NEC

# BIPOLAR ANALOG INTEGRATED CIRCUIT
# μPC7900A Series

## THREE TERMINAL NEGATIVE VOLTAGE REGULATOR

### DESCRIPTION

μPC7900A 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): μPC7905AHF
- Low noise.

### ORDERING INFORMATION

| Part Number | Output Voltage | Package |
|---|---|---|
| μPC7905AHF | –5 V | MP-45G (ISOLATED TO-220) |
| μPC7908AHF | –8 V | MP-45G (ISOLATED TO-220) |
| μPC7912AHF | –12 V | MP-45G (ISOLATED TO-220) |
| μPC7915AHF | –15 V | MP-45G (ISOLATED TO-220) |
| μPC7918AHF | –18 V | MP-45G (ISOLATED TO-220) |
| μPC7924AHF | –24 V | MP-45G (ISOLATED TO-220) |



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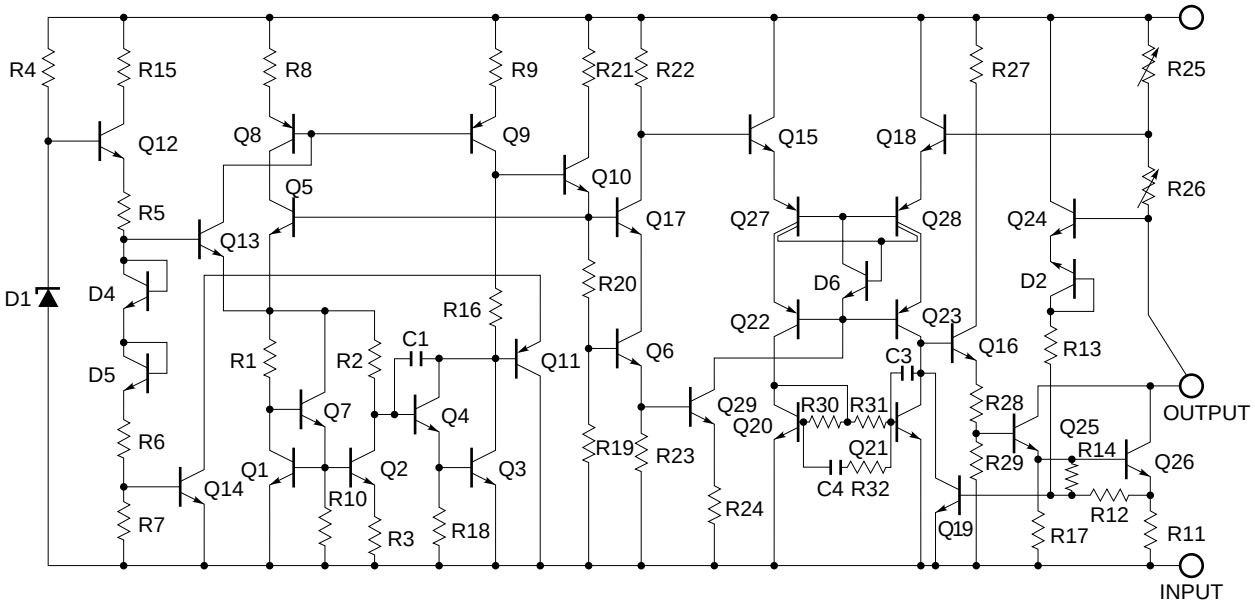
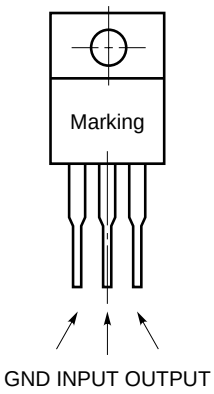
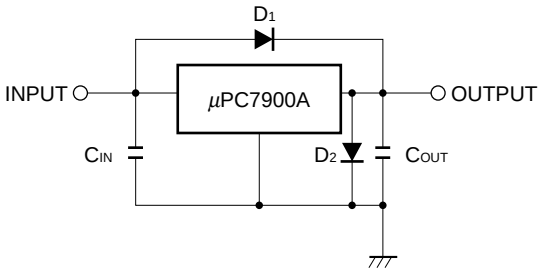
## EQUIVALENT CIRCUIT




## CONNECTION DIAGRAM




## TYPICAL CONNECTION




$C_{IN}$ : More than 2.2 μF

$C_{OUT}$ : More than 0.33 μF

$D_1$ : Needed for $V_{IN} > V_O$

$D_2$ : 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 | $\Delta I_{BIAS}$ | –7 V ≤ $V_{IN}$ ≤ –25 V | | | 1.3 | mA |
| | | 5 mA ≤ $I_O$ ≤ 1 A | | | 0.5 | |
| Output Noize 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, $I_O$ = 1A | | 1.2 | | V |
| Peak Output Current | $I_{Opeak}$ | $T_J$ = 25 °C | 1.6 | 2.2 | 2.8 | A |
| Temperature Coefficient of Output Voltage | $\lvert\Delta V_O/\Delta T\rvert$ | $I_O$ = 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 | $\Delta I_{BIAS}$ | –10.5 V ≤ $V_{IN}$ ≤ –25 V | | | 1.0 | mA |
| | | 5 mA ≤ $I_O$ ≤ 1 A | | | 0.5 | |
| Output Noize 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 | $\lvert\Delta V_O/\Delta T\rvert$ | $I_O$ = 5 mA | | 0.32 | | mV/°C |

**μPC7912A**

**($V_{IN}$ = –19 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 | –11.5 | –12 | –12.5 | V |
| | | –14.5 V ≤ $V_{IN}$ ≤ –27 V, 5 mA ≤ $I_O$ ≤ 1 A, $P_T$ ≤ 15 W | –11.4 | | –12.6 | |
| | | –30 °C ≤ $T_J$ ≤ +125 °C | –11.4 | | –12.6 | |
| Line Regulation | $REG_{IN}$ | $T_J$ = 25 °C, –14.5 V ≤ $V_{IN}$ ≤ –30 V | | 60 | 200 | mV |
| | | $T_J$ = 25 °C, –16 V ≤ $V_{IN}$ ≤ –22 V | | 25 | 100 | |
| Load Regulation | $REG_L$ | $T_J$ = 25 °C, 5 mA ≤ $I_O$ ≤ 1.5 A | | 70 | 220 | mV |
| | | $T_J$ = 25 °C, 250 mA ≤ $I_O$ ≤ 750 mA | | 20 | 110 | |
| Quiescent Current | $I_{BIAS}$ | $T_J$ = 25 °C | | 4.1 | 6.2 | mA |
| Quiescent Current Change | $\Delta I_{BIAS}$ | –14.5 V ≤ $V_{IN}$ ≤ –30 V | | | 1.0 | mA |
| | | 5 mA ≤ $I_O$ ≤ 1A | | | 0.5 | |
| Output Noize Voltage | $V_n$ | $T_J$ = 25 °C, 10 Hz ≤ f ≤ 100 kHz | | 140 | | μVr.m.s |
| Ripple Rejection | R•R | $T_J$ = 25 °C, f = 120 Hz, –15 V ≤ $V_{IN}$ ≤ –25 V, $I_O$ = 500 mA | 49 | 56 | | dB |
| Dropout Voltage | $V_{DIF}$ | $T_J$ = 25 °C, $I_O$ = 1A | | 1.2 | | V |
| Peak Output Current | $I_{Opeak}$ | $T_J$ = 25 °C | 1.6 | 2.2 | 2.8 | A |
| Temperature Coefficient of Output Voltage | $\lvert\Delta V_O/\Delta T\rvert$ | $I_O$ = 5 mA | | 0.04 | | mV/°C |

**μPC7915A**

**($V_{IN}$ = –23 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 | –14.4 | –15 | –15.6 | V |
| | | –17.5 V ≤ $V_{IN}$ ≤ –30 V, 5 mA ≤ $I_O$ ≤ 1 A, $P_T$ ≤ 15 W | –14.25 | | –15.75 | |
| | | –30 °C ≤ $T_J$ ≤ +125 °C | –14.25 | | –15.75 | |
| Line Regulation | $REG_{IN}$ | $T_J$ = 25 °C, –17.5 V ≤ $V_{IN}$ ≤ –30 V | | 60 | 200 | mV |
| | | $T_J$ = 25 °C, –20 V ≤ $V_{IN}$ ≤ –26 V | | 30 | 100 | |
| Load Regulation | $REG_L$ | $T_J$ = 25 °C, 5 mA ≤ $I_O$ ≤ 1.5 A | | 100 | 300 | mV |
| | | $T_J$ = 25 °C, 250 mA ≤ $I_O$ ≤ 750 mA | | 30 | 150 | |
| Quiescent Current | $I_{BIAS}$ | $T_J$ = 25 °C | | 4.2 | 6.2 | mA |
| Quiescent Current Change | $\Delta I_{BIAS}$ | –17.5 V ≤ $V_{IN}$ ≤ –30 V | | | 1.0 | mA |
| | | 5 mA ≤ $I_O$ ≤ 1 A | | | 0.5 | |
| Output Noize Voltage | $V_n$ | $T_J$ = 25 °C, 10 Hz ≤ f ≤ 100 kHz | | 240 | | μVr.m.s |
| Ripple Rejection | R•R | $T_J$ = 25 °C, f = 120 Hz, –18.5 V ≤ $V_{IN}$ ≤ –28.5 V, $I_O$ = 500 mA | 47 | 54 | | 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 | $\lvert\Delta V_O/\Delta T\rvert$ | $I_O$ = 5 mA | | 1.2 | | mV/°C |

**μPC7918A**

**($V_{IN}$ = –27 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 | –17.3 | –18 | –18.7 | V |
| | | –21 V ≤ $V_{IN}$ ≤ –33 V, 5 mA ≤ $I_O$ ≤ 1 A, $P_T$ ≤ 15 W | –17.1 | | –18.9 | |
| | | –30 ˚C ≤ $T_J$ ≤ +125 ˚C | –17.1 | | –18.9 | |
| Line Regulation | $REG_{IN}$ | $T_J$ = 25 ˚C, –21 V ≤ $V_{IN}$ ≤ –33 V | | 60 | 240 | mV |
| | | $T_J$ = 25 ˚C, –24 V ≤ $V_{IN}$ ≤ –30 V | | 30 | 120 | |
| Load Regulation | $REG_L$ | $T_J$ = 25 ˚C, 5 mA ≤ $I_O$ ≤ 1.5 A | | 125 | 360 | mV |
| | | $T_J$ = 25 ˚C, 250 mA ≤ $I_O$ ≤ 750 mA | | 47 | 180 | |
| Quiescent Current | $I_{BIAS}$ | $T_J$ = 25 ˚C | | 4.1 | 6.5 | mA |
| Quiescent Current Change | $\Delta I_{BIAS}$ | –21 V ≤ $V_{IN}$ ≤ –33 V | | | 1.0 | mA |
| | | 5 mA ≤ $I_O$ ≤ 1 A | | | 0.5 | |
| Output Noize Voltage | $V_n$ | $T_J$ = 25 ˚C, 10 Hz ≤ f ≤ 100 kHz | | 190 | | μVr.m.s |
| Ripple Rejection | R•R | $T_J$ = 25 ˚C, f = 120 Hz, –22 V ≤ $V_{IN}$ ≤ –32 V, $I_O$ = 500 mA | 45 | 53 | | 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 | $\lvert\Delta V_O/\Delta T\rvert$ | $I_O$ = 5 mA | | 0.24 | | mV/˚C |

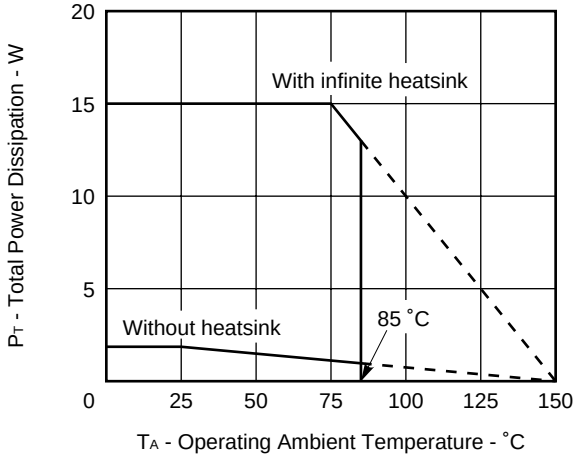
**μPC7924A**

**($V_{IN}$ = –33 V, $I_O$ = 500 mA, 0 ˚C ≤ $T_J$ ≤ +125 ˚C)**

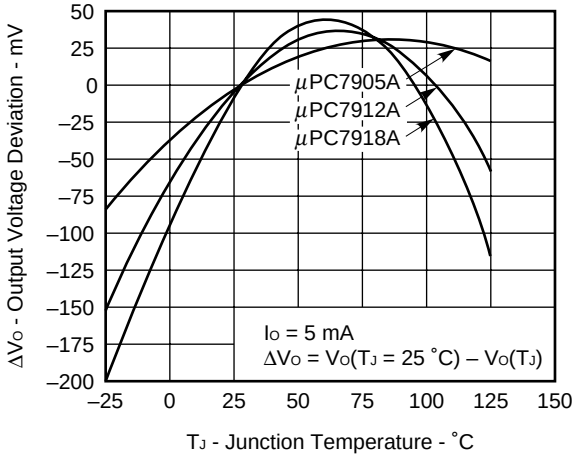
| Parameter | Symbol | Conditions | MIN. | TYP. | MAX. | Unit |
|---|---|---|---|---|---|---|
| Output Voltage | $V_O$ | $T_J$ = 25 ˚C | –23.0 | –24 | –25.0 | V |
| | | –27 V ≤ $V_{IN}$ ≤ –38 V, 5 mA ≤ $I_O$ ≤ 1 A, $P_T$ ≤ 15 W | –22.8 | | –25.2 | |
| | | –30 ˚C ≤ $T_J$ ≤ +125 ˚C | –22.8 | | –25.2 | |
| Line Regulation | $REG_{IN}$ | $T_J$ = 25 ˚C, –27 V ≤ $V_{IN}$ ≤ –38 V | | 70 | 280 | mV |
| | | $T_J$ = 25 ˚C, –30 V ≤ $V_{IN}$ ≤ –36 V | | 37 | 140 | |
| Load Regulation | $REG_L$ | $T_J$ = 25 ˚C, 5 mA ≤ $I_O$ ≤ 1.5 A | | 160 | 480 | mV |
| | | $T_J$ = 25 ˚C, 250 mA ≤ $I_O$ ≤ 750 mA | | 60 | 240 | |
| Quiescent Current | $I_{BIAS}$ | $T_J$ = 25 ˚C | | 4.2 | 6.5 | mA |
| Quiescent Current Change | $\Delta I_{BIAS}$ | –27 V ≤ $V_{IN}$ ≤ –38 V | | | 1.0 | mA |
| | | 5 mA ≤ $I_O$ ≤ 1 A | | | 0.5 | |
| Output Noize Voltage | $V_n$ | $T_J$ = 25 ˚C, 10 Hz ≤ f ≤ 100 kHz | | 240 | | μVr.m.s |
| Ripple Rejection | R•R | $T_J$ = 25 ˚C, f = 120 Hz, –28 V ≤ $V_{IN}$ ≤ –38 V, $I_O$ = 500 mA | 43 | 49 | | 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 | $\lvert\Delta V_O/\Delta T\rvert$ | $I_O$ = 5 mA | | 1.1 | | mV/˚C |

## TYPICAL CHARACTERISTICS ($T_A$ = 25 °C)

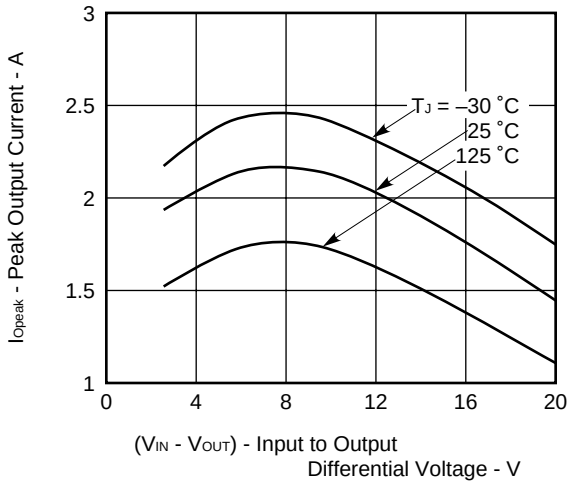
$P_T$ - $T_A$



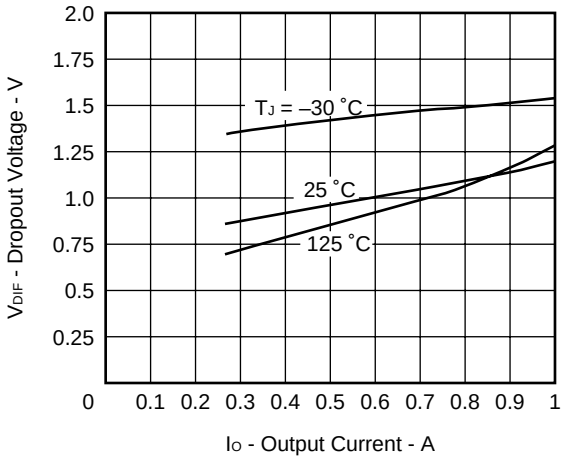

$\Delta V_O$ - $T_J$



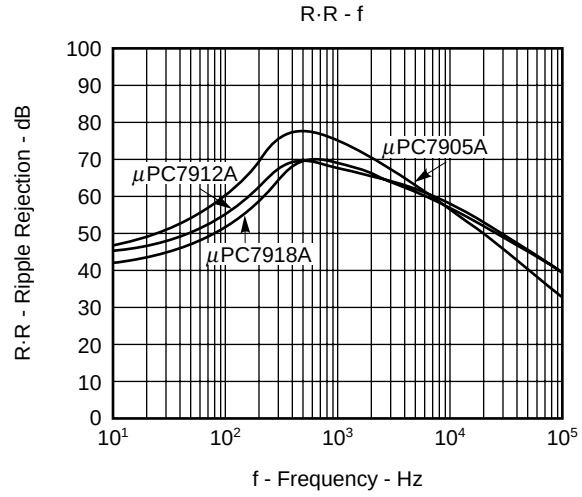

$I_{Opeak}$ - ($V_{IN}$ - $V_{OUT}$)




$V_{DIF}$ - $I_O$

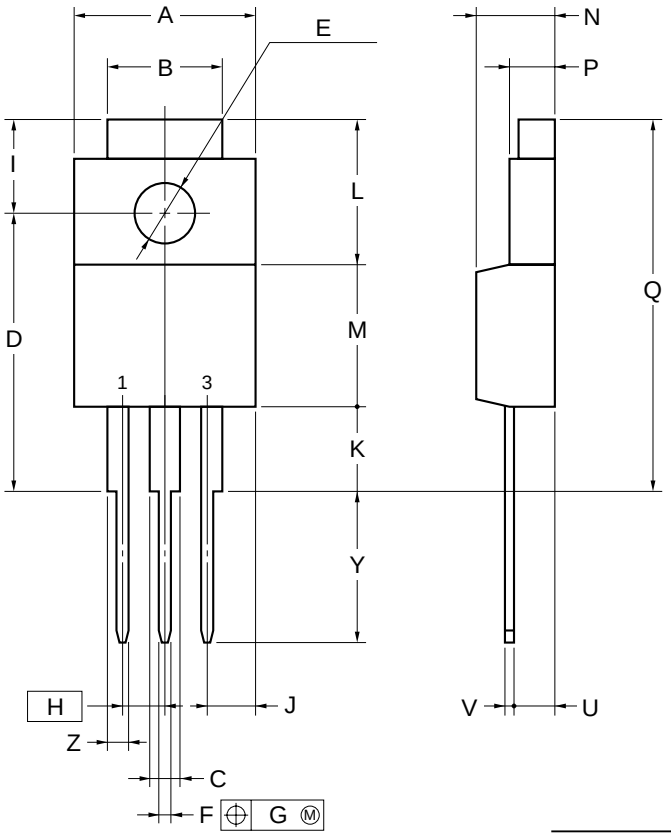



R·R - f



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.<br>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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