MAX16191

Ultra-High, 0.35% Accuracy Supervisory Circuit

General Description

The MAX16191 is a single-channel, ultra-high accuracy supervisor circuit that monitors low core system supply voltages. The reset output asserts when the monitored supply voltage falls outside of the factory-trimmed under-voltage/overvoltage threshold window. The reset output deasserts after reset timeout period when the monitored supply voltage falls within the threshold window. The re-set output is active-low and available in open-drain or push-pull configuration.

The MAX16191's nominal input voltage level is factory-programmable to any voltage between 0.6V to 0.9V. Together with the ±2% to ±5% undervoltage/overvoltage window threshold range, the MAX16191 offers the flexibility to monitor a wide range of system supply voltages. The undervoltage/overvoltage threshold levels are factory programmable and are symmetrical with respect to the nominal input voltage setting.

The MAX16191 is available in a small, 2mm x 2mm, 8-pin TDFN side-wettable package and operates over the automotive temperature range of -40°C to +125°C.

Applications

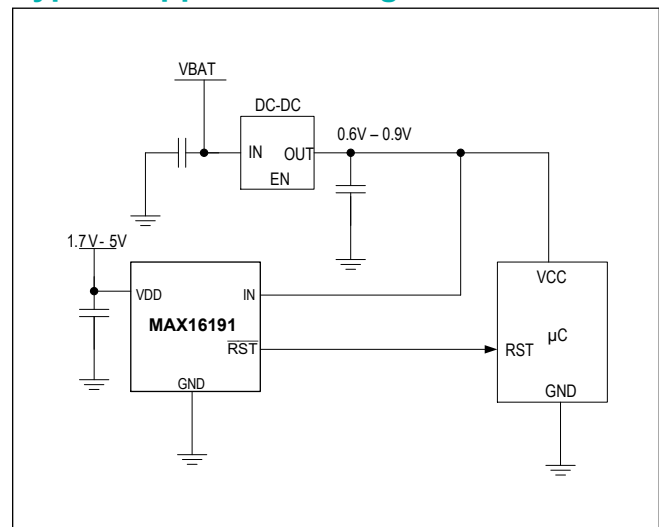- Advanced Driver-Assistance Systems (ADAS)
- Multivoltage ASICs
- Servers
- Storage Equipment

Benefits and Features

- ±0.35% Threshold Accuracy
- AEC-Q100 Qualified
- 0.6V to 0.9V Nominal Threshold Range
- ±2% to ±5% UV/OV Monitoring Range
- Open-Drain/Push-Pull Reset Output Options
- 8-Pin TDFN, 2mm x 2mm Side-Wettable Flanks with No Exposed Pad
- -40°C to +125°C Temperature Range

Ordering Information appears at end of data sheet.

Typical Application Diagram

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Absolute Maximum Ratings

V_{DD} to GND... -0.3V to +6V
IN, $\overline{RST}$ to GND... -0.3V to +6V
Input/Output Continuous Current .... ±20mA
Continuous Power Dissipation (T_A = +70°C)
　T822CY+2C, 8-Pin TDFN (Multilayer derate 6.2mW/°C above
　70°C).. 496mW

Operating Temperature Range ....-40°C to +125°C
Junction Temperature ....+150°C
Soldering Temperature (Reflow)......................................+260°C
Storage Temperature Range ....-65°C to +150°C
Lead Temperature (Soldering, 10s).................................+300˚C

Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

Package Information

8 TDFN (T822CY+2C)

Package Code	T822CY+2C
Outline Number	21-100341
Land Pattern Number	90-100117
Thermal Resistance, Single Layer Board:	
Junction to Ambient (θ_{JA})	
Junction to Case Thermal Resistance (θ_{JC})	
Thermal Resistance, Four Layer Board:	
Junction to Ambient (θ_{JA})	162
Junction to Case Thermal Resistance (θ_{JC})	20

For the latest package outline information and land patterns (footprints), go to *www.maximintegrated.com/packages*. Note that +, #, or - in the package code indicates RoHS status only. Package drawings may show a different suffix character, but the drawing pertains to the package regardless of RoHS status.

Package thermal resistances were obtained using the method described in JEDEC specification JESD51-7, using a four-layer board. For detailed information on package thermal considerations, refer to *www.maximintegrated.com/thermal-tutorial*.

Electrical Characteristics

(V_{DD} = 3.3V, V_{IN} = 0.875V, T_A = T_J = -40°C to +125°C, unless otherwise noted. Typical values are at T_A = +25°C under normal conditions, unless otherwise noted.)

| PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
POWER SUPPLY						
Operating Voltage Range	V_{DD}	Output guaranteed to be at known state. Comparators functional.	1.7		5.5	V
Minimum Supply Voltage	V_{DD}	$\overline{RST}$ is guaranteed to be at a known logic	1.1			V
Supply Current	I_{DD}	$\overline{RST}$ not asserted		30	55	µA
Undervoltage Lockout Threshold	V_{UVLO}	V_{DD} rising	1.30	1.50	1.68	V
Undervoltage Lockout Hysteresis	V_{UVLO_HYS}	V_{DD} falling		47		mV
INPUT VOLTAGE (IN)						
Nominal Input Threshold Voltage Range	V_{IN_NOM}		0.6		0.9	V
Undervoltage/ Overvoltage Programming Range	TOL	Reset occurs when V_{IN_NOM} falls outside of V_{IN_NOM} x (1±TOL)	±2		±5	% of V_{IN_NOM}
INPUT THRESHOLD ACCURACY						
Undervoltage Threshold Accuracy	V_{UVTH_A}	All V_{IN_TH} setting, V_{IN_NOM} falling, V_{UVTH} = V_{IN_NOM} x (1 - TOL%)	-0.35		+0.35	%
Overvoltage Threshold Accuracy	V_{OVTH_A}	All V_{IN_TH} setting, V_{IN_NOM} rising, V_{OVTH} = V_{IN_NOM} x (1 + TOL%)	-0.35		+0.35	%
Undervoltage/ Overvoltage Hysteresis	V_{HYS}			0.15		%V_{TH}
Input Current	I_{IN}			3	6	µA
RESET OUTPUT ($\overline{RST}$)						
Reset Timeout Period Accuracy	t_{RP_A}	From the time V_{IN} enters overvoltage/ undervoltage threshold window to the time $\overline{RST}$ goes high	-20		+20	%
IN-to-$\overline{RST}$ Propagation Delay	t_D	(V_{OVTH} - 1%) to (V_{OVTH} + 1%)		5		µs
IN-to-$\overline{RST}$ Reset Propagation Delay	t_D	(V_{UVTH} + 1%) to (V_{UVTH} - 1%)		5		µs
OUTPUT VOLTAGE						
Output Voltage Low	V_{OL}	V_{DD} ≥ 4.25V, I_{SINK} = 1mA			0.1	V
		V_{DD} = 2.5V, I_{SINK} = 250µA			0.1	
		V_{DD} = 1.2V, I_{SINK} = 25µA			0.1	

Note 1: Limits are 100% tested at TA = +25°C. Limits over the operating temperature range and relevant supply voltage range are guaranteed by design and characterization.
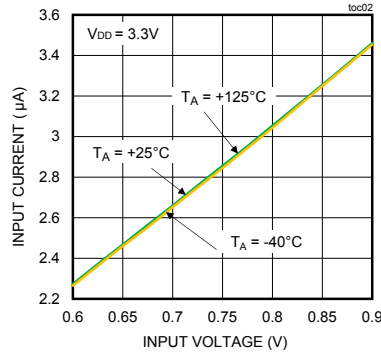
Typical Operating Characteristics

(V_{DD} = 1.7V to 5.5V, T_A = T_{MIN} to T_{MAX} unless otherwise noted.)
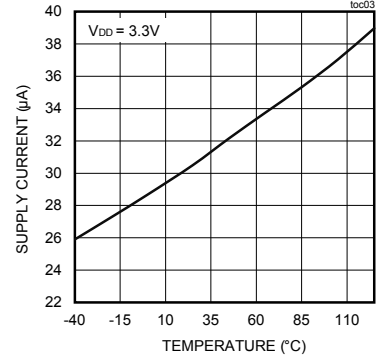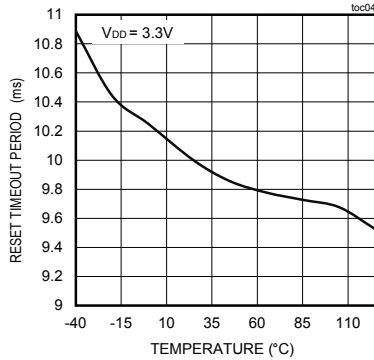
SUPPLY CURRENT vs. SUPPLY VOLTAGE
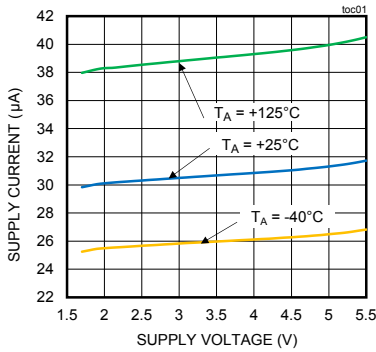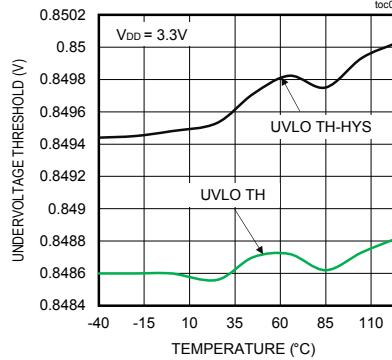
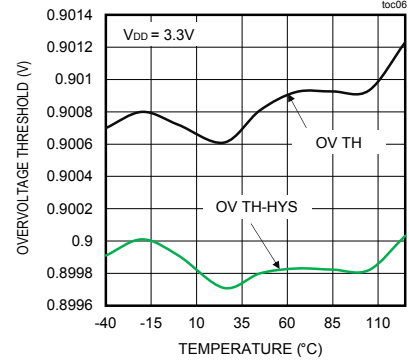INPUT CURRENT vs. INPUT VOLTAGE

SUPPLY CURRENT vs. TEMPERATURE

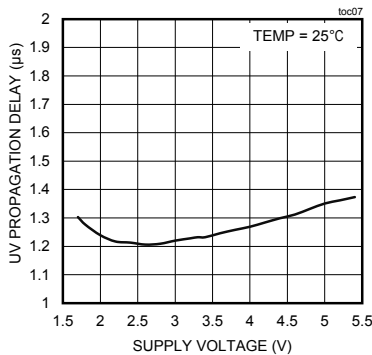RESET TIMEOUT PERIOD vs. TEMPERATURE

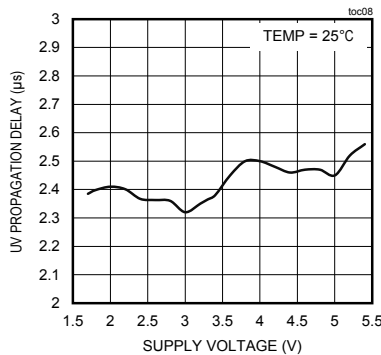UNDERVOLTAGE THRESHOLD vs. TEMPERATURE
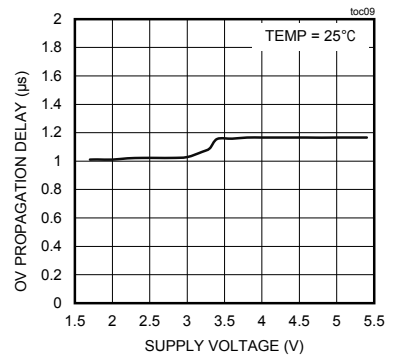
OVERVOLTAGE THRESHOLD vs. TEMPERATURE

UV PROPAGATION DELAY vs. SUPPLY VOLTAGE (OD=100mV)

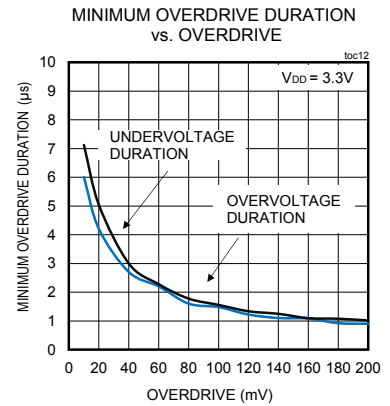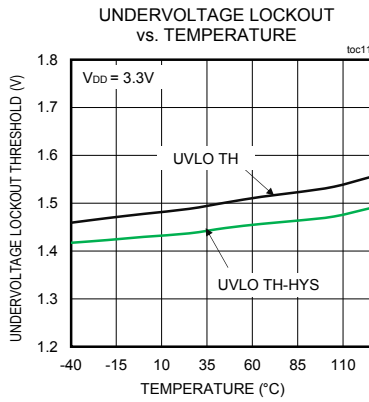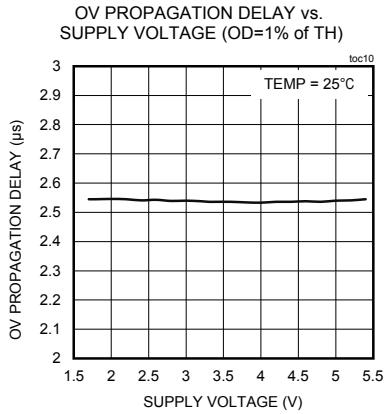UV PROPAGATION DELAY vs. SUPPLY VOLTAGE (OD=1% of TH)

OV PROPAGATION DELAY vs. SUPPLY VOLTAGE (OD=100mV)

Typical Operating Characteristics (continued)

(V_{DD} = 1.7V to 5.5V, T_A = T_{MIN} to T_{MAX} unless otherwise noted.)

OV PROPAGATION DELAY vs. SUPPLY VOLTAGE (OD=1% of TH)
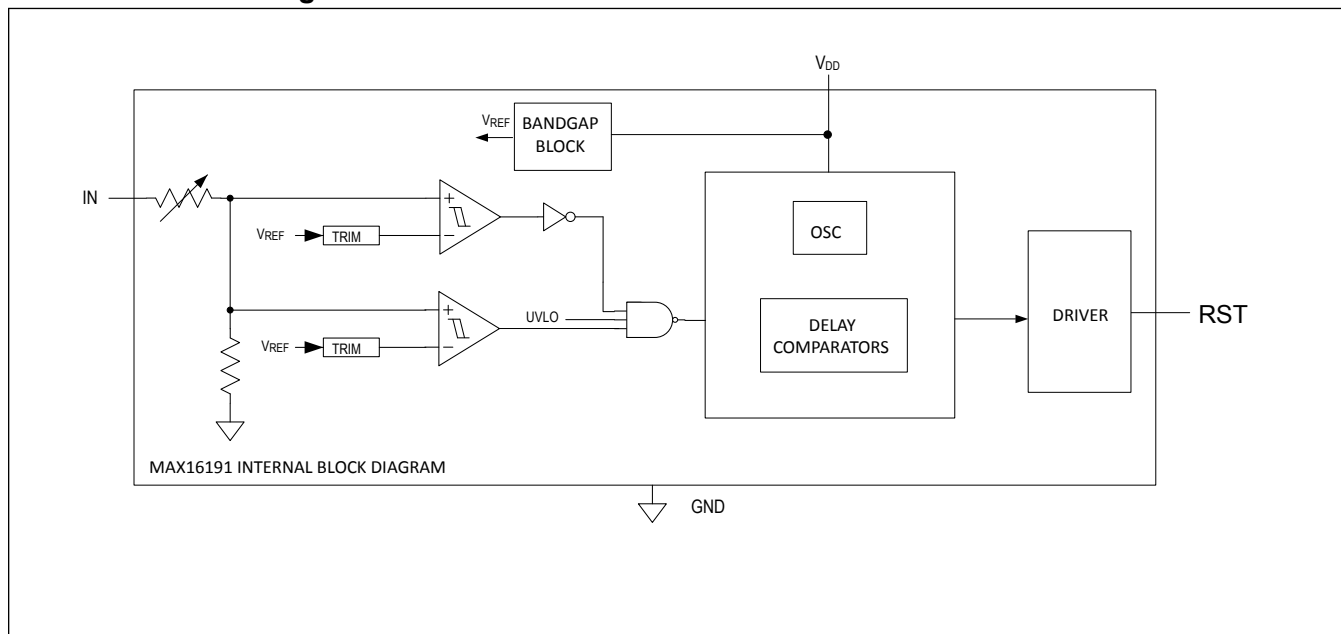

UNDERVOLTAGE LOCKOUT vs. TEMPERATURE

MINIMUM OVERDRIVE DURATION vs. OVERDRIVE

Pin Configuration

8-Pin TDFN

TOP VIEW

```
        VDD  | 1 | +                           | 8 |  N.C
                            MAXIM
         IN  | 2 |        MAX16191              | 7 |  RST

        N.C. | 3 |                              | 6 |  N.C

        GND  | 4 |                              | 5 |  N.C.

                        2mm x 2mm
                         8-TDFN
```
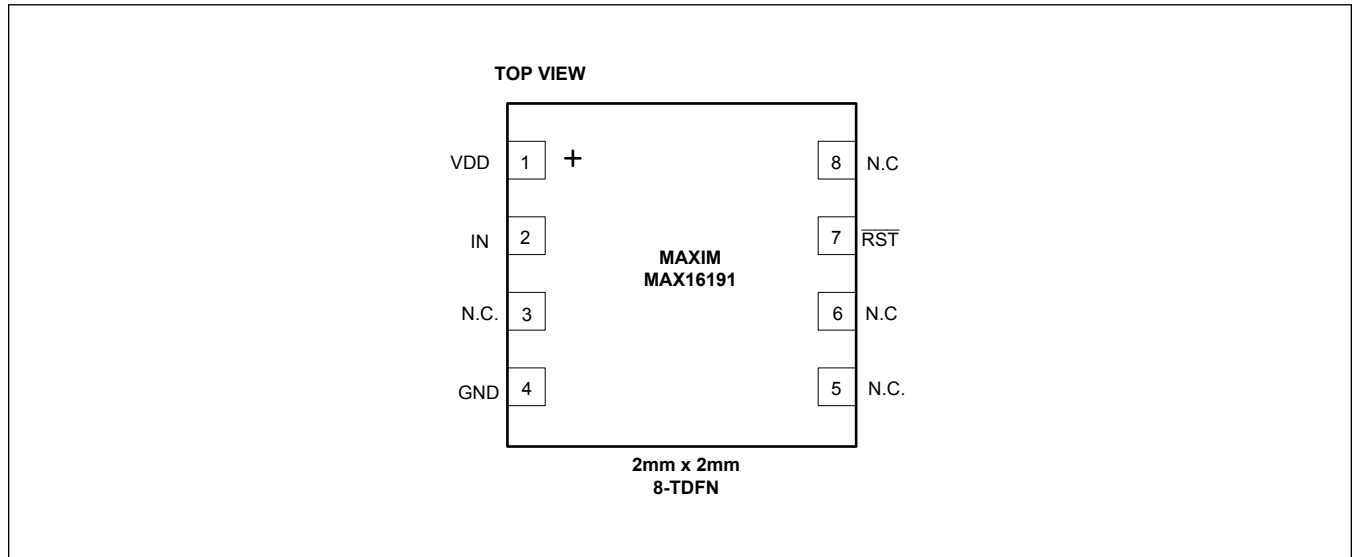
Pin Description

PIN	NAME	FUNCTION
1	V_{DD}	Supply Input. Bypass V_{DD} to ground with a 0.1µF capacitor.
2	IN	Monitoring Input. IN monitors supply rails for undervoltage/overvoltage faults with respect to the nominal input setting. When V_{IN} falls outside the undervoltage/overvoltage thresholds' window, $\overline{RST}$ asserts and stays asserted for the reset timeout period after V_{IN} falls within the undervoltage/ overvoltage thresholds' window.
3	N.C.	No Connect
4	GND	Ground
5, 6	N.C.	No Connect
7	$\overline{RST}$	Acitve-Low Open-Drain Reset Output
8	N.C.	No Connect

Functional Diagrams

Functional Block Diagram

MAX16191 INTERNAL BLOCK DIAGRAM

Detailed Description

The MAX16191 is a low voltage, 0.35% accurate window-detector supervisor circuit that monitors a single system supply voltage. The MAX16191 offers factory-trimmed nominal input voltage levels from 0.6V to 0.9V and a factory-trimmed undervoltage/overvoltage thresholds' window from ±2% to ±5%. Contact Maxim Integrated for a threshold not listed in the Ordering Information table.

Reset Timeout Period

The active-low, open-drain reset output ($\overline{RST}$) asserts low when the input voltage falls outside the set undervoltage and overvoltage window threshold. The reset output deasserts after the reset timeout period when the input voltage falls within the set window threshold. At power-up, resets stay asserted for the reset timeout period once V_{DD} is above the UVLO. The reset output is available in open-drain or push-pull option.The reset output with open-drain configuration requires a pullup resistor. See Figure 1 for more details.
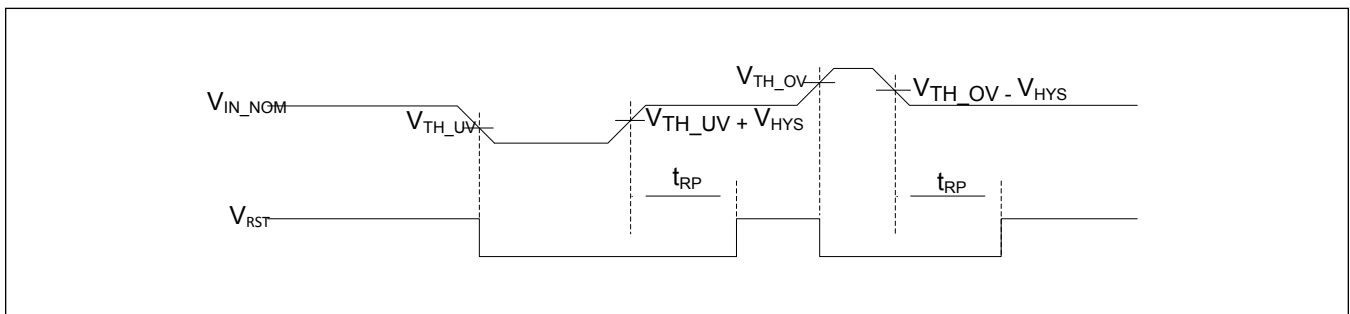

Figure 1. Reset Output Timing Diagram

Applications Information

Setting Input Thresholds and Hysteresis

The MAX16191 monitors a system supply voltage for undervoltage/overvoltage window-threshold. Depending on the system supply tolerance requirement, the undervoltage/overvoltage thresholds can be factory-trimmed from ±2% to ±5%. The tolerance setting is symmetrical with respect to the selected nominal input threshold voltage. The following is a detailed calculation of how to determine the undervoltage/overvoltage threshold levels with ±3% threshold accuracy.

V_{IN_NOM} = 0.875V
TOL = ±3%
V_{UVTH} = V_{IN_NOM} (1 − 3%) = 0.875V x (1 − 0.03) = 0.875V − 0.02625V = 0.84875V
V_{OVTH} = V_{IN_NOM} (1 + 3%) = 0.875V x (1 + 0.03) = 0.875V + 0.02625V = 0.90125V

Where V_{IN_NOM} is the selected nominal input threshold voltage, TOL is the input tolerance, V_{UVTH} is undervoltage threshold voltage, and V_{OVTH} is the overvoltage threshold voltage.

The MAX16191 monitors the supply voltage with ±0.35% accuracy over the operating temperature and supply range. The accuracy range for the 0.875V ±0.35% is shown as follows:

V_{UVTH_A} = V_{IN_NOM} (1 - 3% ±0.35%)
V_{OVTH_A} = V_{IN_NOM} (1 + 3% ±0.35%)

Where V_{UVTH_A} is the undervoltage threshold accuracy range and V_{OVTH_A} is the overvoltage threshold accuracy range. See Figure 2 for details.
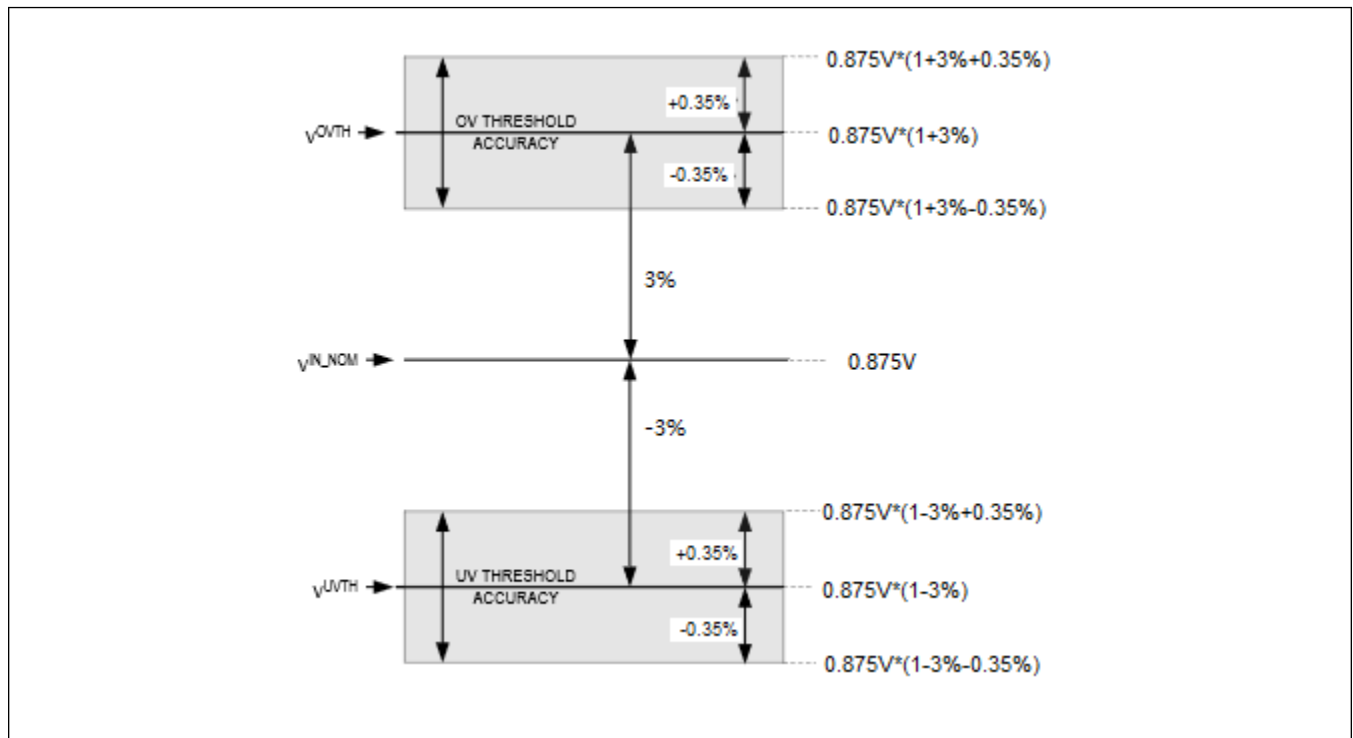

Figure 2. Undervoltage/Overvoltage Threshold Accuracy

Hysteresis adds noise immunity to the voltage monitors and prevents oscillation due to repeated triggering when the monitored voltage is near the threshold trip voltage.

Use the following equation to calculate the threshold hysteresis:

V_{IN_NOM} = 0.875V

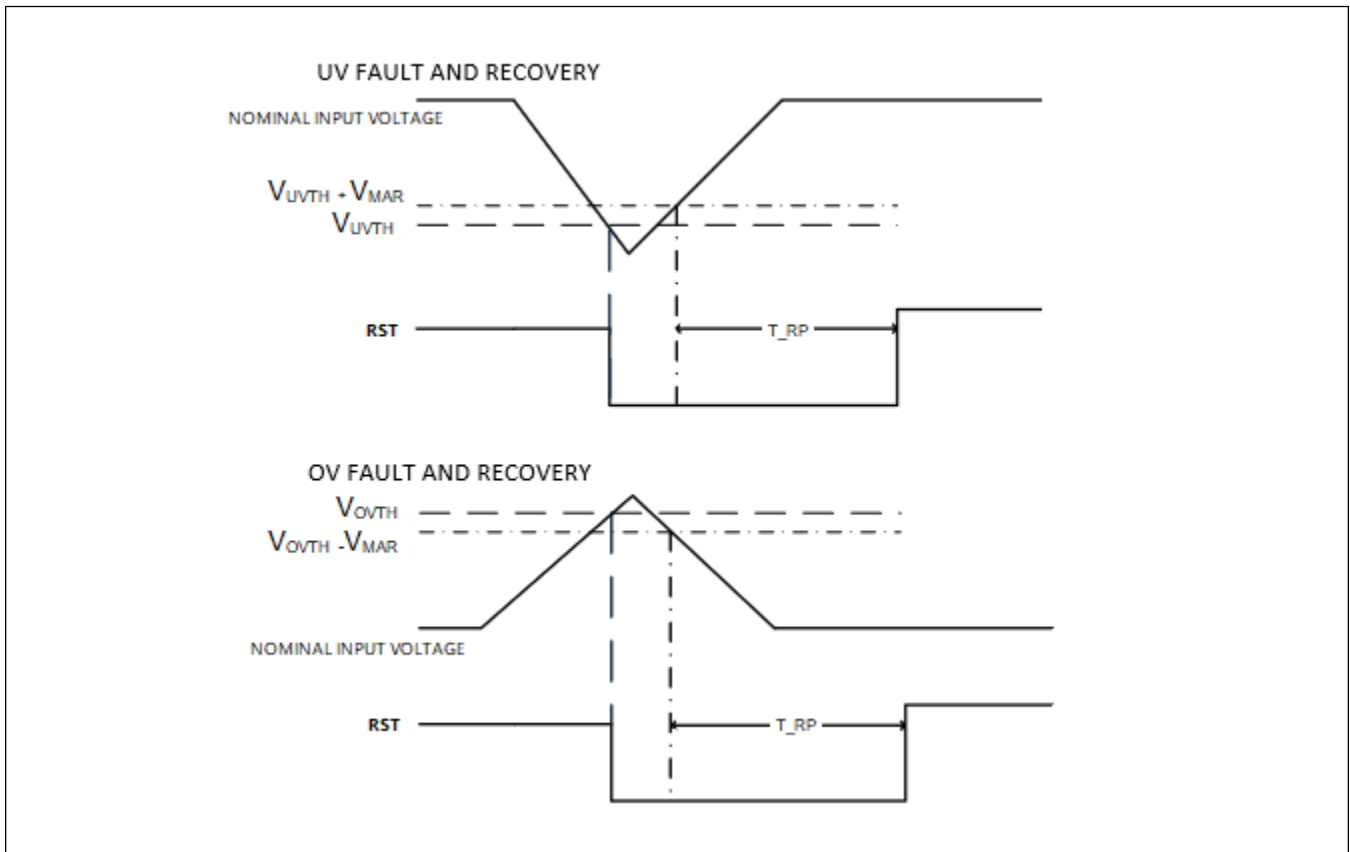Hysteresis = 0.15%

V_{HYST} = 0.875V x 0.15% = 0.001313V

Figure 3. Undervoltage/Overvoltage Threshold Hysteresis

Power-Supply Bypassing/Noise Immunity

The MAX16191 operates from a 1.7V to 5.5V supply. Bypass V_{DD} to ground with a 0.1µF capacitor as close to the device as possible. An additional capacitor improves transient immunity.

Selector Guide Table

PART NUMBER	THRESHOLD VOLTAGE	TOLERANCE	HYSTERESIS	RESET TIMEOUT
MAX16191ATA00/VY+T	0.875V	3%	0.15%	10ms

Typical Application Circuits

Typical Application Circuit
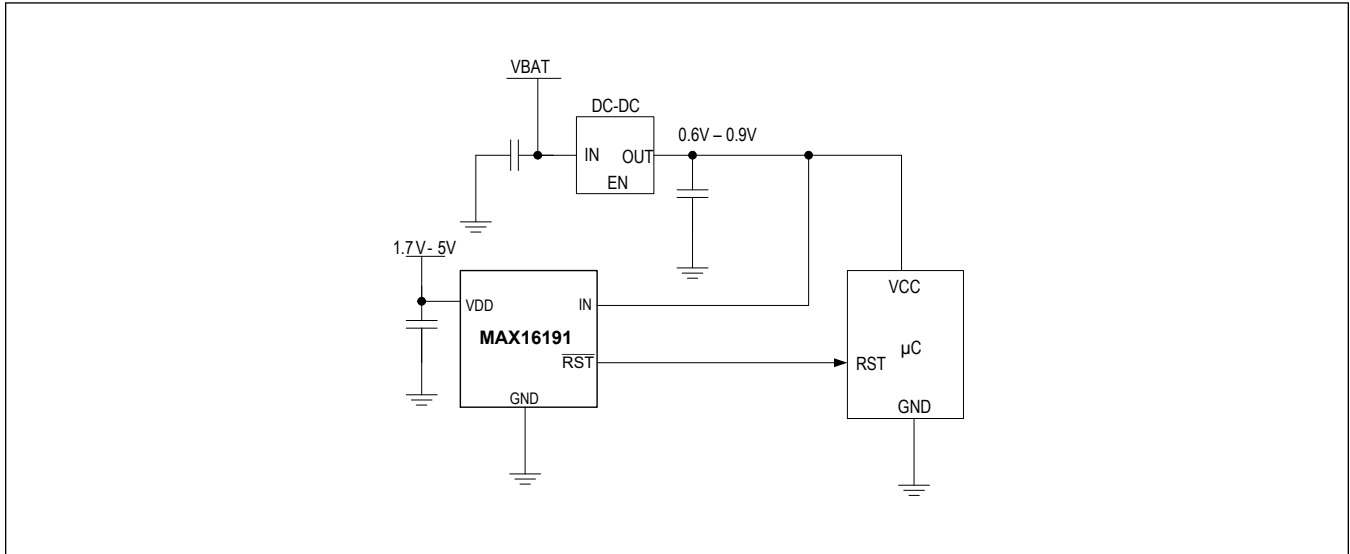
Ordering Information

PART NUMBER	TEMPERATURE RANGE	PIN-PACKAGE
MAX16191ATA00/VY+T	-40°C to +125°C	8-TDFN

+Denotes a lead(Pb)-free/RoHS-compliant package.

T = Tape and reel.

/V denotes an automotive qualified part.

Y = Side-wettable package.

Revision History

REVISION NUMBER	REVISION DATE	DESCRIPTION	PAGES CHANGED
0	8/21	Release for Market Intro	—