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## Low Voltage Detector

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NO.EA-160-071109

### OUTLINE

The R3114 series are CMOS-based voltage detector IC with high detector threshold accuracy and ultra-low supply current, which can be operated at an extremely low voltage and is used for system reset as an example.

Each of these ICs consists of a voltage reference unit, a comparator, resistors for detector threshold setting, an output driver and a hysteresis circuit. The detector threshold is fixed with high accuracy internally and does not require any adjustment.

Two output types, Nch open drain type and CMOS type are available.

The R3114 series are operable at a lower voltage than that of the R3111x series, and can be driven by a single battery.

Three types of packages, SOT-23-5, SC-82AB, and DFN(PLP)1010-4 are available.

### FEATURES

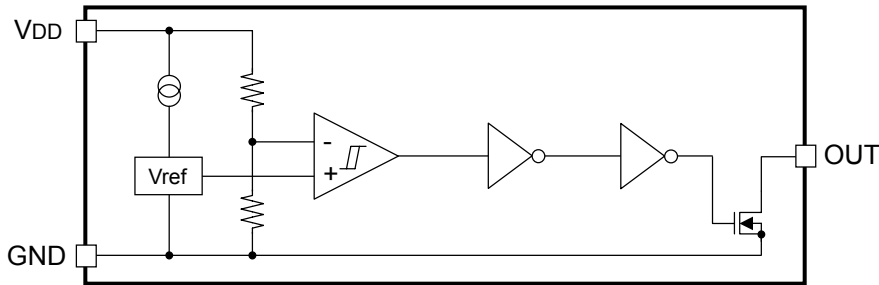
Ultra-low Supply Current .....	TYP. 0.35 $\mu$ A(at V <sub>DD</sub> =2.5V, T <sub>opt</sub> =25°C)
Wide Range of Operating Voltage .....	0.45V to 6.0V(T <sub>opt</sub> =25°C)
Detector Threshold .....	Stepwise setting with a step of 0.1V in the range of 0.7V to 5.0V
High Accuracy Detector Threshold .....	$\pm$ 0.8%(T <sub>opt</sub> =25°C)
Detector Threshold temperature Coefficient.....	$\pm$ 30ppm/°C (TYP.)
Two Output Types.....	Nch Open Drain and CMOS
Three Types of Packages .....	SOT-23-5(Mini-mold), SC-82AB, DFN(PLP)-1010-4

### APPLICATIONS

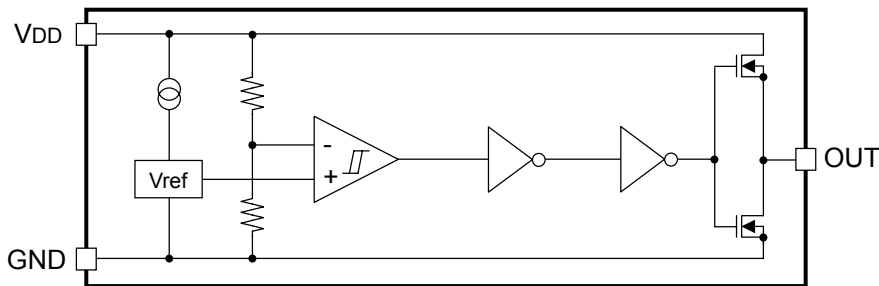
- CPU and Logic Circuit Reset
- Battery Checker
- Window Comparator
- Wave Shaping Circuit
- Battery Back-up Circuit
- Power Failure Detector

**BLOCK DIAGRAMS**

Nch Open Drain (R3114xxx1A)



CMOS (R3114xxx1C)



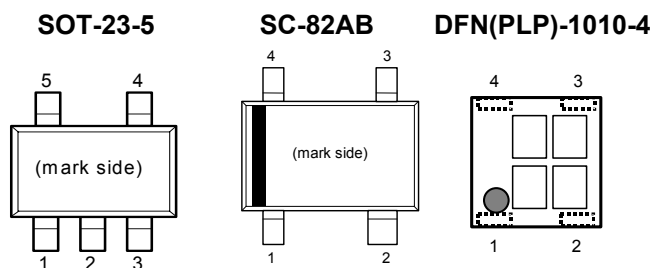
**SELECTION GUIDE**

The package type, the detector threshold, the output type and the taping type of R3114 series can be designated at users' request by specifying the part number as follows;

R3114xxx1x-xx-x ←Part Number  
 ↑↑↑ ↑↑↑ ↑  
 a b c d e

Code	Description
a	Designation of Package Type; <b>N</b> : SOT-23-5 <b>Q</b> : SC-82AB <b>K</b> : DFN(PLP)-1010-4
b	Setting Detector Threshold (-VDET); Stepwise setting with a step of 0.1V in the range of 0.7V to 5.0V
c	Designation of Output Type; <b>A</b> : Nch Open Drain (Output "L" at VDD=-VDET) <b>C</b> : CMOS (Output "L" at VDD=-VDET)
d	Designation of Packing or Taping Type; <b>TR</b> prescribed as standard direction
e	Designation of Composition of PIN solder; <b>-F</b> : Lead Free Solder (SOT-23-5, SC-82AB, DFN(PLP)-1010-4)

## PIN CONFIGURATION



## PIN DESCRIPTION

SOT-23-5	
PIN No.	Symbol
1	OUT
2	VDD
3	GND
4	NC
5	NC

SC-82AB	
PIN No.	Symbol
1	OUT
2	VDD
3	NC
4	GND

DFN(PLP)-1010-4	
PIN No.	Symbol
1	OUT
2	NC
3	GND
4	VDD

**ABSOLUTE MAXIMUM RATINGS**

Item	Symbol	Rating		Unit
Supply Voltage	VDD	7.0		V
Output Voltage	VOUT	R3114xxx1A	VSS-0.3 to 7.0	V
		R3114xxx1C	VSS-0.3 to VDD+0.3	
Output Current	IOUT	20		mA
Power Dissipation (mounted on board)	PD *Note1	R3114Qxx1A/C	380	mW
		R3114Nxx1A/C	420	
		R3114Kxx1A/C	400	
Operation Temperature Range	Topt	-40 to +85		°C
Storage Temperature Range	Tstg	-55 to +125		°C

\*Note1: For Power Dissipation, please refer to the following pages

**ABSOLUTE MAXIMUM RATINGS**

The ABSOLUTE MAXIMUM RATINGS are threshold limit values that must not be exceeded even for an instant under any condition. Moreover, such values for any two items must not be reached simultaneously. Operation above these absolute maximum ratings may cause degradation or permanent damage to the device. These are stress ratings only and do not necessarily imply functional operation below these limits.

## POWER DISSIPATION

### SC-82AB

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

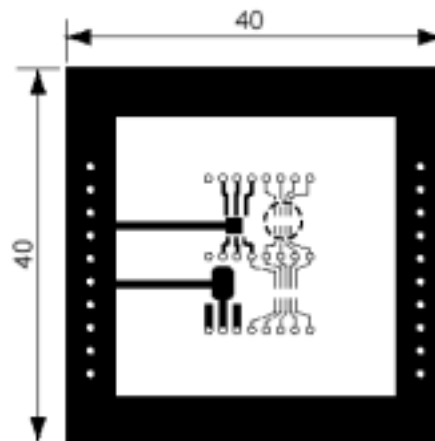
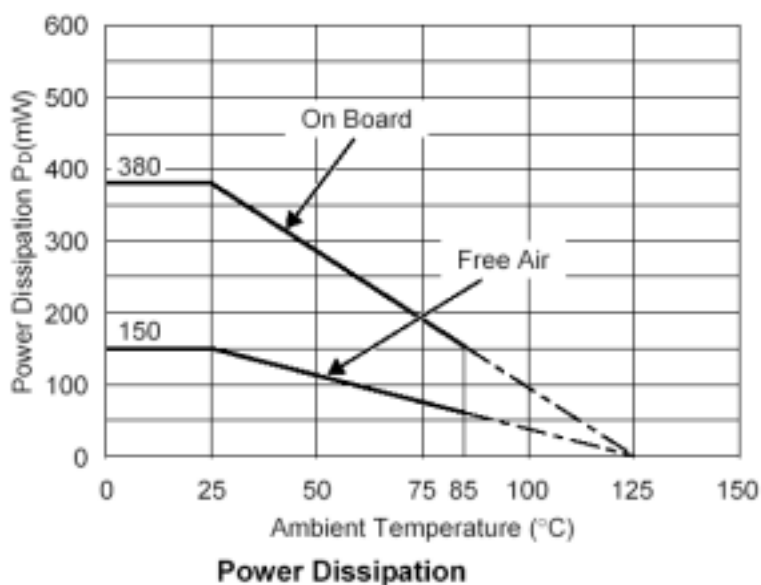
#### Measurement Conditions

	Standard Land Pattern
Environment	Mounting on Board (Wind velocity=0m/s)
Board Material	Glass cloth epoxy plastic (Double sided)
Board Dimensions	40mm x 40mm x 1.6mm
Copper Ratio	Top side : Approx. 50%, Back side Approx. 50%
Through-hole	$\phi 0.5\text{mm}$ x 44pcs

#### Measurement Result

( $T_{opt}=25^\circ\text{C}$ ,  $T_{jmax}=125^\circ\text{C}$ )

	Standard Land Pattern	Free Air
Power Dissipation	380mW	150mW
Thermal Resistance	$\Theta_{ja}=(125-25^\circ\text{C})/0.38\text{W}=263^\circ\text{C}/\text{W}$	$667^\circ\text{C}/\text{W}$



Measurement Board Pattern

○ IC Mount Area (Unit : mm)

**SOT-23-5**

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

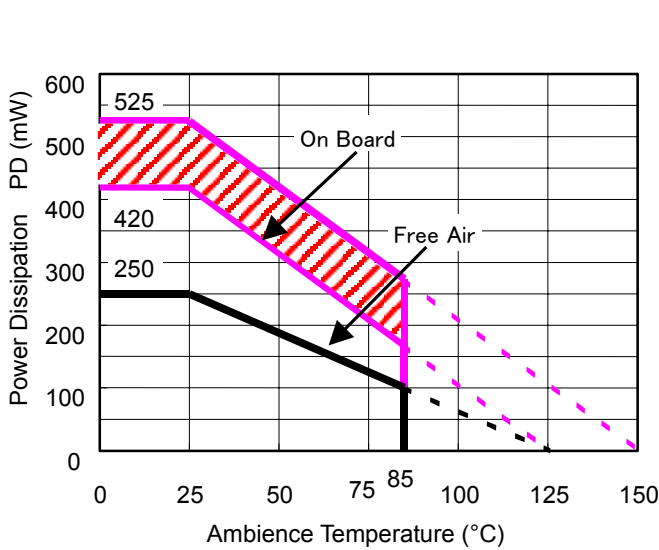
Measurement Conditions

	Standard Land Pattern
Environment	Mounting on Board (Wind velocity=0m/s)
Board Material	Glass cloth epoxy plastic (Double sided)
Board Dimensions	40mm x 40mm x 1.6mm
Copper Ratio	Top side : Approx. 50%, Back side Approx. 50%
Through-hole	φ0.5mm x 44pcs

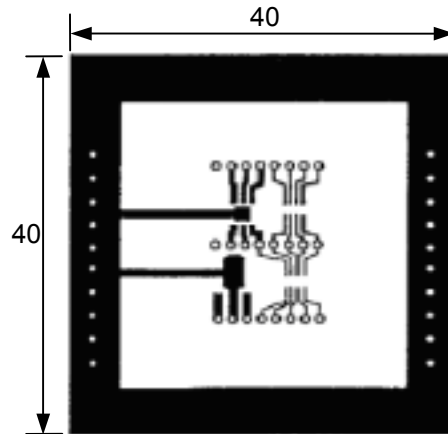
Measurement Result

(T<sub>opt</sub>=25°C, T<sub>jmax</sub>=125°C)

	Standard Land Pattern	Free Air
Power Dissipation	420mW	250mW
Thermal Resistance	$\Theta_{ja}=(125-25^{\circ}\text{C})/0.42\text{W}=238^{\circ}\text{C}/\text{W}$	400°C /W



**Power Dissipation**



**Measurement Board Pattern**

○ IC Mount Area Unit : mm

- Use in the oblique-line-area might be influence the product-life cycle, please suppress by 9,000 hours about use. 9,000 hours will correspond in six years when using it for four hours a day.

**DFN(PLP)-1010-4**

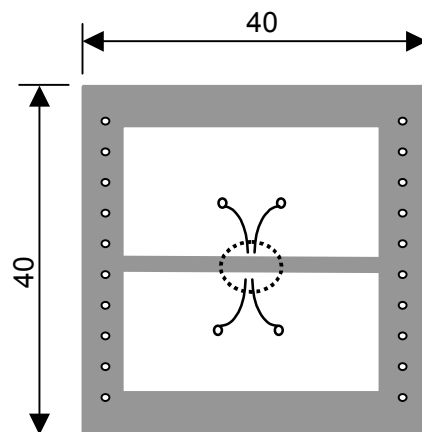
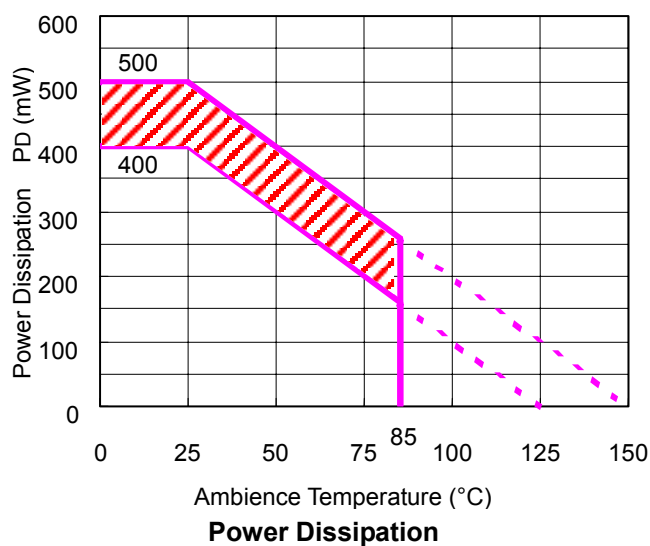
This specification is mounted on board. Power Dissipation (PD) depends on conditions of mounting on board. This specification is based on the measurements at the condition below:


Measurement Conditions

	Standard Land Pattern
Environment	Mounting on Board (Wind velocity=0m/s)
Board Material	Glass cloth epoxy plastic (Double sided)
Board Dimensions	40mm x 40mm x 1.6mm
Copper Ratio	Top side : Approx. 50%, Back side Approx. 50%
Through-hole	φ0.54mm x 24pcs

Measurement Result (Topt=25°C, Tjmax=125°C)

	Standard Land Pattern
Power Dissipation	400mW (Tjmax=125°C) 500mW (Tjmax=150°C)
Thermal Resistance	$\Theta_{ja}=(125-25^{\circ}\text{C})/0.4\text{W}=250^{\circ}\text{C}/\text{W}$ $\Theta_{jc}=67^{\circ}\text{C}/\text{W}$



**Measurement Board Pattern**  
 IC Mount Area Unit : mm

- Use in the oblique-line-area might be influence the product-life cycle, please suppress by 13,000 hours about use. 13,000 hours will correspond in nine years when using it for four hours a day.

**R3114x****ELECTRICAL CHARACTERISTICS****R3114x071A/C**Bold values indicate  $-40^{\circ}\text{C} \leq T_{\text{opt}} \leq 85^{\circ}\text{C}$ , unless otherwise noted.[ $T_{\text{opt}}=25^{\circ}\text{C}$ ]

Symbol	Item	Conditions	MIN.	TYP.	MAX.	Unit
-VDET	Detector Threshold		0.6880 <b>0.6775</b>		0.7120 <b>0.7225</b>	V
VHYS	Detector Threshold Hysteresis		<b>0.028</b>		<b>0.049</b>	V
ISS	Supply Current	VDD=0.6V			<b>1.400</b>	$\mu\text{A}$
		VDD=1.7V			<b>1.200</b>	
VDDH	Maximum Operating Voltage				<b>6</b>	V
VDDL	Minimum Operating Voltage <sup>*Note1</sup>	$T_{\text{opt}}=25^{\circ}\text{C}$			0.50	V
		$-40^{\circ}\text{C} \leq T_{\text{opt}} \leq 85^{\circ}\text{C}$			<b>0.55</b>	
IOUT	Output Current (Driver Output Pin)	Nch VDD=0.55V, VDS=0.05V VDD=0.6V, VDS=0.5V	<b>7</b> <b>0.020</b>			mA
		Pch <sup>*Note2</sup> VDD=4.5V, VDS=-2.1V	<b>0.650</b>			
ILEAK	Nch Driver Leakage Current <sup>*Note3</sup>	VDD=6.0V, VDS=7.0V			<b>80</b>	nA
$\Delta\text{-VDET}/\Delta T_{\text{opt}}$	Detector Threshold Temperature Coefficient	$-40^{\circ}\text{C} \leq T_{\text{opt}} \leq 85^{\circ}\text{C}$		<b><math>\pm 30</math></b>		ppm/ $^{\circ}\text{C}$
tPLH	Output Delay Time	VDD=0.55V $\rightarrow$ 2.7V			<b>100</b>	$\mu\text{s}$

**R3114x151A/C**Bold values indicate  $-40^{\circ}\text{C} \leq T_{\text{opt}} \leq 85^{\circ}\text{C}$ , unless otherwise noted.[ $T_{\text{opt}}=25^{\circ}\text{C}$ ]

Symbol	Item	Conditions	MIN.	TYP.	MAX.	Unit
-VDET	Detector Threshold		1.4880 <b>1.4775</b>		1.5210 <b>1.5225</b>	V
VHYS	Detector Threshold Hysteresis		<b>0.060</b>		<b>0.105</b>	V
ISS	Supply Current	VDD=1.4V			<b>1.400</b>	$\mu\text{A}$
		VDD=2.5V			<b>1.200</b>	
VDDH	Maximum Operating Voltage				<b>6</b>	V
VDDL	Minimum Operating Voltage <sup>*Note1</sup>	$T_{\text{opt}}=25^{\circ}\text{C}$			0.50	V
		$-40^{\circ}\text{C} \leq T_{\text{opt}} \leq 85^{\circ}\text{C}$			<b>0.55</b>	
IOUT	Output Current (Driver Output Pin)	Nch VDD=0.55V, VDS=0.05V VDD=1.0V, VDS=0.5V	<b>7</b> <b>0.400</b>			mA
		Pch <sup>*Note2</sup> VDD=4.5V, VDS=-2.1V	<b>0.650</b>			
ILEAK	Nch Driver Leakage Current <sup>*Note3</sup>	VDD=6.0V, VDS=7.0V			<b>80</b>	nA
$\Delta\text{-VDET}/\Delta T_{\text{opt}}$	Detector Threshold Temperature Coefficient	$-40^{\circ}\text{C} \leq T_{\text{opt}} \leq 85^{\circ}\text{C}$		<b><math>\pm 30</math></b>		ppm/ $^{\circ}\text{C}$
tPLH	Output Delay Time	VDD=0.55V $\rightarrow$ 3.5V			<b>100</b>	$\mu\text{s}$

\*Note1 Minimum operating voltage means the value of input voltage when output voltage maintains 0.1V or less. (In case of Nch Open Drain Output type, the output pin is pulled up with a resistance of 470k $\Omega$  to 5.0V)

\*Note2 In case of CMOS type

\*Note3 In case of Nch Open Drain type



## R3114x271A/C

Bold values indicate  $-40^{\circ}\text{C} \leq T_{\text{opt}} \leq 85^{\circ}\text{C}$ , unless otherwise noted.[ $T_{\text{opt}}=25^{\circ}\text{C}$ ]

Symbol	Item	Conditions	MIN.	TYP.	MAX.	Unit
-VDET	Detector Threshold		2.6784 <b>2.6595</b>		2.7216 <b>2.7405</b>	V
VHYS	Detector Threshold Hysteresis		<b>0.108</b>		<b>0.189</b>	V
ISS	Supply Current	VDD=2.6V			<b>1.500</b>	μA
		VDD=3.7V			<b>1.200</b>	
VDDH	Maximum Operating Voltage				<b>6</b>	V
VDDL	Minimum Operating Voltage <sup>*Note1</sup>	T <sub>opt</sub> =25°C			0.50	V
		-40°C ≤ T <sub>opt</sub> ≤ 85°C			<b>0.55</b>	
IOUT	Output Current (Driver Output Pin)	Nch VDD=0.55V, VDS=0.05V VDD=1.5V, VDS=0.5V	<b>7</b> <b>1.000</b>			mA
		Pch <sup>*Note2</sup> VDD=4.5V, VDS=-2.1V	<b>0.650</b>			
ILEAK	Nch Driver Leakage Current <sup>*Note3</sup>	VDD=6.0V, VDS=7.0V			<b>80</b>	nA
Δ-VDET/Δ T <sub>opt</sub>	Detector Threshold Temperature Coefficient	-40°C ≤ T <sub>opt</sub> ≤ 85°C		<b>±30</b>		ppm/ °C
tPLH	Output Delay Time	VDD=0.55V → 4.7V			<b>100</b>	μs

## R3114x451A/C

Bold values indicate  $-40^{\circ}\text{C} \leq T_{\text{opt}} \leq 85^{\circ}\text{C}$ , unless otherwise noted.[ $T_{\text{opt}}=25^{\circ}\text{C}$ ]

Symbol	Item	Conditions	MIN.	TYP.	MAX.	Unit
-VDET	Detector Threshold		4.4640 <b>4.4325</b>		4.5360 <b>4.5675</b>	V
VHYS	Detector Threshold Hysteresis		<b>0.180</b>		<b>0.315</b>	V
ISS	Supply Current	VDD=4.4V			<b>1.700</b>	μA
		VDD=5.5V			<b>1.400</b>	
VDDH	Maximum Operating Voltage				<b>6</b>	V
VDDL	Minimum Operating Voltage <sup>*Note1</sup>	T <sub>opt</sub> =25°C			0.50	V
		-40°C ≤ T <sub>opt</sub> ≤ 85°C			<b>0.55</b>	
IOUT	Output Current (Driver Output Pin)	Nch VDD=0.55V, VDS=0.05V VDD=3.0V, VDS=0.5V	<b>7</b> <b>2.400</b>			mA
		Pch <sup>*Note2</sup> VDD=4.5V, VDS=-2.1V	<b>0.900</b>			
ILEAK	Nch Driver Leakage Current <sup>*Note3</sup>	VDD=6.0V, VDS=7.0V			<b>80</b>	nA
Δ-VDET/Δ T <sub>opt</sub>	Detector Threshold Temperature Coefficient	-40°C ≤ T <sub>opt</sub> ≤ 85°C		<b>±30</b>		ppm/ °C
tPLH	Output Delay Time	VDD=0.55V → 6.0V			<b>100</b>	μs

\*Note1 Minimum operating voltage means the value of input voltage when output voltage maintains 0.1V or less. (In case of Nch Open Drain Output type, the output pin is pulled up with a resistance of 470kΩ to 5.0V)

\*Note2 In case of CMOS type

\*Note3 In case of Nch Open Drain type

# R3114x

## ELECTRICAL CHARACTERISTICS BY DETECTOR THRESHOLD

R3114x071A/C to R3114x501A/C

**Bold values indicate  $-40^{\circ}\text{C} \leq T_{\text{opt}} \leq 85^{\circ}\text{C}$ , unless otherwise noted.**

[ $T_{\text{opt}}=25^{\circ}\text{C}$ ]

Part Number	Detector Threshold1		Detector Threshold2		Detector Threshold Hysteresis		Supply Current1		Supply Current2		Max. Op. Voltage	Min. Op. Voltage
	-V <sub>DET1</sub> [V]		-V <sub>DET2</sub> [V]		V <sub>HYS</sub> [V]		I <sub>SS1</sub> [ $\mu$ A]		I <sub>SS2</sub> [ $\mu$ A]		V <sub>DDH</sub> [V]	V <sub>DDL</sub> [V]
	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	Cond.	MAX.	Cond.	MAX.	MAX.	MAX.
R3114x071A/C	0.6880	0.7120	<b>0.6775</b>	<b>0.7225</b>	<b>0.028</b>	<b>0.049</b>	V <sub>DD</sub> = -V <sub>DET</sub> -0.1V	1.400	V <sub>DD</sub> = -V <sub>DET</sub> +1.0V	1.200	6	0.50
R3114x081A/C	0.7880	0.8120	<b>0.7775</b>	<b>0.8225</b>	<b>0.032</b>	<b>0.056</b>						
R3114x091A/C	0.8880	0.9120	<b>0.8775</b>	<b>0.9225</b>	<b>0.036</b>	<b>0.063</b>						
R3114x101A/C	0.9880	1.0120	<b>0.9775</b>	<b>1.0225</b>	<b>0.040</b>	<b>0.070</b>						
R3114x111A/C	1.0880	1.1120	<b>1.0775</b>	<b>1.1225</b>	<b>0.044</b>	<b>0.077</b>						
R3114x121A/C	1.1880	1.2120	<b>1.1775</b>	<b>1.2225</b>	<b>0.048</b>	<b>0.084</b>						
R3114x131A/C	1.2880	1.3120	<b>1.2775</b>	<b>1.3225</b>	<b>0.052</b>	<b>0.091</b>						
R3114x141A/C	1.3880	1.4120	<b>1.3775</b>	<b>1.4225</b>	<b>0.056</b>	<b>0.098</b>						
R3114x151A/C	1.4880	1.5120	<b>1.4775</b>	<b>1.5225</b>	<b>0.060</b>	<b>0.105</b>						
R3114x161A/C	1.5872	1.6128	<b>1.5760</b>	<b>1.6240</b>	<b>0.064</b>	<b>0.112</b>						
R3114x171A/C	1.6864	1.7136	<b>1.6745</b>	<b>1.7255</b>	<b>0.068</b>	<b>0.119</b>						
R3114x181A/C	1.7856	1.8144	<b>1.7730</b>	<b>1.8270</b>	<b>0.072</b>	<b>0.126</b>						
R3114x191A/C	1.8848	1.9152	<b>1.8715</b>	<b>1.9285</b>	<b>0.076</b>	<b>0.133</b>						
R3114x201A/C	1.9840	2.0160	<b>1.9700</b>	<b>2.0300</b>	<b>0.080</b>	<b>0.140</b>						
R3114x211A/C	2.0832	2.1168	<b>2.0685</b>	<b>2.1315</b>	<b>0.084</b>	<b>0.147</b>						
R3114x221A/C	2.1824	2.2176	<b>2.1670</b>	<b>2.2330</b>	<b>0.088</b>	<b>0.154</b>						
R3114x231A/C	2.2816	2.3184	<b>2.2655</b>	<b>2.3345</b>	<b>0.092</b>	<b>0.161</b>						
R3114x241A/C	2.3808	2.4192	<b>2.3640</b>	<b>2.4360</b>	<b>0.096</b>	<b>0.168</b>						
R3114x251A/C	2.4800	2.5200	<b>2.4625</b>	<b>2.5375</b>	<b>0.100</b>	<b>0.175</b>						
R3114x261A/C	2.5792	2.6208	<b>2.5610</b>	<b>2.6390</b>	<b>0.104</b>	<b>0.182</b>						
R3114x271A/C	2.6784	2.7216	<b>2.6595</b>	<b>2.7405</b>	<b>0.108</b>	<b>0.189</b>						
R3114x281A/C	2.7776	2.8224	<b>2.7580</b>	<b>2.8420</b>	<b>0.112</b>	<b>0.196</b>						
R3114x291A/C	2.8768	2.9232	<b>2.8565</b>	<b>2.9435</b>	<b>0.116</b>	<b>0.203</b>						
R3114x301A/C	2.9760	3.0240	<b>2.9550</b>	<b>3.0450</b>	<b>0.120</b>	<b>0.210</b>						
R3114x311A/C	3.0752	3.1248	<b>3.0535</b>	<b>3.1465</b>	<b>0.124</b>	<b>0.217</b>						
R3114x321A/C	3.1744	3.2256	<b>3.1520</b>	<b>3.2480</b>	<b>0.128</b>	<b>0.224</b>						
R3114x331A/C	3.2736	3.3264	<b>3.2505</b>	<b>3.3495</b>	<b>0.132</b>	<b>0.231</b>						
R3114x341A/C	3.3728	3.4272	<b>3.3490</b>	<b>3.4510</b>	<b>0.136</b>	<b>0.238</b>						
R3114x351A/C	3.4720	3.5280	<b>3.4475</b>	<b>3.5525</b>	<b>0.140</b>	<b>0.245</b>						
R3114x361A/C	3.5712	3.6288	<b>3.5460</b>	<b>3.6540</b>	<b>0.144</b>	<b>0.252</b>						
R3114x371A/C	3.6704	3.7296	<b>3.6445</b>	<b>3.7555</b>	<b>0.148</b>	<b>0.259</b>						
R3114x381A/C	3.7696	3.8304	<b>3.7430</b>	<b>3.8570</b>	<b>0.152</b>	<b>0.266</b>						
R3114x391A/C	3.8688	3.9312	<b>3.8415</b>	<b>3.9585</b>	<b>0.156</b>	<b>0.273</b>						
R3114x401A/C	3.9680	4.0320	<b>3.9400</b>	<b>4.0600</b>	<b>0.160</b>	<b>0.280</b>						
R3114x411A/C	4.0672	4.1328	<b>4.0385</b>	<b>4.1615</b>	<b>0.164</b>	<b>0.287</b>						
R3114x421A/C	4.1664	4.2336	<b>4.1370</b>	<b>4.2630</b>	<b>0.168</b>	<b>0.294</b>						
R3114x431A/C	4.2656	4.3344	<b>4.2355</b>	<b>4.3645</b>	<b>0.172</b>	<b>0.301</b>						
R3114x441A/C	4.3648	4.4352	<b>4.3340</b>	<b>4.4660</b>	<b>0.176</b>	<b>0.308</b>						
R3114x451A/C	4.4640	4.5360	<b>4.4325</b>	<b>4.5675</b>	<b>0.180</b>	<b>0.315</b>						
R3114x461A/C	4.5632	4.6368	<b>4.5310</b>	<b>4.6690</b>	<b>0.184</b>	<b>0.322</b>						
R3114x471A/C	4.6624	4.7376	<b>4.6295</b>	<b>4.7705</b>	<b>0.188</b>	<b>0.329</b>						
R3114x481A/C	4.7616	4.8384	<b>4.7280</b>	<b>4.8720</b>	<b>0.192</b>	<b>0.336</b>						
R3114x491A/C	4.8608	4.9392	<b>4.8265</b>	<b>4.9735</b>	<b>0.196</b>	<b>0.343</b>						
R3114x501A/C	4.9600	5.0400	<b>4.9250</b>	<b>5.0750</b>	<b>0.200</b>	<b>0.350</b>						

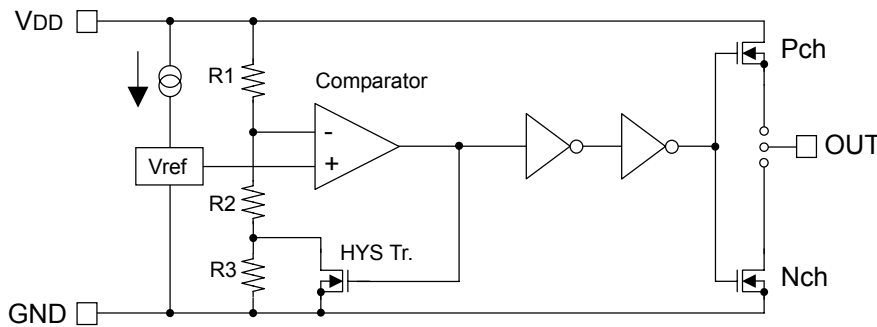
\*Note1 V<sub>DD</sub> value when output voltage is equal or less than 0.1V. In the case of Nch Open Drain output type, the output pin is pulled up to 5.0V through 470k $\Omega$  resistor.

Nch Driver Output Current1		Nch Driver Output Current2		Pch Driver Output Current		Nch Driver Leak Current		Detector Threshold Temperature Coefficient	Output Delay Time	
I <sub>OUT1</sub> [ $\mu$ A]		I <sub>OUT2</sub> [mA]		I <sub>OUT3</sub> [mA]		I <sub>LEAK</sub> [nA]		$\Delta$ -V <sub>DET</sub> / $\Delta$ T <sub>opt</sub> [ppm/ $^{\circ}$ C]	t <sub>PLH</sub> [ $\mu$ s]	
Cond.	MIN.	Cond.	MIN.	Cond.	MIN.	Cond.	MAX.	TYP.	Cond.	MAX.
V <sub>DD</sub> = 0.55V  V <sub>DS</sub> = 0.05V	7	V <sub>DD</sub> = 0.6V V <sub>DS</sub> = 0.5V	0.020	V <sub>DD</sub> = 4.5V V <sub>DS</sub> = -2.1V	0.650	V <sub>DD</sub> = 6.0V V <sub>DS</sub> = 7.0V	80	$\pm$ 30	V <sub>DD</sub> = 0.55V ↓ -V <sub>DET</sub> +2.0V  *Note2	100
		V <sub>DD</sub> = 1.0V V <sub>DS</sub> = 0.5V	0.400							
		V <sub>DD</sub> = 1.5V V <sub>DS</sub> = 0.5V	1.000							
		V <sub>DD</sub> = 3.0V V <sub>DS</sub> = 0.5V	2.400	V <sub>DD</sub> = 6.0V V <sub>DS</sub> = -2.1V	0.900			V <sub>DD</sub> = 0.55V ↓ 6.0V  *Note2	200	

\*Note2 In the case of CMOS output type: when the voltage is forced from 0.55V to (-V<sub>DET</sub>)+2.0V or a 6.0V pulse voltage is added to V<sub>DD</sub>, time interval that the output voltage reaches V<sub>DD</sub>/2.  
In the case of Nch Open Drain output type: the output pin is pulled up to 5.0V through 470k $\Omega$ , and when the voltage is forced from 0.55V to (-V<sub>DET</sub>)+2.0V or a 6.0V pulse voltage is added to V<sub>DD</sub>, time interval that the output voltage reaches 2.5V.

## OPERATION

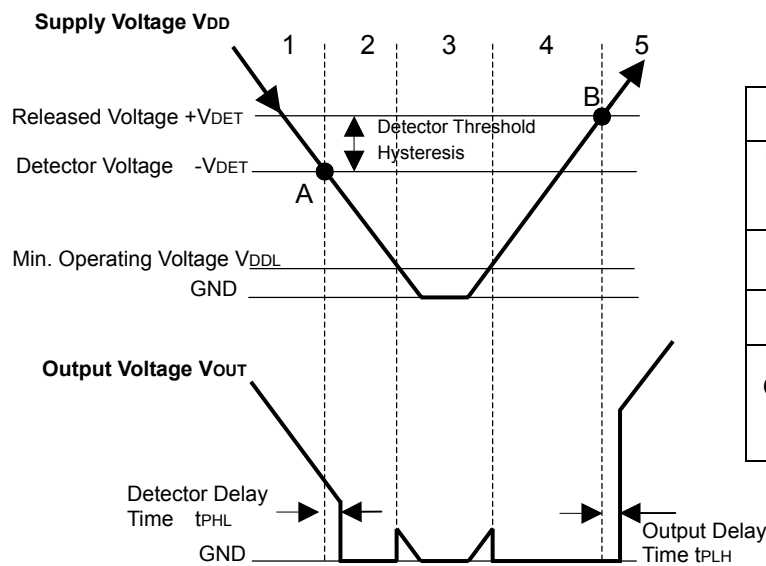
### Operation of (R3114xxx1A/C)



In the case of CMOS output type, the drain of Nch Tr. and Pch Tr. are connected to the OUT pin.

In the case of Nch Open Drain output type, the drain of Nch Tr. is connected to the OUT pin. (OUT pin should be pulled up to VDD or an external voltage level.)

Block Diagram 1



Step	1	2	3	4	5
Comparator(-) Pin Input Voltage	I	II	II	II	I
Comparator Output	L	H	Indefinite	H	L
HYS Tr.	OFF	ON	Indefinite	ON	OFF
Output Tr.	Nch	OFF	ON	Indefinite	ON
	Pch	ON	OFF	Indefinite	OFF

$$I \quad \frac{R2+R3}{R1+R2+R3} \times VDD$$

$$II \quad \frac{R2}{R1+R2} \times VDD$$

Operation Diagram

### Explanation of operation

- Step 1. The output voltage is equal to the supply voltage (Nch Open Drain type is equal to the pull-up voltage).
- Step 2. At Point "A",  $Vref \leq VDD \times (R2+R3)/(R1+R2+R3)$  is true, as a result, the output of comparator is reversed from "H" to "L", therefore the output voltage becomes the GND level. The voltage level of Point A means a detector threshold voltage ( $-V_{DET}$ ).
- Step 3. When the supply voltage is lower than the minimum operating voltage, the operation of the output transistor becomes indefinite. The output voltage is equal to the pull-up voltage for Nch Open Drain type.
- Step 4. The output Voltage is equal to the GND level.
- Step 5. At Point "B",  $Vref \leq VDD \times R2/(R1+R2)$  is true, as a result, the output of comparator is reversed from "L" to "H", then the output voltage is equal to the pull-up voltage. The voltage level of Point B means a released voltage ( $+V_{DET}$ ).

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

## DEFINITION OF OUTPUT DELAY TIME $t_{PLH}$

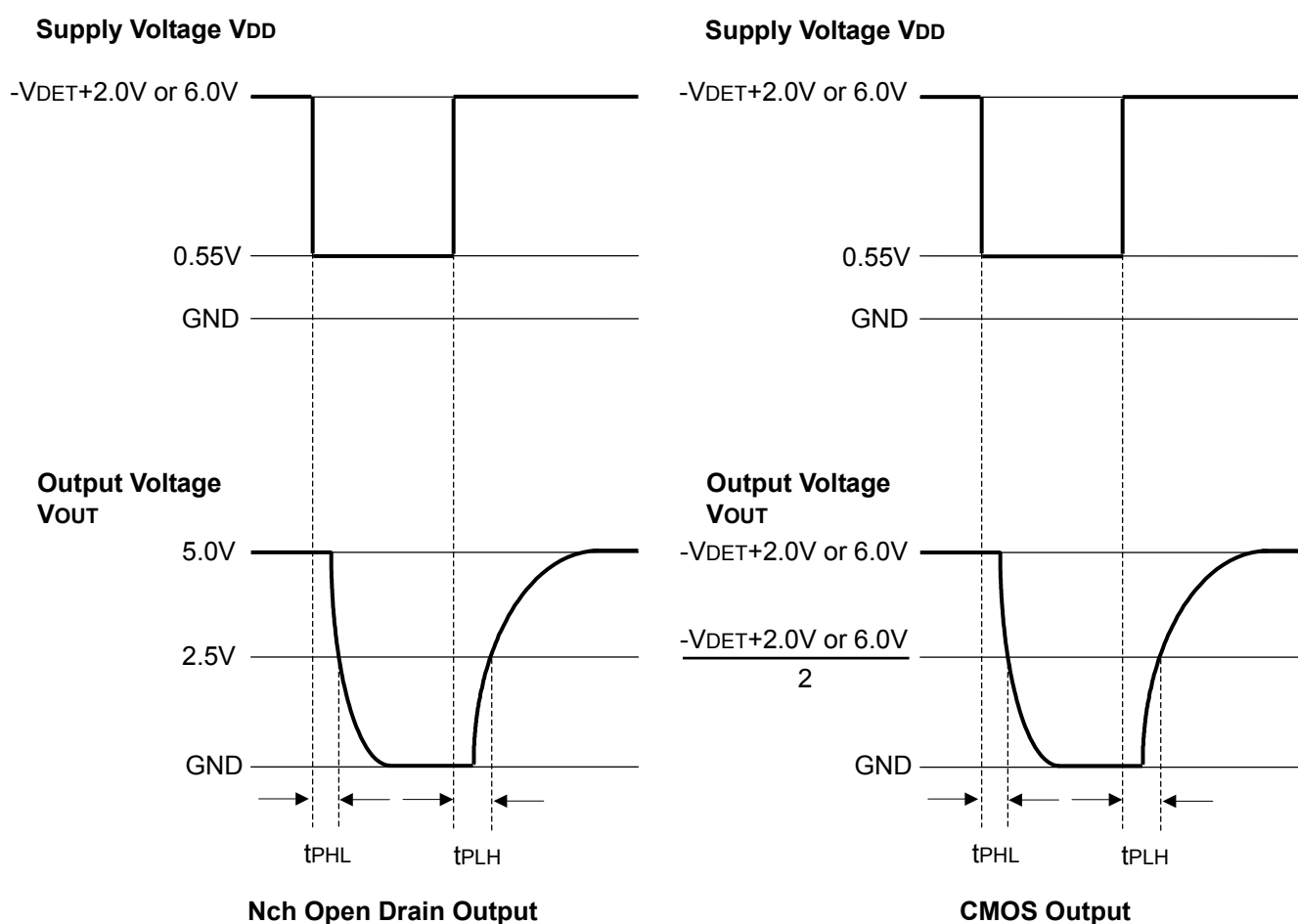
Output Delay Time ( $t_{PLH}$ ) is defined as follows:

1. In the case of Nch Open Drain Output:(R3114xxxxA)

Under the condition of the output pin (OUT) is pulled up through a resistor of 470k $\Omega$  to 5V, the time interval between the rising edge of  $V_{DD}$  pulse from 0.55V to  $(-V_{DET})+2.0V$  or the time interval of 6.0V pulse voltage is supplied, the becoming of the output voltage to 2.5V.

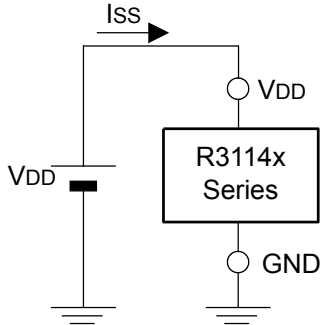
2. In the case of CMOS Output:(R3114xxxxC)

The time interval between the rising edge of  $V_{DD}$  pulse from 0.55V to  $(-V_{DET})+2.0V$  or the time interval of 6.0V pulse voltage is supplied, the becoming of the output voltage to  $V_{DD}/2$ .

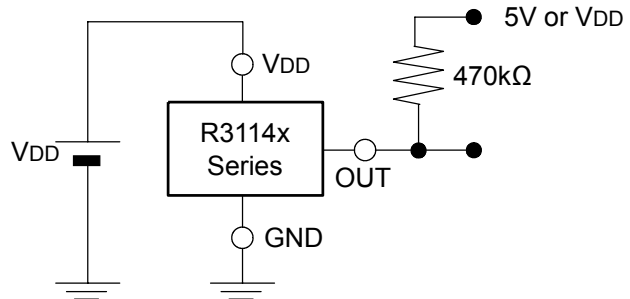


TEST CIRCUITS

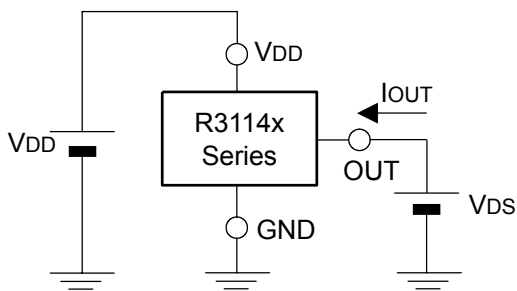
Supply Current Test Circuit



Detector Threshold Test Circuit  
(Pull-up circuit is not necessary for CMOS Output type)

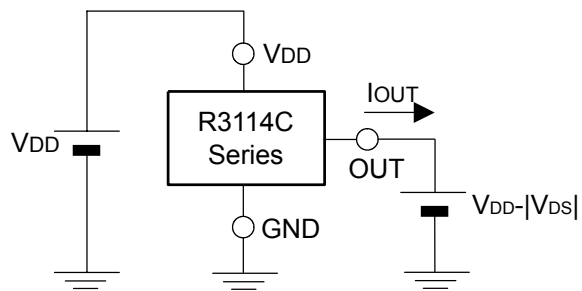


Nch Driver Output Current Test Circuit

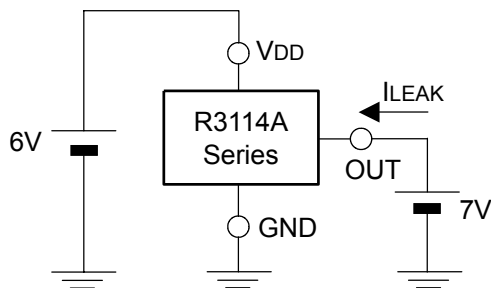


Pch Driver Output Test Circuit

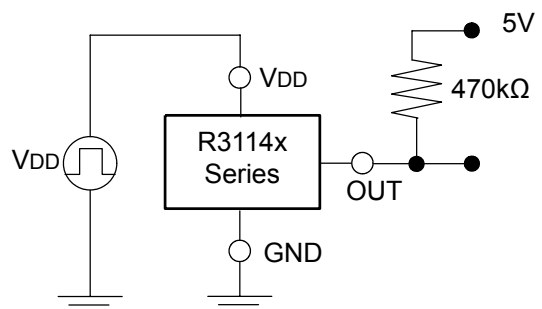
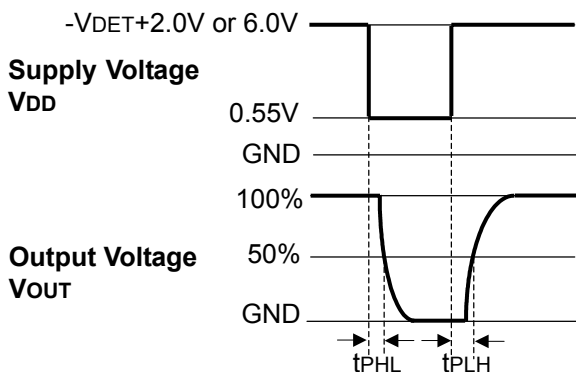
\*Apply to CMOS Output type only



Nch Driver Output Current Leak Test Circuit \*Apply to Nch Open Drain Output type only



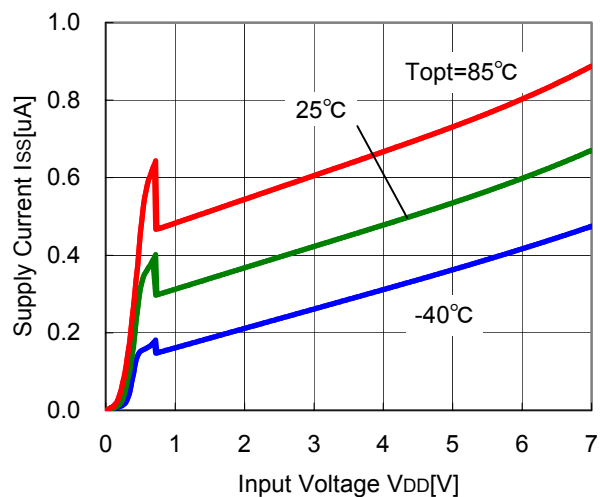
Output Delay Time Test Circuit (Pull-Up circuit is not necessary for CMOS Output type)



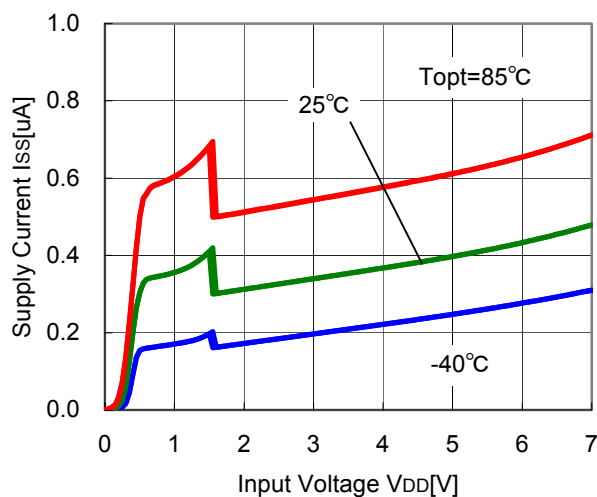
## TYPICAL CHARACTERISTICS

### 1) Supply Current vs. Input Voltage

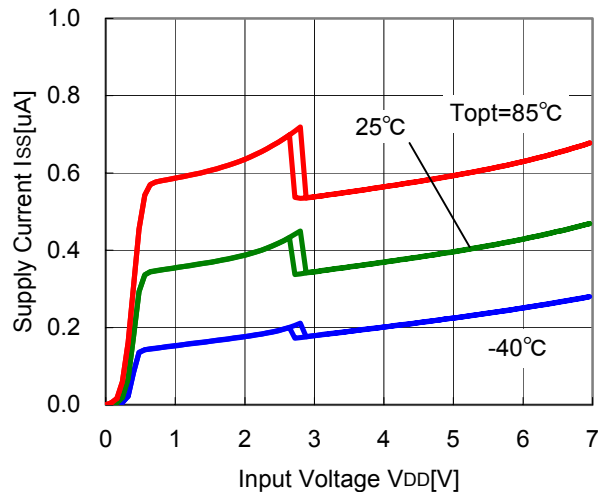
R3114x071A/C



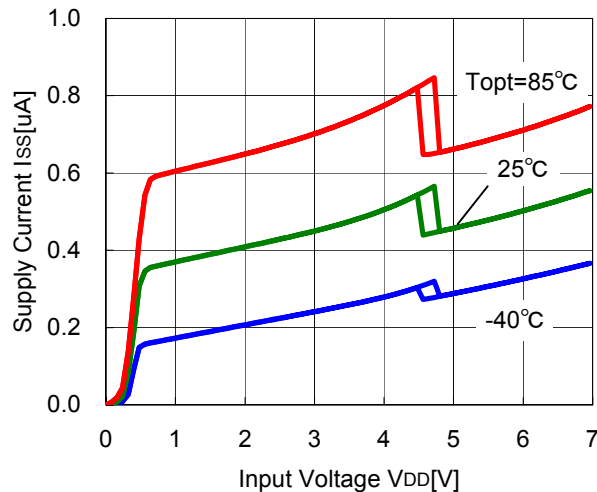
R3114x151A/C



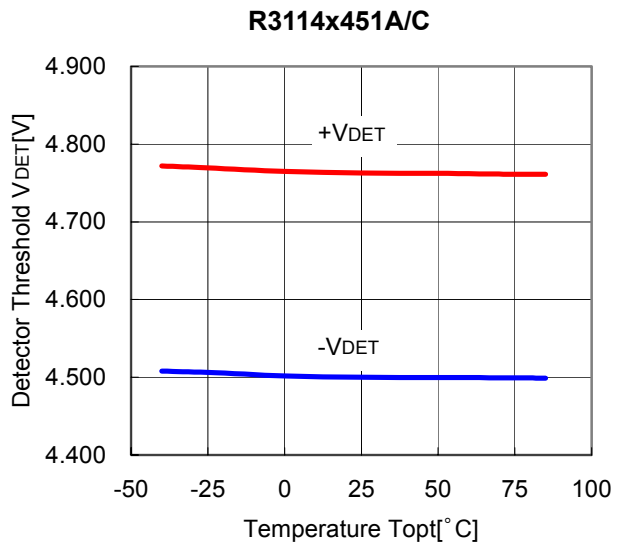
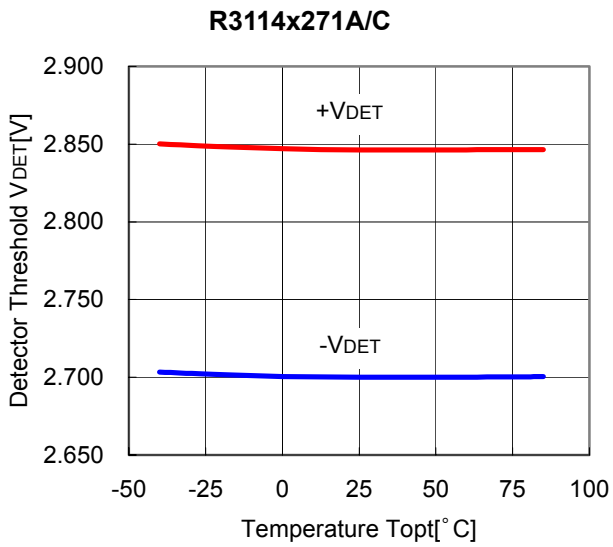
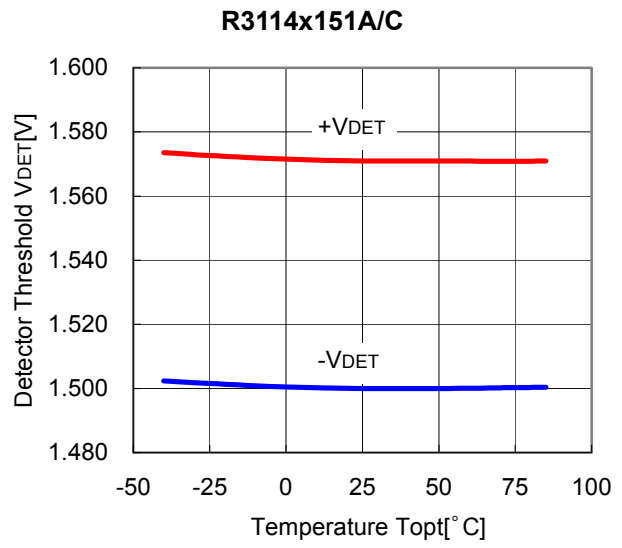
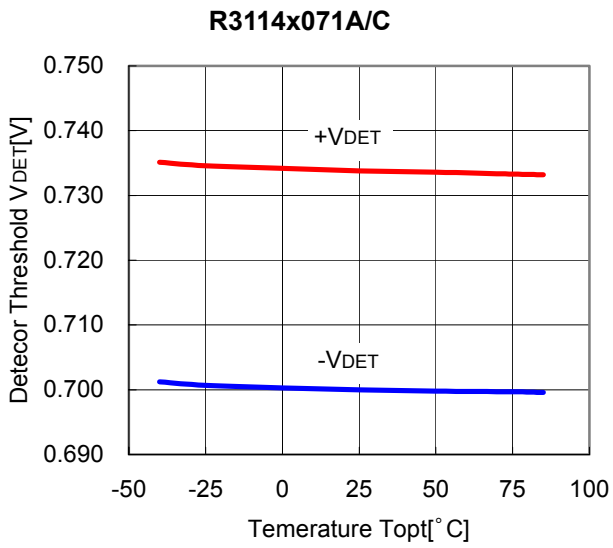
R3114x271A/C



R3114x451A/C

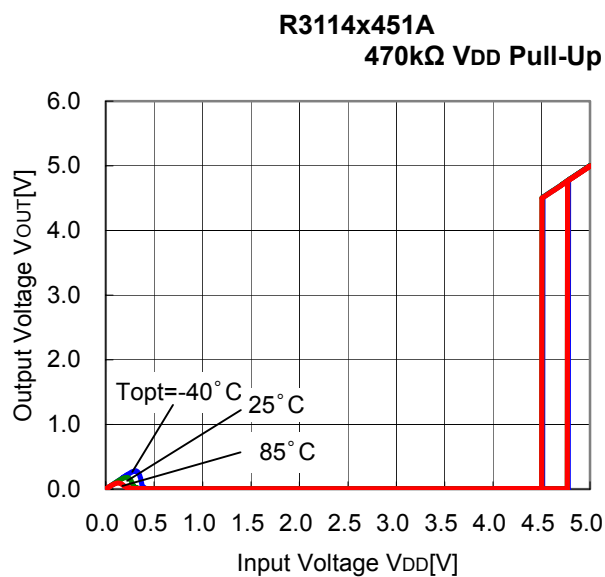
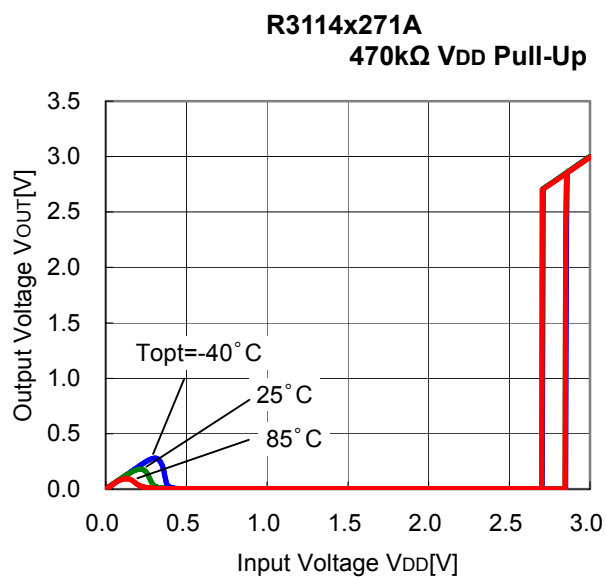
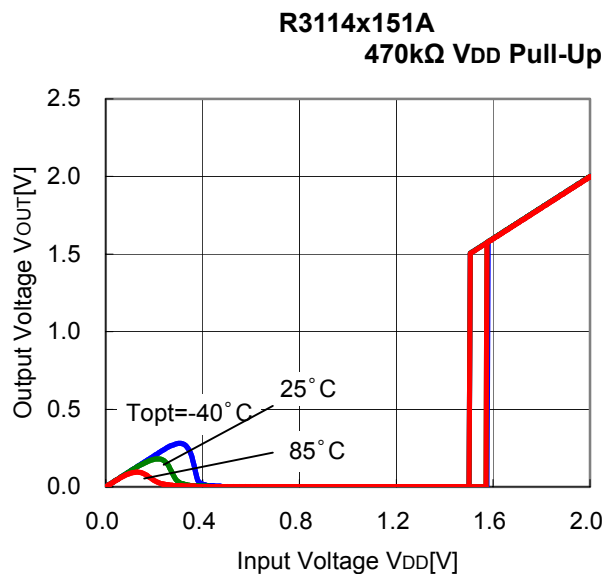
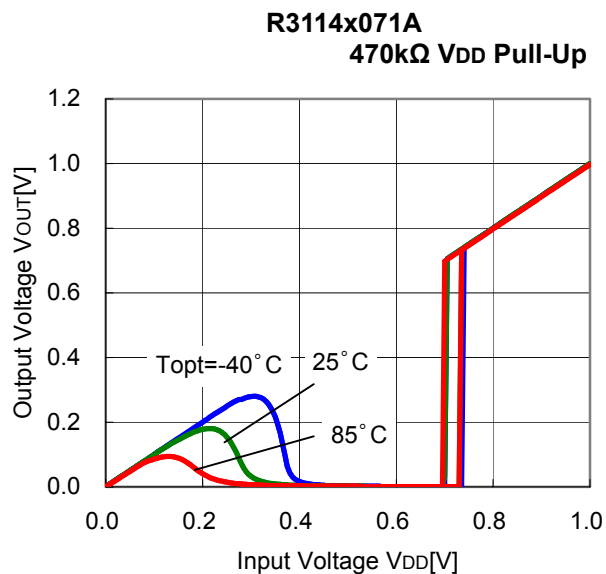


2) Detector Threshold Hysteresis vs. Temperature

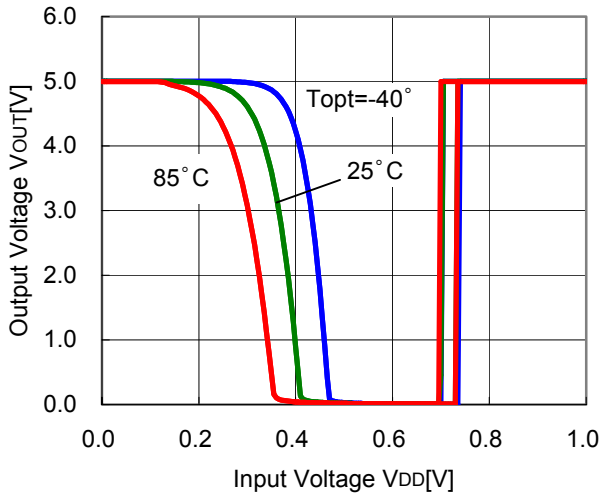




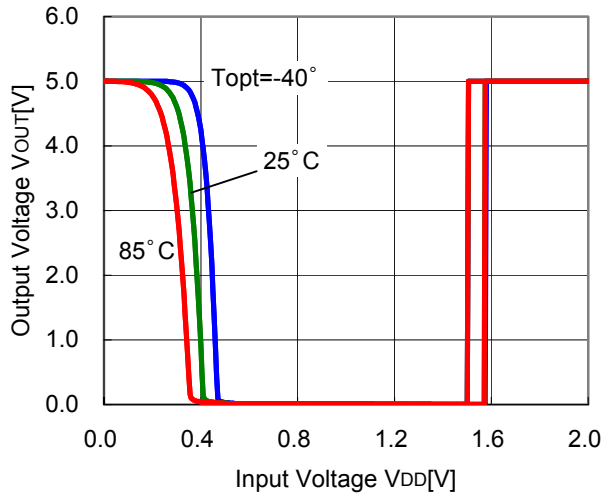
## 3) Output Voltage vs. Input Voltage



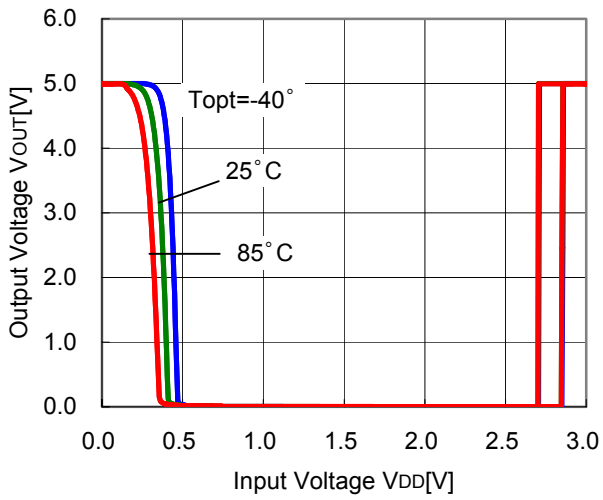
R3114x071A  
470kΩ 5V Pull-Up



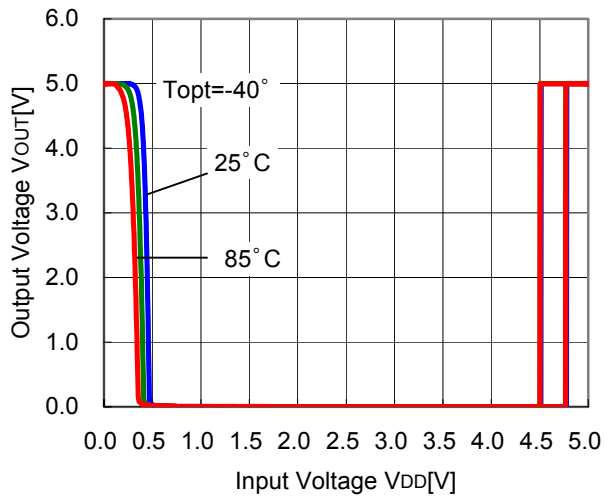
R3114x151A  
470kΩ 5V Pull-Up



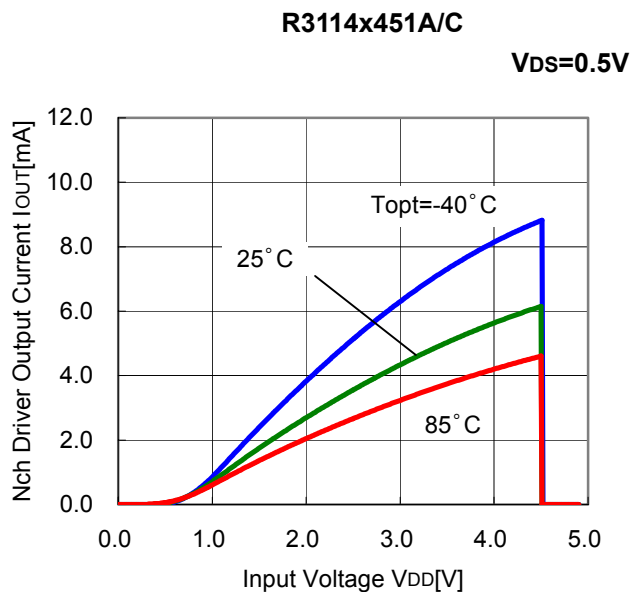
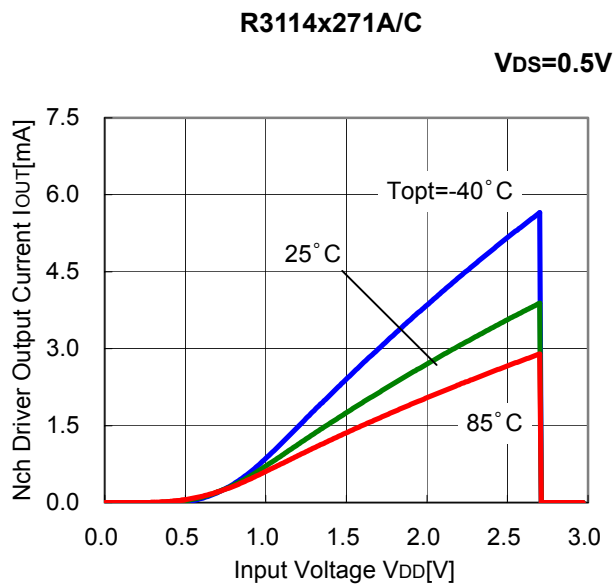
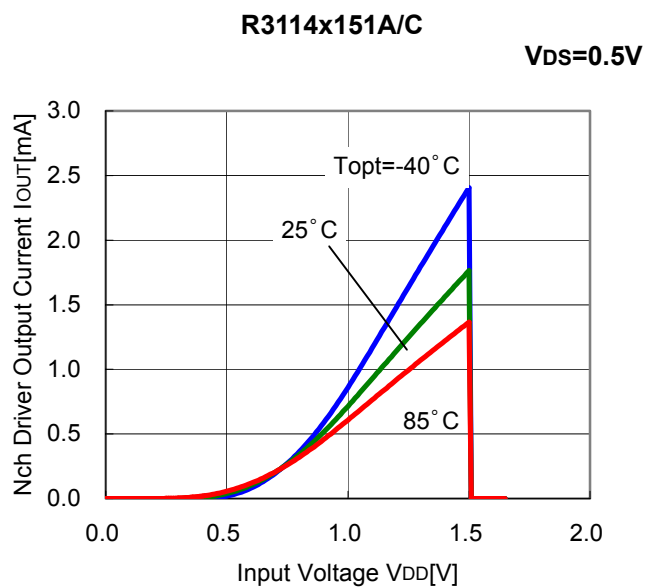
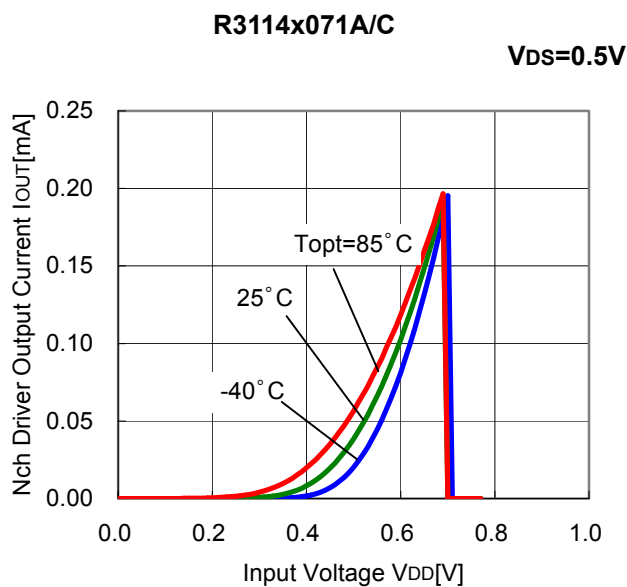
R3114x271A  
470kΩ 5V Pull-Up



R3114x451A  
470kΩ 5V Pull-Up

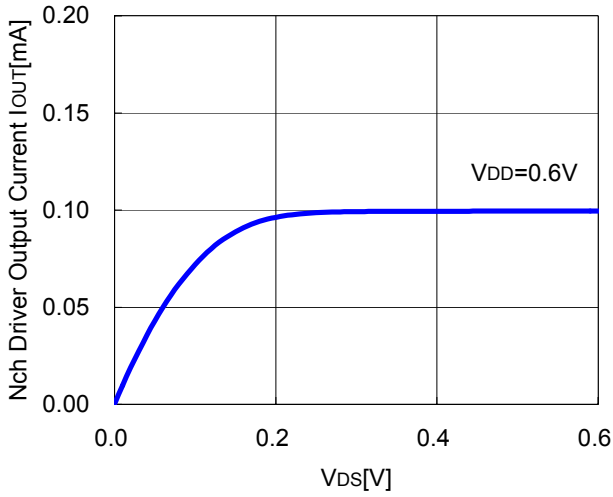


## 4) Nch Driver Output Current vs. Vds

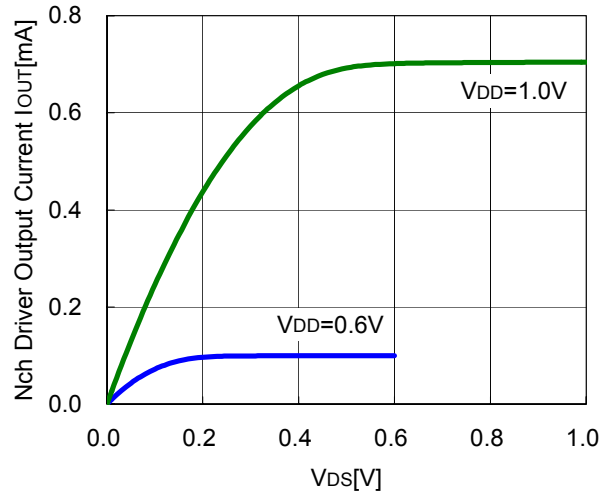


5) Nch Driver Output Current vs. Input Voltage

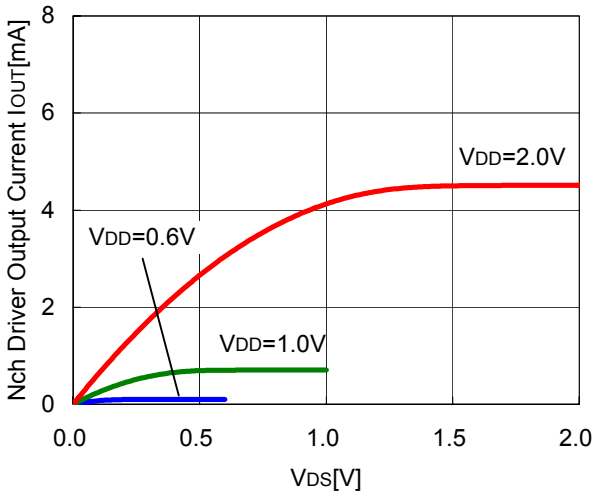
R3114x071A/C



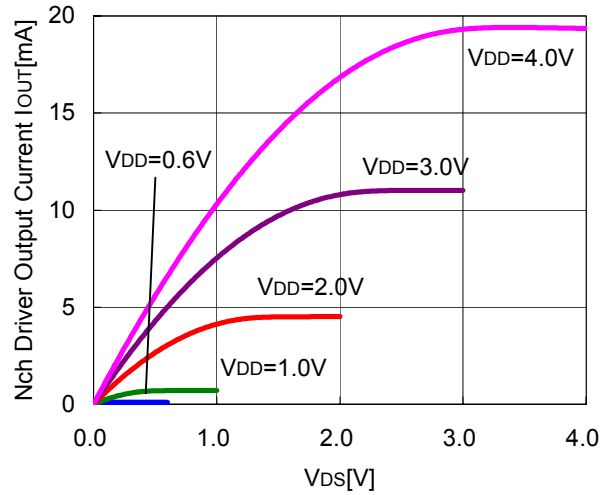
R3114x151xA/C



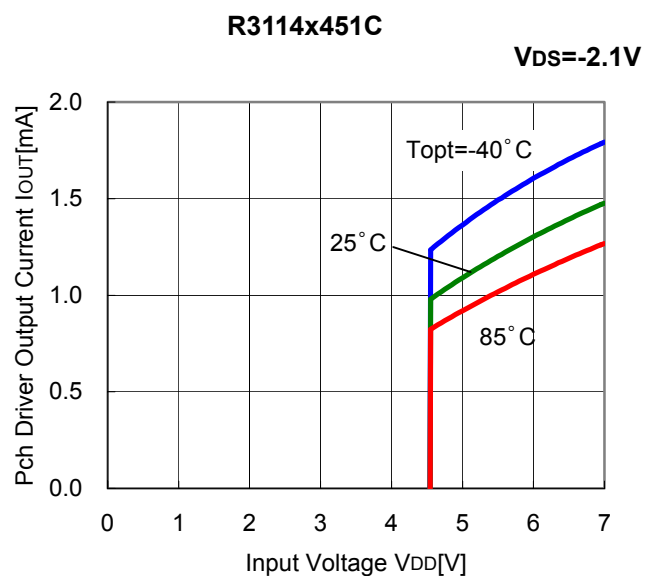
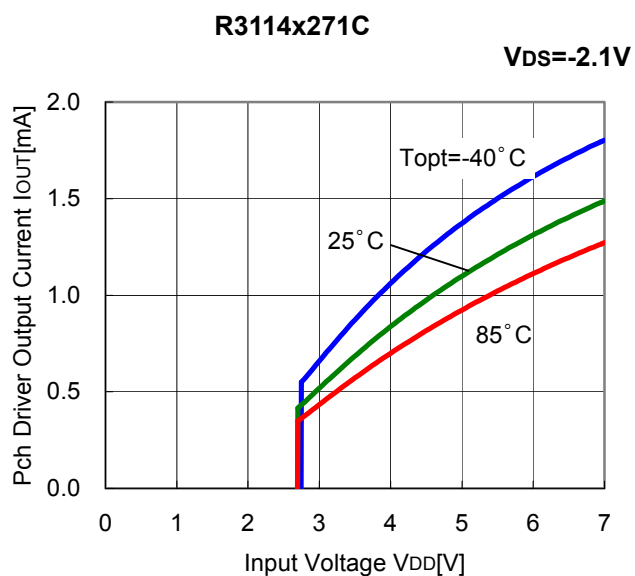
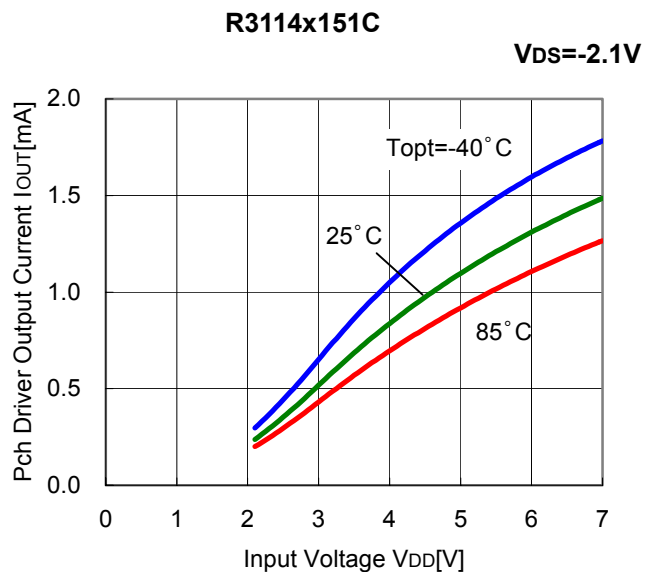
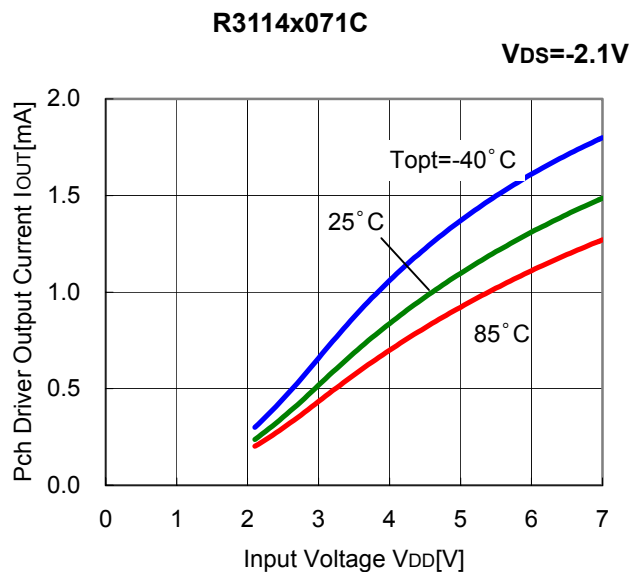
R3114x271A/C



R3114x451A/C

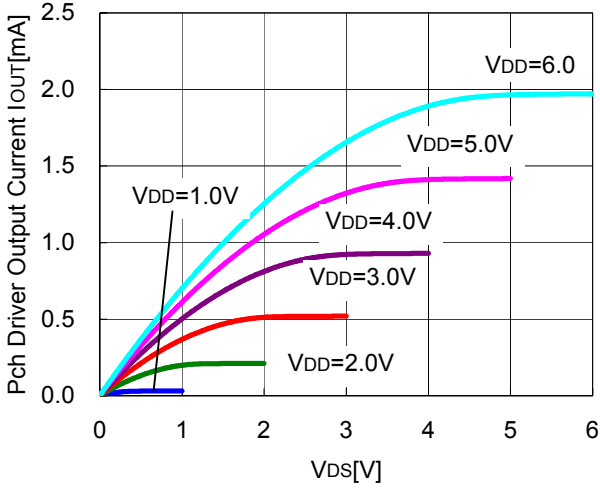


## 6) Pch Driver Output Current vs. Input Voltage

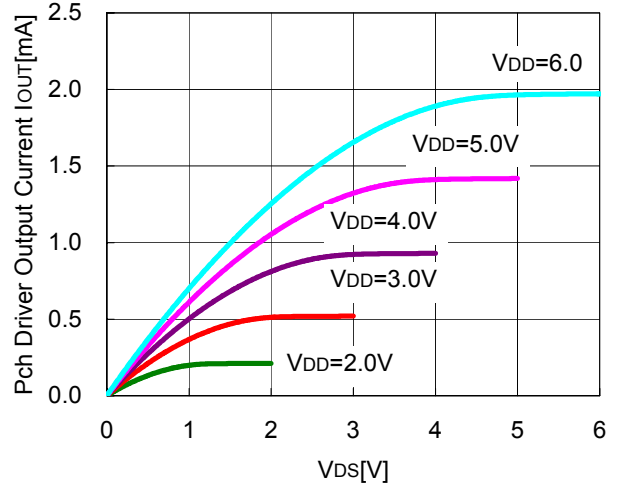


7) Pch Driver Output Current vs. Vds

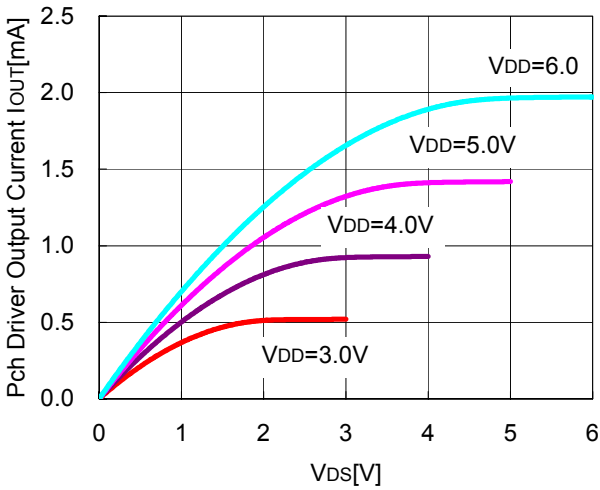
R3114x071C



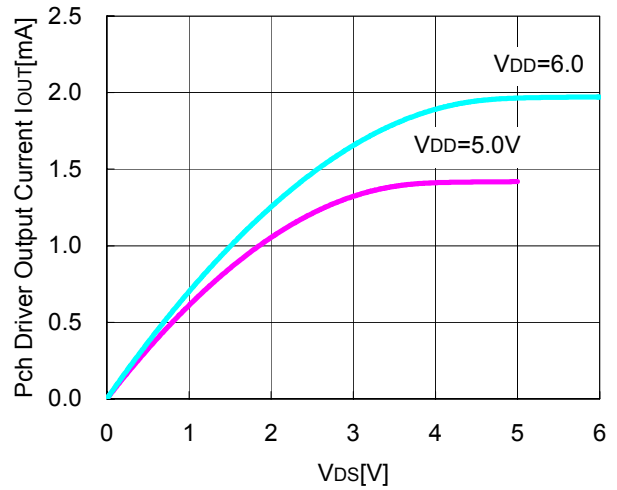
R3114x151C



R3114x271C

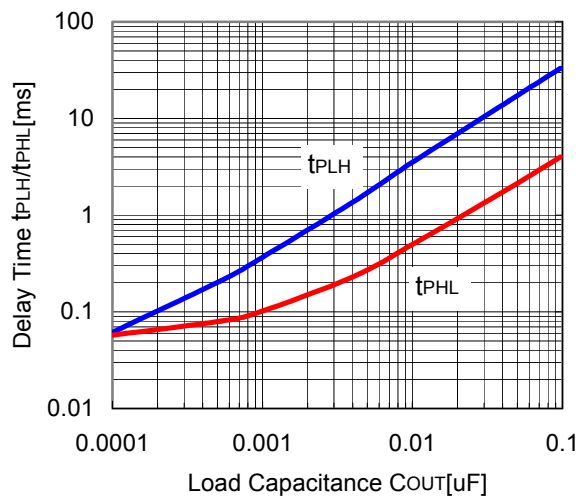


R3114x451C

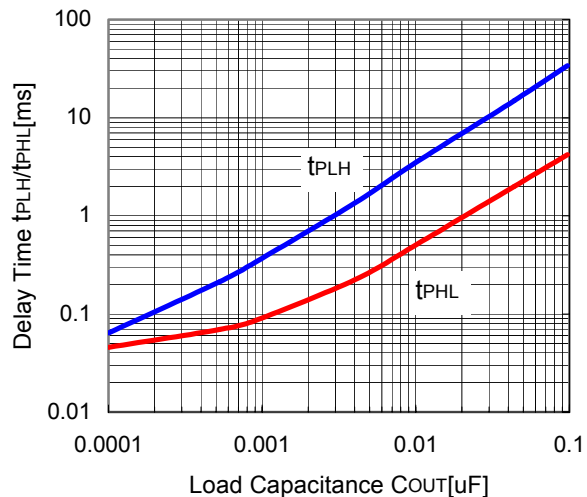


## 8) Output Delay Time vs. Load Capacitance

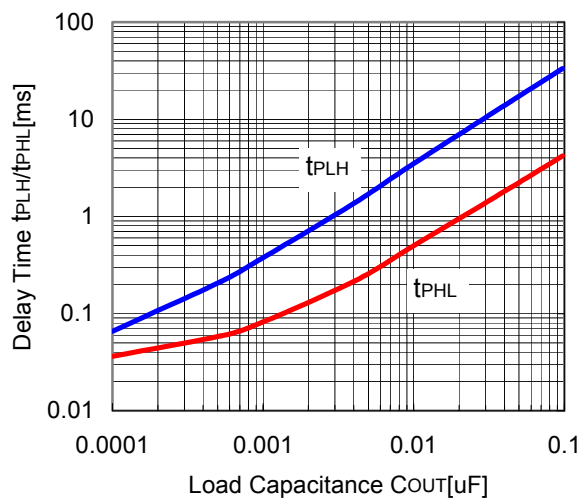
R3114x071A



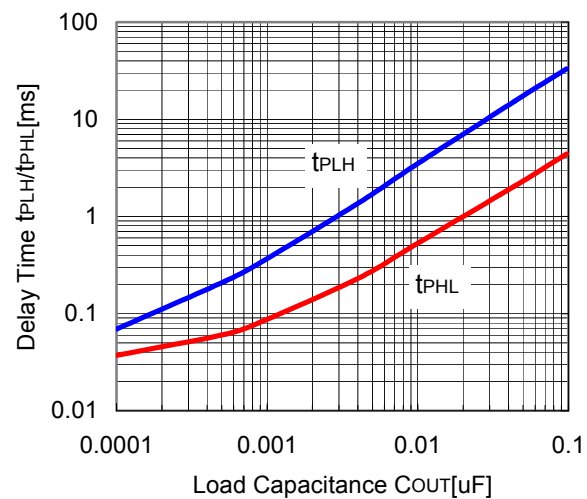
R3114x151A



R3114x271A



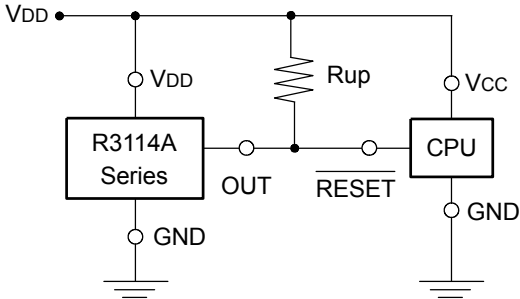
R3114x451A



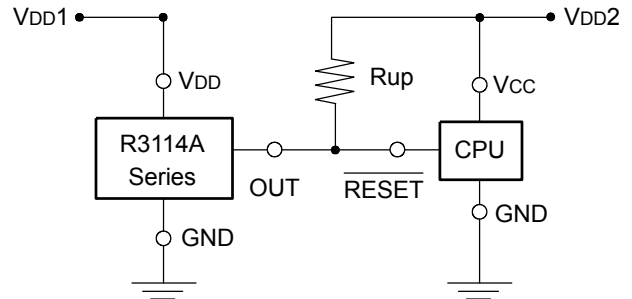
**TYPICAL APPLICATION**

**CPU Reset Circuit 1 (Nch Open Drain Output)**

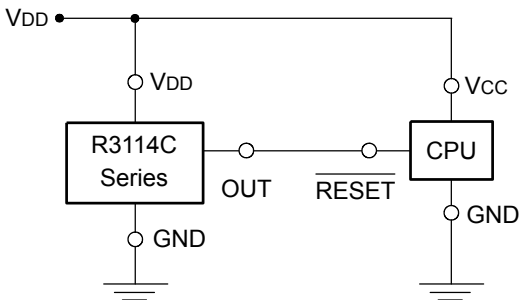
(1) Input Voltage to R3114A series is equal to Input Voltage to CPU



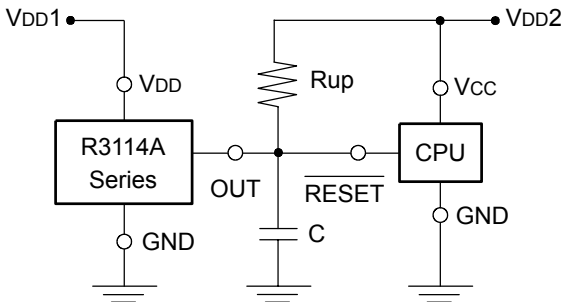
(2) Input Voltage to R3114A series is unequal to Input Voltage to CPU



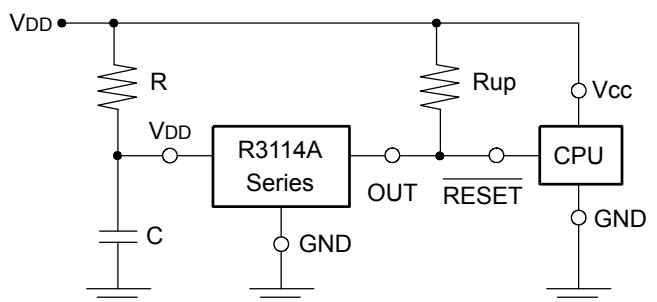
**CPU Reset Circuit 2 (CMOS Output)**



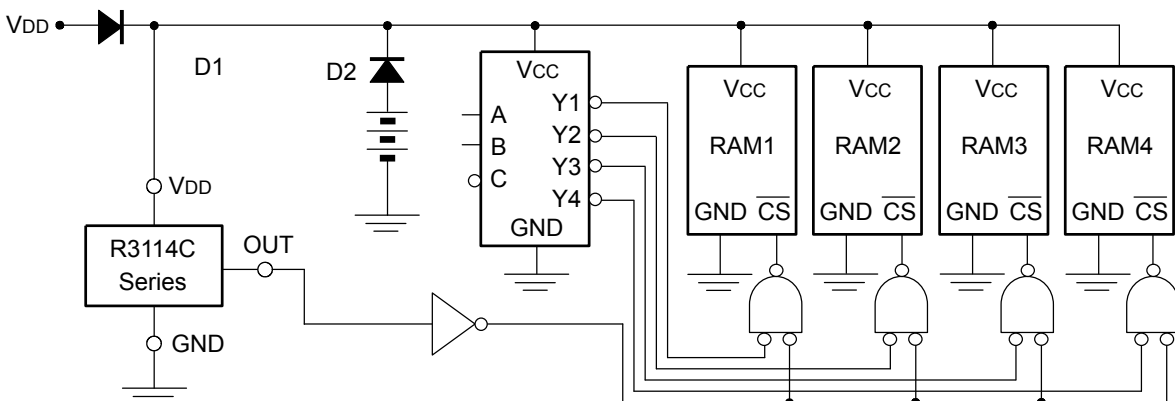
**Output Delay Time Circuit 1 (Nch Open Drain Output)**



**Output Delay Time Circuit 2 (Nch Open Drain Output)**

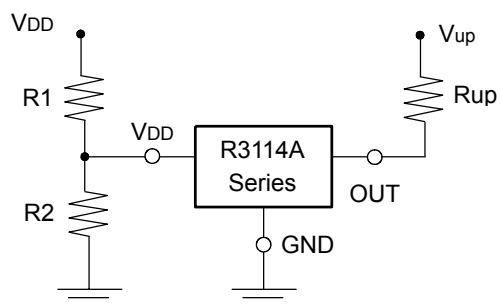


**Memory Back-up Circuit**





### Detector Threshold Adjustable Circuit 1 (Nch Open Drain Output)

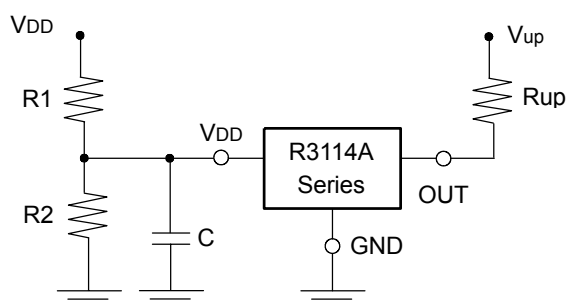


Adjustable Detector Threshold =  $(-V_{det}) \times (R1+R2) / R2$

Hysteresis Voltage =  $(V_{HYS}) \times (R1+R2) / R2$

- \*1) To prevent oscillation, set  $R1 \leq 1k\Omega$ ,  $R2 \leq 100\Omega$
- \*2) If the value of R1 is set excessively large, voltage drop may occur caused by the supply current of IC itself, and detector threshold and hysteresis voltage may vary.
- \*3) If Vup and VDD are connected, the voltage dropdown caused by Rup, may cause difference in the hysteresis voltage.

### Detector Threshold Adjustable Circuit 2 (Nch Open Drain Output)

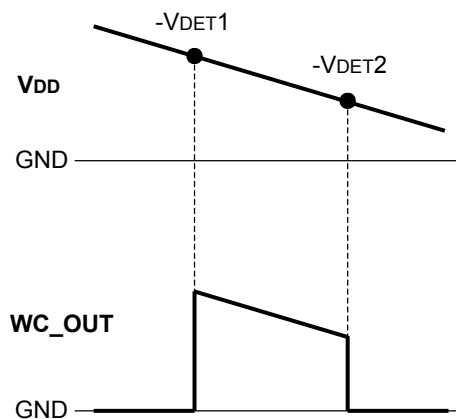
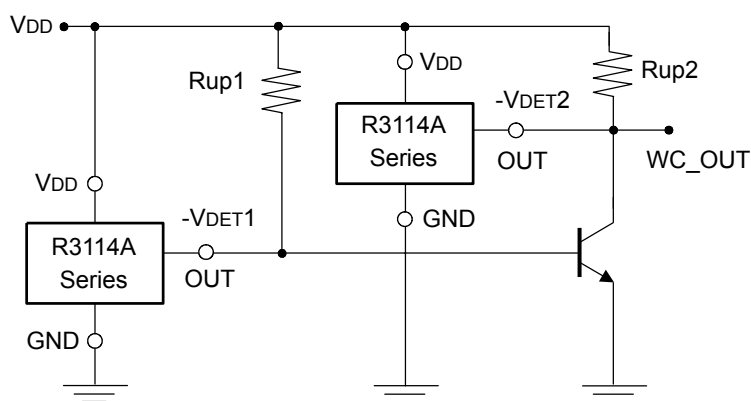


Adjustable Detector Threshold =  $(-V_{DET}) \times (R1+R2) / R2$

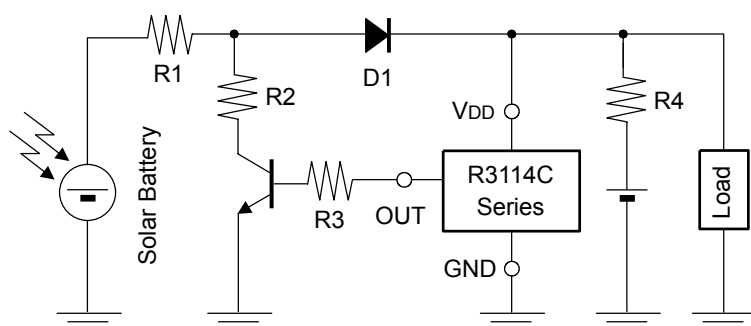
Hysteresis Voltage =  $V_{HYS} \times (R1+R2) / R2$

- \*1) To prevent oscillation, set  $R1 \leq 100k\Omega$ ,  $C \geq 0.01\mu F$ .
- \*2) If the value of R1 is set excessively large, voltage drop may occur caused by the supply current of IC itself, and detector threshold and hysteresis voltage may vary.
- \*3) If Vup and VDD are connected, the voltage dropdown caused by Rup, may cause difference in the hysteresis voltage.
- \*4) If the value of R1, R2 and C are set excessively large, the delay of the start-up may become too long.

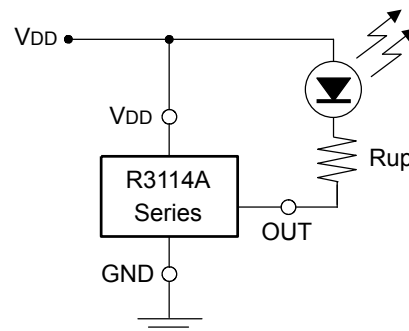
### Window Comparator Circuit (Nch Open Drain Output)



### Over-charge Preventing Circuit



### Voltage level Indicator Circuit (lighted when the power runs out)



### TECHNICAL NOTES

When R3114xxx1A/C is used in Figure X, if the value of R1 is set excessively large, the dropdown voltage caused by the consumption current of IC itself, may vary the detector threshold and the release voltage. Also, if the value of R1 is set excessively large, there may be delay in start-up and may cause oscillation generated by cross conduction current.

When R3114xxx1A/C is used in Figure Y, if the value of R1 is set excessively large, the dropdown voltage caused by the consumption current of IC itself, may vary the detector threshold and the released voltage. Also, if the value of R1 and R2 is set excessively large, there may be delay in start-up and may cause oscillation generated by cross conduction current.

When R3114xxx1A/C is used in Figure Z, if the value of R1 is set excessively large, the dropdown voltage caused by the consumption current of IC itself may vary the detector threshold and the release voltage. Also, if the value of R1 is set excessively large, there may be delay in start-up and may cause oscillation generated by cross conduction current. Furthermore, if the value of R1 is set large and the value of R3 is set small, released voltage level may shift and the minimum operating voltage may differ. If the value of R3 is set excessively small from R1, release may not occur and may cause oscillation.

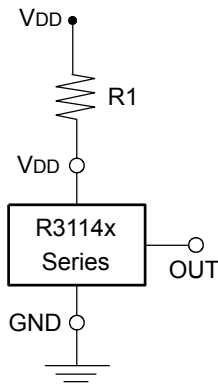


Figure X

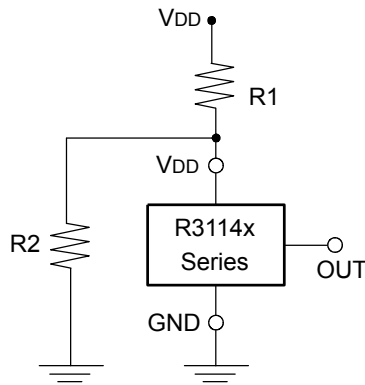


Figure Y

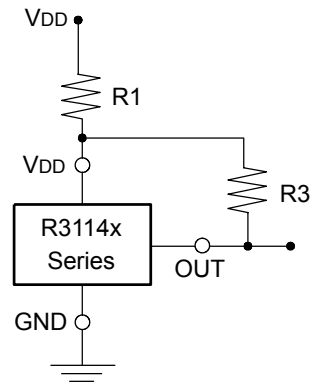


Figure Z