élantec
HIGH PERFORMANCE ANALOG INTEGRATED CIRCUITS

EL2243/EL2243C

Dual Fast Single-Supply Decompensated Op Amp

ELANTEC INC T-79-10

Features

- Inputs and outputs operate at negative supply rail
- Gain bandwidth product—70 MHz
- High slew rate—90 V/μs
- Settles to 0.01% of a 10V swing in 400 ns
- Operates with supplies as low as 3V or as great as 32V while consuming only 3.7 mA per amplifier
- Large open loop gain—114 dB
- Inputs tolerant of overload
- MIL-STD-883 Rev. C compliant

Applications

- Battery-powered instruments
- 12-bit DAC output amplifiers
- Fast-settling instrumentation amplifiers

Ordering Information

Part No.	Temp. Range	Package	Outline #
EL2243CJ	0°C to +75°C	8-Pin CerDIP	MDP0010
EL2243CN	0°C to +75°C	8-Pin P-DIP	MDP0031
EL2243CM	0°C to +75°C	20-Lead SOL	MDP0027
EL2243J	−55°C to +125°C	8-Pin CerDIP	MDP0010
EL2243J/883B	−55°C to +125°C	8-Pin CerDIP	MDP0010

General Description

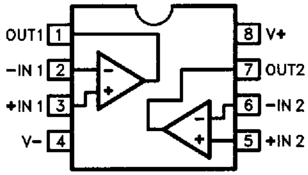
The EL2243 dual monolithic operational amplifier is as flexible as prior 324 devices but offers 100 times the bandwidth and slewrate. Its inputs and outputs are able to operate down to the negative supply and are not damaged by overloads.

The EL2243 is useable in battery-operated systems with supplies as low as 3V, yet it has excellent gain and settling times while consuming only 3.7 mA per amplifier.

Elantec's EL2243/883B complies with MIL-STD-883 Revision C in all aspects, including burn-in at 125°C. Elantec's facilities comply with MIL-I-45208A and other applicable quality specifications. For information on Elantec's military processing, see the Elantec document QRA-2: *"Elantec's Military processing-Monolithic Products"*.

Connection Diagrams

DIP



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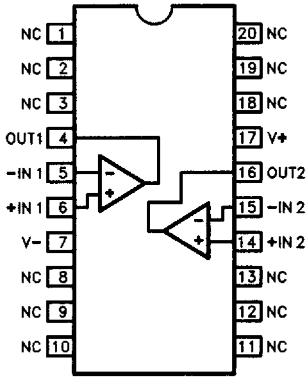
SOL



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July 1992 Rev C

EL2243/EL2243C

Dual Fast Single-Supply Decompensated Op Amp

Absolute Maximum Ratings (T_A = 25°C)

Voltage between V+ and V−	36V
Voltage between −IN and +IN Pins	36V
Voltage at −IN or +IN Pins	V+ to V−
Output Current	50 mA (Peak)
	30 mA (Continuous)
Current into +IN or −IN	5 mA
Internal Power Dissipation	See Curves
Operating Ambient Temperature Range	
EL2243	−55°C to +125°C
EL2243C	0°C to +75°C
Operating Junction Temperature	
CerDIP	175°C
Plastic DIP	150°C
Storage Temperature Range	−65°C to +150°C
Lead Temperature	
DIP Package	
(Soldering, 10 seconds)	300°C
SOL Package	
Vapor Phase (<60 seconds)	215°C
Infrared (<15 seconds)	220°C

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 inspection. Elantec performs most electrical tests using modern high-speed automatic test equipment, specifically the LTX77 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 at T_A = 25°C for information purposes only.

DC Electrical Characteristics V_S = ±15V, R_L = 1k; T_A = 25°C unless otherwise specified

Parameter	Description	Temp	Min	Typ	Max	Test Level EL2243	Test Level EL2243C	Units
V_{OS}	Input Offset Voltage	25°C		1.5	7	I	I	mV
		Full			9	I	III	mV
TCV_{OS}	Average Offset Voltage Drift	Full		5		V	V	μV/C
I_B	Input Bias Current	25°C		0.5	1.0	I	I	μA
		Full			2.0	I	III	μA
I_{OS}	Input Offset Current	25°C		0.01	0.1	I	I	μA
		Full			0.2	I	III	μA
R_{IN}, Diff	Input Differential Resistance	25°C		10		V	V	MΩ
R_{IN}, Comm	Input Common-Mode Resistance	25°C		100		V	V	MΩ
C_{IN}	Input Capacitance	25°C		2		V	V	pF
V_{CM+}	Positive Common-Mode Input Range	Full	12	13.3		I	II	V
V_{CM-}	Negative Common-Mode Input Range	Full	−15	−15.3		I	II	V
E_{IN}	Input Noise Voltage (f = 1 kHz, R_G = 0Ω)	25°C		12		V	V	nV/√Hz
A_{VOL}	Large Signal Voltage Gain (V_O = ±10V)	25°C	250	500		I	I	V/mV
		Full	15			I	III	V/mV
CMRR	Common-Mode Rejection Ratio (Note 1)	Full	70	100		I	II	dB

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EL2243/EL2243C

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DC Electrical Characteristics $V_S = \pm 15V$, $R_L = 1k$; $T_A = 25°C$ unless otherwise specified — Contd.

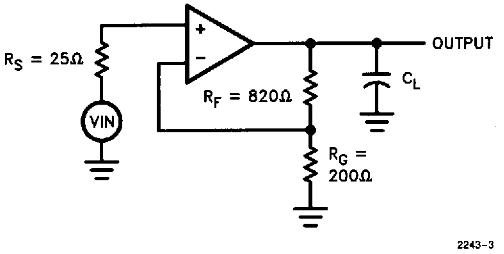
Parameter	Description	Temp	Min	Typ	Max	Test Level		Units
						EL2243	EL2243C	
PSRR	Power-Supply Rejection Ratio (Note 2)	Full	70	100		I	II	dB
V_O	Output Voltage Swing Negative Swing, R_L to V−	Full Full	±12 −14.98	±13.5 −15		I I	II II	V V
I_O	Output Current (Note 3)	Full	±12	±25	±50	I	II	mA
I_S	Supply Current (Both Amplifiers)	Full		8.2	10	I	II	mA

AC Electrical Characteristics $V_S = \pm 15V$; $R_L = 1\ k\Omega$; $C_L = 20$ pF; $T_A = 25°C$; unless otherwise specified

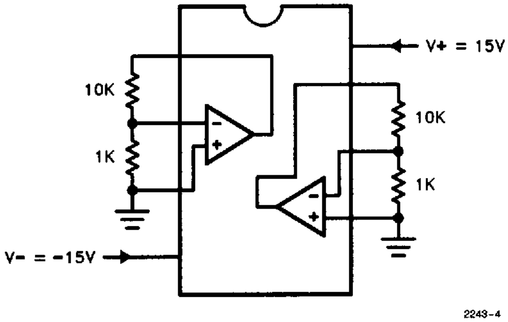
Parameter	Description	Min	Typ	Max	Test Level		Units
					EL2243	EL2243C	
GBW	Gain-Bandwidth Product (Note 4)		70		V	V	MHz
SR	Slew Rate ($V_O = \pm 10V$)		90		V	V	V/μs
OS	Overshoot (Note 4)		30		V	V	%
t_s	Settling Time 10V Step, to 0.1% to 0.01%		320 380		V V	V V	ns ns

Note 1: Two tests are performed with V_{CM} = 0V to −12V and V_{CM} = 0V to 12V.
Note 2: Two tests are performed with V+ = 3V, V− changed from −2V to −27V; V− = −2V, V+ changed from 3V to 28V.
Note 3: The inputs are overdriven by ±15V and the output R1 = 100Ω.
Note 4: V_{OUT} = 100 mV peak-to-peak.

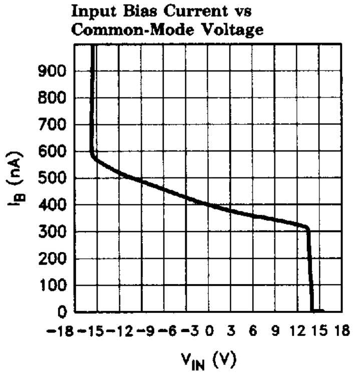
Test Circuit

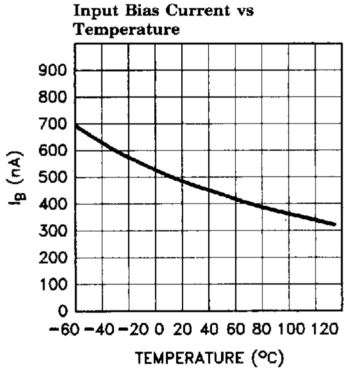


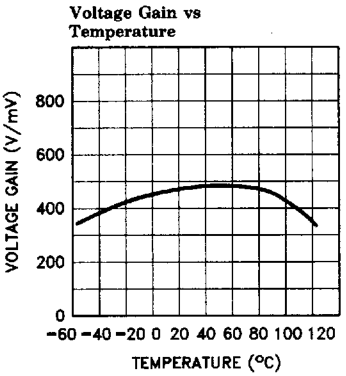
Burn-In Circuit

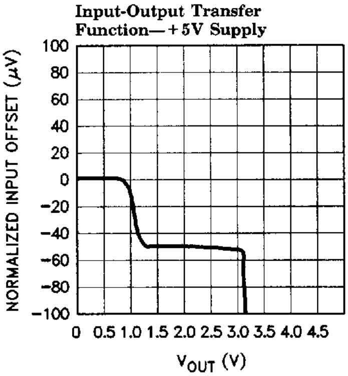


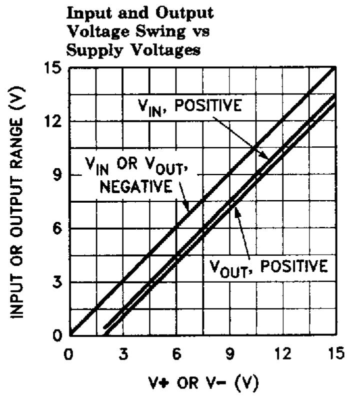
Typical Performance Curves

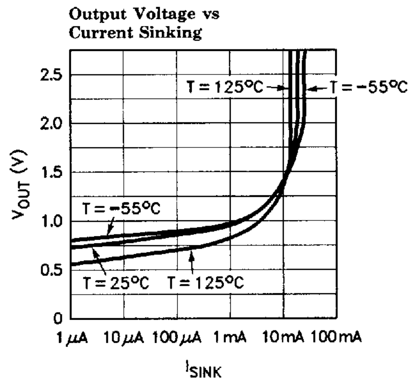












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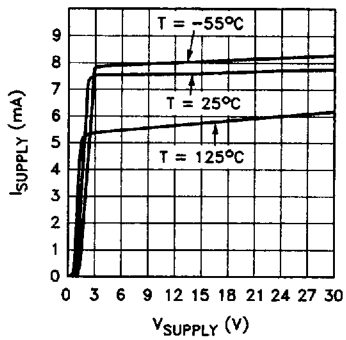
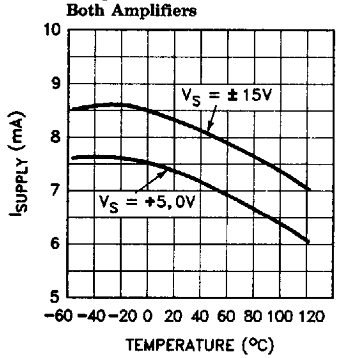
Typical Performance Curves — Contd.

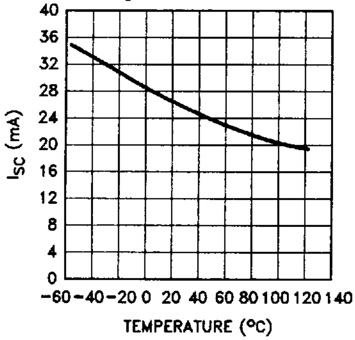
Supply Current vs Supply Voltage— Both Amplifiers



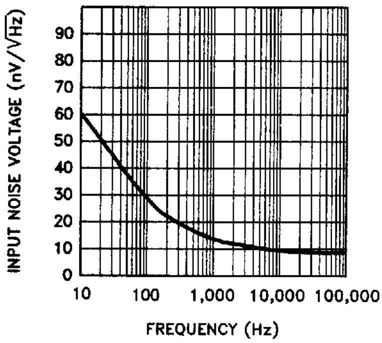
Supply Current vs Temperature— Both Amplifiers



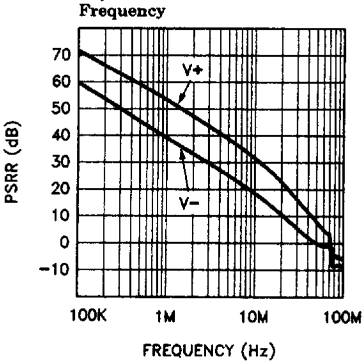
Output Short-Circuit Current vs Temperature



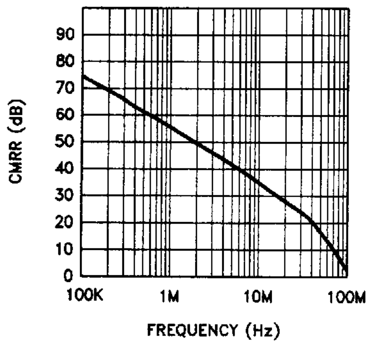
Input Voltage Noise vs Frequency



Power Supply Rejection Ratio vs Frequency



Common-Mode Rejection Ratio vs Frequency



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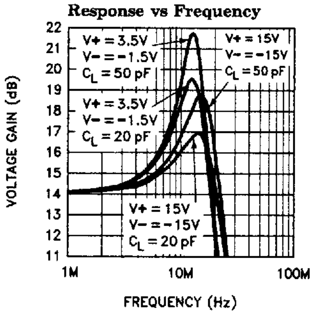
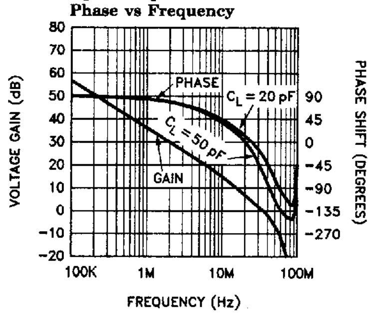
Typical Performance Curves — Contd.

Gain of +5 Response vs Frequency



Open-Loop Gain and Phase vs Frequency



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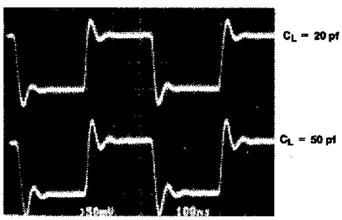
Pulse Response with V+ = 15V, V− = −15V



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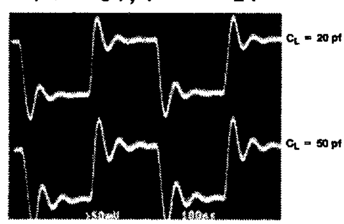
Pulse Response with V+ = 3V, V− = −2V



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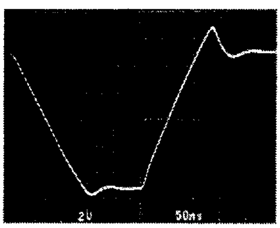
Slew Characteristic



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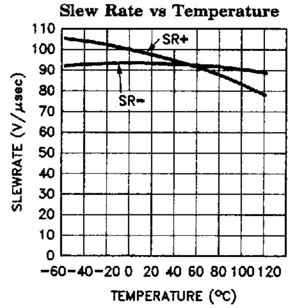
Slew Rate vs Temperature



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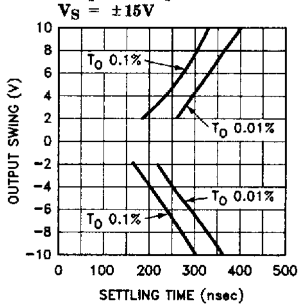
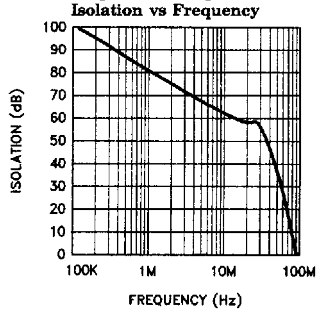
Settling Time vs Output Swing V_S = ±15V



Amplifier-to-Amplifier Isolation vs Frequency



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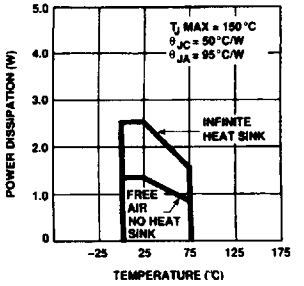
Typical Performance Curves — Contd.

8-Lead Plastic DIP
Maximum Power Dissipation
vs Ambient Temperature



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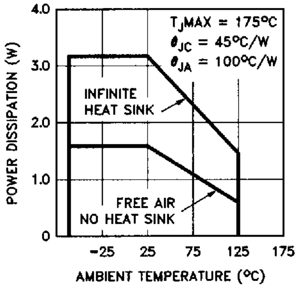
8-Pin CerDIP Package
Maximum Power Dissipation
vs Ambient Temperature



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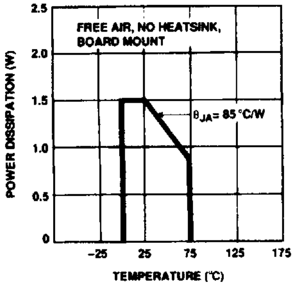
20-Lead SOL
Maximum Power Dissipation
vs Ambient Temperature



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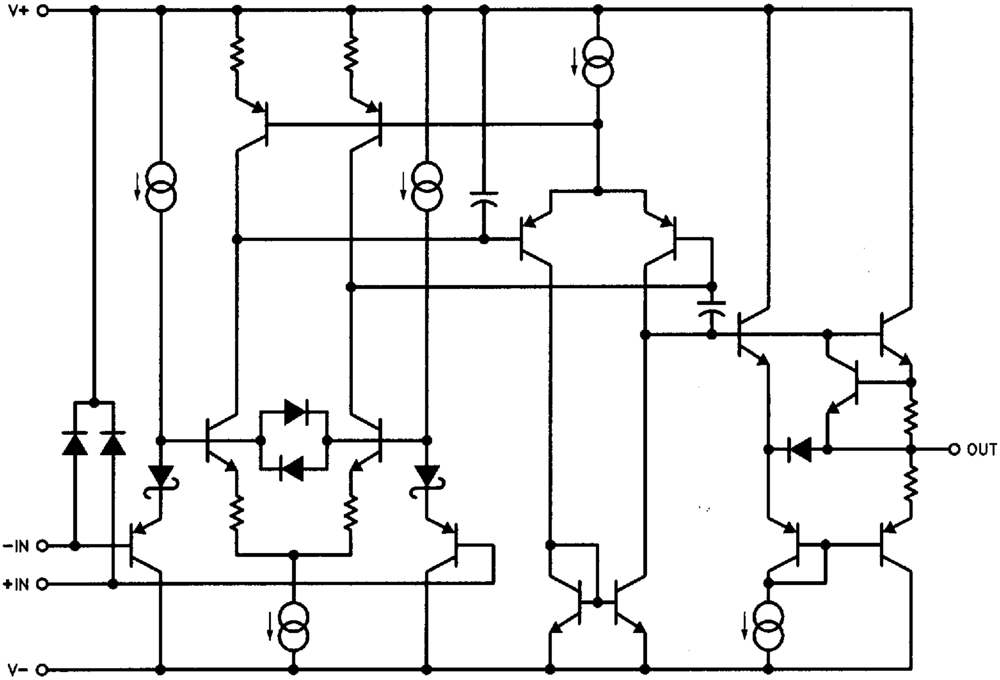
Simplified Schematic (One Amplifier)



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Applications Information

The EL2243 is a fast amplifier designed to operate from a very wide range of power supply voltages. The inputs operate all the way to the negative supply (actually about 200 mV below it) and up to typically 2V below the positive supply. The outputs swing a similar range, but some attention is required in practice.

Specifically, while the output NPN transistor can source load current over the full output span (see the simplified schematic), the output PNP device simply turns off at negative swings below about a volt above the negative supply rail. This property is shown in the "Output Voltage vs. Current-Sinking" typical curve. All single-supply amplifiers have this characteristic, and the solution is to provide a load resistor from the output to the negative supply rail.

When the output is in this extreme negative swing region, the bandwidth, gain, and settling properties are all degraded by a factor of about 2. Even so, the AC characteristics are well-behaved in this region.

Electrostatic discharge protection devices clamp the inputs a diode drop above V+ and a diode drop below V−.

As for all amplifiers, good supply bypassing will optimize settling and amplifier-to-amplifier rejection. 4.7 μF tantalum capacitors seem to be the best, and no additional small capacitor is needed in parallel for very high-frequency bypassing. Reasonably low feedback impedances are important to preserving closed-loop stability, 1k or less being acceptable when capacitive parasitics are minimized. Stability is best when the EL2243 is operated from large supplies, especially when driving capacitive loads.

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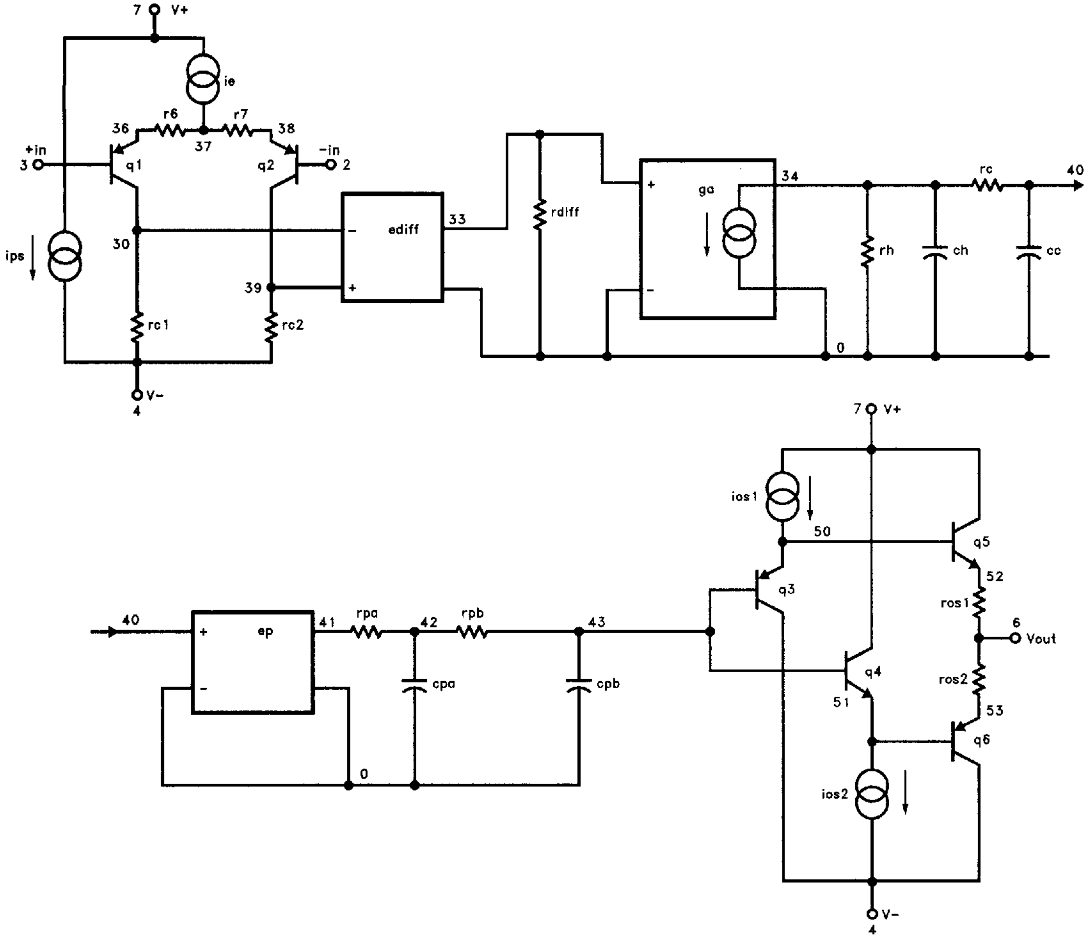
EL2243 Macromodel

```
* Connections:     +input
*                   |    -input
*                   |     |    +Vsupply
*                   |     |     |    -Vsupply
*                   |     |     |     |    output
*                   |     |     |     |     |
.subckt M2243       3     2     7     4     6
* Input stage
ie 7 37 200uA
r6 36 37 1K
r7 38 37 1K
rc1 4 30 3K
rc2 4 39 3K
q1 30 3 36 qp
q2 39 2 38 qpa
ediff 33 0 39 30 1.0
rdiff 33 0 1Meg
* Compensation Section
ga 0 34 33 0 1m
rh 34 0 175Meg
ch 34 0 4pF
rc 34 40 1K
cc 40 0 4pF
* Poles
ep 41 0 40 0 1.0
rpa 41 42 1K
cpa 42 0 4pF
rpb 42 43 1K
cpb 43 0 2pF
* Output Stage
ios1 7 50 1.0mA
ios2 51 4 1.0mA
q3 4 43 50 qp
q4 7 43 51 qn
q5 7 50 52 qn
q6 4 51 53 qp
ros1 52 6 25
ros2 6 53 25
* Power Supply Current
ips 7 4 1.5mA
* Models
.model qn npn(is=800e-18 bf=100 tf=0.2nS)
.model qpa pnp(is=864e-18 bf=150 tf=0.2nS)
.model qp pnp(is=800e-18 bf=125 tf=0.2nS)
.ends
```

EL2243 Macromodel — Contd.



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