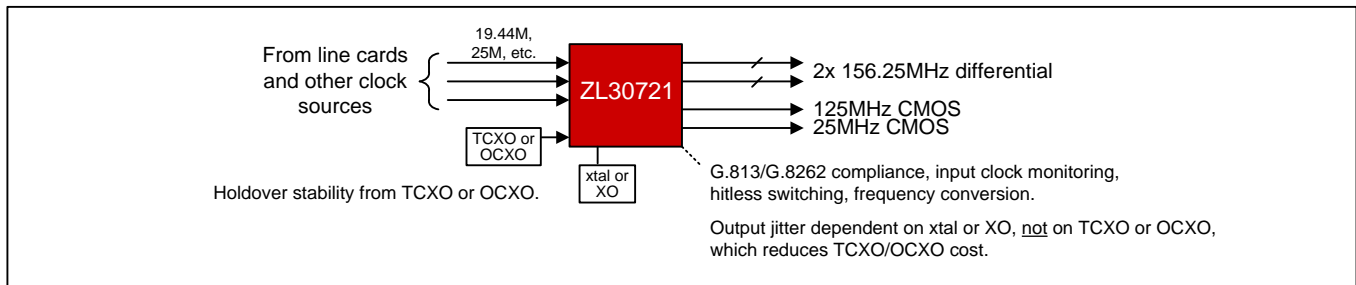
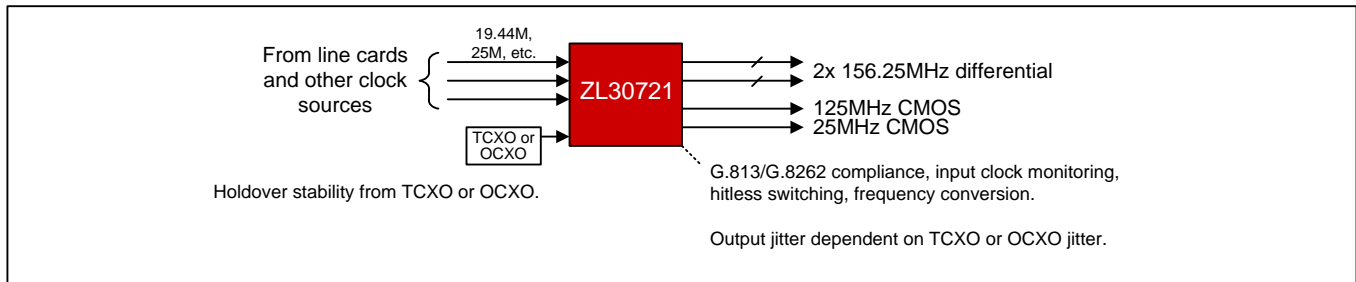


## 1. Application Examples



**Figure 2 – Telecom Timing Card Application, TCXO + Crystal/XO for Lowest Jitter**



**Figure 3 – Telecom Timing Card Application, TCXO Only**

## 2. Detailed Features

### 2.1 Time Synchronization Algorithm

- External algorithm controls software digital PLL to adjust frequency and phase alignment
- Frequency, phase and time synchronization over IP, MPLS and Ethernet packet networks
- Frequency accuracy performance for GSM, WCDMA-FDD, LTE-FDD femtocell, small cell (residential, urban, rural, enterprise), picocell and macrocell applications, with target performance less than  $\pm 15$  ppb
- Frequency performance for ITU-T G.8263 for PEC-S-F (Packet Equipment Clock - Slave - Frequency)
- Frequency performance for ITU-T G.823 and G.824 synchronization interface, as well as G.8261 PNT EEC, PNT PEC and CES interface specifications
- Phase synchronization performance for WCDMA-TDD, Mobile WiMAX, TD-SCDMA, CDMA2000, LTE-TDD and LTE-A femtocell, small cell (residential, urban, rural, enterprise), picocell and macrocell applications with target performance less than  $\pm 1\mu\text{s}$  phase alignment.
- Phase performance for ITU-T packet clock drafts or recommendations in development
  - ITU-T G.8273.2 T-BC & T-TSC, when not using SyncE input
  - ITU-T G.8273.4 T-BC-P & T-TSC-P
- Supports hybrid mode for mixing SyncE and IEEE1588 inputs
- Time Synchronization for TAI, UTC-traceability and GNSS/GPS replacement.
- Client reference switching between multiple servers
- Client holdover when server packet connectivity is lost
- Client synchronization to best server with monitoring of secondary server references

### 2.2 Master Clock Jitter Attenuator and Multiplier

- Enables the DPLL to operate from any TCXO or OCXO  $\geq 10\text{MHz}$  regardless of jitter
- When a low-cost crystal or XO is used, output jitter depends on crystal/XO, not on TCXO/OCXO jitter
- Reduces cost by removing tight jitter requirement from TCXO or OCXO

### 2.3 Input Block Features

- Up to three input clocks, two differential or single-ended, one single-ended
- Input clocks can be any frequency from 8kHz up to 1250MHz (differential) or 300MHz (single-ended)

- Supported telecom frequencies include PDH, SDH, Synchronous Ethernet, OTN, wireless
- Inputs constantly monitored by programmable activity monitors and frequency monitors
- Fast activity monitor can disqualify the selected reference after a few missing clock cycles
- Frequency measurement and monitoring with 1ppm resolution and accept/reject hysteresis
- Optional input clock invalidation on GPIO assertion to react to LOS signals from PHYs

## 2.4 Electrical Clock Engine Features

- Very high-resolution DPLL architecture
- State machine automatically transitions between tracking and freerun/holdover states
- Revertive or nonrevertive reference selection algorithm
- Programmable bandwidth from 0.1Hz to 10Hz
- Less than 0.1dB gain peaking
- Programmable phase-slope limiting
- Programmable tracking range (i.e. hold-in range)
- Truly hitless reference switching with <200ps output clock phase transient
  - Physical-clock-to-physical-clock reference switching
  - Physical-clock-to-packet-timing reference switching
  - Packet-timing-to-physical-clock reference switching
  - Packet-timing-to-packet-timing reference switching
- Support for SyncE and SONET/SDH equipment clock specifications
  - ITU-T G.8262 option 1 EEC
  - ITU-T G.8262 option 2 EEC
  - ITU-T G.813 option 1 SEC
  - IUT-T G.813 option 2 SEC
- Output phase adjustment in 10ps steps
- High-resolution frequency and phase measurement
- Fast detection of input clock failure and transition to holdover mode
- Holdover frequency averaging with programmable averaging time and delay time

## 2.5 APLL Features

- Very high-resolution fractional scaling (i.e. non-integer multiplication)
- Any-to-any frequency conversion with 0ppm error
- Two high-speed dividers (integers 4 to 15, half divides 4.5 to 7.5)
- Easy-to-configure, completely encapsulated design requires no external VCXO or loop filter components

## 2.6 Output Clock Features

- Three low-jitter output clocks
- Each output can be one differential output or two CMOS outputs
- Output clocks can be any frequency from 1Hz to 1035MHz (250MHz max for CMOS and HSTL outputs)
- Output jitter as low as 0.25ps RMS (12kHz to 20MHz)
- In CMOS mode, an additional divider allows the OCxN pin to be an integer divisor of the OCxP pin (Example 1: OC3P 125MHz, OC3N 25MHz. Example 2: OC2P 25MHz, OC2N 1Hz)
- Outputs easily interface with CML, LVDS, LVPECL, HSTL, SSTL, HCSL and CMOS components
- Supported telecom frequencies include PDH, SDH, Synchronous Ethernet, OTN
- Sophisticated output-to-output phase alignment
- Per-output phase adjustment with high resolution and unlimited range
- Per-output enable/disable
- Per-output glitchless start/stop (stop high or low)

## 2.7 General Features

- SPI or I<sup>2</sup>C serial microprocessor interface
- Automatic self-configuration at power-up from internal EEPROM memory; pin control to specify one of four stored configurations
- Numerically controlled oscillator (NCO) mode allows system software to steer DPLL frequency with resolution better than 0.01ppb

- Input-to-output alignment with external feedback
- Up to eight general-purpose I/O pins each with many possible status and control options
- Output frame sync signals: 2kHz or 8kHz (SONET/SDH), 1Hz (IEEE 1588) or other frequency
- Internal compensation for local oscillator frequency error

## 2.8 API Software

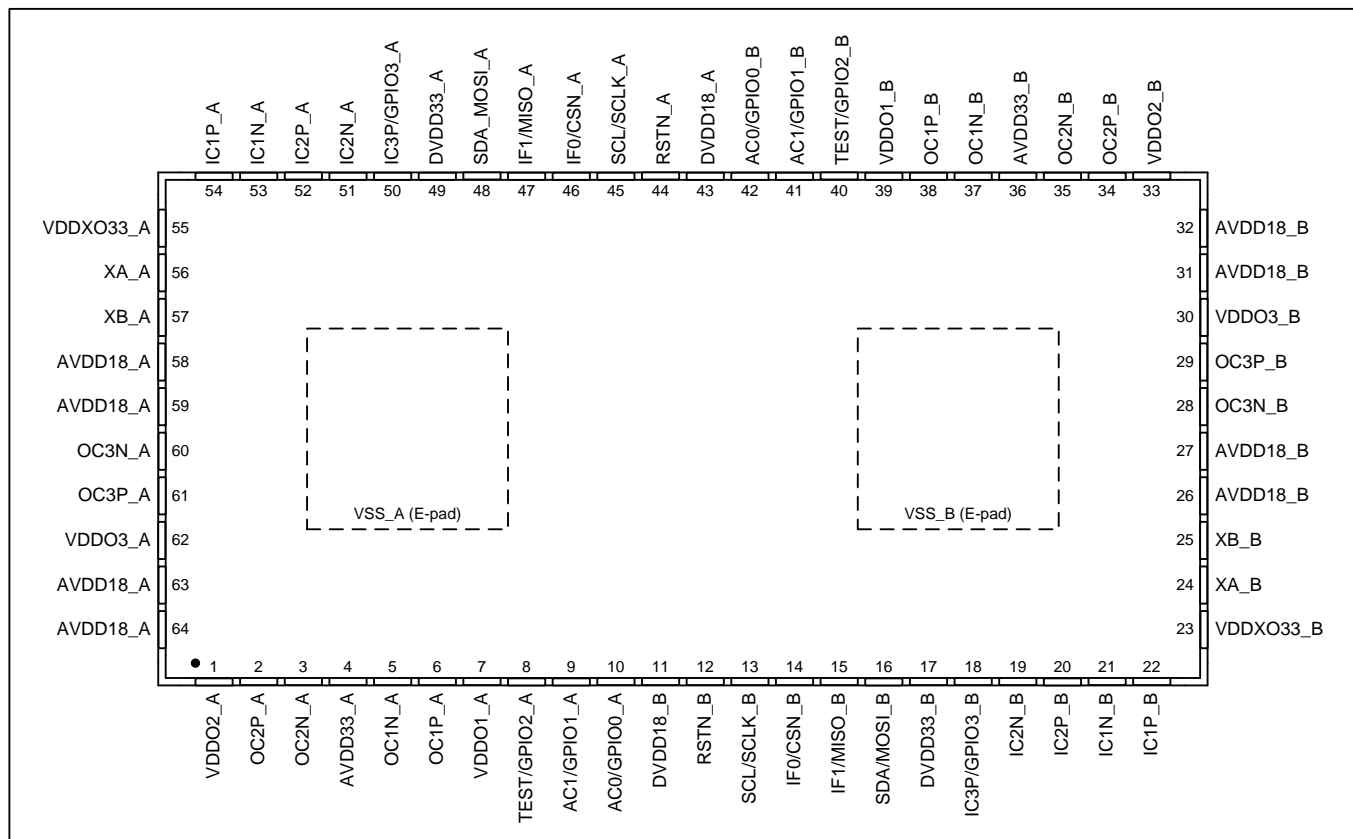
- Interfaces to 1588-capable PHYs and switches with integrated timestamping
- Abstraction layer for independence from OS and CPU, from embedded SoC to home-grown
- Fits into centralized, highly integrated “pizza box” architectures as well as distributed architectures with multiple line cards and timing cards

## 3. Applications

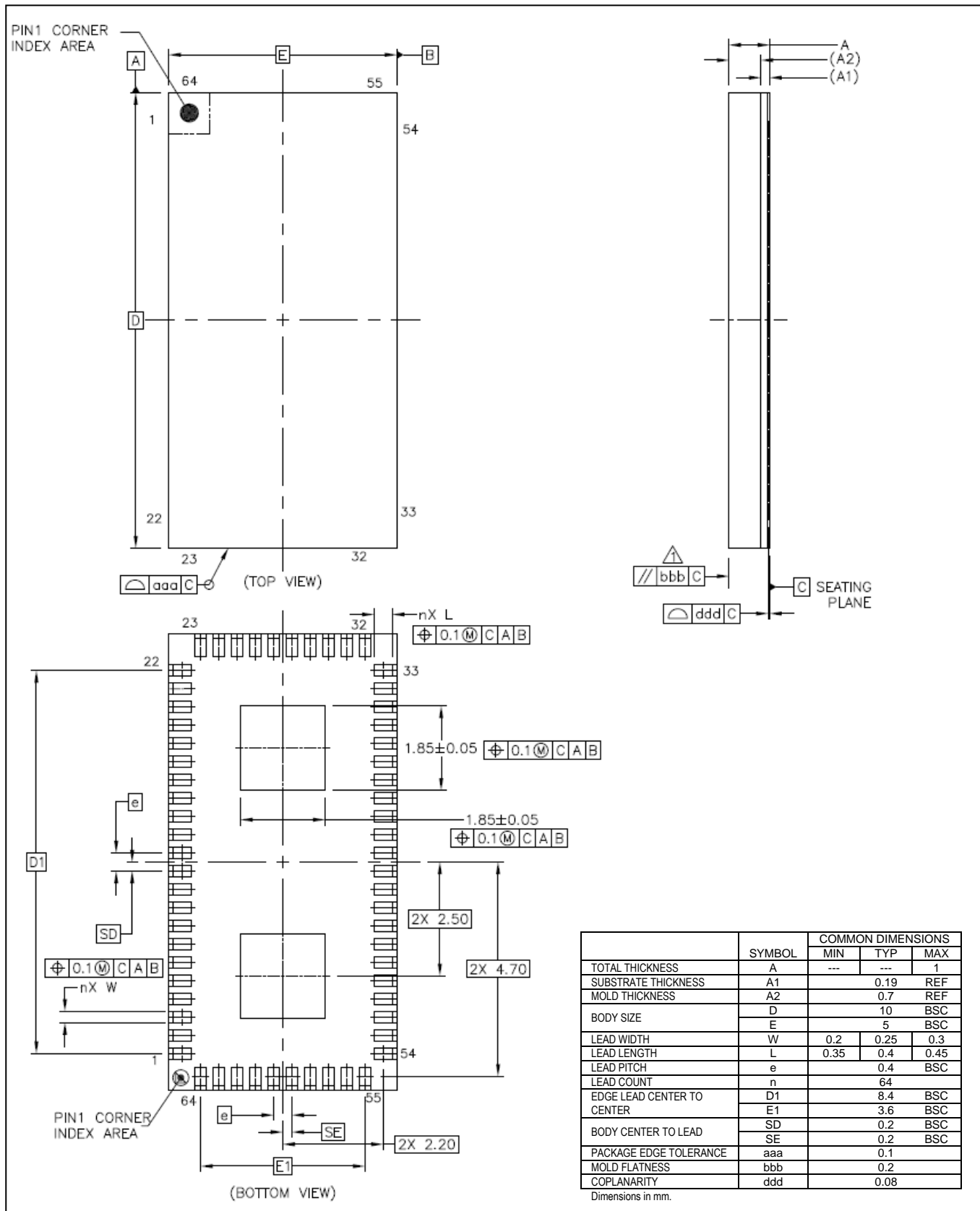
- ITU-T G.8262 system timing cards for Synchronous Ethernet systems
- System timing cards which support ITU-T G.781 SETS (SDH Equipment Timing Source)
- Integrated basestation reference synchronization for air interfaces for
  - GSM, WCDMA, TD-SCDMA, LTE and LTE-A
  - FDD or TDD mobile technology
  - Femtocells, small cells (residential, urban, rural, enterprise), picocells and macrocells
- Mobile Backhaul NID, cell-site router, edge switch/router, microwave or access aggregation node
- EPON/GPON OLT and ONU/ONT
- DSLAM and RT-DSLAM
- 10G, 40G and 100G line cards
- SONET/SDH, Fibre Channel, XAUI

## 4. Pin Diagram

The device is packaged in a 5x10mm 64-pin LGA.



## 5. Mechanical Drawing





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