Use Case:

Designing low-power, connected healthcare devices with Cypress' PSoC® 6 MCUs and Honeywell Pressure Sensors

The role of Smart Health Technologies in the future of healthcare is expected to be significant, driving bullish growth forecasts for the medical wearables market which are set to amount to $14.4 billion by 2022. This rapid growth is attributed to the technological advances in medical devices, supported a growing focus on personal fitness to improve quality of life; and underpinned by increased smartphone ownership with associated healthcare apps that allow users to monitor and track every aspect of health by linking with wearable devices. The scope of Medical Wearables could be vast. Potential applications could measure blood pressure, rhythm, and other health diagnostics allowing for early detection of known conditions and making a significant difference to people's lives – whether they are generally healthy and monitoring as part of their general fitness regime, or in 'at-risk' categories with monitoring put in place by their medical physician or doctor.

Nevertheless, the challenges faced by the broader wearable market are also true here – centred around battery life and size, but with the added need for enhanced security due to the personal nature of data. For the market to grow at the rate forecasted, medical wearables need to fit into people's lives and therefore cross the boundary from required monitoring to elected monitoring – and for this to happen devices need to provide convenience.

Cypress' PSoC 6 MCUs, coupled with Honeywell Pressure Sensors enable unique Medical Wearable solutions which provides the enhanced accuracy, stability and reliability required in medical applications, along with the benefit of ultra-low power and security for a medical design, addressing key challenges facing design engineers in this market.

- **Size and flexibility:** Convenience is about having a device that fits neatly into your life so that you almost forget it's there. The PSoC 6 MCU provides a dual-core Arm® Cortex®-M architecture that allows developers of medical devices to optimize performance for power. It is particularly well-suited for developers of connected medical devices (like Medical Wearables) as both cores can be leveraged strategically – for example using the Cortex-M4 core to process health-related sensor data, and the Cortex-M0 core to run a Bluetooth Stack to wirelessly transmit that data to a patient's mobile phone. The PSoC 6 MCU architecture provides industry-leading flexibility with its software-defined peripherals to create custom analog and digital circuits (to be able to for example, easily interface with any of Honeywell's Pressure Sensors). The PSoC architecture integrates external components and coupled with its programmability, allows engineers to reduce BOM and PCB size, support last minute design-changes, and avoid multiple board re-spins. In addition, Cypress provides the industry's best capacitive-touch solution, CapSense® - to allow for the replacement of mechanical buttons on Medical Wearables with capacitive buttons, reducing wear and tear and allowing for a sleek, next-generation interface.
- **Battery:** Long lifecycles in between battery charges is a design requirement by next-generation Medical Wearable devices and this is addressed by the PSoC 6 MCU's industry-leading power consumption. In active power mode the PSoC 6 MCU consume just 22-µA/MHz on the M4 core, and 15-µA/MHz on the M0+ core. This is made possible by the ultra-low-power 40-nm architecture of the PSoC 6 MCU.
- **Security:** Prevention of unauthorized access to health data, one of the biggest concerns in medical device application development, is addressed by the PSoC 6 MCU as well. PSoC 6 provides integrated Secure Element functionality with a hardware-based root-of-trust and hardware-accelerated cryptography within the PSoC 6 MCU.
- **Accuracy vs Cost:** The limited cost differential between sensors can provide challenging decisions for design engineers as they balance accuracy with cost. A fully amplified plug-and play sensor with TEB of 1.5%FSS may be $13 whilst an uncompensated sensor with a total Error band (TEB) of greater than 30%FSS may cost $9, but it is only worth choosing the latter option is the additional circuitry required to improve the accuracy of the less-expensive sensors, including components and design and calibration time, is less than $4. Using plug-and-play solutions such as fully amplified, compensated sensors eliminate the need for additional circuitry and design time to develop, providing greater value although if it doesn't provide accurate data, the benefit of easier installation could be negated. The MPR series from Honeywell is a very small piezoresistive silicon pressure sensor offering a digital output for reading pressure over the specified full scale pressure span and temperature range. It is calibrated and compensated over a specific temperature range for sensor offset, sensitivity, temperature effects, and non-linearity using an on-board Application Specific Integrated Circuit (ASIC). The MPR series provides 24bit digital I"C or SPI compatible outputs in pressure ranges 60 mBar to 2.5Bar pressure range.

element14 has brought together PSoC 6 MCUs with Honeywell's Pressure Sensors to provide the ultimate in ease of design for Medical Wearables. There are multiple hardware platforms available from element14 to enable fast prototyping including the PSoC 6 BLE Pioneer Kit featuring the PSoC 63 MCU with BLE 5.0 as well as a E-ink Display shield. Multiple medical example projects with Honeywell Pressure Sensors and the PSoC 6 BLE Pioneer Kit, including source code and full documentation, are available on the element14 community, allowing design engineers to speed up their development, prototype quickly and ultimately bring their product to market faster than ever before.

Visit farnell.com/smart-care to view the projects and order hardware.