NEC

BIPOLAR ANALOG INTEGRATED CIRCUIT

μPC1943,1944

ADJUSTABLE PRECISION SHUNT REGULATORS

DESCRIPTION

The μPC1943,1944 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.

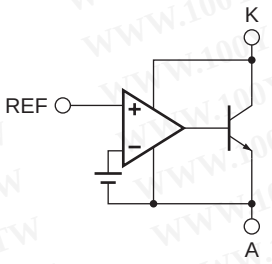
FEATURES

- Low voltage operation and High accuracy. V_{REF} = 1.26 V ± 2.4 %
- Adjustable output voltage by two external resistors. $V_{REF} \leq V_{OUT} \leq 24$ V
- Pin compatible to μPC1093.

ORDERING INFORMATION

	Part Number	Package
★	μPC1943T	Power mini mold (SOT-89)
★	μPC1944T	Power mini mold (SOT-89)
	μPC1944J	3-pin plastic SIP (TO-92)
	μPC1944GR	8-pin plastic SOP (5.72 mm (225))

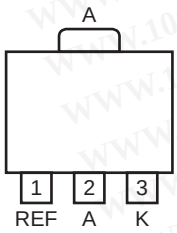
BLOCK DIAGRAM



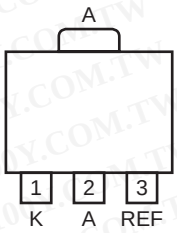
PIN CONFIGURATION (Marking Side)

★ Power mini mold (SOT-89)

μPC1943T

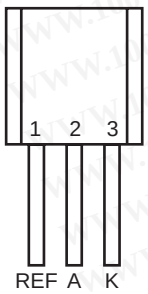


μPC1944T



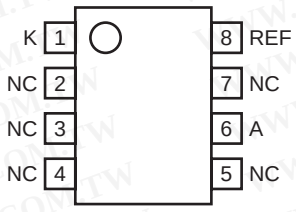
3-pin plastic SIP (TO-92)

μPC1944J



3-pin plastic SOP (5.72 mm (225))

μPC1944GR



A: Anode
K: Cathode
REF: Reference
NC: No Connection

The information in this document is subject to change without notice. Before using this document, please confirm that this is the latest version.
Not all devices/types available in every country. Please check with local NEC representative for availability and additional information.

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Printed in Japan

The mark ★ shows major revised points.

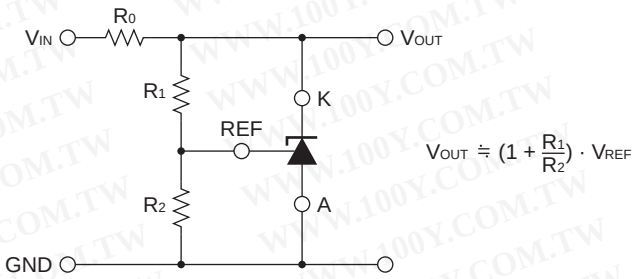
ABSOLUTE MAXIMUM RATINGS (T_A = +25 °C, unless otherwise specified.)

	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 μPC1943T	P_T	320 (1600[Note])	mW
★	μPC1944T		320 (1600[Note])	mW
	μPC1944J		560	mW
	μPC1944GR		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

Note with 16 $cm^2 \times 0.7$ 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

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 $cm^2 \times 0.7$ mm ceramic substrate.

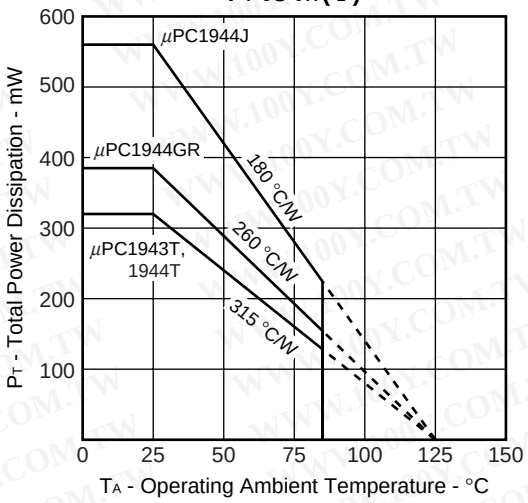
Caution The recommended operating range may be exceeded without causing any problems provided that the absolute maximum ratings are not exceeded. However, if the device is operated in a way that exceeds the recommended operating conditions, the margin between the actual conditions of use and the absolute 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 mA, T_A = +25 °C, unless otherwise specified.)

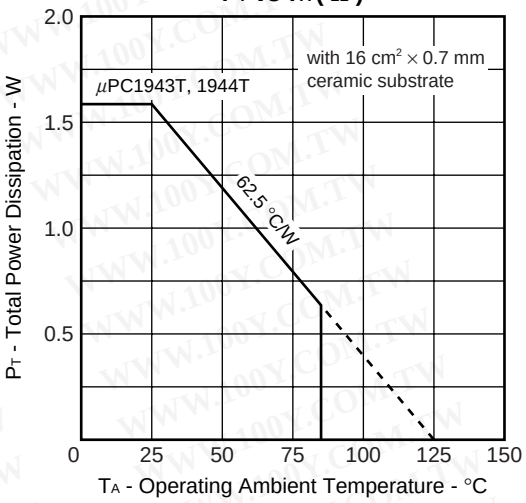
Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Reference Voltage	V_{REF}	$V_{KA} = V_{REF}$	1.23	1.26	1.29	V
Reference Voltage Deviation Over Temperature	ΔV_{REF}	$V_{KA} = V_{REF}$, 0 °C ≤ T_A ≤ 70 °C		±5	±30	mV
Reference Voltage Deviation Over Cathode Voltage	$\Delta V_{REF}/\Delta V_{KA}$	| V_{REF} | ≤ V_{KA} ≤ 5V			2.7	mV/V
		5 V ≤ V_{KA} ≤ 24V			2.0	mV/V
Reference Input Current	I_{REF}	$V_{KA} = V_{REF}$, R_1 = 10 kΩ, R2 = ∞		2.0	4.0	μA
Reference Input Current Deviation Over Temperature	ΔI_{REF}	$V_{KA} = V_{REF}$, 0 °C ≤ T_A ≤ 70 °C, R_1 = 10 kΩ, R2 = ∞		0.3	1.2	μA
Minimum Cathode Current	I_{Kmin}	$V_{KA} = V_{REF}$, ΔV_{REF} = 2 %		0.16	1.0	mA
Off-state Cathode Current	I_{Koff}	V_{KA} = 24 V, V_{REF} = 0 V		0.01	1.0	μA
Dynamic Impedance	| Z_{KA} |	$V_{KA} = V_{REF}$, f ≤ 1 kHz, 1 mA ≤ I_K ≤ 30 mA		0.12	0.5	Ω

TYPICAL CHARACTERISTIC (T_A = +25 °C, unless otherwise specified. Nominal)

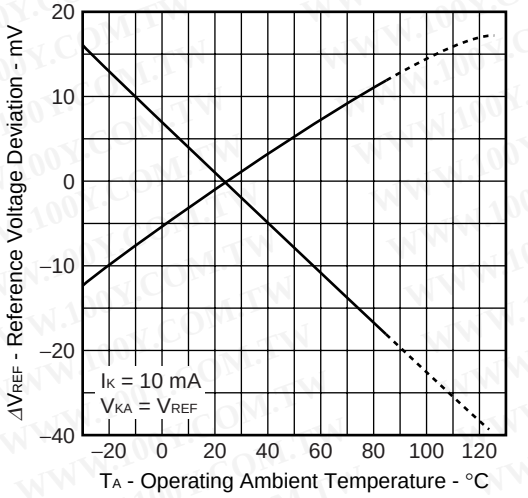
★ P_T vs T_A (I)



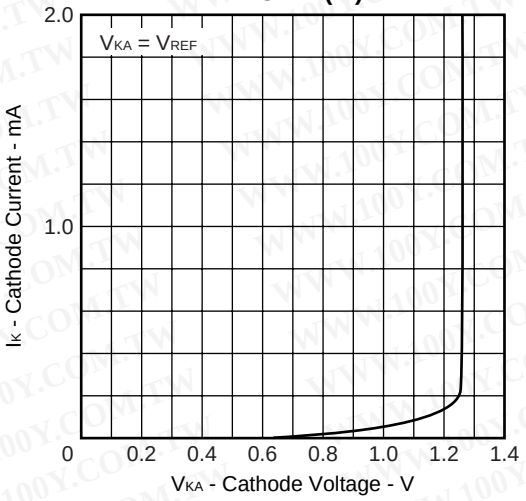
★ P_T vs T_A (II)



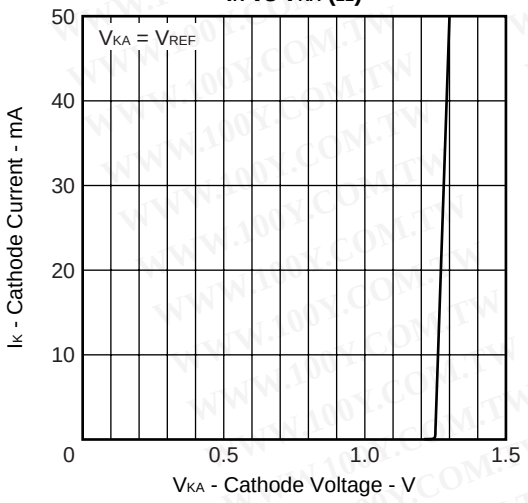
ΔV_{REF} vs T_A



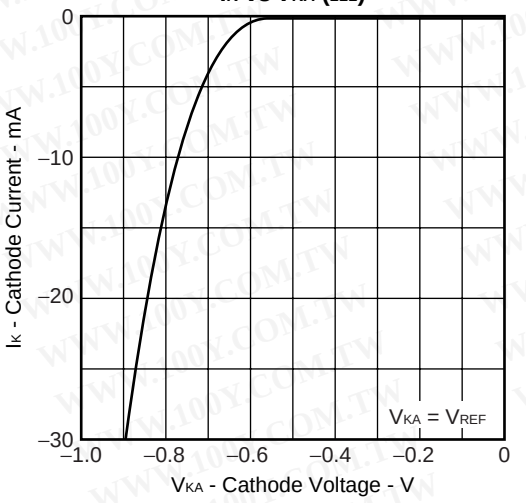
I_K vs V_{KA} (I)



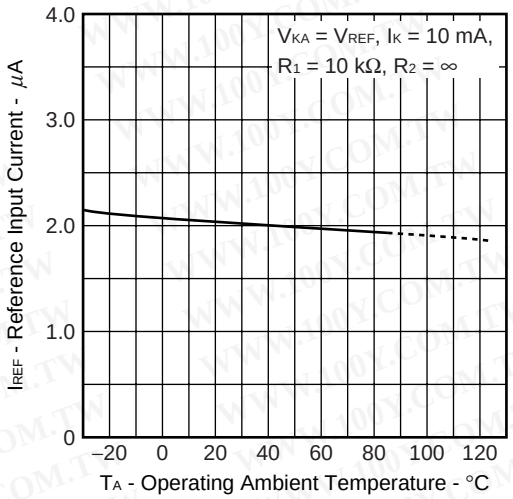
★ I_K vs V_{KA} (II)



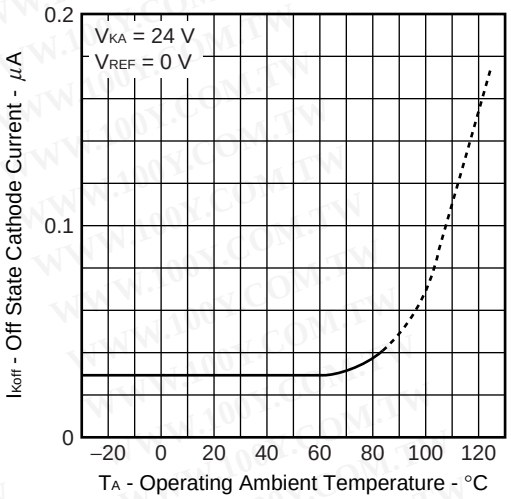
★ I_K vs V_{KA} (III)



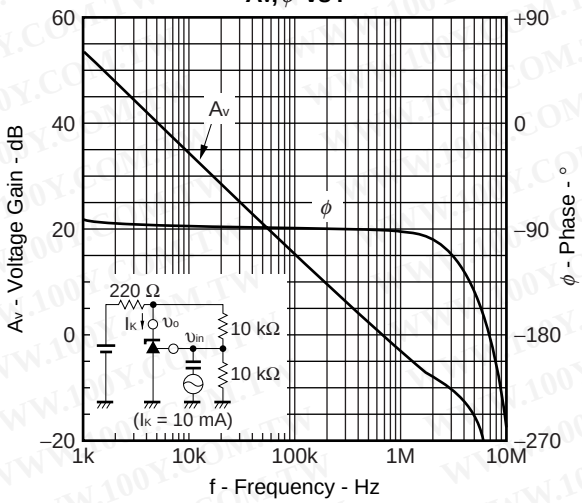
I_{REF} vs T_A



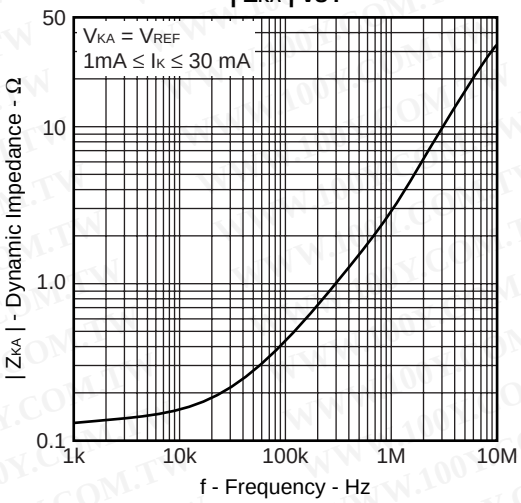
I_{Koff} vs T_A



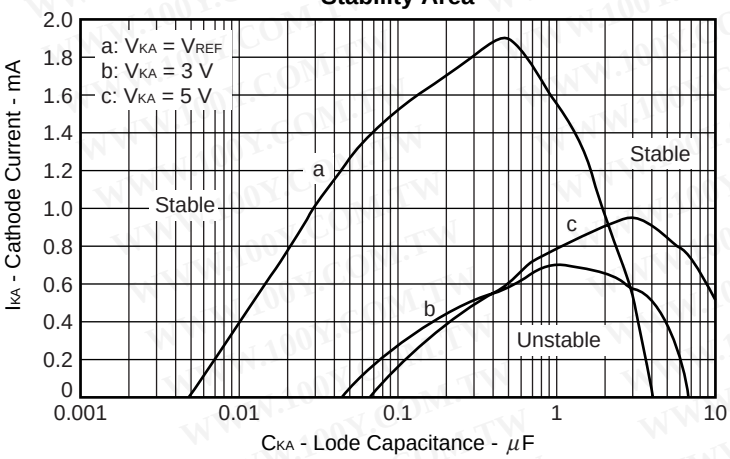
★ **A_V, ϕ vs f**



★ **| Z_{KA} | vs f**

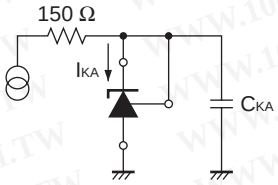


★ **Stability Area**

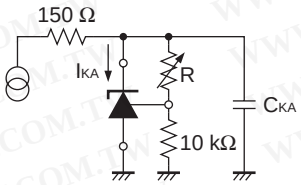


★ **Test Circuit**

a:



b, c:



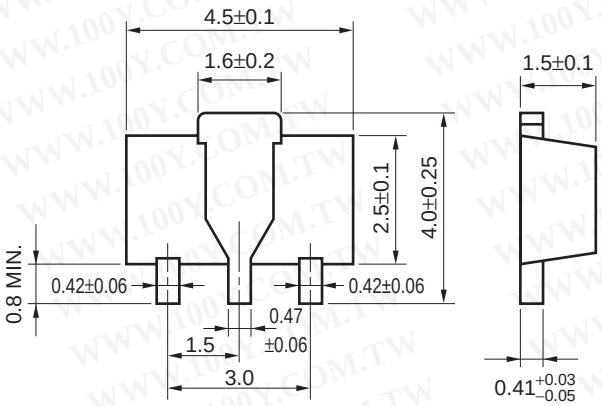
C_{KA}: Monolithic Ceramic Capacitor

★ **Caution of Stability Area**

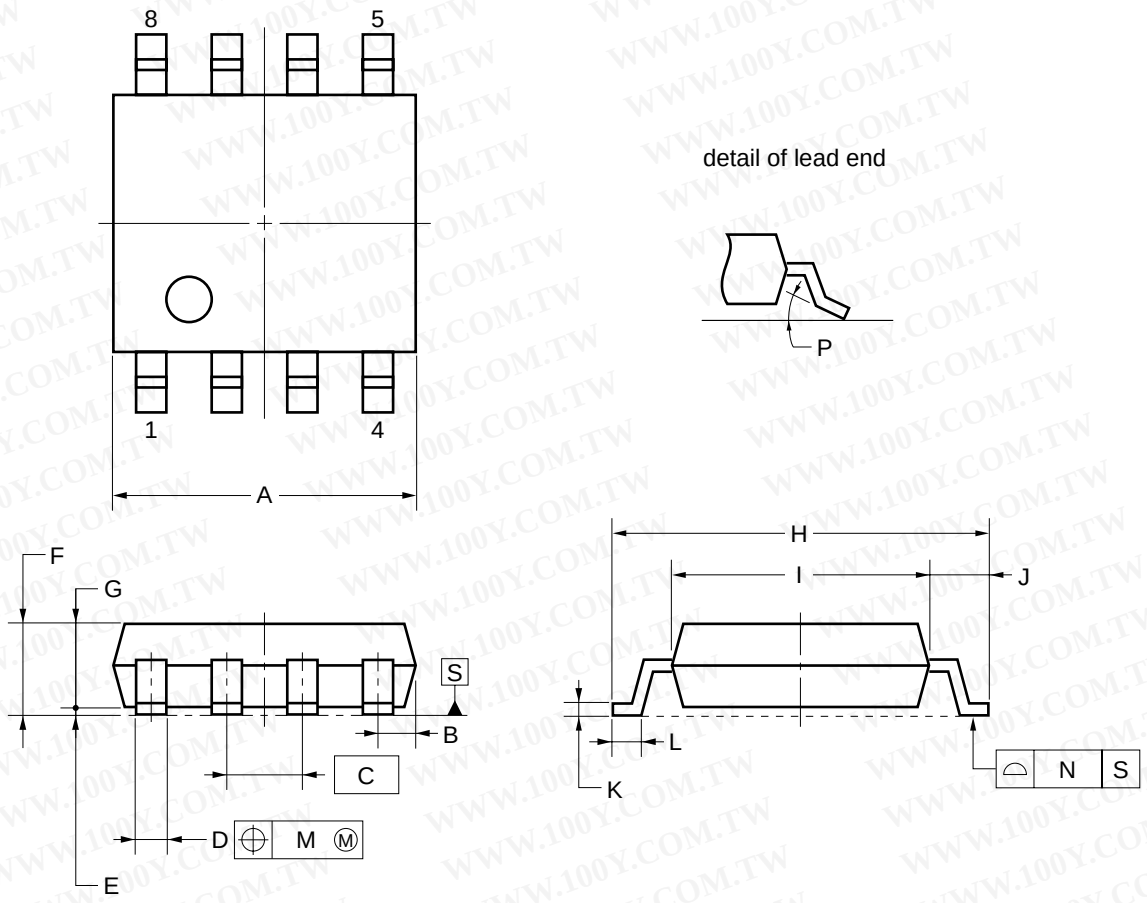
If the Aluminum electrolytic capacitor is used, it should be kept $C_{KA} \geq 6.8\ \mu F$. When using plural different types of capacitors, each capacitor is needed to be stable independently.

PACKAGE DRAWINGS

★ **POWER MINI MOLD (SOT-89) (Unit: mm)**



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



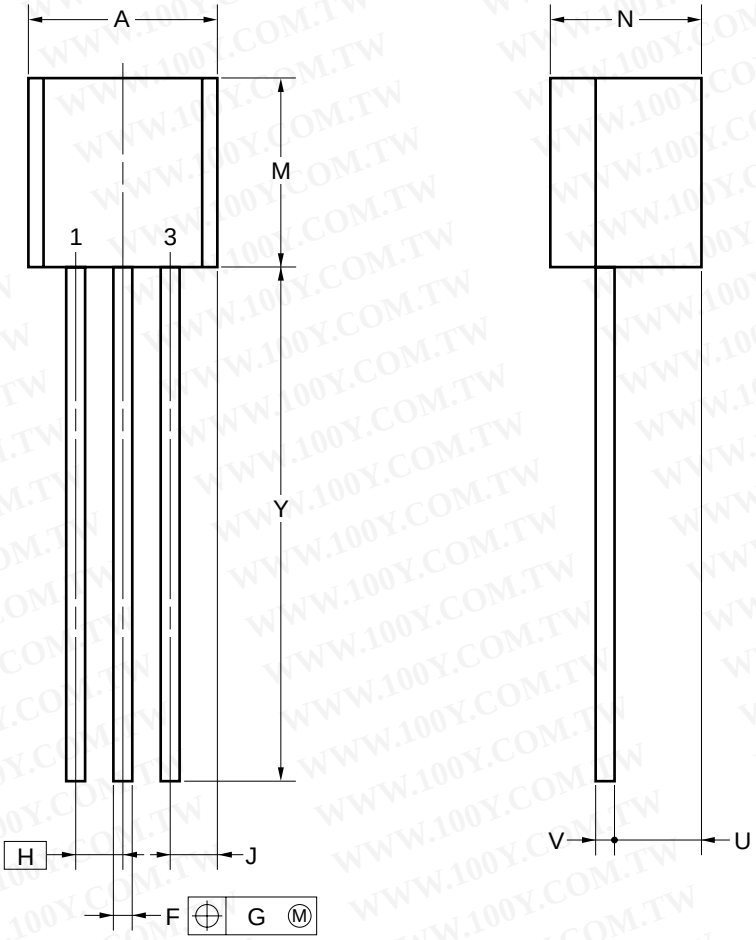
NOTE

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	$3^{\circ}{}^{+7^{\circ}}_{-3^{\circ}}$

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

★ **μPC1943T, 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.

μPC1944GR : 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

μPC1944J : 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

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

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