Telephony Tone Generation Megafunction

Target Applications:
Data Communications
Telecommunications

Family:
FLEX® 10K

Vendor:

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Features

- Generates single- and dual-frequency tones used in telephony applications
- Outputs ST-Bus, IOM-2, IDL, and other standard-compatible serial data streams, containing from 1 to 32 tones
- Supports both Mu-Law and A-Law encoding algorithms
- Provides fully configurable gain control for individual tones and each frequency component that makes up a tone
- Parameterization via the Altera® MegaWizard™ Plug-In features tone creation, tone editing, and tone testing using a sound-capable computer

General Description

The NComm Tone Generation (ToneGen) megafunction is a Mitel ST-Bus-compatible device providing 1 to 32 user-programmable tones used in telephony applications. The ToneGen megafunction can generate any combination of single- and/or dual-frequency tone sequences, such as dialtone, ringback, busy, DTMF, SS7 path validation, MF, and other custom tone sequences. The megafunction supports gain control, Mu-law or A-law encoding, and other parameters on a tone-by-tone basis, providing complete control over the generated tones.

The MegaWizard Plug-In allows designers to configure new tones, edit existing tones, listen to a generated tone on a sound-capable computer, and minimize the ROM storage required to contain the tones. The MegaWizard Plug-In provides a simple yet powerful way to add tone generation to telephony or other applications for any design, including VHDL, Verilog HDL, or the Altera Hardware Description Language (AHDL).

Functional Description

The ToneGen megafunction uses a 4.096-MHz clock and a 125-µs frame pulse as standard ST-Bus inputs. The megafunction generates an ST-Bus-compatible serial output stream and output frame pulse, identifying the first of the 32 tone channels within the ST-Bus stream. The tones synthesized by the ToneGen megafunction are placed into the first time slots of an ST-Bus stream, as shown in Figure 1.

Figure 1. ST-Bus Stream Waveform
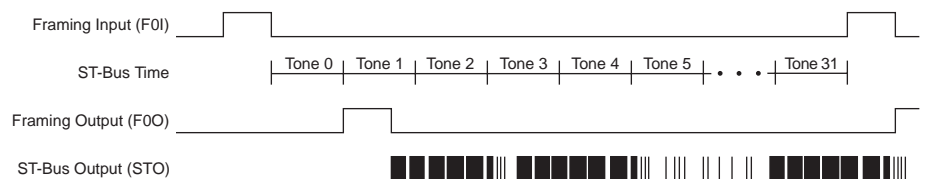
ToneGen MegaWizard Plug-In

When the ToneGen megafunction is parameterized with the MegaWizard Plug-In, designers can create virtually any set of tones required by the target application. In addition, the MegaWizard Plug-In allows designers to optimize the number of embedded array blocks (EABs) required to synthesize the set of tones by calculating the least number of pulse-code modulation (PCM) samples required to generate the desired tone sequences.

Applications

The ToneGen megafunction can generate tones for a small office PBX system, MF tones for T-1 trunk signaling, SS7 path verification tones (2,000 Hz), and DTMF tones. A PBX application typically requires the following tones:

■ Dialtone
■ Ringback
■ Busy
■ Digital Milliwatt

Figure 2 shows how to use the ToneGen MegaWizard Plug-In to create the dialtone, ringback, and busy tones.

Figure 2. ToneGen MegaWizard Plug-In
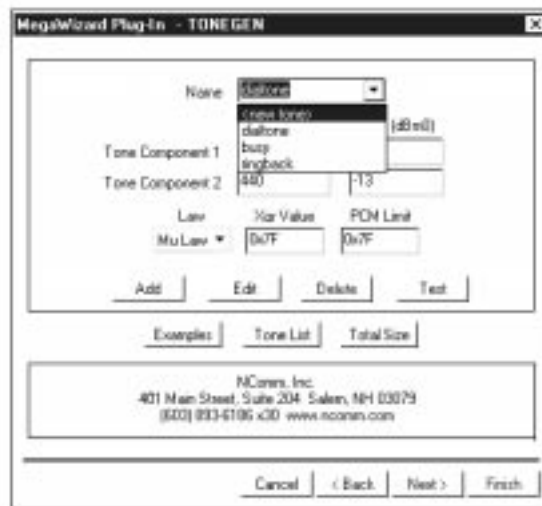
The MAX+PLUS® II development system will compile the megafunction as specified by the MegaWizard Plug-In. For example, the ToneGen megafunction in Figure 2 will synthesize the tones and place them into an ST-Bus stream such that dialtone appears in time slot 0, busy appears in time slot 1, and ringback appears in time slot 2. If the program is run on a sound-equipped PC, the tones can be verified by choosing the **Test** button in the MegaWizard Plug-In Manager.

Figure 3 shows how to use the ToneGen megafunction to construct a PBX.

Figure 3. Constructing a PBX with the ToneGen Megafunction
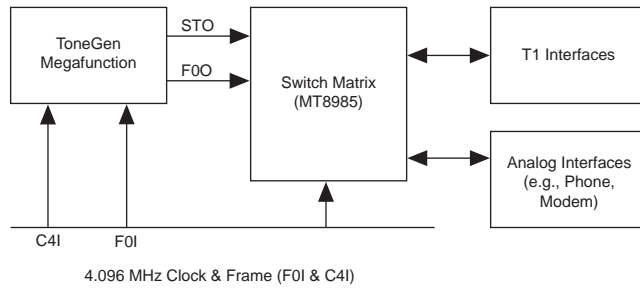
If the analog interface in Figure 3 requires dialtone, the switch matrix, such as the Mitel MT8985, can switch the time slot containing the dialtone to the analog interface. Likewise, the ToneGen megafunction can be configured to generate MF tones for MF signaling over a T1 interface.

Hardware Verification

The ToneGen megafunction has been fully tested using an AT&T CODEC, a Mitel SLIC, and a telephone. Contact NComm for further information.

Utilization

Table 1 lists the typical device utilization results for the megafunction.

Table 1. Typical Device Utilization for the ToneGen Megafunction

Device	Speed Grade	Utilization		Performance (MHz)	Parameter Setting
		Logic Elements	EABs		
EPF10K20	-3	445	4	30.86	Dialtone
		136	6	26.24	Dialtone, busy tone, and ringback
EPF10K50	-4	50	4	30.48	MF tones 0-9, ST, and KP
EPF10K100	-4	445	6	23.14	MF tones 0-9, ST, and KP
		136	6	26.24	Dialtone, busy tone, and ringback

Altera Corporation