Overview

The Freescale Healthcare AFE reference platform integrates a full set of solutions for portable medical and personal healthcare applications. It offers product development solutions for portable electrocardiographs, heart rate monitors, pulse oximeters, glucose monitors, blood pressure monitors, spirometers and Doppler ultrasound stethoscopes.

The Healthcare AFE reference platform is based on the highly integrated Kinetis K50 MCU family, which includes a complete set of analog peripherals, including transimpedance amplifiers and general-purpose amplifiers. This advanced integration allows for improved measurement accuracy and a reduction in board size and bill of materials. Precision analog components from Linear Technology™ are included to provide greater design flexibility.

Application Development

The Healthcare AFE reference platform was developed using the Kinetis K53 MCU, featuring an ARM® Cortex™-M4 core embedded in the ready-to-develop Tower System hardware platform. This combination makes the Healthcare AFE reference platform an accurate, rapid prototyping solution for portable medical application design.

The Healthcare AFE reference platform includes six healthcare-specific plug-in boards with reusable software and hardware, providing developers with fast prototyping tools that reduce time to market and allow for greater focus on product key differentiators.
Healthcare AFE Reference Platform Contents

- TWR-K53N512 Kinetis embedded control board
- TWR-SER serial communications board
- TWR-LCD
- TWR-ELEV
- MED-EKG electrocardiograph development board with and without Linear Technology analog components
- MED-SPO2 pulse oximeter development board with and without Linear Technology analog components
- MED-GLU glucose meter development board with and without Linear Technology analog components
- MED-BPM blood pressure monitor development board with and without Linear Technology analog components
- MED-SPI spirometer development board
- MED-STETH ultrasound stethoscope development board
- EKG cables
- Pulse oximetry finger sensor
- BPM pneumatic kit and arm cuff
- Ultrasound transducer and speaker
- Spirometry mouthpiece
- Blood glucose test strips

Price/Availability

The Healthcare AFE reference platform will not be available for sale. Please contact your local Freescale sales person for a demonstration and access to the reference platform. All application notes, schematics and source code are available at freescale.com/healthcareAFE.

Kinetis K53 Measurement Engine Overview

<table>
<thead>
<tr>
<th>Module</th>
<th>Description</th>
<th>Features</th>
</tr>
</thead>
</table>
| ADC | 16-bit successive approximation analog-to-digital converter (ADC) | • Up to 16-bit resolution  
• Up to four pairs of differential and 24 single-ended external analog inputs  
• Hardware average  
• Temperature sensor  
• Selectable voltage reference  
• Self-calibration mode  
• Programmable gain amplifier up to x64 gain |
| DAC | 12-bit low-power general-purpose digital-to-analog converter (DAC) | • Programmable voltage gain  
• Low-input offset voltage and current  
• Low-input bias current  
• Low current consumption |
| Op-Amp | CMOS single supply, low-input offset voltage, low-input offset and bias current amplifier | • Programmable voltage gain  
• Low-input offset voltage and current  
• Low-input bias current  
• Low current consumption |
| Tri-Amp | CMOS single supply, low-input offset voltage, low-input offset and bias current amplifier | • On-chip generation of bias voltages  
• Low-input offset voltage and current  
• Low-input bias current  
• Low current consumption |
| VREF | Reference voltage supply that can be trimmed in 0.5 mV | • Programmable trim register with 0.5 mV steps  
• Programmable buffer mode selection  
• 1.2 V output at room temperature  
• Dedicated output pin, VREF_OUT |
| PDB | Provides control delays to the hardware trigger inputs of ADCs and/or generates the interval triggers to DACs | • Up to 15 trigger input sources and one software trigger source  
• Up to eight configurable PDB channels for ADC hardware trigger  
• Up to eight DAC interval triggers  
• Up to eight pulse outputs |
| CMP | Provides a circuit for comparing two analog input voltages | • Operational over the entire supply range  
• Programmable hysteresis control  
• Selectable interrupt on rising edge, falling edge or both edges of the comparator output  
• Selectable inversion of comparator output  
• DMA transfer support |

Healthcare Plug-In Board Summary

<table>
<thead>
<tr>
<th>Board</th>
<th>Description</th>
<th>Applications</th>
</tr>
</thead>
</table>
| MED-EKG | MED-EKG is an auxiliary board in the development of solutions oriented toward electrocardiography and heart rate monitoring. This board allows designers to speed the development of medical devices based on electrocardiography, providing a scalable solution that can be adjusted to the final product needs. | • Heart rate monitors  
• Electrocardiographs  
• Defibrillators  
• Multi-parameter patient monitors |
| MED-SPO2 | MED-SPO2 is a pulse oximeter solution development board ideal for designing applications requiring an SpO2 measurement or beats per minute (bpm) determination using non invasive procedures. This board is reduced in size and includes most of the required components for pulse oximetry determination. | • Pulse oximeters  
• Anesthesia units  
• Optical heart rate monitors  
• Multi-parameter patient monitors |
| MED-GLU | MED-GLU is a single-board glucometer solution. This board is reduced in size and enables developers with tools to ease the design of medical or industrial solutions based on glucometry. This board can be used together with the Tower System, offering a complete suite of solutions including serial communications and LCD screens. | • Blood glucose meters |
| MED-BPM | MED-BPM is a development board which eases and accelerates the design of blood pressure monitor applications. It includes isolation circuitry for an air pump and escape valve and is designed for operation with 3.3 V | • Blood pressure monitors  
• Multi-parameter patient monitors |
| MED-SPI | MED-SPI is a development board which demonstrates the basic implementation of a spirometer solution. It includes a MPXV7025DP differential pressure sensor that facilitates the measurement of the air flow and allows the calculation of lung capacity measurement. | • Spirometers  
• Anesthesia units |
| MED-STETH | MED-STETH implements a stethoscope solution based on the use of ultrasonic waves. This board is auxiliary in the design of applications using ultrasound in the detection of heart rate such as digital stethoscopes or fetal heart rate monitors. | • Digital stethoscope  
• Fetal heart rate monitors |

For more information, visit freescale.com/healthcareAFE