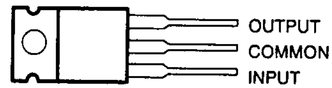
D2733, APRIL 1983–REVISED AUGUST 1991

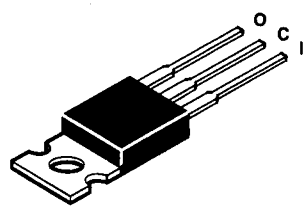
- Input-Output Differential Less Than 0.6 V
- Output Current of 150 mA
- Reverse Battery Protection
- Line Transient Protection
- 40-V Load-Dump Protection
- Internal Short Circuit Current Limiting
- Internal Thermal Overload Protection
- Mirror-Image Insertion Protection
- Direct Replacement for National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

KC PACKAGE
(TOP VIEW)

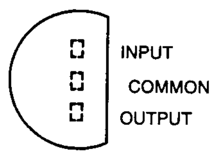


The common terminal is in electrical contact with the mounting base.

TO-220AB



LP
SILECT PACKAGE
(TOP VIEW)



TO-226AA

OCI

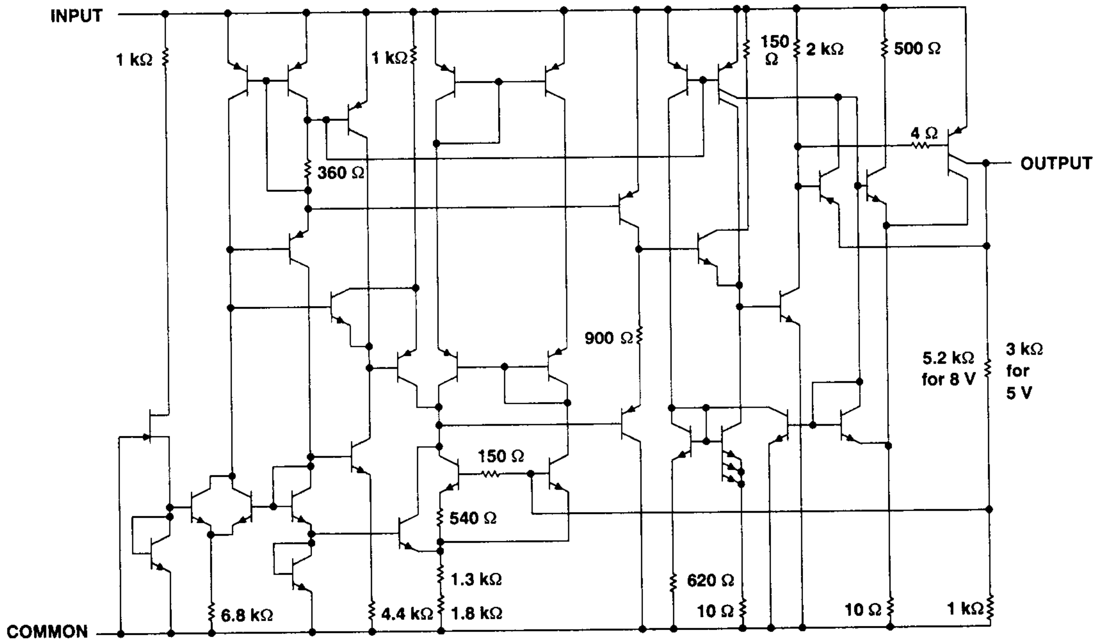
description

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.

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.

DISSIPATION RATING TABLE 1 – FREE-AIR TEMPERATURE

PACKAGE	$T_A \leq 25°C$ POWER RATING	DERATING FACTOR	DERATE ABOVE T_A	$T_A = 70°C$ 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	$T_A \leq 25°C$ POWER RATING	DERATING FACTOR	DERATE ABOVE T_C	$T_C = 125°C$ 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 V, I_O = 150 mA (unless otherwise noted)

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

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

PARAMETER	TEST CONDITIONS†		MIN	TYP	MAX	UNIT
Output voltage	V_I = 6 V to 26 V, T_J = −40°C to 125°C	I_O = 5 mA to 150 mA,	7.2	8	8.8	V
Input regulation	I_O = 5 mA	V_I = 9.4 V to 16 V		12	50	mV
		V_I = 9.4 V to 26 V		50	100	
Ripple rejection	f = 120 Hz			52		dB
Output regulation	I_O = 5 mA to 150 mA			25	50	mV
Output voltage long-term drift‡	After 1000 h at T_J = 125°C			30		mV
Dropout voltage	I_O = 150 mA			0.32	0.6	V
Output noise voltage	f = 10 Hz to 100 kHz			90		μV
Output voltage during line transients	V_I = −12 V to 40 V,	R_L = 100 Ω	−0.3		8.8	V
Output impedance	I_O = 100 mA, I_O = 10 mA (rms), f = 100 Hz to 10 kHz			300		mΩ
Bias current	I_O = 10 mA			4	7	mA
	I_O = 150 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.

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

NORMALIZED OUTPUT VOLTAGE
vs
VIRTUAL JUNCTION TEMPERATURE

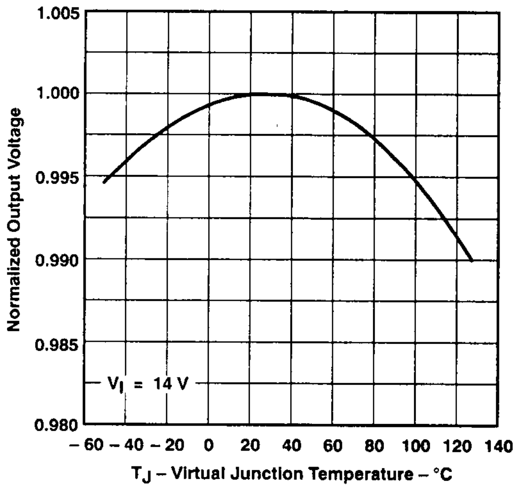


Figure 1

LM2930-5
OUTPUT VOLTAGE
vs
INPUT VOLTAGE

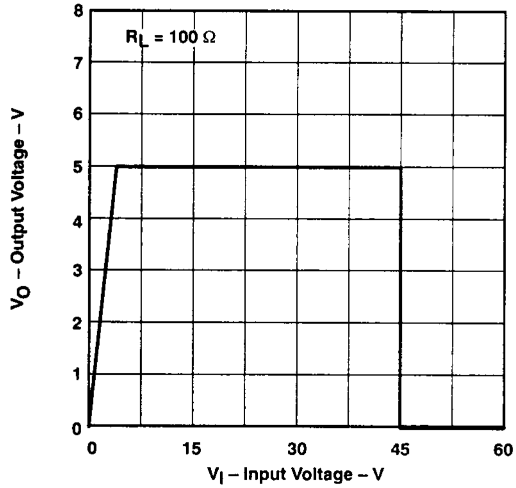


Figure 2

LM2930-5
OUTPUT VOLTAGE
vs
INPUT VOLTAGE

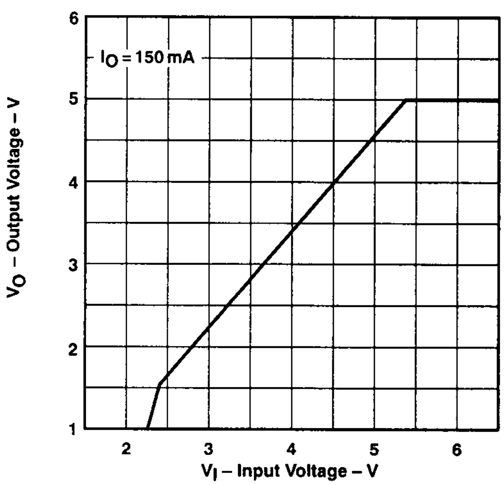


Figure 3

RIPPLE REJECTION
vs
FREQUENCY

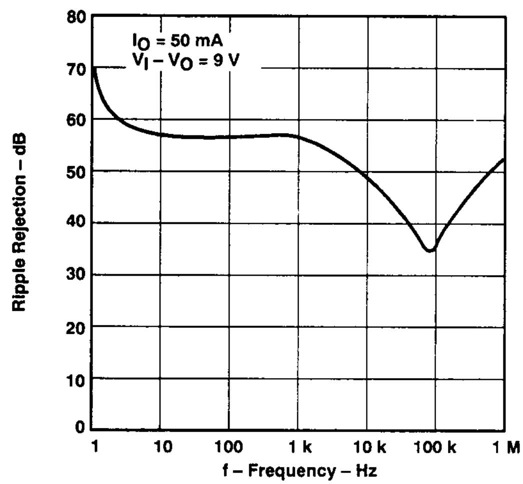


Figure 4

TYPICAL CHARACTERISTICS

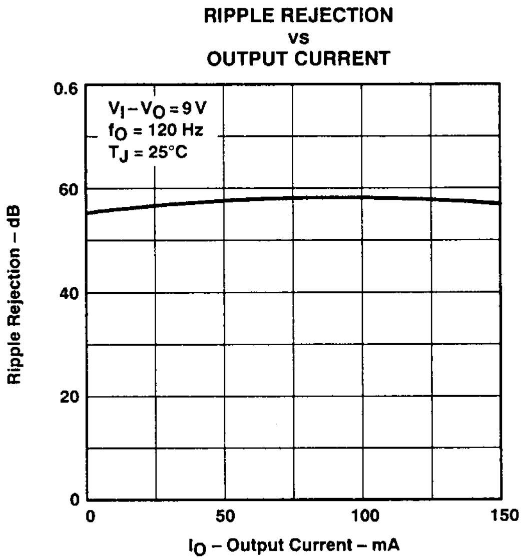


Figure 5

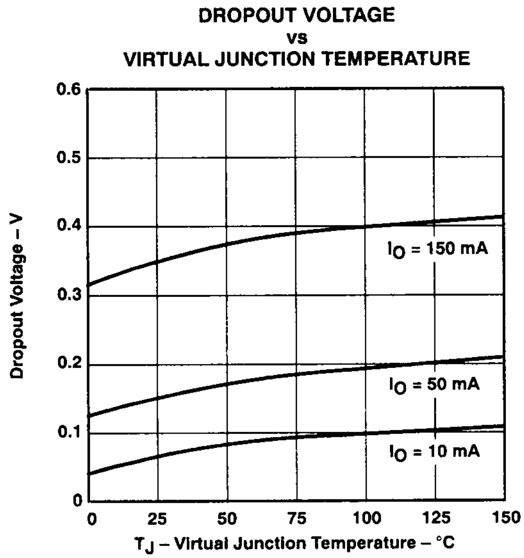


Figure 6

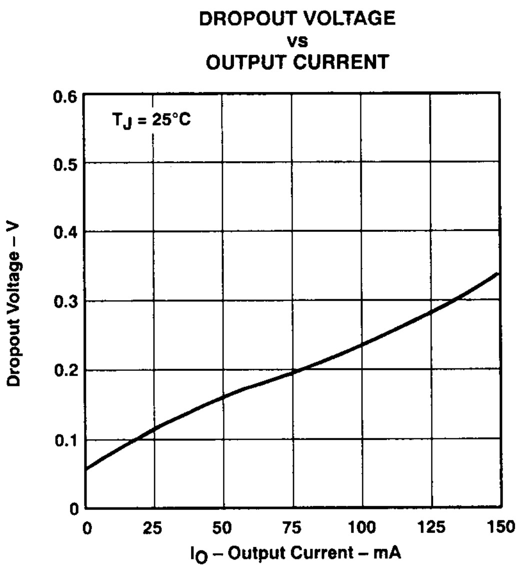


Figure 7

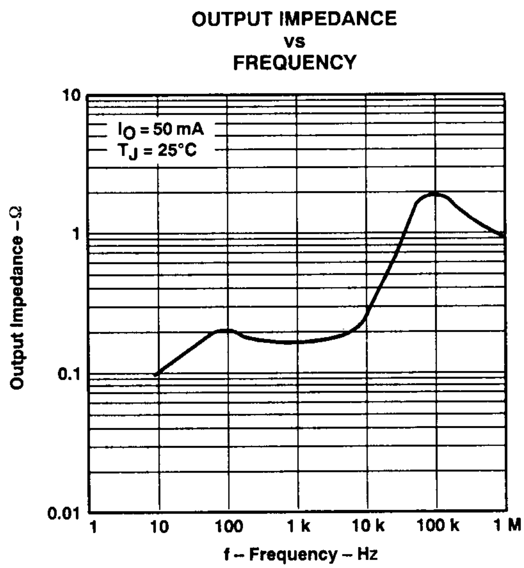


Figure 8

TYPICAL CHARACTERISTICS

INPUT CURRENT vs INPUT VOLTAGE

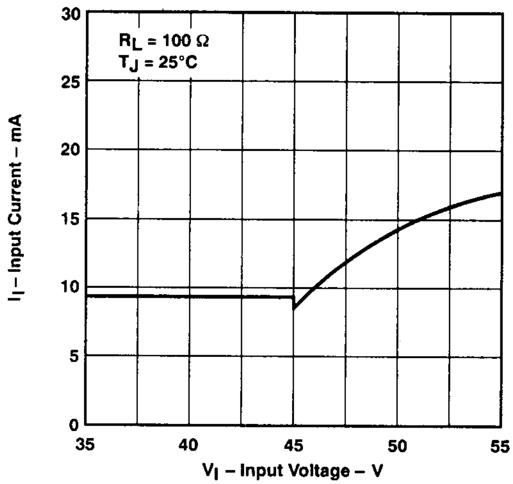


Figure 9

LINE TRANSIENT RESPONSE

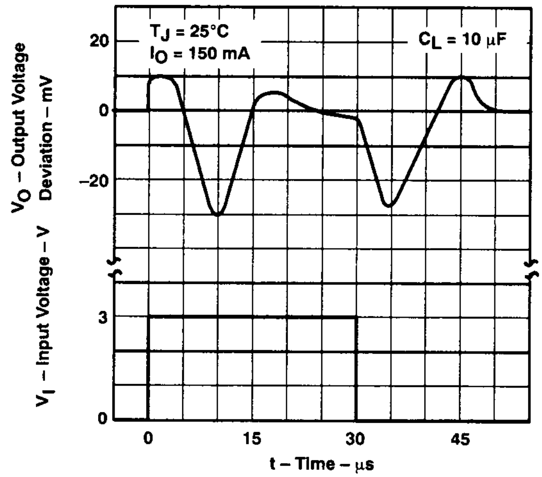


Figure 10

INPUT CURRENT vs REVERSE INPUT VOLTAGE

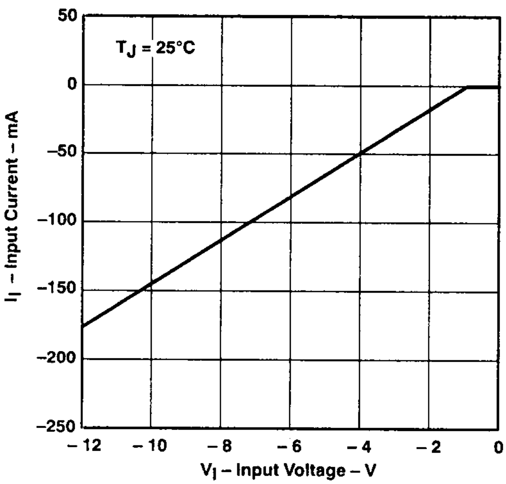


Figure 11

OUTPUT VOLTAGE vs REVERSE INPUT VOLTAGE

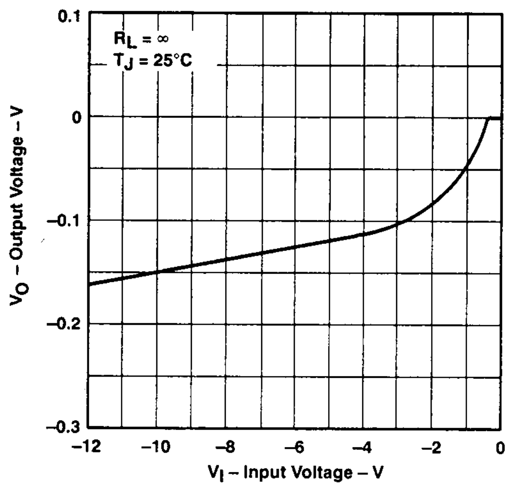


Figure 12

TYPICAL CHARACTERISTICS

LOAD TRANSIENT RESPONSE

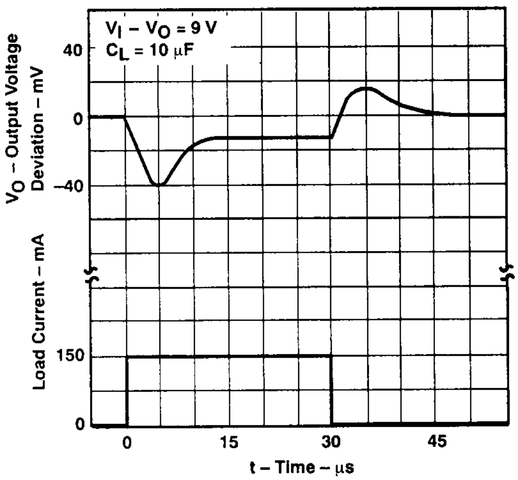


Figure 13

BIAS CURRENT vs OUTPUT CURRENT

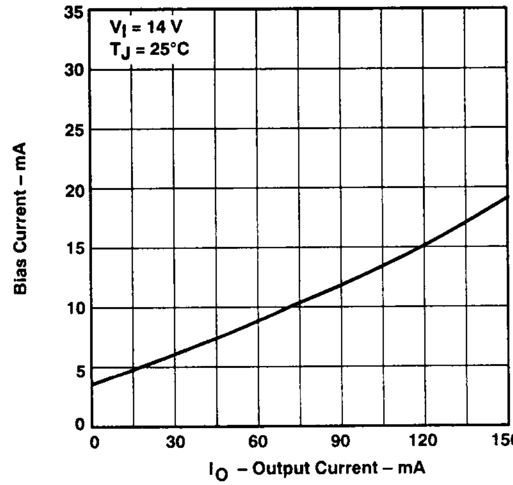


Figure 14

BIAS CURRENT vs VIRTUAL JUNCTION TEMPERATURE

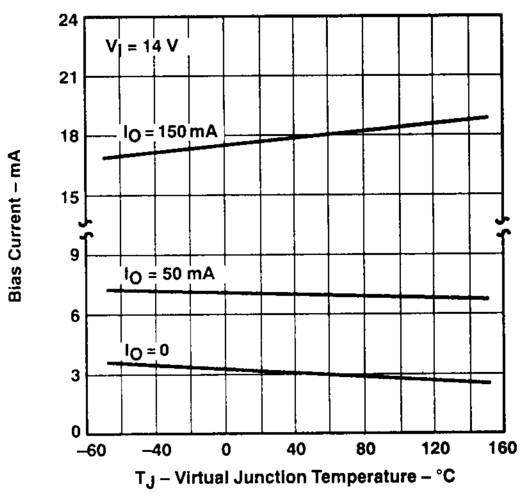


Figure 15

LM2930-5 BIAS CURRENT vs INPUT VOLTAGE

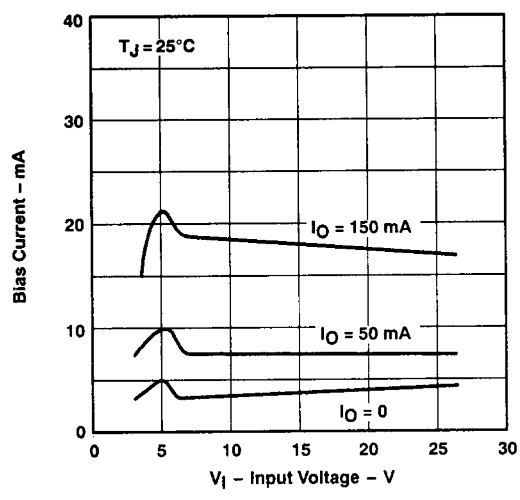
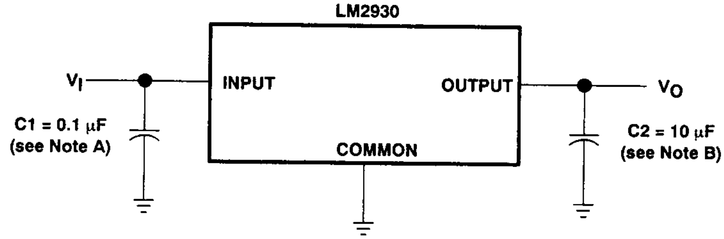


Figure 16

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 μF. The capacitor must be rated for operation at −40°C to guarantee stability to that extreme.

Figure 17