

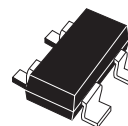
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## Open drain microprocessor reset

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### Features

- Low supply current of 1.5µA (typ)
- ±1.8% reset threshold accuracy (25°C)
- Guaranteed  $\overline{\text{RST}}$  assertion down to  $V_{\text{CC}} = 1.0\text{V}$
- Open drain  $\overline{\text{RST}}$  output can exceed  $V_{\text{CC}}$
- Power supply transient immunity
- Operating temperature: -40 to +125°C
- Available in SOT143-4 package.



SOT143-4 (W1)

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# 1Summary description

The STM6315 Microprocessor Reset Circuit is a low power supervisory device used to monitor power supplies. It performs a single function: asserting a reset signal whenever the  $V_{CC}$  supply voltage drops below a preset value and keeping it asserted until  $V_{CC}$  has risen above the preset threshold for a minimum period of time ( $t_{rec}$ ). It also provides a manual reset input ( $\overline{MR}$ ). The open drain  $\overline{RST}$  output can be pulled up to a voltage higher than  $V_{CC}$ , but less than 6V.

The STM6315 comes with standard factory-trimmed reset thresholds of 2.63V, 2.93V, 3.08V, 4.38V, and 4.63V. The STM6315 is available in the SOT143-4 package.

Figure 1. Logic diagram

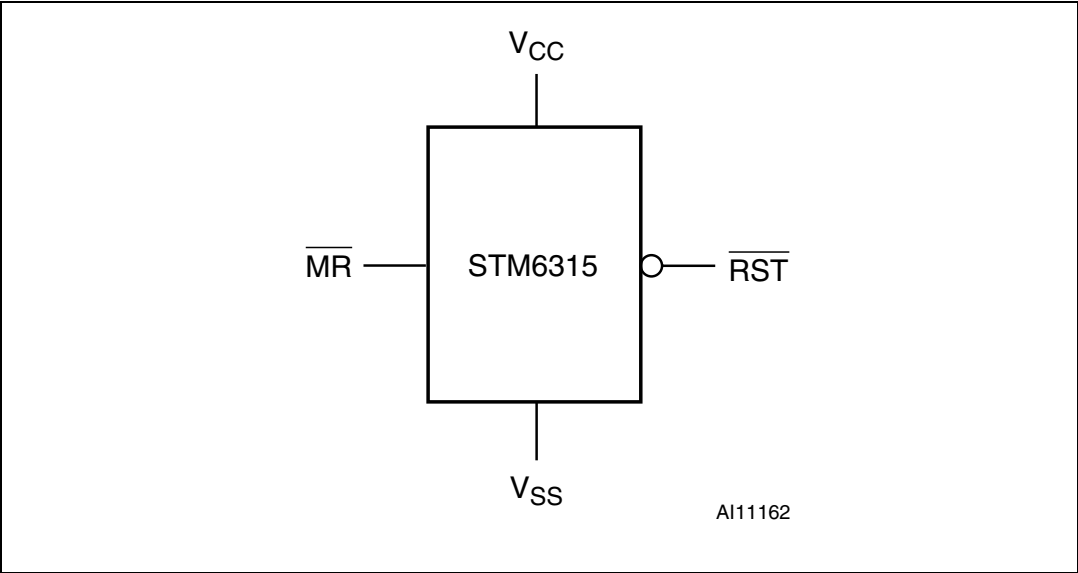


Table 1. Signal names

| Symbol           | Description                        |
|------------------|------------------------------------|
| $V_{CC}$         | Supply voltage                     |
| $\overline{MR}$  | Manual reset input                 |
| $\overline{RST}$ | Active-low open drain reset output |
| $V_{SS}$         | Ground                             |

Figure 2. SOT143-4 connections (top view)

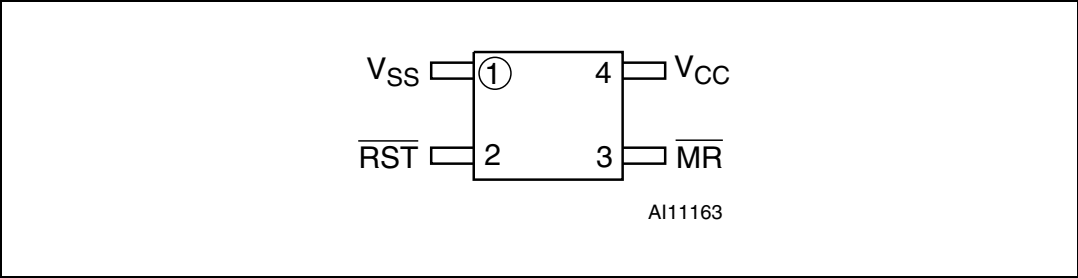


Figure 3. Block diagram

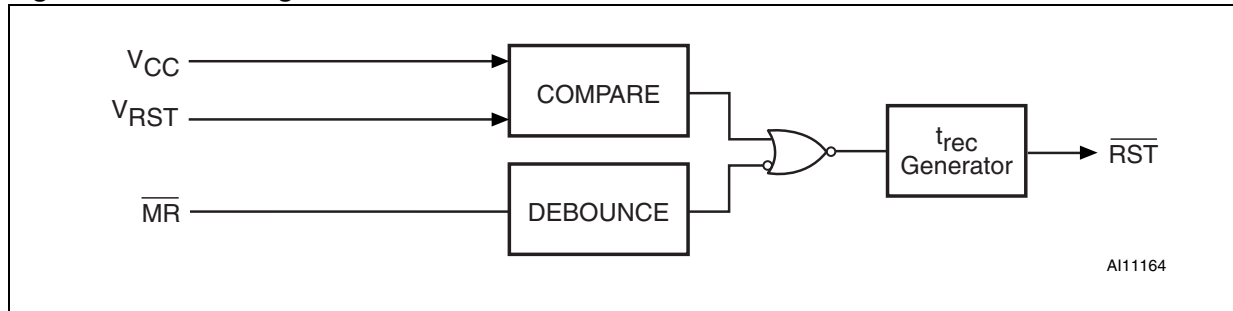
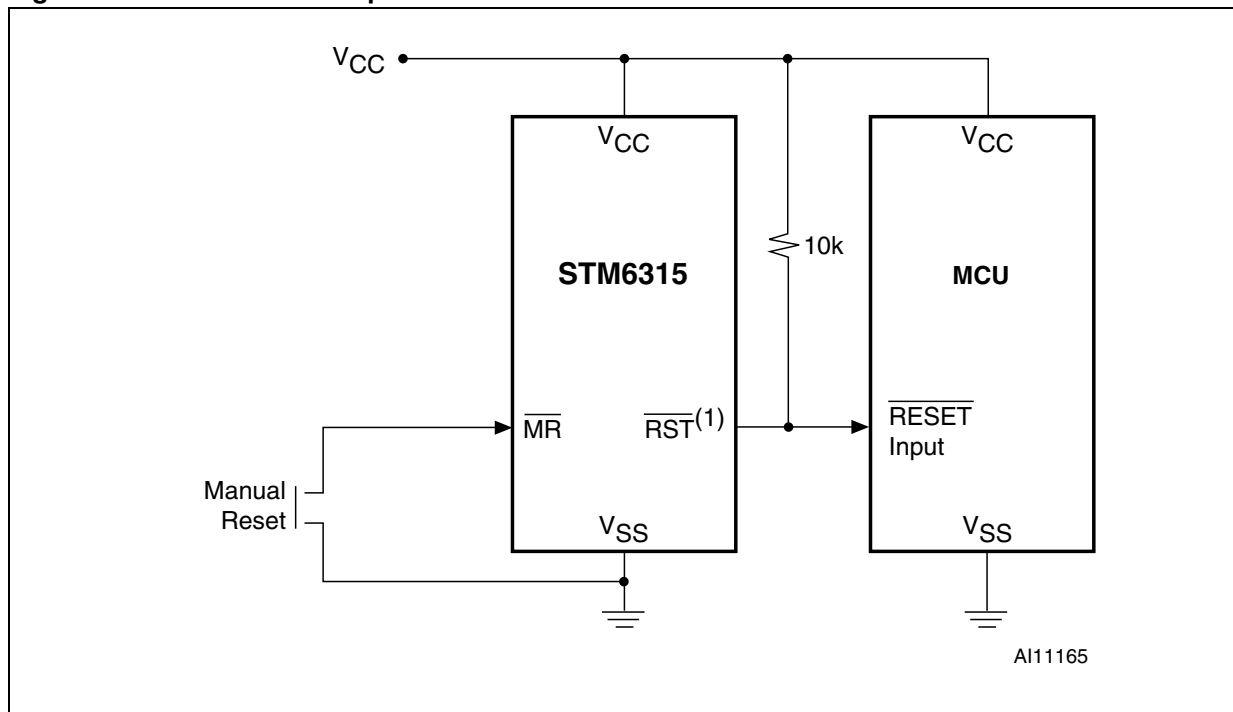


Figure 4. Hardware hookup



1. Open drain  $\overline{RST}$  output requires external pull-up resistor.

## 2 Operation

### 2.1 Reset output

The STM6315 Microprocessor Reset Circuit has an active-low, open drain reset output. This output structure will sink current when  $\overline{RST}$  is asserted. Connect a pull-up resistor from  $\overline{RST}$  to any supply voltage up to 6V (see [Figure 4 on page 6](#)). Select a resistor value large enough to register a logic low, and small enough to register a logic high while supplying all input current and leakage paths connected to the reset output line. A 10k pull-up is sufficient in most applications.

The STM6315 asserts a reset signal to the MCU whenever  $V_{CC}$  goes below the reset threshold ( $V_{RST}$ ), or when the manual reset input ( $\overline{MR}$ ) is taken low (see [Figure 5](#) and [Figure 6 on page 8](#)).  $\overline{RST}$  is guaranteed valid down to  $V_{CC} = 1.0V$ .

During power-up, (once  $V_{CC}$  exceeds the reset threshold) an internal timer keeps  $\overline{RST}$  low for the reset time-out period,  $t_{rec}$ . After this interval,  $\overline{RST}$  returns high.

If  $V_{CC}$  drops below the reset threshold,  $\overline{RST}$  goes low. Each time  $\overline{RST}$  is asserted, it stays low for at least the reset time-out period. Any time  $V_{CC}$  goes below the reset threshold, the internal timer clears. The reset timer starts when  $V_{CC}$  returns above the reset threshold.

### 2.2 Manual reset input

A logic low on  $\overline{MR}$  asserts  $\overline{RST}$ .  $\overline{RST}$  remains asserted while  $\overline{MR}$  is low, and for  $t_{rec}$  after it returns high. The  $\overline{MR}$  input has an internal pull-up resistor 63k $\Omega$  (typ), allowing it to be left open if not used.

This input can be driven with TTL/CMOS-logic levels or with open drain/collector outputs. Connect a standard open push-button switch from  $\overline{MR}$  to  $V_{SS}$  to create a manual reset function (see [Figure 4 on page 6](#)); external debounce circuitry is not required. If the device is used in a noisy environment, connect a 0.1 $\mu F$  capacitor from  $\overline{MR}$  to  $V_{SS}$  to provide additional noise immunity.

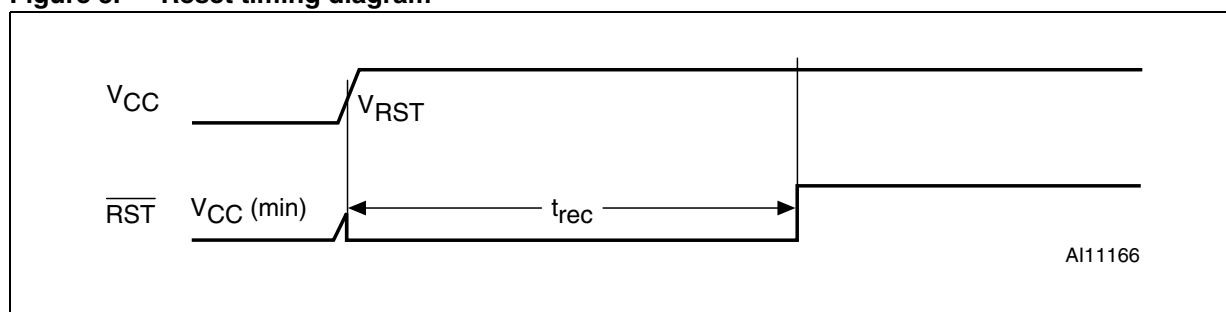
### 2.3 Negative-going $V_{CC}$ transients

The STM6315 is relatively immune to negative-going  $V_{CC}$  transients (glitches). [Figure 12 on page 11](#) shows typical transient duration versus reset comparator overdrive (for which the STM6315 will NOT generate a reset pulse). The graph was generated using a negative pulse applied to  $V_{CC}$ , starting at 0.5V above the actual reset threshold and ending below it by the magnitude indicated (Reset Threshold Overdrive). The graph 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 (see [Figure 12](#)). A 0.1 $\mu F$  bypass capacitor mounted as close as possible to the  $V_{CC}$  pin provides additional transient immunity.

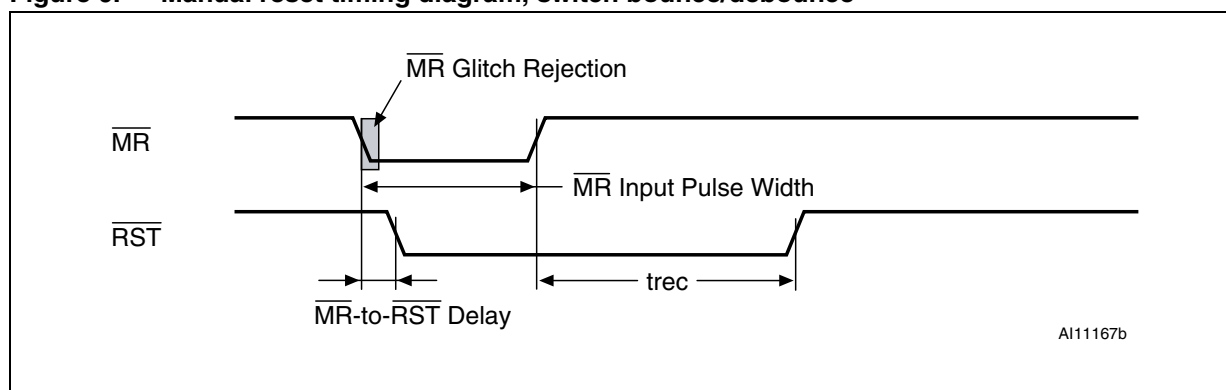
## 2.4 Valid $\overline{\text{RST}}$ output down to $V_{\text{CC}} = 0\text{V}$

When  $V_{\text{CC}}$  falls below 1V, the  $\overline{\text{RST}}$  output no longer sinks current, but becomes an open circuit. In most systems this is not a problem, as most MCUs do not operate below 1V. However, in applications where  $\overline{\text{RST}}$  output must be valid down to 0V, a pull-down resistor may be added to hold the  $\overline{\text{RST}}$  output low. This resistor must be large enough to not load the  $\overline{\text{RST}}$  output, and still be small enough to pull the output to Ground. A 100K $\Omega$  resistor is recommended.

**Figure 5. Reset timing diagram**



**Figure 6. Manual reset timing diagram, switch bounce/debounce**





### 3 Typical operating characteristics

Note: Typical values are at  $T_A = 25^\circ\text{C}$ .

Figure 7. Supply current vs. supply voltage,  $V_{RST} = 2.63\text{V}$

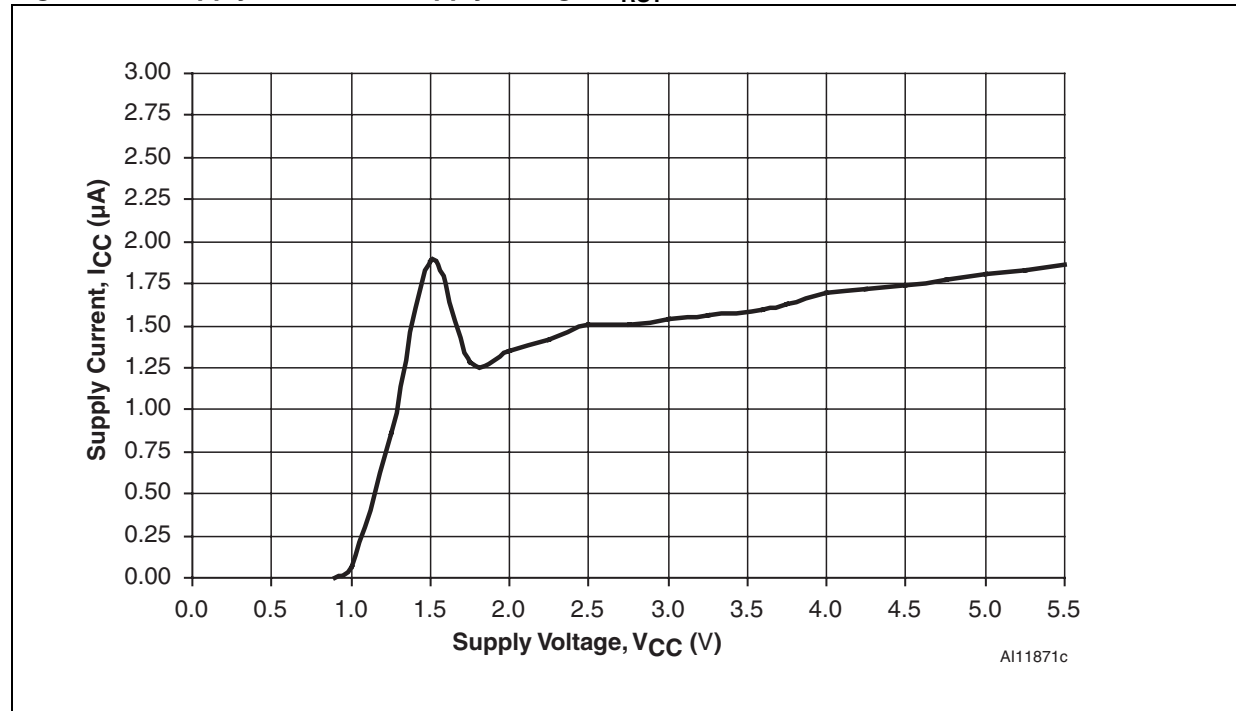


Figure 8. Supply current vs. temperature (no load),  $V_{RST} = 2.63\text{V}$

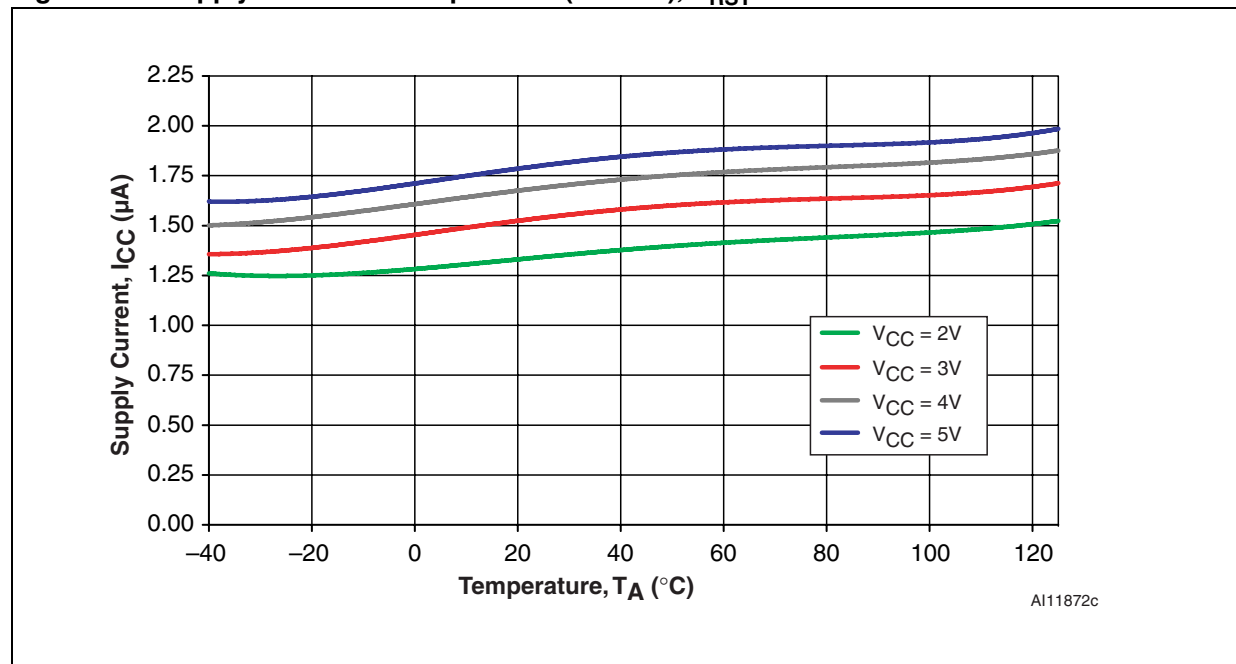


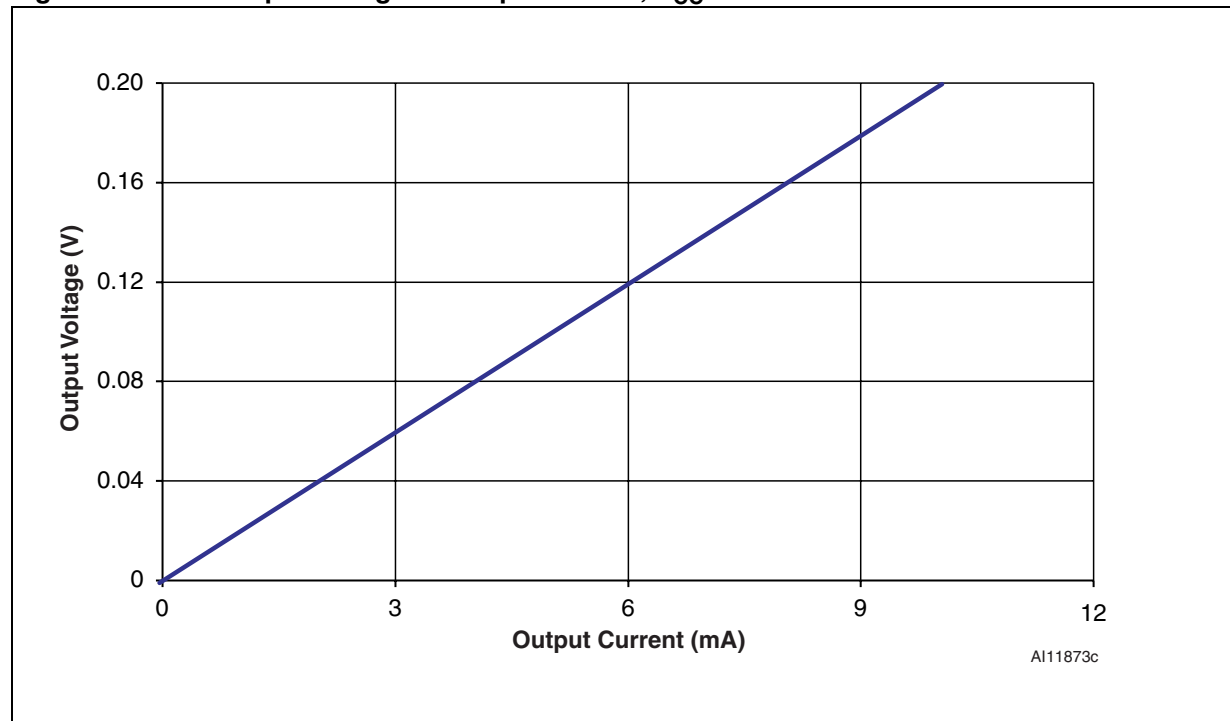
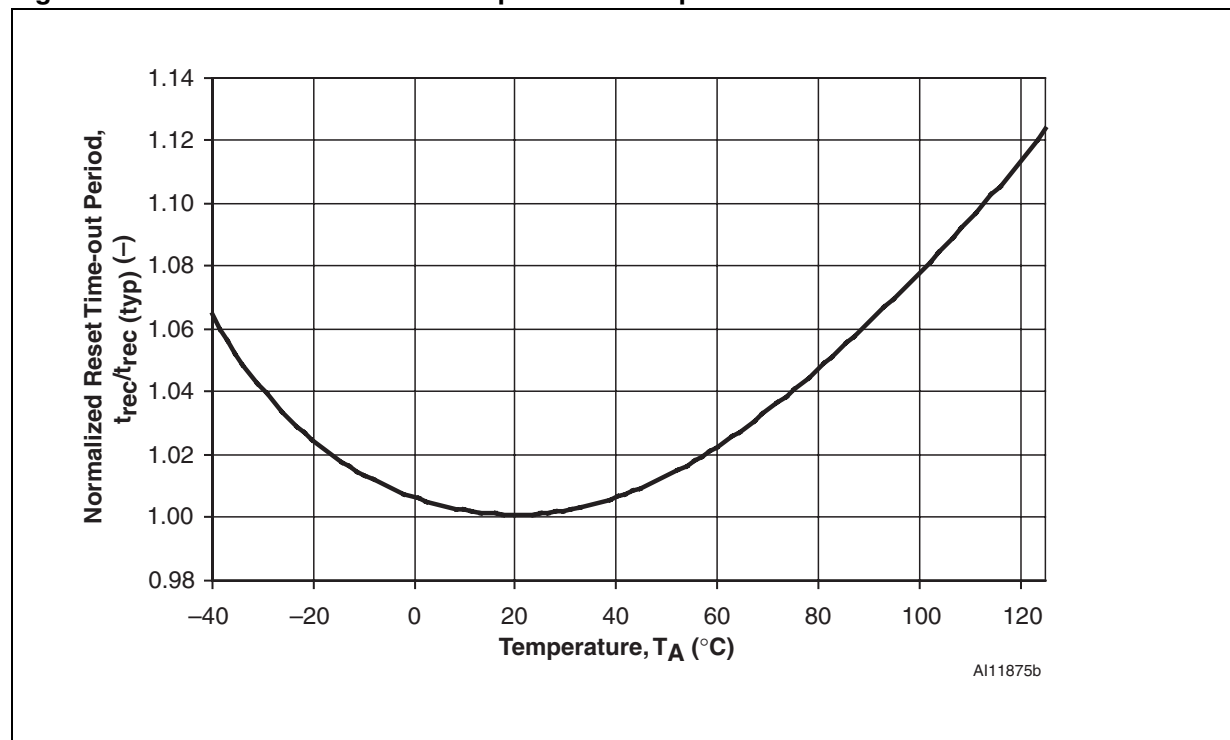
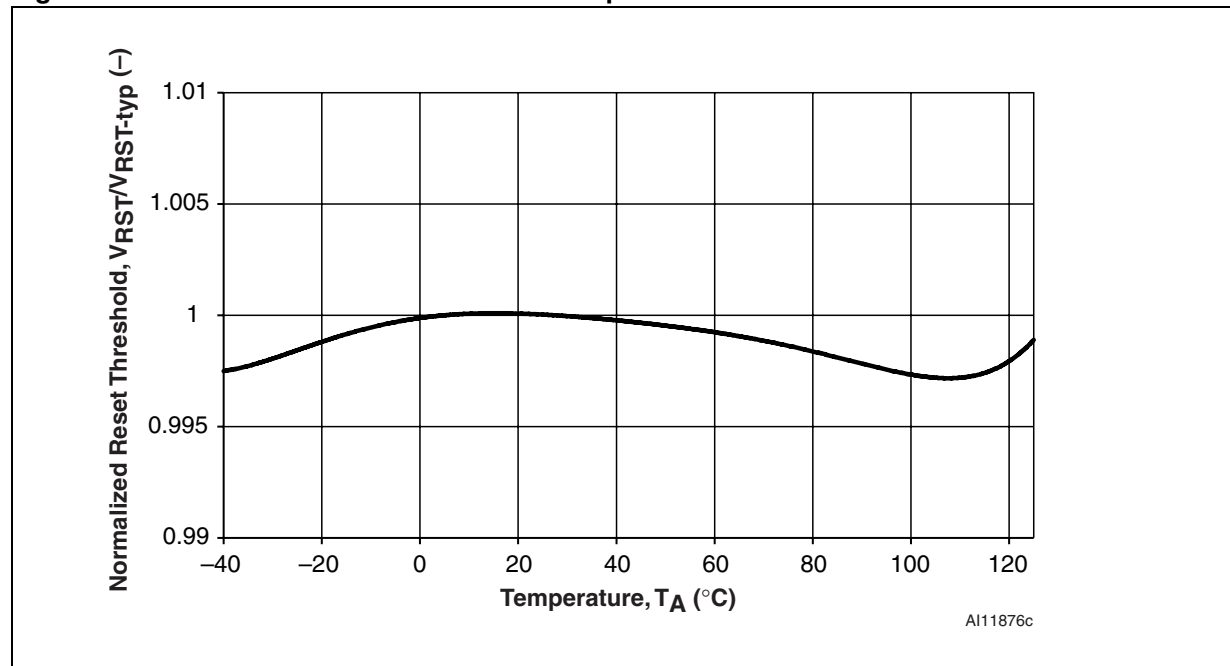
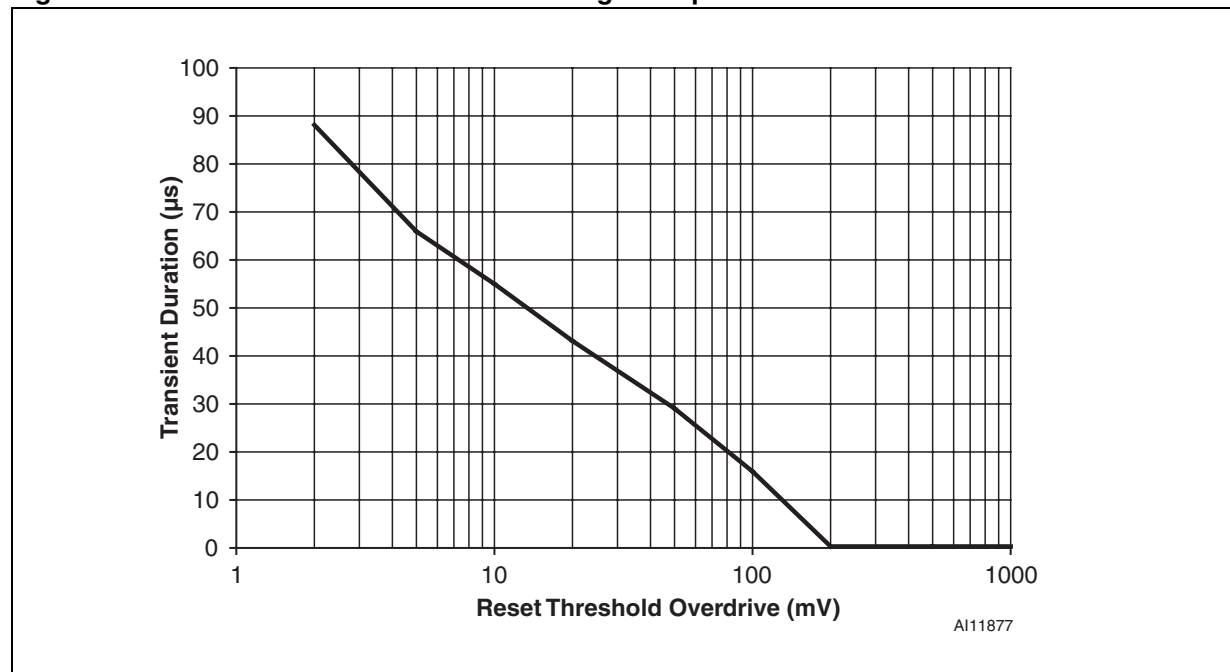
Figure 9.  $\overline{\text{RST}}$  output voltage vs. output current,  $V_{\text{CC}} = 4.25\text{V}$ 

Figure 10. Normalized reset time-out period vs. temperature



**Figure 11. Normalized reset threshold vs. temperature****Figure 12. Max. transient duration not causing reset pulse vs. reset threshold Overdrive**

**Note:** Reset occurs above the curve.

## 4 Maximum rating

Stressing the device above the rating listed in the [Table 2: 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 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   |
| $V_{IO}$        | 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).

# 5 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 3: 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 3. Operating and AC measurement conditions**

| Parameter                                       | STM6315                   | Unit |
|-------------------------------------------------|---------------------------|------|
| V <sub>CC</sub> Supply Voltage                  | 1.0 to 5.5                | V    |
| Ambient Operating Temperature (T <sub>A</sub> ) | −40 to +125               | °C   |
| Input Rise and Fall Times                       | ~5                        | ns   |
| Input Pulse Voltages                            | 0.2 to 0.8V <sub>CC</sub> | V    |
| Input and Output Timing Reference Voltages      | 0.3 to 0.7V <sub>CC</sub> | V    |

**Figure 13. AC testing input/output waveforms**

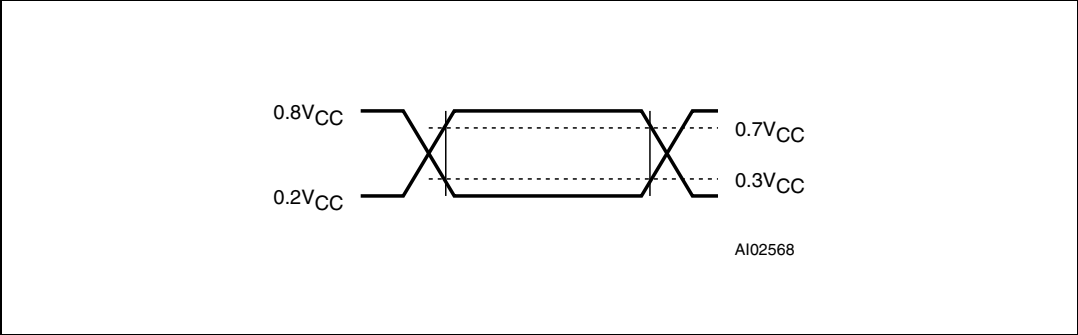


Table 4. DC and AC characteristics

| Sym              | Description                                                                                     |               | Test Condition <sup>(1)</sup>                                                                         | Min                     | Typ              | Max                     | Unit   |
|------------------|-------------------------------------------------------------------------------------------------|---------------|-------------------------------------------------------------------------------------------------------|-------------------------|------------------|-------------------------|--------|
| V <sub>CC</sub>  | Operating voltage                                                                               |               |                                                                                                       | 1.0                     |                  | 5.5                     | V      |
| I <sub>CC</sub>  | V <sub>CC</sub> supply current                                                                  |               | V <sub>CC</sub> = 5.5V, no load<br>T <sub>A</sub> = −40 to +85°C                                      |                         | 2.0              | 12                      | μA     |
|                  |                                                                                                 |               | V <sub>CC</sub> = 5.5V, no load<br>T <sub>A</sub> = −40 to +125°C                                     |                         |                  | 15                      | μA     |
|                  |                                                                                                 |               | V <sub>CC</sub> = 3.6V, no load<br>T <sub>A</sub> = −40 to +85°C                                      |                         | 1.5              | 10                      | μA     |
|                  |                                                                                                 |               | V <sub>CC</sub> = 3.6V, no load<br>T <sub>A</sub> = −40 to +125°C                                     |                         |                  | 12                      | μA     |
| V <sub>OL</sub>  | $\overline{\text{RST}}$ output voltage                                                          |               | V <sub>CC</sub> > 4.25V, I <sub>SINK</sub> = 3.2mA                                                    |                         |                  | 0.4                     | V      |
|                  |                                                                                                 |               | V <sub>CC</sub> > 2.5V, I <sub>SINK</sub> = 1.2mA                                                     |                         |                  | 0.3                     | V      |
|                  |                                                                                                 |               | V <sub>CC</sub> > 1.0V, I <sub>SINK</sub> = 80μA                                                      |                         |                  | 0.3                     | V      |
|                  | $\overline{\text{RST}}$ output open drain Leakage Current                                       |               | V <sub>CC</sub> > V <sub>RST</sub> , $\overline{\text{RST}}$ not asserted                             |                         |                  | 1                       | μA     |
| Reset Thresholds |                                                                                                 |               |                                                                                                       |                         |                  |                         |        |
| V <sub>RST</sub> | Reset threshold <sup>(2)</sup><br>(see <a href="#">Table 6 on page 18</a> for detailed listing) |               | V <sub>CC</sub> falling; T <sub>A</sub> = 25°C                                                        | V <sub>RST</sub> − 1.8% | V <sub>RST</sub> | V <sub>RST</sub> + 1.8% | V      |
|                  |                                                                                                 |               | V <sub>CC</sub> falling; T <sub>A</sub> = −40 to 85°C                                                 | V <sub>RST</sub> − 2.5% |                  | V <sub>RST</sub> + 2.5% | V      |
|                  |                                                                                                 |               | V <sub>CC</sub> falling; T <sub>A</sub> = −40 to 125°C                                                | V <sub>RST</sub> − 3.5% |                  | V <sub>RST</sub> + 3.5% | V      |
| t <sub>RD</sub>  | V <sub>CC</sub> -to- $\overline{\text{RST}}$ delay                                              |               | V <sub>CC</sub> falling from<br>(V <sub>RST</sub> + 100mV) to<br>(V <sub>RST</sub> − 200mV) at 1mV/μs |                         | 35               |                         | μs     |
| t <sub>rec</sub> | $\overline{\text{RST}}$ pulse width <sup>(2)</sup>                                              | STM6315xAxxxx | T <sub>A</sub> = −40 to +85°C                                                                         | 1                       | 1.5              | 2                       | ms     |
|                  |                                                                                                 |               | T <sub>A</sub> = −40 to +125°C                                                                        | 0.8                     |                  | 2.4                     | ms     |
|                  |                                                                                                 | STM6315xBxxxx | T <sub>A</sub> = −40 to +85°C                                                                         | 20                      | 30               | 40                      | ms     |
|                  |                                                                                                 |               | T <sub>A</sub> = −40 to +125°C                                                                        | 16                      |                  | 48                      | ms     |
|                  |                                                                                                 | STM6315xDxxxx | T <sub>A</sub> = −40 to +85°C                                                                         | 140                     | 210              | 280                     | ms     |
|                  |                                                                                                 |               | T <sub>A</sub> = −40 to +125°C                                                                        | 112                     |                  | 336                     | ms     |
|                  |                                                                                                 | STM6315xGxxxx | T <sub>A</sub> = −40 to +85°C                                                                         | 1120                    | 1680             | 2240                    | ms     |
|                  |                                                                                                 |               | T <sub>A</sub> = −40 to +125°C                                                                        | 896                     |                  | 2688                    | ms     |
|                  | Reset threshold temperature coefficient                                                         |               |                                                                                                       |                         | 60               |                         | ppm/°C |

Table 4. DC and AC characteristics (continued)

| Sym                       | Description                                               | Test Condition <sup>(1)</sup> | Min                | Typ | Max                | Unit |
|---------------------------|-----------------------------------------------------------|-------------------------------|--------------------|-----|--------------------|------|
| <b>Manual Reset Input</b> |                                                           |                               |                    |     |                    |      |
| V <sub>IL</sub>           | $\overline{\text{MR}}$ low input threshold                | V <sub>RST</sub> > 4.0V       | 0.8                |     |                    | V    |
|                           |                                                           | V <sub>RST</sub> < 4.0V       | 0.3V <sub>CC</sub> |     |                    | V    |
| V <sub>IH</sub>           | $\overline{\text{MR}}$ low input threshold                | V <sub>RST</sub> > 4.0V       |                    |     | 2.4                | V    |
|                           |                                                           | V <sub>RST</sub> < 4.0V       |                    |     | 0.7V <sub>CC</sub> | V    |
|                           | $\overline{\text{MR}}$ input pulse width                  |                               | 1                  |     |                    | μs   |
|                           | $\overline{\text{MR}}$ glitch rejection                   |                               |                    | 100 |                    | ns   |
|                           | $\overline{\text{MR}}$ -to- $\overline{\text{RST}}$ delay |                               |                    | 500 |                    | ns   |
|                           | $\overline{\text{MR}}$ pull-up resistance                 |                               | 32                 | 63  | 100                | kΩ   |

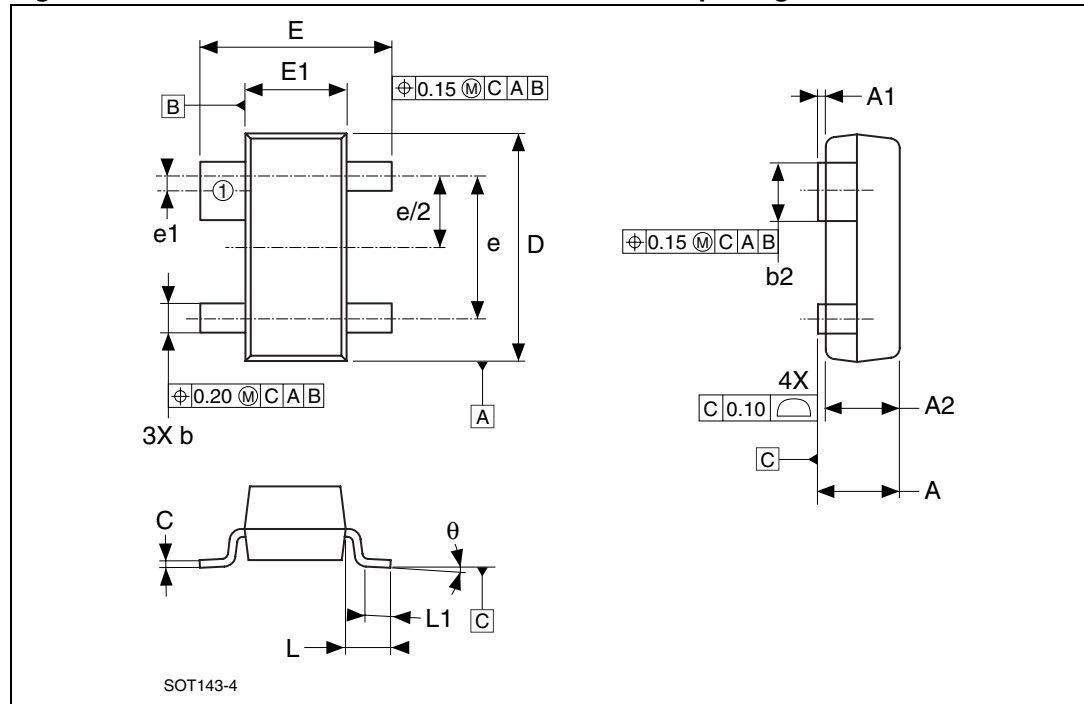
1. Valid for ambient operating temperature: T<sub>A</sub> = -40 to 125°C; V<sub>CC</sub> = 2.5 to 5.5V (except where noted).
2. Other V<sub>RST</sub> thresholds and t<sub>rec</sub> timings are offered. Minimum order quantities may apply. Contact local sales office for availability.

## 6 Package mechanical data

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 14. SOT143-4 – 4-lead small outline transistor package outline



Note: Drawing is not to scale.

Table 5. SOT143-4 – 4-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      | —    | 0.37 | 0.51 | —      | 0.015 | 0.020 |
| b2     | —    | 0.76 | 0.94 | —      | 0.030 | 0.037 |
| C      | —    | 0.09 | 0.18 | —      | 0.004 | 0.007 |
| 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      | 1.92 | —    | —    | 0.076  | —     | —     |
| e1     | 0.20 | —    | —    | 0.008  | —     | —     |
| L      | 0.55 | —    | —    | 0.022  | —     | —     |
| L1     | —    | 0.40 | 0.60 | —      | 0.016 | 0.024 |
| θ      |      | 0°   | 10°  |        | 0°    | 10°   |
| N      | 4    |      |      | 4      |       |       |

# 7 Part numbering

Table 6. Ordering information scheme

|                                        |         |   |   |    |   |   |
|----------------------------------------|---------|---|---|----|---|---|
| Example:                               | STM6315 | R | D | W1 | 3 | F |
| Device Type                            | STM6315 |   |   |    |   |   |
| Reset Threshold Voltage <sup>(1)</sup> |         |   |   |    |   |   |
| L = V <sub>RST</sub> = 4.63V           |         |   |   |    |   |   |
| M = V <sub>RST</sub> = 4.38V           |         |   |   |    |   |   |
| S = V <sub>RST</sub> = 2.93V           |         |   |   |    |   |   |
| R = V <sub>RST</sub> = 2.63V           |         |   |   |    |   |   |
| RST Pulse Width <sup>(1)</sup>         |         |   |   |    |   |   |
| A = t <sub>rec</sub> = 1.5ms           |         |   |   |    |   |   |
| B = t <sub>rec</sub> = 30ms            |         |   |   |    |   |   |
| D = t <sub>rec</sub> = 210ms           |         |   |   |    |   |   |
| G = t <sub>rec</sub> = 1680ms          |         |   |   |    |   |   |
| Package                                |         |   |   |    |   |   |
| W1 = SOT143-4                          |         |   |   |    |   |   |
| Temperature Range                      |         |   |   |    |   |   |
| 3 = -40 to 125°C                       |         |   |   |    |   |   |
| Shipping Method                        |         |   |   |    |   |   |
| F = ECOPACK Package, Tape & Reel       |         |   |   |    |   |   |

1. Other V<sub>RST</sub> thresholds and t<sub>rec</sub> timings are offered. Minimum order quantities may apply. Contact local sales office for availability.

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



**Table 7. Marking description**

| Part Number | Reset Threshold <sup>(1)</sup><br>(V) | RST Pulse Width <sup>(1)</sup><br>(ms) | Output                             | Topside<br>Marking <sup>(2)</sup> |
|-------------|---------------------------------------|----------------------------------------|------------------------------------|-----------------------------------|
| STM6315LB   | 4.63                                  | 30                                     | Open drain $\overline{\text{RST}}$ | 9LBx                              |
| STM6315MD   | 4.38                                  | 210                                    | Open drain $\overline{\text{RST}}$ | 9MDx                              |
| STM6315SD   | 2.93                                  | 210                                    | Open drain $\overline{\text{RST}}$ | 9SDx                              |
| STM6315RA   | 2.63                                  | 1.5                                    | Open drain $\overline{\text{RST}}$ | 9RAx                              |
| STM6315RB   | 2.63                                  | 30                                     | Open drain $\overline{\text{RST}}$ | 9RBx                              |
| STM6315RD   | 2.63                                  | 210                                    | Open drain $\overline{\text{RST}}$ | 9RDx                              |
| STM6315RG   | 2.63                                  | 1680                                   | Open drain $\overline{\text{RST}}$ | 9RGx                              |

1. Other  $V_{\text{RST}}$  thresholds and  $t_{\text{rec}}$  timings are offered. Minimum order quantities may apply. Contact local sales office for availability.
2. Where "x" = Assembly Work Week (A to Z), such that "A" = WW01-02, "B" = WW03-04, and so forth.

## 8 Revision history

**Table 8. Document revision history**

| Date        | Revision | Changes                                                                                    |
|-------------|----------|--------------------------------------------------------------------------------------------|
| 14-Nov-2005 | 1.0      | First edition.                                                                             |
| 08-Feb-2006 | 2.0      | Update template, characteristics, marking (Figure 7, 8, 9, 10, and 11; Table 4, 6, and 7). |
| 12-Apr-2006 | 3        | Updated characteristics (Figure 7, 8, and 11; Table 4, 6, and 7).                          |
| 27-Jul-2006 | 4        | Updated Table 3, 5 and 6.                                                                  |
| 21-Mar-2007 | 5        | Updated Table 2, 6, and 7.                                                                 |

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