $0.66 in MLP8, for orders over 1000 pieces. Alternative pricing options may be available for higher quantities. The device may also be supplied in wafer form on request.

Further technical information:
ST's dual-interface memories are EEPROMs that provide non-volatile storage for system parameters, data logged from external sources or program code. Each device provides an I2C serial interface as well as a wireless interface compatible with the ISO-IEC 15693 13.56MHz radio standard for RFID and ISO15693-capable NFC systems. The memory can communicate with the host system in the same way as a standard serial EEPROM, or it can be read/written directly using equipment such as an RFID reader or mobile phone. Wireless operation requires an antenna that can simply be etched on the printed circuit board.

A data protection scheme is built in, including 32-bit password protection to safeguard stored data against threats such as accidental over-writing and unauthorized access or tampering.

The new M24LR16E integrates additional power-management circuitry to make harvested energy available to other devices on the pc-board via an output pin. The nominal output voltage is between 1.7 to 2.3V, allowing the memory to supply many types of devices including low-voltage CMOS ICs.

The electrical power available to drive external devices depends on various factors, such as the RF power of the reader, the distance between the reader and the memory's connected antenna, and the relative sizes of the reader and memory antennas. Assuming adequate RF strength, an RFID device can even be used to power multiple items of equipment placed within range. The EEPROM's energy harvesting mode can be turned on or off, and the maximum output current set from 300µA to 6mA, by adjusting settings in an internal register.

The evaluation board ROBOT-M24LR16E-A, demonstrating energy-harvesting capabilities of the M24LR16E dual-interface EEPROM, is available from ST.

Further information on ST can be found at www.st.com [1].

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Links:
[1] http://www.st.com