

R3134x SERIES

LOW VOLTAGE DETECTOR WITH BUILT-IN DELAY CIRCUIT

NO.EA-209-160316

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	Τур. 0.8μA (R3134x27Ex, V _{DD} =3.0V)
Operating Voltage Range	0.75V to 6.0V (Topt=25°C)
Detector Threshold Range	1.0V to 5.0V (0.1V steps)
	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

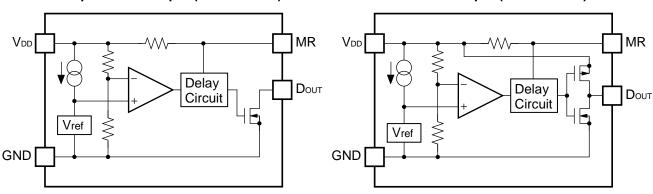
APPLICATIONS

- · 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.

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Product Name	Package	Quantity per Reel	Pb Free	Halogen Free
R3134KxxE*(y)-TR	DFN(PLP)1212-6	5,000 pcs	Yes	Yes
R3134QxxE*(y)-TR-FE	SC-88A	3,000 pcs	Yes	Yes
R3134NxxE*(y)-TR-FE	SOT-23-5	3,000 pcs	Yes	Yes

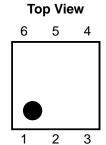
xx: The detector threshold can be designated in the range from 1.0V(10) to 5.0V(50) in 0.1V steps.

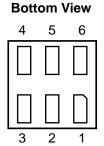
- * : Designation of Output Type
 - (A) Nch Open Drain
 - (C) CMOS

y: If the detector threshold includes the 3rd digit, indicate the digit of 0.01V. (Example) If the detector threshold is 2.63V, R3134x26E*3-TR-x

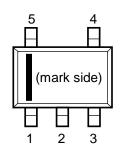
PIN CONFIGURATIONS

• DFN(PLP)1212-6

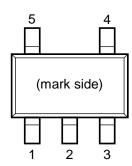




• SC-88A







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 оит	Output Pin ("L" at detection)
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 оит	Output Pin ("L" at detection)
5	NC	No Connection

• SOT-23-5

Pin No.	Symbol	Description
1	D оит	Output Pin ("L" at detection)
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 $1M\Omega$ (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
Vout	Output Voltage (Nch Open Drain Output)	Vss-0.3 to 6.5	V
VOUT	Output Voltage (CMOS Output)	Vss-0.3 to Vpp+0.3	V
V _{MR}	Input Voltage	Vss-0.3 to Vpp+0.3	V
Іоит	Output Current	20	mA
	Power Dissipation (DFN(PLP)1212-6)*	400	
P□	Power Dissipation (SC-88A)*	380	mW
	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 $-40^{\circ}\text{C} \le \text{Topt} \le 85^{\circ}\text{C}$.

Topt=25°C

Symbol	Item	Co	onditions	Min.	Тур.	Max.	Unit
VDET	Detector Threshold			V _{DET} ×0.982		V _{DET} ×1.018	V
Iss ₁	Supply Current1	VDD=VDET-C	0.1V, І оυт=0А			2.0	μΑ
Iss2	Supply Current2	VDD=VDET+C	0.1V, Iоυт=0A			2.0	μΑ
			VDET < 1.6V			3.6	
lss3	Supply Current3	Vdd=6V, lout=0A	1.6 ≤ VDET < 2.7V			3.0	μΑ
			2.7V ≤ VDET			2.5	
	On a ratio a Malta a	Topt=25°C		0.75		6.00	V
VDD	V _{DD} Operating Voltage		$-40^{\circ}C \le T_{opt} \le 85^{\circ}C$			6.00	V
Vон	"H" Output Voltage		Refer to	the followin	g table		
Vol	"L" Output Voltage		Refer to	the followin	g table		
ViH	MR pin "H" Input Voltage	$V_{DD} \ge V_{DET} +$	-0.1V	0.75×V _{DD}			V
VIL	MR pin "L" Input Voltage	$V_{DD} \ge V_{DET} +$	-0.1V			0.2×V _{DD}	V
R _{MR}	MR pin pull-up Resistance	Topt=25°C		0.5	1.0	4.0	$M\Omega$
$\Delta V_{DET}/$ ΔT_{Opt}	Detector Threshold Temperature Coefficient	-40°C ≤ To	pt ≤ 85°C		±100		ppm /°C
treset	Output Delay Time for detect *	V _{DD} =V _{DET} →	VDET-0.1V		15		μS
tdelay	Output Delay Time for release	V _{DD} =0.8V	→ V _{DET} +1.0	204	240	276	ms

^{*)} 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 (Vон) table

Topt=25°C

Products	Detector Threshold	"H" Output Voltage Vон (V)						
	V _{DET} (V)	Conditions	Min.	Тур.	Max.			
	VDET < 1.2V	Vdd=Vdet+0.1V, Ioh=50μA						
D2424xavEC	1.2V ≤ VDET < 2.0V	VDD=VDET+0.1V, IOH=150μA	00.1/					
R3134xxxEC	2.0V ≤ VDET < 3.1V	Vdd=Vdet+0.1V, Ioh=500μA	0.8×V _{DD}					
	3.1V ≤ Vdet	Vdd=Vdet+0.1V, Iон=800µA						

VDET is a set value.

• "L" Output Voltage (VoL) table

 $Topt=25^{\circ}C$

Draduoto	Detector Threshold	"L" Output Voltage Vo∟ (V)						
Products	V _{DET} (V)	Conditions	Min.	Тур.	Max.			
	VDET < 1.2V	Vdd=Vdet-0.1V, Iol=200μA			0.04			
D2424vav/Ev	1.2V ≤ VDET < 2.0V	Vdd=Vdet-0.1V, Iol=750μA			0.06			
R3134xxxEx	2.0V ≤ VDET < 3.1V	VDD=VDET-0.1V, IOL=1.2mA			0.05			
	3.1V ≤ Vdet	VDD=VDET-0.1V, IOL=3.2mA			0.06			

VDET is a set value.

DETECTOR THRESHOLD SPECIFICATIONS BY PART NUMBER

• R3134x

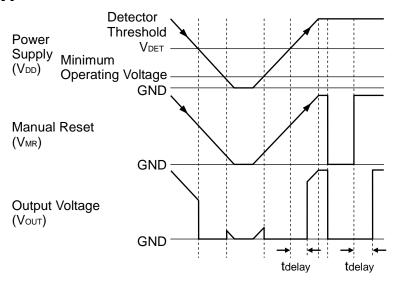
		Operating Voltage		Detec	tor Thre	shold	Supply Current 1			
Part Number		٧	'DD [V]			VDET [V]		Iss1 [μ Α]	
	Conditions	Min.	Conditions	Min.	Min.	Тур.	Max.	Conditions	Тур.	Max.
R3134x23Ex2					2.278	2.320	2.362			
R3134x26Ex3					2.583	2.630	2.677		0.8	
R3134x29Ex3	T . 0500		4000 · T · · 0500	0.05	2.877	2.930	2.983	VDD=VDET-0.1V		
R3134x30Ex8	Topt=25°C	0.75	$-40^{\circ}\text{C} \le \text{Topt} \le 85^{\circ}\text{C}$	-40°C ≤ Topt ≤ 85°C 0.85 3.025 3.080 3.135 IouT=0A 4.301 4.380 4.459			2.0			
R3134x43Ex8					0.9					
R3134x46Ex3					4.547	4.630	4.713			
R3134x10Ex					0.982	1.000	1.018			
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		0.8	
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	1	2.533 2.600 2.647 2.651 2.700 2.749 2.750 2.800 2.850	2.651 2.700 2.749				-			
R3134x28Ex				l 						
R3134x29Ex					2.848	2.900	2.952			
R3134x30Ex	Topt=25°C	0.75	-40°C ≤ Topt ≤ 85°C	0.85	2.946	3.000	3.054	VDD=VDET-0.1V		2.0
R3134x31Ex	1001 20 0	0.70	10 0 = 10pt = 00 0	0.00	3.044	3.100	3.156	Iout=0A		2.0
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		0.9	
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 Cu	ırrent 2		Supply C	urrent 3	1	"H" Output Vol	age
Iss2 [µ			Issa [μΑ]	1	Vон [V]	
Conditions	Тур.	Max.	Conditions	Тур.	Max.	Conditions	Min.
VDD=VDET+0.1V	0.0	0.0	VDD=6.0V	1.2	3.0	Vdd=Vdet+0.1V Ioн=500µA	0.8×
Іоит=0А	0.8	2.0	Іоит=0А	1.0	2.5	Vdd=Vdet+0.1V Ioh=800μA	VDD
						VDD=VDET+0.1V IOH=50µA	
				1.4	3.6	Vdd=Vdet+0.1V	
				1.4		VDD=VDE1+0.TV IOH=150μA	
					3.0		-
			1.2		Vdd=Vdet+0.1V Ιοн=500μΑ		
VDD=VDET+0.1V IOUT=0A	0.8	2.0	Vdd=6.0V Iout=0A				0.8× - Vdd
				1.0	2.5	Vdd=Vdet+0.1V Ioн=800µA	
				0.8			

	"L" Output Vo	oltage	MR pin "H" Voltage		MR pin "L" l Voltage		MR pin p	oull-up re	esistanc	е							
Part Number	Vol [V]		ViH [V]		Vı∟ [V]	VIL [V] RMR [MΩ]		:]									
	Conditions	Max.	Conditions	Min.	Conditions	Max.	Conditions	Min.	Тур.	Max.							
R3134x23Ex2																	
R3134x26Ex3	VDD=VDET-0.1V	VDD=VDET-0.1V	0.05														
R3134x29Ex3	IoL=1.2mA	0.05	\/>\/\0.4	0.75×	\/>\/\0.4	0.2×	T 0500	0.5	4.0	4.0							
R3134x30Ex8			VDD ≥ VDET+0.1	VDD	VDD ≥ VDET+0.1	VDD	Topt=25°C	0.5	1.0	4.0							
R3134x43Ex8	VDD=VDET-0.1V	0.00	1														
R3134x46Ex3	IoL=3.2mA	0.06															
R3134x10Ex	VDD=VDET-0.1V	0.04															
R3134x11Ex	IoL=200μA	0.04															
R3134x12Ex																	
R3134x13Ex																	
R3134x14Ex																	
R3134x15Ex	VDD=VDET-0.1V																
R3134x16Ex	IoL=750μA	0.06															
R3134x17Ex	<u> </u>																
R3134x18Ex																	
R3134x19Ex																	
R3134x20Ex			-														
R3134x21Ex																	
R3134x22Ex																	
R3134x23Ex																	
R3134x24Ex																	
R3134x25Ex	VDD=VDET-0.1V	0.05															
R3134x26Ex	loL=1.2mA		0.03	0.03													
R3134x27Ex		_															
R3134x28Ex																	
R3134x29Ex																	
R3134x30Ex			VDD ≥ VDET+0.1	0.75×	Vdd ≥ Vdet+0.1	0.2×	Topt=25°C	0.5	1.0	4.0							
R3134x31Ex			VDD = VDETTO.T	VDD	VDD = VDEITO.T	VDD	1001 20 0	0.0	1.0	1.0							
R3134x32Ex	1																
R3134x33Ex																	
R3134x34Ex																	
R3134x35Ex	-																
R3134x36Ex	1																
R3134x37Ex	-																
R3134x38Ex	_																
R3134x39Ex	_																
R3134x40Ex	VDD=VDET-0.1V																
R3134x41Ex	IOL=3.2mA	0.06															
R3134x41Ex R3134x42Ex	- 101-0.2111/																
	- - -																
R3134x43Ex R3134x44Ex																	
R3134x45Ex																	
R3134x46Ex	4																
R3134x47Ex	_																
R3134x48Ex	_																
R3134x49Ex	4																
R3134x50Ex		1	Ì	1		1			I								

Output Delay Time for Release				Detector Threshold Temperature Coefficient	
tdelay [ms]				ΔVDET/ΔTopt [ppm/°C]	
Conditions	Min.	Тур.	Max.	Conditions	Тур.
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

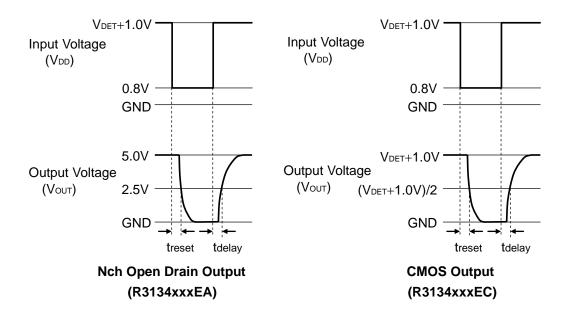
Output Delay Time (tdelay) is specified as follows:

1. In the case of Nch Open Drain Output:

The time interval from rising edge of V_{DD} pulse 0.8V 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 470k Ω resistor.

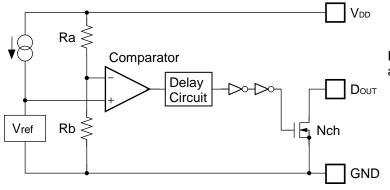
2. In the case of CMOS Output:

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.



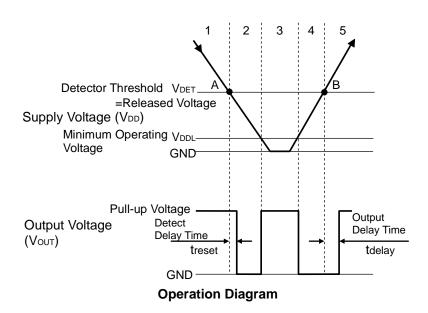
OPERATION

Operation of R3134xxxEA



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

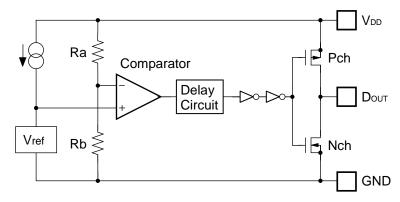
Block Diagram



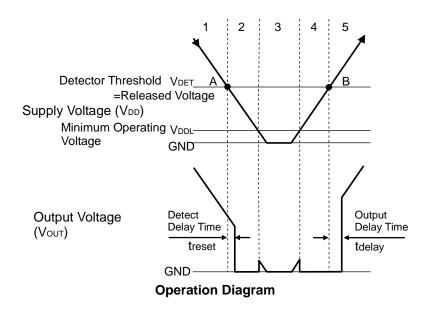
Explanation of operation

- Step 1. The output voltage is equal to the pull-up voltage.
- Step 2. At Point "A", Vref ≥ V_{DD}×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", Vref ≤ Vdd×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 (Vdet).
- *) There is no hysteresis range between the detector threshold and the released voltage.

Operation of R3134xxxEC



Block Diagram

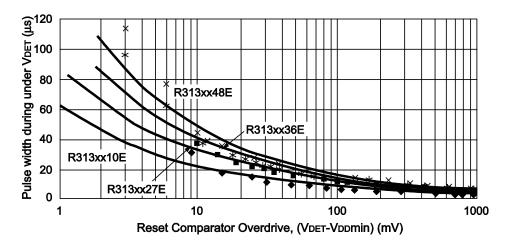


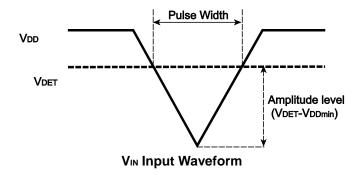
Explanation of operation

- Step 1. The output voltage is equal to the supply voltage (VDD).
- Step 2. At Point "A", Vref ≥ V_{DD}×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", Vref ≤ V_{DD}×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 VDD pin

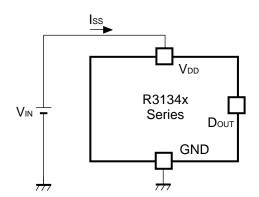
When the IC is released and a large pulse (glitch) crosses the detector threshold is forced, the IC may not maintain the released condition. The amplitude of the pulse (VDET-VDDmin) and the pulse width the IC can maintain the released level is described in the graph as follows:



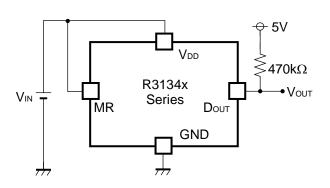


The graph above shows the condition for the maximum transient duration without generating a reset. If the larger amplitude or larger pulse width noise than the graph may be on the V_{DD} , the reset signal may be generated.

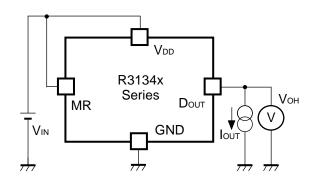
TEST CIRCUITS



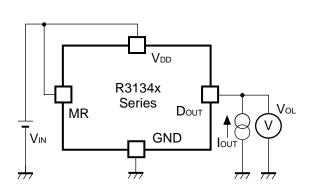
Supply Current Test Circuit



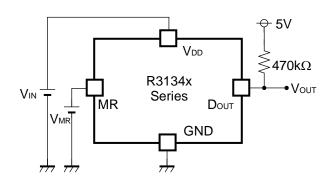
Detector Threshold Test Circuit (Pull-up circuit is not necessary for CMOS Output type.)



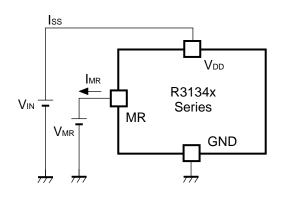
"H" Output Voltage Test Circuit (CMOS Output Type only)



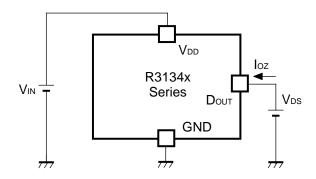
"L" Output Voltage Test Circuit



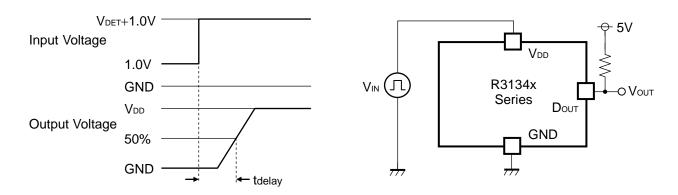
MR pin Input Voltage Test Circuit (Pull-up circuit is not necessary for CMOS Output type.)



MR pin Pull-up Resistance Test Circuit



Off Leakage Current Test Circuit

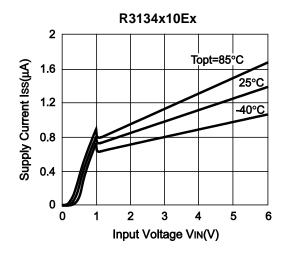


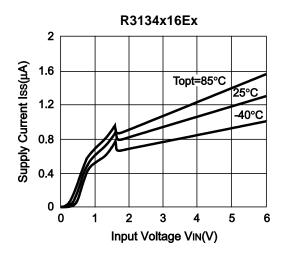
Output Delay Time Test Circuit

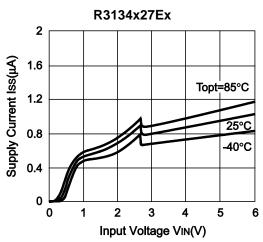
(Pull-up circuit is not necessary for CMOS Output type.)

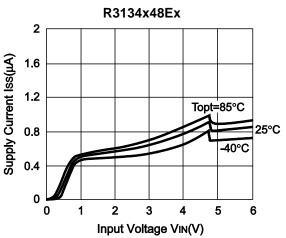
TYPICAL CHARACTERISTICS

1) Supply Current vs. Input Voltage

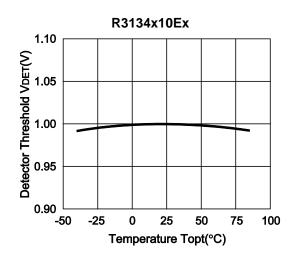


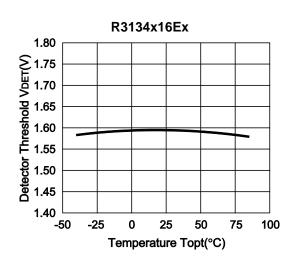


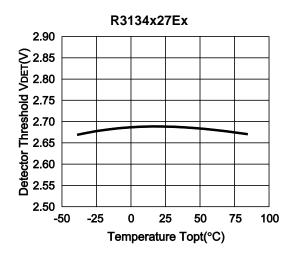


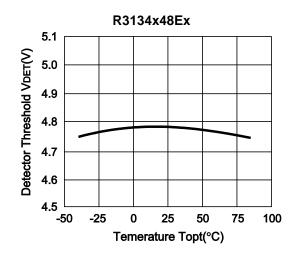


2) Detector Threshold vs. Temperature

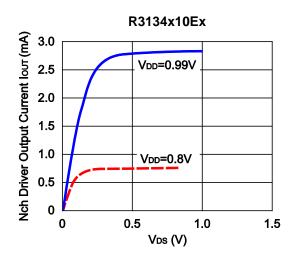


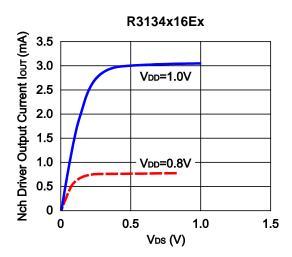


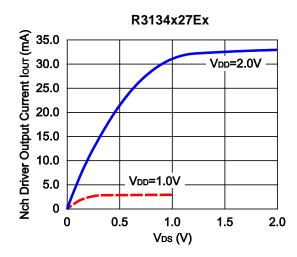


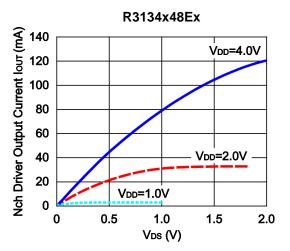


3) Nch Driver Output Current vs. VDS (Topt=25°C)

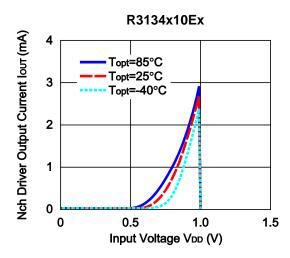


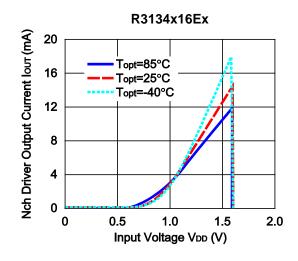


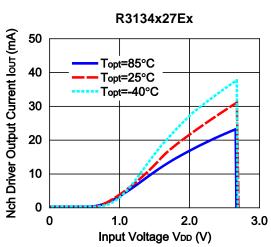


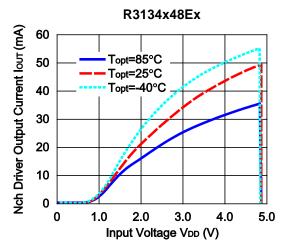


4) Nch Driver Output Current vs. Input Voltage

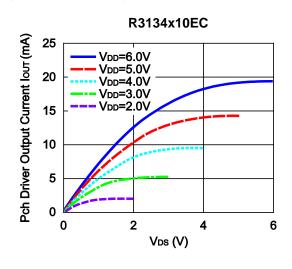


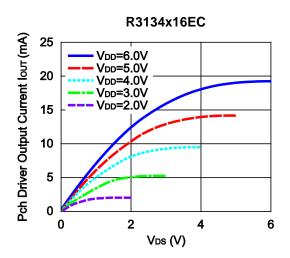


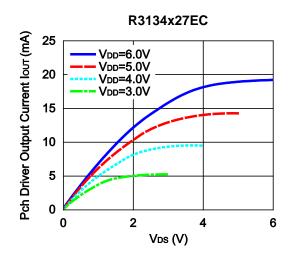


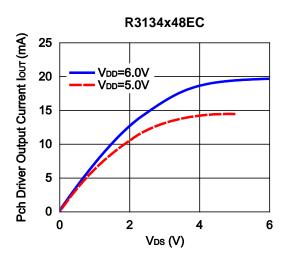


5) Pch Driver Output Current vs. VDS

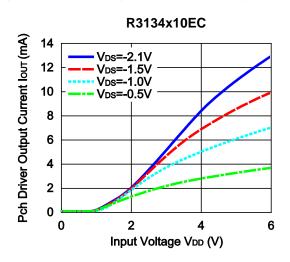


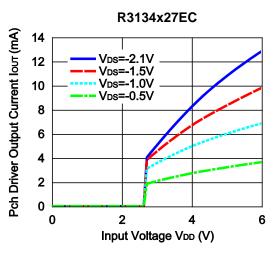


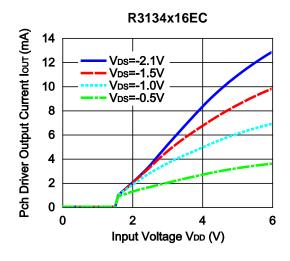


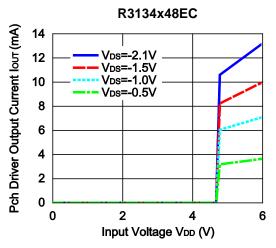


6) Pch Driver Output Current vs. Input Voltage

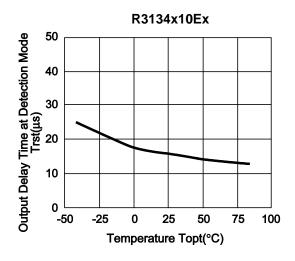


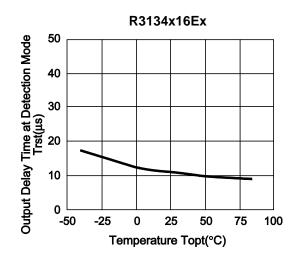


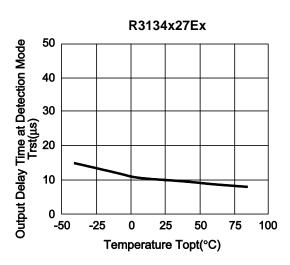


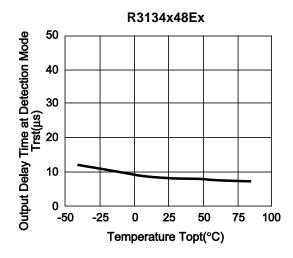


7) Output Delay Time at Detection Mode vs. Temperature

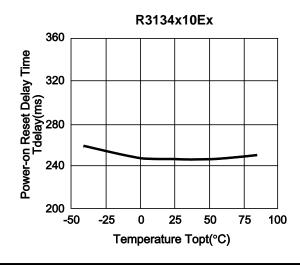


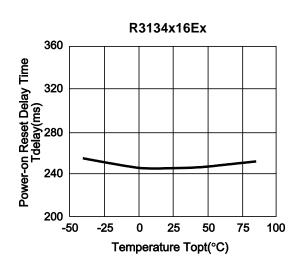


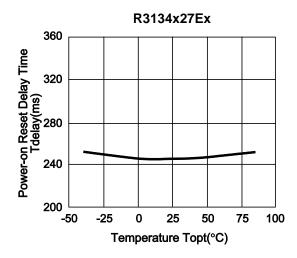


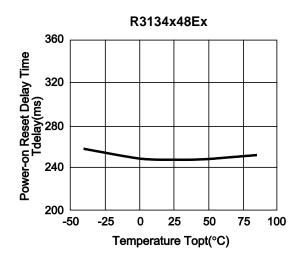


8) Power-on Reset Delay Time vs. Temperature









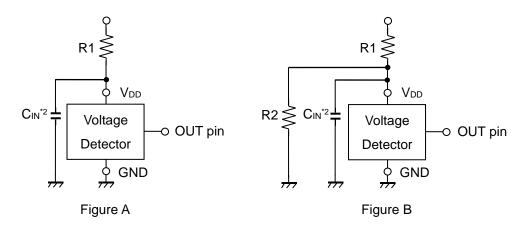
TECHNICAL NOTES

When connecting resistors to the device's input pin

When connecting a resistor (R1) to an input of this device, the input voltage decreases by [Device's Consumption Current] x [Resistance Value] only. And, the cross conduction current*1, which occurs when changing from the detecting state to the release state, is decreased the input voltage by [Cross Conduction Current] x [Resistance Value] only. And then, this device will enter the re-detecting state if the input voltage reduction is larger than the difference between the detector voltage and the released voltage.

When the input resistance value is large and the VDD is gone up at mildly in the vicinity of the released voltage, repeating the above operation may result in the occurrence of output.

As shown in Figure A/B, set R1 to become 100 k Ω or less as a guide, and connect C_{IN} of 0.1 μ F and more to between the input pin and GND. Besides, make evaluations including temperature properties under the actual usage condition, with using the evaluation board like this way. As a result, make sure that the cross conduction current has no problem.



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

^{*2} Note the bias dependence of capacitors.



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