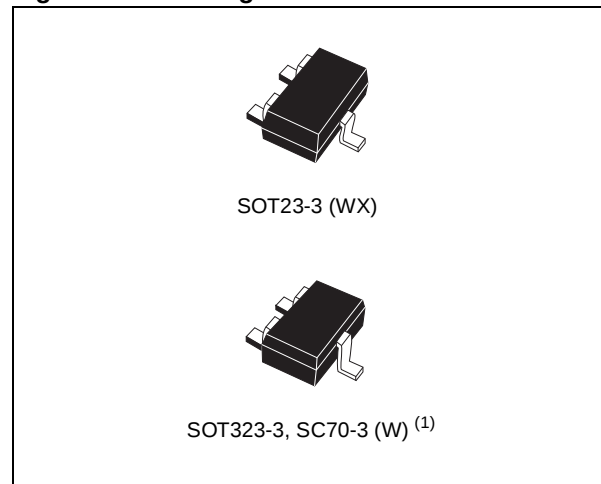


## Low Power Voltage Detector

### Features

- Factory-trimmed Voltage Thresholds in 0.1V Increments from 1.6 to 5.5V
- $\pm 2\%$  Voltage Threshold Accuracy
- Operating Voltage 0.7 to 6.0V
- Open Drain Output
- Low Supply Current of 0.9 $\mu$ A (typ)
- Guaranteed  $\overline{\text{OUT}}$  Assertion Down to  $V_{\text{CC}} = 0.7\text{V}$
- Power Supply Transient Immunity
- Available in SOT23-3 and SOT323-3 (SC70-3) packages
- Operating Temperature  $-40$  to  $85^{\circ}\text{C}$ .

**Figure 1. Packages**



1. Contact local sales office for availability.

# Contents

|          |                                                          |           |
|----------|----------------------------------------------------------|-----------|
| <b>1</b> | <b>Summary Description</b>                               | <b>5</b>  |
| <b>2</b> | <b>Pin Descriptions</b>                                  | <b>7</b>  |
| 2.1      | OUT (Open Drain)                                         | 7         |
| 2.2      | V <sub>CC</sub>                                          | 7         |
| 2.3      | V <sub>SS</sub>                                          | 7         |
| <b>3</b> | <b>Operation</b>                                         | <b>8</b>  |
| 3.1      | Output                                                   | 8         |
| 3.2      | Negative-Going V <sub>CC</sub> Transients and Undershoot | 8         |
| <b>4</b> | <b>Typical Operating Characteristics</b>                 | <b>9</b>  |
| <b>5</b> | <b>Maximum Rating</b>                                    | <b>13</b> |
| <b>6</b> | <b>DC and AC Parameters</b>                              | <b>14</b> |
| <b>7</b> | <b>Package Mechanical</b>                                | <b>17</b> |
| <b>8</b> | <b>Part Numbering</b>                                    | <b>20</b> |
| <b>9</b> | <b>Revision History</b>                                  | <b>22</b> |

## List of tables

|           |                                                                                       |    |
|-----------|---------------------------------------------------------------------------------------|----|
| Table 1.  | Signal Names . . . . .                                                                | 5  |
| Table 2.  | Pin Functions . . . . .                                                               | 7  |
| Table 3.  | Absolute Maximum Ratings . . . . .                                                    | 13 |
| Table 4.  | Operating and AC Measurement Conditions . . . . .                                     | 14 |
| Table 5.  | DC and AC Characteristics . . . . .                                                   | 16 |
| Table 6.  | SOT23-3 – 3-lead Small Outline Transistor Package Mechanical Data . . . . .           | 18 |
| Table 7.  | SOT323-3 (SC70-3) – 3-lead Small Outline Transistor Package Mechanical Data . . . . . | 19 |
| Table 8.  | Ordering Information Scheme . . . . .                                                 | 20 |
| Table 9.  | Factory-Trimmed Thresholds with Marking Description . . . . .                         | 21 |
| Table 10. | Document Revision History . . . . .                                                   | 22 |

## List of figures

|            |                                                                             |    |
|------------|-----------------------------------------------------------------------------|----|
| Figure 1.  | Packages .....                                                              | 1  |
| Figure 2.  | Logic Diagram .....                                                         | 5  |
| Figure 3.  | SOT23-3 Connections .....                                                   | 5  |
| Figure 4.  | SOT323-3 (SC70-3) Connections .....                                         | 6  |
| Figure 5.  | N-Channel Open Drain Output Block Diagram .....                             | 6  |
| Figure 6.  | STM1061N Active-Low, Open Drain Hardware Hookup .....                       | 6  |
| Figure 7.  | Supply Current vs. Input Voltage .....                                      | 9  |
| Figure 8.  | Supply Current vs. Ambient Temperature .....                                | 9  |
| Figure 9.  | Output Detect Delay Time vs. Ambient Temperature .....                      | 10 |
| Figure 10. | Output Release Delay Time vs. Ambient Temperature .....                     | 10 |
| Figure 11. | Maximum Transient Duration vs. Reset Threshold Overdrive .....              | 11 |
| Figure 12. | Detect, Release Voltage vs. Ambient Temperature for $V_{TH-} = 3.4V$ .....  | 11 |
| Figure 13. | N-channel Driver Output Current vs. $V_{DS}$ .....                          | 12 |
| Figure 14. | N-channel Driver Output Current vs. Input Voltage for $V_{DS} = 0.5V$ ..... | 12 |
| Figure 15. | AC Testing Input/Output Waveforms .....                                     | 14 |
| Figure 16. | Voltage Timing Waveform .....                                               | 15 |
| Figure 17. | SOT23-3 – 3-lead Small Outline Transistor Package Outline .....             | 17 |
| Figure 18. | SOT323-3 (SC70-3) – 3-lead Small Outline Transistor Package Outline .....   | 19 |

# 1 Summary Description

The STM1061 low power voltage detector provides monitoring of battery, power-supply, and regulated system voltages. A precision voltage reference and comparator monitors the  $V_{CC}$  input and compares it with a specified voltage threshold condition. When  $V_{CC}$  falls below a specified trip point threshold, the output ( $\overline{OUT}$ ) is forced low and remains asserted as long as the  $V_{CC}$  input remains below  $V_{TH-}$  + hysteresis ( $V_{HYST}$ ). The STM1061 device is guaranteed to output the correct logic state for  $V_{CC}$  down to 0.7V. They are also designed to ignore fast transients on  $V_{CC}$ .

This small, low power device is ideal for portable applications and is available in space-saving SOT23-3 and SOT323-3 (SC70-3) packages.

Figure 2. Logic Diagram

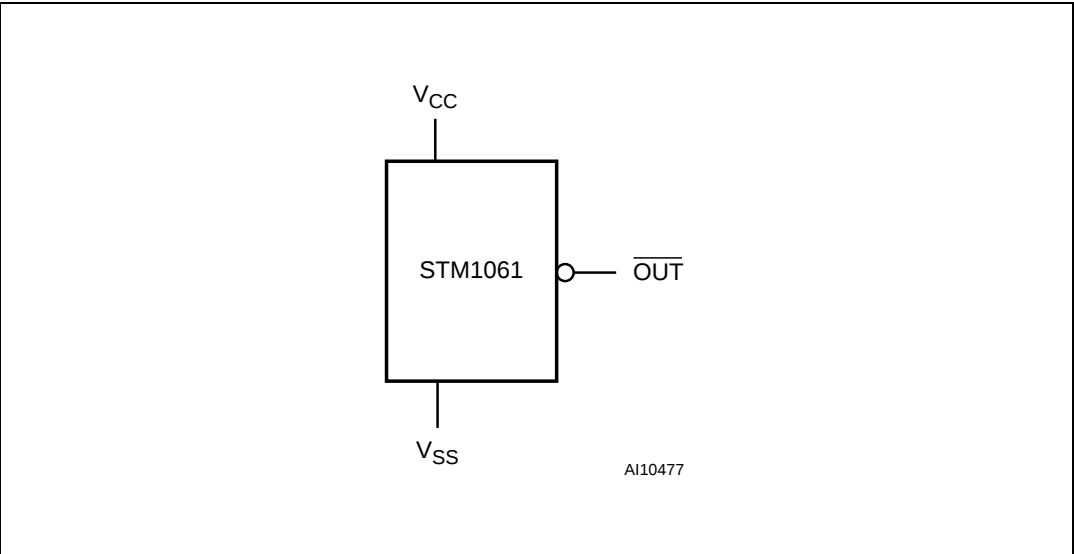


Table 1. Signal Names

|          |                              |
|----------|------------------------------|
| OUT      | Open Drain Active-Low Output |
| $V_{CC}$ | Supply Voltage               |
| $V_{SS}$ | Ground                       |

Figure 3. SOT23-3 Connections

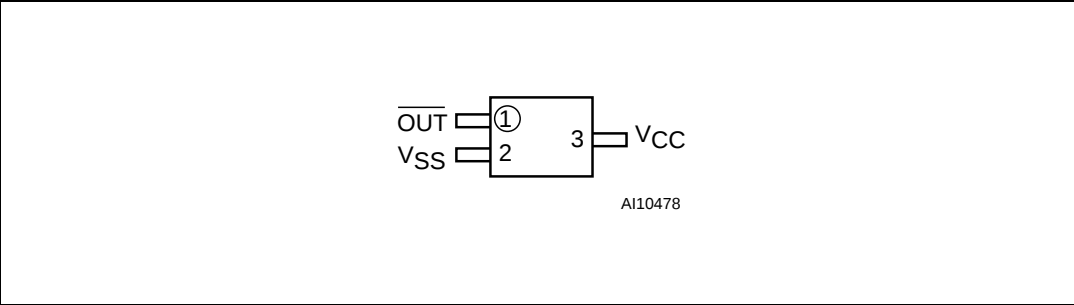


Figure 4. SOT323-3 (SC70-3) Connections

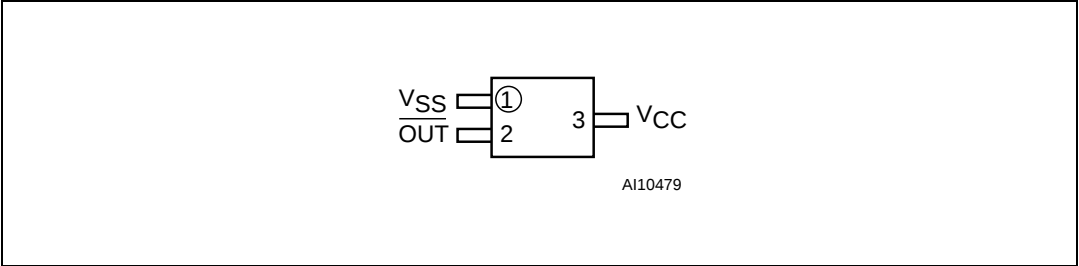


Figure 5. N-Channel Open Drain Output Block Diagram

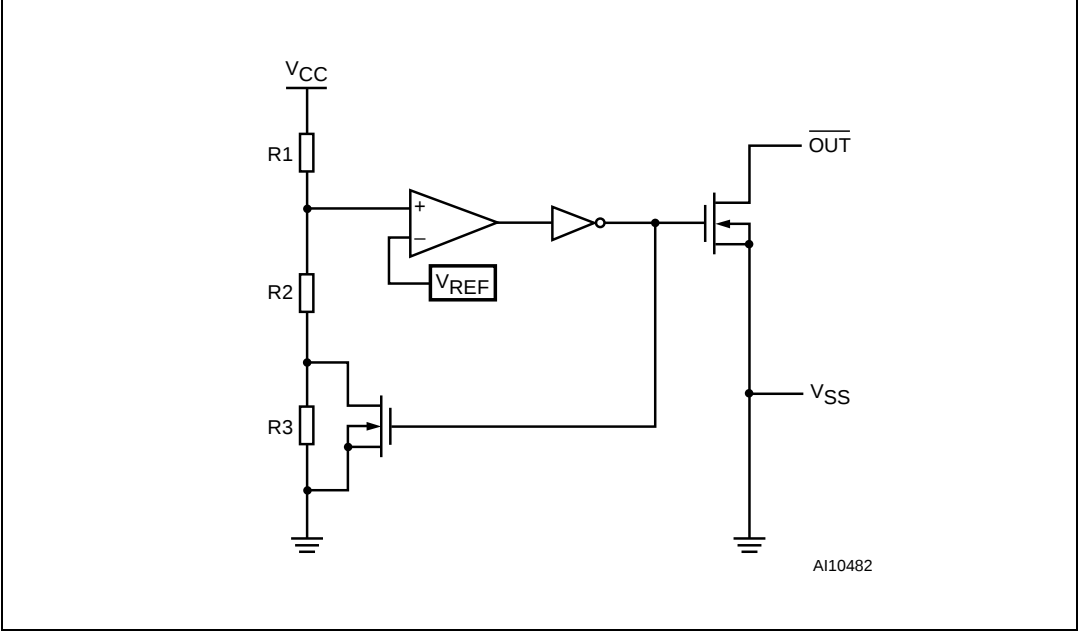
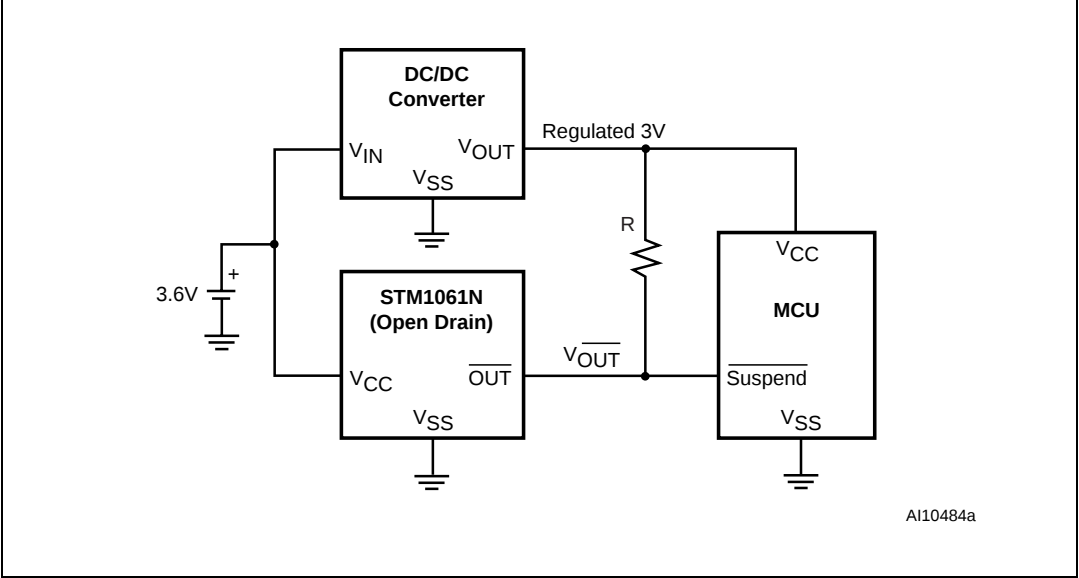


Figure 6. STM1061N Active-Low, Open Drain Hardware Hookup



## 2 Pin Descriptions

See [Figure 2 on page 5](#) and [Table 1 on page 5](#) for a brief overview of the signals connected to this device.

### 2.1 $\overline{\text{OUT}}$ (Open Drain)

This is the Open Drain Output. It goes low when  $V_{CC}$  drops below  $V_{TH-}$ , and remains low as long as  $V_{CC}$  is below  $V_{TH-} + V_{HYST}$ .

### 2.2 $V_{CC}$

This is the Supply voltage and input for the Voltage Detector.

### 2.3 $V_{SS}$

Ground,  $V_{SS}$ , is the reference for the power supply. It must be connected to the system ground.

**Table 2. Pin Functions**

| Pin     |                      | Name     | Function                     |
|---------|----------------------|----------|------------------------------|
| SOT23-3 | SOT323-3<br>(SC70-3) |          |                              |
| 1       | 2                    | OUT      | Active-Low Open Drain Output |
| 3       | 3                    | $V_{CC}$ | Supply Voltage               |
| 2       | 1                    | $V_{SS}$ | Ground                       |

## 3 Operation

### 3.1 Output

The STM1061 Voltage Detector monitors system voltages from 1.6 to 5V in 100mV increments. The detector is designed to ignore fast transients on  $V_{CC}$  and has a voltage hysteresis ( $V_{HYST}$ ). The STM1061 asserts an output signal ( $\overline{OUT}$ ) whenever  $V_{CC}$  goes below the Voltage Detect Threshold ( $V_{TH-}$ ). The output signal ( $\overline{OUT}$ ) stays asserted until  $V_{CC}$  goes above the Voltage Detect Release ( $V_{TH+}$ ). Output voltage ( $V_{\overline{OUT}}$ ) is guaranteed valid down to  $V_{CC} = 0.7V$  at 25°C.

The STM1061 has an open drain active-low output which will sink current when output is asserted. Connect a pull-up resistor from  $\overline{OUT}$  to any supply voltage up to 6V (see [Figure 6 on page 6](#)). 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 10k pull-up is sufficient in most applications.

The advantages of open drain output is the ability to connect more open drain outputs in parallel (wired OR connections) as well as connect the output to a power supply voltage different from  $V_{CC}$ .

### 3.2 Negative-Going $V_{CC}$ Transients and Undershoot

The STM1061 device is relatively immune to negative-going  $V_{CC}$  transients (glitches). The graph (see [Figure 11 on page 11](#)) indicates the maximum pulse width a negative  $V_{CC}$  transient can have without causing a reset pulse. As the magnitude of the transient increases (further below the threshold), the maximum allowable pulse width decreases. Any combination of duration and overdrive which lies under the curve will NOT generate a reset signal.

A 0.1 $\mu$ F bypass capacitor mounted as close as possible to the  $V_{CC}$  pin provides additional transient immunity.

## 4 Typical Operating Characteristics

Figure 7. Supply Current vs. Input Voltage

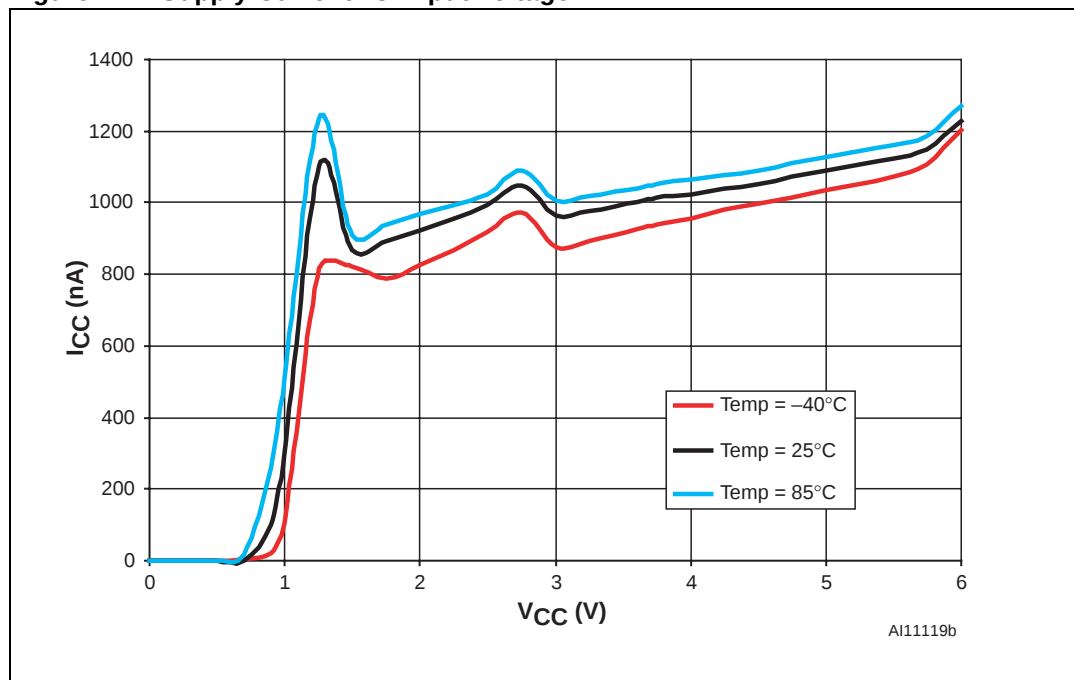


Figure 8. Supply Current vs. Ambient Temperature

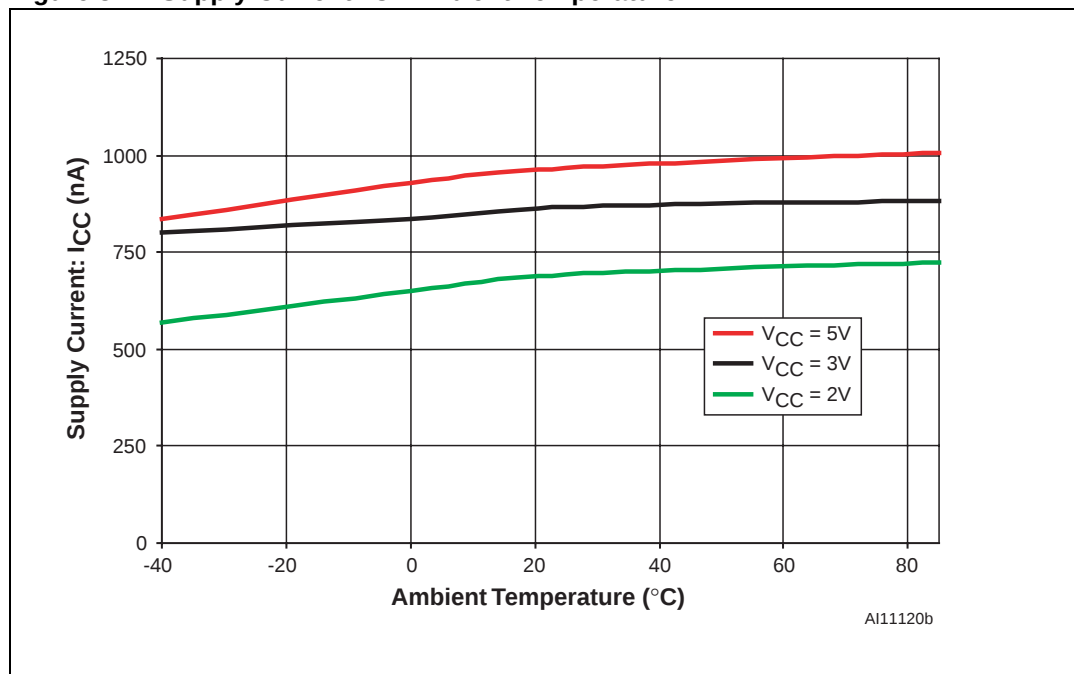


Figure 9. Output Detect Delay Time vs. Ambient Temperature

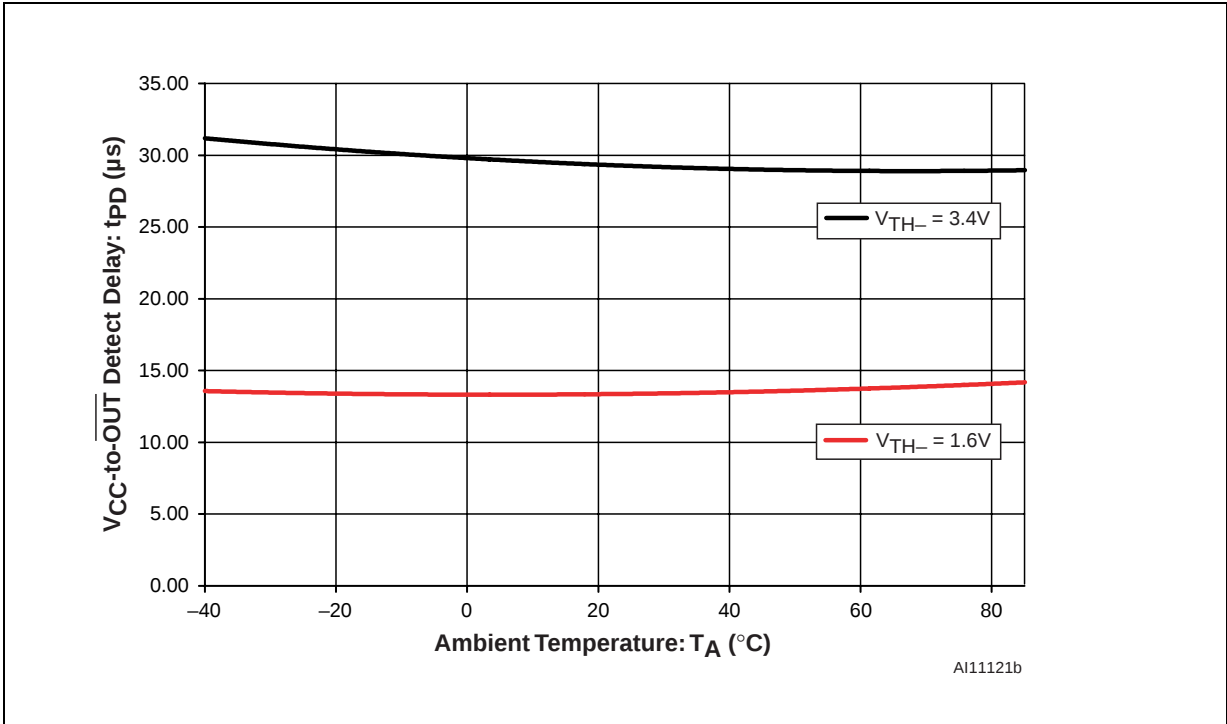


Figure 10. Output Release Delay Time vs. Ambient Temperature

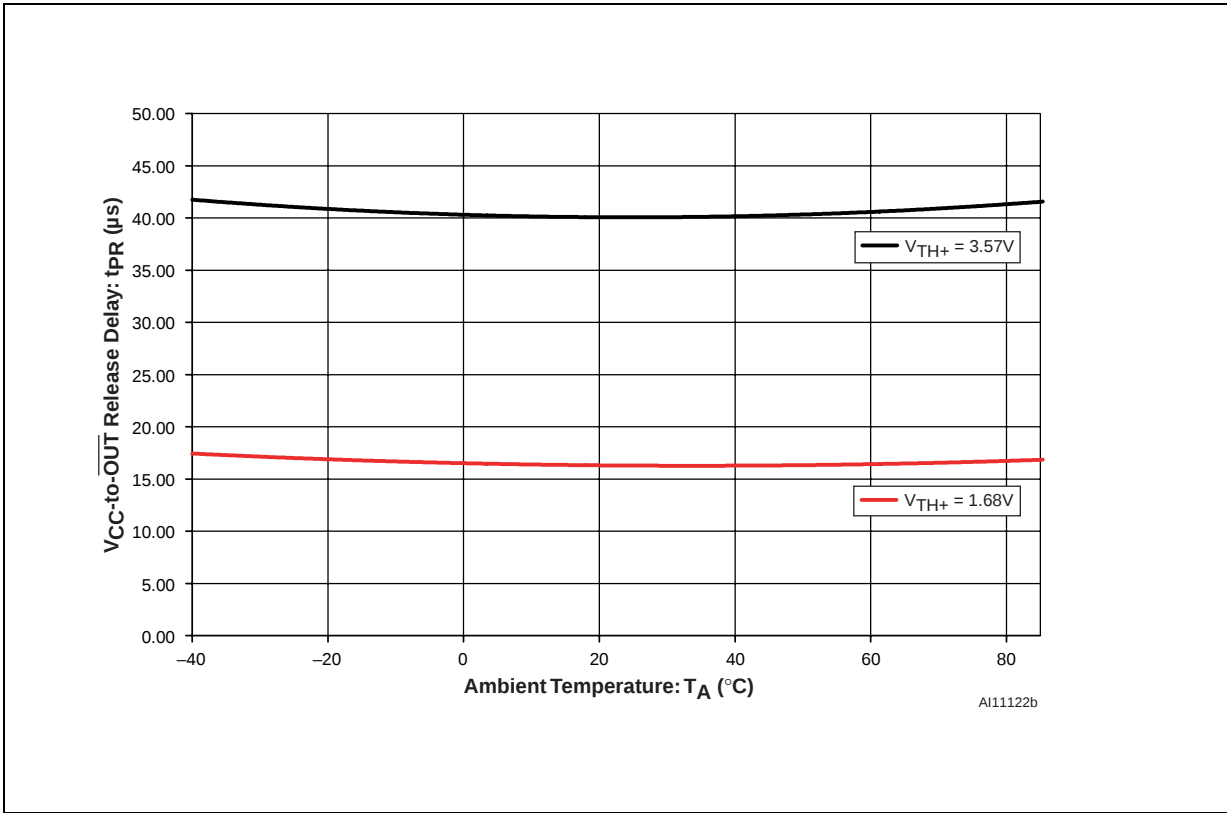
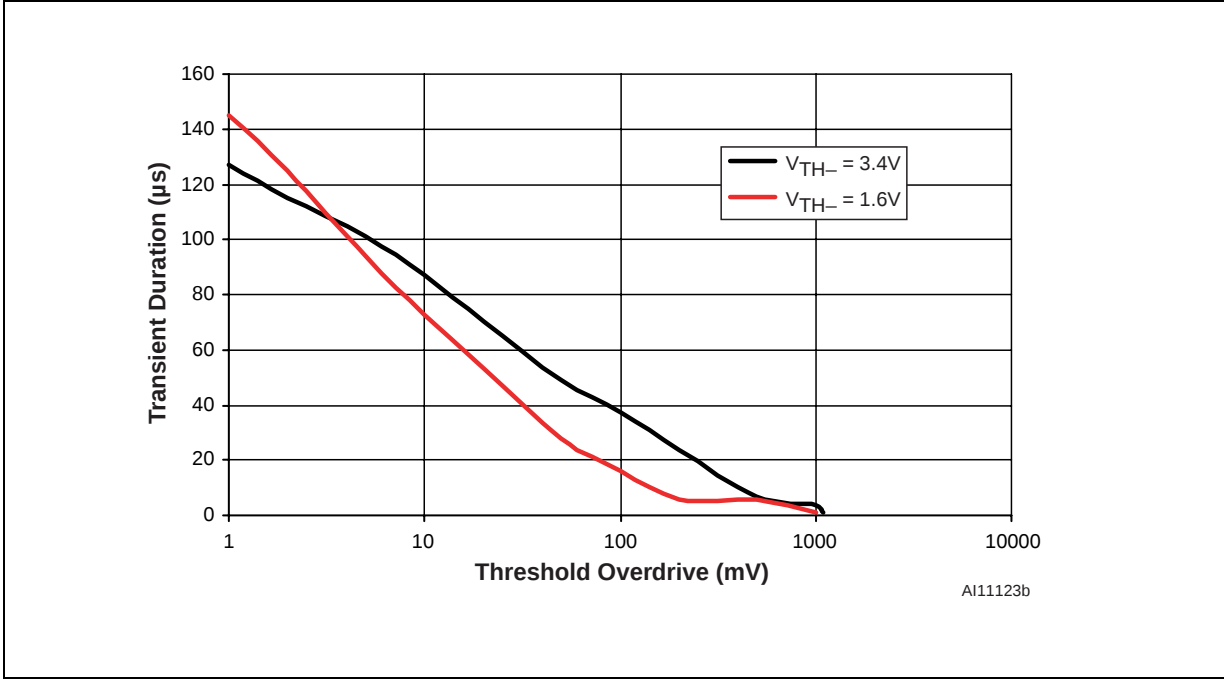


Figure 11. Maximum Transient Duration vs. Reset Threshold Overdrive



1. Reset occurs above the curve.

Figure 12. Detect, Release Voltage vs. Ambient Temperature for  $V_{TH-} = 3.4V$

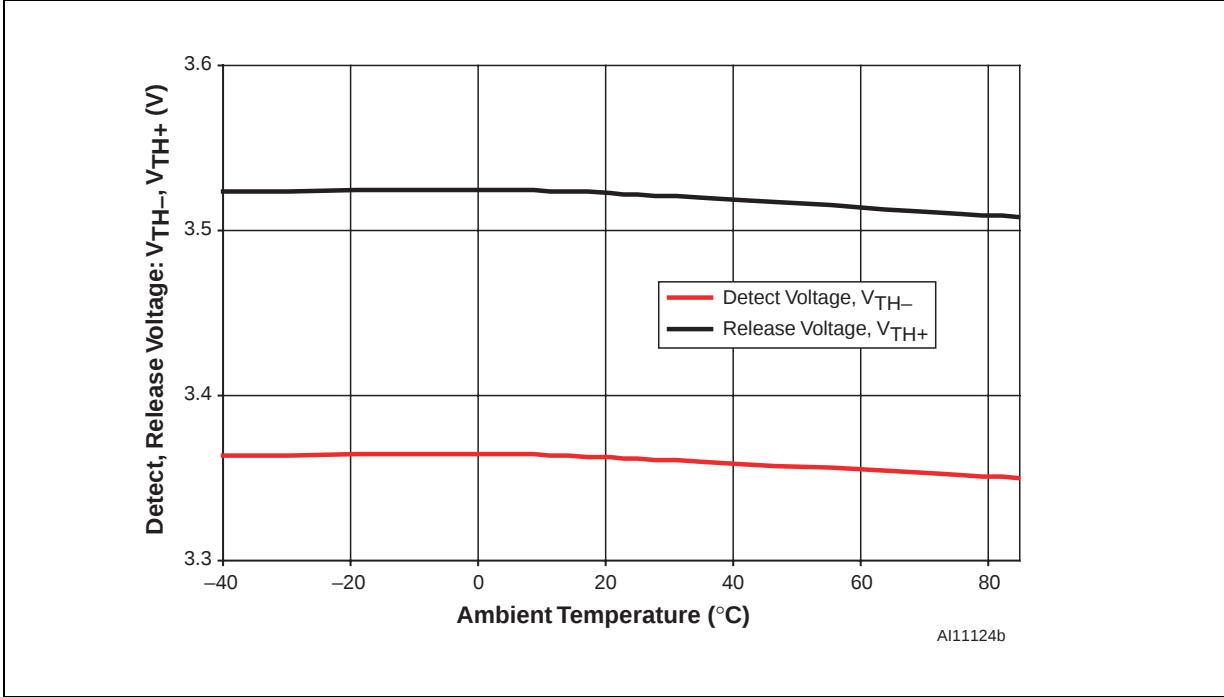


Figure 13. N-channel Driver Output Current vs.  $V_{DS}$

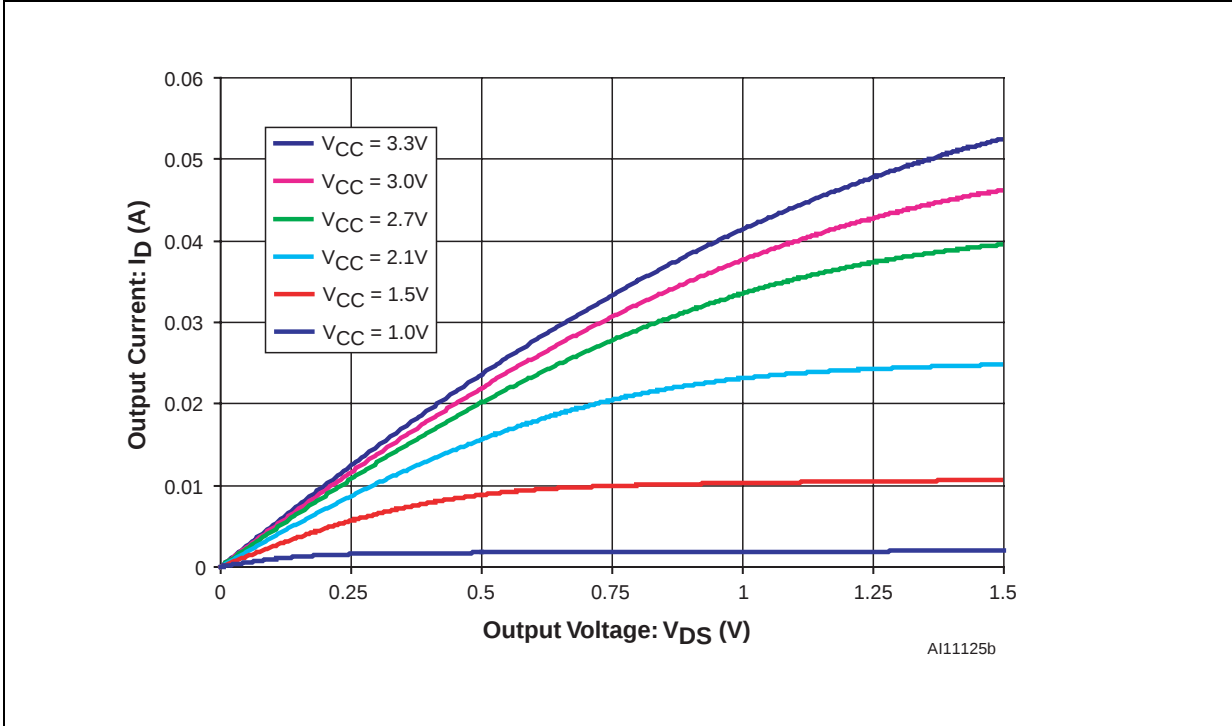
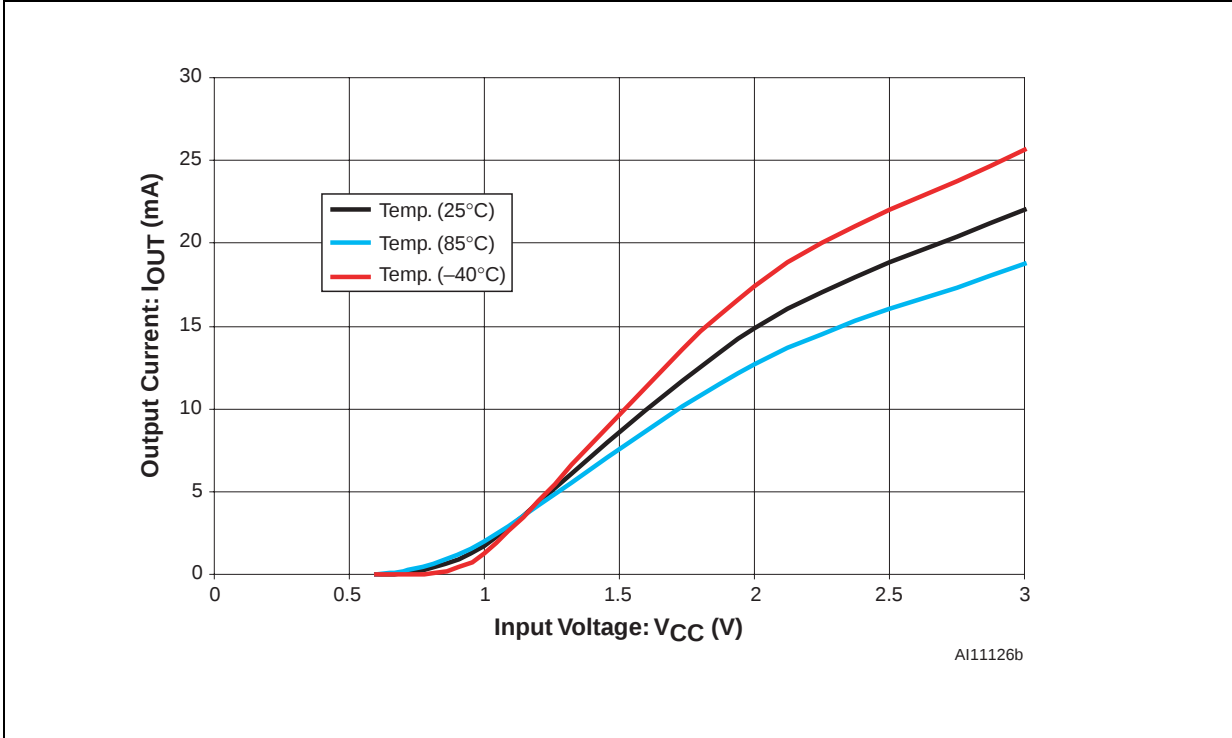


Figure 14. N-channel Driver Output Current vs. Input Voltage for  $V_{DS} = 0.5V$



## 5 Maximum Rating

Stressing the device above the rating listed in the [Table 3: Absolute Maximum Ratings](#) 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. Refer also to the STMicroelectronics SURE Program and other relevant quality documents.

**Table 3. Absolute Maximum Ratings**

| Symbol          | Parameter                                          | Value                  | Unit |
|-----------------|----------------------------------------------------|------------------------|------|
| $T_{STG}$       | Storage Temperature ( $V_{CC}$ Off, $V_{BAT}$ Off) | -55 to 150             | °C   |
| $T_{SLD}^{(1)}$ | Lead Solder Temperature for 10 seconds             | 260                    | °C   |
| $V_{IO}$        | Input or Output Voltage                            | -0.3 to $V_{CC} + 0.3$ | V    |
| $V_{CC}$        | Supply Voltage                                     | -0.3 to 7.0            | V    |
| $I_O$           | Output Current                                     | 20                     | mA   |
| $P_D$           | Power Dissipation                                  | 320                    | mW   |

1. Reflow at peak temperature of 260°C (total thermal budget not to exceed 245°C for greater than 30 seconds).

## 6 DC and AC Parameters

This section summarizes the operating measurement conditions, and the DC and AC characteristics of the device. The parameters in the DC and AC characteristics Tables that follow, are derived from tests performed under the Measurement Conditions summarized in [Table 4: Operating and AC Measurement Conditions](#). Designers should check that the operating conditions in their circuit match the operating conditions when relying on the quoted parameters.

**Table 4. Operating and AC Measurement Conditions**

| Sym             | Parameter                             | STM1061                   | Unit |
|-----------------|---------------------------------------|---------------------------|------|
| V <sub>CC</sub> | Supply Voltage                        | 0.7 to 6.0                | V    |
| T <sub>A</sub>  | Ambient Operating Temperature         | −40 to 85                 | °C   |
|                 | Input Rise and Fall Times             | ≤ 5                       | ns   |
|                 | Input Pulse Voltages                  | 0.2 to 0.8V <sub>CC</sub> | V    |
|                 | Input and Output Timing Ref. Voltages | 0.3 to 0.7V <sub>CC</sub> | V    |

**Figure 15. AC Testing Input/Output Waveforms**

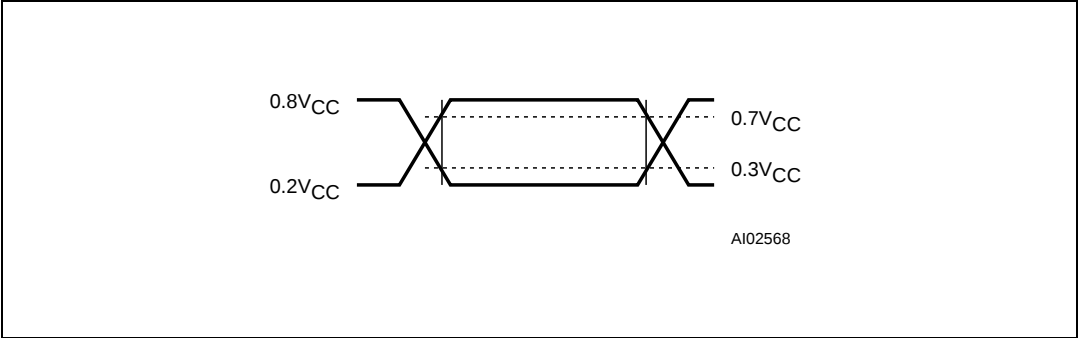


Figure 16. Voltage Timing Waveform

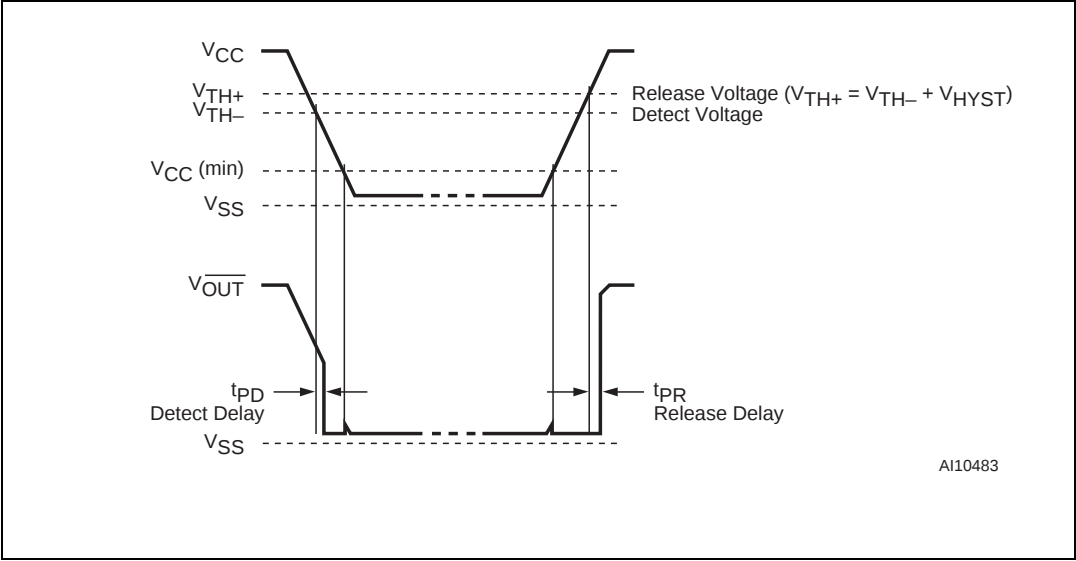


Table 5. DC and AC Characteristics

| Sym.               | Description                                                                                    | Test Condition <sup>(1)</sup>                                                                    | Min                   | Typ                                  | Max                   | Unit   |
|--------------------|------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|-----------------------|--------------------------------------|-----------------------|--------|
| V <sub>CC</sub>    | Operating Voltage                                                                              |                                                                                                  | 0.7                   |                                      | 6.0                   | V      |
| I <sub>CC</sub>    | V <sub>CC</sub> Supply Current                                                                 | V <sub>CC</sub> = 3.0V, No Load                                                                  |                       | 0.9                                  | 3.0                   | μA     |
|                    |                                                                                                | V <sub>CC</sub> = 5.5V, No Load                                                                  |                       | 1.1                                  | 3.6                   | μA     |
| I <sub>OUT</sub>   | Output Current, N-channel (V <sub>DS</sub> = 0.5V), Reset asserted                             | V <sub>CC</sub> = 1.0V                                                                           | 1.0                   | 1.7                                  |                       | mA     |
|                    |                                                                                                | V <sub>CC</sub> = 2.0V                                                                           | 3.0                   | 14                                   |                       | mA     |
|                    |                                                                                                | V <sub>CC</sub> = 3.0V                                                                           | 5.0                   | 22                                   |                       | mA     |
|                    |                                                                                                | V <sub>CC</sub> = 4.0V                                                                           | 6.0                   | 26                                   |                       | mA     |
|                    |                                                                                                | V <sub>CC</sub> = 5.0V                                                                           | 7.0                   | 30                                   |                       | mA     |
| Voltage Thresholds |                                                                                                |                                                                                                  |                       |                                      |                       |        |
| V <sub>TH-</sub>   | Detect Voltage <sup>(2)</sup><br>(see <a href="#">Table 9 on page 21</a> for detailed listing) |                                                                                                  | V <sub>TH-</sub> – 2% | V <sub>TH-</sub>                     | V <sub>TH-</sub> + 2% | V      |
| V <sub>TH+</sub>   | Release Voltage                                                                                |                                                                                                  |                       | V <sub>TH-</sub> + V <sub>HYST</sub> |                       | V      |
| V <sub>HYST</sub>  | Threshold Hysteresis                                                                           |                                                                                                  | 0.02V <sub>TH-</sub>  | 0.05V <sub>TH-</sub>                 | 0.08V <sub>TH-</sub>  | V      |
| t <sub>PD</sub>    | V <sub>CC</sub> to $\overline{OUT}$ Detect Delay                                               | V <sub>CC</sub> falling from (V <sub>TH-</sub> + 100mV) to (V <sub>TH-</sub> – 100mV) at 10mV/μs |                       | 25                                   |                       | μs     |
| t <sub>PR</sub>    | V <sub>CC</sub> to $\overline{OUT}$ Release Delay                                              | V <sub>CC</sub> rising from (V <sub>TH+</sub> – 100mV) to (V <sub>TH+</sub> + 100mV) at 10mV/μs  |                       | 30                                   | 200                   | μs     |
|                    | Threshold Temperature Coefficient                                                              |                                                                                                  |                       | ±100                                 |                       | ppm/°C |

1. Valid for Ambient Operating Temperature:  $T_A = 25^{\circ}C$ .

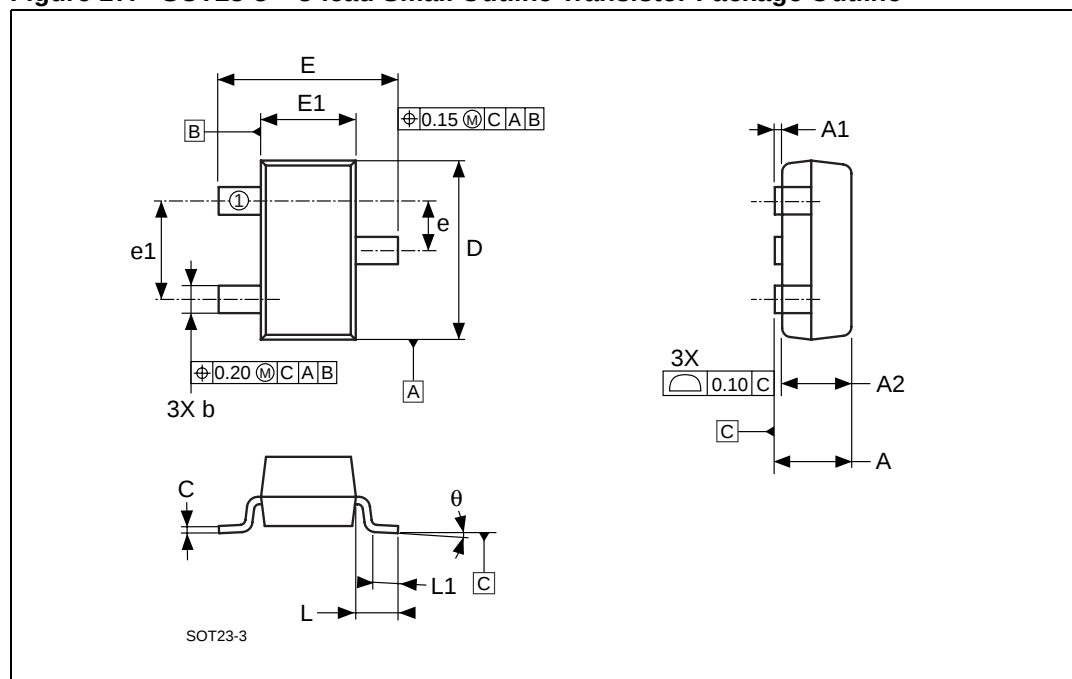
2. Other  $V_{TH-}$  threshold are offered. Minimum order quantities may apply. Contact local sales office for availability.

## 7 Package Mechanical

In order to meet environmental requirements, ST offers these devices in ECOPACK® packages. These packages have a Lead-free second level interconnect. The category of second Level Interconnect is marked on the package and on the inner box label, in compliance with JEDEC Standard JESD97.

The maximum ratings related to soldering conditions are also marked on the inner box label. ECOPACK is an ST trademark. ECOPACK specifications are available at: [www.st.com](http://www.st.com).

**Figure 17. SOT23-3 – 3-lead Small Outline Transistor Package Outline**

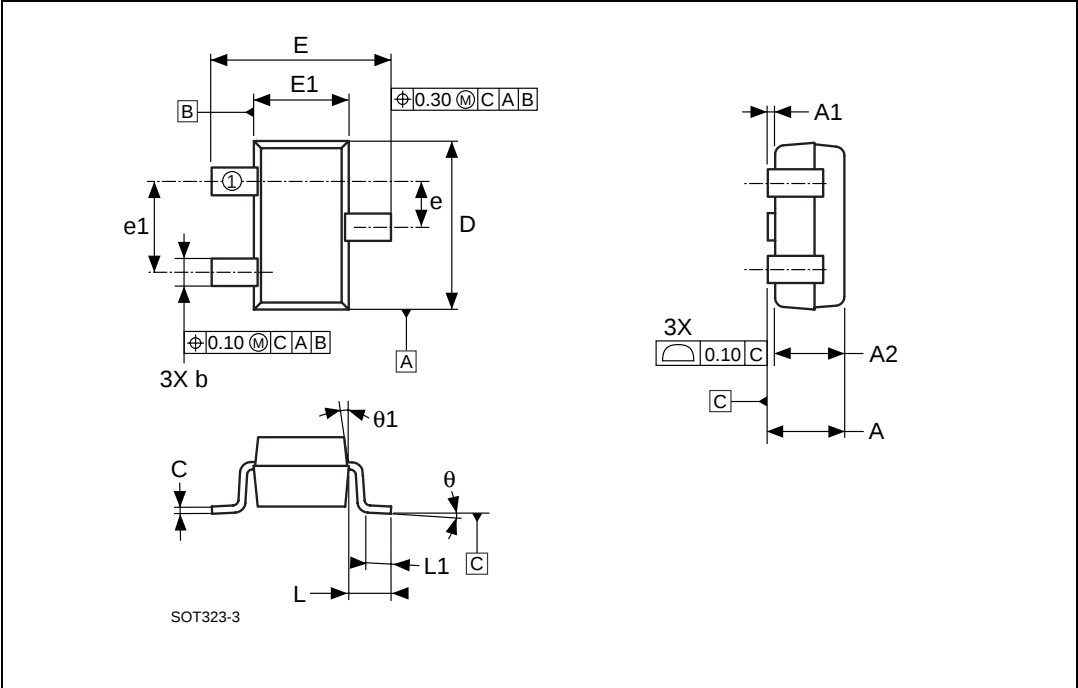


1. Drawing is not to scale.

**Table 6. SOT23-3 – 3-lead Small Outline Transistor Package Mechanical Data**

| Symbol | mm   |      |      | inches |       |       |
|--------|------|------|------|--------|-------|-------|
|        | Typ  | Min  | Max  | Typ    | Min   | Max   |
| A      |      | 0.89 | 1.12 |        | 0.035 | 0.044 |
| A1     |      | 0.01 | 0.10 |        | 0.001 | 0.004 |
| A2     |      | 0.88 | 1.02 |        | 0.035 | 0.042 |
| b      |      | 0.30 | 0.50 |        | 0.012 | 0.020 |
| C      |      | 0.08 | 0.20 |        | 0.003 | 0.008 |
| D      |      | 2.80 | 3.04 |        | 0.110 | 0.120 |
| E      |      | 2.10 | 2.64 |        | 0.083 | 0.104 |
| E1     |      | 1.20 | 1.40 |        | 0.047 | 0.055 |
| e      |      | 0.89 | 1.03 |        | 0.035 | 0.041 |
| e1     |      | 1.78 | 2.05 |        | 0.070 | 0.081 |
| L      | 0.54 |      |      | 0.021  |       |       |
| L1     |      | 0.40 | 0.60 |        | 0.016 | 0.024 |
| Q      |      | 0°   | 8°   |        | 0°    | 8°    |
| N      |      | 3    |      |        | 3     |       |

Figure 18. SOT323-3 (SC70-3) – 3-lead Small Outline Transistor Package Outline



1. Drawing is not to scale.

Table 7. SOT323-3 (SC70-3) – 3-lead Small Outline Transistor Package Mechanical Data

| Symbol | mm  |      |      | inches |       |       |
|--------|-----|------|------|--------|-------|-------|
|        | Typ | Min  | Max  | Typ    | Min   | Max   |
| A      |     | 0.80 | 1.10 |        | 0.031 | 0.043 |
| A1     |     | 0.00 | 0.10 |        | 0.000 | 0.004 |
| A2     |     | 0.80 | 1.00 |        | 0.031 | 0.039 |
| b      |     | 0.25 | 0.40 |        | 0.010 | 0.016 |
| C      |     | 0.10 | 0.18 |        | 0.004 | 0.007 |
| D      |     | 1.80 | 2.20 |        | 0.071 | 0.087 |
| E      |     | 1.80 | 2.40 |        | 0.071 | 0.094 |
| E1     |     | 1.15 | 1.35 |        | 0.045 | 0.053 |
| e      |     | 0.65 |      |        | 0.026 |       |
| e1     |     | 1.30 |      |        | 0.051 |       |
| L      |     | 0.35 | 0.45 |        | 0.014 | 0.018 |
| L1     |     | 0.10 | 0.30 |        | 0.004 | 0.012 |
| Q      |     | 0°   | 30°  |        | 0°    | 30°   |
| Ø1     |     | 8°   | 12°  |        | 8°    | 12°   |
| N      | 3   |      |      | 3      |       |       |

# 8 Part Numbering

**Table 8. Ordering Information Scheme**

|                                             |         |   |    |    |   |   |
|---------------------------------------------|---------|---|----|----|---|---|
| Example:                                    | STM1061 | N | xx | WX | 6 | F |
| <b>Device Type</b>                          |         |   |    |    |   |   |
| STM1061                                     |         |   |    |    |   |   |
| <b>Output Type</b>                          |         |   |    |    |   |   |
| N = Open Drain (Active-Low)                 |         |   |    |    |   |   |
| <b>Threshold Voltage <sup>(1)</sup></b>     |         |   |    |    |   |   |
| xx = See <a href="#">Table 9 on page 21</a> |         |   |    |    |   |   |
| <b>Package</b>                              |         |   |    |    |   |   |
| WX = SOT23-3                                |         |   |    |    |   |   |
| W = SOT323-3 (SC70-3) <sup>(1)</sup>        |         |   |    |    |   |   |
| <b>Temperature Range</b>                    |         |   |    |    |   |   |
| 6 = -40 to 85°C                             |         |   |    |    |   |   |
| <b>Shipping Method</b>                      |         |   |    |    |   |   |
| F = ECOPACK Package, Tape & Reel            |         |   |    |    |   |   |

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

For other options, or for more information on any aspect of this device, please contact the ST Sales Office nearest you.

**Table 9. Factory-Trimmed Thresholds with Marking Description**

| Suffix | Threshold Voltage $V_{TH-}$ (V) at $T_A = 25^\circ\text{C}$ <sup>(1)</sup> |       |           | Topside Marking |
|--------|----------------------------------------------------------------------------|-------|-----------|-----------------|
|        | Min (-2%)                                                                  | Typ   | Max (+2%) |                 |
| 16     | 1.568                                                                      | 1.600 | 1.632     | 16Nx            |
| 17     | 1.666                                                                      | 1.700 | 1.734     | 17Nx            |
| 19     | 1.862                                                                      | 1.900 | 1.938     | 19Nx            |
| 21     | 2.058                                                                      | 2.100 | 2.142     | 21Nx            |
| 22     | 2.156                                                                      | 2.200 | 2.244     | 22Nx            |
| 23     | 2.254                                                                      | 2.300 | 2.346     | 23Nx            |
| 25     | 2.450                                                                      | 2.500 | 2.550     | 25Nx            |
| 26     | 2.548                                                                      | 2.600 | 2.652     | 26Nx            |
| 27     | 2.646                                                                      | 2.700 | 2.754     | 27Nx            |
| 28     | 2.744                                                                      | 2.800 | 2.856     | 28Nx            |
| 29     | 2.842                                                                      | 2.900 | 2.958     | 29Nx            |
| 30     | 2.940                                                                      | 3.000 | 3.060     | 30Nx            |
| 31     | 3.038                                                                      | 3.100 | 3.162     | 31Nx            |
| 34     | 3.332                                                                      | 3.400 | 3.468     | 34Nx            |
| 38     | 3.724                                                                      | 3.800 | 3.876     | 38Nx            |

1. Other  $V_{TH-}$  thresholds are offered. Minimum order quantities may apply. Contact local sales office for availability.

## 9 Revision History

**Table 10. Document Revision History**

| Date            | Version | Description                                                                                                                                                                                                                                                                                                                                           |
|-----------------|---------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 20-January-2004 | 1.0     | First Edition                                                                                                                                                                                                                                                                                                                                         |
| 01-Aug-05       | 1.1     | Update Operation section, characteristics; insert new graphics; add ECOPACK information ( <a href="#">Figure 7</a> , <a href="#">8</a> , <a href="#">9</a> , <a href="#">10</a> , <a href="#">11</a> , <a href="#">12</a> , <a href="#">13</a> , and <a href="#">14</a> ; Table <a href="#">Table 5</a> , <a href="#">8</a> , and <a href="#">9</a> ) |
| 02-Sep-05       | 1.2     | Update characteristics, remove 'push-pull output' reference ( <a href="#">Figure 8</a> , <a href="#">9</a> , <a href="#">10</a> , <a href="#">11</a> , <a href="#">12</a> , and <a href="#">16</a> ; Table <a href="#">Table 2</a> , <a href="#">5</a> , and <a href="#">8</a> )                                                                      |
| 19-Oct-05       | 2.0     | Status upgrade; update characteristics; add Marking information ( <a href="#">Figure 7</a> , <a href="#">8</a> , <a href="#">9</a> , <a href="#">10</a> , <a href="#">11</a> , <a href="#">12</a> , <a href="#">13</a> , and <a href="#">14</a> ; Table <a href="#">Table 8</a> , and <a href="#">9</a> )                                             |
| 18-Nov-05       | 3.0     | Update characteristics ( <a href="#">Table 3</a> , and <a href="#">4</a> )                                                                                                                                                                                                                                                                            |
| 27-Jul-2006     | 4       | Update <a href="#">Chapter : Features</a> , <a href="#">Figure 1</a> , <a href="#">5</a> , <a href="#">6</a> , <a href="#">Table 8</a> and <a href="#">9</a> .                                                                                                                                                                                        |

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