TYPE LM350
3-AMP ADJUSTABLE REGULATOR

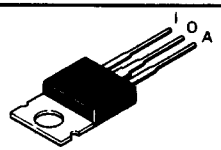
D2716, MARCH 1983—REVISED NOVEMBER 1983

- **Adjustable Output . . . 1.2 V to 33 V**
- **3-A Output Current Capability**
- **Line Regulation . . . 0.005%/V Typ**
- **Load Regulation . . . 0.1% Typ**
- **Current Limit Constant with Temperature**
- **Guaranteed Thermal Regulation**
- **Direct Replacement for National Semiconductor LM350**

KC PACKAGE
(TOP VIEW)

THE OUTPUT TERMINAL IS IN ELECTRICAL CONTACT WITH THE MOUNTING BASE

TO-220AB



description

The LM350 is an adjustable 3-terminal positive-voltage regulator capable of supplying 3 amperes over an output voltage range of 1.2 volts to 33 volts. The device is easy to use and requires only two external resistors to set the output voltage. Both input and output regulation are better than standard fixed regulators.

In addition to higher performance than fixed regulators, the LM350 offers full overload protection available only in integrated circuits. Included on the chip current limit, thermal overload protection, and safe-area protection. All overload protection circuitry remains fully functional even if the adjustment terminal is disconnected. Normally, no capacitors are needed unless the device is situated far from the input filter capacitors in which case an input bypass is needed. An optional output capacitor can be added to improve transient response. The adjustment terminal can be bypassed to achieve very high ripple rejection, which is difficult to achieve with standard 3-terminal regulators.

Besides replacing fixed regulators, the LM350 is useful in a wide variety of other applications. Even though the regulator is floating and sees only the input-to-output differential voltage, use of these devices to regulate voltages that would cause the maximum-rated differential voltage to be exceeded if the output became shorted to ground is not recommended. The TL783 or TL783A is recommended for output voltages exceeding 33 volts. The primary application of the LM350 is that of a programmable output regulator, but by connecting a fixed resistor between the adjustment terminal and the output terminal, this device can be used as a precision current regulator. Supplies with electronic shutdown can be achieve by clamping the adjustment terminal to ground, which programs the output to 1.2 volts where most loads draw little current.

The LM350 is characterized for operation from 0°C to 125°C.

ADVANCE INFORMATION

This document contains information on a new product.

TEXAS

absolute maximum ratings over operating temperature range (unless otherwise noted)

Input-to-output differential voltage	35 V
Continuous total power dissipation at 25°C free-air temperature (see Note 1)	2 W
Continuous total power dissipation at (or below) 25°C case temperature (see Note 1)	30 W
Operating free-air, case, or virtual junction temperature range	−55°C to 150°C
Storage temperature range	−65°C to 150°C
Lead temperature 1,6 mm (1/16 inch) from case for 60 seconds	260°C

NOTE 1: For operation above 25°C free-air or case temperature, refer to Figures 1 and 2. To avoid exceeding the design maximum virtual junction temperature, these ratings should not be exceeded. Due to variations in individual device electrical characteristics and thermal resistance, the built-in thermal overload protection may be activated at power levels slightly above or below the rated dissipation.

recommended operating conditions

	MIN	MAX	UNIT
Output current, I_O		3	A
Operating virtual junction temperature, T_J	0	125	°C

electrical characteristics over recommended ranges of operating virtual junction temperature, $V_I - V_O = 5$ V, $I_O = 1.5$ A (unless otherwise noted)

PARAMETER	TEST CONDITIONS		MIN	TYP	MAX	UNIT
Input regulation (see Note 2)	$V_I - V_O$ = 3 V to 35 V, See Note 3	T_J = 25°C		0.005	0.03	%/V
		T_J = 0°C to 125°C		0.02	0.07	
Ripple rejection	V_O = 10 V,	f = 120 Hz		65		dB
	V_O = 10 V, 10-μF capacitor between ADJ and ground	f = 120 Hz,	66			
Output regulation	I_O = 10 mA to 3 A, T_J = 25°C, See Note 3	$V_O \le 5$ V		5	25	mV
		$V_O > 5$ V		0.1	0.5	%
	I_O = 10 mA to 3 A, See Note 3	$V_O \le 5$ V		20	70	mV
		$V_O > 5$ V		0.3	1.5	%
Output voltage change with temperature	T_J = 0°C to 125°C			1		%
Thermal regulation	t_W = 20 ms			0.002	0.03	%/W
Output voltage long-term drift (see Note 4)	After 1000 h at T_J = 125°C			0.3	1	%
Output noise voltage	f = 10 Hz to 10 kHz,	T_J = 25°C		0.003		%
Minimum output current to maintain regulation	$V_I - V_O$ = 35 V			3.5	10	mA
Peak output current	$V_I - V_O \le 10$ V		3	4.5		A
	$V_I - V_O$ = 30 V,	T_J = 25°C	0.25	1		
Adjustment-terminal current				50	100	μA
Change in adjustment-terminal current	$V_I - V_O$ = 3 V to 35 V, I_O = 10 mA to 3 A			0.2	5	μA
Reference voltage (output to ADJ)	$V_I - V_O$ = 3 V to 35 V, I_O = 10 mA to 3 A,	P ≤ 30 W	1.2	1.25	1.3	V

NOTES: 2. Input regulation is expressed as the percentage change in output voltage per 1-volt change at the input.
3. Input regulation and output regulation are measured using pulse techniques ($t_W \le 10$ μs, duty cycle ≤ 5%) to limit changes in average internal dissipation. Output voltage changes due to large changes in internal dissipation must be taken into account separately.
4. Since long-term drift cannot be measured on the individual devices prior to shipment, this specification is not intended to be a guarantee or warranty. It is an engineering estimate of the average drift to be expected from lot to lot.

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THERMAL INFORMATION

FREE-AIR TEMPERATURE
DISSIPATION DERATING CURVE

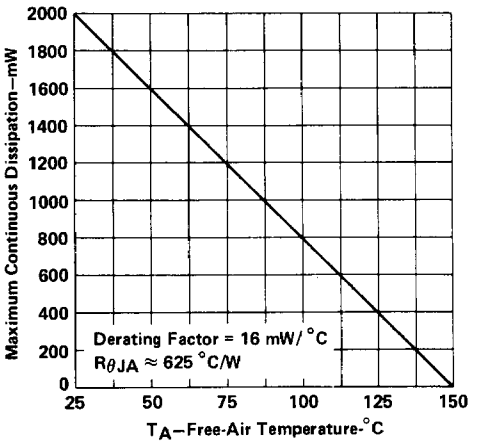


FIGURE 1

CASE TEMPERATURE
DISSIPATION DERATING CURVE

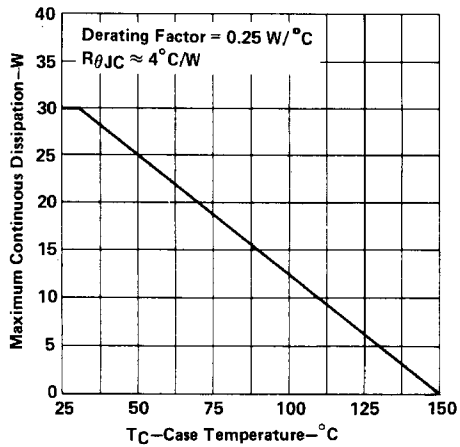


FIGURE 2

TYPICAL CHARACTERISTICS

OUTPUT VOLTAGE DEVIATION
vs
VIRTUAL JUNCTION TEMPERATURE

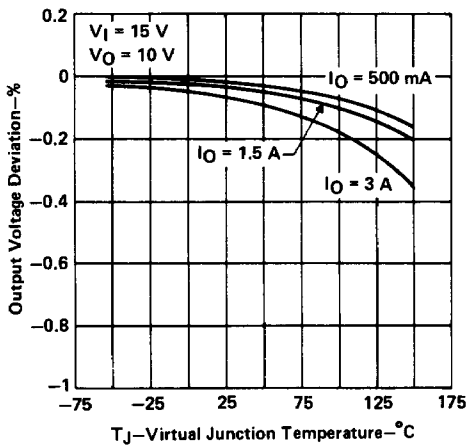


FIGURE 3

OUTPUT CURRENT
vs
INPUT-OUTPUT DIFFERENTIAL VOLTAGE

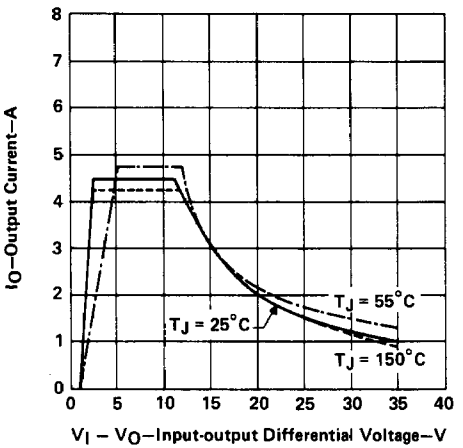


FIGURE 4

TYPICAL CHARACTERISTICS

ADJUSTMENT CURRENT
vs
VIRTUAL JUNCTION TEMPERATURE

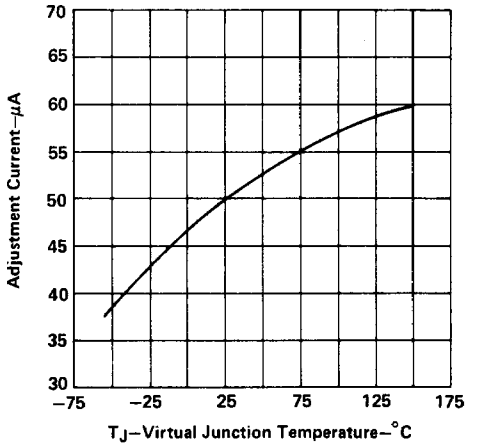


FIGURE 5

REFERENCE VOLTAGE
vs
VIRTUAL JUNCTION TEMPERATURE

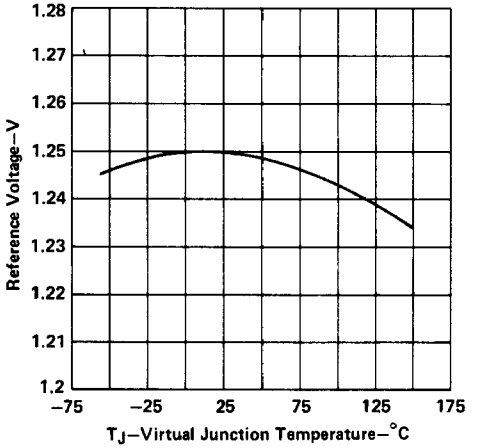
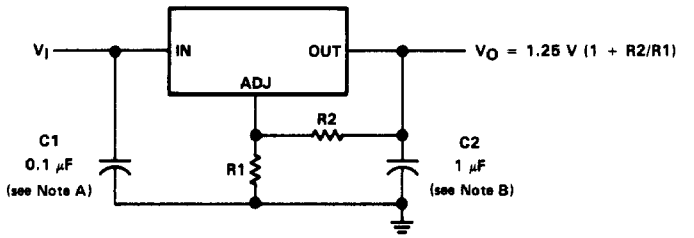


FIGURE 6

TYPICAL APPLICATION DATA



NOTES: A. Capacitor C1 is required if regulator is not located in close proximity to the power supply amplifier.
B. Capacitor C2 may be used to improve transient response.

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