

# 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

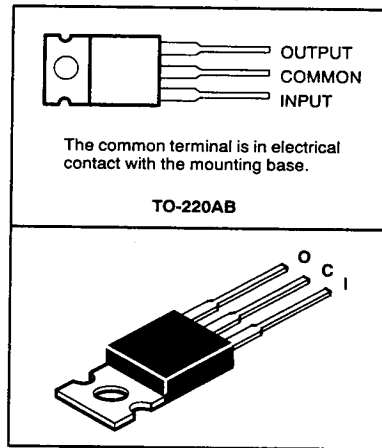
## description

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.

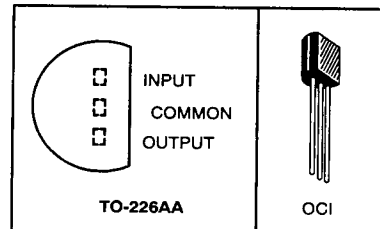
The LM2930 series has low voltage dropout, making it useful for certain battery applications. For example, the low voltage dropout feature allows a longer battery discharge before the output falls out of regulation; the battery supplying the regulator input voltage may discharge to 5.6 V and still properly 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)



PRODUCTION DATA Information is current as of publication date. Products conform to specifications per the terms of Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.

TEXAS  
INSTRUMENTS

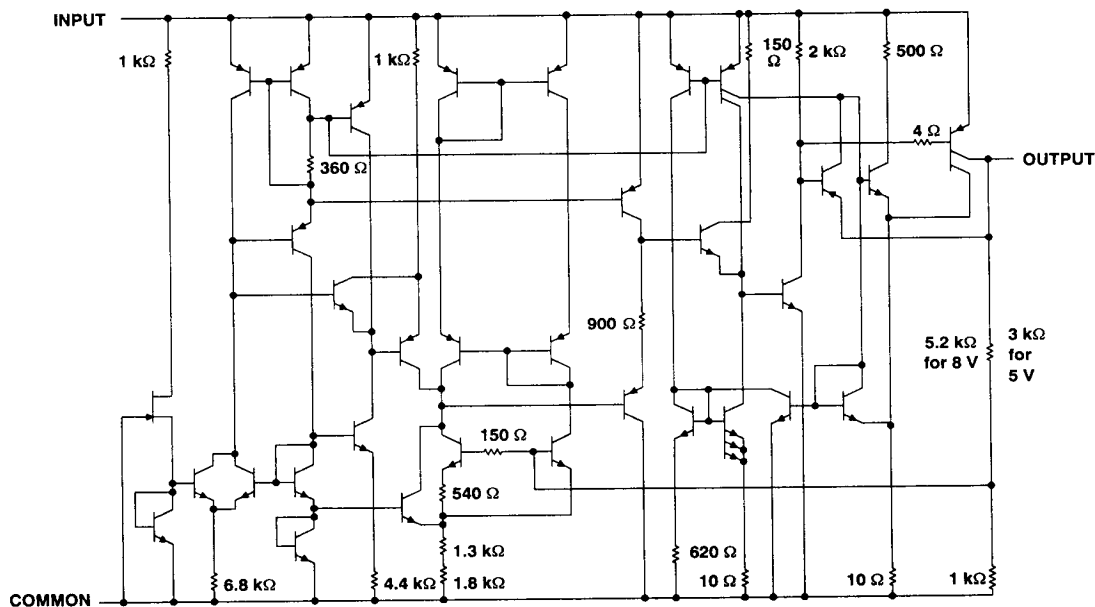
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# LM2930-5, LM2930-8 3-TERMINAL POSITIVE REGULATORS

## 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: $t = 1 \text{ s}$                   | 40 V                                  |
| Continuous reverse input voltage                             | -6 V                                  |
| Transient reverse input voltage: $t = 100 \text{ ms}$        | -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 <sub>A</sub> ≤ 25°C<br>POWER RATING | DERATING<br>FACTOR | DERATE<br>ABOVE T <sub>A</sub> | T <sub>A</sub> = 70°C<br>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 <sub>A</sub> ≤ 25°C<br>POWER RATING | DERATING<br>FACTOR | DERATE<br>ABOVE T <sub>C</sub> | T <sub>C</sub> = 125°C<br>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 <sub>O</sub> Output current                         |     | 150 | mA   |
| T <sub>J</sub> Operating virtual junction temperature | –40 | 125 | °C   |

**LM2930-5 electrical characteristics at 25°C virtual junction temperature, V<sub>I</sub> = 14 V, I<sub>O</sub> = 150 mA (unless otherwise noted)**

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



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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                        | $V_I = 6\text{ V to }26\text{ V}$ ,<br>$T_J = -40^\circ\text{C to }125^\circ\text{C}$     | $I_O = 5\text{ mA to }150\text{ mA}$ , | 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  |     | 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 |
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TYPICAL CHARACTERISTICS

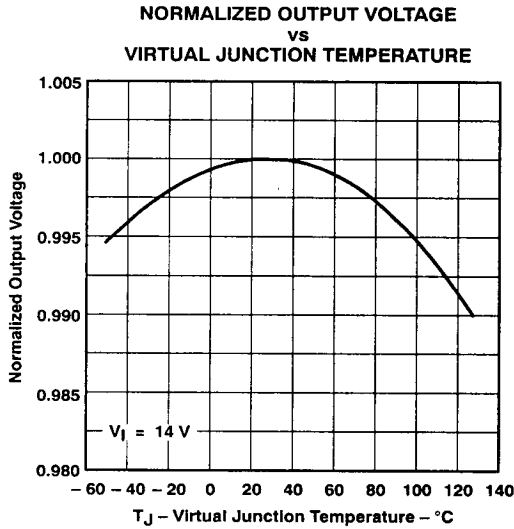


Figure 1

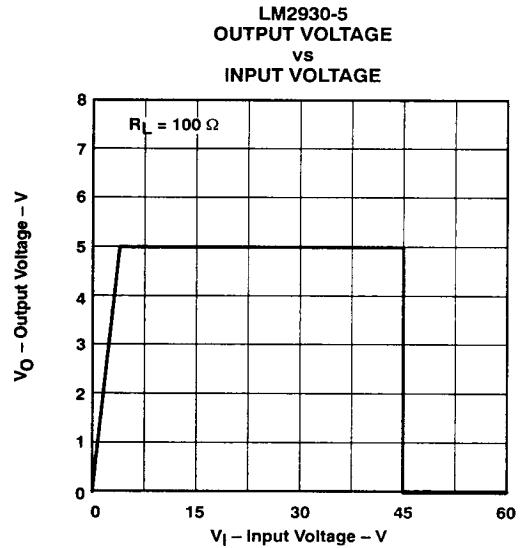


Figure 2

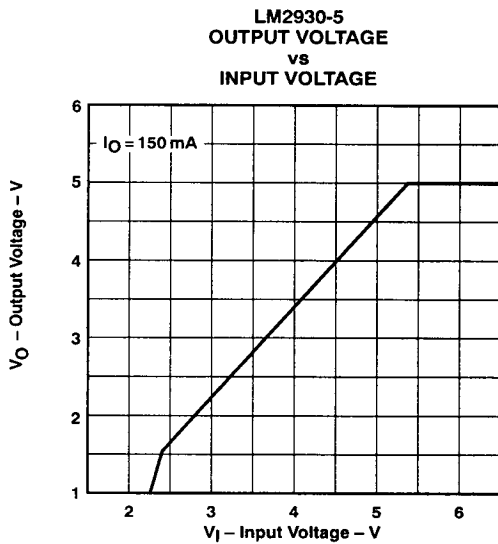


Figure 3

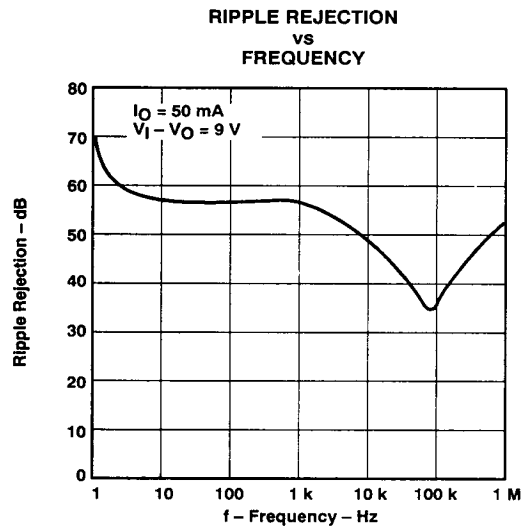


Figure 4



TYPICAL CHARACTERISTICS

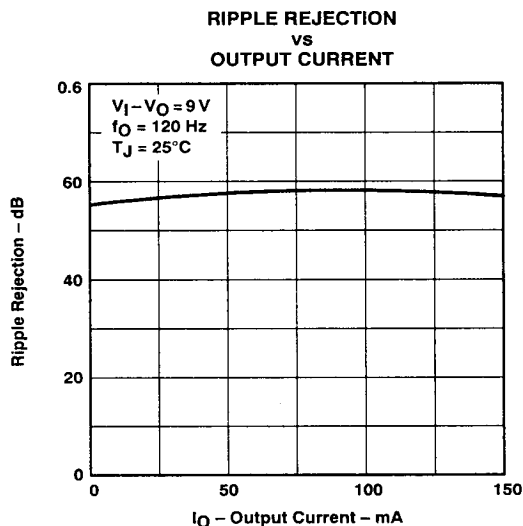


Figure 5

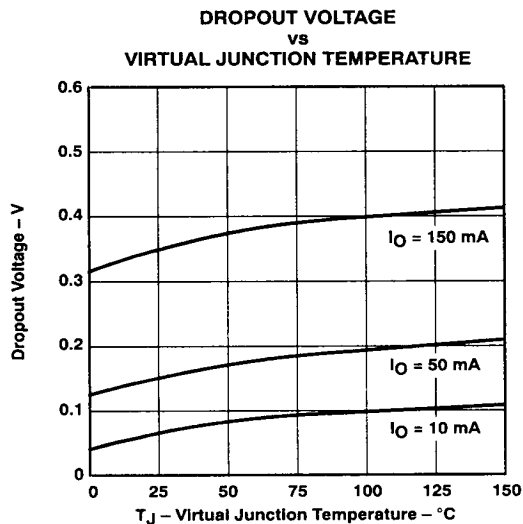


Figure 6

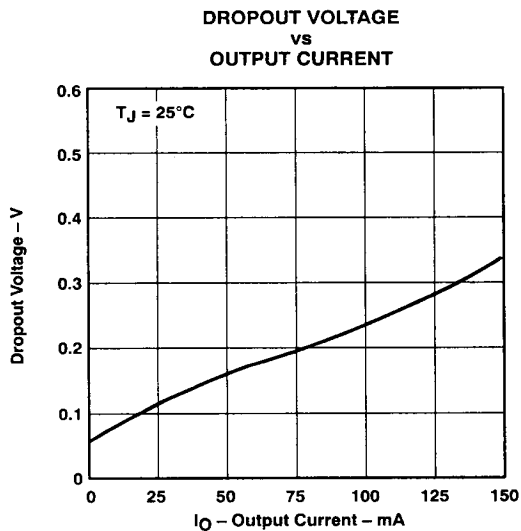


Figure 7

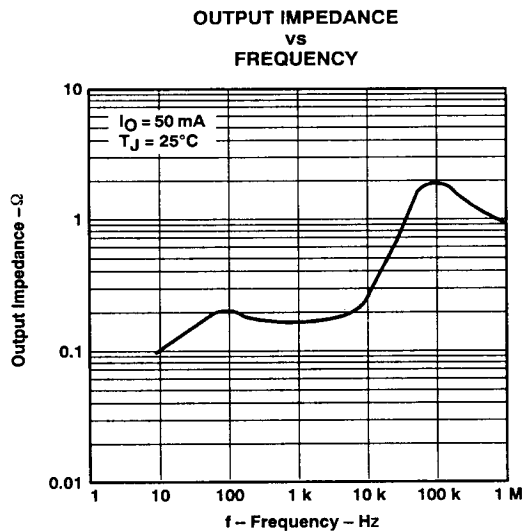


Figure 8



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TYPICAL CHARACTERISTICS

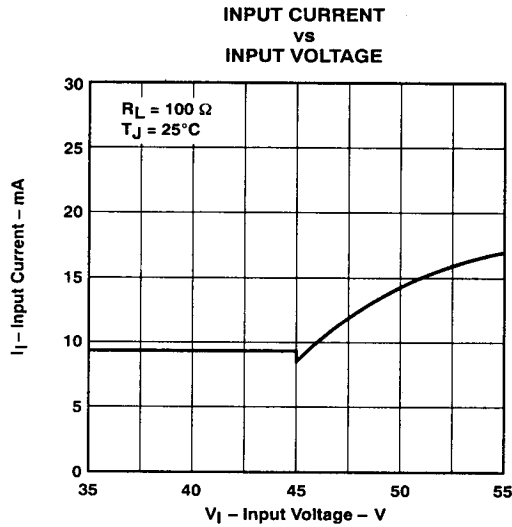


Figure 9

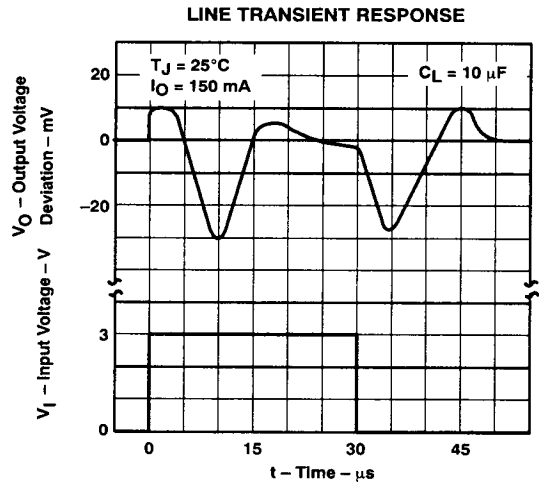


Figure 10

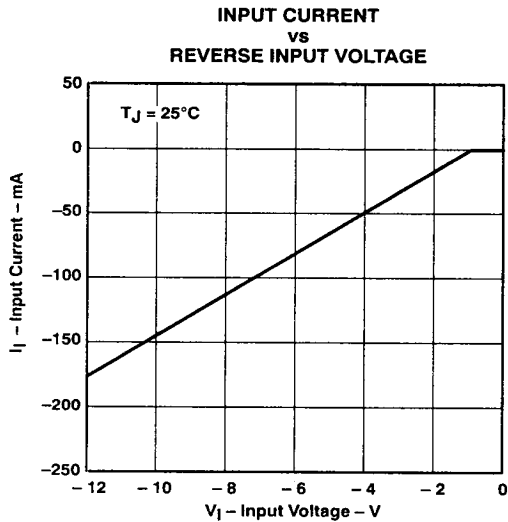


Figure 11

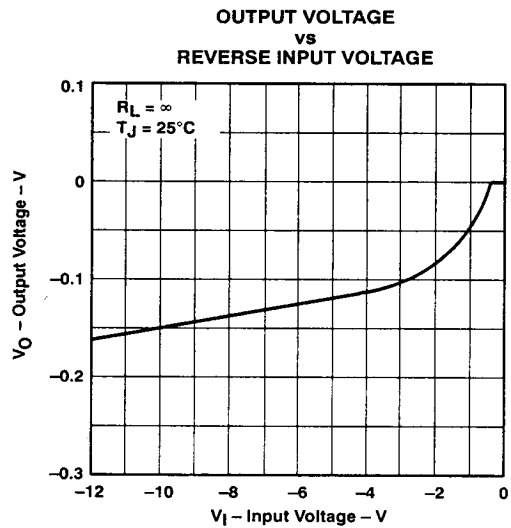


Figure 12



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TYPICAL CHARACTERISTICS

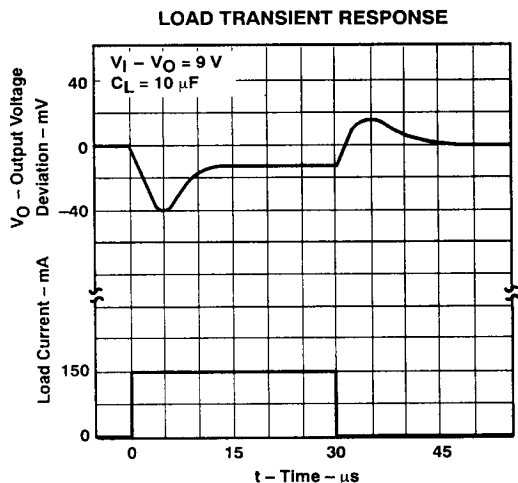


Figure 13

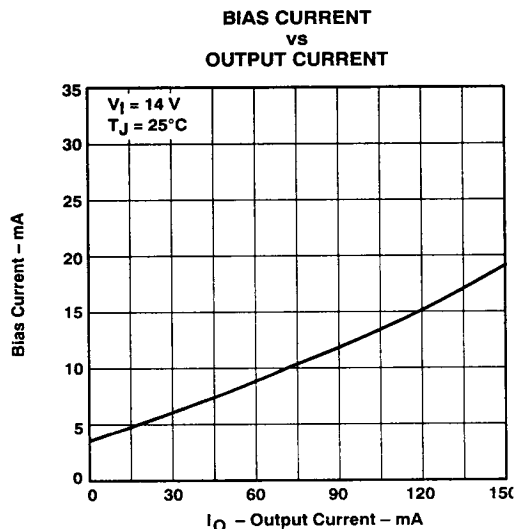


Figure 14

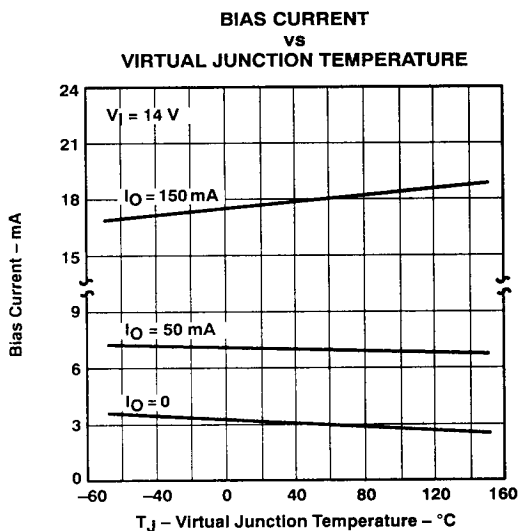


Figure 15

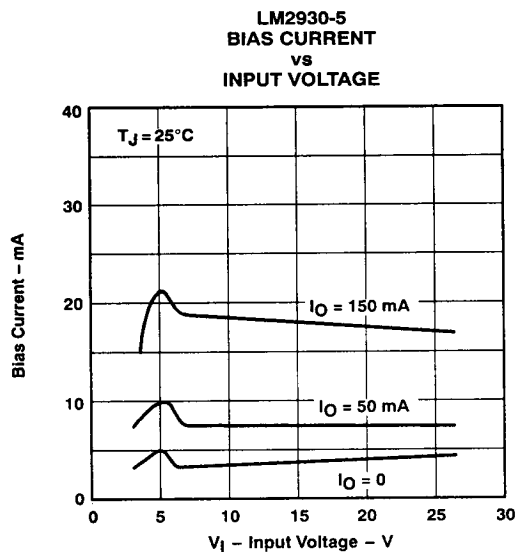
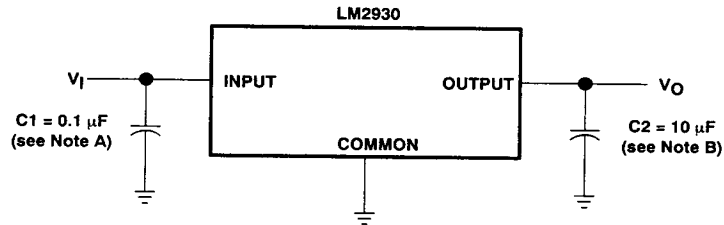


Figure 16

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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  $\mu F$ . The capacitor must be rated for operation at  $-40^\circ C$  to guarantee stability to that extreme.

Figure 17