

* R3111E (TO-92) is the discontinued product as of April, 2017.



R3111x SERIES

LOW VOLTAGE DETECTOR

NO.EA-056-170428

OUTLINE

The R3111x series are CMOS-based voltage detector ICs with high detector threshold accuracy and ultra-low supply current, which can be operated at an extremely low voltage and is used for system reset as an example.

Each of these ICs consists of a voltage reference unit, a comparator, resistors for detector threshold setting, an output driver and a hysteresis circuit. The detector threshold is fixed with high accuracy internally and does not require any adjustment.

Three output types, Nch open drain "L" type, Nch open drain "H" type and CMOS type are available.

The R3111x Series are operable at a lower voltage than that for the Rx5VL series, and can be driven by a single battery.

Seven types of packages, TO-92, SOT-89, SOT-23-3, SOT-23-5, SC-82AB, SC-88A and SON1612-6 are available.

FEATURES

- Supply Current Typ. 0.8 μ A (-V_{DET}=1.5V, V_{DD}=-V_{DET}-0.1V)
- Operating Voltage Range..... 0.7V to 10.0V (Ta=25°C)
- Detector Threshold Range..... 0.9V to 6.0V (0.1V steps)
(For other voltages, please refer to MARK INFORMATIONS.)
- Detector Threshold Accuracy..... \pm 2.0%
- Temperature-Drift Coefficient of Detector Threshold Typ. \pm 100ppm/°C
- Output Types..... Nch Open Drain "L", Nch Open Drain "H", and CMOS
- Packages SON1612-6, SC-82AB, SC-88A, SOT-23-3, SOT-23-5, SOT-89, TO-92

APPLICATIONS

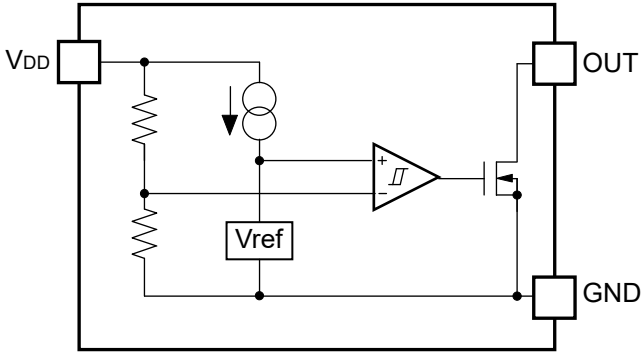
- CPU and Logic Circuit Reset
- Battery Checker
- Window Comparator
- Wave Shaping Circuit
- Battery Back-up Circuit
- Power Failure Detector

* R3111E (TO-92) is the discontinued product as of April, 2017.

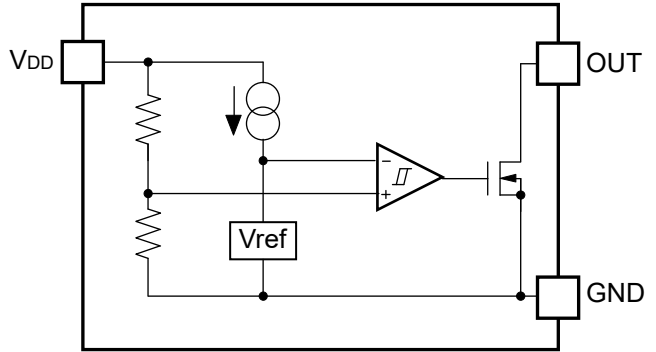
R3111x

BLOCK DIAGRAMS

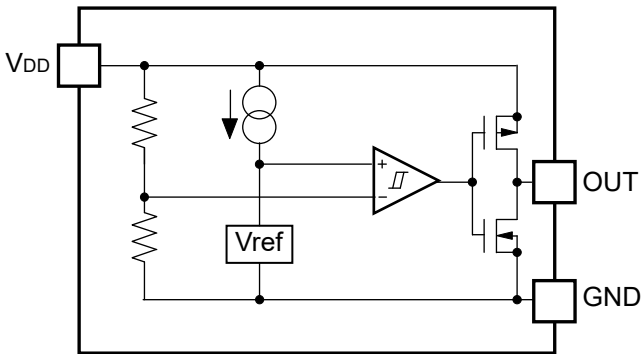
R3111xxxxA



R3111xxxxB



R3111xxxxC



SELECTION GUIDE

The package type, the detector threshold, the output type and the taping type for the ICs can be selected at the users' request. The selection can be made with designating the part number as shown below;

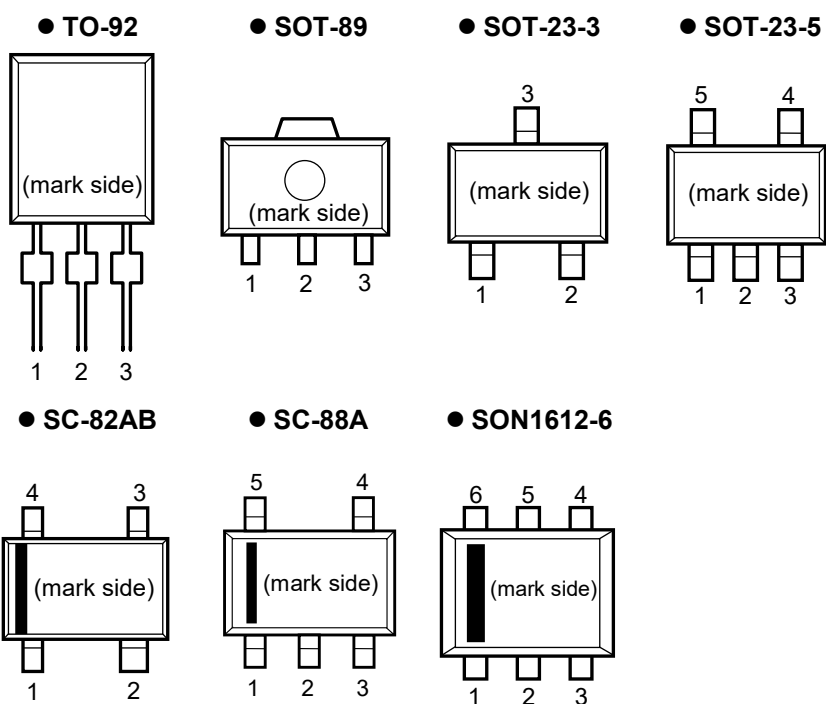
| Product Name | Package | Quantity per Reel | Pb Free | Halogen Free |
|-------------------|-----------|-------------------|---------|--------------|
| R3111Dxx1*-TR-FE | SON1612-6 | 4,000 pcs | Yes | Yes |
| R3111Qxx1*-TR-FE | SC-82AB | 3,000 pcs | Yes | Yes |
| R3111Qxx2*-TR-FE | SC-88A | 3,000 pcs | Yes | Yes |
| R3111Nxx1*-TR-FE | SOT-23-5 | 3,000 pcs | Yes | Yes |
| R3111Nxx2\$-TR-FE | SOT-23-3 | 3,000 pcs | Yes | Yes |
| R3111Hxx1\$-T1-FE | SOT-89 | 1,000 pcs | Yes | Yes |
| R3111Exx1\$-TZ-F | TO-92 | 2,500 pcs | Yes | No |

xx: The detector threshold can be designated in the range from 0.9V(09) to 6.0V(60) in 0.1V steps.
(For other voltages, please refer to MARK INFORMATIONS.)

* : Designation of Output Type
 (A) Nch Open Drain (Output "L" at Detection)
 (B) Nch Open Drain (Output "H" at Detection)
 (C) CMOS (Output "L" at Detection)

\$: Designation of Output Type
 (A) Nch Open Drain (Output "L" at Detection)
 (C) CMOS (Output "L" at Detection)

PIN CONFIGURATIONS



PIN DESCRIPTIONS

● TO-92

| Pin No. | Symbol |
|---------|-----------------|
| 1 | V _{DD} |
| 2 | GND |
| 3 | OUT |

● SOT-89

| Pin No. | Symbol |
|---------|-----------------|
| 1 | OUT |
| 2 | V _{DD} |
| 3 | GND |

● SOT-23-3

| Pin No. | Symbol |
|---------|-----------------|
| 1 | OUT |
| 2 | GND |
| 3 | V _{DD} |

● SOT-23-5

| Pin No. | Symbol |
|---------|-----------------|
| 1 | OUT |
| 2 | V _{DD} |
| 3 | GND |
| 4 | NC |
| 5 | NC |

● SC-82AB

| Pin No. | Symbol |
|---------|-----------------|
| 1 | OUT |
| 2 | V _{DD} |
| 3 | NC |
| 4 | GND |

● SC-88A

| Pin No. | Symbol |
|---------|-----------------|
| 1 | OUT |
| 2* | NC |
| 3 | V _{DD} |
| 4 | NC |
| 5 | GND |

● SON1612-6

| Pin No. | Symbol |
|---------|-----------------|
| 1 | OUT |
| 2 | V _{DD} |
| 3 | GND |
| 4 | NC |
| 5 | V _{DD} |
| 6 | NC |

* Pin No. 2 is connected to the bottom of the IC. It is recommended that the pin be connected to the V_{DD} pin on the board, or otherwise be left floating so that there is no contact with other potentials.

ABSOLUTE MAXIMUM RATINGS

| Symbol | Item | Rating | Unit |
|-----------|--------------------------------|------------------------------|------|
| V_{DD} | Supply Voltage | 12 | V |
| V_{OUT} | Output Voltage (CMOS) | $V_{SS}-0.3$ to $V_{DD}+0.3$ | V |
| | Output Voltage (Nch) | $V_{SS}-0.3$ to 12 | |
| I_{OUT} | Output Current | 70 | mA |
| P_D | Power Dissipation (TO-92)* | 300 | mW |
| | Power Dissipation (SOT-89)* | 900 | |
| | Power Dissipation (SOT-23-3)* | 420 | |
| | Power Dissipation (SOT-23-5)* | 420 | |
| | Power Dissipation (SC-82AB)* | 380 | |
| | Power Dissipation (SC-88A)* | 380 | |
| | Power Dissipation (SON1612-6)* | 500 | |
| T_a | Operating Temperature Range | -40 to 85 | °C |
| T_{stg} | Storage Temperature Range | -55 to 125 | °C |

*) For Power Dissipation, please refer to PACKAGE INFORMATION.

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 (ELECTRICAL CHARACTERISTICS)

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.

R3111x

ELECTRICAL CHARACTERISTICS

• R3111xxxxA

Ta=25°C

| Symbol | Item | Conditions | | Min. | Typ. | Max. | Unit |
|------------------------------------|--|---|------------------------------|-----------------------------|-----------------------------|-----------------------------|-------------------------|
| $-V_{DET}$ | Detector Threshold | | | $-V_{DET}$ $\times 0.98$ | | $-V_{DET}$ $\times 1.02$ | V |
| V_{HYS} | Detector Threshold Hysteresis | | | $-V_{DET}$ $\times 0.03$ | $-V_{DET}$ $\times 0.05$ | $-V_{DET}$ $\times 0.07$ | V |
| I_{SS} | Supply Current | $0.9V \leq -V_{DET} < 2.0V$ | $V_{DD}=-V_{DET} -0.10V$ | | 0.8 | 2.4 | μA |
| | | | $V_{DD}=-V_{DET} +2.0V$ | | 1.0 | 3.0 | |
| | | $2.0V \leq -V_{DET} < 3.0V$ | $V_{DD}=-V_{DET} -0.10V$ | | 0.9 | 2.7 | |
| | | | $V_{DD}=-V_{DET} +2.0V$ | | 1.1 | 3.3 | |
| | | $3.0V \leq -V_{DET} < 4.0V$ | $V_{DD}=-V_{DET} -0.13V$ | | 1.0 | 3.0 | |
| | | | $V_{DD}=-V_{DET} +2.0V$ | | 1.2 | 3.6 | |
| | | $4.0V \leq -V_{DET} < 5.0V$ | $V_{DD}=-V_{DET} -0.16V$ | | 1.1 | 3.3 | |
| | | | $V_{DD}=-V_{DET} +2.0V$ | | 1.3 | 3.9 | |
| $5.0V \leq -V_{DET} \leq 6.0V$ | $V_{DD}=-V_{DET} -0.20V$ | | 1.2 | 3.6 | | | |
| | $V_{DD}=-V_{DET} +2.0V$ | | 1.4 | 4.2 | | | |
| V_{DDH} | Maximum Operating Voltage | | | | | 10 | V |
| V_{DDL} | Minimum Operating Voltage*1 | Ta=25°C | | | 0.55 | 0.70 | V |
| | | $-40^{\circ}C \leq Ta \leq 85^{\circ}C$ | | | 0.65 | 0.80 | |
| I_{OUT} | Output Current (Driver Output Pin) | Nch | $V_{DS}=0.05V, V_{DD}=0.70V$ | | 0.01 | 0.05 | mA |
| | | | $0.9V \leq -V_{DET} < 1.1V$ | $V_{DS}=0.50V$ | 0.05 | 0.5 | |
| | | | | $V_{DD}=0.85V$ | | | |
| | | | $1.1V \leq -V_{DET} < 1.6V$ | $V_{DS}=0.50V$ | 0.2 | 1.0 | |
| $V_{DD}=1.00V$ | | | | | | | |
| $1.6V \leq -V_{DET} \leq 6.0V$ | $V_{DS}=0.50V$ | 1.0 | 2.0 | | | | |
| | $V_{DD}=1.50V$ | | | | | | |
| t_{PLH} | Output Delay Time*2 | | | | | 100 | μs |
| $\frac{\Delta-V_{DET}}{\Delta Ta}$ | Detector Threshold Temperature Coefficient | $-40^{\circ}C \leq Ta \leq 85^{\circ}C$ | | | ± 100 | | $\frac{ppm}{^{\circ}C}$ |

*1: Minimum operating voltage means the value of input voltage when output voltage maintains 0.1V or less. (In the case of the output pin is pulled up with a resistance of 470k Ω to 5.0V.)

*2: The output pin is pulled up with a resistance of 470k Ω to 5.0V, the time interval between the rising edge of V_{DD} input pulse from 0.7V to $(+V_{DET}) + \square 2.0V$ and output voltage level becoming to 2.5V.

● R3111xxxxB

Ta=25°C

| Symbol | Item | Conditions | | Min. | Typ. | Max. | Unit |
|--------------------------------|--|---|---------------------------------|-----------------------------|-----------------------------|-----------------------------|------------------|
| $-V_{DET}$ | Detector Threshold | | | $-V_{DET}$ $\times 0.98$ | | $-V_{DET}$ $\times 1.02$ | V |
| V_{HYS} | Detector Threshold Hysteresis | | | $-V_{DET}$ $\times 0.03$ | $-V_{DET}$ $\times 0.05$ | $-V_{DET}$ $\times 0.07$ | V |
| I_{SS} | Supply Current | $0.9V \leq -V_{DET} < 2.0V$ | $V_{DD} = -V_{DET} - 0.10V$ | | 0.8 | 2.4 | μA |
| | | | $V_{DD} = -V_{DET} + 2.0V$ | | 1.0 | 3.0 | |
| | | $2.0V \leq -V_{DET} < 3.0V$ | $V_{DD} = -V_{DET} - 0.10V$ | | 0.9 | 2.7 | |
| | | | $V_{DD} = -V_{DET} + 2.0V$ | | 1.1 | 3.3 | |
| | | $3.0V \leq -V_{DET} < 4.0V$ | $V_{DD} = -V_{DET} - 0.13V$ | | 1.0 | 3.0 | |
| | | | $V_{DD} = -V_{DET} + 2.0V$ | | 1.2 | 3.6 | |
| | | $4.0V \leq -V_{DET} < 5.0V$ | $V_{DD} = -V_{DET} - 0.16V$ | | 1.1 | 3.3 | |
| | | | $V_{DD} = -V_{DET} + 2.0V$ | | 1.3 | 3.9 | |
| $5.0V \leq -V_{DET} \leq 6.0V$ | $V_{DD} = -V_{DET} - 0.20V$ | | 1.2 | 3.6 | | | |
| | $V_{DD} = -V_{DET} + 2.0V$ | | 1.4 | 4.2 | | | |
| V_{DDH} | Maximum Operating Voltage | | | | | 10 | V |
| V_{DDL} | Minimum Operating Voltage*1 | Ta=25°C | | | 0.55 | 0.70 | V |
| | | $-40^{\circ}C \leq Ta \leq 85^{\circ}C$ | | | 0.65 | 0.80 | |
| I_{OUT} | Output Current (Driver Output Pin) | Nch | $V_{DS} = 0.10V, V_{DD} = 6.5V$ | 2.5 | | | mA |
| t_{PLH} | Output Delay Time*2 | | | | | 100 | μs |
| $\Delta V_{DET} / \Delta Ta$ | Detector Threshold Temperature Coefficient | $-40^{\circ}C \leq Ta \leq 85^{\circ}C$ | | | ± 100 | | ppm/ $^{\circ}C$ |

*1: Minimum operating voltage means the value of input voltage when output voltage maintains 0.1V or less. (In the case of the output pin is pulled up with a resistance of 470k Ω to 5.0V.)

*2: The output pin is pulled up with a resistance of 470k Ω to 5.0V, the time interval between the rising edge of V_{DD} input pulse from 0.7V to $(+V_{DET}) + \square 2.0V$ and output voltage level becoming to 2.5V.

* R3111E (TO-92) is the discontinued product as of April, 2017.

R3111x

• R3111xxxxC

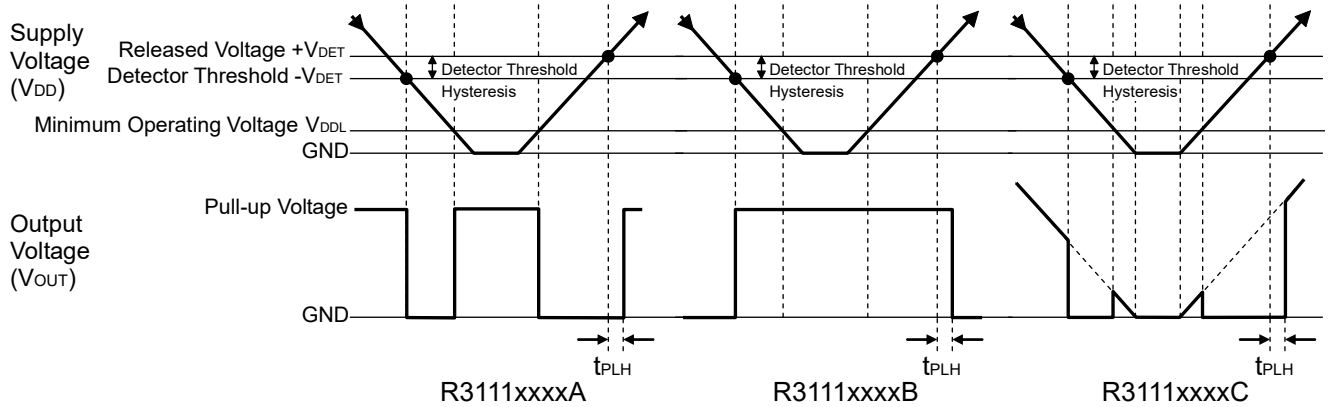
Ta=25°C

| Symbol | Item | Conditions | Min. | Typ. | Max. | Unit | | |
|-------------------------------------|--|---------------------------------------|----------------------------------|--------------------------------------|-----------------------------|-----------------|---------|--|
| $-V_{DET}$ | Detector Threshold | | $-V_{DET}$ $\times 0.98$ | | $-V_{DET}$ $\times 1.02$ | V | | |
| V_{HYS} | Detector Threshold Hysteresis | | $-V_{DET}$ $\times 0.03$ | $-V_{DET}$ $\times 0.05$ | $-V_{DET}$ $\times 0.07$ | V | | |
| I_{SS} | Supply Current | $0.9V \leq -V_{DET} < 2.0V$ | $V_{DD} = -V_{DET} - 0.10V$ | | 0.8 | 2.4 | μA | |
| | | | $V_{DD} = -V_{DET} + 2.0V$ | | 1.0 | 3.0 | | |
| | | $2.0V \leq -V_{DET} < 3.0V$ | $V_{DD} = -V_{DET} - 0.10V$ | | 0.9 | 2.7 | | |
| | | | $V_{DD} = -V_{DET} + 2.0V$ | | 1.1 | 3.3 | | |
| | | $3.0V \leq -V_{DET} < 4.0V$ | $V_{DD} = -V_{DET} - 0.13V$ | | 1.0 | 3.0 | | |
| | | | $V_{DD} = -V_{DET} + 2.0V$ | | 1.2 | 3.6 | | |
| | | $4.0V \leq -V_{DET} < 5.0V$ | $V_{DD} = -V_{DET} - 0.16V$ | | 1.1 | 3.3 | | |
| | | | $V_{DD} = -V_{DET} + 2.0V$ | | 1.3 | 3.9 | | |
| $5.0V \leq -V_{DET} \leq 6.0V$ | $V_{DD} = -V_{DET} - 0.20V$ | | 1.2 | 3.6 | | | | |
| | $V_{DD} = -V_{DET} + 2.0V$ | | 1.4 | 4.2 | | | | |
| V_{DDH} | Maximum Operating Voltage | | | | 10 | V | | |
| V_{DDL} | Minimum Operating Voltage*1 | Ta=25°C | | 0.55 | 0.70 | V | | |
| | | $-40^\circ C \leq Ta \leq 85^\circ C$ | | 0.65 | 0.80 | | | |
| I_{OUT} | Output Current (Driver Output Pin) | Nch | $V_{DS} = 0.05V, V_{DD} = 0.70V$ | 0.01 | 0.05 | mA | | |
| | | | $0.9V \leq -V_{DET} < 1.1V$ | $V_{DS} = 0.50V$ $V_{DD} = 0.85V$ | 0.05 | | 0.5 | |
| | | | $1.1V \leq -V_{DET} < 1.6V$ | $V_{DS} = 0.50V$ $V_{DD} = 1.00V$ | 0.2 | | 1.0 | |
| | | | $1.6V \leq -V_{DET} \leq 6.0V$ | $V_{DS} = 0.50V$ $V_{DD} = 1.50V$ | 1.0 | | 2.0 | |
| | | Pch | $0.9V \leq -V_{DET} < 4.0V$ | $V_{DS} = -2.1V$ $V_{DD} = 4.5V$ | 1.0 | 2.0 | | |
| | | | $4.0V \leq -V_{DET} \leq 6.0V$ | $V_{DS} = -2.1V$ $V_{DD} = 8.0V$ | 1.5 | 3.0 | | |
| t_{PLH} | Output Delay Time*2 | | | | 100 | μs | | |
| $\frac{\Delta -V_{DET}}{\Delta Ta}$ | Detector Threshold Temperature Coefficient | $-40^\circ C \leq Ta \leq 85^\circ C$ | | ± 100 | | ppm/ $^\circ C$ | | |

*1: Minimum operating voltage means the value of input voltage when output voltage maintains 0.1V or less.

*2: The time interval between the rising edge of V_{DD} input pulse from 0.7V to $(+V_{DET}) + \square 2.0V$ and output voltage level becoming to $((+V_{DET}) + 2.0V) / 2$.

TIMING CHART



DEFINITION OF OUTPUT DELAY TIME

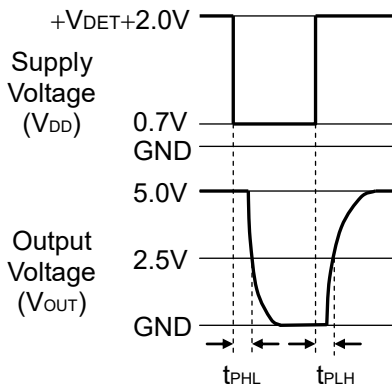
Output Delay Time (t_{PLH}) is defined as follows:

1. In the case of Nch Open Drain Output:(R3111xxxxA/B)

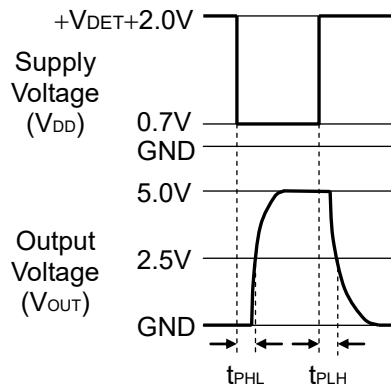
Under the condition of the output pin (OUT) is pulled up through a resistor of 470k Ω to 5V, the time interval between the rising edge of V_{DD} pulse from 0.7V to $(+V_{DET})+2.0V$ and becoming of the output voltage to 2.5V.

2. In the case of CMOS Output:(R3111xxxxC)

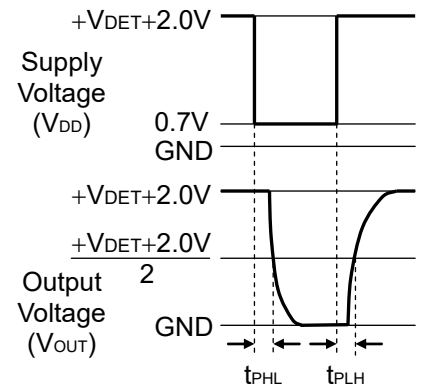
The time interval between the rising edge of V_{DD} pulse from 0.7V to $(+V_{DET})+2.0V$ and becoming of the output voltage to $((+V_{DET})+2.0V)/2$.



Nch Open Drain Output
(R3111xxxxA)



Nch Open Drain Output
(R3111xxxxB)



CMOS Output
(R3111xxxxC)

R3111x

ELECTRICAL CHARACTERISTICS BY DETECTOR THRESHOLD

● R3111x09x to R3111x60x

| Part Number | Detector Threshold | | | Detector Threshold Hysteresis | | | Supply Current 1 | | | Supply Current 2 | | |
|-------------|-----------------------|-------|-------|-------------------------------|-------|-------|---|------|------|-----------------------|------|------|
| | -V _{DET} [V] | | | V _{HYS} [V] | | | I _{SS1} [μA] | | | I _{SS2} [μA] | | |
| | Min. | Typ. | Max. | Min. | Typ. | Max. | Condition | Typ. | Max. | Condition | Typ. | Max. |
| R3111x09xx | 0.882 | 0.900 | 0.918 | 0.027 | 0.045 | 0.063 | V _{DD} = (-V _{DET}) -0.10V | 0.8 | 2.4 | 1.0 | 3.0 | |
| R3111x10xx | 0.980 | 1.000 | 1.020 | 0.030 | 0.050 | 0.070 | | | | | | |
| R3111x11xx | 1.078 | 1.100 | 1.122 | 0.033 | 0.055 | 0.077 | | | | | | |
| R3111x12xx | 1.176 | 1.200 | 1.224 | 0.036 | 0.060 | 0.084 | | | | | | |
| R3111x13xx | 1.274 | 1.300 | 1.326 | 0.039 | 0.065 | 0.091 | | | | | | |
| R3111x14xx | 1.372 | 1.400 | 1.428 | 0.042 | 0.070 | 0.098 | | | | | | |
| R3111x15xx | 1.470 | 1.500 | 1.530 | 0.045 | 0.075 | 0.105 | | | | | | |
| R3111x16xx | 1.568 | 1.600 | 1.632 | 0.048 | 0.080 | 0.112 | | | | | | |
| R3111x17xx | 1.666 | 1.700 | 1.734 | 0.051 | 0.085 | 0.119 | | | | | | |
| R3111x18xx | 1.764 | 1.800 | 1.836 | 0.054 | 0.090 | 0.126 | | | | | | |
| R3111x19xx | 1.862 | 1.900 | 1.938 | 0.057 | 0.095 | 0.133 | | | | | | |
| R3111x20xx | 1.960 | 2.000 | 2.040 | 0.060 | 0.100 | 0.140 | | | | | | |
| R3111x21xx | 2.058 | 2.100 | 2.142 | 0.063 | 0.105 | 0.147 | | | | | | |
| R3111x22xx | 2.156 | 2.200 | 2.244 | 0.066 | 0.110 | 0.154 | | | | | | |
| R3111x23xx | 2.254 | 2.300 | 2.346 | 0.069 | 0.115 | 0.161 | | | | | | |
| R3111x24xx | 2.352 | 2.400 | 2.448 | 0.072 | 0.120 | 0.168 | | | | | | |
| R3111x25xx | 2.450 | 2.500 | 2.550 | 0.075 | 0.125 | 0.175 | | | | | | |
| R3111x26xx | 2.548 | 2.600 | 2.652 | 0.078 | 0.130 | 0.182 | | | | | | |
| R3111x27xx | 2.646 | 2.700 | 2.754 | 0.081 | 0.135 | 0.189 | | | | | | |
| R3111x28xx | 2.744 | 2.800 | 2.856 | 0.084 | 0.140 | 0.196 | | | | | | |
| R3111x29xx | 2.842 | 2.900 | 2.958 | 0.087 | 0.145 | 0.203 | | | | | | |
| R3111x30xx | 2.940 | 3.000 | 3.060 | 0.090 | 0.150 | 0.210 | V _{DD} = (-V _{DET}) -0.13V | 1.0 | 3.0 | 1.2 | 3.6 | |
| R3111x31xx | 3.038 | 3.100 | 3.162 | 0.093 | 0.155 | 0.217 | | | | | | |
| R3111x32xx | 3.136 | 3.200 | 3.264 | 0.096 | 0.160 | 0.224 | | | | | | |
| R3111x33xx | 3.234 | 3.300 | 3.366 | 0.099 | 0.165 | 0.231 | | | | | | |
| R3111x34xx | 3.332 | 3.400 | 3.468 | 0.102 | 0.170 | 0.238 | | | | | | |
| R3111x35xx | 3.430 | 3.500 | 3.570 | 0.105 | 0.175 | 0.245 | | | | | | |
| R3111x36xx | 3.528 | 3.600 | 3.672 | 0.108 | 0.180 | 0.252 | | | | | | |
| R3111x37xx | 3.626 | 3.700 | 3.774 | 0.111 | 0.185 | 0.259 | | | | | | |
| R3111x38xx | 3.724 | 3.800 | 3.876 | 0.114 | 0.190 | 0.266 | | | | | | |
| R3111x39xx | 3.822 | 3.900 | 3.978 | 0.117 | 0.195 | 0.273 | | | | | | |
| R3111x40xx | 3.920 | 4.000 | 4.080 | 0.120 | 0.200 | 0.280 | V _{DD} = (-V _{DET}) -0.16V | 1.1 | 3.3 | 1.3 | 3.9 | |
| R3111x41xx | 4.018 | 4.100 | 4.182 | 0.123 | 0.205 | 0.287 | | | | | | |
| R3111x42xx | 4.116 | 4.200 | 4.284 | 0.126 | 0.210 | 0.294 | | | | | | |
| R3111x43xx | 4.214 | 4.300 | 4.386 | 0.129 | 0.215 | 0.301 | | | | | | |
| R3111x44xx | 4.312 | 4.400 | 4.488 | 0.132 | 0.220 | 0.308 | | | | | | |
| R3111x45xx | 4.410 | 4.500 | 4.590 | 0.135 | 0.225 | 0.315 | | | | | | |
| R3111x46xx | 4.508 | 4.600 | 4.692 | 0.138 | 0.230 | 0.322 | | | | | | |
| R3111x47xx | 4.606 | 4.700 | 4.794 | 0.141 | 0.235 | 0.329 | | | | | | |
| R3111x48xx | 4.704 | 4.800 | 4.896 | 0.144 | 0.240 | 0.336 | | | | | | |
| R3111x49xx | 4.802 | 4.900 | 4.998 | 0.147 | 0.245 | 0.343 | V _{DD} = (-V _{DET}) -0.20V | 1.2 | 3.6 | 1.4 | 4.2 | |
| R3111x50xx | 4.900 | 5.000 | 5.100 | 0.150 | 0.250 | 0.350 | | | | | | |
| R3111x51xx | 4.998 | 5.100 | 5.202 | 0.153 | 0.255 | 0.357 | | | | | | |
| R3111x52xx | 5.096 | 5.200 | 5.304 | 0.156 | 0.260 | 0.364 | | | | | | |
| R3111x53xx | 5.194 | 5.300 | 5.406 | 0.159 | 0.265 | 0.371 | | | | | | |
| R3111x54xx | 5.292 | 5.400 | 5.508 | 0.162 | 0.270 | 0.378 | | | | | | |
| R3111x55xx | 5.390 | 5.500 | 5.610 | 0.165 | 0.275 | 0.385 | | | | | | |
| R3111x56xx | 5.488 | 5.600 | 5.712 | 0.168 | 0.280 | 0.392 | | | | | | |
| R3111x57xx | 5.586 | 5.700 | 5.814 | 0.171 | 0.285 | 0.399 | | | | | | |
| R3111x58xx | 5.684 | 5.800 | 5.916 | 0.174 | 0.290 | 0.406 | | | | | | |
| R3111x59xx | 5.782 | 5.900 | 6.018 | 0.177 | 0.295 | 0.413 | | | | | | |
| R3111x60xx | 5.880 | 6.000 | 6.120 | 0.180 | 0.300 | 0.420 | | | | | | |

*1) In the case of CMOS output type; when the voltage is forced to V_{DD} from 0.7V to (+V_{DET})+2.0V, time interval between the rising edge of V_{DD} and the reaching point at ((+V_{DET})+2.0V)/2. In the case of Nch open drain output type: The output pin is pulled up to 5V through 470kΩ, and when the voltage is forced to V_{DD} from 0.7V to (+V_{DET})+2.0V, time interval between the rising edge of V_{DD} and the reaching point at ((+V_{DET})+2.0V)/2.

*2) V_{DD} value when Output Voltage is equal or less than 0.1V. In the case of Nch open drain output type, the output pin is pulled up to 5V through 470kΩ resistor.

Condition 1: Ta=25°C

Condition 2: -40°C ≤ Ta ≤ 85°C

* R3111E (TO-92) is the discontinued product as of April, 2017.

R3111x

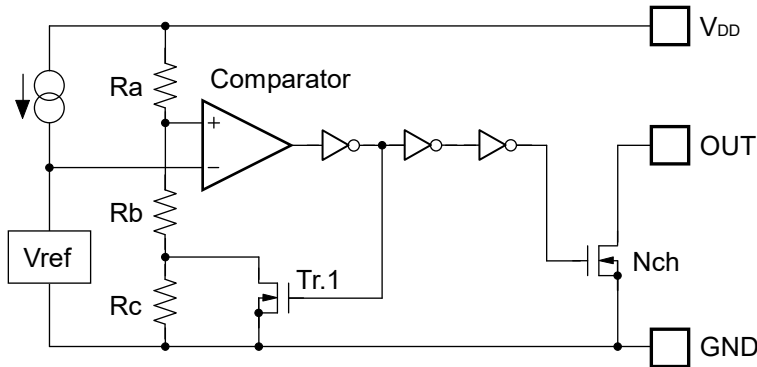
| Output Current 1 | | | Output Current 2 *3 | | | Output Delay Time | Minimum Operating Voltage | | Detector Threshold Temperature Coefficient | | |
|---|------|------|------------------------------|-----------------------|------|-----------------------|---------------------------|--|--|-------------------------------------|------|
| I _{OUT1} [mA] | | | I _{OUT2} [mA] | | | t _{PLH} [μs] | V _{DDL} [V] | | Δ-V _{DET} /ΔT _a [ppm/°C] | | |
| Condition | Min. | Typ. | Condition | Min. | Typ. | Max. | Typ. | Max. | Condition | Typ. | |
| <A/C version> Nch V _{DS} =0.05V V _{DD} =0.7V | 0.01 | 0.05 | V _{DD} =0.85V | 0.05 | 0.5 | | | | | | |
| | | | V _{DD} =1.0V | 0.2 | 1.0 | | | | | | |
| | | | Nch V _{DS} =0.5V | V _{DD} =1.5V | 1.0 | 2.0 | 100 *1 | *2 Condition 1 0.55 Condition 2 0.65 | *2 Condition 1 0.70 Condition 2 0.80 | -40°C ≦ T _a ≦ 85°C | ±100 |
| <B version> Nch V _{DS} =0.10V V _{DD} =6.5V | 2.5 | - | | | | | | | | | |

*3) Only A/C versions.

R3111x

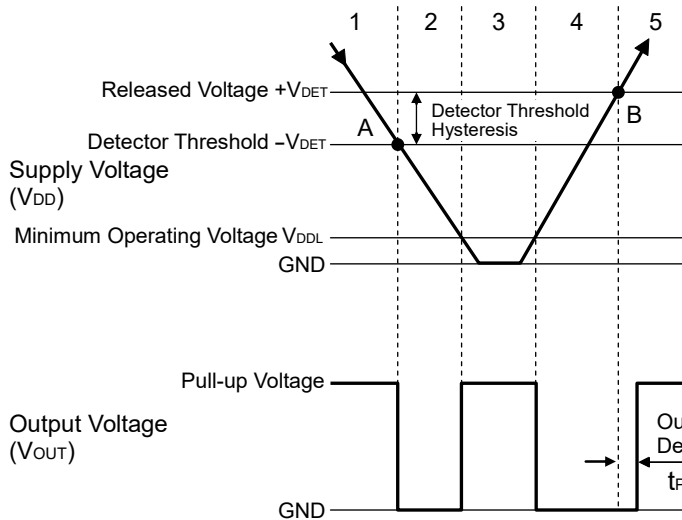
OPERATION

• Operation of R3111xxxxA



OUT pin should be pulled-up to V_{DD} or an external voltage level.

Block Diagram (R3111xxxxA)



| Step | 1 | 2 | 3 | 4 | 5 |
|----------------------------------|-----|----|------------|----|-----|
| Comparator (+) Pin Input Voltage | I | II | II | II | I |
| Comparator Output | H | L | Indefinite | L | H |
| Tr.1 | OFF | ON | Indefinite | ON | OFF |
| Output Tr. Nch | OFF | ON | Indefinite | 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

• Explanation of operation

Step 1. The output voltage is equal to the pull-up voltage.

Step 2. At Point "A", $V_{ref} \geq V_{DD} \times (R_b + R_c) / (R_a + R_b + R_c)$ is true, as a result, the output of comparator is reversed from "H" to "L", therefore the output voltage becomes the GND level. The voltage level of Point A means a detector threshold voltage ($-V_{DET}$).

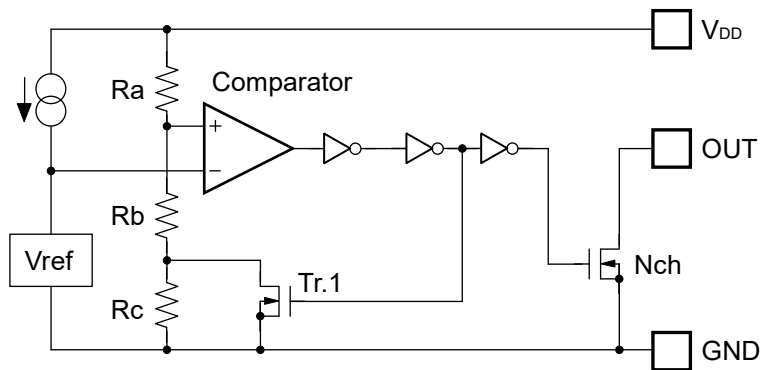
Step 3. When the supply voltage is lower than the minimum operating voltage, the operation of the output transistor becomes indefinite. The output voltage is equal to the pull-up voltage.

Step 4. The output Voltage is equal to the GND level.

Step 5. At Point "B", $V_{ref} \leq V_{DD} \times R_b / (R_a + R_b)$ is true, as a result, the output of comparator is reversed from "L" to "H", then the output voltage is equal to the pull-up voltage. The voltage level of Point B means a released voltage ($+V_{DET}$).

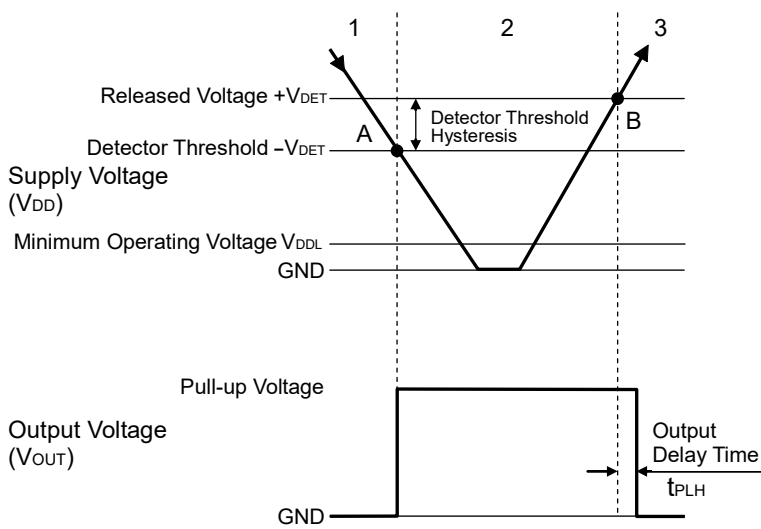
*) The difference between a released voltage and a detector threshold voltage is a detector threshold hysteresis.

• Operation of R3111xxxxB



OUT pin should be pulled-up to V_{DD} or an external voltage level.

Block Diagram (R3111xxxxB)



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

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

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

Operation Diagram

• Explanation of operation

Step 1. The output voltage is equal to the GND level.

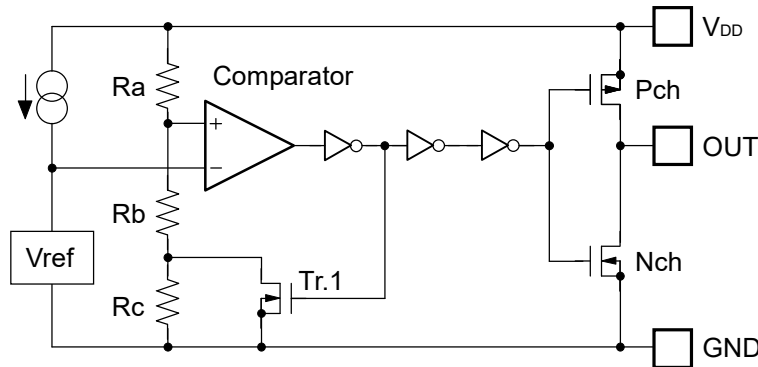
Step 2. At Point "A", $V_{ref} \geq V_{DD} \times (R_b+R_c)/(R_a+R_b+R_c)$ is true, as a result, the output of comparator is reversed from "L" to "H", therefore the output voltage becomes the pull-up voltage. The voltage level of Point A means a detector threshold voltage ($-V_{DET}$).

Step 3. At Point "B", $V_{ref} \leq V_{DD} \times R_b/(R_a+R_b)$ is true, as a result, the output of comparator is reversed from "H" to "L", then the output voltage is equal to the GND level. The voltage level of Point B means a released voltage ($+V_{DET}$).

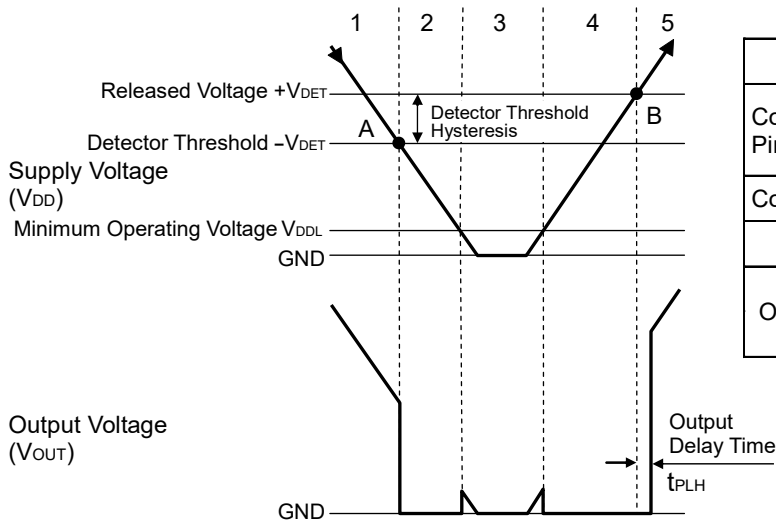
*) The difference between a released voltage and a detector threshold voltage is a detector threshold hysteresis.

R3111x

• Operation of R3111xxxxC



Block Diagram (R3111xxxxC)



| Step | 1 | 2 | 3 | 4 | 5 | |
|----------------------------------|-----|-----|------------|------------|-----|-----|
| Comparator (+) Pin Input Voltage | I | II | II | II | I | |
| Comparator Output | H | L | Indefinite | L | H | |
| Tr.1 | OFF | ON | Indefinite | ON | OFF | |
| Output Tr. | Pch | ON | OFF | Indefinite | OFF | ON |
| | Nch | OFF | ON | Indefinite | 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

• Explanation of operation

Step 1. The output voltage is equal to the supply voltage (V_{DD}).

Step 2. At Point "A", $V_{ref} \geq V_{DD} \times (R_b + R_c) / (R_a + R_b + R_c)$ is true, as a result, the output of comparator is reversed from "H" to "L", therefore the output voltage becomes the GND level. The voltage level of Point A means a detector threshold voltage ($-V_{DET}$).

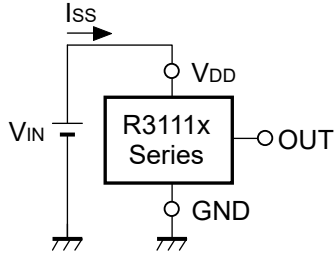
Step 3. When the supply voltage is lower than the minimum operating voltage, the operation of the output transistor becomes indefinite.

Step 4. The output Voltage is equal to the GND level.

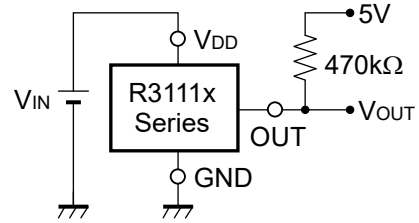
Step 5. At Point "B", $V_{ref} \leq V_{DD} \times R_b / (R_a + R_b)$ is true, as a result, the output of comparator is reversed from "L" to "H", then the output voltage is equal to the supply voltage (V_{DD}). The voltage level of Point B means a released voltage ($+V_{DET}$).

*) The difference between a released voltage and a detector threshold voltage is a detector threshold hysteresis.

TEST CIRCUITS

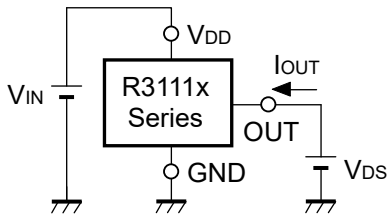


Supply Current Test Circuit

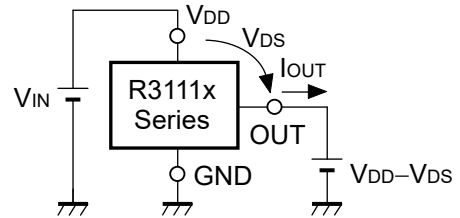


Detector Threshold Test Circuit

(Pull-up circuit is not necessary for CMOS Output type.)

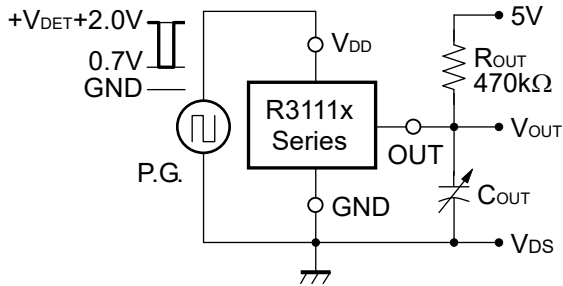


Nch Driver Output Current Test Circuit



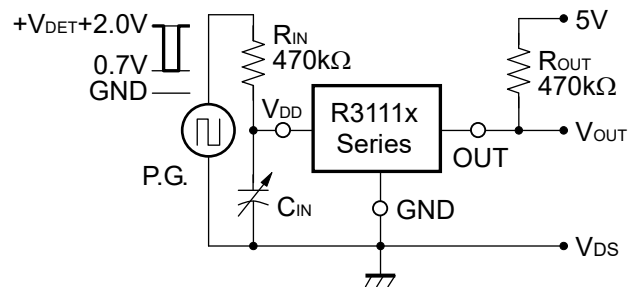
Pch Driver Output Current Test Circuit

*Apply to CMOS Output type only



Output Delay Time Test Circuit (1)

(Pull-up circuit is not necessary for CMOS Output type.)



Output Delay Time Test Circuit (2)

R3111x

● **Power Dissipation (SON1612-6)**

Power Dissipation (P_D) depends on conditions of mounting on board.
 This specification is based on the measurement at the condition below:

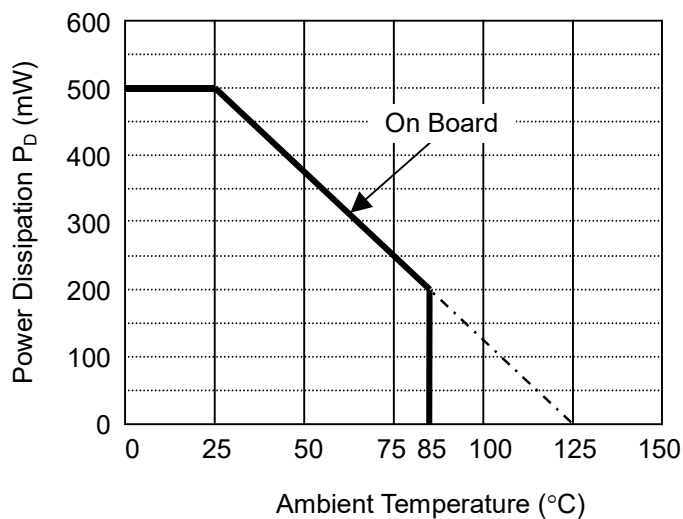
Measurement Conditions

| | Standard Land Pattern |
|------------------|---|
| Environment | Mounting on Board (Wind velocity 0m/s) |
| Board Material | Glass cloth epoxy plastic (Double layers) |
| Board Dimensions | 40mm × 40mm × 1.6mm |
| Copper Ratio | Top side: Approx. 50%, Back side: Approx. 50% |
| Through - hole | φ 0.5mm × 24pcs |

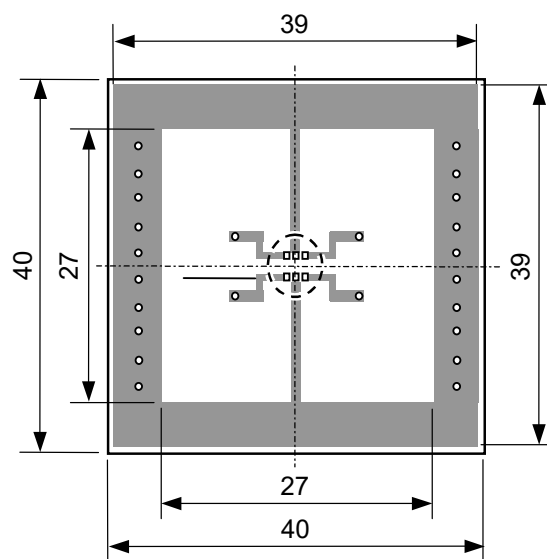
Measurement Results

($T_a=25^\circ\text{C}$, $T_{j\text{max}}=125^\circ\text{C}$)

| | Standard Land Pattern |
|--------------------|--|
| Power Dissipation | 500mW |
| Thermal Resistance | $\theta_{ja} = (125-25^\circ\text{C}) / 0.5\text{W} = 200^\circ\text{C/W}$ |



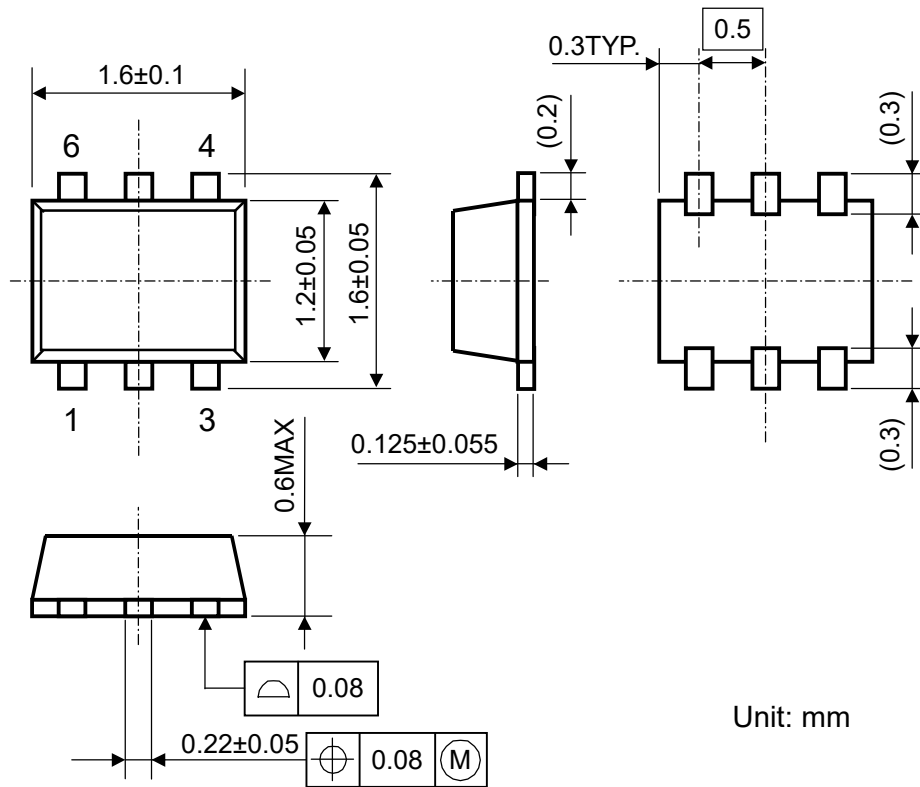
SON1612-6 Power Dissipation



Measurement Board Pattern

○ IC Mount Area Unit : mm

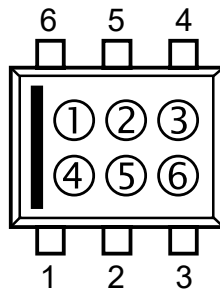
• Package Dimensions (SON1612-6)



• Mark Specification (SON1612-6)

①②③④ : Product Code ... **Refer to Mark Specification Table (SON1612-6).**

⑤⑥ : Lot No. Alphnumeric Serial Number



* R3111E (TO-92) is the discontinued product as of April, 2017.

R3111x

• Marking Specification Table (SON1612-6)

| R3111Dxx1A | | R3111Dxx1C | | R3111Dxx1B | |
|-------------------|-------------|-------------------|-------------|-------------------|-------------|
| Part Number | ①②③④ | Part Number | ①②③④ | Part Number | ①②③④ |
| R3111D091A | A09A | R3111D091C | A09C | R3111D091B | A09B |
| R3111D101A | A10A | R3111D101C | A10C | R3111D101B | A10B |
| R3111D111A | A11A | R3111D111C | A11C | R3111D111B | A11B |
| R3111D121A | A12A | R3111D121C | A12C | R3111D121B | A12B |
| R3111D131A | A13A | R3111D131C | A13C | R3111D131B | A13B |
| R3111D141A | A14A | R3111D141C | A14C | R3111D141B | A14B |
| R3111D151A | A15A | R3111D151C | A15C | R3111D151B | A15B |
| R3111D161A | A16A | R3111D161C | A16C | R3111D161B | A16B |
| R3111D171A | A17A | R3111D171C | A17C | R3111D171B | A17B |
| R3111D181A | A18A | R3111D181C | A18C | R3111D181B | A18B |
| R3111D191A | A19A | R3111D191C | A19C | R3111D191B | A19B |
| R3111D201A | A20A | R3111D201C | A20C | R3111D201B | A20B |
| R3111D211A | A21A | R3111D211C | A21C | R3111D211B | A21B |
| R3111D221A | A22A | R3111D221C | A22C | R3111D221B | A22B |
| R3111D231A | A23A | R3111D231C | A23C | R3111D231B | A23B |
| R3111D241A | A24A | R3111D241C | A24C | R3111D241B | A24B |
| R3111D251A | A25A | R3111D251C | A25C | R3111D251B | A25B |
| R3111D261A | A26A | R3111D261C | A26C | R3111D261B | A26B |
| R3111D271A | A27A | R3111D271C | A27C | R3111D271B | A27B |
| R3111D281A | A28A | R3111D281C | A28C | R3111D281B | A28B |
| R3111D291A | A29A | R3111D291C | A29C | R3111D291B | A29B |
| R3111D301A | A30A | R3111D301C | A30C | R3111D301B | A30B |
| R3111D311A | A31A | R3111D311C | A31C | R3111D311B | A31B |
| R3111D321A | A32A | R3111D321C | A32C | R3111D321B | A32B |
| R3111D331A | A33A | R3111D331C | A33C | R3111D331B | A33B |
| R3111D341A | A34A | R3111D341C | A34C | R3111D341B | A34B |
| R3111D351A | A35A | R3111D351C | A35C | R3111D351B | A35B |
| R3111D361A | A36A | R3111D361C | A36C | R3111D361B | A36B |
| R3111D371A | A37A | R3111D371C | A37C | R3111D371B | A37B |
| R3111D381A | A38A | R3111D381C | A38C | R3111D381B | A38B |
| R3111D391A | A39A | R3111D391C | A39C | R3111D391B | A39B |
| R3111D401A | A40A | R3111D401C | A40C | R3111D401B | A40B |
| R3111D411A | A41A | R3111D411C | A41C | R3111D411B | A41B |
| R3111D421A | A42A | R3111D421C | A42C | R3111D421B | A42B |
| R3111D431A | A43A | R3111D431C | A43C | R3111D431B | A43B |
| R3111D441A | A44A | R3111D441C | A44C | R3111D441B | A44B |
| R3111D451A | A45A | R3111D451C | A45C | R3111D451B | A45B |
| R3111D461A | A46A | R3111D461C | A46C | R3111D461B | A46B |
| R3111D471A | A47A | R3111D471C | A47C | R3111D471B | A47B |
| R3111D481A | A48A | R3111D481C | A48C | R3111D481B | A48B |
| R3111D491A | A49A | R3111D491C | A49C | R3111D491B | A49B |
| R3111D501A | A50A | R3111D501C | A50C | R3111D501B | A50B |
| R3111D511A | A51A | R3111D511C | A51C | R3111D511B | A51B |
| R3111D521A | A52A | R3111D521C | A52C | R3111D521B | A52B |
| R3111D531A | A53A | R3111D531C | A53C | R3111D531B | A53B |
| R3111D541A | A54A | R3111D541C | A54C | R3111D541B | A54B |
| R3111D551A | A55A | R3111D551C | A55C | R3111D551B | A55B |
| R3111D561A | A56A | R3111D561C | A56C | R3111D561B | A56B |
| R3111D571A | A57A | R3111D571C | A57C | R3111D571B | A57B |
| R3111D581A | A58A | R3111D581C | A58C | R3111D581B | A58B |
| R3111D591A | A59A | R3111D591C | A59C | R3111D591B | A59B |
| R3111D601A | A60A | R3111D601C | A60C | R3111D601B | A60B |

● **Power Dissipation (SC-82AB)**

Power Dissipation (P_D) depends on conditions of mounting on board. This specification is based on the measurement at the condition below;

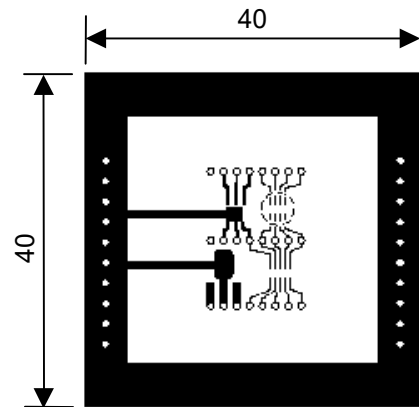
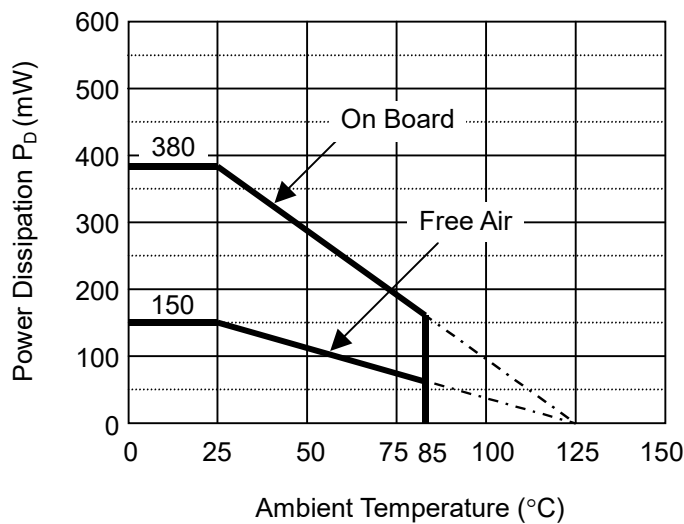
Measurement Conditions

| | Standard Land Pattern |
|------------------|---|
| Environment | Mounting on Board (Wind velocity=0m/s) |
| Board Material | Glass cloth epoxy plastic (Double Layers) |
| Board Dimensions | 40mm × 40mm × 1.6mm |
| Copper Ratio | Top side: Approx. 50%, Back side: Approx. 50% |
| Through-hole | φ0.5mm × 44pcs |

Measurement Result

($T_a=25^{\circ}\text{C}$, $T_{j\text{max}}=125^{\circ}\text{C}$)

| | Standard Land Pattern | Free Air |
|--------------------|---|--------------------------|
| Power Dissipation | 380mW | 150mW |
| Thermal Resistance | $\theta_{ja}=(125-25^{\circ}\text{C})/0.38\text{W}=263^{\circ}\text{C/W}$ | 667 $^{\circ}\text{C/W}$ |

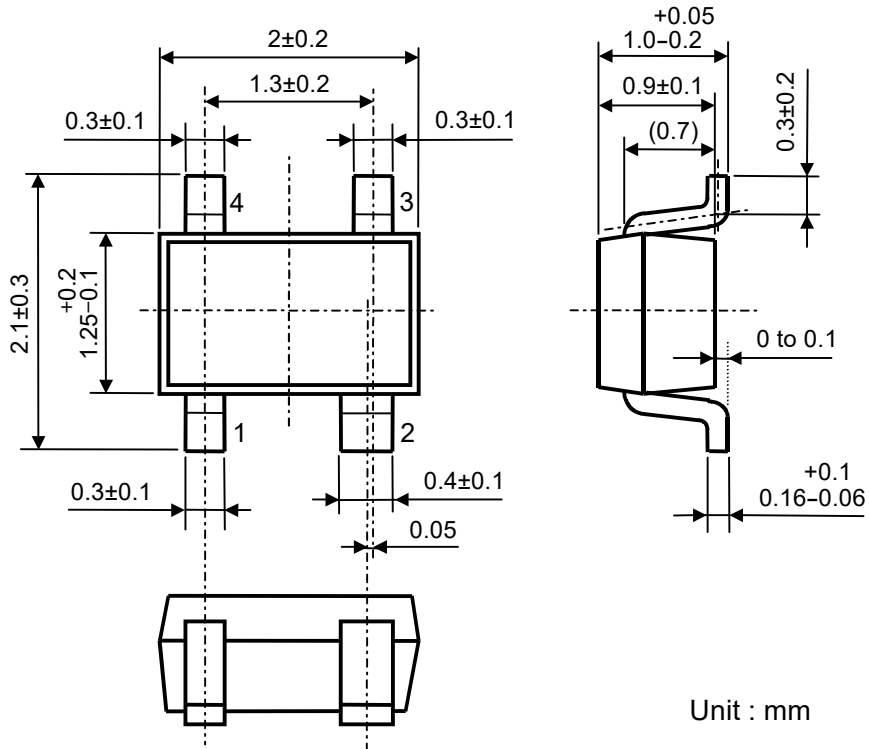


Measurement Board Pattern

○ IC Mount Area (Unit : mm)

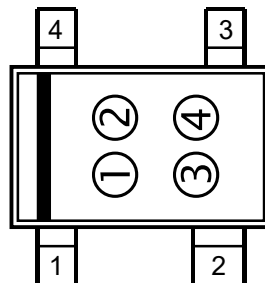
R3111x

• **Package Dimensions (SC-82AB)**



• **Mark Specification (SC-82AB)**

- ①② : Product Code ... **Refer to Mark Specification Table (SC-82AB).**
- ③④ : Lot No. Alphnumeric Serial Number



* R3111E (TO-92) is the discontinued product as of April, 2017.

R3111x

• **Marking Specification Table (SC-82AB)**

| R3111Qxx1A | | R3111Qxx1C | | R3111Qxx1B | |
|-------------------|-----------|-------------------|-----------|-------------------|-----------|
| Part Number | ①② | Part Number | ①② | Part Number | ①② |
| R3111Q091A | K9 | R3111Q091C | T9 | R3111Q091B | 09 |
| R3111Q101A | L0 | R3111Q101C | U0 | R3111Q101B | 10 |
| R3111Q111A | L1 | R3111Q111C | U1 | R3111Q111B | 11 |
| R3111Q121A | L2 | R3111Q121C | U2 | R3111Q121B | 12 |
| R3111Q131A | L3 | R3111Q131C | U3 | R3111Q131B | 13 |
| R3111Q141A | L4 | R3111Q141C | U4 | R3111Q141B | 14 |
| R3111Q151A | L5 | R3111Q151C | U5 | R3111Q151B | 15 |
| R3111Q161A | L6 | R3111Q161C | U6 | R3111Q161B | 16 |
| R3111Q171A | L7 | R3111Q171C | U7 | R3111Q171B | 17 |
| R3111Q181A | L8 | R3111Q181C | U8 | R3111Q181B | 18 |
| R3111Q191A | L9 | R3111Q191C | U9 | R3111Q191B | 19 |
| R3111Q201A | M0 | R3111Q201C | V0 | R3111Q201B | 20 |
| R3111Q211A | M1 | R3111Q211C | V1 | R3111Q211B | 21 |
| R3111Q221A | M2 | R3111Q221C | V2 | R3111Q221B | 22 |
| R3111Q231A | M3 | R3111Q231C | V3 | R3111Q231B | 23 |
| R3111Q241A | M4 | R3111Q241C | V4 | R3111Q241B | 24 |
| R3111Q251A | M5 | R3111Q251C | V5 | R3111Q251B | 25 |
| R3111Q261A | M6 | R3111Q261C | V6 | R3111Q261B | 26 |
| R3111Q271A | M7 | R3111Q271C | V7 | R3111Q271B | 27 |
| R3111Q281A | M8 | R3111Q281C | V8 | R3111Q281B | 28 |
| R3111Q291A | M9 | R3111Q291C | V9 | R3111Q291B | 29 |
| R3111Q301A | N0 | R3111Q301C | W0 | R3111Q301B | 30 |
| R3111Q311A | N1 | R3111Q311C | W1 | R3111Q311B | 31 |
| R3111Q321A | N2 | R3111Q321C | W2 | R3111Q321B | 32 |
| R3111Q331A | N3 | R3111Q331C | W3 | R3111Q331B | 33 |
| R3111Q341A | N4 | R3111Q341C | W4 | R3111Q341B | 34 |
| R3111Q351A | N5 | R3111Q351C | W5 | R3111Q351B | 35 |
| R3111Q361A | N6 | R3111Q361C | W6 | R3111Q361B | 36 |
| R3111Q371A | N7 | R3111Q371C | W7 | R3111Q371B | 37 |
| R3111Q381A | N8 | R3111Q381C | W8 | R3111Q381B | 38 |
| R3111Q391A | N9 | R3111Q391C | W9 | R3111Q391B | 39 |
| R3111Q401A | P0 | R3111Q401C | X0 | R3111Q401B | 40 |
| R3111Q411A | P1 | R3111Q411C | X1 | R3111Q411B | 41 |
| R3111Q421A | P2 | R3111Q421C | X2 | R3111Q421B | 42 |
| R3111Q431A | P3 | R3111Q431C | X3 | R3111Q431B | 43 |
| R3111Q441A | P4 | R3111Q441C | X4 | R3111Q441B | 44 |
| R3111Q451A | P5 | R3111Q451C | X5 | R3111Q451B | 45 |
| R3111Q461A | P6 | R3111Q461C | X6 | R3111Q461B | 46 |
| R3111Q471A | P7 | R3111Q471C | X7 | R3111Q471B | 47 |
| R3111Q481A | P8 | R3111Q481C | X8 | R3111Q481B | 48 |
| R3111Q491A | P9 | R3111Q491C | X9 | R3111Q491B | 49 |
| R3111Q501A | R0 | R3111Q501C | Y0 | R3111Q501B | 50 |
| R3111Q511A | R1 | R3111Q511C | Y1 | R3111Q511B | 51 |
| R3111Q521A | R2 | R3111Q521C | Y2 | R3111Q521B | 52 |
| R3111Q531A | R3 | R3111Q531C | Y3 | R3111Q531B | 53 |
| R3111Q541A | R4 | R3111Q541C | Y4 | R3111Q541B | 54 |
| R3111Q551A | R5 | R3111Q551C | Y5 | R3111Q551B | 55 |
| R3111Q561A | R6 | R3111Q561C | Y6 | R3111Q561B | 56 |
| R3111Q571A | R7 | R3111Q571C | Y7 | R3111Q571B | 57 |
| R3111Q581A | R8 | R3111Q581C | Y8 | R3111Q581B | 58 |
| R3111Q591A | R9 | R3111Q591C | Y9 | R3111Q591B | 59 |
| R3111Q601A | S0 | R3111Q601C | Z0 | R3111Q601B | 60 |

* R3111E (TO-92) is the discontinued product as of April, 2017.

R3111x

• Power Dissipation (SC-88A)

Power Dissipation (P_D) depends on conditions of mounting on board. This specification is based on the measurement at the condition below;

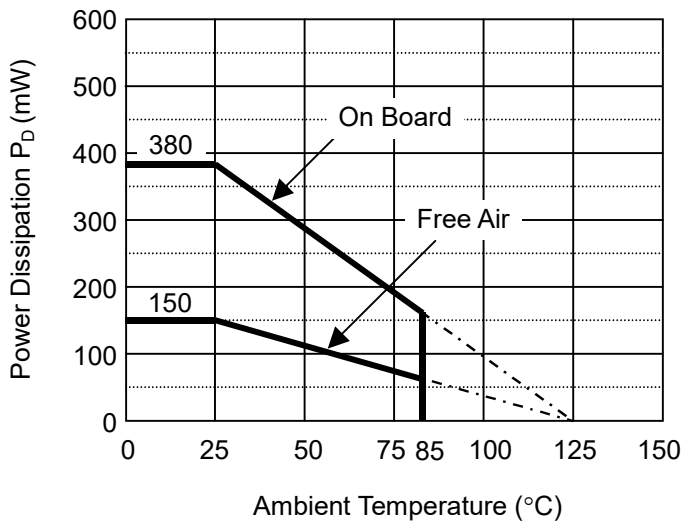
Measurement Conditions

| | Standard Land Pattern |
|------------------|---|
| Environment | Mounting on Board (Wind velocity=0m/s) |
| Board Material | Glass cloth epoxy plastic (Double Layers) |
| Board Dimensions | 40mm × 40mm × 1.6mm |
| Copper Ratio | Top side: Approx. 50%, Back side: Approx. 50% |
| Through-hole | φ0.5mm × 44pcs |

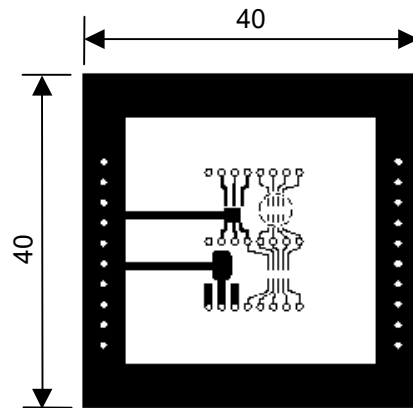
Measurement Result

($T_a=25^\circ\text{C}$, $T_{j\text{max}}=125^\circ\text{C}$)

| | Standard Land Pattern | Free Air |
|--------------------|---|---|
| Power Dissipation | 380mW | 150mW |
| Thermal Resistance | $\theta_{ja}=(125-25^\circ\text{C})/0.38\text{W}=263^\circ\text{C/W}$ | $\theta_{ja}=(125-25^\circ\text{C})/0.15\text{W}=667^\circ\text{C/W}$ |
| | $\theta_{jc}=75^\circ\text{C/W}$ | - |



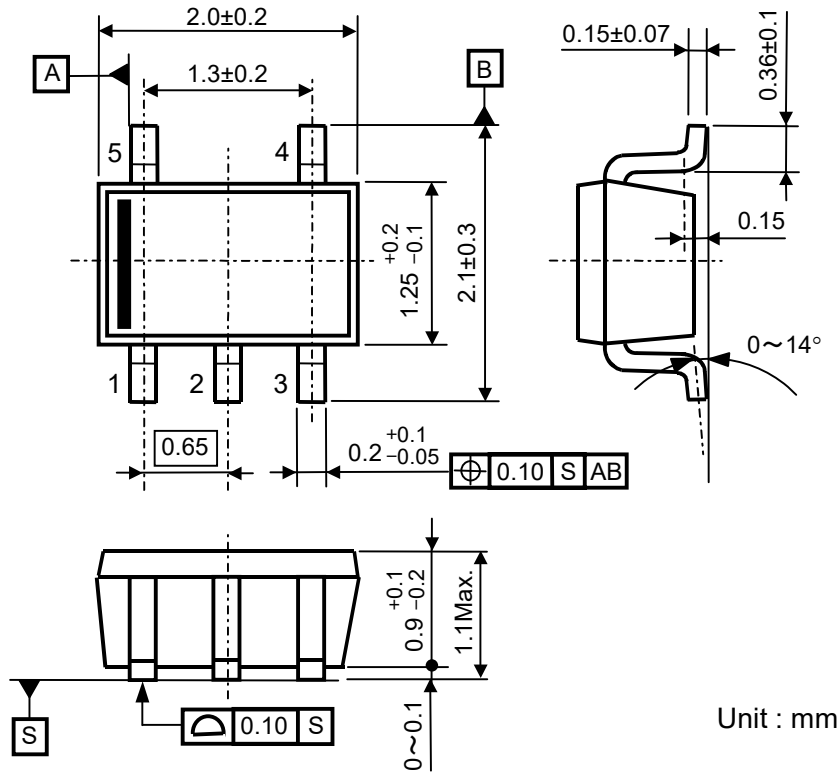
Power Dissipation



Measurement Board Pattern

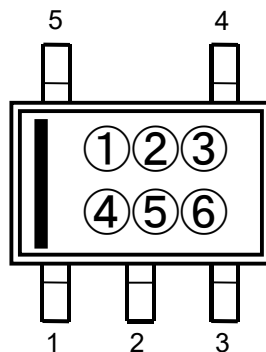
○ IC Mount Area (Unit : mm)

• Package Dimensions (SC-88A)



• Mark Specification (SC-88A)

- ①②③④ : Product Code ... **Refer to Mark Specification Table (SC-88A).**
- ⑤⑥ : Lot No. Alphnumeric Serial Number



* R3111E (TO-92) is the discontinued product as of April, 2017.

R3111x

• Marking Specification Table (SC-88A)

| R3111Qxx2A | | R3111Qxx2C | | R3111Qxx2B | |
|-------------|------|-------------|------|-------------|------|
| Part Number | ①②③④ | Part Number | ①②③④ | Part Number | ①②③④ |
| R3111Q092A | U009 | R3111Q092C | V009 | R3111Q092B | W009 |
| R3111Q102A | U010 | R3111Q102C | V010 | R3111Q102B | W010 |
| R3111Q112A | U011 | R3111Q112C | V011 | R3111Q112B | W011 |
| R3111Q122A | U012 | R3111Q122C | V012 | R3111Q122B | W012 |
| R3111Q132A | U013 | R3111Q132C | V013 | R3111Q132B | W013 |
| R3111Q142A | U014 | R3111Q142C | V014 | R3111Q142B | W014 |
| R3111Q152A | U015 | R3111Q152C | V015 | R3111Q152B | W015 |
| R3111Q162A | U016 | R3111Q162C | V016 | R3111Q162B | W016 |
| R3111Q172A | U017 | R3111Q172C | V017 | R3111Q172B | W017 |
| R3111Q182A | U018 | R3111Q182C | V018 | R3111Q182B | W018 |
| R3111Q192A | U019 | R3111Q192C | V019 | R3111Q192B | W019 |
| R3111Q202A | U020 | R3111Q202C | V020 | R3111Q202B | W020 |
| R3111Q212A | U021 | R3111Q212C | V021 | R3111Q212B | W021 |
| R3111Q222A | U022 | R3111Q222C | V022 | R3111Q222B | W022 |
| R3111Q232A | U023 | R3111Q232C | V023 | R3111Q232B | W023 |
| R3111Q242A | U024 | R3111Q242C | V024 | R3111Q242B | W024 |
| R3111Q252A | U025 | R3111Q252C | V025 | R3111Q252B | W025 |
| R3111Q262A | U026 | R3111Q262C | V026 | R3111Q262B | W026 |
| R3111Q272A | U027 | R3111Q272C | V027 | R3111Q272B | W027 |
| R3111Q282A | U028 | R3111Q282C | V028 | R3111Q282B | W028 |
| R3111Q292A | U029 | R3111Q292C | V029 | R3111Q292B | W029 |
| R3111Q302A | U030 | R3111Q302C | V030 | R3111Q302B | W030 |
| R3111Q312A | U031 | R3111Q312C | V031 | R3111Q312B | W031 |
| R3111Q322A | U032 | R3111Q322C | V032 | R3111Q322B | W032 |
| R3111Q332A | U033 | R3111Q332C | V033 | R3111Q332B | W033 |
| R3111Q342A | U034 | R3111Q342C | V034 | R3111Q342B | W034 |
| R3111Q352A | U035 | R3111Q352C | V035 | R3111Q352B | W035 |
| R3111Q362A | U036 | R3111Q362C | V036 | R3111Q362B | W036 |
| R3111Q372A | U037 | R3111Q372C | V037 | R3111Q372B | W037 |
| R3111Q382A | U038 | R3111Q382C | V038 | R3111Q382B | W038 |
| R3111Q392A | U039 | R3111Q392C | V039 | R3111Q392B | W039 |
| R3111Q402A | U040 | R3111Q402C | V040 | R3111Q402B | W040 |
| R3111Q412A | U041 | R3111Q412C | V041 | R3111Q412B | W041 |
| R3111Q422A | U042 | R3111Q422C | V042 | R3111Q422B | W042 |
| R3111Q432A | U043 | R3111Q432C | V043 | R3111Q432B | W043 |
| R3111Q442A | U044 | R3111Q442C | V044 | R3111Q442B | W044 |
| R3111Q452A | U045 | R3111Q452C | V045 | R3111Q452B | W045 |
| R3111Q462A | U046 | R3111Q462C | V046 | R3111Q462B | W046 |
| R3111Q472A | U047 | R3111Q472C | V047 | R3111Q472B | W047 |
| R3111Q482A | U048 | R3111Q482C | V048 | R3111Q482B | W048 |
| R3111Q492A | U049 | R3111Q492C | V049 | R3111Q492B | W049 |
| R3111Q502A | U050 | R3111Q502C | V050 | R3111Q502B | W050 |
| R3111Q512A | U051 | R3111Q512C | V051 | R3111Q512B | W051 |
| R3111Q522A | U052 | R3111Q522C | V052 | R3111Q522B | W052 |
| R3111Q532A | U053 | R3111Q532C | V053 | R3111Q532B | W053 |
| R3111Q542A | U054 | R3111Q542C | V054 | R3111Q542B | W054 |
| R3111Q552A | U055 | R3111Q552C | V055 | R3111Q552B | W055 |
| R3111Q562A | U056 | R3111Q562C | V056 | R3111Q562B | W056 |
| R3111Q572A | U057 | R3111Q572C | V057 | R3111Q572B | W057 |
| R3111Q582A | U058 | R3111Q582C | V058 | R3111Q582B | W058 |
| R3111Q592A | U059 | R3111Q592C | V059 | R3111Q592B | W059 |
| R3111Q602A | U060 | R3111Q602C | V060 | R3111Q602B | W060 |
| R3111Q222A5 | U001 | | | | |

● **Power Dissipation (SOT-23-5)**

Power Dissipation (P_D) depends on conditions of mounting on board. This specification is based on the measurement at the condition below:

(Power Dissipation (SOT-23-5) is substitution of SOT-23-6.)

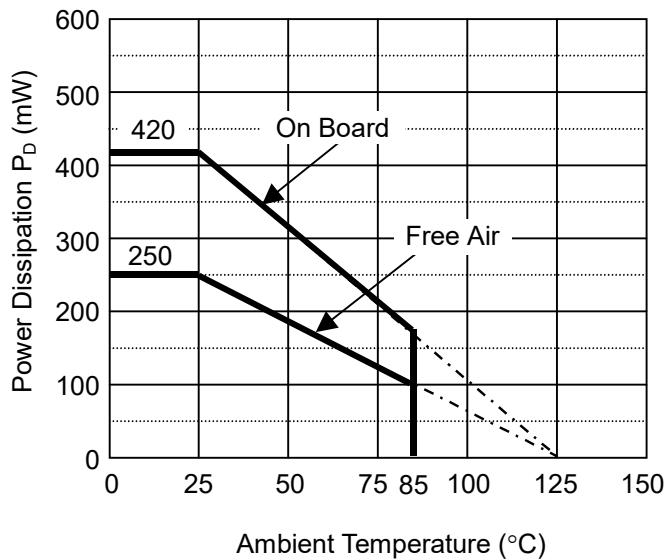
Measurement Conditions

| | Standard Test Land Pattern |
|------------------|---|
| Environment | Mounting on Board (Wind velocity=0m/s) |
| Board Material | Glass cloth epoxy plastic (Double sided) |
| Board Dimensions | 40mm × 40mm × 1.6mm |
| Copper Ratio | Top side: Approx. 50%, Back side: Approx. 50% |
| Through-holes | φ 0.5mm × 44pcs |

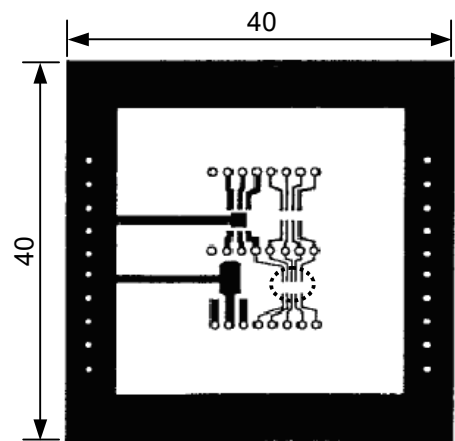
Measurement Result

($T_a=25^\circ\text{C}$, $T_{j\text{max}}=125^\circ\text{C}$)

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



Power Dissipation



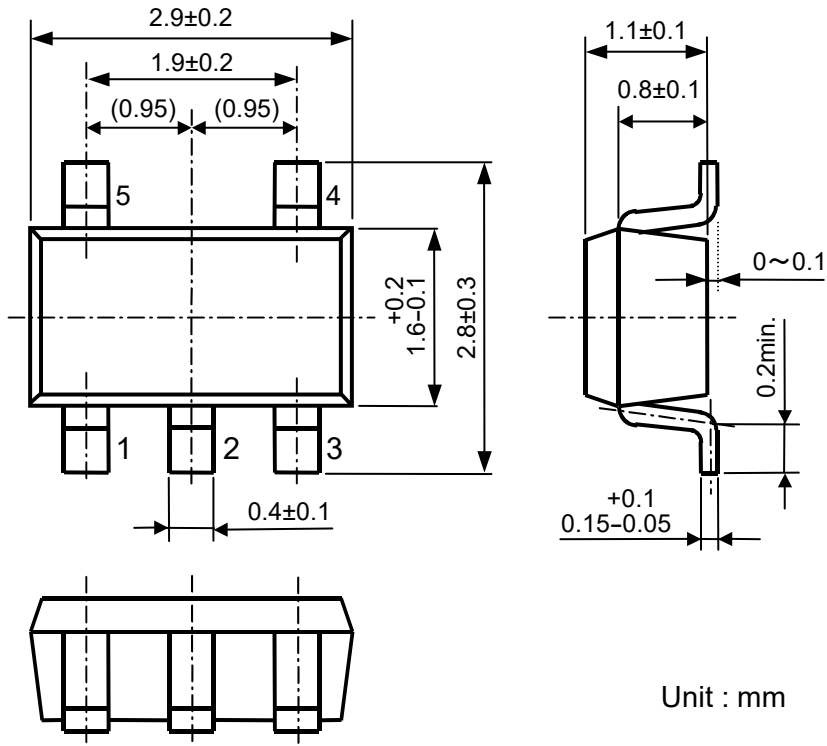
Measurement Board Pattern

○ IC Mount Area (Unit: mm)

* R3111E (TO-92) is the discontinued product as of April, 2017.

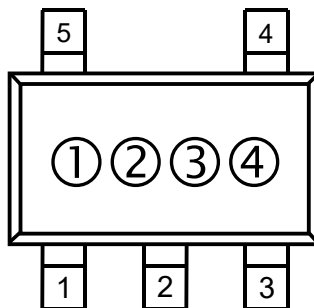
R3111x

• Package Dimensions (SOT-23-5)



• Mark Specification (SOT-23-5)

- ①② : Product Code ...**Refer to Mark Specification Table (SOT-23-5).**
- ③④ : Lot No. Alphabetic Serial Number



* R3111E (TO-92) is the discontinued product as of April, 2017.

R3111x

• Marking Specification Table (SOT-23-5)

| R3111Nxx1A | | R3111Nxx1C | | R3111Nxx1B | |
|-------------|----|-------------|----|-------------|----|
| Part Number | ①② | Part Number | ①② | Part Number | ①② |
| R3111N091A | 9A | R3111N091C | 9H | R3111N091B | D1 |
| R3111N101A | 0B | R3111N101C | 0J | R3111N101B | D2 |
| R3111N111A | 1B | R3111N111C | 1J | R3111N111B | D3 |
| R3111N121A | 2B | R3111N121C | 2J | R3111N121B | D4 |
| R3111N131A | 3B | R3111N131C | 3J | R3111N131B | D5 |
| R3111N141A | 4B | R3111N141C | 4J | R3111N141B | D6 |
| R3111N151A | 5B | R3111N151C | 5J | R3111N151B | D7 |
| R3111N161A | 6B | R3111N161C | 6J | R3111N161B | D8 |
| R3111N171A | 7B | R3111N171C | 7J | R3111N171B | D9 |
| R3111N181A | 8B | R3111N181C | 8J | R3111N181B | J1 |
| R3111N191A | 9B | R3111N191C | 9J | R3111N191B | J2 |
| R3111N201A | 0C | R3111N201C | 0K | R3111N201B | J3 |
| R3111N211A | 1C | R3111N211C | 1K | R3111N211B | J4 |
| R3111N221A | 2C | R3111N221C | 2K | R3111N221B | J5 |
| R3111N231A | 3C | R3111N231C | 3K | R3111N231B | J6 |
| R3111N241A | 4C | R3111N241C | 4K | R3111N241B | J7 |
| R3111N251A | 5C | R3111N251C | 5K | R3111N251B | EB |
| R3111N261A | 6C | R3111N261C | 6K | R3111N261B | EC |
| R3111N271A | 7C | R3111N271C | 7K | R3111N271B | ED |
| R3111N281A | 8C | R3111N281C | 8K | R3111N281B | EE |
| R3111N291A | 9C | R3111N291C | 9K | R3111N291B | EF |
| R3111N301A | 0D | R3111N301C | 0L | R3111N301B | EG |
| R3111N311A | 1D | R3111N311C | 1L | R3111N311B | EH |
| R3111N321A | 2D | R3111N321C | 2L | R3111N321B | EJ |
| R3111N331A | 3D | R3111N331C | 3L | R3111N331B | EK |
| R3111N341A | 4D | R3111N341C | 4L | R3111N341B | KB |
| R3111N351A | 5D | R3111N351C | 5L | R3111N351B | KC |
| R3111N361A | 6D | R3111N361C | 6L | R3111N361B | KD |
| R3111N371A | 7D | R3111N371C | 7L | R3111N371B | KE |
| R3111N381A | 8D | R3111N381C | 8L | R3111N381B | KF |
| R3111N391A | 9D | R3111N391C | 9L | R3111N391B | KG |
| R3111N401A | 0E | R3111N401C | 0M | R3111N401B | KH |
| R3111N411A | 1E | R3111N411C | 1M | R3111N411B | KJ |
| R3111N421A | 2E | R3111N421C | 2M | R3111N421B | KK |
| R3111N431A | 3E | R3111N431C | 3M | R3111N431B | QB |
| R3111N441A | 4E | R3111N441C | 4M | R3111N441B | QC |
| R3111N451A | 5E | R3111N451C | 5M | R3111N451B | QD |
| R3111N461A | 6E | R3111N461C | 6M | R3111N461B | QE |
| R3111N471A | 7E | R3111N471C | 7M | R3111N471B | QF |
| R3111N481A | 8E | R3111N481C | 8M | R3111N481B | QG |
| R3111N491A | 9E | R3111N491C | 9M | R3111N491B | QH |
| R3111N501A | 0F | R3111N501C | 0N | R3111N501B | QJ |
| R3111N511A | 1F | R3111N511C | 1N | R3111N511B | QK |
| R3111N521A | 2F | R3111N521C | 2N | R3111N521B | VB |
| R3111N531A | 3F | R3111N531C | 3N | R3111N531B | VC |
| R3111N541A | 4F | R3111N541C | 4N | R3111N541B | VD |
| R3111N551A | 5F | R3111N551C | 5N | R3111N551B | VE |
| R3111N561A | 6F | R3111N561C | 6N | R3111N561B | VF |
| R3111N571A | 7F | R3111N571C | 7N | R3111N571B | VG |
| R3111N581A | 8F | R3111N581C | 8N | R3111N581B | VH |
| R3111N591A | 9F | R3111N591C | 9N | R3111N591B | VJ |
| R3111N601A | 0G | R3111N601C | 0P | R3111N601B | VK |

R3111x

• **Power Dissipation (SOT-23-3)**

Power Dissipation (P_D) depends on conditions of mounting on board. This specification is based on the measurement at the condition below:

(Power Dissipation (SOT-23-3) is substitution of SOT-23-6.)

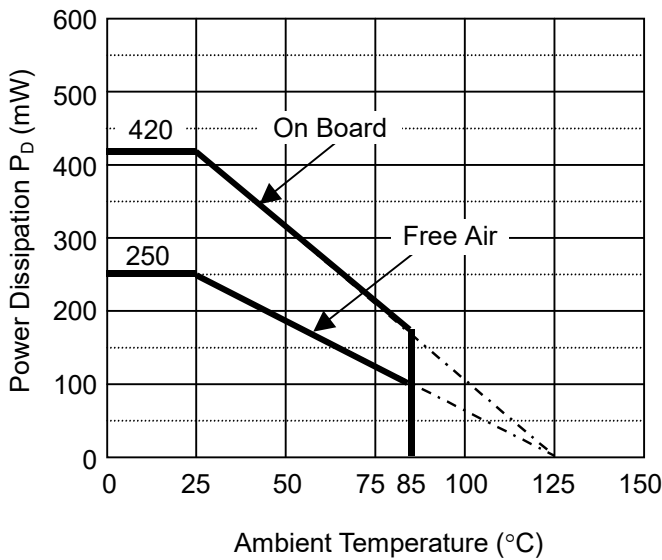
Measurement Conditions

| | Standard Test Land Pattern |
|------------------|---|
| Environment | Mounting on Board (Wind velocity=0m/s) |
| Board Material | Glass cloth epoxy plastic (Double sided) |
| Board Dimensions | 40mm × 40mm × 1.6mm |
| Copper Ratio | Top side: Approx. 50%, Back side: Approx. 50% |
| Through-holes | φ 0.5mm × 44pcs |

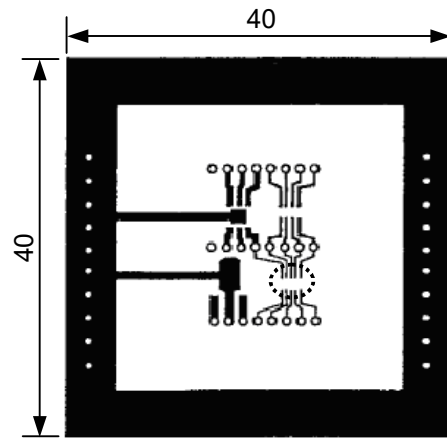
Measurement Result

($T_a=25^{\circ}\text{C}$, $T_{j\text{max}}=125^{\circ}\text{C}$)

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



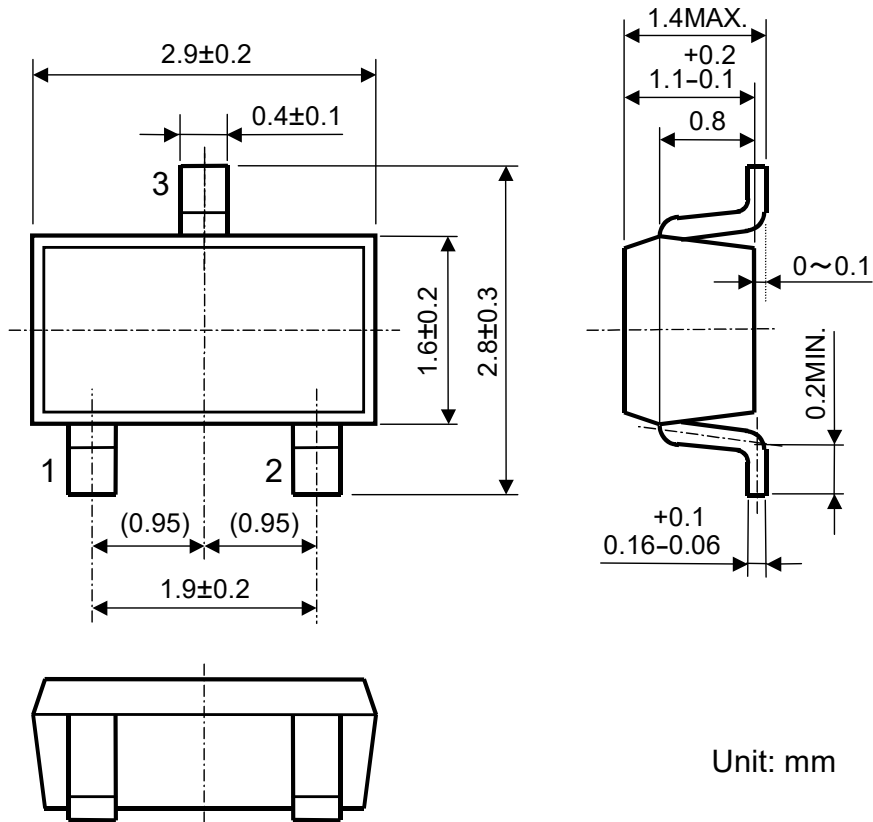
Power Dissipation



Measurement Board Pattern

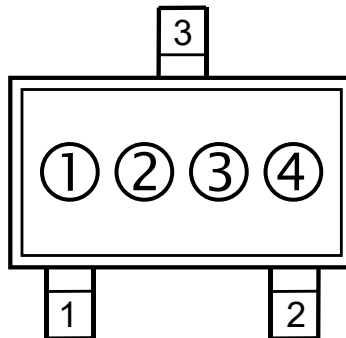
○ IC Mount Area (Unit: mm)

● Package Dimensions (SOT-23-3)



● Mark Specification (SOT-23-3)

- ①② : Product Code ... Refer to Mark Specification Table (SOT-23-3).
- ③④ : Lot No. Alphnumeric Serial Number



* R3111E (TO-92) is the discontinued product as of April, 2017.

R3111x

• Marking Specification Table (SOT-23-3)

| R3111Nxx2A | | R3111Nxx2C | |
|-------------------|-----------|-------------------|-----------|
| Part Number | ①② | Part Number | ①② |
| R3111N092A | A9 | R3111N092C | H9 |
| R3111N102A | B0 | R3111N102C | J0 |
| R3111N112A | B1 | R3111N112C | J1 |
| R3111N122A | B2 | R3111N122C | J2 |
| R3111N132A | B3 | R3111N132C | J3 |
| R3111N142A | B4 | R3111N142C | J4 |
| R3111N152A | B5 | R3111N152C | J5 |
| R3111N162A | B6 | R3111N162C | J6 |
| R3111N172A | B7 | R3111N172C | J7 |
| R3111N182A | B8 | R3111N182C | J8 |
| R3111N192A | B9 | R3111N192C | J9 |
| R3111N202A | C0 | R3111N202C | K0 |
| R3111N212A | C1 | R3111N212C | K1 |
| R3111N222A | C2 | R3111N222C | K2 |
| R3111N232A | C3 | R3111N232C | K3 |
| R3111N242A | C4 | R3111N242C | K4 |
| R3111N252A | C5 | R3111N252C | K5 |
| R3111N262A | C6 | R3111N262C | K6 |
| R3111N272A | C7 | R3111N272C | K7 |
| R3111N282A | C8 | R3111N282C | K8 |
| R3111N292A | C9 | R3111N292C | K9 |
| R3111N302A | D0 | R3111N302C | L0 |
| R3111N312A | D1 | R3111N312C | L1 |
| R3111N322A | D2 | R3111N322C | L2 |
| R3111N332A | D3 | R3111N332C | L3 |
| R3111N342A | D4 | R3111N342C | L4 |
| R3111N352A | D5 | R3111N352C | L5 |
| R3111N362A | D6 | R3111N362C | L6 |
| R3111N372A | D7 | R3111N372C | L7 |
| R3111N382A | D8 | R3111N382C | L8 |
| R3111N392A | D9 | R3111N392C | L9 |
| R3111N402A | E0 | R3111N402C | M0 |
| R3111N412A | E1 | R3111N412C | M1 |
| R3111N422A | E2 | R3111N422C | M2 |
| R3111N432A | E3 | R3111N432C | M3 |
| R3111N442A | E4 | R3111N442C | M4 |
| R3111N452A | E5 | R3111N452C | M5 |
| R3111N462A | E6 | R3111N462C | M6 |
| R3111N472A | E7 | R3111N472C | M7 |
| R3111N482A | E8 | R3111N482C | M8 |
| R3111N492A | E9 | R3111N492C | M9 |
| R3111N502A | F0 | R3111N502C | N0 |
| R3111N512A | F1 | R3111N512C | N1 |
| R3111N522A | F2 | R3111N522C | N2 |
| R3111N532A | F3 | R3111N532C | N3 |
| R3111N542A | F4 | R3111N542C | N4 |
| R3111N552A | F5 | R3111N552C | N5 |
| R3111N562A | F6 | R3111N562C | N6 |
| R3111N572A | F7 | R3111N572C | N7 |
| R3111N582A | F8 | R3111N582C | N8 |
| R3111N592A | F9 | R3111N592C | N9 |
| R3111N602A | G0 | R3111N602C | P0 |

● **Power Dissipation (SOT-89-3)**

Power Dissipation (P_D) depends on conditions of mounting on board. This specification is based on the measurement at the condition below:

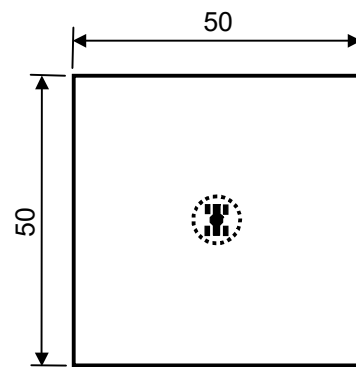
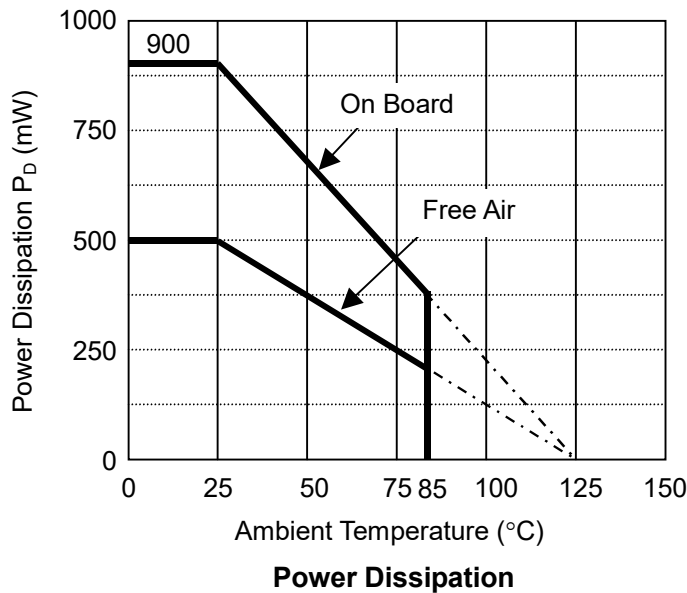
Measurement Conditions

| | Standard Land Pattern |
|------------------|--|
| Environment | Mounting on Board (Wind velocity=0m/s) |
| Board Material | Glass cloth epoxy plastic (Double sided) |
| Board Dimensions | 50mm × 50mm × 1.6mm |
| Copper Ratio | Top side : Approx. 10% , Back side : Approx. 100% |
| Through-hole | - |

Measurement Result

($T_a=25^\circ\text{C}, T_{j\text{max}}=125^\circ\text{C}$)

| | Standard Land Pattern | Free Air |
|--------------------|--|----------|
| Power Dissipation | 900mW | 500mW |
| Thermal Resistance | $\theta_{ja} = (125-25^\circ\text{C})/0.9\text{W} = 111^\circ\text{C/W}$ | 200°C/W |



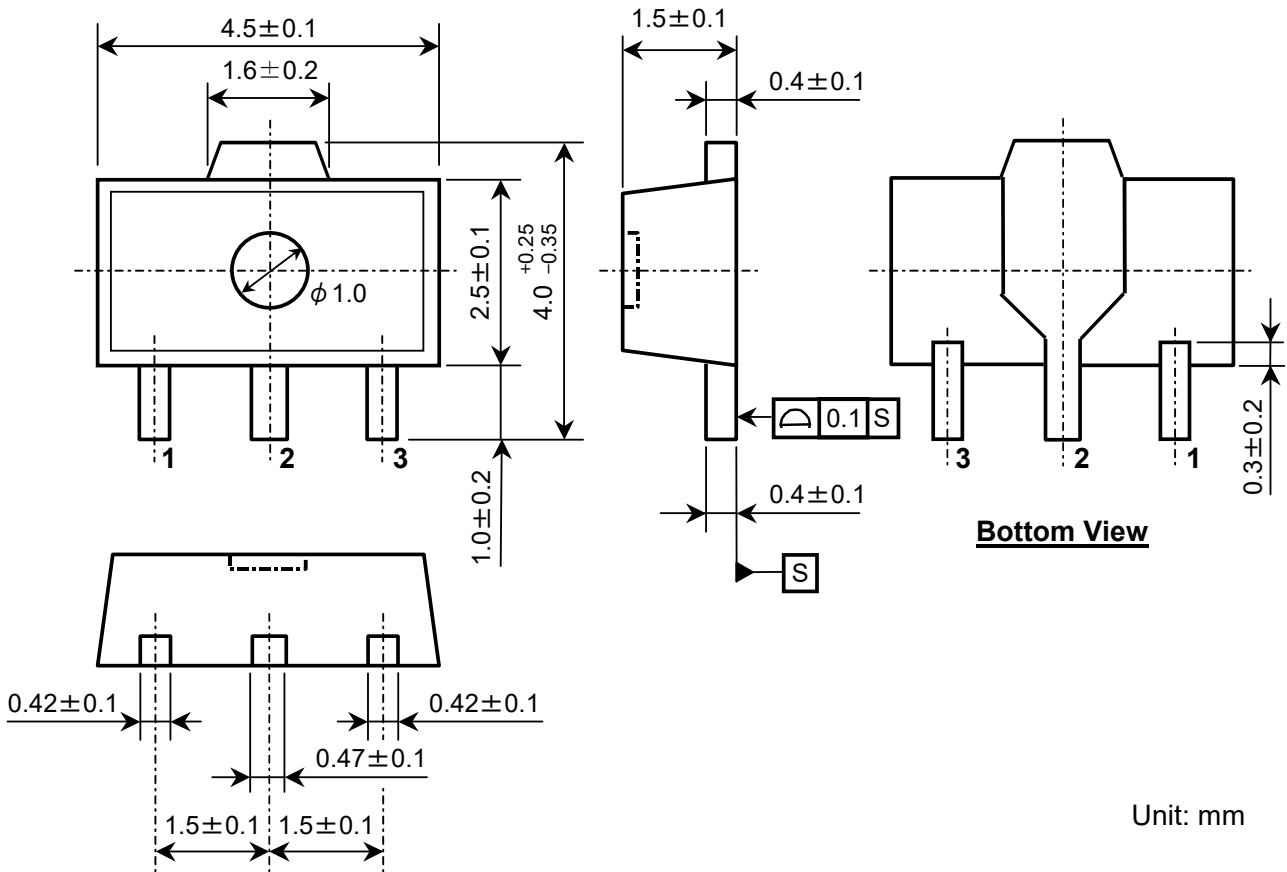
Measurement Board Pattern

○ IC Mount Area Unit : mm

* R3111E (TO-92) is the discontinued product as of April, 2017.

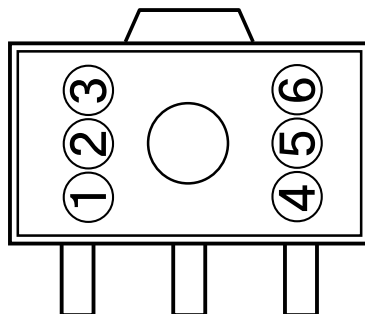
R3111x

• **Package Dimensions (SOT-89-3)**



• **Mark Specification (SOT-89-3)**

- ①②③④ : Product Code ... **Refer to Mark Specification Table (SOT-89-3).**
- ⑤⑥ : Lot No. Alphabetic Serial Number



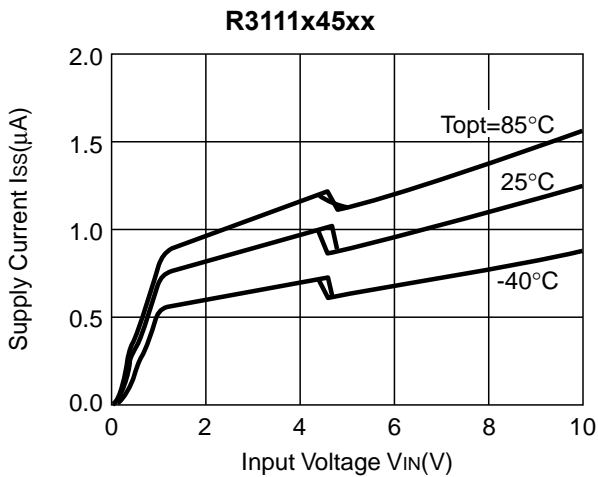
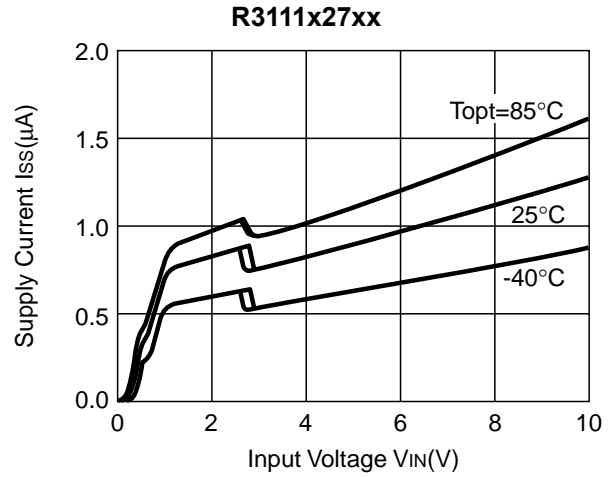
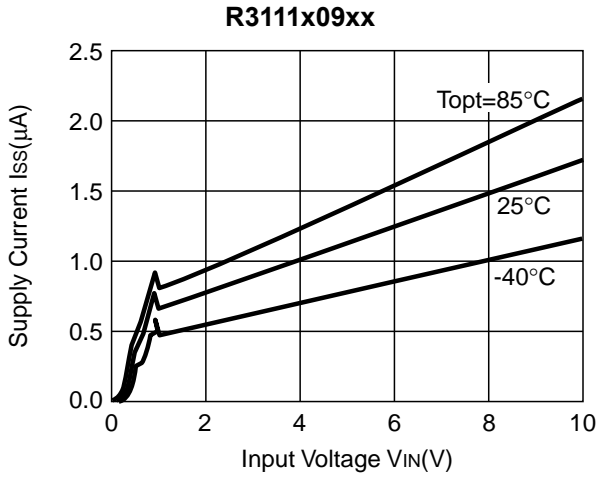
● Marking Specification Table (SOT-89-3)

| R3111Hxx1A | | R3111Hxx1C | |
|-------------|-------------|-------------|-------------|
| Part Number | ①②③④ | Part Number | ①②③④ |
| R3111H091A | A09A | R3111H091C | A09C |
| R3111H101A | A10A | R3111H101C | A10C |
| R3111H111A | A11A | R3111H111C | A11C |
| R3111H121A | A12A | R3111H121C | A12C |
| R3111H131A | A13A | R3111H131C | A13C |
| R3111H141A | A14A | R3111H141C | A14C |
| R3111H151A | A15A | R3111H151C | A15C |
| R3111H161A | A16A | R3111H161C | A16C |
| R3111H171A | A17A | R3111H171C | A17C |
| R3111H181A | A18A | R3111H181C | A18C |
| R3111H191A | A19A | R3111H191C | A19C |
| R3111H201A | A20A | R3111H201C | A20C |
| R3111H211A | A21A | R3111H211C | A21C |
| R3111H221A | A22A | R3111H221C | A22C |
| R3111H231A | A23A | R3111H231C | A23C |
| R3111H241A | A24A | R3111H241C | A24C |
| R3111H251A | A25A | R3111H251C | A25C |
| R3111H261A | A26A | R3111H261C | A26C |
| R3111H271A | A27A | R3111H271C | A27C |
| R3111H281A | A28A | R3111H281C | A28C |
| R3111H291A | A29A | R3111H291C | A29C |
| R3111H301A | A30A | R3111H301C | A30C |
| R3111H311A | A31A | R3111H311C | A31C |
| R3111H321A | A32A | R3111H321C | A32C |
| R3111H331A | A33A | R3111H331C | A33C |
| R3111H341A | A34A | R3111H341C | A34C |
| R3111H351A | A35A | R3111H351C | A35C |
| R3111H361A | A36A | R3111H361C | A36C |
| R3111H371A | A37A | R3111H371C | A37C |
| R3111H381A | A38A | R3111H381C | A38C |
| R3111H391A | A39A | R3111H391C | A39C |
| R3111H401A | A40A | R3111H401C | A40C |
| R3111H411A | A41A | R3111H411C | A41C |
| R3111H421A | A42A | R3111H421C | A42C |
| R3111H431A | A43A | R3111H431C | A43C |
| R3111H441A | A44A | R3111H441C | A44C |
| R3111H451A | A45A | R3111H451C | A45C |
| R3111H461A | A46A | R3111H461C | A46C |
| R3111H471A | A47A | R3111H471C | A47C |
| R3111H481A | A48A | R3111H481C | A48C |
| R3111H491A | A49A | R3111H491C | A49C |
| R3111H501A | A50A | R3111H501C | A50C |
| R3111H511A | A51A | R3111H511C | A51C |
| R3111H521A | A52A | R3111H521C | A52C |
| R3111H531A | A53A | R3111H531C | A53C |
| R3111H541A | A54A | R3111H541C | A54C |
| R3111H551A | A55A | R3111H551C | A55C |
| R3111H561A | A56A | R3111H561C | A56C |
| R3111H571A | A57A | R3111H571C | A57C |
| R3111H581A | A58A | R3111H581C | A58C |
| R3111H591A | A59A | R3111H591C | A59C |
| R3111H601A | A60A | R3111H601C | A60C |

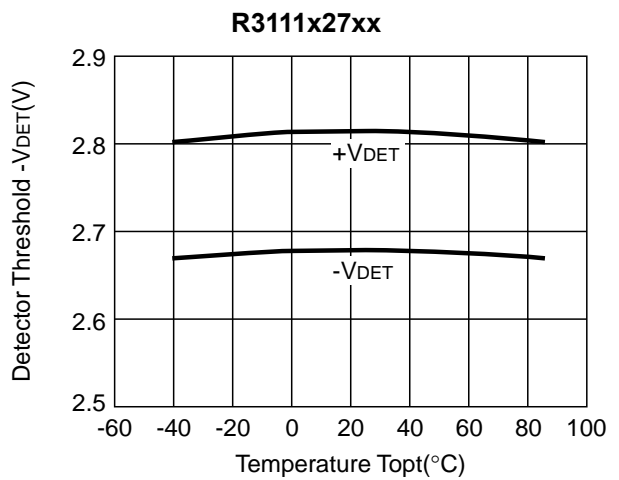
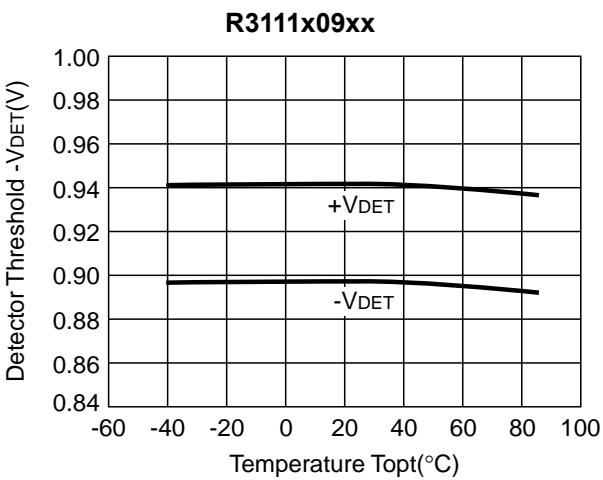
R3111x

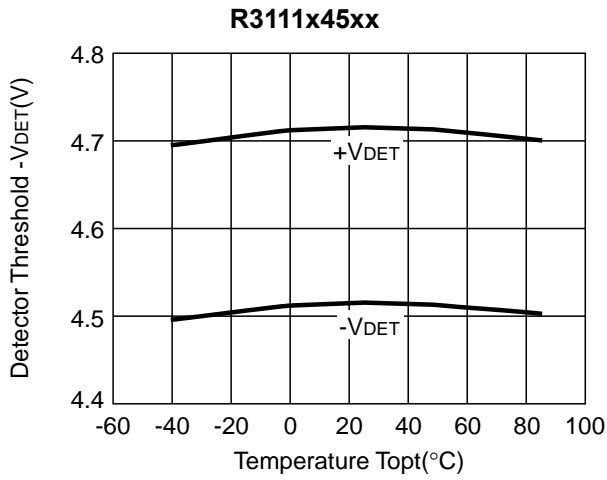
TYPICAL CHARACTERISTICS

1) Supply Current vs. Input Voltage

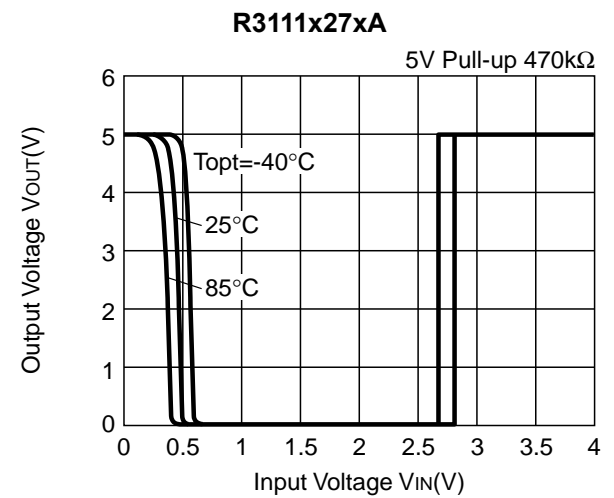
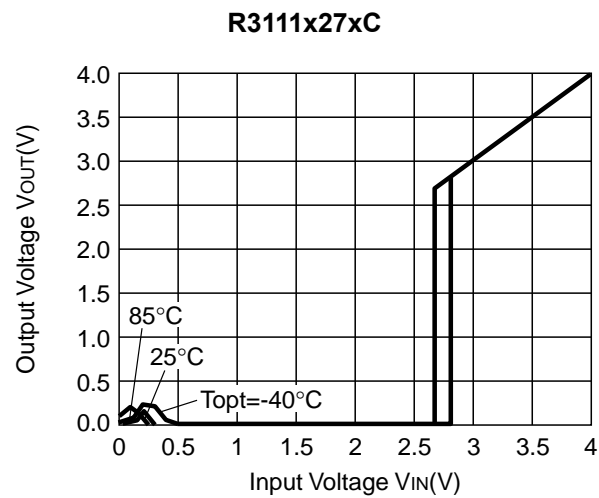
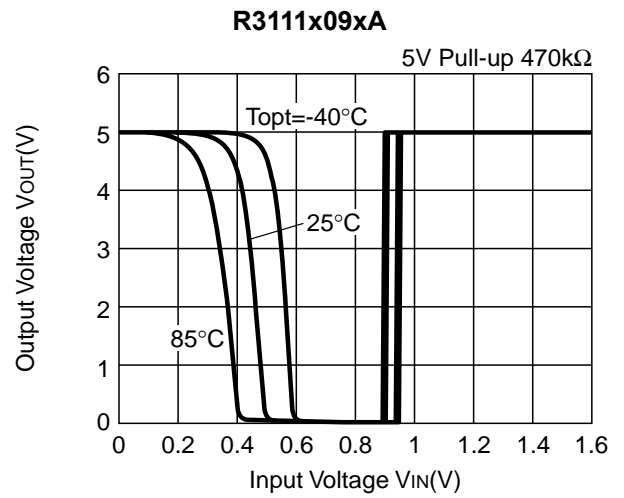
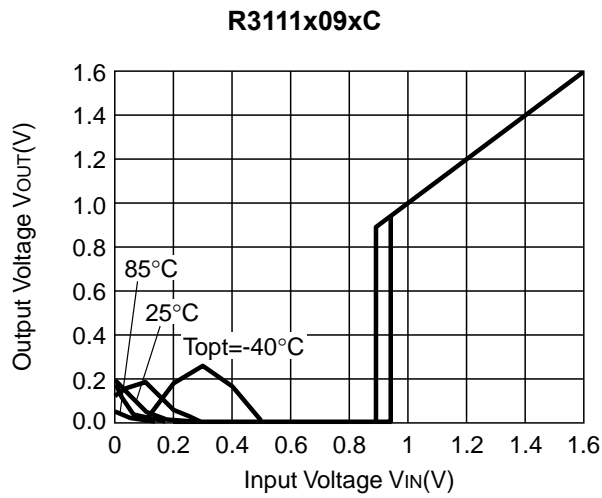


2) Detector Threshold Hysteresis vs. Temperature





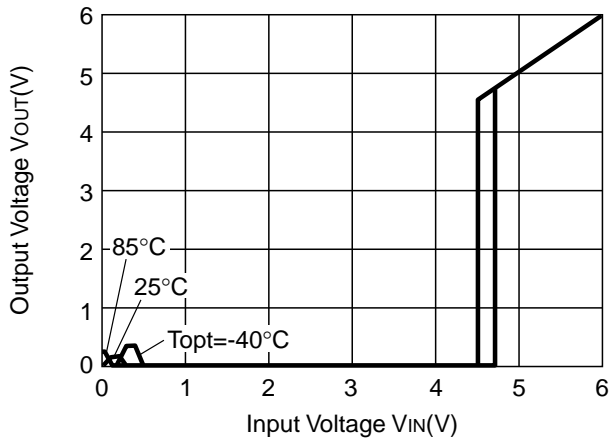
3) Output Voltage vs. Input Voltage



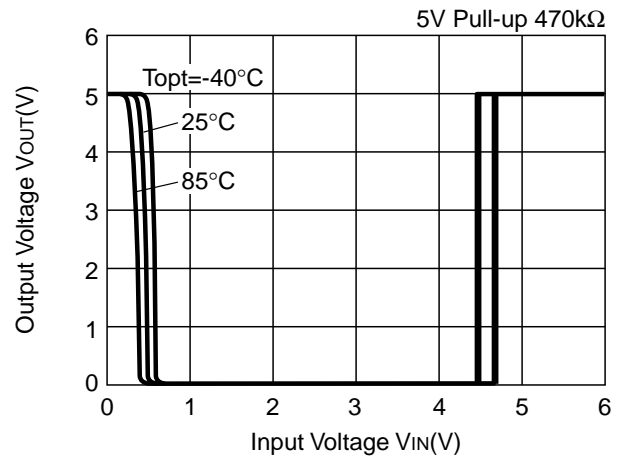
* R3111E (TO-92) is the discontinued product as of April, 2017.

R3111x

R3111x45xC

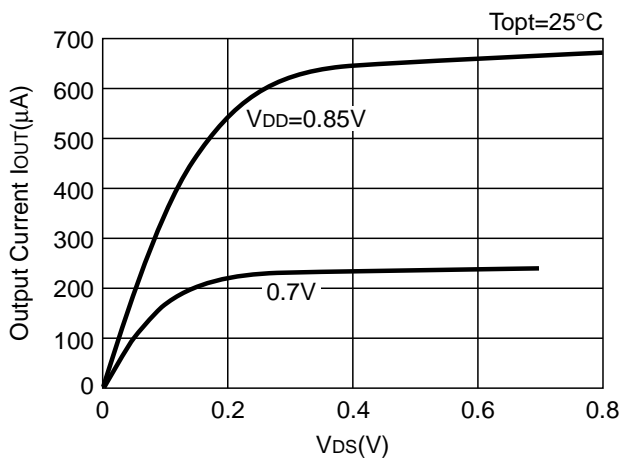


R3111x45xA

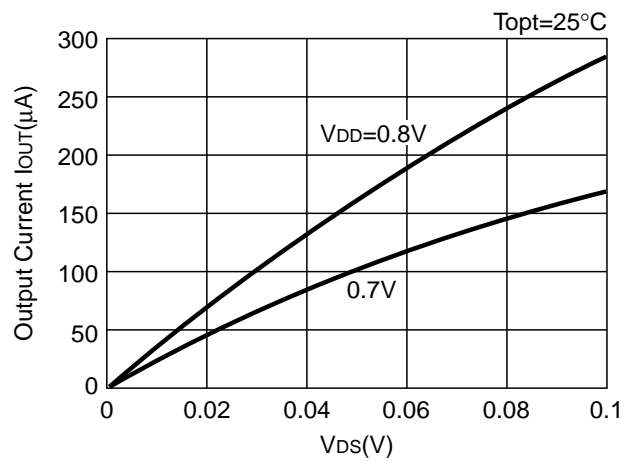


4) Nch Driver Output Current vs. V_{DS}

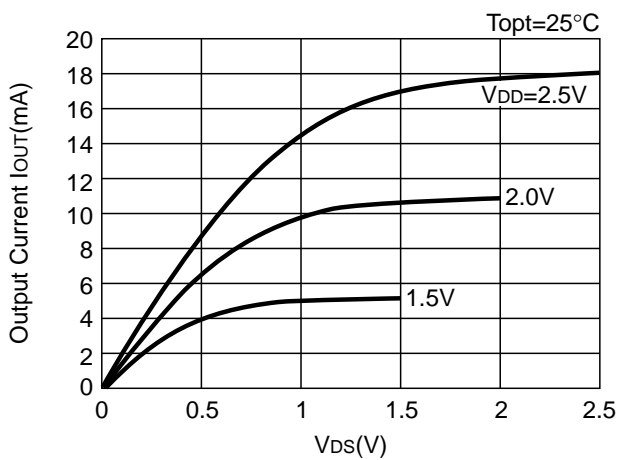
R3111x09xx



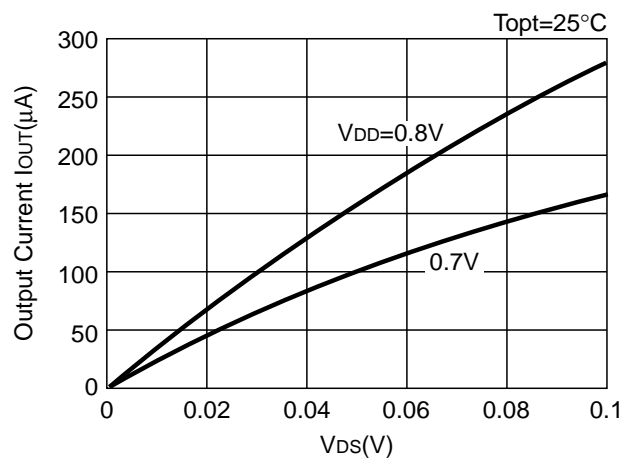
R3111x09xx



R3111x27xx

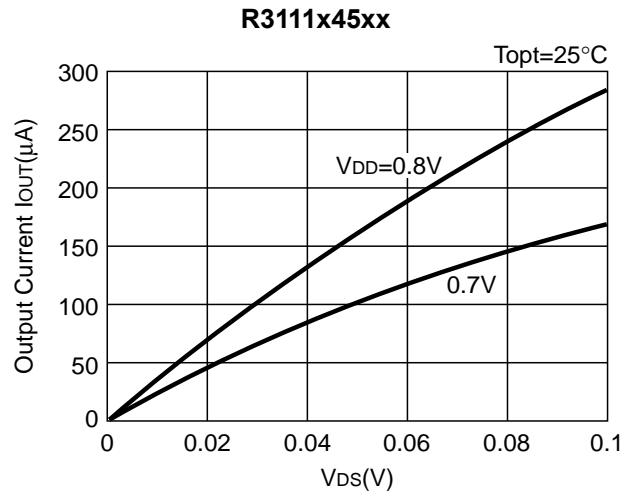
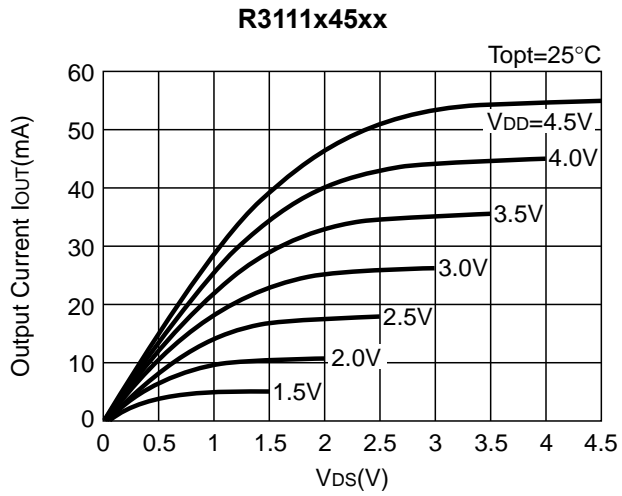


R3111x27xx

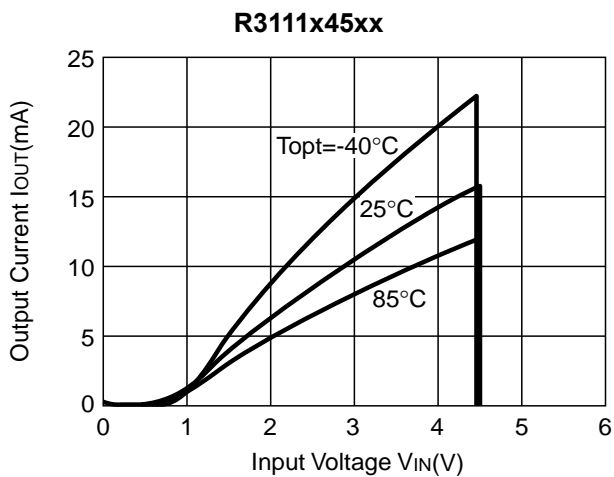
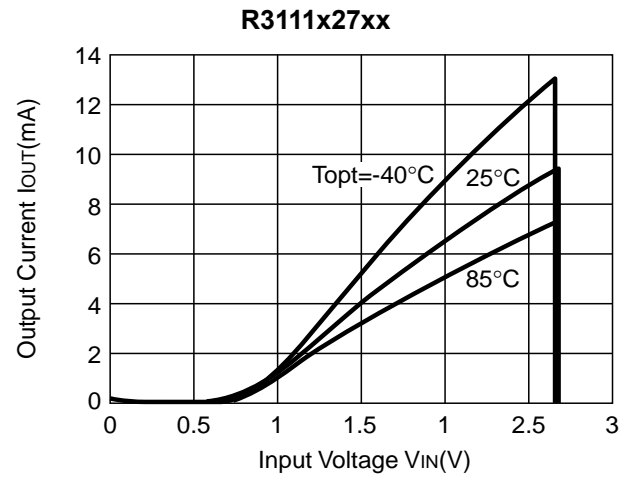
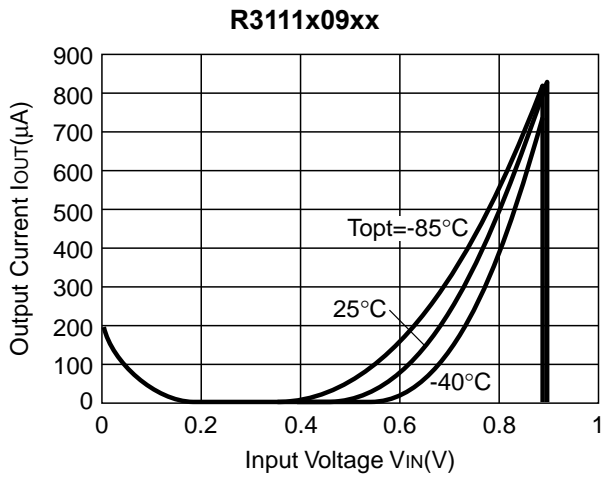


* R3111E (TO-92) is the discontinued product as of April, 2017.

R3111x

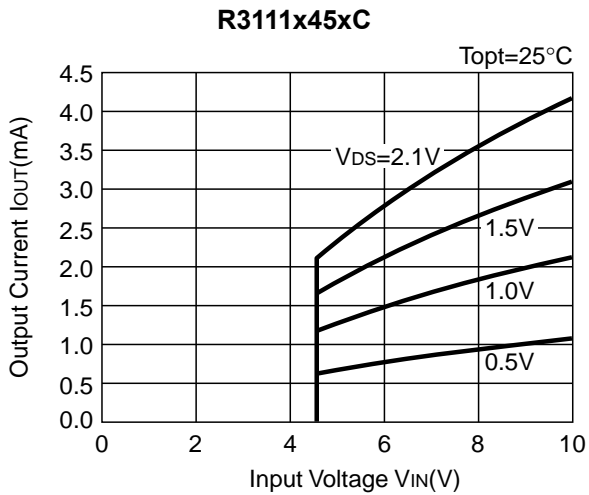
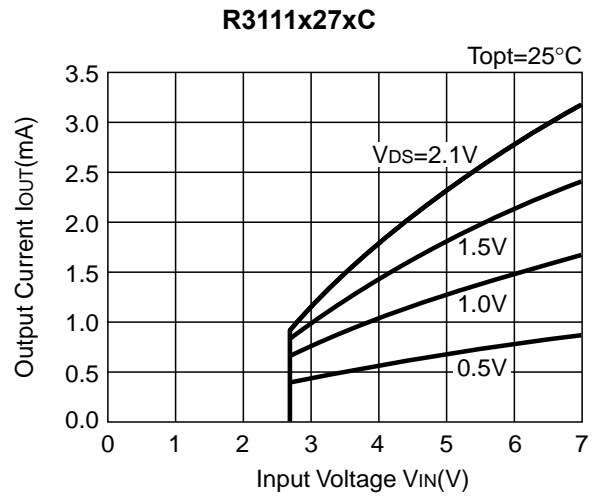
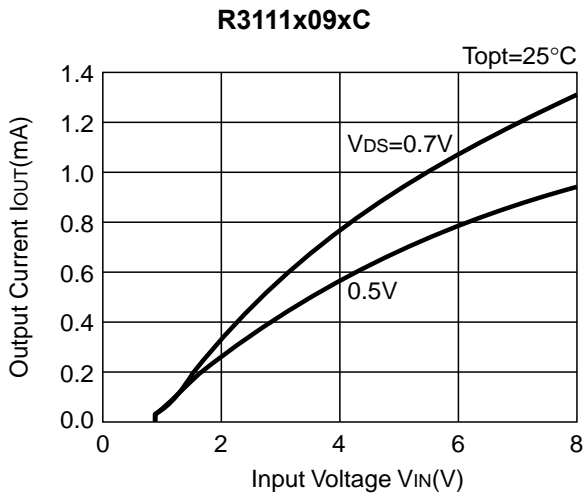


5) Nch Driver Output Current vs. Input Voltage

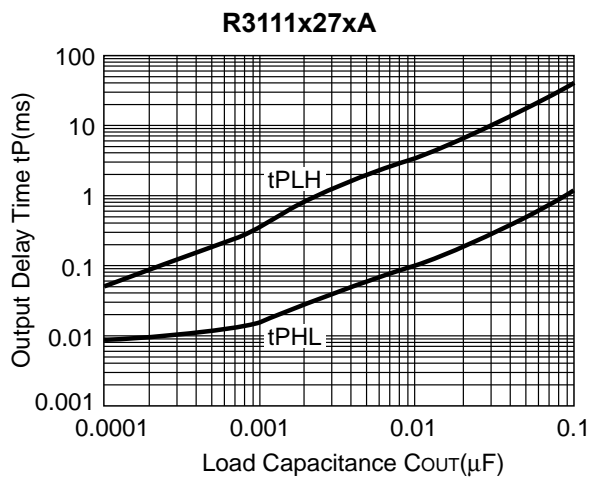
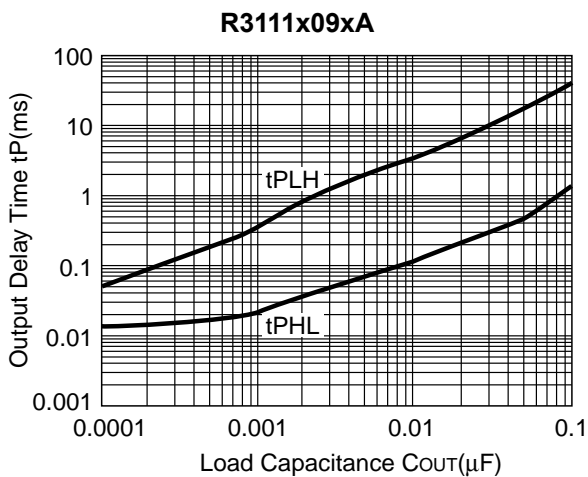


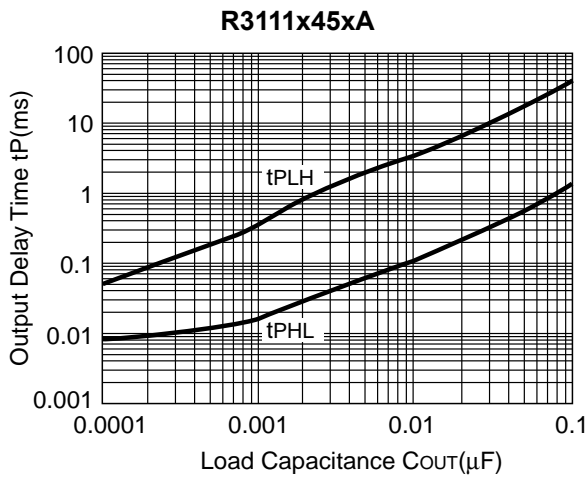
R3111x

6) Pch Driver Output Current vs. Input Voltage

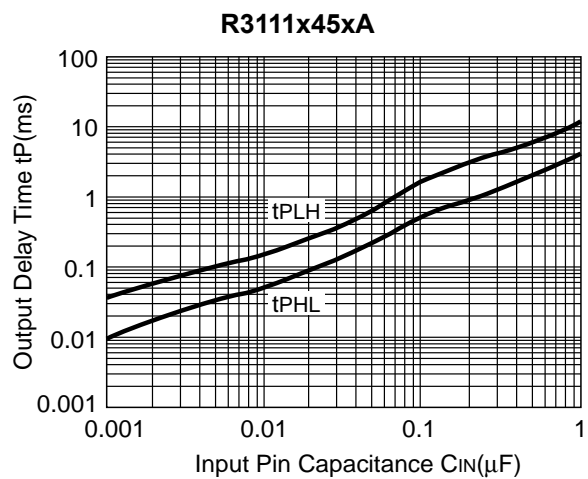
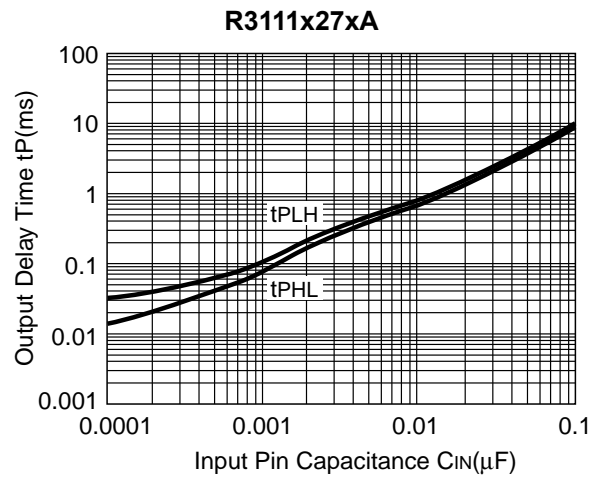
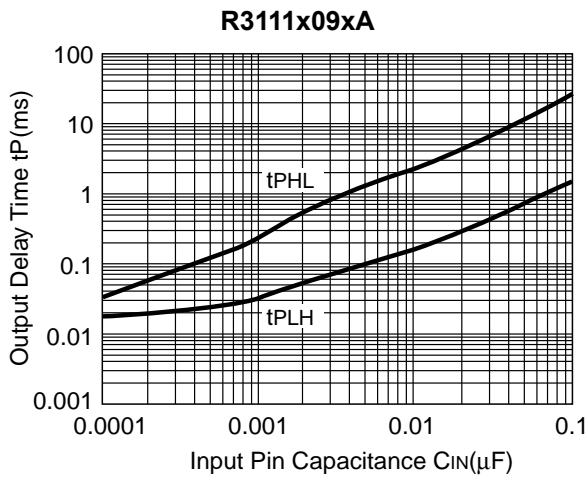


7) Output Delay Time vs. Load Capacitance ($T_a=25^\circ C$)





8) Output Delay Time vs. Input Pin Capacitance

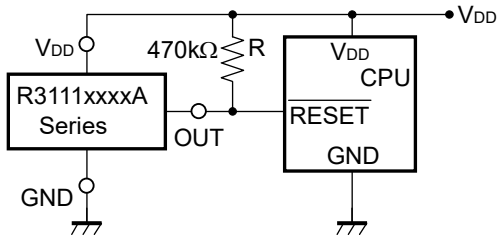


R3111x

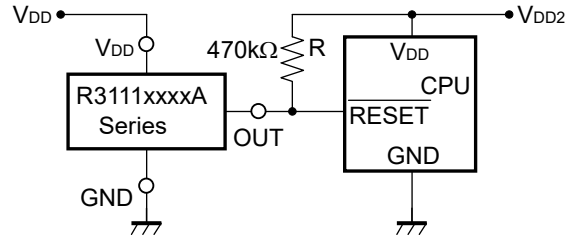
TYPICAL APPLICATION

• R3111xxxxA CPU Reset Circuit (Nch Open Drain Output)

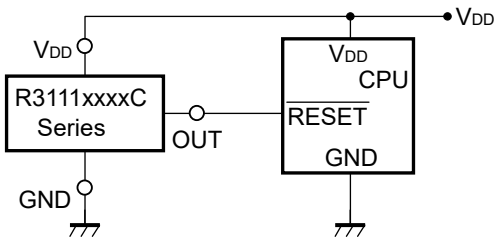
Case 1. Input Voltage to R3111xxxxA is equal to Input Voltage to CPU



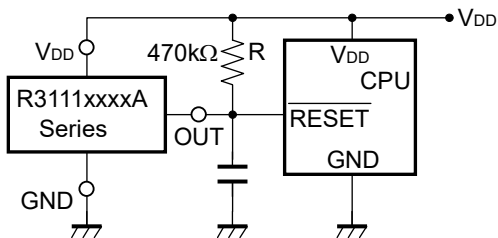
Case 2. Input Voltage to R3111xxxxA is unequal to Input Voltage to CPU



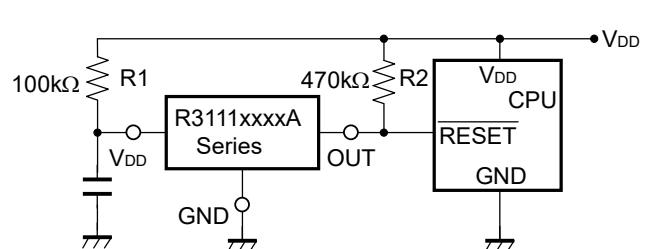
• R3111xxxxC CPU Reset Circuit (CMOS Output)



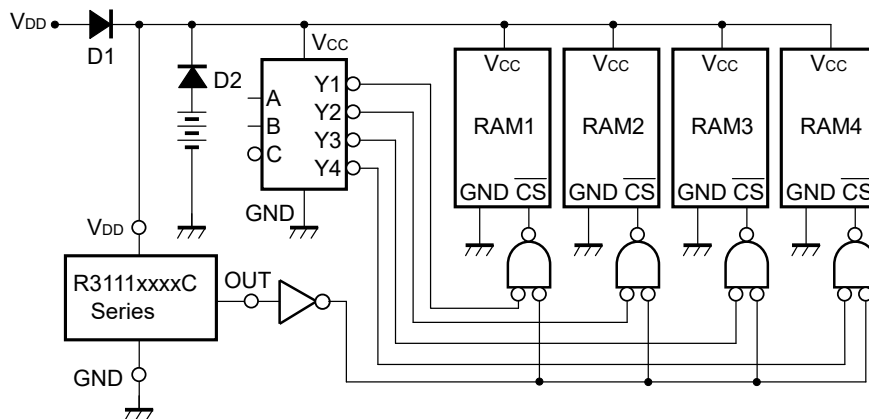
• R3111xxxxA Output Delay Time Circuit 1 (Nch Open Drain Output)



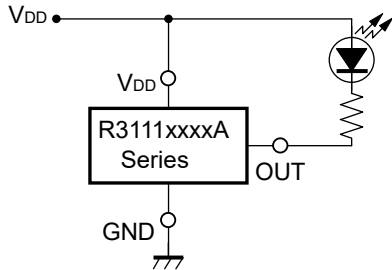
• R3111xxxxA Output Delay Time Circuit 2 (Nch Open Drain Output)



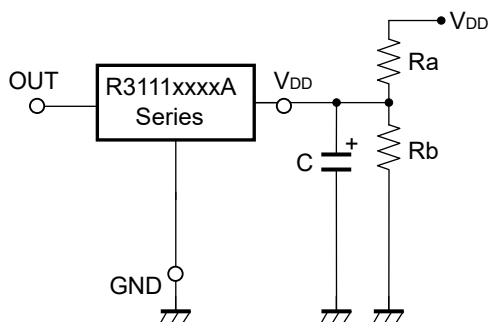
• Memory Back-up Circuit



- **Voltage level Indicator Circuit (lighted when the power runs out)**
(Nch Open Drain Output)



- **Detector Threshold Adjustable Circuit**
(Nch Open Drain Output)

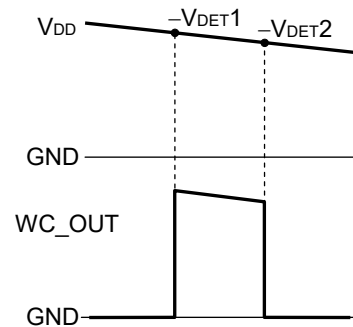
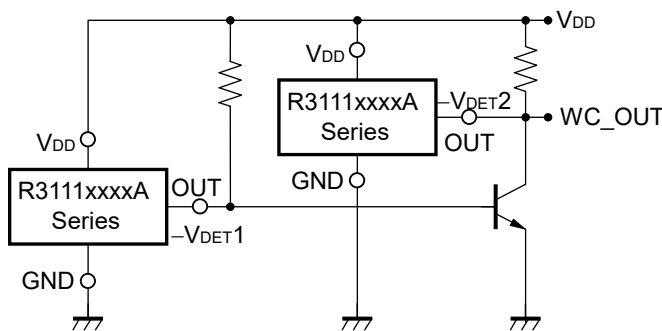


Adjusted Detector Threshold
 $= (-V_{DET}) \times (Ra + Rb) / Rb$

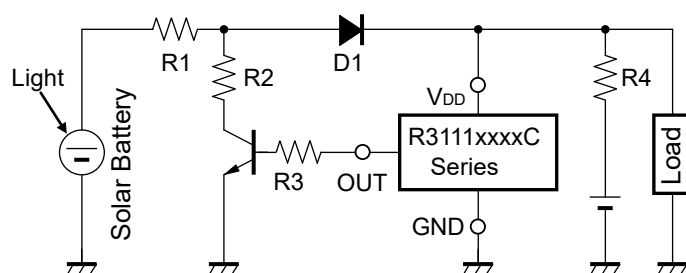
Hysteresis Voltage
 $= (V_{HYS}) \times (Ra + Rb) / Rb$

*) If the value of Ra is set excessively large, voltage drop may occur caused by the supply current of IC itself, and detector threshold may vary.

- **Window Comparator Circuit**
(Nch Open Drain Output)



- **Over-charge Preventing 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*¹, 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 100 kΩ or less as a guide, and connect C_{IN} of 0.1 μF 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 a result, make sure that the cross conduction current has no problem.

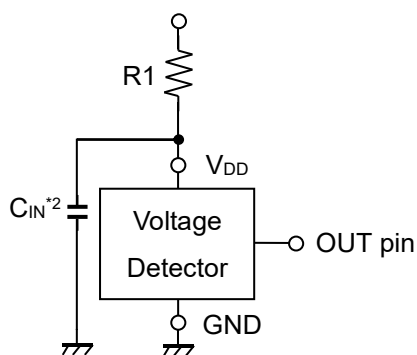


Figure A

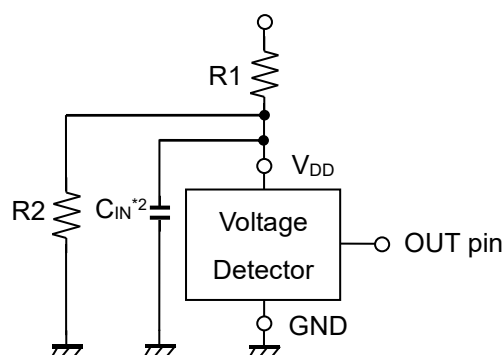


Figure B

*¹ In the CMOS output type, a charging current for OUT pin is included.

*² Note the bias dependence of capacitors.



1. The products and the product specifications described in this document are subject to change or discontinuation of production without notice for reasons such as improvement. Therefore, before deciding to use the products, please refer to Ricoh sales representatives for the latest information thereon.
2. The materials in this document may not be copied or otherwise reproduced in whole or in part without prior written consent of Ricoh.
3. Please be sure to take any necessary formalities under relevant laws or regulations before exporting or otherwise taking out of your country the products or the technical information described herein.
4. The technical information described in this document shows typical characteristics of and example application circuits for the products. The release of such information is not to be construed as a warranty of or a grant of license under Ricoh's or any third party's intellectual property rights or any other rights.
5. The products listed in this document are intended and designed for use as general electronic components in standard applications (office equipment, telecommunication equipment, measuring instruments, consumer electronic products, amusement equipment etc.). Those customers intending to use a product in an application requiring extreme quality and reliability, for example, in a highly specific application where the failure or misoperation of the product could result in human injury or death (aircraft, spacevehicle, nuclear reactor control system, traffic control system, automotive and transportation equipment, combustion equipment, safety devices, life support system etc.) should first contact us.
6. We are making our continuous effort to improve the quality and reliability of our products, but semiconductor products are likely to fail with certain probability. In order to prevent any injury to persons or damages to property resulting from such failure, customers should be careful enough to incorporate safety measures in their design, such as redundancy feature, fire containment feature and fail-safe feature. We do not assume any liability or responsibility for any loss or damage arising from misuse or inappropriate use of the products.
7. Anti-radiation design is not implemented in the products described in this document.
8. The X-ray exposure can influence functions and characteristics of the products. Confirm the product functions and characteristics in the evaluation stage.
9. WLCSP products should be used in light shielded environments. The light exposure can influence functions and characteristics of the products under operation or storage.
10. There can be variation in the marking when different AOI (Automated Optical Inspection) equipment is used. In the case of recognizing the marking characteristic with AOI, please contact Ricoh sales or our distributor before attempting to use AOI.
11. Please contact Ricoh sales representatives should you have any questions or comments concerning the products or the technical information.



Ricoh is committed to reducing the environmental loading materials in electrical devices with a view to contributing to the protection of human health and the environment.

Ricoh has been providing RoHS compliant products since April 1, 2006 and Halogen-free products since April 1, 2012.

RICOH RICOH ELECTRONIC DEVICES CO., LTD.

<https://www.e-devices.ricoh.co.jp/en/>

Sales & Support Offices

Ricoh Electronic Devices Co., Ltd.

Shin-Yokohama Office (International Sales)

2-3, Shin-Yokohama 3-chome, Kohoku-ku, Yokohama-shi, Kanagawa, 222-8530, Japan
Phone: +81-50-3814-7687 Fax: +81-45-474-0074

Ricoh Americas Holdings, Inc.

675 Campbell Technology Parkway, Suite 200 Campbell, CA 95008, U.S.A.
Phone: +1-408-610-3105

Ricoh Europe (Netherlands) B.V.

Semiconductor Support Centre

Prof. W.H. Keesomlaan 1, 1183 DJ Amstelveen, The Netherlands
Phone: +31-20-5474-309

Ricoh International B.V. - German Branch

Semiconductor Sales and Support Centre

Oberrather Strasse 6, 40472 Düsseldorf, Germany
Phone: +49-211-6546-0

Ricoh Electronic Devices Korea Co., Ltd.

3F, Haesung Bldg, 504, Teheran-ro, Gangnam-gu, Seoul, 135-725, Korea
Phone: +82-2-2135-5700 Fax: +82-2-2051-5713

Ricoh Electronic Devices Shanghai Co., Ltd.

Room 403, No.2 Building, No.690 Bibo Road, Pu Dong New District, Shanghai 201203,
People's Republic of China
Phone: +86-21-5027-3200 Fax: +86-21-5027-3299

Ricoh Electronic Devices Shanghai Co., Ltd.

Shenzhen Branch

1205, Block D (Jinlong Building), Kingkey 100, Hongbao Road, Luohu District,
Shenzhen, China
Phone: +86-755-8348-7600 Ext 225

Ricoh Electronic Devices Co., Ltd.

Taipei office

Room 109, 10F-1, No.51, Hengyang Rd., Taipei City, Taiwan (R.O.C.)
Phone: +886-2-2313-1621/1622 Fax: +886-2-2313-1623