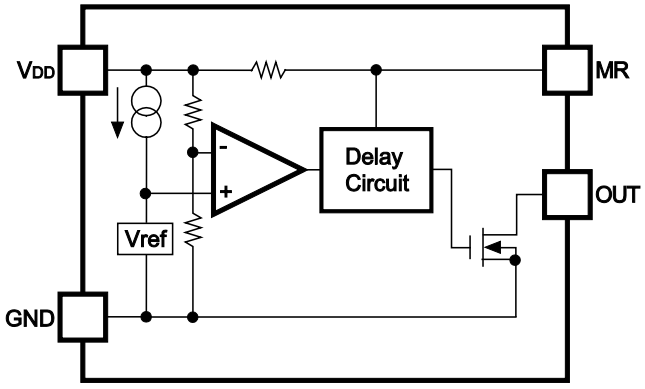
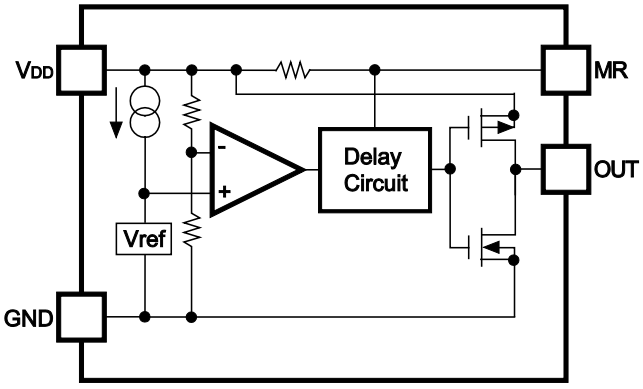
# BLOCK DIAGRAMS

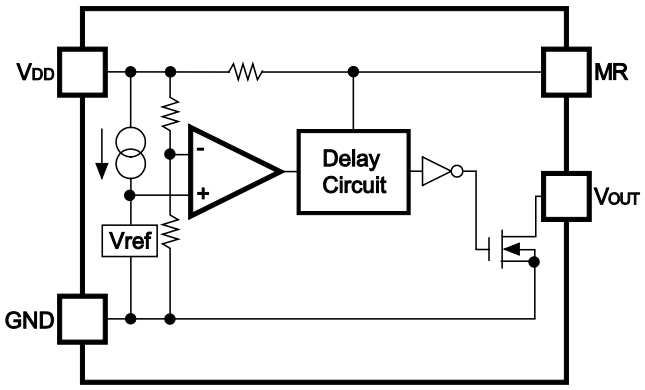
**R3132xxxEA Nch Open Drain Output**



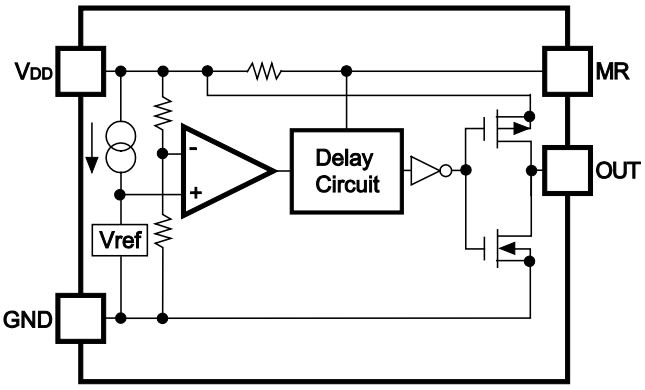

**R3132xxxEC CMOS Output**




**R3133xxxEA Nch Open Drain Output**




**R3133xxxEC CMOS Output**



# 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.

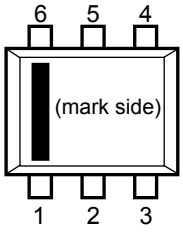
| Product Name | Package | Quantity per Reel | Pb Free | Halogen Free |
|---|---|---|---|---|
| R3132DxxE∗(y)-TR-FE<br>R3133DxxE∗(y)-TR-FE | SON1612-6 | 4,000 pcs | Yes | Yes |
| R3132QxxE∗(y)-TR-FE<br>R3133QxxE∗(y)-TR-FE | SC-82AB | 3,000 pcs | Yes | Yes |

xx: The detector threshold can be designated in the range from 1.0V(10) to 5.0V(50) in 0.1V steps.
y: If the detector threshold includes the 3rd digit, indicate the digit of 0.01V.
(2.32V, 2.63V, 2.93V, 3.08V, 4.38V, 4.63V)
Ex. If the detector threshold is 2.63V, R3132x26E∗3-TR-FE.

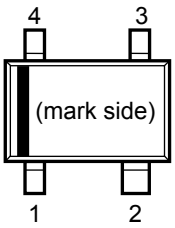
∗ : Designation of Output Type
(A) Nch Open Drain
(C) CMOS

# PIN CONFIGURATIONS

● **SON1612-6**




● **SC-82AB**




# PIN DESCRIPTIONS

● **SON1612-6**

| Pin No | Symbol | Pin Description |
|---|---|---|
| 1 | $V_{DD}$ | Input Pin |
| 2 | GND | Ground Pin |
| 3 | MR | Manual Reset Input Pin<br>Active at “L” input. Pulled up via 1MΩ. If MR pin is not necessary, open this node, or connect to $V_{DD}$. |
| 4 | OUT | Output Pin<br>R3132D Series:"L" at detection<br>R3133D Series:"H" at detection |
| 5 | GND | Ground Pin |
| 6 | NC | No Connection |

● **SC-82AB**

| Pin No | Symbol | Pin Description |
|---|---|---|
| 1 | GND | Ground Pin |
| 2 | OUT | Output Pin<br>R3132Q Series :"L" at detection<br>R3133Q Series :"H" at detection |
| 3 | MR | Manual Reset Input Pin<br>Active at "L" input. Pulled up via 1MΩ. If MR pin is not necessary, open this node, or connect to $V_{DD}$. |
| 4 | $V_{DD}$ | Input Pin |

# 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 (SON1612-6)*1, *2 | 500 | mW |
| | Power Dissipation (SC-82AB)*2 | 380 | |
| Topt | Operating Temperature Range | –40 to 85 | °C |
| Tstg | Storage Temperature Range | –55 to 125 | °C |
| Tsolder | Soldering Temperature | 260°C, 10s | |

∗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%
∗2) 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

Topt=25°C

| Symbol | Item | Test Conditions | | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|---|
| $V_{DD}$ | Operating Voltage | R3132 | Topt=25°C | 0.75 | | 6.0 | V |
| | | | −40°C≤Topt≤85°C | 0.85 | | 6.0 | |
| | | R3133 | Topt=25°C | 0.80 | | 6.0 | |
| | | | −40°C≤Topt≤85°C | 0.90 | | 6.0 | |
| $V_{DET}$ | Detector Threshold | | | $V_{DET}\times$ 0.98 | | $V_{DET}\times$ 1.02 | 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 | $V_{DD}$=6.0V, $I_{OUT}$=0A | $V_{DET}$<1.6V | | | 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 following table. | | | | | |
| $V_{OL}$ | "L" Output Voltage | Refer to the following table. | | | | | |
| $R_{MR}$ | MR pin pull-up resistance | Topt=25°C | | 0.5 | 1.0 | 4.0 | MΩ |
| $T_{rst}$* | Output Delay Time for detect | $V_{DD}=V_{DET}$ to $V_{DET}-0.1V$ | | | 15 | | μs |
| Tdelay | 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 |

∗) 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 | Test Conditions | | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| R3132xxxEC | $V_{DET}$<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 | | | | |
| R3133xxxEC | $V_{DET}$<1.2V | $V_{DD}$=$V_{DET}$−0.1V, $I_{OH}$=−10μA | 0.8×$V_{DD}$ | | | V |
| | 1.2V≤$V_{DET}$<2.0V | $V_{DD}$=$V_{DET}$−0.1V, $I_{OH}$=−100μA | | | | |
| | 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

| Symbol | Item | Test Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| R3132xxxEx | $V_{DET}$<1.2V | $V_{DD}$=$V_{DET}$−0.1V, $I_{OL}$=20μA | | | 0.3 | V |
| | 1.2V≤$V_{DET}$<1.6V | $V_{DD}$=$V_{DET}$−0.1V, $I_{OL}$=750μA | | | | |
| | 1.6V≤$V_{DET}$<3.1V | $V_{DD}$=$V_{DET}$−0.1V, $I_{OL}$=1.2mA | | | | |
| | 3.1V≤$V_{DET}$ | $V_{DD}$=$V_{DET}$−0.1V, $I_{OL}$=3.2mA | | | 0.4 | V |
| R3133xxxEx | $V_{DET}$<1.2V | $V_{DD}$=$V_{DET}$+0.1V, $I_{OL}$=20μA | | | 0.3 | V |
| | 1.2V≤$V_{DET}$<1.6V | $V_{DD}$=$V_{DET}$+0.1V, $I_{OL}$=750μA | | | | |
| | 1.6V≤$V_{DET}$<3.1V | $V_{DD}$=$V_{DET}$+0.1V, $I_{OL}$=1.2mA | | | | |
| | 3.1V≤$V_{DET}$ | $V_{DD}$=$V_{DET}$+0.1V, $I_{OL}$=3.2mA | | | 0.4 | V |

$V_{DET}$ is a set value.

# DETECTOR THRESHOLD SPECIFICATIONS BY PART NUMBER

- **R3132x**

| Part Number | Operating Voltage | | | | Detector Threshold | | | Supply Current 1 | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | $V_{DD}$[V] | | | | $V_{DET}$[V] | | | $I_{SS1}$[µA] | | |
| | Conditions | Min. | Conditions | Min. | Min. | Typ. | Max. | Conditions | Typ. | Max. |
| R3132x23Ex2 | Topt=25°C | 0.75 | −40°C≤Topt≤85°C | 0.85 | 2.274 | 2.320 | 2.366 | $V_{DD}$=$V_{DET}$−0.1V<br>$I_{OUT}$=0A | 0.8 | 2.0 |
| R3132x26Ex3 | | | | | 2.578 | 2.630 | 2.682 | | | |
| R3132x29Ex3 | | | | | 2.872 | 2.930 | 2.988 | | 0.9 | |
| R3132x30Ex8 | | | | | 3.019 | 3.080 | 3.141 | | | |
| R3132x43Ex8 | | | | | 4.293 | 4.380 | 4.467 | | | |
| R3132x46Ex3 | | | | | 4.538 | 4.630 | 4.722 | | | |
| R3132x10Ex | Topt=25°C | 0.75 | −40°C≤Topt≤85°C | 0.85 | 0.980 | 1.000 | 1.020 | $V_{DD}$=$V_{DET}$−0.1V<br>$I_{OUT}$=0A | 0.8 | 2.0 |
| R3132x11Ex | | | | | 1.078 | 1.100 | 1.122 | | | |
| R3132x12Ex | | | | | 1.176 | 1.200 | 1.224 | | | |
| R3132x13Ex | | | | | 1.274 | 1.300 | 1.326 | | | |
| R3132x14Ex | | | | | 1.372 | 1.400 | 1.428 | | | |
| R3132x15Ex | | | | | 1.470 | 1.500 | 1.530 | | | |
| R3132x16Ex | | | | | 1.568 | 1.600 | 1.632 | | | |
| R3132x17Ex | | | | | 1.666 | 1.700 | 1.734 | | | |
| R3132x18Ex | | | | | 1.764 | 1.800 | 1.836 | | | |
| R3132x19Ex | | | | | 1.862 | 1.900 | 1.938 | | | |
| R3132x20Ex | | | | | 1.960 | 2.000 | 2.040 | | | |
| R3132x21Ex | | | | | 2.058 | 2.100 | 2.142 | | | |
| R3132x22Ex | | | | | 2.156 | 2.200 | 2.244 | | | |
| R3132x23Ex | | | | | 2.254 | 2.300 | 2.346 | | | |
| R3132x24Ex | | | | | 2.352 | 2.400 | 2.448 | | | |
| R3132x25Ex | | | | | 2.450 | 2.500 | 2.550 | | | |
| R3132x26Ex | | | | | 2.548 | 2.600 | 2.652 | | | |
| R3132x27Ex | | | | | 2.646 | 2.700 | 2.754 | | 0.9 | |
| R3132x28Ex | | | | | 2.744 | 2.800 | 2.856 | | | |
| R3132x29Ex | | | | | 2.842 | 2.900 | 2.958 | | | |
| R3132x30Ex | | | | | 2.940 | 3.000 | 3.060 | | | |
| R3132x31Ex | | | | | 3.038 | 3.100 | 3.162 | | | |
| R3132x32Ex | | | | | 3.136 | 3.200 | 3.264 | | | |
| R3132x33Ex | | | | | 3.234 | 3.300 | 3.366 | | | |
| R3132x34Ex | | | | | 3.332 | 3.400 | 3.468 | | | |
| R3132x35Ex | | | | | 3.430 | 3.500 | 3.570 | | | |
| R3132x36Ex | | | | | 3.528 | 3.600 | 3.672 | | | |
| R3132x37Ex | | | | | 3.626 | 3.700 | 3.774 | | | |
| R3132x38Ex | | | | | 3.724 | 3.800 | 3.876 | | | |
| R3132x39Ex | | | | | 3.822 | 3.900 | 3.978 | | | |
| R3132x40Ex | | | | | 3.920 | 4.000 | 4.080 | | | |
| R3132x41Ex | | | | | 4.018 | 4.100 | 4.182 | | | |
| R3132x42Ex | | | | | 4.116 | 4.200 | 4.284 | | | |
| R3132x43Ex | | | | | 4.214 | 4.300 | 4.386 | | | |
| R3132x44Ex | | | | | 4.312 | 4.400 | 4.488 | | | |
| R3132x45Ex | | | | | 4.410 | 4.500 | 4.590 | | | |
| R3132x46Ex | | | | | 4.508 | 4.600 | 4.692 | | | |
| R3132x47Ex | | | | | 4.606 | 4.700 | 4.794 | | | |
| R3132x48Ex | | | | | 4.704 | 4.800 | 4.896 | | | |
| R3132x49Ex | | | | | 4.802 | 4.900 | 4.998 | | | |
| R3132x50Ex | | | | | 4.900 | 5.000 | 5.100 | | | |

| 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. |
| $V_{DD}=V_{DET}+0.1V$<br>$I_{OUT}=0A$ | 0.8 | 2.0 | $V_{DD}=6.0V$<br>$I_{OUT}=0A$ | 1.2 | 3.0 | $V_{DD}=V_{DET}+0.1V$<br>$I_{OH}=-500\mu A$ | 0.8×<br>$V_{DD}$ |
| | | | | 1.0 | 2.5 | $V_{DD}=V_{DET}+0.1V$<br>$I_{OH}=-800\mu A$ | |
| $V_{DD}=V_{DET}+0.1V$<br>$I_{OUT}=0A$ | 0.8 | 2.0 | $V_{DD}=6.0V$<br>$I_{OUT}=0A$ | 1.4 | 3.6 | $V_{DD}=V_{DET}+0.1V$<br>$I_{OH}=-50\mu A$ | 0.8×<br>$V_{DD}$ |
| | | | | | | $V_{DD}=V_{DET}+0.1V$<br>$I_{OH}=-150\mu A$ | |
| | | | | 1.2 | 3.0 | $V_{DD}=V_{DET}+0.1V$<br>$I_{OH}=-500\mu A$ | |
| | | | | 1.0 | 2.5 | $V_{DD}=V_{DET}+0.1V$<br>$I_{OH}=-800\mu A$ | |
| | | | | 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. |
| R3132x23Ex2 | $V_{DD}$=$V_{DET}$−0.1V<br>$I_{OL}$=+1.2mA | 0.3 | $V_{DD}$≥$V_{DET}$+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 |
| R3132x26Ex3 | | | | | | | | | | |
| R3132x29Ex3 | | | | | | | | | | |
| R3132x30Ex8 | | | | | | | | | | |
| R3132x43Ex8 | $V_{DD}$=$V_{DET}$−0.1V<br>$I_{OL}$=+3.2mA | 0.4 | | | | | | | | |
| R3132x46Ex3 | | | | | | | | | | |
| R3132x10Ex | $V_{DD}$=$V_{DET}$−0.1V<br>$I_{OL}$=+20μA | 0.3 | $V_{DD}$≥$V_{DET}$+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 |
| R3132x11Ex | | | | | | | | | | |
| R3132x12Ex | $V_{DD}$=$V_{DET}$−0.1V<br>$I_{OL}$=+750μA | | | | | | | | | |
| R3132x13Ex | | | | | | | | | | |
| R3132x14Ex | | | | | | | | | | |
| R3132x15Ex | | | | | | | | | | |
| R3132x16Ex | $V_{DD}$=$V_{DET}$−0.1V<br>$I_{OL}$=+1.2mA | | | | | | | | | |
| R3132x17Ex | | | | | | | | | | |
| R3132x18Ex | | | | | | | | | | |
| R3132x19Ex | | | | | | | | | | |
| R3132x20Ex | | | | | | | | | | |
| R3132x21Ex | | | | | | | | | | |
| R3132x22Ex | | | | | | | | | | |
| R3132x23Ex | | | | | | | | | | |
| R3132x24Ex | | | | | | | | | | |
| R3132x25Ex | | | | | | | | | | |
| R3132x26Ex | | | | | | | | | | |
| R3132x27Ex | | | | | | | | | | |
| R3132x28Ex | | | | | | | | | | |
| R3132x29Ex | | | | | | | | | | |
| R3132x30Ex | | | | | | | | | | |
| R3132x31Ex | $V_{DD}$=$V_{DET}$−0.1V<br>$I_{OL}$=+3.2mA | 0.4 | | | | | | | | |
| R3132x32Ex | | | | | | | | | | |
| R3132x33Ex | | | | | | | | | | |
| R3132x34Ex | | | | | | | | | | |
| R3132x35Ex | | | | | | | | | | |
| R3132x36Ex | | | | | | | | | | |
| R3132x37Ex | | | | | | | | | | |
| R3132x38Ex | | | | | | | | | | |
| R3132x39Ex | | | | | | | | | | |
| R3132x40Ex | | | | | | | | | | |
| R3132x41Ex | | | | | | | | | | |
| R3132x42Ex | | | | | | | | | | |
| R3132x43Ex | | | | | | | | | | |
| R3132x44Ex | | | | | | | | | | |
| R3132x45Ex | | | | | | | | | | |
| R3132x46Ex | | | | | | | | | | |
| R3132x47Ex | | | | | | | | | | |
| R3132x48Ex | | | | | | | | | | |
| R3132x49Ex | | | | | | | | | | |
| R3132x50Ex | | | | | | | | | | |

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

- **R3133x**

| Part Number | Operating Voltage | | | | Detector Threshold | | | Supply Current 1 | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | $V_{DD}$[V] | | | | $V_{DET}$[V] | | | $I_{SS1}$[µA] | | |
| | Conditions | Min. | Conditions | Min. | Min. | Typ. | Max. | Conditions | Typ. | Max. |
| R3133x23Ex2 | Topt=25°C | 0.80 | −40°C≤Topt≤85°C | 0.90 | 2.274 | 2.320 | 2.366 | $V_{DD}$=$V_{DET}$−0.1V<br>$I_{OUT}$=0A | 0.8 | 2.0 |
| R3133x26Ex3 | | | | | 2.578 | 2.630 | 2.682 | | | |
| R3133x29Ex3 | | | | | 2.872 | 2.930 | 2.988 | | 0.9 | |
| R3133x30Ex8 | | | | | 3.019 | 3.080 | 3.141 | | | |
| R3133x43Ex8 | | | | | 4.293 | 4.380 | 4.467 | | | |
| R3133x46Ex3 | | | | | 4.538 | 4.630 | 4.722 | | | |
| R3133x10Ex | Topt=25°C | 0.80 | −40°C≤Topt≤85°C | 0.90 | 0.980 | 1.000 | 1.020 | $V_{DD}$=$V_{DET}$−0.1V<br>$I_{OUT}$=0A | 0.8 | 2.0 |
| R3133x11Ex | | | | | 1.078 | 1.100 | 1.122 | | | |
| R3133x12Ex | | | | | 1.176 | 1.200 | 1.224 | | | |
| R3133x13Ex | | | | | 1.274 | 1.300 | 1.326 | | | |
| R3133x14Ex | | | | | 1.372 | 1.400 | 1.428 | | | |
| R3133x15Ex | | | | | 1.470 | 1.500 | 1.530 | | | |
| R3133x16Ex | | | | | 1.568 | 1.600 | 1.632 | | | |
| R3133x17Ex | | | | | 1.666 | 1.700 | 1.734 | | | |
| R3133x18Ex | | | | | 1.764 | 1.800 | 1.836 | | | |
| R3133x19Ex | | | | | 1.862 | 1.900 | 1.938 | | | |
| R3133x20Ex | | | | | 1.960 | 2.000 | 2.040 | | | |
| R3133x21Ex | | | | | 2.058 | 2.100 | 2.142 | | | |
| R3133x22Ex | | | | | 2.156 | 2.200 | 2.244 | | | |
| R3133x23Ex | | | | | 2.254 | 2.300 | 2.346 | | | |
| R3133x24Ex | | | | | 2.352 | 2.400 | 2.448 | | | |
| R3133x25Ex | | | | | 2.450 | 2.500 | 2.550 | | | |
| R3133x26Ex | | | | | 2.548 | 2.600 | 2.652 | | | |
| R3133x27Ex | | | | | 2.646 | 2.700 | 2.754 | | 0.9 | |
| R3133x28Ex | | | | | 2.744 | 2.800 | 2.856 | | | |
| R3133x29Ex | | | | | 2.842 | 2.900 | 2.958 | | | |
| R3133x30Ex | | | | | 2.940 | 3.000 | 3.060 | | | |
| R3133x31Ex | | | | | 3.038 | 3.100 | 3.162 | | | |
| R3133x32Ex | | | | | 3.136 | 3.200 | 3.264 | | | |
| R3133x33Ex | | | | | 3.234 | 3.300 | 3.366 | | | |
| R3133x34Ex | | | | | 3.332 | 3.400 | 3.468 | | | |
| R3133x35Ex | | | | | 3.430 | 3.500 | 3.570 | | | |
| R3133x36Ex | | | | | 3.528 | 3.600 | 3.672 | | | |
| R3133x37Ex | | | | | 3.626 | 3.700 | 3.774 | | | |
| R3133x38Ex | | | | | 3.724 | 3.800 | 3.876 | | | |
| R3133x39Ex | | | | | 3.822 | 3.900 | 3.978 | | | |
| R3133x40Ex | | | | | 3.920 | 4.000 | 4.080 | | | |
| R3133x41Ex | | | | | 4.018 | 4.100 | 4.182 | | | |
| R3133x42Ex | | | | | 4.116 | 4.200 | 4.284 | | | |
| R3133x43Ex | | | | | 4.214 | 4.300 | 4.386 | | | |
| R3133x44Ex | | | | | 4.312 | 4.400 | 4.488 | | | |
| R3133x45Ex | | | | | 4.410 | 4.500 | 4.590 | | | |
| R3133x46Ex | | | | | 4.508 | 4.600 | 4.692 | | | |
| R3133x47Ex | | | | | 4.606 | 4.700 | 4.794 | | | |
| R3133x48Ex | | | | | 4.704 | 4.800 | 4.896 | | | |
| R3133x49Ex | | | | | 4.802 | 4.900 | 4.998 | | | |
| R3133x50Ex | | | | | 4.900 | 5.000 | 5.100 | | | |

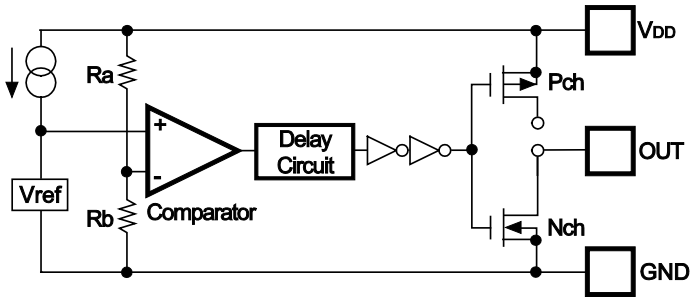
| Supply Current 2 | | | Supply Current 3 | | | "H" Output Voltage | |
|---|---|---|---|---|---|---|---|
| $I_{SS2}$[μA] | | | $I_{SS3}$[μA] | | | $V_{OH}$[V] | |
| Conditions | Typ. | Max. | Conditions | Typ. | Max. | Conditions | Min. |
| $V_{DD}=V_{DET}+0.1V$<br>$I_{OUT}=0A$ | 0.8 | 2.0 | $V_{DD}=6.0V$<br>$I_{OUT}=0A$ | 1.2 | 3.0 | $V_{DD}=V_{DET}-0.1V$<br>$I_{OH}=-500\mu A$ | 0.8×<br>$V_{DD}$ |
| | | | | 1.0 | 2.5 | $V_{DD}=V_{DET}-0.1V$<br>$I_{OH}=-800\mu A$ | |
| $V_{DD}=V_{DET}+0.1V$<br>$I_{OUT}=0A$ | 0.8 | 2.0 | $V_{DD}=6.0V$<br>$I_{OUT}=0A$ | 1.4 | 3.6 | $V_{DD}=V_{DET}-0.1V$<br>$I_{OH}=-10\mu A$ | 0.8×<br>$V_{DD}$ |
| | | | | | | $V_{DD}=V_{DET}-0.1V$<br>$I_{OH}=-100\mu A$ | |
| | | | | 1.2 | 3.0 | $V_{DD}=V_{DET}-0.1V$<br>$I_{OH}=-500\mu A$ | |
| | | | | 1.0 | 2.5 | $V_{DD}=V_{DET}-0.1V$<br>$I_{OH}=-800\mu A$ | |
| | | | | 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. |
| R3133x23Ex2 | $V_{DD}$=$V_{DET}$+0.1V<br>$I_{OL}$=+1.2mA | 0.3 | $V_{DD}$≥$V_{DET}$+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 |
| R3133x26Ex3 | | | | | | | | | | |
| R3133x29Ex3 | | | | | | | | | | |
| R3133x30Ex8 | | | | | | | | | | |
| R3133x43Ex8 | $V_{DD}$=$V_{DET}$+0.1V<br>$I_{OL}$=+3.2mA | 0.4 | | | | | | | | |
| R3133x46Ex3 | | | | | | | | | | |
| R3133x10Ex | $V_{DD}$=$V_{DET}$+0.1V<br>$I_{OL}$=+20μA | 0.3 | $V_{DD}$≥$V_{DET}$+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 |
| R3133x11Ex | | | | | | | | | | |
| R3133x12Ex | $V_{DD}$=$V_{DET}$+0.1V<br>$I_{OL}$=+750μA | | | | | | | | | |
| R3133x13Ex | | | | | | | | | | |
| R3133x14Ex | | | | | | | | | | |
| R3133x15Ex | | | | | | | | | | |
| R3133x16Ex | $V_{DD}$=$V_{DET}$+0.1V<br>$I_{OL}$=+1.2mA | | | | | | | | | |
| R3133x17Ex | | | | | | | | | | |
| R3133x18Ex | | | | | | | | | | |
| R3133x19Ex | | | | | | | | | | |
| R3133x20Ex | | | | | | | | | | |
| R3133x21Ex | | | | | | | | | | |
| R3133x22Ex | | | | | | | | | | |
| R3133x23Ex | | | | | | | | | | |
| R3133x24Ex | | | | | | | | | | |
| R3133x25Ex | | | | | | | | | | |
| R3133x26Ex | | | | | | | | | | |
| R3133x27Ex | | | | | | | | | | |
| R3133x28Ex | | | | | | | | | | |
| R3133x29Ex | | | | | | | | | | |
| R3133x30Ex | | | | | | | | | | |
| R3133x31Ex | $V_{DD}$=$V_{DET}$+0.1V<br>$I_{OL}$=+3.2mA | 0.4 | | | | | | | | |
| R3133x32Ex | | | | | | | | | | |
| R3133x33Ex | | | | | | | | | | |
| R3133x34Ex | | | | | | | | | | |
| R3133x35Ex | | | | | | | | | | |
| R3133x36Ex | | | | | | | | | | |
| R3133x37Ex | | | | | | | | | | |
| R3133x38Ex | | | | | | | | | | |
| R3133x39Ex | | | | | | | | | | |
| R3133x40Ex | | | | | | | | | | |
| R3133x41Ex | | | | | | | | | | |
| R3133x42Ex | | | | | | | | | | |
| R3133x43Ex | | | | | | | | | | |
| R3133x44Ex | | | | | | | | | | |
| R3133x45Ex | | | | | | | | | | |
| R3133x46Ex | | | | | | | | | | |
| R3133x47Ex | | | | | | | | | | |
| R3133x48Ex | | | | | | | | | | |
| R3133x49Ex | | | | | | | | | | |
| R3133x50Ex | | | | | | | | | | |

| Output Delay Time for Release | | | | Detector Threshold Temperature Coefficient | |
|---|---|---|---|---|---|
| Tdelay[ms] | | | | ΔVDET/ΔTopt[ppm/°C] | |
| Conditions | Min. | Typ. | Max. | Conditions | Typ. |
| 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 |

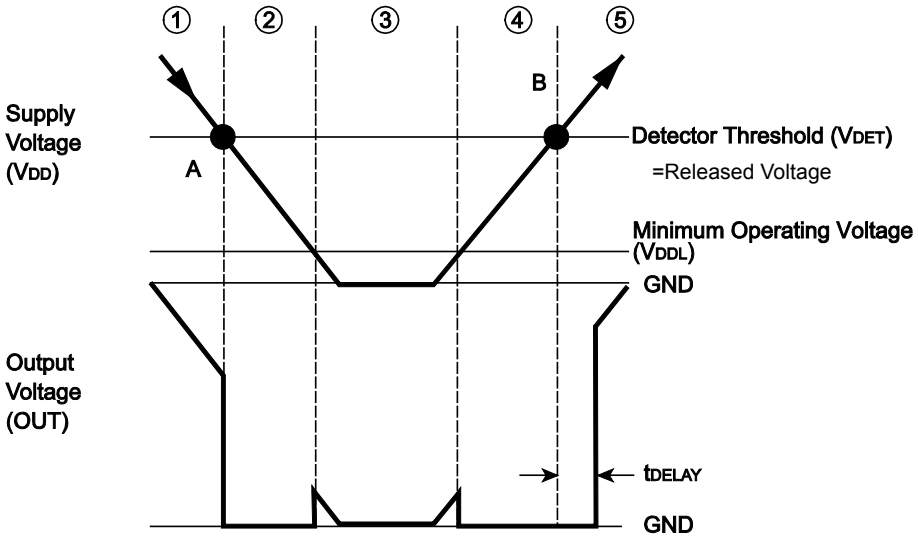
# OPERATION

## • Operation of R3132x 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), $Vref \geq V_{DD} \times Rb / (Ra+Rb)$ is true. Then, the output of the comparator is reversed, thus output voltage becomes equal to GND level.

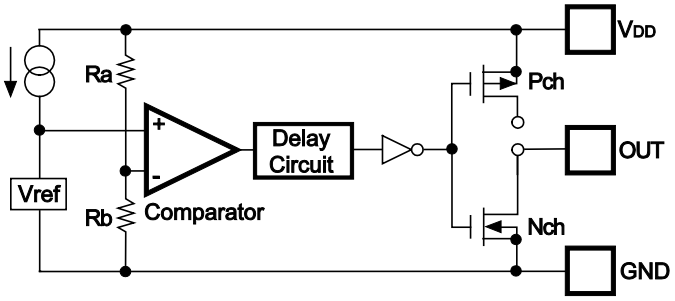
③ When the supply voltage is lower than minimum operating voltage, the output of transistor is indefinite, therefore the output is also indefinite.

④ Output voltage is equal to GND level.

⑤ When the supply voltage is higher than the released voltage (Point B), $Vref \leq V_{DD} \times Rb / (Ra+Rb)$ 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).

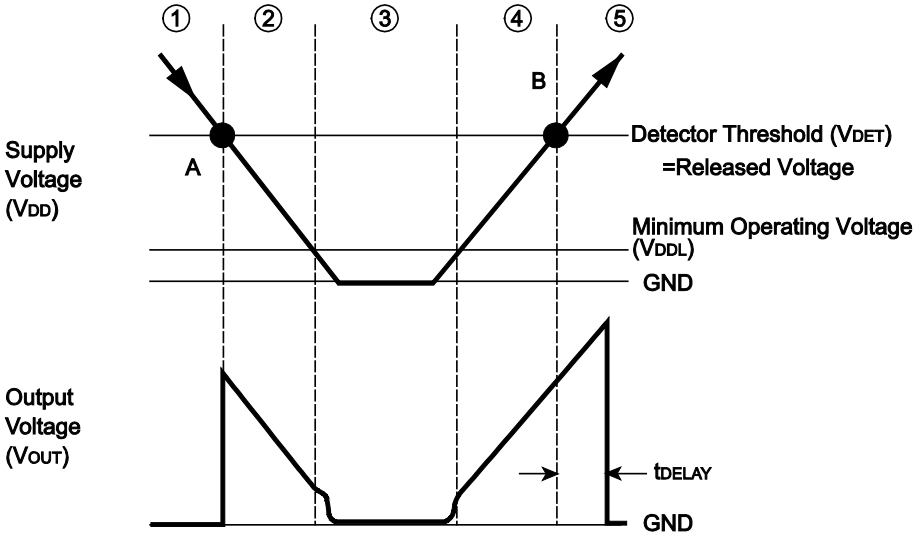
∗ There is no hysteresis range between the detector threshold and the released voltage.

## • Operation of R3133x 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.)




**Operation Diagram**

In the above diagram,

① Output voltage becomes equal to GND level.

② When the supply voltage is down to the detector threshold level (Point A), Vref≥$V_{DD}$ × Rb / (Ra+Rb) is true. Then, the output of the comparator is reversed, thus output voltage becomes equal to the supply voltage (Nch open drain output type; equal to pull-up voltage).

③ When the supply voltage is lower than minimum operating voltage, the output of transistor is indefinite, therefore the output is also indefinite. (Nch open drain output type; the output voltage level is equal to pull-up voltage.)

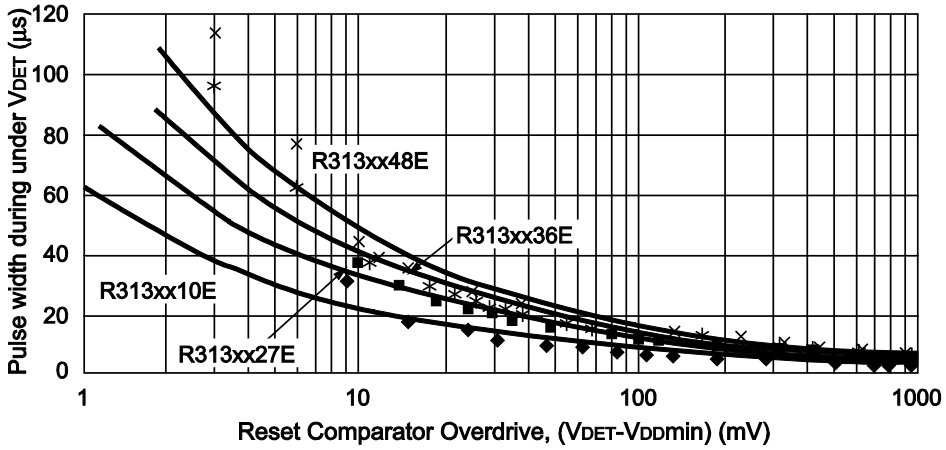
④ Output voltage is equal to the supply voltage. (Nch open drain output type; equal to pull-up Voltage.)

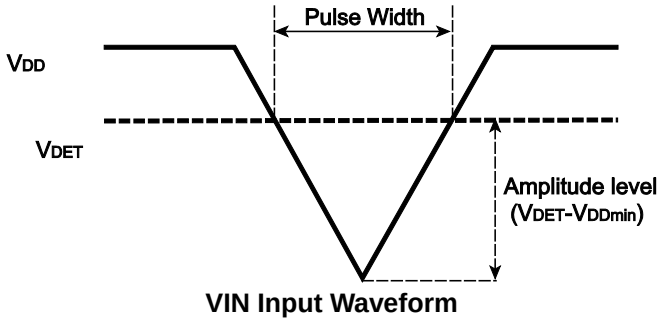
⑤ When the supply voltage is higher than the released voltage (Point B), Vref≤$V_{DD}$ × Rb / (Ra+Rb) is true. Then the output of the comparator is reversed, thus the output voltage becomes equal to GND level after the output delay time.

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

# TECHNICAL NOTES

When the IC is released, if a large pulse (glitch) which crosses the detector threshold voltage is in, 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.

### 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 kΩ or less as a guide, and connect $C_{IN}$ of 0.1 µF 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.

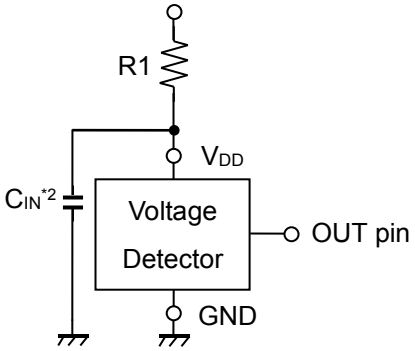



Figure A

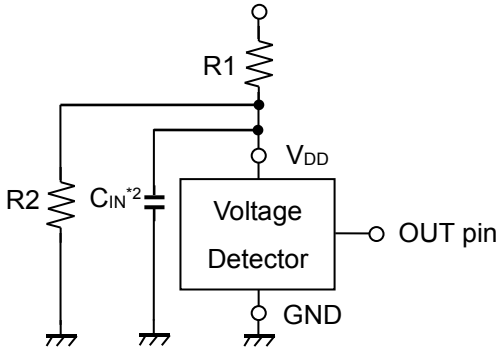
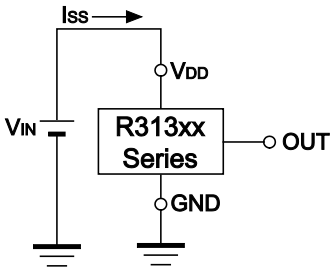



Figure B

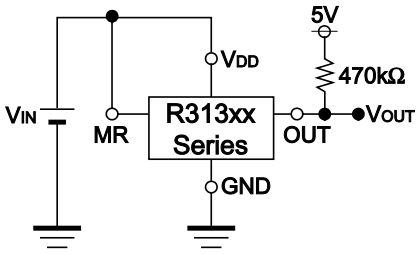
*1 In the CMOS output type, a charging current for OUT pin is included.

*2 Note the bias dependence of capacitors.

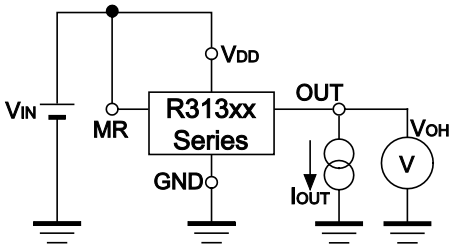
# TEST CIRCUITS



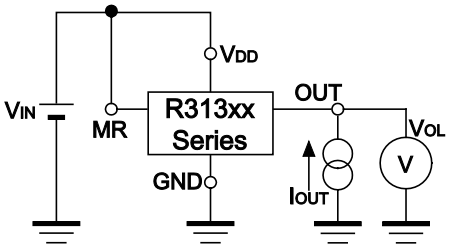

**Supply Current Test Circuit**



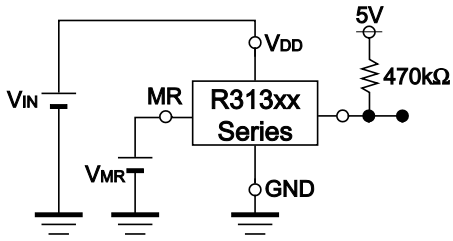

**Detector Threshold Test Circuit**
**(CMOS Output type; pull-up part is not necessary.)**



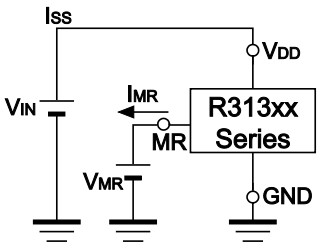

**"H" Output Voltage Test Circuit**
**(CMOS Output Type only)**



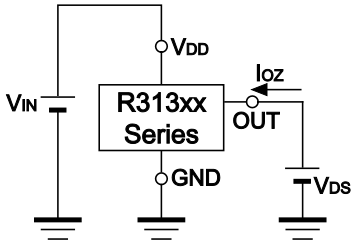

**"L" Output Voltage Test Circuit**



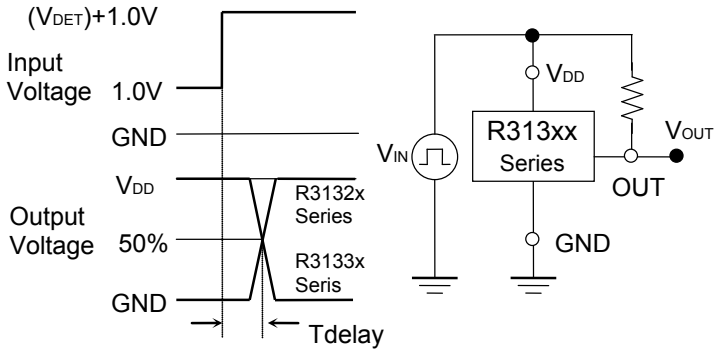

**MR pin Input Voltage Test Circuit**
**(CMOS Output type; pull-up part is not necessary.)**




**MR pin Pull-up Resistance Test Circuit**




**Off Leakage Current Test Circuit**

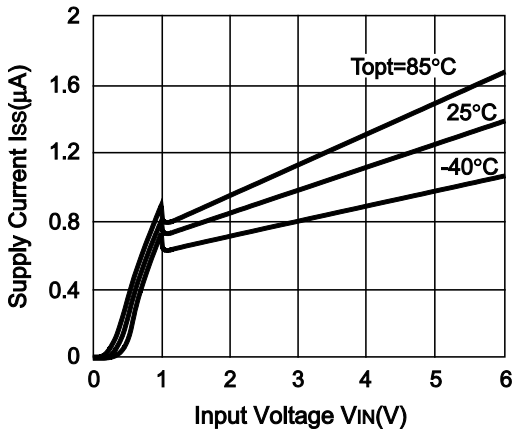



**Output Delay Time Test Circuit**
**(CMOS Output type; pull-up is not necessary.)**

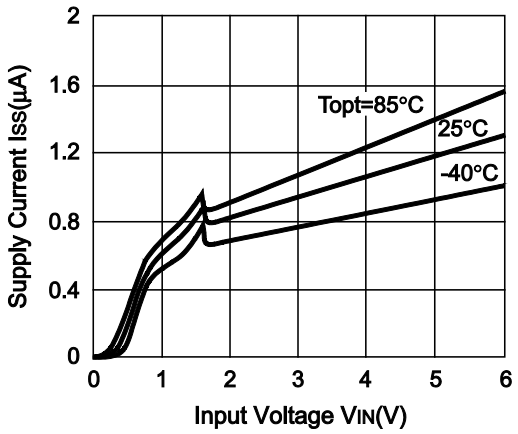
# TYPICAL CHARACTERISTICS

## 1) Supply Current vs. Input Voltage

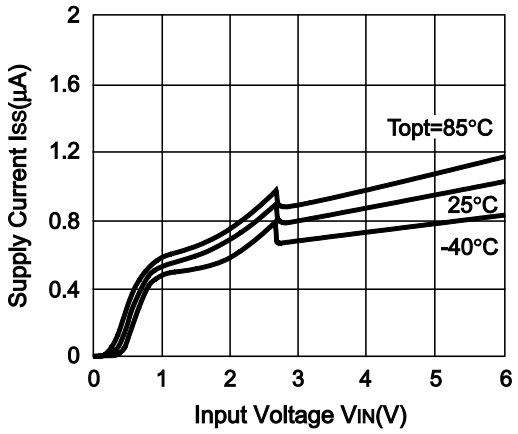
R3132x10Ex/R3133x10Ex



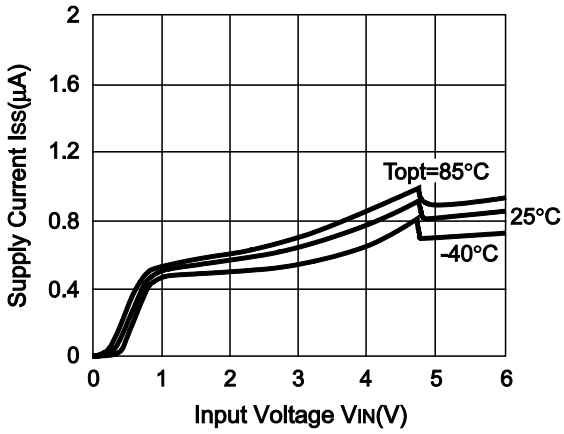

R3132x16Ex/R3133x16Ex




R3132x27Ex/R3133x27Ex

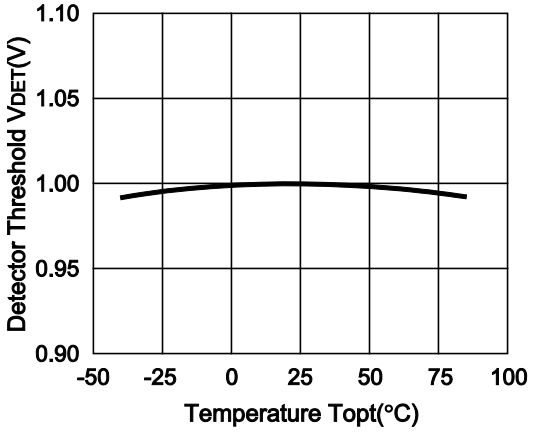



R3132x48Ex/R3133x48Ex

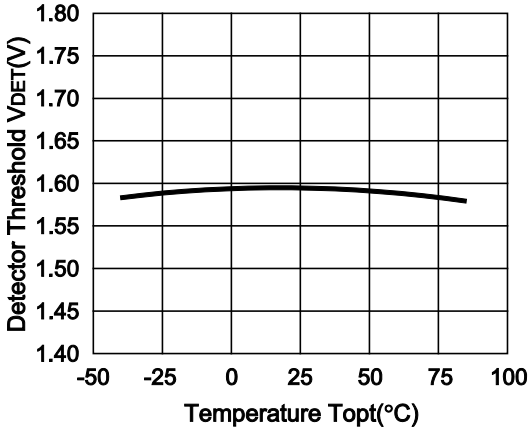



## 2) Detector Threshold vs. Temperature

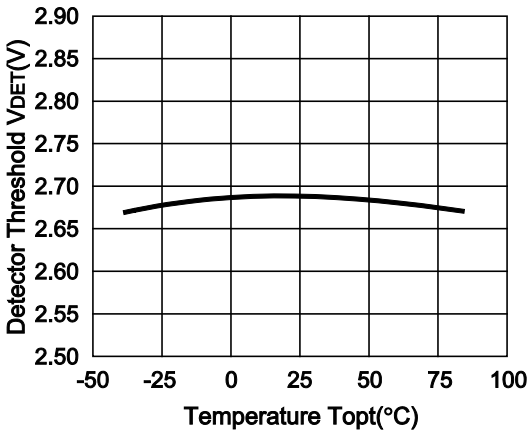
R3132x10Ex/R3133x10Ex



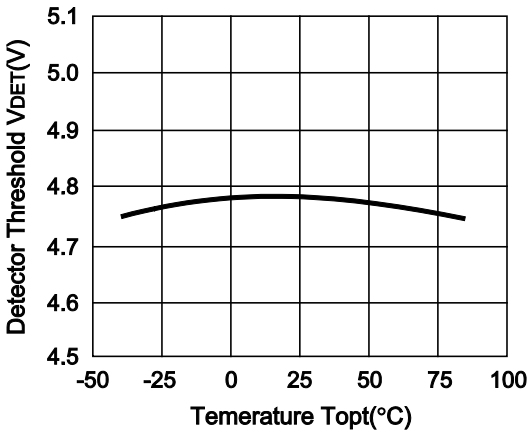

R3132x16Ex/R3133x16Ex



R3132x27Ex/R3133x27Ex

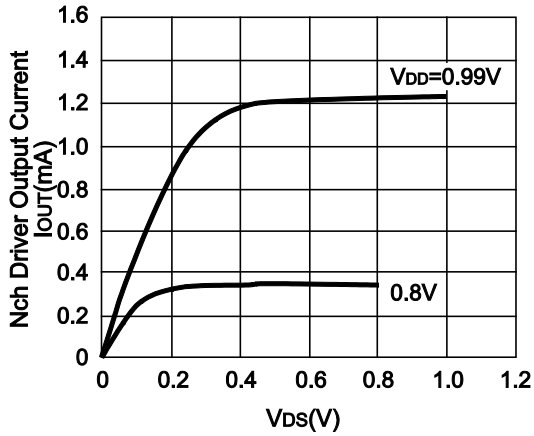



R3132x48Ex/R3133x48Ex

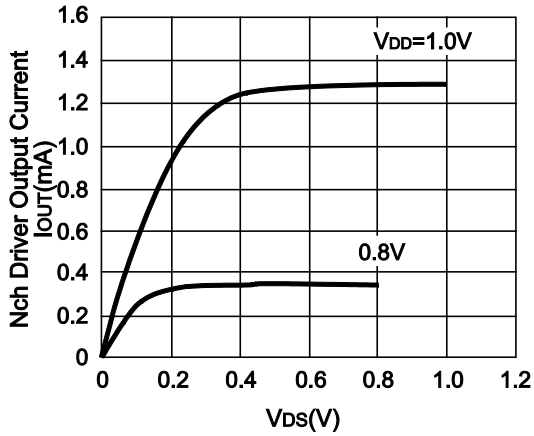



### 3) Nch Driver Output Current vs. $V_{DS}$ (Topt=25°C)

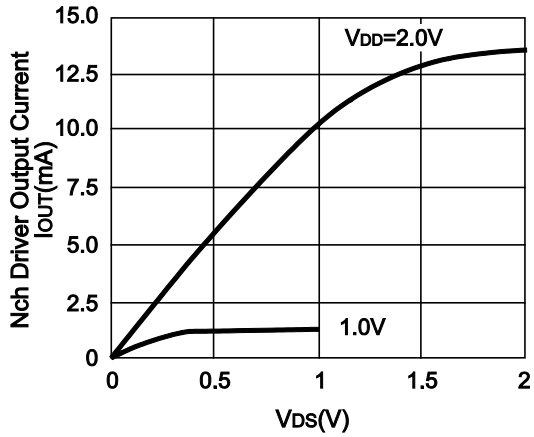
R3132x10Ex



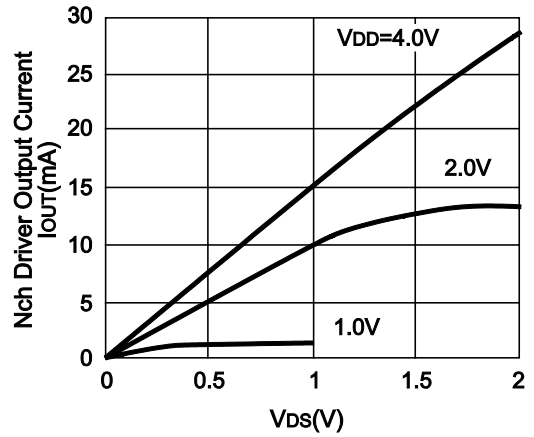

R3132x16Ex



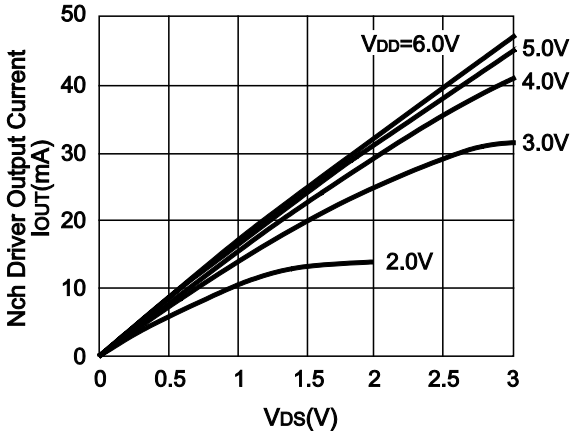

R3132x27Ex



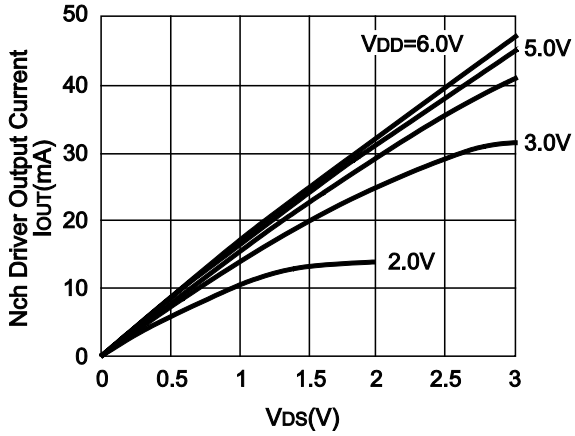

R3132x48Ex



R3133x10Ex




R3133x16Ex

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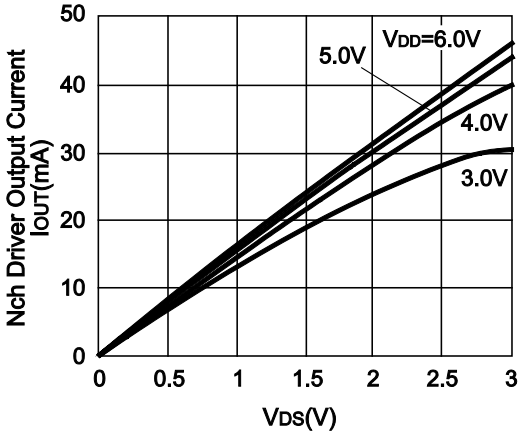
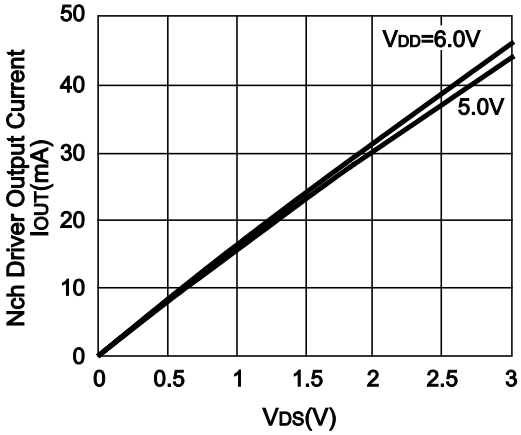
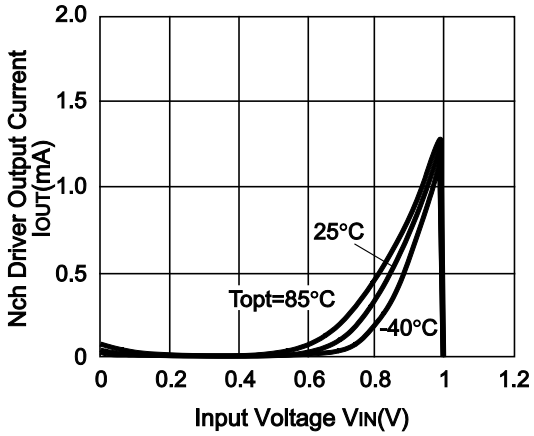



R3133x48Ex




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

R3132x10Ex

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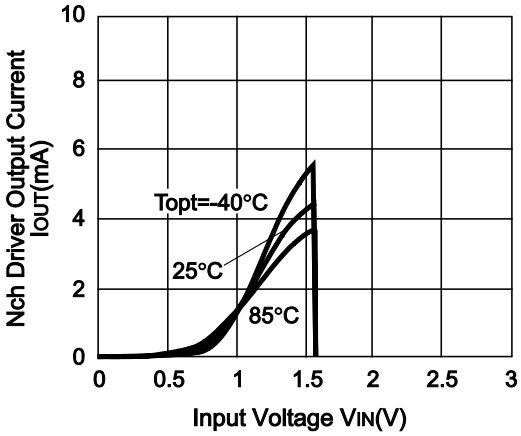
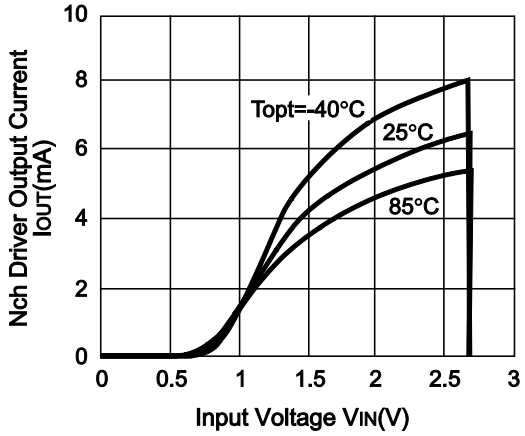


## R3132x/R3133x

R3132x27Ex

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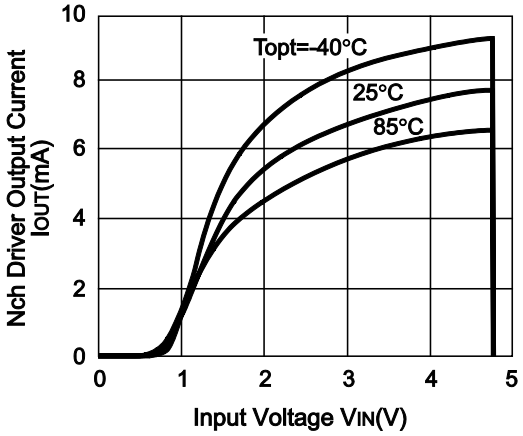
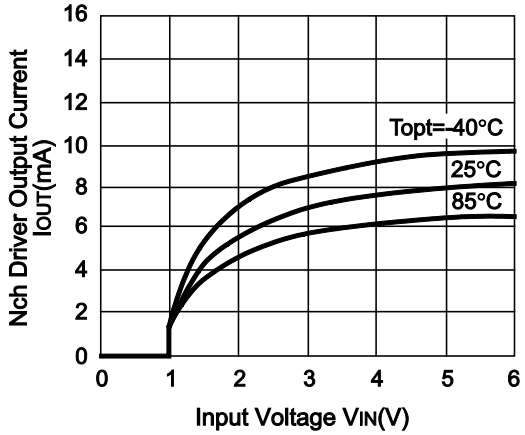



R3133x10Ex

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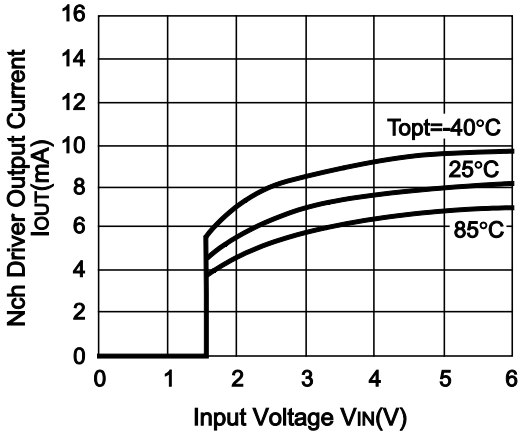


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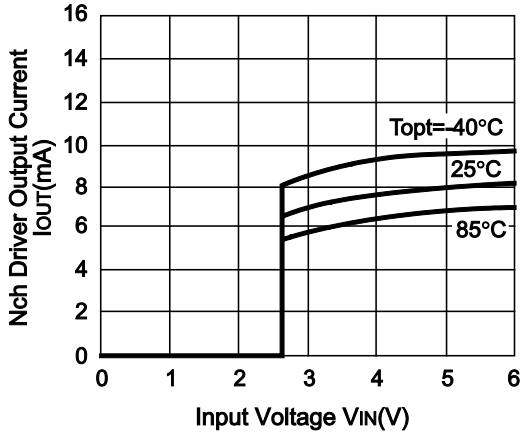


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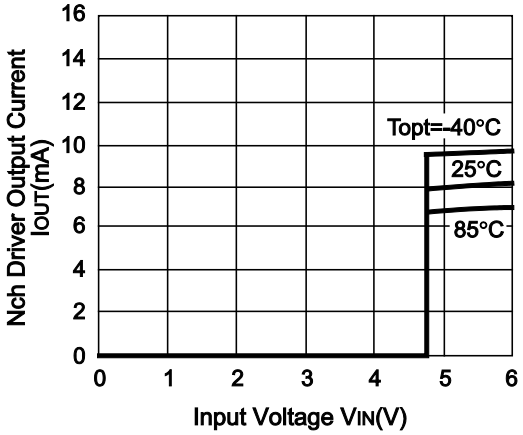
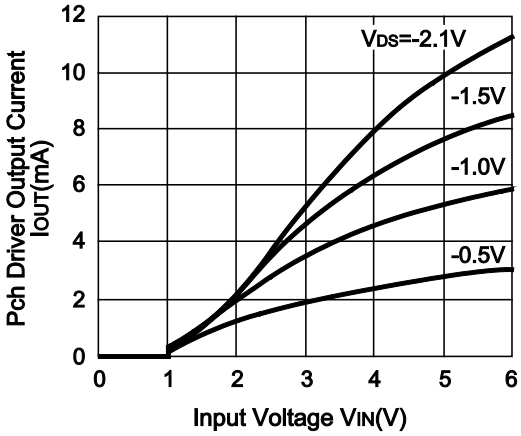


### 5) Pch Driver Output Current vs. Input Voltage

R3132x10Ex

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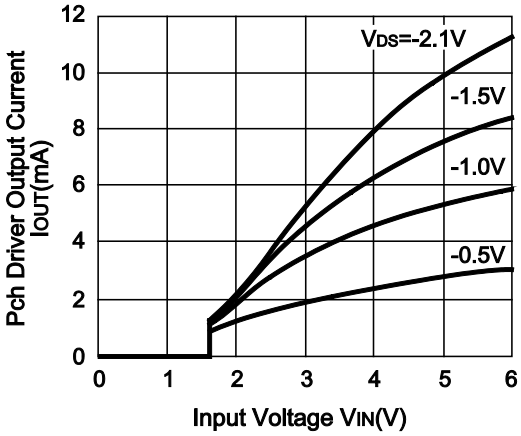


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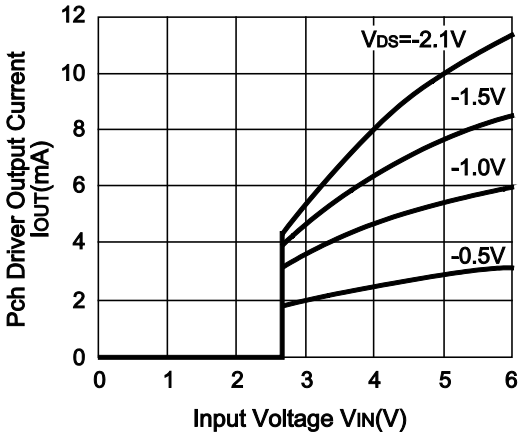


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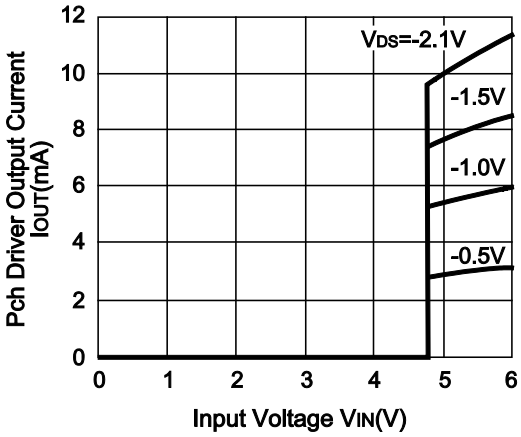


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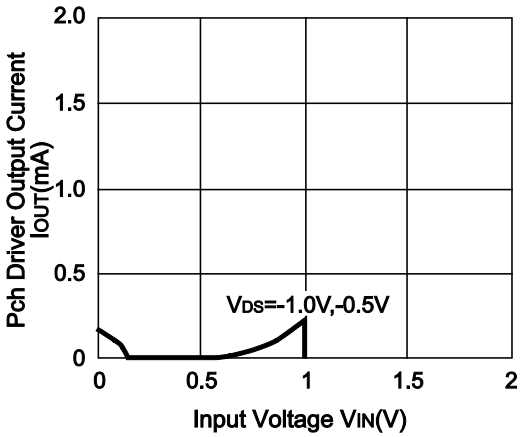


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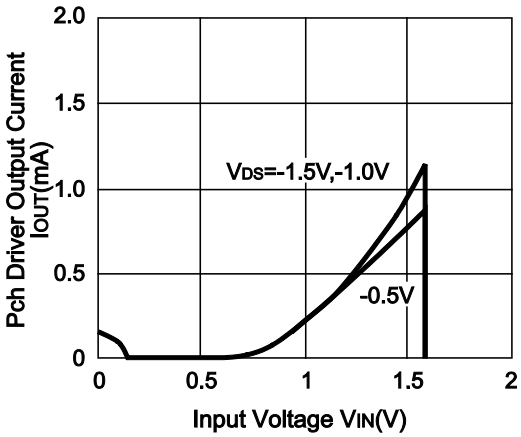

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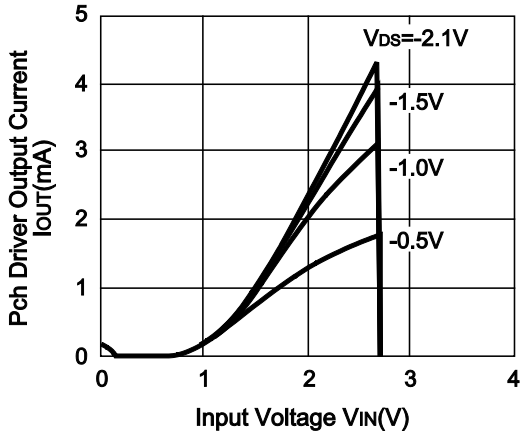


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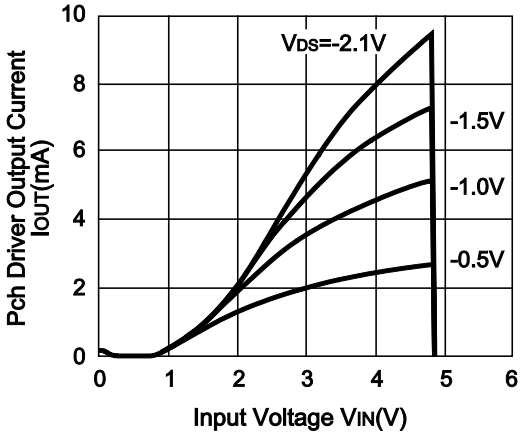
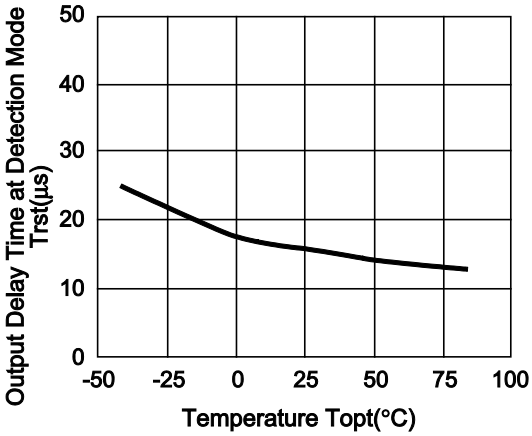
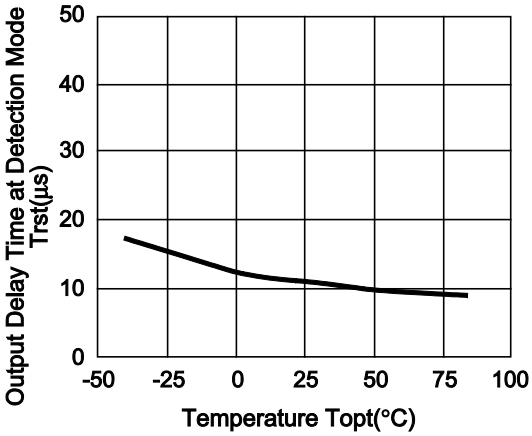



### 6) Output Delay Time at Detection Mode vs. Temperature

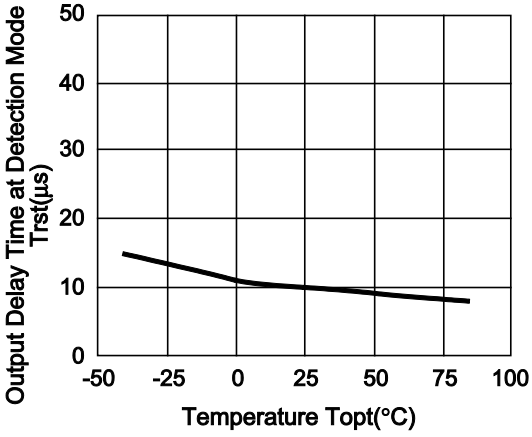
R3132x10Ex/R3133x10Ex



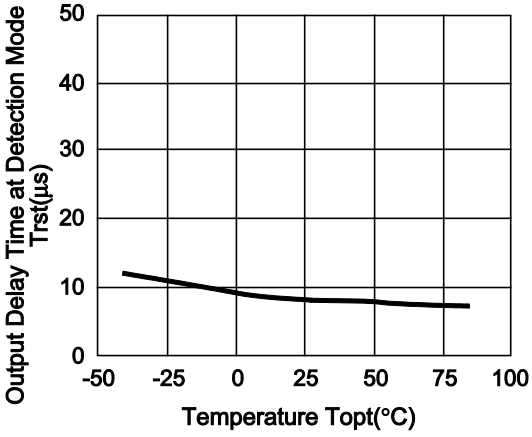

R3132x16Ex/R3133x16Ex




R3132x27Ex/R3133x27Ex

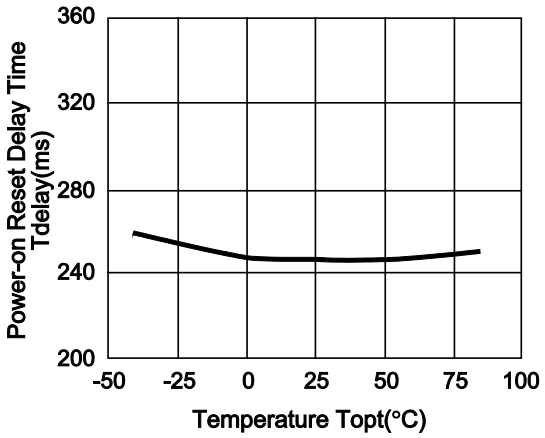



R3132x48Ex/R3133x48Ex

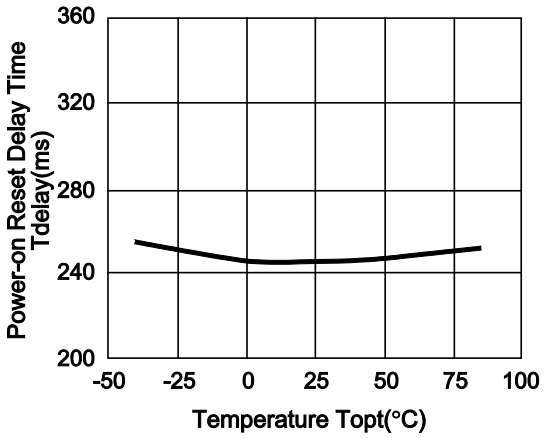


### 7) Power-on Reset Delay Time vs. Temperature

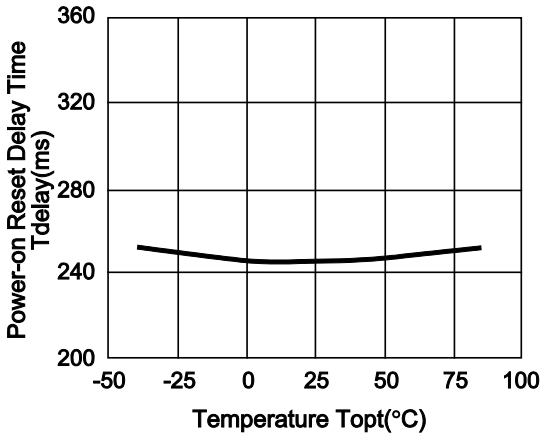
R3132x10Ex/R3133x10Ex



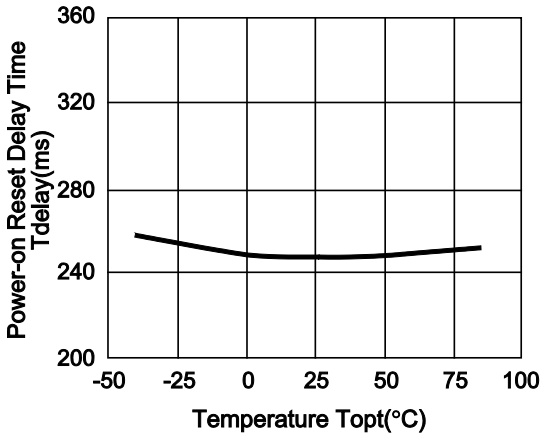

R3132x16Ex/R3133x16Ex




R3132x27Ex/R3133x27Ex




R3132x48Ex/R3133x48Ex



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