# **RICOH** R3152N-Y Series

## 42 V Input Window Voltage Detector for Industrial Applications

No. EY-405-200904

#### **OVERVIEW**

The R3152N is a window voltage detector suited for achieving the functional safety. This device monitors over- and under- voltage of the output voltage from the power supply IC for a microprocessor and a sensor, and can prevent malfunction of system caused by abnormal voltage. 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.

#### **KEY BENEFITS**

- A stable voltage with supplying the battery voltage can provide the power supply and the voltage supervising separately.
- High-accuracy detection enables with Overvoltage/Undervoltage Detection Accuracy of -1.25% to 0.75% and Hysteresis of 1.5%.
- Small package of SOT-23-6 is adopted, and a safe and secure pin assignment with considering a short among adjacent pins.

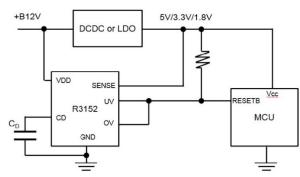
#### **KEY SPECIFICATIONS**

- Operating Voltage Range (Max. Rating): 3.0 V to 42.0 V (50.0 V)
- Operating Temperature Range: -50°C to 125°C
- Supply Current: Typ. 1.5 µA
- Overvoltage Detection: 1.1 V to 5.9 V (0.01 V step)
- Undervoltage Detection: 1.0 V to 4.8 V (0.01 V step)
- Detection Release Hysteresis: A, Typ. 1.0% with hysteresis

#### B, No hysteresis

- Detection Voltage Accuracy: ±0.5% (Ta = 25°C)
  - -1.25% to 0.75% (-50°C to 125°C)
- Release Delay Time: Typ. 4 ms ( $C_D = 0.01 \ \mu F$ )
- Output Type: Nch. Open Drain

#### **TYPICAL APPLICATIONS**



 $C_{\mbox{\scriptsize D}}$ : a capacitor set according to the release delay times

#### APPLICATIONS

- Factory Automation Equipment, Smart meters
- High Temperature Devices: Surveillance Cameras and Vending Machines
- Self-heating Devices: Motors and Lightings

#### SELECTION GUIDE

Product Name	Package	Quantity per Reel
R3152Nxxx\$-TR-YE	SOT-23-6	3,000 pcs

xxx: The combination of an overvoltage detection setting voltage (VOVSET) and an undervoltage detection setting voltage (VUVSET)

Refer to Product-specific Electrical Characteristics for more details.

#### \$: Hysteresis

<del>+</del> ••• <b>)</b> ••••					
\$	Hysteresis				
Α	Yes				
В	No				

#### PACKAGE



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

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## **SELECTION GUIDE**

The overvoltage detection setting voltage ( $V_{OVSET}$ ) and the undervoltage detection setting voltage ( $V_{UVSET}$ ) are user-selectable options.

#### **Selection Guide**

Product Name	Package	Quantity per Reel	Pb Free	Halogen Free	
R3152Nxxx\$-TR-YE	SOT-23-6	3,000 pcs	Yes	Yes	

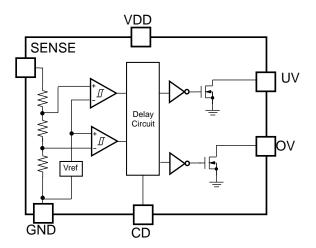
xxx: The combination of an overvoltage detection setting voltage (V<sub>OVSET</sub>) and an undervoltage detection setting voltage (V<sub>UVSET</sub>).

Refer to Product-specific Electrical Characteristics for more details.

\$: Hysteresis

\$	Hysteresis
А	Yes
В	No

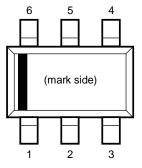
**BLOCK DIAGRAM** 



**R3152N Block Diagram** 

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## **PIN DESCRIPTIONS**

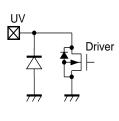


**SOT-23-6 Pin Configuration** 

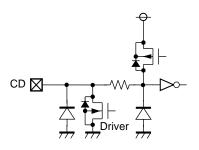
Pin No.	Symbol	Description
1	VDD	Supply Voltage Pin
2	CD	VD Release Delay Time Set Pin (for connecting with external capacitor for delay)
3	UV	Undervoltage Detection Output Pin ("Low" at detection)
4	OV	Overvoltage Detection Output Pin ("Low" at detection)
5	GND	GND Pin
6	SENSE	SENSE Pin

#### Internal Equivalent Circuit for Each Pin

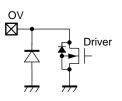




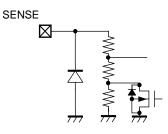
CD Pin











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## **ABSOLUTE MAXIMUM RATINGS**

#### **Absolute Maximum Ratings**

Symbol	Parameter	Rating	Unit
	Supply Voltage	-0.3 to 50.0	V
Vdd	Peak Voltage <sup>(1)</sup>	60	V
Vcd	CD Pin Output Voltage	-0.3 to 50.0	V
Vuvout	UV Pin Output Voltage	-0.3 to 7.0	V
Vovout	OV Pin Output Voltage	-0.3 to 7.0	V
VSENSE	SENSE Pin Input Voltage	-0.3 to 7.0	V
Ιυνουτ	UV Pin Output Current	30	mA
Ιονουτ	OV Pin Output Current	30	mA
PD	Power Dissipation <sup>(2)</sup> (SOT-23-6, JEDEC STD.51-7)	830	mW
Tj	Junction Temperature Range	-50 to 150	°C
Tstg	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.

## **RECCOMENDED OPERATING CONDITIONS**

#### Recommended Operating Conditions

Symbol	Parameter	Rating	Unit
Vdd	Operating Voltage	3.0 to 42	V
VSENSE	SENSE Pin Input Voltage	0 to 6.0	V
Та	Operating Temperature Range	-50 to 125	°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> Duration Time: 200 ms

<sup>&</sup>lt;sup>(2)</sup> Refer to POWER DISSIPATION for detailed information.



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## **ELECTRICAL CHARACTERISTICS**

 $V_{DD}$  = 14 V,  $C_D$  = 0.01 µF, pulled-up to 5 V with 100 k $\Omega$ , unless otherwise specified. The specifications surrounded by are guaranteed by design engineering at  $-50^{\circ}C \le Ta \le 125^{\circ}C$ .

R3152N (·	<b>3152N (-YE) Electrical Characteristics</b> (Ta= 25°C)						
Symbol	Parameter	Test Conditions/Comments	Min.	Тур.	Max.	Unit	
Vovdet	Overvoltage (OV) Detector	Ta = 25°C	x0.995		x1.005	V	
VOVDET	Threshold	–50°C ≤ Ta ≤ 125°C	x0.9875		x1.0075	V	
VUVDET	Undervoltage (UV) Detector	Ta = 25°C	x0.995		x1.005	V	
V UVDET	Threshold	–50°C ≤ Ta ≤ 125°C	x0.9875		x1.0075	V	
V <sub>OVHYS</sub>	Overvoltage (OV) Threshold Hysteresis	With Hysteresis	V <sub>OVDET</sub> ×0.005	V <sub>OVDET</sub> ×0.01	V <sub>OVDET</sub> ×0.015	V	
		No Hysteresis	0		10	mV	
Vuvhys	Undervoltage (UV) Threshold Hysteresis	With Hysteresis	V <sub>UVDET</sub> ×0.005	V <sub>UVDET</sub> ×0.01	V <sub>UVDET</sub> ×0.015	V	
		No Hysteresis	0		10	mV	
Iss	Consumption Current	VUVDET < SENSE < VOVDET		1.5	3.2	μA	
RSENSE	SENSE Pin Resistance		7	14	28	MΩ	
Vuvlo	UVLO Detector Threshold			1.8	2.8	V	
VUVLOHYS	UVLO Threshold Hysteresis			0.1	0.2	V	
Vovout	Overvoltage (OV) pulled-up output voltage				6.0	V	
VUVOUT	Undervoltage (UV) pulled-up output voltage				6.0	V	
V <sub>DDLOV</sub>	Overvoltage (OV) Low-operating Voltage <sup>(1)</sup>				1.7	V	
Vddluv	Undervoltage (UV) Low-operating Voltage <sup>(1)</sup>				1.7	V	
laum.	OV Pin Nch. Driver Output Current	$V_{DD} = 3.0, V_{DS} = 0.1 V$	0.8	1.8		mA	
I <sub>OUT</sub>	UV Pin Nch. Driver Output Current	$V_{DD} = 3.0, V_{DS} = 0.1 V$	0.8	1.8		mA	
	OV Pin Nch.Driver Leak Current	Vovout = 5.5 V			0.3	μA	
LEAK	UV Pin Nch Driver Leak Current	Vuvout = 5.5 V			0.3	μA	
t <sub>DELAY</sub>	Release Delay Time		2.5	4	8	ms	

All test items listed under Electrical Characteristics are done under the pulse load condition (Tj  $\approx$  Ta = 25°C).

 $<sup>^{(1)}</sup>$  Minimum value of power supply voltage when an output voltage will become less than 0.1 V at detection. (Pulled-up resistance: 100 k $\Omega$ , Pulled-up voltage: 5 V)

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 $V_{DD} = 14 \text{ V}, C_D = 0.01 \mu\text{F}, \text{ pulled-up to 5 V with 100 k}\Omega, \text{ unless otherwise specified.}$ The specifications surrounded by \_\_\_\_\_\_ are guaranteed by design engineering at  $-50^{\circ}\text{C} \le \text{Ta} \le 125^{\circ}\text{C}.$ 

#### R3152N (-YE) Product-specific Electrical Characteristics

(Ta = 25°C)

Product	Vo	VDET <b>(V)</b>		V	UVDET (	IVDET (V) VOVHYS (V)					VUVHYS (V)			
name	Min.	Тур.	Max.	Min.	Тур.	Max.	Min.	Тур.	Max.	Min.	Тур.	Max.		
R3152N001A	5.27350	5.30	5.32650	4.67650	4.70	4.72350	0.02650	0.05300	0.07950	0.02350	0.04700	0.07050		
R3152N002A	3.52230	3.54	3.55770	3.03475	3.05	3.06525	0.01770	0.03540	0.05310	0.01525	0.03050	0.04575		
R3152N003B	3.55215	3.57	3.58785	2.48750	2.50	2.51250	0	-	0.01000	0	-	0.01000		
R3152N004A	1.86065	1.87	1.87935	1.73130	1.74	1.74870	0.00935	0.01870	0.02805	0.00870	0.01740	0.02610		
R3152N005A	3.41285	3.43	3.44715	3.17405	3.19	3.20595	0.01715	0.03430	0.05145	0.01595	0.03190	0.04785		
R3152N013A	1.32335	1.33	1.33665	1.16415	1.17	1.17585	0.00665	0.01330	0.01995	0.00585	0.01170	0.01755		
R3152N014A	1.16415	1.17	1.17585	1.06963	1.075	1.08037	0.00585	0.01170	0.01755	0.00538	0.01075	0.01613		
R3152N015A	1.28355	1.29	1.29645	1.15420	1.16	1.16580	0.00645	0.01290	0.01935	0.00580	0.01160	0.01740		
R3152N017A	3.55215	3.57	3.58785	2.72630	2.74	2.75370	0.01785	0.03570	0.05355	0.01370	0.02740	0.04110		
R3152N020A	1.24375	1.25	1.25625	1.11440	1.12	1.12560	0.00625	0.01250	0.01875	0.00560	0.01120	0.01680		
R3152N201B	1.23380	1.24	1.24620	1.16415	1.17	1.17585	0	-	0.01000	0	-	0.01000		
R3152N101B	2.58700	2.60	2.61300	2.39795	2.41	2.42205	0	-	0.01000	0	-	0.01000		
R3152N102B	3.41285	3.43	3.44715	3.16410	3.18	3.19590	0	-	0.01000	0	-	0.01000		
R3152N203A	1.39300	1.40	1.40700	0.99500	1.00	1.00500	0.00700	0.01400	0.02100	0.00500	0.01000	0.01500		
R3152N204A	1.62185	1.63	1.63815	1.40295	1.41	1.41705	0.00815	0.01630	0.02445	0.00705	0.01410	0.02115		
R3152N103A	5.77100	5.80	5.82900	4.75610	4.78	4.80390	0.02900	0.05800	0.08700	0.02390	0.04780	0.07170		
R3152N104A	3.38300	3.40	3.41700	1.59200	1.60	1.60800	0.01700	0.03400	0.05100	0.00800	0.01600	0.02400		

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 $V_{DD} = 14 \text{ V}, C_D = 0.01 \mu\text{F}, \text{ pulled-up to 5 V with 100 k}\Omega, \text{ unless otherwise specified.}$ The specifications surrounded by \_\_\_\_\_\_ are guaranteed by design engineering at  $-50^{\circ}\text{C} \le \text{Ta} \le 125^{\circ}\text{C}.$ 

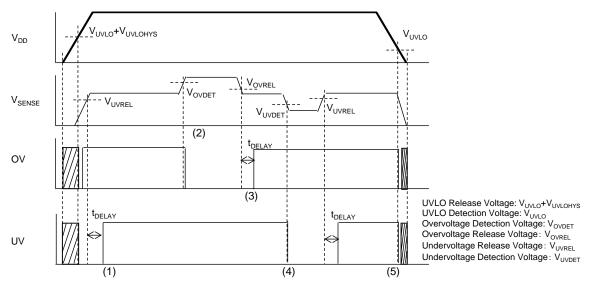
#### R3152N (-YE) Product-specific Electrical Characteristics

#### (–50°C ≤ Ta ≤ 125°C)

· · · ·	,	•					-			(			
Product	V	OVDET (	/)	v	UVDET (	V)	,	Vovnys (V)			VUVHYS (V)		
name	Min.	Тур.	Max.	Min.	Тур.	Max.	Min.	Тур.	Max.	Min.	Тур.	Max.	
R3152N001A	5.23375	5.30	5.33975	4.64125	4.70	4.73525	0.02650	0.0530	0.07950	0.02350	0.04700	0.07050	
R3152N002A	3.49575	3.54	3.56655	3.01188	3.05	3.07287	0.01770	0.0354	0.05310	0.01525	0.03050	0.04575	
R3152N003B	3.52538	3.57	3.59678	2.46875	2.50	2.51875	0	-	0.01000	0	-	0.01000	
R3152N004A	1.84663	1.87	1.88403	1.71825	1.74	1.75305	0.00935	0.01870	0.02805	0.00870	0.01740	0.02610	
R3152N005A	3.38713	3.43	3.45573	3.15013	3.19	3.21392	0.01715	0.03430	0.05145	0.01595	0.0319	0.04785	
R3152N013A	1.31338	1.33	1.33997	1.15538	1.17	1.17877	0.00665	0.01330	0.01995	0.00585	0.01170	0.01755	
R3152N014A	1.15537	1.17	1.17878	1.06156	1.075	1.08307	0.00585	0.01170	0.01755	0.00538	0.01075	0.01613	
R3152N015A	1.27387	1.29	1.29968	1.14550	1.16	1.16870	0.00645	0.01290	0.01935	0.00580	0.01160	0.01740	
R3152N017A	3.52537	3.57	3.59678	2.70575	2.74	2.76055	0.01785	0.03570	0.05355	0.01370	0.02740	0.04110	
R3152N020A	1.23438	1.25	1.25937	1.10600	1.12	1.12840	0.00625	0.01250	0.01875	0.00560	0.01120	0.01680	
R3152N201B	1.22450	1.24	1.24930	1.15538	1.17	1.17877	0	-	0.01000	0	-	0.01000	
R3152N101B	2.56750	2.60	2.61950	2.37988	2.41	2.42807	0	-	0.01000	0	-	0.01000	
R3152N102B	3.38713	3.43	3.45572	3.14025	3.18	3.20385	0	-	0.01000	0	-	0.01000	
R3152N203A	1.38250	1.40	1.41050	0.98750	1.00	1.00750	0.00700	0.01400	0.02100	0.00500	0.01000	0.01500	
R3152N204A	1.60963	1.63	1.64222	1.39238	1.41	1.42057	0.00815	0.01630	0.02445	0.00705	0.01410	0.02115	
R3152N103A	5.72750	5.80	5.84350	4.72025	4.78	4.81585	0.02900	0.05800	0.08700	0.02390	0.04780	0.07170	
R3152N104A	3.35750	3.40	3.42550	1.58000	1.60	1.61200	0.01700	0.03400	0.05100	0.00800	0.01600	0.02400	

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## THEORY OF OPERATION



**R3152N Timing Chart** 

- (1) When the SENSE pin voltage (V<sub>SENSE</sub>) exceed the undervoltage release voltage (V<sub>UVREL</sub>), the UV pin output becomes "High" after the release delay time (t<sub>DELAY</sub>).
- (2) When V<sub>SENSE</sub> exceed the overvoltage detection voltage (V<sub>OVDET</sub>) by increasing in voltage, the OV pin output becomes "Low" after the detection delay time (Typ.10 μs) and enters the overvoltage detecting state.
- (3) When V<sub>SENSE</sub> decreases less than the overvoltage release voltage (V<sub>OVREL</sub>), the OV pin output becomes "High" after the release delay time (t<sub>DELAY</sub>).
- (4) When V<sub>SENSE</sub> decreases less than the undervoltage detection voltage (V<sub>UVDET</sub>), the UV pin output becomes "Low" after the detection delay time (Typ.10 μs).
- (5) When the VDD pin voltage (V<sub>DD</sub>) decreases less than the UVLO detection voltage (V<sub>UVLO</sub>), the OV and UV pins output become "Low".

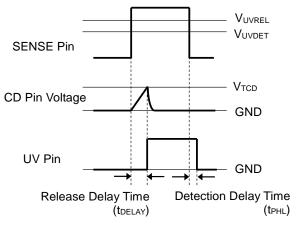
Note: A certain tilting angle of power supply voltage of the R3152NxxxB may cause chattering at detection or at release. To prevent the occurrence of chattering, connect a 10-nF or more capacitor to the CD pin.

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#### Delay in Operation and Delay Time (t<sub>DELAY</sub>)

#### At Undervoltage Detection

When supplying a voltage higher than the undervoltage release voltage ( $V_{UVREL}$ ) to the SENSE pin, a charging to an external capacitor starts and the CD pin voltage ( $V_{CD}$ ) increases. The UV pin voltage ( $V_{UV}$ ) maintains "Low" until  $V_{CD}$  reaches the CD pin threshold voltage ( $V_{TCD}$ ). When  $V_{CD}$  exceeds  $V_{TCD}$ ,  $V_{UV}$  is inverted from "Low" to "High". The release delay time ( $t_{DELAY}$ ) is the period from the SENSE pin voltage ( $V_{SENSE}$ ) exceeds  $V_{UVREL}$  to a rising edge of  $V_{UV}$ . When the output voltage turns from "Low" to "High", a charge carrier of the external capacitor starts discharging. When the voltage lower than  $V_{UV}$  is supplied to the SENSE pin, the detection delay time ( $t_{PHL}$ ), which is the period that  $V_{UV}$  is inverted from "High" to "Low", remains constant independent of the external capacitor.



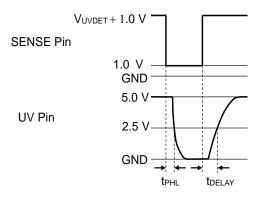
**Undervoltage Release Delay Timing Diagram** 

#### Calculation of Release Delay Time (t<sub>DELAY</sub>)

The following equation can calculate a typical value of the release delay time ( $t_{DELAY}$ ) with using the external capacitor ( $C_D$ ).

 $t_{\text{DELAY}}$  (s) = 0.73 × C<sub>D</sub> (F) / (1.5×10<sup>-6</sup>)

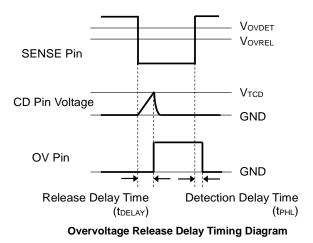
 $t_{DELAY}$  is the period from supplying a pulse voltage of 1.0 V  $\rightarrow$  (V<sub>UVDET</sub>) + 1.0 V to the SENSE pin to the UV pins reached 2.5 V.



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#### At Overvoltage Detection

When supplying a voltage lower than the overvoltage release voltage ( $V_{OVREL}$ ) to the SENSE pin, a charging to an external capacitor starts and the CD pin voltage ( $V_{CD}$ ) increases. The OV pin voltage ( $V_{OV}$ ) maintains "Low" until VCD reaches the CD pin threshold voltage ( $V_{TCD}$ ). When  $V_{CD}$  exceeds  $V_{TCD}$ ,  $V_{OV}$  is inverted from "Low" to "High". The release delay time ( $t_{DELAY}$ ) is the period from the SENSE pin voltage ( $V_{SENSE}$ ) falls below  $V_{OVREL}$  to a rising edge of  $V_{OV}$ . When the output voltage turns from "Low" to "High", a charge carrier of the external capacitor starts discharging. When the voltage higher than  $V_{OV}$  is supplied to the SENSE pin, the detection delay time ( $t_{PHL}$ ), which is the period that  $V_{OV}$  is inverted from "High" to "Low", remains constant independent of the external capacitor.

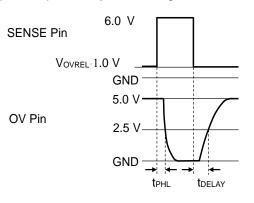


#### Calculation of Release Delay Time (t<sub>DELAY</sub>)

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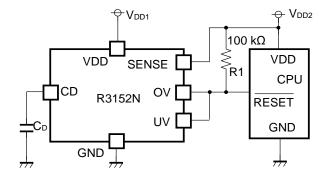
 $t_{\text{DELAY}}$  (s) = 0.73 × C<sub>D</sub> (F) / (1.5×10<sup>-6</sup>)

t<sub>DELAY</sub> is the period from supplying a pulse voltage of 1.0 V  $\rightarrow$  (V<sub>OVREL</sub>) + 1.0 V to the SENSE pin to the OV pin reached 2.5 V after the OV pin is pulled up to 5V by connecting with a resistor of 100k $\Omega$ .



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## **APPLICATION INFORMATION**





#### **Recommended External Components**

Symbol	Description
	A capacitor corresponding to setting of Release Delay Time is required. Refer to "Delay in
CD	Operation and Released Delay Time (t <sub>DELAY</sub> )" in Operation Description for details.
	A resistor is required to set with consideration of the output current at Nch. driver's ON and the
R1	leakage current at Nch. driver's OFF. Refer to "Electrical Characteristic" for details - provided
	the evaluation result with using a resistor of 100 k $\Omega$ .

## **RICOH**

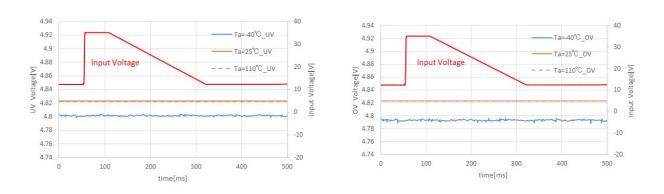
No. EY-405-200904

## **TYPICAL CHARACTERISTICS**

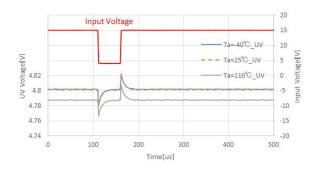
Typical Characteristics are intended to be used as reference data, they are not guaranteed.

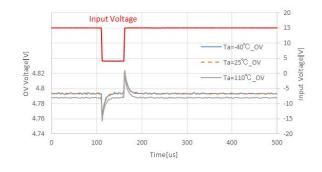
#### 1) Load Dump

VUVSET = 3.0 V, VOVSET = 3.6 V, VSENSE = 3.3 V, Pulled-up to 5.0 V

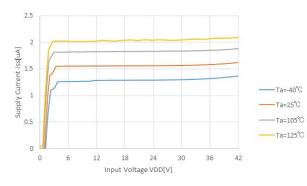


2) Cold Crank  $V_{\text{UVSET}} = 3.0 \text{ V}, V_{\text{OVSET}} = 3.6 \text{ V}, V_{\text{SENSE}} = 3.3 \text{ V}, \text{Pulled-up to } 5.0 \text{ V}$ 

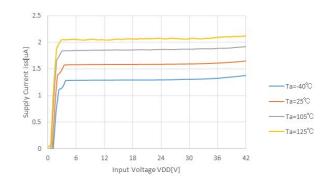






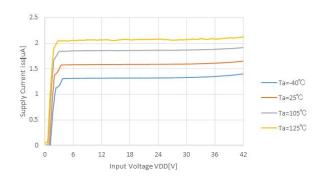


 $V_{\text{UVSET}}$  = 3.0 V,  $V_{\text{OVSET}}$  = 3.6 V

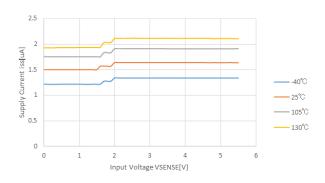


No. EY-405-200904

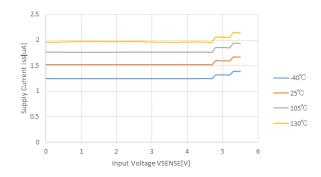
 $V_{UVSET} = 4.7 \text{ V}, V_{OVSET} = 5.3 \text{ V}$ 



**4) Supply Current vs. V<sub>SENSE</sub>** VUVSET = 1.6 V, VOVSET = 2.0 V

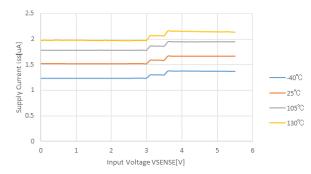


 $V_{UVSET} = 4.7 \text{ V}, V_{OVSET} = 5.3 \text{ V}$ 



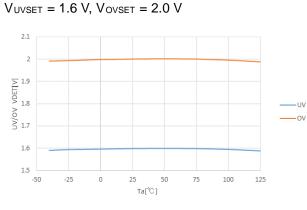
 $V_{UVSET} = 3.0 \text{ V}, V_{OVSET} = 3.6 \text{ V}$ 

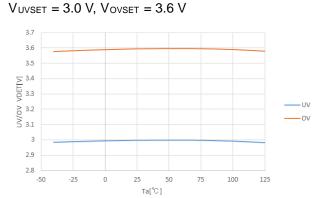
**RICOH** 



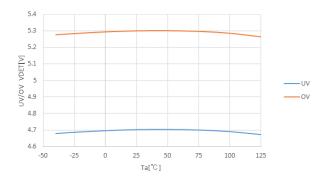
No. EY-405-200904

#### 5) UV/OV Detection Voltage vs. Ambient Temperature



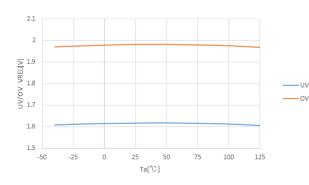


 $V_{UVSET} = 4.7 \text{ V}, V_{OVSET} = 5.3 \text{ V}$ 

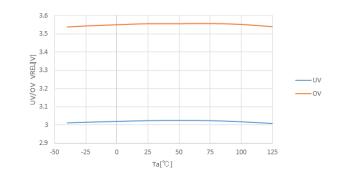


6) UV/OV Release Voltage vs. Ambient Temperature

 $V_{\text{UVSET}} = 1.6 \text{ V}, V_{\text{OVSET}} = 2.0 \text{ V}$ 

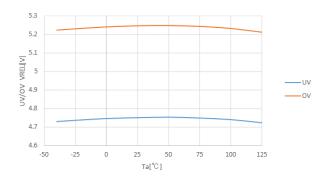


 $V_{UVSET}$  = 3.0 V,  $V_{OVSET}$  = 3.6 V

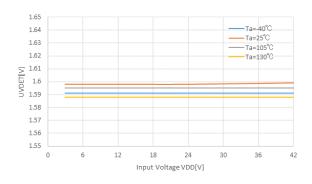


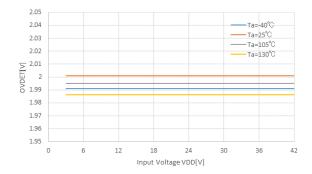
No. EY-405-200904

 $V_{UVSET} = 4.7 \text{ V}, V_{OVSET} = 5.3 \text{ V}$ 

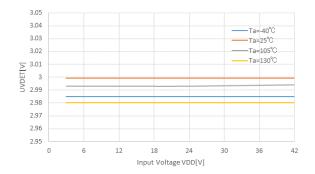


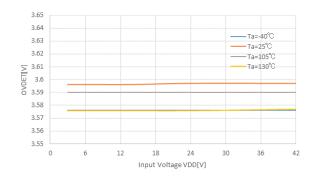
7) UV/OV Detection Voltage vs.  $V_{DD}$ VUVSET = 1.6 V, VOVSET = 2.0 V





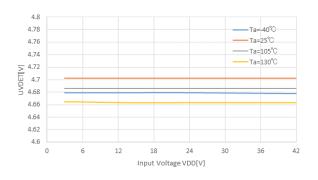
 $V_{UVSET} = 3.0 \text{ V}, V_{OVSET} = 3.6 \text{ V}$ 

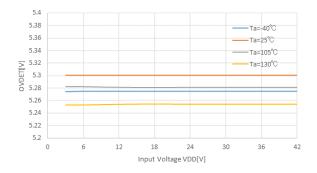




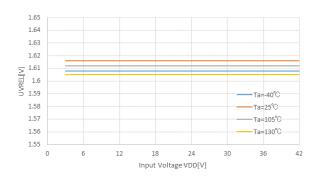
No. EY-405-200904

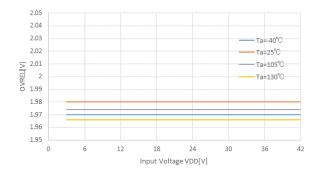
 $V_{UVSET} = 4.7 V$ ,  $V_{OVSET} = 5.3 V$ 



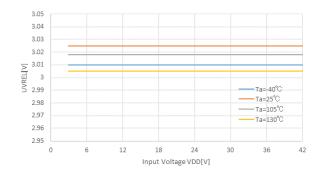


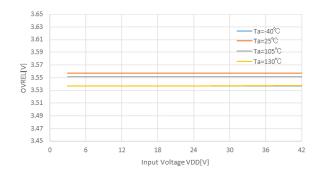
8) UV/OV Release Voltage vs.  $V_{DD}$ V<sub>UVSET</sub> = 1.6 V, V<sub>OVSET</sub> = 2.0 V





 $V_{UVSET} = 3.0V$ ,  $V_{OVSET} = 3.6 V$ 

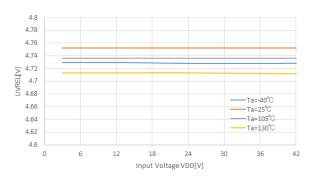


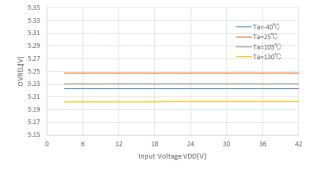




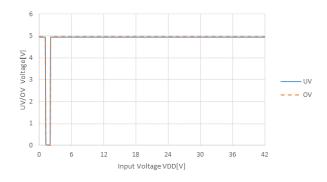
No. EY-405-200904

 $V_{UVSET} = 4.7 V$ ,  $V_{OVSET} = 5.3 V$ 

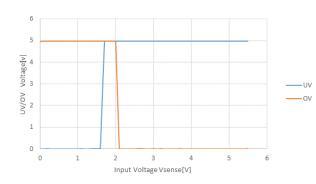




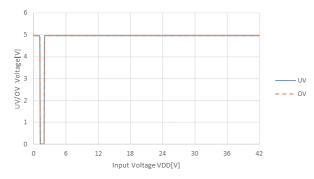




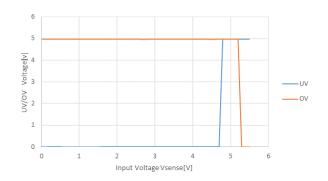
**10) UV/OV Voltage vs. V**<sub>SENSE</sub> (Ta = 25°C) V<sub>UVSET</sub> = 1.6 V, V<sub>OVSET</sub> = 2.0 V



 $V_{UVSET} = 4.7 V$ ,  $V_{OVSET} = 5.3 V$ 



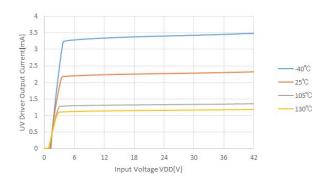
 $V_{UVSET} = 4.7 \text{ V}, V_{OVSET} = 5.3 \text{ V}$ 



No. EY-405-200904

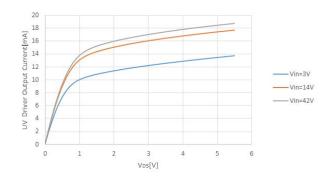
#### 11) Driver Output Current vs. V<sub>DD</sub>

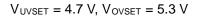
 $V_{UVSET} = 4.7 V$ ,  $V_{OVSET} = 5.3 V$ 

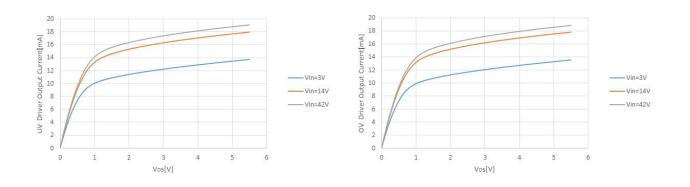




V<sub>UVSET</sub> = 1.6 V, V<sub>OVSET</sub> = 2.0 V







20

18

2

0

0

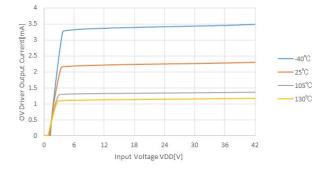
1

2

3

VDS[V]

4



Vin=3V

Vin=14V

5

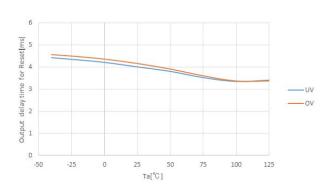
6

-Vin=42V

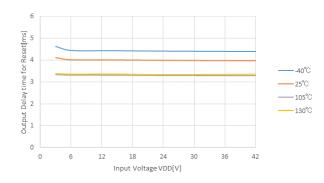


No. EY-405-200904

## 13) Release Delay Time vs. Ambient Temperature $V_{UVSET} = 4.7 V$ , $V_{OVSET} = 5.3 V$

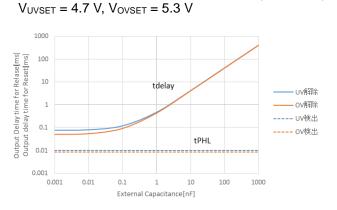


14) Release Delay Time vs.  $V_{DD}$ VUVSET = 4.7 V, VOVSET = 5.3 V

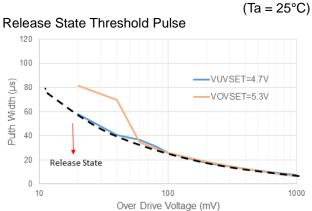


#### б time for Reset[ms] -40°C **-**25°C Output Delay t -105°C -130°C 0 0 12 18 36 42 6 24 30 Input Voltage VDD[V]

## 15) Detection / Release Delay Time vs. External Capacitor for CD Pin $(Ta = 25^{\circ}C)$



15) Detection / Release Delay Time vs. External 16) SENSE Pulse Width vs. Over Drive Voltage



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## POWER DISSIPATION

### SOT-23-6

 $(Ta = 25^{\circ}C, Tjmax = 150^{\circ}C)$ 

Ver. A

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.

ltem	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

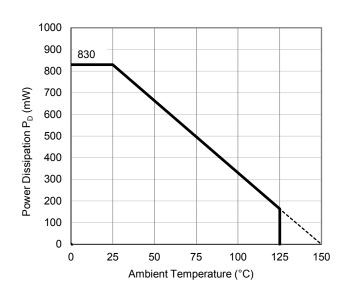
#### **Measurement Conditions**

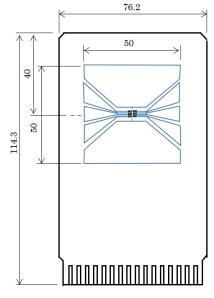
#### **Measurement Result**

	( , <b>j</b> ,
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

wjt: Junction-to-Top Thermal Characterization Parameter





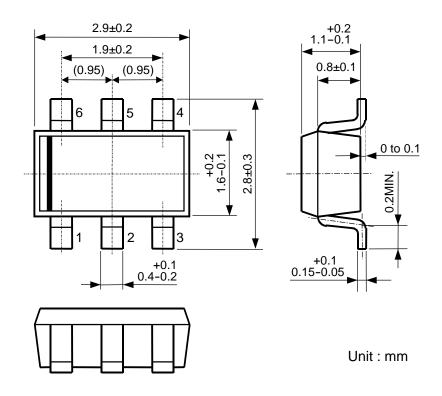
Power Dissipation vs. Ambient Temperature

**Measurement Board Pattern** 

## PACKAGE DIMENSIONS

## SOT-23-6

Ver. A





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