**EP563 SD3.0/SDIO/eMMC Slave Controller**

**FEATURES**
- Compatible with SD/SDIO specification 3.0.
- Supports SD memory, SDHC and SDXC with option for SDIO support and SD combo device.
- UHS-I Ultra High Speed support including 104Mbyte/sec (SDR104) and Double Data Rate (DDR50).
- Simple 32-bit bus master interface to DMA data into user memory space.
- Optional interrupt-based transfer mode to allow local CPU maximum control.
- Optional two clock domain implementation allows user bus interface and SD clock operates at different clock domains.
- Selectable maximum block size from 512 to 2Kbytes.
- Process most commands automatically without needing support from user logic.
- Contains SD memory and SDIO standard slave register set.
- Supports CPRM security commands and Rev 3.0 extended command set.
- Choice of user interface bus including AHB, AXI, Wishbone, PLB and generic bus.
- Supports multi-function SD cards, suspend and resume, read wait, block transfers, and SDIO interrupts.
- Password Protection for SD cards.

**BLOCK DIAGRAM**

![Block Diagram Image]
The SD Card Slave Controller is designed to reside within an SD memory, SDIO, or SD Combo Card. It serves as an interface between the SD bus and user logic that provides the actual function of the card. It is designed to integrate with user logic to make various devices using the SD bus protocol, such as storage or wireless network cards.

The SD slave controller supports both 1 and 4 bit SD interface and SPI mode. It supports SD high speed mode and UHS-I high speed mode up to 104Mbyte/sec. It supports all the 3.0 bus timing specifications including SDR104, SDR50, DDR50, SDR25 and backward compatible to SDR12. Features such as plug and play, autodetection, error correction, write protection, and rev 3.0 extended command set are standard with SD card interface and are supported.

As a slave device, the SD slave controller receives commands from the host through the SD interface. Most of the commands are processed locally by the controller without any help from the user logic. The majority of the standard SD register set is also implemented within the slave controller and process by the core without help from the user logic.

In case of memory or IO access that needs to be forwarded to the user logic, the slave controller handles all the SD bus protocol and presents the request to the user logic as simple read and write request through parallel address and data buses. Burst transfer and user defined wait states are supported on the user interface to maximize data bandwidth. The slave controller also contains data buffer to match the speed differences between the user interface and the SD interface. It allows a much more efficient use of the user interface.

SD Combo card and multi-function cards are optional features of the EP563. With Combo card and multi-function, the SD memory and each SDIO function has dedicated data buffer and user interface to allow parallel processing.

The user interface of the EP563 core can operate either in DMA mode or interrupt mode. In the DMA mode, the EP563 is a bus master that transfers data directly with the user’s memory and then forward to the SD host. It functions like a DMA controller under the control of the SD host. In the optional interrupt mode, the communication between the EP563 and the user logic is interrupt driven. The EP563 asserts interrupt to the local CPU whenever it needs to access user memory. The main body of this data sheets describe the EP563 in DMA mode and the interrupt mode is described in the Appendix.

With the EP563, SD card design can be realized with very little development cost. The designer can add SD memory and SDIO interface capability to the design by simply adding the EP563 module without changing the rest of the system architecture.
**Application Diagrams**

EP563 SD3.0/SDIO/eMMC Slave Controller

1. **EP563 in DMA mode**
   - SD bus
   - EP563 SD Slave Controller
   - Memory Subsystem or User Logic
   - SD/eMMC memory or SDIO card

2. **EP563 in Interrupt mode**
   - SD bus
   - EP563 SD Slave Controller
   - Interrupt
   - Local CPU
   - Memory Subsystem or User Logic
   - SD/eMMC memory or SDIO card
Optional Features

The EP560 standard core features a simple generic user interface which can be connected easily into any design. Eureka also offer the EP560 with AHB, AXI, PLB, Wishbone and Avalon bus interface. The EP560 can also come with interrupt mode interface to allow use logic to access EP560 as a slave device or in DMA mode which allows the EP560 to access user logic.

Microsemi Device Utilization Data

<table>
<thead>
<tr>
<th>Family</th>
<th>Device</th>
<th>Utilization</th>
<th>Performance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(speed grade)</td>
<td>SEQ</td>
<td>COMB</td>
</tr>
<tr>
<td>ProASIC3</td>
<td>A3P1000-2</td>
<td>1529</td>
<td>10232</td>
</tr>
<tr>
<td>Fusion</td>
<td>AFS1500</td>
<td>1598</td>
<td>8853</td>
</tr>
<tr>
<td>IGLOO2</td>
<td>M2GL100-1</td>
<td>1641</td>
<td>6377</td>
</tr>
<tr>
<td>SmartFusion2</td>
<td>M2S100-1</td>
<td>1641</td>
<td>6377</td>
</tr>
</tbody>
</table>