

ADJUSTABLE PRECISION SHUNT REGULATORS

DESCRIPTION

The μ PC1093 are adjustable precision shunt regulators with guaranteed thermal stability. The output voltage can be set to any value between reference voltage (2.495 V) and 36 V by two external resistors.

These ICs can apply to error amplifier of switching regulators.

FEATURES

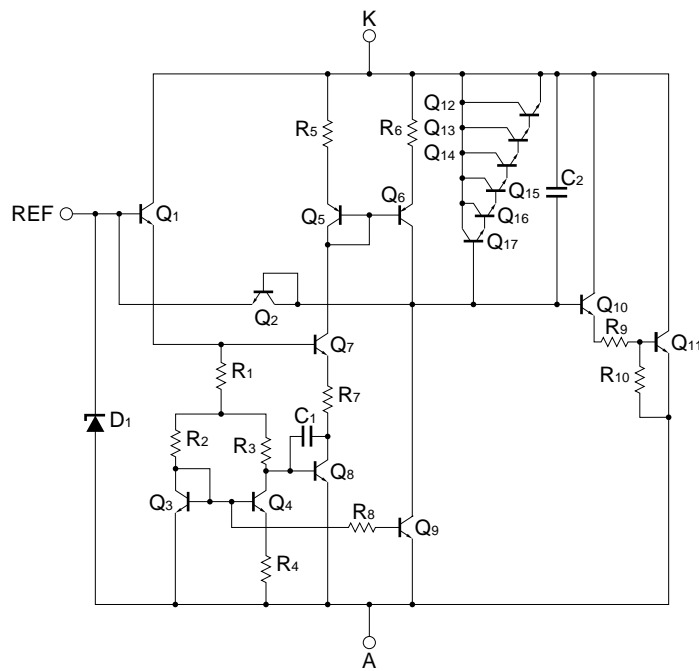
- High Accuracy $V_{REF} = 2.495 V \pm 2 \%$
- Low Temperature Coefficient $\Delta V_{REF}/\Delta T \leq 100 \text{ ppm}/^\circ\text{C}$
- Adjustable Output Voltage by two External Resistors $V_{REF} \leq V_o \leq 36 V$
- Low Dynamic Impedance $|Z_{KA}| = 0.1 \Omega \text{ TYP.}$

ORDERING INFORMATION

| | Part Number | Package |
|---|----------------|----------------------------------|
| | μ PC1093J | 3-pin plastic SIP (TO-92) |
| | μ PC1093G | 8-pin plastic SOP (225 mil) |
| ★ | μ PC1093T | Power mini mold (SOT-89) |
| ★ | μ PC1093TA | 5-pin plastic mini mold (SC-74A) |

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

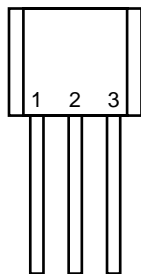
EQUIVALENT CIRCUIT



PIN CONFIGURATION (Marking Side)

3-pin plastic SIP (TO-92)

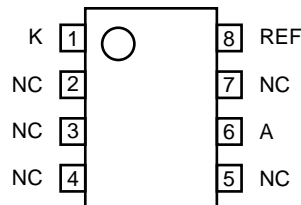
- μPC1093J



1 : REF
2 : A
3 : K

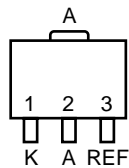
8-pin plastic SOP (225 mil)

- μPC1093G



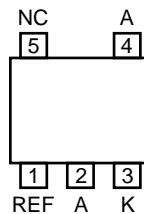
★ Power mini mold (SOT-89)

- μPC1093T



★ 5-pin plastic mini mold (SC-74A)

- μPC1093TA



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

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

| Parameter | | Symbol | Ratings | Unit |
|---------------------------------|-----------|-------------------|-----------------------------|------|
| Cathode Voltage | | V _{KA} | 37 | V |
| Cathode Current | | I _K | 150 | mA |
| Cathode-Anode Reverse Current | | -I _K | -100 | mA |
| Reference Voltage | | V _{REF} | 7 | V |
| Reference Input Current | | I _{REF} | 50 | μA |
| Reference-Anode Reverse Current | | -I _{REF} | -10 | mA |
| Power Dissipation | μPC1093J | P _T | 700 | mW |
| | μPC1093G | | 480 | |
| | μPC1093T | | 400/2 000 ^{Note 1} | |
| | μPC1093TA | | 180/510 ^{Note 2} | |
| Operating Ambient Temperature | | T _A | -20 ~ +85 | °C |
| Storage Temperature | | T _{stg} | -65 ~ +150 | °C |

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- Notes** 1. with 16 cm² × 0.7 mm ceramic substrate
 2. with 75 mm² × 0.7 mm ceramic substrate

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.

RECOMMENDED OPERATING CONDITIONS

| Parameter | | Symbol | MIN. | TYP. | MAX. | Unit |
|-------------------------------|-----------|-----------------|------------------|------|---------------------------|------|
| Cathode Voltage | | V _{KA} | V _{REF} | 5 | 36 | V |
| Cathode Current | | I _K | 1 | 10 | 100 | mA |
| Power Dissipation | μPC1093J | P _T | | 50 | 220 | mW |
| | μPC1093G | | | 50 | 150 | |
| | μPC1093T | | | 50 | 125/640 ^{Note 1} | |
| | μPC1093TA | | | 50 | 58/160 ^{Note 2} | |
| Operating Ambient Temperature | | T _A | -20 | | +85 | °C |

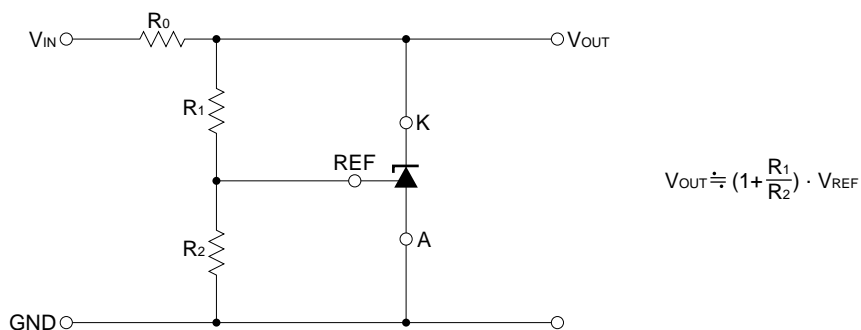
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- Notes** 1. with 16 cm² × 0.7 mm ceramic substrate
 2. with 75 mm² × 0.7 mm ceramic substrate

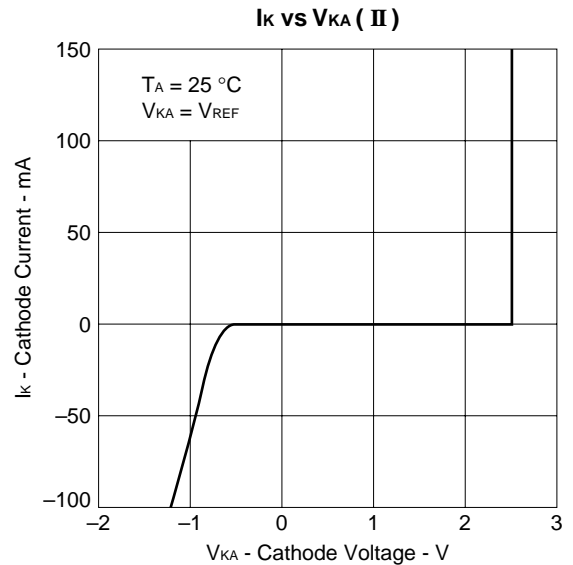
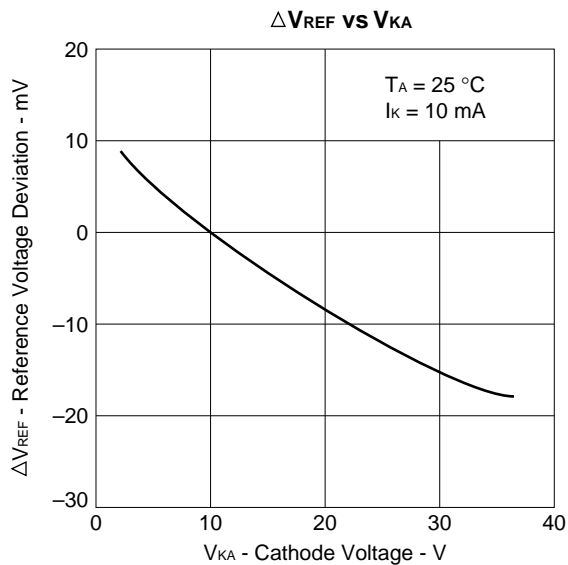
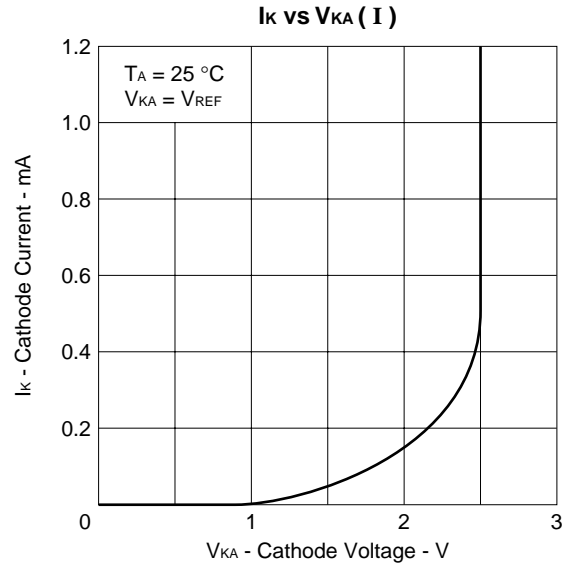
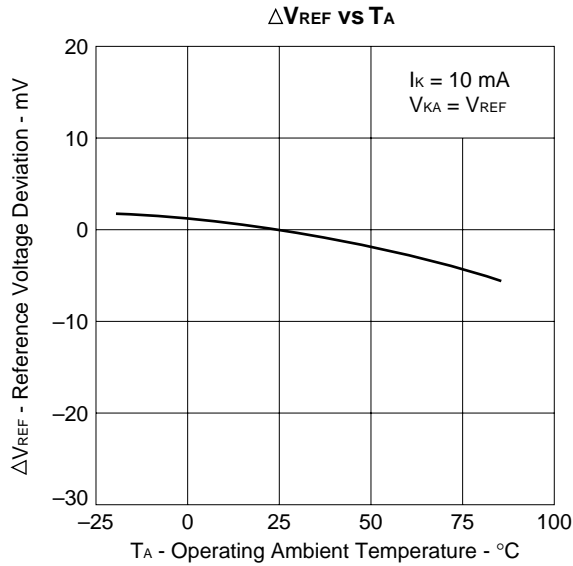
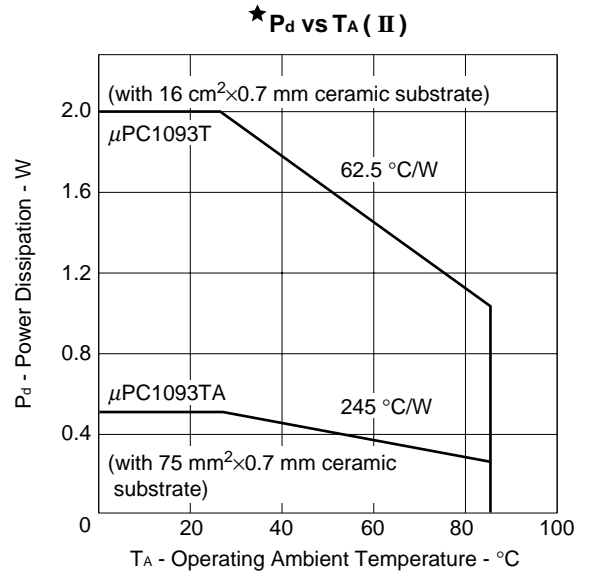
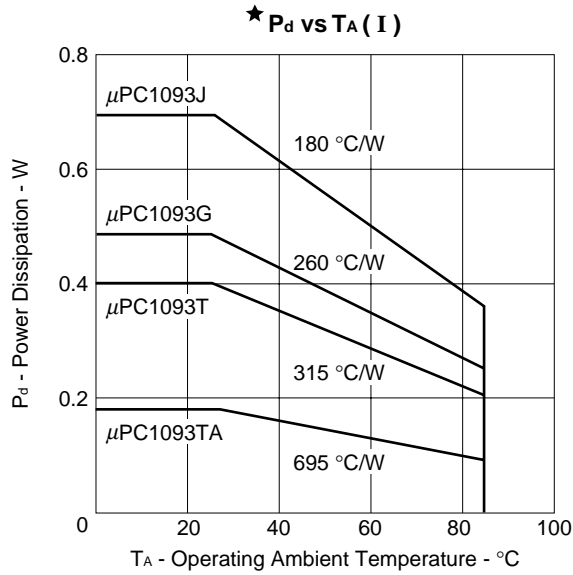
ELECTRICAL CHARACTERISTICS (T_A = 25 °C, I_K = 10 mA, unless otherwise specified.)

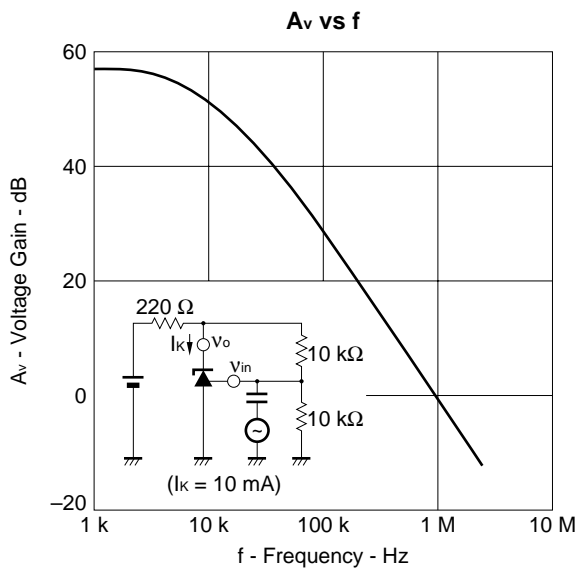
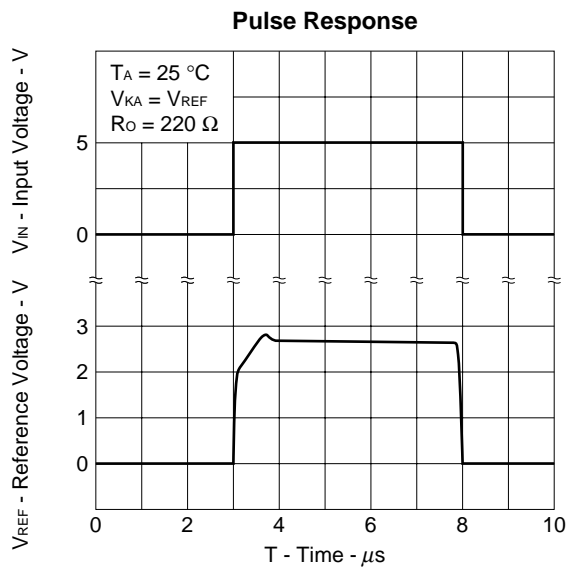
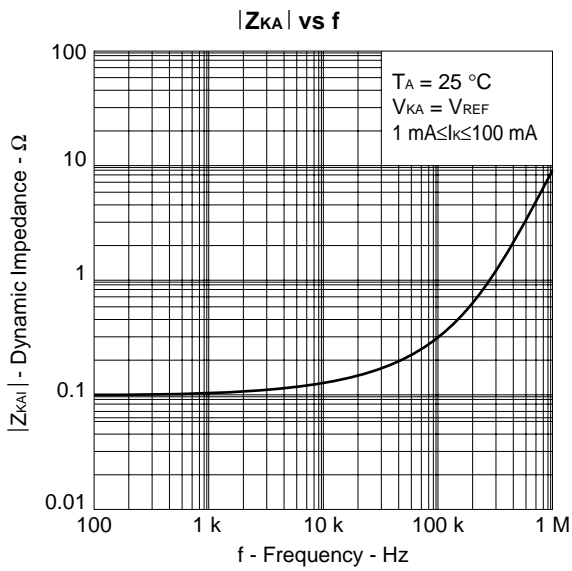
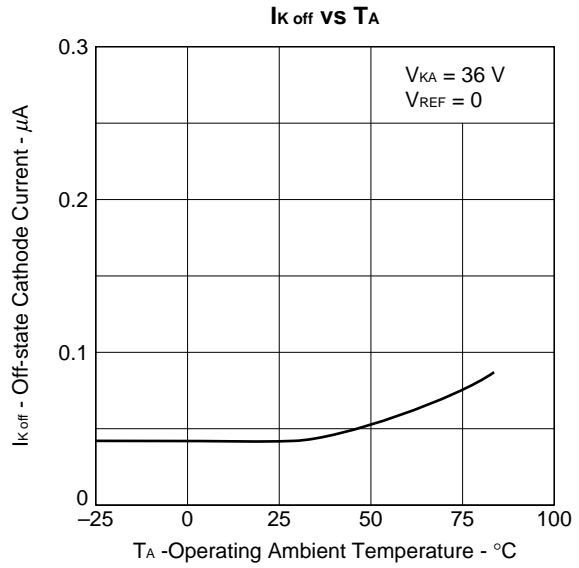
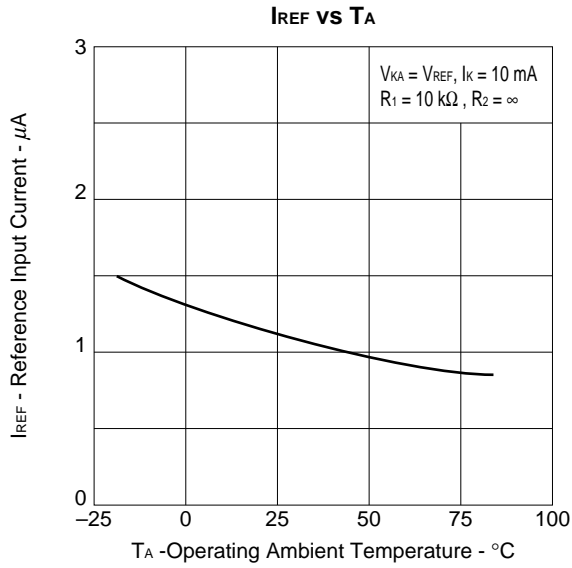
| Parameter | Symbol | Conditions | MIN. | TYP. | MAX. | Unit |
|--|----------------------------|---|-------|-------|-------|------|
| Reference Voltage | V _{REF} | V _{K_A} = V _{REF} | 2.440 | 2.495 | 2.550 | V |
| Reference Voltage Deviation Over Temperature | ΔV _{REF} | 0 °C ≤ T _A ≤ 70 °C, V _{K_A} = V _{REF} | | 7 | 17 | mV |
| Reference Voltage Deviation Over Cathode Voltage | ΔV _{REF} /ΔV | V _{REF} ≤ V _{K_A} ≤ 10 V | | 1.2 | 2.7 | mV/V |
| | | 10 V ≤ V _{K_A} ≤ 36 V | | 0.7 | 2 | mV/V |
| Reference Input Current | I _{REF} | V _{K_A} = V _{REF} , R ₁ = 10 kΩ, R ₂ = ∞ | | 1 | 4 | μA |
| Reference Input Current Deviation Over Temperature | ΔI _{REF} | 0 °C ≤ T _A ≤ 70 °C, V _{K_A} = V _{REF} , R ₁ = 10 kΩ, R ₂ = ∞ | | 0.4 | 1.2 | μA |
| Minimum Cathode Current | I _{K min.} | V _{K_A} = V _{REF} , ΔV _{REF} = 2 % | | 0.4 | 1 | mA |
| Off-state Cathode Current | I _{K off} | V _{K_A} = 36 V, V _{REF} = 0 | | 0.1 | 1 | μA |
| Dynamic Impedance | Z _{K_A} | V _{K_A} = V _{REF} , f ≤ 1 kHz 1 mA ≤ I _K ≤ 100 mA | | 0.1 | 0.5 | Ω |

TEST AND APPLICATION CIRCUIT

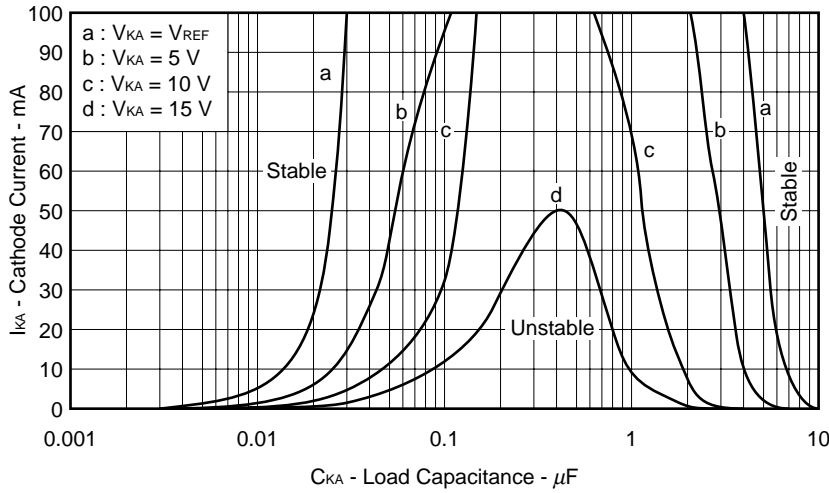


TYPICAL CHARACTERISTICS

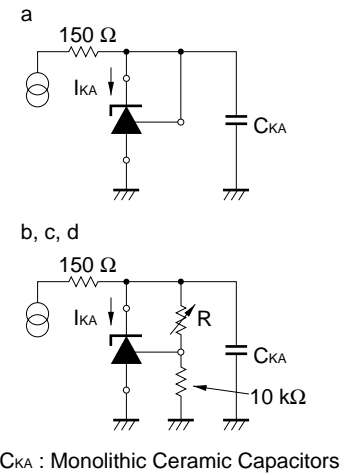




★ STABILITY AREA



★ TEST CIRCUIT



★ Caution of Stability Area

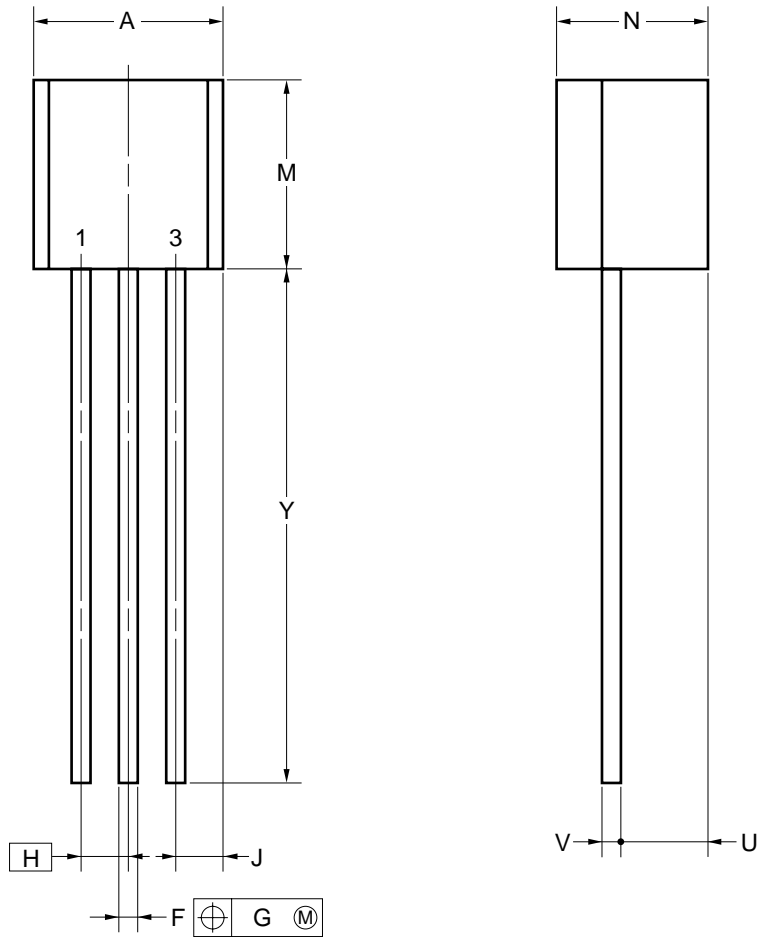
If the Aluminum electrolytic capacitor is used, it should be kept $C_{KA} \geq 2.2\ \mu\text{F}$.

When using plural different types of capacitors, each capacitor is needed to be stable independently.

When designing a circuit, take the characteristic variation among devices into consideration, so that the designed circuit has an enough characteristic margin supporting the standard specifications described above.

PACKAGE DRAWINGS

3 PIN PLASTIC SIP (TO-92)



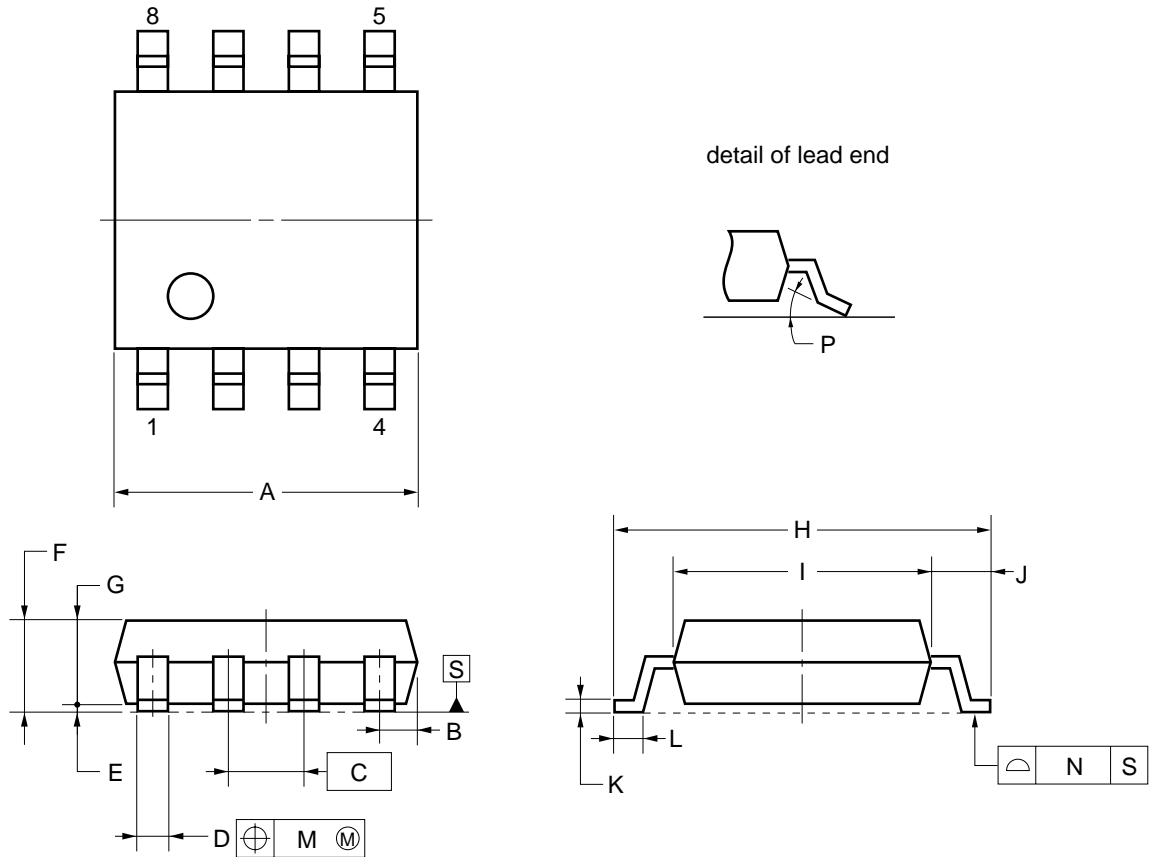
NOTE

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 | 0.5 ^{+0.3} _{-0.1} |
| 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 | 0.5±0.1 |
| Y | 15.0±0.7 |

P3J-127B-2

8 PIN PLASTIC SOP (225 mil)



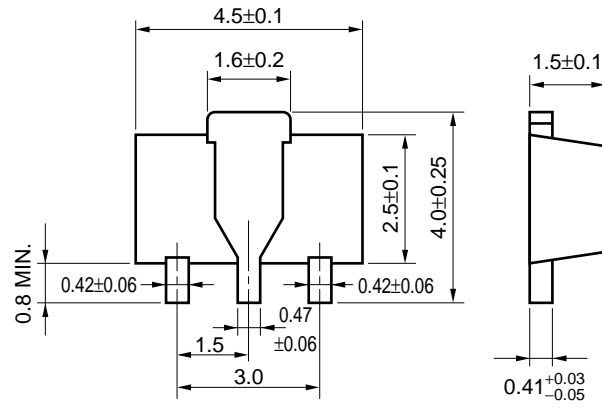
NOTE

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°} |

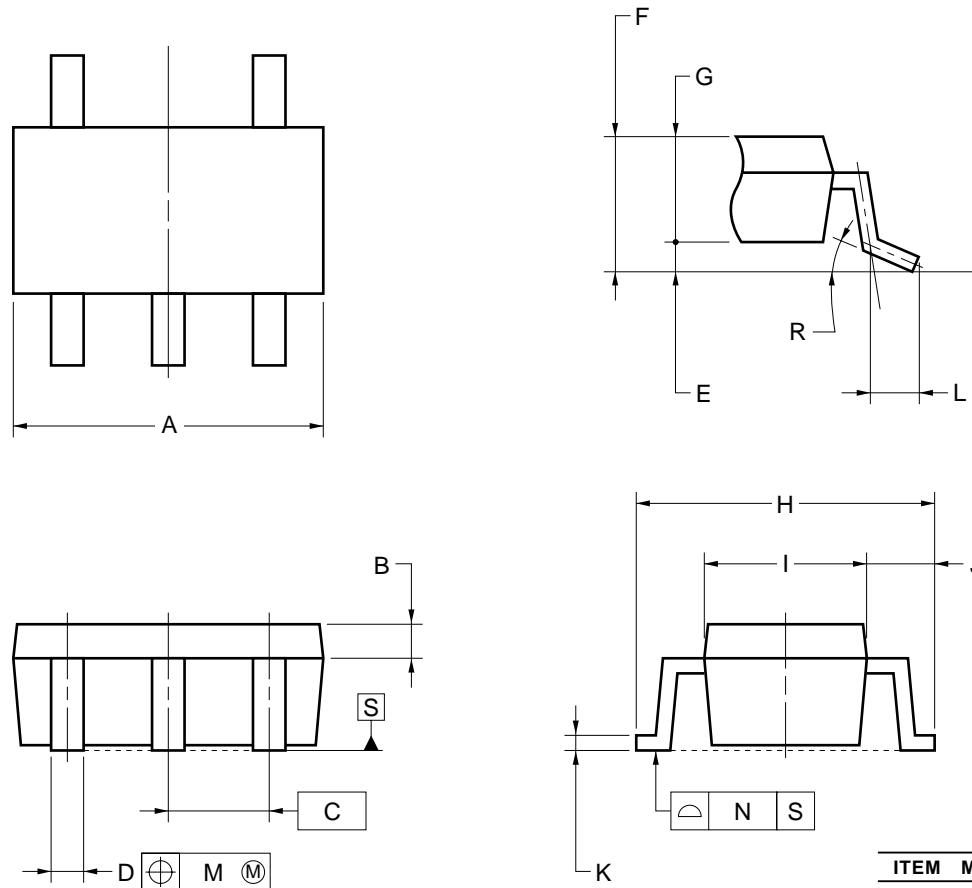
S8GM-50-225B-5

★ POWER MINI MOLD (SOT-89) (Unit: mm)



★ 5 PIN PLASTIC MINI MOLD

detail of lead end



| ITEM | MILLIMETERS |
|------|--|
| A | 2.9±0.2 |
| B | 0.3 |
| C | 0.95 (T.P.) |
| D | 0.32 ^{+0.05} _{-0.02} |
| E | 0.05±0.05 |
| F | 1.4 MAX. |
| G | 1.1 ^{+0.2} _{-0.1} |
| H | 2.8±0.2 |
| I | 1.5 ^{+0.2} _{-0.1} |
| J | 0.65 ^{+0.1} _{-0.15} |
| K | 0.16 ^{+0.1} _{-0.06} |
| L | 0.4±0.2 |
| M | 0.19 |
| N | 0.1 |
| R | 5°±5° |

S5TA-95-15A

★ 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 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).

Through-hole device

μPC1093J: 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.

Surface mount devices

μPC1093G: 8-pin plastic SOP (225 mil)

| Process | Conditions | Symbol |
|---------------------|---|-----------|
| Infrared ray reflow | Peak temperature: 230 °C or below (Package surface temperature), Reflow time: 30 seconds or less (at 210 °C or higher), Maximum number of reflow processes: 1 time. | IR30-00-1 |
| 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.

μPC1093T: 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.

μPC1093TA: 5-pin plastic mini mold (SC-74A)

| 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: 3 times. | IR35-00-3 |
| 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: 3 times. | VP15-00-3 |
| 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.

★ REFERENCE DOCUMENTS

| | |
|---|----------|
| Quality Grades on NEC Semiconductor Devices | C11531E |
| Semiconductor Device Mounting Technology Manual | C10535E |
| IC Package Manual | C10943X |
| Semiconductors Selection Guide | X10679E |
| NEC Semiconductor Device Reliability/Quality Control System | IEI-1212 |
| -Three Terminal Regulator | |

★ REMARK OF THE PACKAGE MARK

The package marks of the μ PC1093T and the μ PC1093TA are the symbols as follows.

| Part Number | Mark |
|----------------|------|
| μ PC1093T | 93 |
| μ PC1093TA | K93 |

[MEMO]

[MEMO]

The application circuits and their parameters are for reference only and are not intended for use in actual design-ins.

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

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Anti-radioactive design is not implemented in this product.