

RICOH

R3111x SERIES

LOW VOLTAGE DETECTOR

NO.EA-056-160310

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 ($T_a=25^{\circ}C$)
- Detector Threshold Range 0.9V to 6.0V (0.1V steps)
(For other voltages, please refer to MARK INFORMATION.)
- Detector Threshold Accuracy $\pm 2.0\%$
- Temperature-Drift Coefficient of Detector Threshold Typ. $\pm 100ppm/^{\circ}C$
- 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

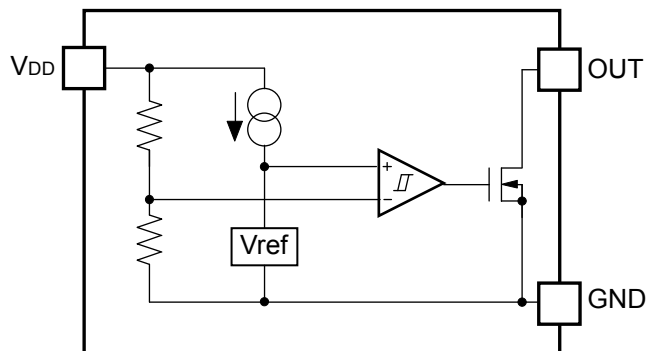
APPLICATIONS

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

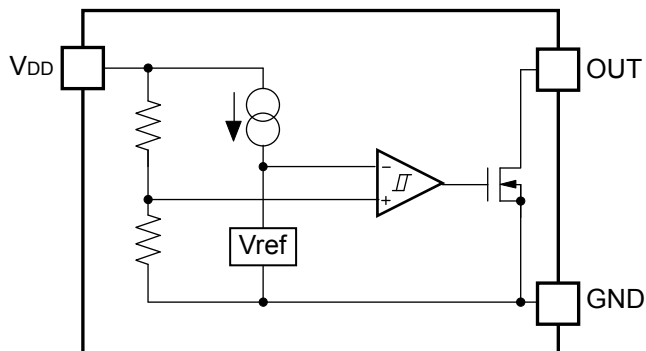
R3111x

BLOCK DIAGRAMS

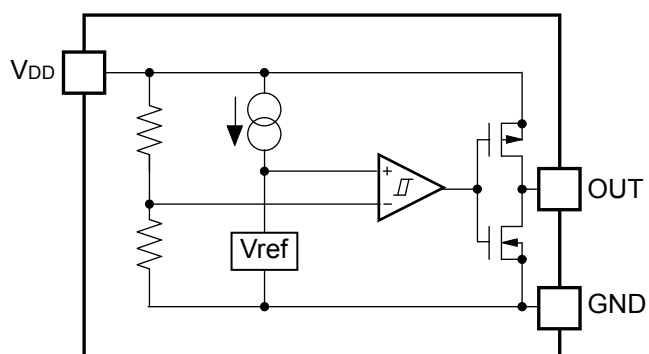
R3111xxxxA



R3111xxxxB



R3111xxxxC



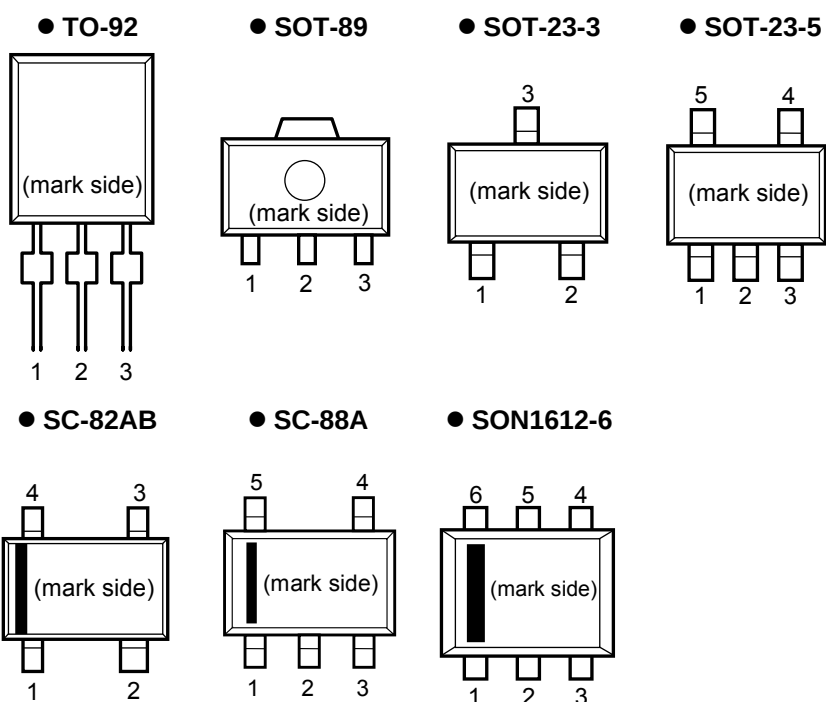
SELECTION GUIDE

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 INFORMATION.) * : 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)				

R3111x

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

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.

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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
			$0.9V \leq -V_{DET} < 1.1V$	$V_{DS}=0.50V$ $V_{DD}=0.85V$	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	
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.

● **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/°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.

R3111x

• R3111xxxxC

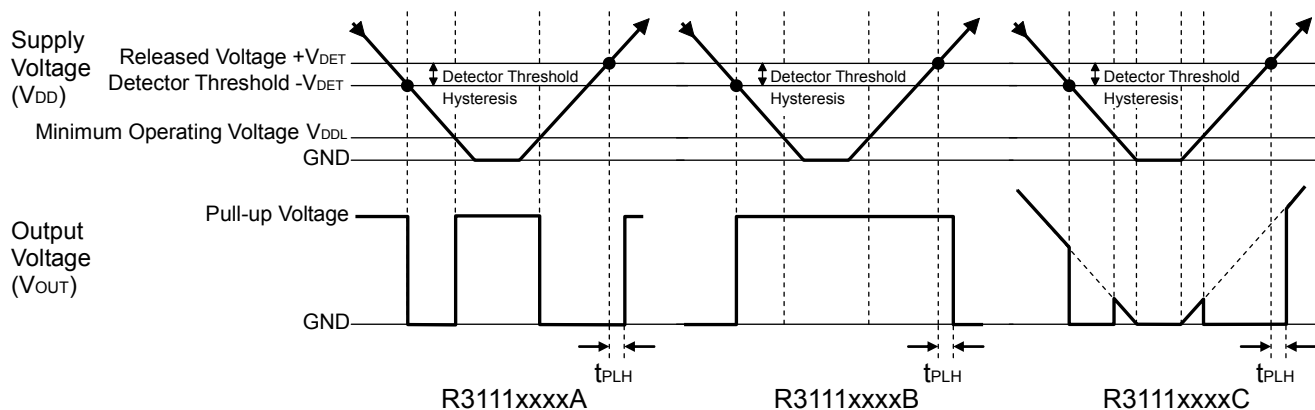
Ta=25°C

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	
			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 $((+V_{DET}) + 2.0V)/2$.

TIMING CHART



DEFINITION OF OUTPUT DELAY TIME

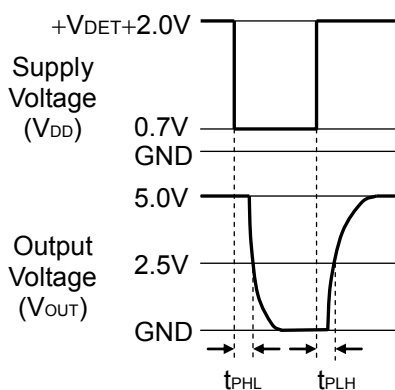
Output Delay Time (t_{PLH}) is defined as follows:

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

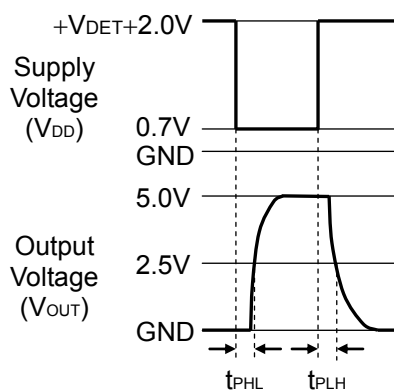
Under the condition of the output pin (OUT) is pulled up through a resistor of 470k Ω to 5V, the time interval between the rising edge of V_{DD} pulse from 0.7V to $(+V_{DET}) + 2.0V$ and becoming of the output voltage to 2.5V.

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

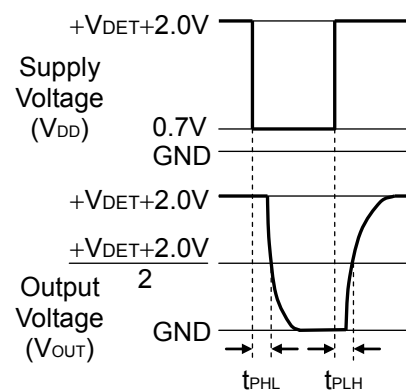
The time interval between the rising edge of V_{DD} pulse from 0.7V to $(+V_{DET}) + 2.0V$ and becoming of the output voltage to $((+V_{DET}) + 2.0V) / 2$.



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	V _{DD} = (-V _{DET}) +2.0V	0.9	2.7
R3111x10xx	0.980	1.000	1.020	0.030	0.050	0.070					1.0	3.0
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		0.9	2.7		1.1	3.3
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	V _{DD} = (-V _{DET}) -0.13V	1.0	3.0	1.2	3.6	
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}) -0.16V	1.1	3.3	1.3	3.9	
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						V _{DD} = (-V _{DET}) -0.20V
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	V _{DD} = (-V _{DET}) -0.20V	1.2	3.6	1.4	4.2	
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 March, 2016.

R3111x

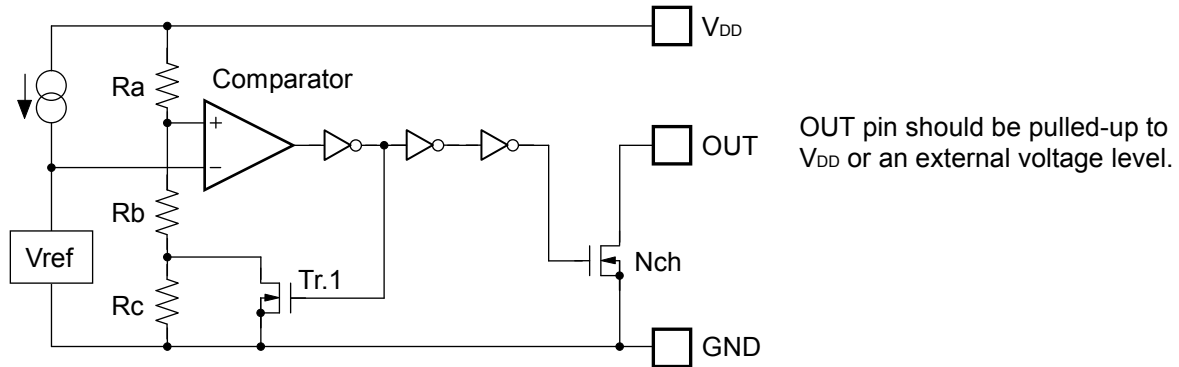
Output Current 1			Output Current 2 *3				Output Delay Time	Minimum Operating Voltage		Detector Threshold Temperature Coefficient	
IOUT1[mA]			IOUT2[mA]				tPLH[μs]	VDDL[V]		Δ-VDET/ΔTa[ppm/°C]	
Condition	Min.	Typ.	Condition		Min.	Typ.	Max.	Typ.	Max.	Condition	Typ.
<A/C version> Nch VDS=0.05V VDD=0.7V	0.01	0.05		VDD=0.85V	0.05	0.5	100 *1			−40°C ≤ Ta ≤ 85°C	±100
				VDD=1.0V	0.2	1.0					
<B version> Nch VDS=0.10V VDD=6.5V	2.5	-	Nch VDS=0.5V	VDD=1.5V	1.0	2.0		*2 Condition 1 0.55 Condition 2 0.65	*2 Condition 1 0.70 Condition 2 0.80		

*3) Only A/C versions.

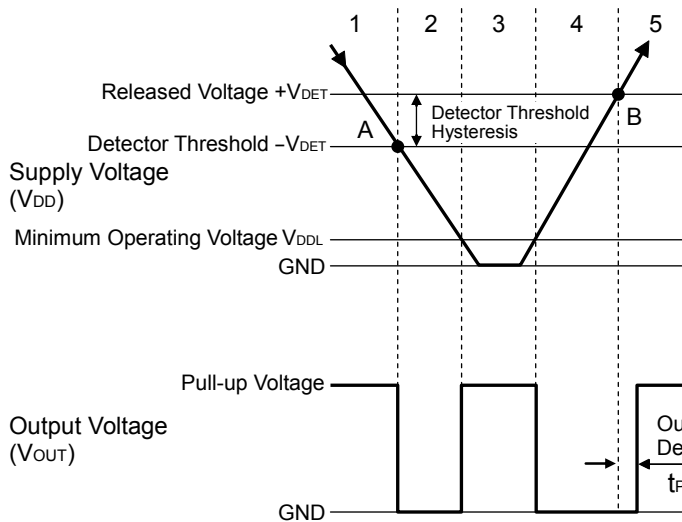
R3111x

OPERATION

• Operation of R3111xxxxA



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 ($-V_{DET}$).

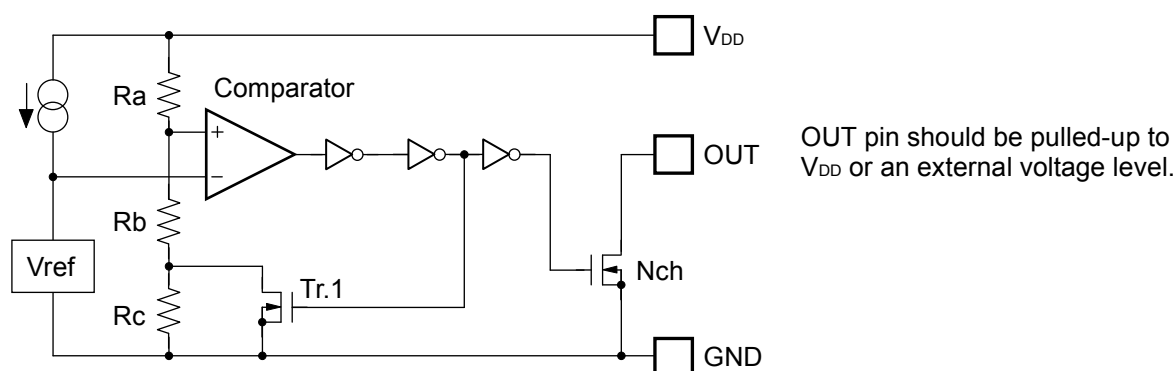
Step 3. When the supply voltage is lower than the minimum operating voltage, the operation of the output transistor becomes indefinite. The output voltage is equal to the pull-up voltage.

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

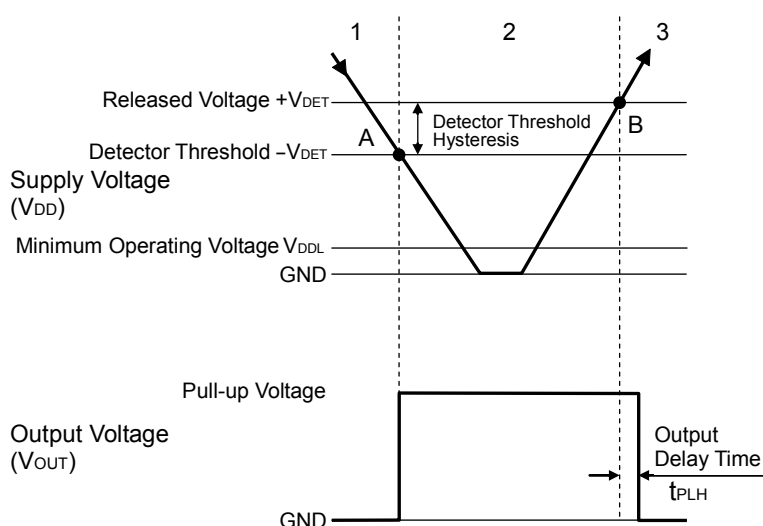
Step 5. At Point "B", $V_{ref} \leq V_{DD} \times R_b / (R_a + R_b)$ is true, as a result, the output of comparator is reversed from "L" to "H", then the output voltage is equal to the pull-up voltage. The voltage level of Point B means a released voltage ($+V_{DET}$).

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

• Operation of R3111xxxxB



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.

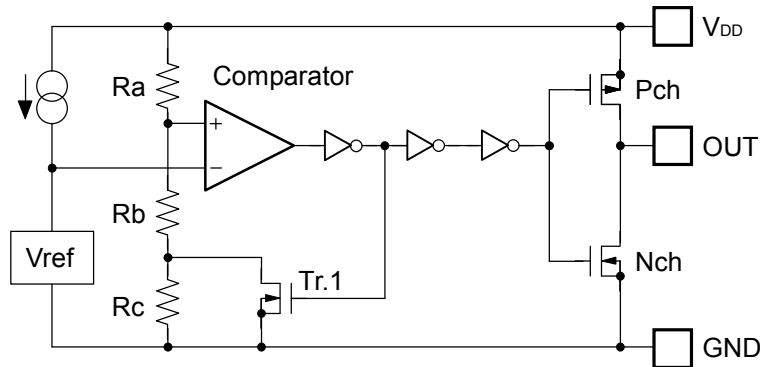
Step 2. At Point "A", $V_{ref} \geq V_{DD} \times (R_b + R_c) / (R_a + R_b + R_c)$ is true, as a result, the output of comparator is reversed from "L" to "H", therefore the output voltage becomes the pull-up voltage. The voltage level of Point A means a detector threshold voltage ($-V_{DET}$).

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 ($+V_{DET}$).

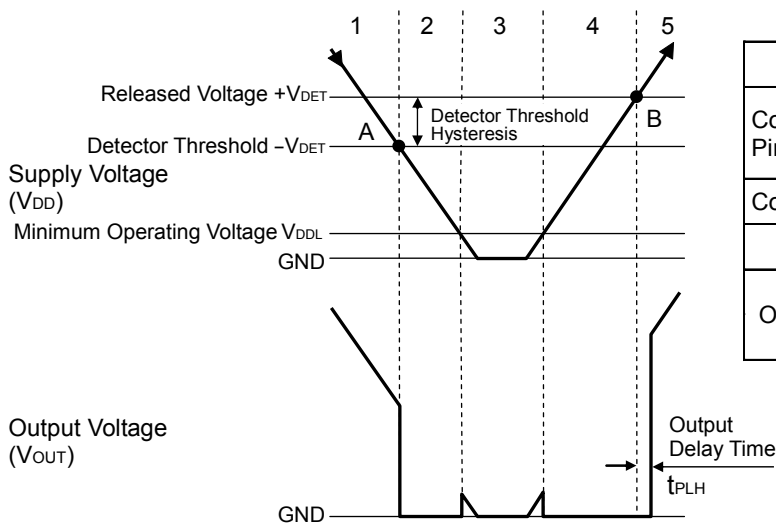
*) The difference between a released voltage and a detector threshold voltage is a detector threshold hysteresis.

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
	Nch	OFF	ON	Indefinite	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 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 ($-V_{DET}$).

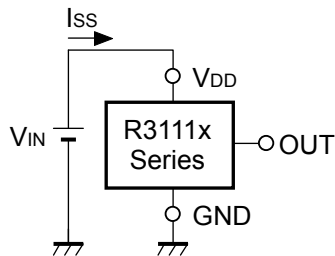
Step 3. When the supply voltage is lower than the minimum operating voltage, the operation of the output transistor becomes indefinite.

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

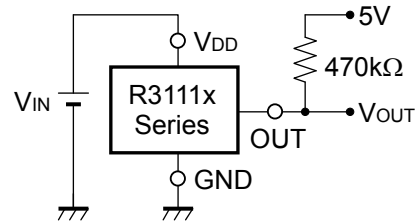
Step 5. At Point "B", $V_{ref} \leq V_{DD} \times R_b / (R_a + R_b)$ is true, as a result, the output of comparator is reversed from "L" to "H", then the output voltage is equal to the supply voltage (V_{DD}). The voltage level of Point B means a released voltage ($+V_{DET}$).

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

TEST CIRCUITS

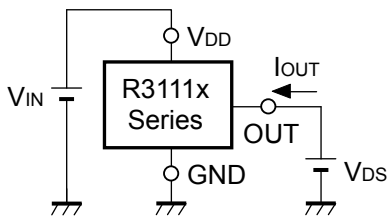


Supply Current Test Circuit

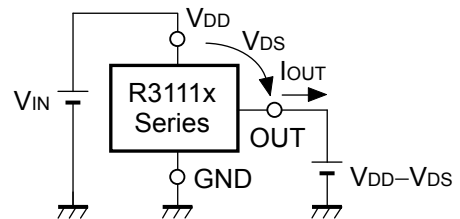


Detector Threshold Test Circuit

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

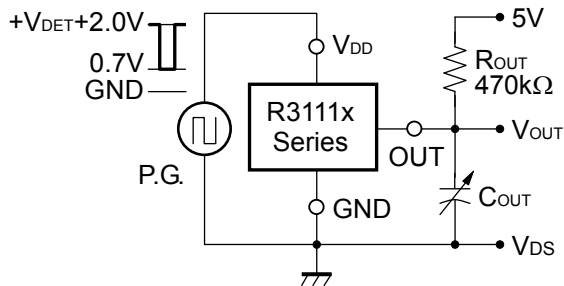


Nch Driver Output Current Test Circuit



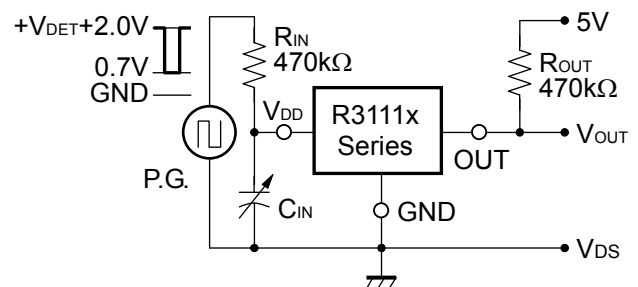
Pch Driver Output Current Test Circuit

*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:

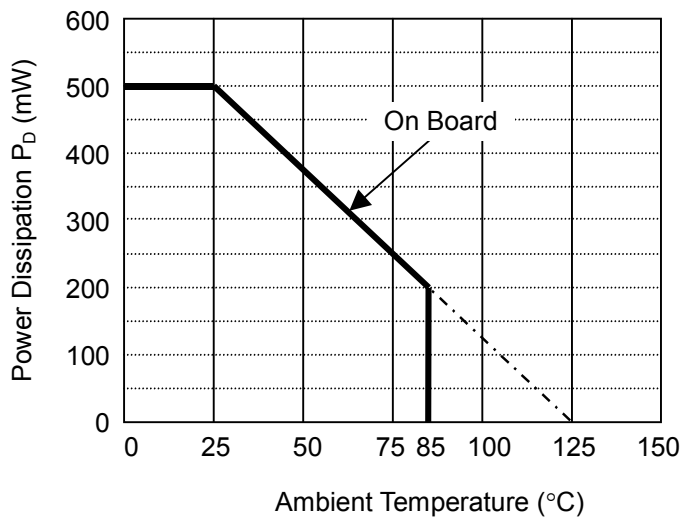
Measurement Conditions

	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

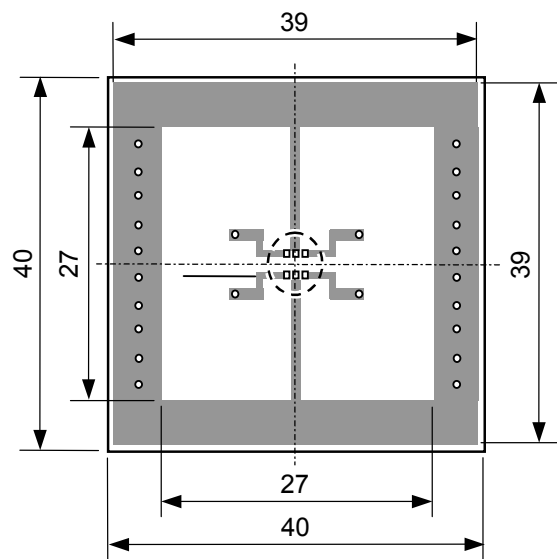
Measurement Results

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

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



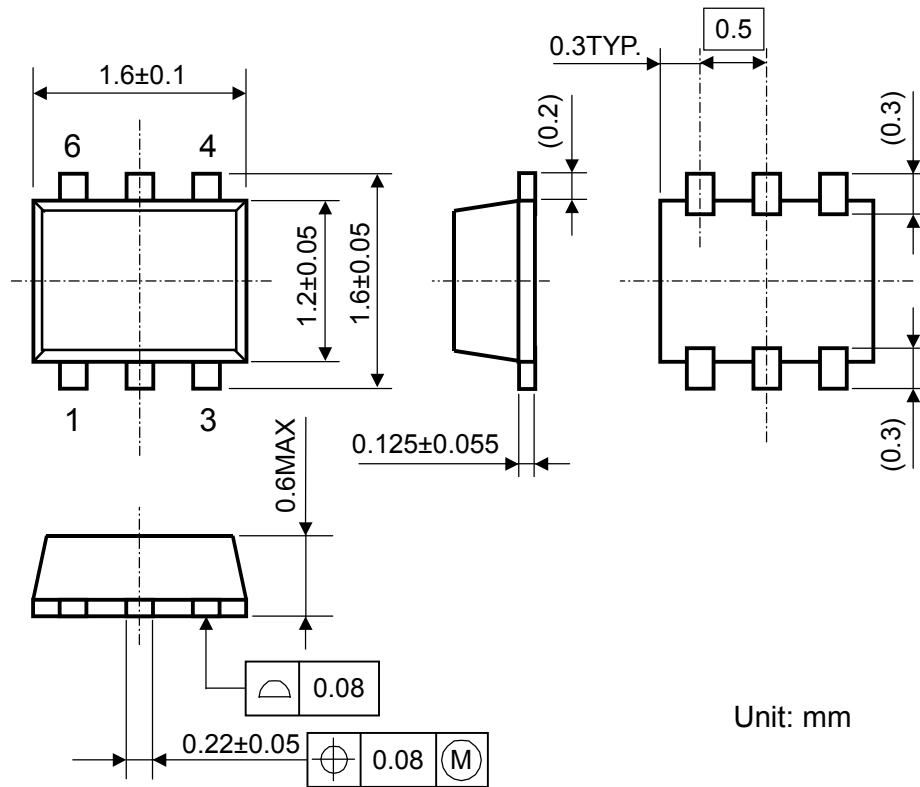
SON1612-6 Power Dissipation



Measurement Board Pattern

○ IC Mount Area Unit : mm

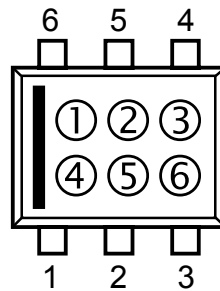
• Package Dimensions (SON1612-6)



• Mark Specification (SON1612-6)

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

⑤⑥ : Lot No. Alphabetic Serial Number



* R3111E (TO-92) is the discontinued product as of March, 2016.

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;

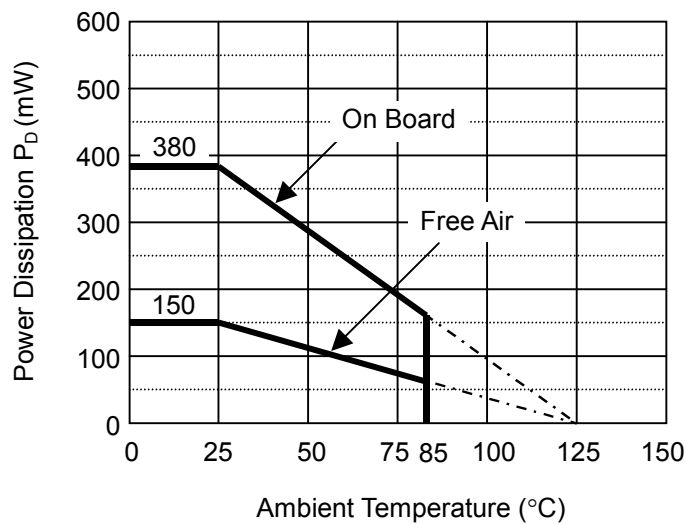
Measurement Conditions

	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

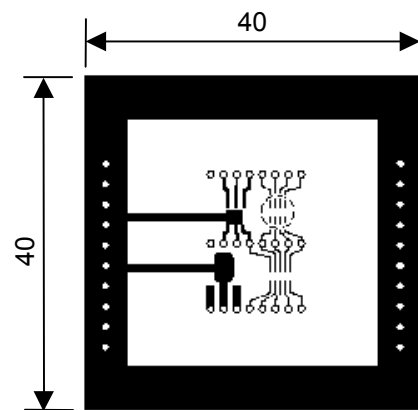
Measurement Result

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

	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 $^{\circ}\text{C/W}$



Power Dissipation

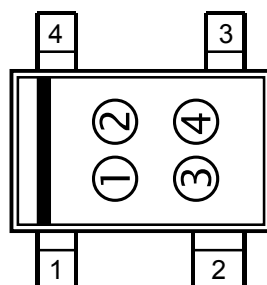


Measurement Board Pattern

○ IC Mount Area (Unit : mm)

Technical drawing of a mechanical part showing three views: front, side, and top. The front view shows a rectangular part with four mounting tabs labeled 1, 2, 3, and 4. Dimensions include overall width 2 ± 0.2 , overall height 2.1 ± 0.3 , and various tab widths and positions. The side view shows the profile of the part with a top flange and a base. Dimensions include top flange width $1.0 - 0.2$, base width $0.16 - 0.06$, and a central cutout width of 0.7 . The top view shows the part from above, highlighting the mounting tabs. All dimensions are in mm.

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



• **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

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;

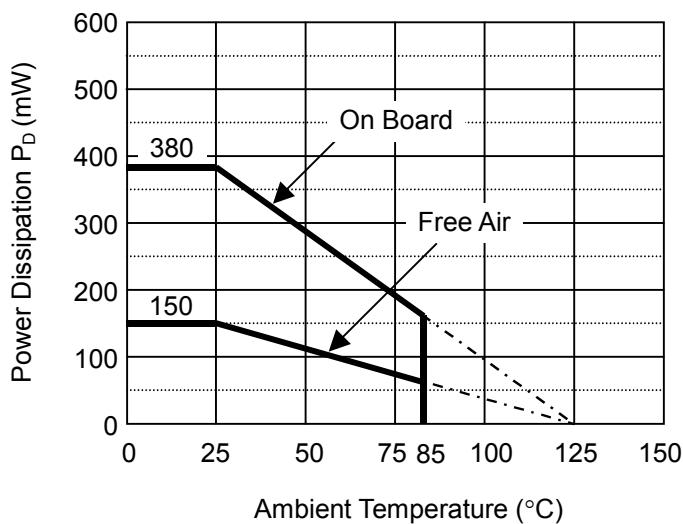
Measurement Conditions

	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

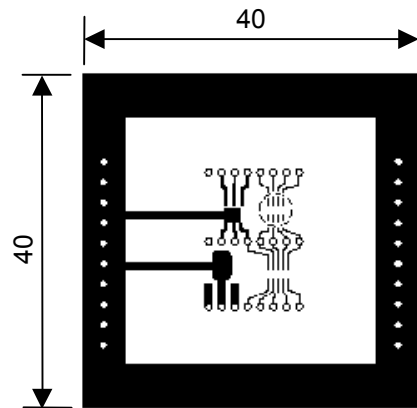
Measurement Result

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

	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)

Unit : mm

* R3111E (TO-92) is the discontinued product as of March, 2016.

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.)

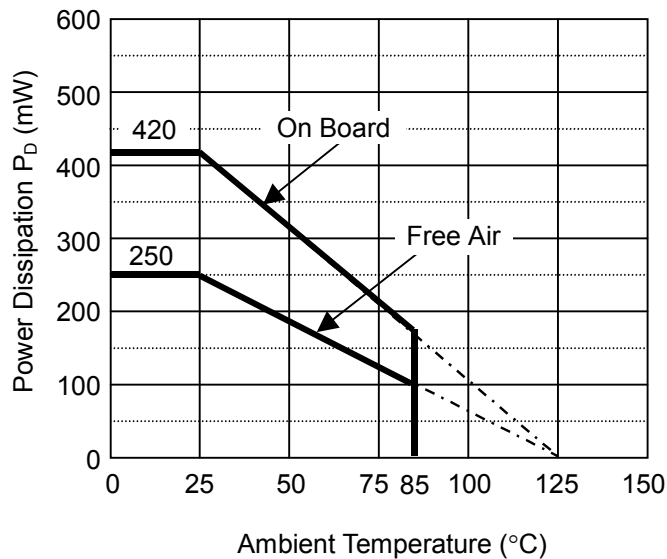
Measurement Conditions

	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

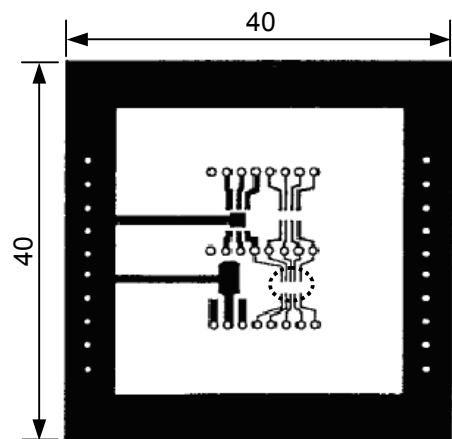
Measurement Result

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

	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

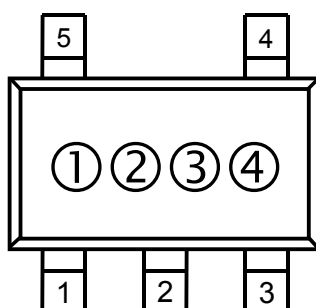


Measurement Board Pattern

○ IC Mount Area (Unit: mm)

[illegible]

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



• **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.)

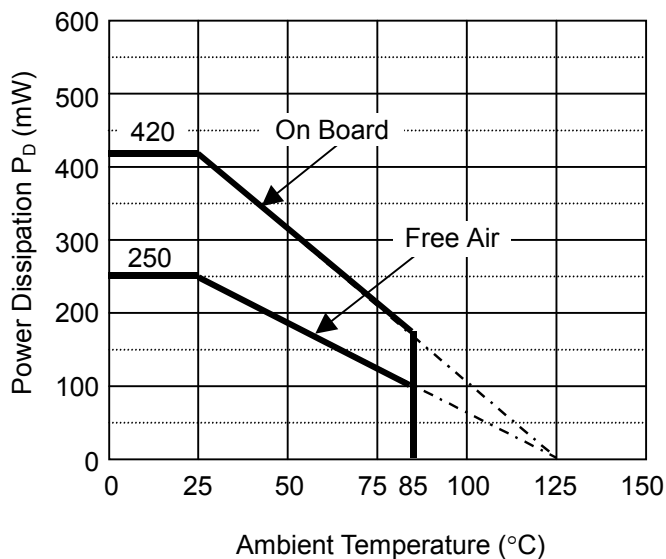
Measurement Conditions

	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

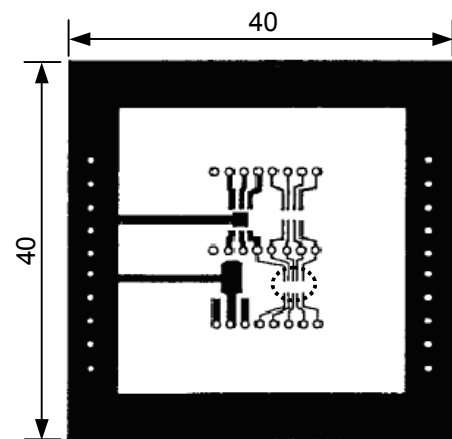
Measurement Result

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

	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 $^{\circ}\text{C/W}$



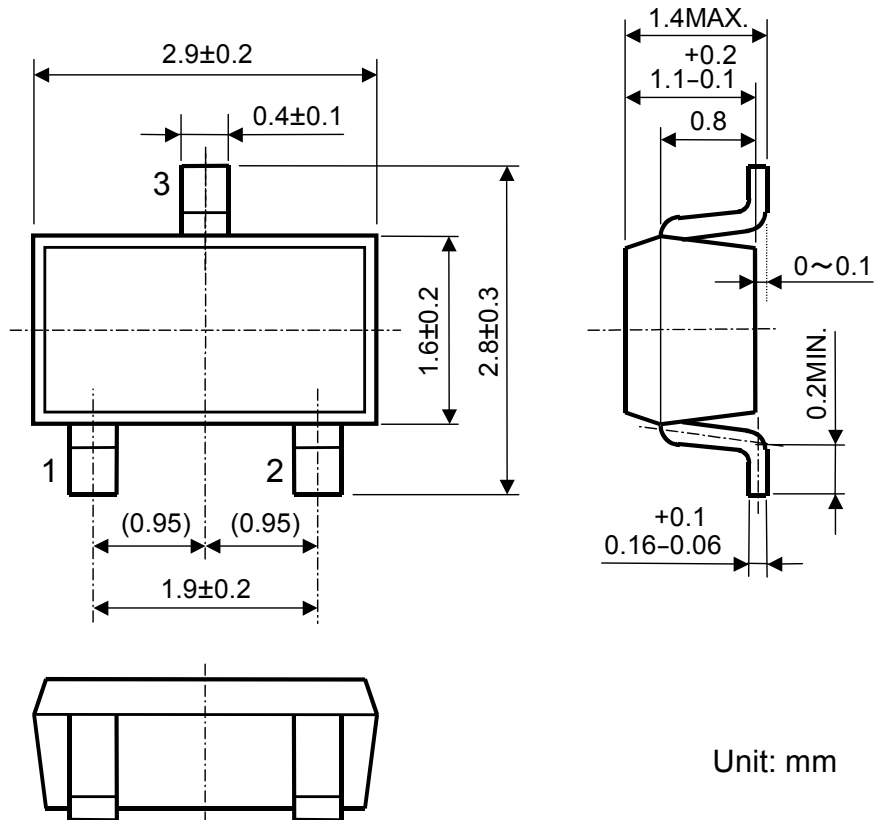
Power Dissipation



Measurement Board Pattern

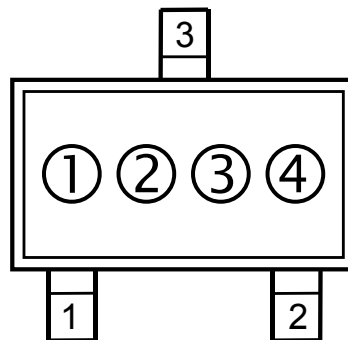
○ IC Mount Area (Unit: mm)

• Package Dimensions (SOT-23-3)



• Mark Specification (SOT-23-3)

- ① ② : Product Code ... Refer to Mark Specification Table (SOT-23-3).
- ③ ④ : Lot No. Alphnumeric Serial Number



* R3111E (TO-92) is the discontinued product as of March, 2016.

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:

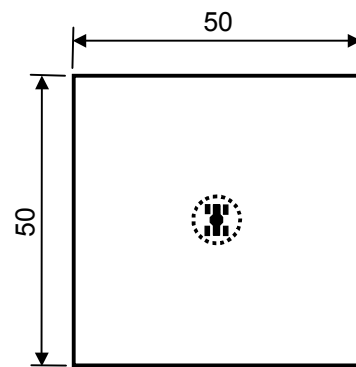
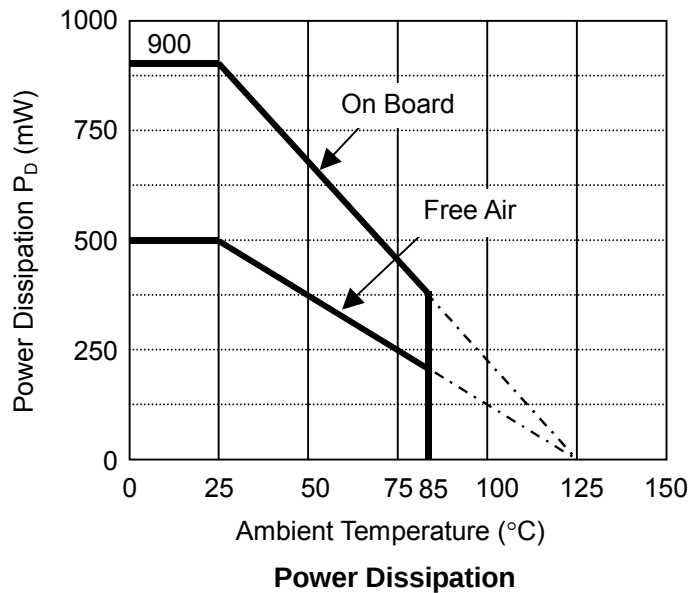
Measurement Conditions

	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 $^{\circ}\text{C/W}$

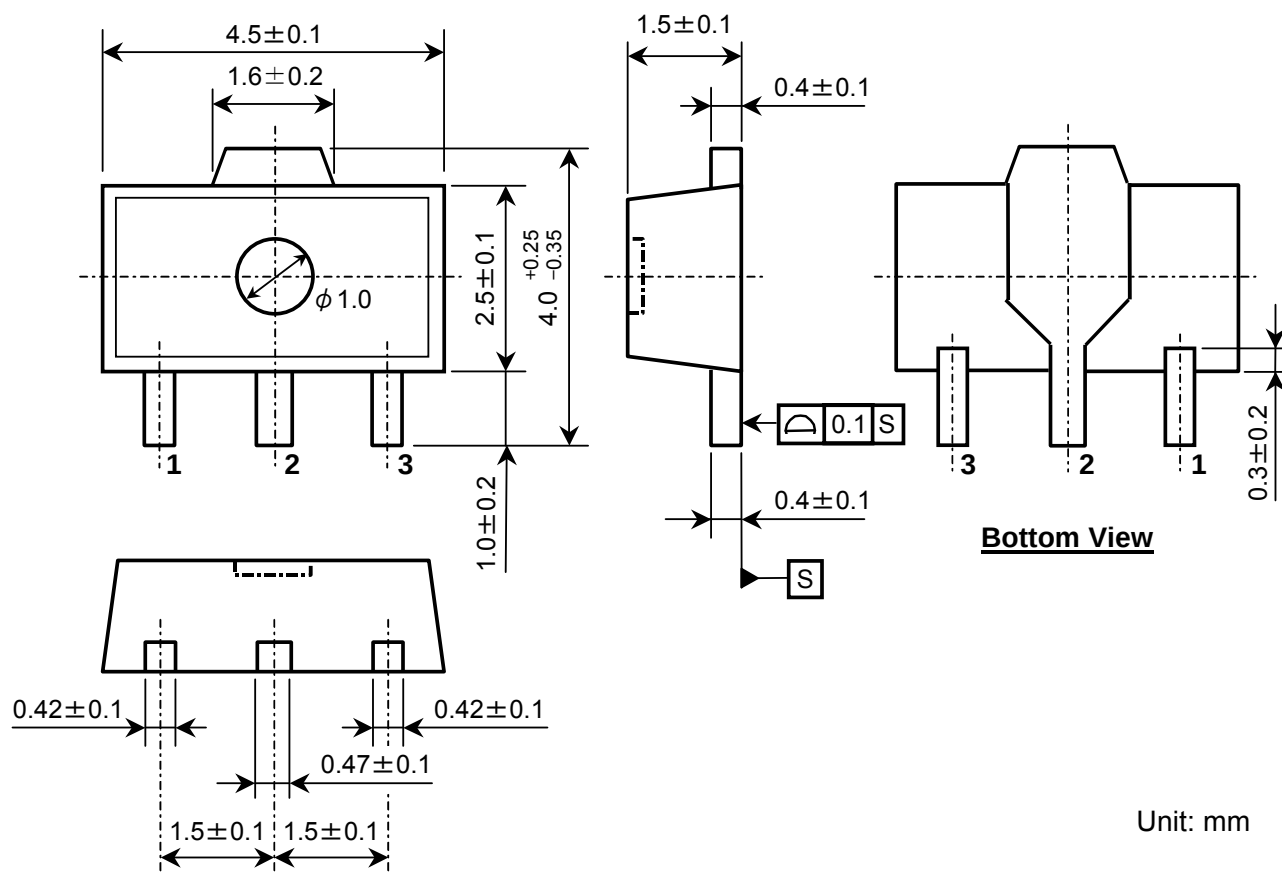


Measurement Board Pattern

○ IC Mount Area Unit : mm

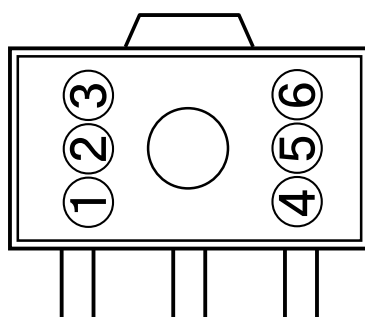
R3111x

• 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



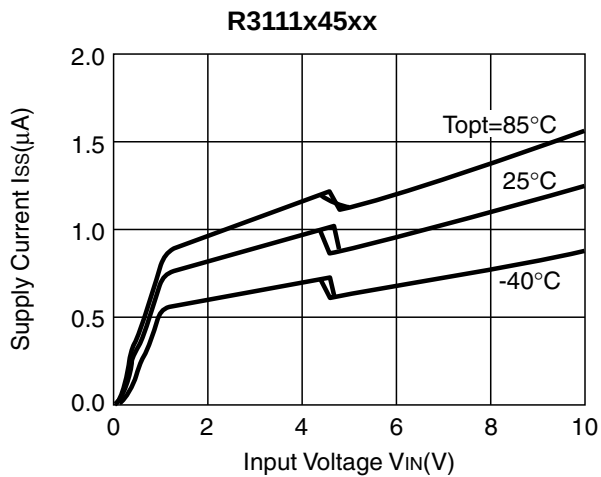
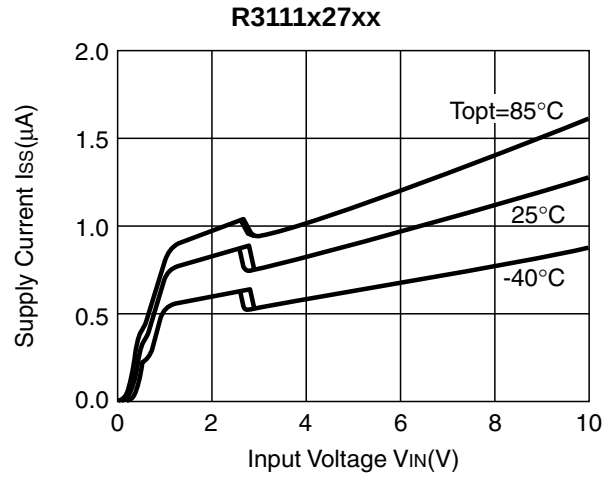
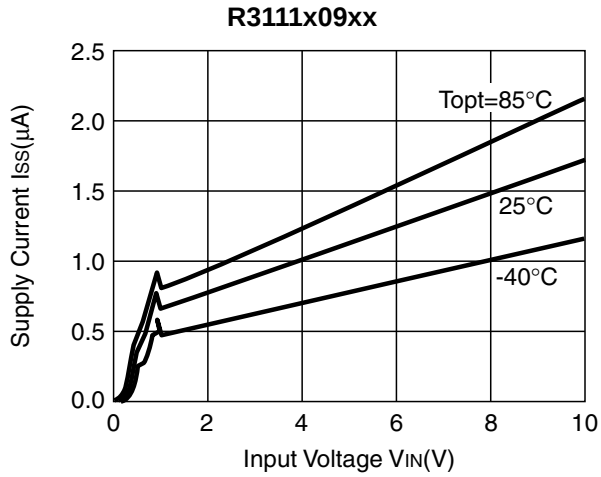
● Marking Specification Table (SOT-89-3)

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

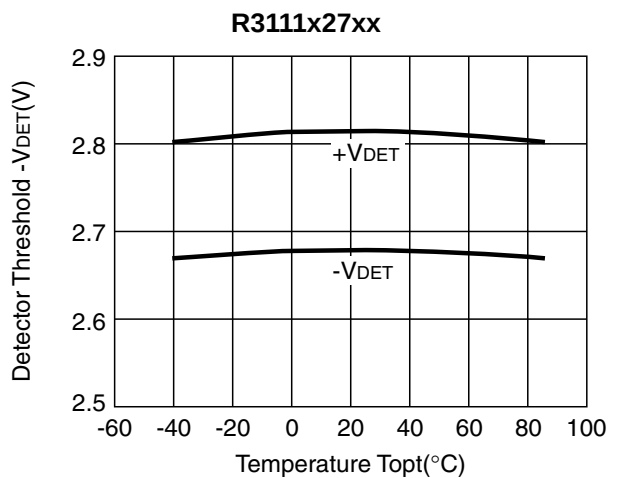
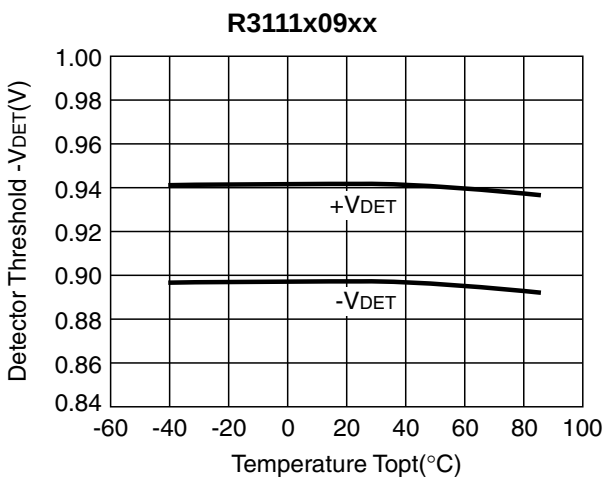
R3111x

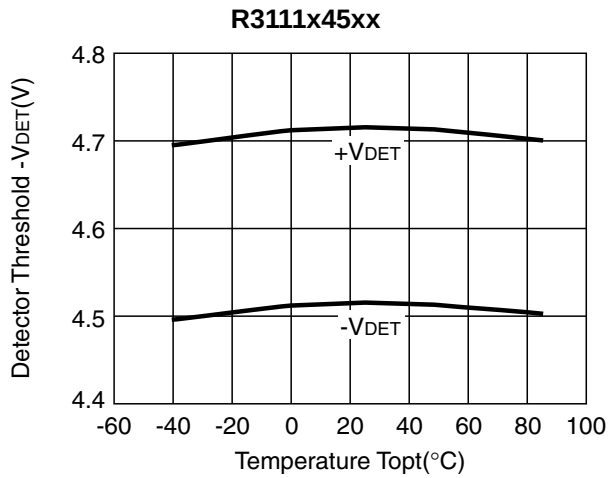
TYPICAL CHARACTERISTICS

1) Supply Current vs. Input Voltage

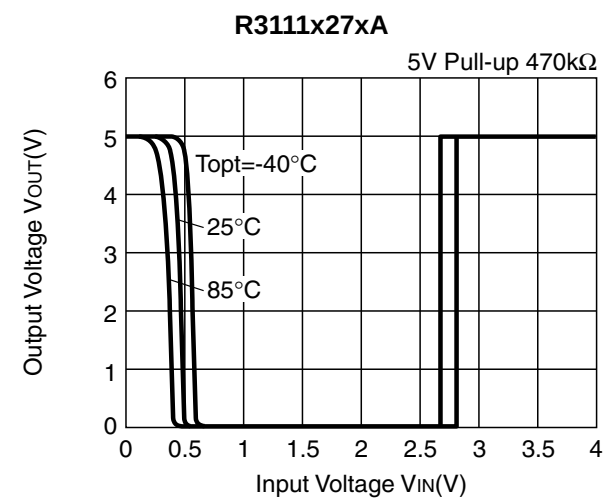
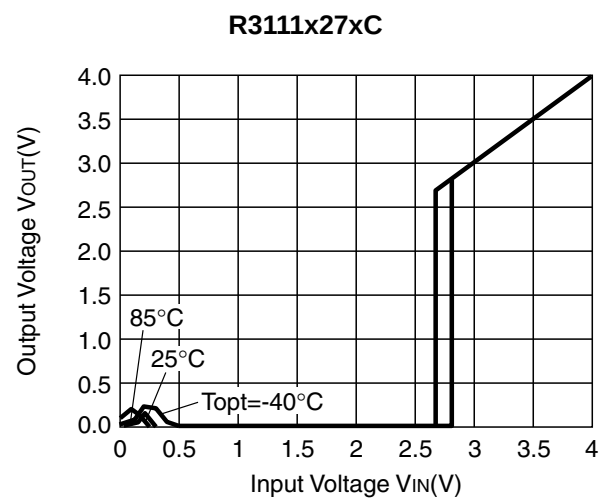
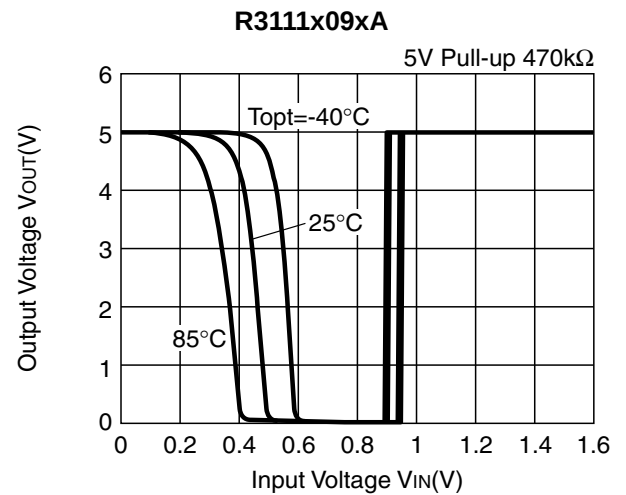
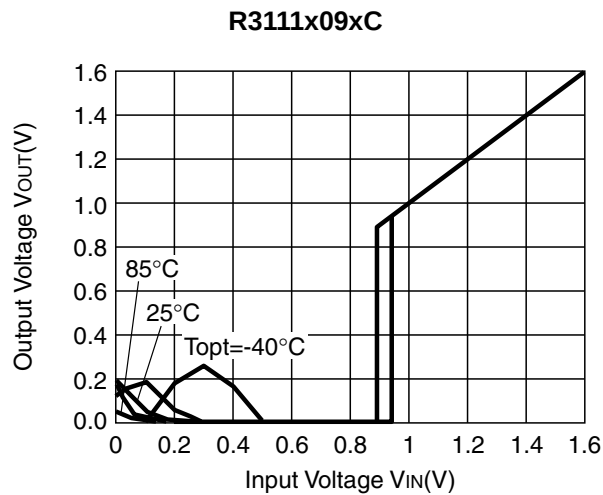


2) Detector Threshold Hysteresis vs. Temperature



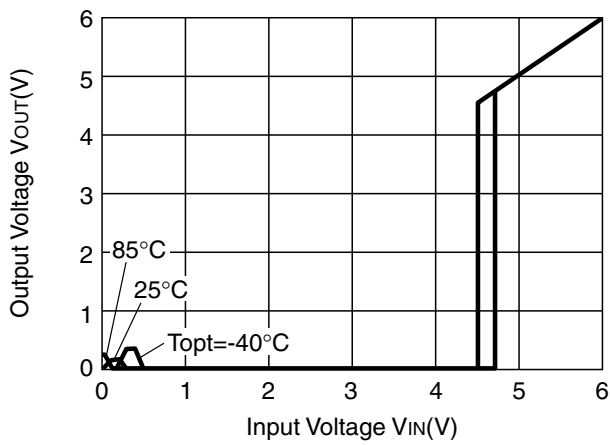


3) Output Voltage vs. Input Voltage

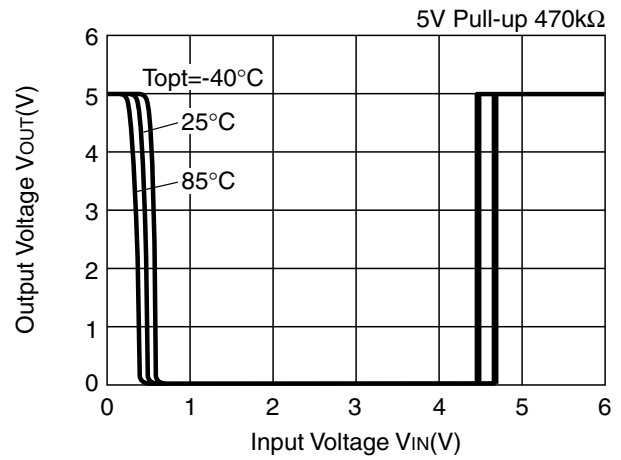


R3111x

R3111x45xC

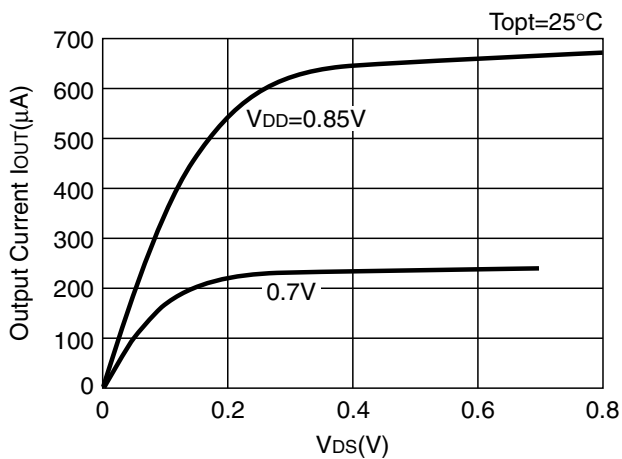


R3111x45xA

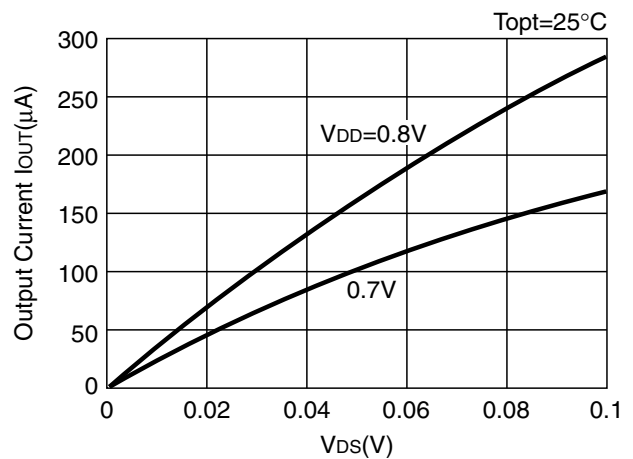


4) Nch Driver Output Current vs. V_{DS}

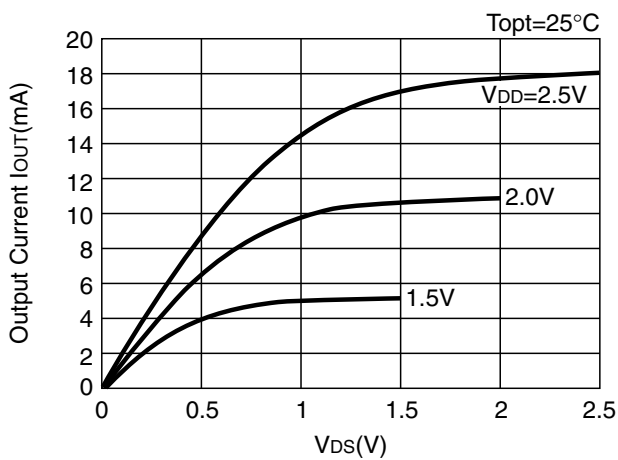
R3111x09xx



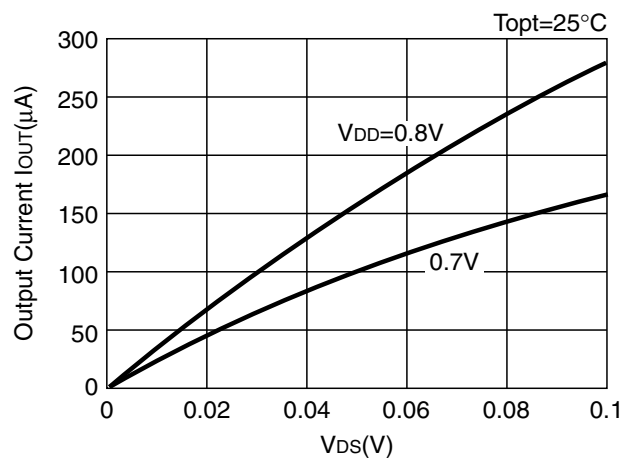
R3111x09xx

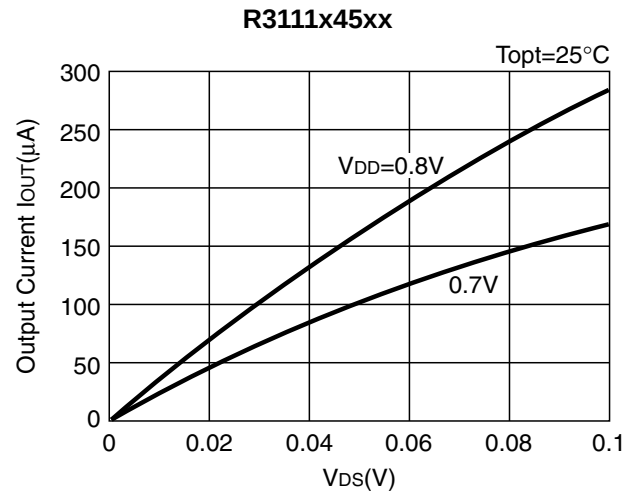
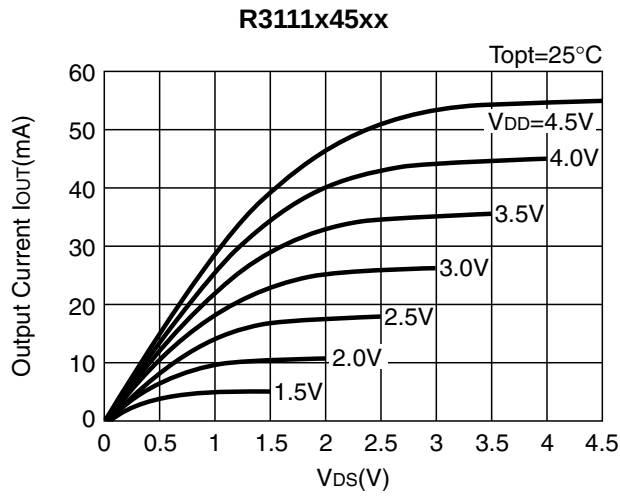


R3111x27xx

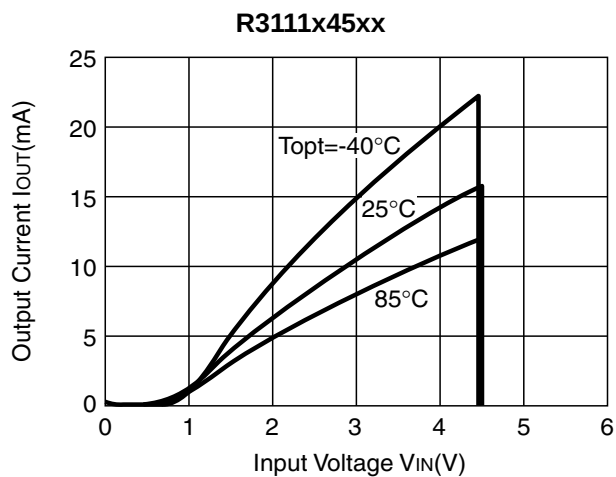
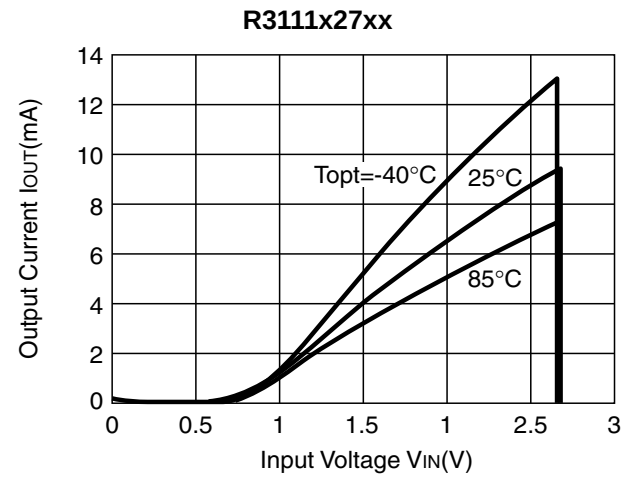
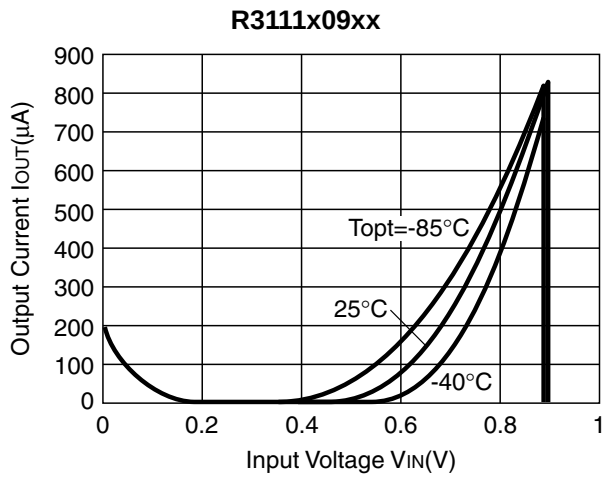


R3111x27xx





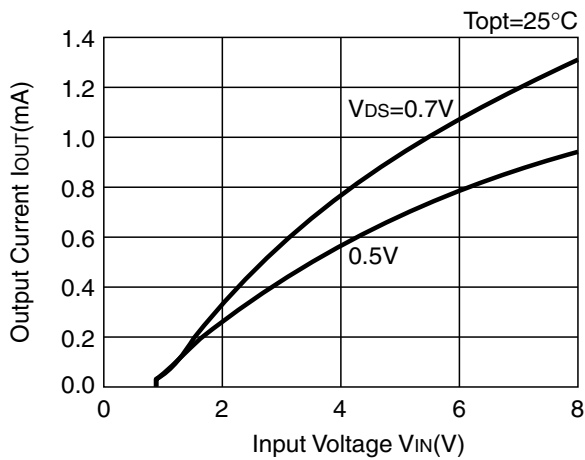
5) Nch Driver Output Current vs. Input Voltage



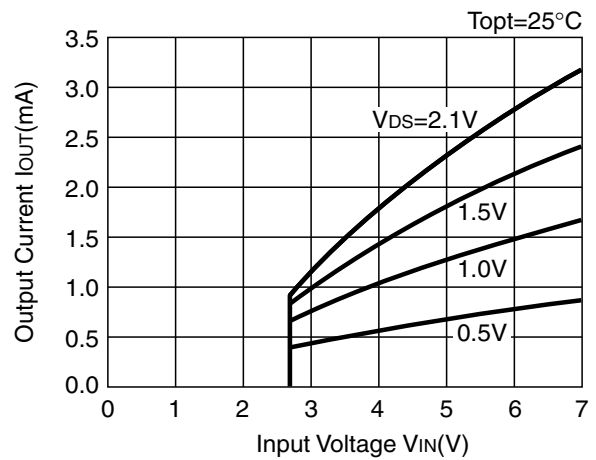
R3111x

6) Pch Driver Output Current vs. Input Voltage

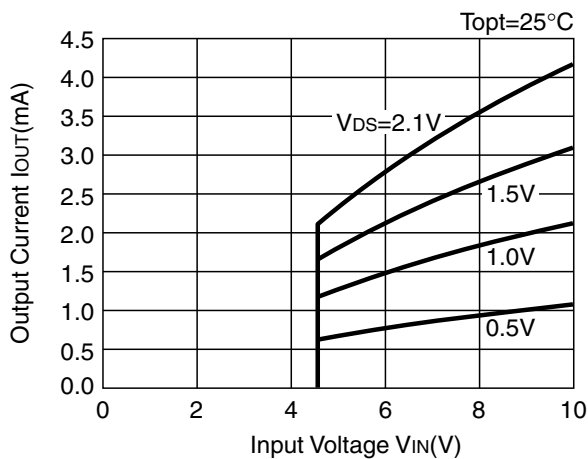
R3111x09xC



R3111x27xC

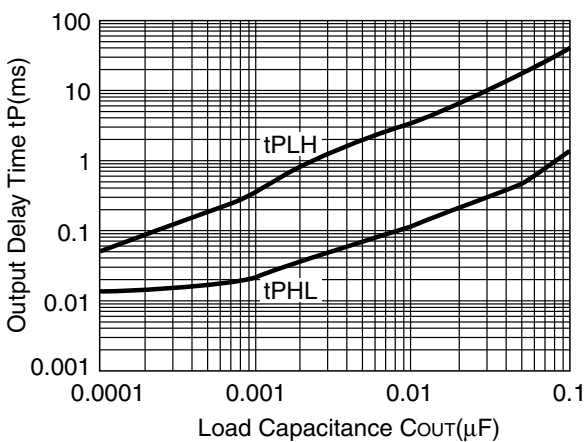


R3111x45xC

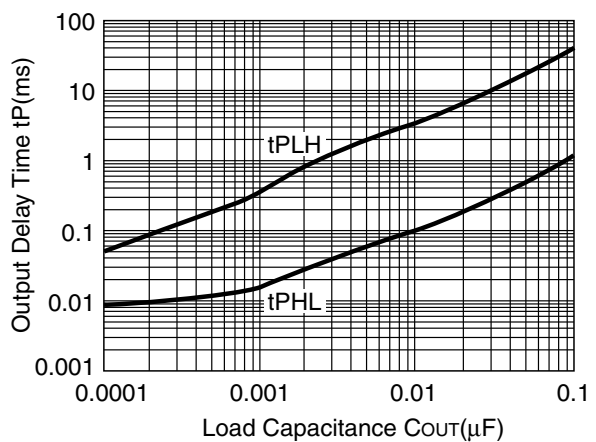


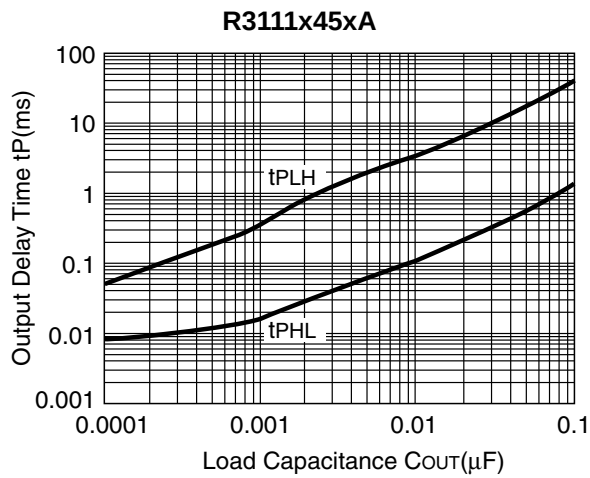
7) Output Delay Time vs. Load Capacitance ($T_a=25^{\circ}\text{C}$)

R3111x09xA

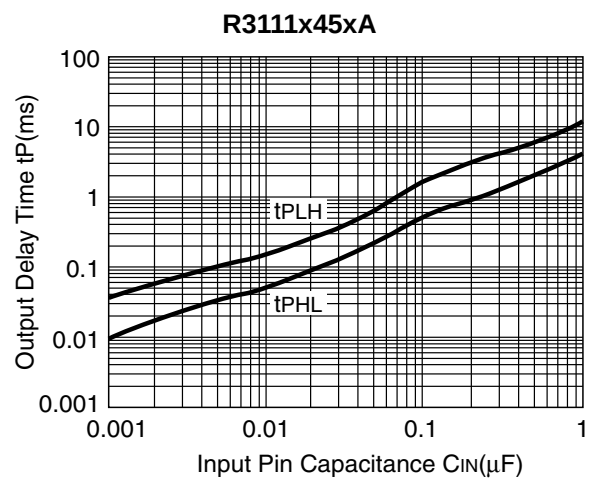
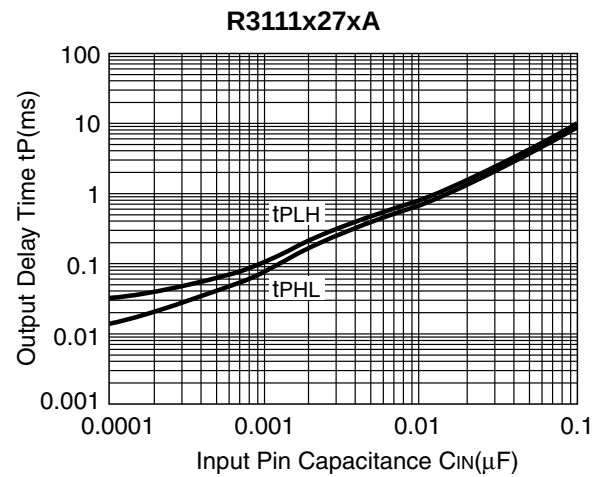
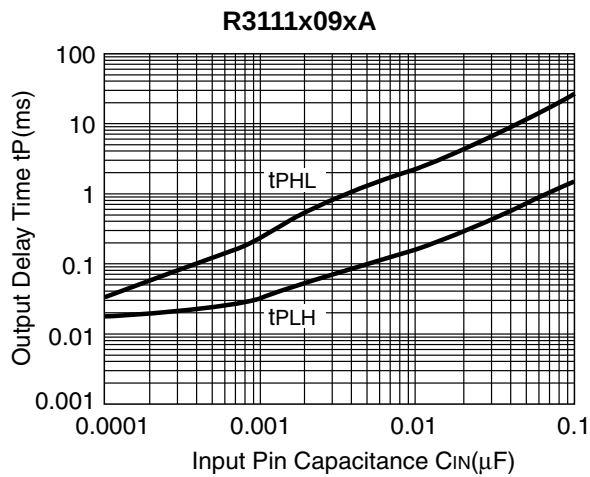


R3111x27xA





8) Output Delay Time vs. Input Pin Capacitance

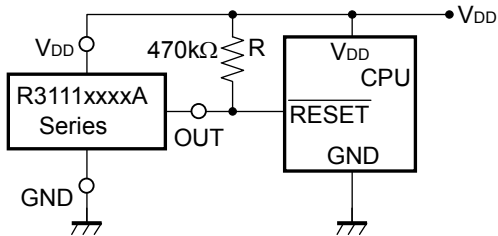


R3111x

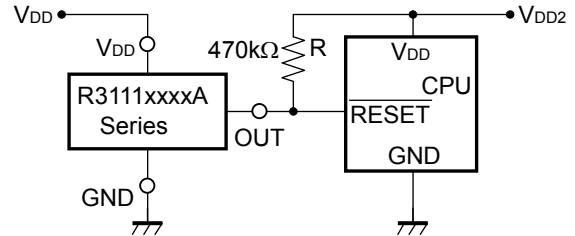
TYPICAL APPLICATION

• R3111xxxxA CPU Reset Circuit (Nch Open Drain Output)

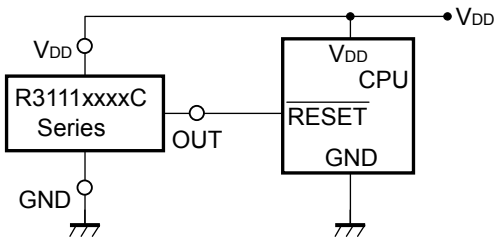
Case 1. Input Voltage to R3111xxxxA is equal to Input Voltage to CPU



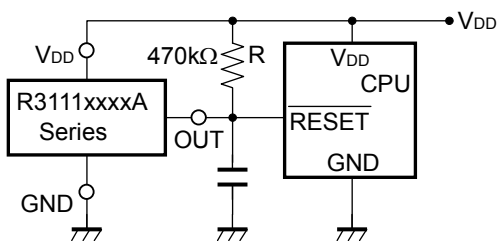
Case 2. Input Voltage to R3111xxxxA is unequal to Input Voltage to CPU



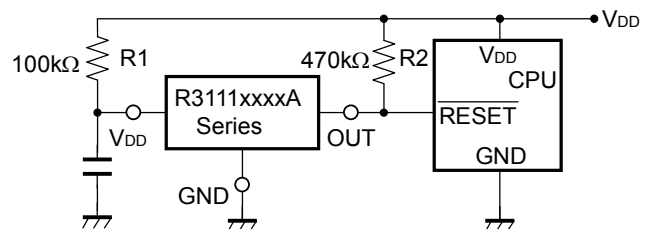
• R3111xxxxC CPU Reset Circuit (CMOS Output)



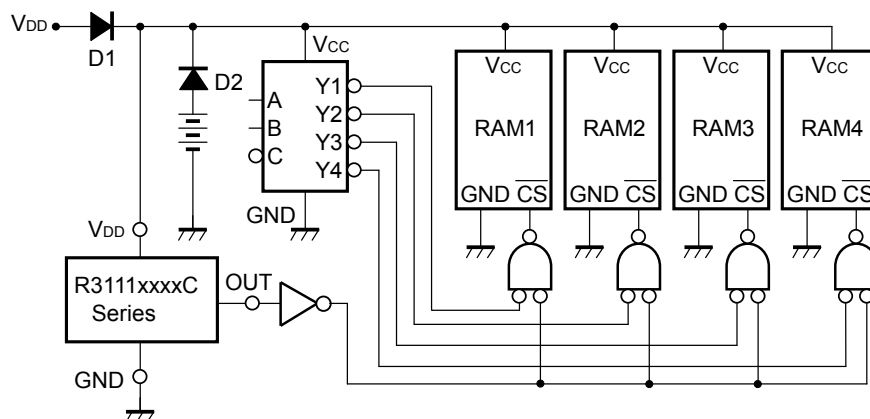
• R3111xxxxA Output Delay Time Circuit 1 (Nch Open Drain Output)



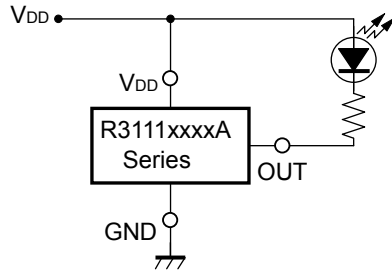
• R3111xxxxA Output Delay Time Circuit 2 (Nch Open Drain Output)



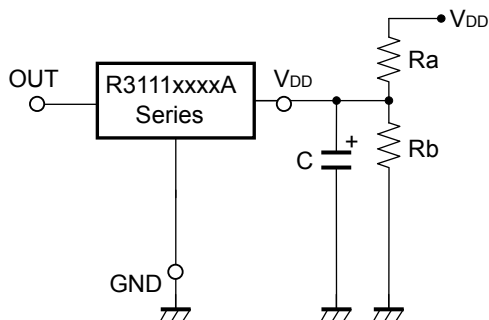
• Memory Back-up Circuit



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



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

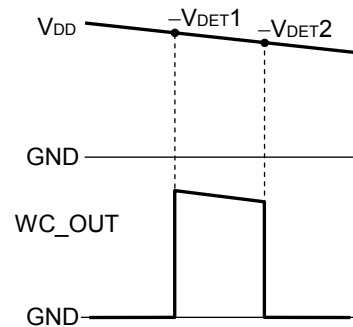
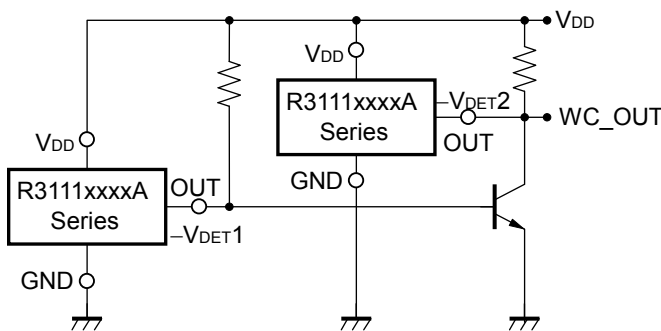


Adjusted Detector Threshold
 $= (-V_{DET}) \times (Ra + Rb) / Rb$

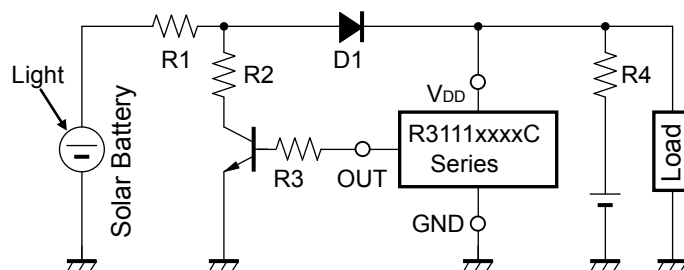
Hysteresis Voltage
 $= (V_{HYS}) \times (Ra + Rb) / Rb$

*) 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.

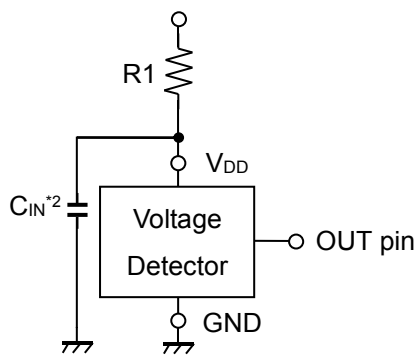


Figure A

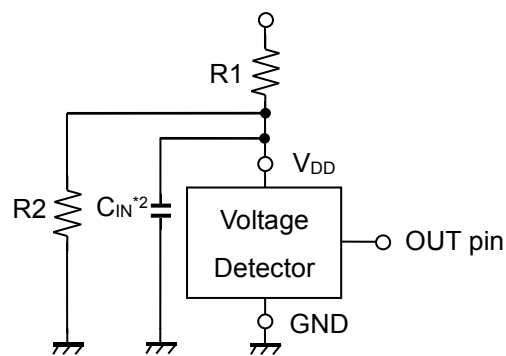


Figure B

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

*² Note the bias dependence of capacitors.



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Sales & Support Offices

RICOH ELECTRONIC DEVICES CO., LTD.

Higashi-Shinagawa Office (International Sales)
3-32-3, Higashi-Shinagawa, Shinagawa-ku, Tokyo 140-8655, Japan
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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 CO., LTD.

Taipei office
Room 109, 10F-1, No.51, Hengyang Rd., Taipei City, Taiwan (R.O.C.)
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<u>R3111Q272A-TR-FE</u>	<u>R3111Q411A-TR-FE</u>	<u>R3111Q371A-TR-FE</u>	<u>R3111H221C-T1-FE</u>	<u>R3111Q371B-TR-FE</u>
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<u>R3111N301A-TR-FE</u>	<u>R3111Q301C-TR-FE</u>	<u>R3111Q271C-TR-FE</u>	<u>R3111N271A-TR-FE</u>	<u>R3111Q281A-TR-FE</u>
<u>R3111Q271A-TR-FE</u>	<u>R3111Q281C-TR-FE</u>	<u>R3111N311A-TR-FE</u>	<u>R3111N271B-TR-FE</u>	<u>R3111N302C-TR-FE</u>
<u>R3111N311C-TR-FE</u>	<u>R3111N312A-TR-FE</u>	<u>R3111N312C-TR-FE</u>	<u>R3111H311C-T1-FE</u>	<u>R3111Q362A-TR-FE</u>
<u>R3111Q371C-TR-FE</u>	<u>R3111Q381A-TR-FE</u>	<u>R3111Q381C-TR-FE</u>	<u>R3111Q401B-TR-FE</u>	<u>R3111Q401C-TR-FE</u>
<u>R3111Q281B-TR-FE</u>	<u>R3111Q302A-TR-FE</u>	<u>R3111Q302B-TR-FE</u>	<u>R3111Q351C-TR-FE</u>	<u>R3111Q361A-TR-FE</u>
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