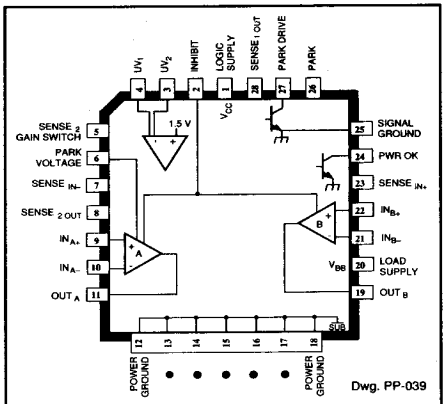
8931

VOICE COIL MOTOR DRIVER



Dwg. PP-039

ABSOLUTE MAXIMUM RATINGS at T_A = 25°C

Supply Voltages, V_{BB} and V_{CC} ..... **16 V**
Output Current, I_{OUT} ..... **±1.0 A**
Park Drive Output Current, I_{PARK}
Continuous ..... **250 mA**
Peak ..... **1.0 A**
Amplifier Input Voltage Range, V_{IN} ..... **-2.0 V to V_{CC}**
Sense Input Voltage Range, $V_{SENSE\ IN}$ ..... **-0.3 V to V_{CC}**
Comparator and Digital Inputs,
V_{IN} ..... **-0.3 V to 10 V**
I_{IN} ..... **±10 mA**
Open Collector Outputs, V_{CEX} ..... **20 V**
I_C ..... **30 mA**
Output Clamp Diode Current, I_F (pulsed) ..... **1.0 A**
Package Power Dissipation, P_D .. **See Graph**
Operating Temperature Range, T_A ..... **-20°C to +85°C**
Junction Temperature, T_J ..... **150°C***
Storage Temperature Range, T_S ..... **-55°C to +150°C**

* Fault conditions that produce excessive junction temperature will activate device thermal shutdown circuitry. These conditions can be tolerated but should be avoided.

Providing control and drive of the voice coil motor used for head positioning in disk drive applications, the A8931SEA is a full-bridge driver which can be configured so that its output current is a direct function of an externally applied control voltage or current. This linear current control function is supplemented by additional circuitry to protect the heads and the data disk during system failure or normal system shutdown.

The two ±800 mA driver outputs provide very-low saturation voltage drops and precise current control utilizing a single current-sensing resistor connected in series with the load. Under-voltage lockout disables the system in a controlled sequence if a fault condition occurs.

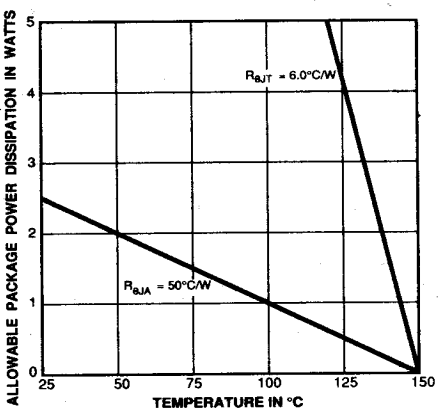
When activated by the under-voltage comparator, or a park command, the output power drivers change from a controlled current to a user-determined constant park voltage. Other features include a 4:1 transconductance gain switch for improved on-track performance, a power ok flag, an over-riding output disable to shut down both power amplifiers and reduce quiescent supply current, and internal thermal shutdown which disables the load (but still allowing the head to be parked) in the event of excessive junction temperature. The load is re-enabled when the junction temperature returns to a safe level.

The A8931SEA is supplied in a 28-lead power PLCC for surface-mount applications. The copper half-batwing construction provides for maximum package power dissipation in a minimum package size. It is rated for continuous operation over the temperature range of -20°C to +85°C.

FEATURES

- Controlled-Velocity Head Parking
- 4 V to 15 V Operation
- Zero Deadband
- High Transconductance Bandwidth
- User-Adjustable Transconductance Gain
- 4:1 Digital Transconductance Gain Switch
- ±800 mA Load Current
- Dual Under-Voltage Monitors with Flag and User-Selectable Trip Points
- Internal Thermal Shutdown Circuitry

Always order by complete part number: **A8931SEA** .



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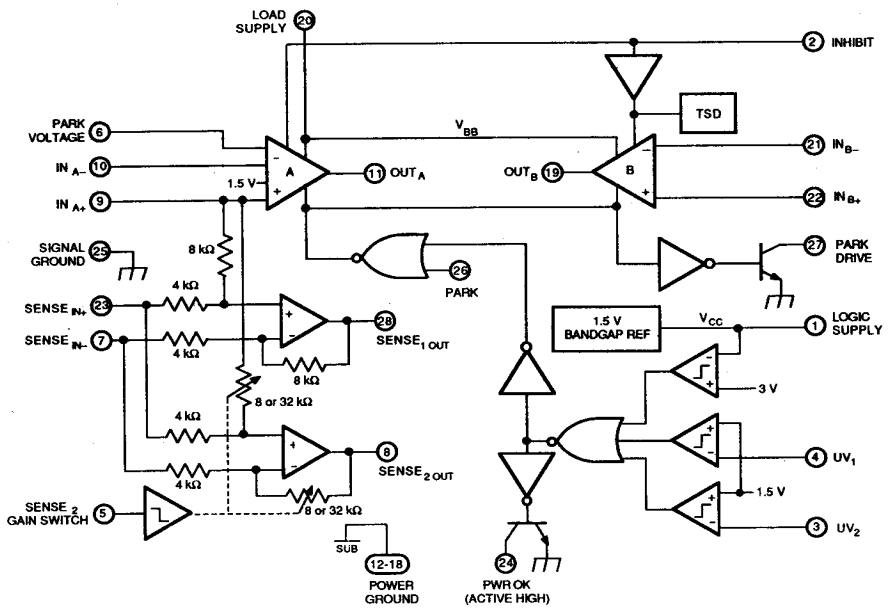
FUNCTIONAL BLOCK DIAGRAM



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ELECTRICAL CHARACTERISTICS at T_A = +25°C, V_{CC} = V_{BB} = 12 V

Characteristic	Symbol	Test Conditions	Limits			
			Min.	Typ.	Max.	Units
Logic Supply Voltage Range	V_{CC}	Operating	3.0	12	16	V
Logic Supply UV Threshold	V_{CC}		—	2.8	3.0	V
Logic Supply UV Hysteresis	ΔV_{CC}		—	200	—	mV
Supply Current	I_{BB}	V_{OUT} = 6 V, no load	—	20	—	mA
	I_{CC}		—	1.0	—	mA
Output Disabled Supply Current	—	I_{BB} + I_{CC}, $V_{INHIBIT} \geq$ 1.7 V	—	3.0	6.0	mA
Thermal Shutdown Temp.	T_J		—	165	—	°C
Thermal Shutdown Hysteresis	ΔT_J		—	8.0	—	°C
Power Amplifiers						
Output Saturation Voltage	V_{SAT}	I_{OUT} = 250 mA	—	250	—	mV
		I_{OUT} = 800 mA	—	450	—	mV
		I_{OUT} = -250 mA	—	750	—	mV
		I_{OUT} = -800 mA	—	950	—	mV
Total Saturation Voltage	V_{SAT}	I_{LOAD} = 250 mA	—	1.0	1.2	V
		I_{LOAD} = 800 mA	—	1.4	1.6	V
Input Offset Voltage	V_{IO}	V_{CM} = 6 V	—	—	8.0	mV
Input Offset Drift *	ΔV_{IO}		—	—	25	µV/°C
Input Bias Current	I_{IN}	Except IN_{A+}, V_{CM} = 6 V	—	-150	-500	nA
		IN_{A+} to $SENSE_{IN+}$ = 12 kΩ, T_J = 25°C	69	84	105	µA/V
Input Offset Current	I_{IO}	IN_B only, V_{CM} = 6 V	—	—	200	nA
Large Signal Gain	A_{VS}	V_{OUT} = 1 V to 11 V, I_{OUT} = ±500 mA	1.5	5.0	—	V/mV
Slew Rate	SR		—	1.0	—	V/µs
Unity Gain Bandwidth	BW	Amplifier A	0.5	2.0	—	MHz
		Amplifier B	0.5	1.0	—	MHz
Common-Mode Rejection	k_{CMR}	V_{CM} = 1 V to 10 V	70	90	—	dB
Clamp Diode Forward Voltage	V_F	I_F = 800 mA, $V_{INHIBIT} \geq$ 1.7 V	—	1.0	1.2	V
High-Side Current Limit	I_{OUT}	T_J = 25°C	—	1.0	1.2	A
Power Supply Rejection	k_{SVR}	V_{CC} = 4 V to 15 V, V_{CM} = 1.5 V	70	90	—	dB

Negative current is defined as coming out of (sourcing) the specified device terminal.

Continued next page...

Typical Data is for design information only.

* This parameter, although guaranteed, is not tested in production.

ELECTRICAL CHARACTERISTICS continued

Characteristic	Symbol	Test Conditions	Limits			
			Min.	Typ.	Max.	Units
Current Sense Amplifiers						
Input Offset Voltage	V_{IO}	V_{CM} = 6 V	—	—	2.0	mV
Input Offset Drift	ΔV_{IO}	V_{CM} = 0 V to 12 V	—	—	1500	µV/V
		See *	—	—	8.0	µV/°C
GAIN SWITCH Threshold	V_{GS}		0.7	1.1	1.7	V
GAIN SWITCH Input Current	I_{GS}	V_{GS} = 1.7 V	—	—	100	µA
Voltage Gain	A_{VS1}	V_{ID} = -1 V to +1 V, V_{CM} = 6 V	1.95	2.00	2.05	—
	A_{VS2}	V_{ID} = -1 V to +1 V, V_{CM} = 6 V, V_{GS} = 0	1.95	2.00	2.05	—
		V_{ID} = -1 V to +1 V, V_{CM} = 6 V, V_{GS} = 1.7 V	7.8	8.0	8.2	—
Output Saturation Voltage	V_{SAT}	V_{OUT}, I_{OUT} = 1.5 mA	—	300	500	mV
		V_{CC} - V_{OUT}, I_{OUT} = -1.5 mA	—	400	700	mV
Park Function						
PARK DRIVE Leakage Current	I_{CEX}	V_{CEX} = 20 V	—	—	100	µA
PARK DRIVE Saturation Voltage	$V_{CE(SAT)}$	I_C = 200 mA	—	300	500	mV
PARK Input Threshold	V_{PARK}		0.7	1.1	1.7	V
PARK Input Current	I_{PARK}	V_{PARK} = 1.7 V	—	—	100	µA
PARK VOLTAGE Input Current	$I_{PARK\ V}$		—	-150	-500	nA
Under-Voltage Protection						
UV Threshold	V_{UV}	Low-to-High Trans., Other Input = 6 V	1.48	1.50	1.52	V
UV Threshold Hysteresis	ΔV_{UV}		15	25	40	mV
UV Input Current	I_{UV}	V_{UV} = 1 V	—	-0.5	-1.5	µA
PWR OK Saturation Voltage	$V_{CE(SAT)}$	I_C = 5 mA	—	—	450	mV
PWR OK Leakage Current	I_{CEX}	V_{CEX} = 20 V	—	—	5.0	µA
Inhibit Function						
INHIBIT Input Threshold	$V_{INHIBIT}$		0.7	1.1	1.7	V
INHIBIT Input Current	$I_{INHIBIT}$	$V_{INHIBIT}$ = 1.7 V	—	—	200	µA

Negative current is defined as coming out of (sourcing) the specified device terminal.

Typical Data is for design information only.

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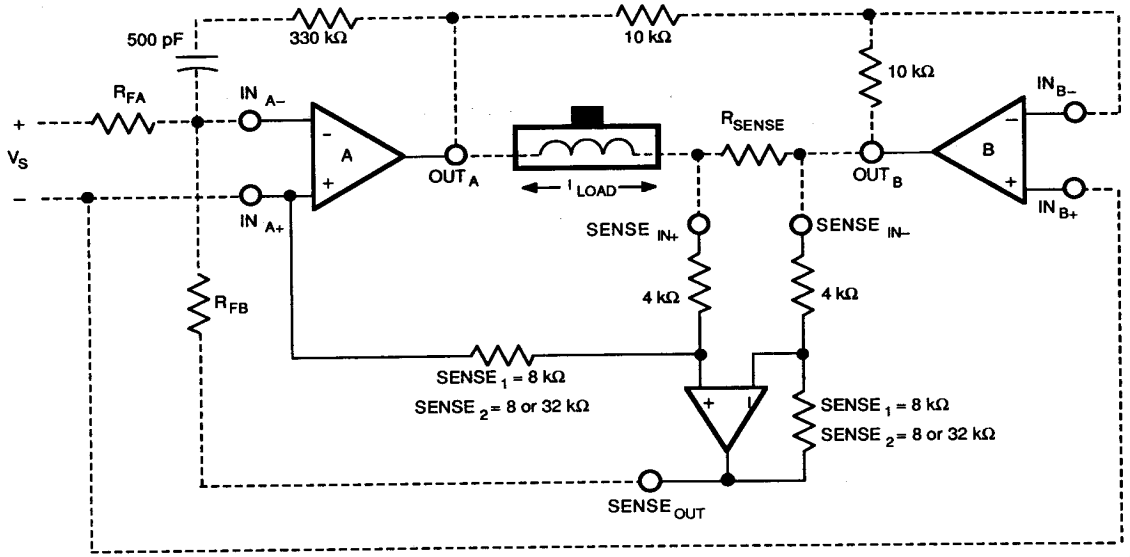
TERMINAL FUNCTIONS

Terminal Number	Terminal Name	Function
1	LOGIC SUPPLY	V_{CC}; logic supply voltage in the range of +3 V to +16 V.
2	INHIBIT	An active-high input that inhibits the output stages without initiating a park.
3 and 4	UV_1 and UV_2	Under-voltage detection inputs. If not used, these terminals must be connected to the logic supply (V_{CC}).
5	$SENSE_2$ GAIN SWITCH	An active-high input that changes the gain of current sense error amplifier number 2 from 2 to 8 (typical).
6	PARK VOLTAGE	Auxiliary inverting input to power amplifier A.
7	$SENSE_{IN-}$	Inverting input to current sense error amplifers.
8	$SENSE_{2\ OUT}$	Output of current sense error amplifier number 2.
9	IN_{A+}	Non-inverting input to power amplifier A.
10	IN_{A-}	Inverting input to power amplifier A.
11	OUT_A	Power amplifier A output to voice coil motor.
12-18	POWER GROUND	High-level power ground and thermal heat sink.
19	OUT_B	Power amplifier B output to voice coil motor.
20	LOAD SUPPLY	V_{BB}; load supply voltage in the range of +3 V to +16 V.
21	IN_{B-}	Inverting input to power amplifier B.
22	IN_{B+}	Non-inverting input to power amplifier B.
23	$SENSE_{IN+}$	Non-inverting input to current sense error amplifiers.
24	PWR OK	A logic low at this output indicates an under-voltage condition.
25	SIGNAL GROUND	Low-level signal and logic ground; circuit reference.
26	PARK	An active-high logic input that activates the park function.
27	PARK DRIVE	Power transistor for retract current control on power down or park command.
28	$SENSE_{1\ OUT}$	Output of current sense error amplifier number 1.

CURRENT SENSING



$$I_{LOAD} = g_m V_S = \frac{R_{FB} V_S}{R_{FA} A_{VS} R_{SENSE}}$$

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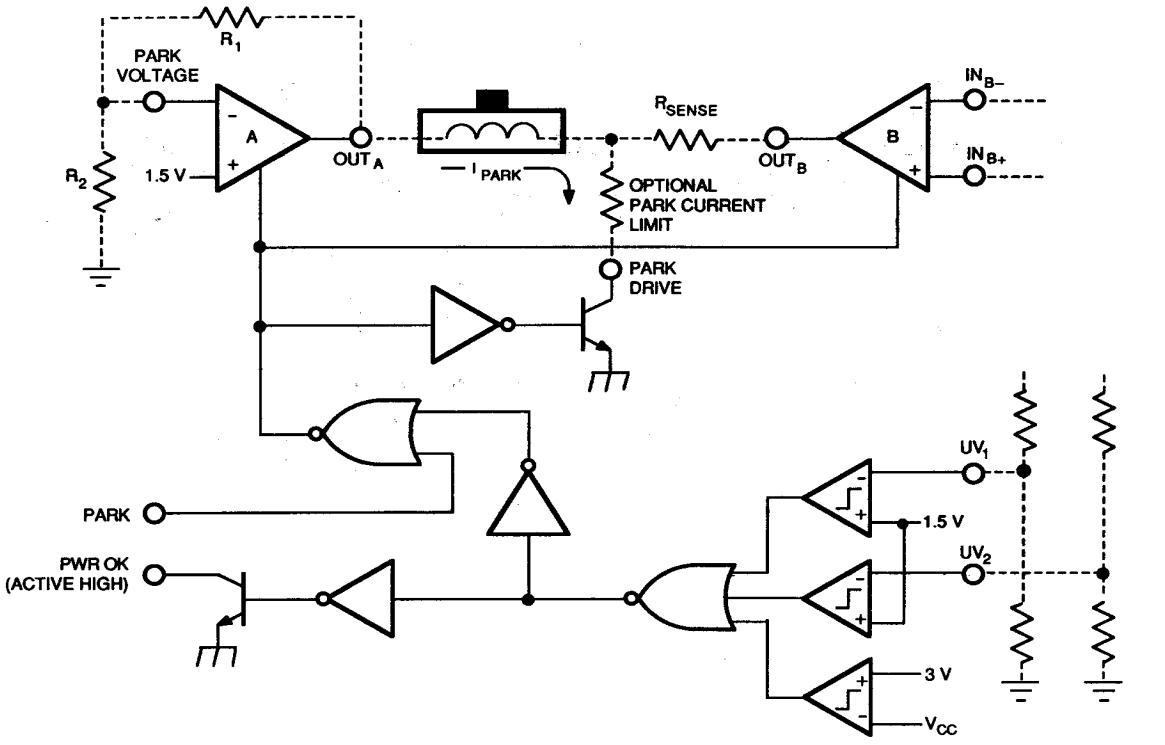
where $A_{VS1} = 2$

$A_{VS2} = 2$ or 8

PARKING FUNCTION



$$V_{OUT\ A} = \frac{1.5\ (R_1 + R_2)}{R_2}$$

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