IDT LINE CARD SOLUTIONS:

**Line Card PLL Features**
- Dual PLL chip: one can be used for the transmit path and the other for the receive path
- Programmable DPLL bandwidth
- Supports automatic hitless reference switching
- Generates output clocks for Synchronous Ethernet, SONET, SDH, BITS, GPS, 3G and GSM components
- Available in QFN, lead-free packages

**Jitter Attenuator Features**
- FemtoClock® product is a frequency multiplier and jitter attenuator component that generates low jitter Ethernet clocks and can easily meet 10 Gigabit Ethernet requirements
- Optimized for 10G Ethernet jitter attenuation
- Attenuates the phase jitter of the input clock by using a low-cost pullable fundamental mode VCXO crystal
- Available in QFN lead-free packages

IDT TIMING CARD SOLUTIONS

**IDT SETS PLL Features**
- Up to 14 total inputs and 14 outputs
- IEEE 1588 Support (External DCO Control)
- 2 independent DPLL + APLL paths
  - T0 path for node timing synchronization
  - T4 path for equipment synchronization
- Frequency Range: 1 Hz to 650 MHz
- Phase noise <1 ps RMS (12 kHz to 20 MHz)

Architecture Overview

Communication equipment requires synchronization to transport multiple services (voice, data and video) over Carrier networks. The timing fabric, as illustrated in Figure 1 and Figure 2, enables equipment such as routers, multi-service switching platforms, PON (Passive Optical Network) and DSLAM (Digital Subscriber Line Access Multiplexer), to meet the stringent synchronization requirements of communication networks.

The architecture in Figure 1 segments the timing fabric into 2 major elements: timing cards and line cards. On the timing cards, the SETS PLLs are primarily responsible for compliance with synchronization standards. The T1/E1 LIUs receive external BITS/SSU references for the T0 DPLLs which generate standards compliant synchronous clocks and distribute them to the backplane for the line cards. Recovered clocks from the line card PHYs are used as references by the T4 DPLLs which rate convert them for the T1/E1 LIU transmitters that provide line references to the external BITS/SSU. On the line cards DPLLs select a backplane reference from one of the timing cards, the reference is rate converted and jitter attenuated to meet the needs of the specific PHYs used on these cards. Depending on the number of PHY reference clocks required on each line card a discrete fan-out buffer may also be needed. Recovered clocks from line card PHYs are rate converted to a backplane frequency (8 kHz, 19.44 MHz, or 25 MHz) and sent to the backplane for the T4 DPLLs on the timing cards.

The architecture in Figure 2 has the timing fabric in one up-link transmission card. Both the traditional timing card and line card functionality are combined into one card. The recovered clock from the PHY is sent to the SETS PLL for filtering, frequency translation and generation of backplane clocks. The clock generated by the SETS PLL used as a transmitting clock for the PHY + Framer.

As the only supplier with all of the different timing components to provide complete solutions, IDT is uniquely positioned to meet the needs of communication equipment suppliers and offer compelling solutions for all timing fabric architectures.

- Standards compliant SMU PLLs (independent SETS PLL plus T-BC, T-TSC [ITU-T G.8273.2] PLL)
- T1/E1 Dual LIUs
- Line card PLLs
- Jitter attenuators and frequency translators
- Differential fanout buffers with low additive RMS phase jitter
- Backplane interface / translators (as needed)

* With supporting 1588 filtering algorithm software
IDT T1/E1 LIU Features
- Dual and Single channel LIU devices available
- Supports Hitless Protection Switching for 1+1 protection without external relays
- Receiver sensitivity exceeds -36 db @ 772 kHz and -43 db @ 1024 kHz
- Programmable T1/E1/J1 switchability allows one bill of material for any line condition
- Loss of signal (LOS) and Alarm Indication Signal (AIS) detection
- JTAG interface
- Available in TQFQ or FQPGA lead-free packages

Figure 2 - Timing Fabric Architecture (Up-link Transmission Card)

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Product Type</th>
<th>Outputs &amp; Types</th>
<th>Output Frequencies (MHz)</th>
<th>Inputs &amp; Type</th>
<th>Phase Jitter Type RMS (ps)</th>
<th>Pkg. Dimensions</th>
</tr>
</thead>
<tbody>
<tr>
<td>8T49N241</td>
<td>FemtoClock® NG Universal Frequency Translator</td>
<td>4 HCSL, LVCMOS, LVDS, LVPECL*</td>
<td>0.008 to 1000</td>
<td>2 HCSL, LVCMOS, LVDS, LVHSTL, LVPECL, LVTTL*</td>
<td>0.35</td>
<td>6.0 x 6.0 x 0.9</td>
</tr>
<tr>
<td>8T49N242</td>
<td>FemtoClock® NG Universal Frequency Translator</td>
<td>4 HCSL, LVCMOS, LVDS, LVPECL</td>
<td>0.008 to 1000</td>
<td>2 HCSL, LVCMOS, LVDS, LVHSTL, LVPECL, LVTTL*</td>
<td>0.35</td>
<td>6.0 x 6.0 x 0.9</td>
</tr>
<tr>
<td>8T49N285</td>
<td>FemtoClock® NG Universal Frequency Translator (2-in/1-PLL/8-out)</td>
<td>8 HCSL, LVCMOS, LVDS, LVPECL</td>
<td>0.008 to 1000</td>
<td>2 HCSL, LVCMOS, LVDS, LVHSTL, LVPECL</td>
<td>0.28</td>
<td>8.0 x 8.0 x 0.85</td>
</tr>
<tr>
<td>8T49N286</td>
<td>FemtoClock® NG Universal Frequency Translator (4-in/2-PLL/8-out)</td>
<td>8 HCSL, LVCMOS, LVDS, LVPECL</td>
<td>0.008 to 1000</td>
<td>4 HCSL, LVCMOS, LVDS, LVHSTL, LVPECL, LVTTL</td>
<td>0.28</td>
<td>10.0 x 10.0 x 1</td>
</tr>
<tr>
<td>8T49N287</td>
<td>FemtoClock® NG Universal Frequency Translator (2-in/2-PLL/8-out)</td>
<td>8 HCSL, LVCMOS, LVDS, LVPECL</td>
<td>0.008 to 1000</td>
<td>2 HCSL, LVCMOS, LVDS, LVHSTL, LVPECL, LVTTL</td>
<td>0.28</td>
<td>8.0 x 8.0 x 0.85</td>
</tr>
<tr>
<td>8V89308i</td>
<td>Jitter Attenuator &amp; FemtoClock Multiplier</td>
<td>2 LVPECL</td>
<td>25.0 to 156.25</td>
<td>1 LVDS, LVPECL</td>
<td>0.223</td>
<td>5.0 x 5.0 x 1</td>
</tr>
</tbody>
</table>

IDT T1/E1 LIU Features
- Dual and Single channel LIU devices available
- Supports Hitless Protection Switching for 1+1 protection without external relays
- Receiver sensitivity exceeds -36 db @ 772 kHz and -43 db @ 1024 kHz
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<table>
<thead>
<tr>
<th>Part Number</th>
<th>Product Type</th>
<th>Clock Support</th>
<th>Channels (#)</th>
<th>Inputs (#)</th>
<th>Diff. Inputs</th>
<th>Input Freq. Range Type</th>
<th>Output Freq. Range Type</th>
<th>Phase Jitter Type RMS (ps)</th>
<th>Outputs (#)</th>
<th>Diff. Outputs</th>
</tr>
</thead>
<tbody>
<tr>
<td>82P33714</td>
<td>Synchronous Equipment Timing Source for Synchronous Ethernet</td>
<td>G.813 (SEC), G.8262 (ECC), GR-253-CORE (SONET ST3/SMC), GR-1244-CORE (ST3/ST4/ST4E)</td>
<td>2</td>
<td>6</td>
<td>4</td>
<td>1 Hz to 650 MHz</td>
<td>1 Hz to 650 MHz</td>
<td>0.56</td>
<td>12</td>
<td>4</td>
</tr>
<tr>
<td>82P33731</td>
<td>Synchronous Equipment Timing Source for 10G to 40G Synchronous Ethernet</td>
<td>G.813 (SEC), G.8262 (ECC), GR-253-CORE (SONET ST3/SMC), GR-1244-CORE (ST3/ST4/ST4E)</td>
<td>2</td>
<td>14</td>
<td>6</td>
<td>1 Hz to 650 MHz, Composite Clock (G.703 64 kbps)</td>
<td>1 Hz to 650 MHz, Composite Clock (G.703 64 kbps)</td>
<td>0.23</td>
<td>14</td>
<td>6</td>
</tr>
</tbody>
</table>