ECG® Semiconductors

ECG1903, ECG1905, ECG1907, ECG1909, ECG1917

3-Terminal, Negative VR

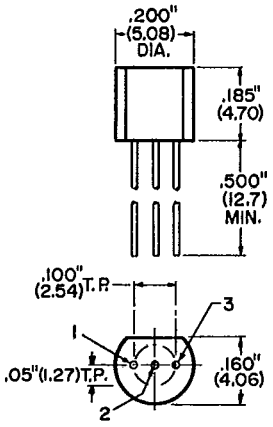
T-58-11-13

Features

- **No external components required**
- **Internal short-circuit current limiting**
- **Internal thermal overload protection**

This series of 3-terminal negative voltage regulators features thermal shutdown and current limiting, making them remarkably rugged. In most applications, no external components are required for operation.

These devices are useful for on-card regulation or any other application where a regulated negative voltage at a modest current level is needed. These regulators offer substantial advantage over the common resistor/zener diode approach.

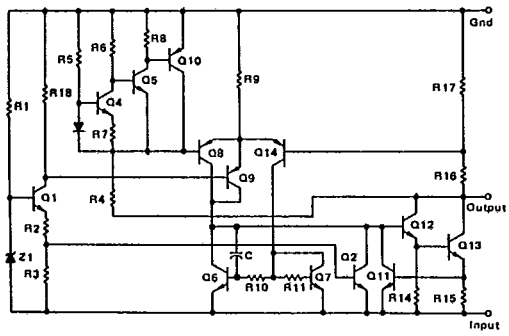


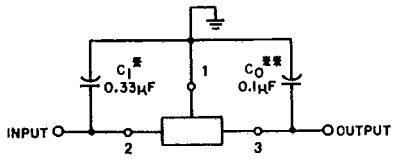
Pin 1. Ground
2. Input
3. Output

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Characteristic	Symbol	Rating	Unit
Input Voltage (−5, −12, −15, −18 V) (−24 V)	V_I	 −35 −40	Vdc
Storage Temperature Range	T_{stg}	−55 to +150	°C
Junction Temperature Range	T_J	0 to +125	°C

Circuit Schematic





A common ground is required between the input and the output voltages. The input voltage must remain typically 2.0 V above the output voltage even during the low point on the input ripple voltage.

* = C_I is required if regulator is located an apreciable distance from power supply filter.

** = C_O improve stability and transient response.

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ECG1903 Electrical Characteristics ($V_I = -19$ V, $I_O = 40$ mA, $C_I = 0.33$ µF, $C_O = 0.1$ µF, $T_A = +25°C$)

Characteristics	Symbol	Min	Typ	Max	Unit
Output Voltage	V_O	−11.5	−12	−12.5	Vdc
Input Regulation −14.5 Vdc≥V_I≥−27 Vdc −16 Vdc≥V_I≥−27 Vdc	Reg_{line}	 -- --	 -- --	 250 200	mV
Load Regulation 1.0 mA ≤I_O≤100 mA 1.0 mA ≤I_O≤40 mA	Reg_{load}	 -- --	 -- --	 100 50	mV
Output Voltage −14.5 V_{dc}≥V_I≥−27 Vdc, 1.0 mA≤I_O≤40 mA V_I = −19 Vdc, 1.0 mA≤I_O≤70 mA	V_O	 −11.4 −11.4	 -- --	 −12.6 −12.6	V_{dc}
Input Bias Current	I_{IB}	--	--	6.5	mA
Input Bias Current Change −16 Vdc≥V_I≥−27 Vdc 1.0 mA≤I_O≤40 mA	ΔI_{IB}	 -- --	 -- --	 1.5 0.1	mA
Output Noise Voltage 10 Hz≤f≤100 kHz	V_N	--	80	--	µV
Ripple Rejection −15≤V_I≤−25 Vdc, f = 120 Hz	RR	37	42	--	dB
Input-Output Voltage Differential I_O = 40 mA	$/V_I - V_O/$	--	1.7	--	Vdc

ECG1905 Electrical Characteristics ($V_I = -23$ V, $I_O = 40$ mA, $C_I = 0.33$ µF, $C_O = 0.1$ µF, $T_A = +25°C$)

Characteristics	Symbol	Min	Typ	Max	Unit
Output Voltage	V_O	−14.4	−15	−15.6	Vdc
Input Regulation −17.5 Vdc≥V_I≥−30 Vdc −20 Vdc≥V_I≥−30 Vdc	Reg_{line}	 -- --	 -- --	 300 250	mV
Load Regulation 1.0 mA ≤I_O≤100 mA 1.0 mA ≤I_O≤40 mA	Reg_{load}	 -- --	 -- --	 150 75	mV
Output Voltage −17.5 V_{dc}≥V_I≥−30 Vdc, 1.0 mA≤I_O≤40 mA V_I = −23 Vdc, 1.0 mA≤I_O≤70 mA	V_O	 −14.25 −14.25	 -- --	 −15.75 −15.75	V_{dc}
Input Bias Current	I_{IB}	--	--	6.5	mA
Input Bias Current Change −20 Vdc≥V_I≥−30 Vdc 1.0 mA≤I_O≤40 mA	ΔI_{IB}	 -- --	 -- --	 1.5 0.1	mA
Output Noise Voltage 10 Hz≤f≤100 kHz	V_N	--	90	--	µV
Ripple Rejection −18.5≤V_I≤−28.5 Vdc, f = 120 Hz	RR	34	39	--	dB
Input-Output Voltage Differential I_O = 40 mA	$/V_I - V_O/$	--	1.7	--	Vdc

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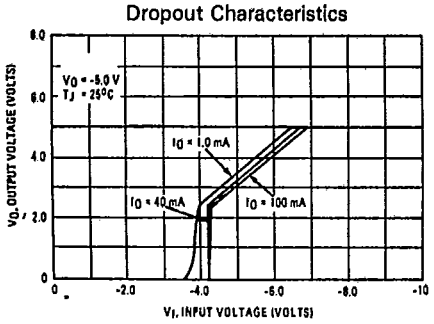
ECG1907 Electrical Characteristics ($V_I = -27$ V, $I_O = 40$ mA, $C_I = 0.33\ \mu F$, $C_O = 0.1\ \mu F$, $T_A = +25°C$)

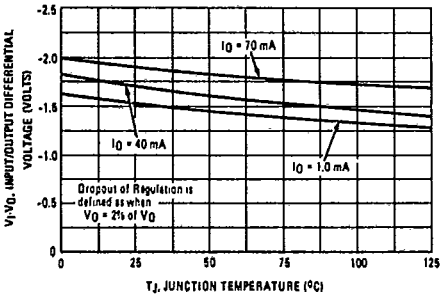
Characteristics	Symbol	Min	Typ	Max	Unit
Output Voltage	V_O	−17.3	−18	−18.7	Vdc
Input Regulation	Reg_{line}				mV
−20.7 Vdc≥V_I≥−33 Vdc		--	--	325	
−21.4 Vdc≥V_I≥−33 Vdc		--	--	--	
−22 Vdc≥V_I≥−33 Vdc		--	--	--	
−21 Vdc≥V_I≥−33 Vdc		--	--	275	
Load Regulation	Reg_{load}				mV
1.0 mA ≤I_O≤100 mA		--	--	170	
1.0 mA ≤I_O≤40 mA		--	--	85	
Output Voltage	V_O				V_{dc}
−20.7 V_{dc}≥V_I≥−33 Vdc, 1.0 mA≤I_O≤40 mA		−17.1	--	−18.9	
−21.4 Vdc≥V_I≥−33 Vdc, 1.0 mA≤I_O≤40 mA		--	--	--	
V_I = −27 Vdc, 1.0 mA≤I_O≤70 mA		−17.1	--	−18.9	
Input Bias Current	I_{IB}	--	--	6.5	mA
Input Bias Current Change	ΔI_{IB}				mA
−21 Vdc≥V_I≥−33 Vdc		--	--	1.5	
−27 Vdc≥V_I≥−33 Vdc		--	--	--	
1.0 mA≤I_O≤40 mA		--	--	0.1	
Output Noise Voltage 10 Hz≤f≤100 kHz	V_N	--	150	--	μV
Ripple Rejection −23≤V_I≤−33 Vdc, f = 120 Hz	RR	33	48	--	dB
Input-Output Voltage Differential I_O = 40 mA	$/V_I - V_O/$	--	1.7	--	Vdc

Typical Characteristics (V_O≒−5.0, T_A = 25°C unless otherwise noted)

Dropout Characteristics



Dropout Voltage vs Junction Temperature



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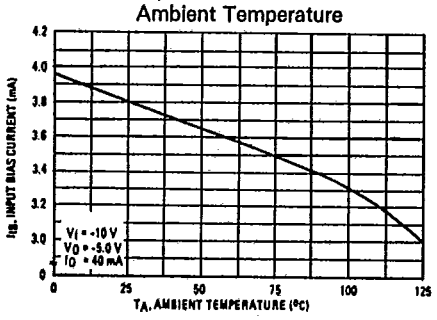
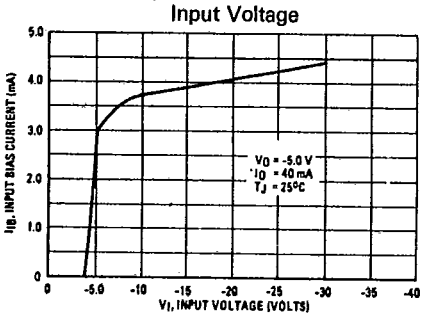
ECG1909 Electrical Characteristics (V_I = −33 V, I_O = 40 mA, C_I = 0.33 μF, C_O = 0.1 μF, T_A = +25°C)

Characteristics	Symbol	Min	Typ	Max	Unit
Output Voltage	V_O	−23	−24	−25	Vdc
Input Regulation	Reg_{line}				mV
−27 Vdc≥V_I≥−38 Vdc		--	--	350	
−27.5 Vdc≥V_I≥−38 Vdc		--	--	--	
−28 Vdc≥V_I≥−38 Vdc		--	--	300	
Load Regulation	Reg_{load}				mV
1.0 mA ≤I_O≤100 mA		--	--	200	
1.0 mA ≤I_O≤40 mA		--	--	100	
Output Voltage	V_O				V_{dc}
−27 Vdc≥V_I≥−38 Vdc, 1.0 mA≤I_O≤40 mA		−22.8	--	−25.2	
−28 Vdc≥V_I≥−38 Vdc, 1.0 mA≤I_O≤40 mA		--	--	--	
V_I = −33 Vdc, 1.0 mA≤I_O≤70 mA		−22.8	--	−25.2	
Input Bias Current	I_{IB}	--	--	6.5	mA
Input Bias Current Change	ΔI_{IB}				mA
−28 Vdc≥V_I≥−38 Vdc		--	--	1.5	
1.0 mA≤I_O≤40 mA		--	--	0.1	
Output Noise Voltage 10 Hz≤f≤100 kHz	V_N	--	200	--	μV
Ripple Rejection −29≤V_I≤−35 Vdc, f = 120 Hz	RR	31	47	--	dB
Input-Output Voltage Differential I_O = 40 mA	$/V_I$-$V_O/$	--	1.7	--	Vdc

Input Bias Current vs Ambient Temperature



Input Bias Current vs Input Voltage



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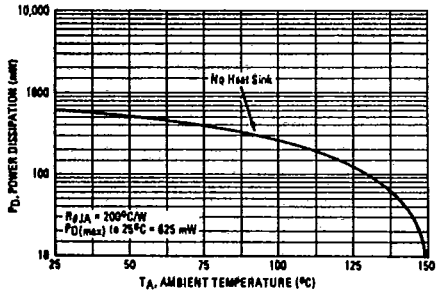
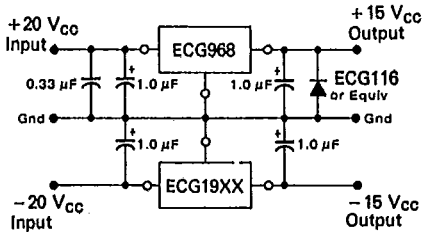
ECG1917 Electrical Characteristics ($V_I = -10$ V, $I_O = 40$ mA, $C_I = 0.33\ \mu F$, $C_O = 0.1\ \mu F$, $T_A = +25°C$)

Characteristics	Symbol	Min	Typ	Max	Unit
Output Voltage	V_O	−4.8	−5.0	−5.2	Vdc
Input Regulation	Reg_{line}				mV
−7.0 Vdc ≥ V_I ≥ −20 Vdc		--	--	150	
−8.0 Vdc ≥ V_I ≥ −20 Vdc		--	--	100	
Load Regulation	Reg_{load}				mV
1.0 mA ≤ I_O ≤ 100 mA		--	--	60	
1.0 mA ≤ I_O ≤ 40 mA		--	--	30	
Output Voltage	V_O				Vdc
−7.0 Vdc ≥ V_I ≥ −20 Vdc, 1.0 mA ≤ I_O ≤ 40 mA		−4.75	--	−5.25	
V_I = −10 Vdc, 1.0 mA ≤ I_O ≤ 70 mA		−4.75	--	−5.25	
Input Bias Current	I_{IB}	--	--	6.0	mA
Input Bias Current Change	ΔI_{IB}				mA
−8.0 Vdc ≥ V_I ≥ −20 Vdc		--	--	1.5	
1.0 mA ≤ I_O ≤ 40 mA		--	--	0.1	
Output Noise Voltage (T_A = +25°C, 10 Hz ≤ f ≤ 100 kHz)	V_N	--	40	--	μV
Ripple Rejection (−8.0 ≥ V_I ≥ 18 Vdc, f = 120 kHz)	RR	41	49	--	dB
Input-Output Voltage Differential I_O = 40 mA	$\lvert V_I - V_O \rvert$	--	1.7	--	Vdc

Maximum Average Power Dissipation vs Ambient Temperature

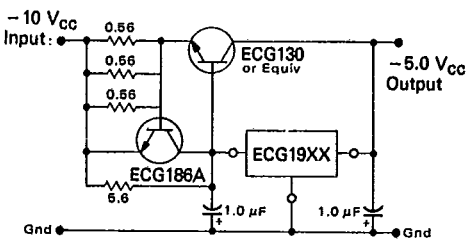


Operational Amplifier Supply
(±15 V @ 1.0 A)



The ECG968 and ECG19XX positive and negative regulators may be connected as shown to obtain a dual power supply for operational amplifiers. A clamp diode should be used at the output of the ECG968 to prevent potential latch-up problems.

Current Boost Regulator
(−5.0 V @ 4.0 A, with 5.0 A Current Limiting)



* Mounted on common heat sink

When a boost transistor is used, short-circuit currents are equal to the sum of the series pass and regulator limits, which are measured at 3.2 A and 1.8 A respectively in this case. Series pass limiting is approximately equal to 0.6 V/R_{SC}. Operation beyond this point to the peak current capability of the ECG19XX is possible if the regulator is mounted on a heat sink; otherwise thermal shutdown will occur when the additional load current is picked up by the regulator.