RICOH

R3121N-Y Series

36 V Input Voltage Detector with Release Delay Function for Industrial Applications

No. EY-532-191122

OVERVIEW

R3121N is the 36 V Maximum Input Voltage Detector (Maximum Rating : 50 V). Selectable options of VDD Pin Detection Type (R3121NxxxA), SENSE Pin Detection Type (R3121NxxxE) and VDD Pin Detection without Hysteresis Type (R3121NxxxG), depending on the system configurations. This is a high-reliability semiconductor device for industrial applications (-Y) that has passed both the screening at high temperature and the reliability test with extended hours.

KEY BENEFITS

- Highly accurate voltage detection with detector threshold accuracy ±1.5% (Ta = 25°C)
- Selectable options of VDD Pin Detection, SENSE Pin Detection and VDD Pin Detection without Hysteresis
- Adjustiment of the release delay time (Power-on Reset Time) by connecting external capacitors
- Reduction of mounting area by using compact package of SOT-23-6

KEY SPECIFICATIONS

- Operating Voltage Range (Maximum Rating) :
  R3121NxxxA/G: 1.4 V to 36.0 V (50.0 V)
  R3121NxxxE : 2.4 V to 6.0 V (7.0 V)
- Operating Temperature Range: −40°C to 125°C
- Supply Current: R3121NxxxA/G: Typ. 3.8 µA
  R3121NxxxE: Typ. 3.5 µA
- Detector Threshold Range:
  3.0 V to12.0 V (in 0.1 V step)
- Detector Threshold Accuracy: ± 1.5% (Ta = 25°C)
  -2.2% to 2.5% (−40°C ≤ Ta ≤ 125°C)
- Release Delay Accuracy:
  −40% to 80% (−40°C ≤ Ta ≤ 125°C)

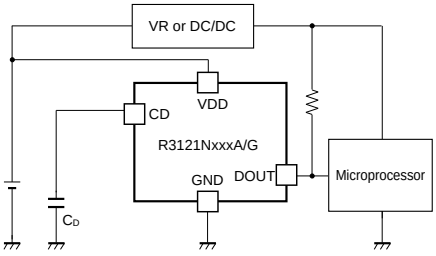
SELECTION GUIDE

Product Name	Package	Quantity per Reel
R3121Nxxx*-TR-YE	SOT-23-6	3,000 pcs

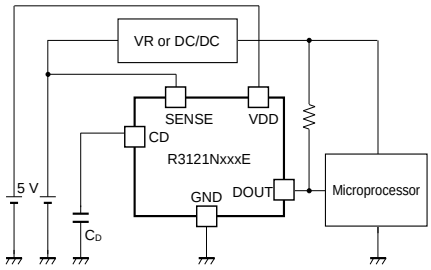
xxx: Specify the detector threshold ($-V_{DET}$) in the range of 3.0 V (030) to 12.0 V (120) in 0.1 V step

* : Select the voltage detection type
A: VDD Pin Detection Type
E: SENSE Pin Detection Type
G: VDD Pin Detection without Hysteresis Type

TYPICAL APPLICATIONS

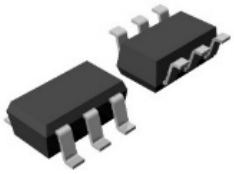


VDD Pin Detection Type



SENSE Pin Detection Type

PACKAGES



SOT-23-6
2.9 x 2.8 x 1.1 (mm)

APPLICATIONS

- Industrial apparatus such as Factory Automation Equipment and Smart Meters

SELECTION GUIDE

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

Selection Guide

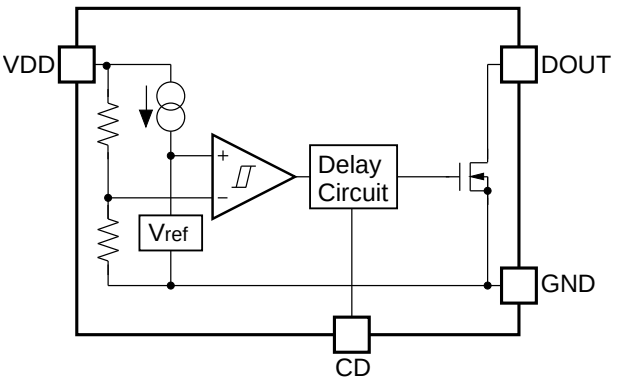
Product Name	Package	Quantity per Reel	Pb Free	Halogen Free
R3121Nxxx∗-TR-YE	SOT-23-6	3,000 pcs	Yes	Yes

xxx : Specify the detector threshold ($-V_{DET}$) in the range of 3.0 V (030) to 12.0 V (120) in 0.1 V step.

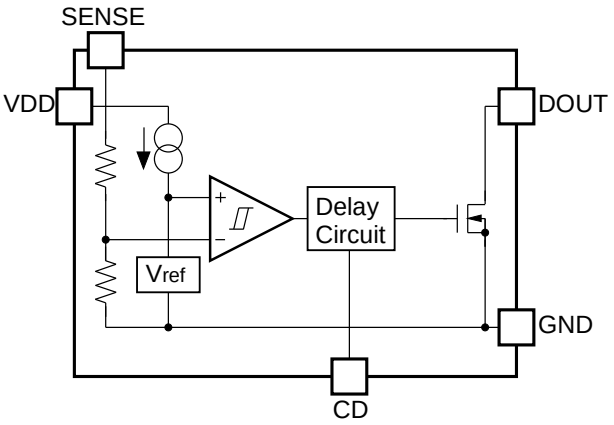
∗ : Select the voltage detection type from the following;
A: VDD Pin Detection Type
E: SENSE Pin Detection Type
G: VDD Pin Detection without Hysteresis Type

BLOCK DIAGRAMS

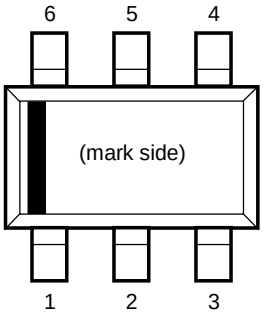
R3121NxxxA/R3121NxxxG



R3121NxxxE



PIN DESCRIPTION



R3121N（SOT-23-6) Pin Configuration

R3121N Pin Description

Pin No.	Symbol	Description
1	CD	Release Delay Time Set Pin
2	NC	No Connection
3	NC	No Connection (R3121NxxxA/R3121NxxxG)
	SENSE	VD Voltage SENSE Pin (R3121NxxxE)
4	VDD	Input Supply Voltage Pin
5	GND	Ground Pin
6	DOUT	VD Output Pin, Nch Open Drain

ABSOLUTE MAXIMUM RATINGS

Absolute Maximum Ratings

Symbol	Item		Rating	Unit
V_{DD}	Supply Voltage (R3121NxxxA/ R3121NxxxG)		−0.3 to 50.0	V
	Supply Voltage (R3121NxxxE)		−0.3 to 7.0	
V_{DOUT}	DOUT Pin Output Voltage		−0.3 to 7.0	V
V_{CD}	CD Pin Output Voltage		−0.3 to 7.0	V
V_{SENSE}	SENSE Pin Input Voltage (R3121NxxxE)		−0.3 to 50.0	V
I_{DOUT}	DOUT Pin Output Current		20	mA
P_D	Power Dissipation (1)	SOT-23-6, JEDEC STD. 51	830	mW
Tj	Junction Temperature		−40 to 150	°C
Tstg	Storage Temperature		−55 to 150	°C

ABSOLUTE MAXIMUM RATINGS

Electronic and mechanical stress momentarily exceeded absolute maximum ratings may cause permanent damage and may degrade the lifetime 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

Recommended Operating Conditions

Symbol	Item	Rating	Unit
V_{DD}	Operating Voltage (R3121NxxxA/ R3121NxxxG) (2)	1.4 to 36.0	V
	Operating Voltage (R3121NxxxE)(2)	2.4 to 6.0	
V_{SENSE}	SENSE Pin Input Voltage (R3121NxxxE)	0 to 36.0	V
Ta	Operating Temperature Range	−40 to 125	°C

RECOMMENDED OPERATING CONDITONS

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 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.

(1) Refer to *POWER DISSIPATION* for detailed information.
(2) Minimum value in V_{DD} indicates the minimum operating voltage to define V_{DOUT}.

ELECTRICAL CHARACTERISTICS

C_D = 1000 pF, pulled-up to 5 V with 100 kΩ, unless otherwise specified.

The specifications surrounded by ☐ are guaranteed by design engineering at −40°C ≤ Ta ≤ 125°C.

R3121NxxxA/R3121NxxxG (VDD Pin Detection Type) (Ta =25°C)

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
I_{SS}	Supply Current	V_{DD} = −V_{DET} −0.1 V		3.8	7.0	µA
		V_{DD} = +V_{DET} +1.0 V		3.8	7.5	
−V_{DET}	Detector Voltage	Ta = 25°C	x 0.985		x 1.015	V
		−40°C ≤ Ta ≤ 125°C	x 0.978		x 1.025	
V_{HYS}	Detector Threshold Hysteresis	R3121NxxxA	4.3	5	5.5	%
		R3121NxxxG	0		10	mV
t_{PHL}	Detection Delay Time(1)		38	80	160	µs
t_{DELAY}	Release Delay Time(2)		6.0	10	18.0	ms
I_{DOUT}	Output Current (Nch Driver)	V_{DD} = 4.5V, V_{DS} = 0.05 V	0.4		2.0	mA
R_{CDDIS}	CD Pin Discharge NMOS On-Resistance	V_{DD} = 13.0V, V_{CD} = 0.5 V	0.50		3.40	kΩ

R3121NxxxE (SENSE Pin Detection Type) (Ta =25°C)

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
I_{SS}	Supply Current(3)	V_{DD} = 5.0 V, V_{SENSE} = −V_{DET} −0.1 V		3.5	5.7	µA
		V_{DD} = 5.0 V, V_{SENSE} = +V_{DET} +1.0 V		3.5	6.2	
R_{SENSE}	SENSE Resistance		3.2		51.5	MΩ
-V_{DET}	Detector Threshold	Ta = 25°C	x 0.985		x 1.015	V
		−40°C ≤ Ta ≤ 125°C	x 0.978		x 1.025	
V_{HYS}	Detector threshold Hysteresis		4.3	5	5.5	%
t_{PHL}	Detector Delay Time(4)	V_{DD} = 4.5 V	38	80	160	µs
t_{DELAY}	Release Delay Time(5)	V_{DD} = 4.5 V	6.0	10	18.0	ms
I_{DOUT}	Output Current (Nch Driver)	V_{DD} = 5.0 V, V_{DS} = 0.05 V V_{SENSE} = −V_{DET} −0.1 V	0.4		2.0	mA
R_{CDDIS}	CD Pin Discharge NMOS On-Resistance	V_{DD} = 4.5 V, V_{SENSE}= 13.0 V, V_{CD} = 0.5V	0.50		3.40	kΩ

(1) A time that V_{DOUT} requires to reach 2.5 V when V_{DD} changes from "−V_{DET} + 1.0 V" to "−V_{DET} − 0.5 V"
(2) A time that V_{DOUT} requires to reach 2.5 V when V_{DD} changes from "−V_{DET} − 0.5 V" to "−V_{DET} + 1.0 V"
(3) Not including the current for SENSE resistance
(4) A time that V_{DOUT} requires to reach 2.5 V when V_{SENSE} changes from "−V_{DET} + 1.0 V" to "−V_{DET} − 1.0 V".
(5) A time that V_{DOUT} requires to reach 2.5 V when V_{SENSE} changes from "+V_{DET} − 1.0 V" to "+V_{DET} + 1.0 V"

The specifications surrounded by ☐ are guaranteed by design engineering at −40°C ≤ Ta ≤ 125°C.

R3121NxxxA/E/G Product-specific Electrical Characteristics

Product Name	$-V_{DET}$ [V]				
	Ta = 25°C			−40 °C ≤ Ta ≤ 125°C	
	Min.	Typ.	Max.	Min.	Max.
R3121N030x	2.955	3.000	3.045	2.934	3.075
R3121N031x	3.054	3.100	3.146	3.031	3.178
R3121N032x	3.152	3.200	3.248	3.129	3.280
R3121N033x	3.251	3.300	3.349	3.227	3.383
R3121N034x	3.349	3.400	3.451	3.325	3.485
R3121N035x	3.448	3.500	3.552	3.423	3.588
R3121N036x	3.546	3.600	3.654	3.520	3.690
R3121N037x	3.645	3.700	3.755	3.618	3.793
R3121N038x	3.743	3.800	3.857	3.716	3.895
R3121N039x	3.842	3.900	3.958	3.814	3.998
R3121N040x	3.940	4.000	4.060	3.912	4.100
R3121N041x	4.039	4.100	4.161	4.009	4.203
R3121N042x	4.137	4.200	4.263	4.107	4.305
R3121N043x	4.236	4.300	4.364	4.205	4.408
R3121N044x	4.334	4.400	4.466	4.303	4.510
R3121N045x	4.433	4.500	4.567	4.401	4.613
R3121N046x	4.531	4.600	4.669	4.498	4.715
R3121N047x	4.630	4.700	4.770	4.596	4.818
R3121N048x	4.728	4.800	4.872	4.694	4.920
R3121N049x	4.827	4.900	4.973	4.792	5.023
R3121N050x	4.925	5.000	5.075	4.890	5.125
R3121N051x	5.024	5.100	5.176	4.987	5.228
R3121N052x	5.122	5.200	5.278	5.085	5.330
R3121N053x	5.221	5.300	5.379	5.183	5.433
R3121N054x	5.319	5.400	5.481	5.281	5.535
R3121N055x	5.418	5.500	5.582	5.379	5.638
R3121N056x	5.516	5.600	5.684	5.476	5.740
R3121N057x	5.615	5.700	5.785	5.574	5.843
R3121N058x	5.713	5.800	5.887	5.672	5.945
R3121N059x	5.812	5.900	5.988	5.770	6.048
R3121N060x	5.910	6.000	6.090	5.868	6.150
R3121N061x	6.009	6.100	6.191	5.965	6.253
R3121N062x	6.107	6.200	6.293	6.063	6.355
R3121N063x	6.206	6.300	6.394	6.161	6.458
R3121N064x	6.304	6.400	6.496	6.259	6.560
R3121N065x	6.403	6.500	6.597	6.357	6.663
R3121N066x	6.501	6.600	6.699	6.454	6.765
R3121N067x	6.600	6.700	6.800	6.552	6.868
R3121N068x	6.698	6.800	6.902	6.650	6.970
R3121N069x	6.797	6.900	7.003	6.748	7.073

The specifications surrounded by ☐ are guaranteed by design engineering at −40°C ≤ Ta ≤ 125°C.

R3121NxxxA/E/G Product-specific Electrical Characteristics (Continued)

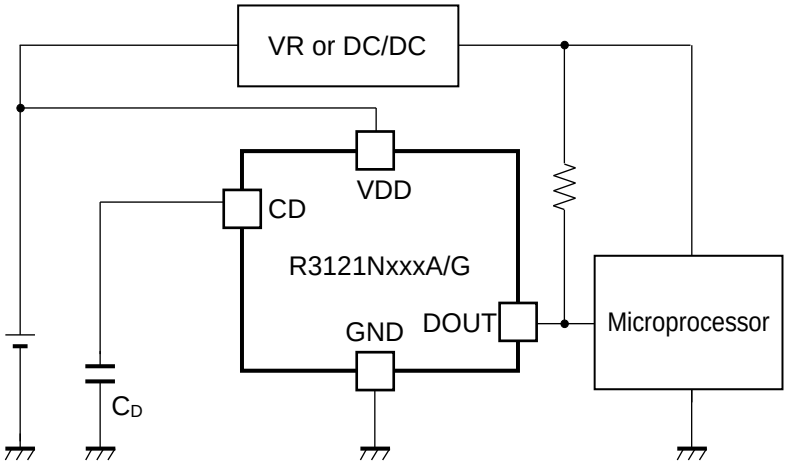
Product Name	$-V_{DET}$ [V]				
	Ta = 25°C			−40 °C ≤ Ta ≤ 125°C	
	Min.	Typ.	Max.	Min.	Max.
R3121N070x	6.895	7.000	7.105	6.846	7.175
R3121N071x	6.994	7.100	7.206	6.943	7.278
R3121N072x	7.092	7.200	7.308	7.041	7.380
R3121N073x	7.191	7.300	7.409	7.139	7.483
R3121N074x	7.290	7.400	7.511	7.237	7.585
R3121N075x	7.388	7.500	7.612	7.335	7.688
R3121N076x	7.487	7.600	7.714	7.432	7.790
R3121N077x	7.585	7.700	7.815	7.530	7.893
R3121N078x	7.684	7.800	7.917	7.628	7.995
R3121N079x	7.782	7.900	8.018	7.726	8.098
R3121N080x	7.881	8.000	8.120	7.824	8.200
R3121N081x	7.979	8.100	8.221	7.921	8.303
R3121N082x	8.078	8.200	8.323	8.019	8.405
R3121N083x	8.176	3121	8.424	8.117	8.508
R3121N084x	8.275	8.400	8.526	8.215	8.610
R3121N085x	8.373	8.500	8.627	8.313	8.713
R3121N086x	8.472	8.600	8.729	8.410	8.815
R3121N087x	8.570	8.700	8.830	8.508	8.918
R3121N088x	8.669	8.800	8.932	8.606	9.020
R3121N089x	8.767	8.900	9.033	8.704	9.123
R3121N090x	8.866	9.000	9.135	8.802	9.225
R3121N091x	8.964	9.100	9.236	8.899	9.328
R3121N092x	9.063	9.200	9.338	8.997	9.430
R3121N093x	9.161	9.300	9.439	9.095	9.533
R3121N094x	9.260	9.400	9.541	9.193	9.635
R3121N095x	9.358	9.500	9.642	9.291	9.738
R3121N096x	9.457	9.600	9.744	9.388	9.840
R3121N097x	9.555	9.700	9.845	9.486	9.943
R3121N098x	9.654	9.800	9.947	9.584	10.045
R3121N099x	9.752	9.900	10.048	9.682	10.148
R3121N100x	9.850	10.000	10.150	9.780	10.250
R3121N101x	9.949	10.100	10.251	9.877	10.353
R3121N102x	10.047	10.200	10.353	9.975	10.455
R3121N103x	10.146	10.300	10.454	10.073	10.558
R3121N104x	10.244	10.400	10.556	10.171	10.660
R3121N105x	10.343	10.500	10.657	10.269	10.763
R3121N106x	10.441	10.600	10.759	10.366	10.865
R3121N107x	10.540	10.700	10.860	10.464	10.968
R3121N108x	10.638	10.800	10.962	10.562	11.070
R3121N109x	10.737	10.900	11.063	10.660	11.173

The specifications surrounded by ☐ are guaranteed by design engineering at −40°C ≤ Ta ≤ 125°C.

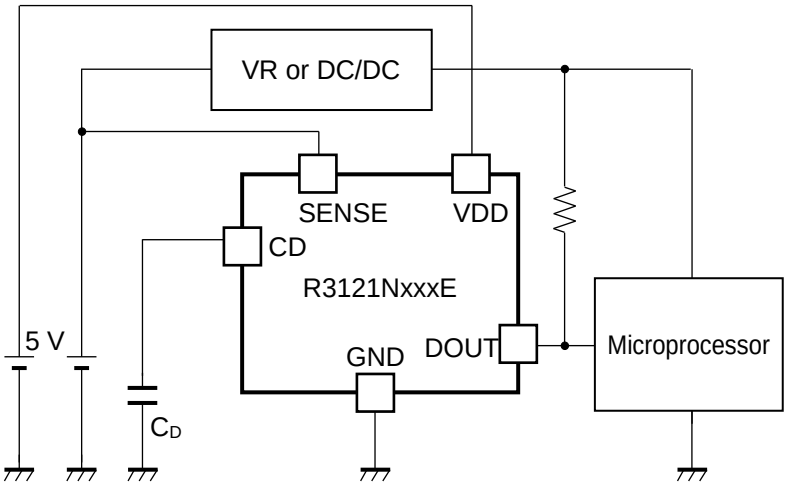
R3121NxxxA/E/G Product-specific Electrical Characteristics (Continued)

Product Name	$-V_{DET}$ [V]				
	Ta = 25°C			−40 °C ≤ Ta ≤ 125°C	
	Min.	Typ.	Max.	Min.	Max.
R3121N101x	10.835	11.000	11.165	10.758	11.275
R3121N110x	10.934	11.100	11.266	10.855	11.378
R3121N111x	11.032	11.200	11.368	10.953	11.480
R3121N112x	11.131	11.300	11.469	11.051	11.583
R3121N113x	11.229	11.400	11.571	11.149	11.685
R3121N114x	11.328	11.500	11.672	11.247	11.788
R3121N115x	11.426	11.600	11.774	11.344	11.890
R3121N116x	11.525	11.700	11.875	11.442	11.993
R3121N117x	11.623	11.800	11.977	11.540	12.095
R3121N118x	11.722	11.900	12.078	11.638	12.198
R3121N120x	11.820	12.000	12.180	11.736	12.300

TYPICAL APPLICATION CIRCUIT



R3121NxxxA/G Typical Application Circuit



R3121NxxxE Typical Application Circuit

THEORY OF OPERATION

R3121NxxxA (VDD Pin Detection Type)

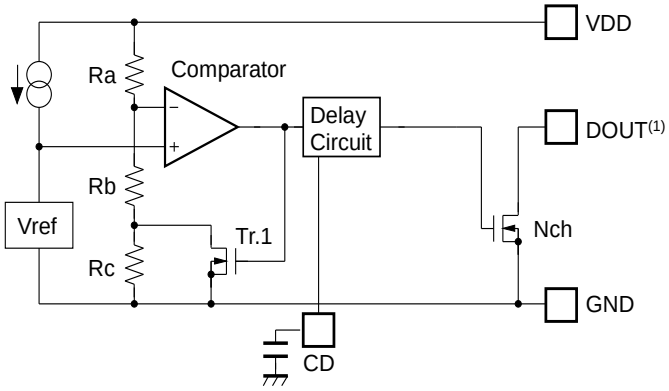
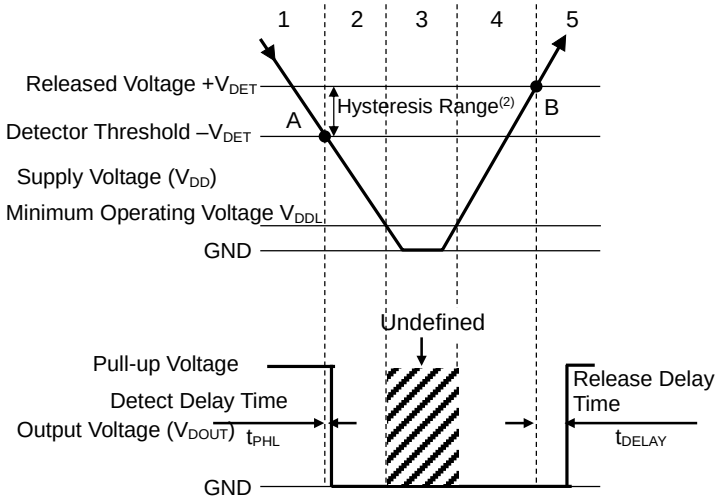


Diagram for R3121NxxxA with External Capacitor



Operating Condition	1	2	3	4	5
Comparator (-) pin Input Voltage	I	II	II	II	I
Comparator Output	L	H	Undefined	H	L
Tr.1	OFF	ON	Undefined	ON	OFF
Output Tr. (Nch)	OFF	ON	Undefined	ON	OFF

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

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

R3121NxxxA Operation

OPERATION

1. The output voltage is equal to the pull-up voltage.
2. At A point, Vref ≥ V_{DD} x (Rb+Rc) / (Ra+Rb+Rc) is true. So, the comparator output voltage will be reversed from “L” to “H”. As a result, the output voltage will be “L”.
3. If the supply voltage remains lower than the minimum operating voltage, the output voltage will be undefined.
4. The “L” voltage is output.
5. At B point, Vref ≤ V_{DD} x Rb / (Ra+Rb) is true. So, the comparator output voltage will be reversed from “H” to “L”. As a result, output voltage will be equal to the pull-up voltage.

(1) The DOUT pin should be pulled-up to VDD pin or an external voltage level.
(2) Hysteresis is a voltage difference between the released voltage and the detector threshold.

● **R3121NxxxG (VDD Pin Detection Type))**

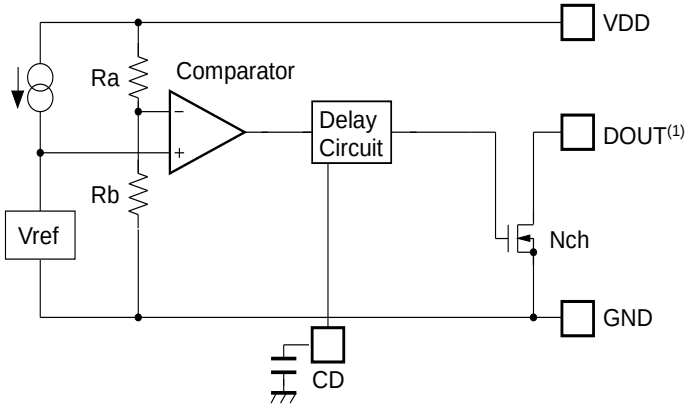
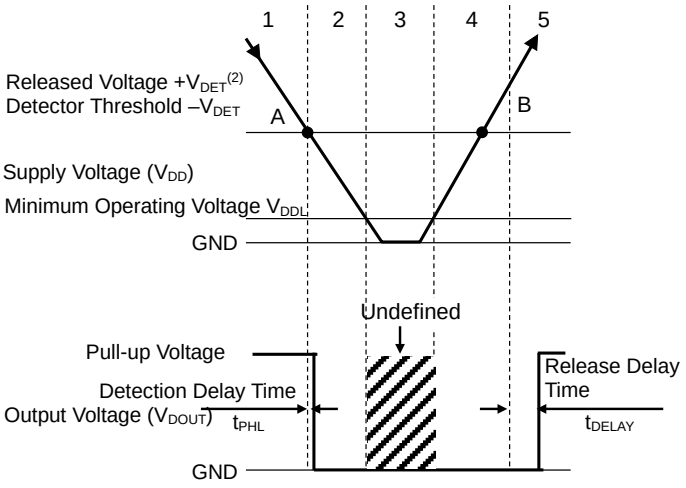


Diagram for R3121NxxxG with External Capacitor



Operating Condition	1	2	3	4	5
Comparator (-) pin Input Voltage	I	I	I	I	I
Comparator Output	L	H	Undefined	H	L
Tr.1	OFF	ON	Undefined	ON	OFF
Output Tr. (Nch)	OFF	ON	Undefined	ON	OFF

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

R3121NxxxG Operation

OPERATION

1. The output voltage is equal to the pull-up voltage.
2. At A point, Vref ≥ V_{DD} x Rb / (Ra+Rb) is true. So, the comparator output voltage will be reversed from “L” to “H”. As a result, the output voltage will be “L”.
3. If the supply voltage remains lower than the minimum operating voltage, the output voltage will be undefined.
4. The “L” voltage is output.
5. At B point, Vref ≤ V_{DD} x Rb / (Ra+Rb) is true. So, the comparator output voltage will be reversed from “H” to “L”. As a result, output voltage will be equal to the pull-up voltage.

(1) The DOUT pin should be pulled-up to VDD pin or an external voltage level.

(2) As for R3121NxxxG, whether or not Chattering may occur at detecting / Release depends on the tilt of supply voltage fluctuations. If the chattering becomes a problem, connect a capacitor of 10nF or more with the CD pin.

R3121xxxE (SENSE Pin Detection Type)

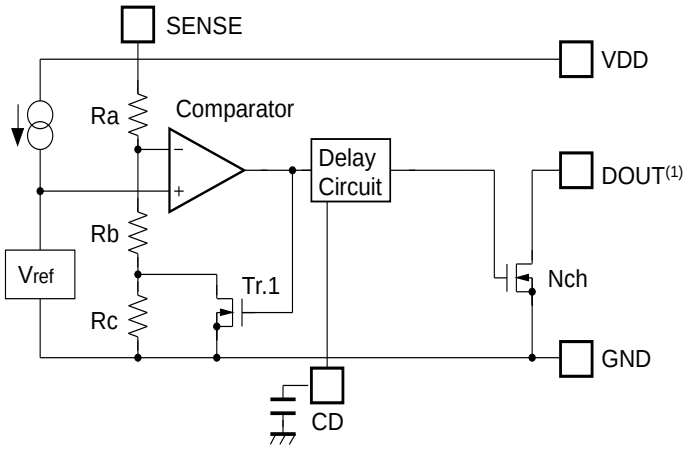
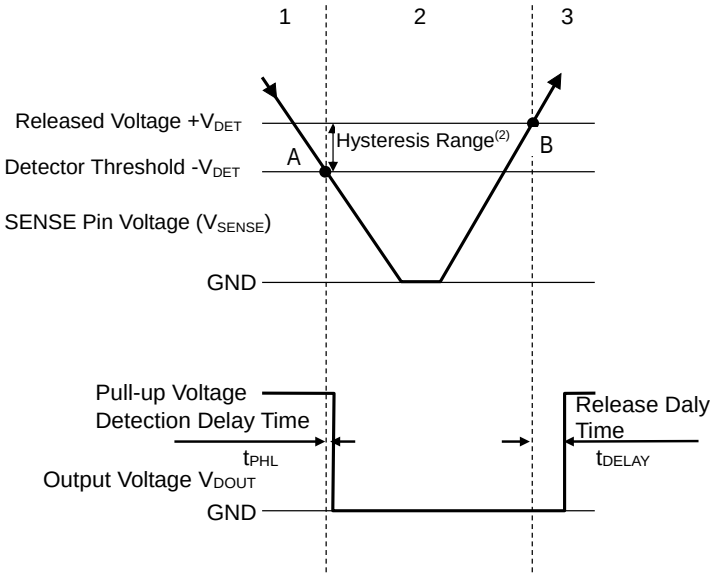


Diagram for R3121xxxE with External Capacitor



Operating Condition	1	2	3
Comparator (-) pin Input voltage	I	II	I
Comparator Output	L	H	L
Tr.1	OFF	ON	OFF
Output Tr. (Nch)	OFF	ON	OFF

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

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

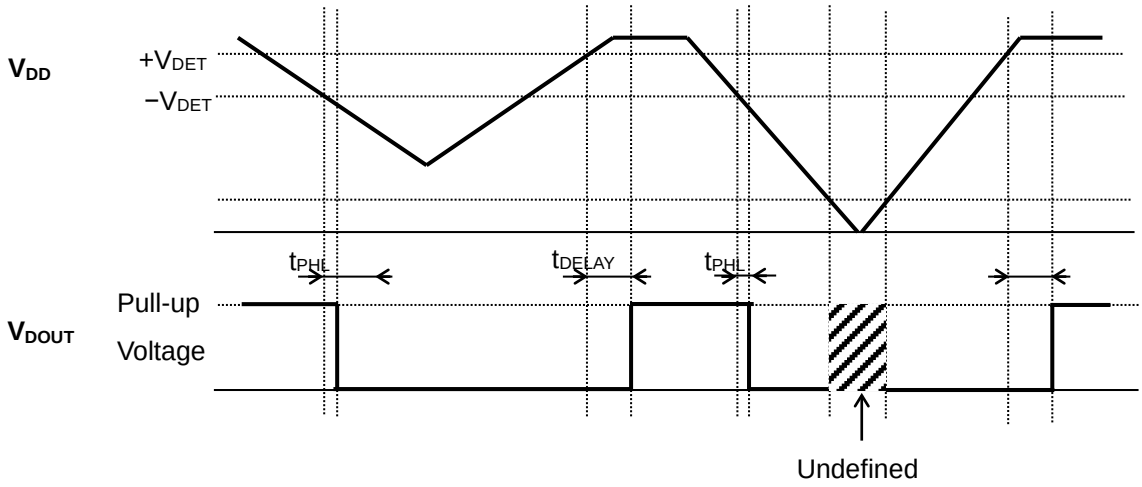
R3121NxxxE Operation

OPERATION

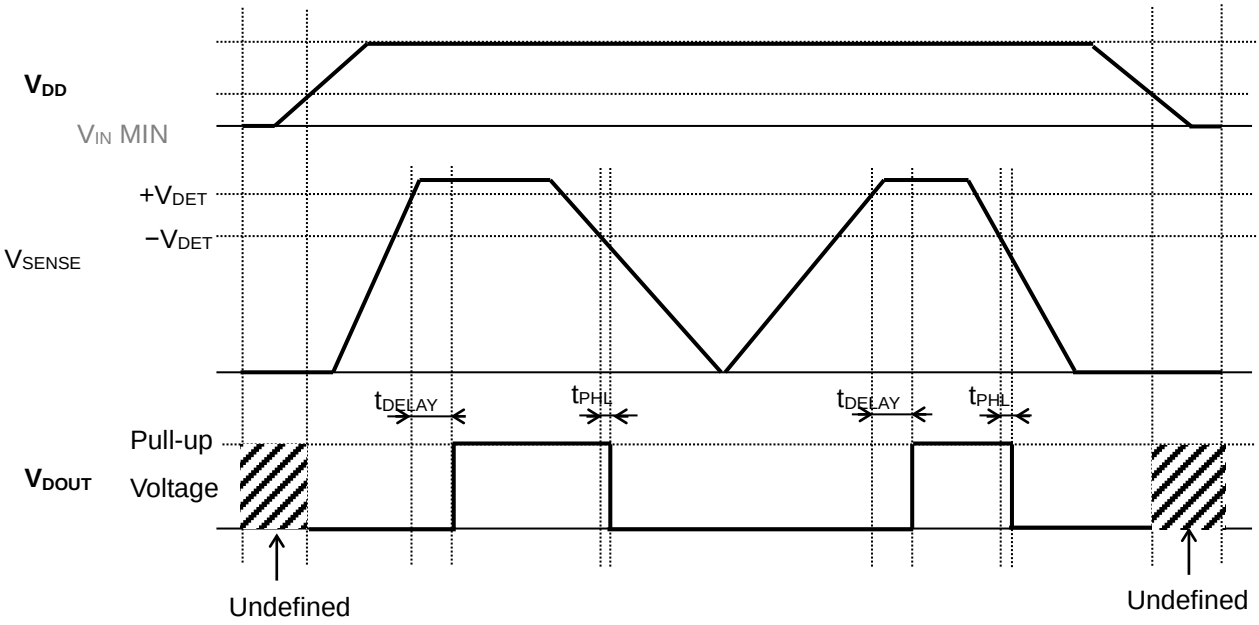
1. The SENSE pin voltage is higher than the detector threshold; the output voltage is equal to the pull-up voltage.
2. At A point, Vref ≥ V_{SENSE} x (Rb+Rc) / (Ra+Rb+Rc) is true. So, the comparator output voltage will be reversed from “L” to “H”. As a result, the output voltage will be “L”. If the supply voltage remains higher than the minimum operating voltage, the output voltage will stay in “L”.
3. At B point, Vref ≤ V_{SENSE} x Rb / (Ra+Rb) is true. So, the comparator output voltage will be reversed from “H” to “L”. As a result, output voltage will be equal to the pull-up voltage.

(1) The DOUT pin should be pulled-up to an external voltage level.
(2) Hysteresis is a voltage difference between the released voltage and the detector threshold.

TIMING CHARTS



R3121NxxxA/R3121NxxxG (VDD Pin Detection Type)



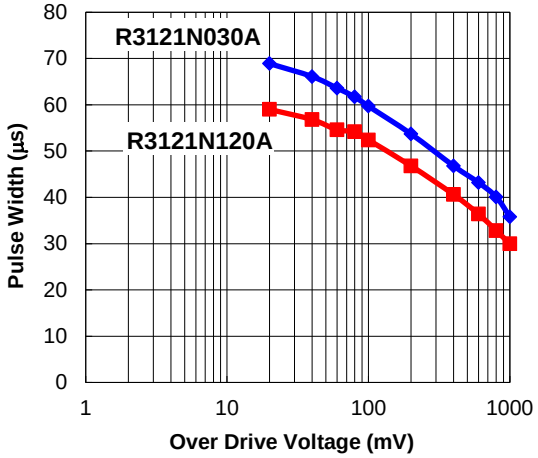
R3121NxxxE (SENSE Pin Detection Type)

POWER SEQUENCE

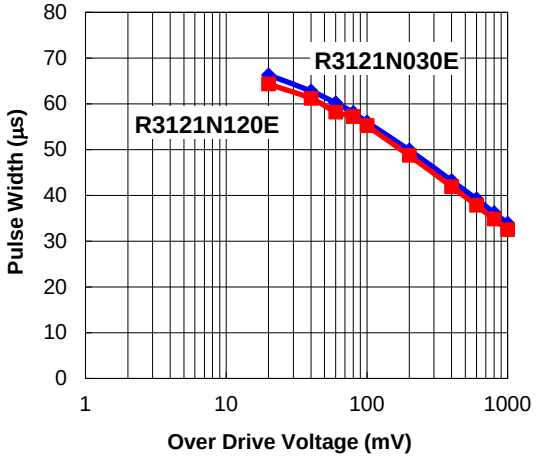
The R3121NxxxE is a SENSE pin voltage detection type which supervises the SENSE pin voltage. When powering up, either the VDD pin or the SENSE pin can power up first. In the case of powering up the VDD pin from the minimum voltage or lower, after the powering up of the SENSE pin, the VDD pin have to be powered up 10 V/ms or less. In the case of powering down the VDD pin, the SENSE pin has to be powered down first. After the detection delay time (t_{RESET}), the VDD pin has to be powered down.

GLITCH DETECTION by VDD and SENSE PINS

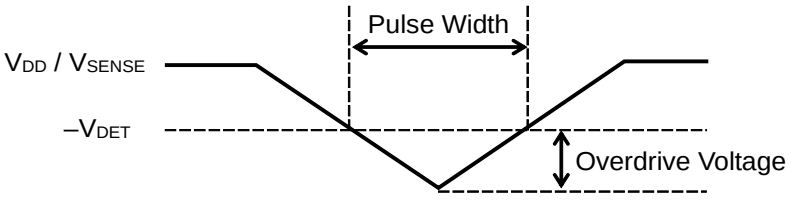
The following graphs are the released conditions when a pulse voltage less than or equal to the detector threshold ($-V_{DET}$) is applied to VDD (R3121NxxxA/G) / VSENSE (R3121NxxxE) pin during the release operation. The graphs indicate the maximum pulse condition. If a pulse increased in width and voltage is applied to V_{DD} (R3121NxxxA/G) / V_{SENSE} (R3121NxxxE), the reset signal may occur.



R3121NxxxA/G Pulse Width vs. Over Drive Voltage



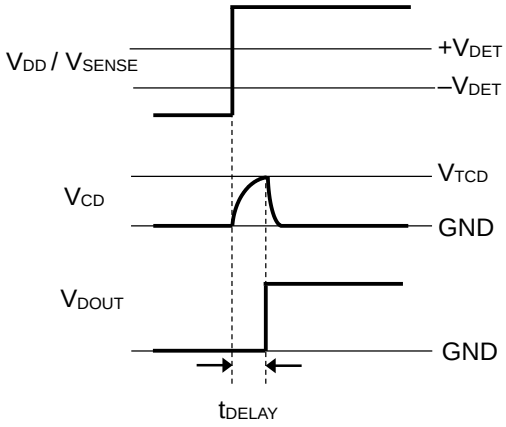
R3121NxxxE Pulse Width vs. Over Drive Voltage



V_{DD}/V_{SENSE} Input Waveform

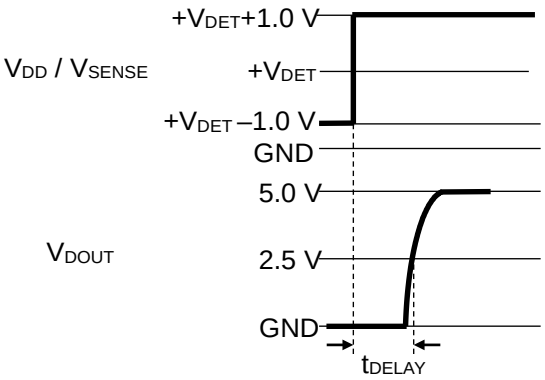
RELEASE DELAY TIME (t_{DELAY})

When the voltage higher than the released voltage is applied to the VDD / SENSE pin while the voltage lower than the detector threshold ($-V_{DET}$) is applied to VDD/ SENSE pin, charging the external capacitor starts and the CD pin voltage (V_{CD}) is increased. The output voltage maintains the released output until V_{CD} reaches the threshold voltage of the release output delay pin (V_{TCD}). And when V_{CD} exceeds V_{TCD}, the output voltage is inverted from the detected output to the released output. That is, the charged external capacitor starts discharging.



R3121NxxxA/E/G Released Delay Time

Release Delay Time (t_{DELAY}) indicates the time between the instance when V_{DD} / V_{SENSE} shift from "$+V_{DET}$ -1.0 V" to "$+V_{DET}$+1.0 V" by the application of a pulse voltage and the instance when the output voltage reaches 2.5 V after pulled up the output pin (D_{OUT}) to 5.0 V with a resistor of 100 kΩ.
This is given by the expression t_{DELAY} (s) = C_D x 10^7, where C_D (F) represents capacitance of the external capacitor.



R3121NxxxA/E/G Released Delay Time

TECHNICAL NOTES

When connecting resistors to VDD pin

When connecting a resistor (R1) to VDD pin, 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 V_{DD} 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 result, make sure that the cross conduction current has no problem.

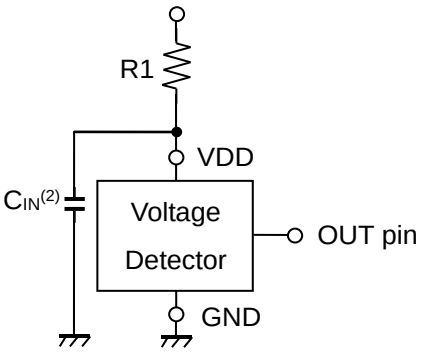


図 A

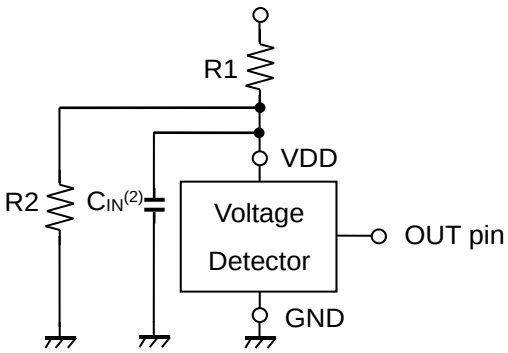


図 B

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

Prohibited Area of Supply Voltage Fluctuations (VDD Pin Detection Type)

As for the steep change of the supply voltages in the prohibited area as shown in Figure C, the detector may cause a false detection if the supply voltage is over the detector threshold, as shown in Figure D.

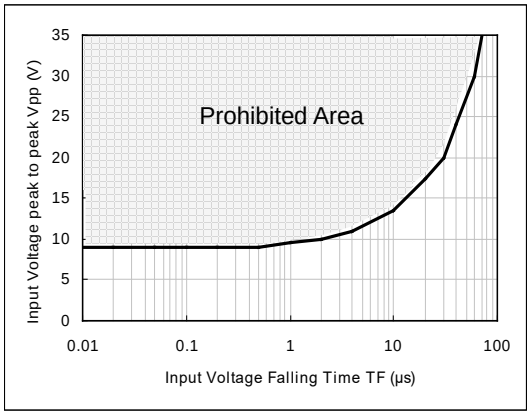


Figure C: Prohibited Area

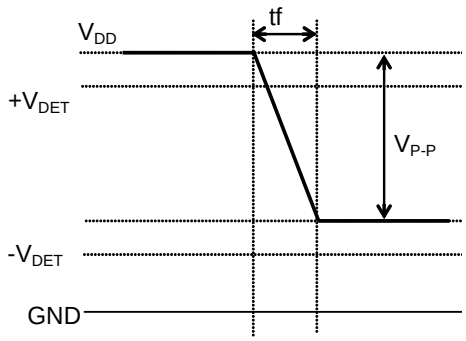


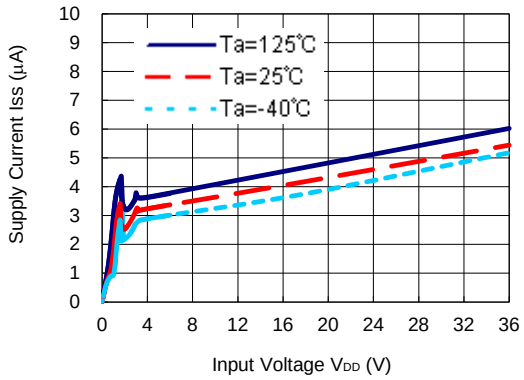
Figure D

TYPICAL CHARACTERISTICS

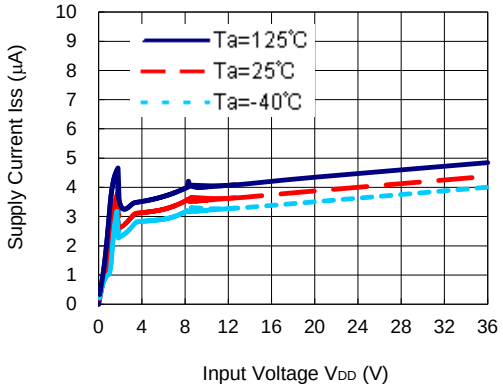
Note: Typical Characteristics are intended to be used as reference data; they are not guaranteed.

1) Supply Current vs. Input Voltage

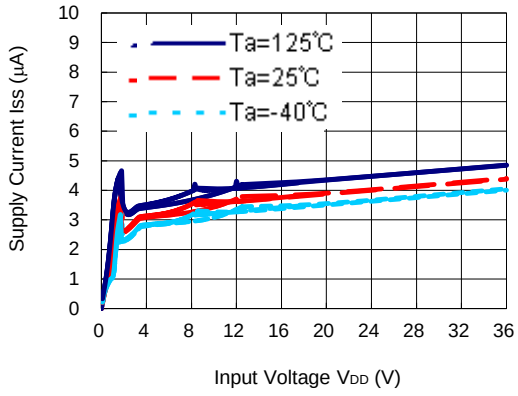
R3121N030A/G



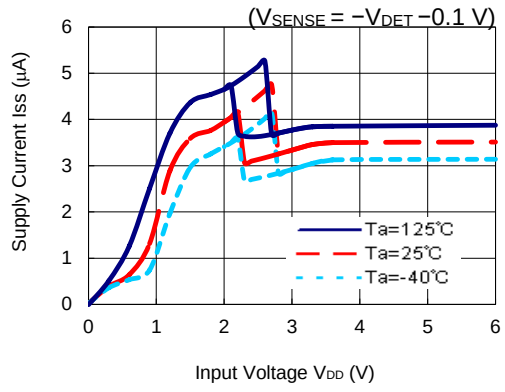
R3121N083A/G



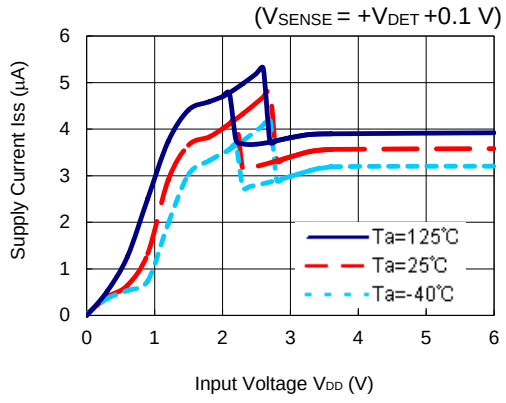
R3121N120A/G



R3121NxxxE (V_{SENSE} = −V_{DET} −0.1 V)



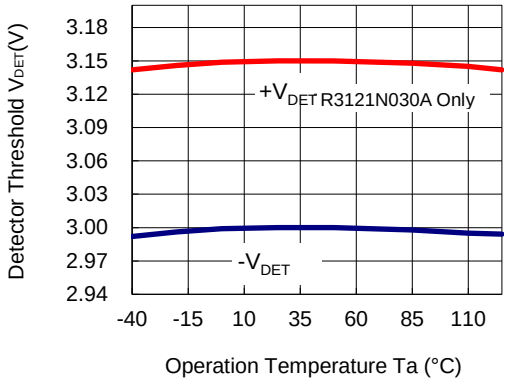
R3121NxxxE (V_{SENSE} = +V_{DET} +0.1 V)



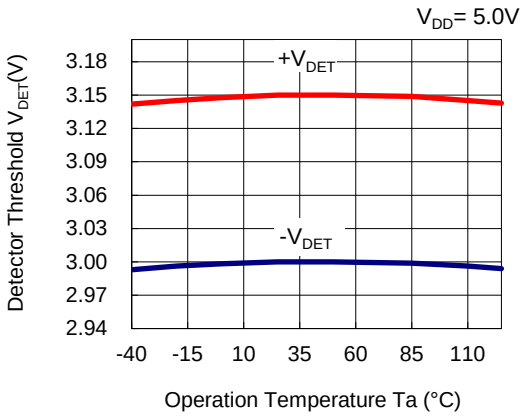
RICOH

2) Detector Threshold vs. Temperature

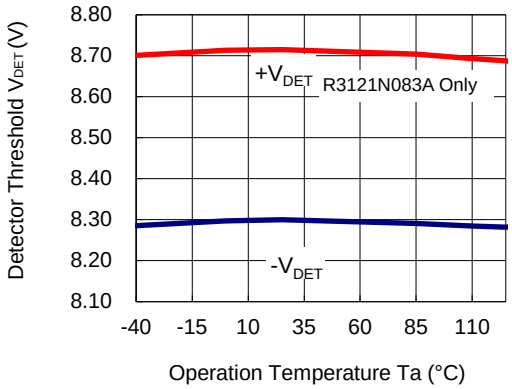
R3121N030A/G



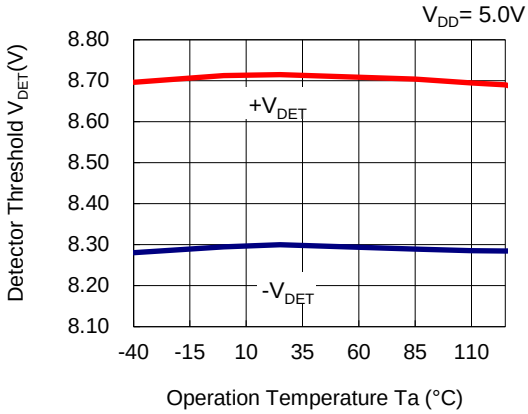
R3121N030E



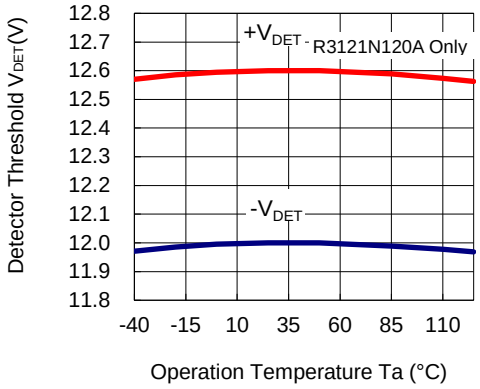
R3121N083A/G



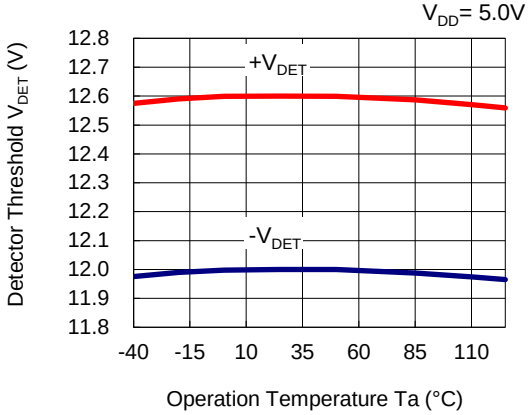
R3121N083E



R3121N120A/G

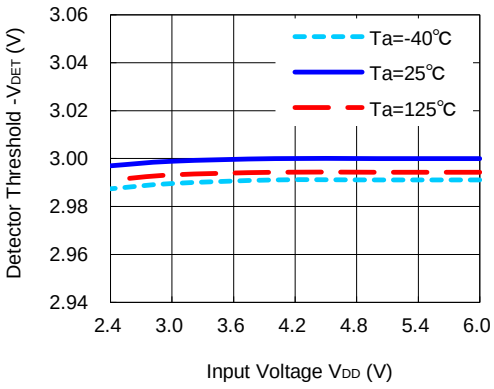


R3121N120E

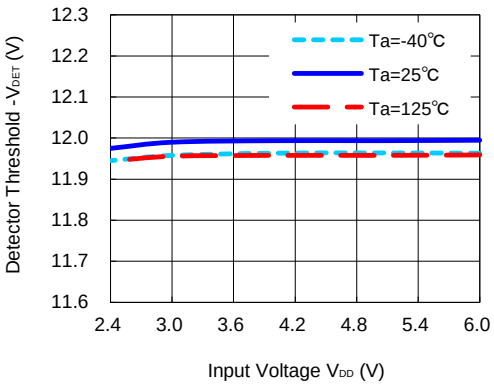


3) Detector Threshold vs. Input Voltage

R3121N030E

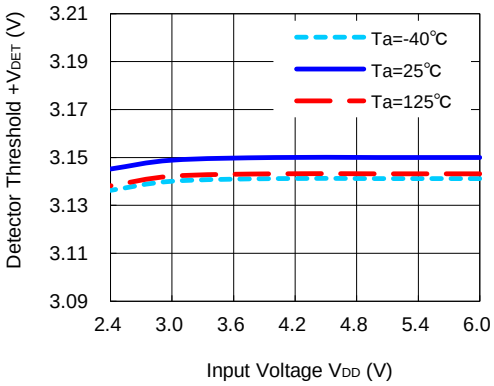


R3121N120E

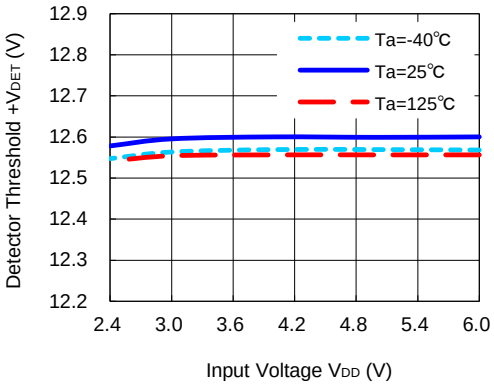


4) Release Voltage vs. Input Voltage

R3121N030E

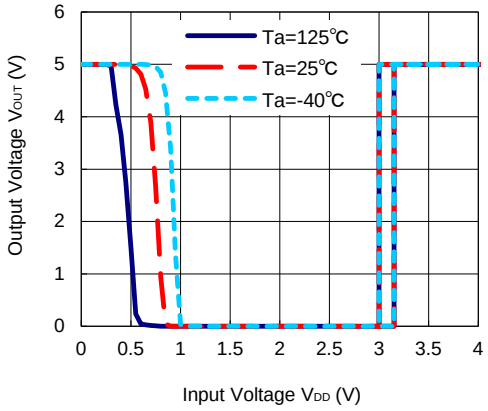


R3121N120E

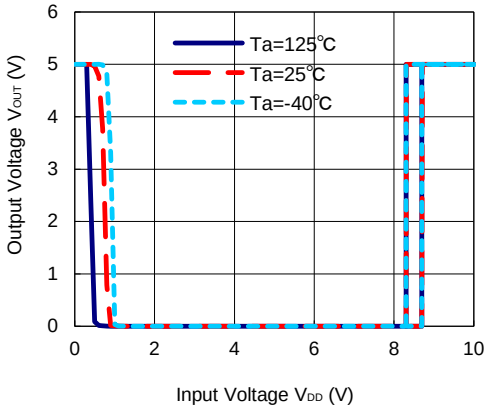


5) Output Voltage vs. Input Voltage (Ta = 25°C, D_{OUT}: pulled-up to 5.0 V with 100 kΩ)

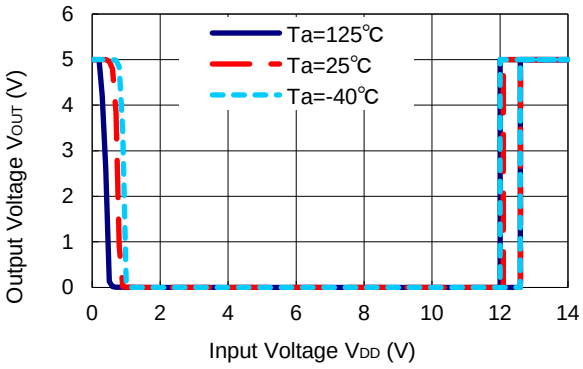
R3121N030A



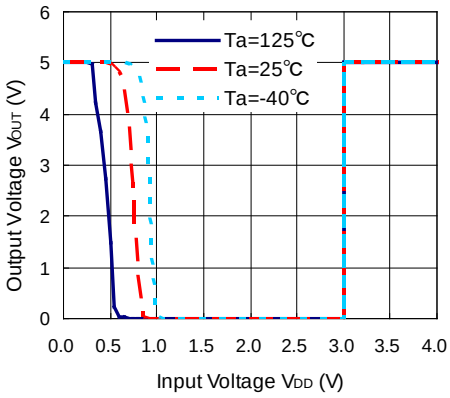
R3121N083A



R3121N120A

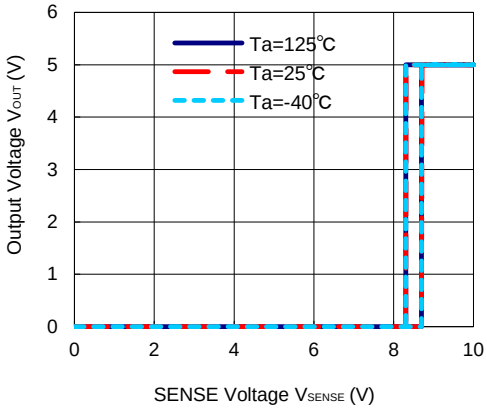


R3121N030G

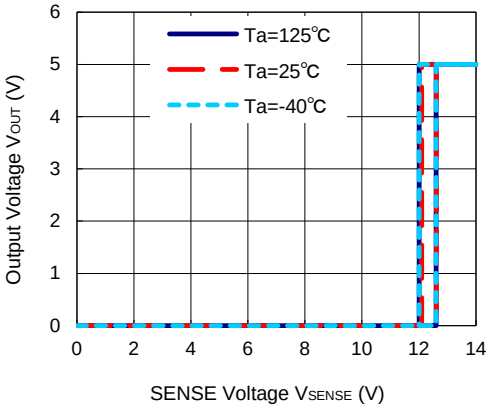


6) Output Voltage vs. SENSE Pin Voltage (V_{DD} = 5.0 V, D_{OUT}: pulled-up to 5.0 V with 100 kΩ)

R3121N083E



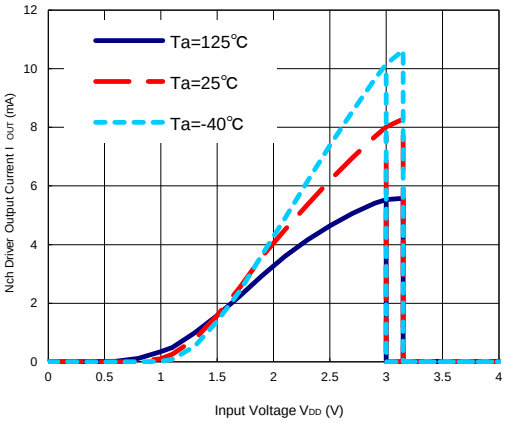
R3121N120E



7) Nch. Driver Output Current vs. Input Voltage

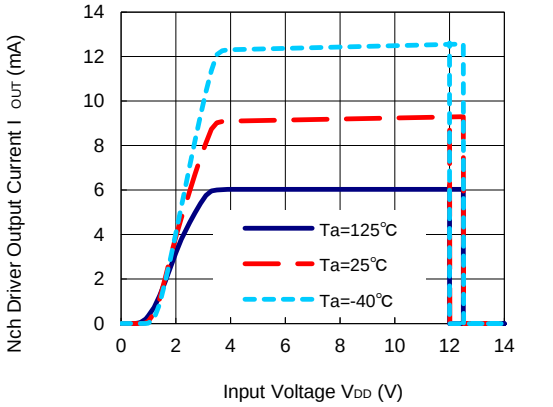
R3121N030A

(V_{DOUT} = 0.5V)



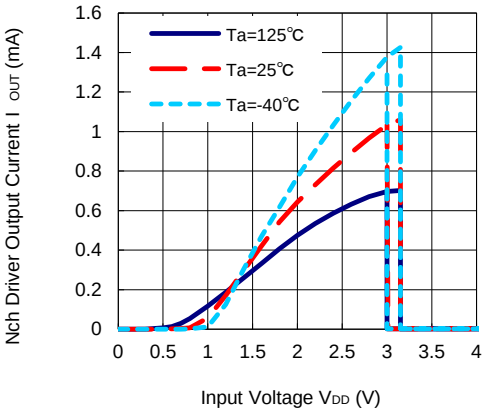
R3121N120A

(V_{DOUT} = 0.5V)



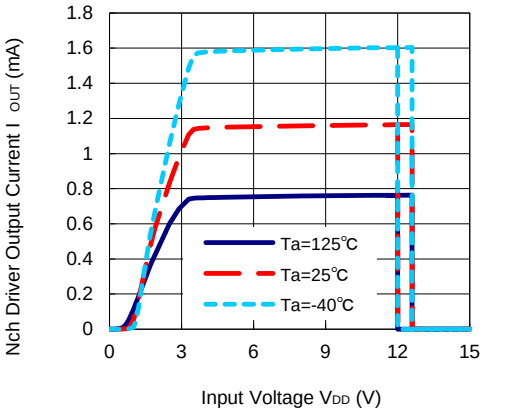
R3121N030A

(V_{DOUT} = 0.05 V)



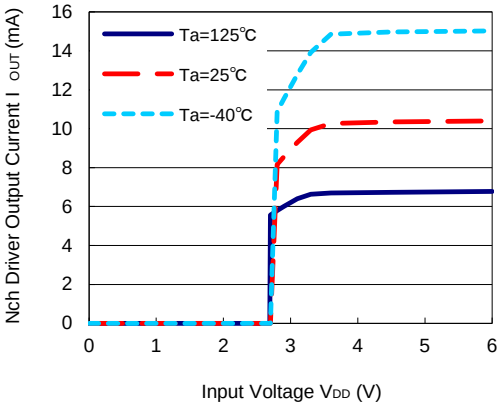
R3121N120A

(V_{DOUT} = 0.05 V)



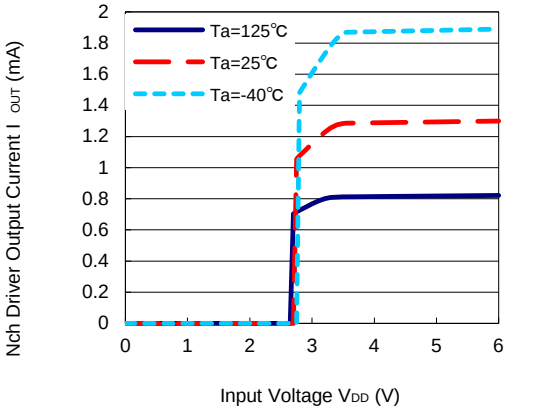
R3121NxxxE

(V_{SENSE} = −V_{DET} −1.0 V, V_{DOUT} = 0.5 V)



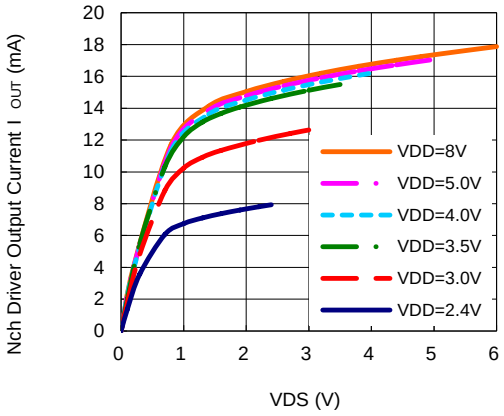
R3121NxxxE

(V_{SENSE} = −V_{DET} −1.0 V, V_{DOUT} = 0.05 V)

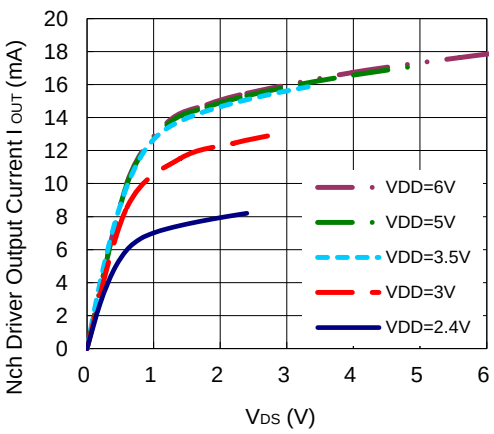


8) Nch. Driver Output Current vs. V_{DS} (Ta = 25°C)

R3121NxxxA/G

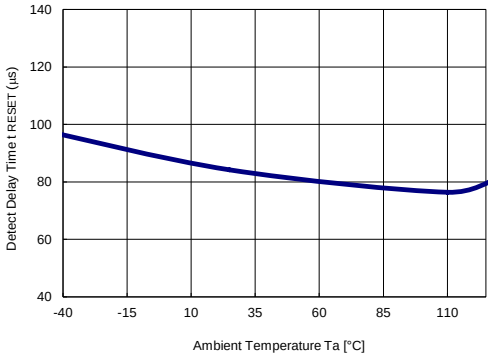


R3121NxxxE

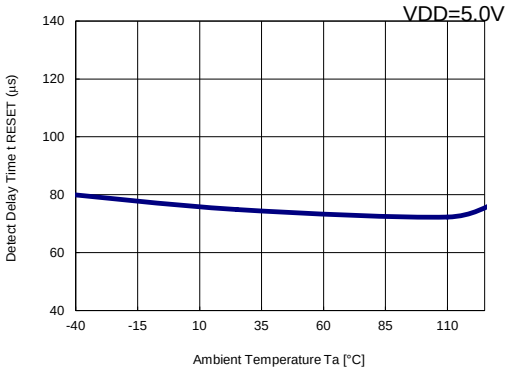


9) Detection Delay Time vs. Temperature

R3121NxxxA/G

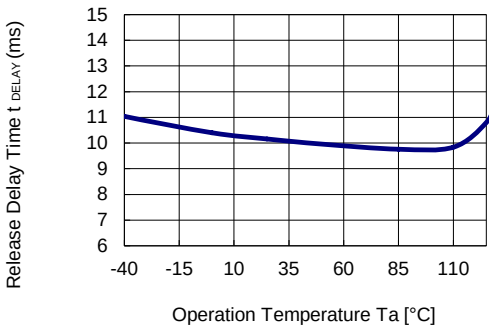


R3121NxxxE

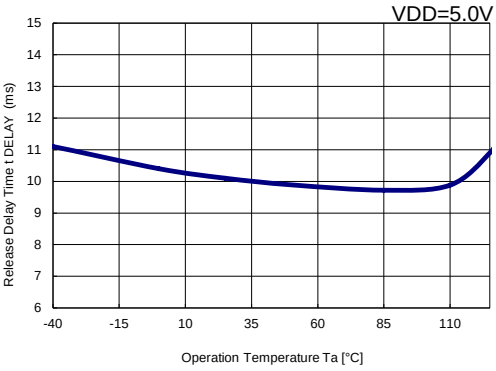


10) Release Delay Time vs. Temperature (C_D = 1.0µF)

R3121NxxxA/G

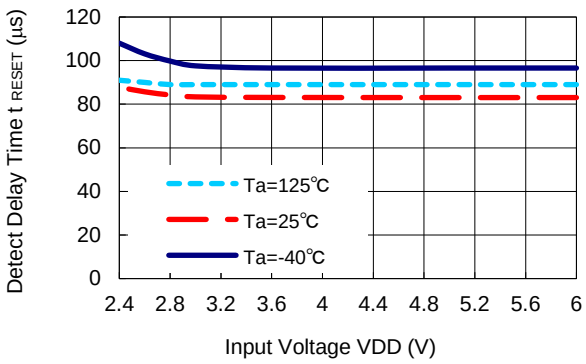


R3121NxxxE



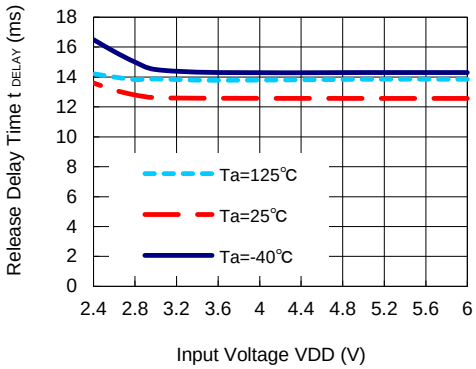
11) Detection Delay Time vs. Input Voltage

R3121NxxxE



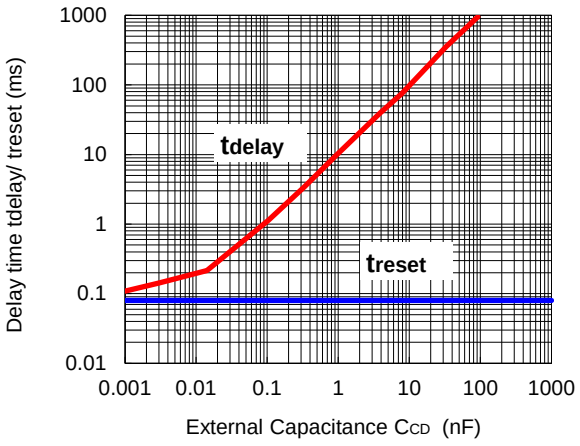
12) Release Delay Time vs. Input Voltage

R3121NxxxE

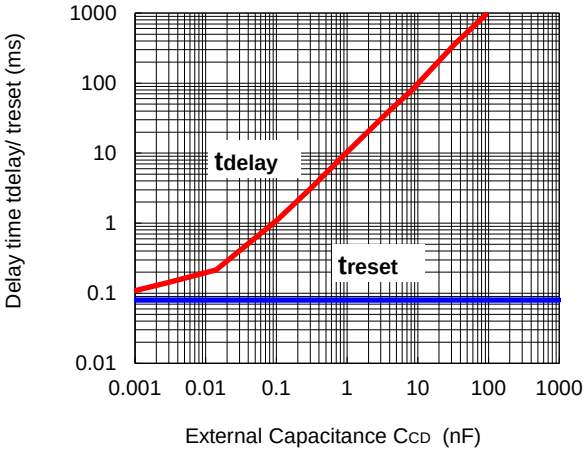


13) Release Delay Time vs. External Capacitor for CD Pin (Ta = 25°C)

R3121NxxxA/G



R3121NxxxE



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The power dissipation of the package is dependent on PCB material, layout, and environmental conditions. The following measurement conditions are based on JEDEC STD. 51-7.

Measurement Conditions

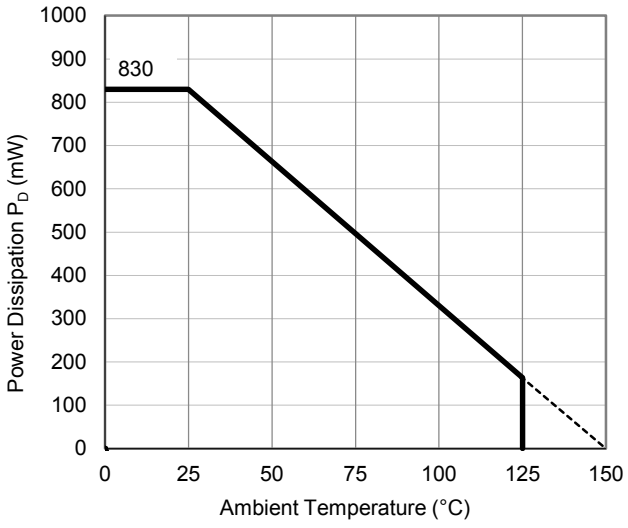
Item	Measurement Conditions
Environment	Mounting on Board (Wind Velocity = 0 m/s)
Board Material	Glass Cloth Epoxy Plastic (Four-Layer Board)
Board Dimensions	76.2 mm × 114.3 mm × 0.8 mm
Copper Ratio	Outer Layer (First Layer): Less than 95% of 50 mm Square Inner Layers (Second and Third Layers): Approx. 100% of 50 mm Square Outer Layer (Fourth Layer): Approx. 100% of 50 mm Square
Through-holes	ϕ 0.3 mm × 7 pcs

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

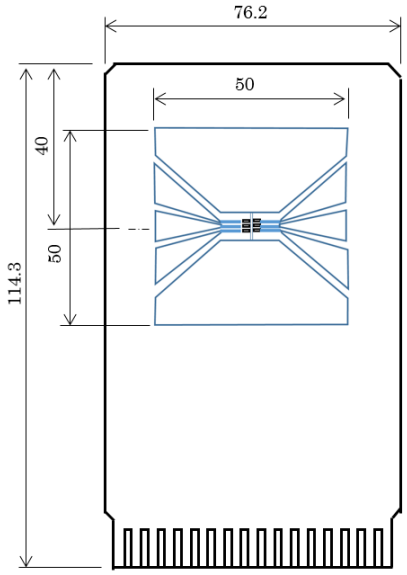
Item	Measurement Result
Power Dissipation	830 mW
Thermal Resistance (θja)	θja = 150°C/W
Thermal Characterization Parameter (ψjt)	ψjt = 51°C/W

θja: Junction-to-Ambient Thermal Resistance

ψjt: Junction-to-Top Thermal Characterization Parameter



Power Dissipation vs. Ambient Temperature



Measurement Board Pattern

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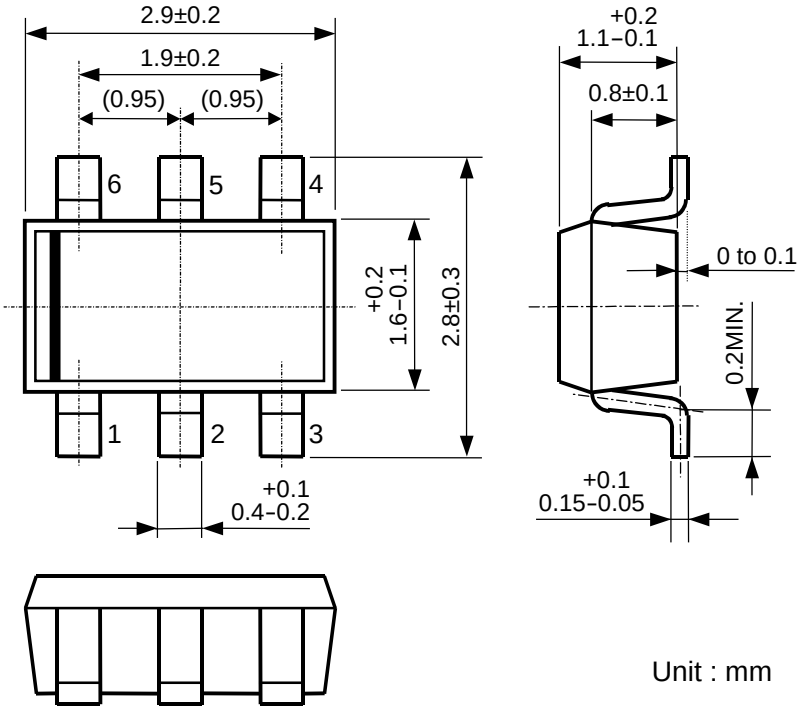

Unit : mm

SOT-23-6 Package Dimensions

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