VLSI TECHNOLOGY, INC.

RISC DEVELOPMENT TOOLS OVERVIEW
BLUE STREAK DEVELOPMENT BOARD

FEATURES

- Hardware and software prototyping vehicle

- 1 MByte or 4 MByte memory

- IBM PC/AT drop-in card

- PC bus-master code

- RISC can access PC memory or PC I/O space

- RS-232C serial port

- Single bootstrap EPROM

- On-board memory manager (MEMC chip)

- Spare socket for 53C90-type SCSI adapter

- Fully supports OC disk and I/O operations

- Includes full source code for RISC monitor programs

DESCRIPTION

The Blue Streak is a PC/AT® add-in card that contains a VL86C010, VL86C110, and VL86C410 all operating at 8 MHz. The board is intended as a hardware/software development platform for the processor. The hardware architecture is such that the card is a bus master on the PC expansion bus and therefore the RISC has direct access to the PC memory and I/O space. For PC-to-board communication a simple mail box register is used. The VL86C010 accesses the PC bus under programmed I/O to simulate a DMA channel. An expansion bus is available on a 96-pin DIN connector to allow custom hardware to be attached for prototype development. The VL86C410 provides a full-duplex RS-232 port for downloading code into other target systems. Also on the board (but not supported in beta site versions) is a SCSI interface directly into the RISC system. Full schematics of the board are available to assist customers in interface issues with slower buses. The board is available 1 Mbyte and 4 Mbyte configurations or without memory for customers who can supply their own memory devices.

DEVELOPMENT SUPPORT

Included with the Blue Streak are all programs necessary for interface to the PC and several software development tools such as: debuggers, assemblers, and linkers. Programs are downloaded into the Blue Streak from the PC via the parallel bus. Monitor programs operating in both systems coordinate all I/O activity between the two systems.

Programs can be written in assembler language using the Compiling Assembler™ (CASM™) or the Super-C ANSI C Compiler. CASM is included with the Blue Streak system utilities; Super-C is an additional-cost item.

CASM - CASM supports high-level features like run-time expression evaluation in addition to the traditional macro capability. Structured constructs are also provided.

Super-C - Super-C is a full ANSI standard implementation of the C language for the VL86C010. The VLSI Technology, Inc. developed compiler generates code that is easily placed into ROMs.

LIBR - The object files created by the compiler or assembler may be merged into one or more libraries by the LIBR (librarian) utility program. LIBR is included with CASM.

CLINK - The CLINK linker is compatible with output files from either language. It links modules from both languages together into an executable format, and is included with the CASM assembler.

For beta site releases, CASM, Super-C, LIBR, and CLINK all execute on the PC. Full production releases will support execution on either the PC or Blue Streak.

VBUG - Programs running on the Blue Streak can be debugged using the VBUG Machine Debugger. The VBUG program allows for totally non-intrusive debugging in all processor modes. VBUG supports debug functions such as break pointing, single step, instruction tracing, register manipulation, and memory manipulation.
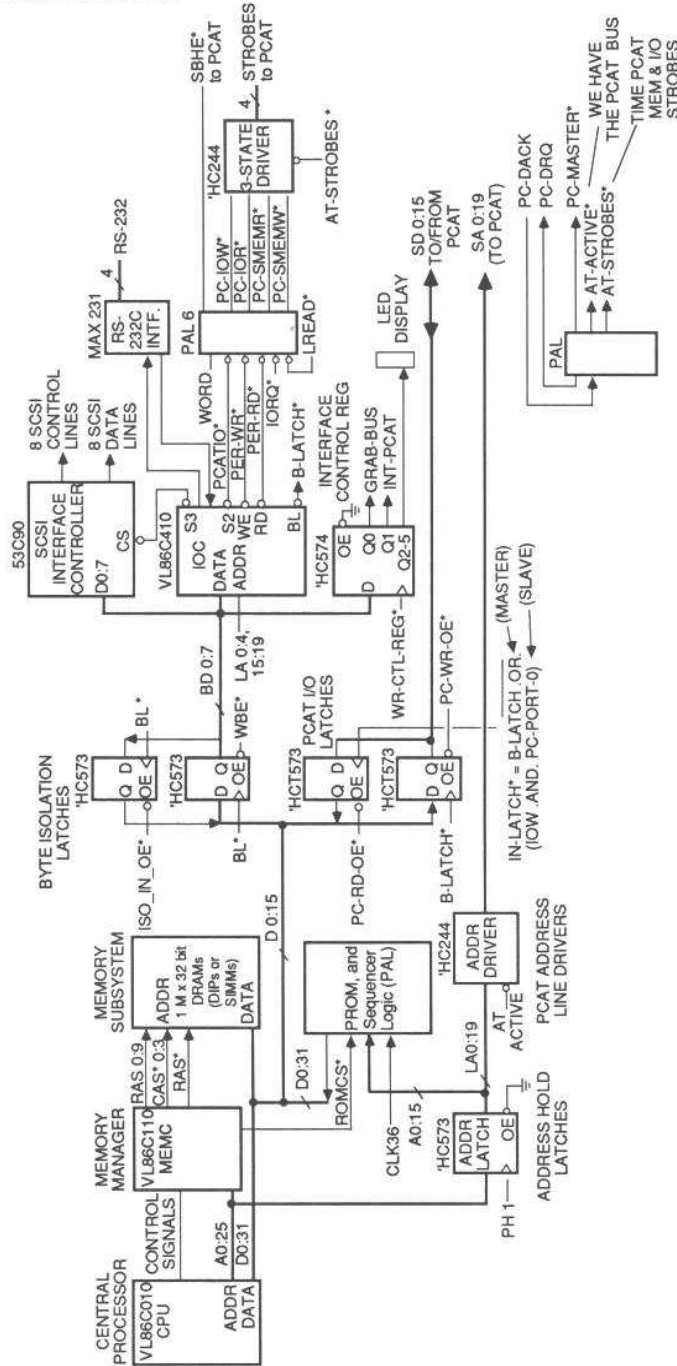
ORDER INFORMATION

Number	Description
VL86C010-SB (No memory version) VL86C010-SB3 (1 meg version) VL86C010-SB4 (4 meg version)	Blue Streak Board
VL86C010 - DB1	Arm-3 Daughter Card
VL86C010-SW1-CASMPC VL86C010-SW1-CASMRS	Compiling Assembler (CASM)™
VL86C010-SW1-SUPCPC VL86C010-SW1-SUPCRS	Super-C ANSI C Compiler
VL86C010-VBUG	VBUG Machine Level Debugger

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BLUE STREAK SYSTEM DIAGRAM

CENTRAL PROCESSOR
VL86C010 CPU
CONTROL SIGNALS
ADDR
DATA
A0:25
D0:31

MEMORY MANAGER
VL86C110 MEMC
RAS 0:9
CAS* 0:3
RAS*

MEMORY SUBSYSTEM
ADDR
1 M x 32 bit DRAMs (DIPs or SIMMs)
DATA
ISO_IN_OE*

BYTE ISOLATION LATCHES
'HC573
Q D OE*
BL*
'HC573
D Q OE*
BL*

BD 0:7
LA 0:4, 15:19
WBE*

53C90 SCSI INTERFACE CONTROLLER
D0:7 CS
8 SCSI CONTROL LINES
8 SCSI DATA LINES

VL86C410 IOC
DATA S3
ADDR WE S2
RD
BL

MAX 231
RS-232C INTF.
RS-232
4

PAL 6
PCATIO*
PER-WR*
PER-RD*
IORQ*
B-LATCH*
WORD

PC-IOW*
PC-IOR*
PC-SMEMR*
PC-SMEMW*
LREAD*

'HC244
3-STATE DRIVER
4

SBHE* to PCAT
STROBES to PCAT
AT-STROBES *

INTERFACE CONTROL REG
'HC574
OE Q0
D Q1
Q2-5
GRAB-BUS
INT-PCAT

LED DISPLAY

SD 0:15 TO/FROM PCAT
SA 0:19 (TO PCAT)

PC-DACK
PC-DRQ
PC-MASTER*
AT-ACTIVE*
AT-STROBES*
WE HAVE THE PCAT BUS
TIME PCAT MEM & I/O STROBES

PAL

PCAT I/O LATCHES
'HCT573
Q D OE
'HCT573
D Q OE
PC-RD-OE*
WR-CTL-REG*
PC-WR-OE*
IN-LATCH* = B-LATCH .OR. (IOW .AND. PC-PORT-0)
(MASTER)
(SLAVE)
B-LATCH*

PROM, and Sequencer Logic (PAL)
ROMCS*
D0:31
D0:15
CLK36

'HC244
ADDR DRIVER
LA0:19
AT ACTIVE

PCAT ADDRESS LINE DRIVERS

'HC573
ADDR LATCH
OE
A0:15
PH 1

ADDRESS HOLD LATCHES

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ARM-3 DAUGHTER CARD

DESCRIPTION

This is a daughter card that connects to the Blue Streak board. It contains a VL86C020 processor with 4 Kbytes of instruction and data cache on-chip.

This card contains a PLCC adapter that lets it replace the processor chip on the Blue Streak. The new processor runs at 20 MHz, but uses the same 8 MHz memory subsystem of the unmodified

Blue Streak. Most programs then run 2.5 - 3.0 times faster than the original processor, when the cache is enabled. The new board is fully software compatible with the original processor.

COMPILING ASSEMBLER (CASM)

DESCRIPTION

The CASM Assembler provides the ability to program at the machine level effectively and efficiently. Since the processor has fully interlocked pipelines and very simple parallelism, programming in assembler for the VL86C010 is very similar to the more traditional CISC architectures. Performance from the processor does not depend on highly optimized compilers, so the assembly programmer is not required to manage pipeline flows and optimal scheduling strategy as in other RISC processors.

CASM can be used as an ordinary macro assembler or in a compiling mode that generates machine code similar to high-level language statements. Support for listing indentation and structured flow control statements improve programmer productivity.

CASM creates relocatable object modules.

Included with CASM is the CLINK linker. It allows modules to be assembled or compiled independently, and combined into one module for execution. CLINK supports 16 location counters and allows programs to be partitioned for different classes of memory (ROM, RAM, stack, common memory, etc.).

Also included is the LIBR program librarian. This utility merges commonly-used program modules together into a single file. The linker can then automatically search that (library) file for any modules that it needs to complete the construction of a program. This eliminates the requirement to tell the linker the detailed names for common

utility modules often used by programs.

DEVELOPMENT ENVIRONMENT

Two versions are available. One that executes on the IBM PC and the other directly on the Blue Streak board. The Blue Streak includes both CASM and CLINK in the basic system. Users who wish to develop code on the IBM PC and download into their target hardware may purchase a cross assembler copy that executes on the PC and produces VL86C010 code.

Modules created on the Blue Streak board may be freely mixed with those created on the PC environment, and vice versa, during the program linking process.

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SUPER-C ANSI C COMPILER

DESCRIPTION

The SUPER-C ANSI C Compiler implements the full ANSI specification of the C language for the VL86C010 family processors. The instruction set architecture of the VL86C010 lends itself to efficient compiler implementations and optimization. The compiler uses the conditional execution and condition code control provided by the instruction set to produce optimized code. In addition, efficient register allocation minimizes the number of load/store instructions.

The object code modules produced by SUPER-C are compatible with the CASM and CLINK programs to allow modules written in the high-level language and assembler to be combined.

The runtime libraries follow the ANSI definitions, and support the Blue Streak hardware environment. Source code may be purchased for the libraries so that they may be ported to alternative hardware configurations.

DEVELOPMENT ENVIRONMENT

Two versions are available. One that executes on the IBM PC and the other directly on the Blue Streak board. Users who wish to develop code on the IBM PC and download into their target hardware may purchase a cross compiler copy that executes on the PC and generates VL86C010 code.

Modules created on the Blue Streak board may be freely mixed with those created on the PC environment, and vice versa, during the program linking process.

LIBR LIBRARIAN UTILITY (INCLUDED WITH CASM)

DESCRIPTION

LIBR is a librarian utility that merges software object modules into a single file. The resulting library file is used by the CLINK linker. Placing commonly used functions and modules into a library file minimizes the effort needed to link programs. It also allows pro-grams to be grouped conveniently, such as a different library for different hardware configurations.

DEVELOPMENT ENVIRONMENT

Two versions are available. One that executes on the IBM PC and the other directly on the Blue Streak board. Modules created on the Blue Streak board may be freely mixed with those created on the PC environment, and vice versa, during the library merging process.

ODUMP OBJECT DUMP UTILITY (INCLUDED WITH CASM)

DESCRIPTION

ODUMP is a utility program that extracts and dumps information on an object module to the screen. It may be used to inspect data such as the object file header containing dates, times, source environment, and the like. It is also used to inspect relocation records, displaying them in an easy-to-read manner.

DEVELOPMENT ENVIRONMENT

Only one version is provided, it executes on the PC. It may dump data from modules created on either the PC or on the Blue Streak environments.

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VBUG MACHINE LEVEL DEBUGGER

DESCRIPTION

The VBUG program is a machine-level debugger for the VL86C010. It supports software development at the object code level. VBUG allows programs to be loaded into the Blue Streak and controlled via the keyboard. Functions supported include trace, single-step, register examination, and register/memory modification.

Both Step and Step-Over modes are supported for the Single-Step and the Trace commands. Step-Over mode does not perform tracing inside a subroutine that may be called. During both Single Step and Tracing,

options may be selected such that each instruction, all 16 registers are displayed. Alternatively, only the registers referenced by the instruction, or only the registers changed by the instruction, may be automatically displayed.

It is possible to trace or single-step in any of the four processor modes, and through transitions from one such mode to another. It is possible, therefore, to trace from User mode into an SWI call (if not using Step-Over tracing).

At all times that VBUG is in control of the keyboard, the user's memory is as it

was left. That is, no code is left in the memory after a trace or a Step has been completed. This means that program crashes will not cause debugger code to be left in the user memory areas.

Separate copies are kept of the register environments for each of the possible processor machine states.

ROM areas cannot be traced.

DEVELOPMENT ENVIRONMENT
VBUG is provided with the Blue Streak development board. It is currently only available on Blue Streak as a disk based debugger.

BLUE STREAK FIRMWARE AND PC/AT SHELL (INCLUDED WITH BLUE STREAK BOARD)

DESCRIPTION

The Blue Streak support firmware is comprised of four sections: Bootstrap ROM code, Blue Streak initializer, the RISC-resident monitor, and the PC/AT resident I/O support shell.

The ROM code contains a short program to set up the initial state of the Blue Streak card and to load a (monitor) program from the PC/AT. The initializer program operating in the PC/AT loads the RISC's monitor program from a disk file.

The monitor is a single-tasking program that maintains an operating environment for the user code. It supports both character and disk I/O through DOS, via the PC/AT shell program. Because of the DMA-like bus interface on the Blue Streak card, transfers between the monitor and the shell are very fast.

An interface shell program runs on the PC, and provides I/O services to the RISC's monitor. Both keyboard and

disk I/Os are handled, using standard DOS indirection facilities.

The monitor does not support the SCSI adaptor device on the Blue Streak card. Source code is available for all of these programs.

DEVELOPMENT ENVIRONMENT
The bootstrap and the monitor programs execute on the Blue Streak board itself, while the initializer and shell operate on the PC/AT.

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