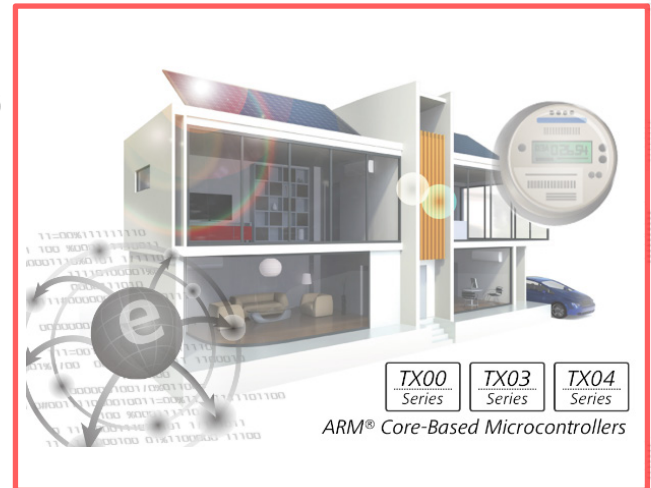


MICROCONTROLLER

> SMART METER MCUs

ARM® CORE-BASED MICROCONTROLLERS

Toshiba introduces new microcontrollers to meet the growing global trend for smart meters (watt-hour meters with communication functions) which require highly precise measurement, adoption of various types of region dependent communication technology and a variety of circuit integration. Toshiba's microcontrollers incorporate a 24-bit delta-sigma AD converter that can precisely measure electric energy usage at high speed. The built-in high-performance calculation engine can monitor power consumption including real power, reactive power, power factor and fluctuations in voltage or frequency. Toshiba's microcontroller solutions offer an analogue front end, a control block and a communication block, improving the accuracy of communication and reducing board space. Furthermore, Toshiba original power saving mode minimizes the battery power consumption which is highly effective in an emergency such as a power outage or in the period before installation.



> APPLICATIONS

- Smart Meter
- HEMS

> FEATURES

Toshiba original RTC/LCD mode transition

Low-power consumption in a power outage or in RTC mode.

Large capacity memory

> ADVANTAGES

Power service conditions or time can be displayed on the LCD panel without the start up of the CPU during a power outage.

The power consumption is less than 1.0 mA when only the RTC is operating. Down to 1.5 V low-voltage operation is allowed.

Network protocol stack can be configured using the internal memory only.

> BENEFITS

- A battery drive time can be lengthened
- No external memory is needed

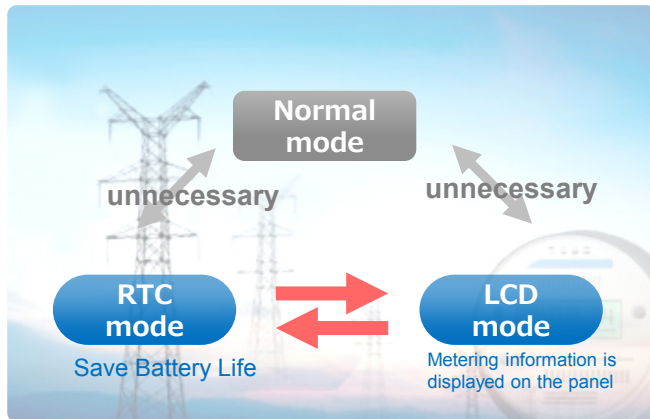
> PRODUCT LINEUP

Function	Part Number	ROM Size	RAM Size	Package	Features
For measurement	TMPM061FWFG	128 KB	8 KB	LQFP100 (14 x 14 mm)	Three units high-accuracy 24-bit $\Delta\Sigma$ AD converter, built-in power calculation engine
	TMPM311CHDUG	NA	16 KB : Program 5 KB : Data	LQFP48 (7 x 7 mm)	Four units high-accuracy 24-bit $\Delta\Sigma$ AD converter
For measurement / communications	TMPM411F20XBG	2 MB	290 KB	VFBGA193 (14 x 14 mm)	Two high-performance ARM® Cortex®-M4F cores with a maximum clock rate of 80 MHz
For measurement	TMPM36BF10FG	1 MB	258 KB	LQFP100 (14 x 14 mm)	Large-capacity internal 1 MB Flash ROM / 258 KB SRAM for large scale software
	TMPM36BFYFG	256 KB	66 KB		Built-in high-speed 12-bit AD converter
	TMPM46BF10FG	1 MB	514 KB		Large-capacity 514 KB SRAM, NAND Flash controller, security engine

> TOSHIBA ORIGINAL RTC / LCD MODE TRANSITION

Toshiba microcontrollers for smart meters provide RTC mode and LCD mode, besides NORMAL mode. In a power outage or the period before installation, the microcontrollers enter RTC mode and the functions enter standby state to reduce the power consumption except for the minimum necessary functions.

In LCD mode, metering information is displayed on the LCD panel by external instructions from a house owner or power company without the start-up of the CPU. At this time, the microcontroller directly enters LCD mode from RTC mode without NORMAL mode. This transition between RTC mode and LCD mode can improve the power reduction of the battery in a power outage while the LCD can continue to display.

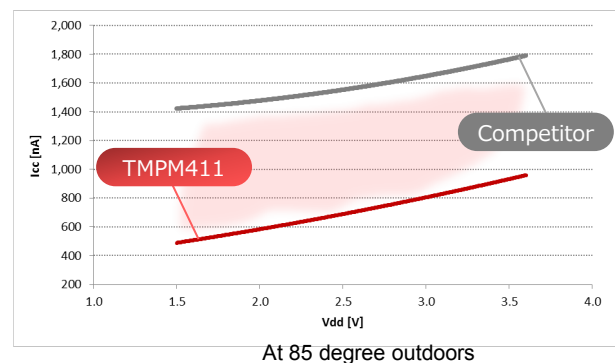
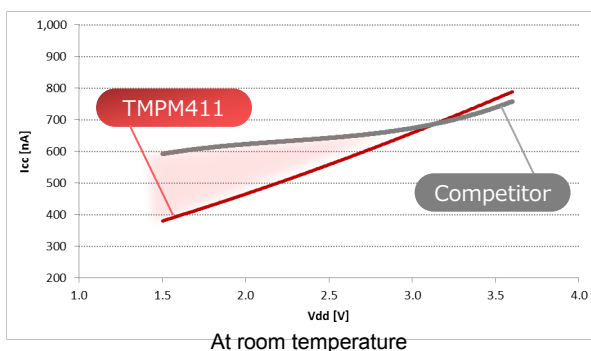


- The MCU enters RTC mode by the instruction of the software in a power outage or before installation
- In LCD mode, the MCU displays metering information on the panel by external instructions
- The MCU returns to RTC mode from LCD mode after the specified time has elapsed
- The MCU returns to NORMAL mode after the power supply returns

> LOW-POWER CONSUMPTION IN POWER OUTAGE OR IN RTC MODE

The power consumption of the microcontroller in RTC mode varies depending on the environment. If an EDLC (Electric Double-Layer Capacitor) operates as a battery at low voltages, the battery drive time can be lengthened.

When a smart meter is driven by the battery including an EDLC, the supply voltage is gradually decreased. Toshiba microcontrollers can reduce the power consumption to the minimum when the smart meter operates at low voltages. For example, if a smart meter is driven at 1.5V, the consumption current is 400nA. This value is 30% lower than any other competitors product. This feature provides a noticeable reduction in power consumption under high-temperature conditions such as exposure to direct sunlight outdoors.



Toshiba TMPM411

- Source: Measured data (@Typ. Condition)
- The power supply pin that is used to drive the RTC block is measured
- 32 kHz oscillator running
- RTC running
- 128 byte data backup

Competitor

- Source: data in the data sheet
- 32 kHz oscillator running
- RTC running
- 64 byte data backup