

μA7800 SERIES POSITIVE-VOLTAGE REGULATORS

SLVS056B – MAY 1976 – REVISED OCTOBER 1996

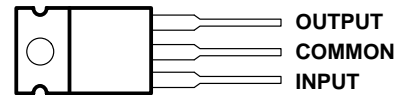
- 3-Terminal Regulators
- Output Current Up to 1.5 A
- Internal Thermal Overload Protection
- High Power Dissipation Capability
- Internal Short-Circuit Current Limiting
- Output Transistor Safe-Area Compensation
- Direct Replacements for Fairchild μA7800 Series

description

This series of fixed-voltage monolithic integrated-circuit voltage regulators is designed for 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 used as the power-pass element in precision regulators.

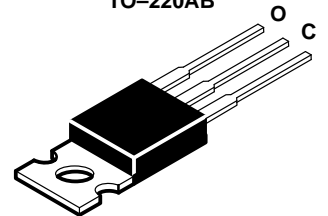
The μA7800C series is characterized for operation over the virtual junction temperature range of 0°C to 125°C. The μA7805Q and μA7812Q are characterized for operation over the virtual junction temperature range of -40°C to 125°C.

**KC PACKAGE
(TOP VIEW)**

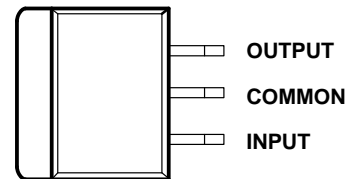


The common terminal is in electrical contact with the mounting base.

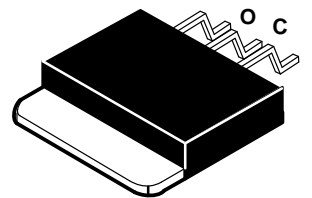
TO-220AB



**KTE PACKAGE
(TOP VIEW)**



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



AVAILABLE OPTIONS

| T _J | V _{O(nom)} (V) | PACKAGED DEVICES | | |
|----------------|----------------------------|---------------------------------|--------------------------------|------------------|
| | | PLASTIC FLANGE-MOUNT (KC) | HEAT-SINK MOUNTED† (KTE) | CHIP FORM (Y) |
| 0°C to 125°C | 5 | μA7805CKC | μA7805CKTE | μA7805Y |
| | 6 | μA7806CKC | μA7806CKTE | μA7806Y |
| | 8 | μA7808CKC | μA7808CKTE | μA7808Y |
| | 8.5 | μA7885CKC | μA7885CKTE | μA7885Y |
| | 10 | μA7810CKC | μA7810CKTE | μA7810Y |
| | 12 | μA7812CKC | μA7812CKTE | μA7812Y |
| | 15 | μA7815CKC | μA7815CKTE | μA7815Y |
| | 18 | μA7818CKC | μA7818CKTE | μA7818Y |
| -40°C to 125°C | 5 | μA7805QKC | μA7805QKTE | — |
| | 12 | μA7812QKC | μA7812QKTE | — |

† 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**

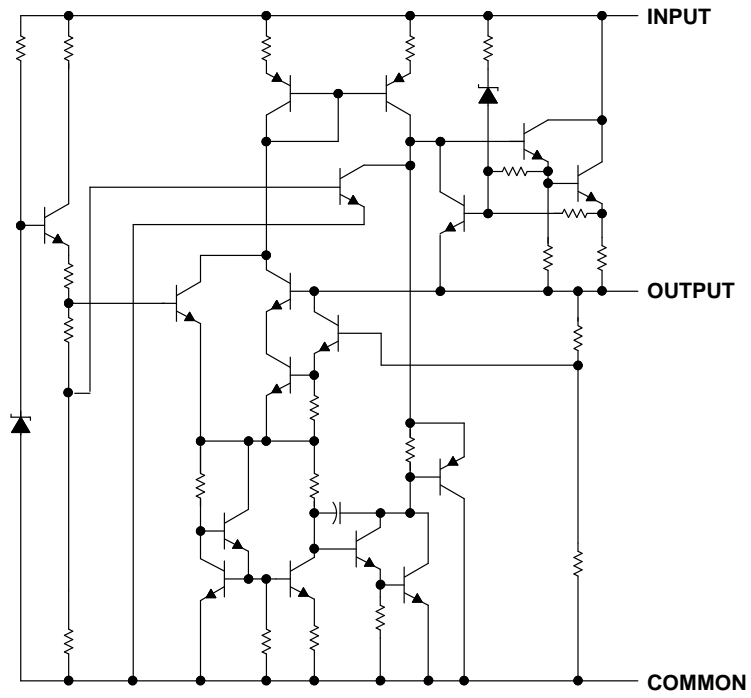
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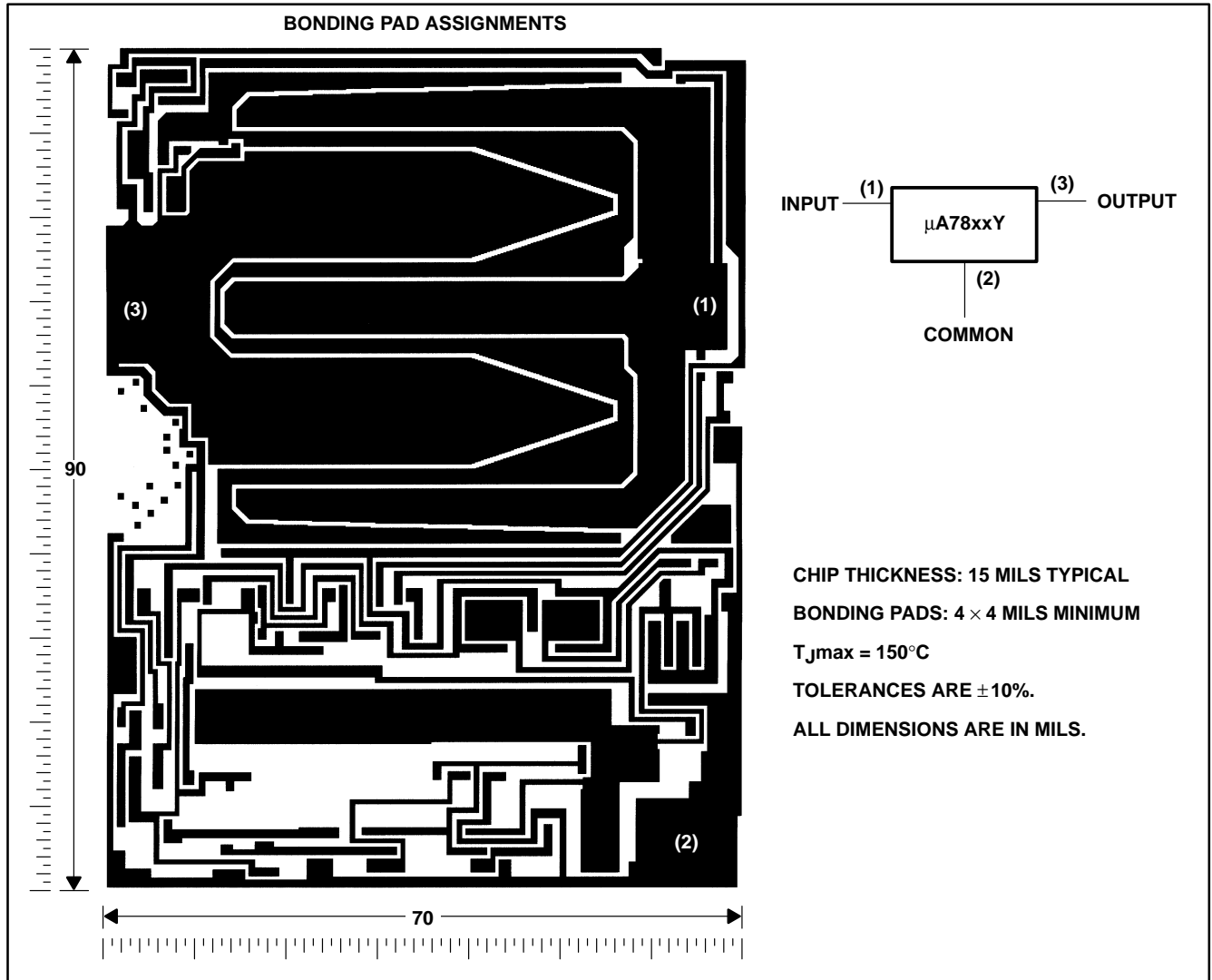
schematic



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μA78xxY chip information

These chips, when properly assembled, display characteristics similar to the μA78xxC. Thermal compression or ultrasonic bonding may be used on the doped aluminum bonding pads. The chips may be mounted with conductive epoxy or a gold-silicon preform.



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absolute maximum ratings over operating temperature ranges (unless otherwise noted)†

| | |
|--|-------------------------------|
| Input voltage, V_i : μA7824C | 40 V |
| All others | 35 V |
| Continuous total power dissipation at (or below) $T_A = 25^\circ\text{C}$ (see Note 1) | See Dissipation Rating Tables |
| Continuous total power dissipation at (or below) $T_C = 90^\circ\text{C}$ (see Note 1) | See Dissipation Rating Tables |
| Operating free-air, T_A , case, T_C , or virtual junction, T_J , temperature range | -40 to 150°C |
| Storage temperature range, T_{stg} | -65 to 150°C |
| Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds | 260°C |

† Stresses beyond those listed under “absolute maximum ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

NOTE 1: For operation above 25°C free-air or 90°C case temperature, refer to Figure 1 and Figure 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 | $T_A \leq 25^\circ\text{C}$ POWER RATING | DERATING FACTOR ABOVE $T_A = 25^\circ\text{C}$ | $T_A = 70^\circ\text{C}$ POWER RATING | $T_A = 105^\circ\text{C}$ POWER RATING | $T_A = 125^\circ\text{C}$ POWER RATING |
|---------|---|---|--|---|---|
| KC | 2000 mW | 16.0 mW/°C | 1280 mW | 720 mW | 400 mW |
| KTE | 1900 mW | 15.2 mW/°C | 1216 mW | 684 mW | 380 mW |

DISSIPATION RATING TABLE — CASE TEMPERATURE

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

FREE-AIR TEMPERATURE
DISSIPATION DERATING CURVE

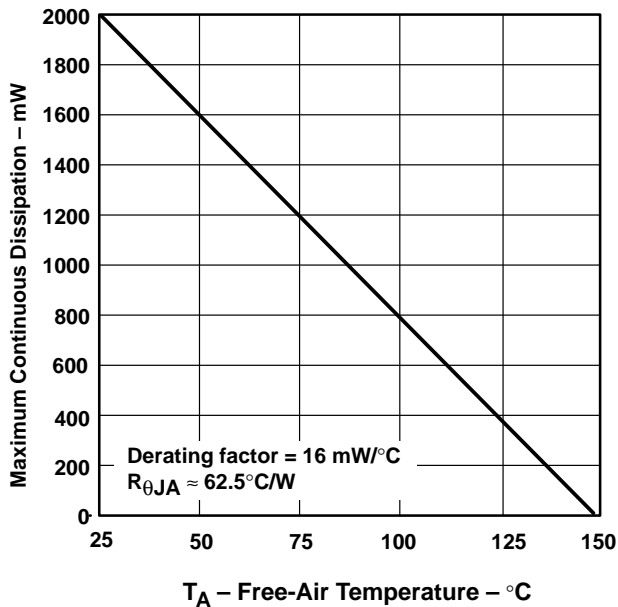


Figure 1

CASE TEMPERATURE
DISSIPATION DERATING CURVE

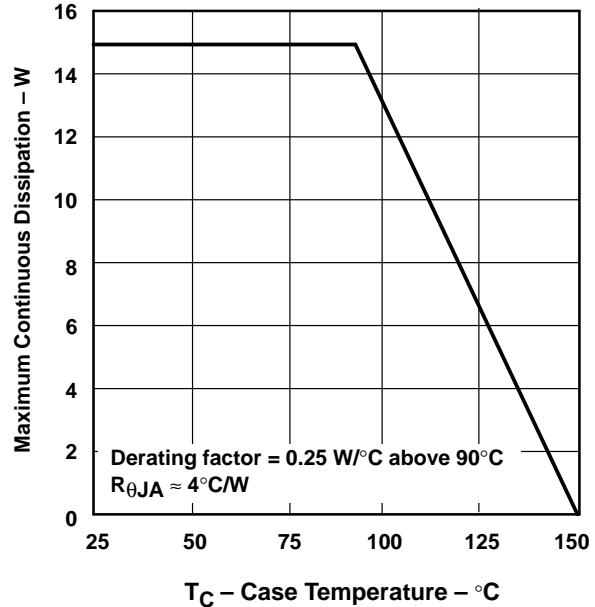


Figure 2



μA7800 SERIES POSITIVE-VOLTAGE REGULATORS

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recommended operating conditions

| | | MIN | MAX | UNIT |
|---|------------------|------|-----|------|
| Input voltage, V_I | μA7805C | 7 | 25 | V |
| | μA7806C | 8 | 25 | |
| | μA7808C | 10.5 | 25 | |
| | μA7885C | 10.5 | 25 | |
| | μA7810C | 12.5 | 28 | |
| | μA7812C | 14.5 | 30 | |
| | μA7815C | 17.5 | 30 | |
| | μA7818C | 21 | 33 | |
| | μA7824C | 27 | 38 | |
| Output current, I_O | | | 1.5 | A |
| Operating virtual junction temperature, T_J | μA7800C Series | 0 | 125 | °C |
| | μA7805Q, μA7812Q | -40 | 125 | |

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

| PARAMETER | TEST CONDITIONS | T_J † | μA7805C, μA7805Q | | | UNIT |
|---|---|-------------|------------------|-----|------|-------|
| | | | MIN | TYP | MAX | |
| Output voltage‡ | | 25°C | 4.8 | 5 | 5.2 | V |
| | $I_O = 5$ mA to 1 A, $V_I = 7$ V to 20 V, $P \leq 15$ W | Full range§ | 4.75 | | 5.25 | |
| Input voltage regulation | $V_I = 7$ V to 25 V | 25°C | | 3 | 100 | mV |
| | $V_I = 8$ V to 12 V | | | 1 | 50 | |
| Ripple rejection | $V_I = 8$ V to 18 V, $f = 120$ Hz | Full range§ | 62 | 78 | | dB |
| Output voltage regulation | $I_O = 5$ mA to 1.5 A | 25°C | | 15 | 100 | mV |
| | $I_O = 250$ mA to 750 mA | | | 5 | 50 | |
| Output resistance | $f = 1$ kHz | Full range§ | 0.017 | | | Ω |
| Temperature coefficient of output voltage | $I_O = 5$ mA | Full range§ | -1.1 | | | mV/°C |
| Output noise voltage | $f = 10$ Hz to 100 kHz | 25°C | 40 | | | μV |
| Dropout voltage | $I_O = 1$ A | 25°C | 2 | | | V |
| Bias current | | 25°C | 4.2 | | 8 | mA |
| Bias current change | $V_I = 7$ V to 25 V | Full range§ | | | 1.3 | mA |
| | $I_O = 5$ mA to 1 A | | | | 0.5 | |
| Short-circuit output current | | 25°C | 750 | | | mA |
| Peak output current | | 25°C | 2.2 | | | A |

† Pulse-testing techniques 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 0.33-μF capacitor across the input and a 0.1-μF capacitor across the output.

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

§ Full range virtual junction temperature is 0°C to 125°C for the μA7805C and -40°C to 125°C for the μA7805Q.

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electrical characteristics at specified virtual junction temperature, $V_I = 11\text{ V}$, $I_O = 500\text{ mA}$ (unless otherwise noted)

| PARAMETER | TEST CONDITIONS | T_J † | μA7806C | | | UNIT |
|---|---|--------------|---------|-----|------|-------|
| | | | MIN | TYP | MAX | |
| Output voltage‡ | | 25°C | 5.75 | 6 | 6.25 | V |
| | $I_O = 5\text{ mA to }1\text{ A}$, $V_I = 8\text{ V to }21\text{ V}$, $P \leq 15\text{ W}$ | 0°C to 125°C | 5.7 | | 6.3 | |
| Input voltage regulation | $V_I = 8\text{ V to }25\text{ V}$ | 25°C | | 5 | 120 | mV |
| | $V_I = 9\text{ V to }13\text{ V}$ | | | 1.5 | 60 | |
| Ripple rejection | $V_I = 9\text{ V to }19\text{ V}$, $f = 120\text{ Hz}$ | 0°C to 125°C | 59 | 75 | | dB |
| Output voltage regulation | $I_O = 5\text{ mA to }1.5\text{ A}$ | 25°C | | 14 | 120 | mV |
| | $I_O = 250\text{ mA to }750\text{ mA}$ | | | 4 | 60 | |
| Output resistance | $f = 1\text{ kHz}$ | 0°C to 125°C | 0.019 | | | Ω |
| 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 | 45 | | | μV |
| Dropout voltage | $I_O = 1\text{ A}$ | 25°C | 2 | | | V |
| Bias current | | 25°C | 4.3 | 8 | | mA |
| Bias current change | $V_I = 8\text{ V to }25\text{ V}$ | 0°C to 125°C | | | 1.3 | mA |
| | $I_O = 5\text{ mA to }1\text{ A}$ | | | | 0.5 | |
| Short-circuit output current | | 25°C | 550 | | | mA |
| Peak output current | | 25°C | 2.2 | | | A |

† Pulse-testing techniques 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 0.33-μF capacitor across the input and a 0.1-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, $V_I = 14\text{ V}$, $I_O = 500\text{ mA}$ (unless otherwise noted)

| PARAMETER | TEST CONDITIONS | T_J † | μA7808C | | | UNIT |
|---|--|--------------|---------|-----|-----|-------|
| | | | MIN | TYP | MAX | |
| Output voltage‡ | | 25°C | 7.7 | 8 | 8.3 | V |
| | $I_O = 5\text{ mA to }1\text{ A}$, $V_I = 10.5\text{ V to }23\text{ V}$, $P \leq 15\text{ W}$ | 0°C to 125°C | 7.6 | | 8.4 | |
| Input voltage regulation | $V_I = 10.5\text{ V to }25\text{ V}$ | 25°C | | 6 | 160 | mV |
| | $V_I = 11\text{ V to }17\text{ V}$ | | | 2 | 80 | |
| Ripple rejection | $V_I = 11.5\text{ V to }21.5\text{ V}$, $f = 120\text{ Hz}$ | 0°C to 125°C | 55 | 72 | | dB |
| Output voltage regulation | $I_O = 5\text{ mA to }1.5\text{ A}$ | 25°C | | 12 | 160 | mV |
| | $I_O = 250\text{ mA to }750\text{ mA}$ | | | 4 | 80 | |
| Output resistance | $f = 1\text{ kHz}$ | 0°C to 125°C | 0.016 | | | Ω |
| 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 | 52 | | | μV |
| Dropout voltage | $I_O = 1\text{ A}$ | 25°C | 2 | | | V |
| Bias current | | 25°C | 4.3 | 8 | | mA |
| Bias current change | $V_I = 10.5\text{ V to }25\text{ V}$ | 0°C to 125°C | | | 1 | mA |
| | $I_O = 5\text{ mA to }1\text{ A}$ | | | | 0.5 | |
| Short-circuit output current | | 25°C | 450 | | | mA |
| Peak output current | | 25°C | 2.2 | | | A |

† Pulse-testing techniques 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 0.33-μF capacitor across the input and a 0.1-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, $V_I = 15\text{ V}$, $I_O = 500\text{ mA}$ (unless otherwise noted)

| PARAMETER | TEST CONDITIONS | T_J † | μA7885C | | | UNIT |
|---|---|--------------|---------|-----|------|-------|
| | | | MIN | TYP | MAX | |
| Output voltage‡ | | 25°C | 8.15 | 8.5 | 8.85 | V |
| | $I_O = 5\text{ mA to }1\text{ A}$, $V_I = 11\text{ V to }23.5\text{ V}$, $P \leq 15\text{ W}$ | 0°C to 125°C | 8.1 | | 8.9 | |
| Input voltage regulation | $V_I = 10.5\text{ V to }25\text{ V}$ | 25°C | | 6 | 170 | mV |
| | $V_I = 11\text{ V to }17\text{ V}$ | | | 2 | 85 | |
| Ripple rejection | $V_I = 11.5\text{ V to }21.5\text{ V}$, $f = 120\text{ Hz}$ | 0°C to 125°C | 54 | 70 | | dB |
| Output voltage regulation | $I_O = 5\text{ mA to }1.5\text{ A}$ | 25°C | | 12 | 170 | mV |
| | $I_O = 250\text{ mA to }750\text{ mA}$ | | | 4 | 85 | |
| Output resistance | $f = 1\text{ kHz}$ | 0°C to 125°C | 0.016 | | | Ω |
| 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 | 55 | | | μV |
| Dropout voltage | $I_O = 1\text{ A}$ | 25°C | 2 | | | V |
| Bias current | | 25°C | 4.3 | 8 | | mA |
| Bias current change | $V_I = 10.5\text{ V to }25\text{ V}$ | 0°C to 125°C | | | 1 | mA |
| | $I_O = 5\text{ mA to }1\text{ A}$ | | | | 0.5 | |
| Short-circuit output current | | 25°C | 450 | | | mA |
| Peak output current | | 25°C | 2.2 | | | A |

† Pulse-testing techniques 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 0.33-μF capacitor across the input and a 0.1-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, $V_I = 17\text{ V}$, $I_O = 500\text{ mA}$ (unless otherwise noted)

| PARAMETER | TEST CONDITIONS | T_J † | μA7810C | | | UNIT |
|---|---|--------------|---------|-----|------|-------|
| | | | MIN | TYP | MAX | |
| Output voltage‡ | | 25°C | 9.6 | 10 | 10.4 | V |
| | $I_O = 5\text{ mA to }1\text{ A}$, $V_I = 12.5\text{ V to }25\text{ V}$, $P \leq 15\text{ W}$ | 0°C to 125°C | 9.5 | 10 | 10.5 | |
| Input voltage regulation | $V_I = 12.5\text{ V to }28\text{ V}$ | 25°C | | 7 | 200 | mV |
| | $V_I = 14\text{ V to }20\text{ V}$ | | | 2 | 100 | |
| Ripple rejection | $V_I = 13\text{ V to }23\text{ V}$, $f = 120\text{ Hz}$ | 0°C to 125°C | 55 | 71 | | dB |
| Output voltage regulation | $I_O = 5\text{ mA to }1.5\text{ A}$ | 25°C | | 12 | 200 | mV |
| | $I_O = 250\text{ mA to }750\text{ mA}$ | | | 4 | 100 | |
| Output resistance | $f = 1\text{ kHz}$ | 0°C to 125°C | 0.018 | | | Ω |
| 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 | 70 | | | μV |
| Dropout voltage | $I_O = 1\text{ A}$ | 25°C | 2 | | | V |
| Bias current | | 25°C | 4.3 | 8 | | mA |
| Bias current change | $V_I = 12.5\text{ V to }28\text{ V}$ | 0°C to 125°C | | | 1 | mA |
| | $I_O = 5\text{ mA to }1\text{ A}$ | | | | 0.5 | |
| Short-circuit output current | | 25°C | 400 | | | mA |
| Peak output current | | 25°C | 2.2 | | | A |

† Pulse-testing techniques 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 0.33-μF capacitor across the input and a 0.1-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 † | μA7812C | | | UNIT |
|---|--|-------------|---------|-----|------|-------|
| | | | MIN | TYP | MAX | |
| Output voltage‡ | | 25°C | 11.5 | 12 | 12.5 | V |
| | $I_O = 5\text{ mA to }1\text{ A}$, $V_I = 14.5\text{ V to }27\text{ V}$, $P \leq 15\text{ W}$ | Full range§ | 11.4 | | 12.6 | |
| Input voltage regulation | $V_I = 14.5\text{ V to }30\text{ V}$ | 25°C | | 10 | 240 | mV |
| | $V_I = 16\text{ V to }22\text{ V}$ | | | 3 | 120 | |
| Ripple rejection | $V_I = 15\text{ V to }25\text{ V}$, $f = 120\text{ Hz}$ | Full range§ | 55 | 71 | | dB |
| Output voltage regulation | $I_O = 5\text{ mA to }1.5\text{ A}$ | 25°C | | 12 | 240 | mV |
| | $I_O = 250\text{ mA to }750\text{ mA}$ | | | 4 | 120 | |
| Output resistance | $f = 1\text{ kHz}$ | Full range§ | 0.018 | | | Ω |
| Temperature coefficient of output voltage | $I_O = 5\text{ mA}$ | Full range§ | -1 | | | mV/°C |
| Output noise voltage | $f = 10\text{ Hz to }100\text{ kHz}$ | 25°C | 75 | | | μV |
| Dropout voltage | $I_O = 1\text{ A}$ | 25°C | 2 | | | V |
| Bias current | | 25°C | 4.3 | | 8 | mA |
| Bias current change | $V_I = 14.5\text{ V to }30\text{ V}$ | Full range§ | | | 1 | mA |
| | $I_O = 5\text{ mA to }1\text{ A}$ | | | | 0.5 | |
| Short-circuit output current | | 25°C | 350 | | | mA |
| Peak output current | | 25°C | 2.2 | | | A |

† Pulse-testing techniques 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 0.33-μF capacitor across the input and a 0.1-μF capacitor across the output.

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

§ Full range virtual junction temperature is 0°C to 125°C for the μA7812C and -40°C to 125°C for the μA7812Q.

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 † | μA7815C | | | UNIT |
|---|--|--------------|---------|-----|-------|-------|
| | | | MIN | TYP | MAX | |
| Output voltage‡ | | 25°C | 14.4 | 15 | 15.6 | V |
| | $I_O = 5\text{ mA to }1\text{ A}$, $V_I = 17.5\text{ V to }30\text{ V}$, $P \leq 15\text{ W}$ | 0°C to 125°C | 14.25 | | 15.75 | |
| Input voltage regulation | $V_I = 17.5\text{ V to }30\text{ V}$ | 25°C | | 11 | 300 | mV |
| | $V_I = 20\text{ V to }26\text{ V}$ | | | 3 | 150 | |
| Ripple rejection | $V_I = 18.5\text{ V to }28.5\text{ V}$, $f = 120\text{ Hz}$ | 0°C to 125°C | 54 | 70 | | dB |
| Output voltage regulation | $I_O = 5\text{ mA to }1.5\text{ A}$ | 25°C | | 12 | 300 | mV |
| | $I_O = 250\text{ mA to }750\text{ mA}$ | | | 4 | 150 | |
| Output resistance | $f = 1\text{ kHz}$ | 0°C to 125°C | 0.019 | | | Ω |
| 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 | 90 | | | μV |
| Dropout voltage | $I_O = 1\text{ A}$ | 25°C | 2 | | | V |
| Bias current | | 25°C | 4.4 | | 8 | mA |
| Bias current change | $V_I = 17.5\text{ V to }30\text{ V}$ | 0°C to 125°C | | | 1 | mA |
| | $I_O = 5\text{ mA to }1\text{ A}$ | | | | 0.5 | |
| Short-circuit output current | | 25°C | 230 | | | mA |
| Peak output current | | 25°C | 2.1 | | | A |

† Pulse-testing techniques 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 0.33-μF capacitor across the input and a 0.1-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, $V_I = 27\text{ V}$, $I_O = 500\text{ mA}$ (unless otherwise noted)

| PARAMETER | TEST CONDITIONS | T_J † | μA7818C | | | UNIT |
|---|---|--------------|---------|-----|------|-------|
| | | | MIN | TYP | MAX | |
| Output voltage‡ | | 25°C | 17.3 | 18 | 18.7 | V |
| | $I_O = 5\text{ mA to }1\text{ A}$, $V_I = 21\text{ V to }33\text{ V}$, $P \leq 15\text{ W}$ | 0°C to 125°C | 17.1 | | 18.9 | |
| Input voltage regulation | $V_I = 21\text{ V to }33\text{ V}$ | 25°C | | 15 | 360 | mV |
| | $V_I = 24\text{ V to }30\text{ V}$ | | | 5 | 180 | |
| Ripple rejection | $V_I = 22\text{ V to }32\text{ V}$, $f = 120\text{ Hz}$ | 0°C to 125°C | 53 | 69 | | dB |
| Output voltage regulation | $I_O = 5\text{ mA to }1.5\text{ A}$ | 25°C | | 12 | 360 | mV |
| | $I_O = 250\text{ mA to }750\text{ mA}$ | | | 4 | 180 | |
| Output resistance | $f = 1\text{ kHz}$ | 0°C to 125°C | 0.022 | | | Ω |
| 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 | 110 | | | μV |
| Dropout voltage | $I_O = 1\text{ A}$ | 25°C | 2 | | | V |
| Bias current | | 25°C | 4.5 | 8 | | mA |
| Bias current change | $V_I = 21\text{ V to }33\text{ V}$ | 0°C to 125°C | | | 1 | mA |
| | $I_O = 5\text{ mA to }1\text{ A}$ | | | | 0.5 | |
| Short-circuit output current | | 25°C | 200 | | | mA |
| Peak output current | | 25°C | 2.1 | | | A |

† Pulse-testing techniques 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 0.33-μF capacitor across the input and a 0.1-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, $V_I = 33\text{ V}$, $I_O = 500\text{ mA}$ (unless otherwise noted)

| PARAMETER | TEST CONDITIONS | T_J † | μA7824C | | | UNIT |
|---|---|--------------|---------|-----|------|-------|
| | | | MIN | TYP | MAX | |
| Output voltage‡ | | 25°C | 23 | 24 | 25 | V |
| | $I_O = 5\text{ mA to }1\text{ A}$, $V_I = 27\text{ V to }38\text{ V}$, $P \leq 15\text{ W}$ | 0°C to 125°C | 22.8 | | 25.2 | |
| Input voltage regulation | $V_I = 27\text{ V to }38\text{ V}$ | 25°C | | 18 | 480 | mV |
| | $V_I = 30\text{ V to }36\text{ V}$ | | | 6 | 240 | |
| Ripple rejection | $V_I = 28\text{ V to }38\text{ V}$, $f = 120\text{ Hz}$ | 0°C to 125°C | 50 | 66 | | dB |
| Output voltage regulation | $I_O = 5\text{ mA to }1.5\text{ A}$ | 25°C | | 12 | 480 | mV |
| | $I_O = 250\text{ mA to }750\text{ mA}$ | | | 4 | 240 | |
| Output resistance | $f = 1\text{ kHz}$ | 0°C to 125°C | 0.028 | | | Ω |
| Temperature coefficient of output voltage | $I_O = 5\text{ mA}$ | 0°C to 125°C | -1.5 | | | mV/°C |
| Output noise voltage | $f = 10\text{ Hz to }100\text{ kHz}$ | 25°C | 170 | | | μV |
| Dropout voltage | $I_O = 1\text{ A}$ | 25°C | 2 | | | V |
| Bias current | | 25°C | 4.6 | 8 | | mA |
| Bias current change | $V_I = 27\text{ V to }38\text{ V}$ | 0°C to 125°C | | | 1 | mA |
| | $I_O = 5\text{ mA to }1\text{ A}$ | | | | 0.5 | |
| Short-circuit output current | | 25°C | 150 | | | mA |
| Peak output current | | 25°C | 2.1 | | | A |

† Pulse-testing techniques 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 0.33-μF capacitor across the input and a 0.1-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, $V_I = 10\text{ V}$, $I_O = 500\text{ mA}$, $T_J = 25^\circ\text{C}$ † (unless otherwise noted)

| PARAMETER | TEST CONDITIONS | μA7805Y | | | UNIT |
|---|---|---------|-------|-----|-------|
| | | MIN | TYP | MAX | |
| Output voltage‡ | | | 5 | | V |
| Input voltage regulation | $V_I = 7\text{ V to }25\text{ V}$ | | 3 | | mV |
| | $V_I = 8\text{ V to }12\text{ V}$ | | 1 | | |
| Ripple rejection | $V_I = 8\text{ V to }18\text{ V}$, $f = 120\text{ Hz}$ | | 78 | | dB |
| Output voltage regulation | $I_O = 5\text{ mA to }1.5\text{ A}$ | | 15 | | mV |
| | $I_O = 250\text{ mA to }750\text{ mA}$ | | 5 | | |
| Output resistance | $f = 1\text{ kHz}$ | | 0.017 | | Ω |
| Temperature coefficient of output voltage | $I_O = 5\text{ mA}$ | | -1.1 | | mV/°C |
| Output noise voltage | $f = 10\text{ Hz to }100\text{ kHz}$ | | 40 | | μV |
| Dropout voltage | $I_O = 1\text{ A}$ | | 2 | | V |
| Bias current | | | 4.2 | | mA |
| Short-circuit output current | | | 750 | | mA |
| Peak output current | | | 2.2 | | A |

† Pulse-testing techniques 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 0.33-μF capacitor across the input and a 0.1-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, $V_I = 11\text{ V}$, $I_O = 500\text{ mA}$, $T_J = 25^\circ\text{C}$ † (unless otherwise noted)

| PARAMETER | TEST CONDITIONS | μA7806Y | | | UNIT |
|---|---|---------|-------|-----|-------|
| | | MIN | TYP | MAX | |
| Output voltage‡ | | | 6 | | V |
| Input voltage regulation | $V_I = 8\text{ V to }25\text{ V}$ | | 5 | | mV |
| | $V_I = 9\text{ V to }13\text{ V}$ | | 1.5 | | |
| Ripple rejection | $V_I = 9\text{ V to }19\text{ V}$, $f = 120\text{ Hz}$ | | 75 | | dB |
| Output voltage regulation | $I_O = 5\text{ mA to }1.5\text{ A}$ | | 14 | | mV |
| | $I_O = 250\text{ mA to }750\text{ mA}$ | | 4 | | |
| Output resistance | $f = 1\text{ kHz}$ | | 0.019 | | Ω |
| Temperature coefficient of output voltage | $I_O = 5\text{ mA}$ | | -0.8 | | mV/°C |
| Output noise voltage | $f = 10\text{ Hz to }100\text{ kHz}$ | | 45 | | μV |
| Dropout voltage | $I_O = 1\text{ A}$ | | 2 | | V |
| Bias current | | | 4.3 | | mA |
| Short-circuit output current | | | 550 | | mA |
| Peak output current | | | 2.2 | | A |

† Pulse-testing techniques 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 0.33-μF capacitor across the input and a 0.1-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, $V_I = 14\text{ V}$, $I_O = 500\text{ mA}$, $T_J = 25^\circ\text{C}$ † (unless otherwise noted)

| PARAMETER | TEST CONDITIONS | μA7808Y | | | UNIT |
|---|---|---------|-------|-----|-------|
| | | MIN | TYP | MAX | |
| Output voltage‡ | | | 8 | | V |
| Input voltage regulation | $V_I = 10.5\text{ V to }25\text{ V}$ | | 6 | | mV |
| | $V_I = 11\text{ V to }17\text{ V}$ | | 2 | | |
| Ripple rejection | $V_I = 11.5\text{ V to }21.5\text{ V}, f = 120\text{ Hz}$ | | 72 | | dB |
| Output voltage regulation | $I_O = 5\text{ mA to }1.5\text{ A}$ | | 12 | | mV |
| | $I_O = 250\text{ mA to }750\text{ mA}$ | | 4 | | |
| Output resistance | $f = 1\text{ kHz}$ | | 0.016 | | Ω |
| Temperature coefficient of output voltage | $I_O = 5\text{ mA}$ | | -0.8 | | mV/°C |
| Output noise voltage | $f = 10\text{ Hz to }100\text{ kHz}$ | | 52 | | μV |
| Dropout voltage | $I_O = 1\text{ A}$ | | 2 | | V |
| Bias current | | | 4.3 | | mA |
| Short-circuit output current | | | 450 | | mA |
| Peak output current | | | 2.2 | | A |

† Pulse-testing techniques 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 0.33-μF capacitor across the input and a 0.1-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, $V_I = 15\text{ V}$, $I_O = 500\text{ mA}$, $T_J = 25^\circ\text{C}$ † (unless otherwise noted)

| PARAMETER | TEST CONDITIONS | μA7885Y | | | UNIT |
|---|---|---------|-------|-----|-------|
| | | MIN | TYP | MAX | |
| Output voltage‡ | | | 8.5 | | V |
| Input voltage regulation | $V_I = 10.5\text{ V to }25\text{ V}$ | | 6 | | mV |
| | $V_I = 11\text{ V to }17\text{ V}$ | | 2 | | |
| Ripple rejection | $V_I = 11.5\text{ V to }21.5\text{ V}, f = 120\text{ Hz}$ | | 70 | | dB |
| Output voltage regulation | $I_O = 5\text{ mA to }1.5\text{ A}$ | | 12 | | mV |
| | $I_O = 250\text{ mA to }750\text{ mA}$ | | 4 | | |
| Output resistance | $f = 1\text{ kHz}$ | | 0.016 | | Ω |
| Temperature coefficient of output voltage | $I_O = 5\text{ mA}$ | | -0.8 | | mV/°C |
| Output noise voltage | $f = 10\text{ Hz to }100\text{ kHz}$ | | 55 | | μV |
| Dropout voltage | $I_O = 1\text{ A}$ | | 2 | | V |
| Bias current | | | 4.3 | | mA |
| Short-circuit output current | | | 450 | | mA |
| Peak output current | | | 2.2 | | A |

† Pulse-testing techniques 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 0.33-μF capacitor across the input and a 0.1-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, $V_I = 17\text{ V}$, $I_O = 500\text{ mA}$, $T_J = 25^\circ\text{C}$ † (unless otherwise noted)

| PARAMETER | TEST CONDITIONS | μA7810Y | | | UNIT |
|---|--|---------|-------|-----|-------|
| | | MIN | TYP | MAX | |
| Output voltage‡ | | | 10 | | V |
| Input voltage regulation | $V_I = 12.5\text{ V to }28\text{ V}$ | | 7 | | mV |
| | $V_I = 14\text{ V to }20\text{ V}$ | | 2 | | |
| Ripple rejection | $V_I = 13\text{ V to }23\text{ V}$, $f = 120\text{ Hz}$ | | 71 | | dB |
| Output voltage regulation | $I_O = 5\text{ mA to }1.5\text{ A}$ | | 12 | | mV |
| | $I_O = 250\text{ mA to }750\text{ mA}$ | | 4 | | |
| Output resistance | $f = 1\text{ kHz}$ | | 0.018 | | Ω |
| Temperature coefficient of output voltage | $I_O = 5\text{ mA}$ | | -1 | | mV/°C |
| Output noise voltage | $f = 10\text{ Hz to }100\text{ kHz}$ | | 70 | | μV |
| Dropout voltage | $I_O = 1\text{ A}$ | | 2 | | V |
| Bias current | | | 4.3 | | mA |
| Short-circuit output current | | | 400 | | mA |
| Peak output current | | | 2.2 | | A |

† Pulse-testing techniques 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 0.33-μF capacitor across the input and a 0.1-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, $V_I = 19\text{ V}$, $I_O = 500\text{ mA}$, $T_J = 25^\circ\text{C}$ † (unless otherwise noted)

| PARAMETER | TEST CONDITIONS | μA7812Y | | | UNIT |
|---|--|---------|-------|-----|-------|
| | | MIN | TYP | MAX | |
| Output voltage‡ | | | 12 | | V |
| Input voltage regulation | $V_I = 14.5\text{ V to }30\text{ V}$ | | 10 | | mV |
| | $V_I = 16\text{ V to }22\text{ V}$ | | 3 | | |
| Ripple rejection | $V_I = 15\text{ V to }25\text{ V}$, $f = 120\text{ Hz}$ | | 71 | | dB |
| Output voltage regulation | $I_O = 5\text{ mA to }1.5\text{ A}$ | | 12 | | mV |
| | $I_O = 250\text{ mA to }750\text{ mA}$ | | 4 | | |
| Output resistance | $f = 1\text{ kHz}$ | | 0.018 | | Ω |
| Temperature coefficient of output voltage | $I_O = 5\text{ mA}$ | | -1 | | mV/°C |
| Output noise voltage | $f = 10\text{ Hz to }100\text{ kHz}$ | | 75 | | μV |
| Dropout voltage | $I_O = 1\text{ A}$ | | 2 | | V |
| Bias current | | | 4.3 | | mA |
| Short-circuit output current | | | 350 | | mA |
| Peak output current | | | 2.2 | | A |

† Pulse-testing techniques 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 0.33-μF capacitor across the input and a 0.1-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, $V_I = 23\text{ V}$, $I_O = 500\text{ mA}$, $T_J = 25^\circ\text{C}$ † (unless otherwise noted)

| PARAMETER | TEST CONDITIONS | μA7815Y | | | UNIT |
|---|--|---------|-------|-----|-------|
| | | MIN | TYP | MAX | |
| Output voltage‡ | | | 15 | | V |
| Input voltage regulation | $V_I = 17.5\text{ V to }30\text{ V}$ | | 11 | | mV |
| | $V_I = 20\text{ V to }26\text{ V}$ | | 3 | | |
| Ripple rejection | $V_I = 18.5\text{ V to }28.5\text{ V}$, $f = 120\text{ Hz}$ | | 70 | | dB |
| Output voltage regulation | $I_O = 5\text{ mA to }1.5\text{ A}$ | | 12 | | mV |
| | $I_O = 250\text{ mA to }750\text{ mA}$ | | 4 | | |
| Output resistance | $f = 1\text{ kHz}$ | | 0.019 | | Ω |
| Temperature coefficient of output voltage | $I_O = 5\text{ mA}$ | | -1 | | mV/°C |
| Output noise voltage | $f = 10\text{ Hz to }100\text{ kHz}$ | | 90 | | μV |
| Dropout voltage | $I_O = 1\text{ A}$ | | 2 | | V |
| Bias current | | | 4.4 | | mA |
| Short-circuit output current | | | 230 | | mA |
| Peak output current | | | 2.1 | | A |

† Pulse-testing techniques 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 0.33-μF capacitor across the input and a 0.1-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, $V_I = 27\text{ V}$, $I_O = 500\text{ mA}$, $T_J = 25^\circ\text{C}$ † (unless otherwise noted)

| PARAMETER | TEST CONDITIONS | μA7818Y | | | UNIT |
|---|--|---------|-------|-----|-------|
| | | MIN | TYP | MAX | |
| Output voltage‡ | | | 18 | | V |
| Input voltage regulation | $V_I = 21\text{ V to }33\text{ V}$ | | 15 | | mV |
| | $V_I = 24\text{ V to }30\text{ V}$ | | 5 | | |
| Ripple rejection | $V_I = 22\text{ V to }32\text{ V}$, $f = 120\text{ Hz}$ | | 69 | | dB |
| Output voltage regulation | $I_O = 5\text{ mA to }1.5\text{ A}$ | | 12 | | mV |
| | $I_O = 250\text{ mA to }750\text{ mA}$ | | 4 | | |
| Output resistance | $f = 1\text{ kHz}$ | | 0.022 | | Ω |
| Temperature coefficient of output voltage | $I_O = 5\text{ mA}$ | | -1 | | mV/°C |
| Output noise voltage | $f = 10\text{ Hz to }100\text{ kHz}$ | | 110 | | μV |
| Dropout voltage | $I_O = 1\text{ A}$ | | 2 | | V |
| Bias current | | | 4.5 | | mA |
| Short-circuit output current | | | 200 | | mA |
| Peak output current | | | 2.1 | | A |

† Pulse-testing techniques 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 0.33-μF capacitor across the input and a 0.1-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, $V_I = 33\text{ V}$, $I_O = 500\text{ mA}$, $T_J = 25^\circ\text{C}$ †
(unless otherwise noted)

| PARAMETER | TEST CONDITIONS | μA7824Y | | | UNIT |
|---|--|---------|-------|-----|-------|
| | | MIN | TYP | MAX | |
| Output voltage‡ | | | 24 | | V |
| Input voltage regulation | $V_I = 27\text{ V to }38\text{ V}$ | | 18 | | mV |
| | $V_I = 30\text{ V to }36\text{ V}$ | | 6 | | |
| Ripple rejection | $V_I = 28\text{ V to }38\text{ V}$, $f = 120\text{ Hz}$ | | 66 | | dB |
| Output voltage regulation | $I_O = 5\text{ mA to }1.5\text{ A}$ | | 12 | | mV |
| | $I_O = 250\text{ mA to }750\text{ mA}$ | | 4 | | |
| Output resistance | $f = 1\text{ kHz}$ | | 0.028 | | Ω |
| Temperature coefficient of output voltage | $I_O = 5\text{ mA}$ | | -1.5 | | mV/°C |
| Output noise voltage | $f = 10\text{ Hz to }100\text{ kHz}$ | | 170 | | μV |
| Dropout voltage | $I_O = 1\text{ A}$ | | 2 | | V |
| Bias current | | | 4.6 | | mA |
| Short-circuit output current | | | 150 | | mA |
| Peak output current | | | 2.1 | | A |

† Pulse-testing techniques 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 0.33-μF capacitor across the input and a 0.1-μF capacitor across the output.

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



APPLICATION INFORMATION

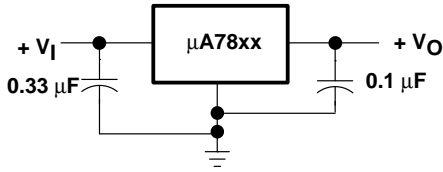


Figure 3. Fixed Output Regulator

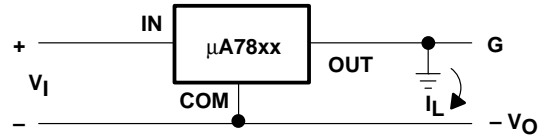
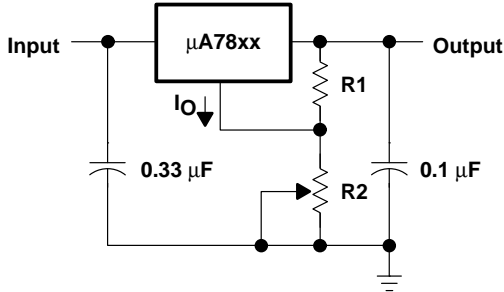


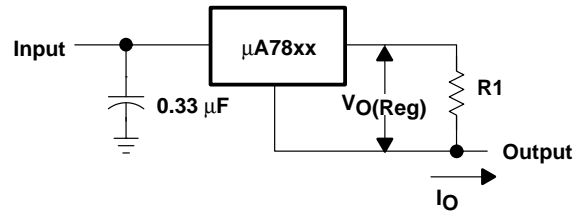
Figure 4. Positive Regulator in Negative Configuration (V_I Must Float)



NOTE A: The following formula is used when V_{xx} is the nominal output voltage (output to common) of the fixed regulator.

$$V_O = V_{xx} + \left(\frac{V_{xx}}{R1} + I_Q \right) R2$$

Figure 5. Adjustable Output Regulator



$$I_O = (V_O/R1) + I_O \text{ Bias Current}$$

Figure 6. Current Regulator

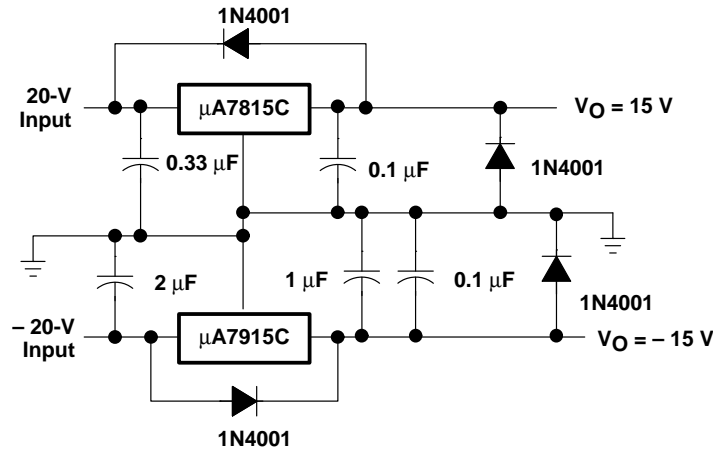


Figure 7. Regulated Dual Supply

APPLICATION INFORMATION

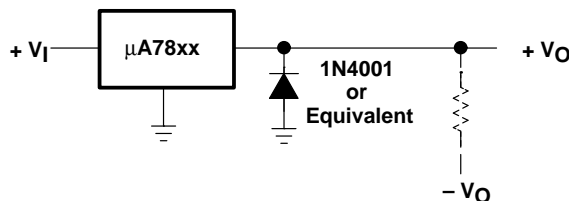


Figure 8. Output Polarity-Reversal Protection Circuit

operation with a load common to a voltage of opposite polarity

In many cases, a regulator powers a load that is not connected to ground but instead is connected to a voltage source of opposite polarity (e.g., op amps, level-shifting circuits, etc.). In these cases, a clamp diode should be connected to the regulator output as shown in Figure 8. This protects the regulator from output polarity reversals during startup and short-circuit operation.

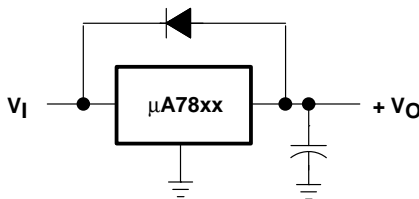


Figure 9. Reverse-Bias Protection Circuit

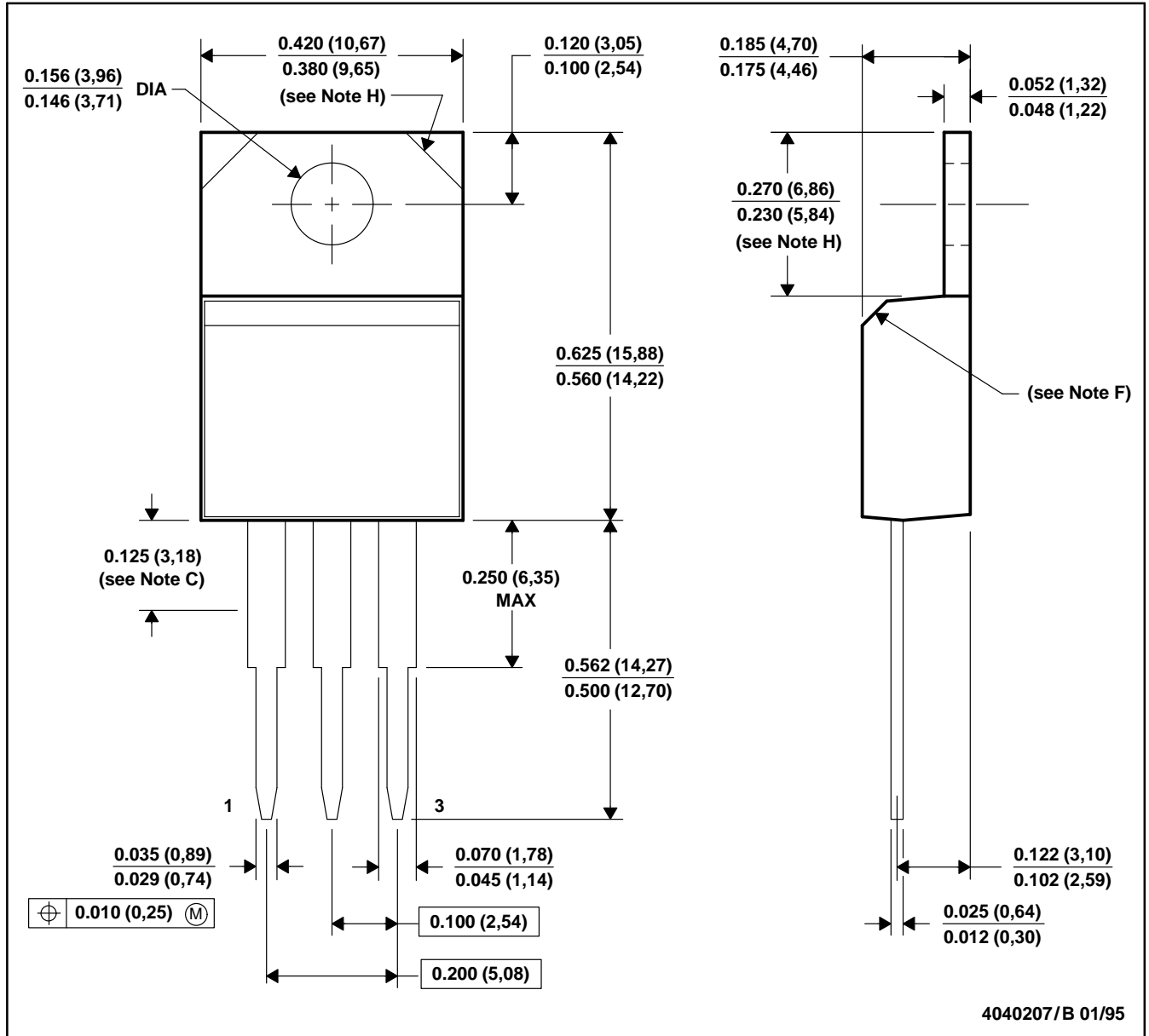
reverse-bias protection

Occasionally, there exists the possibility that the input voltage to the regulator can collapse faster than the output voltage. This could occur, for example, when the input supply is crowbarred during an output overvoltage condition. If the output voltage is greater than approximately 7 V, the emitter-base junction of the series pass element (internal or external) could break down and be damaged. To prevent this, a diode shunt can be employed as shown in Figure 9.

MECHANICAL INFORMATION

KC (R-PSFM-T3)

PLASTIC FLANGE-MOUNT PACKAGE



- NOTES: B. All linear dimensions are in inches (millimeters).
 C. This drawing is subject to change without notice.
 D. Lead dimensions are not controlled within this area.
 E. All lead dimensions apply before solder dip.
 F. The center lead is in electrical contact with the mounting tab.
 G. The chamfer is optional.
 H. Falls within JEDEC TO-220AB
 I. Tab contour optional within these dimensions

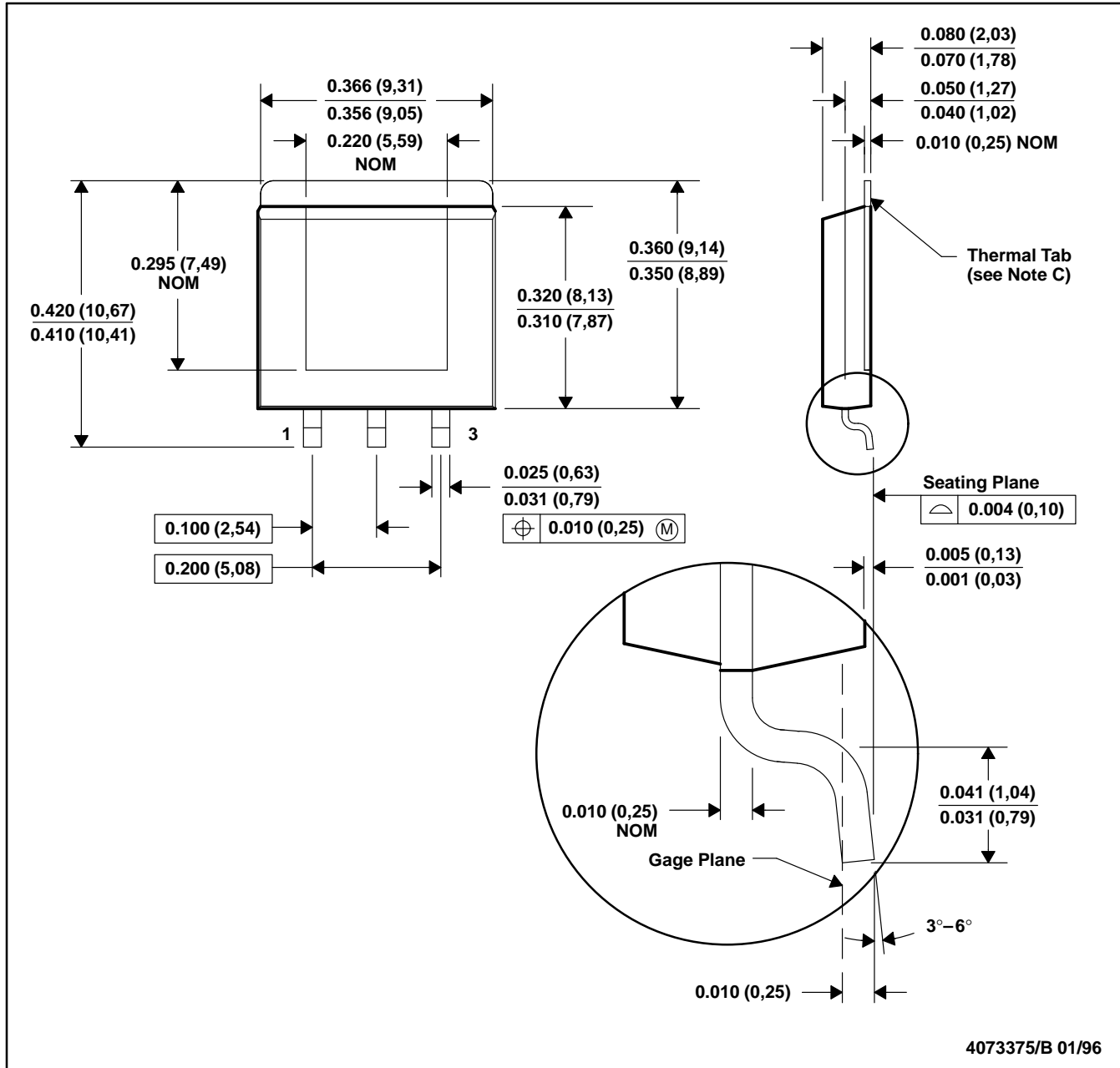
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MECHANICAL INFORMATION

KTE (R-PSFM-T3)

PLASTIC FLANGE-MOUNT PACKAGE



- NOTES: A. All linear dimensions are in inches (millimeters).
 B. This drawing is subject to change without notice.
 C. The center lead is in electrical contact with the thermal tab.

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