# Electronic Tamper Detection Smart Meter Reference Design

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## Overview

The smart grid needs to physically secure all elements that may include smart meters, data concentrators, intelligent electronic devices (IEDs) and secure gateways. Freescale provides a high performance electronic tamper detection smart meter reference design that integrates an ultra low-power Xtrinsic 3-axis tilt sensor used for electronic tamper detection. This reference design has the ability to connect to a ZigBee® network through an internal daughter card. Hence, it can easily become part of the smart grid network. Firmware for this reference design is based on the MQX™ real-time operating system. All standard metering values are displayed on the built-in LCD and selectable via the push button. A variety of communication interfaces are available for remote data collecting, making this an ideal solution for advanced residential metering.

## Metrology Key Features

- 5(100)A current range, nominal current is 5A, peak current is 100 A
- 85V...264V voltage range
- 47Hz...63Hz frequency range
- 4-quadrant measurement
- Fast Fourier Transform (FFT) DSP processing implemented
- IEC50470-3 and ANSI C12.20 compatible
- Active and reactive energy accuracy: IEC50470-3 Class B, 1%
- Line frequency measurement (for precision zero-cross detection)
- Current transformer for current sensing circuit implementation
- Cost-effective bill of materials (BOM)
- Low-power modes effectively implemented, including the use of the built-in RTC (Libattery backed-up)
- LCD display, 4x44 segments including charge pump

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# Documentation

- Design Reference Manual
- FFT-based algorithm for metering applications (AN4255)
- Quick Start Guide for MK30ETAMP3PHMTR
- MQX Reference Manual
- MQX User's Guide
- MC1322x Low-Power Node Reference Manual
- Device development tools / demo kits: MK30ETAMP3PHMTR
- Device documentation: MK30X256
- Xtrinsic MMA8491Q tilt sensor documentation

## MK30X256 Microcontroller

- Up to 100 MHz freq. with 1.25 DMIPS/MHz
- ARM® Cortex™-M4 Core
- 256 KB of program flash memory
- 256 KB of FlexNVM and 4KB FlexRAM
- 64 KB of SRAM
- 16 independently selectable DMA channels
- Integrated 16-bit SAR ADCs with PGAs
- Integrated two 12-bit DACs
- Programmable 1.2 V voltage reference
- Hi-speed analog comparator with 6-bit DAC
- WDOG + External Watchdog Monitor
- HW CRC generator circuit (16/32-bit)
- External Bus Interface (FlexBus) - for ext. memories, gate-array logic, or an LCD
- Communications: CAN, I²C, I²S, SDHC, SPI, UART
- Timers: FlexTimers, Programmable delay block (PDB), Programmable interrupt timer (PIT), Low-power timer (LPT), Carrier modulator timer (CMT), Real-Time-Clock
- HMI: touch-sensing, segment LCD
- 10 low-power operating modes
- 144-pin LQFP or MAPBGA packages
- -40°C to +105°C operating temperature range

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Freescale Technology    Optional
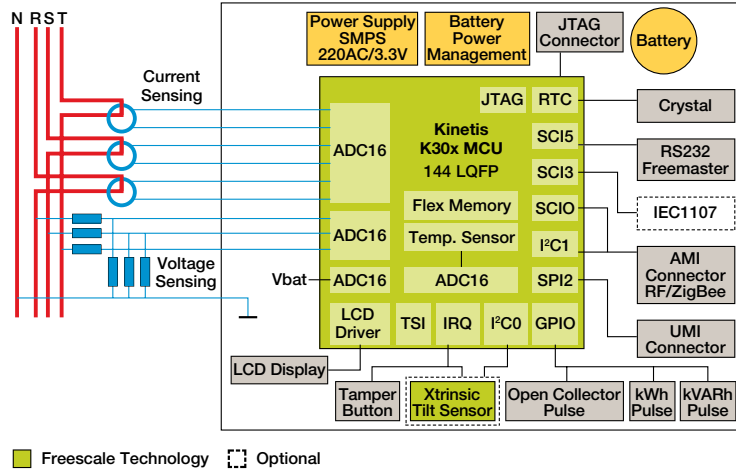
## MMA8491Q Xtrinsic 3-Axis MEMS Tilt Sensor
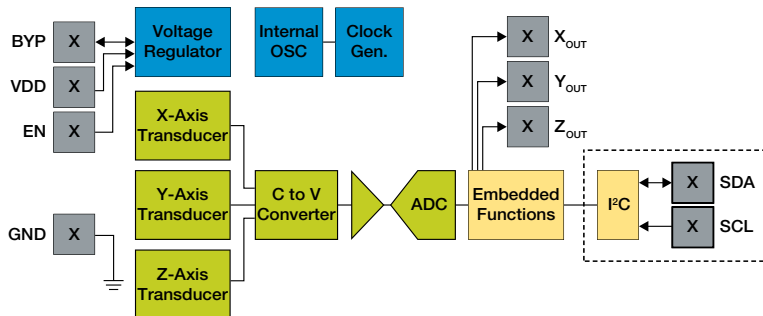


## MC1322x Low Power Node

- Full 802.15.4 compliant wireless node based on Freescale's third-generation ZigBee® platform
- 2.4 GHz radio frequency transceiver
- 32-bit ARM7 core-based MCU
- Hardware acceleration for both the IEEE 802.15.4 MAC and AES security
- Connectivity from simple point-to-point to a complete ZigBee® mesh
- On-board balun and antenna switch in package (valid for 1322x-LPN module)
- Over-the-air data rate of 250 kbps
- Typical range (outdoors, line of sight) is 300 meters
- 99-pin LGA Platform-in-Package (PiP)

## MMA8491Q Xtrinsic 3-Axis MEMS Tilt Sensor

- Miniature 3 mm x 3 mm QFN 12-pin package
  o 0.65 mm lead pitch
  o Visual solder joint inspection capable
- Integrated tilt algorithms
- Low current consumption: 400 nA at 1 Hz sample rate
- Fast turn on time
- 14-bit accelerometer data
- MEMS technology
- 1.95V to 3.6V VDD supply range

## For more information, visit freescale.com/metering