VT8233

VLINK CLIENT HIGHLY INTEGRATED SOUTH BRIDGE

HIGH BANDWIDTH VLINK CLIENT CONTROLLER
INTEGRATED FAST ETHERNET, LPC,
INTEGRATED DIRECT SOUND AC97 AUDIO,
ULTRADMA-33/66/100 MASTER MODE EIDE CONTROLLER,
SIX PORT USB CONTROLLER, KEYBOARD CONTROLLER, RTC,
SERIAL IRQ, PLUG AND PLAY, ACPI,
ENHANCED POWER MANAGEMENT, AND SMBUS
PC99 COMPLIANT

- **Inter-operable with VIA Host-to-Vlink Host Controller**
  - Combine with VT8633 for a complete 66 / 100 / 133 MHz Socket-370 or Slot-1 system (Apollo Pro266)
- **High Bandwidth 266 MB/S 8-bit Vlink Client Controller**
  - Supports 66 MHz Vlink Client interface with peak bandwidth of 266 MB/S
  - Vlink operates in 2X or 4X modes
  - Full duplex commands with separate Strobe / Command
  - Request / Data split transaction
  - Configurable outstanding transaction queue for Vlink Client accesses
  - Auto Client Retry to eliminate Vlink Host-Client Retry cycles
  - Intelligent Vlink transaction protocol to eliminate data wait-state / throttle transfer latency; all Vlink transactions for both Host and Client have a consistent view of transaction data depth and buffer size to avoid data overflow.
  - Highly efficient Vlink arbitration with minimum overhead; all Vlink transactions have predictable cycle length with known Command / Data duration.
  - Auto connect / reconnect capability for minimum power consumption
- **Integrated Peripheral Controllers**
  - Integrated Fast Ethernet Controller with 1 / 10 / 100 Mbit capability
  - Integrated USB Controller with three root hub and six function ports
  - Dual channel UltraDMA-33 / 66 / 100 master mode EIDE controller
  - AC-link interface for AC-97 audio codec and modem codec
  - HSP modem support
  - Interface for optional external modem DSP
  - Integrated DirectSound compatible digital audio controller
  - LPC interface for Low Pin Count interface to Super-I/O or ROM
- **Integrated Legacy Functions**
  - Integrated Keyboard Controller with PS2 mouse support
  - Integrated DS12885-style Real Time Clock with extended 256 byte CMOS RAM and Day/Month Alarm for ACPI
  - Integrated ISA Bus Controller including DMA, timer, and interrupt controller
  - Serial IRQ for docking and non-docking applications
  - Fast reset and Gate A20 operation

- **Concurrent PCI Bus Controller**
  - 33 MHz operation
  - Supports up to five PCI masters
  - Peer concurrency
  - Concurrent multiple PCI master transactions; i.e., allow PCI masters from both PCI buses active at the same time
  - Zero wait state PCI master and slave burst transfer rate
  - PCI to system memory data streaming up to 132Mbyte/sec (data sent to north bridge via high speed Vlink Interface)
  - PCI master snoop ahead and snoop filtering
  - Eight DW of CPU to PCI posted write buffers
  - Byte merging in the write buffers to reduce the number of PCI cycles and to create further PCI bursting possibilities
  - Enhanced PCI command optimization (MRL, MRM, MWI, etc.)
  - Four lines of post write buffers from PCI masters to DRAM
  - Sixteen levels (double-words) of prefetch buffers from DRAM for access by PCI masters
  - Delay transaction from PCI master accessing DRAM
  - Transaction timer for fair arbitration between PCI masters (granularity of two PCI clocks)
  - Symmetric arbitration between Host/PCI bus for optimized system performance
  - Complete steerable PCI interrupts
  - PCI-2.2 compliant, 32 bit 3.3V PCI interface with 5V tolerant inputs
- **Fast Ethernet Controller**
  - High performance PCI master interface with scatter / gather and bursting capability
  - Standard MII interface to external PHYceiver
  - 1 / 10 / 100 MHz full and half duplex operation
  - Independent 2K byte FIFOs for receive and transmit
  - Flexible dynamically loadable EEPROM algorithm
  - Physical, Broadcast, and Multicast address filtering using hashing function
  - Magic packet and wake-on-address filtering
  - Software controllable power down
- **UltraDMA-33 / 66 / 100 Master Mode EIDE Controller**
  - Dual channel master mode hard disk controller supporting four Enhanced IDE devices
  - Transfer rate up to 33MB/sec to cover PIO mode 4, multi-word DMA mode 2 drives, and UltraDMA-33 interface
  - Increased reliability using UltraDMA-66/100 transfer protocols
  - Thirty-two levels (doublewords) of prefetch and write buffers
  - Dual DMA engine for concurrent dual channel operation
  - Bus master programming interface for SFF-8038i rev.1.0 and Windows-95 compliant
  - Full scatter gather capability
  - Support ATAPI compliant devices including DVD devices
  - Support PCI native and ATA compatibility modes
  - Complete software driver support
- **Direct Sound Ready AC97 Digital Audio Controller**
  - AC-Link access to 4 CODECs (AC97 + AMC97 + MC97)
  - Multichannel Audio
  - Bus Master Scatter / Gather DMA
  - Dedicated read and write channels supporting simultaneous stereo playback and record
  - Dedicated read and write channels supporting simultaneous modem receive and transmit
  - 4 DirectSound channels with source / volume control / mixer
  - 1 dedicated channel supporting multi-channel audio
  - 32-byte line-bufers for each SGD channel
  - Programmable 8bit / 16bit mono / stereo PCM data format support
  - AC97 2.1 compliant
- **System Management Bus Interface**
  - Host interface for processor communications
  - Slave interface for external SMBus masters

- **Universal Serial Bus Controller**
  - USB v.1.1 and Intel Universal HCI v.1.1 compatible
  - Eighteen level (doublewords) data FIFO with full scatter and gather capability
  - Root hub and six function ports
  - Integrated physical layer transceivers with optional over-current detection status on USB inputs
  - Legacy keyboard and PS/2 mouse support
- **Sophisticated PC99-Compatible Mobile Power Management**
  - Supports both ACPI (Advanced Configuration and Power Interface) and legacy (APM) power management
  - ACPI v1.0 Compliant
  - APM v1.2 Compliant
  - CPU clock throttling and clock stop control for complete ACPI C0 to C3 state support
  - PCI bus clock run, Power Management Enable (PME) control, and PCI/CPU clock generator stop control
  - Supports multiple system suspend types: power-on suspends with flexible CPU/PCI bus reset options, suspend to DRAM, and suspend to disk (soft-off), all with hardware automatic wake-up
  - Multiple suspend power plane controls and suspend status indicators
  - One idle timer, one peripheral timer and one general purpose timer, plus 24/32-bit ACPI compliant timer
  - Normal, doze, sleep, suspend and conserve modes
  - Global and local device power control
  - System event monitoring with two event classes
  - Primary and secondary interrupt differentiation for individual channels
  - Dedicated input pins for power and sleep buttons, external modem ring indicator, and notebook lid open/close for system wake-up
  - 32 general purpose input ports and 32 output ports
  - Multiple internal and external SMI sources for flexible power management models
  - Enhanced integrated real time clock (RTC) with date alarm, month alarm, and century field
  - Thermal alarm on external temperature sensing circuit
  - I/O pad leakage control
- **Plug and Play Controller**
  - PCI interrupts steerable to any interrupt channel
  - Steerable interrupts for integrated peripheral controllers: USB, floppy, serial, parallel, and audio
  - Microsoft Windows 98™, Windows NT™, Windows 95™ and plug and play BIOS compliant
- **Built-in NAND-tree pin scan test capability**
- **0.22um, 2.5V, low power CMOS process**
- **Single chip 27x27 mm, 376 pin BGA**

OVERVIEW

The VT8233 South Bridge is a high integration, high performance, power-efficient, and high compatibility device that supports Intel and non-Intel based processor to V-Link bus bridge functionality to make a complete Microsoft PC99-compliant PCI/ISA system. In addition to complete ISA extension bus functionality, the VT8233 includes standard intelligent peripheral controllers:

a) Master mode enhanced IDE controller with dual channel DMA engine and interlaced dual channel commands. Dedicated FIFO coupled with scatter and gather master mode operation allows high performance transfers between PCI and IDE devices. In addition to standard PIO and DMA mode operation, the VT8233 also supports the UltraDMA-33 standard to allow reliable data transfer rates up to 33 MB/sec throughput. The VT8233 also supports the UltraDMA-66 / 100 standard. The IDE controller is SFF-8038i v1.0 and Microsoft Windows-family compliant.

b) Universal Serial Bus controller that is USB v1.1 and Universal HCI v1.1 compliant. The VT8233 includes the root hub with six function ports with integrated physical layer transceivers. The USB controller allows hot plug and play and isochronous peripherals to be inserted into the system with universal driver support. The controller also implements legacy keyboard and mouse support so that legacy software can run transparently in a non-USB-aware operating system environment.

c) Keyboard controller with PS2 mouse support.

d) Real Time Clock with 256 byte extended CMOS. In addition to the standard ISA RTC functionality, the integrated RTC also includes the date alarm, century field, and other enhancements for compatibility with the ACPI standard.

e) Notebook-class power management functionality compliant with ACPI and legacy APM requirements. Multiple sleep states (power-on suspend, suspend-to-DRAM, and suspend-to-Disk) are supported with hardware automatic wake-up. Additional functionality includes event monitoring, CPU clock throttling and stop (Intel processor protocol), PCI bus clock stop control, modular power, clock and leakage control, hardware-based and software-based event handling, general purpose I/O, chip select and external SMI.

f) Full System Management Bus (SMBus) interface.

g) Integrated bus-mastering dual full-duplex direct-sound AC97-link-compatible sound system.

h) Plug and Play controller that allows complete steerability of all PCI interrupts and internal interrupts / DMA channels to any interrupt channel. One additional steerable interrupt channel is provided to allow plug and play and reconfigurability of on-board peripherals for Windows family compliance.

The VT8233 also enhances the functionality of the standard ISA peripherals. The integrated interrupt controller supports both edge and level triggered interrupts channel by channel. The integrated DMA controller supports type F DMA in addition to standard ISA DMA modes. Compliant with the PCI-2.2 specification, the VT8233 supports delayed transactions and remote power management so that slower ISA peripherals do not block the traffic of the PCI bus. Special circuitry is built in to allow concurrent operation without causing dead lock even in a PCI-to-PCI bridge environment. The chip also includes eight levels (doublewords) of line buffers from the PCI bus to the ISA bus to further enhance overall system performance.

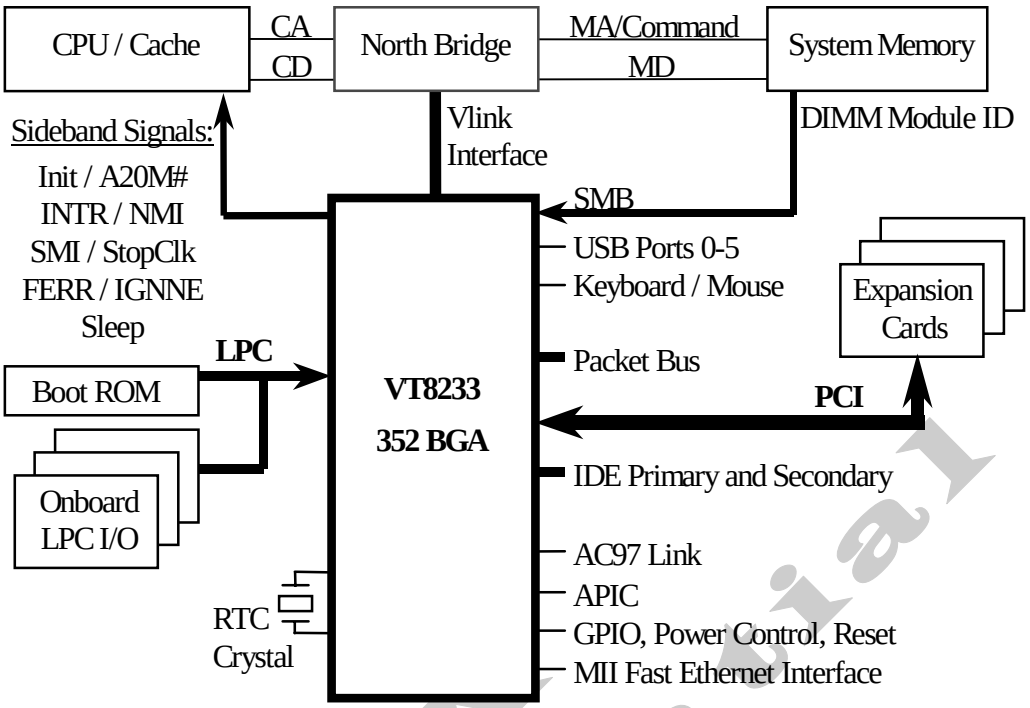

Figure 1. PC System Configuration Using the VT8233