

Product Bulletin

# AC7 Integrated Voice and Data (IVD) ADSL Chipset

The new AC7 integrated voice and data (IVD) reference design from Texas Instruments gives designers a flexible, advanced and complete solution for implementing the combination of narrowband voice service of POTS and broadband DSL service in a tightly integrated fashion. It also adds the option for packetization of baseband voice (VoP) and aggregation with data across the packet network.

The aggregation of VoP and ADSL traffic and IP multicast traffic is handled through a high performance aggregation processor providing a leading-edge triple play

platform that designers can effectively use to meet the rapidly growing need for converged voice, video and data applications.

Building upon the AC7 platform, TI's seventh generation central office (CO) chipset, the AC7-IVD incorporates TI's ADSL with POTS functionality on one line card. Both VoP and packet aggregation capabilities are provided as additional modules. TI's TNETV class of voice processing DSPs running Tology Software™ handles all voice packet processing. Wintegra's WinPath™ Access Packet Processor handles all multi-protocol data management.

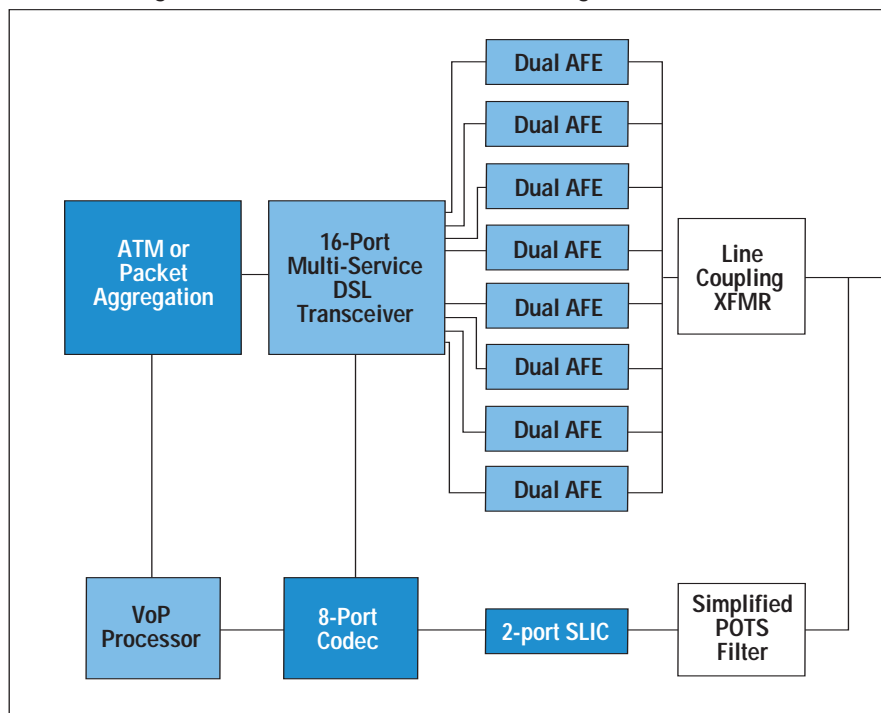
**Key Features**

- Flexible and integrated ADSL with POTS+VoP reference design
- 24-port design scalable solution
- Highly integrated, performance optimized and simplified POTS filter
- Integrated analog front end
- Ultra-low board space per port
- Leading performance-based interoperability based on AC7
- Fully system tested and verified through TI interOps Labs™
- Wintegra WinPath™ Access Packet processor
- Legerity programmable POTS SLIC and SLAC

Legerity's Subscriber Line Interface Circuit™ (SLIC) and Subscriber Line Audio-processing Circuit (SLAC) chip set is used to implement the POTS interface function.

By deploying Integrated Voice and Data line cards, operators can quickly and easily upgrade their large installed base of POTS customers for DSL service. AC7-IVD-based line cards can also be pre-deployed, making DSL

AC7-IVD Integrated Voice and Data Reference Design



available on every POTS line, thereby reducing future deployment cost and complexity through remote configuration of DSL when a subscriber orders DSL service.

### **Unparalleled Flexibility and Standards Support**

AC7-IVD is designed with high levels of flexibility and modularity to accommodate varying system requirements. For ATM networks, designers can choose to use only the ADSL with POTS line card design combined with their own ATM aggregation design. Manufacturers targeting Ethernet networks where packet aggregation occurs at the access point may choose to build designs based on ADSL with POTS + VoP + aggregation processing.

The AC7-IVD is a 24-port design with high levels of scalability and an easy migration path to 32 ports and higher. Additionally, the solution's POTS functionality is fully software programmable so that designers can be assured AC7-IVD-based systems can be deployed worldwide without hardware design changes required. The solution currently supports all ADSL standards, including ADSL1, ADSL2 and ADSL2+ and interoperability performance standards such as TR-048 and TR-067.

### **Integration and Cost Savings**

AC7-IVD represents one of the industry's most highly integrated solutions enabling deployments in traditional DSLAM/IP DSLAM and space constrained locations like remote cabinets and digital loop carriers (DLCs). AC7-IVD-based designs also benefit from the solution's high level of analog integration. By confining analog circuits into a very small area, designers avoid the concerns they might confront with these elements scattered

throughout the board. The AC7-IVD reduces cumbersome and noise prone analog signal traces between chipset devices, simplifying board designs and layouts and reducing overall PCB costs.

### **Intelligent Integration**

In any DSL design with legacy POTS support, intelligent integration and tuning for high performance of the POTS filter is key to the operational characteristics of the system. The AC7-IVD provides a simplified and cost reduced POTS filter, thereby freeing up board space while ensuring optimal DSL and POTS performance.

### **Legerity POTS**

Legerity's VoiceEdge 790 SLIC/SLAC Series coupled with the VoiceEdge Control Processor (VCP) provides a low cost, high performance, fully software programmable POTS solution. The SLIC and SLAC integrated voice chipset implement an eight channel universal telephone line interface, enabling the design of a single, low cost, high performance, fully software programmable line interface card for multiple country applications worldwide. With key features such as integrated ringing and carrier class line/self-test and line-test capabilities the Legerity solution is crucial for applications where dedicated test hardware is no longer cost effective.

### **Wintegra Access Packet Processor**

The AC7-IVD includes a Wintegra WinPath™ Access Packet Processor for ATM and IP support, plus DSL data path software. This WinPath silicon and software solution complements the AC7 with a blend of programmability, scalability and ease of use that gives designers an easy migration path to new designs.

### **Unmatched Interoperability**

The AC7-IVD builds on TI's industry leadership in interoperability. The significant investments TI has made in the capital equipment needed to establish a leading interoperability lab and the extensive man-hours devoted to testing and pre-qualification of its chipsets help manufacturers achieve superior interoperability performance, enhancing network qualification success. The cumulative effect of the many years that TI has devoted to ADSL interoperability issues is an extensive database of knowledge and human expertise that is applied to new generations of ADSL infrastructure technology. As such, the AC7-IVD leverages this expertise as well as the experience gained from shipping over 50 million ports worldwide.

### **AC7-IVD Reference Design Support**

Hardware design kits (HDK) from TI provide the technical information necessary to build and test a product based on the AC7 chipset and include AC7-IVD evaluation module, AC7 application reports, AC7 data sheets, hardware design manuals as well as schematic, Gerber layout and PCB files.

### **For More Information**

For more information on the AC7-IVD, please contact your local TI field sales office or visit: <http://www.ti.com/ac7ivd>

## Devices in the Reference Design

### TNETD7160 ADSL Transceiver

The TNETD7160 embeds an ARM7 processor for all real-time modem operation and maintenance (OAM) control, extensively uses TI programmable DSP capability for transceiver training and steady-state functions, and includes all necessary program, data, interleaver memory, and interprocessor communications paths to reduce bill-of-materials costs. Each modem port can be configured dynamically to support ADSL, ADSL2, ADSL2+ (up to 24 Mbps), extended reach and enhanced upstream (up to 3.5 Mbps) with the same software load.

**Single chip integrates all digital functions for 16 Asymmetric Digital Subscriber Line (ADSL) ATU-C modems including digital section of the codec function.**

**Supports:**

- 16 ADSL modems
- ANSI T1.413, Issue 2
- ITU-T G.992.1 G.dmt (s=1/2 framing)
- ITU-T G.992.3 G.dmt.bis (ADSL2-Annex A)
- ITU-T G.992.3 (Annex I, J, M) Enhanced Upstream
- ITU-T G.992.3 (Annex L) Extended Reach
- ITU-T G.992.5 (ADSL2+ -Annex A)

- ITU-T G.992.5 (Annex M) Enhanced Upstream
- ITU-T G.994.1 G.hs
- ITU-T G.997.1 G.ploam
- ADSL2 Packet transfer mode (PTM)
- ADSL2+ s=1/4 framing

**Data interfaces include:**

- UTOPIA 2
- Packet over Sonet (POS-PHY)
- Optional in-band management eliminates need for local microcontroller
- Glueless interface to TNETD7122 dual channel AFE line interface

**On chip:**

- ARM processor and memory
- Interleaving memory compliant to all ANSI and ITU standards
- Two bit error rate tester (BERT) modules
- OAM register interface compatible with AC5 and AC6 for easy software migration
- Operating free-air temperature range -40°C to 85°C
- Packaged in a 480-terminal ball grid array with 1-mm Pitch for easy mounting

### TNETD7122 Dual Channel Analog Front End (AFE)

The TNETD7122, used in plain old telephone service (POTS) implementations, is a dual low-power differential ADSL central-office (CO) front end containing line driver/receiver, codec, analog filters and hybrid used in conjunction with the TNETD7160. These devices feature active-termination drivers that eliminate the matching resistors required with traditional ADSL line drivers. The transmitter and receiver have full-bandwidth access, allowing for SELT/DELT capability and line characterization. The selectable integrated hybrid optimizes performance over different loop impedances.

- Integrates codec functionality to reduce chip count
- Low-power dual-channel zero-overhead Class-G design
- ±5-V power rails
- Active termination differential driver/receiver
- Bypassable filters allow full bandwidth access for SELT/DELT
- Programmable integrated hybrid for enhanced upstream performance
- Multiple power-saving modes to support L0-L3 ITU specifications
- 64-terminal PowerPAD™ Plastic Quad Flat pack (PAP)

### WinPath™ Access Packet Processor

**Protocol Supporting**

**IP routing:**

- Support for IPv4 and IPv6 RFC 2460

**IP classification:**

- Supports multifeild classification and differentiated services according to RFC 2474 and 2475

**IP Address resolution PPP and ML-PPP:**

- Supports PPP (RFC 1661), HDLC and ML-PPP (RFC 1990)

**IP interworking:**

- Per flow WFQ and shaping
- Routing and forwarding over ATM (RFC 1483/2684/1577)
- IP routing and forwarding over PPP (RFC 1661)
- Supports IPv4 IP routing and forwarding over Ethernet (RFC894)
- IP/AAL2 interworking

**L2 Ethernet switching:**

- Using MAC address or 802.1P/Q VLAN tags. Bridging of ATM Ports to Ethernet ports

**MPLS:**

- Tagging and detagging

**Statistics:**

- Extensive collection at the channel and flow

## Serial Interfaces

### Two UTOPIA-2 or POS interfaces:

- Supporting up to 50-MHz operations

### Two 10/100 MAC interfaces:

- Supporting MII or RMII

### Gigabit Ethernet:

- Supported through WinPath POS I/F to External MAC on 777 and 737
- GE MACs included in 78X devices

### Eight serial interfaces:

- Supports T1, E1, J1, xDSL, E3, DS-3 or other serial interfaces up to 50 MHz
- Built-in support for ATM Transmission Convergence
- Through on-chip TDM machine, supports fractional ATM, HDLC and transparent/CES modes

### General system functions:

- 32-bit Timer
- 16550 Compatible UART
- General Purpose Interrupt Controller
- I<sup>2</sup>C Connection to boot EEPROM Master mode supported
- JTAG-based Debug port

## TNETV Class VoP Processor

### The TNETV class processor is based on a fixed point

### TMS320C55x™ DSP featuring:

- 128 ms echo canceller
- Jitter buffer
- Comprehensive tone package
- Voice activity detection
- Caller ID generation

- Signaling (CAS/CCS)
- In-band signaling (AAL2 Type 3, RFC 2833)
- RTCP
- Network encapsulation
- Fax relay
- Any codec on any channel
- Variable packet sizes (5 ms to 80 ms, depending upon codec)

- 10 ms - RTP
- 5/5.5 ms - AAL2
- Full-featured diagnostics

### Codec Support:

- G.711
- G.726
- G.723.1
- G.729AB

## Legerity Le79232/252 SLIC

### Monitor of two-wire interface voltages and currents supports:

- Voice transmission
- Internal ringing generation
- Programmable DC feed characteristics
- Independent of battery
- Current limited
- Selectable off-hook and ground-key thresholds

- Subscriber line diagnostics
- Leakage resistance
- Loop resistance
- Line capacitance
- Bell capacitance
- Foreign voltage sensing
- Power cross and fault detection
- Supports external and internal ringing
- 3.3 V and battery supplies

- Dual battery operation for system power saving
- Automatic battery switching
- Intelligent thermal management compatible with inexpensive protection networks

## Legerity Le792288 SLAC

### High-performance DSP provides programmable control of all major line card functions:

- A-law/ $\mu$ -law and linear codec
- Transmit and receive gain
- Two-wire AC impedance
- Transhybrid balance
- Equalization
- DC loop feeding

- Smooth or abrupt polarity reversal
- Loop supervision
- Off-hook debounce circuit
- Ground-key and ring-trip filters
- Internal ringing generation and integrated ring-trip detection
- Adaptive hybrid balance
- Line and circuit testing
- Meets GR-909 and GR-844 test requirements

- Tone generation (DTMF, FSK, random noise, and arbitrary tone)
- Metering generation at 12 kHz and 16 kHz
- Envelope shaping and level control
- Modem tone detection

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