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OVERVIEW

The KCUSB16 Controller has been specifically designed to provide an easy to use interface between a USB and Ethernet 802.3. The chip contains a USB transceiver and SIE (Serial Interface Engine), a micro-controller with internal RAM and ROM, a 10Mhz Ethernet MAC and all the necessary function blocks needed to control and integrate the above functions. To simplify system design, we have added several key functions such as an I²C interface for serial EPROMS as well as a memory controller that can interface to external SRAM, DRAM and ROM, should additional memory be required beyond what is on-chip. The block diagram of figure 1 highlights the primary functions of the KCUSB16.

Block Diagram of Ethernet Controller
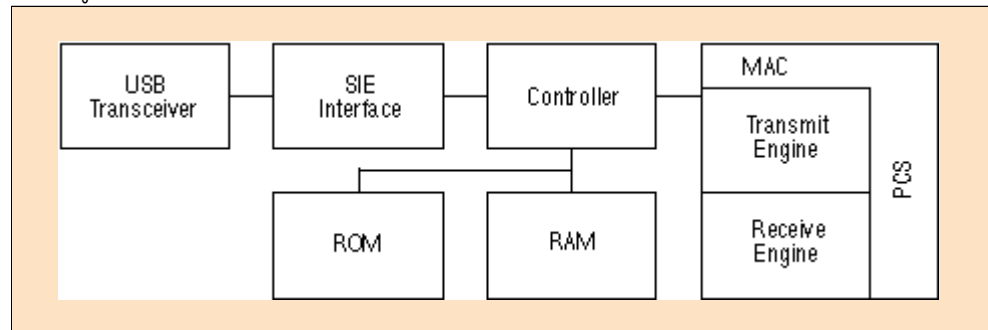
KEY FEATURES

- High Speed Microprocessor
- Supports DMA Transfers
- 3KB RAM
- 8KB ROM
- Minimal external components required
- Glue-less interface to PHY and memory

Interface Options
- Serial EPROM interface
- External SRAM, DRAM and ROM

USB Functionality
- 12 M bits/second transfer rate
- Guaranteed service latency
- Guaranteed bandwidth allocation
- Built-in error detection and recovery

Ethernet Functionality
- Full Duplex operation
- Conforms to 802.3 specification

Software
- Standard Win 95 "Class" drivers
- NDIS drivers provided

Physical Specifications
- 3.3V, 0.5 Micron CMOS Technology
- Low power
- 100 pin QFP Package

SIE
(SERIAL INTERFACE ENGINE)

The USB Function SIE interface specification describes the interfacing signals between the USB Function SIE Reference VHDL design (referred to as 'Function SIE') and the surrounding USB Function interface logic. The Function SIE utilizes a Slave oriented eight bit bus interface. Interface signals are divided into four groups:

- Status: provides output information regarding the results of the last attempted USB transaction.
- Bus Interface: interface signals to access data to/from the SIE
- Transceiver Interface: interface signals to connect the SIE to a USB compatible differential transceiver

- Control: Function input to the SIE to control the state transitions of the SIE state machine based on the following variables:
  - Valid Address/Endpoint values
  - Availability of Buffer space or Data
  - Error conditions

For the remainder of this document the 'Host' will refer to the hardware/software to which the SIE is connected in the Function. The USB Host will be referred to as "USB Host".

Function SIE Interface
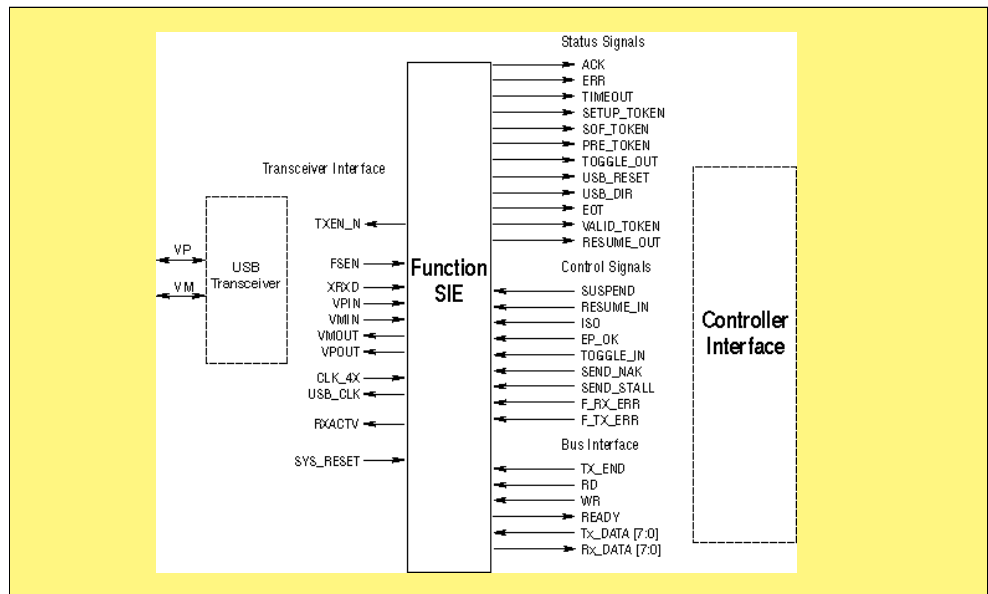
ETHERNET MAC

Ethernet MAC

The Ethernet MAC (Media Access Control) logic supports the standard IEEE 802.3 specification for 10 MB. The MAC supports full duplex operation at 10M bit data rates.

PHY Interface

The PHY interface implements the PCS (Physical Coding Sublayer) function allowing for a glue-less interface to a TP-PMD (Twisted Pair-Physical Medium Dependent) PHY with a Manchester ENDEC (ENCoder DECoder). Both full and half duplex operational modes are supported.

- Configuration Options including CRC generation, padding of small packets to minimum packet size, and transmission of giant (>1518 byte) packets are also available.
- Status reporting including CRC errors, excessive collisions, late collisions, transmit FIFO underrun, receive FIFO overrun, and transmitted and received byte counts.
- Built in jabber protection and loss of carrier and SQE (Signal Quality Error) detection are also built into the KCUSB16.

Module Diagram

MEMORY INTERFACE

The KCUSB16 contains 8KB of mask ROM and 3KB of SRAM. While this is sufficient for many applications, additional external memory can easily be added.

DRAM

The KCUSB16 contains an integrated DRAM controller and provides a glue-less interface to standard DRAM chips.

SRAM Interface

ROM Interface

I^2C Interface facilitates the interconnection to a serial EPROM device. The EPROM can be used to store serial numbers, Manufacturers ID and other product code information.

SOFTWARE DRIVERS

Networking support is provided via an NDIS 4.0 intermediate mini-driver. This NDIS intermediate mini-driver will dynamically connect to a USB driver for data transport. If the USB driver is not available (the USB device is not connected or disabled), the NDIS driver will return a status of NOT_AVAILABLE. This behavior allows the user to disconnect and reconnect their USB Ethernet without reinstalling their NDIS drivers and rebooting.

Drivers are available for the following operating systems: Windows NT 5.0, Windows 95 OSR 2.1, and Windows 98.

Typical Application Example:

For a typical Ethernet application, only the KCUSB16, PHY and transformer are required. If additional memory for buffering or serial numbers are required, they can be readily interfaced to the KCUSB16.

KLSI INCORPORATED

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