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April 1st, 2010
Renesas Electronics Corporation

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DATA SHEET

BIPOLAR ANALOG INTEGRATED CIRCUIT

# μPC2400A Series

## THREE TERMINAL LOW DROPOUT VOLTAGE REGULATOR

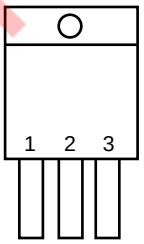
### DESCRIPTION

μPC2400A Series are low dropout regulators which have 1 A capable for the output current.
These ICs are built-in the saturation protection circuit of the output transistor.

### FEATURES

- Built-in the saturation protection circuit of the output transistor.
- The capability of output current is 1 A
- High accuracy of output voltage.
  $|\Delta V_O| \leq \pm 2$ % ($T_J$ = 25 ˚C)
  $|\Delta V_O| \leq \pm 3$ % (0 ˚C ≤ $T_J$ ≤ 125 ˚C)
- Low dropout voltage.
  $V_{DIF} \leq 1$ V ($I_O \leq 1$ A, $T_J \leq 125$ ˚C)
- Built-in overcurrent protection circuit, thermal shut-down circuit.
- Built-in Safe Operating Area protection circuit.
- Compatible for μPC2400 Series.

### CONNECTION DIAGRAM
(TOP VIEW)




1: INPUT
2: GND
3: OUTPUT

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### ORDERING INFORMATION

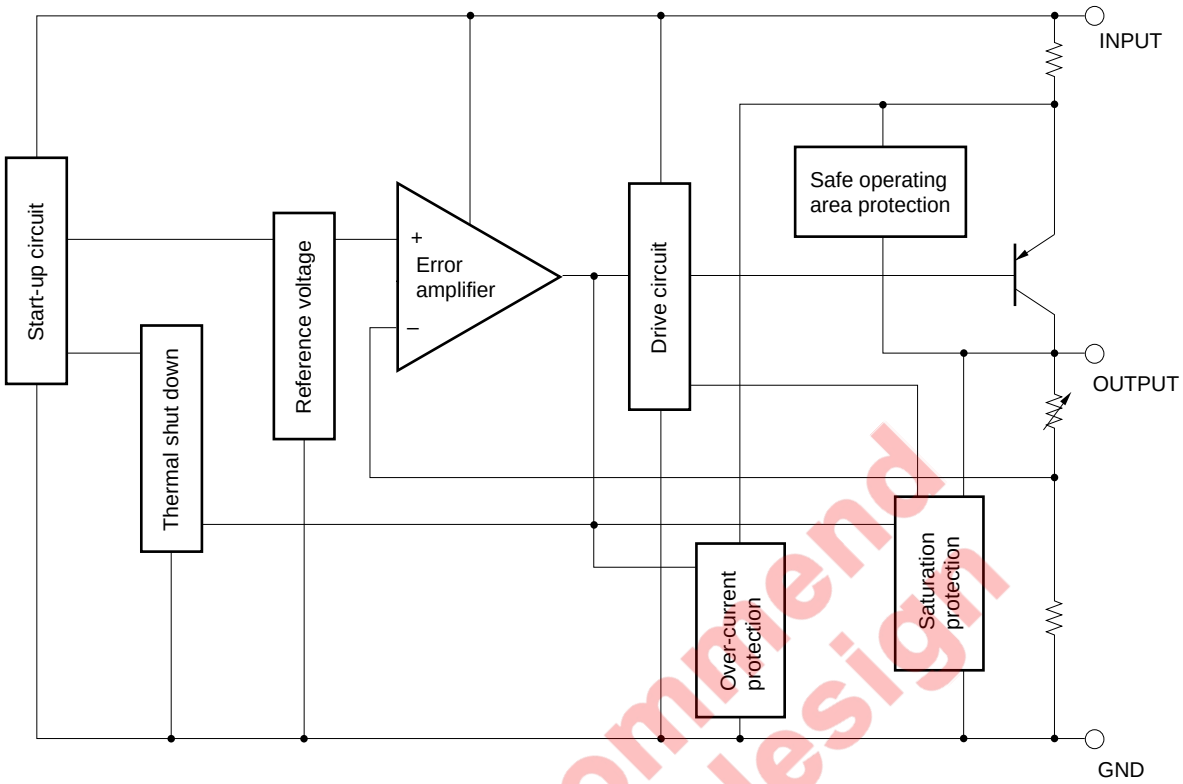
| Output Voltage | Type Number | Package |
|---|---|---|
| 5 V | μPC2405AHF | MP-45G (Isolated TO-220) |
| 6 V | μPC2406AHF | |
| 7 V | μPC2407AHF | |
| 8 V | μPC2408AHF | |
| 9 V | μPC2409AHF | |
| 10 V | μPC2410AHF | |
| 12 V | μPC2412AHF | |
| 15 V | μPC2415AHF | |
| 18 V | μPC2418AHF | |

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## BLOCK DIAGRAM




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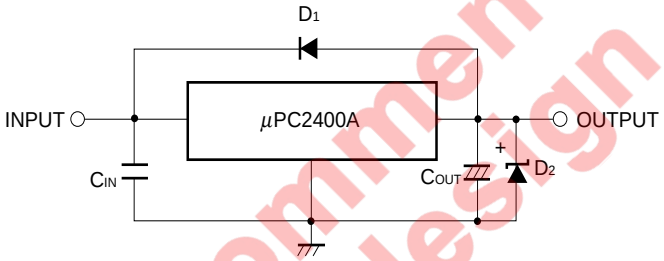
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## ABSOLUTE MAXIMUM RATINGS ($T_A$ = 25 °C, Unless otherwise specified.)

| PARAMETER | SYMBOL | RATING | UNIT |
|---|---|---|---|
| Input Voltage | $V_{IN}$ | 36 | V |
| Internal Power Dissipation | $P_{T(Tc = 25 °C)}$ | 15 **Note** | W |
| Operating Ambient Temperature Range | $T_A$ | –20 to +85 | °C |
| Operating Junction Temperature Range | $T_J$ | –20 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** Internally limited

## TYPICAL CONNECTION




$C_{IN}$ : 0.1 to 0.47 μF.
$C_{OUT}$ : More than 47 μF.
$D_1$ : Need for $V_O > V_{IN}$.
$D_2$ : Need for $V_O < GND$.

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## RECOMMENDED OPERATING CONDITIONS

| PARAMETER | SYMBOL | TYPE NUMBER | MIN. | TYP. | MAX. | UNIT |
|---|---|---|---|---|---|---|
| Input Voltage | $V_{IN}$ | μPC2405AHF | 6 | 9 | 20 | V |
| | | μPC2406AHF | 7 | 10 | 21 | |
| | | μPC2407AHF | 8 | 11 | 22 | |
| | | μPC2408AHF | 9 | 13 | 23 | |
| | | μPC2409AHF | 10 | 14 | 24 | |
| | | μPC2410AHF | 11 | 15 | 25 | |
| | | μPC2412AHF | 13 | 18 | 27 | |
| | | μPC2415AHF | 16 | 22 | 27 | |
| | | μPC2418AHF | 19 | 25 | 28 | |
| Output Current | $I_O$ | All | 0 | | 1 | A |
| Operating Ambient Temperature Range | $T_A$ | All | –20 | | +85 | °C |
| Operating Junction Temperature Range | $T_J$ | All | –20 | | +125 | °C |



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## ELECTRICAL CHARACTERISTICS

**μPC2405A ($V_{IN}$ = 9 V, $I_O$ = 500 mA, $T_J$ = 25 °C, Unless otherwise specified)**

| PARAMETER | SYMBOL | MIN. | TYP. | MAX. | UNIT | TEST CONDITIONS |
|---|---|---|---|---|---|---|
| Output Voltage | $V_O$ | 4.9 | 5.0 | 5.1 | V | |
| | | 4.85 | | 5.15 | | 6 V ≤ $V_{IN}$ ≤ 20 V, 5 mA ≤ $I_O$ ≤ 500 mA, 0 °C ≤ $T_J$ ≤ 125 °C |
| | | 4.85 | | 5.15 | | 5 mA ≤ $I_O$ ≤ 1 A, 0 °C ≤ $T_J$ ≤ 125 °C |
| Line Regulation | $REG_{IN}$ | | 6 | 50 | mV | 6.5 V ≤ $V_{IN}$ ≤ 20 V |
| Load Regulation | $REG_L$ | | 3 | 50 | mV | 5 mA ≤ $I_O$ ≤ 1 A |
| Quiescent Current | $I_{BIAS}$ | | 2.3 | 3.2 | mA | $I_O$ = 0 |
| | | | 9 | 60 | | $I_O$ = 1 A |
| Start-up Current | $I_{BIAS(S)}$ | | | 15 | mA | $V_{IN}$ = 4.5 V, $I_O$ = 0 mA |
| | | | | 75 | | $V_{IN}$ = 4.5 V, $I_O$ = 1 A |
| Quiescent Current Change | $\Delta I_{BIAS}$ | | | 20 | mA | 6.5 V ≤ $V_{IN}$ ≤ 20 V, $I_O$ = 1 A |
| Output Noise Voltage | $V_n$ | | 90 | | $\mu V_{rms}$ | 10 Hz ≤ f ≤ 100 kHz |
| Ripple Rejection | R·R | 59 | 64 | | dB | f = 120 Hz, 6.5 V ≤ $V_{IN}$ ≤ 16.5 V |
| Dropout Voltage | $V_{DIF}$ | | 0.5 | 1.0 | V | $I_O$ = 1 A, 0 °C ≤ $T_J$ ≤ 125 °C |
| Short Circuit Current | $I_{Oshort}$ | | 1.2 | | A | $V_{IN}$ = 20 V |
| Peak Output Current | $I_{Opeak}$ | 1.65 | 2.2 | 3.1 | A | |
| Temperature Coefficient of Output Voltage | $\Delta V_O/\Delta T$ | | −0.4 | | mV/°C | $I_O$ = 5 mA, 0 °C ≤ $T_J$ ≤ 125 °C |

**μPC2406A ($V_{IN}$ = 10 V, $I_O$ = 500 mA, $T_J$ = 25 °C, Unless otherwise specified)**

| PARAMETER | SYMBOL | MIN. | TYP. | MAX. | UNIT | TEST CONDITIONS |
|---|---|---|---|---|---|---|
| Output Voltage | $V_O$ | 5.88 | 6.0 | 6.12 | V | |
| | | 5.82 | | 6.18 | | 7 V ≤ $V_{IN}$ ≤ 21 V, 5 mA ≤ $I_O$ ≤ 500 mA, 0 °C ≤ $T_J$ ≤ 125 °C |
| | | 5.82 | | 6.18 | | 5 mA ≤ $I_O$ ≤ 1 A, 0 °C ≤ $T_J$ ≤ 125 °C |
| Line Regulation | $REG_{IN}$ | | 7 | 60 | mV | 7.5 V ≤ $V_{IN}$ ≤ 21 V |
| Load Regulation | $REG_L$ | | 4 | 60 | mV | 5 mA ≤ $I_O$ ≤ 1A |
| Quiescent Current | $I_{BIAS}$ | | 2.3 | 3.2 | mA | $I_O$ = 0 |
| | | | 9 | 60 | | $I_O$ = 1 A |
| Start-up Current | $I_{BIAS(S)}$ | | | 15 | mA | $V_{IN}$ = 5.5 V, $I_O$ = 0 mA |
| | | | | 75 | | $V_{IN}$ = 5.5 V, $I_O$ = 1 A |
| Quiescent Current Change | $\Delta I_{BIAS}$ | | | 20 | mA | 7.5 V ≤ $V_{IN}$ ≤ 21 V, $I_O$ = 1 A |
| Output Noise Voltage | $V_n$ | | 110 | | $\mu V_{rms}$ | 10 Hz ≤ f ≤ 100 kHz |
| Ripple Rejection | R·R | 58 | 63 | | dB | f = 120 Hz, 7.5 V ≤ $V_{IN}$ ≤ 17.5 V |
| Dropout Voltage | $V_{DIF}$ | | 0.5 | 1.0 | V | $I_O$ = 1 A, 0 °C ≤ $T_J$ ≤ 125 °C |
| Short Circuit Current | $I_{Oshort}$ | | 1.2 | | A | $V_{IN}$ = 21 V |
| Peak Output Current | $I_{Opeak}$ | 1.65 | 2.2 | 3.1 | A | |
| Temperature Coefficient of Output Voltage | $\Delta V_O/\Delta T$ | | 0.4 | | mV/°C | $I_O$ = 5 mA, 0 °C ≤ $T_J$ ≤ 125 °C |

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**μPC2407A ($V_{IN}$ = 11 V, $I_O$ = 500 mA, $T_J$ = 25 °C, Unless otherwise specified)**

| PARAMETER | SYMBOL | MIN. | TYP. | MAX. | UNIT | TEST CONDITIONS |
|---|---|---|---|---|---|---|
| Output Voltage | $V_O$ | 6.86 | 7.0 | 7.14 | V | |
| | | 6.79 | | 7.21 | | 8 V ≤ $V_{IN}$ ≤ 22 V, 5 mA ≤ $I_O$ ≤ 500 mA, 0 °C ≤ $T_J$ ≤ 125 °C |
| | | 6.79 | | 7.21 | | 5 mA ≤ $I_O$ ≤ 1 A, 0 °C ≤ $T_J$ ≤ 125 °C |
| Line Regulation | $REG_{IN}$ | | 8 | 70 | mV | 8.5 V ≤ $V_{IN}$ ≤ 22 V |
| Load Regulation | $REG_L$ | | 4 | 70 | mV | 5 mA ≤ $I_O$ ≤ 1 A |
| Quiescent Current | $I_{BIAS}$ | | 2.3 | 3.2 | mA | $I_O$ = 0 |
| | | | 9 | 60 | | $I_O$ = 1 A |
| Start-up Current | $I_{BIAS(S)}$ | | | 15 | mA | $V_{IN}$ = 6.5 V, $I_O$ = 0 mA |
| | | | | 75 | | $V_{IN}$ = 6.5 V, $I_O$ = 1 A |
| Quiescent Current Change | $\Delta I_{BIAS}$ | | | 20 | mA | 8.5 V ≤ $V_{IN}$ ≤ 22 V, $I_O$ = 1 A |
| Output Noise Voltage | $V_n$ | | 130 | | $\mu V_{rms}$ | 10 Hz ≤ f ≤ 100 kHz |
| Ripple Rejection | R·R | 57 | 62 | | dB | f = 120 Hz, 8.5 V ≤ $V_{IN}$ ≤ 18.5 V |
| Dropout Voltage | $V_{DIF}$ | | 0.5 | 1.0 | V | $I_O$ = 1 A, 0 °C ≤ $T_J$ ≤ 125 °C |
| Short Circuit Current | $I_{Oshort}$ | | 1.2 | | A | $V_{IN}$ = 22 V |
| Peak Output Current | $I_{Opeak}$ | 1.65 | 2.2 | 3.1 | A | |
| Temperature Coefficient of Output Voltage | $\Delta V_O/\Delta T$ | | 0.4 | | mV/°C | $I_O$ = 5 mA, 0 °C ≤ $T_J$ ≤ 125 °C |

**μPC2408A ($V_{IN}$ = 13 V, $I_O$ = 500 mA, $T_J$ = 25 °C, Unless otherwise specified)**

| PARAMETER | SYMBOL | MIN. | TYP. | MAX. | UNIT | TEST CONDITIONS |
|---|---|---|---|---|---|---|
| Output Voltage | $V_O$ | 7.85 | 8.0 | 8.15 | V | |
| | | 7.75 | | 8.25 | | 9 V ≤ $V_{IN}$ ≤ 23 V, 5 mA ≤ $I_O$ ≤ 500 mA, 0 °C ≤ $T_J$ ≤ 125 °C |
| | | 7.75 | | 8.25 | | 5 mA ≤ $I_O$ ≤ 1 A, 0 °C ≤ $T_J$ ≤ 125 °C |
| Line Regulation | $REG_{IN}$ | | 9 | 80 | mV | 9.5 V ≤ $V_{IN}$ ≤ 23 V |
| Load Regulation | $REG_L$ | | 5 | 80 | mV | 5 mA ≤ $I_O$ ≤ 1 A |
| Quiescent Current | $I_{BIAS}$ | | 2.3 | 3.2 | mA | $I_O$ = 0 |
| | | | 9 | 60 | | $I_O$ = 1 A |
| Start-up Current | $I_{BIAS(S)}$ | | | 15 | mA | $V_{IN}$ = 7.5 V, $I_O$ = 0 mA |
| | | | | 75 | | $V_{IN}$ = 7.5 V, $I_O$ = 1 A |
| Quiescent Current Change | $\Delta I_{BIAS}$ | | | 20 | mA | 9.5 V ≤ $V_{IN}$ ≤ 23 V, $I_O$ = 1 A |
| Output Noise Voltage | $V_n$ | | 150 | | $\mu V_{rms}$ | 10 Hz ≤ f ≤ 100 kHz |
| Ripple Rejection | R·R | 56 | 61 | | dB | f = 120 Hz, 9.5 V ≤ $V_{IN}$ ≤ 19.5 V |
| Dropout Voltage | $V_{DIF}$ | | 0.5 | 1.0 | V | $I_O$ = 1 A, 0 °C ≤ $T_J$ ≤ 125 °C |
| Short Circuit Current | $I_{Oshort}$ | | 1.2 | | A | $V_{IN}$ = 23 V |
| Peak Output Current | $I_{Opeak}$ | 1.6 | 2.2 | 3.05 | A | |
| Temperature Coefficient of Output Voltage | $\Delta V_O/\Delta T$ | | 0.5 | | mV/°C | $I_O$ = 5 mA, 0 °C ≤ $T_J$ ≤ 125 °C |

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**μPC2409A ($V_{IN}$ = 14 V, $I_O$ = 500 mA, $T_J$ = 25 ˚C, Unless otherwise specified)**

| PARAMETER | SYMBOL | MIN. | TYP. | MAX. | UNIT | TEST CONDITIONS |
|---|---|---|---|---|---|---|
| Output Voltage | $V_O$ | 8.82 | 9.0 | 9.18 | V | |
| | | 8.73 | | 9.27 | | 10 V ≤ $V_{IN}$ ≤ 24 V, 5 mA ≤ $I_O$ ≤ 500 mA, 0 ˚C ≤ $T_J$ ≤ 125 ˚C |
| | | 8.73 | | 9.27 | | 5 mA ≤ $I_O$ ≤ 1 A, 0 ˚C ≤ $T_J$ ≤ 125 ˚C |
| Line Regulation | $REG_{IN}$ | | 11 | 90 | mV | 10.5 V ≤ $V_{IN}$ ≤ 24 V |
| Load Regulation | $REG_L$ | | 5 | 90 | mV | 5 mA ≤ $I_O$ ≤ 1 A |
| Quiescent Current | $I_{BIAS}$ | | 2.4 | 3.2 | mA | $I_O$ = 0 |
| | | | 9 | 60 | | $I_O$ = 1 A |
| Start-up Current | $I_{BIAS(S)}$ | | | 15 | mA | $V_{IN}$ = 8.5 V, $I_O$ = 0 mA |
| | | | | 75 | | $V_{IN}$ = 8.5 V, $I_O$ = 1 A |
| Quiescent Current Change | $\Delta I_{BIAS}$ | | | 20 | mA | 10.5 V ≤ $V_{IN}$ ≤ 24 V, $I_O$ = 1 A |
| Output Noise Voltage | $V_n$ | | 170 | | $\mu V_{rms}$ | 10 Hz ≤ f ≤ 100 kHz |
| Ripple Rejection | R·R | 55 | 60 | | dB | f = 120 Hz, 10.5 V ≤ $V_{IN}$ ≤ 20.5 V |
| Dropout Voltage | $V_{DIF}$ | | 0.5 | 1.0 | V | $I_O$ = 1 A, 0 ˚C ≤ $T_J$ ≤ 125 ˚C |
| Short Circuit Current | $I_{Oshort}$ | | 1.0 | | A | $V_{IN}$ = 24 V |
| Peak Output Current | $I_{Opeak}$ | 1.6 | 2.2 | 3.05 | A | |
| Temperature Coefficient of Output Voltage | $\Delta V_O/\Delta T$ | | 0.9 | | mV/˚C | $I_O$ = 5 mA, 0 ˚C ≤ $T_J$ ≤ 125 ˚C |

**μPC2410A ($V_{IN}$ = 15 V, $I_O$ = 500 mA, $T_J$ = 25 ˚C, Unless otherwise specified)**

| PARAMETER | SYMBOL | MIN. | TYP. | MAX. | UNIT | TEST CONDITIONS |
|---|---|---|---|---|---|---|
| Output Voltage | $V_O$ | 9.8 | 10 | 10.2 | V | |
| | | 9.7 | | 10.3 | | 11 V ≤ $V_{IN}$ ≤ 25 V, 5 mA ≤ $I_O$ ≤ 500 mA, 0 ˚C ≤ $T_J$ ≤ 125 ˚C |
| | | 9.7 | | 10.3 | | 5 mA ≤ $I_O$ ≤ 1 A, 0 ˚C ≤ $T_J$ ≤ 125 ˚C |
| Line Regulation | $REG_{IN}$ | | 12 | 100 | mV | 11.5 V ≤ $V_{IN}$ ≤ 25 V |
| Load Regulation | $REG_L$ | | 6 | 100 | mV | 5 mA ≤ $I_O$ ≤ 1A |
| Quiescent Current | $I_{BIAS}$ | | 2.4 | 3.2 | mA | $I_O$ = 0 |
| | | | 9 | 60 | | $I_O$ = 1 A |
| Start-up Current | $I_{BIAS(S)}$ | | | 15 | mA | $V_{IN}$ = 9.5 V, $I_O$ = 0 mA |
| | | | | 75 | | $V_{IN}$ = 9.5 V, $I_O$ = 1 A |
| Quiescent Current Change | $\Delta I_{BIAS}$ | | | 20 | mA | 11.5 V ≤ $V_{IN}$ ≤ 25 V, $I_O$ = 1 A |
| Output Noise Voltage | $V_n$ | | 190 | | $\mu V_{rms}$ | 10 Hz ≤ f ≤ 100 kHz |
| Ripple Rejection | R·R | 54 | 59 | | dB | f = 120 Hz, 11.5 V ≤ $V_{IN}$ ≤ 21.5 V |
| Dropout Voltage | $V_{DIF}$ | | 0.5 | 1.0 | V | $I_O$ = 1 A, 0 ˚C ≤ $T_J$ ≤ 125 ˚C |
| Short Circuit Current | $I_{Oshort}$ | | 1.0 | | A | $V_{IN}$ = 25 V |
| Peak Output Current | $I_{Opeak}$ | 1.6 | 2.2 | 3.05 | A | |
| Temperature Coefficient of Output Voltage | $\Delta V_O/\Delta T$ | | 0.8 | | mV/˚C | $I_O$ = 5 mA, 0 ˚C ≤ $T_J$ ≤ 125 ˚C |

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**μPC2412A ($V_{IN}$ = 18 V, $I_O$ = 500 mA, $T_J$ = 25 °C, Unless otherwise specified)**

| PARAMETER | SYMBOL | MIN. | TYP. | MAX. | UNIT | TEST CONDITIONS |
|---|---|---|---|---|---|---|
| Output Voltage | $V_O$ | 11.75 | 12 | 12.25 | V | |
| | | 11.65 | | 12.35 | | 13 V ≤ $V_{IN}$ ≤ 27 V, 5 mA ≤ $I_O$ ≤ 500 mA, 0 °C ≤ $T_J$ ≤ 125 °C |
| | | 11.65 | | 12.35 | | 5 mA ≤ $I_O$ ≤ 1 A, 0 °C ≤ $T_J$ ≤ 125 °C |
| Line Regulation | $REG_{IN}$ | | 14 | 120 | mV | 14 V ≤ $V_{IN}$ ≤ 27 V |
| Load Regulation | $REG_L$ | | 7 | 120 | mV | 5 mA ≤ $I_O$ ≤ 1 A |
| Quiescent Current | $I_{BIAS}$ | | 2.4 | 3.2 | mA | $I_O$ = 0 |
| | | | 10 | 60 | | $I_O$ = 1 A |
| Start-up Current | $I_{BIAS(S)}$ | | | 15 | mA | $V_{IN}$ = 11.5 V, $I_O$ = 0 mA |
| | | | | 75 | | $V_{IN}$ = 11.5 V, $I_O$ = 1 A |
| Quiescent Current Change | $\Delta I_{BIAS}$ | | | 20 | mA | 14 V ≤ $V_{IN}$ ≤ 27 V, $I_O$ = 1 A |
| Output Noise Voltage | $V_n$ | | 230 | | $\mu V_{rms}$ | 10 Hz ≤ f ≤ 100 kHz |
| Ripple Rejection | R·R | 53 | 58 | | dB | f = 120 Hz, 14 V ≤ $V_{IN}$ ≤ 24 V |
| Dropout Voltage | $V_{DIF}$ | | 0.5 | 1.0 | V | $I_O$ = 1 A, 0 °C ≤ $T_J$ ≤ 125 °C |
| Short Circuit Current | $I_{Oshort}$ | | 0.8 | | A | $V_{IN}$ = 27 V |
| Peak Output Current | $I_{Opeak}$ | 1.58 | 2.2 | 3.03 | A | |
| Temperature Coefficient of Output Voltage | $\Delta V_O/\Delta T$ | | 0.8 | | mV/°C | $I_O$ = 5 mA, 0 °C ≤ $T_J$ ≤ 125 °C |

**μPC2415A ($V_{IN}$ = 22 V, $I_O$ = 500 mA, $T_J$ = 25 °C, Unless otherwise specified)**

| PARAMETER | SYMBOL | MIN. | TYP. | MAX. | UNIT | TEST CONDITIONS |
|---|---|---|---|---|---|---|
| Output Voltage | $V_O$ | 14.7 | 15 | 15.3 | V | |
| | | 14.55 | | 15.45 | | 16 V ≤ $V_{IN}$ ≤ 27 V, 5 mA ≤ $I_O$ ≤ 500 mA, 0 °C ≤ $T_J$ ≤ 125 °C |
| | | 14.55 | | 15.45 | | 5 mA ≤ $I_O$ ≤ 1 A, 0 °C ≤ $T_J$ ≤ 125 °C |
| Line Regulation | $REG_{IN}$ | | 18 | 150 | mV | 17 V ≤ $V_{IN}$ ≤ 27 V |
| Load Regulation | $REG_L$ | | 9 | 150 | mV | 5 mA ≤ $I_O$ ≤ 1A |
| Quiescent Current | $I_{BIAS}$ | | 2.5 | 3.2 | mA | $I_O$ = 0 |
| | | | 10 | 60 | | $I_O$ = 1 A |
| Start-up Current | $I_{BIAS(S)}$ | | | 15 | mA | $V_{IN}$ = 14.5 V, $I_O$ = 0 mA |
| | | | | 75 | | $V_{IN}$ = 14.5 V, $I_O$ = 1 A |
| Quiescent Current Change | $\Delta I_{BIAS}$ | | | 20 | mA | 17 V ≤ $V_{IN}$ ≤ 27 V, $I_O$ = 1 A |
| Output Noise Voltage | $V_n$ | | 290 | | $\mu V_{rms}$ | 10 Hz ≤ f ≤ 100 kHz |
| Ripple Rejection | R·R | 51 | 56 | | dB | f = 120 Hz, 17 V ≤ $V_{IN}$ ≤ 27 V |
| Dropout Voltage | $V_{DIF}$ | | 0.5 | 1.0 | V | $I_O$ = 1 A, 0 °C ≤ $T_J$ ≤ 125 °C |
| Short Circuit Current | $I_{Oshort}$ | | 0.8 | | A | $V_{IN}$ = 27 V |
| Peak Output Current | $I_{Opeak}$ | 1.55 | 2.2 | 3.0 | A | |
| Temperature Coefficient of Output Voltage | $\Delta V_O/\Delta T$ | | 1.6 | | mV/°C | $I_O$ = 5 mA, 0 °C ≤ $T_J$ ≤ 125 °C |

Not recommend for new design



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**μPC2418A ($V_{IN}$ = 25 V, $I_O$ = 500 mA, $T_J$ = 25 ˚C, Unless otherwise specified)**

| PARAMETER | SYMBOL | MIN. | TYP. | MAX. | UNIT | TEST CONDITIONS |
|---|---|---|---|---|---|---|
| Output Voltage | $V_O$ | 17.64 | 18 | 18.36 | V | |
| | | 17.46 | | 18.54 | | 19 V ≤ $V_{IN}$ ≤ 28 V, 5 mA ≤ $I_O$ ≤ 500 mA, 0 ˚C ≤ $T_J$ ≤ 125 ˚C |
| | | 17.46 | | 18.54 | | 5 mA ≤ $I_O$ ≤ 1 A, 0 ˚C ≤ $T_J$ ≤ 125 ˚C |
| Line Regulation | $REG_{IN}$ | | 22 | 180 | mV | 20 V ≤ $V_{IN}$ ≤ 28 V |
| Load Regulation | $REG_L$ | | 11 | 180 | mV | 5 mA ≤ $I_O$ ≤ 1 A |
| Quiescent Current | $I_{BIAS}$ | | 2.5 | 3.2 | mA | $I_O$ = 0 |
| | | | 10 | 60 | | $I_O$ = 1 A |
| Start-up Current | $I_{BIAS(S)}$ | | | 15 | mA | $V_{IN}$ = 17.5 V, $I_O$ = 0 mA |
| | | | | 75 | | $V_{IN}$ = 17.5 V, $I_O$ = 1 A |
| Quiescent Current Change | $\Delta I_{BIAS}$ | | | 20 | mA | 20 V ≤ $V_{IN}$ ≤ 28 V, $I_O$ = 1 A |
| Output Noise Voltage | $V_n$ | | 350 | | $\mu V_{rms}$ | 10 Hz ≤ f ≤ 100 kHz |
| Ripple Rejection | R·R | 49 | 54 | | dB | f = 120 Hz, 20 V ≤ $V_{IN}$ ≤ 28 V |
| Dropout Voltage | $V_{DIF}$ | | 0.5 | 1.0 | V | $I_O$ = 1 A, 0 ˚C ≤ $T_J$ ≤ 125 ˚C |
| Short Circuit Current | $I_{Oshort}$ | | 0.8 | | A | $V_{IN}$ = 28 V |
| Peak Output Current | $I_{Opeak}$ | 1.55 | 2.2 | 3.0 | A | |
| Temperature Coefficient of Output Voltage | $\Delta V_O/\Delta T$ | | 2.5 | | mV/˚C | $I_O$ = 5 mA, 0 ˚C ≤ $T_J$ ≤ 125 ˚C |

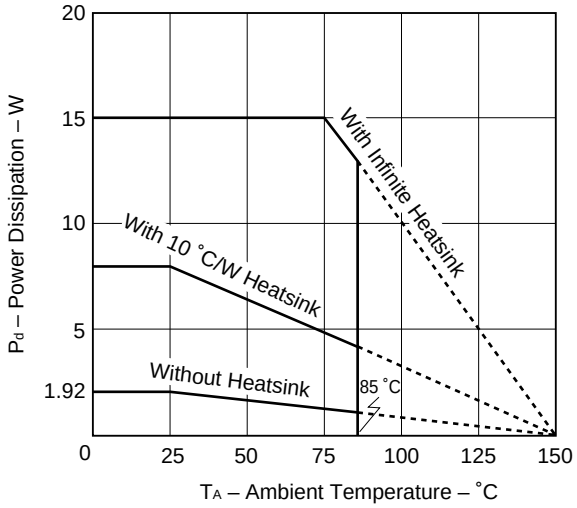
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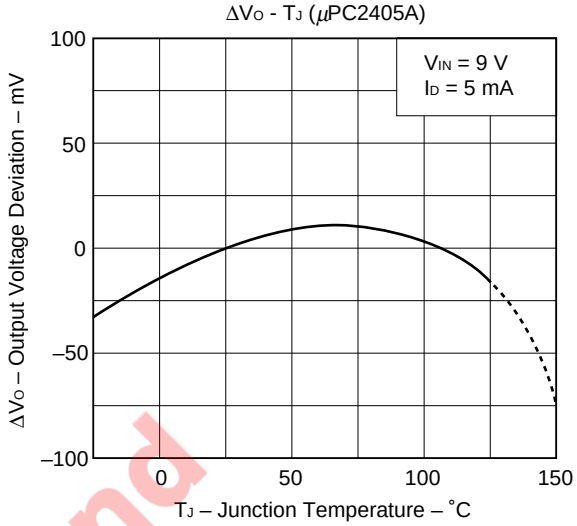
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## TYPICAL CHARACTERISTICS

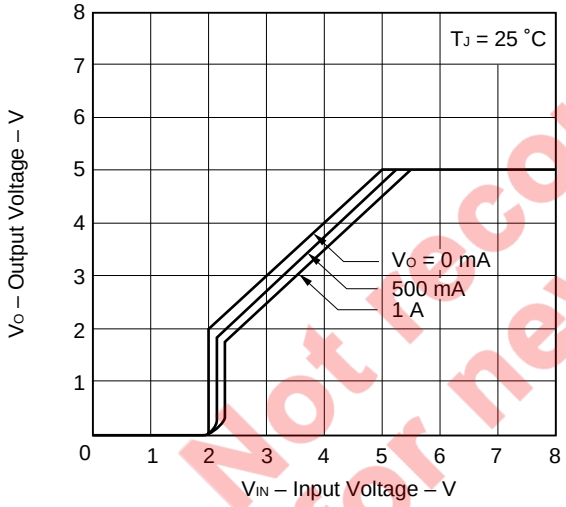
$P_d$ - $T_A$



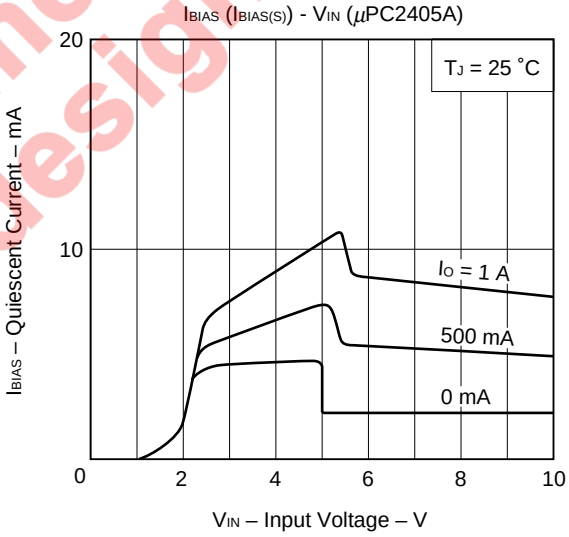

$\Delta V_O$ - $T_J$ ($\mu$PC2405A)



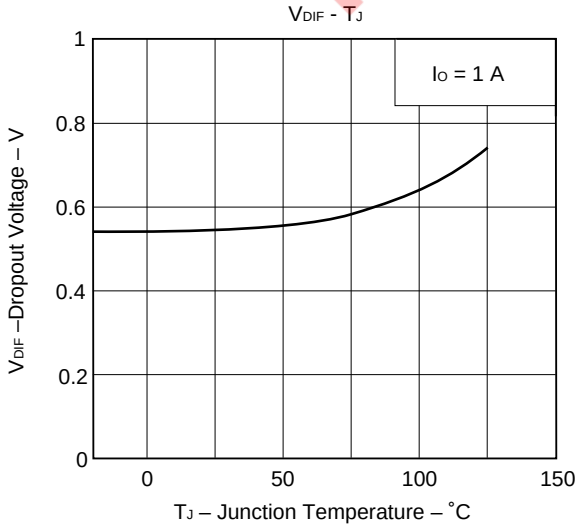

$V_O$ - $V_{IN}$ ($\mu$PC2405A)



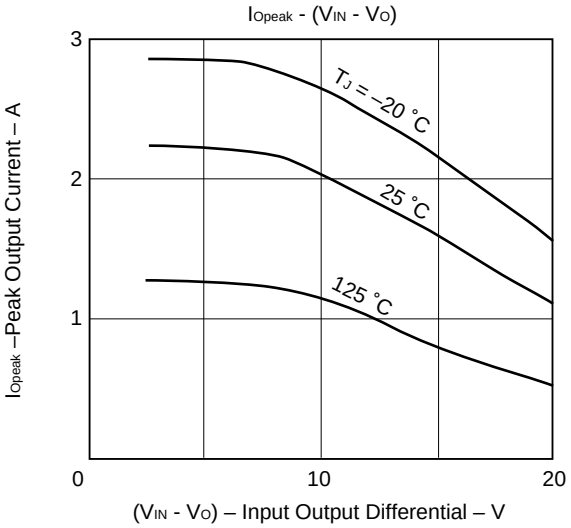

$I_{BIAS}$ ($I_{BIAS(S)}$) - $V_{IN}$ ($\mu$PC2405A)




$V_{DIF}$ - $T_J$




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



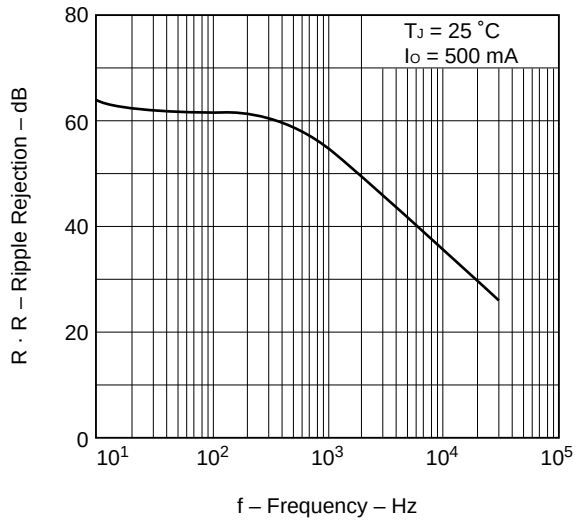

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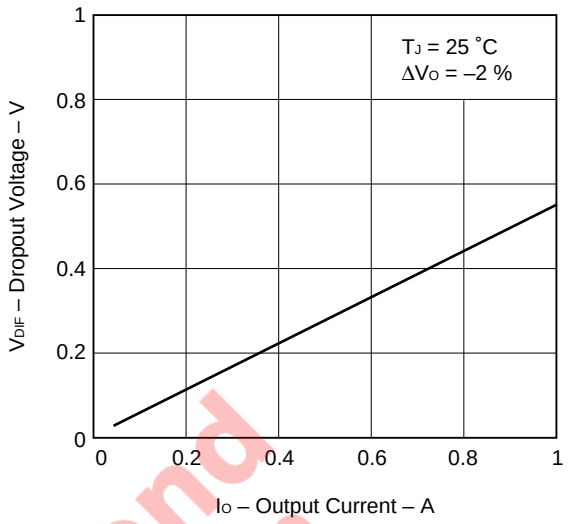
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## TYPICAL CHARACTERISTICS

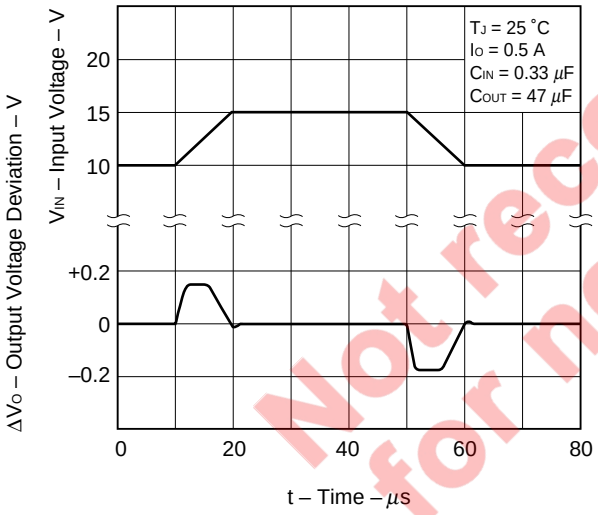
R · R - f (μPC2405A)



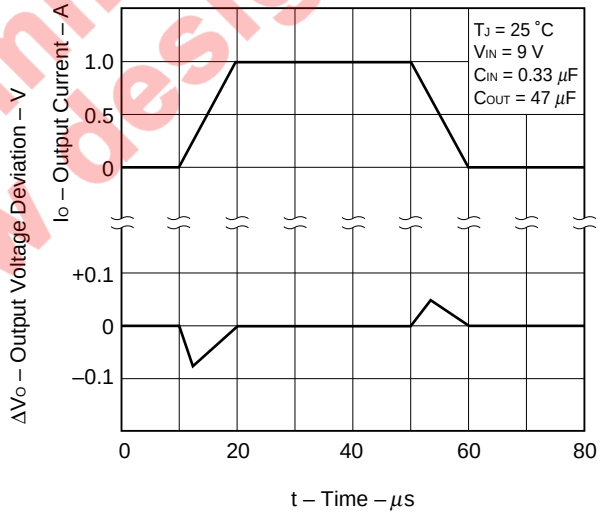

VDIF - IO




LINE TRANSIENT RESPONSE (μPC2405A)




LOAD TRANSIENT RESPONSE (μPC2405A)




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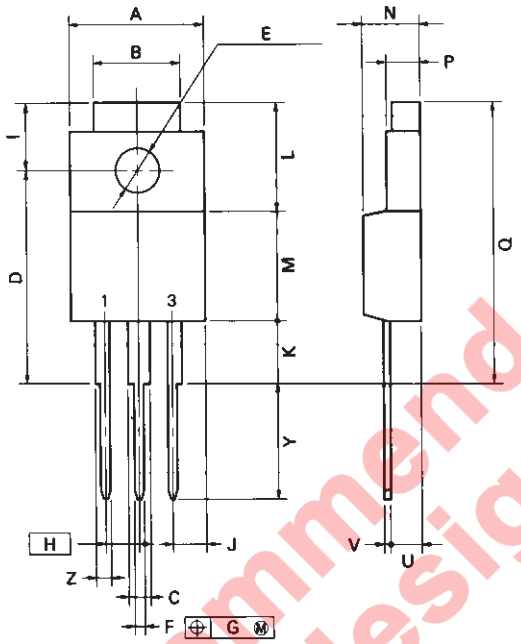


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## PACKAGE DIMENSIONS (Unit: mm)

μPC2400AHF Series

3PIN PLASTIC SIP (MP-45G)




P3HF-254B-1

**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 | $17.0^{\pm 0.3}$ | $0.669^{+0.013}_{-0.012}$ |
| E | $\phi 3.3^{\pm 0.2}$ | $\phi 0.130^{\pm 0.008}$ |
| F | $0.75^{\pm 0.10}$ | $0.030^{+0.004}_{-0.005}$ |
| G | 0.25 | 0.010 |
| H | 2.54 (T.P.) | 0.100 (T.P.) |
| I | $5.0^{\pm 0.3}$ | $0.197^{\pm 0.012}$ |
| 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 | $4.5^{\pm 0.2}$ | $0.177^{\pm 0.008}$ |
| P | $2.8^{\pm 0.2}$ | $0.110^{+0.009}_{-0.008}$ |
| Q | 22.4 MAX. | 0.882 MAX. |
| U | $2.4^{\pm 0.5}$ | $0.094^{+0.021}_{-0.020}$ |
| V | $0.65^{\pm 0.10}$ | $0.026^{+0.004}_{-0.005}$ |
| Y | $8.9^{\pm 0.7}$ | $0.350^{\pm 0.028}$ |
| Z | 1.0 MIN. | 0.039 MIN. |

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## RECOMMENDED SOLDERING CONDITIONS

The following conditions (see table below) must be met when soldering this product.

Please consult with our sales offices in case other soldering process is used, or in case soldering is done under different conditions.

## TYPES OF THROUGH HOLE MOUNT DEVICE

**μPC2400AHF 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. | IEI-1209 |
| Semiconductor device mounting technology manual. | IEI-1207 |
| Semiconductor device package manual. | IEI-1213 |
| Guide to quality assurance for semiconductor devices. | MEI-1202 |
| Semiconductor selection guide. | MF-1134 |

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**[MEMO]**

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NEC devices are classified into the following three quality grades:

"Standard", "Special", and "Specific". The Specific quality grade applies only to devices developed based on a customer designated "quality assurance program" for a specific application. The recommended applications of a device depend on its quality grade, as indicated below. Customers must check the quality grade of each device before using it in a particular application.

- 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 in "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 NEC Sales Representative in advance.

Anti-radioactive design is not implemented in this product.

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