SGS L200

LINEAR INTEGRATED CIRCUIT

ADJUSTABLE VOLTAGE AND CURRENT REGULATOR

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

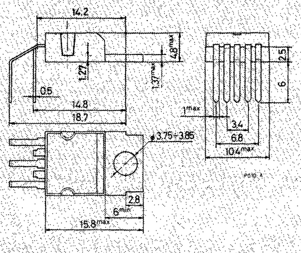
The L200 is a monolithic integrated circuit for voltage and current programmable regulation. It is available in Pentawatt® package or 4-lead TO-3 metal case. Current limiting, power limiting, thermal shutdown and input overvoltage protection (up to 60V) make the L200 virtually blowout proof. The L200 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.

ABSOLUTE MAXIMUM RATINGS

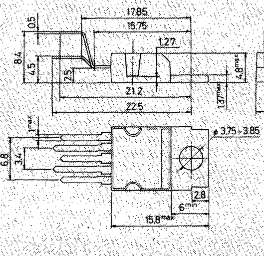
V_i	DC input voltage	40	V
V_i	Peak input voltage (10 ms)	60	V
ΔV_{i-o}	Dropout voltage	32	V
I_o	Output current	internally limited	
P_{tot}	Power dissipation	internally limited	
T_{stg}	Storage temperature	-55 to 150	°C
T_{op}	Operating junction temperature for L200C	-25 to 150	°C
	for L200	-55 to 150	°C

MECHANICAL DATA

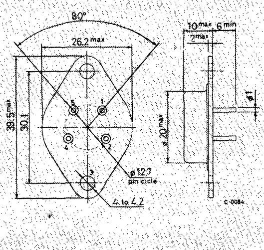
Dimensions in mm



Pentawatt H



Pentawatt V



TO-3

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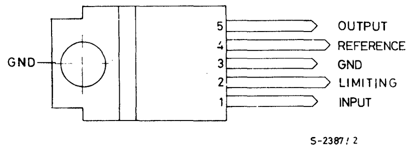
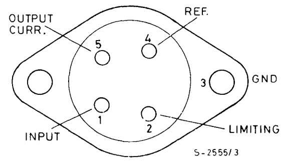
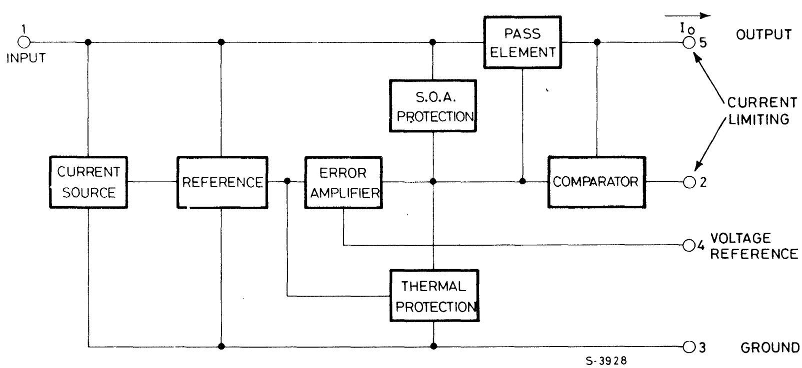
CONNECTION DIAGRAMS AND ORDERING NUMBERS
(top views)



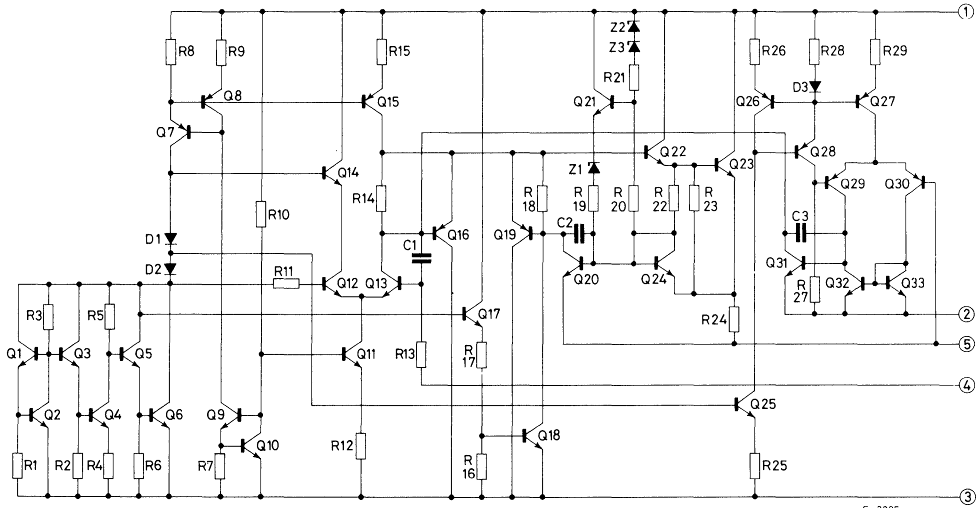


Type	Pentawatt®	TO-3
L 200		L 200 T
L 200 C	L 200 CH L 200 CV	L 200 CT

BLOCK DIAGRAM



SCHEMATIC DIAGRAM



S-2385

THERMAL DATA

			TO-3	Pentawatt®
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	4 °C/W	3 °C/W
$R_{th\ j\text{-}amb}$	Thermal resistance junction-ambient	max	35 °C/W	50 °C/W

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

Parameter		Test conditions	Min.	Typ.	Max.	Unit
VOLTAGE REGULATION LOOP						
I_d	Quiescent drain current (pin 3)	V_i = 20V		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= 2A ΔI_o= 1.5A		0.15 0.1	1 0.9	% %
$\frac{\Delta V_i}{\Delta V_o}$	Line regulation	V_o= 5V V_i = 8 to 18V	48	60		dB
SVR	Supply voltage rejection	V_o= 5V I_o= 500 mA ΔV_i= 10 V_{pp} f = 100 Hz (note 2)	48	60		dB

ELECTRICAL CHARACTERISTICS (continued)

Parameter		Test conditions	Min.	Typ.	Max.	Unit
ΔV_{i-o}	Droupout voltage between pins 1 and 5	I_o = 1.5A $\Delta V_o \leq$ 2%		2	2.5	V
V_{ref}	Reference voltage (pin 4)	V_i = 20V I_o = 10 mA	2.64	2.77	2.86	V
ΔV_{ref}	Average temperature coefficient of reference voltage	V_i = 20V 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 = 10V V_o= V_{ref} I_o= 0.5A f = 100 Hz		1.5		mΩ

CURRENT REGULATION LOOP

V_{SC}	Current limit sense voltage between pins 5 and 2	V_i = 10V 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 = 10V ΔV_o= 3V I_o = 0.5A I_o = 1A I_o = 1.5A		 1.4 1 0.9		 % % %
I_{sc}	Peak short circuit current	V_i - V_o = 14V (pins 2 and 5 short circuited)			3.6	A

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

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

Fig. 1 - Typical safe operating area protection

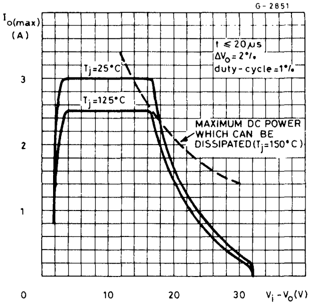


Fig. 2 - Quiescent current vs. supply voltage

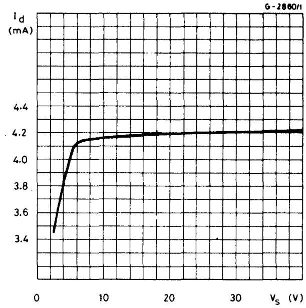


Fig. 3 - Quiescent current vs. junction temperature

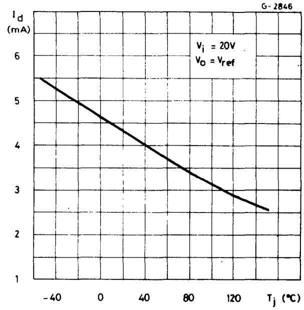


Fig. 4 - Quiescent current vs. output current

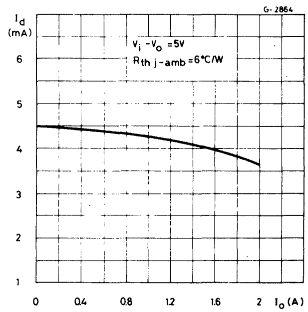


Fig. 5 - Output noise voltage vs. output voltage

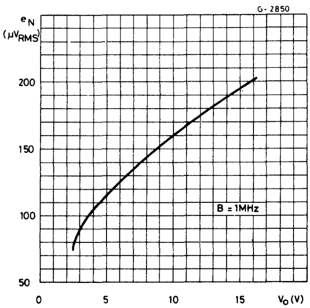


Fig. 6 - Output noise voltage vs. frequency

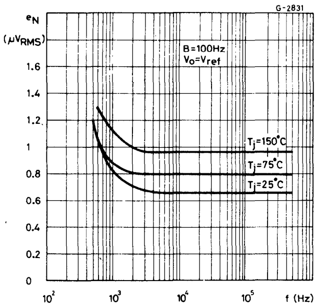


Fig. 7 - Reference voltage vs. junction temperature

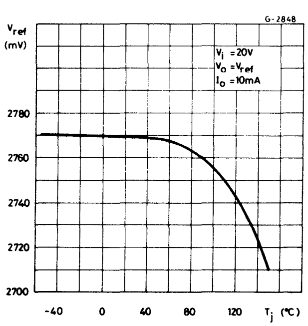


Fig. 8 - Voltage load regulation vs. junction temperature

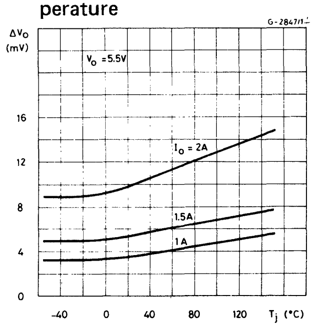


Fig. 9 - Supply voltage rejection vs. frequency

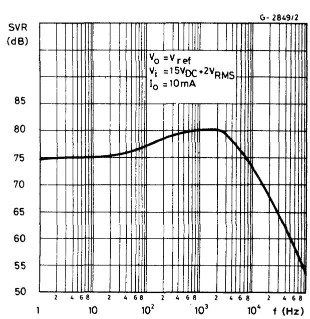


Fig. 10 - Dropout voltage vs. junction temperature

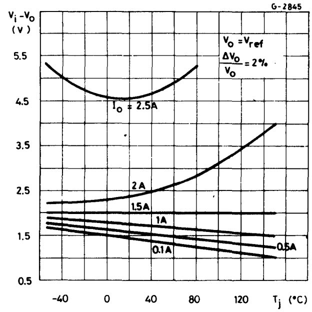


Fig. 11 - Output impedance vs. frequency

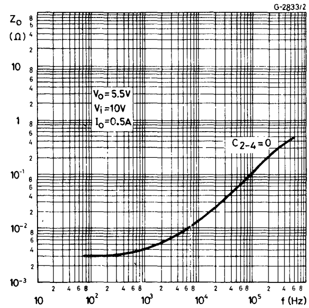


Fig. 12 - Output impedance vs. output current

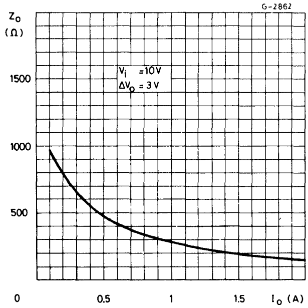


Fig. 13 - Voltage transient response

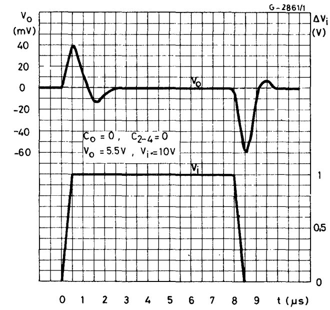


Fig. 14 - Load transient response

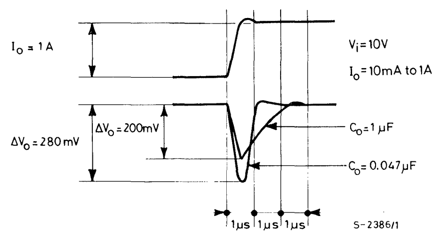


Fig. 15 - Load transient response

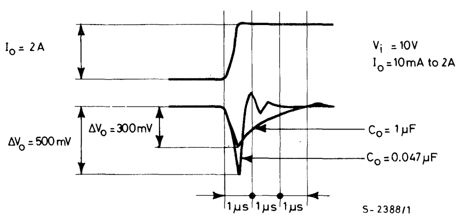
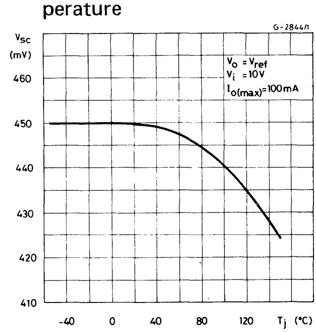


Fig. 16 - Current limit sense voltage vs. junction temperature



APPLICATION CIRCUITS

Fig. 17 - Programmable voltage regulator

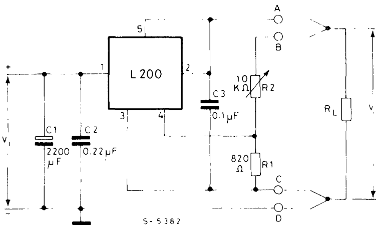


Fig. 18 - P.C. board and components layout of fig. 17 (1 : 1 scale)

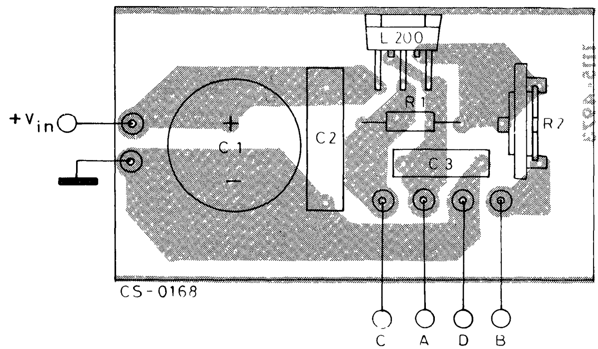


Fig. 19 - Programmable voltage regulator with current limiting

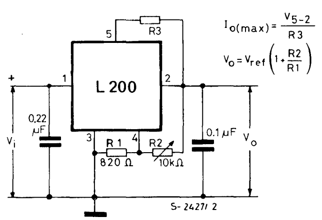


Fig. 20 - Programmable current regulator

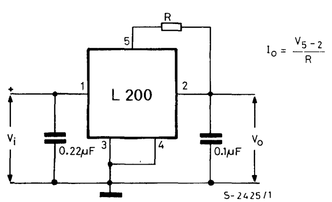


Fig. 21 - High current voltage regulator with short circuit protection

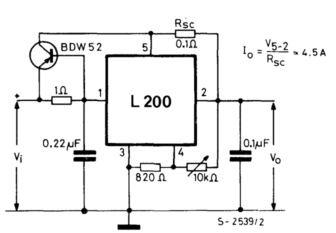
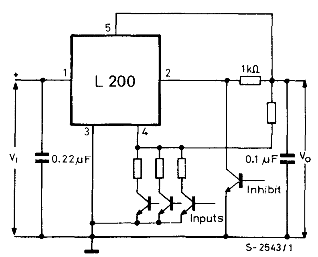
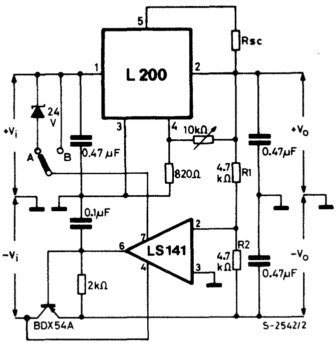


Fig. 22 - Digitally selected regulator with inhibit



APPLICATION CIRCUITS

Fig. 23 – Tracking voltage regulator



A : $V_{i(max)} \leqslant \pm 34V$; $3 < V_o < 30$.
B : $V_{i(max)} \leqslant \pm 22V$; $3 < V_o < 18$.

Fig. 24 – High current regulator with NPN pass transistor

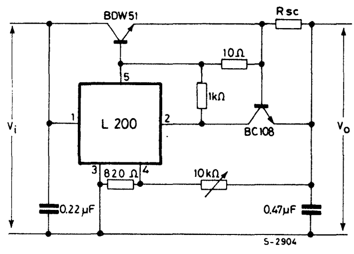
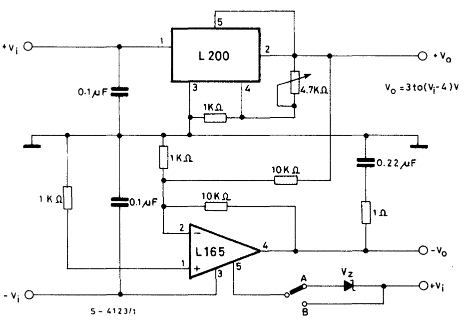


Fig. 25 – High current tracking regulator

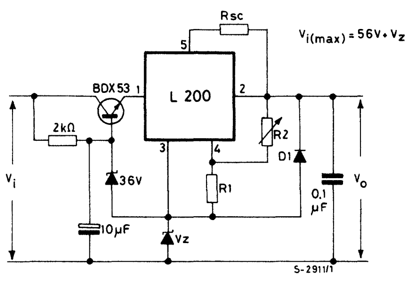


A: for $\pm 18 \leqslant V_i \leqslant \pm 32$

Note — V_Z must be chosen in order to verify $2\,V_i - V_Z \leqslant 36V$

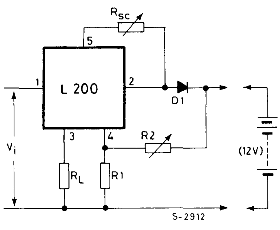
B: for $V_i \leqslant \pm 18V$

Fig. 26 – High input and output voltage



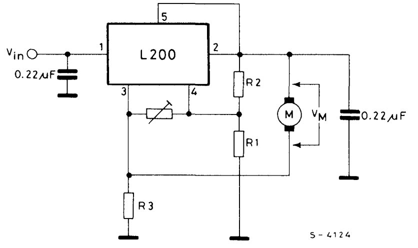
APPLICATION CIRCUITS (continued)

Fig. 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 12V/50 mA rating this will indicate incorrect connection.

Fig. 28 - 30W Motor speed control



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

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

Fig. 29 - Low turn on

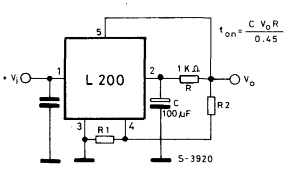
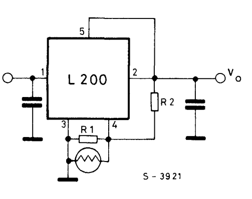
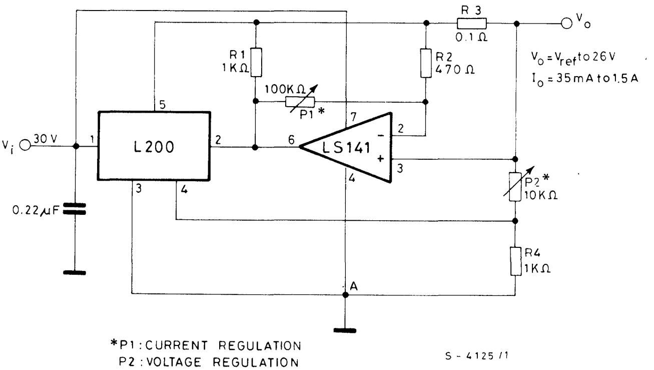


Fig. 30 - Light controller



APPLICATION CIRCUITS (continued)

Fig. 31 – Programmable voltage and current regulator



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

NOTE – For a more detailed description of the L200 and its applications refer to SGS-TECHNICAL NOTES TN146 and TN150.