Digital Audio Broadcasting

Programmable Solutions for the Broadcast Industry
Portable DAB Receiver Issues

- Adding DAB functionality to existing units
- Interfacing DAB chipsets to processors
- Adding other features to DAB units
  - e.g. GPS navigation
- Custom display support
- Power management
- Lack of board space
Peripheral Interfacing and System Glue

Interface features to the host processor
Quickly add new capabilities to existing products
Portable DAB Receiver
Lowest Power CPLD Solution

*Estimated 128 macrocell device with eight 16-bit counters @ 50MHz

Typical standby power
1.8V X 2000µA = 3600µW

Typical standby power
1.8V X 25µA = 45µW

36mW* Dynamic

360mW* Dynamic

12mW* Dynamic

Sense Amp Based CPLDs

Other CMOS CPLDs
Keeping Processors Asleep

- Reducing the number of interrupts to a processor will increase its time in a power saving state.
- A low power CPLD that responds to and handles system interrupts will perform such a task.
Interrupt Handling

- Two interrupt types
  - data acquisition
  - data processing

- Data acquisition interrupts can be serviced by CPLD
  - Memory access
  - I²C, UART, SPI, ISA
  - General Purpose I/O
  - LCD interface

- Download design for free!
Power Saving Benefits

Standalone Microprocessor

CoolRunner-II

Increased Power Saving Area

Operating Time

Power Consumption
System Battery Management

• Typical battery management issues:
  – Little advance knowledge that about to run out
  – Can’t determine if capable of supplying adequate power for additional load (e.g. to spin a hard drive)
  – Chargers must be tailored for use with a specific battery chemistry
    • may cause damage if used with a different chemistry

One solution is to use Smart Batteries and SMBus
Smart Batteries and SMBus

- SMBus is the System Management Bus
- I²C compatible derivative
- Used in industry standard Smart Battery System Specifications
- Download CoolRunner design for free!
Control Simple User Interfaces

- **ICONS** - Easier control (ON/OFF)
- **7-SEGMENT FIGURES** - Slightly more complex state machine
- **PUSH BUTTONS** - Simple User Input and Control
Programmable LCD Control

- PLAY STATUS (2:0)
- TRACK (4:0)
- DOWNLOAD MODE
- DISPLAY ERROR
- SONG START
- UPDATE TRACK
- BATTERY STATUS
- VOLUME STATUS

**ICON_CTRL**
- 3:8 Demux (Play Status)
- Other Icon Status

**7SEG_CTRL**
- Binary to 7-segment decoder
- Binary to 7-segment decoder

**PLAY ICON**
- FORWARD ICON
- REWIND ICON
- ERROR ICON
- DOWNLOAD ICON

**TRACK NUMBER**
- TRACK NUMBER

DAB Receivers 12
DAB Receiver Example

- Oscillator
- Power Management
- I2C Master
- Main Control Logic
  - HCI Bridge
  - IrDA/UART Interface
  - Flash Controller
- User Interface Control
- User Interface
- LCD Display
- Digital/Analog Converter
- Speakers
- DAB Decoder
- Bluetooth Module
- PC IrDA/Serial Port
- Flash Bank
- CoolRunner-II
- Xilinx
- Embedded Logic
- Mixed Signal
- Non-Xilinx
- Memory
- CPU

DAB Receivers 13
## Multiple Storage Standards

<table>
<thead>
<tr>
<th>Storage Technology</th>
<th>Companies</th>
<th>Size</th>
<th>Advantages</th>
<th>Disadvantages</th>
<th>Applications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compact Flash</td>
<td>SanDisk, Hitachi, SiliconTech, Kingston Tech</td>
<td>2MB - 512MB</td>
<td>Acceptance, Small size, durability, capacity</td>
<td>Largest of the Flash types - not suitable for some small devices</td>
<td>Digital Cameras, notebooks, handhelds, PCs, industrial</td>
</tr>
<tr>
<td>Smart Media</td>
<td>SanDisk, Siemens (backed by Nokia, Ericsson, and Motorola)</td>
<td>8MB - 126MB</td>
<td>Small size, cheap, durability</td>
<td>No I/O controller</td>
<td>Digital cameras, digital audio players</td>
</tr>
<tr>
<td>MultimediaCard</td>
<td>SanDisk, Siemens (backed by Nokia, Ericsson, and Motorola)</td>
<td>8MB - 54MB</td>
<td>Ultra small, durability</td>
<td>Not interoperable with SD Card of same form factor</td>
<td>Digital Audio players, cellular handsets, mobile commerce</td>
</tr>
<tr>
<td>Secure Digital (SD) Memory Card</td>
<td>Toshiba, Panasonic and SanDisk</td>
<td>8MB - 126MB</td>
<td>Encrypted data, ultra small, durability</td>
<td>Not interoperable with MMC Card of same form factor</td>
<td>Copyright protected content (audio, video)</td>
</tr>
<tr>
<td>MemoryStick</td>
<td>Sony</td>
<td>16MB - 128MB</td>
<td>Ultra small, durability</td>
<td>Sony controlled</td>
<td>Digital cameras, digital audio players, digital camcorders</td>
</tr>
<tr>
<td>PocketZip</td>
<td>Iomega</td>
<td>40MB</td>
<td>Portability</td>
<td>Iomega controlled</td>
<td>Laptops</td>
</tr>
<tr>
<td>IBM Microdrive</td>
<td>IBM, Iomega</td>
<td>340MB - 1GB</td>
<td>Performance, Capacity</td>
<td>Moving parts</td>
<td>Digital cameras, digital audio players, PDAs</td>
</tr>
</tbody>
</table>

- Many storage technologies addressing information appliance market
- Need for multi-standard support in these applications
- **CoolRunner-II offers flexibility to act as storage controller between multiple technologies**
Example: NAND Flash Controller

- NAND Flash is sequential access device appropriate for mass storage applications
  - Offers low cost per bit, high performance and highest density non-volatile memory
  - Ideal for information appliances
- CoolRunner-II is an ideal platform to implement Flash I/F
CoolRunner-II NAND Flash Interface Design

• CoolRunner-II is responsible for several functions
  – Decode read or write from address bus
  – Interpret system address bus commands
  – Assert interface signals to UltraNAND Flash device
  – Monitor Ready/Busy output from Flash memory device

• NAND Flash interface design is capable of supporting devices from various NAND flash manufacturers

• See http://www.xilinx.com/xapp/xapp354.pdf for more info
Flash Design Derivatives

• NOR type Flash memory can just as easily be implemented
  – NOR Flash is a random access device appropriate for code storage applications
• One or many of the Flash standards can be interfaced within one device
• Programmable fabric allows customization for any application requirements

Coolrunner-II devices are ideal for Flash interfacing solutions for portable and handheld devices
Storage Reference Designs

- **PCMCIA**
  - Card-side (Spartan & CPLD)
  - Host-side (Spartan only)
- **CompactFlash+**
  - Card-side (Spartan & CPLD)
  - Host-side (Spartan only)
- **SD/MMC**
  - Card-side (Spartan & CPLD)
  - Host-side (Spartan only)
- **IDE/ATA**
  - Host-side only (Spartan)
Low Cost Packaging Options

Pb-Free Packaging Available
Automotive DAB Issues

• Adding DAB functionality to existing units
• Interfacing DAB chipsets to processor
• Adding other features to DAB units
  – e.g. GPS navigation
• Custom display support
• Lack of board space
• Choosing the right networking standards
  – Flexibility to support any interface
• Power management and the move to 42 volts
Emerging Car Networks

- **Comfort**
  - Power Seat
  - Power Mirrors
  - Sunroof
  - Climate Sensors

- **Security**
  - Alarm
  - Keyless Entry

- **Non Safety Sensors**

- **Multimedia**
  - Radio
  - DVD/CD
  - TV/Internet

- **Navigation**
  - GPS

- **Instrumentation**
  - Cell Phone
  - Voice Recognition

- **Engine Control**
  - Cruise Control

- **Brakes**
  - ABS/TCS
  - Brake-by-Wire

- **Safety**
  - Airbags
  - Collision Avoidance

Controller Area Network (CAN)
Vehicle Area Network (VAN)
Local Interconnect Network (LIN)
Intelligent Transportation Systems Data Bus (IDB)
Media-Oriented Systems Transfer (MOST)
ISO 9141
J1850
Time-Triggered Protocol (TTP/C)
D2B

Mobile Multimedia Link
IEEE1394
Connected Car PC
Domestic Digital Bus
FlexRay
AutoPilot
Multi Media Link
Auto PC
Universal Serial Bus (USB)

Gateway
Bridging Automotive Networks

Control Network
- CAN
- VAN
- LIN
- IDB
- Proprietary

Multimedia Network
- MOST
- IEEE1394
- USB
- PCI
- Proprietary

- GPS Antenna
- Wheel Sensors
- Gyroscope
- DAB/GPS Control Unit

XILINX®

DAB Receivers 22
The Move to 42V

- Automotive industry looking to move to higher in-car voltage: 42V
- Addition of AutoPCs, GPS, TVs, DVDs etc. increases power consumption from 1,500W to 7,000W
- 42V means lower currents and negates the need to move to thick and heavier wiring
- Low power, low heat dissipation semiconductor devices are required
- CoolRunner-II devices are therefore an ideal fit at the consumer equipment end
Multimedia Platform Design Approach

**Prototyping**
- Architecture Choice
- Components
- Prototyping
- Technology Evaluation
- Pretesting
- Generic Software Services
- Changing specifications & protocols

**Production**
- Business Plan orientated
- Frozen Specification
- Manufacturable
- Design Customer Specific Services
- Printed Circuit Boards
- Configuration
- Mechanics

**Application**
- Product Derivatives
- Cosmetics
- Customisation
- Look and Feel of Product
- Aesthetic Decisions

Development System Environment
Multimedia Platform Benefits

- Easier control of software & hardware development
- Reuse of software or hardware components
- Increase in time developers spend on creating value as opposed to creating system interconnect structures
- Reduction of risk through clearer understanding of basic components
- Increased productivity through application of modern development tools
- Increased openness of system, supporting use of standards and 3rd party integration
Quicker time to market and reprogrammability provide the best chance of achieving full product profit potential.
DAB Receiver Solutions

• Xilinx CPLDs and FPGAs provide time-to-market and flexibility advantages for DAB systems
  – Quickly add DAB functionality to PDA, cell phone etc.
    • Interface DAB chipset to host processor without waiting for ASSP/ASIC re-spin
  – Or add extra features to DAB units, like GPS

• Ease of integration
  – Small packaging and minimal thermal impact

• Power saving benefits without performance sacrifice
  – Operating mode and battery management
  – Support higher automotive voltages or lower consumer voltages

• Adds additional performance
  – Reduce processor workload by handling interfaces
  – Expand microprocessor I/O
Xilinx in the Broadcast Chain

- Gamma Correction
- Codecs
- Scaling/Resampling
- Colour Space
- Network Interfacing
- Chip Interfacing
- Video Filtering
- Effects (Wipe/Key)
- Memory Control
- FEC/Modulation
- System Control
Real Time HD/Multichannel DSP

- Highest performance on-chip DSP blocks, multipliers and memory
- Reduce size of DSP farms
- Support real time HD processing
- Support multiple channels of SD processing through resource sharing
- Reduce cost-per-channel for FEC and modulation
Cost Effective Connectivity

- Significant cost-per-channel reductions
- Portfolio of audio/video connectivity solutions
  - SDI, HD-SDI and DVB-ASI
  - Video-over-IP
- Wide range of general telecom, datacom and backplane solutions available
  - Ethernet, PCI Express, ATM, Fibre Channel, SONET, SPI, RapidIO, HyperTransport...

~70% cheaper than ASSP SDI solutions!
Flexible Embedded Processing

**PicoBlaze**

- 8-bit Microcontroller
- Simple state-machines and “localised” on-chip control
- Pixel processing & display control

**MicroBlaze PowerPC™**

- 32-bit Microprocessors
- Cost/performance tradeoffs
- Extensive peripherals, RTOS & bus structures
- Networking & wireless comms, control & instrumentation
Xilinx in Broadcast

Programmable Solutions for the Broadcast Industry

More info on a wide range of applications and technologies

www.xilinx.com/broadcast