DATA SHEET

NEC

BIPOLAR ANALOG INTEGRATED CIRCUIT

# μPC29M00 Series

## THREE TERMINAL LOW DROPOUT VOLTAGE REGULATOR

The μPC29M00 series of low dropout voltage three terminal positive regulators is constructed with PNP output transistor. The μPC29M00 series feature the ability to source 0.5 A of output current with a low dropout voltage of typically 0.5 V.

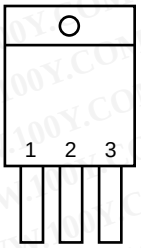
The power dissipation of the μPC29M00 series can be drastically reduced compared with the conventional three terminal positive voltage regulators that is constructed with NPN output transistor. Also, this series corresponds to the low voltage output (3 V, 3.3 V) which is not in the conventional low dropout regulators (μPC24M00A series).

### FEATURES

- Output current in excess of 0.5 A
- Low dropout voltage $V_{DIF}$ = 0.5 V TYP. (at $I_O$ = 0.5 A)
- On-chip overcurrent and thermal protection circuit
- On-chip output transistor safe area protection circuit

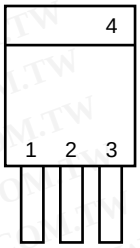
### PIN CONFIGURATION (Marking Side)

μPC29M00HF Series: MP-45G




1: INPUT
2: GND
3: OUTPUT

μPC29M00HB Series: MP-3
μPC29M00T Series: MP-3Z




1: INPUT
2: GND
3: OUTPUT
4: GND (Fin)



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

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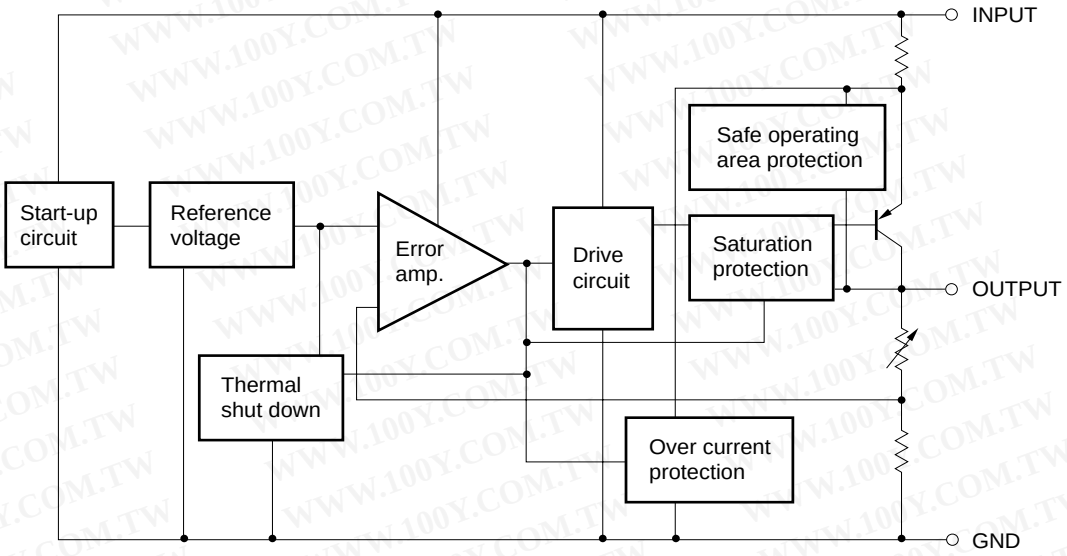
**The mark ★ shows major revised points.**

## BLOCK DIAGRAM




## ORDERING INFORMATION

| | Part Number | Package | Output Voltage |
|---|---|---|---|
| | μPC29M03HF | MP-45G (Isolated TO-220) | 3.0 V |
| | μPC29M03HB | MP-3 (SC-64) | 3.0 V |
| | μPC29M03T | MP-3Z (SC-63) | 3.0 V |
| | μPC29M33HF | MP-45 (Isolated TO-220) | 3.3 V |
| | μPC29M33HB | MP-3 (SC-64) | 3.3 V |
| | μPC29M33T | MP-3Z (SC-63) | 3.3 V |
| | μPC29M05HF | MP-45G (Isolated TO-220) | 5.0 V |
| | μPC29M05HB | MP-3 (SC-64) | 5.0 V |
| | μPC29M05T | MP-3Z (SC-63) | 5.0 V |
| ★ | μPC29M06HF | MP-45G (Isolated TO-220) | 6.0 V |
| ★ | μPC29M06HB | MP-3 (SC-64) | 6.0 V |
| ★ | μPC29M06T | MP-3Z (SC-63) | 6.0 V |
| ★ | μPC29M07HF | MP-45G (Isolated TO-220) | 7.0 V |
| ★ | μPC29M07HB | MP-3 (SC-64) | 7.0 V |
| ★ | μPC29M07T | MP-3Z (SC-63) | 7.0 V |
| | μPC29M08HF | MP-45G (Isolated TO-220) | 8.0 V |
| | μPC29M08HB | MP-3 (SC-64) | 8.0 V |
| | μPC29M08T | MP-3Z (SC-63) | 8.0 V |
| | μPC29M09HF | MP-45G (Isolated TO-220) | 9.0 V |
| | μPC29M09HB | MP-3 (SC-64) | 9.0 V |
| | μPC29M09T | MP-3Z (SC-63) | 9.0 V |
| | μPC29M10HF | MP-45G (Isolated TO-220) | 10.0 V |
| | μPC29M10HB | MP-3 (SC-64) | 10.0 V |
| | μPC29M10T | MP3Z (SC-63) | 10.0 V |
| | μPC29M12HF | MP-45G (Isolated TO-220) | 12.0 V |
| | μPC29M12HB | MP-3 (SC-64) | 12.0 V |
| | μPC29M12T | MP-3Z (SC-63) | 12.0 V |

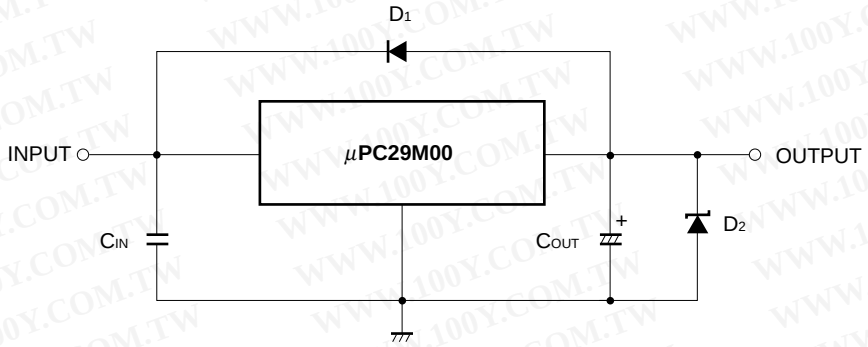
## ABSOLUTE MAXIMUM RATINGS ($T_A$ = 25 °C, Unless otherwise specified.)

| Parameter | Symbol | Rating | | Unit |
|---|---|---|---|---|
| | | μPC29M00HF | μPC29M00HB, μPC29M00T | |
| Input Voltage | $V_{IN}$ | 20 | | V |
| Internal Power Dissipation[Note] | $P_T$ | 15 | 10 | W |
| Operating Ambient Temperature | $T_A$ | –30 to +85 | | °C |
| Operating Junction Temperature | $T_J$ | –30 to +150 | | °C |
| Storage Temperature | $T_{stg}$ | –55 to +150 | | °C |
| Thermal Resistance (Junction to Case) | $R_{th\ (J-C)}$ | 7 | 12.5 | °C/W |
| Thermal Resistance (Junction to Ambient) | $R_{th\ (J-A)}$ | 65 | 125 | °C/W |

**Note** $T_C$ = 25 °C, Internally limited
When operating junction temperature rises up to 150 °C, the internal circuit shutdown output voltage.

**Caution Exposure to Absolute Maximum Ratings for extended periods may affect device reliability; exceeding the ratings could cause permanent damage. The parameters apply independently. The device should be operated within the limits specified under DC and AC Characteristics.**

## TYPICAL CONNECTION




$C_{IN}$ : More than 0.1 μF. Required if regulator is located an appreciable distance from power supply filter. You must use to prevent from the parasitic oscillation.
$C_{OUT}$ : More than 47 μF. You must use the Low-impedance-type (low ESR) capacitor.
$D_1$ : Need for $V_O > V_{IN}$
$D_2$ : Need a shottky barrier diode for $V_O$ < GND.

## RECOMMENDED OPERATING CONDITIONS

| Parameter | Symbol | Type Number | MIN. | TYP. | MAX. | Unit |
|---|---|---|---|---|---|---|
| Input Voltage | $V_{IN}$ | μPC29M03 | 4 | | 16 | V |
| | | μPC29M33 | 4.3 | | 16 | |
| | | μPC29M05 | 6 | | 16 | |
| ★ | | μPC29M06 | 7 | | 16 | |
| ★ | | μPC29M07 | 8 | | 16 | |
| | | μPC29M08 | 9 | | 18 | |
| | | μPC29M09 | 10 | | 18 | |
| | | μPC29M10 | 11 | | 18 | |
| | | μPC29M12 | 13 | | 18 | |
| Output Current | $I_O$ | all | 0 | | 0.5 | A |
| Operating Ambient Temperature | $T_A$ | all | –30 | | +85 | °C |
| Operating Junction Temperature | $T_J$ | all | –30 | | +125 | °C |

## ELECTRICAL CHARACTERISTICS μPC29M03 ($T_J$ = 25 °C, $V_{IN}$ = 5 V, $I_O$ = 350 mA, $C_{IN}$ = 0.22 μF, $C_{OUT}$ = 47 μF, unless otherwise specified.)

| Parameters | Symbol | Conditions | MIN. | TYP. | MAX. | Unit |
|---|---|---|---|---|---|---|
| Output Voltage | $V_O$ | | 2.88 | 3.0 | 3.12 | V |
| | | 0 °C ≤ $T_J$ ≤ 125 °C, 4.0 V ≤ $V_{IN}$ ≤ 16 V, 0 A ≤ $I_O$ ≤ 350 mA | 2.85 | | 3.15 | |
| | | 0 °C ≤ $T_J$ ≤ 125 °C, 0 A ≤ $I_O$ ≤ 0.5 A | | | | |
| Line Regulation | $REG_{IN}$ | 4.0 V ≤ $V_{IN}$ ≤ 16 V | | 7 | 30 | mV |
| Load Regulation | $REG_L$ | 0 A ≤ $I_O$ ≤ 0.5 A | | 8 | 30 | mV |
| Quiescent Current | $I_{BIAS}$ | $I_O$ = 0 A | | 1.8 | 4.0 | mA |
| | | $I_O$ = 0.5 A | | 17 | 30 | |
| Startup Quiescent Current | $I_{BIAS\ (s)}$ | $V_{IN}$ = 2.95 V, $I_O$ = 0 A | | 7 | 30 | mA |
| | | $V_{IN}$ = 2.95 V, $I_O$ = 0.5 A | | | 80 | |
| Quiescent Current Change | $\Delta I_{BIAS}$ | 0 °C ≤ $T_J$ ≤ 125 °C, 4.0 V ≤ $V_{IN}$ ≤ 16 V | | 3.2 | 20 | mA |
| Output Noise Voltage | $V_n$ | 10 Hz ≤ f ≤ 100 kHz | | 51 | | $\mu V_{r.m.s.}$ |
| Ripple Rejection | R·R | f = 120 Hz, 4.0 V ≤ $V_{IN}$ ≤ 16 V | 48 | 64 | | dB |
| Dropout Voltage | $V_{DIF}$ | 0 °C ≤ $T_J$ ≤ 125 °C, $I_O$ = 0.5 A | | 0.5 | 1.0 | V |
| Short Circuit Current | $I_{O\ short}$ | $V_{IN}$ = 4.5 V | 0.65 | 1.0 | 1.5 | A |
| | | $V_{IN}$ = 16 V | | 0.6 | | |
| Peak Output Current | $I_{O\ peak}$ | $V_{IN}$ = 4.5 V | 0.7 | 1.0 | 1.5 | A |
| | | $V_{IN}$ = 16 V | 0.6 | 0.9 | 1.5 | |
| Temperature Coefficient of Output Voltage | $\Delta V_O/\Delta T$ | 0 °C ≤ $T_J$ ≤ 125 °C, $I_O$ = 5 mA | | –0.3 | | mV/°C |

**ELECTRICAL CHARACTERISTICS μPC29M33 ($T_J$ = 25 °C, $V_{IN}$ = 5 V, $I_O$ = 350 mA, $C_{IN}$ = 0.22 μF, $C_{OUT}$ = 47 μF, unless otherwise specified.)**

| Parameters | Symbol | Conditions | MIN. | TYP. | MAX. | Unit |
|---|---|---|---|---|---|---|
| Output Voltage | $V_O$ | | 3.17 | 3.3 | 3.43 | V |
| | | 0 °C ≤ $T_J$ ≤ 125 °C, 4.3 V ≤ $V_{IN}$ ≤ 16 V, 0 A ≤ $I_O$ ≤ 350 mA | 3.14 | | 3.46 | |
| | | 0 °C ≤ $T_J$ ≤ 125 °C, 0 A ≤ $I_O$ ≤ 0.5 A | | | | |
| Line Regulation | $REG_{IN}$ | 4.3 V ≤ $V_{IN}$ ≤ 16 V | | 8 | 33 | mV |
| Load Regulation | $REG_L$ | 0 A ≤ $I_O$ ≤ 0.5 A | | 10 | 33 | mV |
| Quiescent Current | $I_{BIAS}$ | $I_O$ = 0 A | | 1.8 | 4.0 | mA |
| | | $I_O$ = 0.5 A | | 15 | 30 | |
| Startup Quiescent Current | $I_{BIAS\ (s)}$ | $V_{IN}$ = 3.1 V, $I_O$ = 0 A | | 9 | 30 | mA |
| | | $V_{IN}$ = 3.1 V, $I_O$ = 0.5 A | | | 80 | |
| Quiescent Current Change | $\Delta I_{BIAS}$ | 0 °C ≤ $T_J$ ≤ 125 °C, 4.3 V ≤ $V_{IN}$ ≤ 16 V | | 2.9 | 20 | mA |
| Output Noise Voltage | $V_n$ | 10 Hz ≤ f ≤ 100 kHz | | 56 | | $\mu V_{r.m.s.}$ |
| Ripple Rejection | R·R | f = 120 Hz, 4.3 V ≤ $V_{IN}$ ≤ 16 V | 48 | 64 | | dB |
| Dropout Voltage | $V_{DIF}$ | 0 °C ≤ $T_J$ ≤ 125 °C, $I_O$ = 0.5 A | | 0.5 | 1.0 | V |
| Short Circuit Current | $I_{O\ short}$ | $V_{IN}$ = 4.5 V | 0.7 | 1.1 | 1.5 | A |
| | | $V_{IN}$ = 16 V | | 0.6 | | |
| Peak Output Current | $I_{O\ peak}$ | $V_{IN}$ = 4.5 V | 0.7 | 1.2 | 1.5 | A |
| | | $V_{IN}$ = 16 V | 0.6 | 1.0 | 1.5 | |
| Temperature Coefficient of Output Voltage | $\Delta V_O/\Delta T$ | 0 °C ≤ $T_J$ ≤ 125 °C, $I_O$ = 5 mA | | –0.4 | | mV/°C |

**ELECTRICAL CHARACTERISTICS μPC29M05 ($T_J$ = 25 °C, $V_{IN}$ = 8 V, $I_O$ = 350 mA, $C_{IN}$ = 0.22 μF, $C_{OUT}$ = 47 μF, unless otherwise specified.)**

| Parameters | Symbol | Conditions | MIN. | TYP. | MAX. | Unit |
|---|---|---|---|---|---|---|
| Output Voltage | $V_O$ | | 4.8 | 5.0 | 5.2 | V |
| | | 0 °C ≤ $T_J$ ≤ 125 °C, 6 V ≤ $V_{IN}$ ≤ 16 V, 0 A ≤ $I_O$ ≤ 350 mA | 4.75 | | 5.25 | |
| | | 0 °C ≤ $T_J$ ≤ 125 °C, 0 A ≤ $I_O$ ≤ 0.5 A | | | | |
| Line Regulation | $REG_{IN}$ | 6 V ≤ $V_{IN}$ ≤ 16 V | | 26 | 50 | mV |
| Load Regulation | $REG_L$ | 0 A ≤ $I_O$ ≤ 0.5 A | | 17 | 50 | mV |
| Quiescent Current | $I_{BIAS}$ | $I_O$ = 0 A | | 1.9 | 4.0 | mA |
| | | $I_O$ = 0.5 A | | 16 | 30 | |
| Startup Quiescent Current | $I_{BIAS (s)}$ | $V_{IN}$ = 4.5 V, $I_O$ = 0 A | | 10 | 30 | mA |
| | | $V_{IN}$ = 4.5 V, $I_O$ = 0.5 A | | | 80 | |
| Quiescent Current Change | $\Delta I_{BIAS}$ | 0 °C ≤ $T_J$ ≤ 125 °C, 6 V ≤ $V_{IN}$ ≤ 16 V | | 2.4 | 20 | mA |
| Output Noise Voltage | $V_n$ | 10 Hz ≤ f ≤ 100 kHz | | 87 | | $\mu V_{r.m.s.}$ |
| Ripple Rejection | R·R | f = 120 Hz, 6 V ≤ $V_{IN}$ ≤ 16 V | 46 | 60 | | dB |
| Dropout Voltage | $V_{DIF}$ | 0 °C ≤ $T_J$ ≤ 125 °C, $I_O$ = 0.5 A | | 0.5 | 1.0 | V |
| Short Circuit Current | $I_{O\ short}$ | $V_{IN}$ = 6.5 V | 0.65 | 1.1 | 1.5 | A |
| | | $V_{IN}$ = 16 V | | 0.6 | | |
| Peak Output Current | $I_{O\ peak}$ | $V_{IN}$ = 6.5 V | 0.7 | 1.2 | 1.5 | A |
| | | $V_{IN}$ = 16 V | 0.6 | 1.1 | 1.5 | |
| Temperature Coefficient of Output Voltage | $\Delta V_O/\Delta T$ | 0 °C ≤ $T_J$ ≤ 125 °C, $I_O$ = 5 mA | | 0.7 | | mV/°C |

★ **ELECTRICAL CHARACTERISTICS μPC29M06 ($T_J$ = 25 °C, $V_{IN}$ = 9 V, $I_O$ = 350 mA, $C_{IN}$ = 0.22 μF, $C_{OUT}$ = 47 μF, unless otherwise specified.)**

| Parameters | Symbol | Conditions | MIN. | TYP. | MAX. | Unit |
|---|---|---|---|---|---|---|
| Output Voltage | $V_O$ | | 5.76 | 6.0 | 6.24 | V |
| | | 0 °C ≤ $T_J$ ≤ 125 °C, 7 V ≤ $V_{IN}$ ≤ 16 V, 0 A ≤ $I_O$ ≤ 350 mA | 5.70 | | 6.30 | |
| | | 0 °C ≤ $T_J$ ≤ 125 °C, 0 A ≤ $I_O$ ≤ 0.5 A | | | | |
| Line Regulation | $REG_{IN}$ | 7 V ≤ $V_{IN}$ ≤ 16 V | | 30 | 60 | mV |
| Load Regulation | $REG_L$ | 0 A ≤ $I_O$ ≤ 0.5 A | | 30 | 60 | mV |
| Quiescent Current | $I_{BIAS}$ | $I_O$ = 0 A | | 2.0 | 4.0 | mA |
| | | $I_O$ = 0.5 A | | 16 | 30 | |
| Startup Quiescent Current | $I_{BIAS\ (s)}$ | $V_{IN}$ = 5.5 V, $I_O$ = 0 A | | 10 | 30 | mA |
| | | $V_{IN}$ = 5.5 V, $I_O$ = 0.5 A | | | 80 | |
| Quiescent Current Change | $\Delta I_{BIAS}$ | 0 °C ≤ $T_J$ ≤ 125 °C, 7 V ≤ $V_{IN}$ ≤ 16 V | | 2.5 | 20 | mA |
| Output Noise Voltage | $V_n$ | 10 Hz ≤ f ≤ 100 kHz | | 126 | | $\mu V_{r.m.s.}$ |
| Ripple Rejection | R·R | f = 120 Hz, 7 V ≤ $V_{IN}$ ≤ 16 V | 42 | 58 | | dB |
| Dropout Voltage | $V_{DIF}$ | 0 °C ≤ $T_J$ ≤ 125 °C, $I_O$ = 0.5 A | | 0.5 | 1.0 | V |
| Short Circuit Current | $I_{O\ short}$ | $V_{IN}$ = 7.5 V | 0.7 | 1.1 | 1.5 | A |
| | | $V_{IN}$ = 16 V | | 0.6 | | |
| Peak Output Current | $I_{O\ peak}$ | $V_{IN}$ = 7.5 V | 0.7 | 1.1 | 1.5 | A |
| | | $V_{IN}$ = 16 V | 0.6 | 1.1 | 1.5 | |
| Temperature Coefficient of Output Voltage | $\Delta V_O/\Delta T$ | 0 °C ≤ $T_J$ ≤ 125 °C, $I_O$ = 5 mA | | 0.44 | | mV/°C |

★ **ELECTRICAL CHARACTERISTICS μPC29M07 ($T_J$ = 25 °C, $V_{IN}$ = 10 V, $I_O$ = 350 mA, $C_{IN}$ = 0.22 μF, $C_{OUT}$ = 47 μF, unless otherwise specified.)**

| Parameters | Symbol | Conditions | MIN. | TYP. | MAX. | Unit |
|---|---|---|---|---|---|---|
| Output Voltage | $V_O$ | | 6.72 | 7.0 | 7.28 | V |
| | | 0 °C ≤ $T_J$ ≤ 125 °C, 8 V ≤ $V_{IN}$ ≤ 16 V, 0 A ≤ $I_O$ ≤ 350 mA | 6.65 | | 7.35 | |
| | | 0 °C ≤ $T_J$ ≤ 125 °C, 0 A ≤ $I_O$ ≤ 0.5 A | | | | |
| Line Regulation | $REG_{IN}$ | 8 V ≤ $V_{IN}$ ≤ 16 V | | 35 | 70 | mV |
| Load Regulation | $REG_L$ | 0 A ≤ $I_O$ ≤ 0.5 A | | 35 | 70 | mV |
| Quiescent Current | $I_{BIAS}$ | $I_O$ = 0 A | | 2.0 | 4.0 | mA |
| | | $I_O$ = 0.5 A | | 16 | 30 | |
| Startup Quiescent Current | $I_{BIAS\ (s)}$ | $V_{IN}$ = 6.5 V, $I_O$ = 0 A | | 10 | 30 | mA |
| | | $V_{IN}$ = 6.5 V, $I_O$ = 0.5 A | | | 80 | |
| Quiescent Current Change | $\Delta I_{BIAS}$ | 0 °C ≤ $T_J$ ≤ 125 °C, 8 V ≤ $V_{IN}$ ≤ 16 V | | 2.6 | 20 | mA |
| Output Noise Voltage | $V_n$ | 10 Hz ≤ f ≤ 100 kHz | | 147 | | $\mu V_{r.m.s.}$ |
| Ripple Rejection | R·R | f = 120 Hz, 8 V ≤ $V_{IN}$ ≤ 16 V | 40 | 56 | | dB |
| Dropout Voltage | $V_{DIF}$ | 0 °C ≤ $T_J$ ≤ 125 °C, $I_O$ = 0.5 A | | 0.5 | 1.0 | V |
| Short Circuit Current | $I_{O\ short}$ | $V_{IN}$ = 8.5 V | 0.7 | 1.1 | 1.5 | A |
| | | $V_{IN}$ = 16 V | | 0.6 | | |
| Peak Output Current | $I_{O\ peak}$ | $V_{IN}$ = 8.5 V | 0.7 | 1.2 | 1.5 | A |
| | | $V_{IN}$ = 16 V | 0.6 | 1.1 | 1.5 | |
| Temperature Coefficient of Output Voltage | $\Delta V_O/\Delta T$ | 0 °C ≤ $T_J$ ≤ 125 °C, $I_O$ = 5 mA | | 0.7 | | mV/°C |

**ELECTRICAL CHARACTERISTICS μPC29M08 ($T_J$ = 25 °C, $V_{IN}$ = 11 V, $I_O$ = 350 mA, $C_{IN}$ = 0.22 μF, $C_{OUT}$ = 47 μF, unless otherwise specified.)**

| Parameters | Symbol | Conditions | MIN. | TYP. | MAX. | Unit |
|---|---|---|---|---|---|---|
| Output Voltage | $V_O$ | | 7.68 | 8.0 | 8.32 | V |
| | | 0 °C ≤ $T_J$ ≤ 125 °C, 9 V ≤ $V_{IN}$ ≤ 18 V, 0 A ≤ $I_O$ ≤ 350 mA | 7.6 | | 8.4 | |
| | | 0 °C ≤ $T_J$ ≤ 125 °C, 0 A ≤ $I_O$ ≤ 0.5 A | | | | |
| Line Regulation | $REG_{IN}$ | 9 V ≤ $V_{IN}$ ≤ 18 V | | 40 | 80 | mV |
| Load Regulation | $REG_L$ | 0 A ≤ $I_O$ ≤ 0.5 A | | 40 | 80 | mV |
| Quiescent Current | $I_{BIAS}$ | $I_O$ = 0 A | | 2.0 | 4.0 | mA |
| | | $I_O$ = 0.5 A | | 15 | 30 | |
| Startup Quiescent Current | $I_{BIAS\ (s)}$ | $V_{IN}$ = 7.5 V, $I_O$ = 0 A | | 10 | 30 | mA |
| | | $V_{IN}$ = 7.5 V, $I_O$ = 0.5 A | | | 80 | |
| Quiescent Current Change | $\Delta I_{BIAS}$ | 0 °C ≤ $T_J$ ≤ 125 °C, 9 V ≤ $V_{IN}$ ≤ 18 V | | 3.0 | 20 | mA |
| Output Noise Voltage | $V_n$ | 10 Hz ≤ f ≤ 100 kHz | | 150 | | $\mu V_{r.m.s.}$ |
| Ripple Rejection | R·R | f = 120 Hz, 9 V ≤ $V_{IN}$ ≤ 18 V | 42 | 58 | | dB |
| Dropout Voltage | $V_{DIF}$ | 0 °C ≤ $T_J$ ≤ 125 °C, $I_O$ = 0.5 A | | 0.5 | 1.0 | V |
| Short Circuit Current | $I_{O\ short}$ | $V_{IN}$ = 9.5 V | | 1.0 | | A |
| | | $V_{IN}$ = 18 V | | 0.55 | | |
| Peak Output Current | $I_{O\ peak}$ | $V_{IN}$ = 9.5 V | 0.7 | 1.2 | 1.5 | A |
| | | $V_{IN}$ = 18 V | 0.6 | 1.1 | 1.5 | |
| Temperature Coefficient of Output Voltage | $\Delta V_O/\Delta T$ | 0 °C ≤ $T_J$ ≤ 125 °C, $I_O$ = 5 mA | | 0.7 | | mV/°C |

**ELECTRICAL CHARACTERISTICS μPC29M09 ($T_J$ = 25 °C, $V_{IN}$ = 12 V, $I_O$ = 350 mA, $C_{IN}$ = 0.22 μF, $C_{OUT}$ = 47 μF, unless otherwise specified.)**

| Parameters | Symbol | Conditions | MIN. | TYP. | MAX. | Unit |
|---|---|---|---|---|---|---|
| Output Voltage | $V_O$ | | 8.64 | 9.0 | 9.36 | V |
| | | 0 °C ≤ $T_J$ ≤ 125 °C, 10 V ≤ $V_{IN}$ ≤ 18 V, 0 A ≤ $I_O$ ≤ 350 mA | 8.55 | | 9.45 | |
| | | 0 °C ≤ $T_J$ ≤ 125 °C, 0 A ≤ $I_O$ ≤ 0.5 A | | | | |
| Line Regulation | $REG_{IN}$ | 10 V ≤ $V_{IN}$ ≤ 18 V | | 45 | 90 | mV |
| Load Regulation | $REG_L$ | 0 A ≤ $I_O$ ≤ 0.5 A | | 45 | 90 | mV |
| Quiescent Current | $I_{BIAS}$ | $I_O$ = 0 A | | 2.0 | 4.0 | mA |
| | | $I_O$ = 0.5 A | | 15 | 30 | |
| Startup Quiescent Current | $I_{BIAS\ (s)}$ | $V_{IN}$ = 8.5 V, $I_O$ = 0 A | | 10 | 30 | mA |
| | | $V_{IN}$ = 8.5 V, $I_O$ = 0.5 A | | | 80 | |
| Quiescent Current Change | $\Delta I_{BIAS}$ | 0 °C ≤ $T_J$ ≤ 125 °C, 10 V ≤ $V_{IN}$ ≤ 18 V | | | 20 | mA |
| Output Noise Voltage | $V_n$ | 10 Hz ≤ f ≤ 100 kHz | | 170 | | $\mu V_{r.m.s.}$ |
| Ripple Rejection | R·R | f = 120 Hz, 10 V ≤ $V_{IN}$ ≤ 18 V | 41 | 57 | | dB |
| Dropout Voltage | $V_{DIF}$ | 0 °C ≤ $T_J$ ≤ 125 °C, $I_O$ = 0.5 A | | 0.5 | 1.0 | V |
| Short Circuit Current | $I_{O\ short}$ | $V_{IN}$ = 10.5 V | | 1.0 | | A |
| | | $V_{IN}$ = 18 V | | 0.55 | | |
| Peak Output Current | $I_{O\ peak}$ | $V_{IN}$ = 10.5 V | 0.7 | 1.2 | 1.5 | A |
| | | $V_{IN}$ = 18 V | 0.6 | 1.1 | 1.5 | |
| Temperature Coefficient of Output Voltage | $\Delta V_O/\Delta T$ | 0 °C ≤ $T_J$ ≤ 125 °C, $I_O$ = 5 mA | | 0.8 | | mV/°C |

**ELECTRICAL CHARACTERISTICS μPC29M10 ($T_J$ = 25 °C, $V_{IN}$ = 13 V, $I_O$ = 350 mA, $C_{IN}$ = 0.22 μF, $C_{OUT}$ = 47 μF, unless otherwise specified.)**

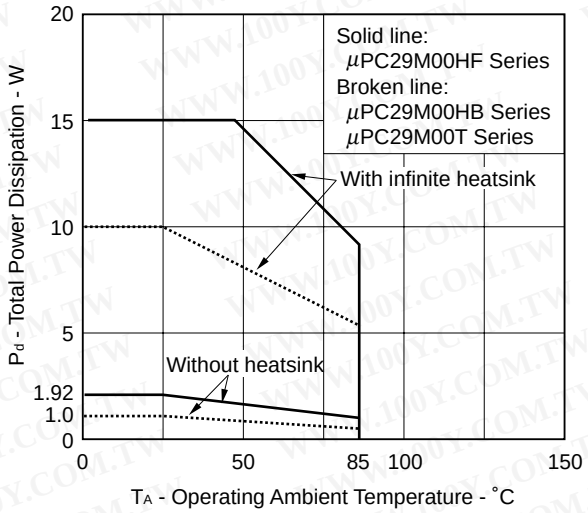
| Parameters | Symbol | Conditions | MIN. | TYP. | MAX. | Unit |
|---|---|---|---|---|---|---|
| Output Voltage | $V_O$ | | 9.6 | 10.0 | 10.4 | V |
| | | 0 °C ≤ $T_J$ ≤ 125 °C, 11 V ≤ $V_{IN}$ ≤ 18 V, 0 A ≤ $I_O$ ≤ 350 mA | 9.5 | | 10.5 | |
| | | 0 °C ≤ $T_J$ ≤ 125 °C, 0 A ≤ $I_O$ ≤ 0.5 A | | | | |
| Line Regulation | $REG_{IN}$ | 11 V ≤ $V_{IN}$ ≤ 18 V | | 34 | 100 | mV |
| Load Regulation | $REG_L$ | 0 A ≤ $I_O$ ≤ 0.5 A | | 10 | 100 | mV |
| Quiescent Current | $I_{BIAS}$ | $I_O$ = 0 A | | 2.1 | 4.0 | mA |
| | | $I_O$ = 0.5 A | | 16 | 30 | |
| Startup Quiescent Current | $I_{BIAS\ (s)}$ | $V_{IN}$ = 9.5 V, $I_O$ = 0 A | | 10 | 30 | mA |
| | | $V_{IN}$ = 9.5 V, $I_O$ = 0.5 A | | | 80 | |
| Quiescent Current Change | $\Delta I_{BIAS}$ | 0 °C ≤ $T_J$ ≤ 125 °C, 11 V ≤ $V_{IN}$ ≤ 18 V | | 1.9 | 20 | mA |
| Output Noise Voltage | $V_n$ | 10 Hz ≤ f ≤ 100 kHz | | 180 | | $\mu V_{r.m.s.}$ |
| Ripple Rejection | R·R | f = 120 Hz, 11 V ≤ $V_{IN}$ ≤ 18 V | 40 | 53 | | dB |
| Dropout Voltage | $V_{DIF}$ | 0 °C ≤ $T_J$ ≤ 125 °C, $I_O$ = 0.5 A | | 0.5 | 1.0 | V |
| Short Circuit Current | $I_{O\ short}$ | $V_{IN}$ = 11.5 V | | 0.9 | | A |
| | | $V_{IN}$ = 18 V | | 0.5 | | |
| Peak Output Current | $I_{O\ peak}$ | $V_{IN}$ = 11.5 V | 0.7 | 1.2 | 1.5 | A |
| | | $V_{IN}$ = 18 V | 0.6 | 1.2 | 1.5 | |
| Temperature Coefficient of Output Voltage | $\Delta V_O/\Delta T$ | 0 °C ≤ $T_J$ ≤ 125 °C, $I_O$ = 5 mA | | 0.9 | | mV/°C |

**ELECTRICAL CHARACTERISTICS μPC29M12 ($T_J$ = 25 °C, $V_{IN}$ = 15 V, $I_O$ = 350 mA, $C_{IN}$ = 0.22 μF, $C_{OUT}$ = 47 μF, unless otherwise specified.)**

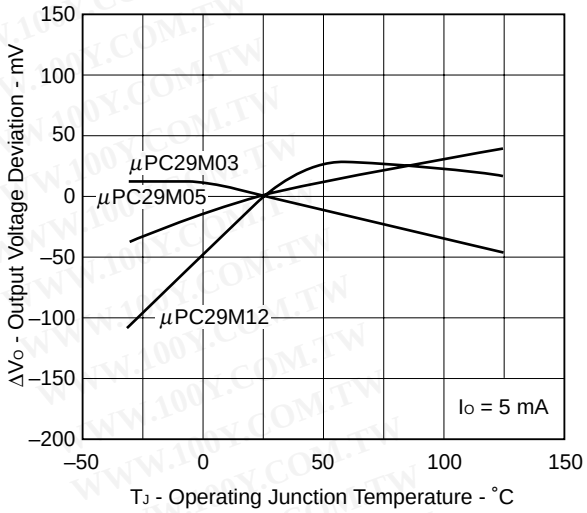
| Parameters | Symbol | Conditions | MIN. | TYP. | MAX. | Unit |
|---|---|---|---|---|---|---|
| Output Voltage | $V_O$ | | 11.52 | 12 | 12.48 | V |
| | | 0 °C ≤ $T_J$ ≤ 125 °C, 13 V ≤ $V_{IN}$ ≤ 18 V, 0 A ≤ $I_O$ ≤ 350 mA | 11.4 | | 12.6 | |
| | | 0 °C ≤ $T_J$ ≤ 125 °C, 0 A ≤ $I_O$ ≤ 0.5 A | | | | |
| Line Regulation | $REG_{IN}$ | 13 V ≤ $V_{IN}$ ≤ 18 V | | 25 | 120 | mV |
| Load Regulation | $REG_L$ | 0 A ≤ $I_O$ ≤ 0.5 A | | 13 | 120 | mV |
| Quiescent Current | $I_{BIAS}$ | $I_O$ = 0 A | | 2.1 | 4.0 | mA |
| | | $I_O$ = 0.5 A | | 14 | 30 | |
| Startup Quiescent Current | $I_{BIAS\ (s)}$ | $V_{IN}$ = 11.5 V, $I_O$ = 0 A | | 10 | 30 | mA |
| | | $V_{IN}$ = 11.5 V, $I_O$ = 0.5 A | | | 80 | |
| Quiescent Current Change | $\Delta I_{BIAS}$ | 0 °C ≤ $T_J$ ≤ 125 °C, 13 V ≤ $V_{IN}$ ≤ 18 V | | 1.7 | 20 | mA |
| Output Noise Voltage | $V_n$ | 10 Hz ≤ f ≤ 100 kHz | | 210 | | $\mu V_{r.m.s.}$ |
| Ripple Rejection | R·R | f = 120 Hz, 13 V ≤ $V_{IN}$ ≤ 18 V | 40 | 53 | | dB |
| Dropout Voltage | $V_{DIF}$ | 0 °C ≤ $T_J$ ≤ 125 °C, $I_O$ = 0.5 A | | 0.5 | 1.0 | V |
| Short Circuit Current | $I_{O\ short}$ | $V_{IN}$ = 14 V | | 0.7 | | A |
| | | $V_{IN}$ = 18 V | | 0.5 | | |
| Peak Output Current | $I_{O\ peak}$ | $V_{IN}$ = 14 V | 0.7 | 1.2 | 1.5 | A |
| | | $V_{IN}$ = 18 V | 0.6 | 1.1 | 1.5 | |
| Temperature Coefficient of Output Voltage | $\Delta V_O/\Delta T$ | 0 °C ≤ $T_J$ ≤ 125 °C, $I_O$ = 5 mA | | 1.2 | | mV/°C |

## TYPICAL CHARACTERISTICS

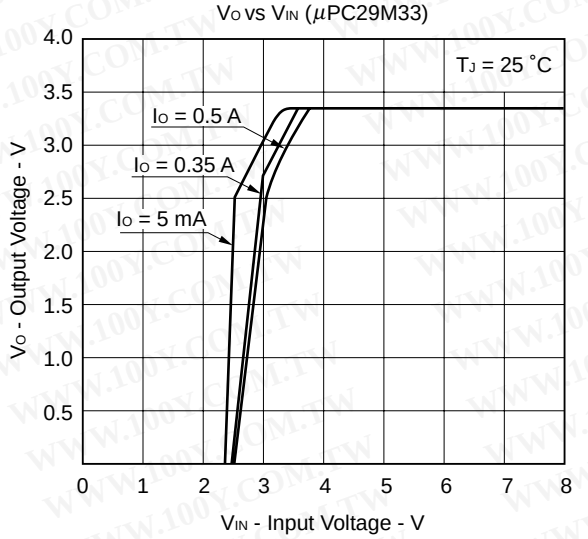
$P_d$ vs $T_A$



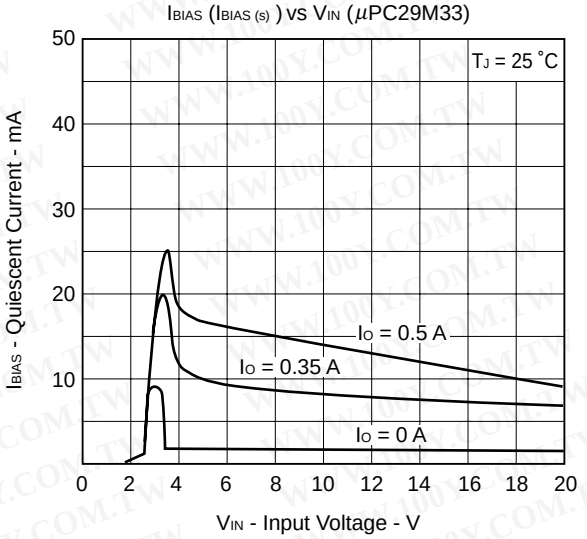

$\Delta V_O$ vs $T_J$



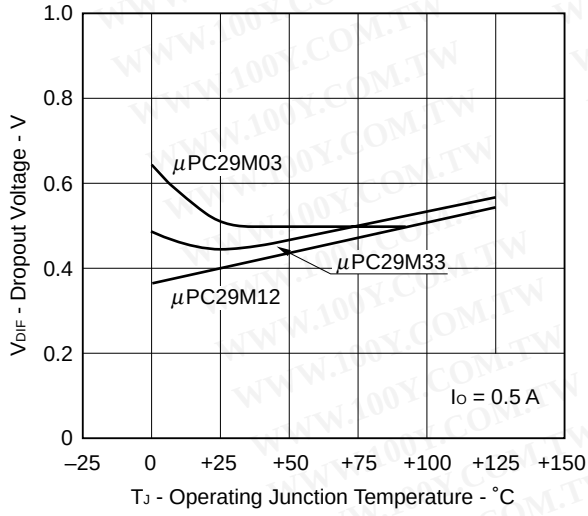

$V_O$ vs $V_{IN}$ ($\mu$PC29M33)



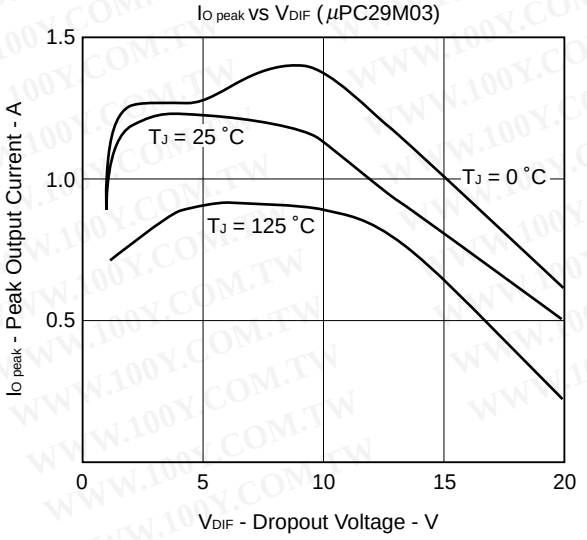

$I_{BIAS}$ ($I_{BIAS\ (S)}$) vs $V_{IN}$ ($\mu$PC29M33)



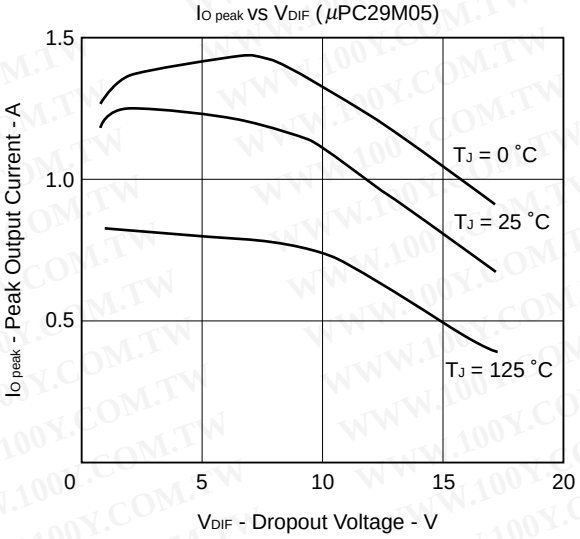

$V_{DIF}$ vs $T_J$



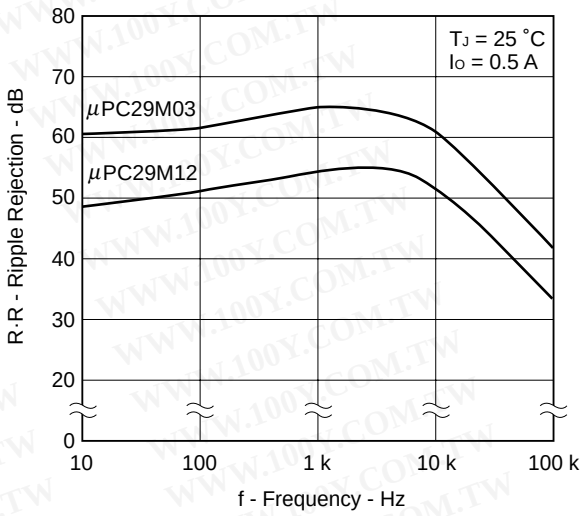

$I_{O\ peak}$ vs $V_{DIF}$ ($\mu$PC29M03)



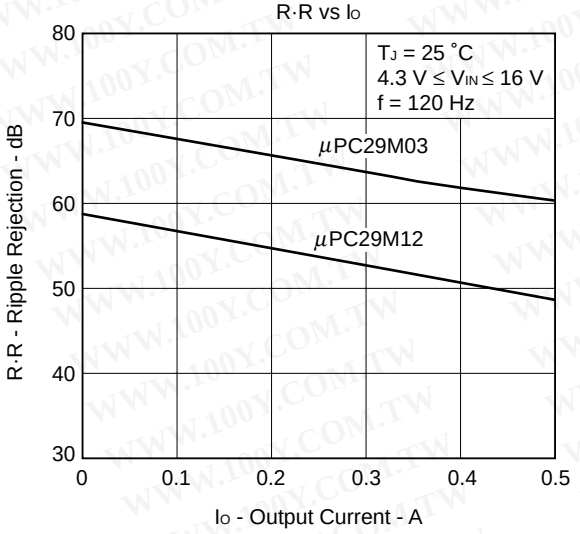
$I_{O\ peak}$ vs $V_{DIF}$ (μPC29M05)



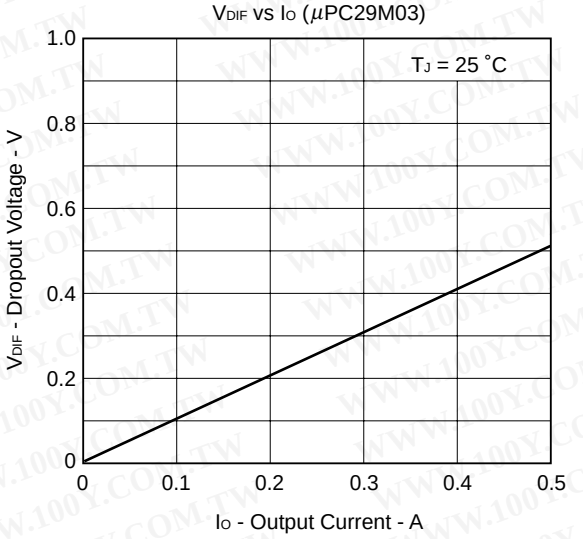

R·R vs f



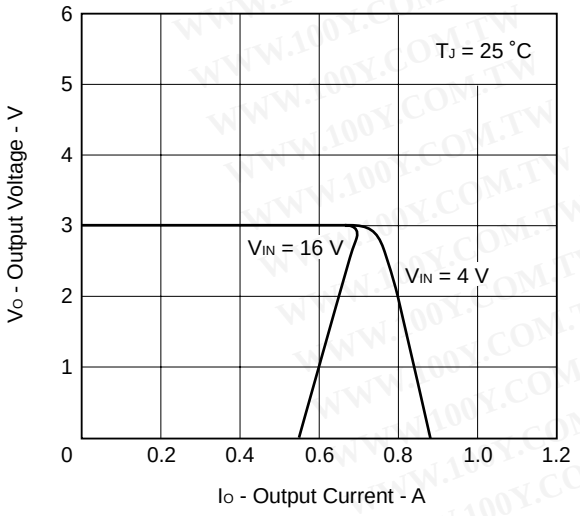

R·R vs $I_O$




$V_{DIF}$ vs $I_O$ (μPC29M03)



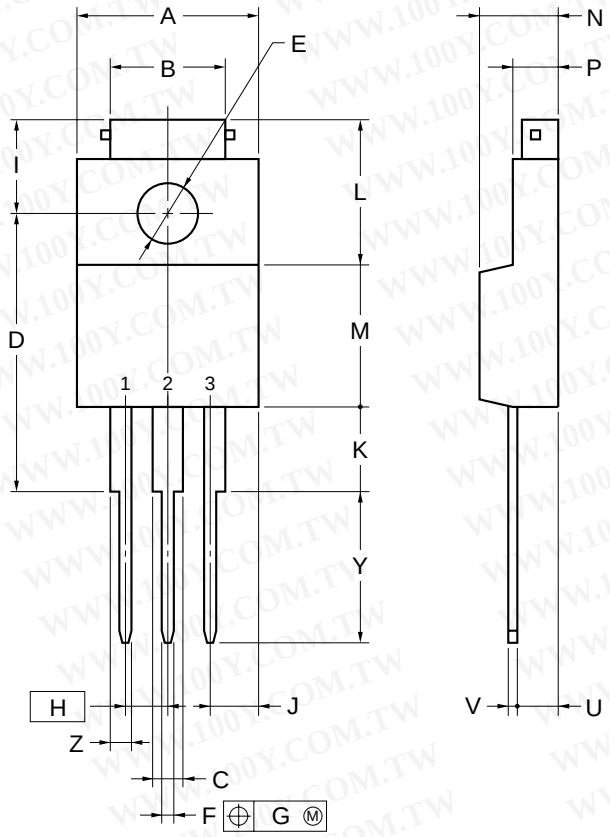

$V_O$ vs $I_O$ (μPC29M03)



## PACKAGE DRAWINGS

### μPD29M00HF Series

### 3PIN PLASTIC SIP (MP-45G)




**NOTE**

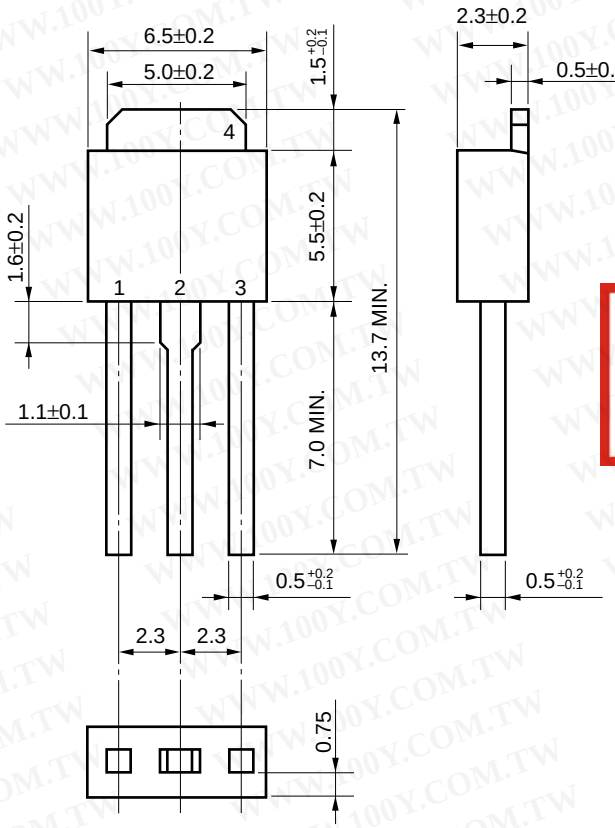
Each lead centerline is located within 0.25 mm of its true position (T.P.) at maximum material condition.

| ITEM | MILLIMETERS |
|---|---|
| A | 10.0±0.2 |
| B | 7.0±0.2 |
| C | 1.50±0.2 |
| D | 17.0±0.3 |
| E | φ3.3±0.2 |
| F | 0.75±0.10 |
| G | 0.25 |
| H | 2.54 (T.P.) |
| I | 5.0±0.3 |
| J | 2.46±0.2 |
| K | 5.0±0.2 |
| L | 8.5±0.2 |
| M | 8.5±0.2 |
| N | 4.5±0.2 |
| P | 2.8±0.2 |
| U | 2.4±0.5 |
| V | 0.65±0.10 |
| Y | 8.9±0.7 |
| Z | 1.30±0.2 |

P3HF-254B-4

### μPC29M00HB Series

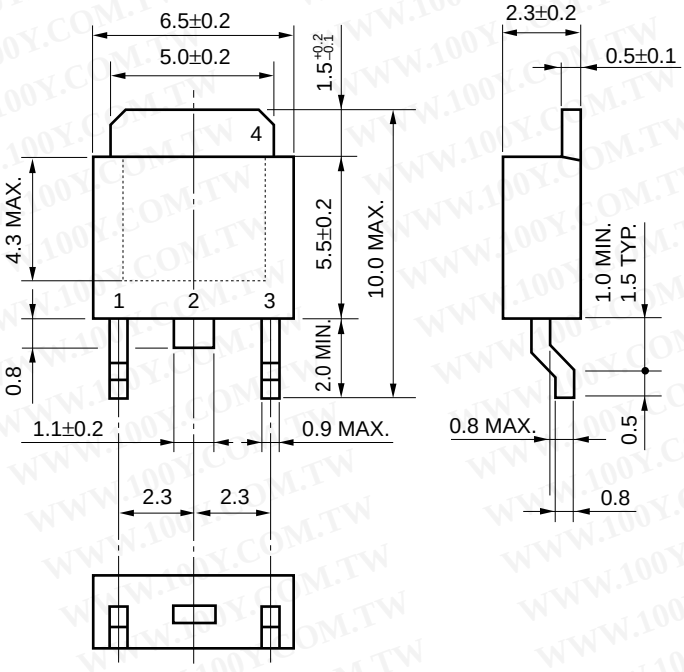
**MP-3 (SC-64) (Unit: mm)**






### μPC29M00T Series

**MP-3Z (SC-63) (Unit: mm)**



## 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 perfomed under different condition, please make sure to consult with our sales offices.

Fof more details, refer to our document **"SEMICONDUCTOR DEVICE MOUNTING TECHNOLOGY MANUAL" (C10535E)**.

### Surface mount devices

**μPC29M00T Series: MP-3Z**

| Process | Conditions | Symbol |
|---|---|---|
| Infrared ray reflow | Peak temperature: 235 °C or below (Package surface temperature),<br>Reflow time: 30 seconds or less (at 210 °C or higher),<br>Maximum number of reflow processes: 2 times. | IR35-00-2 |
| VPS | Peak temperature: 215 °C or below (Package surface temperature),<br>Reflow time: 40 seconds or less (at 200 °C or higher),<br>Maximum number of reflow processes: 2 times. | VP15-00-2 |
| Wave soldering | Solder temperature: 260 °C or below, Flow time: 10 seconds or less,<br>Maximum number of flow processes: 1 time,<br>Pre-heating temperature: 120 °C or below (Package surface temperature). | WS60-00-1 |
| ★ Partial heating method | Pin temperature: 300 °C or below,<br>Heat time: 3 seconds or less (Per each side of the device). | — |

**Caution Apply only one kind of soldering condition to a device, except for "partial heating method", or the device will be damaged by heat stress.**

### Through-hole devices

**μPC29M00HF Series: MP-45G**
**μPC29M00HB Series: MP-3**

| Process | Conditions |
|---|---|
| Wave soldering<br>(only to leads) | Solder temperature: 260 °C or below,<br>Flow time: 10 seconds or less. |
| ★ Partial heating method | Pin temperature: 300 °C or below,<br>Heat time: 3 seconds or less (Per each pin). |

**Caution For through-hole device, the wave soldering process must be applied only to leads, and make sure that the package body does not get jet soldered.**

## CAUTION ON USE

When using the μPC29M00 series at the input voltage which is lower than in the recommended operating condition, the big quiescent current flows through devices because the transistor of the output paragraph is saturated (Refer to $I_{BIAS}$ ($I_{BIAS\,(S)}$) vs $V_{IN}$ curves in **TYPICAL CHARACTERISTICS**). The μPC29M00 series have saturation protection circuits, but they sometimes need about 80 mA current. Therefore the power supply on the input needs the enough current capacity to pass this quiescent current when the devices startup.

## REFERENCE DOCUMENTS

| | |
|---|---|
| ★ QUALITY GRADE ON NEC SEMICONDUCTOR DEVICES | C11531E |
| SEMICONDUCTOR DEVICE MOUNTING TECHNOLOGY MANUAL | C10535E |
| IC PACKAGE MANUAL | C10943X |
| GUIDE TO QUALITY ASSUARANCE FOR SEMICONDUCTOR DEVICES | MEI-1202 |
| SEMICONDUCTORS SELECTION GUIDE | X10679E |
| NEC SEMICONDUCTOR DEVICE RELIABILITY/QUALITY CONTROL | IEI-1212 |
| SYSTEM-THREE TERMINAL REGULATOR | |

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