

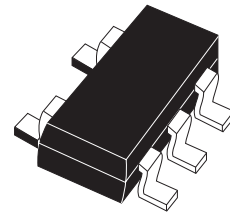


STM1831

Voltage detector with sense input
and external delay capacitor

Features

- Voltage monitored on separate sense input V_{SEN}
- Factory-trimmed voltage thresholds in 100 mV increments from 1.6 V to 5.7 V
- $\pm 2\%$ voltage threshold accuracy
- Operating voltage 1.6 V to 6.0 V
- Open drain output
- Low supply current of 0.8 μA (typ.)
- Time delay programmable by external capacitor
- Power supply transient immunity
- Available in SOT23-5 package
- Operating temperature -40 to $85\text{ }^{\circ}\text{C}$



SOT23-5

Applications

- Microprocessor reset circuitry
- Charge voltage monitors
- Memory battery backup switch circuits
- Power failure detection circuits

Contents

1 **Description 5**

 1.1 Pin descriptions 6

2 **Operation 8**

3 **Typical operating characteristics 9**

4 **Maximum ratings 17**

5 **DC and AC parameters 18**

6 **Package mechanical data 20**

7 **Part numbering 22**

8 **Revision history 23**



List of tables

Table 1. Pin descriptions 5

Table 2. Absolute maximum ratings 17

Table 3. Operating and AC measurement conditions..... 18

Table 4. DC and AC characteristics 19

Table 5. SOT23-5 - 5-lead small outline transistor package mechanical data 21

Table 6. STM1831 ordering information scheme 22

Table 7. Document revision history 23

List of figures

Figure 1.	Logic diagram	5
Figure 2.	SOT23-5 pin connections (top view)	5
Figure 3.	Block diagram	7
Figure 4.	Application hookup	7
Figure 5.	Timing waveforms	8
Figure 6.	Supply current vs. sense voltage, $V_{CC} = 3.0\text{ V}$, $V_{DET} = 2.0\text{ V}$	9
Figure 7.	Supply current vs. input voltage, $V_{SEN} = 1.9\text{ V}$ ($\overline{RST}$ asserted)	9
Figure 8.	Detect voltage vs. ambient temperature, $V_{DET} = 2.4\text{ V}$	10
Figure 9.	Detect voltage vs. supply voltage, $V_{DET} = 2.4\text{ V}$	10
Figure 10.	Hysteresis voltage vs. ambient temperature, $V_{DET} = 2.4\text{ V}$	11
Figure 11.	C_D pin sink current vs. supply voltage, $V_{SEN} = 0\text{ V}$, $V_{CD} = 0.5\text{ V}$	11
Figure 12.	Output voltage vs. sense voltage, $V_{DET} = 2.4\text{ V}$, $T_A = 25\text{ }^\circ\text{C}$, external pull-up resistor on $\overline{RST}$ is $100\text{ k}\Omega$, C_D pin open	12
Figure 13.	Output voltage vs. supply voltage, $V_{SEN} = V_{CC}$, external pull-up resistor on $\overline{RST}$ is $100\text{ k}\Omega$, C_D pin open	12
Figure 14.	Output current vs. supply voltage, $V_{SEN} = 0\text{ V}$, $V_{\overline{RST}} = 0.5\text{ V}$	13
Figure 15.	Relative delay resistance vs. ambient temperature, $V_{CC} = 5\text{ V}$, $V_{SEN} = 6\text{ V}$, $V_{CD} = 0\text{ V}$. .	13
Figure 16.	Release delay time vs. delay capacitance, $T_A = 25\text{ }^\circ\text{C}$	14
Figure 17.	Detect delay time vs. delay capacitance, $T_A = 25\text{ }^\circ\text{C}$	14
Figure 18.	$\overline{RST}$ output leakage current vs. ambient temperature, $V_{CC} = V_{SEN} = V_{OUT} = 6.0\text{ V}$, C_D pin open	15
Figure 19.	$\overline{RST}$ output leakage current vs. output voltage, $V_{CC} = V_{SEN} = 6.0\text{ V}$, $T_A = 85\text{ }^\circ\text{C}$, C_D pin open	15
Figure 20.	Sense current vs. supply voltage, $V_{SEN} = 1.9\text{ V}$	16
Figure 21.	Sense current vs. ambient temperature, $V_{CC} = V_{SEN} = 5\text{ V}$	16
Figure 22.	AC testing input/output waveforms	18
Figure 23.	SOT23-5 - 5-lead small outline transistor package mechanical drawing	21

1Description

The STM1831 is a voltage detector with very low current consumption. It monitors a voltage on a separate input pin (V_{SEN}), which is fully functional even if the monitored voltage goes down to 0 V. In addition, the delay of the output can be adjusted by an external capacitor.

Figure 1. Logic diagram

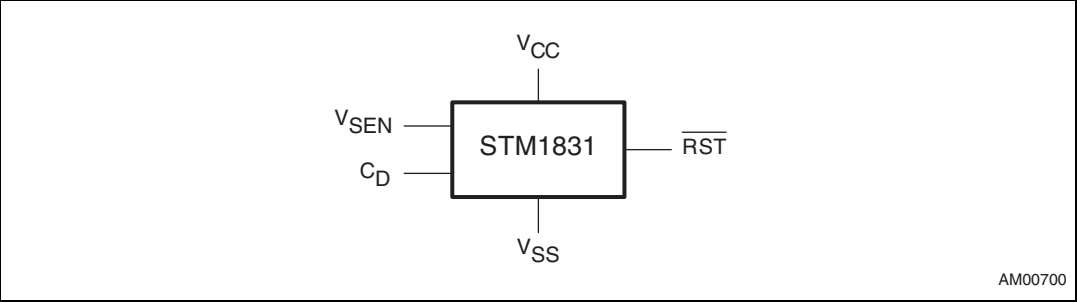
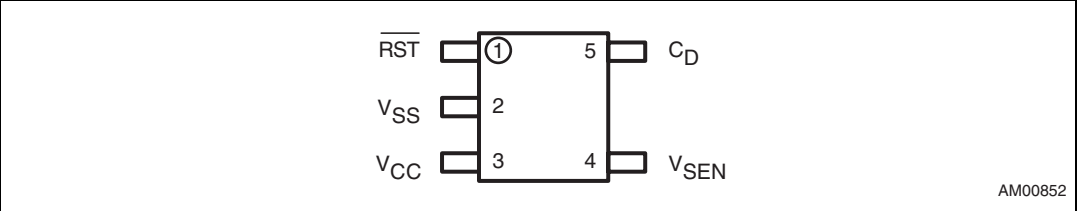


Table 1. Pin descriptions

Pin	Type	Name	Function
1	Output open drain	$\overline{RST}$	Active-low reset output
2	Power	V_{SS}	Ground
3	Power	V_{CC}	Supply voltage
4	Input	V_{SEN}	Sense voltage
5	I/O	C_D	Delay capacitor

Figure 2. SOT23-5 pin connections (top view)



1.1 Pin descriptions

See [Figure 1](#) and [Table 1](#) for a brief overview of the signals available on this device.

Power supply (V_{CC})

This pin is used to provide power to the device. A 0.1 μF decoupling ceramic capacitor is recommended to be connected between the V_{CC} and V_{SS} pins, as close to the STM1831 device as possible.

Sense voltage input (V_{SEN})

Input voltage on this pin is monitored. When it drops below the threshold (V_{DET}), reset output ($\overline{RST}$) is asserted. If V_{CC} is close to 0 V, internal logic disconnects the voltage divider from V_{SEN} input in order to minimize I_{SEN} current (see [Figure 3](#) and [Figure 20](#)).

Reset output ($\overline{RST}$)

Reset output is asserted when the voltage on the V_{SEN} input pin drops below the threshold (V_{DET}).

The STM1831 has an open drain, active-low output which sinks current when the output is asserted. Connect a pull-up resistor from $\overline{RST}$ to any supply voltage up to 6 V (see [Figure 4](#)). Select a resistor value large enough to register a logic low, and small enough to register a logic high, while all of the input current and leakage paths connected to the reset output line are being supplied. A 10 k Ω pull-up is sufficient in most applications.

The advantages of open drain output include the ability to connect more open drain outputs in parallel (wired OR connections) as well as connecting the output to a power supply voltage other than V_{CC} .

Delay capacitor (C_D)

Capacitor C_D determines the delay (t_{CD}) between reset deassertion and the moment when V_{SEN} voltage exceeds the V_{DET} threshold (see [Figure 5](#) with calculations for more details).

Any external leakage due to poor quality timing capacitors or excessive humidity may cause a significant leakage current which extends the t_{CD} timing. To minimize this effect, the PCB tracks between the C_D pin and its respective timing capacitor should be as short as possible, properly covered with solder mask and isolated from other tracks (especially V_{SS}) by as great a distance as possible. Low-leakage timing capacitors (ceramic or film capacitor) should be used.

Leave C_D pin open if unused (i.e. $t_{CD} = 0$ ms).

Figure 3. Block diagram

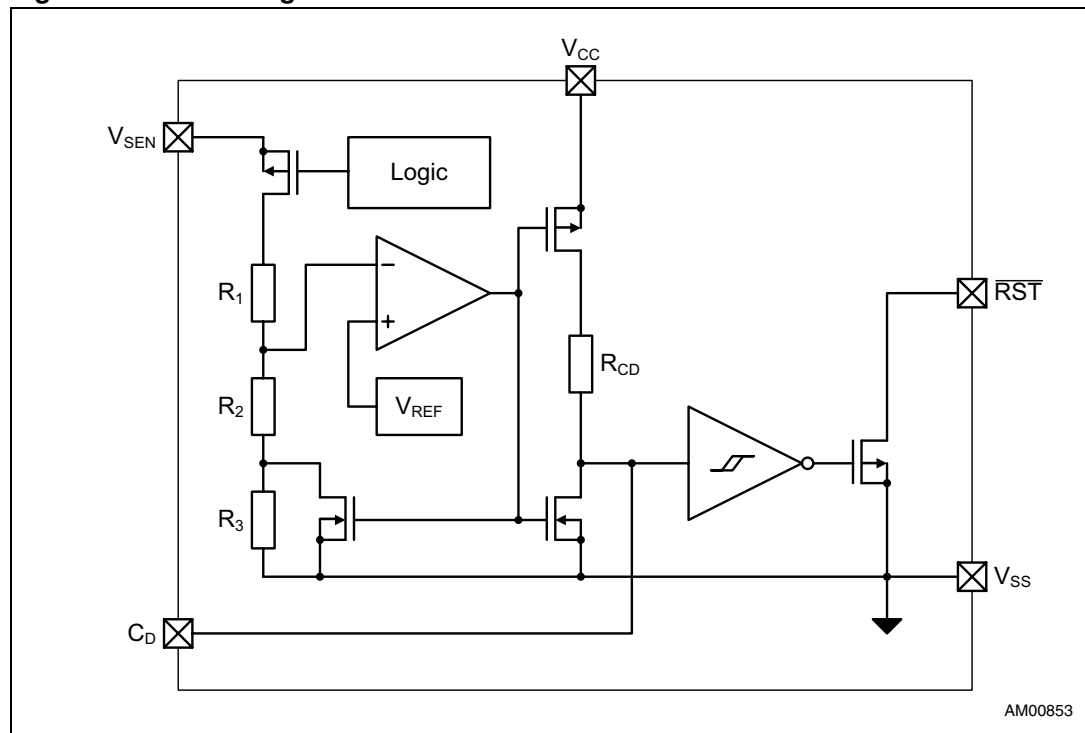
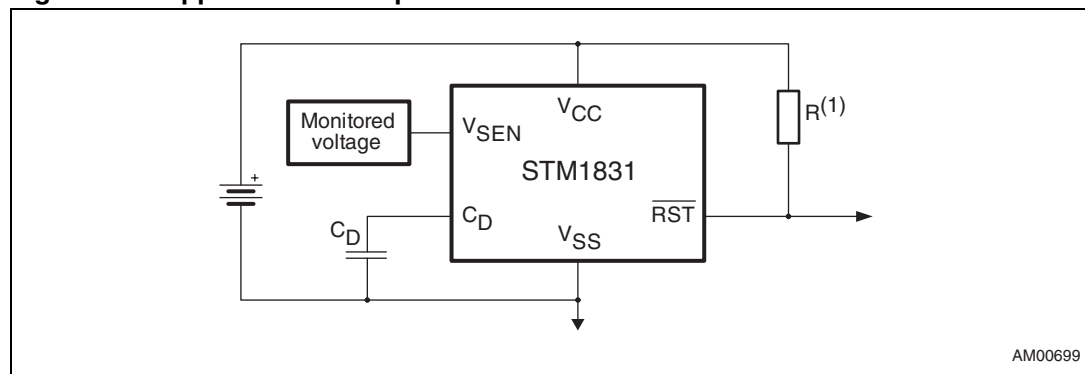


Figure 4. Application hookup



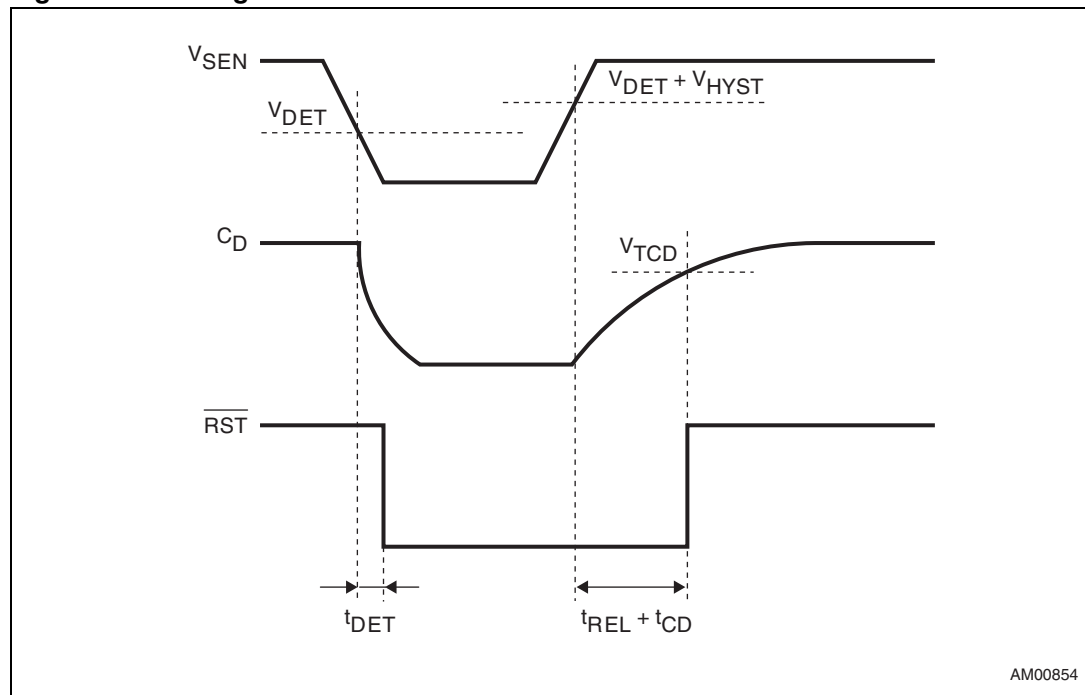
1. External pull-up resistor is needed for open drain $\overline{\text{RST}}$ output. A 10 k Ω is sufficient in most applications.

2 Operation

The STM1831 voltage detector monitors system voltages from 1.6 V to 5.7 V in 100 mV increments, has a voltage hysteresis (V_{HYS}) and an output delay programmable by external capacitor C_D .

The STM1831 asserts a reset output ($\overline{RST}$) whenever V_{CC} goes below the detect voltage (V_{DET}). The reset output stays asserted until V_{CC} goes above the detect voltage with hysteresis ($V_{DET} + V_{HYS}$). If the external capacitor is connected to the C_D pin, the reset output deassertion is adequately delayed (see [Figure 5](#) with calculations below for more details). Leave the C_D pin open if unused (i.e. $t_{CD} = 0$ ms).

Figure 5. Timing waveforms



t_{DET} detect delay time

t_{REL} release delay time (measured when external capacitor C_D is disconnected)

t_{CD} delay by external capacitor C_D .

The t_{CD} delay can be calculated based on [Equation 1](#):

Equation 1

$$t_{CD} = -R_{CD} \times C_D \times \ln\left(1 - \frac{V_{TCD}}{V_{CC}}\right)$$

and considering $R_{CD} = 2 \text{ M}\Omega$ (typ.) and $V_{TCD} = 1.5 \text{ V}$ (typ.) at $V_{CC} = 3.0 \text{ V}$:

Equation 2

$$t_{CD} \cong 1.39 \times 10^6 \times C_D(\text{s, F})$$

3 Typical operating characteristics

Figure 6. Supply current vs. sense voltage, $V_{CC} = 3.0\text{ V}$, $V_{DET} = 2.0\text{ V}$

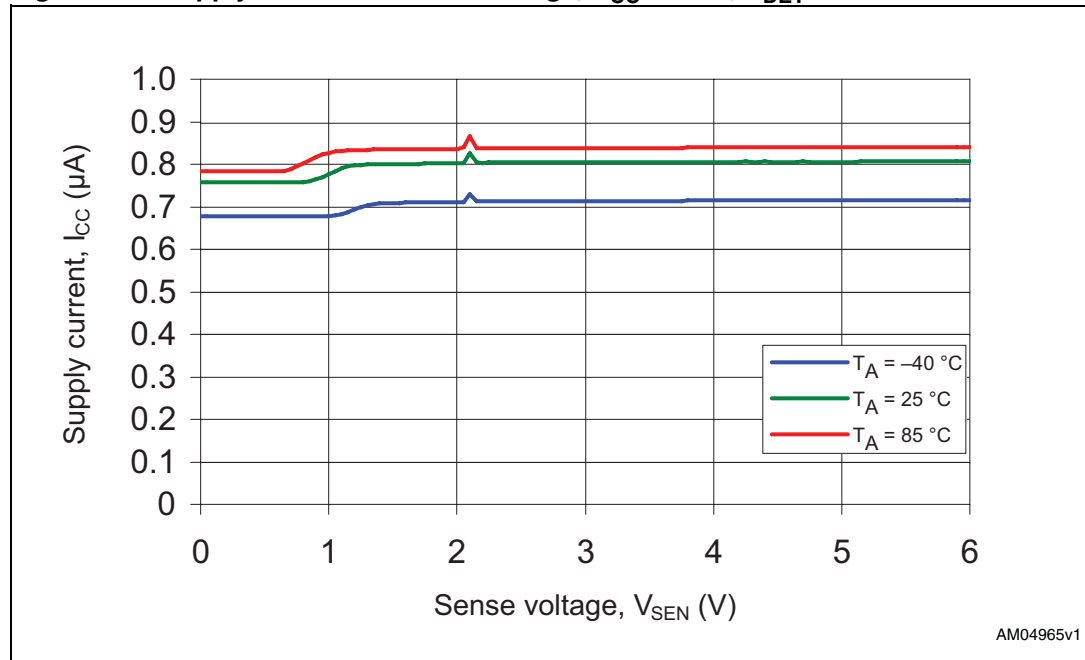


Figure 7. Supply current vs. input voltage, $V_{SEN} = 1.9\text{ V}$ ($\overline{\text{RST}}$ asserted)

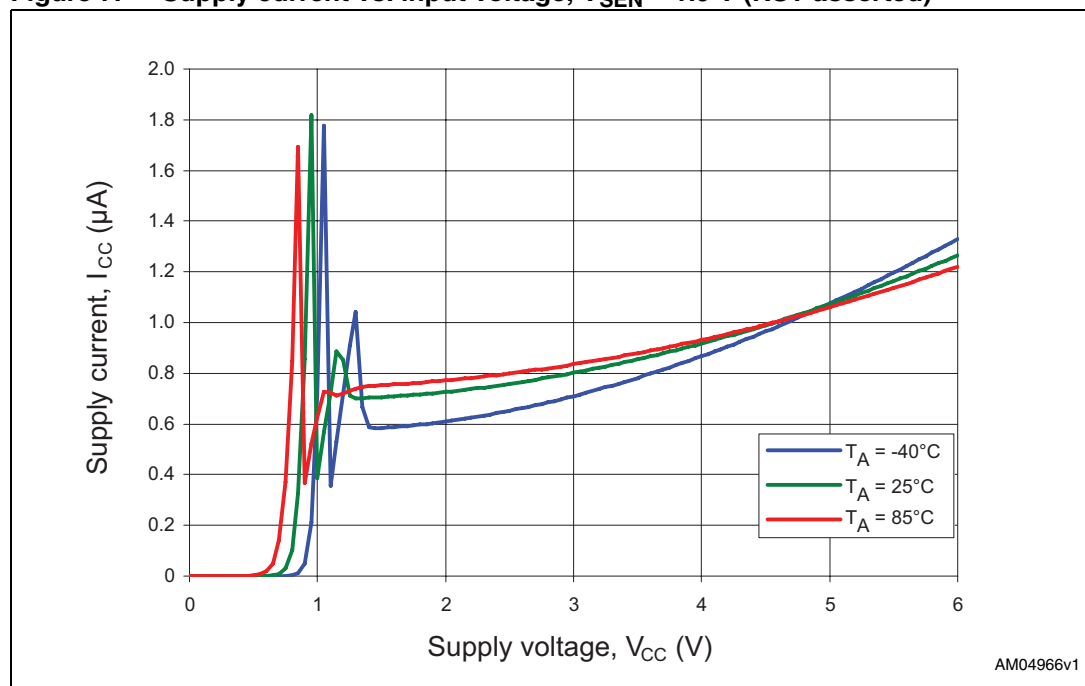


Figure 8. Detect voltage vs. ambient temperature, $V_{DET} = 2.4\text{ V}$

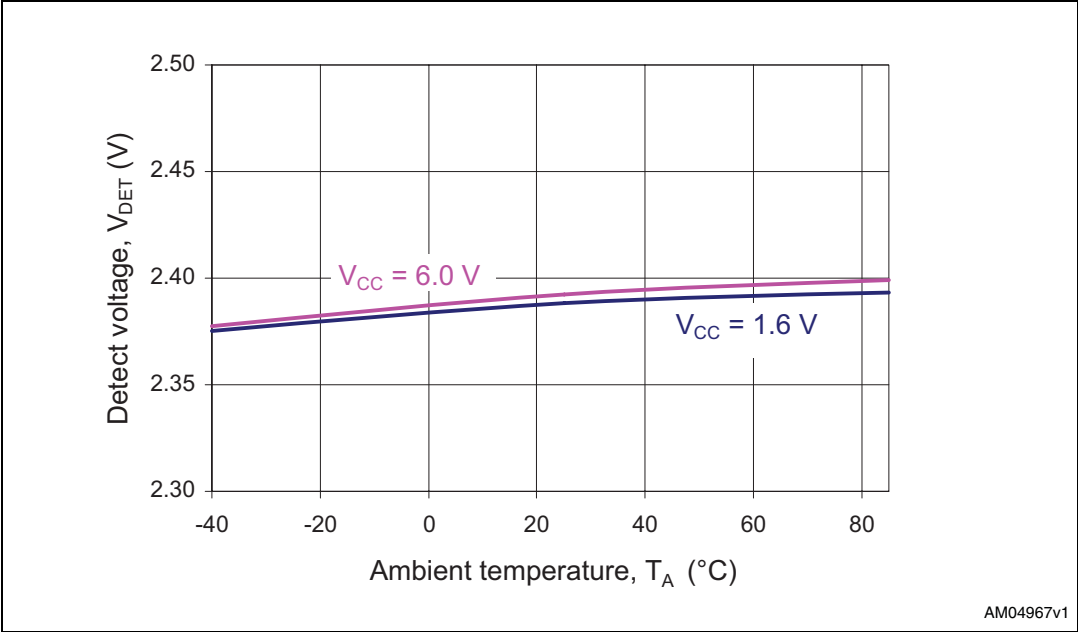


Figure 9. Detect voltage vs. supply voltage, $V_{DET} = 2.4\text{ V}$

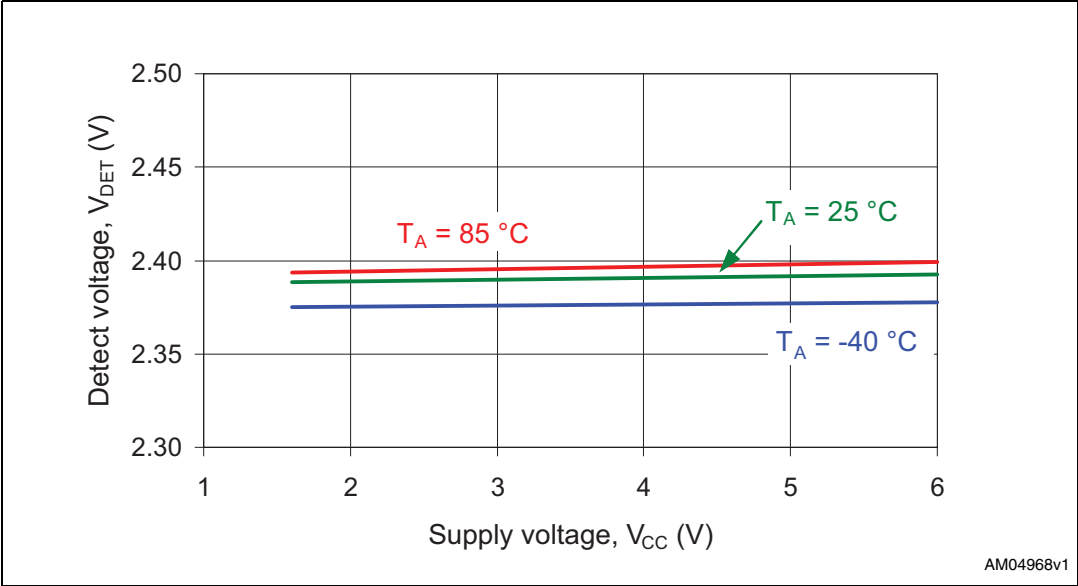


Figure 10. Hysteresis voltage vs. ambient temperature, $V_{DET} = 2.4\text{ V}$

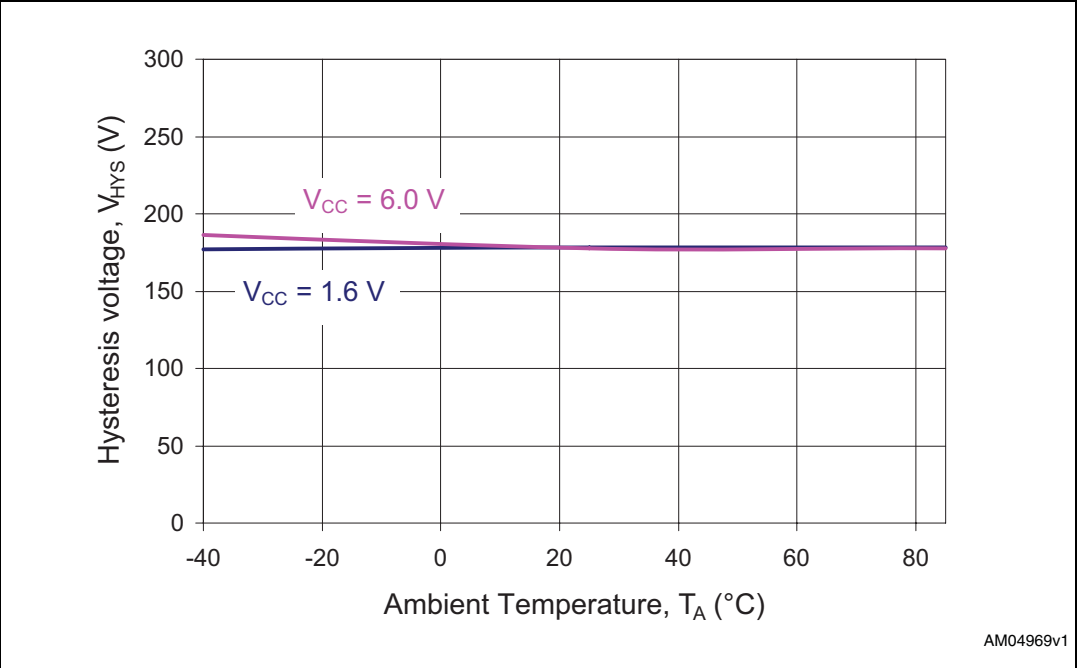


Figure 11. C_D pin sink current vs. supply voltage, $V_{SEN} = 0\text{ V}$, $V_{CD} = 0.5\text{ V}$

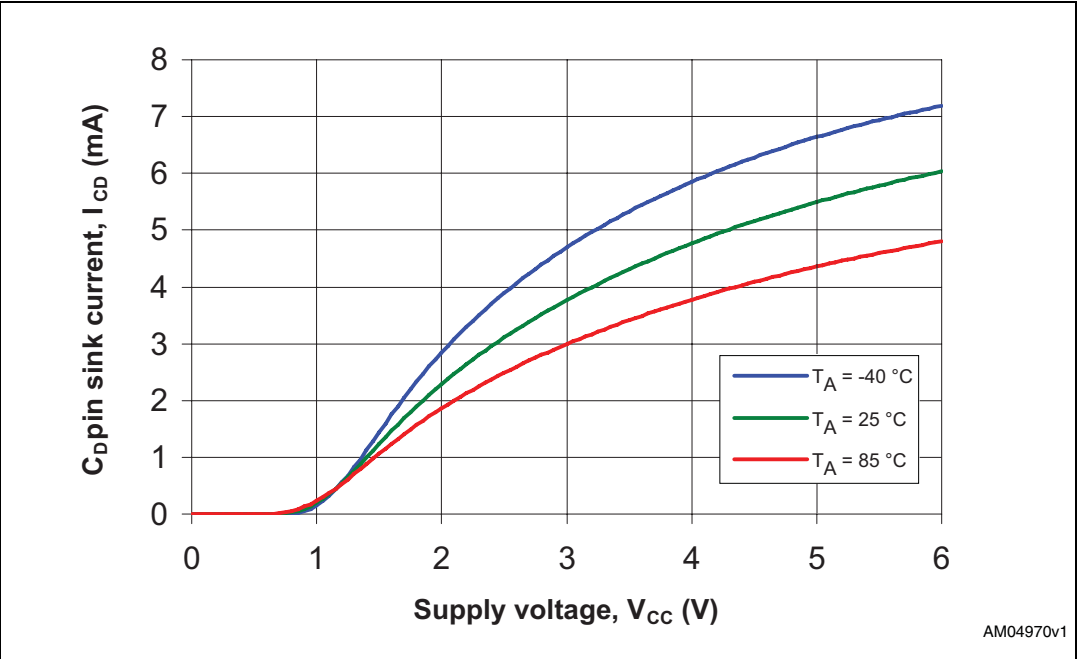


Figure 12. Output voltage vs. sense voltage, $V_{DET} = 2.4\text{ V}$, $T_A = 25\text{ }^{\circ}\text{C}$, external pull-up resistor on RST is $100\text{ k}\Omega$, C_D pin open

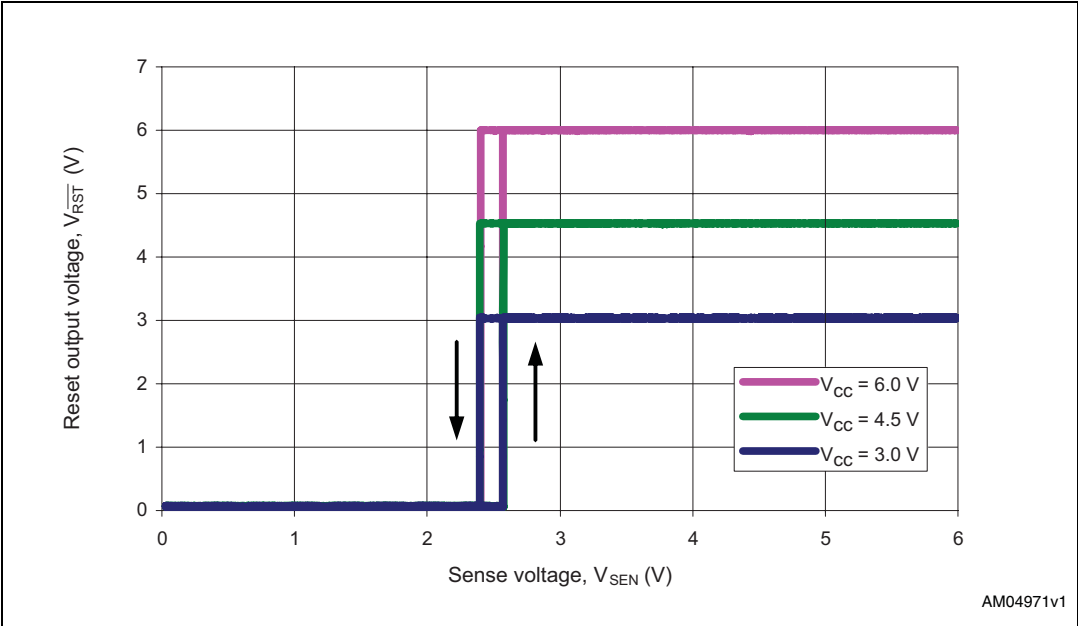


Figure 13. Output voltage vs. supply voltage, $V_{SEN} = V_{CC}$, external pull-up resistor on RST is $100\text{ k}\Omega$, C_D pin open

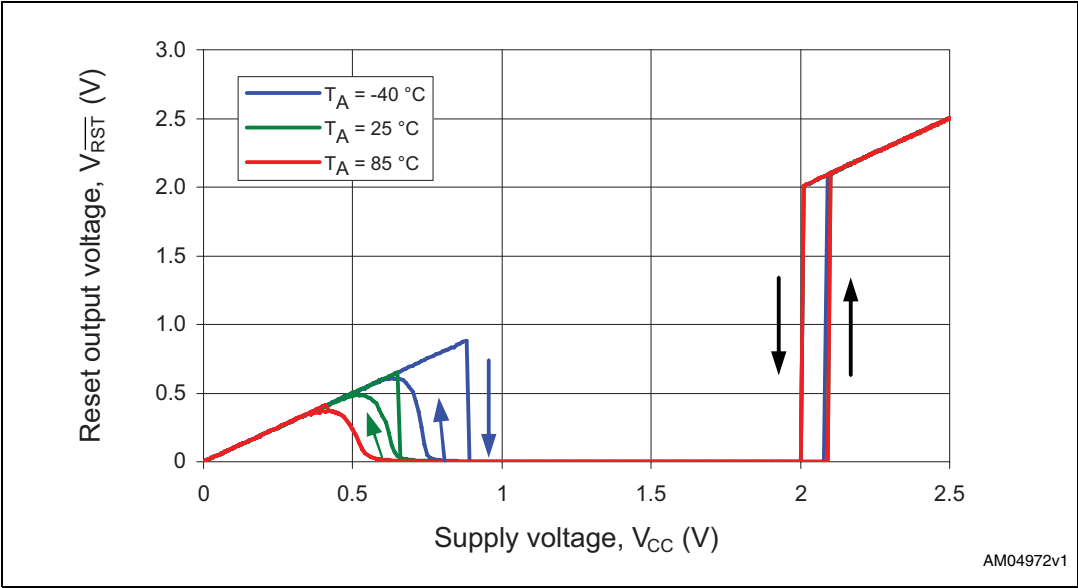


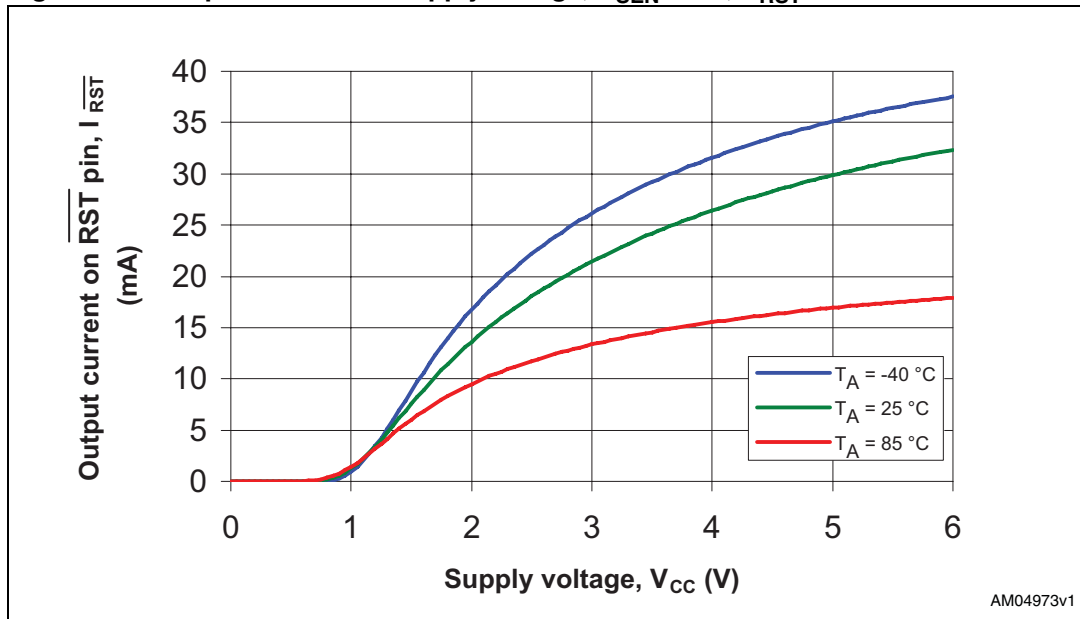
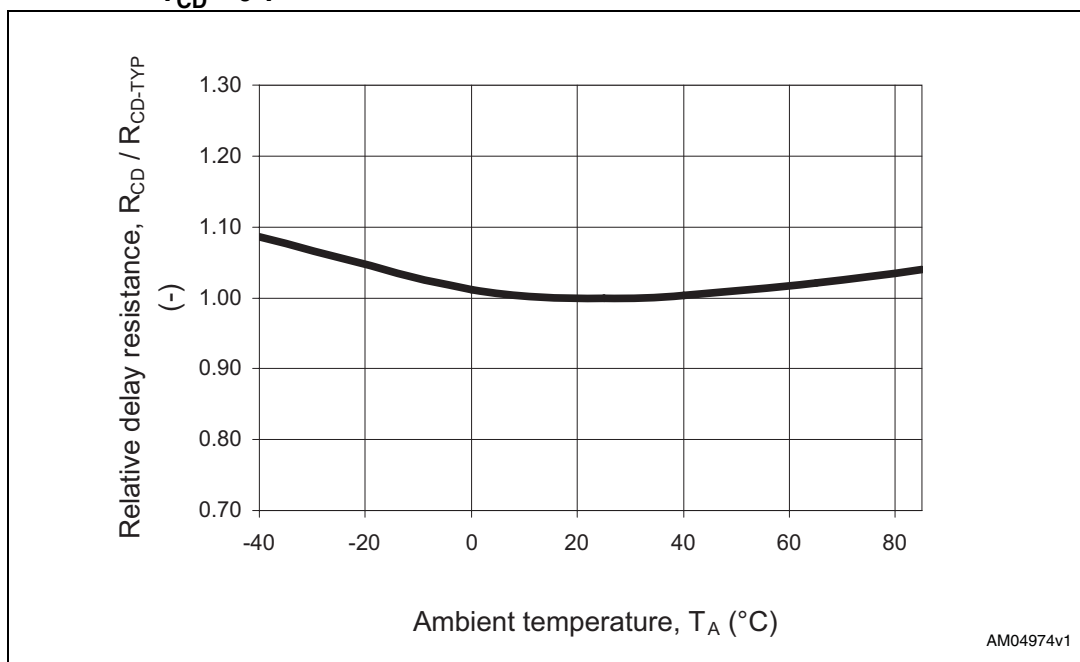
Figure 14. Output current vs. supply voltage, $V_{SEN} = 0\text{ V}$, $V_{\overline{RST}} = 0.5\text{ V}$ Figure 15. Relative delay resistance vs. ambient temperature, $V_{CC} = 5\text{ V}$, $V_{SEN} = 6\text{ V}$, $V_{CD} = 0\text{ V}$ 

Figure 16. Release delay time vs. delay capacitance, $T_A = 25\text{ }^{\circ}\text{C}$

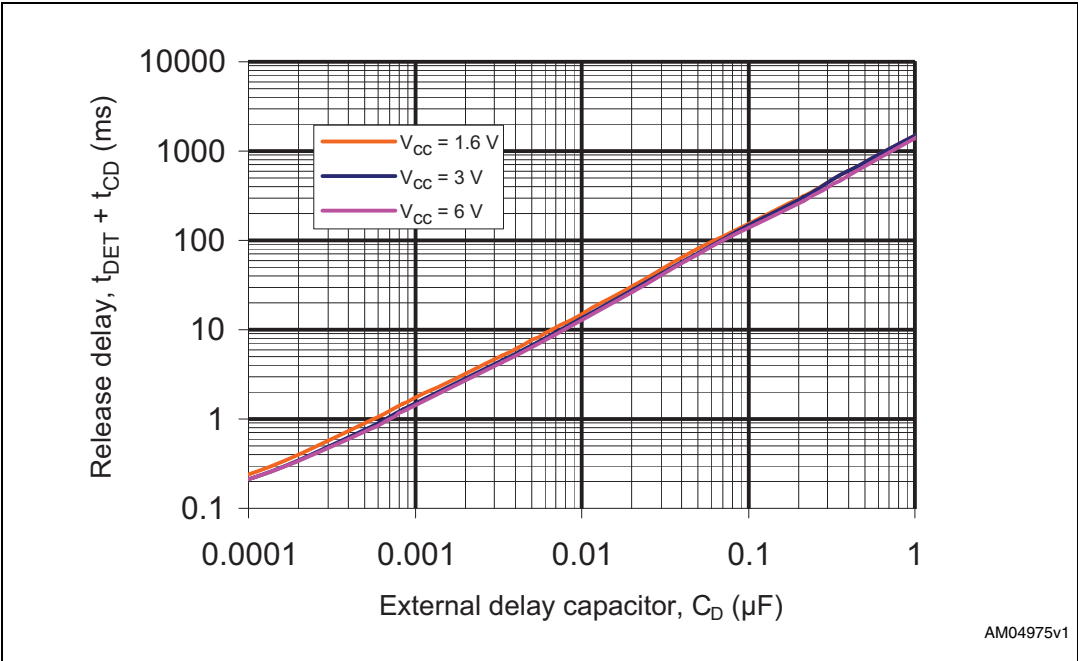


Figure 17. Detect delay time vs. delay capacitance, $T_A = 25\text{ }^{\circ}\text{C}$

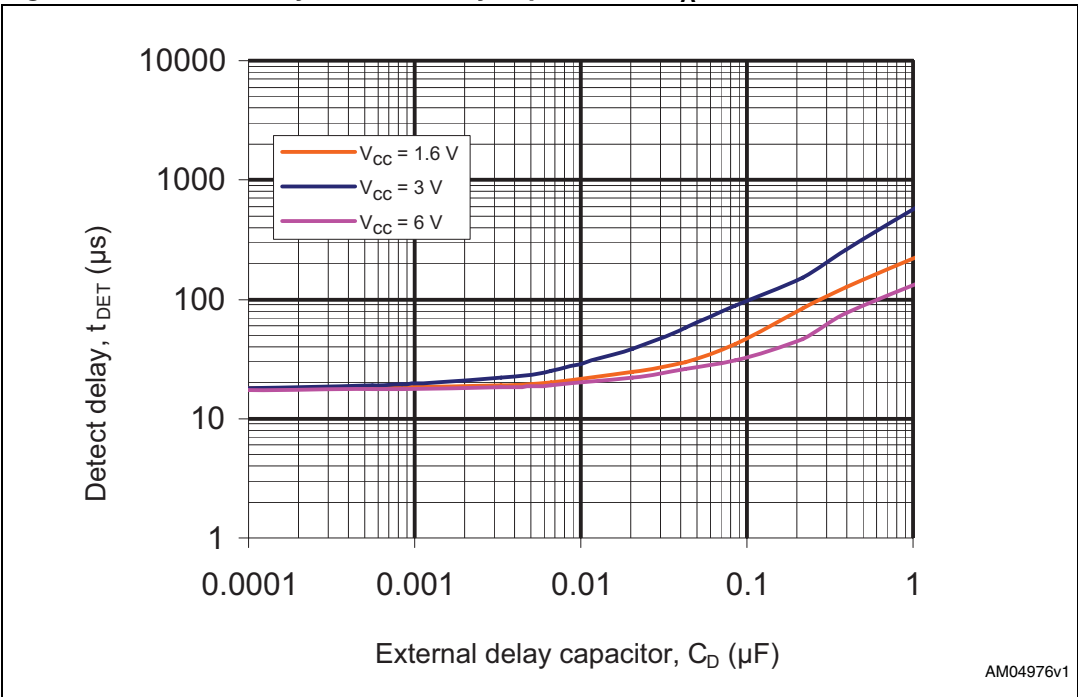


Figure 18. $\overline{\text{RST}}$ output leakage current vs. ambient temperature, $V_{\text{CC}} = V_{\text{SEN}} = V_{\text{OUT}} = 6.0 \text{ V}$, C_{D} pin open

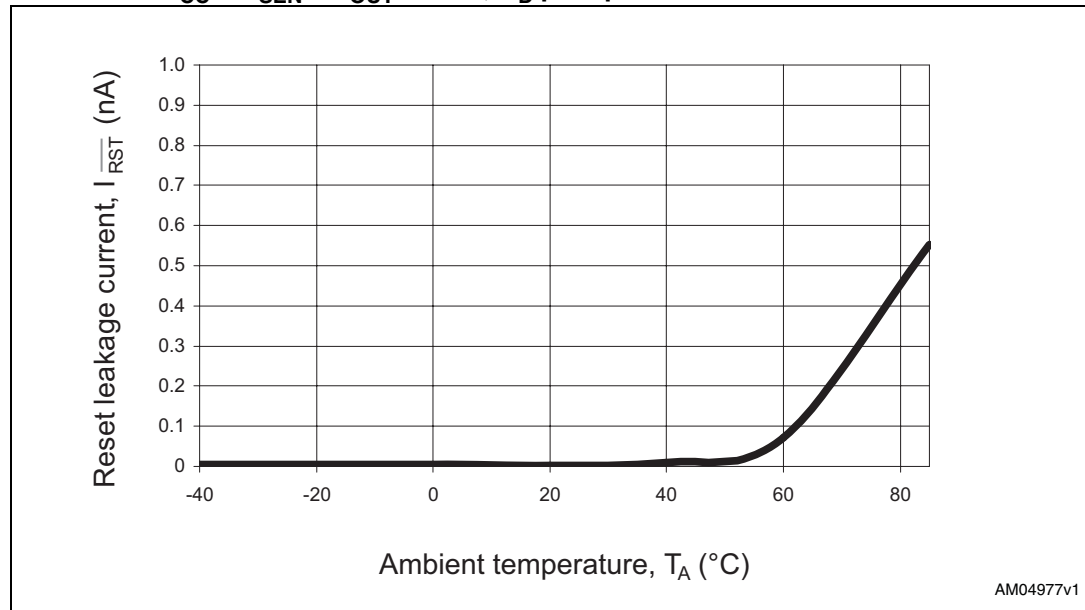


Figure 19. $\overline{\text{RST}}$ output leakage current vs. output voltage, $V_{\text{CC}} = V_{\text{SEN}} = 6.0 \text{ V}$, $T_{\text{A}} = 85 \text{ °C}$, C_{D} pin open

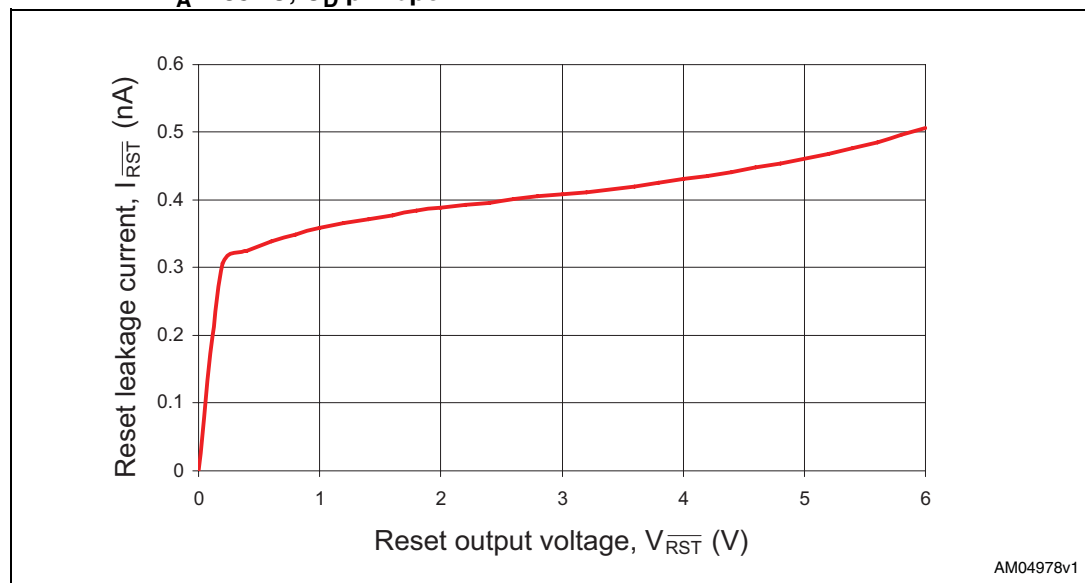


Figure 20. Sense current vs. supply voltage, $V_{SEN} = 1.9\text{ V}$

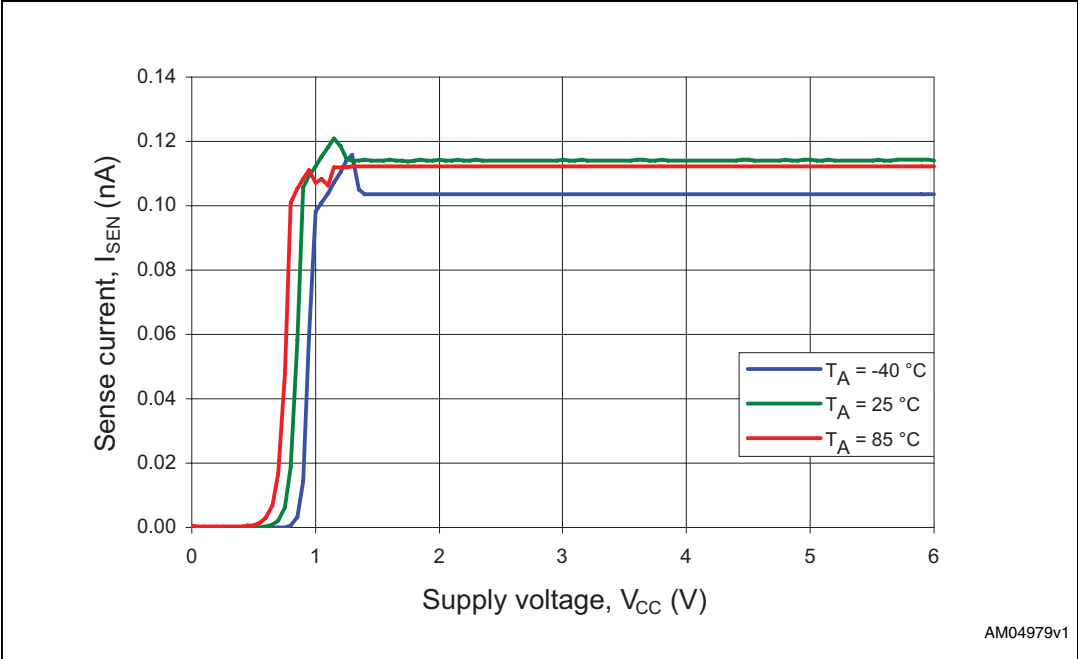
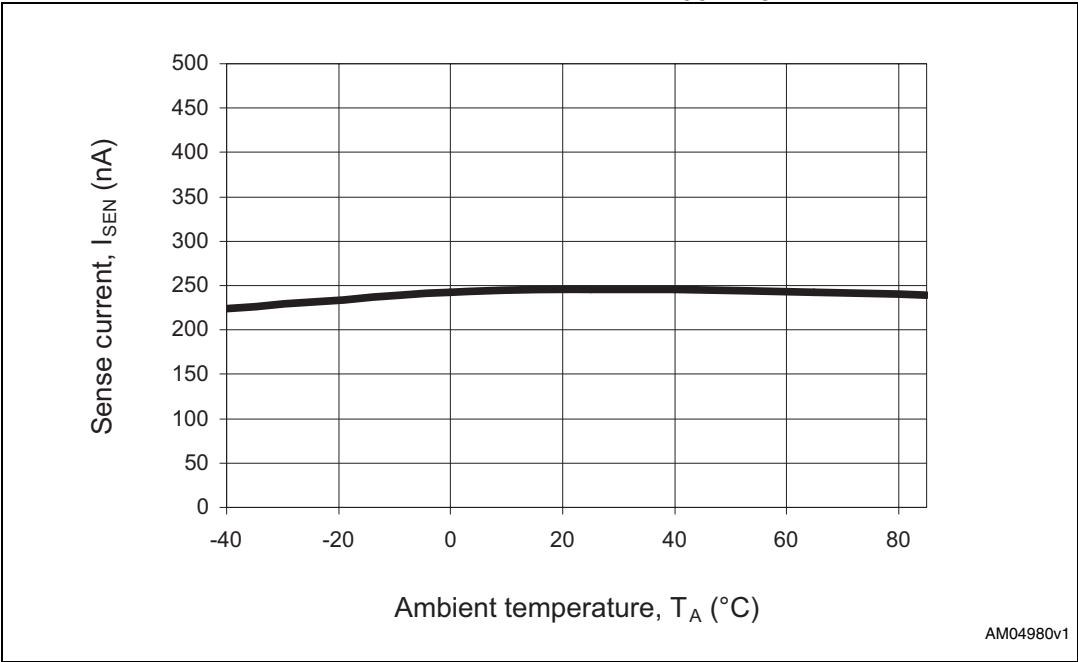


Figure 21. Sense current vs. ambient temperature, $V_{CC} = V_{SEN} = 5\text{ V}$



4 Maximum ratings

Stressing the device above the ratings listed in [Table 2](#) may cause permanent damage to the device. These are stress ratings only and operation of the device at these or any other conditions above those indicated in the operating sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

Table 2. Absolute maximum ratings

Symbol	Parameter	Value	Unit
T_{STG}	Storage temperature (V_{CC} off)	–55 to 150	°C
$T_{SLD}^{(1)}$	Lead solder temperature for 10 seconds	260	°C
T_J	Maximum junction temperature	125	°C
V_{CC}	Supply voltage	–0.3 to 7.0	V
V_{CD}	Delay capacitor pin voltage	–0.3 to $V_{CC} + 0.3$	V
V_{RST}	Reset output voltage – N-channel open drain	–0.3 to 7.0	V
V_{ESD}	ESD voltage – Human body model (MIL-STD-883, Method 3015) – Machine model	2000 200	V

1. Reflow at peak temperature of 260 °C. The time above 255 °C must not exceed 30 seconds.

5 DC and AC parameters

This section summarizes the operating measurement conditions, and the DC and AC characteristics of the device. The parameters in [Table 4](#) that follow, are derived from tests performed under the measurement conditions summarized in [Table 3](#) and [Figure 5](#) with measurement conditions for t_{DET} and t_{REL} . Designers should check that the operating conditions in their circuit match the operating conditions when relying on the quoted parameters.

Table 3. Operating and AC measurement conditions

Parameter	Value	Unit
Supply voltage (V_{CC})	1.6 to 6.0	V
Ambient operating temperature (T_A)	−40 to 85	°C
Input rise and fall times	≤ 5	ns
Input pulse voltages	0.2 to 0.8 V_{CC}	V
Input and output timing ref. voltages	0.3 to 0.7 V_{CC}	V

Figure 22. AC testing input/output waveforms

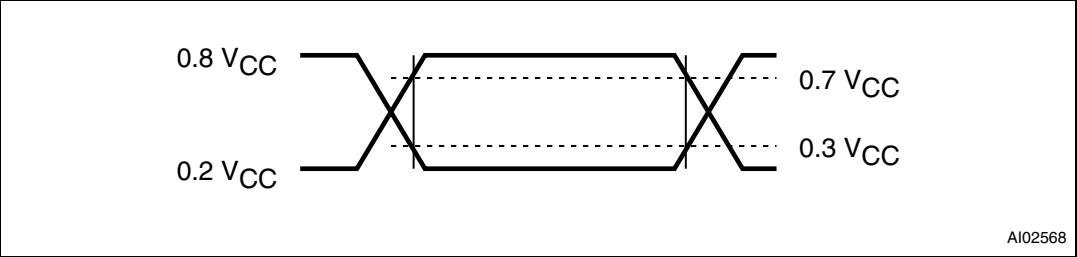


Table 4. DC and AC characteristics

Symbol	Parameter	Conditions ⁽¹⁾		Min.	Typ.	Max.	Units
V_{CC}	Operating voltage	$-40\text{ }^{\circ}\text{C} < T_A < 85\text{ }^{\circ}\text{C}$		1.6	—	6.0	V
V_{DET}	Detect voltage ⁽²⁾			$V_{DET} - 2\%$	V_{DET}	$V_{DET} + 2\%$	V
V_{HYS}	Hysteresis voltage			$0.02 V_{DET}$	$0.05 V_{DET}$	$0.08 V_{DET}$	V
I_{CC}	Supply current		$V_{CC} = 1.6\text{ V}$	—	0.70	1.20	μA
			$V_{CC} = 3.0\text{ V}$	—	0.80	1.40	
			$V_{CC} = 6.0\text{ V}$	—	1.20	2.00	
I_{RST}	Output current	$V_{SEN} = 0\text{ V},$ $V_{RST} = 0.5\text{ V}$	$V_{CC} = 1.6\text{ V}$	0.8	7.0	—	mA
			$V_{CC} = 2.0\text{ V}$	5.0	14.0	—	
			$V_{CC} = 3.0\text{ V}$	10.0	22.0	—	
			$V_{CC} = 4.0\text{ V}$	15.0	28.0	—	
			$V_{CC} = 5.0\text{ V}$	17.0	32.0	—	
			$V_{CC} = 6.0\text{ V}$	20.0	35.0	—	
I_{LEAK}	Output leakage current	$V_{CC} = 6.0\text{ V}, V_{SEN} = 6.0\text{ V},$ $V_{RST} = 6.0\text{ V}, C_D: \text{open}$		—	—	400	nA
$\Delta V_{DET} / (\Delta T_A \cdot V_{DET})$	Temperature variation	$-40\text{ }^{\circ}\text{C} < T_A < 85\text{ }^{\circ}\text{C}$		—	± 100	—	ppm/ $^{\circ}\text{C}$
I_{SEN}	Sense current	$V_{CC} = 0\text{ V}$		—	10	—	nA
		$V_{CC} > 1.6\text{ V}, V_{SEN} = 5.0\text{ V}$		—	300	500	
R_{CD}	Delay resistance	$V_{SEN} = 6.0\text{ V}, V_{CC} = 5.0\text{ V},$ $V_{CD} = 0\text{ V}$		1.4	2.0	2.6	M Ω
I_{CD}	Delay capacitance pin sink current	$V_{CD} = 0.5\text{ V}, V_{CC} = 1.6\text{ V}$		0.2	1.4	—	mA
V_{TCD}	Delay capacitance pin threshold voltage	$V_{SEN} = 6.0\text{ V}, V_{CC} = 1.6\text{ V}$		0.70	0.85	1.00	V
		$V_{SEN} = 6.0\text{ V}, V_{CC} = 3.0\text{ V}$		1.25	1.50	1.70	
		$V_{SEN} = 6.0\text{ V}, V_{CC} = 6.0\text{ V}$		2.45	2.65	2.85	
t_{DET}	Detect delay time	$V_{CC} = 6.0\text{ V}, V_{SEN} = 6.0\text{ V} \rightarrow$ $0\text{ V}, C_D: \text{open}$		—	40	75	μs
t_{REL}	Release delay time	$V_{CC} = 6.0\text{ V}, V_{SEN} = 0\text{ V} \rightarrow 6$ $\text{V}, C_D: \text{open}$		—	55	170	μs

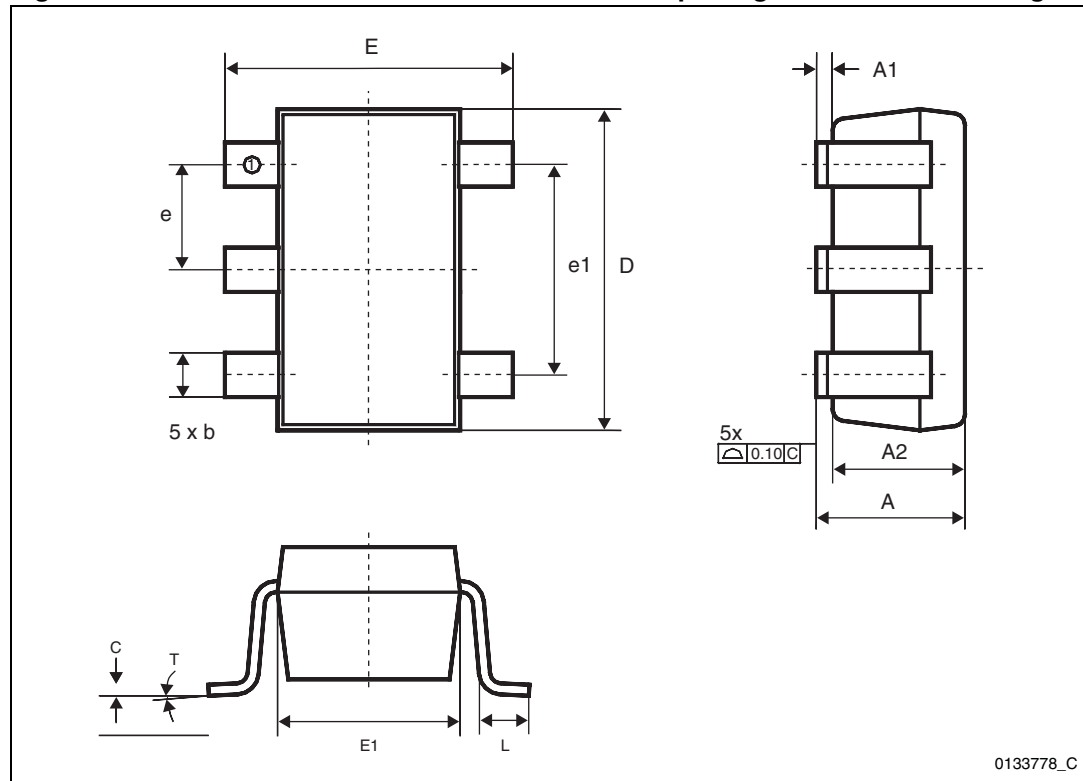
1. Valid for ambient operating temperature: $T_A = 25\text{ }^{\circ}\text{C}$; $V_{CC} = 1.6\text{ V}$ to 6.0 V (except where noted).

2. Factory-trimmed voltage thresholds in 100 mV increments from 1.6 V to 5.7 V.

6 Package mechanical data

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK[®] packages, depending on their level of environmental compliance. ECOPACK[®] specifications, grade definitions and product status are available at: www.st.com. ECOPACK[®] is an ST trademark.

The maximum ratings related to soldering conditions are also marked on the inner box label.

Figure 23. SOT23-5 - 5-lead small outline transistor package mechanical drawing

Note: Drawing is not to scale.

Table 5. SOT23-5 - 5-lead small outline transistor package mechanical data

Symbol	Millimeters			Inches			Note
	Typ.	Min.	Max.	Typ.	Min.	Max.	
A			1.45			0.057	
A1		0.00	0.15		0.00	0.006	
A2	1.15	0.90	1.30	0.045	0.035	0.051	
b		0.30	0.50		0.012	0.020	
c		0.08	0.22		0.003	0.009	
D	2.90			0.114			
E	2.80			0.110			
E1	1.60			0.063			
e	0.95			0.037			
e1	1.90			0.075			
L	0.45	0.30	0.60	0.018	0.012	0.024	
θ	4	0	8	4	0	8	Degrees
N	5			5			

7 Part numbering

Table 6. STM1831 ordering information scheme

Example:	STM1831	L	24	WY	6	F
Device type	STM1831					
Reset output polarity	L: active-low					
Detector threshold ⁽¹⁾	24: 2.4 V typ. (100 mV steps from 1.6 V to 5.7 V available)					
Package	WY: SOT23-5					
Temperature range	6: -40 °C to +85 °C					
Shipping method	F: Lead-free ECOPACK [®] package, tape and reel					

1. Other detector thresholds are offered. Minimum order quantities may apply. Contact local ST sales office for availability.



8 Revision history

Table 7. Document revision history

Date	Revision	Changes
16-Nov-2010	1	Initial release.

Please Read Carefully:

Information in this document is provided solely in connection with ST products. STMicroelectronics NV and its subsidiaries ("ST") reserve the right to make changes, corrections, modifications or improvements, to this document, and the products and services described herein at any time, without notice.

All ST products are sold pursuant to ST's terms and conditions of sale.

Purchasers are solely responsible for the choice, selection and use of the ST products and services described herein, and ST assumes no liability whatsoever relating to the choice, selection or use of the ST products and services described herein.

No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted under this document. If any part of this document refers to any third party products or services it shall not be deemed a license grant by ST for the use of such third party products or services, or any intellectual property contained therein or considered as a warranty covering the use in any manner whatsoever of such third party products or services or any intellectual property contained therein.

UNLESS OTHERWISE SET FORTH IN ST'S TERMS AND CONDITIONS OF SALE ST DISCLAIMS ANY EXPRESS OR IMPLIED WARRANTY WITH RESPECT TO THE USE AND/OR SALE OF ST PRODUCTS INCLUDING WITHOUT LIMITATION IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE (AND THEIR EQUIVALENTS UNDER THE LAWS OF ANY JURISDICTION), OR INFRINGEMENT OF ANY PATENT, COPYRIGHT OR OTHER INTELLECTUAL PROPERTY RIGHT.

UNLESS EXPRESSLY APPROVED IN WRITING BY AN AUTHORIZED ST REPRESENTATIVE, ST PRODUCTS ARE NOT RECOMMENDED, AUTHORIZED OR WARRANTED FOR USE IN MILITARY, AIR CRAFT, SPACE, LIFE SAVING, OR LIFE SUSTAINING APPLICATIONS, NOR IN PRODUCTS OR SYSTEMS WHERE FAILURE OR MALFUNCTION MAY RESULT IN PERSONAL INJURY, DEATH, OR SEVERE PROPERTY OR ENVIRONMENTAL DAMAGE. ST PRODUCTS WHICH ARE NOT SPECIFIED AS "AUTOMOTIVE GRADE" MAY ONLY BE USED IN AUTOMOTIVE APPLICATIONS AT USER'S OWN RISK.

Resale of ST products with provisions different from the statements and/or technical features set forth in this document shall immediately void any warranty granted by ST for the ST product or service described herein and shall not create or extend in any manner whatsoever, any liability of ST.

ST and the ST logo are trademarks or registered trademarks of ST in various countries.

Information in this document supersedes and replaces all information previously supplied.

The ST logo is a registered trademark of STMicroelectronics. All other names are the property of their respective owners.

© 2010 STMicroelectronics - All rights reserved

STMicroelectronics group of companies

Australia - Belgium - Brazil - Canada - China - Czech Republic - Finland - France - Germany - Hong Kong - India - Israel - Italy - Japan - Malaysia - Malta - Morocco - Philippines - Singapore - Spain - Sweden - Switzerland - United Kingdom - United States of America

www.st.com

Mouser Electronics

Authorized Distributor

Click to View Pricing, Inventory, Delivery & Lifecycle Information:

[STMicroelectronics:](#)

[STM1831L24WY6F](#)