

BIPOLAR ANALOG INTEGRATED CIRCUIT

μ PC1943,1944

ADJUSTABLE PRECISION SHUNT REGULATORS

DESCRIPTION

The μ PC1943,1944 are adjustable precision shunt regulators with guaranteed thermal stability. The output voltage can be set to any value between reference voltage (1.26 V) and 24 V by two external resistors.

These ICs can apply to error amplifier of switching regulators.

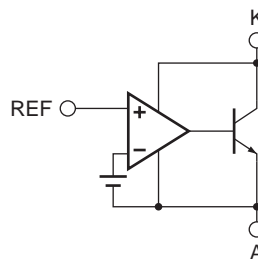
FEATURES

- Low voltage operation and High accuracy. $V_{REF} = 1.26 \text{ V} \pm 2.4 \%$
- Adjustable output voltage by two external resistors. $V_{REF} \leq V_{OUT} \leq 24 \text{ V}$
- Pin compatible to μ PC1093.

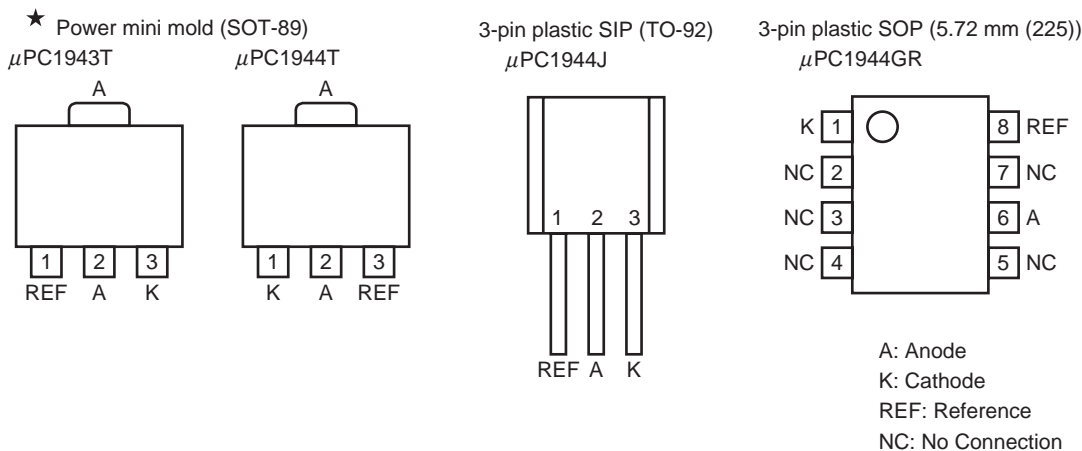
ORDERING INFORMATION

| | Part Number | Package |
|---|----------------|-----------------------------------|
| ★ | μ PC1943T | Power mini mold (SOT-89) |
| ★ | μ PC1944T | Power mini mold (SOT-89) |
| | μ PC1944J | 3-pin plastic SIP (TO-92) |
| | μ PC1944GR | 8-pin plastic SOP (5.72 mm (225)) |

BLOCK DIAGRAM



PIN CONFIGURATION (Marking Side)



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Not all devices/types available in every country. Please check with local NEC representative for availability and additional information.

ABSOLUTE MAXIMUM RATINGS (T_A = +25 °C, unless otherwise specified.)

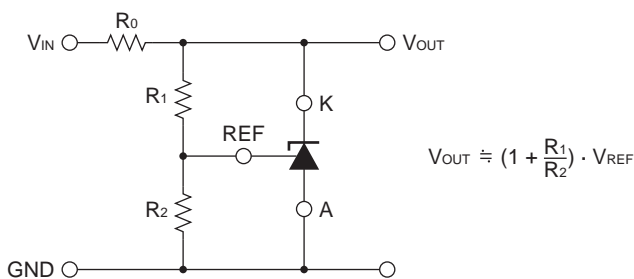
| Parameter | Symbol | Ratings | Unit | |
|------------------------------------|--------------------|----------------|-----------------------------|----|
| Cathode Voltage | V _{KA} | 25 | V | |
| Cathode Current | I _K | 50 | mA | |
| Cathode to Anode Reverse Current | - I _K | -30 | mA | |
| Reference Voltage | V _{REF} | 7 | V | |
| Reference Input Current | I _{REF} | 50 | μA | |
| Reference to Anode Reverse Current | - I _{REF} | - 10 | mA | |
| Total Power Dissipation | μ PC1943T | P _T | 320 (1600 ^{Note}) | mW |
| | μ PC1944T | | 320 (1600 ^{Note}) | mW |
| | μ PC1944J | | 560 | mW |
| | μ PC1944GR | | 385 | mW |
| Operating Ambient Temperature | T _A | - 30 to + 85 | °C | |
| Operating Junction Temperature | T _J | - 30 to + 125 | °C | |
| Storage Temperature | T _{stg} | - 65 to + 125 | °C | |

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Note with 16 cm² × 0.7 mm ceramic substrate.

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



RECOMMENDED OPERATING CONDITIONS

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| Parameter | | Symbol | MIN. | TYP. | MAX. | Unit |
|--------------------------------|-----------|----------|-----------|------|---------------------------|------|
| Cathode Voltage | | V_{KA} | V_{REF} | | 24 | V |
| Cathode Current | | I_K | 1 | 10 | 30 | mA |
| Total Power Dissipation | μPC1943T | P_T | | | 45 (240 ^{Note}) | mW |
| | μPC1944T | | | | 45 (240 ^{Note}) | mW |
| | μPC1944J | | | | 83 | mW |
| | μPC1944GR | | | | 57 | mW |
| Operating Ambient Temperature | | T_A | -30 | | +85 | °C |
| Operating Junction Temperature | | T_J | -30 | | +100 | °C |

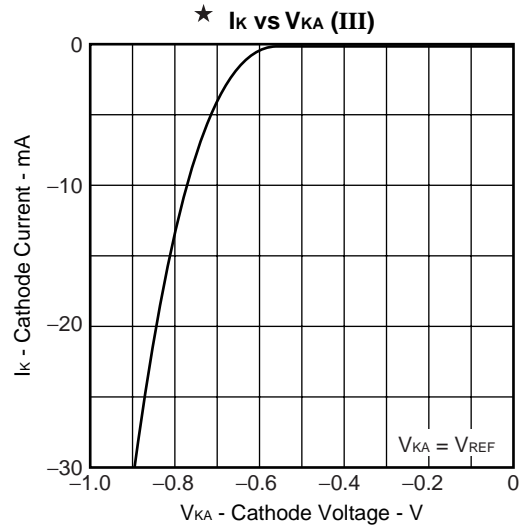
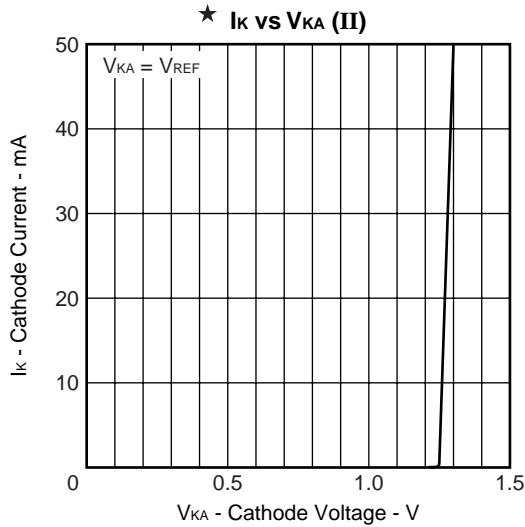
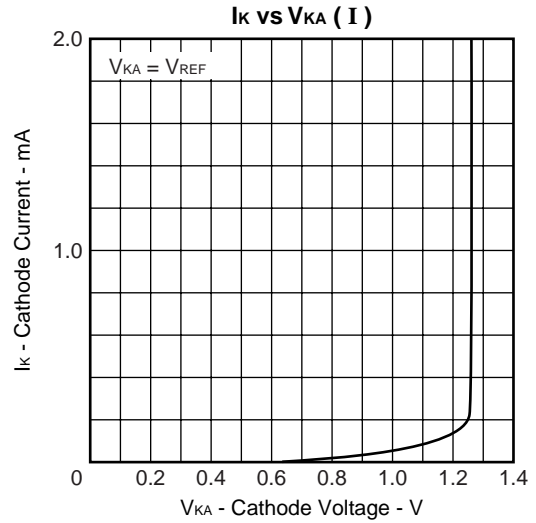
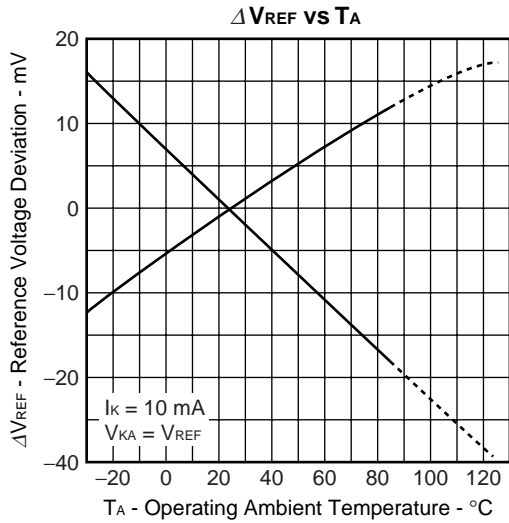
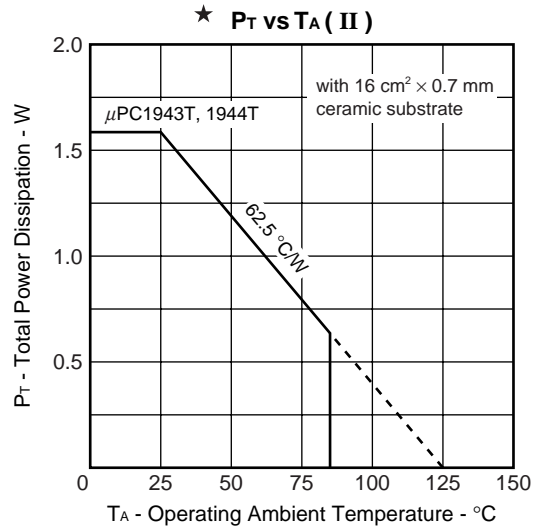
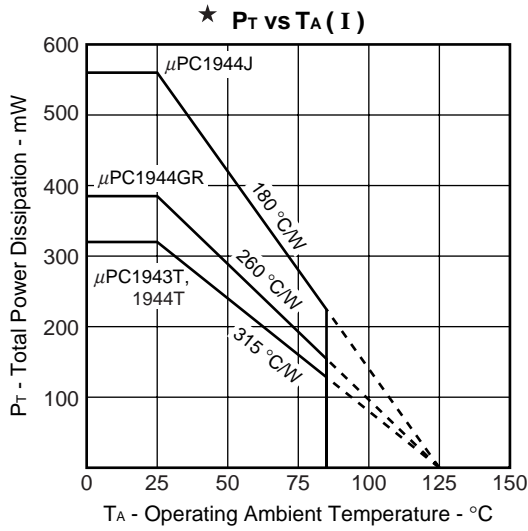
Note with 16 cm² × 0.7 mm ceramic substrate.

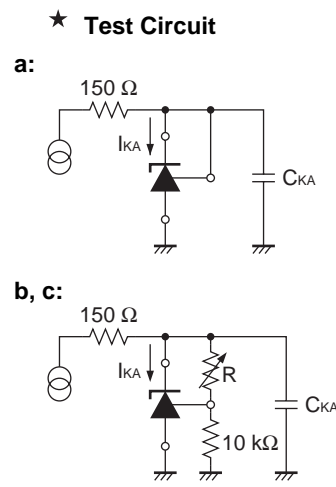
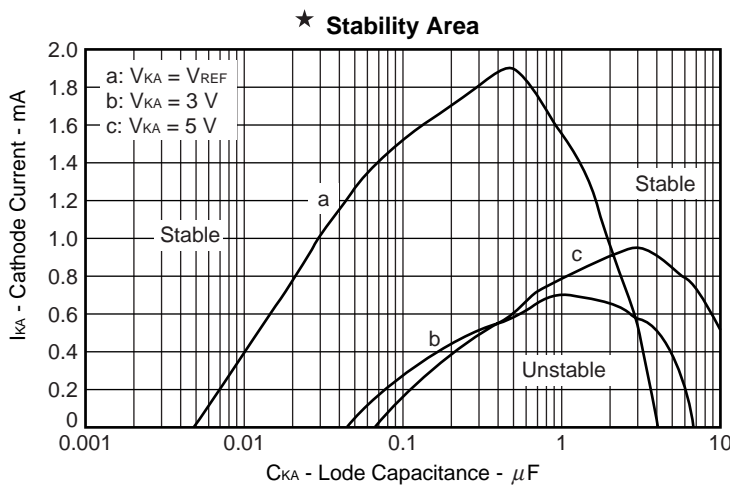
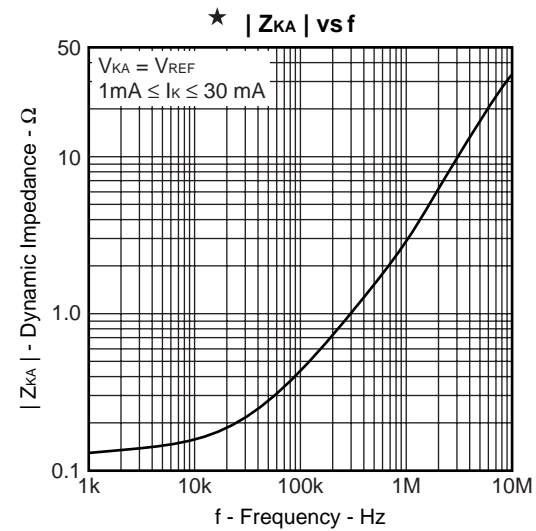
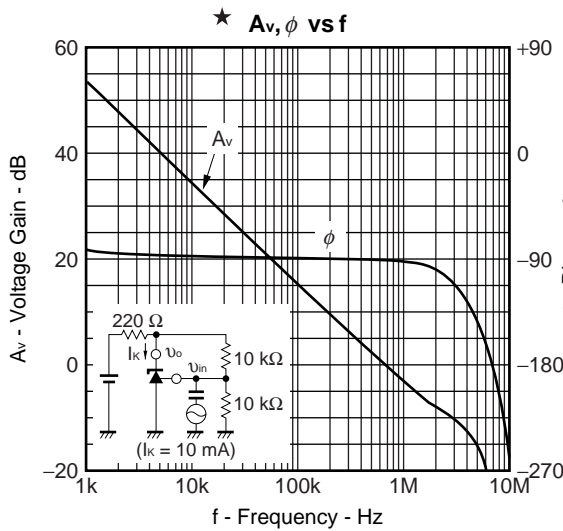
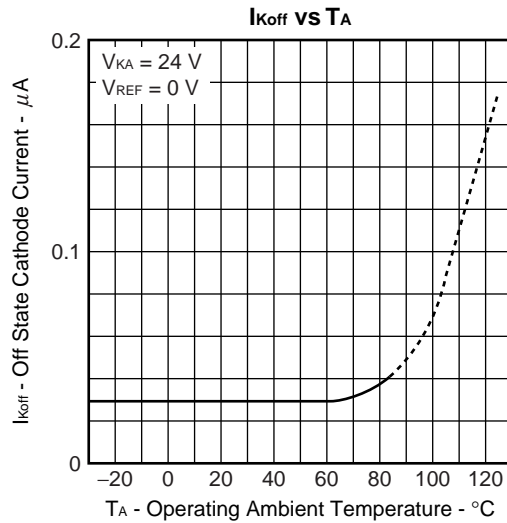
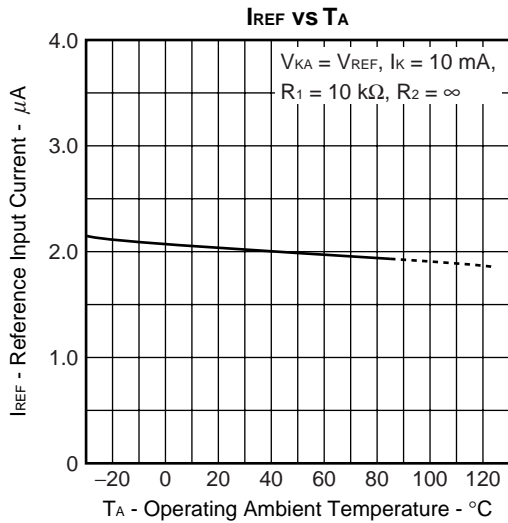
Caution The recommended operating range may be exceeded without causing any problems provided that the absolute maximum ratings are not exceeded. However, if the device is operated in a way that exceeds the recommended operating conditions, the margin between the actual conditions of use and the absolute maximum ratings is small, and therefore thorough evaluation is necessary. The recommended operating conditions do not imply that the device can be used with all values at their maximum values.

ELECTRICAL CHARACTERISTICS ($I_K = 10\text{ mA}$, $T_A = +25\text{ °C}$, unless otherwise specified.)

| Parameter | Symbol | Conditions | MIN. | TYP. | MAX. | Unit |
|--|--------------------------------|--|------|------|------|------|
| Reference Voltage | V_{REF} | $V_{KA} = V_{REF}$ | 1.23 | 1.26 | 1.29 | V |
| Reference Voltage Deviation Over Temperature | ΔV_{REF} | $V_{KA} = V_{REF}$, $0\text{ °C} \leq T_A \leq 70\text{ °C}$ | | ±5 | ±30 | mV |
| Reference Voltage Deviation Over Cathode Voltage | $\Delta V_{REF}/\Delta V_{KA}$ | $ V_{REF} \leq V_{KA} \leq 5V$ | | | 2.7 | mV/V |
| | | $5V \leq V_{KA} \leq 24V$ | | | 2.0 | mV/V |
| Reference Input Current | I_{REF} | $V_{KA} = V_{REF}$, $R_1 = 10\text{ k}\Omega$, $R_2 = \infty$ | | 2.0 | 4.0 | μA |
| Reference Input Current Deviation Over Temperature | ΔI_{REF} | $V_{KA} = V_{REF}$, $0\text{ °C} \leq T_A \leq 70\text{ °C}$, $R_1 = 10\text{ k}\Omega$, $R_2 = \infty$ | | 0.3 | 1.2 | μA |
| Minimum Cathode Current | I_{Kmin} | $V_{KA} = V_{REF}$, $\Delta V_{REF} = 2\%$ | | 0.16 | 1.0 | mA |
| Off-state Cathode Current | I_{Koff} | $V_{KA} = 24\text{ V}$, $V_{REF} = 0\text{ V}$ | | 0.01 | 1.0 | μA |
| Dynamic Impedance | $ Z_{KA} $ | $V_{KA} = V_{REF}$, $f \leq 1\text{ kHz}$, $1\text{ mA} \leq I_K \leq 30\text{ mA}$ | | 0.12 | 0.5 | Ω |

TYPICAL CHARACTERISTIC ($T_A = +25^\circ\text{C}$, unless otherwise specified. Nominal)





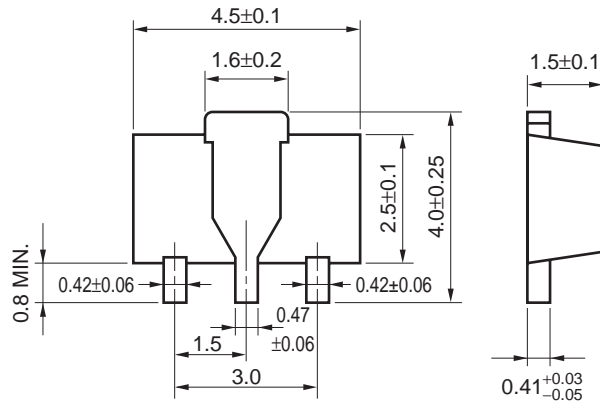
C_{KA}: Monolithic Ceramic Capacitor

★ **Caution of Stability Area**

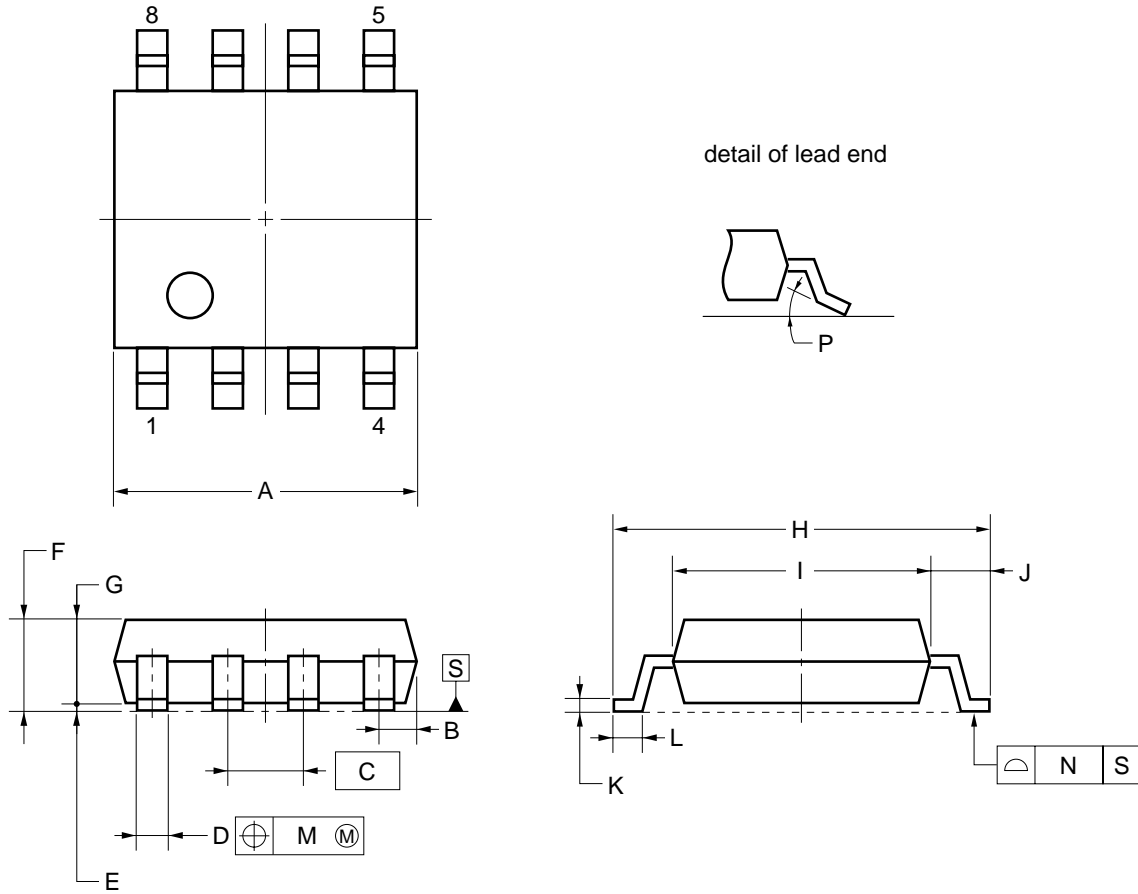
If the Aluminum electrolytic capacitor is used, it should be kept $C_{KA} \geq 6.8 \mu F$. When using plural different types of capacitors, each capacitor is needed to be stable independently.

PACKAGE DRAWINGS

★ POWER MINI MOLD (SOT-89) (Unit: mm)



8-PIN PLASTIC SOP (5.72 mm (225))



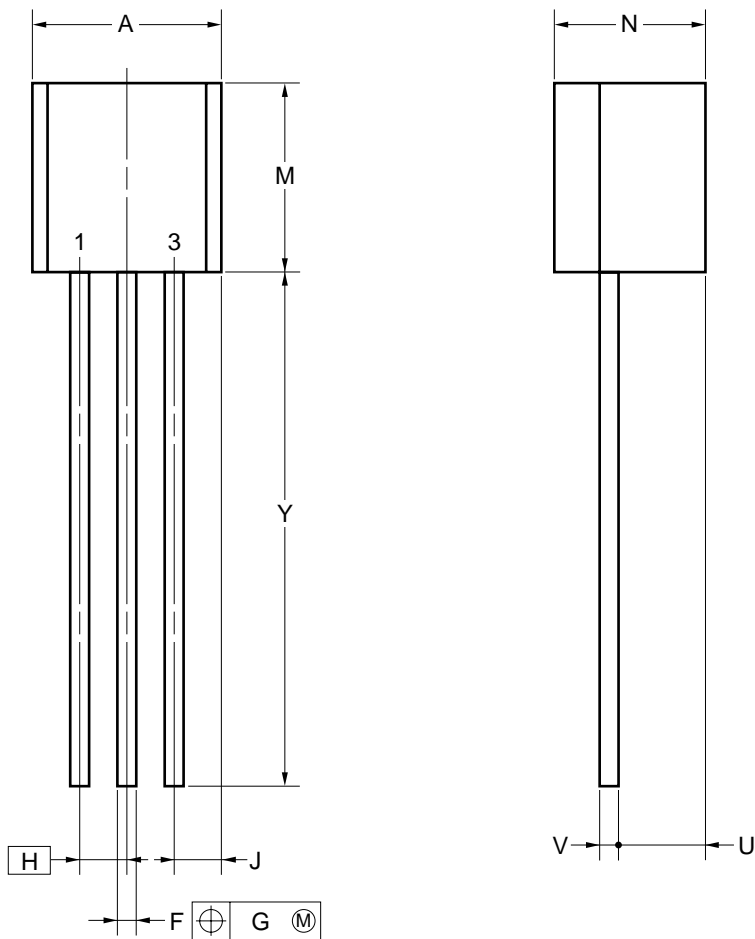
NOTE

Each lead centerline is located within 0.12 mm of its true position (T.P.) at maximum material condition.

| ITEM | MILLIMETERS |
|------|-------------------------|
| A | 5.2 $^{+0.17}_{-0.20}$ |
| B | 0.78 MAX. |
| C | 1.27 (T.P.) |
| D | 0.42 $^{+0.08}_{-0.07}$ |
| E | 0.1±0.1 |
| F | 1.59±0.21 |
| G | 1.49 |
| H | 6.5±0.3 |
| I | 4.4±0.15 |
| J | 1.1±0.2 |
| K | 0.17 $^{+0.08}_{-0.07}$ |
| L | 0.6±0.2 |
| M | 0.12 |
| N | 0.10 |
| P | 3° $^{+7}_{-3}$ ° |

S8GM-50-225B-6

3-PIN PLASTIC SIP (TO-92)



NOTE

Each lead centerline is located within 0.12 mm of its true position (T.P.) at maximum material condition.

| ITEM | MILLIMETERS |
|------|--|
| A | 5.0±0.2 |
| F | 0.50 ^{+0.30} _{-0.10} |
| G | 0.12 |
| H | 1.27 |
| J | 1.33 MAX. |
| M | 5.0±0.5 |
| N | 4.0±0.2 |
| U | 2.8 MAX. |
| V | 0.50±0.10 |
| Y | 15.0±0.7 |

P3J-127B-3

RECOMMENDED SOLDERING CONDITIONS

When soldering these products, there are 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).

Type of Surface Mount Device

★ **μ PC1943T, 1944T : Power mini mold (SOT-89)**

| Process | Conditions | Symbol |
|---------------------|---|-----------|
| Infrared ray reflow | Peak temperature: 235 °C or below (Package surface temperature), Reflow time: 30 seconds or less (at 210 °C or higher), Maximum number of reflow processes: 2 times. | IR35-00-2 |
| VPS | Peak temperature: 215 °C or below (Package surface temperature), Reflow time: 40 seconds or less (at 200 °C or higher), Maximum number of reflow processes: 2 times. | VP15-00-2 |
| Wave soldering | Solder temperature: 260 °C or below, Flow time: 10 seconds or less, Maximum number of flow processes: 1 time, Pre-heating temperature: 120 °C or below (Package surface temperature). | WS60-00-1 |

Caution Apply only one kind of soldering condition to a device, or the device will be damaged by heat stress.

★ **μ PC1944GR : 8-pin plastic SOP (5.72 mm (225))**

| Process | Conditions | Symbol |
|---------------------|---|-----------|
| Infrared ray reflow | Peak temperature: 235 °C or below (Package surface temperature), Reflow time: 30 seconds or less (at 210 °C or higher), Maximum number of reflow processes: 1 time. | IR35-00-1 |
| VPS | Peak temperature: 215 °C or below (Package surface temperature), Reflow time: 40 seconds or less (at 200 °C or higher), Maximum number of reflow processes: 1 time. | VP15-00-1 |
| Wave soldering | Solder temperature: 260 °C or below, Flow time: 10 seconds or less, Maximum number of flow processes: 1 time, Pre-heating temperature: 120 °C or below (Package surface temperature). | WS60-00-1 |

Caution Apply only one kind of soldering condition to a device, or the device will be damaged by heat stress.

Type of Through-hole Device

★ **μ PC1944J : 3-pin plastic SIP (TO-92)**

| Process | Conditions |
|--------------------------------|---|
| Wave soldering (only to leads) | Solder temperature: 260 °C or below, Flow time: 10 seconds or less. |

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.

★ **REMARK OF THE PACKAGE MARK**

The package marks of the μPC1943T and the μPC1944T are the symbols as follows.

| Part Number | Mark |
|-------------|------|
| μPC1943T | 9B |
| μPC1944T | 9C |

REFERENCE DOCUMENTS

| | |
|---|---------|
| Semiconductor Device Mounting Technology Manual | C10535E |
| Semiconductor Selection Guide -Products and Packages- | X13769X |

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