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September 2014

LM350
3-Terminal 3 A Positive Adjustable Regulator

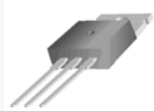
Features

- Output Adjustable Between 1.2 V and 33 V
- Guaranteed 3 A Output Current
- Internal Thermal Overload Protection
- Load Regulation (Typical: 0.1%)
- Line Regulation (Typical: 0.015%/V)
- Internal Short-Circuit Current Limit
- Output Transistor Safe-Area Compensation

Description

The LM350 is an adjustable 3-terminal positive voltage regulator capable of supplying in excess of 3.0 A over an output voltage range of 1.2 V to 33 V.

TO-220 (Single Gauge)



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1. Adj 2. Output 3. Input

Ordering Information

Product Number	Marking	Package	Packing Method	Operating Temperature
LM350T	LM350	TO-220 3L (Single Gauge)	Rail	0 to +125°C

Block Diagram

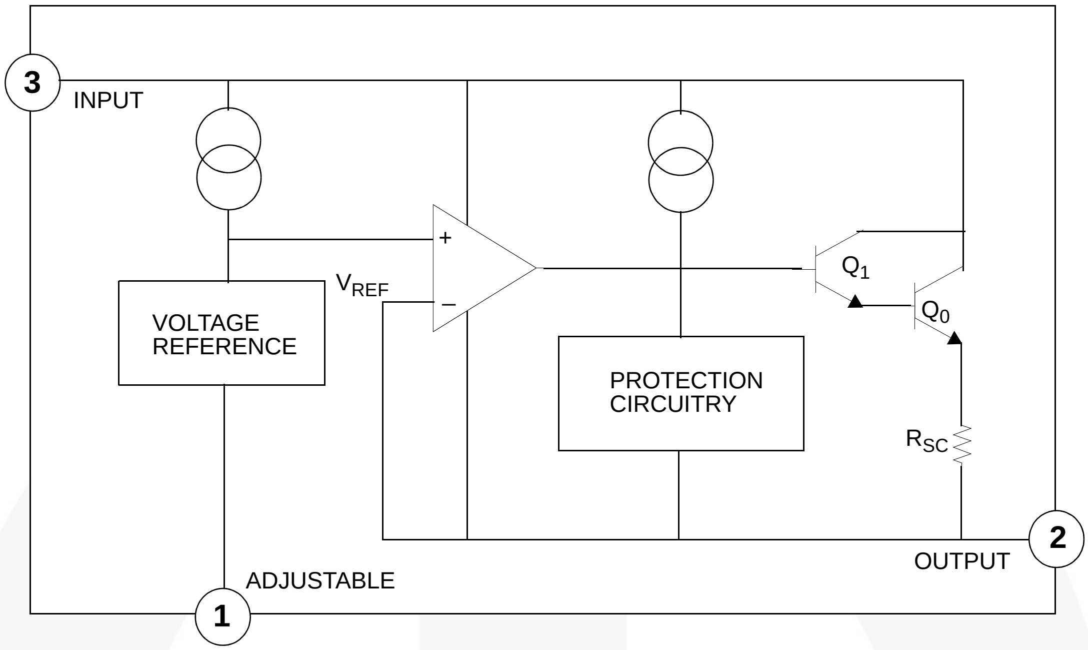

Figure 1. Block Diagram

Absolute Maximum Ratings

Stresses exceeding the absolute maximum ratings may damage the device. The device may not function or be operable above the recommended operating conditions and stressing the parts to these levels is not recommended. In addition, extended exposure to stresses above the recommended operating conditions may affect device reliability. The absolute maximum ratings are stress ratings only. Values are at T_A = 25°C unless otherwise noted.

Symbol	Parameter	Value	Unit
V_I - V_O	Input-Output Voltage Differential	35	V
T_{LEAD}	Lead Temperature (Soldering, 10 sec)	300	°C
T_{OPR}	Operating Temperature Range	0 to +125	°C
T_{STG}	Storage Temperature Range	-65 to +150	°C

Thermal Characteristics

Values are at T_A = 25°C unless otherwise noted.

Symbol	Parameter	Value	Unit
P_D	Power Dissipation	Internally Limited	W

Electrical Characteristics

V_I - V_O = 5 V, I_O = 1.5 A, 0°C ≤ T_J ≤ +125°C, P_D ≤ P_{DMAX}, unless otherwise specified.

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
Rline	Line Regulation[1]	T_A = +25°C, 3 V ≤ V_I - V_O ≤ 35 V		0.015	0.030	%/V
Rload	Load Regulation[1]	T_A = +25°C, 3 V ≤ V_I - V_O ≤ 35 V, V_O ≤ 5V		5	25	mV
		T_A = +25°C, 3 V ≤ V_I - V_O ≤ 35 V, V_O ≥ 5V		0.1	0.5	%
I_{ADJ}	Adjustment Pin Current	-		50	100	µA
ΔI_{ADJ}	Adjustment Pin Current Change	3 V ≤ V_I - V_O ≤ 35 V, 10 mA ≤ I_O ≤ 3 A, P_D ≤ P_{MAX}		0.2	5.0	µA
REG_T	Thermal Regulation	Pulse = 20 ms, T_A = +25°C		0.002		%/W
V_{REF}	Reference Voltage	3 V ≤ V_I - V_O ≤ 35 V, 10 mA ≤ I_O ≤ 3 A, P_D ≤ 30 W	1.20	1.25	1.30	V
Rline	Line Regulation	3.0 V ≤ V_I - V_O ≤ 35 V		0.02	0.07	%/W
Rload	Load Regulation	10 mA ≤ I_O ≤ 3.0 A, V_O ≤ 5.0 V		20	70	mV
		10 mA ≤ I_O ≤ 3.0 A, V_O ≥ 5.0 V		0.3	1.5	%
ST_T	Temperature Stability	T_J = 0°C to +125°C		1.0		%
$I_{O(MAX)}$	Maximum Output Current	V_I - V_O ≤ 10 V, P_D ≤ P_{MAX}	3.0	4.5		A
		V_I - V_O = 30 V, P_D ≤ P_{MAX}, T_A = +25°C	0.25	1.0		
$I_{L(MIN)}$	Minimum Load Current	V_I - V_O = 35 V		3.5	10	mA
V_N	RMS Noise, %of V_{OUT}	10 Hz ≤ f ≤ 10 kHz, T_A = +25°C		0.003		%/V_o
RR	Ripple Rejection	V_O = 10 V, f = 120 Hz, C_{ADJ} = 0		65		dB
		V_O = 10 V, f = 120 Hz, C_{ADJ} = 10 µF	66	80		
ST	Long-Term Stability	T_J = +125°C		0.3	1	%/ 1000HR

Note:

1. Regulation is measured at constant junction temperature. Changes in output voltage due to heating effects must be taken into account separately. Pulse testing with low duty cycle is used.

Typical Performance Characteristics

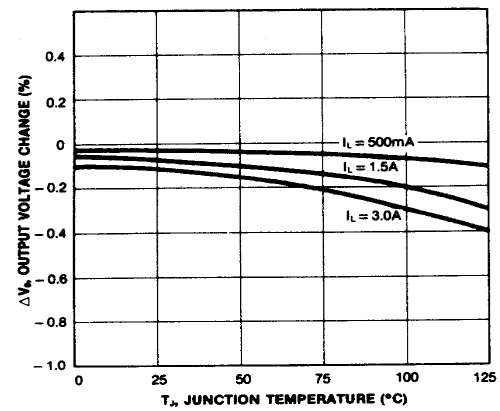

Figure 2. Load Regulation

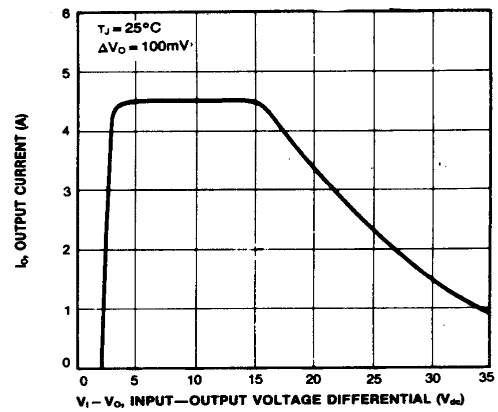

Figure 3. Current Limit

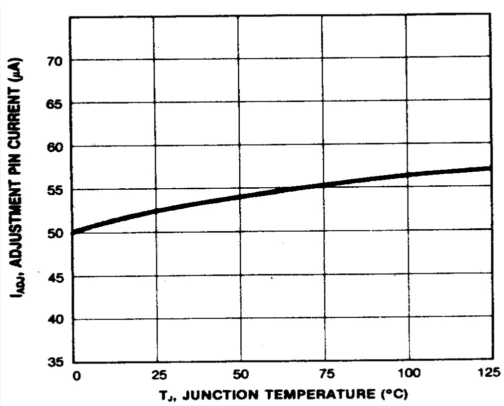

Figure 4. Adjustment Pin Current

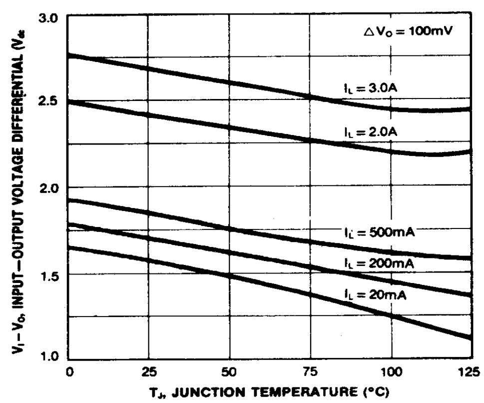

Figure 5. Dropout Voltage

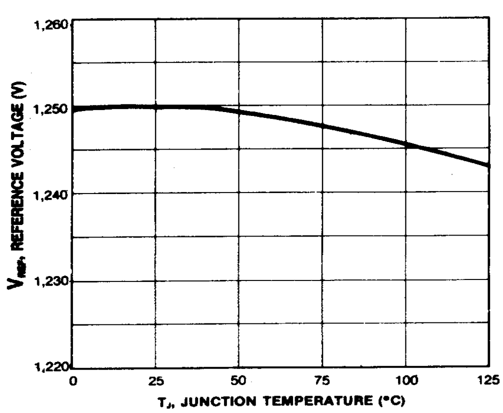

Figure 6. Temperature Stability

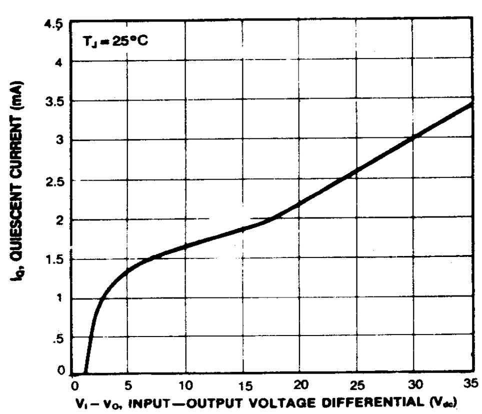

Figure 7. Minimum Load Current

Typical Performance Characteristics (Continued)

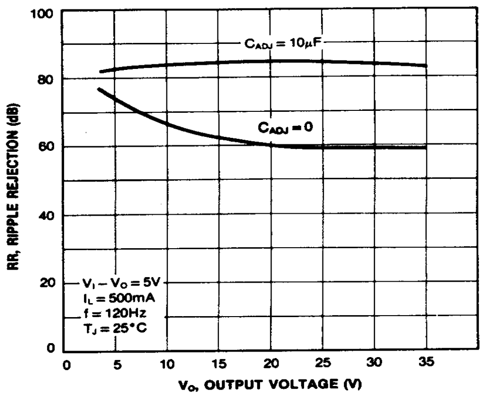

Figure 8. Ripple Rejection vs. V_O

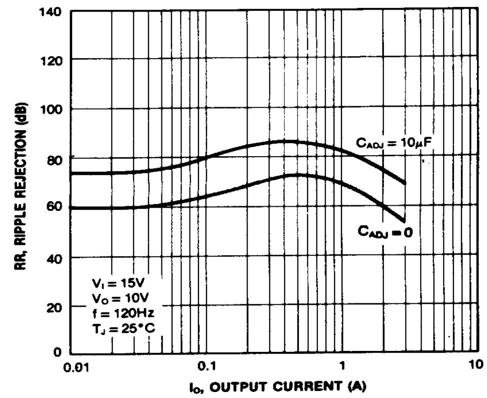

Figure 9. Ripple Rejection vs. I_O

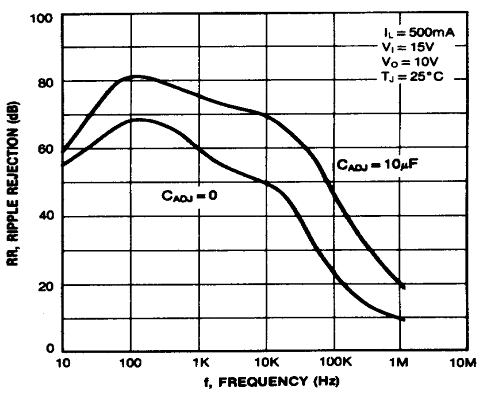

Figure 10. Ripple Rejection vs Frequency

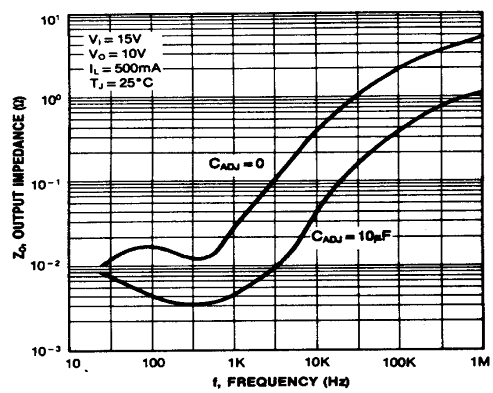

Figure 11. Output Impedan

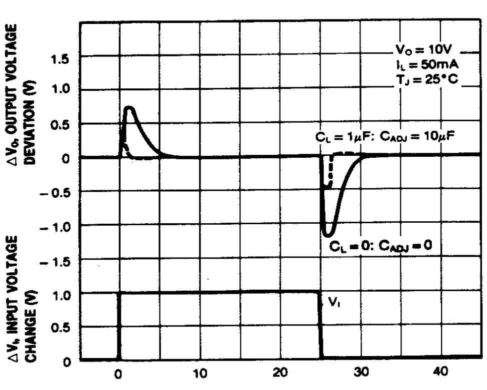

Figure 12. Line Transient Response

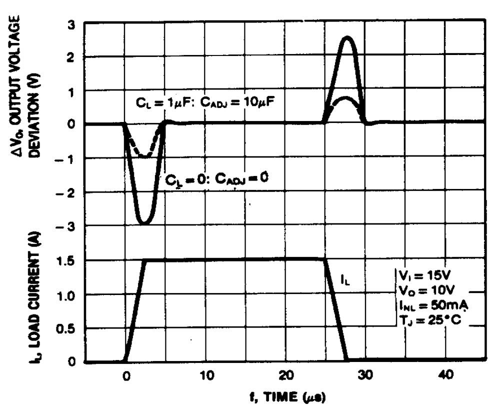

Figure 13. Load Transient Response

Typical Application[2]

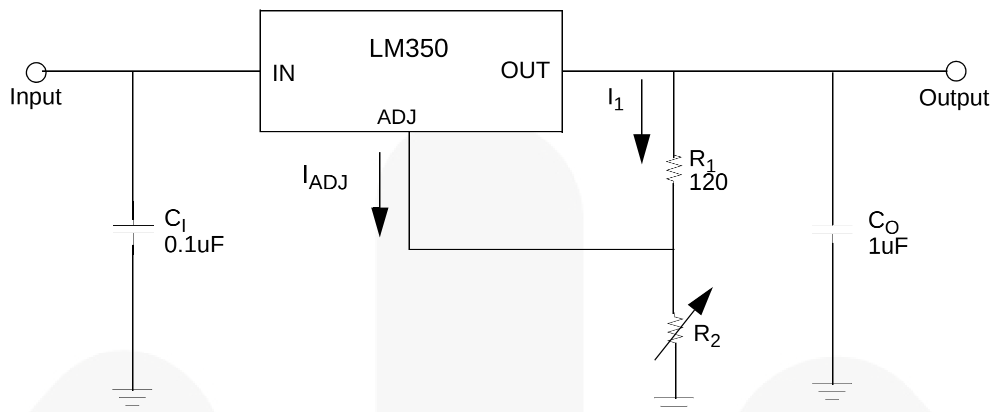

Figure 14.

Note:

2. C_I: C_I is required if the regulator is located an appreciable distance from power supply filter.
   C_O: Output capacitors in the range of 1 μF to 100 μF of aluminum or tantalum electronic are commonly used to provide improved output impedance and rejection of transients.

In operation, the LM350 develops a nominal 1.25 V reference voltage, V_{REF}, between the output and adjustment terminal. The reference voltage is impressed across program resistor R_1 and, since the voltage is constant, a constant current I_1 then flows through the output set resistor R_2, giving an output voltage of

$$V_O = 1.25\ V(1+R_2/R_1) + I_{ADJ}\ R_2$$

Since I_{ADJ} current (less than 100 mA) from the adjustment terminal represents an error term, the LM350 was designed to minimize I_{ADJ} and make it very constant with line and load changes. To do this, all quiescent operating current is returned to the output establishing a minimum load current requirement. If there is insufficient load on the output, the output voltage will rise. Since the LM350 is a floating regulator, it is only the voltage differential across the circuit which is important to performance, and operation at high voltage with respect to ground is possible.
Since I_{ADJ} is controlled to less than 100 mA, the error associated with this term is negligible in most applications.

Physical Dimensions

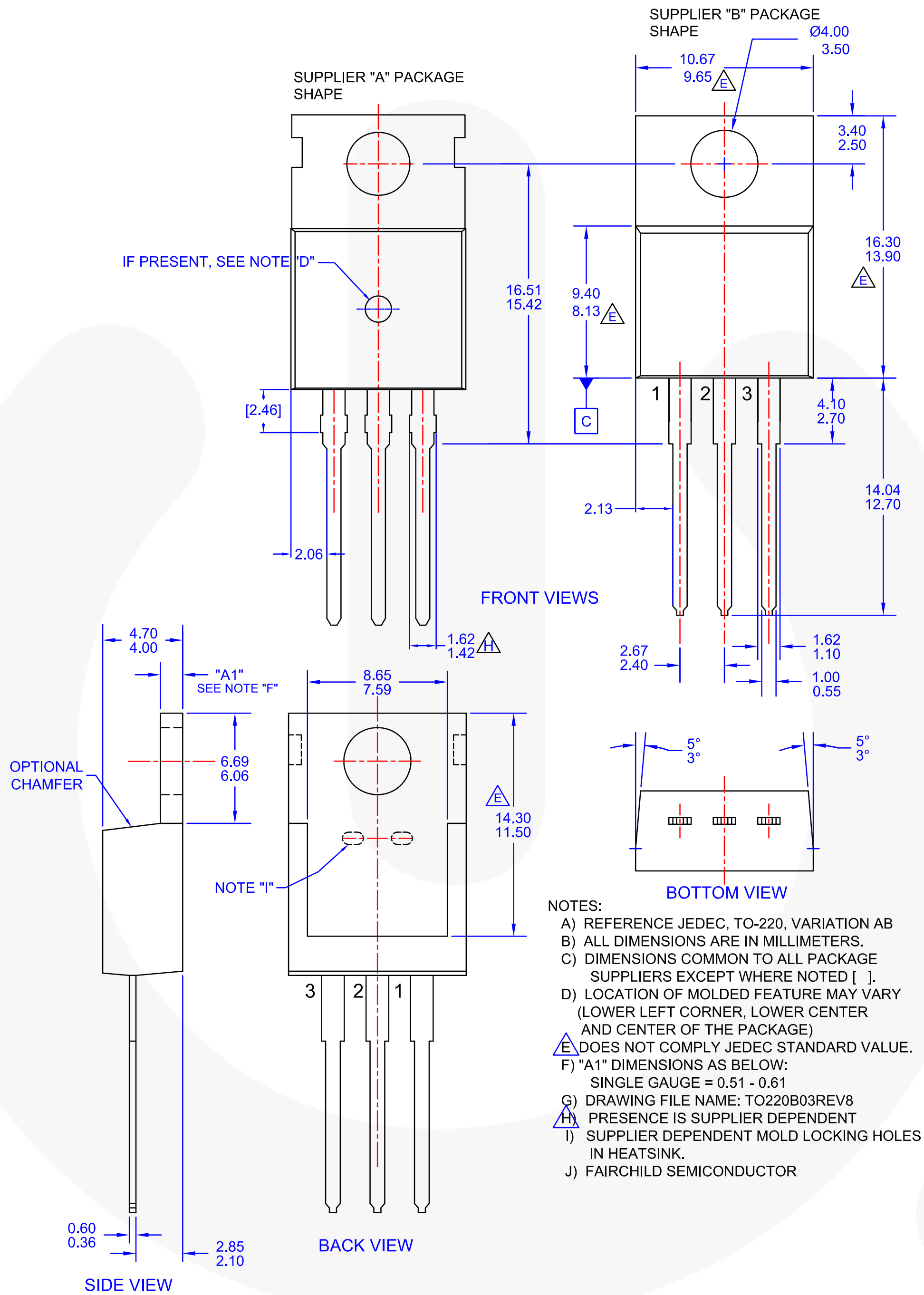

Figure 15. TO-220, MOLDED, 3LEAD, JEDEC VARIATION AB

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