

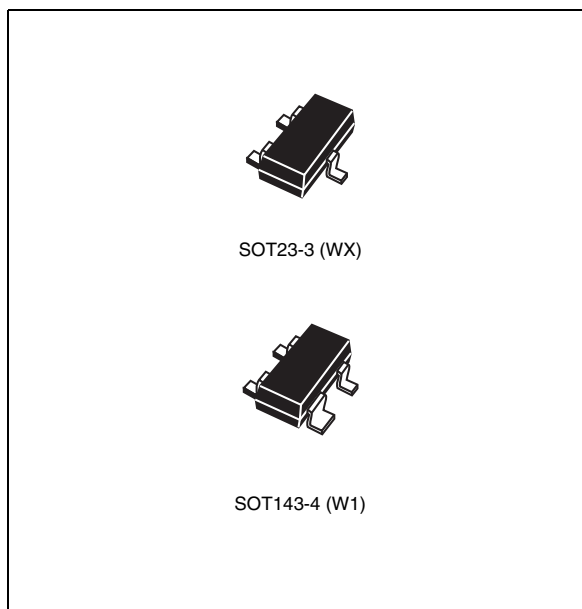


# THE DATASHEET OF STM811MW16F



### Features

- Precision monitoring of 3 V, 3.3 V, and 5 V supply voltages
- Two output configurations
  - Push-pull  $\overline{\text{RST}}$  output (STM809/811)
  - Push-pull RST output (STM810/812)
- 140 ms reset pulse width (min)
- Low supply current - 6  $\mu\text{A}$  (typ)
- Guaranteed  $\overline{\text{RST}}$ /RST assertion down to  $V_{\text{CC}} = 1.0 \text{ V}$
- Operating temperature:
  - 40 °C to 85 °C (industrial grade)
- Lead-free, small SOT23 and SOT143 package



**Table 1. Device summary**

|        | Active-low reset | Active-high reset | Manual reset input | Package  |
|--------|------------------|-------------------|--------------------|----------|
| STM809 | ✓                |                   |                    | SOT23-3  |
| STM810 |                  | ✓                 |                    | SOT23-3  |
| STM811 | ✓                |                   | ✓                  | SOT143-4 |
| STM812 |                  | ✓                 | ✓                  | SOT143-4 |

# Contents

|          |   |           |
|----------|---|-----------|
| <b>1</b> | <b>Description</b> .....  | <b>5</b>  |
| <b>2</b> | <b>Operation</b> .....  | <b>7</b>  |
|          | 2.1 Reset output .....  | 7         |
|          | 2.2 Push-button reset input (STM811/812) .....                        | 7         |
|          | 2.3 Negative-going $V_{CC}$ transients .....                          | 7         |
|          | 2.4 Valid $\overline{RST}$ output down to $V_{CC} = 0\text{ V}$ ..... | 8         |
| <b>3</b> | <b>Typical operating characteristics</b> .....                        | <b>9</b>  |
| <b>4</b> | <b>Maximum ratings</b> .....  | <b>12</b> |
| <b>5</b> | <b>DC and AC parameters</b> .....                                     | <b>13</b> |
| <b>6</b> | <b>Package mechanical data</b> .....                                  | <b>16</b> |
| <b>7</b> | <b>Part numbering</b> .....   | <b>18</b> |
| <b>8</b> | <b>Revision history</b> .....   | <b>20</b> |

## List of tables

|           |   |    |
|-----------|---|----|
| Table 1.  | Device summary . . . . .  | 1  |
| Table 2.  | Signal names . . . . .  | 5  |
| Table 3.  | Absolute maximum ratings . . . . .  | 12 |
| Table 4.  | Operating and AC measurement conditions. . . . .                            | 13 |
| Table 5.  | DC and AC characteristics . . . . .   | 14 |
| Table 6.  | SOT23-3 – 3-lead small outline transistor package mechanical data. . . . .  | 16 |
| Table 7.  | SOT143-4 – 4-lead small outline transistor package mechanical data. . . . . | 17 |
| Table 8.  | Ordering information scheme . . . . .                                       | 18 |
| Table 9.  | Marking description. . . . .  | 19 |
| Table 10. | Document revision history . . . . .   | 20 |

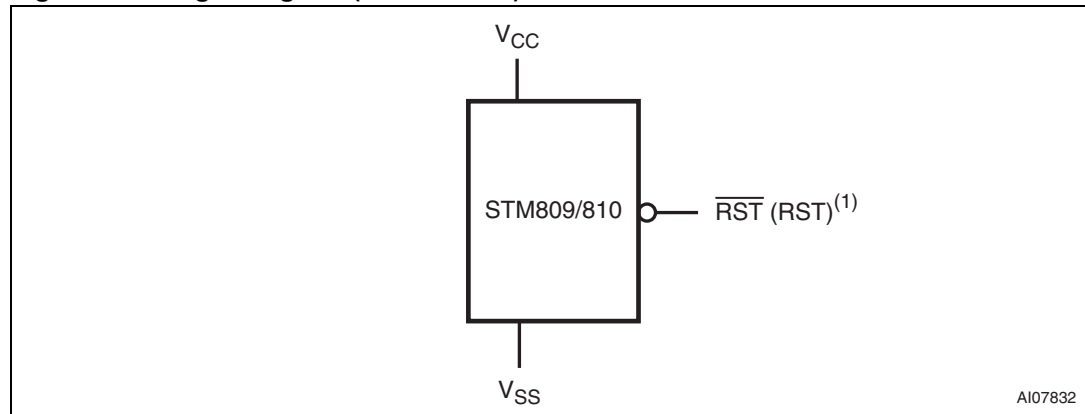
## List of figures

|            |   |    |
|------------|---|----|
| Figure 1.  | Logic diagram (STM809/810) .....  | 5  |
| Figure 2.  | Logic diagram (STM811/812) .....  | 5  |
| Figure 3.  | SOT23-3 connections .....   | 6  |
| Figure 4.  | SOT143-4 connections .....  | 6  |
| Figure 5.  | Block diagram .....   | 6  |
| Figure 6.  | Hardware hookup .....   | 6  |
| Figure 7.  | Supply current vs. temperature, L/M/R/S/T (no load) .....                           | 9  |
| Figure 8.  | Power-down reset delay vs. temperature - $V_{OD} = V_{TH} - V_{CC}$ (L/M) .....     | 9  |
| Figure 9.  | Power-down reset delay vs. temperature - $V_{OD} = V_{TH} - V_{CC}$ (R/S/T) .....   | 10 |
| Figure 10. | Power-up $t_{rec}$ vs. temperature .....  | 10 |
| Figure 11. | Normalized reset threshold vs. temperature .....                                    | 11 |
| Figure 12. | Max transient duration NOT causing reset pulse vs. reset comparator overdrive ..... | 11 |
| Figure 13. | AC testing input/output waveforms .....   | 13 |
| Figure 14. | MR timing waveform .....  | 13 |
| Figure 15. | SOT23-3 – 3-lead small outline transistor package outline .....                     | 16 |
| Figure 16. | SOT143-4 – 4-lead small outline transistor package outline .....                    | 17 |

# 1 Description

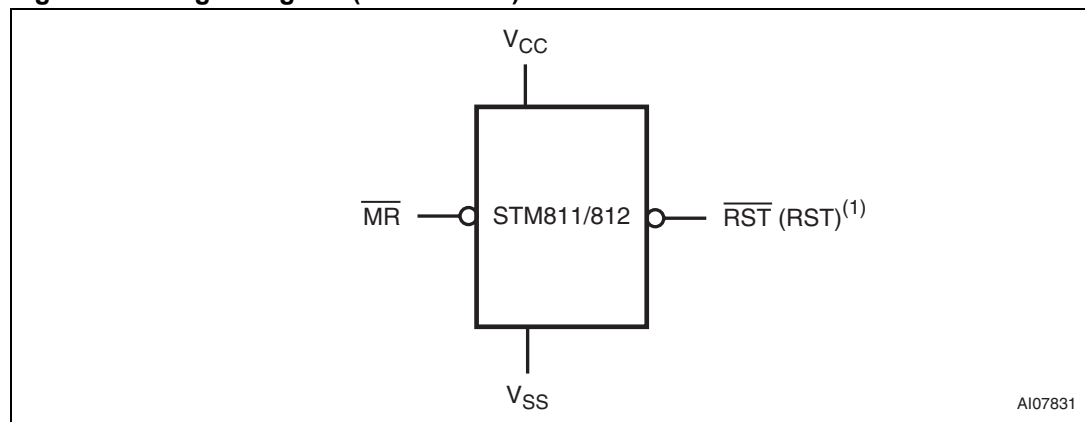
The STM809/810/811/812 microprocessor reset circuits are low-power supervisory devices used to monitor power supplies. They perform a single function: asserting a reset signal whenever the  $V_{CC}$  supply voltage drops below a preset value and keeping it asserted until  $V_{CC}$  has risen above the preset threshold for a minimum period of time ( $t_{rec}$ ). The STM811/812 also provide a push-button reset input ( $\overline{MR}$ ).

**Figure 1. Logic diagram (STM809/810)**



1. For STM810

**Figure 2. Logic diagram (STM811/812)**



1. For STM812

**Table 2. Signal names**

|                       |                          |
|-----------------------|--------------------------|
| $V_{SS}$              | Ground                   |
| $\overline{RST}$      | Active-low reset output  |
| $RST^{(1)}$           | Active-high reset output |
| $V_{CC}$              | Supply voltage           |
| $\overline{MR}^{(2)}$ | Manual reset input       |

1. STM810/812 only

2. STM811/812 only

Figure 3. SOT23-3 connections

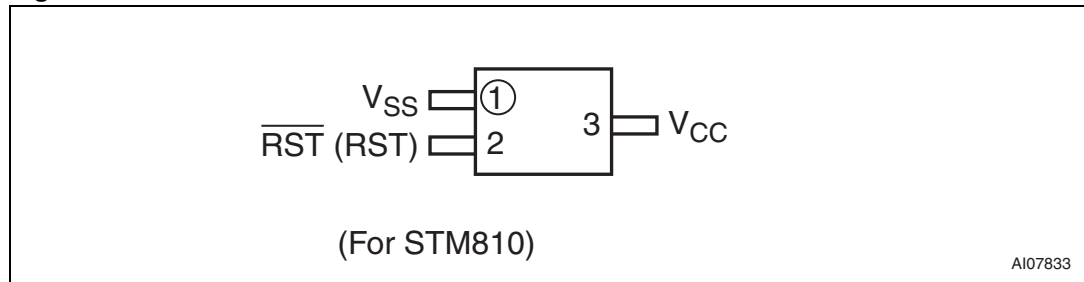


Figure 4. SOT143-4 connections

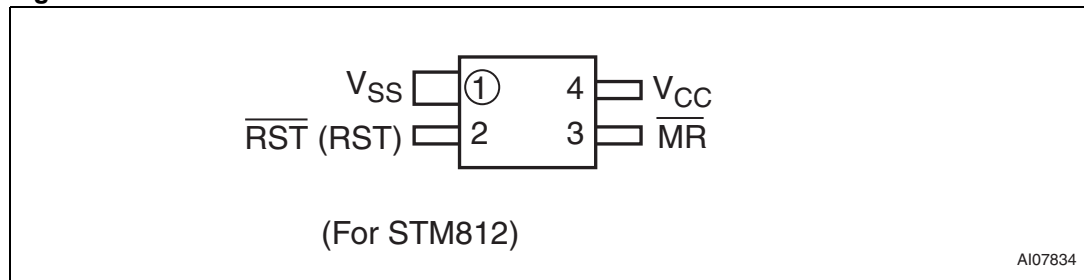
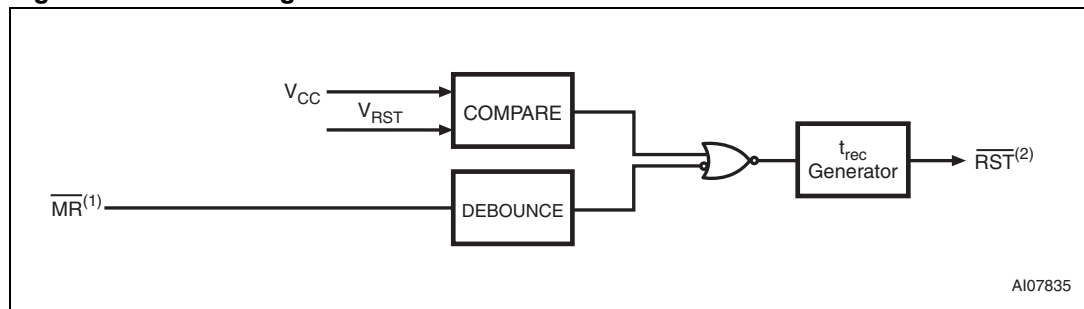
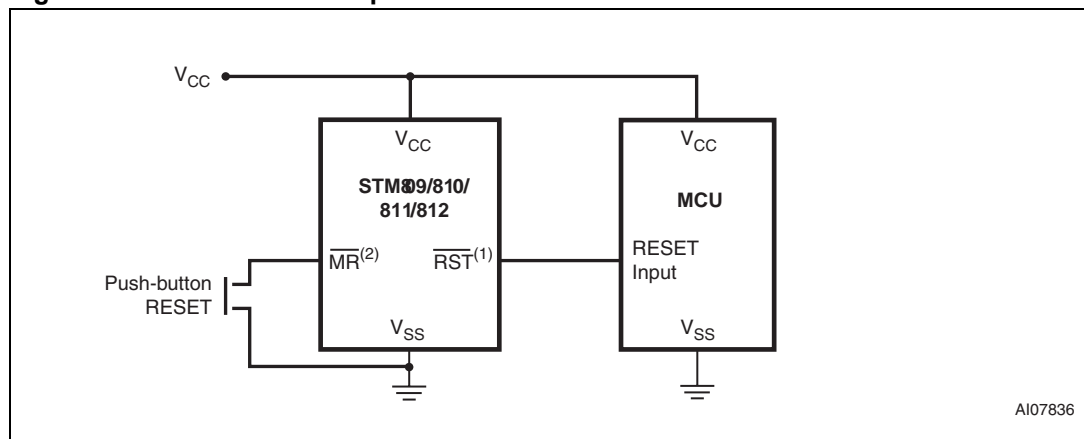


Figure 5. Block diagram



- 1. STM811/812 only
- 2. RST for STM810/812

Figure 6. Hardware hookup



- 1. STM809/811 only (RST for STM810/812)
- 2. STM811/812 only

## 2 Operation

### 2.1 Reset output

The STM809/810/811/812 microprocessor reset circuit asserts a reset signal to the MCU whenever  $V_{CC}$  goes below the reset threshold ( $V_{RST}$ ), or when the push-button reset input ( $\overline{MR}$ ) is taken low (see [Figure 14 on page 13](#)).  $\overline{RST}$  (active high for STM810/812) is guaranteed valid down to  $V_{CC} = 1\text{ V}$  ( $0^\circ$  to  $70^\circ\text{C}$ ).

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. The active-low reset ( $\overline{RST}$ ) and active-high reset ( $RST$ ) both source and sink current.

### 2.2 Push-button reset input (STM811/812)

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  $20\text{ k}\Omega$  pull-up resistor, 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 normally open push-button switch from  $\overline{MR}$  to GND to create a manual reset function; external debounce circuitry is not required. If the device is used in a noisy environment, connect a  $0.1\text{ }\mu\text{F}$  capacitor from  $\overline{MR}$  to GND to provide additional noise immunity.

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

The STM809/810/811/812 are 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 STM809/810/811/812 will NOT generate a reset pulse). The graph was generated using a negative pulse applied to  $V_{CC}$ , starting at  $0.5\text{ V}$  above the actual reset threshold and ending below it by the magnitude indicated (comparator 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. Typically, a  $V_{CC}$  transient that goes  $100\text{ mV}$  below the reset threshold and lasts  $20\text{ }\mu\text{s}$  or less will not cause a reset pulse. A  $0.1\text{ }\mu\text{F}$  bypass capacitor mounted as close as possible to the  $V_{CC}$  pin provides additional transient immunity.

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

When  $V_{CC}$  falls below 1 V, the  $\overline{RST}$  (STM809/811) 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 1 V. However, in applications where  $\overline{RST}$  output must be valid down to 0 V, a pull-down resistor may be added to hold the  $\overline{RST}$  output low. This resistor must be large enough to not load the  $\overline{RST}$  output, and still be small enough to pull the output to ground. A 100 k $\Omega$  resistor is recommended.

*Note:* The same situation applies for the active-high RST of the STM810/812. A 100 k $\Omega$  pull-up resistor to  $V_{CC}$  should be used if RST must remain valid for  $V_{CC} < 1.0\text{ V}$ .

### 3 Typical operating characteristics

Note: Typical values are at  $T_A = 25\text{ }^\circ\text{C}$ ,  $V_{CC} = 5\text{ V}$  for L/M versions,  $V_{CC} = 3.3\text{ V}$  for T/S versions, and  $V_{CC} = 3.0\text{ V}$  for R versions.

Figure 7. Supply current vs. temperature, L/M/R/S/T (no load)

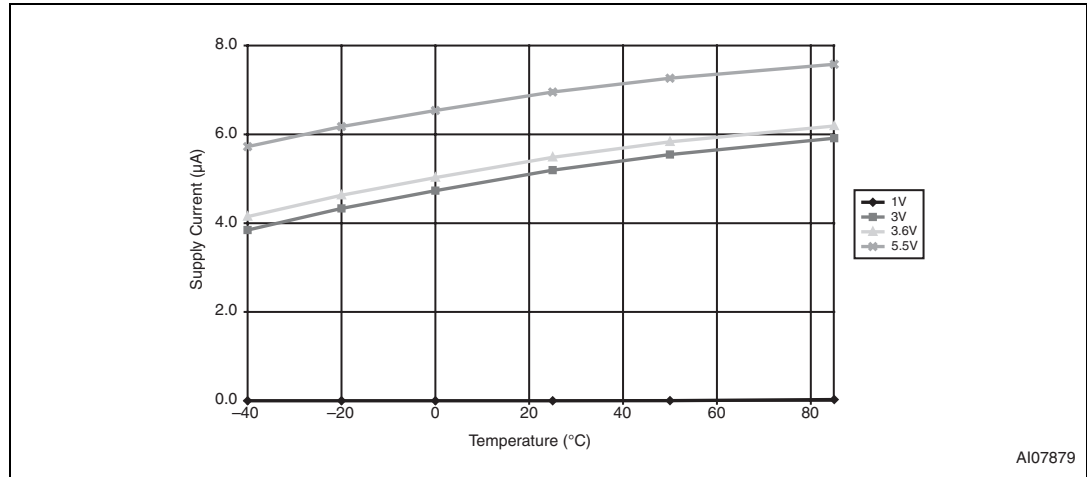


Figure 8. Power-down reset delay vs. temperature -  $V_{OD} = V_{TH} - V_{CC}$  (L/M)

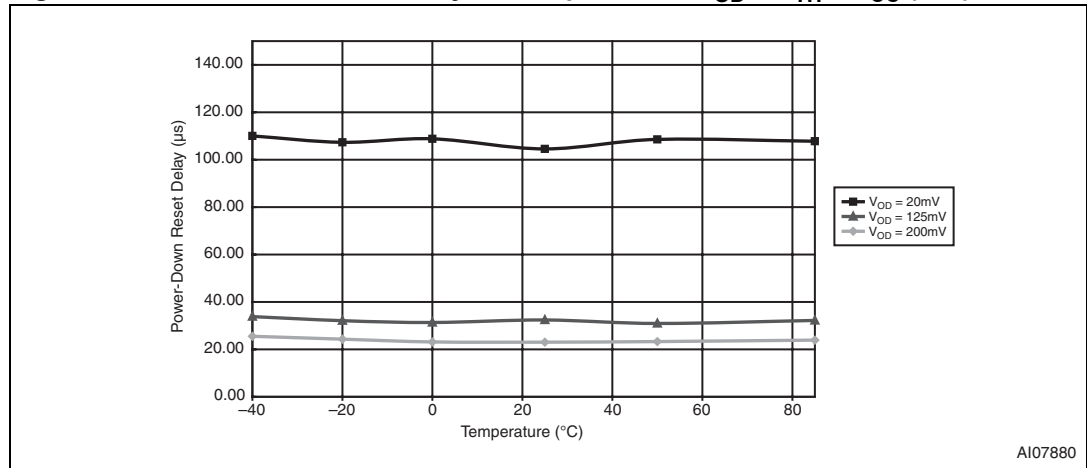


Figure 9. Power-down reset delay vs. temperature -  $V_{OD} = V_{TH} - V_{CC}$  (R/S/T)

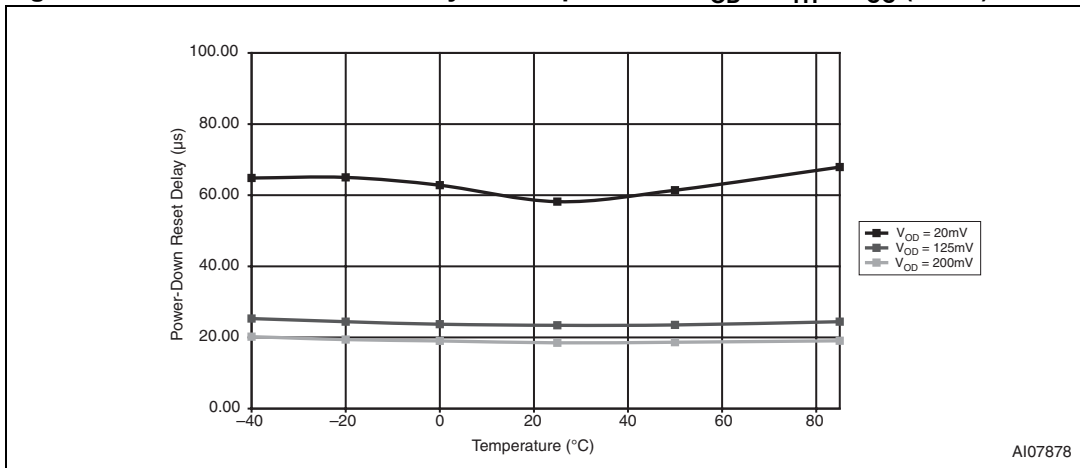


Figure 10. Power-up  $t_{rec}$  vs. temperature

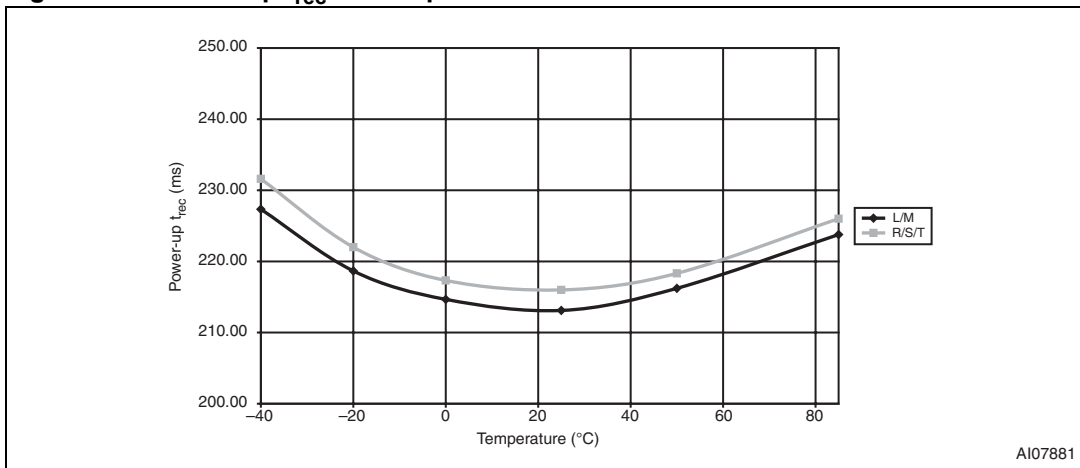


Figure 11. Normalized reset threshold vs. temperature

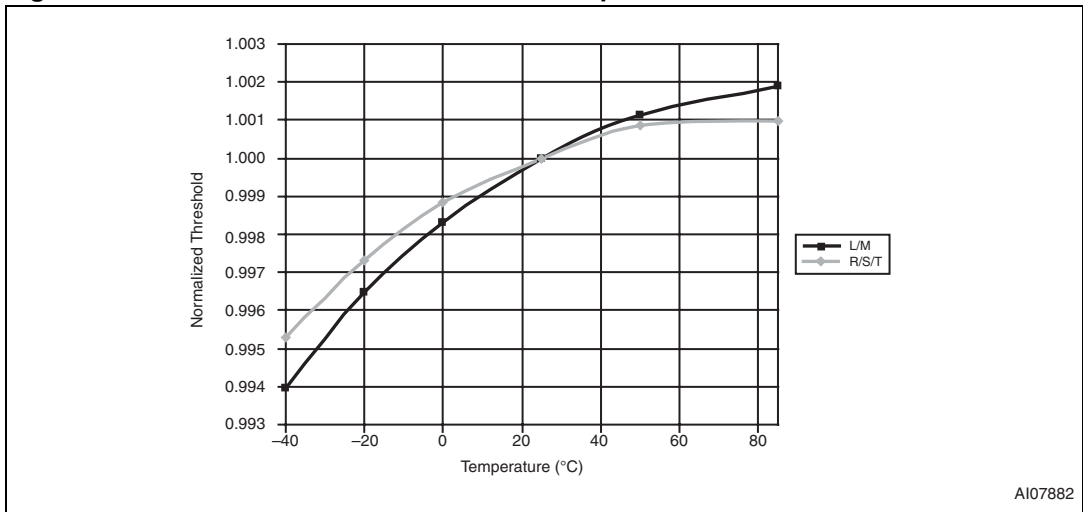
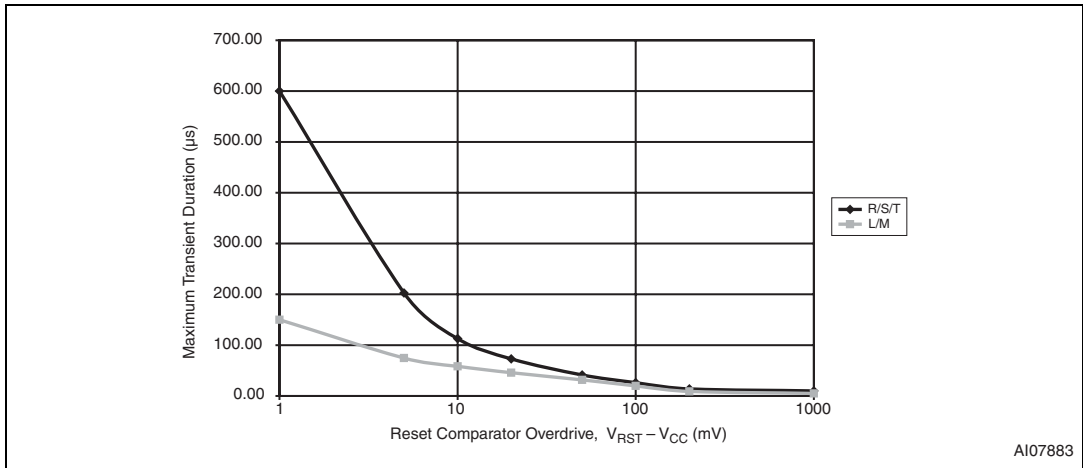


Figure 12. Max transient duration NOT causing reset pulse vs. reset comparator overdrive



## 4 Maximum ratings

Stressing the device above the rating listed in the absolute maximum ratings table 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)    | -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. The time above 255 °C must not exceed 30 seconds.

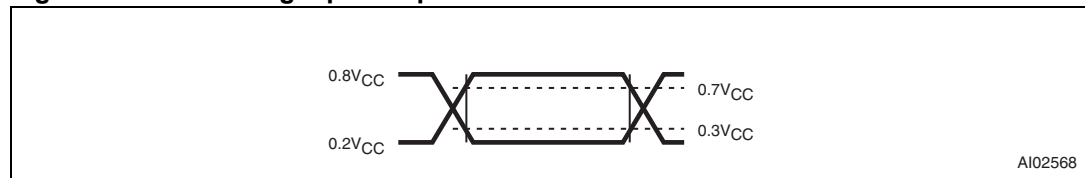
## 5 DC and AC parameters

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

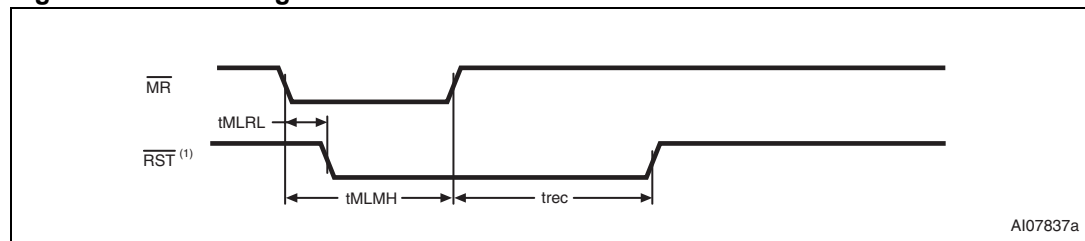
**Table 4. Operating and AC measurement conditions**

| Parameter                                       | STM809/810/811/812         | Unit |
|---|----------------------------|------|
| V <sub>CC</sub> supply voltage                  | 1.0 to 5.5                 | V    |
| Ambient operating temperature (T <sub>A</sub> ) | -40 to 85                  | °C   |
| Input rise and fall times                       | ≤ 5                        | ns   |
| Input pulse voltages                            | 0.2 to 0.8 V <sub>CC</sub> | V    |
| Input and output timing ref. voltages           | 0.3 to 0.7 V <sub>CC</sub> | V    |

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



**Figure 14. MR timing waveform**



1. RST for STM810/812

Table 5. DC and AC characteristics

| Sym                     | Alternative  | Description   | Test condition <sup>(1)</sup>   | Min                 | Typ  | Max                  | Unit   |   |
|-------------------------|--------------|---|---|---------------------|------|----------------------|--------|---|
| V <sub>CC</sub>         |              | Operating voltage   | T <sub>A</sub> = -40 to +85 °C  | 1.2                 |      | 5.5                  | V      |   |
|                         |              |   | T <sub>A</sub> = 0 to +70 °C  | 1.0                 |      | 5.5                  | V      |   |
| I <sub>CC</sub>         |              | V <sub>CC</sub> supply current  | V <sub>CC</sub> < 3.6 V   |                     | 5.5  | 10                   | µA     |   |
|                         |              |   | V <sub>CC</sub> < 5.5 V   |                     | 7    | 15                   | µA     |   |
| V <sub>IH</sub>         |              | $\overline{MR}$ input high voltage                                      | V <sub>CC</sub> > V <sub>RST</sub> (max), STM8XXL/M                                       | 2.2                 |      |                      | V      |   |
|                         |              |   | V <sub>CC</sub> > V <sub>RST</sub> (max), STM8XXR/S/T                                     | 0.7 V <sub>CC</sub> |      |                      | V      |   |
| V <sub>IL</sub>         |              | $\overline{MR}$ input low voltage                                       | V <sub>CC</sub> > V <sub>RST</sub> (max), STM8XXL/M                                       |                     |      | 0.8                  | V      |   |
|                         |              |   | V <sub>CC</sub> > V <sub>RST</sub> (max), STM8XXR/S/T                                     |                     |      | 0.25 V <sub>CC</sub> | V      |   |
| V <sub>OL</sub>         |              | $\overline{RST}$ output low voltage (active high <sup>(2)</sup> or low) | STM8XXR/S/T only,<br>I <sub>OL</sub> = 1.2 mA<br>V <sub>CC</sub> = V <sub>RST</sub> (min) |                     |      | 0.3                  | V      |   |
|                         |              |   | STM8XXL/M only,<br>I <sub>OL</sub> = 3.2 mA<br>V <sub>CC</sub> = V <sub>RST</sub> (min)   |                     |      | 0.4                  | V      |   |
| V <sub>OL</sub>         |              | $\overline{RST}$ output low voltage                                     | I <sub>OL</sub> = 50 µA; V <sub>CC</sub> > 1.0 V  |                     |      | 0.3                  | V      |   |
| V <sub>OH</sub>         |              | $\overline{RST}$ output high voltage                                    | STM8XXR/S/T only,<br>I <sub>OH</sub> = 500 µA   | 0.8 V <sub>CC</sub> |      |                      | V      |   |
|                         |              |   | STM8XXL/M only,<br>I <sub>OH</sub> = 800 µA   | 0.8 V <sub>CC</sub> |      |                      | V      |   |
|                         |              | RST output high voltage   | I <sub>OH</sub> = 150 µA,<br>1.8 V < V <sub>CC</sub> < V <sub>RST</sub> (min)             | 0.8 V <sub>CC</sub> |      |                      | V      |   |
| <b>Reset thresholds</b> |              |   |   |                     |      |                      |        |   |
| V <sub>RST</sub>        |              | Reset threshold   | STM8XXL   | 25 °C               | 4.56 | 4.63                 | 4.70   | V |
|                         |              |   |   | -40 to 85 °C        | 4.50 |                      | 4.75   | V |
|                         |              |   | STM8XXM   | 25 °C               | 4.31 | 4.38                 | 4.45   | V |
|                         |              |   |   | -40 to 85 °C        | 4.25 |                      | 4.50   | V |
|                         |              |   | STM8XXT   | 25 °C               | 3.04 | 3.08                 | 3.11   | V |
|                         |              |   |   | -40 to 85 °C        | 3.00 |                      | 3.15   | V |
|                         |              |   | STM8XXS   | 25 °C               | 2.89 | 2.93                 | 2.96   | V |
|                         |              |   |   | -40 to 85 °C        | 2.85 |                      | 3.00   | V |
| STM8XXR                 | 25 °C        | 2.59  | 2.63  | 2.66                | V    |                      |        |   |
|                         | -40 to 85 °C | 2.55  |   | 2.70                | V    |                      |        |   |
|                         |              | V <sub>RST</sub> temperature coefficient                                | V <sub>CC</sub> = 3.3 V   |                     | 45   |                      | ppm/°C |   |
|                         |              | V <sub>CC</sub> to $\overline{RST}$ delay                               | V <sub>CC</sub> = V <sub>RST</sub> to (V <sub>RST</sub> - 100 mV)                         | STM8XXL/M           | 40   |                      | µs     |   |
|                         |              |   |   | STM8XXR/S/T         | 20   |                      | µs     |   |

| Sym                            | Alter-native | Description   | Test condition <sup>(1)</sup> | Min | Typ | Max | Unit             |
|--------------------------------|--------------|---|-------------------------------|-----|-----|-----|------------------|
| <b>Push-button reset input</b> |              |   |                               |     |     |     |                  |
| $t_{MLMH}$                     | $t_{MR}$     | $\overline{MR}$ pulse width                                     |                               | 10  |     |     | $\mu\text{s}$    |
| $t_{MLRL}$                     | $t_{MRD}$    | $\overline{MR}$ to $\overline{RST}$ output delay <sup>(3)</sup> |                               |     | 0.5 |     | $\mu\text{s}$    |
|                                |              | $\overline{MR}$ glitch immunity <sup>(4)</sup>                  |                               |     | 100 |     | ns               |
|                                |              | $\overline{MR}$ pull-up resistance                              |                               | 10  | 20  | 30  | $\text{k}\Omega$ |
|                                | $t_{rec}$    | $\overline{RST}$ pulse width                                    |                               | 140 | 210 | 280 | ms               |

1. Valid for ambient operating temperature:  $T_A = -40$  to  $85$  °C;  $V_{CC} = 1.2$  V to  $5.5$  V (except where noted).

2. For active high (RST);  $V_{CC} = V_{RST}$  (max)

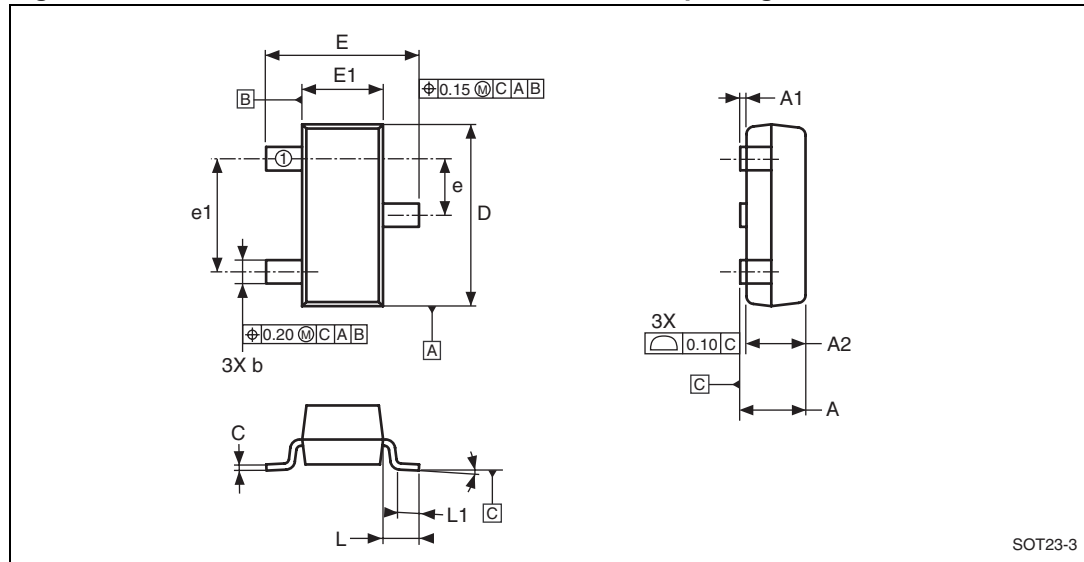
3. RST output for STM810/812

4. "Glitches" of 100 ns or less typically will not generate a reset pulse.

## 6 Package mechanical data

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

**Figure 15. SOT23-3 – 3-lead small outline transistor package outline**

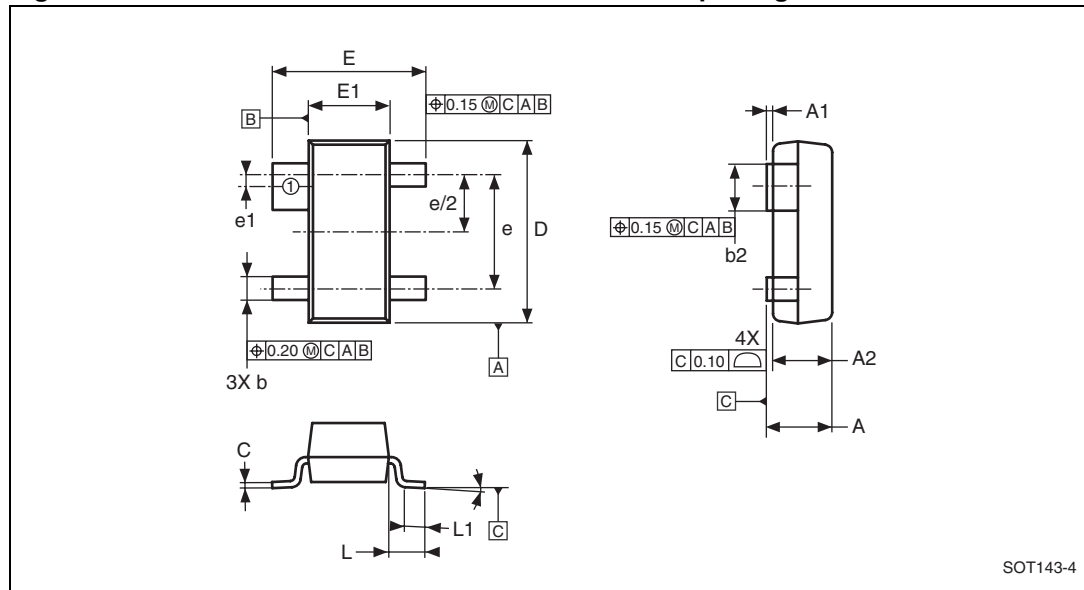


Note: Drawing is not to scale.

**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 |
| θ      |      | 0°   | 8°   |        | 0°    | 8°    |
| N      |      | 3    |      |        | 3     |       |

Figure 16. SOT143-4 – 4-lead small outline transistor package outline



Note: Drawing is not to scale.

Table 7. 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 |
| $\theta$ |      | 0°   | 10°  |        | 0°    | 10°   |
| N        |      | 4    |      |        | 4     |       |

## 7 Part numbering

**Table 8. Ordering information scheme**

| Example:                       | STM8XX | L  | WX  | 6  | F   |
|--------------------------------|--------|--|---|--|---|
| <b>Device type</b>             | STM8XX |  |   |  |   |
| <b>Reset threshold voltage</b> |        | L = $V_{RST} = 4.50\text{ V to }4.75\text{ V}$<br>M = $V_{RST} = 4.25\text{ V to }4.50\text{ V}$<br>T = $V_{RST} = 3.00\text{ V to }3.15\text{ V}$<br>S = $V_{RST} = 2.85\text{ V to }3.00\text{ V}$<br>R = $V_{RST} = 2.55\text{ V to }2.70\text{ V}$ |   |  |   |
| <b>Package</b>                 |        |  | WX = SOT23-3 (STM809, STM810)<br>W1 = SOT143-4 (STM811, STM812) |  |   |
| <b>Temperature range</b>       |        |  |   | 6 = $-40\text{ to }85\text{ }^{\circ}\text{C}$ |   |
| <b>Shipping method</b>         |        |  |   |  | F = ECOPACK <sup>®</sup> package, tape & reel |

For a list of available options (e.g., speed, package) or for further information on any aspect of this device, please contact the ST sales office nearest to you.

Table 9. Marking description

| Part number | Reset threshold | Output                            | Topside marking <sup>(1)</sup> |
|-------------|-----------------|-----------------------------------|--------------------------------|
| STM809L     | 4.63 V          | Push-pull $\overline{\text{RST}}$ | 8AAx                           |
| STM809M     | 4.38 V          | Push-pull $\overline{\text{RST}}$ | 8ABx                           |
| STM809T     | 3.08 V          | Push-pull $\overline{\text{RST}}$ | 8ACx                           |
| STM809S     | 2.93 V          | Push-pull $\overline{\text{RST}}$ | 8ADx                           |
| STM809R     | 2.63 V          | Push-pull $\overline{\text{RST}}$ | 8AEx                           |
| STM810L     | 4.63 V          | Push-pull RST                     | 8AFx                           |
| STM810M     | 4.38 V          | Push-pull RST                     | 8AGx                           |
| STM810T     | 3.08 V          | Push-pull RST                     | 8AHx                           |
| STM810S     | 2.93 V          | Push-pull RST                     | 8AJx                           |
| STM810R     | 2.63 V          | Push-pull RST                     | 8AKx                           |
| STM811L     | 4.63 V          | Push-pull $\overline{\text{RST}}$ | 8ALx                           |
| STM811M     | 4.38 V          | Push-pull $\overline{\text{RST}}$ | 8AMx                           |
| STM811T     | 3.08 V          | Push-pull $\overline{\text{RST}}$ | 8ANx                           |
| STM811S     | 2.93 V          | Push-pull $\overline{\text{RST}}$ | 8APx                           |
| STM811R     | 2.63 V          | Push-pull $\overline{\text{RST}}$ | 8AQx                           |
| STM812L     | 4.63 V          | Push-pull RST                     | 8ARx                           |
| STM812M     | 4.38 V          | Push-pull RST                     | 8ASx                           |
| STM812T     | 3.08 V          | Push-pull RST                     | 8ATx                           |
| STM812S     | 2.93 V          | Push-pull RST                     | 8AUx                           |
| STM812R     | 2.63 V          | Push-pull RST                     | 8AVx                           |

1. x = letter assigned to indicate assembly work week (i.e., A = WW01 and WW02, B = WW03 and WW04, C = WW05 and WW06..., Z = WW51, WW52, and WW53).

## 8 Revision history

**Table 10. Document revision history**

| Date        | Revision | Changes   |
|-------------|----------|---|
| 02-Sep-2003 | 1        | First issue   |
| 03-Oct-2003 | 1.1      | Update operating characteristics ( <a href="#">Figure 7</a> , <a href="#">Figure 8</a> , <a href="#">Figure 9</a> , <a href="#">Figure 10</a> , <a href="#">Figure 11</a> , <a href="#">Figure 12</a> ) |
| 16-Oct-2003 | 1.2      | Update characteristics ( <a href="#">Table 5</a> ); modify illustration ( <a href="#">Figure 12</a> )   |
| 17-Nov-2003 | 1.3      | Modified with JEDEC timing symbols ( <a href="#">Figure 14</a> ; <a href="#">Table 5</a> )  |
| 04-Dec-2003 | 2        | Reformatted; promoted; updated ( <a href="#">Figure 14</a> ; <a href="#">Table 5</a> , <a href="#">6</a> )  |
| 09-Dec-2003 | 2.1      | Correct timing label, combine characteristics ( <a href="#">Figure 10</a> ; <a href="#">Table 5</a> )   |
| 10-Feb-2004 | 3        | Clarify package; update DC characteristics ( <a href="#">Table 5</a> , <a href="#">Table 8</a> )  |
| 19-Nov-2004 | 4        | Update dimensions ( <a href="#">Table 6</a> ).  |
| 05-Jan-2010 | 5        | Updated footnote in <a href="#">Table 3</a> , added text to <a href="#">Section 6: Package mechanical data</a> , added footnote to <a href="#">Table 9</a> .  |

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