Embedded Processor Software Toolkit for Medical Imaging
Version 2.0

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Agenda

- Product Announcement
  - Embedded Processor Software Toolkit for Medical Imaging
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    - Documentation
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  - C6472 Evaluation Module
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Embedded Processor Software Toolkit for Medical Imaging

- TI’s Embedded Processor Software Toolkit for Medical Imaging Version 2.0 is an updated and expanded collection of standard processing functions optimized for TI’s C64x+ DSP
- Goal: To make it easier for new customers to evaluate and develop medical imaging applications on TI DSPs
  - Demonstrate use and performance of TI DSP devices for medical imaging
  - Provide jump start in customer development and acceptance
  - Provide optimized code to shorten development time and increase customer efficiency on C64x+ platforms
Improved Performance, Lower Development Costs

- Optimized implementations of commonly used C64x+ DSP processing blocks
- Source Code:
  - Ultrasound:
    - B-mode (Envelop Detection & Compression) New!
    - DAS Receive Beam-forming
    - Doppler Processing
    - RF Demodulation and Decimation
    - Scan Conversion
  - Optical Coherence Tomography
    - Cubic Spline Interpolation New!
    - Optimized FFT New!
  - 3D Rendering
    - Affine Warp New!
Ultrasound Components

<table>
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<tr>
<th>Component</th>
<th>Production</th>
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</thead>
<tbody>
<tr>
<td>Delay and Sum (DAS) receive beam-forming</td>
<td>Source</td>
</tr>
<tr>
<td>RF demodulation and decimation</td>
<td>Source</td>
</tr>
<tr>
<td>B-Mode</td>
<td>Source</td>
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<tr>
<td>Wall Filter for Color Flow</td>
<td>Source</td>
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<tr>
<td>1D Color Flow</td>
<td>Source</td>
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<tr>
<td>2D Color Flow</td>
<td>Source</td>
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<tr>
<td>Power Estimator</td>
<td>Source</td>
</tr>
<tr>
<td>Scan Conversion</td>
<td>Source</td>
</tr>
<tr>
<td>Optimized math utilities</td>
<td>Source</td>
</tr>
</tbody>
</table>

Product Availability and Design Disclaimer - The system block diagram depicted above and the devices recommended are designed in this manner as a reference. Please contact your local TI sales office or distributor for system design specifics and product availability.
Optical Coherence Tomography (OCT) Components

- Cross-sect images from coherent optical reflections
- Live sub-surface images to ~3mm depth
- Superior Resolution (<10um)

Ophthalmology
Topcon 3D OCT-1000

Dentistry

Signal Processing

- ADC → Cubic Spline → FFT → Magnitude computation → Log Compression → Display

- Contained in STK 2.0

Texas Instruments
Software Toolkit - Key Features/Benefits

- Optimized building blocks
  - Reduce development effort
  - Shorten time to market
  - Create a more efficient system.

- Full source code
  - Provides full visibility
  - Enables customization
  - Enables differentiation

- Well defined APIs
  - Provides abstraction
  - Simplifies development
  - Eases integration

- Complete benchmarks
  - Quick & easy evaluation
  - Comparison to other architectures

- Test benches
  - Assures module functionality
  - Aides in eval & development
  - Easily expandable

- Full documentation
  - Provides coding illustrations
  - Serves as optimization model
C6455 DSP Starter Kit for Medical Imaging

- TI is also offering a DSP Starter Kit for Medical Imaging, a low-cost development platform ideal for evaluating the STK 2.0
- Re-packaged C6455 DSK (1.2GHz)
- STK CD includes collateral:
  - Medical Applications Guide
  - App notes
  - White papers
  - Embedded Processors for Medical Imaging Brochure
  - Analog data sheets
  - DSP data sheets
- Available now through e-Store
C6472 DSP EVM for Multicore Medical Imaging

C6472 Evaluation Module

Software debug platform for high performance application development

EVM highlights:
- Single C6472 processor
- 256MB of 533MHz DDR2
- 64MB Nand Flash
- 1Mb I2C EEPROM for local boot (remote boot possible)
- 2 RGMII 10/100/1000 Ethernet ports with MDIO
- RS232 UART
- Single module 170-pin AMC expansion for SRIO, TSIP, EMAC1 and I2C
- C6455 EVM pin-compatible HPI daughtercard connector
- 2 user programmable LEDs and DIP SWs
- 14-pin JTAG emulator header
- Embedded JTAG emulation with USB Host interface (Provided as upgrade Option)
- Board-specific Code Composer Studio™ Integrated Development Environment
- Simple setup
- Includes design files such as Orcad and Gerber
- Board support library accelerates software development on the EVM

Support:
- Broad market support: Product Information Center - FAE - Community forums - Documentation - Training

TMDXEVM6472: Available now through e-Store

SW – CCSv4, BSP, CSL, POST, NDK
Medical Ultrasound Demo Rev. 2
All B-Mode, Color Flow, and Scan Conversion Processing on OMAP3530

<table>
<thead>
<tr>
<th>Input Data Size (Post RF Demod)</th>
<th>Scan Lines</th>
<th>Samples/Scan Line</th>
<th>Bytes/Sample</th>
<th>Ensemble</th>
<th>kB/frame</th>
</tr>
</thead>
<tbody>
<tr>
<td>B-mode + Scan Conversion</td>
<td>128</td>
<td>416</td>
<td>4</td>
<td>-</td>
<td>208</td>
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<tr>
<td>Color Flow + Scan Conversion</td>
<td>64</td>
<td>256</td>
<td>4</td>
<td>8</td>
<td>512</td>
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<table>
<thead>
<tr>
<th>Loading</th>
<th>DSP</th>
<th>ARM</th>
<th>ms/fm</th>
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</thead>
<tbody>
<tr>
<td>B-Mode</td>
<td>19%</td>
<td>6%</td>
<td>15</td>
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<tr>
<td>B-Mode+ Color Flow</td>
<td>46%</td>
<td>21%</td>
<td>28</td>
</tr>
</tbody>
</table>

ARM Cortex A-8 600MHz
- Runs Linux O/S
- User Interface, Control, Display

C64x+ DSP 430MHz
- Runs Ultrasound Algorithms

- B-mode Estimation
  - Envelope Detection
  - Compression
  - Scan Conversion

- Color Flow
  - Ensemble Aggregation
  - Wall Filter
  - Flow Estimation
  - Scan Conversion
  - Tissue Flow & Blending

Display 640x480 @20fps

TI OMAP3530 Mistral EVM

- DDR
- C64x+ DSP 430MHz
- ARM Cortex A-8 600MHz
More Information and Support

- **STK-MED tool folder:**
  [http://focus.ti.com/docs/toolsw/folders/print/s2meddus.html](http://focus.ti.com/docs/toolsw/folders/print/s2meddus.html)

- **DSP starter kit tool folder:**
  [http://focus.ti.com/docs/toolsw/folders/print/tmdsmdsk6455.html](http://focus.ti.com/docs/toolsw/folders/print/tmdsmdsk6455.html)

- **TMS320C6472 EVM folder:**
  [http://focus.ti.com/docs/toolsw/folders/print/tmdsevm6472.html](http://focus.ti.com/docs/toolsw/folders/print/tmdsevm6472.html)

- **Medical ultrasound demo on OMAP3530:**
  [https://gstreamer.ti.com/gf/project/med_ultrasound/](https://gstreamer.ti.com/gf/project/med_ultrasound/)

- **TI’s medical imaging portfolio:** [www.ti.com/medicalimaging](http://www.ti.com/medicalimaging)
Questions?

MEDICAL IMAGING


Enable faster, more accurate results and empower innovation for new applications with TI's complete signal chain portfolio for medical imaging.

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