

Product name	What kind of tool?	Target CPUs supported	Languages supported	Platforms supported	hardware/software co-design				Requirements tracking	Defect tracking	Other system engineering tool	Cable support	Code generation	UML support	Days of free phone support							Product updates	Training	Price	Comments	
					Co-verification	Object-oriented software design	Version control	BBS's/Web R&D's							Phone support, bug lists, other	Phone support, standard	24-hour response									
CodeTEST Software-In-Circuit	Software Test and Analysis Tools	All major 32 bit and many 16 bit													0	U	\$	\$	\$	\$				Allow test and analysis in actual target hardware, without external hardware tools. Provide a true run-time tool set for coverage, memory analysis, and software trace.		
CodeTEST VME	Software Test and Analysis Tools	All major 32 bit and many 16 bit													0	U	\$	\$	\$	\$				Test and analysis tool suite designed for VME software developers and testers. View of complex VME embedded program operation, providing detailed software trace, VME performance, memory and coverage analysis.		
LiveCODE	Object-oriented software design	PowerPC	C, C++	Windows 3.1/95/98/NT, Solaris			✓			✓					0	U	\$	U	\$	\$				Interactive run-time tracing system, capture execution history and insert source-level statements directly.		
ARTISAN Software Tools, Portland, OR, (503) 245-6200, www.artisansw.com															ARTISAN Software Tools, Portland, OR, (503) 245-6200, www.artisansw.com											
Real-time Studio			C, C++, Java	Windows 3.1/95/98/NT	✓		✓	✓	✓								\$		U	\$				Real-time Studio is a suite of development tools that includes ARTISAN's Real-time Studio Professional and Real-time Modeler. Using Real-time Studio products, design teams can capture software and system design, automate these captured designs and integrate them into a complete process, without disrupting existing development environments.		
Ashling Microsystems, Inc., Sunnyvale, CA, (408) 732-6490, www.ashling.com															Ashling Microsystems, Inc., Sunnyvale, CA, (408) 732-6490, www.ashling.com											
CodeScan Code Coverage Measurement		68HC11, 8051XA, M16C, 7700, MELPS 7700, 8051 and derivatives, Smart Cards, Dallas 87C550 Philips 509xy	Assembly, Embedded C++, C++, C, EC++, SDL	Windows 3.1/95/98/NT, Windows 2000					✓	✓					365	U	U	\$	\$	\$	850			Ashling's CodeScan Code Coverage Measurement System detects all tested, untested or partially-tested source lines in the program under test. Untested or unreachable code can be identified at-a-glance, and CodeScan provides statistics on test coverage for each function, module and program. Installed as a hardware option in Ashling's Ultra-Series Emulators, CodeScan is integrated in Ashling's PathFinder Debugger.		
STARS Performance Analyzer		68HC11, 8051XA, MELPS 7700, 8051 and derivatives, Dallas 87C550 Philips 509xy, Smart Cards, 7700, M16C	Assembly, C++, EC++, Embedded C++, SDL, C	Windows 3.1/95/98/NT, Windows 2000						✓					365	U	U	\$	\$	\$	2400			Ashling's STARS Performance Analyzer (Software Test, Analysis and Reporting System) is a Real-Time Performance Analyzer for embedded development. STARS time-stamps all functions and interrupt-routines, and shows the minimum, maximum, average and total execution time in a graphical display. Installed as a hardware option in Ashling's Ultra-Series Emulators, the displays are integrated in Ashling's PathFinder Debugger.		
Beach Solutions, Tavistock, United Kingdom, +44 1822 619901, www.beachsolutions.com															Beach Solutions, Tavistock, United Kingdom, +44 1822 619901, www.beachsolutions.com											
EASI-Appnote		All processors for which an ANSI compiler is available	C	Windows 3.1/95/98/NT, Windows 2000	✓	✓					✓		✓		30	\$		\$	\$	\$				Provides a pick and place approach to building reference device-driver code for new SoC devices. Ability to include graphical documentation is available together with an associated tool (EASI-P) that ensures the programmer only selects from a library of valid access functions and macros to interface with the hardware		
EASI-AUTHOR		All processors for which an ANSI compiler is available	Any language	Windows 3.1/95/98/NT, Windows 2000	✓	✓			✓		✓		✓		30	U		\$	\$	\$				Automatically generates device manuals in both HTML and RTF formats for SOC designs from hardware specification. Manual will always up to date throughout the project. Formats and styles are customizable		
EASI-C		All processors for which an ANSI compiler is available	C	Windows 3.1/95/98/NT, Windows 2000	✓	✓				✓		✓			30	U		\$	\$	\$				Automatically generates a comprehensive set of access libraries in C for all peripheral blocks in an embedded system. Functions and macros are derived directly from the programmable hardware interface description. The result is a reliable and maintainable, easy-to-read Application Programming Interface, that requires no knowledge of the underlying hardware detail.		
EASI-P		All processors for which an ANSI compiler is available	C	Windows 3.1/95/98/NT, Windows 2000	✓	✓				✓		✓			30	?	?	?	?	?	?	POA			EASI-P gives instant access to automatically-generated EASI-C libraries, that provide the lowest software layer needed in an SOC development to perform Hardware test, Verification and Software design. EASI's avoid the need for engineers to have a detailed knowledge of the underlying hardware, yet allow the production of efficient, maintainable code.	
EASI-Verilog		All major 32 bit and many 16 bit	Verilog	Windows 3.1/95/98/NT, Windows 2000	✓	✓				✓		✓			30	?	?	?	?	?	?	POA			Automatic Verilog code generator for the bus interface of any IP block. With a design specification partitioned into the core block and its bus interface, EASI-Verilog creates the address-decoder, data-multiplexer and associated control in RTL for the specified bus. IP porting to new bus architectures then also becomes trivial.	
EASI-VHDL		All major 32 bit and many 16 bit	VHDL	Windows 3.1/95/98/NT, Windows 2000	✓	✓				✓		✓			30	\$		\$	\$	\$				Automatic VHDL code generator for the bus interface of any IP block. With a design specification partitioned into the core block and its bus interface, EASI-VHDL creates the address-decoder, data-multiplexer and associated control in RTL for the specified bus. IP porting to new bus architectures then also becomes trivial		
blue river software GmbH, Nuremberg, Germany, +49-911-20 626 0, www.blue-river-software.com															blue river software GmbH, Nuremberg, Germany, +49-911-20 626 0, www.blue-river-software.com											
E32		CPUindependent	C	Windows 3.1/95/98/NT	✓								✓		180	U	\$	\$	\$	\$	DM12.350			E32 software life cycle for embedded systems based on V32.		
O32		CPUindependent	C++	Windows 3.1/95/98/NT	✓								✓		180	U	\$	\$	\$	\$				O32 object-oriented software life cycle. A graphical interface for object-oriented modeling based on UML.		

REAL-TIME OPERATING SYSTEMS/KERNELS/EXECUTIVES

Product name	Target CPU's supported	Languages supported	Typical ROM required: min in 1000's of bytes		Typical RAM: max in 1000's of bytes	Typical RAM required: min in 1000's of bytes	Min RAM req'd per task in bytes	Multitasking strategy	Typical context switch time, in clock cycles	MMU support	Modular link	Resource lockings	Semaphores, mailboxes and queues	Multiprocessor support	PDF/SL compliant	TQ/TP support available	Included a debugger	Includes sample programs	Source code included	Sourcecode optional if not included	Royalty payments	Java available	Sparcok, installed base	Debuggers supported	Compilers supported	Days free phone support BBS's, Web FAX's, bul lists, other Phone support, standard Phone support, 24 hour response Product updates Training Price Comments									
3L Ltd., Edinburgh, United Kingdom, 44-131-662-4333															3L Ltd., Edinburgh, United Kingdom, 44-131-662-4333																				
Diamond	TMS320 and other TI DSPs	Assembly, C			5	10		Round Robin, Time Slice, Fixed priority, Tasks can dynamically alter priorities					✓	✓			✓	✓				3,000	TI C6000 Code Composer	TI C6000 C code generation tools	90	U	\$		\$	\$		\$3,500	Simplifies code development for high-performance, multi-processor DSP systems. During design, the functional components or an appli-cation are mapped to logical tasks independent of hardware topology		
Acacetus, Dorval, PQ, Canada, 514-422-9164, www.acacetus.com															Acacetus, Dorval, PQ, Canada, 514-422-9164, www.acacetus.com																				
M Task	68HC12	C	2K	6K	128 bytes	0.25 K	Applicati on de-pendent	Round Robin, Cooperative multitask-ing, Tasks can dynami-cally alter priorities				✓	✓				✓	✓						ICC12											
Accelerated Technology Inc., Mobile, AL, (334) 661-5770, www.acceleratedtechnology.com															Accelerated Technology Inc., Mobile, AL, (334) 661-5770, www.acceleratedtechnology.com																				
Nucleus GRAFIX	68K, x86 Protected Mode, SH, ARM, MIPS, PowerPC, MPC8xx, ColdFire	Assembly, C							4 to 30								✓	✓						Nucleus UDB, SDS, CAD-UL, MetaWare, GHS, Hitachi	Diab Data, GNU, ARM, SDS, GHS, Hitachi, MetWare, CAD-UL	180	\$	\$	\$	\$	\$	9,995 to 12,995	Portable embedded GUI.		
Nucleus miPLUS	ARM, x86 Real Mode, MPC8xx, PowerPC, V850E, H8S, SHx, 680x0, StrongARM, TriCore	Assembly, C															✓	✓						ARM, SDS, Microsoft, Green Hills, Metrowerks, TASKING	ARM, Diab Data, Microsoft, Green Hills, Metrowerks, TASKING	180	\$	\$	\$	\$		2995.00	Includes access to the complete, na-tive Nucleus PLUS interface.		
Nucleus OSEK	C16x	Assembly, C															✓	✓						TASKING	TASKING							\$29,000	Nucleus OSEK is Accelerated Technology's OSEK-compliant oper-ating system.		
Nucleus PLUS	68K, SPARC, PowerPC, LEXRA, QED, NKK, Nec, IDT, H8S, H8/300H, Thumb, StrongARM, V850E, StrongARM 110, Intel StrongARM SA 1100, ARC, M16C, TriCore, M Core, x86 Real Mode, x86 Protected Mode, V800, TMS320 and other TI DSPs, C16x, i960, MIPS, MPC8xx, MPC82xx, 8260 8240, MPC 603E EC603E 740 750, SAM8, SHx, Able to port, V850, IBM PPC4xx, ColdFire, ARM	Assembly, Java, C, C++	<3	45	2	4	168 + (stack)	Time Slice, Cooperative multitask-ing, Proprietary, Tasks can dynamically alter priorities		✓	✓	✓	✓	✓		✓	✓	✓		✓		2,300	Nucleus UDB, SDS, EST VisionCLICK, MetaWare, SSI, Paradigm, CAD-UL, CodeWarrior, GHS, Hitachi, XTENSA, NSC, IAR, TI	GNU, ARM, Diab Data, SDS, MetaWare, Watcom, Borland, IAR, CAD-UL, Microsoft, SSI, TASKING, GHS, Hitachi, Mentor, NSC, Intermetrics, TI, IAR, IDT/Red Hat, Kyoto Micro Computer GNU, Intel, Algorithmics, IBM High C/C++, XTENSA	180	\$	\$	\$	\$	\$	12,495	Nucleus PLUS is a real-time, pre-emptive, multitasking kernel de-signed for time-critical embedded applications. Nucleus PLUS is ex-tremely portable and is available for use with most microprocessor fami-lies.			
Aisys Inc., Santa Clara, CA, (408) 327-8820, www.aisysinc.com															Aisys Inc., Santa Clara, CA, (408) 327-8820, www.aisysinc.com																				
DriveWay	MPC8xx, MPC8260, PowerPC	C, C++																							Diab Data, GNU C, Green Hills, Microtec										
Aonix, San Diego, CA, (858) 257-2700, www.aonix.com															Aonix, San Diego, CA, (858) 257-2700, www.aonix.com																				
RAVEN	68K, x86 Real Mode, PowerPC	Ada						Rate Monotonic scheduling											✓	✓				ObjectAda	ObjectAda	90	\$	\$	\$	\$	\$		\$15,000		
AppForge, Inc., Atlanta, GA, (678) 686-9000, www.appforge.com															AppForge, Inc., Atlanta, GA, (678) 686-9000, www.appforge.com																				
AppForge Virtual Machine	68K, ARM, Motorola, M Core, SH	Assembly, C, C++	256		128			Round Robin, Proprietary, Cooperative multitask-ing, Fixed priority				✓	✓				✓	✓								90	U	\$	\$	\$	\$			The AppForge Virtual Machine runs programs written using the AppForge Toolkit for Visual Basic.	
Applied Dynamics International, Ann Arbor, MI, (734) 973-1300, www.adi.com															Applied Dynamics International, Ann Arbor, MI, (734) 973-1300, www.adi.com																				
RTexec	6800, 68336, 68040, PowerPC	Assembly, C, Other, Fortran						Fixed priority, Rate Monotonic scheduling					✓			✓	✓																		

Product name	Target CPUs supported	Platforms supported	Technical Support							Price	Comments	
			Days of free phone support	888/ Web FAXs	bug lists, other	Phone support	Phone support, standard	Product updates	Training			
Accelent Systems Inc., Akron, OH, (330) 864-2300, www.accelent.com												
DeviceWare	ARM, StrongARM	Linux, Windows CE									A library of software and hardware modules (device drivers) used to link board level components with the operating system. These modules, combined with Accelent's engineering services, provide framework from which to develop Internet appliances.	
Anna Technology, Poway, CA, (858) 435-2000, www.annatechnology.com												
Jump Start 2.11 Platform Library Kit	x86 Protected Mode, x86 Real Mode	Windows CE	60	U	U	\$	\$	\$	\$	\$4,995	A ready-to-run board support package that enables PC-compatible H/W to run Windows CE. The PLK comes with a full set of PC drivers (incl. floppy, HDD, CD-ROM), the CE Launcher boot loader, and a build tree.	
Jump Start 2.11 Platform Library Kit for SC400	AMD Elan SC400	Windows CE	60	U	U	\$	\$	\$	\$	\$4,995	A S/W suite that supports the integration of Windows CE with a SC400-based H/W platform, particularly rev. 3 of the AMD evaluation platform. It includes AMD's bootloader, drivers, and a build tree for image creation.	
Jump Start 2.11 Platform Library Kit for the SA-1100	ARM, Intel StrongARM SA 1100	Windows CE	60	U	U	\$	\$	\$	\$	\$4,995	A kit that supports the integration of Windows CE with a StrongARM-based H/W platform, especially the Brutus evaluation platform. Included is an OAL adaptation, boot loader, driver suite, and build tree.	
Video Driver Kit for CHIPS 69000	CHIPS 69000 Video Controller	Windows CE	60	U	U	\$	\$	\$	\$	\$995	Contains the driver for the chip as well as software tools for adapting the driver to support different resolutions, cursor shapes and color depths.	
Video Driver Kit for the CHIPS 65550/54	CHIPS 655xx Video Controllers	Windows CE	60	U	U	\$	\$	\$	\$	\$995	Contains the driver for the chip as well as software tools for adapting the driver to support different resolutions, cursor shapes and color depths.	
Blackhawk, Marlton, NJ, (856) 983-4514, www.blackhawk-dsp.com												
Blackhawk Libraries	TMS320 and other TI DSPs		0	U	\$	\$	\$	\$	\$		Blackhawk libraries are free, open source, and can be called from applications running on the Blackhawk OS. Current library functions include extensive math and FFT routines.	
BlueWater Systems Inc., Edmonds, WA, (425) 771-3610, www.bluewatersystems.com												
Driver Developer Kit	Alpha, x86 Protected Mode	Windows 3.1/95/98/NT, Windows 2000	180	U	\$	\$	\$	\$	\$	\$1,250	Provides a complete set of driver development tools including one copy of WinDK, WinRT and WinRT-VB at significant savings when compared to individual purchases.	
Driver Development Suite	Alpha, x86 Protected Mode	Windows 3.1/95/98/NT, Windows 2000	360	U	\$	\$	\$	\$	\$	\$1,995	Includes one copy of WinDK with Source Code, WinRT and WinRT-VB. Subscription support for WinDK and WinRT, and the assurances of remaining updates on the latest bus architectures and operating systems.	
Time Critical Extension (TCX)	MIPS, SH, x86 Protected Mode, MPC8xx, PowerPC	Windows CE	90	U	\$	\$	\$	\$	\$	\$995	A time critical extension to Windows CE. Allows very low latency interrupts and timers on Windows CE. Solves the problems of long and non-deterministic IST latencies that developers face in developing device drivers for Windows CE.	
WinDK	Alpha, x86 Protected Mode	Windows 3.1/95/98/NT, Windows 2000	180	U	\$	\$	\$	\$	\$	\$995	Adds new components for complete support of new Windows 2000/NT 4.0 and Windows 98 Plug and Play and Power Management. This toolkit is for hard-core kernel driver creation.	
WinDK for Windows CE	ARM, x86 Protected Mode, MPC8xx, PowerPC, SH, MIPS	Windows CE	90	U	\$	\$	\$	\$	\$	\$2,495	The first full-featured device driver development tool for embedded systems and industrial control developers using Windows CE. With WinDK for Windows CE developers can create high-performance device drivers for Windows CE.	
WinRT	x86 Protected Mode	Windows 3.1/95/98/NT	180	U	\$	\$	\$	\$	\$	\$395	A versatile toolkit for Win32 hardware control and provides direct binary compatibility between Windows 95, Windows 98 and Windows NT. Access Port I/O, Memory I/O, interrupts, DMA and Kernel mode timers without using the DDK.	
WinRT-VB	x86 Protected Mode	Windows 3.1/95/98/NT	180	U	\$	\$	\$	\$	\$	\$125	An integrated ActiveX control tool for developing memory I/O and port I/O hardware controls for Visual Basic 4.0 and 5.0 (32-bit) Windows applications.	

Product name	Target CPUs supported	Platforms supported	Technical Support							Price	Comments	
			Days of free phone support	888/ Web FAXs	bug lists, other	Phone support, standard	Phone support, 24-hour response	Product updates	Training			
Blunk Microsystems, San Jose, CA, (408) 323-1758, www.blunkmicro.com												
TargetFFS	68K, MPC8xx, PowerPC, MIPS, ColdFire, MPC82xx, MPC8260	Linux, UNIX, TargetOS, WindRiver VxWorks, VxWorks	365	U	U			U	\$	5,000	Full implementation of Standard C and POSIX File API. Wear leveling. Power failure recovery. Minimum number of configurable parameters. Platform independent. Highly portable. Royalty free annual site license.	
Logo enhancement placeholder		BSQUARE Corp., Bellevue, WA, (425) 519-5900, www.bsquare.com										
Time Critical Extension (TCX)	MIPS, MPC8xx, SH, x86 Protected Mode, PowerPC	Windows CE	90	U					\$	\$	995	A time critical extension to Windows CE. Allows very low latency interrupts and timers on Windows CE. Solves the problems of long and non-deterministic IST latencies that developers face in developing device drivers for Windows CE.
Coreco, St. Laurent, Canada, (514) 333-1301, www.coreco.com												
eWiT	x86 Protected Mode	Windows 3.1/95/98/NT	520	U	U	U	U	U	\$		\$2,800	Offers a visual programming software package for imaging application development. WiT 5.3 for windows delivers a multi-threaded scheduler to drive execution on dual or quad Pentium systems of imaging dataflow graphs created in a CAD-I.
CrosStor Software, South Plainfield, NJ, (908) 226-0100, www.crosstor.com												
CrosStor Volume Manager	68K, ARM, MIPS, PowerPC, i960, x86 Protected Mode	Solaris, Nucleus, VxWorks, PSOS	0	\$	\$	\$	\$	\$	\$			A software-based RAID alternative for OEMs requiring RAID or volume management or creating RAID-configured, dedicated storage appliances. Provides all traditional hardware RAID functions.
DC Micro Development, Lawrenceville, GA, (678) 442-1623, www.dcmicro.com												
Crusher! Data Compression Toolkit	29K, 68HC11, 68K, 8051 and derivatives, 80196, SPARC, SH, PowerPC, MIPS, i960, i860, ColdFire, ARM, x86 Real Mode, x86 Protected Mode, TMS320 and other TI DSPs, Alpha, 68HC16	Any platform that supports ANSI C compiler	60	U	U	U	\$	U	\$		349	High-performance, cross-platform data compression libraries with C source code. 45-function API provides buffer compression, file compression, archiving, encryption, self-extracting EXE's and more.
html++ Dynamic HTML Class Library	29K, 6800, 68HC11, 80196, Alpha, ColdFire, ARM, x86 Protected Mode, TMS320 and other TI DSPs, SPARC, SH, PowerPC, MIPS, MELPS 7700, i960, Z80/Z180, x86 Real Mode, i860, 8051 and derivatives	DOS, Windows 3.1/95/98/NT, Solaris, HP, Mac, FreeBSD, Windows 2000, Windows CE, BSD/OS, UNIX, AIX, Linux	60	U	U	U	\$	U	\$		\$349	Develop dynamic web pages using C++ objects instead of html tags. Features include multipart mime decoding (HTTP file uploads), ISAPI and CGI support, automatic encryption and decryption of hidden fields and URL-encoded data, session and state management, and more.
NetKit TCP/IP Class Library	29K, 78K series, Alpha, i860, ARM, Z80/Z180, x86 Real Mode, x86 Protected Mode, TMS320 and other TI DSPs, SPARC, SH, PowerPC, MIPS, MELPS 7700, i960, 80196	DOS, Windows 3.1/95/98/NT, Linux, Solaris, HP, UNIX, AIX, FreeBSD, Windows 2000, Windows CE, BSD/OS, NetBSD, SGI	60	U	U	U	\$	U	\$		\$349	Portable C++ class library providing adanced client and server objects for HTTP, POP3, SMTP, FTP, DNS, and more. Supports cookies, mime, http uploads, firewalls, proxy servers, authentication, plus many more features.
DDC-I, Phoenix, AZ, (602) 275-7172, www.ddci.com												
DDC-I Ada Compiler Systems (DACs)	1750A, 68K, i960	Solaris, HP-UX, VAS/VMS	0	\$	\$	\$	\$	\$	\$			
DDC-I JOVIAL Compiler Systems (DJCS)	1750A, Z8002	Solaris, HP-UX, VAX/VMS	0	\$	\$	\$	\$	\$	\$			

IN-CIRCUIT EMULATORS

Product name	Target CPUs supported	Platforms supported	Debuggers supported	Overlay RAM size, standard	Overlay RAM size, maximum	Trace buffer size, depth	Trace buffer size, bits width	# of SW breakpoints	# of address-only HW breakpoints	# of complex breakpoints	Nesting levels for complex breakpoints	Pass counter included	Time stamp recorded in trace buffer	Can collect and display trace data w/o halting emulation	Code coverage available	Performance analyzer available	Real-time trace triggers provided	Seconds to download a 64K file	Cost to support additional CPU	Days of free phone support	BBS/Web FAQs, bug help, other support	Phone support, standard	Phone support, 24-hour response	Product updates	Training	Price	Comments	
Advanced Transdata Corp., Dallas, TX, (972) 980-2960, www.adv-transdata.com														Advanced Transdata Corp., Dallas, TX, (972) 980-2960, www.adv-transdata.com														
ICD-87XP	PIC	Windows 3.1/95/98/NT, Windows 2000	PICICD debugger running under Win 95/98/NT/ME/2000, source level support on MPASM, PICC, MPC, PicBasicPro, PCM, etc.					1				no					30		U	U	U		\$		159	Debugger and programmer combined in a small board, it supports the PIC16F87X only. Uses the chip's built-in programming and debugging capabilities to provide low-cost emulation. Connects to the PC's printer port and comes with a demo board for evaluation and prototyping tests.		
RICE17A	PIC	Windows 3.1/95/98/NT, Windows 2000	Comes with IDE; Source level support on MPASM, MPC, MPLAB-C17, MPLAB-C18, PICC, PICC18 (from Hi-Tech Software), iccpic, icpic18 (from IAR), PCB, PCM	64K word	64K word	32K	24	U	1	1	2	varies	✓		✓		2 to 3	\$225 to \$475	U	U	U		\$		450+probe	Supports all PIC12/14/16/17/18 and connects to parallel port to provide fast downloading. Comes with 12-clip external probes, 64K program memory and 32K real-time trace. Full-speed and real-time emulators with full-featured emulation controls. Optional time stamp function. Real-time data breakpoints on selected new modules.		
RICE2000	M16C	Windows 3.1/95/98/NT, Windows 2000	Comes with debugger, provides source level support on IEEE695 and UBROF outputs from IAR and Mitsubishi assembler	2MB		32K	64	U	1	1	2	yes	✓		✓	✓	2 to 3	\$1200	U	U	U		\$		3000	Connected to a parallel port for emulation. It provides low-voltage emulation, frequency synthesizer to 20mhz, complex breakpoints, 20-bit time stamp, complex watch variables and 12-clip external probe which provides break input, break output, trigger output, eight trace lines and GND.		
RICE65	65C02 from WDC, Rockwell, UMC	Windows 3.1/95/98/NT, Windows 2000	Comes with debugger, provides source level support on 2500AC, WDC/ZardoZ C compilers	64K		8K	24	U	1	1		No					5		U	U	U		\$		995	Connects to a parallel port. It provides a 32-bit cycle counter to time instruction execution. The data capture break feature generates halt the processor when specified program memory satisfies the break condition. Comes with 12-clip probe.		
SXISD-100	SX chips from Scenix Semiconductor	Windows 3.1/95/98/NT, Windows 2000	Win95/98/2000 debugger, SASM assembler, source level support on SASM, SXC and SX C from CCS			8K software trace	72	1	1			no					20	0	U	U	U		\$		275	An in-system debugger/programmer which utilizes the SX chip's built-in debugging capability for emulation.Supports to full speed of 100 mhz. Codes and fuse data are programmed into the SX chip in circuit test for debugging. Optional SX Demo/Proto board for evaluation and testing.		
Logo enhancement placeholder	American Arium, Tustin, CA, (714) 731-1661, www.arium.com														Logo enhancement placeholder		American Arium, Tustin, CA, (714) 731-1661, www.arium.com											
	ECM-20	Other, Pentium II III Xeon processors, Pentium II III Slot 1 processors, Celeron, Mobile Pentium II processors, Pentium II, Pentium III, Pentium II socket 370 processors	Windows 3.1/95/98/NT, Windows 2000	WinDb				64	4	4	0	no					4	\$4,000	365	U	\$	\$	\$	\$	\$20,000	In-target probe for Intel Pentium, Pentium II/III Xeon, and Pentium 4 processors. Provides limited trace function with Pentium 4 processors.		
	ECM-30	Other	Windows 3.1/95/98/NT, Windows 2000	WinDb				64	8	4	0	no					4	4,000	365	U	\$	\$	\$	\$	\$20,000	In-target probe for Intel Itanium processors.		
	ECM-55	Pentium, Pentium III	Windows 3.1/95/98/NT	WinDb				64	4	4	1	no					4	0	365	U	\$	\$	\$	\$	\$8,000	In-target probe ICE.		
	ECM-52	Celeron, Pentium II, Pentium III	Windows 3.1/95/98/NT	WinDb				64	4	4	0	no					4	0	365	U	\$	\$	\$	\$	\$12,000	In-target probe ICE.		
	TRC-20	Celeron, Pentium II III Slot 1 processors, Pentium III, Pentium II socket 370 processors	Windows 3.1/95/98/NT, Windows 2000	WinDb			256	207	64	4	10	4	yes	✓		✓	4	4,000	365	U	\$			\$	\$40,000	Up to 100 MHz real-time front-side bus trace. Real-time data breakpoints based on exclusive state-per-transfer technology. Various packages supported. Symmetrical multi-processing (SMP) supported.		
	TRC-55	Pentium	Windows 3.1/95/98/NT	WinDb			128	207	64	4	10	4	yes	✓		✓	4	0	365	U	\$	\$	\$	\$	\$20,000	Real-time front-side bus trace and breakpoints.		
	TRC-6	Pentium II III Slot 1 processors, Pentium III, Pentium II socket 370 processors, Pentium II III Xeon processors	Windows 3.1/95/98/NT, Windows 2000	WinDb			128	207	64	4	10	4	yes	✓		✓	4	\$8,000	365	U	\$	\$	\$	\$	\$30,000	Up to 100 MHz real-time front-side bus trace. Advanced real-time data breakpoints based on exclusive state-per-transfer technology. Various packages supported. Symmetrical multi-processing (SMP) supported.		



BDM/JTAG-BASED EMULATORS

Product name	Target CPUs supported	Platforms supported	Debuggers supported	Serial interface available	Parallel interface available	SCI interface available	TQ/JP interface available	Ethernet interface available	PC plug-in card	Second to download 64K program file	Supports 3.3 volts	Includes hardware breakpoints	Upgrade path to real-time trace	Performance analysis	Flash programming	Days of free phone support	BBS/Web FAQs, bug lists, other	Phone support, standard	Phone support, 24-hour response	Product updates	Training	Price	Comments	
Logo enhancement placeholder	Agilent Technologies, Palo Alto, CA, (650) 752-5000, www.agilent.com									Logo enhancement placeholder	Agilent Technologies, Palo Alto, CA, (650) 752-5000, www.agilent.com													
Emulation Modules	ARM, PowerPC, MELPS 7700, MPC8xx, MIPS	DOS, Windows 3.1/95/98/NT, Solaris, HP-UX	Green Hills, Mentor Graphics, SDS	✓			✓	✓		<1	✓	✓	✓	✓	✓		\$	\$	\$	\$	\$	\$	\$2,500	
Applied Microsystems Corp., Redmond, WA, (800) 426-3925, www.amc.com										Applied Microsystems Corp., Redmond, WA, (800) 426-3925, www.amc.com														
CodeTAP 8xx	MPC8xx, PowerPC	Windows 3.1/95/98/NT, Solaris, HP-UX	MWX-ICE, Metrowerks CodeWarrior, WindRiver GB Tornado, ISI Prism Plus				✓	✓		1.5	✓	✓	✓	✓	✓	90	\$	\$	\$	\$	\$			Cache-on visibility of entire program; virtual memory support; debug code in cache, ROM, RAM flash; fast flash programming; memory diagnostics; RTOS integration, logic analyzer.
PowerTAP	PowerPC, MPC 603E EC603E 740 750, 8260 8240	Windows 3.1/95/98/NT, Solaris	MWX-ICE, Metrowerks CodeWarrior, WindRiver GB, Tornado, ISI Prism Plus				✓	✓		2.2	✓	✓	✓	✓	✓	90	\$	\$	\$	\$	\$			Cache-on visibility of program; MMU and virtual memory visibility; remote telnet support over LAN; debug code in cache, ROM, RAM and flash; fast flash programming; memory diagnostics
Ashling Microsystems, Inc., Sunnyvale, CA, (408) 732-6490, www.ashling.com										Ashling Microsystems, Inc., Sunnyvale, CA, (408) 732-6490, www.ashling.com														
Genia Networked JTAG Emulator	ARM, MIPS, MPC8xx, PowerPC, Intel StrongARM SA 1100, Thumb, 4xx, 5xx, 6xx, 7xx, 8xx, 82xx, StrongARM, TriCore	Windows 3.1/95/98/NT, Windows 2000		✓			✓	✓			✓	✓	✓	✓	✓									Powerful Networked JTAG Emulator for all popular 32-bit RISC devices. Easy-to-use, easy-to-learn PathFinder debugger. Support for IEEE-5001 (NEXUS) debug interface. Open debugger API. Non-intrusive debugging with On-the-Fly monitoring. Optional Real-time Trigger and Code Trace System. RTOS System-level debugging window. Supports NEXUS, BDM, JTAG, EJTAG and OCDS interfaces. Ethernet and USB host connections.
Opella Entry-level JTAG Emulator	ARM, 4xx, 5xx, 6xx, 7xx, 8xx, 82xx, Thumb, StrongARM, Intel StrongARM SA 1100, TriCore, MIPS, MPC8xx, PowerPC	Windows 3.1/95/98/NT, Windows 2000			✓						✓			✓										Low-cost, entry-level JTAG emulator for all popular 32-bit RISC devices. Easy-to-use, easy-to-learn PathFinder debugger. Support for IEEE-5001 (NEXUS) debug interface. Open debugger API. Non-intrusive debugging with On-the-Fly monitoring. RTOS System-level debugging window. Reconfigurable for NEXUS, BDM, JTAG, EJTAG and OCDS debug interfaces. Parallel port host connection.
Vitra Networked JTAG Emulator with Trace	PowerPC, TriCore, StrongARM, Intel StrongARM SA 1100, Thumb, 4xx, 5xx, 6xx, 7xx, 8xx, 82xx, ARM, MPC8xx, MIPS	Windows 3.1/95/98/NT, Windows 2000		✓			✓	✓			✓	✓	✓	✓	✓									Powerful Networked JTAG Emulator with Real-Time Trace for all popular 32-bit RISC devices. Easy-to-use, easy-to-learn PathFinder debugger. Support for IEEE-5001 (NEXUS) debug interface. Open debugger API. Non-intrusive debugging with On-the-Fly monitoring. Real-time Trigger and Code Trace System. RTOS System-level debugging window. Supports NEXUS, BDM, JTAG, EJTAG and OCDS interfaces. Ethernet and USB host connections.
Avocet Systems Inc., Rockport, ME, (207) 236-9055, www.avocetsystems.com										Avocet Systems Inc., Rockport, ME, (207) 236-9055, www.avocetsystems.com														
BackGround Mode Debugger (BMD)	68HC12, ColdFire, IBM PPC4xx, PowerPC	Windows 3.1/95/98/NT, Solaris, HP	SourceGate, GDB	✓							✓	✓			✓	180	U	\$	\$	\$	\$	\$895		USB and serial interface versions available.
Bama Instrument, Huntsville, AL, 256 837-9219, BamaInc.com										Bama Instrument, Huntsville, AL, 256 837-9219, BamaInc.com														
BamaICE	ARM	Windows 3.1/95/98/NT, Linux		✓	✓		✓	✓			✓	✓		✓										Low cost ARM development
Blackhawk, Marlton, NJ, (856) 983-4514, www.blackhawk-dsp.com										Blackhawk, Marlton, NJ, (856) 983-4514, www.blackhawk-dsp.com														
Blackhawk USB-JTAG Emulator	TMS320 and other TI DSPs	Windows 3.1/95/98/NT														365	U	\$	\$	\$	\$			JTAG Emulator attaches to USB port of Windows-based PC. Includes drivers for Code Composer and TMS320 Series DSP chips.
Corelis Inc., Cerritos, CA, (562) 926-6727, www.corelis.com										Corelis Inc., Cerritos, CA, (562) 926-6727, www.corelis.com														
EMDT/29K	29K	Windows 3.1/95/98/NT	UDB						✓							90	U	\$		\$	\$			
EMDT/960	i960	Windows 3.1/95/98/NT	UDB						✓		✓					90	U	\$		\$	\$			
PowerEM	PowerPC	Windows 3.1/95/98/NT	UDB				✓	✓	✓		✓	✓				90	U	\$		\$	\$			
ScanICE	MIPS	Windows 3.1/95/98/NT	UDB				✓	✓	✓		✓	✓				90	U	\$		\$	\$			
ScanICE-BCM3310	i960, PowerPC, MIPS	Windows 3.1/95/98/NT	UDB					✓	✓	2	✓	✓		✓		90	U	\$	\$	\$	\$			
Domain Technologies, Inc., Plano, TX, (972) 578-1121, www.domaintec.com										Domain Technologies, Inc., Plano, TX, (972) 578-1121, www.domaintec.com														
SB-56K	DSP56xxx	Windows 3.1/95/98/NT, Windows 2000		✓							✓	✓		✓										Supports multiple JTAG devices from DSP563xx, DSP566xx or DSP568xx families or two OnCE devices from DSP560xx family. RS-232 host interface. 4.5"x2.6"x1".
SB-USB	TMS320 and other TI DSPs, DSP56xxx	Windows 2000		✓							✓	✓		✓										Supports TI C54xx DSPs with Code Composer Studio. Motorola multiple DSP563xx, DSP566xx, DSP568xx or two DSP560xx with BoxView debugger. USB interface. 4.5"x2.6"x1".

MICROCONTROLLERS/EMBEDDED MICROPROCESSORS

08 bits

Atmel Corp., San Jose, CA, (408) 441-0311, www.atmel.com

8051	8 bits	16 bits	2.7	6	25	100		33	512	1 to 32		1 to 32	3	UART		SPI		32	1	1		2	3		\$2.00	20/40/44/48 PDIP, TQFP, PLCC, SOIP	
AVR	8 bits	16 bits	1.8	6	15	5	1	12	4k			128k	4	2		2	8 channel	10	64	4	1	2	10	1	0	\$1 to \$10	8/20/28/32/40/44/64 PDIP, SSOP, SOIC, TQFP, PLCC, VQFP

Cygnal Integrated Products, Inc., Austin, TX, (512) 327-7088, www.cygnal.com

C8051F000	8 bits	16 bits	2.7	3.6	10	10	5	20	256			32k	4	1		2	1	12/10	32	up to 5	1		10	2	0	\$11.00	64T QFP, 48 TQFP, 32 LQFP
C8051F005	8 bits	16 bits	2.7	3.6	10	10	5	25	2304			32k	4	1		2	1	12/10	32	up to 5	1		10	2	0	\$12	64 TQFP, 48 TQFP, 32 LQFP
C8051F200	8 bits	16 bits	2.7	3.6	10.5	2.0	0.1	25	256-1280			8k	3	1		1	1	8	32		1		2	2	0	\$5.00	48 TQFP, 32 LQFP
C8051F206	8 bits	16 bits	2.7	3.6	10.5	2.0	0.1	25	1280			8k	3	1		1	1	12	32		1		2	2	0	\$9.00	

Cypress MicroSystems, Inc., Bechtel, WA, 1-425-939-1000, www.cypressmicro.com

PSoC Microcontroller	8 bits	16 bits	3.0	5.5	20	4	4	24	256			16k	0-6 selectable	0-6 selectable		0-4 selectable	0-4 selectable	5-14	44	0-8 selectable	1	0	44	13	0	2.75	8PDIP, 20PDIP/SOIC/SSOP, 28PDIP/SOIC/SSOP, 48PDIP/SSOP, 44QFP
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Cypress Semiconductor, San Jose, CA, (800) 541-4736, www.cypress.com

Cypress USB M8 Microcontrollers	8 bits	12 bits	4	5.5	25	10	10	12 (USB Apps),16 (General Purpose)	256	0	8K	0	5	1		1	0		40 (GPIOs)	2	1	40 (GPIOs)	40 (GPIOs)	10	2	\$2 to \$7	20/24/28/40/48/56 SOIC, PDIP, SSOP, QSOP, Windowed CerDIP, Sidebraced
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Dallas Semiconductor, Dallas, TX, (972) 371-4000, www.dalsemi.com

DS80C310	8 bits	16 bits	4.5	5.5	30	15	1	33	256	0			3	1				24				6	3		\$3.70	40 DIP, 44 PLCC, 44 TQFP
DS80C320	8 bits	16 bits	4.5	5.5	4.5	25	1	33	256	0			3	2				24		1		6	3		\$4.50	40 DIP, 44 PLCC, 44 TQFP
DS80C323	8 bits	16 bits	3	5.5	10	6	0.1	18	256	0			3	2				24		1		6	3		\$5.10	40 DIP, 44 PLCC, 44 TQFP
DS87C520	8 bits	16 bits	4.5	5.5	30	8	1	33	1,280		16K		3	2				32		1		6	3		\$8.40	Windowed 40 DIP, 40 DIP, 44 PLCC, 44 TQFP
DS87C530	8 bits	16 bits	4.5	5.5	30	8	1	33	1,280		16		3	2				32		1		6	3		\$9.50	Windowed 52 PLCC, 52 PLCC, 52 TQFP
DS87C550	8 bits	16 bits	4.5	5.5	30	8	1	33	1,280		8K		3	2			8	10	52	4	1	6	3		\$11.00	Windowed 68 PLCC, 68 PLCC, 80 PQFP

Domosys Corporation, Sainte-Foy, PQ, 418-681-8022, www.domosys.com

U-Chip	8 bits	24 bits	2.25	3.6	40	no stand by mode	no sleep mode	30	6	0	4	64	4	UART		SPI	4	1	48	2	1		5	2	0		48 LQFP and 80 LQFP
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Fujitsu Microelectronics Inc., San Jose, CA, (800) 866-8608, www.fujitsumicro.com

MB89160 series (LCD, Remote controller)	8 bits	16 bits	2.2V	6V	10	15	1	4.2	128-512	4-16K			5			1ch	8 channel	8	54	2	1		12	3			80 LQFP, 80 QFP
MB89180 series (LCD, Remote controller)	8 bits	16 bits	2.2	6	4.5	15	1	4.2	128-256	4-16K			3			1ch			43		1		12	3			QFP-64P

DIGITAL SIGNAL PROCESSORS

Processor family name													Number of on-board counter/timers												
This processor is in bits													No. on-board asynchronous serial ports												
External data bus width is in bits													No. on-board synchronous serial ports												
External address bus width is in bits													Maximum number of chip select outputs												
Supply voltage: minimum													Number of interrupt pins to chip												
Supply voltage: maximum													Number of interrupt priority levels												
Max current consumption (in milliamperes)													Number of DMA channels												
Max current cons., standby, microamperes													Packages available (pin count and type)												
Max current cons., sleep, microamperes													Typical price in 1,000 quantities												
Maximum clock speed, MHz													Intended application												
Instructions executed per clock																									
Sustained MIPS rate																									
Size of on-board RAM in bytes																									
Size of on-board masked ROM in bytes																									
Amphion Semiconductor, Inc., San Jose, CA, 408 441 1248, www.Amphion.com																									
ASVC													Application-Specific Virtual Components (IP Cores) for high-performance video, image, speech and signal processing: MPEG-4, MPEG-2, JPEG, JPEG2000, ADPCM, Reed-Solomon, Viterbi, Turbo-code, FFT, DCT, FIR.												
Analog Devices, Norwood, MA, (781) 329-4700, www.analog.com																									
ADMC32x													The ADMC32x Family of 28-pin ROM Memory DSP Motor Controllers are designed for applications such as Washing Machines, Refrigerator Compressors, Fans, Pumps and Industrial Variable Speed Drives, controlling motors such as AC Induction Motors (ACIM), Permanent Magnet Synchronous Motors (PMSM), Brushless DC Motors (BDCM) and Switched Reluctance Motors (SR).												
ADMC331													The ADMC32x Family of 28-pin ROM Memory DSP Motor Controllers are designed for applications such as Washing Machines, Refrigerator Compressors, Fans, Pumps and Industrial Variable Speed Drives, controlling motors such as AC Induction Motors (ACIM), Permanent Magnet Synchronous Motors (PMSM), Brushless DC Motors (BDCM) and Switched Reluctance Motors (SR).												
ADMC401													The ADMC32x Family of 28-pin ROM Memory DSP Motor Controllers are designed for applications such as Washing Machines, Refrigerator Compressors, Fans, Pumps and Industrial Variable Speed Drives, controlling motors such as AC Induction Motors (ACIM), Permanent Magnet Synchronous Motors (PMSM), Brushless DC Motors (BDCM) and Switched Reluctance Motors (SR).												
ADMCF32x													The ADMCF32x Family of 28-pin Flash Memory DSP Motor Controllers are designed for applications such as Washing Machines, Refrigerator Compressors, Fans, Pumps and Industrial Variable Speed Drives, controlling motors such as AC Induction Motors (ACIM), Permanent Magnet Synchronous Motors (PMSM), Brushless DC Motors (BDCM) and Switched Reluctance Motors (SR).												
ADSP-2116x													Audio, medical, military, wireless communications, graphics, imaging, motor control, and telephony												
ADSP-2153x (Blackfin)													Markets include cellular terminals, internet and consumer appliances, internet and telecommunications infrastructure, consumer and PC-related markets, automotive, central office/network switch, high-performance digital audio.												
ADSP-218xM													General purpose DSPs for use in consumer telephony, embedded speech processing, zero install full-duplex hands-free car kit, speaker phones, digital speech interpolation, pattern matching, navigation, network access servers.												
ADSP-218xN													General purpose DSPs for use in consumer telephony, embedded speech processing, multi-channel voice processing, industrial measurement and control, data encryption, VoIP phone, global positioning, Internet gateway.												
ADSP-219x													Suitable for range of applications including integrated access devices, data acquisition, multi-mode modems, PBX gateways/PBX voice functions, echo cancellers, VOIP, transcoders, media gateways												

SINGLE-BOARD COMPUTERS

Bus	Technical Support																
	Single board computers	Data acquisition boards	Daughter cards and modules	I/O boards	DSP boards	Special purpose boards	Full custom boards	Days of free phone support	BBS/Web FAQs	bug lists	other support	Phone support, standard	Phone support, 24-hour response	Product updates	Training	Price	
AAEON Electronics, Inc., Hazlet, NJ, (732) 203-9300, www.aaeon.com																	
ISA, Other								U	U	U							
Abia Technology, Cypress, 714-821-8762, www.abiatech.com																	
PC/104	✓							un-lim-ited	?	?	?	?	?	?		126	
PC/104	✓							un-lim-ited	?	?	?	?	?	?		136	
Other	✓							un-lim-ited	?	?	?	?	?	?		200	
ISA	✓							un-lim-ited	?	?	?	?	?	?		150	
PCI	✓					✓	✓	un-lim-ited	?	?	?	?	?	?		180	
Other	✓							un-lim-ited	?	?	?	?	?	?		330	
Other	✓							un-lim-ited	?	?	?	?	?	?		400	
Acacetus, Dorval, PQ, Canada, 514-422-9164, www.acacetus.com																	
Other	✓		✓			✓	✓										
Accelent Systems Inc., Akron, OH, (330) 864-2300, www.accelent.com																	
PCMCIA, Other	✓		✓	✓		✓	✓									\$2,995	
Acrosser USA, Cypress, CA, (714) 827-9938, www.acrosser.com																	
PCI, PC/104, ISA	✓	✓		✓		✓										140	
ACT/Technico, Ivyland, PA, (215) 957-9071, www.acttechnico.com																	
VME, PCI, PC/104, ISA, PCMCIA, CompactPCI	✓	✓	✓	✓	✓	✓	✓										
Actis Computer, Phoenix, AZ, 602 494 2931, www.actis-computer.com																	
VME, CompactPCI	✓	✓	✓	✓		✓	✓	180	?	?	?	?	?	?			
VME, CompactPCI	✓	✓	✓	✓		✓	✓	180	?	?	?	?	?	?			
Adastra Systems Corp., Hayward, CA, (510) 732-6900, www.adastra.com																	
PC/104	✓		✓	✓		✓	✓		U	U	U						
Other	✓		✓	✓		✓	✓		U	U	U						

SINGLE-BOARD COMPUTERS

Bus	Technical Support										Price			
	Single board computers	Data acquisition boards	Daughter cards and modules	I/O boards	DSP boards	Special purpose boards	Full custom boards	Days of free phone support	BBS/Web FAQs, bug lists, other	Phone support, standard		Phone support, 24-hour response	Product updates	Training
ADPI (Analog & Digital Peripherals Inc.), Troy, OH, (937) 339-2241, www.adpi.com														
PC/104, ISA, PCMCIA	✓	✓	✓	✓		✓	✓	U						\$395
Advantech Technologies Inc., Irvine, CA, (949) 789-7178, www.advantech.com														
PCI, PC/104, ISA, PCMCIA	✓			✓			✓	Unlimited	U	U	U	U	U	
Aerotech World Trade Ltd., Westlake Village, CA, (818) 991-2972, www.aerotechusa.com														
VME, PCI, ISA, CompactPCI, Other	✓	✓	✓	✓	✓	✓								
aJile Systems, San Jose, 408-557-0829, www.ajile.com														
Other	✓							unlimited	?	?	?	?	?	999.0
									?	?	?	?	?	
									?	?	?	?	?	
PC/104	✓							unlimited	?	?	?	?	?	599.0
									?	?	?	?	?	
									?	?	?	?	?	
Alacron Inc., Nashua, NH, (603) 891-2750, www.alacron.com														
VME, PCI, Other			✓		✓	✓								
Algorithmics Ltd., Cambridge, United Kingdom, +44 1223 706200, www.algor.co.uk														
PCI, ISA, PCMCIA	✓							60	U	\$	\$	\$	\$	\$3,950
Allen Systems, Columbus, OH, (614) 488-7122, members.aol.com/allensys														
Other	✓	✓	✓	✓			✓	U	U	U		U	U	\$39
Alta Technology/Linux NetworX, Sandy, UT, (801) 562-1010, www.altatech.com														
PCI, CompactPCI	✓							365		U	\$	\$		
Amer.com, Largo, FL, (727) 540-0505														
PCI, PC/104, ISA, CompactPCI	✓						✓		?	?	?	?	?	
									?	?	?	?	?	
Ampro Computers, Inc., San Jose, CA, (408) 360-0200, www.ampro.com														
PC/104	✓		✓	✓			✓		U	U	U	U		300
PCI, Other			✓						U	U	U	U		500
ANT Computer Inc., Walnut, CA, (909) 598-3315, www.antcomputer.com														
Other										U		U		
Applied Data Systems, Columbia, MD, (301) 490-4007, www.flatpanels.com; www.applieddata.net														
PCMCIA	✓													\$300-\$500
Arbor Technology, San Jose, +408 577 1798, www.arbor.com.tw														
PC/104	✓	✓	✓	✓					?	?	?	?	?	200
									?	?	?	?	?	
									?	?	?	?	?	