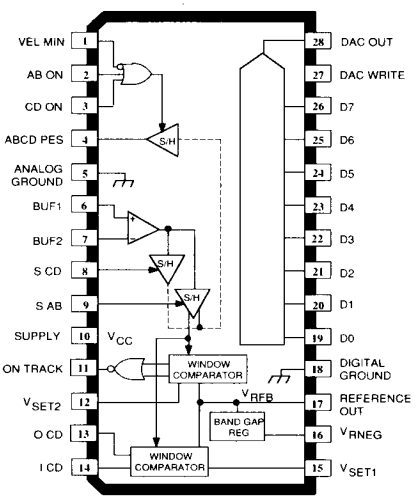
# 8951

## SERVO CONTROLLER SYSTEM




Dwg. No. PC-006

### ABSOLUTE MAXIMUM RATINGS at $T_A$ = 25°C

Supply Voltage, $V_{CC}$ ..... **6.0 V**
Output Current, $I_{OUT}$ ..... **±1.0 mA**
Reference Output Current, $I_{RFB}$ ..... **±5.0 mA**
Input Voltage Range,
$V_{IN}$ ..... **-0.3 V to $V_{CC}$ + 0.3 V**
Package Power Dissipation, $P_D$ ..... **1.2 W**
Operating Temperature Range,
$T_A$ ..... **0°C to +70°C**
Junction Temperature, $T_J$ ..... **150°C**
Storage Temperature Range,
$T_S$ ..... **-55°C to +150°C**

*Caution: This CMOS device has input static protection but is susceptible to damage when exposed to extremely high static electrical charges.*

The A8951CLW generates the analog position-error signal used for the voice-coil actuator in 5 V hard disk drives. Digital circuitry provides tracking signals to the system microcontroller. This device, with the A8952CLW loop compensator, is an alternative to a full DSP servo approach. Included on chip are an 8-bit, R/2R, digital-to-analog converter and a stable band gap voltage reference.

Each circuit function is optimized for the servo controller application. The signal-path switching transmission gates feature short propagation delays, the operational amplifiers feature low input offset voltages and individual logic-switched feedback loops, and the CMOS sample-and-hold amplifiers provide low droop.

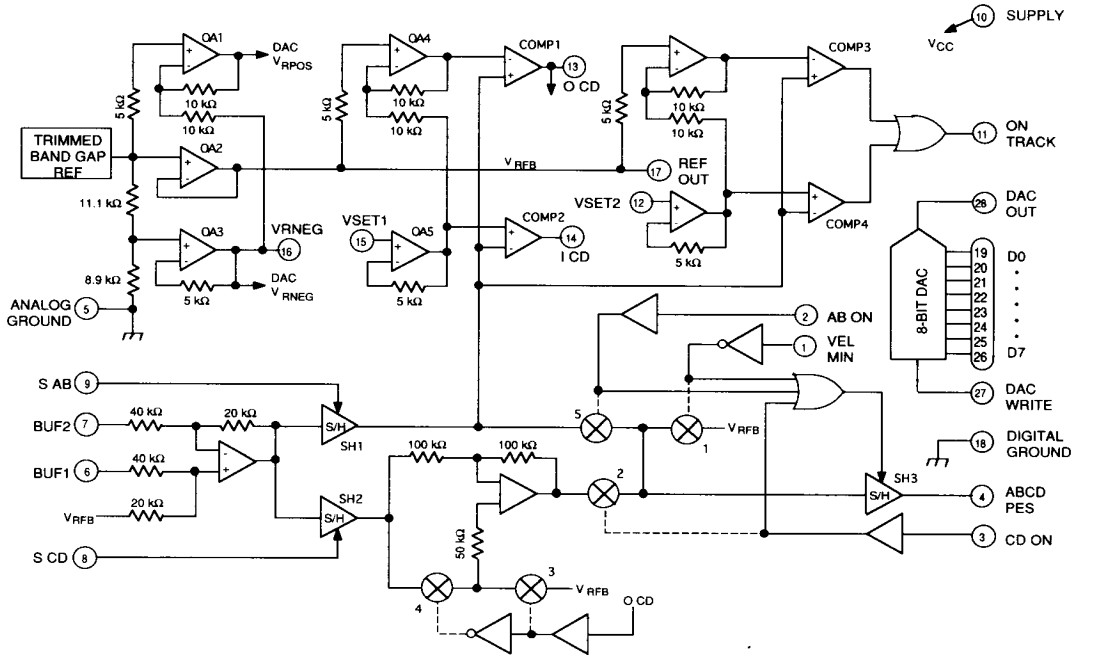
The A8951CLW is supplied in a 28-lead SOIC for surface-mount applications. It is rated for continuous operation over the temperature range of 0°C to +70°C.

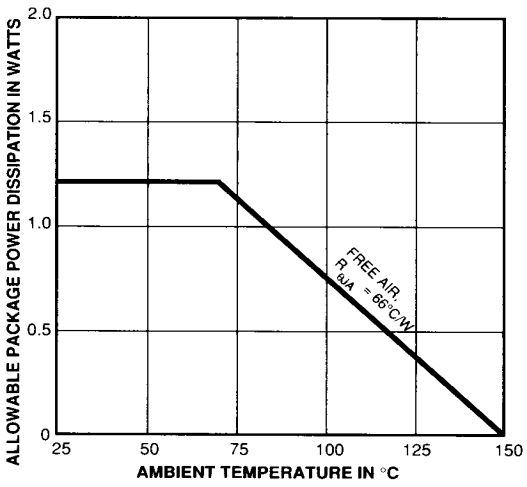
## FEATURES

- Position-Error Signal Generation
- Track Position Detection Functions
- On-Track Signal Generation
- 8-Bit DAC
- Low Offset Operational Amplifiers
- Low Droop Sample/Hold Amplifiers
- Short Delay Transmission Gates
- Guaranteed DAC Monotonicity

Always order by complete part number: **A8951CLW** .

## FUNCTIONAL BLOCK DIAGRAM




Dwg. No. GP-034-1

**ELECTRICAL CHARACTERISTICS at $T_A$ = +25°C, $V_{CC}$ = SAB = AB ON = VEL MIN = 5.0 V, CD ON = 0 V, BUF1 = BUF2 = $V_{RFB}$ (unless otherwise specified).**

| | | | Limits | | | |
|---|---|---|---|---|---|---|
| **Characteristic** | **Symbol** | **Test Conditions** | **Min.** | **Typ.** | **Max.** | **Units** |
| Supply Voltage Range | $V_{CC}$ | Operating | 4.5 | 5.0 | 5.5 | V |
| Supply Current | $I_{CC}$ | No Load | — | — | 15 | mA |
| Logic Input Voltage | $V_{IN(0)}$ | | — | — | 0.8 | V |
| | $V_{IN(1)}$ | | 3.5 | — | — | V |
| Logic Input Current | $I_{IN}$ | | — | — | ±100 | nA |
| **REFERENCE PARAMETERS** | | | | | | |
| Reference Output Voltage | $V_{RFB}$ | No Load | 2.228 | 2.250 | 2.273 | V |
| Dropout Voltage | $V_{CC}$ | | — | — | 4.5 | V |
| Load Regulation | $\Delta V_{RFB}$ | 0 mA ≤ $I_{RFB}$ ≤ -2 mA | — | — | ±20 | mV |
| | | 0 mA ≤ $I_{RFB}$ ≤ +2 mA | — | — | ±20 | mV |
| Power Supply Rejection Ratio | PSRR | f = 1 kHz, $V_{in}$ = 250 mV | 60 | 75 | — | dB |
| **DIGITAL-TO-ANALOG CONVERTER PARAMETERS** | | | | | | |
| Linearity Error | $E_L$ | End-point method | — | — | ±3.0 | % |
| Full-Scale Output Voltage | $V_{FS}$ | | 3.40 | 3.50 | 3.60 | V |
| Zero-Scale Output Voltage | $V_{ZS}$ | | 0.90 | 1.00 | 1.10 | V |
| Minimum Write Pulse Duration | $t_w$ | | — | — | 320 | ns |
| Minimum Data Set-Up Time | $t_{ds}$ | | — | — | 320 | ns |
| Minimum Data Hold Time | $t_{dh}$ | | — | — | 300 | ns |
| Power Supply Rejection Ratio | PSRR | f = 1 kHz, $V_{in}$ = 250 mV | — | 75 | 60 | dB |
| **COMPARATOR TRIP POINTS REFERENCED TO BUF2; BUF1 = $V_{RFB}$** | | | | | | |
| I CD | — | $V_{SET1}$ = 1.75 V | 3.061 | — | 3.448 | V |
| O CD | — | $V_{SET1}$ = 1.75 V | 1.162 | — | 1.337 | V |
| ON TRACK Low | — | $V_{SET2}$ = 2.10 V | 2.379 | — | 2.730 | V |
| ON TRACK High | — | $V_{SET2}$ = 2.10 V | 1.816 | — | 2.087 | V |

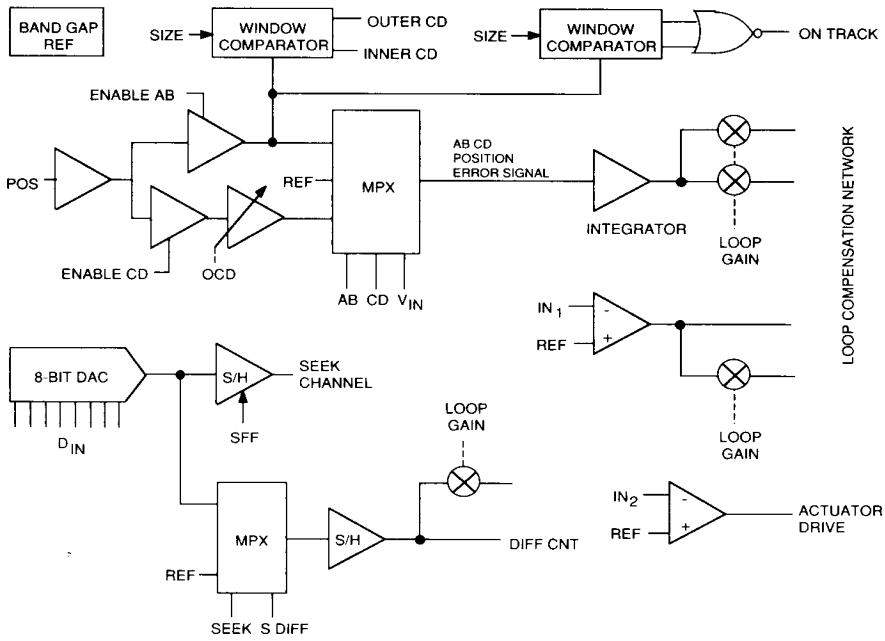
Continued...

...Electrical Characteristics (continued)

| Characteristic | Symbol | Test Conditions | Limits | | | |
|---|---|---|---|---|---|---|
| | | | Min. | Typ. | Max. | Units |
| **ABCD PES Parameters with S AB = S CD = AB ON = CD ON = VEL MIN = O CD = 0 V (unless otherwise specified); offset measurements are referenced to $V_{RFB}$** | | | | | | |
| ABCD PES Gain | $A_e$ | S AB = AB ON = 5 V, S CD = 0 V | — | 0.5 | — | V/V |
| ABCD PES Gain | $A_e$ | S CD = AB ON = 5 V, S AB = 0 V | — | 0.5 | — | V/V |
| AB Channel Offset Voltage | — | S AB = AB ON = VEL MIN = 5.0 V | — | — | ±25 | mV |
| CD Channel Offset Voltage | — | S CD = CD ON = VEL MIN = 5.0 V | — | — | ±30.5 | mV |
| VEL MIN Channel Offset Voltage | — | | — | — | ±15 | mV |
| **SAMPLE AND HOLD PARAMETERS** | | | | | | |
| SH1 Pedestal Error | $E_{p1}$ | $V_{IN}$ = 2.5 V, switch S AB | — | ±10 | ±50 | mV |
| SH2 Pedestal Error | $E_{p2}$ | $V_{IN}$ = 2.5 V, switch S CD | — | ±10 | ±50 | mV |
| SH3 Pedestal Error | $E_{p3}$ | $V_{IN}$ = 2.5 V, switch AB ON | — | ±10 | ±50 | mv |
| SH3 Pedestal Error | $E_{p3}$ | $V_{IN}$ = 2.5 V, switch CD ON | — | ±10 | ±50 | mv |
| SH3 Pedestal Error | $E_{p3}$ | $V_{IN}$ = 2.5 V, switch VEL MIN | — | ±10 | ±50 | mv |
| SH1 Droop | — | Hold on 2.25 V, average over 10 ms | — | 100 | 500 | µV/ms |
| SH2 Droop | — | Hold on 2.25 V, average over 10 ms | — | 100 | 500 | µV/ms |
| SH3 Droop | — | Hold on 2.25 V, average over 10 ms | — | 100 | 500 | µV/ms |

Negative current is defined as coming out of (sourcing) the specified device terminal.
Typical Data is for design information only.

## TYPICAL DISK–DRIVE APPLICATION USING A8951CLW AND A8952CLW




Dwg. No. FC-004

Voice–coil servo motors in disk–drive head–positioning systems utilize complex algorithms and sophisticated circuitry to provide good track–seeking and track–following performance. A typical hard–disk track geometry requires precise voice–coil motor control to ensure accurate positioning of the head above the desired track.

The A8951CLW servo controller system and A8952CLW servo loop compensator are companion devices that provide most of the circuitry to accomplish the head–positioning servo functions. A digital velocity command is converted into an analog signal and, through signal processing with multiple operational amplifiers and sample–and–hold circuits, is utilized to develop a position–error signal to correct the servo loop.

Surface–mount technology provides major benefits of reduced package size and weight, and improved system reliability through the reduction of printed wiring board through holes. Improved quality as well as lower assembly cost are obtained through the adaptability of these devices to high–speed, automated, pick–and–place assembly.