élantec
HIGH PERFORMANCE ANALOG INTEGRATED CIRCUITS

EL2017/EL2017C

High Efficiency Precision Servo Controller

Features

- Low Saturation Voltage
- Precision Current Sense Amplifier
- Efficient Class D Switch Mode
- Linear Class B Track Mode
- Single Supply Operation 4.5 to 20V

Applications

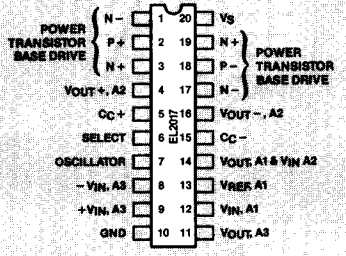
- Winchester Disc Head Positioning Servo
- 3.5" Disc Drive Servo
- Galvo Motors
- Robotics
- DC Motor Controls

Ordering Information

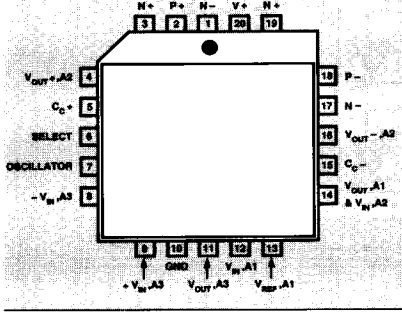
Part No.	Temp. Range	Pkg.	Outline#
EL2017CN	–25 to +85°C	20-Pin P-Dip	MDP0008
EL2017CJ	–25 to +85°C	20-Pin Cerdip	MDP0016
EL2017CPL	–25 to +85°C	20-Lead PLCC	MDP0018
EL2017J	–55 to +125°C	20-Pin Cerdip	MDP0016
EL2017J/883B	–55 to +125°C	20-Pin Cerdip	MDP0016

Connection Diagrams

Dip Package
(Top View)



PLCC Package



General Description

The EL2017 is designed to reduce the power consumption and space required for closed-loop control of voice coil actuator motors in disc head positioning servos and other precision servos. The EL2017 includes the current sense amplifier, bridge output power drive and the error amplifier.

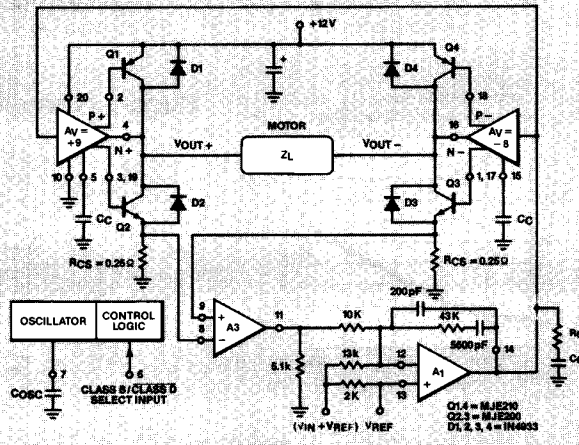
The EL2017 saves power by using a Class D (chopper) mode output drive during the high current "seek" operation. System dissipation is reduced a factor of three providing higher reliability and easier heat management. During the lower current "tracking" operation, the amplifier switches to conventional Class B analog mode for noise-free data retrieval. A logic input selects the operation mode. The bridge output stage is designed for minimum saturation voltage allowing efficient operation with single supply voltage from 4.5 to 20V.

A low offset differential amplifier senses the output current in the bridge ground return and provides a proportional voltage added to the externally-generated common-mode reference voltage. This closes the loop and makes the servo amplifier a voltage in, current out system.

The EL2017 contains all of the control circuitry required for the application. This allows the circuit designer to select power transistors and catch diodes to meet the output voltage and current specifications of almost any application. External transistors also allow greater flexibility for thermal and space management.

The EL2017 is available in both 20-lead dual-in-line plastic or ceramic packages.

Typical Application



For design equations and applications examples please refer to the EL2007 data sheet.

EL2017/EL2017C

High Efficiency Precision Servo Controller

Absolute Maximum Ratings

V_S	Supply Voltage	20V	T_A	Operating Temperature Range	
V_{IN}	Input Voltage Range (any logic pin)	$-0.3V$ to V_S		EL2017	$-55°C$ to $+125°C$
	Sense Amp Input Voltage Range	$-1.5V$ to V_S		EL2017C	$-25°C$ to $+85°C$
	Sense Amp Differential Input Voltage Range	$\pm 5V$		Lead Temperature	
T_J	Junction Temperature	150°C		(soldering, 10 seconds)	300°C
			T_{ST}	Storage Temperature	$-65°C$ to $+150°C$
			P_D	Power Dissipation ($T_A = 25°C$)	1.25W

Important Note: All parameters having Min./Max. specifications are guaranteed. The Test Level column indicates the specific device testing actually performed during production and Quality Assurance inspection. Elantec performs most electrical tests using modern high-speed automatic test equipment, specifically the LTX 77 Series system. Unless otherwise noted, all tests are pulsed tests, therefore $T_J = T_C = T_A$.

Test Level — **Test Procedure**

- I — 100% production tested and QA sample tested per QA test plan QCX0002.
- II — 100% production tested at $T_A = 25°C$, and QA sample tested at $T_A = 25°C$, T_{MAX} and T_{MIN} per QA test plan QCX0002.
- III — QA sample tested per QA test plan QCX0002.
- IV — Parameter is guaranteed (but not tested) by Design and Characterization Data.
- V — Parameter is typical value for information purposes only.

Electrical Characteristics $T_J = T_A = 25°C$, EL2017, EL2017C (Note 7)

	Parameter	Mode	Volts			Min.	Typ.	Max.	Test Level	Units
			V_S	V_{REF}	V_{IN}					
SYSTEM, CLOSED-LOOP										
K	Gain Constant, I_{OUT}/V_{IN}, $I_{OUT} = \pm 100mA$	B	12	5	Note 1	0.85	1	1.15	I	A/V
I_{OS}	Output Offset Current	B	12	5	5	−35	5	35	I	mA
		B	12	8	8	−40	5	40	I	mA
		B	12	2	2	−40	5	40	I	mA
		B	4.5	2	2	−40	5	40	I	mA
		B	20	2	2	−40	5	40	I	mA
		B	20	16	16	−40	5	40	I	mA
		Standby	12	5	5	−2	0	2	I	mA
I_Q	Quiescent Supply Current	B	12	5	Open		25	50	I	mA
		D	12	5	Open		20	50	I	mA
		Standby	12	5	Open		12	25	I	mA
		B	20	5	Open		40	100	I	mA
		D	20	5	Open		25	100	I	mA
		Standby	20	5	Open		20	50	I	mA
I_{OUT}	Output Drive Current	B	12	5	Note 2	15	30		I	mA
		D	12	5	Note 2	45	60		I	mA
R_{OUT}	Standby Output Resistance (Note 4)	Standby	12	5	Open	1	4		I	kΩ
I_{IH}	Select High Current (20V)	B	12	5	5		0	10	I	μA
I_{IL}	Select Low Current (0V)	D	12	5	5		−10	−200	I	μA
I_{IL}	Oscillator Low Current (0.4V)	Standby	12	5	5		−100	−400	I	μA
I_{BREF}	Reference Voltage Bias Current	Standby	12	5	Open	0.2	0.6	1	I	mA

Electrical Characteristics — (Continued) $T_J = T_A = 25°C$, EL2017, EL2017C (Note 7)

	Parameter	Mode	Volts V_S	Volts V_{REF}	Volts V_{IN}	Min.	Typ.	Max.	Test Level	Units
CURRENT SENSE AMPLIFIER										
A3	Current Sense Amp Gain, Pin 9 = ±400 mV	Standby	12	5	Open	3.6	4	4.4	I	V/V
V_{OSO}	Current Sense Amp Output Offset	Standby	12	5	Open	−20	5	20	I	mV
		Standby	12	8	Open	−30	5	30	I	mV
		Standby	12	2	Open	−30	5	30	I	mV
		Standby	4.5	2	Open	−30	5	30	I	mV
		Standby	20	2	Open	−30	5	30	I	mV
		Standby	20	16	Open	−30	5	30	I	mV
RVRR	Reference Voltage Rejection Ratio	Standby	20	Note 5	Open	50	75		I	dB
PSRR	Power Supply Rejection Ratio	Standby	Note 6	2	Open	50	75		I	dB
CMRR	Common-Mode Rejection Ratio Pin 8 − Pin 9 = ±500 mV	Standby	12	5	Open	50	75		I	dB
I_{OUT}	Output Source Current	Standby	12	5	Open	+5	+10		I	mA
I_B	Input Current	Standby	12	5	Open	0.2	0.6	1	I	mA
ERROR AMPLIFIER										
V_{OS}	Offset Voltage	B	12	5	Open	−10	2	10	I	mV
		B	12	8	Open	−10	2	10	I	mV
		B	12	2	Open	−10	2	10	I	mV
		B	4.5	2	Open	−10	2	10	I	mV
		B	20	2	Open	−10	2	10	I	mV
		B	20	16	Open	−10	2	10	I	mV
RVRR	Reference Voltage Rejection Ratio	B	20	Note 5	Open	50	75		I	dB
PSRR	Power Supply Rejection Ratio	B	Note 6	2	Open	50	75		I	dB
I_{OUT}	Output Current	B	12	5	Open	±5	±20		I	mA
DRIVER AMPLIFIER										
A2	Driver Amp Gain, I_{OUT} = ±750 mA	B	12	5	Note 1	10	17	20	I	V/V
f_{OSC}	Switching Frequency, I_{OUT} = ±500 mA	D	12	5	Note 1	20	30	40	I	kHz
	Duty Cycle, I_{OUT} = ±500 mA	D	12	5	Note 1	35	45	55	I	%
V_S	Supply Voltage Operating Range	Guaranteed by above tests				4.5	12	20	I	V
V_{REF}	Reference Operating Range	Guaranteed by above tests				2	5	V_S−4	I	V

Note 1: V_{IN} is adjusted to set I_{OUT}.

Note 2: $V_{IN} = 2V$ for $I_{OUT} < 0A$, and $V_{IN} = 8V$ for $I_{OUT} > 0A$.

Note 3: $2.5V < V_{REF} < 16V$.

Note 4: $V_{OUT} = V_S/2$.

Note 5: $2V < V_{REF} < 16V$.

Note 6: $4.5V < V_S < 20V$.

Note 7: Mode B is forced with pin 6 = 2.0V and pin 7 open. Mode D is forced with pin 6 = 0.6V and pin 7 open. Standby is forced with pin 6 = 0.6V and pin 7 = 0.4V.

Note 8: $5.5V < V_S < 20V$.

EL2017/EL2017C
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Electrical Characteristics $T_J = T_A = T_{MIN}, T_{MAX}$, for the Military EL2017 only (Output Transistors 25°C)

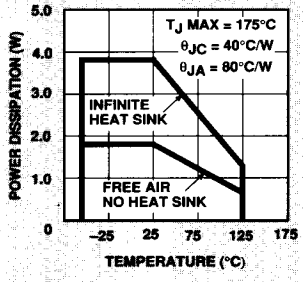
	Parameter	Mode	Volts			Min.	Typ.	Max.	Test Level	Units
			V_S	V_{REF}	V_{IN}					
SYSTEM, CLOSED-LOOP										
K	Gain Constant, I_{OUT}/V_{IN}, $I_{OUT} = \pm 100$mA	B	12	5	Note 1	0.85	1	1.15	I	A/V
I_{OS}	Output Offset Current	B	12	5	5	−35	5	35	I	mA
		B	12	8	8	−40	5	40	I	mA
		B	12	2.5	2.5	−40	5	40	I	mA
		B	5.5	2.5	2.5	−40	5	40	I	mA
		B	20	2.5	2.5	−40	5	40	I	mA
		B	20	16	16	−40	5	40	I	mA
		Standby	12	5	5	−2	0	2	I	mA
I_Q	Quiescent Supply Current	D	12	5	Open		20	50	I	mA
		Standby	12	5	Open		12	25	I	mA
		D	20	5	Open		25	100	I	mA
		Standby	20	5	Open		20	50	I	mA
I_{OUT}	Output Drive Current	B	12	5	Note 2	10	20		I	mA
R_{OUT}	Standby Output Resistance (Note 4)	Standby	12	5	Open	1	4		I	kΩ
I_{IH}	Select High Current (20V)	B	12	5	5		0	10	I	μA
I_{IL}	Select Low Current (0V)	D	12	5	5		−10	−200	I	μA
I_{IL}	Oscillator Low Current (0.4V)	Standby	12	5	5		−100	−400	I	μA
I_{BREF}	Reference Voltage Bias Current	Standby	12	5	Open	0.2	0.6	1	I	mA
CURRENT SENSE AMPLIFIER										
A3	Current Sense Amp Gain, Pin 9 = ±400mV	Standby	12	5	Open	3.6	4	4.4	I	V/V
V_{OSO}	Current Sense Amp Output Offset	Standby	12	5	Open	−20	5	20	I	mV
		Standby	12	8	Open	−30	5	30	I	mV
		Standby	12	2.5	Open	−30	5	30	I	mV
		Standby	5.5	2.5	Open	−30	5	30	I	mV
		Standby	20	2.5	Open	−30	5	30	I	mV
		Standby	20	16	Open	−30	5	30	I	mV
RVRR	Reference Voltage Rejection Ratio	Standby	20	Note 3	Open	50	75		I	dB
PSRR	Power Supply Rejection Ratio	Standby	Note 8	2.5	Open	50	75		I	dB
CMRR	Common-Mode Rejection Ratio Pin 8 = Pin 9 = ±400mV	Standby	12	5	Open	50	75		I	dB
I_{OUT}	Output Source Current	Standby	12	5	Open	+5	+10		I	mA
I_B	Input Current	Standby	12	5	Open	0.2	0.6	1	I	mA

Electrical Characteristics — (Continued) $T_J = T_A = T_{MIN}, T_{MAX}$, for the Military EL2017 only (Output Transistors 25°C)

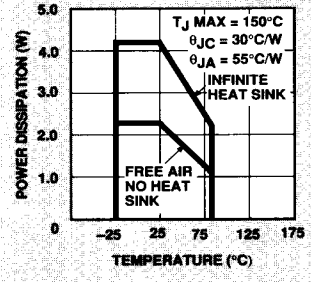
Parameter		Mode	Volts V_S	Volts V_{REF}	Volts V_{IN}	Min.	Typ.	Max.	Test Level	Units
ERROR AMPLIFIER										
V_{OS}	Offset Voltage	B	12	5	Open	−10	2	10	I	mV
		B	12	8	Open	−10	2	10	I	mV
		B	12	2.5	Open	−10	2	10	I	mV
		B	5.5	2.5	Open	−10	2	10	I	mV
		B	20	2.5	Open	−10	2	10	I	mV
		B	20	16	Open	−10	2	10	I	mV
RVRR	Reference Voltage Rejection Ratio	B	20	Note 3	Open	50	75		I	dB
PSRR	Power Supply Rejection Ratio	B	Note 8	2.5	Open	50	75		I	dB
I_{OUT}	Output Current	B	12	5	Open	±5	±20		I	mA
DRIVER AMPLIFIER										
A2	Driver Amp Gain, I_{OUT} = ±750 mA	B	12	5	Note 1	10	17	20	I	V/V
V_S	Supply Voltage Operating Range	Guaranteed by above tests				5.5	12	20	I	V
V_{REF}	Reference Operating Range	Guaranteed by above tests				2.5	5	V_S−4	I	V

Typical Performance Curves

20-Lead CerDIP
Maximum Power Dissipation
vs Ambient Temperature



20-Lead Plastic DIP
Maximum Power Dissipation
vs Ambient Temperature



20-Lead PLCC
Maximum Power Dissipation
vs Ambient Temperature