

December 1997

DESCRIPTION

The SSI 32P4937A is a high performance BiCMOS read channel IC that provides all of the functions needed to implement an entire Partial Response Class 4 (PR4) read channel for zoned recording hard disk drive systems with data rates from 80 to 240 Mbit/s.

Functional blocks include a bi-directional serial port, an automatic gain control amplifier, a programmable filter, an offset canceller, a peak detecting pulse qualifier, an adaptive transversal filter, a Viterbi qualifier for maximum likelihood detection, a 8/9 GCR ENDEC, a data synchronizer, a time base generator, an integrating servo demodulator, a thermal asperity detector and suppression circuit, and a channel quality monitor.

The part requires a single +5 V power supply. The SSI 32P4937A utilizes an advanced BiCMOS process technology along with advanced circuit design techniques which results in a high performance device with low power consumption.

FEATURES

GENERAL

- Register programmable data rates from 80 to 240 Mbit/s
- Sampled data read channel with Viterbi qualification
- Programmable filter for PR4 equalization
- Five tap transversal filter with adaptive PR4 equalization
- 8/9 GCR ENDEC
- Data scrambler/descrambler
- Presettable precoder state
- Programmable write precompensation
- Register programmable power management (<10 mW power down mode)
- 4 bit nibble and byte wide bi-directional NRZ data interfaces
- 8-bit direct write mode automatically configured for $RCLK = VCO/8$
- Serial interface port to read from and write to internal program storage registers

- Single power supply ($5\text{ V} \pm 10\%$)
- Small package footprint: 100-Lead FTQFP
- Digital channel quality monitor
- IO map capability
- Area detect servo w/dibit detector
- Thermal asperity suppression
- Multi-level write precomp

AUTOMATIC GAIN CONTROL

- Dual mode AGC, continuous time during acquisition, sampled during data reads
- Separate AGC level storage pins for data and servo
- Dual rate attack and decay charge pump for rapid AGC recovery in continuous time mode
- Programmable, symmetric, charge pump currents for data reads in sampled mode
- Charge pump currents track programmable data rate during data reads
- Low drift AGC hold circuitry
- Low-Z circuitry at AGC input provides for rapid external coupling capacitor recovery
- AGC Amplifier squelch during Low-Z
- Wide bandwidth amplitude feedback circuit to allow improved stability of AGC level vs. frequency
- Programmable AGC controls
 - Separate external input pins for AGC hold, fast recovery, and Low-Z control or
 - Internal Low-Z and fast recovery timing for rapid transient recovery and AGC acquisition. Timing set with external resistors (2). Ultra fast decay current set with external resistor.

(continued)

BLOCK DIAGRAM



SSI 32P4937A

PR4ML Read Channel

with 8/9 ENDEC and Area Detect Servo

FILTER/EQUALIZER

- Programmable, 7-pole, continuous time filter with asymmetrical zeros provides:
 - Channel filter and pulse slimming equalization for coarse equalization to PR4
 - Programmable cutoff frequency from 10 to 62.5 MHz
 - Programmable boost/equalization of 0 to 13 dB
- Programmable “zeros” equalization provides time asymmetry compensation
- $\pm 3\%$ group delay variation from 0.3 Fc to Fc with Fc = 62.5 MHz
- Low-Z switch for fast offset recovery at the filter output
- No external coupling capacitors required
- DC offset compensation provided at the filter output
- Three or five tap transversal filter for fine equalization to PR4
 - Self adapting symmetric inner taps
 - Programmable symmetric outer taps with 4 bits of resolution
- Equalization hold input
- “Zeros” channel quality output
- Asymmetry factor output

PULSE QUALIFICATION

- Sampled Viterbi qualification of signal equalized to PR4
- Register programmable hysteresis or window qualification peak detector for servo reads, positive and negative thresholds are independently programmable
- Dibit detect mode with programmable transition interval period available at RDS
- Selectable RDS pulse width for servo grey code reads
- RDS and PPOL outputs are disabled during burst capture to reduce noise generation

TIME BASE GENERATOR

- Better than 1% frequency resolution
- Up to 270 MHz frequency output
- Independent M and N divide-by registers
- No active external components required

DATA SEPARATOR

- Fully integrated data separator includes data synchronizer and 8/9 GCR ENDEC
- Register programmable to 240 Mbit/s
- Fast acquisition, sampled data phase locked loop
- Decision directed clock recovery from data samples
- Adaptive clock recovery thresholds
- Programmable damping ratio for data synchronizer PLL is constant for all data rates
- Data scrambler/descrambler to reduce fixed pattern effects
- 4-bit nibble and byte wide NRZ data interfaces
- Time base tracking, programmable multi-level write precompensation
- Differential PECL write data output
- Semi-auto training and sync byte generation available for single sync byte operation
- Surface defect scan mode
- KM1 preset function allows the adaptive equalizer training time to be reduced
- Force frame function allows data to be recovered even if the framing bytes are damaged
- Force sync byte function allows data to be recovered if sync bytes are damaged
- Programmable separation of sync bytes
- Channel quality monitor circuitry allows for digital feedback of the quality of the equalized samples

SERVO

- Separate, automatically selected, registers for servo Fc, boost, and threshold
- Wide bandwidth, high precision full-wave rectifier is optimized for low-level linearity
- Integrator circuit has an auto-zero function to actively remove any DC offsets
- 3 bits of fine gain control to accommodate a wide range of pulse densities into the area detector

SSI 32P4937A

PR4ML Read Channel

with 8/9 ENDEC and Area Detect Servo

SERVO (continued)

- 4-burst servo capture with A, B, C, D outputs
- Internal hold capacitors
- Servo calibration output available

THERMAL ASPERITY DETECTION AND SUPPRESSION

- Internal TA detector monitors the DP/DN output from the continuous time filter for the occurrence of thermal asperities, both positive and negative events can be detected
- Thermal asperity threshold is independently selectable for Servo and non-Servo modes of operation
- Hi-Y input modulation to rapidly attenuate offset due to a TA
- AGC and PLL hold may be automatically triggered by a TA event
- $\overline{\text{TAD}}$ input pin allows use of an external TA event detector