General Purpose Power Supply

National Semiconductor
Linear Brief 28
June 1974

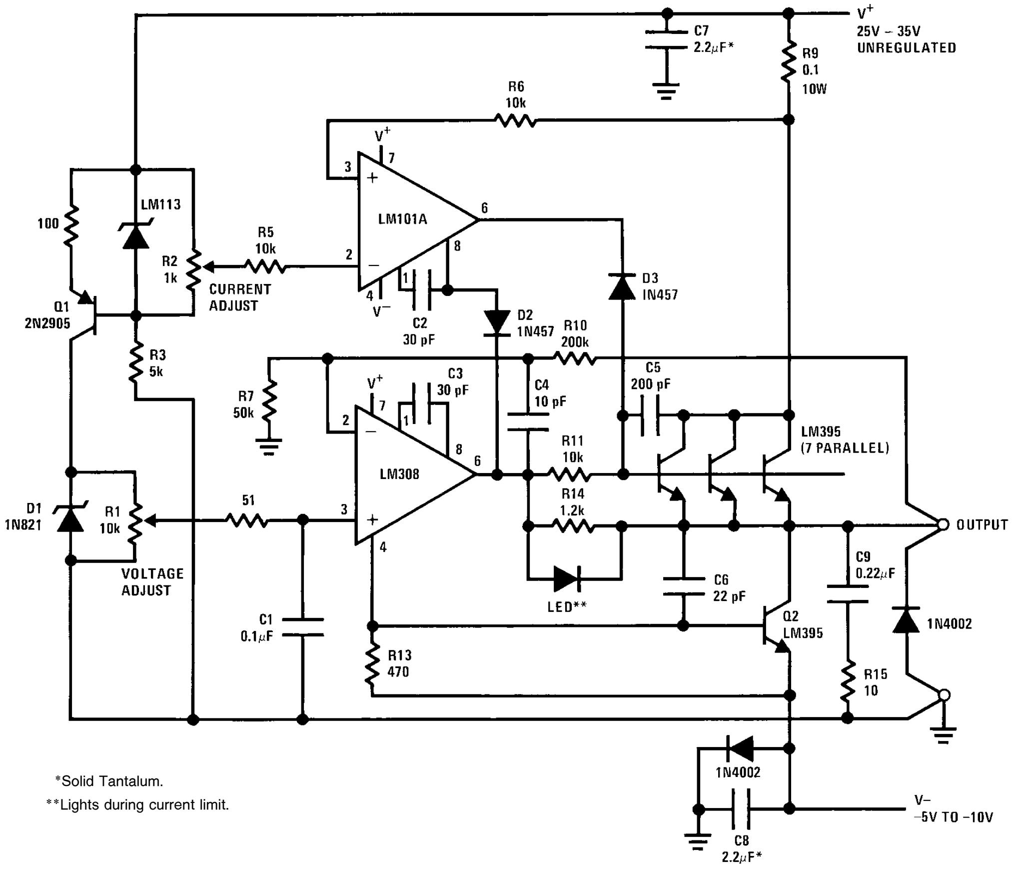
INTRODUCTION

A general purpose lab type constant voltage/constant current power supply is easily made using standard integrated circuits. The circuit shown will provide up to 25V at up to 10A output with both the output voltage and current adjustable down to zero. Although relatively simple, very high performance is obtained.

Lab supplies must withstand considerable abuse. Good control of maximum output current is mandatory both to protect the supply and the powered circuitry. One of the shortcomings of many commercial supplies is the use of a large output capacitor to help frequency compensate the regulator loop. This output capacitor can discharge many times the peak output current of the supply into the load as well as degrade the ac output impedance when the supply is used as a constant current source. (Of course, the output capacitor helps keep the ac output impedance low when the supply is used as a constant voltage source.) The circuit shown has good response both as a constant voltage or constant current source.

The use of the LM395 monolithic power transistor as the pass element considerably simplifies the design power. The LM395 acts as a 2A current limited, thermally limited, high gain power transistor. Since only a maximum of 10 μA is needed to drive the pass elements and complete overload protection is included on the chip, external biasing and protection circuitry is minimized. Only two control op amps are needed−one for voltage control and one for current control.

In constant voltage operation, a reference voltage is fed from voltage control pot, R1, through a high frequency filter into the non-inverting input of an LM308 op amp. The output of the LM308 drives seven paralleled LM395's as emitter followers to obtain a 10A capability.



*Solid Tantalum.

**Lights during current limit.

TL/H/8477–1

Feedback is taken through R10 directly from the output with the overall gain set at 5 by the ratio of R10 to R7. An additional LM395 is driven from the negative power supply lead of the LM308 to provide some output current sink capability (2A) so the supply can be quickly programmed even with large capacitive loads. Frequency compensation is achieved with C3 for the LM308 and C4 for the overall loop. Resistor R11, capacitors C5 and C6 and network R15–C9 suppress parasitic high frequency oscillations.

When the circuit is used in the constant current mode, the LM101A overcomes the constant voltage loop to control the output. Output current is sensed in R9 and compared with the voltage between V^+ and the arm of R2. R2 is connected across an LM113 low voltage reference diode to provide a 0V to 1.2V reference for 0A to 12A output. When the output current is below the set level, the LM101A output is positive, reverse biasing D3 and the LM308 control the outpput. When the current increases to the control point the output of the LM101A swings negative and decreases the drive to the output pass devices through D3, limiting the current. (Note that no separate positive supply is needed since the common mode operative range of the LM101A is equal to the positive supply.) Diode, D2, clamps the output of the LM101A when it is not regulating, decreasing the switchover time from voltage to current mode operation.

A few special precautions are needed in construction for proper operation. All LM395's should be mounted on the same heat sink to insure good current sharing. Also, a large heat sink is necessary since 300W will be dissipated under worst case conditions. Since the LM395's are high devices, the supply bypasses should be near the power transistors.

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