



TMS320F243 DSK

Optimized for Digital Motor Control

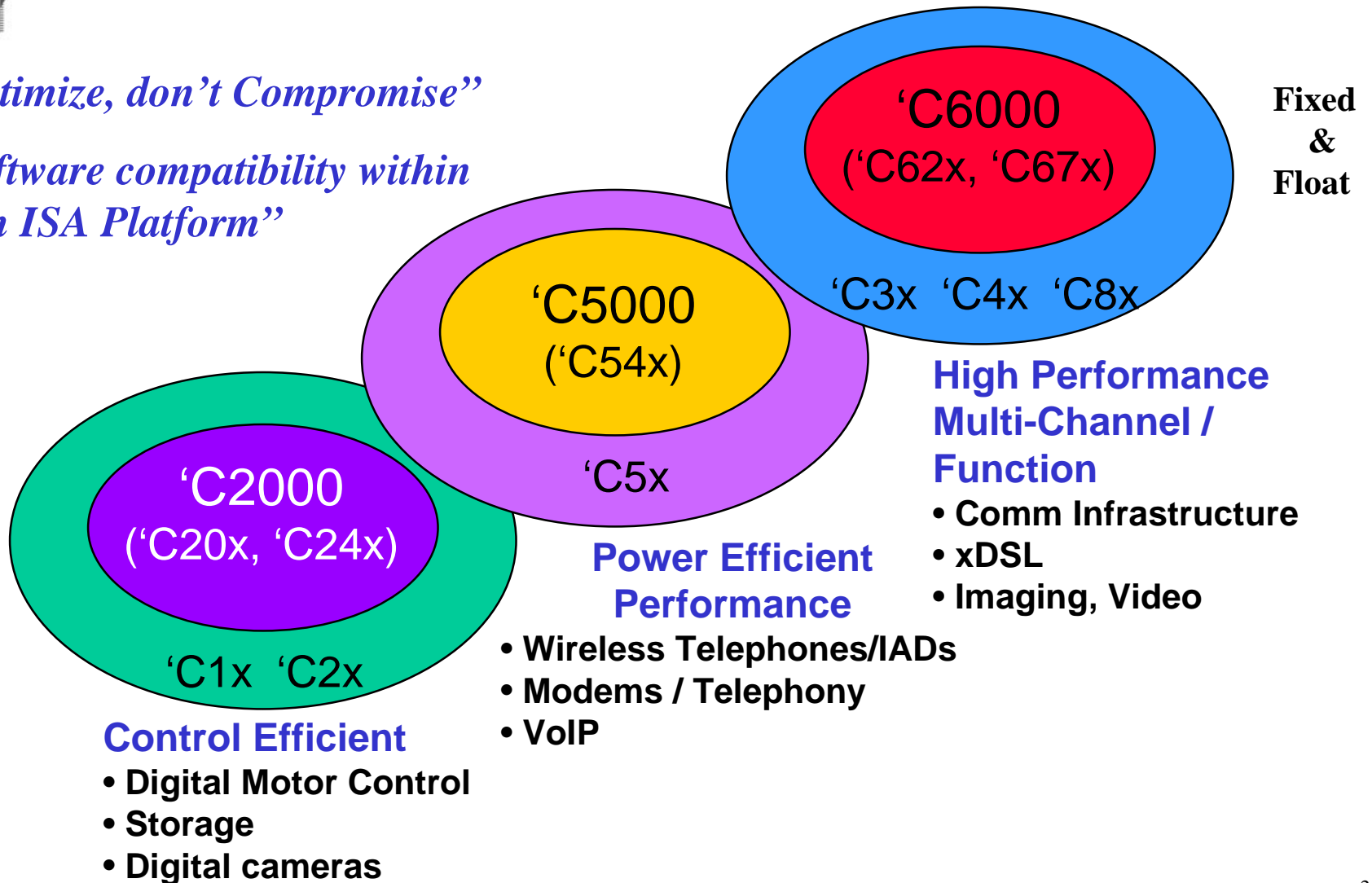
- Low Cost: \$199
- Easy to use
- Outstanding learning tool for DSP & Motor Control
- Availability: August '99
 - ◆ from TI Distributors (Arrow, Avnet/Marshall, Wyle)
 - ◆ from Spectrum Digital



TMS320 DSP “3 ISA” Platforms

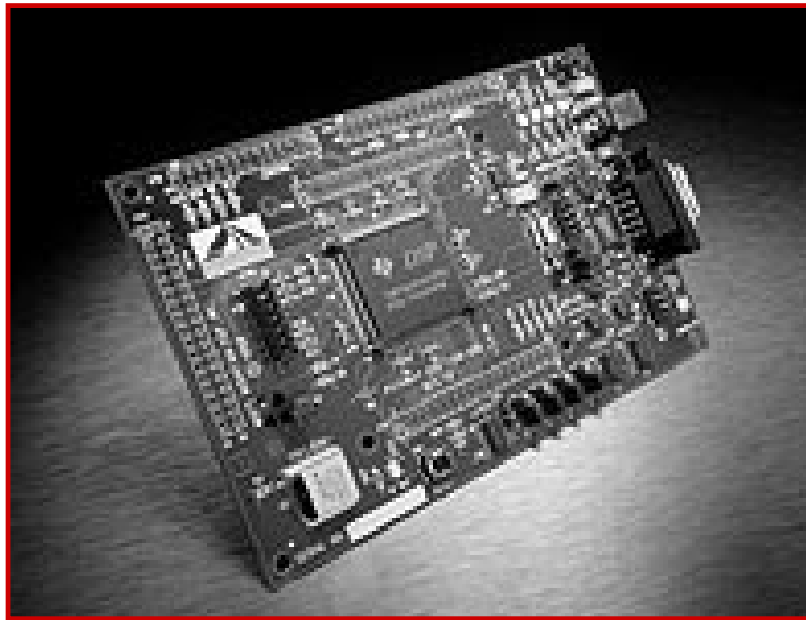
“Optimize, don’t Compromise”

“Software compatibility within each ISA Platform”





'F243 DSK Contents



Spectrum Digital Part Number: 701024

TI Part Number: TMDS3P701024

Available 8/99

Price: \$199

◆ Hardware

- TMS320F243 DSP
- 32K of on-board program/data RAM
- 10MHz crystal
- 3 Expansion Interfaces (I/O, Analog, Expansion)
- JTAG capability (IEEE 1149.1)
- 5V power supply
- RS-232 serial cable to interface w/ host PC

◆ Software

- Symbolic assembler
- Code Explorer debugger

◆ Documentation

- Installation Guide and Tutorial
- Hardware and Software Manuals



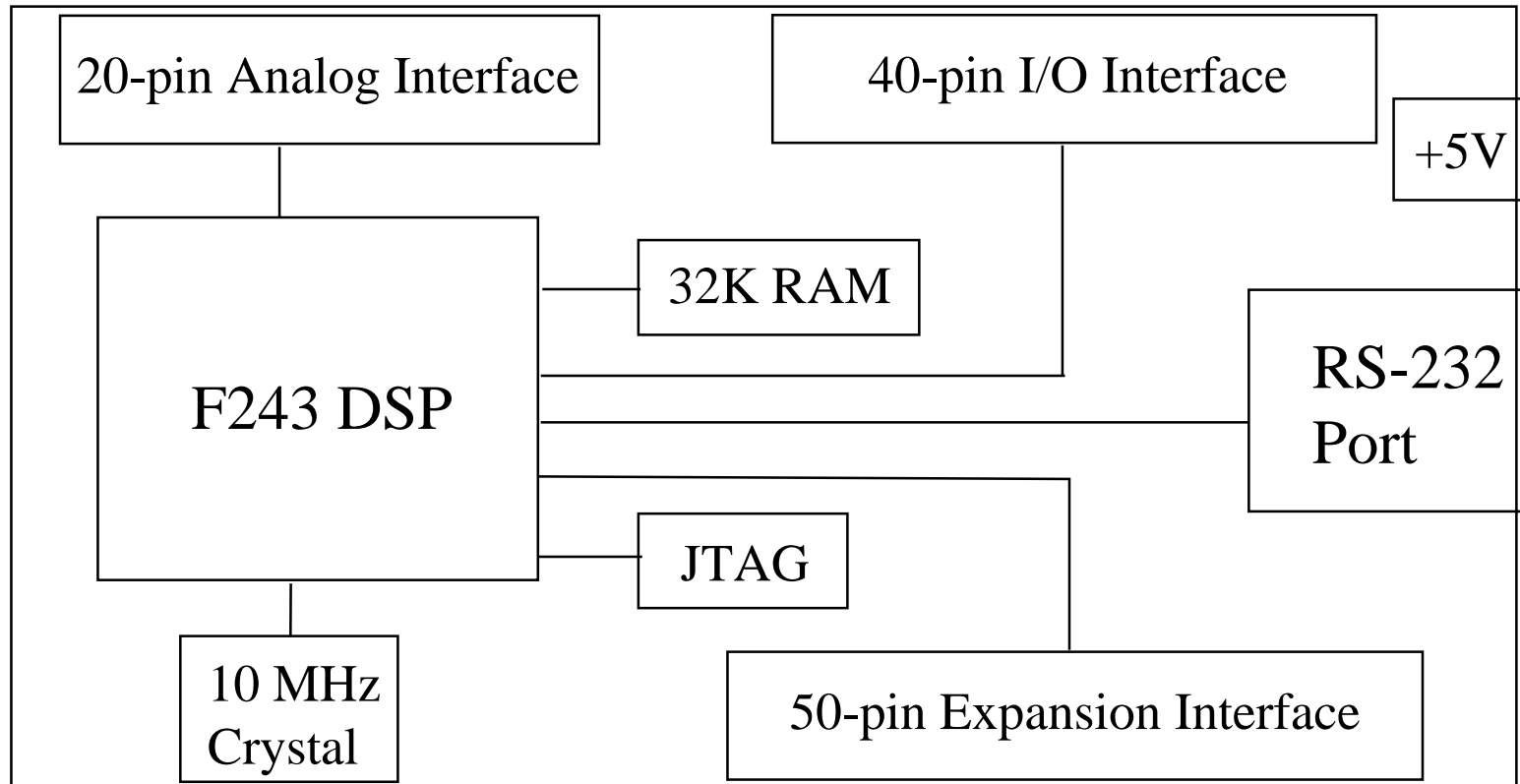
DSK based on TMS320F243



- ◆ CORE
 - 16-bit Fixed-Point processor
 - 20MHz/20MIPS
 - 32-bit ALU and Accumulator
- ◆ MEMORY
 - 8K words of FLASH memory
 - 544 words of RAM
- ◆ PERIPHERALS
 - Controller Area Network (CAN) controller
 - 10-bit on-chip A/D Converter
 - 8 Compare/PWM channels
 - 3 Capture units, 2 w/ QEP
 - 2 serial ports (SPI and SCI)
 - 16-bit External Memory Interface
 - 2 16-bit, General Purpose Timers



'F243 DSK Board Layout



Dimensions: 4 x 2.5 inches



DSK Software Tools

◆ **Symbolic Assembler**

- Defines and references symbols

◆ **Code Explorer Debugger**

- Familiar Windows-based debugger reduces learning curve
 - ◆ Single button access to commonly used functions
 - ◆ Online help for target and instruction set
- Basic debugging features
 - ◆ Dis-Assembly window
 - ◆ Single stepping & Run to breakpoint
 - ◆ Memory/register modification
- Advance debugging features
 - ◆ Signal Probe for O-scope like analysis
 - ◆ Graphical Signal Analysis
 - ◆ File I/O



Code Explorer Debugger

C2XX Code Explorer

File Edit View Debug Options Window Help

DSP HALTED Options StepInto StepOver StepOut Run Halt Reset Animate

Dis-Assembly

```

886A AE03 SPLK #9fffh,3h
886C AE00 SPLK #7dh,0h
886E AE04 SPLK #1040h,4h
8870      loop
8870 BC06 LDP #6h
8871 BF08 LAR ARO,#455h
8873 B200 LAR AR2,#0h
8874 8B8A MAR *,AR2
8875 BF80 LACC #0h
8877 8BE0 MAR *0+
8878 3F90 SUB *-,15
8879 7780 DMOV *
887A 7390 LT *-
887B 54A0 MPY **
887C BE04 APAC
887D BE09 SFL
887E 9880 SACH *
887F 9851 SACH 51h
8880 BF08 LAR ARO,#458h
8882 B200 LAR AR2,#0h
8883 8B8A MAR *,AR2
8884 BF80 LACC #0h
8886 8BE0 MAR *0+
            
```

C2xx Registers

```

ACC = F9827C68  ARO = 03FF  PC = 88A4
PREG = FFFEB9DE  AR1 = FEEE  SK0 = FFFF
TREG = 014A     AR2 = 0457  SK1 = FFFF
                AR3 = 0458  SK2 = FFFF
ARP = AR3      AR4 = 1699  SK3 = FFFF
DP = 0300      AR5 = 0000  SK4 = FFFF
ST0 = 6406     AR6 = 00D2  SK5 = FFFF
ST1 = 77FD     AR7 = 0001  SK6 = FFFF

IMR = 0010     OV = 0     C = 1    TC = 0
IFR = 0000     OVM = 0    PM = 1    XF = 1
GREG = 0000    INTM = 0    SXM = 1   CNF = 1
            
```

Peripheral Registers

```

WSGR = 07FF
            
```

Sum of 2 sine waves

(0.625 msec, 4364) Options

Output buffer of filter

(10.6 msec, 0) Options

Program Memory (Hex - C Style)

```

0x8873: 0xB200 0x8B8A 0xBF80
0x8876: 0x0000 0x8BE0 0x3F90
0x8879: 0x7780 0x7390 0x54A0
0x887C: 0xBE04 0xBE09 0x9880
0x887F: 0x9851 0xBF08 0x0458
0x8882: 0xB200 0x8B8A 0xBF80
0x8885: 0x0000 0x8BE0 0x3F90
0x8888: 0x7780 0x7390 0x54A0
0x888B: 0xBE04 0xBE09 0x9880
0x888E: 0x9852 0xBF80 0x0000
0x8891: 0x1F51 0x2F52 0x9800
0x8894: 0x2F52 0x2F52 0x9800
            
```

Data Memory (Hex - C Style)

```

0x0351: 0x1BE0 0xE6B4
0x0353: 0x7D8A 0x1BE0
0x0355: 0x1856 0x5A82
0x0357: 0xE6B4 0xFBF9
0x0359: 0xF982 0xF982
0x035B: 0xF6C8 0xF46E
0x035D: 0xF283 0xF114
0x035F: 0xF02C 0xEFDB
0x0361: 0xF02C 0xF121
0x0363: 0xF2B3 0xF4CC
0x0365: 0xF751 0xFA21
0x0367: 0xED21 0x0038
            
```



Free Development Resources

(Available for download, not included with DSK)

◆ Flash Programming Utilities

<http://www.ti.com/sc/docs/tools/dsp/c2000/software.htm#C24x>

- ◆ For serial and JTAG connections

◆ DMC Software Library

<http://www-d.connect.ti.com/dsp/tpcat/tpcodec.nsf?OpenDatabase>

- ◆ Common control algorithms reduce assembly-level coding, development time

◆ Application Design Kits

<http://www.ti.com/sc/docs/apps/digital/kits.htm>

- ◆ Reference designs w/App notes, S/W and schematics for ACI, BLDC & PM motors

◆ Application Notes

http://www.ti.com/sc/docs/apps/dsp/tms320c24x.html#App_Notes

- ◆ Oversampling techniques for 15-bit resolution
- ◆ Sensorless Control with Kalman Filter



DMC Software Modules & Systems

MODULES

- ◆ Current Measurement
- ◆ Speed Measurement
- ◆ Tachogenerator Position
- ◆ Clarke Transform
- ◆ Park Transform
- ◆ Inverse Clarke Transform
- ◆ Inverse Park Transform
- ◆ Space Vector PWM
- ◆ PID Controller
- ◆ Sin/Cos Function
- ◆ Rotor Flux Model
- ◆ '24x Initialization
- ◆ 3-Phase Sine Generator
- ◆ Ramp Generator
- ◆ DAC Output Driver
- ◆ Random PWM***
- ◆ V/Hz Profile***
- ◆ Power Factor Correction***

SYSTEMS

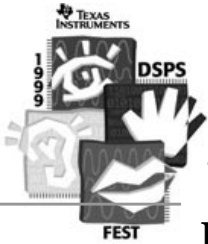
- ◆ Sensored Field Oriented Control (FOC) for AC Induction motors
- ◆ Open Loop V/Hz Control for AC Induction motors

***These modules coming soon (2H99)

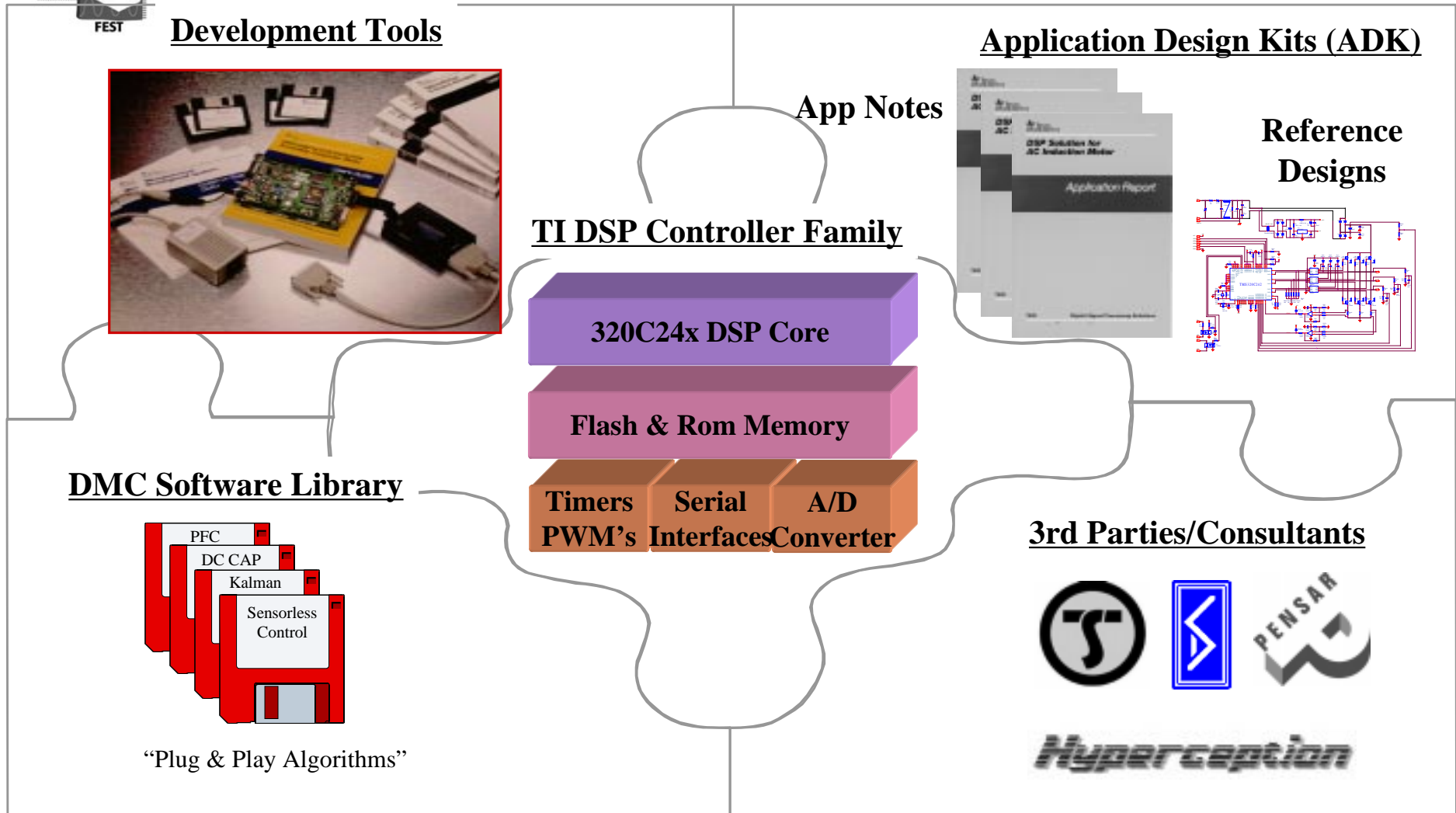


C24x Development Tools

'C24x Tools	Description	Availability
Software Development Tools		
Code Generation	'C2xx Assembler/Linker	Now
	'C2xx C-Compiler/Assembler/Linker	Now
Simulator	'C2xx Code Composer Simulator	Now
Emulator Debugger	'C2xx Code Composer Integrated Development Environment (IDE)	Now
Hardware Development Boards		
F240 DSK	DSP Starter Kit w/ DSK-specific Asm/Lnk, Code Explorer	Now
F243 DSK	DSK-specific Asm/Lnk, Code Explorer	Now
F240 EVM	Asm/Lnk, TI HLL Debugger, XDS510PP	Now
F243 EVM	C-Comp/Asm/Lnk, Code Composer IDE, XDS510PP	Now
F2407 EVM	C-Comp/Asm/Lnk, Code Composer IDE, XDS510PP	4Q99
F243 MSK	Motion Starter Kit w/ 32KB RAM, basic Asm/Lnk/Debugger	Now
F240 MCK	Motion Control Kit w/ BLDC motor, Hall sensors & 3-phase inverter	Now
JTAG Emulation Hardware		
XDS510 Board	ISA card that enables debuggers to communicate w/ target system	Now
XDS510PP Pod	Parallel Port pod that enables debuggers to communicate w/ target	Now
Flash Programming Utilities		
F240 Utilities	Single device programmer over JTAG and serial port interfaces	Now
F241/243 Utilities	Single device programmer over JTAG and serial port interfaces	Now



TI's Complete Solution for DMC





Summary & Call to Action

- ◆ TMS320F243 DSK is excellent learning tool for students
 - ◆ Great DSP and digital motor control experience on industry recognized DSP
 - ◆ Optimized DSPs powerful enough to develop & evaluate motor control algorithms
- ◆ Thinking about *motor control*? Think about **C24x DSPs!**
- ◆ Come to the Product Expo Thursday night to learn about the DSK and TI DSPs
- ◆ Take home a Digital Motor Control Brochure (Lit # SPRB130)
- ◆ BUY THE TMS320F243 DSK! \$199
 - Available from Spectrum Digital (www.spectrumdigital.com)
 - Arrow (www.arrow.com)
 - Wyle (www.wyle.com)
 - Avnet (www.avnet.com)