

## 36 V Input Voltage Detector with Delay Function for Automotive Applications

NO.EC-187-180530

### OUTLINE

The R3119N is a CMOS-based 36V input (absolute maximum ratings: 50V) voltage detector (VD) provided with high detector threshold accuracy and ultra-low supply current. Internally, the R3119N consists of a voltage reference unit, a hysteresis comparator, a resistor net for setting output voltage and an output driver transistor.

The R3119NxxxA is equipped with a C<sub>D</sub> pin and the R3119NxxxE is equipped with a SENSE pin.

The supply current of IC is only 3.3  $\mu$ A. The detector threshold range is 2.3 V to 12 V, and the detector threshold accuracy is 1.5%. The output type is Nch. open drain "L" output.

The R3119N is available in a 5-pin SOT-23-5 package. Use of this package achieves high-density mounting on boards.

### FEATURES

- Operating Voltage Range (Maximum Rating) ..... R3119NxxxA: 1.2 V to 36.0 V (50.0V)  
R3119NxxxE: 2.1 V to 6.0 V (7.0V)
- Operating Temperature Range ..... -40°C to 105°C
- Supply Current ..... Typ. 3.3  $\mu$ A
- Detector Threshold Range ..... 2.3 V to 12.0 V (0.1 V steps)
- Detector Threshold Accuracy .....  $\pm 1.5\%$  (Ta=25°C)
- Detector Threshold Temperature Coefficient ..... Typ.  $\pm 100$  ppm / °C
- Release Output Delay Time ..... R3119NxxxA : Typ.85 ms (at C<sub>D</sub> = 0.01  $\mu$ F)
- Release Output Delay Time Accuracy ..... R3119NxxxA : -50% to 80%
- Output Type ..... Nch. Open Drain
- Package ..... SOT-23-5

### APPLICATIONS

- Voltage monitoring for electronic control units such as EV inverter and battery charge control unit.

**R3119N**

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**SELECTION GUIDE**

The detector threshold and the voltage detection type are user selectable options.

| Product Name     | Package  | Quantity per Reel | Pb Free | Halogen Free |
|------------------|----------|-------------------|---------|--------------|
| R3119Nxxx*-TR-#E | SOT-23-5 | 3,000 pcs         | Yes     | Yes          |

xxx : Specify the set detector threshold ( $-V_{SET}$ ) in the range of 2.3 V (023) to 12.0 V (120) in 0.1 V steps.

\*: Select the voltage detection type from the following;

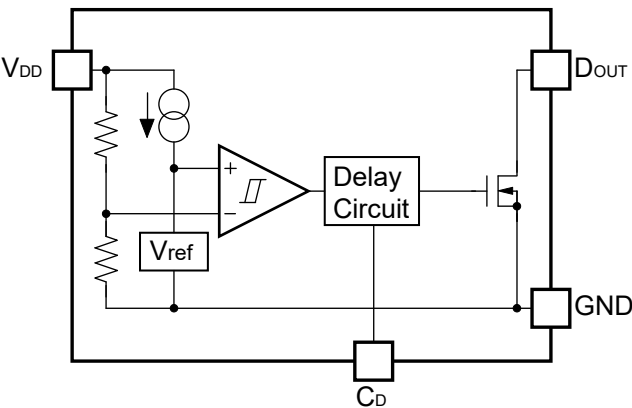
- A: with  $C_D$  pin type
- E: with SENSE pin type

#: Specify the automotive class code.

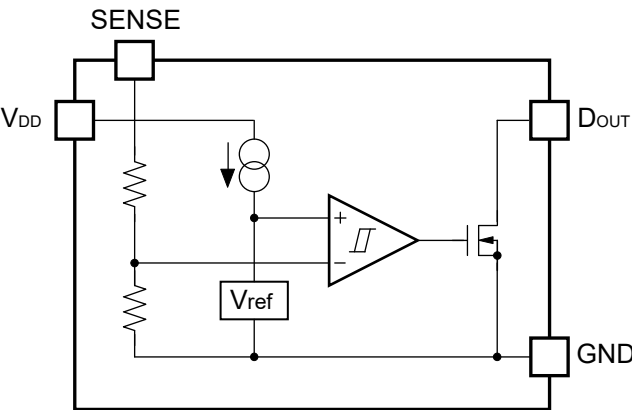
|   | Operating Temperature Range | Guaranteed Specs Temperature Range | Screening                 | AEC-Q100 |
|---|-----------------------------|------------------------------------|---------------------------|----------|
| J | -40°C to 105°C              | -40°C to 105°C                     | Low and High Temperatures | Grade 2  |

**BLOCK DIAGRAMS**

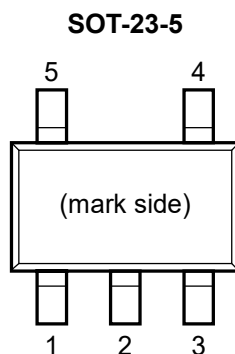
**R3119NxxxA**



**R3119NxxxE**



## PIN CONFIGURATIONS



**R3119N Pin Configurations**

| Pin No. | Symbol             | Description                               |
|---------|--------------------|-------------------------------------------|
| 1       | $V_{DD}$           | Input Pin                                 |
| 2       | GND <sup>(1)</sup> | Ground Pin                                |
| 3       | GND <sup>1</sup>   | Ground Pin                                |
| 4       | D <sub>OUT</sub>   | Output Pin ("L" active at detection)      |
| 5       | C <sub>D</sub>     | Release Output Delay Set Pin (R3119NxxxA) |
|         | SENSE              | VD Voltage SENSE Pin (R3119NxxxE)         |

<sup>(1)</sup> No.2 and No.3 pins must be wired to the GND plane when mounted on board.

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### ABSOLUTE MAXIMUM RATINGS

| Symbol             | Item                                           |                       | Rating       | Unit |
|--------------------|------------------------------------------------|-----------------------|--------------|------|
| V <sub>DD</sub>    | Supply Voltage (R3119NxxxA)                    |                       | −0.3 to 50.0 | V    |
|                    | Supply Voltage (R3119NxxxE)                    |                       | −0.3 to 7.0  | V    |
| V <sub>DOUT</sub>  | D <sub>OUT</sub> Pin Output Voltage            |                       | −0.3 to 7.0  | V    |
| V <sub>CD</sub>    | C <sub>D</sub> Pin Output Voltage (R3119NxxxA) |                       | −0.3 to 7.0  | V    |
| V <sub>SENSE</sub> | SENSE Pin Input Voltage (R3119NxxxE)           |                       | −0.3 to 50.0 | V    |
| I <sub>OUT</sub>   | D <sub>OUT</sub> Pin Output Current            |                       | 20           | mA   |
| P <sub>D</sub>     | Power Dissipation (SOT-23-5) <sup>(1)</sup>    | Standard Land Pattern | 420          | mW   |
| T <sub>j</sub>     | Junction Temperature                           |                       | −40 to 125   | °C   |
| T <sub>stg</sub>   | Storage Temperature                            |                       | −55 to 125   | °C   |

#### ABSOLUTE MAXIMUM RATINGS

Electronic and mechanical stress momentarily exceeded absolute maximum ratings may cause the permanent damages and may degrade the life time and safety for both device and system using the device in the field. The functional operation at or over these absolute maximum ratings is not assured.

### RECOMMENDED OPERATING CONDITIONS

| Symbol             | Item                                 |  | Rating     | Unit |
|--------------------|--------------------------------------|--|------------|------|
| V <sub>DD</sub>    | Operating Voltage (R3119NxxxA)       |  | 1.25 to 36 | V    |
|                    | Operating Voltage (R3119NxxxE)       |  | 2.1 to 6   | V    |
| V <sub>SENSE</sub> | SENSE Pin Input Voltage (R3119NxxxE) |  | 0 to 36    | V    |
| T <sub>a</sub>     | Operating Temperature Range          |  | −40 to 105 | °C   |

#### RECOMMENDED OPERATING CONDITIONS

All of electronic equipment should be designed that the mounted semiconductor devices operate within the recommended operating conditions. The semiconductor devices cannot operate normally over the recommended operating conditions, even if when they are used over such conditions by momentary electronic noise or surge. And the semiconductor devices may receive serious damage when they continue to operate over the recommended operating conditions.

<sup>(1)</sup> Refer to *POWER DISSIPATION* for detailed information.

## ELECTRICAL CHARACTERISTICS

$C_D = 1000 \text{ pF}$ , pulled-up to 5 V with 100 k $\Omega$ , unless otherwise specified.

### R3119NxxxA

( $-40^\circ\text{C} \leq T_a \leq 105^\circ\text{C}$ )

| Symbol      | Item                                      | Conditions                                                                                        |                                                      | Min.    | Typ. | Max.    | Unit          |
|-------------|-------------------------------------------|---------------------------------------------------------------------------------------------------|------------------------------------------------------|---------|------|---------|---------------|
| $-V_{DET}$  | Detector Threshold                        | $V_{DD}$ pin                                                                                      | $T_a = 25^\circ\text{C}$                             | x 0.985 |      | x 1.015 | V             |
|             |                                           |                                                                                                   | $-40^\circ\text{C} \leq T_a \leq 105^\circ\text{C}$  | x 0.970 |      | x 1.020 |               |
| $V_{HYS}$   | Detector Threshold Hysteresis             |                                                                                                   |                                                      | 3.5     | 5    | 6.5     | %             |
| $I_{SS}$    | Supply Current                            | $V_{DD} = -V_{SET} - 0.1 \text{ V}$                                                               |                                                      |         | 3.3  | 5.6     | $\mu\text{A}$ |
|             |                                           | $V_{DD} = -V_{SET} + 1.0 \text{ V}$                                                               |                                                      |         | 3.3  | 5.5     |               |
| $V_{DDL}$   | Minimum Operating Voltage <sup>(1)*</sup> | $T_a = 25^\circ\text{C}$                                                                          |                                                      |         |      | 1.2     | V             |
|             |                                           | $-40^\circ\text{C} \leq T_a \leq 105^\circ\text{C}$                                               |                                                      |         |      | 1.25    |               |
| $I_{OUT}$   | Output Current<br>(Nch Driver Output Pin) | $V_{DD} = 1.5 \text{ V}, V_{DS} = 0.05 \text{ V}$                                                 |                                                      | 230     |      |         | $\mu\text{A}$ |
|             |                                           | $2.3 \text{ V} \leq -V_{SET} < 2.6 \text{ V}$                                                     | $V_{DD} = 2.2 \text{ V}$<br>$V_{DS} = 0.5 \text{ V}$ | 2.8     |      |         | mA            |
|             |                                           | $2.6 \text{ V} \leq -V_{SET} < 3.0 \text{ V}$                                                     | $V_{DD} = 2.5 \text{ V}$<br>$V_{DS} = 0.5 \text{ V}$ | 3.3     |      |         |               |
|             |                                           | $3.0 \text{ V} \leq -V_{SET}$                                                                     | $V_{DD} = 2.9 \text{ V}$<br>$V_{DS} = 0.5 \text{ V}$ | 3.5     |      |         |               |
| $I_{LEAK}$  | Nch. Driver Leakage Current               | $V_{DD} = 36 \text{ V}, V_{DS} = 6.0 \text{ V}$                                                   |                                                      |         |      | 0.2     | $\mu\text{A}$ |
| $t_{delay}$ | Release Output Delay Time                 | $V_{DD} = 1.5 \text{ V} \rightarrow -V_{SET} + 2.0 \text{ V}$<br>$C_D = 0.01 \text{ }\mu\text{F}$ |                                                      | 45      | 85   | 150     | ms            |

<sup>(1)</sup> The value is the minimum operating voltage when the output voltage is 0.1 V or less at detection. (The pull-up resistance; 100 k $\Omega$ , the pull-up voltage; 5.0 V)

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Pulled-up to 5 V with 100 kΩ, unless otherwise specified.

**R3119NxxxE**( $-40^{\circ}\text{C} \leq T_a \leq 105^{\circ}\text{C}$ )

| Symbol             | Item                                       | Conditions                                                                                                   |                                                                   | Min.    | Typ. | Max.    | Unit          |
|--------------------|--------------------------------------------|--------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------|---------|------|---------|---------------|
| $-V_{\text{DET}}$  | Detector Threshold                         | SENSE pin<br>$V_{\text{DD}} = 6\text{ V}$                                                                    | $T_a = 25^{\circ}\text{C}$                                        | x 0.985 |      | x 1.015 | V             |
|                    |                                            |                                                                                                              | $-40^{\circ}\text{C} \leq T_a \leq 105^{\circ}\text{C}$           | x 0.970 |      | x 1.020 |               |
| $V_{\text{HYS}}$   | Detector Threshold Hysteresis              | $V_{\text{DD}} = 6\text{ V}$                                                                                 |                                                                   | 3.5     | 5    | 6.5     | %             |
| $I_{\text{SS}}$    | Supply Current                             | $V_{\text{DD}} = 6\text{ V}, V_{\text{SENSE}} = -V_{\text{SET}} - 0.1\text{ V}$                              |                                                                   |         | 3.3  | 5.5     | $\mu\text{A}$ |
|                    |                                            | $V_{\text{DD}} = 6\text{ V}, V_{\text{SENSE}} = -V_{\text{SET}} + 1.0\text{ V}$                              |                                                                   |         | 3.3  | 5.5     |               |
| $V_{\text{DDL}}$   | Minimum Operating Voltage <sup>(1)*</sup>  |                                                                                                              |                                                                   |         |      | 2.1     | V             |
| $R_{\text{SENSE}}$ | SENSE Resistance                           |                                                                                                              |                                                                   | 4.5     |      | 120     | MΩ            |
| $I_{\text{OUT}}$   | Output Current<br>(Nch. Driver Output Pin) | $V_{\text{SENSE}} < -V_{\text{DET}}$                                                                         | $V_{\text{DD}} = 2.1\text{ V}$<br>$V_{\text{DS}} = 0.05\text{ V}$ | 420     |      |         | $\mu\text{A}$ |
|                    |                                            | $V_{\text{SENSE}} < -V_{\text{DET}}$                                                                         | $V_{\text{DD}} = 2.2\text{ V}$<br>$V_{\text{DS}} = 0.5\text{ V}$  | 2.8     |      |         | mA            |
| $I_{\text{LEAK}}$  | Nch. Driver Leakage Current                | $V_{\text{DD}} = 6\text{ V}, V_{\text{SENSE}} = 36\text{ V}, V_{\text{DS}} = 6.0\text{ V}$                   |                                                                   |         |      | 0.2     | $\mu\text{A}$ |
| $t_{\text{PLH}}$   | Release Output Delay Time                  | $V_{\text{DD}} = 6\text{ V}$<br>$V_{\text{SENSE}} = 1.5\text{ V} \rightarrow -V_{\text{SET}} + 2.0\text{ V}$ |                                                                   |         | 15   |         | $\mu\text{s}$ |

<sup>(1)</sup> The value is the minimum operating voltage to define  $V_{\text{DOUT}}$ .

## Product-specific Electric Characteristics

## R3119NxxxAE

| Product Name | -V <sub>DET</sub> [V] (Ta = 25°C) |       |       | -V <sub>DET</sub> [V] (-40°C ≤ Ta ≤ 105°C) |       |       |
|--------------|-----------------------------------|-------|-------|--------------------------------------------|-------|-------|
|              | Min.                              | Typ.  | Max.  | Min.                                       | Typ.  | Max.  |
| R3119N023x   | 2.266                             | 2.300 | 2.334 | 2.231                                      | 2.300 | 2.346 |
| R3119N024x   | 2.364                             | 2.400 | 2.436 | 2.328                                      | 2.400 | 2.448 |
| R3119N025x   | 2.463                             | 2.500 | 2.537 | 2.425                                      | 2.500 | 2.550 |
| R3119N026x   | 2.561                             | 2.600 | 2.639 | 2.522                                      | 2.600 | 2.652 |
| R3119N027x   | 2.660                             | 2.700 | 2.740 | 2.619                                      | 2.700 | 2.754 |
| R3119N028x   | 2.758                             | 2.800 | 2.842 | 2.716                                      | 2.800 | 2.856 |
| R3119N029x   | 2.857                             | 2.900 | 2.943 | 2.813                                      | 2.900 | 2.958 |
| R3119N030x   | 2.955                             | 3.000 | 3.045 | 2.910                                      | 3.000 | 3.060 |
| R3119N031x   | 3.054                             | 3.100 | 3.146 | 3.007                                      | 3.100 | 3.162 |
| R3119N032x   | 3.152                             | 3.200 | 3.248 | 3.104                                      | 3.200 | 3.264 |
| R3119N033x   | 3.251                             | 3.300 | 3.349 | 3.201                                      | 3.300 | 3.366 |
| R3119N034x   | 3.349                             | 3.400 | 3.451 | 3.298                                      | 3.400 | 3.468 |
| R3119N035x   | 3.448                             | 3.500 | 3.552 | 3.395                                      | 3.500 | 3.570 |
| R3119N036x   | 3.546                             | 3.600 | 3.654 | 3.492                                      | 3.600 | 3.672 |
| R3119N037x   | 3.645                             | 3.700 | 3.755 | 3.589                                      | 3.700 | 3.774 |
| R3119N038x   | 3.743                             | 3.800 | 3.857 | 3.686                                      | 3.800 | 3.876 |
| R3119N039x   | 3.842                             | 3.900 | 3.958 | 3.783                                      | 3.900 | 3.978 |
| R3119N040x   | 3.940                             | 4.000 | 4.060 | 3.880                                      | 4.000 | 4.080 |
| R3119N041x   | 4.039                             | 4.100 | 4.161 | 3.977                                      | 4.100 | 4.182 |
| R3119N042x   | 4.137                             | 4.200 | 4.263 | 4.074                                      | 4.200 | 4.284 |
| R3119N043x   | 4.236                             | 4.300 | 4.364 | 4.171                                      | 4.300 | 4.386 |
| R3119N044x   | 4.334                             | 4.400 | 4.466 | 4.268                                      | 4.400 | 4.488 |
| R3119N045x   | 4.433                             | 4.500 | 4.567 | 4.365                                      | 4.500 | 4.590 |
| R3119N046x   | 4.531                             | 4.600 | 4.669 | 4.462                                      | 4.600 | 4.692 |
| R3119N047x   | 4.630                             | 4.700 | 4.770 | 4.559                                      | 4.700 | 4.794 |
| R3119N048x   | 4.728                             | 4.800 | 4.872 | 4.656                                      | 4.800 | 4.896 |
| R3119N049x   | 4.827                             | 4.900 | 4.973 | 4.753                                      | 4.900 | 4.998 |
| R3119N050x   | 4.925                             | 5.000 | 5.075 | 4.850                                      | 5.000 | 5.100 |
| R3119N051x   | 5.024                             | 5.100 | 5.176 | 4.947                                      | 5.100 | 5.202 |
| R3119N052x   | 5.122                             | 5.200 | 5.278 | 5.044                                      | 5.200 | 5.304 |
| R3119N053x   | 5.221                             | 5.300 | 5.379 | 5.141                                      | 5.300 | 5.406 |
| R3119N054x   | 5.319                             | 5.400 | 5.481 | 5.238                                      | 5.400 | 5.508 |
| R3119N055x   | 5.418                             | 5.500 | 5.582 | 5.335                                      | 5.500 | 5.610 |
| R3119N056x   | 5.516                             | 5.600 | 5.684 | 5.432                                      | 5.600 | 5.712 |
| R3119N057x   | 5.615                             | 5.700 | 5.785 | 5.529                                      | 5.700 | 5.814 |
| R3119N058x   | 5.713                             | 5.800 | 5.887 | 5.626                                      | 5.800 | 5.916 |
| R3119N059x   | 5.812                             | 5.900 | 5.988 | 5.723                                      | 5.900 | 6.018 |
| R3119N060x   | 5.910                             | 6.000 | 6.090 | 5.820                                      | 6.000 | 6.120 |
| R3119N061x   | 6.009                             | 6.100 | 6.191 | 5.917                                      | 6.100 | 6.222 |
| R3119N062x   | 6.107                             | 6.200 | 6.293 | 6.014                                      | 6.200 | 6.324 |
| R3119N063x   | 6.206                             | 6.300 | 6.394 | 6.111                                      | 6.300 | 6.426 |
| R3119N064x   | 6.304                             | 6.400 | 6.496 | 6.208                                      | 6.400 | 6.528 |
| R3119N065x   | 6.403                             | 6.500 | 6.597 | 6.305                                      | 6.500 | 6.630 |
| R3119N066x   | 6.501                             | 6.600 | 6.699 | 6.402                                      | 6.600 | 6.732 |
| R3119N067x   | 6.600                             | 6.700 | 6.800 | 6.499                                      | 6.700 | 6.834 |
| R3119N068x   | 6.698                             | 6.800 | 6.902 | 6.596                                      | 6.800 | 6.936 |
| R3119N069x   | 6.797                             | 6.900 | 7.003 | 6.693                                      | 6.900 | 7.038 |

## R3119N

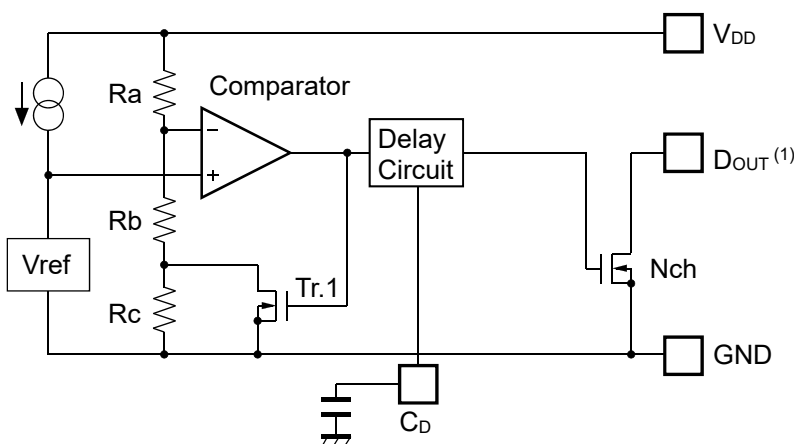
NO.EC-187-180530

| Product Name | -V <sub>DET</sub> [V] (Ta = 25°C) |        |        | -V <sub>DET</sub> [V] (-40°C ≤ Ta ≤ 105°C) |        |        |
|--------------|-----------------------------------|--------|--------|--------------------------------------------|--------|--------|
|              | Min.                              | Typ.   | Max.   | Min.                                       | Typ.   | Max.   |
| R3119N070x   | 6.895                             | 7.000  | 7.105  | 6.790                                      | 7.000  | 7.140  |
| R3119N071x   | 6.994                             | 7.100  | 7.206  | 6.887                                      | 7.100  | 7.242  |
| R3119N072x   | 7.092                             | 7.200  | 7.308  | 6.984                                      | 7.200  | 7.344  |
| R3119N073x   | 7.191                             | 7.300  | 7.409  | 7.081                                      | 7.300  | 7.446  |
| R3119N074x   | 7.289                             | 7.400  | 7.511  | 7.178                                      | 7.400  | 7.548  |
| R3119N075x   | 7.388                             | 7.500  | 7.612  | 7.275                                      | 7.500  | 7.650  |
| R3119N076x   | 7.486                             | 7.600  | 7.714  | 7.372                                      | 7.600  | 7.752  |
| R3119N077x   | 7.585                             | 7.700  | 7.815  | 7.469                                      | 7.700  | 7.854  |
| R3119N078x   | 7.684                             | 7.800  | 7.917  | 7.567                                      | 7.800  | 7.956  |
| R3119N079x   | 7.782                             | 7.900  | 8.018  | 7.663                                      | 7.900  | 8.058  |
| R3119N080x   | 7.880                             | 8.000  | 8.120  | 7.760                                      | 8.000  | 8.160  |
| R3119N081x   | 7.979                             | 8.100  | 8.221  | 7.858                                      | 8.100  | 8.262  |
| R3119N082x   | 8.078                             | 8.200  | 8.323  | 7.955                                      | 8.200  | 8.364  |
| R3119N083x   | 8.176                             | 8.300  | 8.424  | 8.052                                      | 8.300  | 8.466  |
| R3119N084x   | 8.274                             | 8.400  | 8.526  | 8.148                                      | 8.400  | 8.568  |
| R3119N085x   | 8.373                             | 8.500  | 8.627  | 8.246                                      | 8.500  | 8.670  |
| R3119N086x   | 8.472                             | 8.600  | 8.729  | 8.343                                      | 8.600  | 8.772  |
| R3119N087x   | 8.570                             | 8.700  | 8.830  | 8.440                                      | 8.700  | 8.874  |
| R3119N088x   | 8.669                             | 8.800  | 8.932  | 8.537                                      | 8.800  | 8.976  |
| R3119N089x   | 8.767                             | 8.900  | 9.033  | 8.634                                      | 8.900  | 9.078  |
| R3119N090x   | 8.866                             | 9.000  | 9.135  | 8.731                                      | 9.000  | 9.180  |
| R3119N091x   | 8.964                             | 9.100  | 9.236  | 8.828                                      | 9.100  | 9.282  |
| R3119N092x   | 9.063                             | 9.200  | 9.338  | 8.925                                      | 9.200  | 9.384  |
| R3119N093x   | 9.161                             | 9.300  | 9.439  | 9.022                                      | 9.300  | 9.486  |
| R3119N094x   | 9.260                             | 9.400  | 9.541  | 9.119                                      | 9.400  | 9.588  |
| R3119N095x   | 9.358                             | 9.500  | 9.642  | 9.216                                      | 9.500  | 9.690  |
| R3119N096x   | 9.457                             | 9.600  | 9.744  | 9.313                                      | 9.600  | 9.792  |
| R3119N097x   | 9.555                             | 9.700  | 9.845  | 9.410                                      | 9.700  | 9.894  |
| R3119N098x   | 9.654                             | 9.800  | 9.947  | 9.507                                      | 9.800  | 9.996  |
| R3119N099x   | 9.752                             | 9.900  | 10.048 | 9.604                                      | 9.900  | 10.098 |
| R3119N100x   | 9.850                             | 10.000 | 10.150 | 9.700                                      | 10.000 | 10.200 |
| R3119N101x   | 9.949                             | 10.100 | 10.251 | 9.797                                      | 10.100 | 10.302 |
| R3119N102x   | 10.047                            | 10.200 | 10.353 | 9.894                                      | 10.200 | 10.404 |
| R3119N103x   | 10.146                            | 10.300 | 10.454 | 9.991                                      | 10.300 | 10.506 |
| R3119N104x   | 10.244                            | 10.400 | 10.556 | 10.088                                     | 10.400 | 10.608 |
| R3119N105x   | 10.343                            | 10.500 | 10.657 | 10.185                                     | 10.500 | 10.710 |
| R3119N106x   | 10.441                            | 10.600 | 10.759 | 10.282                                     | 10.600 | 10.812 |
| R3119N107x   | 10.540                            | 10.700 | 10.860 | 10.379                                     | 10.700 | 10.914 |
| R3119N108x   | 10.638                            | 10.800 | 10.962 | 10.476                                     | 10.800 | 11.016 |
| R3119N109x   | 10.737                            | 10.900 | 11.063 | 10.573                                     | 10.900 | 11.118 |
| R3119N110x   | 10.835                            | 11.000 | 11.165 | 10.670                                     | 11.000 | 11.220 |
| R3119N111x   | 10.934                            | 11.100 | 11.266 | 10.767                                     | 11.100 | 11.322 |
| R3119N112x   | 11.032                            | 11.200 | 11.368 | 10.864                                     | 11.200 | 11.424 |
| R3119N113x   | 11.131                            | 11.300 | 11.469 | 10.961                                     | 11.300 | 11.526 |
| R3119N114x   | 11.229                            | 11.400 | 11.571 | 11.058                                     | 11.400 | 11.628 |
| R3119N115x   | 11.328                            | 11.500 | 11.672 | 11.155                                     | 11.500 | 11.730 |
| R3119N116x   | 11.426                            | 11.600 | 11.774 | 11.252                                     | 11.600 | 11.832 |
| R3119N117x   | 11.525                            | 11.700 | 11.875 | 11.349                                     | 11.700 | 11.934 |
| R3119N118x   | 11.623                            | 11.800 | 11.977 | 11.446                                     | 11.800 | 12.036 |
| R3119N119x   | 11.722                            | 11.900 | 12.078 | 11.543                                     | 11.900 | 12.138 |
| R3119N120x   | 11.820                            | 12.000 | 12.180 | 11.640                                     | 12.000 | 12.240 |

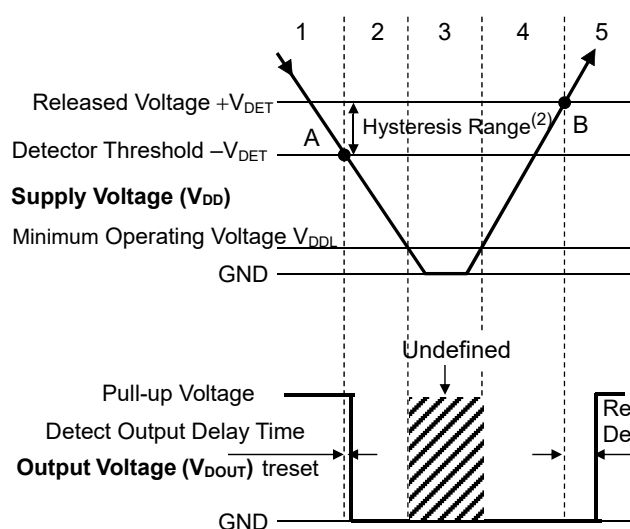


## THEORY OF OPERATION

### R3119NxxxA (C<sub>D</sub> Pin Type)



Block Diagram with External Capacitors



| Operating Conditions                | 1   | 2  | 3         | 4  | 5   |
|-------------------------------------|-----|----|-----------|----|-----|
| Comparator (-)<br>Pin Input Voltage | I   | II | II        | II | I   |
| Comparator Output                   | L   | H  | Undefined | H  | L   |
| Tr.1                                | OFF | ON | Undefined | ON | OFF |
| Output Tr. (Nch)                    | OFF | ON | Undefined | ON | OFF |

$$I \quad \frac{R_b + R_c}{R_a + R_b + R_c} \times V_{DD}$$

$$II \quad \frac{R_b}{R_a + R_b} \times V_{DD}$$

Operation Diagram

### OPERATING CONDITIONS

1. The output voltage is equal to the pull-up voltage.
2. At A point,  $V_{ref} \geq V_{DD} \times (R_b + R_c) / (R_a + R_b + R_c)$  is true. So, the comparator output voltage will be reversed from "L" to "H". As a result, the output voltage will be "L".
3. If the supply voltage remains lower than the minimum operating voltage, the output voltage will be undefined.
4. The "L" voltage is output.
5. At B point,  $V_{ref} \leq V_{DD} \times R_b / (R_a + R_b)$  is true. So, the comparator output voltage will be reversed from "H" to "L". As a result, output voltage will be equal to the pull-up voltage.

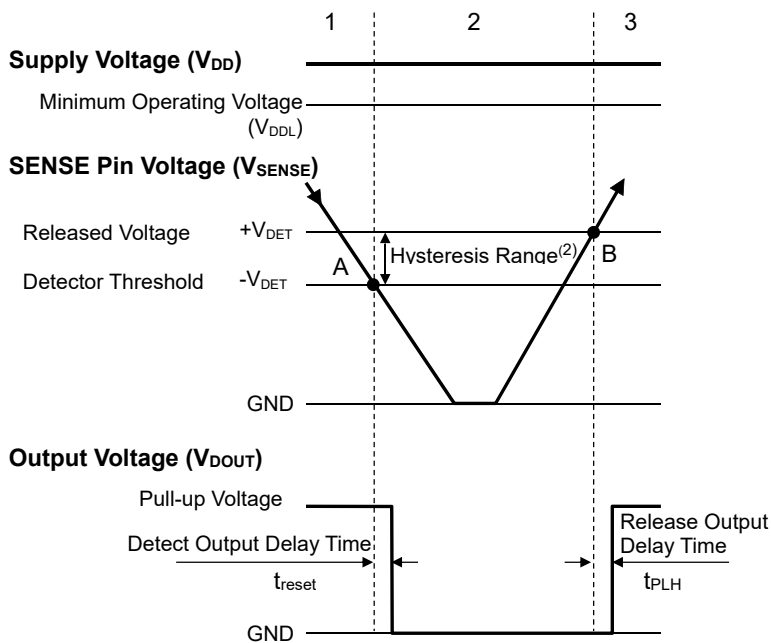
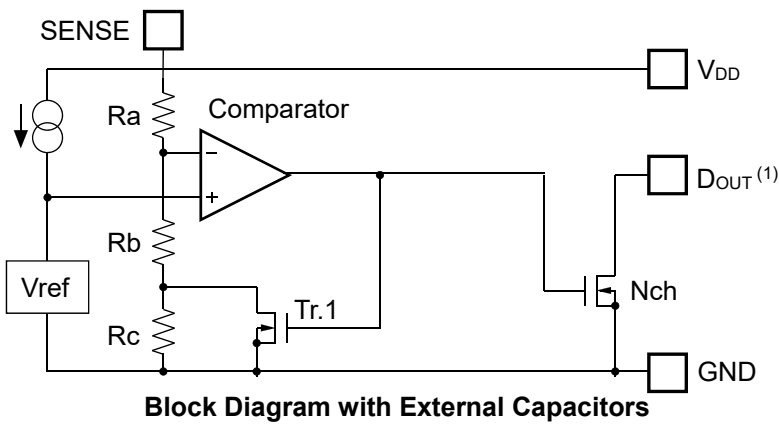
(1) The D<sub>OUT</sub> pin should be pulled-up to an external voltage level.

(2) Hysteresis is a voltage differential between the released voltage and the detector threshold.

R3119N

NO.EC-187-180530

R3119NxxxE (SENSE Pin Type)



| Operating Conditions             | 1   | 2  | 3   |
|----------------------------------|-----|----|-----|
| Comparator (–) Pin Input Voltage | I   | II | I   |
| Comparator Output                | L   | H  | L   |
| Tr.1                             | OFF | ON | OFF |
| Output Tr. (Nch)                 | OFF | ON | OFF |

I  $\frac{R_b + R_c}{R_a + R_b + R_c} \times V_{SENSE}$

II  $\frac{R_b}{R_a + R_b} \times V_{SENS}$

Operating Conditions

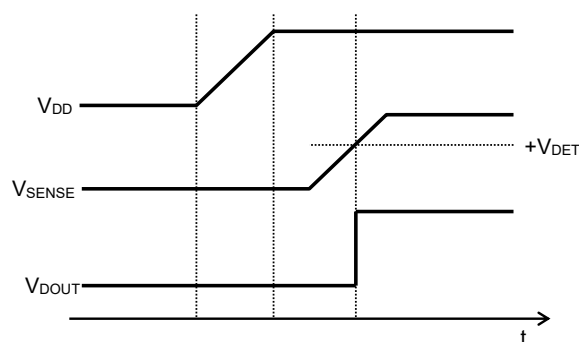
1. The SENSE pin voltage is higher than the detector threshold; the output voltage is equal to the pull-up voltage.
2. At A point,  $V_{ref} \geq V_{SENSE} \times (R_b + R_c) / (R_a + R_b + R_c)$  is true. So, the comparator output voltage will be reversed from “L” to “H”. As a result, the output voltage will be “L”. If the supply voltage remains higher than the minimum operating voltage, the output voltage will stay in “L”.
3. At B point,  $V_{ref} \leq V_{SENSE} \times R_b / (R_a + R_b)$  is true. So, the comparator output voltage will be reversed from “H” to “L”. As a result, output voltage will be equal to the pull-up voltage.

(1) The D<sub>OUT</sub> pin should be pulled-up to an external voltage level.  
(2) Hysteresis is a voltage differential between the released voltage and the detector threshold.

## Power Sequence

The R3119NxxxE can supervise the voltage of the SENSE pin. Regarding the power-on sequence, the SENSE pin must be powered on after the power-on to the  $V_{DD}$  pin, as shown below.

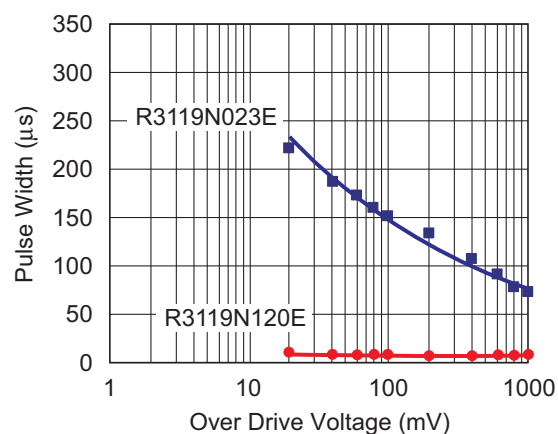
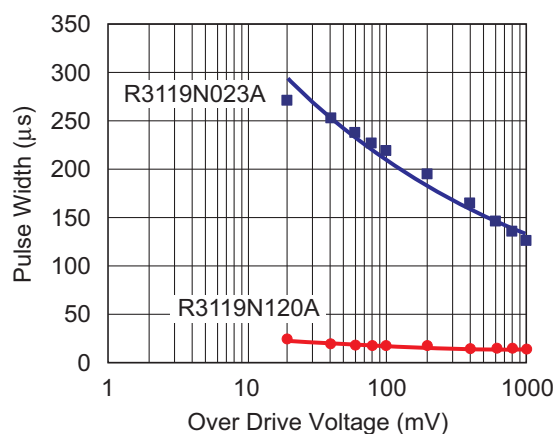
If the SENSE pin voltage is equal or more than the released voltage ( $+V_{DET}$ ),  $D_{OUT}$  pin becomes "H". Besides, a voltage beyond  $V_{DD}$  pin is also acceptable to SENSE pin.



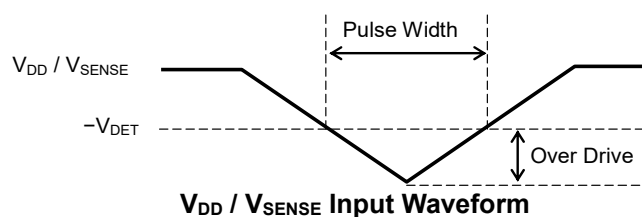
Power-On Timing Diagram

## Glitch Detection by $V_{dd}$ , Sense Pins

The following graphs are the released conditions when a pulse voltage less than or equal to the detector threshold ( $-V_{DET}$ ) is applied to  $V_{DD}$  (R3119NxxxA) /  $V_{SENSE}$  (R3119NxxxE) pin during the release operation. This graph indicates the maximum pulse condition. If a pulse increased in width and voltage is applied to  $V_{DD}$  (R3119NxxxA) /  $V_{SENSE}$  (R3119NxxxE), the reset signal may occur.



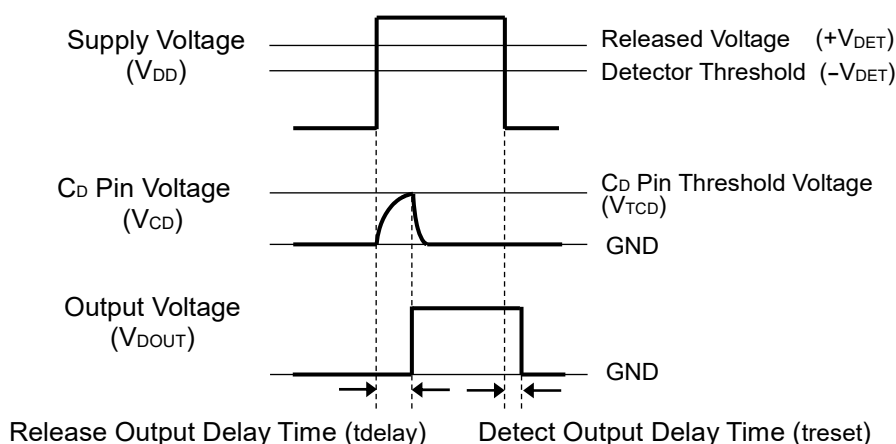
R3119NxxxA Pulse Width vs. Over Drive Voltage    R3119NxxxE Pulse Width vs. Over Drive Voltage



## Timing Chart

When the operating voltage higher than the released voltage is applied to  $V_{DD}$  pin, charge to an external capacitor starts, then  $C_D$  pin voltage ( $V_{CD}$ ) increases. The output voltage maintains the released output until  $V_{CD}$  reaches the threshold voltage of the release output delay pin ( $V_{TCD}$ ). And when  $V_{CD}$  is over  $V_{TCD}$ , the output voltage is inverted from the detected output to the released output. That is, the charged external capacitor starts discharging.

When the operating voltage lower than the detector threshold is applied to  $V_{DD}$  pin, the detect output delay time, which is the time until the output voltage is inverted from “H” to “L”, remains constant independent of the external capacitor.

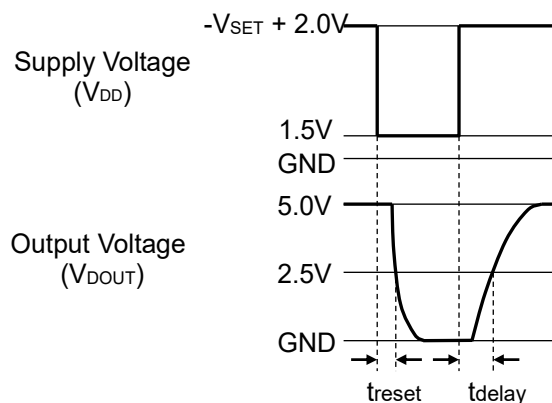


**Delay Timing Diagram**

## Release Output Delay Time ( $t_{delay}$ )

Release Output Delay Time ( $t_{delay}$ ) indicates the time between the instance when  $V_{DD}$  shift from “1.5 V” to “ $-V_{SET} + 2.0$  V” by the application of a pulse voltage and the instance when the output voltage reaches 2.5 V after pulled up the output pin ( $D_{OUT}$ ) to 5.0 V with a resistor of 100 k $\Omega$ .

This is given by the expression  $t_{delay} (s) = 8.5 \times 10^6 \times C_D (F)$ , where  $C_D (F)$  represents capacitance of the external capacitor.

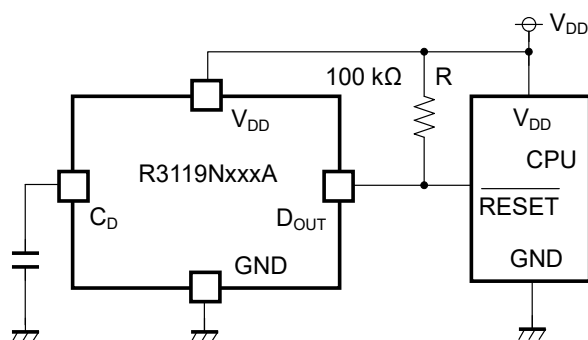


**R3119NxxxA**

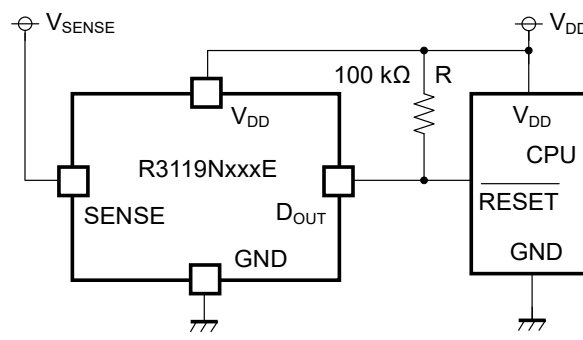
## APPLICATION INFORMATION

### Typical Application Circuits

#### ■ When using a shared input voltage between R3119N and CPU

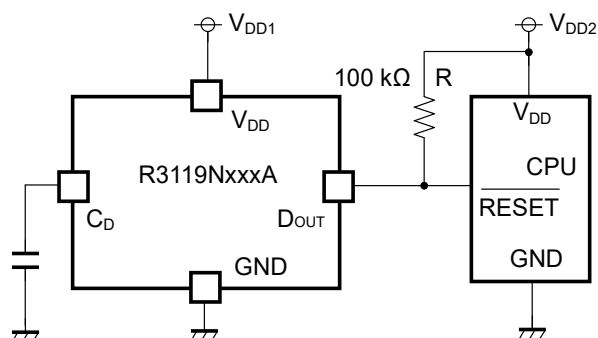


R3119NxxxA Typical Application Circuit

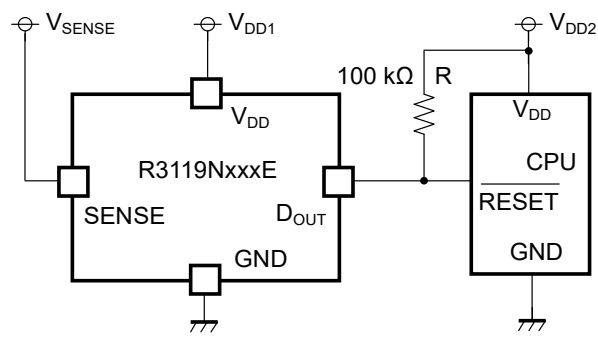


R3119NxxxE Typical Application Circuit

#### ■ When using different input voltages between R3119N and CPU



R3119NxxxA Typical Application Circuit



R3119NxxxE Typical Application Circuit

## TECHNICAL NOTES

### When connecting resistors to the device's input pin

When connecting a resistor (R1) to an input of this device, the input voltage decreases by [Device's Consumption Current] x [Resistance Value] only. And, the cross conduction current<sup>(1)</sup>, which occurs when changing from the detecting state to the release state, is decreased the input voltage by [Cross Conduction Current] x [Resistance Value] only. And then, this device will enter the re-detecting state if the input voltage reduction is larger than the difference between the detector voltage and the released voltage.

When the input resistance value is large and the VDD is gone up at mildly in the vicinity of the released voltage, repeating the above operation may result in the occurrence of output.

As shown in Figure A/B, set R1 to become 100kΩ or less as a guide, and connect C<sub>IN</sub><sup>(2)</sup> of 0.1μF and more to between the input pin and GND. Besides, make evaluations including temperature properties under the actual usage condition, with using the evaluation board like this way. As result, make sure that the cross conduction current has no problem.

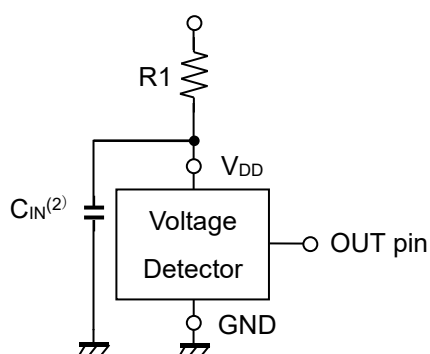


Figure A

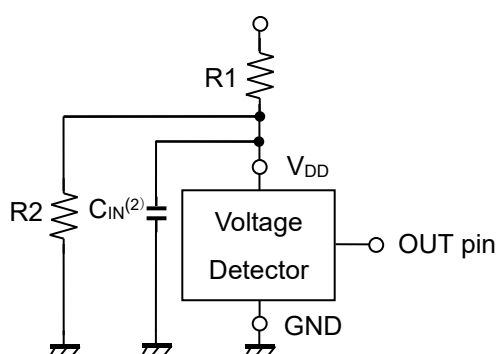


Figure B

<sup>(1)</sup> In the CMOS output type, a charging current for OUT pin is included.

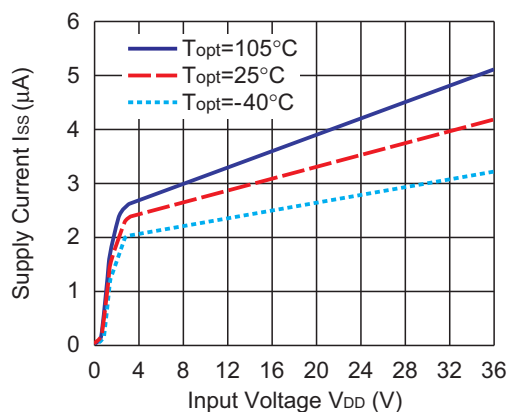
<sup>(2)</sup> Note the bias dependence of capacitors.

## TYPICAL CHARACTERISTICS

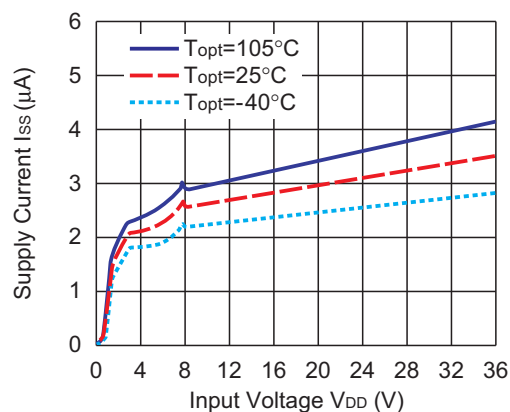
Note: Typical Characteristics are intended to be used as reference data; they are not guaranteed.

### 1) Supply Current vs. Input Voltage

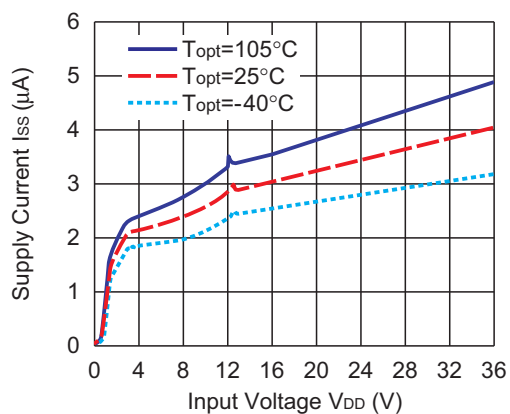
R3119N023A



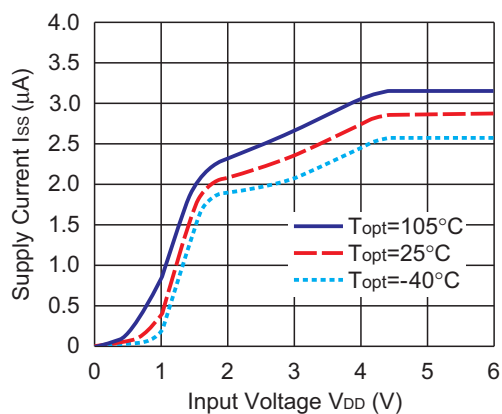
R3119N077A



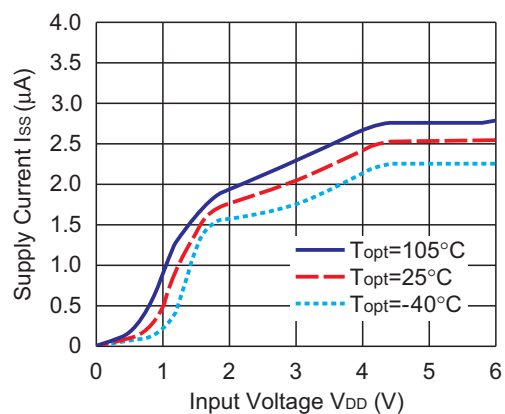
R3119N120A



R3119NxxxE (at release)



R3119NxxxE (at detecting)



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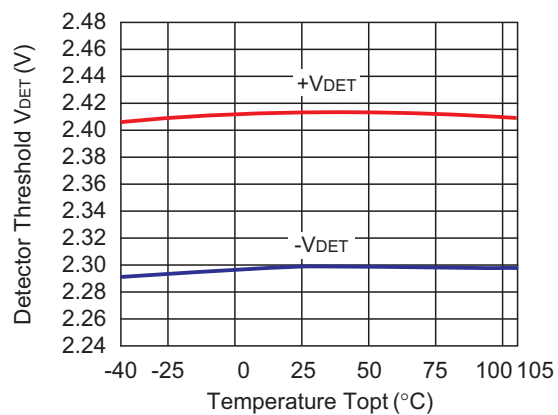
## R3119N

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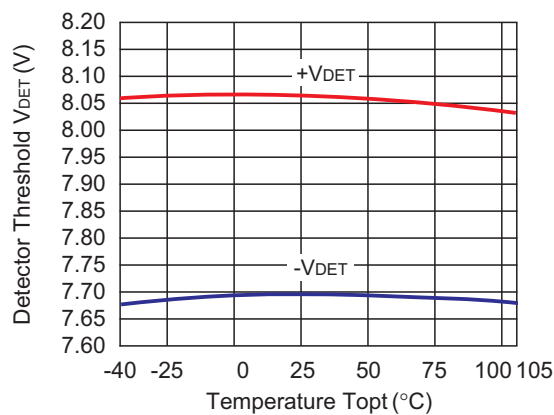
NO.EC-187-180530

### 2) Detector Threshold vs. Temperature

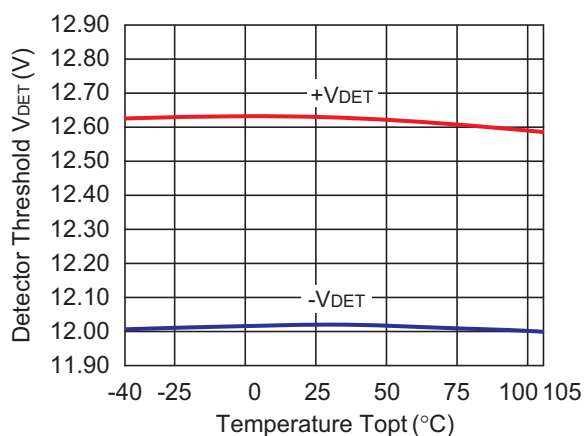
R3119N023A/E



R3119N077A/E

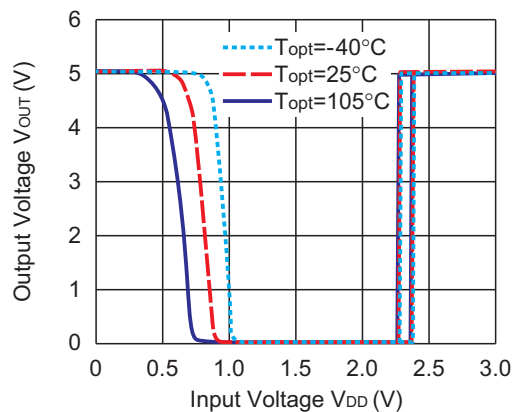


R3119N120A/E

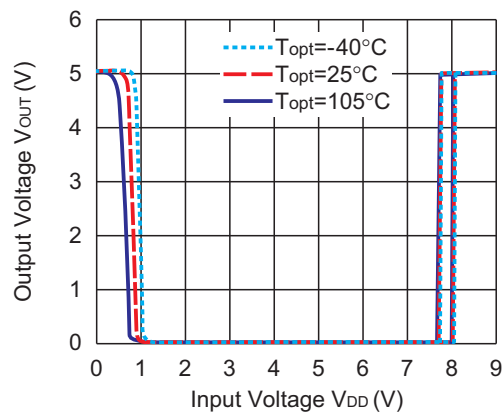


### 3) Output Voltage vs. Input Voltage

R3119N023A/E

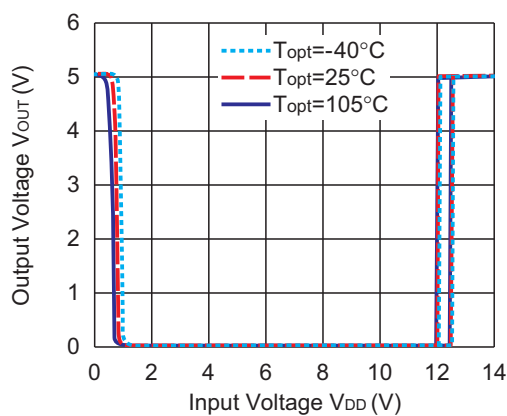


R3119N077A/E



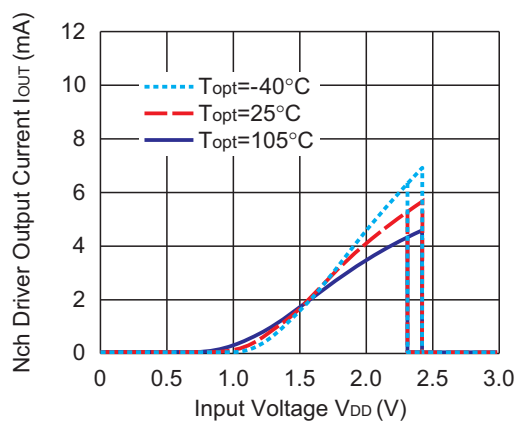


R3119N120A/E

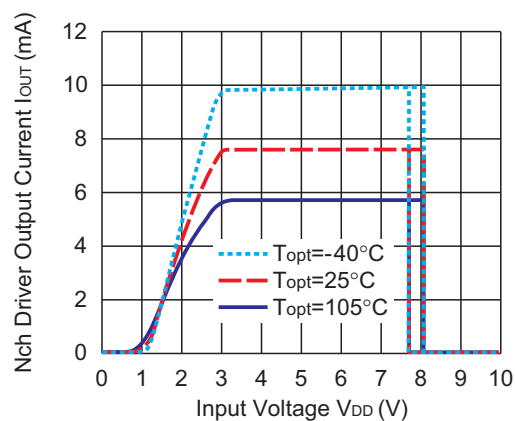


## 4) Nch. Driver Output Current vs. Input Voltage

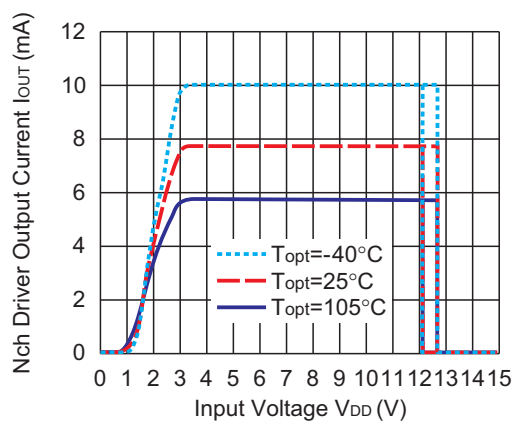
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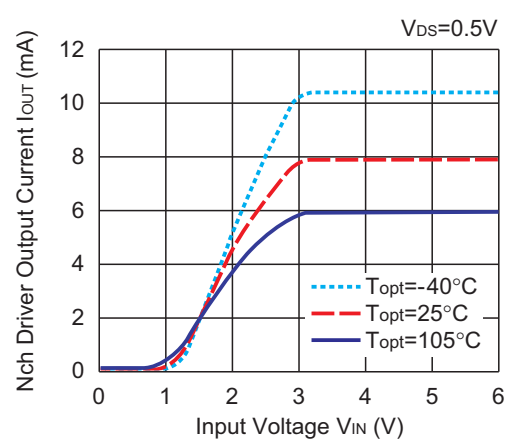
R3119N077A



R3119N120A



R3119NxxxE

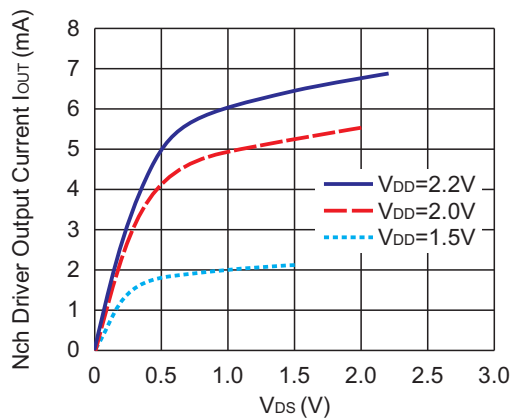


## R3119N

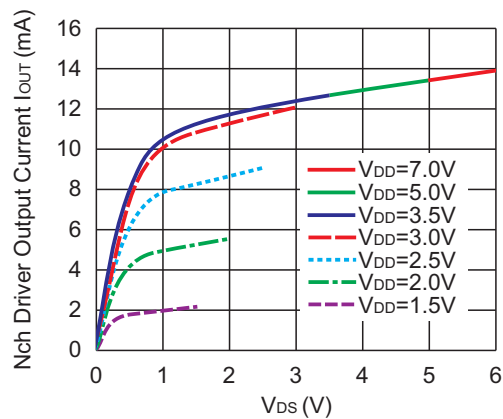
NO.EC-187-180530

### 5) Nch. Driver Output Current vs. $V_{DS}$

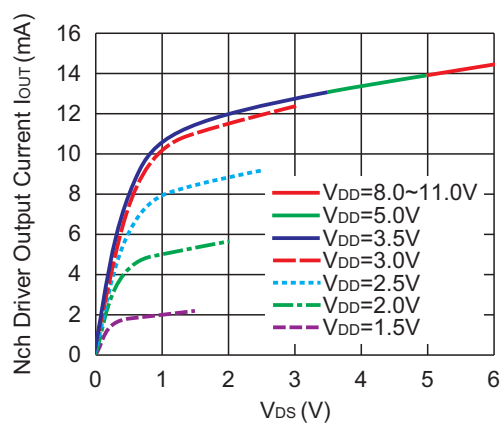
R3119N023A



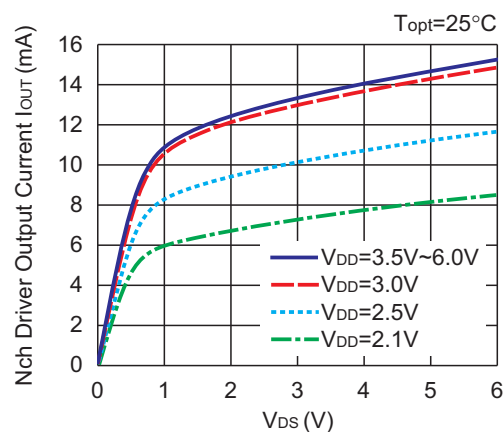
R3119N077A



R3119N120A

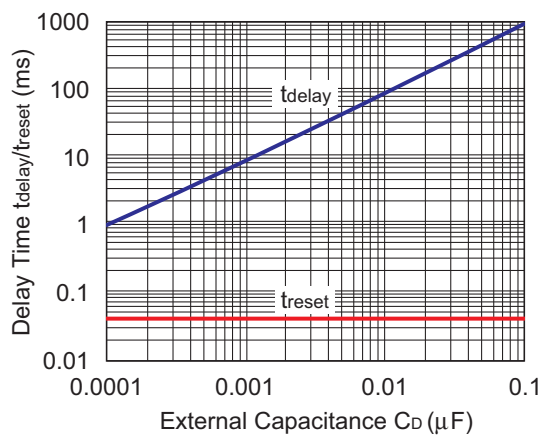


R3119NxxxE

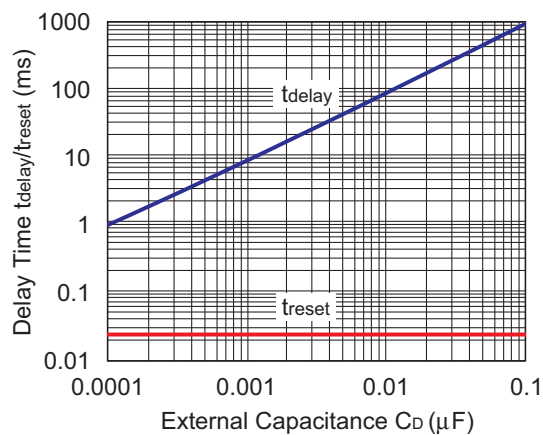


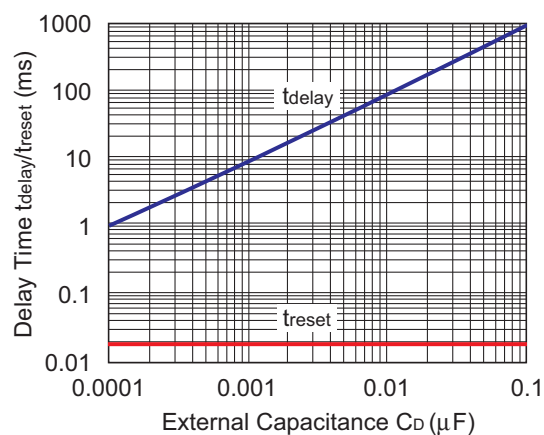
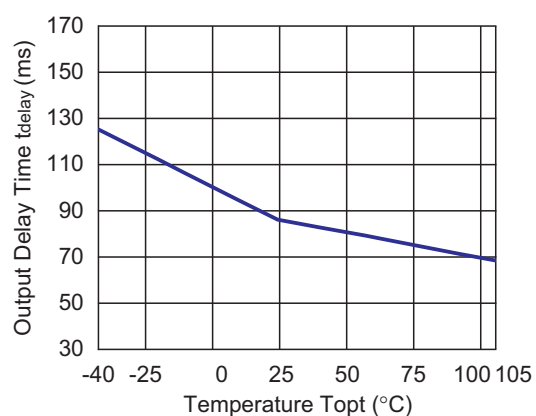
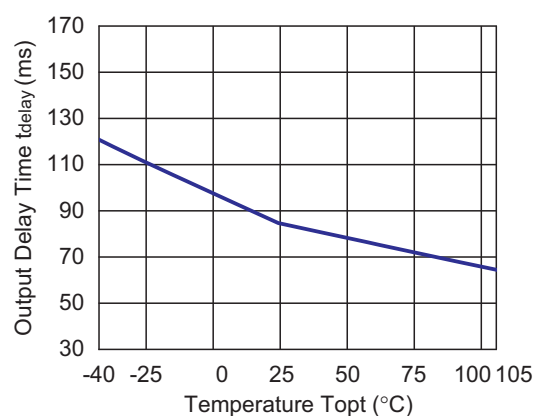
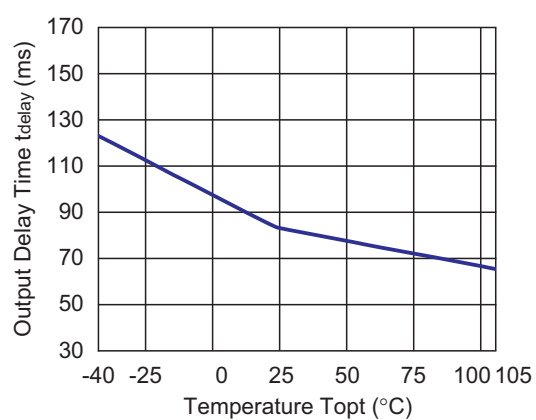
### 6) Delay Time vs. External Capacitor for $C_D$ Pin ( $T_a = 25^{\circ}\text{C}$ )

R3119N023A



R3119N077A



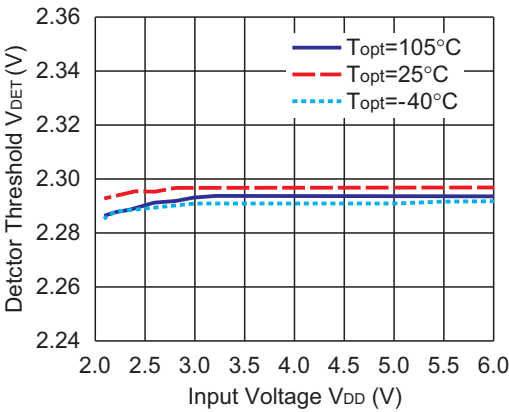
**R3119N120A****7) Release Output Delay Time vs. Temperature ( $C_D = 0.01\mu F$ )****R3119N023A****R3119N077A****R3119N120A**

# R3119N

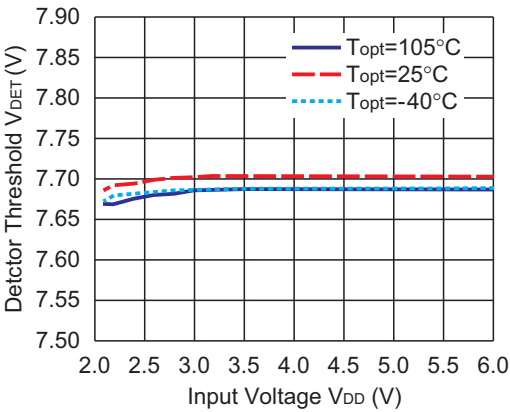
NO.EC-187-180530

## 8) Detector Threshold vs. Input Voltage

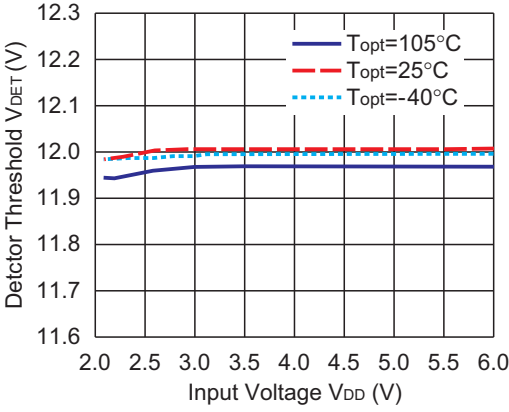
R3119N023E



R3119N077E

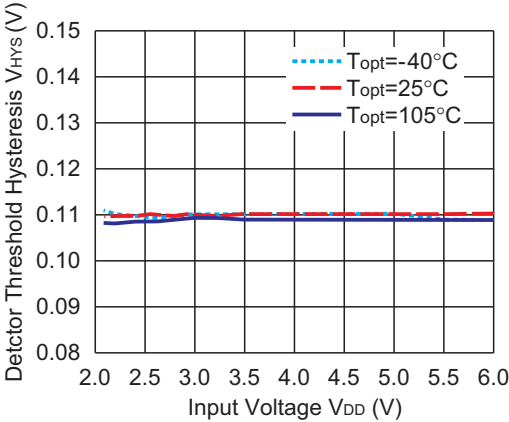


R3119N120E

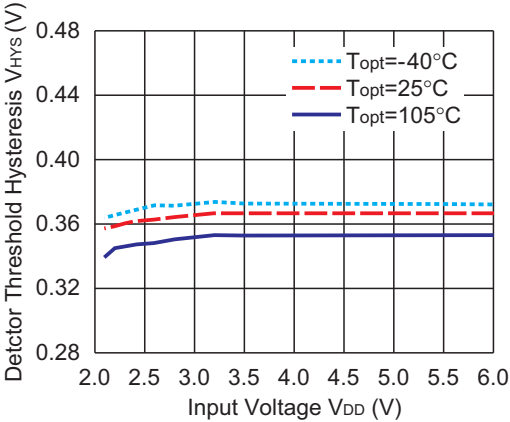


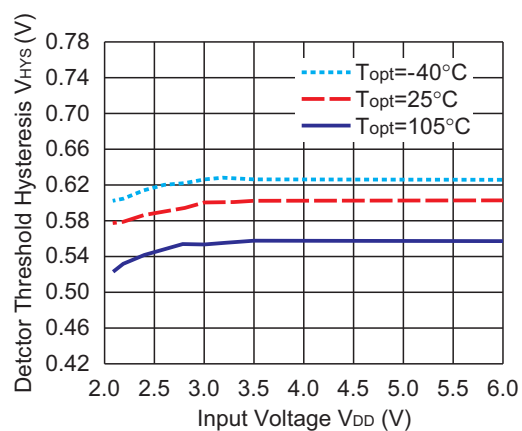
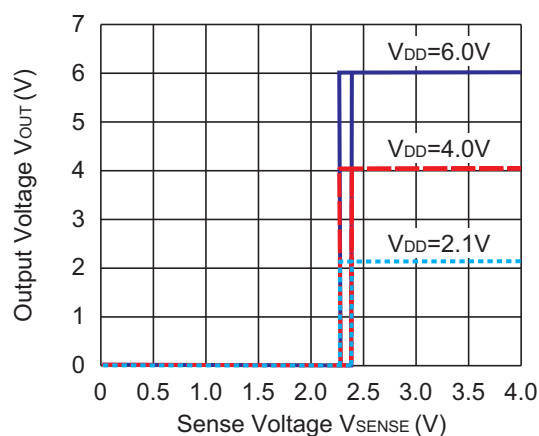
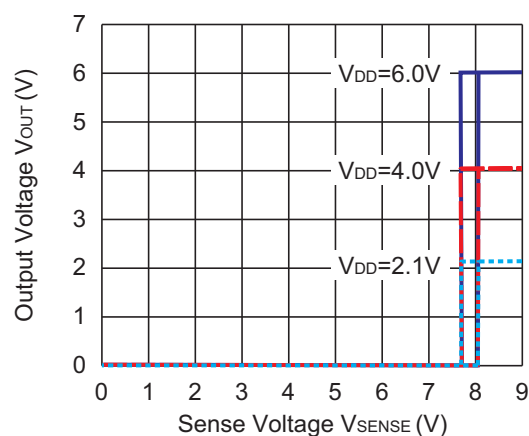
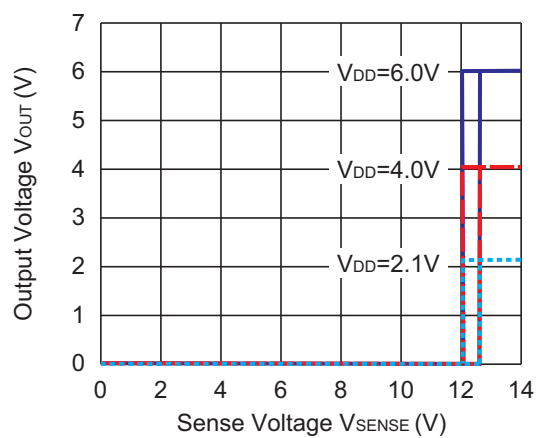
## 9) Hysteresis Range vs. Input Voltage

R3119N023E



R3119N077E



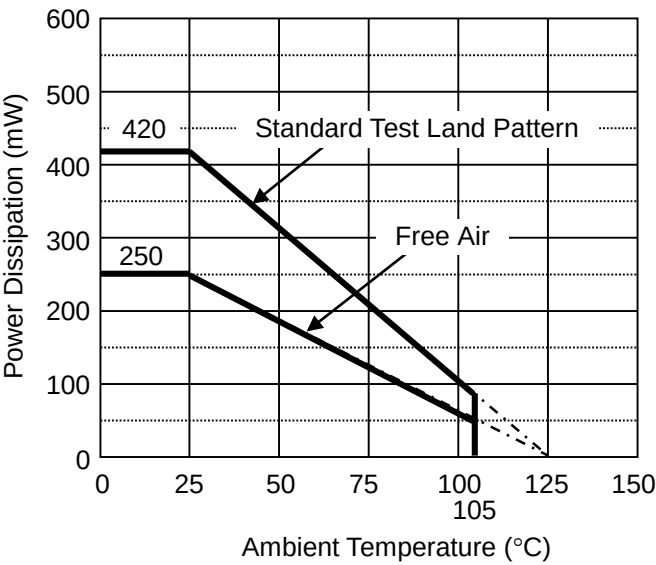
**R3119N120E****10) Output Voltage vs. SENSE Pin Input Voltage ( $T_a = 25^{\circ}\text{C}$ ,  $D_{OUT}$ : pulled-up to  $V_{DD}$  with 100 k $\Omega$ )****R3119N023E****R3119N077E****R3119N120E**

The power dissipation of the package is dependent on PCB material, layout, and environmental conditions. The following conditions are used in this measurement.

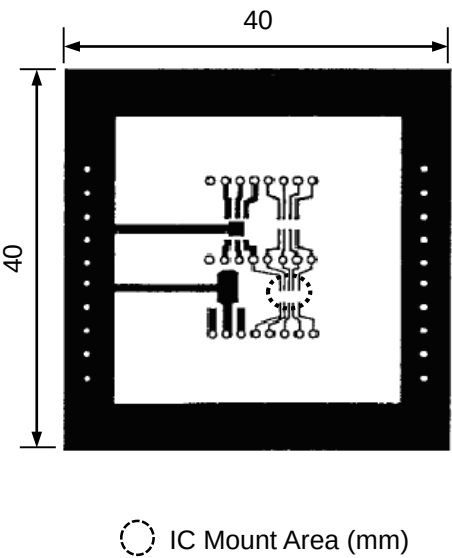
Measurement Conditions

|                  | Standard Test Land Pattern                        |
|------------------|---------------------------------------------------|
| Environment      | Mounting on Board (Wind Velocity = 0 m/s)         |
| Board Material   | Glass Cloth Epoxy Plastic (Double-sided Board)    |
| Board Dimensions | 40 mm × 40 mm × 1.6 mm                            |
| Copper Ratio     | Top Side: Approx. 50%<br>Bottom Side: Approx. 50% |
| Through-holes    | φ 0.5 mm × 44 pcs                                 |

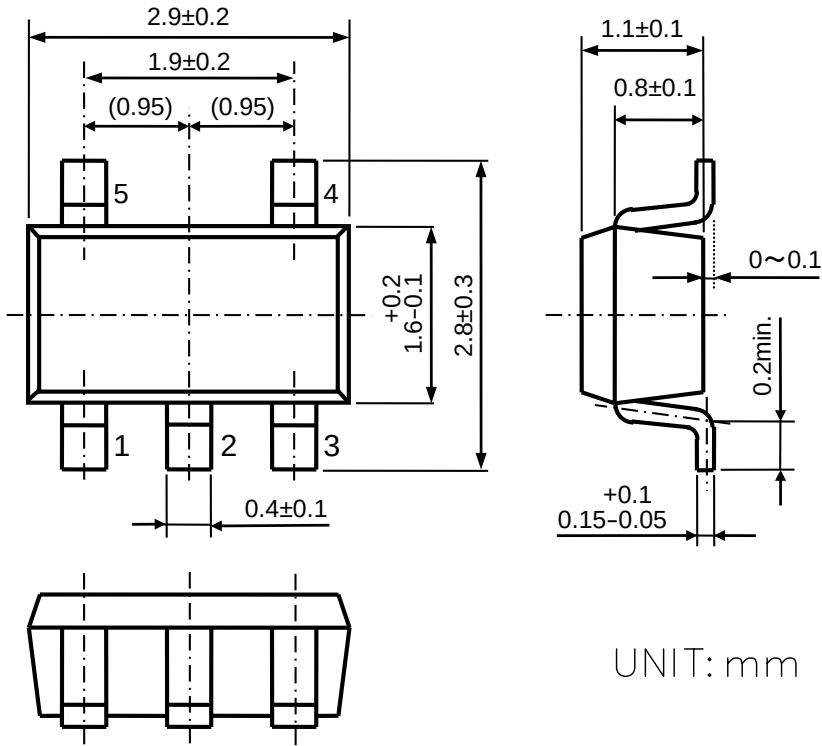
| Measurement Result | Standard Test Land Pattern                                                          | Free Air |
|--------------------|-------------------------------------------------------------------------------------|----------|
|                    | (Ta = 25°C, Tjmax = 125°C)                                                          |          |
| Power Dissipation  | 420 mW                                                                              | 250 mW   |
| Thermal Resistance | $\theta_{ja} = (125 - 25^{\circ}\text{C}) / 0.42 \text{ W} = 238^{\circ}\text{C/W}$ | 400°C/W  |



Power Dissipation vs. Ambient Temperature



Measurement Board Pattern



SOT-23-5 Package Dimensions



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