

BIPOLAR ANALOG INTEGRATED CIRCUIT

μ PC7900A Series

THREE TERMINAL NEGATIVE VOLTAGE REGULATOR

DESCRIPTION

μ PC7900A series are monolithic three terminal negative regulators which employ internally current limiting, thermal shut down, output transistor safe operating area protection make them essentially indestructible.

They are intended as fixed voltage regulators in a wide range of application including local on card regulation for elimination of distribution problems associated wide single point regulation.

FEATURES

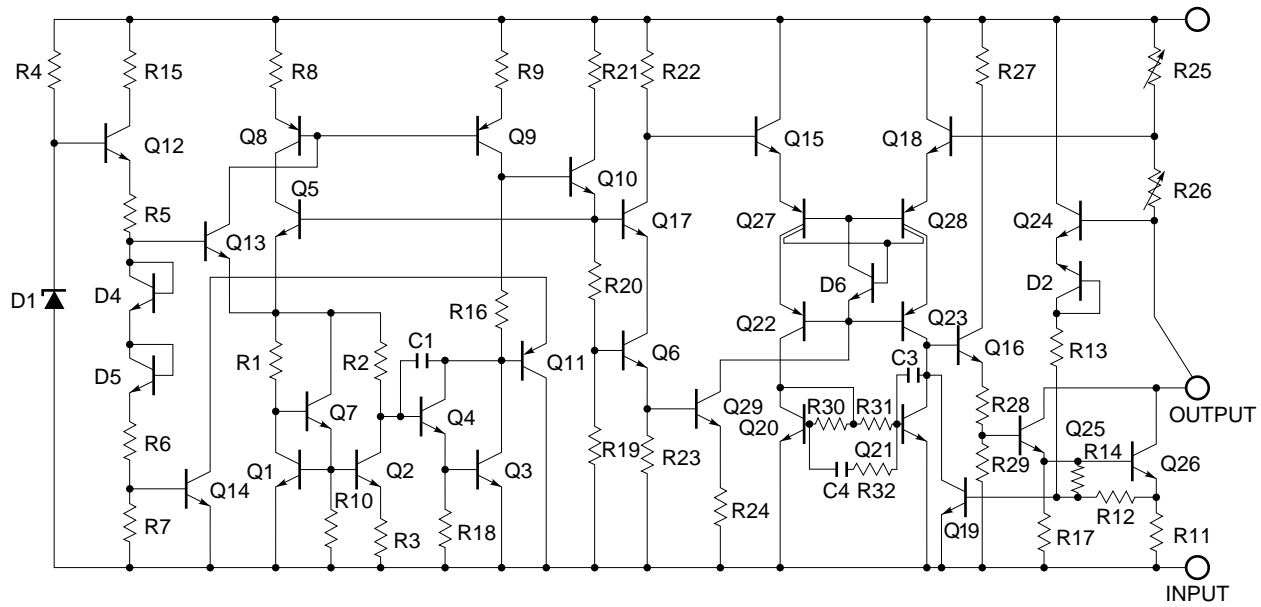
- Wide operation temperature range.
T_A: -30 °C to +85 °C
- Good load regulation.
7 mV TYP. (250 mA ≤ I_o ≤ 750 mA): μ PC7905AHF
- Low noise.

ORDERING INFORMATION

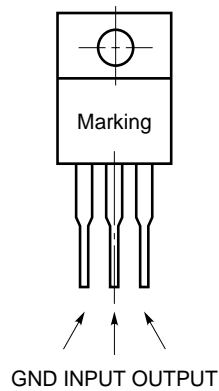
| Part Number | Output Voltage | Package |
|-----------------|----------------|--------------------------|
| μ PC7905AHF | -5 V | MP-45G (ISOLATED TO-220) |
| μ PC7908AHF | -8 V | MP-45G (ISOLATED TO-220) |
| μ PC7912AHF | -12 V | MP-45G (ISOLATED TO-220) |
| μ PC7915AHF | -15 V | MP-45G (ISOLATED TO-220) |
| μ PC7918AHF | -18 V | MP-45G (ISOLATED TO-220) |
| μ PC7924AHF | -24 V | MP-45G (ISOLATED TO-220) |

The information in this document is subject to change without notice.

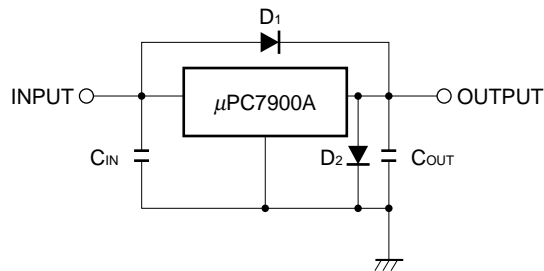
EQUIVALENT CIRCUIT



CONNECTION DIAGRAM



TYPICAL CONNECTION



- C_{IN} : More than 2.2 μF
- C_{OUT}: More than 0.33 μF
- D₁ : Needed for V_{IN} > V_O
- D₂ : Needed for V_O > GND

ABSOLUTE MAXIMUM REATINGS (T_A = 25 °C)

| Parameter | Symbol | Rating | Unit |
|--|----------------------|-----------------------|------|
| Input Voltage | V _{IN} | -35/-40 Note 1 | V |
| Internal Power Dissipation | P _T | 15 Note 2 | W |
| Operating Ambient Temperature Range | T _A | -30 to +85 | °C |
| Operating Junction Temperature Range | T _J | -30 to +150 | °C |
| Storage Temperature Range | T _{stg} | -55 to +150 | °C |
| Thermal Resistance (junction to case) | R _{th(J-C)} | 5.0 | °C/W |
| Thermal Resistance (junction to ambient) | R _{th(J-A)} | 65 | °C/W |

Note 1. μPC7905A, 08A, 12A, 15A, 18A: -35 V, μPC7924A: -40 V

2. Internally limited

RECOMMENDED OPERATING CONDITIONS

| Parameter | Symbol | Part Number | MIN. | TYP. | MAX. | Unit |
|--------------------------------------|-----------------|-------------|-------|------|------|------|
| Input Voltage | V _{IN} | μPC7905AHF | -7 | -10 | -25 | V |
| | | μPC7908AHF | -10.5 | -14 | -25 | |
| | | μPC7912AHF | -14.5 | -19 | -30 | |
| | | μPC7915AHF | -17.5 | -23 | -30 | |
| | | μPC7918AHF | -21 | -27 | -33 | |
| | | μPC7924AHF | -27 | -33 | -38 | |
| Output Current | I _o | All | 0.005 | | 1 | A |
| Operating Ambient Temperature | T _A | All | -30 | | +85 | °C |
| Operating Junction Temperature Range | T _J | All | -30 | | +125 | °C |

ELECTRICAL CHARACTERISTICS (T_A = 25 °C)

μPC7905A

(V_{IN} = -10 V, I_o = 500 mA, 0 °C ≤ T_J ≤ +125 °C)

| Parameter | Symbol | Conditions | MIN. | TYP. | MAX. | Unit |
|---|---------------------|---|-------|------|-------|---------|
| Output Voltage | V _O | T _J = 25 °C | -4.8 | -5.0 | -5.2 | V |
| | | -7 V ≤ V _{IN} ≤ -20 V, 5 mA ≤ I _o ≤ 1 A, P _T ≤ 15 W | -4.75 | | -5.25 | |
| | | -30 °C ≤ T _J ≤ +125 °C | -4.75 | | -5.25 | |
| Line Regulation | REG _{IN} | T _J = 25 °C, -7 V ≤ V _{IN} ≤ -25 V | | 25 | 100 | mV |
| | | T _J = 25 °C, -8 V ≤ V _{IN} ≤ -12 V | | 3 | 50 | |
| Load Regulation | REG _L | T _J = 25 °C, 5 mA ≤ I _o ≤ 1.5 A | | 30 | 100 | mV |
| | | T _J = 25 °C, 250 mA ≤ I _o ≤ 750 mA | | 7 | 50 | |
| Quiescent Current | I _{BIAS} | T _J = 25 °C | | 3.6 | 6.0 | mA |
| Quiescent Current Change | ΔI _{BIAS} | -7 V ≤ V _{IN} ≤ -25 V | | | 1.3 | mA |
| | | 5 mA ≤ I _o ≤ 1 A | | | 0.5 | |
| Output Noise Voltage | V _n | T _J = 25 °C, 10 Hz ≤ f ≤ 100 kHz | | 77 | | μVr.m.s |
| Ripple Rejection | R•R | T _J = 25 °C, f = 120 Hz, -8 V ≤ V _{IN} ≤ -18 V, I _o = 500 mA | 56 | 63 | | dB |
| Dropout Voltage | V _{DIF} | T _J = 25 °C, I _o = 1 A | | 1.2 | | V |
| Peak Output Current | I _{Opeak} | T _J = 25 °C | 1.6 | 2.2 | 2.8 | A |
| Temperature Coefficient of Output Voltage | ΔV _O /ΔT | I _o = 5 mA | | 0.36 | | mV/°C |

μPC7908A

(V_{IN} = -14 V, I_o = 500 mA, 0 °C ≤ T_J ≤ +125 °C)

| Parameter | Symbol | Conditions | MIN. | TYP. | MAX. | Unit |
|---|---------------------|--|------|------|------|---------|
| Output Voltage | V _O | T _J = 25 °C | -7.7 | -8.0 | -8.3 | V |
| | | -10.5 V ≤ V _{IN} ≤ -23 V, 5 mA ≤ I _o ≤ 1 A, P _T ≤ 15 W | -7.6 | | -8.4 | |
| | | -30 °C ≤ T _J ≤ +125 °C | -7.6 | | -8.4 | |
| Line Regulation | REG _{IN} | T _J = 25 °C, -10.5 V ≤ V _{IN} ≤ -25 V | | 33 | 150 | mV |
| | | T _J = 25 °C, -11 V ≤ V _{IN} ≤ -17 V | | 14 | 75 | |
| Load Regulation | REG _L | T _J = 25 °C, 5 mA ≤ I _o ≤ 1.5 A | | 40 | 160 | mV |
| | | T _J = 25 °C, 250 mA ≤ I _o ≤ 750 mA | | 14 | 80 | |
| Quiescent Current | I _{BIAS} | T _J = 25 °C | | 3.9 | 6.0 | mA |
| Quiescent Current Change | ΔI _{BIAS} | -10.5 V ≤ V _{IN} ≤ -25 V | | | 1.0 | mA |
| | | 5 mA ≤ I _o ≤ 1 A | | | 0.5 | |
| Output Noise Voltage | V _n | T _J = 25 °C, 10 Hz ≤ f ≤ 100 kHz | | 130 | | μVr.m.s |
| Ripple Rejection | R•R | T _J = 25 °C, -11.5 V ≤ V _{IN} ≤ -21.5 V, f = 120 Hz, I _o = 500 mA | 52 | 58 | | dB |
| Dropout Voltage | V _{DIF} | T _J = 25 °C, I _o = 1 A | | 1.2 | | V |
| Peak Output Current | I _{Opeak} | T _J = 25 °C | 1.6 | 2.2 | 2.8 | A |
| Temperature Coefficient of Output Voltage | ΔV _O /ΔT | I _o = 5 mA | | 0.32 | | mV/°C |

μPC7912A

($V_{IN} = -19\text{ V}$, $I_o = 500\text{ mA}$, $0\text{ }^{\circ}\text{C} \leq T_J \leq +125\text{ }^{\circ}\text{C}$)

| Parameter | Symbol | Conditions | MIN. | TYP. | MAX. | Unit |
|---|-------------------------|--|-------|------|-------|---------|
| Output Voltage | V_O | $T_J = 25\text{ }^{\circ}\text{C}$ | -11.5 | -12 | -12.5 | V |
| | | $-14.5\text{ V} \leq V_{IN} \leq -27\text{ V}$, $5\text{ mA} \leq I_o \leq 1\text{ A}$, $P_T \leq 15\text{ W}$ | -11.4 | | -12.6 | |
| | | $-30\text{ }^{\circ}\text{C} \leq T_J \leq +125\text{ }^{\circ}\text{C}$ | -11.4 | | -12.6 | |
| Line Regulation | REG_{IN} | $T_J = 25\text{ }^{\circ}\text{C}$, $-14.5\text{ V} \leq V_{IN} \leq -30\text{ V}$ | | 60 | 200 | mV |
| | | $T_J = 25\text{ }^{\circ}\text{C}$, $-16\text{ V} \leq V_{IN} \leq -22\text{ V}$ | | 25 | 100 | |
| Load Regulation | REG_L | $T_J = 25\text{ }^{\circ}\text{C}$, $5\text{ mA} \leq I_o \leq 1.5\text{ A}$ | | 70 | 220 | mV |
| | | $T_J = 25\text{ }^{\circ}\text{C}$, $250\text{ mA} \leq I_o \leq 750\text{ mA}$ | | 20 | 110 | |
| Quiescent Current | I_{BIAS} | $T_J = 25\text{ }^{\circ}\text{C}$ | | 4.1 | 6.2 | mA |
| Quiescent Current Change | ΔI_{BIAS} | $-14.5\text{ V} \leq V_{IN} \leq -30\text{ V}$ | | | 1.0 | mA |
| | | $5\text{ mA} \leq I_o \leq 1\text{ A}$ | | | 0.5 | |
| Output Noise Voltage | V_n | $T_J = 25\text{ }^{\circ}\text{C}$, $10\text{ Hz} \leq f \leq 100\text{ kHz}$ | | 140 | | μVr.m.s |
| Ripple Rejection | $R \cdot R$ | $T_J = 25\text{ }^{\circ}\text{C}$, $f = 120\text{ Hz}$, $-15\text{ V} \leq V_{IN} \leq -25\text{ V}$, $I_o = 500\text{ mA}$ | 49 | 56 | | dB |
| Dropout Voltage | V_{DIF} | $T_J = 25\text{ }^{\circ}\text{C}$, $I_o = 1\text{ A}$ | | 1.2 | | V |
| Peak Output Current | I_{Opeak} | $T_J = 25\text{ }^{\circ}\text{C}$ | 1.6 | 2.2 | 2.8 | A |
| Temperature Coefficient of Output Voltage | $ \Delta V_O/\Delta T $ | $I_o = 5\text{ mA}$ | | 0.04 | | mV/°C |

μPC7915A

($V_{IN} = -23\text{ V}$, $I_o = 500\text{ mA}$, $0\text{ }^{\circ}\text{C} \leq T_J \leq +125\text{ }^{\circ}\text{C}$)

| Parameter | Symbol | Conditions | MIN. | TYP. | MAX. | Unit |
|---|-------------------------|--|--------|------|--------|---------|
| Output Voltage | V_O | $T_J = 25\text{ }^{\circ}\text{C}$ | -14.4 | -15 | -15.6 | V |
| | | $-17.5\text{ V} \leq V_{IN} \leq -30\text{ V}$, $5\text{ mA} \leq I_o \leq 1\text{ A}$, $P_T \leq 15\text{ W}$ | -14.25 | | -15.75 | |
| | | $-30\text{ }^{\circ}\text{C} \leq T_J \leq +125\text{ }^{\circ}\text{C}$ | -14.25 | | -15.75 | |
| Line Regulation | REG_{IN} | $T_J = 25\text{ }^{\circ}\text{C}$, $-17.5\text{ V} \leq V_{IN} \leq -30\text{ V}$ | | 60 | 200 | mV |
| | | $T_J = 25\text{ }^{\circ}\text{C}$, $-20\text{ V} \leq V_{IN} \leq -26\text{ V}$ | | 30 | 100 | |
| Load Regulation | REG_L | $T_J = 25\text{ }^{\circ}\text{C}$, $5\text{ mA} \leq I_o \leq 1.5\text{ A}$ | | 100 | 300 | mV |
| | | $T_J = 25\text{ }^{\circ}\text{C}$, $250\text{ mA} \leq I_o \leq 750\text{ mA}$ | | 30 | 150 | |
| Quiescent Current | I_{BIAS} | $T_J = 25\text{ }^{\circ}\text{C}$ | | 4.2 | 6.2 | mA |
| Quiescent Current Change | ΔI_{BIAS} | $-17.5\text{ V} \leq V_{IN} \leq -30\text{ V}$ | | | 1.0 | mA |
| | | $5\text{ mA} \leq I_o \leq 1\text{ A}$ | | | 0.5 | |
| Output Noise Voltage | V_n | $T_J = 25\text{ }^{\circ}\text{C}$, $10\text{ Hz} \leq f \leq 100\text{ kHz}$ | | 240 | | μVr.m.s |
| Ripple Rejection | $R \cdot R$ | $T_J = 25\text{ }^{\circ}\text{C}$, $f = 120\text{ Hz}$, $-18.5\text{ V} \leq V_{IN} \leq -28.5\text{ V}$, $I_o = 500\text{ mA}$ | 47 | 54 | | dB |
| Dropout Voltage | V_{DIF} | $T_J = 25\text{ }^{\circ}\text{C}$, $I_o = 1\text{ A}$ | | 1.2 | | V |
| Peak Output Current | I_{Opeak} | $T_J = 25\text{ }^{\circ}\text{C}$ | 1.6 | 2.2 | 2.8 | A |
| Temperature Coefficient of Output Voltage | $ \Delta V_O/\Delta T $ | $I_o = 5\text{ mA}$ | | 1.2 | | mV/°C |

μPC7918A

($V_{IN} = -27\text{ V}$, $I_o = 500\text{ mA}$, $0\text{ °C} \leq T_J \leq +125\text{ °C}$)

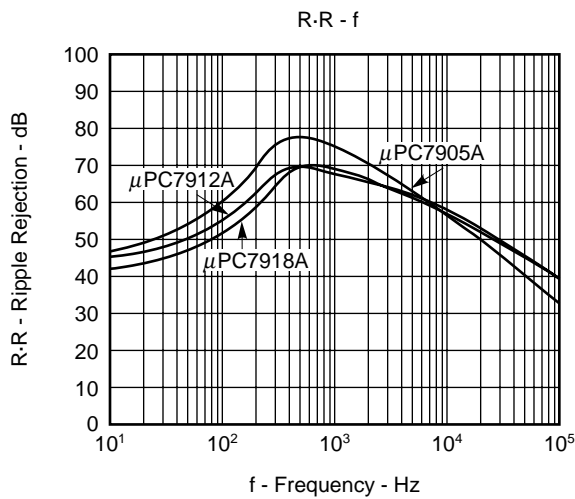
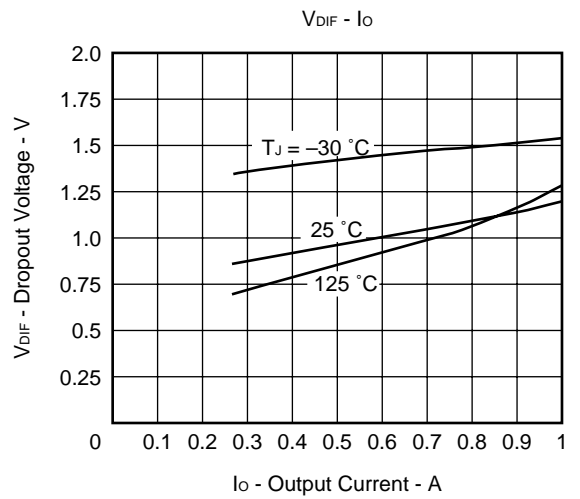
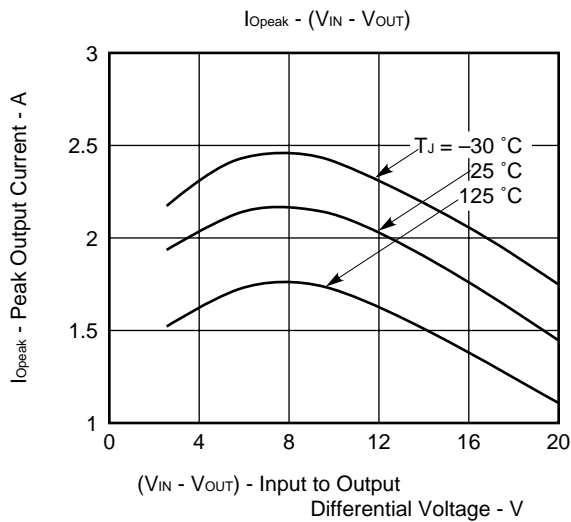
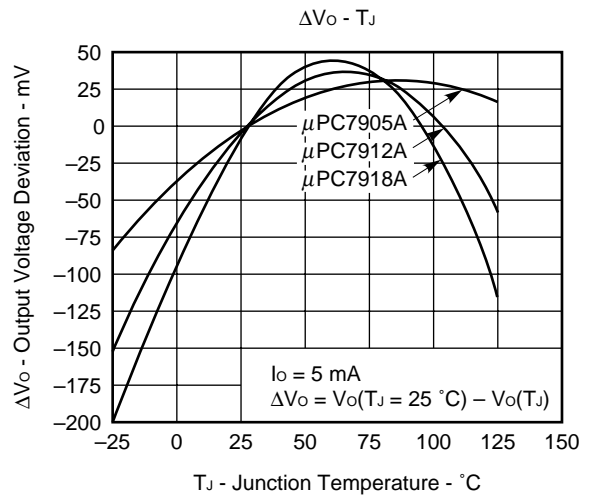
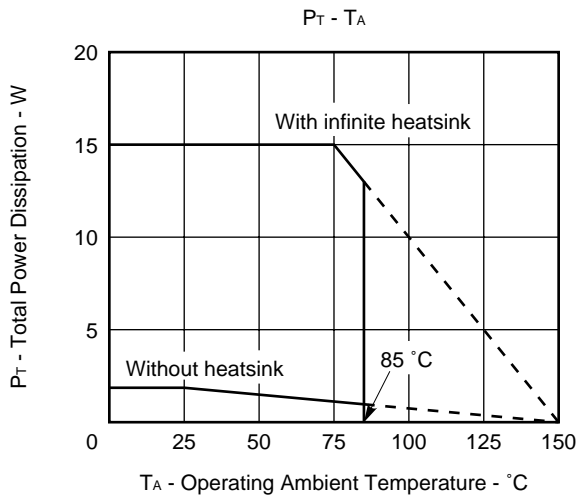
| Parameter | Symbol | Conditions | MIN. | TYP. | MAX. | Unit |
|---|-------------------------|--|-------|------|-------|---------|
| Output Voltage | V_o | $T_J = 25\text{ °C}$ | -17.3 | -18 | -18.7 | V |
| | | $-21\text{ V} \leq V_{IN} \leq -33\text{ V}$, $5\text{ mA} \leq I_o \leq 1\text{ A}$, $P_T \leq 15\text{ W}$ | -17.1 | | -18.9 | |
| | | $-30\text{ °C} \leq T_J \leq +125\text{ °C}$ | -17.1 | | -18.9 | |
| Line Regulation | REG_{IN} | $T_J = 25\text{ °C}$, $-21\text{ V} \leq V_{IN} \leq -33\text{ V}$ | | 60 | 240 | mV |
| | | $T_J = 25\text{ °C}$, $-24\text{ V} \leq V_{IN} \leq -30\text{ V}$ | | 30 | 120 | |
| Load Regulation | REG_L | $T_J = 25\text{ °C}$, $5\text{ mA} \leq I_o \leq 1.5\text{ A}$ | | 125 | 360 | mV |
| | | $T_J = 25\text{ °C}$, $250\text{ mA} \leq I_o \leq 750\text{ mA}$ | | 47 | 180 | |
| Quiescent Current | I_{BIAS} | $T_J = 25\text{ °C}$ | | 4.1 | 6.5 | mA |
| Quiescent Current Change | ΔI_{BIAS} | $-21\text{ V} \leq V_{IN} \leq -33\text{ V}$ | | | 1.0 | mA |
| | | $5\text{ mA} \leq I_o \leq 1\text{ A}$ | | | 0.5 | |
| Output Noise Voltage | V_n | $T_J = 25\text{ °C}$, $10\text{ Hz} \leq f \leq 100\text{ kHz}$ | | 190 | | μVr.m.s |
| Ripple Rejection | $R \cdot R$ | $T_J = 25\text{ °C}$, $f = 120\text{ Hz}$, $-22\text{ V} \leq V_{IN} \leq -32\text{ V}$, $I_o = 500\text{ mA}$ | 45 | 53 | | dB |
| Dropout Voltage | V_{DIF} | $T_J = 25\text{ °C}$, $I_o = 1\text{ A}$ | | 1.2 | | V |
| Peak Output Current | I_{Opeak} | $T_J = 25\text{ °C}$ | 1.6 | 2.2 | 2.8 | A |
| Temperature Coefficient of Output Voltage | $ \Delta V_o/\Delta T $ | $I_o = 5\text{ mA}$ | | 0.24 | | mV/°C |

μPC7924A

($V_{IN} = -33\text{ V}$, $I_o = 500\text{ mA}$, $0\text{ °C} \leq T_J \leq +125\text{ °C}$)

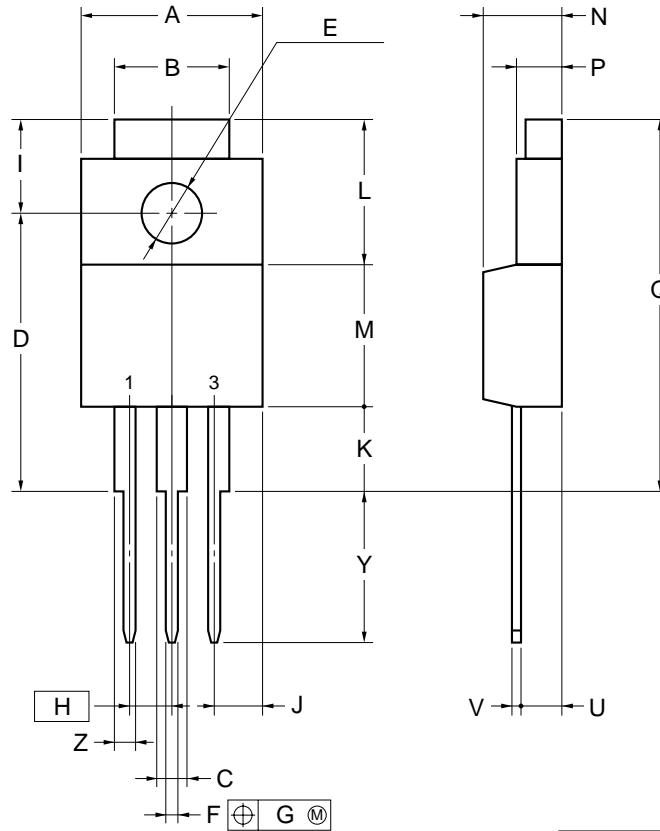
| Parameter | Symbol | Conditions | MIN. | TYP. | MAX. | Unit |
|---|-------------------------|--|-------|------|-------|---------|
| Output Voltage | V_o | $T_J = 25\text{ °C}$ | -23.0 | -24 | -25.0 | V |
| | | $-27\text{ V} \leq V_{IN} \leq -38\text{ V}$, $5\text{ mA} \leq I_o \leq 1\text{ A}$, $P_T \leq 15\text{ W}$ | -22.8 | | -25.2 | |
| | | $-30\text{ °C} \leq T_J \leq +125\text{ °C}$ | -22.8 | | -25.2 | |
| Line Regulation | REG_{IN} | $T_J = 25\text{ °C}$, $-27\text{ V} \leq V_{IN} \leq -38\text{ V}$ | | 70 | 280 | mV |
| | | $T_J = 25\text{ °C}$, $-30\text{ V} \leq V_{IN} \leq -36\text{ V}$ | | 37 | 140 | |
| Load Regulation | REG_L | $T_J = 25\text{ °C}$, $5\text{ mA} \leq I_o \leq 1.5\text{ A}$ | | 160 | 480 | mV |
| | | $T_J = 25\text{ °C}$, $250\text{ mA} \leq I_o \leq 750\text{ mA}$ | | 60 | 240 | |
| Quiescent Current | I_{BIAS} | $T_J = 25\text{ °C}$ | | 4.2 | 6.5 | mA |
| Quiescent Current Change | ΔI_{BIAS} | $-27\text{ V} \leq V_{IN} \leq -38\text{ V}$ | | | 1.0 | mA |
| | | $5\text{ mA} \leq I_o \leq 1\text{ A}$ | | | 0.5 | |
| Output Noise Voltage | V_n | $T_J = 25\text{ °C}$, $10\text{ Hz} \leq f \leq 100\text{ kHz}$ | | 240 | | μVr.m.s |
| Ripple Rejection | $R \cdot R$ | $T_J = 25\text{ °C}$, $f = 120\text{ Hz}$, $-28\text{ V} \leq V_{IN} \leq -38\text{ V}$, $I_o = 500\text{ mA}$ | 43 | 49 | | dB |
| Dropout Voltage | V_{DIF} | $T_J = 25\text{ °C}$, $I_o = 1\text{ A}$ | | 1.2 | | V |
| Peak Output Current | I_{Opeak} | $T_J = 25\text{ °C}$ | 1.6 | 2.2 | 2.8 | A |
| Temperature Coefficient of Output Voltage | $ \Delta V_o/\Delta T $ | $I_o = 5\text{ mA}$ | | 1.1 | | mV/°C |

TYPICAL CHARACTERISTICS ($T_A = 25\text{ }^\circ\text{C}$)



μPC7900AHF Series

3PIN PLASTIC SIP (MP-45G)



NOTE

Each lead centerline is located within 0.25 mm (0.01 inch) of its true position (T.P.) at maximum material condition.

| ITEM | MILLIMETERS | INCHES |
|------|-------------|---|
| A | 10.4 MAX. | 0.410 MAX. |
| B | 7.0 | 0.276 |
| C | 1.2 MIN. | 0.047 MIN. |
| D | 17.0±0.3 | 0.669 ^{+0.013} _{-0.012} |
| E | φ3.3±0.2 | φ0.130±0.008 |
| F | 0.75±0.10 | 0.030 ^{+0.004} _{-0.005} |
| G | 0.25 | 0.010 |
| H | 2.54 (T.P.) | 0.100 (T.P.) |
| I | 5.0±0.3 | 0.197±0.012 |
| J | 2.66 MAX. | 0.105 MAX. |
| K | 4.8 MIN. | 0.188 MIN. |
| L | 8.5 | 0.335 |
| M | 8.5 | 0.335 |
| N | 4.5±0.2 | 0.177±0.008 |
| P | 2.8±0.2 | 0.110 ^{+0.009} _{-0.008} |
| Q | 22.4 MAX. | 0.882 MAX. |
| U | 2.4±0.5 | 0.094 ^{+0.021} _{-0.020} |
| V | 0.65±0.10 | 0.026 ^{+0.004} _{-0.005} |
| Y | 8.9±0.7 | 0.350±0.028 |
| Z | 1.0 MIN. | 0.039 MIN. |

P3HF-254B-2

RECOMMENDED SOLDERING CONDITIONS

When soldering this product, it is highly recommended to observe the conditions as shown below. If other soldering processes are used, or if the soldering is performed under different conditions, please make sure to consult with our sales offices.

For more details, refer to our document “**SEMICONDUCTOR DEVICE MOUNTING TECHNOLOGY MANUAL**” (C10535E).

TYPES OF THROUGH HOLE MOUNT DEVICE

μPC7900AHF Series

| Soldering Process | Soldering Conditions | Symbol |
|-------------------|---|--------|
| Wave soldering | Solder temperature: 260 °C or below. Flow Time: 10 seconds or below. | |

REFERENCE

| Document Name | Document No. |
|--|--------------|
| NEC semiconductor device reliability/quality control system. | IEI-1212 |
| Quality grade on NEC semiconductor devices. | C11531E |
| Semiconductor device mounting technology manual. | C10535E |
| IC package manual. | C10943X |
| Guide to quality assurance for semiconductor devices. | MEI-1202 |
| Semiconductors selection guide. | X10679E |

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Standard: Computers, office equipment, communications equipment, test and measurement equipment, audio and visual equipment, home electronic appliances, machine tools, personal electronic equipment and industrial robots

Special: Transportation equipment (automobiles, trains, ships, etc.), traffic control systems, anti-disaster systems, anti-crime systems, safety equipment and medical equipment (not specifically designed for life support)

Specific: Aircrafts, aerospace equipment, submersible repeaters, nuclear reactor control systems, life support systems or medical equipment for life support, etc.

The quality grade of NEC devices is "Standard" unless otherwise specified in NEC's Data Sheets or Data Books. If customers intend to use NEC devices for applications other than those specified for Standard quality grade, they should contact an NEC sales representative in advance.

Anti-radioactive design is not implemented in this product.