36 V Input Voltage Detector with Delay Function for Industrial Applications

NO.EA-378-160613

OUTLINE

The R3119x is a CMOS-based 36 V input (absolute maximum ratings: 50 V) voltage detector (VD) provided with high detector threshold accuracy and ultra-low supply current. Internally, the R3119x consists of a voltage reference unit, a hysteresis comparator, a resistor net for setting output voltage and an output driver transistor. The R3119xxxxA is equipped with a C_D pin and the R3119xxxxE is equipped with a SENSE pin.

The supply current of IC is only 3.3 µA. The detector threshold range is 2.3 V to 12 V, and the detector threshold accuracy is 1.5%. The output type is Nch. open drain "L" output.

The R3119x is offered in a small-size 6-pin DFN(PLP)1820-6 package in addition to a 5-pin SOT-23-5 package.

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. This line of products operate in a wide temperature range from low temperature to high temperature to support harsh environment applications.

FEATURES

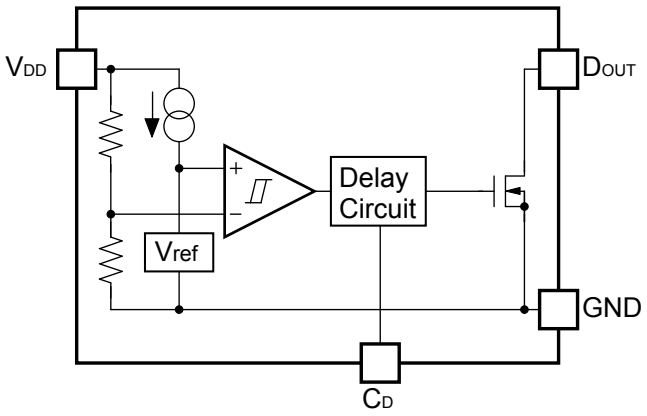
- Operating Voltage Range (Maximum Rating) ·····R3119xxxxA: 1.2 V to 36.0 V (50.0V)
  R3119xxxxE: 2.1 V to 6.0 V (7.0V)
- Operating Temperature Range·····−50°C to 105°C
- Supply Current ·····Typ. 3.3 µA
- Detector Threshold Range ·····2.3 V to 12.0 V (0.1 V steps)
- Detector Threshold Accuracy·····±1.5% (Ta=25°C)
- Detector Threshold Temperature Coefficient ····· Typ. ±100 ppm / °C
- Release Output Delay Time····· R3119xxxxA : Typ.85 ms (at C_D = 0.01 µF)
- Release Output Delay Time Accuracy·····R3119xxxxA : −50% to 80%
- Output Type·····Nch. Open Drain
- Package ·····DFN(PLP)1820-6, SOT-23-5

APPLICATIONS

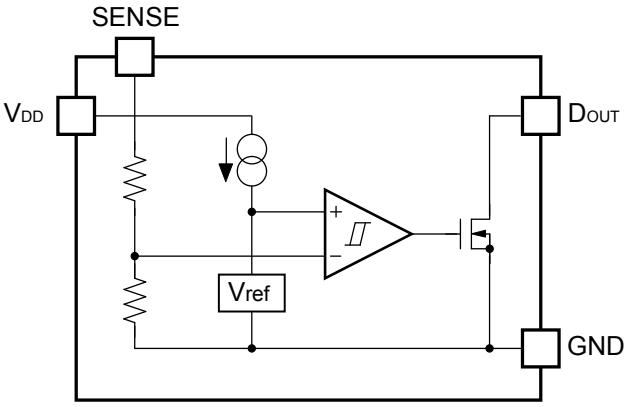
- Industrial equipments such as FAs and smart meters
- Equipments used under high-temperature conditions such as surveillance camera and vending machine
- Equipments accompanied by self-heating such as motor and lighting

BLOCK DIAGRAMS

R3119xxxxA



R3119xxxxE



SELECTION GUIDE

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

Product Name	Package	Quantity per Reel	Pb Free	Halogen Free
R3119Kxxx∗-TR-Y	DFN(PLP)1820-6	5,000 pcs	Yes	Yes
R3119Nxxx∗-TR-YE	SOT-23-5	3,000 pcs	Yes	Yes

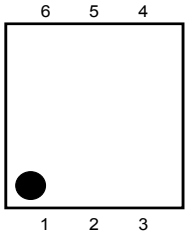
xxx : Specify the set detector threshold ($-V_{SET}$) in the range of 2.3 V (023) to 12.0 V (120) in 0.1 V steps.

∗: Select the voltage detection type from the following;
A: with C_D pin type
E: with SENSE pin type

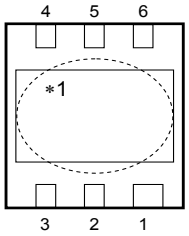
PIN CONFIGURATIONS

●DFN(PLP)1820-6

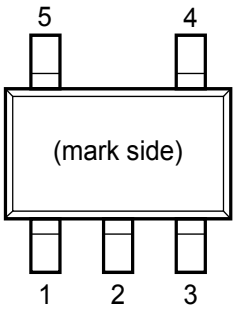
Top View



Bottom View



● SOT-23-5



DFN(PLP)1820-6

Pin No.	Symbol	Description
1	GND	Ground Pin
2	NC	No Connection
3	V_{DD}	Input Pin
4	C_D	Connecting pin with external capacitor for setting delay time (R3119KxxxA)
	SENSE	Voltage Detector Voltage Sense Pin (R3119KxxxE)
5	NC	No Connection
6	D_{OUT}	Output Pin ("L" at detection)

*1 Tab is GND level. (They are connected to the reverse side of this IC.) The tab is better to be connected to the GND, but leaving it open is also acceptable.

SOT-23-5

Pin No.	Symbol	Description
1	V_{DD}	Input Pin
2	GND*1	Ground Pin
3	GND*1	Ground Pin
4	D_{OUT}	Output Pin ("L" active at detection)
5	C_D	Release Output Delay Set Pin (R3119NxxxA)
	SENSE	VD Voltage SENSE Pin (R3119NxxxE)

*1 No.2 and No.3 pins must be wired to the GND plane when mounted on board.

ABSOLUTE MAXIMUM RATINGS

Symbol	Item		Rating	Unit
V_{DD}	Supply Voltage (R3119xxxxA)		−0.3 to 50.0	V
	Supply Voltage (R3119xxxxE)		−0.3 to 7.0	V
V_{DOUT}	D_{OUT} Pin Output Voltage		−0.3 to 7.0	V
V_{CD}	C_D Pin Output Voltage (R3119xxxxA)		−0.3 to 7.0	V
V_{SENSE}	SENSE Pin Input Voltage (R3119xxxxE)		−0.3 to 50.0	V
I_{OUT}	D_{OUT} Pin Output Current		20	mA
P_D	Power Dissipation (DFN(PLP)1820-6) *1	Standard Land Pattern	880	mW
	Power Dissipation (SOT-23-5) *1	Standard Land Pattern	420	
Tj	Junction Temperature		−50 to 125	°C
Tstg	Storage Temperature		−55 to 125	°C

*1 Please refer to *PACKAGE INFORMATION* for detailed information.

ABSOLUTE MAXIMUM RATINGS

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

RECOMMENDED OPERATING CONDITIONS

Symbol	Item	Rating	Unit
V_{DD}	Operating Voltage (R3119xxxxA)	1.25 to 36	V
	Operating Voltage (R3119xxxxE)	2.1 to 6	V
V_{SENSE}	SENSE Pin Input Voltage (R3119xxxxE)	0 to 36	V
Ta	Operating Temperature Range	−50 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 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.

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 -50°C ≤ Ta ≤105°C.

R3119xxxxA (Ta = 25°C)

Symbol	Item	Conditions		Min.	Typ.	Max.	Unit
$-V_{DET}$	Detector Threshold	V_{DD} pin	Ta = 25°C	x 0.985		x 1.015	V
			−50°C ≤ Ta ≤ 105°C	[x 0.970]		[x 1.020]	
V_{HYS}	Detector Threshold Hysteresis			[3.5]	5	[6.5]	%
I_{SS}	Supply Current	V_{DD} = $-V_{SET}$ −0.1 V			3.3	[5.6]	µA
		V_{DD} = $-V_{SET}$ +1.0 V			3.3	[5.5]	
V_{DDL}	Minimum Operating Voltage*1	Ta = 25°C				1.2	V
		−40°C ≤ Ta ≤ 105°C				[1.25] *2	
		−50°C ≤ Ta ≤ 105°C				[1.3]	
I_{OUT}	Output Current (Nch Driver Output Pin)	V_{DD} = 1.5 V, V_{DS} = 0.05 V		[230]			µA
		2.3 V ≤ $-V_{SET}$ < 2.6 V	V_{DD} = 2.2 V, V_{DS} = 0.5 V	[2.8]			mA
		2.6 V ≤ $-V_{SET}$ < 3.0 V	V_{DD} = 2.5 V, V_{DS} = 0.5 V	[3.3]			
		3.0V ≤ $-V_{SET}$	V_{DD} = 2.9 V, V_{DS} = 0.5 V	[3.5]			
I_{LEAK}	Nch. Driver Leakage Current	V_{DD} = 36 V, V_{DS} = 6.0 V				[0.2]	µA
tdelay	Release Output Delay Time	V_{DD} = 1.5 V → $-V_{SET}$ + 2.0 V, C_D = 0.01 µF	−40°C ≤ Ta ≤ 105°C	[45]	85	[150] *2	ms
			−50°C ≤ Ta ≤ 105°C	[45]	85	[200]	

All test items listed under Electrical Characteristics are done under the pulse load condition (Tj≈Ta=25ºC).

*1 The value is the minimum operating voltage when the output voltage is 0.1 V or less at detection.
(The pull-up resistance; 100 kΩ, the pull-up voltage; 5.0 V)

*2 Guaranteed by design engineering at Ta = −40°C.

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 -50°C ≤ Ta ≤105°C.

R3119xxxxE (Ta = 25°C)

Symbol	Item	Conditions		Min.	Typ.	Max.	Unit
$-V_{DET}$	Detector Threshold	SENSE pin V_{DD} = 6 V	Ta = 25°C	x 0.985		x 1.015	V
			−50°C ≤ Ta ≤ 105°C	[x 0.970]		[x 1.020]	
V_{HYS}	Detector Threshold Hysteresis	V_{DD} = 6 V		[3.5]	5	[6.5]	%
I_{SS}	Supply Current	V_{DD} = 6 V, V_{SENSE} = $-V_{SET}$ − 0.1 V			3.3	[5.5]	μA
		V_{DD} = 6 V, V_{SENSE} = $-V_{SET}$ + 1.0 V			3.3	[5.5]	
V_{DDL}	Minimum Operating Voltage*1					[2.1]	V
R_{SENSE}	SENSE Resistance			[4.5]		[120]	MΩ
I_{OUT}	Output Current (Nch. Driver Output Pin)	V_{SENSE} < $-V_{DET}$	V_{DD} = 2.1 V, V_{DS} = 0.05 V	[420]			μA
		V_{SENSE} < $-V_{DET}$	V_{DD} = 2.2 V, V_{DS} = 0.5 V	[2.8]			mA
I_{LEAK}	Nch. Driver Leakage Current	V_{DD} = 6 V, V_{SENSE} = 36 V, V_{DS} = 6.0 V				[0.2]	μA
t_{PLH}	Release Output Delay Time	V_{DD} = 6 V, V_{SENSE} = 1.5 V → $-V_{SET}$ + 2.0 V			15		μs

All test items listed under Electrical Characteristics are done under the pulse load condition (Tj≈Ta=25ºC).
*1 The value is the minimum operating voltage to define V_{DOUT}.

Product-specific Electric Characteristics

The specifications surrounded by [ ] are guaranteed by design engineering at -50°C ≤ Ta ≤105°C.

R3119xxxxA/E

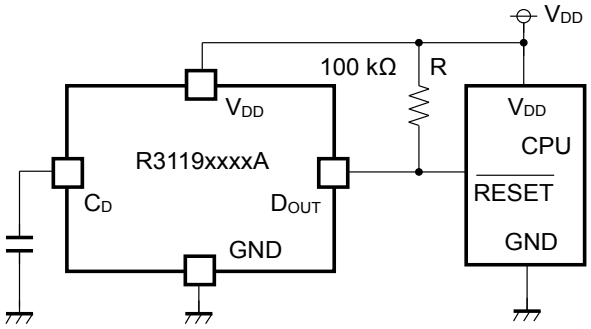
Product Name	$-V_{DET}$ [V] (Ta = 25°C)			$-V_{DET}$ [V] (−50°C ≤ Ta ≤ 105°C)		
	Min.	Typ.	Max.	Min.	Typ.	Max.
R3119x023x	2.266	2.300	2.334	2.231	2.300	2.346
R3119x024x	2.364	2.400	2.436	2.328	2.400	2.448
R3119x025x	2.463	2.500	2.537	2.425	2.500	2.550
R3119x026x	2.561	2.600	2.639	2.522	2.600	2.652
R3119x027x	2.660	2.700	2.740	2.619	2.700	2.754
R3119x028x	2.758	2.800	2.842	2.716	2.800	2.856
R3119x029x	2.857	2.900	2.943	2.813	2.900	2.958
R3119x030x	2.955	3.000	3.045	2.910	3.000	3.060
R3119x031x	3.054	3.100	3.146	3.007	3.100	3.162
R3119x032x	3.152	3.200	3.248	3.104	3.200	3.264
R3119x033x	3.251	3.300	3.349	3.201	3.300	3.366
R3119x034x	3.349	3.400	3.451	3.298	3.400	3.468
R3119x035x	3.448	3.500	3.552	3.395	3.500	3.570
R3119x036x	3.546	3.600	3.654	3.492	3.600	3.672
R3119x037x	3.645	3.700	3.755	3.589	3.700	3.774
R3119x038x	3.743	3.800	3.857	3.686	3.800	3.876
R3119x039x	3.842	3.900	3.958	3.783	3.900	3.978
R3119x040x	3.940	4.000	4.060	3.880	4.000	4.080
R3119x041x	4.039	4.100	4.161	3.977	4.100	4.182
R3119x042x	4.137	4.200	4.263	4.074	4.200	4.284
R3119x043x	4.236	4.300	4.364	4.171	4.300	4.386
R3119x044x	4.334	4.400	4.466	4.268	4.400	4.488
R3119x045x	4.433	4.500	4.567	4.365	4.500	4.590
R3119x046x	4.531	4.600	4.669	4.462	4.600	4.692
R3119x047x	4.630	4.700	4.770	4.559	4.700	4.794
R3119x048x	4.728	4.800	4.872	4.656	4.800	4.896
R3119x049x	4.827	4.900	4.973	4.753	4.900	4.998
R3119x050x	4.925	5.000	5.075	4.850	5.000	5.100
R3119x051x	5.024	5.100	5.176	4.947	5.100	5.202
R3119x052x	5.122	5.200	5.278	5.044	5.200	5.304
R3119x053x	5.221	5.300	5.379	5.141	5.300	5.406
R3119x054x	5.319	5.400	5.481	5.238	5.400	5.508
R3119x055x	5.418	5.500	5.582	5.335	5.500	5.610
R3119x056x	5.516	5.600	5.684	5.432	5.600	5.712
R3119x057x	5.615	5.700	5.785	5.529	5.700	5.814
R3119x058x	5.713	5.800	5.887	5.626	5.800	5.916
R3119x059x	5.812	5.900	5.988	5.723	5.900	6.018
R3119x060x	5.910	6.000	6.090	5.820	6.000	6.120
R3119x061x	6.009	6.100	6.191	5.917	6.100	6.222
R3119x062x	6.107	6.200	6.293	6.014	6.200	6.324
R3119x063x	6.206	6.300	6.394	6.111	6.300	6.426
R3119x064x	6.304	6.400	6.496	6.208	6.400	6.528
R3119x065x	6.403	6.500	6.597	6.305	6.500	6.630
R3119x066x	6.501	6.600	6.699	6.402	6.600	6.732
R3119x067x	6.600	6.700	6.800	6.499	6.700	6.834
R3119x068x	6.698	6.800	6.902	6.596	6.800	6.936
R3119x069x	6.797	6.900	7.003	6.693	6.900	7.038

The specifications surrounded by [ ] are guaranteed by design engineering at -50°C ≤ Ta ≤105°C.

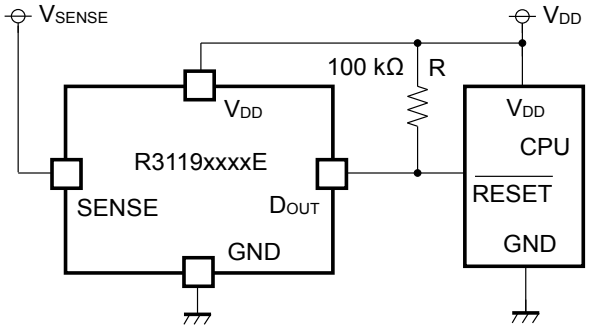
Product Name	$-V_{DET}$ [V] (Ta = 25°C)			$-V_{DET}$ [V] (−50°C ≤ Ta ≤ 105°C)		
	Min.	Typ.	Max.	Min.	Typ.	Max.
R3119x070x	6.895	7.000	7.105	6.790	7.000	7.140
R3119x071x	6.994	7.100	7.206	6.887	7.100	7.242
R3119x072x	7.092	7.200	7.308	6.984	7.200	7.344
R3119x073x	7.191	7.300	7.409	7.081	7.300	7.446
R3119x074x	7.289	7.400	7.511	7.178	7.400	7.548
R3119x075x	7.388	7.500	7.612	7.275	7.500	7.650
R3119x076x	7.486	7.600	7.714	7.372	7.600	7.752
R3119x077x	7.585	7.700	7.815	7.469	7.700	7.854
R3119x078x	7.684	7.800	7.917	7.567	7.800	7.956
R3119x079x	7.782	7.900	8.018	7.663	7.900	8.058
R3119x080x	7.880	8.000	8.120	7.760	8.000	8.160
R3119x081x	7.979	8.100	8.221	7.858	8.100	8.262
R3119x082x	8.078	8.200	8.323	7.955	8.200	8.364
R3119x083x	8.176	8.300	8.424	8.052	8.300	8.466
R3119x084x	8.274	8.400	8.526	8.148	8.400	8.568
R3119x085x	8.373	8.500	8.627	8.246	8.500	8.670
R3119x086x	8.472	8.600	8.729	8.343	8.600	8.772
R3119x087x	8.570	8.700	8.830	8.440	8.700	8.874
R3119x088x	8.669	8.800	8.932	8.537	8.800	8.976
R3119x089x	8.767	8.900	9.033	8.634	8.900	9.078
R3119x090x	8.866	9.000	9.135	8.731	9.000	9.180
R3119x091x	8.964	9.100	9.236	8.828	9.100	9.282
R3119x092x	9.063	9.200	9.338	8.925	9.200	9.384
R3119x093x	9.161	9.300	9.439	9.022	9.300	9.486
R3119x094x	9.260	9.400	9.541	9.119	9.400	9.588
R3119x095x	9.358	9.500	9.642	9.216	9.500	9.690
R3119x096x	9.457	9.600	9.744	9.313	9.600	9.792
R3119x097x	9.555	9.700	9.845	9.410	9.700	9.894
R3119x098x	9.654	9.800	9.947	9.507	9.800	9.996
R3119x099x	9.752	9.900	10.048	9.604	9.900	10.098
R3119x100x	9.850	10.000	10.150	9.700	10.000	10.200
R3119x101x	9.949	10.100	10.251	9.797	10.100	10.302
R3119x102x	10.047	10.200	10.353	9.894	10.200	10.404
R3119x103x	10.146	10.300	10.454	9.991	10.300	10.506
R3119x104x	10.244	10.400	10.556	10.088	10.400	10.608
R3119x105x	10.343	10.500	10.657	10.185	10.500	10.710
R3119x106x	10.441	10.600	10.759	10.282	10.600	10.812
R3119x107x	10.540	10.700	10.860	10.379	10.700	10.914
R3119x108x	10.638	10.800	10.962	10.476	10.800	11.016
R3119x109x	10.737	10.900	11.063	10.573	10.900	11.118
R3119x110x	10.835	11.000	11.165	10.670	11.000	11.220
R3119x111x	10.934	11.100	11.266	10.767	11.100	11.322
R3119x112x	11.032	11.200	11.368	10.864	11.200	11.424
R3119x113x	11.131	11.300	11.469	10.961	11.300	11.526
R3119x114x	11.229	11.400	11.571	11.058	11.400	11.628
R3119x115x	11.328	11.500	11.672	11.155	11.500	11.730
R3119x116x	11.426	11.600	11.774	11.252	11.600	11.832
R3119x117x	11.525	11.700	11.875	11.349	11.700	11.934
R3119x118x	11.623	11.800	11.977	11.446	11.800	12.036
R3119x119x	11.722	11.900	12.078	11.543	11.900	12.138
R3119x120x	11.820	12.000	12.180	11.640	12.000	12.240

TYPICAL APPLICATION CIRCUITS

When using a shared input voltage between R3119x and CPU

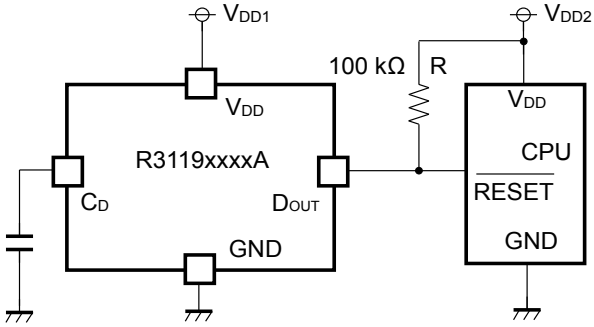


R3119xxxxA Typical Application Circuit

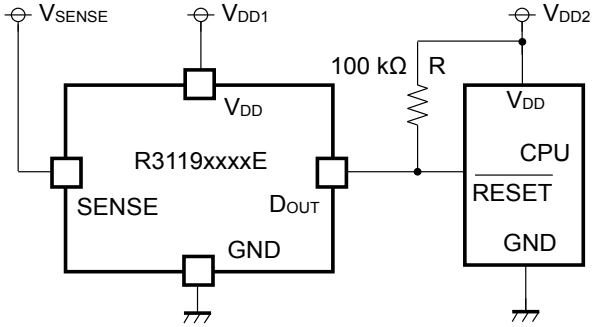


R3119xxxxE Typical Application Circuit

When using different input voltages between R3119x and CPU



R3119xxxxA Typical Application Circuit



R3119xxxxE Typical Application 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 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 100kΩ or less as a guide, and connect C_{IN} 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.

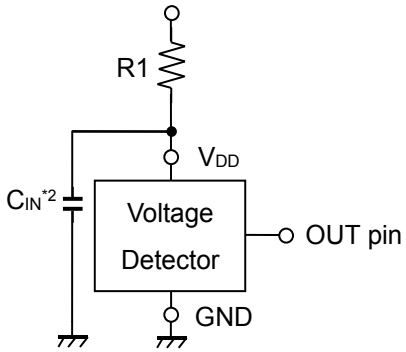


Figure A

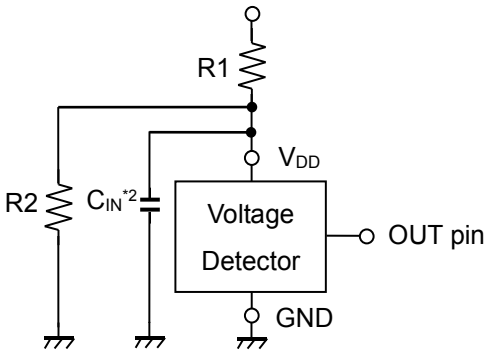


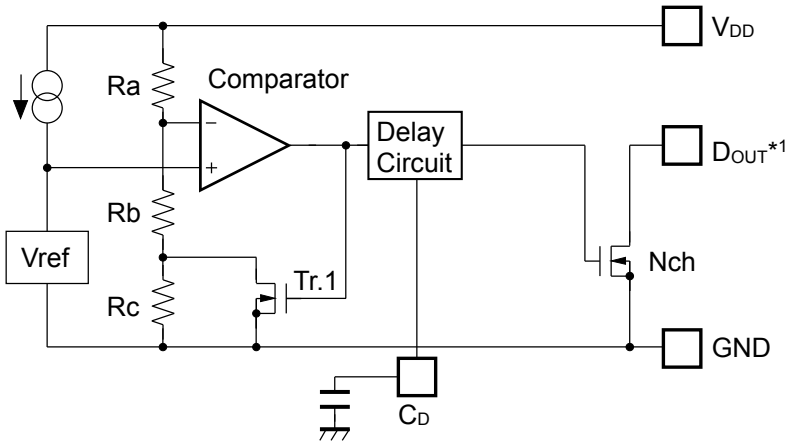
Figure B

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

*2 Note the bias dependence of capacitors.

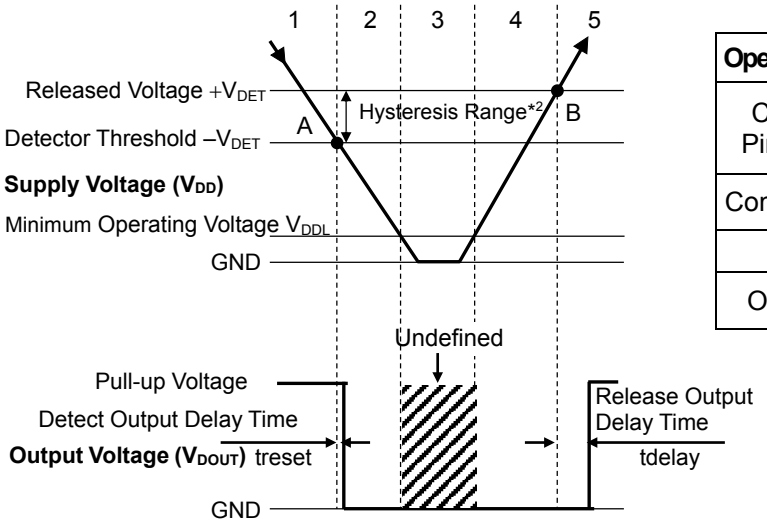
OPERATING DESCRIPTIONS

R3119xxxxA (C_D Pin Type)



Block Diagram with External Capacitors

*1 The D_{OUT} pin should be pulled-up to an external voltage level.



Operating Conditions	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

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

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

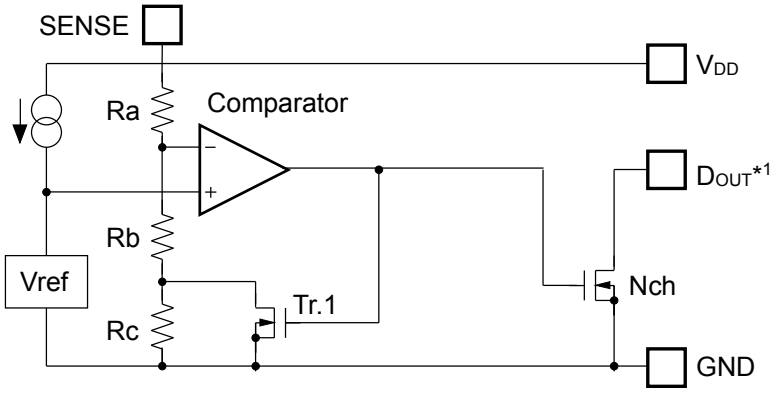
Operation Diagram

*2 Hysteresis is a voltage differential between the released voltage and the detector threshold.

OPERATING CONDITIONS

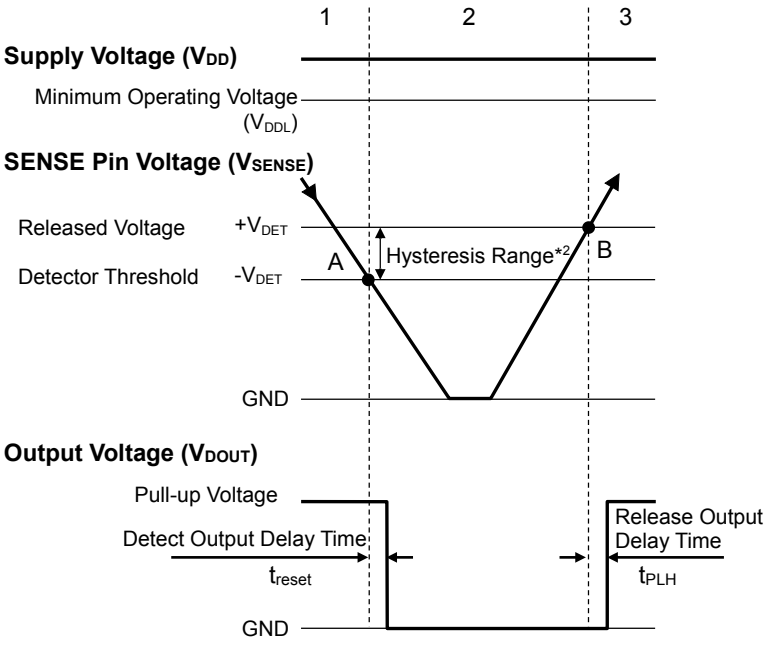
1. The output voltage is equal to the pull-up voltage.
2. At A point, Vref ≥ V_{DD} x (Rb+Rc) / (Ra+Rb+Rc) is true. So, the comparator output voltage will be reversed from “L” to “H”. As a result, the output voltage will be “L”.
3. If the supply voltage remains lower than the minimum operating voltage,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

R3119xxxxE (SENSE Pin Type)



Block Diagram with External Capacitors

*1 The D_{OUT} pin should be pulled-up to an external voltage level.



Operating Conditions	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

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

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

Operation Diagram

*2 Hysteresis is a voltage differential between the released voltage and the detector threshold.

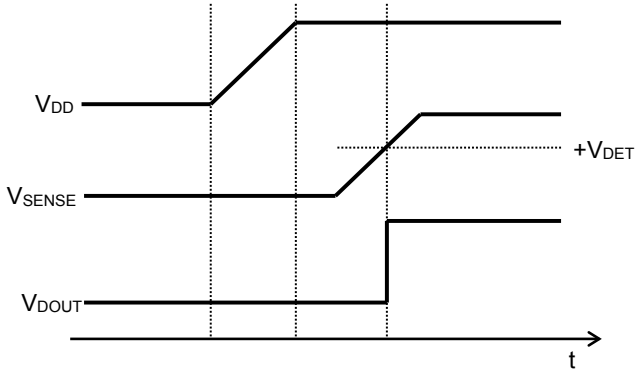
OPERATING CONDITIONS

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.

POWER SEQUENCE

The R3119xxxxE can supervise the voltage of the SENSE pin. Regarding the power-on sequence, the SENSE pin must be powered on after the power-on to the V_{DD} pin, as shown below.

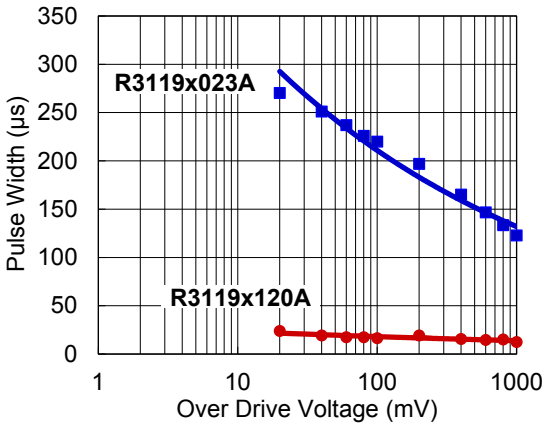
If the SENSE pin voltage is equal or more than the released voltage ($+V_{DET}$), D_{OUT} pin becomes "H". Besides, a voltage beyond V_{DD} pin is also acceptable to SENSE pin.



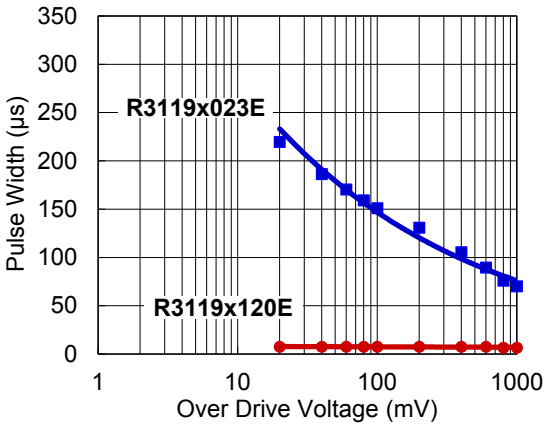
Power-On Timing Diagram

GLITCH DETECTION by V_{DD}, SENSE PINS

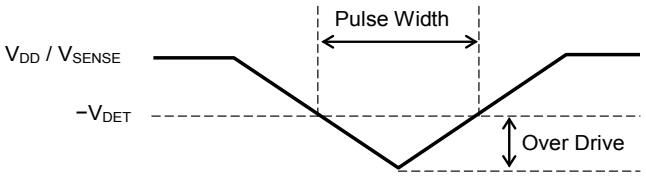
The following graphs are the released conditions when a pulse voltage less than or equal to the detector threshold ($-V_{DET}$) is applied to V_{DD} (R3119xxxxA) / V_{SENSE} (R3119xxxxE) pin during the release operation. This graph indicates the maximum pulse condition. If a pulse increased in width and voltage is applied to V_{DD} (R3119xxxxA) / V_{SENSE} (R3119xxxxE), the reset signal may occur.



R3119xxxxA Pulse Width vs. Over Drive Voltage



R3119xxxxE Pulse Width vs. Over Drive Voltage

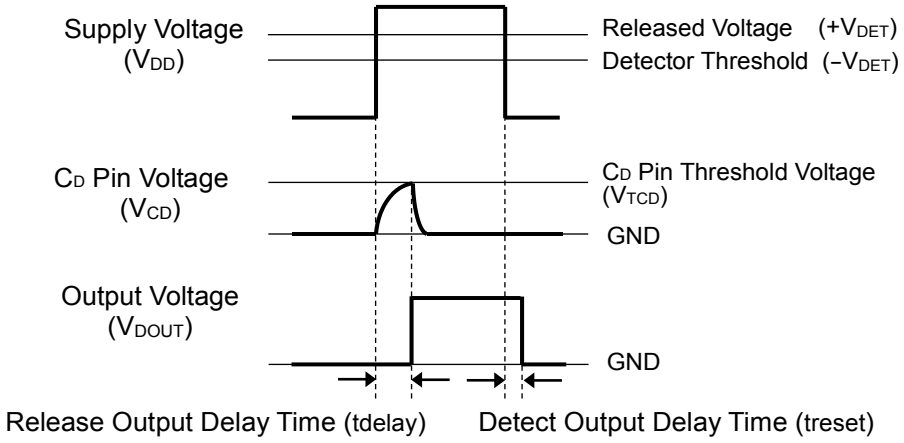


V_{DD} / V_{SENSE} Input Waveform

TIMING CHART

When the operating voltage higher than the released voltage is applied to V_{DD} pin, charge to an external capacitor starts, then C_D pin voltage (V_{CD}) increases. 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} is over V_{TCD}, the output voltage is inverted from the detected output to the released output. That is, the charged external capacitor starts discharging.

When the operating voltage lower than the detector threshold is applied to V_{DD} pin, the detect output delay time, which is the time until the output voltage is inverted from "H" to "L", remains constant independent of the external capacitor.

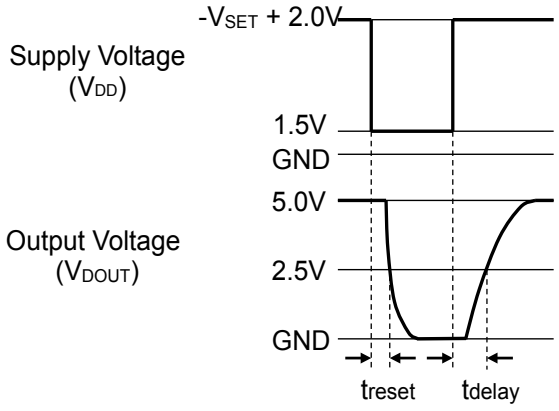


Delay Timing Diagram

RELEASE OUTPUT DELAY TIME (tdelay)

Release Output Delay Time (tdelay) indicates the time between the instance when V_{DD} shift from "1.5 V" to "$-V_{SET}$ + 2.0 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 tdelay (s) = 8.5 x 10^6 x C_D (F), where C_D (F) represents capacitance of the external capacitor.



R3119xxxxA

PACKAGE INFORMATION

POWER DISSIPATION (DFN(PLP)1820-6)

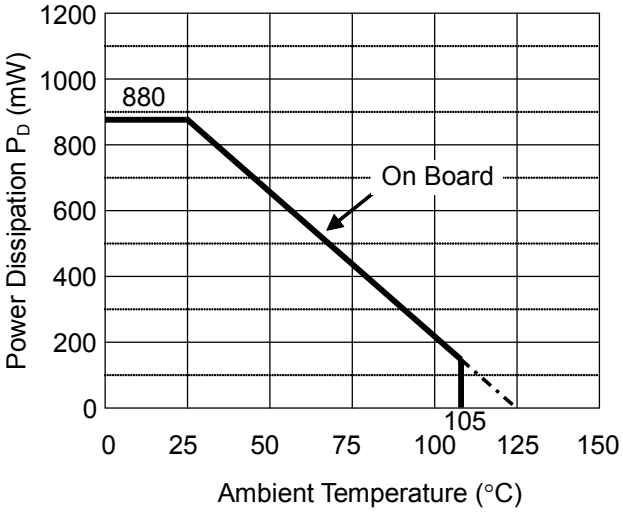
Power Dissipation (P_D) depends on conditions of mounting on board. This specification is based on the measurement at the condition below:

Measurement Conditions

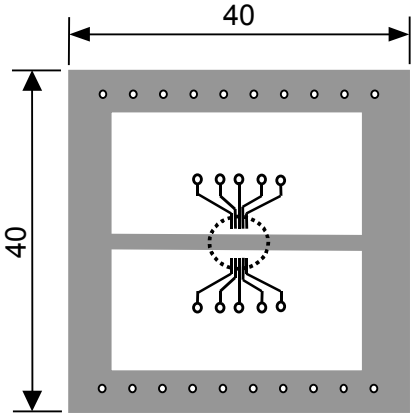
	Standard Test Land Pattern
Environment	Mounting on Board (Wind velocity=0m/s)
Board Material	Glass cloth epoxy plastic (Double sided)
Board Dimensions	40mm*40mm*1.6mm
Copper Ratio	Top side: Approx. 50%, Back side: Approx. 50%
Through-holes	ϕ 0.54mm * 30pcs

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

	Standard Test Land Pattern
Power Dissipation	880mW
Thermal Resistance	θja = (125-25 °C) / 0.88W = 114 °C/W



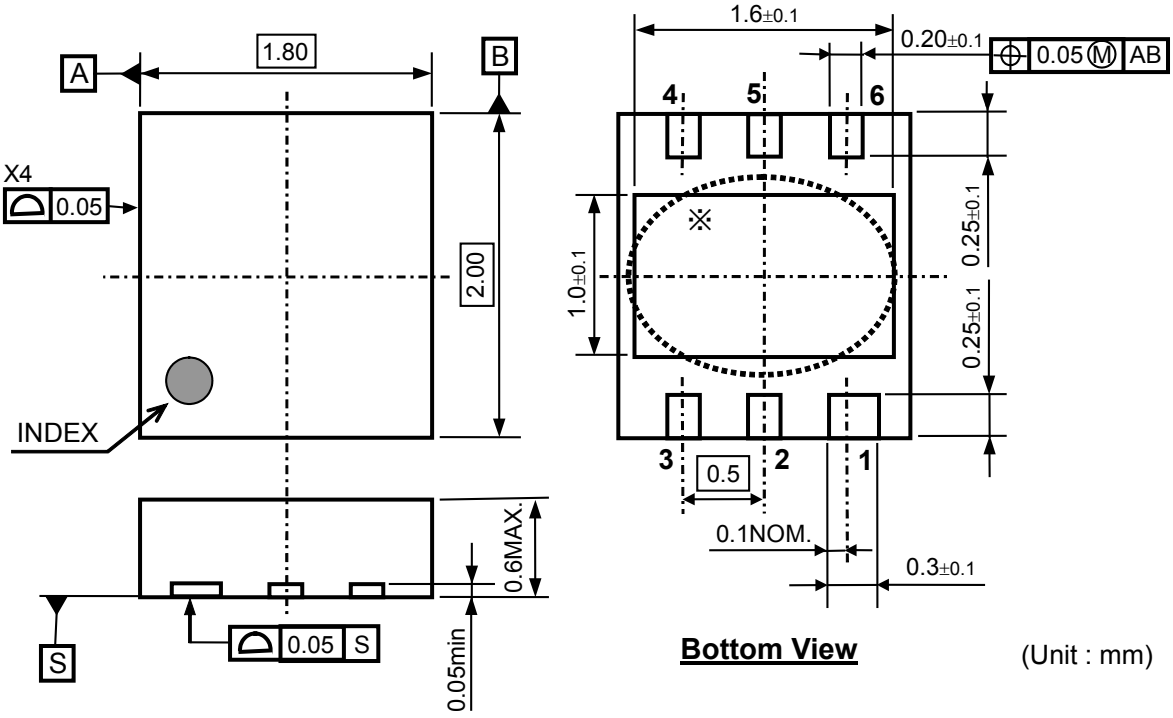
Power Dissipation



Measurement Board Pattern

IC Mount Area (Unit : mm)

PACKAGE DIMENSIONS (DFN(PLP)1820-6)

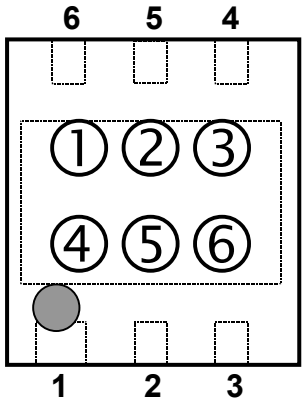


(Unit : mm)

※) Tab is GND level. (They are connected to the reverse side of this IC.)
The tab is better to be connected to the GND, but leaving it open is also acceptable.

MARK SPECIFICATION (DFN(PLP)1820-6)

①②③④ : Product Code ··· **Refer to *MARK SPECIFICATION TABLE***
⑤⑥ : Lot No. ··· Alphanumeric Serial Number



MARK SPECIFICATION TABLE (DFN(PLP)1820-6)

R3119KxxxA

Product Name	①②③④	Set Voltage	Product Name	①②③④	Set Voltage
R3119K023A	EU23	2.3 V	R3119K080A	EU80	8.0 V
R3119K024A	EU24	2.4 V	R3119K081A	EU81	8.1 V
R3119K025A	EU25	2.5 V	R3119K082A	EU82	8.2 V
R3119K026A	EU26	2.6 V	R3119K083A	EU83	8.3 V
R3119K027A	EU27	2.7 V	R3119K084A	EU84	8.4 V
R3119K028A	EU28	2.8 V	R3119K085A	EU85	8.5 V
R3119K029A	EU29	2.9 V	R3119K086A	EU86	8.6 V
			R3119K087A	EU87	8.7 V
R3119K030A	EU30	3.0 V	R3119K088A	EU88	8.8 V
R3119K031A	EU31	3.1 V	R3119K089A	EU89	8.9 V
R3119K032A	EU32	3.2 V			
R3119K033A	EU33	3.3 V	R3119K090A	EU90	9.0 V
R3119K034A	EU34	3.4 V	R3119K091A	EU91	9.1 V
R3119K035A	EU35	3.5 V	R3119K092A	EU92	9.2 V
R3119K036A	EU36	3.6 V	R3119K093A	EU93	9.3 V
R3119K037A	EU37	3.7 V	R3119K094A	EU94	9.4 V
R3119K038A	EU38	3.8 V	R3119K095A	EU95	9.5 V
R3119K039A	EU39	3.9 V	R3119K096A	EU96	9.6 V
			R3119K097A	EU97	9.7 V
R3119K040A	EU40	4.0 V	R3119K098A	EU98	9.8 V
R3119K041A	EU41	4.1 V	R3119K099A	EU99	9.9 V
R3119K042A	EU42	4.2 V			
R3119K043A	EU43	4.3 V	R3119K100A	EU00	10.0 V
R3119K044A	EU44	4.4 V	R3119K101A	EU01	10.1 V
R3119K045A	EU45	4.5 V	R3119K102A	EU02	10.2 V
R3119K046A	EU46	4.6 V	R3119K103A	EU03	10.3 V
R3119K047A	EU47	4.7 V	R3119K104A	EU04	10.4 V
R3119K048A	EU48	4.8 V	R3119K105A	EU05	10.5 V
R3119K049A	EU49	4.9 V	R3119K106A	EU06	10.6 V
			R3119K107A	EU07	10.7 V
R3119K050A	EU50	5.0 V	R3119K108A	EU08	10.8 V
R3119K051A	EU51	5.1 V	R3119K109A	EU09	10.9 V
R3119K052A	EU52	5.2 V			
R3119K053A	EU53	5.3 V	R3119K110A	EU10	11.0 V
R3119K054A	EU54	5.4 V	R3119K111A	EU11	11.1 V
R3119K055A	EU55	5.5 V	R3119K112A	EU12	11.2 V
R3119K056A	EU56	5.6 V	R3119K113A	EU13	11.3 V
R3119K057A	EU57	5.7 V	R3119K114A	EU14	11.4 V
R3119K058A	EU58	5.8 V	R3119K115A	EU15	11.5 V
R3119K059A	EU59	5.9 V	R3119K116A	EU16	11.6 V
			R3119K117A	EU17	11.7 V
R3119K060A	EU60	6.0 V	R3119K118A	EU18	11.8 V
R3119K061A	EU61	6.1 V	R3119K119A	EU19	11.9 V
R3119K062A	EU62	6.2 V			
R3119K063A	EU63	6.3 V	R3119K120A	EU20	12.0 V
R3119K064A	EU64	6.4 V			
R3119K065A	EU65	6.5 V			
R3119K066A	EU66	6.6 V			
R3119K067A	EU67	6.7 V			
R3119K068A	EU68	6.8 V			
R3119K069A	EU69	6.9 V			
R3119K070A	EU70	7.0 V			
R3119K071A	EU71	7.1 V			
R3119K072A	EU72	7.2 V			
R3119K073A	EU73	7.3 V			
R3119K074A	EU74	7.4 V			
R3119K075A	EU75	7.5 V			
R3119K076A	EU76	7.6 V			
R3119K077A	EU77	7.7 V			
R3119K078A	EU78	7.8 V			
R3119K079A	EU79	7.9 V			

R3119KxxxE

Product Name	①②③④	Set Voltage	Product Name	①②③④	Set Voltage
R3119K023E	EV23	2.3 V	R3119K080E	EV80	8.0 V
R3119K024E	EV24	2.4 V	R3119K081E	EV81	8.1 V
R3119K025E	EV25	2.5 V	R3119K082E	EV82	8.2 V
R3119K026E	EV26	2.6 V	R3119K083E	EV83	8.3 V
R3119K027E	EV27	2.7 V	R3119K084E	EV84	8.4 V
R3119K028E	EV28	2.8 V	R3119K085E	EV85	8.5 V
R3119K029E	EV29	2.9 V	R3119K086E	EV86	8.6 V
			R3119K087E	EV87	8.7 V
R3119K030E	EV30	3.0 V	R3119K088E	EV88	8.8 V
R3119K031E	EV31	3.1 V	R3119K089E	EV89	8.9 V
R3119K032E	EV32	3.2 V			
R3119K033E	EV33	3.3 V	R3119K090E	EV90	9.0 V
R3119K034E	EV34	3.4 V	R3119K091E	EV91	9.1 V
R3119K035E	EV35	3.5 V	R3119K092E	EV92	9.2 V
R3119K036E	EV36	3.6 V	R3119K093E	EV93	9.3 V
R3119K037E	EV37	3.7 V	R3119K094E	EV94	9.4 V
R3119K038E	EV38	3.8 V	R3119K095E	EV95	9.5 V
R3119K039E	EV39	3.9 V	R3119K096E	EV96	9.6 V
			R3119K097E	EV97	9.7 V
R3119K040E	EV40	4.0 V	R3119K098E	EV98	9.8 V
R3119K041E	EV41	4.1 V	R3119K099E	EV99	9.9 V
R3119K042E	EV42	4.2 V			
R3119K043E	EV43	4.3 V	R3119K100E	EV00	10.0 V
R3119K044E	EV44	4.4 V	R3119K101E	EV01	10.1 V
R3119K045E	EV45	4.5 V	R3119K102E	EV02	10.2 V
R3119K046E	EV46	4.6 V	R3119K103E	EV03	10.3 V
R3119K047E	EV47	4.7 V	R3119K104E	EV04	10.4 V
R3119K048E	EV48	4.8 V	R3119K105E	EV05	10.5 V
R3119K049E	EV49	4.9 V	R3119K106E	EV06	10.6 V
			R3119K107E	EV07	10.7 V
R3119K050E	EV50	5.0 V	R3119K108E	EV08	10.8 V
R3119K051E	EV51	5.1 V	R3119K109E	EV09	10.9 V
R3119K052E	EV52	5.2 V			
R3119K053E	EV53	5.3 V	R3119K110E	EV10	11.0 V
R3119K054E	EV54	5.4 V	R3119K111E	EV11	11.1 V
R3119K055E	EV55	5.5 V	R3119K112E	EV12	11.2 V
R3119K056E	EV56	5.6 V	R3119K113E	EV13	11.3 V
R3119K057E	EV57	5.7 V	R3119K114E	EV14	11.4 V
R3119K058E	EV58	5.8 V	R3119K115E	EV15	11.5 V
R3119K059E	EV59	5.9 V	R3119K116E	EV16	11.6 V
			R3119K117E	EV17	11.7 V
R3119K060E	EV60	6.0 V	R3119K118E	EV18	11.8 V
R3119K061E	EV61	6.1 V	R3119K119E	EV19	11.9 V
R3119K062E	EV62	6.2 V			
R3119K063E	EV63	6.3 V	R3119K120E	EV20	12.0 V
R3119K064E	EV64	6.4 V			
R3119K065E	EV65	6.5 V			
R3119K066E	EV66	6.6 V			
R3119K067E	EV67	6.7 V			
R3119K068E	EV68	6.8 V			
R3119K069E	EV69	6.9 V			
R3119K070E	EV70	7.0 V			
R3119K071E	EV71	7.1 V			
R3119K072E	EV72	7.2 V			
R3119K073E	EV73	7.3 V			
R3119K074E	EV74	7.4 V			
R3119K075E	EV75	7.5 V			
R3119K076E	EV76	7.6 V			
R3119K077E	EV77	7.7 V			
R3119K078E	EV78	7.8 V			
R3119K079E	EV79	7.9 V			

POWER DISSIPATION (SOT-23-5)

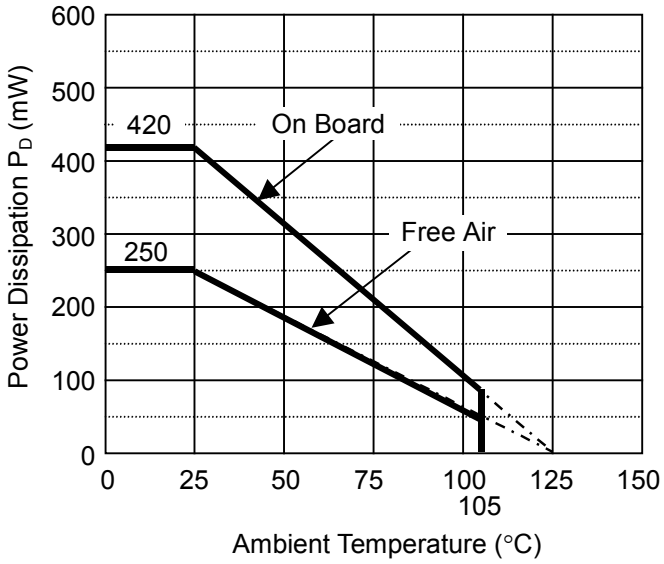
Power Dissipation (P_D) depends on conditions of mounting on board. This specification is based on the measurement at the condition below:
(Power Dissipation (SOT-23-5) is substitution of SOT-23-6.)

* Measurement Conditions

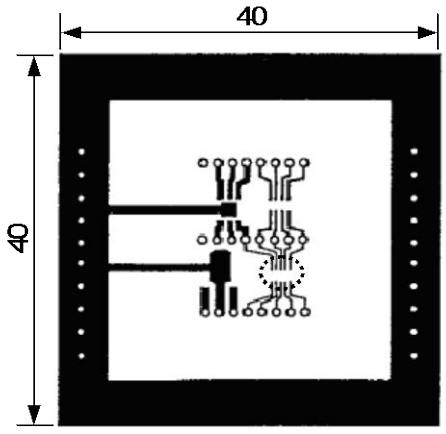
	Standard Test Land Pattern
Environment	Mounting on Board (Wind velocity=0m/s)
Board Material	Glass cloth epoxy plastic (Double sided)
Board Dimensions	40mm*40mm*1.6mm
Copper Ratio	Top side: Approx. 50%, Back side: Approx. 50%
Through-holes	ϕ 0.5mm * 44pcs

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

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



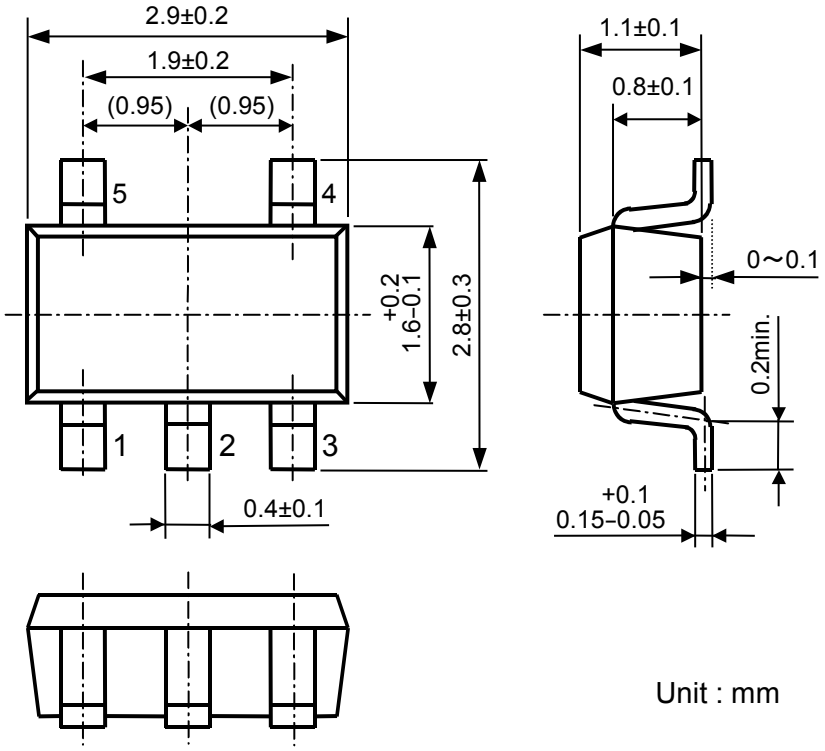
Power Dissipation



Measurement Board Pattern

IC Mount Area (Unit: mm)

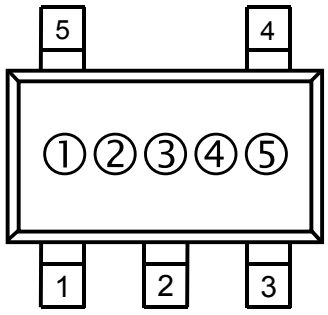
PACKAGE DIMENSIONS (SOT-23-5)



Unit : mm

MARK SPECIFICATION (SOT-23-5)

①②③ : Product Code ･･･ **Refer to *MARK SPECIFICATION TABLE***
④⑤ : Lot No. ･･･ Alphanumeric Serial Number



MARK SPECIFICATION TABLE (SOT-23-5)

R3119NxxxA

Product Name	①②③	Set Voltage
R3119N023A	V 0 A	2.3 V
R3119N024A	V 0 B	2.4 V
R3119N025A	V 0 C	2.5 V
R3119N026A	V 0 D	2.6 V
R3119N027A	V 0 E	2.7 V
R3119N028A	V 0 F	2.8 V
R3119N029A	V 0 G	2.9 V
R3119N030A	V 0 H	3.0 V
R3119N031A	V 0 J	3.1 V
R3119N032A	V 0 K	3.2 V
R3119N033A	V 0 L	3.3 V
R3119N034A	V 0 M	3.4 V
R3119N035A	V 0 N	3.5 V
R3119N036A	V 0 P	3.6 V
R3119N037A	V 0 R	3.7 V
R3119N038A	V 0 S	3.8 V
R3119N039A	V 0 T	3.9 V
R3119N040A	V 0 U	4.0 V
R3119N041A	V 0 V	4.1 V
R3119N042A	V 0 W	4.2 V
R3119N043A	V 0 X	4.3 V
R3119N044A	V 0 Y	4.4 V
R3119N045A	V 0 Z	4.5 V
R3119N046A	W 0 A	4.6 V
R3119N047A	W 0 B	4.7 V
R3119N048A	W 0 C	4.8 V
R3119N049A	W 0 D	4.9 V
R3119N050A	W 0 E	5.0 V
R3119N051A	W 0 F	5.1 V
R3119N052A	W 0 G	5.2 V
R3119N053A	W 0 H	5.3 V
R3119N054A	W 0 J	5.4 V
R3119N055A	W 0 K	5.5 V
R3119N056A	W 0 L	5.6 V
R3119N057A	W 0 M	5.7 V
R3119N058A	W 0 N	5.8 V
R3119N059A	W 0 P	5.9 V
R3119N060A	W 0 R	6.0 V
R3119N061A	W 0 S	6.1 V
R3119N062A	W 0 T	6.2 V
R3119N063A	W 0 U	6.3 V
R3119N064A	W 0 V	6.4 V
R3119N065A	W 0 W	6.5 V
R3119N066A	W 0 X	6.6 V
R3119N067A	W 0 Y	6.7 V
R3119N068A	W 0 Z	6.8 V
R3119N069A	X 0 A	6.9 V
R3119N070A	X 0 B	7.0 V
R3119N071A	X 0 C	7.1 V
R3119N072A	X 0 D	7.2 V
R3119N073A	X 0 E	7.3 V
R3119N074A	X 0 F	7.4 V
R3119N075A	X 0 G	7.5 V
R3119N076A	X 0 H	7.6 V
R3119N077A	X 0 J	7.7 V
R3119N078A	X 0 K	7.8 V
R3119N079A	X 0 L	7.9 V

Product Name	①②③	Set Voltage
R3119N080A	X 0 M	8.0 V
R3119N081A	X 0 N	8.1 V
R3119N082A	X 0 P	8.2 V
R3119N083A	X 0 R	8.3 V
R3119N084A	X 0 S	8.4 V
R3119N085A	X 0 T	8.5 V
R3119N086A	X 0 U	8.6 V
R3119N087A	X 0 V	8.7 V
R3119N088A	X 0 W	8.8 V
R3119N089A	X 0 X	8.9 V
R3119N090A	X 0 Y	9.0 V
R3119N091A	X 0 Z	9.1 V
R3119N092A	Y 0 A	9.2 V
R3119N093A	Y 0 B	9.3 V
R3119N094A	Y 0 C	9.4 V
R3119N095A	Y 0 D	9.5 V
R3119N096A	Y 0 E	9.6 V
R3119N097A	Y 0 F	9.7 V
R3119N098A	Y 0 G	9.8 V
R3119N099A	Y 0 H	9.9 V
R3119N100A	Y 0 J	10.0 V
R3119N101A	Y 0 K	10.1 V
R3119N102A	Y 0 L	10.2 V
R3119N103A	Y 0 M	10.3 V
R3119N104A	Y 0 N	10.4 V
R3119N105A	Y 0 P	10.5 V
R3119N106A	Y 0 R	10.6 V
R3119N107A	Y 0 S	10.7 V
R3119N108A	Y 0 T	10.8 V
R3119N109A	Y 0 U	10.9 V
R3119N110A	Y 0 V	11.0 V
R3119N111A	Y 0 W	11.1 V
R3119N112A	Y 0 X	11.2 V
R3119N113A	Y 0 Y	11.3 V
R3119N114A	Y 0 Z	11.4 V
R3119N115A	Z 0 A	11.5 V
R3119N116A	Z 0 B	11.6 V
R3119N117A	Z 0 C	11.7 V
R3119N118A	Z 0 D	11.8 V
R3119N119A	Z 0 E	11.9 V
R3119N120A	Z 0 F	12.0 V

R3119NxxxE

Product Name	①②③	Set Voltage
R3119N023E	V 1 A	2.3 V
R3119N024E	V 1 B	2.4 V
R3119N025E	V 1 C	2.5 V
R3119N026E	V 1 D	2.6 V
R3119N027E	V 1 E	2.7 V
R3119N028E	V 1 F	2.8 V
R3119N029E	V 1 G	2.9 V
R3119N030E	V 1 H	3.0 V
R3119N031E	V 1 J	3.1 V
R3119N032E	V 1 K	3.2 V
R3119N033E	V 1 L	3.3 V
R3119N034E	V 1 M	3.4 V
R3119N035E	V 1 N	3.5 V
R3119N036E	V 1 P	3.6 V
R3119N037E	V 1 R	3.7 V
R3119N038E	V 1 S	3.8 V
R3119N039E	V 1 T	3.9 V
R3119N040E	V 1 U	4.0 V
R3119N041E	V 1 V	4.1 V
R3119N042E	V 1 W	4.2 V
R3119N043E	V 1 X	4.3 V
R3119N044E	V 1 Y	4.4 V
R3119N045E	V 1 Z	4.5 V
R3119N046E	W 1 A	4.6 V
R3119N047E	W 1 B	4.7 V
R3119N048E	W 1 C	4.8 V
R3119N049E	W 1 D	4.9 V
R3119N050E	W 1 E	5.0 V
R3119N051E	W 1 F	5.1 V
R3119N052E	W 1 G	5.2 V
R3119N053E	W 1 H	5.3 V
R3119N054E	W 1 J	5.4 V
R3119N055E	W 1 K	5.5 V
R3119N056E	W 1 L	5.6 V
R3119N057E	W 1 M	5.7 V
R3119N058E	W 1 N	5.8 V
R3119N059E	W 1 P	5.9 V
R3119N060E	W 1 R	6.0 V
R3119N061E	W 1 S	6.1 V
R3119N062E	W 1 T	6.2 V
R3119N063E	W 1 U	6.3 V
R3119N064E	W 1 V	6.4 V
R3119N065E	W 1 W	6.5 V
R3119N066E	W 1 X	6.6 V
R3119N067E	W 1 Y	6.7 V
R3119N068E	W 1 Z	6.8 V
R3119N069E	X 1 A	6.9 V
R3119N070E	X 1 B	7.0 V
R3119N071E	X 1 C	7.1 V
R3119N072E	X 1 D	7.2 V
R3119N073E	X 1 E	7.3 V
R3119N074E	X 1 F	7.4 V
R3119N075E	X 1 G	7.5 V
R3119N076E	X 1 H	7.6 V
R3119N077E	X 1 J	7.7 V
R3119N078E	X 1 K	7.8 V
R3119N079E	X 1 L	7.9 V

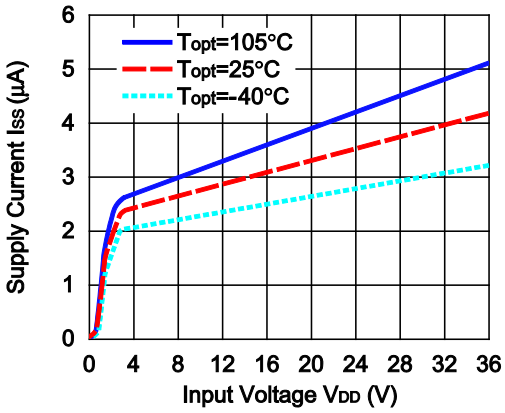
Product Name	①②③	Set Voltage
R3119N080E	X 1 M	8.0 V
R3119N081E	X 1 N	8.1 V
R3119N082E	X 1 P	8.2 V
R3119N083E	X 1 R	8.3 V
R3119N084E	X 1 S	8.4 V
R3119N085E	X 1 T	8.5 V
R3119N086E	X 1 U	8.6 V
R3119N087E	X 1 V	8.7 V
R3119N088E	X 1 W	8.8 V
R3119N089E	X 1 X	8.9 V
R3119N090E	X 1 Y	9.0 V
R3119N091E	X 1 Z	9.1 V
R3119N092E	Y 1 A	9.2 V
R3119N093E	Y 1 B	9.3 V
R3119N094E	Y 1 C	9.4 V
R3119N095E	Y 1 D	9.5 V
R3119N096E	Y 1 E	9.6 V
R3119N097E	Y 1 F	9.7 V
R3119N098E	Y 1 G	9.8 V
R3119N099E	Y 1 H	9.9 V
R3119N100E	Y 1 J	10.0 V
R3119N101E	Y 1 K	10.1 V
R3119N102E	Y 1 L	10.2 V
R3119N103E	Y 1 M	10.3 V
R3119N104E	Y 1 N	10.4 V
R3119N105E	Y 1 P	10.5 V
R3119N106E	Y 1 R	10.6 V
R3119N107E	Y 1 S	10.7 V
R3119N108E	Y 1 T	10.8 V
R3119N109E	Y 1 U	10.9 V
R3119N110E	Y 1 V	11.0 V
R3119N111E	Y 1 W	11.1 V
R3119N112E	Y 1 X	11.2 V
R3119N113E	Y 1 Y	11.3 V
R3119N114E	Y 1 Z	11.4 V
R3119N115E	Z 1 A	11.5 V
R3119N116E	Z 1 B	11.6 V
R3119N117E	Z 1 C	11.7 V
R3119N118E	Z 1 D	11.8 V
R3119N119E	Z 1 E	11.9 V
R3119N120E	Z 1 F	12.0 V

TYPICAL CHARACTERISTICS

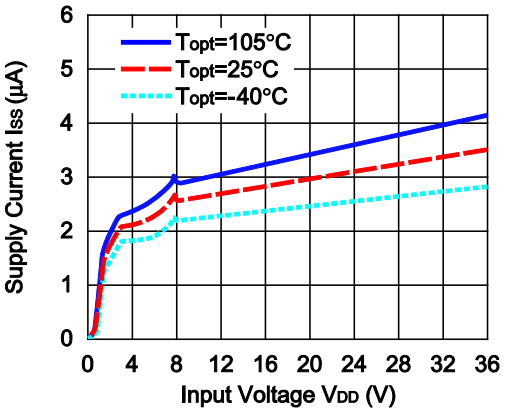
Note: Typical Characteristics are intended to be used as reference data; they are not guaranteed.

1) Supply Current vs. Input Voltage

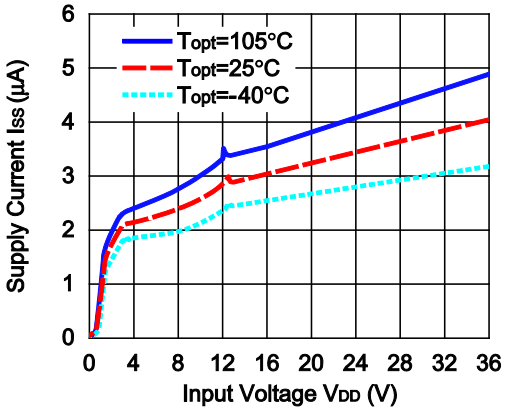
R3119x023A



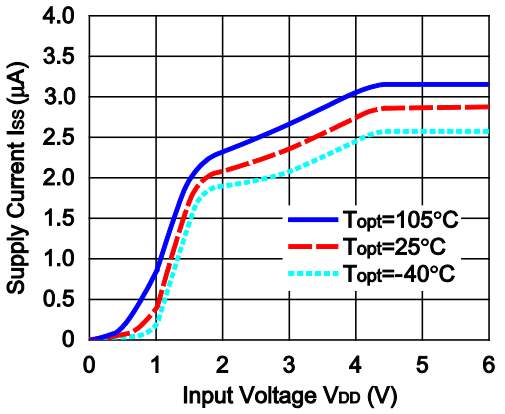
R3119x077A



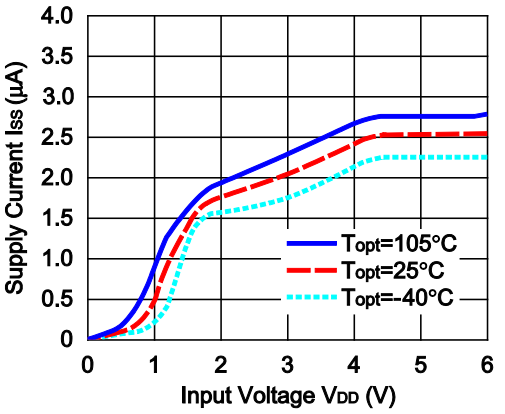
R3119x120A



R3119xxxxE (at release)

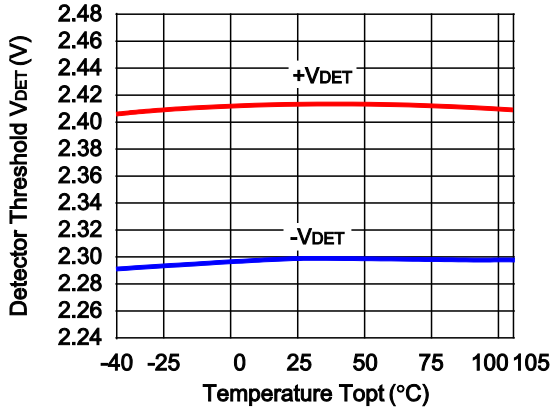


R3119xxxxE (at detecting)

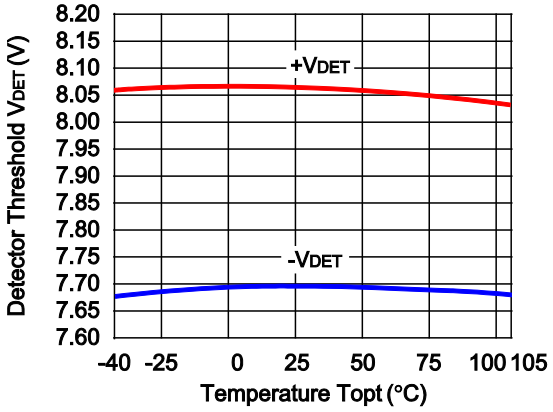


2）Detector Threshold vs. Temperature

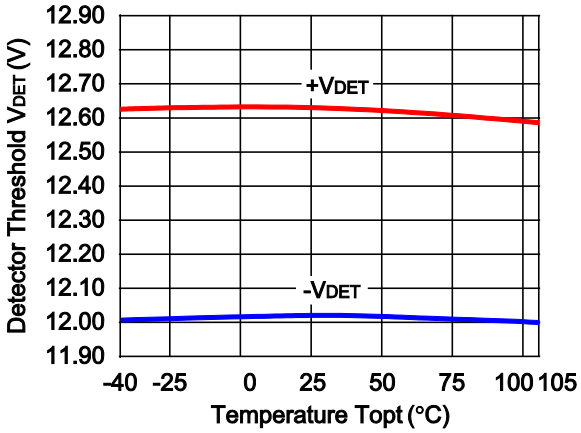
R3119x023A/E



R3119x077A/E

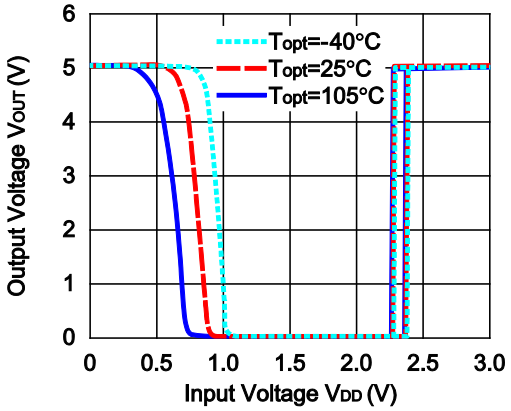


R3119x120A/E

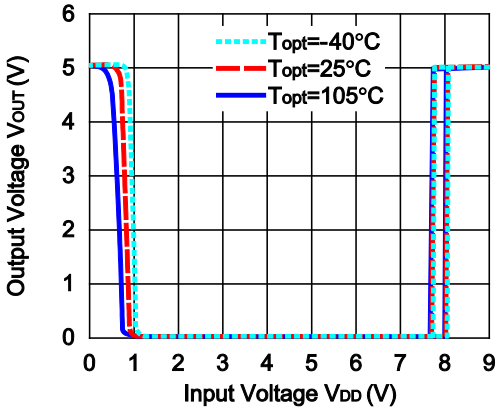


3）Output Voltage vs. Input Voltage

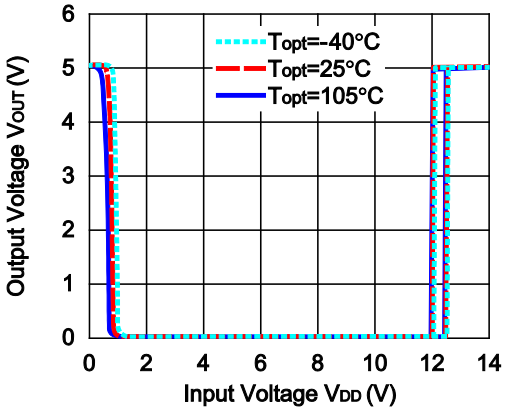
R3119x023A/E



R3119x077A/E

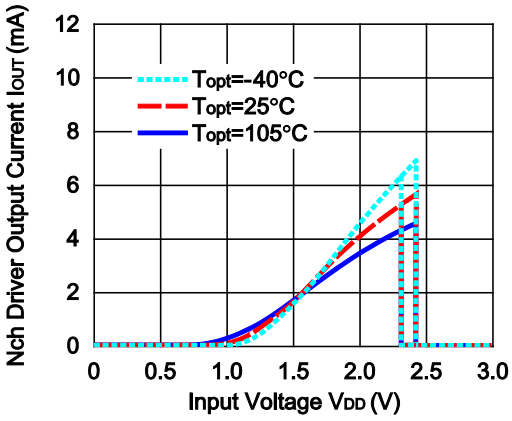


R3119x120A/E

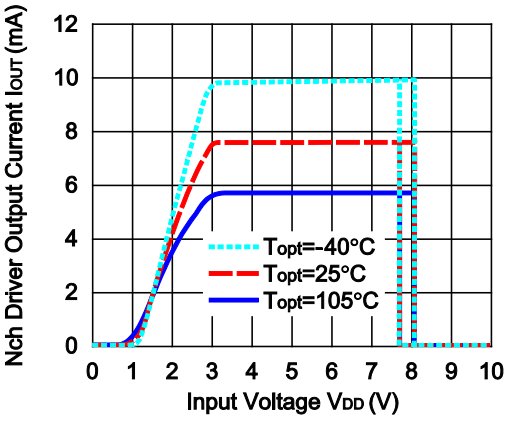


4) Nch. Driver Output Current vs. Input Voltage

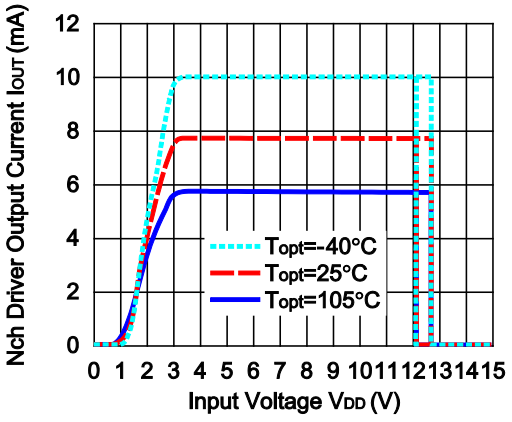
R3119x023A



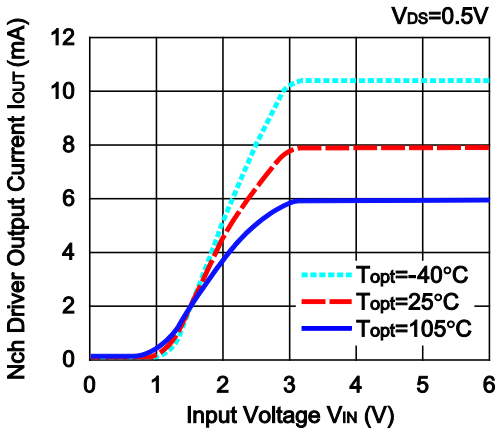
R3119x077A



R3119x120A

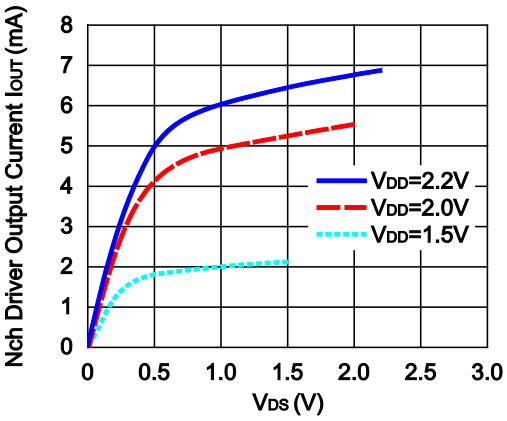


R3119xxxxE

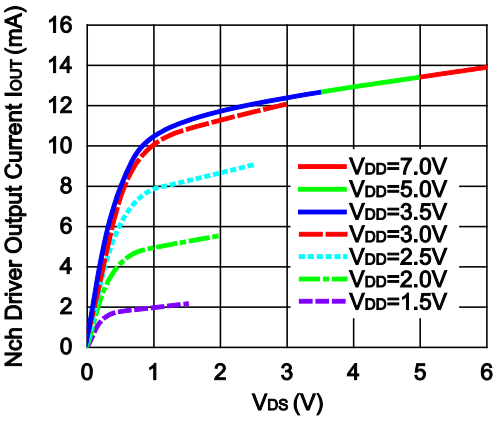


5) Nch. Driver Output Current vs. V_{DS}

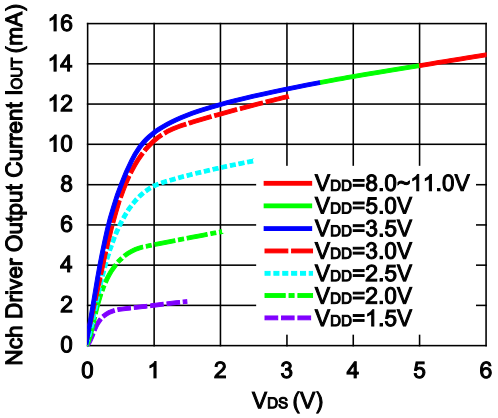
R3119x023A



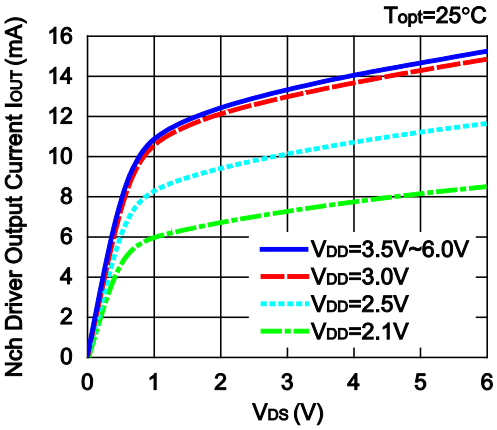
R3119x077A



R3119x120A

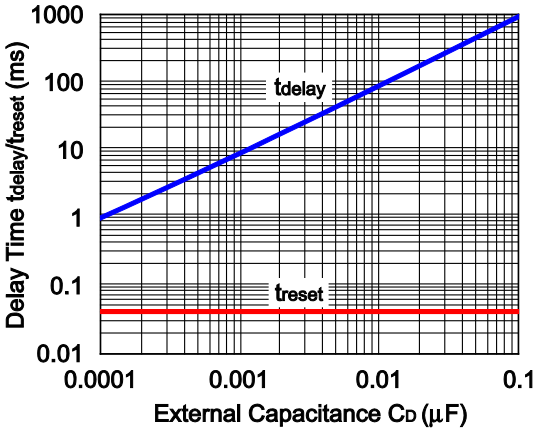


R3119xxxxE

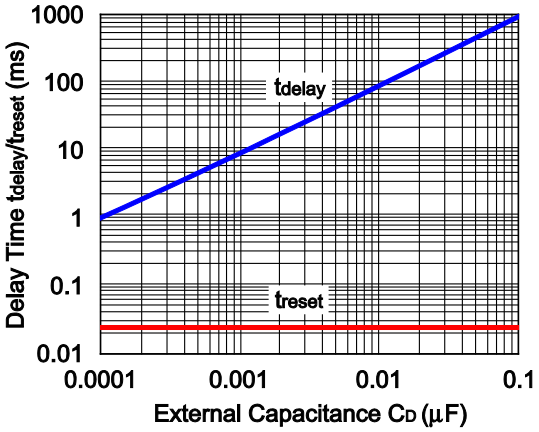


6) Delay Time vs. External Capacitor for C_D Pin (Ta = 25°C)

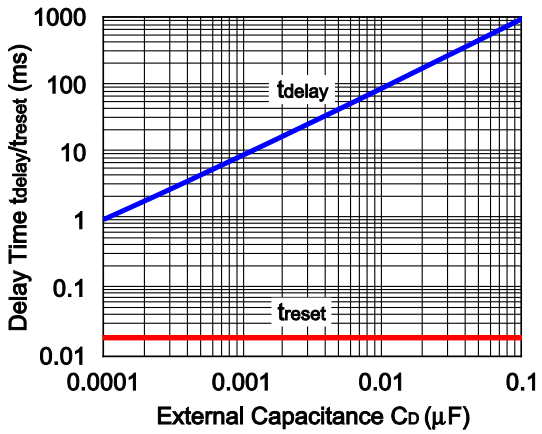
R3119x023A



R3119x077A

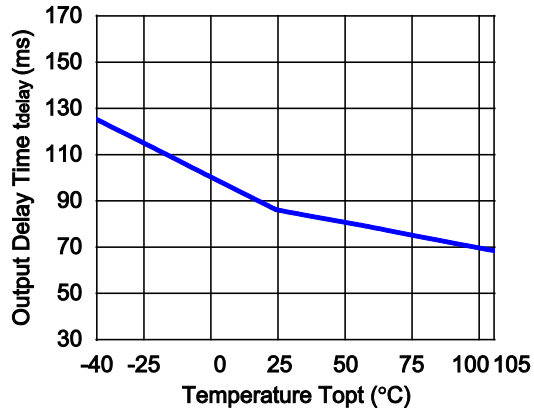


R3119x120A

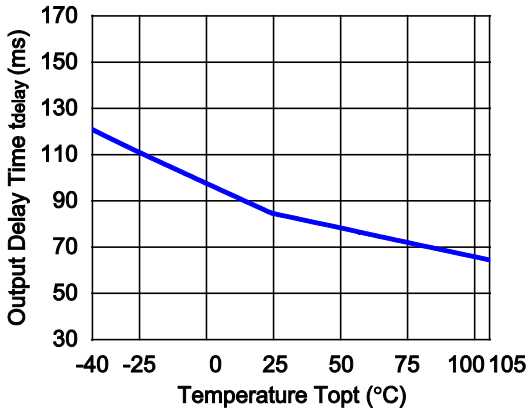


7）Release Output Delay Time vs. Temperature (C_D = 0.01∝F)

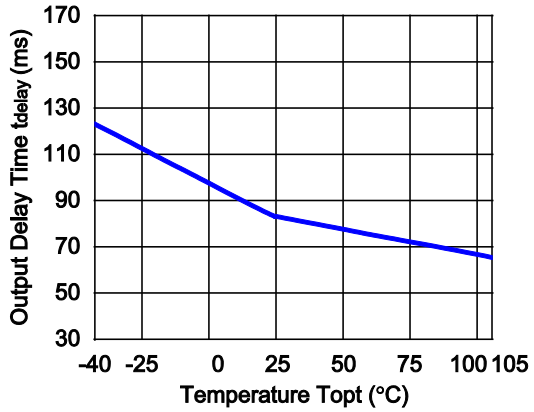
R3119x023A



R3119x077A

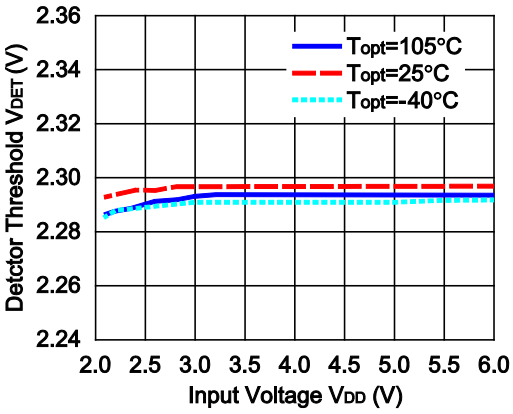


R3119x120A

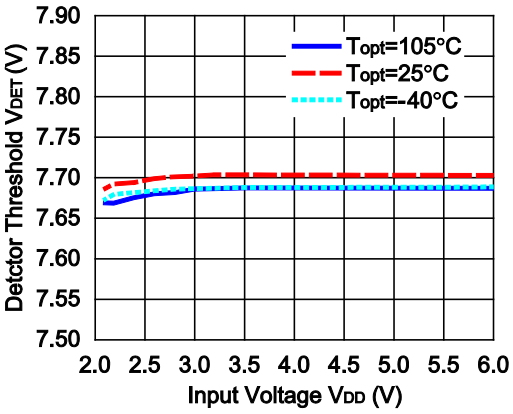


8）Detector Threshold vs. Input Voltage

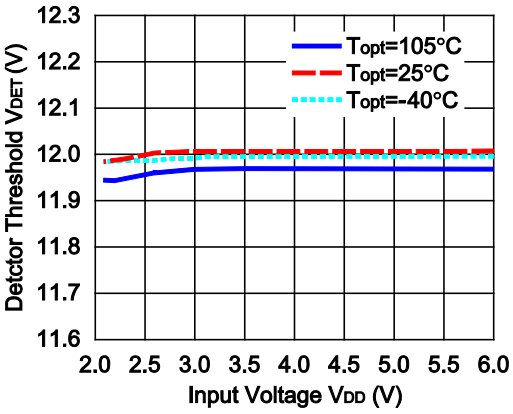
R3119x023E



R3119x077E

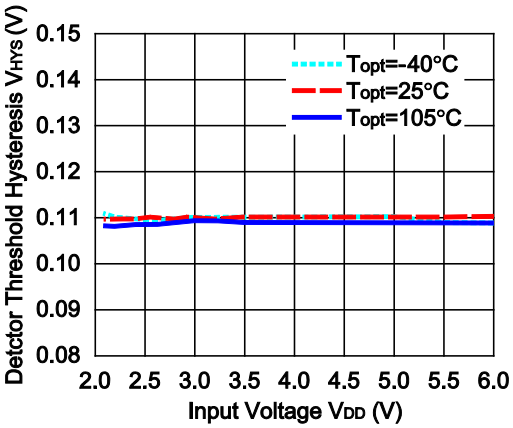


R3119x120E

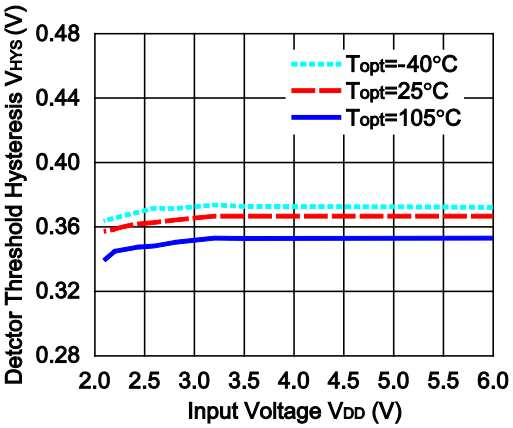


9）Hysteresis Range vs. Input Voltage

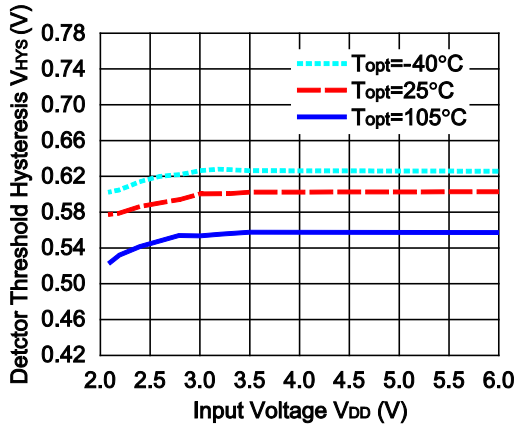
R3119x023E



R3119x077E

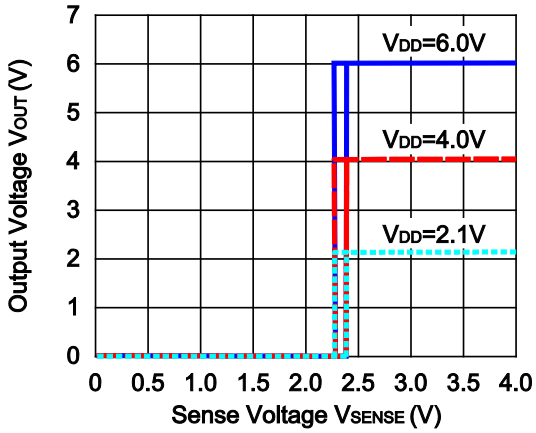


R3119x120E

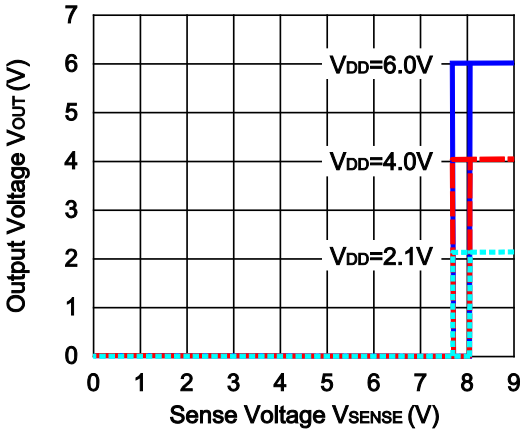


10）Output Voltage vs. SENSE Pin Input Voltage （Ta = 25°C, D_{OUT}: pulled-up to V_{DD} with 100 kΩ）

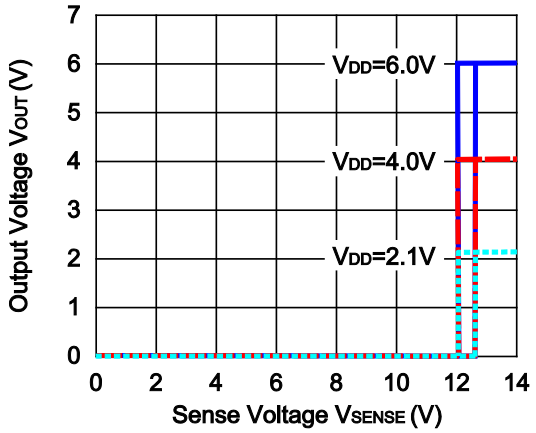
R3119x023E



R3119x077E



R3119x120E



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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.

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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.
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