

UPC1093

Adjustable Precision Shunt Regulators

DESCRIPTION

UPC1093 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

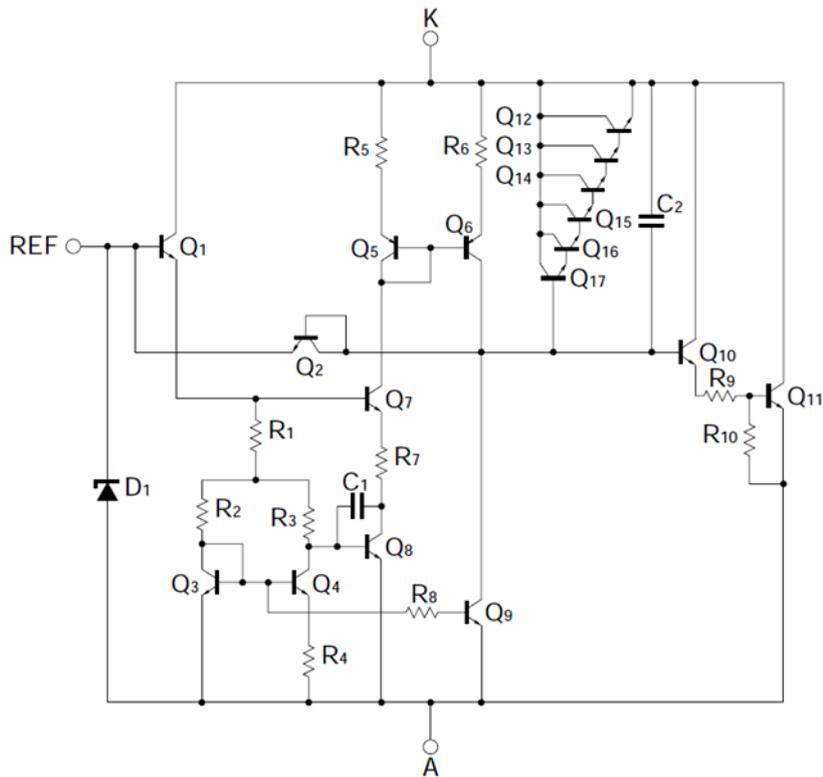
- High Accuracy $V_{REF} = 2.495\text{ V} \pm 2\%$
- Low Temperature Coefficient $\Delta V_{REF}/\Delta T \leq 100\text{ ppm}/^\circ\text{C}$
- Adjustable Output Voltage by two External Resistors $V_{REF} \leq V_O \leq 36\text{ V}$
- Low Dynamic Impedance $|Z_{KA}| = 0.1\Omega\text{ TYP.}$

ORDERING INFORMATION

Order Name	Selected Grade	Package
UPC1093G-AX ⁽¹⁾	Standard	8-pin plastic SOP (225 mil)
UPC1093G-1-AX ⁽¹⁾	Reference voltage selection	8-pin plastic SOP (225 mil)
UPC1093T-A ⁽²⁾	Standard	Power mini mold (SOT-89)
UPC1093T-1-A ⁽²⁾	Reference voltage selection	Power mini mold (SOT-89)
UPC1093TA-A ⁽²⁾	Standard	5-pin plastic mini mold (SC-74A)

- (1) Order names containing E1 or E2 indicate that the packaging format is embossed taping. Pin 1 of E1 is on draw-out side, and pin 1 of E2 is at take-up side.
- (2) The packaging format is embossed taping, and the order names include E1 (pin 1 on the tape take-up side) or E2 (pin 1 on the tape draw-out side), indicating the taping direction.

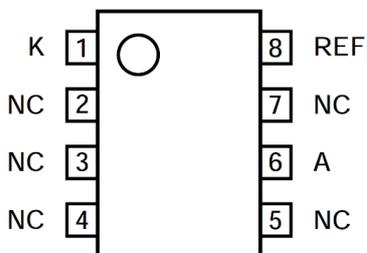
EQUIVALENT CIRCUIT



PIN CONFIGURATION (Marking side)

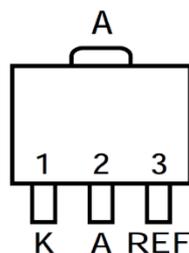
8-pin plastic SOP (225 mil)

- UPC1093G, UPC1093G-1



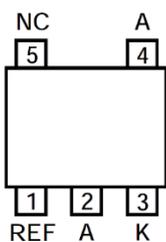
Power mini mold (SOT-89)

- UPC1093T, UPC1093T-1



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

- UPC1093TA



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

ABSOLUTE MAXIMUM RATINGS ($T_A = 25^\circ\text{C}$, 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	UPC1093G	P_T	480	mW
	UPC1093G-1			
	UPC1093T		400/2,000 ^{Note1}	
	UPC1093T-1			
	UPC1093TA			
Operating Ambient Temperature		T_A	-20 ~ +85	$^\circ\text{C}$
Storage Temperature		T_{stg}	-65 ~ +150	$^\circ\text{C}$

Notes 1. with $16\text{ cm}^2 \times 0.7\text{ mm}$ ceramic substrate.

2. with $75\text{ mm}^2 \times 0.7\text{ mm}$ 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	UPC1093G	P_T		50	150	mW
	UPC1093G-1					
	UPC1093T		50	125/640 ^{Note1}		
	UPC1093T-1					
	UPC1093TA				50	
Operating Ambient Temperature		T_A	-20		+85	$^\circ\text{C}$

Notes 1. with $16\text{ cm}^2 \times 0.7\text{ mm}$ ceramic substrate.

2. with $75\text{ mm}^2 \times 0.7\text{ mm}$ ceramic substrate.

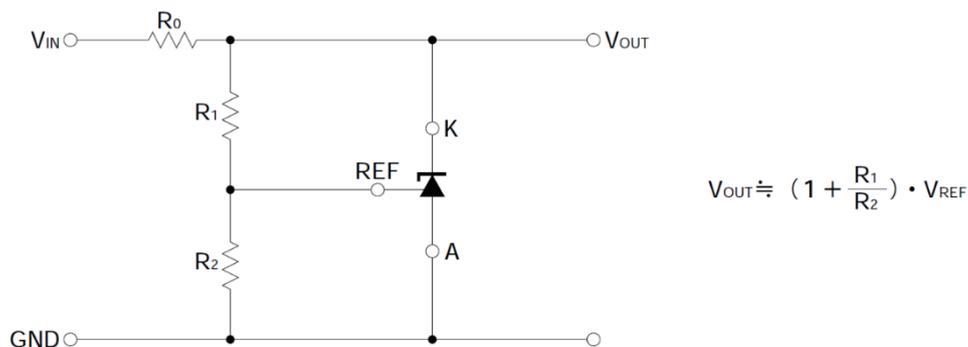
ELECTRICAL CHARACTERISTICS ($T_A = 25^\circ\text{C}$, $I_K = 10\text{ mA}$, unless otherwise specified.)

Standard (UPC1093G, UPC1093T, UPC1093TA)

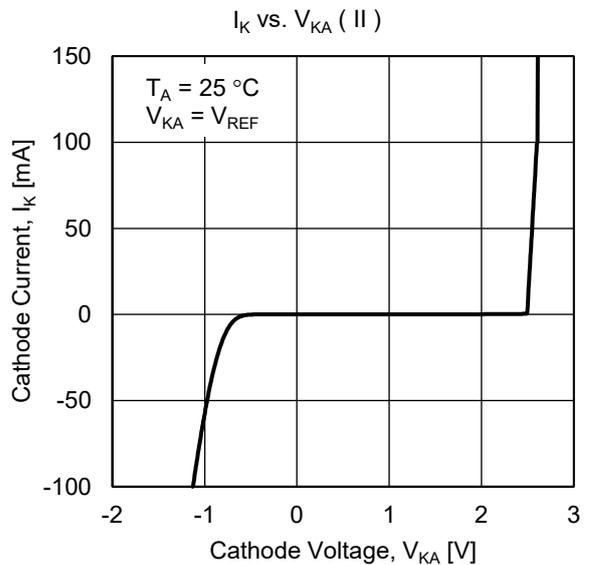
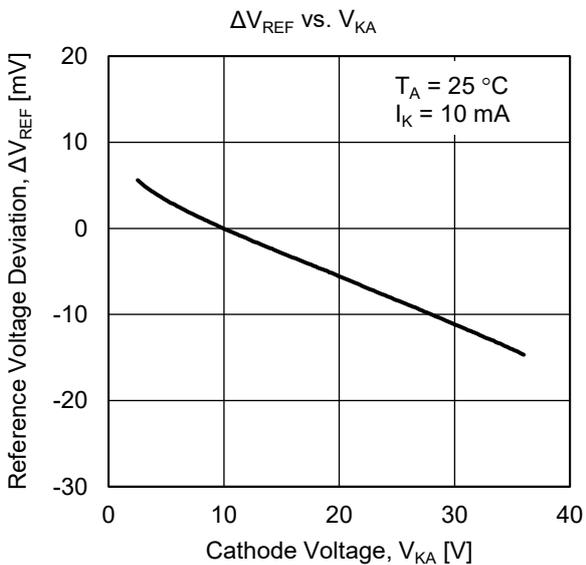
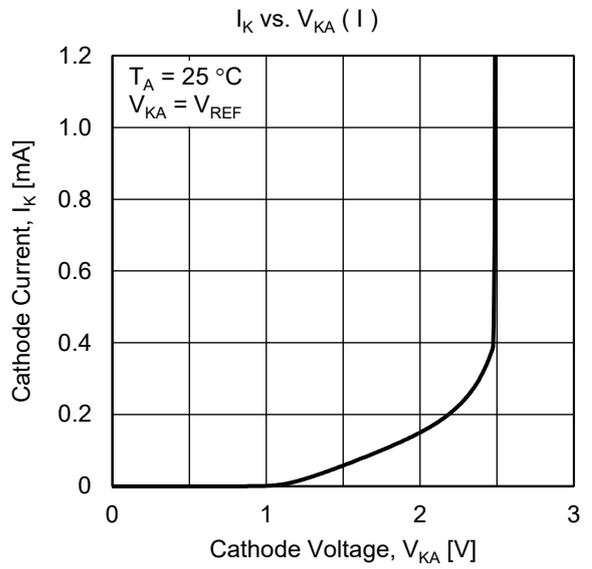
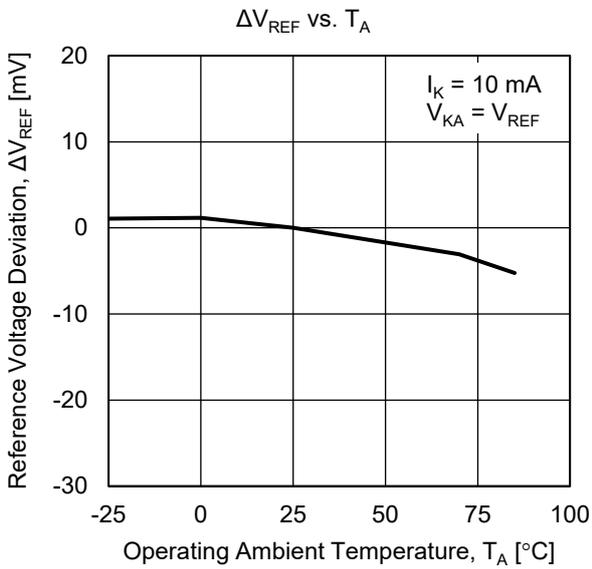
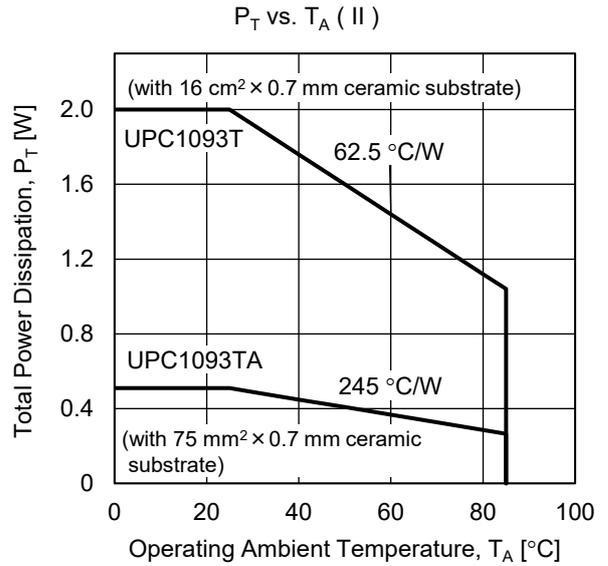
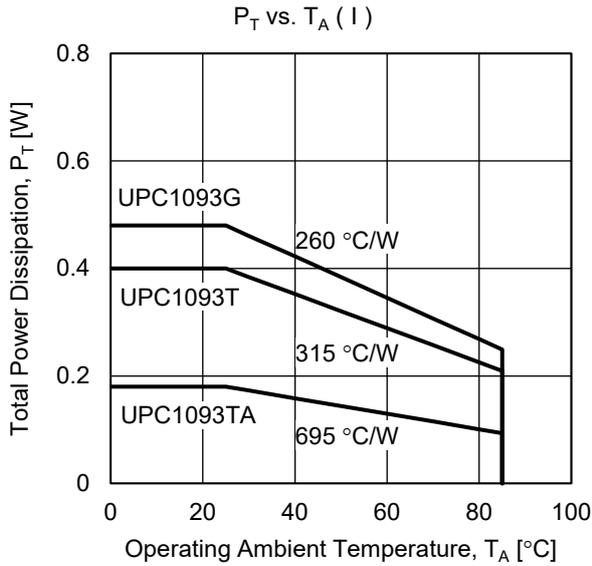
Parameter	Symbol	MIN.	TYP.	MAX.	Unit	Test Conditions
Reference Voltage	V_{REF}	2.440	2.495	2.550	V	$V_{KA} = V_{REF}$
Reference Voltage Deviation Over Temperature	ΔV_{REF}		7	17	mV	$0^\circ\text{C} \leq T_A \leq 70^\circ\text{C}$, $V_{KA} = V_{REF}$
Reference Voltage Deviation Over Cathode Voltage	$\Delta V_{REF}/\Delta V$		1.2	2.7	mV/V	$ V_{REF} \leq V_{KA} \leq 10\text{V}$
			0.7	2	mV/V	$10\text{V} \leq V_{KA} \leq 36\text{V}$
Reference Input Current	I_{REF}		1	4	μA	$V_{KA} = V_{REF}$, $R_1 = 10\text{k}\Omega$, $R_2 = \infty$
Reference Input Current Deviation Over Temperature	ΔI_{REF}		0.4	1.2	μA	$0^\circ\text{C} \leq T_A \leq 70^\circ\text{C}$, $V_{KA} = V_{REF}$, $R_1 = 10\text{k}\Omega$, $R_2 = \infty$
Minimum Cathode Current	$I_{K\text{ min.}}$		0.4	1	mA	$V_{KA} = V_{REF}$, $\Delta V_{REF} = 2\%$
Off-state Cathode Current	$I_{K\text{ off}}$		0.1	1	μA	$V_{KA} = 36\text{V}$, $V_{REF} = 0$
Dynamic Impedance	$ Z_{KA} $		0.1	0.5	Ω	$V_{KA} = V_{REF}$, $f \leq 1\text{kHz}$, $1\text{mA} \leq I_K \leq 100\text{ mA}$

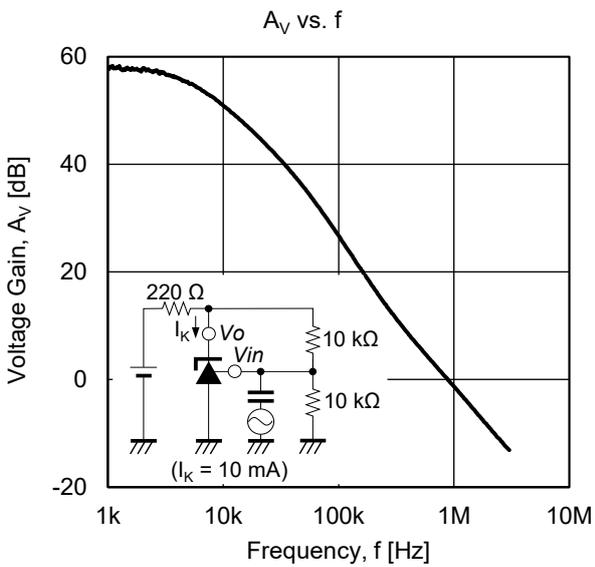
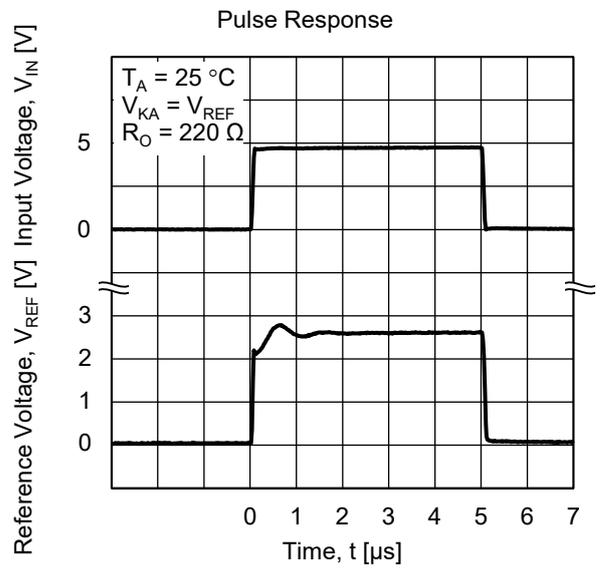
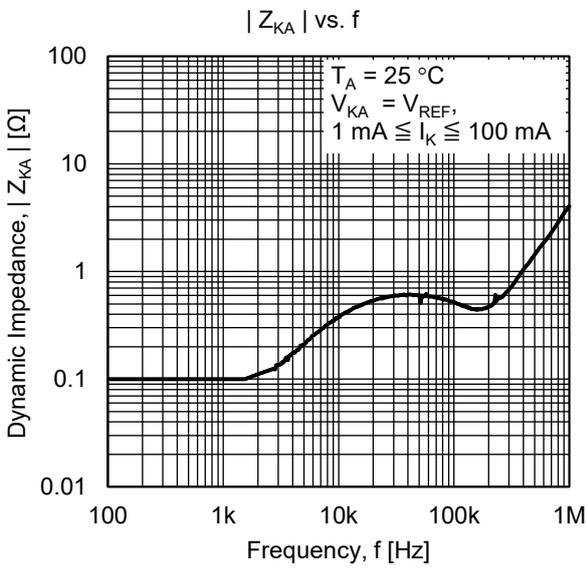
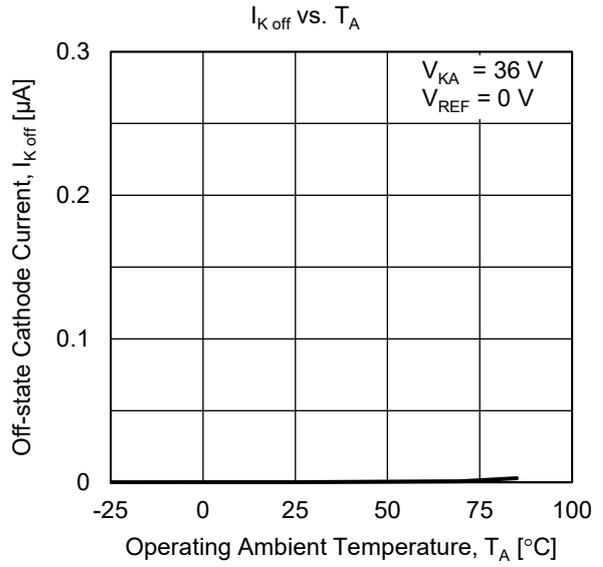
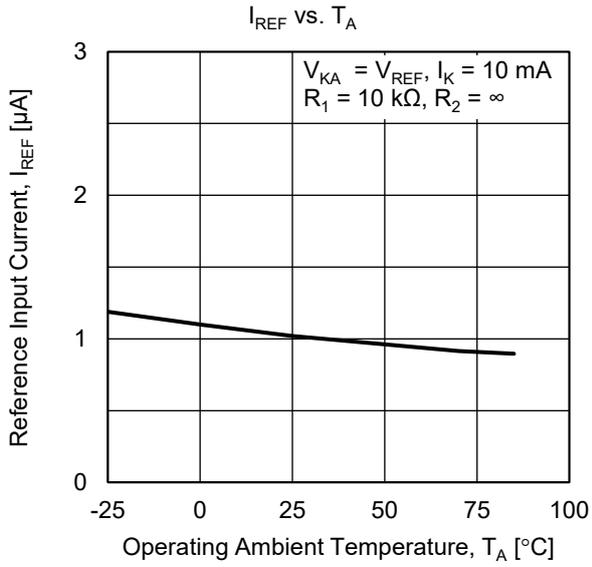
Reference voltage selection (UPC1093G-1, UPC1093T-1)

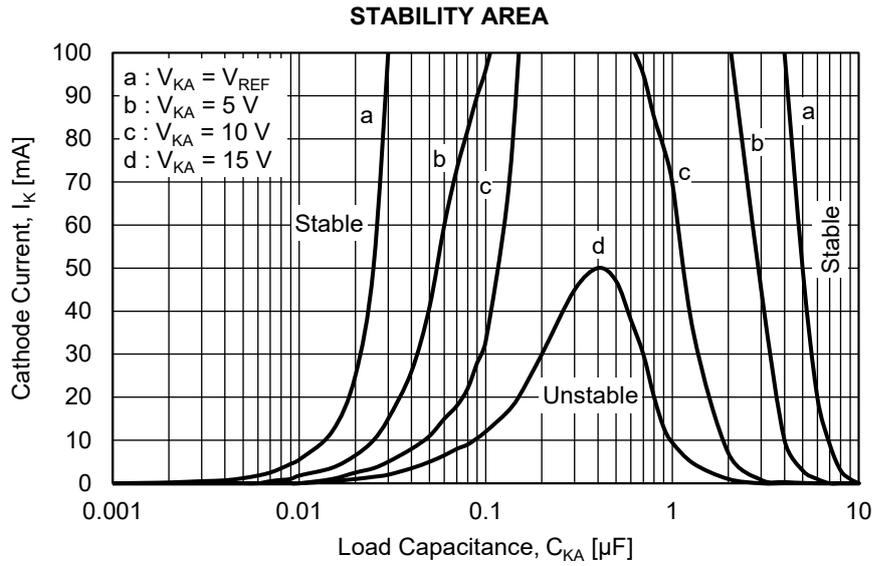
Parameter	Symbol	MIN.	TYP.	MAX.	Unit	Test Conditions
Reference Voltage	V_{REF}	2.475		2.525	V	$V_{KA} = V_{REF}$
Reference Voltage Deviation Over Temperature	ΔV_{REF}		7	17	mV	$0^\circ\text{C} \leq T_A \leq 70^\circ\text{C}$, $V_{KA} = V_{REF}$
Reference Voltage Deviation Over Cathode Voltage	$\Delta V_{REF}/\Delta V$		1.2	2.7	mV/V	$ V_{REF} \leq V_{KA} \leq 10\text{V}$
			0.7	2	mV/V	$10\text{V} \leq V_{KA} \leq 36\text{V}$
Reference Input Current	I_{REF}		1	4	μA	$V_{KA} = V_{REF}$, $R_1 = 10\text{k}\Omega$, $R_2 = \infty$
Reference Input Current Deviation Over Temperature	ΔI_{REF}		0.4	1.2	μA	$0^\circ\text{C} \leq T_A \leq 70^\circ\text{C}$, $V_{KA} = V_{REF}$, $R_1 = 10\text{k}\Omega$, $R_2 = \infty$
Minimum Cathode Current	$I_{K\text{ min.}}$		0.4	1	mA	$V_{KA} = V_{REF}$, $\Delta V_{REF} = 2\%$
Off-state Cathode Current	$I_{K\text{ off}}$		0.1	1	μA	$V_{KA} = 36\text{V}$, $V_{REF} = 0$
Dynamic Impedance	$ Z_{KA} $		0.1	0.5	Ω	$V_{KA} = V_{REF}$, $f \leq 1\text{kHz}$, $1\text{mA} \leq I_K \leq 100\text{ mA}$

TEST AND APPLICATION CIRCUIT

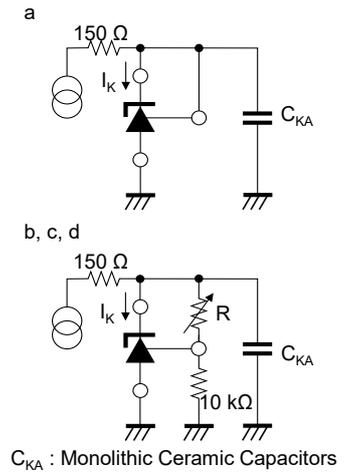
TYPICAL PERFORMANCE CHARACTERISTICS







TEST CIRCUIT



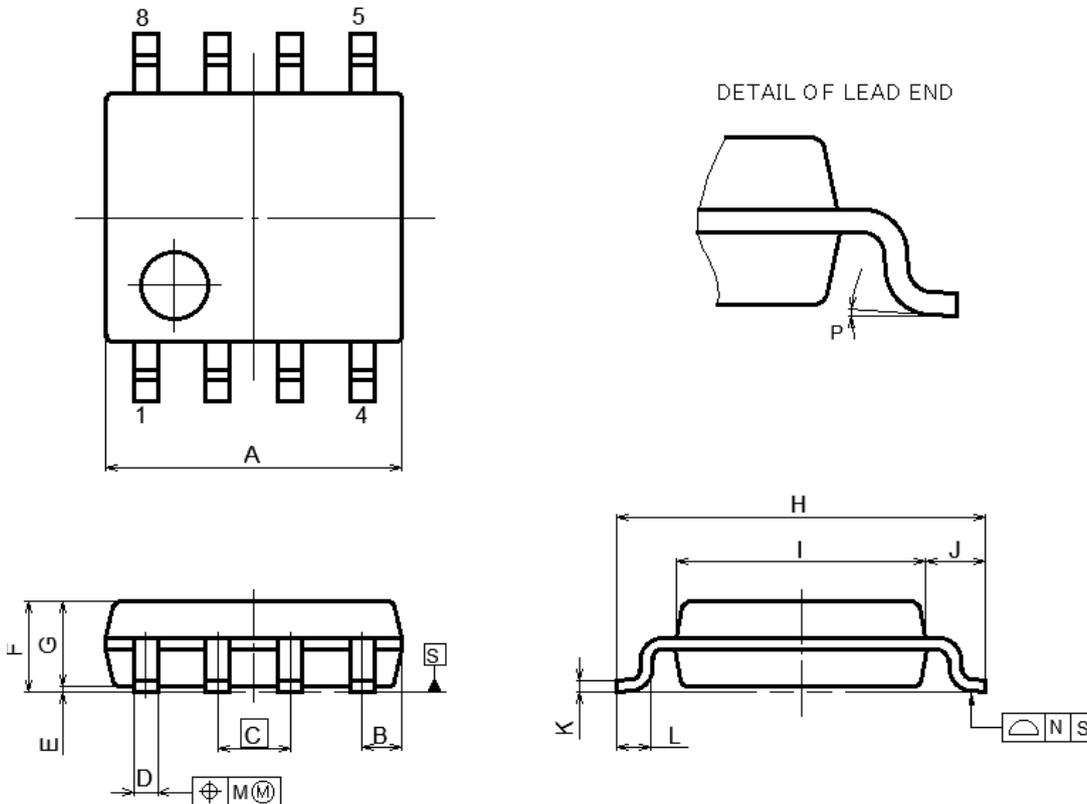
Caution of Stability Area

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

8-PIN PLASTIC SOP

JEITA Package code	RENESAS code	MASS (TYP.) [g]
P-LSOP8-4.4×5.2-1.27	PLSP0008DE-A	0.09[g]



NOTE

EACH LEAD CENTERLINE IS LOCATED WITHIN 0.12 MM OF ITS TRUE POSITION(T.P.) AT MAXIMUM MATERIAL CONDITION.

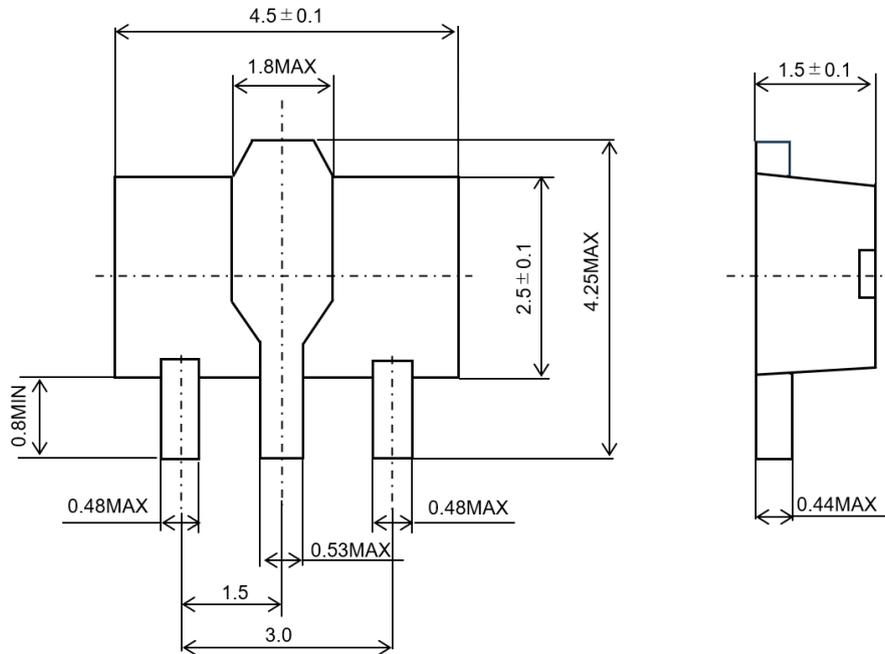
(UNIT:mm)

ITEM	DIMENSIONS
A	5.2±0.17
B	0.78MAX
C	1.27(T.P)
D	0.40±0.05
E	0.1±0.1
F	1.59±0.21
G	1.49
H	6.5±0.3
I	4.4±0.1
J	1.05±0.15
K	0.2±0.07
L	0.6±0.20
M	0.1MAX
N	0.1MAX
P	4°±4°

POWER MINI MOLD (SOT-89)

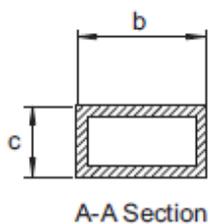
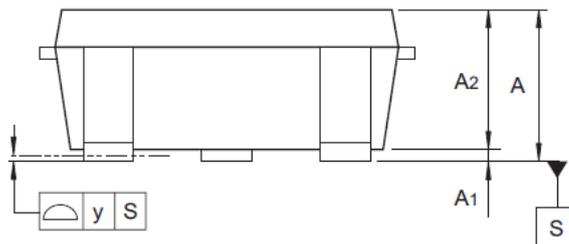
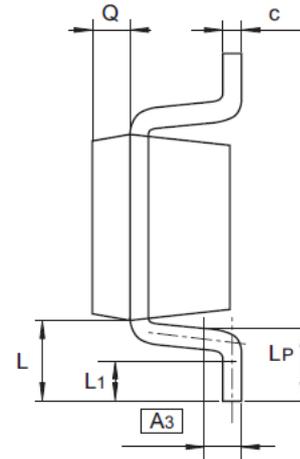
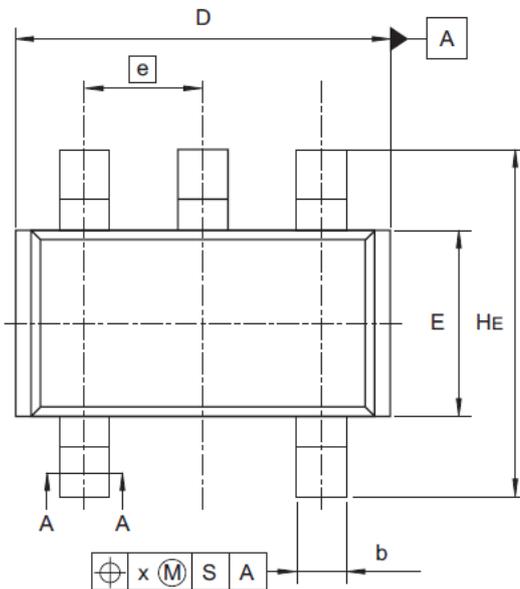
JEITA Package code	RENESAS code	Previous code	MASS(TYP.) [g]
SC-62	PLZZ0004CA-A	UPAK / UPAKV	0.050[g]

(UNIT : mm)



5 PIN PLASTIC MINI MOLD (SC-74A)

JEITA Package Code	RENESAS Code	Previous code	MASS (TYP.) [g]
SC-74A	PLSP0005ZB-A	MPAK-5 / MPAK-5V	0.015[g]



(UNIT : mm)

Reference Symbol	Dimensions in millimeters		
	Min	Nom	Max
A	1.0	—	1.4
A ₁	0	—	0.1
A ₂	1.0	1.1	1.3
A ₃	—	0.25	—
b	0.35	0.4	0.5
c	0.11	0.16	0.26
D	2.8	2.95	3.1
E	1.5	1.6	1.8
e	—	0.95	—
H _E	2.5	2.8	3.0
L	0.3	—	0.7
L ₁	0.1	—	0.5
LP	0.2	—	0.6
x	—	—	0.05
y	—	—	0.05
Q	—	0.3	—

Notice

1. Descriptions of circuits, software and other related information in this document are provided only to illustrate the operation of semiconductor products and application examples. You are fully responsible for the incorporation or any other use of the circuits, software, and information in the design of your product or system. Renesas Electronics disclaims any and all liability for any losses and damages incurred by you or third parties arising from the use of these circuits, software, or information.
2. Renesas Electronics hereby expressly disclaims any warranties against and liability for infringement or any other claims involving patents, copyrights, or other intellectual property rights of third parties, by or arising from the use of Renesas Electronics products or technical information described in this document, including but not limited to, the product data, drawings, charts, programs, algorithms, and application examples.
3. No license, express, implied or otherwise, is granted hereby under any patents, copyrights or other intellectual property rights of Renesas Electronics or others.
4. You shall be responsible for determining what licenses are required from any third parties, and obtaining such licenses for the lawful import, export, manufacture, sales, utilization, distribution or other disposal of any products incorporating Renesas Electronics products, if required.
5. You shall not alter, modify, copy, or reverse engineer any Renesas Electronics product, whether in whole or in part. Renesas Electronics disclaims any and all liability for any losses or damages incurred by you or third parties arising from such alteration, modification, copying or reverse engineering.
6. Renesas Electronics products are classified according to the following two quality grades: "Standard" and "High Quality". The intended applications for each Renesas Electronics product depends on the product's quality grade, as indicated below.
 - "Standard": Computers; office equipment; communications equipment; test and measurement equipment; audio and visual equipment; home electronic appliances; machine tools; personal electronic equipment; industrial robots; etc.
 - "High Quality": Transportation equipment (automobiles, trains, ships, etc.); traffic control (traffic lights); large-scale communication equipment; key financial terminal systems; safety control equipment; etc.Unless expressly designated as a high reliability product or a product for harsh environments in a Renesas Electronics data sheet or other Renesas Electronics document, Renesas Electronics products are not intended or authorized for use in products or systems that may pose a direct threat to human life or bodily injury (artificial life support devices or systems; surgical implantations; etc.), or may cause serious property damage (space system; undersea repeaters; nuclear power control systems; aircraft control systems; key plant systems; military equipment; etc.). Renesas Electronics disclaims any and all liability for any damages or losses incurred by you or any third parties arising from the use of any Renesas Electronics product that is inconsistent with any Renesas Electronics data sheet, user's manual or other Renesas Electronics document.
7. No semiconductor product is absolutely secure. Notwithstanding any security measures or features that may be implemented in Renesas Electronics hardware or software products, Renesas Electronics shall have absolutely no liability arising out of any vulnerability or security breach, including but not limited to any unauthorized access to or use of a Renesas Electronics product or a system that uses a Renesas Electronics product. RENESAS ELECTRONICS DOES NOT WARRANT OR GUARANTEE THAT RENESAS ELECTRONICS PRODUCTS, OR ANY SYSTEMS CREATED USING RENESAS ELECTRONICS PRODUCTS WILL BE INVULNERABLE OR FREE FROM CORRUPTION, ATTACK, VIRUSES, INTERFERENCE, HACKING, DATA LOSS OR THEFT, OR OTHER SECURITY INTRUSION ("Vulnerability Issues"). RENESAS ELECTRONICS DISCLAIMS ANY AND ALL RESPONSIBILITY OR LIABILITY ARISING FROM OR RELATED TO ANY VULNERABILITY ISSUES. FURTHERMORE, TO THE EXTENT PERMITTED BY APPLICABLE LAW, RENESAS ELECTRONICS DISCLAIMS ANY AND ALL WARRANTIES, EXPRESS OR IMPLIED, WITH RESPECT TO THIS DOCUMENT AND ANY RELATED OR ACCOMPANYING SOFTWARE OR HARDWARE, INCLUDING BUT NOT LIMITED TO THE IMPLIED WARRANTIES OF MERCHANTABILITY, OR FITNESS FOR A PARTICULAR PURPOSE.
8. When using Renesas Electronics products, refer to the latest product information (data sheets, user's manuals, application notes, "General Notes for Handling and Using Semiconductor Devices" in the reliability handbook, etc.), and ensure that usage conditions are within the ranges specified by Renesas Electronics with respect to maximum ratings, operating power supply voltage range, heat dissipation characteristics, installation, etc. Renesas Electronics disclaims any and all liability for any malfunctions, failure or accident arising out of the use of Renesas Electronics products outside of such specified ranges.
9. Although Renesas Electronics endeavors to improve the quality and reliability of Renesas Electronics products, semiconductor products have specific characteristics, such as the occurrence of failure at a certain rate and malfunctions under certain use conditions. Unless designated as a high reliability product or a product for harsh environments in a Renesas Electronics data sheet or other Renesas Electronics document, Renesas Electronics products are not subject to radiation resistance design. You are responsible for implementing safety measures to guard against the possibility of bodily injury, injury or damage caused by fire, and/or danger to the public in the event of a failure or malfunction of Renesas Electronics products, such as safety design for hardware and software, including but not limited to redundancy, fire control and malfunction prevention, appropriate treatment for aging degradation or any other appropriate measures. Because the evaluation of microcomputer software alone is very difficult and impractical, you are responsible for evaluating the safety of the final products or systems manufactured by you.
10. Please contact a Renesas Electronics sales office for details as to environmental matters such as the environmental compatibility of each Renesas Electronics product. You are responsible for carefully and sufficiently investigating applicable laws and regulations that regulate the inclusion or use of controlled substances, including without limitation, the EU RoHS Directive, and using Renesas Electronics products in compliance with all these applicable laws and regulations. Renesas Electronics disclaims any and all liability for damages or losses occurring as a result of your noncompliance with applicable laws and regulations.
11. Renesas Electronics products and technologies shall not be used for or incorporated into any products or systems whose manufacture, use, or sale is prohibited under any applicable domestic or foreign laws or regulations. You shall comply with any applicable export control laws and regulations promulgated and administered by the governments of any countries asserting jurisdiction over the parties or transactions.
12. It is the responsibility of the buyer or distributor of Renesas Electronics products, or any other party who distributes, disposes of, or otherwise sells or transfers the product to a third party, to notify such third party in advance of the contents and conditions set forth in this document.
13. This document shall not be reprinted, reproduced or duplicated in any form, in whole or in part, without prior written consent of Renesas Electronics.
14. Please contact a Renesas Electronics sales office if you have any questions regarding the information contained in this document or Renesas Electronics products.

(Note1) "Renesas Electronics" as used in this document means Renesas Electronics Corporation and also includes its directly or indirectly controlled subsidiaries.

(Note2) "Renesas Electronics product(s)" means any product developed or manufactured by or for Renesas Electronics.

(Rev.5.0-1 October 2020)

Corporate Headquarters

TOYOSU FORESIA, 3-2-24 Toyosu,
Koto-ku, Tokyo 135-0061, Japan
www.renesas.com

Trademarks

Renesas and the Renesas logo are trademarks of Renesas Electronics Corporation. All trademarks and registered trademarks are the property of their respective owners.

Contact information

For further information on a product, technology, the most up-to-date version of a document, or your nearest sales office, please visit:
www.renesas.com/contact/.