DATA SHEET

NEC

# BIPOLAR ANALOG INTEGRATED CIRCUIT

# μPC2918,2925,2926

## THREE-TERMINAL LOW DROPOUT VOLTAGE REGULATOR

### DESCRIPTION

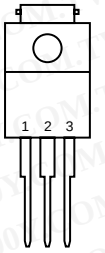
The μPC2918, 2925 and 2926 are three-terminal low dropout voltage regulators with the 1-A output. The μPC2918 outputs 1.8 V, the μPC2925 outputs 2.5 V and the μPC2926 outputs 2.6 V. Since these regulators use a PNP transistor for the output stage, they achieve a low dropout voltage of 0.7 V TYP. at $I_O$ = 1 A and minimize the power dissipation of the IC. As a result, these regulators can be used to realize sets with lower voltage and power dissipation.

### FEATURES

- Output current capacity: 1 A
- Low dropout voltage
  ($V_{DIF}$ = 0.5 V MAX. ($I_O$ = 0.5 A))
- Output voltage accuracy: ±2%
- On-chip saturation protector rising edge of input voltage (at low input voltage)
- On-chip overcurrent limiter and thermal protection
- On-chip output transistor safe operation area protection

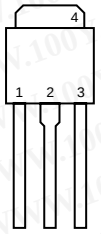
### ★ PIN CONFIGURATIONS (Marking Side)

μPC2918HF
μPC2925HF: Isolated TO-220 (MP-45G)
μPC2926HF



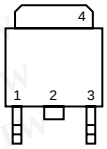

1: INPUT
2: GND
3: OUTPUT

μPC2918HB
μPC2925HB: SC-64 (MP-3)
μPC2926HB




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

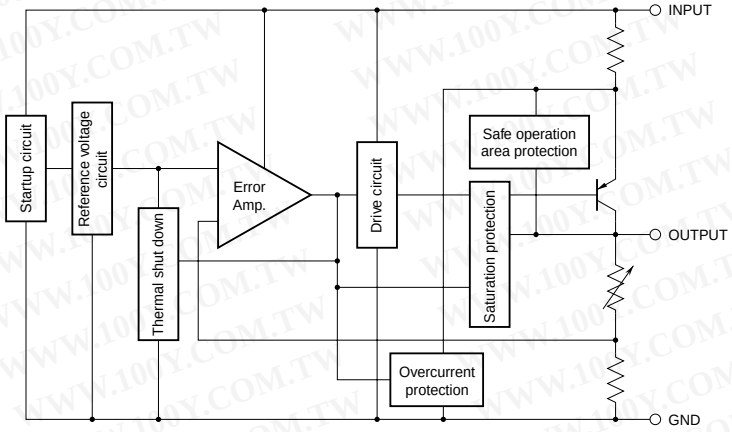
μPC2918T
μPC2925T: SC-64 (MP-3Z)
μPC2926T




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



### BLOCK DIAGRAM

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

## ORDERING INFORMATION

| Part Number | Package | Marking | Packing Type |
|---|---|---|---|
| ★ μPC29xxHF | Isolated TO-220 (MP-45G) | 29xx | • Bag stuffing |
| μPC29xxHB | SC-64 (MP-3) | 29xx | • Bag stuffing |
| μPC29xxT | SC-63 (MP-3Z) | 29xx | • Bag stuffing |
| μPC29xxT-E1 | SC-63 (MP-3Z) | 29xx | • Embossed-type taping (16 mm tape)<br>• Pin 1 on drawout side<br>• 2000 pcs/reel |
| μPC29xxT-E2 | SC-63 (MP-3Z) | 29xx | • Embossed-type taping (16 mm tape)<br>• Pin 1 at takeup side<br>• 2000 pcs/reel |
| μPC29xxT-T1 | SC-63 (MP-3Z) | 29xx | • Adhesive-type taping (32 mm tape)<br>• Pin 1 on drawout side<br>• 1500 pcs/reel |
| μPC29xxT-T2 | SC-63 (MP-3Z) | 29xx | • Adhesive-type taping (32 mm tape)<br>• Pin 1 at takeup side<br>• 1500 pcs/reel |

”xx” mark of the part number and marking columns expresses output voltage.

Example

| Output Voltage | Part Number | Marking |
|---|---|---|
| 1.8 V | μPC2918T | 2918 |
| 2.5 V | μPC2925T | 2925 |
| 2.6 V | μPC2926T | 2926 |

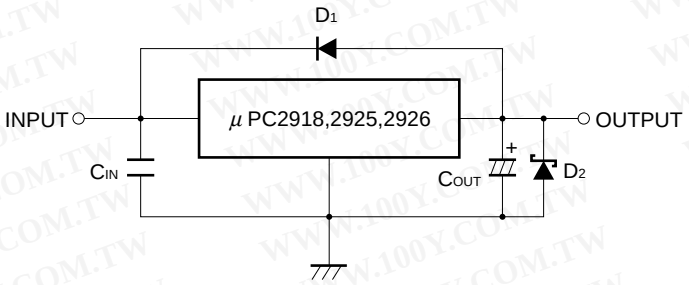
## ★ ABSOLUTE MAXIMUM RATINGS ($T_A$ = 25°C, unless otherwise specified)

| Parameter | Symbol | Rating | | Unit |
|---|---|---|---|---|
| | | μPC2918HF, μPC2925HF, μPC2926HF | μPC2918HB, μPC2925HB, μPC2926HB, μPC2918T, μPC2925T, μPC2926T | |
| Input Voltage | $V_{IN}$ | 20 | | V |
| Internal Power Dissipation ($T_C$ = 25°C) 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** Internally limited. When the operating junction temperature rises over 150°C, the internal circuit shuts down the output voltage.

**Caution Product quality may suffer if the absolute maximum rating is exceeded even momentarily for any parameter. That is, the absolute maximum ratings are rated values at which the product is on the verge of suffering physical damage, and therefore the product must be used under conditions that ensure that the absolute maximum ratings are not exceeded.**

## TYPICAL CONNECTION




$C_{IN}$: 0.1 μF or higher. Set this value according to the length of the line between the regulator and INPUT pin. Be sure to connect $C_{IN}$ to prevent parasitic oscillation. Use of a film capacitor or other capacitor with excellent voltage and temperature characteristics is recommended. If using a laminated ceramic capacitor, it is necessary to ensure that $C_{IN}$ is 0.1 μF or higher for the voltage and temperature range to be used.

$C_{OUT}$: 10 μF or higher. Be sure to connect $C_{OUT}$ to prevent oscillation and improve excessive load regulation. Place $C_{IN}$ and $C_{OUT}$ as close as possible to the IC pins (within 2 cm). Also, use an electrolytic capacitor with low impedance characteristics if considering use at sub-zero temperatures.

$D_1$: If the OUTPUT pin has a higher voltage than the INPUT pin, connect a diode.

$D_2$: If the OUTPUT pin has a lower voltage than the GND pin, connect a Schottky barrier diode.

**Caution Make sure that no voltage is applied to the OUTPUT pin from external.**

## RECOMMENDED OPERATING CONDITIONS

| Parameter | Symbol | Type Number | MIN. | TYP. | MAX. | Unit |
|---|---|---|---|---|---|---|
| Input Voltage | $V_{IN}$ | μPC2918 | 2.8 | | 16 | V |
| | | μPC2925 | 3.5 | | 16 | V |
| | | μPC2926 | 3.6 | | 16 | V |
| Output Current | $I_O$ | All | 0 | | 1 | A |
| Operating Ambient Temperature | $T_A$ | All | −30 | | +85 | °C |
| Operating Junction Temperature | $T_J$ | All | −30 | | +125 | °C |

**Caution Use of conditions other than the above-listed recommended operating conditions is not a problem as long as the absolute maximum ratings are not exceeded. However, since the use of such conditions diminishes the margin of safety, careful evaluation is required before such conditions are used. Moreover, using the MAX. value for all the recommended operating conditions is not guaranteed to be safe.**

## ELECTRICAL CHARACTERISTICS

**μPC2918 ($T_J$ = 25°C, $V_{IN}$ = 2.8 V, $I_O$ = 0.5 A, $C_{IN}$ = 0.1 μF, $C_{OUT}$ = 10 μF, unless otherwise specified)**

| Parameter | Symbol | Conditions | MIN. | TYP. | MAX. | Unit |
|---|---|---|---|---|---|---|
| Output Voltage | $V_O$ | | 1.764 | 1.8 | 1.836 | V |
| | | 2.8 V ≤ $V_{IN}$ ≤ 5 V, 0 A ≤ $I_O$ ≤ 1 A, 0°C ≤ $T_J$ ≤ 125°C | (1.71) | | (1.854) | V |
| Line Regulation | $REG_{IN}$ | 2.8 V ≤ $V_{IN}$ ≤ 16 V | | 6 | 25 | mV |
| Load Regulation | $REG_L$ | 0 A ≤ $I_O$ ≤ 1 A | | 7 | 30 | mV |
| Quiescent Current | $I_{BIAS}$ | $I_O$ = 0 A | | 2 | 4 | mA |
| | | $I_O$ = 1 A | | 20 | 60 | mA |
| Startup Quiescent Current | $I_{BIAS(S)}$ | $V_{IN}$ = 2.4 V, $I_O$ = 0 A | | 10 | 30 | mA |
| | | $V_{IN}$ = 2.4 V, $I_O$ = 1 A | | | 80 | mA |
| Quiescent Current Change | $\Delta I_{BIAS}$ | 2.8 V ≤ $V_{IN}$ ≤ 16 V, 0°C ≤ $T_J$ ≤ 125°C | | 2.9 | 20 | mA |
| Output Noise Voltage | $V_n$ | 10 Hz ≤ f ≤ 100 kHz | | 40 | | $\mu V_{r.m.s.}$ |
| Ripple Rejection | R•R | f = 120 Hz, 2.8 V ≤ $V_{IN}$ ≤ 9 V | 45 | 60 | | dB |
| Dropout Voltage | $V_{DIF}$ | $I_O$ = 0.5 A | | 0.25 | 0.5 | V |
| | | $I_O$ = 1 A, 0°C ≤ $T_J$ ≤ 125°C | | 0.7 | | V |
| Short Circuit Current | $I_{Oshort}$ | $V_{IN}$ = 2.8 V | 1.2 | 1.7 | 3.0 | A |
| | | $V_{IN}$ = 16 V | | 1.2 | | A |
| Peak Output Current | $I_{Opeak}$ | $V_{IN}$ = 2.8 V | 1.0 | 1.5 | 3.0 | A |
| | | $V_{IN}$ = 16 V | | 1.1 | | A |
| Temperature Coefficient of Output Voltage | $\Delta V_O/\Delta T$ | $I_O$ = 5 mA, 0°C ≤ $T_J$ ≤ 125°C | | −0.4 | | mV/°C |

**Remark** Values in parentheses have been measured during product design and are provided as reference values.

**μPC2925 ($T_J$ = 25°C, $V_{IN}$ = 3.5 V, $I_O$ = 0.5 A, $C_{IN}$ = 0.1 μF, $C_{OUT}$ = 10 μF, unless otherwise specified)**

| Parameter | Symbol | Conditions | MIN. | TYP. | MAX. | Unit |
|---|---|---|---|---|---|---|
| Output Voltage | $V_O$ | | 2.45 | 2.5 | 2.55 | V |
| | | 3.5 V ≤ $V_{IN}$ ≤ 5 V, 0 A ≤ $I_O$ ≤ 1 A, 0°C ≤ $T_J$ ≤ 125°C | (2.375) | | (2.575) | V |
| Line Regulation | $REG_{IN}$ | 3.5 V ≤ $V_{IN}$ ≤ 16 V | | 6 | 25 | mV |
| Load Regulation | $REG_L$ | 0 A ≤ $I_O$ ≤ 1 A | | 7 | 30 | mV |
| Quiescent Current | $I_{BIAS}$ | $I_O$ = 0 A | | 2 | 4 | mA |
| | | $I_O$ = 1 A | | 20 | 60 | mA |
| Startup Quiescent Current | $I_{BIAS(S)}$ | $V_{IN}$ = 2.4 V, $I_O$ = 0 A | | 10 | 30 | mA |
| | | $V_{IN}$ = 3.0 V, $I_O$ = 1 A | | | 80 | mA |
| Quiescent Current Change | $\Delta I_{BIAS}$ | 3.5 V ≤ $V_{IN}$ ≤ 16 V, 0°C ≤ $T_J$ ≤ 125°C | | 2.9 | 20 | mA |
| Output Noise Voltage | $V_n$ | 10 Hz ≤ f ≤ 100 kHz | | 40 | | $\mu V_{r.m.s.}$ |
| Ripple Rejection | R•R | f = 120 Hz, 3.5 V ≤ $V_{IN}$ ≤ 9 V | 45 | 60 | | dB |
| Dropout Voltage | $V_{DIF}$ | $I_O$ = 0.5 A | | 0.25 | 0.5 | V |
| | | $I_O$ = 1 A, 0°C ≤ $T_J$ ≤ 125°C | | 0.7 | | V |
| Short Circuit Current | $I_{Oshort}$ | $V_{IN}$ = 3.5 V | 1.2 | 1.7 | 3.0 | A |
| | | $V_{IN}$ = 16 V | | 1.2 | | A |
| Peak Output Current | $I_{Opeak}$ | $V_{IN}$ = 3.5 V | 1.0 | 1.5 | 3.0 | A |
| | | $V_{IN}$ = 16 V | | 1.1 | | A |
| Temperature Coefficient of Output Voltage | $\Delta V_O/\Delta T$ | $I_O$ = 5 mA, 0°C ≤ $T_J$ ≤ 125°C | | −0.5 | | mV/°C |

**Remark** Values in parentheses have been measured during product design and are provided as reference values.

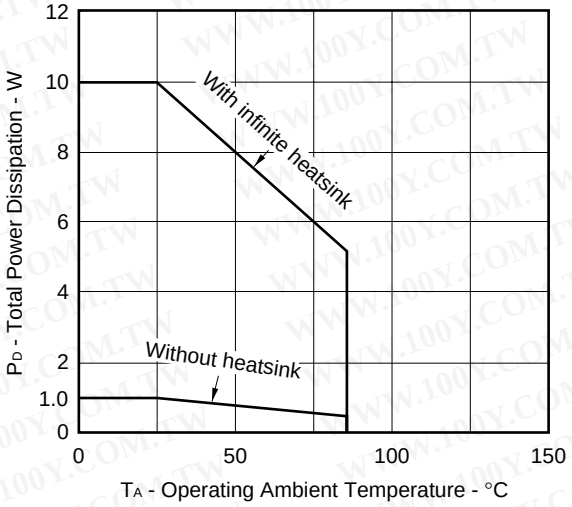
**μPC2926 ($T_J$ = 25°C, $V_{IN}$ = 3.6 V, $I_O$ = 0.5 A, $C_{IN}$ = 0.1 μF, $C_{OUT}$ = 10 μF, unless otherwise specified)**

| Parameter | Symbol | Conditions | MIN. | TYP. | MAX. | Unit |
|---|---|---|---|---|---|---|
| Output Voltage | $V_O$ | | 2.548 | 2.6 | 2.652 | V |
| | | 3.6 V ≤ $V_{IN}$ ≤ 5 V, 0 A ≤ $I_O$ ≤ 1 A, 0°C ≤ $T_J$ ≤ 125°C | (2.470) | | (2.678) | V |
| Line Regulation | $REG_{IN}$ | 3.6 V ≤ $V_{IN}$ ≤ 16 V | | 6 | 25 | mV |
| Load Regulation | $REG_L$ | 0 A ≤ $I_O$ ≤ 1 A | | 7 | 30 | mV |
| Quiescent Current | $I_{BIAS}$ | $I_O$ = 0 A | | 2 | 4 | mA |
| | | $I_O$ = 1 A | | 20 | 60 | mA |
| Startup Quiescent Current | $I_{BIAS(S)}$ | $V_{IN}$ = 2.4 V, $I_O$ = 0 A | | 10 | 30 | mA |
| | | $V_{IN}$ = 3.0 V, $I_O$ = 1 A | | | 80 | mA |
| Quiescent Current Change | $\Delta I_{BIAS}$ | 3.6 V ≤ $V_{IN}$ ≤ 16 V, 0°C ≤ $T_J$ ≤ 125°C | | 2.9 | 20 | mA |
| Output Noise Voltage | $V_n$ | 10 Hz ≤ f ≤ 100 kHz | | 40 | | $\mu V_{r.m.s.}$ |
| Ripple Rejection | R•R | f = 120 Hz, 3.6 V ≤ $V_{IN}$ ≤ 9 V | 45 | 60 | | dB |
| Dropout Voltage | $V_{DIF}$ | $I_O$ = 0.5 A | | 0.25 | 0.5 | V |
| | | $I_O$ = 1 A, 0°C ≤ $T_J$ ≤ 125°C | | 0.7 | | V |
| Short Circuit Current | $I_{Oshort}$ | $V_{IN}$ = 3.6 V | 1.2 | 1.7 | 3.0 | A |
| | | $V_{IN}$ = 16 V | | 1.2 | | A |
| Peak Output Current | $I_{Opeak}$ | $V_{IN}$ = 3.6 V | 1.0 | 1.5 | 3.0 | A |
| | | $V_{IN}$ = 16 V | | 1.1 | | A |
| Temperature Coefficient of Output Voltage | $\Delta V_O/\Delta T$ | $I_O$ = 5 mA, 0°C ≤ $T_J$ ≤ 125°C | | −0.5 | | mV/°C |

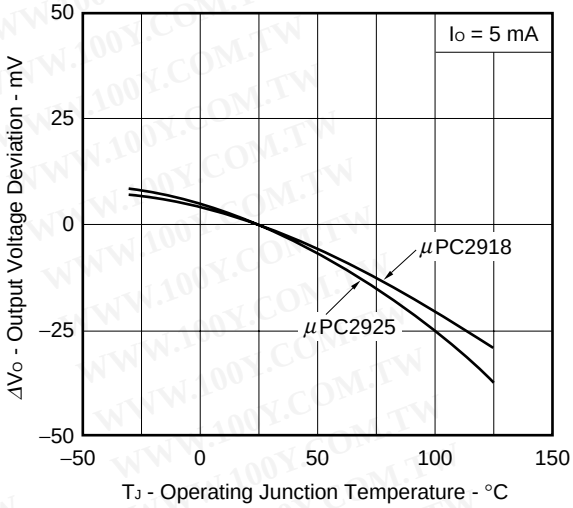
**Remark** Values in parentheses have been measured during product design and are provided as reference values.

## TYPICAL CHARACTERISTICS (Reference Values)

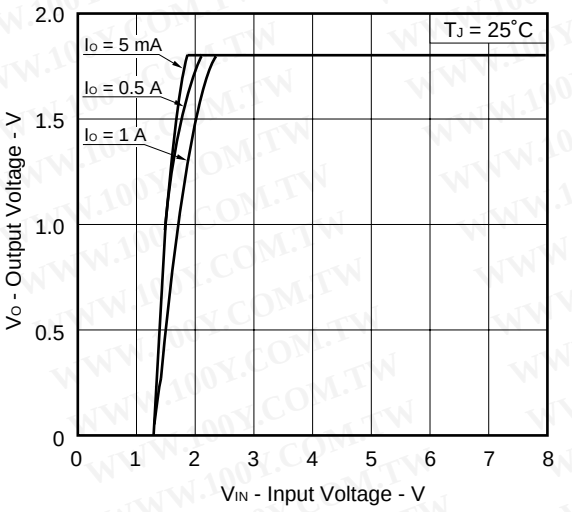
PD vs. TA



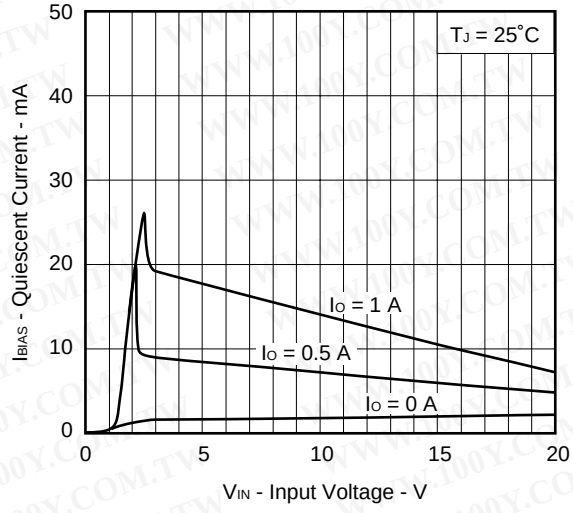

ΔVO vs. TJ



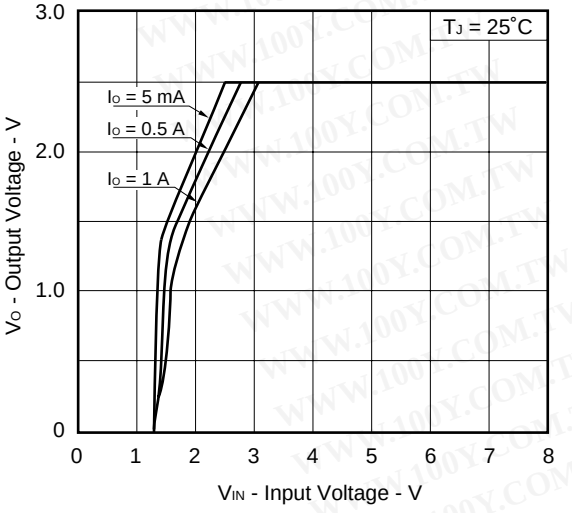

VO vs. VIN (μPC2918)



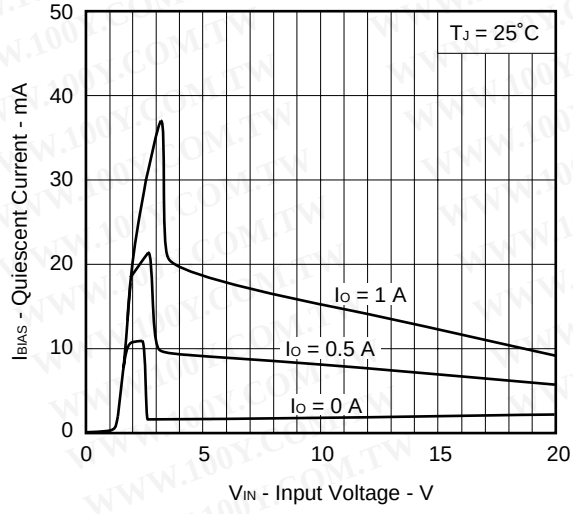

IBIAS (IBIAS(S)) vs. VIN (μPC2918)



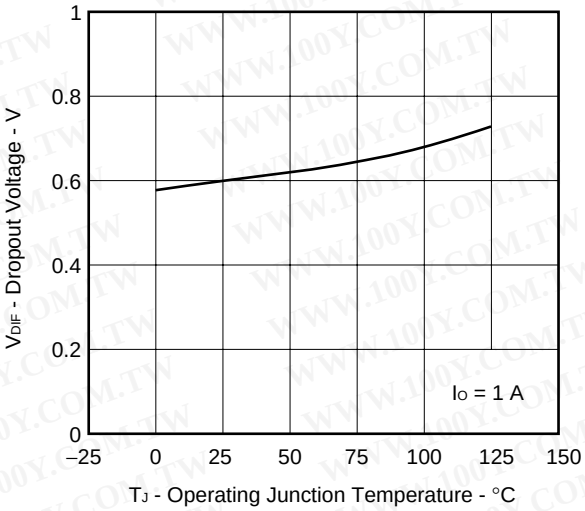

VO vs. VIN (μPC2925)



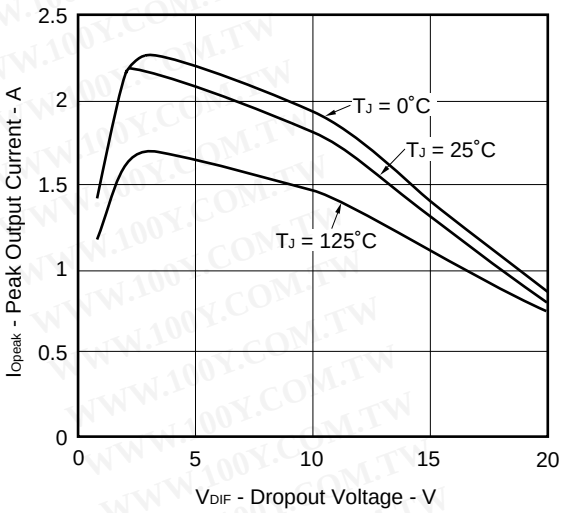

IBIAS (IBIAS(S)) vs. VIN (μPC2925)



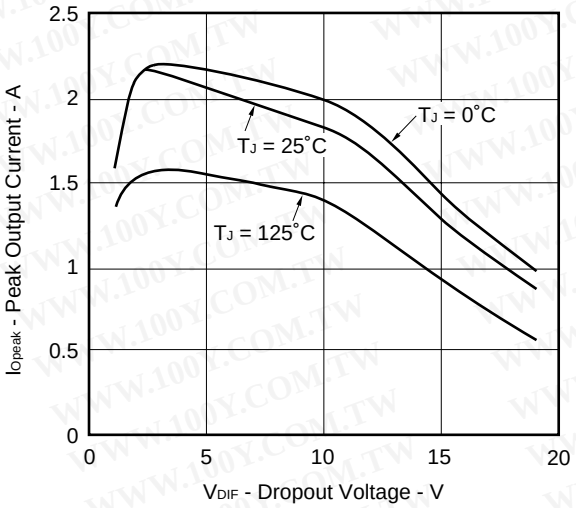
$V_{DIF}$ vs. $T_J$



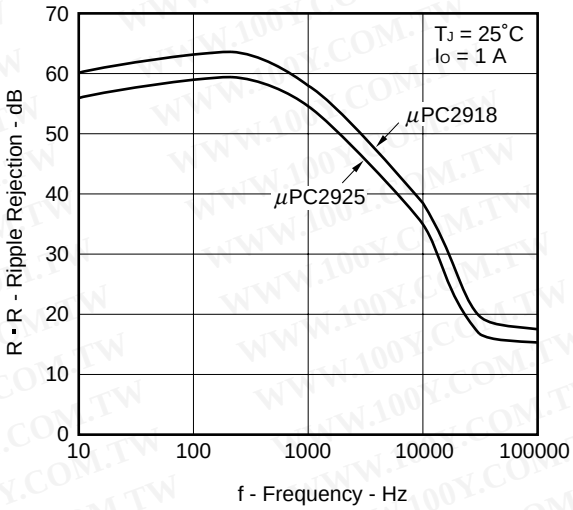

$I_{Opeak}$ vs. $V_{DIF}$ (μPC2918)



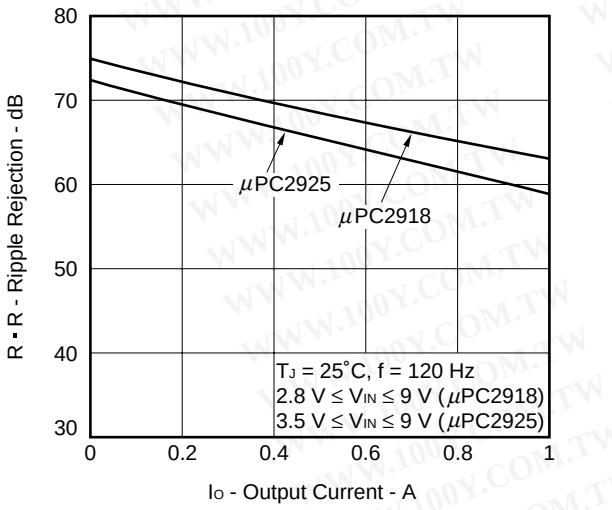

$I_{Opeak}$ vs. $V_{DIF}$ (μPC2925)



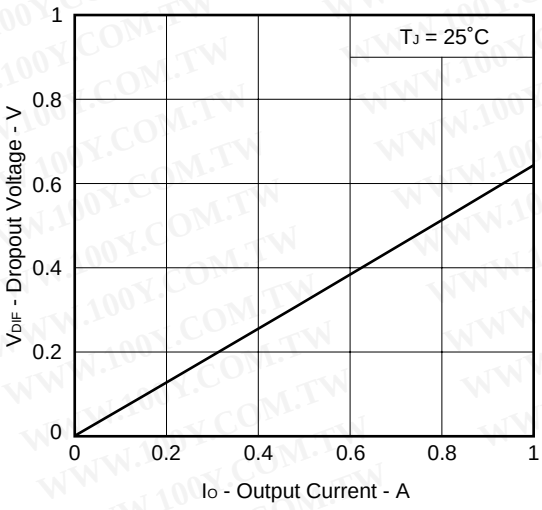

R ▪ R vs. f

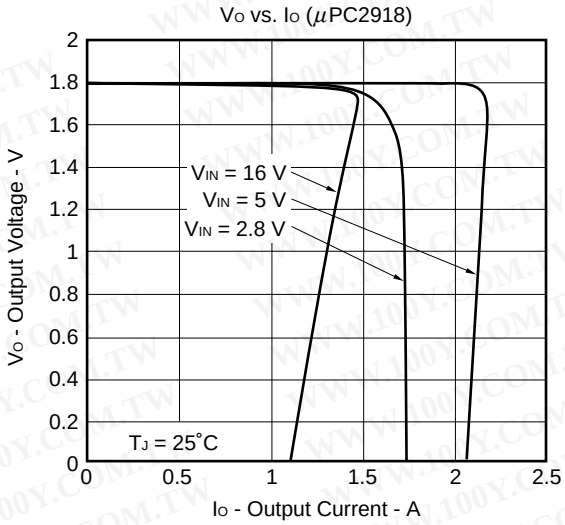


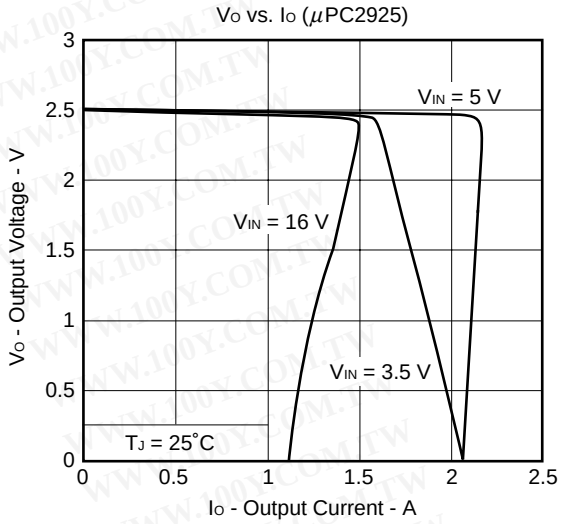

R ▪ R vs. $I_O$




$V_{DIF}$ vs. $I_O$



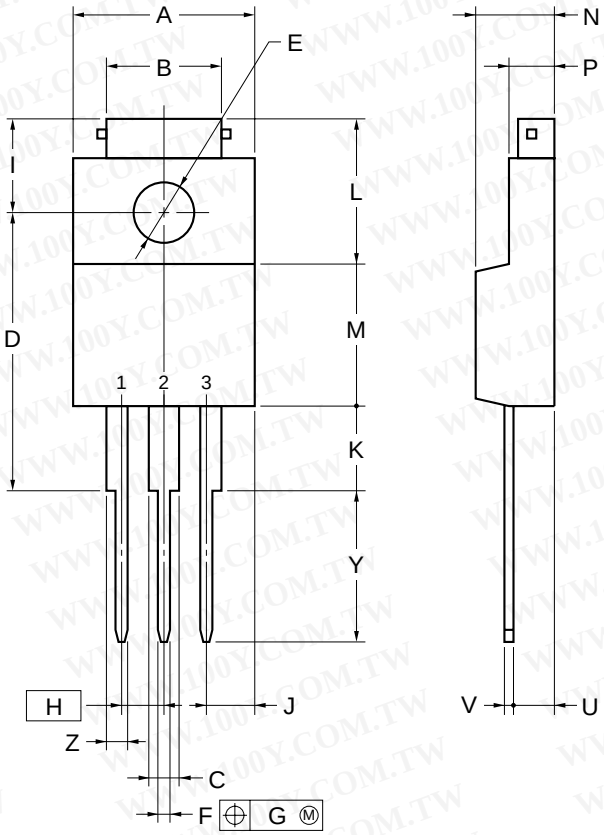


## ★ PACKAGE DRAWINGS

**μPC2918HF, μPC2925HF, μPC2926HF**

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




**NOTE**

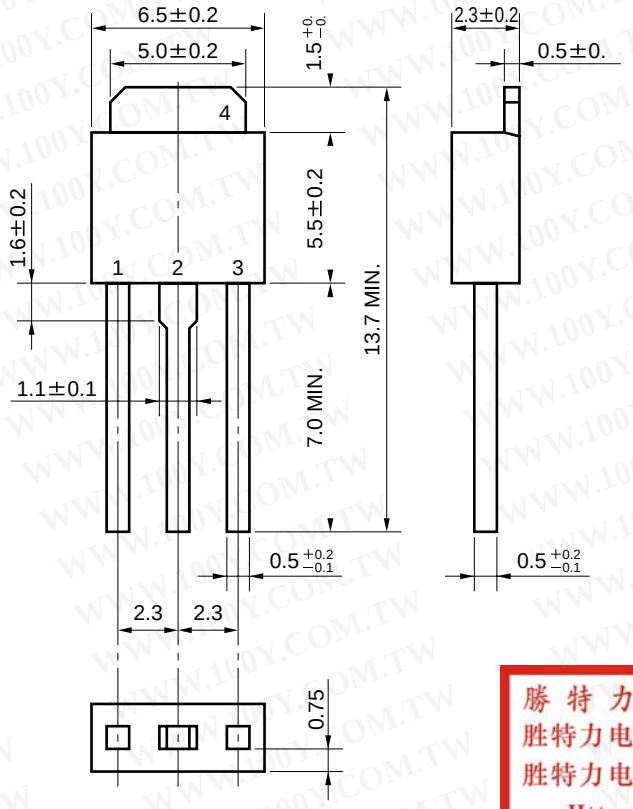
Each lead centerline is located within 0.25 mm of its true position (T.P.) at maximum material condition.

| 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**

**μPC2918HB, μPC2925HB, μPC2926HB**

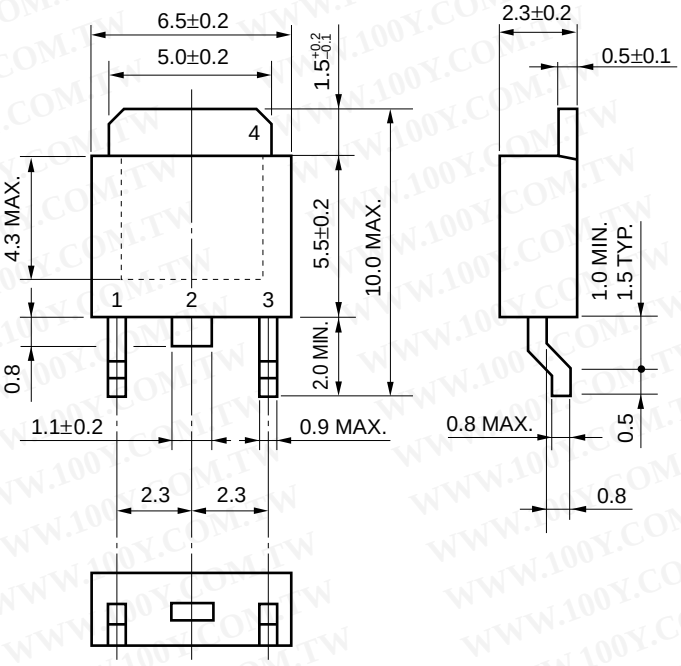
**SC-64 (MP-3) (Unit: mm)**






**μPC2918T, μPC2925T, μPC2926T**

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



## ★ RECOMMENDED MOUNTING CONDITIONS

The following conditions must be met for mounting conditions of the μPC2918,2925,2926.

For more details, refer to the **Semiconductor Device Mount Manual (http://www.necel.com/pkg/en/mount/index.html).**

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



**Type of Surface Mount Device**

**μPC2918T, μPC2925T, μPC2926T: SC-63 (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 reflows processes: 3 times or less. | IR35-00-3 |
| Vapor Phase Soldering | 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 reflows processes: 3 times or less. | VP15-00-3 |
| 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.**

**Remark** Flux: Rosin-based flux with low chlorine content (chlorine 0.2 Wt% or below) is recommended.

**Type of Through-hole Device**

**μPC2918HF, μPC2925HF, μPC2926HF: Isolated TO-220 (MP-45G)**
**μPC2918HB, μPC2925HB, μPC2926HB: SC-64 (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.**

## NOTES ON USE

**When the μPC2918, 2925, and 2926 are used with an input voltage that is lower than the value indicated in the recommended operating conditions, a large quiescent current flows through the device due to saturation of the transistor of the output stage. (Refer to the $I_{BIAS}$ ($I_{BIAS(S)}$) vs. $V_{IN}$ curves in TYPICAL CHARACTERISTICS).**

**These products have saturation protector, but a current of up to 80 mA MAX. may flow through the device. Thus, the power supply on the input side must have sufficient capacity to allow this quiescent current to pass when the device starts up.**

## REFERENCE DOCUMENTS

| | Document Name | | Document No. |
|---|---|---|---|
| | Usage of Three-Terminal Regulators | User's Manual | G12702E |
| | Voltage Regulator of SMD | Information | G11872E |
| ★ | Semiconductor Device Mount Manual | Information | http://www.necel.com/pkg/en/mount/index.html |
| | SEMICONDUCTOR SELECTION GUIDE - Products and Packages- | | X13769X |

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