RICOH

R3134x SERIES

LOW VOLTAGE DETECTOR WITH BUILT-IN DELAY CIRCUIT

NO.EA-209-090821

OUTLINE

R3134x Series are CMOS-based voltage detector ICs with built-in delay circuit, high detector threshold accuracy, and ultra low supply current, which can operate at low voltage.

These ICs can be used as system reset generators, and each of these ICs consists of a voltage reference, a comparator, resistors for setting voltage detector threshold, an output driver transistor, manual reset circuit, and an output delay generator.

Detector threshold is fixed internally with high accuracy and requires no adjustment. When a supply voltage crosses a setting detector threshold voltage from a high value to a lower value, this IC generates reset signal.

R3134x Series output "L" at its detect.

Since each of R3134x Series embeds an output delay generator, during a setting 240ms delay time, which is fixed in the IC, this IC keeps the reset condition after they are released. Released conditions will be kept for the delay time from when a supply voltage crosses a setting detector threshold voltage from a low value to a higher value, or from when the manual reset signal is released.

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

Since the packages for these ICs are DFN(PLP)1212-6, SOT-23-5, and SC-88A, high density mounting of the ICs on board is possible.

FEATURES

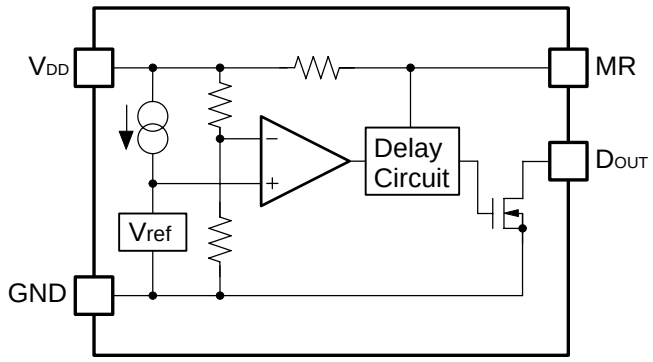
- Supply Current ..... Typ. 0.8μA (R3134x27Ex, V_{DD}=3.0V)
- Operating Voltage Range ..... 0.75V to 6.0V (T_{opt}=25°C)
- Detector Threshold Range ..... Setting with a step of 0.1V in the range of 1.0V to 5.0V is possible.
  Further, 2.32V, 2.63V, 2.93V, 3.08V, 4.38V, and 4.63V can be provided as standard.
- Detector Threshold Accuracy ..... ±1.8%
- Temperature-Drift Coefficient of Detector Threshold ..... Typ. ±100ppm/°C
- Built-in Delay Time Circuit ..... Typ. 240ms
- Output Delay Time Accuracy ..... ±15%
- Output Types ..... Nch Open Drain and CMOS
- Packages ..... DFN(PLP)1212-6, SC-88A, SOT-23-5

APPLICATIONS

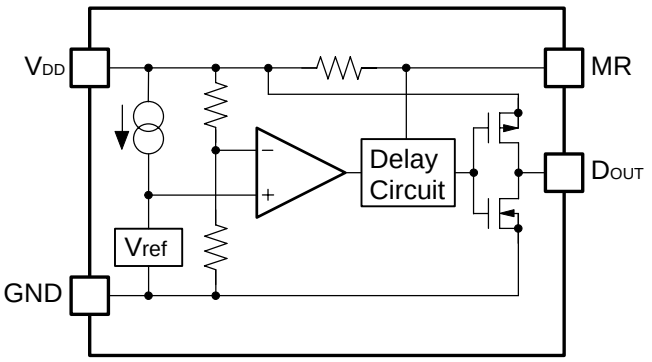
- CPU and Logic Circuit Reset
- Battery Checker
- Window Comparator
- Wave Shaping Circuit
- Battery Back-up Circuit
- Power Failure Detector

BLOCK DIAGRAMS

Nch Open Drain Output (R3134xxxEA)



CMOS Output (R3134xxxEC)



SELECTION GUIDE

The package type, the detector threshold, the output type and the taping type for the ICs can be selected at the users' request.

The selection can be made with designating the part number as shown below;

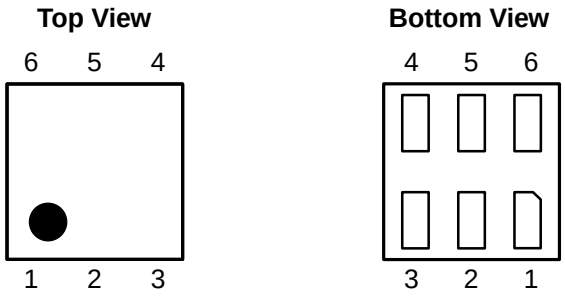
R3134xxxEx(x)-xx-x ← Part Number

a b c b' d e

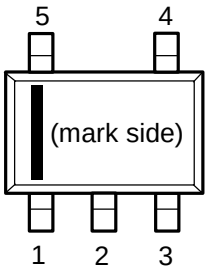
Code	Contents
a	Designation of Package Type; K: DFN(PLP)1212-6 Q: SC-88A N: SOT-23-5
b, b'	Setting Detector Threshold (V_{DET}); Stepwise setting with a step of 0.1V in the range of 1.0V to 5.0V is possible. b' describes the last digit of the next items; 2.32V/2.63V/2.93V/3.08V/4.63V Ex. 2.63V Output: R3134x26Ex3-xx-x
c	Designation of Output Type; A: Nch Open Drain C: CMOS
d	Designation of Taping Type ; TR (Refer to Taping Specifications; TR type is the standard direction.)
e	Designation of Composition of pin plating -F : Lead free solder plating (SC-88A, SOT-23-5) None: Au plating (DFN(PLP)1212-6)

PIN CONFIGURATIONS

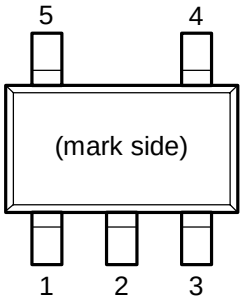
● **DFN(PLP)1212-6**



● **SC-88A**



● **SOT-23-5**



PIN DESCRIPTIONS

● **DFN(PLP)1212-6**

Pin No.	Symbol	Description
1	V_{DD}	Input Pin
2	NC	No Connection
3	GND	Ground Pin
4	D_{OUT}	Output Pin ("L" at detection, "H" at released)
5	NC	No Connection
6	MR	Manual Reset Input Pin*

● **SC-88A**

Pin No.	Symbol	Description
1	V_{DD}	Input Pin
2	GND	Ground Pin
3	MR	Manual Reset Input Pin*
4	D_{OUT}	Output Pin ("L" at detection, "H" at released)
5	NC	No Connection

● **SOT-23-5**

Pin No.	Symbol	Description
1	D_{OUT}	Output Pin ("L" at detection, "H" at released)
2	V_{DD}	Input Pin
3	GND	Ground Pin
4	MR	Manual Reset Input Pin*
5	NC	No Connection

*) MR pin is active at "L" input. Pulled up via 1MΩ (Typ.). If MR pin is not necessary, open this node, or connect it to V_{DD}.

ABSOLUTE MAXIMUM RATINGS

Symbol	Item	Rating	Unit
V_{DD}	Supply Voltage	6.5	V
V_{OUT}	Output Voltage (Nch Open Drain Output)	V_{SS}–0.3 to 6.5	V
	Output Voltage (CMOS Output)	V_{SS}–0.3 to V_{DD}+0.3	
V_{MR}	Input Voltage	V_{SS}–0.3 to V_{DD}+0.3	V
I_{OUT}	Output Current	20	mA
P_D	Power Dissipation (DFN(PLP)1212-6)*	400	mW
	Power Dissipation (SC-88A)*	380	
	Power Dissipation (SOT-23-5)*	420	
Topt	Operating Temperature Range	–40 to 85	°C
Tstg	Storage Temperature Range	–55 to 125	°C

∗) For Power Dissipation, please refer to PACKAGE INFORMATION.

ABSOLUTE MAXIMUM RATINGS

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

ELECTRICAL CHARACTERISTICS

- **R3134x**

The specification in ☐ is checked and guaranteed by design engineering at −40°C ≤ Topt ≤ 85°C.

Topt=25°C

Symbol	Item	Conditions		Min.	Typ.	Max.	Unit
V_{DET}	Detector Threshold			V_{DET} ×0.982		V_{DET} ×1.018	V
I_{SS1}	Supply Current1	$V_{DD}=V_{DET}-0.1V$, $I_{OUT}=0A$				2.0	μA
I_{SS2}	Supply Current2	$V_{DD}=V_{DET}+0.1V$, $I_{OUT}=0A$				2.0	μA
I_{SS3}	Supply Current3	V_{DD}=6V, I_{OUT}=0A	V_{DET} < 1.6V			3.6	μA
			1.6 ≤ V_{DET} < 2.7V			3.0	
			2.7V ≤ V_{DET}			2.5	
V_{DD}	Operating Voltage	Topt=25°C		0.75		6.00	V
		−40°C ≤ Topt ≤ 85°C		0.85		6.00	
V_{OH}	"H" Output Voltage	Refer to the following table					
V_{OL}	"L" Output Voltage	Refer to the following table					
V_{IH}	MR pin "H" Input Voltage	$V_{DD} \geq V_{DET}+0.1V$		0.75×V_{DD}			V
V_{IL}	MR pin "L" Input Voltage	$V_{DD} \geq V_{DET}+0.1V$				0.2×V_{DD}	V
R_{MR}	MR pin pull-up Resistance	Topt=25°C		0.5	1.0	4.0	MΩ
$\Delta V_{DET}/\Delta Topt$	Detector Threshold Temperature Coefficient	−40°C ≤ Topt ≤ 85°C			±100		ppm /°C
treset	Output Delay Time for detect *	$V_{DD}=V_{DET}\rightarrow V_{DET}-0.1V$			15		μs
tdelay	Output Delay Time for release	V_{DD}=0.8V→ V_{DET}+1.0		204	240	276	μs

*) Guaranteed by design, not mass production tested.

RECOMMENDED OPERATING CONDITIONS (ELECTRICAL CHARACTERISTICS)

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.

- **"H" Output Voltage (V_{OH}) table**

Topt=25°C

Products	Detector Threshold V_{DET} (V)	"H" Output Voltage V_{OH} (V)			
		Conditions	Min.	Typ.	Max.
R3134xxxEC	V_{DET} < 1.2V	V_{DD}=V_{DET}+0.1V, I_{OH}=50μA	0.8×V_{DD}		
	1.2V ≤ V_{DET} < 2.0V	V_{DD}=V_{DET}+0.1V, I_{OH}=150μA			
	2.0V ≤ V_{DET} < 3.1V	V_{DD}=V_{DET}+0.1V, I_{OH}=500μA			
	3.1V ≤ V_{DET}	V_{DD}=V_{DET}+0.1V, I_{OH}=800μA			

V_{DET} is a set value.

- **"L" Output Voltage (V_{OL}) table**

Topt=25°C

Products	Detector Threshold V_{DET} (V)	"L" Output Voltage V_{OL} (V)			
		Conditions	Min.	Typ.	Max.
R3134xxxEx	V_{DET} < 1.2V	V_{DD}=V_{DET}–0.1V, I_{OL}=200μA			0.04
	1.2V ≤ V_{DET} < 2.0V	V_{DD}=V_{DET}–0.1V, I_{OL}=750μA			0.06
	2.0V ≤ V_{DET} < 3.1V	V_{DD}=V_{DET}–0.1V, I_{OL}=1.2mA			0.05
	3.1V ≤ V_{DET}	V_{DD}=V_{DET}–0.1V, I_{OL}=3.2mA			0.06

V_{DET} is a set value.

DETECTOR THRESHOLD SPECIFICATIONS BY PART NUMBER

- **R3134x**

Part Number	Operating Voltage				Detector Threshold			Supply Current 1		
	V_{DD} [V]				V_{DET} [V]			I_{SS1} [µA]		
	Conditions	Max.	Conditions	Max.	Min.	Typ.	Max.	Conditions	Typ.	Max.
R3134x23Ex2	Topt=25°C	0.75	−40°C ≤ Topt ≤ 85°C	0.85	2.278	2.320	2.362	V_{DD}=V_{DET}−0.1V I_{OUT}=0A	0.8	2.0
R3134x26Ex3					2.583	2.630	2.677			
R3134x29Ex3					2.877	2.930	2.983		0.9	
R3134x30Ex8					3.025	3.080	3.135			
R3134x43Ex8					4.301	4.380	4.459			
R3134x46Ex3					4.547	4.630	4.713			
R3134x10Ex	Topt=25°C	0.75	−40°C ≤ Topt ≤ 85°C	0.85	0.982	1.000	1.018	V_{DD}=V_{DET}−0.1V I_{OUT}=0A	0.8	2.0
R3134x11Ex					1.080	1.100	1.120			
R3134x12Ex					1.178	1.200	1.222			
R3134x13Ex					1.277	1.300	1.323			
R3134x14Ex					1.375	1.400	1.425			
R3134x15Ex					1.473	1.500	1.527			
R3134x16Ex					1.571	1.600	1.629			
R3134x17Ex					1.669	1.700	1.731			
R3134x18Ex					1.768	1.800	1.832			
R3134x19Ex					1.866	1.900	1.934			
R3134x20Ex					1.964	2.000	2.036			
R3134x21Ex					2.062	2.100	2.138			
R3134x22Ex					2.160	2.200	2.240			
R3134x23Ex					2.259	2.300	2.341			
R3134x24Ex					2.357	2.400	2.443			
R3134x25Ex					2.455	2.500	2.545			
R3134x26Ex					2.553	2.600	2.647			
R3134x27Ex					2.651	2.700	2.749		0.9	
R3134x28Ex					2.750	2.800	2.850			
R3134x29Ex					2.848	2.900	2.952			
R3134x30Ex					2.946	3.000	3.054			
R3134x31Ex					3.044	3.100	3.156			
R3134x32Ex					3.142	3.200	3.258			
R3134x33Ex					3.241	3.300	3.359			
R3134x34Ex					3.339	3.400	3.461			
R3134x35Ex					3.437	3.500	3.563			
R3134x36Ex					3.535	3.600	3.665			
R3134x37Ex					3.633	3.700	3.767			
R3134x38Ex					3.732	3.800	3.868			
R3134x39Ex					3.830	3.900	3.970			
R3134x40Ex					3.928	4.000	4.072			
R3134x41Ex					4.026	4.100	4.174			
R3134x42Ex					4.124	4.200	4.276			
R3134x43Ex					4.223	4.300	4.377			
R3134x44Ex					4.321	4.400	4.479			
R3134x45Ex					4.419	4.500	4.581			
R3134x46Ex					4.517	4.600	4.683			
R3134x47Ex					4.615	4.700	4.785			
R3134x48Ex					4.714	4.800	4.886			
R3134x49Ex					4.812	4.900	4.988			
R3134x50Ex					4.910	5.000	5.090			

Supply Current 2			Supply Current 3			"H" Output Voltage	
I_{SS2} [µA]			I_{SS3} [µA]			V_{OH} [V]	
Conditions	Typ.	Max.	Conditions	Typ.	Max.	Conditions	Min.
$V_{DD}=V_{DET}+0.1V$ $I_{OUT}=0A$	0.8	2.0	$V_{DD}=6.0V$ $I_{OUT}=0A$	1.2	3.0	$V_{DD}=V_{DET}+0.1V$ $I_{OH}=500\mu A$	$0.8\times V_{DD}$
				1.0	2.5	$V_{DD}=V_{DET}+0.1V$ $I_{OH}=800\mu A$	
$V_{DD}=V_{DET}+0.1V$ $I_{OUT}=0A$	0.8	2.0	$V_{DD}=6.0V$ $I_{OUT}=0A$	1.4	3.6	$V_{DD}=V_{DET}+0.1V$ $I_{OH}=50\mu A$	$0.8\times V_{DD}$
						$V_{DD}=V_{DET}+0.1V$ $I_{OH}=150\mu A$	
				1.2	3.0	$V_{DD}=V_{DET}+0.1V$ $I_{OH}=500\mu A$	
				1.0	2.5	$V_{DD}=V_{DET}+0.1V$ $I_{OH}=800\mu A$	
				0.8			

Part Number	"L" Output Voltage		MR pin "H" Input Voltage		MR pin "L" Input Voltage		MR pin pull-up resistance			
	V_{OL} [V]		V_{IH} [V]		V_{IL} [V]		R_{MR} [MΩ]			
	Conditions	Max.	Conditions	Min.	Conditions	Max.	Conditions	Min.	Typ.	Max.
R3134x23Ex2	$V_{DD}=V_{DET}-0.1V$ $I_{OL}=1.2\mu A$	0.05	$V_{DD} \geq V_{DET}+0.1$	0.75× V_{DD}	$V_{DD} \geq V_{DET}+0.1$	0.2× V_{DD}	Topt=25°C	0.5	1.0	4.0
R3134x26Ex3										
R3134x29Ex3										
R3134x30Ex8										
R3134x43Ex8	$V_{DD}=V_{DET}-0.1V$ $I_{OL}=3.2\mu A$	0.06								
R3134x46Ex3										
R3134x10Ex	$V_{DD}=V_{DET}-0.1V$ $I_{OL}=200\mu A$	0.04	$V_{DD} \geq V_{DET}+0.1$	0.75× V_{DD}	$V_{DD} \geq V_{DET}+0.1$	0.2× V_{DD}	Topt=25°C	0.5	1.0	4.0
R3134x11Ex										
R3134x12Ex	$V_{DD}=V_{DET}-0.1V$ $I_{OL}=750\mu A$	0.06								
R3134x13Ex										
R3134x14Ex										
R3134x15Ex										
R3134x16Ex										
R3134x17Ex										
R3134x18Ex										
R3134x19Ex										
R3134x20Ex	$V_{DD}=V_{DET}-0.1V$ $I_{OL}=1.2\mu A$	0.05								
R3134x21Ex										
R3134x22Ex										
R3134x23Ex										
R3134x24Ex										
R3134x25Ex										
R3134x26Ex										
R3134x27Ex										
R3134x28Ex										
R3134x29Ex										
R3134x30Ex										
R3134x31Ex	$V_{DD}=V_{DET}-0.1V$ $I_{OL}=3.2\mu A$	0.06								
R3134x32Ex										
R3134x33Ex										
R3134x34Ex										
R3134x35Ex										
R3134x36Ex										
R3134x37Ex										
R3134x38Ex										
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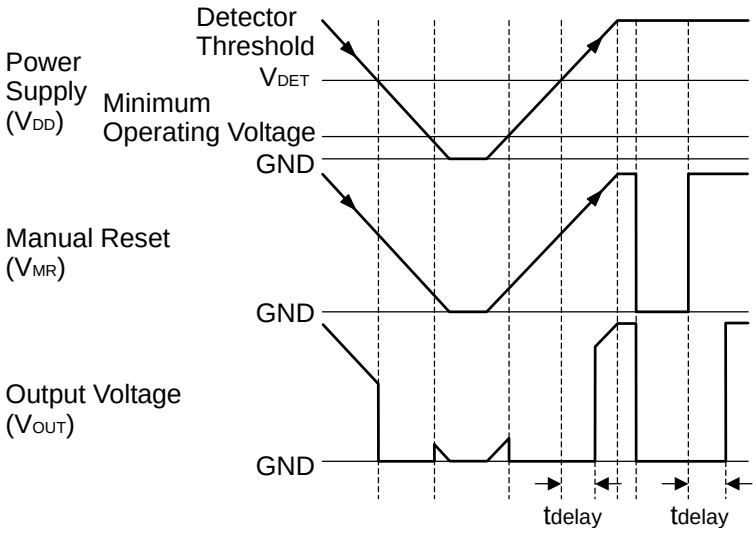
R3134x40Ex										
R3134x41Ex										
R3134x42Ex										
R3134x43Ex										
R3134x44Ex										
R3134x45Ex										
R3134x46Ex										
R3134x47Ex										
R3134x48Ex										
R3134x49Ex										
R3134x50Ex										

Output Delay Time for Release				Detector Threshold Temperature Coefficient	
Tdelay [μs]				ΔVDET/ΔTopt [ppm/°C]	
Conditions	Min.	Typ.	Max.	Conditions	
VDD=0.8V→VDET+1.0V Topt=25°C	204	240	276	−40°C ≤ Topt ≤ 85°C	±100
VDD=0.8V→VDET+1.0V Topt=25°C	204	240	276	−40°C ≤ Topt ≤ 85°C	±100

TIMING CHART



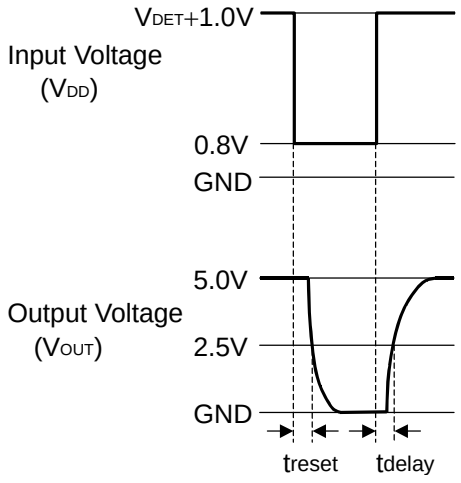
R3134x Operating Diagram

DEFINITION OF OUTPUT DELAY TIME

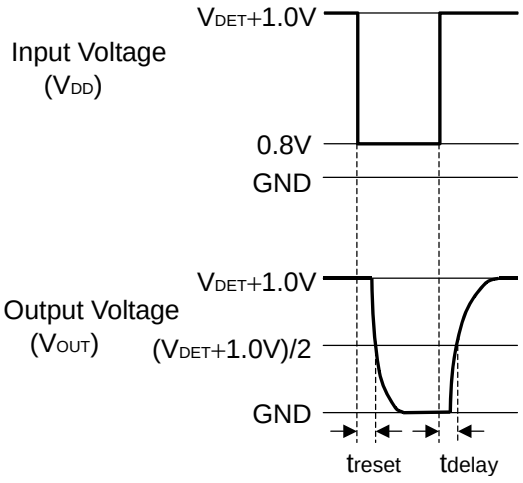
Output Delay Time (t_{delay}) is specified as follows:

1. In the case of Nch Open Drain Output:
   The time interval from rising edge of V_{DD} pulse 0.8V to V_{DET}+1.0V to the time at which the output reaches 2.5V under the condition that the output pin (D_{OUT}) is pulled up to 5V through a 470kΩ resistor.

2. In the case of CMOS Output:
   The time interval from rising edge of V_{DD} pulse 0.8V to V_{DET}+1.0V to the time at the output reaches (V_{DET}+1.0V)/2.



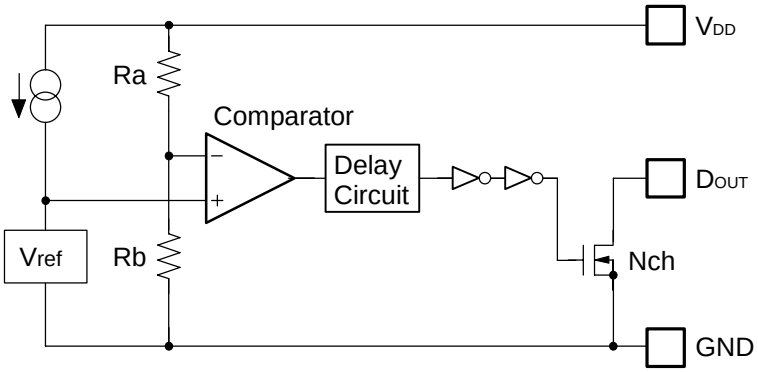
Nch Open Drain Output
(R3134xxxEA)



CMOS Output
(R3134xxxEC)

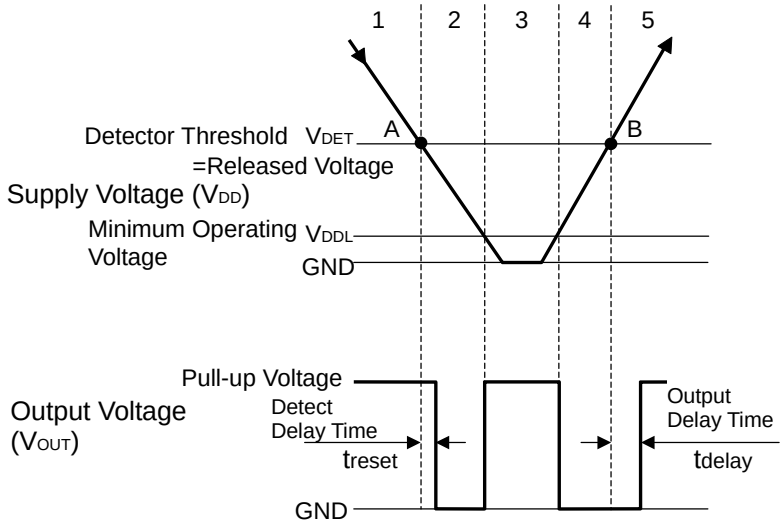
OPERATION

- **Operation of R3134xxxEA**



DOUT pin should be pulled-up to an external voltage level.

Block Diagram



Operation Diagram

- **Explanation of operation**

Step 1. The output voltage is equal to the pull-up voltage.

Step 2. At Point "A", $V_{ref} \geq V_{DD} \times Rb/(Ra+Rb)$ is true, as a result, the output of comparator is reversed from "L" to "H", therefore the output voltage becomes the GND level. The voltage level of Point A means a detector threshold voltage (V_{DET}).

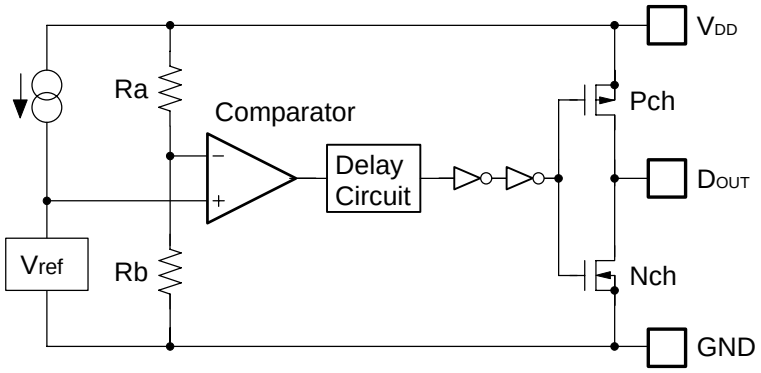
Step 3. When the supply voltage is lower than the minimum operating voltage, the operation of the output transistor becomes indefinite. The output voltage is equal to the pull-up voltage.

Step 4. The output voltage is equal to the GND level.

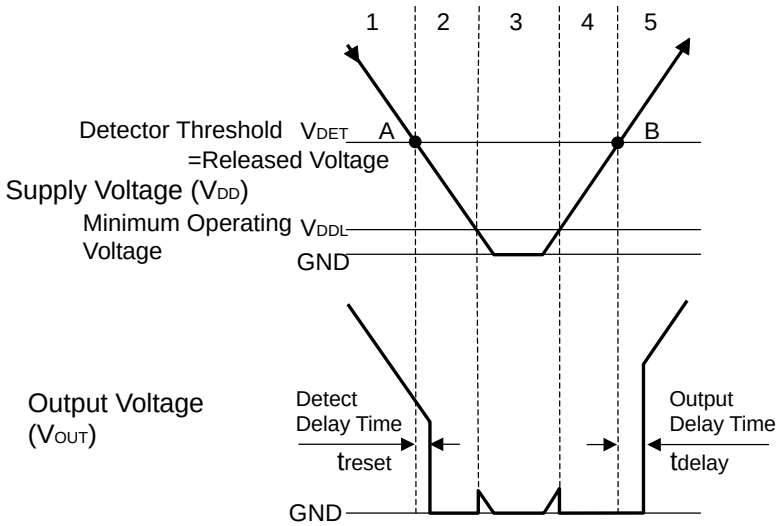
Step 5. At Point "B", $V_{ref} \leq V_{DD} \times Rb/(Ra+Rb)$ is true, as a result, the output of comparator is reversed from "H" to "L", then the output voltage is equal to the pull-up voltage. The voltage level of Point B means a released voltage (V_{DET}).

∗) There is no hysteresis range between the detector threshold and the released voltage.

- **Operation of R3134xxxEC**



Block Diagram



Operation Diagram

- **Explanation of operation**

Step 1. The output voltage is equal to the supply voltage (V_{DD}).

Step 2. At Point "A", $V_{ref} \geq V_{DD} \times Rb/(Ra+Rb)$ is true, as a result, the output of comparator is reversed from "L" to "H", 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.

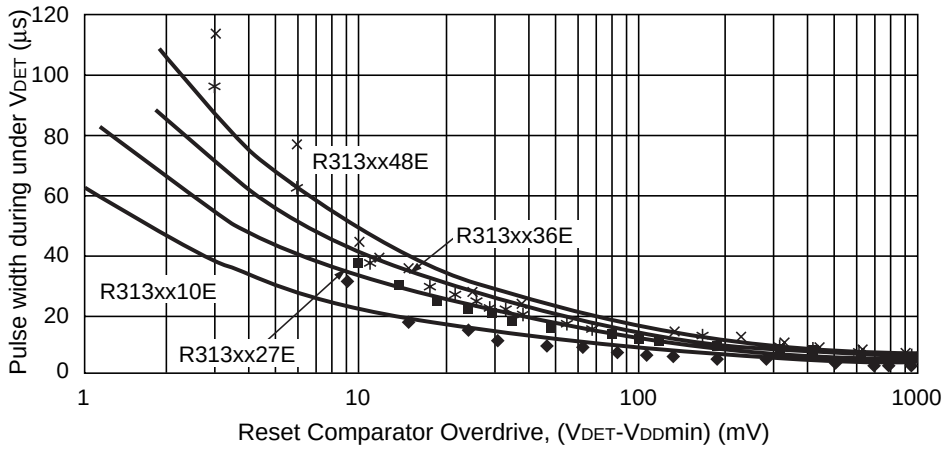
Step 4. The output voltage is equal to the GND level.

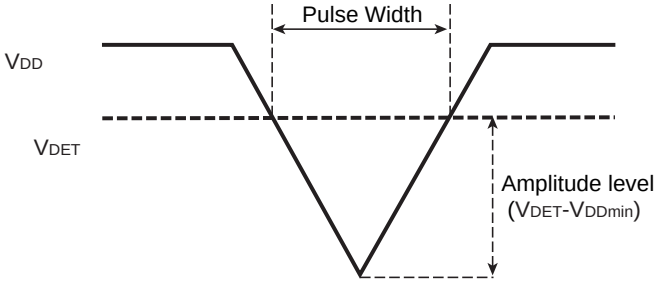
Step 5. At Point "B", $V_{ref} \leq V_{DD} \times Rb/(Ra+Rb)$ is true, as a result, the output of comparator is reversed from "H" to "L", then the output voltage is equal to the supply voltage (V_{DD}). The voltage level of Point B means a released voltage (V_{DET}).

∗) There is no hysteresis range between the detector threshold and the released voltage.

Detector Operation vs. glitch input voltage to the V_{DD} pin

When the IC is released and a large pulse (glitch) crosses the detector threshold is forced, the IC may not maintain the released condition. The amplitude of the pulse (V_{DET}-V_{DD}min) and the pulse width the IC can maintain the released level is described in the graph as follows:

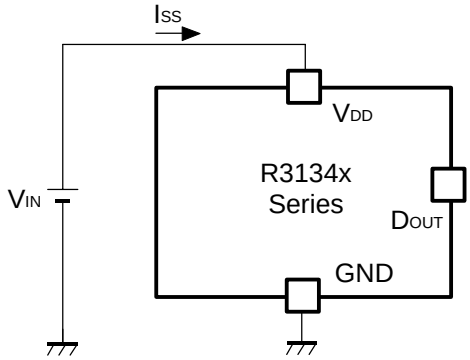




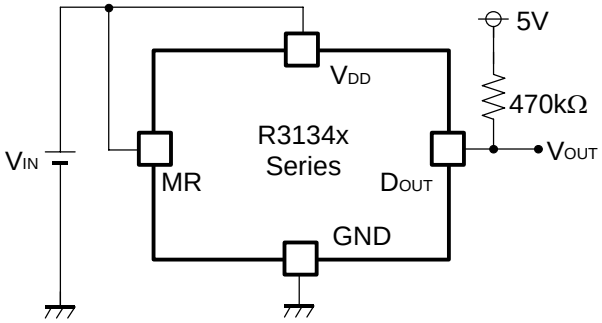
V_{IN} Input Waveform

The graph above shows the condition for the maximum transient duration without generating a reset. If the larger amplitude or larger pulse width noise than the graph may be on the V_{DD}, the reset signal may be generated.

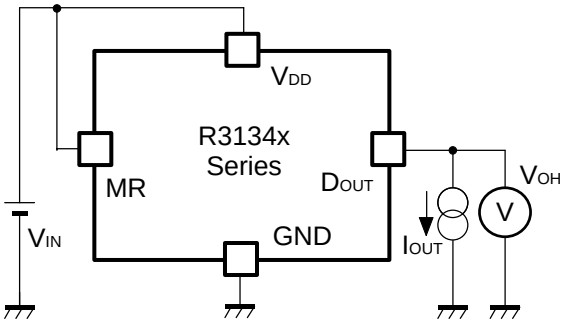
TEST CIRCUITS



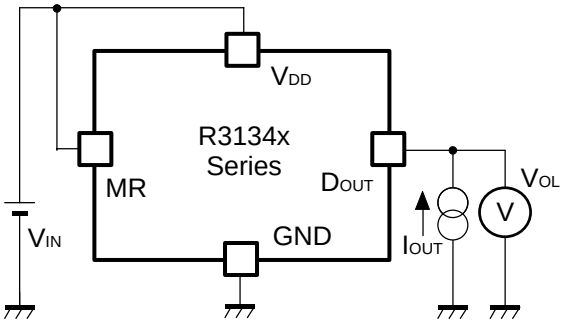
Supply Current Test Circuit



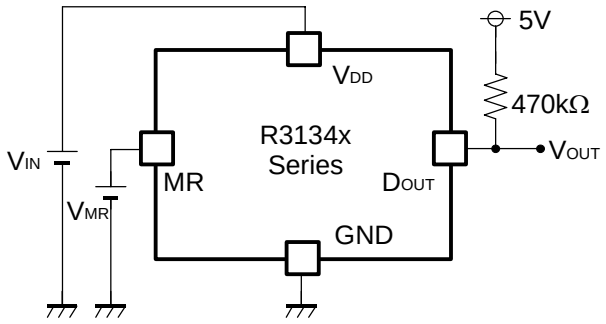
Detector Threshold Test Circuit
(Pull-up circuit is not necessary for CMOS Output type.)



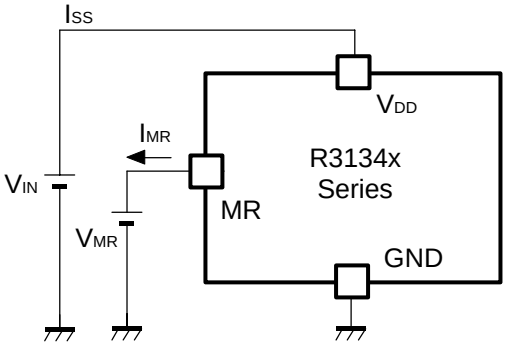
"H" Output Voltage Test Circuit
(CMOS Output Type only)



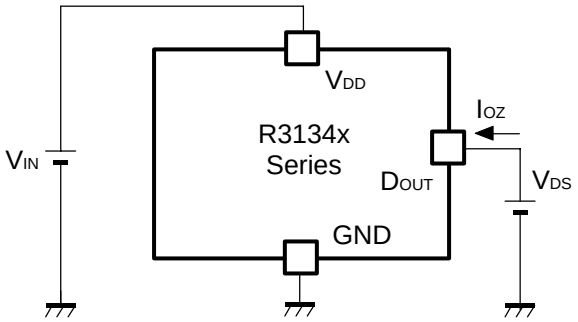
"L" Output Voltage Test Circuit



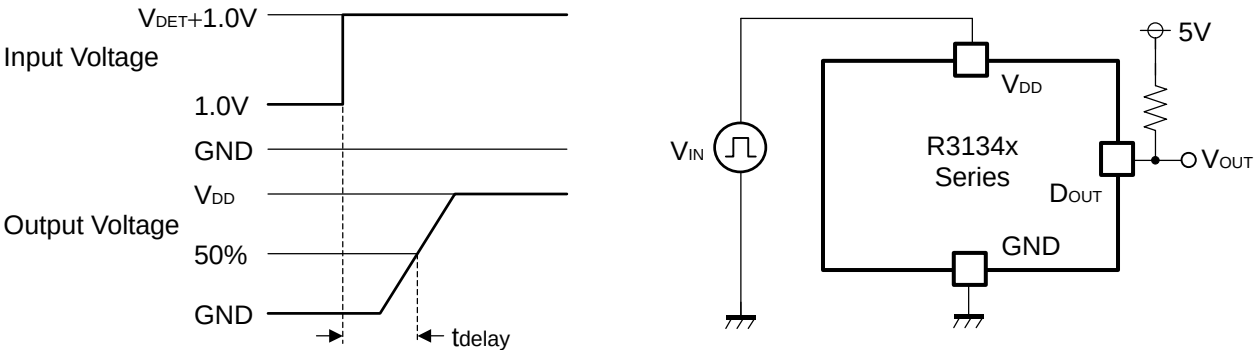
MR pin Input Voltage Test Circuit
(Pull-up circuit is not necessary for CMOS Output type.)



MR pin Pull-up Resistance Test Circuit



Off Leakage Current Test Circuit

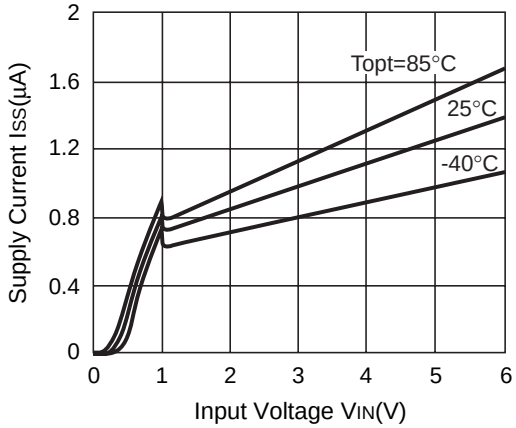


Output Delay Time Test Circuit
(Pull-up circuit is not necessary for CMOS Output type.)

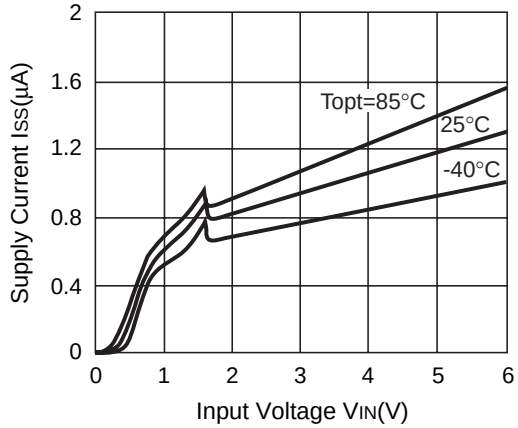
TYPICAL CHARACTERISTICS

1) Supply Current vs. Input Voltage

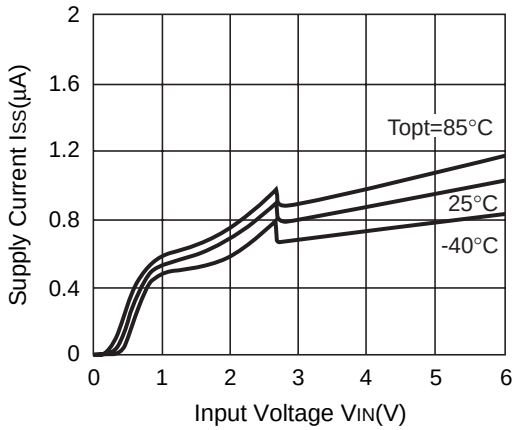
R3134x10Ex



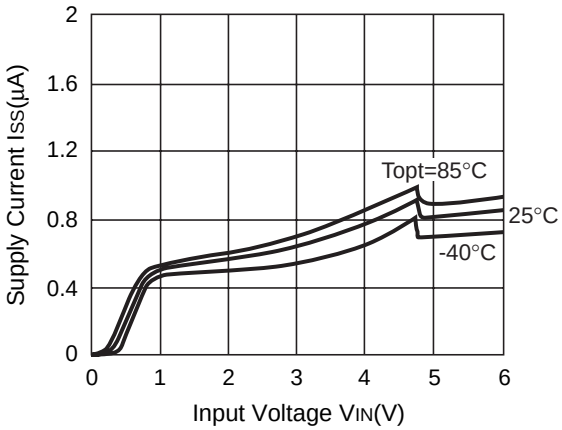
R3134x16Ex



R3134x27Ex

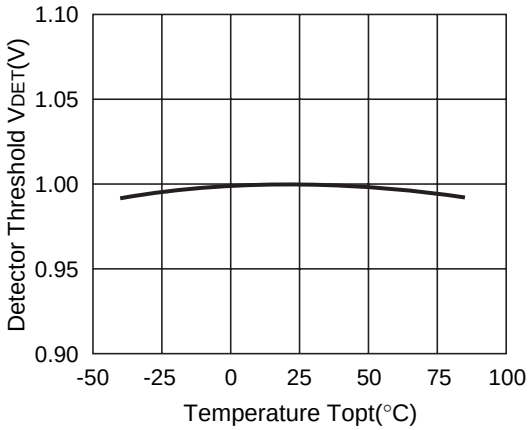


R3134x48Ex



2) Detector Threshold vs. Temperature

R3134x10Ex



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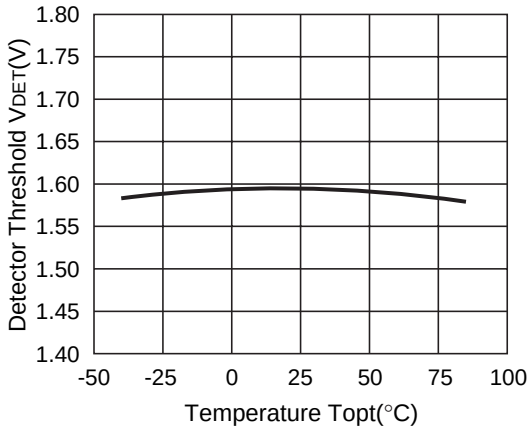
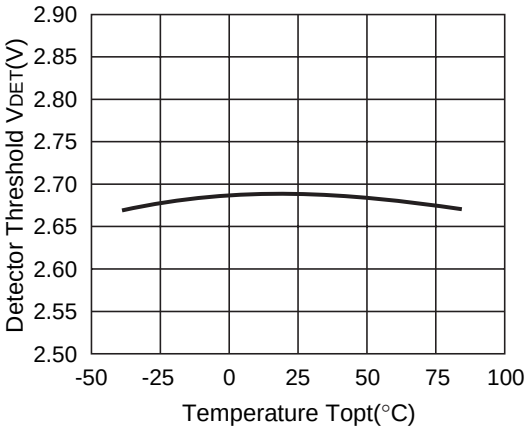
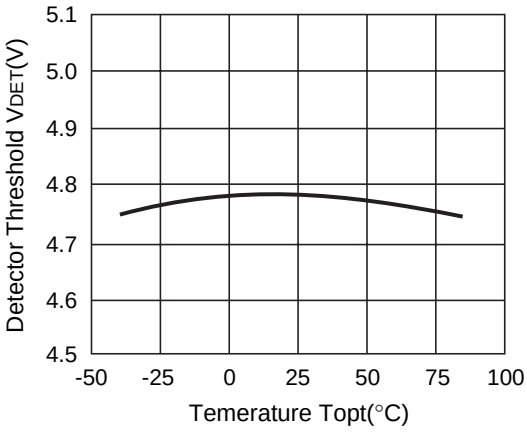


R3134x27Ex

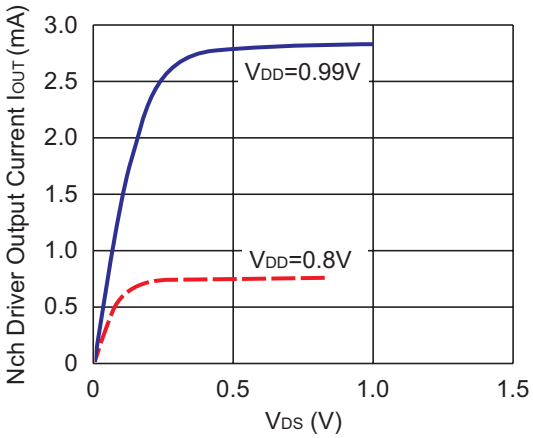


R3134x48Ex



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

R3134x10Ex



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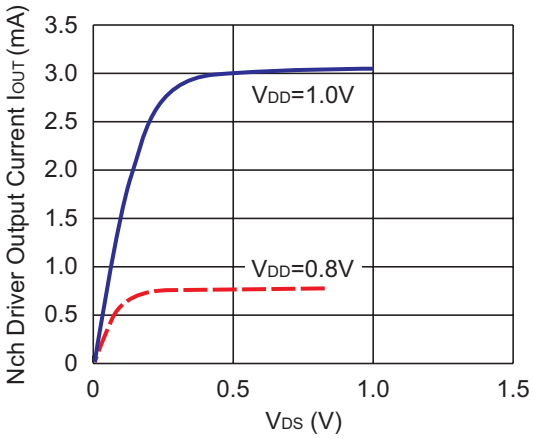

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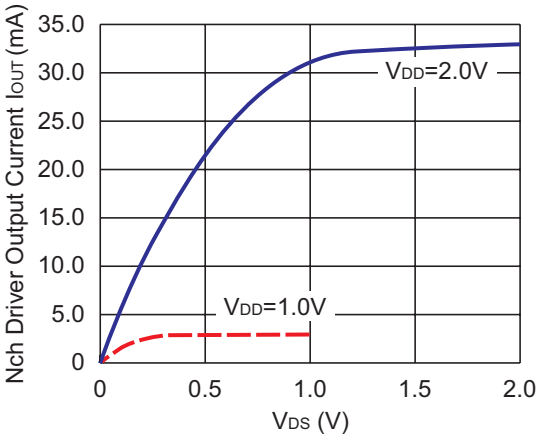
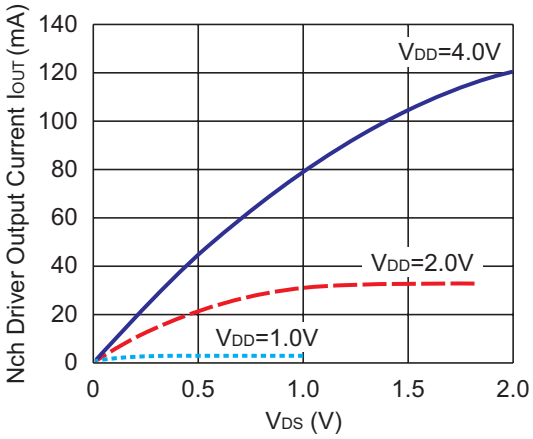
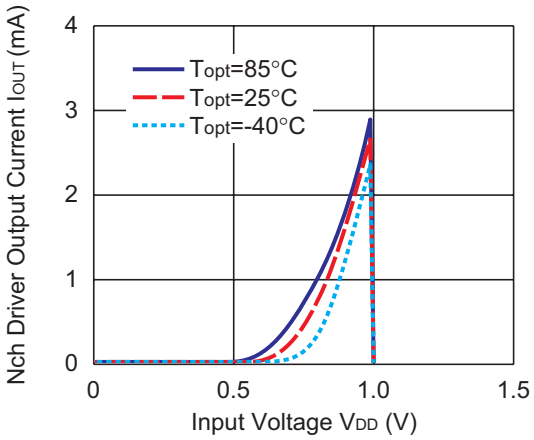


R3134x48Ex

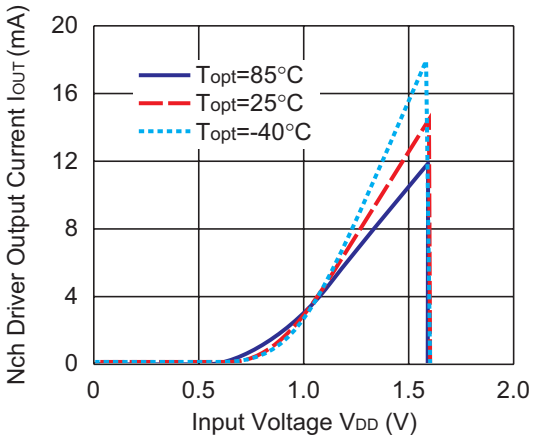


4) Nch Driver Output Current vs. Input Voltage

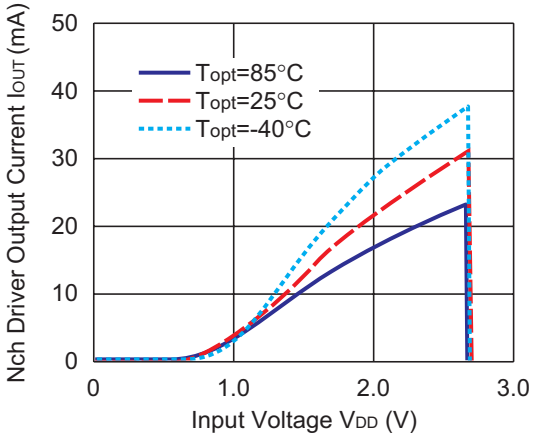
R3134x10Ex



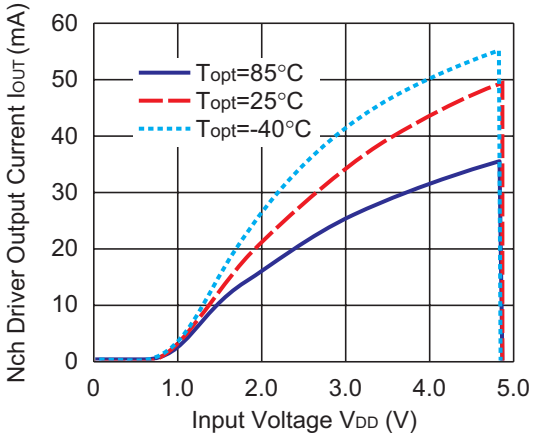
R3134x16Ex



R3134x27Ex

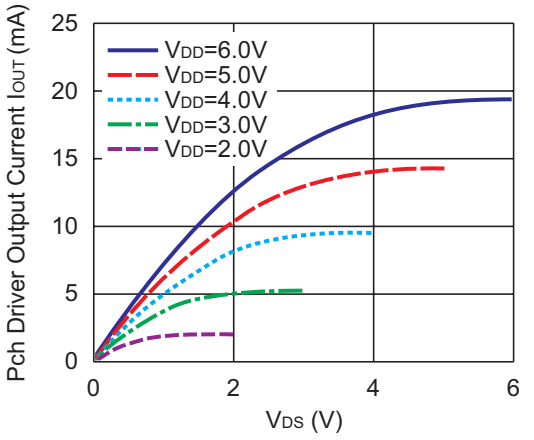


R3134x48Ex



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

R3134x10EC



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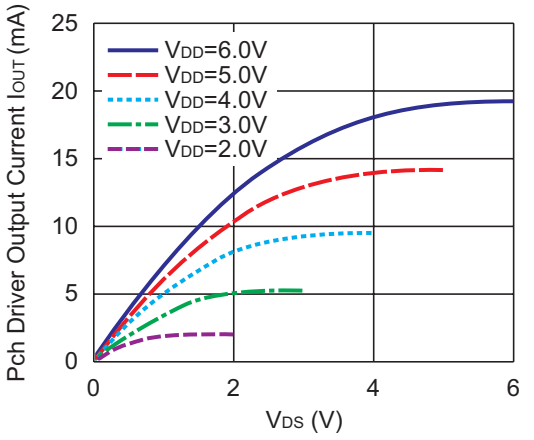

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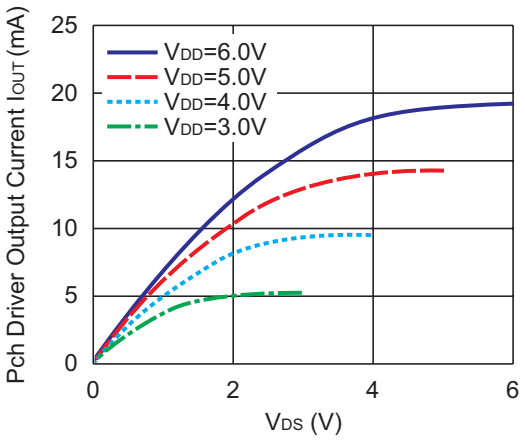

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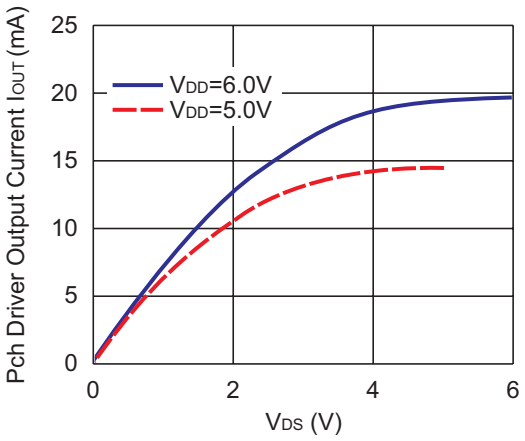
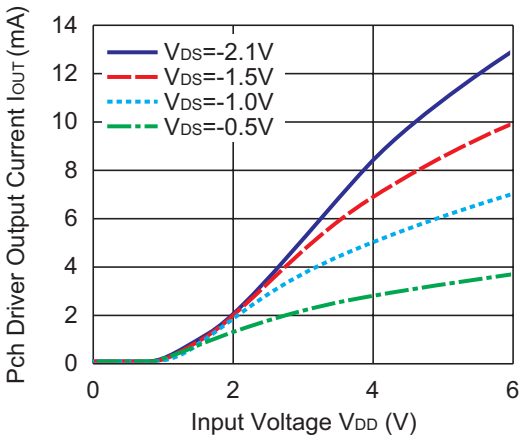
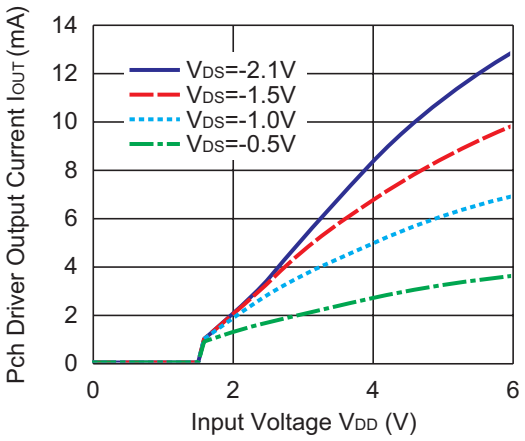


6) Pch Driver Output Current vs. Input Voltage

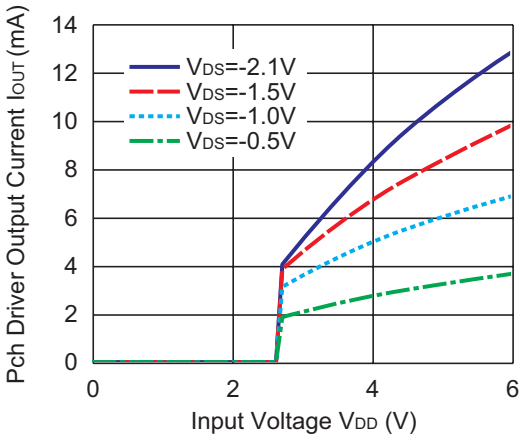
R3134x10EC



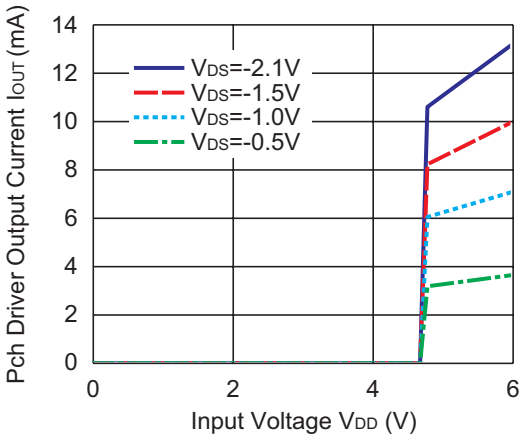
R3134x16EC



R3134x27EC

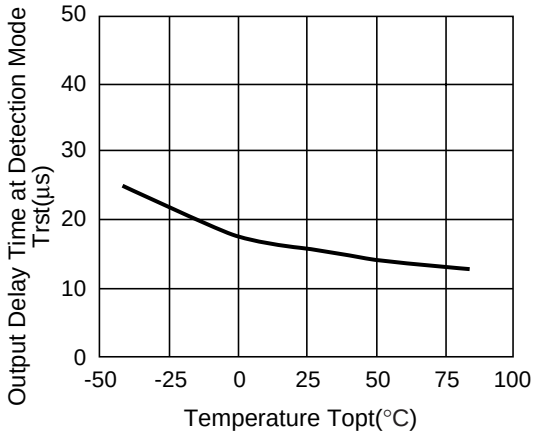


R3134x48EC

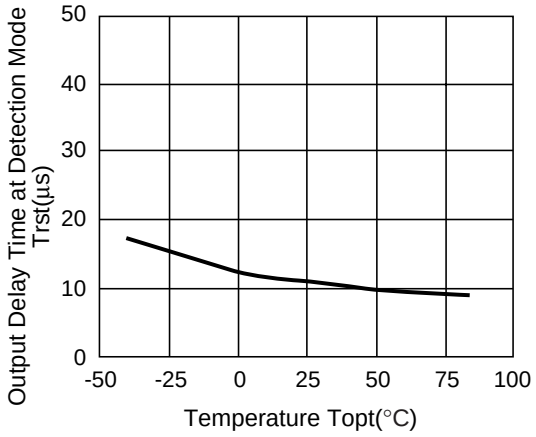


7) Output Delay Time at Detection Mode vs. Temperature

R3134x10Ex



R3134x16Ex



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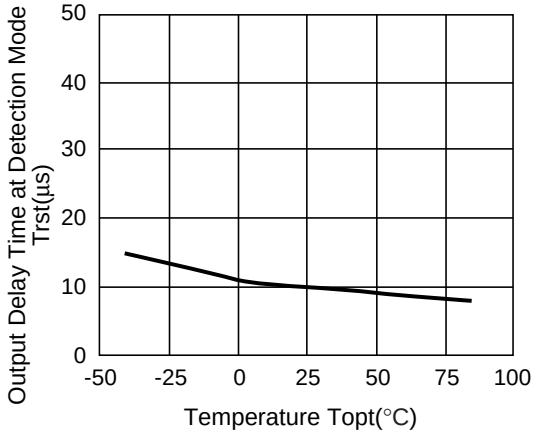
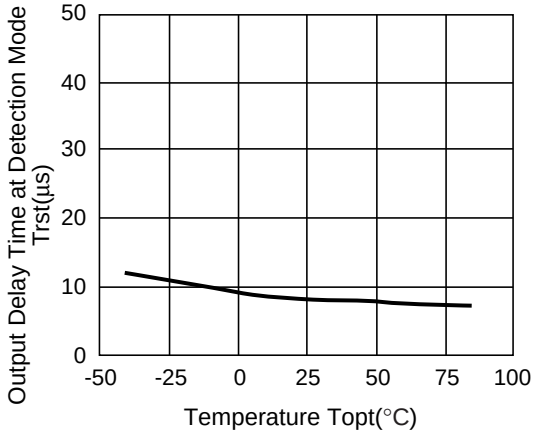
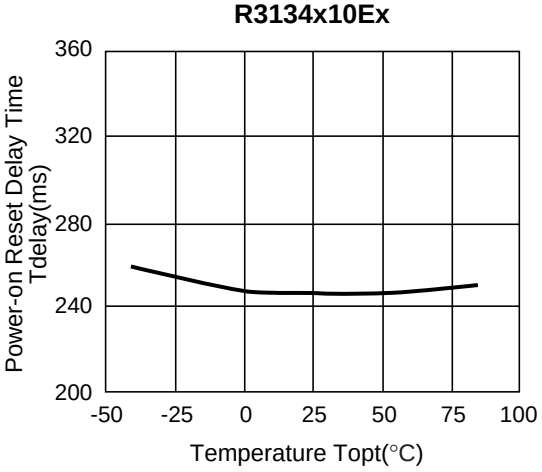


R3134x48Ex

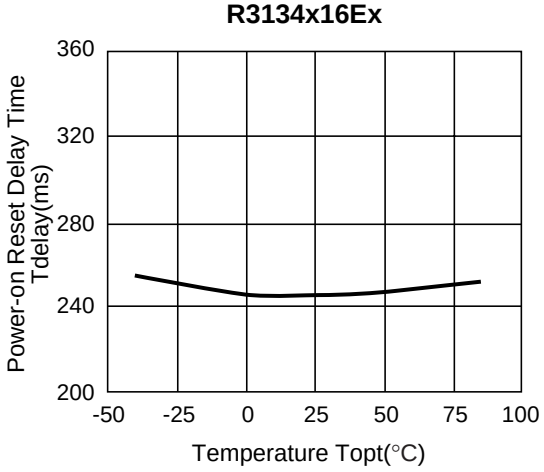


8) Power-on Reset Delay Time vs. Temperature

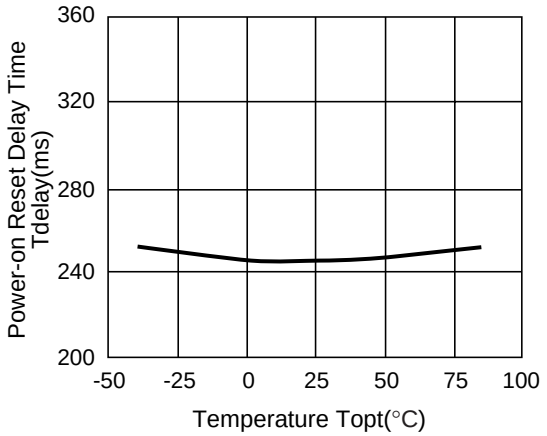
R3134x10Ex



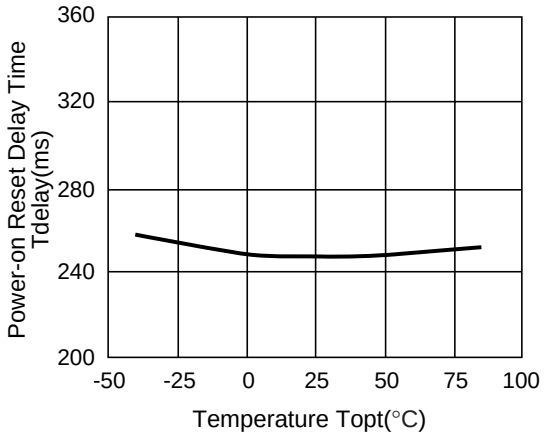
R3134x16Ex



R3134x27Ex



R3134x48Ex



TECHNICAL NOTES

The connection such as Figure A and Figure B may cause the loop oscillation because of the cross conduction current. Not only that, these types connection may make shift the detector threshold level because of the voltage dropout with consumption current of the IC itself.

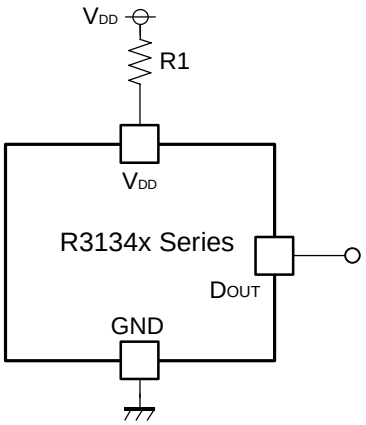


Figure A

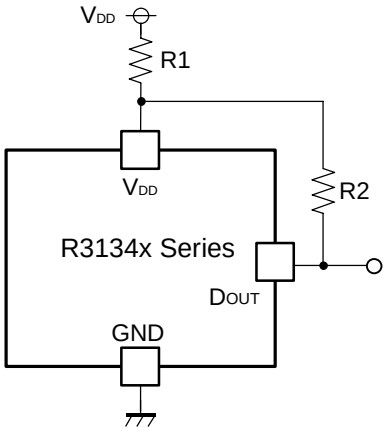


Figure B

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■Ricoh awarded ISO 14001 certification.
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