

# LM2930-5, LM2930-8 3-TERMINAL POSITIVE REGULATORS

D2733, APRIL 1983—REVISED AUGUST 1991

- Input-Output Differential Less Than 0.6 V
- Output Current of 150 mA
- Reverse Battery Protection
- Line Transient Protection
- 40-V Load-Dump Protection
- Internal Short Circuit Current Limiting
- Internal Thermal Overload Protection
- Mirror-Image Insertion Protection
- Direct Replacement for National LM2930 Series

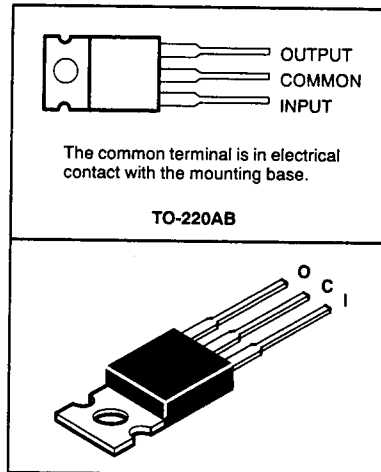
## description

The LM2930-5 and LM2930-8 are 3-terminal positive regulators that provide fixed 5-V and 8-V regulated outputs. Each features the ability to source 150 mA of output current with an input-output differential of 0.6 V or less. Familiar regulator features such as current limit and thermal overload protection are also provided.

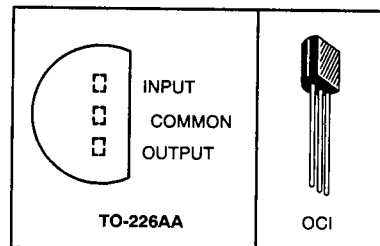
The LM2930 series has low voltage dropout, making it useful for certain battery applications. For example, the low voltage dropout feature allows a longer battery discharge before the output falls out of regulation; the battery supplying the regulator input voltage may discharge to 5.6 V and still properly regulate the system and load voltage. Supporting this feature, the LM2930 series protects both itself and the regulated system from reverse battery installation or 2-battery jumps.

Other protection features include line transient protection for load dump of up to 40 V. In this case, the regulator shuts down to avoid damaging internal and external circuits. The LM2930 series regulator cannot be harmed by temporary mirror-image insertion.

KC PACKAGE  
(TOP VIEW)

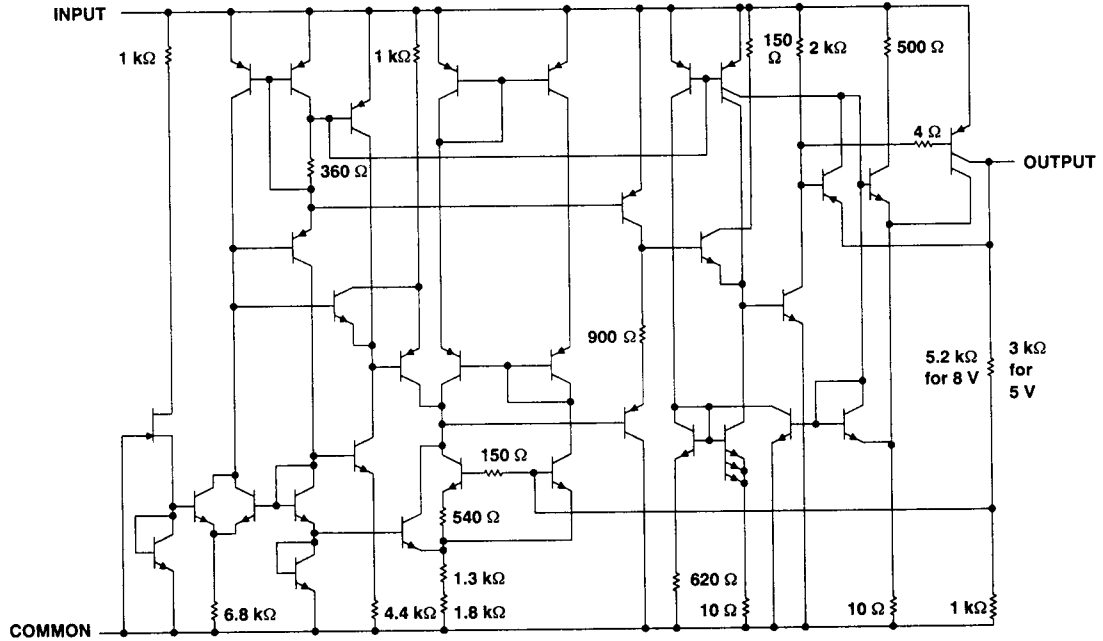


LP  
SILECT PACKAGE  
(TOP VIEW)



**LM2930-5, LM2930-8  
3-TERMINAL POSITIVE REGULATORS**

**schematic diagram**



All component values are nominal.

**absolute maximum ratings over operating free-air temperature ranges (unless otherwise noted)**

Continuous input voltage	26 V
Transient input voltage: t = 1 s	40 V
Continuous reverse input voltage	-6 V
Transient reverse input voltage: t = 100 ms	-12 V
Continuous total dissipation (see Note 1)	See Dissipation Rating Tables 1 and 2
Operating free-air, case, or virtual junction temperature	-40°C to 150°C
Storage temperature range	-65°C to 150°C
Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds	260°C

NOTE 1: To avoid exceeding the design maximum virtual junction temperature, these ratings should not be exceeded. Due to variation 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.



# LM2930-5, LM2930-8 3-TERMINAL POSITIVE REGULATORS

**DISSIPATION RATING TABLE 1 – FREE-AIR TEMPERATURE**

PACKAGE	$T_A \leq 25^\circ\text{C}$ POWER RATING	DERATING FACTOR	DERATE ABOVE $T_A$	$T_A = 70^\circ\text{C}$ POWER RATING
KC	2000 mW	16 mW/°C	25°C	1280 mW
LP	775 mW	6.2 mW/°C	25°C	496 mW

**DISSIPATION RATING TABLE 2 – CASE TEMPERATURE**

PACKAGE	$T_A \leq 25^\circ\text{C}$ POWER RATING	DERATING FACTOR	DERATE ABOVE $T_C$	$T_C = 125^\circ\text{C}$ POWER RATING
KC	20 W	0.25 W/°C	70°C	6.25 W
LP	1600 mW	28.6 mW/°C	94°C	715 mW

### recommended operating conditions

	MIN	MAX	UNIT
$I_O$ Output current		150	mA
$T_J$ Operating virtual junction temperature	-40	125	°C

### LM2930-5 electrical characteristics at 25°C virtual junction temperature, $V_I = 14\text{ V}$ , $I_O = 150\text{ mA}$ (unless otherwise noted)

PARAMETER	TEST CONDITIONS†	MIN	TYP	MAX	UNIT
Output voltage	$V_I = 6\text{ V to }26\text{ V}$ , $T_J = -40^\circ\text{C to }125^\circ\text{C}$ , $I_O = 5\text{ mA to }150\text{ mA}$ ,	4.5	5	5.5	V
Input regulation	$I_O = 5\text{ mA}$		7	25	mV
	$V_I = 9\text{ V to }16\text{ V}$		30	80	
	$V_I = 6\text{ V to }26\text{ V}$				
Ripple rejection	$f = 120\text{ Hz}$		56		dB
Output regulation	$I_O = 5\text{ mA to }150\text{ mA}$		14	50	mV
Output voltage long-term drift‡	After 1000 hours at $T_J = 125^\circ\text{C}$		20		mV
Dropout voltage	$I_O = 150\text{ mA}$		0.32	0.6	V
Output noise voltage	$f = 10\text{ Hz to }100\text{ kHz}$		60		µV
Output voltage during line transients	$V_I = -12\text{ V to }40\text{ V}$ , $R_L = 100\ \Omega$	-0.3		5.5	V
Output impedance	$I_O = 100\text{ mA}$ , $I_O = 10\text{ mA (rms)}$ , 100 Hz to 10 kHz		200		mΩ
Bias current	$I_O = 10\text{ mA}$		4	7	mA
	$I_O = 150\text{ mA}$		18	40	
Peak output current		150	300	700	mA

† Pulse-testing techniques are used to maintain the junction temperature as close to the ambient temperature as possible. Thermal effects must be taken into account separately. All characteristics are measured with a 0.1-µF capacitor across the input and a 10-µF capacitor across the output.

‡ Since long-term drift cannot be measured on the individual devices prior to shipment, this specification is intended to be an engineering estimate of the average drift to be expected from lot to lot.

# LM2930-5, LM2930-8 3-TERMINAL POSITIVE REGULATORS

**LM2930-8 electrical characteristics at 25°C virtual junction temperature,  $V_I = 14\text{ V}$ ,  $I_O = 150\text{ mA}$  (unless otherwise noted)**

PARAMETER	TEST CONDITIONS†	MIN	TYP	MAX	UNIT	
Output voltage	$V_I = 6\text{ V to }26\text{ V}$ , $T_J = -40^\circ\text{C to }125^\circ\text{C}$	$I_O = 5\text{ mA to }150\text{ mA}$	7.2	8	8.8	V
Input regulation	$I_O = 5\text{ mA}$	$V_I = 9.4\text{ V to }16\text{ V}$		12	50	mV
		$V_I = 9.4\text{ V to }26\text{ V}$		50	100	
Ripple rejection	$f = 120\text{ Hz}$		52			dB
Output regulation	$I_O = 5\text{ mA to }150\text{ mA}$		25	50		mV
Output voltage long-term drift‡	After 1000 h at $T_J = 125^\circ\text{C}$		30			mV
Dropout voltage	$I_O = 150\text{ mA}$		0.32	0.6		V
Output noise voltage	$f = 10\text{ Hz to }100\text{ kHz}$		90			$\mu\text{V}$
Output voltage during line transients	$V_I = -12\text{ V to }40\text{ V}$ , $R_L = 100\ \Omega$		-0.3	8.8		V
Output impedance	$I_O = 100\text{ mA}$ , $I_O = 10\text{ mA (rms)}$ , $f = 100\text{ Hz to }10\text{ kHz}$		300			$\text{m}\Omega$
Bias current	$I_O = 10\text{ mA}$		4	7		mA
	$I_O = 150\text{ mA}$		18	40		
Peak output current		150	300	700		mA

† Pulse-testing techniques are used to maintain the junction temperature as close to the ambient temperature as possible. Thermal effects must be taken into account separately. All characteristics are measured with a 0.1- $\mu\text{F}$  capacitor across the input and a 10- $\mu\text{F}$  capacitor across the output.

‡ Since long-term drift cannot be measured on the individual devices prior to shipment, this specification is intended to be an engineering estimate of the average drift to be expected from lot to lot.

## TYPICAL CHARACTERISTICS

### table of graphs

	FIGURE
Normalized Output Voltage vs Virtual Junction Temperature	1
Output Voltage vs Input Voltage	2
Output Voltage vs Input Voltage	3
Ripple Rejection vs Frequency	4
Ripple Rejection vs Output Current	5
Dropout Voltage vs Virtual Junction Temperature	6
Dropout Voltage vs Output Current	7
Output Impedance vs Frequency	8
Input Current vs Input Voltage	9
Line Transient Response	10
Input Current vs Reverse Input Voltage	11
Output Voltage vs Reverse Input Voltage	12
Load Transient Response	13
Bias Current vs Output Current	14
Bias Current vs Virtual Junction Temperature	15
Bias Current vs Input Voltage	16



TYPICAL CHARACTERISTICS

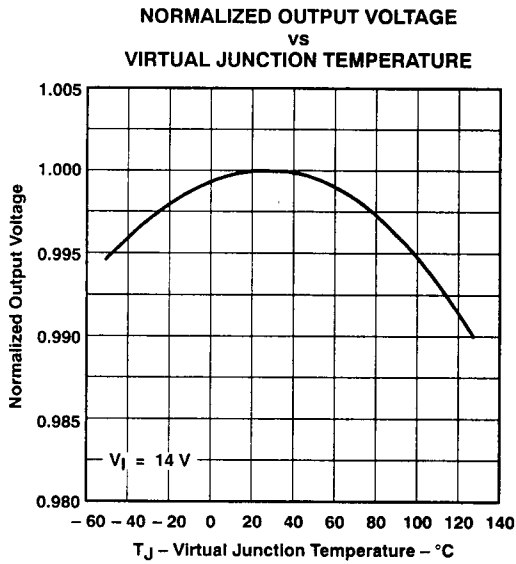


Figure 1

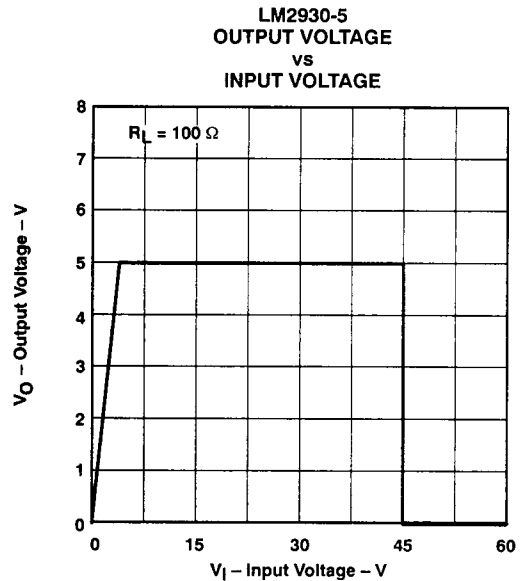


Figure 2

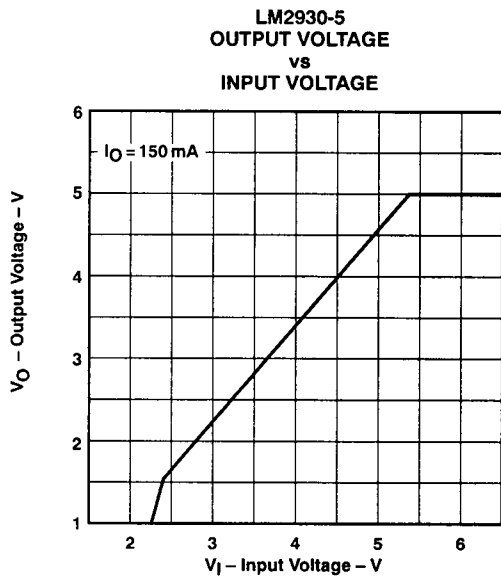


Figure 3

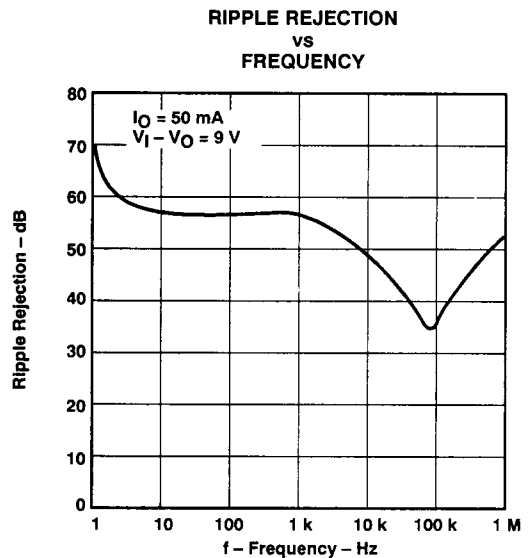


Figure 4

TYPICAL CHARACTERISTICS

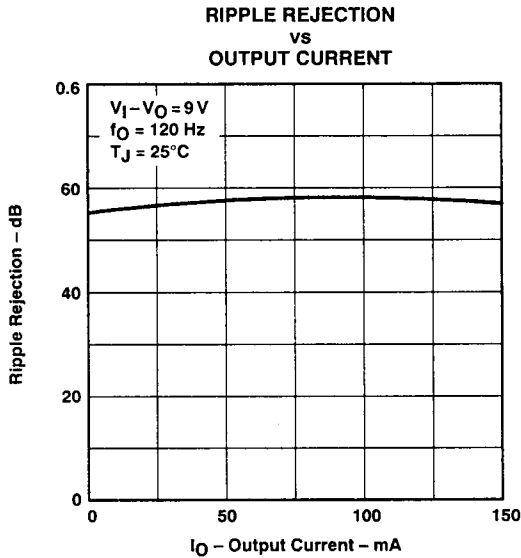


Figure 5

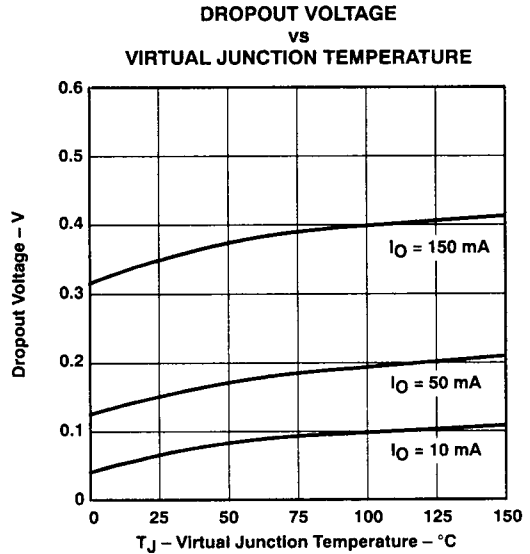


Figure 6

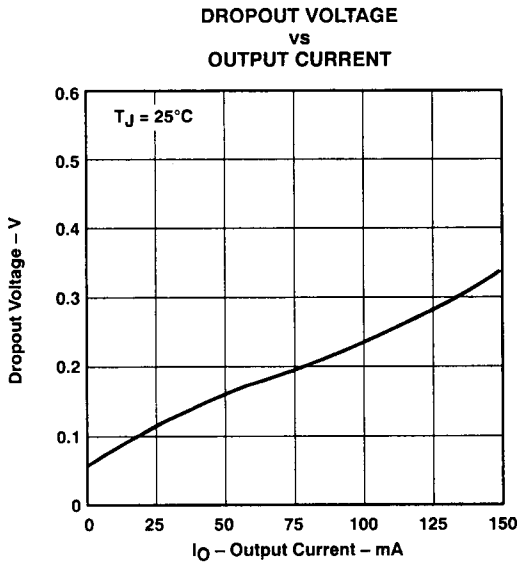


Figure 7

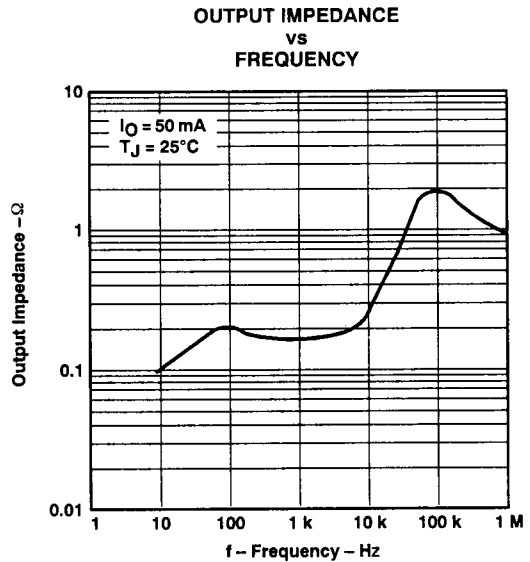


Figure 8

TYPICAL CHARACTERISTICS

INPUT CURRENT  
vs  
INPUT VOLTAGE

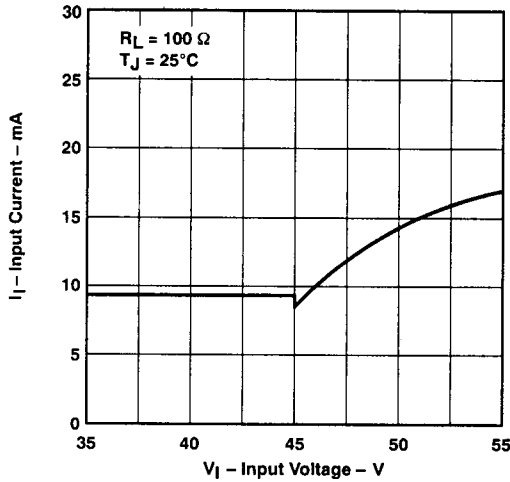


Figure 9

LINE TRANSIENT RESPONSE

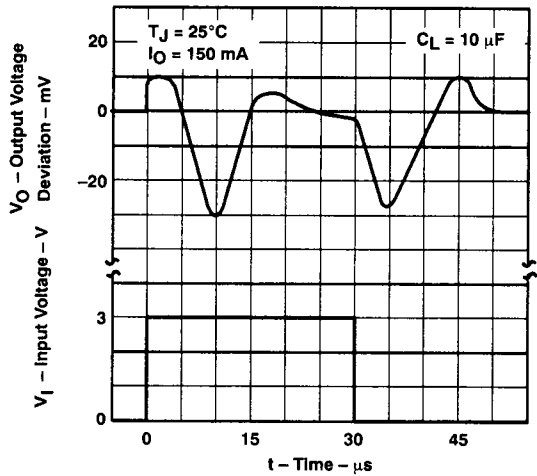


Figure 10

INPUT CURRENT  
vs  
REVERSE INPUT VOLTAGE

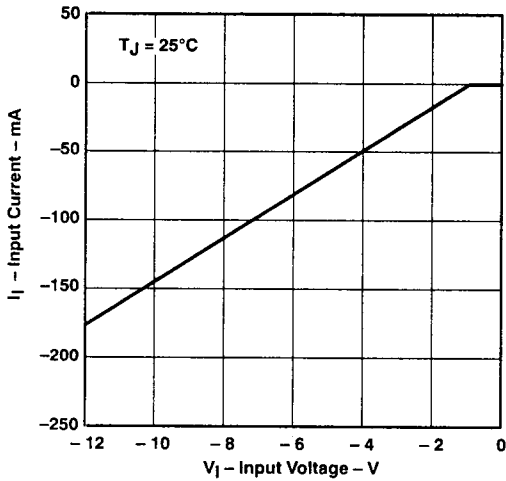


Figure 11

OUTPUT VOLTAGE  
vs  
REVERSE INPUT VOLTAGE

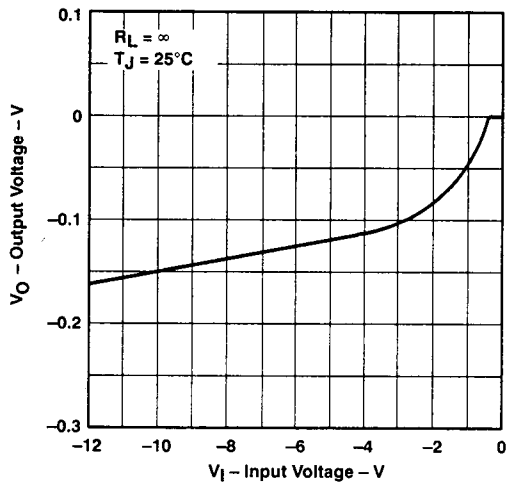


Figure 12

TYPICAL CHARACTERISTICS

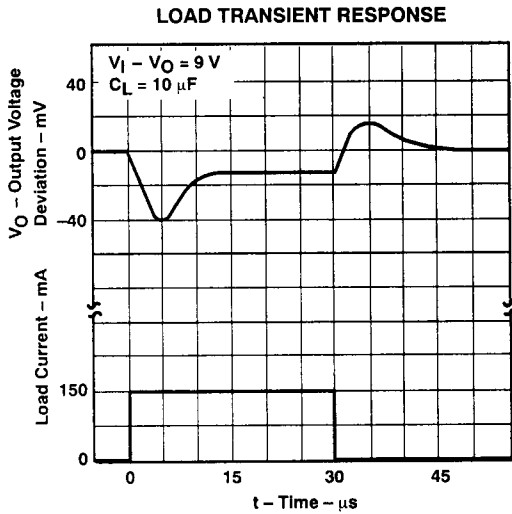


Figure 13

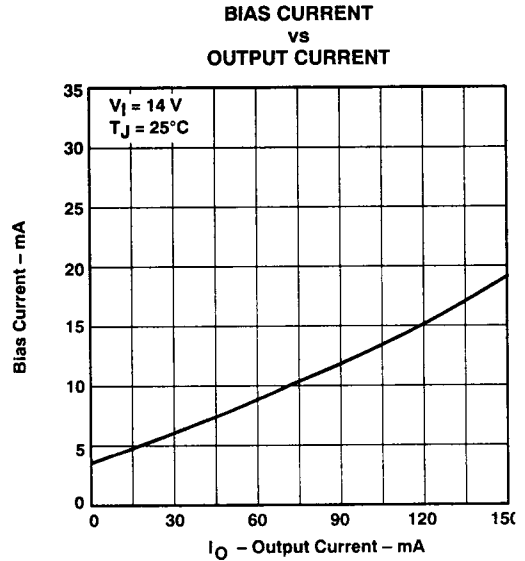


Figure 14

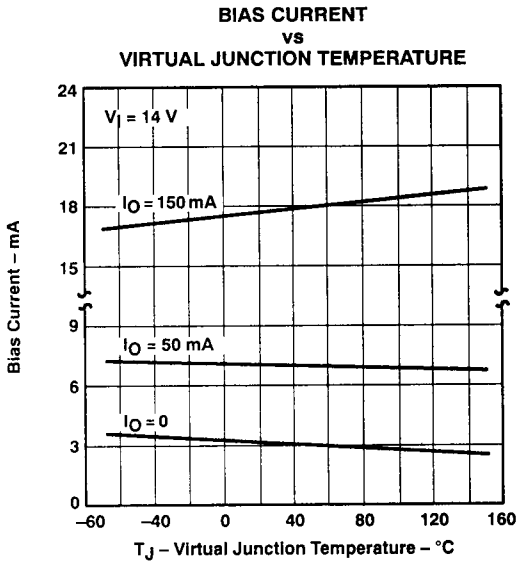


Figure 15

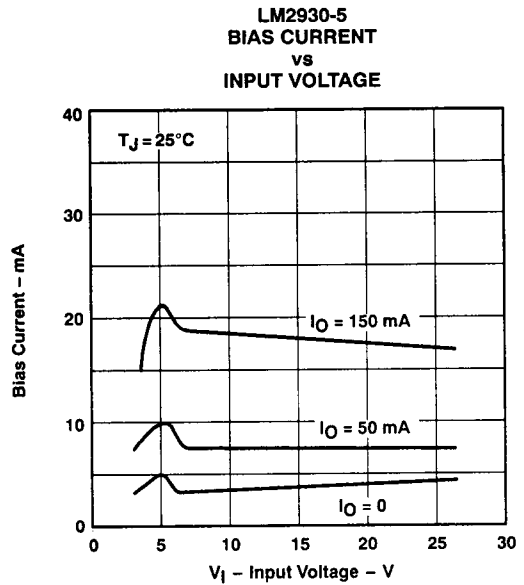
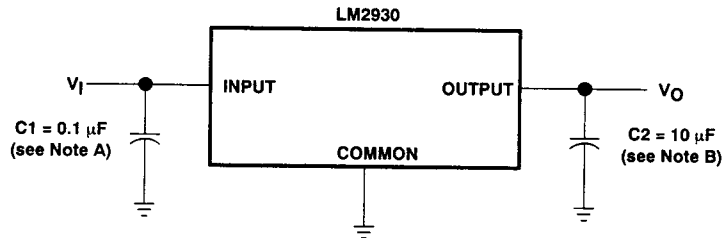


Figure 16



APPLICATION INFORMATION



- NOTES: A. Use of C1 is required if the regulator is not located in close proximity to the supply filter.  
B. Capacitor C2 must be located as close as possible to the regulator and may be an aluminum or tantalum-type capacitor. The minimum value required for stability is  $10 \mu\text{F}$ . The capacitor must be rated for operation at  $-40^\circ\text{C}$  to guarantee stability to that extreme.

Figure 17