RICOH

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. 0.8μA (-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... ±2.0%
- Temperature-Drift Coefficient of Detector Threshold .... Typ. ±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
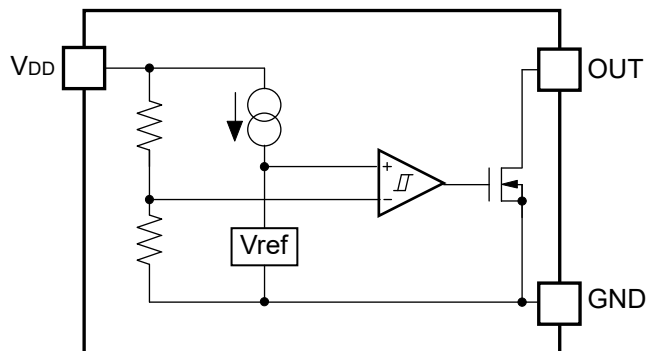
APPLICATIONS

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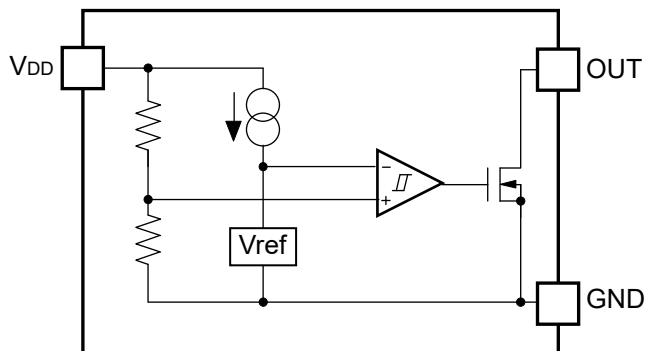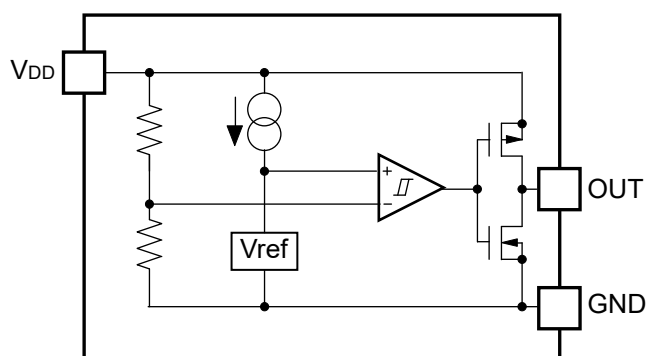- Battery Back-up Circuit
- Power Failure Detector

1

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

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BLOCK DIAGRAMS

R3111xxxxA

R3111xxxxB

R3111xxxxC

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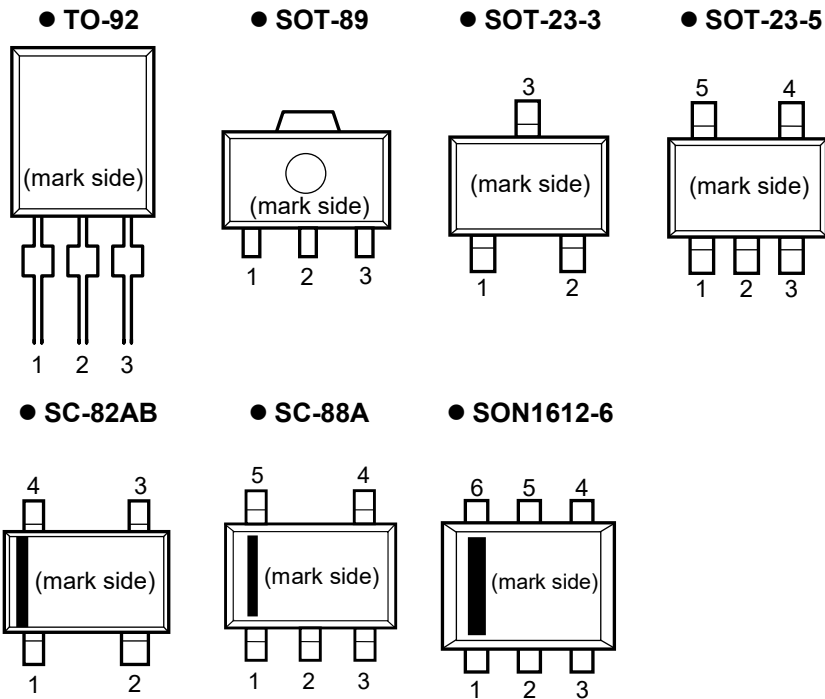
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SELECTION GUIDE

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)

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PIN CONFIGURATIONS

● **TO-92** ● **SOT-89** ● **SOT-23-3** ● **SOT-23-5**

● **SC-82AB** ● **SC-88A** ● **SON1612-6**

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 VDD pin on the board, or otherwise be left floating so that there is no contact with other potentials.

4

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R3111x

5

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	
Ta	Operating Temperature Range	−40 to 85	°C
Tstg	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.

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ELECTRICAL CHARACTERISTICS

● **R3111xxxxA**   Ta=25°C

Symbol	Item	Conditions			Min.	Typ.	Max.	Unit
-V_{DET}	Detector Threshold				-V_{DET} × 0.98		-V_{DET} × 1.02	V
V_{HYS}	Detector Threshold Hysteresis				-V_{DET} × 0.03	-V_{DET} × 0.05	-V_{DET} × 0.07	V
I_{SS}	Supply Current	0.9V ≤ -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 ≤ -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 ≤ -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 ≤ -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 ≤ -V_{DET} ≤ 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°C ≤ Ta ≤ 85°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 ≤ -V_{DET} < 1.1V	V_{DS}=0.50V V_{DD}=0.85V	0.05	0.5		mA
			1.1V ≤ -V_{DET} < 1.6V	V_{DS}=0.50V V_{DD}=1.00V	0.2	1.0		
			1.6V ≤ -V_{DET} ≤ 6.0V	V_{DS}=0.50V V_{DD}=1.50V	1.0	2.0		
t_{PLH}	Output Delay Time[*2]						100	μs
Δ-V_{DET}/ΔTa	Detector Threshold Temperature Coefficient	−40°C ≤ Ta ≤ 85°C				±100		ppm/°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 470kΩ to 5.0V.)

∗2: The output pin is pulled up with a resistance of 470kΩ to 5.0V, the time interval between the rising edge of V_{DD} input pulse from 0.7V to (+V_{DET}) +□2.0V and output voltage level becoming to 2.5V.
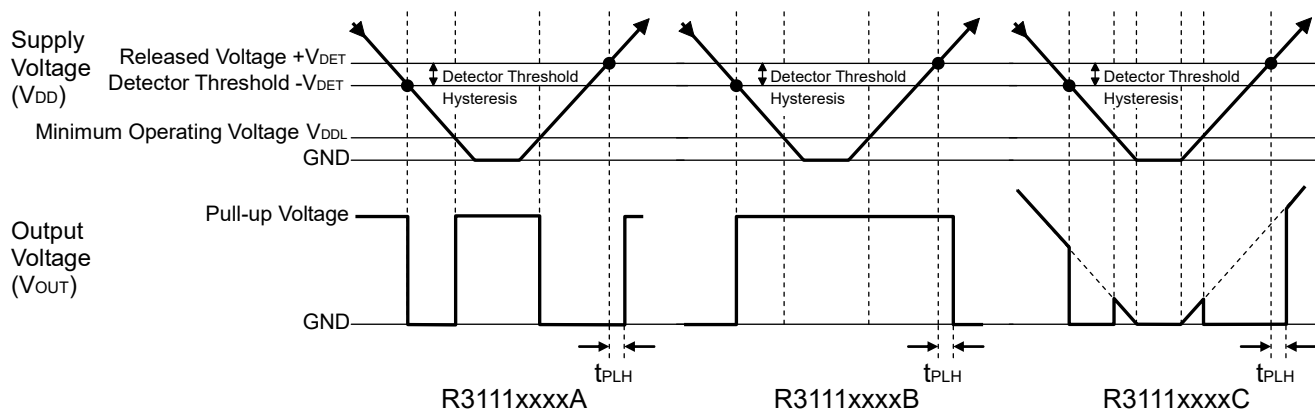
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● **R3111xxxxB**
Ta=25°C

Symbol	Item	Conditions			Min.	Typ.	Max.	Unit
-V_{DET}	Detector Threshold				-V_{DET} × 0.98		-V_{DET} × 1.02	V
V_{HYS}	Detector Threshold Hysteresis				-V_{DET} × 0.03	-V_{DET} × 0.05	-V_{DET} × 0.07	V
I_{SS}	Supply Current	0.9V ≤ -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 ≤ -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 ≤ -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 ≤ -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 ≤ -V_{DET} ≤ 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°C ≤ Ta ≤ 85°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
Δ-V_{DET}/ ΔTa	Detector Threshold Temperature Coefficient	−40°C ≤ Ta ≤ 85°C				±100		ppm/°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 470kΩ to 5.0V.)

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

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7

R3111x

● **R3111xxxxC**
<div align="right">Ta=25°C</div>

Symbol	Item	Conditions			Min.	Typ.	Max.	Unit
-V$_{DET}$	Detector Threshold				-V$_{DET}$ × 0.98		-V$_{DET}$ × 1.02	V
V$_{HYS}$	Detector Threshold Hysteresis				-V$_{DET}$ × 0.03	-V$_{DET}$ × 0.05	-V$_{DET}$ × 0.07	V
I$_{SS}$	Supply Current	0.9V ≤ -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 ≤ -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 ≤ -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 ≤ -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 ≤ -V$_{DET}$ ≤ 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°C ≤ Ta ≤ 85°C				0.65	0.80	
I$_{OUT}$	Output Current (Driver Output Pin)		V$_{DS}$=0.05V, V$_{DD}$=0.70V		0.01	0.05		mA
		Nch	0.9V ≤ -V$_{DET}$ < 1.1V	V$_{DS}$=0.50V V$_{DD}$=0.85V	0.05	0.5		mA
			1.1V ≤ -V$_{DET}$ < 1.6V	V$_{DS}$=0.50V V$_{DD}$=1.00V	0.2	1.0		
			1.6V ≤ -V$_{DET}$ ≤ 6.0V	V$_{DS}$=0.50V V$_{DD}$=1.50V	1.0	2.0		
		Pch	0.9V ≤ -V$_{DET}$ < 4.0V	V$_{DS}$=−2.1V V$_{DD}$=4.5V	1.0	2.0		
			4.0V ≤ -V$_{DET}$ ≤ 6.0V	V$_{DS}$=−2.1V V$_{DD}$=8.0V	1.5	3.0		
t$_{PLH}$	Output Delay Time[*2]						100	μs
Δ-V$_{DET}$/ΔTa	Detector Threshold Temperature Coefficient	−40°C ≤ Ta ≤ 85°C				±100		ppm/°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$_{DET}$) +□2.0V and output voltage level becoming to ((+V$_{DET}$)+2.0V)/2.

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TIMING CHART

Supply
Voltage
(V$_{DD}$)

Released Voltage +V$_{DET}$
Detector Threshold -V$_{DET}$

Detector Threshold
Hysteresis

Minimum Operating Voltage V$_{DDL}$

GND

Output
Voltage
(V$_{OUT}$)

Pull-up Voltage

GND

t$_{PLH}$

R3111xxxxA   R3111xxxxB   R3111xxxxC

DEFINITION OF OUTPUT DELAY TIME

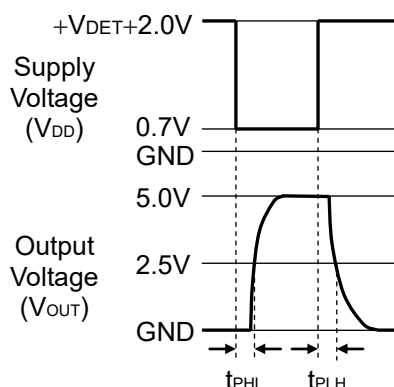Output Delay Time (t$_{PLH}$) is defined as follows:

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 470kΩ 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.
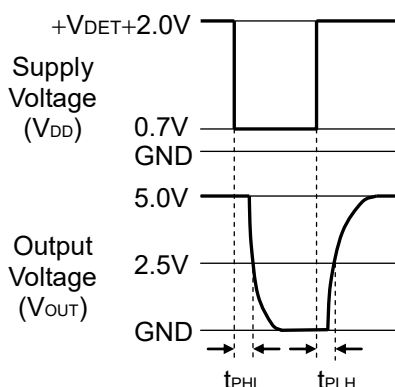
+V$_{DET}$+2.0V

Supply
Voltage
(V$_{DD}$)

0.7V
GND

5.0V

Output
Voltage
(V$_{OUT}$)

2.5V

GND

t$_{PHL}$ t$_{PLH}$

Nch Open Drain Output
(R3111xxxxA)

+V$_{DET}$+2.0V

Supply
Voltage
(V$_{DD}$)

0.7V
GND

5.0V

Output
Voltage
(V$_{OUT}$)

2.5V

GND

t$_{PHL}$ t$_{PLH}$

Nch Open Drain Output
(R3111xxxxB)

+V$_{DET}$+2.0V

Supply
Voltage
(V$_{DD}$)

0.7V
GND

+V$_{DET}$+2.0V

$\dfrac{+V_{DET}+2.0V}{2}$

Output
Voltage
(V$_{OUT}$)

GND

t$_{PHL}$ t$_{PLH}$
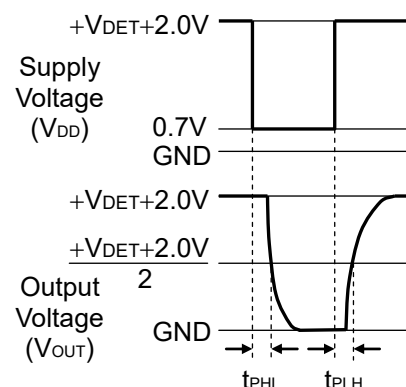
CMOS Output
(R3111xxxxC)

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9

ELECTRICAL CHARACTERISTICS BY DETECTOR THRESHOLD

● R3111x09x to R3111x60x

Part Number	Detector Threshold −V_{DET}[V]			Detector Threshold Hysteresis V_{HYS}[V]			Supply Current 1 I_{SS1}[μA]			Supply Current 2 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					0.9	2.7
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		0.8	2.4		1.0	3.0
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	V_{DD}= (−V_{DET}) −0.10V					
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		0.9	2.7		1.1	3.3
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						
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	V_{DD}= (−V_{DET}) −0.13V	1.0	3.0	V_{DD}= (−V_{DET}) +2.0V	1.2	3.6
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						
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	V_{DD}= (−V_{DET}) −0.16V	1.1	3.3		1.3	3.9
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						
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	V_{DD}= (−V_{DET}) −0.20V	1.2	3.6		1.4	4.2
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 VDD 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

RICOH

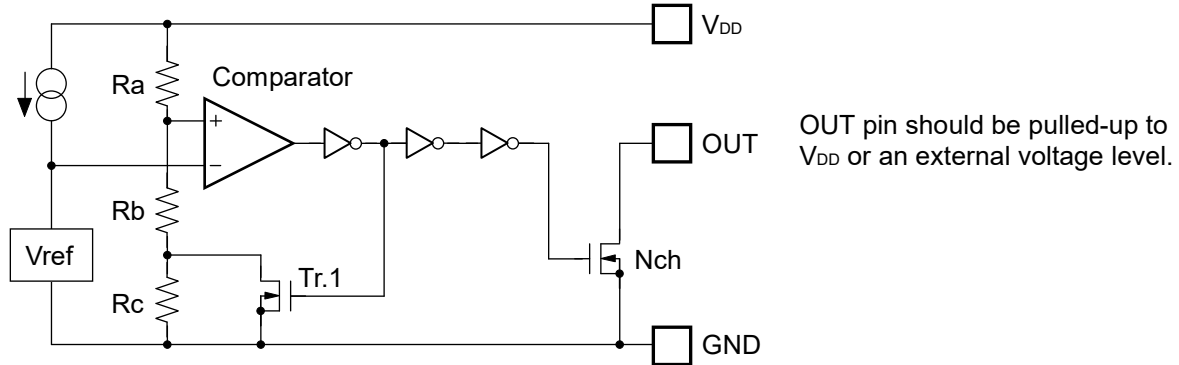∗ R3111E (TO-92) is the discontinued product as of April, 2017.

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}/ΔTa[ppm/°C]	
Condition	Min.	Typ.	Condition		Min.	Typ.	Max.	Typ.	Max.	Condition	Typ.
				$V_{DD}=$ 0.85V	0.05	0.5					
				$V_{DD}=$ 1.0V	0.2	1.0					
\<A/C version\> Nch $V_{DS}=0.05V$ $V_{DD}=0.7V$	0.01	0.05	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 ≦ Ta ≦ 85°C	±100
\<B version\> Nch $V_{DS}=0.10V$ $V_{DD}=6.5V$	2.5	-									

*3) Only A/C versions.

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11

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

R3111x

OPERATION

- **Operation of R3111xxxxA**

Block Diagram (R3111xxxxA)
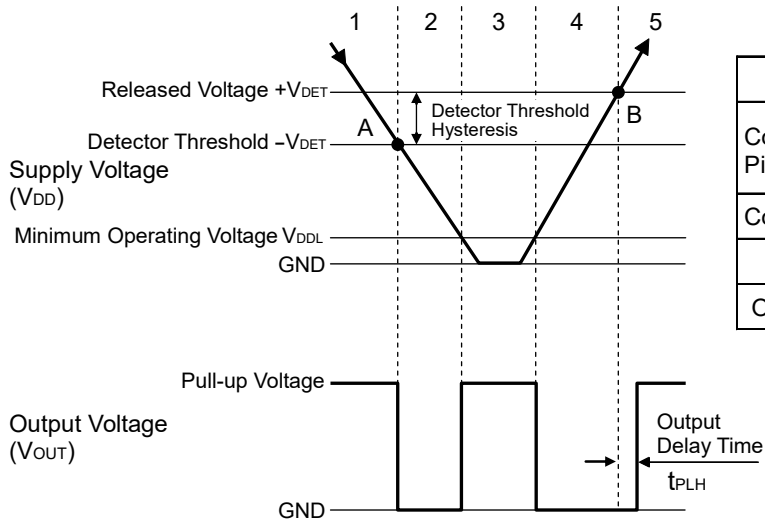
OUT pin should be pulled-up to V_{DD} or an external voltage level.

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

$$I \quad \frac{Rb+Rc}{Ra+Rb+Rc} \times V_{DD}$$

$$II \quad \frac{Rb}{Ra+Rb} \times V_{DD}$$

Operation Diagram

- **Explanation of operation**

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

Step 2. At Point "A", $Vref \geq V_{DD} \times (Rb+Rc)/(Ra+Rb+Rc)$ 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", $Vref \leq V_{DD} \times Rb/(Ra+Rb)$ 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.

RICOH

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

R3111x

● **Operation of R3111xxxxB**

Block Diagram (R3111xxxxB)

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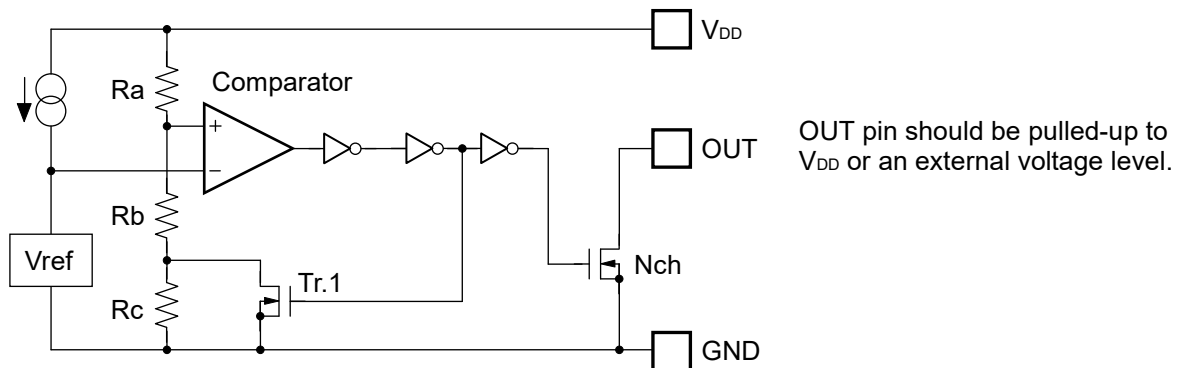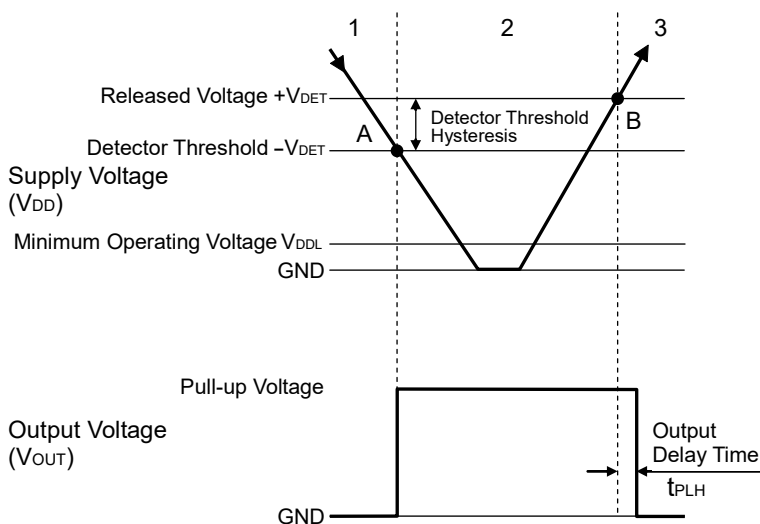
Operation Diagram

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

$$\text{I} \quad \frac{Rb+Rc}{Ra+Rb+Rc} \times VDD$$

$$\text{II} \quad \frac{Rb}{Ra+Rb} \times VDD$$

● **Explanation of operation**

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

Step 2. At Point "A", $Vref \geq V_{DD} \times (Rb+Rc)/(Ra+Rb+Rc)$ 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", $Vref \leq V_{DD} \times Rb/(Ra+Rb)$ 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.

RICOH

13

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

R3111x

● **Operation of R3111xxxxC**
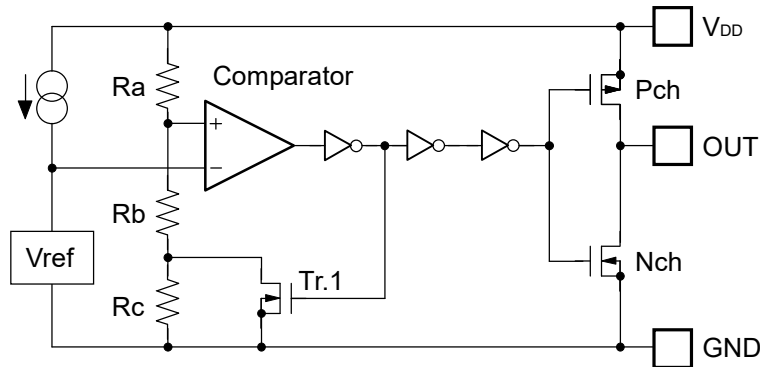
Block Diagram (R3111xxxxC)
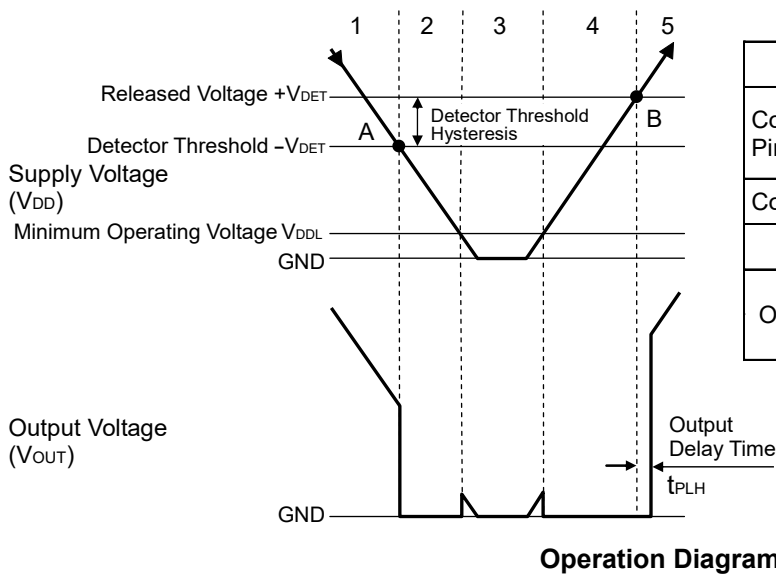
Step	1	2	3	4	5
Comparator (+) Pin Input Voltage	I	II	II	II	I
Comparator Output	H	L	Indefinite	L	H
Tr.1	OFF	ON	Indefinite	ON	OFF
Output Tr. — Pch	ON	OFF	Indefinite	OFF	ON
Output Tr. — Nch	OFF	ON	Indefinite	ON	OFF

$$\text{I}\quad \frac{Rb+Rc}{Ra+Rb+Rc}\times V_{DD}$$

$$\text{II}\quad \frac{Rb}{Ra+Rb}\times V_{DD}$$

Operation Diagram

● **Explanation of operation**

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

Step 2. At Point "A", Vref $\geq$ $V_{DD}\times$(Rb+Rc)/(Ra+Rb+Rc) 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", Vref $\leq$ $V_{DD}\times$Rb/(Ra+Rb) 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.

RICOH

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

R3111x
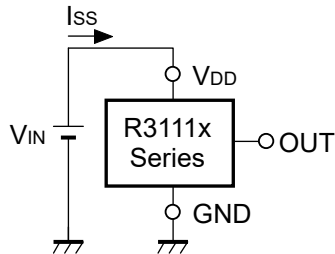
TEST CIRCUITS

Supply Current Test Circuit
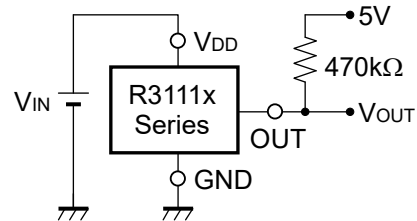
Detector Threshold Test Circuit
(Pull-up circuit is not necessary for
CMOS Output type.)
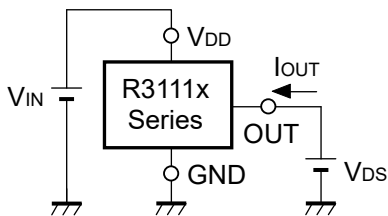
Nch Driver Output Current Test Circuit
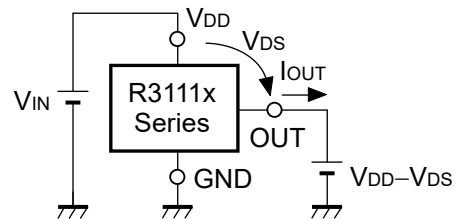
Pch Driver Output Current Test Circuit
∗Apply to CMOS Output type only
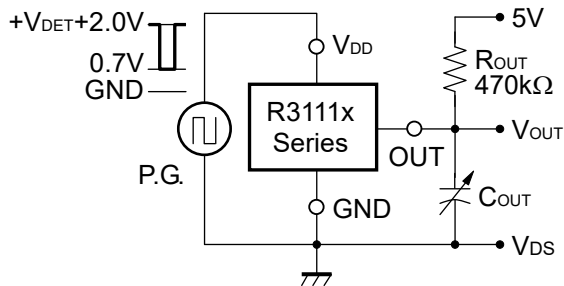
Output Delay Time Test Circuit (1)
(Pull-up circuit is not necessary for
CMOS Output type.)

Output Delay Time Test Circuit (2)

RICOH

∗ R3111E (TO-92) is the discontinued product as of April, 2017.
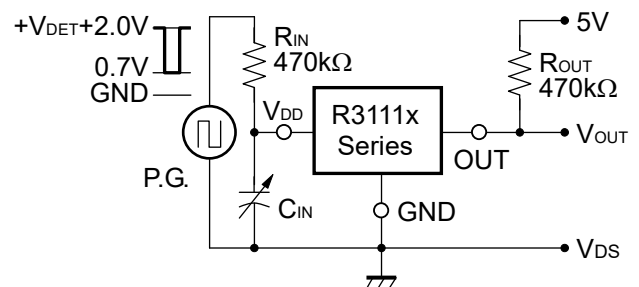
R3111x

● **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:

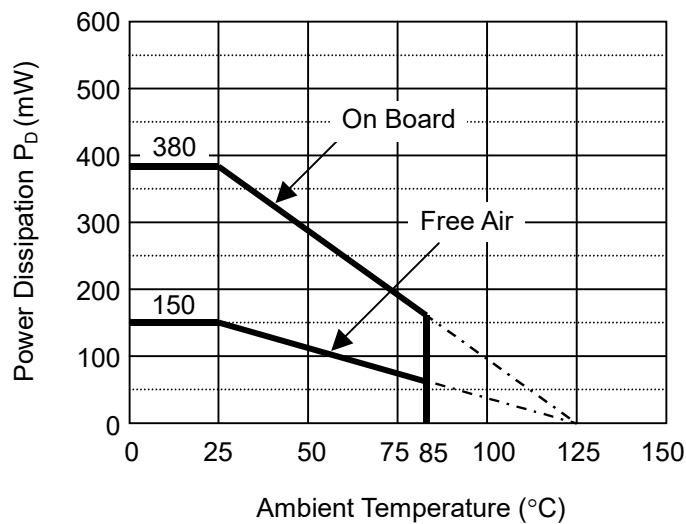Measurement Conditions

	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   (Ta=25°C, Tjmax=125°C)

	Standard Land Pattern
Power Dissipation	500mW
Thermal Resistance	θja = (125-25°C)/ 0.5W = 200°C/W

SON1612-6 Power Dissipation

Measurement Board Pattern

IC Mount Area Unit : mm

RICOH

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

R3111x

● **Package Dimensions (SON1612-6)**

1.6±0.1

6   4

1.2±0.05

1.6±0.05

1   3

0.6MAX

0.3TYP.

0.5

(0.2)

0.125±0.055

(0.3)

(0.3)

| △ | 0.08 |

0.22±0.05 | ⊕ | 0.08 | Ⓜ |

Unit: mm

● **Mark Specification (SON1612-6)**

①②③④   : Product Code … **Refer to _Mark Specification Table (SON1612-6)._**

⑤⑥   : Lot No. ……….. Alphanumeric Serial Number

6   5   4

①②③
④⑤⑥

1   2   3

R3111x

● **Marking Specification Table (SON1612-6)**

R3111Dxx1A

Part Number	①②③④
R3111D091A	**A09A**
R3111D101A	**A10A**
R3111D111A	**A11A**
R3111D121A	**A12A**
R3111D131A	**A13A**
R3111D141A	**A14A**
R3111D151A	**A15A**
R3111D161A	**A16A**
R3111D171A	**A17A**
R3111D181A	**A18A**
R3111D191A	**A19A**
R3111D201A	**A20A**
R3111D211A	**A21A**
R3111D221A	**A22A**
R3111D231A	**A23A**
R3111D241A	**A24A**
R3111D251A	**A25A**
R3111D261A	**A26A**
R3111D271A	**A27A**
R3111D281A	**A28A**
R3111D291A	**A29A**
R3111D301A	**A30A**
R3111D311A	**A31A**
R3111D321A	**A32A**
R3111D331A	**A33A**
R3111D341A	**A34A**
R3111D351A	**A35A**
R3111D361A	**A36A**
R3111D371A	**A37A**
R3111D381A	**A38A**
R3111D391A	**A39A**
R3111D401A	**A40A**
R3111D411A	**A41A**
R3111D421A	**A42A**
R3111D431A	**A43A**
R3111D441A	**A44A**
R3111D451A	**A45A**
R3111D461A	**A46A**
R3111D471A	**A47A**
R3111D481A	**A48A**
R3111D491A	**A49A**
R3111D501A	**A50A**
R3111D511A	**A51A**
R3111D521A	**A52A**
R3111D531A	**A53A**
R3111D541A	**A54A**
R3111D551A	**A55A**
R3111D561A	**A56A**
R3111D571A	**A57A**
R3111D581A	**A58A**
R3111D591A	**A59A**
R3111D601A	**A60A**

R3111Dxx1C

Part Number	①②③④
R3111D091C	**A09C**
R3111D101C	**A10C**
R3111D111C	**A11C**
R3111D121C	**A12C**
R3111D131C	**A13C**
R3111D141C	**A14C**
R3111D151C	**A15C**
R3111D161C	**A16C**
R3111D171C	**A17C**
R3111D181C	**A18C**
R3111D191C	**A19C**
R3111D201C	**A20C**
R3111D211C	**A21C**
R3111D221C	**A22C**
R3111D231C	**A23C**
R3111D241C	**A24C**
R3111D251C	**A25C**
R3111D261C	**A26C**
R3111D271C	**A27C**
R3111D281C	**A28C**
R3111D291C	**A29C**
R3111D301C	**A30C**
R3111D311C	**A31C**
R3111D321C	**A32C**
R3111D331C	**A33C**
R3111D341C	**A34C**
R3111D351C	**A35C**
R3111D361C	**A36C**
R3111D371C	**A37C**
R3111D381C	**A38C**
R3111D391C	**A39C**
R3111D401C	**A40C**
R3111D411C	**A41C**
R3111D421C	**A42C**
R3111D431C	**A43C**
R3111D441C	**A44C**
R3111D451C	**A45C**
R3111D461C	**A46C**
R3111D471C	**A47C**
R3111D481C	**A48C**
R3111D491C	**A49C**
R3111D501C	**A50C**
R3111D511C	**A51C**
R3111D521C	**A52C**
R3111D531C	**A53C**
R3111D541C	**A54C**
R3111D551C	**A55C**
R3111D561C	**A56C**
R3111D571C	**A57C**
R3111D581C	**A58C**
R3111D591C	**A59C**
R3111D601C	**A60C**

R3111Dxx1B

Part Number	①②③④
R3111D091B	**A09B**
R3111D101B	**A10B**
R3111D111B	**A11B**
R3111D121B	**A12B**
R3111D131B	**A13B**
R3111D141B	**A14B**
R3111D151B	**A15B**
R3111D161B	**A16B**
R3111D171B	**A17B**
R3111D181B	**A18B**
R3111D191B	**A19B**
R3111D201B	**A20B**
R3111D211B	**A21B**
R3111D221B	**A22B**
R3111D231B	**A23B**
R3111D241B	**A24B**
R3111D251B	**A25B**
R3111D261B	**A26B**
R3111D271B	**A27B**
R3111D281B	**A28B**
R3111D291B	**A29B**
R3111D301B	**A30B**
R3111D311B	**A31B**
R3111D321B	**A32B**
R3111D331B	**A33B**
R3111D341B	**A34B**
R3111D351B	**A35B**
R3111D361B	**A36B**
R3111D371B	**A37B**
R3111D381B	**A38B**
R3111D391B	**A39B**
R3111D401B	**A40B**
R3111D411B	**A41B**
R3111D421B	**A42B**
R3111D431B	**A43B**
R3111D441B	**A44B**
R3111D451B	**A45B**
R3111D461B	**A46B**
R3111D471B	**A47B**
R3111D481B	**A48B**
R3111D491B	**A49B**
R3111D501B	**A50B**
R3111D511B	**A51B**
R3111D521B	**A52B**
R3111D531B	**A53B**
R3111D541B	**A54B**
R3111D551B	**A55B**
R3111D561B	**A56B**
R3111D571B	**A57B**
R3111D581B	**A58B**
R3111D591B	**A59B**
R3111D601B	**A60B**

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

R3111x

● **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;
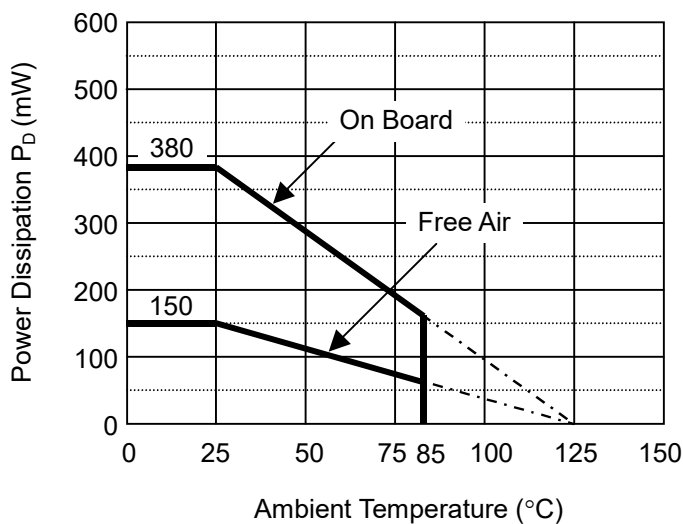
Measurement Conditions

	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   (Ta=25°C, Tjmax=125°C)

	Standard Land Pattern	Free Air
Power Dissipation	380mW	150mW
Thermal Resistance	$\theta ja=(125-25°C)/0.38W=263°C/W$	667°C/W

Power Dissipation

Measurement Board Pattern

⬚ IC Mount Area (Unit : mm)

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19

R3111x

● **Package Dimensions (SC-82AB)**

Unit : mm

● **Mark Specification (SC-82AB)**

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

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∗ R3111E (TO-92) is the discontinued product as of April, 2017.
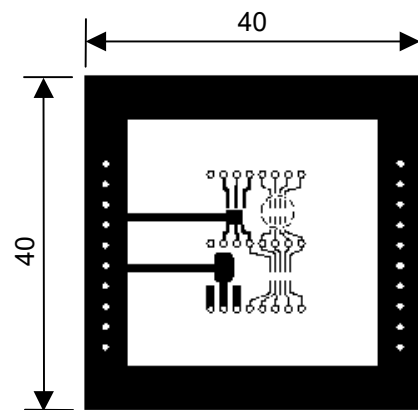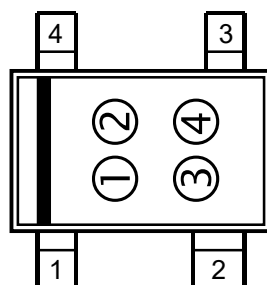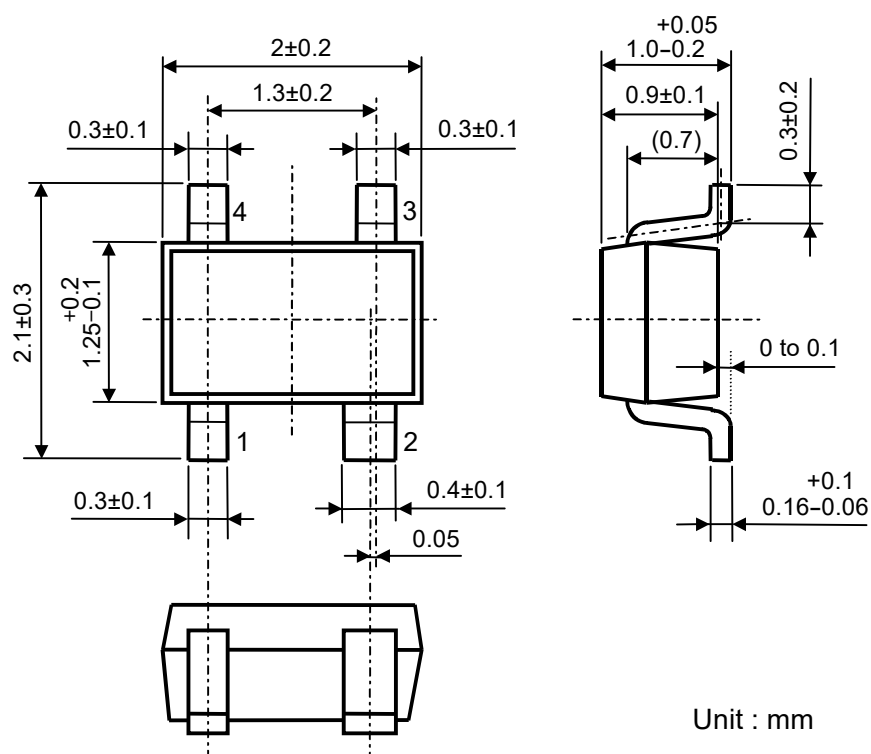
R3111x

- **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**

RICOH

21

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 $\times$ 40mm $\times$ 1.6mm
Copper Ratio	Top side: Approx. 50%, Back side: Approx. 50%
Through-hole	ϕ0.5mm $\times$ 44pcs

Measurement Result   (Ta=25°C, Tjmax=125°C)

	Standard Land Pattern	Free Air
Power Dissipation	380mW	150mW
Thermal Resistance	θja=(125-25°C)/0.38W=263°C/W	θja=(125-25°C)/0.15W=667°C/W
	θjc=75°C/W	-

Power Dissipation

Measurement Board Pattern

⋯ IC Mount Area (Unit : mm)

RICOH

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

R3111x

● **Package Dimensions (SC-88A)**

Unit : mm

● **Mark Specification (SC-88A)**

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

RICOH

R3111x

- **Marking Specification Table (SC-88A)**

R3111Qxx2A

Part Number	①②③④
R3111Q092A	U009
R3111Q102A	U010
R3111Q112A	U011
R3111Q122A	U012
R3111Q132A	U013
R3111Q142A	U014
R3111Q152A	U015
R3111Q162A	U016
R3111Q172A	U017
R3111Q182A	U018
R3111Q192A	U019
R3111Q202A	U020
R3111Q212A	U021
R3111Q222A	U022
R3111Q232A	U023
R3111Q242A	U024
R3111Q252A	U025
R3111Q262A	U026
R3111Q272A	U027
R3111Q282A	U028
R3111Q292A	U029
R3111Q302A	U030
R3111Q312A	U031
R3111Q322A	U032
R3111Q332A	U033
R3111Q342A	U034
R3111Q352A	U035
R3111Q362A	U036
R3111Q372A	U037
R3111Q382A	U038
R3111Q392A	U039
R3111Q402A	U040
R3111Q412A	U041
R3111Q422A	U042
R3111Q432A	U043
R3111Q442A	U044
R3111Q452A	U045
R3111Q462A	U046
R3111Q472A	U047
R3111Q482A	U048
R3111Q492A	U049
R3111Q502A	U050
R3111Q512A	U051
R3111Q522A	U052
R3111Q532A	U053
R3111Q542A	U054
R3111Q552A	U055
R3111Q562A	U056
R3111Q572A	U057
R3111Q582A	U058
R3111Q592A	U059
R3111Q602A	U060
R3111Q222A5	U001

R3111Qxx2C

Part Number	①②③④
R3111Q092C	V009
R3111Q102C	V010
R3111Q112C	V011
R3111Q122C	V012
R3111Q132C	V013
R3111Q142C	V014
R3111Q152C	V015
R3111Q162C	V016
R3111Q172C	V017
R3111Q182C	V018
R3111Q192C	V019
R3111Q202C	V020
R3111Q212C	V021
R3111Q222C	V022
R3111Q232C	V023
R3111Q242C	V024
R3111Q252C	V025
R3111Q262C	V026
R3111Q272C	V027
R3111Q282C	V028
R3111Q292C	V029
R3111Q302C	V030
R3111Q312C	V031
R3111Q322C	V032
R3111Q332C	V033
R3111Q342C	V034
R3111Q352C	V035
R3111Q362C	V036
R3111Q372C	V037
R3111Q382C	V038
R3111Q392C	V039
R3111Q402C	V040
R3111Q412C	V041
R3111Q422C	V042
R3111Q432C	V043
R3111Q442C	V044
R3111Q452C	V045
R3111Q462C	V046
R3111Q472C	V047
R3111Q482C	V048
R3111Q492C	V049
R3111Q502C	V050
R3111Q512C	V051
R3111Q522C	V052
R3111Q532C	V053
R3111Q542C	V054
R3111Q552C	V055
R3111Q562C	V056
R3111Q572C	V057
R3111Q582C	V058
R3111Q592C	V059
R3111Q602C	V060

R3111Qxx2B

Part Number	①②③④
R3111Q092B	W009
R3111Q102B	W010
R3111Q112B	W011
R3111Q122B	W012
R3111Q132B	W013
R3111Q142B	W014
R3111Q152B	W015
R3111Q162B	W016
R3111Q172B	W017
R3111Q182B	W018
R3111Q192B	W019
R3111Q202B	W020
R3111Q212B	W021
R3111Q222B	W022
R3111Q232B	W023
R3111Q242B	W024
R3111Q252B	W025
R3111Q262B	W026
R3111Q272B	W027
R3111Q282B	W028
R3111Q292B	W029
R3111Q302B	W030
R3111Q312B	W031
R3111Q322B	W032
R3111Q332B	W033
R3111Q342B	W034
R3111Q352B	W035
R3111Q362B	W036
R3111Q372B	W037
R3111Q382B	W038
R3111Q392B	W039
R3111Q402B	W040
R3111Q412B	W041
R3111Q422B	W042
R3111Q432B	W043
R3111Q442B	W044
R3111Q452B	W045
R3111Q462B	W046
R3111Q472B	W047
R3111Q482B	W048
R3111Q492B	W049
R3111Q502B	W050
R3111Q512B	W051
R3111Q522B	W052
R3111Q532B	W053
R3111Q542B	W054
R3111Q552B	W055
R3111Q562B	W056
R3111Q572B	W057
R3111Q582B	W058
R3111Q592B	W059
R3111Q602B	W060

RICOH

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

R3111x

● **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:

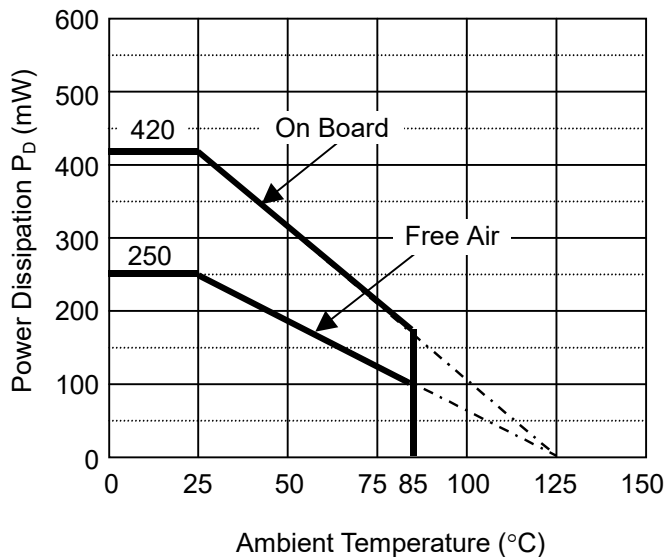(Power Dissipation (SOT-23-5) is substitution of SOT-23-6.)

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

(Ta=25°C, Tjmax=125°C)

	Standard Land Pattern	**Free Air**
Power Dissipation	420mW	250mW
Thermal Resistance	θja = (125-25°C)/0.42W = 238°C/W	400°C/W

Power Dissipation

Measurement Board Pattern

⬭ IC Mount Area (Unit: mm)

RICOH

25

R3111x

● **Package Dimensions (SOT-23-5)**

2.9±0.2
1.9±0.2
(0.95) (0.95)

5   4

$1.6^{+0.2}_{-0.1}$

2.8±0.3

1   2   3

0.4±0.1

1.1±0.1
0.8±0.1

0～0.1

0.2min.

$0.15^{+0.1}_{-0.05}$

Unit : mm

● **Mark Specification (SOT-23-5)**

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

5   4

① ② ③ ④

1   2   3

RICOH

∗ R3111E (TO-92) is the discontinued product as of April, 2017.
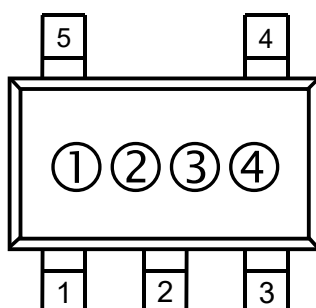
R3111x

● **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

RICOH

27

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   (Ta=25°C, Tjmax=125°C)

	Standard Land Pattern	**Free Air**
Power Dissipation	420mW	250mW
Thermal Resistance	$\theta ja = (125-25°C)/0.42W = 238°C/W$	400°C/W
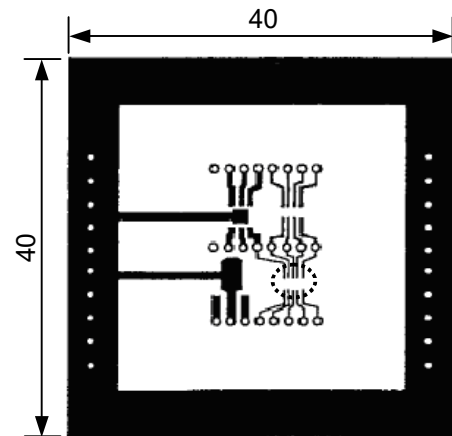
Power Dissipation

Measurement Board Pattern

IC Mount Area (Unit: mm)

28

RICOH

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

R3111x

- **Package Dimensions (SOT-23-3)**

2.9±0.2

0.4±0.1

3

1.6±0.2

2.8±0.3

1   2

(0.95)   (0.95)

1.9±0.2

1.4MAX.

1.1$\begin{smallmatrix}+0.2\\-0.1\end{smallmatrix}$

0.8

0∼0.1

0.2MIN.

0.16$\begin{smallmatrix}+0.1\\-0.06\end{smallmatrix}$

Unit: mm
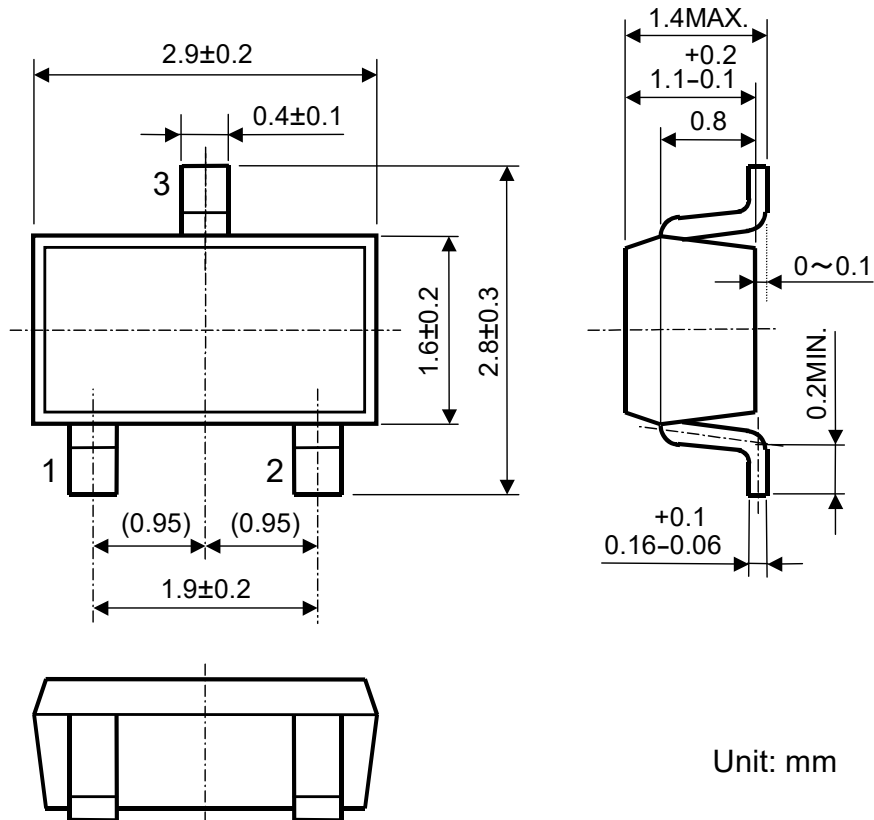
- **Mark Specification (SOT-23-3)**

①②   : Product Code … **Refer to *Mark Specification Table (SOT-23-3).***

③④   : Lot No. ………... Alphanumeric Serial Number

3

① ② ③ ④

1   2

RICOH

∗ R3111E (TO-92) is the discontinued product as of April, 2017.
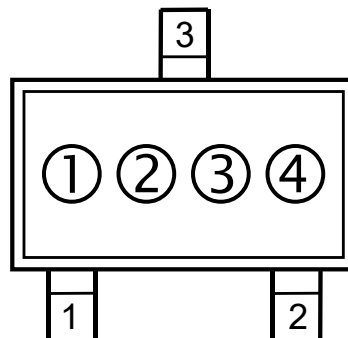
R3111x

● **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**

RICOH

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

R3111x

● **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   (Ta=25°C,Tjmax=125°C)

	Standard Land Pattern	Free Air
Power Dissipation	900mW	500mW
Thermal Resistance	θja = (125-25°C)/0.9W = 111°C/W	200°C/W

Power Dissipation
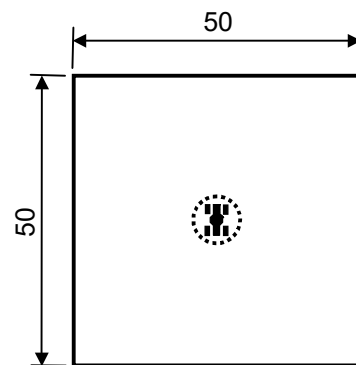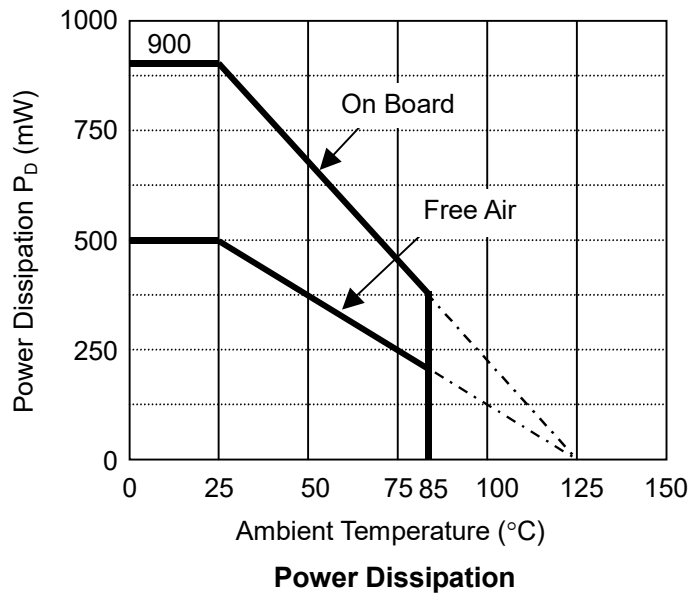
Measurement Board Pattern

IC Mount Area Unit : mm

R3111x

● **Package Dimensions (SOT-89-3)**

4.5±0.1

1.6±0.2

ϕ 1.0

2.5±0.1

$4.0^{+0.25}_{-0.35}$

1.0±0.2

1   2   3

1.5±0.1

0.4±0.1

0.1 S

0.4±0.1

S

0.3±0.2

Bottom View

3   2   1

0.42±0.1   0.42±0.1

0.47±0.1

1.5±0.1   1.5±0.1

Unit: mm
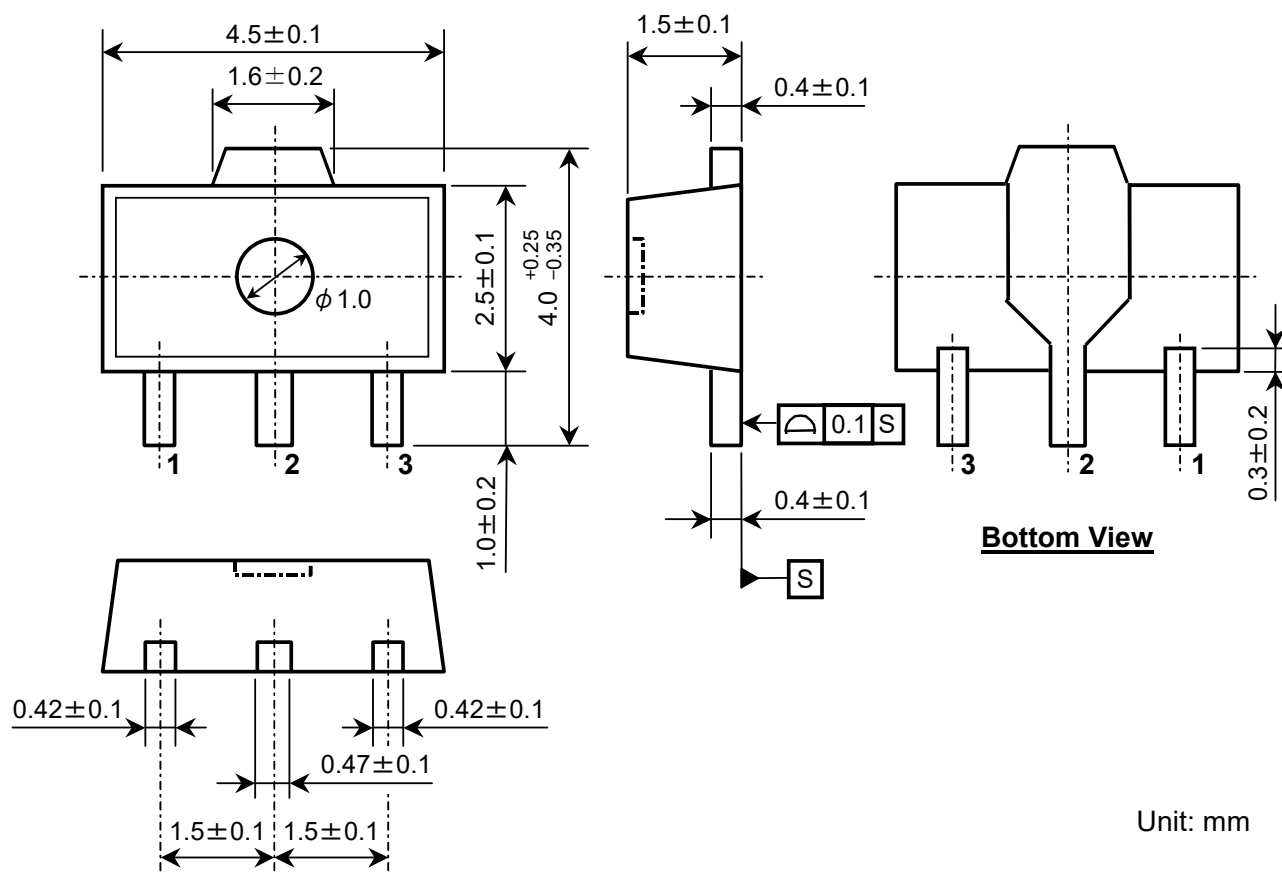
● **Mark Specification (SOT-89-3)**

①②③④ : Product Code …**Refer to *Mark Specification Table (SOT-89-3).***

⑤⑥ : Lot No. ………... Alphanumeric Serial Number

①②③ ④⑤⑥

32

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∗ R3111E (TO-92) is the discontinued product as of April, 2017.
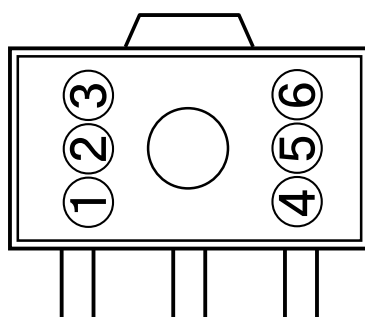
R3111x

● **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**

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R3111x

TYPICAL CHARACTERISTICS

1) Supply Current vs. Input Voltage

R3111x09xx

R3111x27xx
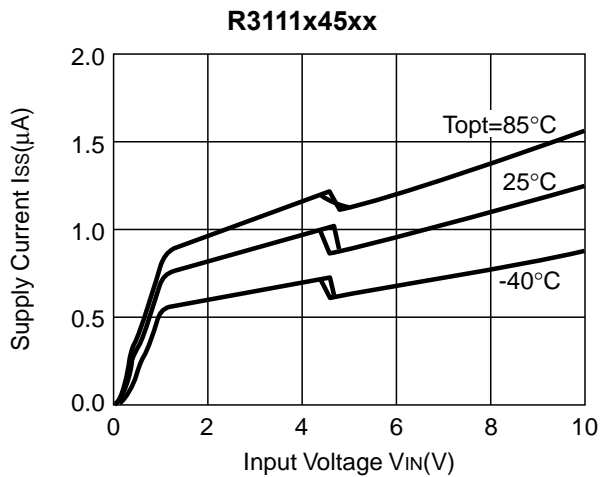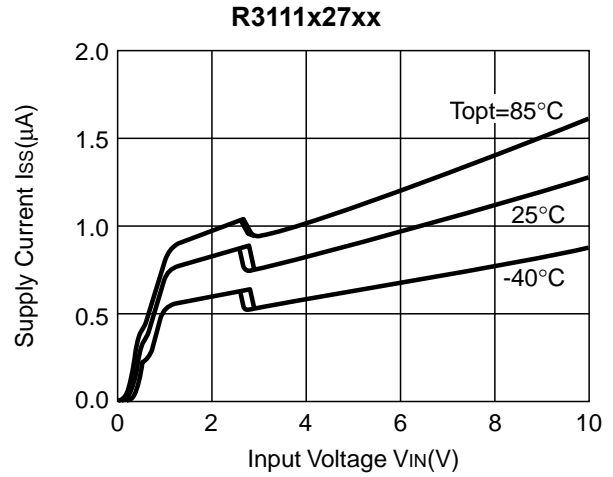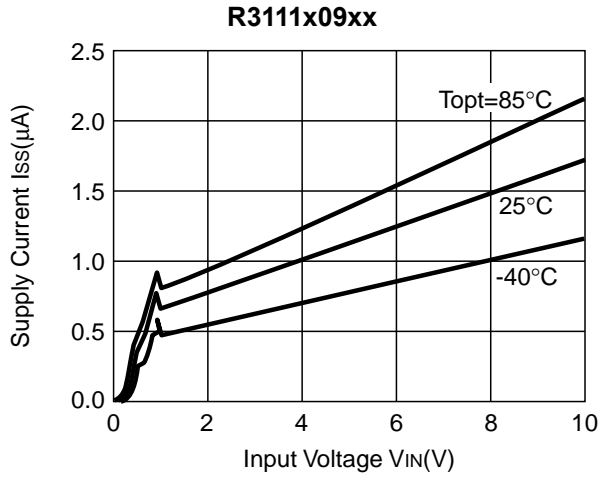
R3111x45xx

2) Detector Threshold Hysteresis vs. Temperature

R3111x09xx

R3111x27xx

34

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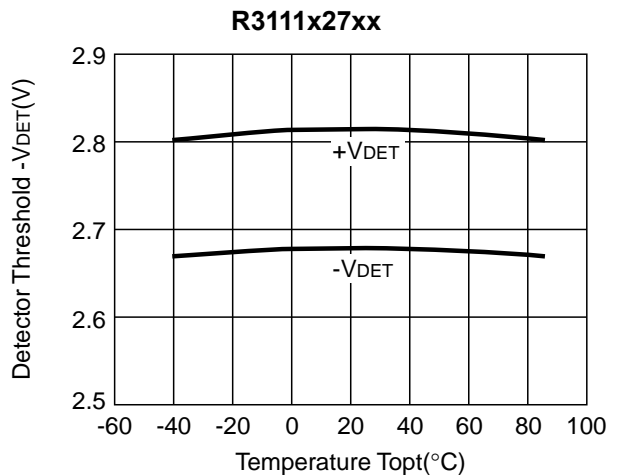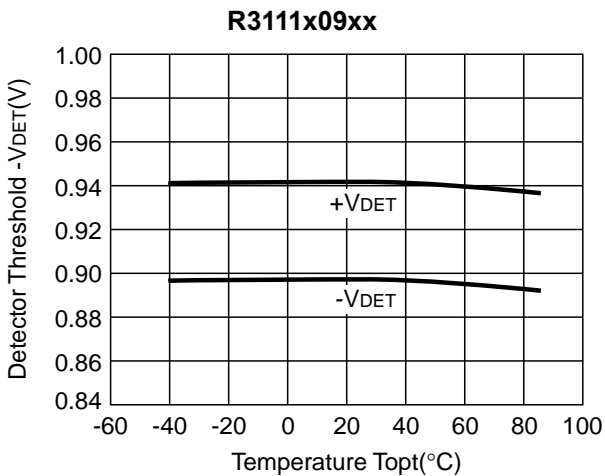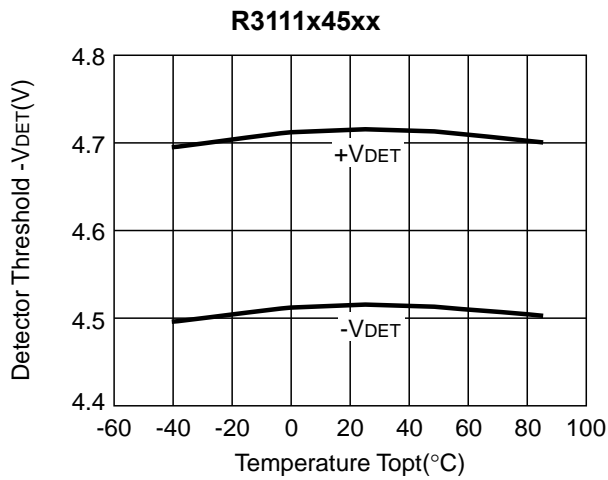
R3111x45xx

3) Output Voltage vs. Input Voltage

R3111x09xC

R3111x09xA

R3111x27xC

R3111x27xA

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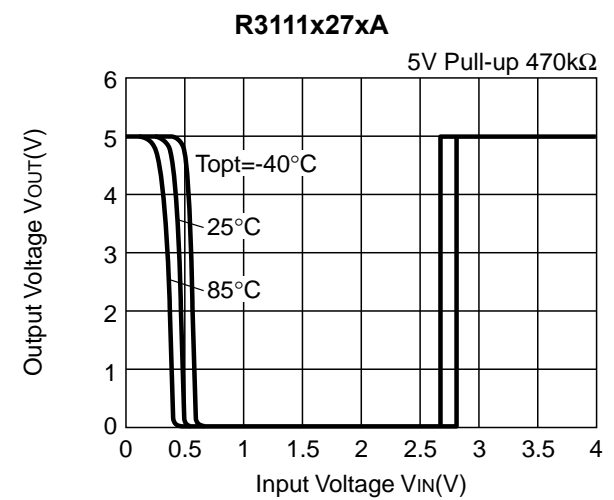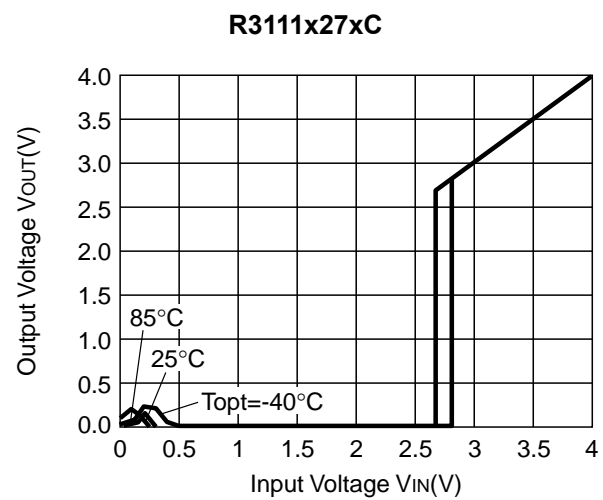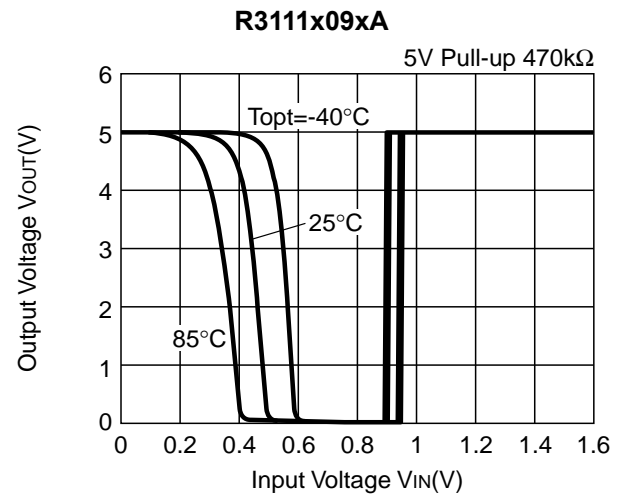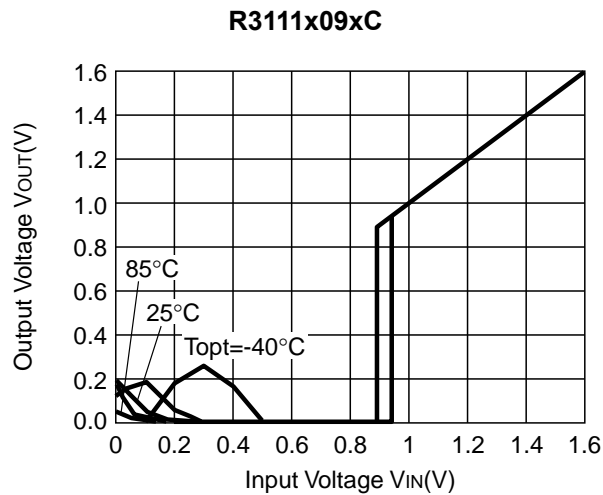
R3111x

R3111x45xC

R3111x45xA

5V Pull-up 470kΩ
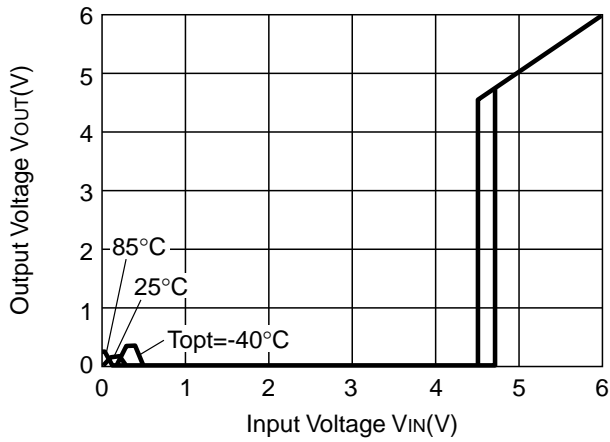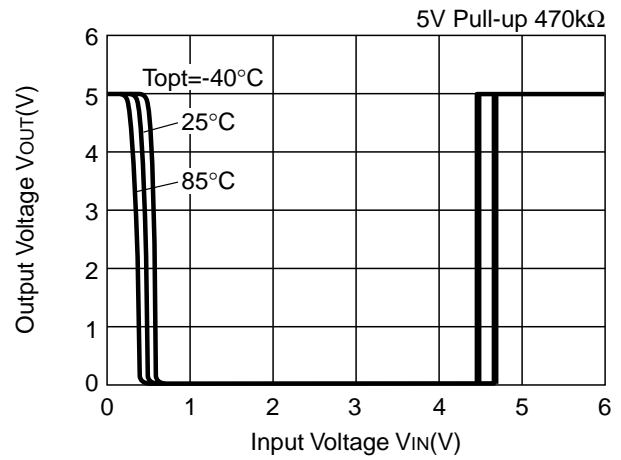
4) Nch Driver Output Current vs. V$_{DS}$

R3111x09xx

Topt=25°C

V$_{DD}$=0.85V

0.7V

R3111x09xx

Topt=25°C

V$_{DD}$=0.8V

0.7V

R3111x27xx

Topt=25°C

V$_{DD}$=2.5V

2.0V

1.5V

R3111x27xx

Topt=25°C

V$_{DD}$=0.8V

0.7V

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

R3111x

R3111x45xx

Topt=25°C

Output Current I$_{OUT}$(mA) vs V$_{DS}$(V)

V$_{DD}$=4.5V, 4.0V, 3.5V, 3.0V, 2.5V, 2.0V, 1.5V

R3111x45xx

Topt=25°C

Output Current I$_{OUT}$(μA) vs V$_{DS}$(V)

V$_{DD}$=0.8V, 0.7V

5) Nch Driver Output Current vs. Input Voltage

R3111x09xx

Output Current I$_{OUT}$(μA) vs Input Voltage V$_{IN}$(V)

Topt=-85°C, 25°C, -40°C

R3111x27xx

Output Current I$_{OUT}$(mA) vs Input Voltage V$_{IN}$(V)

Topt=-40°C, 25°C, 85°C

R3111x45xx

Output Current I$_{OUT}$(mA) vs Input Voltage V$_{IN}$(V)

Topt=-40°C, 25°C, 85°C

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37

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

R3111x

6) Pch Driver Output Current vs. Input Voltage

R3111x09xC

Topt=25°C

VDS=0.7V

0.5V

Output Current IOUT(mA)

Input Voltage VIN(V)

R3111x27xC

Topt=25°C

VDS=2.1V

1.5V

1.0V

0.5V

Output Current IOUT(mA)

Input Voltage VIN(V)

R3111x45xC

Topt=25°C

VDS=2.1V

1.5V

1.0V

0.5V

Output Current IOUT(mA)
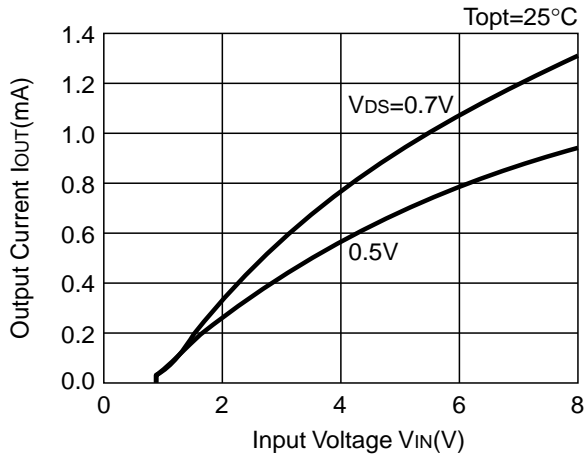
Input Voltage VIN(V)

7) Output Delay Time vs. Load Capacitance (Ta=25°C)

R3111x09xA

tPLH

tPHL

Output Delay Time tP(ms)

Load Capacitance COUT(µF)

R3111x27xA

tPLH

tPHL

Output Delay Time tP(ms)

Load Capacitance COUT(µF)

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

R3111x

R3111x45xA

Load Capacitance C_{OUT}(µF)
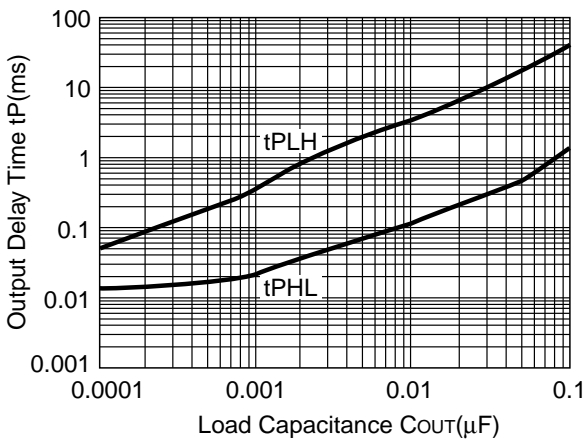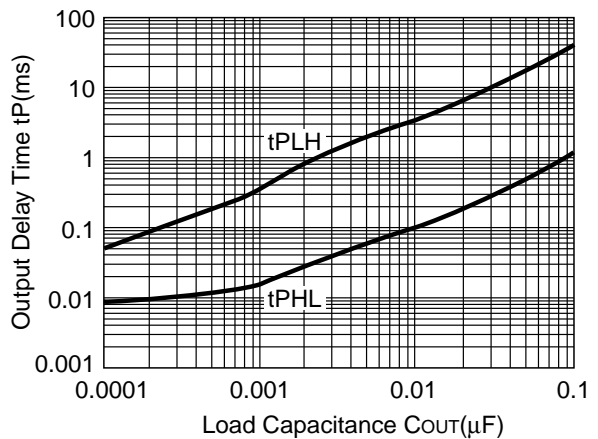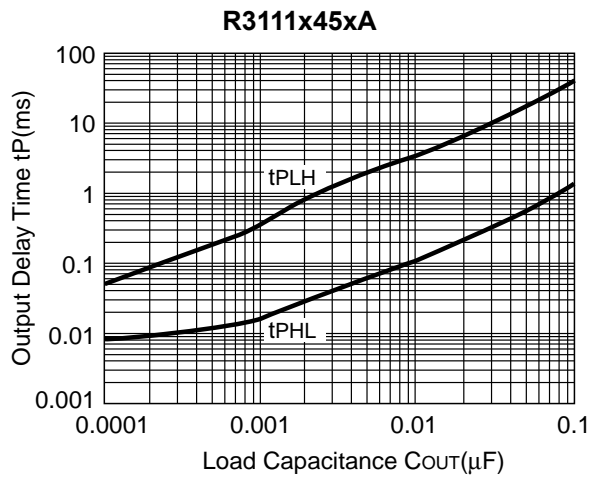
8) Output Delay Time vs. Input Pin Capacitance

R3111x09xA

Input Pin Capacitance C_{IN}(µF)

R3111x27xA

Input Pin Capacitance C_{IN}(µF)

R3111x45xA

Input Pin Capacitance C_{IN}(µF)
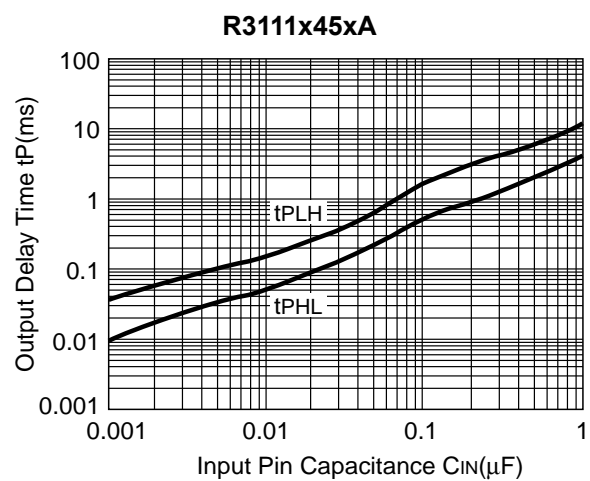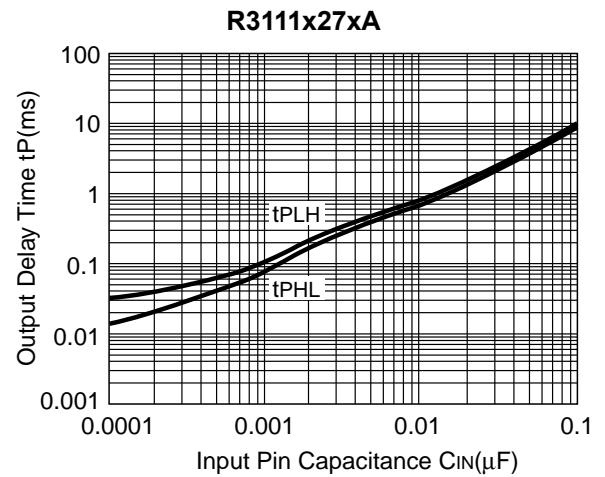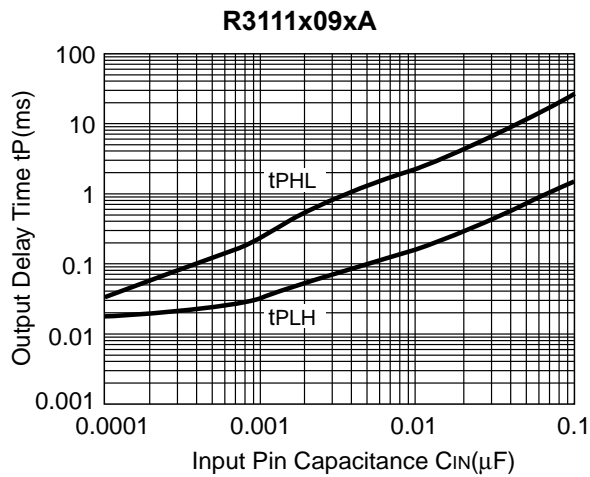
R3111x

TYPICAL APPLICATION

- **R3111xxxxA CPU Reset Circuit (Nch Open Drain Output)**

Case 1. Input Voltage to R3111xxxxA is equal to Input Voltage to CPU
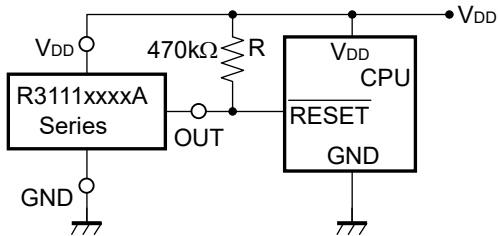
Case 2. Input Voltage to R3111xxxxA is unequal to Input Voltage to CPU
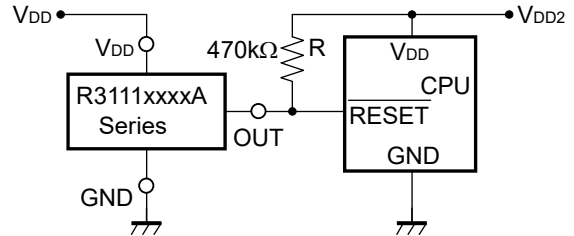
- **R3111xxxxC CPU Reset Circuit (CMOS Output)**
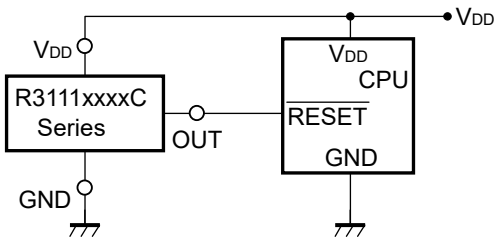
- **R3111xxxxA Output Delay Time Circuit 1 (Nch Open Drain Output)**
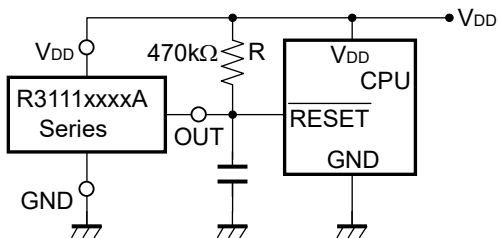
- **R3111xxxxA Output Delay Time Circuit 2 (Nch Open Drain Output)**

- **Memory Back-up Circuit**

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

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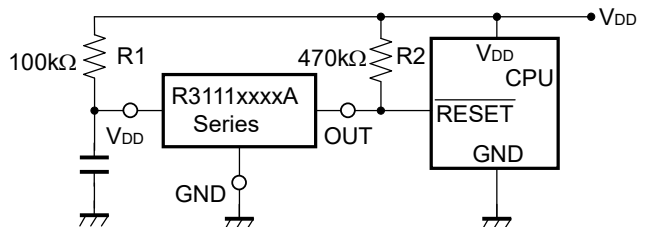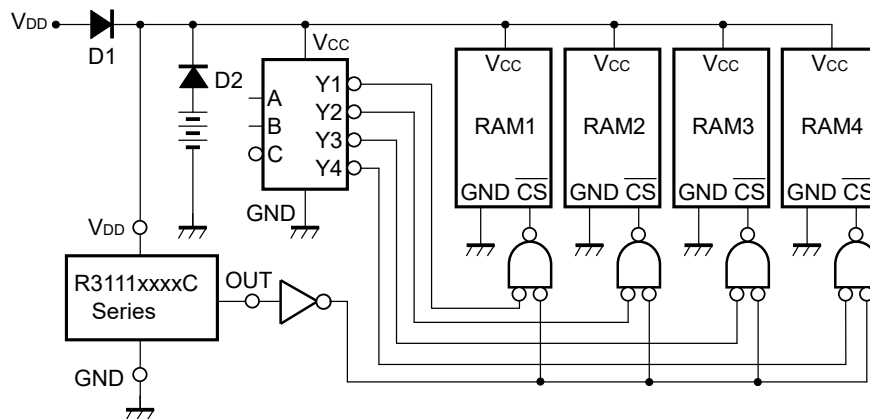
● **Voltage level Indicator Circuit (lighted when the power runs out)**
  (Nch Open Drain Output)
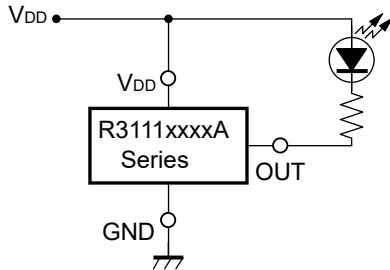
● **Detector Threshold Adjustable Circuit**
  (Nch Open Drain Output)
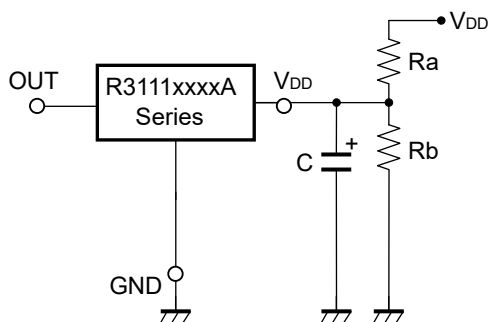
Adjusted Detector Threshold
$=(-V_{DET}) \times (Ra+Rb)/Rb$

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)
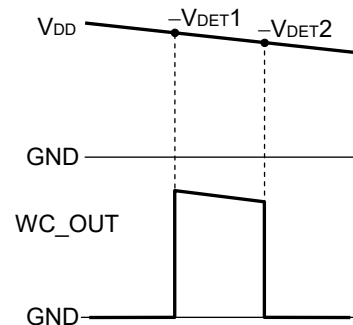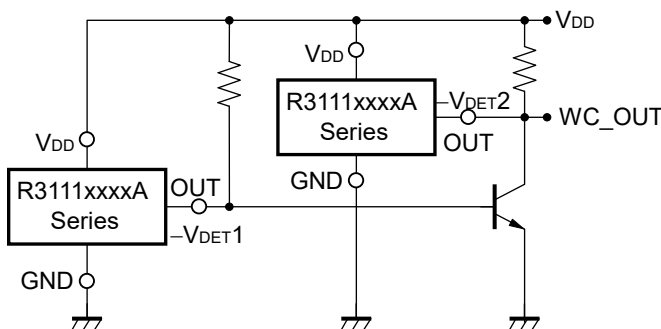
● **Over-charge Preventing Circuit**

R3111x
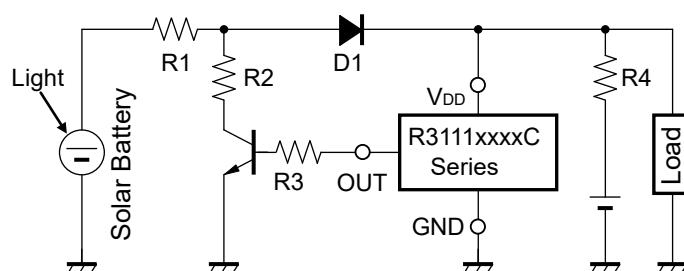
TECHNICAL NOTES

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.
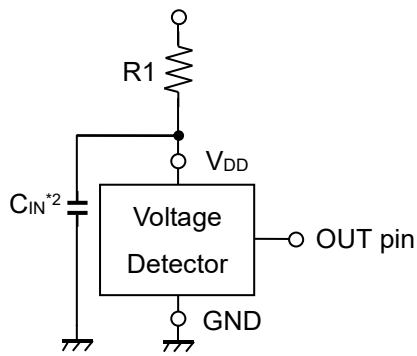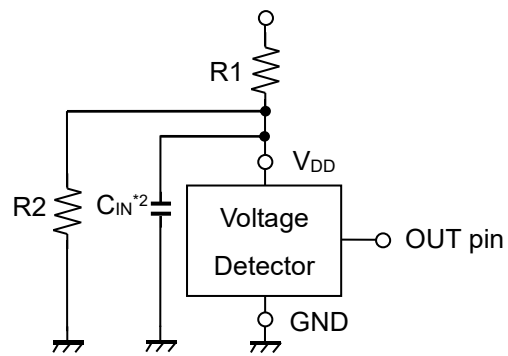
Figure A   Figure B

∗1 In the CMOS output type, a charging current for OUT pin is included.
∗2 Note the bias dependence of capacitors.

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