

# TMS320C5000<sup>™</sup> : The Personal DSP

World's Most Power-Efficient DSPs

## Platform Update August 2000

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# C5000 Platform Update Agenda

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- ▶▶ Market Positioning
- ▶▶ Market Acceptance
- ▶▶ Targeted Applications
- ▶▶ Silicon Status
- ▶▶ Foundation Software
- ▶▶ Development Tools
- ▶▶ Complementary Analog Products
- ▶▶ Summary

# Three DSP Breakthroughs Announced in 2000

DSPS Fest  
2000

Impacting Future of Broadband, Emerging and Mass Markets

## C2000™ DSP

Motor  
Control  
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

## C5000™ DSP

Personal  
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

## C6000™ DSP

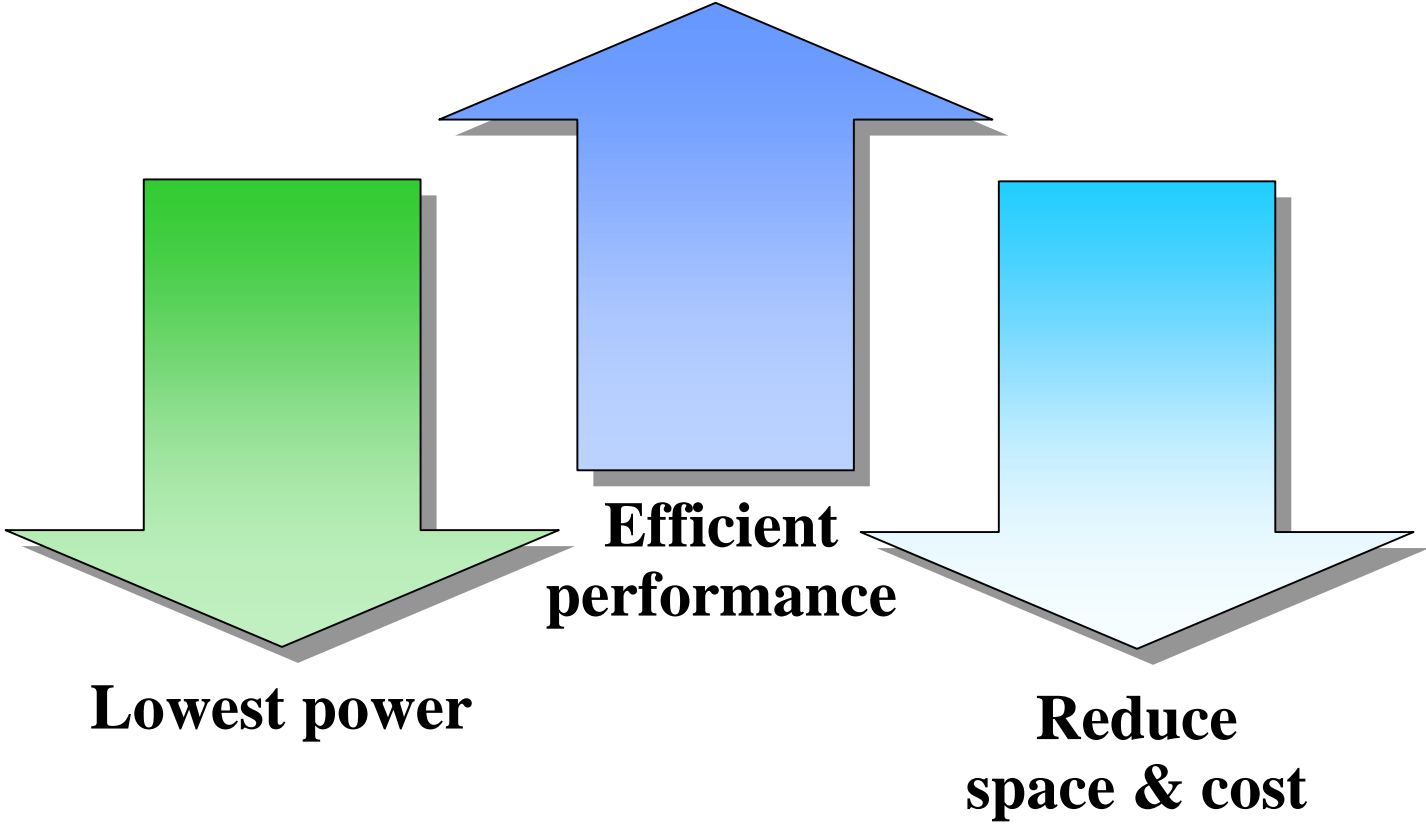
Broadband  
Infrastruc-  
ture DSP

**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

# C5000: Power-Efficient Performance

**Efficiency in power, performance, space, cost!**



# C5000 DSP Platform:

## Most Popular DSPs in the Industry

C5000 Personal DSP

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### ◆ C5000™ DSP platform market acceptance:

- Over 300 MU using C54x™ core shipped since 1997
- TI's most successful DSP platform to date has garnered \$3B in design-ins across 15 code-compatible standard C54x generation product offerings since 1997
- C54x generation is the DSP choice for communications:
  - ◆ 2/3 of all digital cellular handsets shipped today
  - ◆ 80% of all VoP gateways
  - ◆ Dozens of design-ins with digital portable audio players, digital still cameras, and PDAs
  - ◆ Hundreds of other applications with thousands of developers
  - ◆ C5402 ramped to 1Mu in 9 months (volume across hundreds of customers)

# C5000 Market Opportunities

C5000 Personal DSP

DSPS Fest 2000

C5000 MIPS

Higher  
(multi-DSPs, multi-core)

Lower  
(1 DSP, 1 core)



Desirable

Power Efficiency

Critical

THE WORLD LEADER IN DSP AND ANALOG

TEXAS INSTRUMENTS

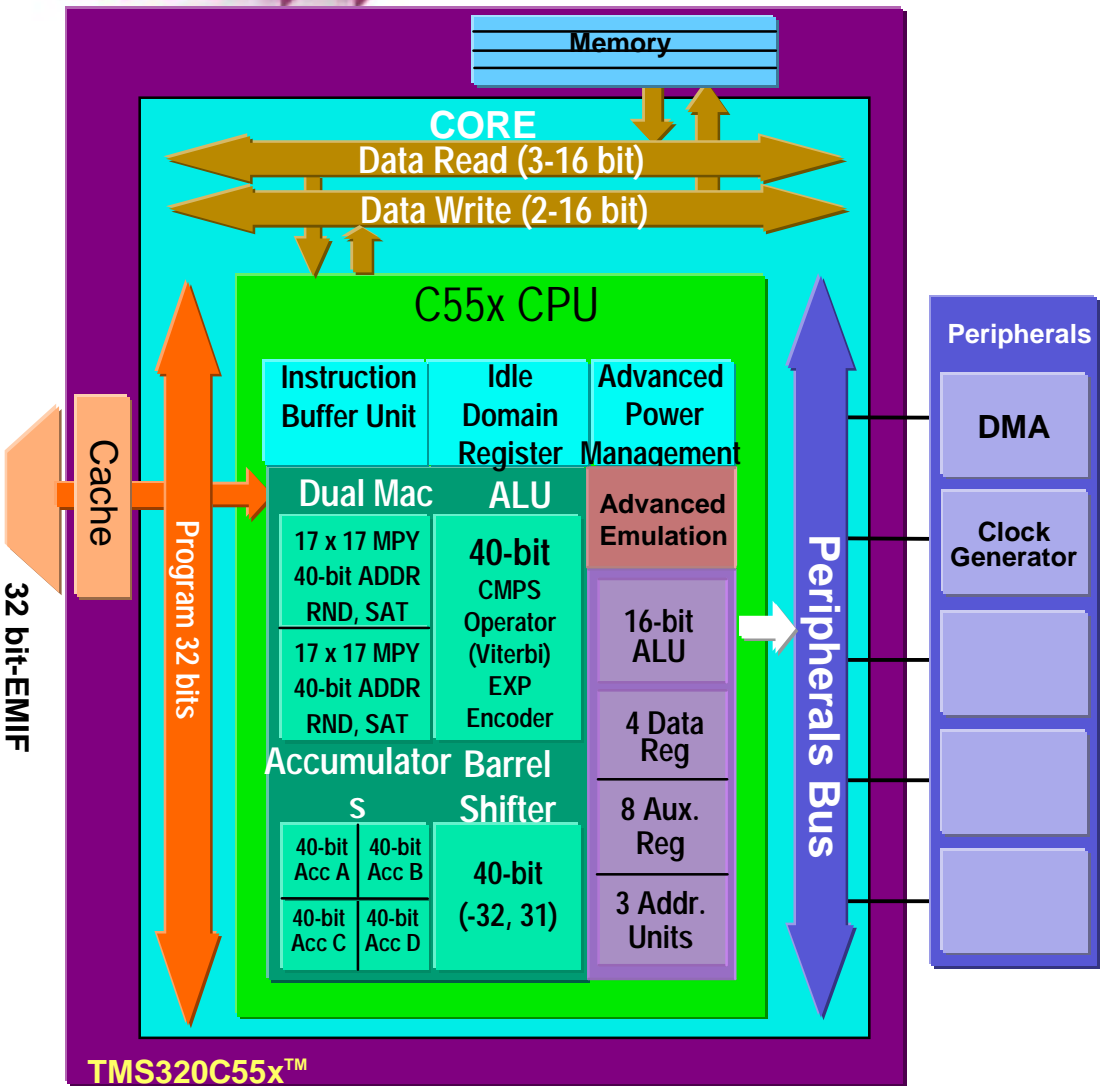


# C5000 Catalog DSP Portfolio

	SINGLE CORE					MULTI-CORE		
Features	C5402	C5409	C5410	C5416	C5510	C5420	C5421	C5441
MIPS	30/80/100	30/80/100	100/120	160	400	200	200	532
RAM (words)	16K	32K	64K	128K	160K	200K	256K	640K
ROM (words)	4K	16K	16K	16K	16K	--	4K	--
McBSP	2	3	3	3	3	6	6	12
HPI	8-bit	8/16-bit	8-bit	8/16-bit	8/16-bit	16-bit	8/16-bit	8/16-bit
DMA	6-ch	6-ch	6-ch	6-ch	6-ch	12-ch	12-ch	24-ch
Timer	2	1	1	1	2	2	2	4
Core Voltage	1.8V 1.2V	1.8V 1.2V	2.5V	1.5V	1.6V	1.8V	1.8V	1.5V
Power	60mW (100MHz)	72mW (100MHz)	115mW (100MHz)	90mW (160MHz)	100mW (200MHz)	266mW (100MHz)	160mW (100MHz)	550mW (133MHz)
Package	144 LQFP 144 BGA	144 LQFP 144 BGA	144 LQFP 176 BGA	144 LQFP 144 BGA	240 BGA	144 LQFP 144 BGA	144 LQFP 144 BGA	176 LQFP 169 BGA
Samples	--	--	--	NOW	NOW	--	--	3Q00
Production	NOW	NOW	NOW	4Q00	4Q00	NOW	NOW	1Q01
Price (1KU)	\$6	\$10-\$14	\$30	\$37	\$45	\$63	\$75	\$120

# C5000 Personal DSP C55x - Most Power Efficient DSP

DSPTS Fest 2000



## Lowest Power per MIPS

- Advanced power management
- Low power design

## Low System Cost

- Improved code efficiency
- Expanded options for external memory

## Enhanced Performance

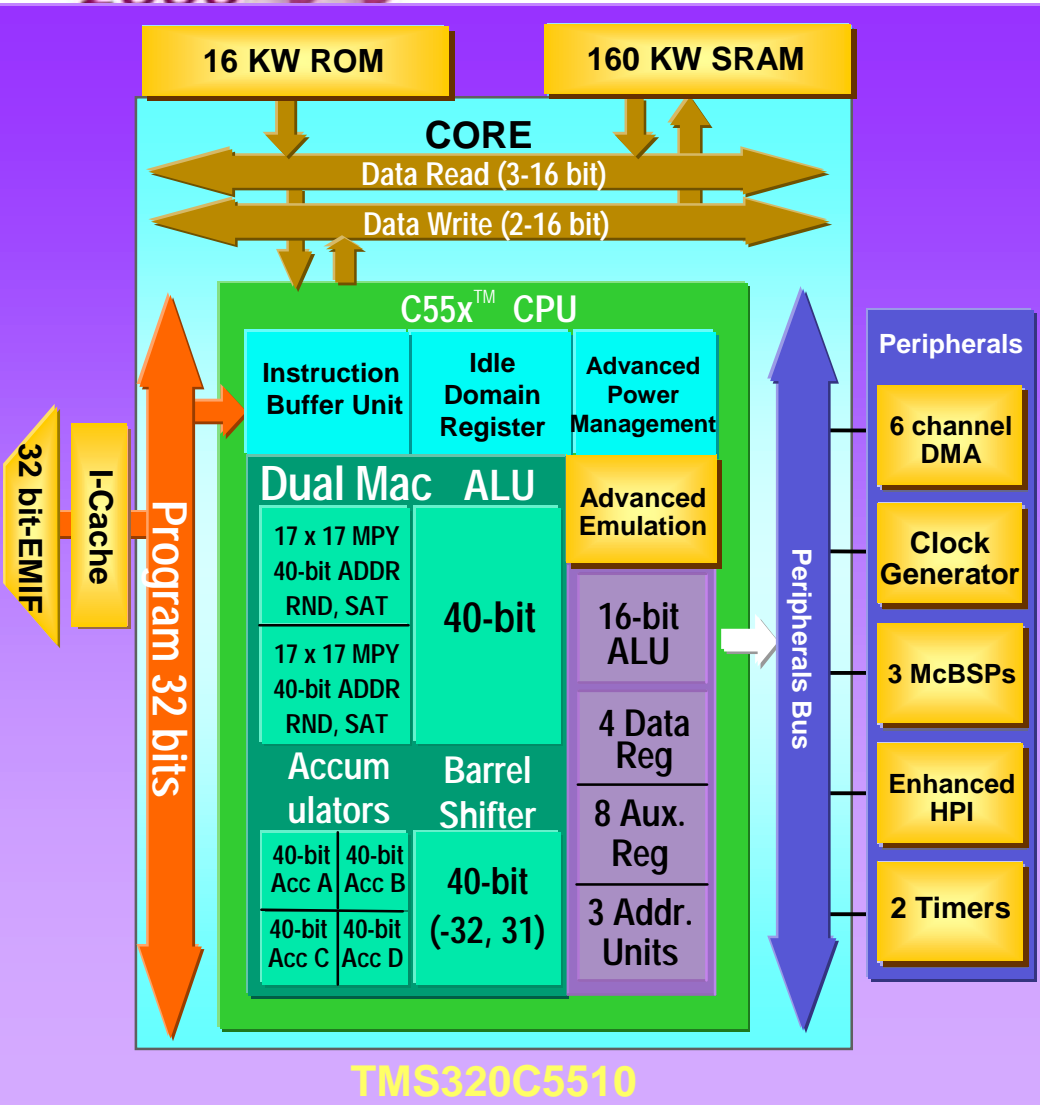
- Increased cycle efficiency
- Increased clock rate



# C5510: First Device in C55x Low Power Generation

C5000 Personal DSP

DSPS Fest 2000

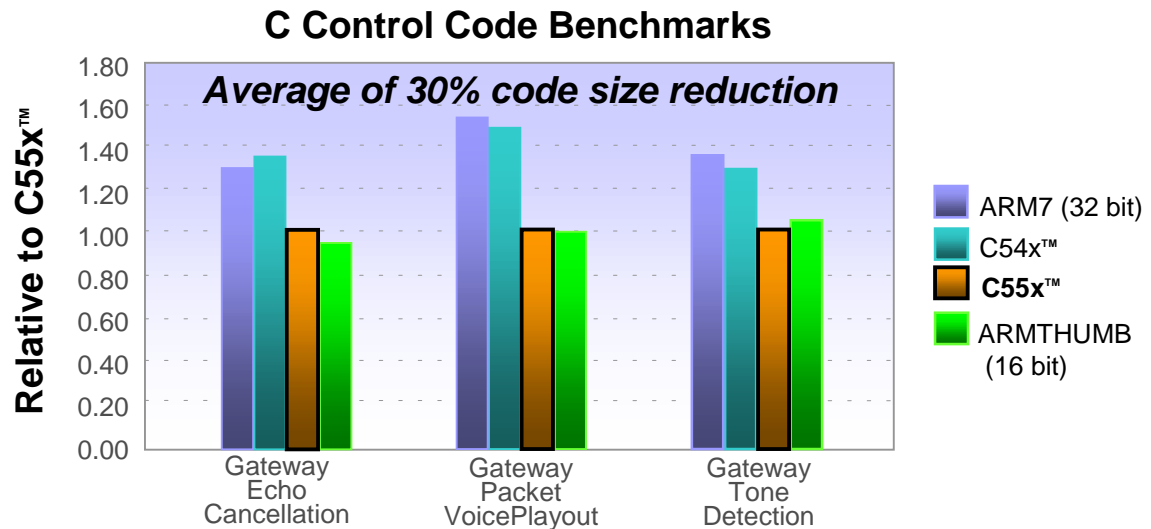
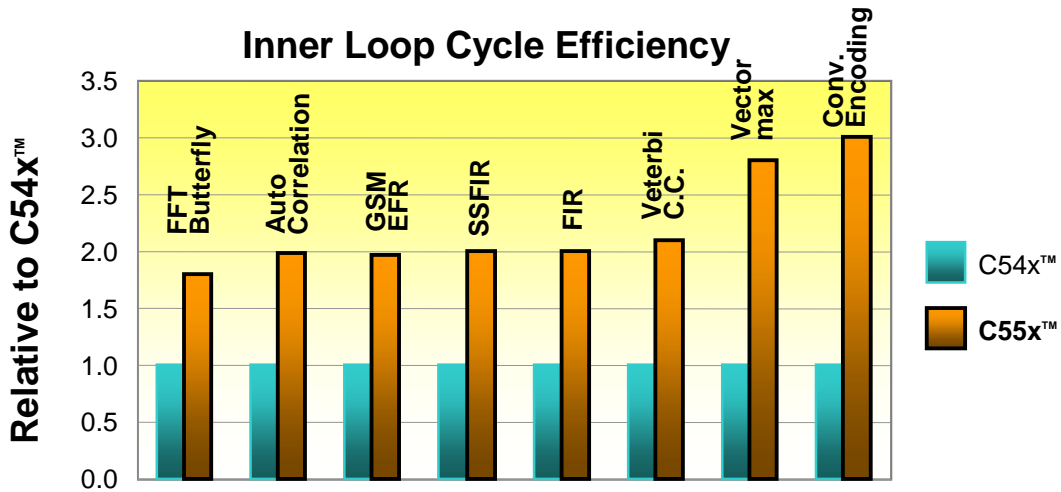
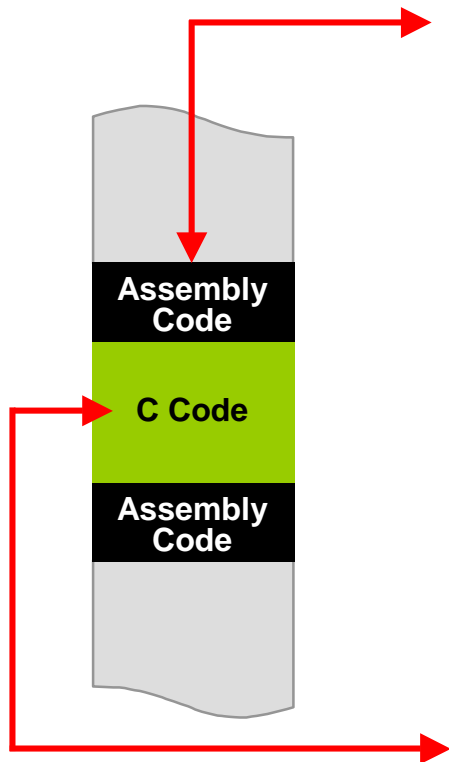


<b>Performance</b>	160/200 Mhz (320/400 MIPS)
<b>Power Dissipation</b>	0.25 mW / MIPS
<b>On-chip memory</b>	160K x 16-bit on-chip RAM
	16K x 16-bit ROM
<b>Address range</b>	8M x 16-bit (pgm / data)
<b>Instruction Cache</b>	24 Kbytes (I-cache)
<b>Peripherals</b>	6-channel DMA controller
	3 Multi-channel buffered serial ports
	16-bit Host Port Interface
	2 20-bit timers; 8 GPIO lines
	On-chip clock generator (Digital PLL)
<b>Process / Voltage</b>	0.15um (1.5V core / 3.3V I/O)
<b>Packaging</b>	15x15mm / 240-ball u*BGA

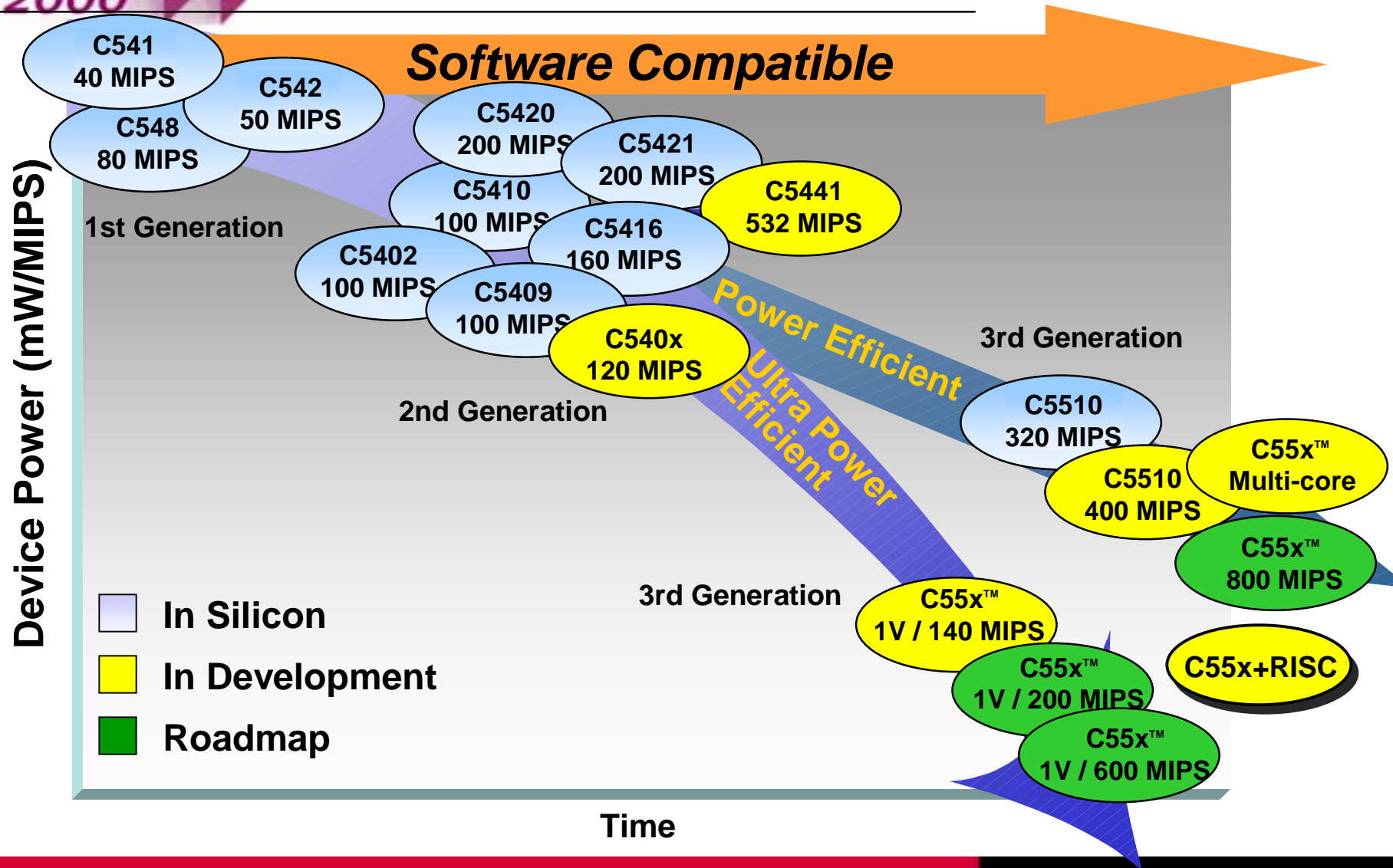
# C55x Maximizes Cycle Efficiency and Code Density

C5000 Personal DSP

DSPS Fest 2000



# C5000 Platform Roadmap



# C5000 Code Composer Studio™ IDE



## SOLUTIONS FOR THE C5000™ DSP: Free Evaluation Tools

- Try before you buy
- Code Composer Studio™  
Compile Tools
  - full function and features for 30-days
- Multi-Media Guided Tour and Tutorial (on CD version)

## SOLUTIONS FOR THE C5000™ DSP: Get to market faster

- Tightly integrated development environment in a single easy-to-use application
- Open Plug-in Architecture
- Real Time Analysis Tools
- Scalable real-time kernel (DSP/BIOS)
- TMS320™ DSP Algorithm Standard
- Advanced Data visualization Tools

[www.ti.com/expressdsp](http://www.ti.com/expressdsp)

# C5000 Code Composer Studio v2.0

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- ✓ IDE : Large project and version control support
- ✓ Addition of Update Advisor capability
- ✓ Heterogeneous Multiprocessor support (RTDX/BIOS)
- ✓ BIOS supported in simulation - enabled by RTDX
- ✓ CSL Integration
- ✓ Compiler performance improvements for C55x
- ✓ Full C++ compile and debug support (C55x)
- ✓ Enhanced emulation capability - Thunderstorm ready
- ✓ Shared Memory Support
- ✓ Full C5510 support (DSP BIOS II, RTDX, Sim, Emu, and Visual Linker)



## TMS320C5402 DSP Starter Kit (DSK)

SOLUTIONS FOR THE C5000™ DSP:  
Get Started with TI DSPs today

### Hardware Summary

- 100 Mhz C5402 DSP
- Embedded JTAG emulation via the TBC & IEEE-1284 parallel port
- On-board controller allows host PC to use parallel port for emulation or directly access C5402 HPI
- Two 3.5mm audio jacks for mic & speaker
- RJ-11 connector for DAA access
- DB-9F RS-232 serial I/O port
- Expansion port connectors (future modules)
- Expansion connectors for add-on accessories
- +5V universal power supply



(Part Number TMDX320005402)

**Price: \$295**



# TMS320C5402 DSP Starter Kit (DSK)

SOLUTIONS FOR THE C5000™ DSP:  
Get Started with TI DSPs today

## Software Summary

- Code Generation Tools  
    C Compiler, Assembler and Linker
- Code Composer Debugger
- Example Programs and Software Utilities



(Part Number TMDX320005402)

**Price: \$295**

# TMS320C5402 DSP Starter Kit (DSK)

## SOLUTIONS FOR THE C5000™ DSP: Get Started with TI DSPs today

### August 1-day Workshops (Americas)

- August 3, 2000 Tampa, FL
- August 8, 2000 Boston, MA
- August 10, 2000 Ft. Lauderdale, FL
- August 10, 2000 Totowa, NJ
- August 17, 2000 Minneapolis (Bloomington), MN

Workshops scheduled from May - October '00:  
<http://www.ti.com/sc/docs/training/workshop/c5000/index.htm>



**> 50 C5000 1-day workshops  
in locations worldwide**

**C5000 1-day workshop**

**Price: \$349**

Fee includes all training, materials  
and a C5402 DSK

# C5000™ DSP Foundation Software

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▶▶▶ 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)
  - ◆ Over 50 C-callable optimized assembly kernels for C54x & C55x (FFT, filtering & adaptive filtering, correlation, math functions, trigonometric, matrix & others)

## ▶▶ Application Technology Demonstration Kits (TDKs)

- ▶ Demonstrate C5000 capabilities in various applications
  - ◆ Telephony TDK (G.726, G.165, DTMF, CPTD, V.22bis, V.32bis, etc.) - Availability in 4Q00
  - ◆ Others TBD

# TI Data Converters Optimized for TI DSPs

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2000*

- ◆ 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

# Power Management for C5000 Roadmap

TODAY

Ramp

NEXT

\*4Q00 planned availability

	TODAY	Ramp	NEXT
Voice-band Infrastructure	<p><b>C5420</b> 1.8V / 3.3V</p> <p>TPS3306-18 Dual SVS, WDI/PFI PT6937- Dual Plug In Module TPS56302 - Switcher, dual UC385-ADJ - 5A LDO</p>	<p><b>C5421</b></p> <p>TPS3306-18 Dual SVS, WDI, PFI PT6937- Dual Plug In Module TPS56302 - Switcher, dual UC385-ADJ - 5A LDO</p>	<p><b>C5440</b>      <b>C5441</b></p> <p><b>C5421A</b></p> <p>*TPS5631x - Switcher, Dual w/ RESET *TPS755xx - 5A LDO *TPS543xx - 3A switcher with FET</p>
Access / Edge Equip.	<p><b>C5410</b> 120 MIPS</p> <p>TPS3306-25 - Dual SVS, WDI, PFI PT6937 - Dual Plug In Module TPS56302 - Switcher, dual TPS75425 - 2A LDO</p>	<p><b>C5416</b> 160 MIPS</p> <p>TPS3306-15 - Dual SVS, PFI, WDI PT6937 - Dual Plug In Module TPS56302 - Switcher, dual TPS75115 - 1.5A LDO</p>	<p><b>C5510</b> 320 MIPS</p> <p>TPS3307-33 - SVS, dual config PT6937 - Dual Plug In Module *TPS5631x - Switcher, dual with RESET *TPS543xx - 3A switcher with FET TPS75115 - 1.5A LDO</p>
Personal & Portable	<p><b>C5410</b> 100 MIPS</p> <p>TPS61003 - Low power Boost Converter TPS3306-25 - Dual SVS TPS70758 - Dual LDO w/ sequencing</p>	<p><b>C5409</b> 100 MIPS</p> <p>TPS61002 - Low power Boost Converter TPS3306-18 Dual SVS, WDI, PFI TPS70751 - Dual LDO w/ Sequencing</p>	<p><b>C5410A</b></p> <p>TPS61003 - Low power Boost Converter TPS3306-25 - Dual SVS, WDI, PFI TPS70158 - Dual LDO w/ sequencing</p>
Client-side Telephony	<p><b>C5402</b></p> <p>TPS61002 - Low power Boost Converter TPS3306-18 - Dual SVS, WDI, PFI TPS70758 - Dual LDO w/ sequencing</p>	<p><b>C5409</b> 80 MIPS</p> <p>TPS61002 - Low power Boost Converter TPS3306-18 - Dual SVS, WDI, PFI TPS70758 - Dual LDO w/ sequencing</p>	<p><b>C5409A</b></p> <p>TPS61002 - Low power Boost Converter TPS3306-18 - Dual SVS, WDI, PFI TPS70758 - Dual LDO w/ sequencing</p>



# C5000™ DSP Call to Action

DSPTS Fest  
2000

- ▶▶ Commit your low power designs to C5000™: The Personal DSP
  - ▶ Fifteen code-compatible devices, 14 available today, offering scalable, programmable performance from \$5 to over 500 MIPS
  - ▶ eXpressDSP™ real-time software technology, featuring industry leading code density, speeds time to market
- ▶▶ Create eXpressDSP™ compliant solutions
  - ▶ C5402 DSK daughter cards
  - ▶ CCS plug-ins (Algorithm Standard; Telephony TDK)
- ▶▶ Continue incorporating C5000™ DSP into university curriculum
  - ▶ New DSK and text books for laboratory courses
  - ▶ Low power, portable end-equipment research focus