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

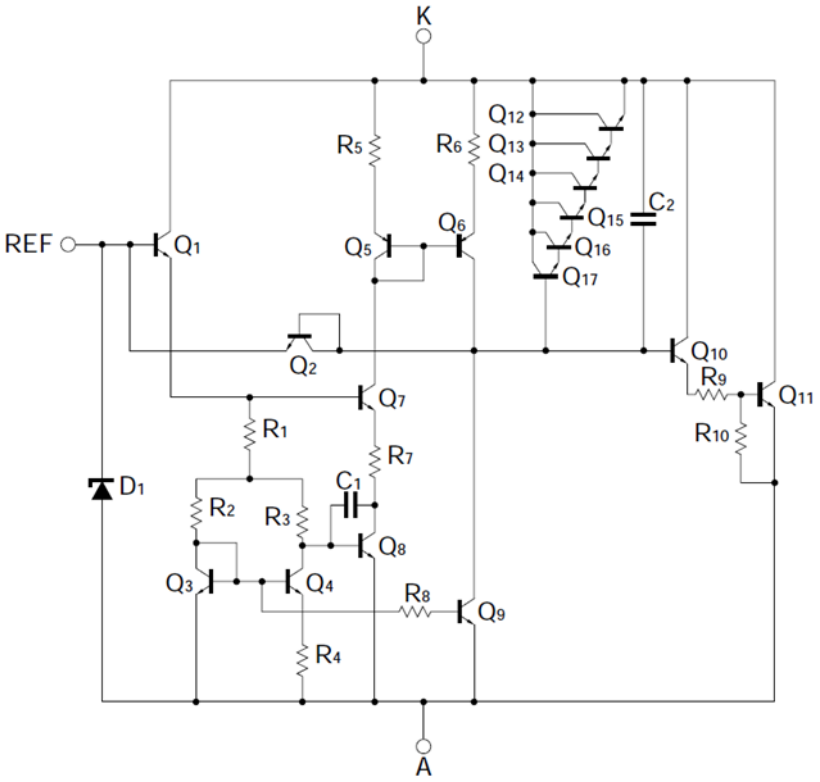
- High Accuracy — V_{REF} = 2.495 V ± 2%
- Low Temperature Coefficient — $\Delta V_{REF}/\Delta T \leq 100$ ppm/°C
- Adjustable Output Voltage by two External Resistors — $V_{REF} \leq V_O \leq 36V$
- Low Dynamic Impedance — $|Z_{KA}|$ = 0.1Ω TYP.

ORDERING INFORMATION

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

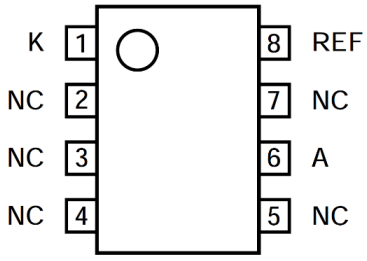
EQUIVALENT CIRCUIT



PIN CONFIGURATION (Marking side)

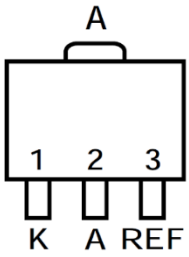
8-pin plastic SOP (225 mil)

・UPC1093G, UPC1093G-1



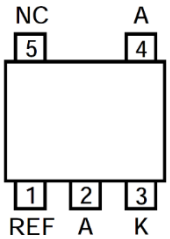
Power mini mold (SOT-89)

・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°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		180/510 Note2	
Operating Ambient Temperature		T_A	-20 ~ +85	°C
Storage Temperature		T_{stg}	-65 ~ +150	°C

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	UPC1093G	P_T		50	150	mW
	UPC1093G-1					
	UPC1093T			50	125/640 Note1	
	UPC1093T-1					
	UPC1093TA			50	58/160 Note2	
Operating Ambient Temperature		T_A	-20		+85	°C

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.)

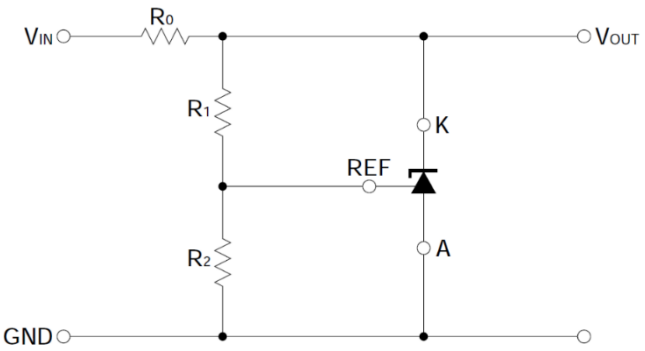
Standard (UPC1093G, UPC1093T, UPC1093TA)

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	Δ V_{REF}		7	17	mV	0°C ≤ T_A ≤ 70°C, V_{KA} =V_{REF}
Reference Voltage Deviation Over Cathode Voltage	Δ V_{REF}/ΔV		1.2	2.7	mV/V	$\lvert V_{REF} \rvert$ ≤ V_{KA} ≤ 10V
			0.7	2	mV/V	10V ≤ V_{KA} ≤ 36V
Reference Input Current	I_{REF}		1	4	μA	V_{KA} =V_{REF}, R_1=10kΩ, R_2=∞
Reference Input Current Deviation Over Temperature	Δ I_{REF}		0.4	1.2	μA	0°C ≤ T_A ≤ 70°C, V_{KA} =V_{REF} R_1=10kΩ, R_2=∞
Minimum Cathode Current	$I_{K\ min.}$		0.4	1	mA	V_{KA} =V_{REF}, ΔV_{REF} =2%
Off-state Cathode Current	$I_{K\ off}$		0.1	1	μA	V_{KA} =36V, V_{REF} =0
Dynamic Impedance	$\lvert Z_{KA} \rvert$		0.1	0.5	Ω	V_{KA} =V_{REF}, f ≤ 1kHz 1mA ≤ I_K ≤ 100 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	Δ V_{REF}		7	17	mV	0°C ≤ T_A ≤ 70°C, V_{KA} =V_{REF}
Reference Voltage Deviation Over Cathode Voltage	Δ V_{REF}/ΔV		1.2	2.7	mV/V	$\lvert V_{REF} \rvert$ ≤ V_{KA} ≤ 10V
			0.7	2	mV/V	10V ≤ V_{KA} ≤ 36V
Reference Input Current	I_{REF}		1	4	μA	V_{KA} =V_{REF}, R_1=10kΩ, R_2=∞
Reference Input Current Deviation Over Temperature	Δ I_{REF}		0.4	1.2	μA	0°C ≤ T_A ≤ 70°C, V_{KA} =V_{REF} R_1=10kΩ, R_2=∞
Minimum Cathode Current	$I_{K\ min.}$		0.4	1	mA	V_{KA} =V_{REF}, ΔV_{REF} =2%
Off-state Cathode Current	$I_{K\ off}$		0.1	1	μA	V_{KA} =36V, V_{REF} =0
Dynamic Impedance	$\lvert Z_{KA} \rvert$		0.1	0.5	Ω	V_{KA} =V_{REF}, f ≤ 1kHz 1mA ≤ I_K ≤ 100 mA

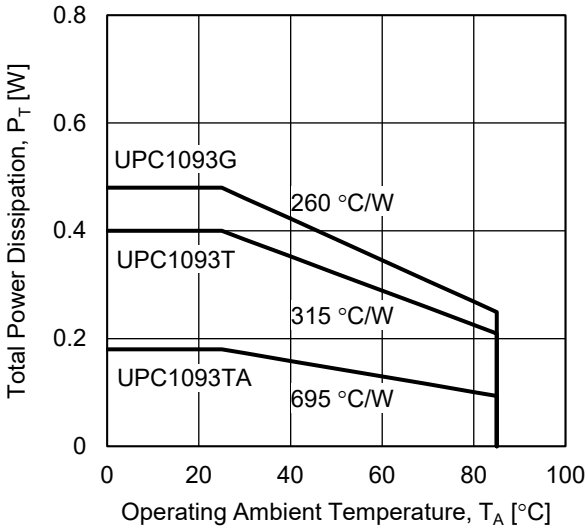
TEST AND APPLICATION CIRCUIT



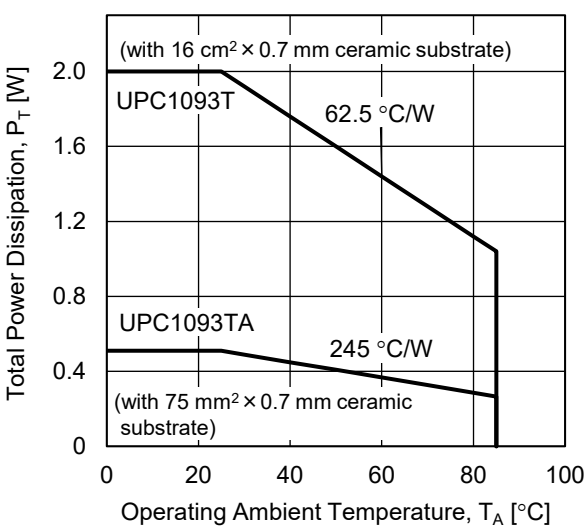
$$V_{OUT} \fallingdotseq \left(1 + \frac{R_1}{R_2}\right) \cdot V_{REF}$$

TYPICAL PERFORMANCE CHARACTERISTICS

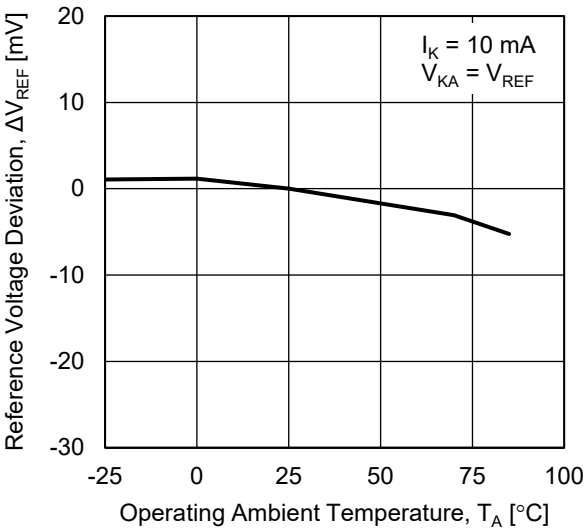
P_T vs. T_A (I)



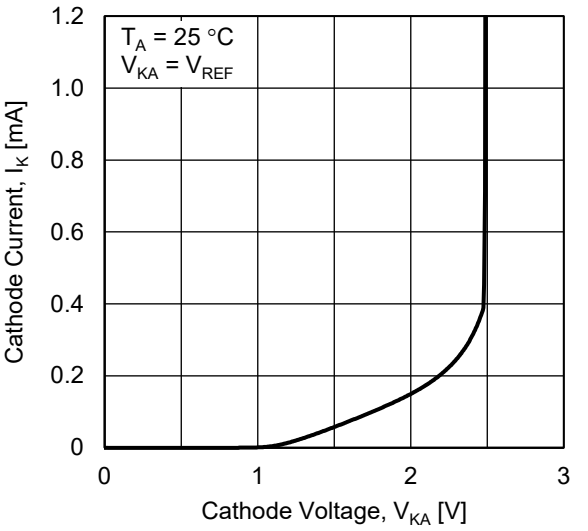
P_T vs. T_A (II)



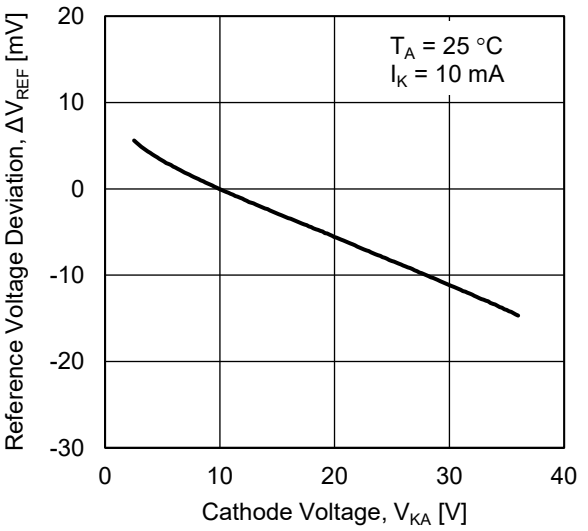
ΔV_{REF} vs. T_A



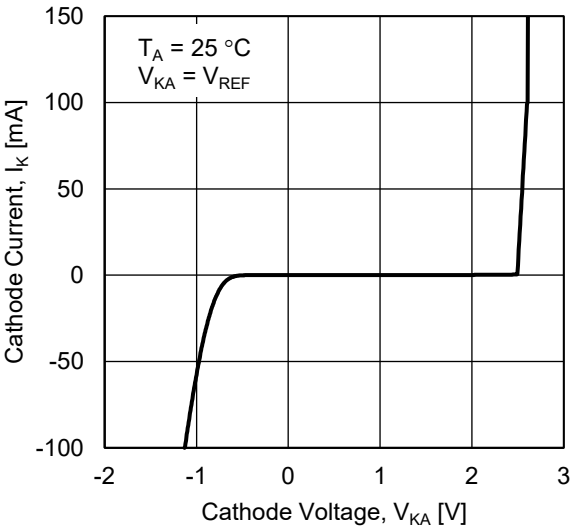
I_K vs. V_{KA} (I)



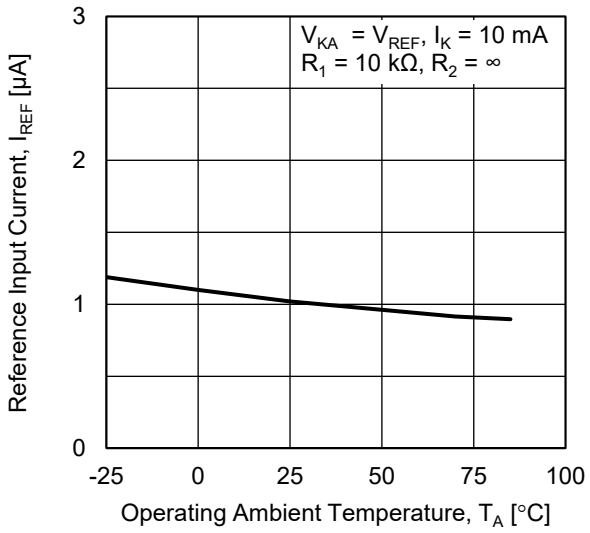
ΔV_{REF} vs. V_{KA}



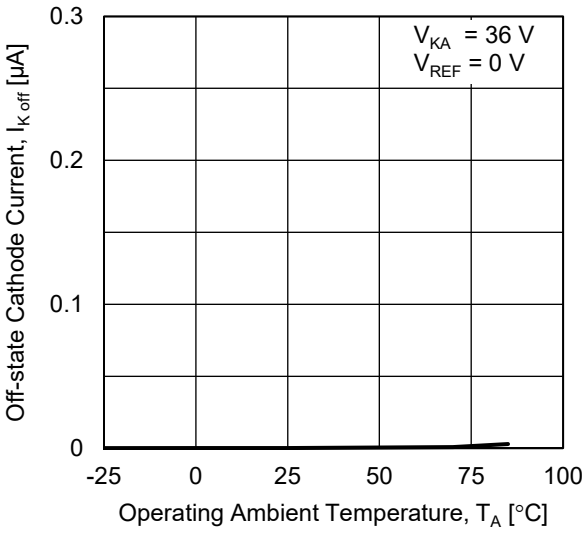
I_K vs. V_{KA} (II)



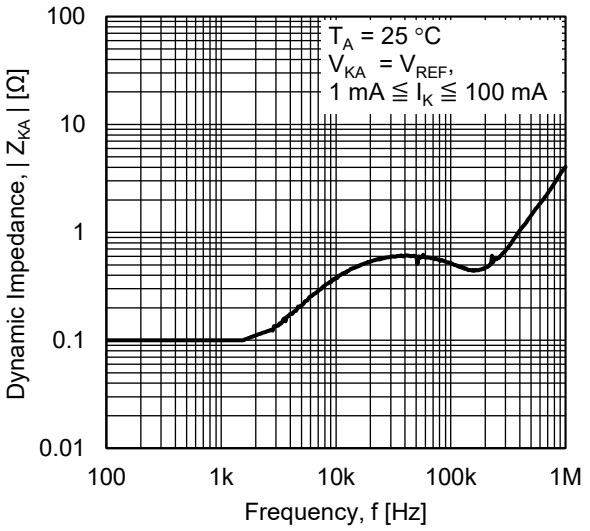
I_{REF} vs. T_A



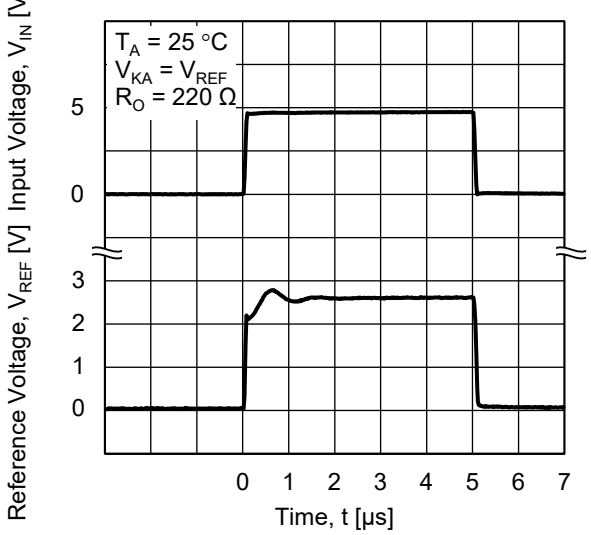
$I_{K\,off}$ vs. T_A



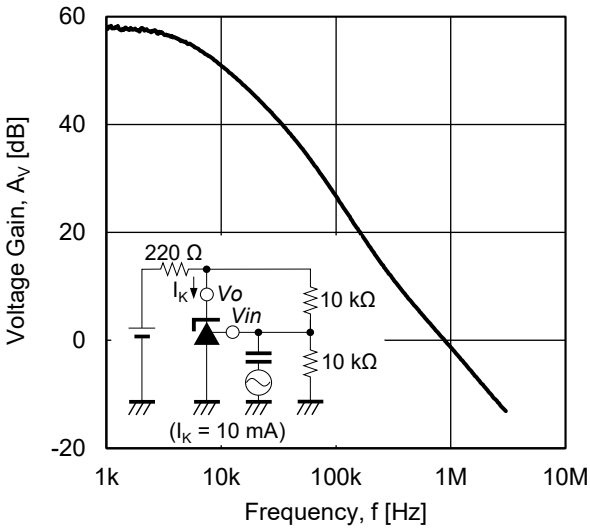
| Z_{KA} | vs. f



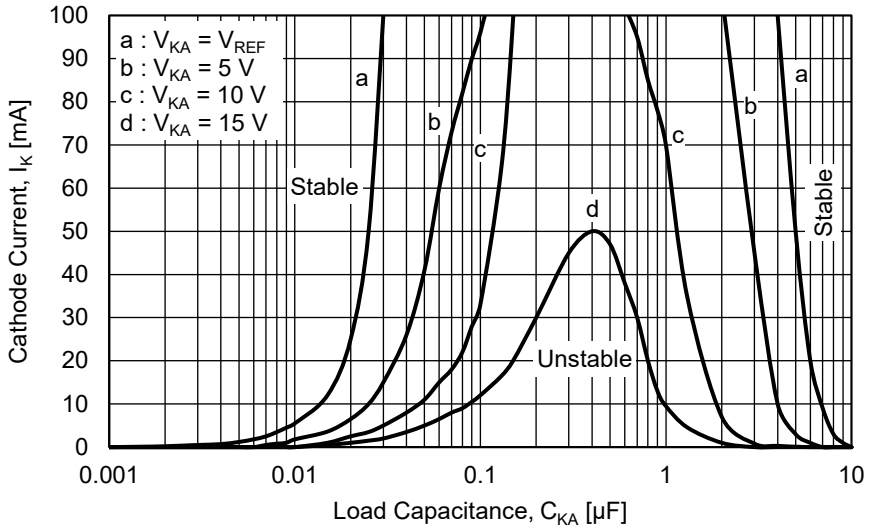
Pulse Response



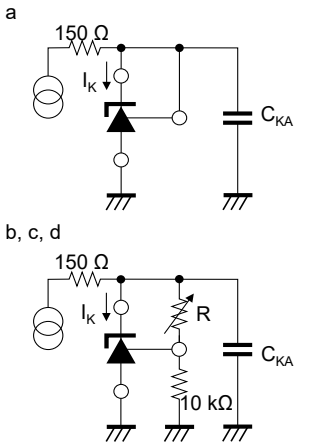
A_V vs. f



STABILITY AREA



TEST CIRCUIT



C_{KA} : Monolithic Ceramic Capacitors

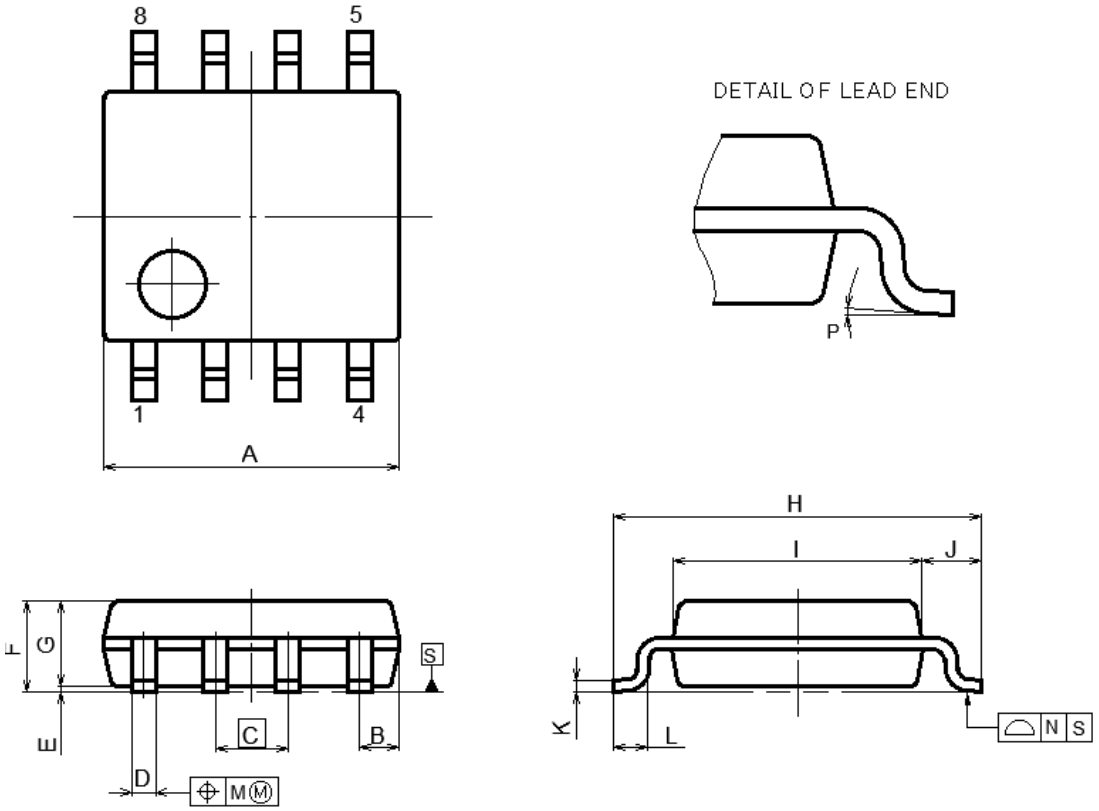
Caution of Stability Area

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

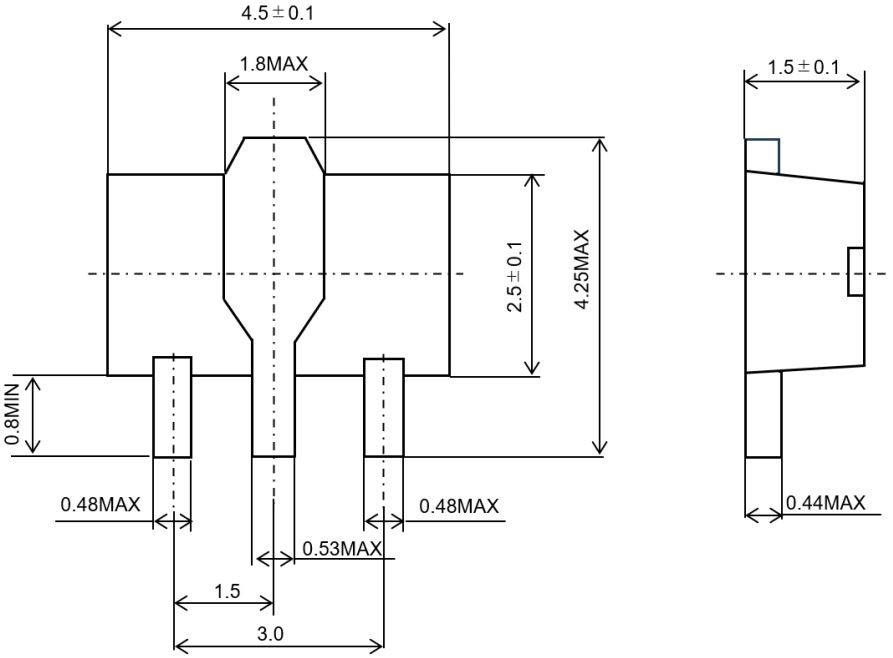
(UNIT:mm)

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)

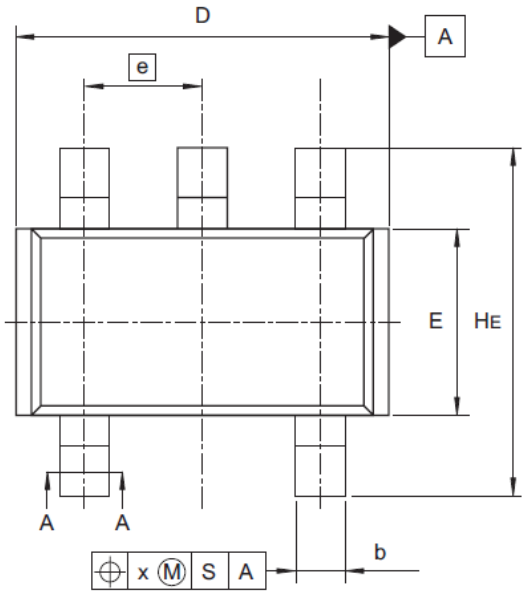
JEITA Package code	RENESAS code	Previous code	MASS(TYP.) [g]
SC-62	PLZZ0004CA-A	UPAK / UPAKV	0.050[g]

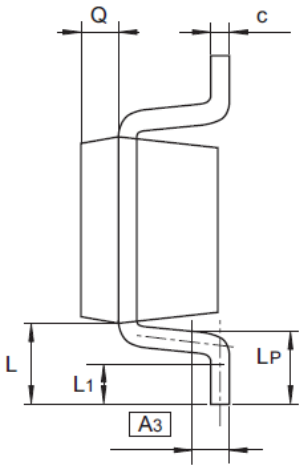
(UNIT : mm)

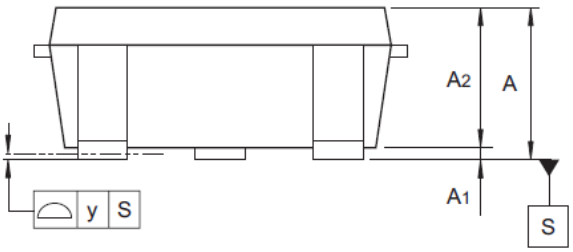


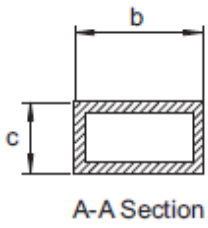
5 PIN PLASTIC MINI MOLD (SC-74A)

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









A-A Section

(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
L_P	0.2	—	0.6
x	—	—	0.05
y	—	—	0.05
Q	—	0.3	—

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