BACKGROUND/INTRODUCTION

IDT™ has a complete solution for customer premises equipment (CPE). Driven by the service provider’s desire to supply equipment that offers high-speed Internet access with close to zero initial investment from the consumer (in a similar strategy to that taken by cell-phone providers, the service provider recoups his/her investment through the commitment of a customer to a long-term contract), the suppliers of the “gateway” systems are under extreme pressure to minimize system cost. This drives the need to implement low-device-count solutions on low-cost printed circuit boards. At the same time, the emerging nature of this business is driving box providers to be flexible enough to support the broad range of I/O interfaces being proposed for home local area network (LAN) connectivity, including wired and wireless. Filling that need requires an integrated communications processor that combines a processor core with a myriad of on-chip communications peripheral interfaces. It also requires high performance, low power and a small footprint that is highly configurable to many CPE solutions—aimed not only at current CPE protocols and services, but also with the flexibility to embrace future requirements.

MARKETING TRENDS, REQUIREMENTS AND DESIGN CHALLENGES

The universal adoption of LANs into the home-office environment is in its infancy. A study by the Yankee Group showed that only about 4 percent of American households featured any kind of home network. As seen in Figure 1, the deployment of the differing network technologies shows that Ethernet is the most popular networking technology today. However, other emerging LAN standards such as HPNA (Home Phone Network Alliance), wireless, HomePLUG, etc. are competing strongly. This means that there is a clear need for the development of highly flexible systems capable of supporting a broad range of not only existing technologies, but new ones as well.

IDT SOLUTION

The RC32351/RC32355 integrated communications processors are part of a complete CPE solution. They were developed by IDT to meet the need for cost-effective communication solutions. These integrated processors couple IDT’s award-winning 32-bit RISC™ 32300 CPU core with IDT’s IPBus system-level integration design methodology, and a series of general-purpose and communication-specific peripherals to form a product ideally suited for a wide variety of CPE. These range from the simplest DSL modems to higher-end integrated access devices that incorporate support for voice as well as data services.

In addition to the RC32300 CPU core, the RC32351/RC32355 devices incorporate a number of communication-specific building blocks. Among these is a 10/100 Mbps Ethernet controller, which provides an industry-standard media independent interface (MII), as well as an ATM (asynchronous transfer mode) interface, which supports the Utopia 1 and Utopia 2 industry-standard bus architectures. Also included on-chip is a v.1.1-compliant universal serial bus (USB) controller and a time-division multiplexed (TDM) bus interface (RC32355 only), which is compatible with a broad range of industry-standard buses. With the addition of a high-performance direct memory access (DMA) engine, customers can move data in any format without restrictions, increasing both system and software flexibility and allowing the processor to handle the transmission and reception of data at maximum line rates on all four communications interfaces concurrently.
REFERENCE DESIGN

IDT has worked in conjunction with several semiconductor partners to develop two reference platforms, one based on the RC32355 device and one that utilizes the RC32351. The first platform, the 79RP355 enables customers to evaluate the capability of the RC32355 to support the requirements of gateways based on a broad range of technologies. Specifically, the board is optimized to operate the RC32355 in an ADSL-based environment. The board includes six connectors to allow connection to standard Ethernet networks, HomePNA wiring, ATM and ADSL lines. Additionally, the board provides both USB device and USB host connections, to allow a multitude of USB peripherals (including Bluetooth controllers, printers and scanners) to be interfaced. The board also includes three expansion connectors, enabling customers to evaluate alternative WAN and LAN connectivity, such as peripheral component interconnect (PCI)-based peripherals, home wireless technologies and non-DSL-based WAN interfaces, including cable and fiber.

IDT provides both the electronic schematics and Gerber files so customers can reuse any element of this reference design for their own system development. Figure 2 shows a conceptual block diagram of a home gateway reference design.

In addition to having a hardware solution optimized for the CPE market, it becomes increasingly important to address the software aspect of the system development. Realizing the need for both software and hardware solutions, IDT has initiated several partnerships to deliver a complete hardware/software solution for the CPE market. One example is the OpenRG package from Jungo™ Software Technologies, Inc. This is a comprehensive software package of device drivers, protocol stacks and management code optimized for this marketplace. This software package has been ported to all IDT integrated communications processors, permitting customers to develop a broad range of gateway systems based on a common software solution. This significantly compresses development cycles.

FEATURES AND BENEFITS OF THE RC32351/ RC32355

<table>
<thead>
<tr>
<th>Feature</th>
<th>Capability</th>
<th>Benefit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum</td>
<td>150 Mbps</td>
<td>Affords maximum design flexibility</td>
</tr>
<tr>
<td>CPU Frequency</td>
<td>133 for RC32351</td>
<td>for today’s systems, as well as emerging technologies</td>
</tr>
<tr>
<td>DMA Controller</td>
<td>16 channels, Vc cache</td>
<td>Offloads the CPU core of data movement tasks, enabling the CPU core to be used to implement added-value software, including security algorithms, system management/statistics and voice algorithms</td>
</tr>
<tr>
<td>Memory Bandwidth</td>
<td>300 Mbps at 75 MHz</td>
<td>High system performance to support high data-transfer rates across communications interfaces</td>
</tr>
<tr>
<td>CPU Performance</td>
<td>200 MIPS at 150 MHz</td>
<td>Allows for expansion of system capabilities, such as higher-speed WAN interfaces, and the inclusion of security and quality-of-service features</td>
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</tbody>
</table>
### FEATURES AND BENEFITS OF THE RC32351/RC32355, CONTINUED

<table>
<thead>
<tr>
<th>Feature</th>
<th>Capability</th>
<th>Benefit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ethernet Interface</td>
<td>10/100 Mbps, standard MII interface</td>
<td>Simplifies connectivity to wired and wireless home LANs</td>
</tr>
<tr>
<td>ATM Interface</td>
<td>&lt;25 Mbps throughout for AAL5 data across a bus configurable to Utopia 1 or Utopia 2 modes</td>
<td>Supports the WAN interface performance requirements of non-DSL solutions, including wireless and fiber. Compatible with IDT switch fabric, to provide simple connectivity as low-cost system management CPU for DSLAM systems</td>
</tr>
<tr>
<td>TDM Interface (RC32355 only)</td>
<td>Supports data rates up to 2 Mbps, across wide range of bus standards including Lucent CHI and Mitel ST protocols</td>
<td>Maximizes compatibility with a wide range of bus standards already in use</td>
</tr>
<tr>
<td>USB</td>
<td>12 Mbps fully compatible with v.1.1 of USB specification</td>
<td>Allows connection to single-PC gateway units</td>
</tr>
<tr>
<td>Package</td>
<td>208-pin quad flat pack</td>
<td>Minimizes system board cost</td>
</tr>
<tr>
<td>Power Consumption</td>
<td>1.5 watts (typical) at 150 MHz</td>
<td>Enables development of fan-less and heatsink-less systems to improve system reliability</td>
</tr>
</tbody>
</table>

### IDT RELATED DOCUMENTATION
- **Gateway reference design product brief**
  [http://www.idt.com](http://www.idt.com)
- **RC32355 integrated communications processor product brief**
  [http://www.idt.com](http://www.idt.com)

### COMPLEMENTARY IDT DEVICES
- **Coder-Decoder (CODEC)**
  Quad CODEC
  [http://www.idt.com](http://www.idt.com)

### THIRD-PARTY SUPPORT PARTNERS
- **Alcatel chipset interfaces to ADSL line**
- **Agere provides the Homewire™ chipset, based on the HomePNA standard**
  [http://www.agere.com](http://www.agere.com)
- **Wind River Systems delivers hardware/software solutions**
  [http://www.windriver.com](http://www.windriver.com)
- **HomePNA consortium**
  [http://www.homepna.com](http://www.homepna.com)
- **Jungo: Linux-based gateway software**
  [http://www.jungo.com/open](http://www.jungo.com/open)

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