

TMS320C6000<sup>TM</sup>:

The Broadband Infrastructure and Imaging DSP

World's Highest Performance DSP

**Platform Update**

**August 2000**

**Henry Wiechman**

**Worldwide C6000<sup>TM</sup> DSP Product Marketing Manager**

# Three DSP Breakthroughs Announced in 2000

## Impacting Future of Broadband, Emerging & Mass Markets



### C2000™ DSP

Motor  
Control  
DSP

### C5000™ DSP

Personal  
DSP

### C6000™ DSP

Broadband  
Infrastructure  
DSP

**TI C28x™ DSP Core:**  
The world's first control  
optimized DSPs

- Up to 400 extended precision MIPs
- Best C/C++ Control Code Efficiency
- Software compatible with C24x™ DSP

**TI C55x™ DSP Core:**  
The world's lowest  
mW/MIPS DSPs

- As low as 0.05mW/MIPs for longest battery life
- Best code density
- Software compatible with C54x™ DSP

**TI C64x™ DSP Core:**  
The world's highest  
performance DSPs

- Scalable to 1.1GHz
- Best DSP compiler, ease of use
- Software compatible with C62x™ DSP

# Performance Driven Markets Endorse C6000™ DSP

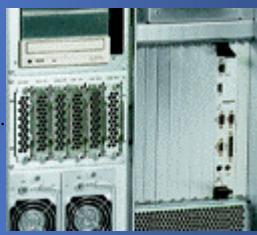
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2000

- ▶ Nearly \$2 billion of design-ins spanning a range of performance intensive applications
- ▶ Millions of units shipped with 8 different code-compatible catalog products available today
- ▶ More than 9,000 developers as measured by tool shipments
- ▶ More than 100 third parties committed to the 'C6000 platform offering a variety of hardware and software products
- ▶ Two university textbooks available today with others planned
- ▶ Widely adopted by communications and imaging markets
  - ▶ Designs at 8 of top 10 3G wireless basestation OEMs
  - ▶ Programmable ADSL designs at 4 of top 6 PC OEMs
  - ▶ Designs in leading-edge network camera, medical imaging, and video infrastructure OEMs

# C6000™ DSP Drives Broadband and Imaging with the Highest Programmable Performance

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## Broadband Communications



- DSL modems
- Pooled modems
- Base station transceivers
- Wireless LAN
- Enterprise PBX
- Speech recognition
- Multimedia gateway
- Professional audio
- Networked camera
- Machine vision
- Security identification
- Industrial scanner
- High speed printer
- Advanced encryption

## Wireless 3G Base Stations



## Imaging



# TI Provides Best Price/Performance and Easiest to Use Floating-Point DSPs



600 MFLOPS  
for \$9.95 (volume)

**SAMPLES AVAILABLE  
NOW**

**Best Price/  
Performance  
Floating-Point  
DSP**

**Broad  
Number of  
Applications**

Drives innovation  
in cost-sensitive audio,  
industrial automation  
and precision systems

**eXpressDSP™  
Software Technology  
speeds time to market**

**Easiest to Use  
DSPs**

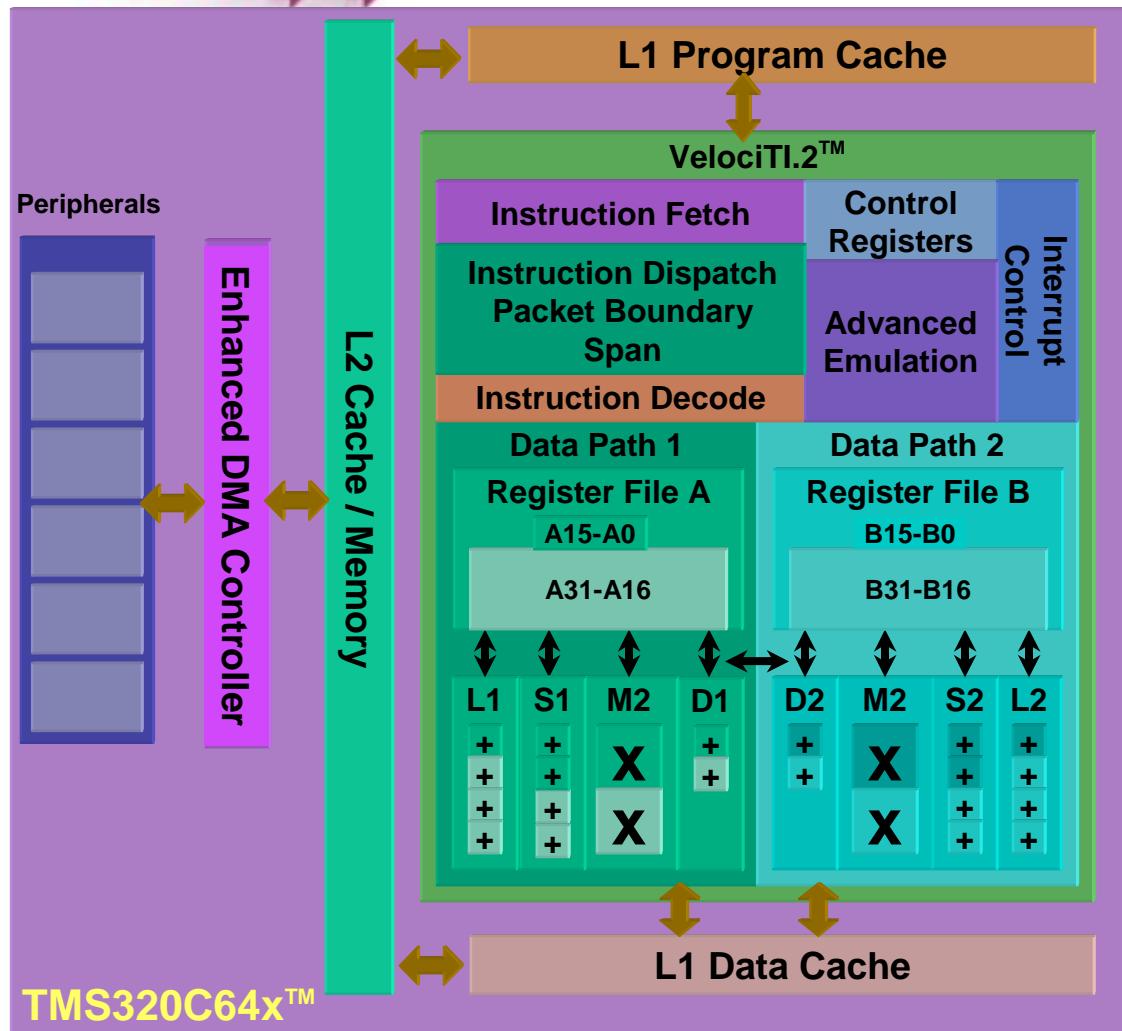
TI Internal Data - NDA Material

THE WORLD LEADER IN DSP AND ANALOG

**TEXAS INSTRUMENTS**

# C64x™: Maximizes Performance, Easiest to Use

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**Highest Performance**  
through **VelociTI.2™ VLIW**

- More work per cycle
  - Increased parallelism
  - Special purpose instructions
- Very fast clocking
  - New logic techniques for high speed without high power.

**Easiest to Use**

- Improved orthogonality
- 2x register file
- 25% code size reduction

# C6000™ DSPs 1st & 2nd Generation Spec Summary

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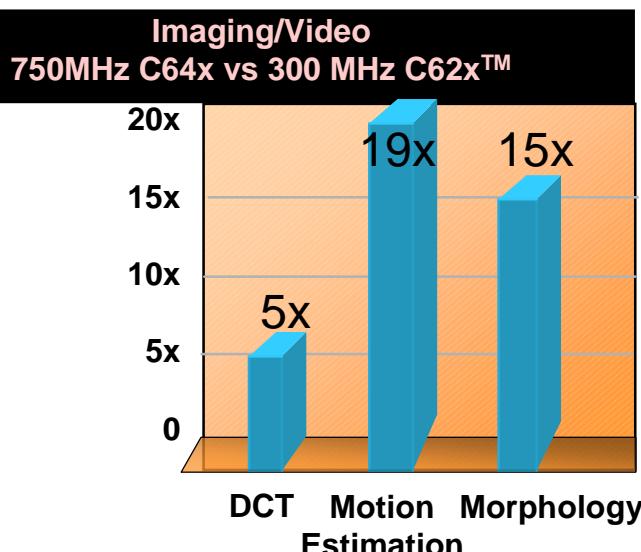
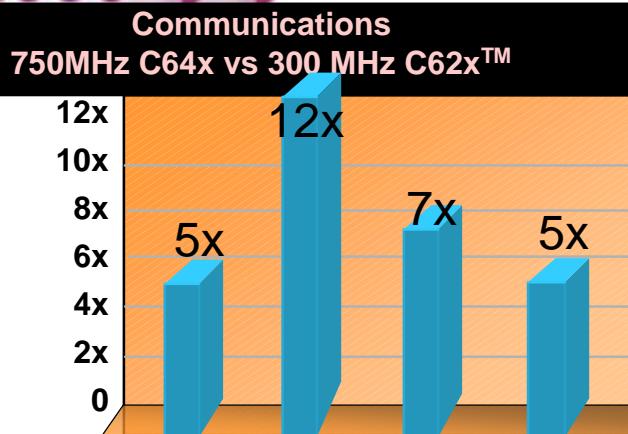
## *Software Compatible*

VelociTI™ C62x™      VelociTI.2™ C64x      Improvement

MHz	150-300	600-1100	<b>4X</b>
MIPS	1200-2400	4800-8800	<b>4X</b>
16-bit MMACs	300-600	2400-4400	<b>8X</b>
8-bit MMACs	300-600	4800-8800	<b>16X</b>
Communications	General	Special purpose instructions	<b>8X</b>
Imaging	General	Special purpose instructions	<b>15X</b>
Code size reduction		Advanced instruction packing	<b>25%</b>
<b>Overall Performance</b>			<b>10X</b>

# C64x™ Performance Speeds Past Competition

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Complete benchmark results for C6000 DSPs can be found at [www.ti.com/sc/c6000](http://www.ti.com/sc/c6000)

Eliminates need for ASICs and FPGAs in many communication and imaging applications

- C64x™ solution enables field upgradable applications
- Programmability and flexibility clobbers ASIC

**More than 10x the performance of the industry's fastest DSP**

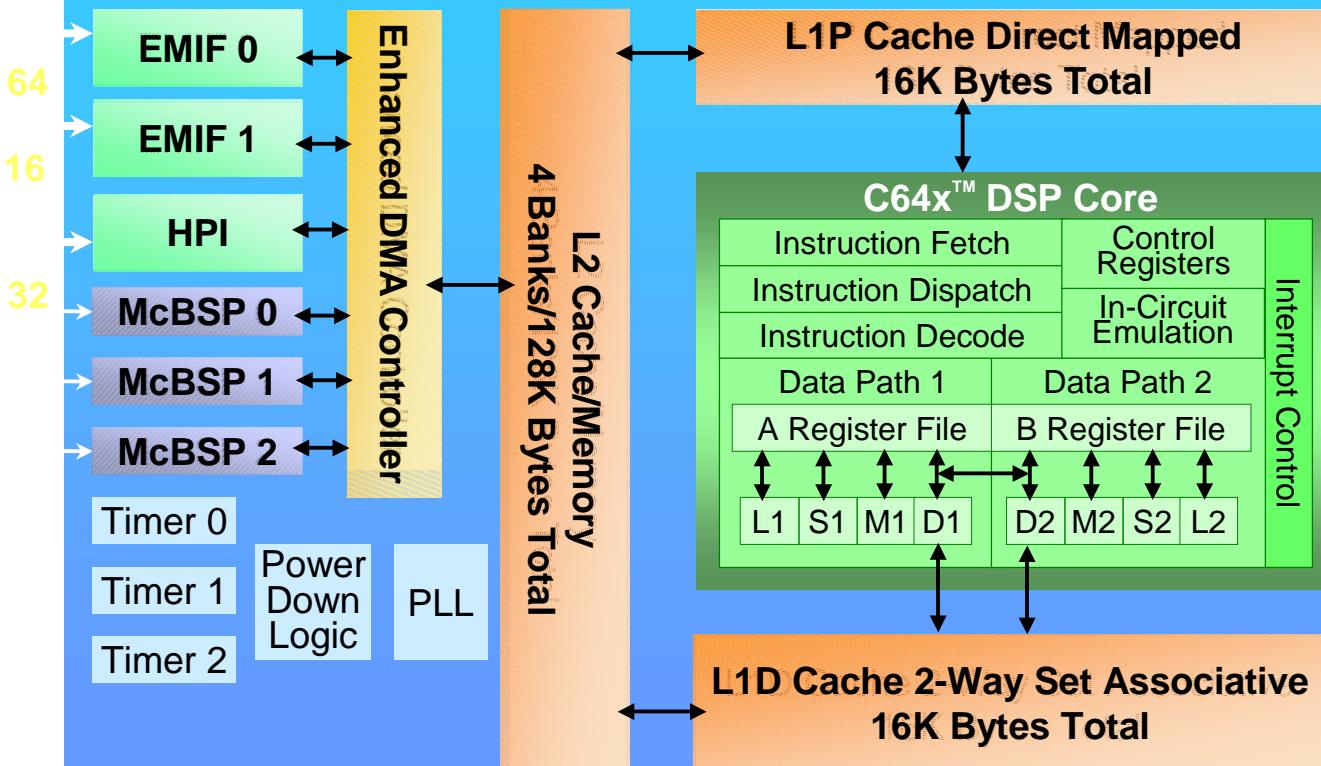
- C64x™ extends C62x™ leadership with virtually unlimited performance headroom

\* Source: Texas Instruments Incorporated

# Gigabytes of Bandwidth Fuel World's Fastest DSP Core for Ultimate Performance

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## C64x™ DSP Initial Implementation



Three External Buses Providing Over 1.8 Gigabytes Bandwidth

- 64-bit synchronous external memory Interface (EMIF)
- 16-bit EMIF for I/O
- 32-bit HPI

Three McBSPs with 128 Channel Support

Enhanced DMA (EDMA)

L1/L2 Cache Architecture

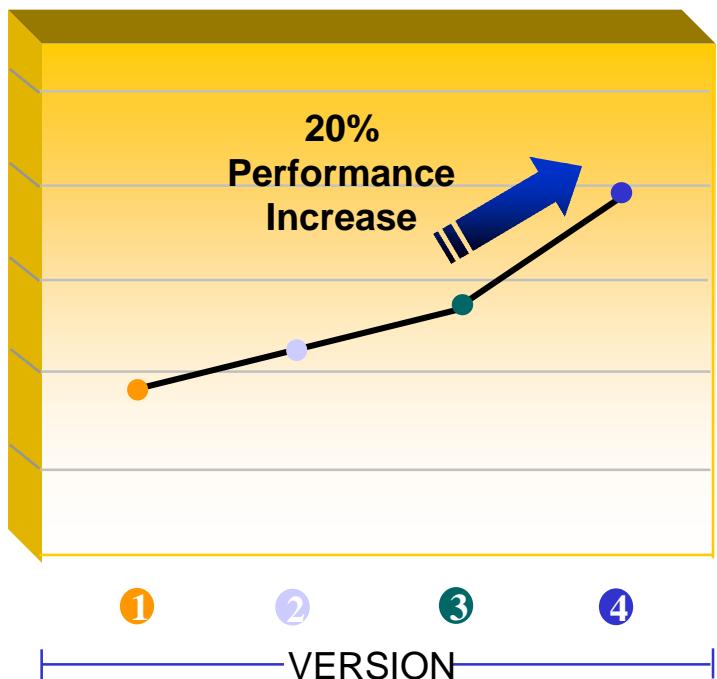
# eXpressDSP™ Real-Time Software Technology Speeds Time-To-Market



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[www.ti.com/sc/c6000compiler](http://www.ti.com/sc/c6000compiler)

## Out-of-the-box Compiler Performance Improvement



Industry's Best C Compiler for DSP Extends Performance Lead

- Achieves 80-90% performance vs. hand coded assembly
- Performance statistics backed up with real code examples downloadable today
- Out-of-the-box C code focus has produced more than 20% performance improvement
- Unique compiler feedback
- Support for C++

Check out [www.ti.com](http://www.ti.com) for details

## ► System Software

- ▶ APIs for configuring and controlling peripherals
  - ◆ CSL (Chip Support Library)
  - ◆ BSL (Board Support Library)

## ► Function libraries

- ▶ DSPLib (DSP Library)
  - ◆ General purpose DSP kernels
- ▶ ImageLib (Imaging & Video Library)
  - ◆ Imaging kernels

## ► Application Technology Demonstration Kits (TDKs)

- ▶ Demonstrate C6000 capabilities in various applications
  - ◆ Multi-channel Vocoder TDK available today
  - ◆ Imaging TDK (alpha release in progress)
  - ◆ Others TBD

# C6000™ DSP Multi-Channel Vocoder TDK Now Online

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## ► Demo code now available

- ◆ G.726/729/729A/723.1/EFR-GSM/EVRC vocoders
- ◆ G.165/168 echo cancellation

## ► First third party plug-in now available

- ◆ Signals and Software Ltd complete
- ◆ Others in progress including Commetrex, Radisys, and Delphi
- ◆ Third parties to offer source code licensing on their web site
- ◆ Featured third party algorithms are eXpressDSP™ compliant

# TI Data Converters Optimized for TI DSPs

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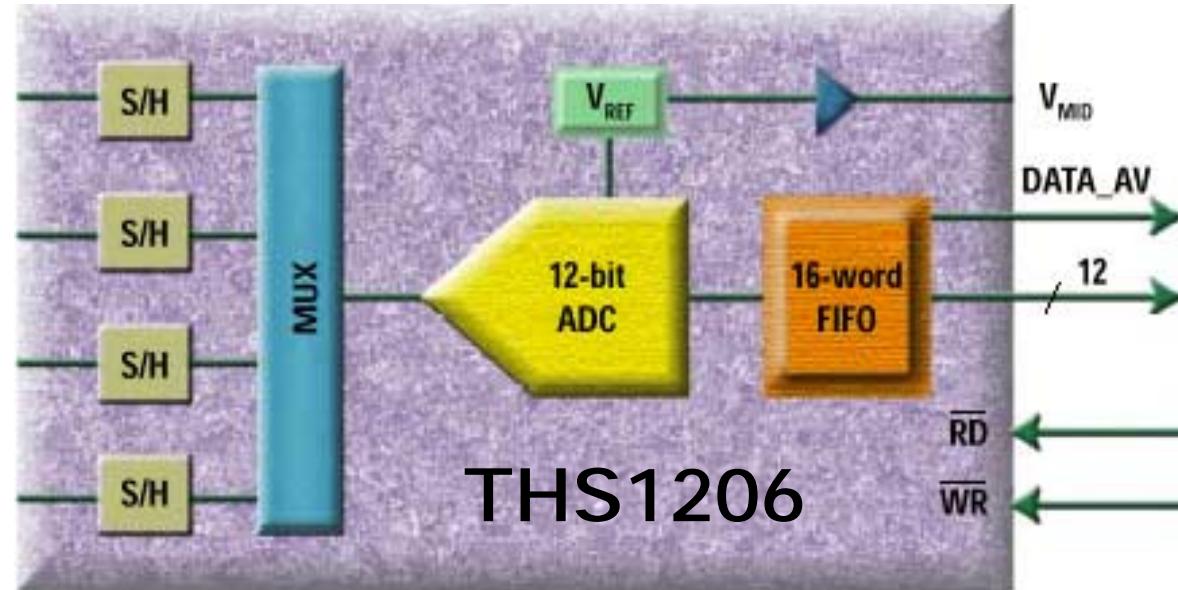
- ◆ Acquisition of Burr-Brown adds new analog expertise, enhances product portfolio, and accelerates new product development of DSP solutions
- ◆ 50 new converters in 2000 to support digital signal processing solutions
- ◆ The TI Data Converter Difference
  - Integrated FIFOs optimize DMA transfers
  - Core, I/O, and system power requirements suited for new low power DSPs
  - Code Composer Studio software plug-ins speed time-to-evaluate
  - Common connector evaluation boards interface easily with DSP evaluation boards

# TMS320C6000™ DSP Compatible Data Converters

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## New ADC Family:

- 10/12-bit, 6/8 MSPS
- Simultaneous sampling inputs
- Channel auto-scan
- Integrated 16X FIFO
- Integrated voltage ref
- Flexible DSP interface



## ADC Eval. board:

Direct connect to DSP DSKs and EVMs, featuring the common-connector interface (TMS320C6211, 'C6701, 'C6201, 'C5402)

## Add'l Tools:

Application reports, data converter CCS™ configuration plug-ins

# 18-Bit 48KSPS Audio-Band DSPcodec



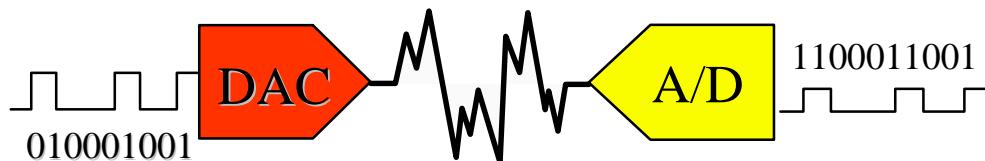
## Features

- AC97 Version 2.1 Compliant Codec
- 18-Bit Audio Codec
- SNR: 95dB (typ)
- Power Dissipation: 139mW @ 3.3V
- 4 Modes of Operation: 2 Channel / 6 Channel I2S / Quad / Modem
- Variable Sampling Rates (KHz):
  - 8000      • 22050
  - 11025      • 44100
  - 16000      • 48000

**TLV320AIC27**

## Applications

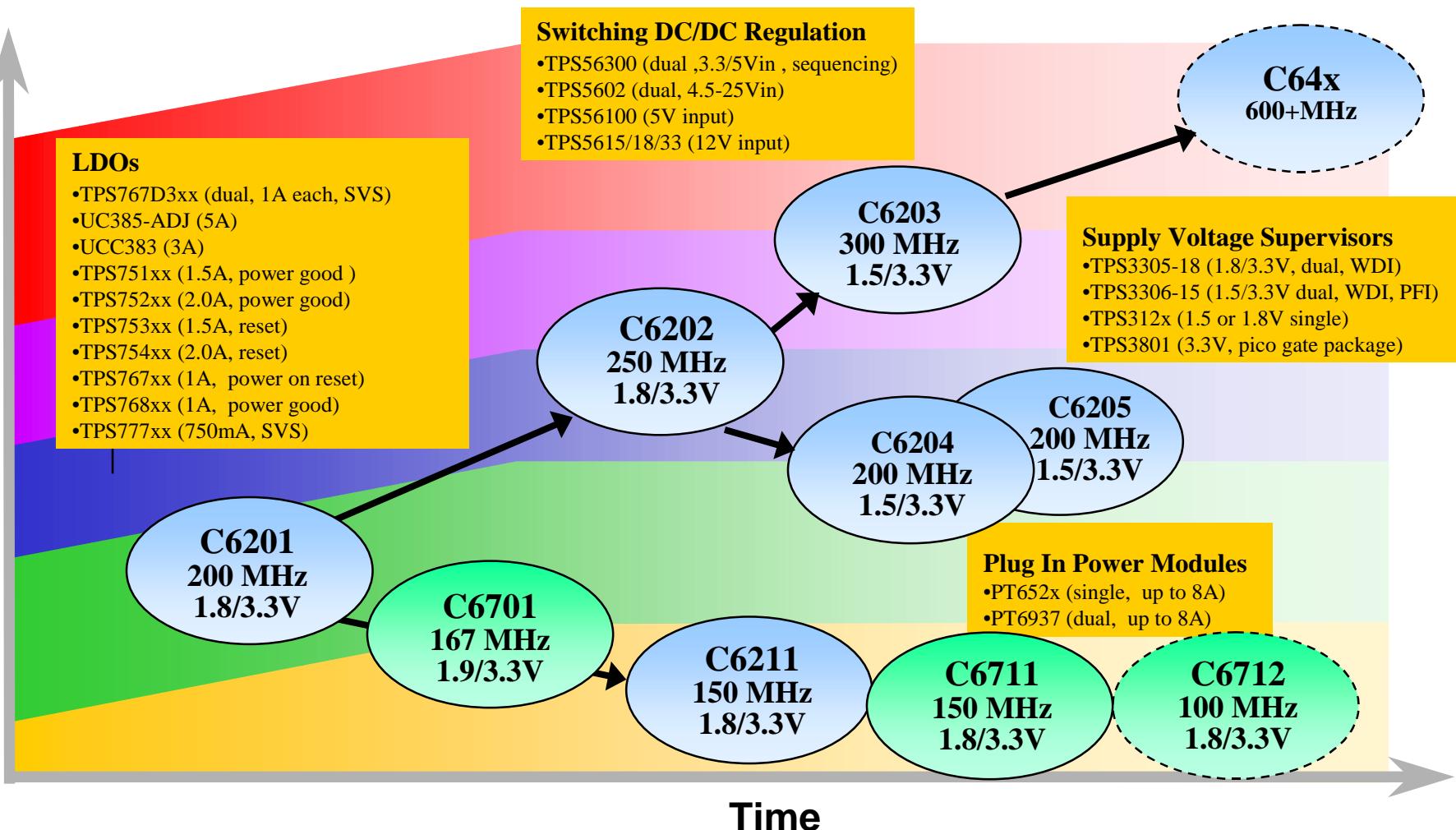
- Telecom
- USB Applications
- Teleconferencing
- Web TV



# Power Management Roadmap for C6000™ DSP

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Performance/Integration



# C6000™ DSP Call to Action

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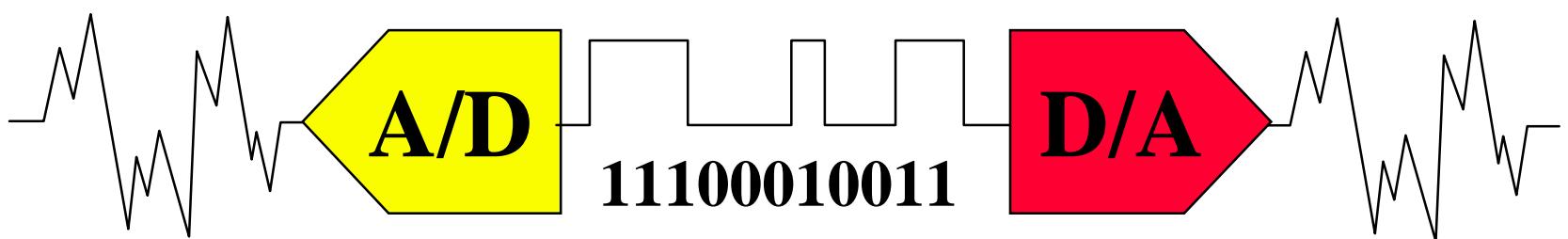


- ▶ Commit your high performance designs to C6000™ DSP: The Broadband Infrastructure and Imaging DSP
  - ▶ Eight code-compatible devices, available today, offering scalable, programmable performance to over 1.1GHz
  - ▶ eXpressDSP™ real-time software technology, featuring the industry's best C compiler performance, speeds time to market
- ▶ Create eXpressDSP™ compliant solutions
  - ▶ Multichannel vocoder and imaging TDK plug-ins
  - ▶ C6711 DSK daughter cards
- ▶ Continue incorporating C6000™ DSP into university curriculum
  - ▶ New DSK and text books for laboratory courses
  - ▶ Additional broadband infrastructure and imaging research needed



# Backup Slides

# *More Data Converters Optimized for TMS320C6000<sup>TM</sup> DSPs*



## *Bridging the Analog & Digital Worlds*

# 14 Bit, 3 MSPS DSPS ADC

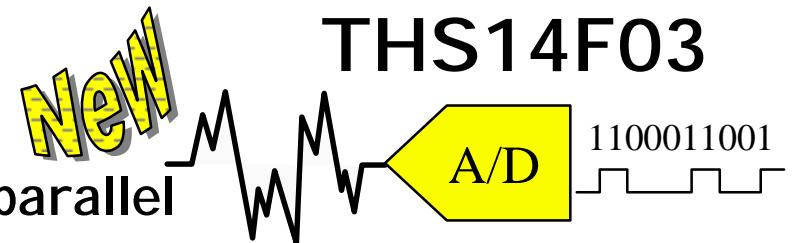


## Features

- ◆ TMS320C6000™ DSP compatible parallel Interface
- ◆ 32-Word FIFO optimizes DMA transfers
- ◆ Differential inputs, PGA
- ◆ On chip voltage reference

## Key Differentiators

- ◆ Programmable Gain Amplifier (PGA)
- ◆ Parallel interface with FIFO
- ◆ Designed for TMS320C6000™ DSP



## Applications

- ◆ Communications
- ◆ Scanners
- ◆ Data acquisition
- ◆ Instrumentation

# High-Speed Data Acquisition for TMS320C6000™ DSP Applications

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- ✓ with internal FIFO memory (16X, 32X)
- ✓ without internal FIFO memory

*Multi-purpose ADC options:*

<i>Device</i>	<i>Resolution</i>	<i>Sample Rate</i>	<i>Channels</i>	<i>FIFO</i>
THS14F03	14-bit	3 MSPS	1	32X
THS14F01		1 MSPS	1	32X
THS1408		8 MSPS	1	none
THS1403/1		3/1 MSPS	1	none
THS1206	12-bit	6 MSPS	4	16X
THS12082		8 MSPS	2	16X
THS1207		6 MSPS	4	none
THS1209		8 MSPS	2	none
THS10064	10-bit	6 MSPS	4	16X
THS10082		8 MSPS	2	16X
THS1007		6 MSPS	4	none
THS1009		8 MSPS	2	none

# 12 Bit, 40 MSPS ADC

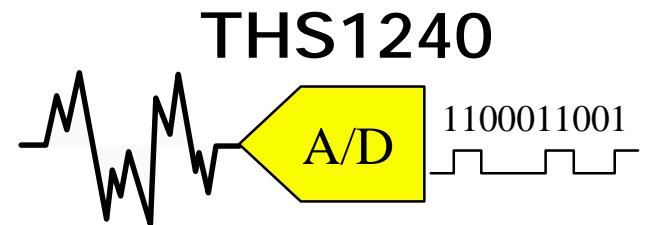


## Features

- ◆ Single 5 V Supply
- ◆ No Missing Codes over Full Temp Range
- ◆ On Chip T/H and Internal Reference
- ◆ 73 dB typical Spurious Free Dynamic Range at  $f_{IN} = 15.5$  MHz
- ◆ 82 MHz Bandwidth
- ◆ High Input Impedance ( $1M\Omega$ )

## Schedule

- ◆ Samples: today
- ◆ Production: 8/31/00



## Applications

- ◆ Wireless Local Loop
- ◆ Magnetic Resonant Imaging
- ◆ Medical Ultrasound
- ◆ Cable Modem Receivers
- ◆ Wireless Internet Access

# 16-Bit 22KSPS Voice-Band DSPcodec



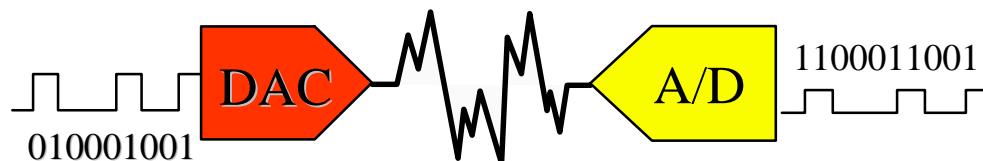
## Features

- 16-bit, 22KSPS
- Low Power Dissipation: 39mW @ 8KSPS
- Powerful Glueless Serial Interface to SPI and TMS320 DSPs
- 3.0V to 5.5V Analog Operation
- Built-in microphone bias and interface
- Supports up to 7 slaves with 1 master
- 85dB SNR for ADC and DAC

**TLV320AIC10**

## Applications

- Hands-Free Car Kits
- Cable Modems
- Feature Phones
- Speech Recognition
- USB Headsets
- Digital Cameras w/Voice



# TLV320AIC10 Block Diagram

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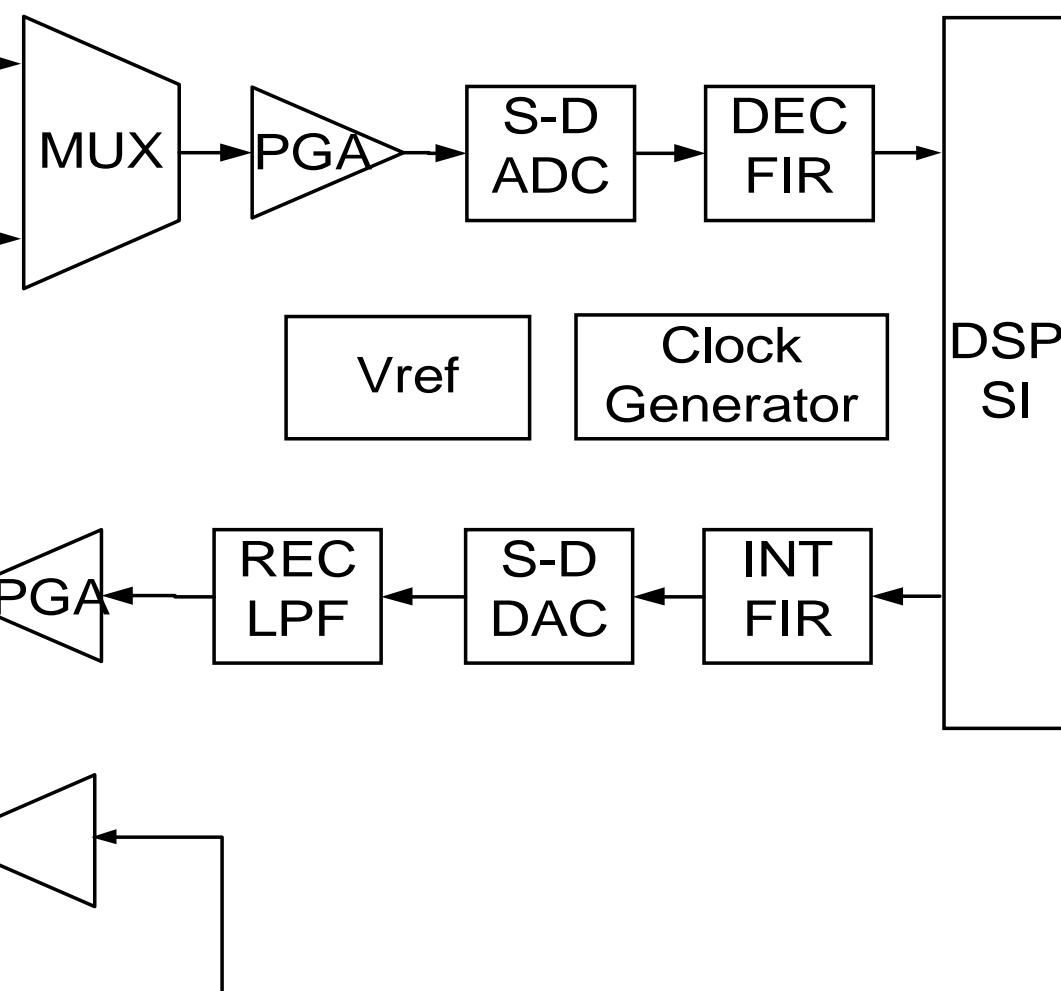
MIC/Hybrid

Op-Amp

Normal  
Analog Input

Analog  
Output

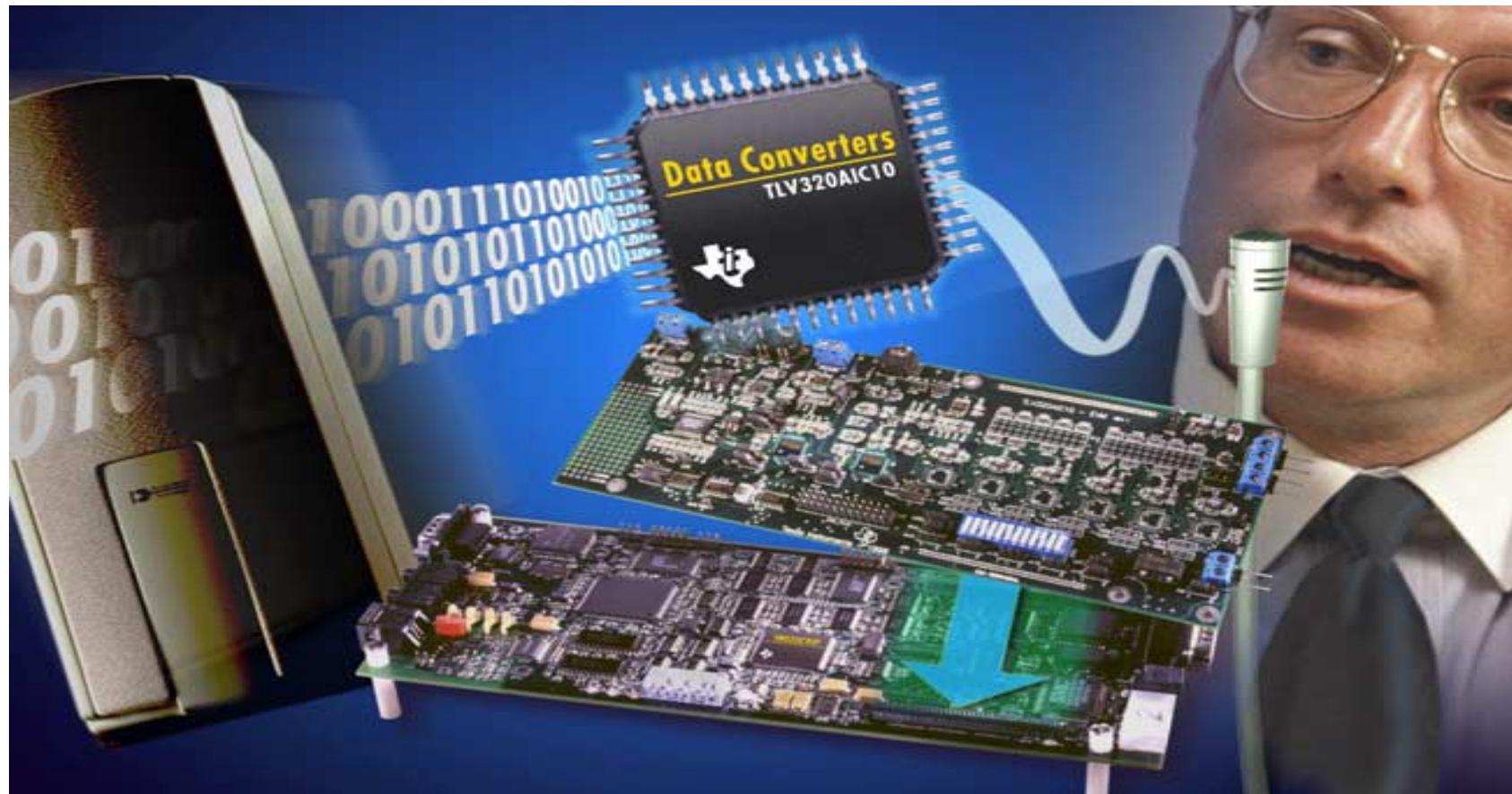
Transmitter  
Op-Amp



# TLV320AIC10 Evaluation Board (AIC10-EVM)

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***TLV320AIC10, A Complete Mixed Signal CODEC  
solution for Voice Band Applications !***



# 18-Bit 48KSPS Audio-Band DSPcodec

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