

## OUTLINE

The R5107G is a microprocessor supervisory circuit and has high accuracy and ultra low supply current voltage detector with built-in delay circuit and watchdog timer. When the supply voltage is down across the threshold, or the watchdog timer does not detect the system clock from the microprocessor, the reset output is generated. The voltage detector circuit is used for the system reset, etc. The detector threshold is fixed internally, and the accuracy is  $\pm 1.0\%$ . The released delay time (Power-on Reset Delay) circuit is built-in, and output delay time is adjustable with an external capacitor, and the accuracy is  $\pm 16\%$  (R5107Gxx1x-TR-JE:  $-40^{\circ}\text{C} \leq T_a \leq 105^{\circ}\text{C}$ )<sup>(1)</sup>. When the supply voltage becomes the released voltage, the reset state will be maintained during the delay time. The output type of the reset is selectable, Nch open-drain, or CMOS.

The time out period of the watchdog timer can be also set with an external capacitor, and the accuracy is  $\pm 33\%$ <sup>(1)</sup>.

The function to stop supervising clock by the watchdog timer (INH function) and manual reset function are built in this IC. There are another 4 products by the difference of packages and the function of voltage detector and watchdog timer. The package of R5107G is SSOP-8G.

## FEATURES

- Operating Voltage Range (Maximum Rating) ..... 0.9V to 6.0V (7.0V)
- Supply Current ..... Typ. 11 $\mu$ A

### < Voltage Detector Part >

- Detector Threshold Range ..... 1.5V to 5.5V (0.1V steps)
- Detector Threshold Accuracy .....  $\pm 1.0\%$
- Detector Threshold Temperature Coefficient ..... Typ.  $\pm 100$  ppm/ $^{\circ}\text{C}$   
R5107Gxx1x-TR-AE:  $-40^{\circ}\text{C} \leq T_a \leq 125^{\circ}\text{C}$   
R5107Gxx1x-TR-JE:  $-40^{\circ}\text{C} \leq T_a \leq 105^{\circ}\text{C}$
- Power-on Reset Delay Time accuracy<sup>(1)</sup> .....  $\pm 18\%$  (R5107Gxx1x-TR-AE:  $-40^{\circ}\text{C} \leq T_a \leq 125^{\circ}\text{C}$ )  
 $\pm 16\%$  (R5107Gxx1x-TR-JE:  $-40^{\circ}\text{C} \leq T_a \leq 105^{\circ}\text{C}$ )
- Power-on reset delay time of the voltage detector ..... Typ. 370ms with an external capacitor : 0.1 $\mu$ F
- With Manual Reset pin (MR) ..... Able to reset voltage detector and watchdog timer

### < Watchdog Timer Part >

- Built-in a watchdog timer's time out period accuracy<sup>(1)</sup> .....  $\pm 33\%$   
R5107Gxx1x-TR-AE:  $-40^{\circ}\text{C} \leq T_a \leq 125^{\circ}\text{C}$   
R5107Gxx1x-TR-JE:  $-40^{\circ}\text{C} \leq T_a \leq 105^{\circ}\text{C}$
- Timeout period for watchdog timer ..... Typ. 310ms with an external capacitor : 0.1 $\mu$ F
- Reset timer for watchdog timer ..... Typ. 34ms with an external capacitor : 0.1 $\mu$ F
- With Inhibit pin (INH) ..... Able to stop watchdog timer
- Package ..... SSOP-8G

## APPLICATIONS

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

## R5107G

NO.EC-170-200602

## SELECTION GUIDE

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
R5107Gxx1*-TR-#E	SSOP-8G	3,000 pcs	Yes	Yes

xx: The detector threshold ( $-V_{DET}$ ) can be designated in the range from 1.5V(15) to 5.5V(55) in 0.1V steps.

\* : Designation of Output Type  
(A) Nch Open Drain  
(C) CMOS

# : Quality Class

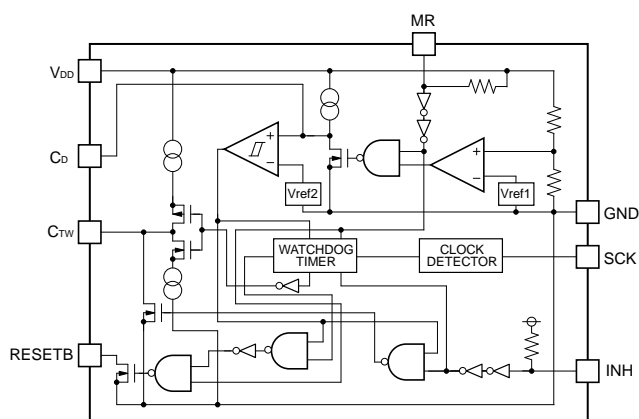
	Operating Temperature Range	Test Temp.
A	-40°C to 125°C	25°C, High
J	-40°C to 105°C	Low, 25°C, High

### Series Selection

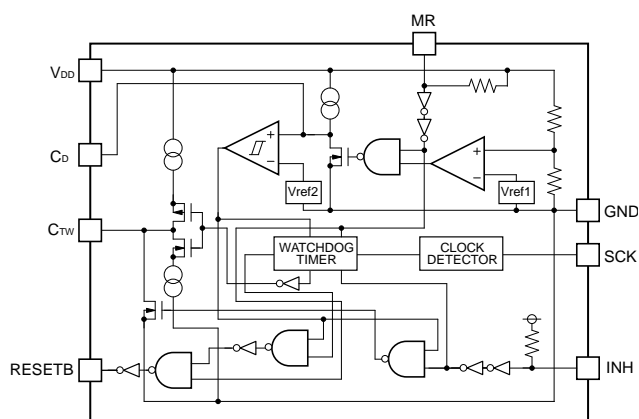
	R5105N	R5106N	R5107G	R5108G	R5109G
Package	SOT-23-6		SSOP-8G		
With INH pin (Inhibit)	No	Yes			
2 clock input	No				Yes
With MR pin (Manual Reset)	No		Yes	No	
With SENSE pin	No			Yes	No
Remarks		C <sub>D</sub> pin and C <sub>TW</sub> pin are combined uses.		Operating Voltage Range 1.5V to 6.0V	Supply Current 11.5μA

## BLOCK DIAGRAMS

**R5107Gxx1A**  
(Nch Open Drain Output)

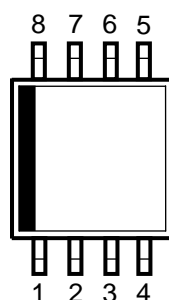


**R5107Gxx1C**  
(CMOS Output)



## PIN DESCRIPTIONS

### • SSOP-8G



Pin No.	Symbol	Description
1	RESETB	Output Pin for Reset signal of Watchdog timer and Voltage Detector. (Output "L" at detecting Detector Threshold and Watchdog Timer Reset.)
2	MR	Manual Reset Pin (Active"L")
3	CD	External Capacitor Pin for Setting Delay Time of Voltage Detector
4	GND	Ground Pin
5	SCK	Clock Input Pin from Microprocessor
6	INH	Inhibit Pin ("L": Inhibit the watchdog timer)
7	CTW	External Capacitor Pin for Setting Reset and Watchdog Timeout Periods
8	VDD	Power supply Pin

## R5107G

NO.EC-170-200602

## ABSOLUTE MAXIMUM RATINGS

(Ta=25°C)

Symbol	Item		Rating	Unit
V <sub>DD</sub>	Supply Voltage		−0.3 to 7.0	V
V <sub>CD</sub>	Output Voltage	Voltage of C <sub>D</sub> Pin	−0.3 to V <sub>DD</sub> + 0.3	V
V <sub>CTW</sub>		Voltage of C <sub>TW</sub> Pin	−0.3 to V <sub>DD</sub> + 0.3	V
V <sub>RESETB</sub>		Voltage of RESETB Pin	−0.3 to 7.0	V
V <sub>SCK</sub>	Input Voltage	Voltage of SCK Pin	−0.3 to 7.0	V
V <sub>INH</sub>		Voltage of INH Pin	−0.3 to 7.0	V
V <sub>MR</sub>		Voltage of MR Pin	−0.3 to 7.0	V
I <sub>RESETB</sub>	Output Current	Current of RESETB Pin	20	mA
P <sub>D</sub>	Power Dissipation <sup>(1)</sup> (SSOP-8G, Standard Test Land Pattern)		475	mW
T <sub>j</sub>	Junction Temperature		−40 to 150	°C
T <sub>stg</sub>	Storage Temperature Range		−55 to 150	°C

### ABSOLUTE MAXIMUM RATINGS

Electronic and mechanical stress momentarily exceeded absolute maximum ratings may cause permanent damage 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 are not assured.

## RECOMMENDED OPERATING CONDITIONS

Symbol	Item		Rating	Unit
V <sub>DD</sub>	Operating Voltage		0.9 to 6.0	V
Ta	Operating Temperature Range	R5107Gxx1x-TR-AE	−40 to 125	°C
		R5107Gxx1x-TR-JE	−40 to 105	°C

### RECOMMENDED OPERATING CONDITIONS

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

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

## ELECTRICAL CHARACTERISTICS

VDD=6.0V, CTW=0.1μF, CD=0.1μF, In case of Nch Open Drain Output type, the output pin is pulled up with a resistance of 100kΩ (R5107Gxx1A), unless otherwise noted.

The specification in   is checked and guaranteed by design engineering at  $-40^{\circ}\text{C} \leq T_a \leq 125^{\circ}\text{C}$ .

### R5107Gxx1A/C-TR-AE (Ta=25°C)

Symbol	Item	Conditions	Min.	Typ.	Max.	Unit
I <sub>SS</sub>	Supply Current	V <sub>DD</sub> = -V <sub>DET</sub> +0.5V, Clock pulse input		11	<span style="border: 1px solid black; padding: 0 2px;">15</span>	μA

### VD Part

Symbol	Item	Conditions	Min.	Typ.	Max.	Unit
-V <sub>DET</sub>	Detector Threshold	Ta=25°C	×0.990		×1.010	V
		-40°C ≤ Ta ≤ 125°C	<span style="border: 1px solid black; padding: 0 2px;">×0.972</span>		<span style="border: 1px solid black; padding: 0 2px;">×1.015</span>	
V <sub>HYS</sub>	Detector Threshold Hysteresis		$\frac{-V_{DET}}{\times 0.03}$	$\frac{-V_{DET}}{\times 0.05}$	$\frac{-V_{DET}}{\times 0.07}$	V
t <sub>PLH</sub>	Output Delay Time	C <sub>D</sub> =0.1μF <sup>(1)</sup>	<span style="border: 1px solid black; padding: 0 2px;">340</span>	370	<span style="border: 1px solid black; padding: 0 2px;">485</span>	ms
I <sub>RESETB</sub>	Output Current (RESETB Output pin)	Nch V <sub>DD</sub> =1.2V, V <sub>DS</sub> =0.1V	<span style="border: 1px solid black; padding: 0 2px;">0.36</span>	0.8		mA
		Pch <sup>(2)</sup> V <sub>DD</sub> =6.0V, V <sub>DS</sub> =0.5V	<span style="border: 1px solid black; padding: 0 2px;">0.63</span>	0.9		mA
V <sub>MRH</sub>	MR Input "H" <sup>(3)</sup>		<span style="border: 1px solid black; padding: 0 2px;">1.0</span>		<span style="border: 1px solid black; padding: 0 2px;">6.0</span>	V
V <sub>MRL</sub>	MR Input "L"		<span style="border: 1px solid black; padding: 0 2px;">0</span>		<span style="border: 1px solid black; padding: 0 2px;">0.35</span>	V
t <sub>MRW</sub>	MR Input Pulse Width <sup>(4)</sup>		<span style="border: 1px solid black; padding: 0 2px;">3</span>			μs
R <sub>MR</sub>	MR Pull-up Resistance		<span style="border: 1px solid black; padding: 0 2px;">60</span>	110	<span style="border: 1px solid black; padding: 0 2px;">164</span>	kΩ

### WDT Part

Symbol	Item	Conditions	Min.	Typ.	Max.	Unit
t <sub>WD</sub>	Watchdog Timeout period	C <sub>TW</sub> =0.1μF <sup>(1)</sup>	<span style="border: 1px solid black; padding: 0 2px;">230</span>	310	<span style="border: 1px solid black; padding: 0 2px;">450</span>	ms
t <sub>WR</sub>	Reset Hold Time of WDT	C <sub>TW</sub> =0.1μF <sup>(1)</sup>	<span style="border: 1px solid black; padding: 0 2px;">29</span>	34	<span style="border: 1px solid black; padding: 0 2px;">48</span>	ms
V <sub>SCKH</sub>	SCK Input "H"		$V_{DD} \times 0.8$		<span style="border: 1px solid black; padding: 0 2px;">6.0</span>	V
V <sub>SCKL</sub>	SCK Input "L"		<span style="border: 1px solid black; padding: 0 2px;">0</span>		$V_{DD} \times 0.2$	V
V <sub>INH</sub>	INH Input "H"		<span style="border: 1px solid black; padding: 0 2px;">1.0</span>		<span style="border: 1px solid black; padding: 0 2px;">6.0</span>	V
V <sub>INHL</sub>	INH Input "L"		<span style="border: 1px solid black; padding: 0 2px;">0</span>		<span style="border: 1px solid black; padding: 0 2px;">0.35</span>	V
R <sub>INH</sub>	INH pull-up Resistance		<span style="border: 1px solid black; padding: 0 2px;">60</span>	110	<span style="border: 1px solid black; padding: 0 2px;">164</span>	kΩ
t <sub>SCKW</sub>	SCK Input Pulse Width	V <sub>SCKL</sub> =V <sub>DD</sub> ×0.2, V <sub>SCKH</sub> =V <sub>DD</sub> ×0.8	<span style="border: 1px solid black; padding: 0 2px;">500</span>			ns

On all of unit, all items except MR Input Pulse Width in the above are tested and specified under load conditions such that T<sub>j</sub>≈Ta=25°C.

<sup>(1)</sup> The specification does not contain the temperature characteristics of the external capacitor.

<sup>(2)</sup> In case of CMOS type (R5107Gxx1C)

<sup>(3)</sup> In case of CMOS type (R5107Gxx1C)

<sup>(4)</sup> MR input pulse width specification guarantee the minimum input pulse width of MR pin for output "L" from RESETB pin. If the "L" pulse width of MR is short, t<sub>PLH</sub> may be short. Refer to the timing diagram for details.

## R5107G

NO.EC-170-200602

VDD=6.0V, CTW=0.1μF, CD=0.1μF, In case of Nch Open Drain Output type, the output pin is pulled up with a resistance of 100kΩ (R5107Gxx1A), unless otherwise noted.

The specification in   is checked and guaranteed by design engineering at  $-40^{\circ}\text{C} \leq T_a \leq 105^{\circ}\text{C}$ .

### R5107Gxx1A/C-TR-JE (Ta=25°C)

Symbol	Item	Conditions	Min.	Typ.	Max.	Unit
I <sub>SS</sub>	Supply Current	V <sub>DD</sub> = -V <sub>DET</sub> +0.5V, Clock pulse input		11	<span style="border: 1px solid black; padding: 0 2px;">15</span>	μA

### VD Part

Symbol	Item	Conditions	Min.	Typ.	Max.	Unit
-V <sub>DET</sub>	Detector Threshold	Ta=25°C	×0.990		×1.010	V
		-40°C ≤ Ta ≤ 105°C	<span style="border: 1px solid black; padding: 0 2px;">×0.972</span>		<span style="border: 1px solid black; padding: 0 2px;">×1.015</span>	
V <sub>HYS</sub>	Detector Threshold Hysteresis		<span style="border: 1px solid black; padding: 0 2px;">-V<sub>DET</sub> ×0.03</span>	-V <sub>DET</sub> ×0.05	<span style="border: 1px solid black; padding: 0 2px;">-V<sub>DET</sub> ×0.07</span>	V
t <sub>PLH</sub>	Output Delay Time	C <sub>D</sub> =0.1μF <sup>(1)</sup>	<span style="border: 1px solid black; padding: 0 2px;">340</span>	370	<span style="border: 1px solid black; padding: 0 2px;">467</span>	ms
I <sub>RESETB</sub>	Output Current (RESETB Output pin)	Nch V <sub>DD</sub> =1.2V, V <sub>DS</sub> =0.1V	<span style="border: 1px solid black; padding: 0 2px;">0.38</span>	0.8		mA
		Pch <sup>(2)</sup> V <sub>DD</sub> =6.0V, V <sub>DS</sub> =0.5V	<span style="border: 1px solid black; padding: 0 2px;">0.65</span>	0.9		mA
V <sub>MRH</sub>	MR Input "H" <sup>(3)</sup>		<span style="border: 1px solid black; padding: 0 2px;">1.0</span>		<span style="border: 1px solid black; padding: 0 2px;">6.0</span>	V
V <sub>MRL</sub>	MR Input "L"		<span style="border: 1px solid black; padding: 0 2px;">0</span>		<span style="border: 1px solid black; padding: 0 2px;">0.35</span>	V
t <sub>MRW</sub>	MR Input Pulse Width <sup>(4)</sup>		<span style="border: 1px solid black; padding: 0 2px;">3</span>			μs
R <sub>M</sub>	MR Pull-up Resistance		<span style="border: 1px solid black; padding: 0 2px;">60</span>	110	<span style="border: 1px solid black; padding: 0 2px;">164</span>	kΩ

### WDT Part

Symbol	Item	Conditions	Min.	Typ.	Max.	Unit
t <sub>WD</sub>	Watchdog Timeout period	C <sub>TW</sub> =0.1μF <sup>(1)</sup>	<span style="border: 1px solid black; padding: 0 2px;">230</span>	310	<span style="border: 1px solid black; padding: 0 2px;">450</span>	ms
t <sub>WR</sub>	Reset Hold Time of WDT	C <sub>TW</sub> =0.1μF <sup>(1)</sup>	<span style="border: 1px solid black; padding: 0 2px;">29</span>	34	<span style="border: 1px solid black; padding: 0 2px;">48</span>	ms
V <sub>SCKH</sub>	SCK Input "H"		<span style="border: 1px solid black; padding: 0 2px;">V<sub>DD</sub>×0.8</span>		<span style="border: 1px solid black; padding: 0 2px;">6.0</span>	V
V <sub>SCKL</sub>	SCK Input "L"		<span style="border: 1px solid black; padding: 0 2px;">0</span>		<span style="border: 1px solid black; padding: 0 2px;">V<sub>DD</sub>×0.2</span>	V
V <sub>INH</sub>	INH Input "H"		<span style="border: 1px solid black; padding: 0 2px;">1.0</span>		<span style="border: 1px solid black; padding: 0 2px;">6.0</span>	V
V <sub>INHL</sub>	INH Input "L"		<span style="border: 1px solid black; padding: 0 2px;">0</span>		<span style="border: 1px solid black; padding: 0 2px;">0.35</span>	V
R <sub>INH</sub>	INH pull-up Resistance		<span style="border: 1px solid black; padding: 0 2px;">64</span>	110	<span style="border: 1px solid black; padding: 0 2px;">152</span>	kΩ
t <sub>SCKW</sub>	SCK Input Pulse Width	V <sub>SCKL</sub> =V <sub>DD</sub> ×0.2, V <sub>SCKH</sub> =V <sub>DD</sub> ×0.8	<span style="border: 1px solid black; padding: 0 2px;">500</span>			ns

On all of unit, all items except MR Input Pulse Width in the above are tested and specified under load conditions such that T<sub>j</sub>≈Ta=25°C.

<sup>(1)</sup> The specification does not contain the temperature characteristics of the external capacitor.

<sup>(2)</sup> In case of CMOS type (R5107Gxx1C)

<sup>(3)</sup> In case of CMOS type (R5107Gxx1C)

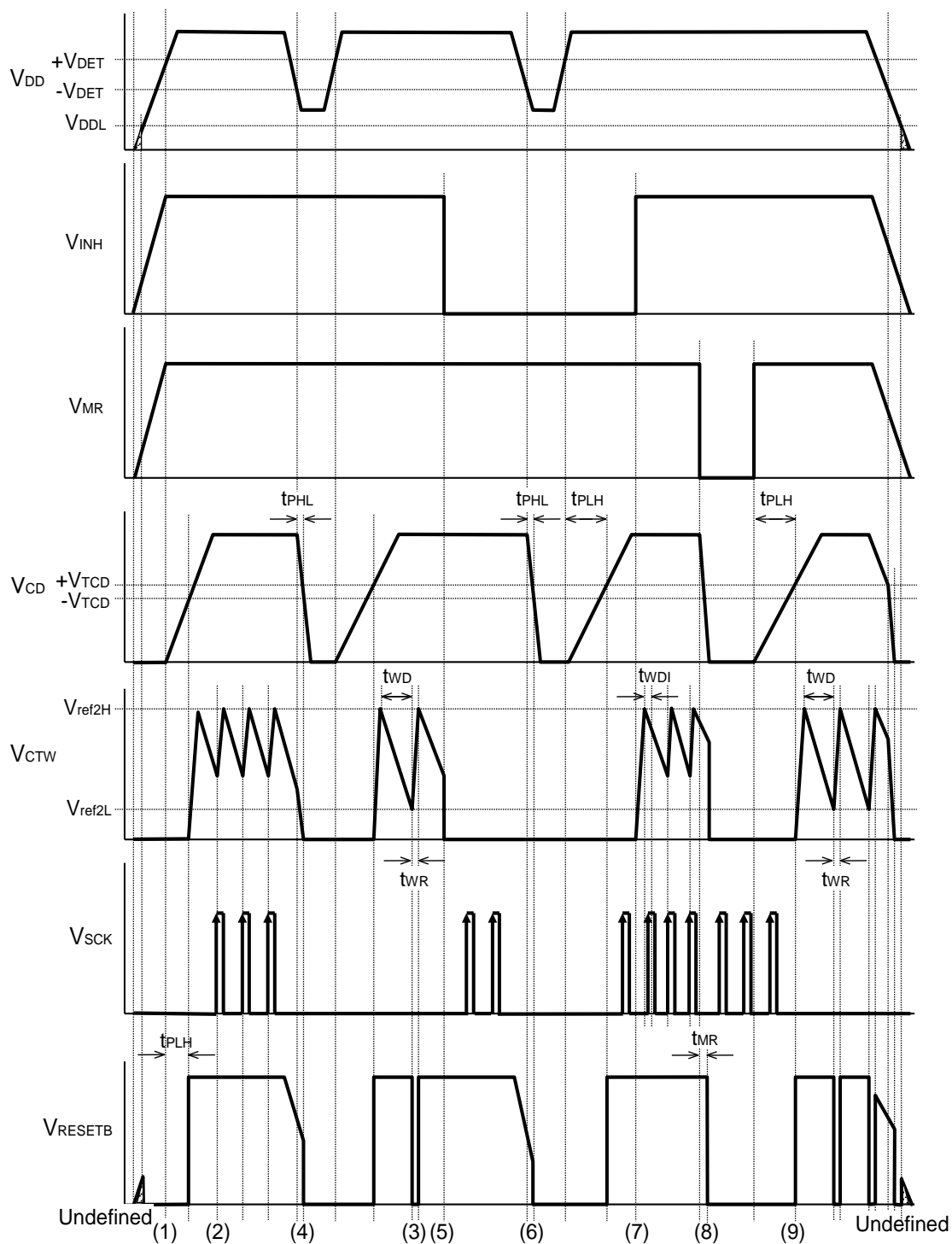
<sup>(4)</sup> MR input pulse width specification guarantee the minimum input pulse width of MR pin for output "L" from RESETB pin. If the "L" pulse width of MR is short, t<sub>PLH</sub> may be short. Refer to the timing diagram for details.

## Product-specific Electrical Characteristics

Product Name	-V <sub>DET</sub>						V <sub>HYS</sub>		
	Ta = 25°C			-40°C ≤ Ta ≤ 125 °C/ -40°C ≤ Ta ≤ 105 °C					
	Min.	Typ.	Max.	Min.	Typ.	Max.	Min.	Typ.	Max.
R5107G151x	1.485	1.500	1.515	1.4580	1.500	1.5225	0.045	0.075	0.105
R5107G161x	1.584	1.600	1.616	1.5552	1.600	1.6240	0.048	0.080	0.112
R5107G171x	1.683	1.700	1.717	1.6524	1.700	1.7255	0.051	0.085	0.119
R5107G181x	1.782	1.800	1.818	1.7496	1.800	1.8270	0.054	0.090	0.126
R5107G191x	1.881	1.900	1.919	1.8468	1.900	1.9285	0.057	0.095	0.133
R5107G201x	1.980	2.000	2.020	1.9440	2.000	2.0300	0.060	0.100	0.140
R5107G211x	2.079	2.100	2.121	2.0412	2.100	2.1315	0.063	0.105	0.147
R5107G221x	2.178	2.200	2.222	2.1384	2.200	2.2330	0.066	0.110	0.154
R5107G231x	2.277	2.300	2.323	2.2356	2.300	2.3345	0.069	0.115	0.161
R5107G241x	2.376	2.400	2.424	2.3328	2.400	2.4360	0.072	0.120	0.168
R5107G251x	2.475	2.500	2.525	2.4300	2.500	2.5375	0.075	0.125	0.175
R5107G261x	2.574	2.600	2.626	2.5272	2.600	2.6390	0.078	0.130	0.182
R5107G271x	2.673	2.700	2.727	2.6244	2.700	2.7405	0.081	0.135	0.189
R5107G281x	2.772	2.800	2.828	2.7216	2.800	2.8420	0.084	0.140	0.196
R5107G291x	2.871	2.900	2.929	2.8188	2.900	2.9435	0.087	0.145	0.203
R5107G301x	2.970	3.000	3.030	2.9160	3.000	3.0450	0.090	0.150	0.210
R5107G311x	3.069	3.100	3.131	3.0132	3.100	3.1465	0.093	0.155	0.217
R5107G321x	3.168	3.200	3.232	3.1104	3.200	3.2480	0.096	0.160	0.224
R5107G331x	3.267	3.300	3.333	3.2076	3.300	3.3495	0.099	0.165	0.231
R5107G341x	3.366	3.400	3.434	3.3048	3.400	3.4510	0.102	0.170	0.238
R5107G351x	3.465	3.500	3.535	3.4020	3.500	3.5525	0.105	0.175	0.245
R5107G361x	3.564	3.600	3.636	3.4992	3.600	3.6540	0.108	0.180	0.252
R5107G371x	3.663	3.700	3.737	3.5964	3.700	3.7555	0.111	0.185	0.259
R5107G381x	3.762	3.800	3.838	3.6936	3.800	3.8570	0.114	0.190	0.266
R5107G391x	3.861	3.900	3.939	3.7908	3.900	3.9585	0.117	0.195	0.273
R5107G401x	3.960	4.000	4.040	3.8880	4.000	4.0600	0.120	0.200	0.280
R5107G411x	4.059	4.100	4.141	3.9852	4.100	4.1615	0.123	0.205	0.287
R5107G421x	4.158	4.200	4.242	4.0824	4.200	4.2630	0.126	0.210	0.294
R5107G431x	4.257	4.300	4.343	4.1796	4.300	4.3645	0.129	0.215	0.301
R5107G441x	4.356	4.400	4.444	4.2768	4.400	4.4660	0.132	0.220	0.308
R5107G451x	4.455	4.500	4.545	4.3740	4.500	4.5675	0.135	0.225	0.315
R5107G461x	4.554	4.600	4.646	4.4712	4.600	4.6690	0.138	0.230	0.322
R5107G471x	4.653	4.700	4.747	4.5684	4.700	4.7705	0.141	0.235	0.329
R5107G481x	4.752	4.800	4.848	4.6656	4.800	4.8720	0.144	0.240	0.336
R5107G491x	4.851	4.900	4.949	4.7628	4.900	4.9735	0.147	0.245	0.343
R5107G501x	4.950	5.000	5.050	4.8600	5.000	5.0750	0.150	0.250	0.350
R5107G511x	5.049	5.100	5.151	4.9572	5.100	5.1765	0.153	0.255	0.357
R5107G521x	5.148	5.200	5.252	5.0544	5.200	5.2780	0.156	0.260	0.364
R5107G531x	5.247	5.300	5.353	5.1516	5.300	5.3795	0.159	0.265	0.371
R5107G541x	5.346	5.400	5.454	5.2488	5.400	5.4810	0.162	0.270	0.378
R5107G551x	5.445	5.500	5.555	5.3460	5.500	5.5825	0.165	0.275	0.385

# THEORY OF OPERATION

## TIMING CHART



- \*)  $V_{TCD}$  : Threshold voltage of  $C_D$  pin when a power-on reset pulse inverting.
- \*)  $V_{ref2H}$  :  $C_{TW}$  pin voltage at the end of WDT timeout period.
- \*)  $V_{ref2L}$  :  $C_{TW}$  pin voltage at the begin of WDT timeout period.
- \*)  $V_{DDL}$  : 0.9 V (Max.)



### Operating Description

- (1) When the power supply,  $V_{DD}$  pin voltage becomes more than the released voltage ( $+V_{DET}$ ), after the released delay time (or the power on reset time  $t_{PLH}$ ), the output of RESETB becomes "H" level.
- (2) When the SCK pulse is input, the watchdog timer is cleared, and  $C_{TW}$  pin mode changes from the discharge mode to the charge mode. When the  $C_{TW}$  pin voltage becomes higher than  $V_{ref2H}$ , the mode will change into the discharge mode, and next watchdog time count starts.
- (3) Unless the SCK pulse is input, WDT will not be cleared, and during the charging period of  $C_{TW}$  pin, RESETB="L".
- (4) When the  $V_{DD}$  pin becomes lower than the detector threshold voltage ( $-V_{DET}$ ), RESETB outputs "L" after the  $t_{PHL}$ .
- (5) If "L" signal is input to the INH pin, the RESETB outputs "H", regardless the SCK clock state.
- (6) During the "L" period of INH pin, the voltage detector monitors the supply voltage.
- (7) When the signal to the INH pin is set from "L" to "H", the watchdog starts supervising the system clock, or charge cycle to the  $C_{TW}$  pin starts, the capacitor connected to the  $C_{TW}$  pin is charged with the current of setting Reset time of WDT.
- (8) If "L" signal is input to the MR pin, the RESETB outputs "L" after the  $t_{MR}$ , regardless the SCK clock state and  $V_{DD}$  voltage.
- (9) When the signal to the MR pin is set from "L" to "H", the RESETB outputs "H" after the  $t_{PLH}$ , the watchdog starts supervising the system clock.

### Watchdog Timeout period/Reset hold time

The watchdog timeout period and reset hold time can be set with an external capacitor to  $C_{TW}$  pin.

The next equations describe the relation between the watchdog timeout period and the external capacitor value, or the reset hold time and the external capacitor value.

$$t_{WD} (s) = 3.1 \times 10^6 \times C (F)$$

$$t_{WR} (s) = t_{WD}/9$$

The watchdog timer (WDT) timeout period is determined with the discharge time of the external capacitor.

During the watchdog timeout period, if the clock pulse from the system is detected, WDT is cleared and the capacitor is charged. When the charge of the capacitor completes, another watchdog timeout period starts again. During the watchdog timeout period, if the clock pulse from the system is not detected, during the next reset hold time RESETB pin outputs "L".

During the reset time, (while charging the external capacitor) and after starting the watchdog timeout period, (just after from the discharge of the external capacitor) even if the clock pulse is input during the time period " $t_{WDI}$ ", the clock pulse is ignored.

$$t_{WDI} (s) = t_{WD}/10$$

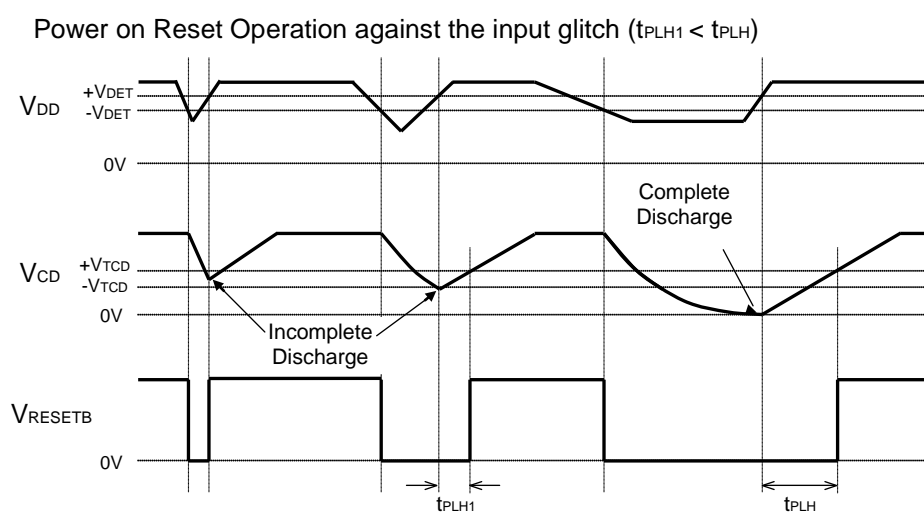
**Released Delay Time (Power-on Reset delay time)**

The released delay time can be set with an external capacitor connected to the C<sub>D</sub> pin. The next equation describes the relation between the capacitance value and the released delay time (t<sub>PLH</sub>).

$$t_{PLH}(s) = 3.7 \times 10^6 \times C(F)$$

The capacitor connected to C<sub>D</sub> pin determines t<sub>WD</sub>, t<sub>WR</sub>, and t<sub>PLH</sub>.

When the V<sub>DD</sub> voltage becomes equal or less than (-V<sub>DET</sub>), discharge of the capacitor connected to the C<sub>D</sub> pin starts. Therefore, if the discharge is not enough and V<sub>DD</sub> voltage returns to (+V<sub>DET</sub>) or more, thereafter the delay time will be shorter than t<sub>PLH</sub> which is expected.

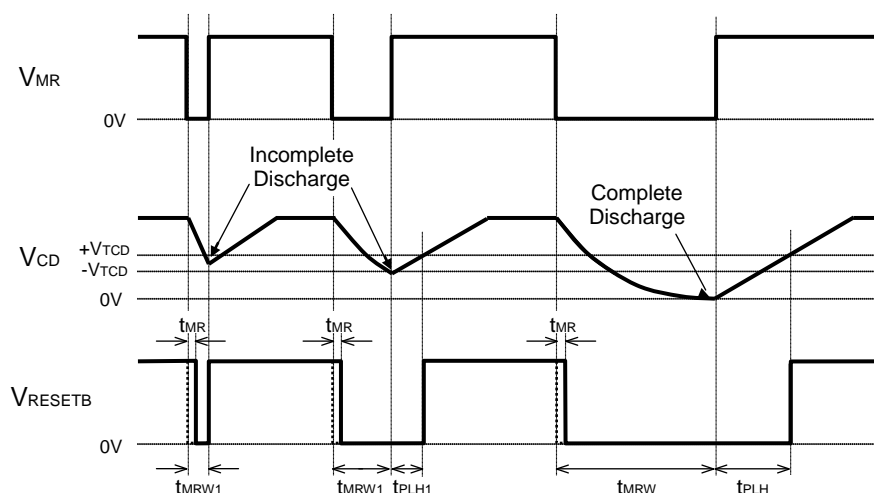
**Minimum Operating Voltage**

We specified the minimum operating voltage as the minimum input voltage in which the condition of RESETB pin being 0.1V or lower than 0.1V. (Herein, pull-up resistance is set as 100kΩ in the case of the Nch open-drain output type.)

## Manual Reset (MR) Function

By setting MR pin as "L", the output of RESETB can be forced to set "L". After pull-down the MR pin to "L", the delay time ( $t_{MR}$ ) to the output "L" from RESETB is  $1\mu s$  as maximum. MR pin is pulled-up via the built-in resistor. (Typ.  $110k\Omega$ ). If MR pin voltage  $> V_{DD}$  voltage, a current flows into MR pin. However, the current value is limit by the pull-up resistor, therefore there is not bad impact on the operation. When the "L" signal is input to MR pin, the discharge of  $C_D$  pin capacitor ( $C_D$ ) starts. If the term of "L" for MR pin is short,  $C_D$  will not be discharged enough. As a result, the delay time after setting "H" for MR pin will be shorter than expected. Because of this, confirm the operation under the same conditions as users' applications. For example, in case of  $C_D$  is set at  $0.1\mu F$ , and the condition to maintain the delay time value after MR pin's returning to "H", is described as the minimum "L" term of MR pin, or  $150\mu s$ . When MR input pulse ( $t_{MRW}$ ) is less than  $3.0\mu s$ , output delay time ( $t_{PLH}$ ) might not exist.

Power on Reset Operation with MR pin input ( $t_{PLH1} < t_{PLH}$ ,  $t_{MRW1} < t_{MRW}$ )



## Inhibit (INH) Function

If INH pin is set at "L", the watchdog timer stops monitoring the clock, and the RESETB output will be dominant by the voltage detector's operation. Therefore, if the supply voltage is set at more than the detector threshold level, RESETB outputs "H" regardless the clock pulse. INH pin is pulled up with a resistor (Typ.  $110k\Omega$ ) internally.

## RESETB Output

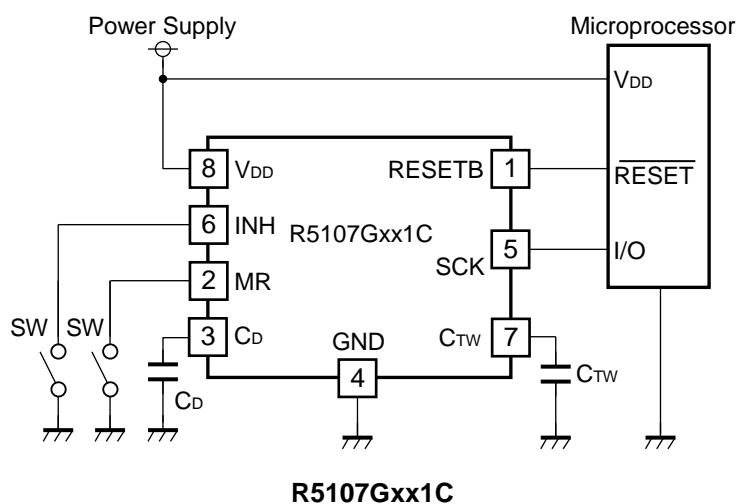
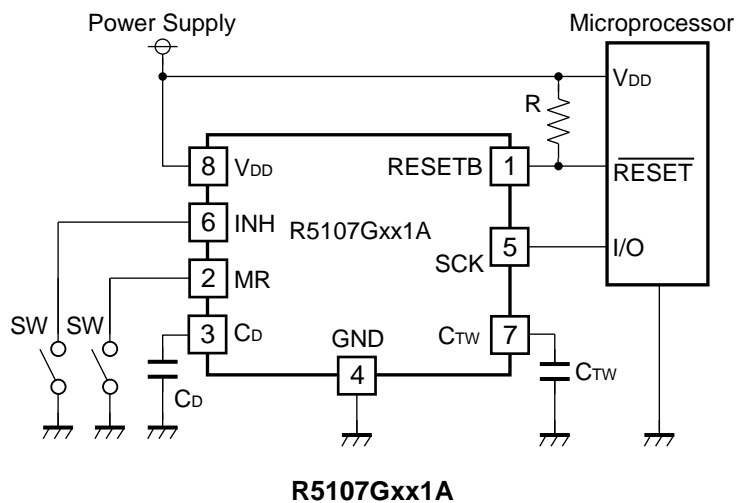
RESETB pin's output type is selectable either the Nch open-drain output or CMOS output. If the Nch open-drain type output is selected, the RESETB pin is pulled up with an external resistor to an appropriate voltage source.

## Clock Pulse Input

Built-in watchdog timer is cleared with the SCK clock pulse within the watchdog timeout period.

## APPLICATION INFORMATION

### Typical Application Circuits



## TECHNICAL NOTES

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

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

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

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

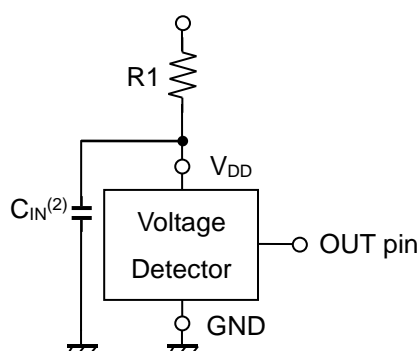


Figure A

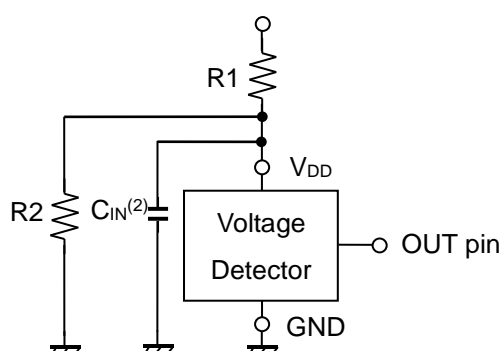


Figure B

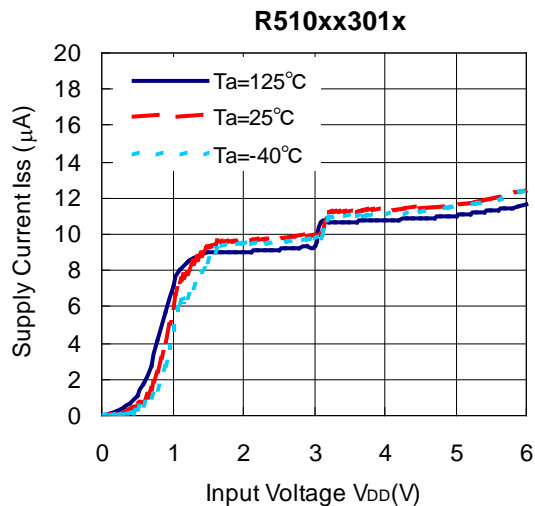
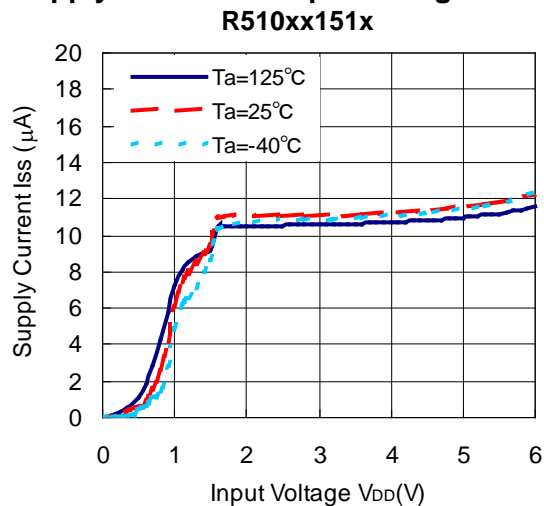
<sup>(1)</sup> In the CMOS output type, a charging current for OUT pin is included.

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

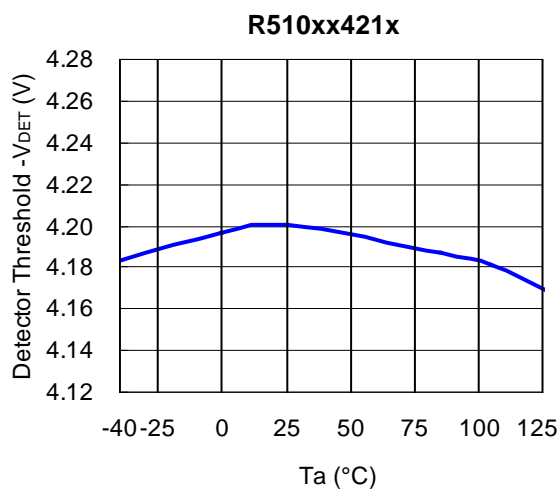
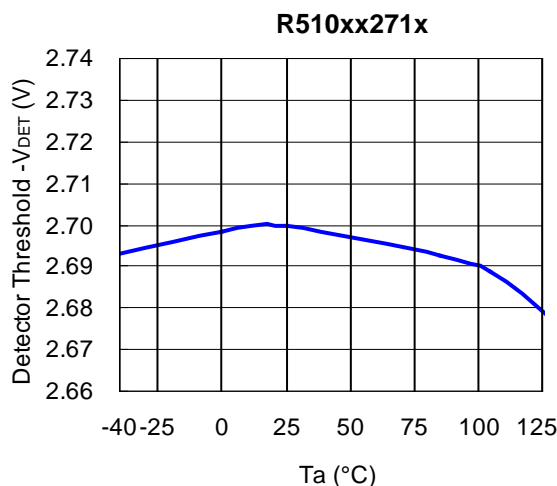
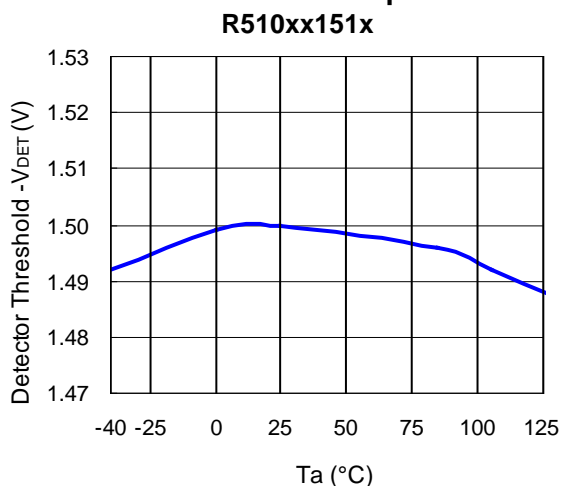
## TYPICAL CHARACTERISTICS

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

### 1) Supply Current vs. Input Voltage

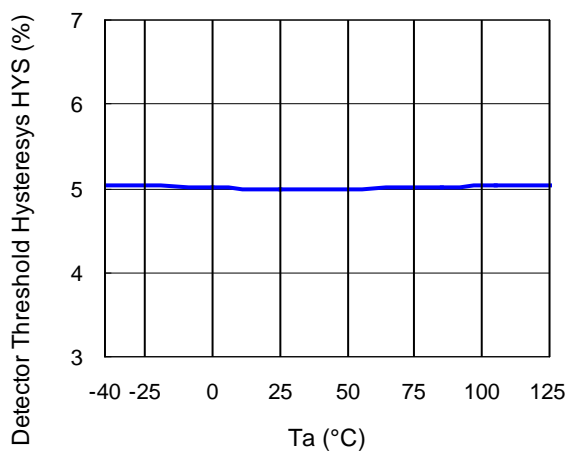


### 2) Detector Threshold vs. Temperature

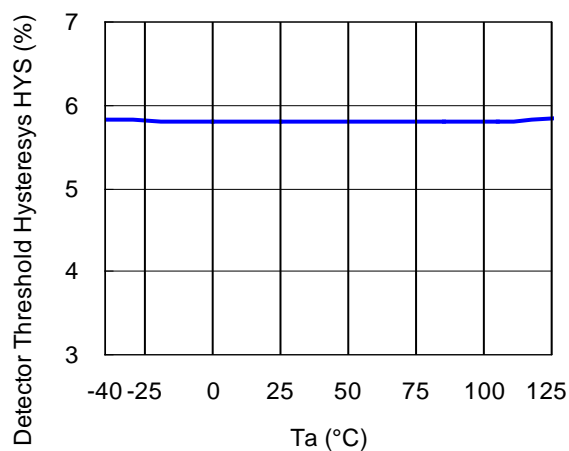


### 3) Detector Threshold Hysteresis vs. Temperature

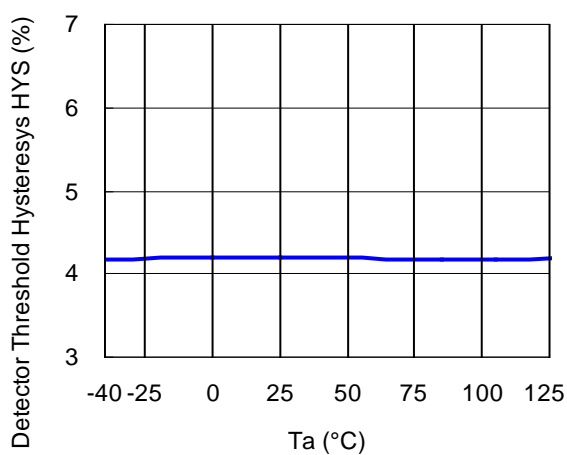
R510xx151x



R510xx271x

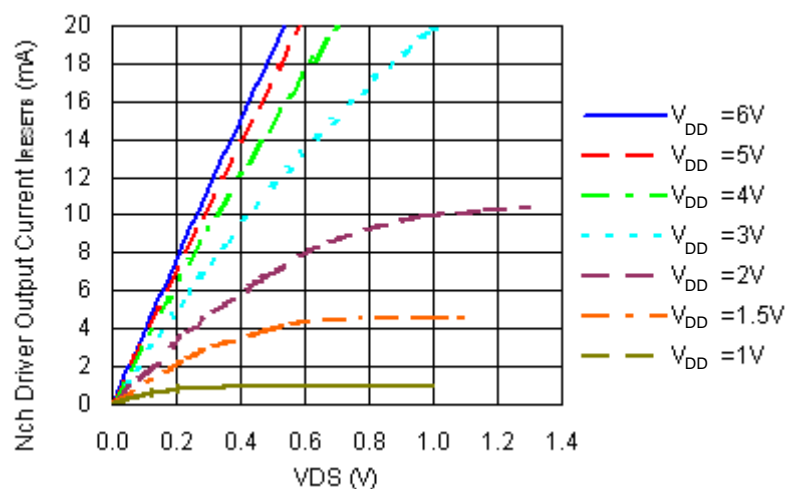


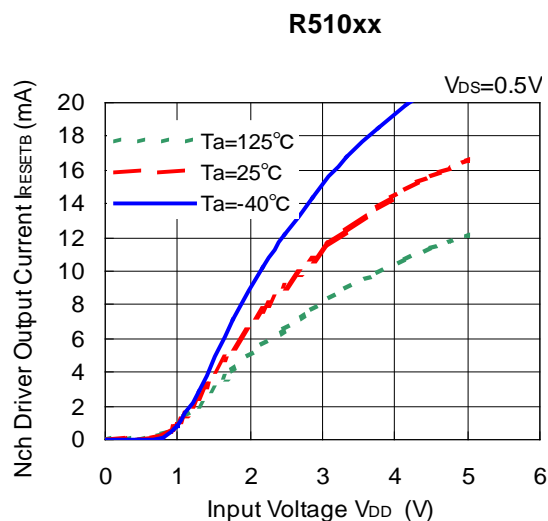
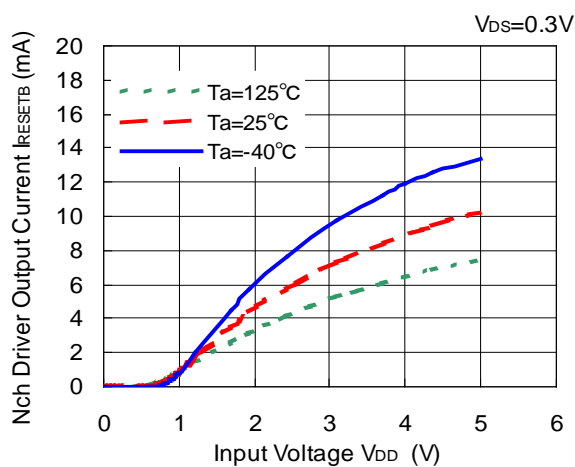
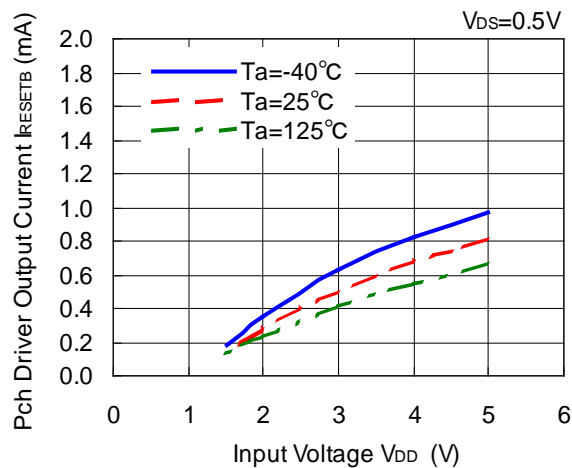
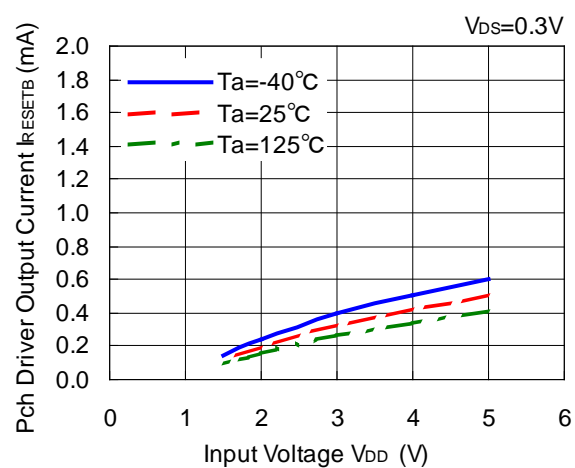
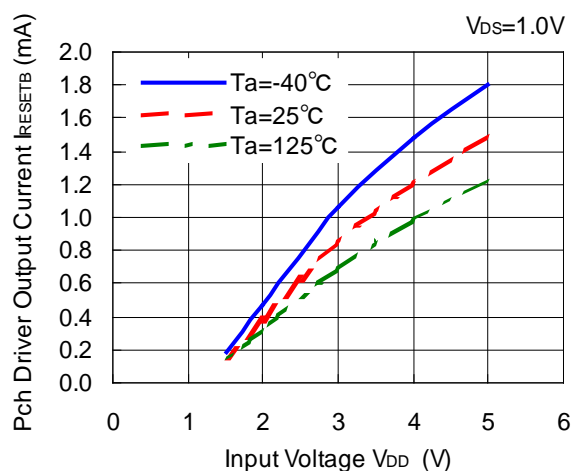
R510xx421x



### 4) Nch Driver Output Current vs. Vds

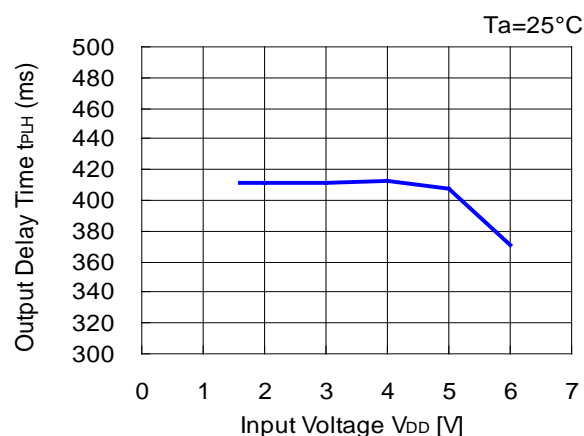
R510xx



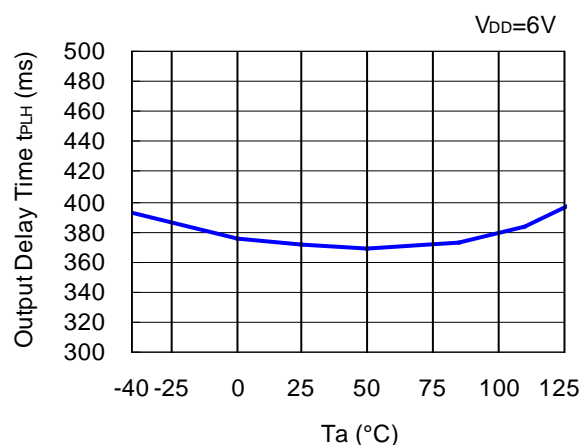
**5) Nch Driver Output Current vs. Input Voltage**
**R510xx**

**6) Pch Driver Output Current vs. Input Voltage**
**R510xx**

**R510xx**




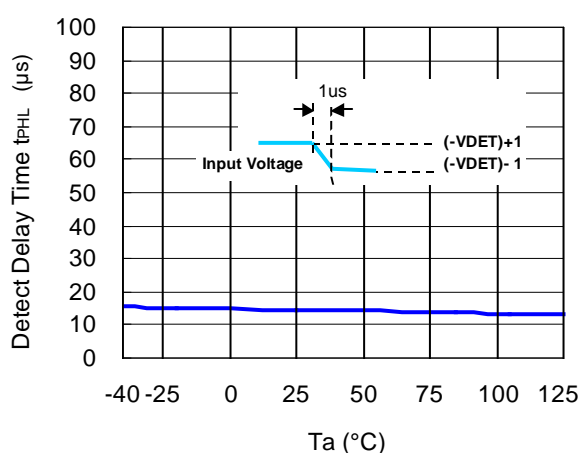
### 7) Released Delay Time vs. Input Voltage R510xx



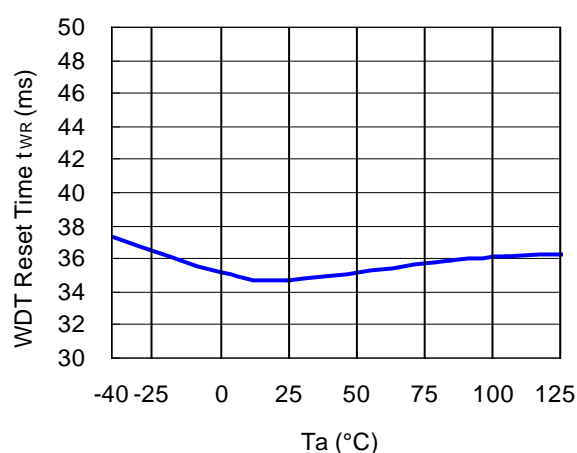
### 8) Released Delay Time vs. Temperature R510xx



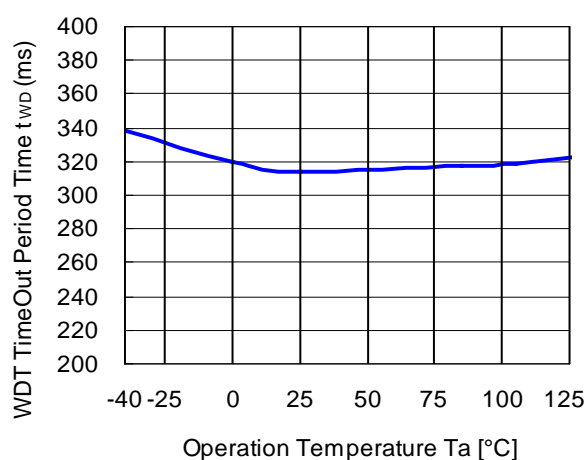
### 9) Detector Output Delay Time vs. Temperature R510xx



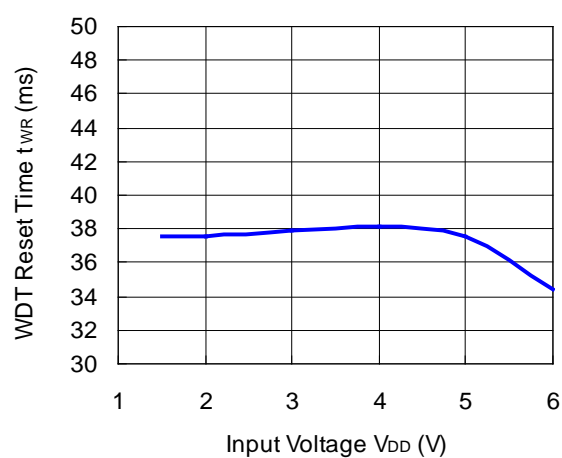
### 10) WDT Reset Timer vs. Temperature R510xx



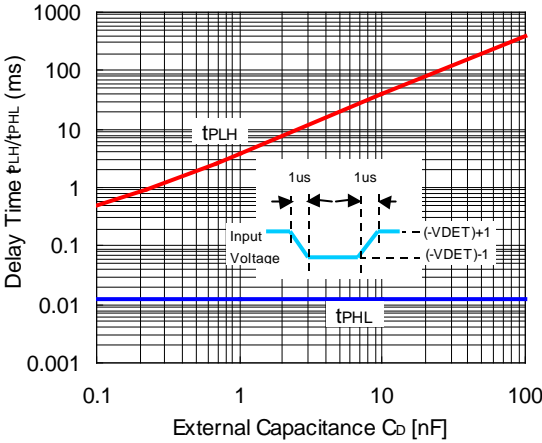
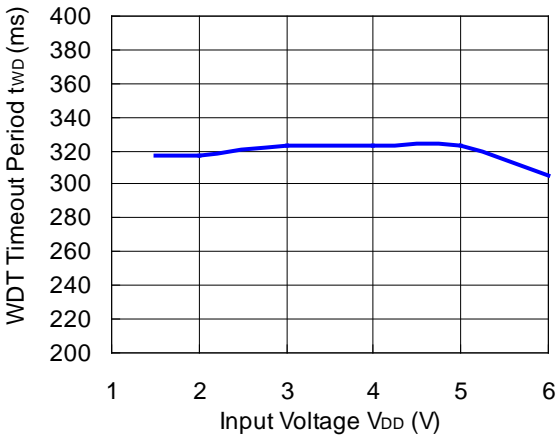
### 11) WDT Timeout Period vs. Temperature R510xx



### 12) WDT Reset Timer vs. Input Voltage R510xx



13) WDT Timeout Period vs. Input Voltage      14) Output Delay Time vs. External Capacitance  
R510xx      R510xx



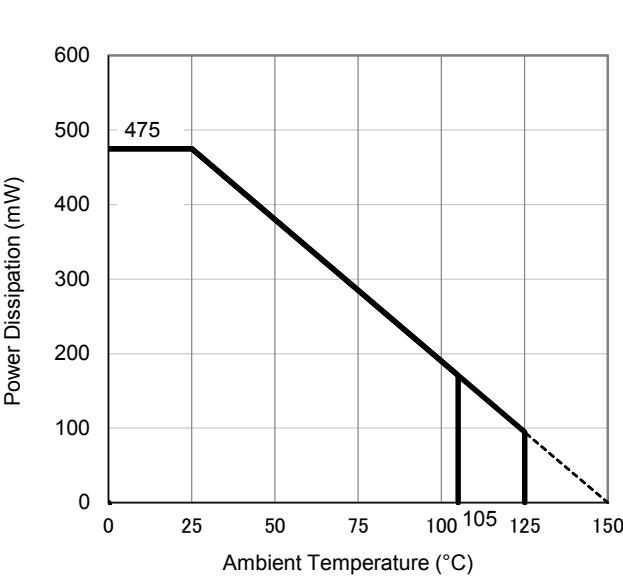
The power dissipation of the package is dependent on PCB material, layout, and environmental conditions. The following conditions are used in this measurement.

Measurement Conditions

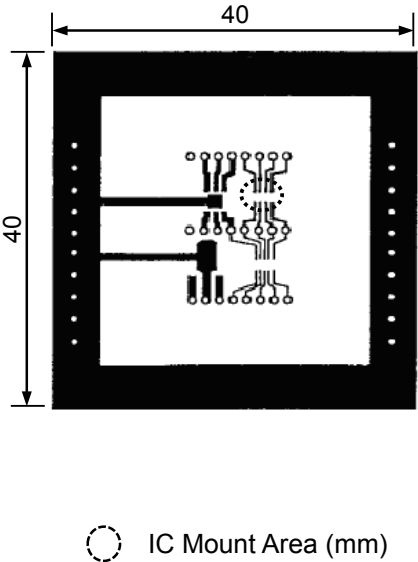
	Standard Test Land Pattern
Environment	Mounting on Board (Wind Velocity = 0 m/s)
Board Material	Glass Cloth Epoxy Plastic (Double-Sided Board)
Board Dimensions	40 mm × 40 mm × 1.6 mm
Copper Ratio	Top Side: Approx. 50% Bottom Side: Approx. 50%
Through-holes	φ 0.5 mm × 44 pcs

Measurement Result (Ta = 25°C, Tjmax = 150°C)

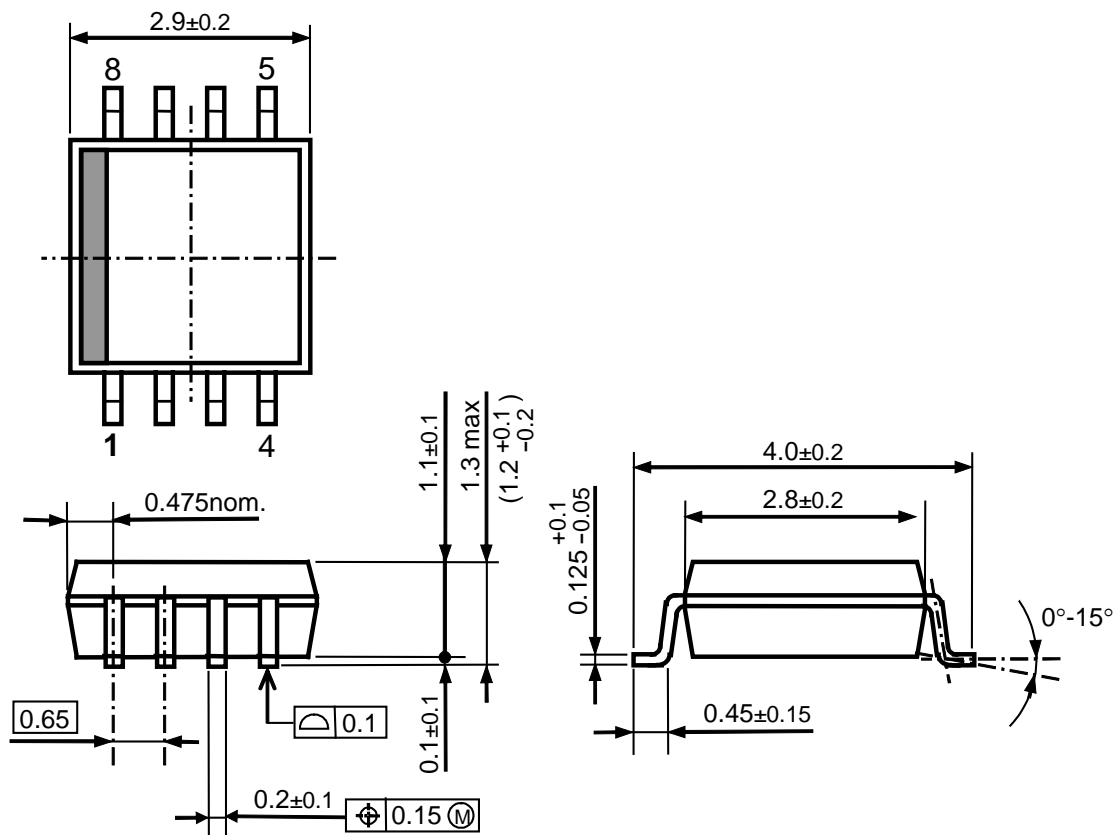
	Standard Test Land Pattern
Power Dissipation	475 mW
Thermal Resistance	$\theta_{ja} = (150 - 25^{\circ}\text{C}) / 0.475 \text{ W} = 263^{\circ}\text{C/W}$
	$\theta_{jc} = 60^{\circ}\text{C/W}$



Power Dissipation vs. Ambient Temperature



Measurement Board Pattern



SSOP-8G Package Dimensions (Unit: mm)



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



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

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

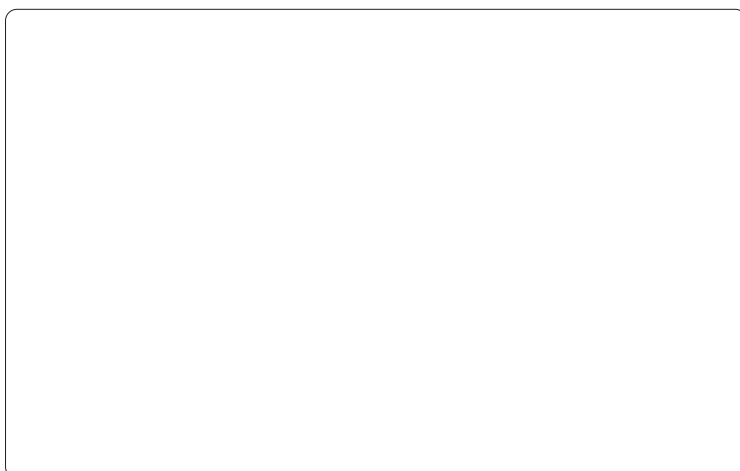
**RICOH** RICOH ELECTRONIC DEVICES CO., LTD.

**Official website**

<https://www.n-redc.co.jp/en/>

**Contact us**

<https://www.n-redc.co.jp/en/buy/>



# Mouser Electronics

Authorized Distributor

Click to View Pricing, Inventory, Delivery & Lifecycle Information:

## Ricoh Electronics:

[R5107G271A-TR-JE](#) [R5107G281A-TR-JE](#) [R5107G291A-TR-JE](#) [R5107G301A-TR-JE](#) [R5107G311A-TR-JE](#)  
[R5107G371A-TR-JE](#) [R5107G411A-TR-JE](#) [R5107G421A-TR-JE](#) [R5107G431A-TR-JE](#)