Silent Motor Controller Enables Battery-Powered Stepper Motors To Run in Stealth Mode

TRINAMIC's TMC2300 motor driver IC enables battery-powered stepper motors to run in "stealth mode," emitting virtually no noise or vibration. Small, precise, and extremely efficient with a standby current draw of <50 nA, the two-phase stepper motor driver will change the way motors are used in portable and IoT devices, according to the vendor (Fig. 1).

The TMC2300 is being introduced as the world's smallest single-chip motor driver, and uses the company's StealthChop technology to enable virtually silent operation. Designed to drive two-phase stepper motors up to 1.2 Arms and with a voltage range of 1.8 V to 11 V dc, the TMC2300 consumes very low power while operating from one or two Li-Ion cells or two AA batteries.

The driver chip incorporates three Trinamic technologies:

- StealthChop2, a high-precision algorithm that produces drive waveforms which enable motors to be inaudible—both in motion and at standstill;
- StallGuard, sensorless motor load measurement, which is a combination of on-chip circuitry and firmware that enables the driver to perform sensorless homing (eliminating the need for limit switches) and detect mechanical obstacles.; and
- CoolStep Sensorless, load-dependent current control that optimizes the motor's energy consumption on-the-fly, enabling energy savings of up to 80% over conventional motor drives.

The TMC2300's low-power characteristics are made possible by the StealthChop2 chopper circuit and the device's extremely low $R_{DS(ON)}$, supported by an integrated charge pump. When used in combination with the driver's CoolStep feature, the TMC2300 can reduce a motor's energy consumption by up to 90% over a standard chopper, according to the company. This enables battery-powered applications to enjoy longer running time and cooler operation (Fig. 2).

Offering high energy efficiency, silent operation, and advanced development tools for fast, easy customization, the TMC2300 is well suited as a platform for IoT and handheld devices, battery-operated equipment, point-of-sale devices and printers, toys, miniature medical devices, office and home automation products—including smart thermostatic radiator valves—and much more.

The TMC2300's capabilities support new use cases for portable devices, such as silent-running prosthetics and wearable devices that don't draw attention to their users. Because the TMC2300 doesn't compromise on performance, it's also well suited for turning once-stationary devices into mobile, battery-powered devices that are convenient to use.

Michael Randt, founder and CEO of Trinamic explains: "Small motors are ubiquitous. They have made their way into our daily lives. It's time to advance the Fourth Industrial Revolution by changing the way motors are used in portable devices. The TMC2300 is the perfect low-voltage solution for big innovations in a small package."

Other features include single-wire UART and step/dir interfaces for easy, reliable motor and control connections, up to 256x microstepping for extreme precision, the latest current control and diagnostics technologies, and a 3-mm x 3-mm QFN20 package. For more information, visit TRINAMIC's motion control page, the TMC2300 product page or the datasheet.

Fig. 1. The TMC2300 stepper motor driver addresses key mobile design requirements and offers a superior end-user experience by enabling virtually silent and vibration free operation. Applications range from IoT-connected devices and portable printers to wearable medical devices.

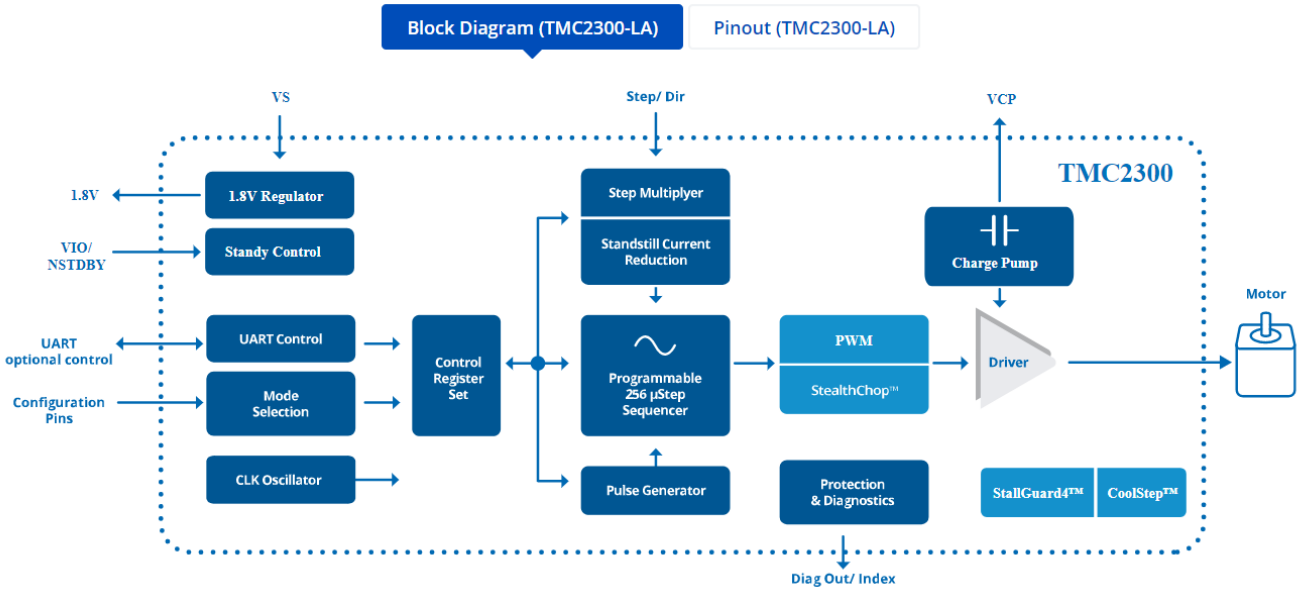

Fig. 2. In addition to silent stepper operation in motion and in standstill, the TMC2300 offers benefits such as low-voltage operation from one or two Li-Ion cells or two double AA batteries; sensorless motor load measurement, eliminating the need for end-stop switches, performing sensorless homing and detecting mechanical obstacles; and high energy efficiency, using load dependent current control to optimize the motor's energy consumption on-the-fly. Additionally, the driver IC uses a simple control interface and has an extensive array of design and development tools.