

# AN1433SSM

High accuracy, variable output, low voltage operation shunt regulator

## ■ Overview

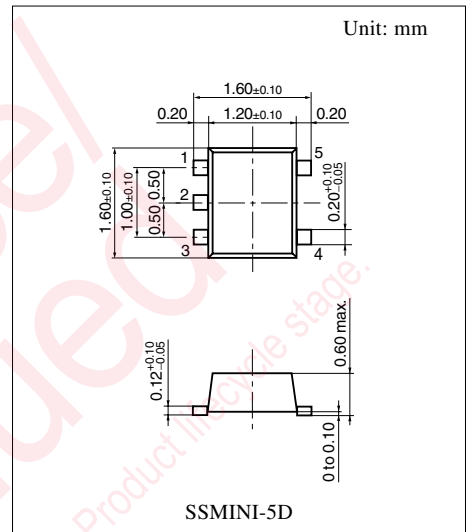
The AN1433SSM is a low voltage operation and highly accurate positive voltage variable output type shunt regulator IC. Since the output voltage is adjustable from approximately 1.25 V to 15 V, it is suitable for a power supply of small-sized 3 V-system portable equipment. Also, it contributes to the miniaturization of set equipment by the adoption of the small type surface mounting package.

## ■ Features

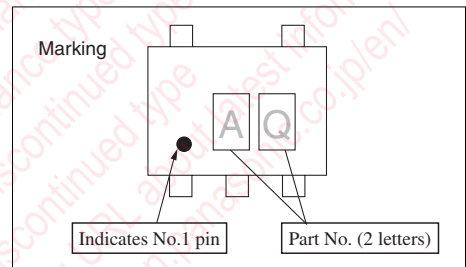
- Highly accurate reference voltage: 1.25 V (allowance:  $\pm 1\%$ )
- Low voltage operation: 1.25 V to 14 V
- Small type surface mounting package

## ■ Applications

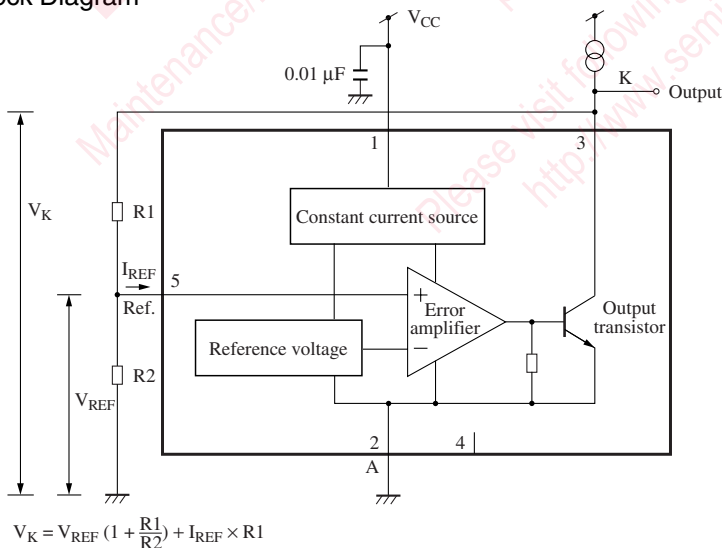
- Cellular phone, PHS, office automation equipment and other small-sized portable equipment



Note) The package of this product will be changed to lead-free type (SSMINI-5DA). See the new package dimensions section later of this datasheet.



## ■ Block Diagram



### ■ Pin Descriptions

| Pin No. | Description |   |
|---------|-------------|---|
| 1       | $V_{CC}$    | Power source current supply pin.  |
| 2       | Anode       | The reference voltage pin for the constant voltage of this shunt regulator IC. The current from $V_{CC}$ , cathode and reference flow out from this pin.  |
| 3       | K: Cathode  | The constant voltage output pin of this shunt regulator. The supplied current more than necessary to this pin is bypassed to anode pin by the output transistor.  |
| 4       | N.C.        | Nothing is connected to this pin. If high voltage is applied, the characteristics of the IC may be affected.  |
| 5       | Reference   | The reference voltage (1.25 V typical) pin. Although the impedance is high under the normal using conditions, be careful that the impedance drops and current flows into the IC inside if a current or voltage is forced to apply from the outside. |

### ■ Absolute Maximum Ratings

| Parameter                                   | Symbol    | Rating      | Unit         |
|---|-----------|-------------|--------------|
| Cathode voltage                             | $V_K$     | 14.2        | V            |
| Reference voltage                           | $V_{REF}$ | 7           | V            |
| Supply current                              | $I_K$     | 1.5         | mA           |
| Reference current                           | $I_{REF}$ | 50          | $\mu$ A      |
| Cathode-anode reverse current               | $-I_{KA}$ | -10         | mA           |
| Cathode-reference reverse current           | $-I_{KR}$ | -10         | mA           |
| Cathode current                             | $I_K$     | 20          | mA           |
| Power dissipation <sup>*2</sup>             | $P_D$     | 50          | mW           |
| Operating ambient temperature <sup>*1</sup> | $T_{opr}$ | -30 to +85  | $^{\circ}$ C |
| Storage temperature <sup>*1</sup>           | $T_{stg}$ | -55 to +150 | $^{\circ}$ C |

Note) 1. Do not apply external currents or voltages to any pins not specifically mentioned.

For circuit currents, '+' denotes current flowing into the IC and '-' denotes current flowing out of the IC.

2. <sup>\*1</sup>: Except for the power dissipation, operating ambient temperature and storage temperature, all ratings are for  $T_a = 25^{\circ}$ C.

<sup>\*2</sup>: The value at  $T_a = 85^{\circ}$ C.

### ■ Recommended Operating Range

| Parameter      | Symbol   | Range           | Unit |
|----------------|----------|-----------------|------|
| Supply voltage | $V_{CC}$ | $V_{REF}$ to 14 | V    |

■ Electrical Characteristics at  $V_{CC} = 1.8\text{ V}$ ,  $T_a = 25^\circ\text{C}$

| Parameter                                     | Symbol                                 | Conditions  | Min    | Typ   | Max    | Unit          |
|---|--|---|--------|-------|--------|---------------|
| Reference voltage                             | $V_{REF}$                              | $I_K = 10\text{ mA}$  | 1.2375 | 1.25  | 1.2625 | V             |
| Reference voltage supply voltage fluctuation  | $\frac{\Delta V_{REF}}{\Delta V_{CC}}$ | $1.7\text{ V} \leq V_{CC} \leq 14.0\text{ V}$ ,<br>$I_K = 10\text{ mA}$ | —      | -0.73 | -1.5   | mV/V          |
| Reference voltage cathode current fluctuation | $\frac{\Delta V_{REF}}{\Delta I_K}$    | $0.2\text{ mA} \leq I_K \leq 20\text{ mA}$                              | —      | 0.04  | 0.3    | mV/mA         |
| Reference input current                       | $I_{REF}$                              | $R_1 = 10\text{ k}\Omega$ , $I_K = 10\text{ mA}$                        | —      | 4.0   | 10     | $\mu\text{A}$ |
| Minimum cathode current                       | $I_{K\text{ min}}$                     | $V_K = V_{REF}$   | —      | —     | 0.2    | mA            |
| Off time total current                        | $I_{OFF}$                              | $V_K = 14.0\text{ V}$ , $V_{REF} = 0\text{ V}$                          | —      | —     | 1      | $\mu\text{A}$ |
| Cathode saturation voltage                    | $V_{K\text{ sat}}$                     | $I_K = 10\text{ mA}$ , $V_{REF} = 1.3\text{ V}$                         | —      | 0.08  | 0.15   | V             |
| Supply current                                | ICC                                    | $I_K = 10\text{ mA}$  | —      | 0.75  | 1.50   | mA            |

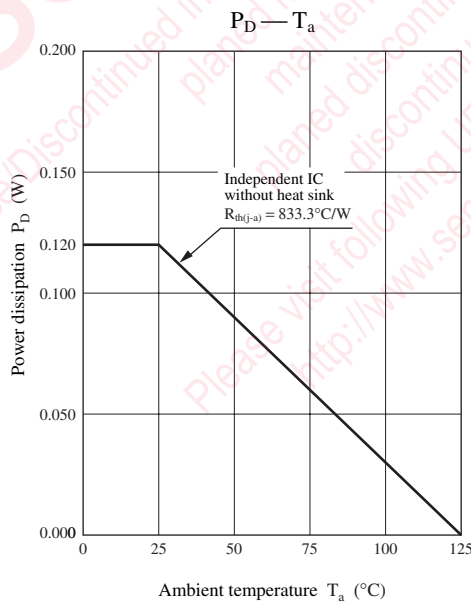
• Design reference data

Note) The characteristics listed below are theoretical values based on the IC design and are not guaranteed.

| Parameter                                       | Symbol                              | Conditions  | Reference value | Unit |
|---|-------------------------------------|---|-----------------|------|
| Reference voltage change with temperature       | $\frac{\Delta V_{REF}}{\Delta T_a}$ | $V_{KA} = V_{REF}$ , $I_{KA} = 10\text{ mA}$<br>$0^\circ\text{C} \leq T_a \leq +70^\circ\text{C}$     | 3               | mV   |
| Reference input current change with temperature | $\frac{\Delta I_{REF}}{\Delta T_a}$ | $R_1 = 10\text{ k}\Omega$ , $I_K = 10\text{ mA}$<br>$0^\circ\text{C} \leq T_a \leq +70^\circ\text{C}$ | 1.1             | mA   |

■ Application Notes

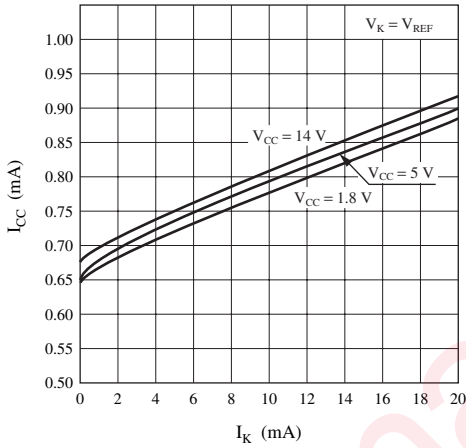
1.  $P_D - T_a$  curves of SSMINI-5D package



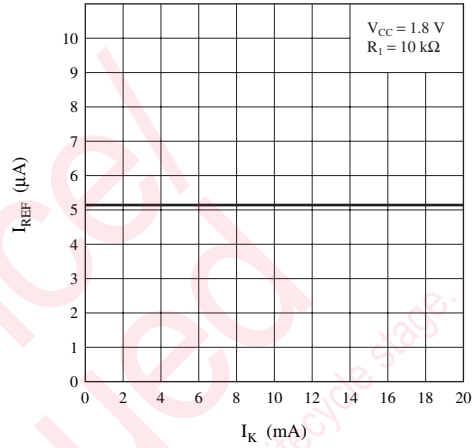
■ Application Notes (continued)

2. Main Characteristics

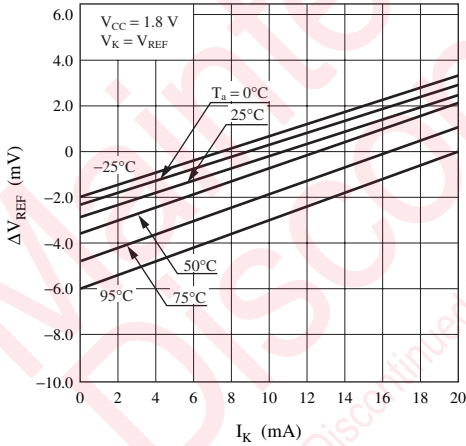
Supply current



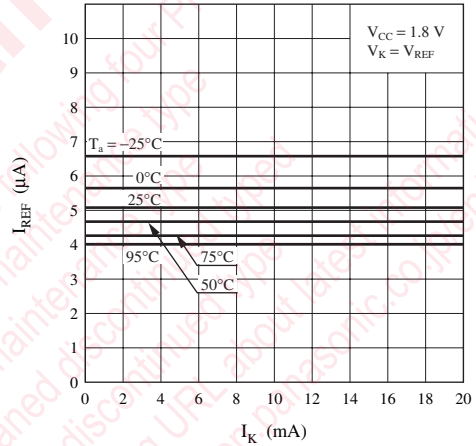
Reference input current



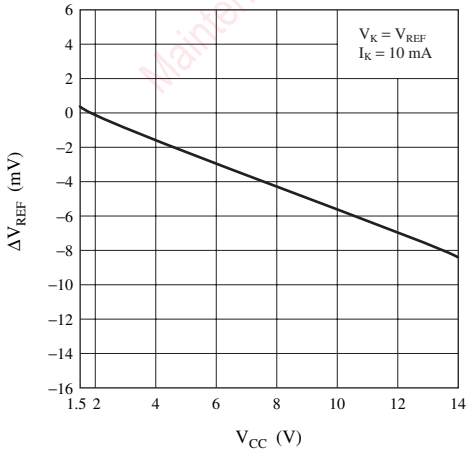
Reference voltage (temperature characteristics)



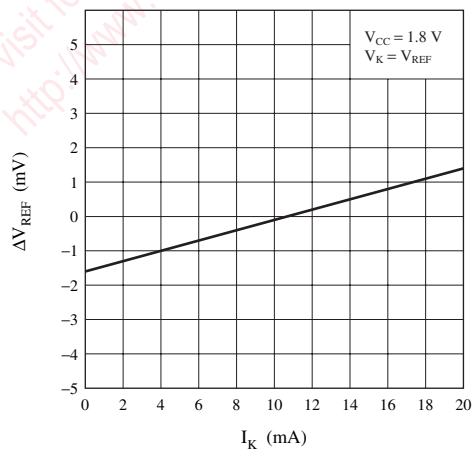
Reference current (temperature characteristics)



Reference voltage supply voltage fluctuation



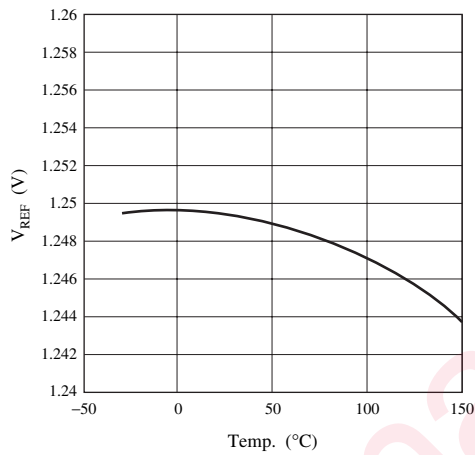
Reference voltage cathode current fluctuation



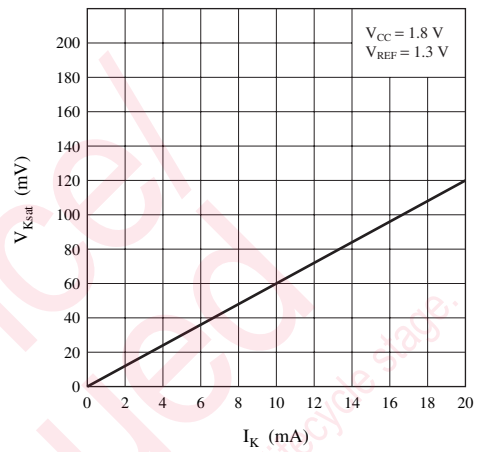
■ Application Notes (continued)

2. Main Characteristics (continued)

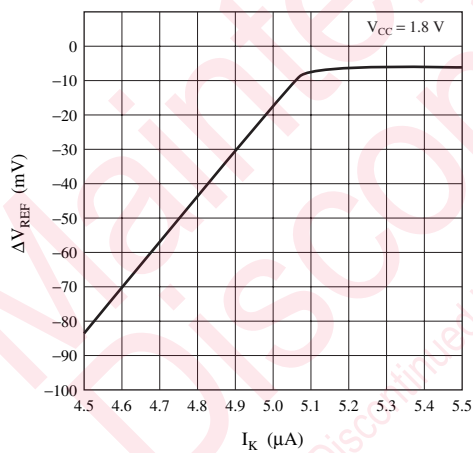
$V_{REF}$  temperature characteristic



Cathode saturation voltage



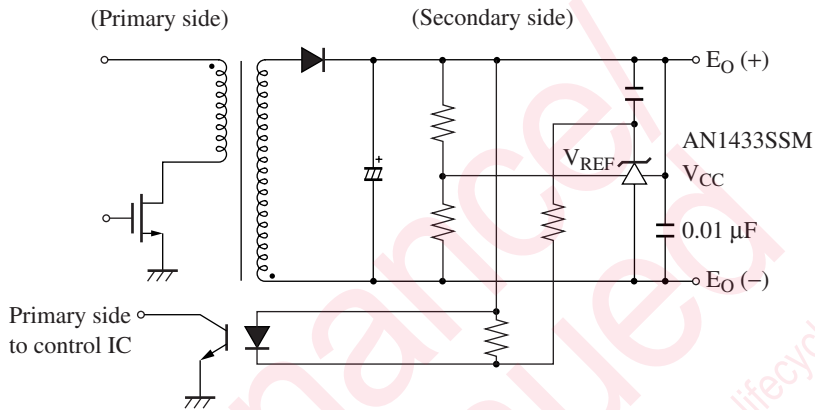
Minimum cathode current



■ Application Circuit Example

This circuit amplifies the error voltage of the secondary side output voltage in the insulation type switching power supply, then transfers it to the primary side via a photocoupler.

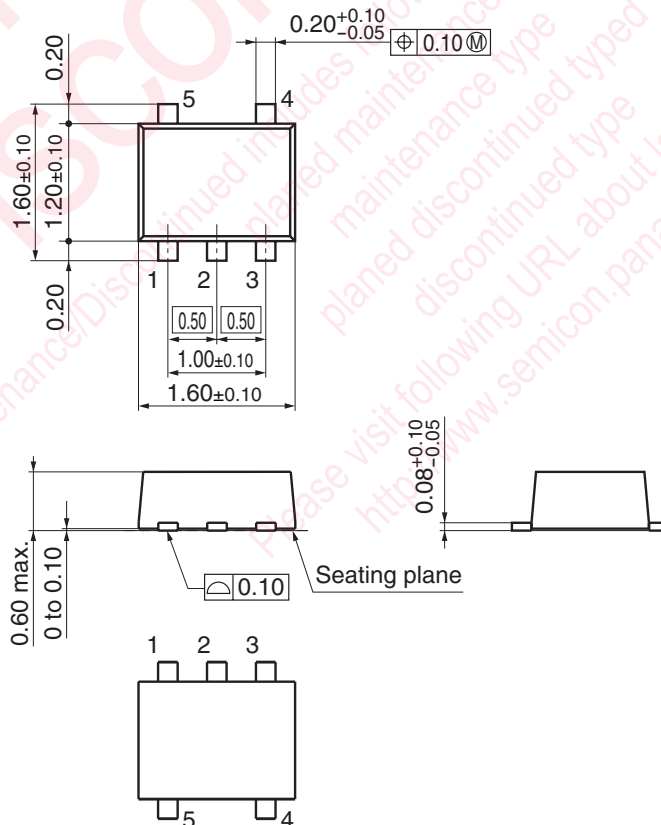
Replaceable with the conventional products (AN1431M, AN1431T, AN1432MS).



Note) As  $V_{CC}$  and cathode pin are separated,  $V_K$  can operate till  $0.15 V_{max}$  (at  $I_K = 10 \text{ mA}$ ) at least.

■ New Package Dimensions (Unit: mm)

- SSMINI-5DA (Lead-free package)



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