

# BIPOLAR ANALOG INTEGRATED CIRCUIT

# $\mu$ PC1943,1944

## ADJUSTABLE PRECISION SHUNT REGULATORS

### DESCRIPTION

The  $\mu$  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.

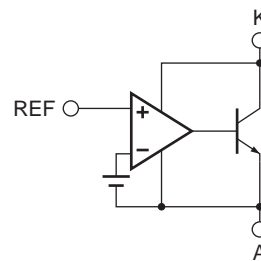
### FEATURES

- 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  $\mu$  PC1093.

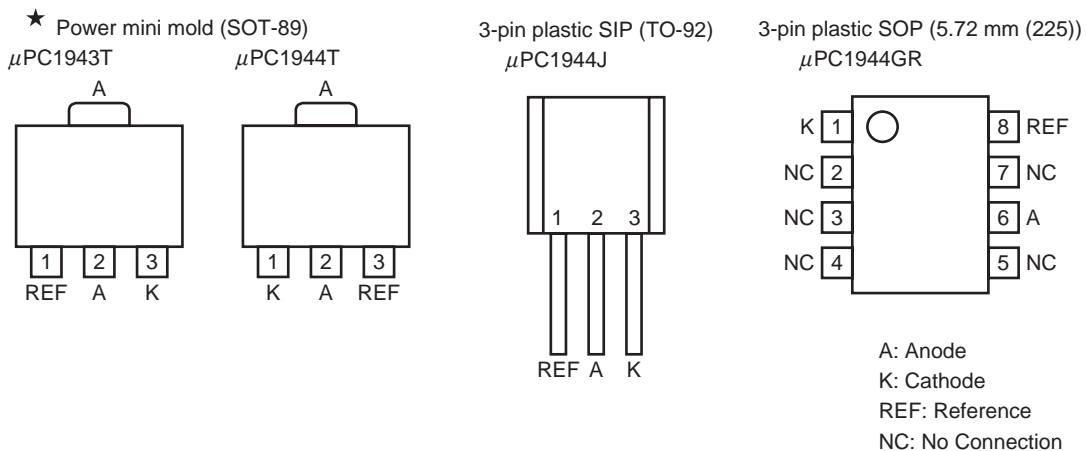
### ORDERING INFORMATION

	Part Number	Package
★	$\mu$ PC1943T	Power mini mold (SOT-89)
★	$\mu$ PC1944T	Power mini mold (SOT-89)
	$\mu$ PC1944J	3-pin plastic SIP (TO-92)
	$\mu$ 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<sub>A</sub> = +25 °C, unless otherwise specified.)**

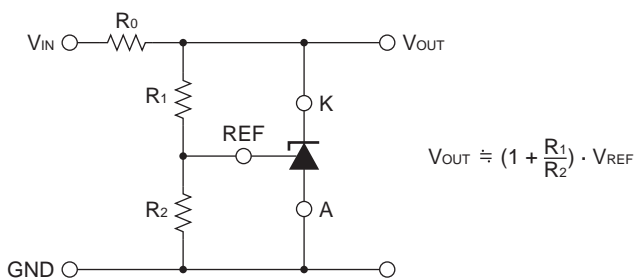
Parameter	Symbol	Ratings	Unit	
Cathode Voltage	V <sub>KA</sub>	25	V	
Cathode Current	I <sub>K</sub>	50	mA	
Cathode to Anode Reverse Current	- I <sub>K</sub>	-30	mA	
Reference Voltage	V <sub>REF</sub>	7	V	
Reference Input Current	I <sub>REF</sub>	50	μA	
Reference to Anode Reverse Current	- I <sub>REF</sub>	- 10	mA	
Total Power Dissipation	μ PC1943T	P <sub>T</sub>	320 (1600 <sup>Note</sup> )	mW
	μ PC1944T		320 (1600 <sup>Note</sup> )	mW
	μ PC1944J		560	mW
	μ PC1944GR		385	mW
Operating Ambient Temperature	T <sub>A</sub>	- 30 to + 85	°C	
Operating Junction Temperature	T <sub>J</sub>	- 30 to + 125	°C	
Storage Temperature	T <sub>stg</sub>	- 65 to + 125	°C	

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**Note** with 16 cm<sup>2</sup> × 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	μ PC1943T	$P_T$			45 (240 <sup>Note</sup> )	mW
	μ PC1944T				45 (240 <sup>Note</sup> )	mW
	μ PC1944J				83	mW
	μ PC1944GR				57	mW
Operating Ambient Temperature		$T_A$	-30		+85	°C
Operating Junction Temperature		$T_J$	-30		+100	°C

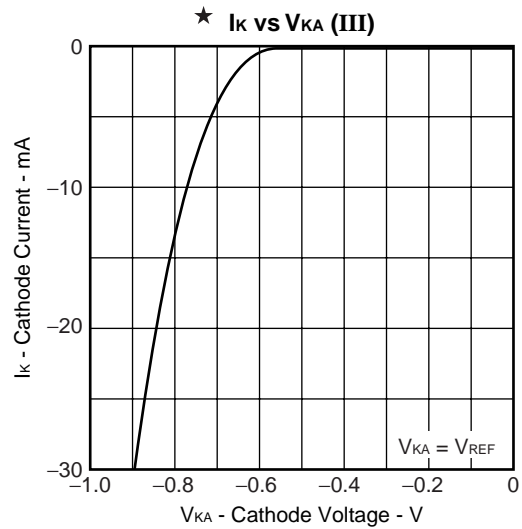
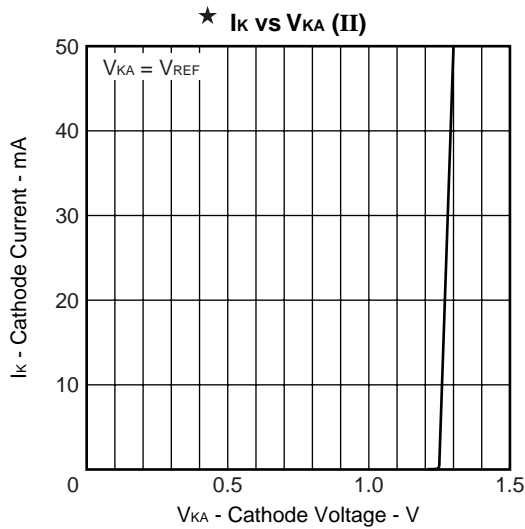
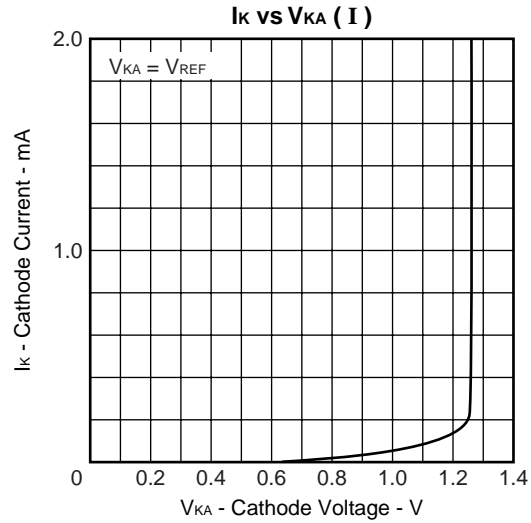
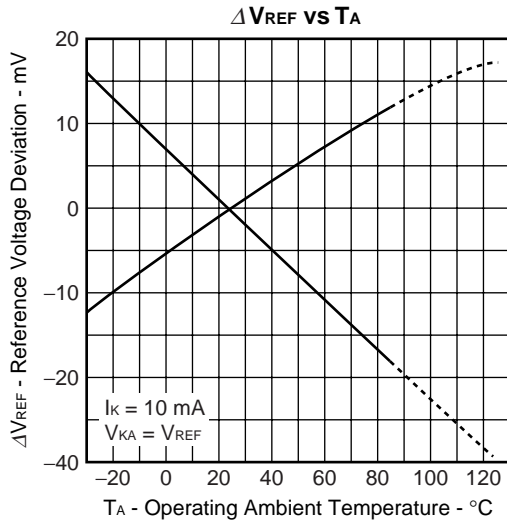
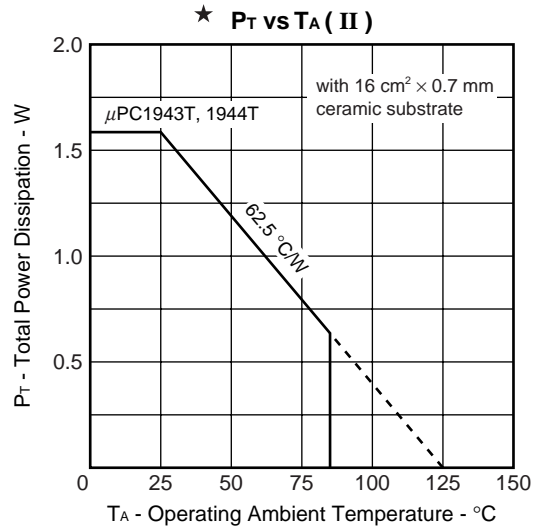
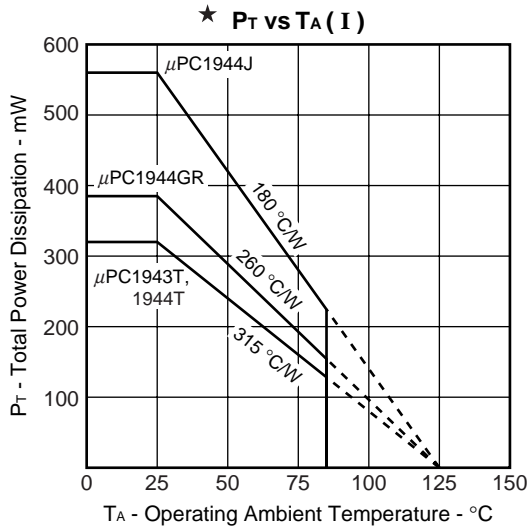
**Note** with 16 cm<sup>2</sup> × 0.7 mm ceramic substrate.

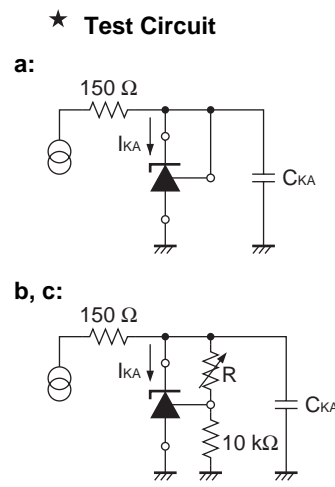
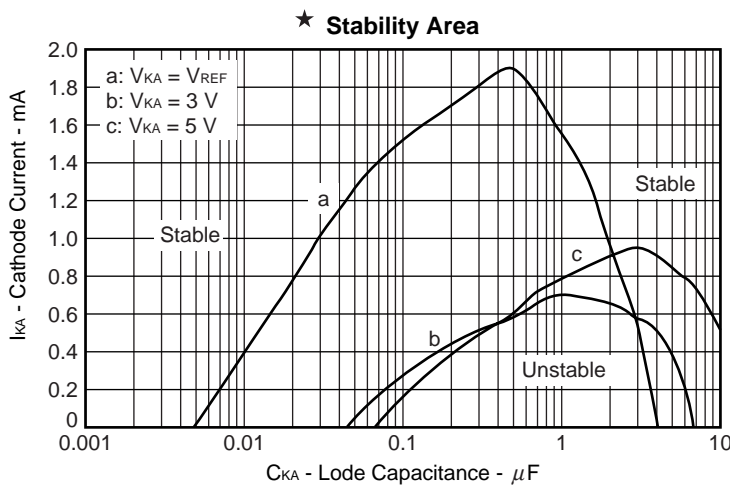
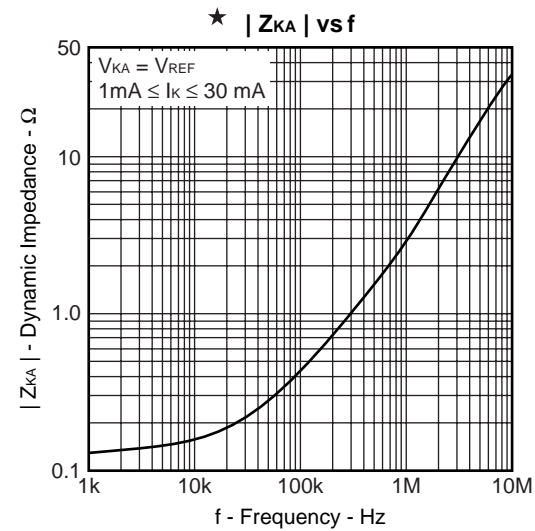
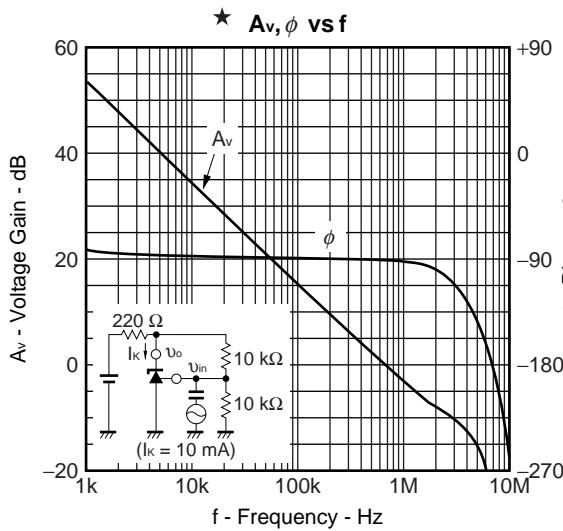
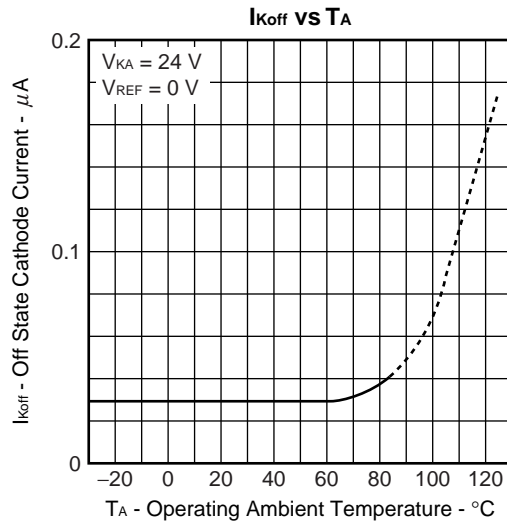
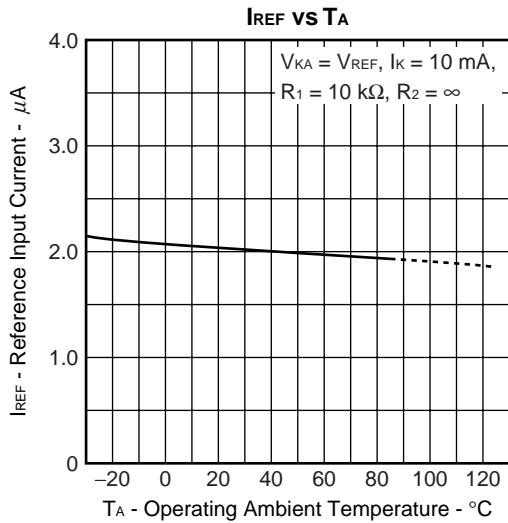
**Caution** The recommended operating range may be exceeded without causing any problems provided that the absolute maximum ratings are not exceeded. However, if the device is operated in a way that exceeds the recommended operating conditions, the margin between the actual conditions of use and the 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	$\Delta V_{REF}$	$V_{KA} = V_{REF}$ , $0\text{ °C} \leq T_A \leq 70\text{ °C}$		±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	$\Delta I_{REF}$	$V_{KA} = V_{REF}$ , $0\text{ °C} \leq T_A \leq 70\text{ °C}$ , $R_1 = 10\text{ k}\Omega$ , $R_2 = \infty$		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)





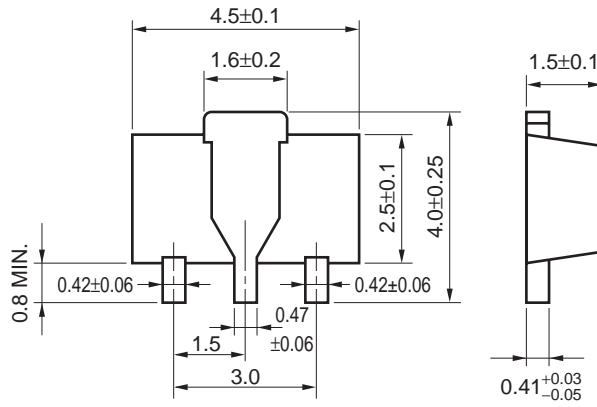
C<sub>KA</sub>: Monolithic Ceramic Capacitor

★ Caution of Stability Area

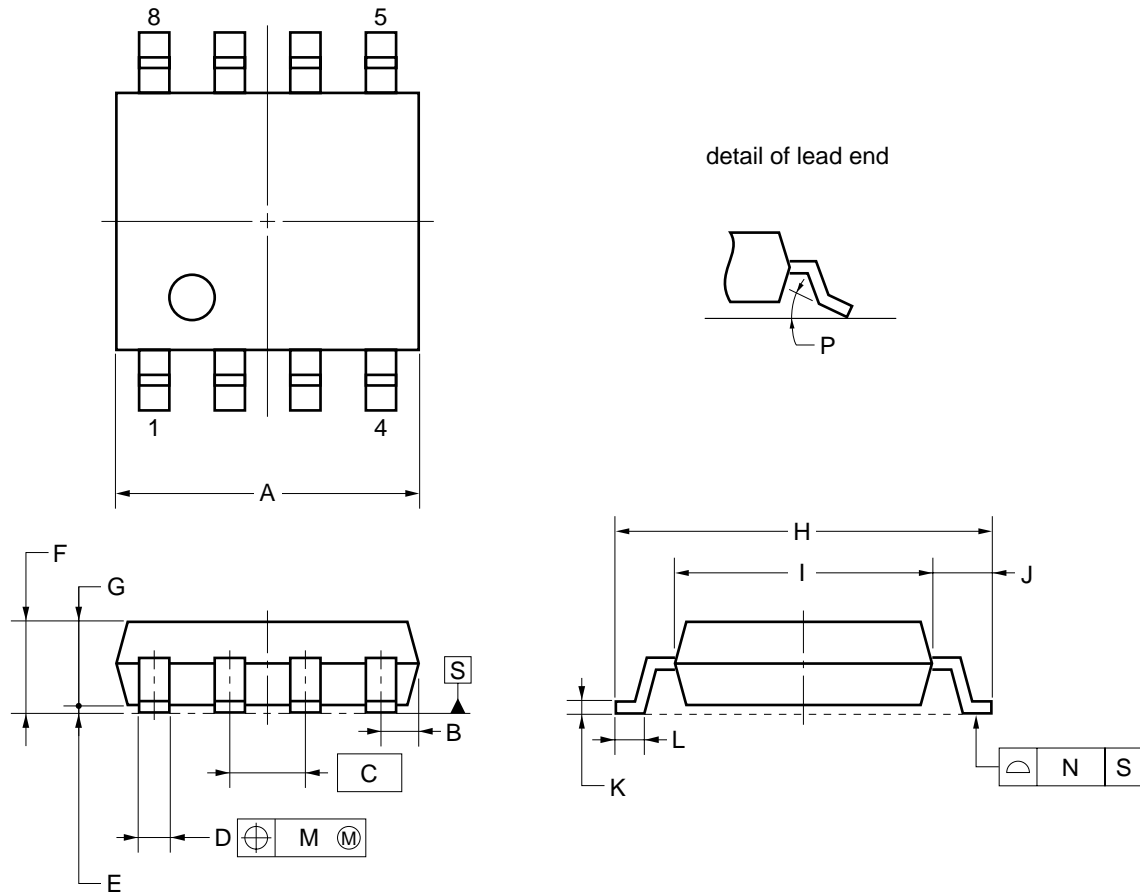
If the Aluminum electrolytic capacitor is used, it should be kept  $C_{KA} \geq 6.8 \mu F$ . When using plural different types of capacitors, each capacitor is needed to be stable independently.

PACKAGE DRAWINGS

★ POWER MINI MOLD (SOT-89) (Unit: mm)



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



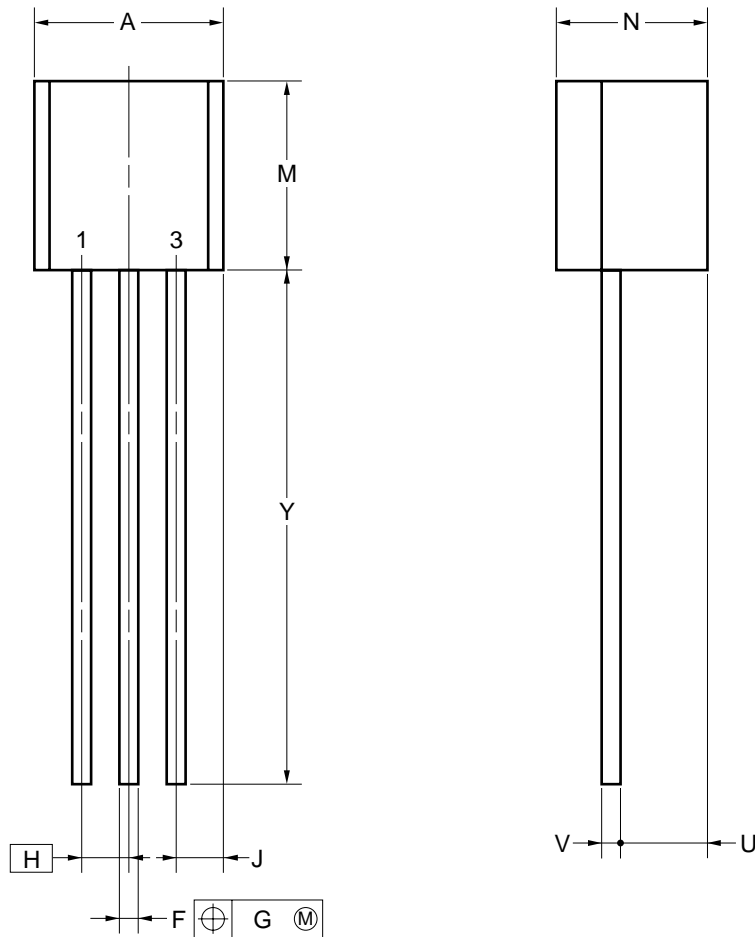
**NOTE**

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

ITEM	MILLIMETERS
A	5.2 <sup>+0.17</sup> / <sub>-0.20</sub>
B	0.78 MAX.
C	1.27 (T.P.)
D	0.42 <sup>+0.08</sup> / <sub>-0.07</sub>
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 <sup>+0.08</sup> / <sub>-0.07</sub>
L	0.6±0.2
M	0.12
N	0.10
P	3° <sup>+7°</sup> / <sub>-3°</sub>

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 <sup>+0.30</sup> <sub>-0.10</sub>
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  $\mu$ PC1943T and the  $\mu$ PC1944T are the symbols as follows.

Part Number	Mark
$\mu$ PC1943T	9B
$\mu$ PC1944T	9C

## REFERENCE DOCUMENTS

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

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  - NEC devices are classified into the following three quality grades:  
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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.
- The quality grade of NEC devices is "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 an NEC sales representative in advance.

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