RICOH

LOW VOLTAGE DETECTOR WITH BUILT-IN DELAY CIRCUIT

R3134x SERIES

NO. EA-209-090128

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 ultra small DFN (PLP)1212-6 package, SOT-23-5, and SC-88A, high density mounting of the ICs on board is possible.

FEATURES

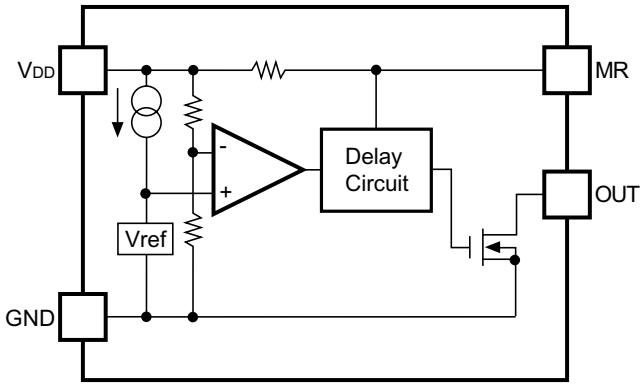
- Ultra-low supply current..... Typ. 0.8μA (R3134x27x: V_{DD}=3.0V)
- Operating Voltage Range..... 0.75V to 6.0V (Topt=25°C)
- Detector Threshold..... Setting with a step of 0.1V in the range of 1.0V to 5.0V is possible. Further, 2.32V, 2.63V, 2.93V, 3.08V, 4.38V, and 4.63V can be provided as standard.
- Embedded Power on Reset Delay Time Circuit..... Typ. 240ms
- High Accuracy Detector Threshold..... ±1.8%
- High Accuracy Released Delay Time..... ±36ms
- Low Temperature-Drift Coefficient of Detector Threshold.... ±100ppm/°C
- Two Output Types ..... Nch Open Drain and CMOS
- Small Packages..... SC-88A, DFN(PLP)1212-6, SOT23-5

APPLICATIONS

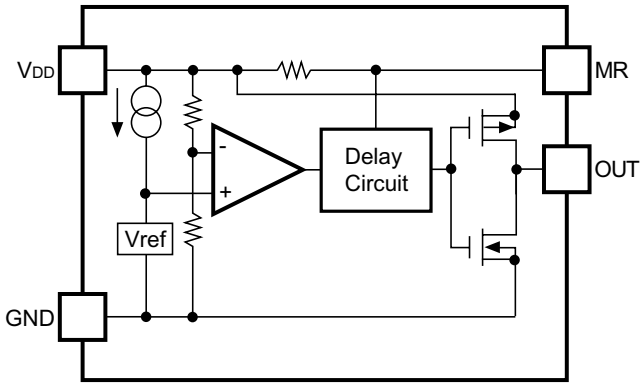
- CPU & Logic Circuit Reset
- Battery Checker
- Window Comparator
- Wave Shaping Circuit
- Battery Backup Circuit
- Power Failure Detector

BLOCK DIAGRAMS

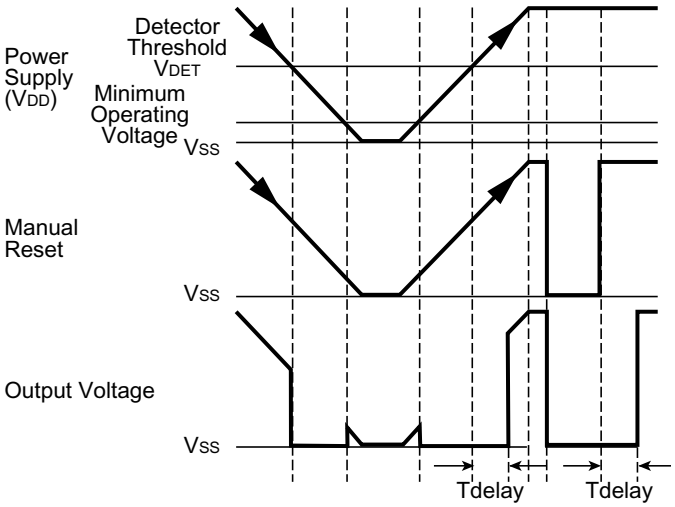
R3134xxxEA Nch Open Drain Output



R3134xxxEC CMOS Output



TIMING CHART

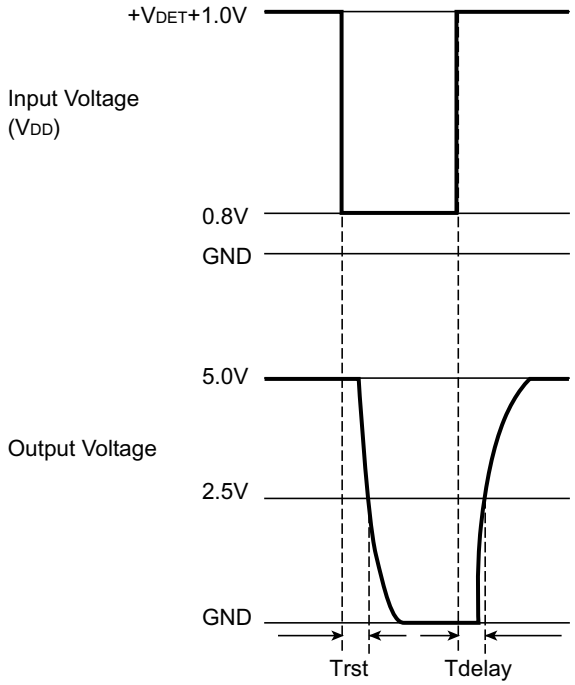


R3134x Operation Diagram

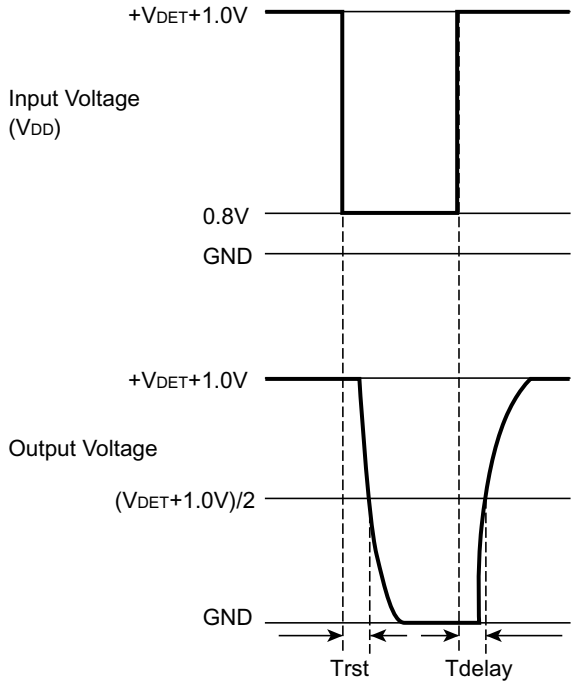
- **Output Delay Operation**

Output Delay Time, or Tdelay 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→(V_{DET})+1.0V) to the time at which the output reaches 2.5V under the condition that the output pin (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→(V_{DET})+1.0V) to the time at the output reaches V_{DD}/2.



Nch Open Drain Output



CMOS Output

SELECTION GUIDE

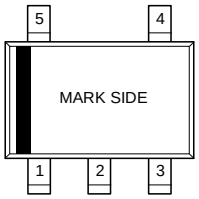
The detector threshold and the output type of R3134x Series can be designated at the user's request by specifying the part number as follows:

R3134xxxEx (x)-TR-x ←Part Number
↑↑ ↑ ↑ ↑ ↑
a b c b' d e

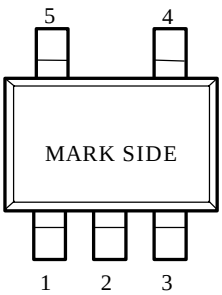
Code	Contents
a	Package Designation Q: SC-88A N: SOT-23-5 K: DFN (PLP)1212-6
b/b'	Setting Detector Threshold (V_{DET}) Stepwise setting with a step of 0.1V in the range of 1.0V to 5.0V is possible. a' describes the last digit of the next items; 2.32V/2.63V/2.93V/3.08V/4.63V ex. 2.63V Output → R313xx26Ex3-TR
c	Designation of Output type A: Nch Open Drain C: CMOS
d	TR: Designation of Taping Direction (Refer to Taping Specification)
e	Designation of Composition of pin plating -F: Lead free solder plating (SC-88A, SOT-23-5)

PIN CONFIGURATION

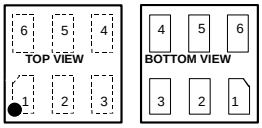
● **SC-88A**



● **SOT23-5**



● **DFN(PLP)1212-6**



PIN DESCRIPTION

- **SC-88A**

Pin No.	Symbol	Description
1	V_{DD}	Input Pin
2	GND	Ground Pin
3	MR	Manual Reset Input Pin Active at “L” input. Pulled up via 1MΩ. If MR pin is not necessary, open this node, or connect it to V_{DD}.
4	OUT	Output Pin Output “L” at detect, Output “H” at release.
5	NC	No Connection

- **SOT23-5**

Pin No.	Symbol	Description
1	OUT	Output Pin Output “L” at detect, Output “H” at release.
2	V_{DD}	Input Pin
3	GND	Ground Pin
4	MR	Manual Reset Input Pin Active at “L” input. Pulled up via 1MΩ. If MR pin is not necessary, open this node, or connect it to V_{DD}.
5	NC	No Connection

- **DFN(PLP)1212-6**

Pin No.	Symbol	Description
1	V_{DD}	Input Pin
2	NC	No Connection
3	GND	Ground Pin
4	OUT	Output Pin Output “L” at detect, Output “H” at release.
5	NC	No Connection
6	MR	Manual Reset Input Pin Active at “L” input. Pulled up via 1MΩ. 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	CMOS V_{SS}–0.3 to V_{DD}+0.3	V
		Nch V_{SS}–0.3 to 6.5	V
V_{MR}	Input Voltage	V_{SS}–0.3 to V_{DD}+0.3	V
I_{OUT}	Output Current	30	mA
P_D	Power Dissipation*Note1	380(SC-88A)	mW
		420(SOT23-5)	
		400(DFN(PLP)1212-6)	
Topt	Operating Temperature Range	–40 to +85	°C
Tstg	Storage Temperature Range	–55 to +125	°C

*Note 1: This specification is at mounted on board.
P_D depends on conditions of mounting on board. This specification is based on the measurement at the condition below:

∗Measurement Conditions
Environment: Mounted on board (Wind velocity 0m/s)
Board Material: FR-4 (2-layer)
Board dimensions : 40mm x 40mm x t1.6mm
Copper Area : 50%

ABSOLUTE MAXIMUM RATINGS

Absolute Maximum Ratings are threshold limit values that must not be exceeded under any conditions.
Moreover, such values for any items must not be reached simultaneously. Operation above these absolute maximum ratings may cause degradation or permanent damage to the device. These are just stress ratings and do not necessarily imply to guarantee the operation below these limits.

ELECTRICAL CHARACTERISTICS

Topt=25°C

Symbol	Item	Test Conditions		Min.	Typ.	Max.	Unit
V_{DD}	Operating Voltage	Topt=25°C		0.75		6.00	V
		−40°C ≦ Topt ≦ 85°C		0.85		6.00	
V_{DET}	Detector Threshold			$V_{DET}\times$ 0.982		$V_{DET}\times$ 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_{DET}<1.6V	V_{DD}=6.0V, I_{OUT}=0A			3.6	μA
		1.6V ≦ V_{DET}<2.7V				3.0	
		2.7V ≦ V_{DET}				2.5	
V_{OH}	"H" Output Voltage	Refer to the specification table below.					
V_{OL}	"L" Output Voltage	Refer to the specification table below.					
R_{MR}	MR pin pull-up resistance	Topt=25°C		0.5	1.0	4.0	MΩ
Trst*Note1	Output Delay Time for detect	$V_{DD}=V_{DET}$ to $V_{DET}-0.1V$			15		μs
Tdelay(*2)	Output Delay Time for release	V_{DD}=0.8V to V_{DET}+1.0V		204	240	276	ms
$\Delta V_{DET}/\Delta Topt$	Detector Threshold Temperature Coefficient	−40°C ≦ Topt ≦ 85°C			±100		ppm/°C

Note1) Guaranteed by design, not mass production tested.
Note 2) The Surrounded values with ☐ means the specifications guaranteed by design under the temperature condition range as -40°C≤Ta≤85°C

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

Topt=25°C

Products	Test Conditions		Min.	Typ.	Max.	Unit
R3134xxx1C	V_{DET}<1.2V	V_{DD}=V_{DET}+0.1V, I_{OH}=–50µA	0.8×V_{DD}			V
	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				

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

Topt=25°C

Symbol	Item	Test Conditions	Min.	Typ.	Max.	Unit
R3132xxx1x	V_{DET}<1.2V	V_{DD}=V_{DET}–0.1V, I_{OL}=200µA			0.04	V
	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	

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			

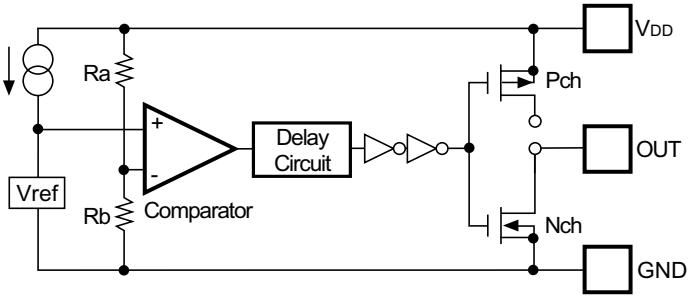
Supply Current 2			Supply Current 3			"H" Output Voltage	
I_{SS2}[μA]			I_{SS3}[μA]			V_{OH}[V]	
Conditions	Typ.	Max.	Conditions	Typ.	Max.	Conditions	Min.
$V_{DD}=V_{DET}+0.1V$ $I_{OUT}=0A$	0.8	2.0	$V_{DD}=6.0V$ $I_{OUT}=0A$	1.2	3.0	$V_{DD}=V_{DET}+0.1V$ $I_{OH}=-500uA$	$0.8\times V_{DD}$
				1.0	2.5	$V_{DD}=V_{DET}+0.1V$ $I_{OH}=-800uA$	
$V_{DD}=V_{DET}+0.1V$ $I_{OUT}=0A$	0.8	2.0	$V_{DD}=6.0V$ $I_{OUT}=0A$	1.4	3.6	$V_{DD}=V_{DET}+0.1V$ $I_{OH}=-50uA$	$0.8\times V_{DD}$
						$V_{DD}=V_{DET}+0.1V$ $I_{OH}=-150uA$	
				1.2	3.0	$V_{DD}=V_{DET}+0.1V$ $I_{OH}=-500uA$	
				1.0	2.5	$V_{DD}=V_{DET}+0.1V$ $I_{OH}=-800uA$	
				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}=+1.2mA	0.05	V_{DD} ≧ V_{DET}+0.1	0.75×V_{DD}	V_{DD} ≧ 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}=+3.2mA	0.06								
R3134x46Ex3										
R3134x10Ex	V_{DD}=V_{DET}−0.1V I_{OL}=+200μA	0.04	V_{DD} ≧ V_{DET}+0.1	0.75×V_{DD}	V_{DD} ≧ 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}=+750μA	0.06								
R3134x13Ex										
R3134x14Ex										
R3134x15Ex										
R3134x16Ex										
R3134x17Ex										
R3134x18Ex										
R3134x19Ex										
R3134x20Ex	V_{DD}=V_{DET}−0.1V I_{OL}=+1.2mA	0.05								
R3134x21Ex										
R3134x22Ex										
R3134x23Ex										
R3134x24Ex										
R3134x25Ex										
R3134x26Ex										
R3134x27Ex										
R3134x28Ex										
R3134x29Ex										
R3134x30Ex										
R3134x31Ex	V_{DD}=V_{DET}−0.1V I_{OL}=+3.2mA	0.06								
R3134x32Ex										
R3134x33Ex										
R3134x34Ex										
R3134x35Ex										
R3134x36Ex										
R3134x37Ex										
R3134x38Ex										
R3134x39Ex										
R3134x40Ex										
R3134x41Ex										
R3134x42Ex										
R3134x43Ex										
R3134x44Ex										
R3134x45Ex										
R3134x46Ex										
R3134x47Ex										
R3134x48Ex										
R3134x49Ex										
R3134x50Ex										

Output Delay Time for Release				Detector Threshold Temperature Coefficient	
Tdelay[ms]				$\Delta V_{DET}/\Delta Topt$[ppm/°C]	
Conditions	Min.	Typ.	Max.	Conditions	
V_{DD}=0.8V→ V_{DET}+1.0V Topt=25°C	204	240	276	−40°C ≦ Topt ≦ 85°C	±100
V_{DD}=0.8V→ V_{DET}+1.0V Topt=25°C	204	240	276	−40°C ≦ Topt ≦ 85°C	±100

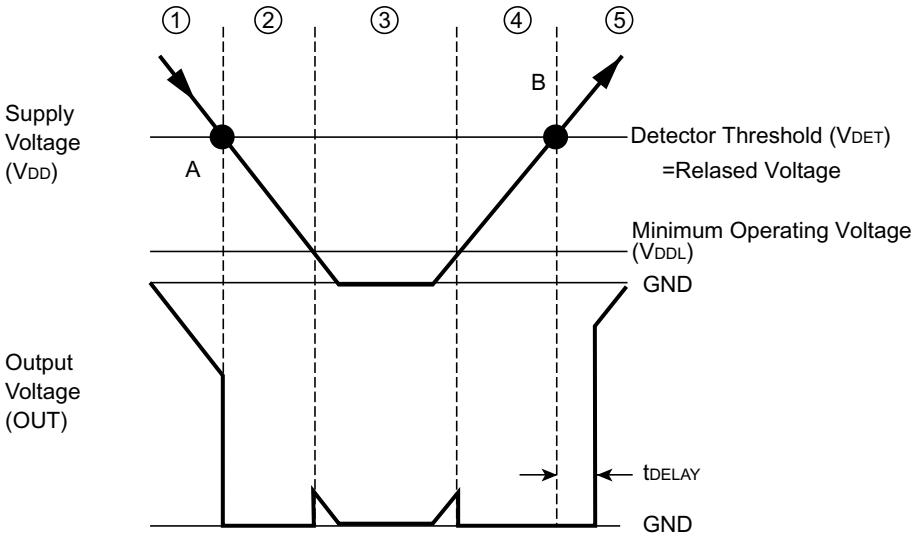
OPERATION

- **Operation of R3134x Series**



Block Diagram

- CMOS Output Type
  OUT pin is connected to the drain of Nch Tr. and Pch Tr. in this IC.
- Nch Open Drain Output Type
  OUT pin is connected to the drain of Nch Tr. in this IC.
  (OUT pin should be pulled up to V_{DD} or an external voltage level.)



Operating Diagram

In the above diagram,

① Output voltage becomes equal to supply voltage (Nch open drain output type; equal to pull-up Voltage).

② When the supply voltage is down to the detector threshold level (Point A), Vref ≧ $V_{DD} \times$ Rb / (Ra+Rb) is true. Then, the output of the comparator is reversed, thus output voltage becomes equal to GND level.

③ When the supply voltage is lower than minimum operating voltage, the output of transistor is indefinite, therefore the output is also indefinite.

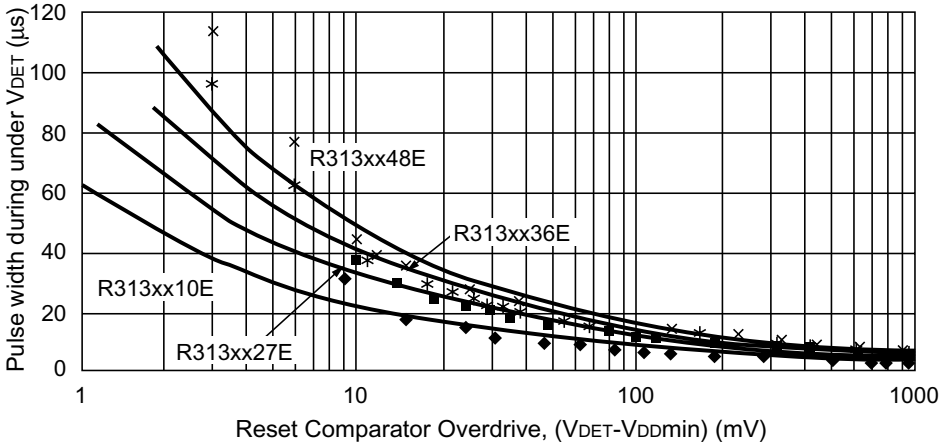
④ Output voltage is equal to GND level.

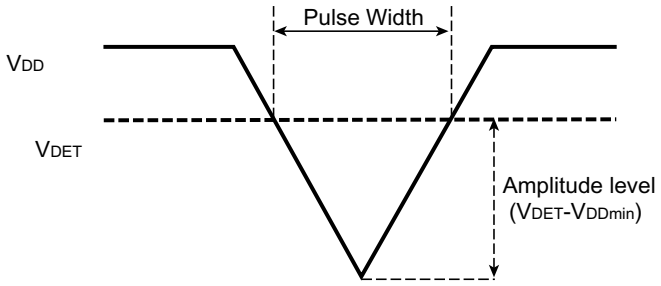
⑤ When the supply voltage is higher than the released voltage (Point B), Vref ≧ $V_{DD} \times$ Rb / (Ra+Rb) is true. Then the output of the comparator is reversed, thus the output voltage becomes equal to the supply voltage (Nch open drain output type; equal to pull-up voltage).

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

TECHNICAL NOTES

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:





VIN Input Waveform

Notes:

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.

Application Notes

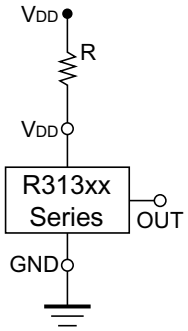


Figure A

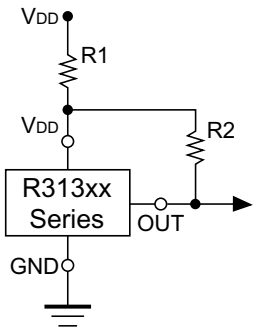
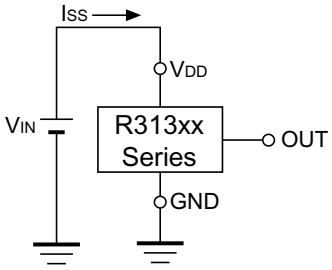


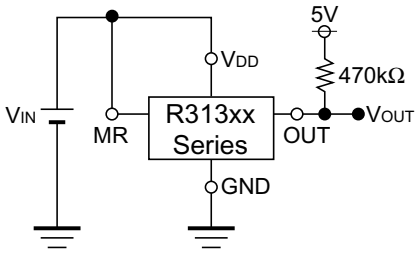
Figure B

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.

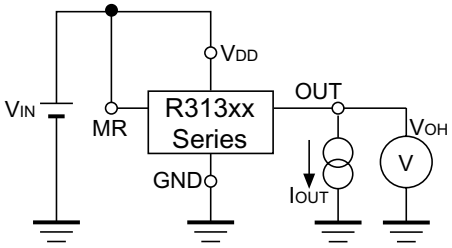
TEST CIRCUITS



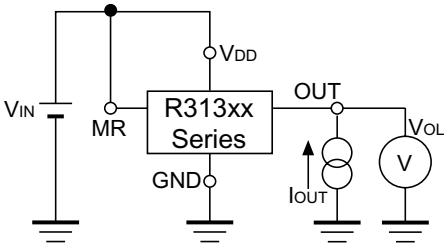
Test Circuit for Supply Current



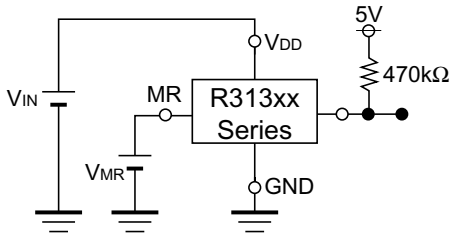
Test Circuit for Detector Threshold
(CMOS Output type; pull-up part is not necessary.)



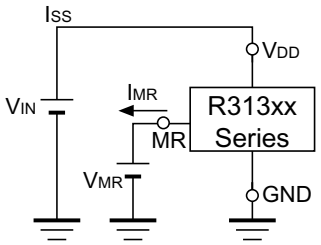
Test Circuit for "H" Output Voltage
(CMOS Output Type only)



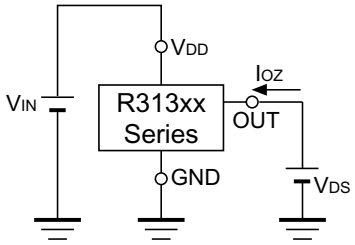
Test Circuit for "L" Output Voltage



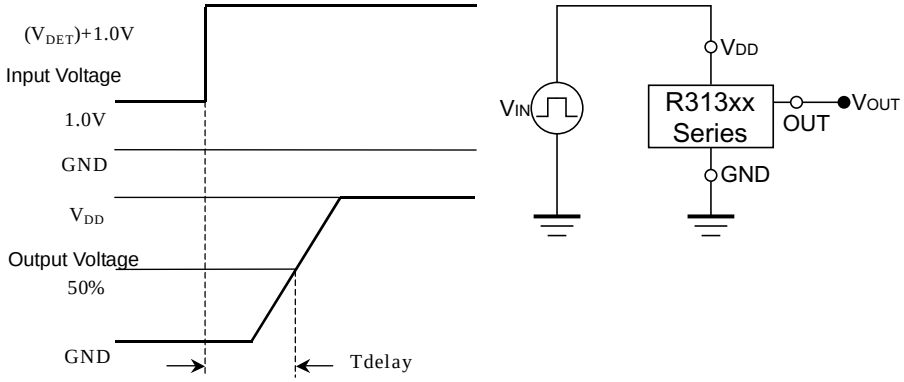
Test Circuit for MR pin Input Voltage
(CMOS Output type; pull-up part is not necessary.)



Test Circuit for MR pin Pull-up Resistance



Test Circuit for Off Leakage Current

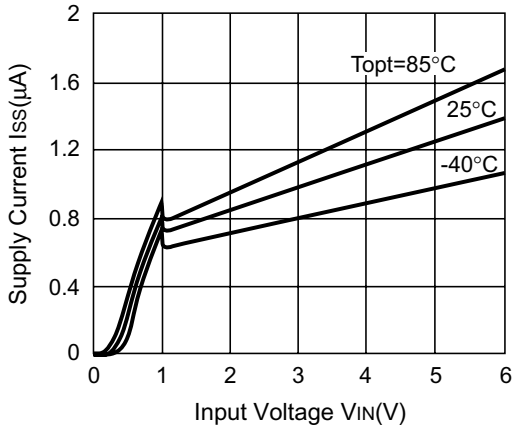


Test Circuit for Output Delay Time
(CMOS Output type; pull-up is not necessary.)

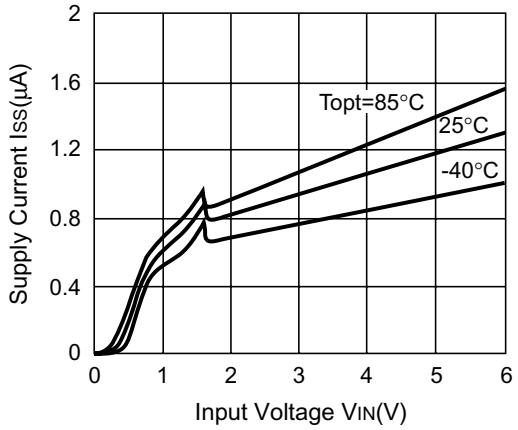
TYPICAL CHARACTERISTICS

1) Supply Current vs. Input Voltage

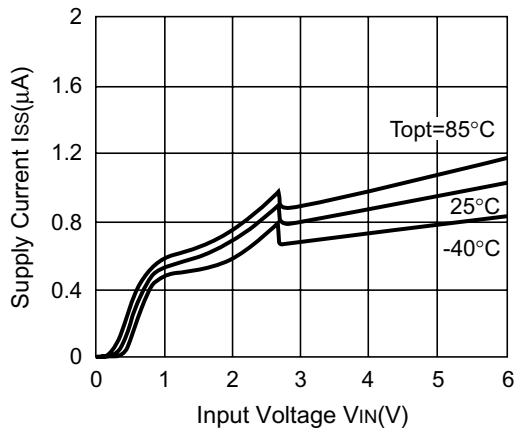
R3134x101x



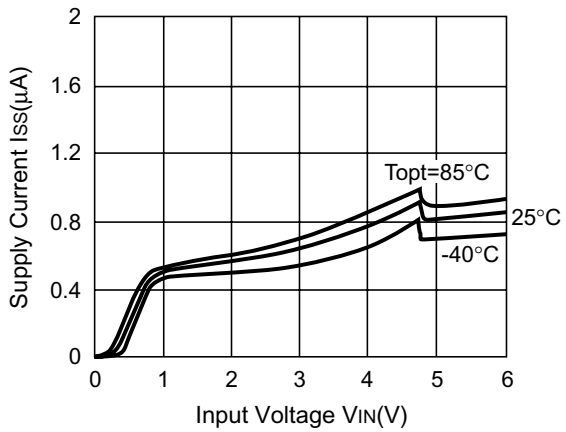
R3134x161x



R3134x271x

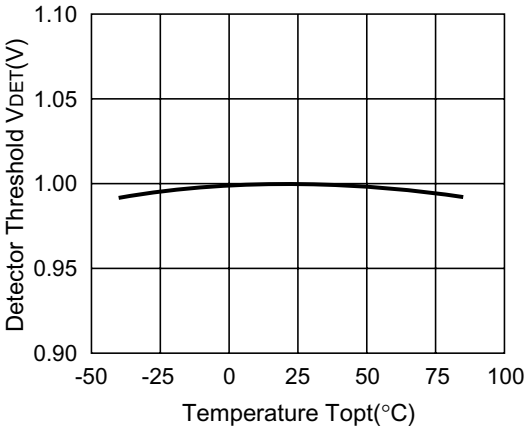


R3134x481x

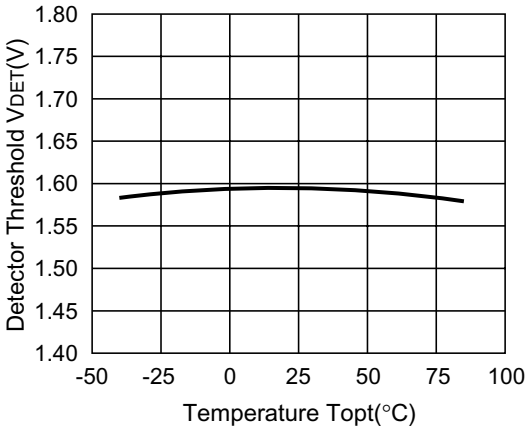


2) Detector Threshold vs. Temperature

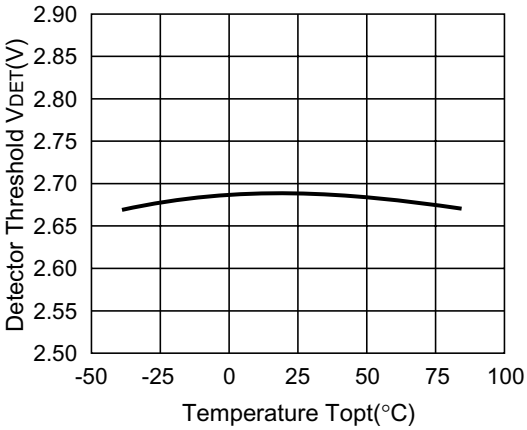
R3134x101x



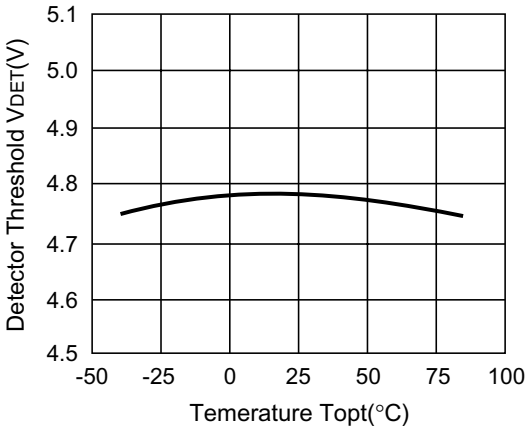
R3134x161x



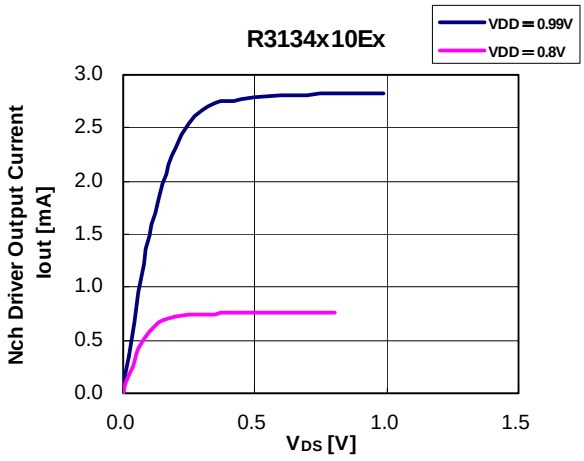
R3134x271x

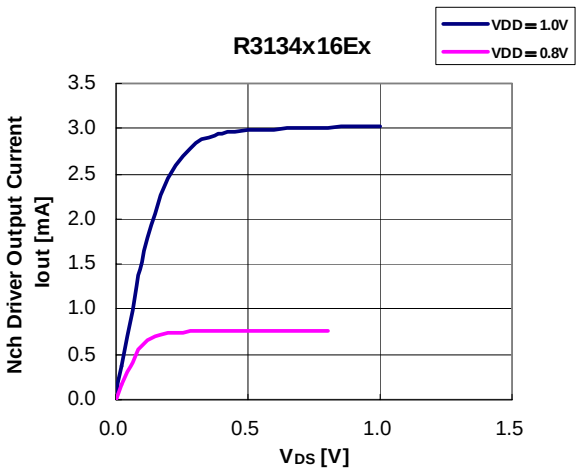


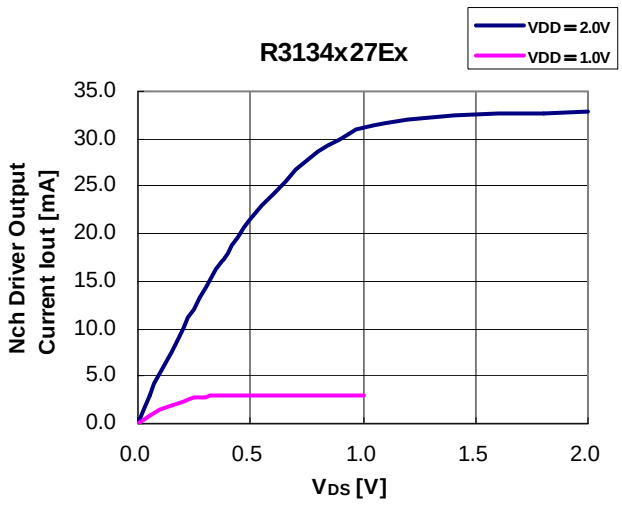
R3134x481x

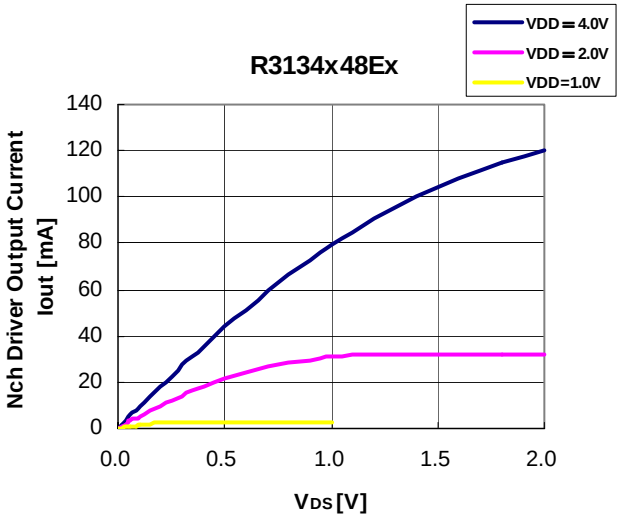


3) Nch Driver Output Current vs. V_{DS} (Topt=25°C)

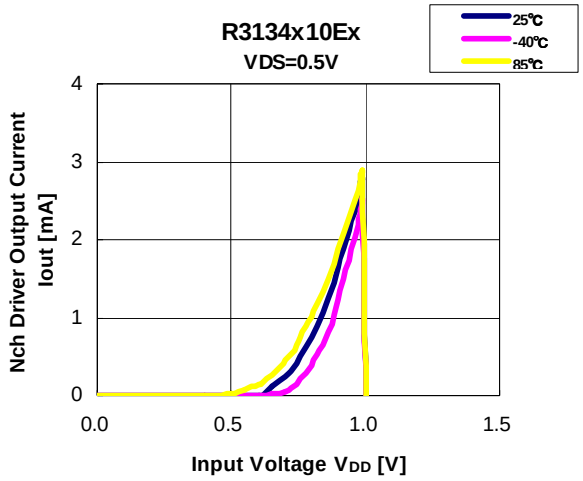


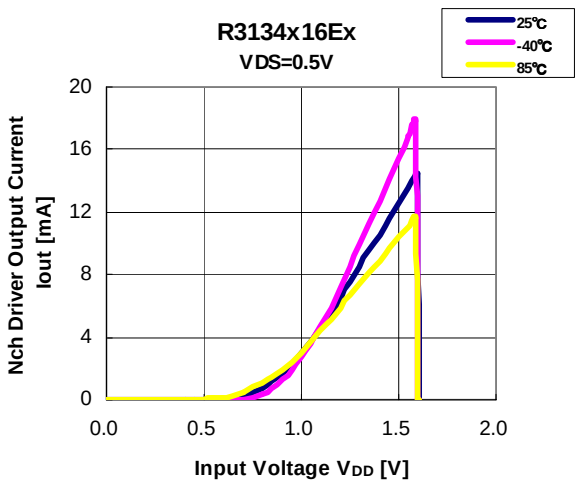


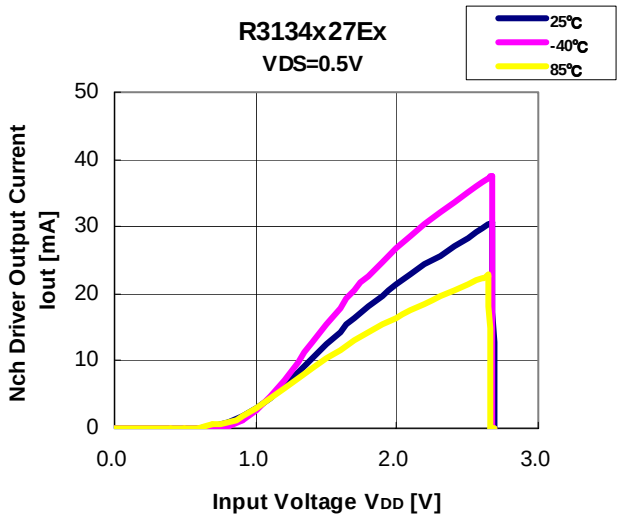


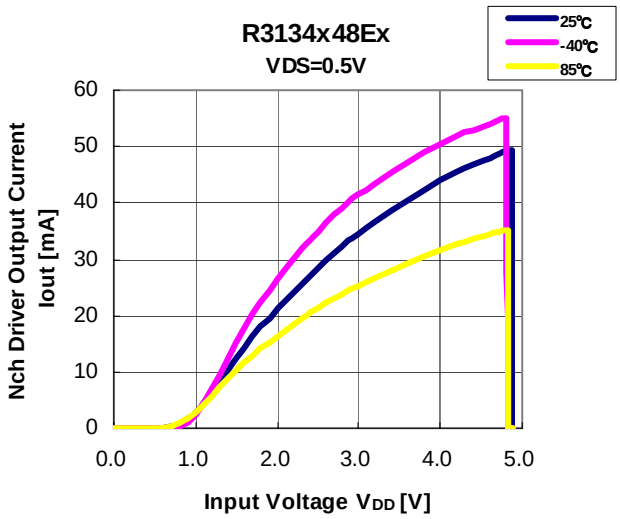


4) Nch Driver Output Current vs. Input Voltage (V_{DS}=0.5V)

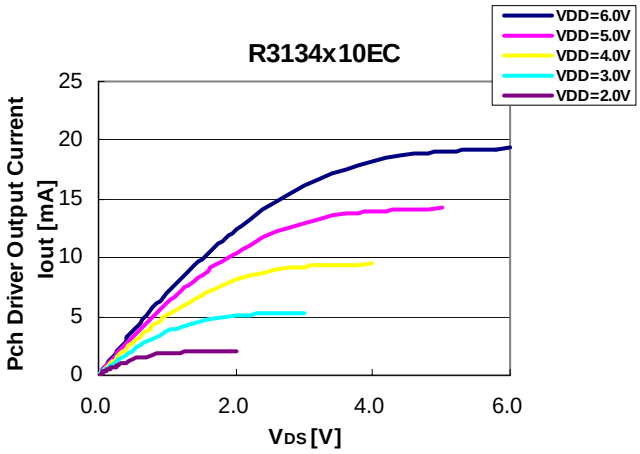


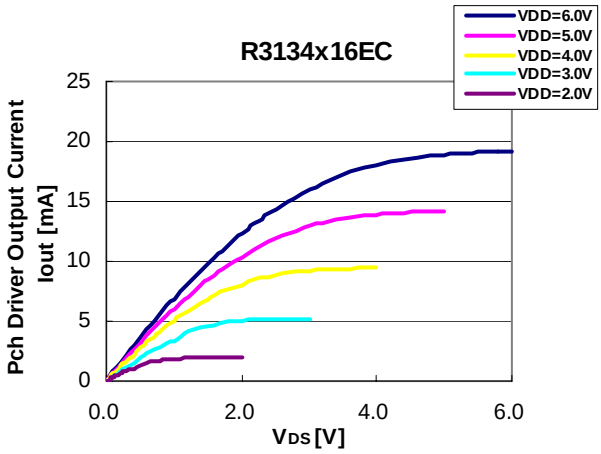


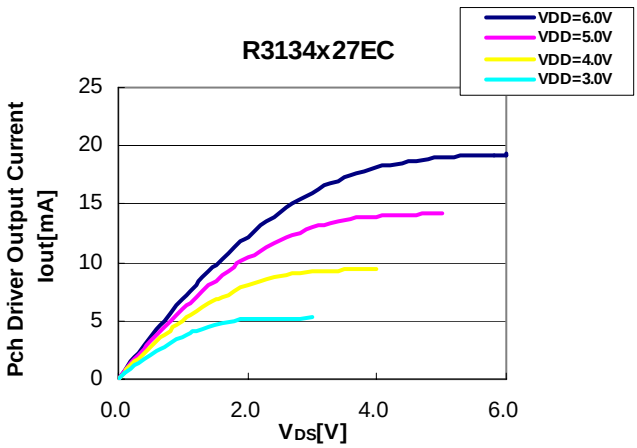


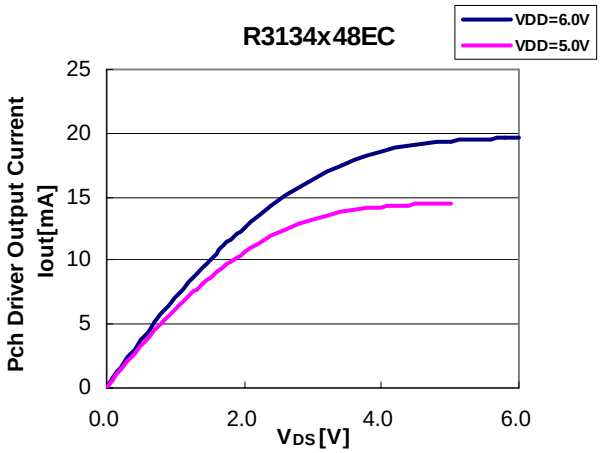


5) Pch Driver Output Current vs. Input Voltage

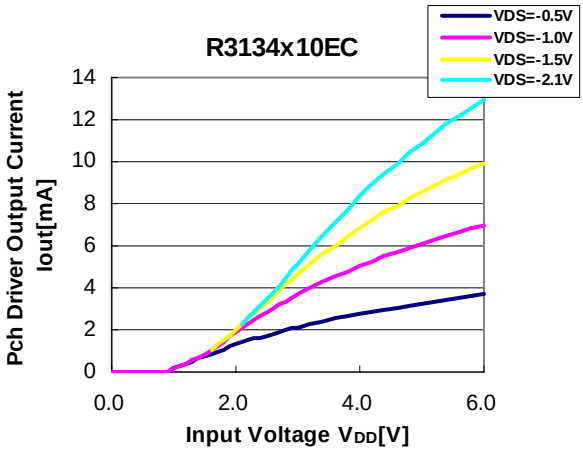


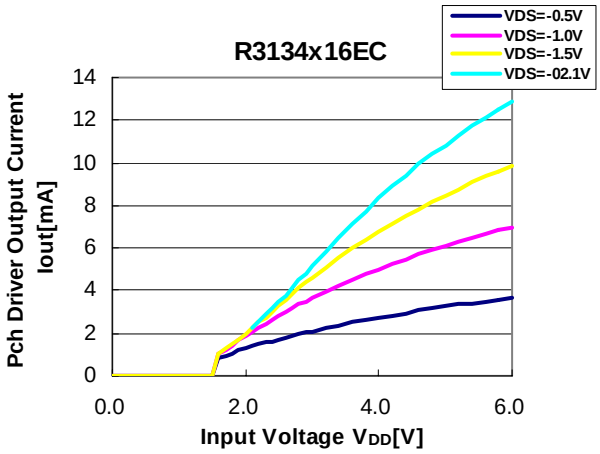


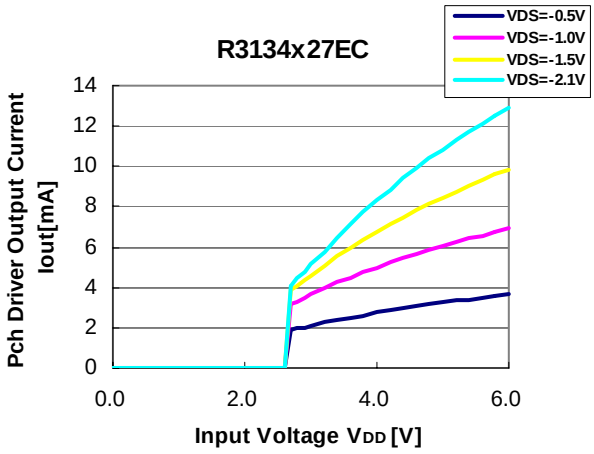


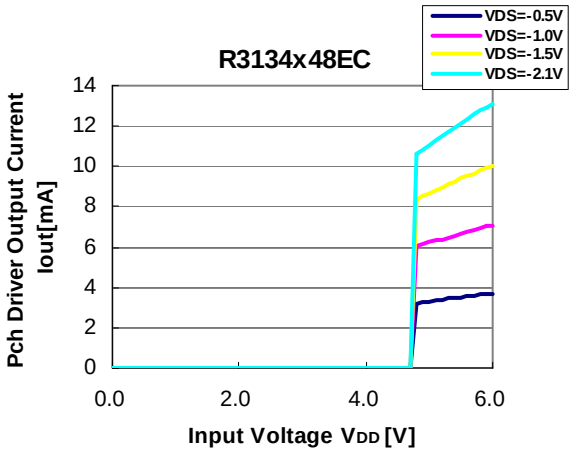


6) Pch Driver Output Current vs. Input Voltage

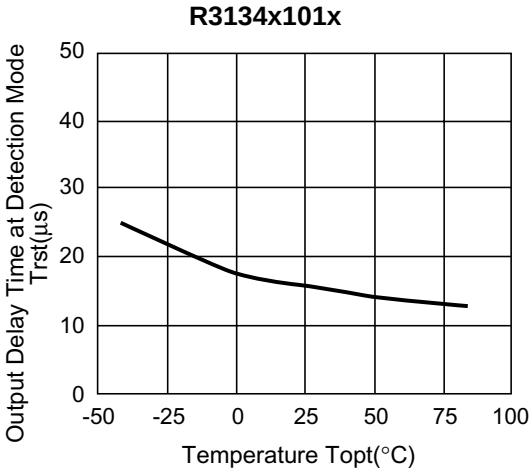


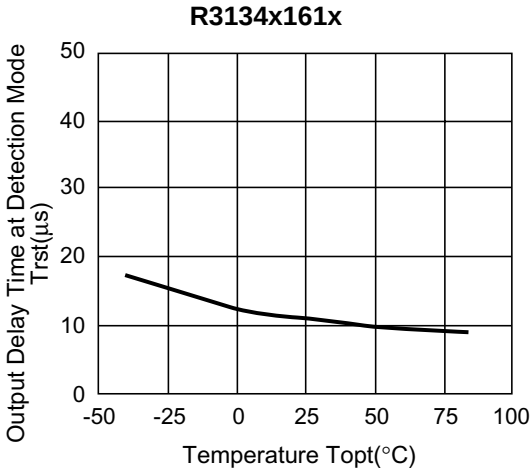




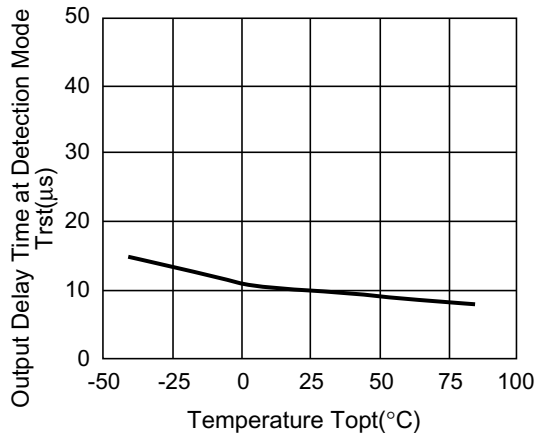


7) Output Delay Time at Detection Mode vs. Temperature

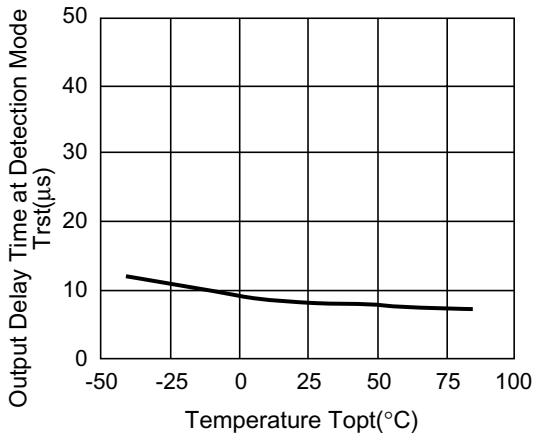




R3134x271x

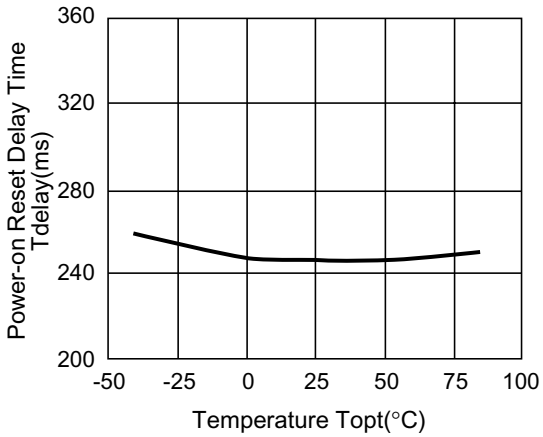


R3134x481x

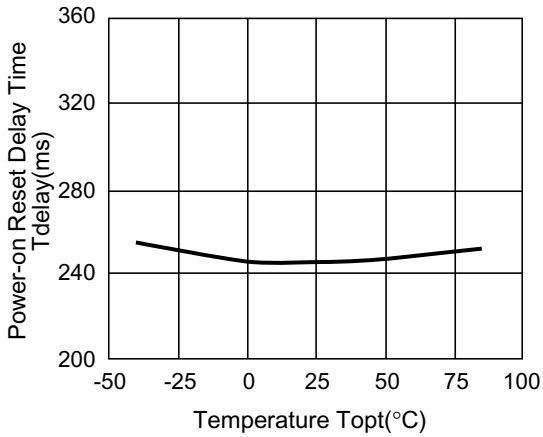


8) Power-on Reset Delay Time vs. Temperature

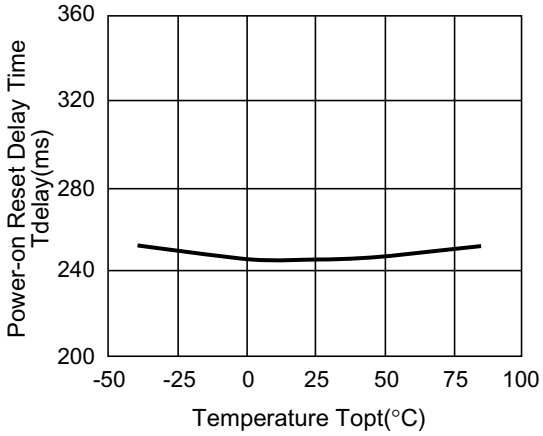
R3134x101x



R3134x161x



R3134x271x



R3134x481x