SGS-THOMSON MICROELECTRONICS

L200

ADJUSTABLE VOLTAGE AND CURRENT REGULATOR

- ADJUSTABLE OUTPUT CURRENT UP TO 2 A (GUARANTEED UP TO T_j = 150 °C)
- ADJUSTABLE OUTPUT VOLTAGE DOWN TO 2.85 V
- INPUT OVERVOLTAGE PROTECTION (UP TO 60 V, 10 ms)
- SHORT CIRCUIT PROTECTION
- OUTPUT TRANSISTOR S.O.A. PROTECTION
- THERMAL OVERLOAD PROTECTION
- LOW BIAS CURRENT ON REGULATION PIN
- LOW STANDBY CURRENT DRAIN

DESCRIPTION

The L200 is a monolithic integrated circuit for voltage and current programmable regulation. It is available in Pentawatt® package or 4-lead TO-3 metal case. Current limiting, power limiting, thermal shutdown and input overvoltage protection (up to 60 V) make the L200 virtually blow-out proof. The L200 can be used to replace fixed voltage regulators when high output voltage precision is required and eliminates the need to stock a range of fixed voltage regulators.

Pentawatt® TO–3 (4 lead)

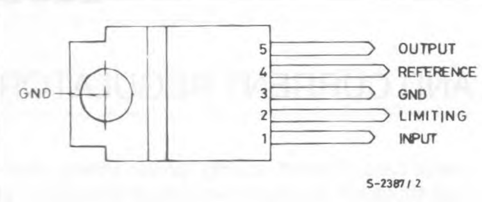
ABSOLUTE MAXIMUM RATINGS

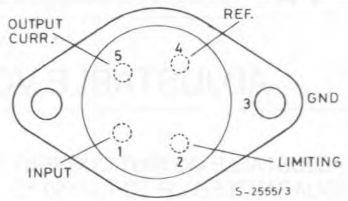
Symbol	Parameter	Value	Unit
V_i	DC Input Voltage	40	V
V_i	Peak Input Voltage (10 ms)	60	V
ΔV_{i-o}	Dropout Voltage	32	V
I_o	Output Current	internally limited	
P_{tot}	Power Dissipation	internally limited	
T_{stg}	Storage Temperature	– 55 to 150	°C
T_{op}	Operating Junction Temperature for L200C for L200	– 25 to 150 – 55 to 150	°C °C

THERMAL DATA

			TO–3	Pentawatt
$R_{th\ j-case}$	Thermal Resistance Junction-case	Max	4 °C/W	3 °C/W
$R_{th\ j-amb}$	Thermal Resistance Junction-ambient	Max	35 °C/W	50 °C/W

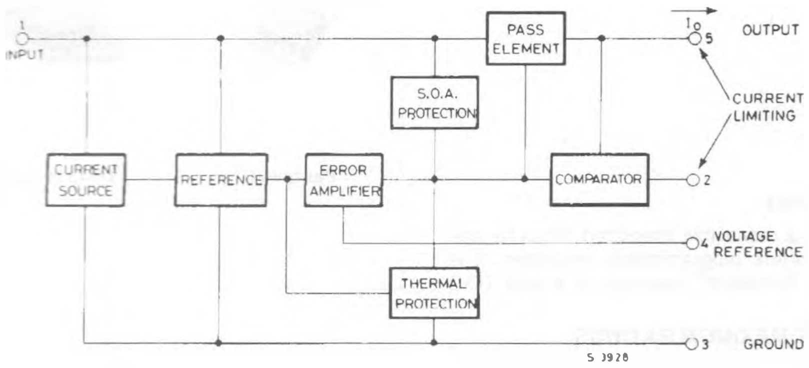
CONNECTION DIAGRAMS AND ORDER CODES (top views)





Type	Pentawatt®	TO–3
L200		L200 T
L200 C	L200 CH L200 CV	L200 CT

BLOCK DIAGRAM



APPLICATION CIRCUITS

Figure 1 : Programmable Voltage Regulator with Current Limiting.

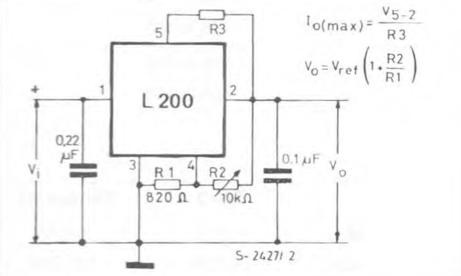
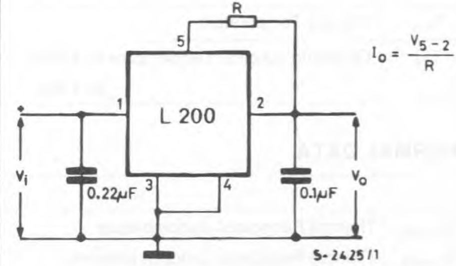
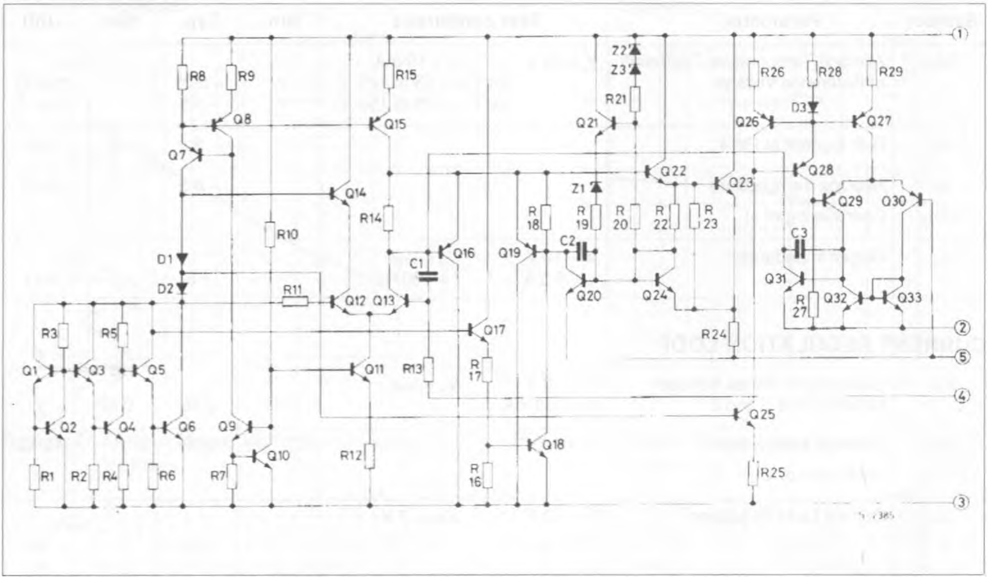


Figure 2 : Programmable Current Regulator.



SCHEMATIC DIAGRAM



ELECTRICAL CHARACTERISTICS (T_{amb} = 25 °C, unless otherwise specified)

VOLTAGE REGULATION LOOP

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_d	Quiescent Drain Current (pin 3)	V_i = 20 V		4.2	9.2	mA
e_N	Output Noise Voltage	$V_o = V_{ref}$ I_o = 10 mA B = 1 MHz		80		µV
V_o	Output Voltage Range	I_o = 10 mA	2.85		36	V
$\frac{\Delta V_o}{V_o}$	Voltage Load Regulation (note 1)	ΔI_o = 2 A ΔI_o = 1.5 A		0.15 0.1	1 0.9	% %
$\frac{\Delta V_i}{\Delta V_o}$	Line Regulation	V_o = 5 V V_i = 8 to 18 V	48	60		dB
SVR	Supply Voltage Rejection	V_o = 5 V I_o = 500 mA ΔV_i = 10 V_{pp} f = 100 Hz (note 2)	48	60		dB
ΔV_{i-o}	Droupout Voltage between Pins 1 and 5	I_o = 1.5 A $\Delta V_o \leq$ 2 %		2	2.5	V
V_{ref}	Reference Voltage (pin 4)	V_i = 20 V I_o = 10 mA	2.64	2.77	2.86	V

ELECTRICAL CHARACTERISTICS (continued)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
ΔV_{ref}	Average Temperature Coefficient of Reference Voltage	V_i = 20 V I_o = 10 mA for T_j = – 25 to 125 °C for T_j = 125 to 150 °C		– 0.25 – 1.5		mV/°C mV/°C
I_4	Bias Current at Pin 4			3	10	μA
$\frac{\Delta I_4}{\Delta T \cdot I_4}$	Average Temperature Coefficient (pin 4)			– 0.5		%/°C
Z_o	Output Impedance	V_i = 10 V $V_o = V_{ref}$ I_o = 0.5 A f = 100 Hz		1.5		mΩ

CURRENT REGULATION LOOP

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_{SC}	Current Limit Sense Voltage between Pins 5 and 2	V_i = 10 V $V_o = V_{ref}$ I_5 = 100 mA	0.38	0.45	0.52	V
$\frac{\Delta V_{SC}}{\Delta T \cdot V_{SC}}$	Average Temperature Coefficient of V_{SC}			0.03		%/°C
$\frac{\Delta I_o}{I_o}$	Current Load Regulation	V_i = 10 V ΔV_o = 3 V I_o = 0.5 A I_o = 1 A I_o = 1.5 A		1.4 1 0.9		% % %
I_{SC}	Peak Short Circuit Current	$V_i - V_o$ = 14 V (pins 2 and 5 short circuited)			3.6	A

Note 1 : A load step of 2 A can be applied provided that input-output differential voltage is lower than 20 V (see Figure 3)

Note 2 : The same performance can be maintained at higher output levels if a bypassing capacitor is provided between pins 2 and 4.

Figure 3 : Typical Safe Operating Area Protection.

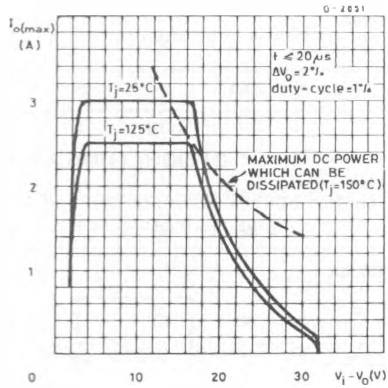


Figure 4 : Quiescent Current vs. Supply Voltage.

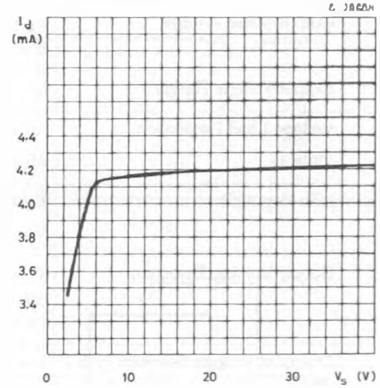


Figure 5 : Quiescent Current vs. Junction Voltage.

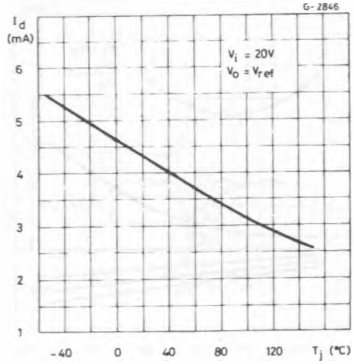


Figure 6 : Quiescent Current vs. Output Current.

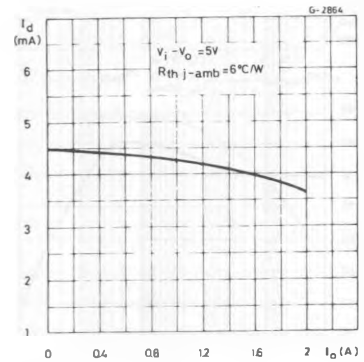


Figure 7 : Output Noise Voltage vs. Output Voltage.

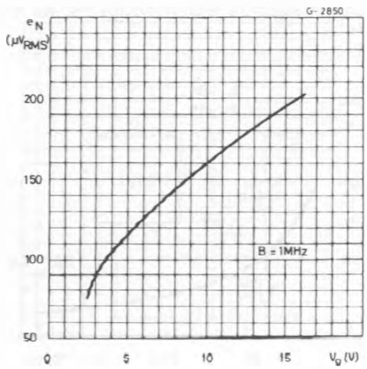


Figure 8 : Output Noise Voltage vs. Frequency.

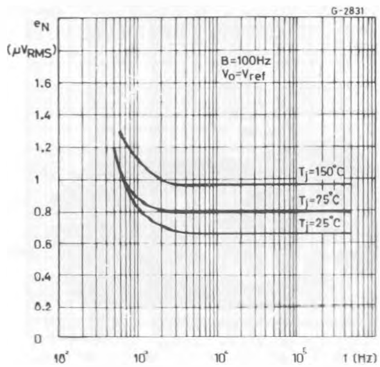


Figure 9 : Reference Voltage vs. Junction Temperature.

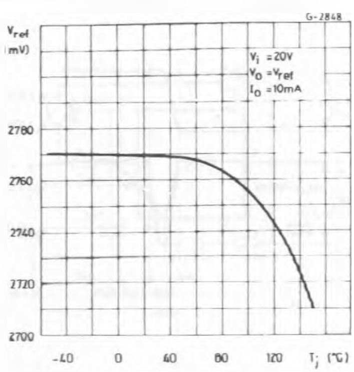


Figure 10 : Voltage Load Regulation vs. Junction Temperature.

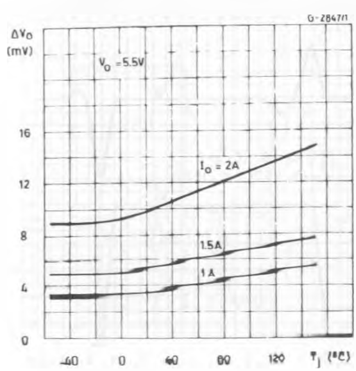


Figure 11 : Supply Voltage Rejection vs. Frequency.

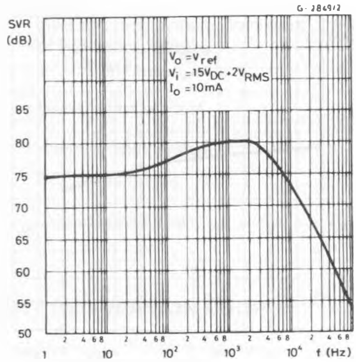


Figure 12 : Dropout Voltage vs. Junction Temperature.

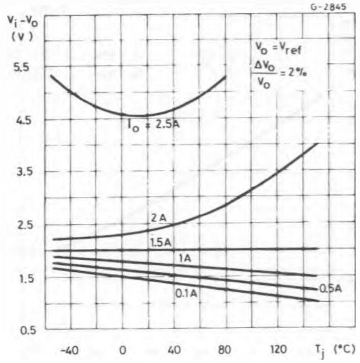


Figure 13 : Output Impedance vs. Frequency.

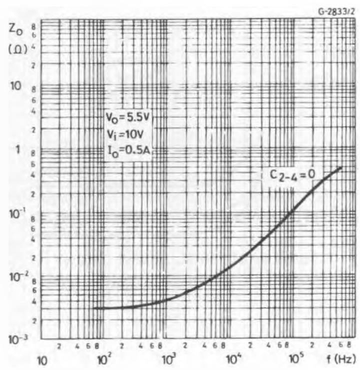


Figure 14 : Output Impedance vs. Output Current.

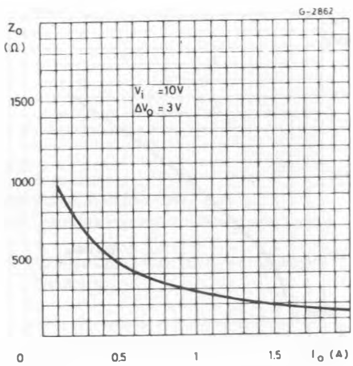


Figure 15 : Voltage Transient Response.

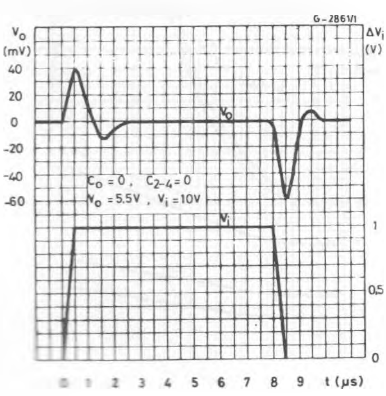


Figure 16 : Load Transient Response.

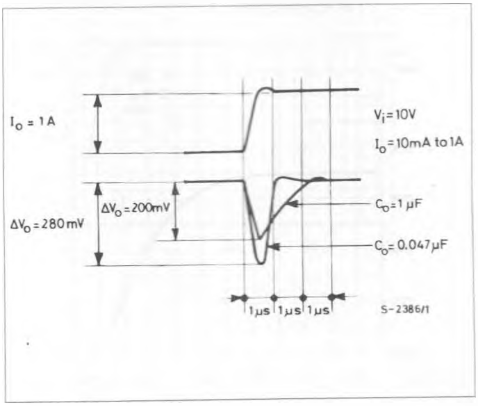


Figure 17 : Load Transient Response.

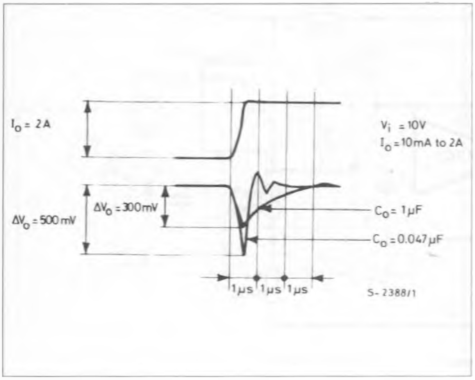
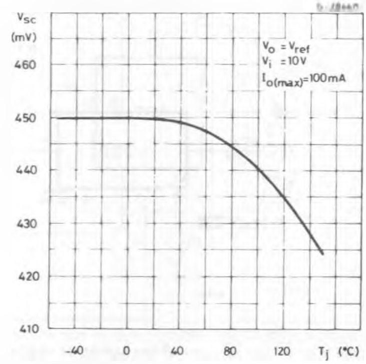


Figure 18 : Current Limit Sense Voltage vs. Junction Temperature.



APPLICATION CIRCUITS

Figure 19 : Programmable Voltage Regulator.

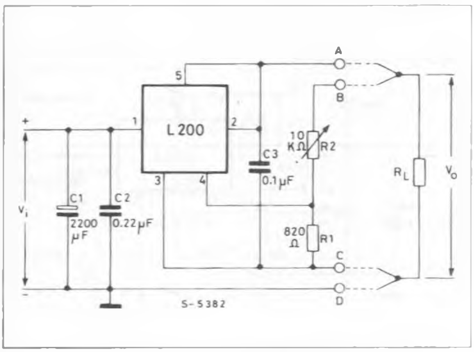


Figure 20 : P.C. Board and Components Layout of Figure 19.

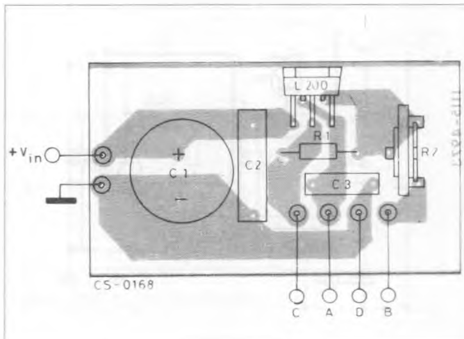


Figure 21 : High Current Voltage Regulator with Short Circuit Protection.

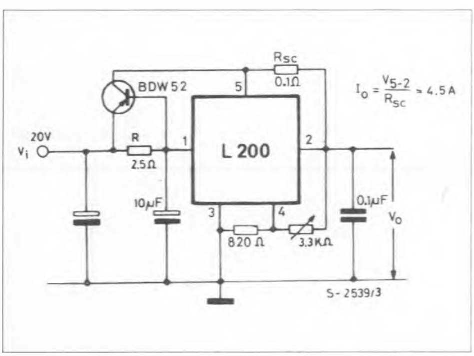


Figure 22 : Digitally Selected Regulator with Inhibit.

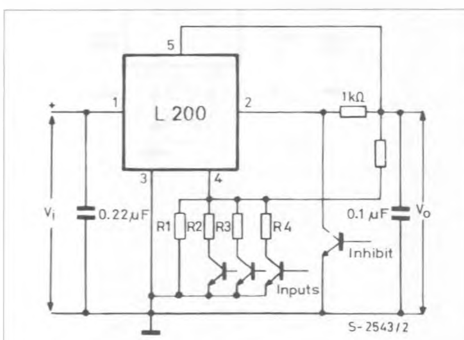
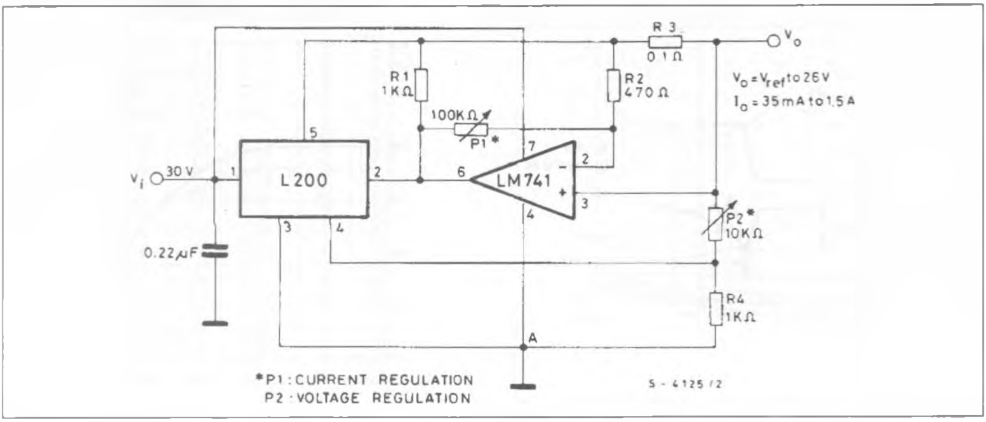


Figure 23 : Programmable Voltage and Current Regulator.



Note Connecting point A to a negative voltage (for example – 3 V/10 mA) it is possible to extend the output voltage range down to 0 V and to obtain the current limiting down to this level (output short-circuit condition).

Figure 24 : High Current Regulator with NPN Pass Transistor.

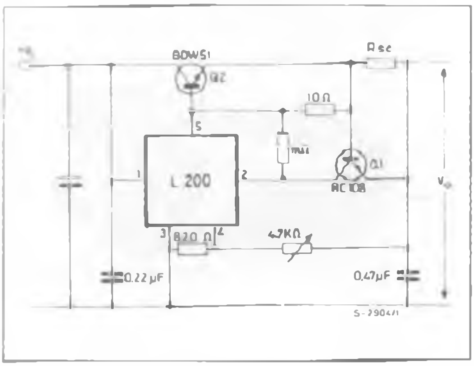
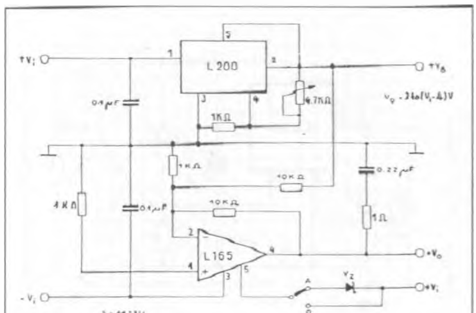


Figure 25 : High Current Tracking Regulator.



A : for $\pm 18 \leq V_i \leq \pm 32$

Note – V_z must be chosen in order to verify $2V_i - V_z \leq 36$ V

Figure 26 : High Input and Output Voltage.

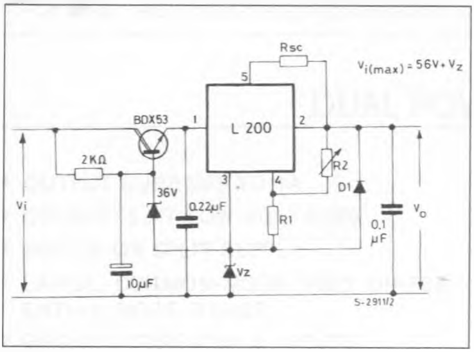
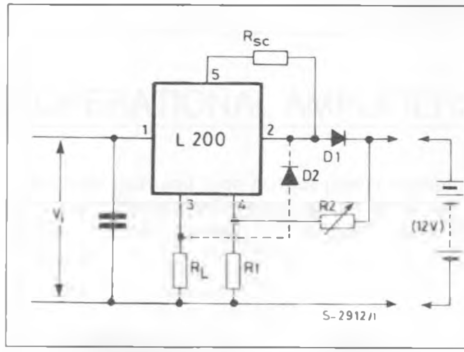


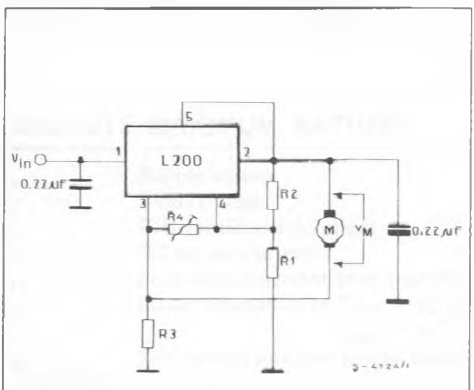
Figure 27 : Constant Current Battery Charger.



The resistors R_1 and R_2 determine the final charging voltage and R_{SC} the initial charging current. D_1 prevents discharge of the battery throught the regulator.

The resistor R_L limits the reverse currents through the regulator (which should be 100 mA max) when the battery is accidentally reverse connected. If R_L is in series with a bulb of 12 V/50 mA rating this will indicate incorrect connection.

Figure 28 : 30 W Motor Speed Control.



$R_3 = \frac{R_1}{R_2} \cdot R_M$

$V_M = V_{ref} \cdot (1 + \frac{R_2}{R_1})$

Figure 29 : Low Turn on.

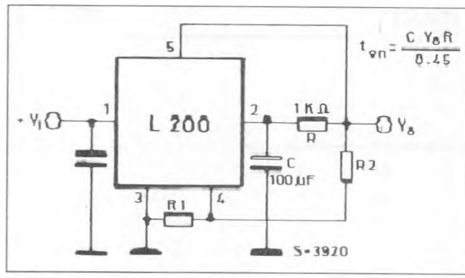


Figure 30 : Light Controller.