

# Micro-Power Voltage Detector

## General Description

The RT9827 is a micro-power voltage detector supervising the power supply voltage level for microprocessors ( $\mu$ P) or digital systems. It provides internally fixed threshold levels with 0.1V per step ranging from 1.2V to 5V, which covers most digital applications. It features low supply current of 3 $\mu$ A. The RT9827 performs supervisory function by sending out a reset signal whenever the  $V_{DD}$  voltage falls below a preset threshold level. This reset signal will last the whole period before  $V_{DD}$  recovering. Once  $V_{DD}$  recovered upcrossing the threshold level, the reset signal will be released after a certain delay time. RT9827 is provided in SC-82, SC-70-3, SOT-23-3, SOT-23-5 and SOT-89 packages.

## Ordering Information

| RT9827□-□□□□ |                                       |
|--------------|---------------------------------------|
| □            | Package Type                          |
| U3           | : SC-70-3                             |
| V            | : SOT-23-3                            |
| VL           | : SOT-23-3 (L-Type)                   |
| B            | : SOT-23-5                            |
| X            | : SOT-89                              |
| Y            | : SC-82                               |
| YR           | : SC-82 (R-Type)                      |
| □            | Lead Plating System                   |
| P            | : Pb Free                             |
| G            | : Green (Halogen Free and Pb Free)    |
| □            | Threshold Voltage                     |
| 12           | : 1.2V                                |
| 13           | : 1.3V                                |
| ⋮            |                                       |
| 49           | : 4.9V                                |
| 50           | : 5.0V                                |
| □            | Reset Active Timeout Period           |
| A            | = 0ms ( $\overline{\text{RESET}}$ )   |
| B            | = 55ms ( $\overline{\text{RESET}}$ )  |
| C            | = 220ms ( $\overline{\text{RESET}}$ ) |
| D            | = 450ms ( $\overline{\text{RESET}}$ ) |
| E            | = 0ms (RESET)                         |
| F            | = 55ms (RESET)                        |
| G            | = 220ms (RESET)                       |
| H            | = 450ms (RESET)                       |

Note :

Richtek products are :

- ▶ RoHS compliant and compatible with the current requirements of IPC/JEDEC J-STD-020.
- ▶ Suitable for use in SnPb or Pb-free soldering processes.

## Features

- Internally Fixed Threshold 1.2V to 5V in 0.1V Step
- High Accuracy  $\pm 1.5\%$
- Low Supply Current 3 $\mu$ A
- No External Components Required
- Quick Reset within 20 $\mu$ s
- Built-in Recovery Delay Include 0ms, 55ms, 220ms, 450ms Options
- Low Functional Supply Voltage 0.9V
- N-Channel Open-Drain Output
- Small SC-82, SC-70-3, SOT-23-3, SOT-23-5, SOT-89 Packages
- RoHS Compliant and 100% Lead (Pb)-Free

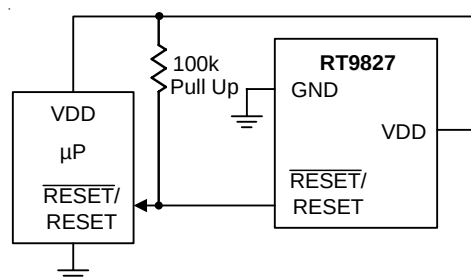
## Applications

- Computers
- Controllers
- Intelligent Instruments
- Critical  $\mu$ P and  $\mu$ C Power Monitoring
- Portable/Battery-Powered Equipment

## Marking Information

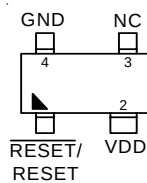
For marking information, contact our sales representative directly or through a Richtek distributor located in your area.

## Typical Application Circuit

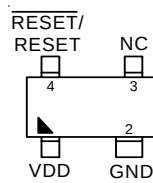


## Pin Configurations

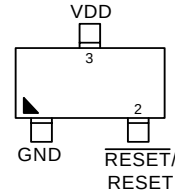
(TOP VIEW)



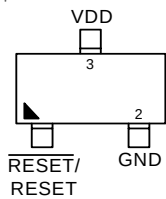
SC-82



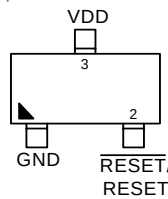
SC-82 (R-Type)



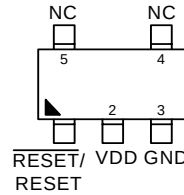
SC-70-3



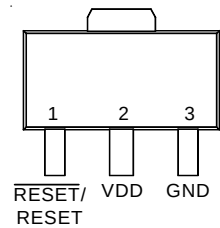
SOT-23-3



SOT-23-3 (L-Type)



SOT-23-5

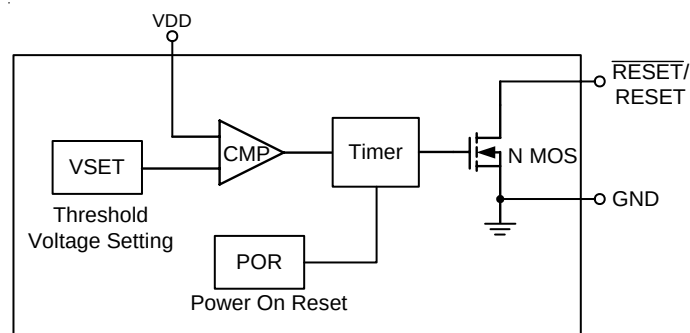


SOT-89

## Functional Pin Description

| Pin Name                  | Pin Function                         |
|---------------------------|--------------------------------------|
| GND                       | Ground.                              |
| $\overline{\text{RESET}}$ | Active Low Open-Drain Reset Output.  |
| RESET                     | Active High Open-Drain Reset Output. |
| VDD                       | Supply Voltage Input.                |

## Function Block Diagram



## Absolute Maximum Ratings (Note 1)

- Terminal Voltage (with Respect to GND)
  - $V_{DD}$  ----- -0.3V to 6.0V
- All Other Inputs ----- -0.3V to ( $V_{DD} + 0.3V$ )
- Input Current,  $I_{VDD}$  ----- 20mA
- Power Dissipation,  $P_D$  @  $T_A = 25^\circ C$ 
  - SC-70 / SC-82 ----- 0.25W
  - SOT-23-3 ----- 0.4W
  - SOT-23-5 ----- 0.4W
  - SOT-89 ----- 0.55W
- Package Thermal Resistance (Note 2)
  - SC-70 / SC-82,  $\theta_{JA}$  -----  $400^\circ C/W$
  - SOT-23-3,  $\theta_{JA}$  -----  $250^\circ C/W$
  - SOT-23-5,  $\theta_{JA}$  -----  $250^\circ C/W$
  - SOT-89,  $\theta_{JA}$  -----  $180^\circ C/W$
- Lead Temperature (Soldering, 10sec.) -----  $260^\circ C$
- Storage Temperature Range -----  $-65^\circ C$  to  $125^\circ C$
- ESD Susceptibility (Note 3)
  - HBM (Human Body Mode) ----- 2kV
  - MM (Machine Mode) ----- 200V

## Recommended Operating Conditions (Note 4)

- Junction Temperature Range -----  $-40^\circ C$  to  $125^\circ C$
- Ambient Temperature Range -----  $-40^\circ C$  to  $85^\circ C$

## Electrical Characteristics

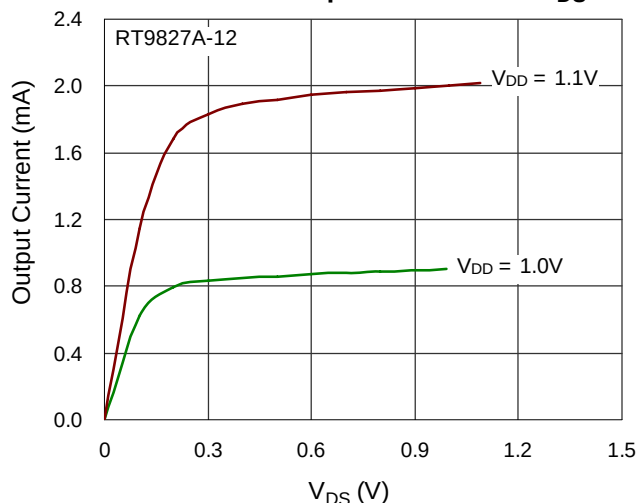
( $V_{DD} = 3V$ ,  $T_A = 25^\circ C$ , unless otherwise specified)

| Parameter                              |           | Symbol          | Test Conditions                          | Min  | Typ          | Max           | Unit    |
|----------------------------------------|-----------|-----------------|------------------------------------------|------|--------------|---------------|---------|
| Operating $V_{DD}$ ( $V_{OUT}$ ) Range |           | $V_{DD}$        |                                          | 0.9  | --           | 6             | V       |
| Supply Current                         |           | $I_{DD}$        | $V_{TH} = 3V$ , $V_{DD} = 4.5V$          | --   | 3            | 8             | $\mu A$ |
| Reset Threshold                        |           | $V_{TH}$        |                                          | --   | 1.2 to 5     | --            | V       |
| Threshold Voltage Accuracy             |           | $\Delta V_{TH}$ |                                          | -1.5 | --           | 1.5           | %       |
| $V_{DD}$ Drop to Reset Delay           |           | $t_{RD}$        | Drop = $V_{TH} - 125mV$                  | --   | 20           | --            | $\mu s$ |
| Reset Active Time<br>Out Period        | RT9827A/E | $t_{RP}$        | $V_{DD} \geq 1.02 \times V_{TH}$         | --   | 0            | --            | ms      |
|                                        | RT9827B/F |                 |                                          | 35   | 55           | 75            |         |
|                                        | RT9827C/G |                 |                                          | 143  | 220          | 297           |         |
|                                        | RT9827D/H |                 |                                          | 292  | 450          | 608           |         |
| RESET Output Voltage Low<br>(Note 5)   |           | $V_{OL}$        | $3 = V_{DD} < V_{TH}$ $I_{SINK} > 3.5mA$ | --   | --           | 0.4           | V       |
| Hysteresis Width                       |           | $V_{HYS}$       |                                          | --   | $0.01V_{TH}$ | $0.016V_{TH}$ | V       |

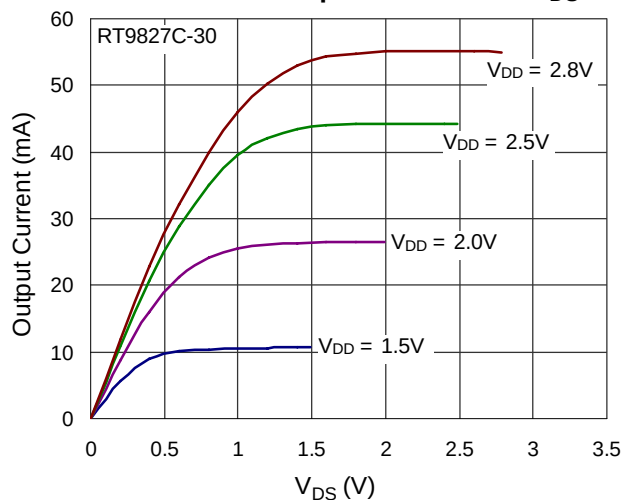
- Note 1.** Stresses listed as the above “Absolute Maximum Ratings” may cause permanent damage to the device. These are for stress ratings. Functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may remain possibility to affect device reliability.
- Note 2.**  $\theta_{JA}$  is measured in the natural convection at  $T_A = 25^\circ\text{C}$  on a low effective thermal conductivity test board of JEDEC 51-3 thermal measurement standard.
- Note 3.** Devices are ESD sensitive. Handling precaution is recommended.
- Note 4.** The device is not guaranteed to function outside its operating conditions.
- Note 5.** The voltage  $V_{OL}$  can be calculated by  $V_{OL} = V_{DD} - I_r * R$ . Where R is the pull-up resistor and  $I_r$  is the current flowing through the pull-up resistor. For typical application ( $R=100\text{k}\Omega$ ),  $V_{OL}$  is less than 0.2V.

# Typical Operating Characteristics

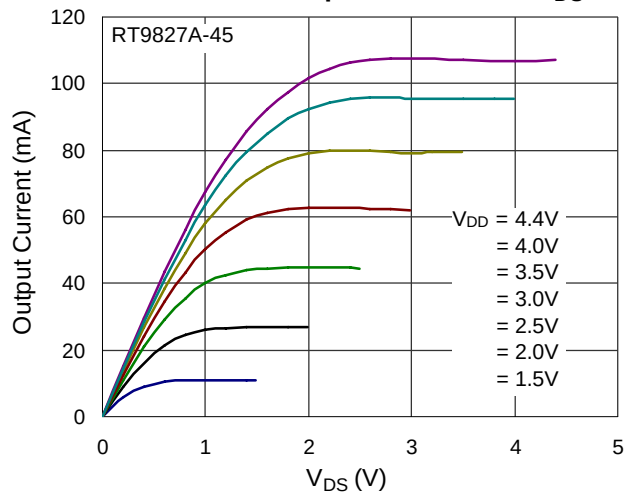
Nch Driver Output Current vs.  $V_{DS}$



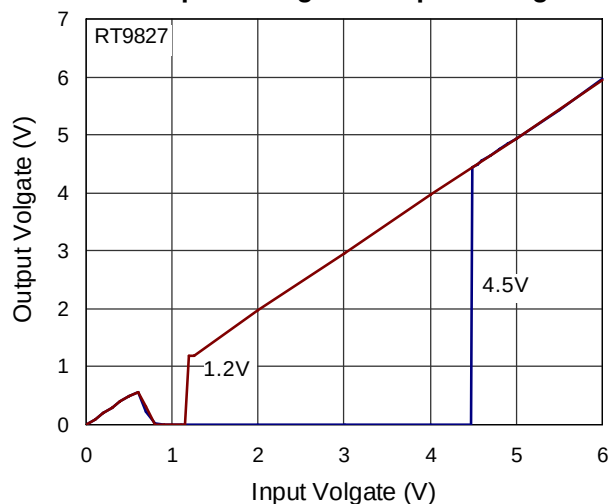
Nch Driver Output Current vs.  $V_{DS}$



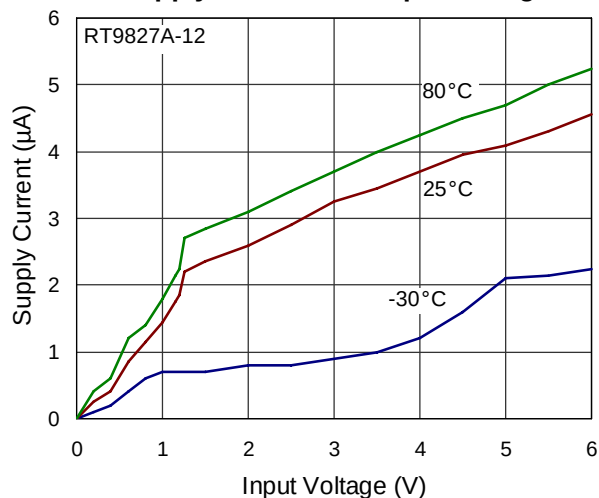
Nch Driver Output Current vs.  $V_{DS}$



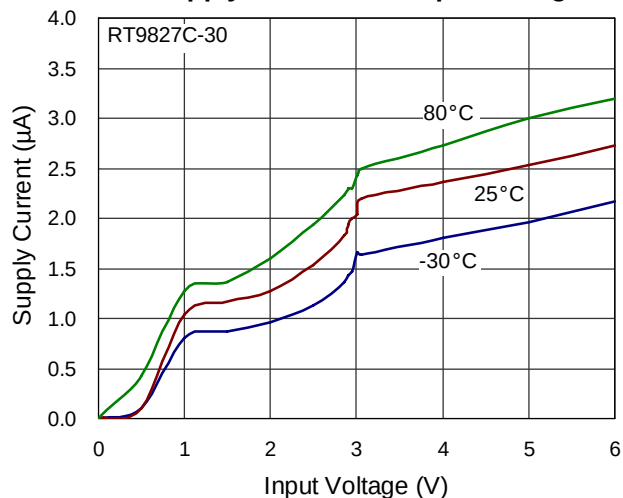
Output Voltage vs. Input Voltage



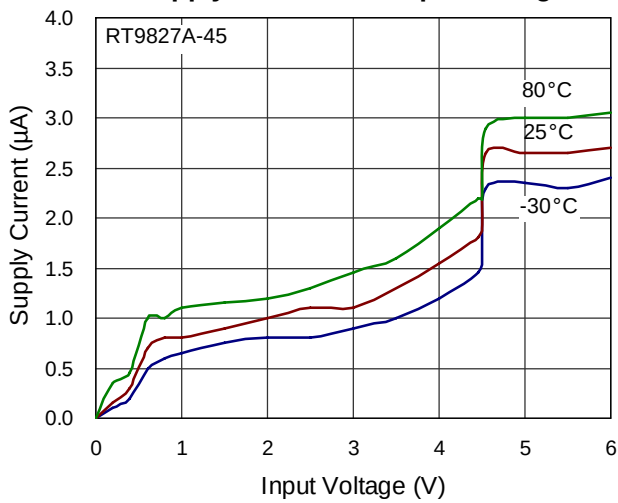
Supply Current vs. Input Voltage



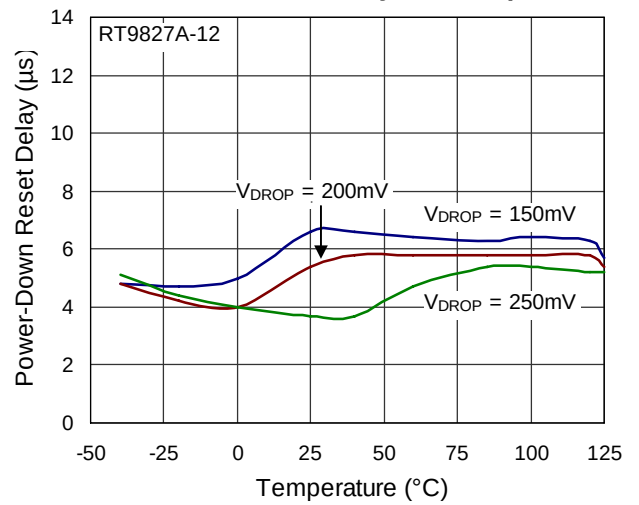
Supply Current vs. Input Voltage



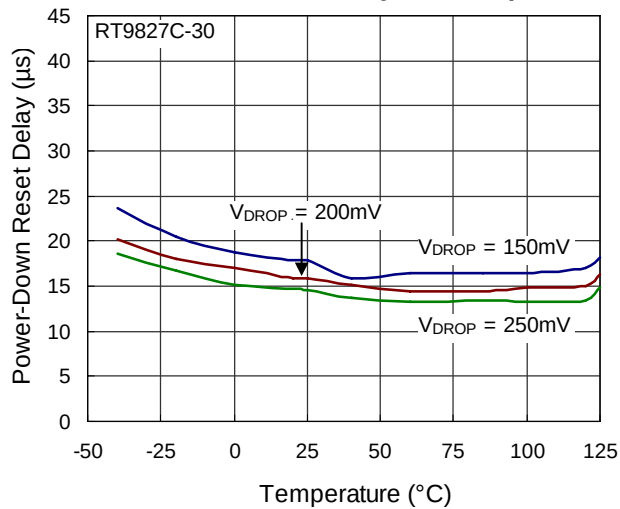
### Supply Current vs. Input Voltage



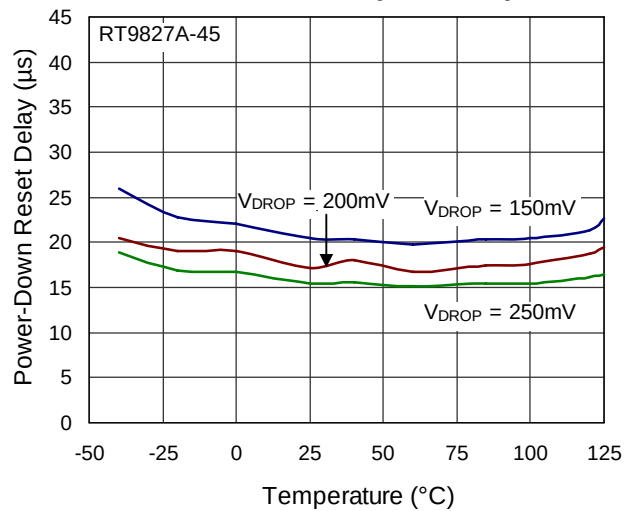
### Power-Down Reset Delay vs. Temperature



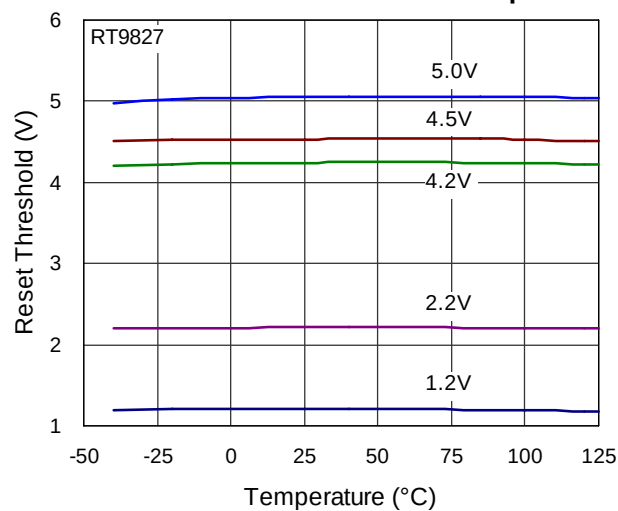
### Power-Down Reset Delay vs. Temperature



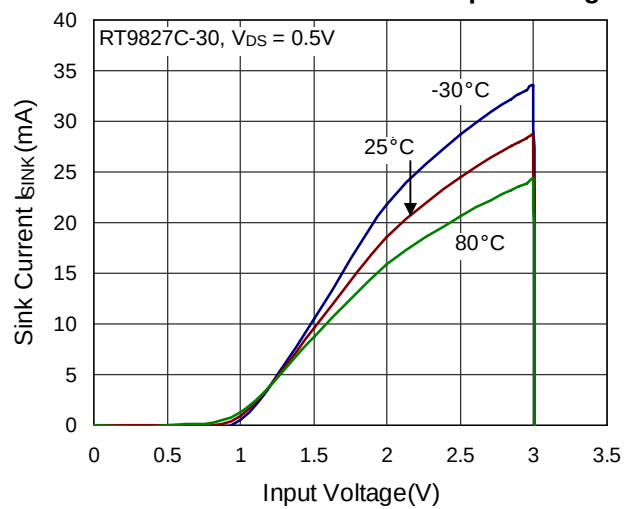
### Power-Down Reset Delay vs. Temperature



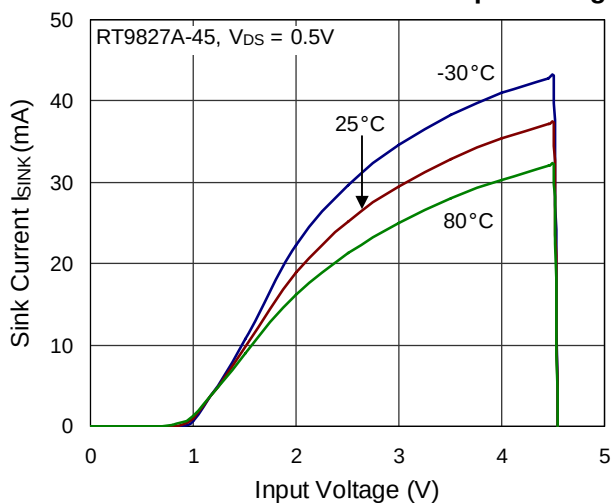
### Reset Threshold Deviation vs. Temperature



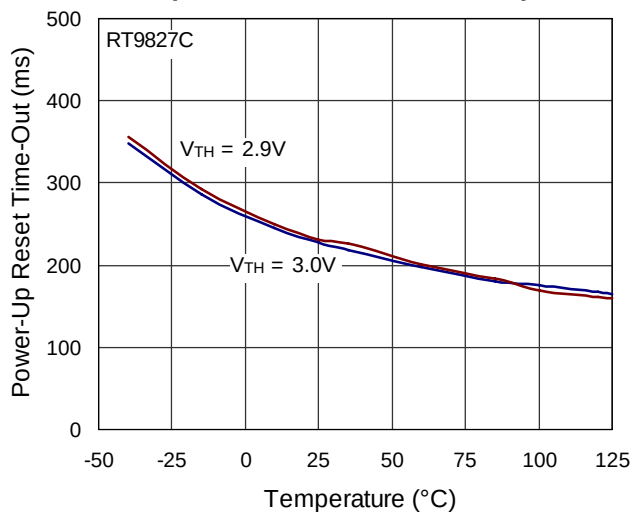
### Nch Driver Sink Current vs. Input Voltage



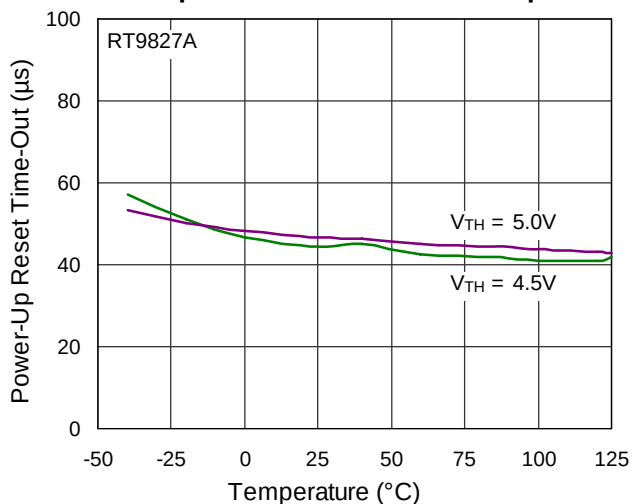
Nch Driver Sink Current vs. Input Voltage



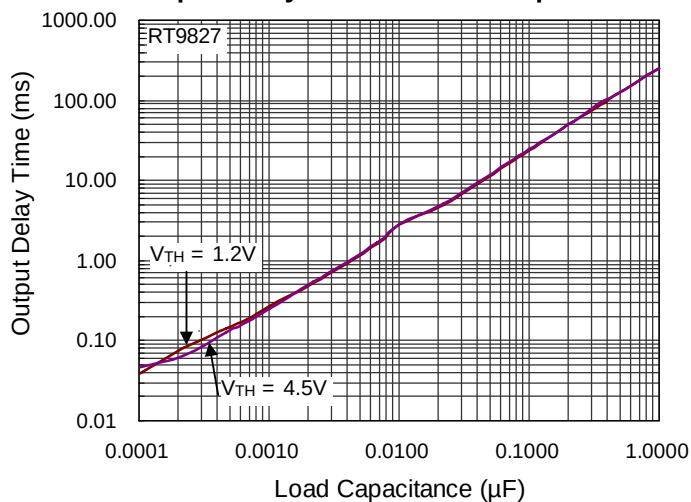
Power-Up Reset Time-Out vs. Temperature



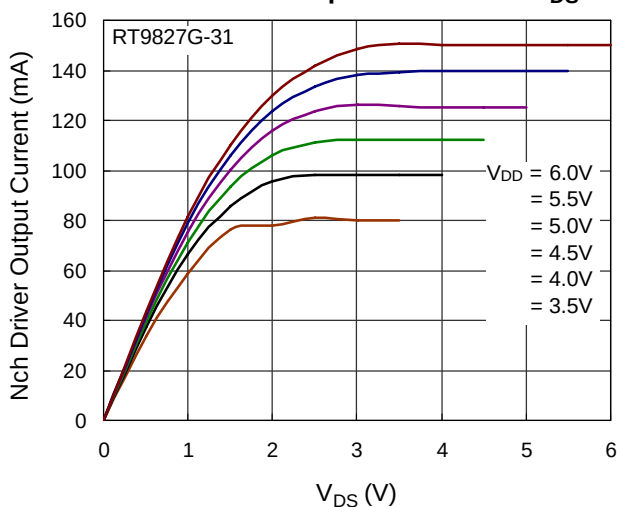
Power-Up Reset Time-Out vs. Temperature



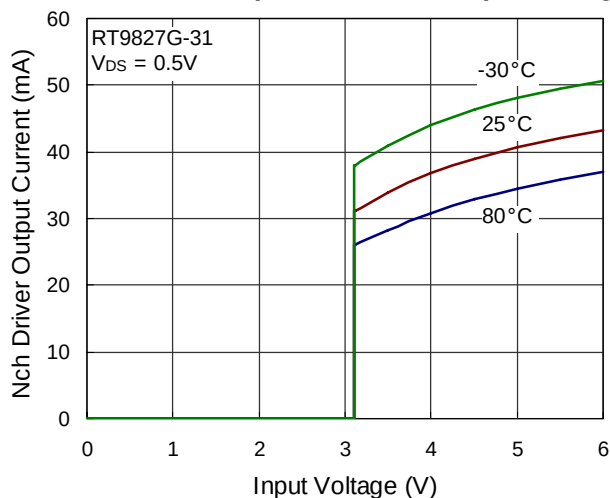
Output Delay Time vs. Load Capacitance



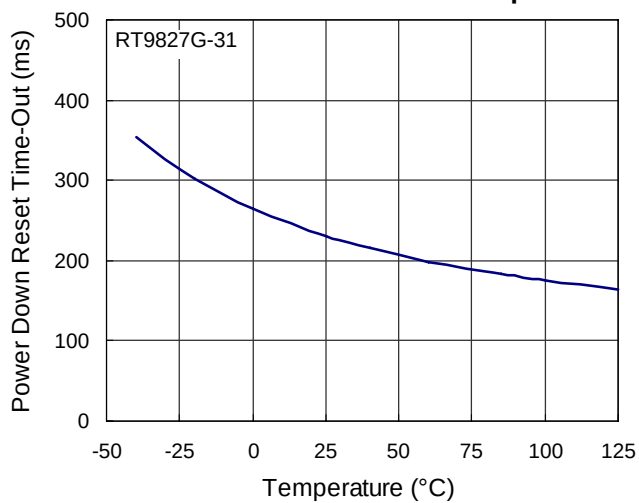
Nch Driver Output Current vs.  $V_{DS}$



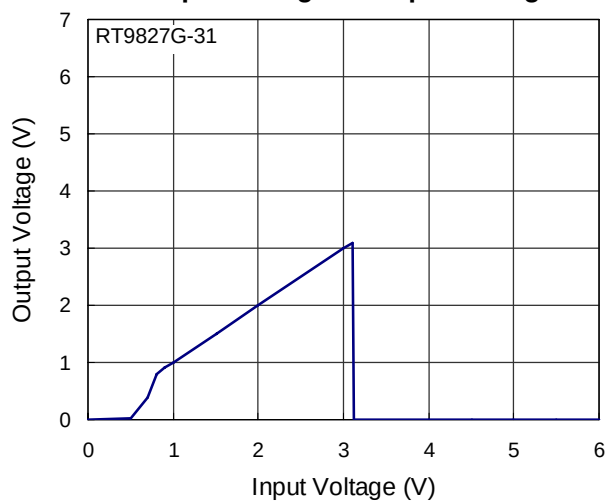
Nch Driver Output Current vs. Input Voltage



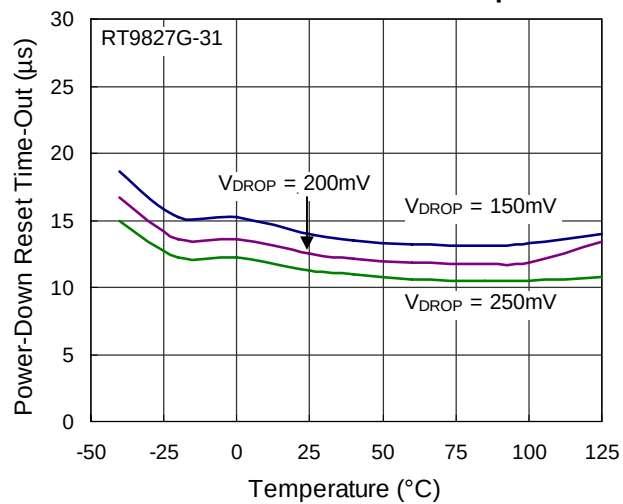
**Power Down Reset Time-Out vs. Temperature**



**Output Voltage vs. Input Voltage**



**Power Down Reset Time-Out vs. Temperature**



## Application Information

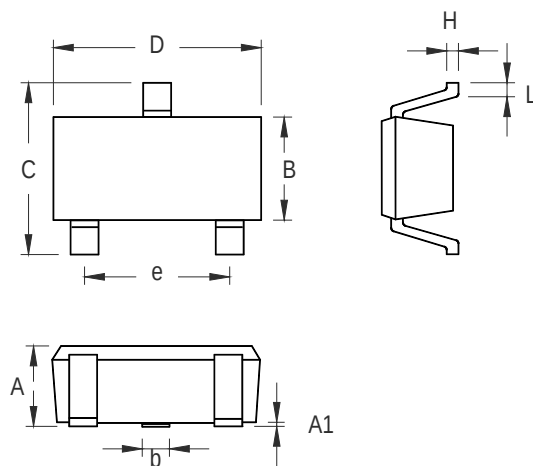
### Multiple Supplies

Mainly, the pull-up connected to the RT9827 will connect to the supply voltage that is being monitored at the IC's VDD pin. However, some systems may use the open-drain output to level-shift from the monitored supply to reset circuitry powered by some other supply.

### Benefits of Highly Accurate Reset Threshold

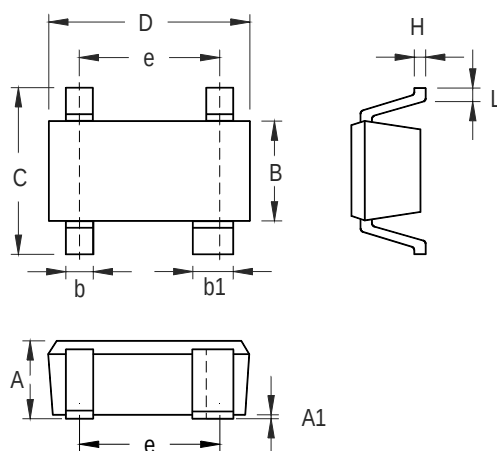
Most  $\mu$ P supervisor ICs have reset threshold voltages between 1% and 1.5% below the value of nominal supply voltages. This ensures a reset will not occur within 1% of the nominal supply, but will occur when the supply is 1.5% below nominal.

## Outline Dimension



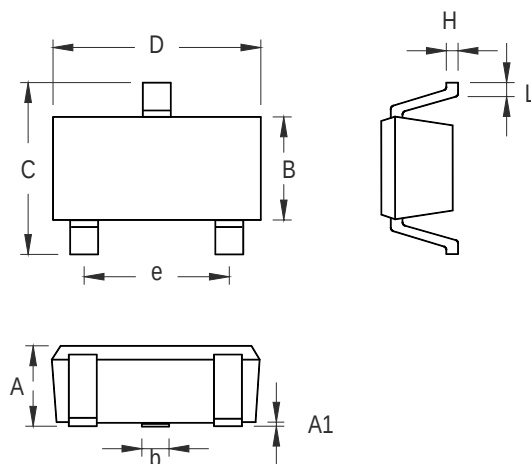
| Symbol | Dimensions In Millimeters |       | Dimensions In Inches |       |
|--------|---------------------------|-------|----------------------|-------|
|        | Min                       | Max   | Min                  | Max   |
| A      | 0.800                     | 1.100 | 0.031                | 0.044 |
| A1     | 0.000                     | 0.100 | 0.000                | 0.004 |
| B      | 1.150                     | 1.350 | 0.045                | 0.054 |
| b      | 0.150                     | 0.400 | 0.006                | 0.016 |
| C      | 1.800                     | 2.450 | 0.071                | 0.096 |
| D      | 1.800                     | 2.250 | 0.071                | 0.089 |
| e      | 1.300                     |       | 0.051                |       |
| H      | 0.080                     | 0.260 | 0.003                | 0.010 |
| L      | 0.210                     | 0.460 | 0.008                | 0.018 |

SC-70-3 Surface Mount Package



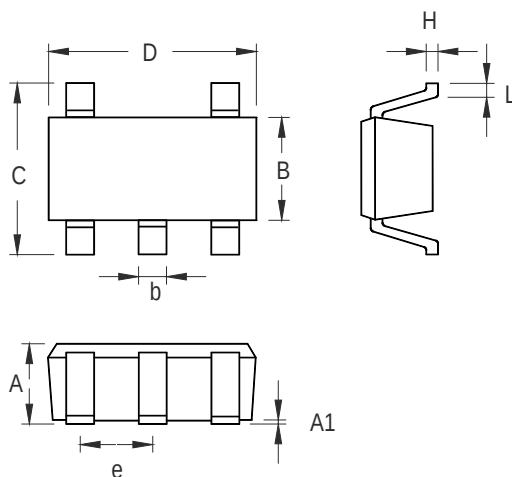
| Symbol | Dimensions In Millimeters |       | Dimensions In Inches |       |
|--------|---------------------------|-------|----------------------|-------|
|        | Min                       | Max   | Min                  | Max   |
| A      | 0.800                     | 1.100 | 0.031                | 0.043 |
| A1     | 0.000                     | 0.100 | 0.000                | 0.004 |
| B      | 1.150                     | 1.350 | 0.045                | 0.053 |
| b      | 0.150                     | 0.400 | 0.006                | 0.016 |
| b1     | 0.350                     | 0.500 | 0.014                | 0.020 |
| C      | 1.800                     | 2.450 | 0.071                | 0.096 |
| D      | 1.800                     | 2.200 | 0.071                | 0.087 |
| e      | 1.300                     |       | 0.051                |       |
| H      | 0.080                     | 0.260 | 0.003                | 0.010 |
| L      | 0.200                     | 0.460 | 0.008                | 0.018 |

SC-82 Surface Mount Package



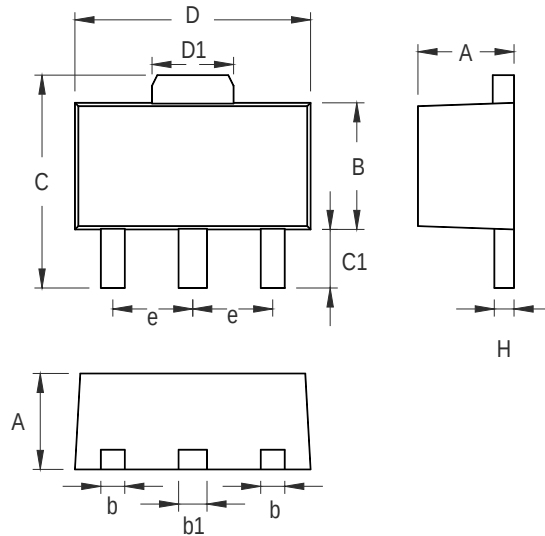
| Symbol | Dimensions In Millimeters |       | Dimensions In Inches |       |
|--------|---------------------------|-------|----------------------|-------|
|        | Min                       | Max   | Min                  | Max   |
| A      | 0.889                     | 1.295 | 0.035                | 0.051 |
| A1     | 0.000                     | 0.152 | 0.000                | 0.006 |
| B      | 1.397                     | 1.803 | 0.055                | 0.071 |
| b      | 0.356                     | 0.508 | 0.014                | 0.020 |
| C      | 2.591                     | 2.997 | 0.102                | 0.118 |
| D      | 2.692                     | 3.099 | 0.106                | 0.122 |
| e      | 1.803                     | 2.007 | 0.071                | 0.079 |
| H      | 0.080                     | 0.254 | 0.003                | 0.010 |
| L      | 0.300                     | 0.610 | 0.012                | 0.024 |

### SOT-23-3 Surface Mount Package



| Symbol | Dimensions In Millimeters |       | Dimensions In Inches |       |
|--------|---------------------------|-------|----------------------|-------|
|        | Min                       | Max   | Min                  | Max   |
| A      | 0.889                     | 1.295 | 0.035                | 0.051 |
| A1     | 0.000                     | 0.152 | 0.000                | 0.006 |
| B      | 1.397                     | 1.803 | 0.055                | 0.071 |
| b      | 0.356                     | 0.559 | 0.014                | 0.022 |
| C      | 2.591                     | 2.997 | 0.102                | 0.118 |
| D      | 2.692                     | 3.099 | 0.106                | 0.122 |
| e      | 0.838                     | 1.041 | 0.033                | 0.041 |
| H      | 0.080                     | 0.254 | 0.003                | 0.010 |
| L      | 0.300                     | 0.610 | 0.012                | 0.024 |

**SOT-23-5 Surface Mount Package**



| Symbol | Dimensions In Millimeters |       | Dimensions In Inches |       |
|--------|---------------------------|-------|----------------------|-------|
|        | Min                       | Max   | Min                  | Max   |
| A      | 1.397                     | 1.600 | 0.055                | 0.063 |
| b      | 0.356                     | 0.483 | 0.014                | 0.019 |
| B      | 2.388                     | 2.591 | 0.094                | 0.102 |
| b1     | 0.406                     | 0.533 | 0.016                | 0.021 |
| C      | 3.937                     | 4.242 | 0.155                | 0.167 |
| C1     | 0.787                     | 1.194 | 0.031                | 0.047 |
| D      | 4.394                     | 4.597 | 0.173                | 0.181 |
| D1     | 1.397                     | 1.753 | 0.055                | 0.069 |
| e      | 1.448                     | 1.549 | 0.057                | 0.061 |
| H      | 0.356                     | 0.432 | 0.014                | 0.017 |

### 3-Lead SOT-89 Surface Mount Package

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