Texas Instruments (TI) offers a broad family of scalable VoIP solutions based on TMS320C54x™ and TMS320C55x™ DSP core technology and Telogy Software® for both residential/SOHO and enterprise gateway applications.

TI’s full range of VoIP solutions offers optimized solution density and faster time to market for manufacturers. With the largest installed base and field-hardened solutions, TI’s VoIP solutions reduce risk and offer a field-proven technology.

VoIP gateway solutions are available in two platform architectures to meet the needs of all gateway devices. TI offers several highly integrated solutions where voice processing and host processing are integrated into a single device (access communications processor):

- TNETV1010
- TNETV1060
- TNETV2021

These solutions not only increase system integration and performance but also reduce power consumption and application space.

When packet processing (host) is not needed on the same device as voice processing (DSP), TI offers stand-alone DSP-only solutions:

- TNETV2402
- TNETV2409
- TNETV2510
- TNETV2840

These DSP-only solutions give manufacturers the flexibility needed to design the right product for their market.
**Gateway Applications**

The customer premises gateway market can be divided into four major subdivisions, each with its own requirements and features.

**Terminal Adapters:**
- Low-end solution
- Typically for residential VoIP service
- Single packet network interface (Ethernet)
- Connects to an external cable or DSL modem

**Residential Gateways:**
- Two or more packet network interfaces
- Provides routing of data packets between LAN and WAN
- Connects to an external cable or DSL modem

**Integrated Access Devices:**
- Two or more packet network interfaces
- Provides routing of data packets between LAN and WAN
- Integrates cable or DSL modem functionality

**Enterprise Gateways (IP PBX, Switch/Router, Media Access Gateway):**
- Typically provides 8-60 channels per card
- Includes traditional gateway components geared toward VoIP

**TNETV1060 VoIP Gateway Solution**

TI’s TNETV1060 VoIP Gateway Solution integrates Telogy Software products with TI’s DSP-based access communications processor to provide a cost-effective, highly integrated platform for customer premises equipment gateways.

**TNETV1010 VoIP Gateway Solution**

TI’s TNETV1010 Residential and SOHO VoIP Gateway Solution integrates Telogy Software products with TI’s DSP-based access communications processor to provide a cost-effective, low-density platform for residential terminal adapter applications and new generation Internet appliances.

TI’s integrated access communications processor includes a C54x™ DSP core and ARM7 RISC processor, memory and common system functions (including Ethernet switch), system interfaces and two Ethernet MACs. The TNETV1010 can support up to two channels of low bit rate (LBR) vocoders or Fax Relay T.38 along with a 16 ms echo canceller tail. Supported codecs include G.711, G.726, G.723.1A and G.729AB.
TI’s integrated access communications processor includes a C55x™ DSP core and a MIPS RISC processor, memory and common system functions, system interfaces and two Ethernet MACs/PHYs. The TNETV1060 can support up to four channels of LBR vocoders or Fax Relay T.38 along with a 32 ms echo canceller tail. Supported codecs include G.711, G.726, G.723.1A and G.729AB.

**TNETV2021 VoIP Gateway Solution**

TI’s TNETV2021 Enterprise VoIP Gateway Solution integrates Telygon Software products with TI’s DSP-based access communications processor to provide a scalable and cost competitive single-chip solution for integrated access devices (IAD) and gateways for SOHO and enterprise applications. TI’s Enterprise VoIP Solution supports up to T1/E1-based gateways.

The TNETV2021 access communications processor includes an integration of two C54x DSP cores and a MIPS RISC processor, memory and common system functions and system interfaces. Key features also include two 10/100 Ethernet MACs, PCI and USB. The TNETV2021 can support up to 10 channels of LBR vocoders along with a 64 ms echo canceller tail. Supported codecs include G.729AB, G.723 and G.711.

Channel densities of up to T1/E1 can be achieved by combining the TNETV2021 with the TNETV2840. The RISC processor in the TNETV2021 provides the host (packet) processing for channels on both devices.

**TNETV2840 VoIP Gateway Solution**

TI’s TNETV2840 VoIP Gateway Solution integrates Telygon Software products with four TI DSP cores to provide an ideal solution for enterprise and high density VoIP/FoIP gateway applications. By integrating four C54x DSP cores, the TNETV2840 provides up to 48 PCM channels and supports up to 128 ms echo cancellation. In addition, this gateway solution can be used to support modem and fax termination in combination with an external RISC processor for the controller functions. Supported codecs include G.711, G.729AB and G.723.
**TNETV2510 VoIP Gateway Solution**

TI’s TNETV2510 VoIP Gateway Solution integrates Telogy Software products with a DSP-only architecture to provide a flexible solution for residential and enterprise gateway applications. With complex features suite support and increased channel density, the TNETV2510 is ideal for voice add-on modules. This C5510 DSP-based solution supports up to eight channels of LBR vocoders along with a 128 ms echo canceller tail. Supported codecs include G.711, G.726, G.729AB, G.723.1A and GSM.

**TNETV2402 and TNETV2409 VoIP Gateway Solutions**

TI’s TNETV2402 and TNETV2409 VoIP Gateway Solutions integrate Telogy Software products with a DSP-only architecture to provide a voice add-on solution for cost-sensitive residential applications. The C5402 DSP-based solution supports up to two channels of LBR vocoders along with an 8 ms echo canceller tail. The C5409 DSP-based solution supports up to four channels of LBR vocoders along with a 16 ms echo canceller tail. Supported codecs include G.711, G.726, G.729AB and G.723.1A.

**Telogy Software**

Telogy Software provides the broadest range of VoIP features available. Key Telogy Software capabilities include:
- Voice over IP
- Fax Relay
- Signaling
- Network Management

With the largest installed base of field-hardened gateway specific solutions since 1995, Telogy Software provides world-class VoIP software solutions that industry giants rely on.

**Voice**

Voice over IP (VoIP) software processes voice samples for transmission over a data network. There are many functions included in good quality VoIP software. Its sub-components perform echo cancellation, voice compression (to conserve bandwidth), voice-activity detection, jitter removal and voice packetization. VoIP consists of the following functions:
Fax Relay
Fax relay provides reliable real-time fax service between two analog fax machines over a packet network. The equipment at both ends of the packet network spoofs the analog fax machines such that they operate as if directly connected over a PSTN connection.

The equipment performing fax relay functions must handle the effects of network delay, jitter (variable delay) and lost packets while preventing the fax machines from timing out.

Standard protocols such as T.38 support fax relay over packet networks. Proprietary techniques are often used to improve the interoperability between different fax machines that are subjected to long delay and other packet-network effects.

Fax relay, as part of this gateway solution, is T.38 compliant. In addition, forward error correction and advanced error concealment techniques are employed to improve document quality.

Fax relay consists of the following functions:
- Fax Modem Pumps: V.17, V.29, V.27ter, V.21
- Fax Relay Protocol: T.38 (TCP/IP)
- Fax Machine Spoofing Protocols: Proprietary
- T.30 protocol support

Signaling
Gateway platforms must support signaling for call establishment, in-band signaling and call termination. Both Channel Associated Signaling (CAS) and Common Channel Signaling (CCS) are employed by networks and must be supported.

The following signaling functions are supported and run on a combination of the DSP and an external RISC processor:
**Network Management**

Fundamental to any communications system is the ability to discover, isolate and remedy problems as quickly as possible to minimize or eliminate the degree to which users are impacted.

Telogy Software provides APIs that enable a gateway system provider to develop network management applications. Telogy Software APIs can be mapped to standard MIBs and include the following functions:

- Configuration on per channel basis including setable country code specific information
- Per channel statistics and status reporting
- Per channel real-time trace and diagnostics capabilities

**Telogy Software Architecture**

Figure 1 describes the software architecture for gateway solutions. Each box represents a software component required to implement the features for voice, fax, modem, signaling, and network management functions.

Multiple instances of each software component can exist to facilitate support of concurrent, multi-channel operation. Each instance shares common program memory and has unique channel-specific data memory to maintain information regarding the state of the channel, including network management and diagnostic information. The software runs on TI’s BIOS Real-Time Kernel.

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**Features: Telogy Software for CPE Gateway Solutions**

<table>
<thead>
<tr>
<th>Voice and Fax Features</th>
<th>Voice Activity Detection (VAD) silence suppression</th>
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<tbody>
<tr>
<td>G.711 PCM 64 Kbps</td>
<td>Comfort Noise Generation (CNG)</td>
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<tr>
<td>G.723.1 5.3/6.3 Kbps</td>
<td>Comfort noise level control</td>
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<tr>
<td>and Annex A (silence compression)</td>
<td>RTP packet encapsulation for voice</td>
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<td>G.726 ADPCM 16, 24, 32, 40 Kbps</td>
<td>DTMF Relay</td>
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<td>G.727 ADPCM</td>
<td>DTMF detection during voice mode</td>
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<td>G.728 16 Kbps</td>
<td>Configurable call progress detection parameters</td>
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<td>G.729 8 Kbps</td>
<td>Configurable voice packetization rates</td>
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<tr>
<td>G.729 AB 8 Kbps (Annex A and B – VAD, CNG)</td>
<td>V.17 at 7200, 9600, 12,000 and 14,000 bps</td>
</tr>
<tr>
<td>G.729 Annex E 11.8 Kbps</td>
<td>V.27ter at 2400 and 4800 bps</td>
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<tr>
<td>GSM Enhanced Full Rate</td>
<td>V.29 at 7200 and 9600 bps</td>
</tr>
<tr>
<td>G.165/6.168 echo cancellation</td>
<td>Fax Pass-Through (PCM)</td>
</tr>
</tbody>
</table>

- T.38 real time Fax Relay
- In-band signaling
- DTMF generation/detection
- MF R1, R2 tone generation/detection
- CP tone detection for T1 CAS
- SS7 ring-back tone generation
- SS7 COT
- API support (management, event monitoring/reporting, statistics)
- Telchemy VQmon support
- Loopback test capabilities
- Core dump facility
- Memory read/write support
- Trace messages

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For more information, please contact your TI sales representative or call 972-644-5580.

[www.ti.com/voip](http://www.ti.com/voip)