

# HJKE

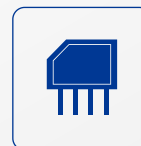
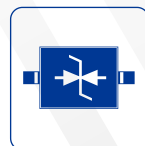
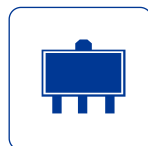
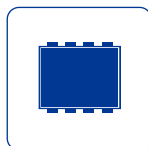
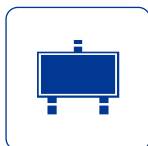
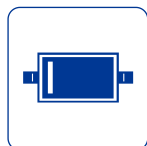
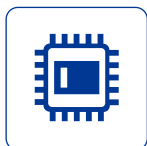
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## PRODUCT SPECIFICATION

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### MAIN PRODUCTS



## Description

The RT9013 family are the 500mA LDO with auto discharge function. It uses an advanced CMOS process and a PMOSFET pass device to achieve high power supply rejection ratio (PSRR), low noise, low dropout, low ground current, fast start-up and excellent output accuracy.

The RT9013 family are stable with a 1.0 $\mu$ F ceramic output capacitor, uses a precision voltage reference and feedback loop to achieve excellent Regulation and transient response.

The RT9013 family offered in a small SOT23-5 SC70-5 package, which are ideal for small form factor portable equipment.

## Features

- Low Power Consumption: 35  $\mu$ A (Typ)
- Maximum Output Current: 500mA
- Low Dropout Voltage:  
130mV@100mA ( $V_{OUT}=3.3V$ )  
450mV@300mA ( $V_{OUT}=3.3V$ )
- Operating Voltage Range: 2.0V ~ 7.0V
- Output Voltage Accurate:  $\pm 1\%$
- High PSRR: 80dB @1kHz
- Very Low Noise is 45uVrms at 1.2V output
- Good Transient Response
- Integrated Short-Circuit Protection
- Over-Temperature Protection
- Output Current Limit
- Low Temperature Coefficient
- Stable with Ceramic Capacitor
- RoHS Compliant and Lead (Pb) Free
- -40°C to +85°C Operating Temperature Range
- Fixed Output Voltage Versions: 1.2, 1.5, 1.8, 2.5, 2.8, 3.0 and 3.3V (steps 0.05V)  
Special Request: Any Voltage between 1.0V and 3.3V under specific business agreement
- Available in Green SOT23-5 SC70-5 Package

## Applications

- Battery-powered equipment
- Wireless Communication Equipment
- Reference voltage sources
- Audio/Video Equipment
- Low Power Microcontrollers
- Portable games

## Application Circuits

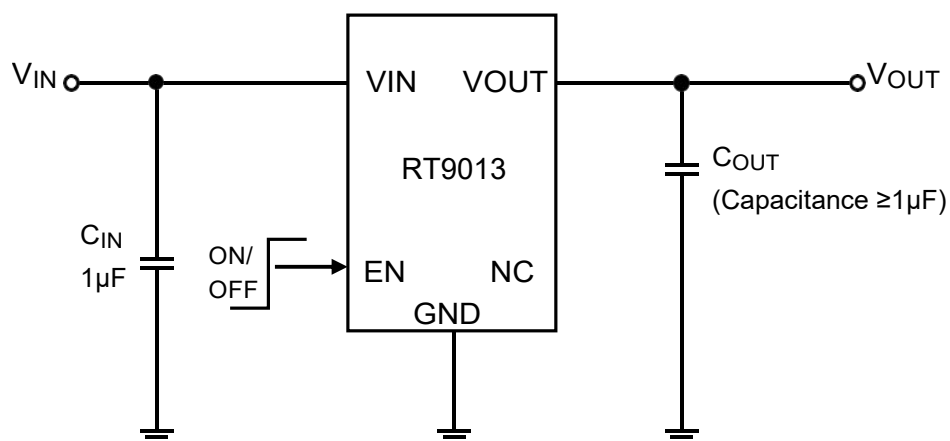
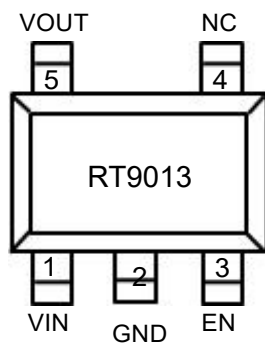


Figure 1. Typical Application Circuit

## Pin Configuration (TOP VIEW)



SOT23-5/SC70-5

## Pin Description

| Pin No. | Pin Name | Pin Function                                                                                     |
|---------|----------|--------------------------------------------------------------------------------------------------|
| 1       | VIN      | Supply input pin. Must be closely decoupled to GND with a 1 $\mu$ F or greater ceramic capacitor |
| 2       | GND      | Ground                                                                                           |
| 3       | EN       | Enable control input, active high. Do not leave EN floating                                      |
| 4       | NC       | No Connect                                                                                       |
| 5       | VOOUT    | Output pin. A 1 $\mu$ F low-ESR capacitor should be connected to this pin to ground              |

## Order Information

RT9013-XXYY

| Designator | Symbol              | Description                                     |
|------------|---------------------|-------------------------------------------------|
| XX         | Integer e.g 3.3V=33 | Output Voltage 1.2,1.5,1.8,2.5,2.8,3.0 and 3.3V |
| YY         | GB/GU5              | GB=SOT23-5 GU5=SC70-5                           |

## Absolute Maximum Ratings

| Item                                                       |         | Symbol            | Rating                       | Unit  |
|------------------------------------------------------------|---------|-------------------|------------------------------|-------|
| Supply Input Voltage                                       |         | V <sub>IN</sub>   | -0.3 ~ 7.0                   | V     |
| EN to GND                                                  |         | V <sub>EN</sub>   | -0.3 ~ V <sub>IN</sub> +0.3V | V     |
| Regulated Output Voltage                                   |         | V <sub>OUT</sub>  | -0.3 ~ V <sub>IN</sub> +0.3V | V     |
| Output Current                                             |         | I <sub>OUT</sub>  | Internally limited           | mA    |
| Power Dissipation<br>P <sub>D</sub> @T <sub>A</sub> =+25°C | SOT23-5 | P <sub>D</sub>    | 500                          | mW    |
|                                                            | SC70-5  | P <sub>D</sub>    | 400                          |       |
| Thermal Resistance<br>(Junction to air)                    | SOT23-5 | θ <sub>JA</sub>   | 250                          | °C /W |
|                                                            | SC70-5  | θ <sub>JA</sub>   | 315                          |       |
| Human Body Model (HBM)                                     |         |                   | ±4000                        | V     |
| Charged Device Mode (CDM)                                  |         |                   | ±1500                        | V     |
| Machine Mode (MM)                                          |         |                   | 200                          | V     |
| Storage Temperature Range                                  |         | T <sub>STG</sub>  | -65 ~ +150                   | °C    |
| Operating Junction Temperature                             |         | T <sub>J</sub>    | +150                         | °C    |
| Lead Temperature (Soldering 10s)                           |         | T <sub>LEAD</sub> | +260                         | °C    |

Note:

- 1、Stresses beyond those listed under Absolute Maximum Ratings may cause permanent damage to the device. These are stress ratings only and functional operation of the device at these conditions is not implied. Exposure to absolute-maximum-rated conditions for extended period may affect device reliability.
- 2、Ratings apply to ambient temperature at +25°C.
- 3、The package thermal impedance is calculated in accordance to JESD 51-7.

## Recommended Operating Conditions

| Item                          | Min | Max | Unit |
|-------------------------------|-----|-----|------|
| Operating Ambient Temperature | -40 | +85 | °C   |
| Input Voltage                 | 2.0 | 7.0 | V    |
| Output Voltage                | 0.8 | 3.3 | V    |

## Electronic Characteristics

Test Conditions:  $V_{IN} = V_{OUT} + 1V$ ,  $C_{IN} = C_{OUT} = 1\mu F$ ,  $T_A = 25^\circ C$ , unless otherwise specified

| Parameter                                 | Symbol                                         | Test Conditions                                                                      |         | Min                        | Typ   | Max                        | Unit  |
|-------------------------------------------|------------------------------------------------|--------------------------------------------------------------------------------------|---------|----------------------------|-------|----------------------------|-------|
| Input Voltage                             | V <sub>IN</sub>                                |                                                                                      |         | 2.0                        | ——    | 7.0                        | V     |
| Quiescent Current                         | I <sub>Q</sub>                                 | V <sub>IN</sub> > V <sub>OUTNOM</sub> , V <sub>IN</sub> =EN<br>I <sub>OUT</sub> =0mA |         | ——                         | 35    | 50                         | μA    |
| Shutdown Current                          | I <sub>SHDN</sub>                              | EN=0 V , V <sub>OUT</sub> =0 V                                                       |         | ——                         | 0.01  | 0.05                       | μA    |
| Output Voltage                            | V <sub>OUT</sub>                               | V <sub>IN</sub> = V <sub>OUTNOM</sub> +1V<br>I <sub>OUT</sub> =10mA                  |         | V <sub>OUT</sub> x<br>0.99 | ——    | V <sub>OUT</sub> x<br>1.01 | V     |
| Output Current                            | I <sub>OUT</sub>                               | V <sub>IN</sub> = V <sub>OUTNOM</sub> +1V                                            |         | 400                        | ——    | ——                         | mA    |
| Dropout Voltage<br>V <sub>OUT</sub> =3.3V | V <sub>DROP</sub>                              | I <sub>OUT</sub> =100mA                                                              |         | ——                         | 130   | ——                         | mV    |
|                                           |                                                | I <sub>OUT</sub> =300mA                                                              |         | ——                         | 450   | ——                         |       |
| Line Regulation                           | Δ V <sub>LINE</sub>                            | I <sub>OUT</sub> =10mA<br>V <sub>OUTNOM</sub> +1.0V ≤ V <sub>IN</sub> ≤ 5.5V         |         | ——                         | 0.03  | 0.1                        | % / V |
| Load Regulation                           | Δ V <sub>LOAD</sub>                            | V <sub>IN</sub> = V <sub>OUTNOM</sub> +1V<br>1mA ≤ I <sub>OUT</sub> ≤ 300mA          |         | ——                         | 20    | 30                         | mV    |
| EN Threshold<br>Voltage                   | V <sub>CEH</sub>                               | CE“High”Voltage                                                                      |         | 1.5                        | ——    | ——                         | V     |
|                                           | V <sub>CEL</sub>                               | CE“Low”Voltage                                                                       |         | ——                         | ——    | 0.3                        | V     |
| EN PIN Current                            | I <sub>EN</sub>                                |                                                                                      |         | ——                         | 0.01  | ——                         | μA    |
| Current Limit                             | I <sub>LIMIT</sub>                             |                                                                                      |         | ——                         | 500   | ——                         | mA    |
| Short Current                             | I <sub>SHORT</sub>                             | V <sub>OUT</sub> = GND                                                               |         | ——                         | 100   | ——                         | mA    |
| Output Noise Voltage                      | V <sub>ON</sub>                                | V <sub>OUT</sub> =2.8V , I <sub>OUT</sub> =200mA<br>BW = 10Hz~100KHz,                |         | ——                         | 70    | ——                         | μVrms |
|                                           |                                                | V <sub>OUT</sub> =1.2V , I <sub>OUT</sub> =200mA<br>BW = 10Hz~100KHz,                |         | ——                         | 45    | ——                         | μVrms |
| Power Supply<br>Rejection Rate            | PSRR                                           | I <sub>OUT</sub> =20mA                                                               | f=1kHz  | ——                         | 80    | ——                         | dB    |
|                                           |                                                | V <sub>OUT</sub> =3.3V                                                               | f=10kHz | ——                         | 75    | ——                         | dB    |
| Temperature<br>Coefficient                | Δ V <sub>OUT</sub> /<br>Δ T * V <sub>OUT</sub> | I <sub>OUT</sub> =30mA ,T <sub>A</sub> =0~70℃                                        |         | ——                         | ± 100 | ——                         | ppm/℃ |
| Soft-start Time                           | T <sub>S</sub>                                 | From enable to power on                                                              |         | ——                         | 25    | ——                         | μs    |
| ENpull-down resistance                    | RPD                                            | EN pull-down resistance                                                              |         | 0.8                        | 1     | 1.3                        | MΩ    |
| Thermal Shutdown<br>Temperature           | T <sub>SHDN</sub>                              | ——                                                                                   |         | ——                         | 155   | ——                         | ℃     |
| Thermal Shutdown<br>Hysteresis            | ΔT <sub>SHD</sub>                              | ——                                                                                   |         | ——                         | 20    | ——                         | ℃     |

Note : All limits specified at room temperature ( $T_A = 25^\circ C$ ) unless otherwise specified. All room temperature limits are 100% production tested. All limits at temperature extremes are ensured through correlation using standard Statistical Quality Control (SQC) methods. All limits are used to calculate Average Outgoing Quality Level (AOQL).

## Functional Block Diagram

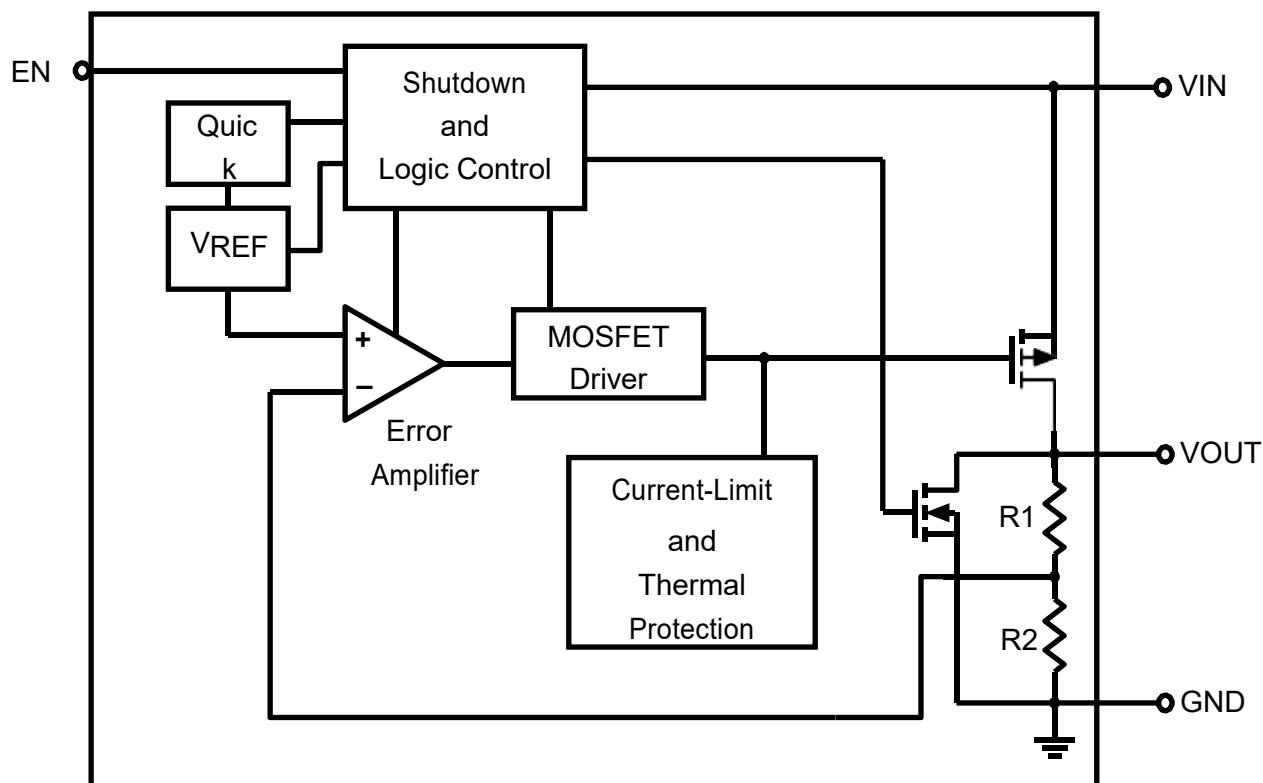
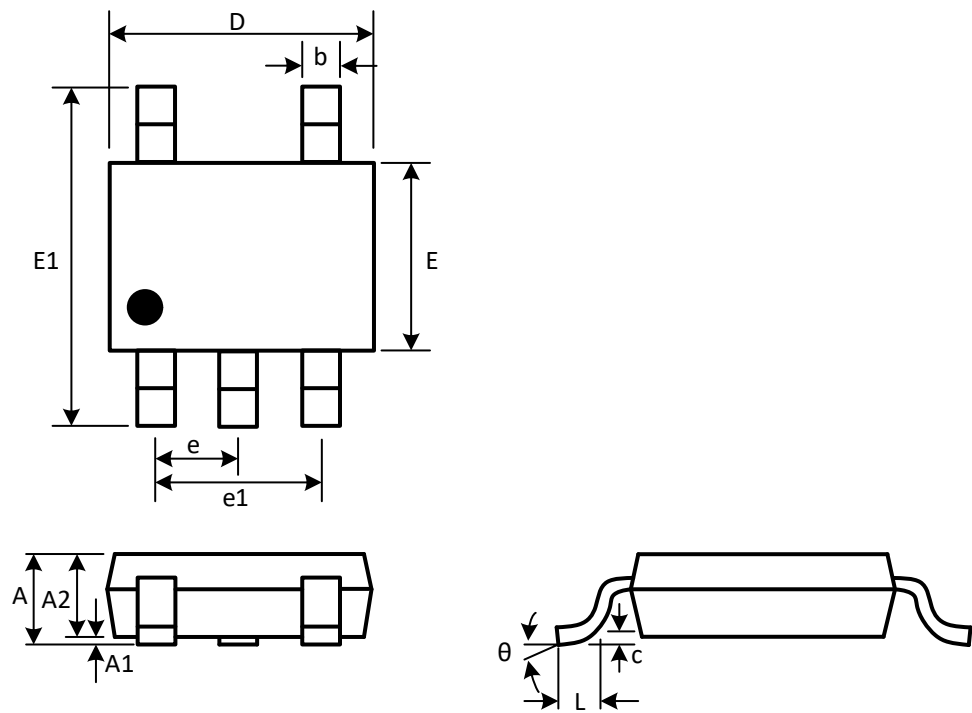


Figure 2.RT9013 Block Diagram

PACKAGE DESCRIPTION

SOT23-5



(Unit: mm)

| Symbol | Min        | Max   |
|--------|------------|-------|
| A      | 1.050      | 1.250 |
| A1     | 0.000      | 0.100 |
| A2     | 1.050      | 1.150 |
| b      | 0.300      | 0.500 |
| c      | 0.100      | 0.200 |
| D      | 2.820      | 3.020 |
| e      | 0.950(BSC) |       |
| e1     | 1.800      | 2.000 |
| E      | 1.500      | 1.700 |
| E1     | 2.650      | 2.950 |
| L      | 0.300      | 0.600 |
| θ      | 0°         | 8°    |