

# μA7900 SERIES NEGATIVE-VOLTAGE REGULATORS

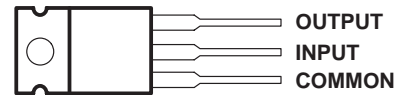
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- 3-Terminal Regulators
- Output Current Up to 1.5 A
- No External Components
- Internal Thermal Overload Protection
- High-Power Dissipation Capability
- Internal Short-Circuit Current Limiting
- Output Transistor Safe-Area Compensation
- Essentially Equivalent to National LM320 Series

## description

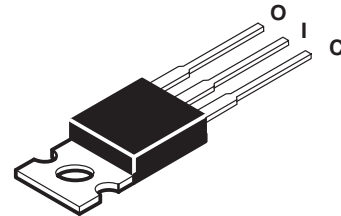
This series of fixed-negative-voltage monolithic integrated-circuit voltage regulators is designed to complement Series μA7800 in a wide range of applications. These applications include on-card regulation for elimination of noise and distribution problems associated with single-point regulation. Each of these regulators can deliver up to 1.5 A of output current. The internal current limiting and thermal shutdown features of these regulators make them essentially immune to overload. In addition to use as fixed-voltage regulators, these devices can be used with external components to obtain adjustable output voltages and currents and also as the power pass element in precision regulators.

KC PACKAGE  
(TOP VIEW)

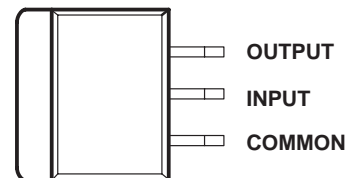


The input terminal is in electrical contact with the mounting base

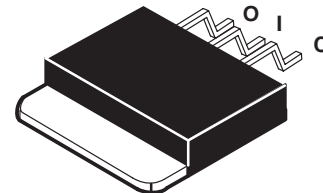
TO-220AB



KTE PACKAGE  
(TOP VIEW)



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



## AVAILABLE OPTIONS

| T <sub>A</sub> | V <sub>O(nom)</sub><br>(V) | PACKAGED DEVICES          |                             | CHIP FORM<br>(Y) |
|----------------|----------------------------|---------------------------|-----------------------------|------------------|
|                |                            | HEAT-SINK MOUNTED<br>(KC) | HEAT-SINK MOUNTED†<br>(KTE) |                  |
| 0°C to 125°C   | -5                         | μA7905CKC                 | μA7905CKTE                  | μA7905Y          |
|                | -5.2                       | μA7952CKC                 | μA7952CKTE                  | μA7952Y          |
|                | -6                         | μA7906CKC                 | μA7906CKTE                  | μA7906Y          |
|                | -8                         | μA7908CKC                 | μA7908CKTE                  | μA7908Y          |
|                | -12                        | μA7912CKC                 | μA7912CKTE                  | μA7912Y          |
|                | -15                        | μA7915CKC                 | μA7915CKTE                  | μA7915Y          |
|                | -18                        | μA7918CKC                 | μA7918CKTE                  | μA7918Y          |
|                | -24                        | μA7924CKC                 | μA7924CKTE                  | μA7924Y          |

† The KTE package is also available taped and reeled.



Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.

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**

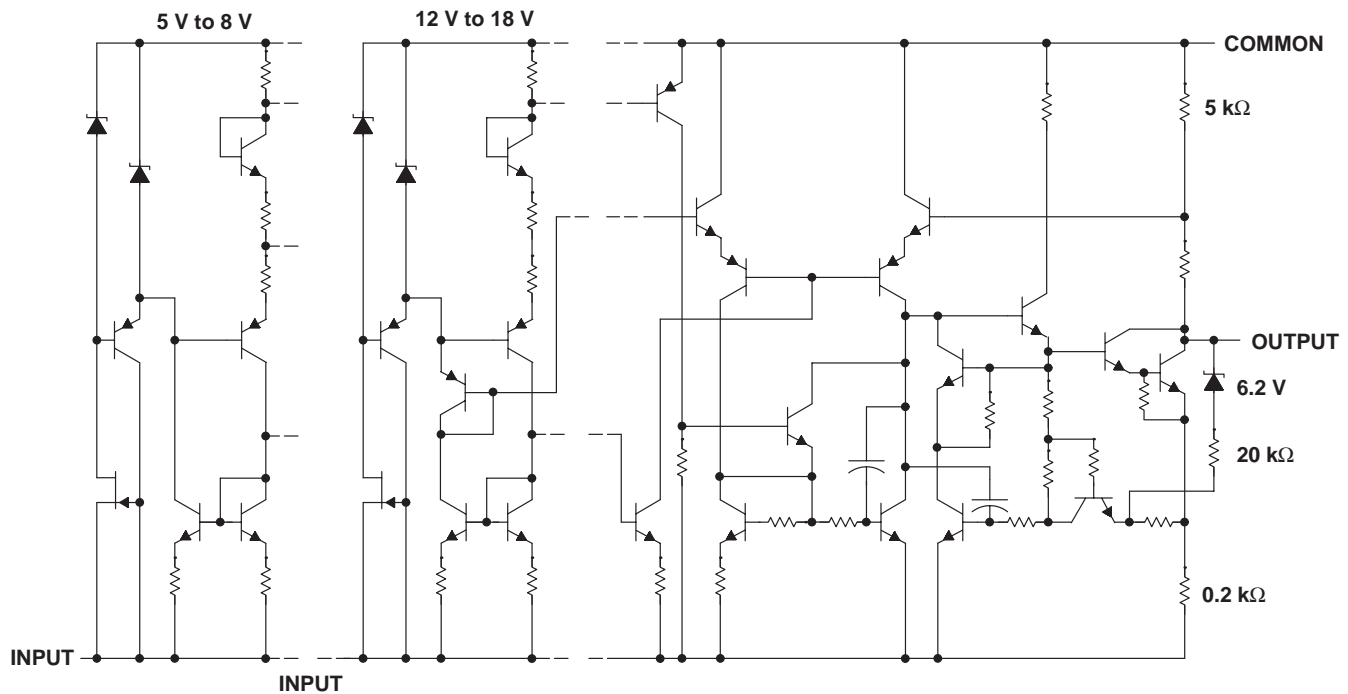
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# μA7900 SERIES NEGATIVE-VOLTAGE REGULATORS

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## schematic



All component values are nominal.

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

|  |                               |
|--|-------------------------------|
| Input voltage, $V_I$ : $\mu A7924C$ .....  | -40 V                         |
| All others .....   | -35 V                         |
| Continuous total power dissipation at (or below): $T_A = 25^\circ C$ (see Note 1) ...          | See Dissipation Rating Tables |
| $T_C = 90^\circ C$ (see Note 1) ...  | See Dissipation Rating Tables |
| Operating free-air, $T_A$ , case, $T_C$ , or virtual junction, $T_J$ , temperature range ..... | 0 to $150^\circ C$            |
| Storage temperature range, $T_{stg}$ .....   | -65 to $150^\circ C$          |
| Lead temperature 3.2 mm (1/8 inch) from case for 10 seconds .....                              | $260^\circ C$                 |

NOTE 1: For operation above  $25^\circ C$  free-air or  $90^\circ C$  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.

DISSIPATION RATING TABLE — FREE-AIR TEMPERATURE

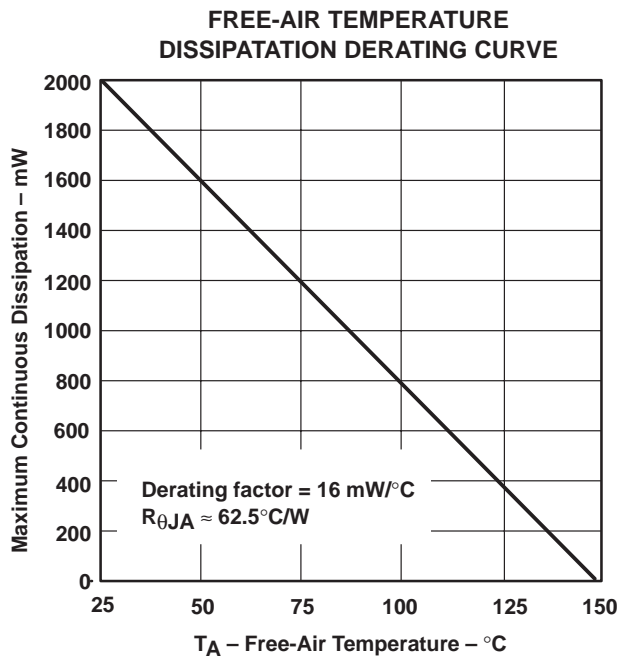
| PACKAGE | $T_A \leq 25^\circ C$<br>POWER RATING | DERATING FACTOR<br>ABOVE $T_A = 25^\circ C$ | $T_A = 70^\circ C$<br>POWER RATING | $T_A = 105^\circ C$<br>POWER RATING | $T_A = 125^\circ C$<br>POWER RATING |
|---------|---------------------------------------|---|------------------------------------|-------------------------------------|-------------------------------------|
| KC      | 2000 mW                               | 16.0 mW/ $^\circ C$                         | 1280 mW                            | 720 mW                              | 400 mW                              |
| KTE     | 1900 mW                               | 15.2 mW/ $^\circ C$                         | 1216 mW                            | 684 mW                              | 380 mW                              |

DISSIPATION RATING TABLE — CASE TEMPERATURE

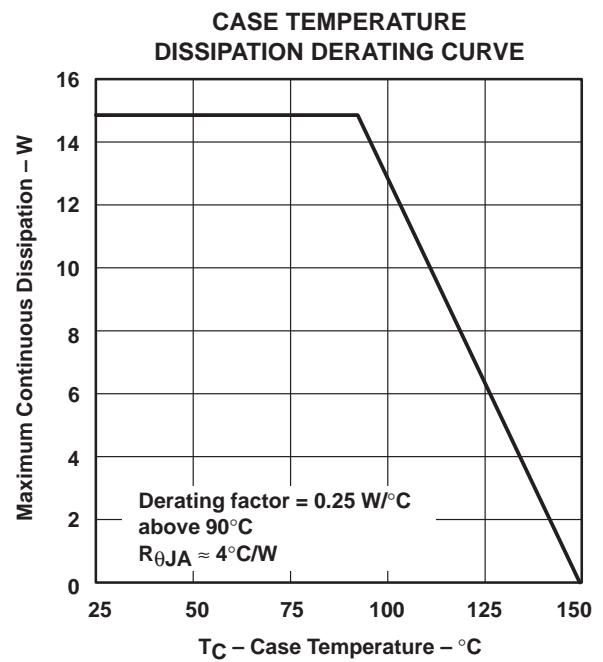
| PACKAGE | $T_C \leq 90^\circ C$<br>POWER RATING | DERATING FACTOR<br>ABOVE $T_C = 90^\circ C$ | $T_A = 125^\circ C$<br>POWER RATING |
|---------|---------------------------------------|---|-------------------------------------|
| KC      | 15000 mW                              | 250.0 mW/ $^\circ C$                        | 6250 mW                             |
| KTE     | 14300 mW                              | 238.0 mW/ $^\circ C$                        | 5970 mW                             |



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**Figure 1**



**Figure 2**

**recommended operating conditions**

|   |         | MIN   | MAX | UNIT |
|---|---------|-------|-----|------|
| Input voltage, $V_I$                          | μA7905C | -7    | -25 | V    |
|   | μA7952C | -7.2  | -25 |      |
|   | μA7906C | -8    | -25 |      |
|   | μA7908C | -10.5 | -25 |      |
|   | μA7912C | -14.5 | -30 |      |
|   | μA7915C | -17.5 | -30 |      |
|   | μA7918C | -21   | -33 |      |
|   | μA7924C | -27   | -28 |      |
| Output current, $I_O$                         |         |       | 1.5 | A    |
| Operating virtual junction temperature, $T_J$ |         | 0     | 125 | °C   |

# μA7900 SERIES NEGATIVE-VOLTAGE REGULATORS

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**electrical characteristics at specified virtual junction temperature,  $V_I = -10$  V,  $I_O = 500$  mA (unless otherwise noted)**

| PARAMETER                                 | TEST CONDITIONS   | $T_J$ †      | μA7905C |      |       | UNITS |
|---|---|--------------|---------|------|-------|-------|
|   |   |              | MIN     | TYP  | MAX   |       |
| Output voltage‡                           |   | 25°C         | -4.8    | -5   | -5.2  | V     |
|   | $I_O = 5$ mA to 1 A,<br>$P \leq 15$ W<br>$V_I = -7$ V to -20 V, | 0°C to 125°C | -4.75   |      | -5.25 |       |
| Input regulation                          | $V_I = -7$ V to -25 V   |              |         | 12.5 | 50    | mV    |
|   | $V_I = -8$ V to -12 V   |              |         | 4    | 15    |       |
| Ripple rejection                          | $V_I = -8$ V to -18 V, $f = 120$ Hz                             | 0°C to 125°C | 54      | 60   |       | dB    |
| Output regulation                         | $I_O = 5$ mA to 1.5 A   |              |         | 15   | 100   | mV    |
|   | $I_O = 250$ mA to 750 mA  |              |         | 5    | 50    |       |
| Temperature coefficient of output voltage | $I_O = 5$ mA  | 0°C to 125°C | -0.4    |      |       | mV/°C |
| Output noise voltage                      | $f = 10$ Hz to 100 kHz  | 25°C         |         | 125  |       | μV    |
| Dropout voltage                           | $I_O = 1$ A   | 25°C         |         | 1.1  |       | V     |
| Bias current                              |   | 25°C         |         | 1.5  | 2     | mA    |
| Bias current change                       | $V_I = -7$ V to -25 V   |              |         | 0.15 | 0.5   | mA    |
|   | $I_O = 5$ mA to 1 A   |              |         | 0.08 | 0.5   |       |
| Peak output current                       |   | 25°C         |         | 2.1  |       | A     |

† 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 2-μF capacitor across the input and a 1-μF capacitor across the output.

‡ This specification applies only for dc power dissipation permitted by absolute maximum ratings.

**electrical characteristics at specified virtual junction temperature,  $V_I = -10$  V,  $I_O = 500$  mA (unless otherwise noted)**

| PARAMETER                                 | TEST CONDITIONS   | $T_J$ †      | μA7952C |      |       | UNITS |
|---|---|--------------|---------|------|-------|-------|
|   |   |              | MIN     | TYP  | MAX   |       |
| Output voltage‡                           |   | 25°C         | -5      | -5.2 | -5.4  | V     |
|   | $I_O = 5$ mA to 1 A,<br>$P \leq 15$ W<br>$V_I = -7.2$ V to -20 V, | 0°C to 125°C | -4.95   |      | -5.45 |       |
| Input regulation                          | $V_I = -7.2$ V to -25 V   |              |         | 12.5 | 100   | mV    |
|   | $V_I = -8.2$ V to -12 V   |              |         | 4    | 50    |       |
| Ripple rejection                          | $V_I = -8.2$ V to -18 V, $f = 120$ Hz                             | 0°C to 125°C | 54      | 60   |       | dB    |
| Output regulation                         | $I_O = 5$ mA to 1.5 A   |              |         | 15   | 100   | mV    |
|   | $I_O = 250$ mA to 750 mA  |              |         | 5    | 50    |       |
| Temperature coefficient of output voltage | $I_O = 5$ mA  | 0°C to 125°C | -0.4    |      |       | mV/°C |
| Output noise voltage                      | $f = 10$ Hz to 100 kHz  | 25°C         |         | 125  |       | μV    |
| Dropout voltage                           | $I_O = 1$ A   | 25°C         |         | 1.1  |       | V     |
| Bias current                              |   | 25°C         |         | 1.5  | 2     | mA    |
| Bias current change                       | $V_I = -7.2$ V to -25 V   |              |         | 0.15 | 1.3   | mA    |
|   | $I_O = 5$ mA to 1 A   |              |         | 0.08 | 0.5   |       |
| Peak output current                       |   | 25°C         |         | 2.1  |       | A     |

† 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 2-μF capacitor across the input and a 1-μF capacitor across the output.

‡ This specification applies only for dc power dissipation permitted by absolute maximum ratings.



# μA7900 SERIES NEGATIVE-VOLTAGE REGULATORS

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**electrical characteristics at specified virtual junction temperature,  $V_I = -11$  V,  $I_O = 500$  mA (unless otherwise noted)**

| PARAMETER                                 | TEST CONDITIONS   | $T_J$ †      | μA7906C |      |       | UNITS |
|---|---|--------------|---------|------|-------|-------|
|   |   |              | MIN     | TYP  | MAX   |       |
| Output voltage‡                           |   | 25°C         | -5.75   | -6   | -6.25 | V     |
|   | $I_O = 5$ mA to 1 A, $V_I = -8$ V to -21 V, $P \leq 15$ W | 0°C to 125°C | -5.7    |      | -6.3  |       |
| Input regulation                          | $V_I = -8$ V to -25 V                                     |              |         | 12.5 | 120   | mV    |
|   | $V_I = -9$ V to -13 V                                     |              |         | 4    | 60    |       |
| Ripple rejection                          | $V_I = -9$ V to -19 V, $f = 120$ Hz                       | 0°C to 125°C | 54      | 60   |       | dB    |
| Output regulation                         | $I_O = 5$ mA to 1.5 A                                     |              |         | 15   | 120   | mV    |
|   | $I_O = 250$ mA to 750 mA                                  |              |         | 5    | 60    |       |
| Temperature coefficient of output voltage | $I_O = 5$ mA  | 0°C to 125°C |         | -0.4 |       | mV/°C |
| Output noise voltage                      | $f = 10$ Hz to 100 kHz                                    | 25°C         |         | 150  |       | μV    |
| Dropout voltage                           | $I_O = 1$ A   | 25°C         |         | 1.1  |       | V     |
| Bias current                              |   | 25°C         |         | 1.5  | 2     | mA    |
| Bias current change                       | $V_I = -8$ V to -25 V                                     |              |         | 0.15 | 1.3   | mA    |
|   | $I_O = 5$ mA to 1 A                                       |              |         | 0.08 | 0.5   |       |
| Peak output current                       |   | 25°C         |         | 2.1  |       | A     |

† 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 2-μF capacitor across the input and a 1-μF capacitor across the output.

‡ This specification applies only for dc power dissipation permitted by absolute maximum ratings.

**electrical characteristics at specified virtual junction temperature,  $V_I = -14$  V,  $I_O = 500$  mA (unless otherwise noted)**

| PARAMETER                                 | TEST CONDITIONS  | $T_J$ †      | μA7908C |      |      | UNITS |
|---|--|--------------|---------|------|------|-------|
|   |  |              | MIN     | TYP  | MAX  |       |
| Output voltage‡                           |  | 25°C         | -7.7    | -8   | -8.3 | V     |
|   | $I_O = 5$ mA to 1 A, $V_I = -10.5$ V to -23 V, $P \leq 15$ W | 0°C to 125°C | -7.6    |      | -8.4 |       |
| Input regulation                          | $V_I = -10.5$ V to -25 V                                     |              |         | 12.5 | 160  | mV    |
|   | $V_I = -11$ V to -17 V                                       |              |         | 4    | 80   |       |
| Ripple rejection                          | $V_I = -11.5$ V to -21.5 V, $f = 120$ Hz                     | 0°C to 125°C | 54      | 60   |      | dB    |
| Output regulation                         | $I_O = 5$ mA to 1.5 A  |              |         | 15   | 160  | mV    |
|   | $I_O = 250$ mA to 750 mA                                     |              |         | 5    | 80   |       |
| Temperature coefficient of output voltage | $I_O = 5$ mA   | 0°C to 125°C |         | -0.6 |      | mV/°C |
| Output noise voltage                      | $f = 10$ Hz to 100 kHz                                       | 25°C         |         | 200  |      | μV    |
| Dropout voltage                           | $I_O = 1$ A  | 25°C         |         | 1.1  |      | V     |
| Bias current                              |  | 25°C         |         | 1.5  | 2    | mA    |
| Bias current change                       | $V_I = -10.5$ V to -25 V                                     |              |         | 0.15 | 1    | mA    |
|   | $I_O = 5$ mA to 1 A  |              |         | 0.08 | 0.5  |       |
| Peak output current                       |  | 25°C         |         | 2.1  |      | A     |

† 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 2-μF capacitor across the input and a 1-μF capacitor across the output.

‡ This specification applies only for dc power dissipation permitted by absolute maximum ratings.



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**electrical characteristics at specified virtual junction temperature,  $V_I = -19\text{ V}$ ,  $I_O = 500\text{ mA}$  (unless otherwise noted)**

| PARAMETER                                 | TEST CONDITIONS  | $T_J$ †      | μA7912C |      |       | UNITS |
|---|--|--------------|---------|------|-------|-------|
|   |  |              | MIN     | TYP  | MAX   |       |
| Output voltage‡                           |  | 25°C         | -11.5   | -12  | -12.5 | V     |
|   | $I_O = 5\text{ mA to }1\text{ A}$ , $V_I = -14.5\text{ V to }-27\text{ V}$ ,<br>$P \leq 15\text{ W}$ | 0°C to 125°C | -11.4   |      | -12.6 |       |
| Input regulation                          | $V_I = -14.5\text{ V to }-30\text{ V}$   |              |         | 5    | 80    | mV    |
|   | $V_I = -16\text{ V to }-22\text{ V}$   |              |         | 3    | 30    |       |
| Ripple rejection                          | $V_I = -15\text{ V to }-25\text{ V}$ , $f = 120\text{ Hz}$   | 0°C to 125°C | 54      | 60   |       | dB    |
| Output regulation                         | $I_O = 5\text{ mA to }1.5\text{ A}$  |              |         | 15   | 200   | mV    |
|   | $I_O = 250\text{ mA to }750\text{ mA}$   |              |         | 5    | 75    |       |
| Temperature coefficient of output voltage | $I_O = 5\text{ mA}$  | 0°C to 125°C |         | -0.8 |       | mV/°C |
| Output noise voltage                      | $f = 10\text{ Hz to }100\text{ kHz}$   | 25°C         |         | 300  |       | μV    |
| Dropout voltage                           | $I_O = 1\text{ A}$   | 25°C         |         | 1.1  |       | V     |
| Bias current                              |  | 25°C         |         | 2    | 3     | mA    |
| Bias current change                       | $V_I = -14.5\text{ V to }-30\text{ V}$   |              |         | 0.04 | 0.5   | mA    |
|   | $I_O = 5\text{ mA to }1\text{ A}$  |              |         | 0.06 | 0.5   |       |
| Peak output current                       |  | 25°C         |         | 2.1  |       | A     |

† 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 2-μF capacitor across the input and a 1-μF capacitor across the output.

‡ This specification applies only for dc power dissipation permitted by absolute maximum ratings.

**electrical characteristics at specified virtual junction temperature,  $V_I = -23\text{ V}$ ,  $I_O = 500\text{ mA}$  (unless otherwise noted)**

| PARAMETER                                 | TEST CONDITIONS  | $T_J$ †      | μA7915C |      |        | UNITS |
|---|--|--------------|---------|------|--------|-------|
|   |  |              | MIN     | TYP  | MAX    |       |
| Output voltage‡                           |  | 25°C         | -14.4   | -15  | -15.6  | V     |
|   | $I_O = 5\text{ mA to }1\text{ A}$ , $V_I = -17.5\text{ V to }-30\text{ V}$ ,<br>$P \leq 15\text{ W}$ | 0°C to 125°C | -14.25  |      | -15.75 |       |
| Input regulation                          | $V_I = -17.5\text{ V to }-30\text{ V}$   |              |         | 5    | 100    | mV    |
|   | $V_I = -20\text{ V to }-26\text{ V}$   |              |         | 3    | 50     |       |
| Ripple rejection                          | $V_I = -18.5\text{ V to }-28.5\text{ V}$ , $f = 120\text{ Hz}$                                       | 0°C to 125°C | 54      | 60   |        | dB    |
| Output regulation                         | $I_O = 5\text{ mA to }1.5\text{ A}$  |              |         | 20   | 300    | mV    |
|   | $I_O = 250\text{ mA to }750\text{ mA}$   |              |         | 8    | 150    |       |
| Temperature coefficient of output voltage | $I_O = 5\text{ mA}$  | 0°C to 125°C |         | -1   |        | mV/°C |
| Output noise voltage                      | $f = 10\text{ Hz to }100\text{ kHz}$   | 25°C         |         | 375  |        | μV    |
| Dropout voltage                           | $I_O = 1\text{ A}$   | 25°C         |         | 1.1  |        | V     |
| Bias current                              |  | 25°C         |         | 2    | 3      | mA    |
| Bias current change                       | $V_I = -17.5\text{ V to }-30\text{ V}$   |              |         | 0.04 | 0.5    | mA    |
|   | $I_O = 5\text{ mA to }1\text{ A}$  |              |         | 0.06 | 0.5    |       |
| Peak output current                       |  | 25°C         |         | 2.1  |        | A     |

† 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 2-μF capacitor across the input and a 1-μF capacitor across the output.

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**electrical characteristics at specified virtual junction temperature,  $V_I = -27$  V,  $I_O = 500$  mA (unless otherwise noted)**

| PARAMETER                                 | TEST CONDITIONS  | $T_J$ †      | μA7918C |      |       | UNITS |
|---|--|--------------|---------|------|-------|-------|
|   |  |              | MIN     | TYP  | MAX   |       |
| Output voltage‡                           |  | 25°C         | -17.3   | -18  | -18.7 | V     |
|   | $I_O = 5$ mA to 1 A, $V_I = -21$ V to -33 V, $P \leq 15$ W | 0°C to 125°C | -17.1   |      | -18.9 |       |
| Input regulation                          | $V_I = -21$ V to -33 V                                     |              |         | 5    | 360   | mV    |
|   | $V_I = -24$ V to -30 V                                     |              |         | 3    | 180   |       |
| Ripple rejection                          | $V_I = -22$ V to -32 V, $f = 120$ Hz                       | 0°C to 125°C | 54      | 60   |       | dB    |
| Output regulation                         | $I_O = 5$ mA to 1.5 A                                      |              |         | 30   | 360   | mV    |
|   | $I_O = 250$ mA to 750 mA                                   |              |         | 10   | 180   |       |
| Temperature coefficient of output voltage | $I_O = 5$ mA   | 0°C to 125°C |         | -1   |       | mV/°C |
| Output noise voltage                      | $f = 10$ Hz to 100 kHz                                     | 25°C         |         | 450  |       | μV    |
| Dropout voltage                           | $I_O = 1$ A  | 25°C         |         | 1.1  |       | V     |
| Bias current                              |  | 25°C         |         | 2    | 3     | mA    |
| Bias current change                       | $V_I = -21$ V to -33 V                                     |              |         | 0.04 | 1     | mA    |
|   | $I_O = 5$ mA to 1 A  |              |         | 0.06 | 0.5   |       |
| Peak output current                       |  | 25°C         |         | 2.1  |       | A     |

† 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 2-μF capacitor across the input and a 1-μF capacitor across the output.

‡ This specification applies only for dc power dissipation permitted by absolute maximum ratings.

**electrical characteristics at specified virtual junction temperature,  $V_I = -33$  V,  $I_O = 500$  mA (unless otherwise noted)**

| PARAMETER                                 | TEST CONDITIONS  | $T_J$ †      | μA7924C |      |       | UNITS |
|---|--|--------------|---------|------|-------|-------|
|   |  |              | MIN     | TYP  | MAX   |       |
| Output voltage‡                           |  | 25°C         | -23     | -24  | -25   | V     |
|   | $I_O = 5$ mA to 1 A, $V_I = -27$ V to -38 V, $P \leq 15$ W | 0°C to 125°C | -22.8   |      | -25.2 |       |
| Input regulation                          | $V_I = -27$ V to -38 V                                     |              |         | 5    | 480   | mV    |
|   | $V_I = -30$ V to -36 V                                     |              |         | 3    | 240   |       |
| Ripple rejection                          | $V_I = -28$ V to -38 V, $f = 120$ Hz                       | 0°C to 125°C | 54      | 60   |       | dB    |
| Output regulation                         | $I_O = 5$ mA to 1.5 A                                      |              |         | 85   | 480   | mV    |
|   | $I_O = 250$ mA to 750 mA                                   |              |         | 25   | 240   |       |
| Temperature coefficient of output voltage | $I_O = 5$ mA   | 0°C to 125°C |         | -1   |       | mV/°C |
| Output noise voltage                      | $f = 10$ Hz to 100 kHz                                     | 25°C         |         | 600  |       | μV    |
| Dropout voltage                           | $I_O = 1$ A  | 25°C         |         | 1.1  |       | V     |
| Bias current                              |  | 25°C         |         | 2    | 3     | mA    |
| Bias current change                       | $V_I = -27$ V to -38 V                                     |              |         | 0.04 | 1     | mA    |
|   | $I_O = 5$ mA to 1 A  |              |         | 0.06 | 0.5   |       |
| Peak output current                       |  | 25°C         |         | 2.1  |       | A     |

† 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 2-μF capacitor across the input and a 1-μF capacitor across the output.

‡ This specification applies only for dc power dissipation permitted by absolute maximum ratings.









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